AMERICAN ACADEMY OF PEDIATRICS

Policy of the American Academy of Pediatrics

Pediatric Clinical Practice Guidelines & Policies

A Compendium of Evidence-based Research for Pediatric Practice

14th Edition

Text *and* CD-ROM all in one!

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Pediatric Clinical Practice Guidelines & Policies

A Compendium of Evidence-based Research for Pediatric Practice

14th Edition

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INTRODUCTION TO
PEDIATRIC CLINICAL PRACTICE GUIDELINES & POLICIES: A COMPENDIUM OF EVIDENCE-BASED RESEARCH FOR PEDIATRIC PRACTICE

Clinical practice guidelines have long provided physicians with evidence-based decision-making tools for managing common pediatric conditions. Policy statements issued and endorsed by the American Academy of Pediatrics (AAP) are developed to provide physicians with a quick reference guide to the AAP position on child health care issues. We have combined these 2 authoritative resources into one comprehensive manual/CD-ROM resource to provide easy access to important clinical and policy information.

This manual contains

- Clinical practice guidelines from the AAP, plus related recommendation summaries, *ICD-9-CM/ICD-10-CM* coding information, and AAP patient education handouts
- Technical report summaries
- Clinical practice guidelines endorsed by the AAP, including abstracts where applicable
- Policy statements, clinical reports, and technical reports issued or endorsed through December 2013, including abstracts where applicable
- Full text of all 2013 AAP policy statements, clinical reports, and technical reports

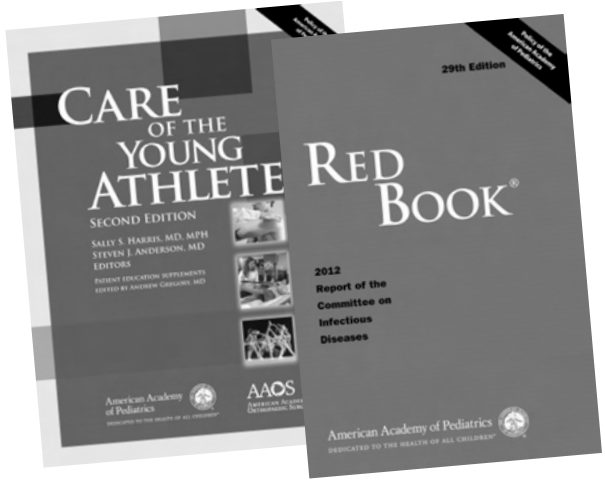
The CD-ROM, which is located on the inside back cover of this manual, builds on the content of the manual and includes full text of all AAP

- Clinical practice guidelines
- Policy statements
- Clinical reports
- Technical reports
- Endorsed clinical practice guidelines and policies

For easy reference within this publication, the dates when AAP clinical practice guidelines, policy statements, clinical reports, and technical reports first appeared in the AAP journal *Pediatrics* are provided. In 2009, the online version of *Pediatrics* at http://pediatrics.aappublications.org became the official journal of record; therefore, the date of online publication is given for policies from 2010 to present.

Additional information about AAP policy can be found in a variety of professional publications such as
Care of the Young Athlete, 2nd Edition
Guidelines for Perinatal Care, 7th Edition
Pediatric Environmental Health, 3rd Edition
Pediatric Nutrition, 7th Edition
Red Book®, 29th Edition, and *Red Book*® *Online* (www.aapredbook.org)
School Health: Policy & Practice, 6th Edition

For more information on these titles and similar resources or for ordering information, please call 888/227-1770 or visit our online Bookstore at www.aap.org/bookstore.



All policy statements, clinical reports, and technical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time. Please check the American Academy of Pediatrics Web site at www.aap.org for up-to-date reaffirmations, revisions, and retirements.

AMERICAN ACADEMY OF PEDIATRICS

The American Academy of Pediatrics (AAP) and its member pediatricians dedicate their efforts and resources to the health, safety, and well-being of infants, children, adolescents, and young adults. The AAP has approximately 62,000 members in the United States, Canada, and Latin America. Members include pediatricians, pediatric medical subspecialists, and pediatric surgical specialists.

Core Values. ***We believe***

- In the inherent worth of all children; they are our most enduring and vulnerable legacy.
- Children deserve optimal health and the highest quality health care.
- Pediatricians are the best qualified to provide child health care.

The American Academy of Pediatrics is the organization to advance child health and well-being.

Vision. Children have optimal health and well-being and are valued by society. Academy members practice the highest quality health care and experience professional satisfaction and personal well-being.

Mission. The mission of the American Academy of Pediatrics is to attain optimal physical, mental, and social health and well-being for all infants, children, adolescents, and young adults. To accomplish this mission, the Academy shall support the professional needs of its members.

Table of Contents

SECTION 5

CURRENT POLICIES FROM THE AMERICAN ACADEMY OF PEDIATRICS

SECTION 6

ENDORSED POLICIES

APPENDIX 1

POLICIES BY COMMITTEE

SECTION 1

Clinical Practice Guidelines

From the American Academy of Pediatrics

- *Clinical Practice Guidelines*
  EVIDENCE-BASED DECISION-MAKING TOOLS FOR MANAGING COMMON PEDIATRIC CONDITIONS

- *Technical Reports and Summaries*
  BACKGROUND INFORMATION TO SUPPORT AMERICAN ACADEMY OF PEDIATRICS POLICY

- *Quick Reference Tools*
  TOOLS FOR IMPLEMENTING AMERICAN ACADEMY OF PEDIATRICS GUIDELINES IN YOUR PRACTICE AND AT THE POINT OF CARE

FOREWORD

In response to the growing trend toward the practice of evidence-based medicine, the American Academy of Pediatrics (AAP) created an organizational process and methodology for developing clinical practice guidelines. These guidelines provide physicians with an evidence-based decision-making tool for managing common pediatric conditions.

The evidence-based approach to developing clinical practice guidelines requires carefully defining the problem and identifying interventions and health outcomes. An extensive literature review and data analysis provide the basis for guideline recommendations. Clinical practice guidelines are also subjected to a thorough peer-review process prior to publication and subsequent dissemination, implementation, and evaluation. They are periodically reviewed to ensure that they are based on the most current data available.

American Academy of Pediatrics clinical practice guidelines are designed to provide physicians with an analytic framework for evaluating and treating common pediatric conditions and are not intended as an exclusive course of treatment or standard of care. When using AAP clinical practice guidelines, physicians should continue to consider other sources of information as well as variations in individual circumstances. The AAP recognizes the incompleteness of data and acknowledges the use of expert consensus in cases in which data do not exist; thus, AAP clinical practice guidelines allow for flexibility and adaptability at the local level and should not replace sound clinical judgment.

This manual contains clinical practice guidelines, technical reports, and technical report summaries developed and published by the AAP. Full technical reports are available on the companion CD-ROM. Each full technical report contains a summary of the data reviewed, results of data analysis, complete evidence tables, and a bibliography of articles included in the review. This manual also contains abstracts and introductions for evidence-based clinical practice guidelines from other organizations that the AAP has endorsed. Clinical practice guidelines will continually be added to this compendium as they are released or updated. We encourage you to look forward to these future guidelines. Additionally, this edition includes the full text of all policy statements, clinical reports, and technical reports published in 2013 by the AAP as well as abstracts of all active AAP and endorsed policy statements and reports. The full text of all endorsed clinical practice guidelines, as well as all active AAP and endorsed policy statements and reports published prior to 2013, is included on the companion CD-ROM.

If you have any questions about current or future clinical practice guidelines, please contact Caryn Davidson at the AAP at 800/433-9016, extension 4317. To order copies of the patient education resources that accompany each guideline, please call the AAP at 888/227-1770 or visit the online AAP Bookstore at www.aap.org/bookstore.

Xavier D. Sevilla, MD, FAAP
Chairperson, Council of Quality Improvement and Patient Safety

ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents

- *Clinical Practice Guideline*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 2 for more information.

CLINICAL PRACTICE GUIDELINE

ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/ Hyperactivity Disorder in Children and Adolescents

SUBCOMMITTEE ON ATTENTION-DEFICIT/HYPERACTIVITY DISORDER, STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT

KEY WORDS
attention-deficit/hyperactivity disorder, children, adolescents, preschool, behavioral therapy, medication

ABBREVIATIONS
AAP—American Academy of Pediatrics
ADHD—attention-deficit/hyperactivity disorder
DSM-PC—*Diagnostic and Statistical Manual for Primary Care*
CDC—Centers for Disease Control and Prevention
FDA—Food and Drug Administration
DSM-IV—*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*
MTA—Multimodal Therapy of ADHD

The recommendations in this report do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

www.pediatrics.org/cgi/doi/10.1542/peds.2011-2654

doi:10.1542/peds.2011-2654

All clinical practice guidelines from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

abstract


Attention-deficit/hyperactivity disorder (ADHD) is the most common neurobehavioral disorder of childhood and can profoundly affect the academic achievement, well-being, and social interactions of children; the American Academy of Pediatrics first published clinical recommendations for the diagnosis and evaluation of ADHD in children in 2000; recommendations for treatment followed in 2001. *Pediatrics* 2011;128: 1007–1022

Summary of key action statements:

1. The primary care clinician should initiate an evaluation for ADHD for any child 4 through 18 years of age who presents with academic or behavioral problems and symptoms of inattention, hyperactivity, or impulsivity (quality of evidence B/strong recommendation).
2. To make a diagnosis of ADHD, the primary care clinician should determine that *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria have been met (including documentation of impairment in more than 1 major setting); information should be obtained primarily from reports from parents or guardians, teachers, and other school and mental health clinicians involved in the child's care. The primary care clinician should also rule out any alternative cause (quality of evidence B/strong recommendation).
3. In the evaluation of a child for ADHD, the primary care clinician should include assessment for other conditions that might coexist with ADHD, including emotional or behavioral (eg, anxiety, depressive, oppositional defiant, and conduct disorders), developmental (eg, learning and language disorders or other neurodevelopmental disorders), and physical (eg, tics, sleep apnea) conditions (quality of evidence B/strong recommendation).
4. The primary care clinician should recognize ADHD as a chronic condition and, therefore, consider children and adolescents with ADHD as children and youth with special health care needs. Management of children and youth with special health care needs should follow the principles of the chronic care model and the medical home (quality of evidence B/strong recommendation).

5. Recommendations for treatment of children and youth with ADHD vary depending on the patient's age:
   a. For *preschool-aged children (4–5 years of age)*, the primary care clinician should prescribe evidence-based parent- and/or teacher-administered behavior therapy as the first line of treatment (quality of evidence A/strong recommendation) and may prescribe methylphenidate if the behavior interventions do not provide significant improvement and there is moderate-to-severe continuing disturbance in the child's function. In areas where evidence-based behavioral treatments are not available, the clinician needs to weigh the risks of starting medication at an early age against the harm of delaying diagnosis and treatment (quality of evidence B/recommendation).
   b. For *elementary school–aged children (6–11 years of age)*, the primary care clinician should prescribe US Food and Drug Administration–approved medications for ADHD (quality of evidence A/strong recommendation) and/or evidence-based parent- and/or teacher-administered behavior therapy as treatment for ADHD, preferably both (quality of evidence B/strong recommendation). The evidence is particularly strong for stimulant medications and sufficient but less strong for atomoxetine, extended-release guanfacine, and extended-release clonidine (in that order) (quality of evidence A/strong recommendation). The school environment, program, or placement is a part of any treatment plan.
   c. For *adolescents (12–18 years of age)*, the primary care clinician should prescribe Food and Drug Administration–approved medications for ADHD with the assent of the adolescent (quality of evidence A/strong recommendation) and may prescribe behavior therapy as treatment for ADHD (quality of evidence C/recommendation), preferably both.
6. The primary care clinician should titrate doses of medication for ADHD to achieve maximum benefit with minimum adverse effects (quality of evidence B/strong recommendation).

INTRODUCTION

This document updates and replaces 2 previously published clinical guidelines from the American Academy of Pediatrics (AAP) on the diagnosis and treatment of attention-deficit/hyperactivity disorder (ADHD) in children: "Clinical Practice Guideline: Diagnosis and Evaluation of the Child With Attention-Deficit/Hyperactivity Disorder" (2000)[1] and "Clinical Practice Guideline: Treatment of the School-aged Child With Attention-Deficit/Hyperactivity Disorder" (2001).[2] Since these guidelines were published, new information and evidence regarding the diagnosis and treatment of ADHD has become available. Surveys conducted before and after the publication of the previous guidelines have also provided insight into pediatricians' attitudes and practices regarding ADHD. On the basis of an increased understanding regarding ADHD and the challenges it raises for children and families and as a source for clinicians seeking to diagnose and treat children, this guideline pays particular attention to a number of areas.

Expanded Age Range

The previous guidelines addressed diagnosis and treatment of ADHD in children 6 through 12 years of age. There is now emerging evidence to expand the age range of the recommendations to include preschool-aged children and adolescents. This guideline addresses the diagnosis and treatment of ADHD in children 4 through 18 years of age, and attention is brought to special circumstances or concerns in particular age groups when appropriate.

Expanded Scope

Behavioral interventions might help families of children with hyperactive/impulsive behaviors that do not meet full diagnostic criteria for ADHD. Guidance regarding the diagnosis of problem-level concerns in children based on the *Diagnostic and Statistical Manual for Primary Care* (DSM-PC), *Child and Adolescent Version*,[3] as well as suggestions for treatment and care of children and families with problem-level concerns, are provided here. The current DSM-PC was published in 1996 and, therefore, is not consistent with intervening changes to *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM). Although this version of the DSM-PC should not be used as a definitive source for diagnostic codes related to ADHD and comorbid conditions, it certainly may continue to be used as a resource for enriching the understanding of ADHD manifestations. The DSM-PC will be revised when both the DSM-V and ICD-10 are available for use.

A Process of Care for Diagnosis and Treatment

This guideline and process-of-care algorithm (see Supplemental Fig 2 and Supplemental Appendix) recognizes evaluation, diagnosis, and treatment as a continuous process and provides recommendations for both the guideline and the algorithm in this single publication. In addition to the formal recommendations for assessment, diagnosis, and treatment, this guideline

provides a single algorithm to guide the clinical process.

Integration With the Task Force on Mental Health

This guideline fits into the broader mission of the AAP Task Force on Mental Health and its efforts to provide a base from which primary care providers can develop alliances with families, work to prevent mental health conditions and identify them early, and collaborate with mental health clinicians.

The diagnosis and management of ADHD in children and youth has been particularly challenging for primary care clinicians because of the limited payment provided for what requires more time than most of the other conditions they typically address. The procedures recommended in this guideline necessitate spending more time with patients and families, developing a system of contacts with school and other personnel, and providing continuous, coordinated care, all of which is time demanding. In addition, relegating mental health conditions exclusively to mental health clinicians also is not a viable solution for many clinicians, because in many areas access to mental health clinicians to whom they can refer patients is limited. Access in many areas is also limited to psychologists when further assessment of cognitive issues is required and not available through the education system because of restrictions from third-party payers in paying for the evaluations on the basis of them being educational and not health related.

Cultural differences in the diagnosis and treatment of ADHD are an important issue, as they are for all pediatric conditions. Because the diagnosis and treatment of ADHD depends to a great extent on family and teacher perceptions, these issues might be even more prominent an issue for ADHD. Specific cultural issues are beyond the scope of this guideline but are important to consider.

METHODOLOGY

As with the 2 previously published clinical guidelines, the AAP collaborated with several organizations to develop a working subcommittee that represented a wide range of primary care and subspecialty groups. The subcommittee included primary care pediatricians, developmental-behavioral pediatricians, and representatives from the American Academy of Child and Adolescent Psychiatry, the Child Neurology Society, the Society for Pediatric Psychology, the National Association of School Psychologists, the Society for Developmental and Behavioral Pediatrics, the American Academy of Family Physicians, and Children and Adults With Attention-Deficit/Hyperactivity Disorder (CHADD), as well as an epidemiologist from the Centers for Disease Control and Prevention (CDC).

This group met over a 2-year period, during which it reviewed the changes in practice that have occurred and issues that have been identified since the previous guidelines were published. Delay in completing the process led to further conference calls and extended the years of literature reviewed in order to remain as current as possible. The AAP funded the development of this guideline; potential financial conflicts of the participants were identified and taken into consideration in the deliberations. The guideline will be reviewed and/or revised in 5 years unless new evidence emerges that warrants revision sooner.

The subcommittee developed a series of research questions to direct an extensive evidence-based review in partnership with the CDC and the University of Oklahoma Health Sciences Center. The diagnostic review was conducted by the CDC, and the evidence was evaluated in a combined effort of the AAP, CDC, and University of Oklahoma Health Sciences Center staff. The treatment-related evidence relied on a recent evidence review by the Agency for Healthcare Research and Quality and was supplemented by evidence identified through the CDC review.

The diagnostic issues were focused on 5 areas:

1. ADHD prevalence—specifically: (*a*) What percentage of the general US population aged 21 years or younger has ADHD? (*b*) What percentage of patients presenting at pediatricians' or family physicians' offices in the United States meet diagnostic criteria for ADHD?
2. Co-occurring mental disorders—of people with ADHD, what percentage has 1 or more of the following co-occurring conditions: sleep disorders, learning disabilities, depression, anxiety, conduct disorder, and oppositional defiant disorder?
3. What are the functional impairments of children and youth diagnosed with ADHD? Specifically, in what domains and to what degree do youth with ADHD demonstrate impairments in functional domains, including peer relations, academic performance, adaptive skills, and family functioning?
4. Do behavior rating scales remain the standard of care in assessing the diagnostic criteria for ADHD?
5. What is the prevalence of abnormal findings on selected medical screening tests commonly recommended as standard components of an evaluation of a child with suspected ADHD? How accurate are these tests in the diagnosis of ADHD compared with a reference standard (ie, what are the psychometric properties of these tests)?

The treatment issues were focused on 3 areas:

1. What new information is available

regarding the long-term efficacy and safety of medications approved by the US Food and Drug Administration (FDA) for the treatment of ADHD (stimulants and nonstimulants), and specifically, what information is available about the efficacy and safety of these medications in preschool-aged and adolescent patients?

2. What evidence is available about the long-term efficacy and safety of psychosocial interventions (behavioral modification) for the treatment of ADHD for children, and specifically, what information is available about the efficacy and safety of these interventions in preschool-aged and adolescent patients?
3. Are there any additional therapies that reach the level of consideration as evidence based?

Evidence-Review Process for Diagnosis

A multilevel, systematic approach was taken to identify the literature that built the evidence base for both diagnosis and treatment. To increase the likelihood that relevant articles were included in the final evidence base, the reviewers first conducted a scoping review of the literature by systematically searching literature using relevant key words and then summarized the primary findings of articles that met standard inclusion criteria. The reviewers then created evidence tables that were reviewed by content-area experts who were best able to identify articles that might have been missed through the scoping review. Articles that were missed were reviewed carefully to determine where the abstraction methodology failed, and adjustments to the search strategy were made as required (see technical report to be published). Finally, although published literature reviews did not contribute directly to the evidence base, the articles included in review articles were cross-referenced with the final evidence tables to ensure that all relevant articles were included in the final evidence tables.

For the scoping review, articles were abstracted in a stratified fashion from 3 article-retrieval systems that provided access to articles in the domains of medicine, psychology, and education: PubMed (www.ncbi.nlm.nih.gov/sites/entrez), PsycINFO (www.apa.org/pubs/databases/psycinfo/index.aspx), and ERIC (www.eric.ed.gov). English-language, peer-reviewed articles published between 1998 and 2009 were queried in the 3 search engines. Key words were selected with the intent of including all possible articles that might have been relevant to 1 or more of the questions of interest (see the technical report to be published). The primary abstraction included the following terms: "attention deficit hyperactivity disorder" or "attention deficit disorder" or "hyperkinesis" and "child." A second, independent abstraction was conducted to identify articles related to medical screening tests for ADHD. For this abstraction, the same search terms were used as in the previous procedure along with the additional condition term "behavioral problems" to allow for the inclusion of studies of youth that sought to diagnose ADHD by using medical screening tests. Abstractions were conducted in parallel fashion across each of the 3 databases; the results from each abstraction (complete reference, abstract, and key words) were exported and compiled into a common reference database using EndNote 10.0.[4] References were subsequently and systematically deduplicated by using the software's deduplication procedure. References for books, chapters, and theses were also deleted from the library. Once a deduplicated library was developed, the semifinal database of 8267 references was reviewed for inclusion on the basis of inclusion criteria listed in the technical report. Included articles were then pulled in their entirety, the inclusion criteria were reconfirmed, and then the study findings were summarized in evidence tables. The articles included in relevant review articles were revisited to ensure their inclusion in the final evidence base. The evidence tables were then presented to the committee for expert review.

Evidence-Review Process for Treatment

In addition to this systematic review, for treatment we used the review from the Agency for Healthcare Research and Quality (AHRQ) Effective Healthcare Program "Attention Deficit Hyperactivity Disorder: Effectiveness of Treatment in At-Risk Preschoolers; Long-term Effectiveness in All Ages; and Variability in Prevalence, Diagnosis, and Treatment."[5] This review addressed a number of key questions for the committee, including the efficacy of medications and behavioral interventions for preschoolers, children, and adolescents. Evidence identified through the systematic evidence review for diagnosis was also used as a secondary data source to supplement the evidence presented in the AHRQ report. The draft practice guidelines were developed by consensus of the committee regarding the evidence. It was decided to create 2 separate components. The guideline recommendations were based on clear characterization of the evidence. The second component is a practice-of-care algorithm (see Supplemental Fig 2) that provides considerably more detail about how to implement the guidelines but is, necessarily, based less on available evidence and more on consensus of the committee members. When data were lacking, particularly in the

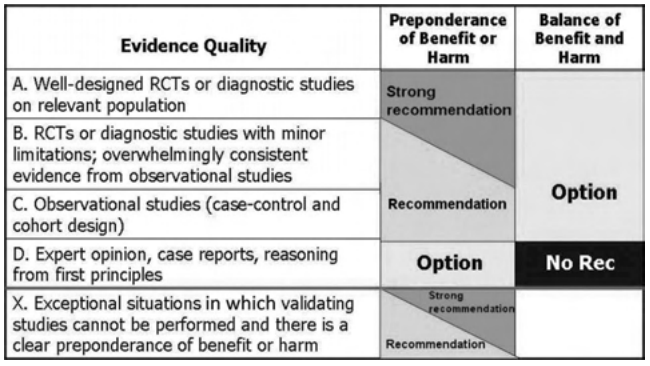


FIGURE 1

Integrating evidence-quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is conducted leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation. The evidence is discussed in more detail in a technical report that will follow in a later publication. RCT indicates randomized controlled trial; Rec, recommendation.

process-of-care algorithmic portion of the guidelines, a combination of evidence and expert consensus was used. Action statements labeled "strong recommendation" or "recommendation" were based on high- to moderate-quality scientific evidence and a preponderance of benefit over harm.[6] Option-level action statements were based on lesser-quality or limited data and expert consensus or high-quality evidence with a balance between benefits and harms. These clinical options are interventions that a reasonable health care provider might or might not wish to implement in his or her practice. The quality of evidence supporting each recommendation and the strength of each recommendation were assessed by the committee member most experienced in epidemiology and graded according to AAP policy (Fig 1).[6]

The guidelines and process-of-care algorithm underwent extensive peer review by committees, sections, councils, and task forces within the AAP; numerous outside organizations; and other individuals identified by the subcommittee. Liaisons to the subcommittee also were invited to distribute the draft to entities within their organizations. The resulting comments were compiled and reviewed by the chairperson, and relevant changes were incorporated into the draft, which was then reviewed by the full committee.

ABOUT THIS GUIDELINE

Key Action Statements

In light of the concerns highlighted previously and informed by the available evidence, the AAP has developed 6 action statements for the evaluation, diagnosis, and treatment of ADHD in children. These action statements provide for consistent and quality care for children and families with concerns about or symptoms that suggest attention disorders or problems.

Context

This guideline is intended to be integrated with the broader algorithms developed as part of the mission of the AAP Task Force on Mental Health.[7]

Implementation: A Process-of-Care Algorithm

The AAP recognizes the challenge of instituting practice changes and adopting new recommendations for care. To address the need, a process-of-care algorithm has been developed and has been used in the revision of the AAP ADHD toolkit.

Implementation: Preparing the Practice

Full implementation of the action statements described in this guideline and the process-of-care algorithm might require changes in office procedures and/or preparatory efforts to identify community resources. The section titled "Preparing the Practice" in the process-of-care algorithm and further information can be found in the supplement to the Task Force on Mental Health report.[7] It is important to document all aspects of the diagnostic and treatment procedures in the patients' records. Use of rating scales for the diagnosis of ADHD and assessment for comorbid conditions and as a method for monitoring treatment as described in the process algorithm (see Supplemental Fig 2), as well as information provided to parents such as management plans, can help facilitate a clinician's accurate documentation of his or her process.

Note

The AAP acknowledges that some primary care clinicians might not be confident of their ability to successfully diagnose and treat ADHD in a child because of the child's age, coexisting conditions, or other concerns. At any point at which a clinician feels that he or she is not adequately trained or is uncertain about making a diagnosis or continuing with treatment, a referral to a pediatric or mental health subspecialist should be made. If a diagnosis of ADHD or other condition is made by a subspecialist, the primary care clinician should develop a management strategy with the subspecialist that ensures that the child will continue to receive appropriate care consistent with a medical home model wherein the pediatrician part-

ners with parents so that both health and mental health needs are integrated.

KEY ACTION STATEMENTS FOR THE EVALUATION, DIAGNOSIS, TREATMENT, AND MONITORING OF ADHD IN CHILDREN AND ADOLESCENTS

Action statement 1: The primary care clinician should initiate an evaluation for ADHD for any child 4 through 18 years of age who presents with academic or behavioral problems and symptoms of inattention, hyperactivity, or impulsivity (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** In a considerable number of children, ADHD goes undiagnosed. Primary care clinicians' systematic identification of children with these problems will likely decrease the rate of undiagnosed and untreated ADHD in children.
- **Harms/risks/costs:** Children in whom ADHD is inappropriately diagnosed might be labeled inappropriately, or another condition might be missed, and they might receive treatments that will not benefit them.
- **Benefits-harms assessment:** The high prevalence of ADHD and limited mental health resources require primary care pediatricians to play a significant role in the care of their patients with ADHD so that children with this condition receive the appropriate diagnosis and treatment. Treatments available have shown good evidence of efficacy, and lack of treatment results in a risk for impaired outcomes.
- **Value judgments:** The committee considered the requirements for establishing the diagnosis, the prevalence of ADHD, and the efficacy and adverse effects of treatment as well as the long-term outcomes.
- **Role of patient preferences:** Success with treatment depends on patient and family preference, which has to be taken into account.
- **Exclusions:** None.
- **Intentional vagueness:** The limits between what can be handled by a primary care clinician and what should be referred to a subspecialist because of the varying degrees of skills among primary care clinicians.
- **Strength: strong recommendation.**

The basis for this recommendation is essentially unchanged from that in the previous guideline. ADHD is the most common neurobehavioral disorder in children and occurs in approximately 8% of children and youth[8–10]; the number of children with this condition is far greater than can be managed by the mental health system. There is now increased evidence that appropriate diagnosis can be provided for preschool-aged children[11] (4–5 years of age) and for adolescents.[12]

Action statement 2: To make a diagnosis of ADHD, the primary care clinician should determine that *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV-TR) criteria have been met (including documentation of impairment in more than 1 major setting), and information should be obtained primarily from reports from parents or guardians, teachers, and other school and mental health clinicians involved in the child's care. The primary care clinician should also rule out any alternative cause (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** The use of DSM-IV criteria has lead to more uniform categorization of the condition across professional disciplines.
- **Harms/risks/costs:** The DSM-IV system does not specifically provide for developmental-level differences and might lead to some misdiagnoses.
- **Benefits-harms assessment:** The benefits far outweigh the harm.
- **Value judgments:** The committee took into consideration the importance of coordination between pediatric and mental health services.
- **Role of patient preferences:** Although there is some stigma associated with mental disorder diagnoses resulting in some families preferring other diagnoses, the need for better clarity in diagnoses was felt to outweigh this preference.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

As with the findings in the previous guideline, the DSM-IV criteria continue to be the criteria best supported by evidence and consensus. Developed through several iterations by the American Psychiatric Association, the DSM-IV criteria were created through use of consensus and an expanding research foundation.[13] The DSM-IV system is used by professionals in psychiatry, psychology, health care systems, and primary care. Use of DSM-IV criteria, in addition to having the best evidence to date for criteria for ADHD, also affords the best method for communication across clinicians and is established with third-party payers. The criteria are under review for the development of the DSM-V, but these changes will not be available until at least 1 year after the publication of this current guideline. The diagnostic criteria have not changed since the previous guideline and are presented in Supplemental Table 2. An anticipated change in the DSM-V is increasing the age limit for when ADHD needs to have first presented from 7 to 12 years.[14]

Special Circumstances: Preschool-aged Children (4–5 Years Old)

There is evidence that the diagnostic criteria for ADHD can be applied to preschool-aged children; however, the subtypes detailed in the DSM-IV might not be valid for this population.[15–21] A review of the literature, including the multisite study of the efficacy of methylphenidate in preschool-aged children, revealed that the criteria could appropriately identify children with the condition.[11] However, there are added challenges in determining the presence of key symptoms. Preschool-aged children are not likely to have a separate observer if they do not attend a preschool or child care program, and even if they do attend, staff in those programs might be less qualified than certified teachers to provide accurate observations. Here, too, focused checklists can help physicians in the diagnostic evaluation, although only the Conners Comprehensive Behavior Rating Scales and the ADHD Rating Scale IV are DSM-IV–based scales that have been validated in preschool-aged children.[22]

When there are concerns about the availability or quality of nonparent observations of a child's behavior, physicians may recommend that parents complete a parent-training program before confirming an ADHD diagnosis for preschool-aged children and consider placement in a qualified preschool program if they have not done so already. Information can be obtained from parents and teachers through the use of validated DSM-IV–based ADHD rating scales. The parent-training program must include helping parents develop age-appropriate developmental expectations and specific management skills for problem behaviors. The clinician may obtain reports from the parenting class instructor about the parents' ability to manage their children, and if the children are in programs in which they are directly observed, instructors can report information about the core symptoms and function of the child directly. Qualified preschool programs include programs such as Head Start or other public prekindergarten programs. Preschool-aged children who display significant emotional or behavioral concerns might also qualify for Early Childhood Special Education services through their local school districts, and the evaluators for these programs and/or Early Childhood Special Education teachers might be excellent reporters of core symptoms.

Special Circumstances: Adolescents

Obtaining teacher reports for adolescents might be more challenging, because many adolescents will have multiple teachers. Likewise, parents might have less opportunity to observe their adolescent's behaviors than they had when their children were younger. Adolescents' reports of their own behaviors often differ from those of other observers, because they tend to minimize their own problematic behaviors.[23–25] Adolescents are less likely to exhibit overt hyperactive behavior. Despite the difficulties, clinicians need to try to obtain (with agreement from the adolescent) information from at least 2 teachers as well as information from other sources such as coaches, school guidance counselors, or leaders of community activities in which the adolescent participates. In addition, it is unusual for adolescents with behavioral/attention problems not to have been previously given a diagnosis of ADHD. Therefore, it is important to establish the younger manifestations of the condition that were missed and to strongly consider substance use, depression, and anxiety as alternative or co-occurring diagnoses. Adolescents with ADHD, especially when untreated, are at greater risk of substance abuse.[26] In addition, the risks of mood and anxiety disorders and risky sexual behaviors increase during adolescence.[12]

Special Circumstances: Inattention or Hyperactivity/Impulsivity (Problem Level)

Teachers, parents, and child health professionals typically encounter children with behaviors relating to activity level, impulsivity, and inattention who might not fully meet DSM-IV criteria. The DSM-PC[3] provides a guide to the more common behaviors seen in pediatrics. The manual describes common variations in behavior as well as more problematic behaviors at levels of less impairment than those specified in the DSM-IV.

The behavioral descriptions of the DSM-PC have not yet been tested in community studies to determine the prevalence or severity of developmental variations and problems in the areas of inattention, hyperactivity, or impulsivity. They do, however, provide guidance to clinicians regarding elements of treatment for children with problems with mild-to-moderate inattention, hyperactivity, or impulsivity. The DSM-PC also considers environmental influences on a child's behavior and provides information on differential diagnosis with a developmental perspective.

Action statement 3: In the evaluation of a child for ADHD, the primary care clinician should include assessment for other conditions that might coexist with ADHD, including emotional or behavioral (eg, anxiety, depressive, oppositional defiant, and conduct disorders), developmental (eg, learning and language disorders or other neurodevelopmental disorders), and physical (eg, tics, sleep apnea) conditions (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** Identifying coexisting conditions is important for developing the most appropriate treatment plan.
- **Harms/risks/costs:** The major risk is misdiagnosing the conditions and providing inappropriate care.
- **Benefits-harms assessment:** There is a preponderance of benefit over harm.
- **Value judgments:** The committee members took into consideration the common occurrence of coexisting conditions and the importance of addressing them in making this recommendation.
- **Role of patient preferences:** None.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

A variety of other behavioral, developmental, and physical conditions can coexist in children who are evaluated for ADHD. These conditions include, but are not limited to, learning problems, language disorder, disruptive behavior, anxiety, mood disorders, tic disorders, seizures, developmental coordination disorder, or sleep disorders.[23,24,27–38] In some cases, the presence of a coexisting condition will alter the treatment of ADHD. The primary care clinician might benefit from additional support and guidance or might need to refer a child with ADHD and coexisting conditions, such as severe mood or anxiety disorders, to subspecialists for assessment and management. The subspecialists could include child psychiatrists, developmental-behavioral pediatricians, neurodevelopmental disability physicians, child neurologists, or child or school psychologists.

Given the likelihood that another condition exists, primary care clinicians should conduct assessments that determine or at least identify the risk of coexisting conditions. Through its Task Force on Mental Health, the AAP has developed algorithms and a toolkit[39] for assessing and treating (or comanaging) the most common developmental disorders and mental health concerns in children. These resources might be useful in assessing children who are being evaluated for ADHD. Payment for evaluation and treatment must cover the fixed and variable costs of providing the services, as noted in the AAP policy statement "Scope of Health Care Benefits for Children From Birth Through Age 26.[40]

Special Circumstances: Adolescents

Clinicians should assess adolescent patients with newly diagnosed ADHD for symptoms and signs of substance abuse; when these signs and symptoms are found, evaluation and treatment for addiction should precede treatment for ADHD, if possible, or careful treatment for ADHD can begin if necessary.[25]

Action statement 4: The primary care clinician should recognize ADHD as a chronic condition and, therefore, consider children and adolescents with ADHD as children and youth with special health care needs. Management of children and youth with special health care needs should follow the principles of the chronic care model and the medical home (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** The recommendation describes the coordinated services most appropriate for managing the condition.
- **Harms/risks/costs:** Providing the services might be more costly.
- **Benefits-harms assessment:** There is a preponderance of benefit over harm.
- **Value judgments:** The committee members considered the value of medical home services when deciding to make this recommendation.
- **Role of patient preferences:** Family preference in how these services are provided is an important consideration.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

As in the previous guideline, this recommendation is based on the evidence that ADHD continues to cause symptoms and dysfunction in many children who have the condition over long periods of time, even into adulthood, and that the treatments available address symptoms and function but are usually not curative. Although the chronic illness model has not been specifically studied in children and youth with ADHD, it has been effective for other chronic conditions such as asthma,[23] and the medical home model has been accepted as the preferred standard of care.[41] The management process is also helped by encouraging strong family-school partnerships.[42]

Longitudinal studies have found that, frequently, treatments are not sustained despite the fact that long-term outcomes for children with ADHD indicate that they are at greater risk of significant problems if they discontinue treatment.[43] Because a number of parents of children with ADHD also have ADHD, extra support might be necessary to help those parents provide medication on a consistent basis and institute a consistent behavioral program. The medical home and chronic illness approach is provided in the process algorithm (Supplemental Fig 2). An important process in ongoing care is bidirectional communication with teachers and other school and mental health clinicians involved in the child's care as well as with parents and patients.

Special Circumstances: Inattention or Hyperactivity/Impulsivity (Problem Level)

Children with inattention or hyperactivity/impulsivity at the problem level (DSM-PC) and their families might also benefit from the same chronic illness and medical home principles.

Action statement 5: Recommendations for treatment of children and youth with ADHD vary depending on the patient's age.

Action statement 5a: For *preschool-aged children (4–5 years of age)*, the primary care clinician should prescribe evidence-based parent- and/or teacher-administered behavior therapy as the first line of treatment (quality of evidence A/strong recommendation) and may prescribe methylphenidate if the behavior interventions do not provide significant improvement and there is moderate-to-severe continuing disturbance in the child's function. In areas in which evidence-based behavioral treatments are not available, the clinician needs to weigh the risks of starting medication at an early age against the harm of delaying diagnosis and treatment (quality of evidence B/recommendation).

Evidence Profile

- **Aggregate evidence quality:** A for behavior; B for methylphenidate.
- **Benefits:** Both behavior therapy and methylphenidate have been demonstrated to reduce behaviors associated with ADHD and improve function.
- **Harms/risks/costs:** Both therapies increase the cost of care, and behavior therapy requires a higher level of family involvement, whereas methylphenidate has some potential adverse effects.
- **Benefits-harms assessment:** Given the risks of untreated ADHD, the benefits outweigh the risks.
- **Value judgments:** The committee members included the effects of untreated ADHD when deciding to make this recommendation.
- **Role of patient preferences:** Family preference is essential in determining the treatment plan.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

Action statement 5b: For *elementary school-aged children (6–11 years of age)*, the primary care clinician should prescribe FDA-approved medications for ADHD (quality of evidence A/strong recommendation) and/or evidence-based parent- and/or teacher-administered behavior therapy as treatment for ADHD, preferably both (quality of evidence B/strong recommendation). The evidence is particularly strong for stimulant medications and sufficient but less strong for atomoxetine, extended-release guanfacine, and extended-release clonidine (in that order) (quality of evidence A/strong recommendation). The school environment, program, or placement is a part of any treatment plan.

Evidence Profile

- **Aggregate evidence quality:** A for treatment with FDA-approved medications; B for behavior therapy.
- **Benefits:** Both behavior therapy and FDA-approved medications have been demonstrated to reduce behaviors associated with ADHD and improve function.
- **Harms/risks/costs:** Both therapies increase the cost of care, and behavior therapy requires a higher level of family involvement, whereas FDA-approved medications have some potential adverse effects.
- **Benefits-harms assessment:** Given the risks of untreated ADHD, the benefits outweigh the risks.
- **Value judgments:** The committee members included the effects of untreated ADHD when deciding to make this recommendation.
- **Role of patient preferences:** Family preference is essential in determining the treatment plan.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

Action statement 5c: For *adolescents (12–18 years of age)*, the primary care clinician should prescribe FDA-approved medications for ADHD with the assent of the adolescent (quality of evidence A/strong recommendation) and may prescribe behavior therapy as treatment for ADHD (quality of evidence C/recommendation), preferably both.

Evidence Profile

- **Aggregate evidence quality:** A for medications; C for behavior therapy.
- **Benefits:** Both behavior therapy and FDA-approved medications have been demonstrated to reduce behaviors associated with ADHD and improve function.
- **Harms/risks/costs:** Both therapies increase the cost of care, and behavior therapy requires a higher level of family involvement, whereas FDA-approved medications have some potential adverse effects.
- **Benefits-harms assessment:** Given the risks of untreated ADHD, the benefits outweigh the risks.
- **Value judgments:** The committee members included the effects of untreated ADHD when deciding to make this recommendation.
- **Role of patient preferences:** Family preference, including patient preference, is essential in determining the treatment plan.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation/ recommendation.**

Medication

Similar to the recommendations from the previous guideline, stimulant medications are highly effective for most children in reducing core symptoms of ADHD.[44] One selective norepinephrine-reuptake inhibitor (atomoxetine[45,46]) and 2 selective α_2-adrenergic agonists (extended-release guanfacine[47,48] and extended-release clonidine[49]) have also demonstrated efficacy in reducing core symptoms. Because norepinephrine-reuptake inhibitors and α_2-adrenergic agonists are newer, the evidence base that supports them—although adequate for FDA approval—is considerably smaller than that for stimulants. None of them have been approved for use in preschool-aged children. Compared with stimulant medications that have an effect size [effect size = (treatment mean − control mean)/control SD] of approximately 1.0,[50] the effects of the nonstimulants are slightly weaker; atomoxetine has an effect size of approximately 0.7, and extended-release guanfacine and extended-release clonidine also have effect sizes of approximately 0.7.

The accompanying process-of-care algorithm provides a list of the currently available FDA-approved medications for ADHD (Supplemental Table 3). Characteristics of each medication are provided to help guide the clinician's choice in prescribing medication.

As was identified in the previous guideline, the most common stimulant adverse effects are appetite loss, abdominal pain, headaches, and sleep disturbance. The results of the Multimodal Therapy of ADHD (MTA) study revealed a more persistent effect of stimulants on decreasing growth velocity than have most previous studies, particularly when children were on higher and more consistently administered doses. The effects diminished by the third year of treatment, but no compensatory rebound effects were found.[51] However, diminished growth was in the range of 1 to 2 cm. An uncommon additional significant adverse effect of stimulants is the occurrence of hallucinations and other psychotic symptoms.[52] Although concerns have been raised about the rare occurrence of sudden cardiac death among children using stimulant medications,[53] sudden death in children on stimulant medication is extremely rare, and evidence is conflicting as to whether stimulant medications increase the risk of sudden death.[54–56] It is important to expand the history to include specific cardiac symptoms, Wolf-Parkinson-White syndrome, sudden death in the family, hypertrophic cardiomyopathy, and long QT syndrome. Preschool-aged children might experience increased mood lability and dysphoria.[57] For the nonstimulant atomoxetine, the adverse effects include initial somnolence and gastrointestinal tract symptoms, particularly if the dosage is increased too rapidly; decrease in appetite; increase in suicidal thoughts (less common); and hepatitis (rare). For the nonstimulant α_2-adrenergic agonists extended-release guanfacine and extended-release clonidine, adverse effects include somnolence and dry mouth.

Only 2 medications have evidence to support their use as adjunctive therapy with stimulant medications sufficient to achieve FDA approval: extended-release guanfacine[26] and extended-release clonidine. Other medications have been used in combination off-label, but there is currently only anecdotal evidence for their safety or efficacy, so their use cannot be recommended at this time.

Special Circumstances: Preschool-aged Children

A number of special circumstances support the recommendation to initiate ADHD treatment in preschool-aged children (ages 4–5 years) with behavioral therapy alone first.[57] These circumstances include:

- The multisite study of methylphenidate[57] was limited to preschool-aged children who had moderate-to-severe dysfunction.
- The study also found that many children (ages 4–5 years) experience improvements in symptoms with behavior therapy alone, and the overall evidence for behavior therapy in preschool-aged children is strong.
- Behavioral programs for children 4 to 5 years of age typically run in the form of group parent-training programs and, although not always compensated by health insurance, have a lower cost. The process algorithm (see Supplemental pages s15-16) contains criteria for the clinician to use in assessing the quality of the behavioral therapy. In addition, programs such as Head Start and Children and Adults With Attention Deficit Hyperactivity Disorder (CHADD) (www.chadd.org) might provide some behavioral supports.

Many young children with ADHD might still require medication to achieve maximum improvement, and medication is not contraindicated for children 4 through 5 years of age. However, only 1 multisite study has carefully assessed medication use in preschool-aged children. Other considerations in the recommendation about treating children 4 to 5 years of age with stimulant medications include:

- The study was limited to preschool-aged children who had moderate-to-severe dysfunction.
- Research has found that a number of young children (4–5 years of age) experience improvements in symptoms with behavior therapy alone.
- There are concerns about the possi-

ble effects on growth during this rapid growth period of preschool-aged children.

- There has been limited information about and experience with the effects of stimulant medication in children between the ages of 4 and 5 years.

Here, the criteria for enrollment (and, therefore, medication use) included measures of severity that distinguished treated children from the larger group of preschool-aged children with ADHD. Thus, before initiating medications, the physician should assess the severity of the child's ADHD. Given current data, only those preschool-aged children with ADHD who have moderate-to-severe dysfunction should be considered for medication. Criteria for this level of severity, based on the multisite-study results,[57] are (1) symptoms that have persisted for at least 9 months, (2) dysfunction that is manifested in both the home and other settings such as preschool or child care, and (3) dysfunction that has not responded adequately to behavior therapy. The decision to consider initiating medication at this age depends in part on the clinician's assessment of the estimated developmental impairment, safety risks, or consequences for school or social participation that could ensue if medications are not initiated. It is often helpful to consult with a mental health specialist who has had specific experience with preschool-aged children if possible.

Dextroamphetamine is the only medication approved by the FDA for use in children younger than 6 years of age. This approval, however, was based on less stringent criteria in force when the medication was approved rather than on empirical evidence of its safety and efficacy in this age group. Most of the evidence for the safety and efficacy of treating preschool-aged children with stimulant medications has been from methylphenidate.[57] Methylphenidate evidence consists of 1 multisite study of 165 children and 10 other smaller single-site studies that included from 11 to 59 children (total of 269 children); 7 of the 10 single-site studies found significant efficacy. It must be noted that although there is moderate evidence that methylphenidate is safe and efficacious in preschool-aged children, its use in this age group remains off-label. Although the use of dextroamphetamine is on-label, the insufficient evidence for its safety and efficacy in this age group does not make it possible to recommend at this time.

If children do not experience adequate symptom improvement with behavior therapy, medication can be prescribed, as described previously. Evidence suggests that the rate of metabolizing stimulant medication is slower in children 4 through 5 years of age, so they should be given a lower dose to start, and the dose can be increased in smaller increments. Maximum doses have not been adequately studied.[57]

Special Circumstances: Adolescents

As noted previously, before beginning medication treatment for adolescents with newly diagnosed ADHD, clinicians should assess these patients for symptoms of substance abuse. When substance use is identified, assessment when off the abusive substances should precede treatment for ADHD (see the Task Force on Mental Health report[7]). Diversion of ADHD medication (use for other than its intended medical purposes) is also a special concern among adolescents[58]; clinicians should monitor symptoms and prescription-refill requests for signs of misuse or diversion of ADHD medication and consider prescribing medications with no abuse potential, such as atomoxetine (Strattera [Ely Lilly Co, Indianapolis, IN]) and extended-release guanfacine (Intuniv [Shire US Inc, Wayne, PA]) or extended-release clonidine (Kapvay [Shionogi Inc, Florham Park, NJ]) (which are not stimulants) or stimulant medications with less abuse potential, such as lisdexamfetamine (Vyvanse [Shire US Inc]), dermal methylphenidate (Daytrana [Noven Therapeutics, LLC, Miami, FL]), or OROS methylphenidate (Concerta [Janssen Pharmaceuticals, Inc, Titusville, NJ]). Because lisdexamfetamine is dextroamphetamine, which contains an additional lysine molecule, it is only activated after ingestion, when it is metabolized by erythrocyte cells to dexamphetamine. The other preparations make extraction of the stimulant medication more difficult.

Given the inherent risks of driving by adolescents with ADHD, special concern should be taken to provide medication coverage for symptom control while driving. Longer-acting or late-afternoon, short-acting medications might be helpful in this regard.[59]

Special Circumstances: Inattention or Hyperactivity/Impulsivity (Problem Level)

Medication is not appropriate for children whose symptoms do not meet DSM-IV criteria for diagnosis of ADHD, although behavior therapy does not require a specific diagnosis, and many of the efficacy studies have included children without specific mental behavioral disorders.

Behavior Therapy

Behavior therapy represents a broad set of specific interventions that have a common goal of modifying the physical and social environment to alter or change behavior. Behavior therapy usually is implemented by training parents in specific techniques that improve their abilities to modify and

TABLE 1 Evidence-Based Behavioral Treatments for ADHD

Intervention Type	Description	Typical Outcome(s)	Median Effect Size[a]
Behavioral parent training (BPT)	Behavior-modification principles provided to parents for implementation in home settings	Improved compliance with parental commands; improved parental understanding of behavioral principles; high levels of parental satisfaction with treatment	0.55
Behavioral classroom management	Behavior-modification principles provided to teachers for implementation in classroom settings	Improved attention to instruction; improved compliance with classroom rules; decreased disruptive behavior; improved work productivity	0.61
Behavioral peer interventions (BPI)[b]	Interventions focused on peer interactions/relationships; these are often group-based interventions provided weekly and include clinic-based social-skills training used either alone or concurrently with behavioral parent training and/or medication	Office-based interventions have produced minimal effects; interventions have been of questionable social validity; some studies of BPI combined with clinic-based BPT found positive effects on parent ratings of ADHD symptoms; no differences on social functioning or parent ratings of social behavior have been revealed	

[a] Effect size = (treatment median − control median)/control SD.

[b] The effect size for behavioral peer interventions is not reported, because the effect sizes for these studies represent outcomes associated with combined interventions. A lower effect size means that they have less of an effect. The effect sizes found are considered moderate.

Adapted from Pelham W, Fabiano GA. *J Clin Child Adolesc Psychol.* 2008;37(1):184–214.

shape their child's behavior and to improve the child's ability to regulate his or her own behavior. The training involves techniques to more effectively provide rewards when their child demonstrates the desired behavior (eg, positive reinforcement), learn what behaviors can be reduced or eliminated by using planned ignoring as an active strategy (or using praising and ignoring in combination), or provide appropriate consequences or punishments when their child fails to meet the goals (eg, punishment). There is a need to consistently apply rewards and consequences as tasks are achieved and then to gradually increase the expectations for each task as they are mastered to shape behaviors. Although behavior therapy shares a set of principles, individual programs introduce different techniques and strategies to achieve the same ends.

Table 1 lists the major behavioral intervention approaches that have been demonstrated to be evidence based for the management of ADHD in 3 different types of settings. The table is based on 22 studies, each completed between 1997 and 2006.

Evidence for the effectiveness of behavior therapy in children with ADHD is derived from a variety of studies[60–62] and an Agency for Healthcare Research and Quality review.[5] The diversity of interventions and outcome measures makes meta-analysis of the effects of behavior therapy alone or in association with medications challenging. The long-term positive effects of behavior therapy have yet to be determined. Ongoing adherence to a behavior program might be important; therefore, implementing a chronic care model for child health might contribute to the long-term effects.[63]

Study results have indicated positive effects of behavior therapy when combined with medications. Most studies that compared behavior therapy to stimulants found a much stronger effect on ADHD core symptoms from stimulants than from behavior therapy. The MTA study found that combined treatment (behavior therapy and stimulant medication) was not significantly more efficacious than treatment with medication alone for the core symptoms of ADHD after correction for multiple tests in the primary analysis.[64] However, a secondary analysis of a combined measure of parent and teacher ratings of ADHD symptoms revealed a significant advantage for the combination with a small effect size of $d = 0.26$.[65] However, the same study also found that the combined treatment compared with medication alone did offer greater improvements on academic and conduct measures when ADHD coexisted with anxiety and when children lived in low socioeconomic environments. In addition, parents and teachers of children who were receiving combined therapy were significantly more satisfied with the treatment plan. Finally, the combination of medication management and behavior therapy allowed for the use of lower dosages of stimulants, which possibly reduced the risk of adverse effects.[66]

School Programming and Supports

Behavior therapy programs coordinating efforts at school as well as home might enhance the effects. School programs can provide classroom adaptations, such as preferred seating, modified work assignments, and test modifications (to the location at which it is administered and time allotted for taking the test), as well as behavior plans as part of a 504 Rehabilitation Act Plan or special education Individualized Education Program (IEP) under the "other health impairment" designation as part of the Individuals With

Disability Education Act (IDEA).[67] It is helpful for clinicians to be aware of the eligibility criteria in their state and school district to advise families of their options. Youths documented to have ADHD can also get permission to take college-readiness tests in an untimed manner by following appropriate documentation guidelines.[68]

The effect of coexisting conditions on ADHD treatment is variable. In some cases, treatment of the ADHD resolves the coexisting condition. For example, treatment of ADHD might resolve oppositional defiant disorder or anxiety.[68] However, sometimes the co-occurring condition might require treatment that is in addition to the treatment for ADHD. Some coexisting conditions can be treated in the primary care setting, but others will require referral and comanagement with a subspecialist.

Action statement 6: Primary care clinicians should titrate doses of medication for ADHD to achieve maximum benefit with minimum adverse effects (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** The optimal dose of medication is required to reduce core symptoms to or as close to the levels of children without ADHD.
- **Harms/risks/costs:** Higher levels of medication increase the chances of adverse effects.
- **Benefits-harms assessment:** The importance of adequately treating ADHD outweighs the risk of adverse effects.
- **Value judgments:** The committee members included the effects of untreated ADHD when deciding to make this recommendation.
- **Role of patient preferences:** The families' preferences and comfort need to be taken into consideration in developing a titration plan.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

The findings from the MTA study suggested that more than 70% of children and youth with ADHD respond to one of the stimulant medications at an optimal dose when a systematic trial is used.[65] Children in the MTA who were treated in the community with care as usual from whomever they chose or to whom they had access received lower doses of stimulants with less frequent monitoring and had less optimal results.[65] Because stimulants might produce positive but suboptimal effects at a low dose in some children and youth, titration to maximum doses that control symptoms without adverse effects is recommended instead of titration strictly on a milligram-per-kilogram basis.

Education of parents is an important component in the chronic illness model to ensure their cooperation in efforts to reach appropriate titration (remembering that the parents themselves might be challenged significantly by ADHD).[69,70] The primary care clinician should alert parents and children that changing medication dose and occasionally changing a medication might be necessary for optimal medication management, that the process might require a few months to achieve optimal success, and that medication efficacy should be systematically monitored at regular intervals.

Because stimulant medication effects are seen immediately, trials of different doses of stimulants can be accomplished in a relatively short time period. Stimulant medications can be effectively titrated on a 3- to 7-day basis.[65]

It is important to note that by the 3-year follow-up of 14-month MTA interventions (optimal medications management, optimal behavioral management, the combination of the 2, or community treatment), all differences among the initial 4 groups were no longer present. After the initial 14-month intervention, the children no longer received the careful monthly monitoring provided by the study and went back to receiving care from their community providers. Their medications and doses varied, and a number of them were no longer taking medication. In children still on medication, the growth deceleration was only seen for the first 2 years and was in the range of 1 to 2 cm.

CONCLUSION

Evidence continues to be fairly clear with regard to the legitimacy of the diagnosis of ADHD and the appropriate diagnostic criteria and procedures required to establish a diagnosis, identify co-occurring conditions, and treat effectively with both behavioral and pharmacologic interventions. However, the steps required to sustain appropriate treatments and achieve successful long-term outcomes still remain a challenge. To provide more detailed information about how the recommendations of this guideline can be accomplished, a more detailed but less strongly evidence-based algorithm is provided as a companion article.

AREAS FOR FUTURE RESEARCH

Some specific research topics pertinent to the diagnosis and treatment of ADHD or developmental variations or problems in children and adolescents in primary care to be explored include:

- identification or development of reliable instruments suitable to use in primary care to assess the nature or degree of functional impairment in children/adolescents with ADHD and monitor improvement over time;
- study of medications and other therapies used clinically but not approved by the FDA for ADHD, such as

electroencephalographic biofeedback;

- determination of the optimal schedule for monitoring children/adolescents with ADHD, including factors for adjusting that schedule according to age, symptom severity, and progress reports;
- evaluation of the effectiveness of various school-based interventions;
- comparisons of medication use and effectiveness in different ages, including both harms and benefits;
- development of methods to involve parents and children/adolescents in their own care and improve adherence to both behavior and medication treatments;
- standardized and documented tools that will help primary care providers in identifying coexisting conditions;
- development and determination of effective electronic and Web-based systems to help gather information to diagnose and monitor children with ADHD;
- improved systems of communication with schools and mental health professionals, as well as other community agencies, to provide effective collaborative care;
- evidence for optimal monitoring by some aspects of severity, disability, or impairment; and
- long-term outcomes of children first identified with ADHD as preschool-aged children.

SUBCOMMITTEE ON ATTENTION DEFICIT HYPERACTIVITY DISORDER (OVERSIGHT BY THE STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT, 2005–2011)

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Attention-Deficit/Hyperactivity Disorder Clinical Practice Guideline Quick Reference Tools

- Action Statement Summary
  — ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for ADHD
- Bonus Features
  — ADHD Coding Fact Sheet for Primary Care Physicians
  — Continuum Model for ADHD
- AAP Patient Education Handouts
  — *Understanding ADHD: Information for Parents About Attention-Deficit/Hyperactivity Disorder*
  — *Medicines for ADHD: Questions From Teens Who Have ADHD*
  — *What Is ADHD? Questions From Teens*

Action Statement Summary

ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents

Action statement 1

The primary care clinician should initiate an evaluation for ADHD for any child 4 through 18 years of age who presents with academic or behavioral problems and symptoms of inattention, hyperactivity, or impulsivity (quality of evidence B/strong recommendation).

Action statement 2

To make a diagnosis of ADHD, the primary care clinician should determine that *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV-TR) criteria have been met (including documentation of impairment in more than 1 major setting), and information should be obtained primarily from reports from parents or guardians, teachers, and other school and mental health clinicians involved in the child's care. The primary care clinician should also rule out any alternative cause (quality of evidence B/strong recommendation).

Action statement 3

In the evaluation of a child for ADHD, the primary care clinician should include assessment for other conditions that might coexist with ADHD, including emotional or behavioral (eg, anxiety, depressive, oppositional defiant, and conduct disorders), developmental (eg, learning and language disorders or other neurodevelopmental disorders), and physical (eg, tics, sleep apnea) conditions (quality of evidence B/strong recommendation).

Action statement 4

The primary care clinician should recognize ADHD as a chronic condition and, therefore, consider children and adolescents with ADHD as children and youth with special health care needs. Management of children and youth with special health care needs should follow the principles of the chronic care model and the medical home (quality of evidence B/strong recommendation).

Action statement 5

Recommendations for treatment of children and youth with ADHD vary depending on the patient's age.

Action statement 5a

For *preschool-aged children (4–5 years of age)*, the primary care clinician should prescribe evidence-based parent and/or teacher-administered behavior therapy as the first line of treatment (quality of evidence A/strong recommendation) and may prescribe methylphenidate if the behavior interventions do not provide significant improvement and there is moderate-to-severe continuing disturbance in the child's function. In areas in which evidence-based behavioral treatments are not available, the clinician needs to weigh the risks of starting medication at an early age against the harm of delaying diagnosis and treatment (quality of evidence B/recommendation).

Action statement 5b

For *elementary school-aged children (6–11 years of age)*, the primary care clinician should prescribe FDA-approved medications for ADHD (quality of evidence A/strong recommendation) and/or evidence based parent- and/or teacher-administered behavior therapy as treatment for ADHD, preferably both (quality of evidence B/strong recommendation). The evidence is particularly strong for stimulant medications and sufficient but less strong for atomoxetine, extended-release guanfacine, and extended-release clonidine (in that order) (quality of evidence A/strong recommendation). The school environment, program, or placement is a part of any treatment plan.

Action statement 5c

For *adolescents (12–18 years of age)*, the primary care clinician should prescribe FDA-approved medications for ADHD with the assent of the adolescent (quality of evidence A/strong recommendation) and may prescribe behavior therapy as treatment for ADHD (quality of evidence C/recommendation), preferably both.

Action statement 6

Primary care clinicians should titrate doses of medication for ADHD to achieve maximum benefit with minimum adverse effects (quality of evidence B/strong recommendation).

Coding Quick Reference for ADHD	
ICD-9-CM	*ICD-10-CM*
314.00 Attention deficit disorder without hyperactivity	**F90.0** Attention-deficit hyperactivity disorder, predominantly inattentive type
314.01 Attention deficit disorder with hyperactivity	**F90.1** Attention-deficit hyperactivity disorder, predominantly hyperactive type

ADHD Coding Fact Sheet for Primary Care Physicians

Current Procedural Terminology (CPT®) (Procedure) Codes

Initial assessment usually involves a lot of time determining the differential diagnosis, a diagnostic plan, and potential treatment options. Therefore, most pediatricians will report either an office or outpatient evaluation and management (E/M) code using time as the key factor or a consultation code for the initial assessment.

Physician Evaluation and Management Services

99201 Office or other outpatient visit, *new*[a] patient; self limited or minor problem, 10 min.
99202 low to moderate severity problem, 20 min.
99203 moderate severity problem, 30 min.
99204 moderate to high severity problem, 45 min.
99205 high severity problem, 60 min.
99211 Office or other outpatient visit, *established* patient; minimal problem, 5 min.
99212 self limited or minor problem, 10 min.
99213 low to moderate severity problem, 15 min.
99214 moderate severity problem, 25 min.
99215 moderate to high severity problem, 40 min.
99241 Office or other outpatient *consultation*,[b–d] new or established patient; self-limited or minor problem, 15 min.
99242 low severity problem, 30 min.
99243 moderate severity problem, 45 min.
99244 moderate to high severity problem, 60 min.
99245 moderate to high severity problem, 80 min.
+99354 Prolonged physician services in office or other outpatient setting, with direct patient contact; first hour (*use in conjunction with time-based codes* **99201–99215, 99241–99245, 99301–99350, 90837**)
+99355 each additional 30 min. (*use in conjunction with* **99354**)

- Used when a physician provides prolonged services beyond the usual service (ie, beyond the typical time).
- Time spent does not have to be continuous.
- Prolonged service of less than 15 minutes beyond the first hour or less than 15 minutes beyond the final 30 minutes is not reported separately.
- If reporting E/M service based on time and not key factors (history, examination, medical decision-making), the physician must reach the typical time in the highest code in the code set being reported (eg, **99205, 99215, 99245**) before face-to-face prolonged services can be reported.

[a] A new patient is one who has not received any professional services (face-to-face services) rendered by physicians and other qualified health care professionals who may report E/M services using one or more specific *CPT* codes from the physician/qualified health care professional or another physician/qualified health care professional of the exact same specialty and subspecialty who belongs to the same group practice, within the past 3 years (*CPT 2014 Professional Edition,* American Medical Association, p 4).

[b] Use of these codes **(99241–99245)** requires the following actions:
1. Written or verbal request for consultation is documented in the patient chart.
2. Consultant's opinion as well as any services ordered or performed are documented in the patient chart.
3. Consultant's opinion and any services that are performed are prepared in a written report, which is sent to the requesting physician or other appropriate source.

[c] Patients/parents may not initiate a consultation.

[d] For more information on consultation code changes for 2010, see www.aap.org/moc/loadsecure.cfm/reimburse/PositiononMedicareConsultationPolicy.doc.

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.

Reporting E/M Services Using "Time"

- When counseling or coordination of care dominates (more than 50%) the physician/patient or family encounter (face-to-face time in the office or other outpatient setting or floor/unit time in the hospital or nursing facility), time shall be considered the key or controlling factor to qualify for a particular level of E/M services (*CPT 2014 Professional Edition,* p 10).
- This includes time spent with parties who have assumed responsibility for the care of the patient or decision-making, whether or not they are family members (eg, foster parents, person acting in loco parentis, legal guardian). The extent of counseling or coordination of care must be documented in the medical record (*CPT 2014 Professional Edition,* p 10).
- For coding purposes, face-to-face time for these services is defined as only that time that the physician spends face-to-face with the patient or family. This includes the time in which the physician performs such tasks as obtaining a history, performing an examination, and counseling the patient (*CPT 2014 Professional Edition,* p 8).
- When codes are ranked in sequential typical times (eg, office-based E/M services, consultation codes) and the actual time is between 2 typical times, the code with the typical time closest to the actual time is used (*CPT 2014 Professional Edition,* p xv).
  - **Example:** A physician sees an established patient in the office to discuss the current attention-deficit/hyperactivity disorder (ADHD) medication the patient was placed on. The total face-to-face time was 22 minutes, of which 15 minutes was spent in counseling the mom and patient. Because more than 50% of the total time was spent in counseling, the physician would report the E/M service based on time. The physician would report **99214** instead of **99213** because the total face-to-face time was closer to **99214** (25 minutes) than **99213** (15 minutes).

ADHD Follow-up During a Routine Preventive Medicine Service

- A good time to follow up with a patient regarding his or her ADHD could be during a preventive medicine service.
- If the follow-up requires little additional work on behalf of the physician, it should be reported under the preventive medicine service rather than as a separate service.
- If the follow-up work requires an additional E/M service in addition to the preventive medicine service, it should be reported as a separate service.
- Chronic conditions should only be reported if they are separately addressed.
- When reporting a preventive medicine service in addition to an office-based E/M service and the services are significant and separately identifiable, modifier **25** will be required on the office-based E/M service.
  - **Example:** A 12-year-old established patient presents for his routine preventive medicine service and while he and Mom are there, Mom asks about changing his ADHD medication because of some side effects he is experiencing. The physician completes the routine preventive medicine check and then addresses the mom's concerns in a separate service. The additional E/M service takes 15 minutes, of which the physician spends about 10 minutes in counseling and coordinating care; therefore, the E/M service is reported based on time.
    - Code **99394** and **99213-25** account for both E/M services and link each to the appropriate *ICD-9-CM* code.
    - Modifier **25** is required on the problem-oriented office visit code (eg, **99213**) when it is significant and separately identifiable from another service.

Physician Non–Face-to-Face Services

99339 Care Plan Oversight—Individual physician supervision of a patient (patient not present) in home, domiciliary or rest home (e.g., assisted living facility) requiring complex and multidisciplinary care modalities involving regular physician development and/or revision of care plans, review of subsequent reports of patient status, review of related laboratory and other studies, communication (including telephone calls) for purposes of assessment or care decisions with health care professional(s), family member(s), surrogate decision maker(s) (e.g., legal guardian) and/or key caregiver(s) involved in patient's care, integration of new information into the medical treatment plan and/or adjustment of medical therapy, within a calendar month; 15–29 minutes

99340 30 minutes or more

99358[a] Prolonged physician services without direct patient contact; first hour

+99359 each additional 30 min. (+ *designated add-on code, use in conjunction* with **99358**)

99367 Medical team conference by physician with interdisciplinary team of health care professionals, patient and/or family not present, 30 minutes or more

99441 Telephone evaluation and management to patient, parent or guardian not originating from a related E/M service within the previous 7 days nor leading to an E/M service or procedure within the next 24 hours or soonest available appointment; 5–10 minutes of medical discussion

99442 11–20 minutes of medical discussion

99443 21–30 minutes of medical discussion

99444 Online E/M service provided by a physician or other qualified health care professional to an established patient, guardian or health care provider not originating from a related E/M service provided within the previous 7 days, using the internet or similar electronic communications network

[a] This code **(99358)** is no longer an add-on service and can be reported alone.

Psychiatry

+90785 Interactive complexity (Use in conjunction with codes for diagnostic psychiatric evaluation **[90791, 90792]**, psychotherapy **[90832, 90834, 90837]**, psychotherapy when performed with an evaluation and management service **[90833, 90836, 90838, 99201–99255, 99304–99337, 99341–99350]**, and group psychotherapy **[90853]**)

Psychiatric Diagnostic or Evaluative Interview Procedures

90791 Psychiatric diagnostic interview examination evaluation

90792 Psychiatric diagnostic evaluation with medical services

Psychotherapy

90832 Psychotherapy, 30 min with patient and/or family;

+90833 with medical E/M (Use in conjunction with **99201–99255, 99304–99337, 99341–99350**)

90834 Psychotherapy, 45 min with patient and/or family;

+90836 with medical E/M services (Use in conjunction with **99201–99255, 99304–99337, 99341–99350**)

90837 Psychotherapy, 60 min with patient and/or family;

+90838 with medical E/M services (Use in conjunction with **99201–99255, 99304–99337, 99341–99350**)

+90785 Interactive complexity (Use in conjunction with codes for diagnostic psychiatric evaluation **[90791, 90792],** psychotherapy **[90832, 90834, 90837],** psychotherapy when performed with an evaluation and management service **[90833, 90836, 90838, 99201–99255, 99304–99337, 99341–99350],** and group psychotherapy **[90853]**)

- Refers to specific communication factors that complicate the delivery of a psychiatric procedure. Common factors include more difficult communication with discordant or emotional family members and engagement of young and verbally undeveloped or impaired patients. Typical encounters include
  - — Patients who have other individuals legally responsible for their care
  - — Patients who request others to be present or involved in their care such as translators, interpreters, or additional family members
  - — Patients who require the involvement of other third parties such as child welfare agencies, schools, or probation officers

90846 Family psychotherapy (without patient present)

90847 Family psychotherapy (conjoint psychotherapy) (with patient present)

Other Psychiatric Services/Procedures

90863 Pharmacologic management, including prescription and review of medication, when performed with psychotherapy services (Use in conjunction with **90832, 90834, 90837**)

- For pharmacologic management with psychotherapy services performed by a physician or other qualified health care professional who may report E/M codes, use the appropriate E/M codes **99201–99255, 99281–99285, 99304–99337, 99341–99350** and the appropriate psychotherapy with E/M service **90833, 90836,90838**).
- Note code **90862** was deleted.

90887 Interpretation or explanation of results of psychiatric, other medical exams, or other accumulated data to family or other responsible persons, or advising them how to assist patient

90889 Preparation of reports on patient's psychiatric status, history, treatment, or progress (other than for legal or consultative purposes) for other physicians, agencies, or insurance carriers

Psychological Testing

96101 Psychological testing (includes psychodiagnostic assessment of emotionality, intellectual abilities, personality and psychopathology, e.g., MMPI, Rorschach, WAIS), per hour of the *psychologist's or physician's time,* both face-to-face time administering tests to the patient and time interpreting these test results and preparing the report

96102 Psychological testing (includes psychodiagnostic assessment of emotionality, intellectual abilities,

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.

personality and psychopathology, e.g., MMPI, Rorschach, WAIS), with *qualified health care professional* interpretation and report, administered by technician, per hour of technician time, face-to-face

96103 Psychological testing (includes psychodiagnostic assessment of emotionality, intellectual abilities, personality and psychopathology, e.g., MMPI, Rorschach, WAIS), administered by a computer, with *qualified health care professional* interpretation and report

96110 Developmental screening, per standardized screen, with interpretation and report

96111 Developmental testing (includes assessment of motor, language, social, adaptive and/or cognitive functioning by standardized instruments) with interpretation and report

96116 Neurobehavioral status exam (clinical assessment of thinking, reasoning and judgment, eg, acquired knowledge, attention, language, memory, planning and problem solving, and visual spatial abilities), per hour of the psychologist's or physician's time, both face-to-face time with the patient and time interpreting test results and preparing the report

Nonphysician Provider (NPP) Services

99366 Medical team conference with interdisciplinary team of health care professionals, face-to-face with patient and/or family, 30 minutes or more, participation by a nonphysician qualified health care professional

99368 Medical team conference with interdisciplinary team of health care professionals, patient and/or family not present, 30 minutes or more, participation by a nonphysician qualified health care professional

96120 Neuropsychological testing (eg, Wisconsin Card Sorting Test), administered by a computer, with qualified health care professional interpretation and report

96150 Health and behavior assessment performed by nonphysician provider (health-focused clinical interviews, behavior observations) to identify psychological, behavioral, emotional, cognitive or social factors important to management of physical health problems, 15 min., initial assessment

96151 re-assessment

96152 Health and behavior intervention performed by nonphysician provider to improve patient's health and well-being using cognitive, behavioral, social, and/or psychophysiological procedures designed to ameliorate specific disease-related problems, individual, 15 min.

96153 group (2 or more patients)

96154 family (with the patient present)

96155 family (without the patient present)

Non–Face-to-Face Services: NPP

98966 Telephone assessment and management service provided by a qualified nonphysician health care professional to an established patient, parent or guardian not originating from a related assessment and management service provided within the previous seven days nor leading to an assessment and management service or procedure within the next 24 hours or soonest available appointment;

5–10 minutes of medical discussion

98967 11–20 minutes of medical discussion

98968 21–30 minutes of medical discussion

98969 Online assessment and management service provided by a qualified nonphysician health care professional to an established patient or guardian not originating from a related assessment and management service provided within the previous seven days nor using the internet or similar electronic communications network

Miscellaneous Services

99071 Educational supplies, such as books, tapes, or pamphlets, provided by the physician for the patient's education at cost to the physician

International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)/ Diagnostic and Statistical Manual for Primary Care (DSM-PC) (Diagnosis) Codes

- Use as many diagnosis codes that apply to document the patient's complexity and report the patient's symptoms or adverse environmental circumstances.
- Once a definitive diagnosis is established, report the appropriate definitive diagnosis code(s) as the primary code, plus any other symptoms that the patient is exhibiting as secondary diagnoses.
- Counseling diagnosis codes can be used when the patient is present or when counseling the parent(s) or guardian(s) when the patient is not physically present.

285.9 Anemia, unspecified

292.84 Drug-induced mood disorder (Add E-code to identify the drug)

293.84 Anxiety disorder in conditions classified elsewhere

296.81 Atypical manic disorder

296.90 Unspecified episodic mood disorder

299.00 Autistic disorder, current or active state

299.01 Autistic disorder, residual state

300.00 Anxiety state, unspecified

300.01 Panic disorder

300.02 Generalized anxiety disorder

300.20 Phobia, unspecified

300.23 Social phobia

300.29 Other isolated or specific phobia

300.4 Dysthymic disorder

300.9 Unspecified nonpsychotic mental disorder

304.3 Cannabis dependence

304.4 Amphetamine and other psychostimulant dependence

304.9 Unspecified drug dependence

Substance Dependence/Abuse

For the following codes **(305.0X–305.9X),** fifth-digit subclassification is as follows:

0 unspecified
1 continuous
2 episodic
3 in remission

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.

Nondependent Abuse of Drugs

305.0X Alcohol abuse
305.1X Tobacco use disorder
305.2X Cannabis abuse
305.3X Hallucinogenic abuse
305.4X Sedative, hypnotic or anxiolytic abuse
305.5X Opioid abuse
305.6X Cocaine abuse
305.7X Amphetamine or related acting sympathomimetic abuse
305.8X Antidepressant type abuse
305.9X Other mixed, or unspecified drug abuse (eg, caffeine intoxication, laxative habit)
307.0 Stuttering
307.20 Tic disorder, unspecified
307.21 Transient tic disorder
307.22 Chronic motor or vocal tic disorder
307.23 Tourette's disorder
307.40 Nonorganic sleep disorder, unspecified
307.41 Transient disorder of initiating or maintaining sleep
307.42 Persistent disorder of initiating or maintaining sleep
307.46 Sleep arousal disorder
307.49 Other sleep disorder
307.50 Eating disorder, unspecified
307.52 Pica
307.6 Enuresis
307.9 Other and unspecified special symptoms or syndromes, not elsewhere classified (NEC)
308.0 Predominant disturbance of emotions
309.0 Adjustment disorder with depressed mood
309.21 Separation anxiety disorder
309.24 Adjustment disorder with anxiety
309.3 Adjustment reaction; with disturbance of conduct
309.9 Unspecified adjustment reaction
310.2 Postconcussion syndrome
310.8 Other specified nonpsychotic mental disorders following organic brain damage
310.9 Unspecified nonpsychotic mental disorders following organic brain damage
312.00 Undersocialized conduct disorder, aggressive type; unspecified
312.30 Impulse control disorder, unspecified
312.81 Conduct disorder, childhood onset type
312.82 Conduct disorder, adolescent onset type
312.9 Unspecified disturbance of conduct
313.3 Relationship problems
313.81 Oppositional defiant disorder
313.83 Academic underachievement disorder
313.9 Unspecified emotional disturbance of childhood or adolescence
314.00 Attention-deficit disorder, without mention of hyperactivity
314.01 Attention-deficit disorder, with mention of hyperactivity
314.1 Hyperkinesis with developmental delay *(Use additional code to identify any associated neurological disorder)*
314.2 Hyperkinetic conduct disorder
314.8 Other specified manifestations of hyperkinetic syndrome
314.9 Unspecified hyperkinetic syndrome
315.00 Reading disorder, unspecified
315.01 Alexia
315.02 Developmental dyslexia
315.09 Specific reading disorder; other
315.1 Mathematics disorder
315.2 Specific learning difficulties; other
315.31 Expressive language disorder
315.32 Mixed receptive-expressive language disorder
315.34 Speech and language developmental delay due to hearing loss
315.39 Developmental speech or language disorder; other
315.4 Developmental coordination disorder
315.5 Mixed development disorder
315.8 Specified delays in development; other
315.9 Unspecified delay in development
317 Mild mental retardation
318.0 Moderate mental retardation
318.1 Severe mental retardation
318.2 Profound mental retardation
319 Unspecified mental retardation
389.03 Conductive hearing loss, middle ear
527.7 Disturbance of salivary secretion (eg, dry mouth/xerostomia)
564.00 Constipation, unspecified
780.4 Dizziness
780.50 Sleep disturbances, unspecified
781.0 Abnormal involuntary movement (eg, tremor)
781.3 Lack of coordination
782.1 Rash and other nonspecific skin eruptions
783.1 Abnormal weight gain
783.21 Loss of weight
783.3 Feeding difficulties and mismanagement
783.42 Delayed milestones
783.43 Short stature
784.0 Headache
787.01 Nausea with vomiting
787.03 Vomiting
787.91 Diarrhea
788.36 Nocturnal enuresis
789.00 Abdominal pain, unspecified
984.9 Toxic effect of lead, unspecified lead compound (Use E code in addition)

The following diagnosis codes **(V11.1–V79.9)** are used to deal with occasions when circumstances other than a disease or an injury are recorded as diagnoses or problems. Some carriers may request supporting documentation for the reporting of V codes. These codes may also be reported in addition to the primary *ICD-9-CM* code to list any contributing factors or those factors that influence the person's health status but are not in themselves a current illness or injury.

V11.1 Personal history of affective disorders
V11.8 Personal history of other mental disorders
V11.9 Personal history of unspecified mental disorders
V12.1 Personal history of a nutritional deficiency
V12.2 Personal history of endocrine, metabolic, and nutritional disorders
V12.3 Personal history of diseases of blood and blood-forming organs
V12.40 Unspecified disorder of the neurological system and sense organs
V12.49 Other disorders of the nervous system and sense organs
V12.69 Other disorders of the respiratory system

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.

V12.79 Other diseases of the digestive system
V13.6 Congenital malformations
V14.9 Personal history of allergy to unspecified medicinal agent
V15.0 Allergy, other than to medicinal agents
V15.41 History of physical abuse
V15.42 History of emotional abuse
V15.49 Other psychological trauma
V15.52 History of traumatic brain injury
V15.81 Noncompliance with medical treatment
V15.82 History of tobacco use
V15.86 Contact with and (suspected) exposure to lead
V17.0 Family history of psychiatric disorder
V18.2 Family history of anemia
V18.4 Family history of mental retardation
V40.0 Problems with learning
V40.1 Problems with communication (including speech)
V40.2 Mental problems; other
V40.3 Behavioral problems; other
V40.9 Mental or behavioral problems; unspecified
V58.69 Long-term (current) use of other medications
V60.0 Lack of housing
V60.1 Inadequate housing
V60.2 Inadequate material resources (eg, economic problem, poverty, NOS)
V60.81 Foster care
V61.20 Counseling for parent-child problem; unspecified
V61.23 Counseling for parent-biological child problem
V61.24 Counseling for parent-adopted child problem
V61.25 Counseling for parent (guardian)-foster child problem
V61.29 Counseling for parent-child problem; other
V61.41 Health problems within family; alcoholism
V61.42 Health problems within family; substance abuse
V61.49 Health problems within family; other
V61.8 Health problems within family; other specified family circumstances
V61.9 Health problems within family; unspecified family circumstances
V62.3 Educational circumstances
V62.4 Social maladjustment
V62.5 Legal circumstances
V62.81 Interpersonal problems, NEC
V62.89 Other psychological or physical stress; NEC, other
V62.9 Other psychosocial circumstance
V65.40 Counseling NOS
V65.49 Other specified counseling
V79.0 Special screening for depression
V79.2 Special screening for mental retardation
V79.3 Special screening for developmental handicaps in early childhood
V79.8 Special screening for other specified mental disorders and developmental handicaps
V79.9 Unspecified mental disorder and developmental handicapped

International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) Codes

- Use as many diagnosis codes that apply to document the patient's complexity and report the patient's symptoms and/or adverse environmental circumstances.
- Once a definitive diagnosis is established, report the appropriate definitive diagnosis code(s) as the primary code, plus any other symptoms that the patient is exhibiting as secondary diagnoses that are not part of the usual disease course or are considered incidental.
- ***ICD-10-CM* codes are only valid on or after October 1, 2014.**

Depressive Disorders

F34.1 Dysthymic disorder (depressive personality disorder, dysthymia neurotic depression)
F39 Mood (affective) disorder, unspecified
F30.8 Other manic episode

Anxiety Disorders

F06.4 Anxiety disorder due to known physiological conditions
F40.10 Social phobia, unspecified
F40.11 Social phobia, generalized
F40.8 Phobic anxiety disorders, other (phobic anxiety disorder of childhood)
F40.9 Phobic anxiety disorder, unspecified
F41.1 Generalized anxiety disorder
F41.9 Anxiety disorder, unspecified

Feeding and Eating Disorders/Elimination Disorders

F50.8 Eating disorders, other
F50.9 Eating disorder, unspecified
F98.0 Enuresis not due to a substance or known physiological condition
F98.1 Encopresis not due to a substance or known physiological condition
F98.3 Pica (infancy or childhood)

Impulse Disorders

F63.9 Impulse disorder, unspecified

Trauma- and Stressor-Related Disorders

F43.20 Adjustment disorder, unspecified
F43.21 Adjustment disorder with depressed mood
F43.22 Adjustment disorder with anxiety
F43.23 Adjustment disorder with mixed anxiety and depressed mood
F43.24 Adjustment disorder with disturbance of conduct

Neurodevelopmental/Other Developmental Disorders

F70 Mild intellectual disabilities
F71 Moderate intellectual disabilities
F72 Severe intellectual disabilities
F73 Profound intellectual disabilities
F79 Unspecified intellectual disabilities
F80.0 Phonological (speech) disorder
F80.1 Expressive language disorder
F80.2 Mixed receptive-expressive language disorder
F80.4 Speech and language developmental delay due to hearing loss (code also hearing loss)
F80.81 Stuttering
F80.89 Other developmental disorders of speech and language
F80.9 Developmental disorder of speech and language, unspecified
F81.0 Specific reading disorder

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.

F81.2 Mathematics disorder
F81.89 Other developmental disorders of scholastic skills
F82 Developmental coordination disorder
F88 Specified delays in development; other
F89 Unspecified delay in development
F81.9 Developmental disorder of scholastic skills, unspecified

Behavioral/Emotional Disorders

F90.0 Attention-deficit hyperactivity disorder, predominantly inattentive type
F90.1 Attention-deficit hyperactivity disorder, predominantly hyperactive type
F90.8 Attention-deficit hyperactivity disorder, other type
F90.9 Attention-deficit hyperactivity disorder, unspecified type
F91.1 Conduct disorder, childhood-onset type
F91.2 Conduct disorder, adolescent-onset type
F91.3 Oppositional defiant disorder
F91.9 Conduct disorder, unspecified
F93.0 Separation anxiety disorder
F93.8 Other childhood emotional disorders (relationship problems)
F93.9 Childhood emotional disorder, unspecified
F94.9 Childhood disorder of social functioning, unspecified
F95.0 Transient tic disorder
F95.1 Chronic motor or vocal tic disorder
F95.2 Tourette's disorder
F95.9 Tic disorder, unspecified
F98.8 Other specified behavioral and emotional disorders with onset usually occurring in childhood and adolescence (nail-biting, nose-picking, thumb-sucking)

Other

F07.81 Postconcussional syndrome
F07.89 Personality and behavioral disorders due to known physiological condition, other
F07.9 Personality and behavioral disorder due to known physiological condition, unspecified
F48.8 Nonpsychotic mental disorders, other (neurasthenia)
F48.9 Nonpsychotic mental disorders, unspecified
F45.41 Pain disorder exclusively related to psychological factors
F51.01 Primary insomnia
F51.02 Adjustment insomnia
F51.03 Paradoxical insomnia
F51.04 Psychophysiologic insomnia
F51.05 Insomnia due to other mental disorder (Code also associated mental disorder)
F51.09 Insomnia, other (not due to a substance or known physiological condition)
F51.3 Sleepwalking [somnambulism]
F51.4 Sleep terrors [night terrors]
F51.8 Other sleep disorders
F93.8 Childhood emotional disorders, other
R46.89 Other symptoms and signs involving appearance and behavior

Substance-Related and Addictive Disorders

If a provider documents multiple patterns of use, only one should be reported. Use the following hierarchy: use–abuse–dependence (eg, if use and dependence are documented, only code for dependence).

When a minus symbol (-) is included in codes **F10–F17,** a last digit is required. Be sure to include the last digit from the following list:

0 anxiety disorder
2 sleep disorder
8 other disorder
9 unspecified disorder

Alcohol

F10.10 Alcohol abuse, uncomplicated
F10.14 Alcohol abuse with alcohol-induced mood disorder
F10.159 Alcohol abuse with alcohol-induced psychotic disorder, unspecified
F10.18- Alcohol abuse with alcohol-induced
F10.19 Alcohol abuse with unspecified alcohol-induced disorder
F10.20 Alcohol dependence, uncomplicated
F10.21 Alcohol dependence, in remission
F10.24 Alcohol dependence with alcohol-induced mood disorder
F10.259 Alcohol dependence with alcohol-induced psychotic disorder, unspecified
F10.28- Alcohol dependence with alcohol-induced
F10.29 Alcohol dependence with unspecified alcohol-induced disorder
F10.94 Alcohol use, unspecified with alcohol-induced mood disorder
F10.959 Alcohol use, unspecified with alcohol-induced psychotic disorder, unspecified
F10.98- Alcohol use, unspecified with alcohol-induced
F10.99 Alcohol use, unspecified with unspecified alcohol-induced disorder

Cannabis

F12.10 Cannabis abuse, uncomplicated
F12.18- Cannabis abuse with cannabis-induced
F12.19 Cannabis abuse with unspecified cannabis-induced disorder
F12.20 Cannabis dependence, uncomplicated
F12.21 Cannabis dependence, in remission
F12.28- Cannabis dependence with cannabis-induced
F12.29 Cannabis dependence with unspecified cannabis-induced disorder
F12.90 Cannabis use, unspecified, uncomplicated
F12.98- Cannabis use, unspecified with
F12.99 Cannabis use, unspecified with unspecified cannabis-induced disorder

Sedatives

F13.10 Sedative, hypnotic or anxiolytic abuse, uncomplicated
F13.129 Sedative, hypnotic or anxiolytic abuse with intoxication, unspecified
F13.14 Sedative, hypnotic or anxiolytic abuse with sedative, hypnotic or anxiolytic-induced mood disorder
F13.18- Sedative, hypnotic or anxiolytic abuse with sedative,

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.

hypnotic or anxiolytic-induced
F13.21 Sedative, hypnotic or anxiolytic dependence, in remission
F13.90 Sedative, hypnotic, or anxiolytic use, unspecified, uncomplicated
F13.94 Sedative, hypnotic or anxiolytic use, unspecified with sedative, hypnotic or anxiolytic-induced mood disorder
F13.98- Sedative, hypnotic or anxiolytic use, unspecified with sedative, hypnotic or anxiolytic-induced
F13.99 Sedative, hypnotic or anxiolytic use, unspecified with unspecified sedative, hypnotic or anxiolytic-induced disorder

Stimulants (eg, Caffeine, Amphetamines)

F15.10 Other stimulant (amphetamine-related disorders or caffeine) abuse, uncomplicated
F15.14 Other stimulant (amphetamine-related disorders or caffeine) abuse with stimulant-induced mood disorder
F15.18- Other stimulant (amphetamine-related disorders or caffeine) abuse with stimulant-induced
F15.19 Other stimulant (amphetamine-related disorders or caffeine) abuse with unspecified stimulant-induced disorder
F15.20 Other stimulant (amphetamine-related disorders or caffeine) dependence, uncomplicated
F15.21 Other stimulant (amphetamine-related disorders or caffeine) dependence, in remission
F15.24 Other stimulant (amphetamine-related disorders or caffeine) dependence with stimulant-induced mood disorder
F15.28- Other stimulant (amphetamine-related disorders or caffeine) dependence with stimulant-induced
F15.29 Other stimulant (amphetamine-related disorders or caffeine) dependence with unspecified stimulant-induced disorder
F15.90 Other stimulant (amphetamine-related disorders or caffeine) use, unspecified, uncomplicated
F15.94 Other stimulant (amphetamine-related disorders or caffeine) use, unspecified with stimulant-induced mood disorder
F15.98- Other stimulant (amphetamine-related disorders or caffeine) use, unspecified with stimulant-induced
F15.99 Other stimulant (amphetamine-related disorders or caffeine) use, unspecified with unspecified stimulant-induced disorder

Nicotine (eg, Cigarettes)

F17.200 Nicotine dependence, unspecified, uncomplicated
F17.201 Nicotine dependence, unspecified, in remission
F17.203 Nicotine dependence unspecified, with withdrawal
F17.20- Nicotine dependence, unspecified, with
F17.210 Nicotine dependence, cigarettes, uncomplicated
F17.211 Nicotine dependence, cigarettes, in remission
F17.213 Nicotine dependence, cigarettes, with withdrawal
F17.218- Nicotine dependence, cigarettes, with

Symptoms, Signs, and Ill-Defined Conditions

- Use these codes in absence of a definitive mental diagnosis or when the sign or symptom is not part of the disease course or considered incidental.

G47.9 Sleep disorder, unspecified
H90.0 Conductive hearing loss, bilateral
H90.11 Conductive hearing loss, unilateral, right ear, with unrestricted hearing on the contralateral side
H90.12 Conductive hearing loss, unilateral, left ear, with unrestricted hearing on the contralateral side
K11.7 Disturbance of salivary secretions
K59.00 Constipation, unspecified
N39.44 Nocturnal enuresis
R10.0 Acute abdomen pain
R11.11 Vomiting without nausea
R11.2 Nausea with vomiting, unspecified
R19.7 Diarrhea, unspecified
R21 Rash, NOS
R25.0 Abnormal head movements
R25.1 Tremor, unspecified
R25.3 Twitching, NOS
R25.8 Other abnormal involuntary movements
R25.9 Unspecified abnormal involuntary movements
R27.8 Other lack of coordination (excludes ataxia)
R27.9 Unspecified lack of coordination
R41.83 Borderline intellectual functioning
R42 Dizziness
R48.0 Alexia/dyslexia, NOS
R51 Headache
R62.0 Delayed milestone in childhood
R62.52 Short stature (child)
R63.3 Feeding difficulties
R63.4 Abnormal weight loss
R63.5 Abnormal weight gain
R68.2 Dry mouth, unspecified
T56.0X1A Toxic effect of lead and its compounds, accidental (unintentional), initial encounter

Z Codes

Z codes represent reasons for encounters. Categories **Z00–Z99** are provided for occasions when circumstances other than a disease, injury, or external cause classifiable to categories **A00–Y89** are recorded as *diagnoses* or *problems.* This can arise in 2 main ways.

1. When a person who may or may not be sick encounters the health services for some specific purpose, such as to receive limited care or service for a current condition, to donate an organ or tissue, to receive prophylactic vaccination (immunization), or to discuss a problem that is in itself not a disease or an injury.
2. When some circumstance or problem is present which influences the person's health status but is not in itself a current illness or injury.

Z13.89 Encounter for screening for other disorder
Z55.0 Illiteracy and low-level literacy
Z55.2 Failed school examinations
Z55.3 Underachievement in school
Z55.4 Educational maladjustment and discord with teachers and classmates
Z55.8 Other problems related to education and literacy
Z55.9 Problems related to education and literacy, unspecified (**Z55** codes exclude those conditions reported with **F80–F89**)
Z62.0 Inadequate parental supervision and control
Z60.4 Social exclusion and rejection

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.

Z60.8 Other problems related to social environment
Z60.9 Problem related to social environment, unspecified
Z62.21 Foster care status (child welfare)
Z62.6 Inappropriate (excessive) parental pressure
Z62.810 Personal history of physical and sexual abuse in childhood
Z62.811 Personal history of psychological abuse in childhood
Z62.820 Parent-biological child conflict
Z62.821 Parent-adopted child conflict
Z62.822 Parent-foster child conflict
Z63.72 Alcoholism and drug addiction in family
Z63.8 Other specified problems related to primary support group
Z65.3 Problems related to legal circumstances
Z71.89 Counseling, other specified
Z71.9 Counseling, unspecified
Z72.0 Tobacco use
Z77.011 Contact with and (suspected) exposure to lead
Z79.899 Other long term (current) drug therapy
Z81.0 Family history of intellectual disabilities (conditions classifiable to **F70–F79**)
Z81.8 Family history of other mental and behavioral disorders
Z83.2 Family history of diseases of the blood and blood-forming organs (anemia) (conditions classifiable to **D50–D89**)
Z86.2 Personal history of diseases of the blood and blood-forming organs
Z86.39 Personal history of other endocrine, nutritional, and metabolic disease
Z86.59 Personal history of other mental and behavioral disorders
Z86.69 Personal history of other diseases of the nervous system and sense organs
Z87.09 Personal history of other diseases of the respiratory system
Z87.19 Personal history of other diseases of the digestive system
Z87.798 Personal history of other (corrected) congenital malformations
Z87.820 Personal history of traumatic brain injury
Z88.9 Allergy status to unspecified drugs, medicaments, and biological substances status
Z91.09 Other allergy status, other than to drugs and biological substances
Z91.128 Patient's intentional underdosing of medication regimen for other reason (report drug code)
Z91.138 Patient's unintentional underdosing of medication regimen for other reason (report drug code)
Z91.14 Patient's other noncompliance with medication regimen
Z91.19 Patient's noncompliance with other medical treatment and regimen
Z91.411 Personal history of adult psychological abuse

+ Codes are *add-on codes,* meaning they are reported separately in addition to the appropriate code for the service provided.

Continuum Model for ADHD

The following continuum model from *Coding for Pediatrics 2014* has been devised to express the various levels of service for ADHD. This model demonstrates the cumulative effect of the key criteria for each level of service using a single diagnosis as the common denominator. It also shows the importance of other variables, such as patient age, duration and severity of illness, social contexts, and comorbid conditions that often have key roles in pediatric cases.

Quick Reference for Office or Other Outpatient Codes Used in Continuum for ADHD[a]

E/M Code Level	History	Examination	MDM	Time
99211[b]	NA	NA	NA	5 minutes
99212	Problem-focused	Problem-focused	Straightforward	10 minutes
99213	Expanded problem-focused	Expanded problem-focused	Low	15 minutes
99214	Detailed	Detailed	Moderate	25 minutes
99215	Comprehensive	Comprehensive	High	40 minutes

Abbreviations: E/M, evaluation and management; MDM, medical decision-making; NA, not applicable.
[a] Use of a code level requires that you meet or exceed 2 of the 3 key components based on medical necessity.
[b] Low level E/M service that may not require the presence of a physician.

Adapted from American Academy of Pediatrics. *Coding for Pediatrics 2014: A Manual for Pediatric Documentation and Payment.* 19th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2014.

Continuum Model for Attention-Deficit/Hyperactivity Disorder (ADHD)

CPT Code Vignette	History	Physical Examination	Medical Decision-making
99211* Nurse visit to follow up growth or blood pressure prior to renewing prescription for psychoactive drugs	1. Chief complaint 2. Brief HPI, existing medications, and desired/undesired effects	1. Weight, blood pressure 2. Overall appearance	1. Refill existing prescription
99212 Follow-up visit to recheck prior weight loss in patient with established ADHD otherwise stable on stimulant medication	Problem focused 1. Chief complaint 2. Document brief HPI, existing medications, and desired/undesired effects	Problem focused 1. Weight, blood pressure 2. Overall appearance	Straightforward 1. Refill existing prescription
99213 3- to 6-month follow-up of child with ADHD who is presently doing well using medication and without other problems	Expanded problem focused 1. Reason for the visit 2. Review of medications 3. Effect of medication on appetite, mood, sleep 4. Quality of schoolwork (eg, review report cards) 5. Absence of tics 6. Problem-pertinent ROS	Expanded problem focused 1. General multisystem examination or single organ system examination with special reference to neurologic examination 2. Rating Scale Review: Teacher Vanderbilt ADHD Rating Scale results reviewed	Low complexity 1. Review rating scale results and feedback materials from teacher. 2. Discuss 6-month treatment plan with adjustment of medication. 3. Plan for further monitoring.

*There are no required key components; however, the nurse must document his or her history, physical examination, and assessment to support medical necessity.

Continuum Model for Attention-Deficit/Hyperactivity Disorder (ADHD), continued

CPT Code Vignette	History	Physical Examination	Medical Decision-making
99214 Follow-up evaluation of an established patient with ADHD with failure to improve on medication and/or weight loss	Detailed All data implicit in **99213** expanded plus pertinent review of PFSH and extended ROS including gastrointestinal and psychiatric	Detailed 1. General multisystem examination or detailed single organ system examination of the neurologic system 2. Rating Scale Review: Parent and Teacher Vanderbilt ADHD Rating Scales results reviewed	Moderate complexity Discussion of possible interventions including, but not limited to, 1. Educational intervention 2. Alteration in medications 3. Obtaining drug levels 4. Psychiatric intervention 5. Behavioral modification program
99215 Initial evaluation of an established patient experiencing difficulty in classroom, home, or social situation and suspected of having ADHD This could be billed as a consultation if the established patient is referred by school for opinion or advice (not transfer of care) and the criteria for reporting a consultation are met.	Comprehensive 1. Chief complaint 2. History of the problem, extended 3. Complete PFSH 4. Complete ROS	Comprehensive 1. General multisystem examination with special attention to neurologic examination and mental health status 2. Rating Scale Review: Parent and Teacher Vanderbilt ADHD Rating Scales results reviewed	High complexity Review of Vanderbilt scores, school record, any other formal evaluations completed to date, discussion of differential diagnoses, possible interventions including, but not limited to, 1. Educational interventions 2. Initiation of medications 3. Obtaining drug levels or rule out substance abuse, if appropriate 4. Laboratory tests as indicated (eg, complete blood cell count and iron studies, serum lead levels) 5. Psychological and/or psychiatric interventions 6. Behavioral modification program 7. Consideration of neurology consultation 8. Coordination of care services with school, family, and other providers

Understanding ADHD:

Information for Parents About Attention-Deficit/Hyperactivity Disorder

Almost all children have times when their behavior veers out of control. They may speed about in constant motion, make noise nonstop, refuse to wait their turn, and crash into everything around them. At other times they may drift as if in a daydream, failing to pay attention or finish what they start.

However, for some children, these kinds of behaviors are more than an occasional problem. Children with attention-deficit/hyperactivity disorder (ADHD) have behavior problems that are so frequent and severe that they interfere with their ability to live normal lives.

These children often have trouble getting along with siblings and other children at school, at home, and in other settings. Those who have trouble paying attention usually have trouble learning. An impulsive nature may put them in actual physical danger. Because children with ADHD have difficulty controlling this behavior, they may be labeled "bad kids" or "space cadets."

Left untreated, some of the children with ADHD will continue to have serious, lifelong problems, such as poor grades in school, run-ins with the law, failed relationships, and the inability to keep a job.

Effective treatment is available. If your child has ADHD, your pediatrician can offer a long-term treatment plan to help your child lead a happy and healthy life. As a parent, you have a very important role in this treatment.

What is ADHD?

ADHD is a condition of the brain that makes it difficult for children to control their behavior. It is one of the most common chronic conditions of childhood. It affects 4% to 12% of school-aged children. About 3 times more boys than girls are diagnosed with ADHD.

The condition affects behavior in specific ways.

What are the symptoms of ADHD?

ADHD includes 3 groups of behavior symptoms: inattention, hyperactivity, and impulsivity. Table 1 explains these symptoms.

Are there different types of ADHD?

Not all children with ADHD have all the symptoms. They may have one or more of the symptom groups listed in Table 1. The symptoms usually are classified as the following types of ADHD:

- **Inattentive only** (formerly known as attention-deficit disorder [ADD])—Children with this form of ADHD are not overly active. Because they do not disrupt the classroom or other activities, their symptoms may not be noticed. Among girls with ADHD, this form is more common.
- **Hyperactive/Impulsive**—Children with this type of ADHD show both hyperactive and impulsive behavior, but can pay attention. They are the least common group and are frequently younger.
- **Combined Inattentive/Hyperactive/Impulsive**—Children with this type of ADHD show a number of symptoms in all 3 dimensions. It is the type that most people think of when they think of ADHD.

Table 1. Symptoms of ADHD

Symptom	How a child with this symptom may behave
Inattention	Often has a hard time paying attention, daydreams
	Often does not seem to listen
	Is easily distracted from work or play
	Often does not seem to care about details, makes careless mistakes
	Frequently does not follow through on instructions or finish tasks
	Is disorganized
	Frequently loses a lot of important things
	Often forgets things
	Frequently avoids doing things that require ongoing mental effort
Hyperactivity	Is in constant motion, as if "driven by a motor"
	Cannot stay seated
	Frequently squirms and fidgets
	Talks too much
	Often runs, jumps, and climbs when this is not permitted
	Cannot play quietly
Impulsivity	Frequently acts and speaks without thinking
	May run into the street without looking for traffic first
	Frequently has trouble taking turns
	Cannot wait for things
	Often calls out answers before the question is complete
	Frequently interrupts others

How can I tell if my child has ADHD?

Remember, it is normal for all children to show some of these symptoms from time to time. Your child may be reacting to stress at school or home. She may be bored or going through a difficult stage of life. It does not mean she has ADHD.

Sometimes a teacher is the first to notice inattention, hyperactivity, and/or impulsivity and bring these symptoms to the parents' attention.

Perhaps questions from your pediatrician raised the issue. At routine visits, pediatricians often ask questions such as

- How is your child doing in school?
- Are there any problems with learning that you or your child's teachers have seen?

- Is your child happy in school?
- Is your child having problems completing class work or homework?
- Are you concerned with any behavior problems in school, at home, or when your child is playing with friends?

Your answers to these questions may lead to further evaluation for ADHD. If your child has shown symptoms of ADHD on a regular basis for more than 6 months, discuss this with your pediatrician.

Keep safety in mind

If your child shows any symptoms of ADHD, it is very important that you pay close attention to safety. A child with ADHD may not always be aware of dangers and can get hurt easily. Be especially careful around

- Traffic
- Firearms
- Swimming pools
- Tools such as lawn mowers
- Poisonous chemicals, cleaning supplies, or medicines

Diagnosis

Your pediatrician will determine whether your child has ADHD using standard guidelines developed by the American Academy of Pediatrics. These diagnosis guidelines are specifically for children 4 to 18 years of age.

It is difficult to diagnose ADHD in children younger than 4 years. This is because younger children change very rapidly. It is also more difficult to diagnose ADHD once a child becomes a teenager.

There is no single test for ADHD. The process requires several steps and involves gathering a lot of information from multiple sources. You, your child, your child's school, and other caregivers should be involved in assessing your child's behavior.

Children with ADHD show signs of inattention, hyperactivity, and/or impulsivity in specific ways. (See the behaviors listed in Table 1.) Your pediatrician will look at how your child's behavior compares to that of other children her own age, based on the information reported about your child by you, her teacher, and any other caregivers who spend time with your child, such as coaches or child care workers.

To confirm a diagnosis of ADHD, symptoms

- Occur in more than one setting, such as home, school, and social situations and cause some impairment
- Significantly impair your child's ability to function in some of the activities of daily life, such as schoolwork, relationships with you and her brothers and/or sisters, and relationships with friends or in her ability to function in groups such as sports teams
- Start before the child reaches 7 years of age (However, these may not be recognized as ADHD symptoms until a child is older.)
- Have continued for more than 6 months

In addition to looking at your child's behavior, your pediatrician will do a physical and neurologic examination. A full medical history will be needed to put your child's behavior in context and screen for other conditions that may affect her behavior. Your pediatrician also will talk with your child about how she acts and feels.

Your pediatrician may refer your child to a pediatric subspecialist or mental health clinician if there are concerns in one of the following areas:

- Intellectual disability (mental retardation)
- Developmental disorder such as speech problems, motor problems, or a learning disability
- Chronic illness being treated with a medication that may interfere with learning
- Trouble seeing and/or hearing
- History of abuse
- Major anxiety or major depression
- Severe aggression
- Possible seizure disorder
- Possible sleep disorder

How can parents help with the diagnosis?

As a parent, you will provide crucial information about your child's behavior and how it affects her life at home, in school, and in other social settings. Your pediatrician will want to know what symptoms your child is showing, how long the symptoms have occurred, and how the behavior affects your child and your family. You may need to fill in checklists or rating scales about your child's behavior.

In addition, sharing your family history can offer important clues about your child's condition.

How will my child's school be involved?

For an accurate diagnosis, your pediatrician will need to get information about your child directly from your child's classroom teacher or another school professional. Children at least 4 years of age and older spend many of their waking hours at preschool or school. Teachers provide valuable insights. Your child's teacher may write a report or discuss the following with your pediatrician:

- Your child's behavior in the classroom
- Your child's learning patterns
- How long the symptoms have been a problem
- How the symptoms are affecting your child's progress at school
- Ways the classroom program is being adapted to help your child
- Whether other conditions may be affecting the symptoms

In addition, your pediatrician may want to see report cards, standardized tests, and samples of your child's schoolwork.

How will others who care for my child be involved?

Other caregivers may also provide important information about your child's behavior. Former teachers, religious and scout leaders, or coaches may have valuable input. If your child is homeschooled, it is especially important to assess his behavior in settings outside of the home.

Your child may not behave the same way at home as he does in other settings. Direct information about the way your child acts in more than one setting is required. It is important to consider other possible causes of your child's symptoms in these settings.

In some cases, other mental health care professionals may also need to be involved in gathering information for the diagnosis.

Coexisting conditions

As part of the diagnosis, your pediatrician will look for other conditions that show the same types of symptoms as ADHD. Your child may simply have a different condition or ADHD and another condition. Most children who have been diagnosed with ADHD have at least one coexisting condition.

Common coexisting conditions include

- **Learning disabilities—**Learning disabilities are conditions that make it difficult for a child to master specific skills such as reading or math. ADHD is not a learning disability. However, ADHD can make it hard for a child to do well in school. Diagnosing learning disabilities requires evaluations, such as IQ and academic achievement tests, and requires educational interventions.
- **Oppositional defiant disorder or conduct disorder—**Up to 35% of children with ADHD also have oppositional defiant disorder or conduct disorder. Children with oppositional defiant disorder tend to lose their temper easily and annoy people on purpose and are defiant and hostile toward authority figures. Children with conduct disorder break rules, destroy property, get suspended or expelled from school, and violate the rights of other people. Children with coexisting conduct disorder are at much higher risk for getting into trouble with the law or having substance abuse problems than children who have only ADHD. Studies show that this type of coexisting condition is more common among children with the primarily hyperactive/impulsive and combination types of ADHD. Your pediatrician may recommend behavioral therapy for your child if she has this condition.
- **Mood disorders/depression—**About 18% of children with ADHD also have mood disorders such as depression or bipolar disorder (formerly called manic depression). There is frequently a family history of these types of disorders. Coexisting mood disorders may put children at higher risk for suicide, especially during the teenage years. These disorders are more common among children with inattentive and combined types of ADHD. Children with mood disorders or depression often require additional interventions or a different type of medication than those normally used to treat ADHD.
- **Anxiety disorders—**These affect about 25% of children with ADHD. Children with anxiety disorders have extreme feelings of fear, worry, or panic that make it difficult to function. These disorders can produce physical symptoms such as racing pulse, sweating, diarrhea, and nausea. Counseling and/or different medication may be needed to treat these coexisting conditions.
- **Language disorders—**Children with ADHD may have difficulty with how they use language. It is referred to as a pragmatic language disorder. It may not show up with standard tests of language. A speech and language clinician can detect it by observing how a child uses language in her day-to-day activities.

Are there other tests for ADHD?

You may have heard theories about other tests for ADHD. There are no other proven tests for ADHD at this time.

Many theories have been presented, but studies have shown that the following tests have little value in diagnosing an individual child:

- Screening for high lead levels in the blood
- Screening for thyroid problems
- Computerized continuous performance tests
- Brain imaging studies such as CAT scans, MRIs, etc
- Electroencephalogram (EEG) or brain-wave test

While these tests are not helpful in diagnosing ADHD, your pediatrician may see other signs or symptoms in your child that warrant blood tests, brain imaging studies, or an EEG.

What causes ADHD?

ADHD is one of the most studied conditions of childhood, but ADHD may be caused by a number of things.

Research to date has shown

- ADHD is a neurobiological condition whose symptoms are also dependent on the child's environment.
- A lower level of activity in the parts of the brain that control attention and activity level may be associated with ADHD.
- ADHD frequently runs in families. Sometimes a parent is diagnosed with ADHD at the same time as the child.
- In very rare cases, toxins in the environment may lead to ADHD. For instance, lead in the body can affect child development and behavior. Lead may be found in many places, including homes built before 1978 when lead was added to paint.
- Significant head injuries may cause ADHD in some cases.
- Prematurity increases the risk of developing ADHD.
- Prenatal exposures, such as alcohol or nicotine from smoking, increase the risk of developing ADHD.

There is little evidence that ADHD is caused by

- Eating too much sugar
- Food additives
- Allergies
- Immunizations

Treatment

Once the diagnosis is confirmed, the outlook for most children who receive treatment for ADHD is encouraging. There is no specific cure for ADHD, but there are many treatment options available.

Each child's treatment must be tailored to meet his individual needs. In most cases, treatment for ADHD should include

- A long-term management plan with
  - Target outcomes for behavior
  - Follow-up activities
  - Monitoring
- Education about ADHD
- Teamwork among doctors, parents, teachers, caregivers, other health care professionals, and the child
- Medication
- Behavior therapy including parent training
- Individual and family counseling

Treatment for ADHD uses the same principles that are used to treat other chronic conditions like asthma or diabetes. Long-term planning is needed because these conditions are not cured. Families must manage them on an ongoing basis. In the case of ADHD, schools and other caregivers must also be involved in managing the condition.

Educating the people involved about ADHD is a key part of treating your child. As a parent, you will need to learn about ADHD. Read about the condition and talk to people who understand it. This will help you manage the ways ADHD affects your child and your family on a day-to-day basis. It will also help your child learn to help himself.

Setting target outcomes

At the beginning of treatment, your pediatrician should help you set around 3 target outcomes (goals) for your child's behavior. These target outcomes will guide the treatment plan. Your child's target outcomes should focus on helping her function as well as possible at home, at school, and in your community. You need to identify what behaviors are most preventing your child from success.

The following are examples of target outcomes:

- Improved relationships with parents, siblings, teachers, and friends (eg, fewer arguments with brothers or sisters or being invited more frequently to friends' houses or parties)
- Better schoolwork (eg, completing class work or homework assignments)
- More independence in self-care or homework (eg, getting ready for school in the morning without supervision)
- Improved self-esteem (eg, increase in feeling that she can get her work done)
- Fewer disruptive behaviors (eg, decrease in the number of times she refuses to obey rules)
- Safer behavior in the community (eg, when crossing streets)

The target outcomes should be

- Realistic
- Something your child will be able to do
- Behaviors that you can observe and count (eg, with rating scales)

Your child's treatment plan will be set up to help her achieve these goals.

Medication

For most children, stimulant medications are a safe and effective way to relieve ADHD symptoms. As glasses help people focus their eyes to see, these medications help children with ADHD focus their thoughts better and ignore distractions. This makes them more able to pay attention and control their behavior.

Stimulants may be used alone or combined with behavior therapy. Studies show that about 80% of children with ADHD who are treated with stimulants improve a great deal once the right medication and dose are determined.

Two forms of stimulants are available: immediate-release (short-acting) and extended-release (intermediate-acting and long-acting). (See Table 2.) Immediate-release medications usually are taken every 4 hours, when needed. They are the cheapest of the medications. Extended-release medications usually are taken once in the morning.

Children who use extended-release forms of stimulants can avoid taking medication at school or after school. It is important not to chew or crush extended-release capsules or tablets. However, extended-release capsules that are made up of beads can be opened and sprinkled on food for children who have difficulties swallowing tablets or capsules.

There are 2 newer medications that have been approved by the Food and Drug Administration (FDA) that are non-stimulants. Non-stimulants can be tried when stimulant medications don't work or cause bothersome side effects.

Which medication is best for my child?

It may take some time to find the best medication, dosage, and schedule for your child.

Your child may need to try different types of stimulants or other medication. Some children respond to one type of stimulant but not another.

Table 2. Common medications

Type of medication	Brand name	Generic name	Duration
Short-acting amphetamine stimulants	Adderall	Mixed amphetamine salts	4 to 6 hours
	Dexedrine	Dextroamphetamine	4 to 6 hours
	Dextrostat	Dextroamphetamine	4 to 6 hours
Short-acting methylphenidate stimulants	Focalin	Dexmethylphenidate	4 to 6 hours
	Methylin	Methylphenidate (tablet, liquid, and chewable tablets)	3 to 5 hours
	Ritalin	Methylphenidate	3 to 5 hours
Intermediate-acting methylphenidate stimulants	Metadate CD	Extended-release methylphenidate	6 to 8 hours
	Ritalin LA	Extended-release methylphenidate	6 to 8 hours
Long-acting amphetamine stimulants	Adderall-XR	Extended-release amphetamine	10 to 12 hours
	Dexedrine Spansule	Extended-release amphetamine	6+ hours
	Vyvanse	Lisdexamfetamine	10 to 12 hours
Long-acting methylphenidate stimulants	Concerta	Extended-release methylphenidate	10 to 12 hours
	Daytrana	Extended-release methylphenidate (skin patch)	11 to 12 hours
	Focalin XR	Extended-release dexmethylphenidate	8 to 12 hours
Long-acting non-stimulants	Intuniv	Guanfacine	24 hours
	Strattera	Atomoxetine	24 hours

Products are mentioned for informational purposes only and do not imply an endorsement by the American Academy of Pediatrics. Your doctor or pharmacist can provide you with important safety information for the products listed.

The amount of medication (dosage) that your child needs also may need to be adjusted. The dosage is not based solely on his weight. Your pediatrician will vary the dosage over time to get the best results and control possible side effects.

The medication schedule also may be adjusted depending on the target outcome. For example, if the goal is to get relief from symptoms mostly at school, your child may take the medication only on school days.

It is important for your child to have regular medical checkups to monitor how well the medication is working and check for possible side effects.

What side effects can stimulants cause?

Side effects occur sometimes. These tend to happen early in treatment and are usually mild and short-lived, but in rare cases can be prolonged or more severe.

The most common side effects include

- Decreased appetite/weight loss
- Sleep problems
- Social withdrawal

Some less common side effects include

- Rebound effect (increased activity or a bad mood as the medication wears off)
- Transient muscle movements or sounds called tics
- Minor growth delay

Very rare side effects include

- Significant increase in blood pressure or heart rate
- Bizarre behaviors

The same sleep problems do not exist for atomoxetine, but initially it may make your child sleepy or upset her stomach. There have been very rare cases of atomoxetine needing to be stopped because it was causing liver damage. Rarely atomoxetine increased thoughts of suicide. Guanfacine can cause drowsiness, fatigue, or a decrease in blood pressure.

More than half of children who have tic disorders, such as Tourette syndrome, also have ADHD. Tourette syndrome is an inherited condition associated with frequent tics and unusual vocal sounds. The effect of stimulants on tics is not predictable, although most studies indicate that stimulants are safe for children with ADHD and tic disorders in most cases. It is also possible to use atomoxetine or guanfacine for children with ADHD and Tourette syndrome. Most side effects can be relieved by

- Changing the medication dosage
- Adjusting the schedule of medication
- Using a different stimulant or trying a non-stimulant (See Table 2.)

Close contact with your pediatrician is required until you find the best medication and dose for your child. After that, periodic monitoring by your doctor is important to maintain the best effects. To monitor the effects of the medication, your pediatrician will probably have you and your child's teacher(s) fill out behavior rating scales; observe changes in your child's target goals; notice any side effects; and monitor your child's height, weight, pulse, and blood pressure.

Stimulants, atomoxetine, and guanfacine may not be an option for children who are taking certain other medications or who have some medical conditions, such as congenital heart disease.

Behavior therapy

Most experts recommend using both medication and behavior therapy to treat ADHD. This is known as a multimodal treatment approach.

There are many forms of behavior therapy, but all have a common goal—to change the child's physical and social environments to help the child improve his behavior.

Under this approach, parents, teachers, and other caregivers learn better ways to work with and relate to the child with ADHD. You will learn how to set and enforce rules, help your child understand what he needs to do, use discipline effectively, and encourage good behavior. Your child will learn better ways to control his behavior as a result. You will learn how to be more consistent.

Table 3 shows specific behavior therapy techniques that can be effective with children with ADHD.

Behavior therapy recognizes the limits that having ADHD puts on a child. It focuses on how the important people and places in the child's life can adapt to encourage good behavior and discourage unwanted behavior. It is different from play therapy or other therapies that focus mainly on the child and his emotions.

Principles for behavior therapy

Behavior therapy has 3 basic principles.

1. **Set specific doable goals.** Set clear and reasonable goals for your child, such as staying focused on homework for a certain time or sharing toys with friends.
2. **Provide rewards and consequences.** Give your child a specified reward (positive reinforcement) every time she shows the desired behavior. Give your child a consequence (unwanted result or punishment) consistently when she has inappropriate behaviors.
3. **Keep using the rewards and consequences.** Using the rewards and consequences consistently for a long time will shape your child's behavior in a positive way.

How can I help my child control her behavior?

As the child's primary caregivers, parents play a major role in behavior therapy. Parent training is available to help you learn more about ADHD and specific, positive ways to respond to ADHD-type behaviors. This will help your child improve. In many cases parenting classes with other parents will be sufficient, but with more challenging children, individual work with a counselor/coach may be needed.

Taking care of yourself also will help your child. Being the parent of a child with ADHD can be tiring and trying. It can test the limits of even the best parents. Parent training and support groups made up of other families who are dealing with ADHD can be a great source of help. Learn stress-management techniques to help you respond calmly to your child. Seek counseling if you feel overwhelmed or hopeless.

Ask your pediatrician to help you find parent training, counseling, and support groups in your community. Additional resources are listed at the end of this publication.

Table 3. Behavior therapy techniques

Technique	Description	Example
Positive reinforcement	Complimenting and providing rewards or privileges in response to desired behavior.	Child completes an assignment and is permitted to play on the computer.
Time-out	Removing access to desired activity because of unwanted behavior.	Child hits sibling and, as a result, must sit for 5 minutes in the corner of the room.
Response cost	Withdrawing rewards or privileges because of unwanted behavior.	Child loses free-time privileges for not completing homework.
Token economy	Combining reward and consequence. Child earns rewards and privileges when performing desired behaviors. She loses the rewards and privileges as a result of unwanted behavior.	Child earns stars or points for completing assignments and loses stars for getting out of seat. The child cashes in the sum of her stars at the end of the week for a prize.

How can my child's school help?

Your child's school is a key partner in providing effective behavior therapy for your child. In fact, these principles work well in the classroom for most students.

Classroom management techniques may include

- Keeping a set routine and schedule for activities
- Using a system of clear rewards and consequences, such as a point system or token economy (See Table 3.)
- Sending daily or weekly report cards or behavior charts to parents to inform them about the child's progress
- Seating the child near the teacher
- Using small groups for activities
- Encouraging students to pause a moment before answering questions
- Keeping assignments short or breaking them into sections
- Close supervision with frequent, positive cues to stay on task
- Changes to where and how tests are given so students can succeed (For example, allowing students to take tests in a less distracting environment or allowing more time to complete tests.)

Tips for helping your child control his behavior

- **Keep your child on a daily schedule.** Try to keep the time that your child wakes up, eats, bathes, leaves for school, and goes to sleep the same each day.
- **Cut down on distractions.** Loud music, computer games, and TV can be overstimulating to your child. Make it a rule to keep the TV or music off during mealtime and while your child is doing homework. Don't place a TV in your child's bedroom. Whenever possible, avoid taking your child to places that may be too stimulating, like busy shopping malls.
- **Organize your house.** If your child has specific and logical places to keep his schoolwork, toys, and clothes, he is less likely to lose them. Save a spot near the front door for his school backpack so he can grab it on the way out the door.
- **Reward positive behavior.** Offer kind words, hugs, or small prizes for reaching goals in a timely manner or good behavior. Praise and reward your child's efforts to pay attention.
- **Set small, reachable goals.** Aim for slow progress rather than instant results. Be sure that your child understands that he can take small steps toward learning to control himself.
- **Help your child stay "on task."** Use charts and checklists to track progress with homework or chores. Keep instructions brief. Offer frequent, friendly reminders.
- **Limit choices.** Help your child learn to make good decisions by giving him only 2 or 3 options at a time.
- **Find activities at which your child can succeed.** All children need to experience success to feel good about themselves.
- **Use calm discipline.** Use consequences such as time-out, removing the child from the situation, or distraction. Sometimes it is best to simply ignore the behavior. Physical punishment, such as spanking or slapping, is *not* helpful. Discuss your child's behavior with him when both of you are calm.
- **Develop a good communication system with your child's teacher** so that you can coordinate your efforts and monitor your child's progress.

Your child's school should work with you and your pediatrician to develop strategies to assist your child in the classroom. When a child has ADHD that is severe enough to interfere with her ability to learn, 2 federal laws offer help. These laws require public schools to cover the costs of evaluating the educational needs of the affected child and providing the needed services.

1. The Individuals with Disabilities Education Act, Part B (IDEA) requires public schools to cover the costs of evaluating the educational needs of the affected child and providing the needed special education services if your child qualifies because her learning is impaired by his ADHD.
2. Section 504 of the Rehabilitation Act of 1973 does not have strict qualification criteria but is limited to changes in the classroom and modifications in homework assignments and taking tests in a less distracting environment or allowing more time to complete tests.

If your child has ADHD and a coexisting condition, she may need additional special services such as a classroom aide, private tutoring, special classroom settings or, in rare cases, a special school.

It is important to remember that once diagnosed and treated, children with ADHD are more likely to achieve their goals in school.

Keeping the treatment plan on track

Ongoing monitoring of your child's behavior and medications is required to find out if the treatment plan is working. Office visits, phone conversations, behavior checklists, written reports from teachers, and behavior report cards are common tools for following the child's progress.

Treatment plans for ADHD usually require long-term efforts on the part of families and schools. Medication schedules may be complex. Behavior therapies require education and patience. Sometimes it can be hard for everyone to stick with it. Your efforts play an important part in building a healthy future for your child.

Ask your pediatrician to help you find ways to keep your child's treatment plan on track.

What if my child does not reach his target outcomes?

Most school-aged children with ADHD respond well when their treatment plan includes both medication and behavior therapy. If your child is not achieving his goals, your pediatrician will assess the following factors:

- Were the target outcomes realistic?
- Is more information needed about the child's behavior?
- Is the diagnosis correct?
- Is another condition hindering treatment?
- Is the treatment plan being followed?
- Has the treatment failed?

While treatment for ADHD should improve your child's behavior, **it may not completely eliminate the symptoms** of inattention, hyperactivity, and impulsivity. Children who are being treated successfully may still have trouble with their friends or schoolwork.

However, if your child clearly is not meeting his specific target outcomes, your pediatrician will need to reassess the treatment plan.

Unproven treatments

You may have heard media reports or seen advertisements for "miracle cures" for ADHD. Carefully research any such claims. Consider whether the source of the information is valid. At this time, there is no scientifically proven cure for this condition.

The following methods **need more scientific evidence to prove that they work**:

- Megavitamins and mineral supplements
- Anti–motion-sickness medication (to treat the inner ear)
- Treatment for candida yeast infection
- EEG biofeedback (training to increase brain-wave activity)
- Applied kinesiology (realigning bones in the skull)
- Reducing sugar consumption
- Optometric vision training (asserts that faulty eye movement and sensitivities cause the behavior problems)

Always tell your pediatrician about any alternative therapies, supplements, or medications that your child is using. These may interact with prescribed medications and harm your child.

Will there be a cure for ADHD soon?

While there are no signs of a cure at this time, research is ongoing to learn more about the role of the brain in ADHD and the best ways to treat the disorder. Additional research is looking at the long-term outcomes for people with ADHD.

Frequently asked questions

Will my child outgrow ADHD?

ADHD continues into adulthood in most cases. However, by developing their strengths, structuring their environments, and using medication when needed, adults with ADHD can lead very productive lives. In some careers, having a high-energy behavior pattern can be an asset.

Why do so many children have ADHD?

The number of children who are being treated for ADHD has risen. It is not clear whether more children have ADHD or more children are being diagnosed with ADHD. Also, more children with ADHD are being treated for a longer period. ADHD is now one of the most common and most studied conditions of childhood. Because of more awareness and better ways of diagnosing and treating this disorder, more children are being helped. It may also be the case that school performance has become more important because of the higher technical demand of many jobs, and ADHD frequently interferes with school functioning.

Are schools putting children on ADHD medication?

Teachers are often the first to notice behavior signs of possible ADHD. However, only physicians can prescribe medications to treat ADHD. The diagnosis of ADHD should follow a careful process.

Are children getting high on stimulant medications?

When taken as directed by a doctor, there is no evidence that children are getting high on stimulant drugs such as methylphenidate and amphetamine. At therapeutic doses, these drugs also do not sedate or tranquilize children and do not increase the risk of addiction.

Stimulants are classified as Schedule II drugs by the US Drug Enforcement Administration because there is abuse potential of this class of medication. If your child is on medication, it is always best to supervise the use of the medication closely. Atomoxetine and guanfacine are not Schedule II drugs because they don't have abuse potential, even in adults.

Teenagers with ADHD

The teenage years can be a special challenge. Academic and social demands increase. In some cases, symptoms may be better controlled as the child grows older; however, frequently the demands for performance also increase so that in most cases, ADHD symptoms persist and continue to interfere with their ability to function adequately. According to the National Institute of Mental Health, about 80% of those who required medication for ADHD as children still need it as teenagers.

Parents play an important role in helping teenagers become independent. Encourage your teenager to help herself with strategies such as

- Using a daily planner for assignments and appointments
- Making lists
- Keeping a routine
- Setting aside a quiet time and place to do homework
- Organizing storage for school supplies, clothes, CDs, sports equipment, etc
- Being safety conscious (eg, always wearing seat belts, using protective gear for sports)
- Talking about problems with someone she trusts
- Getting enough sleep
- Understanding her increased risk of abusing substances such as tobacco and alcohol

Activities such as sports, drama, and debate teams can be good places to channel excess energy and develop friendships. Find what your teenager does well and support her efforts to "go for it."

Milestones such as learning to drive and dating offer new freedom and risks. Parents must stay involved and set limits for safety. Your child's ADHD increases her risk of incurring traffic violations and accidents.

It remains important for parents of teenagers to keep in touch with teachers and make sure that their teenager's schoolwork is going well.

Talk with your pediatrician if your teenager shows signs of severe problems such as depression, drug abuse, or gang-related activities.

Are stimulant medications "gateway" drugs leading to illegal drug or alcohol abuse?

People with ADHD are naturally impulsive and tend to take risks. But those patients with ADHD who are taking stimulants are not at greater risk and actually may be at a lower risk of using other drugs. Children and teenagers who have ADHD and also have coexisting conditions may be at higher risk for drug and alcohol abuse, regardless of the medication used.

Resources

The following is a list of support groups and additional resources for further information about ADHD. Check with your pediatrician for resources in your community.

National Resource Center on AD/HD
www.help4adhd.org/

Children and Adults with Attention-Deficit/Hyperactivity Disorder (CHADD)
800/233-4050
www.chadd.org

Attention Deficit Disorder Association
856/439-9099
www.add.org

National Dissemination Center for Children with Disabilities
800/695-0285
www.nichcy.org

National Institute of Mental Health
866/615-6464
www.nimh.nih.gov

National Tourette Syndrome Association, Inc
800/237-0717
www.tsa-usa.org

Inclusion on this list does not imply an endorsement by the American Academy of Pediatrics (AAP). The AAP is not responsible for the content of the resources mentioned above. Phone numbers and Web site addresses are as current as possible, but may change at any time.

Products are mentioned for informational purposes only and do not imply an endorsement by the American Academy of Pediatrics.

The information contained in this publication should not be used as a substitute for the medical care and advice of your pediatrician. There may be variations in treatment that your pediatrician may recommend based on individual facts and circumstances

From your doctor

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

medicines for ADHD questions from teens who have ADHD

Q: What can I do besides taking medicines?

A: Medicines and behavior therapies are the only treatments that have been shown by scientific studies to work consistently for ADHD symptoms. Medicines are prescribed by a doctor, while behavior therapies usually are done with a trained counselor in behavior treatment. These 2 treatments are probably best used together, but you might be able to do well with one or the other. You can't rely on other treatments such as biofeedback, allergy treatments, special diets, vision training, or chiropractic because there isn't enough evidence that shows they work.

Counseling may help you learn how to cope with some issues you may face. And there are things you can do to help yourself. For example, things that may help you stay focused include using a daily planner for schoolwork and other activities, making to-do lists, and even getting enough sleep. Counseling can help you find an organization system or a checklist.

Q: How can medicines help me?

A: There are several different ADHD medicines. They work by causing the brain to have more *neurotransmitters* in the right places. Neurotransmitters are chemicals in the brain that help us focus our attention, control our impulses, organize and plan, and stick to routines. Medicines for ADHD can help you focus your thoughts and ignore distractions so that you can reach your full potential. They also can help you control your emotions and behavior. Check with your doctor to learn more about this.

Q: Are medicines safe?

A: For most teens with ADHD, stimulant medicines are safe and effective if taken as recommended. However, like most medicines, there could be side effects. Luckily, the side effects tend to happen early on, are usually mild, and don't last too long. If you have any side effects, tell your doctor. Changes may need to be made in your medicines or their dosages.

- **Most common side effects** include decreased appetite or weight loss, problems falling asleep, headaches, jitteriness, and stomachaches.
- **Less common side effects** include a bad mood as medicines wear off (called the rebound effect) and facial twitches or tics.

Q: Will medicines change my personality?

A: Medicines won't change who you are and should not change your personality. If you notice changes in your mood or personality, tell your doctor. Occasionally when medicines wear off, some teens become more irritable for a short time. An adjustment of the medicines by your doctor may be helpful.

Q: Will medicines affect my growth?

A: Medicines will not keep you from growing. Significant growth delay is a very rare side effect of some medicines prescribed for ADHD. Most scientific studies show that taking these medicines has little to no long-term effect on growth in most cases.

Q: Do I need to take medicines at school?

A: There are 3 types of medicines used for teens with ADHD: ***short acting*** (immediate release), ***intermediate acting,*** and ***long acting.*** You can avoid taking medicines at school if you take the intermediate- or long-acting kind. Long-acting medicines usually are taken once in the morning or evening. Short-acting medicines usually are taken every 4 hours.

Q: Does taking medicines make me a drug user?

A: No! Although you may need medicines to help you stay in control of your behavior, medicines used to treat ADHD do not lead to drug abuse. In fact, taking medicines as prescribed by your doctor and doing better in school may help you avoid drug use and abuse. (But never give or share your medicines with anyone else.)

Q: Will I have to take medicines forever?

A: In most cases, ADHD continues later in life. Whether you need to keep taking medicines as an adult depends on your own needs. The need for medicines may change over time. Many adults with ADHD have learned how to succeed in life without medicines by using behavior therapies or finding jobs that suit their strengths and weaknesses.

The persons whose photographs are depicted in this publication are professional models. They have no relation to the issues discussed. Any characters they are portraying are fictional.

The information contained in this publication should not be used as a substitute for the medical care and advice of your pediatrician. There may be variations in treatment that your pediatrician may recommend based on individual facts and circumstances.

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what is ADHD? questions from teens

Attention-deficit/hyperactivity disorder (ADHD) is a condition of the brain that makes it difficult for people to concentrate or pay attention in certain areas where it is easy for others, like school or homework. The following are quick answers to some common questions:

Q: What causes ADHD?

A: There isn't just one cause. Research shows that

- ADHD is a medical condition caused by small changes in how the brain works. It seems to be related to 2 chemicals in your brain called *dopamine* and *norepinephrine.* These chemicals help send messages between nerve cells in the brain—especially those areas of the brain that control attention and activity level.
- ADHD most often runs in families.
- In a few people with ADHD, being born prematurely or being exposed to alcohol during the pregnancy can contribute to ADHD.
- Immunizations and eating too much sugar do NOT cause ADHD. And there isn't enough evidence that shows allergies and food additives cause ADHD.

Q: How can you tell if someone has ADHD?

A: You can't tell if someone has ADHD just by looks. People with ADHD don't look any different, but how they act may make them stand out from the crowd. Some people with ADHD are very hyperactive (they move around a lot and are not able to sit still) and have behavior problems that are obvious to everyone. Other people with ADHD are quiet and more laid back on the outside, but on the inside struggle with attention to schoolwork and other tasks. They are distracted by people and things around them when they try to study; they may have trouble organizing schoolwork or forget to turn in assignments.

Q: Can ADHD cause someone to act up or get in trouble?

A: Having ADHD can cause you to struggle in school or have problems controlling your behavior. Some people may say or think that your struggles and problems are because you are bad, lazy, or not smart. But they're wrong. It's important that you get help so your impulses don't get you into serious trouble.

Q: Don't little kids who have ADHD outgrow it by the time they are teens?

A: Often kids with the hyperactive kind of ADHD get less hyperactive as they get into their teens, but usually they still have a lot of difficulty paying attention, remembering what they have read, and getting their work done. They may or may not have other behavior problems. Some kids with ADHD have never been hyperactive at all, but usually their attention problems also continue into their teens.

Q: If I have trouble with homework or tests, do I have ADHD?

A: There could be many reasons why a student struggles with schoolwork and tests. ADHD could be one reason. It may or may not be, but your doctor is the best person to say for sure. Kids with ADHD often say it's hard to concentrate, focus on a task (for example, schoolwork, chores, or a job), manage their time, and finish tasks. This could explain why they may have trouble with schoolwork and tests. Whatever the problem, there are many people willing to help you. You need to find the approach that works best for you.

Q: Does having ADHD mean a person is not very smart?

A: Absolutely not! People who have trouble paying attention may have problems in school, but that doesn't mean they're not smart. In fact, some people with ADHD are very smart, but may not be able to reach their potential in school until they get treatment.

ADHD is a common problem. Teens with ADHD have the potential to do well in school and live a normal life with the right treatment.

Q: Is ADHD more common in boys?

A: More boys than girls are diagnosed with ADHD—about 2 or 3 boys to every 1 girl. However, these numbers do not include the number of girls with the inattentive type of ADHD who are not diagnosed. Girls with the inattentive type of ADHD tend to be overlooked entirely or do not attract attention until they are older.

Q: What do I do if I think I have ADHD?

A: Don't be afraid to talk with your parents or other adults that you trust. Together you can meet with your doctor and find out if you really have ADHD. If you do, your doctor will help you learn how to live with ADHD and find ways to deal with your condition.

From your doctor

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Diagnosis and Management of Bronchiolitis

- *Clinical Practice Guideline*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 2 for more information.

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CLINICAL PRACTICE GUIDELINE

Diagnosis and Management of Bronchiolitis

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Subcommittee on Diagnosis and Management of Bronchiolitis

Endorsed by the American Academy of Family Physicians, the American College of Chest Physicians, and the American Thoracic Society.

ABSTRACT

Bronchiolitis is a disorder most commonly caused in infants by viral lower respiratory tract infection. It is the most common lower respiratory infection in this age group. It is characterized by acute inflammation, edema, and necrosis of epithelial cells lining small airways, increased mucus production, and bronchospasm.

The American Academy of Pediatrics convened a committee composed of primary care physicians and specialists in the fields of pulmonology, infectious disease, emergency medicine, epidemiology, and medical informatics. The committee partnered with the Agency for Healthcare Research and Quality and the RTI International-University of North Carolina Evidence-Based Practice Center to develop a comprehensive review of the evidence-based literature related to the diagnosis, management, and prevention of bronchiolitis. The resulting evidence report and other sources of data were used to formulate clinical practice guideline recommendations.

This guideline addresses the diagnosis of bronchiolitis as well as various therapeutic interventions including bronchodilators, corticosteroids, antiviral and antibacterial agents, hydration, chest physiotherapy, and oxygen. Recommendations are made for prevention of respiratory syncytial virus infection with palivizumab and the control of nosocomial spread of infection. Decisions were made on the basis of a systematic grading of the quality of evidence and strength of recommendation. The clinical practice guideline underwent comprehensive peer review before it was approved by the American Academy of Pediatrics.

This clinical practice guideline is not intended as a sole source of guidance in the management of children with bronchiolitis. Rather, it is intended to assist clinicians in decision-making. It is not intended to replace clinical judgment or establish a protocol for the care of all children with this condition. These recommendations may not provide the only appropriate approach to the management of children with bronchiolitis.

INTRODUCTION

THIS GUIDELINE EXAMINES the published evidence on diagnosis and acute management of the child with bronchiolitis in both outpatient and hospital settings, including the roles of supportive therapy, oxygen, bronchodilators, antiinflammatory agents, antibacterial agents, and antiviral agents and make recommendations to influence clinician behavior on the basis of the evidence. Methods of prevention

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All clinical practice guidelines from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

The recommendations in this guideline do not indicate an exclusive course of treatment or serve as a standard of care. Variations, taking into account individual circumstances, may be appropriate.

Key Word
bronchiolitis

Abbreviations
CAM— complementary and alternative medicine
LRTI—lower respiratory tract infection
AHRQ—Agency for Healthcare Research and Quality
RSV—respiratory syncytial virus
AAP—American Academy of Pediatrics
AAFP—American Academy of Family Physicians
RCT—randomized, controlled trial
CLD— chronic neonatal lung disease
SBI—serious bacterial infection
UTI— urinary tract infection
AOM—acute otitis media
Spo_2— oxyhemoglobin saturation
LRTD—lower respiratory tract disease

are reviewed, as is the potential role of complementary and alternative medicine (CAM).

The goal of this guideline is to provide an evidence-based approach to the diagnosis, management, and prevention of bronchiolitis in children from 1 month to 2 years of age. The guideline is intended for pediatricians, family physicians, emergency medicine specialists, hospitalists, nurse practitioners, and physician assistants who care for these children. The guideline does not apply to children with immunodeficiencies including HIV, organ or bone marrow transplants, or congenital immunodeficiencies. Children with underlying respiratory illnesses such as chronic neonatal lung disease (CLD; also known as bronchopulmonary dysplasia) and those with significant congenital heart disease are excluded from the sections on management unless otherwise noted but are included in the discussion of prevention. This guideline will not address long-term sequelae of bronchiolitis, such as recurrent wheezing, which is a field with distinct literature of its own.

Bronchiolitis is a disorder most commonly caused in infants by viral lower respiratory tract infection (LRTI). It is the most common lower respiratory infection in this age group. It is characterized by acute inflammation, edema and necrosis of epithelial cells lining small airways, increased mucus production, and bronchospasm. Signs and symptoms are typically rhinitis, tachypnea, wheezing, cough, crackles, use of accessory muscles, and/or nasal flaring.[1] Many viruses cause the same constellation of symptoms and signs. The most common etiology is the respiratory syncytial virus (RSV), with the highest incidence of RSV infection occurring between December and March.[2] Ninety percent of children are infected with RSV in the first 2 years of life,[3] and up to 40% of them will have lower respiratory infection.[4,5] Infection with RSV does not grant permanent or long-term immunity. Reinfections are common and may be experienced throughout life.[6] Other viruses identified as causing bronchiolitis are human metapneumovirus, influenza, adenovirus, and parainfluenza. RSV infection leads to more than 90 000 hospitalizations annually. Mortality resulting from RSV has decreased from 4500 deaths annually in 1985 in the United States[2,6] to an estimated 510 RSV-associated deaths in 1997[6] and 390 in 1999.[7] The cost of hospitalization for bronchiolitis in children less than 1 year old is estimated to be more than $700 million per year.[8]

Several studies have shown a wide variation in how bronchiolitis is diagnosed and treated. Studies in the United States,[9] Canada,[10] and the Netherlands[11] showed variations that correlated more with hospital or individual preferences than with patient severity. In addition, length of hospitalization in some countries averages twice that of others.[12] This variable pattern suggests a lack of consensus among clinicians as to best practices.

In addition to morbidity and mortality during the acute illness, infants hospitalized with bronchiolitis are more likely to have respiratory problems as older children, especially recurrent wheezing, compared with those who did not have severe disease.[13–15] Severe disease is characterized by persistently increased respiratory effort, apnea, or the need for intravenous hydration, supplemental oxygen, or mechanical ventilation. It is unclear whether severe viral illness early in life predisposes children to develop recurrent wheezing or if infants who experience severe bronchiolitis have an underlying predisposition to recurrent wheezing.

METHODS

To develop the clinical practice guideline on the diagnosis and management of bronchiolitis, the American Academy of Pediatrics (AAP) convened the Subcommittee on Diagnosis and Management of Bronchiolitis with the support of the American Academy of Family Physicians (AAFP), the American Thoracic Society, the American College of Chest Physicians, and the European Respiratory Society. The subcommittee was chaired by a primary care pediatrician with expertise in clinical pulmonology and included experts in the fields of general pediatrics, pulmonology, infectious disease, emergency medicine, epidemiology, and medical informatics. All panel members reviewed the AAP Policy on Conflict of Interest and Voluntary Disclosure and were given an opportunity to declare any potential conflicts.

The AAP and AAFP partnered with the AHRQ and the RTI International-University of North Carolina Evidence-Based Practice Center (EPC) to develop an evidence report, which served as a major source of information for these practice guideline recommendations.[1] Specific clinical questions addressed in the AHRQ evidence report were the (1) effectiveness of diagnostic tools for diagnosing bronchiolitis in infants and children, (2) efficacy of pharmaceutical therapies for treatment of bronchiolitis, (3) role of prophylaxis in prevention of bronchiolitis, and (4) cost-effectiveness of prophylaxis for management of bronchiolitis. EPC project staff searched Medline, the Cochrane Collaboration, and the Health Economics Database. Additional articles were identified by review of reference lists of relevant articles and ongoing studies recommended by a technical expert advisory group. To answer the question on diagnosis, both prospective studies and randomized, controlled trials (RCTs) were used. For questions related to treatment and prophylaxis in the AHRQ report, only RCTs were considered. For the cost-effectiveness of prophylaxis, studies that used economic analysis were reviewed. For all studies, key inclusion criteria included outcomes that were both clinically relevant and able to be abstracted. Initially, 744 abstracts were identified for possible inclusion, of which 83 were retained for systematic review. Results of the literature review were presented in evidence tables and published in the final evidence report.[1]

An additional literature search of Medline and the Cochrane Database of Systematic Reviews was performed in July 2004 by using search terms submitted by the members of the Subcommittee on the Diagnosis and Management of Bronchiolitis. The methodologic quality of the research was appraised by an epidemiologist before consideration by the subcommittee.

The evidence-based approach to guideline development requires that the evidence in support of a policy be identified, appraised, and summarized and that an explicit link between evidence and recommendations be defined. Evidence-based recommendations reflect the quality of evidence and the balance of benefit and harm that is anticipated when the recommendation is followed. The AAP policy statement "Classifying Recommendations for Clinical Practice Guidelines"[16] was followed in designating levels of recommendation (Fig 1; Table 1).

A draft version of this clinical practice guideline underwent extensive peer review by committees and sections within the AAP, American Thoracic Society, European Respiratory Society, American College of Chest Physicians, and AAFP, outside organizations, and other individuals identified by the subcommittee as experts in the field. Members of the subcommittee were invited to distribute the draft to other representatives and committees within their specialty organizations. The resulting comments were reviewed by the subcommittee and, when appropriate, incorporated into the guideline.

This clinical practice guideline is not intended as a sole source of guidance in the management of children with bronchiolitis. Rather, it is intended to assist clinicians in decision-making. It is not intended to replace clinical judgment or establish a protocol for the care of all children with this condition. These recommendations may not provide the only appropriate approach to the management of children with bronchiolitis.

All AAP guidelines are reviewed every 5 years.

Definitions used in the guideline are:

- Bronchiolitis: a disorder most commonly caused in infants by viral LRTI; it is the most common lower respiratory infection in this age group and is characterized by acute inflammation, edema and necrosis of epithelial cells lining small airways, increased mucus production, and bronchospasm.
- CLD, also known as bronchopulmonary dysplasia: an infant less than 32 weeks' gestation evaluated at 36 weeks' postmenstrual age or one of more than 32 weeks' gestation evaluated at more than 28 days but less than 56 days of age who has been receiving supplemental oxygen for more than 28 days.[17]
- Routine: a set of customary and often-performed procedures such as might be found in a routine admission order set for children with bronchiolitis.
- Severe disease: signs and symptoms associated with poor feeding and respiratory distress characterized by tachypnea, nasal flaring, and hypoxemia.
- Hemodynamically significant congenital heart disease: children with congenital heart disease who are receiving medication to control congestive heart failure, have moderate to severe pulmonary hypertension, or have cyanotic heart disease.

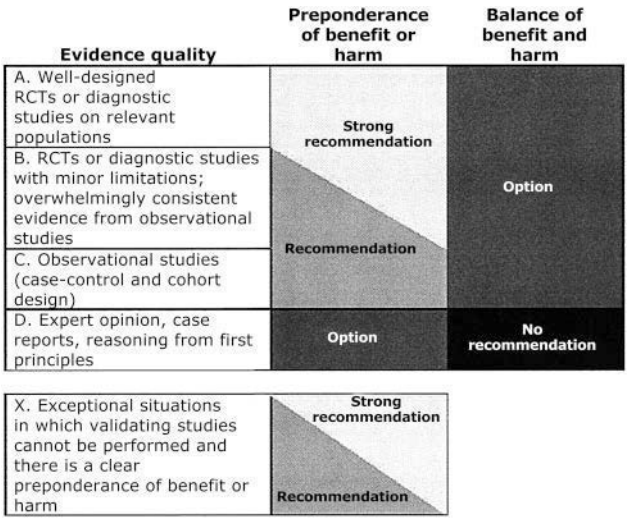

FIGURE 1
Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is carried out leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation.

RECOMMENDATION 1a

Clinicians should diagnose bronchiolitis and assess disease severity on the basis of history and physical examination. Clinicians should not routinely order laboratory and radiologic studies for diagnosis (recommendation: evidence level B; diagnostic studies with minor limitations and observational studies with consistent findings; preponderance of benefits over harms and cost).

RECOMMENDATION 1b

Clinicians should assess risk factors for severe disease such as age less than 12 weeks, a history of prematurity, underlying cardiopulmonary disease, or immunodeficiency when making decisions about evaluation and management of children with bronchiolitis (recommendation: evidence level B; observational studies with consistent findings; preponderance of benefits over harms).

The 2 goals in the history and physical examination of infants presenting with cough and/or wheeze, particularly in the winter season, are the differentiation of infants with probable bronchiolitis from those with other disorders and the estimation of the severity of illness. Most clinicians recognize bronchiolitis as a constellation of clinical symptoms and signs including a viral upper respiratory prodrome followed by increased respi-

TABLE 1 **Guideline Definitions for Evidence-Based Statements**

Statement	Definition	Implication
Strong recommendation	A strong recommendation in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms (as a strong recommendation against an action is made when the anticipated harms clearly exceed the benefits) and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendations may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A recommendation in favor of a particular action is made when the anticipated benefits exceed the harms but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high-quality evidence is impossible to obtain but the anticipated benefits outweigh the harms.	Clinicians would be prudent to follow a recommendation but should remain alert to new information and sensitive to patient preferences.
Option	Options define courses that may be taken when either the quality of evidence is suspect or carefully performed studies have shown little clear advantage to one approach over another.	Clinicians should consider the option in their decision-making, and patient preference may have a substantial role.
No recommendation	No recommendation indicates that there is a lack of pertinent published evidence and that the anticipated balance of benefits and harms is presently unclear.	Clinicians should be alert to new published evidence that clarifies the balance of benefit versus harm.

ratory effort and wheezing in children less than 2 years of age. Clinical signs and symptoms of bronchiolitis consist of rhinorrhea, cough, wheezing, tachypnea, and increased respiratory effort manifested as grunting, nasal flaring, and intercostal and/or subcostal retractions.

Respiratory rate in otherwise healthy children changes considerably over the first year of life, decreasing from a mean of approximately 50 breaths per minute in term newborns to approximately 40 breaths per minute at 6 months of age and 30 breaths per minute at 12 months.[18–20] Counting respiratory rate over the course of 1 minute may be more accurate than measurements extrapolated to 1 minute but observed for shorter periods.[21] The absence of tachypnea correlates with the lack of LRTIs or pneumonia (viral or bacterial) in infants.[22,23]

The course of bronchiolitis is variable and dynamic, ranging from transient events such as apnea or mucus plugging to progressive respiratory distress from lower airway obstruction. Important issues to assess include the impact of respiratory symptoms on feeding and hydration and the response, if any, to therapy. The ability of the family to care for the child and return for further care should be assessed. History of underlying conditions such as prematurity, cardiac or pulmonary disease, immunodeficiency, or previous episodes of wheezing should be identified.

The physical examination reflects the variability in the disease state and may require serial observations over time to fully assess the child's status. Upper airway obstruction may contribute to work of breathing. Nasal suctioning and positioning of the child may affect the assessment. Physical examination findings of importance include respiratory rate, increased work of breathing as evidenced by accessory muscle use or retractions, and auscultatory findings such as wheezes or crackles.

The evidence relating the presence of specific findings in the assessment of bronchiolitis to clinical outcomes is limited. Most studies are retrospective and lack valid and unbiased measurement of baseline and outcome variables. Most studies designed to identify the risk of severe adverse outcomes such as requirement for intensive care or mechanical ventilation have focused on inpatients.[24–26] These events are relatively rare among all children with bronchiolitis and limit the power of these studies to detect clinically important risk factors associated with disease progression.

Several studies have associated premature birth (less than 37 weeks) and young age of the child (less than 6–12 weeks) with an increased risk of severe disease.[26–28] Young infants with bronchiolitis may develop apnea, which has been associated with an increased risk for prolonged hospitalization, admission to intensive care, and mechanical ventilation.[26] Other underlying conditions that have been associated with an increased risk of progression to severe disease or mortality include hemodynamically significant congenital heart disease,[26,29] chronic lung disease (bronchopulmonary dysplasia, cystic fibrosis, congenital anomaly),[26] and the presence of an immunocompromised state.[26,30]

Findings on physical examination have been less consistently associated with outcomes of bronchiolitis. Tachypnea, defined as a respiratory rate of 70 or more breaths per minute, has been associated with increased risk for severe disease in some studies[24,27,31] but not oth-

ers.[32] An AHRQ report[1] found 43 of 52 treatment trials that used clinical scores, all of which included measures of respiratory rate, respiratory effort, severity of wheezing, and oxygenation. The lack of uniformity of scoring systems made comparison between studies difficult.[1] The most widely used clinical score, the Respiratory Distress Assessment Instrument,[33] is reliable with respect to scoring but has not been validated for clinical predictive value in bronchiolitis. None of the other clinical scores used in the various studies have been assessed for reliability and validity. Studies that have assessed other physical examination findings have not found clinically useful associations with outcomes.[27,32] The substantial temporal variability in physical findings as well as potential differences in response to therapy may account for this lack of association. Repeated observation over a period of time rather than a single examination may provide a more valid overall assessment.

Pulse oximetry has been rapidly adopted into clinical assessment of children with bronchiolitis on the basis of data suggesting that it can reliably detect hypoxemia that is not suspected on physical examination.[27,34] Few studies have assessed the effectiveness of pulse oximetry to predict clinical outcomes. Among inpatients, perceived need for supplemental oxygen that is based on pulse oximetry has been associated with higher risk of prolonged hospitalization, ICU admission, and mechanical ventilation.[24,26,35] Among outpatients, available evidence differs on whether mild reductions in pulse oximetry (less than 95% on room air) predict progression of disease or need for a return visit for care.[27,32]

Radiography may be useful when the hospitalized child does not improve at the expected rate, if the severity of disease requires further evaluation, or if another diagnosis is suspected. Although many infants with bronchiolitis have abnormalities that show on chest radiographs, data are insufficient to demonstrate that chest radiograph abnormalities correlate well with disease severity.[16] Two studies suggest that the presence of consolidation and atelectasis on a chest radiograph is associated with increased risk for severe disease.[26,27] One study showed no correlation between chest radiograph findings and baseline severity of disease.[36] In prospective studies including 1 randomized trial, children with suspected LRTI who received radiographs were more likely to receive antibiotics without any difference in time to recovery.[37,38] Current evidence does not support routine radiography in children with bronchiolitis.

The clinical utility of diagnostic testing in infants with suspected bronchiolitis is not well supported by evidence.[39–41] The occurrence of serious bacterial infections (SBIs; eg, urinary tract infections [UTIs], sepsis, meningitis) is very low.[42,43] The use of complete blood counts has not been shown to be useful in either diagnosing bronchiolitis or guiding its therapy.[1]

Virologic tests for RSV, if obtained during peak RSV season, demonstrate a high predictive value. However, the knowledge gained from such testing rarely alters management decisions or outcomes for the vast majority of children with clinically diagnosed bronchiolitis.[1] Virologic testing may be useful when cohorting of patients is feasible.

Evidence Profile 1a: Diagnosis

- Aggregate evidence quality: B; diagnostic studies with minor limitations and observational studies with consistent findings
- Benefit: cost saving, limitation of radiation and blood tests
- Harm: risk of misdiagnosis
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: recommendation

Evidence Profile 1b: Risk Factors

- Aggregate evidence quality: B; observational studies with consistent findings
- Benefit: improved care of patients with risk factors for severe disease
- Harm: increased costs, increased radiation and blood testing
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: recommendation

RECOMMENDATION 2a

Bronchodilators should not be used routinely in the management of bronchiolitis (recommendation: evidence level B; RCTs with limitations; preponderance of harm of use over benefit).

RECOMMENDATION 2b

A carefully monitored trial of α-adrenergic or β-adrenergic medication is an option. Inhaled bronchodilators should be continued only if there is a documented positive clinical response to the trial using an objective means of evaluation (option: evidence level B; RCTs with limitations and expert opinion; balance of benefit and harm).

The use of bronchodilator agents continues to be controversial. RCTs have failed to demonstrate a consistent benefit from α-adrenergic or β-adrenergic agents. Several studies and reviews have evaluated the use of bronchodilator medications for viral bronchiolitis. A Cochrane systematic review[44] found 8 RCTs involving 394 children.[33,45–50] Some of the studies included infants who had a history of previous wheezing. Several used agents other than albuterol/salbutamol or epinephrine/adrenaline (eg, ipratropium and metaproterenol). Overall, results of the meta-analysis indicated that, at most, 1 in 4

children treated with bronchodilators might have a transient improvement in clinical score of unclear clinical significance. This needs to be weighed against the potential adverse effects and cost of these agents and the fact that most children treated with bronchodilators will not benefit from their use. Studies assessing the impact of bronchodilators on long-term outcomes have found no impact on the overall course of the illness.[1,44,51]

Albuterol/Salbutamol

Some outpatient studies have demonstrated modest improvement in oxygen saturation and/or clinical scores. Schweich et al[52] and Schuh et al[53] evaluated clinical scores and oxygen saturation after 2 treatments of nebulized albuterol. Each study showed improvement in the clinical score and oxygen saturation shortly after completion of the treatment. Neither measured outcomes over time. Klassen et al[47] evaluated clinical score and oxygen saturation 30 and 60 minutes after a single salbutamol treatment. Clinical score, but not oxygen saturation, was significantly improved at 30 minutes, but no difference was demonstrated 60 minutes after a treatment. Gadomski et al[54] showed no difference between those in groups on albuterol or placebo after 2 nebulized treatments given 30 minutes apart.

Studies of inpatients have not shown a clinical change that would justify recommending albuterol for routine care. Dobson et al[55] conducted a randomized clinical trial in infants who were hospitalized with moderately severe viral bronchiolitis and failed to demonstrate clinical improvement resulting in enhanced recovery or an attenuation of the severity of illness. Two meta-analyses[1,56] could not directly compare inpatient studies of albuterol because of widely differing methodology. Overall, the studies reviewed did not show the use of albuterol in infants with bronchiolitis to be beneficial in shortening duration of illness or length of hospital stay.

Epinephrine/Adrenaline

The AHRQ evidence report[1] notes that the reviewed studies show that nebulized epinephrine has "some potential for being efficacious." In contrast, a later multicenter controlled trial by Wainwright et al[51] concluded that epinephrine did not impact the overall course of the illness as measured by hospital length of stay. Analysis of outpatient studies favors nebulized epinephrine over placebo in terms of clinical score, oxygen saturation, and respiratory rate at 60 minutes[57] and heart rate at 90 minutes.[58] However, the differences were small, and it could not be established that they are clinically significant in altering the course of the illness. One study[59] found significant improvement in airway resistance (but no change in oxygen need), suggesting that a trial of this agent may be reasonable for such infants.

Several studies have compared epinephrine to albuterol (salbutamol) or epinephrine to placebo. Racemic epinephrine has demonstrated slightly better clinical effect than albuterol. It is possible that the improvement is related to the α effect of the medication.[60] Hartling et al[61] performed a meta-analysis of studies comparing epinephrine to albuterol and also participated in the Cochrane review of epinephrine.[62] The Cochrane report concluded: "There is insufficient evidence to support the use of epinephrine for the treatment of bronchiolitis among inpatients. There is some evidence to suggest that epinephrine may be favorable to salbutamol (albuterol) and placebo among outpatients."

Although there is no evidence from RCTs to justify routine use of bronchodilators, clinical experience suggests that, in selected infants, there is an improvement in the clinical condition after bronchodilator administration.[47,52,53,57,58] It may be reasonable to administer a nebulized bronchodilator and evaluate clinical response. Individuals and institutions should assess the patient and document pretherapy and posttherapy changes using an objective means of evaluation. Some of the documentation tools that have been used can be found in articles by Alario et al,[45] Bierman and Pierson,[63] Gadomski et al,[54] Lowell et al,[33] Wainwright et al,[51] Schuh et al,[64] and Gorelick et al.[65] In addition, a documentation tool has been developed by Cincinnati Children's Hospital (Cincinnati, OH).[66]

Extrapolation from the studies discussed above suggests that epinephrine may be the preferred bronchodilator for this trial in the emergency department and in hospitalized patients. In the event that there is documented clinical improvement, there is justification for continuing the nebulized bronchodilator treatments. In the absence of a clinical response, the treatment should not be continued.

Because of a lack of studies, short duration of action, and potential adverse effects, epinephrine is usually not used in the home setting. Therefore, it would be more appropriate that a bronchodilator trial in the office or clinic setting use albuterol/salbutamol rather than racemic epinephrine. Parameters to measure its effectiveness include improvements in wheezing, respiratory rate, respiratory effort, and oxygen saturation.

Anticholinergic agents such as ipratropium have not been shown to alter the course of viral bronchiolitis. Although a minority of individual patients may show a positive clinical response to anticholinergic agents, studies have shown that the groups as a whole showed no significant improvement. At this point there is no justification for using anticholinergic agents, either alone or in combination with β-adrenergic agents, for viral bronchiolitis.[67–69]

Evidence Profile 2a: Routine Use of Bronchodilators

- Aggregate evidence quality: B; RCTs with limitations
- Benefit: short-term improvement in clinical symptoms

- Harm: adverse effects, cost of medications, cost to administer
- Benefits-harms assessment: preponderance of harm over benefit
- Policy level: recommendation

Evidence Profile 2b: Trial of Bronchodilators

- Aggregate evidence quality: B; RCTs with limitations
- Benefit: some patients with significant symptomatic improvement
- Harm: adverse effects, cost of medications, cost to administer
- Benefits-harms assessment: preponderance of benefit over harm in select patients
- Policy level: option

RECOMMENDATION 3

Corticosteroid medications should not be used routinely in the management of bronchiolitis (recommendation: evidence level B; based on RCTs with limitations and a preponderance of risk over benefit).

Reports indicate that up to 60% of infants admitted to the hospital for bronchiolitis receive corticosteroid therapy.[9,12,70] Systematic review and meta-analyses of RCTs involving close to 1200 children with viral bronchiolitis have not shown sufficient evidence to support the use of steroids in this illness.[1,71,72]

A Cochrane database review on the use of glucocorticoids for acute bronchiolitis[71] included 13 studies.[37,50,64,73–82] The 1198 patients showed a pooled decrease in length of stay of 0.38 days. However, this decrease was not statistically significant. The review concluded: "No benefits were found in either LOS [length of stay] or clinical score in infants and young children treated with systemic glucocorticoids as compared with placebo. There were no differences in these outcomes between treatment groups; either in the pooled analysis or in any of the sub analyses. Among the three studies evaluating hospital admission rates following the initial hospital visit there was no difference between treatment groups. There were no differences found in respiratory rate, hemoglobin oxygen saturation, or hospital revisit or readmission rates. Subgroup analyses were significantly limited by the low number of studies in each comparison. Specific data on the harm of corticosteroid therapy in this patient population are lacking. Available evidence suggests that corticosteroid therapy is not of benefit in this patient group."[71]

The 2 available studies that evaluated inhaled corticosteroids in bronchiolitis[83,84] showed no benefit in the course of the acute disease. Because the safety of high-dose inhaled corticosteroids in infants is still not clear, their use should be avoided unless there is a clear likelihood of benefit.

There are insufficient data to make a recommendation regarding the use of leukotriene modifiers in bronchiolitis. Until additional randomized clinical trials are completed, no conclusions can be drawn.

Evidence Profile 3: Corticosteroids

- Aggregate evidence quality: B; randomized clinical trials with limitations
- Benefit: possibility that corticosteroid may be of some benefit
- Harm: exposure to unnecessary medication
- Benefits-harms assessment: preponderance of harm over benefit
- Policy level: recommendation

RECOMMENDATION 4

Ribavirin should not be used routinely in children with bronchiolitis (recommendation: evidence level B; RCTs with limitations and observational studies; preponderance of harm over benefit).

The indications for specific antiviral therapy for bronchiolitis are controversial. A recent review of 11 randomized clinical trials of ribavirin therapy for RSV LRTIs, including bronchiolitis, summarized the reported outcomes.[85] Nine of the studies measured the effect of ribavirin in the acute phase of illness.[86–94] Two evaluated the effect on long-term wheezing and/or pulmonary function.[95,96] Three additional studies were identified with similar results. Two of these evaluated effectiveness in the acute phase[97,98] and one on subsequent respiratory status.[99]

Each of the 11 studies that addressed the acute treatment effects of ribavirin included a small sample size ranging from 26 to 53 patients and cumulatively totaling 375 subjects. Study designs and outcomes measured were varied and inconsistent. Seven of the trials demonstrated some improvement in outcome attributed to ribavirin therapy, and 4 did not. Of those showing benefit, 4 documented improved objective outcomes (eg, better oxygenation, shorter length of stay), and 3 reported improvement in subjective findings such as respiratory scores or subjective clinical assessment. The quality of the studies was highly variable.

Of the studies that focused on long-term pulmonary function, one was an RCT assessing the number of subsequent wheezing episodes and LRTIs over a 1-year period.[96] Two others were follow-up studies of previous randomized trials and measured subsequent pulmonary function as well as wheezing episodes.[95,99] The first study[96] found fewer episodes of wheezing and infections in the ribavirin-treated patients, and the latter 2 studies[95,99] found no significant differences between groups.

No randomized studies of other antiviral therapies of bronchiolitis were identified.

Specific antiviral therapy for RSV bronchiolitis remains controversial because of the marginal benefit, if any, for most patients. In addition, cumbersome delivery requirements,[100] potential health risks for caregivers,[101] and high cost[102] serve as disincentives for use in the majority of patients. Nevertheless, ribavirin may be considered for use in highly selected situations involving documented RSV bronchiolitis with severe disease or in those who are at risk for severe disease (eg, immunocompromised and/or hemodynamically significant cardiopulmonary disease).

Evidence Profile 4: Ribavirin

- Aggregate evidence quality: B; RCTs with limitations and observational studies
- Benefit: some improvement in outcome
- Harm: cost, delivery method, potential health risks to caregivers
- Benefits-harms assessment: preponderance of harm over benefit
- Policy level: recommendation

RECOMMENDATION 5

Antibacterial medications should be used only in children with bronchiolitis who have specific indications of the coexistence of a bacterial infection. When present, bacterial infection should be treated in the same manner as in the absence of bronchiolitis (recommendation: evidence level B; RCTs and observational studies; preponderance of benefit over harm).

Children with bronchiolitis frequently receive antibacterial therapy because of fever,[103] young age,[104] or the concern over secondary bacterial infection.[105] Early RCTs[106,107] showed no benefit from antibacterial treatment of bronchiolitis. However, concern remains regarding the possibility of bacterial infections in young infants with bronchiolitis; thus, antibacterial agents continue to be used.

Several retrospective studies[41,108–113] identified low rates of SBI (0%–3.7%) in patients with bronchiolitis and/or infections with RSV. When SBI was present, it was more likely to be a UTI than bacteremia or meningitis. In a study of 2396 infants with RSV bronchiolitis, 69% of the 39 patients with SBI had a UTI.[110]

Three prospective studies of SBI in patients with bronchiolitis and/or RSV infections also demonstrated low rates of SBI (1%–12%).[42,43,114] One large study of febrile infants less than 60 days of age[43] with bronchiolitis and/or RSV infections demonstrated that the overall risk of SBI in infants less than 28 days of age, although significant, was not different between RSV-positive and RSV-negative groups (10.1% and 14.2%, respectively). All SBIs in children between 29 and 60 days of age with RSV-positive bronchiolitis were UTIs. The rate of UTIs in RSV-positive patients between 28 and 60 days old was significantly lower than those who were RSV-negative (5.5% vs 11.7%).

Approximately 25% of hospitalized infants with bronchiolitis will have radiographic evidence of atelectasis or infiltrates, often misinterpreted as possible bacterial infection.[115] Bacterial pneumonia in infants with bronchiolitis without consolidation is unusual.[116]

Although acute otitis media (AOM) in bronchiolitic infants may be caused by RSV alone, there are no clinical features that permit viral AOM to be differentiated from bacterial. Two studies address the frequency of AOM in patients with bronchiolitis. Andrade et al[117] prospectively identified AOM in 62% of 42 patients who presented with bronchiolitis. AOM was present in 50% on entry to the study and developed in an additional 12% within 10 days. Bacterial pathogens were isolated from 94% of middle-ear aspirates, with *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis* being the most frequent isolates. A subsequent report[118] followed 150 children hospitalized for bronchiolitis for the development of AOM. Seventy-nine (53%) developed AOM, two thirds within the first 2 days of hospitalization. Tympanocentesis was performed on 64 children with AOM, and 33 middle-ear aspirates yielded pathogens. *H influenzae*, *S pneumoniae*, and *M catarrhalis* were the ones most commonly found. AOM did not influence the clinical course or laboratory findings of bronchiolitis. When found, AOM should be managed according to the AAP/AAFP guidelines for diagnosis and management of AOM.[119]

Evidence Profile 5: Antibacterial Therapy

- Aggregate evidence quality: B; RCTs and observational studies with consistent results
- Benefit: appropriate treatment of bacterial infections, decreased exposure to unnecessary medications and their adverse effects when a bacterial infection is not present, decreased risk of development of resistant bacteria
- Harm: potential to not treat patient with bacterial infection
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: recommendation

RECOMMENDATION 6a

Clinicians should assess hydration and ability to take fluids orally (strong recommendation: evidence level X; validating studies cannot be performed; clear preponderance of benefit over harm).

RECOMMENDATION 6b

Chest physiotherapy should not be used routinely in the management of bronchiolitis (recommendation: evidence level B; RCTs with limitations; preponderance of harm over benefit).

The level of respiratory distress caused by bronchiolitis guides the indications for use of other treatments.

Intravenous Fluids

Infants with mild respiratory distress may require only observation, particularly if feeding remains unaffected. When the respiratory rate exceeds 60 to 70 breaths per minute, feeding may be compromised, particularly if nasal secretions are copious. Infants with respiratory difficulty may develop nasal flaring, increased intercostal or sternal retractions, and prolonged expiratory wheezing and be at increased risk of aspiration of food into the lungs.[120] Children who have difficulty feeding safely because of respiratory distress should be given intravenous fluids. The possibility of fluid retention related to production of antidiuretic hormone has been reported in patients with bronchiolitis.[121,122] Clinicians should adjust fluid management accordingly.

Airway Clearance

Bronchiolitis is associated with airway edema and sloughing of the respiratory epithelium into airways, which results in generalized hyperinflation of the lungs. Lobar atelectasis is not characteristic of this disease, although it can be seen on occasion. A Cochrane review[123] found 3 RCTs that evaluated chest physiotherapy in hospitalized patients with bronchiolitis.[124–126] No clinical benefit was found using vibration and percussion techniques. Suctioning of the nares may provide temporary relief of nasal congestion. There is no evidence to support routine "deep" suctioning of the lower pharynx or larynx.

Evidence Profile 6a: Fluids

- Aggregate evidence quality: evidence level X; validating studies cannot be performed
- Benefit: prevention of dehydration
- Harm: overhydration, especially if syndrome of inappropriate secretion of antidiuretic hormone (SIADH) is present
- Benefits-harms assessment: clear preponderance of benefit over harm
- Policy level: strong recommendation

Evidence Profile 6b: Chest Physiotherapy

- Aggregate evidence quality: B; RCTs with limitations
- Benefit: clearance of secretions, prevention of atelectasis
- Harm: stress to infant during procedure, cost of administering chest physiotherapy
- Benefits-harms assessment: preponderance of harm over benefit
- Policy level: recommendation

RECOMMENDATION 7a

Supplemental oxygen is indicated if oxyhemoglobin saturation (Spo_2) falls persistently below 90% in previously healthy infants. If the Spo_2 does persistently fall below 90%, adequate supplemental oxygen should be used to maintain Spo_2 at or above 90%. Oxygen may be discontinued if Spo_2 is at or above 90% and the infant is feeding well and has minimal respiratory distress (option: evidence level D; expert opinion and reasoning from first principles; some benefit over harm).

RECOMMENDATION 7b

As the child's clinical course improves, continuous measurement of Spo_2 is not routinely needed (option: evidence level D; expert opinion; balance of benefit and harm).

RECOMMENDATION 7c

Infants with a known history of hemodynamically significant heart or lung disease and premature infants require close monitoring as the oxygen is being weaned (strong recommendation: evidence level B; observational studies with consistent findings; preponderance of benefit over harm).

Healthy infants have an Spo_2 greater than 95% on room air, although transient decreases to an Spo_2 of less than 89% occur.[127,128] In bronchiolitis, airway edema and sloughing of respiratory epithelial cells cause mismatching of ventilation and perfusion and subsequent reductions in oxygenation (Pao_2 and Spo_2).

In the clinical setting, pulse oximeters are convenient, safe tools to measure oxygenation status. Clinicians ordering pulse oximetry should understand that the shape of the oxyhemoglobin dissociation curve dictates that when Spo_2 is above 90%, large increases in Pao_2 are associated with small increases in Spo_2. In contrast, when Spo_2 is below 90%, a small decrease in Pao_2 is associated with large decreases in Spo_2 (Fig 2). This raises the question of whether there is a single value for Spo_2 that can serve as a decision point to hospitalize or initiate supplemental oxygen in infants with bronchiolitis.

In studies that examined treatment for bronchiolitis in hospitalized infants, some investigators started supplemental oxygen when Spo_2 fell below 90%, and others started oxygen before the Spo_2 reached 90%.[98,129]

Although data are lacking to codify a single value of Spo_2 to be used as a cutoff point for initiating or discontinuing supplemental oxygen, these studies and the relationship between Pao_2 and Spo_2 support the position that otherwise healthy infants with bronchiolitis who have Spo_2 at or above 90% at sea level while breathing

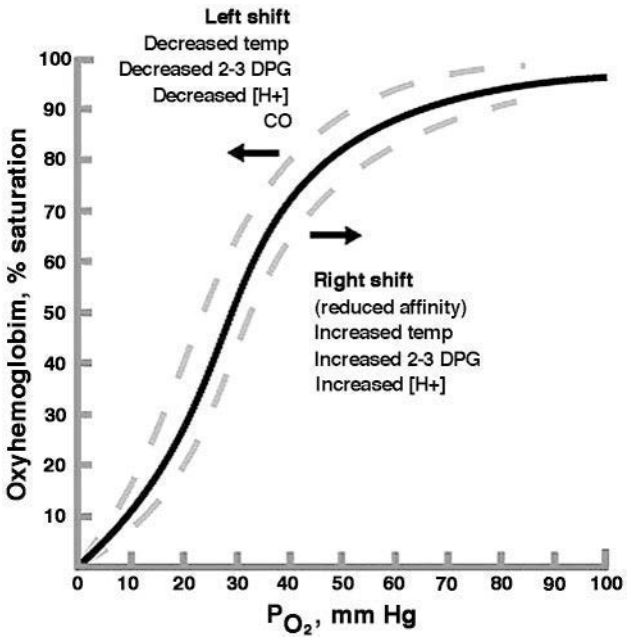

FIGURE 2
Oxyhemoglobin dissociation curve showing percent saturation of hemoglobin at various partial pressures of oxygen. Note that the position of the curve and the affinity of hemoglobin for oxygen changes with changing physiologic conditions. (Reproduced with permission from the educational website www.anaesthesiauk.com.)

room air likely gain little benefit from increasing Pao_2 with supplemental oxygen, particularly in the absence of respiratory distress and feeding difficulties. Because several factors including fever, acidosis, and some hemoglobinopathies shift the oxyhemoglobin dissociation curve so that large decreases in Pao_2 begin to occur at an Spo_2 of more than 90%, clinicians should consider maintaining a higher Spo_2 in children with these risk factors.[130,131]

Although widely used pulse oximeters have some shortcomings, under normal circumstances the accuracy of Spo_2 may vary slightly (most oximeters are accurate to ±2%). More importantly, poorly placed probes and motion artifact will lead to inaccurate measurements and false readings and alarms.[132] Before instituting O_2 therapy, the accuracy of the initial reading should be verified by repositioning the probe and repeating the measurement. The infant's nose and, if necessary, oral airway should be suctioned. If Spo_2 remains below 90%, O_2 should be administered. The infant's clinical work of breathing should also be assessed and may be considered as a factor in a decision to use oxygen supplementation.

Premature or low birth weight infants and infants with bronchopulmonary dysplasia or hemodynamically significant congenital heart disease merit special attention because they are at risk to develop severe illness that requires hospitalization, often in the ICU.[7,29,133–135] These infants often have abnormal baseline oxygenation coupled with an inability to cope with the pulmonary inflammation seen in bronchiolitis. This can result in more severe and prolonged hypoxia compared with normal infants, and clinicians should take this into account when developing strategies for using and weaning supplemental oxygen.

Evidence Profile 7a: Supplemental Oxygen

- Aggregate evidence quality: D; expert opinion and reasoning from first principles
- Benefit: use of supplemental oxygen only when beneficial, shorter hospitalization
- Harm: inadequate oxygenation
- Benefits-harms assessment: some benefit over harm
- Policy level: option

Evidence Profile 7b: Measurement of Spo_2

- Aggregate evidence quality: D; expert opinion
- Benefit: shorter hospitalization
- Harm: inadequate oxygenation between measurements
- Benefits-harms assessment: some benefit over harm
- Policy level: option

Evidence Profile 7c: High-Risk Infants

- Aggregate evidence quality: B; observational studies with consistent findings
- Benefit: improved care of high-risk infants
- Harm: longer hospitalization, use of oxygen when not beneficial
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: Strong recommendation

RECOMMENDATION 8a

Clinicians may administer palivizumab prophylaxis to selected infants and children with CLD or a history of prematurity (less than 35 weeks' gestation) or with congenital heart disease (recommendation: evidence level A; RCT; preponderance of benefit over harm).

RECOMMENDATION 8b

When given, prophylaxis with palivizumab should be given in 5 monthly doses, usually beginning in November or December, at a dose of 15 mg/kg per dose administered intramuscularly (recommendation: evidence level C; observational studies and expert opinion; preponderance of benefit over cost).

The 2006 Report of the Committee on Infectious Disease (*Red Book*) included the following recommendations for the use of palivizumab[136]:

- Palivizumab prophylaxis should be considered for infants and children younger than 24 months of age with chronic lung disease of prematurity who have

required medical therapy (supplemental oxygen, bronchodilator or diuretic or corticosteroid therapy) for CLD within 6 months before the start of the RSV season. Patients with more severe CLD who continue to require medical therapy may benefit from prophylaxis during a second RSV season. Data are limited regarding the effectiveness of palivizumab during the second year of life. Individual patients may benefit from decisions made in consultation with neonatologists, pediatric intensivists, pulmonologists, or infectious disease specialists.

- Infants born at 32 weeks of gestation or earlier may benefit from RSV prophylaxis, even if they do not have CLD. For these infants, major risk factors to consider include their gestational age and chronologic age at the start of the RSV season. Infants born at 28 weeks of gestation or earlier may benefit from prophylaxis during their first RSV season, whenever that occurs during the first 12 months of life. Infants born at 29 to 32 weeks of gestation may benefit most from prophylaxis up to 6 months of age. For the purpose of this recommendation, 32 weeks' gestation refers to an infant born on or before the 32nd week of gestation (ie, 32 weeks, 0 days). Once a child qualifies for initiation of prophylaxis at the start of the RSV season, administration should continue throughout the season and not stop at the point an infant reaches either 6 months or 12 months of age.
- Although palivizumab has been shown to decrease the likelihood of hospitalization in infants born between 32 and 35 weeks of gestation (ie, between 32 weeks, 1 day and 35 weeks, 0 days), the cost of administering prophylaxis to this large group of infants must be considered carefully. Therefore, most experts recommend that prophylaxis should be reserved for infants in this group who are at greatest risk of severe infection and who are younger than 6 months of age at the start of the RSV season. Epidemiologic data suggest that RSV infection is more likely to lead to hospitalization for these infants when the following risk factor are present: child care attendance, school-aged siblings, exposure to environmental air pollutants, congenital abnormalities of the airways, or severe neuromuscular disease. However, no single risk factor causes a very large increase in the rate of hospitalization, and the risk is additive as the number of risk factors for an individual infant increases. Therefore, prophylaxis should be considered for infants between 32 and 35 weeks of gestation only if 2 or more of these risk factors are present. Passive household exposure to tobacco smoke has not been associated with an increased risk of RSV hospitalization on a consistent basis. Furthermore, exposure to tobacco smoke is a risk factor that can be controlled by the family of an infant at increased risk of severe RSV disease, and preventive measures will be far less costly than palivizumab prophylaxis. High-risk infants never should be exposed to tobacco smoke. In contrast to the well-documented beneficial effect of breastfeeding against many viral illnesses, existing data are conflicting regarding the specific protective effect of breastfeeding against RSV infection. High-risk infants should be kept away from crowds and from situations in which exposure to infected individuals cannot be controlled. Participation in group child care should be restricted during the RSV season for high-risk infants whenever feasible. Parents should be instructed on the importance of careful hand hygiene. In addition, all high-risk infants and their contacts should be immunized against influenza beginning at 6 months of age.
- In the Northern hemisphere and particularly within the United States, RSV circulates predominantly between November and March. The inevitability of the RSV season is predictable, but the severity of the season, the time of onset, the peak of activity, and the end of the season cannot be predicted precisely. There can be substantial variation in timing of community outbreaks of RSV disease from year to year in the same community and between communities in the same year, even in the same region. These variations, however, occur within the overall pattern of RSV outbreaks, usually beginning in November or December, peaking in January or February, and ending by the end of March or sometime in April. Communities in the southern United States tend to experience the earliest onset of RSV activity, and Midwestern states tend to experience the latest. The duration of the season for western and northeast regions typically occurs between that noted in the South and the Midwest. In recent years, the national median duration of the RSV season has been 15 weeks and even in the South, with a seasonal duration of 16 weeks, the range is 13 to 20 weeks. Results from clinical trials indicate that palivizumab trough serum concentrations >30 days after the fifth dose will be well above the protective concentration for most infants. If the first dose is administered in November, 5 monthly doses of palivizumab will provide substantially more than 20 weeks of protective serum antibody concentrations for most of the RSV season, even with variation in season onset and end. Changes from this recommendation of 5 monthly doses require careful consideration of the benefits and costs.
- Children who are 24 months of age or younger with hemodynamically significant cyanotic and acyanotic congenital heart disease will benefit from palivizumab prophylaxis. Decisions regarding prophylaxis with palivizumab in children with congenital heart disease should be made on the basis of the degree of physiologic cardiovascular compromise. Children younger

than 24 months of age with congenital heart disease who are most likely to benefit from immunoprophylaxis include:

- Infants who are receiving medication to control congestive heart failure
- Infants with moderate to severe pulmonary hypertension
- Infants with cyanotic heart disease

Results from 2 blinded, randomized, placebo-controlled trials with palivizumab involving 2789 infants and children with prematurity, CLD, or congenital heart disease demonstrated a reduction in RSV hospitalization rates of 39% to 78% in different groups.[137,138] Results from postlicensure observational studies suggest that monthly immunoprophylaxis may reduce hospitalization rates to an even greater extent than that described in the prelicensure clinical trials.[139] Palivizumab is not effective in the treatment of RSV disease and is not approved for this indication.

Several economic analyses of RSV immunoprophylaxis have been published.[140–147] The primary benefit of immunoprophylaxis with palivizumab is a decrease in the rate of RSV-associated hospitalization. None of the 5 clinical RCTs have demonstrated a significant decrease in rate of mortality attributable to RSV infection in infants who receive prophylaxis. Most of the economic analyses fail to demonstrate overall savings in health care dollars because of the high cost if all at-risk children were to receive prophylaxis. Estimates of cost per hospitalization prevented have been inconsistent because of considerable variation in the baseline rate of hospitalization attributable to RSV in different high-risk groups. Other considerations that will influence results include the effect of prophylaxis on outpatient costs and a resolution of the question of whether prevention of RSV infection in infancy decreases wheezing and lower respiratory tract problems later in childhood.

Evidence Profile 8a: Palivizumab Prophylaxis

- Aggregate evidence quality: A; RCTs
- Benefit: prevention of morbidity and mortality in high-risk infants
- Harm: cost
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: recommendation

Evidence Profile 8b: Five-Dose Regimen

- Aggregate evidence quality: C; observational studies and expert opinion
- Benefit: decreased cost resulting from using minimal number of needed doses
- Harm: risk of illness from RSV outside the usual season
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: recommendation

RECOMMENDATION 9a

Hand decontamination is the most important step in preventing nosocomial spread of RSV. Hands should be decontaminated before and after direct contact with patients, after contact with inanimate objects in the direct vicinity of the patient, and after removing gloves (strong recommendation: evidence level B; observational studies with consistent results; strong preponderance of benefit over harm).

RECOMMENDATION 9b

Alcohol-based rubs are preferred for hand decontamination. An alternative is hand-washing with antimicrobial soap (recommendation: evidence level B; observational studies with consistent results; preponderance of benefit over harm).

RECOMMENDATION 9c

Clinicians should educate personnel and family members on hand sanitation (recommendation: evidence level C; observational studies; preponderance of benefit over harm).

Efforts should be made to decrease the spread of RSV and other causative agents of bronchiolitis in medical settings, especially in the hospital. RSV RNA has been identified in air samples as much as 22 feet from the patient's bedside.[148] Secretions from infected patients can be found on beds, crib railings, tabletops, and toys. Organisms on fomites may remain viable and contagious for several hours.[149]

It has been shown that RSV as well as many other viruses can be carried and spread to others on the hands of caregivers.[150] Frequent hand-washing by health care workers has been shown to reduce RSV's nosocomial spread.[150] The Centers for Disease Control and Prevention published an extensive review of the hand-hygiene literature and made recommendations as to indications for hand-washing and hand antisepsis.[151] Among the recommendations are that hands should be decontaminated before and after direct contact with patients, after contact with inanimate objects in the direct vicinity of the patient, and after removing gloves. If hands are not visibly soiled, an alcohol-based rub is preferred. An alternative is to wash hands with an antimicrobial soap. The guideline also describes the appropriate technique for using these products.

Other methods that have been shown to be effective in controlling the spread of RSV are education of personnel and family members; surveillance for the onset of RSV season; use of gloves, with frequent changes to avoid the spread of organisms on the gloves; and wearing gowns for direct contact with the patient. It has not

been clearly shown that wearing masks offers additional benefit to the above-listed measures.[149] Isolation and/or cohorting of RSV-positive patients, including assignment of personnel to care only for these patients, is effective[152,153] but may not be feasible. Strict hand decontamination and education of staff and families about prevention of spread of organisms is essential regardless of whether isolation is used.

Programs that implement the above-mentioned principles have been shown to decrease the nosocomial spread of RSV. Johns Hopkins Hospital (Baltimore, MD) instituted a program of pediatric droplet precaution for all children less than 2 years old with respiratory symptoms during RSV season until the child is shown to not have RSV. Nosocomial transmission of RSV decreased by approximately 50%. Before intervention, a patient was 2.6 times more likely to have nosocomially transmitted RSV than after the intervention.[154] A similar program at Children's Hospital of Philadelphia (Philadelphia, PA) resulted in a decrease of nosocomial RSV infections of 39%.[155]

Evidence Profile 9a: Hand Decontamination

- Aggregate evidence quality: B; observational studies with consistent findings
- Benefit: decreased spread of infection
- Harm: time
- Benefits-harms assessment: strong preponderance of benefit over harm
- Policy level: strong recommendation

Evidence Profile 9b: Alcohol-Based Rubs

- Aggregate evidence quality: B; observational studies with consistent findings
- Benefit: decreased spread of infection
- Harm: irritative effect of alcohol-based rubs
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: recommendation

Evidence Profile 9c: Education

- Aggregate evidence quality: C; observational studies
- Benefit: decreased spread of infection
- Harm: time, cost of gloves and gowns if used, barriers to parental contact with patient
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: recommendation

RECOMMENDATION 10a

Infants should not be exposed to passive smoking (strong recommendation: evidence level B; observational studies with consistent results; strong preponderance of benefit over harm).

RECOMMENDATION 10b

Breastfeeding is recommended to decrease a child's risk of having lower respiratory tract disease (LRTD) (recommendation: evidence level C; observational studies; preponderance of benefit over harm).

Tobacco Smoke

Passive smoking increases the risk of having an RSV infection with a reported odds ratio of 3.87.[156] There have been numerous studies on the effect of passive smoking on respiratory illness in infants and children. In a systematic review of passive smoking and lower respiratory illness in infants and children, Strachan and Cook[157] showed a pooled odds ratio of 1.57 if either parent smoked and an odds ratio of 1.72 if the mother smoked. Stocks and Dezateux[158] reviewed 20 studies of pulmonary function in infants. These studies showed a significant decrease in pulmonary function in infants of mothers who smoked during and after pregnancy. Forced expiratory flow was decreased by approximately 20%. Other measures of pulmonary function were likewise abnormal.

Paternal smoking also has an effect. The prevalence of upper respiratory tract illness increased from 81.6% to 95.2% in infants under 1 year of age in households where only the father smoked.[159]

Breastfeeding

Breast milk has been shown to have immune factors to RSV including immunoglobulin G and A antibodies[160] and interferon-α.[161] Breast milk has also been shown to have neutralizing activity against RSV.[162] In one study the relative risk of hospital admission with RSV was 2.2 in children who were not being breastfed.[163] In another study, 8 (7%) of 115 children hospitalized with RSV were breastfed, and 46 (27%) of 167 controls were breastfed.[164]

A meta-analysis of the relationship of breastfeeding and hospitalization for LRTD in early infancy[165] examined 33 studies, all of which showed a protective association between breastfeeding and the risk of hospitalization for LRTD. Nine studies met all inclusion criteria for analysis. The conclusion was that infants who were not breastfed had almost a threefold greater risk of being hospitalized for LRTD than those exclusively breastfed for 4 months (risk ratio: 0.28).

Evidence Profile 10a: Secondhand Smoke

- Aggregate evidence quality: B; observational studies with consistent findings
- Benefit: decreased risk of LRTI

- Harm: none
- Benefits-harms assessment: strong preponderance of benefit over harm
- Policy level: strong recommendation

Evidence Profile 10b: Breastfeeding

- Aggregate evidence quality: C; observational studies
- Benefit: improved immunity, decreased risk of LRTI, improved nutrition
- Harm: implied inadequacy of mothers who cannot or prefer to not breastfeed
- Benefits-harms assessment: preponderance of benefit over harm
- Policy level: recommendation

RECOMMENDATION 11

Clinicians should inquire about use of CAM (option: evidence level D; expert opinion; some benefit over harm).

No recommendations for CAM for treatment of bronchiolitis are made because of limited data. Clinicians now recognize that an increasing number of parents/caregivers are using various forms of nonconventional treatment for their children. Treatments that have been used specifically for bronchiolitis include homeopathy, herbal remedies, osteopathic manipulation, and applied kinesiology. Substantially more data are available regarding the use of homeopathic and herbal remedies for the treatment of bronchitis and the common cold. Whether these therapies would prevent the development of bronchiolitis is unknown. A single recent trial indicated that an herbal preparation containing *Echinacea*, propolis, and vitamin C prevented the development of upper respiratory infections in children between the ages of 1 and 5 years.[166] Bronchiolitis was not specifically studied.

To date, there are no studies that conclusively show a beneficial effect of alternative therapies used for the treatment of bronchiolitis. Recent interest in the use of CAM has led to research efforts to investigate its efficacy. It is difficult to design and conduct studies on certain forms of CAM because of the unique nature of the treatment. Any study conducted will need to show proof of effectiveness of a specific therapy when compared with the natural history of the disease. Conclusions regarding CAM cannot be made until research evidence is available. However, because of the widespread use of CAM, clinicians should ask parents what alternative forms of treatment they are using and be ready to discuss potential benefits or risks.

Evidence Profile 11: Asking About CAM

- Aggregate evidence quality: D; expert opinion
- Benefit: improved parent-physician communication, awareness of other, possibly harmful treatments being used
- Harm: time required for discussion, lack of knowledge about CAM by many pediatricians
- Benefits-harms assessment: some benefit over harm
- Policy level: option

FUTURE RESEARCH

The AHRQ evidence report[1] points out that outcomes measured in future studies of bronchiolitis should be clinically relevant and of interest to parents, clinicians, and health systems. Among the recommended outcomes are rates of hospitalization, need for more intensive services in the hospital, costs of care, and parental satisfaction with treatment.[1] One of the difficulties with the bronchiolitis literature is the absence of validated clinical scoring scales that are objective, replicable, and can be easily be performed in the hospital, emergency department, and outpatient settings. Studies should also be of sufficient size to be able to draw meaningful conclusions for the above-mentioned outcomes. Because bronchiolitis is a self-limited disease, large numbers of patients would need to be enrolled to observe small changes in outcome. This would necessitate large multicenter study protocols. Currently, such multicentered studies are being conducted in the United States and Canada on the use of corticosteroids in the emergency department.

Future research should include:

- development of rapid, cost-effective tests for viruses other than RSV that may also play a role in bronchiolitis;
- studies to determine if there are selected patients who may benefit from bronchodilators or corticosteroids;
- clinical studies of the target Spo_2 for the most efficient use of oxygen and oxygen monitoring;
- development of new therapies including new antiviral medications;
- continued research into the development of an RSV vaccine; and
- continued development of immunoprophylaxis that would require fewer doses and decreased cost.

SUMMARY

This clinical practice guideline provides evidence-based recommendations on the diagnosis and management of bronchiolitis in infants less than 2 years of age. It emphasizes using only diagnostic and management modalities that have been shown to affect clinical outcomes.

Bronchiolitis is a clinical diagnosis that does not require diagnostic testing. Many of the commonly used management modalities have not been shown to be effective in improving the clinical course of the illness. This includes the routine use of bronchodilators, corti-

costeroids, ribavirin, antibiotics, chest radiography, chest physiotherapy, and complementary and alternative therapies. Options for the appropriate use of oxygen and oxygen monitoring have been presented. Specific prevention with palivizumab and general prevention, particularly the use of hand decontamination to prevent nosocomial spread, were also discussed.

CONCLUSIONS

1a. Clinicians should diagnose bronchiolitis and assess disease severity on the basis of history and physical examination. Clinicians should not routinely order laboratory and radiologic studies for diagnosis (recommendation).

1b. Clinicians should assess risk factors for severe disease such as age less than 12 weeks, a history of prematurity, underlying cardiopulmonary disease, or immunodeficiency when making decisions about evaluation and management of children with bronchiolitis (recommendation).

2a. Bronchodilators should not be used routinely in the management of bronchiolitis (recommendation).

2b. A carefully monitored trial of α-adrenergic or β-adrenergic medication is an option. Inhaled bronchodilators should be continued only if there is a documented positive clinical response to the trial using an objective means of evaluation (option).

3. Corticosteroid medications should not be used routinely in the management of bronchiolitis (recommendation).

4. Ribavirin should not be used routinely in children with bronchiolitis (recommendation).

5. Antibacterial medications should only be used in children with bronchiolitis who have specific indications of the coexistence of a bacterial infection. When present, bacterial infection should be treated in the same manner as in the absence of bronchiolitis (recommendation).

6a. Clinicians should assess hydration and ability to take fluids orally (strong recommendation).

6b. Chest physiotherapy should not be used routinely in the management of bronchiolitis (recommendation).

7a. Supplemental oxygen is indicated if Spo_2 falls persistently below 90% in previously healthy infants. If the Spo_2 does persistently fall below 90%, adequate supplemental oxygen should be used to maintain an Spo_2 at or above 90%. Oxygen may be discontinued if Spo_2 is at or above 90% and the infant is feeding well and has minimal respiratory distress (option).

7b. As the child's clinical course improves, continuous measurement of Spo_2 is not routinely needed (option).

7c. Infants with a known history of hemodynamically significant heart or lung disease and premature infants require close monitoring as oxygen is being weaned (strong recommendation).

8a. Clinicians may administer palivizumab prophylaxis for selected infants and children with CLD or a history of prematurity (less than 35 weeks' gestation) or with congenital heart disease (recommendation).

8b. When given, prophylaxis with palivizumab should be given in 5 monthly doses, usually beginning in November or December, at a dose of 15 mg/kg per dose administered intramuscularly (recommendation).

9a. Hand decontamination is the most important step in preventing nosocomial spread of RSV. Hands should be decontaminated before and after direct contact with patients, after contact with inanimate objects in the direct vicinity of the patient, and after removing gloves (strong recommendation).

9b. Alcohol-based rubs are preferred for hand decontamination. An alternative is hand-washing with antimicrobial soap (recommendation).

9c. Clinicians should educate personnel and family members on hand sanitation (recommendation).

10a. Infants should not be exposed to passive smoking (strong recommendation).

10b. Breastfeeding is recommended to decrease a child's risk of having LRTD (recommendation).

11. Clinicians should inquire about use of CAM (option).

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Bronchiolitis Clinical Practice Guideline Quick Reference Tools

- Recommendation Summary
  — Diagnosis and Management of Bronchiolitis
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Bronchiolitis
- AAP Patient Education Handout
  — *Bronchiolitis and Your Young Child*

Recommendation Summary

Diagnosis and Management of Bronchiolitis

Recommendation 1a

Clinicians should diagnose bronchiolitis and assess disease severity on the basis of history and physical examination. Clinicians should not routinely order laboratory and radiologic studies for diagnosis (recommendation: evidence level B; diagnostic studies with minor limitations and observational studies with consistent findings; preponderance of benefits over harms and cost).

Recommendation 1b

Clinicians should assess risk factors for severe disease such as age less than 12 weeks, a history of prematurity, underlying cardiopulmonary disease, or immunodeficiency when making decisions about evaluation and management of children with bronchiolitis (recommendation: evidence level B; observational studies with consistent findings; preponderance of benefits over harms).

Recommendation 2a

Bronchodilators should not be used routinely in the management of bronchiolitis (recommendation: evidence level B; RCTs with limitations; preponderance of harm of use over benefit).

Recommendation 2b

A carefully monitored trial of α-adrenergic or ß-adrenergic medication is an option. Inhaled bronchodilators should be continued only if there is a documented positive clinical response to the trial using an objective means of evaluation (option: evidence level B; RCTs with limitations and expert opinion; balance of benefit and harm).

Recommendation 3

Corticosteroid medications should not be used routinely in the management of bronchiolitis (recommendation: evidence level B; based on RCTs with limitations and a preponderance of risk over benefit).

Recommendation 4

Ribavirin should not be used routinely in children with bronchiolitis (recommendation: evidence level B; RCTs with limitations and observational studies; preponderance of harm over benefit).

Recommendation 5

Antibacterial medications should be used only in children with bronchiolitis who have specific indications of the coexistence of a bacterial infection. When present, bacterial infection should be treated in the same manner as in the absence of bronchiolitis (recommendation: evidence level B; RCTs and observational studies; preponderance of benefit over harm).

Recommendation 6a

Clinicians should assess hydration and ability to take fluids orally (strong recommendation: evidence level X; validating studies cannot be performed; clear preponderance of benefit over harm).

Recommendation 6b

Chest physiotherapy should not be used routinely in the management of bronchiolitis (recommendation: evidence level B; RCTs with limitations; preponderance of harm over benefit).

Recommendation 7a

Supplemental oxygen is indicated if oxyhemoglobin saturation (Spo_2) falls persistently below 90% in previously healthy infants. If the Spo_2 does persistently fall below 90%, adequate supplemental oxygen should be used to maintain Spo_2 at or above 90%. Oxygen may be discontinued if Spo_2 is at or above 90% and the infant is feeding well and has minimal respiratory distress (option: evidence level D; expert opinion and reasoning from first principles; some benefit over harm).

Recommendation 7b

As the child's clinical course improves, continuous measurement of Spo_2 is not routinely needed (option: evidence level D; expert opinion; balance of benefit and harm).

Recommendation 7c

Infants with a known history of hemodynamically significant heart or lung disease and premature infants require close monitoring as the oxygen is being weaned (strong recommendation: evidence level B; observational studies with consistent findings; preponderance of benefit over harm).

Recommendation 8a

Clinicians may administer palivizumab prophylaxis to selected infants and children with CLD or a history of prematurity (less than 35 weeks' gestation) or with congenital heart disease (recommendation: evidence level A; RCT; preponderance of benefit over harm).

Recommendation 8b

When given, prophylaxis with palivizumab should be given in 5 monthly doses, usually beginning in November or December, at a dose of 15 mg/kg per dose administered intramuscularly (recommendation: evidence level C; observational studies and expert opinion; preponderance of benefit over cost).

Recommendation 9a

Hand decontamination is the most important step in preventing nosocomial spread of RSV. Hands should be decontaminated before and after direct contact with patients, after contact with inanimate objects in the direct vicinity of the patient, and after removing gloves (strong recommendation: evidence level B; observational studies with consistent results; strong preponderance of benefit over harm).

Recommendation 9b

Alcohol-based rubs are preferred for hand decontamination. An alternative is hand-washing with antimicrobial soap (recommendation: evidence level B; observational studies with consistent results; preponderance of benefit over harm).

Recommendation 9c

Clinicians should educate personnel and family members on hand sanitation (recommendation: evidence level C; observational studies; preponderance of benefit over harm).

Recommendation 10a

Infants should not be exposed to passive smoking (strong recommendation: evidence level B; observational studies with consistent results; strong preponderance of benefit over harm).

Recommendation 10b

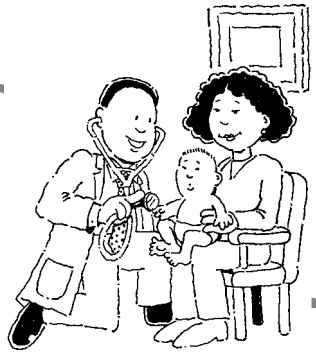
Breastfeeding is recommended to decrease a child's risk of having lower respiratory tract disease (LRTD) (recommendation: evidence level C; observational studies; preponderance of benefit over harm).

Recommendation 11

Clinicians should inquire about use of CAM (option: evidence level D; expert opinion; some benefit over harm).

Coding Quick Reference for Bronchiolitis	
ICD-9-CM	***ICD-10-CM***
466.11 Acute bronchiolitis due to respiratory syncytial virus (RSV)	**J21.0** Acute bronchiolitis due to syncytial virus
466.19 Acute bronchiolitis due to other infectious organisms	**J21.8** Acute bronchiolitis due to other specified organisms

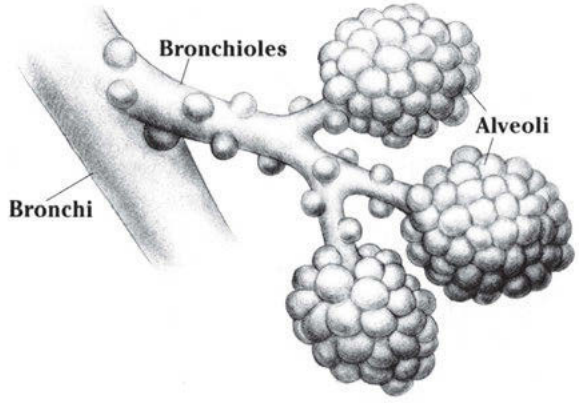
Bronchiolitis and Your Young Child



Bronchiolitis is a common respiratory illness among infants. One of its symptoms is trouble breathing, which can be scary for parents and children. Read on for more information from the American Academy of Pediatrics about bronchiolitis, its causes, signs and symptoms, how to treat it, and how to prevent it.

What is bronchiolitis?

Bronchiolitis is an infection that causes the small breathing tubes of the lungs (bronchioles) to swell. This blocks airflow through the lungs, making it hard to breathe. It occurs most often in infants because their airways are smaller and more easily blocked than in older children. Bronchiolitis is not the same as *bronchitis*, which is an infection of the larger, more central airways that typically causes problems in adults.



What causes bronchiolitis?

Bronchiolitis is caused by one of several viruses. *Respiratory syncytial virus* (RSV) is the most likely cause from October through March. Other viruses can also cause bronchiolitis.

Infants with RSV infection are more likely to get bronchiolitis with wheezing and difficulty breathing. Most adults and many older children with RSV infection only get a cold. RSV is spread by contact with an infected person's mucus or saliva (respiratory droplets produced during coughing or wheezing). It often spreads through families and child care centers. (See "How can you prevent your baby from getting bronchiolitis?")

What are the signs and symptoms of bronchiolitis?

Bronchiolitis often starts with signs of a cold, such as a runny nose, mild cough, and fever. After a day or two, the cough may get worse and the infant will begin to breathe faster. The following signs may mean that the infant is having trouble breathing:

- He may widen his nostrils and squeeze the muscles under his rib cage to try to get more air in and out of his lungs.
- When he breathes, he may grunt and tighten his stomach muscles.
- He will make a high-pitched whistling sound, called a wheeze, when he breathes out.
- He may have trouble drinking because he may have trouble sucking and swallowing.
- If it gets very hard for him to breathe, you may notice a bluish tint around his lips and fingertips. This tells you that his airways are so blocked that there is not enough oxygen getting into his blood.

If your baby shows any of these signs of troubled breathing, call your child's doctor.

Your child may become dehydrated if he cannot comfortably drink fluids. Call your child's doctor if your baby develops any of the following signs of dehydration:

- Drinking less than normal
- Dry mouth
- Crying without tears
- Urinating less often than normal

Bronchiolitis may cause more severe illness in children who have a chronic illness. If you think your child has bronchiolitis *and* your child has any of the following conditions, call your child's doctor:

- Cystic fibrosis
- Congenital heart disease
- Chronic lung disease (seen in some infants who were on breathing machines or respirators as newborns)
- Immune deficiency disease (like acquired immunodeficiency syndrome [AIDS])
- Organ or bone marrow transplant
- A cancer for which he is receiving chemotherapy

Can bronchiolitis be treated at home?

There is no specific treatment for RSV or the other viruses that cause bronchiolitis. Antibiotics are not helpful because they treat illnesses caused by bacteria, not viruses. However, you can try to ease your child's symptoms.

To relieve a stuffy nose

- **Thin the mucus** using saline nose drops recommended by your child's doctor. *Never use nonprescription nose drops that contain any medicine.*
- **Clear your baby's nose** with a suction bulb. Squeeze the bulb first. Gently put the rubber tip into one nostril, and slowly release the bulb. This suction will draw the clogged mucus out of the nose. This works best when your baby is younger than 6 months.

To relieve fever

- **Give your baby acetaminophen.** (Follow the recommended dosage for your child's age.) Do not give your baby aspirinbecause it has been associated with Reye syndrome, a disease that affects the liver and brain. Check with your child's doctor first before giving any other cold medicines.

To prevent dehydration

- **Make sure your baby drinks lots of fluid.** She may want clear liquids rather than milk or formula. She may feed more slowly or not feel like eating because she is having trouble breathing.

How will your pediatrician treat bronchiolitis?

If your baby is having mild to moderate trouble breathing, your child's doctor may try using a drug that opens up the breathing tubes. This may help some infants.

Some children with bronchiolitis need to be treated in a hospital for breathing problems or dehydration. Breathing problems may need to be treated with oxygen and medicine. Dehydration is treated with a special liquid diet or intravenous (IV) fluids.

In very rare cases when these treatments aren't working, an infant might have to be put on a respirator. This usually is only temporary until the infection is gone.

How can you prevent your baby from getting bronchiolitis?

The best steps you can follow to reduce the risk that your baby becomes infected with RSV or other viruses that cause bronchiolitis include

- Make sure everyone washes their hands before touching your baby.
- Keep your baby away from anyone who has a cold, fever, or runny nose.
- Avoid sharing eating utensils and drinking cups with anyone who has a cold, fever, or runny nose.

If you have questions about the treatment of bronchiolitis, call your child's doctor.

From your doctor

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

The American Academy of Pediatrics is an organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of infants, children, adolescents, and young adults.

American Academy of Pediatrics
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Management of Newly Diagnosed Type 2 Diabetes Mellitus (T2DM) in Children and Adolescents

- *Clinical Practice Guideline*
- *Technical Report*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 2 for more information.

Readers of this clinical practice guideline are urged to review the technical report to enhance the evidence-based decision-making process. The full technical report is available following the clinical practice guideline and on the companion CD-ROM.

CLINICAL PRACTICE GUIDELINE

Management of Newly Diagnosed Type 2 Diabetes Mellitus (T2DM) in Children and Adolescents

abstract

FREE

Over the past 3 decades, the prevalence of childhood obesity has increased dramatically in North America, ushering in a variety of health problems, including type 2 diabetes mellitus (T2DM), which previously was not typically seen until much later in life. The rapid emergence of childhood T2DM poses challenges to many physicians who find themselves generally ill-equipped to treat adult diseases encountered in children. This clinical practice guideline was developed to provide evidence-based recommendations on managing 10- to 18-year-old patients in whom T2DM has been diagnosed. The American Academy of Pediatrics (AAP) convened a Subcommittee on Management of T2DM in Children and Adolescents with the support of the American Diabetes Association, the Pediatric Endocrine Society, the American Academy of Family Physicians, and the Academy of Nutrition and Dietetics (formerly the American Dietetic Association). These groups collaborated to develop an evidence report that served as a major source of information for these practice guideline recommendations. The guideline emphasizes the use of management modalities that have been shown to affect clinical outcomes in this pediatric population. Recommendations are made for situations in which either insulin or metformin is the preferred first-line treatment of children and adolescents with T2DM. The recommendations suggest integrating lifestyle modifications (ie, diet and exercise) in concert with medication rather than as an isolated initial treatment approach. Guidelines for frequency of monitoring hemoglobin A1c (HbA1c) and finger-stick blood glucose (BG) concentrations are presented. Decisions were made on the basis of a systematic grading of the quality of evidence and strength of recommendation. The clinical practice guideline underwent peer review before it was approved by the AAP. This clinical practice guideline is not intended to replace clinical judgment or establish a protocol for the care of all children with T2DM, and its recommendations may not provide the only appropriate approach to the management of children with T2DM. Providers should consult experts trained in the care of children and adolescents with T2DM when treatment goals are not met or when therapy with insulin is initiated. The AAP acknowledges that some primary care clinicians may not be confident of their ability to successfully treat T2DM in a child because of the child's age, coexisting conditions, and/or other concerns. At any point at which a clinician feels he or she is not adequately trained or is uncertain about treatment, a referral to a pediatric medical subspecialist should be made. If a diagnosis of T2DM is made by a pediatric medical subspecialist, the primary care clinician should develop a comanagement strategy with the subspecialist to ensure that the child continues to receive appropriate care consistent with a medical home model in which the pediatrician partners with parents to ensure that all health needs are met. *Pediatrics* 2013;131:364–382

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KEY WORDS

diabetes, type 2 diabetes mellitus, childhood, youth, clinical practice guidelines, comanagement, management, treatment

ABBREVIATIONS

AAP—American Academy of Pediatrics
AAFP—American Academy of Family Physicians
BG—blood glucose
FDA—US Food and Drug Administration
HbA1c—hemoglobin A1c
PES—Pediatric Endocrine Society
T1DM—type 1 diabetes mellitus
T2DM—type 2 diabetes mellitus
TODAY—Treatment Options for type 2 Diabetes in Adolescents and Youth

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Key action statements are as follows:

1. Clinicians must ensure that insulin therapy is initiated for children and adolescents with T2DM who are ketotic or in diabetic ketoacidosis and in whom the distinction between types 1 and 2 diabetes mellitus is unclear and, in usual cases, should initiate insulin therapy for patients
   a. who have random venous or plasma BG concentrations ≥250 mg/dL; or
   b. whose HbA1c is >9%.

2. In all other instances, clinicians should initiate a lifestyle modification program, including nutrition and physical activity, and start metformin as first-line therapy for children and adolescents at the time of diagnosis of T2DM.

3. The committee suggests that clinicians monitor HbA1c concentrations every 3 months and intensify treatment if treatment goals for finger-stick BG and HbA1c concentrations are not being met (intensification is defined in the Definitions box).

4. The committee suggests that clinicians advise patients to monitor finger-stick BG (see Key Action Statement 4 in the guideline for further details) concentrations in patients who
   a. are taking insulin or other medications with a risk of hypoglycemia; or
   b. are initiating or changing their diabetes treatment regimen; or
   c. have not met treatment goals; or
   d. have intercurrent illnesses.

5. The committee suggests that clinicians incorporate the Academy of Nutrition and Dietetics' *Pediatric Weight Management Evidence-Based Nutrition Practice Guidelines* in their dietary or nutrition counseling of patients with T2DM at the time of diagnosis and as part of ongoing management.

6. The committee suggests that clinicians encourage children and adolescents with T2DM to engage in moderate-to-vigorous exercise for at least 60 minutes daily and to limit nonacademic "screen time" to less than 2 hours a day.

Definitions

Adolescent: an individual in various stages of maturity, generally considered to be between 12 and 18 years of age.

Childhood T2DM: disease in the child who typically

- is overweight or obese (BMI ≥85th–94th and >95th percentile for age and gender, respectively);
- has a strong family history of T2DM;
- has substantial residual insulin secretory capacity at diagnosis (reflected by normal or elevated insulin and C-peptide concentrations);
- has insidious onset of disease;
- demonstrates insulin resistance (including clinical evidence of polycystic ovarian syndrome or acanthosis nigricans);
- lacks evidence for diabetic autoimmunity (negative for autoantibodies typically associated with T1DM). These patients are more likely to have hypertension and dyslipidemia than are those with T1DM.

Clinician: any provider within his or her scope of practice; includes medical practitioners (including physicians and physician extenders), dietitians, psychologists, and nurses.
Diabetes: according to the American Diabetes Association criteria, defined as

1. HbA1c ≥6.5% (test performed in an appropriately certified laboratory); or
2. fasting (defined as no caloric intake for at least 8 hours) plasma glucose ≥126 mg/dL (7.0 mmol/L); or
3. 2-hour plasma glucose ≥200 mg/dL (11.1 mmol/L) during an oral glucose tolerance test performed as described by the World Health Organization by using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water; or
4. a random plasma glucose ≥200 mg/dL (11.1 mmol/L) with symptoms of hyperglycemia.

(In the absence of unequivocal hyperglycemia, criteria 1–3 should be confirmed by repeat testing.)

Diabetic ketoacidosis: acidosis resulting from an absolute or relative insulin deficiency, causing fat breakdown and formation of β hydroxybutyrate. Symptoms include nausea, vomiting, dehydration, Kussmaul respirations, and altered mental status.

Fasting blood glucose: blood glucose obtained before the first meal of the day and after a fast of at least 8 hours.

Glucose toxicity: The effect of high blood glucose causing both insulin resistance and impaired β-cell production of insulin.

Intensification: Increase frequency of blood glucose monitoring and adjustment of the dose and type of medication in an attempt to normalize blood glucose concentrations.

Intercurrent illnesses: Febrile illnesses or associated symptoms severe enough to cause the patient to stay home from school and/or seek medical care.

Microalbuminuria: Albumin:creatinine ratio ≥30 mg/g creatinine but <300 mg/g creatinine.

Moderate hyperglycemia: blood glucose = 180–250 mg/dL.

Moderate-to-vigorous exercise: exercise that makes the individual breathe hard and perspire and that raises his or her heart rate. An easy way to define exercise intensity for patients is the "talk test": during moderate physical activity a person can talk, but not sing. During vigorous activity, a person cannot talk without pausing to catch a breath.

Obese: BMI ≥95th percentile for age and gender.

Overweight: BMI between the 85th and 94th percentile for age and gender.

Prediabetes: Fasting plasma glucose ≥100–125 mg/dL or 2-hour glucose concentration during an oral glucose tolerance test ≥126 but <200 mg/dL or an HbA1c of 5.7% to 6.4%.

Severe hyperglycemia: blood glucose >250 mg/dL.

Thiazolidinediones (TZDs): Oral hypoglycemic agents that exert their effect at least in part by activation of the peroxisome proliferator-activated receptor γ.

Type 1 diabetes mellitus (T1DM): Diabetes secondary to autoimmune destruction of β cells resulting in absolute (complete or near complete) insulin deficiency and requiring insulin injections for management.

Type 2 diabetes mellitus (T2DM): The investigators' designation of the diagnosis was used for the purposes of the literature review. The committee acknowledges the distinction between T1DM and T2DM in this population is not always clear cut, and clinical judgment plays an important role. Typically, this diagnosis is made when hyperglycemia is secondary to insulin resistance accompanied by impaired β-cell function resulting in inadequate insulin production to compensate for the degree of insulin resistance.

Youth: used interchangeably with "adolescent" in this document.

INTRODUCTION

Over the past 3 decades, the prevalence of childhood obesity has increased dramatically in North America,[1–5] ushering in a variety of health problems, including type 2 diabetes mellitus (T2DM), which previously was not typically seen until much later in life. Currently, in the United States, up to 1 in 3 new cases of diabetes mellitus diagnosed in youth younger than 18 years is T2DM (depending on the ethnic composition of the patient population),[6,7] with a disproportionate representation in ethnic minorities[8,9] and occurring most commonly among youth between 10 and 19 years of age.[5,10] This trend is not limited to the United States but is occurring internationally[11]; it is projected that by the year 2030, an estimated 366 million people worldwide will have diabetes mellitus.[12]

The rapid emergence of childhood T2DM poses challenges to many physicians who find themselves generally ill-equipped to treat adult diseases encountered in children. Most diabetes education materials designed for pediatric patients are directed primarily to families of children with type 1 diabetes mellitus (T1DM) and emphasize insulin treatment and glucose monitoring, which may or may not be appropriate for children with

T2DM.[13,14] The National Diabetes Education Program TIP sheets (which can be ordered or downloaded from www.yourdiabetesinfo.org or ndep.nih.gov) provide guidance on healthy eating, physical activity, and dealing with T2DM in children and adolescents, but few other resources are available that are directly targeted at youth with this disease.[15] Most medications used for T2DM have been tested for safety and efficacy only in people older than 18 years, and there is scant scientific evidence for optimal management of children with T2DM.[16,17] Recognizing the scarcity of evidence-based data, this report provides a set of guidelines for the management and treatment of children with T2DM that is based on a review of current medical literature covering a period from January 1, 1990, to July 1, 2008.

Despite these limitations, the practicing physician is likely to be faced with the need to provide care for children with T2DM. Thus, the American Academy of Pediatrics (AAP), the Pediatric Endocrine Society (PES), the American Academy of Family Physicians (AAFP), American Diabetes Association, and the Academy of Nutrition and Dietetics (formerly the American Dietetic Association) partnered to develop a set of guidelines that might benefit endocrinologists and generalists, including pediatricians and family physicians alike. This clinical practice guideline may not provide the only appropriate approach to the management of children with T2DM. It is not expected to serve as a sole source of guidance in the management of children and adolescents with T2DM, nor is it intended to replace clinical judgment or establish a protocol for the care of all children with this condition. Rather, it is intended to assist clinicians in decision-making.

Primary care providers should endeavor to obtain the requisite skills to care for children and adolescents with T2DM, and should communicate and work closely with a diabetes team of subspecialists when such consultation is available, practical, and appropriate. The frequency of such consultations will vary, but should usually be obtained at diagnosis and then at least annually if possible. When treatment goals are not met, the committee encourages clinicians to consult with an expert trained in the care of children and adolescents with T2DM.[18,19] When first-line therapy (eg, metformin) fails, recommendations for intensifying therapy should be generally the same for pediatric and adult populations. The picture is constantly changing, however, as new drugs are introduced, and some drugs that initially appeared to be safe demonstrate adverse effects with wider use. Clinicians should, therefore, remain alert to new developments with regard to treatment of T2DM. Seeking the advice of an expert can help ensure that the treatment goals are appropriately set and that clinicians benefit from cutting-edge treatment information in this rapidly changing area.

The Importance of Family-Centered Diabetes Care

Family structure, support, and education help inform clinical decision-making and negotiations with the patient and family about medical preferences that affect medical decisions, independent of existing clinical recommendations. Because adherence is a major issue in any lifestyle intervention, engaging the family is critical not only to maintain needed changes in lifestyle but also to foster medication adherence.[20–22] The family's ideal role in lifestyle interventions varies, however, depending on the child's age. Behavioral interventions in younger children have shown a favorable effect. With adolescents, however, interventions based on target-age behaviors (eg, including phone or Internet-based interventions as well as face-to-face or peer-enhanced activities) appear to foster better results, at least for weight management.[23]

Success in making lifestyle changes to attain therapeutic goals requires the initial and ongoing education of the patient and the entire family about healthy nutrition and exercise. Any behavior change recommendations must establish realistic goals and take into account the families' health beliefs and behaviors. Understanding the patient and family's perception of the disease (and overweight status) before establishing a management plan is important to dispel misconceptions and promote adherence.[24] Because T2DM disproportionately affects minority populations, there is a need to ensure culturally appropriate, family-centered care along with ongoing education.[25–28] Several observational studies cite the importance of addressing cultural issues within the family.[20–22]

Restrictions in Creating This Document

In developing these guidelines, the following restrictions governed the committee's work:

- Although the importance of diabetes detection and screening of at-risk populations is acknowledged and referenced, the guidelines are restricted to patients meeting the diagnostic criteria for diabetes (eg, this document focuses on treatment postdiagnosis). Specifically, this document and its recommendations do not pertain to patients with impaired fasting plasma glucose (100–125 mg/dL) or impaired glucose tolerance (2-hour oral glucose tolerance test plasma glucose: 140–200 mg/dL) or isolated insulin resistance.
- Although it is noted that the distinction between types 1 and 2 diabetes mellitus in children may be

difficult,[29,30] these recommendations pertain specifically to patients 10 to less than 18 years of age with T2DM (as defined above).

- Although the importance of high-risk care and glycemic control in pregnancy, including pregravid glycemia, is affirmed, the evidence considered and recommendations contained in this document do not pertain to diabetes in pregnancy, including diabetes in pregnant adolescents.
- Recommended screening schedules and management tools for select comorbid conditions (hypertension, dyslipidemia, nephropathy, microalbuminuria, and depression) are provided as resources in the accompanying technical report.[31] These therapeutic recommendations were adapted from other recommended guideline documents with references, without an independent assessment of their supporting evidence.

METHODS

A systematic review was performed and is described in detail in the accompanying technical report.[31] To develop the clinical practice guideline on the management of T2DM in children and adolescents, the AAP convened the Subcommittee on Management of T2DM in Children and Adolescents with the support of the American Diabetes Association, the PES, the AAFP, and the Academy of Nutrition and Dietetics. The subcommittee was co-chaired by 2 pediatric endocrinologists preeminent in their field and included experts in general pediatrics, family medicine, nutrition, Native American health, epidemiology, and medical informatics/guideline methodology. All panel members reviewed the AAP policy on Conflict of Interest and Voluntary Disclosure and declared all potential conflicts (see conflicts statements in the Task Force member list).

These groups partnered to develop an evidence report that served as a major source of information for these practice guideline recommendations.[31] Specific clinical questions addressed in the evidence review were as follows: (1) the effectiveness of treatment modalities for T2DM in children and adolescents, (2) the efficacy of pharmaceutical therapies for treatment of children and adolescents with T2DM, (3) appropriate recommendations for screening for comorbidities typically associated with T2DM in children and adolescents, and (4) treatment recommendations for comorbidities of T2DM in children and adolescents. The accompanying technical report contains more information on comorbidities.[31]

Epidemiologic project staff searched Medline, the Cochrane Collaboration, and Embase. MESH terms used in various combinations in the search included diabetes, mellitus, type 2, type 1, treatment, prevention, diet, pediatric, T2DM, T1DM, NIDDM, metformin, lifestyle, RCT, meta-analysis, child, adolescent, therapeutics, control, adult, obese, gestational, polycystic ovary syndrome, metabolic syndrome, cardiovascular, dyslipidemia, men, and women. In addition, the Boolean operators NOT, AND, OR were included in various combinations. Articles addressing treatment of diabetes mellitus were prospectively limited to those that were published in English between January 1990 and June 2008, included abstracts, and addressed children between the ages of 120 and 215 months with an established diagnosis of T2DM. Studies in adults were considered for inclusion if >10% of the study population was 45 years of age or younger. The Medline search limits included the following: clinical trial; meta-analysis; randomized controlled trial; review; child: 6–12 years; and adolescent: 13–18 years. Additional articles were identified by review of reference lists of relevant articles and ongoing studies recommended by a technical expert advisory group. All articles were reviewed for compliance with the search limitations and appropriateness for inclusion in this document.

Initially, 199 abstracts were identified for possible inclusion, of which 52 were retained for systematic review. Results of the literature review were presented in evidence tables and published in the final evidence report. An additional literature search of Medline and the Cochrane Database of

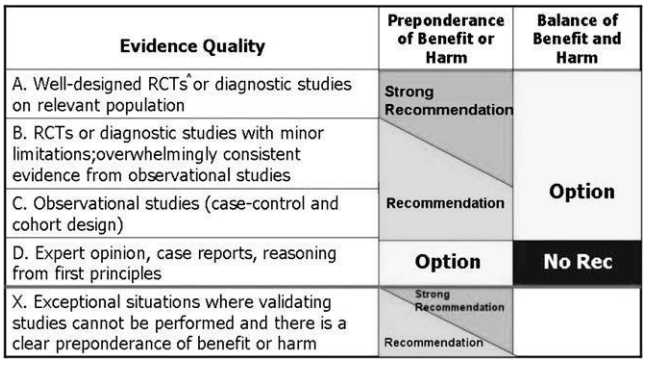

FIGURE 1

Evidence quality. Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is carried out leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation.[32] RCT, randomized controlled trial; Rec, recommendation.

TABLE 1 Definitions and Recommendation Implications

Statement	Definition	Implication
Strong recommendation	A *strong recommendation* in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms (as a strong recommendation against an action is made when the anticipated harms clearly exceed the benefits) and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendations may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A *recommendation* in favor of a particular action is made when the anticipated benefits exceed the harms but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high-quality evidence is impossible to obtain but the anticipated benefits outweigh the harms.	Clinicians would be prudent to follow a recommendation but should remain alert to new information and sensitive to patient preferences.
Option	*Options* define courses that may be taken when either the quality of evidence is suspect or carefully performed studies have shown little clear advantage to 1 approach over another.	Clinicians should consider the option in their decision-making, and patient preference may have a substantial role.
No recommendation	*No recommendation* indicates that there is a lack of pertinent published evidence and that the anticipated balance of benefits and harms is presently unclear.	Clinicians should be alert to new published evidence that clarifies the balance of benefit versus harm.

It should be noted that, because childhood T2DM is a relatively recent medical phenomenon, there is a paucity of evidence for many or most of the recommendations provided. In some cases, supporting references for a specific recommendation are provided that do not deal specifically with childhood T2DM, such as T1DM, childhood obesity, or childhood "prediabetes," or that were not included in the original comprehensive search. Committee members have made every effort to identify those references that did not affect or alter the level of evidence for specific recommendations.

Systematic Reviews was performed in July 2009 for articles discussing recommendations for screening and treatment of 5 recognized comorbidities of T2DM: cardiovascular disease, dyslipidemia, retinopathy, nephropathy, and peripheral vascular disease. Search criteria were the same as for the search on treatment of T2DM, with the inclusion of the term "type 1 diabetes mellitus." Search terms included, in various combinations, the following: diabetes, mellitus, type 2, type 1, pediatric, T2DM, T1DM, NIDDM, hyperlipidemia, retinopathy, microalbuminuria, comorbidities, screening, RCT, meta-analysis, child, and adolescent. Boolean operators and search limits mirrored those of the primary search.

An additional 336 abstracts were identified for possible inclusion, of which 26 were retained for systematic review. Results of this subsequent literature review were also presented in evidence tables and published in the final evidence report. An epidemiologist appraised the methodologic quality of the research before it was considered by the committee members.

The evidence-based approach to guideline development requires that the evidence in support of each key action statement be identified, appraised, and summarized and that an explicit link between evidence and recommendations be defined. Evidence-based recommendations reflect the quality of evidence and the balance of benefit and harm that is anticipated when the recommendation is followed. The AAP policy statement, "Classifying Recommendations for Clinical Practice Guidelines,"[32] was followed in designating levels of recommendation (see Fig 1 and Table 1).

To ensure that these recommendations can be effectively implemented, the Guidelines Review Group at Yale Center for Medical Informatics provided feedback on a late draft of these recommendations, using the GuideLine Implementability Appraisal.[33] Several potential obstacles to successful implementation were identified and resolved in the final guideline. Evidence was incorporated systematically into 6 key action statements about appropriate management facilitated by BRIDGE-Wiz software (Building Recommendations in a Developer's Guideline Editor; Yale Center for Medical Informatics).

A draft version of this clinical practice guideline underwent extensive peer review by 8 groups within the AAP, the American Diabetes Association, PES, AAFP, and the Academy of Nutrition and Dietetics. Members of the subcommittee were invited to distribute the draft to other representatives and committees within their specialty organizations. The resulting comments were reviewed by the subcommittee and incorporated into the guideline, as appropriate. All AAP guidelines are reviewed every 5 years.

KEY ACTION STATEMENTS

Key Action Statement 1

Clinicians must ensure that insulin therapy is initiated for children and adolescents with T2DM who are ketotic or in diabetic ketoacidosis and in whom the distinction between T1DM and T2DM is unclear; and, in usual cases, should initiate insulin therapy for patients:

a. who have random venous or plasma BG concentrations ≥250 mg/dL; or

b. whose HbA1c is >9%.

(Strong Recommendation: evidence quality X, validating studies cannot be performed, and C, observational studies and expert opinion; preponderance of benefit over harm.)

Action Statement Profile KAS 1

Aggregate evidence quality	X (validating studies cannot be performed)
Benefits	Avoidance of progression of diabetic ketoacidosis (DKA) and worsening metabolic acidosis; resolution of acidosis and hyperglycemia; avoidance of coma and/or death. Quicker restoration of glycemic control, potentially allowing islet β cells to "rest and recover," increasing long-term adherence to treatment; avoiding progression to DKA if T1DM. Avoiding hospitalization. Avoidance of potential risks associated with the use of other agents (eg, abdominal discomfort, bloating, loose stools with metformin; possible cardiovascular risks with sulfonylureas).
Harms/risks/cost	Potential for hypoglycemia, insulin-induced weight gain, cost, patient discomfort from injection, necessity for BG testing, more time required by the health care team for patient training.
Benefits-harms assessment	Preponderance of benefit over harm.
Value judgments	Extensive clinical experience of the expert panel was relied on in making this recommendation.
Role of patient preferences	Minimal.
Exclusions	None.
Intentional vagueness	None.
Strength	Strong recommendation.

The presentation of T2DM in children and adolescents varies according to the disease stage. Early in the disease, before diabetes diagnostic criteria are met, insulin resistance predominates with compensatory high insulin secretion, resulting in normoglycemia. Over time, β cells lose their ability to secrete adequate amounts of insulin to overcome insulin resistance, and hyperglycemia results. Early in this process, blood glucose (BG) concentrations may be normal much of the time and the patient likely will be asymptomatic. At this stage, the disease may only be detected by abnormal BG concentrations identified during screening. As insulin secretion declines further, the patient is likely to develop symptoms of hyperglycemia, occasionally with ketosis or frank ketoacidosis. High glucose concentrations can cause a reversible toxicity to islet β cells that contributes further to insulin deficiency. Of adolescents in whom T2DM is subsequently diagnosed, 5% to 25% present with ketoacidosis.[34]

Diabetic ketoacidosis must be treated with insulin and fluid and electrolyte replacement to prevent worsening metabolic acidosis, coma, and death. Children and adolescents with symptoms of hyperglycemia (polyuria, polydipsia, and polyphagia) who are diagnosed with diabetes mellitus should be evaluated for ketosis (serum or urine ketones) and, if positive, for ketoacidosis (venous pH), even if their phenotype and risk factor status (obesity, acanthosis nigricans, positive family history of T2DM) suggests T2DM. Patients in whom ketoacidosis is diagnosed require immediate treatment with insulin and fluid replacement in an inpatient setting under the supervision of a physician who is experienced in treating this complication.

Youth and adolescents who present with T2DM with poor glycemic control (BG concentrations ≥250 mg/dL or HbA1c >9%) but who lack evidence of ketosis or ketoacidosis may also benefit from initial treatment with insulin, at least on a short-term basis.[34] This allows for quicker restoration of glycemic control and, theoretically, may allow islet β cells to "rest and recover."[35,36] Furthermore, it has been noted that initiation of insulin may increase long-term adherence to treatment in children and adolescents with T2DM by enhancing the patient's perception of the seriousness of the disease.[7,37–40] Many patients with T2DM can be weaned gradually from insulin therapy and subsequently managed with metformin and lifestyle modification.[34]

As noted previously, in some children and adolescents with newly diagnosed diabetes mellitus, it may be difficult to distinguish between type 1 and type 2 disease (eg, an obese child presenting with ketosis).[39,41] These patients are best managed initially with insulin therapy while appropriate tests are performed to differentiate between T1DM and T2DM. The care of children and adolescents who have either newly diagnosed T2DM or undifferentiated-type diabetes and who require initial insulin treatment should be supervised by a physician experienced in treating diabetic patients with insulin.

Key Action Statement 2

In all other instances, clinicians should initiate a lifestyle modification program, including nutrition

and physical activity, and start metformin as first-line therapy for children and adolescents at the time of diagnosis of T2DM. (Strong recommendation: evidence quality B; 1 RCT showing improved outcomes with metformin versus lifestyle; preponderance of benefits over harms.)

Action Statement Profile KAS 2

Aggregate evidence quality	B (1 randomized controlled trial showing improved outcomes with metformin versus lifestyle combined with expert opinion).
Benefit	Lower HbA1c, target HbA1c sustained longer, less early deterioration of BG, less chance of weight gain, improved insulin sensitivity, improved lipid profile.
Harm (of using metformin)	Gastrointestinal adverse effects or potential for lactic acidosis and vitamin B_{12} deficiency, cost of medications, cost to administer, need for additional instruction about medication, self-monitoring blood glucose (SMBG), perceived difficulty of insulin use, possible metabolic deterioration if T1DM is misdiagnosed and treated as T2DM, potential risk of lactic acidosis in the setting of ketosis or significant dehydration. It should be noted that there have been no cases reported of vitamin B_{12} deficiency or lactic acidosis with the use of metformin in children.
Benefits-harms assessment	Preponderance of benefit over harm.
Value judgments	Committee members valued faster achievement of BG control over not medicating children.
Role of patient preferences	Moderate; precise implementation recommendations likely will be dictated by patient preferences regarding healthy nutrition, potential medication adverse reaction, exercise, and physical activity.
Exclusions	Although the recommendation to start metformin applies to all, certain children and adolescents with T2DM will not be able to tolerate metformin. In addition, certain older or more debilitated patients with T2DM may be restricted in the amount of moderate-to-vigorous exercise they can perform safely. Nevertheless, this recommendation applies to the vast majority of children and adolescents with T2DM.
Intentional vagueness	None.
Policy level	Strong recommendation.

Metformin as First-Line Therapy

Because of the low success rate with diet and exercise alone in pediatric patients diagnosed with T2DM, metformin should be initiated along with the promotion of lifestyle changes, unless insulin is needed to reverse glucose toxicity in the case of significant hyperglycemia or ketoacidosis (see Key Action Statement 1). Because gastrointestinal adverse effects are common with metformin therapy, the committee recommends starting the drug at a low dose of 500 mg daily, increasing by 500 mg every 1 to 2 weeks, up to an ideal and maximum dose of 2000 mg daily in divided doses.[41] It should be noted that the main gastrointestinal adverse effects (abdominal pain, bloating, loose stools) present at initiation of metformin often are transient and often disappear completely if medication is continued. Generally, doses higher than 2000 mg daily do not provide additional therapeutic benefit.[34,42,43] In addition, the use of extended-release metformin, especially with evening dosing, may be considered, although data regarding the frequency of adverse effects with this preparation are scarce. Metformin is generally better tolerated when taken with food. It is important to recognize the paucity of credible RCTs in adolescents with T2DM. The evidence to recommend initiating metformin at diagnosis along with lifestyle changes comes from 1 RCT, several observational studies, and consensus recommendations.

Lifestyle modifications (including nutrition interventions and increased physical activity) have long been the cornerstone of therapy for T2DM. Yet, medical practitioners recognize that effecting these changes is both challenging and often accompanied by regression over time to behaviors not conducive to maintaining the target range of BG concentrations. In pediatric patients, lifestyle change is most likely to be successful when a multidisciplinary approach is used and the entire family is involved. (Encouragement of healthy eating and physical exercise are discussed in Key Action Statements 5 and 6.) Unfortunately, efforts at lifestyle change often fail for a variety of reasons, including high rates of loss to follow-up; a high rate of depression in teenagers, which affects adherence; and peer pressure to participate in activities that often center on unhealthy eating.

Expert consensus is that fewer than 10% of pediatric T2DM patients will attain their BG goals through lifestyle interventions alone.[6,35,44] It is possible that the poor long-term success rates observed from lifestyle interventions stem from patients' perception that the intervention is not important because medications are not being prescribed. One might speculate that prescribing medications, particularly insulin therapy, may convey a greater degree of concern for the patient's health and the seriousness of the diagnosis, relative to that conveyed when medications are not needed, and that improved treatment adherence and follow-up may result from the use of medication. Indeed, 2 prospective observational studies revealed that treatment with

lifestyle modification alone is associated with a higher rate of loss to follow-up than that found in patients who receive medication.[45]

Before initiating treatment with metformin, a number of important considerations must be taken into account. First, it is important to determine whether the child with a new diagnosis has T1DM or T2DM, and it is critical to err on the side of caution if there is any uncertainty. The 2009 *Clinical Practice Consensus Guidelines on Type 2 Diabetes in Children and Adolescents* from the International Society for Pediatric and Adolescent Diabetes provides more information on the classification of diabetes in children and adolescents with new diagnoses.[46] If the diagnosis is unclear (as may be the case when an obese child with diabetes presents also with ketosis), the adolescent must be treated with insulin until the T2DM diagnosis is confirmed.[47] Although it is recognized that some children with newly diagnosed T2DM may respond to metformin alone, the committee believes that the presence of either ketosis or ketoacidosis dictates an absolute initial requirement for insulin replacement. (This is addressed in Key Action Statement 1.)

Although there is little debate that a child presenting with significant hyperglycemia and/or ketosis requires insulin, children presenting with more modest levels of hyperglycemia (eg, random BG of 200–249 mg/dL) or asymptomatic T2DM present additional therapeutic challenges to the clinician. In such cases, metformin alone, insulin alone, or metformin with insulin all represent reasonable options. Additional agents are likely to become reasonable options for initial pharmacologic management in the near future. Although metformin and insulin are the only antidiabetic agents currently approved by the US Food and Drug Administration (FDA) for use in children, both thiazolidinediones and incretins are occasionally used in adolescents younger than 18 years.[48]

Metformin is recommended as the initial pharmacologic agent in adolescents presenting with mild hyperglycemia and without ketonuria or severe hyperglycemia. In addition to improving hepatic insulin sensitivity, metformin has a number of practical advantages over insulin:

- Potential weight loss or weight neutrality.[37,48]
- Because of a lower risk of hypoglycemia, less frequent finger-stick BG measurements are required with metformin, compared with insulin therapy or sulfonylureas.[37,42,49–51]
- Improves insulin sensitivity and may normalize menstrual cycles in females with polycystic ovary syndrome. (Because metformin may also improve fertility in patients with polycystic ovary syndrome, contraception is indicated for sexually active patients who wish to avoid pregnancy.)
- Taking pills does not have the discomfort associated with injections.
- Less instruction time is required to start oral medication, making it is easier for busy practitioners to prescribe.
- Adolescents do not always accept injections, so oral medication might enhance adherence.[52]

Potential advantages of insulin over metformin for treatment at diabetes onset include the following:

- Metabolic control may be achieved more rapidly with insulin compared with metformin therapy.[37]
- With appropriate education and targeting the regimen to the individual, adolescents are able to accept and use insulin therapy with improved metabolic outcomes.[53]
- Insulin offers theoretical benefits of improved metabolic control while preserving β-cell function or even reversing β-cell damage.[34,35]
- Initial use of insulin therapy may convey to the patient a sense of seriousness of the disease.[7,53]

Throughout the writing of these guidelines, the authors have been following the progress of the National Institute of Diabetes and Digestive and Kidney Diseases–supported Treatment Options for type 2 Diabetes in Adolescents and Youth (TODAY) trial,[54] designed to compare standard (metformin alone) therapy versus more aggressive therapy as the initial treatment of youth with recent-onset T2DM. Since the completion of these guidelines, results of the TODAY trial have become available and reveal that metformin alone is inadequate in effecting sustained glycemic control in the majority of youth with diabetes. The study also revealed that the addition of rosiglitazone to metformin is superior to metformin alone in preserving glycemic control. Direct application of these findings to clinical practice is problematic, however, because rosiglitazone is not FDA-approved for use in children, and its use, even in adults, is now severely restricted by the FDA because of serious adverse effects reported in adults. Thus, the results suggest that therapy that is more aggressive than metformin monotherapy may be required in these adolescents to prevent loss of glycemic control, but they do not provide specific guidance because it is not known whether the effect of the additional agent was specific to rosiglitazone or would be seen with the addition of other agents. Unfortunately, there are limited data for the use of other currently available oral or injected hypoglycemic agents in this age range, except for insulin. Therefore,

the writing group for these guidelines continues to recommend metformin as first-line therapy in this age group but with close monitoring for glycemic deterioration and the early addition of insulin or another pharmacologic agent if needed.

Lifestyle Modification, Including Nutrition and Physical Activity

Although lifestyle changes are considered indispensable to reaching treatment goals in diabetes, no significant data from RCTs provide information on success rates with such an approach alone.

A potential downside for initiating lifestyle changes alone at T2DM onset is potential loss of patients to follow-up and worse health outcomes. The value of lifestyle modification in the management of adolescents with T2DM is likely forthcoming after a more detailed analysis of the lifestyle intervention arm of the multicenter TODAY trial becomes available.[54] As noted previously, although it was published after this guideline was developed, the TODAY trial indicated that results from the metformin-plus-lifestyle intervention were not significantly different from either metformin alone or the metformin-plus-rosiglitazone intervention in maintaining glycemic control over time.[54]

Summary

As noted previously, metformin is a safe and effective agent for use at the time of diagnosis in conjunction with lifestyle changes. Although observational studies and expert opinion strongly support lifestyle changes as a key component of the regimen in addition to metformin, randomized trials are needed to delineate whether using lifestyle options alone is a reasonable first step in treating any select subgroups of children with T2DM.

Key Action Statement 3

The committee suggests that clinicians monitor HbA1c concentrations every 3 months and intensify treatment if treatment goals for BG and HbA1c concentrations are not being met. (Option: evidence quality D; expert opinion and studies in children with T1DM and in adults with T2DM; preponderance of benefits over harms.)

Action Statement Profile KAS 3

Aggregate evidence quality	D (expert opinion and studies in children with T1DM and in adults with T2DM; no studies have been performed in children and adolescents with T2DM).
Benefit	Diminishing the risk of progression of disease and deterioration resulting in hospitalization; prevention of microvascular complications of T2DM.
Harm	Potential for hypoglycemia from overintensifying treatment to reach HbA1c target goals; cost of frequent testing and medical consultation; possible patient discomfort.
Benefits-harms assessment	Preponderance of benefits over harms.
Value judgments	Recommendation dictated by widely accepted standards of diabetic care.
Role of patient preferences	Minimal; recommendation dictated by widely accepted standards of diabetic care.
Exclusions	None.
Intentional vagueness	Intentional vagueness in the recommendation as far as setting goals and intensifying treatment attributable to limited evidence.
Policy level	Option.

HbA1c provides a measure of glycemic control in patients with diabetes mellitus and allows an estimation of the individual's average BG over the previous 8 to 12 weeks. No RCTs have evaluated the relationship between glycemic control and the risk of developing microvascular and/or macrovascular complications in children and adolescents with T2DM. A number of studies of children with T1DM[55–57] and adults with T2DM have, however, shown a significant relationship between glycemic control (as measured by HbA1c concentration) and the risk of microvascular complications (eg, retinopathy, nephropathy, and neuropathy).[58,59] The relationship between HbA1c concentration and risk of microvascular complications appears to be curvilinear; the lower the HbA1c concentration, the lower the downstream risk of microvascular complications, with the greatest risk reduction seen at the highest HbA1c concentrations.[57]

It is generally recommended that HbA1c concentrations be measured every 3 months.[60] For adults with T1DM, the American Diabetes Association recommends target HbA1c concentrations of less than 7%; the American Association of Clinical Endocrinologists recommends target concentrations of less than 6.5%. Although HbA1c target concentrations for children and adolescents with T1DM are higher,[13] several review articles suggest target HbA1c concentrations of less than 7% for children and adolescents with T2DM.[40,61–63] The committee concurs that, ideally, target HbA1c concentration should be less than 7% but notes that specific goals must be achievable for the individual patient and that this concentration may not be applicable for all patients. For patients in whom a target concentration of less than 7% seems unattainable, individualized goals should be set, with the ultimate goal of reaching guideline target concentrations. In addition, in the absence of hypoglycemia, even lower HbA1c target concentrations can be considered on the basis of an absence of hypoglycemic events and other individual considerations.

When concentrations are found to be above the target, therapy should be intensified whenever possible, with the goal of bringing the concentration to target. Intensification activities may include, but are not limited to, increasing the frequency of clinic visits, engaging in more frequent BG monitoring, adding 1 or more antidiabetic agents, meeting with a registered dietitian and/or diabetes educator, and increasing attention to diet and exercise regimens. Patients whose HbA1c concentrations remain relatively stable may only need to be tested every 6 months. Ideally, real-time HbA1c concentrations should be available at the time of the patient's visit with the clinician to allow the physician and patient and/or parent to discuss intensification of therapy during the visit, if needed.

Key Action Statement 4

The committee suggests that clinicians advise patients to monitor finger-stick BG concentrations in those who

a. are taking insulin or other medications with a risk of hypoglycemia; or
b. are initiating or changing their diabetes treatment regimen; or
c. have not met treatment goals; or
d. have intercurrent illnesses.

(Option: evidence quality D; expert consensus. Preponderance of benefits over harms.)

Glycemic control correlates closely with the frequency of BG monitoring in adolescents with T1DM.[64,65] Although studies evaluating the efficacy of frequent BG monitoring have not been conducted in children and adolescents with T2DM, benefits have been described in insulin-treated adults with T2DM who tested their BG 4 times per day, compared with adults following a less frequent monitoring regimen.[66] These data support the value of BG monitoring in adults treated with insulin, and likely are relevant to youth with T2DM as well, especially those treated with insulin, at the onset of the disease, when treatment goals are not met, and when the treatment regimen is changed. The committee believes that current (2011) ADA recommendations for finger-stick BG monitoring apply to most youth with T2DM[67]:

- Finger-stick BG monitoring should be performed 3 or more times daily for patients using multiple insulin injections or insulin pump therapy.
- For patients using less-frequent insulin injections, noninsulin therapies, or medical nutrition therapy alone, finger-stick BG monitoring may be useful as a guide to the success of therapy.
- To achieve postprandial glucose targets, postprandial finger-stick BG monitoring may be appropriate.

Action Statement Profile KAS 4

Aggregate evidence quality	D (expert consensus).
Benefit	Potential for improved metabolic control, improved potential for prevention of hypoglycemia, decreased long-term complications.
Harm	Patient discomfort, cost of materials.
Benefits-harms assessment	Benefit over harm.
Value judgments	Despite lack of evidence, there were general committee perceptions that patient safety concerns related to insulin use or clinical status outweighed any risks from monitoring.
Role of patient preferences	Moderate to low; recommendation driven primarily by safety concerns.
Exclusions	None.
Intentional vagueness	Intentional vagueness in the recommendation about specific approaches attributable to lack of evidence and the need to individualize treatment.
Policy level	Option.

Recognizing that current practices may not always reflect optimal care, a 2004 survey of practices among members of the PES revealed that 36% of pediatric endocrinologists asked their pediatric patients with T2DM to monitor BG concentrations twice daily; 12% asked patients to do so once daily; 13% asked patients to do so 3 times per day; and 12% asked patients to do so 4 times daily.[61] The questionnaire provided to the pediatric endocrinologists did not ask about the frequency of BG monitoring in relationship to the diabetes regimen, however.

Although normoglycemia may be difficult to achieve in adolescents with T2DM, a fasting BG concentration of 70 to 130 mg/dL is a reasonable target for most. In addition, because postprandial hyperglycemia has been associated with increased risk of cardiovascular events in adults, postprandial BG testing may be valuable in select patients. BG concentrations obtained 2 hours after meals (and paired with pre-meal concentrations) provide an index of glycemic excursion, and may be useful in improving glycemic control, particularly for the patient whose fasting plasma glucose is normal but whose HbA1c is not at target.[68] Recognizing the limited evidence for benefit of FSBG testing in this population, the committee provides suggested guidance for testing frequency, tailored to the medication regimen, as follows:

BG Testing Frequency for Patients With Newly Diagnosed T2DM: Fasting, Premeal, and Bedtime Testing

The committee suggests that all patients with newly diagnosed T2DM, regardless of prescribed treatment plan, should perform finger-stick BG monitoring before meals (including a morning fasting concentration) and

at bedtime until reasonable metabolic control is achieved.[69] Once BG concentrations are at target levels, the frequency of monitoring can be modified depending on the medication used, the regimen's intensity, and the patient's metabolic control. Patients who are prone to marked hyperglycemia or hypoglycemia or who are on a therapeutic regimen associated with increased risk of hypoglycemia will require continued frequent BG testing. Expectations for frequency and timing of BG monitoring should be clearly defined through shared goal-setting between the patient and clinician. The adolescent and family members should be given a written action plan stating the medication regimen, frequency and timing of expected BG monitoring, as well as follow-up instructions.

BG Testing Frequency for Patients on Single Insulin Daily Injections and Oral Agents

Single bedtime long-acting insulin: The simplest insulin regimen consists of a single injection of long-acting insulin at bedtime (basal insulin only). The appropriateness of the insulin dose for patients using this regimen is best defined by the fasting/prebreakfast BG test. For patients on this insulin regimen, the committee suggests daily fasting BG measurements. This regimen is associated with some risk of hypoglycemia (especially overnight or fasting hypoglycemia) and may not provide adequate insulin coverage for mealtime ingestions throughout the day, as reflected by fasting BG concentrations in target, but daytime readings above target. In such cases, treatment with meglitinide (Prandin [Novo Nordisk Pharmaceuticals] or Starlix [Novartis Pharmaceuticals]) or a short-acting insulin before meals (see below) may be beneficial.

Oral agents: Once treatment goals are met, the frequency of monitoring can be decreased; however, the committee recommends some continued BG testing for all youth with T2DM, at a frequency determined within the clinical context (e.g. medication regimen, HbA1c, willingness of the patient, etc.). For example, an infrequent or intermittent monitoring schedule may be adequate when the patient is using exclusively an oral agent associated with a low risk of hypoglycemia and if HbA1c concentrations are in the ideal or non-diabetic range. A more frequent monitoring schedule should be advised during times of illness or if symptoms of hyperglycemia or hypoglycemia develop.

Oral agent plus a single injection of a long-acting insulin: Some youth with T2DM can be managed successfully with a single injection of long-acting insulin in conjunction with an oral agent. Twice a day BG monitoring (fasting plus a second BG concentration – ideally 2-hour post prandial) often is recommended, as long as HbA1c and BG concentrations remain at goal and the patient remains asymptomatic.

BG Testing Frequency for Patients Receiving Multiple Daily Insulin Injections (eg, Basal Bolus Regimens): Premeal and Bedtime Testing

Basal bolus regimens are commonly used in children and youth with T1DM and may be appropriate for some youth with T2DM as well. They are the most labor intensive, providing both basal insulin plus bolus doses of short-acting insulin at meals. Basal insulin is provided through either the use of long-acting, relatively peak-free insulin (by needle) or via an insulin pump. Bolus insulin doses are given at meal-time, using one of the rapid-acting insulin analogs. The bolus dose is calculated by using a correction algorithm for the premeal BG concentration as well as a "carb ratio," in which 1 unit of a rapid-acting insulin analog is given for "X" grams of carbohydrates ingested (see box below). When using this method, the patient must be willing and able to count the number of grams of carbohydrates in the meal and divide by the assigned "carb ratio (X)" to know how many units of insulin should be taken. In addition, the patient must always check BG concentrations before the meal to determine how much additional insulin should be given as a correction dose using an algorithm assigned by the care team if the fasting BG is not in target. Insulin pumps are based on this concept of "basal-bolus" insulin administration and have the capability of calculating a suggested bolus dosage, based on inputted grams of carbohydrates and BG concentrations. Because the BG value determines the amount of insulin to be given at each meal, the recommended testing frequency for patients on this regimen is before every meal.

Box 1 Example of Basal Bolus Insulin Regimen

If an adolescent has a BG of 250 mg/dL, is to consume a meal containing 60 g of carbohydrates, with a carbohydrate ratio of 1:10 and an assigned correction dose of 1:25>125 (with 25 being the insulin sensitivity and 125 mg/dL the target blood glucose level), the mealtime bolus dose of insulin would be as follows:

60 g/10 "carb ratio" =

6 units rapid-acting insulin for meal

plus

(250–125)/25 = 125/25 =

5 units rapid-acting insulin for correction

Thus, total bolus insulin coverage at mealtime is: **11 U** (6 + 5) of rapid-acting insulin.

Key Action Statement 5

The committee suggests that clinicians incorporate the Academy of Nutrition and Dietetics' *Pediatric Weight Management Evidence-Based Nutrition Practice Guidelines* in the nutrition counseling of patients with T2DM both at the time of diagnosis and as part of ongoing management. (Option; evidence quality D; expert opinion; preponderance of benefits over harms. Role of patient preference is dominant.)

Action Statement Profile KAS 5

Aggregate evidence quality	D (expert opinion).
Benefit	Promotes weight loss; improves insulin sensitivity; contributes to glycemic control; prevents worsening of disease; facilitates a sense of well-being; and improves cardiovascular health.
Harm	Costs of nutrition counseling; inadequate reimbursement of clinicians' time; lost opportunity costs vis-a-vis time and resources spent in other counseling activities.
Benefits-harms assessment	Benefit over harm.
Value judgments	There is a broad societal agreement on the benefits of dietary recommendations.
Role of patient preference	Dominant. Patients may have different preferences for how they wish to receive assistance in managing their weight-loss goals. Some patients may prefer a referral to a nutritionist while others might prefer accessing online sources of help. Patient preference should play a significant role in determining an appropriate weight-loss strategy.
Exclusions	None.
Intentional vagueness	Intentional vagueness in the recommendation about specific approaches attributable to lack of evidence and the need to individualize treatment.
Policy level	Option.

Consuming more calories than one uses results in weight gain and is a major contributor to the increasing incidence of T2DM in children and adolescents. Current literature is inconclusive about a single best meal plan for patients with diabetes mellitus, however, and studies specifically addressing the diet of children and adolescents with T2DM are limited. Challenges to making recommendations stem from the small sample size of these studies, limited specificity for children and adolescents, and difficulties in generalizing the data from dietary research studies to the general population.

Although evidence is lacking in children with T2DM, numerous studies have been conducted in overweight children and adolescents, because the great majority of children with T2DM are obese or overweight at diagnosis.[26] The committee suggests that clinicians encourage children and adolescents with T2DM to follow the Academy of Nutrition and Dietetics' recommendations for maintaining healthy weight to promote health and reduce obesity in this population. The committee recommends that clinicians refer patients to a registered dietitian who has expertise in the nutritional needs of youth with T2DM. Clinicians should incorporate the Academy of Nutrition and Dietetics' *Pediatric Weight Management Evidence-Based Nutrition Practice Guidelines*, which describe effective, evidence-based treatment options for weight management, summarized below (A complete list of these recommendations is accessible to health care professionals at: http://www.andevidencelibrary.com/topic.cfm?cat=4102&auth=1.)

According to the Academy of Nutrition and Dietetics' guidelines, when incorporated with lifestyle changes, balanced macronutrient diets at 900 to 1200 kcal per day are associated with both short- and long-term (eg, $\geq$ 1 year) improvements in weight status and body composition in children 6 to 12 years of age.[70] These calorie recommendations are to be incorporated with lifestyle changes, including increased activity and possibly medication. Restrictions of no less than 1200 kcal per day in adolescents 13 to 18 years old result in improved weight status and body composition as well.[71] The Diabetes Prevention Program demonstrated that participants assigned to the intensive lifestyle-intervention arm had a reduction in daily energy intake of 450 kcal and a 58% reduction in progression to diabetes at the 2.8-year follow-up.[71] At the study's end, 50% of the lifestyle-arm participants had achieved the goal weight loss of at least 7% after the 24-week curriculum and 38% showed weight loss of at least 7% at the time of their most recent visit.[72] The Academy of Nutrition and Dietetics recommends that protein-sparing, modified-fast (ketogenic) diets be restricted to children who are >120% of their ideal body weight and who have a serious medical complication that would benefit from rapid weight loss.[71] Specific recommendations are for the intervention to be short-term (typically 10 weeks) and to be conducted under the supervision of a multidisciplinary team specializing in pediatric obesity.

Regardless of the meal plan prescribed, some degree of nutrition education must be provided to maximize adherence and positive results. This education should encourage patients to follow healthy eating patterns, such as consuming 3 meals with planned snacks per day, not eating while watching television or using computers, using smaller plates to make portions appear larger, and leaving small amounts of food on the plate.[73] Common dietary recommendations to reduce calorie intake and to promote weight loss in children include the following: (1) eating regular meals and snacks; (2) reducing portion sizes; (3) choosing calorie-free beverages, except for milk; (4) limiting juice to 1 cup per day; (5) increasing consumption of fruits and vegetables; (6) consuming 3 or 4 servings of low-fat dairy products per day; (7) limiting intake of high-fat foods; (8) limiting frequency and size of snacks; and (9) reducing calories consumed in fast-food meals.[74]

Key Action Statement 6

The committee suggests that clinicians encourage children and adolescents with T2DM to engage in moderate-to-vigorous exercise for at least 60 minutes daily and to limit nonacademic screen time to less than 2 hours per day. (Option: evidence quality D, expert opinion and evidence from studies of metabolic syndrome and obesity; preponderance of benefits over harms. Role of patient preference is dominant.)

Action Statement Profile KAS 6

Aggregate evidence quality	D (expert opinion and evidence from studies of metabolic syndrome and obesity).
Benefit	Promotes weight loss; contributes to glycemic control; prevents worsening of disease; facilitates the ability to perform exercise; improves the person's sense of well-being; and fosters cardiovascular health.
Harm	Cost for patient of counseling, food, and time; costs for clinician in taking away time that could be spent on other activities; inadequate reimbursement for clinician's time.
Benefits-harms assessment	Preponderance of benefit over harm.
Value judgments	Broad consensus.
Role of patient preference	Dominant. Patients may seek various forms of exercise. Patient preference should play a significant role in creating an exercise plan.
Exclusions	Although certain older or more debilitated patients with T2DM may be restricted in the amount of moderate-to-vigorous exercise they can perform safely, this recommendation applies to the vast majority of children and adolescents with T2DM.
Intentional vagueness	Intentional vagueness on the sequence of follow-up contact attributable to the lack of evidence and the need to individualize care.
Policy level	Option.

Recommendations From the Academy of Nutrition and Dietetics

Pediatric Weight Management Evidence-Based Nutrition Practice Guidelines

Recommendation	Strength
Interventions to reduce pediatric obesity should be multicomponent and include diet, physical activity, nutritional counseling, and parent or caregiver participation.	Strong
A nutrition prescription should be formulated as part of the dietary intervention in a multicomponent pediatric weight management program.	Strong
Dietary factors that may be associated with an increased risk of overweight are increased total dietary fat intake and increased intake of calorically sweetened beverages.	Strong
Dietary factors that may be associated with a decreased risk of overweight are increased fruit and vegetable intake.	Strong
A balanced macronutrient diet that contains no fewer than 900 kcal per day is recommended to improve weight status in children aged 6–12 y who are medically monitored.	Strong
A balanced macronutrient diet that contains no fewer than 1200 kcal per day is recommended to improve weight status in adolescents aged 13–18 y who are medically monitored.	Strong
Family diet behaviors that are associated with an increased risk of pediatric obesity are parental restriction of highly palatable foods, consumption of food away from home, increased meal portion size, and skipping breakfast.	Fair

Engaging in Physical Activity

Physical activity is an integral part of weight management for prevention and treatment of T2DM. Although there is a paucity of available data from children and adolescents with T2DM, several well-controlled studies performed in obese children and adolescents at risk of metabolic syndrome and T2DM provide guidelines for physical activity. (See the Resources section for tools on this subject.) A summary of the references supporting the evidence for this guideline can be found in the technical report.[31]

At present, moderate-to-vigorous exercise of at least 60 minutes daily is recommended for reduction of BMI and improved glycemic control in patients with T2DM.[75] "Moderate to

vigorous exercise" is defined as exercise that makes the individual breathe hard and perspire and that raises his or her heart rate. An easy way to define exercise intensity for patients is the "talk test"; during moderate physical activity a person can talk but not sing. During vigorous activity, a person cannot talk without pausing to catch a breath.[76]

Adherence may be improved if clinicians provide the patient with a written prescription to engage in physical activity, including a "dose" describing ideal duration, intensity, and frequency.[75] When prescribing physical exercise, clinicians are encouraged to be sensitive to the needs of children, adolescents, and their families. Routine, organized exercise may be beyond the family's logistical and/or financial means, and some families may not be able to provide structured exercise programs for their children. It is most helpful to recommend an individualized approach that can be incorporated into the daily routine, is tailored to the patients' physical abilities and preferences, and recognizes the families' circumstances.[77] For example, clinicians might recommend only daily walking, which has been shown to improve weight loss and insulin sensitivity in adults with T2DM[78] and may constitute "moderate to vigorous activity" for some children with T2DM. It is also important to recognize that the recommended 60 minutes of exercise do not have to be accomplished in 1 session but can be completed through several, shorter increments (eg, 10–15 minutes). Patients should be encouraged to identify a variety of forms of activity that can be performed both easily and frequently.[77] In addition, providers should be cognizant of the potential need to adjust the medication dosage, especially if the patient is receiving insulin, when initiating an aggressive physical activity program.

Reducing Screen Time

Screen time contributes to a sedentary lifestyle, especially when the child or adolescent eats while watching television or playing computer games. The US Department of Health and Human Services recommends that individuals limit "screen time" spent watching television and/or using computers and handheld devices to less than 2 hours per day unless the use is related to work or homework.[79] Physical activity may be gained either through structured games and sports or through everyday activities, such as walking, ideally with involvement of the parents as good role models.

Increased screen time and food intake and reduced physical activity are associated with obesity. There is good evidence that modifying these factors can help prevent T2DM by reducing the individual's rate of weight gain. The evidence profile in pediatric patients with T2DM is inadequate at this time, however. Pending new data, the committee suggests that clinicians follow the AAP Committee on Nutrition's guideline, *Prevention of Pediatric Overweight and Obesity*. The guideline recommends restricting nonacademic screen time to a maximum of 2 hours per day and discouraging the presence of video screens and television sets in children's bedrooms.[80–82] The American Medical Association's Expert Panel on Childhood Obesity has endorsed this guideline.

Valuable recommendations for enhancing patient health include the following:

- With patients and their families, jointly determining an individualized plan that includes specific goals to reduce sedentary behaviors and increase physical activity.
- Providing a written prescription for engaging in 60-plus minutes of moderate-to-vigorous physical activities per day that includes dose, timing, and duration. It is important for clinicians to be sensitive to the needs of children, adolescents, and their families in encouraging daily physical exercise. Graded duration of exercise is recommended for those youth who cannot initially be active for 60 minutes daily, and the exercise may be accomplished through several, shorter increments (eg, 10–15 minutes).
- Incorporating physical activities into children's and adolescents' daily routines. Physical activity may be gained either through structured games and sports or through everyday activities, such as walking.
- Restricting nonacademic screen time to a maximum of 2 hours per day.
- Discouraging the presence of video screens and television sets in children's bedrooms.

Conversations pertaining to the Key Action Statements should be clearly documented in the patient's medical record.

AREAS FOR FUTURE RESEARCH

As noted previously, evidence for medical interventions in children in general is scant and is especially lacking for interventions directed toward children who have developed diseases not previously seen commonly in youth, such as childhood T2DM. Recent studies such as the Search for Diabetes in Youth Study (SEARCH)—an observational multicenter study in 2096 youth with T2DM funded by the Centers for Disease Control and Prevention and the National Institute of Diabetes and Digestive and Kidney Diseases—now provide a detailed description of childhood diabetes. Subsequent trials will describe the short-term and enduring effects of specific interventions

on the progression of the disease with time.

Although it is likely that children and adolescents with T2DM have an aggressive form of diabetes, as reflected by the age of onset, future research should determine whether the associated comorbidities and complications of diabetes also are more aggressive in pediatric populations than in adults and if they are more or less responsive to therapeutic interventions. Additional research should explore whether early introduction of insulin or the use of particular oral agents will preserve β-cell function in these children, and whether recent technologic advances (such as continuous glucose monitoring and insulin pumps) will benefit this population. Additional issues that require further study include the following:

- To delineate whether using lifestyle options without medication is a reliable first step in treating selected children with T2DM.
- To determine whether BG monitoring should be recommended to all children and youth with T2DM, regardless of therapy used; what the optimal frequency of BG monitoring is for pediatric patients on the basis of treatment regimen; and which subgroups will be able to successfully maintain glycemic goals with less frequent monitoring.
- To explore the efficacy of school- and clinic-based diet and physical activity interventions to prevent and manage pediatric T2DM.
- To explore the association between increased "screen time" and reduced physical activity with respect to T2DM's risk factors.

RESOURCES

Several tools are available online to assist providers in improving patient adherence to lifestyle modifications, including examples of activities to be recommended for patients:

- The American Academy of Pediatrics:
  - www.healthychildren.org
  - www.letsmove.gov
  - Technical Report: Management of Type 2 Diabetes Mellitus in Children and Adolescents.[31]
    - Includes an overview and screening tools for a variety of comorbidities.
  - Gahagan S, Silverstein J; Committee on Native American Child Health and Section on Endocrinology. Clinical report: prevention and treatment of type 2 diabetes mellitus in children, with special emphasis on American Indian and Alaska Native Children. *Pediatrics*. 2003;112 (4):e328–e347. Available at: http://www.pediatrics.org/cgi/content/full/112/4/e328[63]
    - Fig 3 presents a screening tool for microalbumin.
  - Bright Futures: http://brightfutures.aap.org/
  - Daniels SR, Greer FR; Committee on Nutrition. Lipid screening and cardiovascular health in childhood. *Pediatrics*. 2008;122 (1):198–208. Available at:
- The American Diabetes Association: www.diabetes.org
  - Management of dyslipidemia in children and adolescents with diabetes. *Diabetes Care*. 2003;26(7):2194–2197. Available at: http://care.diabetesjournals.org/content/26/7/2194.full
- Academy of Nutrition and Dietetics:
  - http://www.eatright.org/childhoodobesity/
  - http://www.eatright.org/kids/
  - http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/index.html
  - Pediatric Weight Management Evidence-Based Nutrition Practice Guidelines: http://www.adaevidencelibrary.com/topic.cfm?cat=2721
- American Heart Association:
  - American Heart Association *Circulation*. 2006 Dec 12;114(24):2710-2738. Epub 2006 Nov 27. Review.
- Centers for Disease Control and Prevention:
  - http://www.cdc.gov/obesity/childhood/solutions.html
  - BMI and other growth charts can be downloaded and printed from the CDC Web site: http://www.cdc.gov/growthcharts.
  - Center for Epidemiologic Studies Depression Scale (CES-D): http://www.chcr.brown.edu/pcoc/cesdscale.pdf; see attachments
- *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed. Washington, DC: American Psychiatric Association; 1994
- Let's Move Campaign: www.letsmove.gov
- The Reach Institute. *Guidelines for Adolescent Depression in Primary Care (GLAD-PC) Toolkit*, 2007. Contains a listing of the criteria for major depressive disorder as defined by the DSM-IV-TR. Available at: http://www.gladpc.org
- The National Heart, Lung, and Blood Institute (NHLBI) hypertension guidelines: http://www.nhlbi.nih.gov/guidelines/hypertension/child_tbl.htm
- The National Diabetes Education Program and TIP sheets (including tip sheets on youth transitioning to adulthood and adult providers, Staying Active, Eating Healthy, Ups and Downs of Diabetes, etc): www.ndep.nih.gov or www.yourdiabetesinfo.org

- National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents: *Pediatrics*. 2004;114:555–576. Available at: http://pediatrics.aappublications.org/content/114/Supplement_2/555.long
- National Initiative for Children's Healthcare Quality (NICHQ): childhood obesity section: http://www.nichq.org/childhood_obesity/index.html
- The National Institute of Child Health and Human Development (NICHD): www.NICHD.org
- President's Council on Physical Fitness and Sports: http://www.presidentschallenge.org/home_kids.aspx
- US Department of Agriculture's "My Pyramid" Web site:
- http://www.choosemyplate.gov/
- http://fnic.nal.usda.gov/life-cycle-nutrition/child-nutrition-and-health

SUBCOMMITTEE ON TYPE 2 DIABETES (OVERSIGHT BY THE STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT, 2008–2012)

Kenneth Claud Copeland, MD, FAAP: Co-chair—Endocrinology and Pediatric Endocrine Society Liaison (2009: Novo Nordisk, Genentech, Endo [National Advisory Groups]; 2010: Novo Nordisk [National Advisory Group]); published research related to type 2 diabetes

Janet Silverstein, MD, FAAP: Co-chair—Endocrinology and American Diabetes Association Liaison (small grants with Pfizer, Novo Nordisk, and Lilly; grant review committee for Genentech; was on an advisory committee for Sanofi Aventis, and Abbott Laboratories for a 1-time meeting); published research related to type 2 diabetes

Kelly Roberta Moore, MD, FAAP: General Pediatrics, Indian Health, AAP Committee on Native American Child Health Liaison (board member of the Merck Company Foundation Alliance to Reduce Disparities in Diabetes. Their national program office is the University of Michigan's Center for Managing Chronic Disease.)

Greg Edward Prazar, MD, FAAP: General Pediatrics (no conflicts)

Terry Raymer, MD, CDE: Family Medicine, Indian Health Service (no conflicts)

Richard N. Shiffman, MD, FAAP: Partnership for Policy Implementation Informatician, General Pediatrics (no conflicts)

Shelley C. Springer, MD, MBA, FAAP: Epidemiologist (no conflicts)

Meaghan Anderson, MS, RD, LD, CDE: Academy of Nutrition and Dietetics Liaison (formerly a Certified Pump Trainer for Animas)

Stephen J. Spann, MD, MBA, FAAFP: American Academy of Family Physicians Liaison (no conflicts)

Vidhu V. Thaker, MD, FAAP: QuIIN Liaison, General Pediatrics (no conflicts)

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Susan K. Flinn, MA: Medical Writer (no conflicts)

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ERRATA

Several inaccuracies occurred in the American Academy of Pediatrics "Clinical Practice Guideline: Management of Newly Diagnosed Type 2 Diabetes Mellitus (T2DM) in Children and Adolescents" published in the February 2013 issue of *Pediatrics* (2013;131[2]:364–382).

On page 366 in the table of definitions, "Prediabetes" should be defined as "Fasting plasma glucose ≥100–125 mg/dL or 2-hour glucose concentration during an oral glucose tolerance test of ≥140 but <200 mg/dL or an HbA1c of 5.7% to 6.4%."

On page 378, middle column, under "Reducing Screen Time," the second sentence should read as follows: "The US Department of Health and Human Services reflects the American Academy of Pediatrics policies by recommending that individuals limit "screen time" spent watching television and/or using computers and handheld devices to <2 hours per day unless the use is related to work or homework."[79–81,83]

Also on page 378, middle column, in the second paragraph under "Reducing Screen Time," the fourth sentence should read: "Pending new data, the committee suggests that clinicians follow the policy statement 'Children, Adolescents, and Television' from the AAP Council on Communications and Media (formerly the Committee on Public Education)." The references cited in the next sentence should be 80–83.

Reference 82 should be replaced with the following reference: Barlow SE; Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007;120(suppl 4):S164–S192

Finally, a new reference 83 should be added: American Academy of Pediatrics, Council on Communications and Media. Policy statement: children, adolescents, obesity, and the media. *Pediatrics*. 2011;128(1):201–208

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TECHNICAL REPORT

Management of Type 2 Diabetes Mellitus in Children and Adolescents

abstract

OBJECTIVE: Over the last 3 decades, the prevalence of childhood obesity has increased dramatically in North America, ushering in a variety of health problems, including type 2 diabetes mellitus (T2DM), which previously was not typically seen until much later in life. This technical report describes, in detail, the procedures undertaken to develop the recommendations given in the accompanying clinical practice guideline, "Management of Type 2 Diabetes Mellitus in Children and Adolescents," and provides in-depth information about the rationale for the recommendations and the studies used to make the clinical practice guideline's recommendations.

METHODS: A primary literature search was conducted relating to the treatment of T2DM in children and adolescents, and a secondary literature search was conducted relating to the screening and treatment of T2DM's comorbidities in children and adolescents. Inclusion criteria were prospectively and unanimously agreed on by members of the committee. An article was eligible for inclusion if it addressed treatment (primary search) or 1 of 4 comorbidities (secondary search) of T2DM, was published in 1990 or later, was written in English, and included an abstract. Only primary research inquiries were considered; review articles were considered if they included primary data or opinion. The research population had to constitute children and/or adolescents with an existing diagnosis of T2DM; studies of adult patients were considered if at least 10% of the study population was younger than 35 years. All retrieved titles, abstracts, and articles were reviewed by the consulting epidemiologist.

RESULTS: Thousands of articles were retrieved and considered in both searches on the basis of the aforementioned criteria. From those, in the primary search, 199 abstracts were identified for possible inclusion, 58 of which were retained for systematic review. Five of these studies were classified as grade A studies, 1 as grade B, 20 as grade C, and 32 as grade D. Articles regarding treatment of T2DM selected for inclusion were divided into 4 major subcategories on the basis of type of treatment being discussed: (1) medical treatments (32 studies); (2) nonmedical treatments (9 studies); (3) provider behaviors (8 studies); and (4) social issues (9 studies). From the secondary search, an additional 336 abstracts relating to comorbidities were identified for possible inclusion, of which 26 were retained for systematic review. These articles included the following: 1 systematic review of literature regarding comorbidities of T2DM in adolescents; 5 expert

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KEY WORDS

childhood, clinical practice guidelines, comanagement, diabetes, management, treatment, type 2 diabetes mellitus, youth

ABBREVIATIONS

AAP—American Academy of Pediatrics
ACE—angiotensin-converting enzyme
ADA—American Diabetes Association
AHA—American Heart Association
BG—blood glucose
CAM—complementary and alternative medicine
CES-D—Center for Epidemiologic Studies Depression Scale
CVD—cardiovascular disease
HbA1c—hemoglobin A1c
LDL-C—low-density lipoprotein cholesterol
PCP—primary care provider
QDS—Quality Data Set
RCT—randomized controlled trial
T1DM—type 1 diabetes mellitus
T2DM—type 2 diabetes mellitus

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opinions presenting global recommendations not based on evidence; 5 cohort studies reporting natural history of disease and comorbidities; 3 with specific attention to comorbidity patterns in specific ethnic groups (case-control, cohort, and clinical report using adult literature); 3 reporting an association between microalbuminuria and retinopathy (2 case-control, 1 cohort); 3 reporting the prevalence of nephropathy (cohort); 1 reporting peripheral vascular disease (case series); 2 discussing retinopathy (1 case-control, 1 position statement); and 3 addressing hyperlipidemia (American Heart Association position statement on cardiovascular risks; American Diabetes Association consensus statement; case series). A breakdown of grade of recommendation shows no grade A studies, 10 grade B studies, 6 grade C studies, and 10 grade D studies. With regard to screening and treatment recommendations for comorbidities, data in children are scarce, and the available literature is conflicting. Therapeutic recommendations for hypertension, dyslipidemia, retinopathy, microalbuminuria, and depression were summarized from expert guideline documents and are presented in detail in the guideline. The references are provided, but the committee did not independently assess the supporting evidence. Screening tools are provided in the Supplemental Information. *Pediatrics* 2013;131:e648–e664

INTRODUCTION

This technical report details the procedures undertaken to develop the recommendations given in the accompanying clinical practice guideline, "Management of Type 2 Diabetes Mellitus in Children and Adolescents." What follows is a description of the process, including the committee's objectives; methods of evidence identification, retrieval, review, and analysis; and summaries of the committee's conclusions.

Statement of the Issue

Over the last 3 decades, type 2 diabetes mellitus (T2DM), a disease previously confined to adult patients, has markedly increased in prevalence among children and adolescents. Currently, in the United States, approximately 1 in 3 new cases of diabetes mellitus diagnosed in patients younger than 18 years is T2DM,[1,2] with a disproportionate representation in ethnic minorities,[3,4] especially among adolescents.[5] This trend is not limited to the United States but is occurring internationally as well.[6]

The rapid emergence of childhood T2DM poses challenges to the physician who is unequipped to treat adult diseases encountered in children. Most diabetes training and educational materials designed for pediatric patients address type 1 diabetes mellitus (T1DM) and emphasize insulin treatment and glucose monitoring, which may or may not be appropriate for children with T2DM.[7,8] Most medications used for T2DM have been tested for safety and efficacy only in individuals older than 18 years, and there is scant scientific evidence for optimal management of children with T2DM.[9,10] Extrapolation of data from adult studies to pediatric populations may not be valid because the hormonal milieu of the prepubescent and pubescent patient with T2DM can affect treatment goals and modalities in ways heretofore unencountered in adult patients.[11]

The United States has a severe shortage of pediatric endocrinologists, making access to these specialists difficult or, in some cases, impossible.[12] Vast geographic areas lack a pediatric endocrinologist: in 2011, 3 states had no pediatric endocrinologists, and 22 had fewer than 10, and the situation is unlikely to improve in the near future.[13] In 2004, the National Association of Children's Hospitals and Related Institutions performed a workforce survey and found that patients had to wait almost 9 weeks for an appointment to see an endocrinologist.[14] Because the number of patients with T1DM and T2DM has increased since then, this situation is presumably worse today. Regardless of their age, most patients in the United States who have T2DM are cared for by primary care providers (PCPs).[15] Furthermore, given the expected increases in the national and global incidence of T2DM and the near impossibility that the pediatric endocrine workforce will increase proportionately, PCPs must be prepared for and capable of managing children and adolescents who have uncomplicated T2DM.

Numerous experts have argued that the ideal care of a child with T2DM is provided through a team approach, with care shared among a pediatric endocrinologist, diabetes nurse educator, nutritionist, and behavioral specialist.[16–18] In areas of limited access to pediatric endocrinologists, however, contact with the pediatric endocrinology team might involve contact at diagnosis for initial diabetes education and intermittently thereafter; annually, with interval care by a PCP and interval communication with the pediatric endocrinology team; or at every visit, for those patients who are either doing poorly or are taking insulin.

In areas where access to subspecialists is hampered by geographic distances and/or professional shortages, care provided by local generalists who are skilled in treating children and youth with T2DM is likely to improve access to medical care. Although there are no pediatric studies evaluating this issue, the committee believes that this improved access to care might result in:

- Reduced wait times and increased timeliness of care.
- Reduced economic burden to the patient, including reduced need to travel and reduced time lost from work and/or school.
- Potentially improved patient retention. Kawahara et al[19] reported that 56.9% of patients with T2DM stopped coming to their hospital diabetes clinic appointments, most commonly because they were "too busy" to keep their appointments.

Recent advances in medical technology have the potential to ameliorate limited access to specialists. Reporting on the provision of clinical specialty diabetes care to remote locations using telemedicine, Malasanos et al[20] found that weekly telemedicine clinics were able to effectively replace quarterly face-to-face clinics after an initial face-to-face clinic visit. This more frequent contact provided by the telemedicine clinics resulted in improved hemoglobin A1c (HbA1c) concentrations, better patient satisfaction, fewer days missed from work or school, more time spent with the patient during clinic visits, and fewer subsequent hospitalizations and emergency department visits. Telemedicine is costly, however, and requires equipment to be in place at both the subspecialist's office and the remote clinic; it is, therefore, not appropriate for every practice. It is possible that a similar model of service could be provided by a generalist working locally and in close communication with a specialist.

For family physicians and others who care for adult patients, managing T2DM in children poses potential challenges. The first is that what works for adults may not work for children. Experiences and results observed in adults do not necessarily apply to children. Children (and even adolescents) are not small adults; they have a changing hormonal environment, have differences in physiology, and their growth can have effects on medication doses, toxicity, and responses.[11] As a result, generalists who are confident in caring for adults with diabetes may attempt to apply adult practice experiences to children, in whom these may not necessarily be appropriate. Kaufman cited data on various drugs' effects in children and argued that harm may occur if children with T2DM are treated like adults with T2DM.[11] The author called for treatment trials for children with T2DM, to "better define the risk-benefit ratio in children and youth, since this may differ substantially from that in the adult type 2 diabetic population." In contrast, others have noted that most adolescents with T2DM are similar to adults in terms of size and reproductive maturity and argued that, in the absence of studies specifically targeted to adolescents, treatment regimens can be extrapolated from studies of adults with T2DM; they do agree, however, that more randomized controlled trials (RCTs) are needed in the pediatric population.[1]

A second challenge is presented by the conflicting evidence regarding outcomes in patients with diabetes who are managed by generalists versus subspecialists. Some studies in adult patients indicate that generalists are capable of achieving outcomes similar to those of subspecialists. Greenfield et al[21] observed that physiologic and functional status (ie, physical, psychological, social functioning) were similar at both 2 and 4 years and mortality was similar at 7 years in adult hypertensive patients with diabetes treated in multispecialty groups versus health maintenance organization general practices. Other studies indicate that generalists may achieve outcomes similar to those of diabetes specialists, as long as they have input from subspecialists.

Indeed, unlike diseases in several other specialties, care for children with diabetes that is conducted by generalists without input from specialists may be inferior to that provided by specialists. Ziemer et al[22] used an RCT design to examine the effect of providing 5 minutes of direct feedback from an endocrinologist to a PCP every 2 weeks. Performance in the feedback group was sustained after 3 years, and performance decayed in a comparison group that received computer-generated decision support reminders, including a flow-sheet section showing previous clinical data and a recommendations section. Specialist feedback contributed independently to intensification of diabetes management. In addition, "clinical inertia" (defined as failure by providers to intensify pharmacologic therapy for hyperglycemia) was more likely in a primary care versus a diabetes clinic setting (91% vs 52%) and resulted in higher HbA1c concentrations among patients.[23]

How these observations might be applied to the child who has T2DM is not entirely clear, but they suggest that regular, direct contact between the generalist and a specialist can have a positive outcome on these patients. De Berardis et al[24] reported that, compared with adult patients with diabetes mellitus who were seen in general practice offices, patients cared for in diabetes clinics were more likely to conform with process-of-care measures, including HbA1c concentrations, blood pressure, total cholesterol and low-density lipoprotein cholesterol (LDL-C) levels, microalbuminuria testing, and foot and eye examinations and were more likely to have adequate concentrations of total cholesterol. No differences were found in glycemic, blood pressure, or LDL-C control, however. In that same study, all process-of-care measures improved when the patient was seen by a single physician

as opposed to being seen by several different physicians. No similar studies have been performed in children, and it is therefore unknown whether similar outcomes can be achieved in the pediatric population.

A third challenge is presented by the fact that children with T2DM are overrepresented among racial and ethnic minority populations and are more likely to be living in poverty; therefore, they may face significant challenges in accessing specialists, even under the best situations.[25] Recognizing these barriers to care and patients' real-world needs, it is the committee's consensus that it is impractical to expect every patient with T2DM to be able to access a pediatric endocrinologist on a regular basis. It is also unreasonable to assume that these visits will be frequent enough to provide the level of care needed to maintain the best possible metabolic control. For this reason alone, PCPs must have a thorough knowledge of the management of T2DM, including its unique aspects related to childhood and adolescence.

The committee also believes it is the PCP's responsibility to obtain the requisite skills for such care and to communicate and work closely with a diabetes team of subspecialists whenever possible. For this reason, when treatment goals are not met, the committee encourages clinicians to consult with an expert trained in the care of children and adolescents with T2DM. When first-line therapy fails (eg, metformin), recommendations for intensifying therapy should be generally the same for pediatric and adult populations. The picture is constantly changing, however, as new drugs are being introduced, and some drugs that initially seemed to be safe exhibit adverse effects with wider use. Clinicians should, therefore, remain alert to new developments in this area. Seeking the advice of an expert can help ensure that the treatment goals are appropriately set and that clinicians benefit from cutting-edge treatment information in this rapidly changing area.

Stated Objective of the American Academy of Pediatrics

Because the PCP caring for children will likely encounter T2DM, the American Academy of Pediatrics (AAP), the Pediatric Endocrine Society, the American Academy of Family Physicians, the American Diabetes Association (ADA), and the American Dietetic Association undertook a cooperative effort to develop clinical guidelines for the treatment of T2DM in children and adolescents, for the benefit of subspecialists and generalists alike. Representatives from these groups collaborated on developing an evidence profile that served as a major source of information for the accompanying clinical practice guideline recommendations. This report, based on a review of the current medical literature covering a period from January 1, 1990, to July 1, 2009, provides a set of evidence-based guidelines for the management and treatment of T2DM in children and adolescents.

It should be noted that, because childhood T2DM is a relatively recent medical phenomenon, there is a paucity of evidence for many or most of the recommendations provided in the accompanying guideline. Committee members have made every effort to demarcate in the guideline those references that were not identified in the original literature search and are not included in this technical report. Although provided for the reader's information, these references not identified in the literature search did not affect or alter the level of evidence for specific recommendations.

Composition of the Committee

The ad hoc multidisciplinary committee was cochaired by 2 pediatric endocrinologists pre-eminent in their field and included experts in general pediatrics, family medicine, nutrition, Native American health, epidemiology, and medical informatics. All panel members reviewed the AAP Policy on Conflict of Interest and Voluntary Disclosure and declared all potential conflicts.

Definitions

- Children and adolescents: patients ≥10 and ≥18 years of age.
- Childhood T2DM*:* disease in the child who typically: is obese (BMI ≥85th to 94th percentile and >95th percentile for age and gender, respectively); has a strong family history of T2DM; has substantial residual insulin secretory capacity at diagnosis (reflected by normal or elevated insulin and C-peptide concentrations); has insidious onset of disease; demonstrates insulin resistance (including clinical evidence of polycystic ovarian syndrome or acanthosis nigricans); and lacks evidence of diabetic autoimmunity. These patients are more likely to have hypertension and dyslipidemia than those with T1DM.
- Hyperglycemia: definition as accepted by the ADA. Specifically: fasting blood glucose (BG) concentration >126 mg/dL, random or 2-hour post-Glucola (Ames Co, Elkhart, IN) BG concentration >200 mg/dL.
- Clinician: any provider within his or her scope of practice; includes medical practitioners (including physicians and physician extenders), dietitians, psychologists, and nurses.
- Comorbidities: specifically limited to cardiovascular disease (CVD), hypertension, dyslipidemias and hypercholesterolemias, atherosclerosis, peripheral neuropathy, retinopathy, and nephropathy (microvascular and macrovascular). Obesity was considered a prediabetic condition and was specifically excluded.

- Diabetes: according to the ADA criteria, defined as:
  1. HbA1c concentration ≥6.5% (test performed in an appropriately certified laboratory); or
  2. Fasting (defined as no caloric intake for at least 8 hours) plasma glucose concentration ≥126 mg/dL (7.0 mmol/L); or
  3. Two-hour plasma glucose concentration ≥200 mg/dL (11.1 mmol/L) during an oral glucose tolerance test (test performed as described by the World Health Organization by using a glucose load containing the equivalent of 75 g of anhydrous glucose dissolved in water); or
  4. A random plasma glucose concentration ≥200 mg/dL (11.1 mmol/L) with symptoms of hyperglycemia.

(In the absence of unequivocal hyperglycemia, criteria 1–3 should be confirmed by repeat testing.)

- Diabetic ketoacidosis: the absolute or relative insulin deficiency resulting in fat breakdown with resultant formation of β-hydroxybutyrate and accompanying acidosis. Symptoms include nausea, vomiting, Kussmaul respirations, dehydration, and altered mental status.
- Fasting BG: BG concentration obtained before the first meal of the day and after a fast of at least 8 hours.
- Glucose toxicity: the effect of high BG causing both insulin resistance and impaired β-cell production of insulin.
- Intensification: increasing frequency of BG monitoring and adjustment of the dose and type of medication to decrease BG concentrations.
- Intercurrent illnesses: febrile illnesses or associated symptoms severe enough to cause the patient to stay home from school and/or seek medical care.
- Microalbuminuria: albumin-to-creatinine ratio ≥30 mg/g creatinine but <300 mg/g creatinine.
- Moderate hyperglycemia: BG concentration of 180 to 250 mg/dL.
- Moderate to vigorous exercise: exercise that makes the individual breathe hard and perspire and which raises his or her heart rate. An easy way to define exercise intensity for patients is the "talk test": during moderate physical activity a person can talk but not sing. During vigorous activity, a person cannot talk without pausing to catch a breath.
- Obese: BMI ≥95th percentile for age and gender.
- Overweight: BMI between 85th and 94th percentile for age and gender.
- Prediabetes: Fasting plasma glucose concentration ≥100 to 125 mg/dL or 2-hour glucose concentration during an oral glucose tolerance test ≥126 mg/dL but <200 mg/dL or HbA1c of 5.7% to 6.4%.
- Severe hyperglycemia: BG concentration >250 mg/dL.
- Thiazolidinediones: oral hypoglycemic agents that exert their effect at least in part by activation of the peroxisome proliferator-activated receptor-γ.
- T1DM: diabetes secondary to autoimmune destruction of β-cells resulting in absolute (complete or near complete) insulin deficiency and requiring insulin injections for management.
- T2DM: The investigators' designation of the diagnosis was used for the purposes of the literature review. The committee acknowledges that the distinction between T1DM and T2DM in this population is not always clear-cut, and clinical judgment plays an important role. Typically, this diagnosis is made when hyperglycemia is secondary to insulin resistance accompanied by impaired β-cell function, resulting in inadequate insulin production to compensate for the degree of insulin resistance.
- Youth: used interchangeably with "adolescent" in this document.

FORMULATION AND ARTICULATION OF THE QUESTION ADDRESSED BY THE COMMITTEE

The committee first formulated explicit questions for which evidence would be queried by the epidemiologist. Specific clinical questions addressed by the committee included: (1) the effectiveness of treatment modalities for T2DM in children and adolescents; (2) the efficacy of pharmaceutical therapies for treatment of children and adolescents with T2DM; (3) appropriate recommendations for screening for comorbidities typically associated with T2DM in children and adolescents; and (4) treatment recommendations for comorbidities of T2DM in children and adolescents.

These recommendations pertain specifically to patients at least 10 but younger than 18 years of age with T2DM. Although the distinction between T1DM and T2DM in children may be difficult,[26,27] for purposes of this report, the definition of childhood T2DM includes the child who typically is overweight or obese (defined as having a BMI ≥85th to 94th percentile and >95th percentile for age and gender, respectively); has a strong family history of T2DM; has substantial residual insulin secretory capacity at diagnosis (reflected by normal or elevated insulin and C-peptide concentrations); has insidious onset of disease; demonstrates insulin resistance (including clinical evidence of polycystic ovarian syndrome or acanthosis nigricans); and lacks

evidence of diabetic autoimmunity (negative for autoantibodies typically associated with T1DM). Patients with T2DM are more likely to have hypertension and dyslipidemia than are those with T1DM.

Methods

Primary Literature Search: Treatment of T2DM

The committee unanimously agreed on the objectives of the guideline and scope of the evidence search. A primary literature search was conducted by the consulting epidemiologist, using the strategy as described in the following text.

An article was eligible for inclusion if it addressed treatment of T2DM, was published in 1990 or later, was written in English, and included an abstract. Only primary research inquiries were considered; review articles were considered if they included primary data or opinion. Children and/or adolescents with an existing diagnosis of T2DM were required to constitute the research population; studies of adult patients were considered if ≥10% of their population was younger than 35 years.

The electronic databases PubMed, Cochrane Collaboration, and Embase were searched using the following Medical Subject Headings, alone and in various combinations: diabetes, mellitus, type 2, type 1, treatment, prevention, insipidus, diet, pediatric, T2DM, T1DM, non–insulin dependent diabetes mellitus (NIDDM), metformin, lifestyle, RCT, meta-analysis, child, adolescent, therapeutics, control, adult, obese, gestational, polycystic ovary syndrome, metabolic syndrome, cardiovascular, dyslipidemia, men, and women. In addition, the Boolean operators NOT, AND, and OR were used with the aforementioned terms, also in various combinations. Search limits included clinical trial, meta-analysis, randomized controlled trial, review, child: 6–12 years, and adolescent: 13–18 years.

Reference lists of identified articles were searched for additional studies using the same criteria for inclusion enumerated earlier. Finally, articles personally known to members of the committee that were not identified by other means were submitted for consideration and were included if they fulfilled the inclusion criteria.

A total of 196 articles were identified by using these search criteria. Of those, 58 were accepted as evidence for the guideline, and 138 were rejected as not meeting all requirements. A summary evidence table for the accepted articles can be found in Supplemental Information A.

Secondary Literature Search: Comorbidities of T2DM

After completion of the primary literature review, at the request of the committee, a second literature review was conducted to identify evidence relating to screening, diagnosis, and treatment of comorbidities of T2DM in children and adolescents. Similar to inclusion criteria for the primary review, an article relating to comorbidities was eligible for inclusion if it was published in 1990 or later, was written in English, and included an abstract. Again, only primary research inquiries were considered; review articles were considered if they included primary data or opinion. Children and/or adolescents in whom either T1DM or T2DM was diagnosed were required to constitute the research population; studies of adult patients were considered if ≥10% of the population was younger than 35 years. The focus of the research article must be hyperlipidemia, microalbuminuria, retinopathy, or "comorbidities of diabetes mellitus."

The electronic databases PubMed, Cochrane Collaboration, and Embase were searched using the following Medical Subject Headings, alone and in various combinations: diabetes, mellitus, type 2, type 1, pediatric, T2DM, T1DM, NIDDM, hyperlipidemia, retinopathy, microalbuminuria, comorbidities, screening, RCT, meta-analysis, child, and adolescent. In addition, the Boolean operators NOT, AND, and OR were used with the aforementioned terms, also in various combinations. Search limitations included clinical trial, meta-analysis, randomized controlled trial, review, child: 6–12 years, and adolescent: 13–18 years. Reference lists of identified articles were searched for additional studies, with the use of the same criteria for inclusion enumerated earlier. Finally, articles personally known to members of the committee that were not identified by other means were submitted for consideration and were included if they fulfilled the inclusion criteria.

A total of 75 articles were identified by using these search criteria. Of those, 26 were accepted as evidence for the guideline, and 49 were rejected as not meeting all requirements. A summary evidence table for the accepted comorbidity articles can be found in Supplemental Information B.

Analysis of Available Evidence

A strict evidence-based approach was used to extract data used to develop the recommendations presented in the accompanying clinical practice guideline. Individual articles meeting the prospective search criteria were critically appraised for strength of methodology, and they were assigned an evidence level grade on the basis of guidelines published by the University of Oxford's Centre for Evidence-based Medicine, which are synthesized in the next discussion.[28]

Levels of Evidence (Based on Methodology)

- Level 1A: Systematic review with homogeneity of included RCTs.

- Level 1B: Individual RCT with narrow CI and >80% follow-up.
- Level 2A: Systematic review with homogeneity of cohort studies.
- Level 2B: Individual cohort study, follow-up of untreated controls in an RCT, or low-quality RCT (ie, less than 80% follow-up).
- Level 2C: "Outcomes research."
- Level 3A: Systematic review with homogeneity of case-control studies.
- Level 3B: Individual case-control studies.
- Level 4: Case series; poor-quality cohort and/or case-control studies.
- Level 5: Expert opinion without explicit critical appraisal or based on physiology, bench research, or "first principles."

Grades of Evidence Supporting the Recommendations

The AAP policy statement, "Classifying Recommendations for Clinical Practice Guidelines," was followed in designating grades of recommendation (Fig 1, Table 1), based on the levels of available evidence. AAP policy stipulates that the evidence in support of each key action statement be prospectively identified, appraised, and summarized and that an explicit link between level of evidence and grade of recommendation be defined.

Possible grades of recommendations range from A to D, with A being the highest. Some qualification of the grade is further allowed on the basis of subtle characteristics of the level of supporting evidence. The AAP policy statement is consistent with the grading recommendations advanced by the University of Oxford's Centre for Evidence-based Medicine. The AAP policy statement "Classifying Recommendations for Clinical Practice Guidelines" offers further details.[29]

- Grade A: Consistent level 1 studies. (Examples include meta-analyses with appropriate adjustments for heterogeneity, well-designed RCTs, or high-quality diagnostic studies on relevant populations.)
- Grade B: Consistent level 2 or level 3 studies or extrapolations from level 1 studies. (Examples include RCTs or diagnostic studies with methodologic flaws or performed in less relevant populations; consistent and persuasive evidence from well-designed observational trials.)
- Grade C: Level 4 studies or extrapolations from level 2 or level 3 studies. (Examples include poor-quality observational studies, including case-control and cohort design methodologies, as well as case series.)
- Grade D: Level 5 evidence, or troublingly inconsistent or inconclusive studies of any level. (Examples include case reports, expert opinion, reasoning from first principles, or methodologically troubling studies with questionable validity.)
- Level X: Not an explicit level of evidence as outlined by the Centre for Evidence-based Medicine. Reserved for interventions that are unethical or impossible to test in a controlled or scientific fashion, in which the preponderance of benefit or harm is overwhelming, precluding rigorous investigation.

The relationship between grades of evidence supporting recommendations and recommended key action statements is depicted in Fig 1. Note that any given recommended key action statement may only be as strong as its supporting evidence will allow.

Recommended Key Action Statements

After considering the available levels of evidence and grades of recommendations, the committee formulated

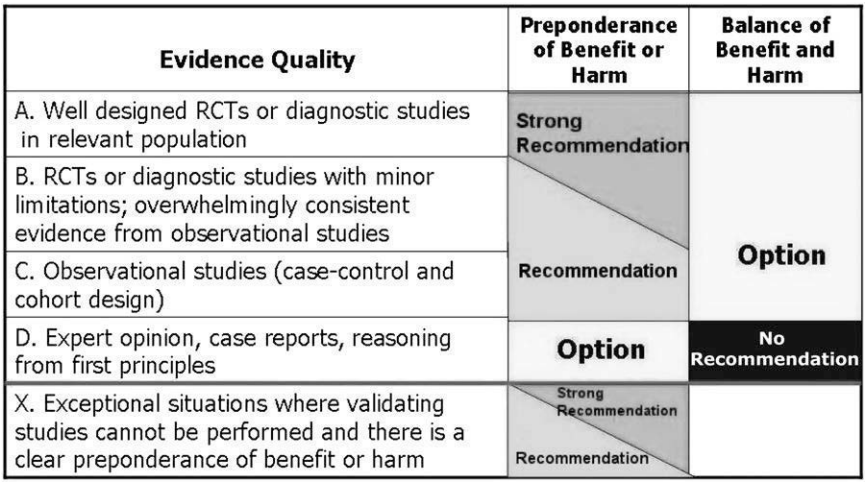

FIGURE 1
Evidence quality. Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is carried out leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation.

TABLE 1 Grades of Study According to Subdivision

Evidence Quality	Medical Treatment	Nonmedical Treatment	Provider Behaviors	Social Issues
A	4	1	0	0
B	0	1	0	0
C	4	3	7	6
D	24	4	1	3

several recommended key action statements, published in the companion clinical practice guideline. As discussed previously, recommended key action statements vary in strength on the basis of the quality of the supporting evidence.

- Strong recommendation: The highest level of recommendation, this category is reserved for recommendations supported by grade A or grade B evidence demonstrating a preponderance of benefit or harm. Interventions based on level X evidence may also be categorized as strong on the basis of their risk/benefit profile. A strong recommendation in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms (as a strong recommendation against an action is made when the anticipated harms clearly exceed the benefits) and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendations may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms. The implication for clinicians is that they should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
- Recommendation: A recommended key action statement is made when the anticipated benefit exceeds the harms but the evidence is not as methodologically sound. Recommended key action statements must be supported by grade B or grade C evidence; level X evidence may also result in a recommendation depending on risk/benefit considerations. A recommendation in favor of a particular action is made when the anticipated benefits exceed the harms, but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high-quality evidence is impossible to obtain but the anticipated benefits outweigh the harms. The implication for clinicians is that they would be prudent to follow a recommendation but should remain alert to new information and sensitive to patient preferences.
- Option: Option statements are offered when the available evidence is grade D or the anticipated benefit is balanced with the potential harm. Options define courses that may be taken when either the quality of evidence is suspect or carefully performed studies have shown little clear advantage to 1 approach over another. The implication for clinicians is that they should consider the option in their decision-making, and patient preference may have a substantial role.
- No recommendation: When published evidence is lacking, and/or what little evidence is available demonstrates an equivocal risk/benefit profile, no recommended key action can be offered. No recommendation indicates that there is a lack of pertinent published evidence and that the anticipated balance of benefits and harms is presently unclear. The implication for clinicians is that they should be alert to new published evidence that clarifies the balance of benefit versus harm.

Implementation Strategy

Implementing the guideline's recommendations to improve care processes involves identifying potential barriers to the use of the knowledge, creating strategies to address those barriers, and selecting appropriate quality improvement methods (eg, education, audit and feedback, computer-based decision support).

Computer-mediated decision support offers an implementation mode that has been demonstrated to be effective[30] and that is expected to be of increasing relevance to pediatricians with the adoption of electronic health records. To facilitate translation of the recommendations into computable statements, the guideline recommendations were transformed into declarative production rule (eg, IF-THEN) statements.[31] The Key Action Statements are displayed as production rules in Supplemental Information C. The concepts required to describe antecedent and consequent clauses in these rules were translated into the following standardized coding systems: SNOMED-CT,[32] RxNorm,[33] and LOINC.[34]

In addition, the concepts described in the guideline recommendations were translated, where possible, into elements of the National Quality Forum's Quality Data Set (QDS).[35] The QDS provides a framework from which performance measurement data can be derived. The QDS is intended to serve as a standard set of reusable data elements that can be used to promote quality measurement. Each QDS element includes a name, a quality data type that describes part of the clinical care process, quality data type specific attributes, a standard code set name, and a code listing. The Methods for Developing the Guidelines section displays the relevant decision variables and actions as well as coding information. A QDS listing of decision variables and actions is provided in Supplemental Information D.

RESULTS

Primary Literature Search: Treatment of T2DM

Thousands of articles were retrieved and considered on the basis of the aforementioned criteria. From those,

199 abstracts were identified for possible inclusion, and 58 were retained for systematic review. Results of the literature review are presented in the following text and listed in the evidence tables in the Supplemental Information.

Of the 58 articles retained for systematic review, 5 studies were classified as grade A studies, 1 as grade B, 20 as grade C, and 32 as grade D. Articles regarding the treatment of T2DM selected for inclusion were divided into 4 major subcategories on the basis of type of treatment being discussed: (1) medical treatments (32 studies); (2) nonmedical treatments (9 studies); (3) provider behaviors (8 studies); and (4) social issues (9 studies). Detailed information about these articles is presented in Supplemental Information A. A graphic depiction of the grades of study according to subdivision is given in Table 1.

Rejected Articles

Of the 257 articles meeting search criteria, 199 were rejected, categorized as follows:

- Comorbidities: 69 studies. (Note: these articles were rejected within the context of the primary search string relating to treatment of T2DM. A second prospective literature search was conducted solely addressing comorbidities, the results of which are presented in the next section.)
- Medical treatment: 99 articles.
- Nonmedical treatment: 16 articles.
- Social issues: 12 articles.
- Provider behaviors: 3 articles.

To view the recommendations related to management of T2DM, please see the accompanying clinical practice guideline.[36]

Secondary Literature Search: Comorbidities of T2DM

Evidence is sparse in children and adolescents regarding the risks for developing various comorbidities of diabetes that are well recognized in adult patients. Numerous reports have documented the occurrence of comorbidities in adolescents with T2DM, but no randomized clinical trials have examined the progression and treatment of comorbidities in youth with T2DM.[29] The evidence that does exist is contradictory with regard to both screening and treatment recommendations. After applying the previously described search criteria and screening to thousands of articles, an additional 336 abstracts relating to comorbidities were identified for possible inclusion, of which 26 were retained for systematic review. Results of this subsequent literature review are presented in Supplemental Information E.

Articles discussing comorbidities ran the gamut of study focus, type, level of evidence, and grade of recommendation. The 26 articles that met the revised objective criteria had the following characteristics:

- Expert opinion global recommendations not based on evidence (5 articles).
- Cohort studies reporting natural history of disease and comorbidities (5 articles).
- Specific attention to comorbidity patterns in specific ethnic groups (case-control, cohort, and clinical report by using adult literature: 3 articles).
- Association between microalbuminuria and retinopathy (2 case-control, 1 cohort: 3 articles).
- Prevalence of nephropathy (cohort: 3 articles).
- Hyperlipidemia (American Heart Association [AHA] position statement on cardiovascular risks, ADA consensus statement, case series: 3 articles).
- Retinopathy (1 case-control, 1 position statement: 2 articles).
- Peripheral vascular disease (case series: 1 article).
- Systematic review of literature regarding comorbidities of T2DM in adolescents (1 article).

A graphic depiction of the grades of recommendation is given in Table 2.

Rejected Articles

A total of 310 articles did not meet primary inclusion criteria and were rejected; details are presented in Supplemental Information F. Profiles of the rejected articles are:

- Articles relating to T1DM (125 articles); specifically on the following topics:
  - Retinopathy (42 articles).
  - Vascular complications (34 articles).
  - Nephropathy (29 articles).
  - Natural history and epidemiology of T1DM (8 articles).
  - Hyperlipidemia (5 articles).
  - Risk factors for comorbidities (ie, ethnicity, puberty: 4 articles).
  - Neuropathy (3 articles).
- Articles involving adults, practice management issues, and other nonpertinent topics (118 articles).
- Articles about nondiabetic subjects, prediabetic subjects, or adults, including recommendations for testing for conditions such as hyperlipidemias and CVD (36 articles).
- Reviews, published trials, guidelines, and position statements not meeting criteria (19 articles).
- Studies addressing methods of testing for comorbidities (12 articles).

The initial search strategy for comorbidities included patients diagnosed with T1DM. The committee thus assumed that (with the exception of initiating screening) the pattern of comorbidities—and the need to screen for and treat them—would be similar between T1DM and T2DM. It was also

assumed that comorbidities would be similar between pediatric and adult patients, with length and severity of disease the driving factors. During the search, articles addressing the following themes were identified and reviewed:

- The pattern of comorbidities in T1DM versus T2DM and the role of puberty (9 articles).
- Differences in comorbidity patterns in children with T2DM compared with adults (8 articles).

Although not included in the final list of studies, these articles are included in the Supplemental Information because they resulted in an alteration to the original inclusion criteria. The results of these articles indicate that the pattern of comorbidities in children and adolescents with T2DM may not resemble that of either T1DM patients (possibly because of the influence of puberty) or adults, as was hypothesized by the committee when identifying the primary search parameters. Accordingly, the search string was modified to include only children and adolescents with the diagnosis of T2DM.

Recommendations Regarding Comorbidities

Unlike T2DM in adult patients, data are scarce in children and adolescents regarding the diagnosis, natural history, progression, screening recommendations, and treatment recommendations. Numerous reports have documented the occurrence of comorbidities in adolescents with T2DM, but no RCTs have examined the progression and treatment of comorbidities in youth with T2DM.

TABLE 2 Grades of Recommendation

Evidence Quality	No. of Studies
A	0
B	10
C	6
D	10

The available literature is conflicting regarding whether clinical signs of pathology in adults are variants of normal for adolescents, the role of puberty in diagnosis and progression of various comorbidities, the screening tests that should be performed and how they should be interpreted, when screenings should be initiated, how often screening should be performed and by whom, and how abnormal results should be treated. Medications commonly prescribed in adult patients have not been rigorously tested in children or adolescents for safety or efficacy. The peculiarities of the developing adolescent brain, typical lifestyle, and social issues confound issues of treatment effectiveness.

Despite the limited evidence available, the committee provides information on expert recommendations for the following selected comorbidities: hypertension, dyslipidemia, retinopathy, microalbuminuria, and depression. These therapeutic recommendations were summarized from expert guideline documents and are presented in detail in the following sections. The references are provided, but the committee did not independently assess the supporting evidence. Sample screening tools are provided in the Supplemental Information (see Supplemental Information H and I).

Hypertension

Hypertension is a significant comorbidity associated with endothelial dysfunction, vessel stiffness, and increased risk of future CVD and chronic kidney disease for the child with diabetes.[37,38] It is present in 36% of youth with T2DM within 1.3 years of diagnosis[39] and was present in 65% of youth with T2DM enrolled in the SEARCH for Diabetes in Youth Study (SEARCH study).[40] Because development of CVD is associated with hypertension, recognition and treatment of this comorbidity are essential, especially in youth with T2DM. Unfortunately, health care providers underdiagnose hypertension in children and adolescents (both with and without diabetes), resulting in a lack of appropriate treatment.[41]

Screening:

- Blood pressure should be measured with an appropriate-sized cuff and reliable equipment, monitored at every clinic visit, and plotted against norms for age, gender, and height provided in tables available at the following Web site: http://www.nhlbi.nih.gov/guidelines/hypertension/child_tbl.htm[42] or in "The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents."[43] (See the Supplemental Information for the National Institutes of Health table.)

Treatment:

- Once a diagnosis of hypertension is established, the clinician can institute appropriate treatment, which might include lifestyle change and/or pharmacologic agents. Although a complete discussion of this topic is beyond the scope of these guidelines, rational treatment guidelines exist.[43,44] In adult patients with T2DM, concomitant treatment of hypertension has been shown to improve microvascular and macrovascular outcomes at least as much as control of BG concentrations.[45,46] Therefore, it is the consensus of this committee that similar benefits are likely with early recognition and treatment of hypertension in the child or adolescent with increased CVD risk secondary to T2DM.[47,48] The committee recommends appropriate surveillance and therapy as outlined in "The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents."[43]

- Initial treatment of blood pressure consistently at, or above, the 95th percentile on at least 3 occasions should consist of efforts at weight loss reduction, limitation of dietary salt, and increased activity.
- If, after 6 months, blood pressure is still above the 95th percentile for age, gender, and height, initiation of an angiotensin-converting enzyme (ACE) inhibitor should be considered to achieve blood pressure values that are less than the 90th percentile.
- If ACE inhibitors are not tolerated because of adverse effects (most commonly cough), an angiotensin receptor blocker should be used.
- If adequate control of hypertension is not achieved, referral to a physician specialist trained in the treatment of hypertension in youth is recommended.

Dyslipidemia

Long-term complications of T2DM in children and adolescents are not as well documented as those found in adults. It should be noted that the pediatric experience with niacin and fibrates is limited. In a review, however, Pinhas-Hamiel and Zeitler[49] noted the presence of dyslipidemia in a substantial proportion of young patients with T2DM in various populations worldwide. The SEARCH study found that 60% to 65% of 2096 youth with T2DM had hypertriglyceridemia, and 73% had a low high-density lipoprotein cholesterol level.[50] Thus, although variations exist in the criteria used for defining hyperlipidemia, there is unequivocal evidence that screening for dyslipidemia is imperative in pediatric patients with T2DM.[49,51,52] Hyperglycemia and insulin resistance may play a direct role in dyslipidemia, and cardiovascular risk is further enhanced by the presence of other risk factors, including obesity and a family history of early CVD.[49,53] The AHA classifies T2DM as a tier 2 condition (moderate risk) in which accelerated atherosclerosis has been documented in patients younger than 30 years.[51] The presence of 2 other risk factors, including obesity, smoking, family history of CVD, and poor exercise history, can accelerate this status to tier 1 (high risk), which is relevant to many young patients with T2DM.

Screening:

- On the basis of current recommendations by the ADA and the AHA, at the initial evaluation, all patients with T2DM should have baseline lipid screening (after initial glycemic control has been established) consisting of a complete fasting lipid profile, with follow-up testing based on the findings or every 2 years thereafter, if initial results are normal.[51–53] (See the Supplemental Information for screening tools.)

Treatment:

The committee suggests following the AHA position statement, "Cardiovascular Risk Reduction in High-risk Pediatric Patients," for management of dyslipidemia.[51] This position statement recommends:

- Evaluation and dietary education by a registered dietitian for all patients, with initiation of intensive therapy and follow-up for patients with a BMI >95th percentile.
- Lipid targets:
  - LDL-C: Initial concentration ≥130 mg/dL: nutritionist training with diet <30% calories from fat, <7% calories from saturated fat, cholesterol intake <200 mg/day, and avoidance of trans fats. LDL measurements should be repeated after 6 months. If concentrations are still 130 to 160 mg/dL, statin therapy should be initiated, with a goal of <130 mg/dL and an ideal target of <100 mg/dL.
  - Triglycerides: If initial concentrations are between 150 and 600 mg/dL, patients should decrease intake of simple carbohydrates and fat, with weight loss management for those who are overweight. If levels are >700 to 1000 mg/dL at initial or follow-up visit, fibrate or niacin should be considered if the patient is older than 10 years because of increased risk of pancreatitis at these concentrations.
- Control of hypertension, per guidelines referenced previously.
- Intensification of management of hyperglycemia.
- Assessment of parental smoking history and patient smoking history if the patient is older than 10 years; active antismoking counseling at every visit and referral to a smoking cessation program, if required.
- Assessment of family history of early CVD along with current family lifestyle habits; a positive family history increases the level of risk.
- Promotion of physical exercise and limitation of sedentary activities.

Retinopathy

The eye has been called a unique window into the neural and vascular health in patients with diabetes.[54] Retinopathy is well documented in adults, both alone and in association with other comorbidities,[55] but descriptions of its frequency and associations with other comorbidities in youth are limited. Some observational and case-control studies show that retinopathy in adolescents with T2DM is present earlier than in adults, whereas others indicate that it appears much later.[56–60]

The review by Pinhas-Hamiel and Zeitler[49] of complications of T2DM among

adolescents cited studies in which the diagnosis of retinopathy appeared to occur strikingly early in the disease process. Two large studies in the Japanese population documented early development of retinopathy in young adults, some even before the diagnosis of diabetes mellitus. In a study of 1065 patients diagnosed with T2DM before 30 years of age, Okudaira et al[57] reported the presence of retinopathy in 99 patients (9.3%) before the first visit. One hundred thirty-five patients (12.7%) developed proliferative retinopathy before 35 years of age, and 32 (23.7%) of these patients were blind by a mean age of 32 years. Bronson-Castain et al[54] used sophisticated techniques to evaluate the neural and vascular health of the retina and reported a much higher incidence of focal retinal neuropathy, retinal thinning, and retinal venular dilation in a cohort of 15 adolescent patients with T2DM matched with 26 controls. Okudaira et al observed the development of retinopathy in 394 patients diagnosed with T2DM before 30 years of age. Of the 322 patients who were free of retinopathy at entry, 88 developed background diabetic retinopathy over 5.7 years, an incidence of 57.7 per 1000 person-years. Fifty of the 160 patients with background retinopathy developed proliferative retinopathy over 7.1 years, an incidence of 17.9 per 1000 person-years. Poor glycemic control, duration of disease, and high blood pressure seemed to be the primary risk factors.

Conversely, the study by Krakoff et al[58] of 178 youth that used the proportional hazards model showed a lower risk for retinopathy in Pima Indians (compared with the Japanese study cited previously), even after adjusting for glucose concentrations and blood pressure. Similar results were reported by Farah et al[59] in 40 African American and Hispanic youth and by Karabouta et al[60] in 7 adolescent patients. It is unclear whether these differences in results arise from variations in study design, population demographic characteristics, and/or techniques used in diagnosis. Given the variability in the results of epidemiologic studies and absence of long-term data, the committee considers it prudent for providers to follow the ADA "Standards of Medical Care in Diabetes" for identification and management of retinopathy in adolescents with T2DM, as follows[61]:

Screening:

- Patients with T2DM should have an initial dilated and comprehensive eye examination performed by an ophthalmologist or optometrist shortly after diabetes diagnosis.
- Subsequent examinations by an ophthalmologist should be repeated annually. Less frequent examinations may be considered (eg, every 2–3 years) after 1 or more normal eye examinations. More frequent examinations are required if retinopathy is progressing.

Treatment:

- Providers should promptly refer patients with any level of macular edema, severe nonproliferative diabetic retinopathy, or any proliferative diabetic retinopathy to an ophthalmologist who is knowledgeable and experienced in the management and treatment of diabetic retinopathy.
- Laser photocoagulation therapy is indicated to reduce the risk of vision loss in patients with high-risk proliferative diabetic retinopathy, clinically significant macular edema, and some cases of severe nonproliferative diabetic retinopathy.

Microalbuminuria

Microalbuminuria is a marker of vascular inflammation and a sign of early nephropathy; it has been found to be associated with CVD risk in adults. It may be present at diagnosis in youth with T2DM.[49] Higher rates of microalbuminuria have been reported among youth with T2DM than in their peers with T1DM.[39,59] Diabetic nephropathy may also be more frequent and severe among youth with T2DM.[62,63]

According to the ADA statement "Care of Children and Adolescents with Type 1 Diabetes," the definition of microalbuminuria is either:

- "Albumin-to-creatinine ratio 30–299 mg/g in a spot urine sample; slightly higher values can be used in females because of the difference in creatinine excretion,"[7,64] or
- "Timed overnight or 24-hour collections: albumin excretion rate of 20–199 mcg/min."[7]

According to the ADA, "an abnormal value should be repeated as exercise, smoking, and menstruation can affect results and albumin excretion can vary from day to day. The diagnosis of persistent abnormal microalbumin excretion requires documentation of two of three consecutive abnormal values obtained on different days."[7,65] In addition, nondiabetes-related causes of renal disease should be excluded; consultation with specialists trained in the care of children with renal diseases should be considered as required. It should be noted that orthostatic proteinuria is not uncommon in adolescents and usually is considered benign. For that reason, all patients with documented microalbuminuria should have a first morning void immediately on arising to determine if this is the case. Orthostatic proteinuria does not require treatment with medication.

The committee considers it prudent for providers to follow the ADA "Standards of Medical Care in Diabetes" for the identification and management of

microalbuminuria in adolescents with T2DM, as described here. Note that monitoring should always be done on a first morning void specimen:

Screening:

- Screening for microalbuminuria should begin at the time of T2DM diagnosis and be repeated annually.
- An annual random spot urine sample for microalbumin-to-creatinine ratio is recommended.[66]

Treatment:

- Treatment with an ACE inhibitor should be initiated in nonpregnant individuals with confirmed persistent microalbuminuria from 2 additional urine specimens, even if blood pressure is not elevated.
- If possible, treatment with an ACE inhibitor should be titrated to normalization of microalbumin excretion. "Microalbumin excretion should be monitored at three- to six-month intervals to assess both the patient's response to therapy and the disease progression, and therapy should be titrated to achieve as normal an albumin-to-creatinine ratio as possible."[7]

Additional relevant issues noted in the ADA statement "Care of Children and Adolescents with Type 1 Diabetes" include[7]:

- Concomitant hypertension should be addressed. If present, hypertension should be aggressively treated to achieve normotension for age, sex, and height.
- Patients should be educated about the importance of attention to glycemic control and avoidance or cessation of smoking in preventing and/or reversing diabetic nephropathy.
- If medical treatment is unsatisfactory, referral to a nephrologist should be considered.

Depression

Depression is a significant comorbidity that can complicate the medical management of diabetes and is associated with poor adherence. Longitudinal studies of the association between T2DM and depression among youth are not available. In a longitudinal study among youth with T1DM, however, Kovacs et al[67] estimated the rate of psychiatric disorders to be 3 times higher in youth with diabetes than in those without diabetes, with the increased morbidity primarily attributable to major depression.[7,67,68] In addition, cross-sectional data from the SEARCH study have shown the prevalence of depressed mood to be higher among males with T2DM than among males with T1DM.[67] Lawrence et al[68] also found higher levels of depressed mood to be associated with poor glycemic control and number of emergency department visits among participants with both T1DM and T2DM, compared with youth with T1DM and T2DM who had "minimal" levels of depressed mood.

Because depression is associated with poor adherence to diabetic treatment recommendations, its identification and proper management are essential for maximizing therapeutic success. Given the serious nature of this comorbidity and its propensity for poor metabolic control, the committee recommends that clinicians assess youth with T2DM for depression at diagnosis; perform periodic, routine screening for depression on all youth with T2DM, especially those with frequent emergency department visits or poor glycemic control; and promptly refer youth who have positive screenings to appropriate mental health care providers for treatment. Addressing a family history of diabetes and its effect on the family unit can be a major factor in depression as well as compliance with the disease management needs.

Screening:

- According to the American Psychiatric Association, a diagnosis of major depressive disorder requires[69]:
  (a). The presence of 5 or more of the following symptoms within the same 2-week period and represents a change from previous functioning. At least 1 of the symptoms is either depressed mood or loss of interest or pleasure.
- Depressed mood most of the day, nearly every day, as indicated by either substantive report or observation made by others. (Note that in children and adolescents, this can be irritable mood.)
- Markedly diminished interest or pleasure in all, or nearly all, activities most of the day, nearly every day.
- Significant weight loss when not dieting or weight gain (eg, more than 5% of body weight in a month), or increased or decreased appetite nearly every day. (Note that in children and adolescents, this should include failure to make expected weight gains.)
- Insomnia or hypersomnia nearly every day.
- Psychomotor agitation or retardation nearly every day (observable by others, not merely the subject's feeling restless or slowed down).
- Fatigue or loss of energy nearly every day.
- Feelings of worthlessness or inappropriate guilt (which may be delusional) nearly every day.
- Diminished ability to think or to concentrate, or indecisiveness, nearly every day.
- Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt, or a specific plan to commit suicide.

(b). The symptoms do not meet the criteria for a mixed episode (defined as a specific time period in which the individual experiences nearly daily fluctuations in mood that qualify for diagnoses of manic episode and major depressive episode).

(c). The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

(d). The symptoms are not due to the direct physiologic effects of a substance (eg, a drug of abuse, medication) or a general medical condition (eg, hypothyroidism).

(e). The symptoms are not better accounted for by bereavement (ie, after the loss of a loved one), symptoms persist longer than 2 months, or symptoms are characterized by marked functional impairment, morbid preoccupation with worthlessness, suicidal ideation, psychotic symptoms, or psychomotor retardation.

- Another potentially valuable screening tool for depression is the Center for Epidemiologic Studies Depression Scale (CES-D), a 20-item scale originally developed for use in adults[70] but which has been used subsequently in studies of youth as young as 12 years.[71–74] (See Supplemental Information G for this scale.)

Treatment:

- Recognition of depression should trigger a referral to a mental health care provider skilled in addressing this condition in children and adolescents.

Other Comorbidities or Associated Medical Conditions

In addition to the comorbidities mentioned previously, T2DM is associated with other obesity-related medical conditions, many of which, when discovered, necessitate consultation with specialists who have specific expertise in the field. These associated conditions include:

- Nonalcoholic fatty liver disease: Baseline aspartate aminotransferase and alanine aminotransferase concentrations should be obtained, especially if treatment with lipid-lowering drugs is instituted. Referral to a pediatric or internal medicine gastroenterologist may be indicated.
- Obstructive sleep apnea: The diagnosis of obstructive sleep apnea can only be made reliably by using a sleep study. If the diagnosis is made, an electrocardiogram and possibly an echocardiogram should be obtained to rule out right ventricular hypertrophy. Referral to a pediatric cardiologist, internal medicine cardiologist, or sleep specialist may be indicated.
- Orthopedic problems: These comorbidities (especially slipped capital femoral epiphysis and Blount disease) require immediate referral to a specialist in orthopedics and will limit the physical activity that can be prescribed to the individual.

COMPLEMENTARY AND ALTERNATIVE MEDICINE

The clinical practice guidelines do not present any evidence-based recommendations for the use of complementary and alternative medicine (CAM) to treat T2DM in children and adolescents. Limited data are available on CAM, and none is specific to this age group. However, noting that adult patients with diabetes are 1.6 times more likely to use CAM than are individuals without diabetes, the committee believes it is important for clinicians to encourage their patients to communicate openly about the use of CAM (especially because the parents may have diabetes themselves) and, when acknowledged, to differentiate between coadministration with the prescribed therapy versus replacement of (and, thus, noncompliance with) the prescribed therapy.[75]

CAM is most likely to be used by West Indian, African, Indian, Latin American, and Asian subjects.[76] CAM is also more common in families with higher income and education levels and an increased interest in self-care. One multicenter study conducted in Germany found that, among 228 families with a T1DM diagnosis, 18.4% reported using at least 1 form of CAM.[77] Reported parental motivators for using CAM for their children included the hope of improving their well-being (92.1%); the desire to try every available treatment option (77.8%); and the assumption that CAM has fewer adverse effects than conventional therapy (55.2%). Many forms of CAM are used because of patient-perceived inadequacies of current treatments.[75]

A wide variety of CAM dietary supplements are targeted at patients with diabetes and promise to lower BG concentrations or prevent and/or treat complications associated with the disease. Common supplements used by individuals with diabetes include aloe, bitter melon, chromium, cinnamon, fenugreek, ginseng, gymnema, and nopal.[78] These products lack product standardization and are not regulated by the US Food and Drug Administration for either safety or possible complications. Although these supplements may or may not have proven beneficial effects on diabetes, many might have harmful adverse effects and/or lead to medication interactions. Adverse effects from dietary supplements can include gastrointestinal discomfort, hypoglycemia, favism, insomnia, and increased blood pressure.[78]

In addition to dietary supplements, patients may use forms of CAM that include prayer, acupuncture, massage, hot tub therapy, biofeedback, and yoga. The University of Chicago's Division of Pediatric Endocrinology interviewed 106 families with T1DM and found that 33% of children had tried CAM in the past year; the most common form used was faith-healing or prayer.[79] Parents who reported the use of CAM for their children were also more likely to report having experienced struggles with adherence to conventional medicine.

It is the committee's opinion that providers should question patients on their use of CAM and also educate patients on potential adverse effects, review evidence for efficacy, and discourage the use of potentially dangerous or ineffective products.

SUMMARY

The clinical practice guideline that this technical report accompanies provides evidence-based recommendations on the management of patients between 10 and 18 years of age who have been diagnosed with T2DM. The document does not pertain to patients with impaired glucose tolerance, isolated insulin resistance, or prediabetes, nor does it pertain to obese but nondiabetic youth. It emphasizes the use of management modalities that have been shown to affect clinical outcomes in this pediatric population. The clinical practice guideline addresses situations in which either insulin or metformin is the preferred first-line treatment of children and adolescents with T2DM. It suggests integrating lifestyle modifications (ie, diet and exercise) in concert with medication rather than as an isolated initial treatment approach. Guidelines for frequency of monitoring HbA1c and finger-stick BG concentrations are presented. The clinical practice guideline is intended to assist clinician decision-making rather than replace clinical judgment and/or establish a protocol for the care of all children with this condition. These recommendations may not provide the only appropriate approach to the management of children with T2DM. Providers should consult experts trained in the care of children and adolescents with T2DM when treatment goals are not met or when therapy with insulin is initiated.

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ERRATUM

An error occurred in the American Academy of Pediatrics "Technical Report: Management of Type 2 Diabetes Mellitus in Children and Adolescents" published in the February 2013 issue of *Pediatrics* (2013;131[2]:e648–e664).

On page e651, third column, under "Definitions," the first sentence should read as follows: "Children and adolescents: children $<$10 years of age; adolescents $\geq$10 years but $\leq$18 years of age."

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Diabetes Clinical Practice Guideline Quick Reference Tools

- Action Statement Summary
  — Management of Newly Diagnosed Type 2 Diabetes Mellitus (T2DM) in Children and Adolescents
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Type 2 Diabetes Mellitus
- AAP Patient Education Handout
  — *Type 2 Diabetes: Tips for Healthy Living*

Action Statement Summary

Management of Newly Diagnosed Type 2 Diabetes Mellitus (T2DM) in Children and Adolescents

Key Action Statement 1

Clinicians must ensure that insulin therapy is initiated for children and adolescents with T2DM who are ketotic or in diabetic ketoacidosis and in whom the distinction between T1DM and T2DM is unclear; and, in usual cases, should initiate insulin therapy for patients:

- who have random venous or plasma BG concentrations ≥250 mg/dL; or
- whose HbA1c is >9%.

(Strong Recommendation: evidence quality X, validating studies cannot be performed, and C, observational studies and expert opinion; preponderance of benefit over harm.)

Key Action Statement 2

In all other instances, clinicians should initiate a lifestyle modification program, including nutrition and physical activity, and start metformin as first-line therapy for children and adolescents at the time of diagnosis of T2DM. (Strong recommendation: evidence quality B; 1 RCT showing improved outcomes with metformin versus lifestyle; preponderance of benefits over harms.)

Key Action Statement 3

The committee suggests that clinicians monitor HbA1c concentrations every 3 months and intensify treatment if treatment goals for BG and HbA1c concentrations are not being met. (Option: evidence quality D; expert opinion and studies in children with T1DM and in adults with T2DM; preponderance of benefits over harms.)

Key Action Statement 4

The committee suggests that clinicians advise patients to monitor finger-stick BG concentrations in those who are taking insulin or other medications with a risk of hypoglycemia; or

- are initiating or changing their diabetes treatment regimen; or
- have not met treatment goals; or
- have intercurrent illnesses.

(Option: evidence quality D; expert consensus. Preponderance of benefits over harms.)

Key Action Statement 5

The committee suggests that clinicians incorporate the Academy of Nutrition and Dietetics' *Pediatric Weight Management Evidence-Based Nutrition Practice Guidelines* in the nutrition counseling of patients with T2DM both at the time of diagnosis and as part of ongoing management. (Option; evidence quality D; expert opinion; preponderance of benefits over harms. Role of patient preference is dominant.)

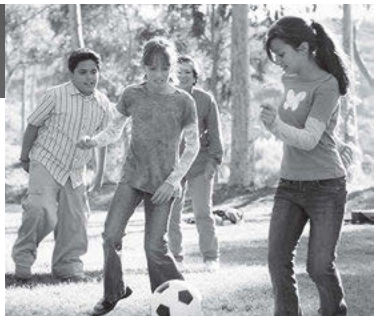
Key Action Statement 6

The committee suggests that clinicians encourage children and adolescents with T2DM to engage in moderate-to-vigorous exercise for at least 60 minutes daily and to limit nonacademic screen time to less than 2 hours per day. (Option: evidence quality D, expert opinion and evidence from studies of metabolic syndrome and obesity; preponderance of benefits over harms. Role of patient preference is dominant.)

Coding Quick Reference for Type 2 Diabetes Mellitus

ICD-9-CM	*ICD-10-CM*
250.00 Type 2 diabetes mellitus, controlled	**E11.8** Type 2 diabetes mellitus with unspecified complications **E11.9** Type 2 diabetes mellitus without complications **E11.649** Type 2 diabetes mellitus with hypoglycemia without coma **E11.65** Type 2 diabetes mellitus with hyperglycemia **E13.9** Other specified diabetes mellitus without complications
250.02 Type 2 diabetes mellitus, uncontrolled	Use codes above (**E11.8–E13.9).** *ICD-10-CM* does not discern between controlled and uncontrolled.

Type 2 Diabetes: Tips for Healthy Living



Children with type 2 diabetes can live a healthy life. If your child has been diagnosed with type 2 diabetes, your child's doctor will talk with you about the importance of lifestyle and medication in keeping your child's blood glucose (blood sugar) levels under control.

Read on for information from the American Academy of Pediatrics (AAP) about managing blood glucose and creating plans for healthy living.

What is blood glucose?

Glucose is found in the blood and is the body's main source of energy. The food your child eats is broken down by the body into glucose. Glucose is a type of sugar that gives energy to the cells in the body.

The cells need the help of insulin to take the glucose from the blood to the cells. Insulin is made by an organ called the pancreas.

In children with type 2 diabetes, the pancreas does not make enough insulin and the cells don't use the insulin very well.

Why is it important to manage blood glucose levels?

Glucose will build up in the blood if it cannot be used by the cells. High blood glucose levels can damage many parts of the body, such as the eyes, kidneys, nerves, and heart.

Your child's blood glucose levels may need to be checked on a regular schedule to make sure the levels do not get too high. Your child's doctor will tell you what your child's blood glucose level should be. You and your child will need to learn how to use a glucose meter. Blood glucose levels can be quickly and easily measured using a glucose meter. First, a lancet is used to prick the skin; then a drop of blood from your child's finger is placed on a test strip that is inserted into the meter.

Are there medicines for type 2 diabetes?

Insulin in a shot or another medicine by mouth may be prescribed by your child's doctor if needed to help control your child's blood glucose levels. If your child's doctor has prescribed a medicine, it's important that your child take it as directed. Side effects from certain medicines may include bloating or gassiness. Check with your child's doctor if you have questions.

Along with medicines, your child's doctor will suggest changes to your child's diet and encourage your child to be physically active.

Tips for healthy living

A healthy diet and staying active are especially important for children with type 2 diabetes. Your child's blood glucose levels are easier to manage when you child is at a healthy weight.

Create a plan for eating healthy

Talk with your child's doctor and registered dietitian about a meal plan that meets the needs of your child. The following tips can help you select foods that are healthy and contain a high content of nutrients (protein, vitamins, and minerals):

- Eat at least 5 servings of fruits and vegetables each day.
- Include high-fiber, whole-grain foods such as brown rice, whole-grain pasta, corns, peas, and breads and cereals at meals. Sweet potatoes are also a good choice.
- Choose lower-fat or fat-free toppings like grated low-fat parmesan cheese, salsa, herbed cottage cheese, nonfat/low-fat gravy, low-fat sour cream, low-fat salad dressing, or yogurt.
- Select lean meats such as skinless chicken and turkey, fish, lean beef cuts (round, sirloin, chuck, loin, lean ground beef—no more than 15% fat content), and lean pork cuts (tenderloin, chops, ham). Trim off all visible fat. Remove skin from cooked poultry before eating.
- Include healthy oils such as canola or olive oil in your diet. Choose margarine and vegetable oils without trans fats made from canola, corn, sunflower, soybean, or olive oils.
- Use nonstick vegetable sprays when cooking.
- Use fat-free cooking methods such as baking, broiling, grilling, poaching, or steaming when cooking meat, poultry, or fish.
- Serve vegetable- and broth-based soups, or use nonfat (skim) or low-fat (1%) milk or evaporated skim milk when making cream soups.
- Use the Nutrition Facts label on food packages to find foods with less saturated fat per serving. Pay attention to the serving size as you make choices. Remember that the percent daily values on food labels are based on portion sizes and calorie levels for adults.

Create a plan for physical activity

Physical activity, along with proper nutrition, promotes lifelong health. Following are some ideas on how to get fit:

- **Encourage your child to be active at least 1 hour a day.** Active play is the best exercise for younger children! Parents can join their children and have fun while being active too. School-aged child should participate every day in 1 hour or more of moderate to vigorous physical activity that is right for their age, is enjoyable, and involves a variety of activities.
- **Limit television watching and computer use.** The AAP discourages TV and other media use by children younger than 2 years and encourages interactive play. For older children, total entertainment screen time should be limited to less than 1 to 2 hours per day.
- **Keep an activity log.** The use of activity logs can help children and teens keep track of their exercise programs and physical activity. Online tools can be helpful.

- **Get the whole family involved.** It is a great way to spend time together. Also, children who regularly see their parents enjoying sports and physical activity are more likely to do so themselves.
- **Provide a safe environment.** Make sure your child's equipment and chosen site for the sport or activity are safe. Make sure your child's clothing is comfortable and appropriate.

For more information

National Diabetes Education Program

http://ndep.nih.gov

From your doctor

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

The American Academy of Pediatrics is an organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of infants, children, adolescents, and young adults.

American Academy of Pediatrics
Web site—www.HealthyChildren.org

Early Detection of Developmental Dysplasia of the Hip

- *Clinical Practice Guideline*
- *Technical Report Summary*

Readers of this clinical practice guideline are urged to review the technical report to enhance the evidence-based decision-making process. The full technical report is available on the companion CD-ROM.

AMERICAN ACADEMY OF PEDIATRICS

Committee on Quality Improvement, Subcommittee on Developmental Dysplasia of the Hip

Clinical Practice Guideline: Early Detection of Developmental Dysplasia of the Hip

ABSTRACT. ***Developmental dysplasia of the hip*** **is the preferred term to describe the condition in which the femoral head has an abnormal relationship to the acetabulum. Developmental dysplasia of the hip includes frank dislocation (luxation), partial dislocation (subluxation), instability wherein the femoral head comes in and out of the socket, and an array of radiographic abnormalities that reflect inadequate formation of the acetabulum. Because many of these findings may not be present at birth, the term *developmental* more accurately reflects the biologic features than does the term *congenital*. The disorder is uncommon. The earlier a dislocated hip is detected, the simpler and more effective is the treatment. Despite newborn screening programs, dislocated hips continue to be diagnosed later in infancy and childhood,[1–11] in some instances delaying appropriate therapy and leading to a substantial number of malpractice claims. The objective of this guideline is to reduce the number of dislocated hips detected later in infancy and childhood. The target audience is the primary care provider. The target patient is the healthy newborn up to 18 months of age, excluding those with neuromuscular disorders, myelodysplasia, or arthrogryposis.**

ABBREVIATIONS. DDH, developmental dysplasia of the hip; AVN, avascular necrosis of the hip.

BIOLOGIC FEATURES AND NATURAL HISTORY

Understanding the developmental nature of developmental dysplasia of the hip (DDH) and the subsequent spectrum of hip abnormalities requires a knowledge of the growth and development of the hip joint.[12] Embryologically, the femoral head and acetabulum develop from the same block of primitive mesenchymal cells. A cleft develops to separate them at 7 to 8 weeks' gestation. By 11 weeks' gestation, development of the hip joint is complete. At birth, the femoral head and the acetabulum are primarily cartilaginous. The acetabulum continues to develop postnatally. The growth of the fibrocartilaginous rim (the labrum) that surrounds the bony acetabulum deepens the socket. Development of the femoral head and acetabulum are intimately related, and normal adult hip joints depend on further growth of these structures. Hip dysplasia may occur in utero, perinatally, or during infancy and childhood.

The acronym DDH includes hips that are unstable, subluxated, dislocated (luxated), and/or have malformed acetabula. A hip is *unstable* when the tight fit between the femoral head and the acetabulum is lost and the femoral head is able to move within (subluxated) or outside (dislocated) the confines of the acetabulum. A *dislocation* is a complete loss of contact of the femoral head with the acetabulum. Dislocations are divided into 2 types: teratologic and typical.[12] *Teratologic dislocations* occur early in utero and often are associated with neuromuscular disorders, such as arthrogryposis and myelodysplasia, or with various dysmorphic syndromes. The *typical dislocation* occurs in an otherwise healthy infant and may occur prenatally or postnatally.

During the immediate newborn period, laxity of the hip capsule predominates, and, if clinically significant enough, the femoral head may spontaneously dislocate and relocate. If the hip spontaneously relocates and stabilizes within a few days, subsequent hip development usually is normal. If subluxation or dislocation persists, then structural anatomic changes may develop. A deep concentric position of the femoral head in the acetabulum is necessary for normal development of the hip. When not deeply reduced (subluxated), the labrum may become everted and flattened. Because the femoral head is not reduced into the depth of the socket, the acetabulum does not grow and remodel and, therefore, becomes shallow. If the femoral head moves further out of the socket (dislocation), typically superiorly and laterally, the inferior capsule is pulled upward over the now empty socket. Muscles surrounding the hip, especially the adductors, become contracted, limiting abduction of the hip. The hip capsule constricts; once this capsular constriction narrows to less than the diameter of the femoral head, the hip can no longer be reduced by manual manipulative maneuvers, and operative reduction usually is necessary.

The hip is at risk for dislocation during 4 periods: 1) the 12th gestational week, 2) the 18th gestational week, 3) the final 4 weeks of gestation, and 4) the postnatal period. During the 12th gestational week, the hip is at risk as the fetal lower limb rotates medially. A dislocation at this time is termed teratologic. All elements of the hip joint develop abnor-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

The Practice Guideline, "Early Detection of Developmental Dysplasia of the Hip," was reviewed by appropriate committees and sections of the American Academy of Pediatrics (AAP) including the Chapter Review Group, a focus group of office-based pediatricians representing each AAP District: Gene R. Adams, MD; Robert M. Corwin, MD; Diane Fuquay, MD; Barbara M. Harley, MD; Thomas J. Herr, MD, Chair; Kenneth E. Matthews, MD; Robert D. Mines, MD; Lawrence C. Pakula, MD; Howard B. Weinblatt, MD; and Delosa A. Young, MD. The Practice Guideline was also reviewed by relevant outside medical organizations as part of the peer review process.

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mally. The hip muscles develop around the 18th gestational week. Neuromuscular problems at this time, such as myelodysplasia and arthrogryposis, also lead to teratologic dislocations. During the final 4 weeks of pregnancy, mechanical forces have a role. Conditions such as oligohydramnios or breech position predispose to DDH.[13] Breech position occurs in ~3% of births, and DDH occurs more frequently in breech presentations, reportedly in as many as 23%. The frank breech position of hip flexion and knee extension places a newborn or infant at the highest risk. Postnatally, infant positioning such as swaddling, combined with ligamentous laxity, also has a role.

The true incidence of dislocation of the hip can only be presumed. There is no "gold standard" for diagnosis during the newborn period. Physical examination, plane radiography, and ultrasonography all are fraught with false-positive and false-negative results. Arthrography (insertion of contrast medium into the hip joint) and magnetic resonance imaging, although accurate for determining the precise hip anatomy, are inappropriate methods for screening the newborn and infant.

The reported incidence of DDH is influenced by genetic and racial factors, diagnostic criteria, the experience and training of the examiner, and the age of the child at the time of the examination. Wynne-Davies[14] reported an increased risk to subsequent children in the presence of a diagnosed dislocation (6% risk with healthy parents and an affected child, 12% risk with an affected parent, and 36% risk with an affected parent and 1 affected child). DDH is not always detectable at birth, but some newborn screening surveys suggest an incidence as high as 1 in 100 newborns with evidence of instability, and 1 to 1.5 cases of dislocation per 1000 newborns. The incidence of DDH is higher in girls. Girls are especially susceptible to the maternal hormone relaxin, which may contribute to ligamentous laxity with the resultant instability of the hip. The left hip is involved 3 times as commonly as the right hip, perhaps related to the left occiput anterior positioning of most nonbreech newborns. In this position, the left hip resides posteriorly against the mother's spine, potentially limiting abduction.

PHYSICAL EXAMINATION

DDH is an evolving process, and its physical findings on clinical examination change.[12,15,16] The newborn must be relaxed and preferably examined on a firm surface. Considerable patience and skill are required. The physical examination changes as the child grows older. No signs are pathognomonic for a dislocated hip. The examiner must look for asymmetry. Indeed, bilateral dislocations are more difficult to diagnose than unilateral dislocations because symmetry is retained. Asymmetrical thigh or gluteal folds, better observed when the child is prone, apparent limb length discrepancy, and restricted motion, especially abduction, are significant, albeit not pathognomonic signs. With the infant supine and the pelvis stabilized, abduction to 75° and adduction to 30° should occur readily under normal circumstances.

The 2 maneuvers for assessing hip stability in the newborn are the Ortolani and Barlow tests. The Ortolani elicits the sensation of the dislocated hip reducing, and the Barlow detects the unstable hip dislocating from the acetabulum. The Ortolani is performed with the newborn supine and the examiner's index and middle fingers placed along the greater trochanter with the thumb placed along the inner thigh. The hip is flexed to 90° but not more, and the leg is held in neutral rotation. The hip is gently abducted while lifting the leg anteriorly. With this maneuver, a "clunk" is felt as the dislocated femoral head reduces into the acetabulum. This is a positive Ortolani sign. The Barlow provocative test is performed with the newborn positioned supine and the hips flexed to 90°. The leg is then gently adducted while posteriorly directed pressure is placed on the knee. A palpable clunk or sensation of movement is felt as the femoral head exits the acetabulum posteriorly. This is a positive Barlow sign. The Ortolani and Barlow maneuvers are performed 1 hip at a time. Little force is required for the performance of either of these tests. The goal is not to prove that the hip can be dislocated. Forceful and repeated examinations can break the seal between the labrum and the femoral head. These strongly positive signs of Ortolani and Barlow are distinguished from a large array of soft or equivocal physical findings present during the newborn period. High-pitched clicks are commonly elicited with flexion and extension and are inconsequential. A dislocatable hip has a rather distinctive clunk, whereas a subluxable hip is characterized by a feeling of looseness, a sliding movement, but without the true Ortolani and Barlow clunks. Separating true dislocations (clunks) from a feeling of instability and from benign adventitial sounds (clicks) takes practice and expertise. This guideline recognizes the broad range of physical findings present in newborns and infants and the confusion of terminology generated in the literature. By 8 to 12 weeks of age, the capsule laxity decreases, muscle tightness increases, and the Barlow and Ortolani maneuvers are no longer positive regardless of the status of the femoral head. In the 3-month-old infant, limitation of abduction is the most reliable sign associated with DDH. Other features that arouse suspicion include asymmetry of thigh folds, a positive Allis or Galeazzi sign (relative shortness of the femur with the hips and knees flexed), and discrepancy of leg lengths. These physical findings alert the examiner that abnormal relationships of the femoral head to the acetabulum (dislocation and subluxation) *may* be present.

Maldevelopments of the acetabulum alone (acetabular dysplasia) can be determined only by imaging techniques. Abnormal physical findings may be absent in an infant with acetabular dysplasia but no subluxation or dislocation. Indeed, because of the confusion, inconsistencies, and misuse of language in the literature (eg, an Ortolani sign called a click by some and a clunk by others), this guideline uses the following definitions.

- A *positive examination* result for DDH is the Barlow or Ortolani sign. This is the clunk of dislocation or reduction.
- An *equivocal examination* or *warning signs* include an array of physical findings that may be found in children with DDH, in children with another orthopaedic disorder, or in children who are completely healthy. These physical findings include asymmetric thigh or buttock creases, an apparent or true short leg, and limited abduction. These signs, used singly or in combination, serve to raise the pediatrician's index of suspicion and act as a threshold for referral. Newborn soft tissue hip clicks are not predictive of DDH[17] but may be confused with the Ortolani and Barlow clunks by some screening physicians and thereby be a reason for referral.

IMAGING

Radiographs of the pelvis and hips have historically been used to assess an infant with suspected DDH. During the first few months of life when the femoral heads are composed entirely of cartilage, radiographs have limited value. Displacement and instability may be undetectable, and evaluation of acetabular development is influenced by the infant's position at the time the radiograph is performed. By 4 to 6 months of age, radiographs become more reliable, particularly when the ossification center develops in the femoral head. Radiographs are readily available and relatively low in cost.

Real-time ultrasonography has been established as an accurate method for imaging the hip during the first few months of life.[15,18–25] With ultrasonography, the cartilage can be visualized and the hip can be viewed while assessing the stability of the hip and the morphologic features of the acetabulum. In some clinical settings, ultrasonography can provide information comparable to arthrography (direct injection of contrast into the hip joint), without the need for sedation, invasion, contrast medium, or ionizing radiation. Although the availability of equipment for ultrasonography is widespread, accurate results in hip sonography require training and experience. Although expertise in pediatric hip ultrasonography is increasing, this examination may not always be available or obtained conveniently. Ultrasonographic techniques include *static evaluation* of the morphologic features of the hip, as popularized in Europe by Graf,[26] and a *dynamic evaluation*, as developed by Harcke[20] that assesses the hip for stability of the femoral head in the socket, as well as static anatomy. Dynamic ultrasonography yields more useful information. With both techniques, there is considerable interobserver variability, especially during the first 3 weeks of life.[7,27]

Experience with ultrasonography has documented its ability to detect abnormal position, instability, and dysplasia not evident on clinical examination. Ultrasonography during the first 4 weeks of life often reveals the presence of minor degrees of instability and acetabular immaturity. Studies[7,28,29] indicate that nearly all these mild early findings, which will not be apparent on physical examination, resolve spontaneously without treatment. Newborn screening with ultrasonography has required a high frequency of reexamination and results in a large number of hips being unnecessarily treated. One study[23] demonstrates that a screening process with higher false-positive results also yields increased prevention of late cases. Ultrasonographic screening of all infants at 4 to 6 weeks of age would be expensive, requiring considerable resources. This practice is yet to be validated by clinical trial. *Consequently, the use of ultrasonography is recommended as an adjunct to the clinical evaluation*. It is the technique of choice for clarifying a physical finding, assessing a high-risk infant, and monitoring DDH as it is observed or treated. Used in this selective capacity, it can guide treatment and may prevent overtreatment.

PRETERM INFANTS

DDH may be unrecognized in prematurely born infants. When the infant has cardiorespiratory problems, the diagnosis and management are focused on providing appropriate ventilatory and cardiovascular support, and careful examination of the hips may be deferred until a later date. The most complete examination the infant receives may occur at the time of discharge from the hospital, and this single examination may not detect subluxation or dislocation. Despite the medical urgencies surrounding the preterm infant, it is critical to examine the entire child.

METHODS FOR GUIDELINE DEVELOPMENT

Our goal was to develop a practice parameter by using a process that would be based whenever possible on available evidence. The methods used a combination of expert panel, decision modeling, and evidence synthesis[30] (see the Technical Report available on *Pediatrics electronic pages* at www.pediatrics.org). The predominant methods recommended for such evidence synthesis are generally of 2 types: a *data-driven* method and a *model-driven*[31,32] method. In data-driven methods, the analyst finds the best data available and induces a conclusion from these data. A model-driven method, in contrast, begins with an effort to define the context for evidence and then searches for the data as defined by that context. Data-driven methods are useful when the quality of evidence is high. A careful review of the medical literature revealed that the published evidence about DDH did not meet the criteria for high quality. There was a paucity of randomized clinical trials.[8] We decided, therefore, to use the model-driven method.

A decision model was constructed based on the perspective of practicing clinicians and determining the best strategy for screening and diagnosis. The target child was a full-term newborn with no obvious orthopaedic abnormalities. We focused on the various options available to the pediatrician* for the detection of DDH, including screening by physical examination, screening by ultrasonography, and episodic screening during health supervision. Because

*In this guideline, the term *pediatrician* includes the range of pediatric primary care providers, eg, family practitioners and pediatric nurse practitioners.

the detection of a dislocated hip usually results in referral by the pediatrician, and because management of DDH is not in the purview of the pediatrician's care, treatment options are not included. We also included in our model a wide range of options for detecting DDH during the first year of life if the results of the newborn screen are negative.

The outcomes on which we focused were a dislocated hip at 1 year of age as the major morbidity of the disease and avascular necrosis of the hip (AVN) as the primary complication of DDH treatment. AVN is a loss of blood supply to the femoral head resulting in abnormal hip development, distortion of shape, and, in some instances, substantial morbidity. Ideally, a gold standard would be available to define DDH at any point in time. However, as noted, no gold standard exists except, perhaps, arthrography of the hip, which is an inappropriate standard for use in a detection model. Therefore, we defined outcomes in terms of the *process of care*. We reviewed the literature extensively. The purpose of the literature review was to provide the probabilities required by the decision model since there were no randomized clinical trials. The article or chapter title and the abstracts were reviewed by 2 members of the methodology team and members of the subcommittee. Articles not rejected were reviewed, and data were abstracted that would provide evidence for the probabilities required by the decision model. As part of the literature abstraction process, the evidence quality in each article was assessed. A computer-based literature search, hand review of recent publications, or examination of the reference section for other articles ("ancestor articles") identified 623 articles; 241 underwent detailed review, 118 of which provided some data. Of the 100 ancestor articles, only 17 yielded useful articles, suggesting that our accession process was complete. By traditional epidemiologic standards,[33] the quality of the evidence in this set of articles was uniformly low. There were few controlled trials and few studies of the follow-up of infants for whom the results of newborn examinations were negative. When the evidence was poor or lacking entirely, extensive discussions among members of the committee and the expert opinion of outside consultants were used to arrive at a consensus. No votes were taken. Disagreements were discussed, and consensus was achieved.

The available evidence was distilled in 3 ways. First, estimates were made of DDH at birth in infants without risk factors. These estimates constituted the baseline risk. Second, estimates were made of the rates of DDH in the children with risk factors. These numbers guide clinical actions: rates that are too high might indicate referral or different follow-up despite negative physical findings. Third, each screening strategy (pediatrician-based, orthopaedist-based, and ultrasonography-based) was scored for the estimated number of children given a diagnosis of DDH at birth, at mid-term (4–12 months of age), and at late-term (12 months of age and older) and for the estimated number of cases of AVN incurred, assuming that all children given a diagnosis of DDH would be treated. These numbers suggest the best strategy, balancing DDH detection with incurring adverse effects.

The baseline estimate of DDH based on orthopaedic screening was 11.5/1000 infants. Estimates from pediatric screening were 8.6/1000 and from ultrasonography were 25/1000. The 11.5/1000 rate translates into a rate for not-at-risk boys of 4.1/1000 boys and a rate for not-at-risk girls of 19/1000 girls. These numbers derive from the facts that the relative risk—the rate in girls divided by the rate in boys across several studies—is 4.6 and because infants are split evenly between boys and girls, so $.5 \times 4.1/1000 + .5 \times 19/1000 = 11.5/1000$.[34,35] We used these baseline rates for calculating the rates in other risk groups. Because the relative risk of DDH for children with a positive family history (first-degree relatives) is 1.7, the rate for boys with a positive family history is $1.7 \times 4.1 = 6.4/1000$ boys, and for girls with a positive family history, $1.7 \times 19 = 32/1000$ girls. Finally, the relative risk of DDH for breech presentation (of all kinds) is 6.3, so the risk for breech boys is $7.0 \times 4.1 = 29/1000$ boys and for breech girls, $7.0 \times 19 = 133/1000$ girls. These numbers are summarized in Table 1.

These numbers suggest that boys without risk or those with a family history have the lowest risk; girls without risk and boys born in a breech presentation have an intermediate risk; and girls with a positive family history, and especially girls born in a breech presentation, have the highest risks. Guidelines, considering the risk factors, should follow these risk profiles. Reports of newborn screening for DDH have included various screening techniques. In some, the screening clinician was an orthopaedist, in

TABLE 1. Relative and Absolute Risks for Finding a Positive Examination Result at Newborn Screening by Using the Ortolani and Barlow Signs

Newborn Characteristics	Relative Risk of a Positive Examination Result	Absolute Risk of a Positive Examination Result per 1000 Newborns With Risk Factors
All newborns	· · ·	11.5
Boys	1.0	4.1
Girls	4.6	19
Positive family history	1.7	
Boys	· · ·	6.4
Girls	· · ·	32
Breech presentation	7.0	
Boys	· · ·	29
Girls	· · ·	133

TABLE 2. Newborn Strategy*

Outcome	Orthopaedist PE	Pediatrician PE	Ultrasonography
DDH in newborn	12	8.6	25
DDH at ~6 mo of age	.1	.45	.28
DDH at 12 mo of age or more	.16	.33	.1
AVN at 12 mo of age	.06	.1	.1

* PE indicates physical examination. Outcome per 1000 infants initially screened.

others, a pediatrician, and in still others, a physiotherapist. In addition, screening has been performed by ultrasonography. In assessing the expected effect of each strategy, we estimated the newborn DDH rates, the mid-term DDH rates, and the late-term DDH rates for each of the 3 strategies, as shown in Table 2. We also estimated the rate of AVN for DDH treated before 2 months of age (2.5/1000 treated) and after 2 months of age (109/1000 treated). We could not distinguish the AVN rates for children treated between 2 and 12 months of age from those treated later. Table 2 gives these data. The total cases of AVN per strategy are calculated, assuming that all infants with positive examination results are treated.

Table 2 shows that a strategy using pediatricians to screen newborns would give the lowest newborn rate but the highest mid- and late-term DDH rates. To assess how much better an ultrasonography-only screening strategy would be, we could calculate a cost-effectiveness ratio. In this case, the "cost" of ultrasonographic screening is the number of "extra" newborn cases that probably include children who do not need to be treated. (The cost from AVN is the same in the 2 strategies.) By using these cases as the cost and the number of later cases averted as the effect, a ratio is obtained of 71 children treated neonatally because of a positive ultrasonographic screen for each later case averted. Because this number is high, and because the presumption of better late-term efficacy is based on a single study, we do not recommend ultrasonographic screening at this time.

RECOMMENDATIONS AND NOTES TO ALGORITHM (Fig 1)

1. **All newborns are to be screened by physical examination**. The evidence† for this recommendation is good. The expert consensus‡ is strong. Although initial screening by orthopaedists§ would be optimal (Table 2), it is doubtful that if widely practiced, such a strategy would give the same good results as those published from pediatric orthopaedic research centers. **It is recommended that screening be done by a properly trained health care provider** (eg, physician, pediatric nurse practitioner, physician assistant, or physical therapist). (Evidence for this recommendation is strong.) A number of studies performed by properly trained nonphysicians report results indistinguishable from those performed by physicians.[36] The examination after discharge from the neonatal intensive care unit should be performed as a newborn examination with appropriate screening. **Ultrasonography of all newborns is not recommended.** (Evidence is fair; consensus is strong.) Although there is indirect evidence to support the use of ultrasonographic screening of all newborns, it is not advocated because it is operator-dependent, availability is questionable, it increases the rate of treatment, and interobserver variability is high. There are probably some increased costs. We considered a strategy of "no newborn screening." This arm is politically indefensible because screening newborns is inherent in pediatrician's care. The technical report details this limb through decision analysis. Regardless of the screening method used for the newborn, DDH is detected in 1 in 5000 infants at 18 months of age.[3] The evidence and consensus for newborn screening remain strong.

Newborn Physical Examination and Treatment

2. **If a positive Ortolani or Barlow sign is found in the newborn examination, the infant should be referred to an orthopaedist**. Orthopaedic referral is recommended when the Ortolani sign is unequivocally positive (a clunk). Orthopaedic referral is not recommended for any softly positive finding in the examination (eg, hip click without dislocation). The precise time frame for the newborn to be evaluated by the orthopaedist cannot be determined from the literature. However, the literature suggests that the majority of "abnormal" physical findings of hip examinations at birth (clicks and clunks) will resolve by 2 weeks; therefore, consultation and possible initiation of treatment are recommended by that time. The data recommending that all those with a positive Ortolani sign be referred to an orthopaedist are limited, but expert panel consensus, nevertheless, was strong, because pediatricians do not have the training to take full responsibility and because true Ortolani clunks are rare and their management is more appropriately performed by the orthopaedist.

If the results of the physical examination at birth are "equivocally" positive (ie, soft click, mild asymmetry, but neither an Ortolani nor a Barlow sign is present), then a follow-up hip examination by the pediatrician in 2 weeks is recommended. (Evidence is good; consensus is strong.) The available data suggest that most clicks resolve by 2 weeks and that these "benign hip clicks" in the newborn period do

†In this guideline, evidence is listed as good, fair, or poor based on the methodologist's evaluation of the literature quality. (See the Technical Report.)

‡Opinion or consensus is listed as *strong* if opinion of the expert panel was unanimous or *mixed* if there were dissenting points of view.

§In this guideline, the term *orthopaedist* refers to an orthopaedic surgeon with expertise in pediatric orthopaedic conditions.

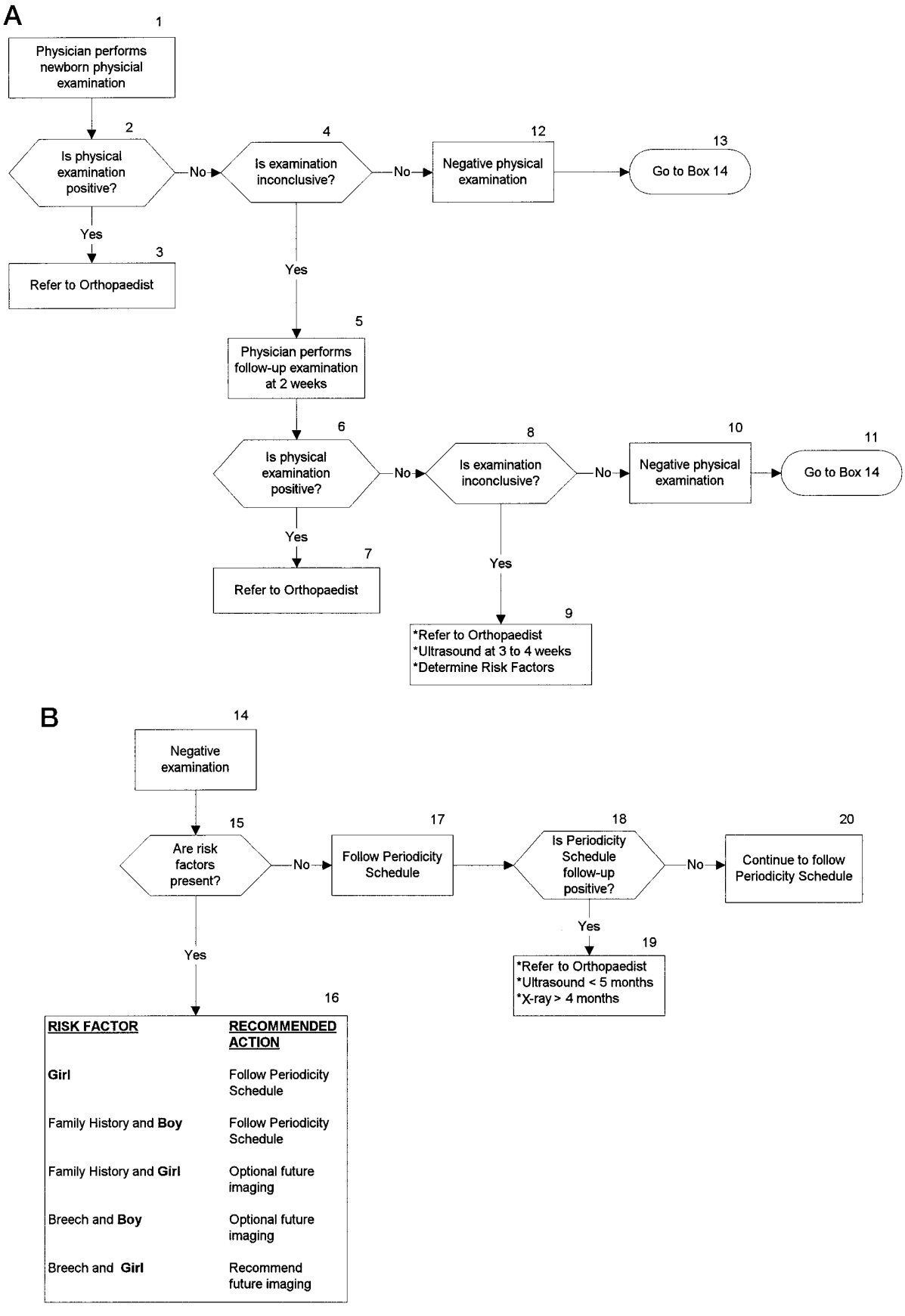

Fig 1. Screening for developmental hip dysplasia—clinical algorithm.

not lead to later hip dysplasia.[9,17,28,37] Thus, for an infant with softly positive signs, the pediatrician should reexamine the hips at 2 weeks before making referrals for orthopaedic care or ultrasonography. We recognize the concern of pediatricians about adherence to follow-up care regimens, but this concern regards all aspects of health maintenance and is not a reason to request ultrasonography or other diagnostic study of the newborn hips.

3. **If the results of the newborn physical examination are positive (ie, presence of an Ortolani or a Barlow sign), ordering an ultrasonographic examination of the newborn is not recommended**. (Evidence is poor; opinion is strong.) Treatment decisions are not influenced by the results of ultrasonography but are based on the results of the physical examination. The treating physician may use a variety of imaging studies during clinical management. **If the results of the newborn physical examination are positive, obtaining a radiograph of the newborn's pelvis and hips is not recommended** (evidence is poor; opinion is strong), because they are of limited value and do not influence treatment decisions.

The use of triple diapers when abnormal physical signs are detected during the newborn period is not recommended. (Evidence is poor; opinion is strong.) Triple diaper use is common practice despite the lack of data on the effectiveness of triple diaper use; and, in instances of frank dislocation, the use of triple diapers may delay the initiation of more appropriate treatment (such as with the Pavlik harness). Often, the primary care pediatrician may not have performed the newborn examination in the hospital. The importance of communication cannot be overemphasized, and triple diapers may aid in follow-up as a reminder that a possible abnormal physical examination finding was present in the newborn.

2-Week Examination

4. **If the results of the physical examination are positive (eg, positive Ortolani or Barlow sign) at 2 weeks, refer to an orthopaedist**. (Evidence is strong; consensus is strong.) Referral is urgent but is not an emergency. Consensus is strong that, as in the newborn, the presence of an Ortolani or Barlow sign at 2 weeks warrants referral to an orthopaedist. An Ortolani sign at 2 weeks may be a new finding or a finding that was not apparent at the time of the newborn examination.

5. **If at the 2-week examination the Ortolani and Barlow signs are absent but physical findings raise suspicions, consider referral to an orthopaedist or request ultrasonography at age 3 to 4 weeks**. Consensus is mixed about the follow-up for softly positive or equivocal findings at 2 weeks of age (eg, adventitial click, thigh asymmetry, and apparent leg length difference). Because it is necessary to confirm the status of the hip joint, the pediatrician can consider referral to an orthopaedist or for ultrasonography if the constellation of physical findings raises a high level of suspicion. However, if the physical findings are minimal, continuing follow-up by the periodicity schedule with focused hip examinations is also an option, provided risk factors are considered. (See "Recommendations" 7 and 8.)

6. **If the results of the physical examination are negative at 2 weeks, follow-up is recommended at the scheduled well-baby periodic examinations**. (Evidence is good; consensus is strong.)

7. **Risk factors**. **If the results of the newborn examination are negative (or equivocally positive), risk factors may be considered**.[13,21,38–41] Risk factors are a study of thresholds to act.[42] Table 1 gives the risk of finding a positive Ortolani or Barlow sign at the time of the initial newborn screening. If this examination is negative, the absolute risk of there being a true dislocated hip is greatly reduced. Nevertheless, the data in Table 1 may influence the pediatrician to perform confirmatory evaluations. Action will vary based on the individual clinician. The following recommendations are made (evidence is strong; opinion is strong):
   - **Girl** (newborn risk of 19/1000). When the results of the newborn examination are negative or equivocally positive, hips should be reevaluated at 2 weeks of age. If negative, continue according to the periodicity schedule; if positive, refer to an orthopaedist or for ultrasonography at 3 weeks of age.
   - **Infants with a positive family history of DDH** (newborn risk for boys of 9.4/1000 and for girls, 44/1000). When the results of the newborn examination in boys are negative or equivocally positive, hips should be reevaluated at 2 weeks of age. If negative, continue according to the periodicity schedule; if positive, refer to an orthopaedist or for ultrasonography at 3 weeks of age. In girls, the absolute risk of 44/1000 may exceed the pediatrician's threshold to act, and imaging with an ultrasonographic examination at 6 weeks of age or a radiograph of the pelvis at 4 months of age is recommended.
   - **Breech presentation** (newborn risk for boys of 26/1000 and for girls, 120/1000). **For negative or equivocally positive newborn examinations, the infant should be reevaluated at regular intervals (according to the periodicity schedule) if the examination results remain negative**. Because an absolute risk of 120/1000 (12%) probably exceeds most pediatricians' threshold to act, imaging with an ultrasonographic examination at 6 weeks of age or with a radiograph of the pelvis and hips at 4 months of age is recommended. In addition, because some reports show a high incidence of hip abnormalities detected at an older age in children born breech, this imaging strategy remains an option for all children born breech, not just girls. These hip abnormalities are, for the most part, inadequate development of the acetabulum. Acetabular dysplasia is best found by a radiographic examination at 6 months of age or older. A

suggestion of poorly formed acetabula may be observed at 6 weeks of age by ultrasonography, but the best study remains a radiograph performed closer to 6 months of age. Ultrasonographic newborn screening of all breech infants will not eliminate the possibility of later acetabular dysplasia.

8. **Periodicity**. **The hips must be examined at every well-baby visit according to the recommended periodicity schedule for well-baby examinations (2–4 days for newborns discharged in less than 48 hours after delivery, by 1 month, 2 months, 4 months, 6 months, 9 months, and 12 months of age)**. If at any time during the follow-up period DDH is suspected because of an abnormal physical examination or by a parental complaint of difficulty diapering or abnormal appearing legs, the pediatrician must confirm that the hips are stable, in the sockets, and developing normally. Confirmation can be made by a focused physical examination when the infant is calm and relaxed, by consultation with another primary care pediatrician, by consultation with an orthopaedist, by ultrasonography if the infant is younger than 5 months of age, or by radiography if the infant is older than 4 months of age. (Between 4 and 6 months of age, ultrasonography and radiography seem to be equally effective diagnostic imaging studies.)

DISCUSSION

DDH is an important term because it accurately reflects the biologic features of the disorder and the susceptibility of the hip to become dislocated at various times. Dislocated hips always will be diagnosed later in infancy and childhood because not every dislocated hip is detectable at birth, and hips continue to dislocate throughout the first year of life. Thus, this guideline requires that the pediatrician follow *a process of care for the detection of DDH*. The process recommended for early detection of DDH includes the following:

- Screen all newborns' hips by physical examination.
- Examine all infants' hips according to a periodicity schedule and follow-up until the child is an established walker.
- Record and document physical findings.
- Be aware of the changing physical examination for DDH.
- If physical findings raise suspicion of DDH, or if parental concerns suggest hip disease, confirmation is required by expert physical examination, referral to an orthopaedist, or by an age-appropriate imaging study.

When this process of care is followed, the number of dislocated hips diagnosed at 1 year of age should be minimized. However, the problem of late detection of dislocated hips will not be eliminated. The results of screening programs have indicated that 1 in 5000 children have a dislocated hip detected at 18 months of age or older.[3]

TECHNICAL REPORT

The Technical Report is available from the American Academy of Pediatrics from several sources. The Technical Report is published in full-text on *Pediatrics electronic pages*. It is also available in a compendium of practice guidelines that contains guidelines and evidence reports together. The objective was to create a recommendation to pediatricians and other primary care providers about their role as screeners for detecting DDH. The patients are a theoretical cohort of newborns. A model-based method using decision analysis was the foundation. Components of the approach include:

- Perspective: primary care provider
- Outcomes: DDH and AVN
- Preferences: expected rates of outcomes
- Model: influence diagram assessed from the subcommittee and from the methodology team with critical feedback from the subcommittee
- Evidence sources: Medline and EMBase (detailed in "Methods" section)
- Evidence quality: assessed on a custom, subjective scale, based primarily on the fit of the evidence in the decision model

The results are detailed in the "Methods" section. Based on the raw evidence and Bayesian hierarchical meta-analysis,[34,35] estimates for the incidence of DDH based on the type of screener (orthopaedist vs pediatrician); the odds ratio for DDH given risk factors of sex, family history, and breech presentation; and estimates for late detection and AVN were determined and are detailed in the "Methods" section and in Tables 1 and 2.

The decision model (reduced based on available evidence) suggests that orthopaedic screening is optimal, but because orthopaedists in the published studies and in practice would differ in pediatric expertise, the supply of pediatric orthopaedists is relatively limited, and the difference between orthopaedists and pediatricians is statistically insignificant, we conclude that pediatric screening is to be recommended. The place for ultrasonography in the screening process remains to be defined because of the limited data available regarding late diagnosis in ultrasonography screening to permit definitive recommendations.

These data could be used by others to refine the conclusion based on costs, parental preferences, or physician style. Areas for research are well defined by our model-based method. All references are in the Technical Report.

RESEARCH QUESTIONS

The quality of the literature suggests many areas for research, because there is a paucity of randomized clinical trials and case-controlled studies. The following is a list of possibilities:

1. Minimum diagnostic abilities of a screener. Although there are data for pediatricians in general, few, if any, studies evaluated the abilities of an individual examiner. What should the minimum

sensitivity and specificity be, and how should they be assessed?
2. Intercurrent screening. There were few studies on systemic processes for screening after the newborn period.[2,43,44] Although several studies assessed postneonatal DDH, the data did not specify how many examinations were performed on each child before the abnormal result was found.
3. Trade-offs. Screening always results in false-positive results, and these patients suffer the adverse effects of therapy. How many unnecessary AVNs are we—families, physicians, and society—willing to tolerate from a screening program for every appropriately treated infant in whom late DDH was averted? This assessment depends on people's values and preferences and is not strictly an epidemiologic issue.
4. Postneonatal DDH after ultrasonographic screening. Although we concluded that ultrasonographic screening did not result in fewer diagnoses of postneonatal DDH, that conclusion was based on only 1 study.[36] Further study is needed.
5. Cost-effectiveness. If ultrasonographic screening reduces the number of postneonatal DDH diagnoses, then there will be a cost trade-off between the resources spent up front to screen everyone with an expensive technology, as in the case of ultrasonography, and the resources spent later to treat an expensive adverse event, as in the case of physical examination-based screening. The level at which the cost per case of postneonatal DDH averted is no longer acceptable is a matter of social preference, not of epidemiology.

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ADDENDUM TO REFERENCES FOR THE DDH GUIDELINE

New information is generated constantly. Specific details of this report must be changed over time.

New articles (additional articles 1–7) have been published since the completion of our literature search and construction of this Guideline. These articles taken alone might seem to contradict some of the Guideline's estimates as detailed in the article and in the Technical Report. However, taken in context with the literature synthesis carried out for the construction of this Guideline, our estimates remain intact and no conclusions are obviated.

ADDITIONAL ARTICLES

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Technical Report Summary: Developmental Dysplasia of the Hip Practice Guideline

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For the complete technical report, including tables, figures, and references, please see the companion CD-ROM.

ABSTRACT

Objective. **To create a recommendation for pediatricians and other primary care providers about their role as screeners for detecting developmental dysplasia of the hip (DDH) in children.**

Patients. **Theoretical cohorts of newborns.**

Method. **Model-based approach using decision analysis as the foundation. Components of the approach include the following:**

Perspective: **Primary care provider.**

Outcomes: **DDH, avascular necrosis of the hip (AVN).**

Options: **Newborn screening by pediatric examination; orthopaedic examination; ultrasonographic examination; orthopaedic or ultrasonographic examination by risk factors. Intercurrent health supervision-based screening.**

Preferences: **0 for bad outcomes, 1 for best outcomes.**

Model: **Influence diagram assessed by the Subcommittee and by the methodology team, with critical feedback from the Subcommittee.**

Evidence Sources: **Medline and EMBASE search of the research literature through June 1996. Hand search of sentinel journals from June 1996 through March 1997. Ancestor search of accepted articles.**

Evidence Quality: **Assessed on a custom subjective scale, based primarily on the fit of the evidence to the decision model.**

Results. **After discussion, explicit modeling, and critique, an influence diagram of 31 nodes was created. The computer-based and the hand literature searches found 534 articles, 101 of which were reviewed by 2 or more readers. Ancestor searches of these yielded a further 17 articles for evidence abstraction. Articles came from around the globe, although primarily Europe, British Isles, Scandinavia, and their descendants. There were 5 controlled trials, each with a sample size less than 40. The remainder were case series. Evidence was available for 17 of the desired 30 probabilities. Evidence quality ranged primarily between one third and two thirds of the maximum attainable score (median: 10–21; interquartile range: 8–14).**

Based on the raw evidence and Bayesian hierarchical meta-analyses, our estimate for the incidence of DDH revealed by physical examination performed by pediatricians is 8.6 per 1000; for orthopaedic screening, 11.5; for ultrasonography, 25. The odds ratio for DDH, given breech delivery, is 5.5; for female sex, 4.1; for positive family history, 1.7, although this last factor is not statistically significant. Postneonatal cases of DDH were divided into mid-term (younger than 6 months of age) and late-term (older than 6 months of age). Our estimates for the mid-term rate for screening by pediatricians is 0.34/1000 children screened; for orthopaedists, 0.1; and for ultrasonography, 0.28. Our estimates for late-term DDH rates are 0.21/1000 newborns screened by pediatricians; 0.08, by orthopaedists; and 0.2 for ultrasonography. The rates of AVN for children referred before 6 months of age is estimated at 2.5/1000 infants referred. For those referred after 6 months of age, our estimate is 109/1000 referred infants.

The decision model (reduced, based on available evidence) suggests that orthopaedic screening is optimal, but because orthopaedists in the published studies and in practice would differ, the supply of orthopaedists is relatively limited, and the difference between orthopaedists and pediatricians is statistically insignificant, we conclude that pediatric screening is to be recommended. The place of ultrasonography in the screening process remains to be defined because there are too few data about postneonatal diagnosis by ultrasonographic screening to permit definitive recommendations. These data could be used by others to refine the conclusions based on costs, parental preferences, or physician style. Areas for research are well defined by our model-based approach. *Pediatrics* **2000;105(4). URL: http://www.pediatrics.org/cgi/content/full/105/4/e57; keywords:** ***developmental dysplasia of the hip, avascular necrosis of the hip, newborn.***

I. GUIDELINE METHODS

A. Decision Model

The steps required to build the model were taken with the Subcommittee as a whole, with individuals in the group, and with members of the methodology team. Agreement on the model was sought from the Subcommittee as a whole during face-to-face meetings.

1. Perspective

Although there are a number of perspectives to take in this problem (parental, child's, societal, and payer's), we opted for the view of the practicing clinician: What are the clinician's obligations, and what is the best strategy for the clinician? This choice of perspective meant that the focus would be on screening for developmental dysplasia of the hip (DDH) and obviated the need to review the evidence for efficacy or effectiveness of specific strategies.

2. Context

The target child is a full-term newborn with no obvious orthopaedic abnormalities. Children with such findings would be referred to an orthopaedist, obviating the need for a practice parameter.

3. Options

We focused on the following options: screening by physical examination (PE) at birth by a pediatrician, orthopaedist, or other care provider; ultrasonographic screening at birth; and episodic screening during health supervision. Treatment options are not included.

We also included in our model a wide range of options for managing the screening process during the first year of life when the newborn screening was negative.

4. Outcomes

Our focus is on dislocated hips at 1 year of age as the major morbidity of the disease and on avascular necrosis of the hip (AVN), as the primary sentinel complication of DDH therapy.

Ideally, we would have a "gold standard" that would define DDH at any point in time, much as cardiac output can be obtained from a pulmonary-artery catheter. However, no gold standard exists. Therefore, we defined our outcomes in terms of the process of care: a pediatrician and an ultrasonographer perform initial or confirmatory examinations and refer the patient, whereas the orthopaedist treats the patient. It is the treatment that has the greatest effect on postneonatal DDH or on complications, so we focus on that intermediate outcome, rather than the orthopaedist's stated diagnosis. We operationalized the definitions of these outcomes for use in abstracting the data from articles. A statement that a "click" was found on PE was considered to refer to an intermediate result, unless the authors defined their "click" in terms of our definition of a positive examination. Dynamic ultrasonographic examinations include those of Harcke et al, and static refers primarily to that of Graf. The radiologic focus switches from ultrasonography to plain radiographs after 4 months of age, in keeping with the development of the femoral head.

5. Decision Structure

We used an influence diagram to represent the decision model. In this representation, nodes refer to actions to be taken or to states of the world (the patient) about which we are uncertain. We devoted substantial effort to the construction of a model that balanced the need to represent the rich array of possible screening pathways with the need to be parsimonious. We constructed the master influence diagram and determined its construct validity through consensus by the Subcommittee before data abstraction. However, the available evidence could specify only a portion of the diagram. The missing components suggest research questions that need to be posed.

6. Probabilities

The purpose of the literature review was to provide the probabilities required by the decision model. The initial number of individual probabilities was 55. (Sensitivity and specificity for a single truth-indicator pair are counted as a single probability because they are garnered from the same table.) Although this is a large number of parameters, the structure of the model helped the team of readers. As 1 reader said, referring to the influence diagram, "Because we did the picture together, it was easy to find the parameters." What follows are some operational rules for matching the data to our parameters. The list is not complete. If an orthopaedic clinic worked at case finding, we used our judgment to determine whether to accept such reports as representing a population incidence.

Risk factors were included generally only if a true control group was used for comparison. For postneonatal diagnoses, no study we reviewed included the examination of all children without DDH, say, 1 year of age, so there is always the possibility of missed cases (false-negative diagnoses) in the screen, which leads to a falsely elevated estimate of the denominator. For studies originating in referral clinics, the data on the reasons for referrals were not usable for our purposes.

7. Preferences

Ideally, we would have cost data for the options, as well as patient data on the human burden of therapy and of DDH itself. We have deferred these assessments to later research. Therefore, we assigned a preference score of 0 to DDH at 1 year of age and 1 to its absence; for AVN, we assigned 0 for presence at 1 year of age and 1 for absence at 1 year of age.

B. Literature Review

For the literature through May 1995, the following sources were searched: Books in Print, CAT-LINE, Current Contents, EMBASE, Federal Research in Progress, Health Care Standards, Health Devices Alerts, Health Planning and Administration, Health Services/Technology Assessment, International Health Technology Assessment, and Medline. Medline and EMBASE were searched through June 1996. The search terms used in all databases included the following: hip dislocation, congenital; hip dysplasia; congenital hip dislocation; developmental dysplasia; ultrasonography/adverse effects; and osteonecrosis. Hand searches of leading orthopaedic journals were performed for the issues from June 1996 to March 1997. The bibliographies of journals accepted for use in formulating the practice parameter also were perused.

The titles and the abstracts were then reviewed by 2 members of the methodology team to determine whether to accept or reject the articles for use. Decisions were reviewed by the Subcommittee, and conflicts were adjudicated. Similarly, articles were read by pairs of reviewers; conflicts were resolved in discussion.

The focus of the data abstraction process was on data that would provide evidence for the probabilities required by the decision model.

As part of the literature abstraction process, the evidence quality in each article was assessed. The scoring process was based on our decision model and involved traditional epidemiologic concerns, like outcome definition and bias of ascertainment, as well as influence–diagram-based concerns, such as how well the data fit into the model.

Cohort definition: Does the cohort represented by the denominator in the study match a node in our influence diagram? Does the cohort represented by the numerator match a node in our influence diagram? The closer the match, the more confident we are that the reported data provide good evidence of the conditional probability implied by the arrow between the corresponding nodes in the influence diagram.

Path: Does the implied path from denominator to numerator lead through 1 or more nodes of the influence diagram? The longer the path, the more likely that uncontrolled biases entered into the study, making us less confident about accepting the raw data as a conditional probability in our model. Assignment and comparison: Was there a control group? How was assignment made to

experimental or control arms? A randomized, controlled study provides the best quality evidence.

Follow-up: Were patients with positive and negative initial findings followed up? The best studies should have data on both.

Outcome definition: Did the language of the outcome definitions (PE, orthopaedic examination, ultrasonography, and radiography) match ours, and, in particular, were PE findings divided into 3 categories or 2? The closer the definition to ours, the more we could pool the data. Studies with only 2 categories do not help to distinguish clicks from "clunks."

Ascertainment: When the denominator represented more than 1 node, to what degree was the denominator a mix of nodes? The smaller the contamination, the more confident we were that the raw data represented a desired conditional probability.

Results: Did the results fill an entire table or were data missing? This is related to the follow-up category but is more general.

C. Synthesis of Evidence

There are 3 levels of evidence synthesis.

1. Listing evidence for individual probabilities
2. Summarizing evidence across probabilities
3. Integrating the pooled evidence for individual probabilities into the decision model

A list of evidence for an individual probability (or arc) is called an *evidence table* and provides the reader a look at the individual pieces of data. The probabilities are summarized in 3 ways: by averaging, by averaging weighted by sample size (pooled), and by meta-analysis. We chose Bayesian meta-analytic techniques, which allow the representation of *prior belief* in the evidence and provide an explicit portrayal of the uncertainty of our conclusions. The framework we used was that of a hierarchical Bayesian model, similar to the random effects model in traditional meta-analysis. In this hierarchical model, each study has its own parameter, which, in turn, is sampled from a wider population parameter. Because there are 2 stages (ie, population to sample and sample to observation), and, therefore, the population parameter of interest is more distant from the data, the computed estimates in the population parameters are, in general, less certain (wider confidence interval) than simply pooling the data across studies. This lower certainty is appropriate in the DDH content area because the studies vary so widely in their raw estimates because of the range in time and geography over which they were performed. In the Bayesian model, the observations were assumed to be Poisson distributed, given the study DDH rates. Those rates, in turn, were assumed to be Gamma distributed, given the population rate. The prior belief on that rate was set as Gamma ($\propto$, ß), with mean $\propto$/ß, and variance $\propto$/ß^2 (as defined in the BUGS software). In this parameterization, $\propto$ has the semantics closest to that of location, and ß has the semantics of certainty: the higher its value, the narrower the distribution and the more certain we are of the estimate. The parameter, $\propto$, was modeled as Exponential (1), and ß, as Gamma (0.01, 1), with a mean of 0.01. Together, these correspond to a prior belief in the rate of a mean of 100 per 1000, and a standard deviation (SD) of 100, representing ignorance of the true rate.

As an example of interpretation, for pediatric newborn screening, the posterior $\propto$ was 1.46, and the posterior ß was 0.17, to give a posterior rate of 8.6/1000, with a variance of 50, or an SD of 7.1. The value of ß rose from 0.01 to 0.17, indicating a higher level of certainty.

The Bayesian confidence interval is the narrowest interval that contains 95% of the area under the posterior-belief curve. The confidence interval for the prior curve is 2.53 to 370. The confidence interval for the posterior curve is 0.25 to 27.5, a significant shrinking and increase in certainty but still broad.

The model for the odds ratios is more complicated and is based on the Oxford data set and analysis in the BUGS manual.

D. Thresholds

In the course of discussions about results, the Subcommittee was surveyed about the acceptable risks of DDH for different levels of interventions.

E. Recommendations

Once the evidence and thresholds were obtained, a decision tree was created from the evidence available and was reviewed by the Subcommittee. In parallel, a consensus guideline (flowchart) was created. The Subcommittee evaluated whether evidence was available for links within the guidelines, as well as their strength of consensus. The decision tree was evaluated to check consistency of the evidence with the conclusions.

F. "Cost"-Effectiveness Ratios

To integrate the results, we defined cost-effectiveness ratios, in which cost was excess neonatal referrals or excess cases of AVNs, and *effectiveness* was a decrease in the number of later cases. The decision tree from section E ("Recommendations") was used to calculate the expected outcomes for each of pediatric, orthopaedic, and ultrasonographic strategies. Pediatric strategy was used as the baseline, because its neonatal screening rate was the lowest. The cost-effectiveness ratios then were calculated as the quotient of the difference in cost and the difference in effect.

RESULTS

A. Articles

The peak number of articles is for 1992, with 10 articles. The articles are from sites all over the world, although the Nordic, Anglo-Saxon, and European communities and their descendants are the most represented.

B. Evidence

By traditional epidemiologic standards, the quality of evidence in this set of articles is uniformly low. There are few controlled trials and few studies in which infants with negative results on their newborn examinations are followed up. (A number of studies attempted to cover all possible places where an affected child might have been ascertained.)

We found data on all chance nodes, for a total of 298 distinct tables. *Decision* nodes were poorly represented: beyond the neonatal strategy, there were almost no

data clarifying the paths for the diagnosis children after the newborn period. Thus, although communities like those in southeast Norway have a postnewborn screening program, it is unclear what the program was, and it was unclear how many examination results were normal before a child was referred to an orthopaedist.

The mode is a score of 10, achieved in 16 articles. The median is 9.9, with an interquartile range of 8 to 14, suggesting that articles with scores below 8 are poor sources of evidence. Note that the maximum achievable quality score is 21, so half the articles do not achieve half the maximum quality score.

Graphing evidence quality against publication year suggests an improvement in quality over time, as shown in Fig 9, but the linear fit through the data is statistically indistinguishable from a flat line. (A nonparametric procedure yields the same conclusion).

The studies include 5 in which a comparative arm was designed into the study. The remainder are divided between prospective and retrospective studies. Surprisingly, the evidence quality is not higher in the former than in the latter (data not shown).

Of the 298 data tables, half the data tables relate to the following:

- probabilities of DDH in different screening strategies
- relative risk of DDH, given risk factors
- the incidence of postneonatal DDH, and
- the incidence of AVN.

The remainder of our discussion will focus on these probabilities.

C. Evidence Tables

The evidence table details are found in the appendix of the full technical report.

1. Newborn Screening

a. Pediatric Screening

There were 51 studies, providing 57 arms, for pediatric screening. However, of these, 17 were unclear on how the intermediate examinations were handled, and, unsurprisingly, their observed rates of positivity (clicks) were much higher than the studies that distinguished 3 categories, as we had specified. Therefore, we included only the 34 studies that used 3 categories.

For pediatric screening, the rate is about 8 positive cases per 1000 examinations. The rates are distributed almost uniformly between 0 and 20 per 1000. All studies represent a large experience: a total of 2 149 972 subjects. Although their methods may not have been the best, the studies demand attention simply because of their size.

In looking for covariates or confounding variables, we studied the relationship between positivity rate and the independent variables, year of publication, evidence quality, and sample size. Year and evidence quality show a positive effect: the higher the year (slope: 0.2; P 5 .018) or evidence quality (slope: 0.6; P 5 .046), the higher the observed rate. A model with both factors has evidence that suggests that most of the effect is in the factor, year (slope for year: 0.08; P 5 .038; slope for quality of evidence: 0.49; P 5 .09). Note that a regression using evidence quality is improper, because our evidence scale is not properly ratio (eg, the distance between 6 and 7 is not necessarily equivalent to the distance between 14 and 15), but the regression is a useful exploratory device.

b. Orthopaedic Screening

Evidence was found in 25 studies. Three studies provided 2 arms each.

The positivity rate for orthopaedic screening is between 7 and 11/1000. One outlier study, with an observed rate of more than 300/1000, skews the unweighted and meta-analytic averages. The estimate (between 7.1 and 11) is just below that of pediatric screening and is statistically indistinguishable. Note, however, that a fair number of studies have rates near 22/1000 or higher.

Unlike with pediatric screening, there are no correlations with other factors.

c. Ultrasonographic Screening

Evidence was found in 17 studies, each providing a single arm.

The rate for ultrasonographic screening is 20/1000 or more. Although the estimates are sensitive to pooling and to the outlier, the positivity rate is clearly higher than in either PE strategy. There are no correlating factors. In particular, studies that use the Graf method 2 or those that use the method of Harcke et al show comparable rates.

2. Postneonatal Cases

We initially were interested in all postneonatal diagnoses of DDH. However, the literature did not provide data within the narrow time frames initially specified for our model. Based on the data that were available, we considered 3 classes of postneonatal DDH: DDH diagnosed after 12 months of age ("late-term"), DDH diagnosed between 6 and 12 months of age ("mid-term"), and DDH diagnosed before 6 months of age. There were few data for the latter group, which often was combined with the newborn screening programs. Therefore, we collected data on only the first 2 groups.

a. After Pediatric Screening

Evidence was found in 24 studies. The study by Dunn and O'Riordan provided 2 arms. It is difficult to discern an estimate rate for mid-term DDH, because the study by Czeizel et al is such an outlier, with a rate of 3.73/1000, and because the weighted and unweighted averages also differ greatly. The meta-analytic estimate of 0.55/1000 seems to be an upper limit.

The late-term rate is easier to estimate at ~0.3/1000. Although it is intuitive that the late-term rate should be lower than the mid-term rate, our data do not allow us to draw that conclusion.

b. After Orthopaedic Screening
There were only 4 studies. The rates were comparable for mid- and late-term: 0.1/1000 newborns. A meta-analytic estimate was not calculated.

c. After Ultrasonographic Screening
Only 1 study, by Rosendahl et al is available; it reported rates for infants with and without initial risk factors (eg, family history and breech presentation). The mid-term rate was 0.28/1000 newborns in the non-risk group, and the late-term rate was 0/1000 in the same group.

3. AVN After Treatment
For these estimates, we grouped together all treatments, because from the viewpoint of the referring primary care provider, orthopaedic treatment is a "black box:" A literature synthesis that teased apart the success and complications of particular *therapeutic* strategies is beyond the scope of the present study.

The complication rate should depend only on the age of the patient at time of orthopaedic referral and on the type of treatment received. We report on the complication rates for children treated before and after 12 months of age.

a. After Early Referral
There were 17 studies providing evidence. Infants were referred to orthopaedists during the newborn period in each study except 2. In the study by Pool et al, infants were referred during the newborn period and before 2 months of age; in the study by Sochart and Paton, infants were referred between 2 weeks and 2 months of age.

The range of AVN rates per 1000 infants referred was huge, from 0 to 123. The largest rate occurred in the study by Pool et al, a sample-based study that included later referrals. Its evidence quality was 8, within the 7 to 13 interquartile range of the other studies in this group. As in earlier tables, the meta-analytic estimate lies between the average and weighted (pooled) average of the studies.

b. After Later Referral
Evidence was obtained from 6 studies. Some of the studies included children referred during the newborn period or during the 2-week to 2-month period, but even in these, the majority of infants were referred later during the first year of life.

There were no outlier rates, although the highest rate (216/1000 referred children) occurred in the study with the oldest referred children in the sample with children referred who were older than 12 months of age. One study contributed 5700 patients to the analysis, more than half of the 9270 total, so its AVN rate of 27/1000 brought the unweighted rate of 116/1000 to 54. A meta-analytic estimate was not computed.

4. Risk Factors
A number of factors are known to predispose infants to DDH. We sought evidence for 3 of these: sex, obstetrical position at birth, and family history. Studies were included in these analyses only if a control group could be ascertained from the available study data.

The key measure is the odds ratio, an estimate of the relative risk. The meaning of the odds ratio is that if the DDH rate for the control group is known, then the DDH rate for the at-risk group is the product of the control-group DDH rate and the odds ratio for the risk factor. An odds ratio statistically significantly greater than 1 indicates that the factor is a risk factor.

The Bayesian meta-analysis produces estimates between the average of the odds ratios and the pooled odds ratio and is, therefore, the estimate we used in our later analyses.

a. Female
The studies were uniform in discerning a risk to girls ~4 times that of boys for being diagnosed with DDH. This risk was seen in all 3 screening environments.

b. Breech
The studies for breech also were confident in finding a risk for breech presentation, on the order of fivefold. One study found breech presentation to be protective, but the study was relatively small and used ultrasonography rather than PE as its outcome measure.

c. Family History
Although some studies found family history to be a risk factor, the range was wide. The confidence intervals for the pooled odds ratio and for the Bayesian analysis contained 1.0, suggesting that family history is *not* an independent risk factor for DDH. However, because of traditional concern with this risk factor, we kept it in our further considerations.

D. Evidence Summary and Risk Implications

To bring all evidence tables together, we constructed a summary table, which contains the estimates we chose for our recommendations. The intervals are asymmetric, in keeping with the intuition that rates near zero cannot be negative, but certainly can be very positive.

Risk factors are based on the pediatrician population rate of 8.6 labeled cases of DDH per 1000 infants screened. In the Subcommittee's discussion, 50/1000 was a cutoff for automatic referral during the newborn period. Hence, girls born in the breech position are classified in a separate category for newborn strategies than infants with other risk factors.

If we use the orthopaedists' rate as our baseline, numbers suggest that boys without risks or those with a family history have the lowest risk; girls without risks and boys born in the breech presentation have an intermediate risk; and girls with a positive family history, and especially girls born in the breech presentation, have the highest risks. Guidelines that consider risk factors should follow these risk profiles.

E. Decision Recommendations

With the evidence synthesized, we can estimate the expected results of the target newborn strategies for postneonatal DDH and AVN.

If a case of DDH is observed in an infant with an initially negative result of screening by an orthopaedist in a newborn screening program, that case is "counted" against the orthopaedist strategy.

The numbers are combined using a simple decision tree, which is not the final tree represented by our influence diagram but is a tree that is supported by our evidence. The results show that pediatricians diagnose fewer newborns with DDH and perhaps have a higher postneonatal DDH rate than orthopaedists but one that is comparable to ultrasonography (acknowledging that our knowledge of postneonatal DDH revealed by ultrasonographic screening is limited). The AVN rates are comparable with pediatrician and ultrasonographic screening and less than with orthopaedist screening.

F. Cost-Effectiveness Ratios

In terms of excess neonatal referrals, the ratios suggest that there is a trade-off: for every case that these strategies detect beyond the pediatric strategy, they require more than 7000 or 16 000 extra referrals, respectively.

DISCUSSION

A. Summary

We derived 298 evidence tables from 118 studies culled from a larger set of 624 articles. Our literature review captured most in our model-based approach, if not all, of the past literature on DDH that was usable. The decision model (reduced based on available evidence) suggests that orthopaedic screening is optimal, but because orthopaedists in the published studies and in practice would differ, the supply of orthopaedists is relatively limited, and the difference between orthopaedists and pediatricians is relatively small, we conclude that pediatric screening is to be recommended. The place of ultrasonography in the screening process remains to be defined because there are too few data about postneonatal diagnosis by ultrasonographic screening to permit definitive recommendations.

Our conclusions are tempered by the uncertainties resulting from the wide range of the evidence. The confidence intervals are wide for the primary parameters. The uncertainties mean that, even with all the evidence collected from the literature, we are left with large doubts about the values of the different parameters.

Our data do not bear directly on the issue about the earliest point that any patient destined to have DDH will show signs of the disease. Our use of the terms *mid-term* and *late-term* DDH addresses that ignorance.

Our conclusions about other areas of the full decision model are more tentative because of the paucity of data about the effectiveness of periodicity examinations. Even the studies that gave data on mid-term and late-term case findings by pediatricians were sparse in their details about how the screening was instituted, maintained, or followed up.

Our literature search was weakest in addressing the European literature, where results about ultrasonography are more prevalent. We found, however, that many of the seminal articles were republished in English or in a form that we could assess.

B. Specific Issues

1. Evidence Quality

Our measure of evidence quality is unique, although it is based on solid principles of study design and decision modeling. In particular, our measure was based on the notion that if the data conform poorly to how we need to use it, we downgrade its value.

However, throughout the analyses, there was never a correlation with the results of a study (in terms of the values of outcomes) and with evidence quality, so we never needed to use the measure for weighting the values of the outcome or for culling articles from our review. Had this been so, the measures would have needed further scrutiny and validation.

2. Outliers

Perhaps the true surrogates for study quality were the outlying values of outcomes. In general, however, there were few cases in which the outliers were clearly the result of poor-quality studies. One example is that of the outcomes of pediatric screening (1–3), in which the DDH rates in studies using only 2 categories were generally higher than those that explicitly specified 3 levels of outcomes.

Our general justification for using estimates that excluded outliers is that the outliers so much drove the results that they dominated the conclusion out of proportion to their sample sizes. As it is, our estimates have wide ranges.

3. Newborn Screening

The set of studies labeled "pediatrician screening" includes studies with a variety of examiners. We could not estimate the sensitivity and specificity of pediatricians' examinations versus those of other primary care providers versus orthopaedists. There are techniques for extracting these measures from agreement studies, but they are beyond the scope of the present study. It is intuitive that the more cases that one examines, the better an examiner one will be, regardless of professional title.

We were surprised that the results did not show a clear difference in results between the Graf and Harcke et al ultrasonographic examinations. Our data make no statement about the relative advantages of these methods for following up children or in addressing treatment.

4. Postneonatal Cases

As mentioned, our data cannot say when a postneonatal case is established or, therefore, the best time to screen children. We established our initial age categories for postneonatal cases based on biology, treatment changes, and optimal imaging and examination strategies. It is frustrating that the data in the literature are not organized to match this pathophysiological way of thinking about DDH. Similarly,

as mentioned, the lack of details by authors on the methods of intercurrent screening means that we cannot recommend a preferred method for mid-term or late-term screening.

5. *AVN*
We used AVN as our primary marker for treatment morbidity. We acknowledge that the studies we grouped together may reflect different philosophies and results of orthopaedic practice. The hierarchical meta-analysis treats every study as an individual case, and the wide range in our confidence intervals reflects the uncertainty that results in grouping disparate studies together.

C. Comments on Methods

This study is unique in its strong use of decision modeling at each step in the process. In the end, our results are couched in traditional terms (estimated rates of disease or morbidity outcomes), although the context is relatively nontraditional: attaching the estimates to strategies rather than to treatments. In this, our study is typical of an *effectiveness* study, which studied results in the real world, rather than of an *efficacy* study, which examines the biological effects of a treatment.

We made strong and recurrent use of the Bayesian hierarchical meta-analysis. A review of the tables will confirm that the Bayesian results were in the same "ballpark" as the average and pooled average estimates and had a more solid grounding.

The usual criticism of using Bayesian methods is that they depend on prior belief. The usual response is to show that the final estimates are relatively insensitive to the prior belief. In fact, for the screening strategies, a wide range of prior beliefs had no effect on the estimate. However, the prior belief used for the screening strategies—with a mean of 100 cases/1000 with a variance of 100—was too broad for the postneonatal case and AVN analyses; when data were sparse, the prior belief overwhelmed the data. For instance, in late-term DDH revealed by orthopaedic screening (53 30), in an analysis not shown, the posterior estimate from the 4 studies was a rate of 0.345 cases per 1000, despite an average and a pooled average on the order of 0.08. Four studies were insufficient to overpower a prior belief of 100.

D. Research Issues

The place of ultrasonography in DDH screening needs more attention, as does the issue of intercurrent pediatrician screening. In the latter case, society and health care systems must assess the effectiveness of education and the "return on investment" for educational programs. The place of preferences—of the parents, of the clinician—must be established.

We hope that the framework we have delineated—of a decision model and of data—can be useful in these future research endeavors.

Dysplasia of the Hip Clinical Practice Guideline Quick Reference Tools

- Recommendation Summary
  — Early Detection of Developmental Dysplasia of the Hip
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Dysplasia of the Hip
- AAP Patient Education Handout
  — *Hip Dysplasia (Developmental Dysplasia of the Hip)*

Recommendation Summary

Early Detection of Developmental Dysplasia of the Hip

Recommendation 1

A. All newborns are to be screened by physical examination. (The evidence for this recommendation is good. The expert consensus is strong.)
B. It is recommended that screening be done by a properly trained health care provider (eg, physician, pediatric nurse practitioner, physician assistant, or physical therapist). (Evidence for this recommendation is strong.)
C. Ultrasonography of all newborns is not recommended. (Evidence is fair; consensus is strong.)

Recommendation 2

A. If a positive Ortolani or Barlow sign is found in the newborn examination, the infant should be referred to an orthopaedist. (The data recommending that all those with a positive Ortolani sign be referred to an orthopaedist are limited, but expert panel consensus, nevertheless, was strong….)
B. If the results of the physical examination at birth are "equivocally" positive (ie, soft click, mild asymmetry, but neither an Ortolani nor a Barlow sign is present), then a follow-up hip examination by the pediatrician in 2 weeks is recommended. (Evidence is good; consensus is strong.)

Recommendation 3

A. If the results of the newborn physical examination are positive (ie, presence of an Ortolani or a Barlow sign), ordering an ultrasonographic examination of the newborn is not recommended. (Evidence is poor; opinion is strong.)
B. If the results of the newborn physical examination are positive, obtaining a radiograph of the newborn's pelvis and hips is not recommended. (Evidence is poor; opinion is strong.)
C. The use of triple diapers when abnormal physical signs are detected during the newborn period is not recommended. (Evidence is poor; opinion is strong.)

Recommendation 4

If the results of the physical examination are positive (eg, positive Ortolani or Barlow sign) at 2 weeks, refer to an orthopaedist. (Evidence is strong; consensus is strong.)

Recommendation 5

If at the 2-week examination the Ortolani and Barlow signs are absent but physical findings raise suspicions, consider referral to an orthopaedist or request ultrasonography at age 3 to 4 weeks.

Recommendation 6

If the results of the physical examination are negative at 2 weeks, follow-up is recommended at the scheduled well-baby periodic examinations. (Evidence is good; consensus is strong.)

Recommendation 7

Risk factors. If the results of the newborn examination are negative (or equivocally positive), risk factors may be considered. The following recommendations are made (evidence is strong; opinion is strong):

A. Girl (newborn risk of 19/1000). When the results of the newborn examination are negative or equivocally positive, hips should be reevaluated at 2 weeks of age. If negative, continue according to the periodicity schedule; if positive, refer to an orthopaedist or for ultrasonography at 3 weeks of age.
B. Infants with a positive family history of DDH (newborn risk for boys of 9.4/1000 and for girls, 44/1000). When the results of the newborn examination in boys are negative or equivocally positive, hips should be reevaluated at 2 weeks of age. If negative, continue according to the periodicity schedule; if positive, refer to an orthopaedist or for ultrasonography at 3 weeks of age. In girls, the absolute risk of 44/1000 may exceed the pediatrician's threshold to act, and imaging with an ultrasonographic examination at 6 weeks of age or a radiograph of the pelvis at 4 months of age is recommended.
C. Breech presentation (newborn risk for boys of 26/1000 and for girls, 120/1000). For negative or equivocally positive newborn examinations, the infant should be reevaluated at regular intervals (according to the periodicity schedule) if the examination results remain negative.

Recommendation 8

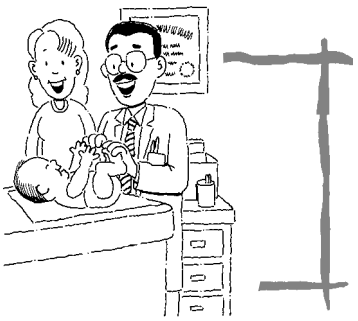
Periodicity. The hips must be examined at every well-baby visit according to the recommended periodicity schedule for well-baby examinations (2–4 days for newborns discharged in less than 48 hours after delivery, by 1 month, 2 months, 4 months, 6 months, 9 months, and 12 months of age).

Coding Quick Reference for Dysplasia of the Hip	
ICD-9-CM	***ICD-10-CM***
755.63 Dysplasia, hip, congenital	**Q65.89** Other specified congenital deformities of hip **Q65.0-** Congenital dislocation of hip, unilateral **Q65.1** Congenital dislocation of hip, bilateral **Q65.2** Congenital dislocation of hip, unspecified **Q65.3-** Congenital partial dislocation of hip, unilateral **Q65.4** Congenital partial dislocation of hip, bilateral **Q65.5** Congenital partial dislocation of hip, unspecified **Q65.6** Congenital unstable hip (Congenital dislocatable hip)

ICD-10-CM Symbol: "-" Requires a fifth digit: 0 = unspecified; 1 = right; 2 = left

Hip Dysplasia

(Developmental Dysplasia of the Hip)



Hip dysplasia (developmental dysplasia of the hip) is a condition in which a child's upper thighbone is dislocated from the hip socket. It can be present at birth or develop during a child's first year of life.

Hip dysplasia is not always detectable at birth or even during early infancy. In spite of careful screening of children for hip dysplasia during regular well-child exams, a number of children with hip dysplasia are not diagnosed until after they are 1 year old.

Hip dysplasia is rare. However, if your baby is diagnosed with the condition, quick treatment is important.

What causes hip dysplasia?

No one is sure why hip dysplasia occurs (or why the left hip dislocates more often than the right hip). One reason may have to do with the hormones a baby is exposed to before birth. While these hormones serve to relax muscles in the pregnant mother's body, in some cases they also may cause a baby's joints to become too relaxed and prone to dislocation. This condition often corrects itself in several days, and the hip develops normally. In some cases, these dislocations cause changes in the hip anatomy that need treatment.

Who is at risk?

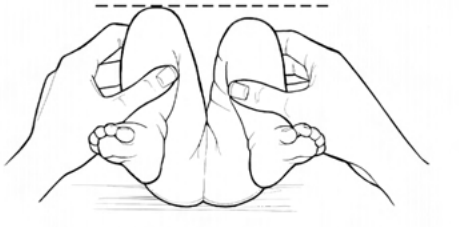
Factors that may increase the risk of hip dysplasia include

- Sex—more frequent in girls
- Family history—more likely when other family members have had hip dysplasia
- Birth position—more common in infants born in the breech position
- Birth order—firstborn children most at risk for hip dysplasia

Detecting hip dysplasia

Your pediatrician will check your newborn for hip dysplasia right after birth and at every well-child exam until your child is walking normally.

During the exam, your child's pediatrician will carefully flex and rotate your child's legs to see if the thighbones are properly positioned in the hip sockets. This does not require a great deal of force and will not hurt your baby.



Your child's pediatrician also will look for other signs that may suggest a problem, including

- Limited range of motion in either leg
- One leg is shorter than the other
- Thigh or buttock creases appear uneven or lopsided

If your child's pediatrician suspects a problem with your child's hip, you may be referred to an orthopedic specialist who has experience treating hip dysplasia.

Treating hip dysplasia

Early treatment is important. The sooner treatment begins, the simpler it will be. In the past parents were told to double or triple diaper their babies to keep the legs in a position where dislocation was unlikely. *This practice is not recommended.* The diapering will not prevent hip dysplasia and will only delay effective treatment. Failure to treat this condition can result in permanent disability.

If your child is diagnosed with hip dysplasia before she is 6 months old, she will most likely be treated with a soft brace (such as the Pavlik harness) that holds the legs flexed and apart to allow the thighbones to be secure in the hip sockets.

Pavlik Harness

The orthopedic consultant will tell you how long and when your baby will need to wear the brace. Your child also will be examined frequently during this time to make sure that the hips remain normal and stable.

In resistant cases or in older children, hip dysplasia may need to be treated with a combination of braces, casts, traction, or surgery. Your child will be admitted to the hospital if surgery is necessary. After surgery, your child will be placed in a hip spica cast for about 3 months. A hip spica cast is a hard cast that immobilizes the hips and keeps them in the correct position. When the cast is removed, your child will need to wear a removable hip brace for several more months.

Remember

If you have any concerns about your child's walking, talk with his pediatrician. If the cause is hip dysplasia, prompt treatment is important.

American Academy of Pediatrics

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Febrile Seizures: Clinical Practice Guideline for the Long-term Management of the Child With Simple Febrile Seizures

- *Clinical Practice Guideline*

CLINICAL PRACTICE GUIDELINE

Febrile Seizures: Clinical Practice Guideline for the Long-term Management of the Child With Simple Febrile Seizures

Steering Committee on Quality Improvement and Management, Subcommittee on Febrile Seizures

ABSTRACT

Febrile seizures are the most common seizure disorder in childhood, affecting 2% to 5% of children between the ages of 6 and 60 months. Simple febrile seizures are defined as brief (<15-minute) generalized seizures that occur once during a 24-hour period in a febrile child who does not have an intracranial infection, metabolic disturbance, or history of afebrile seizures. This guideline (a revision of the 1999 American Academy of Pediatrics practice parameter [now termed clinical practice guideline] "The Long-term Treatment of the Child With Simple Febrile Seizures") addresses the risks and benefits of both continuous and intermittent anticonvulsant therapy as well as the use of antipyretics in children with simple febrile seizures. It is designed to assist pediatricians by providing an analytic framework for decisions regarding possible therapeutic interventions in this patient population. It is not intended to replace clinical judgment or to establish a protocol for all patients with this disorder. Rarely will these guidelines be the only approach to this problem. *Pediatrics* 2008;121:1281–1286

www.pediatrics.org/cgi/doi/10.1542/peds.2008-0939

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Key Word
fever

Abbreviation
AAP—American Academy of Pediatrics

The expected outcomes of this practice guideline include:

1. optimizing practitioner understanding of the scientific basis for using or avoiding various proposed treatments for children with simple febrile seizures;
2. improving the health of children with simple febrile seizures by avoiding therapies with high potential for adverse effects and no demonstrated ability to improve children's long-term outcomes;
3. reducing costs by avoiding therapies that will not demonstrably improve children's long-term outcomes; and
4. helping the practitioner educate caregivers about the low risks associated with simple febrile seizures.

The committee determined that with the exception of a high rate of recurrence, no long-term effects of simple febrile seizures have been identified. The risk of developing epilepsy in these patients is extremely low, although slightly higher than that in the general population. No data, however, suggest that prophylactic treatment of children with simple febrile seizures would reduce the risk, because epilepsy likely is the result of genetic predisposition rather than structural damage to the brain caused by recurrent simple febrile seizures. Although antipyretics have been shown to be ineffective in preventing recurrent febrile seizures, there is evidence that continuous anticonvulsant therapy with phenobarbital, primidone, or valproic acid and intermittent therapy with diazepam are effective in reducing febrile-seizure recurrence. The potential toxicities associated with these agents, however, outweigh the relatively minor risks associated with simple febrile seizures. As such, the committee concluded that, on the basis of the risks and benefits of the effective therapies, neither continuous nor intermittent anticonvulsant therapy is recommended for children with 1 or more simple febrile seizures.

INTRODUCTION

Febrile seizures are seizures that occur in febrile children between the ages of 6 and 60 months who do not have an intracranial infection, metabolic disturbance, or history of afebrile seizures. Febrile seizures are subdivided into 2 categories: simple and complex. Simple febrile seizures last for less than 15 minutes, are generalized (without a focal component), and occur once in a 24-hour period, whereas complex febrile seizures are prolonged (>15 minutes), are focal, or occur more than once in 24 hours.[1] Despite the frequency of febrile seizures (2%–5%), there is no unanimity of opinion about management options. This clinical practice guideline addresses potential therapeutic interventions in neurologically normal children with simple febrile seizures. It is not intended for patients with complex febrile seizures and does not pertain to children with previous neurologic insults, known central nervous system abnor-

malities, or a history of afebrile seizures. This clinical practice guideline is a revision of a 1999 American Academy of Pediatrics (AAP) clinical practice parameter, "The Long-term Treatment of the Child With Simple Febrile Seizures."[2]

For a child who has experienced a simple febrile seizure, there are potentially 4 adverse outcomes that theoretically may be altered by an effective therapeutic agent: (1) decline in IQ; (2) increased risk of epilepsy; (3) risk of recurrent febrile seizures; and (4) death. Neither a decline in IQ, academic performance or neurocognitive inattention nor behavioral abnormalities have been shown to be a consequence of recurrent simple febrile seizures.[3] Ellenberg and Nelson[4] studied 431 children who experienced febrile seizures and observed no significant difference in their learning compared with sibling controls. In a similar study by Verity et al,[5] 303 children with febrile seizures were compared with control children. No difference in learning was identified, except in those children who had neurologic abnormalities before their first seizure.

The second concern, increased risk of epilepsy, is more complex. Children with simple febrile seizures have approximately the same risk of developing epilepsy by the age of 7 years as does the general population (ie, 1%).[6] However, children who have had multiple simple febrile seizures, are younger than 12 months at the time of their first febrile seizure, and have a family history of epilepsy are at higher risk, with generalized afebrile seizures developing by 25 years of age in 2.4%.[7] Despite this fact, no study has demonstrated that successful treatment of simple febrile seizures can prevent this later development of epilepsy, and there currently is no evidence that simple febrile seizures cause structural damage to the brain. Indeed, it is most likely that the increased risk of epilepsy in this population is the result of genetic predisposition.

In contrast to the slightly increased risk of developing epilepsy, children with simple febrile seizures have a high rate of recurrence. The risk varies with age. Children younger than 12 months at the time of their first simple febrile seizure have an approximately 50% probability of having recurrent febrile seizures. Children older than 12 months at the time of their first event have an approximately 30% probability of a second febrile seizure; of those who do have a second febrile seizure, 50% have a chance of having at least 1 additional recurrence.[8]

Finally, there is a theoretical risk of a child dying during a simple febrile seizure as a result of documented injury, aspiration, or cardiac arrhythmia, but to the committee's knowledge, it has never been reported.

In summary, with the exception of a high rate of recurrence, no long-term adverse effects of simple febrile seizures have been identified. Because the risks associated with simple febrile seizures, other than recurrence, are so low and because the number of children who have febrile seizures in the first few years of life is so high, to be commensurate, a proposed therapy would need to be exceedingly low in risks and adverse effects, inexpensive, and highly effective.

METHODS

To update the clinical practice guideline on the treatment of children with simple febrile seizures, the AAP reconvened the Subcommittee on Febrile Seizures. The committee was chaired by a child neurologist and consisted of a neuroepidemiologist, 2 additional child neurologists, and a practicing pediatrician. All panel members reviewed and signed the AAP voluntary disclosure and conflict-of-interest form. The guideline was reviewed by members of the AAP Steering Committee on Quality Improvement and Management; members of the AAP Sections on Neurology, Pediatric Emergency Medicine, Developmental and Behavioral Pediatrics, and Epidemiology; members of the AAP Committees on Pediatric Emergency Medicine and Medical Liability and Risk Management; members of the AAP Councils on Children With Disabilities and Community Pediatrics; and members of outside organizations including the Child Neurology Society and the American Academy of Neurology.

A comprehensive review of the evidence-based literature published since 1998 was conducted with the aim of addressing possible therapeutic interventions in the management of children with simple febrile seizures. The review focused on both the efficacy and potential adverse effects of the proposed treatments. Decisions were made on the basis of a systematic grading of the quality of evidence and strength of recommendations.

The AAP established a partnership with the University of Kentucky (Lexington, KY) to develop an evidence report, which served as a major source of information for these practice-guideline recommendations. The specific issues addressed were (1) effectiveness of continuous anticonvulsant therapy in preventing recurrent febrile seizures, (2) effectiveness of intermittent anticonvulsant therapy in preventing recurrent febrile seizures, (3) effectiveness of antipyretics in preventing recurrent febrile seizures, and (4) adverse effects of either continuous or intermittent anticonvulsant therapy.

In the original practice parameter, more than 300 medical journal articles reporting studies of the natural history of simple febrile seizures or the therapy of these seizures were reviewed and abstracted.[2] An additional 65 articles were reviewed and abstracted for the update. Emphasis was placed on articles that differentiated simple febrile seizures from other types of seizures, that carefully matched treatment and control groups, and that described adherence to the drug regimen. Tables were constructed from the 65 articles that best fit these criteria. A more comprehensive review of the literature on which this report is based can be found in a forthcoming technical report (the initial technical report can be accessed at http://aappolicy.aappublications.org/cgi/content/full/pediatrics;103/6/e86). The technical report also will contain dosing information.

The evidence-based approach to guideline development requires that the evidence in support of a recommendation be identified, appraised, and summarized and that an explicit link between evidence and recommendations be defined. Evidence-based recommendations reflect the quality of evidence and the balance of benefit and harm that is

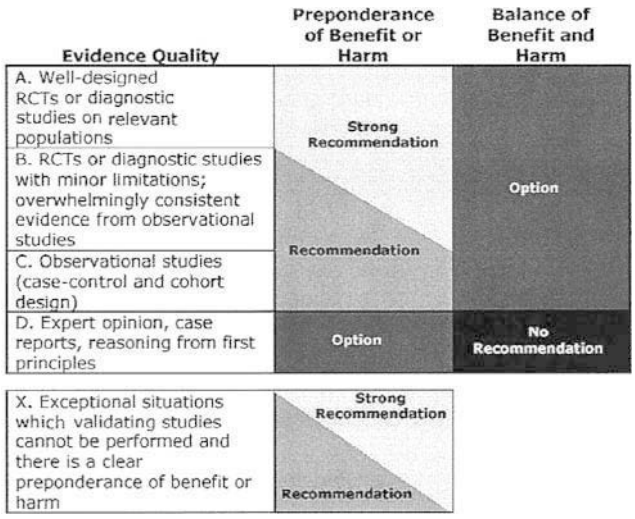

FIGURE 1
Integrating evidence-quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is conducted leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation. RCT indicates randomized, controlled trial.

anticipated when the recommendation is followed. The AAP policy statement "Classifying Recommendations for Clinical Practice Guidelines"[9] was followed in designating levels of recommendations (see Fig 1 and Table 1).

RECOMMENDATION

On the basis of the risks and benefits of the effective therapies, neither continuous nor intermittent anticonvulsant therapy is recommended for children with 1 or more simple febrile seizures.

- Aggregate evidence quality: B (randomized, controlled trials and diagnostic studies with minor limitations).
- Benefit: prevention of recurrent febrile seizures, which are not harmful and do not significantly increase the risk for development of future epilepsy.
- Harm: adverse effects including rare fatal hepatotoxicity (especially in children younger than 2 years who are also at greatest risk of febrile seizures), thrombocytopenia, weight loss and gain, gastrointestinal disturbances, and pancreatitis with valproic acid and hyperactivity, irritability, lethargy, sleep disturbances, and hypersensitivity reactions with phenobarbital; lethargy, drowsiness, and ataxia for intermittent diazepam as well as the risk of masking an evolving central nervous system infection.
- Benefits/harms assessment: preponderance of harm over benefit.
- Policy level: recommendation.

BENEFITS AND RISKS OF CONTINUOUS ANTICONVULSANT THERAPY

Phenobarbital

Phenobarbital is effective in preventing the recurrence of simple febrile seizures.[10] In a controlled double-blind study, daily therapy with phenobarbital reduced the rate of subsequent febrile seizures from 25 per 100 subjects per year to 5 per 100 subjects per year.[11] For the agent to be effective, however, it must be given daily and maintained in the therapeutic range. In a study by Farwell et al,[12] for example, children whose phenobarbital levels were in the therapeutic range had a reduction in recurrent seizures, but because noncompliance was so high, an overall benefit with phenobarbital therapy was not identified.

The adverse effects of phenobarbital include hyperactivity, irritability, lethargy, sleep disturbances, and hypersensitivity reactions. The behavioral adverse effects

TABLE 1 **Guideline Definitions for Evidence-Based Statements**

Statement	Definition	Implication
Strong recommendation	A strong recommendation in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms (as a strong recommendation against an action is made when the anticipated harms clearly exceed the benefits) and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendations may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A recommendation in favor of a particular action is made when the anticipated benefits exceed the harms but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high-quality evidence is impossible to obtain but the anticipated benefits outweigh the harms.	Clinicians would be prudent to follow a recommendation but should remain alert to new information and sensitive to patient preferences.
Option	Options define courses that may be taken when either the quality of evidence is suspect or carefully performed studies have shown little clear advantage to 1 approach over another.	Clinicians should consider the option in their decision-making, and patient preference may have a substantial role.
No recommendation	No recommendation indicates that there is a lack of pertinent published evidence and that the anticipated balance of benefits and harms is presently unclear.	Clinicians should be alert to new published evidence that clarifies the balance of benefit versus harm.

may occur in up to 20% to 40% of patients and may be severe enough to necessitate discontinuation of the drug.[13–16]

Primidone

Primidone, in doses of 15 to 20 mg/kg per day, has also been shown to reduce the recurrence rate of febrile seizures.[17,18] It is of interest that the derived phenobarbital level in a Minigawa and Miura study[17] was below therapeutic (16 μg/mL) in 29 of the 32 children, suggesting that primidone itself may be active in preventing seizure recurrence. As with phenobarbital, adverse effects include behavioral disturbances, irritability, and sleep disturbances.[18]

Valproic Acid

In randomized, controlled studies, only 4% of children taking valproic acid, as opposed to 35% of control subjects, had a subsequent febrile seizure. Therefore, valproic acid seems to be at least as effective in preventing recurrent simple febrile seizures as phenobarbital and significantly more effective than placebo.[19–21]

Drawbacks to therapy with valproic acid include its rare association with fatal hepatotoxicity (especially in children younger than 2 years, who are also at greatest risk of febrile seizures), thrombocytopenia, weight loss and gain, gastrointestinal disturbances, and pancreatitis. In studies in which children received valproic acid to prevent recurrence of febrile seizures, no cases of fatal hepatotoxicity were reported.[15]

Carbamazepine

Carbamazepine has not been shown to be effective in preventing the recurrence of simple febrile seizures. Antony and Hawke[13] compared children who had been treated with therapeutic levels of either phenobarbital or carbamazepine, and 47% of the children in the carbamazepine-treated group had recurrent seizures compared with only 10% of those in the phenobarbital group. In another study, Camfield et al[22] treated children (whose conditions failed to improve with phenobarbital therapy) with carbamazepine. Despite good compliance, 13 of the 16 children treated with carbamazepine had a recurrent febrile seizure within 18 months. It is theoretically possible that these excessively high rates of recurrences might have been attributable to adverse effects of carbamazepine.

Phenytoin

Phenytoin has not been shown to be effective in preventing the recurrence of simple febrile seizures, even when the agent is in the therapeutic range.[23,24] Other anticonvulsants have not been studied for the continuous treatment of simple febrile seizures.

BENEFITS AND RISKS OF INTERMITTENT ANTICONVULSANT THERAPY

Diazepam

A double-blind controlled study of patients with a history of febrile seizures demonstrated that administration of oral diazepam (given at the time of fever) could reduce the recurrence of febrile seizures. Children with a history of febrile seizures were given either oral diazepam (0.33 mg/kg, every 8 hours for 48 hours) or a placebo at the time of fever. The risk of febrile seizures per person-year was decreased 44% with diazepam.[25] In a more recent study, children with a history of febrile seizures were given oral diazepam at the time of fever and then compared with children in an untreated control group. In the oral diazepam group, there was an 11% recurrence rate compared with a 30% recurrence rate in the control group.[26] It should be noted that all children for whom diazepam was considered a failure had been noncompliant with drug administration, in part because of adverse effects of the medication.

There is also literature that demonstrates the feasibility and safety of interrupting a simple febrile seizure lasting less than 5 minutes with rectal diazepam and with both intranasal and buccal midazolam.[27,28] Although these agents are effective in terminating the seizure, it is questionable whether they have any long-term influence on outcome. In a study by Knudsen et al,[29] children were given either rectal diazepam at the time of fever or only at the onset of seizure. Twelve-year follow-up found that the long-term prognosis of the children in the 2 groups did not differ regardless of whether treatment was aimed at preventing seizures or treating them.

A potential drawback to intermittent medication is that a seizure could occur before a fever is noticed. Indeed, in several of these studies, recurrent seizures were likely attributable to failure of method rather than failure of the agent.

Adverse effects of oral and rectal diazepam[26] and both intranasal and buccal midazolam include lethargy, drowsiness, and ataxia. Respiratory depression is extremely rare, even when given by the rectal route.[28,30] Sedation caused by any of the benzodiazepines, whether administered by the oral, rectal, nasal, or buccal route, have the potential of masking an evolving central nervous system infection. If used, the child's health care professional should be contacted.

BENEFITS AND RISKS OF INTERMITTENT ANTIPYRETICS

No studies have demonstrated that antipyretics, in the absence of anticonvulsants, reduce the recurrence risk of simple febrile seizures. Camfield et al[11] treated 79 children who had had a first febrile seizure with either a placebo plus antipyretic instruction (either aspirin or acetaminophen) versus daily phenobarbital plus antipyretic instruction (either aspirin or acetaminophen). Recurrence risk was significantly lower in the phenobarbital-treated group, suggesting that antipyretic instruction, including the use of antipyretics, is ineffective in preventing febrile-seizure recurrence.

Whether antipyretics are given regularly (every 4 hours) or sporadically (contingent on a specific body-temperature elevation) does not influence outcome. Acetaminophen was either given every 4 hours or only for temperature elevations of more than 37.9°C in 104 children. The incidence of febrile episodes did not differ

significantly between the 2 groups, nor did the early recurrence of febrile seizures. The authors determined that administering prophylactic acetaminophen during febrile episodes was ineffective in preventing or reducing fever and in preventing febrile-seizure recurrence.[31]

In a randomized double-blind placebo-controlled trial, acetaminophen was administered along with low-dose oral diazepam.[32] Febrile-seizure recurrence was not reduced, compared with control groups. As with acetaminophen, ibuprofen also has been shown to be ineffective in preventing recurrence of febrile seizures.[33–35]

In general, acetaminophen and ibuprofen are considered to be safe and effective antipyretics for children. However, hepatotoxicity (with acetaminophen) and respiratory failure, metabolic acidosis, renal failure, and coma (with ibuprofen) have been reported in children after overdose or in the presence of risk factors.[36,37]

CONCLUSIONS

The subcommittee has determined that a simple febrile seizure is a benign and common event in children between the ages of 6 and 60 months. Nearly all children have an excellent prognosis. The committee concluded that although there is evidence that both continuous antiepileptic therapy with phenobarbital, primidone, or valproic acid and intermittent therapy with oral diazepam are effective in reducing the risk of recurrence, the potential toxicities associated with antiepileptic drugs outweigh the relatively minor risks associated with simple febrile seizures. As such, long-term therapy is not recommended. In situations in which parental anxiety associated with febrile seizures is severe, intermittent oral diazepam at the onset of febrile illness may be effective in preventing recurrence. Although antipyretics may improve the comfort of the child, they will not prevent febrile seizures.

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Febrile Seizures: Guideline for the Neurodiagnostic Evaluation of the Child With a Simple Febrile Seizure

- *Clinical Practice Guideline*

Clinical Practice Guideline—Febrile Seizures: Guideline for the Neurodiagnostic Evaluation of the Child With a Simple Febrile Seizure

SUBCOMMITTEE ON FEBRILE SEIZURES

KEY WORD
seizure

ABBREVIATIONS
AAP—American Academy of Pediatrics
Hib—*Haemophilus influenzae* type b
EEG—electroencephalogram
CT—computed tomography

The recommendations in this report do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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All clinical practice guidelines from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

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abstract

FREE

OBJECTIVE: To formulate evidence-based recommendations for health care professionals about the diagnosis and evaluation of a simple febrile seizure in infants and young children 6 through 60 months of age and to revise the practice guideline published by the American Academy of Pediatrics (AAP) in 1996.

METHODS: This review included search and analysis of the medical literature published since the last version of the guideline. Physicians with expertise and experience in the fields of neurology and epilepsy, pediatrics, epidemiology, and research methodologies constituted a subcommittee of the AAP Steering Committee on Quality Improvement and Management. The steering committee and other groups within the AAP and organizations outside the AAP reviewed the guideline. The subcommittee member who reviewed the literature for the 1996 AAP practice guidelines searched for articles published since the last guideline through 2009, supplemented by articles submitted by other committee members. Results from the literature search were provided to the subcommittee members for review. Interventions of direct interest included lumbar puncture, electroencephalography, blood studies, and neuroimaging. Multiple issues were raised and discussed iteratively until consensus was reached about recommendations. The strength of evidence supporting each recommendation and the strength of the recommendation were assessed by the committee member most experienced in informatics and epidemiology and graded according to AAP policy.

CONCLUSIONS: Clinicians evaluating infants or young children after a simple febrile seizure should direct their attention toward identifying the cause of the child's fever. Meningitis should be considered in the differential diagnosis for any febrile child, and lumbar puncture should be performed if there are clinical signs or symptoms of concern. For any infant between 6 and 12 months of age who presents with a seizure and fever, a lumbar puncture is an option when the child is considered deficient in *Haemophilus influenzae* type b (Hib) or *Streptococcus pneumoniae* immunizations (ie, has not received scheduled immunizations as recommended), or when immunization status cannot be determined, because of an increased risk of bacterial meningitis. A lumbar puncture is an option for children who are pretreated with antibiotics. In general, a simple febrile seizure does not usually require further evaluation, specifically electroencephalography, blood studies, or neuroimaging. *Pediatrics* 2011;127:389–394

DEFINITION OF THE PROBLEM

This practice guideline provides recommendations for the neurodiagnostic evaluation of neurologically healthy infants and children 6 through 60 months of age who have had a simple febrile seizure and present for evaluation within 12 hours of the event. It replaces the 1996 practice parameter.[1] This practice guideline is not intended for patients who have had complex febrile seizures (prolonged, focal, and/or recurrent), and it does not pertain to children with previous neurologic insults, known central nervous system abnormalities, or history of afebrile seizures.

TARGET AUDIENCE AND PRACTICE SETTING

This practice guideline is intended for use by pediatricians, family physicians, child neurologists, neurologists, emergency physicians, nurse practitioners, and other health care providers who evaluate children for febrile seizures.

BACKGROUND

A febrile seizure is a seizure accompanied by fever (temperature $\geq$ 100.4°F or 38°C[2] by any method), without central nervous system infection, that occurs in infants and children 6 through 60 months of age. Febrile seizures occur in 2% to 5% of all children and, as such, make up the most common convulsive event in children younger than 60 months. In 1976, Nelson and Ellenberg,[3] using data from the National Collaborative Perinatal Project, further defined febrile seizures as being either simple or complex. Simple febrile seizures were defined as primary generalized seizures that lasted for less than 15 minutes and did not recur within 24 hours. Complex febrile seizures were defined as focal, prolonged ($\geq$15 minutes), and/or recurrent within 24 hours. Children who had simple febrile seizures had no evidence of increased mortality, hemiplegia, or mental retardation. During follow-up evaluation, the risk of epilepsy after a simple febrile seizure was shown to be only slightly higher than that of the general population, whereas the chief risk associated with simple febrile seizures was recurrence in one-third of the children. The authors concluded that simple febrile seizures are benign events with excellent prognoses, a conclusion reaffirmed in the 1980 consensus statement from the National Institutes of Health.[3,4]

The expected outcomes of this practice guideline include the following:

1. Optimize clinician understanding of the scientific basis for the neurodiagnostic evaluation of children with simple febrile seizures.
2. Aid the clinician in decision-making by using a structured framework.
3. Optimize evaluation of the child who has had a simple febrile seizure by detecting underlying diseases, minimizing morbidity, and reassuring anxious parents and children.
4. Reduce the costs of physician and emergency department visits, hospitalizations, and unnecessary testing.
5. Educate the clinician to understand that a simple febrile seizure usually does not require further evaluation, specifically electroencephalography, blood studies, or neuroimaging.

METHODOLOGY

To update the clinical practice guideline on the neurodiagnostic evaluation of children with simple febrile seizures,[1] the American Academy of Pediatrics (AAP) reconvened the Subcommittee on Febrile Seizures. The committee was chaired by a child neurologist and consisted of a neuroepidemiologist, 3 additional child neurologists, and a practicing pediatrician. All panel members reviewed and signed the AAP voluntary disclosure and conflict-of-interest form. No conflicts were reported. Participation in the guideline process was voluntary and not paid. The guideline was reviewed by members of the AAP Steering Committee on Quality Improvement and Management; members of the AAP Section on Administration and Practice Management, Section on Developmental and Behavioral Pediatrics, Section on Epidemiology, Section on Infectious Diseases, Section on Neurology, Section on Neurologic Surgery, Section on Pediatric Emergency Medicine, Committee on Pediatric Emergency Medicine, Committee on Practice and Ambulatory Medicine, Committee on Child Health Financing, Committee on Infectious Diseases, Committee on Medical Liability and Risk Management, Council on Children With Disabilities, and Council on Community Pediatrics; and members of outside organizations including the Child Neurology Society, the American Academy of Neurology, the American College of Emergency Physicians, and members of the Pediatric Committee of the Emergency Nurses Association.

A comprehensive review of the evidence-based literature published from 1996 to February 2009 was conducted to discover articles that addressed the diagnosis and evaluation of children with simple febrile seizures. Preference was given to population-based studies, but given the scarcity of such studies, data from hospital-based studies, groups of young children with febrile illness, and comparable groups were reviewed. Decisions were made on the basis of a systematic grading of the quality of evidence and strength of recommendations.

In the original practice parameter,[1] 203 medical journal articles were reviewed and abstracted. An additional 372 articles were reviewed and abstracted for this update. Emphasis was placed on articles that differentiated simple febrile seizures from other types of seizures. Tables were constructed from the 70 articles that best fit these criteria.

The evidence-based approach to guideline development requires that the evidence in support of a recommendation be identified, appraised, and summarized and that an explicit link between

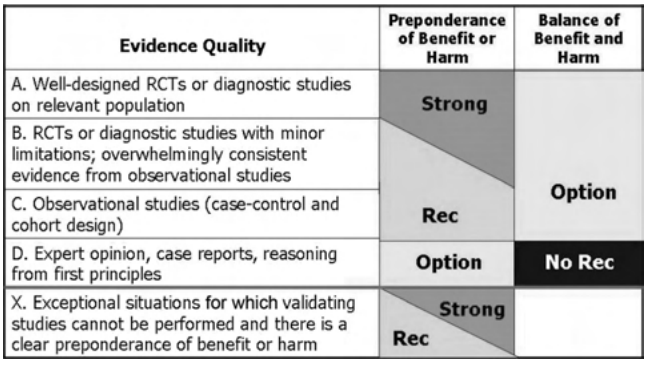

FIGURE 1
Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is carried out leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation. RCT indicates randomized controlled trial; Rec, recommendation.

evidence and recommendations be defined. Evidence-based recommendations reflect the quality of evidence and the balance of benefit and harm that is anticipated when the recommendation is followed. The AAP policy statement "Classifying Recommendations for Clinical Practice Guidelines"[5] was followed in designating levels of recommendations (see Fig 1).

KEY ACTION STATEMENTS

Action Statement 1

Action Statement 1a

A lumbar puncture should be performed in any child who presents with a seizure and a fever and has meningeal signs and symptoms (eg, neck stiffness, Kernig and/or Brudzinski signs) or in any child whose history or examination suggests the presence of meningitis or intracranial infection.

- Aggregate evidence level: B (overwhelming evidence from observational studies).
- Benefits: Meningeal signs and symptoms strongly suggest meningitis, which, if bacterial in etiology, will likely be fatal if left untreated.
- Harms/risks/costs: Lumbar puncture is an invasive and often painful procedure and can be costly.
- Benefits/harms assessment: Preponderance of benefit over harm.
- Value judgments: Observational data and clinical principles were used in making this judgment.
- Role of patient preferences: Although parents may not wish to have their child undergo a lumbar puncture, health care providers should explain that if meningitis is not diagnosed and treated, it could be fatal.
- Exclusions: None.
- Intentional vagueness: None.
- Policy level: Strong recommendation.

Action Statement 1b

In any infant between 6 and 12 months of age who presents with a seizure and fever, a lumbar puncture is an option when the child is considered deficient in *Haemophilus influenzae* type b (Hib) or *Streptococcus pneumoniae* immunizations (ie, has not received scheduled immunizations as recommended) or when immunization status cannot be determined because of an increased risk of bacterial meningitis.

- Aggregate evidence level: D (expert opinion, case reports).
- Benefits: Meningeal signs and symptoms strongly suggest meningitis, which, if bacterial in etiology, will likely be fatal or cause significant long-term disability if left untreated.
- Harms/risks/costs: Lumbar puncture is an invasive and often painful procedure and can be costly.
- Benefits/harms assessment: Preponderance of benefit over harm.
- Value judgments: Data on the incidence of bacterial meningitis from before and after the existence of immunizations against Hib and *S pneumoniae* were used in making this recommendation.
- Role of patient preferences: Although parents may not wish their child to undergo a lumbar puncture, health care providers should explain that in the absence of complete immunizations, their child may be at risk of having fatal bacterial meningitis.
- Exclusions: This recommendation applies only to children 6 to 12 months of age. The subcommittee felt that clinicians would recognize symptoms of meningitis in children older than 12 months.
- Intentional vagueness: None.
- Policy level: Option.

Action Statement 1c

A lumbar puncture is an option in the child who presents with a seizure and fever and is pretreated with antibiotics, because antibiotic treatment can mask the signs and symptoms of meningitis.

- Aggregate evidence level: D (reasoning from clinical experience, case series).
- Benefits: Antibiotics may mask meningeal signs and symptoms but may be insufficient to eradicate meningitis; a diagnosis of meningitis, if bacterial in etiology, will likely be fatal if left untreated.
- Harms/risks/costs: Lumbar puncture is an invasive and often painful procedure and can be costly.

- Benefits/harms assessment: Preponderance of benefit over harm.
- Value judgments: Clinical experience and case series were used in making this judgment while recognizing that extensive data from studies are lacking.
- Role of patient preferences: Although parents may not wish to have their child undergo a lumbar puncture, medical providers should explain that in the presence of pretreatment with antibiotics, the signs and symptoms of meningitis may be masked. Meningitis, if untreated, can be fatal.
- Exclusions: None.
- Intentional vagueness: Data are insufficient to define the specific treatment duration necessary to mask signs and symptoms. The committee determined that the decision to perform a lumbar puncture will depend on the type and duration of antibiotics administered before the seizure and should be left to the individual clinician.
- Policy level: Option.

The committee recognizes the diversity of past and present opinions regarding the need for lumbar punctures in children younger than 12 months with a simple febrile seizure. Since the publication of the previous practice parameter,[1] however, there has been widespread immunization in the United States for 2 of the most common causes of bacterial meningitis in this age range: Hib and *S pneumoniae*. Although compliance with all scheduled immunizations as recommended does not completely eliminate the possibility of bacterial meningitis from the differential diagnosis, current data no longer support routine lumbar puncture in well-appearing, fully immunized children who present with a simple febrile seizure.[6–8] Moreover, although approximately 25% of young children with meningitis have seizures as the presenting sign of the disease, some are either obtunded or comatose when evaluated by a physician for the seizure, and the remainder most often have obvious clinical signs of meningitis (focal seizures, recurrent seizures, petechial rash, or nuchal rigidity).[9–11] Once a decision has been made to perform a lumbar puncture, then blood culture and serum glucose testing should be performed concurrently to increase the sensitivity for detecting bacteria and to determine if there is hypoglycorrhachia characteristic of bacterial meningitis, respectively.

Recent studies that evaluated the outcome of children with simple febrile seizures have included populations with a high prevalence of immunization.[7,8] Data for unimmunized or partially immunized children are lacking. Therefore, lumbar puncture is an option for young children who are considered deficient in immunizations or those in whom immunization status cannot be determined. There are also no definitive data on the outcome of children who present with a simple febrile seizure while already on antibiotics. The authors were unable to find a definition of "pretreated" in the literature, so they consulted with the AAP Committee on Infectious Diseases. Although there is no formal definition, pretreatment can be considered to include systemic antibiotic therapy by any route given within the days before the seizure. Whether pretreatment will affect the presentation and course of bacterial meningitis cannot be predicted but will depend, in part, on the antibiotic administered, the dose, the route of administration, the drug's cerebrospinal fluid penetration, and the organism causing the meningitis. Lumbar puncture is an option in any child pretreated with antibiotics before a simple febrile seizure.

Action Statement 2

An electroencephalogram (EEG) should not be performed in the evaluation of a neurologically healthy child with a simple febrile seizure.

- Aggregate evidence level: B (overwhelming evidence from observational studies).
- Benefits: One study showed a possible association with paroxysmal EEGs and a higher rate of afebrile seizures.[12]
- Harms/risks/costs: EEGs are costly and may increase parental anxiety.
- Benefits/harms assessment: Preponderance of harm over benefit.
- Value judgments: Observational data were used for this judgment.
- Role of patient preferences: Although an EEG might have limited prognostic utility in this situation, parents should be educated that the study will not alter outcome.
- Exclusions: None.
- Intentional vagueness: None.
- Policy level: Strong recommendation.

There is no evidence that EEG readings performed either at the time of presentation after a simple febrile seizure or within the following month are predictive of either recurrence of febrile seizures or the development of afebrile seizures/epilepsy within the next 2 years.[13,14] There is a single study that found that a paroxysmal EEG was associated with a higher rate of afebrile seizures.[12] There is no evidence that interventions based on this test would alter outcome.

Action Statement 3

The following tests should not be performed routinely for the sole purpose of identifying the cause of a simple febrile seizure: measurement of serum electrolytes, calcium, phosphorus, magnesium, or blood glucose or complete blood cell count.

- Aggregate evidence level: B (overwhelming evidence from observational studies).
- Benefits: A complete blood cell count may identify children at risk for bacte-

remia; however, the incidence of bacteremia in febrile children younger than 24 months is the same with or without febrile seizures.

- Harms/risks/costs: Laboratory tests may be invasive and costly and provide no real benefit.
- Benefits/harms assessment: Preponderance of harm over benefit.
- Value judgments: Observational data were used for this judgment.
- Role of patient preferences: Although parents may want blood tests performed to explain the seizure, they should be reassured that blood tests should be directed toward identifying the source of their child's fever.
- Exclusions: None.
- Intentional vagueness: None.
- Policy level: Strong recommendation.

There is no evidence to suggest that routine blood studies are of benefit in the evaluation of the child with a simple febrile seizure.[15–18] Although some children with febrile seizures have abnormal serum electrolyte values, their condition should be identifiable by obtaining appropriate histories and performing careful physical examinations. It should be noted that as a group, children with febrile seizures have relatively low serum sodium concentrations. As such, physicians and caregivers should avoid overhydration with hypotonic fluids.[18] Complete blood cell counts may be useful as a means of identifying young children at risk of bacteremia. It should be noted, however, that the incidence of bacteremia in children younger than 24 months with or without febrile seizures is the same. When fever is present, the decision regarding the need for laboratory testing should be directed toward identifying the source of the fever rather than as part of the routine evaluation of the seizure itself.

Action Statement 4

Neuroimaging should not be performed in the routine evaluation of the child with a simple febrile seizure.

- Aggregate evidence level: B (overwhelming evidence from observational studies).
- Benefits: Neuroimaging might provide earlier detection of fixed structural lesions, such as dysplasia, or very rarely, abscess or tumor.
- Harms/risks/costs: Neuroimaging tests are costly, computed tomography (CT) exposes children to radiation, and MRI may require sedation.
- Benefits/harms assessment: Preponderance of harm over benefit.
- Value judgments: Observational data were used for this judgment.
- Role of patient preferences: Although parents may want neuroimaging performed to explain the seizure, they should be reassured that the tests carry risks and will not alter outcome for their child.
- Exclusions: None.
- Intentional vagueness: None.
- Policy level: Strong recommendation.

The literature does not support the use of skull films in evaluation of the child with a febrile seizure.[15,19] No data have been published that either support or negate the need for CT or MRI in the evaluation of children with simple febrile seizures. Data, however, show that CT scanning is associated with radiation exposure that may escalate future cancer risk. MRI is associated with risks from required sedation and high cost.[20,21] Extrapolation of data from the literature on the use of CT in neurologically healthy children who have generalized epilepsy has shown that clinically important intracranial structural abnormalities in this patient population are uncommon.[22,23]

CONCLUSIONS

Clinicians evaluating infants or young children after a simple febrile seizure should direct their attention toward identifying the cause of the child's fever. Meningitis should be considered in the differential diagnosis for any febrile child, and lumbar puncture should be performed if the child is ill-appearing or if there are clinical signs or symptoms of concern. A lumbar puncture is an option in a child 6 to 12 months of age who is deficient in Hib and *S pneumoniae* immunizations or for whom immunization status is unknown. A lumbar puncture is an option in children who have been pretreated with antibiotics. In general, a simple febrile seizure does not usually require further evaluation, specifically EEGs, blood studies, or neuroimaging.

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OVERSIGHT BY THE STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT, 2009–2011

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Febrile Seizures Clinical Practice Guidelines Quick Reference Tools

- Recommendation Summaries
  - — Febrile Seizures: Clinical Practice Guideline for the Long-term Management of the Child With Simple Febrile Seizures
  - — Febrile Seizures: Guidelines for the Neurodiagnostic Evaluation of the Child With a Simple Febrile Seizure
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Febrile Seizures
- AAP Patient Education Handout
  - — *Febrile Seizures*

Recommendation Summaries

Febrile Seizures: Clinical Practice Guideline for the Long-term Management of the Child With Simple Febrile Seizures

On the basis of the risks and benefits of the effective therapies, neither continuous nor intermittent anticonvulsant therapy is recommended for children with 1 or more simple febrile seizures.

- Aggregate evidence quality: B (randomized, controlled trials and diagnostic studies with minor limitations).
- Benefit: prevention of recurrent febrile seizures, which are not harmful and do not significantly increase the risk for development of future epilepsy.
- Harm: adverse effects including rare fatal hepatotoxicity (especially in children younger than 2 years who are also at greatest risk of febrile seizures), thrombocytopenia, weight loss and gain, gastrointestinal disturbances, and pancreatitis with valproic acid and hyperactivity, irritability, lethargy, sleep disturbances, and hypersensitivity reactions with phenobarbital; lethargy, drowsiness, and ataxia for intermittent diazepam as well as the risk of masking an evolving central nervous system infection.
- Benefits/harms assessment: preponderance of harm over benefit.
- Policy level: recommendation.

Febrile Seizures: Guidelines for the Neurodiagnostic Evaluation of the Child With a Simple Febrile Seizure

Action Statement 1a

A lumbar puncture should be performed in any child who presents with a seizure and a fever and has meningeal signs and symptoms (eg, neck stiffness, Kernig and/or Brudzinski signs) or in any child whose history or examination suggests the presence of meningitis or intracranial infection.

Action Statement 1b

In any infant between 6 and 12 months of age who presents with a seizure and fever, a lumbar puncture is an option when the child is considered deficient in *Haemophilus influenzae* type b (Hib) or *Streptococcus pneumoniae* immunizations (ie, has not received scheduled immunizations as recommended) or when immunization status cannot be determined because of an increased risk of bacterial meningitis.

Action Statement 1c

A lumbar puncture is an option in the child who presents with a seizure and fever and is pretreated with antibiotics, because antibiotic treatment can mask the signs and symptoms of meningitis.

Action Statement 2

An electroencephalogram (EEG) should not be performed in the evaluation of a neurologically healthy child with a simple febrile seizure.

Action Statement 3

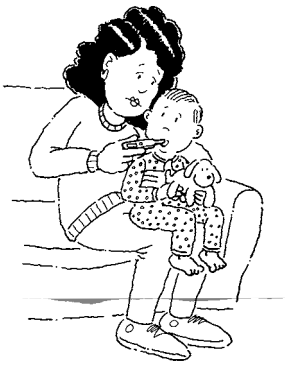
The following tests should not be performed routinely for the sole purpose of identifying the cause of a simple febrile seizure: measurement of serum electrolytes, calcium, phosphorus, magnesium, or blood glucose or complete blood cell count.

Action Statement 4

Neuroimaging should not be performed in the routine evaluation of the child with a simple febrile seizure.

Coding Quick Reference for Febrile Seizures	
ICD-9-CM	***ICD-10-CM***
780.31 Seizure, febrile, simple	**R56.00** Simple febrile convulsions
780.32 Seizure, febrile, complex	**R56.01** Complex febrile convulsions

Febrile Seizures



In some children, fevers can trigger seizures. Febrile seizures occur in 2% to 5% of all children between the ages of 6 months and 5 years. Seizures, sometimes called "fits" or "spells," are frightening, but they usually are harmless. Read on for information from the American Academy of Pediatrics that will help you understand febrile seizures and what happens if your child has one.

What is a febrile seizure?

A febrile seizure usually happens during the first few hours of a fever. The child may look strange for a few moments, then stiffen, twitch, and roll his eyes. He will be unresponsive for a short time, his breathing will be disturbed, and his skin may appear a little darker than usual. After the seizure, the child quickly returns to normal. Seizures usually last less than 1 minute but, although uncommon, can last for up to 15 minutes.

Febrile seizures rarely happen more than once within a 24-hour period. Other kinds of seizures (ones that are not caused by fever) last longer, can affect only one part of the body, and may occur repeatedly.

What do I do if my child has a febrile seizure?

If your child has a febrile seizure, act immediately to prevent injury.

- Place her on the floor or bed away from any hard or sharp objects.
- Turn her head to the side so that any saliva or vomit can drain from her mouth.
- Do not put anything into her mouth; she will not swallow her tongue.
- Call your child's doctor.
- If the seizure does not stop after 5 minutes, call 911 or your local emergency number.

Will my child have more seizures?

Febrile seizures tend to run in families. The risk of having seizures with other episodes of fever depends on the age of your child. Children younger than 1 year of age at the time of their first seizure have about a 50% chance of having another febrile seizure. Children older than 1 year of age at the time of their first seizure have only a 30% chance of having a second febrile seizure.

Will my child get epilepsy?

Epilepsy is a term used for multiple and recurrent seizures. Epileptic seizures are not caused by fever. Children with a history of febrile seizures are at only a slightly higher risk of developing epilepsy by age 7 than children who have not had febrile seizures.

Are febrile seizures dangerous?

While febrile seizures may be very scary, they are harmless to the child. Febrile seizures do not cause brain damage, nervous system problems, paralysis, intellectual disability (formerly called mental retardation), or death.

How are febrile seizures treated?

If your child has a febrile seizure, call your child's doctor right away. He or she will want to examine your child in order to determine the cause of your child's fever. It is more important to determine and treat the cause of the fever rather than the seizure. A spinal tap may be done to be sure your child does not have a serious infection like meningitis, especially if your child is younger than 1 year of age.

In general, doctors do not recommend treatment of a simple febrile seizure with preventive medicines. However, this should be discussed with your child's doctor. In cases of prolonged or repeated seizures, the recommendation may be different.

Medicines like acetaminophen and ibuprofen can help lower a fever, but they do not prevent febrile seizures. Your child's doctor will talk with you about the best ways to take care of your child's fever.

If your child has had a febrile seizure, do not fear the worst. These types of seizures are not dangerous to your child and do not cause long-term health problems. If you have concerns about this issue or anything related to your child's health, talk with your child's doctor.

From your doctor

American Academy of Pediatrics

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Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

- *Clinical Practice Guideline*
- *Technical Report Summary*
- *Technical Report*
- *2009 Commentaries*

Readers of this clinical practice guideline are urged to review the technical reports to enhance the evidence-based decision-making process. The full technical reports are available on the companion CD-ROM.

AMERICAN ACADEMY OF PEDIATRICS

CLINICAL PRACTICE GUIDELINE

Subcommittee on Hyperbilirubinemia

Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

ABSTRACT. Jaundice occurs in most newborn infants. Most jaundice is benign, but because of the potential toxicity of bilirubin, newborn infants must be monitored to identify those who might develop severe hyperbilirubinemia and, in rare cases, acute bilirubin encephalopathy or kernicterus. The focus of this guideline is to reduce the incidence of severe hyperbilirubinemia and bilirubin encephalopathy while minimizing the risks of unintended harm such as maternal anxiety, decreased breastfeeding, and unnecessary costs or treatment. Although kernicterus should almost always be preventable, cases continue to occur. These guidelines provide a framework for the prevention and management of hyperbilirubinemia in newborn infants of 35 or more weeks of gestation. In every infant, we recommend that clinicians 1) promote and support successful breastfeeding; 2) perform a systematic assessment before discharge for the risk of severe hyperbilirubinemia; 3) provide early and focused follow-up based on the risk assessment; and 4) when indicated, treat newborns with phototherapy or exchange transfusion to prevent the development of severe hyperbilirubinemia and, possibly, bilirubin encephalopathy (kernicterus). *Pediatrics* 2004; 114:297–316; *hyperbilirubinemia, newborn, kernicterus, bilirubin encephalopathy, phototherapy.*

ABBREVIATIONS. AAP, American Academy of Pediatrics; TSB, total serum bilirubin; TcB, transcutaneous bilirubin; G6PD, glucose-6-phosphate dehydrogenase; $ETCO_c$, end-tidal carbon monoxide corrected for ambient carbon monoxide; B/A, bilirubin/albumin; UB, unbound bilirubin.

BACKGROUND

In October 1994, the Provisional Committee for Quality Improvement and Subcommittee on Hyperbilirubinemia of the American Academy of Pediatrics (AAP) produced a practice parameter dealing with the management of hyperbilirubinemia in the healthy term newborn.[1] The current guideline represents a consensus of the committee charged by the AAP with reviewing and updating the existing guideline and is based on a careful review of the evidence, including a comprehensive literature review by the New England Medical Center Evidence-Based Practice Center.[2] (See "An Evidence-Based Review of Important Issues Concerning Neonatal Hyperbilirubinemia"[3] for a description of the methodology, questions addressed, and conclusions of this report.) This guideline is intended for use by hospitals and pediatricians, neonatologists, family physicians, physician assistants, and advanced practice nurses who treat newborn infants in the hospital and as outpatients. A list of frequently asked questions and answers for parents is available in English and Spanish at www.aap.org/family/jaundicefaq.htm.

DEFINITION OF RECOMMENDATIONS

The evidence-based approach to guideline development requires that the evidence in support of a policy be identified, appraised, and summarized and that an explicit link between evidence and recommendations be defined. Evidence-based recommendations are based on the quality of evidence and the balance of benefits and harms that is anticipated when the recommendation is followed. This guideline uses the definitions for quality of evidence and balance of benefits and harms established by the AAP Steering Committee on Quality Improvement Management.[4] See Appendix 1 for these definitions.

The draft practice guideline underwent extensive peer review by committees and sections within the AAP, outside organizations, and other individuals identified by the subcommittee as experts in the field. Liaison representatives to the subcommittee were invited to distribute the draft to other representatives and committees within their specialty organizations. The resulting comments were reviewed by the subcommittee and, when appropriate, incorporated into the guideline.

BILIRUBIN ENCEPHALOPATHY AND KERNICTERUS

Although originally a pathologic diagnosis characterized by bilirubin staining of the brainstem nuclei and cerebellum, the term "kernicterus" has come to be used interchangeably with both the acute and chronic findings of bilirubin encephalopathy. Bilirubin encephalopathy describes the clinical central nervous system findings caused by bilirubin toxicity to the basal ganglia and various brainstem nuclei. To avoid confusion and encourage greater consistency in the literature, the committee recommends that in infants the term "acute bilirubin encephalopathy" be used to describe the acute manifestations of bilirubin

The recommendations in this guideline do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

toxicity seen in the first weeks after birth and that the term "kernicterus" be reserved for the chronic and permanent clinical sequelae of bilirubin toxicity.

See Appendix 1 for the clinical manifestations of acute bilirubin encephalopathy and kernicterus.

FOCUS OF GUIDELINE

The overall aim of this guideline is to promote an approach that will reduce the frequency of severe neonatal hyperbilirubinemia and bilirubin encephalopathy and minimize the risk of unintended harm such as increased anxiety, decreased breastfeeding, or unnecessary treatment for the general population and excessive cost and waste. Recent reports of kernicterus indicate that this condition, although rare, is still occurring.[2,5–10]

Analysis of these reported cases of kernicterus suggests that if health care personnel follow the recommendations listed in this guideline, kernicterus would be largely preventable.

These guidelines emphasize the importance of universal systematic assessment for the risk of severe hyperbilirubinemia, close follow-up, and prompt intervention when indicated. The recommendations apply to the care of infants at 35 or more weeks of gestation. These recommendations seek to further the aims defined by the Institute of Medicine as appropriate for health care:[11] safety, effectiveness, efficiency, timeliness, patient-centeredness, and equity. They specifically emphasize the principles of patient safety and the key role of timeliness of interventions to prevent adverse outcomes resulting from neonatal hyperbilirubinemia.

The following are the key elements of the recommendations provided by this guideline. Clinicians should:

1. Promote and support successful breastfeeding.
2. Establish nursery protocols for the identification and evaluation of hyperbilirubinemia.
3. Measure the total serum bilirubin (TSB) or transcutaneous bilirubin (TcB) level on infants jaundiced in the first 24 hours.
4. Recognize that visual estimation of the degree of jaundice can lead to errors, particularly in darkly pigmented infants.
5. Interpret all bilirubin levels according to the infant's age in hours.
6. Recognize that infants at less than 38 weeks' gestation, particularly those who are breastfed, are at higher risk of developing hyperbilirubinemia and require closer surveillance and monitoring.
7. Perform a systematic assessment on all infants before discharge for the risk of severe hyperbilirubinemia.
8. Provide parents with written and verbal information about newborn jaundice.
9. Provide appropriate follow-up based on the time of discharge and the risk assessment.
10. Treat newborns, when indicated, with phototherapy or exchange transfusion.

PRIMARY PREVENTION

In numerous policy statements, the AAP recommends breastfeeding for all healthy term and near-term newborns. This guideline strongly supports this general recommendation.

RECOMMENDATION 1.0: Clinicians should advise mothers to nurse their infants at least 8 to 12 times per day for the first several days[12] *(evidence quality C: benefits exceed harms).*

Poor caloric intake and/or dehydration associated with inadequate breastfeeding may contribute to the development of hyperbilirubinemia.[6,13,14] Increasing the frequency of nursing decreases the likelihood of subsequent significant hyperbilirubinemia in breastfed infants.[15–17] Providing appropriate support and advice to breastfeeding mothers increases the likelihood that breastfeeding will be successful.

Additional information on how to assess the adequacy of intake in a breastfed newborn is provided in Appendix 1.

RECOMMENDATION 1.1: The AAP recommends against routine supplementation of nondehydrated breastfed infants with water or dextrose water (evidence quality B and C: harms exceed benefits).

Supplementation with water or dextrose water will not prevent hyperbilirubinemia or decrease TSB levels.[18,19]

SECONDARY PREVENTION

RECOMMENDATION 2.0: Clinicians should perform ongoing systematic assessments during the neonatal period for the risk of an infant developing severe hyperbilirubinemia.

Blood Typing

RECOMMENDATION 2.1: All pregnant women should be tested for ABO and Rh (D) blood types and have a serum screen for unusual isoimmune antibodies (evidence quality B: benefits exceed harms).

RECOMMENDATION 2.1.1: If a mother has not had prenatal blood grouping or is Rh-negative, a direct antibody test (or Coombs' test), blood type, and an Rh (D) type on the infant's (cord) blood are strongly recommended (evidence quality B: benefits exceed harms).

RECOMMENDATION 2.1.2: If the maternal blood is group O, Rh-positive, it is an option to test the cord blood for the infant's blood type and direct antibody test, but it is not required provided that there is appropriate surveillance, risk assessment before discharge, and follow-up[20] *(evidence quality C: benefits exceed harms).*

Clinical Assessment

RECOMMENDATION 2.2: Clinicians should ensure that all infants are routinely monitored for the development of jaundice, and nurseries should have established protocols for the assessment of jaundice. Jaundice should be assessed whenever the infant's vital signs are measured but no less than every 8 to 12 hours (evidence quality D: benefits versus harms exceptional).

In newborn infants, jaundice can be detected by blanching the skin with digital pressure, revealing the underlying color of the skin and subcutaneous tissue. The assessment of jaundice must be per-

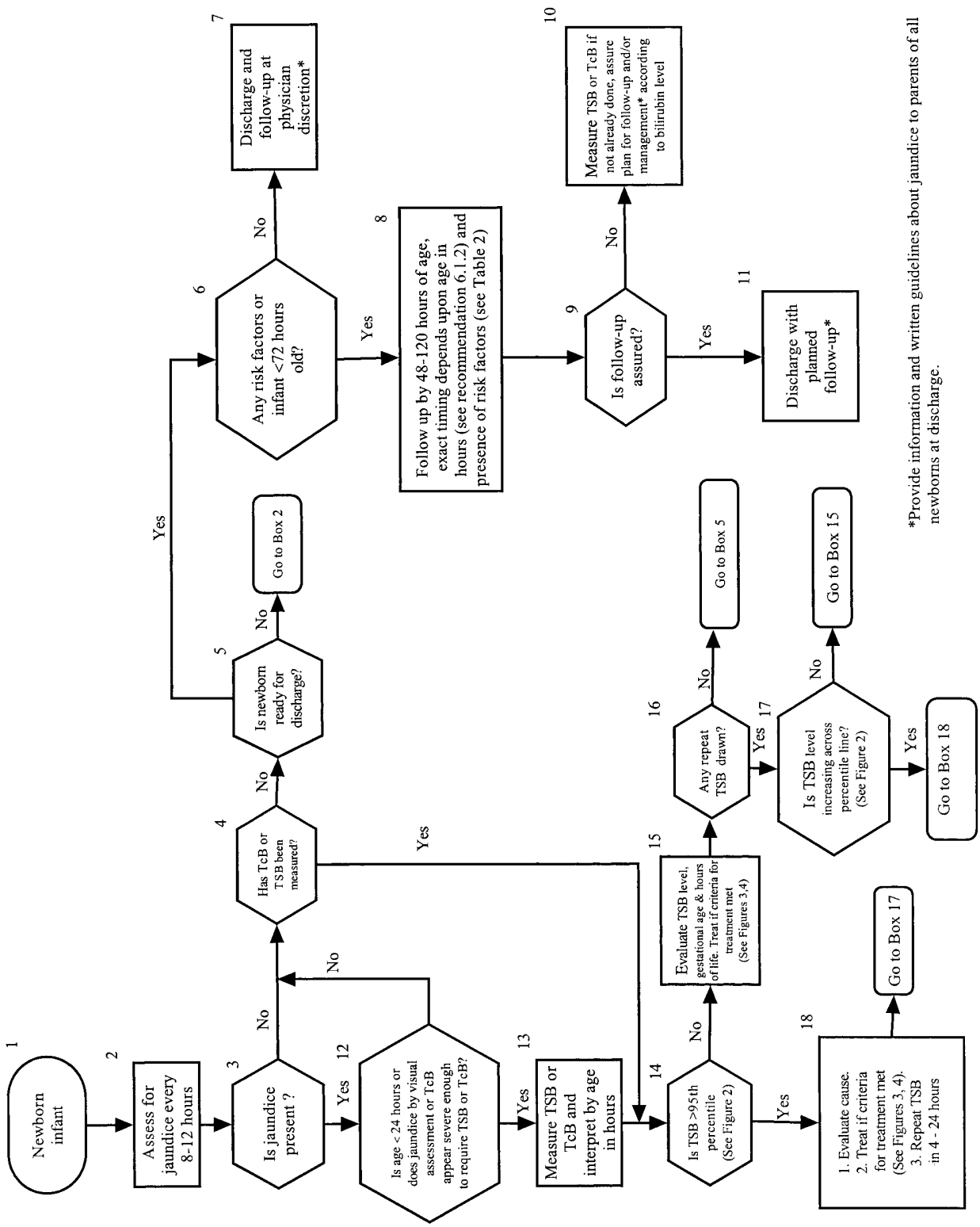


Fig 1. Algorithm for the management of jaundice in the newborn nursery.

formed in a well-lit room or, preferably, in daylight at a window. Jaundice is usually seen first in the face and progresses caudally to the trunk and extremities,[21] but visual estimation of bilirubin levels from the degree of jaundice can lead to errors.[22–24] In most infants with TSB levels of less than 15 mg/dL (257 μmol/L), noninvasive TcB-measurement devices can provide a valid estimate of the TSB level.[2,25–29] See Appendix 1 for additional information on the clinical evaluation of jaundice and the use of TcB measurements.

RECOMMENDATION 2.2.1: Protocols for the assessment of jaundice should include the circumstances in which nursing staff can obtain a TcB level or order a TSB measurement (evidence quality D: benefits versus harms exceptional).

Laboratory Evaluation

RECOMMENDATION 3.0: A TcB and/or TSB measurement should be performed on every infant who is jaundiced in the first 24 hours after birth (Fig 1 and Table 1)[30] (evidence quality C: benefits exceed harms). The need for and timing of a repeat TcB or TSB measurement will depend on the zone in which the TSB falls (Fig 2),[25,31] the age of the infant, and the evolution of the hyperbilirubinemia. Recommendations for TSB measurements after the age of 24 hours are provided in Fig 1 and Table 1.

See Appendix 1 for capillary versus venous bilirubin levels.

RECOMMENDATION 3.1: A TcB and/or TSB measurement should be performed if the jaundice appears excessive for the infant's age (evidence quality D: benefits versus harms exceptional). If there is any doubt about the degree of jaundice, the TSB or TcB should be measured. Visual estimation of bilirubin levels from the degree of jaundice can lead to errors, particularly in darkly pigmented infants (evidence quality C: benefits exceed harms).

RECOMMENDATION 3.2: All bilirubin levels should be interpreted according to the infant's age in hours (Fig 2) (evidence quality C: benefits exceed harms).

Cause of Jaundice

RECOMMENDATION 4.1: The possible cause of jaundice should be sought in an infant receiving phototherapy or whose TSB level is rising rapidly (ie, crossing percentiles [Fig 2]) and is not explained by the history and physical examination (evidence quality D: benefits versus harms exceptional).

RECOMMENDATION 4.1.1: Infants who have an elevation of direct-reacting or conjugated bilirubin should have a urinalysis and urine culture.[32] Additional laboratory evaluation for sepsis should be performed if indicated by history and physical examination (evidence quality C: benefits exceed harms).

See Appendix 1 for definitions of abnormal levels of direct-reacting and conjugated bilirubin.

RECOMMENDATION 4.1.2: Sick infants and those who are jaundiced at or beyond 3 weeks should have a measurement of total and direct or conjugated bilirubin to identify cholestasis (Table 1) (evidence quality D: benefit versus harms exceptional). The results of the newborn thyroid and galactosemia screen should also be checked in these infants (evidence quality D: benefits versus harms exceptional).

RECOMMENDATION 4.1.3: If the direct-reacting or conjugated bilirubin level is elevated, additional evaluation for the causes of cholestasis is recommended (evidence quality C: benefits exceed harms).

RECOMMENDATION 4.1.4: Measurement of the glucose-6-phosphate dehydrogenase (G6PD) level is recommended for a jaundiced infant who is receiving phototherapy and whose family history or ethnic or geographic origin suggest the likelihood of G6PD deficiency or for an infant in whom the response to phototherapy is poor (Fig 3) (evidence quality C: benefits exceed harms).

G6PD deficiency is widespread and frequently unrecognized, and although it is more common in the populations around the Mediterranean and in the Middle East, Arabian peninsula, Southeast Asia, and Africa, immigration and intermarriage have transformed G6PD deficiency into a global problem.[33,34]

TABLE 1. Laboratory Evaluation of the Jaundiced Infant of 35 or More Weeks' Gestation

Indications	Assessments
Jaundice in first 24 h	Measure TcB and/or TSB
Jaundice appears excessive for infant's age	Measure TcB and/or TSB
Infant receiving phototherapy or TSB rising rapidly (ie, crossing percentiles [Fig 2]) and unexplained by history and physical examination	Blood type and Coombs' test, if not obtained with cord blood Complete blood count and smear Measure direct or conjugated bilirubin It is an option to perform reticulocyte count, G6PD, and $ETCO_c$, if available Repeat TSB in 4–24 h depending on infant's age and TSB level
TSB concentration approaching exchange levels or not responding to phototherapy	Perform reticulocyte count, G6PD, albumin, $ETCO_c$, if available
Elevated direct (or conjugated) bilirubin level	Do urinalysis and urine culture. Evaluate for sepsis if indicated by history and physical examination
Jaundice present at or beyond age 3 wk, or sick infant	Total and direct (or conjugated) bilirubin level If direct bilirubin elevated, evaluate for causes of cholestasis Check results of newborn thyroid and galactosemia screen, and evaluate infant for signs or symptoms of hypothyroidism

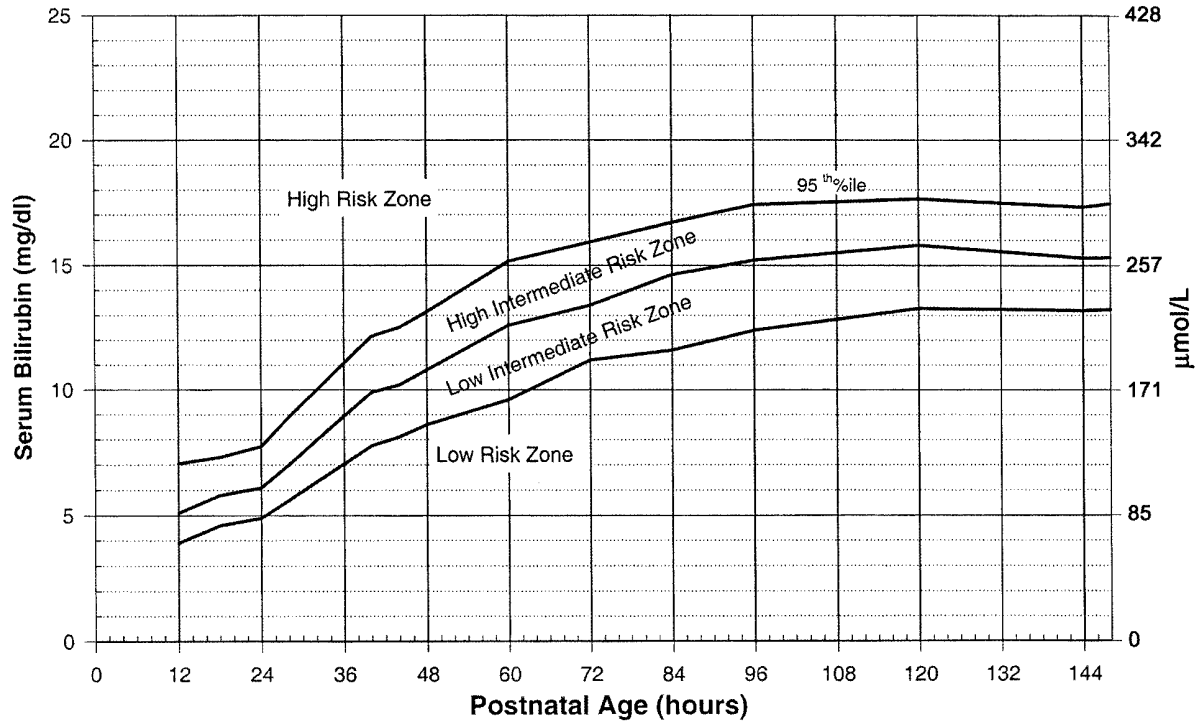


Fig 2. Nomogram for designation of risk in 2840 well newborns at 36 or more weeks' gestational age with birth weight of 2000 g or more or 35 or more weeks' gestational age and birth weight of 2500 g or more based on the hour-specific serum bilirubin values. The serum bilirubin level was obtained before discharge, and the zone in which the value fell predicted the likelihood of a subsequent bilirubin level exceeding the 95th percentile (high-risk zone) as shown in Appendix 1, Table 4. Used with permission from Bhutani et al.[31] See Appendix 1 for additional information about this nomogram, which should not be used to represent the natural history of neonatal hyperbilirubinemia.

Furthermore, G6PD deficiency occurs in 11% to 13% of African Americans, and kernicterus has occurred in some of these infants.[5,33] In a recent report, G6PD deficiency was considered to be the cause of hyperbilirubinemia in 19 of 61 (31.5%) infants who developed kernicterus.[5] (See Appendix 1 for additional information on G6PD deficiency.)

Risk Assessment Before Discharge

RECOMMENDATION 5.1: Before discharge, every newborn should be assessed for the risk of developing severe hyperbilirubinemia, and all nurseries should establish protocols for assessing this risk. Such assessment is particularly important in infants who are discharged before the age of 72 hours (evidence quality C: benefits exceed harms).

RECOMMENDATION 5.1.1: The AAP recommends 2 clinical options used individually or in combination for the systematic assessment of risk: predischarge measurement of the bilirubin level using TSB or TcB and/or assessment of clinical risk factors. Whether either or both options are used, appropriate follow-up after discharge is essential (evidence quality C: benefits exceed harms).

The best documented method for assessing the risk of subsequent hyperbilirubinemia is to measure the TSB or TcB level[25,31,35–38] and plot the results on a nomogram (Fig 2). A TSB level can be obtained at the time of the routine metabolic screen, thus obviating the need for an additional blood sample. Some authors have suggested that a TSB measurement should be part of the routine screening of all newborns.[5,31] An infant whose predischarge TSB is in the low-risk zone (Fig 2) is at very low risk of developing severe hyperbilirubinemia.[5,38]

Table 2 lists those factors that are clinically signif-

TABLE 2. Risk Factors for Development of Severe Hyperbilirubinemia in Infants of 35 or More Weeks' Gestation (in Approximate Order of Importance)

Major risk factors
Predischarge TSB or TcB level in the high-risk zone (Fig 2)[25,31]
Jaundice observed in the first 24 h[30]
Blood group incompatibility with positive direct antiglobulin test, other known hemolytic disease (eg, G6PD deficiency), elevated $ETCO_c$
Gestational age 35–36 wk[39,40]
Previous sibling received phototherapy[40,41]
Cephalohematoma or significant bruising[39]
Exclusive breastfeeding, particularly if nursing is not going well and weight loss is excessive[39,40]
East Asian race[39]*
Minor risk factors
Predischarge TSB or TcB level in the high intermediate-risk zone[25,31]
Gestational age 37–38 wk[39,40]
Jaundice observed before discharge[40]
Previous sibling with jaundice[40,41]
Macrosomic infant of a diabetic mother[42,43]
Maternal age ≥25 y[39]
Male gender[39,40]
Decreased risk (these factors are associated with decreased risk of significant jaundice, listed in order of decreasing importance)
TSB or TcB level in the low-risk zone (Fig 2)[25,31]
Gestational age ≥41 wk[39]
Exclusive bottle feeding[39,40]
Black race[38]*
Discharge from hospital after 72 h[40,44]

* Race as defined by mother's description.

icant and most frequently associated with an increase in the risk of severe hyperbilirubinemia. But, because these risk factors are common and the risk of hyperbilirubinemia is small, individually the factors are of limited use as predictors of significant hyperbilirubinemia.[39] Nevertheless, if no risk factors are present, the risk of severe hyperbilirubinemia is extremely low, and the more risk factors present, the greater the risk of severe hyperbilirubinemia.[39] The important risk factors most frequently associated with severe hyperbilirubinemia are breastfeeding, gestation below 38 weeks, significant jaundice in a previous sibling, and jaundice noted before discharge.[39,40] A formula-fed infant of 40 or more weeks' gestation is at very low risk of developing severe hyperbilirubinemia.[39]

Hospital Policies and Procedures

RECOMMENDATION 6.1: All hospitals should provide written and verbal information for parents at the time of discharge, which should include an explanation of jaundice, the need to monitor infants for jaundice, and advice on how monitoring should be done (evidence quality D: benefits versus harms exceptional).

An example of a parent-information handout is available in English and Spanish at www.aap.org/family/jaundicefaq.htm.

Follow-up

RECOMMENDATION 6.1.1: All infants should be examined by a qualified health care professional in the first few days after discharge to assess infant well-being and the presence or absence of jaundice. The timing and location of this assessment will be determined by the length of stay in the nursery, presence or absence of risk factors for hyperbilirubinemia (Table 2 and Fig 2), and risk of other neonatal problems (evidence quality C: benefits exceed harms).

Timing of Follow-up

RECOMMENDATION 6.1.2: Follow-up should be provided as follows:

Infant Discharged	Should Be Seen by Age
Before age 24 h	72 h
Between 24 and 47.9 h	96 h
Between 48 and 72 h	120 h

For some newborns discharged before 48 hours, 2 follow-up visits may be required, the first visit between 24 and 72 hours and the second between 72 and 120 hours. Clinical judgment should be used in determining follow-up. Earlier or more frequent follow-up should be provided for those who have risk factors for hyperbilirubinemia (Table 2), whereas those discharged with few or no risk factors can be seen after longer intervals (evidence quality C: benefits exceed harms).

RECOMMENDATION 6.1.3: If appropriate follow-up cannot be ensured in the presence of elevated risk for developing severe hyperbilirubinemia, it may be necessary to delay discharge either until appropriate follow-up can be ensured or the period of greatest risk has passed (72-96 hours) (evidence quality D: benefits versus harms exceptional).

Follow-up Assessment

RECOMMENDATION 6.1.4: The follow-up assessment should include the infant's weight and percent change from birth weight, adequacy of intake, the pattern of voiding and stooling, and the presence or absence of jaundice (evidence quality C: benefits exceed harms). Clinical judgment should be used to determine the need for a bilirubin measurement. If there is any doubt about the degree of jaundice, the TSB or TcB level should be measured. Visual estimation of bilirubin levels can lead to errors, particularly in darkly pigmented infants (evidence quality C: benefits exceed harms).

See Appendix 1 for assessment of the adequacy of intake in breastfeeding infants.

TREATMENT

Phototherapy and Exchange Transfusion

RECOMMENDATION 7.1: Recommendations for treatment are given in Table 3 and Figs 3 and 4 (evidence quality C: benefits exceed harms). If the TSB does not fall or continues to rise despite intensive phototherapy, it is very likely that hemolysis is occurring. The committee's recommendations for discontinuing phototherapy can be found in Appendix 2.

RECOMMENDATION 7.1.1: In using the guidelines for phototherapy and exchange transfusion (Figs 3 and 4), the direct-reacting (or conjugated) bilirubin level should not be subtracted from the total (evidence quality D: benefits versus harms exceptional).

In unusual situations in which the direct bilirubin level is 50% or more of the total bilirubin, there are no good data to provide guidance for therapy, and consultation with an expert in the field is recommended.

RECOMMENDATION 7.1.2: If the TSB is at a level at which exchange transfusion is recommended (Fig 4) or if the TSB level is 25 mg/dL (428 μmol/L) or higher at any time, it is a medical emergency and the infant should be admitted immediately and directly to a hospital pediatric service for intensive phototherapy. These infants should not be referred to the emergency department, because it delays the initiation of treatment[54] (evidence quality C: benefits exceed harms).

RECOMMENDATION 7.1.3: Exchange transfusions should be performed only by trained personnel in a neonatal intensive care unit with full monitoring and resuscitation capabilities (evidence quality D: benefits versus harms exceptional).

RECOMMENDATION 7.1.4: In isoimmune hemolytic disease, administration of intravenous γ-globulin (0.5-1 g/kg over 2 hours) is recommended if the TSB is rising despite intensive phototherapy or the TSB level is within 2 to 3 mg/dL (34-51 μmol/L) of the exchange level (Fig 4).[55] If necessary, this dose can be repeated in 12 hours (evidence quality B: benefits exceed harms).

Intravenous γ-globulin has been shown to reduce the need for exchange transfusions in Rh and ABO hemolytic disease.[55–58] Although data are limited, it is reasonable to assume that intravenous γ-globulin will also be helpful in the other types of Rh hemolytic disease such as anti-C and anti-E.

TABLE 3. Example of a Clinical Pathway for Management of the Newborn Infant Readmitted for Phototherapy or Exchange Transfusion

Treatment
Use intensive phototherapy and/or exchange transfusion as indicated in Figs 3 and 4 (see Appendix 2 for details of phototherapy use)
Laboratory tests
TSB and direct bilirubin levels
Blood type (ABO, Rh)
Direct antibody test (Coombs')
Serum albumin
Complete blood cell count with differential and smear for red cell morphology
Reticulocyte count
$ETCO_c$ (if available)
G6PD if suggested by ethnic or geographic origin or if poor response to phototherapy
Urine for reducing substances
If history and/or presentation suggest sepsis, perform blood culture, urine culture, and cerebrospinal fluid for protein, glucose, cell count, and culture
Interventions
If TSB ≥25 mg/dL (428 μmol/L) or ≥20 mg/dL (342 μmol/L) in a sick infant or infant <38 wk gestation, obtain a type and crossmatch, and request blood in case an exchange transfusion is necessary
In infants with isoimmune hemolytic disease and TSB level rising in spite of intensive phototherapy or within 2–3 mg/dL (34–51 μmol/L) of exchange level (Fig 4), administer intravenous immunoglobulin 0.5–1 g/kg over 2 h and repeat in 12 h if necessary
If infant's weight loss from birth is >12% or there is clinical or biochemical evidence of dehydration, recommend formula or expressed breast milk. If oral intake is in question, give intravenous fluids.
For infants receiving intensive phototherapy
Breastfeed or bottle-feed (formula or expressed breast milk) every 2–3 h
If TSB ≥25 mg/dL (428 μmol/L), repeat TSB within 2–3 h
If TSB 20–25 mg/dL (342–428 μmol/L), repeat within 3–4 h. If TSB <20 mg/dL (342 μmol/L), repeat in 4–6 h. If TSB continues to fall, repeat in 8–12 h
If TSB is not decreasing or is moving closer to level for exchange transfusion or the TSB/albumin ratio exceeds levels shown in Fig 4, consider exchange transfusion (see Fig 4 for exchange transfusion recommendations)
When TSB is <13–14 mg/dL (239 μmol/L), discontinue phototherapy
Depending on the cause of the hyperbilirubinemia, it is an option to measure TSB 24 h after discharge to check for rebound

Serum Albumin Levels and the Bilirubin/Albumin Ratio

RECOMMENDATION 7.1.5: It is an option to measure the serum albumin level and consider an albumin level of less than 3.0 g/dL as one risk factor for lowering the threshold for phototherapy use (see Fig 3) (evidence quality D: benefits versus risks exceptional.).

RECOMMENDATION 7.1.6: If an exchange transfusion is being considered, the serum albumin level should be measured and the bilirubin/albumin (B/A) ratio used in conjunction with the TSB level and other factors in determining the need for exchange transfusion (see Fig 4) (evidence quality D: benefits versus harms exceptional).

The recommendations shown above for treating hyperbilirubinemia are based primarily on TSB levels and other factors that affect the risk of bilirubin encephalopathy. This risk might be increased by a prolonged (rather than a brief) exposure to a certain TSB level.[59,60] Because the published data that address this issue are limited, however, it is not possible to provide specific recommendations for intervention based on the duration of hyperbilirubinemia.

See Appendix 1 for the basis for recommendations 7.1 through 7.1.6 and for the recommendations provided in Figs 3 and 4. Appendix 1 also contains a discussion of the risks of exchange transfusion and the use of B/A binding.

Acute Bilirubin Encephalopathy

RECOMMENDATION 7.1.7: Immediate exchange transfusion is recommended in any infant who is jaundiced and manifests the signs of the intermediate to advanced stages of acute bilirubin encephalopathy[61,62] (hypertonia, arching, retrocollis, opisthotonos, fever, high-pitched cry) even if the TSB is falling (evidence quality D: benefits versus risks exceptional).

Phototherapy

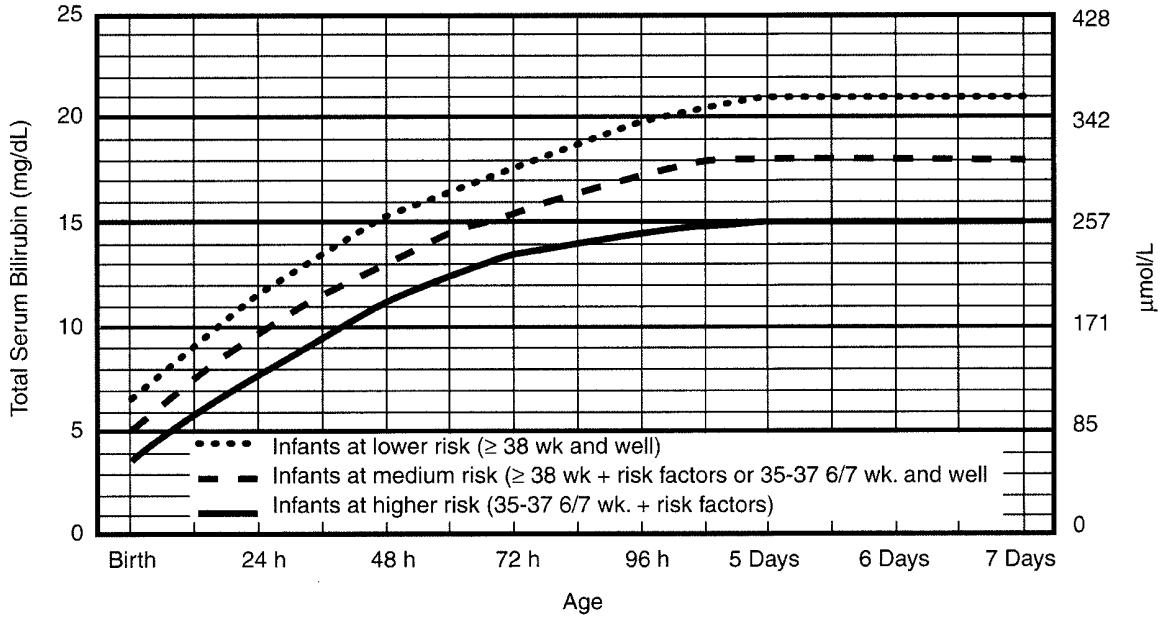
RECOMMENDATION 7.2: All nurseries and services treating infants should have the necessary equipment to provide intensive phototherapy (see Appendix 2) (evidence quality D: benefits exceed risks).

Outpatient Management of the Jaundiced Breastfed Infant

RECOMMENDATION 7.3: In breastfed infants who require phototherapy (Fig 3), the AAP recommends that, if possible, breastfeeding should be continued (evidence quality C: benefits exceed harms). It is also an option to interrupt temporarily breastfeeding and substitute formula. This can reduce bilirubin levels and/or enhance the efficacy of phototherapy[63–65] (evidence quality B: benefits exceed harms). In breastfed infants receiving phototherapy, supplementation with expressed breast milk or formula is appropriate if the infant's intake seems inadequate, weight loss is excessive, or the infant seems dehydrated.

IMPLEMENTATION STRATEGIES

The Institute of Medicine[11] recommends a dramatic change in the way the US health care system



- Use total bilirubin. Do not subtract direct reacting or conjugated bilirubin.
- Risk factors = isoimmune hemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis, or albumin < 3.0g/dL (if measured)
- For well infants 35-37 6/7 wk can adjust TSB levels for intervention around the medium risk line. It is an option to intervene at lower TSB levels for infants closer to 35 wks and at higher TSB levels for those closer to 37 6/7 wk.
- It is an option to provide conventional phototherapy in hospital or at home at TSB levels 2-3 mg/dL (35-50mmol/L) below those shown but home phototherapy should not be used in any infant with risk factors.

Fig 3. Guidelines for phototherapy in hospitalized infants of 35 or more weeks' gestation.

Note: These guidelines are based on limited evidence and the levels shown are approximations. The guidelines refer to the use of intensive phototherapy which should be used when the TSB exceeds the line indicated for each category. Infants are designated as "higher risk" because of the potential negative effects of the conditions listed on albumin binding of bilirubin,[45–47] the blood-brain barrier,[48] and the susceptibility of the brain cells to damage by bilirubin.[48]

"Intensive phototherapy" implies irradiance in the blue-green spectrum (wavelengths of approximately 430–490 nm) of at least 30 $\mu W/cm^2$ per nm (measured at the infant's skin directly below the center of the phototherapy unit) and delivered to as much of the infant's surface area as possible. Note that irradiance measured below the center of the light source is much greater than that measured at the periphery. Measurements should be made with a radiometer specified by the manufacturer of the phototherapy system.

See Appendix 2 for additional information on measuring the dose of phototherapy, a description of intensive phototherapy, and of light sources used. If total serum bilirubin levels approach or exceed the exchange transfusion line (Fig 4), the sides of the bassinet, incubator, or warmer should be lined with aluminum foil or white material.[50] This will increase the surface area of the infant exposed and increase the efficacy of phototherapy.[51]

If the total serum bilirubin does not decrease or continues to rise in an infant who is receiving intensive phototherapy, this strongly suggests the presence of hemolysis.

Infants who receive phototherapy and have an elevated direct-reacting or conjugated bilirubin level (cholestatic jaundice) may develop the bronze-baby syndrome. See Appendix 2 for the use of phototherapy in these infants.

ensures the safety of patients. The perspective of safety as a purely individual responsibility must be replaced by the concept of safety as a property of systems. Safe systems are characterized by a shared knowledge of the goal, a culture emphasizing safety, the ability of each person within the system to act in a manner that promotes safety, minimizing the use of memory, and emphasizing the use of standard procedures (such as checklists), and the involvement of patients/families as partners in the process of care.

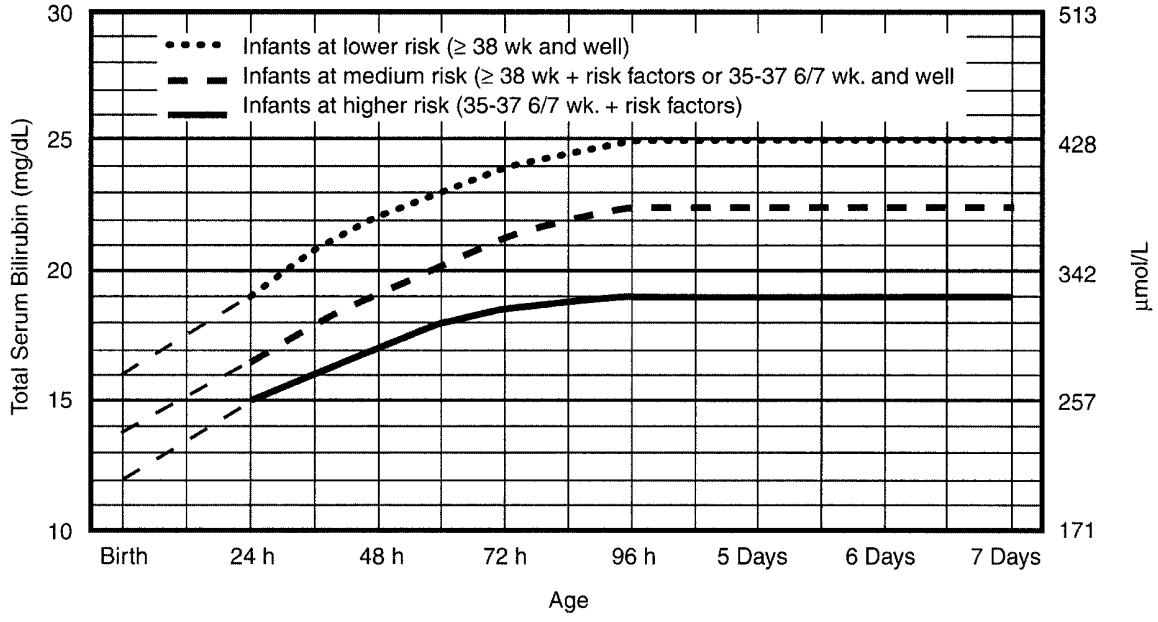
These principles can be applied to the challenge of preventing severe hyperbilirubinemia and kernicterus. A systematic approach to the implementation of these guidelines should result in greater safety. Such approaches might include

- The establishment of standing protocols for nursing assessment of jaundice, including testing TcB and TSB levels, without requiring physician orders.
- Checklists or reminders associated with risk factors, age at discharge, and laboratory test results that provide guidance for appropriate follow-up.
- Explicit educational materials for parents (a key component of all AAP guidelines) concerning the identification of newborns with jaundice.

FUTURE RESEARCH

Epidemiology of Bilirubin-Induced Central Nervous System Damage

There is a need for appropriate epidemiologic data to document the incidence of kernicterus in the newborn population, the incidence of other adverse effects attributable to hyperbilirubinemia and its management, and the number of infants whose TSB levels exceed 25 or 30 mg/dL (428-513 μmol/L). Organizations such as the Centers for Disease Control and Prevention should implement strategies for appropriate data gathering to identify the number of



- The dashed lines for the first 24 hours indicate uncertainty due to a wide range of clinical circumstances and a range of responses to phototherapy.
- Immediate exchange transfusion is recommended if infant shows signs of acute bilirubin encephalopathy (hypertonia, arching, retrocollis, opisthotonos, fever, high pitched cry) or if TSB is ≥5 mg/dL (85 µmol/L) above these lines.
- Risk factors - isoimmune hemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis.
- Measure serum albumin and calculate B/A ratio (See legend)
- Use total bilirubin. Do not subtract direct reacting or conjugated bilirubin
- If infant is well and 35-37 6/7 wk (median risk) can individualize TSB levels for exchange based on actual gestational age.

Fig 4. Guidelines for exchange transfusion in infants 35 or more weeks' gestation.

Note that these suggested levels represent a consensus of most of the committee but are based on limited evidence, and the levels shown are approximations. See ref. 3 for risks and complications of exchange transfusion. During birth hospitalization, exchange transfusion is recommended if the TSB rises to these levels despite intensive phototherapy. For readmitted infants, if the TSB level is above the exchange level, repeat TSB measurement every 2 to 3 hours and consider exchange if the TSB remains above the levels indicated after intensive phototherapy for 6 hours.

The following B/A ratios can be used together with but in not in lieu of the TSB level as an additional factor in determining the need for exchange transfusion[52]:

Risk Category	B/A Ratio at Which Exchange Transfusion Should be Considered	
	TSB mg/dL/Alb, g/dL	TSB µmol/L/Alb, µmol/L
Infants ≥38 0/7 wk	8.0	0.94
Infants 35 0/7–36 6/7 wk and well or ≥38 0/7 wk if higher risk or isoimmune hemolytic disease or G6PD deficiency	7.2	0.84
Infants 35 0/7–37 6/7 wk if higher risk or isoimmune hemolytic disease or G6PD deficiency	6.8	0.80

If the TSB is at or approaching the exchange level, send blood for immediate type and crossmatch. Blood for exchange transfusion is modified whole blood (red cells and plasma) crossmatched against the mother and compatible with the infant.[53]

infants who develop serum bilirubin levels above 25 or 30 mg/dL (428-513 µmol/L) and those who develop acute and chronic bilirubin encephalopathy. This information will help to identify the magnitude of the problem; the number of infants who need to be screened and treated to prevent 1 case of kernicterus; and the risks, costs, and benefits of different strategies for prevention and treatment of hyperbilirubinemia. In the absence of these data, recommendations for intervention cannot be considered definitive.

Effect of Bilirubin on the Central Nervous System

The serum bilirubin level by itself, except when it is extremely high and associated with bilirubin encephalopathy, is an imprecise indicator of long-term neurodevelopmental outcome.[2] Additional studies are needed on the relationship between central nervous system damage and the duration of hyperbilirubinemia, the binding of bilirubin to albumin, and changes seen in the brainstem auditory evoked response. These studies could help to better identify

risk, clarify the effect of bilirubin on the central nervous system, and guide intervention.

Identification of Hemolysis

Because of their poor specificity and sensitivity, the standard laboratory tests for hemolysis (Table 1) are frequently unhelpful.[66,67] However, end-tidal carbon monoxide, corrected for ambient carbon monoxide ($ETCO_c$), levels can confirm the presence or absence of hemolysis, and measurement of $ETCO_c$ is the only clinical test that provides a direct measurement of the rate of heme catabolism and the rate of bilirubin production.[68,69] Thus, $ETCO_c$ may be helpful in determining the degree of surveillance needed and the timing of intervention. It is not yet known, however, how $ETCO_c$ measurements will affect management.

Nomograms and the Measurement of Serum and TcB

It would be useful to develop an age-specific (by hour) nomogram for TSB in populations of newborns that differ with regard to risk factors for hyperbilirubinemia. There is also an urgent need to improve the precision and accuracy of the measurement of TSB in the clinical laboratory.[70,71] Additional studies are also needed to develop and validate noninvasive (transcutaneous) measurements of serum bilirubin and to understand the factors that affect these measurements. These studies should also assess the cost-effectiveness and reproducibility of TcB measurements in clinical practice.[2]

Pharmacologic Therapy

There is now evidence that hyperbilirubinemia can be effectively prevented or treated with tin-mesoporphyrin,[72–75] a drug that inhibits the production of heme oxygenase. Tin-mesoporphyrin is not approved by the US Food and Drug Administration. If approved, tin-mesoporphyrin could find immediate application in preventing the need for exchange transfusion in infants who are not responding to phototherapy.[75]

Dissemination and Monitoring

Research should be directed toward methods for disseminating the information contained in this guideline to increase awareness on the part of physicians, residents, nurses, and parents concerning the issues of neonatal hyperbilirubinemia and strategies for its management. In addition, monitoring systems should be established to identify the impact of these guidelines on the incidence of acute bilirubin encephalopathy and kernicterus and the use of phototherapy and exchange transfusions.

CONCLUSIONS

Kernicterus is still occurring but should be largely preventable if health care personnel follow the recommendations listed in this guideline. These recommendations emphasize the importance of universal, systematic assessment for the risk of severe hyperbilirubinemia, close follow-up, and prompt intervention, when necessary.

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APPENDIX 1: Additional Notes

Definitions of Quality of Evidence and Balance of Benefits and Harms

The Steering Committee on Quality Improvement and Management categorizes evidence quality in 4 levels:

1. Well-designed, randomized, controlled trials or diagnostic studies on relevant populations
2. Randomized, controlled trials or diagnostic studies with minor limitations; overwhelming, consistent evidence from observational studies
3. Observational studies (case-control and cohort design)
4. Expert opinion, case reports, reasoning from first principles

The AAP defines evidence-based recommendations as follows:[1]

- Strong recommendation: the committee believes that the benefits of the recommended approach clearly exceed the harms of that approach and that the quality of the supporting evidence is either excellent or impossible to obtain. Clinicians should follow these recommendations unless a clear and compelling rationale for an alternative approach is present.
- Recommendation: the committee believes that the benefits exceed the harms, but the quality of evidence on which this recommendation is based is not as strong. Clinicians should also generally follow these recommendations but should be alert to new information and sensitive to patient preferences. In this guideline, the term "should" implies a recommendation by the committee.
- Option: either the quality of the evidence that exists is suspect or well-performed studies have shown little clear advantage to one approach over another. Patient preference should have a substantial role in influencing clinical decision-making when a policy is described as an option.
- No recommendation: there is a lack of pertinent evidence and the anticipated balance of benefits and harms is unclear.

Anticipated Balance Between Benefits and Harms

The presence of clear benefits or harms supports stronger statements for or against a course of action. In some cases, however, recommendations are made when analysis of the balance of benefits and harms provides an exceptional dysequilibrium and it would be unethical or impossible to perform clinical trials to "prove" the point. In these cases the balance of benefit and harm is termed "exceptional."

Clinical Manifestations of Acute Bilirubin Encephalopathy and Kernicterus

Acute Bilirubin Encephalopathy

In the early phase of acute bilirubin encephalopathy, severely jaundiced infants become lethargic and hypotonic and suck poorly.[2,3] The intermediate phase is characterized by moderate stupor, irritability, and hypertonia. The infant may develop a fever and high-pitched cry, which may alternate with drowsiness and hypotonia. The hypertonia is manifested by backward arching of the neck (retrocollis) and trunk (opisthotonos). There is anecdotal evidence that an emergent exchange transfusion at this stage, in some cases, might reverse the central nervous system changes.[4] The advanced phase, in which central nervous system damage is probably irreversible, is characterized by pronounced retrocollis-opisthotonos, shrill cry, no feeding, apnea, fever, deep stupor to coma, sometimes seizures, and death.[2,3,5]

Kernicterus

In the chronic form of bilirubin encephalopathy, surviving infants may develop a severe form of athetoid cerebral palsy, auditory dysfunction, dental-enamel dysplasia, paralysis of upward gaze, and, less often, intellectual and other handicaps. Most infants who develop kernicterus have manifested some or all of the signs listed above in the acute phase of bilirubin encephalopathy. However, occasionally there are infants who have developed very high bilirubin levels and, subsequently, the signs of kernicterus but have exhibited few, if any, antecedent clinical signs of acute bilirubin encephalopathy.[3,5,6]

Clinical Evaluation of Jaundice and TcB Measurements

Jaundice is usually seen in the face first and progresses caudally to the trunk and extremities,[7] but because visual estimation of bilirubin levels from the degree of jaundice can lead to errors,[8–10] a low threshold should be used for measuring the TSB.

Devices that provide a noninvasive TcB measurement have proven very useful as screening tools,[11] and newer instruments give measurements that provide a valid estimate of the TSB level.[12–17] Studies using the new TcB-measurement instruments are limited, but the data published thus far suggest that in most newborn populations, these instruments generally provide measurements within 2 to 3 mg/dL (34–51 μmol/L) of the TSB and can replace a measurement of serum bilirubin in many circumstances, particularly for TSB levels less than 15 mg/dL (257 μmol/L).[12–17] Because phototherapy "bleaches" the skin, both visual assessment of jaundice and TcB measurements in infants undergoing phototherapy are not reliable. In addition, the ability of transcutaneous instruments to provide accurate measurements in different racial groups requires additional study.[18,19] The limitations of the accuracy and reproducibility of TSB measurements in the clinical laboratory[20–22] must also be recognized and are discussed in the technical report.[23]

Capillary Versus Venous Serum Bilirubin Measurement

Almost all published data regarding the relationship of TSB levels to kernicterus or developmental outcome are based on capillary blood TSB levels. Data regarding the differences between capillary and venous TSB levels are conflicting.[24,25] In 1 study the capillary TSB levels were higher, but in another they were lower than venous TSB levels.[24,25] Thus, obtaining a venous sample to "confirm" an elevated capillary TSB level is not recommended, because it will delay the initiation of treatment.

Direct-Reacting and Conjugated Bilirubin

Although commonly used interchangeably, direct-reacting bilirubin is not the same as conjugated bilirubin. Direct-reacting bilirubin is the bilirubin that reacts directly (without the addition of an accelerating agent) with diazotized sulfanilic acid. Conjugated bilirubin is bilirubin made water soluble by binding with glucuronic acid in the liver. Depending on the technique used, the clinical laboratory will report total and direct-reacting or unconjugated and conjugated bilirubin levels. In this guideline and for clinical purposes, the terms may be used interchangeably.

Abnormal Direct and Conjugated Bilirubin Levels

Laboratory measurement of direct bilirubin is not precise,[26] and values between laboratories can vary widely. If the TSB is at or below 5 mg/dL (85 μmol/L), a direct or conjugated bilirubin of more than 1.0 mg/dL (17.1 μmol/L) is generally considered abnormal. For TSB values higher than 5 mg/dL (85 μmol/L), a direct bilirubin of more than 20% of the TSB is considered abnormal. If the hospital laboratory measures conjugated bilirubin using the Vitros (formerly Ektachem) system (Ortho-Clinical Diagnostics, Raritan, NJ), any value higher than 1 mg/dL is considered abnormal.

Assessment of Adequacy of Intake in Breastfeeding Infants

The data from a number of studies[27–34] indicate that unsupplemented, breastfed infants experience their maximum weight loss by day 3 and, on average, lose 6.1% ± 2.5% (SD) of their birth weight. Thus, ~5% to 10% of fully breastfed infants lose 10% or more of their birth weight by day 3, suggesting that adequacy of intake should be evaluated and the infant monitored if weight loss is more than 10%.[35] Evidence of adequate intake in breastfed infants also includes 4 to 6 thoroughly wet diapers in 24 hours and the passage of 3 to 4 stools per day by the fourth day. By the third to fourth day, the stools in adequately breastfed infants should have changed from meconium to a mustard yellow, mushy stool.[36] The above assessment will also help to identify breastfed infants who are at risk for dehydration because of inadequate intake.

Nomogram for Designation of Risk

Note that this nomogram (Fig 2) does not describe the natural history of neonatal hyperbilirubinemia, particularly after 48 to 72 hours, for which, because of sampling bias, the lower zones are spuriously elevated.[37] This bias, however, will have much less effect on the high-risk zone (95th percentile in the study).[38]

G6PD Dehydrogenase Deficiency

It is important to look for G6PD deficiency in infants with significant hyperbilirubinemia, because some may develop a sudden increase in the TSB. In addition, G6PD-deficient infants require intervention at lower TSB levels (Figs 3 and 4). It should be noted also that in the presence of hemolysis, G6PD levels can be elevated, which may obscure the diagnosis in the newborn period so that a normal level in a hemolyzing neonate does not rule out G6PD deficiency.[39] If G6PD deficiency is strongly suspected, a repeat level should be measured when the infant is 3 months old. It is also recognized that immediate laboratory determination of G6PD is generally not available in most US hospitals, and thus translating the above information into clinical practice is cur-

TABLE 4. Risk Zone as a Predictor of Hyperbilirubinemia[39]

TSB Before Discharge	Newborns (Total = 2840), *n* (%)	Newborns Who Subsequently Developed a TSB Level >95th Percentile, *n* (%)
High-risk zone (>95th percentile)	172 (6.0)	68 (39.5)
High intermediate-risk zone	356 (12.5)	46 (12.9)
Low intermediate-risk zone	556 (19.6)	12 (2.26)
Low-risk zone	1756 (61.8)	0

rently difficult. Nevertheless, practitioners are reminded to consider the diagnosis of G6PD deficiency in infants with severe hyperbilirubinemia, particularly if they belong to the population groups in which this condition is prevalent. This is important in the African American population, because these infants, as a group, have much lower TSB levels than white or Asian infants.[40,41] Thus, severe hyperbilirubinemia in an African American infant should always raise the possibility of G6PD deficiency.

Basis for the Recommendations 7.1.1 Through 7.1.6 and Provided in Figs 3 and 4

Ideally, recommendations for when to implement phototherapy and exchange transfusions should be based on estimates of when the benefits of these interventions exceed their risks and cost. The evidence for these estimates should come from randomized trials or systematic observational studies. Unfortunately, there is little such evidence on which to base these recommendations. As a result, treatment guidelines must necessarily rely on more uncertain estimates and extrapolations. For a detailed discussion of this question, please see "An Evidence-Based Review of Important Issues Concerning Neonatal Hyperbilirubinemia."[23]

The recommendations for phototherapy and exchange transfusion are based on the following principles:

- The main demonstrated value of phototherapy is that it reduces the risk that TSB levels will reach a level at which exchange transfusion is recommended.[42–44] Approximately 5 to 10 infants with TSB levels between 15 and 20 mg/dL (257–342 μmol/L) will receive phototherapy to prevent the TSB in 1 infant from reaching 20 mg/dL (the number needed to treat).[12] Thus, 8 to 9 of every 10 infants with these TSB levels will not reach 20 mg/dL (342 μmol/L) even if they are not treated. Phototherapy has proven to be a generally safe procedure, although rare complications can occur (see Appendix 2).
- Recommended TSB levels for exchange transfusion (Fig 4) are based largely on the goal of keeping TSB levels below those at which kernicterus has been reported.[12,45–48] In almost all cases, exchange transfusion is recommended only after phototherapy has failed to keep the TSB level below the exchange transfusion level (Fig 4).
- The recommendations to use phototherapy and exchange transfusion at lower TSB levels for infants of lower gestation and those who are sick are based on limited observations suggesting that sick infants (particularly those with the risk factors listed in Figs 3 and 4)[49–51] and those of lower gestation[51–54] are at greater risk for developing kernicterus at lower bilirubin levels than are well infants of more than 38 6/7 weeks' gestation. Nevertheless, other studies have not confirmed all of these associations.[52,55,56] There is no doubt, however, that infants at 35 to 37 6/7 weeks' gestation are at a much greater risk of developing very high TSB levels.[57,58] Intervention for these infants is based on this risk as well as extrapolations from more premature, lower birth-weight infants who do have a higher risk of bilirubin toxicity.[52,53]
- For all newborns, treatment is recommended at lower TSB levels at younger ages because one of the primary goals of treatment is to prevent additional increases in the TSB level.

Subtle Neurologic Abnormalities Associated With Hyperbilirubinemia

There are several studies demonstrating measurable transient changes in brainstem-evoked potentials, behavioral patterns, and the infant's cry[59–63] associated with TSB levels of 15 to 25 mg/dL (257–428 μmol/L). In these studies, the abnormalities identified were transient and disappeared when the serum bilirubin levels returned to normal with or without treatment.[59,60,62,63]

A few cohort studies have found an association between hyperbilirubinemia and long-term adverse neurodevelopmental effects that are more subtle than kernicterus.[64–67] Current studies, however, suggest that although phototherapy lowers the TSB levels, it has no effect on these long-term neurodevelopmental outcomes.[68–70]

Risks of Exchange Transfusion

Because exchange transfusions are now rarely performed, the risks of morbidity and mortality associated with the procedure are difficult to quantify. In addition, the complication rates listed below may not be generalizable to the current era if, like most procedures, frequency of performance is an important determinant of risk. Death associated with exchange transfusion has been reported in approximately 3 in 1000 procedures,[71,72] although in otherwise well infants of 35 or more weeks' gestation, the risk is probably much lower.[71–73] Significant morbidity (apnea, bradycardia, cyanosis, vasospasm, thrombosis, necrotizing enterocolitis) occurs in as many as 5% of exchange transfusions,[71] and the risks associated with the use of blood products must always be considered.[74] Hypoxic-ischemic encephalopathy and acquired immunodeficiency syndrome have occurred in otherwise healthy infants receiving exchange transfusions.[73,75]

Serum Albumin Levels and the B/A Ratio

The legends to Figs 3 and 4 and recommendations 7.1.5 and 7.1.6 contain references to the serum albumin level and the B/A ratio as factors that can be considered in the decision to initiate phototherapy (Fig 3) or perform an exchange transfusion (Fig 4). Bilirubin is transported in the plasma tightly bound to albumin, and the portion that is unbound or loosely bound can more readily leave the intravascular space and cross the intact blood-brain barrier.[76] Elevations of unbound bilirubin (UB) have been associated with kernicterus in sick preterm newborns.[77,78] In addition, elevated UB concentrations are more closely associated than TSB levels with transient abnormalities in the audiometric brainstem response in term[79] and preterm[80] infants. Long-term

studies relating B/A binding in infants to developmental outcome are limited and conflicting.[69,81,82] In addition, clinical laboratory measurement of UB is not currently available in the United States.

The ratio of bilirubin (mg/dL) to albumin (g/dL) does correlate with measured UB in newborns[83] and can be used as an approximate surrogate for the measurement of UB. It must be recognized, however, that both albumin levels and the ability of albumin to bind bilirubin vary significantly between newborns.[83,84] Albumin binding of bilirubin is impaired in sick infants,[84–86] and some studies show an increase in binding with increasing gestational[86,87] and postnatal[87,88] age, but others have not found a significant effect of gestational age on binding.[89] Furthermore, the risk of bilirubin encephalopathy is unlikely to be a simple function of the TSB level or the concentration of UB but is more likely a combination of both (ie, the total amount of bilirubin available [the miscible pool of bilirubin] as well as the tendency of bilirubin to enter the tissues [the UB concentration]).[83] An additional factor is the possible susceptibility of the cells of the central nervous system to damage by bilirubin.[90] It is therefore a clinical option to use the B/A ratio together with, but not in lieu of, the TSB level as an additional factor in determining the need for exchange transfusion[83] (Fig 4).

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APPENDIX 2: Phototherapy

There is no standardized method for delivering phototherapy. Phototherapy units vary widely, as do the types of lamps used in the units. The efficacy of phototherapy depends on the dose of phototherapy administered as well as a number of clinical factors (Table 5).[1]

Measuring the Dose of Phototherapy

Table 5 shows the radiometric quantities used in measuring the phototherapy dose. The quantity most commonly reported in the literature is the spectral irradiance. In the nursery, spectral irradiance can be measured by using commercially available radiometers. These instruments take a single measurement across a band of wavelengths, typically 425 to 475 or 400 to 480 nm. Unfortunately, there is no standardized method for reporting phototherapy dosages in the clinical literature, so it is difficult to compare published studies on the efficacy of phototherapy and manufacturers' data for the irradiance produced by different systems.[2] Measurements of irradiance from the same system, using different radiometers,

TABLE 5. Factors That Affect the Dose and Efficacy of Phototherapy

Factor	Mechanism/Clinical Relevance	Implementation and Rationale	Clinical Application
Spectrum of light emitted	Blue-green spectrum is most effective. At these wavelengths, light penetrates skin well and is absorbed maximally by bilirubin.	Special blue fluorescent tubes or other light sources that have most output in the blue-green spectrum and are most effective in lowering TSB.	Use special blue tubes or LED light source with output in blue-green spectrum for intensive PT.
Spectral irradiance (irradiance in certain wavelength band) delivered to surface of infant	↑ irradiance → ↑ rate of decline in TSB	Irradiance is measured with a radiometer as $\mu W/cm^2$ per nm. Standard PT units deliver 8–10 $\mu W/cm^2$ per nm (Fig 6). Intensive PT requires >30 $\mu W/cm^2$ per nm.	If special blue fluorescent tubes are used, bring tubes as close to infant as possible to increase irradiance (Fig 6). Note: This cannot be done with halogen lamps because of the danger of burn. Special blue tubes 10–15 cm above the infant will produce an irradiance of at least 35 $\mu W/cm^2$ per nm.
Spectral power (average spectral irradiance across surface area)	↑ surface area exposed → ↑ rate of decline in TSB	For intensive PT, expose maximum surface area of infant to PT.	Place lights above and fiber-optic pad or special blue fluorescent tubes* below the infant. For maximum exposure, line sides of bassinet, warmer bed, or incubator with aluminum foil.
Cause of jaundice	PT is likely to be less effective if jaundice is due to hemolysis or if cholestasis is present. (↑ direct bilirubin)		When hemolysis is present, start PT at lower TSB levels. Use intensive PT. Failure of PT suggests that hemolysis is the cause of jaundice. If ↑ direct bilirubin, watch for bronze baby syndrome or blistering.
TSB level at start of PT	The higher the TSB, the more rapid the decline in TSB with PT.		Use intensive PT for higher TSB levels. Anticipate a more rapid decrease in TSB when TSB >20 mg/dL (342 μmol/L).

PT indicates phototherapy; LED, light-emitting diode.
* Available in the Olympic BiliBassinet (Olympic Medical, Seattle, WA).

can also produce significantly different results. The width of the phototherapy lamp's emissions spectrum (narrow versus broad) will affect the measured irradiance. Measurements under lights with a very focused emission spectrum (eg, blue light-emitting diode) will vary significantly from one radiometer to another, because the response spectra of the radiometers vary from manufacturer to manufacturer. Broader-spectrum lights (fluorescent and halogen) have fewer variations among radiometers. Manufacturers of phototherapy systems generally recommend the specific radiometer to be used in measuring the dose of phototherapy when their system is used.

It is important also to recognize that the measured irradiance will vary widely depending on where the measurement is taken. Irradiance measured below the center of the light source can be more than double that measured at the periphery, and this dropoff at the periphery will vary with different phototherapy units. Ideally, irradiance should be measured at multiple sites under the area illuminated by the unit and the measurements averaged. The International Electrotechnical Commission[3] defines the "effective surface area" as the intended treatment surface that is illuminated by the phototherapy light. The commission uses 60 × 30 cm as the standard-sized surface.

Is It Necessary to Measure Phototherapy Doses Routinely?

Although it is not necessary to measure spectral irradiance before each use of phototherapy, it is important to perform periodic checks of phototherapy units to make sure that an adequate irradiance is being delivered.

The Dose-Response Relationship of Phototherapy

Figure 5 shows that there is a direct relationship between the irradiance used and the rate at which the serum bilirubin declines under phototherapy.[4] The data in Fig 5 suggest that there is a saturation point beyond which an increase in the irradiance produces no added efficacy. We do not know, however, that a saturation point exists. Because the conversion of bilirubin to excretable photoproducts is partly irreversible and follows first-order kinetics, there may not be a saturation point, so we do not know the maximum effective dose of phototherapy.

Effect on Irradiance of the Light Spectrum and the Distance Between the Infant and the Light Source

Figure 6 shows that as the distance between the light source and the infant decreases, there is a corresponding increase in the spectral irradiance.[5] Fig 6 also demonstrates the dramatic difference in irradi-

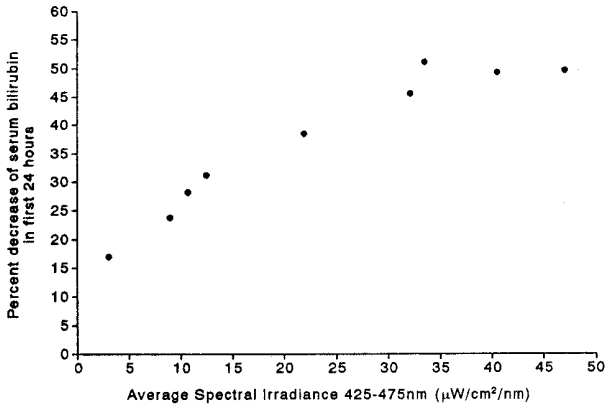

Fig 5. Relationship between average spectral irradiance and decrease in serum bilirubin concentration. Term infants with nonhemolytic hyperbilirubinemia were exposed to special blue lights (Phillips TL 52/20W) of different intensities. Spectral irradiance was measured as the average of readings at the head, trunk, and knees. Drawn from the data of Tan.[4] Source: *Pediatrics*. 1996;98: 283-287.

ance produced within the important 425- to 475-nm band by different types of fluorescent tubes.

What is Intensive Phototherapy?

Intensive phototherapy implies the use of high levels of irradiance in the 430- to 490-nm band (usually 30 $\mu W/cm^2$ per nm or higher) delivered to as much of the infant's surface area as possible. How this can be achieved is described below.

Using Phototherapy Effectively

Light Source

The spectrum of light delivered by a phototherapy unit is determined by the type of light source and any filters used. Commonly used phototherapy units contain daylight, cool white, blue, or "special blue" fluorescent tubes. Other units use tungsten-halogen lamps in different configurations, either free-standing or as part of a radiant warming device. Recently, a system using high-intensity gallium nitride light-emitting diodes has been introduced.[6] Fiber-optic systems deliver light from a high-intensity lamp to a fiber-optic blanket. Most of these devices deliver enough output in the blue-green region of the visible spectrum to be effective for standard phototherapy use. However, when bilirubin levels approach the range at which intensive phototherapy is recommended, maximal efficiency must be sought. The most effective light sources currently commercially available for phototherapy are those that use special blue fluorescent tubes[7] or a specially designed light-emitting diode light (Natus Inc, San Carlos, CA).[6] The special blue fluorescent tubes are labeled F20T12/BB (General Electric, Westinghouse, Sylvania) or TL52/20W (Phillips, Eindhoven, The Netherlands). It is important to note that special blue tubes provide much greater irradiance than regular blue tubes (labeled F20T12/B) (Fig 6). Special blue tubes are most effective because they provide light predominantly in the blue-green spectrum. At these wavelengths, light penetrates skin well and is absorbed maximally by bilirubin.[7]

There is a common misconception that ultraviolet light is used for phototherapy. The light systems used do not emit significant ultraviolet radiation, and the small amount of ultraviolet light that is emitted by fluorescent tubes and halogen bulbs is in longer wavelengths than those that cause erythema. In addition, almost all ultraviolet light is absorbed by the glass wall of the fluorescent tube and the Plexiglas cover of the phototherapy unit.

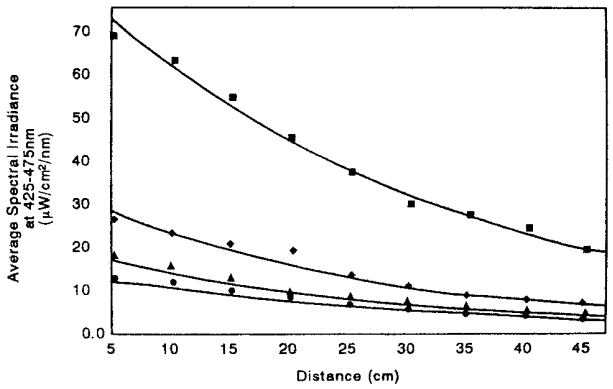

Fig 6. Effect of light source and distance from the light source to the infant on average spectral irradiance. Measurements were made across the 425- to 475-nm band by using a commercial radiometer (Olympic Bilimeter Mark II) and are the average of measurements taken at different locations at each distance (irradiance at the center of the light is much higher than at the periphery). The phototherapy unit was fitted with eight 24-in fluorescent tubes. ■ indicates special blue, General Electric 20-W F20T12/BB tube; ◆, blue, General Electric 20-W F20T12/B tube; ▲, daylight blue, 4 General Electric 20-W F20T12/B blue tubes and 4 Sylvania 20-W F20T12/D daylight tubes; •, daylight, Sylvania 20-W F20T12/D daylight tube. Curves were plotted by using linear curve fitting (True Epistat, Epistat Services, Richardson, TX). The best fit is described by the equation $y = Ae^{Bx}$. Source: *Pediatrics*. 1996;98:283-287.

Distance From the Light

As can be seen in Fig 6, the distance of the light source from the infant has a dramatic effect on the spectral irradiance, and this effect is most significant when special blue tubes are used. To take advantage of this effect, the fluorescent tubes should be placed as close to the infant as possible. To do this, the infant should be in a bassinet, not an incubator, because the top of the incubator prevents the light from being brought sufficiently close to the infant. In a bassinet, it is possible to bring the fluorescent tubes within approximately 10 cm of the infant. Naked term infants do not become overheated under these lights. It is important to note, however, that the halogen spot phototherapy lamps cannot be positioned closer to the infant than recommended by the manufacturers without incurring the risk of a burn. When halogen lamps are used, manufacturers recommendations should be followed. The reflectors, light source, and transparent light filters (if any) should be kept clean.

Surface Area

A number of systems have been developed to provide phototherapy above and below the infant.[8,9] One commercially available system that does this is the BiliBassinet (Olympic Medical, Seattle, WA). This

unit provides special blue fluorescent tubes above and below the infant. An alternative is to place fiber-optic pads below an infant with phototherapy lamps above. One disadvantage of fiber-optic pads is that they cover a relatively small surface area so that 2 or 3 pads may be needed.[5] When bilirubin levels are extremely high and must be lowered as rapidly as possible, it is essential to expose as much of the infant's surface area to phototherapy as possible. In these situations, additional surface-area exposure can be achieved by lining the sides of the bassinet with aluminum foil or a white cloth.[10]

In most circumstances, it is not necessary to remove the infant's diaper, but when bilirubin levels approach the exchange transfusion range, the diaper should be removed until there is clear evidence of a significant decline in the bilirubin level.

What Decline in the Serum Bilirubin Can You Expect?

The rate at which the bilirubin declines depends on the factors listed in Table 5, and different responses can be expected depending on the clinical circumstances. When bilirubin levels are extremely high (more than 30 mg/dL [513 μmol/L]), and intensive phototherapy is used, a decline of as much as 10 mg/dL (171 μmol/L) can occur within a few hours,[11] and a decrease of at least 0.5 to 1 mg/dL per hour can be expected in the first 4 to 8 hours.[12] On average, for infants of more than 35 weeks' gestation readmitted for phototherapy, intensive phototherapy can produce a decrement of 30% to 40% in the initial bilirubin level by 24 hours after initiation of phototherapy.[13] The most significant decline will occur in the first 4 to 6 hours. With standard phototherapy systems, a decrease of 6% to 20% of the initial bilirubin level can be expected in the first 24 hours.[8,14]

Intermittent Versus Continuous Phototherapy

Clinical studies comparing intermittent with continuous phototherapy have produced conflicting results.[15–17] Because all light exposure increases bilirubin excretion (compared with darkness), no plausible scientific rationale exists for using intermittent phototherapy. In most circumstances, however, phototherapy does not need to be continuous. Phototherapy may be interrupted during feeding or brief parental visits. Individual judgment should be exercised. If the infant's bilirubin level is approaching the exchange transfusion zone (Fig 4), phototherapy should be administered continuously until a satisfactory decline in the serum bilirubin level occurs or exchange transfusion is initiated.

Hydration

There is no evidence that excessive fluid administration affects the serum bilirubin concentration. Some infants who are admitted with high bilirubin levels are also mildly dehydrated and may need supplemental fluid intake to correct their dehydration. Because these infants are almost always breastfed, the best fluid to use in these circumstances is a milk-based formula, because it inhibits the enterohepatic circulation of bilirubin and should help to lower the serum bilirubin level. Because the photoproducts responsible for the decline in serum bilirubin are excreted in urine and bile,[18] maintaining adequate hydration and good urine output should help to improve the efficacy of phototherapy. Unless there is evidence of dehydration, however, routine intravenous fluid or other supplementation (eg, with dextrose water) of term and near-term infants receiving phototherapy is not necessary.

When Should Phototherapy Be Stopped?

There is no standard for discontinuing phototherapy. The TSB level for discontinuing phototherapy depends on the age at which phototherapy is initiated and the cause of the hyperbilirubinemia.[13] For infants who are readmitted after their birth hospitalization (usually for TSB levels of 18 mg/dL [308 μmol/L] or higher), phototherapy may be discontinued when the serum bilirubin level falls below 13 to 14 mg/dL (239-239 μmol/L). Discharge from the hospital need not be delayed to observe the infant for rebound.[13,19,20] If phototherapy is used for infants with hemolytic diseases or is initiated early and discontinued before the infant is 3 to 4 days old, a follow-up bilirubin measurement within 24 hours after discharge is recommended.[13] For infants who are readmitted with hyperbilirubinemia and then discharged, significant rebound is rare, but a repeat TSB measurement or clinical follow-up 24 hours after discharge is a clinical option.[13]

Home Phototherapy

Because the devices available for home phototherapy may not provide the same degree of irradiance or surface-area exposure as those available in the hospital, home phototherapy should be used only in infants whose bilirubin levels are in the "optional phototherapy" range (Fig 3); it is not appropriate for infants with higher bilirubin concentrations. As with hospitalized infants, it is essential that serum bilirubin levels be monitored regularly.

Sunlight Exposure

In their original description of phototherapy, Cremer et al[21] demonstrated that exposure of newborns to sunlight would lower the serum bilirubin level. Although sunlight provides sufficient irradiance in the 425- to 475-nm band to provide phototherapy, the practical difficulties involved in safely exposing a naked newborn to the sun either inside or outside (and avoiding sunburn) preclude the use of sunlight as a reliable therapeutic tool, and it therefore is not recommended.

Complications

Phototherapy has been used in millions of infants for more than 30 years, and reports of significant toxicity are exceptionally rare. Nevertheless, phototherapy in hospital separates mother and infant, and eye patching is disturbing to parents. The most important, but uncommon, clinical complication occurs in infants with cholestatic jaundice. When these infants are exposed to phototherapy, they may develop a dark, grayish-brown discoloration of the skin, serum, and urine (the bronze infant syndrome).[22] The

pathogenesis of this syndrome is unknown, but it may be related to an accumulation of porphyrins and other metabolites in the plasma of infants who develop cholestasis.[22,23] Although it occurs exclusively in infants with cholestasis, not all infants with cholestatic jaundice develop the syndrome.

This syndrome generally has had few deleterious consequences, and if there is a need for phototherapy, the presence of direct hyperbilirubinemia should not be considered a contraindication to its use. This is particularly important in sick neonates. Because the products of phototherapy are excreted in the bile, the presence of cholestasis will decrease the efficacy of phototherapy. Nevertheless, infants with direct hyperbilirubinemia often show some response to phototherapy. In infants receiving phototherapy who develop the bronze infant syndrome, exchange transfusion should be considered if the TSB is in the intensive phototherapy range and phototherapy does not promptly lower the TSB. Because of the paucity of data, firm recommendations cannot be made. Note, however, that the direct serum bilirubin should not be subtracted from the TSB concentration in making decisions about exchange transfusions (see Fig 4).

Rarely, purpura and bullous eruptions have been described in infants with severe cholestatic jaundice receiving phototherapy,[24,25] and severe blistering and photosensitivity during phototherapy have occurred in infants with congenital erythropoietic porphyria.[26,27] Congenital porphyria or a family history of porphyria is an absolute contraindication to the use of phototherapy, as is the concomitant use of drugs or agents that are photosensitizers.[28]

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All clinical practice guidelines from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

ERRATUM

Two errors appeared in the American Academy of Pediatrics clinical practice guideline, titled "Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation," that was published in the July 2004 issue of *Pediatrics* (2004;114:297–316). On page 107, Background section, first paragraph, the second sentence should read: "The current guideline represents a consensus of the committee charged by the AAP with reviewing and updating the existing guideline and is based on a careful review of the evidence, including a comprehensive literature review by the Agency for Healthcare Research and Quality and the New England Medical Center Evidence-Based Practice Center.[2″] On page 118, Appendix 1, first paragraph, the 4 levels of evidence quality should have been labeled A, B, C, and D rather than 1, 2, 3, and 4, respectively. The American Academy of Pediatrics regrets these errors.

Technical Report Summary: An Evidence-Based Review of Important Issues Concerning Neonatal Hyperbilirubinemia

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For the complete technical report, including tables, figures, and references, please see the companion CD-ROM.

ABSTRACT. This article is adapted from a published evidence report concerning neonatal hyperbilirubinemia with an added section on the risk of blood exchange transfusion (BET). Based on a summary of multiple case reports that spanned more than 30 years, we conclude that kernicterus, although infrequent, has at least 10% mortality and at least 70% long-term morbidity. It is evident that the preponderance of kernicterus cases occurred in infants with a bilirubin level higher than 20 mg/dL. Given the diversity of conclusions on the relationship between peak bilirubin levels and behavioral and neurodevelopmental outcomes, it is apparent that the use of a single total serum bilirubin level to predict long-term outcomes is inadequate and will lead to conflicting results. Evidence for efficacy of treatments for neonatal hyperbilirubinemia was limited. Overall, the 4 qualifying studies showed that phototherapy had an absolute risk-reduction rate of 10% to 17% for prevention of serum bilirubin levels higher than 20 mg/dL in healthy infants with jaundice. There is no evidence to suggest that phototherapy for neonatal hyperbilirubinemia has any long-term adverse neurodevelopmental effects. Transcutaneous measurements of bilirubin have a linear correlation to total serum bilirubin and may be useful as screening devices to detect clinically significant jaundice and decrease the need for serum bilirubin determinations. Based on our review of the risks associated with BETs from 15 studies consisting mainly of infants born before 1970, we conclude that the mortality within 6 hours of BET ranged from 3 per 1000 to 4 per 1000 exchanged infants who were term and without serious hemolytic diseases. Regardless of the definitions and rates of BET-associated morbidity and the various pre-ex-change clinical states of the exchanged infants, in many cases the morbidity was minor (eg, postexchange anemia). Based on the results from the most recent study to report BET morbidity, the overall risk of permanent sequelae in 25 sick infants who survived BET was from 5% to 10%.

The American Academy of Pediatrics (AAP) requested an evidence report from the Agency for Healthcare Research and Quality (AHRQ) that would critically examine the available evidence regarding the effect of high levels of bilirubin on behavioral and neurodevelopmental outcomes, role of various comorbid effect modifiers (eg, sepsis and hemolysis) on neurodevelopment, efficacy of phototherapy, reliability of various strategies in predicting significant hyperbilirubinemia, and accuracy of transcutaneous bilirubin (TcB) measurements. The report was used by the AAP to update the 1994 AAP guidelines for the management of neonatal hyperbilirubinemia. This review focuses on otherwise healthy term or near-term (at least 34 weeks' estimated gestational age [EGA] or at least 2500 g birth weight) infants with hyperbilirubinemia. This article is adapted from that published report with an added section on the risk of blood exchange transfusion (BET).

Neither hyperbilirubinemia nor kernicterus are reportable diseases, and there are no reliable sources of information providing national annual estimates. Since the advent of effective prevention of rhesus (Rh) incompatibility and treatment of elevated bilirubin levels with phototherapy, kernicterus has become uncommon. When laboratory records of a 1995–1996 birth cohort of more than 50 000 California infants were examined, Newman et al reported that 2% had total serum bilirubin (TSB) levels higher than 20 mg/dL, 0.15% had levels higher than 25 mg/dL, and only 0.01% had levels higher than 30 mg/dL. (These data were from infants with clinically identified hyperbilirubinemia and, as such, represent a minimum estimate of the true incidence of extreme hyperbilirubinemia.) This is undoubtedly the result of successful prevention of hemolytic anemia and the application of effective treatment of elevated serum bilirubin levels in accordance with currently accepted medical practice. Projecting the California estimates to the national birth rate of 4 million per year, one can predict 80 000, 6000, and 400 newborns per year with bilirubin levels of more than 20, 25, and 30 mg/dL, respectively.

Recently, concern has been expressed that the increase in early hospital discharges, coupled with a rise in breastfeeding rates, has led to a rise in the rate of preventable kernicterus resulting from "unattended to" hyperbilirubinemia. However, a report published in 2002, based on a national registry established since 1992, reported only 90 cases of kernicterus, although the efficiency of case ascertainment is not clear. Thus, there are no data to establish incidence trends reliably for either hyperbilirubinemia or kernicterus.

Despite these constraints, there has been substantial research on the neurodevelopmental outcomes of hyperbilirubinemia and its prediction and treatment. Subsequent sections of this review describe in more detail the precise study questions and the existing published work in this area.

METHODOLOGY

This evidence report is based on a systematic review of the medical literature. Our Evidence-Based Practice Center formed a review team consisting of pediatricians and Evidence-Based Practice Center methodologic staff to review the literature and perform data abstraction and analysis. For details regarding methodology, please see the original AHRQ report.

Key Questions

Question 1: What is the relationship between peak bilirubin levels and/or duration of hyperbilirubinemia and neurodevelopmental outcome?
Question 2: What is the evidence for effect modification of the results in question 1 by GA, hemolysis, serum albumin, and other factors? Question 3: What are the quantitative estimates of efficacy of treatment for 1) reducing peak bilirubin levels (eg, number needed to treat [NNT] at 20 mg/dL to keep TSB from rising); 2) reducing the duration of hyperbilirubinemia (eg, average number of hours by which time TSB is higher than 20 mg/dL may be shortened by treatment); and 3) improving neurodevelopmental outcomes?
Question 4: What is the efficacy of various strategies for predicting hyperbilirubinemia, including hour-specific bilirubin percentiles? Question 5: What is the accuracy of TcB measurements?

Search Strategies

We searched the Medline database on September 25, 2001, for publications from 1966 to the present using relevant medical subject heading terms ("hyperbilirubinemia"; "hyperbilirubinemia, hereditary"; "bilirubin"; "jaundice, neonatal"; and "kernicterus") and text words ("bilirubi n,""hyperbilirubinemia,""jaundice," "kernicterus,"and "neonatal"). The abstracts were limited to human subjects and English-language studies focusing on newborns between birth and 1 month of age. In addition, the same text words used for the Medline search were used to search the Pre-Medline database. The strategy yielded 4280 Medline and 45 Pre-Medline abstracts. We consulted domain experts and examined relevant review articles for additional studies. A supplemental search for case reports of kernicterus in reference lists of relevant articles and reviews was performed also.

Screening and Selection Process

In our preliminary screening of abstracts, we identified more than 600 potentially relevant articles in total for questions 1, 2, and 3. To handle this large number of articles, we devised the following scheme to address the key questions and ensure that the report was completed within the time and resource constraints. We included only studies that measured neurodevelopmental or behavioral outcomes (except for question 3, part 1, for which we evaluated all studies addressing the efficacy of treatment). For the specific question of quantitative estimates of efficacy of treatment, all studies concerning therapies designed to prevent hyperbilirubinemia (generally bilirubin greater than or equal to 20 mg/dL) were included in the review.

Inclusion Criteria

The target population of this review was healthy, term infants. For the purpose of this review, we included articles concerning infants who were at least 34 weeks' EGA at the time of birth. From studies that reported birth weight rather than age, infants whose birth weight was greater than or equal to 2500 g were included. This cutoff was derived from findings of the National Institute of Child Health and Human Development (NICHD) hyperbilirubinemia study, in which none of the 1339 infants weighing greater than or equal to 2500 g were less than 34 weeks' EGA. Articles were selected for inclusion in the systematic review based on the following additional criteria:

Question 1 or 2 (Risk Association)

- Population: infants greater than or equal to 34 weeks' EGA or birth weight greater than or equal to 2500 g.
- Sample size: more than 5 subjects per arm
- Predictors: jaundice or hyperbilirubinemia
- Outcomes: at least 1 behavioral/neurodevelopmental outcome reported in the article
- Study design: prospective cohorts (more than 2 arms), prospective cross-sectional study, prospective longitudinal study, prospective single-arm study, or retrospective cohorts (more than 2 arms)

Case Reports of Kernicterus

- Population: kernicterus case
- Study design: case reports with kernicterus as a predictor or an outcome

Kernicterus, as defined by authors, included any of the following: acute phase of kernicterus (poor feeding, lethargy, high-pitched cry, increased tone, opisthotonos, or seizures), kernicterus sequelae (motor delay, sensorineural hearing loss, gaze palsy, dental dysplasia, cerebral palsy, or mental retardation), necropsy finding of yellow staining in the brain nuclei.

Question 3 (Efficacy of Treatment at Reducing Serum Bilirubin)

- Population: infants greater than or equal to 34 weeks' EGA or birth weight greater than or equal to 2500 g
- Sample size: more than 10 subjects per arm
- Treatments: any treatment for neonatal hyperbilirubinemia
- Outcomes: serum bilirubin level higher than or equal to 20 mg/dL or frequency of BET specifically for bilirubin level higher than or equal to 20 mg/dL
- Study design: randomized or nonrandomized, controlled trials

For All Other Issues

- Population: infants greater than or equal to 34 weeks' EGA or birth weight greater than or equal to 2500 g
- Sample size: more than 10 subjects per arm for phototherapy; any sample size for other treatments
- Treatments: any treatment for neonatal hyperbilirubinemia
- Outcomes: at least 1 neurodevelopmental outcome was reported in the article

Question 4 or 5 (Diagnosis)

- Population: infants greater than or equal to 34 weeks' EGA or birth weight greater than or equal to 2500 g
- Sample size: more than 10 subjects
- Reference standard: laboratory-based TSB

Exclusion Criteria

Case reports of kernicterus were excluded if they did not report serum bilirubin level or GA and birth weight.

Results of Screening of Titles and Abstracts

There were 158, 174, 99, 153, and 79 abstracts for questions 1, 2, 3, 4, and 5, respectively. Some articles were relevant to more than 1 question.

Results of Screening of Full-Text Articles

After full-text screening (according to the inclusion and exclusion criteria described previously), 138 retrieved articles were included in this report. There were 35 articles in the correlation section (questions 1 and 2), 28 articles of kernicterus case reports, 21 articles in the treatment section (question 3), and 54 articles in the diagnosis section (questions 4 and 5). There were inevitable overlaps, because treatment effects and assessment of neurodevelopmental outcomes were inherent in many study designs.

Reporting the Results

Articles that passed the full-text screening were grouped according to topic and analyzed in their entirety. Extracted data were synthesized into evidence tables.

Summarizing the Evidence of Individual Studies

Grading of the evidence can be useful for indicating the overall methodologic quality of a study. The evidence-grading scheme used here assesses 4 dimensions that are important for the proper interpretation of the evidence: study size, applicability, summary of results, and methodologic quality.

Definitions of Terminology

- Confounders (for question 1 only): 1) An ideal study design to answer question 1 would follow 2 groups, jaundiced and normal infants, without treating any infant for a current or consequent jaundice condition and observe their neurodevelopmental outcomes. Therefore, any treatment received by the subjects in the study was defined as a confounder. 2) If subjects had known risk factors for jaundice such as prematurity, breastfeeding, or low birth weight, the risk factors were defined as confounders. 3) Any disease condition other than jaundice was defined as a confounder. 4) Because bilirubin level is the essential predictor, if the study did not report or measure bilirubin levels for the subjects, lack of bilirubin measurements was defined as a confounder.
- Acute phase of kernicterus: poor feeding, lethargy, high-pitched cry, increased tone, opisthotonos, or seizures.
- Chronic kernicterus sequelae: motor delay, sensorineural hearing loss, gaze palsy, dental dysplasia, cerebral palsy, or mental retardation.

Statistical Analyses

In this report, 2 statistical analyses were performed in which there were sufficient data: the NNT and receiver operating characteristics (ROC) curve.

NNT

The NNT can be a clinically meaningful metric to assess the benefits of clinical trials. It is calculated by taking the inverse of the absolute risk difference. The absolute risk difference is the difference between the event rates between the treatment and control groups. For example, if the event rate is 15% in the control group and 10% in the treatment group, the absolute risk difference is 5% (an absolute risk reduction of 5%). The NNT then would be 20 (1 divided by 0.05), meaning that 20 patients will need to be treated to see 1 fewer event. In the setting of neonatal hyperbilirubinemia, NNT might be interpreted as the number of newborns needed to be treated (with phototherapy) at 13 to 15 mg/dL to prevent 1 newborn from reaching 20 mg/dL.

ROC Curve

ROC curves were developed for individual studies in question 4 if multiple thresholds of a diagnostic technology were reported. The areas under the curves (AUCs) were calculated to provide an assessment of the overall accuracy of the tests.

Meta-analyses of Diagnostic Test Performance

Meta-analyses were performed to quantify the TcB measurements for which the data were sufficient. We used 3 complementary methods for assessing diagnostic test performance: summary ROC analysis, independently combined sensitivity and specificity values, and meta-analysis of correlation coefficients.

RESULTS

Question 1. What Is the Relationship Between Peak Bilirubin Levels and/or Duration of Hyperbilirubinemia and Neurodevelopmental Outcome?

The first part of the results for this question deals with kernicterus; the second part deals with otherwise healthy term or near-term infants who had hyperbilirubinemia.

Case Reports of Kernicterus

Our literature search identified 28 case-report articles of infants with kernicterus that reported sufficient data for analysis. (The largest case series of 90 healthy term and near-term infants with kernicterus was reported by Johnson et al in 2002, but no individual data were available and therefore were not included in this analysis. Those cases with available individual data previously reported were included in this analysis.) Most of the articles were identified in Medline and published since 1966. We retrieved additional articles published before 1966 based on review of references in articles published since 1966. Our report focuses on term and near-term infants (greater than or equal to 34 weeks' EGA). Only infants with measured peak bilirubin level and known GA or birth weight or with clinical or autop-sy-diagnosed kernicterus were included in the analysis. It is important to note that some of these peak levels were obtained more than 7 days after birth and therefore may not have represented true peak levels. Similarly, some of the diagnoses of kernicterus were made only at autopsies, and the measured bilirubin levels were obtained more than 24 hours before the infants died, and therefore the reported bilirubin levels may not have reported the true peak levels. Because of the small number of subjects, none of the following comparisons are statistically significant. Furthermore, because case reports in this section represent highly selected cases, interpreting these data must be done cautiously.

Demographics of Kernicterus Cases

Articles identified through the search strategy span from 1955 to 2001 with a total of 123 cases of kernicterus. Twelve cases in 2 studies were reported before 1960; however, some studies reported cases that spanned almost 2 decades. Data on subjects' birth years were reported in only 55 cases. Feeding status, gender, racial background, and ethnicity were not noted in most of the reports. Of those that were reported, almost all the subjects were breastfed and most were males.

Geographic Distribution of Reported Kernicterus Cases

The 28 case reports with a total of 123 cases are from 14 different countries. They are the United States, Singapore, Turkey, Greece, Taiwan, Denmark, Canada, Japan, United Kingdom, France, Jamaica, Norway, Scotland, and Germany. The number of kernicterus cases in each study ranged from 1 to 12.

Kernicterus has been defined by pathologic findings, acute clinical findings, and chronic sequelae (such as deafness or athetoid cerebral palsy). Because of the small number of subjects, all definitions of kernicterus have been included in the analysis. Exceptions will be noted in the following discussion.

Kernicterus Cases With Unknown Etiology

Among infants at greater than or equal to 34 weeks' GA or who weighed 2500 g or more at birth and had no known explanation for kernicterus, there were 35 infants with peak bilirubin ranging from 22.5 to 54 mg/dL. Fifteen had no information on gender, 14 were males, and 6 were females. Fourteen had no information on feeding,

20 were breastfed, and 1 was formula-fed. More than 90% of the infants with kernicterus had bilirubin higher than 25 mg/dL: 25% of the kernicterus cases had peak TSB levels up to 29.9 mg/dL, and 50% had peak TSB levels up to 34.9 mg/dL (Fig 2). There was no association between bilirubin level and birth weight.

Four infants died. Four infants who had acute clinical kernicterus had normal follow-up at 3 to 6 years by telephone. One infant with a peak bilirubin level of 44 mg/dL had a flat brainstem auditory evoked response (BAER) initially but normalized at 2 months of age; this infant had normal neurologic and developmental examinations at 6 months of age. Ten infants had chronic sequelae of kernicterus when followed up between 6 months and 7 years of age. Seven infants were noted to have neurologic findings consistent with kernicterus; however, the age at diagnosis was not provided. Nine infants had a diagnosis of kernicterus with no follow-up information provided. To summarize, 11% of this group of infants died, 14% survived with no sequelae, and at least 46% had chronic sequelae. The distribution of peak TSB levels was higher when only infants who died or had chronic sequelae were included.

Kernicterus Cases With Comorbid Factors

In the 88 term and near-term infants diagnosed with kernicterus and who had hemolysis, sepsis, and other neonatal complications, bilirubin levels ranged from 4.0 to 51.0 mg/dL (as previously mentioned, these may not represent true peak levels; the bilirubin level of 4 mg/dL was measured more than 24 hours before the infant died, the diagnosis of kernicterus was made by autopsy). Forty-two cases provided no information on gender, 25 were males, and 21 were females. Seventy-two cases had no information on feeding, 15 were breastfed, and 1 was formula-fed. Most infants with kernicterus had bilirubin levels higher than 20 mg/dL: 25% of the kernicterus cases had peak TSB levels up to 24.9 mg/dL, and 50% had peak TSB levels up to 29.9 mg/dL (Fig 4). In this group, there was no association between the bilirubin levels and birth weight.

Five infants without clinical signs of kernicterus were diagnosed with kernicterus by autopsy. Eight infants died of kernicterus. One infant was found to have a normal neurologic examination at 4 months of age. Another infant with galactosemia and a bilirubin level of 43.6 mg/dL who had acute kernicterus was normal at 5 months of age. Forty-nine patients had chronic sequelae ranging from hearing loss to athetoid cerebral palsy; the follow-up age reported ranged from 4 months to 14 years. Twenty-one patients were diagnosed with kernicterus, with no fol-low-up information. Not including the autopsy-diagnosed kernicterus, 10% of these infants died (8/82), 2% were found to be normal at 4 to 5 months of age, and at least 60% had chronic sequelae. The distribution of peak TSB levels was slightly higher when only infants who died or had chronic sequelae were included.

Evidence Associating Bilirubin Exposures With Neurodevelopmental Outcomes in Healthy Term or Near-Term Infants

This section examines the evidence associating bilirubin exposures with neurodevelopmental outcomes primarily in subjects without kernicterus. Studies that were designed specifically to address the behavioral and neurodevelopmental outcomes in healthy infants at more than or equal to 34 weeks' GA will be discussed first. With the exception of the results from the Collaborative Perinatal Project (CPP) (CPP, with 54 795 subjects, has generated many follow-up studies with a smaller number of subjects, and those studies were discussed together in a separate section in the AHRQ summary report), the remainder of the studies that include mixed subjects (preterm and term, diseased and nondiseased) were categorized and discussed by outcome measures. These measures include behavioral and neurologic outcomes; hearing impairment, including sensorineural hearing loss; and intelligence measurements.

The CPP, with 54 795 live births between 1959 and 1966 from 12 centers in the United States, produced the largest database for the study of hyperbilirubinemia. Newman and Klebanoff, focusing only on black and white infants weighing 2500 g or more at birth, did a comprehensive analysis of 7-year outcome in 33 272 subjects. All causes of jaundice were included in the analysis. The study found no consistent association between peak bilirubin level and intelligence quotient (IQ). Sensorineural hearing loss was not related to bilirubin level. Only the frequency of abnormal or suspicious neurologic examinations was associated with bilirubin level. The specific neurologic examination items most associated with bilirubin levels were mild and nonspecific motor abnormalities.

In other studies stemming from the CPP population, there was no consistent evidence to suggest neurologic abnormalities in children with neonatal bilirubin higher than 20 mg/dL when followed up to 7 years of age.

A question that has concerned pediatricians for many years is whether moderate hyperbilirubinemia is associated with abnormalities in neurodevelopmental outcome in term healthy infants without perinatal or neonatal problems. Only 4 prospective studies and 1 retrospective study have the requisite subject characteristics to address this issue. Although there were some short-term (less than 12 months) abnormal neurologic or behavioral characteristics noted in infants with high bilirubin, the studies had methodologic problems and did not show consistent results.

Evidence Associating Bilirubin Exposures With Neurodevelopmental Outcomes in All Infants

These studies consist of subjects who, in addition to healthy term newborns, might include newborns less than 34 weeks' GA and neonatal complications such as sepsis, respiratory distress, hemolytic disorders, and other factors. Nevertheless, some of the conclusions drawn might be applicable to a healthy term population. In these studies, greater emphasis will be placed on the reported results for the group of infants who were at greater than or equal to 34 weeks' EGA or weighed 2500 g or more at birth.

Studies Measuring Behavioral and Neurologic Outcomes in Infants With Hyperbilirubinemia

A total of 9 studies in 11 publications examined primarily behavioral and neurologic outcomes in patients with hyperbilirubinemia. Of these 9 studies, 3 were of high methodologic quality. One short-term study showed a correlation between bilirubin level and decreased scores on newborn behavioral measurements. One study found no difference in prevalence of central nervous system abnormalities at 4 years old if bilirubin levels were less than 20 mg/dL, but infants with bilirubin levels higher than 20 mg/dL had a higher prevalence of central nervous system abnormalities. Another study that followed infants with bilirubin levels higher than 16 mg/dL found no relationship between bilirubin and neurovisuomotor testing at 61 to 82 months of age. Although data reported in the remainder of the studies are of lower methodologic quality, there is a suggestion of abnormalities in neurodevelopmental screening tests in infants with bilirubin levels higher than 20 mg/dL, at least by the Denver Developmental Screening Test, when infants were followed up at 1 year of age. It seems that bilirubin levels higher than 20 mg/dL may have short-term (up to 1 year of age) adverse effects at least by the Denver Developmental Screening Test, but there is no strong evidence to suggest neurologic abnormalities in children with neonatal bilirubin levels higher than 20 mg/dL when followed up to 7 years of age.

Effect of Bilirubin on Brainstem Auditory Evoked Potential (BAEP)

The following group of studies, in 14 publications, primarily examined the effect of bilirubin on BAEP or hearing impairment. Eight high-quality studies showed a significant relationship between abnormalities in BAEP and high bilirubin levels. Most reported resolution of abnormalities with treatment. Three studies reported hearing impairment associated with elevated bilirubin (higher than 16–20 mg/dL).

Effect of Bilirubin on Intelligence Outcomes

Eight studies looked primarily at the effect of bilirubin on intelligence outcomes. Four high-quality studies with follow-up ranging from 6.5 to 17 years reported no association between IQ and bilirubin level.

Question 2. What Is the Evidence for Effect Modification of the Results in Question 1 by GA, Hemolysis, Serum Albumin, and Other Factors?

There is only 1 article that directly addressed this question. Naeye, using the CPP population, found that at 4 years old the frequency of low IQ with increasing bilirubin levels increased more rapidly in infants with infected amniotic fluid. At 7 years old, neurologic abnormalities also were more prevalent in that subgroup of infants.

When comparing the group of term and near-term infants with comorbid factors who had kernicterus to the group of infants with idiopathic hyperbilirubinemia and kernicterus, the overall mean bilirubin was 31.6 ± 9 mg/dL in the former, versus 35.4 ± 8 mg/dL in the latter (difference not significant). Infants with glucose-6-phosphate dehydrogenase deficiency, sepsis, ABO incompatibility, or Rh incompatibility had similar mean bilirubin levels. Infants with more than 1 comorbid factor had a slightly lower mean bilirubin level of 29.1 ± 16.1 mg/dL.

Eighteen of 23 (78%) term infants with idiopathic hyperbilirubinemia and who developed acute kernicterus survived the neonatal period with chronic sequelae. Thirty-nine of 41 (95%) term infants with kernicterus and ABO or Rh incompatibility had chronic sequelae. Four of 5 (80%) infants with sepsis and kernicterus had chronic sequelae. All 4 infants with multiple comorbid factors had sequelae.

No firm conclusions can be drawn regarding co-morbid factors and kernicterus, because this is a small number of patients from a variety of case reports.

There was no direct study concerning serum albumin level as an effect modifier of neurodevelopmental outcome in infants with hyperbilirubinemia. One report found a significant association between reserve albumin concentration and latency to wave V in BAEP studies.

In addition, Ozmert et al noted that exchange transfusion and the duration that the infant's serum indirect bilirubin level remained higher than 20 mg/dL were important risk factors for prominent neurologic abnormalities.

Question 3. What Are the Quantitative Estimates of Efficacy of Treatment at 1) Reducing Peak Bilirubin Levels (eg, NNT at 20 mg/dL to Keep TSB From Rising); 2) Reducing the Duration of Hyperbilirubinemia (eg, Average Number of Hours by Which Time TSB Levels Higher Than 20 mg/dL May Be Shortened by Treatment); and 3) Improving Neurodevelopmental Outcomes?

Studies on phototherapy efficacy in terms of preventing TSB rising to the level that would require BET (and therefore would be considered "failure of phototherapy") were reviewed for the quantitative estimates of efficacy of phototherapy. Because trials evaluating the efficacy of phototherapy at improving neurodevelopmental outcomes by comparing 1 group of infants with treatment to an

untreated group do not exist, the effects of treatment on neurodevelopmental outcomes could only be reviewed descriptively. Furthermore, all the reports primarily examined the efficacy of treatment at 15 mg/dL to prevent TSB from exceeding 20 mg/dL. There is no study to examine the efficacy of treatment at 20 mg/dL to prevent the TSB from rising.

Efficacy of Phototherapy for Prevention of TSB Levels Higher Than 20 mg/dL

Four publications examined the clinical efficacy of phototherapy for prevention of TSB levels higher than 20 mg/dL.

Two studies evaluated the same sample of infants. Both reports were derived from a randomized, controlled trial of phototherapy for neonatal hyperbilirubinemia commissioned by the NICHD between 1974 and 1976.

Because the phototherapy protocols differed significantly in the remaining studies, their results could not be statistically combined and are reported here separately. A total of 893 term or near-term jaundiced infants (325 in the treatment group and 568 in the control group) were evaluated in the current review.

The development, design, and sample composition of NICHD phototherapy trial were reported in detail elsewhere. The NICHD controlled trial of phototherapy for neonatal hyperbilirubinemia consisted of 672 infants who received phototherapy and 667 control infants. Brown et al evaluated the efficacy of phototherapy for prevention of the need for BET in the NICHD study population. For the purpose of current review, only the subgroup of 140 infants in the treatment groups and 136 in the control groups with birth weights 2500 g or more and greater than or equal to 34 weeks' GA were evaluated. The serum bilirubin level as criterion for BET in infants with birth weights of 2500 g or more was 20 mg/dL at standard risk and 18 mg/dL at high risk. It was found that infants with hyperbilirubinemia secondary to nonhemolytic causes who received phototherapy had a 14.3% risk reduction of BET than infants in no treatment group. NNT for prevention of the need for BET or for TSB levels higher than 20 mg/dL was 7 (95% confidence interval [CI]: 6–8). However, phototherapy did not reduce the need for BET for infants with hemolytic diseases or in the high-risk group. No therapeutic effect on reducing the BET rate in infants at greater than or equal to 34 weeks' GA with hemolytic disease was observed.

The same group of infants, 140 subjects in the treatment group and 136 controls with birth weights 2500 g or more and greater than or equal to 34 weeks' GA, were evaluated for the effect of phototherapy on the hyperbilirubinemia of Coombs' positive hemolytic disease in the study of Maurer et al. Of the 276 infants whose birth weights were 2500 g or more, 64 (23%) had positive Coombs' tests: 58 secondary to ABO incompatibility and 6 secondary to Rh incompatibility. Thirty-four of 64 in this group received phototherapy. The other 30 were placed in the control group. Of the 212 subjects who had negative Coombs' tests, 106 were in the treatment group and the same number was in the control group. No therapeutic effect on reducing the BET rate was observed in infants with Coombs' positive hemolytic disease, but there was a 9.4% absolute risk reduction in infants who had negative Coombs' tests. In this group of infants, the NNT for prevention of the need for BET, or a TSB higher than 20 mg/dL, was 11 (95% CI: 10–12).

A more recent randomized, controlled trial compared the effect of 4 different interventions on hyperbilirubinemia (serum bilirubin concentration greater than or equal to 291 μmol/L or 17 mg/dL) in 125 term breastfed infants. Infants with any congenital anomalies, neonatal complications, hematocrit more than 65%, significant bruising or large cephalohematomas, or hemolytic disease were excluded. The 4 interventions in the study were 1) continue breastfeeding and observe (N = 25); 2) discontinue breastfeeding and substitute formula (N = 26); 3) discontinue breastfeeding, substitute formula, and administer phototherapy (N = 38); and 4) continue breastfeeding and administer phototherapy (N = 36). The interventions were considered failures if serum bilirubin levels reached 324 μmol/L or 20 mg/dL. For the purpose of the current review, we regrouped the subjects into treatment group or phototherapy group and control group or no-phototherapy group. Therefore, the original groups 4 and 3 became the treatment groups I and II, and the original groups 1 and 2 were the corresponding control groups I and II. It was found that treatment I, phototherapy with continuation of breastfeeding, had a 10% absolute risk-reduction rate, and the NNT for prevention of a serum bilirubin level higher than 20 mg/dL was 10 (95% CI: 9–12). Compared with treatment I, treatment II (phototherapy with discontinuation of breastfeeding) was significantly more efficacious. The absolute risk-reduction rate was 17%, and the NNT for prevention of a serum bilirubin level exceeding 20 mg/dL was 6 (95% CI: 5–7).

John reported the effect of phototherapy in 492 term neonates born during 1971 and 1972 who developed unexplained jaundice with bilirubin levels higher than 15 mg/dL. One hundred eleven infants received phototherapy, and 381 did not. The author stated: "The choice of therapy was, in effect, random since two pediatricians approved of the treatment and two did not." The results showed that phototherapy had an 11% risk reduction of BET, performed in treatment and control groups when serum bilirubin levels exceeded 20 mg/dL. Therefore, the NNT for prevention of a serum bilirubin level higher than 20 mg/dL was 9 (95% CI: 8–10).

Regardless of different protocols for phototherapy, the NNT for prevention of serum bilirubin levels higher than 20 mg/dL ranged from 6 to 10 in healthy term or near-term infants. Evidence for the efficacy of treatments

for neonatal hyperbilirubinemia was limited. Overall, the 4 qualifying studies showed that phototherapy had an absolute risk-reduction rate of 10% to 17% for prevention of serum bilirubin exceeding 20 mg/dL in healthy and jaundiced infants (TSB levels higher than or equal to 13 mg/dL) born at greater than or equal to 34 weeks' GA. Phototherapy combined with cessation of breastfeeding and substitution with formula was found to be the most efficient treatment protocol for healthy term or near-term infants with jaundice.

Effectiveness of Reduction in Bilirubin Level on BAER in Jaundiced Infants With Greater Than or Equal to 34 Weeks' EGA

Eight studies that compared BAER before and after treatments for neonatal hyperbilirubinemia are discussed in this section. Of the 8 studies, 3 studies treated jaundiced infants by administering phototherapy followed by BET according to different guidelines, 4 studies treated jaundiced infants with BET only, and 1 study did not specify what treatments jaundiced infants received. All the studies consistently showed that treatments for neonatal hyperbilirubinemia significantly improved abnormal BAERs in healthy jaundiced infants and jaundiced infants with hemolytic disease.

Effect of Phototherapy on Behavioral and Neurologic Outcomes and IQ

Five studies looked at the effect of hyperbilirubinemia and phototherapy on behavior. Of the 5 studies, 4 used the Brazelton Neonatal Behavioral Assessment Scale and 1 used the Vineland Social Maturity Scale. Three studies reported lower scores in the orientation cluster of the Brazelton Neonatal Behavioral Assessment Scale in the infants treated with phototherapy. The other 2 studies did not find behavioral changes in the phototherapy group. One study evaluated IQ at the age of 17 years. In 42 term infants with severe hyperbilirubinemia who were treated with phototherapy, 31 were also treated with BET. Forty-two infants who did not receive phototherapy were selected as controls. No significant difference in IQ between the 2 groups was found.

Effect of Phototherapy on Visual Outcomes

Three studies were identified that studied the effect of serum bilirubin and treatment on visual outcomes. All showed no short-or long-term (up to 36 months) effect on vision as a result of phototherapy when infants' eyes are protected properly during treatment.

Question 4. What Is the Accuracy of Various Strategies for Predicting Hyperbilirubinemia, Including Hour-Specific Bilirubin Percentiles?

Ten qualifying studies published from 1977 to 2001 examining 5 prediction methods of neonatal hyperbilirubinemia were included. A total of 8167 neonates, most healthy near-term or term infants, were subjects. These studies were conducted among multiple racial groups in multiple countries including China, Denmark, India, Israel, Japan, Spain, and the United States. Some studies included subjects with ABO incompatibility, and some did not. Four studies examined the accuracy of cord bilirubin level as a test for predicting the development of clinically significant neonatal jaundice. Four studies investigated the test performance of serum bilirubin levels before 48 hours of life to predict hyperbilirubinemia. Two studies further compared the test performances of cord bilirubin with that of early serum bilirubin levels. The accuracy of end-tidal carbon monoxide concentration as a predictor of the development of hyperbilirubinemia was examined in Okuyama et al and Stevenson et al. The study by Stevenson et al also examined the test performance of a combined strategy of end-tidal carbon monoxide concentration and early serum bilirubin levels. Finally, 2 studies tested the efficacy of predischarge risk assessment, determined by a risk index model and hour-specific bilirubin percentile, respectively, for predicting neonatal hyperbilirubinemia.

ROC curves were developed for 3 of the predictive strategies. The AUCs were calculated to provide an assessment of the overall accuracy of the tests. Hour-specific bilirubin percentiles had an AUC of 0.93, cord bilirubin levels had an AUC of 0.74, and predischarge risk index had an AUC of 0.80. These numbers should not be compared directly with each other, because the studies had different population characteristics and different defining parameters for hyperbilirubinemia.

Question 5. What Is the Accuracy of TcB Measurements?

A total of 47 qualifying studies in 50 publications examining the test performance of TcB measurements and/or the correlation of TcB measurements to serum bilirubin levels was reviewed in this section. Of the 47 studies, the Minolta Air-Shields jaundice meter (Air-Shields, Hatboro, PA) was used in 41 studies, the BiliCheck (SpectRx Inc, Norcross, GA) was used in 3 studies, the Ingram icterometer (Thomas A. Ingram and Co, Birmingham, England; distributed in the United States by Cascade Health Care Products, Salem, OR) was used in 4 studies, and the ColorMate III (Chromatics Color Sciences International Inc, New York, NY) was used in 1 study.

Based on the evidence from the systematic review, TcB measurements by each of the 4 devices described in the literature (the Minolta Air-Shields jaundice meter, Ingram icterometer, BiliCheck, and Chromatics ColorMate

III) have a linear correlation to TSB and may be useful as screening devices to detect clinically significant jaundice and decrease the need for serum bilirubin determinations.

Minolta Air-Shields Jaundice Meter

Generally, TcB readings from the forehead or sternum have correlated well with TSB but with a wide range of correlation coefficients, from a low of 0.52 for subgroup of infants less than 37 weeks' GA to as high as 0.96. Comparison of correlations across studies is difficult because of differences in study design and selection procedures. TcB indices that correspond to various TSB levels vary from institution to institution but seem to be internally consistent. Different TSB threshold levels were used across studies; therefore, there is limited ability to combine data across the studies. Most of the studies used TcB measurements taken at the forehead, several studies used multiple sites and combined results, 1 study used only the midsternum site, and 3 studies took the TcB measurement at multiple sites.

The Minolta Air-Shields jaundice meter seems to perform less well in black infants, compared with white infants, performs best when measurements are made at the sternum, and performs less well when infants have been exposed to phototherapy. This instrument requires daily calibration, and each institution must develop its own correlation curves of TcB to TSB. Eleven studies of the test performance of the Minolta Air-Shields jaundice meter measuring at forehead to predict a serum bilirubin threshold of higher than or equal to 13 mg/dL were included in the following analysis. A total of 1560 paired TcB and serum bilirubin measurements were evaluated. The cutoff points of Minolta AirShields TcB measurements (TcB index) ranged from 13 to 24 for predicting a serum bilirubin level higher than or equal to 13 mg/dL. As a screening test, it does not perform consistently across studies, as evidenced by the heterogeneity in the summary ROC curves not explained by threshold effect. The overall unweighted pooled estimates of sensitivity and specificity were 0.85 (0.77–0.91) and 0.77 (0.66–0.85).

Ingram Icterometer

The Ingram icterometer consists of a strip of transparent Plexiglas on which 5 yellow transverse stripes of precise and graded hue are painted. The correlation coefficients (r) in the 4 studies ranged from 0.63 to 0.97. The icterometer has the added limitation of lacking the objectivity of the other methods, because it depends on observer visualization of depth of yellow color of the skin.

BiliCheck

The recently introduced BiliCheck device, which uses reflectance data from multiple wavelengths, seems to be a significant improvement over the older devices (the Ingram icterometer and the Minolta Air-Shields jaundice meter) because of its ability to determine correction factors for the effect of melanin and hemoglobin. Three studies examined the accuracy of the BiliCheck TcB measurements to predict TSB ("gold standard"). All studies were rated as high quality. The correlation coefficient ranged from 0.83 to 0.91. In 1 study, the BiliCheck was shown to be as accurate as the laboratory measurement of TSB when compared with the reference gold-standard high-performance liquid chromatography (HPLC) measurement of TSB. Analysis of covariance found no differences in test performance by postnatal age, GA, birth weight, or race; however, 66.7% were white and only 4.3% were black.

Chromatics ColorMate III

One study that evaluated the performance of the ColorMate III transcutaneous bilirubinometer was reviewed. The correlation coefficient for the whole study group was 0.9563, and accuracy was not affected by race, weight, or phototherapy. The accuracy of the device is increased by the determination of an infant's underlying skin type before the onset of visual jaundice; thus, a drawback to the method when used as a screening device is that all infants would require an initial baseline measurement.

CONCLUSIONS AND DISCUSSION

Summarizing case reports of kernicterus from different investigators in different countries from different periods is problematic. First, definitions of kernicterus used in these reports varied greatly. They included gross yellow staining of the brain, microscopic neuronal degeneration, acute clinical neuromotor impairment, neuroauditory impairment, and chronic neuromotor impairment. In some cases, the diagnoses were not established until months or years after birth. Second, case reports without controls makes interpretation difficult, especially in infants with comorbid factors, and could very well lead to misinterpretation of the role of bilirubin in neurodevelopmental outcomes. Third, different reports used different outcome measures. "Normal at follow-up" may be based on parental reporting, physician assessment, or formal neuropsychologic testing. Fourth, time of reported follow-up ranged from days to years. Fifth, cases were reported from different countries at different periods and with different standards of practice managing hyperbilirubinemia. Some countries have a high prevalence of glucose-6-phosphate dehydrogenase deficiency. Some have cultural practices that predispose their infants to agents that cause hyperbilirubinemia (such as clothing stored in dressers with naphthalene moth balls). The effect of the differences on outcomes cannot be known for certain. Finally, it is difficult to infer from case reports the true incidence of this uncommon disorder.

To recap our findings, based on a summary of multiple case reports that spanned more than 30 years, we conclude that kernicterus, although infrequent, has significant mortality (at least 10%) and long-term morbidity (at least

70%). It is evident that the preponderance of kernicterus cases occurred in infants with high bilirubin (more than 20 mg/dL).

Of 26 (19%) term or near-term infants with acute manifestations of kernicterus and reported follow-up data, 5 survived without sequelae, whereas only 3 of 63 (5%) infants with acute kernicterus and comorbid factors were reported to be normal at follow-up. This result suggests the importance of comorbid factors in determining long-term outcome in infants initially diagnosed with kernicterus.

For future research, reaching a national consensus in defining this entity, as in the model suggested by Johnson et al, will help in formulating a valid comparison of different databases. It is also apparent that, without good prevalence and incidence data on hyperbilirubinemia and kernicterus, one would not be able to estimate the risk of kernicterus at a given bilirubin level. Making severe hyperbilirubinemia (eg, greater than or equal to 25 mg/dL) and kernicterus reportable conditions would be a first step in that direction. Also, because kernicterus is infrequent, doing a multicenter case-control study with kernicterus may help to delineate the role of bilirubin in the development of kernicterus.

Hyperbilirubinemia, in most cases, is a necessary but not sufficient condition to explain kernicterus. Factors acting in concert with bilirubin must be studied to seek a satisfactory explanation. Information from duration of exposure to bilirubin and albumin binding of bilirubin may yield a more useful profile of the risk of kernicterus.

Only a few prospective controlled studies looked specifically at behavioral and neurodevelopmental outcomes in healthy term infants with hyperbilirubinemia. Most of these studies have a small number of subjects. Two short-term studies with well-defined measurement of newborn behavioral organization and physiologic measurement of cry are of high methodologic quality; however, the significance of long-term abnormalities in newborn behavior scales and variations in cry formant frequencies are unknown. There remains little information on the long-term effects of hyperbilirubinemia in healthy term infants.

Among the mixed studies (combined term and preterm, nonhemolytic and hemolytic, nondiseased and diseased), the following observations can be made:

- Nine of 15 studies (excluding the CPP) addressing neuroauditory development and bilirubin level were of high quality. Six of them showed BAER abnormalities correlated with high bilirubin levels. Most reported resolution with treatment. Three studies reported hearing impairment associated with elevated bilirubin (more than 16 to more than 20 mg/dL). We conclude that a high bilirubin level does have an adverse effect on neuroauditory function, but the adverse effect on BAER is reversible.
- Of the 8 studies reporting intelligence outcomes in subjects with hyperbilirubinemia, 4 studies were considered high quality. These 4 studies reported no association between IQ and bilirubin level, with follow-up ranging from 6.5 to 17 years. We conclude that there is no evidence to suggest a linear association of bilirubin level and IQ.
- The analysis of the CPP population found no consistent association between peak bilirubin level and IQ. Sensorineural hearing loss was not related to bilirubin level. Only the frequency of abnormal or suspicious neurologic examinations was associated with bilirubin level. In the rest of the studies from the CPP population, there was no consistent evidence to suggest neurologic abnormalities in children with neonatal bilirubin levels more than 20 mg/dL when followed up to 7 years of age.

A large prospective study comprising healthy infants greater than or equal to 34 weeks' GA with hyperbilirubinemia, specifically looking at long-term neurodevelopmental outcomes, has yet to be done. The report of Newman and Klebanoff came closest to that ideal because of the large number of subjects and the study's analytic approach. However, a population born from 1959 to 1966 is no longer representative of present-day newborns: 1) there is now increased ethnic diversity in our newborn population; 2) breast milk jaundice has become more common than hemolytic jaundice; 3) phototherapy for hyperbilirubinemia has become standard therapy; and 4) hospital stays are shorter. These changes in biologic, cultural, and health care characteristics make it difficult to apply the conclusions from the CPP population to present-day newborns.

Although short-term studies, in general, have good methodologic quality, they use tools that have unknown long-term predictive abilities. Long-term studies suffer from high attrition rates of the study population and a nonuniform approach to defining "normal neurodevelopmental outcomes." The total bilirubin levels reported in all the studies mentioned were measured anywhere from the first day of life to more than 2 weeks of life. Definitions of significant hyperbilirubinemia ranged from greater than or equal to 12 mg/dL to greater than or equal to 20 mg/dL.

Given the diversity of conclusions reported, except in cases of kernicterus with sequelae, it is evident that the use of a single TSB level (within the range described in this review) to predict long-term behavioral or neurodevelopmental outcomes is inadequate and will lead to conflicting results.

Evidence for the efficacy of treatments for neonatal hyperbilirubinemia was limited. Overall, the 4 qualifying studies showed that phototherapy had an absolute risk-reduction rate of 10% to 17% for prevention of serum bilirubin exceeding 20 mg/dL in healthy jaundiced infants

(TSB higher than or equal to 13 mg/dL) of greater than or equal to 34 weeks' GA. Phototherapy combined with cessation of breastfeeding and substitution with formula was found to be the most efficient treatment protocol for healthy term or near-term infants with jaundice. There is no evidence to suggest that phototherapy for neonatal hyperbilirubinemia has any long-term adverse neurodevelopmental effects in either healthy jaundiced infants or infants with hemolytic disease. It is also noted that in all the studies listed, none of the infants received what is currently known as "intensive phototherapy." Although phototherapy did not reduce the need for BET in infants with hemolytic disease in the NICHD phototherapy trial, it could be attributable to the low dose of phototherapy used. Proper application of "intensive phototherapy" should decrease the need for BET further.

It is difficult to draw conclusions regarding the accuracy of various strategies for prediction of neonatal hyperbilirubinemia. The first challenge is the lack of consistency in defining clinically significant neonatal hyperbilirubinemia. Not only did multiple studies use different levels of TSB to define neonatal hyperbilirubinemia, but the levels of TSB defined as significant also varied by age, but age at TSB determination varied by study as well. For example, significant levels of TSB were defined as more than 11.7, more than or equal to 15, more than 15, more than 16, more than 17, and more than or equal to 25 mg/dL.

A second challenge is the heterogeneity of the study populations. The studies were conducted in many racial groups in different countries including China, Denmark, India, Israel, Japan, Spain, and the United States. Although infants were defined as healthy term and near-term newborns, these studies included neonates with potential for hemolysis from ABO-incompatible pregnancies as well as breastfed and bottle-fed infants (often not specified). Therefore, it is not possible to directly compare the different predicting strategies. However, all the strategies provided strong evidence that early jaundice predicts late jaundice.

Hour-specific bilirubin percentiles had an AUC of 0.93, implying great accuracy of this strategy. In that study, 2976 of 13 003 eligible infants had a postdischarge TSB measurement, as discussed by Maisels and Newman. Because of the large number of infants who did not have a postdischarge TSB, the actual study sample would be deficient in study participants with low predischarge bilirubin levels, leading to false high-sensitivity estimates and false low-specificity estimates. Moreover, the population in the study is not representative of the entire US population. The strategy of using early hour-specific bilirubin percentiles to predict late jaundice looks promising, but a large multicenter study (with evaluation of potential differences by race and ethnicity as well as prenatal, natal, and postnatal factors) may need to be undertaken to produce more applicable data.

TcB measurements by each of the 3 devices described in the literature, the Minolta Air-Shields jaundice meter, the Ingram icterometer, and the Bili-Check, have a linear correlation to TSB and may be useful as screening devices to detect clinically significant jaundice and decrease the need for serum bilirubin determinations.

The recently introduced BiliCheck device, which uses reflectance data from multiple wavelengths, seems to be a significant improvement over the older devices (the Ingram icterometer and the Minolta Air-Shields jaundice meter) because of its ability to determine correction factors for the effect of melanin and hemoglobin. In 1 study, the BiliCheck was shown to be as accurate as laboratory measures of TSB when compared with the reference gold-standard HPLC measurement of TSB.

Future research should confirm these findings in larger samples of diverse populations and address issues that might affect performance, such as race, GA, age at measurement, phototherapy, sunlight exposure, feeding and accuracy as screening instruments, performance at higher levels of bilirubin, and ongoing monitoring of jaundice. Additionally, studies should address cost-effectiveness and reproducibility in actual clinical practice. Given the interlaboratory variability of measurements of TSB, future studies of noninvasive measures of bilirubin should use HPLC and routine laboratory methods of TSB as reference standards, because the transcutaneous measures may prove to be as accurate as the laboratory measurement when compared with HPLC as the gold standard.

Using correlation coefficients to determine the accuracy of TcB measurements should be interpreted carefully because of several limitations:

- The correlation coefficient does not provide any information about the clinical utility of the diagnostic test.
- Although correlation coefficients measure the association between TcB and "standard" serum bilirubin measurements, the correlation coefficient is highly dependent on the distribution of serum bilirubin in the study population selected.
- Correlation measures ignore bias and measure relative rather than absolute agreement.

ADDENDUM: THE RISK OF BET

At the suggestion of AAP technical experts, a review of the risks associated with BET was also undertaken after the original AHRQ report was published. Articles were obtained from an informal survey of studies published since 1960 dealing with large populations that permitted calculations of the risks of morbidity and mortality. Of 15 studies, 8 consisted of subjects born before 1970. One article published in 1997 consisted of subjects born in 1994 and 1995.

Fifteen studies that reported data on BET-related mortality and/or morbidity were included in this review. Three categories were created to describe the percentage

of subjects who met the criteria of the target population of our evidence report (ie, term idiopathic jaundice infants). Category I indicates that more than 50% of the study subjects were term infants whose pre-exchange clinical state was vigorous or stable and without disease conditions other than jaundice. Category II indicates that between 10% and 50% of the study subjects had category I characteristics. Category III indicates that more than 90% of the study subjects were preterm infants and/or term infants whose pre-exchange clinical state was not stable or was critically ill and with other disease conditions.

BET Subject and Study Characteristics

Because BET is no longer the mainstay of treatment for hyperbilirubinemia, most infants who underwent BETs were born in the 1950s to 1970s. Two recent studies reported BET-related mortality and morbidity for infants born from 1981 to 1995. After 1970, there were more infants who were premature, low birth weight or very low birth weight, and/or had a clinical condition(s) other than jaundice who received BETs than those born in earlier years. Not all infants in this review received BETs for hyperbilirubinemia. Because of limited data on subjects' bilirubin levels when the BETs were performed, we could not exclude those nonjaundiced infants.

BET-Associated Mortality

For all infants, the reported BET-related mortality ranged from 0% to 7%. There were no consistent definitions for BET-related mortality in the studies. An infant who died within 6 hours after the BET was the first used to define a BET-related death by Boggs and Westphal in 1960. Including the study from Boggs and Westphal, there were 3 studies reporting the 6-hour mortality, and they ranged from 0% to 1.9%. It is difficult to isolate BET as the sole factor in explaining mortality, because most of the subjects have significant associated pre-exchange disease morbidities. Most of the infants who died from BET had blood incompatibility and sepsis or were premature, had kernicterus, and/or were critically ill before undergoing BET. When only term infants were counted, the 6-hour mortality ranged from 3 to 19 per 1000 exchanged. When those term infants with serious hemolytic diseases (such as Rh incompatibility) were excluded, the 6-hour mortality ranged from 3 to 4 per 1000 exchanged infants. All these infants were born before 1970, and their jaundice was primarily due to ABO incompatibility.

BET-Associated Morbidity

There is an extensive list of complications that have been associated with BETs. Complications include those related to the use of blood products (infection, hemolysis of transfused blood, thromboembolization, graft versus host reactions), metabolic derangements (acidosis and perturbation of the serum concentrations of potassium, sodium, glucose, and calcium), cardiorespiratory reactions (including arrhythmias, apnea, and cardiac arrest), complications related to umbilical venous and arterial catheterization, and other miscellaneous complications. As noted previously, the pre-exchange clinical state of the infants studied varied widely, as did the definitions and rates of BET-associated morbidity. In many cases, however, the morbidity was minor (eg, postexchange anemia).

In the NICHD cooperative phototherapy study, morbidity (apnea, bradycardia, cyanosis, vasospasm, thrombosis) was observed in 22 of 328 (6.7%) patients in whom BETs were performed (no data available in 3 BETs). Of the 22 adverse events, 6 were mild episodes of bradycardia associated with calcium infusion. If those infants are excluded, as well as 2 who experienced transient arterial spasm, the incidence of "serious morbidity" associated with the procedure itself was 5.22%.

The most recent study to report BET morbidity in the era of contemporary neonatal care provides data on infants cared for from 1980 to 1995 at the Children's Hospital and University of Washington Medical Center in Seattle. Of 106 infants receiving BET, 81 were healthy and there were no deaths; however, 1 healthy infant developed severe necrotizing enterocolitis requiring surgery. Of 25 sick infants (12 required mechanical ventilation), there were 5 deaths, and 3 developed permanent sequelae, including chronic aortic obstruction from BET via the umbilical artery, intraventricular hemorrhage with subsequent developmental delay, and sudden respiratory deterioration from a pulmonary hemorrhage and subsequent global developmental delay. The author classified the deaths as "possibly" (n =3) or "probably" (n = 2) and the complications as "possibly" (n = 2) or "probably" (n = 1) resulting from the BET. Thus in 25 sick infants, the overall risk of death or permanent sequelae ranged from 3 of 25 to 8 of 25 (12%–32%) and of permanent sequelae in survivors from 1 of 20 to 2 of 20 (5%–10%).

Most of the mortality and morbidity rates reported date from a time at which BET was a common procedure in nurseries. This is no longer the case, and newer phototherapy techniques are likely to reduce the need for BETs even further. Because the frequency of performance of any procedure is an important determinant of risk, the fact that BET is so rarely performed today could result in higher mortality and morbidity rates. However, none of the reports before 1986 included contemporary monitoring capabilities such as pulse oximetry, which should provide earlier identification of potential problems and might decrease morbidity and mortality. In addition, current standards for the monitoring of transfused blood products has significantly reduced the risk of transfusion-transmitted viral infections.

TECHNICAL REPORT

Phototherapy to Prevent Severe Neonatal Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

abstract

FREE

OBJECTIVE: To standardize the use of phototherapy consistent with the American Academy of Pediatrics clinical practice guideline for the management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation.

METHODS: Relevant literature was reviewed. Phototherapy devices currently marketed in the United States that incorporate fluorescent, halogen, fiber-optic, or blue light-emitting diode light sources were assessed in the laboratory.

RESULTS: The efficacy of phototherapy units varies widely because of differences in light source and configuration. The following characteristics of a device contribute to its effectiveness: (1) emission of light in the blue-to-green range that overlaps the in vivo plasma bilirubin absorption spectrum (~460–490 nm); (2) irradiance of at least 30 $\mu W \cdot cm^{-2} \cdot nm^{-1}$ (confirmed with an appropriate irradiance meter calibrated over the appropriate wavelength range); (3) illumination of maximal body surface; and (4) demonstration of a decrease in total bilirubin concentrations during the first 4 to 6 hours of exposure.

RECOMMENDATIONS (SEE APPENDIX FOR GRADING DEFINITION): The intensity and spectral output of phototherapy devices is useful in predicting potential effectiveness in treating hyperbilirubinemia (group B recommendation). Clinical effectiveness should be evaluated before and monitored during use (group B recommendation). Blocking the light source or reducing exposed body surface should be avoided (group B recommendation). Standardization of irradiance meters, improvements in device design, and lower-upper limits of light intensity for phototherapy units merit further study. Comparing the in vivo performance of devices is not practical, in general, and alternative procedures need to be explored. *Pediatrics* 2011;128:e1046–e1052

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KEY WORDS

phototherapy, newborn jaundice, hyperbilirubinemia, light treatment

ABBREVIATION

LED—light-emitting diode

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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INTRODUCTION

Clinical trials have validated the efficacy of phototherapy in reducing excessive unconjugated hyperbilirubinemia, and its implementation has drastically curtailed the use of exchange transfusions.[1] The initiation and duration of phototherapy is defined by a specific range of total bilirubin values based on an infant's postnatal age and the potential risk for bilirubin neurotoxicity.[1] Clinical response to phototherapy depends on the efficacy of the phototherapy device as well as the balance between an infant's rates of bilirubin production and elimination. The active agent in phototherapy is light delivered in measurable doses, which makes phototherapy conceptually similar to pharmacotherapy. This report standardizes the use of phototherapy consistent with the American Academy of Pediatrics clinical practice guideline for the management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation.

I. COMMERCIAL LIGHT SOURCES

A wide selection of commercial phototherapy devices is available in the United States. A complete discussion of devices is beyond the scope of this review; some are described in Tables 1 and 2. Phototherapy devices can be categorized according to their light source as follows: (1) fluorescent-tube devices that emit different colors (cool white daylight, blue [B], special blue [BB], turquoise, and green) and are straight (F20 T12, 60 cm, 20 W), U-shaped, or spiral-shaped; (2) metal halide bulbs, used in spotlights and incubator lights; (3) light-emitting diodes (LEDs) or metal halide bulbs, used with fiber-optic light guides in pads, blankets, or spotlights; and (4) high-intensity LEDs, used as over- and under-the-body devices.

TABLE 1 Phototherapy Devices Commonly Used in the United States and Their Performance Characteristics

Device	Manufacturer	Distance to Patient (cm)	Footprint Area (Length × Width, cm^2)	% Treatable BSA	Spectrum, Total (nm)	Bandwidth* (nm)	Peak (nm)	Footprint Irradiance ($\mu W/cm^2/nm$)		
								Min	Max	Mean ± SD
Light Emitting Diodes [LED]										
neoBLUE	Natus Medical, San Carlos, CA	30	1152 (48 × 24)	100	420–540	20	462	12	37	30 ± 7
PortaBed	Stanford University, Stanford, CA	≧5	1740 (30 × 58)	100	425–540	27	463	40	76	67 ± 8
Fluorescent										
BiliLite CW/BB	Olympic Medical, San Carlos, CA	45	2928 (48 × 61)	100	380–720	69	578	6	10	8 ± 1
BiliLite BB	Olympic Medical, San Carlos, CA	45	2928 (48 × 61)	100	400–550	35	445	11	22	17 ± 2
BiliLite TL52	Olympic Medical, San Carlos, CA	45	2928 (48 × 61)	100	400–626	69	437	13	23	19 ± 3
BiliBed	Medela, McHenry, IL	0	693 (21 × 33)	71	400–560	80	450	14	59	36 ± 2
Halogen										
MiniBiliLite	Olympic Medical, San Carlos, CA	45	490 (25 diam)	54	350–800	190	580	<1	19	7 ± 5
Phototherapy Lite	Philips Inc, Andover, MA	45	490 (25 diam)	54	370–850	200	590	<1	17	5 ± 5
Halogen fiberoptic										
BiliBlanket	Ohmeda, Fairfield, CT	0	150 (10 × 15)	24	390–600	70	533	9	31	20 ± 6
Wallaby II Preterm	Philips, Inc, Andover, MA	0	117 (9 × 13)	19	400–560	45	513	8	30	16 ± 6
Wallaby II Term	Philips, Inc, Andover, MA	0	280 (8 × 35)	53	400–560	45	513	6	11	8 ± 1
SpotLight 1000	Philips, Inc, Andover, MA	45	490 (25 diam)	54	400–560	45	513	1	11	6 ± 3
PEP Model 2000	PEP, Fryeburg, ME	23	1530 (30 × 51)	100	400–717	63	445	12	49	28 ± 11
Bili Soft	GE Healthcare, Laurel, MD	0	825 (25 × 33)	71	400–670	40	453	1	52	25 ± 16

Data in Table 1 are expanded and updated from that previously reported by Vreman et al.[3] The definitions and standards for device assessment are explained below.

EMISSION SPECTRAL QUALITIES: Measured data of the light delivered by each of the light sources are presented as the minimum, maximum and range. Light source emission spectra within the range of 300–700 nm were recorded after the device had reached stable light emission, using a miniature fiberoptic radiometer (IRRAD2000, Ocean Optics, Inc, Dunedin, FL). For precision based device assessment, the spectral bandwidth (*), which is defined as the width of the emission spectrum in nm at 50% of peak light intensity, is the preferred method to distinguish and compare instead of the total range emission spectrum (data usually provided by manufacturers). Emission peak values are also used to characterize the quality of light emitted by a given light source.

IRRADIANCE: Measured data are presented as mean ± standard deviation (SD), representing the irradiance of blue light (including spectral bandwidth), for each device's light footprint at the manufacturer-recommended distance. To compare diverse devices, the spectral irradiance ($\mu W/cm2/nm$) measurements were made using calibrated BiliBlanket Meters I and II (Ohmeda, GE Healthcare, Fairfield, CT), which were found to yield identical results with stable output phototherapy devices. This type of meter was selected from the several devices with different photonic characteristics that are commercially available, because it has a wide sensitivity range (400–520 nm with peak sensitivity at 450 nm), which overlaps the bilirubin absorption spectrum and which renders it suitable for the evaluation of narrow and broad wavelength band light sources. The devices have been found exceptionally stable during several years of use and agree closely after each annual calibration.

FOOTPRINT: The minimum and maximum irradiance measured (at the intervals provided or defined) in the given irradiance footprint of the device (length × width). The footprint of a device is that area which is occupied by a patient to receive phototherapy. The irradiance footprint has greater dimensions than the emission surface, which is measured at the point where the light exits a phototherapy device. The minimum and maximum values are shown to indicate the range of irradiances encountered with a device and can be used as an indication of the uniformity of the emitted light. Most devices conform to an international standard to deliver a minimum/maximum footprint light ratio of no lower than 0.4.

BSA: BODY SURFACE AREA refers to percent (%) exposure of either the ventral or dorsal planar surface exposed to light and irradiance measurements are accurate to ±0.5.

All of the reported devices are marketed in the United States except the PortaBed, which is a non-licensed Stanford-developed research device and the Dutch Crigler-Najjar Association (used by Crigler-Najjar patients).

TABLE 2 Maximum Spectral Irradiance of Phototherapy Devices (Using Commercial Light Meters at Manufacturer Recommended Distances) Compared to Clear-Sky Sunlight

Light Meter [Range, Peak]	Footprint Irradiance, (μW/cm^2/nm[a])							
	Halogen/Fiberoptic			Fluorescent		LED		Sunlight
	BiliBlanket	Wallaby (Neo)		PEP Bed	Martin/Philips BB	neoBLUE	PortaBed	@ Zenith on 8/31/05
		II	III					
	@ Contact	@ Contact		@ 10 cm	@ 25 cm	@ 30 cm	@ 10 cm	Level Ground
BiliBlanket Meter II [400–520, 450 nm]	34	28	34	40	69	34	76	144
Bili-Meter, Model 22 [425–475, 460 nm]	29	16	32	49	100	25	86	65**
Joey Dosimeter, JD-100 [420–550, 470 nm]	53	51	60	88	174	84	195	304**
PMA-2123 Bilirubin Detector[a] (400–520, 460 nm)	24	24	37	35	70	38	73	81
GoldiLux UVA Photometer, GRP-1[b] [315–400, 365 nm]	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	2489

Data in Table 2 were tested and compiled by Hendrik J. Vreman (June 2007 and reverified December 2010).

** Irradiance presented to this meter exceeded its range. Measurement was made through a stainless-steel screen that attenuated the measured irradiance to 57%, which was subsequently corrected by this factor.

[a] Solar Light Company, Inc., Glenside, PA 19038.

[b] Oriel Instruments, Stratford, CT 06615 and SmartMeter GRP-1 with UV-A probe. GRP-1 measures UV-A light as μW/cm^2. No artificial light source delivered significant (<0.04 μW/cm^2) UV-A radiation at the distances measured.

II. STANDARDS FOR PHOTOTHERAPY DEVICES

Methods for reporting and measuring phototherapy doses are not standardized. Comparisons of commercially available phototherapy devices that use in vitro photodegradation techniques may not accurately predict clinical efficacy.[2] A recent report explored an approach to standardizing and quantifying the magnitude of phototherapy delivered by various devices.[3] Table 1 lists technical data for some of the devices marketed in the United States.[3] Factors to consider in prescribing and implementing phototherapy are (1) emission range of the light source, (2) the light intensity (irradiance), (3) the exposed ("treatable") body surface area illuminated, and (4) the decrease in total bilirubin concentration. A measure of the effectiveness of phototherapy to rapidly configure the bilirubin molecule to less toxic photoisomers (measured in seconds) is not yet clinically available.

A. Light Wavelength

The visible white light spectrum ranges from approximately 350 to 800 nm. Bilirubin absorbs visible light most strongly in the blue region of the spectrum (~460 nm). Absorption of light transforms unconjugated bilirubin molecules bound to human serum albumin in solution into bilirubin photoproducts (predominantly isomers of bilirubin).[2,4,5] Because of the photophysical properties of skin, the most effective light in vivo is probably in the blue-to-green region (~460–490 nm).[2] The first prototype phototherapy device to result in a clinically significant rate of bilirubin decrease used a blue (B) fluorescent-tube light source with 420- to 480-nm emission.[6,7] More effective narrow-band special blue bulbs (F20T12/BB [General Electric, Westinghouse, Sylvania] or TL52/20W [Phillips]) were subsequently used.[8,9] Most recently, commercial compact fluorescent-tube light sources and devices that use LEDs of narrow spectral bandwidth have been used.[9–14] Unless specified otherwise, plastic covers or optical filters need to be used to remove potentially harmful ultraviolet light.

Clinical Context

Devices with maximum emission within the 460- to 490-nm (blue-green) region of the visible spectrum are probably the most effective for treating hyperbilirubinemia.[2,4] Lights with broader emission also will work, although not as effectively. Special blue (BB) fluorescent lights are effective but should not be confused with white lights painted blue or covered with blue plastic sheaths, which should not be used. Devices that contain high-intensity gallium nitride LEDs with emission within the 460- to 490-nm regions are also effective and have a longer lifetime (>20 000 hours), lower heat output, low infrared emission, and no ultraviolet emission.

B. Measuring Light Irradiance

Light intensity or energy output is defined by irradiance and refers to the number of photons (spectral energy) that are delivered per unit area (cm^2) of exposed skin.[1] The dose of phototherapy is a measure of the irradiance delivered for a specific duration and adjusted to the exposed body surface area. Determination of an in vivo dose-response relationship is confounded by the optical properties of skin and the rates of bilirubin production and elimination.[1] Irradiance is measured with a radiometer (W·cm^{-2}) or spectroradiometer (μW·cm^{-2}·nm^{-1}) over a given wavelength band. Table 2 compares the spectral irradiance of some of the devices in the US market, as measured with different brands of me-

ters. Often, radiometers measure wavelengths that do not penetrate skin well or that are far from optimal for phototherapy and, therefore, may be of little value for predicting the clinical efficacy of phototherapy units. A direct relationship between irradiance and the rate of in vivo total bilirubin concentration decrease was described in the report of a study of term "healthy" infants with nonhemolytic hyperbilirubinemia (peak values: 15–18 mg/dL) using fluorescent Philips daylight (TL20W/54, TL20W/52) and special blue (TLAK 40W/03) lamps.[15,16] The American Academy of Pediatrics has recommended that the irradiance for intensive phototherapy be at least 30 $\mu W \cdot cm^{-2} \cdot nm^{-1}$ over the waveband interval 460 to 490 nm.[1] Devices that emit lower irradiance may be supplemented with auxiliary devices. Much higher doses (>65 $\mu W \cdot cm^{-2} \cdot nm^{-1}$) might have (as-yet-unidentified) adverse effects. Currently, no single method is in general use for measuring phototherapy dosages. In addition, the calibration methods, wavelength responses, and geometries of instruments are not standardized. Consequently, different radiometers may show different values for the same light source.[2]

Clinical Context

For routine measurements, clinicians are limited by reliance on irradiance meters supplied or recommended by the manufacturer. Visual estimations of brightness and use of ordinary photometric or colorimetric light meters are inappropriate.[1,2] Maximal irradiance can be achieved by bringing the light source close to the infant[1]; however, this should not be done with halogen or tungsten lights, because the heat generated can cause a burn. Furthermore, with some fixtures, increasing the proximity may reduce the exposed body surface area. Irradiance distribution in the illuminated area (footprint) is rarely uniform; measurements at the center of the footprint may greatly exceed those at the periphery and are variable among phototherapy devices.[1] Thus, irradiance should be measured at several sites on the infant's body surface. The ideal distance and orientation of the light source should be maintained according to the manufacturer's recommendations. The irradiance of all lamps decreases with use; manufacturers may provide useful-lifetime estimates, which should not be exceeded.

C. Optimal Body Surface Area

An infant's total body surface area[17] can be influenced by the disproportionate head size, especially in the more preterm infant. Complete (100%) exposure of the total body surface to light is impractical and limited by use of eye masks and diapers. Circumferential illumination (total body surface exposure from multiple directions) achieves exposure of approximately 80% of the total body surface. In clinical practice, exposure is usually planar: ventral with overhead light sources and dorsal with lighted mattresses. Approximately 35% of the total body surface (ventral or dorsal) is exposed with either method. Changing the infant's posture every 2 to 3 hours may maximize the area exposed to light. Exposed body surface area treated rather than the number of devices (double, triple, etc) used is clinically more important. Maximal skin surface illumination allows for a more intensive exposure and may require combined use of more than 1 phototherapy device.[1]

Clinical Context

Physical obstruction of light by equipment, such as radiant warmers, head covers, large diapers, eye masks that enclose large areas of the scalp, tape, electrode patches, and insulating plastic covers, decrease the exposed skin surface area. Circumferential phototherapy maximizes the exposed area. Combining several devices, such as fluorescent tubes with fiber-optic pads or LED mattresses placed below the infant or bassinet, will increase the surface area exposed. If the infant is in an incubator, the light rays should be perpendicular to the surface of the incubator to minimize reflectance and loss of efficacy.[1,2]

D. Rate of Response Measured by Decrease in Serum Bilirubin Concentration

The clinical impact of phototherapy should be evident within 4 to 6 hours of initiation with an anticipated decrease of more than 2 mg/dL (34 μmol/L) in serum bilirubin concentration.[1] The clinical response depends on the rates of bilirubin production, enterohepatic circulation, and bilirubin elimination; the degree of tissue bilirubin deposition[15,16,18]; and the rates of the photochemical reactions of bilirubin. Aggressive implementation of phototherapy for excessive hyperbilirubinemia, sometimes referred to as the "crash-cart" approach,[19,20] has been reported to reduce the need for exchange transfusion and possibly reduce the severity of bilirubin neurotoxicity.

Clinical Context

Serial measurements of bilirubin concentration are used to monitor the effectiveness of phototherapy, but the value of these measurements can be confounded by changes in bilirubin production or elimination and by a sudden increase in bilirubin concentration (rebound) if phototherapy is stopped. Periodicity of serial measurements is based on clinical judgment.

III. EVIDENCE FOR EFFECTIVE PHOTOTHERAPY

Light-emission characteristics of phototherapy devices help in predicting

TABLE 3 Practice Considerations for Optimal Administration of Phototherapy

Checklist	Recommendation	Implementation
Light source (nm)	Wavelength spectrum in ~460- 490-nm blue-green light region	Know the spectral output of the light source
Light irradiance ($\mu W \cdot cm^{-2} \cdot nm^{-1}$)	Use optimal irradiance: >30 $\mu W \cdot cm^{-2} \cdot nm^{-1}$ within the 460- to 490-nm waveband	Ensure uniformity over the light footprint area
Body surface area (cm^2)	Expose maximal skin area	Reduce blocking of light
Timeliness of implementation	Urgent or "crash-cart" intervention for excessive hyperbilirubinemia	May conduct procedures while infant is on phototherapy
Continuity of therapy	Briefly interrupt for feeding, parental bonding, nursing care	After confirmation of adequate bilirubin concentration decrease
Efficacy of intervention	Periodically measure rate of response in bilirubin load reduction	Degree of total serum/plasma bilirubin concentration decrease
Duration of therapy	Discontinue at desired bilirubin threshold; be aware of possible rebound increase	Serial bilirubin measurements based on rate of decrease

their effectiveness (group B recommendation) (see Appendix). The clinical effectiveness of the device should be known before and monitored during clinical application (group B recommendation). Local guidelines (instructions) for routine clinical use should be available. Important factors that need to be considered are listed in Table 3. Obstructing the light source and reducing the exposed body surface area must be avoided (group B recommendation).

These recommendations are appropriate for clinical care in high-resource settings. In low-resource settings the use of improvised technologies and affordable phototherapy device choices need to meet minimum efficacy and safety standards.

IV. SAFETY AND PROTECTIVE MEASURES

A clinician skilled in newborn care should assess the neonate's clinical status during phototherapy to ensure adequate hydration, nutrition, and temperature control. Clinical improvement or progression of jaundice should also be assessed, including signs suggestive of early bilirubin encephalopathy such as changes in sleeping pattern, deteriorating feeding pattern, or inability to be consoled while crying.[1] Staff should be educated regarding the importance of safely minimizing the distance of the phototherapy device from the infant. They should be aware that the intensity of light decreases at the outer perimeter of the light footprint and recognize the effects of physical factors that could impede or obstruct light exposure. Staff should be aware that phototherapy does not use ultraviolet light and that exposure to the lights is mostly harmless. Four decades of neonatal phototherapy use has revealed no serious adverse clinical effects in newborn infants 35 or more weeks of gestation. For more preterm infants, who are usually treated with prophylactic rather than therapeutic phototherapy, this may not be true. Informed staff should educate parents regarding the care of their newborn infant undergoing phototherapy. Devices must comply with general safety standards listed by the International Electrotechnical Commission.[21] Other clinical considerations include:

a. Interruption of phototherapy: After a documented decrease in bilirubin concentration, continuous exposure to the light source may be interrupted and the eye mask removed to allow for feeding and maternal-infant bonding.[1]
b. Use of eye masks: Eye masks to prevent retinal damage are used routinely, although there is no evidence to support this recommendation. Retinal damage has been documented in the unpatched eyes of newborn monkeys exposed to phototherapy, but there are no similar data available from human newborns, because eye patches have always been used.[22–24] Purulent eye discharge and conjunctivitis in term infants have been reported with prolonged use of eye patches.[25,26]
c. Use of diapers: Concerns for the long-term effects of continuous phototherapy exposure of the reproductive system have been raised but not substantiated.[27–29] Diapers may be used for hygiene but are not essential.
d. Other protective considerations: Devices used in environments with high humidity and oxygen must meet electrical and fire hazard safety standards.[21] Phototherapy is contraindicated in infants with congenital porphyria or those treated with photosensitizing drugs.[1] Prolonged phototherapy has been associated with increased oxidant stress and lipid peroxidation[30] and riboflavin deficiency.[31] Recent clinical reports of other adverse outcomes (eg, malignant melanoma, DNA damage, and skin changes) have yet to be validated.[1,2,32,33] Phototherapy does not exacerbate hemolysis.[34]

V. RESEARCH NEEDS

Among the gaps in knowledge that remain regarding the use of phototherapy to prevent severe neonatal hyperbilirubinemia, the following are among the most important:

1. The ability to measure the actual wavelength and irradiance delivered by a phototherapy device is urgently needed to assess the efficiency of

phototherapy in reducing total serum bilirubin concentrations.

2. The safety and efficacy of home phototherapy remains a research priority.
3. Further delineation of the short- and long-term consequences of exposing infants with conjugated and unconjugated hyperbilirubinemia to phototherapy is needed.
4. Whether use of phototherapy reduces the risk of bilirubin neurotoxicity in a timely and effective manner needs further exploration.

SUMMARY

Clinicians and hospitals should ensure that the phototherapy devices they use fully illuminate the patient's body surface area, have an irradiance level of $\geq 30\ \mu W \cdot cm^{-2} \cdot nm^{-1}$ (confirmed with accuracy with an appropriate spectral radiometer) over the waveband of approximately 460 to 490 nm, and are implemented in a timely manner. Standard procedures should be documented for their safe deployment.

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APPENDIX Definition of Grades for Recommendation and Suggestion for Practice

Grade	Definition	Suggestion for Practice
A	This intervention is recommended. There is a high certainty that the net benefit is substantial	Offer and administer this intervention
B	This intervention is recommended. There is a moderate certainty that the net benefit is moderate to substantial	Offer and administer this intervention
C	This intervention is recommended. There may be considerations that support the use of this intervention in an individual patient. There is a moderate to high certainty that the net benefit is small	Offer and administer this intervention only if other considerations support this intervention in an individual patient
D	This intervention is not recommended. There is a moderate to high certainty that the intervention has no net benefit and that the harms outweigh the benefits	Discourage use of this intervention
I	The current evidence is insufficient to assess the balance of benefits against and harms of this intervention. There is a moderate to high certainty that the intervention has no net benefit and that the harms outweigh the benefits. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined	If this intervention is conducted, the patient should understand the uncertainty about the balance of benefits and harms

US Preventive Services Task Force Grade definitions, May, 2008 (available at www.uspreventiveservicestaskforce.org/3rduspstf/ratings.htm).

Hyperbilirubinemia in the Newborn Infant ≥35 Weeks' Gestation: An Update With Clarifications

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ABBREVIATIONS

AAP—American Academy of Pediatrics
G6PD— glucose-6-phosphate dehydrogenase
TSB—total serum bilirubin
TcB—transcutaneous bilirubin

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In July 2004, the Subcommittee on Hyperbilirubinemia of the American Academy of Pediatrics (AAP) published its clinical practice guideline on the management of hyperbilirubinemia in the newborn infant ≥35 weeks of gestation,[1] and a similar guideline was published in 2007 by the Canadian Paediatric Society.[2] Experience with implementation of the AAP guideline suggests that some areas require clarification. The 2004 AAP guideline also expressed hope that its implementation would "reduce the incidence of severe hyperbilirubinemia and bilirubin encephalopathy. . . ." We do not know how many practitioners are following the guideline, nor do we know the current incidence of bilirubin encephalopathy in the United States. We do know, however, that kernicterus is still occurring in the United States, Canada, and Western Europe.[3–7] In 2002, the National Quality Forum suggested that kernicterus should be classified as a "serious reportable event,"[8] sometimes termed a "never event,"[9] implying that with appropriate monitoring, surveillance, and intervention, this devastating condition can, or should, be eliminated. Although this is certainly a desirable objective, it is highly unlikely that it can be achieved given our current state of knowledge and practice.[10] In certain circumstances (notably, glucose-6-phosphate dehydrogenase [G6PD] deficiency, sepsis, genetic predisposition, or other unknown stressors), acute, severe hyperbilirubinemia can occur and can produce brain damage despite appropriate monitoring and intervention.

In addition to clarifying certain items in the 2004 AAP guideline, we recommend universal predischarge bilirubin screening using total serum bilirubin (TSB) or transcutaneous bilirubin (TcB) measurements, which help to assess the risk of subsequent severe hyperbilirubinemia. We also recommend a more structured approach to management and follow-up according to the predischarge TSB/TcB, gestational age, and other risk factors for hyperbilirubinemia. These recommendations represent a consensus of expert opinion based on the available evidence, and they are supported by several independent reviewers. Nevertheless, their efficacy in preventing kernicterus and their cost-effectiveness are unknown.

METHODS

We reviewed the report on screening for neonatal hyperbilirubinemia published by the Agency for Healthcare Research and Quality and prepared by the Tufts-New England Medical Center Evidence-Based Practice Center,[11] the current report by the US Preventive Services Task Force,[12] and other relevant literature.[1,3–10,13–26]

TABLE 1 Important Risk Factors for Severe Hyperbilirubinemia

Predischarge TSB or TcB measurement in the high-risk or high-intermediate–risk zone
Lower gestational age
Exclusive breastfeeding, particularly if nursing is not going well and weight loss is excessive
Jaundice observed in the first 24 h
Isoimmune or other hemolytic disease (eg, G6PD deficiency)
Previous sibling with jaundice
Cephalohematoma or significant bruising
East Asian race

TABLE 2 Hyperbilirubinemia Neurotoxicity Risk Factors

Isoimmune hemolytic disease
G6PD deficiency
Asphyxia
Sepsis
Acidosis
Albumin <3.0 mg/dL

RISK FACTORS

The 2004 AAP guideline includes 2 categories of risk factors, but the distinction between these 2 categories has not been clear to all users of the guideline.

Laboratory and Clinical Factors That Help to Assess the Risk of Subsequent Severe Hyperbilirubinemia

These "risk factors for hyperbilirubinemia" are listed in Table 1. Understanding the predisposition to subsequent hyperbilirubinemia provides guidance for timely follow-up as well as the need for additional clinical and laboratory evaluation.

Laboratory and Clinical Factors That Might Increase the Risk of Brain Damage in an Infant Who Has Hyperbilirubinemia

These risk factors for bilirubin neurotoxicity are listed in the figures of the 2004 AAP guideline that provide recommendations for the use of phototherapy and exchange transfusion. These "neurotoxicity risk factors" encompass those that might increase the risk of brain damage in an infant who has severe hyperbilirubinemia[1] (see Fig 1 and Table 2). The neurotoxicity risk factors are used in making the decision to initiate phototherapy or perform an exchange transfusion. These interventions are recommended at a lower bilirubin level when any of the neurotoxicity risk factors is present. Some conditions are found in both risk-factor categories. For example, lower gestational age and isoimmune hemolytic disease increase the likelihood of subsequent severe hyperbilirubinemia as well as the risk of brain damage by bilirubin.

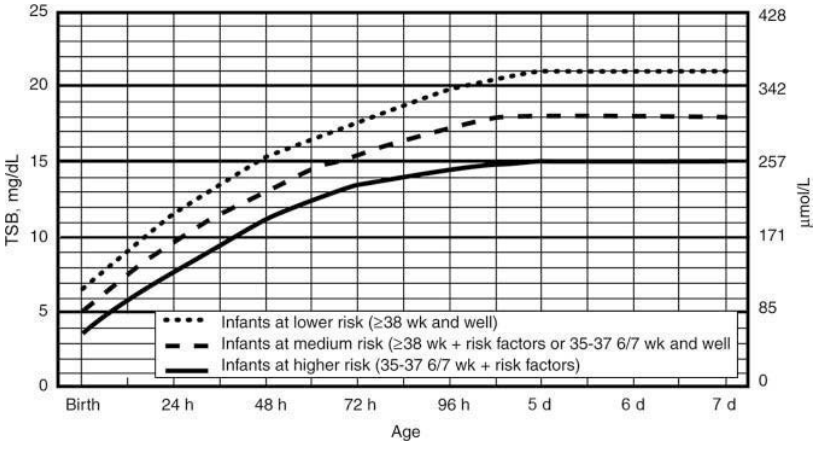

FIGURE 1

Guidelines for phototherapy in hospitalized infants ≥35 weeks' gestation. Note that these guidelines are based on limited evidence and that the levels shown are approximations. The guidelines refer to the use of intensive phototherapy, which should be used when the TSB level exceeds the line indicated for each category.

- Use total bilirubin. Do not subtract direct-reacting or conjugated bilirubin.
- Risk factors are isoimmune hemolytic disease, G6PD deficiency, asphyxia, significant lethargy, temperature instability, sepsis, acidosis, or an albumin level of <3.0 g/dL (if measured).
- For well infants at 35 to 37⁶⁄₇ weeks' gestation, one can adjust TSB levels for intervention around the medium-risk line. It is an option to intervene at lower TSB levels for infants closer to 35 weeks' gestation and at higher TSB levels for those closer to 37⁶⁄₇ weeks' gestation.
- It is an option to provide conventional phototherapy in the hospital or at home at TSB levels of 2 to 3 mg/dL (35–50 µmol/L) below those shown, but home phototherapy should not be used in any infant with risk factors.

PREDISCHARGE RISK ASSESSMENT FOR SUBSEQUENT SEVERE HYPERBILIRUBINEMIA

The 2004 AAP guideline recommends a predischarge bilirubin measurement and/or assessment of clinical risk factors to evaluate the risk of subsequent severe hyperbilirubinemia.[1] New evidence suggests that combining a predischarge measurement of TSB or TcB with clinical risk factors might improve the prediction of the risk of subsequent hyperbilirubinemia.[13,14,23] In addition, when interpreted by using the hour-specific nomogram (Fig 2), measurement of TSB or TcB also provides a quantitative assessment of the degree of hyperbilirubinemia. This provides guidance regarding the need (or lack of need) for additional testing to identify a cause of the hyperbilirubinemia and for additional TSB measurements.[1]

The TSB can be measured from the same sample that is drawn for the

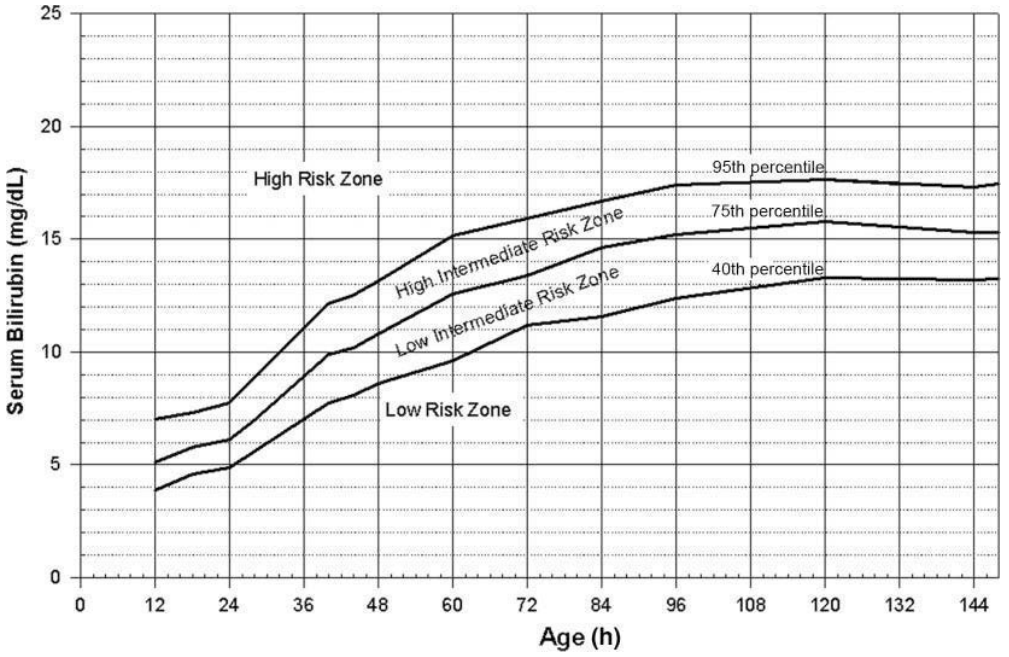

FIGURE 2
Nomogram for designation of risk in 2840 well newborns at ≥36 weeks' gestational age with birth weight of ≥2000 g or ≥35 weeks' gestational age and birth weight of ≥2500 g based on the hour-specific serum bilirubin values. (Reproduced with permission from Bhutani VK, Johnson L, Sivieri EM. *Pediatrics*. 1999;103[1]:6–14.)

metabolic screen. The risk zone (Fig 2) and the other clinical risk factors (Table 3) are then combined to assess the risk of subsequent hyperbilirubinemia and to formulate a plan for management and follow-up (Fig 3). When combined with the risk zone, the factors that are most predictive of hyperbilirubinemia risk are lower gestational age and exclusive breastfeeding.[13,14,23] The lower the gestational age, the greater the risk of developing hyperbilirubinemia.[13,14,23] For those infants from whom ≥2 successive TSB or TcB measurements are obtained, it is helpful to plot the data on the nomogram[15] to assess the rate of rise. Hemolysis is likely if the TSB/TcB is crossing percentiles on the nomogram and suggests the need for further testing and follow-up (see Table 1 in the 2004 AAP guideline).

Therefore, we recommend that a predischarge measurement of TSB or TcB be performed and the risk zone for hyperbilirubinemia determined[15] on the basis of the infant's age in hours and the TSB or TcB measurement.

It should be noted that, even with a low predischarge TSB or TcB level, the risk of subsequent hyperbilirubinemia is not zero,[13,17] so appropriate follow-up should always be provided (Fig 3).

RESPONSE TO PREDISCHARGE TSB MEASUREMENTS

Figure 3 provides our recommendations for management and follow-up, according to predischarge screening. Note that this algorithm represents a consensus of the authors and is based on interpretation of limited evidence (see below).

FOLLOW-UP AFTER DISCHARGE

Most infants discharged at <72 hours should be seen within 2 days of discharge.

Earlier follow-up might be necessary for infants who have risk factors for severe hyperbilirubinemia,[1,13,14,23] whereas those in the lower risk zones with few or no risk factors can be seen later (Fig 3). Figure 3 also provides additional suggestions for evaluation and management at the first follow-up visit.

TcB MEASUREMENTS

TcB measurements are being used with increasing frequency in hospi-

TABLE 3 Other Risk Factors for Severe Hyperbilirubinemia to be Considered with the Gestational Age and the Pre-discharge TSB or TcB level (see Figure 3)

Exclusive breastfeeding, particularly if nursing is not going well and/or weight loss is excessive (>8–10%)
Isoimmune or other hemolytic disease (eg, G6PD deficiency, hereditary spherocytosis)
Previous sibling with jaundice
Cephalohematoma or significant bruising
East Asian race

The gestational age and the predischarge TSB or TcB level are the most important factors that help to predict the risk of hyperbilirubinemia. The risk increases with each decreasing week of gestation from 42–35 weeks (see Figure 3)

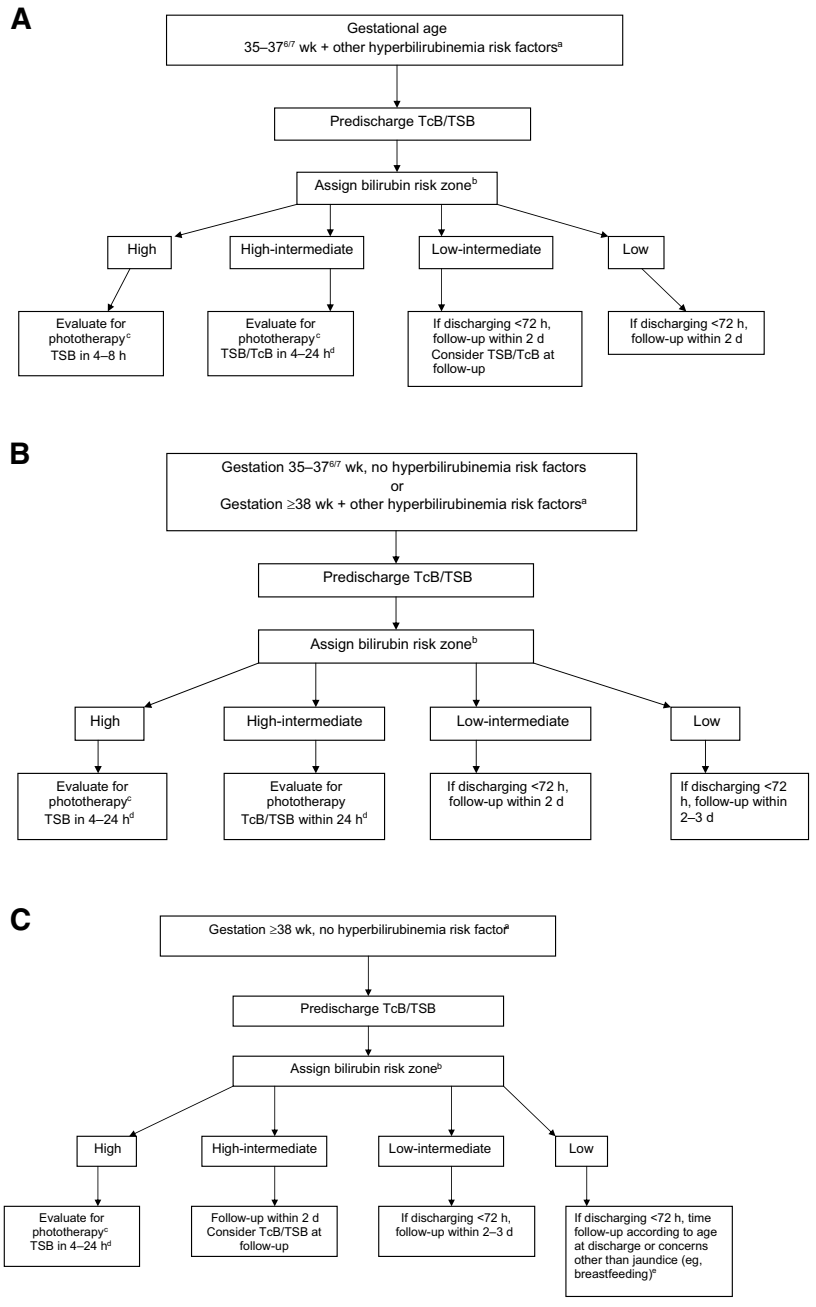

FIGURE 3

Algorithm providing recommendations for management and follow-up according to predischarge bilirubin measurements, gestation, and risk factors for subsequent hyperbilirubinemia.

- Provide lactation evaluation and support for all breastfeeding mothers.
- Recommendation for timing of repeat TSB measurement depends on age at measurement and how far the TSB level is above the 95th percentile (Fig 2). Higher and earlier initial TSB levels require an earlier repeat TSB measurement.
- Perform standard clinical evaluation at all follow-up visits.
- For evaluation of jaundice see 2004 AAP guideline.[1]
- [a] Table 3. [b] Fig 2. [c] Fig 1. [d] In hospital or as outpatient. [e] Follow-up recommendations can be modified according to level of risk for hyperbilirubinemia; depending on the circumstances in infants at low risk, later follow-up can be considered.

tal nurseries and in some outpatient settings. They have the advantage of providing instantaneous information and probably reduce the likelihood of missing a clinically significant TSB, making them particularly useful in outpatient practice. TcB measurements can significantly reduce the number of TSB measurements that are required, but as with any point-of-care test, regular monitoring for appropriate quality assurance by comparison with TSB measurements is necessary. Significant variation can occur among instruments, and the use of a new instrument should be compared with hospital laboratory measurements to ensure that the instrument is working properly; such checks should be performed periodically. TcB is a measurement of the yellow color of the blanched skin and subcutaneous tissue, not the serum, and should be used as a screening tool to help determine whether the TSB should be measured. Although TcB measurements provide a good estimate of the TSB level, they are not a substitute for TSB values, and a TSB level should always be obtained when therapeutic intervention is being considered.

Most studies in term and late-preterm infants have indicated that the TcB tends to underestimate the TSB, particularly at higher TSB levels.[18] Thus, investigators have adopted various techniques to avoid missing a high TSB level (ie, a false-negative TcB measurement). These techniques include measuring the TSB if

- the TcB value is at 70% of the TSB level recommended for the use of phototherapy[19];
- the TcB value is above the 75th percentile on the Bhutani nomogram (Fig 1)[15] or the 95th percentile on a TcB nomogram[16] (in 1 study, if the TcB was <75th percentile on the Bhutani nomogram, 0 of 349 infants

had a TSB level above the 95th percentile [a negative predictive value of 100%][20]; or

- at follow-up after discharge, the TcB value is >13 mg/dL (222 μmol/L)[21] (in this outpatient study, no infant who had a TcB value of ≤13 mg/dL had a TSB level of >17 mg/dL [291 μmol/L]).[21]

COSTS

The introduction of universal predischarge bilirubin screening, follow-up visits, and TSB/TcB measurements might increase costs. Ideally, a cost/benefit analysis should include the cost to prevent 1 case of kernicterus. The cost per case, however, highly depends on the incidence of kernicterus as well as its potential reduction resulting from the intervention. By using a strategy similar to that suggested in this guideline, and assuming an incidence of kernicterus of 1 in 100 000 live births and a relative risk reduction of 70%, the cost to prevent 1 case of kernicterus has been estimated as approximately $5.7 million.[22] Because we do not know the current incidence of kernicterus in the United States or the actual relative risk reduction (if these guidelines were implemented universally), we cannot calculate the true cost/benefit ratio. Taking into account the lifetime cost of an infant with kernicterus, it is possible that there could be savings.[22]

DISCUSSION

While endeavoring to clarify some areas addressed in the 2004 AAP guideline, we have also introduced new recommendations, both for the predischarge assessment of the risk of subsequent hyperbilirubinemia and for follow-up testing. We recognize that the quality of evidence for recommending universal predischarge screening and for the suggested management and follow-up (Fig 3) is limited and, in the absence of higher levels of evidence, our recommendations must, therefore, be based on expert opinion. As indicated in the reviews by the US Preventive Services Task Force[12] and Trikalinos et al[11] in this issue of *Pediatrics*, there are currently no good data to indicate that the implementation of these recommendations will reduce the risk of kernicterus, although published data suggest that predischarge screening can reduce the incidence of a TSB level of ≥25 mg/dL,[24,25] perhaps by increasing the use of phototherapy.[24] Nevertheless, because kernicterus is a devastating condition that leads to serious and permanent neurologic damage, and because published reports and our own review of cases in the medicolegal setting suggest that many of these cases could have been prevented, a reasonable argument can be made for implementing the suggested recommendations in the absence of better evidence. Because kernicterus is a rare condition, it is unlikely that we will be able to obtain adequate evidence in the short-term to support our recommendations. In their elegant polemic, Auerbach et al[26] discussed "the tension between needing to improve care and knowing how to do it." They noted that, in the absence of appropriate evidence, "bold efforts at improvement can consume tremendous resources yet confer only a small benefit."[26] We also recognize that although predischarge testing is relatively inexpensive and convenient, measuring the TSB after discharge is more difficult. TcB measurement is quite easy but is not currently available in most primary care settings. In addition, more evidence is needed to support the cost and efficacy of these recommendations. There is certainly a risk that these recommendations could lead to additional testing and an increase in both appropriate and inappropriate use of phototherapy.[1,24] Nevertheless, it is our opinion that universal screening, when combined with the clinical risk factors (of which gestational age and exclusive breastfeeding are most important) and targeted follow-up, is a systems approach that is easy to implement and understand, and it provides a method of identifying infants who are at high or low risk for the development of severe hyperbilirubinemia. In addition to risk assessment, the measurement of TSB or TcB when interpreted by using the hour-specific nomogram provides the caregiver with an immediate and quantitative mechanism for assessing the degree of hyperbilirubinemia and the need for additional surveillance and testing. As such, it could play an important role in preventing acute bilirubin encephalopathy, although this has yet to be demonstrated.

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Universal Bilirubin Screening, Guidelines, and Evidence

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ABBREVIATIONS
AAP—American Academy of Pediatrics
USPSTF—US Preventive Services Task Force
TSB—total serum bilirubin

Opinions expressed in these commentaries are those of the author and not necessarily those of the American Academy of Pediatrics or its Committees.

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In a commentary[1] and update of the 2004 American Academy of Pediatrics (AAP) guideline "Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation"[2] in this issue of *Pediatrics*, Maisels et al recommend that all newborns have a bilirubin measurement before discharge from their birth hospitalization. In contrast, a recommendation statement from the US Preventive Services Task Force (USPSTF),[3] supported by a systematic review,[4]concludes that evidence is insufficient to make that recommendation. As an author of the commentary[1] and the 2004 AAP jaundice guideline[2] who also has been critical of guidelines based on insufficient evidence,[5–11] I have felt particularly torn about this recommendation.

Perhaps partly because I have served as an expert consultant on dozens of heartbreaking kernicterus legal cases,[12] I find the argument in favor of universal bilirubin screening and systematic follow-up persuasive. We know kernicterus is devastating and that, although rare, cases are continuing to occur. Furthermore, anecdotal evidence suggests that many cases could have been prevented by earlier measurement of bilirubin levels, leading to closer follow-up and earlier initiation of appropriate therapy.[13,14] We have not had randomized trials to show that universal screening and systematic follow-up will lead to a reduction in kernicterus, but considerable research in the area of optimizing patient safety suggests that there is room for improvement in the 2004 guidelines. Specifically, we know that in the absence of universal screening, detection and management of clinically significant hyperbilirubinemia during the birth hospitalization relies on several imperfect steps: (1) nurses and doctors need to remember to examine the infant for jaundice; (2) they need to distinguish visually between jaundice that is and is not clinically significant for the infant's age in hours; and (3) they need to combine information from this visual assessment of jaundice and/or a total serum bilirubin (TSB) level with knowledge of the newborn's other risk factors to determine the need for and timing of bilirubin measurements, follow-up visits, and treatments. We also know that nurseries are busy places and that sometimes people may not do things that they should[15] or might do them under suboptimal conditions, such as assessing jaundice in the dim light found in many hospital rooms. Finally, compared with the devastating effects of kernicterus, the costs and risks of screening seem low, particularly with a transcutaneous bilirubinometer, which may actually decrease the number of serum bilirubin measurements obtained.[16]

On the other hand, as a proponent of evidence-based medicine, I recognize the insufficiency of the data to support the recommendation.[3,4] The rationale outlined above would apply whether the incidence of kernicterus were 1 in 10 000 or 1 in 1 million, but surely the potential benefits of screening depend on how much kernicterus there is to

prevent, and this is not known. Even if we knew the incidence of kernicterus, the proportion that might be preventable by screening and systematic follow-up is unclear. Although plaintiffs in malpractice cases commonly assert that infants with bilirubin levels in the 40s at 4 or 5 days must have had proportionately high levels at the time of discharge (even if no or minimal jaundice was noted at that time), there is little evidence to support this assertion. Studies of the predictive value of early bilirubin levels have had much lower levels of hyperbilirubinemia (TSB of 17–20 mg/dL).[3] Because they may have different causes, such as glucose-6-phosphate dehydrogenase deficiency and infection, the very high levels that lead to kernicterus may be less predictable. Moreover, several studies have revealed that in the absence of any jaundice, a TSB level of $\geq$12 mg/dL is extremely unlikely.[17–20] As an experienced generalist who believes he can recognize at least some newborns who definitely are not jaundiced, I sympathize with colleagues who may question the cost-efficacy of measuring bilirubin (particularly if it involves an additional poke or trying to squeeze more blood out of a recalcitrant heel) in a light-skinned 2-day-old who has no hint of jaundice. Requiring a bilirubin measurement for every such infant because some clinicians may forget or be careless feels like keeping the whole class after school for the transgressions of a few.

After doing my best to reconcile these opposing viewpoints, I believe that universal predischarge bilirubin screening is a good idea but that the evidence is not sufficient to recommend it in an AAP guideline. This is consistent with AAP policy. In a 2004 statement, the Steering Committee on Quality Improvement and Management outlined levels of evidence and strengths of AAP guidelines.[21] The policy stated that except in "exceptional situations where validating studies cannot be performed and there is a clear preponderance of benefit or harm," if the level of evidence is "expert opinion, case reports, and reasoning from first principles," a course of action should be designated an option rather than a recommendation. Because, as is explicitly acknowledged in the commentary, expert opinion, case reports, and reasoning from first principles are exactly the level of evidence that supports the recommendation for universal bilirubin screening, and because we wanted to make that recommendation, it needed to be published as a commentary rather than a guideline.

Is this AAP policy on evidence and guideline recommendations a good one? I believe it is. Practicing clinicians need and appreciate guidance from experts, but they also recognize the impossibility of following every guideline that an expert committee might recommend for them and need protection from well-meaning but sometimes paternalistic committees with their own agendas.[22] Guideline committees tend to be dominated by academics and subspecialists with special interest, expertise, and even emotional investment in the diseases for which they are producing guidelines.[23] Most of us authors of the hyperbilirubinemia commentary are no exception.[12,24] Although interest and expertise are invaluable, the career focus on a particular disease, with resulting close relationships with funders, patients, advocacy groups, industry, and each other, may lead to a narrow perspective in which heroic efforts at preventing or treating the target disease feel justified, even when a favorable balance of benefits over risks and costs is uncertain.[23] And, although slavishly adhering to evidence standards could lead to failure to recommend beneficial treatments[25,26] even what seem like obvious, common-sense interventions can have unintended adverse consequences.[27,28]

The USPSTF uses a different model for producing guidelines, in which expertise at appraising and synthesizing evidence trumps disease-specific expertise.[29] Recommendations of the USPSTF are typically based on the results of systematic reviews of evidence, often performed by one of the Agency for Healthcare Research and Quality's evidence-based practice centers. Such thorough reviews are not within time, expertise, and budget constraints of most guideline committees. Ironically, however, the recommendation to measure a bilirubin level for every infant before discharge was the subject of just such a review,[4] which concluded that the evidence is insufficient to make a recommendation for or against universal bilirubin screening ("I" rating).[3]

The USPSTF statement comments not only on the lack of evidence that universal bilirubin screening will prevent bilirubin encephalopathy but also on the insufficiency of evidence regarding risks and efficacy of phototherapy.[3] This is important, because an unintended consequence of institution of universal bilirubin screening might be a greater focus on the danger of hyperbilirubinemia, leading to excessive use of phototherapy. There is evidence that this has occurred in the Northern California Kaiser Permanente Medical Care Program, in which increased bilirubin testing was associated with a decrease in bilirubin levels of $>$25 mg/dL and also an increase in use of phototherapy at levels lower than those recommended in the 2004 AAP guideline.[30] Thus, it is worth stressing that the recommendation for bilirubin screening should not be misinterpreted as suggesting the need for phototherapy at lower bilirubin levels.

The Maisels et al commentary on hyperbilirubinemia published in this is-

sue came about because of a need to clarify the 2004 guideline and because the AAP had been asked for a statement that either recommended universal bilirubin screening or explained why not. I suspect that having the recommendation for universal screening come in the form of a commentary, rather than a guideline, will be disappointing to both advocates and opponents of universal screening. However, I believe it is the right decision. For now, it represents what some bilirubin experts believe is reasonable on the basis of limited evidence. With additional research, we hope to be able to make a stronger recommendation in the future.

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Hyperbilirubinemia Clinical Practice Guideline Quick Reference Tools

- Recommendation Summary
  — Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Hyperbilirubinemia
- AAP Patient Education Handout
  — *Jaundice and Your Newborn*

Recommendation Summary

Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

The following are the key elements of the recommendations provided by this guideline. Clinicians should:

1. Promote and support successful breastfeeding.
2. Establish nursery protocols for the identification and evaluation of hyperbilirubinemia.
3. Measure the total serum bilirubin (TSB) or transcutaneous bilirubin (TcB) level on infants jaundiced in the first 24 hours.
4. Recognize that visual estimation of the degree of jaundice can lead to errors, particularly in darkly pigmented infants.
5. Interpret all bilirubin levels according to the infant's age in hours.
6. Recognize that infants at less than 38 weeks' gestation, particularly those who are breastfed, are at higher risk of developing hyperbilirubinemia and require closer surveillance and monitoring.
7. Perform a systematic assessment on all infants before discharge for the risk of severe hyperbilirubinemia.
8. Provide parents with written and verbal information about newborn jaundice.
9. Provide appropriate follow-up based on the time of discharge and the risk assessment.
10. Treat newborns, when indicated, with phototherapy or exchange transfusion.

Coding Quick Reference for Hyperbilirubinemia	
ICD-9-CM	***ICD-10-CM***
774.2 Jaundice of prematurity	**P59.0** Neonatal jaundice associated with preterm delivery
774.39 Jaundice, newborn, breast milk	**P59.3** Neonatal jaundice from breast milk inhibitor
774.6 Jaundice, newborn, physiologic jaundice	**P59.9** Neonatal jaundice, unspecified
782.4 Jaundice, unspecified, not newborn	**R17** Unspecified jaundice

Jaundice and Your Newborn

Congratulations on the birth of your new baby!

To make sure your baby's first week is safe and healthy, it is important that

1. You find a pediatrician you are comfortable with for your baby's ongoing care.
2. Your baby is checked for jaundice in the hospital.
3. If you are breastfeeding, you get the help you need to make sure it is going well.
4. Make sure your baby is seen by a doctor or nurse at 3 to 5 days of age.
5. If your baby is discharged before age 72 hours, your baby should be seen by a doctor or nurse within 2 days of discharge from the hospital.

Q: What is jaundice?

A: Jaundice is the yellow color seen in the skin of many newborns. It happens when a chemical called *bilirubin* builds up in the baby's blood. Jaundice can occur in babies of any race or color.

Q: Why is jaundice common in newborns?

A: Everyone's blood contains bilirubin, which is removed by the liver. Before birth, the mother's liver does this for the baby. Most babies develop jaundice in the first few days after birth because it takes a few days for the baby's liver to get better at removing bilirubin.

Q: How can I tell if my baby is jaundiced?

A: The skin of a baby with jaundice usually appears yellow. The best way to see jaundice is in good light, such as daylight or under fluorescent lights. Jaundice usually appears first in the face and then moves to the chest, abdomen, arms, and legs as the bilirubin level increases. The whites of the eyes may also be yellow. Jaundice may be harder to see in babies with darker skin color.

Q: Can jaundice hurt my baby?

A: Most babies have mild jaundice that is harmless, but in unusual situations the bilirubin level can get very high and might cause brain damage. This is why newborns should be checked carefully for jaundice and treated to prevent a high bilirubin level.

Q: How should my baby be checked for jaundice?

A: If your baby looks jaundiced in the first few days after birth, your baby's doctor or nurse may use a skin or blood test to check your baby's bilirubin level. However, because estimating the bilirubin level based on the baby's appearance can be difficult, some experts recommend that a skin or blood test be done even if your baby does not appear jaundiced. A bilirubin level is always needed if jaundice develops before the baby is 24 hours old. Whether a test is needed after that depends on the baby's age, the amount of jaundice, and whether the baby has other factors that make jaundice more likely or harder to see.

Q: Does breastfeeding affect jaundice?

A: Jaundice is more common in babies who are breastfed than babies who are formula-fed, but this occurs mainly in newborns who are not nursing well. If you are breastfeeding, you should nurse your baby at least 8 to 12 times a day for the first few days. This will help you produce enough milk and will help to keep the baby's bilirubin level down. If you are having trouble breastfeeding, ask your baby's doctor or nurse or a lactation specialist for help. Breast milk is the ideal food for your baby.

Q: When should my newborn get checked after leaving the hospital?

A: It is important for your baby to be seen by a nurse or doctor when the baby is between 3 and 5 days old, because this is usually when a baby's bilirubin level is highest. This is why, if your baby is discharged before age 72 hours, your baby should be seen within 2 days of discharge. The timing of this visit may vary depending on your baby's age when released from the hospital and other factors.

Q: Which babies require more attention for jaundice?

A: Some babies have a greater risk for high levels of bilirubin and may need to be seen sooner after discharge from the hospital. Ask your doctor about an early follow-up visit if your baby has any of the following:

- A high bilirubin level before leaving the hospital
- Early birth (more than 2 weeks before the due date)
- Jaundice in the first 24 hours after birth
- Breastfeeding that is not going well
- A lot of bruising or bleeding under the scalp related to labor and delivery
- A parent, brother, or sister who had high bilirubin and received light therapy

Q: When should I call my baby's doctor?

A: Call your baby's doctor if

- Your baby's skin turns more yellow.
- Your baby's abdomen, arms, or legs are yellow.
- The whites of your baby's eyes are yellow.
- Your baby is jaundiced and is hard to wake, fussy, or not nursing or taking formula well.

Q: How is harmful jaundice prevented?

A: Most jaundice requires no treatment. When treatment is necessary, placing your baby under special lights while he or she is undressed will lower the bilirubin level. Depending on your baby's bilirubin level, this can be done in the hospital or at home. Jaundice is treated at levels that are much lower than those at which brain damage is a concern. Treatment can prevent the harmful effects of jaundice. Putting your baby in sunlight is not recommended as a safe way of treating jaundice. Exposing your baby to sunlight might help lower the bilirubin level, but this will only work if the baby is completely undressed. This cannot be done safely inside your home because your baby will get cold, and newborns should never be put in direct sunlight outside because they might get sunburned.

Q: When does jaundice go away?

A: In breastfed babies, jaundice often lasts for more than 2 to 3 weeks. In formula-fed babies, most jaundice goes away by 2 weeks. If your baby is jaundiced for more than 3 weeks, see your baby's doctor.

From your doctor

American Academy of Pediatrics

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The Diagnosis and Management of Acute Otitis Media

- *Clinical Practice Guideline*

CLINICAL PRACTICE GUIDELINE

The Diagnosis and Management of Acute Otitis Media

abstract

FREE

This evidence-based clinical practice guideline is a revision of the 2004 acute otitis media (AOM) guideline from the American Academy of Pediatrics (AAP) and American Academy of Family Physicians. It provides recommendations to primary care clinicians for the management of children from 6 months through 12 years of age with uncomplicated AOM.

In 2009, the AAP convened a committee composed of primary care physicians and experts in the fields of pediatrics, family practice, otolaryngology, epidemiology, infectious disease, emergency medicine, and guideline methodology. The subcommittee partnered with the Agency for Healthcare Research and Quality and the Southern California Evidence-Based Practice Center to develop a comprehensive review of the new literature related to AOM since the initial evidence report of 2000. The resulting evidence report and other sources of data were used to formulate the practice guideline recommendations.

The focus of this practice guideline is the appropriate diagnosis and initial treatment of a child presenting with AOM. The guideline provides a specific, stringent definition of AOM. It addresses pain management, initial observation versus antibiotic treatment, appropriate choices of antibiotic agents, and preventive measures. It also addresses recurrent AOM, which was not included in the 2004 guideline. Decisions were made on the basis of a systematic grading of the quality of evidence and benefit-harm relationships.

The practice guideline underwent comprehensive peer review before formal approval by the AAP.

This clinical practice guideline is not intended as a sole source of guidance in the management of children with AOM. Rather, it is intended to assist primary care clinicians by providing a framework for clinical decision-making. It is not intended to replace clinical judgment or establish a protocol for all children with this condition. These recommendations may not provide the only appropriate approach to the management of this problem. *Pediatrics* 2013;131:e964–e999

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KEY WORDS

acute otitis media, otitis media, otoscopy, otitis media with effusion, watchful waiting, antibiotics, antibiotic prophylaxis, tympanostomy tube insertion, immunization, breastfeeding

ABBREVIATIONS

AAFP—American Academy of Family Physicians
AAP—American Academy of Pediatrics
AHRQ—Agency for Healthcare Research and Quality
AOM—acute otitis media
CI—confidence interval
FDA—US Food and Drug Administration
LAIV—live-attenuated intranasal influenza vaccine
MEE—middle ear effusion
MIC—minimum inhibitory concentration
NNT—number needed to treat
OM—otitis media
OME—otitis media with effusion
OR—odds ratio
PCV7—heptavalent pneumococcal conjugate vaccine
PCV13—13-valent pneumococcal conjugate vaccine
RD—rate difference
SNAP—safety-net antibiotic prescription
TIV—trivalent inactivated influenza vaccine
TM—tympanic membrane
WASP—wait-and-see prescription

(Continued on last page)

Key Action Statement 1A: Clinicians should diagnose acute otitis media (AOM) in children who present with moderate to severe bulging of the tympanic membrane (TM) *or* new onset of otorrhea not due to acute otitis externa. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 1B: Clinicians should diagnose AOM in children who present with mild bulging of the TM *and* recent (less than 48 hours) onset of ear pain (holding, tugging, rubbing of the ear in a nonverbal child) or intense erythema of the TM. Evidence Quality: Grade C. Strength: Recommendation.

Key Action Statement 1C: Clinicians should not diagnose AOM in children who do not have middle ear effusion (MEE) (based on pneumatic otoscopy and/or tympanometry). Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 2: The management of AOM should include an assessment of pain. If pain is present, the clinician should recommend treatment to reduce pain. Evidence Quality: Grade B. Strength: Strong Recommendation.

Key Action Statement 3A: Severe AOM: The clinician should prescribe antibiotic therapy for AOM (bilateral or unilateral) in children 6 months and older with severe signs or symptoms (ie, moderate or severe otalgia or otalgia for at least 48 hours or temperature 39°C [102.2°F] or higher). Evidence Quality: Grade B. Strength: Strong Recommendation.

Key Action Statement 3B: Nonsevere bilateral AOM in young children: The clinician should prescribe antibiotic therapy for bilateral AOM in children 6 months through 23 months of age without severe signs or symptoms (ie, mild otalgia for less than 48 hours and temperature less than 39°C [102.2°F]). Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 3C: Nonsevere unilateral AOM in young children: The clinician should either prescribe antibiotic therapy *or* offer observation with close follow-up based on joint decision-making with the parent(s)/caregiver for unilateral AOM in children 6 months to 23 months of age without severe signs or symptoms (ie, mild otalgia for less than 48 hours and temperature less than 39°C [102.2°F]). When observation is used, a mechanism must be in place to ensure follow-up and begin antibiotic therapy if the child worsens or fails to improve within 48 to 72 hours of onset of symptoms. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 3D: Nonsevere AOM in older children: The clinician should either prescribe antibiotic therapy *or* offer observation with close follow-up based on joint decision-making with the parent(s)/caregiver for AOM (bilateral or unilateral) in children 24 months or older without severe signs or symptoms (ie, mild otalgia for less than 48 hours and temperature less than 39°C [102.2°F]). When observation is used, a mechanism must be in place to ensure follow-up and begin antibiotic therapy if the child worsens or fails to improve within 48 to 72 hours of onset of symptoms. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 4A: Clinicians should prescribe amoxicillin for AOM when a decision to treat with antibiotics has been made *and* the child has not received amoxicillin in the past 30 days *or* the child does not have concurrent purulent conjunctivitis *or* the child is not allergic to penicillin. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 4B: Clinicians should prescribe an antibiotic with additional β-lactamase coverage for AOM when a decision to treat with antibiotics has been made, *and* the child has received amoxicillin in the last 30 days *or* has concurrent purulent conjunctivitis, *or* has a history of recurrent AOM unresponsive to amoxicillin. Evidence Quality: Grade C. Strength: Recommendation.

Key Action Statement 4C: Clinicians should reassess the patient if the caregiver reports that the child's symptoms have worsened or failed to respond to the initial antibiotic treatment within 48 to 72 hours and determine whether a change in therapy is needed. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 5A: Clinicians should not prescribe prophylactic antibiotics to reduce the frequency of episodes of AOM in children with recurrent AOM. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 5B: Clinicians may offer tympanostomy tubes for recurrent AOM (3 episodes in 6 months or 4 episodes in 1 year with 1 episode in the preceding 6 months). Evidence Quality: Grade B. Strength: Option.

Key Action Statement 6A: Clinicians should recommend pneumococcal conjugate vaccine to all children according to the schedule of the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention, American Academy of Pediatrics (AAP), and American Academy of Family Physicians (AAFP). Evidence Quality: Grade B. Strength: Strong Recommendation.

Key Action Statement 6B: Clinicians should recommend annual influenza vaccine to all children according to the schedule of the Advisory Committee on Immunization Practices, AAP, and AAFP. Evidence Quality: Grade B. Strength: Recommendation.

2Key Action Statement 6C: Clinicians should encourage exclusive breastfeeding for at least 6 months. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 6D: Clinicians should encourage avoidance of tobacco smoke exposure. Evidence Quality: Grade C. Strength: Recommendation.

INTRODUCTION

In May 2004, the AAP and AAFP published the "Clinical Practice Guideline: Diagnosis and Management of Acute Otitis Media".[1] The guideline offered 8 recommendations ranked according to level of evidence and benefit-harm relationship. Three of the recommendations—diagnostic criteria, observation, and choice of antibiotics—led to significant discussion, especially among experts in the field of otitis media (OM). Also, at the time the guideline was written, information regarding the heptavalent pneumococcal conjugate vaccine (PCV7) was not yet published. Since completion of the guideline in November 2003 and its publication in May 2004, there has been a significant body of additional literature on AOM.

Although OM remains the most common condition for which antibacterial agents are prescribed for children in the United States[2,3] clinician visits for OM decreased from 950 per 1000 children in 1995–1996 to 634 per 1000 children in 2005–2006. There has been a proportional decrease in antibiotic prescriptions for OM from 760 per 1000 in 1995–1996 to 484 per 1000 in 2005–2006. The percentage of OM visits resulting in antibiotic prescriptions remained relatively stable (80% in 1995–1996; 76% in 2005–2006).[2] Many factors may have contributed to the decrease in visits for OM, including financial issues relating to insurance, such as copayments, that may limit doctor visits, public education campaigns regarding the viral nature of most infectious diseases, use of the PCV7 pneumococcal vaccine, and increased use of the influenza vaccine. Clinicians may also be more attentive to differentiating AOM from OM with effusion (OME), resulting in fewer visits coded for AOM and fewer antibiotic prescriptions written.

Despite significant publicity and awareness of the 2004 AOM guideline, evidence shows that clinicians are hesitant to follow the guideline recommendations. Vernacchio et al[4] surveyed 489 primary care physicians as to their management of 4 AOM scenarios addressed in the 2004 guideline. No significant changes in practice were noted on this survey, compared with a survey administered before the 2004 AOM guideline. Coco[5] used the National Ambulatory Medical Care Survey from 2002 through 2006 to determine the frequency of AOM visits without antibiotics before and after publication of the 2004 guideline. There was no difference in prescribing rates. A similar response to otitis guidelines was found in Italy as in the United States.[6,7] These findings parallel results of other investigations regarding clinician awareness and adherence to guideline recommendations in all specialties, including pediatrics.[8] Clearly, for clinical practice guidelines to be effective, more must be done to improve their dissemination and implementation.

This revision and update of the AAP/AAFP 2004 AOM guideline[1] will evaluate published evidence on the diagnosis and management of uncomplicated AOM and make recommendations based on that evidence. The guideline is intended for primary care clinicians including pediatricians and family physicians, emergency department physicians, otolaryngologists, physician assistants, and nurse practitioners. The scope of the guideline is the diagnosis and management of AOM, including recurrent AOM, in children 6 months through 12 years of age. It applies only to an otherwise healthy child without underlying conditions that may alter the natural course of AOM, including but not limited to the presence of tympanostomy tubes; anatomic abnormalities, including cleft palate; genetic conditions with craniofacial abnormalities, such as Down syndrome; immune deficiencies; and the presence of cochlear implants. Children with OME without AOM are also excluded.

Glossary of Terms

AOM—the rapid onset of signs and symptoms of inflammation in the middle ear[9,10]

Uncomplicated AOM—AOM without otorrhea[1]

Severe AOM—AOM with the presence of moderate to severe otalgia *or* fever equal to or higher than 39°C[9,10]

Nonsevere AOM—AOM with the presence of mild otalgia and a temperature below 39°C[9,10]

Recurrent AOM—3 or more well-documented and separate AOM episodes in the preceding 6 months *or* 4 or more episodes in the preceding 12 months with at least 1 episode in the past 6 months[11,12]

OME—inflammation of the middle ear with liquid collected in the middle ear; the signs and symptoms of acute infection are absent[9]

MEE—liquid in the middle ear without reference to etiology, pathogenesis, pathology, or duration[9]

Otorrhea—discharge from the ear, originating at 1 or more of the following sites: the external auditory canal,

middle ear, mastoid, inner ear, or intracranial cavity

Otitis externa—an infection of the external auditory canal

Tympanometry—measuring acoustic immittance (transfer of acoustic energy) of the ear as a function of ear canal air pressure[13,14]

Number needed to treat (NNT)—the number of patients who need to be treated to prevent 1 additional bad outcome[15]

Initial antibiotic therapy—treatment of AOM with antibiotics that are prescribed at the time of diagnosis with the intent of starting antibiotic therapy as soon as possible after the encounter

Initial observation—initial management of AOM limited to symptomatic relief, with commencement of antibiotic therapy only if the child's condition worsens at any time or does not show clinical improvement within 48 to 72 hours of diagnosis; a mechanism must be in place to ensure follow-up and initiation of antibiotics if the child fails observation

METHODS

Guideline development using an evidence-based approach requires that all evidence related to the guideline is gathered in a systematic fashion, objectively assessed, and then described so readers can easily see the links between the evidence and recommendations made. An evidence-based approach leads to recommendations that are guided by both the quality of the available evidence and the benefit-to-harm ratio that results from following the recommendation. Figure 1 shows the relationship of evidence quality and benefit-harm balance in determining the level of recommendation. Table 1 presents the AAP definitions and implications of different levels of evidence-based recommendations.[16]

In preparing for the 2004 AAP guidelines, the Agency for Healthcare Research and Quality (AHRQ) funded and conducted an exhaustive review of the literature on diagnosis and management of AOM.[17–19] In 2008, the AHRQ and the Southern California Evidence-Based Practice Center began a similar process of reviewing the literature published since the 2001 AHRQ report. The AAP again partnered with AHRQ and the Southern California Evidence-Based Practice Center to develop the evidence report, which served as a major source of data for these practice guideline recommendations.[20,21] New key questions were determined by a technical expert panel. The scope of the new report went beyond the 2001 AHRQ report to include recurrent AOM.

The key questions addressed by AHRQ in the 2010 report were as follows:

1. Diagnosis of AOM: What are the operating characteristics (sensitivity, specificity, and likelihood ratios) of clinical symptoms and otoscopic findings (such as bulging TM) to diagnose uncomplicated AOM and to distinguish it from OME?
2. What has been the effect of the use of heptavalent PCV7 on AOM microbial epidemiology, what organisms (bacterial and viral) are associated with AOM since the introduction of PCV7, and what are the patterns of antimicrobial resistance in AOM since the introduction of PCV7?
3. What is the comparative effectiveness of various treatment options for treating uncomplicated AOM in average risk children?
4. What is the comparative effectiveness of different management options for recurrent OM (uncomplicated) and persistent OM or relapse of AOM?
5. Do treatment outcomes in Questions 3 and 4 differ by characteristics of the condition (AOM), patient, environment, and/or health care delivery system?
6. What adverse effects have been observed for treatments for which outcomes are addressed in Questions 3 and 4?

For the 2010 review, searches of PubMed and the Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, and Education Resources Information Center were conducted by using the same search strategies used for the 2001 report for publications from 1998 through June 2010. Additional terms or conditions not considered in the 2001 review (recurrent OM, new drugs, and heptavalent pneumococcal vaccine) were also included. The Web of Science was also used to search for citations of the 2001 report and its peer-reviewed publications. Titles were screened independently by 2

Evidence Quality	Preponderance of Benefit or Harm	Balance of Benefit and Harm
A. Well designed RCTs or diagnostic studies on relevant population	Strong Recommendation	Option
B. RCTs or diagnostic studies with minor limitations; overwhelmingly consistent evidence from observational studies	Recommendation	
C. Observational studies (case-control and cohort design)		
D. Expert opinion, case reports, reasoning from first principles	Option	No Rec
X. Exceptional situations in which validating studies cannot be performed and there is a clear preponderance of benefit or harm	Strong Recommendation / Recommendation	

FIGURE 1
Relationship of evidence quality and benefit-harm balance in determining the level of recommendation. RCT, randomized controlled trial.

TABLE 1 Guideline Definitions for Evidence-Based Statements

Statement	Definition	Implication
Strong Recommendation	A strong recommendation in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms (as a strong recommendation against an action is made when the anticipated harms clearly exceed the benefits) and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendations may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A recommendation in favor of a particular action is made when the anticipated benefits exceed the harms, but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high-quality evidence is impossible to obtain but the anticipated benefits outweigh the harms.	Clinicians would be prudent to follow a recommendation but should remain alert to new information and sensitive to patient preferences.
Option	Options define courses that may be taken when either the quality of evidence is suspect or carefully performed studies have shown little clear advantage to 1 approach over another.	Clinicians should consider the option in their decision-making, and patient preference may have a substantial role.
No Recommendation	No recommendation indicates that there is a lack of pertinent published evidence and that the anticipated balance of benefits and harms is presently unclear.	Clinicians should be alert to new published evidence that clarifies the balance of benefit versus harm.

pediatricians with experience in conducting systematic reviews.

For the question pertaining to diagnosis, efficacy, and safety, the search was primarily for clinical trials. For the question pertaining to the effect of PCV7 on epidemiology and microbiology, the group searched for trials that compared microbiology in the same populations before and after introduction of the vaccine or observational studies that compared microbiology across vaccinated and unvaccinated populations.

In total, the reviewers examined 7646 titles, of which 686 titles were identified for further review. Of those, 72 articles that met the predetermined inclusion and exclusion criteria were reviewed in detail. Investigators abstracted data into standard evidence tables, with accuracy checked by a second investigator. Studies were quality-rated by 2 investigators by using established criteria. For randomized controlled trials, the Jadad criteria were used.[22] QUADAS criteria[23] were used to evaluate the studies that pertained to diagnosis. GRADE criteria were applied to pooled analyses.[24] Data abstracted included parameters necessary to define study groups, inclusion/exclusion criteria, influencing factors, and outcome measures. Some of the data for analysis were abstracted by a biostatistician and checked by a physician reviewer. A sequential resolution strategy was used to match and resolve the screening and review results of the 2 pediatrician reviewers.

For the assessment of treatment efficacy, pooled analyses were performed for comparisons for which 3 or more trials could be identified. Studies eligible for analyses of questions pertaining to treatment efficacy were grouped for comparisons by treatment options. Each comparison consisted of studies that were considered homogeneous across clinical practice. Because some of the key questions were addressed in the 2001 evidence report,[17] studies identified in that report were included with newly identified articles in the 2010 evidence report.[20]

Decisions were made on the basis of a systematic grading of the quality of evidence and strength of recommendations as well as expert consensus when definitive data were not available. Results of the literature review were presented in evidence tables and published in the final evidence report.[20]

In June 2009, the AAP convened a new subcommittee to review and revise the May 2004 AOM guideline.[1] The subcommittee comprised primary care physicians and experts in the fields of pediatrics, family practice, otolaryngology, epidemiology, infectious disease, emergency medicine, and guideline methodology. All panel members reviewed the AAP policy on conflict of interest and voluntary disclosure and were given an opportunity to present any potential conflicts with the subcommittee's work. All potential conflicts of interest are listed at the end of this document. The project was funded by the AAP. New literature on OM is continually being published. Although the systematic review performed by AHRQ could not be replicated with new literature, members of the Subcommittee on Diagnosis and Management of Acute Otitis Media reviewed additional articles. PubMed was searched by using the single search term "acute otitis media,"

approximately every 6 months from June 2009 through October 2011 to obtain new articles. Subcommittee members evaluated pertinent articles for quality of methodology and importance of results. Selected articles used in the AHRQ review were also reevaluated for their quality. Conclusions were based on the consensus of the subcommittee after the review of newer literature and reevaluation of the AHRQ evidence. Key action statements were generated using BRIDGE-Wiz (Building Recommendations in a Developers Guideline Editor), an interactive software tool that leads guideline development through a series of questions that are intended to create a more actionable set of key action statements.[25] BRIDGE-Wiz also incorporates the quality of available evidence into the final determination of the strength of each recommendation.

After thorough review by the subcommittee for this guideline, a draft was reviewed by other AAP committees and sections, selected outside organizations, and individuals identified by the subcommittee as experts in the field. Additionally, members of the subcommittee were encouraged to distribute the draft to interested parties in their respective specialties. All comments were reviewed by the writing group and incorporated into the final guideline when appropriate.

This clinical practice guideline is not intended as a sole source of guidance in the management of children with AOM. Rather, it is intended to assist clinicians in decision-making. It is not intended to replace clinical judgment or establish a protocol for the care of all children with this condition. These recommendations may not provide the only appropriate approach to the management of children with AOM.

It is AAP policy to review and update evidence-based guidelines every 5 years.

KEY ACTION STATEMENTS

Key Action Statement 1A

Clinicians should diagnose AOM in children who present with moderate to severe bulging of the TM *or* new onset of otorrhea not due to acute otitis externa. (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 1A

Aggregate evidence quality	Grade B
Benefits	• Identify a population of children most likely to benefit from intervention. • Avoid unnecessary treatment of those without highly certain AOM. • Promote consistency in diagnosis.
Risks, harms, cost	May miss AOM that presents with a combination of mild bulging, intense erythema, or otalgia that may not necessarily represent less severe disease and may also benefit from intervention.
Benefits-harms assessment	Preponderance of benefit.
Value judgments	Identification of a population of children with highly certain AOM is beneficial. Accurate, specific diagnosis is helpful to the individual patient. Modification of current behavior of overdiagnosis is a goal. Increased specificity is preferred even as sensitivity is lowered.
Intentional vagueness	By using stringent diagnostic criteria, the TM appearance of less severe illness that might be early AOM has not been addressed.
Role of patient preferences	None
Exclusions	None
Strength	**Recommendation**
Notes	Tympanocentesis studies confirm that using these diagnostic findings leads to high levels of isolation of pathogenic bacteria. Evidence is extrapolated from treatment studies that included tympanocentesis.

Key Action Statement 1B

Clinicians should diagnose AOM in children who present with mild bulging of the TM *and* recent (less than 48 hours) onset of ear pain (holding, tugging, rubbing of the ear in a nonverbal child) or intense erythema of the TM. (Evidence Quality: Grade C, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 1B

Aggregate evidence quality	Grade C
Benefits	Identify AOM in children when the diagnosis is not highly certain.
Risks, harms, cost	Overdiagnosis of AOM. Reduced precision in diagnosis.
Benefits-harms assessment	Benefits greater than harms.
Value judgments	None.
Intentional vagueness	Criteria may be more subjective.
Role of patient preferences	None
Exclusions	None
Strength	**Recommendation**
Notes	Recent onset of ear pain means within the past 48 hours.

Key Action Statement 1C

Clinicians should not diagnose AOM in children who do not have MEE (based on pneumatic otoscopy and/or tympanometry). (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 1C

Aggregate evidence quality	Grade B
Benefits	Reduces overdiagnosis and unnecessary treatment. Increases correct diagnosis of other conditions with symptoms that otherwise might be attributed to AOM. Promotes the use of pneumatic otoscopy and tympanometry to improve diagnostic accuracy.
Risks, harms, cost	Cost of tympanometry. Need to acquire or reacquire skills in pneumatic otoscopy and tympanometry for some clinicians.
Benefits-harms assessment	Preponderance of benefit.
Value judgments	AOM is overdiagnosed, often without adequate visualization of the TM. Early AOM without effusion occurs, but the risk of overdiagnosis supersedes that concern.
Intentional vagueness	None
Role of patient preferences	None
Exclusions	Early AOM evidenced by intense erythema of the TM.
Strength	**Recommendation**

Purpose of This Section

There is no gold standard for the diagnosis of AOM. In fact, AOM has a spectrum of signs as the disease develops.[26] Therefore, the purpose of this section is to provide clinicians and researchers with a working clinical definition of AOM and to differentiate AOM from OME. The criteria were chosen to achieve high specificity recognizing that the resulting decreased sensitivity may exclude less severe presentations of AOM.

Changes From AAP/AAFP 2004 AOM Guideline

Accurate diagnosis of AOM is critical to sound clinical decision-making and high-quality research. The 2004 "Clinical Practice Guideline: Diagnosis and Management of AOM"[1] used a 3-part definition for AOM: (1) acute onset of symptoms, (2) presence of MEE, and (3) signs of acute middle ear inflammation. This definition generated extensive discussion and reanalysis of the AOM diagnostic evidence. The 2004 definition lacked precision to exclude cases of OME, and diagnoses of AOM could be made in children with acute onset of symptoms, including severe otalgia and MEE, without other otoscopic findings of inflammation.[27] Furthermore, the use of "uncertain diagnosis" in the 2004 AOM guideline may have permitted diagnoses of AOM without clear visualization of the TM. Earlier studies may have enrolled children who had OME rather than AOM, resulting in the possible classification of such children as improved because their nonspecific symptoms would have abated regardless of therapy.[28–30] Two studies, published in 2011, used stringent diagnostic criteria for diagnosing AOM with much less risk of conclusions based on data from mixed patients.[31,32]

Since publication of the 2004 AOM guideline, a number of studies have been conducted evaluating scales for the presence of symptoms. These studies did not show a consistent correlation of symptoms with the initial diagnosis of AOM, especially in preverbal children.[33–35]

Recent research has used precisely stated stringent criteria of AOM for purposes of the studies.[31,32] The current guideline endorses stringent otoscopic diagnostic criteria as a basis for management decisions (described later). As clinicians use the proposed stringent criteria to diagnose AOM, they should be aware that children with AOM may also present with recent onset of ear pain and intense erythema of the TM as the only otoscopic finding.

Symptoms

Older children with AOM usually present with a history of rapid onset of ear pain. However, in young preverbal children, otalgia as suggested by tugging/rubbing/holding of the ear, excessive crying, fever, or changes in the child's sleep or behavior pattern as noted by the parent are often relatively nonspecific symptoms. A number of studies have attempted to correlate symptom scores with diagnoses of AOM.

A systematic review[36] identified 4 articles that evaluated the accuracy of symptoms.[37–40] Ear pain appeared useful in diagnosing AOM (combined positive likelihood ratio 3.0–7.3, negative likelihood ratio 0.4–0.6); however, it was only present in 50% to 60% of children with AOM. Conclusions from these studies may be limited, because they (1) enrolled children seen by specialists, not likely to represent the whole spectrum of severity of illness; (2) used a clinical diagnosis of AOM based more on symptomatology rather than on tympanocentesis; and (3) included relatively older children.[37,40]

Laine et al[34] used a questionnaire administered to 469 parents who suspected their children, aged 6 to 35 months, had AOM. Of the children, 237 had AOM using strict otoscopic criteria, and 232 had upper respiratory tract infection without AOM. Restless sleep, ear rubbing, fever, and nonspecific respiratory or gastrointestinal

tract symptoms did not differentiate children with or without AOM.

McCormick et al[30] used 2 symptom scores—a 3-item score (OM-3), consisting of symptoms of physical suffering such as ear pain or fever, emotional distress (irritability, poor appetite), and limitation in activity; and a 5-item score (Ear Treatment Group Symptom Questionnaire, 5 Items [ETG-5]), including fever, earache, irritability, decreased appetite, and sleep disturbance—to assess AOM symptoms at the time of diagnosis and daily during the 10-day treatment or observation period. They found both to be a responsive measure of changes in clinical symptoms. The same group[35] also tested a visual scale, Acute Otitis Media-Faces Scale (AOM-FS), with faces similar to the Wong-Baker pain scale.[41] None of the scales were adequately sensitive for making the diagnosis of AOM based on symptoms. The AOM-FS combined with an otoscopy score, OS-8,[30] were presented as a double-sided pocket card. The combination of AOM-FS and OS-8 was more responsive to change than either instrument alone.

Shaikh et al[33,42] validated a 7-item parent-reported symptom score (Acute Otitis Media Severity of Symptom Scale [AOM-SOS]) for children with AOM, following stringent guidance of the US Food and Drug Administration (FDA) on the development of patient-reported outcome scales. Symptoms included ear tugging/rubbing/holding, excessive crying, irritability, difficulty sleeping, decreased activity or appetite, and fever. AOM-SOS was correlated with otoscopic diagnoses (AOM, OME, and normal middle ear status). AOM-SOS changed appropriately in response to clinical change. Its day-to-day responsiveness supports its usefulness in following AOM symptoms over time.

Signs of AOM

Few studies have evaluated the relationship of otoscopic findings in AOM and tympanocentesis. A study by Karma et al[43] is often cited as the best single study of otoscopic findings in AOM. However, the study uses only a symptom-based diagnosis of AOM plus the presence of MEE. Thus, children with acute upper respiratory tract infection symptoms and OME would have been considered to have AOM. There also were significant differences in findings at the 2 centers that participated in the study.

The investigators correlated TM color, mobility, and position with the presence of middle ear fluid obtained by tympanocentesis. At 2 sites in Finland (Tampere and Oulu), 2911 children were followed from 6 months to 2.5 years of age. A single otolaryngologist at Tampere and a single pediatrician at Oulu examined subjects. Color, position, and mobility were recorded. Myringotomy and aspiration were performed if MEE was suspected. AOM was diagnosed if MEE was found and the child had fever, earache, irritability, ear rubbing or tugging, simultaneous other acute respiratory tract symptoms, vomiting, or diarrhea. The presence or absence of MEE was noted, but no analyses of the fluid, including culture, were performed. Pneumatic otoscopic findings were classified as follows: color—hemorrhagic, strongly red, moderately red, cloudy or dull, slightly red, or normal; position—bulging, retracted, or normal; and mobility—distinctly impaired, slightly impaired, or normal.

For this analysis, 11 804 visits were available. For visits with acute symptoms, MEE was found in 84.9% and 81.8% at the 2 sites at which the study was performed. There were significant differences among the results at the 2 centers involved in the study. Table 2 shows specific data for each finding.

The combination of a "cloudy," bulging TM with impaired mobility was the best predictor of AOM using the symptom-based diagnosis in this study. Impaired mobility had the highest sensitivity and specificity (approximately 95% and 85%, respectively). Cloudiness had the next best combination of high sensitivity (~74%) and high specificity (~93%) in this study. Bulging had high specificity (~97%) but lower sensitivity (~51%). A TM that was hemorrhagic, strongly red, or moderately red also correlated with the presence of AOM, and a TM that was only "slightly red" was not helpful diagnostically.

McCormick et al reported that a bulging TM was highly associated with the presence of a bacterial pathogen, with or without a concomitant viral pathogen.[44] In a small study, 31 children (40 ears) underwent myringotomy.[45] Bulging TMs had positive bacterial cultures 75% of the time. The percentage of positive cultures for a pathogen increased to 80% if the color of the TM was yellow. The conclusion is that moderate to severe bulging of the TM represents the most important characteristic in the diagnosis of AOM—a finding that has

TABLE 2 Otoscopic Findings in Children With Acute Symptoms and MEE[a]

TM Finding in Acute Visits With MEE	Group I (Tampere, Finland), %	Group II (Oulo, Finland), %
Color		
Distinctly red	69.8	65.6
Hemorrhagic	81.3	62.9
Strongly red	87.7	68.1
Moderately red	59.8	66.0
Slightly red	39.4	16.7
Cloudy	95.7	80.0
Normal	1.7	4.9
Position		
Bulging	96.0	89
Retracted	46.8	48.6
Normal	32.1	22.2
Mobility		
Distinctly impaired	94.0	78.5
Slightly impaired	59.7	32.8
Normal	2.7	4.8

[a] Totals are greater than 100%, because each ear may have had different findings.[43]

implications for clinical care, research, and education.

The committee recognized that there is a progression from the presence of MEE to the bulging of the TM, and it is often difficult to differentiate this equivocal appearance from the highly certain AOM criteria advocated in this guideline.[26] As such, there is a role for individualized diagnosis and management decisions. Examples of normal, mild bulging, moderate bulging, and severe bulging can be seen in Fig 2.

Distinguishing AOM From OME

OME may occur either as the aftermath of an episode of AOM or as a consequence of eustachian tube dysfunction attributable to an upper respiratory tract infection.[46] However, OME may also precede and predispose to the development of AOM. These 2 forms of OM may be considered segments of a disease continuum.[47] However, because OME does not represent an acute infectious process that benefits from antibiotics, it is of utmost importance for clinicians to become proficient in distinguishing normal middle ear status from OME or AOM. Doing so will avoid unnecessary use of antibiotics, which leads to increased adverse effects of medication and facilitates the development of antimicrobial resistance.

Examination of the TM

Accurate diagnosis of AOM in infants and young children may be difficult. Symptoms may be mild or overlap with those of an upper respiratory tract illness. The TM may be obscured by cerumen, and subtle changes in the TM may be difficult to discern. Additional factors complicating diagnosis may include lack of cooperation from the child; less than optimal diagnostic equipment, including lack of a pneumatic bulb; inadequate instruments for clearing cerumen from the external auditory canal; inadequate assistance for restraining the child; and lack of experience in removing cerumen and performing pneumatic otoscopy.

The pneumatic otoscope is the standard tool used in diagnosing OM. Valuable also is a surgical head, which greatly facilitates cleaning cerumen from an infant's external auditory canal. Cerumen may be removed by using a curette, gentle suction, or irrigation.[48] The pneumatic otoscope should have a light source of sufficient brightness and an air-tight seal that permits application of positive and negative pressure. In general, nondisposable specula achieve a better seal with less pain because of a thicker, smoother edge and better light transmission properties. The speculum size should be chosen to gently seal at the outer portion of the external auditory canal.

Pneumatic otoscopy permits assessment of the contour of the TM (normal, retracted, full, bulging), its color (gray, yellow, pink, amber, white, red, blue), its translucency (translucent, semiopaque, opaque), and its mobility (normal, increased, decreased, absent). The normal TM is translucent, pearly gray, and has a ground-glass appearance (Fig 2A). Specific landmarks can be visualized. They include the short process and the manubrium of the malleus and the pars flaccida, located superiorly. These are easily observed and help to identify the position of the TM. Inward movement of the TM on positive pressure in the external canal and outward movement on negative pressure should occur, especially in the superior posterior quadrant. When the TM is retracted, the short process of the malleus becomes more prominent, and the manubrium appears shortened because of its change in position within the middle ear. Inward motion occurring with positive pressure is restricted or absent, because the TM is frequently as far inward as its range of motion allows. However, outward mobility can be visualized when negative pressure is applied. If the TM does not move perceptibly with applications of gentle positive or negative pressure, MEE is likely. Sometimes, the application of pressure will make an air-fluid interface behind the TM (which is diagnostic of MEE) more evident.[49]

Instruction in the proper evaluation of the child's middle ear status should begin with the first pediatric rotation in medical school and continue throughout postgraduate training.[50]

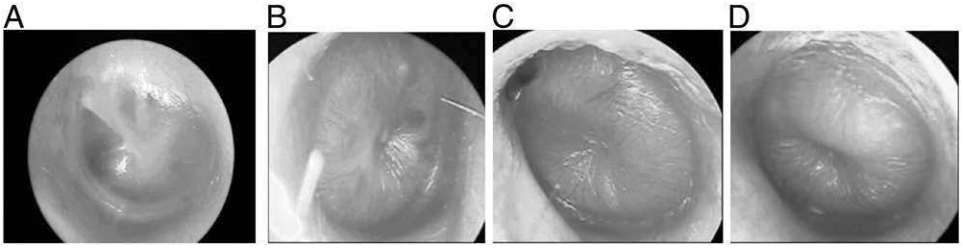

FIGURE 2

A, Normal TM. B, TM with mild bulging. C, TM with moderate bulging. D, TM with severe bulging. Courtesy of Alejandro Hoberman, MD.

Continuing medical education should reinforce the importance of, and retrain the clinician in, the use of pneumatic otoscopy.[51] Training tools include the use of a video-otoscope in residency programs, the use of Web-based educational resources,[49,52] as well as simultaneous or sequential examination of TMs with an expert otoscopist to validate findings by using a double headed or video otoscope. Tools for learning the ear examination can be found in a CD distributed by the Johns Hopkins University School of Medicine and the Institute for Johns Hopkins Nursing,[53] also available at http://www2.aap.org/sections/infectdis/video.cfm,[54] and through a Web-based program, ePROM: Enhancing Proficiency in Otitis Media.[52]

Key Action Statement 2

The management of AOM should include an assessment of pain. If pain is present, the clinician should recommend treatment to reduce pain. (Evidence Quality: Grade B, Rec. Strength: Strong Recommendation)

Key Action Statement Profile: KAS 2

Aggregate evidence quality	Grade B
Benefits	Relieves the major symptom of AOM.
Risks, harms, cost	Potential medication adverse effects. Variable efficacy of some modes of treatment.
Benefits-harms assessment	Preponderance of benefit.
Value judgments	Treating pain is essential whether or not antibiotics are prescribed.
Intentional vagueness	Choice of analgesic is not specified.
Role of patient preferences	Parents may assist in the decision as to what means of pain relief they prefer.
Exclusions	Topical analgesics in the presence of a perforated TM.
Strength	**Strong Recommendation**

Purpose of This Section

Pain is the major symptom of AOM. This section addresses and updates the literature on treating otalgia.

Changes From AAP/AAFP 2004 AOM Guideline

Only 2 new articles directly address the treatment of otalgia. Both address topical treatment. The 2 new articles are consistent with the 2004 guideline statement. The text of the 2004 guideline is, therefore, reproduced here, with the addition of discussion of the 2 new articles. Table 3 has been updated to include the new references.

Treatment of Otalgia

Many episodes of AOM are associated with pain.[55] Some children with OME also have ear pain. Although pain is a common symptom in these illnesses, clinicians often see otalgia as a peripheral concern not requiring direct attention.[56] Pain associated with AOM can be substantial in the first few days of illness and often persists longer in young children.[57] Antibiotic therapy of AOM does not provide symptomatic relief in the first 24 hours[58–61] and even after 3 to 7 days, there may be persistent pain, fever, or both in 30% of children younger than 2 years.[62] In contrast, analgesics do relieve pain associated with AOM within 24 hours[63] and should be used whether antibiotic therapy is or is not prescribed; they should be continued as long as needed. The AAP published the policy statement "The Assessment and Management of Acute Pain in Infants, Children, and Adolescents"[64] to assist the clinician in addressing pain in the context of illness. The management of pain, especially during the first 24 hours of an episode of AOM, should be addressed regardless of the use of antibiotics.

Various treatments of otalgia have been used, but none has been well studied. The clinician should select a treatment on the basis of a consideration of benefits and risks and, wherever possible, incorporate parent/caregiver and patient preference (Table 3).

TABLE 3 Treatments for Otalgia in AOM

Treatment Modality	Comments
Acetaminophen, ibuprofen[63]	Effective analgesia for mild to moderate pain. Readily available. Mainstay of pain management for AOM.
Home remedies (no controlled studies that directly address effectiveness)	May have limited effectiveness.
Distraction	
External application of heat or cold	
Oil drops in external auditory canal	
Topical agents	
Benzocaine, procaine, lidocaine[65,67,70]	Additional, but brief, benefit over acetaminophen in patients older than 5 y.
Naturopathic agents[68]	Comparable to amethocaine/phenazone drops in patients older than 6 y.
Homeopathic agents[71,72]	No controlled studies that directly address pain.
Narcotic analgesia with codeine or analogs	Effective for moderate or severe pain. Requires prescription; risk of respiratory depression, altered mental status, gastrointestinal tract upset, and constipation.
Tympanostomy/myringotomy[73]	Requires skill and entails potential risk.

Since the 2004 guideline was published, there have been only 2 significant new articles.

Bolt et al reported in 2008 on a double-blind placebo-controlled trial at the Australia Children's Hospital emergency department conducted in 2003–2004.[65] They used a convenience sample of children 3 to 17 years of age diagnosed with AOM in the ED. They excluded children with perforation of the TM, pressure-equalizing tube, allergy to local anesthetic or paracetamol, epilepsy, or liver, renal, or cardiac disease. Sixty-three eligible children were randomized to receive aqueous lidocaine or normal saline ear drops up to 3 times in 24 hours. They demonstrated a statistically significant 50% reduction in reported pain at 10 and 30 minutes but not at 20 minutes after application of topical lidocaine, compared with normal saline. Complications were minimal: 3 children reported some dizziness the next day, and none reported tinnitus. A limitation was that some children had received oral acetaminophen before administration of ear drops.

A Cochrane review of topical analgesia for AOM[66] searched the Cochrane register of controlled trials, randomized controlled trials, or quasi-randomized controlled trials that compared otic preparations to placebo or that compared 2 otic preparations. It included studies of adults and children, without TM perforation. It identified 5 trials in children 3 to 18 years of age. Two (including Bolt et al,[65] discussed above) compared anesthetic drops and placebo at diagnosis of AOM. In both studies, some children also received oral analgesics. Three studies compared anesthetic ear drops with naturopathic herbal drops. Naturopathic drops were favored 15 to 30 minutes after installation, and 1 to 3 days after diagnosis, but the difference was not statistically significant. The Cochrane group concluded that there is limited evidence that ear drops are effective at 30 minutes and unclear if results from these studies are a result of the natural course of illness, placebo effect of receiving treatment, soothing effect of any liquid in the ear, or the drops themselves. Three of the studies included in this review were cited in the 2004 AAP guideline[67–69] and the 1 new paper by Bolt et al.[65]

Key Action Statement 3A

Severe AOM

The clinician should prescribe antibiotic therapy for AOM (bilateral or unilateral) in children 6 months and older with severe signs or symptoms (ie, moderate or severe otalgia or otalgia for at least 48 hours, or temperature 39°C [102.2°F] or higher). (Evidence Quality: Grade B, Rec. Strength: Strong Recommendation)

Key Action Statement Profile: KAS 3A

Aggregate evidence quality	Grade B
Benefits	Increased likelihood of more rapid resolution of symptoms. Increased likelihood of resolution of AOM.
Risks, harms, cost	Adverse events attributable to antibiotics, such as diarrhea, diaper dermatitis, and allergic reactions. Overuse of antibiotics leads to increased bacterial resistance. Cost of antibiotics.
Benefits-harms assessment	Preponderance of benefit over harm.
Value judgments	None
Role of patient preference	None
Intentional vagueness	None
Exclusions	None
Strength	**Strong Recommendation**

Key Action Statement 3B

Nonsevere Bilateral AOM in Young Children

The clinician should prescribe antibiotic therapy for bilateral AOM in children younger than 24 months without severe signs or symptoms (ie, mild otalgia for less than 48 hours, temperature less than 39°C [102.2°F]). (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 3B

Aggregate evidence quality	Grade B
Benefits	Increased likelihood of more rapid resolution of symptoms. Increased likelihood of resolution of AOM.
Risks, harms, cost	Adverse events attributable to antibiotics, such as diarrhea, diaper dermatitis, and allergic reactions. Overuse of antibiotics leads to increased bacterial resistance. Cost of antibiotics.
Benefits-harms assessment	Preponderance of benefit over harm.
Value judgments	None
Role of patient preference	None
Intentional vagueness	None
Exclusions	None
Strength	**Recommendation**

Key Action Statement 3C

Nonsevere Unilateral AOM in Young Children

The clinician should either prescribe antibiotic therapy *or* offer observation with close follow-up based on joint decision-making with the parent(s)/caregiver for unilateral AOM in children 6 months to 23 months of age without severe signs or symptoms (ie, mild otalgia for less than 48 hours, temperature less than 39°C [102.2°F]). When observation is used, a mechanism must be in place to ensure

follow-up and begin antibiotic therapy if the child worsens or fails to improve within 48 to 72 hours of onset of symptoms. (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 3C

Aggregate evidence quality	Grade B
Benefits	Moderately increased likelihood of more rapid resolution of symptoms with initial antibiotics. Moderately increased likelihood of resolution of AOM with initial antibiotics.
Risks, harms, cost	Adverse events attributable to antibiotics, such as diarrhea, diaper dermatitis, and allergic reactions. Overuse of antibiotics leads to increased bacterial resistance. Cost of antibiotics.
Benefits-harms assessment	Moderate degree of benefit over harm.
Value judgments	Observation becomes an alternative as the benefits and harms approach balance.
Role of patient preference	Joint decision-making with the family is essential before choosing observation.
Intentional vagueness	Joint decision-making is highly variable from family to family
Exclusions	None
Strength	**Recommendation**
Note	In the judgment of 1 Subcommittee member (AH), antimicrobial treatment of these children is preferred because of a preponderance of benefit over harm. AH did not endorse Key Action Statement 3C

Key Action Statement 3D

Nonsevere AOM in Older Children

The clinician should either prescribe antibiotic therapy *or* offer observation with close follow-up based on joint decision-making with the parent(s)/caregiver for AOM (bilateral or unilateral) in children 24 months or older without severe signs or symptoms (ie, mild otalgia for less than 48 hours, temperature less than 39°C [102.2°F]). When observation is used, a mechanism must be in place to ensure follow-up and begin antibiotic therapy if the child worsens or fails to improve within 48 to 72 hours of onset of symptoms. (Evidence Quality: Grade B, Rec Strength: Recommendation)

Key Action Statement Profile: KAS 3D

Aggregate evidence quality	Grade B
Benefits	*Initial antibiotic treatment*: Slightly increased likelihood of more rapid resolution of symptoms; slightly increased likelihood of resolution of AOM. *Initial observation*: Decreased use of antibiotics; decreased adverse effects of antibiotics; decreased potential for development of bacterial resistance.
Risks, harms, cost	*Initial antibiotic treatment*: Adverse events attributable to antibiotics such as diarrhea, rashes, and allergic reactions. Overuse of antibiotics leads to increased bacterial resistance. *Initial observation*: Possibility of needing to start antibiotics in 48 to 72 h if the patient continues to have symptoms. Minimal risk of adverse consequences of delayed antibiotic treatment. Potential increased phone calls and doctor visits.
Benefits-harms assessment	Slight degree of benefit of initial antibiotics over harm.
Value judgments	Observation is an option as the benefits and harms approach balance.
Role of patient preference	Joint decision-making with the family is essential before choosing observation.
Intentional vagueness	Joint decision-making is highly variable from family to family.
Exclusions	None
Strength	**Recommendation.**

Purpose of This Section

The purpose of this section is to offer guidance on the initial management of AOM by helping clinicians choose between the following 2 strategies:

1. *Initial antibiotic therapy*, defined as treatment of AOM with antibiotics that are prescribed at the time of diagnosis with the intent of starting antibiotic therapy as soon as possible after the encounter.
2. *Initial observation*, defined as initial management of AOM limited to symptomatic relief, with commencement of antibiotic therapy only if the child's condition worsens at any time or does not show clinical improvement within 48 to 72 hours of diagnosis. A mechanism must be in place to ensure follow-up and initiation of antibiotics if the child fails observation.

This section assumes that the clinician has made an accurate diagnosis of AOM by using the criteria and strategies outlined earlier in this guideline. Another assumption is that a clear distinction is made between the role of analgesics and antibiotics in providing symptomatic relief for children with AOM.

Changes From Previous AOM Guideline

The AOM guideline published by the AAP and AAFP in 2004 proposed, for the first time in North America, an "observation option" for selected children with AOM, building on successful implementation of a similar policy in the state of New York[74] and the use of a similar paradigm in many countries in Europe. A common feature of both approaches was to prioritize initial antibiotic therapy according to diagnostic certainty, with greater reliance on observation when the diagnosis was uncertain. In response to criticism that allowing an "uncertain

diagnosis" might condone incomplete visualization of the TM or allow inappropriate antibiotic use, this category has been eliminated with greater emphasis now placed on maximizing diagnostic accuracy for AOM.

Since the earlier AOM guideline was published, there has been substantial new research on initial management of AOM, including randomized controlled trials of antibiotic therapy versus placebo or no therapy,[31,32,75] immediate versus delayed antibiotic therapy,[30,76,77] or delayed antibiotic with or without a concurrent prescription.[78] The Hoberman and Tähtinen articles are especially important as they used stringent criteria for diagnosing AOM.[31,32] Systematic reviews have been published on delayed antibiotic therapy,[79] the natural history of AOM in untreated children,[57] predictive factors for antibiotic benefits,[62] and the effect of antibiotics on asymptomatic MEE after therapy.[80] Observational studies provide additional data on outcomes of initial observation with delayed antibiotic therapy, if needed,[81] and on the relationship of previous antibiotic therapy for AOM to subsequent acute mastoiditis.[82,83]

In contrast to the earlier AOM guideline,[1] which recommended antibiotic therapy for all children 6 months to 2 years of age with a certain diagnosis, the current guideline indicates a choice between initial antibiotic therapy or initial observation in this age group for children with unilateral AOM and mild symptoms but only after joint decision-making with the parent(s)/caregiver (Table 4). This change is supported by evidence on the safety of observation or delayed prescribing in young children.[30,31,32,75,76,81] A mechanism must be in place to ensure follow-up and begin antibiotics if the child fails observation.

Importance of Accurate Diagnosis

The recommendations for management of AOM assume an accurate diagnosis on the basis of criteria outlined in the diagnosis section of this guideline. Many of the studies since the 2004 AAP/AAFP AOM guideline[1] used more stringent and well-defined AOM diagnostic definitions than were previously used. Bulging of the TM was required for diagnosis of AOM for most of the children enrolled in the most recent studies.[31,32] By using the criteria in this guideline, clinicians will more accurately distinguish AOM from OME. The management of OME can be found in guidelines written by the AAP, AAFP, and American Academy of Otolaryngology-Head and Neck Surgery.[84,85]

TABLE 4 Recommendations for Initial Management for Uncomplicated AOM[a]

Age	Otorrhea With AOM[a]	Unilateral or Bilateral AOM[a] With Severe Symptoms[b]	Bilateral AOM[a] Without Otorrhea	Unilateral AOM[a] Without Otorrhea
6 mo to 2 y	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy or additional observation
≥2 y	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy or additional observation	Antibiotic therapy or additional observation[c]

[a] Applies only to children with well-documented AOM with high certainty of diagnosis (see Diagnosis section).
[b] A toxic-appearing child, persistent otalgia more than 48 h, temperature ≥39°C (102.2°F) in the past 48 h, or if there is uncertain access to follow-up after the visit.
[c] This plan of initial management provides an opportunity for shared decision-making with the child's family for those categories appropriate for additional observation. If observation is offered, a mechanism must be in place to ensure follow-up and begin antibiotics if the child worsens or fails to improve within 48 to 72 h of AOM onset.

Age, Severity of Symptoms, Otorrhea, and Laterality

Rovers et al[62] performed a systematic search for AOM trials that (1) used random allocation of children, (2) included children 0 to 12 years of age with AOM, (3) compared antibiotics with placebo or no treatment, and (4) had pain or fever as an outcome. The original investigators were asked for their original data.

Primary outcome was pain and/or fever (>38°C) at 3 to 7 days. The adverse effects of antibiotics were also analyzed. Baseline predictors were age <2 years versus ≥2 years, bilateral AOM versus unilateral AOM, and the presence versus absence of otorrhea. Statistical methods were used to assess heterogeneity and to analyze the data.

Of the 10 eligible studies, the investigators of 6 studies[30,75,86–89] provided the original data requested, and 4 did not. A total of 1642 patients were included in the 6 studies from which data were obtained. Of the cases submitted, the average age was 3 to 4 years, with 35% of children younger than 2 years. Bilateral AOM was present in 34% of children, and 42% of children had a bulging TM. Otorrhea was present in 21% of children. The antibiotic and control groups were comparable for all characteristics.

The rate difference (RD) for pain, fever, or both between antibiotic and control groups was 13% (NNT = 8). For children younger than 2 years, the RD was 15% (NNT = 7); for those ≥2 years, RD was 11% (NNT = 10). For unilateral AOM, the RD was 6% (NNT = 17); for bilateral AOM, the RD was 20% (NNT = 5). When unilateral AOM was broken into age groups, among those younger than 2 years, the RD was 5% (NNT = 20), and among those ≥2 years, the RD was 7% (NNT = 15). For bilateral AOM in children younger than 2 years, the RD was 25% (NNT = 4); for

bilateral AOM in children ≥2 years, the RD was 12% (NNT = 9). For otorrhea, the RD was 36% (NNT = 3). One child in the control group who developed meningitis had received antibiotics beginning on day 2 because of worsening status. There were no cases of mastoiditis.

In a Cochrane Review, Sanders et al[59] identified 10 studies that met the following criteria: (1) randomized controlled trial, (2) compared antibiotic versus placebo or antibiotic versus observation, (3) age 1 month to 15 years, (4) reported severity and duration of pain, (5) reported adverse events, and (6) reported serious complications of AOM, recurrent attacks, and hearing problems. Studies were analyzed for risk of bias and assessment of heterogeneity. The studies were the same as analyzed by Rovers et al[62] but included the 4 studies for which primary data were not available to Rovers.[60,61,90,91]

The authors' conclusions were that antibiotics produced a small reduction in the number of children with pain 2 to 7 days after diagnosis. They also concluded that most cases spontaneously remitted with no complications (NNT = 16). Antibiotics were most beneficial in children younger than 2 years with bilateral AOM and in children with otorrhea.

Two recent studies only included children younger than 3 years[32] or younger than 2 years.[31] Both included only subjects in whom the diagnosis of AOM was certain. Both studies used improvement of symptoms and improvement in the appearance of the TM in their definitions of clinical success or failure.

Hoberman et al[31] conducted a randomized, double-blind, placebo-controlled study of the efficacy of antimicrobial treatment on AOM. The criteria for AOM were acute symptoms with a score of at least 3 on the AOM-SOS, a validated symptom scale[33,92]; MEE; and moderate or marked bulging of the TM or slight bulging accompanied by either otalgia or marked erythema of the TM. They chose to use high-dose amoxicillin-clavulanate (90 mg/kg/day) as active treatment, because it has the best oral antibiotic coverage for organisms causing AOM. Included in the study were 291 patients 6 to 23 months of age: 144 in the antibiotic group and 147 in the placebo group. The primary outcome measures were the time to resolution of symptoms and the symptom burden over time. The initial resolution of symptoms (ie, the first recording of an AOM-SOS score of 0 or 1) was recorded among the children who received amoxicillin-clavulanate in 35% by day 2, 61% by day 4, and 80% by day 7. Among children who received placebo, an AOM-SOS score of 0 or 1 was recorded in 28% by day 2, 54% by day 4, and 74% by day 7 ($P = .14$ for the overall comparison). For sustained resolution of symptoms (ie, the time to the second of 2 successive recordings of an AOM-SOS score of 0 or 1), the corresponding values were 20% at day 2, 41% at day 4, and 67% at day 7 with amoxicillin-clavulanate, compared with 14%, 36%, and 53% with placebo ($P = .04$ for the overall comparison). The symptom burden (ie, mean AOM-SOS scores) over the first 7 days were lower for the children treated with amoxicillin-clavulanate than for those who received placebo ($P = .02$). Clinical failure at or before the 4- to 5-day visit was defined as "either a lack of substantial improvement in symptoms, a worsening of signs on otoscopic examination, or both," and clinical failure at the 10- to 12-day visit was defined as "the failure to achieve complete or nearly complete resolution of symptoms and of otoscopic signs, without regard to the persistence or resolution of middle ear effusion." Treatment failure occurred by day 4 to 5 in 4% of the antimicrobial treatment group versus 23% in the placebo group ($P < .001$) and at day 10 to 12 in 16% of the antimicrobial treatment group versus 51% in the placebo group (NNT = 2.9, $P < .001$). In a comparison of outcome in unilateral versus bilateral AOM, clinical failure rates by day 10 to 12 in children with unilateral AOM were 9% in those treated with amoxicillin-clavulanate versus 41% in those treated with placebo (RD, 32%; NNT = 3) and 23% vs 60% (RD, 37%; NNT = 3) in those with bilateral AOM. Most common adverse events were diarrhea (25% vs 15% in the treatment versus placebo groups, respectively; $P = .05$) and diaper dermatitis (51% vs 35% in the treatment versus placebo groups, respectively; $P = .008$). One placebo recipient developed mastoiditis. According to these results, antimicrobial treatment of AOM was more beneficial than in previous studies that used less stringent diagnostic criteria.

Tähtinen et al[32] conducted a randomized, double-blind, placebo-controlled, intention-to-treat study of amoxicillin-clavulanate (40 mg/kg/day) versus placebo. Three hundred nineteen patients from 6 to 35 months of age were studied: 161 in the antibiotic group and 158 in the placebo group. AOM definition was the presence of MEE, distinct erythema over a bulging or yellow TM, and acute symptoms such as ear pain, fever, or respiratory symptoms. Compliance was measured by using daily patient diaries and number of capsules remaining at the end of the study. Primary outcome was time to treatment failure defined as a composite of 6 independent components: no improvement in overall condition by day 3, worsening of the child's condition at any time, no improvement in otoscopic signs by day 8, perforation of the TM,

development of severe infection (eg, pneumonia, mastoiditis), and any other reason for stopping the study drug/placebo.

Groups were comparable on multiple parameters. In the treatment group, 135 of 161 patients (84%) were younger than 24 months, and in the placebo group, 124 of 158 patients (78%) were younger than 24 months. Treatment failure occurred in 18.6% of the treatment group and 44.9% in the placebo group (NNT = 3.8, $P < .001$). Rescue treatment was needed in 6.8% of the treatment group and 33.5% of placebo patients ($P < .001$). Contralateral AOM developed in 8.2% and 18.6% of treatment and placebo groups, respectively ($P = .007$). There was no significant difference in use of analgesic or antipyretic medicine, which was used in 84.2% of the amoxicillin-clavulanate group and 85.9% of the placebo group.

Parents of child care attendees on placebo missed more days of work ($P = .005$). Clinical failure rates in children with unilateral AOM were 17.2% in those treated with amoxicillin-clavulanate versus 42.7% in those treated with placebo; for bilateral AOM, clinical failure rates were 21.7% for those treated with amoxicillin-clavulanate versus 46.3% in the placebo group. Reported rates of treatment failure by day 8 were 17.2% in the amoxicillin-clavulanate group versus 42.7% in the placebo group in children with unilateral AOM and 21.7% vs 46.3% among those with bilateral disease.

Adverse events, primarily diarrhea and/or rash, occurred in 52.8% of the treatment group and 36.1% of the placebo group ($P = .003$). Overall condition as evaluated by the parents and otoscopic appearance of the TM showed a benefit of antibiotics over placebo at the end of treatment visit ($P < .001$). Two placebo recipients developed a severe infection; 1 developed pneumococcal bacteremia, and 1 developed radiographically confirmed pneumonia.

Most studies have excluded children with severe illness and all exclude those with bacterial disease other than AOM (pneumonia, mastoiditis, meningitis, streptococcal pharyngitis). Kaleida et al[91] compared myringotomy alone with myringotomy plus antibiotics. Severe AOM was defined as temperature >39°C (102.2°F) or the presence of severe otalgia. Patients with severe AOM in the group that received only myringotomy (without initial antibiotics) had much worse outcomes.

Initial Antibiotic Therapy

The rationale for antibiotic therapy in children with AOM is based on a high prevalence of bacteria in the accompanying MEE.[93] Bacterial and viral cultures of middle ear fluid collected by tympanocentesis from children with AOM showed 55% with bacteria only and 15% with bacteria and viruses. A beneficial effect of antibiotics on AOM was first demonstrated in 1968,[94] followed by additional randomized trials and a meta-analysis[95] showing a 14% increase in absolute rates of clinical improvement. Systematic reviews of the literature published before 2011[21,59,62] revealed increases of clinical improvement with initial antibiotics of 6% to 12%.

Randomized clinical trials using stringent diagnostic criteria for AOM in young children[31,32] show differences in clinical improvement of 26% to 35% favoring initial antibiotic treatment as compared with placebo. Greater benefit of immediate antibiotic therapy was observed for bilateral AOM[62,96] or AOM associated with otorrhea.[62] In most randomized trials,[30,75,77,88,89] antibiotic therapy also decreased the duration of pain, analgesic use, or school absence and parent days missed from work.

Children younger than 2 years with AOM may take longer to improve clinically than older children,[57] and although they are more likely to benefit from antibiotics,[31,32] AOM in many children will resolve without antibiotics.[62] A clinically significant benefit of immediate antibiotic therapy is observed for bilateral AOM,[62,96] *Streptococcus pneumoniae* infection, or AOM associated with otorrhea.[62]

Initial Observation for AOM

In systematic reviews of studies that compare antibiotic therapy for AOM with placebo, a consistent finding has been the overall favorable natural history in control groups (NNT = 8–16).[12,59,62,95] However, randomized trials in these reviews had varying diagnostic criteria that would have permitted inclusion of some children with OME, viral upper respiratory infections, or myringitis, thereby limiting the ability to apply these findings to children with a highly certain AOM diagnosis. In more recent AOM studies[31,32] using stringent diagnostic criteria, approximately half of young children (younger than 2–3 years) experienced clinical success when given placebo, but the effect of antibiotic therapy was substantially greater than suggested by studies without precise diagnosis (NNT = 3–4).

Observation as initial management for AOM in properly selected children does not increase suppurative complications, provided that follow-up is ensured and a rescue antibiotic is given for persistent or worsening symptoms.[17] In contrast, withholding of antibiotics in all children with AOM, regardless of clinical course, would risk a return to the suppurative complications observed in the

preantibiotic era. At the population level, antibiotics halve the risk of mastoiditis after AOM, but the high NNT of approximately 4800 patients to prevent 1 case of mastoiditis precludes a strategy of universal antibiotic therapy as a means to prevent mastoiditis.[83]

The favorable natural history of AOM makes it difficult to demonstrate significant differences in efficacy between antibiotic and placebo when a successful outcome is defined by relief or improvement of presenting signs and symptoms. In contrast, when otoscopic improvement (resolution of TM bulging, intense erythema, or both) is also required for a positive outcome,[31,32] the NNT is 3 to 4, compared with 8 to 16 for symptom improvement alone in older studies that used less precise diagnostic criteria. MEE, however, may persist for weeks or months after an AOM episode and is not a criterion for otoscopic failure.

National guidelines for initial observation of AOM in select children were first implemented in the Netherlands[97] and subsequently in Sweden,[98] Scotland,[99] the United States,[1] the United Kingdom,[100] and Italy.[101] All included observation as an initial treatment option under specified circumstances.

In numerous studies, only approximately one-third of children initially observed received a rescue antibiotic for persistent or worsening AOM,[30,32,76,81,89,102] suggesting that antibiotic use could potentially be reduced by 65% in eligible children. Given the high incidence of AOM, this reduction could help substantially in curtailing antibiotic-related adverse events.

McCormick et al[30] reported on 233 patients randomly assigned to receive immediate antibiotics (amoxicillin, 90 mg/kg/day) or to undergo watchful waiting. Criteria for inclusion were symptoms of ear infection, otoscopic evidence of AOM, and nonsevere AOM based on a 3-item symptom score (OM-3) and TM appearance based on an 8-item scale (OS-8). Primary outcomes were parent satisfaction with AOM care, resolution of AOM symptoms after initial treatment, AOM failure and recurrence, and nasopharyngeal carriage of *S pneumoniae* strains resistant to antibiotics after treatment. The study was confounded by including patients who had received antibiotics in the previous 30 days.

In the watchful waiting group, 66% of children completed the study without antibiotics. There was no difference in parent satisfaction scores at day 12. A 5-item symptom score (ETG-5) was assessed at days 0 to 10 by using patient diaries. Subjects receiving immediate antibiotics resolved their symptoms faster than did subjects who underwent watchful waiting (P = .004). For children younger than 2 years, the difference was greater (P = .008). Otoscopic and tympanogram scores were also lower in the antibiotic group as opposed to the watchful waiting group (P = .02 for otoscopic score, P = .004 for tympanogram). Combining all ages, failure and recurrence rates were lower for the antibiotic group (5%) than for the watchful waiting group (21%) at 12 days. By day 30, there was no difference in failure or recurrence for the antibiotic and watchful waiting groups (23% and 24%, respectively). The association between clinical outcome and intervention group was not significantly different between age groups. Immediate antibiotics resulted in eradication of *S pneumoniae* carriage in the majority of children, but *S pneumoniae* strains cultured from children in the antibiotic group at day 12 were more likely to be multidrug resistant than were strains cultured from children in the watchful waiting group.

The decision not to give initial antibiotic treatment and observe should be a joint decision of the clinician and the parents. In such cases, a system for close follow-up and a means of beginning antibiotics must be in place if symptoms worsen or no improvement is seen in 48 to 72 hours.

Initial observation of AOM should be part of a larger management strategy that includes analgesics, parent information, and provisions for a rescue antibiotic. Education of parents should include an explanation about the self-limited nature of most episodes of AOM, especially in children 2 years and older; the importance of pain management early in the course; and the potential adverse effects of antibiotics. Such an approach can substantially reduce prescription fill rates for rescue antibiotics.[103]

A critical component of any strategy involving initial observation for AOM is the ability to provide a rescue antibiotic if needed. This is often done by using a "safety net" or a "wait-and-see prescription,"[76,102] in which the parent/caregiver is given an antibiotic prescription during the clinical encounter but is instructed to fill the prescription only if the child fails to improve within 2 to 3 days or if symptoms worsen at any time. An alternative approach is not to provide a written prescription but to instruct the parent/caregiver to call or return if the child fails to improve within 2 to 3 days or if symptoms worsen.

In one of the first major studies of observation with a safety-net antibiotic prescription (SNAP), Siegel et al[102] enrolled 194 patients with protocol defined AOM, of whom 175 completed the study. Eligible patients were given a SNAP with instructions to fill the prescription only if symptoms worsened or did not improve in 48 hours. The SNAP was valid for 5 days. Pain medicine was recommended to be taken as needed. A phone interview was conducted 5 to 10 days after diagnosis.

One hundred twenty of 175 families did not fill the prescription. Reasons for filling the prescription (more than 1 reason per patient was acceptable) were as follows: continued pain, 23%; continued fever, 11%; sleep disruption, 6%; missed days of work, 3%; missed days of child care, 3%; and no reason given, 5%. One 16-month-old boy completed observation successfully but 6 weeks later developed AOM in the opposite ear, was treated with antibiotics, and developed postauricular cellulitis.

In a similar study of a "wait-and-see prescription" (WASP) in the emergency department, Spiro et al[76] randomly assigned 283 patients to either a WASP or standard prescription. Clinicians were educated on the 2004 AAP diagnostic criteria and initial treatment options for AOM; however, diagnosis was made at the discretion of the clinician. Patients were excluded if they did not qualify for observation per the 2004 guidelines. The primary outcome was whether the prescription was filled within 3 days of diagnosis. Prescriptions were not filled for 62% and 13% of the WASP and standard prescription patients, respectively ($P < .001$). Reasons for filling the prescription in the WASP group were fever (60%), ear pain (34%), or fussy behavior (6%). No serious adverse events were reported.

Strategies to observe children with AOM who are likely to improve on their own without initial antibiotic therapy reduces common adverse effects of antibiotics, such as diarrhea and diaper dermatitis. In 2 trials, antibiotic therapy significantly increased the absolute rates of diarrhea by 10% to 20% and of diaper rash or dermatitis by 6% to 16%.[31,32] Reduced antibiotic use may also reduce the prevalence of resistant bacterial pathogens. Multidrug-resistant *S pneumoniae* continues to be a significant concern for AOM, despite universal immunization of children in the United States with heptavalent pneumococcal conjugate vaccine.[104,105] In contrast, countries with low antibiotic use for AOM have a low prevalence of resistant nasopharyngeal pathogens in children.[106]

Key Action Statement 4A

Clinicians should prescribe amoxicillin for AOM when a decision to treat with antibiotics has been made *and* the child has not received amoxicillin in the past 30 days *or* the child does not have concurrent purulent conjunctivitis *or* the child is not allergic to penicillin. (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 4A

Aggregate evidence quality	Grade B
Benefits	Effective antibiotic for most children with AOM. Inexpensive, safe, acceptable taste, narrow antimicrobial spectrum.
Risks, harms, cost	Ineffective against β-lactamase–producing organisms. Adverse effects of amoxicillin.
Benefits-harms assessment	Preponderance of benefit.
Value judgments	Better to use a drug that has reasonable cost, has an acceptable taste, and has a narrow antibacterial spectrum.
Intentional vagueness	The clinician must determine whether the patient is truly penicillin allergic.
Role of patient preferences	Should be considered if previous bad experience with amoxicillin.
Exclusions	Patients with known penicillin allergy.
Strength	**Recommendation.**

Key Action Statement 4B

Clinicians should prescribe an antibiotic with additional β-lactamase coverage for AOM when a decision to treat with antibiotics has been made *and* the child has received amoxicillin in the past 30 days *or* has concurrent purulent conjunctivitis *or* has a history of recurrent AOM unresponsive to amoxicillin. (Evidence Quality: Grade C, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 4B

Aggregate evidence quality	Grade C
Benefits	Successful treatment of β-lactamase–producing organisms.
Risks, harms, cost	Cost of antibiotic. Increased adverse effects.
Benefits-harms assessment	Preponderance of benefit.
Value judgments	Efficacy is more important than taste.
Intentional vagueness	None.
Role of patient preferences	Concern regarding side effects and taste.
Exclusions	Patients with known penicillin allergy.
Strength	**Recommendation**

Key Action Statement 4C

Clinicians should reassess the patient if the caregiver reports that the child's symptoms have worsened or failed to respond to the initial antibiotic treatment within 48 to 72 hours and determine whether a change in therapy is needed. (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 4C

Aggregate evidence quality	Grade B
Benefits	Identify children who may have AOM caused by pathogens resistant to previous antibiotics.
Risks, harms, cost	Cost. Time for patient and clinician to make change. Potential need for parenteral medication.
Benefit-harm assessment	Preponderance of benefit.
Value judgments	None.
Intentional vagueness	"Reassess" is not defined. The clinician may determine the method of assessment.
Role of patient preferences	Limited.
Exclusions	Appearance of TM improved.
Strength	**Recommendation**

Purpose of This Section

If an antibiotic will be used for treatment of a child with AOM, whether as initial management or after a period of observation, the clinician must choose an antibiotic that will have a high likelihood of being effective against the most likely etiologic bacterial pathogens with considerations of cost, taste, convenience, and adverse effects. This section proposes first- and second-line antibiotics that best meet these criteria while balancing potential benefits and harms.

Changes From AAP/AAFP 2004 AOM Guideline

Despite new data on the effect of PCV7 and updated data on the in vitro susceptibility of bacterial pathogens most likely to cause AOM, the recommendations for the first-line antibiotic remains unchanged from 2004. The current guideline contains revised recommendations regarding penicillin allergy based on new data. The increase of multidrug-resistant strains of pneumococci is noted.

Microbiology

Microorganisms detected in the middle ear during AOM include pathogenic bacteria, as well as respiratory viruses.[107–110] AOM occurs most frequently as a consequence of viral upper respiratory tract infection,[111–113] which leads to eustachian tube inflammation/dysfunction, negative middle ear pressure, and movement of secretions containing the upper respiratory tract infection causative virus and pathogenic bacteria in the nasopharynx into the middle ear cleft. By using comprehensive and sensitive microbiologic testing, bacteria and/or viruses can be detected in the middle ear fluid in up to 96% of AOM cases (eg, 66% bacteria and viruses together, 27% bacteria alone, and 4% virus alone).[114] Studies using less sensitive or less comprehensive microbiologic assays have yielded less positive results for bacteria and much less positive results for viruses.[115–117] The 3 most common bacterial pathogens in AOM are *S pneumoniae*, nontypeable *Haemophilus influenzae*, and *Moraxella catarrhalis*.[111] *Streptococcus pyogenes* (group A β-hemolytic streptococci) accounts for less than 5% of AOM cases. The proportion of AOM cases with pathogenic bacteria isolated from the middle ear fluids varies depending on bacteriologic techniques, transport issues, and stringency of AOM definition. In series of reports from the United States and Europe from 1952–1981 and 1985–1992, the mean percentage of cases with bacterial pathogens isolated from the middle ear fluids was 69% and 72%, respectively.[118] A large series from the University of Pittsburgh Otitis Media Study Group reported bacterial pathogens in 84% of the middle ear fluids from 2807 cases of AOM.[118] Studies that applied more stringent otoscopic criteria and/or use of bedside specimen plating on solid agar in addition to liquid transport media have a reported rate of recovery of pathogenic bacteria from middle ear exudates ranging from 85% to 90%.[119–121] When using appropriate stringent diagnostic criteria, careful specimen handling, and sensitive microbiologic techniques, the vast majority of cases of AOM will involve pathogenic bacteria either alone or in concert with viral pathogens.

Among AOM bacterial pathogens, *S pneumoniae* was the most frequently cultured in earlier reports. Since the debut and routine use of PCV7 in 2000, the ordinal frequency of these 3 major middle ear pathogens has evolved.[105] In the first few years after PCV7 introduction, *H influenzae* became the most frequently isolated middle ear pathogen, replacing *S pneumoniae*.[122,123] Shortly thereafter, a shift to non-PCV7 serotypes of *S pneumoniae* was described.[124] Pichichero et al[104] later reported that 44% of 212 AOM cases seen in 2003–2006 were caused by *H influenzae*, and 28% were caused by *S pneumoniae*, with a high proportion of highly resistant *S pneumoniae*. In that study, a majority (77%) of cases involved recurrent disease or initial treatment failure. A later report[125] with data from 2007 to 2009, 6 to 8 years after the introduction of PCV7 in the United States, showed that PCV7 strains of *S pneumoniae* virtually disappeared from the middle ear fluid of children with AOM who had been vaccinated. However, the frequency of isolation of non-PCV7 serotypes of *S pneumoniae* from the middle ear fluid overall was increased; this has made isolation of *S pneumoniae* and *H influenzae* of children with AOM nearly equal.

In a study of tympanocentesis over 4 respiratory tract illness seasons in a private practice, the percentage of

S pneumoniae initially decreased relative to *H influenzae*. In 2005–2006 (*N* = 33), 48% of bacteria were *S pneumoniae*, and 42% were *H influenzae*. For 2006–2007 (*N* = 37), the percentages were equal at 41%. In 2007–2008 (*N* = 34), 35% were *S pneumoniae*, and 59% were *H influenzae*. In 2008–2009 (*N* = 24), the percentages were 54% and 38%, respectively, with an increase in intermediate and nonsusceptible *S pneumoniae*.[126] Data on nasopharyngeal colonization from PCV7-immunized children with AOM have shown continued presence of *S pneumoniae* colonization. Revai et al[127] showed no difference in *S pneumoniae* colonization rate among children with AOM who have been unimmunized, underimmunized, or fully immunized with PCV7. In a study during a viral upper respiratory tract infection, including mostly PCV7-immunized children (6 months to 3 years of age), *S pneumoniae* was detected in 45.5% of 968 nasopharyngeal swabs, *H influenzae* was detected in 32.4%, and *M catarrhalis* was detected in 63.1%.[128] Data show that nasopharyngeal colonization of children vaccinated with PCV7 increasingly is caused by *S pneumoniae* serotypes not contained in the vaccine.[129–132] With the use of the recently licensed 13-valent pneumococcal conjugate vaccine (PCV13),[133] the patterns of nasopharyngeal colonization and infection with these common AOM bacterial pathogens will continue to evolve.

Investigators have attempted to predict the type of AOM pathogenic bacteria on the basis of clinical severity, but results have not been promising. *S pyogenes* has been shown to occur more commonly in older children[134] and to cause a greater degree of inflammation of the middle ear and TM, a greater frequency of spontaneous rupture of the TM, and more frequent progression to acute mastoiditis compared with other bacterial pathogens.[134–136] As for clinical findings in cases with *S pneumoniae* and nontypeable *H influenzae*, some studies suggest that signs and symptoms of AOM caused by *S pneumoniae* may be more severe (fever, severe earache, bulging TM) than those caused by other pathogens.[44,121,137] These findings were refuted by results of the studies that found AOM caused by nontypeable *H influenzae* to be associated with bilateral AOM and more severe inflammation of the TM.[96,138] Leibovitz et al[139] concluded, in a study of 372 children with AOM caused by *H influenzae* (*N* = 138), *S pneumoniae* (*N* = 64), and mixed *H influenzae* and *S pneumoniae* (*N* = 64), that clinical/otologic scores could not discriminate among various bacterial etiologies of AOM. However, there were significantly different clinical/otologic scores between bacterial culture negative and culture positive cases. A study of middle ear exudates of 82 cases of bullous myringitis has shown a 97% bacteria positive rate, primarily *S pneumoniae*. In contrast to the previous belief, mycoplasma is rarely the causative agent in this condition.[140] Accurate prediction of the bacterial cause of AOM on the basis of clinical presentation, without bacterial culture of the middle ear exudates, is not possible, but specific etiologies may be predicted in some situations. Published evidence has suggested that AOM associated with conjunctivitis (otitis-conjunctivitis syndrome) is more likely caused by nontypeable *H influenzae* than by other bacteria.[141–143]

Bacterial Susceptibility to Antibiotics

Selection of antibiotic to treat AOM is based on the suspected type of bacteria and antibiotic susceptibility pattern, although clinical pharmacology and clinical and microbiologic results and predicted compliance with the drug are also taken into account. Early studies of AOM patients show that 19% of children with *S pneumoniae* and 48% with *H influenzae* cultured on initial tympanocentesis who were not treated with antibiotic cleared the bacteria at the time of a second tympanocentesis 2 to 7 days later.[144] Approximately 75% of children infected with *M catarrhalis* experienced bacteriologic cure even after treatment with amoxicillin, an antibiotic to which it is not susceptible.[145,146]

Antibiotic susceptibility of major AOM bacterial pathogens continues to change, but data on middle ear pathogens have become scanty because tympanocentesis is not generally performed in studies of children with uncomplicated AOM. Most available data come from cases of persistent or recurrent AOM. Current US data from a number of centers indicates that approximately 83% and 87% of isolates of *S pneumoniae* from all age groups are susceptible to regular (40 mg/kg/day) and high-dose amoxicillin (80–90 mg/kg/day divided twice daily), respectively.[130,147–150] Pediatric isolates are smaller in number and include mostly ear isolates collected from recurrent and persistent AOM cases with a high percentage of multidrug-resistant *S pneumoniae*, most frequently nonvaccine serotypes that have recently increased in frequency and importance.[104]

High-dose amoxicillin will yield middle ear fluid levels that exceed the minimum inhibitory concentration (MIC) of all *S pneumoniae* serotypes that are intermediately resistant to penicillin (penicillin MICs, 0.12–1.0 μg/mL), and many but not all highly resistant serotypes (penicillin MICs, ≥2 μg/mL) for a longer period of the dosing interval and has been shown to improve bacteriologic and clinical efficacy

compared with the regular dose.[151–153] Hoberman et al[154] reported superior efficacy of high-dose amoxicillin-clavulanate in eradication of *S pneumoniae* (96%) from the middle ear at days 4 to 6 of therapy compared with azithromycin.

The antibiotic susceptibility pattern for *S pneumoniae* is expected to continue to evolve with the use of PCV13, a conjugate vaccine containing 13 serotypes of *S pneumoniae*.[133,155,156] Widespread use of PCV13 could potentially reduce diseases caused by multidrug-resistant pneumococcal serotypes and diminish the need for the use of higher dose of amoxicillin or amoxicillin-clavulanate for AOM.

Some *H influenzae* isolates produce β-lactamase enzyme, causing the isolate to become resistant to penicillins. Current data from different studies with non-AOM sources and geographic locations that may not be comparable show that 58% to 82% of *H influenzae* isolates are susceptible to regular- and high-dose amoxicillin.[130,147,148,157,158] These data represented a significant decrease in β-lactamase–producing *H influenzae*, compared with data reported in the 2004 AOM guideline.

Nationwide data suggest that 100% of *M catarrhalis* derived from the upper respiratory tract are β-lactamase–positive but remain susceptible to amoxicillin-clavulanate.[159] However, the high rate of spontaneous clinical resolution occurring in children with AOM attributable to *M catarrhalis* treated with amoxicillin reduces the concern for the first-line coverage for this microorganism.[145,146] AOM attributable to *M catarrhalis* rarely progresses to acute mastoiditis or intracranial infections.[102,160,161]

Antibiotic Therapy

High-dose amoxicillin is recommended as the first-line treatment in most patients, although there are a number of medications that are clinically effective (Table 5). The justification for the use of amoxicillin relates to its effectiveness against common AOM bacterial pathogens as well as its safety, low cost, acceptable taste, and narrow microbiologic spectrum.[145,151] In children who have taken amoxicillin in the previous 30 days, those with concurrent conjunctivitis, or those for whom coverage for β-lactamase–positive *H influenzae* and *M catarrhalis* is desired, therapy should be initiated with high-dose amoxicillin-clavulanate (90 mg/kg/day of amoxicillin, with 6.4 mg/kg/day of clavulanate, a ratio of amoxicillin to clavulanate of 14:1, given in 2 divided doses, which is less likely to cause diarrhea than other amoxicillin-clavulanate preparations).[162]

Alternative initial antibiotics include cefdinir (14 mg/kg per day in 1 or 2 doses), cefuroxime (30 mg/kg per day in 2 divided doses), cefpodoxime (10 mg/kg per day in 2 divided doses), or ceftriaxone (50 mg/kg, administered intramuscularly). It is important to note that alternative antibiotics vary in their efficacy against AOM pathogens. For example, recent US data on in vitro susceptibility of *S pneumoniae* to cefdinir and cefuroxime are 70% to 80%, compared with 84% to 92% amoxicillin efficacy.[130,147–149] In vitro efficacy of cefdinir and cefuroxime against *H influenzae* is approximately 98%, compared with 58% efficacy of amoxicillin and nearly 100% efficacy of amoxicillin-clavulanate.[158] A multicenter double tympanocentesis open-label study of

TABLE 5 Recommended Antibiotics for (Initial or Delayed) Treatment and for Patients Who Have Failed Initial Antibiotic Treatment

Initial Immediate or Delayed Antibiotic Treatment		Antibiotic Treatment After 48–72 h of Failure of Initial Antibiotic Treatment	
Recommended First-line Treatment	Alternative Treatment (if Penicillin Allergy)	Recommended First-line Treatment	Alternative Treatment
Amoxicillin (80–90 mg/ kg per day in 2 divided doses)	Cefdinir (14 mg/kg per day in 1 or 2 doses)	Amoxicillin-clavulanate[a] (90 mg/kg per day of amoxicillin, with 6.4 mg/kg per day of clavulanate in 2 divided doses)	Ceftriaxone, 3 d Clindamycin (30–40 mg/kg per day in 3 divided doses), with or without third-generation cephalosporin
or	Cefuroxime (30 mg/kg per day in 2 divided doses)	or	Failure of second antibiotic
Amoxicillin-clavulanate[a] (90 mg/kg per day of amoxicillin, with 6.4 mg/kg per day of clavulanate [amoxicillin to clavulanate ratio, 14:1] in 2 divided doses)	Cefpodoxime (10 mg/kg per day in 2 divided doses)	Ceftriaxone (50 mg IM or IV for 3 d)	Clindamycin (30–40 mg/kg per day in 3 divided doses) plus third-generation cephalosporin
	Ceftriaxone (50 mg IM or IV per day for 1 or 3 d)		Tympanocentesis[b] Consult specialist[b]

IM, intramuscular; IV, intravenous.

[a] May be considered in patients who have received amoxicillin in the previous 30 d or who have the otitis-conjunctivitis syndrome.

[b] Perform tympanocentesis/drainage if skilled in the procedure, or seek a consultation from an otolaryngologist for tympanocentesis/drainage. If the tympanocentesis reveals multidrug-resistant bacteria, seek an infectious disease specialist consultation.

[c] Cefdinir, cefuroxime, cefpodoxime, and ceftriaxone are highly unlikely to be associated with cross-reactivity with penicillin allergy on the basis of their distinct chemical structures. See text for more information.

cefdinir in recurrent AOM attributable to *H influenzae* showed eradication of the organism in 72% of patients.[163]

For penicillin-allergic children, recent data suggest that cross-reactivity among penicillins and cephalosporins is lower than historically reported.[164–167] The previously cited rate of cross-sensitivity to cephalosporins among penicillin-allergic patients (approximately 10%) is likely an overestimate. The rate was based on data collected and reviewed during the 1960s and 1970s. A study analyzing pooled data of 23 studies, including 2400 patients with reported history of penicillin allergy and 39 000 with no penicillin allergic history concluded that many patients who present with a history of penicillin allergy do not have an immunologic reaction to penicillin.[166] The chemical structure of the cephalosporin determines the risk of cross-reactivity between specific agents.[165,168] The degree of cross-reactivity is higher between penicillins and first-generation cephalosporins but is negligible with the second- and third-generation cephalosporins. Because of the differences in the chemical structures, cefdinir, cefuroxime, cefpodoxime, and ceftriaxone are highly unlikely to be associated with cross-reactivity with penicillin.[165] Despite this, the Joint Task Force on Practice Parameters; American Academy of Allergy, Asthma and Immunology; American College of Allergy, Asthma and Immunology; and Joint Council of Allergy, Asthma and Immunology[169] stated that "cephalosporin treatment of patients with a history of penicillin allergy, selecting out those with severe reaction histories, show a reaction rate of 0.1%." They recommend a cephalosporin in cases without severe and/or recent penicillin allergy reaction history when skin test is not available.

Macrolides, such as erythromycin and azithromycin, have limited efficacy against both *H influenzae* and *S pneumoniae*.[130,147–149] Clindamycin lacks efficacy against *H influenzae*. Clindamycin alone (30–40 mg/kg per day in 3 divided doses) may be used for suspected penicillin-resistant *S pneumoniae*; however, the drug will likely not be effective for the multidrug-resistant serotypes.[130,158,166]

Several of these choices of antibiotic suspensions are barely palatable or frankly offensive and may lead to avoidance behaviors or active rejection by spitting out the suspension. Palatability of antibiotic suspensions has been compared in many studies.[170–172] Specific antibiotic suspensions such as cefuroxime, cefpodoxime, and clindamycin may benefit from adding taste-masking products, such as chocolate or strawberry flavoring agents, to obscure the initial bitter taste and the unpleasant aftertaste.[172,173] In the patient who is persistently vomiting or cannot otherwise tolerate oral medication, even when the taste is masked, ceftriaxone (50 mg/kg, administered intramuscularly in 1 or 2 sites in the anterior thigh, or intravenously) has been demonstrated to be effective for the initial or repeat antibiotic treatment of AOM.[174,175] Although a single injection of ceftriaxone is approved by the US FDA for the treatment of AOM, results of a double tympanocentesis study (before and 3 days after single dose ceftriaxone) by Leibovitz et al[175] suggest that more than 1 ceftriaxone dose may be required to prevent recurrence of the middle ear infection within 5 to 7 days after the initial dose.

Initial Antibiotic Treatment Failure

When antibiotics are prescribed for AOM, clinical improvement should be noted within 48 to 72 hours. During the 24 hours after the diagnosis of AOM, the child's symptoms may worsen slightly. In the next 24 hours, the patient's symptoms should begin to improve. If initially febrile, the temperature should decline within 48 to 72 hours. Irritability and fussiness should lessen or disappear, and sleeping and drinking patterns should normalize.[176,177] If the patient is not improved by 48 to 72 hours, another disease or concomitant viral infection may be present, or the causative bacteria may be resistant to the chosen therapy.

Some children with AOM and persistent symptoms after 48 to 72 hours of initial antibacterial treatment may have combined bacterial and viral infection, which would explain the persistence of ongoing symptoms despite appropriate antibiotic therapy.[109,178,179] Literature is conflicting on the correlation between clinical and bacteriologic outcomes. Some studies report good correlation ranging from 86% to 91%,[180,181] suggesting continued presence of bacteria in the middle ear in a high proportion of cases with persistent symptoms. Others report that middle ear fluid from children with AOM in whom symptoms are persistent is sterile in 42% to 49% of cases.[123,182] A change in antibiotic may not be required in some children with mild persistent symptoms.

In children with persistent, severe symptoms of AOM and unimproved otologic findings after initial treatment, the clinician may consider changing the antibiotic (Table 5). If the child was initially treated with amoxicillin and failed to improve, amoxicillin-clavulanate should be used. Patients who were given amoxicillin-clavulanate or oral third-generation cephalosporins may receive intramuscular ceftriaxone (50 mg/kg). In the treatment of AOM unresponsive to initial antibiotics, a 3-day course of ceftriaxone has been shown to be better than a 1-day regimen.[175]

Although trimethoprim-sulfamethoxazole and erythromycin-sulfisoxazole had been useful as therapy for patients with AOM, pneumococcal surveillance studies have indicated that resistance to these 2 combination agents is substantial.[130,149,183] Therefore, when patients fail to improve while receiving amoxicillin, neither trimethoprim-sulfamethoxazole[184] nor erythromycin-sulfisoxazole is appropriate therapy.

Tympanocentesis should be considered, and culture of middle ear fluid should be performed for bacteriologic diagnosis and susceptibility testing when a series of antibiotic drugs have failed to improve the clinical condition. If tympanocentesis is not available, a course of clindamycin may be used, with or without an antibiotic that covers nontypeable *H influenzae* and *M catarrhalis*, such as cefdinir, cefixime, or cefuroxime.

Because *S pneumoniae* serotype 19A is usually multidrug-resistant and may not be responsive to clindamycin,[104,149] newer antibiotics that are not approved by the FDA for treatment of AOM, such as levofloxacin or linezolid, may be indicated.[185–187] Levofloxacin is a quinolone antibiotic that is not approved by the FDA for use in children. Linezolid is effective against resistant Gram-positive bacteria. It is not approved by the FDA for AOM treatment and is expensive. In children with repeated treatment failures, every effort should be made for bacteriologic diagnosis by tympanocentesis with Gram stain, culture, and antibiotic susceptibility testing of the organism (s) present. The clinician may consider consulting with pediatric medical subspecialists, such as an otolaryngologist for possible tympanocentesis, drainage, and culture and an infectious disease expert, before use of unconventional drugs such as levofloxacin or linezolid.

When tympanocentesis is not available, 1 possible way to obtain information on the middle ear pathogens and their antimicrobial susceptibility is to obtain a nasopharyngeal specimen for bacterial culture. Almost all middle ear pathogens derive from the pathogens colonizing the nasopharynx, but not all nasopharyngeal pathogens enter the middle ear to cause AOM. The positive predictive value of nasopharyngeal culture during AOM (likelihood that bacteria cultured from the nasopharynx is the middle ear pathogen) ranges from 22% to 44% for *S pneumoniae*, 50% to 71% for nontypeable *H influenzae*, and 17% to 19% for *M catarrhalis*. The negative predictive value (likelihood that bacteria not found in the nasopharynx are not AOM pathogens) ranges from 95% to 99% for all 3 bacteria.[188,189] Therefore, if nasopharyngeal culture is negative for specific bacteria, that organism is likely not the AOM pathogen. A negative culture for *S pneumoniae*, for example, will help eliminate the concern for multidrug-resistant bacteria and the need for unconventional therapies, such as levofloxacin or linezolid. On the other hand, if *S pneumoniae* is cultured from the nasopharynx, the antimicrobial susceptibility pattern can help guide treatment.

Duration of Therapy

The optimal duration of therapy for patients with AOM is uncertain; the usual 10-day course of therapy was derived from the duration of treatment of streptococcal pharyngotonsillitis. Several studies favor standard 10-day therapy over shorter courses for children younger than 2 years.[162,190–194] Thus, for children younger than 2 years and children with severe symptoms, a standard 10-day course is recommended. A 7-day course of oral antibiotic appears to be equally effective in children 2 to 5 years of age with mild or moderate AOM. For children 6 years and older with mild to moderate symptoms, a 5- to 7-day course is adequate treatment.

Follow-up of the Patient With AOM

Once the child has shown clinical improvement, follow-up is based on the usual clinical course of AOM. There is little scientific evidence for a routine 10- to 14-day reevaluation visit for all children with an episode of AOM. The physician may choose to reassess some children, such as young children with severe symptoms or recurrent AOM or when specifically requested by the child's parent.

Persistent MEE is common and can be detected by pneumatic otoscopy (with or without verification by tympanometry) after resolution of acute symptoms. Two weeks after successful antibiotic treatment of AOM, 60% to 70% of children have MEE, decreasing to 40% at 1 month and 10% to 25% at 3 months after successful antibiotic treatment.[177,195] The presence of MEE without clinical symptoms is defined as OME. OME must be differentiated clinically from AOM and requires infrequent additional monitoring but not antibiotic therapy. Assurance that OME resolves is particularly important for parents of children with cognitive or developmental delays that may be affected adversely by transient hearing loss associated with MEE. Detailed recommendations for the management of the child with OME can be found in the evidence-based guideline from the AAP/AAFP/American Academy of Otolaryngology-Head and Neck Surgery published in 2004.[84,85]

Key Action Statement 5A

Clinicians should *NOT* prescribe prophylactic antibiotics to reduce the frequency of episodes of AOM in children with recurrent AOM. (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 5A

Aggregate evidence quality	Grade B
Benefits	No adverse effects from antibiotic. Reduces potential for development of bacterial resistance. Reduced costs.
Risks, harms, cost	Small increase in episodes of AOM.
Benefit-harm assessment	Preponderance of benefit.
Value judgments	Potential harm outweighs the potential benefit.
Intentional vagueness	None.
Role of patient preferences	Limited.
Exclusions	Young children whose only alternative would be tympanostomy tubes.
Strength	**Recommendation**

Key Action Statement 5B

Clinicians may offer tympanostomy tubes for recurrent AOM (3 episodes in 6 months or 4 episodes in 1 year, with 1 episode in the preceding 6 months). (Evidence Quality: Grade B, Rec. Strength: Option)

Key Action Statement Profile: KAS 5B

Aggregate evidence quality	**Grade B**
Benefits	Decreased frequency of AOM. Ability to treat AOM with topical antibiotic therapy.
Risks, harms, cost	Risks of anesthesia or surgery. Cost. Scarring of TM, chronic perforation, cholesteatoma. Otorrhea.
Benefits-harms assessment	Equilibrium of benefit and harm.
Value judgments	None.
Intentional vagueness	Option based on limited evidence.
Role of patient preferences	Joint decision of parent and clinician.
Exclusions	Any contraindication to anesthesia and surgery.
Strength	**Option**

Purpose of This Section

Recurrent AOM has been defined as the occurrence of 3 or more episodes of AOM in a 6-month period or the occurrence of 4 or more episodes of AOM in a 12-month period that includes at least 1 episode in the preceding 6 months.[20] These episodes should be well documented and separate acute infections.[11]

Winter season, male gender, and passive exposure to smoking have been associated with an increased likelihood of recurrence. Half of children younger than 2 years treated for AOM will experience a recurrence within 6 months. Symptoms that last more than 10 days may also predict recurrence.[196]

Changes From AAP/AAFP 2004 AOM Guideline

Recurrent AOM was not addressed in the 2004 AOM guideline. This section addresses the literature on recurrent AOM.

Antibiotic Prophylaxis

Long-term, low-dose antibiotic use, referred to as antibiotic prophylaxis or chemoprophylaxis, has been used to treat children with recurrent AOM to prevent subsequent episodes.[85] A 2006 Cochrane review analyzed 16 studies of long-term antibiotic use for AOM and found such use prevented 1.5 episodes of AOM per year, reducing in half the number of AOM episodes during the period of treatment.[197] Randomized placebo-controlled trials of prophylaxis reported a decrease of 0.09 episodes per month in the frequency of AOM attributable to therapy (approximately 0.5 to 1.5 AOM episodes per year for 95% of children). An estimated 5 children would need to be treated for 1 year to prevent 1 episode of OM. The effect may be more substantial for children with 6 or more AOM episodes in the preceding year.[12]

This decrease in episodes of AOM occurred only while the prophylactic antibiotic was being given. The modest benefit afforded by a 6-month course of antibiotic prophylaxis does not have longer-lasting benefit after cessation of therapy. Teele showed no differences between children who received prophylactic antibiotics compared with those who received placebo in AOM recurrences or persistence of OME.[198]

Antibiotic prophylaxis is not appropriate for children with long-term MEE or for children with infrequent episodes of AOM. The small reduction in frequency of AOM with long-term antibiotic prophylaxis must be weighed against the cost of such therapy; the potential adverse effects of antibiotics, principally allergic reaction and gastrointestinal tract consequences, such as diarrhea; and their contribution to the emergence of bacterial resistance.

Surgery for Recurrent AOM

The use of tympanostomy tubes for treatment of ear disease in general, and for AOM in particular, has been controversial.[199] Most published studies of surgical intervention for OM focus on children with persistent MEE with or without AOM. The literature on surgery for recurrent AOM as defined here is scant. A lack of consensus among otolaryngologists regarding the role of surgery for recurrent AOM was reported in a survey of Canadian otolaryngologists in which 40% reported they would "never," 30% reported they would "sometimes," and 30% reported they would "often or always" place tympanostomy tubes for a hypothetical 2-year-old child with frequent OM without persistent MEE or hearing loss.[200]

Tympanostomy tubes, however, remain widely used in clinical practice for both OME and recurrent OM.[201] Recurrent

AOM remains a common indication for referral to an otolaryngologist.

Three randomized controlled trials have compared the number of episodes of AOM after tympanostomy tube placement or no surgery.[202] Two found significant improvement in mean number of AOM episodes after tympanostomy tubes during a 6-month follow-up period.[203,204] One study randomly assigned children with recurrent AOM to groups receiving placebo, amoxicillin prophylaxis, or tympanostomy tubes and followed them for 2 years.[205] Although prophylactic antibiotics reduced the rate of AOM, no difference in number of episodes of AOM was noted between the tympanostomy tube group and the placebo group over 2 years. A Cochrane review of studies of tympanostomy tubes for recurrent AOM analyzed 2 studies[204,206] that met inclusion criteria and found that tympanostomy tubes reduced the number of episodes of AOM by 1.5 episodes in the 6 months after surgery.[207] Tympanostomy tube insertion has been shown to improve disease-specific quality-of-life measures in children with OM.[208] One multicenter, nonrandomized observational study showed large improvements in a disease-specific quality-of-life instrument that measured psychosocial domains of physical suffering, hearing loss, speech impairment, emotional distress, activity limitations, and caregiver concerns that are associated with ear infections.[209] These benefits of tympanostomy tubes have been demonstrated in mixed populations of children that include children with OME as well as recurrent AOM.

Beyond the cost, insertion of tympanostomy tubes is associated with a small but finite surgical and anesthetic risk. A recent review looking at protocols to minimize operative risk reported no major complications, such as sensorineural hearing loss, vascular injury, or ossicular chain disruption, in 10 000 tube insertions performed primarily by residents, although minor complications such as TM tears or displaced tubes in the middle ear were seen in 0.016% of ears.[210] Long-term sequelae of tympanostomy tubes include TM structural changes including focal atrophy, tympanosclerosis, retraction pockets, and chronic perforation. One meta-analysis found tympanosclerosis in 32% of patients after placement of tympanostomy tubes and chronic perforations in 2.2% of patients who had short-term tubes and 16.6% of patients with long-term tubes.[211]

Adenoidectomy, without myringotomy and/or tympanostomy tubes, did not reduce the number of episodes of AOM when compared with chemoprophylaxis or placebo.[212] Adenoidectomy alone should not be used for prevention of AOM but may have benefit when performed with placement of tympanostomy tubes or in children with previous tympanostomy tube placement in OME.[213]

Prevention of AOM: Key Action Statement 6A

Pneumococcal Vaccine

Clinicians should recommend pneumococcal conjugate vaccine to all children according to the schedule of the Advisory Committee on Immunization Practices, AAP, and AAFP. (Evidence Quality: Grade B, Rec. Strength: Strong Recommendation)

Key Action Statement Profile: KAS 6A

Aggregate evidence quality	Grade B
Benefits	Reduced frequency of AOM attributable to vaccine serotypes. Reduced risk of serious pneumococcal systemic disease.
Risks, harms, cost	Potential vaccine side effects. Cost of vaccine.
Benefits-harms assessment	Preponderance of benefit.
Value judgments	Potential vaccine adverse effects are minimal.
Intentional vagueness	None.
Role of patient preferences	Some parents may choose to refuse the vaccine.
Exclusions	Severe allergic reaction (eg, anaphylaxis) to any component of pneumococcal vaccine or any diphtheria toxoid-containing vaccine.
Strength	**Strong Recommendation**

Key Action Statement 6B

Influenza Vaccine: Clinicians should recommend annual influenza vaccine to all children according to the schedule of the Advisory Committee on Immunization Practices, AAP, and AAFP. (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 6B

Aggregate evidence quality	Grade B
Benefits	Reduced risk of influenza infection. Reduction in frequency of AOM associated with influenza.
Risks, harms, cost	Potential vaccine adverse effects. Cost of vaccine. Requires annual immunization.
Benefits-harms assessment	Preponderance of benefit.
Value judgments	Potential vaccine adverse effects are minimal.
Intentional vagueness	None
Role of patient preferences	Some parents may choose to refuse the vaccine.
Exclusions	See CDC guideline on contraindications (http://www.cdc.gov/flu/professionals/acip/shouldnot.htm).
Strength	**Recommendation**

Key Action Statement 6C

Breastfeeding: Clinicians should encourage exclusive breastfeeding for at least 6 months. (Evidence Quality: Grade B, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 6C

Aggregate evidence quality	Grade B
Benefits	May reduce the risk of early AOM. Multiple benefits of breastfeeding unrelated to AOM.
Risk, harm, cost	None
Benefit-harm assessment	Preponderance of benefit.
Value judgments	The intervention has value unrelated to AOM prevention.
Intentional vagueness	None
Role of patient preferences	Some parents choose to feed formula.
Exclusions	None
Strength	**Recommendation**

Key Action Statement 6D

Clinicians should encourage avoidance of tobacco smoke exposure. (Evidence Quality: Grade C, Rec. Strength: Recommendation)

Key Action Statement Profile: KAS 6D

Aggregate evidence quality	Grade C
Benefits	May reduce the risk of AOM.
Risks, harms, cost	None
Benefits-harms assessment	Preponderance of benefit.
Value judgments	Avoidance of tobacco exposure has inherent value unrelated to AOM.
Intentional vagueness	None
Role of patient preferences	Many parents/caregivers choose not to stop smoking. Some also remain addicted, and are unable to quit smoking.
Exclusions	None
Strength	**Recommendation**

Purpose of This Section

The 2004 AOM guideline noted data on immunizations, breastfeeding, and lifestyle changes that would reduce the risk of acquiring AOM. This section addresses new data published since 2004.

Changes From AAP/AAFP 2004 AOM Guideline

PCV7 has been in use in the United States since 2000. PCV13 was introduced in the United States in 2010. The 10-valent pneumococcal nontypeable *H influenzae* protein D-conjugate vaccine was recently licensed in Europe for prevention of diseases attributable to *S pneumoniae* and nontypeable *H influenzae*. Annual influenza immunization is now recommended for all children 6 months of age and older in the United States.[214,215] Updated information regarding these vaccines and their effect on the incidence of AOM is reviewed.

The AAP issued a new breastfeeding policy statement in February 2012.[216] This guideline also includes a recommendation regarding tobacco smoke exposure. Bottle propping, pacifier use, and child care are discussed, but no recommendations are made because of limited evidence. The use of xylitol, a possible adjunct to AOM prevention, is discussed; however, no recommendations are made.

Pneumococcal Vaccine

Pneumococcal conjugate vaccines have proven effective in preventing OM caused by pneumococcal serotypes contained in the vaccines. A meta-analysis of 5 studies with AOM as an outcome determined that there is a 29% reduction in AOM caused by all pneumococcal serotypes among children who received PCV7 before 24 months of age.[217] Although the overall benefit seen in clinical trials for all causes of AOM is small (6%–7%),[218–221] observational studies have shown that medical office visits for otitis were reduced by up to 40% comparing years before and after introduction of PCV7.[222–224] Grijvala[223] reported no effect, however, among children first vaccinated at older ages. Poehling et al[225] reported reductions of frequent AOM and PE tube use after introduction of PCV7. The observations by some of greater benefit observed in the community than in clinical trials is not fully understood but may be related to effects of herd immunity or may be attributed to secular trends or changes in AOM diagnosis patterns over time.[223,226–229] In a 2009 Cochrane review,[221] Jansen et al found that the overall reduction in AOM incidence may only be 6% to 7% but noted that even that small rate may have public health relevance. O'Brien et al concurred and noted in addition the potential for cost savings.[230] There is evidence that serotype replacement may reduce the long-term efficacy of pneumococcal conjugate vaccines against AOM,[231] but it is possible that new pneumococcal conjugate vaccines may demonstrate an increased effect on reduction in AOM.[232–234] Data on AOM reduction secondary to the PCV13 licensed in the United States in 2010 are not yet available.

The *H influenzae* protein D-conjugate vaccine recently licensed in Europe has potential benefit of protection against 10 serotypes of *S pneumoniae* and nontypeable *H influenzae*.[221,234]

Influenza Vaccine

Most cases of AOM follow upper respiratory tract infections caused by viruses, including influenza viruses. As many as two-thirds of young children with influenza may have AOM.[235] Investigators have studied the efficacy of trivalent inactivated influenza vaccine (TIV) and live-attenuated intranasal influenza vaccine (LAIV) in preventing AOM. Many studies have demonstrated 30% to 55% efficacy of influenza vaccine in prevention of AOM during the respiratory illness season.[6,235–239] One study reported no benefit of TIV in reducing AOM burden; however, 1 of the 2 respiratory illness seasons during which this study was conducted had a relatively low influenza activity. A pooled analysis[240] of 8 studies comparing LAIV versus TIV or placebo[241–248] showed a higher efficacy of LAIV compared with both placebo and with TIV. Influenza vaccination is now recommended for all children 6 months of age and older in the United States.[214,215]

Breastfeeding

Multiple studies provide evidence that breastfeeding for at least 4 to 6 months reduces episodes of AOM and recurrent AOM.[249–253] Two cohort studies, 1 retrospective study[250] and 1 prospective study,[253] suggest a dose response, with some protection from partial breastfeeding and the greatest protection from exclusive breastfeeding through 6 months of age. In multivariate analysis controlling for exposure to child care settings, the risk of nonrecurrent otitis is 0.61 (95% confidence interval [CI]: 0.4–0.92) comparing exclusive breastfeeding through 6 months of age with no breastfeeding or breastfeeding less than 4 months. In a prospective cohort, Scariatti[253] found a significant dose-response effect. In this study, OM was self-reported by parents. In a systematic review, McNiel et al[254] found that when exclusive breastfeeding was set as the normative standard, the recalculated odds ratios (ORs) revealed the risks of any formula use. For example, any formula use in the first 6 months of age was significantly associated with increased incidence of OM (OR: 1.78; 95% CI: 1.19–2.70; OR: 4.55; 95% CI: 1.64–12.50 in the available studies; pooled OR for any formula in the first 3 months of age, 2.00; 95% CI: 1.40–2.78). A number of studies[255–259] addressed the association of AOM and other infectious illness in infants with duration and exclusivity of breastfeeding, but all had limitations and none had a randomized controlled design. However, taken together, they continue to show a protective effect of exclusive breastfeeding. In all studies, there has been a predominance of white subjects, and child care attendance and smoking exposure may not have been completely controlled. Also, feeding methods were self-reported.

The consistent finding of a lower incidence of AOM and recurrent AOM with increased breastfeeding supports the AAP recommendation to encourage exclusive breastfeeding for the first 6 months of life and to continue for at least the first year and beyond for as long as mutually desired by mother and child.[216]

Lifestyle Changes

In addition to its many other benefits,[260] eliminating exposure to passive tobacco smoke has been postulated to reduce the incidence of AOM in infancy.[252,261–264] Bottles and pacifiers have been associated with AOM. Avoiding supine bottle feeding ("bottle propping") and reducing or eliminating pacifier use in the second 6 months of life may reduce AOM incidence.[265–267] In a recent cohort study, pacifier use was associated with AOM recurrence.[268]

During infancy and early childhood, reducing the incidence of upper respiratory tract infections by altering child care-center attendance patterns can reduce the incidence of recurrent AOM significantly.[249,269]

Xylitol

Xylitol, or birch sugar, is chemically a pentitol or 5-carbon polyol sugar alcohol. It is available as chewing gum, syrup, or lozenges. A 2011 Cochrane review[270] examined the evidence for the use of xylitol in preventing recurrent AOM. A statistically significant 25% reduction in the risk of occurrence of AOM among healthy children at child care centers in the xylitol group compared with the control group (relative risk: 0.75; 95% CI: 0.65 to 0.88; RD: –0.07; 95% CI: –0.12 to –0.03) in the 4 studies met criteria for analysis.[271–274] Chewing gum and lozenges containing xylitol appeared to be more effective than syrup. Children younger than 2 years, those at the greatest risk of having AOM, cannot safely use lozenges or chewing gum. Also, xylitol needs to be given 3 to 5 times a day to be effective. It is not effective for treating AOM and it must be taken daily throughout the respiratory illness season to have an effect. Sporadic or as-needed use is not effective.

Future Research

Despite advances in research partially stimulated by the 2004 AOM guideline, there are still many unanswered clinical questions in the field. Following are possible clinical research questions that still need to be resolved.

Diagnosis

There will probably never be a gold standard for diagnosis of AOM because of the continuum from OME to AOM. Conceivably, new techniques that could be used on the small amount of fluid obtained during tympanocentesis could identify inflammatory markers in addition to the presence of bacteria or viruses. However, performing tympanocentesis studies on children with uncomplicated otitis is likely not feasible because of ethical and other considerations.

Devices that more accurately identify the presence of MEE and bulging that are easier to use than tympanometry during office visits would be welcome, especially in the difficult-to-examine infant. Additional development of inexpensive, easy-to-use video pneumatic otoscopes is still a goal.

Initial Treatment

The recent studies of Hoberman[31] and Tähtinen[32] have addressed clinical and TM appearance by using stringent diagnostic criteria of AOM. However, the outcomes for less stringent diagnostic criteria, a combination of symptoms, MEE, and TM appearance not completely consistent with OME can only be inferred from earlier studies that used less stringent criteria but did not specify outcomes for various grades of findings. Randomized controlled trials on these less certain TM appearances using scales similar to the OS-8 scale[35] could clarify the benefit of initial antibiotics and initial observation for these less certain diagnoses. Such studies must also specify severity of illness, laterality, and otorrhea.

Appropriate end points must be established. Specifically is the appearance of the TM in patients without clinical symptoms at the end of a study significant for relapse, recurrence, or persistent MEE. Such a study would require randomization of patients with unimproved TM appearance to continued observation and antibiotic groups.

The most efficient and acceptable methods of initial observation should continue to be studied balancing the convenience and benefits with the potential risks to the patient.

Antibiotics

Amoxicillin-clavulanate has a broader spectrum than amoxicillin and may be a better initial antibiotic. However, because of cost and adverse effects, the subcommittee has chosen amoxicillin as first-line AOM treatment. Randomized controlled trials comparing the 2 with adequate power to differentiate clinical efficacy would clarify this choice. Stringent diagnostic criteria should be the standard for these studies. Antibiotic comparisons for AOM should now include an observation arm for patients with nonsevere illness to ensure a clinical benefit over placebo. Studies should also have enough patients to show small but meaningful differences.

Although there have been studies on the likelihood of resistant *S pneumoniae* or *H influenzae* in children in child care settings and with siblings younger than 5 years, studies are still needed to determine whether these and other risk factors would indicate a need for different initial treatment than noted in the guideline.

New antibiotics that are safe and effective are needed for use in AOM because of the development of multidrug-resistant organisms. Such new antibiotics must be tested against the currently available medications.

Randomized controlled trials using different durations of antibiotic therapy in different age groups are needed to optimize therapy with the possibility of decreasing duration of antibiotic use. These would need to be performed initially with amoxicillin and amoxicillin-clavulanate but should also be performed for any antibiotic used in AOM. Again, an observation arm should be included in nonsevere illness.

Recurrent AOM

There have been adequate studies regarding prophylactic antibiotic use in recurrent AOM. More and better controlled studies of tympanostomy tube placement would help determine its benefit versus harm.

Prevention

There should be additional development of vaccines targeted at common organisms associated with AOM.[275] Focused epidemiologic studies on the benefit of breastfeeding, specifically addressing AOM prevention, including duration of breastfeeding and partial versus exclusive breastfeeding, would clarify what is now a more general database. Likewise, more focused studies of the effects of lifestyle changes would help clarify their effect on AOM.

Complementary and Alternative Medicine

There are no well-designed randomized controlled trials of the usefulness of complementary and alternative medicine in AOM, yet a large number of families turn to these methods. Although most alternative therapies are relatively inexpensive, some may be costly. Such studies should compare the alternative therapy to observation rather than antibiotics and only use an antibiotic arm if the alternative therapy is shown to be better than observation. Such studies should focus on children with less stringent criteria of AOM but using the same descriptive criteria for the patients as noted above.

DISSEMINATION OF GUIDELINES

An Institute of Medicine Report notes that "Effective multifaceted implementation strategies targeting both individuals and healthcare systems should be employed by implementers to promote adherence to trustworthy [clinical practice guidelines]."[230]

Many studies of the effect of clinical practice guidelines have been performed. In general, the studies show little overt change in practice after a guideline is published. However, as was seen after the 2004 AOM guideline, the number of visits for AOM and the number of prescriptions for antibiotics for AOM had decreased publication. Studies of educational and dissemination methods both at the practicing physician level and especially at the resident level need to be examined.

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Oversight by the Steering Committee on Quality Improvement and Management, 2009–2012

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CLINICAL PRACTICE GUIDELINE

American Academy of Family Physicians, American Academy of Otolaryngology-Head and Neck Surgery, and American Academy of Pediatrics Subcommittee on Otitis Media With Effusion

Otitis Media With Effusion

ABSTRACT. The clinical practice guideline on otitis media with effusion (OME) provides evidence-based recommendations on diagnosing and managing OME in children. This is an update of the 1994 clinical practice guideline "Otitis Media With Effusion in Young Children," which was developed by the Agency for Healthcare Policy and Research (now the Agency for Healthcare Research and Quality). In contrast to the earlier guideline, which was limited to children 1 to 3 years old with no craniofacial or neurologic abnormalities or sensory deficits, the updated guideline applies to children aged 2 months through 12 years with or without developmental disabilities or underlying conditions that predispose to OME and its sequelae. The American Academy of Pediatrics, American Academy of Family Physicians, and American Academy of Otolaryngology-Head and Neck Surgery selected a subcommittee composed of experts in the fields of primary care, otolaryngology, infectious diseases, epidemiology, hearing, speech and language, and advanced-practice nursing to revise the OME guideline.

The subcommittee made a strong recommendation that clinicians use pneumatic otoscopy as the primary diagnostic method and distinguish OME from acute otitis media.

The subcommittee made recommendations that clinicians should 1) document the laterality, duration of effusion, and presence and severity of associated symptoms at each assessment of the child with OME, 2) distinguish the child with OME who is at risk for speech, language, or learning problems from other children with OME and more promptly evaluate hearing, speech, language, and need for intervention in children at risk, and 3) manage the child with OME who is not at risk with watchful waiting for 3 months from the date of effusion onset (if known) or diagnosis (if onset is unknown).

The subcommittee also made recommendations that 4) hearing testing be conducted when OME persists for 3 months or longer or at any time that language delay, learning problems, or a significant hearing loss is suspected in a child with OME, 5) children with persistent OME who are not at risk should be reexamined at 3- to 6-month intervals until the effusion is no longer present, significant hearing loss is identified, or structural abnormalities of the eardrum or middle ear are suspected, and 6) when a child becomes a surgical candidate (tympanostomy tube insertion is the preferred initial procedure). Adenoidectomy should not be performed unless a distinct indication exists (nasal obstruction, chronic adenoiditis); repeat surgery consists of adenoidectomy plus myringotomy with or without tubeinsertion. Tonsillectomy alone or myringotomy alone should not be used to treat OME.

The subcommittee made negative recommendations that 1) population-based screening programs for OME not be performed in healthy, asymptomatic children, and 2) because antihistamines and decongestants are ineffective for OME, they should not be used for treatment; antimicrobials and corticosteroids do not have long-term efficacy and should not be used for routine management.

The subcommittee gave as options that 1) tympanometry can be used to confirm the diagnosis of OME and 2) when children with OME are referred by the primary clinician for evaluation by an otolaryngologist, audiologist, or speech-language pathologist, the referring clinician should document the effusion duration and specific reason for referral (evaluation, surgery) and provide additional relevant information such as history of acute otitis media and developmental status of the child. The subcommittee made no recommendations for 1) complementary and alternative medicine as a treatment for OME, based on a lack of scientific evidence documenting efficacy, or 2) allergy management as a treatment for OME, based on insufficient evidence of therapeutic efficacy or a causal relationship between allergy and OME. Last, the panel compiled a list of research needs based on limitations of the evidence reviewed.

The purpose of this guideline is to inform clinicians of evidence-based methods to identify, monitor, and manage OME in children aged 2 months through 12 years. The guideline may not apply to children more than 12 years old, because OME is uncommon and the natural history is likely to differ from younger children who experience rapid developmental change. The target population includes children with or without developmental disabilities or underlying conditions that predispose to OME and its sequelae. The guideline is intended for use by providers of health care to children, including primary care and specialist physicians, nurses and nurse practitioners, physician assistants, audiologists, speech-language pathologists, and child-development specialists. The guideline is applicable to any setting in which children with OME would be identified, monitored, or managed.

This guideline is not intended as a sole source of guidance in evaluating children with OME. Rather, it is designed to assist primary care and other clinicians by providing an evidence-based framework for decision-making strategies. It is not intended to replace clinical judgment or establish a protocol for all children with this condition and may not provide the only appropriate approach to diagnosing and managing this problem. *Pediatrics* 2004;113:1412–1429; *acute otitis media, antibacterial, antibiotic.*

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ABBREVIATIONS. OME, otitis media with effusion; AOM, acute otitis media; AAP, American Academy of Pediatrics; AHRQ, Agency for Healthcare Research and Quality; EPC, Southern California Evidence-Based Practice Center; CAM, complementary and alternative medicine; HL, hearing level.

Otitis media with effusion (OME) as discussed in this guideline is defined as the presence of fluid in the middle ear without signs or symptoms of acute ear infection.[1,2] OME is considered distinct from acute otitis media (AOM), which is defined as a history of acute onset of signs and symptoms, the presence of middle-ear effusion, and signs and symptoms of middle-ear inflammation. Persistent middle-ear fluid from OME results in decreased mobility of the tympanic membrane and serves as a barrier to sound conduction.[3] Approximately 2.2 million diagnosed episodes of OME occur annually in the United States, yielding a combined direct and indirect annual cost estimate of $4.0 billion.[2]

OME may occur spontaneously because of poor eustachian tube function or as an inflammatory response following AOM. Approximately 90% of children (80% of individual ears) have OME at some time before school age,[4] most often between ages 6 months and 4 years.[5] In the first year of life, >50% of children will experience OME, increasing to >60% by 2 years.[6] Many episodes resolve spontaneously within 3 months, but ~30% to 40% of children have recurrent OME, and 5% to 10% of episodes last 1 year or longer.[1,4,7]

The primary outcomes considered in the guideline include hearing loss; effects on speech, language, and learning; physiologic sequelae; health care utilization (medical, surgical); and quality of life.[1,2] The high prevalence of OME, difficulties in diagnosis and assessing duration, increased risk of conductive hearing loss, potential impact on language and cognition, and significant practice variations in management[8] make OME an important condition for the use of up-to-date evidence-based practice guidelines.

METHODS

General Methods and Literature Search

In developing an evidence-based clinical practice guideline on managing OME, the American Academy of Pediatrics (AAP), American Academy of Family Physicians, and American Academy of Otolaryngology-Head and Neck Surgery worked with the Agency for Healthcare Research and Quality (AHRQ) and other organizations. This effort included representatives from each partnering organization along with liaisons from audiology, speech-language pathology, informatics, and advanced-practice nursing. The most current literature on managing children with OME was reviewed, and research questions were developed to guide the evidence-review process.

The AHRQ report on OME from the Southern California Evidence-Based Practice Center (EPC) focused on key questions of natural history, diagnostic methods, and long-term speech, language, and hearing outcomes.[2] Searches were conducted through January 2000 in Medline, Embase, and the Cochrane Library. Additional articles were identified by review of reference listings in proceedings, reports, and other guidelines. The EPC accepted 970 articles for full review after screening 3200 abstracts. The EPC reviewed articles by using established quality criteria[9,10] and included randomized trials, prospective cohorts, and validations of diagnostic tests (validating cohort studies).

The AAP subcommittee on OME updated the AHRQ review with articles identified by an electronic Medline search through April 2003 and with additional material identified manually by subcommittee members. Copies of relevant articles were distributed to the subcommittee for consideration. A specific search for articles relevant to complementary and alternative medicine (CAM) was performed by using Medline and the Allied and Complementary Medicine Database through April 2003. Articles relevant to allergy and OME were identified by using Medline through April 2003. The subcommittee met 3 times over a 1-year period, ending in May 2003, with interval electronic review and feedback on each guideline draft to ensure accuracy of content and consistency with standardized criteria for reporting clinical practice guidelines.[11]

In May 2003, the Guidelines Review Group of the Yale Center for Medical Informatics used the Guideline Elements Model[12] to categorize content of the present draft guideline. Policy statements were parsed into component decision variables and actions and then assessed for decidability and executability. Quality appraisal using established criteria[13] was performed with Guideline Elements Model-Q Online.[14,15] Implementation issues were predicted by using the Implementability Rating Profile, an instrument under development by the Yale Guidelines Review Group (R. Shiffman, MD, written communication, May 2003). OME subcommittee members received summary results and modified an advanced draft of the guideline.

The final draft practice guideline underwent extensive peer review by numerous entities identified by the subcommittee. Comments were compiled and reviewed by the subcommittee cochairpersons. The recommendations contained in the practice guideline are based on the best available published data through April 2003. Where data are lacking, a combination of clinical experience and expert consensus was used. A scheduled review process will occur 5 years from publication or sooner if new compelling evidence warrants earlier consideration.

Classification of Evidence-Based Statements

Guidelines are intended to reduce inappropriate variations in clinical care, produce optimal health outcomes for patients, and minimize harm. The evidence-based approach to guideline development requires that the evidence supporting a policy be identified, appraised, and summarized and that an explicit link between evidence and statements be defined. Evidence-based statements reflect the quality of evidence and the balance of benefit and harm that is anticipated when the statement is followed. The AAP definitions for evidence-based statements[16] are listed in Tables 1 and 2.

Guidelines are never intended to overrule professional judgment; rather, they may be viewed as a relative constraint on individual clinician discretion in a particular clinical circumstance. Less frequent variation in practice is expected for a strong recommendation than might be expected with a recommendation. Options offer the most opportunity for practice variability.[17] All clinicians should always act and decide in a way that they believe will best serve their patients' interests and needs regardless of guideline recommendations. Guidelines represent the best judgment of a team of experienced clinicians and methodologists addressing the scientific evidence for a particular topic.[16]

Making recommendations about health practices involves value judgments on the desirability of various outcomes associated with management options. Value judgments applied by the OME subcommittee were made in an effort to minimize harm and diminish unnecessary therapy. Emphasis was placed on promptly identifying and managing children at risk for speech, language, or learning problems to maximize opportunities for beneficial outcomes. Direct costs also were considered in the statements concerning diagnosis and screening and to a lesser extent in other statements.

1A. PNEUMATIC OTOSCOPY: CLINICIANS SHOULD USE PNEUMATIC OTOSCOPY AS THE PRIMARY DIAGNOSTIC METHOD FOR OME, AND OME SHOULD BE DISTINGUISHED FROM AOM

This is a strong recommendation based on systematic review of cohort studies and the preponderance of benefit over harm.

TABLE 1. Guideline Definitions for Evidence-Based Statements

Statement	Definition	Implication
Strong Recommendation	A strong recommendation means that the subcommittee believes that the benefits of the recommended approach clearly exceed the harms (or that the harms clearly exceed the benefits in the case of a strong negative recommendation) and that the quality of the supporting evidence is excellent (grade A or B).* In some clearly identified circumstances, strong recommendations may be made based on lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A recommendation means that the subcommittee believes that the benefits exceed the harms (or that the harms exceed the benefits in the case of a negative recommendation), but the quality of evidence is not as strong (grade B or C).* In some clearly identified circumstances, recommendations may be made based on lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits outweigh the harms.	Clinicians also should generally follow a recommendation but should remain alert to new information and sensitive to patient preferences.
Option	An option means that either the quality of evidence that exists is suspect (grade D)* or that well-done studies (grade A, B, or C)* show little clear advantage to one approach versus another.	Clinicians should be flexible in their decision-making regarding appropriate practice, although they may set boundaries on alternatives; patient preference should have a substantial influencing role.
No Recommendation	No recommendation means that there is both a lack of pertinent evidence (grade D)* and an unclear balance between benefits and harms.	Clinicians should feel little constraint in their decision-making and be alert to new published evidence that clarifies the balance of benefit versus harm; patient preference should have a substantial influencing role.

* See Table 2 for the definitions of evidence grades.

TABLE 2. Evidence Quality for Grades of Evidence

Grade	Evidence Quality
A	Well-designed, randomized, controlled trials or diagnostic studies performed on a population similar to the guideline's target population
B	Randomized, controlled trials or diagnostic studies with minor limitations; overwhelmingly consistent evidence from observational studies
C	Observational studies (case-control and cohort design)
D	Expert opinion, case reports, or reasoning from first principles (bench research or animal studies)

1B. TYMPANOMETRY: TYMPANOMETRY CAN BE USED TO CONFIRM THE DIAGNOSIS OF OME

This option is based on cohort studies and a balance of benefit and harm.

Diagnosing OME correctly is fundamental to proper management. Moreover, OME must be differentiated from AOM to avoid unnecessary antimicrobial use.[18,19]

OME is defined as fluid in the middle ear without signs or symptoms of acute ear infection.[2] The tympanic membrane is often cloudy with distinctly impaired mobility,[20] and an air-fluid level or bubble may be visible in the middle ear. Conversely, diagnosing AOM requires a history of acute onset of signs and symptoms, the presence of middle-ear effusion, and signs and symptoms of middle-ear inflammation. The critical distinguishing feature is that only AOM has acute signs and symptoms. Distinct redness of the tympanic membrane should not be a criterion for prescribing antibiotics, because it has poor predictive value for AOM and is present in ~5% of ears with OME.[20]

The AHRQ evidence report[2] systematically reviewed the sensitivity, specificity, and predictive values of 9 diagnostic methods for OME. Pneumatic otoscopy had the best balance of sensitivity and specificity, consistent with the 1994 guideline.[1] Meta-analysis revealed a pooled sensitivity of 94% (95% confidence interval: 91%–96%) and specificity of 80% (95% confidence interval: 75%–86%) for validated observers using pneumatic otoscopy versus myringotomy as the gold standard. Pneumatic otoscopy therefore should remain the primary method of OME diagnosis, because the instrument is readily available

in practice settings, cost-effective, and accurate in experienced hands. Non–pneumatic otoscopy is not advised for primary diagnosis.

The accuracy of pneumatic otoscopy in routine clinical practice may be less than that shown in published results, because clinicians have varying training and experience.[21,22] When the diagnosis of OME is uncertain, tympanometry or acoustic reflectometry should be considered as an adjunct to pneumatic otoscopy. Tympanometry with a standard 226-Hz probe tone is reliable for infants 4 months old or older and has good interobserver agreement of curve patterns in routine clinical practice.[23,24] Younger infants require specialized equipment with a higher probe tone frequency. Tympanometry generates costs related to instrument purchase, annual calibration, and test administration. Acoustic reflectometry with spectral gradient analysis is a low-cost alternative to tympanometry that does not require an airtight seal in the ear canal; however, validation studies primarily have used children 2 years old or older with a high prevalence of OME.[25–27]

Although no research studies have examined whether pneumatic otoscopy causes discomfort, expert consensus suggests that the procedure does not have to be painful, especially when symptoms of acute infection (AOM) are absent. A nontraumatic examination is facilitated by using a gentle touch, restraining the child properly when necessary, and inserting the speculum only into the outer one third (cartilaginous portion) of the ear canal.[28] The pneumatic bulb should be compressed slightly before insertion, because OME often is associated with a negative middle-ear pressure, which can be assessed more accurately by releasing the already compressed bulb. The otoscope must be fully charged, the bulb (halogen or xenon) bright and luminescent,[29] and the insufflator bulb attached tightly to the head to avoid the loss of an air seal. The window must also be sealed.

Evidence Profile: Pneumatic Otoscopy

- Aggregate evidence quality: A, diagnostic studies in relevant populations.
- Benefit: improved diagnostic accuracy; inexpensive equipment.
- Harm: cost of training clinicians in pneumatic otoscopy.
- Benefits-harms assessment: preponderance of benefit over harm.
- Policy level: strong recommendation.

Evidence Profile: Tympanometry

- Aggregate evidence quality: B, diagnostic studies with minor limitations.
- Benefit: increased diagnostic accuracy beyond pneumatic otoscopy; documentation.
- Harm: acquisition cost, administrative burden, and recalibration.
- Benefits-harms assessment: balance of benefit and harm.
- Policy level: option.

1C. SCREENING: POPULATION-BASED SCREENING PROGRAMS FOR OME ARE NOT RECOMMENDED IN HEALTHY, ASYMPTOMATIC CHILDREN

This recommendation is based on randomized, controlled trials and cohort studies, with a preponderance of harm over benefit.

This recommendation concerns population-based screening programs of all children in a community or a school without regard to any preexisting symptoms or history of disease. This recommendation does not address hearing screening or monitoring of specific children with previous or recurrent OME.

OME is highly prevalent in young children. Screening surveys of healthy children ranging in age from infancy to 5 years old show a 15% to 40% point prevalence of middle-ear effusion.[5,7,30–36] Among children examined at regular intervals for a year, ~50% to 60% of child care center attendees[32] and 25% of school-aged children[37] were found to have a middle-ear effusion at some time during the examination period, with peak incidence during the winter months.

Population-based screening has not been found to influence short-term language outcomes,[33] and its long-term effects have not been evaluated in a randomized, clinical trial. Therefore, the recommendation against screening is based not only on the ability to identify OME but more importantly on a lack of demonstrable benefits from treating children so identified that exceed the favorable natural history of the disease. The New Zealand Health Technology Assessment[38] could not determine whether preschool screening for OME was effective. More recently, the Canadian Task Force on Preventive Health Care[39] reported that insufficient evidence was available to recommend including or excluding routine early screening for OME. Although screening for OME is not inherently harmful, potential risks include inaccurate diagnoses, overtreating self-limited disease, parental anxiety, and the costs of screening and unnecessary treatment.

Population-based screening is appropriate for conditions that are common, can be detected by a sensitive and specific test, and benefit from early detection and treatment.[40] The first 2 requirements are fulfilled by OME, which affects up to 80% of children by school entry[2,5,7] and can be screened easily with tympanometry (see recommendation 1B). Early detection and treatment of OME identified by screening, however, have not been shown to improve intelligence, receptive language, or expressive language.[2,39,41,42] Therefore, population-based screening for early detection of OME in asymptomatic children has not been shown to improve outcomes and is not recommended.

Evidence Profile: Screening

- Aggregate evidence quality: B, randomized, controlled trials with minor limitations and consistent evidence from observational studies.
- Benefit: potentially improved developmental outcomes, which have not been demonstrated in the best current evidence.

- Harm: inaccurate diagnosis (false-positive or false-negative), overtreating self-limited disease, parental anxiety, cost of screening, and/or unnecessary treatment.
- Benefits-harms assessment: preponderance of harm over benefit.
- Policy level: recommendation against.

2. DOCUMENTATION: CLINICIANS SHOULD DOCUMENT THE LATERALITY, DURATION OF EFFUSION, AND PRESENCE AND SEVERITY OF ASSOCIATED SYMPTOMS AT EACH ASSESSMENT OF THE CHILD WITH OME

This recommendation is based on observational studies and strong preponderance of benefit over harm.

Documentation in the medical record facilitates diagnosis and treatment and communicates pertinent information to other clinicians to ensure patient safety and reduce medical errors.[43] Management decisions in children with OME depend on effusion duration and laterality plus the nature and severity of associated symptoms. Therefore, these features should be documented at every medical encounter for OME. Although no studies have addressed documentation for OME specifically, there is room for improvement in documentation of ambulatory care medical records.[44]

Ideally, the time of onset and laterality of OME can be defined through diagnosis of an antecedent AOM, a history of acute onset of signs or symptoms directly referable to fluid in the middle ear, or the presence of an abnormal audiogram or tympanogram closely after a previously normal test. Unfortunately, these conditions are often lacking, and the clinician is forced to speculate on the onset and duration of fluid in the middle ear(s) in a child found to have OME at a routine office visit or school screening audiometry.

In ~40% to 50% of cases of OME, neither the affected children nor their parents or caregivers describe significant complaints referable to a middle-ear effusion.[45,46] In some children, however, OME may have associated signs and symptoms caused by inflammation or the presence of effusion (not acute infection) that should be documented, such as

- Mild intermittent ear pain, fullness, or "popping"
- Secondary manifestations of ear pain in infants, which may include ear rubbing, excessive irritability, and sleep disturbances
- Failure of infants to respond appropriately to voices or environmental sounds, such as not turning accurately toward the sound source
- Hearing loss, even when not specifically described by the child, suggested by seeming lack of attentiveness, behavioral changes, failure to respond to normal conversational-level speech, or the need for excessively high sound levels when using audio equipment or viewing television
- Recurrent episodes of AOM with persistent OME between episodes
- Problems with school performance
- Balance problems, unexplained clumsiness, or delayed gross motor development[47–50]
- Delayed speech or language development

The laterality (unilateral versus bilateral), duration of effusion, and presence and severity of associated symptoms should be documented in the medical record at each assessment of the child with OME. When OME duration is uncertain, the clinician must take whatever evidence is at hand and make a reasonable estimate.

Evidence Profile: Documentation

- Aggregate evidence quality: C, observational studies.
- Benefits: defines severity, duration has prognostic value, facilitates future communication with other clinicians, supports appropriate timing of intervention, and, if consistently unilateral, may identify a problem with specific ear other than OME (eg, retraction pocket or cholesteatoma).
- Harm: administrative burden.
- Benefits-harms assessment: preponderance of benefit over harm.
- Policy level: recommendation.

3. CHILD AT RISK: CLINICIANS SHOULD DISTINGUISH THE CHILD WITH OME WHO IS AT RISK FOR SPEECH, LANGUAGE, OR LEARNING PROBLEMS FROM OTHER CHILDREN WITH OME AND SHOULD EVALUATE HEARING, SPEECH, LANGUAGE, AND NEED FOR INTERVENTION MORE PROMPTLY

This recommendation is based on case series, the preponderance of benefit over harm, and ethical limitations in studying children with OME who are at risk.

The panel defines the child at risk as one who is at increased risk for developmental difficulties (delay or disorder) because of sensory, physical, cognitive, or behavioral factors listed in Table 3. These factors are not caused by OME but can make the child less tolerant of hearing loss or vestibular problems secondary to middle-ear effusion. In contrast the child with OME who is not at risk is otherwise healthy and does not have any of the factors shown in Table 3.

Earlier guidelines for managing OME have applied only to young children who are healthy and exhibit no developmental delays.[1] Studies of the relationship between OME and hearing loss or speech/language development typically exclude children with craniofacial anomalies, genetic syndromes, and other developmental disorders. Therefore, the available literature mainly applies to otherwise healthy children who meet inclusion criteria for randomized,

TABLE 3. Risk Factors for Developmental Difficulties*

Permanent hearing loss independent of OME
Suspected or diagnosed speech and language delay or disorder
Autism-spectrum disorder and other pervasive developmental disorders
Syndromes (eg, Down) or craniofacial disorders that include cognitive, speech, and language delays
Blindness or uncorrectable visual impairment
Cleft palate with or without associated syndrome
Developmental delay

* Sensory, physical, cognitive, or behavioral factors that place children who have OME at an increased risk for developmental difficulties (delay or disorder).

controlled trials. Few, if any, existing studies dealing with developmental sequelae caused by hearing loss from OME can be generalized to children who are at risk.

Children who are at risk for speech or language delay would likely be affected additionally by hearing problems from OME,[51] although definitive studies are lacking. For example, small comparative studies of children or adolescents with Down syndrome[52] or cerebral palsy[53] show poorer articulation and receptive language associated with a history of early otitis media. Large studies are unlikely to be forthcoming because of methodologic and ethical difficulties inherent in studying children who are delayed or at risk for further delays. Therefore, clinicians who manage children with OME should determine whether other conditions coexist that put a child at risk for developmental delay (Table 3) and then take these conditions into consideration when planning assessment and management.

Children with craniofacial anomalies (eg, cleft palate; Down syndrome; Robin sequence; coloboma, heart defect, choanal atresia, retarded growth and development, genital anomaly, and ear defect with deafness [CHARGE] association) have a higher prevalence of chronic OME, hearing loss (conductive and sensorineural), and speech or language delay than do children without these anomalies.[54–57] Other children may not be more prone to OME but are likely to have speech and language disorders, such as those children with permanent hearing loss independent of OME,[58,59] specific language impairment,[60] autism-spectrum disorders,[61] or syndromes that adversely affect cognitive and linguistic development. Some retrospective studies[52,62,63] have found that hearing loss caused by OME in children with cognitive delays, such as Down syndrome, has been associated with lower language levels. Children with language delays or disorders with OME histories perform more poorly on speech-perception tasks than do children with OME histories alone.[64,65]

Children with severe visual impairments may be more susceptible to the effects of OME, because they depend on hearing more than children with normal vision.[51] Any decrease in their most important remaining sensory input for language (hearing) may significantly compromise language development and their ability to interact and communicate with others. All children with severe visual impairments should be considered more vulnerable to OME sequelae, especially in the areas of balance, sound localization, and communication.

Management of the child with OME who is at increased risk for developmental delays should include hearing testing and speech and language evaluation and may include speech and language therapy concurrent with managing OME, hearing aids or other amplification devices for hearing loss independent of OME, tympanostomy tube insertion,[54,63,66,67] and hearing testing after OME resolves to document improvement, because OME can mask a permanent underlying hearing loss and delay detection.[59,68,69]

Evidence Profile: Child at Risk

- Aggregate evidence quality: C, observational studies of children at risk; D, expert opinion on the ability of prompt assessment and management to alter outcomes.
- Benefits: optimizing conditions for hearing, speech, and language; enabling children with special needs to reach their potential; avoiding limitations on the benefits of educational interventions because of hearing problems from OME.
- Harm: cost, time, and specific risks of medications or surgery.
- Benefits-harms assessment: exceptional preponderance of benefits over harm based on subcommittee consensus because of circumstances to date precluding randomized trials.
- Policy level: recommendation.

4. WATCHFUL WAITING: CLINICIANS SHOULD MANAGE THE CHILD WITH OME WHO IS NOT AT RISK WITH WATCHFUL WAITING FOR 3 MONTHS FROM THE DATE OF EFFUSION ONSET (IF KNOWN) OR DIAGNOSIS (IF ONSET IS UNKNOWN)

This recommendation is based on systematic review of cohort studies and the preponderance of benefit over harm.

This recommendation is based on the self-limited nature of most OME, which has been well documented in cohort studies and in control groups of randomized trials.[2,70]

The likelihood of spontaneous resolution of OME is determined by the cause and duration of effusion.[70] For example, ~75% to 90% of residual OME after an AOM episode resolves spontaneously by 3 months.[71–73] Similar outcomes of defined onset during a period of surveillance in a cohort study are observed for OME.[32,37] Another favorable situation involves improvement (not resolution) of newly detected OME defined as change in tympanogram from type B (flat curve) to non-B (anything other than a flat curve). Approximately 55% of children so defined improve by 3 months,[70] but one third will have OME relapse within the next 3 months.[4] Although a type B tympanogram is an imperfect measure of OME (81% sensitivity and 74% specificity versus myringotomy), it is the most widely reported measure suitable for deriving pooled resolution rates.[2,70]

Approximately 25% of newly detected OME of unknown prior duration in children 2 to 4 years old resolves by 3 months when resolution is defined as a change in tympanogram from type B to type A/C1 (peak pressure >200 daPa).[2,70,74–77] Resolution rates may be higher for infants and young children in whom the preexisting duration of effusion is generally shorter, and particularly for those observed prospectively in studies or in the course of well-child care. Documented bilateral OME of 3 months' duration or longer resolves spontaneously after 6 to 12 months in ~30% of children primarily 2 years old or older, with only marginal benefits if observed longer.[70]

Any intervention for OME (medical or surgical) other than observation carries some inherent harm. There is little harm associated with a specified period of observation in the child who is not at risk for speech, language, or learning problems. When observing children with OME, clinicians should inform the parent or caregiver that the child may experience reduced hearing until the effusion resolves, especially if it is bilateral. Clinicians may discuss strategies for optimizing the listening and learning environment until the effusion resolves. These strategies include speaking in close proximity to the child, facing the child and speaking clearly, repeating phrases when misunderstood, and providing preferential classroom seating.[78,79]

The recommendation for a 3-month period of observation is based on a clear preponderance of benefit over harm and is consistent with the original OME guideline intent of avoiding unnecessary surgery.[1] At the discretion of the clinician, this 3-month period of watchful waiting may include interval visits at which OME is monitored by using pneumatic otoscopy, tympanometry, or both. Factors to consider in determining the optimal interval(s) for follow-up include clinical judgment, parental comfort level, unique characteristics of the child and/or his environment, access to a health care system, and hearing levels (HLs) if known.

After documented resolution of OME in all affected ears, additional follow-up is unnecessary.

Evidence Profile: Watchful Waiting

- Aggregate evidence quality: B, systematic review of cohort studies.
- Benefit: avoid unnecessary interventions, take advantage of favorable natural history, and avoid unnecessary referrals and evaluations.
- Harm: delays in therapy for OME that will not resolve with observation; prolongation of hearing loss.
- Benefits-harms assessment: preponderance of benefit over harm.
- Policy level: recommendation.

5. MEDICATION: ANTIHISTAMINES AND DECONGESTANTS ARE INEFFECTIVE FOR OME AND ARE NOT RECOMMENDED FOR TREATMENT; ANTIMICROBIALS AND CORTICOSTEROIDS DO NOT HAVE LONG-TERM EFFICACY AND ARE NOT RECOMMENDED FOR ROUTINE MANAGEMENT

This recommendation is based on systematic review of randomized, controlled trials and the preponderance of harm over benefit.

Therapy for OME is appropriate only if persistent and clinically significant benefits can be achieved beyond spontaneous resolution. Although statistically significant benefits have been demonstrated for some medications, they are short-term and relatively small in magnitude. Moreover, significant adverse events may occur with all medical therapies.

The prior OME guideline[1] found no data supporting antihistamine-decongestant combinations in treating OME. Meta-analysis of 4 randomized trials showed no significant benefit for antihistamines or decongestants versus placebo. No additional studies have been published since 1994 to change this recommendation. Adverse effects of antihistamines and decongestants include insomnia, hyperactivity, drowsiness, behavioral change, and blood-pressure variability.

Long-term benefits of antimicrobial therapy for OME are unproved despite a modest short-term benefit for 2 to 8 weeks in randomized trials.[1,80,81] Initial benefits, however, can become nonsignificant within 2 weeks of stopping the medication.[82] Moreover, ~7 children would need to be treated with antimicrobials to achieve one short-term response.[1] Adverse effects of antimicrobials are significant and may include rashes, vomiting, diarrhea, allergic reactions, alteration of the child's nasopharyngeal flora, development of bacterial resistance,[83] and cost. Societal consequences include direct transmission of resistant bacterial pathogens in homes and child care centers.[84]

The prior OME guideline[1] did not recommend oral steroids for treating OME in children. A later meta-analysis[85] showed no benefit for oral steroid versus placebo within 2 weeks but did show a short-term benefit for oral steroid plus antimicrobial versus antimicrobial alone in 1 of 3 children treated. This benefit became nonsignificant after several weeks in a prior meta-analysis[1] and in a large, randomized trial.[86] Oral steroids can produce behavioral changes, increased appetite, and weight gain.[1] Additional adverse effects may include adrenal suppression, fatal varicella infection, and avascular necrosis of the femoral head.[3] Although intranasal steroids have fewer adverse effects, one randomized trial[87] showed statistically equivalent outcomes at 12 weeks for intranasal beclomethasone plus antimicrobials versus antimicrobials alone for OME.

Antimicrobial therapy with or without steroids has not been demonstrated to be effective in long-term resolution of OME, but in some cases this therapy can be considered an option because of short-term benefit in randomized trials, when the parent or caregiver expresses a strong aversion to impending surgery. In this circumstance, a single course of therapy for 10 to 14 days may be used. The likelihood that the OME will resolve long-term with these regimens is small, and prolonged or repetitive courses of antimicrobials or steroids are strongly not recommended.

Other nonsurgical therapies that are discussed in the OME literature include autoinflation of the eustachian tube, oral or intratympanic use of mucolytics, and systemic use of pharmacologic agents other than antimicrobials, steroids, and antihistamine-decongestants. Insufficient data exist for any of these therapies to be recommended in treating OME.[3]

Evidence Profile: Medication

- Aggregate evidence quality: A, systematic review of well-designed, randomized, controlled trials.

- Benefit: avoid side effects and reduce cost by not administering medications; avoid delays in definitive therapy caused by short-term improvement then relapse.
- Harm: adverse effects of specific medications as listed previously; societal impact of antimicrobial therapy on bacterial resistance and transmission of resistant pathogens.
- Benefits-harms assessment: preponderance of harm over benefit.
- Policy level: recommendation against.

6. HEARING AND LANGUAGE: HEARING TESTING IS RECOMMENDED WHEN OME PERSISTS FOR 3 MONTHS OR LONGER OR AT ANY TIME THAT LANGUAGE DELAY, LEARNING PROBLEMS, OR A SIGNIFICANT HEARING LOSS IS SUSPECTED IN A CHILD WITH OME; LANGUAGE TESTING SHOULD BE CONDUCTED FOR CHILDREN WITH HEARING LOSS

This recommendation is based on cohort studies and the preponderance of benefit over risk.

Hearing Testing

Hearing testing is recommended when OME persists for 3 months or longer or at any time that language delay, learning problems, or a significant hearing loss is suspected. Conductive hearing loss often accompanies OME[1,88] and may adversely affect binaural processing,[89] sound localization,[90] and speech perception in noise.[91–94] Hearing loss caused by OME may impair early language acquisition,[95–97] but the child's home environment has a greater impact on outcomes[98]; recent randomized trials[41,99,100] suggest no impact on children with OME who are not at risk as identified by screening or surveillance.

Studies examining hearing sensitivity in children with OME report that average pure-tone hearing loss at 4 frequencies (500, 1000, 2000, and 4000 Hz) ranges from normal hearing to moderate hearing loss (0–55 dB). The 50th percentile is an ~25-dB HL, and ~20% of ears exceed 35-dB HL.[101,102] Unilateral OME with hearing loss results in overall poorer binaural hearing than in infants with normal middle-ear function bilaterally.[103,104] However, based on limited research, there is evidence that children experiencing the greatest conductive hearing loss for the longest periods may be more likely to exhibit developmental and academic sequelae.[1,95,105]

Initial hearing testing for children 4 years old or older can be done in the primary care setting.[106] Testing should be performed in a quiet environment, preferably in a separate closed or sound-proofed area set aside specifically for that purpose. Conventional audiometry with earphones is performed with a fail criterion of more than 20-dB HL at 1 or more frequencies (500, 1000, 2000, and 4000 Hz) in either ear.[106,107] Methods not recommended as substitutes for primary care hearing testing include tympanometry and pneumatic otoscopy,[102] caregiver judgment regarding hearing loss,[108,109] speech audiometry, and tuning forks, acoustic reflectometry, and behavioral observation.[1]

Comprehensive audiologic evaluation is recommended for children who fail primary care testing, are less than 4 years old, or cannot be tested in the primary care setting. Audiologic assessment includes evaluating air-conduction and bone-conduction thresholds for pure tones, speech-detection or speech-recognition thresholds,[102] and measuring speech understanding if possible.[94] The method of assessment depends on the developmental age of the child and might include visual reinforcement or conditioned orienting-response audiometry for infants 6 to 24 months old, play audiometry for children 24 to 48 months old, or conventional screening audiometry for children 4 years old and older.[106] The auditory brainstem response and otoacoustic emission are tests of auditory pathway structural integrity, not hearing, and should not substitute for behavioral pure-tone audiometry.[106]

Language Testing

Language testing should be conducted for children with hearing loss (pure-tone average more than 20-dB HL on comprehensive audiometric evaluation). Testing for language delays is important, because communication is integral to all aspects of human functioning. Young children with speech and language delays during the preschool years are at risk for continued communication problems and later delays in reading and writing.[110–112] In one study, 6% to 8% of children 3 years old and 2% to 13% of kindergartners had language impairment.[113] Language intervention can improve communication and other functional outcomes for children with histories of OME.[114]

Children who experience repeated and persistent episodes of OME and associated hearing loss during early childhood may be at a disadvantage for learning speech and language.[79,115] Although Shekelle et al[2] concluded that there was no evidence to support the concern that OME during the first 3 years of life was related to later receptive or expressive language, this meta-analysis should be interpreted cautiously, because it did not examine specific language domains such as vocabulary and the independent variable was OME and not hearing loss. Other meta-analyses[79,115] have suggested at most a small negative association of OME and hearing loss on children's receptive and expressive language through the elementary school years. The clinical significance of these effects for language and learning is unclear for the child not at risk. For example, in one randomized trial,[100] prompt insertion of tympanostomy tubes for OME did not improve developmental outcomes at 3 years old regardless of baseline hearing. In another randomized trial,[116] however, prompt tube insertion achieved small benefits for children with bilateral OME and hearing loss.

Clinicians should ask the parent or caregiver about specific concerns regarding their child's language development. Children's speech and language can be tested at ages 6 to 36 months by direct engagement of a child and interviewing the parent using the Early Language Milestone Scale.[117] Other approaches require interviewing only the child's parent or caregiver, such

as the MacArthur Communicative Development Inventory[118] and the Language Development Survey.[119] For older children, the Denver Developmental Screening Test II[120] can be used to screen general development including speech and language. Comprehensive speech and language evaluation is recommended for children who fail testing or whenever the child's parent or caregiver expresses concern.[121]

Evidence Profile: Hearing and Language

- Aggregate evidence quality: B, diagnostic studies with minor limitations; C, observational studies.
- Benefit: to detect hearing loss and language delay and identify strategies or interventions to improve developmental outcomes.
- Harm: parental anxiety, direct and indirect costs of assessment, and/or false-positive results.
- Balance of benefit and harm: preponderance of benefit over harm.
- Policy level: recommendation.

7. SURVEILLANCE: CHILDREN WITH PERSISTENT OME WHO ARE NOT AT RISK SHOULD BE REEXAMINED AT 3- TO 6-MONTH INTERVALS UNTIL THE EFFUSION IS NO LONGER PRESENT, SIGNIFICANT HEARING LOSS IS IDENTIFIED, OR STRUCTURAL ABNORMALITIES OF THE EARDRUM OR MIDDLE EAR ARE SUSPECTED

This recommendation is based on randomized, controlled trials and observational studies with a preponderance of benefit over harm.

If OME is asymptomatic and is likely to resolve spontaneously, intervention is unnecessary even if OME persists for more than 3 months. The clinician should determine whether risk factors exist that would predispose the child to undesirable sequelae or predict nonresolution of the effusion. As long as OME persists, the child is at risk for sequelae and must be reevaluated periodically for factors that would prompt intervention.

The 1994 OME guideline[1] recommended surgery for OME persisting 4 to 6 months with hearing loss but requires reconsideration because of later data on tubes and developmental sequelae.[122] For example, selecting surgical candidates using duration-based criteria (eg, OME >3 months or exceeding a cumulative threshold) does not improve developmental outcomes in infants and toddlers who are not at risk.[41,42,99,100] Additionally, the 1994 OME guideline did not specifically address managing effusion without significant hearing loss persisting more than 6 months.

Asymptomatic OME usually resolves spontaneously, but resolution rates decrease the longer the effusion has been present,[36,76,77] and relapse is common.[123] Risk factors that make spontaneous resolution less likely include[124,125]:

- Onset of OME in the summer or fall season
- Hearing loss more than 30-dB HL in the better-hearing ear
- History of prior tympanostomy tubes
- Not having had an adenoidectomy

Children with chronic OME are at risk for structural damage of the tympanic membrane[126] because the effusion contains leukotrienes, prostaglandins, and arachidonic acid metabolites that invoke a local inflammatory response.[127] Reactive changes may occur in the adjacent tympanic membrane and mucosal linings. A relative underventilation of the middle ear produces a negative pressure that predisposes to focal retraction pockets, generalized atelectasis of the tympanic membrane, and cholesteatoma.

Structural integrity is assessed by carefully examining the entire tympanic membrane, which, in many cases, can be accomplished by the primary care clinician using a handheld pneumatic otoscope. A search should be made for retraction pockets, ossicular erosion, and areas of atelectasis or atrophy. If there is any uncertainty that all observed structures are normal, the patient should be examined by using an otomicroscope. All children with these tympanic membrane conditions, regardless of OME duration, should have a comprehensive audiologic evaluation.

Conditions of the tympanic membrane that generally mandate inserting a tympanostomy tube are posterosuperior retraction pockets, ossicular erosion, adhesive atelectasis, and retraction pockets that accumulate keratin debris. Ongoing surveillance is mandatory, because the incidence of structural damage increases with effusion duration.[128]

As noted in recommendation 6, children with persistent OME for 3 months or longer should have their hearing tested. Based on these results, clinicians can identify 3 levels of action based on HLs obtained for the better-hearing ear using earphones or in sound field using speakers if the child is too young for ear-specific testing.

1. HLs of ≥40 dB (at least a moderate hearing loss): A comprehensive audiologic evaluation is indicated if not previously performed. If moderate hearing loss is documented and persists at this level, surgery is recommended, because persistent hearing loss of this magnitude that is permanent in nature has been shown to impact speech, language, and academic performance.[129–131]
2. HLs of 21 to 39 dB (mild hearing loss): A comprehensive audiologic evaluation is indicated if not previously performed. Mild sensorineural hearing loss has been associated with difficulties in speech, language, and academic performance in school,[129,132] and persistent mild conductive hearing loss from OME may have a similar impact. Further management should be individualized based on effusion duration, severity of hearing loss, and parent or caregiver preference and may include strategies to optimize the listening and learning environment (Table 4) or surgery. Repeat hearing testing should be performed in 3 to 6 months if OME persists at follow-up evaluation or tympanostomy tubes have not been placed.
3. HLs of ≤20 dB (normal hearing): A repeat hearing test should be performed in 3 to 6 months if OME persists at follow-up evaluation.

TABLE 4. Strategies for Optimizing the Listening-Learning Environment for Children With OME and Hearing Loss*

Get within 3 feet of the child before speaking.
Turn off competing audio signals such as unnecessary music and television in the background.
Face the child and speak clearly, using visual clues (hands, pictures) in addition to speech.
Slow the rate, raise the level, and enunciate speech directed at the child.
Read to or with the child, explaining pictures and asking questions.
Repeat words, phrases, and questions when misunderstood.
Assign preferential seating in the classroom near the teacher.
Use a frequency-modulated personal- or sound-field-amplification system in the classroom.

* Modified with permission from Roberts et al.[78,79]

In addition to hearing loss and speech or language delay, other factors may influence the decision to intervene for persistent OME. Roberts et al[98,133] showed that the caregiving environment is more strongly related to school outcome than was OME or hearing loss. Risk factors for delays in speech and language development caused by a poor caregiving environment included low maternal educational level, unfavorable child care environment, and low socioeconomic status. In such cases, these factors may be additive to the hearing loss in affecting lower school performance and classroom behavior problems.

Persistent OME may be associated with physical or behavioral symptoms including hyperactivity, poor attention, and behavioral problems in some studies[134–136] and reduced child quality of life.[46] Conversely, young children randomized to early versus late tube insertion for persistent OME showed no behavioral benefits from early surgery.[41,100] Children with chronic OME also have significantly poorer vestibular function and gross motor proficiency when compared with non-OME controls.[48–50] Moreover, vestibular function, behavior, and quality of life can improve after tympanostomy tube insertion.[47,137,138] Other physical symptoms of OME that, if present and persistent, may warrant surgery include otalgia, unexplained sleep disturbance, and coexisting recurrent AOM. Tubes reduce the absolute incidence of recurrent AOM by ~1 episode per child per year, but the relative risk reduction is 56%.[139]

The risks of continued observation of children with OME must be balanced against the risks of surgery. Children with persistent OME examined regularly at 3- to 6-month intervals, or sooner if OME-related symptoms develop, are most likely at low risk for physical, behavioral, or developmental sequelae of OME. Conversely, prolonged watchful waiting of OME is not appropriate when regular surveillance is impossible or when the child is at risk for developmental sequelae of OME because of comorbidities (Table 3). For these children, the risks of anesthesia and surgery (see recommendation 9) may be less than those of continued observation.

Evidence Profile: Surveillance

- Aggregate evidence quality: C, observational studies and some randomized trials.
- Benefit: avoiding interventions that do not improve outcomes.
- Harm: allowing structural abnormalities to develop in the tympanic membrane, underestimating the impact of hearing loss on a child, and/or failing to detect significant signs or symptoms that require intervention.
- Balance of benefit and harm: preponderance of benefit over harm.
- Policy level: recommendation.

8. REFERRAL: WHEN CHILDREN WITH OME ARE REFERRED BY THE PRIMARY CARE CLINICIAN FOR EVALUATION BY AN OTOLARYNGOLOGIST, AUDIOLOGIST, OR SPEECH-LANGUAGE PATHOLOGIST, THE REFERRING CLINICIAN SHOULD DOCUMENT THE EFFUSION DURATION AND SPECIFIC REASON FOR REFERRAL (EVALUATION, SURGERY) AND PROVIDE ADDITIONAL RELEVANT INFORMATION SUCH AS HISTORY OF AOM AND DEVELOPMENTAL STATUS OF THE CHILD

This option is based on panel consensus and a preponderance of benefit over harm.

This recommendation emphasizes the importance of communication between the referring primary care clinician and the otolaryngologist, audiologist, and speech-language pathologist. Parents and caregivers may be confused and frustrated when a recommendation for surgery is made for their child because of conflicting information about alternative management strategies. Choosing among management options is facilitated when primary care physicians and advanced-practice nurses who best know the patient's history of ear problems and general medical status provide the specialist with accurate information. Although there are no studies showing improved outcomes from better documentation of OME histories, there is a clear need for better mechanisms to convey information and expectations from primary care clinicians to consultants and subspecialists.[140–142]

When referring a child for evaluation to an otolaryngologist, the primary care physician should explain the following to the parent or caregiver of the patient:

- Reason for referral: Explain that the child is seeing an otolaryngologist for evaluation, which is likely to include ear examination and audiologic testing, and not necessarily simply to be scheduled for surgery.
- What to expect: Explain that surgery may be recommended, and let the parent know that the otolaryngologist will explain the options, benefits, and risks further.
- Decision-making process: Explain that there are many alternatives for management and that surgical decisions are elective; the parent or caregiver should be encouraged to express to the surgeonany concerns he or she may have about the recommendations made.

When referring a child to an otolaryngologist, audiologist, or speech-language pathologist, the mini-

mum information that should be conveyed in writing includes:

- Duration of OME: State how long fluid has been present.
- Laterality of OME: State whether one or both ears have been affected.
- Results of prior hearing testing or tympanometry.
- Suspected speech or language problems: State whether there had been a delay in speech and language development or whether the parent or a caregiver has expressed concerns about the child's communication abilities, school achievement, or attentiveness.
- Conditions that might exacerbate the deleterious effects of OME: State whether the child has conditions such as permanent hearing loss, impaired cognition, developmental delays, cleft lip or palate, or an unstable or nonsupportive family or home environment.
- AOM history: State whether the child has a history of recurrent AOM.

Additional medical information that should be provided to the otolaryngologist by the primary care clinician includes:

- Parental attitude toward surgery: State whether the parents have expressed a strong preference for or against surgery as a management option.
- Related conditions that might require concomitant surgery: State whether there have been other conditions that might warrant surgery if the child is going to have general anesthesia (eg, nasal obstruction and snoring that might be an indication for adenoidectomy or obstructive breathing during sleep that might mean tonsillectomy is indicated).
- General health status: State whether there are any conditions that might present problems for surgery or administering general anesthesia, such as congenital heart abnormality, bleeding disorder, asthma or reactive airway disease, or family history of malignant hyperthermia.

After evaluating the child, the otolaryngologist, audiologist, or speech-language pathologist should inform the referring physician regarding his or her diagnostic impression, plans for additional assessment, and recommendations for ongoing monitoring and management.

Evidence Profile: Referral

- Aggregate evidence quality: C, observational studies.
- Benefit: better communication and improved decision-making.
- Harm: confidentiality concerns, administrative burden, and/or increased parent or caregiver anxiety.
- Benefits-harms assessment: balance of benefit and harm.
- Policy level: option.

9. SURGERY: WHEN A CHILD BECOMES A SURGICAL CANDIDATE, TYMPANOSTOMY TUBE INSERTION IS THE PREFERRED INITIAL PROCEDURE; ADENOIDECTOMY SHOULD NOT BE PERFORMED UNLESS A DISTINCT INDICATION EXISTS (NASAL OBSTRUCTION, CHRONIC ADENOIDITIS). REPEAT SURGERY CONSISTS OF ADENOIDECTOMY PLUS MYRINGOTOMY, WITH OR WITHOUT TUBE INSERTION. TONSILLECTOMY ALONE OR MYRINGOTOMY ALONE SHOULD NOT BE USED TO TREAT OME

This recommendation is based on randomized, controlled trials with a preponderance of benefit over harm.

Surgical candidacy for OME largely depends on hearing status, associated symptoms, the child's developmental risk (Table 3), and the anticipated chance of timely spontaneous resolution of the effusion. Candidates for surgery include children with OME lasting 4 months or longer with persistent hearing loss or other signs and symptoms, recurrent or persistent OME in children at risk regardless of hearing status, and OME and structural damage to the tympanic membrane or middle ear. Ultimately, the recommendation for surgery must be individualized based on consensus between the primary care physician, otolaryngologist, and parent or caregiver that a particular child would benefit from intervention. Children with OME of any duration who are at risk are candidates for earlier surgery.

Tympanostomy tubes are recommended for initial surgery because randomized trials show a mean 62% relative decrease in effusion prevalence and an absolute decrease of 128 effusion days per child during the next year.[139,143–145] HLs improve by a mean of 6 to 12 dB while the tubes remain patent.[146,147] Adenoidectomy plus myringotomy (without tube insertion) has comparable efficacy in children 4 years old or older[143] but is more invasive, with additional surgical and anesthetic risks. Similarly, the added risk of adenoidectomy outweighs the limited, short-term benefit for children 3 years old or older without prior tubes.[148] Consequently, adenoidectomy is not recommended for initial OME surgery unless a distinct indication exists, such as adenoiditis, postnasal obstruction, or chronic sinusitis.

Approximately 20% to 50% of children who have had tympanostomy tubes have OME relapse after tube extrusion that may require additional surgery.[144,145,149] When a child needs repeat surgery for OME, adenoidectomy is recommended (unless the child has an overt or submucous cleft palate), because it confers a 50% reduction in the need for future operations.[143,150,151] The benefit of adenoidectomy is apparent at 2 years old,[150] greatest for children 3 years old or older, and independent of adenoid size.[143,151,152] Myringotomy is performed concurrent with adenoidectomy. Myringotomy plus adenoidectomy is effective for children 4 years old or older,[143] but tube insertion is advised for younger children, when potential relapse of effusion must be minimized (eg, children at risk) or pronounced inflammation of the tympanic membrane and middle-ear mucosa is present.

Tonsillectomy or myringotomy alone (without adenoidectomy) is not recommended to treat OME. Although tonsillectomy is either ineffective[152] or of limited efficacy,[148,150] the risks of hemorrhage (~2%) and additional hospitalization outweigh any potential benefits unless a distinct indication for tonsillectomy exists. Myringotomy alone, without tube placement or adenoidectomy, is ineffective for chronic OME,[144,145] because the incision closes within several days. Laser-assisted myringotomy extends the ventilation period several weeks,[153] but randomized trials with concurrent controls have not been conducted to establish efficacy. In contrast, tympanostomy tubes ventilate the middle ear for an average of 12 to 14 months.[144,145]

Anesthesia mortality has been reported to be ~1: 50 000 for ambulatory surgery,[154] but the current fatality rate may be lower.[155] Laryngospasm and bronchospasm occur more often in children receiving anesthesia than adults. Tympanostomy tube sequelae are common[156] but are generally transient (otorrhea) or do not affect function (tympanosclerosis, focal atrophy, or shallow retraction pocket). Tympanic membrane perforations, which may require repair, are seen in 2% of children after placement of short-term (grommet-type) tubes and 17% after long-term tubes.[156] Adenoidectomy has a 0.2% to 0.5% incidence of hemorrhage[150,157] and 2% incidence of transient velopharyngeal insufficiency.[148] Other potential risks of adenoidectomy, such as nasopharyngeal stenosis and persistent velopharyngeal insufficiency, can be minimized with appropriate patient selection and surgical technique.

There is a clear preponderance of benefit over harm when considering the impact of surgery for OME on effusion prevalence, HLs, subsequent incidence of AOM, and the need for reoperation after adenoidectomy. Information about adenoidectomy in children less than 4 years old, however, remains limited. Although the cost of surgery and anesthesia is nontrivial, it is offset by reduced OME and AOM after tube placement and by reduced need for reoperation after adenoidectomy. Approximately 8 adenoidectomies are needed to avoid a single instance of tube reinsertion; however, each avoided surgery probably represents a larger reduction in the number of AOM and OME episodes, including those in children who did not require additional surgery.[150]

Evidence Profile: Surgery

- Aggregate evidence quality: B, randomized, controlled trials with minor limitations.
- Benefit: improved hearing, reduced prevalence of OME, reduced incidence of AOM, and less need for additional tube insertion (after adenoidectomy).
- Harm: risks of anesthesia and specific surgical procedures; sequelae of tympanostomy tubes.
- Benefits-harms assessment: preponderance of benefit over harm.
- Policy level: recommendation.

10. CAM: NO RECOMMENDATION IS MADE REGARDING CAM AS A TREATMENT FOR OME

There is no recommendation based on lack of scientific evidence documenting efficacy and an uncertain balance of harm and benefit.

The 1994 OME guideline[1] made no recommendation regarding CAM as a treatment for OME, and no subsequent controlled studies have been published to change this conclusion. The current statement of "no recommendation" is based on the lack of scientific evidence documenting efficacy plus the balance of benefit and harm.

Evidence concerning CAM is insufficient to determine whether the outcomes achieved for OME differ from those achieved by watchful waiting and spontaneous resolution. There are no randomized, controlled trials with adequate sample sizes on the efficacy of CAM for OME. Although many case reports and subjective reviews on CAM treatment of AOM were found, little is published on OME treatment or prevention. Homeopathy[158] and chiropractic treatments[159] were assessed in pilot studies with small numbers of patients that failed to show clinically or statistically significant benefits. Consequently, there is no research base on which to develop a recommendation concerning CAM for OME.

The natural history of OME in childhood (discussed previously) is such that almost any intervention can be "shown" to have helped in an anecdotal, uncontrolled report or case series. The efficacy of CAM or any other intervention for OME can only be shown with parallel-group, randomized, controlled trials with valid diagnostic methods and adequate sample sizes. Unproved modalities that have been claimed to provide benefit in middle-ear disease include osteopathic and chiropractic manipulation, dietary exclusions (such as dairy), herbal and other dietary supplements, acupuncture, traditional Chinese medicine, and homeopathy. None of these modalities, however, have been subjected yet to a published, peer-reviewed, clinical trial.

The absence of any published clinical trials also means that all reports of CAM adverse effects are anecdotal. A systematic review of recent evidence[160] found significant serious adverse effects of unconventional therapies for children, most of which were associated with inadequately regulated herbal medicines. One report on malpractice liability associated with CAM therapies[161] did not address childhood issues specifically. Allergic reactions to echinacea occur but seem to be rare in children.[162] A general concern about herbal products is the lack of any governmental oversight into product quality or purity.[160,163,164] Additionally, herbal products may alter blood levels of allopathic medications, including anticoagulants. A possible concern with homeopathy is the worsening of symptoms, which is viewed as a positive, early sign of homeopathic efficacy. The adverse effects of manipulative therapies (such as chiropractic treatments and osteopathy) in children are difficult to assess because of scant evidence, but a case series of 332 children treated for AOM or OME with chiropractic manipulation did not mention any

side effects.[165] Quadriplegia has been reported, however, after spinal manipulation in an infant with torticollis.[166]

Evidence Profile: CAM

- Aggregate evidence quality: D, case series without controls.
- Benefit: not established.
- Harm: potentially significant depending on the intervention.
- Benefits-harms assessment: uncertain balance of benefit and harm.
- Policy level: no recommendation.

11. ALLERGY MANAGEMENT: NO RECOMMENDATION IS MADE REGARDING ALLERGY MANAGEMENT AS A TREATMENT FOR OME

There is no recommendation based on insufficient evidence of therapeutic efficacy or a causal relationship between allergy and OME.

The 1994 OME guideline[1] made no recommendation regarding allergy management as a treatment for OME, and no subsequent controlled studies have been published to change this conclusion. The current statement of "no recommendation" is based on insufficient evidence of therapeutic efficacy or a causal relationship between allergy and OME plus the balance of benefit and harm.

A linkage between allergy and OME has long been speculated but to date remains unquantified. The prevalence of allergy among OME patients has been reported to range from less than 10% to more than 80%.[167] Allergy has long been postulated to cause OME through its contribution to eustachian tube dysfunction.[168] The cellular response of respiratory mucosa to allergens has been well studied. Therefore, similar to other parts of respiratory mucosa, the mucosa lining the middle-ear cleft is capable of an allergic response.[169,170] Sensitivity to allergens varies among individuals, and atopy may involve neutrophils in type I allergic reactions that enhance the inflammatory response.[171]

The correlation between OME and allergy has been widely reported, but no prospective studies have examined the effects of immunotherapy compared with observation alone or other management options. Reports of OME cure after immunotherapy or food-elimination diets[172] are impossible to interpret without concurrent control groups because of the favorable natural history of most untreated OME. The documentation of allergy in published reports has been defined inconsistently (medical history, physical examination, skin-prick testing, nasal smears, serum immunoglobulin E and eosinophil counts, inflammatory mediators in effusions). Study groups have been drawn primarily from specialist offices, likely lack heterogeneity, and are not representative of general medical practice.

Evidence Profile: Allergy Management

- Aggregate evidence quality: D, case series without controls.
- Benefit: not established.
- Harm: adverse effects and cost of medication, physician evaluation, elimination diets, and desensitization.
- Benefits-harms assessment: balance of benefit and harm.
- Policy level: no recommendation.

RESEARCH NEEDS

Diagnosis

- Further standardize the definition of OME.
- Assess the performance characteristics of pneumatic otoscopy as a diagnostic test for OME when performed by primary care physicians and advanced-practice nurses in the routine office setting.
- Determine the optimal methods for teaching pneumatic otoscopy to residents and clinicians.
- Develop a brief, reliable, objective method for diagnosing OME.
- Develop a classification method for identifying the presence of OME for practical use by clinicians that is based on quantifiable tympanometric characteristics.
- Assess the usefulness of algorithms combining pneumatic otoscopy and tympanometry for detecting OME in clinical practice.
- Conduct additional validating cohort studies of acoustic reflectometry as a diagnostic method for OME, particularly in children less than 2 years old.

Child At Risk

- Better define the child with OME who is at risk for speech, language, and learning problems.
- Conduct large, multicenter, observational cohort studies to identify the child at risk who is most susceptible to potential adverse sequelae of OME.
- Conduct large, multicenter, observational cohort studies to analyze outcomes achieved with alternative management strategies for OME in children at risk.

Watchful Waiting

- Define the spontaneous resolution of OME in infants and young children (existing data are limited primarily to children 2 years old or older).
- Conduct large-scale, prospective cohort studies to obtain current data on the spontaneous resolution of newly diagnosed OME of unknown prior duration (existing data are primarily from the late 1970s and early 1980s).
- Develop prognostic indicators to identify the best candidates for watchful waiting.
- Determine whether the lack of impact from prompt insertion of tympanostomy tubes on speech and language outcomes seen in asymptomatic young children with OME identified by screening or intense surveillance can be generalized to older children with OME or to symptomatic children with OME referred for evaluation.

Medication

- Clarify which children, if any, should receive antimicrobials, steroids, or both for OME.
- Conduct a randomized, placebo-controlled trial on the efficacy of antimicrobial therapy, with or without concurrent oral steroid, in avoiding surgery in children with OME who are surgical candidates and have not received recent antimicrobials.
- Investigate the role of mucosal surface biofilms in refractory or recurrent OME and develop targeted interventions.

Hearing and Language

- Conduct longitudinal studies on the natural history of hearing loss accompanying OME.
- Develop improved methods for describing and quantifying the fluctuations in hearing of children with OME over time.
- Conduct prospective controlled studies on the relation of hearing loss associated with OME to later auditory, speech, language, behavioral, and academic sequelae.
- Develop reliable, brief, objective methods for estimating hearing loss associated with OME.
- Develop reliable, brief, objective methods for estimating speech or language delay associated with OME.
- Evaluate the benefits and administrative burden of language testing by primary care clinicians.
- Agree on the aspects of language that are vulnerable to or affected by hearing loss caused by OME, and reach a consensus on the best tools for measurement.
- Determine whether OME and associated hearing loss place children from special populations at greater risk for speech and language delays.

Surveillance

- Develop better tools for monitoring children with OME that are suitable for routine clinical care.
- Assess the value of new strategies for monitoring OME, such as acoustic reflectometry performed at home by the parent or caregiver, in optimizing surveillance.
- Improve our ability to identify children who would benefit from early surgery instead of prolonged surveillance.
- Promote early detection of structural abnormalities in the tympanic membrane associated with OME that may require surgery to prevent complications.
- Clarify and quantify the role of parent or caregiver education, socioeconomic status, and quality of the caregiving environment as modifiers of OME developmental outcomes.
- Develop methods for minimizing loss to follow-up during OME surveillance.

Surgery

- Define the role of adenoidectomy in children 3 years old or younger as a specific OME therapy.
- Conduct controlled trials on the efficacy of tympanostomy tubes for developmental outcomes in children with hearing loss, other symptoms, or speech and language delay.
- Conduct randomized, controlled trials of surgery versus no surgery that emphasize patient-based outcome measures (quality of life, functional health status) in addition to objective measures (effusion prevalence, HLs, AOM incidence, reoperation).
- Identify the optimal ways to incorporate parent or caregiver preference into surgical decision-making.

CAM

- Conduct randomized, controlled trials on the efficacy of CAM modalities for OME.
- Develop strategies to identify parents or caregivers who use CAM therapies for their child's OME, and encourage surveillance by the primary care clinician.

Allergy Management

- Evaluate the causal role of atopy in OME.
- Conduct randomized, controlled trials on the efficacy of allergy therapy for OME that are generalizable to the primary care setting.

CONCLUSIONS

This evidence-based practice guideline offers recommendations for identifying, monitoring, and managing the child with OME. The guideline emphasizes appropriate diagnosis and provides options for various management strategies including observation, medical intervention, and referral for surgical intervention. These recommendations should provide primary care physicians and other health care providers with assistance in managing children with OME.

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Otitis Media Clinical Practice Guidelines
Quick Reference Tools

- Action Statement Summary
  — The Diagnosis and Management of Acute Otitis Media
  — Otitis Media With Effusion
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Otitis Media
- Bonus Feature
  — Continuum Model for Otitis Media
- AAP Patient Education Handouts
  — *Acute Ear Infections and Your Child*
  — *Middle Ear Fluid and Your Child*

Action Statement Summary

The Diagnosis and Management of Acute Otitis Media

Key Action Statement 1A
Clinicians should diagnose acute otitis media (AOM) in children who present with moderate to severe bulging of the tympanic membrane (TM) *or* new onset of otorrhea not due to acute otitis externa. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 1B
Clinicians should diagnose AOM in children who present with mild bulging of the TM *and* recent (less than 48 hours) onset of ear pain (holding, tugging, rubbing of the ear in a nonverbal child) or intense erythema of the TM. Evidence Quality: Grade C. Strength: Recommendation.

Key Action Statement 1C
Clinicians should not diagnose AOM in children who do not have middle ear effusion (MEE) (based on pneumatic otoscopy and/or tympanometry). Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 2
The management of AOM should include an assessment of pain. If pain is present, the clinician should recommend treatment to reduce pain. Evidence Quality: Grade B. Strength: Strong Recommendation.

Key Action Statement 3A
Severe AOM: The clinician should prescribe antibiotic therapy for AOM (bilateral or unilateral) in children 6 months and older with severe signs or symptoms (ie, moderate or severe otalgia or otalgia for at least 48 hours or temperature 39°C [102.2°F] or higher). Evidence Quality: Grade B. Strength: Strong Recommendation.

Key Action Statement 3B
Nonsevere bilateral AOM in young children: The clinician should prescribe antibiotic therapy for bilateral AOM in children 6 months through 23 months of age without severe signs or symptoms (ie, mild otalgia for less than 48 hours and temperature less than 39°C [102.2°F]). Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 3C
Nonsevere unilateral AOM in young children: The clinician should either prescribe antibiotic therapy *or* offer observation with close follow-up based on joint decision-making with the parent(s)/caregiver for unilateral AOM in children 6 months to 23 months of age without severe signs or symptoms (ie, mild otalgia for less than 48 hours and temperature less than 39°C [102.2°F]). When observation is used, a mechanism must be in place to ensure follow-up and begin antibiotic therapy if the child worsens or fails to improve within 48 to 72 hours of onset of symptoms. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 3D
Nonsevere AOM in older children: The clinician should either prescribe antibiotic therapy *or* offer observation with close follow-up based on joint decision-making with the parent(s)/caregiver for AOM (bilateral or unilateral) in children 24 months or older without severe signs or symptoms (ie, mild otalgia for less than 48 hours and temperature less than 39°C [102.2°F]). When observation is used, a mechanism must be in place to ensure follow-up and begin antibiotic therapy if the child worsens or fails to improve within 48 to 72 hours of onset of symptoms. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 4A
Clinicians should prescribe amoxicillin for AOM when a decision to treat with antibiotics has been made *and* the child has not received amoxicillin in the past 30 days *or* the child does not have concurrent purulent conjunctivitis *or* the child is not allergic to penicillin. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 4B
Clinicians should prescribe an antibiotic with additional β-lactamase coverage for AOM when a decision to treat with antibiotics has been made, *and* the child has received amoxicillin in the last 30 days *or* has concurrent purulent conjunctivitis, *or* has a history of recurrent AOM unresponsive to amoxicillin. Evidence Quality: Grade C. Strength: Recommendation.

Key Action Statement 4C
Clinicians should reassess the patient if the caregiver reports that the child's symptoms have worsened or failed to respond to the initial antibiotic treatment within 48 to 72 hours and determine whether a change in therapy is needed. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 5A
Clinicians should not prescribe prophylactic antibiotics to reduce the frequency of episodes of AOM in children with recurrent AOM. Evidence Quality: Grade B. Strength: Recommendation.

Key Action Statement 5B
Clinicians may offer tympanostomy tubes for recurrent AOM (3 episodes in 6 months or 4 episodes in 1 year with 1 episode in the preceding 6 months). Evidence Quality: Grade B. Strength: Option.

Key Action Statement 6A
Clinicians should recommend pneumococcal conjugate vaccine to all children according to the schedule of the Advisory Committee on Immunization Practices of the Centers for Disease Control and prevention, American Academy of Pediatrics (AAP), and American Academy of Family Physicians (AAFP). Evidence Quality: Grade B. Strength: Strong Recommendation.

Otitis Media With Effusion

1A. Pneumatic Otoscopy
Clinicians should use pneumatic otoscopy as the primary diagnostic method for OME, and OME should be distinguished from AOM.

This is a strong recommendation based on systematic review of cohort studies and the preponderance of benefit over harm.

1B. Tympanometry
Tympanometry can be used to confirm the diagnosis a of OME.

This option is based on cohort studies and a balance of benefit and harm.

1C. Screening
Population-based screening programs for OME are not recommended in healthy, asymptomatic children.

This recommendation is based on randomized, controlled trials and cohort studies, with a preponderance of harm over benefit.

2. Documentation
Clinicians should document the laterality, duration of effusion, and presence and severity of associated symptoms at each assessment of the child with OME.

This recommendation is based on observational studies and strong preponderance of benefit over harm.

3. Child at Risk
Clinicians should distinguish the child with OME who is at risk for speech, language, or learning problems from other children with OME and should evaluate hearing, speech, language, and need for intervention more promptly.

This recommendation is based on case series, the preponderance of benefit over harm, and ethical limitations in studying children with OME who are at risk.

4. Watchful Waiting
Clinicians should manage the child with OME who is not at risk with watchful waiting for 3 months from the date of effusion onset (if known) or diagnosis (if onset is unknown).

This recommendation is based on systematic review of cohort studies and the preponderance of benefit over harm.

5. Medication
Antihistamines and decongestants are ineffective for OME and are not recommended for treatment; antimicrobials and corticosteroids do not have long-term efficacy and are not recommended for routine management.

This recommendation is based on systematic review of randomized, controlled trials and the preponderance of harm over benefit.

6. Hearing and Language
Hearing testing is recommended when OME persists for 3 months or longer or at any time that language delay, learning problems, or a significant hearing loss is suspected in a child with OME; language testing should be conducted for children with hearing loss.

This recommendation is based on cohort studies and the preponderance of benefit over risk.

7. Surveillance
Children with persistent OME who are not at risk should be reexamined at 3- to 6-month intervals until the effusion is no longer present, significant hearing loss is identified, or structural abnormalities of the eardrum or middle ear are suspected.

This recommendation is based on randomized, controlled trials and observational studies with a preponderance of benefit over harm.

8. Referral
When children with OME are referred by the primary care clinician for evaluation by an otolaryngologist, audiologist, or speech-language pathologist, the referring clinician should document the effusion duration and specific reason for referral (evaluation, surgery) and provide additional relevant information such as history of AOM and developmental status of the child.

This option is based on panel consensus and a preponderance of benefit over harm.

9. Surgery
When a child becomes a surgical candidate, tympanostomy tube insertion is the preferred initial procedure; adenoidectomy should not be performed unless a distinct indication exists (nasal obstruction, chronic adenoiditis). Repeat surgery consists of adenoidectomy plus myringotomy, with or without tube insertion. tonsillectomy alone or myringotomy alone should not be used to treat OME.

This recommendation is based on randomized, controlled trials with a preponderance of benefit over harm.

10. CAM
No recommendation is made regarding CAM as a treatment for OME.

There is no recommendation based on lack of scientific evidence documenting efficacy and an uncertain balance of harm and benefit.

11. Allergy Management
No recommendation is made regarding allergy management as a treatment for OME.

There is no recommendation based on insufficient evidence of therapeutic efficacy or a causal relationship between allergy and OME.

Coding Quick Reference for Otitis Media	
ICD-9-CM	***ICD-10-CM***
381.01 Otitis media, acute, serous	**H65.00** Acute serous otitis media, unspecified ear **H65.01** Right ear **H65.02** Left ear **H65.03** Bilateral **H65.04** Recurrent, right ear **H65.05** Recurrent, left ear **H65.06** Recurrent, bilateral **H65.07** Recurrent, unspecified ear
381.10 Otitis media, chronic, serous	**H65.20** Chronic serous otitis media, unspecified ear **H65.21** Right ear **H65.22** Left ear **H65.23** Bilateral
381.4 Otitis media with effusion	**H65.90** Unspecified nonsuppurative otitis media, unspecified ear **H65.91** Right ear **H65.92** Left ear **H65.93** Bilateral
382.00 Otitis media, acute, purulent	**H66.001** Acute suppurative otitis media without spontaneous rupture of ear drum, right ear **H66.002** Left ear **H66.003** Bilateral **H66.004** Recurrent, right ear **H66.005** Recurrent, left ear **H66.006** Recurrent, bilateral **H66.007** Recurrent, unspecified ear **H66.009** Unspecified ear
382.01 Otitis media, acute, purulent, with rupture	**H66.011** Acute suppurative otitis media with spontaneous rupture of ear drum, right ear **H66.012** Left ear **H66.013** Bilateral **H66.014** Recurrent, right ear **H66.015** Recurrent, left ear **H66.016** Recurrent, bilateral **H66.017** Recurrent, unspecified ear **H66.019** Unspecified ear
382.02 Otitis media, acute, purulent with associated condition (code underlying condition first)	**H67.1** Otitis media in diseases classified elsewhere, right ear **H67.2** Left ear **H67.3** Bilateral **H67.9** Unspecified ear
382.3 Otitis media, chronic, purulent	**H66.3X1** Other chronic suppurative otitis media, right ear **H66.3X2** Left ear **H66.3X3** Bilateral **H66.3X9** Unspecified ear

Continuum Model for Otitis Media

The following continuum model from *Coding for Pediatrics 2014* has been devised to express the various levels of service for otitis media. This model demonstrates the cumulative effect of the key criteria for each level of service using a single diagnosis as the common denominator. It also shows the importance of other variables, such as patient age, duration and severity of illness, social contexts, and comorbid conditions that often have key roles in pediatric cases.

Quick Reference for Codes Used in Continuum for Otitis Media

E/M Code Level	History	Examination	MDM	Time
99211[a]	NA	NA	NA	5 minutes
99212	Problem-focused	Problem-focused	Straightforward	10 minutes
99213	Expanded problem-focused	Expanded problem-focused	Low	15 minutes
99214	Detailed	Detailed	Moderate	25 minutes
99215	Comprehensive	Comprehensive	High	40 minutes

Abbreviations: E/M, evaluation and management; MDM; medical decision-making; NA, not applicable.

[a] Low level E/M service that may not require the presence of a physician.

Adapted from American Academy of Pediatrics. *Coding for Pediatrics 2014: A Manual for Pediatric Documentation and Payment.* 19th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2014.

Continuum Model for Otitis Media			
***CPT* Code Vignette**	**History**	**Physical Examination**	**Medical Decision-making**
99211* Nursing evaluations Follow-up on serous fluid or hearing loss with tympanogram (Be sure to code tympanogram **[92567]** and/or audiogram [**92551** series] in addition to **99211.**) **There are no required key components; however, the nurse must document his or her history, physical examination, and assessment to support medical necessity.*	1. Chief complaint 2. History of treatment		1. Completion of medication 2. No need for further therapy 3. No need for further follow-up
99212 Follow-up otitis media, uncomplicated with primary examination being limited to ears	Problem focused 1. Chief complaint 2. History of treatment 3. Difficulties with medication 4. Hearing status	Problem focused 1. Ears	Straightforward 1. Completion of medication 2. No need for further therapy 3. No need for further follow-up
99213 2-year-old presents with pinkeye and recent upper respiratory infection	Problem focused 1. Chief complaint 2. Brief history of present illness (HPI) plus pertinent review of systems (ROS) a. Symptoms b. Duration of illness c. Home management, including over-the-counter medications, and response d. Additional symptoms from ROS	Expanded problem focused 1. Ears 2. Nose 3. Throat 4. Conjunctiva 5. Overall appearance	Moderate or low complexity 1. Observation and nonprescription analgesics

Continuum Model for Otitis Media, continued			
***CPT* Code Vignette**	**History**	**Physical Examination**	**Medical Decision-making**
99214 An infant presents for suspected third episode within 2–3 months Infant presents with fever and cough	Detailed 1. Chief complaint 2. Detailed HPI plus pertinent ROS and pertinent past, family, and social history (PFSH) a. Symptoms of illness b. Fever, other signs c. Any other medications d. Allergies e. Frequency of similar infection in past and response to treatment f. Environmental factors (eg, tobacco exposure, child care) g. Immunization status h. Feeding history	Detailed 1. Overall appearance 2. Hydration status 3. Eyes 4. Ears 5. Nose 6. Throat 7. Lungs 8. Skin	Moderate complexity 1. Treatment including antibiotics and supportive care. 2. Consider/discuss tympanocentesis (**69420** or **69421**). 3. Hearing evaluation planned. 4. Discuss possible referral to an allergist or otolaryngologist for tympanostomy. 5. Discuss contributing environmental factors and supportive treatment.
99215 3-month-old presents with high fever, vomiting, irritability	Detailed 1. Chief complaint 2. Detailed HPI plus pertinent ROS and pertinent PFSH a. Symptoms of illness b. Fever, other signs c. Any other medications d. Allergies e. Frequency of similar infection in past and response to treatment f. Environmental factors (eg, tobacco exposure, child care) g. Immunization status h. Feeding history	Detailed 1. Overall appearance 2. Hydration status 3. Eyes 4. Ears 5. Nose 6. Throat 7. Lungs 8. Skin	High complexity 1. Laboratory tests: Consider a complete blood cell count with differential, blood culture, blood urea nitrogen, creatinine, electrolytes, urinalysis with culture, chest x-ray, and possible lumbar puncture based on history and clinical findings. 2. Antibiotic therapy: Consider parenteral antibiotics. 3. Consider hospitalization based on history, physical findings, and laboratory studies. 4. Determine need for follow-up (eg, reassess later in same day by phone or follow-up visit as well as later follow-up). 5. Attempt oral rehydration in office.

Continuum Model for Otitis Media, continued			
***CPT* Code Vignette**	**History**	**Physical Examination**	**Medical Decision-making**
99214 or **99215** **NOTE:** Depending on the variables (ie, time), this example could be reported as **99214** or **99215.** Extended evaluation of child with chronic or recurrent otitis media **NOTE:** Time is the key factor when counseling and/or coordination of care are more than 50% of the face-to-face time with the patient. For **99214,** the total visit time would be 25 minutes; for **99215,** the total time is 40 minutes. You must document time spent on counseling and/or coordination of care and list the areas discussed.	Detailed History with extended HPI as in **99214,** but complete ROS and PFSH	Detailed or comprehensive General or single organ system (ears, nose, mouth, and throat)	Moderate or high complexity Tests: audiometry and/or tympanometry Extensive discussion of treatment options including but not limited to 1. Continued episodic treatment with antibiotics 2. Myringotomy and tube placement 3. Adenoidectomy 4. Allergy evaluation 5. Steroid therapy with weighing of risk-benefit ratio of various therapies

Acute Ear Infections and Your Child

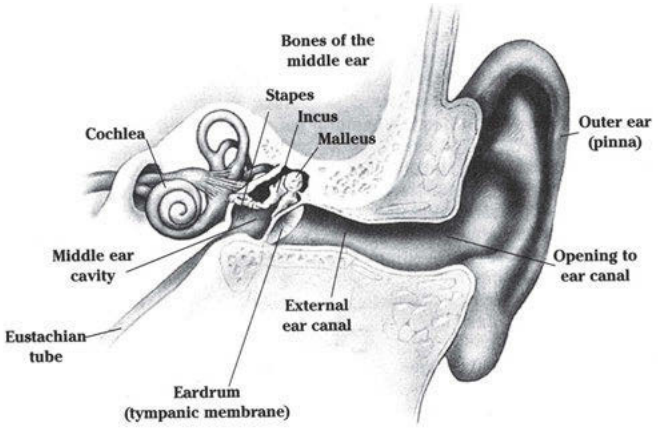
Next to the common cold, an ear infection is the most common childhood illness. In fact, most children have at least one ear infection by the time they are 3 years old. Many ear infections clear up without causing any lasting problems.

The following is information from the American Academy of Pediatrics about the symptoms, treatments, and possible complications of acute *otitis media*, a common infection of the middle ear.

How do ear infections develop?

The ear has 3 parts—the outer ear, middle ear, and inner ear. A narrow channel (eustachian tube) connects the middle ear to the back of the nose. When a child has a cold, nose or throat infection, or allergy, the mucus and fluid can enter the eustachian tube causing a buildup of fluid in the middle ear. If bacteria or a virus infects this fluid, it can cause swelling and pain in the ear. This type of ear infection is called *acute otitis media* (*middle ear inflammation*).

Often after the symptoms of acute otitis media clear up, fluid remains in the ear, creating another kind of ear problem called *otitis media with effusion* (*middle ear fluid*). This condition is harder to detect than acute otitis media because except for the fluid and usually some mild hearing loss, there is often no pain or other symptoms present. This fluid may last several months and, in most cases, disappears on its own. The child's hearing then returns to normal.



Cross-Section of the Ear

Is my child at risk for developing an ear infection?

Risk factors for developing childhood ear infections include

- **Age.** Infants and young children are more likely to get ear infections than older children. The size and shape of an infant's eustachian tube makes it easier for an infection to develop. Ear infections occur most often in children between 6 months and 3 years of age. Also, the younger a child is at the time of the first ear infection, the greater the chance he will have repeated infections.
- **Family history.** Ear infections can run in families. Children are more likely to have repeated middle ear infections if a parent or sibling also had repeated ear infections.
- **Colds.** Colds often lead to ear infections. Children in group child care settings have a higher chance of passing their colds to each other because they are exposed to more viruses from the other children.
- **Tobacco smoke.** Children who breathe in someone else's tobacco smoke have a higher risk of developing health problems, including ear infections.

How can I reduce the risk of an ear infection?

Some things you can do to help reduce your child's risk of getting an ear infection are

- Breastfeed instead of bottle-feed. Breastfeeding may decrease the risk of frequent colds and ear infections.
- Keep your child away from tobacco smoke, especially in your home or car.
- Throw away pacifiers or limit to daytime use, *if your child is older than 1 year*.
- Keep vaccinations up to date. Vaccines against bacteria (such as pneumococcal vaccine) and viruses (such as influenza vaccine) reduce the number of ear infections in children with frequent infections.

What are the symptoms of an ear infection?

Your child may have many symptoms during an ear infection. Talk with your pediatrician about the best way to treat your child's symptoms.

- **Pain.** The most common symptom of an ear infection is pain. Older children can tell you that their ears hurt. Younger children may only seem irritable and cry. You may notice this more during feedings because sucking and swallowing may cause painful pressure changes in the middle ear.
- **Loss of appetite.** Your child may have less of an appetite because of the ear pain.
- **Trouble sleeping.** Your child may have trouble sleeping because of the ear pain.
- **Fever.** Your child may have a temperature ranging from 100°F (normal) to 104°F.

- **Ear drainage.** You might notice yellow or white fluid, possibly blood-tinged, draining from your child's ear. The fluid may have a foul odor and will look different from normal earwax (which is orange-yellow or reddish-brown). Pain and pressure often decrease after this drainage begins, but this doesn't always mean that the infection is going away. If this happens it's not an emergency, but your child will need to see your pediatrician.
- **Trouble hearing.** During and after an ear infection, your child may have trouble hearing for several weeks. This occurs because the fluid behind the eardrum gets in the way of sound transmission. This is usually temporary and clears up after the fluid from the middle ear drains away.

Important: Your doctor *cannot* diagnose an ear infection over the phone; your child's eardrum must be examined by your doctor to confirm fluid buildup and signs of inflammation.

What causes ear pain?

There are other reasons why your child's ears may hurt besides an ear infection. The following can cause ear pain:

- An infection of the skin of the ear canal, often called "swimmer's ear"
- Reduced pressure in the middle ear from colds or allergies
- A sore throat
- Teething or sore gums
- Inflammation of the eardrum alone during a cold (without fluid buildup)

How are ear infections treated?

Because pain is often the first and most uncomfortable symptom of an ear infection, it's important to help comfort your child by giving her pain medicine. Acetaminophen and ibuprofen are over-the-counter (OTC) pain medicines that may help decrease much of the pain. Be sure to use the right dosage for your child's age and size. *Don't give aspirin to your child.* It has been associated with Reye syndrome, a disease that affects the liver and brain. There are also ear drops that may relieve ear pain for a short time. Ask your pediatrician whether these drops should be used. There is no need to use OTC cold medicines (decongestants and antihistamines), because they don't help clear up ear infections.

Not all ear infections require antibiotics. Some children who don't have a high fever and aren't severely ill may be observed without antibiotics. In most cases, pain and fever will improve in the first 1 to 2 days.

If your child is younger than 2 years, has drainage from the ear, has a fever higher than 102.5°F, seems to be in a lot of pain, is unable to sleep, isn't eating, or is acting ill, it's important to call your pediatrician. If your child is older than 2 years and your child's symptoms are mild, you may wait a couple of days to see if she improves.

Your child's ear pain and fever should improve or go away within 3 days of their onset. If your child's condition doesn't improve within 3 days, or worsens at any time, call your pediatrician. Your pediatrician may wish to see your child and may prescribe an antibiotic to take by mouth, if one wasn't given initially. If an antibiotic was already started, your child may need a different antibiotic. Be sure to follow your pediatrician's instructions closely.

If an antibiotic was prescribed, make sure your child finishes the entire prescription. If you stop the medicine too soon, some of the bacteria that caused the ear infection may still be present and cause an infection to start all over again.

As the infection starts to clear up, your child might feel a "popping" in the ears. This is a normal sign of healing. Children with ear infections don't need to stay home if they are feeling well, as long as a child care provider or someone at school can give them their medicine properly, if needed. If your child needs to travel in an airplane, or wants to swim, contact your pediatrician for specific instructions.

What are signs of hearing problems?

Because your child can have trouble hearing without other symptoms of an ear infection, watch for the following changes in behavior (especially during or after a cold):

- Talking more loudly or softly than usual
- Saying "huh?" or "what?" more than usual
- Not responding to sounds
- Having trouble understanding speech in noisy rooms
- Listening with the TV or radio turned up louder than usual

If you think your child may have difficulty hearing, call your pediatrician. Being able to hear and listen to others talk helps a child learn speech and language. This is especially important during the first few years of life.

Are there complications from ear infections?

Although it's very rare, complications from ear infections can develop, including the following:

- An infection of the inner ear that causes dizziness and imbalance (labyrinthitis)
- An infection of the skull behind the ear (mastoiditis)
- Scarring or thickening of the eardrum
- Loss of feeling or movement in the face (facial paralysis)
- Permanent hearing loss

It's normal for children to have several ear infections when they are young—even as many as 2 separate infections within a few months. Most ear infections that develop in children are minor. Recurring ear infections may be a nuisance, but they usually clear up without any lasting problems. With proper care and treatment, ear infections can usually be managed successfully. But, if your child has one ear infection after another for several months, you may want to talk about other treatment options with your pediatrician.

From your doctor

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

The American Academy of Pediatrics is an organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of infants, children, adolescents, and young adults.

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Web site— www.HealthyChildren.org

Middle Ear Fluid and Your Child

The *middle* ear is the space behind the eardrum that is usually filled with air. When a child has middle ear fluid (otitis media with effusion), it means that a watery or mucus-like fluid has collected in the middle ear. *Otitis media* means *middle ear inflammation*, and *effusion* means *fluid*.

Middle ear fluid is **not** the same as an ear infection. An ear infection occurs when middle ear fluid is infected with viruses, bacteria, or both, often during a cold. Children with middle ear fluid have no signs or symptoms of infection. Most children don't have fever or severe pain, but may have mild discomfort or trouble hearing. About 90% of children get middle ear fluid at some time before age 5.

The following is information from the American Academy of Pediatrics about the causes, symptoms, risk reduction, testing, and treatments for middle ear fluid, as well as how middle ear fluid may affect your child's learning.

What causes middle ear fluid?

There is no one cause for middle ear fluid. Often your child's doctor may not know the cause. Middle ear fluid could be caused by

- A past ear infection
- A cold or flu
- Blockage of the eustachian tube (a narrow channel that connects the middle ear to the back of the nose)

What are the symptoms of middle ear fluid?

Many healthy children with middle ear fluid have little or no problems. They usually get better on their own. Often middle ear fluid is found at a regular checkup. Ear discomfort, if present, is usually mild. Your child may be irritable, rub his ears, or have trouble sleeping. Other symptoms include hearing loss, irritability, sleep problems, clumsiness, speech or language problems, and poor school performance. You may notice your child sitting closer to the TV or turning the sound up louder than usual. Sometimes it may seem like your child isn't paying attention to you, especially when at the playground or in a noisy environment.

Talk with your child's doctor if you are concerned about your child's hearing. Keep a record of your child's ear problems. Write down your child's name, child's doctor's name and number, date and type of ear problem or infection, treatment, and results. This may help your child's doctor find the cause of the middle ear fluid.

Can middle ear fluid affect my child's learning?

Some children with middle ear fluid are at risk for delays in speaking or may have problems with learning or schoolwork, especially children with

- Permanent hearing loss not caused by middle ear fluid
- Speech and language delays or disorders
- Developmental delay of social and communication skills disorders (for example, autism spectrum disorders)
- Syndromes that affect cognitive, speech, and language delays (for example, Down syndrome)
- Craniofacial disorders that affect cognitive, speech, and language delays (for example, cleft palate)
- Blindness or visual loss that can't be corrected

If your child is at risk and has ongoing middle ear fluid, her hearing, speech, and language should be checked.

How can I reduce the risk of middle ear fluid?

Children who live with smokers, attend group child care, or use pacifiers have more ear infections. Because some children who have middle ear infections later get middle ear fluid, you may want to

- Keep your child away from tobacco smoke.
- Keep your child away from children who are sick.
- Throw away pacifiers or limit to daytime use, *if your child is older than 1 year*.

Are there special tests to check for middle ear fluid?

Two tests that can check for middle ear fluid are *pneumatic otoscopy* and *tympanometry*. A pneumatic otoscope is the recommended test for middle ear fluid. With this tool, the doctor looks at the eardrum and uses air to see how well the eardrum moves. Tympanometry is another test for middle ear fluid that uses sound to see how well the eardrum moves. An eardrum with fluid behind it doesn't move as well as a normal eardrum. Your child must sit still for both tests; the tests are painless.

Because these tests don't check hearing level, a hearing test may be given, if needed. Hearing tests measure how well your child hears. Although hearing tests don't test for middle ear fluid, they can measure if the fluid is affecting your child's hearing level. The type of hearing test given depends on your child's age and ability to participate.

How can middle ear fluid be treated?

Middle ear fluid can be treated in several ways. Treatment options include observation and tube surgery or adenoid surgery. Because a treatment that works for one child may not work for another, your child's doctor can help you decide which treatment is best for your child and when you should see an ear, nose, and throat (ENT) specialist. If one treatment doesn't work, another treatment can be tried. Ask your child's doctor or ENT specialist about the costs, advantages, and disadvantages of each treatment.

When should middle ear fluid be treated?

Your child is more likely to need treatment for middle ear fluid if she has any of the following:

- Conditions placing her at risk for developmental delays (see "Can middle ear fluid affect my child's learning?")
- Fluid in both ears, especially if present more than 3 months
- Hearing loss or other significant symptoms (see "What are the symptoms of middle ear fluid?")

What treatments are not recommended?

A number of treatments are **not** recommended for young children with middle ear fluid.

- **Medicines** not recommended include antibiotics, decongestants, antihistamines, and steroids (by mouth or in nasal sprays). All of these have side effects and do not cure middle ear fluid.
- **Surgical treatments** not recommended include myringotomy (draining of fluid without placing a tube) and tonsillectomy (removal of the tonsils). If your child's doctor or ENT specialist suggests one of these surgeries, it may be for another medical reason. Ask your doctor why your child needs the surgery.

What about other treatment options?

There is no evidence that complementary and alternative medicine treatments or that treatment for allergies works to decrease middle ear fluid. Some of these treatments may be harmful and many are expensive.

From your doctor

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Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years

- *Clinical Practice Guideline*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 2 for more information.
- *Technical Report*

Readers of this clinical practice guideline are urged to review the technical report to enhance the evidence-based decision-making process. The full technical report is available following the clinical practice guideline and on the companion CD-ROM.

CLINICAL PRACTICE GUIDELINE

Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years

abstract

FREE

OBJECTIVE: To update the American Academy of Pediatrics clinical practice guideline regarding the diagnosis and management of acute bacterial sinusitis in children and adolescents.

METHODS: Analysis of the medical literature published since the last version of the guideline (2001).

RESULTS: The diagnosis of acute bacterial sinusitis is made when a child with an acute upper respiratory tract infection (URI) presents with (1) persistent illness (nasal discharge [of any quality] or daytime cough or both lasting more than 10 days without improvement), (2) a worsening course (worsening or new onset of nasal discharge, daytime cough, or fever after initial improvement), or (3) severe onset (concurrent fever [temperature ≥39°C/102.2°F] and purulent nasal discharge for at least 3 consecutive days). Clinicians should not obtain imaging studies of any kind to distinguish acute bacterial sinusitis from viral URI, because they do not contribute to the diagnosis; however, a contrast-enhanced computed tomography scan of the paranasal sinuses should be obtained whenever a child is suspected of having orbital or central nervous system complications. The clinician should prescribe antibiotic therapy for acute bacterial sinusitis in children with severe onset or worsening course. The clinician should either prescribe antibiotic therapy or offer additional observation for 3 days to children with persistent illness. Amoxicillin with or without clavulanate is the first-line treatment of acute bacterial sinusitis. Clinicians should reassess initial management if there is either a caregiver report of worsening (progression of initial signs/symptoms or appearance of new signs/symptoms) or failure to improve within 72 hours of initial management. If the diagnosis of acute bacterial sinusitis is confirmed in a child with worsening symptoms or failure to improve, then clinicians may change the antibiotic therapy for the child initially managed with antibiotic or initiate antibiotic treatment of the child initially managed with observation.

CONCLUSIONS: Changes in this revision include the addition of a clinical presentation designated as "worsening course," an option to treat immediately or observe children with persistent symptoms for 3 days before treating, and a review of evidence indicating that imaging is not necessary in children with uncomplicated acute bacterial sinusitis. *Pediatrics* 2013;132:e262–e280

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KEY WORDS

acute bacterial sinusitis, sinusitis, antibiotics, imaging, sinus aspiration

ABBREVIATIONS

AAP—American Academy of Pediatrics
AOM—acute otitis media
CT—computed tomography
PCV-13—13-valent pneumococcal conjugate vaccine
RABS—recurrent acute bacterial sinusitis
RCT—randomized controlled trial
URI—upper respiratory tract infection

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INTRODUCTION

Acute bacterial sinusitis is a common complication of viral upper respiratory infection (URI) or allergic inflammation. Using stringent criteria to define acute sinusitis, it has been observed that between 6% and 7% of children seeking care for respiratory symptoms has an illness consistent with this definition.[1–4]

This clinical practice guideline is a revision of the clinical practice guideline published by the American Academy of Pediatrics (AAP) in 2001.[5] It has been developed by a subcommittee of the Steering Committee on Quality Improvement and Management that included physicians with expertise in the fields of primary care pediatrics, academic general pediatrics, family practice, allergy, epidemiology and informatics, pediatric infectious diseases, pediatric otolaryngology, radiology, and pediatric emergency medicine. None of the participants had financial conflicts of interest, and only money from the AAP was used to fund the development of the guideline. The guideline will be reviewed in 5 years unless new evidence emerges that warrants revision sooner.

The guideline is intended for use in a variety of clinical settings (eg, office, emergency department, hospital) by clinicians who treat pediatric patients. The data on which the recommendations are based are included in a companion technical report, published in the electronic pages.[6] The Partnership for Policy Implementation has developed a series of definitions using accepted health information technology standards to assist in the implementation of this guideline in computer systems and quality measurement efforts. This document is available at: http://www2.aap.org/informatics/PPI.html.

This revision focuses on the diagnosis and management of acute sinusitis in children between 1 and 18 years of age. It does not apply to children with subacute or chronic sinusitis. Similar to the previous guideline, this document does not consider neonates and children younger than 1 year or children with anatomic abnormalities of the sinuses, immunodeficiencies, cystic fibrosis, or primary ciliary dyskinesia. The most significant areas of change from the 2001 guideline are in the addition of a clinical presentation designated as "worsening course," inclusion of new data on the effectiveness of antibiotics in children with acute sinusitis,[4] and a review of evidence indicating that imaging is not necessary to identify those children who will benefit from antimicrobial therapy.

METHODS

The Subcommittee on Management of Sinusitis met in June 2009 to identify research questions relevant to guideline revision. The primary goal was to update the 2001 report by identifying and reviewing additional studies of pediatric acute sinusitis that have been performed over the past decade.

Searches of PubMed were performed by using the same search term as in the 2001 report. All searches were limited to English-language and human studies. Three separate searches were performed to maximize retrieval of the most recent and highest-quality evidence for pediatric sinusitis. The first limited results to all randomized controlled trials (RCTs) from 1966 to 2009, the second to all meta-analyses from 1966 to 2009, and the third to all pediatric studies (limited to ages <18 years) published since the last technical report (1999–2009). Additionally, the Web of Science was queried to identify studies that cited the original AAP guidelines. This literature search was replicated in July 2010

Evidence Quality	Preponderance of Benefit or Harm	Balance of Benefit and Harm
A. Well-designed RCTs or diagnostic studies on relevant population	Strong Recommendation	Option
B. RCTs or diagnostic studies with minor limitations;overwhelmingly consistent evidence from observational studies	Recommendation	
C. Observational studies (case-control and cohort design)		
D. Expert opinion, case reports, reasoning from first principles	Option	No Rec
X. Exceptional situations where validating studies cannot be performed and there is a clear preponderance of benefit or harm	Strong Recommendation / Recommendation	

FIGURE 1
Levels of recommendations. Rec, recommendation.

and November 2012 to capture recently published studies. The complete results of the literature review are published separately in the technical report.[6] In summary, 17 randomized studies of sinusitis in children were identified and reviewed. Only 3 trials met inclusion criteria. Because of significant heterogeneity among these studies, formal meta-analyses were not pursued.

The results from the literature review were used to guide development of the key action statements included in this document. These action statements were generated by using BRIDGE-Wiz (Building Recommendations in a Developers Guideline Editor, Yale School of Medicine, New Haven, CT), an interactive software tool that leads guideline development through a series of questions that are intended to create a more actionable set of key action statements.[7] BRIDGE-Wiz also incorporates the quality of available evidence into the final determination of the strength of each recommendation.

The AAP policy statement "Classifying Recommendations for Clinical Practice Guidelines" was followed in designating levels of recommendations (Fig 1).[8] Definitions of evidence-based statements are provided in Table 1. This guideline was reviewed by multiple groups in the AAP and 2 external organizations. Comments were compiled and reviewed by the subcommittee, and relevant changes were incorporated into the guideline.

KEY ACTION STATEMENTS

Key Action Statement 1

Clinicians should make a presumptive diagnosis of acute bacterial sinusitis when a child with an acute URI presents with the following:

- **Persistent illness, ie, nasal discharge (of any quality) or daytime cough or both lasting more than 10 days without improvement;**

OR

- **Worsening course, ie, worsening or new onset of nasal discharge, daytime cough, or fever after initial improvement;**

OR

- **Severe onset, ie, concurrent fever (temperature ≥39°C/102.2°F) and purulent nasal discharge for at least 3 consecutive days (Evidence Quality: B; Recommendation).**

KAS Profile 1

Aggregate evidence quality: B	
Benefit	Diagnosis allows decisions regarding management to be made. Children likely to benefit from antimicrobial therapy will be identified.
Harm	Inappropriate diagnosis may lead to unnecessary treatment. A missed diagnosis may lead to persistent infection or complications
Cost	Inappropriate diagnosis may lead to unnecessary cost of antibiotics. A missed diagnosis leads to cost of persistent illness (loss of time from school and work) or cost of caring for complications.
Benefits-harm assessment	Preponderance of benefit.
Value judgments	None.
Role of patient preference	Limited.
Intentional vagueness	None.
Exclusions	Children aged <1 year or older than 18 years and with underlying conditions.
Strength	Recommendation.

TABLE 1 Guideline Definitions for Evidence-Based Statements

Statement	Definition	Implication
Strong recommendation	A strong recommendation in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms (as a strong recommendation against an action is made when the anticipated harms clearly exceed the benefits) and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendations may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A recommendation in favor of a particular action is made when the anticipated benefits exceed the harms but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high-quality evidence is impossible to obtain but the anticipated benefits outweigh the harms.	Clinicians would be prudent to follow a recommendation, but should remain alert to new information and sensitive to patient preferences.
Option	Options define courses that may be taken when either the quality of evidence is suspect or carefully performed studies have shown little clear advantage to one approach over another.	Clinicians should consider the option in their decision-making, and patient preference may have a substantial role.
No recommendation	No recommendation indicates that there is a lack of pertinent published evidence and that the anticipated balance of benefits and harms is presently unclear.	Clinicians should be alert to new published evidence that clarifies the balance of benefit versus harm.

The purpose of this action statement is to guide the practitioner in making a diagnosis of acute bacterial sinusitis on the basis of stringent clinical criteria. To develop criteria to be used in distinguishing episodes of acute bacterial sinusitis from other common respiratory infections, it is helpful to describe the features of an uncomplicated viral URI. Viral URIs are usually characterized by nasal symptoms (discharge and congestion/obstruction) or cough or both. Most often, the nasal discharge begins as clear and watery. Often, however, the quality of nasal discharge changes during the course of the illness. Typically, the nasal discharge becomes thicker and more mucoid and may become purulent (thick, colored, and opaque) for several days. Then the situation reverses, with the purulent discharge becoming mucoid and then clear again or simply resolving. The transition from clear to purulent to clear again occurs in uncomplicated viral URIs without the use of antimicrobial therapy.

Fever, when present in uncomplicated viral URI, tends to occur early in the illness, often in concert with other constitutional symptoms such as headache and myalgias. Typically, the fever and constitutional symptoms disappear in the first 24 to 48 hours, and the respiratory symptoms become more prominent (Fig 2).

The course of most uncomplicated viral URIs is 5 to 7 days.[9–12] As shown in Fig 2, respiratory symptoms usually peak in severity by days 3 to 6 and then begin to improve; however, resolving symptoms and signs may persist in some patients after day 10.[9,10]

Symptoms of acute bacterial sinusitis and uncomplicated viral URI overlap considerably, and therefore it is their persistence without improvement that suggests a diagnosis of acute sinusitis.[9,10,13] Such symptoms include nasal discharge (of any quality: thick or thin, serous, mucoid, or purulent) or daytime cough (which may be worse at night) or both. Bad breath, fatigue, headache, and decreased appetite, although common, are not specific indicators of acute sinusitis.[14] Physical examination findings are also not particularly helpful in distinguishing sinusitis from uncomplicated URIs. Erythema and swelling of the nasal turbinates are nonspecific findings.[14] Percussion of the sinuses is not useful. Transillumination of the sinuses is difficult to perform correctly in children and has been shown to be unreliable.[15,16] Nasopharyngeal cultures do not reliably predict the etiology of acute bacterial sinusitis.[14,16]

Only a minority (~6%–7%) of children presenting with symptoms of URI will meet criteria for persistence.[3,4,11] As a result, before diagnosing acute bacterial sinusitis, it is important for the practitioner to attempt to (1) differentiate between sequential episodes of uncomplicated viral URI (which may seem to coalesce in the mind of the patient or parent) from the onset of acute bacterial sinusitis with persistent symptoms and (2) establish whether the symptoms are clearly not improving.

A worsening course of signs and symptoms, termed "double sickening," in the context of a viral URI is another presentation of acute bacterial sinusitis.[13,17] Affected children experience substantial and acute worsening of respiratory symptoms (nasal discharge or nasal congestion or daytime cough) or a new fever, often on the sixth or seventh day of illness, after initial signs of recovery from an uncomplicated viral URI. Support for this definition comes from studies in children and adults, for whom antibiotic treatment of worsening symptoms after a period of apparent improvement was associated with better outcomes.[4]

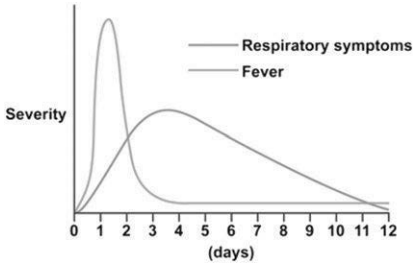

FIGURE 2
Uncomplicated viral URI.

Finally, some children with acute bacterial sinusitis may present with severe onset, ie, concurrent high fever (temperature >39°C) and purulent nasal discharge. These children usually are ill appearing and need to be distinguished from children with uncomplicated viral infections that are unusually severe. If fever is present in uncomplicated viral URIs, it tends to be present early in the illness, usually accompanied by other constitutional symptoms, such as headache and myalgia.[9,13,18] Generally, the constitutional symptoms resolve in the first 48 hours and then the respiratory symptoms become prominent. In most uncomplicated viral infections, including influenza, purulent nasal discharge does not appear for several days. Accordingly, it is the concurrent presentation of high fever and purulent nasal discharge for the first 3 to 4 days of an acute URI that helps to define the severe onset of acute bacterial sinusitis.[13,16,18] This presentation in children is the corollary to acute onset of headache, fever, and facial pain in adults with acute sinusitis.

Allergic and nonallergic rhinitis are predisposing causes of some cases of acute bacterial sinusitis in childhood. In addition, at their onset, these conditions may be mistaken for acute bacterial sinusitis. A family history of atopic conditions, seasonal occurrences, or occurrences with exposure to common allergens and other

allergic diatheses in the index patient (eczema, atopic dermatitis, asthma) may suggest the presence of noninfectious rhinitis. The patient may have complaints of pruritic eyes and nasal mucosa, which will provide a clue to the likely etiology of the condition. On physical examination, there may be a prominent nasal crease, allergic shiners, cobblestoning of the conjunctiva or pharyngeal wall, or pale nasal mucosa as other indicators of the diagnosis.

Key Action Statement 2A

Clinicians should not obtain imaging studies (plain films, contrast-enhanced computed tomography [CT], MRI, or ultrasonography) to distinguish acute bacterial sinusitis from viral URI (Evidence Quality: B; Strong Recommendation).

KAS Profile 2A

Aggregate evidence quality: B; overwhelmingly consistent evidence from observational studies.	
Benefit	Avoids exposure to radiation and costs of studies. Avoids unnecessary therapy for false-positive diagnoses.
Harm	None.
Cost	Avoids cost of imaging.
Benefits-harm assessment	Exclusive benefit.
Value judgments	Concern for unnecessary radiation and costs.
Role of patient preference	Limited. Parents may value a negative study and avoidance of antibiotics as worthy of radiation but panel disagrees.
Intentional vagueness	None.
Exclusions	Patients with complications of sinusitis.
Strength	Strong recommendation.

The purpose of this key action statement is to discourage the practitioner from obtaining imaging studies in children with uncomplicated acute bacterial sinusitis. As emphasized in Key Action Statement 1, acute bacterial sinusitis in children is a diagnosis that is made on the basis of stringent clinical criteria that describe signs, symptoms, and temporal patterns of a URI. Although historically imaging has been used as a confirmatory or diagnostic modality in children suspected to have acute bacterial sinusitis, it is no longer recommended.

The membranes that line the nose are continuous with the membranes (mucosa) that line the sinus cavities, the middle ear, the nasopharynx, and the oropharynx. When an individual experiences a viral URI, there is inflammation of the nasal mucosa and, often, the mucosa of the middle ear and paranasal sinuses as well. The continuity of the mucosa of the upper respiratory tract is responsible for the controversy regarding the usefulness of images of the paranasal sinuses in contributing to a diagnosis of acute bacterial sinusitis.

As early as the 1940s, observations were made regarding the frequency of abnormal sinus radiographs in healthy children without signs or symptoms of current respiratory disease.[19] In addition, several investigators in the 1970s and 1980s observed that children with uncomplicated viral URI had frequent abnormalities of the paranasal sinuses on plain radiographs.[20–22] These abnormalities were the same as those considered to be diagnostic of acute bacterial sinusitis (diffuse opacification, mucosal swelling of at least 4 mm, or an air-fluid level).[16]

As technology advanced and CT scanning of the central nervous system and skull became prevalent, several studies reported on incidental abnormalities of the paranasal sinuses that were observed in children.[23,24] Gwaltney et al[25] showed striking abnormalities (including air-fluid levels) in sinus CT scans of young adults with uncomplicated colds. Manning et al[26] evaluated children undergoing either CT or MRI of the head for indications other than respiratory complaints or suspected sinusitis. Each patient underwent rhinoscopy and otoscopy before imaging and each patient's parent was asked to fill out a questionnaire regarding recent symptoms of URI. Sixty-two percent of patients overall had physical findings or history consistent with an upper respiratory inflammatory process, and 55% of the total group showed some abnormalities on sinus imaging; 33% showed pronounced mucosal thickening or an air-fluid level. Gordts et al[27] made similar observations in children undergoing MRI. Finally, Kristo et al[28] performed MRI in children with URIs and confirmed the high frequency (68%) of major abnormalities seen in the paranasal sinuses.

In summary, when the paranasal sinuses are imaged, either with plain radiographs, contrast-enhanced CT, or MRI in children with uncomplicated URI, the majority of studies will be significantly abnormal with the same kind of findings that are associated with bacterial infection of the sinuses. Accordingly, although normal radiographs or CT or MRI results can ensure that a patient with respiratory symptoms does not have acute bacterial sinusitis, an abnormal image cannot confirm the diagnosis. Therefore, it is not necessary to perform imaging in children with uncomplicated episodes of clinical sinusitis. Similarly, the high likelihood of an abnormal imaging result in a child with an uncomplicated URI indicates that radiographic studies

not be performed in an attempt to eliminate the diagnosis of sinusitis.

Key Action Statement 2B

Clinicians should obtain a contrast-enhanced CT scan of the paranasal sinuses and/or an MRI with contrast whenever a child is suspected of having orbital or central nervous system complications of acute bacterial sinusitis (Evidence Quality: B; Strong Recommendation).

KAS Profile 2B

Aggregate evidence quality: B; overwhelmingly consistent evidence from observational studies.	
Benefit	Determine presence of abscesses, which may require surgical intervention; avoid sequelae because of appropriate aggressive management.
Harm	Exposure to ionizing radiation for CT scans; need for sedation for MRI.
Cost	Direct cost of studies.
Benefits-harm assessment	Preponderance of benefit.
Value judgments	Concern for significant complication that may be unrecognized and, therefore, not treated appropriately.
Role of patient preference	Limited.
Intentional vagueness	None.
Exclusions	None.
Strength	Strong recommendation.

The purpose of this key action statement is to have the clinician obtain contrast-enhanced CT images when children are suspected of having serious complications of acute bacterial sinusitis. The most common complication of acute sinusitis involves the orbit in children with ethmoid sinusitis who are younger than 5 years.[29–31] Orbital complications should be suspected when the child presents with a swollen eye, especially if accompanied by proptosis or impaired function of the extraocular muscles. Orbital complications of acute sinusitis have been divided into 5 categories: sympathetic effusion, subperiosteal abscess, orbital cellulitis, orbital abscess, and cavernous sinus thrombosis.[32] Although sympathetic effusion (inflammatory edema) is categorized as an orbital complication, the site of infection remains confined to the sinus cavities; eye swelling is attributable to the impedance of venous drainage secondary to congestion within the ethmoid sinuses. Alternative terms for sympathetic effusion (inflammatory edema) are preseptal or periorbital cellulitis. The remaining "true" orbital complications are best visualized by contrast-enhanced CT scanning.

Intracranial complications of acute sinusitis, which are substantially less common than orbital complications, are more serious, with higher morbidity and mortality than those involving the orbit. Intracranial complications should be suspected in the patient who presents with a very severe headache, photophobia, seizures, or other focal neurologic findings. Intracranial complications include subdural empyema, epidural empyema, venous thrombosis, brain abscess, and meningitis.[29] Typically, patients with intracranial complications of acute bacterial sinusitis are previously healthy adolescent males with frontal sinusitis.[33,34]

There have been no head-to-head comparisons of the diagnostic accuracy of contrast-enhanced CT scanning to MRI with contrast in the evaluation of orbital and intracranial complications of sinusitis in children. In general, the contrast-enhanced CT scan has been the preferred imaging study when complications of sinusitis are suspected.[35,36] However, there are documented cases in which a contrast-enhanced CT scan has not revealed the abnormality responsible for the clinical presentation and the MRI with contrast has, especially for intracranial complications and rarely for orbital complications.[37,38] Accordingly, the most recent appropriateness criteria from the American College of Radiology endorse both MRI with contrast and contrast-enhanced CT as complementary examinations when evaluating potential complications of sinusitis.[35] The availability and speed of obtaining the contrast-enhanced CT are desirable; however, there is increasing concern regarding exposure to radiation. The MRI, although very sensitive, takes longer than the contrast-enhanced CT and often requires sedation in young children (which carries its own risks). In older children and adolescents who may not require sedation, MRI with contrast, if available, may be preferred when intracranial complications are likely. Furthermore, MRI with contrast should be performed when there is persistent clinical concern or incomplete information has been provided by the contrast-enhanced CT scan.

Key Action Statement 3

Initial Management of Acute Bacterial Sinusitis

3A: "Severe onset and worsening course" acute bacterial sinusitis. The clinician should prescribe antibiotic therapy for acute bacterial sinusitis in children with severe onset or worsening course (signs, symptoms, or both) (Evidence Quality: B; Strong Recommendation).

KAS Profile 3A

Aggregate evidence quality: B; randomized controlled trials with limitations.	
Benefit	Increase clinical cures, shorten illness duration, and may prevent suppurative complications in a high-risk patient population.
Harm	Adverse effects of antibiotics.
Cost	Direct cost of therapy.
Benefits-harm assessment	Preponderance of benefit.
Value judgments	Concern for morbidity and possible complications if untreated.
Role of patient preference	Limited.
Intentional vagueness	None.
Exclusions	None.
Strength	Strong recommendation.

3B: "Persistent illness." The clinician should either prescribe antibiotic therapy OR offer additional outpatient observation for 3 days to children with persistent illness (nasal discharge of any quality or cough or both for at least 10 days without evidence of improvement) (Evidence Quality: B; Recommendation).

The purpose of this section is to offer guidance on initial management of persistent illness sinusitis by helping clinicians choose between the following 2 strategies:

1. Antibiotic therapy, defined as initial treatment of acute bacterial sinusitis with antibiotics, with the intent of starting antibiotic therapy as soon as possible after the encounter.
2. Additional outpatient observation, defined as initial management of acute bacterial sinusitis limited to continued observation for 3 days, with commencement of antibiotic therapy if either the child does not improve clinically within several days of diagnosis or if there is clinical worsening of the child's condition at any time.

KAS Profile 3B

Aggregate evidence quality: B; randomized controlled trials with limitations.	
Benefit	Antibiotics increase the chance of improvement or cure at 10 to 14 days (number needed to treat, 3–5); additional observation may avoid the use of antibiotics with attendant cost and adverse effects.
Harm	Antibiotics have adverse effects (number needed to harm, 3) and may increase bacterial resistance. Observation may prolong illness and delay start of needed antibiotic therapy.
Cost	Direct cost of antibiotics as well as cost of adverse reactions; indirect costs of delayed recovery when observation is used.
Benefits-harm assessment	Preponderance of benefit (because both antibiotic therapy and additional observation with rescue antibiotic, if needed, are appropriate management).
Value judgments	Role for additional brief observation period for selected children with persistent illness sinusitis, similar to what is recommended for acute otitis media, despite the lack of randomized trials specifically comparing additional observation with immediate antibiotic therapy and longer duration of illness before presentation.
Role of patient preference	Substantial role in shared decision-making that should incorporate illness severity, child's quality of life, and caregiver values and concerns.
Intentional vagueness	None.
Exclusions	Children who are excluded from randomized clinical trials of acute bacterial sinusitis, as defined in the text.
Strength	Recommendation.

In contrast to the 2001 AAP guideline,[5] which recommended antibiotic therapy for all children diagnosed with acute bacterial sinusitis, this guideline allows for additional observation of children presenting with persistent illness (nasal discharge of any quality or daytime cough or both for at least 10 days without evidence of improvement). In both guidelines, however, children presenting with severe or worsening illness (which was not defined explicitly in the 2001 guideline[5]) are to receive antibiotic therapy. The rationale for this approach (Table 2) is discussed below.

Antibiotic Therapy for Acute Bacterial Sinusitis

In the United States, antibiotics are prescribed for 82% of children with acute sinusitis.[39] The rationale for antibiotic therapy of acute bacterial sinusitis is based on the recovery of bacteria in high density ($\geq 10^4$ colony-forming units/mL) in 70% of maxillary sinus aspirates obtained from children with a clinical syndrome characterized by persistent nasal discharge, daytime cough, or both.[16,40] Children who present with severe-onset acute bacterial sinusitis are presumed to have bacterial infection, because a temperature of at least 39°C/102.2°F coexisting for at least 3 consecutive days with purulent nasal discharge is not consistent with the well-documented pattern of acute viral URI. Similarly, children with worsening-course acute bacterial sinusitis have a clinical course that is also not consistent with the steady improvement that characterizes an uncomplicated viral URI.[9,10]

Three RCTs have compared antibiotic therapy with placebo for the initial management of acute bacterial sinusitis in children. Two trials by Wald et al[4,41] found an increase in cure or improvement after antibiotic therapy compared with placebo with a number needed to treat of 3 to 5 children. Most children in these studies had persistent acute bacterial sinusitis, but children with severe or worsening illness were also included. Conversely, Garbutt et al,[42] who studied only children with persistent acute bacterial sinusitis, found no difference in outcomes for antibiotic versus placebo. Another RCT by Kristo et al,[43] often cited as showing no benefit from antibiotics for acute bacterial sinusitis, will not be considered further because of methodologic flaws, including weak entry criteria and inadequate dosing of antibiotic treatment.

The guideline recommends antibiotic therapy for severe or worsening acute bacterial sinusitis because of the benefits revealed in RCTs[4,41] and a theoretically higher risk of suppurative complications than for children who present with persistent symptoms. Orbital and intracranial complications of acute bacterial sinusitis have not been observed in RCTs, even when placebo was administered; however, sample sizes have inadequate power to preclude an increased risk. This risk, however, has caused some investigators to exclude children with severe acute bacterial sinusitis from trial entry.[42]

Additional Observation for Persistent Onset Acute Bacterial Sinusitis

The guideline recommends either antibiotic therapy or an additional brief period of observation as initial management strategies for children with persistent acute bacterial sinusitis because, although there are benefits to antibiotic therapy (number needed to treat, 3–5), some children improve on their own, and the risk of suppurative complications is low.[4,41] Symptoms of persistent acute bacterial sinusitis may be mild and have varying effects on a given child's quality of life, ranging from slight (mild cough, nasal discharge) to significant (sleep disturbance, behavioral changes, school or child care absenteeism). The benefits of antibiotic therapy in some trials[4,41] must also be balanced against an increased risk of adverse events (number need to harm, 3), most often self-limited diarrhea, but also including occasional rash.[4]

Choosing between antibiotic therapy or additional observation for initial management of persistent illness sinusitis presents an opportunity for shared decision-making with families (Table 2). Factors that might influence this decision include symptom severity, the child's quality of life, recent antibiotic use, previous experience or outcomes with acute bacterial sinusitis, cost of antibiotics, ease of administration, caregiver concerns about potential adverse effects of antibiotics, persistence of respiratory symptoms, or development of complications. Values and preferences expressed by the caregiver should be taken into consideration (Table 3).

Children with persistent acute bacterial sinusitis who received antibiotic therapy in the previous 4 weeks, those with concurrent bacterial infection (eg, pneumonia, suppurative cervical adenitis, group A streptococcal pharyngitis, or acute otitis media), those with actual or suspected complications of acute bacterial sinusitis, or those with underlying conditions should generally be managed with antibiotic therapy. The latter group includes children with asthma, cystic fibrosis, immunodeficiency, previous sinus surgery, or anatomic abnormalities of the upper respiratory tract.

Limiting antibiotic use in children with persistent acute bacterial sinusitis who may improve on their own reduces common antibiotic-related adverse events, such as diarrhea, diaper dermatitis, and skin rash. The most recent RCT of acute bacterial sinusitis in children[4] found adverse events of 44% with antibiotic and 14% with placebo.

Limiting antibiotics may also reduce the prevalence of resistant bacterial pathogens. Although this is always a desirable goal, no increase in resistant bacterial species was observed within the group of children treated with a single course of antimicrobial agents (compared with those receiving placebo) in 2 recent large studies of antibiotic versus placebo for children with acute otitis media.[44,45]

Key Action Statement 4

Clinicians should prescribe amoxicillin with or without clavulanate as first-line treatment when a decision has been made to initiate antibiotic treatment of acute bacterial sinusitis (Evidence Quality: B; Recommendation).

KAS Profile 4

Aggregate evidence quality: B; randomized controlled trials with limitations.

Benefit	Increase clinical cures with narrowest spectrum drug; stepwise increase in broadening spectrum as risk factors for resistance increase.
Harm	Adverse effects of antibiotics including development of hypersensitivity.
Cost	Direct cost of antibiotic therapy.
Benefits-harm assessment	Preponderance of benefit.
Value judgments	Concerns for not encouraging resistance if possible.
Role of patient preference	Potential for shared decision-making that should incorporate the caregiver's experiences and values.
Intentional vagueness	None.
Exclusions	May include allergy or intolerance.
Strength	Recommendation.

TABLE 2 Recommendations for Initial Use of Antibiotics for Acute Bacterial Sinusitis

Clinical Presentation	Severe Acute Bacterial Sinusitis[a]	Worsening Acute Bacterial Sinusitis[b]	Persistent Acute Bacterial Sinusitis[c]
Uncomplicated acute bacterial sinusitis without coexisting illness	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy or additional observation for 3 days[d]
Acute bacterial sinusitis with orbital or intracranial complications	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy
Acute bacterial sinusitis with coexisting acute otitis media, pneumonia, adenitis, or streptococcal pharyngitis	Antibiotic therapy	Antibiotic therapy	Antibiotic therapy

[a] Defined as temperature ≥39°C and purulent (thick, colored, and opaque) nasal discharge present concurrently for at least 3 consecutive days.

[b] Defined as nasal discharge or daytime cough with sudden worsening of symptoms (manifested by new-onset fever ≥38°C/100.4°F or substantial increase in nasal discharge or cough) after having experienced transient improvement of symptoms.

[c] Defined as nasal discharge (of any quality), daytime cough (which may be worse at night), or both, persisting for >10 days without improvement.

[d] Opportunity for shared decision-making with the child's family; if observation is offered, a mechanism must be in place to ensure follow-up and begin antibiotics if the child worsens at any time or fails to improve within 3 days of observation.

The purpose of this key action statement is to guide the selection of antimicrobial therapy once the diagnosis of acute bacterial sinusitis has been made. The microbiology of acute bacterial sinusitis was determined nearly 30 years ago through direct maxillary sinus aspiration in children with compatible signs and symptoms. The major bacterial pathogens recovered at that time were *Streptococcus pneumoniae* in approximately 30% of children and nontypeable *Haemophilus influenzae* and *Moraxella catarrhalis* in approximately 20% each.[16,40] Aspirates from the remaining 25% to 30% of children were sterile.

Maxillary sinus aspiration is rarely performed at the present time unless the course of the infection is unusually prolonged or severe. Although some authorities have recommended obtaining cultures from the middle meatus to determine the cause of a maxillary sinus infection, there are no data in children with acute bacterial sinusitis that have compared such cultures with cultures of a maxillary sinus aspirate. Furthermore, there are data indicating that the middle meatus in healthy children is commonly colonized with *S pneumoniae*, *H influenzae*, and *M catarrhalis*.[46]

Recent estimates of the microbiology of acute sinusitis have, of necessity, been based primarily on that of acute otitis media (AOM), a condition with relatively easy access to infective fluid through performance of tympanocentesis and one with a similar pathogenesis to acute bacterial sinusitis.[47,48] The 3 most common bacterial pathogens recovered from the middle ear fluid of children with AOM are the same as those that have been associated with acute bacterial sinusitis: *S pneumoniae*, nontypeable *H influenzae*, and *M catarrhalis*.[49] The proportion of each has varied from study to study depending on criteria used for diagnosis of AOM, patient characteristics, and bacteriologic techniques. Recommendations since the year 2000 for the routine use in infants of 7-valent and, more recently, 13-valent pneumococcal conjugate vaccine (PCV-13) have been associated with a decrease in recovery of *S pneumoniae* from ear fluid of children with AOM and a relative increase in the incidence of infections attributable to *H influenzae*.[50] Thus, on the basis of the proportions of bacteria found in middle ear infections, it is estimated that *S pneumoniae* and *H influenzae* are currently each responsible for approximately 30% of cases of acute bacterial sinusitis in children, and *M catarrhalis* is responsible for approximately 10%. These percentages are contingent on the assumption that approximately one-quarter of aspirates of maxillary sinusitis would still be sterile, as reported in earlier studies. *Staphylococcus aureus* is rarely isolated from sinus aspirates in children with acute bacterial sinusitis, and with the exception of acute maxillary sinusitis associated with infections of dental origin,[51] respiratory anaerobes are also rarely recovered.[40,52] Although *S aureus* is a very infrequent cause of acute bacterial sinusitis in children, it is a significant pathogen in the orbital and intracranial complications of sinusitis. The reasons for this discrepancy are unknown.

Antimicrobial susceptibility patterns for *S pneumoniae* vary considerably from community to community. Isolates obtained from surveillance centers nationwide indicate that, at the present time, 10% to 15% of upper respiratory tract isolates of *S pneumoniae* are nonsusceptible to penicillin[53,54]; however, values for penicillin nonsusceptibility as high as 50% to 60% have been reported in some areas.[55,56] Of the organisms that are resistant, approximately half are highly resistant to penicillin and the remaining half are intermediate in resistance. [53,54,56–59] Between 10% and 42% of *H influenzae*[56–59] and close to 100% of *M catarrhalis* are likely to be β-lactamase positive and nonsusceptible to amoxicillin. Because of dramatic geographic variability in the prevalence of β-lactamase–positive *H influenzae*, it is extremely desirable for the practitioner to be familiar with local patterns of susceptibility. Risk factors for the presence of organisms

likely to be resistant to amoxicillin include attendance at child care, receipt of antimicrobial treatment within the previous 30 days, and age younger than 2 years.[50,55,60]

Amoxicillin remains the antimicrobial agent of choice for first-line treatment of uncomplicated acute bacterial sinusitis in situations in which antimicrobial resistance is not suspected. This recommendation is based on amoxicillin's effectiveness, safety, acceptable taste, low cost, and relatively narrow microbiologic spectrum. For children aged 2 years or older with uncomplicated acute bacterial sinusitis that is mild to moderate in degree of severity who do not attend child care and who have not been treated with an antimicrobial agent within the last 4 weeks, amoxicillin is recommended at a standard dose of 45 mg/kg per day in 2 divided doses. In communities with a high prevalence of nonsusceptible *S pneumoniae* (>10%, including intermediate- and high-level resistance), treatment may be initiated at 80 to 90 mg/kg per day in 2 divided doses, with a maximum of 2 g per dose.[55] This high-dose amoxicillin therapy is likely to achieve sinus fluid concentrations that are adequate to overcome the resistance of *S pneumoniae,* which is attributable to alteration in penicillin-binding proteins on the basis of data derived from patients with AOM.[61] If, within the next several years after licensure of PCV-13, a continuing decrease in isolates of *S pneumoniae* (including a decrease in isolates of nonsusceptible *S pneumoniae)* and an increase in β-lactamase–producing *H influenzae* are observed, standard-dose amoxicillin-clavulanate (45 mg/kg per day) may be most appropriate.

Patients presenting with moderate to severe illness as well as those younger than 2 years, attending child care, or who have recently been treated with an antimicrobial may receive high-dose amoxicillin-clavulanate (80–90 mg/kg per day of the amoxicillin component with 6.4 mg/kg per day of clavulanate in 2 divided doses with a maximum of 2 g per dose). The potassium clavulanate levels are adequate to inhibit all β-lactamase–producing *H influenzae* and *M catarrhalis*.[56,59]

A single 50-mg/kg dose of ceftriaxone, given either intravenously or intramuscularly, can be used for children who are vomiting, unable to tolerate oral medication, or unlikely to be adherent to the initial doses of antibiotic.[62–64] The 3 major bacterial pathogens involved in acute bacterial sinusitis are susceptible to ceftriaxone in 95% to 100% of cases.[56,58,59] If clinical improvement is observed at 24 hours, an oral antibiotic can be substituted to complete the course of therapy. Children who are still significantly febrile or symptomatic at 24 hours may require additional parenteral doses before switching to oral therapy.

The treatment of patients with presumed allergy to penicillin has been controversial. However, recent publications indicate that the risk of a serious allergic reaction to second- and third-generation cephalosporins in patients with penicillin or amoxicillin allergy appears to be almost nil and no greater than the risk among patients without such allergy.[65–67] Thus, patients allergic to amoxicillin with a non–type 1 (late or delayed, >72 hours) hypersensitivity reaction can safely be treated with cefdinir, cefuroxime, or cefpodoxime.[66–68] Patients with a history of a serious type 1 immediate or accelerated (anaphylactoid) reaction to amoxicillin can also safely be treated with cefdinir, cefuroxime, or cefpodoxime. In both circumstances, clinicians may wish to determine individual tolerance by referral to an allergist for penicillin and/or cephalosporin skin-testing before initiation of therapy.[66–68] The susceptibility of *S pneumoniae* to cefdinir, cefpodoxime, and cefuroxime varies from 60% to 75%,[56–59] and the susceptibility of *H influenzae* to these agents varies from 85% to 100%.[56,58] In young children (<2 years) with a serious type 1 hypersensitivity to penicillin and moderate or more severe sinusitis, it may be prudent to use a combination of clindamycin (or linezolid) and cefixime to achieve the most comprehensive coverage against both resistant *S pneumoniae* and *H influenzae*. Linezolid has excellent activity against all *S pneumoniae*, including penicillin-resistant strains, but lacks activity against *H influenzae* and *M catarrhalis*. Alternatively, a quinolone, such as levofloxacin, which has a high level of activity against both *S pneumoniae* and *H influenzae*, may be prescribed.[57,58] Although the use of quinolones is usually restricted because of concerns for toxicity, cost, and emerging resistance, their use in this circumstance can be justified.

Pneumococcal and *H influenzae* surveillance studies have indicated that resistance of these organisms to trimethoprim-sulfamethoxazole and azithromycin is sufficient to preclude their use for treatment of acute bacterial sinusitis in patients with penicillin hypersensitivity.[56,58,59,69]

The optimal duration of antimicrobial therapy for patients with acute bacterial sinusitis has not received systematic study. Recommendations based on clinical observations have varied widely, from 10 to 28 days of treatment. An alternative suggestion has been made that antibiotic therapy be continued for 7 days after the patient becomes free of signs and symptoms.[5] This strategy has the advantage of individualizing the treatment of each patient, results in a minimum course of 10 days, and

avoids prolonged antimicrobial therapy in patients who are asymptomatic and therefore unlikely to adhere to the full course of treatment.[5]

Patients who are acutely ill and appear toxic when first seen (see below) can be managed with 1 of 2 options. Consultation can be requested from an otolaryngologist for consideration of maxillary sinus aspiration (with appropriate analgesia/anesthesia) to obtain a sample of sinus secretions for Gram stain, culture, and susceptibility testing so that antimicrobial therapy can be adjusted precisely. Alternatively, inpatient therapy can be initiated with intravenous cefotaxime or ceftriaxone, with referral to an otolaryngologist if the patient's condition worsens or fails to show improvement within 48 hours. If a complication is suspected, management will differ depending on the site and severity.

A recent guideline was published by the Infectious Diseases Society of America for acute bacterial rhinosinusitis in children and adults.[70] Their recommendation for initial empirical antimicrobial therapy for acute bacterial sinusitis in children was amoxicillin-clavulanate based on the concern that there is an increasing prevalence of *H influenzae* as a cause of sinusitis since introduction of the pneumococcal conjugate vaccines and an increasing prevalence of β-lactamase production among these strains. In contrast, this guideline from the AAP allows either amoxicillin or amoxicillin-clavulanate as first-line empirical therapy and is therefore inclusive of the Infectious Diseases Society of America's recommendation. Unfortunately, there are scant data available regarding the precise microbiology of acute bacterial sinusitis in the post–PCV-13 era. Prospective surveillance of nasopharyngeal cultures may be helpful in completely aligning these recommendations in the future.

Key Action Statement 5A

Clinicians should reassess initial management if there is either a caregiver report of worsening (progression of initial signs/symptoms or appearance of new signs/symptoms) OR failure to improve (lack of reduction in all presenting signs/symptoms) within 72 hours of initial management (Evidence Quality: C; Recommendation).

KAS Profile 5A

Aggregate evidence quality: C; observational studies	
Benefits	Identification of patients who may have been misdiagnosed, those at risk of complications, and those who require a change in management.
Harm	Delay of up to 72 hours in changing therapy if patient fails to improve.
Cost	Additional provider and caregiver time and resources.
Benefits-harm assessment	Preponderance of benefit.
Value judgments	Use of 72 hours to assess progress may result in excessive classification as treatment failures if premature; emphasis on importance of worsening illness in defining treatment failures.
Role of patient preferences	Caregivers determine whether the severity of the patient's illness justifies the report to clinician of the patient's worsening or failure to improve.
Intentional vagueness	None.
Exclusions	Patients with severe illness, poor general health, complicated sinusitis, immune deficiency, previous sinus surgery, or coexisting bacterial illness.
Strength	Recommendation.

The purpose of this key action statement is to ensure that patients with acute bacterial sinusitis who fail to improve symptomatically after initial management are reassessed to be certain that they have been correctly diagnosed and to consider initiation of alternate therapy to hasten resolution of symptoms and avoid complications. "Worsening" is defined as progression of presenting signs or symptoms of acute bacterial sinusitis or onset of new signs or symptoms. "Failure to improve" is lack of reduction in presenting signs or symptoms of acute bacterial sinusitis by 72 hours after diagnosis and initial management; patients with persistent but improving symptoms do not meet this definition.

The rationale for using 72 hours as the time to assess treatment failure for acute bacterial sinusitis is based on clinical outcomes in RCTs. Wald et al[41] found that 18 of 35 patients (51%) receiving placebo demonstrated symptomatic improvement within 3 days of initiation of treatment; only an additional 3 patients receiving placebo (9%) improved between days 3 and 10. In the same study, 48 of 58 patients (83%) receiving antibiotics were cured or improved within 3 days; at 10 days, the overall rate of improvement was 79%, suggesting that no additional patients improved between days 3 and 10. In a more recent study, 17 of 19 children who ultimately failed initial therapy with either antibiotic or placebo demonstrated failure to improve within 72 hours.[4] Although Garbutt et al[42] did not report the percentage of patients who improved by day 3, they did demonstrate that the majority of improvement in symptoms occurred within

the first 3 days of study entry whether they received active treatment or placebo.

Reporting of either worsening or failure to improve implies a shared responsibility between clinician and caregiver. Although the clinician should educate the caregiver regarding the anticipated reduction in symptoms within 3 days, it is incumbent on the caregiver to appropriately notify the clinician of concerns regarding worsening or failure to improve. Clinicians should emphasize the importance of reassessing those children whose symptoms are worsening whether or not antibiotic therapy was prescribed. Reassessment may be indicated before the 72-hour process by which such reporting occurs should be discussed at the time the initial management strategy is determined.

Key Action Statement 5B

If the diagnosis of acute bacterial sinusitis is confirmed in a child with worsening symptoms or failure to improve in 72 hours, then clinicians may change the antibiotic therapy for the child initially managed with antibiotic OR initiate antibiotic treatment of the child initially managed with observation (Evidence Quality: D; Option based on expert opinion, case reports, and reasoning from first principles).

KAS Profile 5B

Aggregate evidence quality: D; expert opinion and reasoning from first principles.	
Benefit	Prevention of complications, administration of effective therapy.
Harm	Adverse effects of secondary antibiotic therapy.
Cost	Direct cost of medications, often substantial for second-line agents.
Benefits-harm assessment	Preponderance of benefit.
Value judgments	Clinician must determine whether cost and adverse effects associated with change in antibiotic is justified given the severity of illness.
Role of patient preferences	Limited in patients whose symptoms are severe or worsening, but caregivers of mildly affected children who are failing to improve may reasonably defer change in antibiotic.
Intentional vagueness	None.
Exclusions	None.
Strength	Option.

mark if the patient is substantially worse, because it may indicate the development of complications or a need for parenteral therapy. Conversely, in some cases, caregivers may think that symptoms are not severe enough to justify a change to an antibiotic with a less desirable safety profile or even the time, effort, and resources required for reassessment. Accordingly, the circumstances under which caregivers report back to the clinician and the corresponds to the patient's pattern of illness, as defined in Key Action Statement 1. If caregivers report worsening of symptoms at any time in a patient for whom observation was the initial intervention, the clinician should begin treatment as discussed in Key Action Statement 4. For patients whose symptoms are mild and who have failed to improve but have not worsened, initiation of antimicrobial agents or continued observation (for up to 3 days) is reasonable.

If caregivers report worsening of symptoms after 3 days in a patient initially treated with antimicrobial agents, current signs and symptoms should be reviewed to determine whether acute bacterial sinusitis is still the best diagnosis. If sinusitis is still the best diagnosis, infection with drug-resistant bacteria is probable, and an alternate antimicrobial agent may be administered. Face-to-face reevaluation of the patient is desirable. Once the decision is made to change medications, the clinician should consider the limitations of the initial antibiotic coverage, the anticipated susceptibility of residual bacterial pathogens, and the ability of antibiotics to adequately penetrate the site of infection. Cultures of sinus or nasopharyngeal secretions in patients with initial antibiotic failure have identified a large percentage of bacteria with resistance to the original antibiotic.[71,72] Furthermore, multidrug-resistant *S pneumoniae* and β-lactamase–positive *H influenzae* and *M catarrhalis* are more commonly isolated after previous antibiotic exposure.[73–78] Unfortunately, there are no studies in children that have investigated the microbiology of treatment failure in acute bacterial sinusitis or cure rates using second-line antimicrobial agents. As a result, the likelihood of adequate antibiotic coverage for resistant organisms must be

The purpose of this key action statement is to ensure optimal antimicrobial treatment of children with acute bacterial sinusitis whose symptoms worsen or fail to respond to the initial intervention to prevent complications and reduce symptom severity and duration (see Table 4).

Clinicians who are notified by a caregiver that a child's symptoms are worsening or failing to improve should confirm that the clinical diagnosis of acute bacterial sinusitis

addressed by extrapolations from studies of acute otitis media in children and sinusitis in adults and by using the results of data generated in vitro. A general guide to management of the child who worsens in 72 hours is shown in Table 4.

NO RECOMMENDATION

Adjuvant Therapy

Potential adjuvant therapy for acute sinusitis might include intranasal corticosteroids, saline nasal irrigation or lavage, topical or oral decongestants, mucolytics, and topical or oral antihistamines. A recent Cochrane review on decongestants, antihistamines, and nasal irrigation for acute sinusitis in children found no appropriately designed studies to determine the effectiveness of these interventions.[79]

Intranasal Steroids

The rationale for the use of intranasal corticosteroids in acute bacterial sinusitis is that an antiinflammatory agent may reduce the swelling around the sinus ostia and encourage drainage, thereby hastening recovery. However, there are limited data on how much inflammation is present, whether the inflammation is responsive to steroids, and whether there are differences in responsivity according to age. Nonetheless, there are several RCTs in adolescents and adults, most of which do show significant differences compared with placebo or active comparator that favor intranasal steroids in the reduction of symptoms and the patient's global assessment of overall improvement.[80–85] Several studies in adults with acute bacterial sinusitis provide data supporting the use of intranasal steroids as either monotherapy or adjuvant therapy to antibiotics.[81,86] Only one study did not show efficacy.[85]

There have been 2 trials of intranasal steroids performed exclusively in children: one comparing intranasal corticosteroids versus an oral decongestant[87] and the other comparing intranasal corticosteroids with placebo.[88] These studies showed a greater rate of complete resolution[87] or greater reduction in symptoms in patients receiving the steroid preparation, although the effects were modest.[88] It is important to note that nearly all of these studies (both those reported in children and adults) suffered from substantial methodologic problems. Examples of these methodologic problems are as follows: (1) variable inclusion criteria for sinusitis, (2) mixed populations of allergic and nonallergic subjects, and (3) different outcome criteria. All of these factors make deriving a clear conclusion difficult. Furthermore, the lack of stringent criteria in selecting the subject population increases the chance that the subjects had viral URIs or even persistent allergies rather than acute bacterial sinusitis.

The intranasal steroids studied to date include budesonide, flunisolide, fluticasone, and mometasone. There is no reason to believe that one steroid would be more effective than another, provided equivalent doses are used.

Potential harm in using nasal steroids in children with acute sinusitis includes the increased cost of therapy, difficulty in effectively administering nasal sprays in young children, nasal irritation and epistaxis, and potential systemic adverse effects of steroid use. Fortunately, no clinically significant steroid adverse effects have been discovered in studies in children.[89–96]

Saline Irrigation

Saline nasal irrigation or lavage (not saline nasal spray) has been used to remove debris from the nasal cavity and temporarily reduce tissue edema (hypertonic saline) to promote drainage from the sinuses. There have been very few RCTs using saline nasal irrigation or lavage in acute sinusitis, and these have had mixed results.[97,98] The 1 study in children showed greater improvement in nasal airflow and quality of life as well as a better rate of improvement in total symptom score when compared with placebo in patients treated with antibiotics and decongestants.[98] There are 2 Cochrane reviews published on the use of saline nasal irrigation in acute sinusitis in adults that showed variable results. One review published in 2007[99] concluded that it is a beneficial adjunct, but the other, published in 2010,[100] concluded that most trials were too small or contained too high a risk of bias to be confident about benefits.

Nasal Decongestants, Mucolytics, and Antihistamines

Data are insufficient to make any recommendations about the use of oral or topical nasal decongestants, mucolytics, or oral or nasal spray antihistamines as adjuvant therapy for acute bacterial sinusitis in children.[79] It is the opinion of the expert panel that antihistamines should not be used for the primary indication of acute bacterial sinusitis in any child, although such therapy might be helpful in reducing typical allergic symptoms in patients with atopy who also have acute sinusitis.

OTHER RELATED CONDITIONS

Recurrence of Acute Bacterial Sinusitis

Recurrent acute bacterial sinusitis (RABS) is an uncommon occurrence in healthy children and must be distinguished from recurrent URIs, exacerbations of allergic rhinitis, and chronic sinusitis. The former is defined by episodes of bacterial infection of the paranasal sinuses lasting fewer than 30 days and separated by intervals of

TABLE 3 Parent Information Regarding Initial Management of Acute Bacterial Sinusitis

How common are sinus infections in children?	Thick, colored, or cloudy mucus from your child's nose frequently occurs with a common cold or viral infection and does not by itself mean your child has sinusitis. In fact, fewer than 1 in 15 children get a true bacterial sinus infection during or after a common cold.
How can I tell if my child has bacterial sinusitis or simply a common cold?	Most colds have a runny nose with mucus that typically starts out clear, becomes cloudy or colored, and improves by about 10 d. Some colds will also include fever (temperature >38°C [100.4°F]) for 1 to 2 days. In contrast, acute bacterial sinusitis is likely when the pattern of illness is persistent, severe, or worsening. 1. *Persistent* sinusitis is the most common type, defined as runny nose (of any quality), daytime cough (which may be worse at night), or both for at least 10 days without improvement. 2. *Severe* sinusitis is present when fever (temperature ≥39°C [102.2°F]) lasts for at least 3 days in a row and is accompanied by nasal mucus that is thick, colored, or cloudy. 3. *Worsening* sinusitis starts with a viral cold, which begins to improve but then worsens when bacteria take over and cause new-onset fever (temperature ≥38°C [100.4°F]) or a substantial increase in daytime cough or runny nose.
If my child has sinusitis, should he or she take an antibiotic?	Children with *persistent* sinusitis may be managed with either an antibiotic or with an additional brief period of observation, allowing the child up to another 3 days to fight the infection and improve on his or her own. The choice to treat or observe should be discussed with your doctor and may be based on your child's quality of life and how much of a problem the sinusitis is causing. In contrast, all children diagnosed with *severe* or *worsening* sinusitis should start antibiotic treatment to help them recover faster and more often.
Why not give all children with acute bacterial sinusitis an immediate antibiotic?	Some episodes of *persistent* sinusitis include relatively mild symptoms that may improve on their own in a few days. In addition, antibiotics can have adverse effects, which may include vomiting, diarrhea, upset stomach, skin rash, allergic reactions, yeast infections, and development of resistant bacteria (that make future infections more difficult to treat).

at least 10 days during which the patient is asymptomatic. Some experts require at least 4 episodes in a calendar year to fulfill the criteria for this condition. Chronic sinusitis is manifest as 90 or more uninterrupted days of respiratory symptoms, such as cough, nasal discharge, or nasal obstruction.

Children with RABS should be evaluated for underlying allergies, particularly allergic rhinitis; quantitative and functional immunologic defect(s), chiefly immunoglobulin A and immunoglobulin G deficiency; cystic fibrosis; gastroesophageal reflux disease; or dysmotile cilia syndrome.[101] Anatomic abnormalities obstructing one or more sinus ostia may be present. These include septal deviation, nasal polyps, or concha bullosa (pneumatization of the middle turbinate); atypical ethmoid cells with compromised drainage; a lateralized middle turbinate; and intrinsic ostiomeatal anomalies.[102] Contrast-enhanced CT, MRI, or endoscopy or all 3 should be performed for detection of obstructive conditions, particularly in children with genetic or acquired craniofacial abnormalities.

The microbiology of RABS is similar to that of isolated episodes of acute bacterial sinusitis and warrants the same treatment.[72] It should be recognized that closely spaced sequential courses of antimicrobial therapy may foster the emergence of antibiotic-resistant bacterial species as the causative agent in recurrent episodes. There are no systematically evaluated options for prevention of RABS in children. In general, the use of prolonged prophylactic antimicrobial therapy should be avoided and is not usually recommended for children with recurrent acute otitis media. However, when there are no recognizable predisposing conditions to remedy in children with RABS, prophylactic antimicrobial agents may be used for several months during the respiratory season. Enthusiasm for this strategy is tempered by concerns regarding the encouragement of bacterial resistance. Accordingly, prophylaxis should only be considered in carefully selected children whose infections have been thoroughly documented.

Influenza vaccine should be administered annually, and PCV-13 should be administered at the recommended ages for all children, including those with RABS. Intranasal steroids and nonsedating antihistamines can be helpful for children with allergic rhinitis, as can antireflux medications for those with gastroesophageal reflux disease. Children with anatomic abnormalities may require endoscopic surgery for removal of or reduction in ostiomeatal obstruction.

The pathogenesis of chronic sinusitis is poorly understood and appears to be multifactorial; however, many of the conditions associated with RABS

TABLE 4 Management of Worsening or Lack of Improvement at 72 Hours

Initial Management	Worse in 72 Hours	Lack of Improvement in 72 Hours
Observation	Initiate amoxicillin with or without clavulanate	Additional observation or initiate antibiotic based on shared decision-making
Amoxicillin	High-dose amoxicillin-clavulanate	Additional observation or high-dose amoxicillin-clavulanate based on shared decision-making
High-dose amoxicillin-clavulanate	Clindamycin[a] and cefixime OR linezolid and cefixime OR levofloxacin	Continued high-dose amoxicillin-clavulanate OR clindamycin[a] and cefixime OR linezolid and cefixime OR levofloxacin

[a] Clindamycin is recommended to cover penicillin-resistant *S pneumoniae*. Some communities have high levels of clindamycin-resistant *S pneumoniae*. In these communities, linezolid is preferred.

have also been implicated in chronic sinusitis, and it is clear that there is an overlap between the 2 syndromes.[101,102] In some cases, there may be episodes of acute bacterial sinusitis superimposed on a chronic sinusitis, warranting antimicrobial therapy to hasten resolution of the acute infection.

Complications of Acute Bacterial Sinusitis

Complications of acute bacterial sinusitis should be diagnosed when the patient develops signs or symptoms of orbital and/or central nervous system (intracranial) involvement. Rarely, complicated acute bacterial sinusitis can result in permanent blindness, other neurologic sequelae, or death if not treated promptly and appropriately. Orbital complications have been classified by Chandler et al.[32] Intracranial complications include epidural or subdural abscess, brain abscess, venous thrombosis, and meningitis.

Periorbital and intraorbital inflammation and infection are the most common complications of acute sinusitis and most often are secondary to acute ethmoiditis in otherwise healthy young children. These disorders are commonly classified in relation to the orbital septum; periorbital or preseptal inflammation involves only the eyelid, whereas postseptal (intraorbital) inflammation involves structures of the orbit. Mild cases of preseptal cellulitis (eyelid <50% closed) may be treated on an outpatient basis with appropriate oral antibiotic therapy (high-dose amoxicillin-clavulanate for comprehensive coverage) for acute bacterial sinusitis and daily follow-up until definite improvement is noted. If the patient does not improve within 24 to 48 hours or if the infection is progressive, it is appropriate to admit the patient to the hospital for antimicrobial therapy. Similarly, if proptosis, impaired visual acuity, or impaired and/or painful extraocular mobility is present on examination, the patient should be hospitalized, and a contrast-enhanced CT should be performed. Consultation with an otolaryngologist, an ophthalmologist, and an infectious disease expert is appropriate for guidance regarding the need for surgical intervention and the selection of antimicrobial agents.

Intracranial complications are most frequently encountered in previously healthy adolescent males with frontal sinusitis.[33,34] In patients with altered mental status, severe headache, or Pott's puffy tumor (osteomyelitis of the frontal bone), neurosurgical consultation should be obtained. A contrast-enhanced CT scan (preferably coronal thin cut) of the head, orbits, and sinuses is essential to confirm intracranial or intraorbital suppurative complications; in such cases, intravenous antibiotics should be started immediately. Alternatively, an MRI may also be desirable in some cases of intracranial abnormality. Appropriate antimicrobial therapy for intraorbital complications include vancomycin (to cover possible methicillin-resistant *S aureus* or penicillin-resistant *S pneumoniae*) and either ceftriaxone, ampicillin-sulbactam, or piperacillin-tazobactam.[103] Given the polymicrobial nature of sinogenic abscesses, coverage for anaerobes (ie, metronidazole) should also be considered for intraorbital complications and should be started in all cases of intracranial complications if ceftriaxone is prescribed.

Patients with small orbital, subperiosteal, or epidural abscesses and minimal ocular and neurologic abnormalities may be managed with intravenous antibiotic treatment for 24 to 48 hours while performing frequent visual and mental status checks.[104] In patients who develop progressive signs and symptoms, such as impaired visual acuity, ophthalmoplegia, elevated intraocular pressure (>20 mm), severe proptosis (>5 mm), altered mental status, headache, or vomiting, as well as those who fail to improve within 24 to 48 hours while receiving antibiotics, prompt surgical intervention and drainage of the abscess should be undertaken.[104] Antibiotics can be tailored to the results of culture and sensitivity studies when they become available.

AREAS FOR FUTURE RESEARCH

Since the publication of the original guideline in 2001, only a small number of high-quality studies of the diagnosis and treatment of acute bacterial sinusitis in children have been published.[5] Ironically, the number of published guidelines on the topic (5) exceeds the number of prospective,

placebo-controlled clinical trials of either antibiotics or ancillary treatments of acute bacterial sinusitis. Thus, as was the case in 2001, there are scant data on which to base recommendations. Accordingly, areas for future research include the following:

Etiology

1. Reexamine the microbiology of acute sinusitis in children in the postpneumococcal conjugate vaccine era and determine the value of using newer polymerase chain reaction–based respiratory testing to document viral, bacterial, and polymicrobial disease.
2. Correlate cultures obtained from the middle meatus of the maxillary sinus of infected children with cultures obtained from the maxillary sinus by puncture of the antrum.
3. Conduct more and larger studies to more clearly define and correlate the clinical findings with the various available diagnostic criteria of acute bacterial sinusitis (eg, sinus aspiration and treatment outcome).
4. Develop noninvasive strategies to accurately diagnose acute bacterial sinusitis in children.
5. Develop imaging technology that differentiates bacterial infection from viral infection or allergic inflammation, preferably without radiation.

Treatment

1. Determine the optimal duration of antimicrobial therapy for children with acute bacterial sinusitis.
2. Evaluate a "wait-and-see prescription" strategy for children with persistent symptom presentation of acute sinusitis.
3. Determine the optimal antimicrobial agent for children with acute bacterial sinusitis, balancing the incentives of choosing narrow-spectrum agents against the known microbiology of the disease and resistance patterns of likely pathogens.
4. Determine the causes and treatment of subacute, recurrent acute, and chronic bacterial sinusitis.
5. Determine the efficacy of prophylaxis with antimicrobial agents to prevent RABS.
6. Determine the effects of bacterial resistance among *S pneumoniae*, *H influenzae*, and *M catarrhalis* on outcome of treatment with antibiotics by the performance of randomized, double-blind, placebo-controlled studies in well-defined populations of patients.
7. Determine the role of adjuvant therapies (antihistamines, nasal corticosteroids, mucolytics, decongestants, nasal irrigation, etc) in patients with acute bacterial sinusitis by the performance of prospective, randomized clinical trials.
8. Determine whether early treatment of acute bacterial sinusitis prevents orbital or central nervous system complications.
9. Determine the role of complementary and alternative medicine strategies in patients with acute bacterial sinusitis by performing systematic, prospective, randomized clinical trials.
10. Develop new bacterial and viral vaccines to reduce the incidence of acute bacterial sinusitis.

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TECHNICAL REPORT

Evidence for the Diagnosis and Treatment of Acute Uncomplicated Sinusitis in Children: A Systematic Review

abstract

FREE

In 2001, the American Academy of Pediatrics published clinical practice guidelines for the management of acute bacterial sinusitis (ABS) in children. The technical report accompanying those guidelines included 21 studies that assessed the diagnosis and management of ABS in children. This update to that report incorporates studies of pediatric ABS that have been performed since 2001. Overall, 17 randomized controlled trials of the treatment of sinusitis in children were identified and analyzed. Four randomized, double-blind, placebo-controlled trials of antimicrobial therapy have been published. The results of these studies varied, likely due to differences in inclusion and exclusion criteria. Because of this heterogeneity, formal meta-analyses were not performed. However, qualitative analysis of these studies suggests that children with greater severity of illness at presentation are more likely to benefit from antimicrobial therapy. An additional 5 trials compared different antimicrobial therapies but did not include placebo groups. Six trials assessed a variety of ancillary treatments for ABS in children, and 3 focused on subacute sinusitis. Although the number of pediatric trials has increased since 2001, there are still limited data to guide the diagnosis and management of ABS in children. Diagnostic and treatment guidelines focusing on severity of illness at the time of presentation have the potential to identify those children most likely to benefit from antimicrobial therapy and at the same time minimize unnecessary use of antibiotics. *Pediatrics* 2013;132:e284–e296

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KEY WORDS

acute bacterial sinusitis, antibiotics, ancillary treatment, diagnosis, systematic review

ABBREVIATIONS

AAP—American Academy of Pediatrics

CT—computed tomography

INTRODUCTION

Acute bacterial sinusitis is reported as a complication of 5% to 10% of upper respiratory tract infections in children[1,2] and is 1 of the more common indications for antibiotic use in the United States. In 2001, the American Academy of Pediatrics (AAP) published clinical practice guidelines for the management of sinusitis in children.[3] The 2001 technical report that accompanied those guidelines included an analysis of 21 studies published from January 1966 through March 1999 which assessed the diagnosis and therapeutic management of acute sinusitis in children.[4] These included 5 randomized controlled trials involving 255 children and 8 case series involving 418 children. The primary goal of the current analysis was to update the 2001

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technical report by identifying and reviewing additional studies of pediatric acute sinusitis that have been performed in the last decade to aid the revision of the AAP practice guidelines.

This technical report revisits the same questions as the original report: (1) What is the efficacy of various types of antimicrobial therapy in children with acute sinusitis? (2) What is the efficacy of nonantimicrobial ancillary treatments in children with acute sinusitis? (3) What is the concordance of various clinical, laboratory, and radiographic findings in the diagnosis of acute sinusitis? In addition, the Subcommittee on Management of Sinusitis met before the initial literature search for the current report and raised additional questions:

1. What is the incidence of adverse events in the treatment of sinusitis?
2. Are there data to support the clinical definitions of acute, subacute, and recurrent acute sinusitis?
3. Are there data to recommend a specific duration of symptoms that distinguishes bacterial from viral sinusitis?
4. How have the epidemiology and bacteriology of acute sinusitis changed in the pneumococcal conjugate vaccine era?
5. Is there evidence to support antimicrobial prophylaxis in children with recurrent sinusitis?
6. What other guidelines for the management of acute sinusitis in children exist?

METHODS

Searches of PubMed were performed by using the same search term as in the 2001 report ("sinusitis"). All searches were limited to English language and human studies. Three separate searches were performed to maximize retrieval of the most recent and highest-quality evidence for pediatric sinusitis. The first search limited results to all randomized controlled trials from 1966 to 2009, the second to all meta-analyses from 1966 to 2009, and the third to all pediatric studies (age limit <18 years) published since the last technical report (1999–2009). In addition, Web of Science was used to search for additional studies that cited the 2001 technical report and guidelines as well as citations of each double-blind, randomized controlled pediatric trial identified. The Cochrane Database of Systematic Reviews was also reviewed. Finally, ClinicalTrials.gov was searched to identify results of unpublished and ongoing studies. The Jadad scale (Table 1) was used to assess the quality of randomized trials included in this analysis.[5] Additional literature updates using the same search strategies were performed in July 2010 and November 2012.

Whenever possible, data from randomized controlled trials (preferably placebo controlled) were used to answer the questions raised by the committee. When no such data were available, separate literature searches were performed.

TABLE 1 Criteria for Assessing Randomized Trials

Give 1 point for each of the following:
a. The study is described as randomized
b. The study is described as double-blind
c. There was a description of withdrawals and dropouts
Given 1 additional point if:
a. For randomized studies, the method of randomization was described and is appropriate
b. For double-blind studies, the method of blinding was described and is appropriate
Deduct 1 point if:
c. For randomized studies, the method of randomization was described and is inappropriate
d. For double-blind studies, the method of blinding was described and is inappropriate

Adapted from Jadad et al.[5]

RESULTS

In the initial search, 183 randomized trials were identified, 98 of which were published since 1998. Of these 98, a total of 62 were eliminated on the basis of titles indicating a focus on adults, chronic sinusitis, or postsurgical management. Inclusion criteria and results of the remaining 36 studies were reviewed. Seven studies included adolescents as young as 12 years, but they represented <2% of the study population, and no age-specific results were reported. Twenty-one additional studies included teenagers but did not report how many were included; average ages for these studies were in the third to fourth decade of life. The updated literature search in July 2010 identified 2 additional randomized controlled trials that focused on ancillary treatment of sinusitis in children. A final search performed in November 2012 did not identify any additional controlled trials.

Overall, 17 randomized studies of sinusitis in children were identified and included in the current analysis. The meta-analysis search identified 1 study that focused exclusively on children and 2 others that focused primarily on adults but also assessed and separately reported results of pediatric studies. A review of ClinicalTrials.gov identified 28 sinusitis studies including children aged <18 years, only 3 of which were limited exclusively to children. One of these (Wald et al[6]) has recently been published and is included in the analysis; the other 2 studies are not yet recruiting patients.

TREATMENT

Efficacy of Antimicrobial Therapy

Randomized Placebo-Controlled Trials

Four randomized, double-blind, placebo-controlled trials involving 392 children were identified (Table 2).[6–9] An

additional study[10] that was included in the previous technical report was excluded because it included patients with chronic and subacute sinusitis. The results of these 4 studies varied. Two studies favored treatment, and the other 2 found no significant difference in clinical cure between the treatment and control groups.

Clinical improvement in children receiving placebo ranged from 14% to 79% across the 4 studies, suggesting significant heterogeneity. The outcomes in the treatment groups were less varied, ranging from 50% to 81%. However, the efficacies of specific treatments are difficult to compare directly because the studies were performed over a 25-year period, during which a universal conjugate pneumococcal vaccination program was introduced and the prevalence of penicillin-resistant *Streptococcus pneumoniae* and β-lactamase–producing *Moraxella* and *Haemophilus* species increased.

The disparity in outcomes in the placebo groups is likely explained by the different methods used in each study. Notably, the inclusion criteria differed between each of the 4 studies. For instance, the minimal duration of symptoms required for entry into the study by Kristo et al[9] was not specified and averaged between 8 and 9 days for the treatment and control groups, respectively. Furthermore, only 32% of subjects had symptoms lasting at least 10 days. Therefore, the results of this study are not generalizable to the AAP definition of sinusitis, which is 10 days of symptoms, and should not be considered in the revised guidelines. Inclusion criteria for persistent symptoms in the other 3 studies were similar. Each specified respiratory symptoms that persisted for at least 10 days but <30 days. Only the 1986 study by Wald et al[7] required an abnormal radiograph for study entry. Another study by Wald et al (in 2009)[6] was the only trial to include a subgroup of children who met criteria for worsening (on or after day 6 with fever or increase in symptoms) or severe (temperature ≥102°F with purulent discharge for at least 3 consecutive days) symptoms of sinusitis.

Exclusion criteria for each of these 3 studies had some similarities. Allergy to study drug, recent receipt of antibiotics, and concurrent bacterial infection requiring treatment were exclusion criteria in all of the studies. Complications of sinusitis were also listed as exclusion criteria, although the definitions of this factor differed between the studies. For instance, Garbutt et al[8] excluded children with "fulminant sinusitis," including children with fever ≥39°C (102.2°F); this condition was a specific inclusion criterion for the severe group in the 2009 study by Wald et al.[6] In addition, underlying medical conditions were used to exclude children, but the specific diagnoses differed in the 3 studies. Wald et al[7] excluded children with a variety of underlying medical conditions, including history of asthma and allergic rhinitis. Garbutt et al[8] only excluded children with cystic fibrosis; children with asthma and allergic rhinitis were included. Wald et al[6] only excluded children with immunodeficiency or anatomic abnormality of the upper respiratory tract.

The 3 studies used similar randomization schemes: patients were stratified according to age group and clinical severity before randomization. However, the metrics of clinical severity differed. The 2 studies by Wald et al[6,7] used a 10-point questionnaire (Table 3), and the study by Garbutt et al[8] used the S5 score (Table 4), previously validated by the same author.[11] Although each of these 3 studies stratified patients according to clinical severity before randomization, separate results stratified by severity are not reported. This information may be helpful in the identification of patients (on the basis of clinical grounds) who might benefit from antimicrobial therapy.

Another key methodologic difference is that the study by Wald et al (1986)[7] did not use intention-to-treat analysis. Fifteen (14%) of 108 children were excluded because of lack of compliance or drug toxicity, which may have introduced bias.

Because of these significant differences in study design, formal meta-analyses were not performed. However, qualitative analysis of these results suggests that there may be certain clinical characteristics that identify patients who benefit from antimicrobial therapy.

Randomized Controlled Comparison Trials

In addition to the 4 placebo-controlled studies described previously, there have been other randomized studies of acute sinusitis in children comparing different antimicrobial treatment courses (Table 5).[12–16] Three of these were included in the previous report, and 2 additional studies have been published since 1998. None of these studies demonstrated a clear advantage of 1 therapy over another, and rates of cure or improvement were well above 80%. Although these studies offer some insight into the relative efficacies of different treatments, they do not include a placebo group. This factor is important given that many of the children included in these studies may have improved spontaneously without any specific antimicrobial therapy. In addition, none of these studies was designed as noninferiority or equivalence studies and, therefore, may have been underpowered to detect true differences between competing treatments.

TABLE 2 Randomized, Placebo-Controlled Trials of Antimicrobial Treatment of Acute Sinusitis in Children

Variable	Wald et al[7]	Garbutt et al[8]	Kristo et al[9]	Wald et al[6]
Inclusion criteria	Nasal discharge of any quality	"Persistent upper respiratory symptoms"	Acute respiratory symptoms suggestive of sinusitis that were "not improving"	Persistent: nasal discharge of any quality and/or daytime cough persisting for >10 d without improvement
	and/or		Nasal discharge and obstruction, sneezing, cough	Worsening: worsening on or after day 6 with fever or increase in symptoms
	Cough			Severe: temperature ≥102°F with purulent nasal discharge for at least 3 consecutive days
	Symptoms present for 10–30 d	Symptoms present for 10–28 d	Symptoms present <3 wk, no lower bound	Symptoms present <30 d, lower bound per definitions above
	Age: 2–16 y	Age: 1–18 y	Age: 4–10 y	Age: 1–10 y
	Abnormal radiograph results	NA	Abnormal US	NA
Exclusion criteria	Penicillin allergy	Allergy	Allergy	Allergy
	Previous Rx within 3 d	Previous Rx within 2 wk	Previous Rx within 4 wk	Previous Rx within 15 d
	Underlying conditions (asthma, allergic rhinitis, CF, sickle cell anemia, congenital heart disease, immunodeficiency)	CF only	Previous sinus surgery	Underlying conditions (immunodeficiency or anatomic abnormality of upper respiratory tract)
	Otitis media, pneumonia, GAS pharyngitis (throat/NP culture performed at study enrollment)	"Fulminant sinusitis"	Current antimicrobial Rx	Concurrent bacterial infection
	Severe headache or periorbital swelling	(fever >39°C, facial swelling, facial pain)	"Complications of sinus disease"	Complication of sinusitis requiring hospitalization, IV antibiotics, or subspecialty evaluation.
	Normal radiograph of paranasal sinuses	NA	NA	NA
Source of patients	Primary or secondary care patients at an academic children's hospital	3 suburban primary care practices	1 private health care center	2 private practices, 1 hospital-based clinic
Randomization			Block randomization	Assigned to persistent or nonpersistent group then
	Stratified by age: (<6 and ≥6 y)	Stratified by age: (<7 and ≥7 y)		Stratified by age: (<6 and ≥6 y)
	And clinical severity	And clinical severity		And clinical severity
	Then randomized	Then randomized		Then randomized
Metric for severity	Clinical severity score: <8 is mild and ≥8 is severe	Clinical severity score using S5 score	8 acute symptoms, rated 0–4	Same as Wald et al[7]
Telephone follow-up	1, 2, 3, 5, and 7 d	3, 7, 10, 14, 21, 28, and 60 d	NA	1, 2, 3, 5, 7, 10, 20, and 30 d
Clinical visit	Day 10	Day 14	Day 14	Day 14
Primary outcome	Clinical outcome at 3 and 10 d	Change in sinus symptoms at day 14	% complete cure at 2 wk	Cure at day 14
Secondary outcomes	Not specified	Adverse events	Adverse effects	Adverse events
		Relapse	Improvement without complications	Proportion with treatment failure
		Change in functional status		
		Parental satisfaction with treatment	Days when analgesics, nasal decongestants or cough mixtures were given	
N placebo	35	55	41	28
N treatment group	30 amoxicillin (40 mg/kg per day) divided 3 times/d for 10 d	58 amoxicillin (40 mg/kg per day) divided 3 times/d for 14 d	41 cefuroxime 125 mg 2 times/d for 10 d	28 amoxicillin/clavulanate (90 mg/kg amoxicillin + 6.4 mg clavulanate) divided 2 times/d for 14 days
	28 amoxicillin/clavulanate	48 amoxicillin/clavulanate (45 mg/kg per day amoxicillin) divided 2 times/d for 14 d		
Adjuvant therapy	None were prescribed. Not formally studied	Prescription or over-the-counter symptomatic treatments allowed. Use recorded	Analgesics, nose drops, and cough mixtures allowed. Use recorded in diary	Use "discouraged"—not formally studied
Compliance	History and remaining medications at follow-up visit	Self-report at day 14	Residual drugs collected at day 14	History and remaining medications at follow-up visit

TABLE 2 Continued

Variable	Wald et al[7]	Garbutt et al[8]	Kristo et al[9]	Wald et al[6]
Adverse events	Children who developed rash and diarrhea were excluded from analysis	Assessed at day 14	Assessed at day 14	Assessed at day 14
Loss to follow-up	15 children excluded because of adverse events (8) and noncompliance (7)	None (typographic error in original manuscript)	3 children (2 placebo, 1 treatment) lost to follow-up	6 lost to follow-up in treatment group
Primary outcome	Cure at 10 d: Amoxicillin: 20/30 (67%); Amoxicillin/clavulanate: 18/28 (64%); Placebo: 15/35 (43%) Total: Antibiotic: 38/58; Placebo: 15/35 (66% vs 43%; $P < .05$) Failure at 10 d: Amoxicillin: 5/30; Amoxicillin/clavulanate: 7/28; Placebo: 14/35 Total: Antibiotic: 12/58; Placebo: 15/35 (21% vs 43%; $P < .05$)	Improvement at 14 d: Amoxicillin: 79% (46/58); Amoxicillin/clavulanate: 81% (39/48); Placebo: 79% (43/55)	Cure at 14 d: 22/35 in experimental group vs 21/37 in placebo (63% vs 57%; $P = .64$)	Cure at 14 d: 14/28 in experimental group vs 4/28 in placebo (50% vs 14%' $P = .01$) Failure at 14 d: 4/28 in experimental group vs 19/28 in placebo (14% vs 68%; $P < .001$) If all subjects lost to follow-up were considered failures, therapy is still effective (35% vs 68%; $P = .032$)
Jadad score	3	5	4	4

CF, cystic fibrosis; GAS, group A streptococcal; IV, intravenous; NA, not applicable; NP, nasopharyngeal; Rx, prescription; US, ultrasonography.

In addition to these randomized comparator studies, Garbutt et al[8] and Wald et al[7] used amoxicillin and amoxicillin/clavulanic acid treatments arms in their placebo-controlled studies. No significant differences between these 2 treatments were detected.

TABLE 3 Scale Used in Studies by Wald et al[6,7]

Symptoms or Signs	Points
Abnormal nasal or postnasal discharge	
Minimal	1
Severe	2
Nasal congestion	1
Cough	2
Malodorous breath	1
Facial tenderness	3
Erythematous nasal mucosa	1
Fever	
<38.5°C	1
≥38.5°C	2
Headache (retro-orbital)	
Severe	3
Mild	1

Interpretation: <8 = mild, ≥8 = severe.

TABLE 4 Scale Used by Garbutt et al[11]

Symptom	Points			
	1	2	3	0
Blocked up or stuffy nose	Small	Medium	Large	Not a problem or do not know
Headaches or face pain	Small	Medium	Large	Not a problem or do not know
Coughing during the day	Small	Medium	Large	Not a problem or do not know
Coughing at night	Small	Medium	Large	Not a problem or do not know
Color of child's mucus			Yellow or green	None or clear

S5 score is obtained by averaging the scores for each symptom. In the clinical trial,[8] children were stratified into 2 groups before randomization: S5 score <2 or S5 score ≥2.

Adverse Events Associated With Antimicrobial Therapy

Randomized Placebo-Controlled Trials

Adverse effects of treatment were described in all 3 studies. In the first study by Wald et al,[7] rash developed in 1 child in the amoxicillin group and 1 in the placebo group. Diarrhea, requiring cessation of therapy, developed in 6 children in the amoxicillin/clavulanic acid group and 1 child in the placebo group. In the study by Garbutt et al,[8] one-half of all study participants reported an adverse effect; these events were equally distributed across the study groups. Diarrhea was reported by 20% to 22% of participants ($P = .97$ between the 3 groups). The only reported adverse effect that reached statistical significance was abdominal pain, which occurred in 29% of children in the amoxicillin group but only 15% and 9% of children in the amoxicillin/clavulanate and placebo groups, respectively ($P = .02$). In the most recent study by Wald et al,[6] 44% of children in the experimental group experienced an adverse event compared with 14% in the control group ($P = .014$). The incidences of specific adverse events were not described, but diarrhea was reportedly the most common. Although efficacy data from the study by Kristo et al[9] should not be considered in the guidelines, data can be used to compare adverse events associated with antimicrobial therapy compared with placebo. In this study, 3 children developed self-limited diarrhea (1 in the cefuroxime group and 2 in the placebo group).

Randomized Controlled Comparison Trials

Adverse events were reported in 4 of these studies.[12,14–16] The incidence of

TABLE 5 Randomized Controlled Trials Comparing Different Antimicrobial Treatments for Acute Sinusitis

Author (Year)	Age (y)	Antimicrobial Agents	Duration	*N*	Cured (%)	Improved (%)	Failed (%)	Relapsed (%)	Recurred (%)	Jadad Score
Poachanukoon and Kitcharoensakkul (2008)[12]	1–15	Amoxicillin-clavulanate (80–90 mg/kg per day)	14 d	72	ND	85	ND	11	6	3
		Cefditoren (4–6 mg/kg) 2 times/d	14 d	66	ND	79	ND	9	3	
Simon (1999)[13]	0.5–17	Erythromycin (40 mg/kg per day)	14 d	50	96	ND	4	ND	10	1
		Ceftibuten (9 mg/kg per day)	10 d	50	92	ND	8	ND	12	
		Ceftibuten (9 mg/kg per day)	15 d	50	92	ND	8	ND	8	
		Ceftibuten (9 mg/kg per day)	20 d	50	100	ND	0	ND	8	
Ficnar et al (1997)[14]	0.5–12	Azithromycin (10 mg/kg per day)	3 d	27	96	ND	0	4	ND	1
		Azithromycin (10 mg/kg on day 1, then 5 mg/kg on days 2–5)	5 d	18	100	ND	0	0	ND	
Careddu et al (1993)[15]	2–14	Brodimoprim (10 mg/kg on day 1, then 5 mg/kg per day)	8 d	25	96	ND	4	ND	ND	1
		Amoxicillin-clavulanate (50 mg/kg per day)	NS	27	85	ND	15	ND	ND	
Wald et al (1984)[16]	1–16	Amoxicillin (40 mg/kg per day)	10 d	27	81	4	11	4	4	3
		Cefaclor (40 mg/kg per day)	10 d	23	78	9	4	11	17	

ND, not determined; NS, not specified.

adverse events did not differ between study groups for 3 of these studies. Poachanukoon and Kitcharoensakkul[12] reported a higher rate of diarrhea (18.1%) in children receiving amoxicillin/clavulanate compared with those receiving cefditoren (4.5% [P = .02]). However, diarrhea was self-limited and did not require termination of medication or study withdrawal.

ANCILLARY TREATMENTS

Six randomized-controlled trials have assessed a variety of ancillary treatments for acute sinusitis (Table 6)[17–20] and are summarized here.

Steroids

The 2001 technical report described 1 study that assessed the efficacy of intranasal steroids in children.[17] In that study, 89 children received amoxicillin/clavulanate (40 mg/kg per day) and were randomized to receive either budesonide nasal spray (n = 43) or placebo (n = 46) for 3 weeks. Although no difference in symptom improvement was noted between the groups at the end of therapy (3 weeks), children in the budesonide group had improved cough and nasal discharge at 2 weeks, whereas children in the placebo group did not, suggesting that corticosteroids may lead to more rapid resolution of symptoms. Since then, there has been 1 other randomized controlled trial in children studying the efficacy of intranasal budesonide.[18] In this study, 52 children (mean age: 8 years; age range: 6–16 years) with acute maxillary sinusitis received cefaclor (40 mg/kg) for 10 days with either pseudoephedrine (2 × 30 mg daily) or intranasal budesonide (2 × 100 μg daily) for 10 days. There was no placebo group. Children with underlying allergy were excluded. Children in the budesonide group had statistically significantly better resolution of headache, cough, nasal stuffiness, and nasal drainage. There were no adverse events reported. However, these authors defined acute sinusitis as an infection that could take up to 12 weeks for complete resolution, and the results may therefore not be generalizable to AAP guidelines.

Decongestant-Antihistamine

No randomized controlled studies have been performed since a study cited in the 2001 report.[19] All children in that study received 14 days of amoxicillin (37.5–50 mg/kg per day, divided 3 times per day). They were then randomized to receive either placebo or the combination of oxymetazoline nasal spray and an oral decongestant-antihistamine. Both groups had marked clinical improvement in symptoms 3 days into treatment. In addition, there were no significant differences in clinical or radiographic findings between the 2 groups at the end of treatment.

Nasal Spray

One randomized controlled trial compared the use of 14 days of treatment with Ems mineral salts versus xylometazoline (0.05% solution) nasal spray in children with acute sinusitis.[20] There was no placebo group, and antibiotic use was not permitted. The primary outcome was mucosal inflammation (rubescence, swelling, and discharge) at baseline, day 7, and day 14. There were no significant differences between the 2 groups at day 14. However, at day 7, the mineral salt group had less nasal discharge than the xylometazoline group (P = .0163), suggesting that the spray may lead to more

TABLE 6 Randomized Controlled Trials of Ancillary Therapies for Acute Sinusitis

Author (Year)	Age (y)	Inclusion Criteria	Primary Therapy	LOT	Other Treatments	*N*	Main Outcome	Jadad Score
Barlan et al (1997)[17]	1–15	2 major, or 1 major and 2 minor criteria. Duration >7 d; Major criteria: purulent nasal discharge, purulent pharyngeal drainage, cough; Minor criteria: periorbital edema, facial pain, tooth pain, earache, sore throat, wheeze, headache, foul breath, fever	Intranasal budesonide (50 μg each nostril) 2 times/day; Intranasal placebo bid	21 21	All received amoxicillin/clavulanate (40 mg/kg per day)	43 46	No difference in cough or nasal discharge scores at weeks 1 or 3. Budesonide scores statistically lower (less symptomatic) at week 2 for both outcomes	2
Yilmaz et al (2000)[18]	6–16	Specific symptoms not specified Duration: infection that could take up to 12 wk to resolve	Intranasal budesonide (2 × 100 μg) Oral pseudoephedrine (2 × 30 mg)	10 10	All received cefaclor (40 mg/kg per day)	26 26	Budesonide group statistically better improvement in headache, cough, nasal stuffiness, and nasal drainage at day 10	1
McCormick et al (1996)[19]	1–18	8–29 d of sinusitis symptoms	Oxymetazoline nasal spray (0.05%) plus syrup with decongestant-antihistamine Placebo nasal spray and syrup	14 14	All children received amoxicillin by age/weight: 10–12 kg, 150 mg tid; 12.1–15 kg, 200 mg tid; >15 kg, 250 mg tid Teenagers: 40 mg/kg per day (maximum: 500 tid)	34 34	No difference between groups in mean symptom score at enrollment, day 3, or day 14	4
Michel et al (2005)[20]	2–6	"Definition give[n] by the AAP"	Intranasal isotonic Ems mineral salts Intranasal xylometazoline (0.05%)	14 14	No additional treatment (including antibiotics) allowed	66[a]	No difference in symptoms at day 14. Ems group had statistically significant less inflammation at day 7	2
Wang et al (2009)[21]	3–12	(1) URI with purulent nasal discharge and/or cough >7 d (2) Abnormal findings of 1 or both maxillary sinuses by Water's projection	Standard therapy plus normal saline nasal irrigation, 15–20 mL per nostril 1–3 times/day Standard therapy alone	21 21	"Standard therapy" defined as systemic antibiotics, mucolytics, and nasal decongestants	30 39	Saline group had better scores for daytime rhinorrhea and nighttime nasal congestion. No statistically significant differences in quality of life score, nasal smear, or Water's projection	1
Unuvar et al (2010)[22]	3–12	(1) 10–30 d of URTI symptoms (2) Presence of severe symptoms of rhinosinusitis	Erdosteine syrup (5–8 mg/kg/day orally divided bid) Placebo	14 14	None	49 43	No significant difference in clinical improvement at 14 d between the 2 groups	4

bid, 2 times per day; LOT, length of therapy; tid, 3 times per day; URTI, upper respiratory tract infection.

[a] Sixty-six patients in trial; numbers in each treatment arm not specified.

rapid resolution of symptoms. Wang et al[21] randomized 69 children to receive standard therapy (systemic antibiotics, mucolytic agents, and nasal decongestants) or standard therapy plus nasal irrigation (15–20 mL of normal saline administered via syringe to each nostril 1–3 times per day). Outcomes included a daily nasal symptom score (summarized weekly), pediatric rhinoconjunctivitis quality of life questionnaire (at baseline and 3 weeks), weekly nasal peak expiratory flow rate, weekly nasal smear, and Water's projection (baseline and 3 weeks). The irrigation group had significantly better symptom scores for daytime (but not nighttime) rhinorrhea at weeks 1, 2, and 3 and nighttime (but not daytime) nasal congestion at weeks 1, 2, and 3. Children in the irrigation group also had better nasal peak expiratory flow rates and slightly better quality of life scores at 3 weeks. There were no statistically significant differences in nasal smear or Water's projections between the 2 groups after 3 weeks of treatment.

Mucolytic Agents

One randomized controlled trial assessed S5 scores in 49 children receiving the mucolytic erdosteine

compared with 43 children who received placebo.[22] After 14 days of treatment, there was no significant difference in S5 scores between the 2 groups.

In addition to these studies, which were specifically designed to assess the efficacy of nonantimicrobial therapy, use of ancillary measures was measured and reported for 2 of the randomized trials of antimicrobial use. In the study by Garbutt et al,[8] there were no significant differences in the overall use of ancillary therapies between the treatment and placebo groups (52% vs 48% vs 49%; $P = .92$). Although individual-level data were not presented, this finding makes it unlikely that unbalanced use of adjuvant therapies contributed to the study outcomes. Among individual therapies, only use of combination products was reported more frequently in 1 group (10% of amoxicillin/clavulanate vs 0% and 2% of amoxicillin and placebo, respectively; $P = .01$). In the study by Poachanukoon and Kitcharoensakkul,[12] use of concomitant intranasal corticosteroids (52%) and oral decongestants (22%) was common but did not differ between the study groups.

DIAGNOSIS

Although sinus aspiration remains the gold standard for diagnosis of acute sinusitis, it is rarely practiced outside of the research setting. Furthermore, few recent studies have used aspiration as a criterion for study entry or used bacteriologic cure as an outcome. Despite these microbiologic limitations, evidence from the trials summarized previously can answer a slightly different question: which (if any) clinical, laboratory, and/or radiologic findings are able to discriminate between children who are likely to benefit from antimicrobial therapy and those who are not?

CLINICAL FINDINGS

Duration of Symptoms

The most commonly used diagnostic criterion for acute bacterial sinusitis is persistent or prolonged duration of symptoms for 10 to 14 days.[23] This criterion is based on the observation that most viral upper respiratory tract infections last 5 to 7 days.[3] However, the study by Garbutt et al[8] demonstrated that duration of symptoms alone was not sufficient to warrant antimicrobial therapy. A minimum of 10 days of symptoms was required for study entry, and all 3 groups had a mean duration of symptoms greater than 2 weeks (amoxicillin: 15.8 days; amoxicillin/clavulanate: 18.5 days; placebo: 15.4 days).

Signs and Symptoms

Purulent rhinorrhea, nasal congestion, and headache are other common findings used to diagnose sinusitis.[23] The various clinical trials used different combinations of these findings in their inclusion criteria. The 3 placebo-controlled studies limited to children with at least 10 days of symptoms also used clinical severity scores based on these signs and symptoms

Tables 2 and 3 stratify study participants before randomization. Because this stratification occurred before randomization, severity-specific results might help clarify which children are likely to benefit from antimicrobial therapy.

Imaging Studies

The 2001 guidelines recommended that radiologic studies should not be used to diagnose sinusitis in children 6 years or younger and that computed tomography (CT) should be considered only for children requiring surgery.[3] Ultrasonography has also been suggested as a potential diagnostic tool for acute sinusitis. The 2001 technical report cited 1 study that demonstrated good concordance between ultrasonographic findings and retrieval of fluid on sinus aspiration.[24] On the basis of that study, ultrasonographic findings (either mucosal thickening of $\geq$5 mm or fluid in at least 1 maxillary sinus) were used as entry criteria in the study by Kristo et al.[9] In that study, children also underwent occipitomental radiography, and the film results were defined as positive for sinusitis if there was mucosal thickening of at least 4 mm, an air-fluid level, or total opacification of at least 1 maxillary sinus. Eighty-nine percent of children in the treatment group and 92% of those in the placebo group met this criterion, suggesting good concordance between plain films and ultrasonography. However, these findings were not predictive of which children would benefit from antimicrobial therapy. Radiographic studies were not used in the other 2 recent placebo-controlled studies.[6,8]

Laboratory Studies

None of the studies required routine laboratory studies for study entry. Microbiologic samples were only obtained in 2 placebo-controlled studies and did not include direct sinus sampling. Wald et al[7] used results of throat and nasopharyngeal cultures to exclude patients with group A streptococcal pharyngitis from their study. Kristo et al[9] obtained nasopharyngeal cultures on all patients but only reported those with results positive for *Streptococcus pneumoniae* and *Haemophilus influenzae*, which occurred in 12.5% of study participants.

SUBACUTE SINUSITIS

Subacute sinusitis has been defined as infection that lasts between 30 and 90 days.[3] Three small randomized

controlled trials assessing the efficacy of different treatment strategies for subacute sinusitis were identified (Table 7).[25–27] None of these studies included a placebo group. One compared empirical amoxicillin/clavulanate with culture-based (from nasal mucosa) antimicrobial treatment.[25] Culture of nasal specimens was not performed on the children in the empirical antibiotic group. Five (18.5%) of 27 culture results in the experimental group were positive for amoxicillin/clavulanate-resistant organisms (1 *Pseudomonas* species, 2 resistant to *S pneumoniae,* and 2 anaerobic streptococci), and appropriate therapy was initiated. Nasal obstruction at day 14 was unchanged or worse for 9 children (36%) in the empirical arm but only 4 children (15%) in the culture-based arm (P = .037, per authors). Another study compared azithromycin versus amoxicillin/clavulanate.[26] The third compared amoxicillin, amoxicillin/clavulanic acid, trimethoprim/sulfamethoxazole, and no antimicrobial therapy.[27] In these 2 studies, no advantage was detected in any treatment arm compared with others. However, the studies were small and were likely not powered to detect true differences.

CLINICAL QUESTIONS FOR WHICH HIGH-QUALITY DATA ARE LACKING

Definitions of Acute, Subacute, and Recurrent Acute Sinusitis

The definitions of acute, subacute, and recurrent acute sinusitis are outlined in the 2001 AAP guidelines.[3] Although logical and based on the presumed pathogenesis of these distinct clinical entities, there are few clinical or laboratory data to confirm these definitions in children. One study of subacute sinusitis included 52 sinus aspirations of 40 children with subacute (30–120 days of symptoms) sinusitis and found similar pathogens as in acute sinusitis.[28] The definition of subacute sinusitis used in this study and in the study be Ng et al[26] were derived from an expert consensus panel.[29] The study by El-Hennawi et al[23] cites the 2001 AAP guidelines, and the study by Dohlman et al[25] does not provide a reference for the study definition of subacute sinusitis.

Epidemiology of Sinusitis in the Pneumococcal Conjugate Vaccine Era

A separate literature search was performed to identify studies of sinusitis in the era of the pneumococcal conjugate vaccine. Although there are substantial data regarding the epidemiology of invasive pneumococcal disease and acute otitis media since implementation of pneumococcal immunization, no recent pediatric sinusitis studies that included microbiologic data were identified. Brook et al[30] compared culture results from sinuses of adults before and after introduction of the pneumococcal conjugate vaccine. There was a statistically significant decrease in the prevalence of *S pneumoniae* and a significant increase in the prevalence of *H influenzae*. In addition, there was a 12% decrease in penicillin resistance observed in pneumococcal

TABLE 7 Randomized Controlled Trials of Antimicrobial Therapy for Subacute Sinusitis

Author (Year)	Age (y)	Inclusion Criteria	Antimicrobial Agents	Length	Other Treatments	*N*	Better (%)	Worse or Same (%)	Jadad Score
El-Hennawi et al (2006)[25]	<2	Persistent nasal discharge and nasal obstruction for 30–90 d	Amoxicillin-clavulanate (40 mg/kg per day)	14 d	All had therapeutic nasal suction every third day	30	64	36	2
			Culture-based (nasal suction)			30			
			Amoxicillin/clavulanate (40 mg/kg per day)			12	83	17	
			Amoxicillin/clavulanate (90 mg/kg per day)	14 d		6	100	0	
			Other antibiotics			5	100	0	
			No antibiotics (negative culture result)			4	50	50	
Ng et al (2000)[26]	5–16	Nasal discharge or blockage for 30–120 d and abnormal sinus radiograph	Azithromycin (10 mg/kg per day)	3 d	All received budesonide nasal spray 50 μg/nostril 2 times/day for 91 d	20	ND[a]	30	3
			Amoxicillin/clavulanate (312 mg 3 times/day if aged ≤12 y or 375 mg 3 times/day if aged >12 y)	14 d		21	ND[a]	24	
Dohlman et al (1993)[27]	2–16	Mucoid nasal drainage, cough, or poorly controlled asthma for 3 wk–3 mo and abnormal sinus radiograph	Amoxicillin (30-40 mg/kg per day)	21 d	All received oral phenylephrine, phenylpropanolamine, and guaifenesin; all received saline nasal spray	25	72	28	3
			Amoxicillin-clavulanate (30-40 mg/kg per day)	21 d		26	73	27	
			TMP/SMX (8 mg/kg per day)	21 d		26	69	31	
			None			19	63	37	

ND, not determined; TMP/SMX, trimethoprim/sulfamethoxazole.

[a] This study only reported "failures."

isolates and a 6% increase in β-lactamase–producing *H influenzae,* but these findings did not reach statistical significance. The same authors also compared nasopharyngeal (but not sinus) cultures in children before and after licensure of the pneumococcal conjugate vaccine and found similar results.[31]

Antimicrobial Prophylaxis

One small, nonrandomized study of antimicrobial prophylaxis in children with chronic sinusitis was identified.[32] Twenty-six of 86 children with chronic sinusitis received prophylaxis for 1 year. There was a 50% reduction in the number of episodes of sinusitis in 19 (73%) subjects. Nearly 25% of the children in the cohort had an underlying immunologic defect, but this discovery did not predict efficacy of prophylaxis. A randomized controlled study of azithromycin prophylaxis for acute recurrent sinusitis in children was identified on ClinicalTrials.gov and began recruiting patients in August 2009.

Duration of Symptoms

As presented previously, data from randomized trials suggest that duration of symptoms alone is not predictive of necessity of antimicrobial therapy. A small case series of complications of rhinosinusitis (almost exclusively orbital cellulitis) in children was recently published.[33] The authors noted that only 3 of 20 children admitted to a single institution over a 10-year period had symptoms of sinusitis for >10 days before hospitalization. On the basis of these data, they concluded that prevention of complications should not be a justification for initiating treatment after 10 days of symptoms.

Imaging

Since publication of the guidelines, there have been additional studies of children undergoing CT of the head that have confirmed the poor specificity of CT for acute sinusitis.[34,35] In addition, several small observational studies have assessed the use of MRI to diagnose acute sinusitis.[36–38] In the first, MRI was performed on a group of children 4 to 7 years of age presenting to a primary care center with any sign of respiratory infection.[36] Forty-one (68%) of 60 children had a major abnormality on imaging. Twenty-six children underwent follow-up 2 weeks later. Of these, 18 (69%) still had abnormal MRI findings, although this finding did not correlate with clinical symptoms. Another study by the same authors compared MRI findings in a convenience sample of children without respiratory complaints. Eight of 19 asymptomatic children had abnormal MRI findings.[37] A similar study found abnormal sinuses in 14 (31%) of 45 asymptomatic children.[38]

OTHER PEDIATRIC SINUSITIS GUIDELINES

Published guidelines were identified during the primary literature search. In addition, the Guidelines International Network (www.g-i-n.net) database was searched but yielded no results. Recently published pediatric guidelines for acute bacterial sinusitis are presented in Table 8.[39–42] These include English-language, pediatric-specific guidelines and other English-language guidelines that included separate recommendations for children. These guidelines were in near-complete concordance with the 2001 AAP guidelines in terms of clinical diagnosis, choice of antimicrobial agents, avoidance of radiographic studies, and avoidance of adjuvant therapies. One exception was that the European position paper recommended topical corticosteroids (in addition to oral antibiotics) as a grade A recommendation.[39]

The American College of Radiology Appropriateness Criteria, last updated in 2009, are another set of professional recommendations relevant to the diagnosis of sinusitis in children.[43] In summary, no radiologic studies are recommended by the American College of Radiology for acute uncomplicated sinusitis. Coronal CT of the paranasal sinuses is recommended for children with symptoms that persist after 10 days of appropriate therapy. Cranial CT with contrast, including the sinuses and orbits, is recommended for suspected complications of sinusitis.

DISCUSSION

The 2001 technical report noted a paucity of high-quality evidence for establishing the diagnosis and management of acute sinusitis in children. Nearly a decade later, data are still limited. Overall, 17 randomized controlled trials of pediatric acute sinusitis were identified. Of these, only 10 studies scored 3 points or higher on the Jadad scale, which is considered indicative of good study design.[5] These findings are consistent with other recent systematic reviews of pediatric acute sinusitis. A 2002 Cochrane review included data from 6 randomized controlled trials involving 562 children.[44] However, 2 studies focused on chronic sinusitis and 1 focused on subacute sinusitis. In addition, a recently published meta-analysis of studies comparing antimicrobial therapy versus placebo in all age groups identified only 3 studies that included children, all of which were included in the current review.[45] The publication of another placebo-controlled trial in 2009 is a significant contribution; however, only 310 children with acute sinusitis (392 if the Kristo study is included) have been studied in placebo-controlled fashion, with inconsistent results. Although meta-analysis techniques are designed to increase sample size and power,

TABLE 8 Summary of Other Published Guidelines for the Management of Acute Sinusitis in Children

Guideline	Antimicrobial Guidelines for Acute Bacterial Sinusitis (Sinus and Allergy Health Partnership, 2004)[39]	Cincinnati Children's Hospital Evidence-Based Guideline (2006)[40]	European Position Paper on Primary Care Diagnosis and Management of Rhinosinusitis and Nasal Polyps (2007)[41]	Guidelines for Treatment of Acute and Subacute Rhinosinusitis in Children (Italy, 2008)[42]
Diagnosis	No resolution after 10 d or worsens after 5–7 d with any of the following: nasal drainage, nasal congestion, facial pressure/pain, postnasal drainage, hyposmia/anosmia, fever, cough, fatigue, maxillary dental pain, and ear pressure/fullness	Clinical: at least 10 d without improvement Specific note: character of nasal discharge is not useful	(1) Cold with nasal discharge, daytime cough worsening at night >10 d (2) Cold that seems more severe than usual (3) Cold that was improving but suddenly worsens	(1) URTI without improvement within 10 d (2) URTI with severe symptoms (high fever, purulent rhinorrhea, headache, facial pain) (3) URTI that completely recedes within 3–4 d but recurs within 10 d
Imaging	Not recommended routinely	Not routinely recommended For children with persistent findings or complications, imaging decisions should be made in consultation with consulting subspecialists	Not recommended	Not recommended CT when surgery being considered
Antimicrobials	Mild disease, no recent antibiotics: amoxicillin/clavulanate, amoxicillin, cefpodoxime, cefuroxime, cefdinir	First-line: high-dose amoxicillin or amoxicillin/clavulanate for 10–14 d	Recommended: specific agents not discussed	Amoxicillin 50 mg/kg per day
	For allergies: TMP/SMX, macrolides	Second-line: cefuroxime, cefpodoxime, cefdinir		If recent antibiotic exposure, school-attendance, or suspicion of antibiotic-resistant pathogens: Amoxicillin/clavulanate (80-90 mg/kg per day),cefuroxime (30 mg/kg per day), or cefaclor (50 mg/kg per day)
	Moderate disease or mild disease with recent antibiotics: amoxicillin/clavulanate (high-dose), ceftriaxone	For allergies: second-line antibiotics if non-type I reaction		
	For allergies, same as above, plus clindamycin	Clarithromycin or azithromycin for type I reaction		
Adjuvant therapies	NA	Not recommended (antitussives, mucolytics, inhaled steroids, β_2- agonists, antihistamines, decongestants)	Topical steroids (in addition to systemic antibiotics) listed as a level Ib recommendation (from at least 1 RCT)	Antihistamines, corticosteroids, decongestants, expectorants, mucolytics, and vasoconstrictors not recommended Antibiotic prophylaxis not recommended
Complications	NA	Consult otolaryngologist and/or ophthalmologist	Immediate referral/hospitalization	Prompt, aggressive, multidisciplinary intervention

This table incorporates pediatric-specific guidelines (Cincinnati, Italy) as well as general guidelines with pediatric-specific recommendations (Sinus and Allergy Health Partnership, European Position Paper). CT, computed tomography; NA; not applicable; RCT, randomized controlled trial; TMP/SMX, trimethoprim/sulfamethoxazole; URTI, upper respiratory tract infection.

these were not pursued given the significant heterogeneity between the studies.

There are no reliable diagnostic criteria to distinguish between children with acute viral and bacterial sinusitis. However, the inclusion and exclusion criteria used in the 2 randomized studies that demonstrated a benefit of antimicrobial therapy compared with placebo offer insight into criteria that may identify children who are likely to benefit from antimicrobial therapy. Qualitatively, greater severity of illness at the time of presentation seems to be associated with increased likelihood of antimicrobial efficacy.

No studies of the microbiology of acute sinusitis in children have been published since the introduction of the conjugate pneumococcal vaccine. It is reasonable to assume that the same pathogen shifts observed in acute otitis media are found in acute bacterial sinusitis. However, this assumption would not necessarily imply that the treatment outcomes for otitis and sinusitis are the same.

Although the need for and choice of antimicrobial therapy remains controversial, the short-term adverse effect profiles for common antibacterial agents used in the management of sinusitis seem to be fairly benign. Two studies found no significant differences in adverse events between placebo and antimicrobial therapy.[8,9] A third reported that, although adverse effects were more common in the treatment group, those events occuring in children who received high-dose amoxicillin/clavulanate were mostly mild and self-limited.[6] However, the long-term effects of antimicrobial use on resistance patterns at the population level remain unmeasured

and need to be considered in the revised guidelines.

Evidence to support the use of ancillary measures in the management of acute sinusitis in children is limited. Two small, randomized controlled studies demonstrated that children treated with intranasal steroids had better outcomes compared with children treated with systemic decongestants plus antibiotics[18] or antibiotics alone.[17] One of these studies demonstrated that corticosteroids hastened resolution of symptoms, but cure at the end of the study was equivalent. The other defined acute sinusitis as an infection lasting up to 12 weeks, which may not be applicable to the definition of acute sinusitis used in the AAP guidelines. The efficacy of decongestants and antihistamines for sinusitis has not been proven. Given recent concerns regarding their safety profile in young children, the use of these agents should be avoided.

CONCLUSIONS

There are limited data to guide the diagnosis and management of acute bacterial sinusitis in children. Although there have been 4 placebo-controlled studies of antimicrobial therapy in children with acute sinusitis, the results of these studies varied. It is clear that some children with sinusitis benefit from antibiotic use and some do not. Diagnostic and treatment guidelines focusing on severity of illness at the time of presentation have the potential to identify children who will benefit from therapy and at the same time minimize unnecessary use of antibiotics.

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Sinusitis Clinical Practice Guideline Quick Reference Tools

- Action Statement Summary
  — Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Sinusitis
- AAP Patient Education Handout
  — Sinusitis and Your Child

Action Statement Summary

Clinical Practice Guideline for the Diagnosis and Management of Acute Bacterial Sinusitis in Children Aged 1 to 18 Years

Key Action Statement 1

Clinicians should make a presumptive diagnosis of acute bacterial sinusitis when a child with an acute URI presents with the following:

- Persistent illness, ie, nasal discharge (of any quality) or daytime cough or both lasting more than 10 days without improvement;

OR

- Worsening course, ie, worsening or new onset of nasal discharge, daytime cough, or fever after initial improvement;

OR

- Severe onset, ie, concurrent fever (temperature ≥39°C/102.2°F) and purulent nasal discharge for at least 3 consecutive days (Evidence Quality: B; Recommendation).

Key Action Statement 2A

Clinicians should not obtain imaging studies (plain films, contrast-enhanced computed tomography [CT], MRI, or ultrasonography) to distinguish acute bacterial sinusitis from viral URI (Evidence Quality: B; Strong Recommendation).

Key Action Statement 2B

Clinicians should obtain a contrast-enhanced CT scan of the paranasal sinuses and/or an MRI with contrast whenever a child is suspected of having orbital or central nervous system complications of acute bacterial sinusitis (Evidence Quality: B; Strong Recommendation).

Key Action Statement 3

Initial Management of Acute Bacterial Sinusitis

3A: "Severe onset and worsening course" acute bacterial sinusitis. The clinician should prescribe antibiotic therapy for acute bacterial sinusitis in children with severe onset or worsening course (signs, symptoms, or both) (Evidence Quality: B; Strong Recommendation).

3B: "Persistent illness." The clinician should either prescribe antibiotic therapy OR offer additional outpatient observation for 3 days to children with persistent illness (nasal discharge of any quality or cough or both for at least 10 days without evidence of improvement) (Evidence Quality: B; Recommendation).

Key Action Statement 4

Clinicians should prescribe amoxicillin with or without clavulanate as first-line treatment when a decision has been made to initiate antibiotic treatment of acute bacterial sinusitis (Evidence Quality: B; Recommendation).

Key Action Statement 5A

Clinicians should reassess initial management if there is either a caregiver report of worsening (progression of initial signs/symptoms or appearance of new signs/symptoms) OR failure to improve (lack of reduction in all presenting signs/symptoms) within 72 hours of initial management (Evidence Quality: C; Recommendation).

Key Action Statement 5B

If the diagnosis of acute bacterial sinusitis is confirmed in a child with worsening symptoms or failure to improve in 72 hours, then clinicians may change the antibiotic therapy for the child initially managed with antibiotic OR initiate antibiotic treatment of the child initially managed with observation (Evidence Quality: D; Option based on expert opinion, case reports, and reasoning from first principles).

Coding Quick Reference for Sinusitis	
ICD-9-CM	***ICD-10-CM***
461.9 Sinusitis, acute, unspecified	**J01.90** Acute sinusitis, unspecified **J01.91** Acute recurrent sinusitis, unspecified

Sinusitis and Your Child

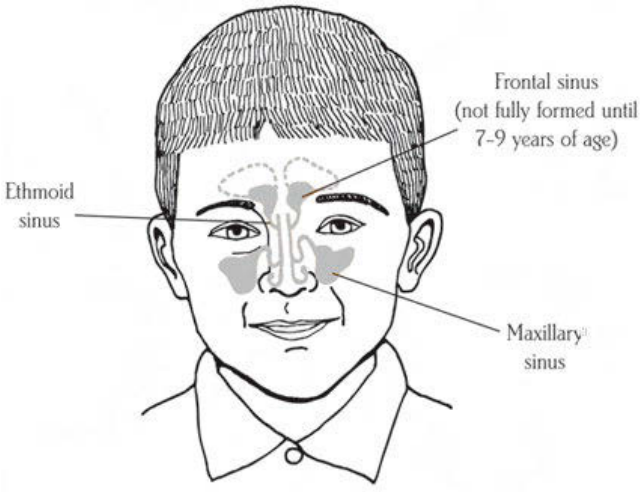
Sinusitis is an inflammation of the lining of the nose and sinuses. It is a very common infection in children.

Viral sinusitis usually accompanies a cold. Allergic sinusitis may accompany allergies such as hay fever. Bacterial sinusitis is a secondary infection caused by the trapping of bacteria in the sinuses during the course of a cold or allergy.

Fluid inside the sinuses

When your child has a viral cold or hay fever, the linings of the nose and sinus cavities swell up and produce more fluid than usual. This is why the nose gets congested and is "runny" during a cold.

Most of the time the swelling disappears by itself as the cold or allergy goes away. However, if the swelling does not go away, the openings that normally allow the sinuses to drain into the back of the nose get blocked and the sinuses fill with fluid. Because the sinuses are blocked and cannot drain properly, bacteria are trapped inside and grow there, causing a secondary infection. Although nose blowing and sniffing may be natural responses to this blockage, when excessive they can make the situation worse by pushing bacteria from the back of the nose into the sinuses.



The linings of the sinuses and the nose always produce some fluid (secretions). This fluid keeps the nose and sinus cavities from becoming too dry and adds moisture to the air that you breathe.

Is it a cold or bacterial sinusitis?

It is often difficult to tell if an illness is just a viral cold or if it is complicated by a bacterial infection of the sinuses.

Generally viral colds have the following characteristics:

- Colds usually last only 5 to 10 days.
- Colds typically start with clear, watery nasal discharge. After a day or 2, it is normal for the nasal discharge to become thicker and white, yellow, or green. After several days, the discharge becomes clear again and dries.
- Colds include a daytime cough that often gets worse at night.
- If a fever is present, it is usually at the beginning of the cold and is generally low grade, lasting for 1 or 2 days.
- Cold symptoms usually peak in severity at 3 or 5 days, then improve and disappear over the next 7 to 10 days.

Signs and symptoms that your child may have bacterial sinusitis include:

- Cold symptoms (nasal discharge, daytime cough, or both) lasting more than 10 days *without improving*
- Thick yellow nasal discharge *and* a fever for at least 3 or 4 days in a row
- A severe headache behind or around the eyes that gets worse when bending over
- Swelling and dark circles around the eyes, especially in the morning
- Persistent bad breath along with cold symptoms (However, this also could be from a sore throat or a sign that your child is not brushing his teeth!)

In very rare cases, a bacterial sinus infection may spread to the eye or the central nervous system (the brain). If your child has the following symptoms, call your pediatrician immediately:

- Swelling and/or redness around the eyes, not just in the morning but all day
- Severe headache and/or pain in the back of the neck
- Persistent vomiting
- Sensitivity to light
- Increasing irritability

Diagnosing bacterial sinusitis

It may be difficult to tell a sinus infection from an uncomplicated cold, especially in the first few days of the illness. Your pediatrician will most likely be able to tell if your child has bacterial sinusitis after examining your child and hearing about the progression of symptoms. In older children, when the diagnosis is uncertain, your pediatrician may order computed tomographic (CT) scans to confirm the diagnosis.

Treating bacterial sinusitis

If your child has bacterial sinusitis, your pediatrician may prescribe an antibiotic for at least 10 days. Once your child is on the medication, symptoms should start to go away over the next 2 to 3 days—the nasal discharge will clear and the cough will improve. *Even though your child may seem better, continue to give the antibiotics for the prescribed length of time. Ending the medications too early could cause the infection to return.*

When a diagnosis of sinusitis is made in children with cold symptoms lasting more than 10 days without improving, some doctors may choose to continue observation for another few days. If your child's symptoms worsen during this time or do not improve after 3 days, antibiotics should be started.

If your child's symptoms show no improvement 2 to 3 days after starting the antibiotics, talk with your pediatrician. Your child might need a different medication or need to be re-examined.

Treating related symptoms of bacterial sinusitis

Headache or sinus pain. To treat headache or sinus pain, try placing a warm washcloth on your child's face for a few minutes at a time. Pain medications such as acetaminophen or ibuprofen may also help. (However, do not give your child aspirin. It has been associated with a rare but potentially fatal disease called Reye syndrome.)

Nasal congestion. If the secretions in your child's nose are especially thick, your pediatrician may recommend that you help drain them with saline nose drops. These are available without a prescription or can be made at home by adding 1/4 teaspoon of table salt to an 8-ounce cup of water. Unless advised by your pediatrician, do not use nose drops that contain medications because they can be absorbed in amounts that can cause side effects.

Placing a cool-mist humidifier in your child's room may help keep your child more comfortable. Clean and dry the humidifier daily to prevent bacteria or mold from growing in it (follow the instructions that came with the humidifier). Hot water vaporizers are not recommended because they can cause scalds or burns.

Remember

If your child has symptoms of a bacterial sinus infection, see your pediatrician. Your pediatrician can properly diagnose and treat the infection and recommend ways to help alleviate the discomfort from some of the symptoms.

From your doctor

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

The American Academy of Pediatrics is an organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of infants, children, adolescents, and young adults.

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Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome

- *Clinical Practice Guideline*
- *Technical Report*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 2 for more information.

Readers of this clinical practice guideline are urged to review the technical report to enhance the evidence-based decision-making process. The full technical report is available following the clinical practice guideline and on the companion CD-ROM.

CLINICAL PRACTICE GUIDELINE

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome

abstract

FREE

OBJECTIVES: This revised clinical practice guideline, intended for use by primary care clinicians, provides recommendations for the diagnosis and management of the obstructive sleep apnea syndrome (OSAS) in children and adolescents. This practice guideline focuses on uncomplicated childhood OSAS, that is, OSAS associated with adenotonsillar hypertrophy and/or obesity in an otherwise healthy child who is being treated in the primary care setting.

METHODS: Of 3166 articles from 1999–2010, 350 provided relevant data. Most articles were level II–IV. The resulting evidence report was used to formulate recommendations.

RESULTS AND CONCLUSIONS: The following recommendations are made. (1) All children/adolescents should be screened for snoring. (2) Polysomnography should be performed in children/adolescents with snoring and symptoms/signs of OSAS; if polysomnography is not available, then alternative diagnostic tests or referral to a specialist for more extensive evaluation may be considered. (3) Adenotonsillectomy is recommended as the first-line treatment of patients with adenotonsillar hypertrophy. (4) High-risk patients should be monitored as inpatients postoperatively. (5) Patients should be reevaluated postoperatively to determine whether further treatment is required. Objective testing should be performed in patients who are high risk or have persistent symptoms/signs of OSAS after therapy. (6) Continuous positive airway pressure is recommended as treatment if adenotonsillectomy is not performed or if OSAS persists postoperatively. (7) Weight loss is recommended in addition to other therapy in patients who are overweight or obese. (8) Intranasal corticosteroids are an option for children with mild OSAS in whom adenotonsillectomy is contraindicated or for mild postoperative OSAS. *Pediatrics* 2012;130:576–584

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KEY WORDS

snoring, sleep-disordered breathing, adenotonsillectomy, continuous positive airway pressure

ABBREVIATIONS

AAP—American Academy of Pediatrics
AHI—apnea hypopnea index
CPAP—continuous positive airway pressure
OSAS—obstructive sleep apnea syndrome

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is a common condition in childhood and can result in severe complications if left untreated. In 2002, the American Academy of Pediatrics (AAP) published a practice guideline for the diagnosis and management of childhood OSAS.[1] Since that time, there has been a considerable increase in publications and research on the topic; thus, the guidelines have been revised.

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The purposes of this revised clinical practice guideline are to (1) increase the recognition of OSAS by primary care clinicians to minimize delay in diagnosis and avoid serious sequelae of OSAS; (2) evaluate diagnostic techniques; (3) describe treatment options; (4) provide guidelines for follow-up; and (5) discuss areas requiring further research. The recommendations in this statement do not indicate an exclusive course of treatment. Variations, taking into account individual circumstances, may be appropriate.

This practice guideline focuses on uncomplicated childhood OSAS—that is, the OSAS associated with adenotonsillar hypertrophy and/or obesity in an otherwise healthy child who is being treated in the primary care setting. This guideline specifically excludes infants younger than 1 year of age, patients with central apnea or hypoventilation syndromes, and patients with OSAS associated with other medical disorders, including but not limited to Down syndrome, craniofacial anomalies, neuromuscular disease (including cerebral palsy), chronic lung disease, sickle cell disease, metabolic disease, or laryngomalacia. These important patient populations are too complex to discuss within the scope of this article and require consultation with a pediatric subspecialist.

Additional information providing justification for the key action statements and a detailed review of the literature are provided in the accompanying technical report available online.[2]

METHODS OF GUIDELINE DEVELOPMENT

Details of the methods of guideline development are included in the accompanying technical report.[2] The AAP selected a subcommittee composed of pediatricians and other experts in the fields of sleep medicine, pulmonology, and otolaryngology, as well as experts from epidemiology and pediatric practice to develop an evidence base of literature on this topic. The committee included liaison members from the AAP Section on Otolaryngology-Head and Neck Surgery, American Thoracic Society, American Academy of Sleep Medicine, American College of Chest Physicians, and the National Sleep Foundation. Committee members signed forms disclosing conflicts of interest.

An automated search of the literature on childhood OSAS from 1999 to 2008 was performed by using 5 scientific literature search engines.[2] The medical subject heading terms that were used in all fields were snoring, apnea, sleep-disordered breathing, sleep-related breathing disorders, upper airway resistance, polysomnography, sleep study, adenoidectomy, tonsillectomy, continuous positive airway pressure, obesity, adiposity, hypopnea, hypoventilation, cognition, behavior, and neuropsychology. Reviews, case reports, letters to the editor, and abstracts were not included. Non–English-language articles, animal studies, and studies relating to infants younger than 1 year and to special populations (eg, children with craniofacial anomalies or sickle cell disease) were excluded. In several steps, a total of 3166 hits was reduced to 350 articles, which underwent detailed review.[2] Committee members selectively updated this literature search for articles published from 2008 to 2011 specific to guideline categories. Details of the literature grading system are available in the accompanying technical report.

Since publication of the previous guidelines, there has been an improvement in the quality of OSAS studies in the literature; however, there remain few randomized, blinded, controlled studies. Most studies were questionnaire or polysomnography based. Many studies used standard definitions for pediatric polysomnography scoring, but the interpretation of polysomnography (eg, the apnea hypopnea index [AHI] criterion used for diagnosis or to determine treatment) varied widely. The guideline notes the quality of evidence for each key action statement. Additional details are available in the technical report.

The evidence-based approach to guideline development requires that the evidence in support of each key action statement be identified, appraised, and summarized and that an explicit link between evidence and recommendations be defined. Evidence-based recommendations reflect the quality of evidence and the balance of benefit and harm that is anticipated when the recommendation is followed. The AAP policy statement, "Classifying Recommendations for Clinical Practice Guidelines,"[3] was followed in designating levels of recommendation (see Fig 1 and Table 1).

DEFINITION

This guideline defines OSAS in children as a "disorder of breathing during sleep characterized by prolonged partial upper airway obstruction and/or intermittent complete obstruction (obstructive apnea) that disrupts normal ventilation during sleep and normal sleep patterns,"[4] accompanied by symptoms or signs, as listed in Table 2. Prevalence rates based on level I and II studies range from 1.2% to 5.7%.[5–7] Symptoms include habitual snoring (often with intermittent pauses, snorts, or gasps), disturbed sleep, and daytime neurobehavioral problems. Daytime sleepiness may occur, but is uncommon in young children. OSAS is associated with neurocognitive impairment, behavioral problems, failure to thrive, hypertension, cardiac dysfunction, and systemic inflammation. Risk factors include adenotonsillar hypertrophy, obesity, craniofacial anomalies, and neuromuscular disorders. Only the first 2 risk factors are

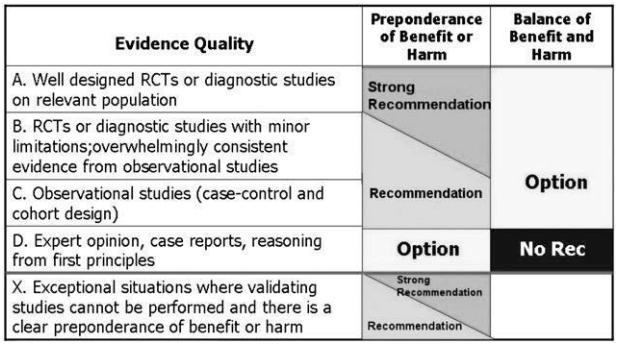

FIGURE 1

Evidence quality. Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is carried out leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation. RCT, randomized controlled trial; Rec, recommendation.

discussed in this guideline. In this guideline, obesity is defined as a BMI >95th percentile for age and gender.[8]

KEY ACTION STATEMENTS

Key Action Statement 1: Screening for OSAS

As part of routine health maintenance visits, clinicians should inquire whether the child or adolescent snores. If the answer is affirmative or if a child or adolescent presents with signs or symptoms of OSAS (Table 2), clinicians should perform a more focused evaluation. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Evidence Profile KAS 1

- Aggregate evidence quality: B
- Benefit: Early identification of OSAS is desirable, because it is a high-prevalence condition, and identification and treatment can result in alleviation of current symptoms, improved quality of life, prevention of sequelae, education of parents, and decreased health care utilization.
- Harm: Provider time, patient and parent time.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: Panelists believe that identification of a serious medical condition outweighs the time expenditure necessary for screening.
- Role of patient preferences: None.
- Exclusions: None.
- Intentional vagueness: None.
- Strength: Recommendation.

Almost all children with OSAS snore,[9–11] although caregivers frequently do not volunteer this information at medical visits.[12] Thus, asking about snoring at each health maintenance visit (as well as at other appropriate times, such as when evaluating for tonsillitis) is a sensitive, albeit nonspecific, screening measure that is quick and easy to perform. Snoring is common in children and adolescents; however, OSAS is less common. Therefore, an affirmative answer should be followed by a detailed history and examination to determine whether further evaluation for OSAS is needed (Table 2); this clinical evaluation alone

TABLE 1 Definitions and Recommendation Implications

Statement	Definition	Implication
Strong recommendation	A strong recommendation in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms (as a strong recommendation against an action is made when the anticipated harms clearly exceed the benefits) and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendations may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A recommendation in favor of a particular action is made when the anticipated benefits exceed the harms but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high-quality evidence is impossible to obtain but the anticipated benefits outweigh the harms.	It would be prudent for clinicians to follow a recommendation, but they should remain alert to new information and sensitive to patient preferences.
Option	Options define courses that may be taken when either the quality of evidence is suspect or carefully performed studies have shown little clear advantage to one approach over another.	Clinicians should consider the option in their decision-making, and patient preference may have a substantial role.
No recommendation	No recommendation indicates that there is a lack of pertinent published evidence and that the anticipated balance of benefits and harms is presently unclear.	Clinicians should be alert to new published evidence that clarifies the balance of benefit versus harm.

TABLE 2 Symptoms and Signs of OSAS

History
Frequent snoring (≥3 nights/wk)
Labored breathing during sleep
Gasps/snorting noises/observed episodes of apnea
Sleep enuresis (especially secondary enuresis)[a]
Sleeping in a seated position or with the neck hyperextended
Cyanosis
Headaches on awakening
Daytime sleepiness
Attention-deficit/hyperactivity disorder
Learning problems
Physical examination
Underweight or overweight
Tonsillar hypertrophy
Adenoidal facies
Micrognathia/retrognathia
High-arched palate
Failure to thrive
Hypertension

[a] Enuresis after at least 6 mo of continence.

does not establish the diagnosis (see technical report). Occasional snoring, for example, with an upper respiratory tract infection, is less of a concern than snoring that occurs at least 3 times a week and is associated with any of the symptoms or signs listed in Table 2.

Key Action Statement 2A: Polysomnography

If a child or adolescent snores on a regular basis and has any of the complaints or findings shown in Table 2, clinicians should either (1) obtain a polysomnogram (Evidence Quality A, Key Action strength: Recommendation) OR (2) refer the patient to a sleep specialist or otolaryngologist for a more extensive evaluation (Evidence quality D, Key Action strength: Option). (Evidence Quality: Grade A for polysomnography; Grade D for specialist referral, Recommendation Strength: Recommendation.)

Evidence Profile KAS 2A: Polysomnography

- Aggregate evidence quality: A
- Benefits: Establish diagnosis and determine severity of OSAS.
- Harm: Expense, time, anxiety/discomfort.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: Panelists weighed the value of establishing a diagnosis as more important than the minor potential harms listed.
- Role of patient preferences: Small because of preponderance of evidence that polysomnography is the most accurate way to make a diagnosis.
- Exclusions: See Key Action Statement 2B regarding lack of availability.
- Intentional vagueness: None.
- Strength: Recommendation.

Evidence Profile KAS 2A: Referral

- Aggregate evidence quality: D
- Benefits: Subspecialist may be better able to establish diagnosis and determine severity of OSAS.
- Harm: Expense, time, anxiety/discomfort.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: Panelists weighed the value of establishing a diagnosis as more important than the minor potential harms listed.
- Role of patient preferences: Large.
- Exclusions: None.
- Intentional vagueness: None.
- Strength: Option.

Although history and physical examination are useful to screen patients and determine which patients need further investigation for OSAS, the sensitivity and specificity of the history and physical examination are poor (see accompanying technical report). Physical examination when the child is awake may be normal, and the size of the tonsils cannot be used to predict the presence of OSAS in an individual child. Thus, objective testing is required. The gold standard test is overnight, attended, in-laboratory polysomnography (sleep study). This is a noninvasive test involving the measurement of a number of physiologic functions overnight, typically including EEG; pulse oximetry; oronasal airflow, abdominal and chest wall movements, partial pressure of carbon dioxide (P_{CO_2}); and video recording.[13] Specific pediatric measuring and scoring criteria should be used.[13] Polysomnography will demonstrate the presence or absence of OSAS. Polysomnography also demonstrates the severity of OSAS, which is helpful in planning treatment and in postoperative short- and long-term management.

Key Action Statement 2B: Alternative Testing

If polysomnography is not available, then clinicians may order alternative diagnostic tests, such as nocturnal video recording, nocturnal oximetry, daytime nap polysomnography, or ambulatory polysomnography. (Evidence Quality: Grade C, Recommendation Strength: Option.)

Evidence Profile KAS 2B

- Aggregate evidence quality: C
- Benefit: Varying positive and negative predictive values for establishing diagnosis.
- Harm: False-negative and false-positive results may underestimate or overestimate severity, expense, time, anxiety/discomfort.
- Benefits-harms assessment: Equilibrium of benefits and harms.
- Value judgments: Opinion of the panel that some objective testing is better than none. Pragmatic decision based on current shortage of pediatric polysomnography facilities (this may change over time).
- Role of patient preferences: Small, if choices are limited by availability;

families may choose to travel to centers where more extensive facilities are available.

- Exclusions: None.
- Intentional vagueness: None.
- Strength: Option.

Although polysomnography is the gold standard for diagnosis of OSAS, there is a shortage of sleep laboratories with pediatric expertise. Hence, polysomnography may not be readily available in certain regions of the country. Alternative diagnostic tests have been shown to have weaker positive and negative predictive values than polysomnography, but nevertheless, objective testing is preferable to clinical evaluation alone. If an alternative test fails to demonstrate OSAS in a patient with a high pretest probability, full polysomnography should be sought.

Key Action Statement 3: Adenotonsillectomy

If a child is determined to have OSAS, has a clinical examination consistent with adenotonsillar hypertrophy, and does not have a contraindication to surgery (see Table 3), the clinician should recommend adenotonsillectomy as the first line of treatment. If the child has OSAS but does not have adenotonsillar hypertrophy, other treatment should be considered (see Key Action Statement 6). Clinical judgment is required to determine the benefits of adenotonsillectomy compared with other treatments in obese children with varying degrees of adenotonsillar hypertrophy. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Evidence Profile KAS 3

- Aggregate evidence quality: B
- Benefit: Improve OSAS and accompanying symptoms and sequelae.
- Harm: Pain, anxiety, dehydration, anesthetic complications, hemorrhage, infection, postoperative respiratory difficulties, velopharyngeal incompetence, nasopharyngeal stenosis, death.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: The panel sees the benefits of treating OSAS as more beneficial than the low risk of serious consequences.
- Role of patient preferences: Low; continuous positive airway pressure (CPAP) is an option but involves prolonged, long-term treatment as compared with a single, relatively low-risk surgical procedure.
- Exclusions: See Table 3.
- Intentional vagueness: None.
- Strength: Recommendation.

Adenotonsillectomy is very effective in treating OSAS. Adenoidectomy or tonsillectomy alone may not be sufficient, because residual lymphoid tissue may contribute to persistent obstruction. In otherwise healthy children with adenotonsillar hypertrophy, adenotonsillectomy is associated with improvements in symptoms and sequelae of OSAS. Postoperative polysomnography typically shows a major decrease in the number of obstructive events, although some obstructions may still be present. Although obese children may have less satisfactory results, many will be adequately treated with adenotonsillectomy; however, further research is needed to determine which obese children are most likely to benefit from surgery. In this population, the benefits of a 1-time surgical procedure, with a small but real risk of complications, need to be weighed against long-term treatment with CPAP, which is associated with discomfort, disruption of family lifestyle, and risks of poor adherence. Potential complications of adenotonsillectomy are shown in Table 4. Although serious complications (including death) may occur, the rate of these complications is low, and the risks of complications need to be weighed against the consequences of untreated OSAS. In general, a 1-time only procedure with a relatively low morbidity is preferable to lifelong treatment with CPAP; furthermore, the efficacy of CPAP is limited by generally suboptimal adherence. Other treatment options, such as anti-inflammatory medications, weight loss, or tracheostomy, are less effective, are difficult to achieve, or have higher morbidity, respectively.

TABLE 3 Contraindications for Adenotonsillectomy

Absolute contraindications
No adenotonsillar tissue (tissue has been surgically removed)
Relative contraindications
Very small tonsils/adenoid
Morbid obesity and small tonsils/adenoid
Bleeding disorder refractory to treatment
Submucus cleft palate
Other medical conditions making patient medically unstable for surgery

Key Action Statement 4: High-Risk Patients Undergoing Adenotonsillectomy

Clinicians should monitor high-risk patients (Table 5) undergoing adenotonsillectomy as inpatients postoperatively. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

TABLE 4 Risks of Adenotonsillectomy

Minor
Pain
Dehydration attributable to postoperative nausea/vomiting and poor oral intake
Major
Anesthetic complications
Acute upper airway obstruction during induction or emergence from anesthesia
Postoperative respiratory compromise
Hemorrhage
Velopharyngeal incompetence
Nasopharyngeal stenosis
Death

TABLE 5 Risk Factors for Postoperative Respiratory Complications in Children With OSAS Undergoing Adenotonsillectomy

Younger than 3 y of age
Severe OSAS on polysomnography[a]
Cardiac complications of OSAS
Failure to thrive
Obesity
Craniofacial anomalies[b]
Neuromuscular disorders[b]
Current respiratory infection

[a] It is difficult to provide exact polysomnographic criteria for severity, because these criteria will vary depending on the age of the child; additional comorbidities, such as obesity, asthma, or cardiac complications of OSAS; and other polysomnographic criteria that have not been evaluated in the literature, such as the level of hypercapnia and the frequency of desaturation (as compared with lowest oxygen saturation). Nevertheless, on the basis of published studies (primarily Level III, see Technical Report), it is recommended that all patients with a lowest oxygen saturation <80% (either on preoperative polysomnography or during observation in the recovery room postoperatively) or an AHI ≥24/h be observed as inpatients postoperatively as they are at increased risk for postoperative respiratory compromise. Additionally, on the basis of expert consensus, it is recommended that patients with significant hypercapnia on polysomnography (peak P_{CO_2} ≥60 mm Hg) be admitted postoperatively. The committee noted that that most published studies were retrospective and not comprehensive, and therefore these recommendations may change if higher-level studies are published. Clinicians may decide to admit patients with less severe polysomnographic abnormalities based on a constellation of risk factors (age, comorbidities, and additional polysomnographic factors) for a particular individual.

[b] Not discussed in these guidelines.

Evidence Profile KAS 4

- Aggregate evidence quality: B
- Benefit: Effectively manage severe respiratory compromise and avoid death.
- Harm: Expense, time, anxiety.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: The panel believes that early recognition of any serious adverse events is critically important.
- Role of patient preferences: Minimal; this is an important safety issue.
- Exclusions: None.
- Intentional vagueness: None.
- Strength: Recommendation.

Patients with OSAS may develop respiratory complications, such as worsening of OSAS or pulmonary edema, in the immediate postoperative period. Death attributable to respiratory complications in the immediate postoperative period has been reported in patients with severe OSAS. Identified risk factors are shown in Table 5. High-risk patients should undergo surgery in a center capable of treating complex pediatric patients. They should be hospitalized overnight for close monitoring postoperatively. Children with an acute respiratory infection on the day of surgery, as documented by fever, cough, and/or wheezing, are at increased risk of postoperative complications and, therefore, should be rescheduled or monitored closely postoperatively. Clinicians should decide on an individual basis whether these patients should be rescheduled, taking into consideration the severity of OSAS in the particular patient and keeping in mind that many children with adenotonsillar hypertrophy have chronic rhinorrhea and nasal congestion, even in the absence of viral infections.

Key Action Statement 5: Reevaluation

Clinicians should clinically reassess all patients with OSAS for persisting signs and symptoms after therapy to determine whether further treatment is required. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Evidence Profile KAS 5A

- Aggregate evidence quality: B
- Benefit: Determine effects of treatment.
- Harm: Expense, time.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: Data show that a significant proportion of children continue to have abnormalities postoperatively; therefore, the panel determined that the benefits of follow-up outweigh the minor inconveniences.
- Role of patient preferences: Minimal; follow-up is good clinical practice.
- Exclusions: None.
- Intentional vagueness: None.
- Strength: Recommendation.

Clinicians should reassess OSAS-related symptoms and signs (Table 2) after 6 to 8 weeks of therapy to determine whether further evaluation and treatment are indicated. Objective data regarding the timing of the postoperative evaluation are not available. Most clinicians recommend reevaluation 6 to 8 weeks after treatment to allow for healing of the operative site and to allow time for upper airway, cardiac, and central nervous system recovery. Patients who remain symptomatic should undergo objective testing (see Key Action Statement 2) or be referred to a sleep specialist for further evaluation.

Key Action Statement 5B: Reevaluation of High-Risk Patients

Clinicians should reevaluate high-risk patients for persistent OSAS after adenotonsillectomy, including those who had a significantly abnormal baseline polysomnogram, have sequelae of OSAS, are obese, or remain symptomatic after treatment, with an objective test (see Key Action Statement 2) or refer such patients to a sleep specialist. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Evidence Profile KAS 5B

- Aggregate evidence quality: B
- Benefit: Determine effects of treatment.
- Harm: Expense, time, anxiety/discomfort.
- Benefits-harms assessment: Preponderance of benefit over harm.

- Value judgments: Given the panel's concerns about the consequences of OSAS and the frequency of postoperative persistence in high-risk groups, the panel believes that the follow-up costs are outweighed by benefits of recognition of persistent OSAS. A minority of panelists believed that all children with OSAS should have follow-up polysomnography because of the high prevalence of persistent postoperative abnormalities on polysomnography, but most panelists believed that persistent polysomnographic abnormalities in uncomplicated children with mild OSAS were usually mild in patients who were asymptomatic after surgery.
- Role of patient preferences: Minimal. Further evaluation is needed to determine the need for further treatment.
- Exclusions: None.
- Intentional vagueness: None.
- Strength: Recommendation.

Numerous studies have shown that a large proportion of children at high risk continue to have some degree of OSAS postoperatively[10,13,14]; thus, objective evidence is required to determine whether further treatment is necessary.

Key Action Statement 6: CPAP

Clinicians should refer patients for CPAP management if symptoms/signs (Table 2) or objective evidence of OSAS persists after adenotonsillectomy or if adenotonsillectomy is not performed. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Evidence Profile KAS 6

- Aggregate evidence quality: B
- Benefit: Improve OSAS and accompanying symptoms and sequelae.
- Harm: Expense, time, anxiety; parental sleep disruption; nasal and skin adverse effects; possible midface remodeling; extremely rare serious pressure-related complications, such as pneumothorax; poor adherence.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: Panelists believe that CPAP is the most effective treatment of OSAS that persists postoperatively and that the benefits of treatment outweigh the adverse effects. Other treatments (eg, rapid maxillary expansion) may be effective in specially selected patients.
- Role of patient preferences: Other treatments may be effective in specially selected patients.
- Exclusions: Rare patients at increased risk of severe pressure complications.
- Intentional vagueness: None.
- Policy level: Recommendation.

CPAP therapy is delivered by using an electronic device that delivers air at positive pressure via a nasal mask, leading to mechanical stenting of the airway and improved functional residual capacity in the lungs. There is no clear advantage of using bilevel pressure over CPAP.[15] CPAP should be managed by an experienced and skilled clinician with expertise in its use in children. CPAP pressure requirements vary among individuals and change over time; thus, CPAP must be titrated in the sleep laboratory before prescribing the device and periodically readjusted thereafter. Behavioral modification therapy may be required, especially for young children or those with developmental delays. Objective monitoring of adherence, by using the equipment software, is important. If adherence is suboptimal, the clinician should institute measures to improve adherence (such as behavioral modification, or treating side effects of CPAP) and institute alternative treatments if these measures are ineffective.

Key Action Statement 7: Weight Loss

Clinicians should recommend weight loss in addition to other therapy if a child/adolescent with OSAS is overweight or obese. (Evidence Quality: Grade C, Recommendation Strength: Recommendation.)

Evidence Profile KAS 7

- Aggregate evidence quality: C
- Benefit: Improve OSAS and accompanying symptoms and sequelae; non–OSAS-related benefits of weight loss.
- Harm: Hard to achieve and maintain weight loss.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: The panel agreed that weight loss is beneficial for both OSAS and other health issues, but clinical experience suggests that weight loss is difficult to achieve and maintain, and even effective weight loss regimens take time; therefore, additional treatment is required in the interim.
- Role of patient preferences: Strong role for patient and family preference regarding nutrition and exercise.
- Exclusions: None.
- Intentional vagueness: None.
- Strength: Recommendation.

Weight loss has been shown to improve OSAS,[16,17] although the degree of weight loss required has not been determined. Because weight loss is a slow and unreliable process, other treatment modalities (such as adenotonsillectomy or CPAP therapy) should be instituted until sufficient weight loss has been achieved and maintained.

Key Action Statement 8: Intranasal Corticosteroids

Clinicians may prescribe topical intranasal corticosteroids for children with mild OSAS in whom adenotonsillectomy is contraindicated or for children with mild postoperative OSAS. (Evidence Quality: Grade B, Recommendation Strength: Option.)

Evidence Profile KAS 8

- Aggregate evidence quality: B
- Benefit: Improves mild OSAS and accompanying symptoms and sequelae.
- Harm: Some subjects may not have an adequate response. It is not known whether therapeutic effect persists long-term; therefore, long-term observation is required. Low risk of steroid-related adverse effects.
- Benefits-harms assessment: Preponderance of benefit over harm.
- Value judgments: The panel agreed that intranasal steroids provide a less invasive treatment than surgery or CPAP and, therefore, may be preferred in some cases despite lower efficacy and lack of data on long-term efficacy.
- Role of patient preferences: Moderate role for patient and family preference if OSAS is mild.
- Exclusions: None.
- Intentional vagueness: None.
- Strength: Option.

Mild OSAS is defined, for this indication, as an AHI <5 per hour, on the basis of studies on intranasal corticosteroids described in the accompanying technical report.[2] Several studies have shown that the use of intranasal steroids decreases the degree of OSAS; however, although OSAS improves, residual OSAS may remain. Furthermore, there is individual variability in response to treatment, and long-term studies have not been performed to determine the duration of improvement. Therefore, nasal steroids are not recommended as a first-line therapy. The response to treatment should be measured objectively after a course of treatment of approximately 6 weeks. Because the long-term effect of this treatment is unknown, the clinician should continue to observe the patient for symptoms of recurrence and adverse effects of corticosteroids.

AREAS FOR FUTURE RESEARCH

A detailed list of research recommendations is provided in the accompanying technical report.[2] There is a great need for further research into the prevalence of OSAS, sequelae of OSAS, best treatment methods, and the role of obesity. In particular, well-controlled, blinded studies, including randomized controlled trials of treatment, are needed to determine the best care for children and adolescents with OSAS.

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Oversight from the Steering Committee on Quality Improvement and Management, 2009–2012

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TECHNICAL REPORT

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome

abstract

FREE

OBJECTIVE: This technical report describes the procedures involved in developing recommendations on the management of childhood obstructive sleep apnea syndrome (OSAS).

METHODS: The literature from 1999 through 2011 was evaluated.

RESULTS AND CONCLUSIONS: A total of 3166 titles were reviewed, of which 350 provided relevant data. Most articles were level II through IV. The prevalence of OSAS ranged from 0% to 5.7%, with obesity being an independent risk factor. OSAS was associated with cardiovascular, growth, and neurobehavioral abnormalities and possibly inflammation. Most diagnostic screening tests had low sensitivity and specificity. Treatment of OSAS resulted in improvements in behavior and attention and likely improvement in cognitive abilities. Primary treatment is adenotonsillectomy (AT). Data were insufficient to recommend specific surgical techniques; however, children undergoing partial tonsillectomy should be monitored for possible recurrence of OSAS. Although OSAS improved postoperatively, the proportion of patients who had residual OSAS ranged from 13% to 29% in low-risk populations to 73% when obese children were included and stricter polysomnographic criteria were used. Nevertheless, OSAS may improve after AT even in obese children, thus supporting surgery as a reasonable initial treatment. A significant number of obese patients required intubation or continuous positive airway pressure (CPAP) postoperatively, which reinforces the need for inpatient observation. CPAP was effective in the treatment of OSAS, but adherence is a major barrier. For this reason, CPAP is not recommended as first-line therapy for OSAS when AT is an option. Intranasal steroids may ameliorate mild OSAS, but follow-up is needed. Data were insufficient to recommend rapid maxillary expansion. *Pediatrics* 2012;130:e714–e755

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KEY WORDS

adenotonsillectomy, continuous positive airway pressure, sleep-disordered breathing, snoring

ABBREVIATIONS

AAP—American Academy of Pediatrics
ADHD—attention-deficit/hyperactivity disorder
AHI—apnea hypopnea index
AT—adenotonsillectomy
BP—blood pressure
BPAP—bilevel positive airway pressure
CBCL—Child Behavior Checklist
CPAP—continuous positive airway pressure
CRP—C-reactive protein
ECG—electrocardiography
HOMA—homeostatic model assessment
HS—habitual snoring
IL—interleukin
OSAS—obstructive sleep apnea syndrome
PAP—positive airway pressure
PSG—polysomnography
PT—partial tonsillectomy
QoL—quality of life
RDI—respiratory distress index
SDB—sleep-disordered breathing
SES—socioeconomic status
Spo_2—oxygen saturation
URI—upper respiratory tract infection

(Continued on last page)

INTRODUCTION

This technical report describes in detail the procedures involved in developing the recommendations for the updated clinical practice guideline on childhood obstructive sleep apnea syndrome (OSAS).[1]

The clinical practice guideline is primarily aimed at pediatricians and other primary care clinicians (family physicians, nurse practitioners,

and physician assistants) who treat children. The secondary audience for the guideline includes sleep medicine specialists, pediatric pulmonologists, neurologists, otolaryngologists, and developmental/behavioral pediatricians.

The primary focus of the committee was on OSAS in childhood.[2] The committee focused on otherwise healthy children who had adenotonsillar hypertrophy or obesity as underlying risk factors. Complex populations, including infants <1 year of age and children who had other medical conditions (eg, craniofacial anomalies, genetic or metabolic syndromes, neuromuscular disease, laryngomalacia, sickle cell disease), were excluded because these patients will typically require subspecialty referral.

Two professional studies recently published related guidelines: the American Academy of Otolaryngology–Head and Neck Surgery[3] and the American Academy of Sleep Medicine.[4] These guidelines have similar recommendations to many of the recommendations in the American Academy of Pediatrics (AAP) guideline.

The recommendations in this statement do not indicate an exclusive course of treatment. Variations, taking into account individual circumstances, may be appropriate.

METHODS

Literature Search

A literature search was performed that included English-language articles, children and adolescents aged 1 through 17.9 years, and publication between 1999 and 2008. Animal studies, abstracts, letters, case reports, and reviews were excluded. The Medical Subject Heading terms that were used in all fields were snoring, apnea, sleep-disordered breathing (SDB), sleep-related breathing disorders, upper airway resistance, polysomnography (PSG), sleep study, adenoidectomy, tonsillectomy, continuous positive airway pressure (CPAP), obesity, adiposity, hypopnea, hypoventilation, cognition, behavior, and neuropsychology. Search engines used were PubMed, Scopus, Ovid, PsycINFO, EBSCO (including Health Source [Nursing], Child Development and Adolescent Studies), and CINAHL. Articles covering special populations (eg, infants aged <1 year, those with craniofacial anomalies or syndromes) were excluded during the title and abstract reviews.

Titles and available abstracts of articles found by the literature search were reviewed by the committee members in several rounds (see Results). In the first round, duplicates and erroneous hits from the literature search were excluded. In the second round, titles were reviewed for relevancy by 2 committee members. Articles with relevant titles were then reviewed by 2 reviewers each, on the basis of the abstract. Because of the large number of remaining articles, text-mining (Statistica, StatSoft version 9; StatSoft, Inc, Tulsa, OK) was performed on the method section of the articles to reduce the large amount of articles for the final step of quality assessment. Text-mining is the combined, automated process of analyzing unstructured, natural language text to discover information and knowledge that are typically difficult to retrieve.[5]

Unfortunately, text-mining revealed that few articles reported research methods, such as the study design (eg, clinical case series, retrospective, observational, clinical experiment), blinding of the assessment, and recruitment and/or scoring, that could have been applied for further selection. A manual screening of the questionable articles after text-mining resulted in a pool of 605 articles. The committee decided on a final round of title selection; that is, each member was assigned a random batch of articles and selected titles based on relevance with respect to the guideline categories. These remaining articles were each reviewed and graded by a committee member, as detailed here. Because of the large volume of articles requiring detailed evaluation, some committee members recruited trainees and colleagues to assist them in the performance of these reviews, under their supervision. Jason Caboot, June Chan, Mary Currie, Fiona Healy, Maureen Josephson, Sofia Konstantinopoulou, H. Madan Kumar, Roberta Leu, Darius Loghmanee, Rajeev Bhatia, Argyri Petrocheilou, Harsha Vardhan, and Colleen Walsh participated. A literature search of more recent articles (2008–2011) was performed by individual committee members, per guideline category, and discussed during the committee meeting.

As would be expected from any panel of experts in a field, some of the citations were the work of the panel members. For this reason, a varied panel, including general pediatricians, pulmonologists, otolaryngologists, and sleep medicine physicians, was arranged to provide balance. For initial guideline drafts, committee members were assigned sections of the report that were not directly in their area of research, and the evidence, search results, and conclusions thereof were discussed by all committee members at a face-to-face meeting. Subsequent drafts of the guidelines and technical report were reviewed by all committee members.

Quality Assessment

The previous literature review form[6] was modified to include the evidence grading system developed by the American Academy of Neurology for the assessment of clinical utility of diagnostic tests (Table 1).[7] A specific customized software (OSA Taskforce;

TABLE 1 Evidence Grading System[7]

Level	Description
I	Evidence provided by a prospective study in a broad spectrum of persons who have the suspected condition, by using a reference (gold) standard for case definition, in which the test is applied in a blinded fashion, and enabling the assessment of appropriate test of diagnostic accuracy. All persons undergoing the diagnostic test have the presence or absence of the disease determined. Level I studies are judged to have a low risk of bias.
II	Evidence provided by a prospective study of a narrow spectrum of persons who have the suspected condition, or a well-designed retrospective study of a broad spectrum of persons who have an established condition (by gold standard) compared with a broad spectrum of controls, in which the test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy. Level II studies are judged to have a moderate risk of bias.
III	Evidence provided by a retrospective study in which either persons who have the established condition or controls are of a narrow spectrum, and in which the reference standard, if not objective, is applied by someone other than the person who performed (interpreted) the test. Level III studies are judged to have a moderate to high risk of bias.
IV	Any study design where the test is not applied in an independent evaluation or evidence is provided by expert opinion alone or in descriptive case series without controls. There is no blinding or there may be inadequate blinding. The spectrum of persons tested may be broad or narrow. Level IV studies are judged to have a very high risk of bias.

copyright Francesco Rundo and Karen Spruyt) was developed for the literature review form to standardize this part of the process. Of note, the quality assessment levels were comparable to the grading levels applied previously.[8,9] The quality assessment applied involved 4 tiers of evidence, with level I studies being judged to have a low risk of bias and level IV studies judged to have a very high level of bias. A weaker level of evidence indicates the need to integrate greater clinical judgment when applying results to clinical decision-making. The committee's quality assessment of data took into account not only the levels of evidence in relevant articles but also the number of articles identified, the magnitude and direction of various findings, and whether articles demonstrated convergent or divergent conclusions.

The evidence-based approach to guideline development requires that the evidence in support of each key action statement be identified, appraised, and summarized and that an explicit link between evidence and recommendations be defined. Evidence-based recommendations reflect the quality of evidence and the balance of benefit and harm that is anticipated when the recommendation is followed. The AAP policy statement "Classifying Recommendations for Clinical Practice Guidelines"[10] was followed in designating levels of recommendations (Fig 1, Table 2).

RESULTS OF LITERATURE SEARCH

The automated Medical Subject Heading search resulted in 3166 hits. After duplicates and erroneous hits were excluded, 2395 hits fulfilled the criteria. After title review, 1091 articles were accepted, with a 0.70 interrater agreement between the 2 reviewers. These remaining articles were reviewed on the basis of the abstract, which resulted in 757 articles remaining, with a 0.60 agreement rate between reviewers. A final decision on those without agreement was made by the chairperson of the committee. Text-mining, although not helpful in reducing the number of articles for further evaluation, illustrated the spectrum of topics covered by the articles (Table 3). A manual screening of the questionable articles after text-mining resulted in a pool of 605 articles. The final round of title selection resulted in 397 articles for detailed review. An additional 47 articles were found to not meet criteria during the detailed review. Thus, a total of 350 articles were included.

On the basis of the final 350 articles, one-third were epidemiologic studies, 26% were diagnostic studies, and 23% were treatment studies. Table 4 lists the type of study design; 34% of studies were descriptive and 32% were nonrandomized concurrent cohort series. PSG was the diagnostic method used for 57% of the articles, whereas 45% used questionnaires. The sample size varied from 9 to 6742 subjects. Figure 2 shows the level of evidence of the articles; 76% of studies were level III or IV. The majority of studies did not include a control group, which degraded the studies to level III or IV. Few studies applied any form of blinding.

Conclusion

There has been a large increase in the number of published studies since the initial guideline was published. However, there are few randomized, blinded, controlled studies. Most articles evaluated were level III or IV, and many studies were hampered by the lack of a control group. In most studies, blinding was not present or not reported. From a methodologic standpoint, a clear need for randomized clinical trials with blinding is evident.

TERMINOLOGY

OSAS in children is defined as a "disorder of breathing during sleep characterized by prolonged partial upper airway obstruction and/or intermittent complete obstruction (obstructive apnea) that disrupts normal ventilation during sleep and normal sleep patterns,"[2] accompanied by symptoms or signs as listed in Table 2 of the accompanying guideline. In this document, the term SDB is used to encompass

both snoring and OSAS when studies did not distinguish between these entities.

PREVALENCE OF OSAS

The original clinical practice guideline found a prevalence of OSAS of 2% (3 studies) and a prevalence of habitual snoring (HS) of 3% to 12% (7 studies). Since publication of the original guideline, 10 studies (in 12 separate articles) used the gold standard of conventional overnight laboratory PSG to diagnose OSAS (Table 5). These studies were all levels I through IV, depending on the size and characteristics of the sample population, and represented many countries and age groups. They used various criteria, not all of which are standard, to diagnose OSAS. Many of the studies had a small sample size and/or studied only a selected high-risk sample of the population. Despite these limitations, the 10 studies found a prevalence of OSAS in the general pediatric population of 0% to 5.7%. Three studies to note were those of Bixler et al[11] from the United States, Li et al[12] from China, and O'Brien et al[13] from the United States. These 3 studies (levels I–II) had large sample sizes from the general pediatric population and reported OSAS prevalence rates of 1.2% to 5.7%. Six studies investigated the prevalence of OSAS by using various ambulatory studies rather than full, laboratory-based PSG (Table 6). Although the sample sizes were generally larger, home studies are not considered the gold standard of diagnosis and were thus level III. These studies found an OSAS prevalence of 0.8% to 24%. The 2 outliers (at 12% and 24%)[14,15] used more liberal criteria to diagnose OSAS. Excluding those studies, the OSAS prevalence was 0.8% to 2.8%.

Several studies attempted to discern variables associated with the presence of OSAS. Three studies found an equal prevalence between males and females,[16–18] and 2 studies found an increased prevalence in males.[12,15] Two studies reported an increased risk in children of ethnic minorities,[11,19] supporting older data.[20] Four studies found an increased risk in obese patients,[12,17,21,22] but 3 studies did

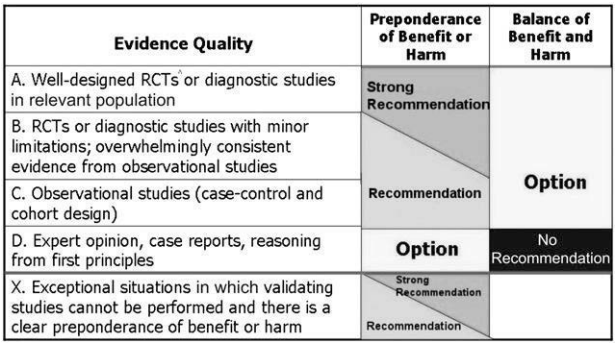

FIGURE 1
Evidence quality. Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is carried out leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation. RCT, randomized controlled trial.

TABLE 2 Definitions and Recommendation Implications

Statement	Definition	Implication
Strong recommendation	A strong recommendation in favor of a particular action is made when the anticipated benefits of the recommended intervention clearly exceed the harms (as a strong recommendation against an action is made when the anticipated harms clearly exceed the benefits) and the quality of the supporting evidence is excellent. In some clearly identified circumstances, strong recommendations may be made when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Recommendation	A recommendation in favor of a particular action is made when the anticipated benefits exceed the harms but the quality of evidence is not as strong. Again, in some clearly identified circumstances, recommendations may be made when high-quality evidence is impossible to obtain but the anticipated benefits outweigh the harms.	Clinicians would be prudent to follow a recommendation but should remain alert to new information and sensitive to patient preferences.
Option	Options define courses that may be taken when either the quality of evidence is suspect or carefully performed studies have shown little clear advantage to 1 approach over another.	Clinicians should consider the option in their decision-making, and patient preference may have a substantial role.
No recommendation	No recommendation indicates that there is a lack of pertinent published evidence and that the anticipated balance of benefits and harms is presently unclear.	Clinicians should be alert to new published evidence that clarifies the balance of benefit versus harm.

TABLE 3 Results of Text-Mining of the Methods Section of 757 Papers

Term Used for Text-Mining	Percentage of Papers
Snore/snoring	58.3
Polysomnography	53.6
Diagnosis	53.4
Medical management	51.6
Survey/questionnaire	38.8
Psychological	37.0
Surgery/surgical	35.9
Treatment	32.1
Design	27.8
Obese/obesity	25.0
BMI	24.6
Randomize	20.2
Blinding	16.4
Sampling	11.7
Control group	8.8
Actigraphy	2.6
Mortality	0.5

TABLE 4 Types of Studies in the Literature Based on 350 Articles

Type of Study	Percentage
Descriptive study	33.7
Nonrandomized concurrent cohort series	32.0
Descriptive study + other	10.8
Nonrandomized historical cohort series	7.8
Randomized clinical trial	4.6
Retrospective	3.6
Case-control study	1.3
Prospective consecutive cohort series	1.3
Cross-sectional population-based survey	1.0
Nonrandomized historical cohort series + other	1.0
Randomized + other	1.0
Undetermined	1.0
Nonrandomized concurrent cohort series + other	0.7
Experimental study	0.3

not.[15,16,23] Another study reported an increased risk of OSAS with increased waist circumference, a marker for obesity.[11] One study found an increased risk with nasal abnormalities,[11] 1 study found an increased risk with prematurity,[19] and 2 studies found increased risk with adenotonsillar hypertrophy.[12,22]

Multiple studies (levels II–IV) investigated the prevalence of HS, which is one of the most prominent manifestations of OSAS (Table 7). The presence of snoring was based on parental or personal questionnaires. Not all of the questionnaires used have been validated, and the data relied on subjective responses rather than objective clinical evaluations. The reported prevalence of HS varied widely, depending on the study and definition used, from 1.5% to 27.6%.

In summary, studies of OSAS and HS show varied prevalence rates, depending on the population studied, the methods used to measure breathing during sleep, and the definitions used for diagnosis. Nevertheless, the preponderance of evidence suggests a prevalence of OSAS in the range of 1% to 5%, making this a relatively common disease that would be encountered by most clinicians in primary practice.

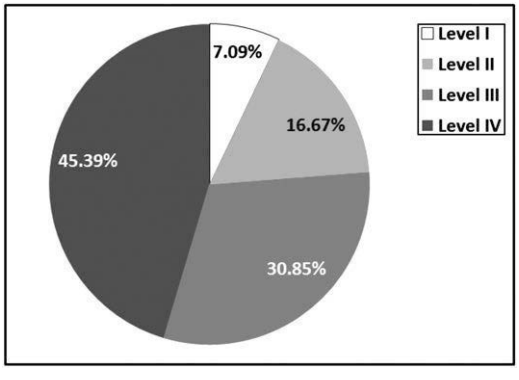

FIGURE 2
Levels of evidence of articles used for this report.

Areas for Future Research

- Population-based studies on the gender and race distribution of OSAS among different age groups.

SEQUELAE OF OSAS

Neuropsychological and Cognitive Problems Associated With OSAS

Of the 350 articles related to this search over the last 10 years, 61 articles directly explored the relationship between SDB and cognitive or neuropsychological deficits. In total, 29 658 subjects were studied, including 2 level I studies[24,25] with a total of 174 subjects and 5 level II studies.[26–30] The diagnosis of SDB was based on clinical symptoms in 29 articles and on PSG in 32 articles.

Cognitive Deficits

All but 1 study (level IV)[31] demonstrated deficits in cognition or neuropsychological function in association with symptoms, signs, or diagnosis of SDB. The 1 exception examined children who had mild OSAS over a wide age range and did not include behavioral assessments. In this study, the mean IQ in the OSAS population was significantly above the standard mean. Some[32–34] but not all studies showed a correlation between the severity of obstructive apnea as measured on PSG and increasing neuropsychological morbidity. There are several reasons why correlations were not found for all studies. Standard PSG was developed to detect cardiorespiratory variations and may not be an adequate tool for detection of sleep changes that affect neuropsychological function. Another possibility is that any degree of SDB is associated with abnormal neuropsychological outcomes and might be affected variably by social, medical, environmental, or socioeconomic factors not measured by using PSG. This

TABLE 5 Prevalence of OSAS on the Basis of Laboratory PSG

Source	Year	No.	No. Undergoing PSG	Country	Age, y	OSASPrevalence	HSPrevalence	OSAS Criteria/Comments
Anuntaseree et al[201]	2001	1005	8	Thailand	6–13	0.69%	8.5%	AHI ≥1
Anuntaseree et al[202]	2005	755	Unclear, possibly 10			1.3%	6.9% "most nights"	Note: 2 studies used same cohort
Beebe et al[21]	2007	60 obese 22 control	All	United States	10–16.9	0% normal 13% obese		AHI >5 ↑ in obese
Bixler et al[11]	2009	5740	700	United States	5–12	1.2%		AHI ≥5 ↑ in ↑ waist circumference ↑ with nasal abnormalities ↑ in minority race
Brunetti et al[203]	2001	895	34 home monitoring	Italy	3–11	1%–1.8%	4.9%	AHI >3
Brunetti et al[23]	2010		12 PSG				5.4% "always"	Not ↑ in obese; Note: 2 studies used same cohort
Li et al[172]	2010	6447	619	China	5–13	4.8%	7.2% "frequently"	Using ICSD-II criteria 4.8%
Li et al[12]	2010							↑ in boys ↑ in obese ↑ in ↑ tonsil size
Ng et al[204]	2002	200	16	Hong Kong	6.4 ± 4	1%	14.5%	AHI >1
O'Brien et al[13]	2003	5728	110	United States	5–7	5.7%	11.7% "frequent and loud"	AHI >5
Sogut et al[16]	2005	1198 total	28	Turkey	3–11	0.9%–1.3%	3.3% >3 times/week	Used AHI >3 Boys = girls Not ↑ in obese
Wing et al[17]	2003	46 obese, 44 control	All	China	7–15	2.3%–4.5% control; 26% to 32.6% obese		OAI ≥1 or RDI ≥5 Boys = girls ↑ in obese
Xu et al[22]	2008	99 obese, 99 control	All	China	Elementary school	0 if not obese and no ATH		AHI >5 or OAI >1 ↑ obese ↑ in ATH

ATH, adenotonsillar hypertrophy; ICSD, International Classification of Sleep Disorders; OAI, obstructive apnea index.

possibility is confirmed by a recent level I study showing that obesity, OSAS, and neurocognitive outcomes are all interdependent.[35] Furthermore, most studies were not controlled for socioeconomic status (SES), which is important because SES strongly affects the results of neurocognitive testing and because OSAS is associated with low SES.[36] Although some studies have shown abnormalities in snorers compared with nonsnoring controls, in many of these studies, data in snorers still fell within the normal range.[24] In addition, cutoffs for OSAS used in some studies resulted in a blurring of boundaries between the OSAS and snoring groups. For example, Chervin et al used an obstructive apnea index cutoff of only ≥0.5/hour to define OSAS, and the mean apnea index for the OSAS group was 2.9 events/hour, indicating that the study group had mild OSAS, which was not that different from the snorers.[37,38] A study with a wider spectrum of severity may have attained different results. Finally, most studies have not controlled for obesity, which has been associated with neurobehavioral and cognitive abnormalities.

Although most studies simply compared groups, others have looked at the correlation between polysomnographic indices and neurocognitive/behavioral outcomes and have shown a correlation between different polysomnographic factors and cognitive outcomes, behavioral outcomes, and sleepiness.[32–34,39]

Cognitive deficits associated with pediatric SDB include general intelligence level as well as processes measured by using IQ subtests (Table 8). Specific functions objectively measured by using neuropsychological assessments and included in the research studies include:

- Learning, memory, and visuospatial skills

TABLE 6 Prevalence of OSAS on the Basis of Ambulatory Monitoring

Source	Year	No.	No. Undergoing Ambulatory Monitoring	Country	Age, y	OSAS Prevalence, %	HS Prevalence	OSAS Criteria and Comments
Castronovo et al[14]	2003	595	265	Italy	3–6	12	34.5% "Often" or "Always"	OAI ≥5
Goodwin et al[15]	2005	480	All	United States	6–11	24	10.5% "Frequently"	RDI ≥1 ↑ in male Not ↑ in obese
Hultcrantz and Löfstrand Tideström[205]	2009	393	26	Sweden	12	0.8	6.9% "Regularly"	AHI ≥1 and/ or OAI ≥1
Rosen et al[19]	2003	850	All	United States	8–11	2.2		AHI ≥5 or OAI ≥1 ↑ in AA ↑ in premature infants
Sánchez-Armengol et al[18]	2001	101	All	Spain	12–16	1.9	14.8% "Often"	Based on RDI ≥10 and snoring, witnessed apneas, and/or excessive daytime sleepiness. Girls = boys
Urschitz et al[206]	2010	1144	183	Germany	7.3–12.4	2.8		AHI ≥1

OAI, obstructive apnea index; AA, African American.

TABLE 7 Prevalence of HS

Source	Year	No.	Country	Age, y	HS Prevalence, %	HS Criteria
Akcay et al[207]	2006	1784	Turkey	4–17	4.1	"Often"
Alexopoulos et al[208]	2006	1821	Greece	5–14	7.4	>3 times/wk
Archbold et al[209]	2002	1038	United States	2–13.9	17.1	"More than half of the time"
Bidad et al[167]	2006	2900	Iran	11–17	7.9	≥3 times/wk
Chng et al[210]	2004	11 114	Singapore	4–7	6.0	>3 times/wk
Corbo et al[166]	2001	2209	Italy	10–15	5.6	"Often"
Ersu et al[211]	2004	2147	Turkey	5–13	7.0	"Often"
Goodwin et al[212]	2003	1494	United States	4–11	10.5	"Snoring frequently or almost always"
Gottlieb et al[213]	2003	3019	United States	5	12	≥3 times/week
Johnson and Roth[45]	2006	1014	United States	13–16	6	"Every or nearly every night"
Kuehni et al[214]	2008	6811	United Kingdom	1–4	7.9	"Almost always"
Liu et al[215]	2005	517 in China 494 in USA	China United States	Grade school	1.5 (China) 9.9 (United States)	Snoring loudly 5–7 times/wk
Liu et al[215]	2005	5979	China	2–12	5.6	"Frequent"
Löfstrand-Tideström and Hultcrantz[216]	2007	509	Sweden	4–6	5.3–6.9	"Snoring every night"
Lu et al[217]	2003	974	Australia	2–5	10.5	≥4 times/week
Montgomery–Downs et al[44]	2003	1010	United States	Preschool	HS and risk of SDB, 22	≥3 times/week
Nelson and Kulnis[218]	2001	405	United States	6–17	17	"Often"
Ng et al[219]	2005	3047	China	6–12	10.9	6–7 times/wk
Perez-Chada et al[220]	2007	2210	Argentina	9–17	9	"Frequent"
Petry et al[221]	2008	998	Brazil	9–14	27.6	"Frequently" or "always"
Sahin et al[222]	2009	1164	Turkey	7–13	3.5	"Frequently" or "almost every day"
Sogut et al[16]	2005	1030	Turkey	12–17	4.0	"Often" or "always"
Tafur et al[223]	2009	806	Ecuador	6–12	15.1	"Often" or "always"
Urschitz et al[164]	2004	1144	Germany	Primary school	9.6	"Always" or "frequently"
Zhang et al[224]	2004	996	Australia	4–12	15.2	>4 times/wk

- Language, verbal fluency, and phonological skills
- Concept formation, analytic thinking, and verbal and nonverbal comprehension
- School performance and mathematical abilities
- Executive functions

Executive functions were measured by using both objective testing and parent questionnaires. Executive functions are a network of skills and higher order functions that control and regulate other cognitive processes. These skills require mental flexibility, impulse control,

TABLE 8 Cognitive Deficits Associated With Pediatric SDB

Type of Deficit	Source	Level	No.	Findings/Comments
Cognition, general intelligence	Beebe et al[225] Blunden et al[226] Kaemingk et al[33] Kennedy et al[34] Kurnatowski et al[227]	IV	895	Deficits of general intelligence, sensorimotor integration by objective measurement; behavioral abnormalities included as well
	Carvalho et al[228] Montgomery-Downs et al[50] Suratt et al[43]	III	1332	Objective measures of general intelligence, verbal skills affected by SDB
	Friedman et al[26] Halbower et al[28] O'Brien et al[29] Kohler et al[30]	II	473	General intelligence, executive function, language all affected by SDB and measured objectively
	O'Brien et al[24] Suratt et al[25]	I	174	General conceptual ability, verbal and nonverbal reasoning, vocabulary affected by SDB (and time in bed[25])
Poor school performance	Chervin et al[42] Johnson and Roth[45] Kaemingk et al[33] Ng et al[219] Perez-Chada et al[220] Shin et al[47] Urschitz et al[229]	IV	11 110	Academic achievement measured either by parent or school grades Additive factors were SES and ethnicity[42,45] or BMI,[42,45,47] which contributed to findings of poor school performance in SDB
	Montgomery-Downs et al[44]	III	1010	Snoring associates with ethnicity, school performance in SES-challenged preschool-aged children
Executive function	Beebe et al[225] LeBourgeois et al[230] Karpinski et al[231]	IV	179	Mental flexibility, impulse control Objective testing performed
	Halbower et al[28] Kohler et al[30]	II	123	Response preparation, working memory, fluid and quantitative reasoning; objective testing performed by blinded tester
Learning, information processing, memory, visuospatial skills	Goodwin et al[212] Hamasaki Uema et al[232] Kaemingk et al[33] Kennedy et al[34] Kurnatowski et al[227] O'Brien et al[233] Spruyt et al[234] Giordani et al[38]	IV	1838	Objective testing performed in all but Goodwin et al[212] (questionnaire)
	Halbower et al[28] Tauman et al[46]	II	112	Race[28] and BMI may play an additive role in inflammation[46] and cognitive dysfunction in SDB
	O'Brien et al[24]	I	118	Primary snoring without gas exchange abnormalities associates with significantly lower learning and memory
Language/verbal skills	Kurnatowski et al[227] O'Brien et al[233] Perez-Chada et al[220] Honaker et al[235] Lundeborg et al[51]	IV	3304	Deficits of language or verbal skills in SDB Objective testing performed in all studies
	Suratt et al[43] Montgomery-Downs et al[50]	III	114	Race and time in bed may contribute to abnormal language associated with SDB
	O'Brien et al[24] Suratt et al[25]	I	118	Primary snoring without gas exchange abnormalities associated with significantly lower verbal skills; deficits of language or verbal skills in SDB
Attention	Beebe et al[225] Chervin et al[236] Galland et al[237] Gottlieb et al[213] Hamasaki Uema et al[232] Kaemingk et al[33] Li et al[238] Mulvaney et al[32] Urschitz et al[229]	IV	6411	Objective testing performed for attention except in refs 32,33,213,229, and 236 in which parent or teacher questionnaires were used
	Chervin et al[37]	I	105	
	O'Brien et al[24]	I	118	Visual and auditory attention

and working memory. Executive functions are required for optimal school performance and are acquired through adolescence in developing children.

Behavioral Abnormalities

The investigations on the cognitive effects of SDB in the 61 studies often included measures of neurobehavioral outcomes (Table 9). Hyperactivity was the most commonly studied and/or reported behavioral abnormality associated with SDB. It was reported as a frequent symptom of SDB in younger children, and in fact, in 1 study, snoring was found to be strongly predictive of a future diagnosis of hyperactivity over the long-term (level IV).[40] Attention-deficit/hyperactivity disorder (ADHD) or ADHD symptoms, hypersomnolence, somatization, depression, atypicality, aggression, and abnormal social behaviors were the other most frequently reported behavioral abnormalities associated with SDB in children. Most behavioral difficulties were defined by using parent or teacher questionnaires in unblinded level IV studies.

Sleepiness

Two studies (levels I–II) have shown a relationship between polysomnographic measures and objective measurement of daytime sleepiness on multiple sleep latency testing.[27,39]

Exacerbation of Neuropsychological Deficits by Other Factors Underlying Childhood SDB

Abnormal behavioral alterations associated with SDB might be modified or directly caused by other sleep disorders, such as coexistent periodic limb movement disorder.[41] In children with SDB displaying deficits of cognition, school performance, or behavioral functioning, there may be additive roles played by race,[28,42–44] decreased time in bed,[25,43] and low SES,[28,42,44,45] at least in part because of the association between obesity and low SES.[42] Markers of inflammation and increased cardiovascular risk may point to 1 mechanism related to decreased cognitive function associated with OSAS,[46] seen also in children who are obese. BMI correlated with abnormal cognitive function in pediatric SDB,[42,45,47] although OSAS was found to be an independent risk factor for cognitive deficits. Finally, in 2 studies examining brain function, neuronal injury of the brain[28] and altered cerebral blood flow[48] were found in children who had SDB compared with normal controls and were associated with behavior and cognitive problems. These findings indicate the possibility of preexisting medical problems causing the development of OSAS or, alternatively, OSAS causing brain injury. Therefore, studies showing improved cognition and behavior after treatment of SDB are 1 key in the determination of causality (see the following discussion).

Neuropsychological and Cognitive Deficits in Children Who Have SDB Improve After Treatment

In the previous guideline, there were few before-and-after treatment studies of pediatric SDB focusing on objectively measured cognitive problems. In the last 10 years, 19 studies have examined changes in behavior and/or cognition after surgical treatment of OSAS. The majority of investigations demonstrated agreement about post-treatment improvement of behavior, quality of life (QoL), hyperactivity, ADHD, and impulsivity (Table 10). The exception was 1 study of exercise treatment (level IV),[49] in which snoring improved in obese children but behavior and sleepiness did not. Most studies used subjective questionnaire reports. Excessive daytime sleepiness improved in 1 study that measured this factor, as did depression, sleep quality, and aggressive behavior. Since publication of the last guideline, 3 additional studies have demonstrated improved cognitive function (by using objective measurement) after treatment of OSAS, including measures of general intelligence, attention, memory, and analytic thinking, including level II,[26] level III,[50] and level IV[37] studies (Table 10). Of concern, however, is that some recent articles suggest that certain deficits of cognition measured by using objective testing may not improve to a large extent after treatment of childhood OSAS. Language, IQ, and executive function did not improve significantly in a well-designed, controlled study of 92 children (level II).[30] General intelligence in at-risk populations improved in 1 study (level III),[50] but phonologic processes and verbal fluency did not improve to normal (level III[50] and level IV[51]). QoL increases after treatment.[37,52–58] Three studies demonstrated long-term (≥1 year) behavioral or QoL improvements.[37,52,53] The majority of these studies suggest that in developing children who are dependent on executive function, cognition, and behavioral skills for daily function and school performance, treatment of childhood SDB has benefits.

Conclusion

In summary, these studies suggest that, in developing children, early diagnosis and treatment of pediatric OSAS may improve a child's long-term cognitive and social potential and school performance. These findings imply that the earlier a child is treated for OSAS, the higher the trajectory for academic and, therefore, economic success, but research is needed to support that implication. There is demonstrated benefit in terms of behavior, attention, and social interactions, as well as likely improvement in cognitive abilities with

TABLE 9 Behavioral Abnormalities Associated With Pediatric SDB

Type of Deficit	Source	Level	No.	Test Conditions
Hyperactivity and/or ADHD	Chervin et al[236]	IV	8101	Hyperactivity generally measured by using parent questionnaire
	Chervin et al[40]			
	Galland et al[237]			
	Golan et al[239]			
	Gottlieb et al[213]			
	Johnson and Roth[45]			
	LeBourgeois et al[230]			
	Mitchell and Kelly[240]			
	Owens et al[189]			
	Roemmich et al[191]			
	Urschitz et al[229]			
	Montgomery-Downs et al[44]	III	1010	Survey data
	Chervin et al[37]	I	105	ADHD assessed by using psychiatric interview and validated instrument
Somatization, depression	Galland et al[237]	IV	205	
	Mitchell and Kelly[240]			
	Mitchell and Kelly[241]			
	Rudnick and Mitchell[242]			
	Suratt et al[43]	III	114	
	O'Brien et al[24]	I	118	
Behavior problems, general	Goldstein et al[55]	IV	1946	Behavior generally measured by using parent questionnaire
	Goldstein et al[243]			
	Hogan et al[48]			
	Li et al[238]			
	Mitchell and Kelly[241]			
	Mulvaney et al[32]			
	Owens et al[189]			
	Roemmich et al[191]			
	Rosen et al[244]			
	Rudnick and Mitchell[242]			
	Tran et al[58]			
	Wei et al[245]			
Aggression, oppositional and social problems	Chervin et al[246]	IV	4407	
	Gottlieb et al[213]			
	Galland et al[237]			
	Mitchell and Kelly[240]			
	Mulvaney et al[32]			
	O'Brien et al[24]	I	118	
Excessive daytime sleepiness	Goodwin et al[212]	IV	9729	Sleepiness measured by using questionnaire
	Perez-Chada et al[220]			
	Shin et al[47]			
	Urschitz et al[229]			
	Johnson and Roth[45]			
	Gozal et al[27]	II	92	Sleepiness measured objectively by multiple sleep latency testing on PSG
	Chervin et al[37]	I	105	Sleepiness measured objectively by multiple sleep latency testing on PSG
Anxiety	O'Brien et al[24]	I	118	

the treatment of pediatric OSAS. However, more long-term studies are needed. The risks of treatment depend on the type of treatment but include risk of surgery, risk of medication, nonadherence to therapy, and cost. The risks of not treating children who have OSAS include potentially affecting the child's trajectory of developmental gains dependent on intelligence, executive function, and proper social interactions, ultimately lowering lifetime academic and social achievements. Therefore, the benefit of treating childhood OSAS outweighs the risk where treatment is feasible.

Areas for Future Research

- Further research is required to determine which domains of cognitive function will improve with treatment of OSAS. Reversibility of cognitive deficits associated with OSAS must be adjusted for the confounding effects of age, length of symptoms, SES, BMI, sleep duration, environment, and race and ethnicity.

Cardiovascular Effects of OSAS

A total of 24 studies related to cardiovascular effects of OSAS in childhood were identified since the last review. The levels of evidence were III and IV.

In a retrospective, level IV study of 271 clinical cases, only 1 child, who had congenital heart disease, had signs of cardiac failure preoperatively, and other cases had no evidence of left or right ventricular hypertrophy.[59] However, studies using more sophisticated, prospective techniques have found subclinical evidence of cardiac dysfunction. These studies are described in Table 11. Although postoperative adenotonsillectomy (AT) cardiac complications are rare (level IV),[59] left and right ventricular hypertrophy is significantly associated with postoperative respiratory complications (level III),[60] supporting the recommendation in the current and the previous guidelines that children who have cardiac abnormalities be monitored as inpatients postoperatively.

Blood pressure (BP) has also been shown to be affected by OSAS in children. There were 9 recent level III or IV studies, most of which showed a correlation between the presence/

TABLE 10 Cognitive, Behavioral, and QoL Abnormalities Improved After Treatment of Pediatric SBD

Deficit Measured	Source	Level	No.	Abnormalities Improved After SDB Treatment
Cognition/IQ	Chervin et al[37]	I	105	Attention measured on continuous performance test improved significantly after treatment
	Montgomery-Downs et al[50]	III	38	General conceptual ability improved (verbal fluency did not improve)
	Friedman et al[26]	II	59	Auditory-visual integration, auditory-motor memory, short-term memory, retention, analytic thinking, IQ/mental processing, attention all improved
Hyperactivity and/or ADHD	Galland et al[237] Li et al[238] Mitchell and Kelly[240] Mitchell and Kelly[241] Roemmich et al[191]	IV	247	Hyperactivity and/or diagnosis of ADHD improved
	Chervin et al[37]	I	105	Long-term improvement in hyperactivity
Somatization, depression	Galland et al[237] Mitchell and Kelly[240] Mitchell and Kelly[241]	IV	153	All showed improvement in depression and/or somatization
Behavior problems, general	Goldstein et al[55]	IV	450	All showed behavior improvement except Davis et al[49]
	Goldstein et al[243] Hogan et al[48] Li et al[238] Roemmich et al[191] Tran et al[58] Wei et al[245] Mitchell et al[53] Davis et al[49]			Long-term behavior improvement in Mitchell et al[53]
Aggression, oppositional, and social problems	Galland et al[237] Mitchell and Kelly[240]	IV	113	Improvement in abnormal social behavior and aggression
Excessive daytime sleepiness	Chervin et al[37]	I	105	Sleepiness improved by 1 min, as measured by using multiple sleep latency testing on PSG
QoL	Colen et al[52]	IV	787	Includes disease-specific and emotional QoL[58]
	Constantin et al[54] Goldstein et al[55] Sohn et al[56] Silva and Leite[57] Tran et al[58]			Long-term improvements ≥1 y[52,53]
	Chervin et al[37]	I	105	Long-term improvements at 1 y
Sleep quality	Constantin et al[54] Wei et al[245]	IV	590	Improved in both studies

severity of OSAS and indices of elevated BP (Table 12).

In a study by Kaditis et al,[61] overnight changes in brain natriuretic peptide levels were large in children who had an apnea hypopnea index (AHI) ≥5/hour when compared with those with milder OSAS and with controls (level III). This finding suggests the presence of nocturnal cardiac strain in children who have moderate to severe OSAS.

Two studies evaluated brain oxygenation and cerebral artery blood flow. Khadra et al[62] reported that male gender, arousal index, and amount of non–rapid eye movement sleep were associated with diminished cerebral oxygenation, whereas increasing mean arterial pressure, age, oxygen saturation (Spo_2), and amount of rapid eye movement sleep were associated with augmented cerebral oxygenation (level III). Hogan et al[48] found a decrease in middle cerebral artery velocity postoperatively in patients treated for OSAS, whereas control subjects showed a slight increase over time (level IV).

Three studies evaluated autonomic variability in children who have OSAS. Constantin et al[63] reported resolution of tachycardia and diminished pulse rate variability after AT in children who had OSAS (diagnosis of OSAS based on oximetry plus questionnaire data) (level IV). Deng et al[64] studied heart rate variability and determined that heart rate chaos was modulated by OSAS as well as by sleep state (level IV). In a study of 28 children who had OSAS, O'Brien and Gozal[65] found evidence of altered autonomic nervous system regulation, as evidenced by increased sympathetic vascular reactivity, during wakefulness in these children (level III). These studies all suggest that OSAS places stress on the autonomic system.

In summary, a large number of studies, albeit primarily level III, found that cardiac changes occur in the presence of OSAS, with an effect on both the right and left ventricles. OSAS in childhood also has an effect on both systolic and diastolic BP. In addition, several studies suggest that childhood OSAS can affect autonomic regulation, brain oxygenation, and cerebral blood flow. These studies suggest that childhood OSAS may jeopardize long-term cardiovascular health.[66]

The association between left ventricular remodeling and 24-hour BP highlighted the role of SDB in increasing cardiovascular morbidity.

Areas for Future Research

- How reversible, after treatment, are cardiovascular changes in children who have OSAS?
- What are the long-term effects of OSAS on the cardiovascular system?

TABLE 11 Structural and Functional Cardiac Abnormalities in Children Who Have OSAS

Source	Level	No.	Findings
Left-sided cardiac dysfunction			
Amin et al[247]	III	28 OSAS 19 PS	Abnormalities of LV geometry in 39% of OSAS vs 15% of PS; OSAS associated with increased LV mass
Amin et al[248]	III	48 OSAS 15 PS	Dose-dependent decrease in LV diastolic function with increased severity of SDB
Right-sided cardiac dysfunction			
Duman et al[249]	III	21 children, ATH; 21 controls	Higher RV myocardial performance index in patient with adenotonsillar hypertrophy than in controls; this decreased significantly after AT, along with symptoms of OSAS
Ugur et al[250]	III	29 OSAS 26 PS	Improved RV diastolic function after AT, with postoperative values similar to controls
Biventricular cardiac dysfunction			
James et al[59]	IV	271	Case review of ECG and chest radiography results found only 1 case of cardiac failure, which occurred in a child who had congenital heart disease; most other cases showed no abnormalities
Weber et al[251]	III	30 OSAS 10 controls	Increased RV diameter and area during both systole and diastole; reduced LV diastolic diameter and ejection fraction

ATH, adenotonsillar hypertrophy; LV, left ventricle; PS, primary snoring; RV, right ventricle.

TABLE 12 BP in Children Who Have OSAS

Source	Level	No.	Findings
Kohyama et al[175]	IV	23 suspected OSAS	REM diastolic BP index correlated with AHI Age, BMI, and AHI were significant predictors of systolic BP index during REM
Kwok et al[66]	III	30 PS	Children with PS had increased daytime BP and reduced arterial distensibility
Leung et al[252]	III	96 suspected OSAS	Children with a higher AHI had higher wake systolic BP and sleep systolic and diastolic BP BMI, age, and desaturation index contributed to elevation of the diastolic BP during sleep, but only BMI contributed to the wake and sleeping systolic BP
Guilleminault et al[253]	III	Retrospective component: 301 suspected OSAS Prospective component: 78 OSAS	Some children who have OSAS have orthostatic hypotension
Li et al[176]	III	306 community sample	OSAS was associated with elevated daytime and nocturnal BP
Amin et al[177]	III	140 suspected OSAS	OSAS associated with an increase in morning BP surge, BP load, and 24-h BP. BP parameters predicted changes in left ventricular wall thickness
Amin et al[254]	III	39 OSAS 21 PS	OSAS was associated with 24-h BP dysregulation AHI, Spo_2, and arousal contribute to abnormal BP control independent of obesity
Enright et al[255]	III	239 community sample	Obesity, sleep efficiency, and RDI were independently associated with elevated systolic BP
Kaditis et al[174]	IV	760 community sample	No difference in morning BP between habitual snorers and nonhabitual snorers

PS, primary snoring; REM, rapid eye movement.

Growth

The section on obesity contains a detailed review of obesity and OSAS, including the relationship between OSAS and the metabolic syndrome. The previous guideline documented many studies showing a relationship between OSAS and growth, and an increase in growth parameters after treatment of SDB by AT; this outcome has been confirmed by a number of more recent studies (as discussed in the recent meta-analysis by Bonuck et al[67]). In a confirmation of previous reports,[68,69] Selimoğlu et al[70] found a decreased level of serum insulin-like growth factor-I in children who have OSAS, which increased significantly 6 months after AT (level III).

Inflammation

Since the publication of the 2002 AAP guideline, there has been growing research on the role of OSAS in systemic inflammation. It has been postulated that OSAS results in intermittent hypoxemia, leading to production of reactive oxygen species. In addition, the hypoxemia and arousals from sleep lead to sympathetic activation. These factors may trigger inflammation or exacerbate obesity-related inflammation. However, the data on OSAS and markers of systemic inflammation in children are scarce and contradictory.

Eight studies (level II–III) measured levels of C-reactive protein (CRP) in children who had OSAS. Four studies (including 2 from the same center) showed no relationship between CRP and OSAS,[71–74] whereas 4 studies (2 from the same center) did show a relationship.[46,75–77] Part of the discrepancy between studies may be attributable to the varying proportions of obese subjects (because obesity is associated with high CRP levels) and varied age of subjects and definitions of OSAS in the different studies. Some studies controlled for obesity and degree of OSAS, whereas others did not. The studies showing a positive relationship indicated that OSAS was associated with elevated

CRP levels only above a certain threshold of severity. Thus, the relationship between OSAS and CRP seems to be complex and is affected by obesity and severity of OSAS.

A few level II and III studies have evaluated other circulating markers of inflammation in children who have OSAS. Two studies showed no difference in circulating intercellular adhesion molecule-1 between patients with OSAS and controls.[71,73] A single study found elevated p-selectin (a measure of platelet activation) in children who had OSAS compared with controls.[73] A single study showed elevated levels of interferon-γ in children who had OSAS.[74] One study showed increased interleukin (IL)-6 and lower IL-10 in those with OSAS,[78] whereas another study did not.[74] Another study reported no difference in cytokines IL-1β, IL-2, IL-4, IL-8, IL-12, and granulocyte macrophage colony-stimulating factor levels between children who had OSAS and controls.[74] Data on tumor necrosis factor-α are conflicting,[74,79] and differences in levels may be related to tumor necrosis factor-α gene polymorphisms.[80]

A pathology-based study found increased glucocorticoid receptors in adenotonsillar tissue from children who had OSAS compared with tissue from children who experienced chronic throat infections (level III)[81]; another study from the same group found elevated leukotriene receptors (level IV).[82] These findings provide a theoretical construct for the potential utility of antiinflammatory drugs as treatment of children who have OSAS, although possibly not for those who have already undergone AT.

In summary, the data on CRP are conflicting, but it may be that CRP levels increase above a certain threshold of severity of OSAS. Further research involving large samples of subjects who have varying degrees of OSAS severity, with results controlled for BMI and age, are needed. There are too few data on other circulating markers of systemic inflammation to enable any recommendations.

Areas for Future Research

- Larger studies, stratified for the severity of OSAS and controlled for obesity, are required to determine whether OSAS is associated with systemic inflammation. If so, what are the long-term sequelae of this inflammation? Are inflammatory biomarkers potential good outcome measurements for OSAS treatment studies? Do they correlate with clinical outcomes or long-term prognosis?

METHODS OF DIAGNOSIS

The previous guideline discussed the diagnosis of OSAS in great detail. On the basis of published evidence at the time, it was concluded that the positive and predictive value of history and physical examination for the diagnosis of OSAS was 65% and 46%, respectively; that is, no better than chance. It was therefore recommended that objective testing be used for the diagnosis of OSAS. An evaluation of the literature regarding nocturnal pulse oximetry, video recording, nap PSG, and ambulatory PSG suggested that these methods tended to be helpful if results were positive but had a poor predictive value if results were negative. Thus, children who had negative study results should be referred for more comprehensive testing. These recommendations were based on only a few studies, most of which had a low level of evidence. Furthermore, it was recognized that these techniques were of limited use in evaluating the severity of OSAS (which is important in determining management, such as whether outpatient surgery can be performed safely). In addition, the cost efficacy of these screening techniques had not been evaluated and would depend, in part, on how many patients eventually required full PSG. Since the publication of the initial guideline, there have been a number of new studies, but few are level I or II. Because few of the studies cited here included data that would enable calculation of overall sensitivity and specificity or positive and negative predictive values, an overall table could not be provided. For this section, PSG was considered the gold standard for diagnosis of OSAS.

Utility of History Alone for the Diagnosis of OSAS

Several level IV studies evaluated the use of history alone for the diagnosis of OSAS. Preutthipan et al[83] found overall poor sensitivity and specificity when evaluating various historical factors. The Pediatric Sleep Questionnaire published by Chervin et al[84] performed slightly better than other published questionnaires, with a sensitivity of 0.85 and a specificity of 0.87 by using a set cutoff. A follow-up study by the same group showed a sensitivity of 78% and a specificity of 72% for PSG-defined OSAS.[85] However, this is still a relatively low sensitivity and specificity for clinical purposes. By using this instrument, the same group also found that negative answers to only 2 questions on the Pediatric Sleep Questionnaire were helpful in identifying patients who had normal PSG results.[86] Taken together, the overall performance of questionnaire tools seems to support their use more as a screening tool than as a diagnostic tool, such that a negative score would be unlikely to mislabel a child with OSAS as being healthy, but a positive score would be unlikely to accurately diagnose a particular child with certainty.

Utility of Clinical Evaluation for the Diagnosis of OSAS

Similar to the data presented in the previous guideline, most studies found that clinical evaluation was not predictive of OSAS on PSG. Godwin et al[15] performed a large (N = 480), population-based study of 6- to 11-year-old children. The study included use of a standardized history, some clinical parameters, and ambulatory, full PSG (level II). They concluded that the sensitivity of any individual or combined clinical symptoms was poor. Certain parameters, such as snoring, excessive daytime sleepiness, and learning problems, had a high specificity.

In a level III study, van Someren et al[87] compared history and clinical examination by a pediatrician or otolaryngologist with abbreviated PSG (video recording, oximetry, and measurement of snoring). Both the sensitivity and specificity of the clinician's impression of moderate/severe OSAS were low (59% and 73%, respectively). In a similar number of cases, the clinicians underestimated (17%) and overestimated (16%) study results.

In a level III study, it was shown that waist circumference z score had a statistically significant but clinically poor correlation with symptoms of OSAS (R = 0.32, P = .006); BMI z score did not correlate with symptoms.[88]

Radiologic Studies

Several studies, all level III or IV, evaluated the utility of radiologic examinations in addition to clinical factors in establishing the diagnosis of OSAS (Table 13). Overall, these studies showed that the presence of airway narrowing on a lateral neck radiograph increased the probability of predicting OSAS on PSG. Cephalometric studies tended to show a small mandible in patients who had OSAS compared with controls, although a study using an MRI did not confirm this.[89] None of the cephalometric studies provided sensitivity and specificity or positive and negative predictive values. Table 13 simplifies the cephalometric findings for the purpose of presentation. A level I study indicated that acoustic pharyngometry may be a useful screening technique for OSAS in older children, but approximately one-half of the children could not cooperate well with the testing.[90] One uncontrolled study (level IV) showed that nasal resistance, as measured by using rhinometry, had a high sensitivity and specificity for predicting polysomnographic OSAS.[91] This technique warrants further study and validation.

Snoring Evaluation

Two level IV studies found a weak association between objective snoring characteristics and the presence/severity of OSAS that was insufficient to assist in clinical diagnosis.[92,93]

Cardiovascular Parameters

Studies have evaluated the utility of screening tests based on heart rate or other vascular factors in predicting OSAS (Table 14). These studies ranged from studies of pulse rate alone to more sophisticated (and, hence, more expensive or time-consuming) studies, such as analyses of heart rate variability, pulse transit time, and peripheral arterial tonometry. Studies were level II through IV. Overall, the studies found changes in cardiovascular variables in children who had OSAS but with varying sensitivities and specificities. Thus, some of these measures may potentially be useful screening tests in the future if combined with other modalities that would increase the sensitivity and specificity but cannot be recommended for clinical use at this point.

Nocturnal Oximetry

The previous AAP guideline, on the basis of a single study by Brouillette et al,[94] indicated that nocturnal pulse oximetry could provide an accurate screen for OSAS if the result was positive but that full PSG was needed if the oximetry result was negative. A need for further research in this area was indicated. Four additional studies were identified for the current report. Two of these did not compare oximetry versus PSG and therefore will not be discussed further.[95,96]

A follow-up study (level II) from the same group as the previous report by Brouillette et al[94] used overnight oximetry, primarily obtained in the home, to develop a scoring algorithm.[97] The subjects' median age was 4 years. The oximetry score correlated with the AHI obtained from PSG as well as with the presence of postoperative complications. However, the positive predictive value of oximetry for major postoperative respiratory compromise was only 13%. Of note, 80% of the 223 children had normal, inconclusive, or technically unsatisfactory oximetry results and were therefore referred for either repeat oximetry or PSG. In contrast, Kirk et al[98] compared overnight home oximetry (by using a system with an automated oximetry analysis algorithm that provided a desaturation index) with laboratory PSG in 58 children aged ≥4 years who had suspected OSAS (level III). They found poor agreement between the desaturation index on the basis of oximetry and the PSG-determined AHI. The sensitivity of oximetry for the identification of moderate OSAS (AHI >5/hour) was 67%, and specificity was 60%. The oximetry algorithm tended to overestimate the AHI at low levels and underestimate at high

TABLE 13 Relationship Between Airway Measurements and OSAS

Clinical Evaluation	Sleep Evaluation	Airway Evaluation	Source	Level	No.	Findings
Standardized history, clinical examination	PSG	Lateral neck radiography	Xu et al[256]	IV	50	Combinations of different predictor variables resulted in positive and negative predictor values ranging from 70% to 80%
Clinical examination	PSG	Lateral neck radiography	Jain and Sahni[257]	IV	40	Degree of OSAS correlated with adenoid size on radiography but not with tonsillar size on clinical examination
Clinical examination	PSG	Lateral neck radiography	Li et al[258]	IV	35	Tonsillar–pharyngeal ratio on radiography correlated with AHI but not clinical tonsil size. Clinical tonsil size did not correlate with AHI For a ratio of 0.479, the sensitivity and specificity in predicting moderately severe OSAS (AHI >10/h) was 96% and 82%, respectively
NA	PSG	Cephalometry	Kawashima et al[259]	III	15 OSAS 30 controls	Evidence of retrognathia in OSAS group
Clinical examination	Ambulatory abbreviated recordings	Cephalometry	Kawashima et al[260]	III	38 OSAS 31 controls	OSAS: retrognathia, long facies in those OSAS subjects who had large tonsils
NA	None	Cephalometry	Kikuchi et al[261]	IV	29 suspected OSAS 41 controls	OSAS: long facies
Questionnaire	None	Cephalometry	Kulnis et al[262]	IV	28 snorers 28 controls	Snorers: retrognathia, shorter maxilla and cranial base
Standardized history	Nap PSG	Cephalometry	Zucconi et al[263]	III	26 snorers 26 controls	Snorers: retrognathia, decreased nasopharyngeal space
NA	PSG	MRI	Schiffman et al[89]	III	24 OSAS 24 controls	No difference in mandibular size between OSAS and controls
Clinical assessment of tonsillar size	Ambulatory cardiorespiratory recordings	Acoustic pharyngometry Cephalometry	Monahan et al[90]	I	203	Degree of OSAS correlated with airway size on pharyngometry but not with tonsillar size Pharyngometric measures also correlated with mandibular length on cephalometry, only 78% of 8- to 11-y-old children could produce minimally acceptable data, and only 54% could produce high-quality data
Questionnaire, clinical examination	PSG	Rhinometry	Rizzi et al[91]	IV	73	Nasal resistance of 0.59 Pa/cm^3/s had a positive predictive value of 97% and a negative predictive value of 86%

levels. The authors concluded that oximetry alone was not adequate for the diagnosis of OSAS. On the basis of these limited studies, it seems as if oximetry alone is insufficient for the diagnosis of OSAS because of the high rate of inconclusive test results and the poor sensitivity and specificity compared with PSG, probably, in part, because children may have OSAS that results in arousals and sleep fragmentation but little desaturation. In addition, children tend to move a lot during sleep, which can result in movement artifact.

Ambulatory PSG

The term "ambulatory PSG" is used for unattended sleep studies conducted in the home. Frequently, ambulatory PSG consists of cardiorespiratory recordings alone. Although the use of ambulatory PSG is considered appropriate under certain circumstances in adults,[99] there is a paucity of studies evaluating ambulatory PSG in children. Zucconi et al[100] evaluated a home portable system comprising measurements of airflow (by using thermistry), snoring, chest and abdominal wall movements, electrocardiography (ECG), position, and oximetry (level II). However, the portable system was used in the sleep laboratory for the purpose of the study. A small sample of 12 children, 3 to 6 years of age, underwent routine PSG and in-laboratory portable testing on a consecutive night with the portable system. The portable system had good sensitivity for detecting a respiratory distress index (RDI) >5/hour (78% with automated scoring; 89% with human scoring) but a specificity of zero. Rosen et al[19] reported on a study of 664 children aged 8 to 11 years who underwent abbreviated ambulatory study (by using inductance plethysmography, oximetry, heart rate, and position) (level III). Of these home studies, 94% were considered technically adequate. A subsample of 55 children also underwent full laboratory PSG. Few details were given regarding this subsample. However, it was reported that the ambulatory studies had a sensitivity

TABLE 14 Utility of Cardiovascular Parameters in Predicting OSAS

Measure	Sleep Evaluation	Source	Level	No.	Findings
Pulse rate	Oximetry	Constantin et al[63]	IV	25 OSAS	Pulse rate decreases in children who have OSAS after AT
Pulse rate	Home cardiorespiratory studies	Noehren et al[264]	III	5 OSAS 20 controls	Pulse rate changes poor at detecting differences between respiratory events and movements, and between central and obstructive apneas
Heart rate variability	PSG	Deng et al[64]	IV	34 OSAS 18 controls	Heart rate chaos intensity had sensitivity of 72% and specificity of 81% for OSAS
Pulse transit time	PSG	Katz et al[265]	III	24 SDB 10 controls	Depending on the severity of the event, 80%–91% of obstructive respiratory events were associated with pulse transit time changes. However, pulse transit time changes also occurred with spontaneous arousals from sleep
Heart rate, pulse transit time	PSG	Foo et al[266] (similar data published in Foo and Lim[267])	III	15 suspected OSAS	Pulse rate had 70% sensitivity and 89% specificity, and pulse transit time had 75% sensitivity and 92% specificity in identifying obstructive events
Peripheral arterial tonometry	PSG	Tauman et al[268]	II	40 OSAS 20 controls	Peripheral arterial tonometry had sensitivity of 95% and specificity of 35% in identifying EEG arousals

of 88% and specificity of 98% in diagnosing a laboratory PSG–based AHI >5/hour. It is not clear why the results of this study were so different from that of Zucconi et al but may possibly be related to the older age of the subjects. Goodwin et al[101] used a full PSG system, including EEG measurements, in the unattended home environment in 157 children aged 5 to 12 years (level IV). Adequate data were obtained from 91% of subjects on the first attempt and 97% when the test was repeated if needed. Data were reported as excellent in 61% of cases and good in 36%. In a small subsample of 5 subjects, data were similar to those with laboratory PSG. This study shows the feasibility of performing unattended full ambulatory PSG in older children, but results may not be the same for young children. In summary, ambulatory PSG seems to be technically feasible in school-aged children, although data are not available for younger children. Studies of differing levels, and studying different age groups, found widely discrepant specificities for diagnosing moderate OSAS. Clearly, additional studies are needed.

Nocturnal PSG

Nocturnal, attended, laboratory PSG is considered the gold standard for diagnosis of OSAS because it provides an objective, quantitative evaluation of disturbances in respiratory and sleep patterns. A recent review describes some of the relationships between PSG and sequelae of OSAS (see "Pediatric Issues" section in Redline et al[102]). PSG allows patients to be stratified in terms of severity, which helps determine which children are at risk for sequelae (thus alerting pediatricians to screen for complications of OSAS); which children are at risk for postoperative complications and would, therefore, benefit from inpatient observation postoperatively; and which children are at high risk of persistence of OSAS postoperatively, who may then need postoperative PSG to assess the need for further treatment (eg, CPAP).

Adult patients may sleep poorly the first time they are in a sleep laboratory because of anxiety, the unfamiliar environment, and the attached sensors. This "first night effect" can lead to altered sleep architecture and possible underestimation of the severity of OSAS. Five studies (levels I–IV) evaluated the night-to-night variability of PSG in children[101,103–106]; in one of these articles,[101] only a small subsample had night-to-night variability evaluated (Table 15). The time difference between PSGs varied from 24 hours to 4 weeks. Although some of the studies showed minor differences in respiratory parameters from night to night, the studies suggest that few children would have been clinically misclassified on the basis of a single night's PSG. Thus, 1 night of PSG seems to be adequate to establish the diagnosis of OSAS. All studies showed significant differences in sleep architecture from night to night. Therefore, research studies evaluating sleep architecture would require >1 night of PSG. For consistency, it is recommended that PSG be performed and scored by using the pediatric criteria from the American Academy of Sleep Medicine scoring manual.[107]

Other Tests

The shape of the maximal flow-volume loop on pulmonary function testing has been used to attempt to screen for OSAS in adults. Young children cannot perform standard maximal flow-volume loops. One small study of 10 subjects evaluated the relationship between tidal breathing flow-volume loops and PSG (level III).[108] The sensitivity was 37.5% and specificity was 100%, indicating that this method is of limited utility in screening for OSAS.

Two studies by the same group evaluated whether urinary/serum

TABLE 15 Night-to-Night Variability in Polysomnographic Respiratory Parameters

Time Between Evaluations	Source	Level	No.	Findings
1–4 wk	Katz et al[103]	I	30 suspected OSAS	No significant group difference in the AHI between nights. Those with the highest AHI had the most variability. However, no patient was reclassified as primary snoring versus OSAS on the basis of the second study
7–50 d	Goodwin et al[101]	IV	12	Used unattended home PSG. Studies were successful in 10. No difference in AHI between nights in this small sample
Consecutive nights	Scholle et al[105]	III	131 OSAS	No difference in AHI between nights
Consecutive nights	Li et al[104]	III	46 obese 44 controls	AHI was greater on night 2 The first night would have correctly identified 11 (85%) of the 13 cases of OSAS if the worst obstructive apnea index over any single night was used as the criterion. However, the 2 cases that would have been missed by the single PSG had only borderline OSAS
Consecutive nights	Verhulst et al [106]	I	70 suspected OSAS	First night classified OSAS correctly in 91% of subjects, if the worst AHI over any night was used as the diagnostic criterion. All but 1 of those who were missed had an AHI <5/h

proteinomic analysis could be used to screen for the presence of OSAS. In a level I study of urinary proteinomics, the investigators found that a combination of urinary proteins could predict OSAS with a sensitivity of 95% and a specificity of 100%.[109] Similarly, in a level III study from the same group, the investigators found that a different set of proteins could be used to identify 15 of 20 children who had OSAS and 18 of 20 children who were snorers.[110] The authors note that they studied a highly selected population matched for age, gender, ethnicity, BMI, and inflammatory respiratory disorders, such as allergic rhinitis or asthma. Thus, this technique, although promising, requires further validation in typical clinical cohorts and duplication in another laboratory.

Summary

In summary, few of the screening techniques mentioned here have a sensitivity and specificity high enough to be relied on for clinical diagnosis. In addition, it should be noted that many of the studies used an AHI >5/hour when determining sensitivity and specificity, although an AHI >1.5/hour is considered statistically abnormal in children.[111–113] Few studies used large study samples, and few were blinded. As a result, some of the studies of screening techniques resulted in contradictory evidence. On a pragmatic level, however, it is realized that current infrastructure is inadequate to provide PSG for all children with suspected OSAS. Therefore, the use of screening tests may be better than no objective testing at all. However, clinicians using these tests should familiarize themselves with the sensitivity and specificity of the test used and consider proceeding to full PSG if the test result is inconclusive.

Areas for Future Research

- Well-designed, large, controlled, blinded, multicenter, prospective studies are required to provide more definitive answers regarding the utility of screening tests for the diagnosis of OSAS. In particular, additional studies of ambulatory PSG in children of varying ages are needed.

TREATMENT OF OSAS

AT

Adenotonsillar hypertrophy is the most common cause of OSAS, and AT continues to be the primary treatment for this issue. Adenoidectomy alone may not be sufficient for children who have OSAS because it does not address oropharyngeal obstruction secondary to tonsillar hyperplasia. The previous guideline stated the importance of AT as the primary treatment for OSAS in children. No new literature is available to suggest a change to these recommendations. Table 3 in the guideline lists relative contraindications to AT. Note that whereas a submucus cleft palate is a relative contraindication to adenoidectomy, a partial adenoidectomy may be performed in such patients. However, postoperative PSG should be performed to ensure that OSAS has resolved.

AT in most children is associated with a low complication rate. Minor complications include pain and poor oral intake. More severe complications may include bleeding, infection, anesthetic complications, respiratory decompensation, velopharyngeal incompetence, subglottic stenosis, and, rarely, death.

Tarasiuk et al found that health care utilization costs were 226% higher in children with OSAS before diagnosis compared with control children[114] and that health care costs decreased by one-third in children who underwent AT, whereas there was no change in health care costs in control children or children who had untreated OSAS[115] (both studies were level IV).

Partial Tonsillectomy

Several newer techniques for tonsillectomy have gained increasing use since publication of the last guideline. The primary goal of these techniques

is to decrease the morbidity associated with traditional tonsillectomy methods. One such technique is partial tonsillectomy (PT), in which a portion of tonsil tissue is left to cover the musculature of the tonsillar fossa. Multiple studies, ranging in level from II to IV, have evaluated recovery times and adverse effects from PT. However, only a few small, lower-level studies have specifically looked at the effect of PT on OSAS. In a level IV study, Tunkel et al[116] evaluated 14 children who underwent PSG before and after PT and found a cure rate (AHI $\leq$1/hour) of 93% postoperatively. In a retrospective study (level IV), Mangiardi et al[117] compared 15 children who underwent PT (of 45 eligible) with 15 children who underwent total tonsillectomy. This study had a number of technical limitations. A variety of techniques (overnight laboratory PSG, nap sleep studies, and limited-channel home sleep studies) were performed in subjects preoperatively, and limited-channel home sleep studies were performed in all patients postoperatively. These different monitoring techniques would be expected to provide varying results.[118,119] In both surgical groups, the authors found a higher rate of postoperative OSAS than typically reported in the literature, with a median (range) AHI of 7.5 $\pm$ 4.3/hour in the PT group and 8.8 $\pm$ 4.7/hour in the total tonsillectomy group (not significant).

PT carries an increased risk of regrowth of the tonsils, which occurred in 0.5% to 16% of patients in studies of varied duration. Celenk et al[120] performed a retrospective review of 42 children 1 to 10 years of age who underwent PT via radiofrequency ablation for symptoms of OSAS (level IV). Follow-up ranged from 6 to 32 months, with a mean follow-up of 14 months. They found tonsillar regrowth on physical examination in 7 (16.6%) patients; 5 of these were symptomatic and underwent completion tonsillectomy. The time frame for occurrence of regrowth ranged from 1 to 18 months. The authors noted that some episodes of regrowth occurred after episodes of tonsillitis. Zagólski[121] evaluated 374 children who underwent PT on the basis of clinical symptoms of OSAS (level IV). Patients underwent otolaryngology examinations annually for 4 years. Twenty-seven (7.2%) children had tonsillar regrowth; of those, 20 had clinical symptoms and, therefore, underwent completion tonsillectomy. Regrowth of the palatine tonsils was observed at a mean period of 3.8 years, suggesting the need for long-term follow-up. In a multicenter, retrospective case series of 870 children with a mean follow-up of 1.2 years, Solares et al[122] found an incidence of tonsillar regrowth of 0.5% (level III). The methods and criteria for assessing regrowth were not detailed in this article but may have been a clinical follow-up at 1 and 6 months postoperatively. The lower rate of regrowth in this study compared with the other studies may have been related to the shorter follow-up period. Eviatar et al[123] performed a long-term (10–14 years), retrospective, telephone survey comparing 33 children who had undergone PT for symptoms of OSAS versus 16 children who underwent tonsillectomy; children undergoing concomitant adenoidectomy were excluded (level III). They found similar rates of parent-reported snoring in the 2 groups (6.1% for PT, 12.5% for total tonsillectomy; not significant) but no cases of OSAS on the basis of symptoms.

PT for the treatment of adenotonsillar hypertrophy has shown some success in decreasing immediate postoperative pain. Derkay et al[124] prospectively evaluated 300 children undergoing either PT or total tonsillectomy for adenotonsillar hypertrophy (level II). They found that children in the PT group had an earlier return to normal activity and were 3 times more likely not to need pain medication at 3 days compared with the total tonsillectomy group. There was no difference between groups in median return to a normal diet (3.0 vs 3.5 days). In a level III, retrospective study of 243 children undergoing PT versus 107 undergoing total tonsillectomy, Koltai et al[125] found less pain and quicker return to a normal diet in children undergoing PT. In a level II study, Sobol et al[126] prospectively evaluated 74 children who had adenotonsillar hypertrophy scheduled for AT. Their results showed a resumption to normal diet 1.7 days earlier in the PT group compared with children undergoing total tonsillectomy. There was no significant difference in the resolution of pain or return to normal activities between the 2 groups, but there was increased intraoperative blood loss in the PT group.

In summary, there are no level I studies comparing PT with total tonsillectomy in the pediatric population. Additional data are needed regarding the efficacy of PT for OSAS, by using objective outcome measurements. There is possibility of tonsillar regrowth after PT, with studies showing varied rates of regrowth. These studies are all limited by lack of blinding, lack of objective measures to quantitate tonsillar regrowth, and lack of polysomnographic data relating tonsillar regrowth to OSAS. Some studies found that patients who undergo PT have less pain and quicker recovery during the first few days compared with children undergoing total tonsillectomy. However, PT may be associated with greater intraoperative blood loss, and there is a risk of recurrent infections in the tonsillar remnants.[120,121,123] At

this point, data are insufficient to recommend any particular surgical technique for tonsillectomy over another in terms of OSAS. However, children undergoing PT should be monitored carefully long-term to ensure that symptoms of OSAS related to tonsillar regrowth do not occur, and families should be warned about the possibility of recurrence of OSAS.

Postoperative Management After AT

Tonsillectomy and adenoidectomy can be safely performed in the vast majority of children on an outpatient basis. Risk factors that increase the risk of postoperative complications include age <3 years, severe OSAS, presence of cardiac complications, failure to thrive, obesity, and presence of upper respiratory tract infection (URI). Although there have been numerous publications regarding postoperative complications since publication of the last guideline, there have been no data to suggest a change in the previous recommendations. Children with medical comorbidities such as craniofacial anomalies, genetic syndromes, and neuromuscular disease are also high risk; these special populations are not covered by this guideline.

An important advantage of the objective documentation of the severity of OSAS by using PSG should be the ability to predict the need for overnight hospital stay after AT on the basis of a higher risk of postoperative complications. Severe OSAS has been proposed as a criterion for inpatient observation; the current evidence to define severe OSAS is derived primarily from level III retrospective studies. Although considerable physiologic information regarding the respiratory pattern and gas exchange during sleep is available from an overnight PSG, the available studies have focused primarily on the AHI and, to a lesser degree, the nadir of the $Sp0_2$. Relevant studies are listed in Table 16. Studies varied with regard to the type of patients included (proportion of obese patients; patients who had craniofacial and genetic syndromes) and severity of OSAS. Although the definition of postoperative respiratory compromise varied, most studies required that an intervention (eg, supplemental oxygen, nasopharyngeal tube, CPAP, intubation) be performed. Most studies found a high rate of postoperative respiratory complications. Different studies showed different PSG predictive factors for postoperative complications, and few studies developed receiver operating characteristic curves.[127] Nevertheless, studies were fairly consistent in indicating that an $Sp0_2$ <80% and an AHI >24/hour were predictive of postoperative respiratory compromise. These criteria are more conservative than the recently published clinical practice guidelines from the American Academy of Otolaryngology–Head and Neck Surgery, which recommend that children who have an AHI ≥10/hour and/or an $Sp0_2$ nadir <80% be admitted for overnight observation after AT.[3]

It is difficult to provide exact PSG criteria for OSAS severity because these criteria will vary depending on the age of the child; additional comorbidities, such as obesity, asthma, or cardiac complications of OSAS; and other PSG criteria that have not been evaluated in the literature, such as the level of hypercapnia and the frequency of desaturation (compared with $Sp0_2$ nadir). Therefore, on the basis of published studies (Table 16), it is recommended that patients who have an $Sp0_2$ nadir <80% (either on preoperative PSG or during observation in the recovery room postoperatively) or an AHI ≥24/hour be observed as inpatients postoperatively because they are at increased risk of postoperative respiratory compromise. In addition, on the basis of expert consensus, it is recommended that patients with significant hypercapnia on PSG (peak P_{C0_2} ≥60 mm Hg) be admitted postoperatively. Clinicians may decide to admit patients who have less severe PSG abnormalities on the basis of a constellation of risk factors (age, comorbidities, and additional PSG factors) on an individual basis.

Data regarding URIs were based on studies of children undergoing general anesthesia for a variety of procedures. The committee could not identify any studies related specifically to URIs and AT. In a large, level III study, Tait et al[128] evaluated 1078 children 1 month to 18 years of age who were undergoing an elective surgical procedure. The presence of a URI was diagnosed by using a parental questionnaire. Data regarding perioperative respiratory events were recorded. There were no differences between children who had active URIs, recent URIs (within 4 weeks), and asymptomatic children with respect to the incidences of laryngospasm and bronchospasm. However, children who had active and recent URIs had significantly more episodes of breath-holding, desaturation <90%, and overall adverse respiratory events than children who had no URIs. Independent risk factors for the development of adverse respiratory events in children who had active URIs included use of an endotracheal tube (in those <5 years of age), preterm birth, history of reactive airway disease, paternal smoking, surgery involving the airway, the presence of copious secretions, and nasal congestion. In a large level III study of 831 children undergoing surgery with a laryngeal mask airway, von Ungern-Sternberg et al[129]

TABLE 16 Relationship Between PSG Parameters and Postoperative Respiratory Complications

Source	Level	Type of Study	No.	Study Group	Age, y	Special Populations Included[a]	Findings
Hill et al[269]	III	Retrospective	83	AHI >10	≤18	Yes	Major respiratory complication in 5%; minor in 20% Only age <2 y ($P < .01$) and AHI >24 ($P < .05$) significantly predicted postoperative airway complications Complication rate only 4% if special populations were excluded AHI >24 predicted 63% of complications
Jaryszak et al[270]	III	Retrospective	151	Any child who had a PSG	Not stated	Yes	Respiratory complication rate was 15% Children with complications had higher AHI (32 vs 14) and lower Spo_2 nadir (72% vs 84%) compared with those without complications
Koomson et al[271]	III	Retrospective	85	AHI >5	Not stated	Yes	Postoperative desaturation in 28% More likely to desaturate postoperatively if PSG Spo_2 nadir <80%
Ma et al[272]	III	Retrospective	86	Any child who had a PSG	1–16	Yes	Postoperative desaturation in 7% No difference in AHI between those with and without postoperative desaturation (11.6 ± 4.5 vs 14.7 ± 16.6)
Sanders et al[273]	I	Prospective	61	61 children who had OSAS vs 21 who had tonsillitis	2–16	No	Respiratory complication rate was 28% Subjects with RDI ≥30 were more likely to have laryngospasm and desaturation At an RDI ≥20, OSAS was more likely to have breath-holding on induction
Schroeder et al[274]	III	Retrospective	53	Severe OSAS (AHI >25)	Not stated	Yes	43% required oxygen or PAP Note: an additional 17 children were electively kept intubated postoperatively
Shine et al[196]	III	Retrospective	26	Obese OSAS	2–17	Obese; other comorbidities not stated	46% had respiratory complications Those requiring intervention for respiratory problems had a lower Spo_2 (68 ± 20% vs 87 ± 18%) but no difference in RDI (27 ± 44 vs 15 ± 28) than those who did not require intervention By using univariate analysis, a preoperative Spo_2 <70% was associated with postoperative respiratory compromise, but no threshold was found for RDI
Ye et al [127]	III	Retrospective	327	AHI ≥5	4–14	No	11% had respiratory complications An AHI of 26 had 74% sensitivity and 92% specificity for predicting postoperative respiratory complications

[a] Special populations include children with genetic syndromes and craniofacial abnormalities.

compared children who had a URI within 2 weeks of surgery versus those without a URI; 27% of children had a recent URI. They found a doubling of the incidence of laryngospasm, bronchospasm, and oxygen desaturation intraoperatively and in the recovery room in the children who had recent URIs, although the overall incidence of these events was low. The risk was highest in young children; those undergoing ear, nose, and throat surgery; and those in whom multiple attempts were made to insert the laryngeal mask airway. On the basis of data available regarding risk with general anesthesia, the committee concluded that children who have an acute respiratory infection on the day of surgery, as documented by fever, cough, and/or wheezing, are at increased risk for postoperative complications and, therefore, should be rescheduled or monitored closely postoperatively. Clinicians should decide on an individual basis whether these patients should be rescheduled, taking into consideration the severity of OSAS in the particular patient and keeping in mind that many children who have adenotonsillar hypertrophy exhibit chronic rhinorrhea and nasal congestion even in the absence of viral infections.

Postoperative Persistence of OSAS After AT

Although the majority of children have a marked improvement in OSAS after AT, OSAS may persist postoperatively. OSAS is especially likely to persist in children who have underlying illnesses such as craniofacial anomalies, Down syndrome, and neuromuscular disease; these special populations are not included in this review.

Over the years since the committee's first consensus report, a number of studies have been published discussing the impact of surgery on childhood OSAS. Most of these studies were omitted from consideration for

this review because of their lack of preoperative and postoperative PSGs. Many other studies reported changes in group averages for polysomnographic and other measures postoperatively. All published articles found that AT leads to significant improvement in polysomnographic parameters in the majority of patients (although not in all). Studies providing data that could be interpreted to provide an estimate of the proportion of patients who were cured of their OSAS are shown in Table 17. Twenty original articles on the topic have been published since 2002, including 2 meta-analyses[130,131] of other articles included in the review. The lack of uniform agreement regarding the polysomnographic criteria for diagnosis of OSAS complicates this analysis of postoperative persistence of OSAS, as it does other aspects of this review, in part because the preoperative PSG criteria for surgery are not uniform across the different articles, but more importantly, because the postoperative prevalence of OSAS is highly dependent on the stringency of diagnostic criteria. In some cases, articles helpfully provided data on residual prevalence of OSAS by using different polysomnographic criteria (eg, AHI >1/hour and AHI >5/hour). At this point, it is generally accepted that AT has a higher success rate than isolated adenoidectomy or tonsillectomy, so although a few of the articles included some patients undergoing only adenoidectomy, only tonsillectomy, or ancillary procedures such as nasal turbinectomy, most focused exclusively on the impact of AT.

As shown in Table 17, a total of 11 articles were published, describing 10 general population cohorts referred either to a pediatric sleep specialist or otolaryngologist for OSAS, and 1 meta-analysis of articles dating back to 1980. Most of these were case series of patients, with significant methodologic flaws, including nonblinding and incomplete follow-up for a high proportion of patients, and these issues were present even in the methodologically strongest articles.[132–134] The polysomnographic criteria for OSAS in each article may or may not have been the same as those used as an indication for AT, and these varied from an AHI ≥1/hour to AHI ≥5/hour and RDI >2 to 5/hour. Surprisingly, the overall estimate of postoperative persistence of OSAS did not seem to vary greatly by polysomnographic criteria for surgery. Conversely, the estimates of residual OSAS were clearly related to which polysomnographic criteria for OSAS were applied to the postoperative PSGs. When using an AHI ≥1/hour as the criterion for residual OSAS, estimates of persistence ranged from 19%[135] to 73%,[133] whereas when using an AHI ≥5/hour as the criterion, the estimate of persistence of OSAS ranged from 13%[134] to 29%.[132] It is important to recognize that there are clearly recognizable risk factors for postoperative persistence of OSAS and that the prevalence of these risk factors in the populations studied had an important impact on their estimates of postoperative persistence of OSAS. For example, >50% of patients in the multicenter study of Bhattacharjee et al[133] were obese, whereas 21% of the patients in the series by Ye et al[134] were obese, defined as 95th percentile for the Chinese population. It should be emphasized that although many of these studies showed a high proportion of patients with residual OSAS after AT, most patients exhibited a marked decrease in AHI postoperatively.

Risk Factors for Postoperative OSAS

1. Obesity

Five studies focused attention on obese patients (defined as 95th percentile for weight or BMI for age), and 1 meta-analysis[131] combined 4 of these studies. The meta-analysis reported that 88% of obese patients still had a postoperative AHI ≥1/hour, 75% had a postoperative AHI ≥2/hour, and 51% had a postoperative AHI ≥5/hour. Preoperative obesity was found to be a significant risk factor for postoperative residual OSAS in several other studies[133–135] as well, even when multivariable modeling was used to control for other factors such as age and preoperative AHI. The odds ratios of persistent OSAS in obese patients ranged in these models from 3.2[134] to 4.7.[136] One study found that the relationship of BMI to risk of persistent OSAS was no longer significant when adjusted for preoperative AHI.[137] In contrast to all of the studies that looked at this factor, a study of obese Greek children found no difference in the prevalence of residual OSAS in obese versus nonobese children; part of the reason for this finding might be that this study used a slightly less stringent criterion for obesity (1.645 SDs weight for age, which is the 90th percentile).[138]

2. Baseline Severity of OSAS

All studies that evaluated baseline AHI as a potential risk factor for persistent postoperative OSAS found it to be a significant risk factor, even when adjusted for other comorbidities such as obesity.[132–134,136,139]

3. Age

A series limited to children aged <3 years reported a high incidence (65%) of treatment failures in these younger children, but this cohort included a large proportion of children who have other risk factors, such as severe OSAS and chromosomal and craniofacial abnormalities.[140] In contrast, 2 studies reported that increasing age (especially 7 years and older) is a risk factor for persistent

TABLE 17 Studies Providing an Estimate of the Proportion of Patients Who Were Cured of OSAS With Surgery

Source	Year	Level	No.	Age, y	Population	Polysomnographic Criterion for Surgery	Operation	Follow-up Period, mo	Subjects Who Had OSAS at Follow-up	Miscellaneous
General population studies										
Chervin et al[37] Dillon et al[275]	2006	I	39	5.0–12.9		AHI ≥1	AT	13 ± 1.4	21%	2 articles documented findings in the same population
Guilleminault et al[135]	2004	III	56	1.25–12.5		AHI ≥1 or RDI >2	AT: 36 (some of whom also had nasal turbinectomy and/or tonsillar wound suturing); A: 8; T: 11	3	AT: 19.4%; A: 100%; T: 100%	Half of AT failures were in obese patients
Guilleminault et al[141]	2007	III	199	1.5–14		AHI ≥1	AT in 183; A or T in 19; nasal turbinectomy in 17.4%	3–5	46.2%	Increased nasal turbinate score, presence of deviated nasal septum and increased Mallampati score of relationship of tongue to uvula and retro position of the mandible were all predictive of higher failure rate
Guilleminault et al[276]	2004	IV	284	2–12.1		AHI >1.5	AT in 228; A or T inferior turbinectomy in 73	3–4	8.8% of those with preoperative AHI <10 and AT; 64.7% of those with preoperative AHI ≥10. No breakdown provided regarding results of AT versus other surgery	An additional 99 children had RDI >1.5 and AHI <1.5. Of this group, 100% had normal RDI after AT and 9.2% had residual abnormal RDI after A or T. Difficult to interpret findings because of inconsistent reporting of data
Mitchell[132]	2007	III	79	3–14		AHI ≥5	AT	1–9.3	16% (AHI ≥5); 29% (AHI >1.5)	Severity of preoperative AHI predicted response: preoperative 5–10, 0% ≥5; preoperative 10–20, postoperative 12% ≥5; preoperative >20, postoperative 36% ≥5; 13/22 with postoperative snoring had AHI ≥5; 0/57 without postoperative snoring had AHI ≥5
Tal et al[277]	2003	IV	36	1.8–12.6		RDI >1	AT	4.6 (1–16)	11.11% had RDI >5	
Tauman et al[137]	2006	III	110	6.4 ± 3.9		AHI ≥1	AT	1–15	46% AHI 1–5, 29% with AHI >5	In logistic regression, AHI before surgery and family history of OSAS were significant predictors of AHI >5 postoperative
Walker et al[278]	2008	IV	34	0.93–5		RDI >5 in REM sleep	AT	9.8	35% with RDI >5	Treatment failures limited to those with preoperative RDI in REM >30
Bhattacharjee et al[133]	2010	III	578	6.9 ± 3.8		AHI ≥1	AT	1–24	72.8% with AHI ≥1; 21.6% >5	Large multicenter study. Age >7 y, increased BMI, presence of asthma, and high preoperative AHI were independent predictors of persistent postoperative OSAS

TABLE 17 Continued

Source	Year	Level	No.	Age, y	Population	Polysomnographic Criterion for Surgery	Operation	Follow-up Period, mo	Subjects Who Had OSAS at Follow-up	Miscellaneous
Brietzke and Gallagher[130]	2006	III	325	4.9	Various	AHI ≥1	AT	3.3	17.1% (depended on OSAS criteria for each study)	Meta-analysis of 11 case series published between 1980 and 2004
Ye et al[134]	2010	IV	84	7.1 ± 3.2	Chinese	AHI ≥5	AT	18–23	31% with AHI ≥1; 13.1% with AHI ≥5	Obesity and high preoperative AHI were significant independent predictors of treatment failure
Focus on obese populations										
Mitchell and Kelly[279]	2004	III	30	3.0–17.2	Obese (BMI > 95th percentile)	AHI >5	AT	5.6	54%	
Mitchell and Kelly[139]	2007	III	72	3–18	Comparison of obese (BMI >95th percentile) with nonobese	AHI ≥2: AHI 2–5 mild, AHI 5–15 moderate AHI ≥15 severe	AT	5–6	Obese: 76%: (46% mild; 15% moderate; 15% severe). Nonobese: 28%: (18% mild; 10% moderate).	Preoperative AHI and obesity were independent risk factors for postoperative OSAS. OR for persistent OSAS in obese, adjusted for preoperative AHI, was 3.7 (95% CI: 1.3–10.8)
O'Brien et al[136]	2006	III	69	7.1 ± 4.2	Obese (weight >2 SDs from mean for age)	RDI ≥5	AT	20.4 ± 16.8	Nonobese: 22.5%; Obese: 55%	Preoperative AHI and obesity were independent risk factors for postoperative OSAS. OR for persistent OSAS in obese, adjusted for preoperative AHI, was 4.7 (95% CI: 1.7–11.2)
Shine et al[194]	2006	IV	19	6.5 ± 4.4	Obese (BMI >95th percentile)	RDI>5	18 AT (1 with UPPP), 1 T	2–6	63%	Missing data
Costa and Mitchell[131]	2009	III	110	7.3–9.3	Obese	Various	AT	3–5.7	88% had postoperative AHI ≥1; 75% had postoperative AHI ≥2; 51% had postoperative AHI ≥5	Meta-analysis of 4 obesity studies included here
Apostolidou et al[138]	2008	IV	70	6.5 ± 2.2	Greek; obese defined as >1.645 SDs from mean weight for age	OAHI ≥1	AT	2-14	Overall: 75.7% with AHI ≥1 (77.3% obese, 75% nonobese). Among children with a preoperative OAHI ≥5: 9% with AHI ≥5 (8% obese, 10% nonobese)	
Focus on other special populations										
Mitchell and Kelly[140]	2005	III	20	1.1–3.0	Children <3 y	RDI >5	AT	4.1–20.4	65%: 25% RDI 5–10; 25% RDI 10–20; 15% RDI >20	Included comorbidities (Down syndrome, cardiac disease, cerebral palsy) excluded from this guideline. 60% of patients were severe, with RDI >20 at baseline
Mitchell and Kelly[280]	2004	III	29	1.4–17	Severe OSAS	RDI >5; severe: RDI ≥30	AT	6	69% with postoperative RDI >5	48% were obese

A, adenoidectomy; CI, confidence interval; OAHI, obstructive AHI; OR, odds ratio; T, tonsillectomy; REM, rapid eye movement; UPPP, uvulopharyngopalatoplasty.

OSAS, even when controlling for obesity.[132,133]

4. Other Potential Risk Factors

Individual studies have noted that nasal abnormalities or craniofacial disproportion,[141] family history of OSAS,[137] and presence of asthma[133] were all predictive of higher failure rate, but these findings were not substantiated by other studies. Of note, Mitchell[132] found that 13 of 22 patients in the cohort who had postoperative snoring had an AHI ≥5/hour, whereas none of the 57 patients who did not exhibit postoperative snoring had an AHI ≥5/hour. This supports the findings of older studies reviewed in the previous technical report that found absence of snoring to have a 100% negative predictive value for postoperative OSAS.[6] However, in the Chinese cohort, 2 of 11 patients who have persistent AHI ≥5/hour reportedly did not snore; it is unclear whether cultural considerations might have affected parental report of snoring.[134]

Summary

AT is the most effective surgical therapy for pediatric patients, leading to an improvement in polysomnographic parameters in the vast majority of patients. Despite this improvement, a significant proportion of patients are left with persistent OSAS after AT. The estimate of this proportion in a relatively low-risk population ranges from a low of 13% to 29% when using an AHI ≥5/hour as the criterion to a high of 73% when including obese children and adolescents and a conservative AHI ≥1/hour. Children at highest risk of persistent OSAS are those who are obese and those with a high preoperative AHI, especially those with an AHI ≥20/hour, as well as children >7 years of age. Absence of snoring postoperatively is reassuring but may not be 100% specific; it may therefore be advisable to obtain a postoperative PSG in very-high-risk children even in the absence of reported persistent snoring.

Areas for Future Research

- What are the risks of persistence of OSAS and long-term recurrence of OSAS after PT versus total tonsillectomy? Large, prospective, randomized trials with objective outcome measures including PSG are needed.
- Better delineation of which patients would benefit from postoperative PSG.
- How well does resolution of OSAS correlate with resolution of complications of OSAS?
- Are some of the newer surgical techniques for AT equally effective in resolving OSAS?
- What are the risks of performing AT in a patient with a URI?
- What are the PSG parameters that predict postoperative respiratory compromise? Future research should focus on refining the AHI and $Sp0_2$ nadir cutoffs for severe OSAS. In addition, it may be possible to glean other predictive information from the PSG, such as the extent of hypoventilation, the percent sleep time spent with $Sp0_2$ <90%, the frequency of desaturation events, the length of apneas and hypopneas, and the presence of central apneas, to create formulae for risk scores.

CPAP

At the time of the previous report, there were few prospective studies on CPAP use in children, although several retrospective studies indicated that CPAP was efficacious in the treatment of pediatric OSAS. Since that time, there have been at least 7 recent studies evaluating the use of positive airway pressure (PAP) in children and adolescents who have OSAS. One of these was a randomized trial with low power (level II),[142] and others were case series without controls (level IV). A descriptive study examined the use of behavioral intervention in improving CPAP adherence.[143] In addition, a level III study described use of a high-flow nasal cannula as an alternative to CPAP.[144] In contrast to the previous guidelines, several of the current studies obtained objective evaluation of CPAP adherence by downloading usage data from the CPAP device. In most studies, CPAP therapy was instituted for persistent OSAS after AT; in many cases, the patients had additional risk factors for OSAS, such as obesity or craniofacial anomalies.

A multicenter study (level II) evaluated PAP in 29 children who were randomly assigned either CPAP or bilevel positive airway pressure (BPAP).[142] Patients demonstrated significant improvement in sleepiness, snoring, AHI, and oxyhemoglobin saturation while using PAP during the 6-month follow-up period. However, approximately one-third of patients dropped out, and of those who used PAP, objective adherence was 5.3 ± 2.5 hours/night. Parents overestimated the hours of PAP use compared with the devices' actual objective recordings of use. There was no significant difference in adherence between the CPAP and BPAP groups. A retrospective chart review of 46 children started on PAP for OSAS that persisted after AT also showed significant improvement in symptoms of OSAS as well as in polysomnographic parameters (level IV).[145] Seventy percent of patients were considered adherent. Parental report of adherence was most divergent from the machines' recording in the least adherent patients. More

than one-half of the children had complicating factors, such as Down syndrome and Prader-Willi syndrome.[145] Another study of a heterogeneous group of patients displayed varying CPAP adherence, with 31 of 79 children showing continued CPAP use (level IV).[146] A small, nonblinded retrospective study (level IV) suggested that adherence to CPAP could be improved with behavioral techniques if the family accepted the interventions.[143]

A retrospective review described 9 children who successfully used BPAP in the intensive care setting because of respiratory compromise after AT.[147] Another retrospective review described the successful use of CPAP in 9 patients of a heterogeneous group of 18 children aged <2 years.[148] A nonrandomized, prospective level III study of 12 children who had OSAS treated in the sleep laboratory with a high-flow open nasal cannula system as an alternative to formal CPAP demonstrated an improvement in oxyhemoglobin saturation and arousals, but not AHI, compared with baseline.[144] There was a decrease in sleep efficiency with the cannula compared with baseline. Long-term use and use in the home situation were not assessed.

In summary, several studies (levels II–IV) have confirmed earlier data demonstrating that nasal CPAP is effective in the treatment of both symptoms and polysomnographic evidence of OSAS, even in young children. However, adherence can be a major barrier to effective CPAP use. For this reason, CPAP is not recommended as first-line therapy for OSAS when AT is an option. However, it is useful in children who do not respond adequately to surgery or in whom surgery is contraindicated. Patient and family preference may also be a consideration (eg, in families with religious beliefs against surgery or blood transfusions). Objective assessment of CPAP adherence is important because parental estimates of use are often inaccurate. If the patient is nonadherent, then attempts should be made to improve adherence (eg, by addressing adverse effects, by using behavior modification techniques), or the patient should be treated with alternative methods. A study described in the previous report noted that CPAP pressures change over time in children, presumably because of growth and development.[149] Therefore, it is recommended that CPAP pressures be periodically reassessed in children.

At this time, data are insufficient to make a recommendation on the use of high-flow, open nasal cannula systems.

Areas for Future Research

- Efficacy of CPAP use as a first-line treatment of obese children.
- Determinants of CPAP adherence and ways to improve adherence.
- Long-term effects of CPAP, particularly on the development of the face, jaw, and teeth.
- Changes in CPAP pressure over time, and the frequency with which this needs to be monitored.
- Development of pediatric-specific devices and interfaces.

Medications

There have been several studies evaluating the use of corticosteroids and leukotriene antagonists in the treatment of OSAS. An older study showed no therapeutic effect of systemic steroids on OSAS.[150] Since then, 3 studies (1 level I, 1 level II, and 1 level III) have evaluated topical nasal steroids as treatment of OSAS, 1 level II study has evaluated montelukast, and 1 level IV study has evaluated a combination thereof. An additional level I study evaluated the effect of intranasal steroids on adenoidal size and symptoms related to adenoidal hypertrophy but did not include PSG in the evaluation.[151]

A small, level II, randomized, double-blind trial,[152] a level I, randomized, double-blind trial of 62 children,[153] and a nonrandomized, open-label level III study of intranasal steroids[154] all showed a moderate improvement in patients who had mild OSAS. However, significant residual OSAS remained in 2 of the studies. Berlucchi et al[151] reported an improvement in symptoms of adenoidal hypertrophy, including snoring and observed apnea, but did not obtain objective evidence of improvement in OSAS. Two studies showed shrinkage of adenoidal tissue.[151,153] All studies were short term (2–6 weeks), although 1 study showed persistent improvement 8 weeks after discontinuation of the steroids (Table 18).[153]

An open-label, nonrandomized, 16-week level IV study of montelukast in children who had mild OSAS found a statistically significant but small change in the AHI (AHI decreased from 3.0 $\pm$ 0.2 to 2.0 $\pm$ 0.3; P = .017).[82] Another small, open-label, nonrandomized, 12-week level IV study of combined montelukast and nasal steroids found a mild but statistically significant improvement in AHI in children who had mild OSAS (AHI decreased from 3.9 $\pm$ 1.2/hour to 0.3 $\pm$ 0.3/hour; $P < .001$).[155]

In summary, several small level I through IV studies suggest that topical steroids may ameliorate mild OSAS. However, the clinical effects are small. On the basis of these studies, intranasal steroids may be considered for treatment of mild OSAS (defined, for this indication, as an AHI <5/hour, on the basis of studies described in Table 18). Steroids should not be used as the primary treatment of moderate

TABLE 18 Studies of Antiinflammatory Medications for the Treatment of OSAS

Medication	Source	Level	No.	Duration, wk	Randomized	Placebo-Controlled	Baseline AHI (per h)	AHI on Treatment (per h)	*P*
Intranasal steroids	Brouillette et al[152]	II	13 OSAS 12 controls	6	Yes	Yes	10.7 ± 9.4	5.8 ± 7.9	.04
Intranasal steroids	Alexopoulos et al[154]	III	27 OSAS	4	No	No	5.2 ± 2.2	3.2 ± 1.5	<.001
Intranasal steroids	Kheirandish-Gozal and Gozal[153]	I	62 OSAS	6; crossover	Yes	Yes	3.7 ± 0.3	1.3 ± 0.2	<.001
Montelukast	Goldbart et al[82]	IV	24 OSAS 16 controls	16	No	No	3.0 ± 0.2	2.0 ± 0.3	.017
Intranasal steroids + montelukast	Kheirandish et al[155]	IV	22 OSAS 14 controls	12	No	No	3.9 ± 1.2	0.3 ± 0.3	<.001

or severe OSAS. Because the long-term effects of intranasal steroids are not known, follow-up evaluation is needed to ensure that the OSAS does not recur and to monitor for adverse effects. Of note, no studies specifically evaluated children who had atopy or chronic rhinitis, although 1 study mentioned that similar improvements were seen in children who had a history of allergic symptoms compared with those without.[153] Further study to determine whether children who have atopy are more likely to respond to this therapy is needed. Data are insufficient at this time to recommend treatment of OSAS with montelukast.

Areas for Future Research

- What is the optimal duration of intranasal steroid use? All trials have been short-term with a short-term follow-up. Does the OSAS recur on discontinuation of therapy? How often should objective assessment of treatment effects be performed?
- What is the efficacy of intranasal steroids in children who have chronic or atopic rhinitis?
- How do the benefits and adverse effects of long-term nasal steroids compare with surgery?
- Larger studies, stratified for severity of OSAS and controlled for obesity, to determine whether OSAS is associated with systemic inflammation
- Will these biomarkers be good outcome measurements for treatment studies? Do they correlate with clinical outcomes or long-term prognosis?

Rapid Maxillary Expansion

Rapid maxillary expansion has recently been used to treat OSAS in select pediatric populations. It is an orthodontic procedure designed to increase the transverse diameter of the hard palate by reopening the midpalatal suture. It does this by means of a fixed appliance with an expansion screw anchored on selected teeth. After 3 to 4 months of expansion, a normal mineralized suture is built up again. The procedure is typically used only in children with maxillary constriction and dental malocclusion. Two case series without controls (level IV) have evaluated this procedure as a treatment of OSAS in children. One study described 31 patients selected from an orthodontic clinic; 4 months after surgery, all patients had normalized AHI.[156] Another screened 260 patients in a sleep center to find 35 that were eligible; only 14 were studied.[157] There was a significant improvement in signs and symptoms of OSAS as well as polysomnographic parameters. In summary, rapid maxillary expansion is an orthodontic technique that holds promise as an alternative treatment of OSAS in children. However, data are insufficient to recommend its use at this time.

Areas for Future Research

- A randomized controlled trial to assess the efficacy of rapid maxillary expansion in the treatment of OSAS in children.

Positional Therapy

Several level IV, retrospective studies evaluated the effect of body position during sleep on OSAS. The studies had conflicting results. One study found that young children had an increased AHI in the supine position,[158] and another study found that young children did not have a positional change in AHI but older children did.[159] Another study found an increased obstructive apnea index but not AHI (except in the obese subgroup) in the supine position,[160] whereas a study of obese and nonobese children, which controlled for sleep stage in each position, found that AHI was lowest when children were prone.[161] No study evaluated the effect of changing body positions or the feasibility of maintaining a child in a certain position overnight. Therefore, at this point, no recommendations can be made with regard to positional therapy for OSAS in children.

Other Treatment Options

Specific craniofacial procedures, such as mandibular distraction osteogenesis, are appropriate for select children with craniofacial anomalies. However, a discussion of these children is beyond the scope of this

guideline. Minimal experience is available regarding intraoral appliances in children.[162] A tracheotomy is extremely effective at treating OSAS but is associated with much morbidity and is typically a last resort if CPAP and other treatments fail to offer improvement for a child who has severe OSAS.

OBESITY AND OSAS

This section reviews the evidence regarding the relationships between obesity and SDB (this term is used to encompass both snoring and OSAS, especially in studies that did not distinguish between these entities) in the pediatric population. The prevalence of childhood obesity is increasing,[163] and many studies on obesity and OSAS have been published since the last guideline. Because childhood obesity has a major impact on OSAS, it is described in detail in this report. Obesity is defined as BMI >95th percentile for age and gender.

Epidemiology: Obesity as a Risk Factor for Snoring and OSAS

A number of large, cross-sectional, community-based studies including more than 21 500 children have examined the risk of SDB conferred by overweight and obesity (Table 19). The majority of these studies obtained information regarding potential SDB from questionnaires, but some included objective measurements such as oximetry or overnight PSG. Similarly, many studies based the determination of BMI on data from questionnaires. The ages ranged from 6 to 17 years, consistent with recruitment strategies using local schools. Countries from around the world are represented, including North America, Asia, Europe, and the Middle East. Taken together, these studies indicate that the risk of snoring in children is increased twofold to fourfold with obesity (defined as BMI ≥90th or 95th percentile). When analyzed, BMI was found to be an independent risk factor for snoring.

Several studies based on surveys of thousands of children, in some cases supplemented by use of physical examinations, showed that overweight/obesity was associated with an increased prevalence of snoring (Table 19).[47,164–167] Fewer studies that included objective measurements to identify SDB were available. Two population-based studies using PSG demonstrated a relationship between overweight/obesity and OSAS.[11,12] In contrast to the findings of the majority of studies, Brunetti et al[23] found that although HS was more prevalent in obese children in a sample of schoolchildren, there was no difference in the incidence of OSAS on PSG among the subset of normal-weight, overweight, and obese children who have HS who had abnormal overnight oximetry results. Similar to the population-based studies, studies using case series or subjects recruited from sleep disorders programs (some of which use PSG and some of which use surveys) also showed a relationship between weight and SDB.[168,169]

From these studies, it can be concluded that obesity is an independent risk factor for snoring and OSAS. The range of evidence from individual studies was II to III (Table 19) and on the aggregate rise to level I. The studies reported on large numbers of children recruited from community-based samples, some of whom had face-to-face examinations and measurements. Data obtained in different settings yielded similar results. The impact of race, if any, is not yet clear. Population-based studies of Hispanic children, a group at high risk of obesity and related comorbidities, are not yet available.[163] For the clinician, it is recommended that particular attention is needed for screening obese and overweight children for signs and symptoms of OSAS, with a low threshold for ordering diagnostic tests. Future research should focus on population-based studies, with objective measurements of both measures of adiposity and PSG, and should include larger numbers of African American and Hispanic youth.

Predictors of Obesity-Related SDB

A number of program-based studies provide information regarding the predictors for SDB in obese children. Carotenuto et al[88] reported via data gathered from parental questionnaires that in obese subjects referred for obesity evaluation and nonobese controls randomly selected from schools, the waist circumference *z* score correlated with symptoms of SDB ($R = 0.37$, $P < .006$) but BMI and subcutaneous fat did not (level III). Verhulst et al[170] examined 91 consecutive overweight or obese children referred for PSG and found that OSAS was not related to indices of obesity, including bioelectric impedance analysis fat mass (level III). Central apnea was significantly predicted by using BMI score, waist circumference, waist-to-hip circumference ratio, and percent fat mass. Tonsillar size was the only significant correlate in their model for moderate to severe OSAS. In a retrospective review of 482 Chinese children referred for PSG and evaluated by using BMI and a tonsillar grading scale, the group of 111 obese children had a significantly higher median AHI and percentage with AHI >1.5/hour than did the nonobese group (level III).[171] In a regression analysis of log AHI as dependent variable, BMI and tonsil grade were predictors, but age and gender were not. In a large study of schoolchildren in

TABLE 19 Risk of SDB Conferred by Overweight and Obesity

Source	Level	Type of Study	No.	Duration	Diagnostic Technique	Other Features	Findings	*P* for Obesity as a Risk Factor
Urschitz et al[164]	II	Community-based sample of third graders	1144	1 y	Parental report of snoring, BMI, SES, risk factors for rhinitis, asthma	Habitual snorers reassessed at 1 y, with 49% continuing to snore	BMI ≥90% conferred a 4 times higher risk of HS versus a BMI <75%; 25% of obese subjects had HS	
Corbo et al[166]	II	Community-based sample of 10- to 15-y-old children from 10 schools	2439	2 y	Parental questionnaire and nasal examination and BMI by physician		Snoring increased significantly with BMI >90% and was >2 times for BMI >95% vs <75%	.000
Shin et al[47]	IV	Cross-sectional community-based sample of high school students	3871	NA	Questionnaire (tested for reliability) completed by subject, caretakers, and sleep partner	Korean children; 81% response rate to survey	Snoring frequency was significantly associated with increasing BMI	<.001
Bidad et al[167]	II	Cross-sectional study of 11- to 17-y-old children	3300	NA	Scripted face-to-face interview and measurements of BMI and tonsil size by physician	7.9% of sample with HS (≥3 nights per week when well)	>Twofold risk of snoring in overweight or obesity	
Stepanski et al[168]	III	Case series; mean age: 5.9 ± 3.7 y	190	NA	Clinical interview, PSG	68% with SDB (≥5 AHI, <90% Spo_2, sleep fragmentation, ECG changes)	BMI was higher in the SDB group	<.01
Rudnick et al[169]	III	Compared children scheduled for AT with control group from same urban setting	170 SDB 129 controls	NA	BMI, ethnicity		African American children who had SDB were more likely to be obese than African American children who did not have SDB	<.02
Li et al[12]	II	Cross-sectional study of 13 primary schools	6447 by questionnaire 410 high risk and 209 low risk with exam and PSG	NA	Questionnaire in all with PSG and examination in high-risk group and low-risk subset for comparison	Hong Kong 9172 sampled with 70% response rate	Male gender, BMI, and AT size were independently associated with OSA	
Li et al[172]	II	Cross-sectional study of 13 primary schools; same population as previous study	6349	NA	Questionnaire	Designed to determine prevalence of HS and associated symptoms.	Prevalence of HS was 7.2%; male gender, BMI, parental HS, nasal allergies, asthma were associated with snoring	<.0001
Brunetti et al[23]	II	Cross-sectional; mean age 7.3 y	1207 screened, 809 eligible	NA	Questionnaire in all followed by oximetry in the 44 who had HS; PSG in subset who had abnormal oximetry results	Southern Italy	HS more common in the obese group; no difference in OSA by PSG across weight groups	.02
Bixler et al[11]	II	Cross-sectional study of grades K–5	5740 had questionnaire 700 randomly selected for PSG, 490 completed	NA	Questionnaire followed by PSG in subset	Prevalence of AHI >5 1.2%. Strong linear relationship between waist circumference and BMI with SDB	Waist circumference associated with all levels of SDB, also nasal complaints and minority race	
Urschitz et al[165]	III	Cross-sectional community-based of primary schoolchildren	995	NA	Overnight oximetry		Overweight, smoke exposure, respiratory allergies were independent risk factors for sleep hypoxemia	

AT, adenotonsillar; K, kindergarten; NA, not available; OSA, obstructive sleep apnea.

Hong Kong, Li et al reported that male gender, BMI score, and tonsillar size were independently associated with OSAS (level II).[12,172] In 490 US schoolchildren studied by using overnight PSG, Bixler et al[11] found waist circumference to be an independent risk factor for all levels of severity of OSAS (level II). Urschitz et al[165] studied 995 children in a cross-sectional, program-based study in Germany and divided those with SDB into mild ($Sp0_2$ nadir 91%–93%), moderate (<90%), and recurrent hypoxemia (>3.9 episodes of desaturation per hour of sleep) groups (level III). Overweight (BMI >75th percentile) was found to be an independent risk factor for mild, moderate, and recurrent hypoxemia during sleep.

From these studies, it is observed that the distribution of body fat may be more important in predicting SDB than BMI alone. In addition, tonsillar size is important in predicting SDB, even in obese children. The authors of these articles comment that SDB is likely more complicated in obese children, with obesity contributing to gas exchange and respiratory pattern abnormalities. Obesity can result in decreased lung volumes, abnormal central nervous system ventilatory responses, decreased upper airway caliber, a potential impact of leptin on ventilation, and other factors. Taken together, the strength of the evidence for these study findings is level II. Findings are limited by the fact that controls were drawn from different populations than subjects and that the studies did not all reach the same conclusions regarding the importance of body fat distribution. The latter may have been affected by the use of different measurement techniques. Anthropomorphic measurement thresholds that indicate increased risk for SDB in children would be of use to clinicians. It is recommended that clinicians consider fat distribution (eg, waist circumference) and not just BMI in their assessment of the risk of SDB.

Comorbidities: Interactions Between Obesity and SDB

Cardiovascular

Adults who have SDB and are obese are at increased risk of cardiovascular disease, including systemic hypertension and blunting of the normal decrease in BP during sleep (nocturnal dipping). This section deals with the evidence that children and adolescents who are obese and have SDB may be similarly at risk. Six studies evaluating SDB, obesity, and cardiovascular complications in children are available. Reade et al[173] retrospectively evaluated 130 patients referred for PSG and described 56 obese subjects (BMI >95th percentile), of whom 70% had hypertension and 54% had OSAS (level IV). Among the 34 nonobese subjects, only 8% ($P < .0005$) had hypertension and 29% had OSAS ($P < .05$). The authors concluded that BMI was a significant determinant of both SDB and diastolic BP, with the number of hypopneas predictive of diastolic BP in both weight categories. In a community-based sample of 760 Greek children evaluated by using morning BP measurements, BMI, and a questionnaire regarding sleep habits, Kaditis et al[174] identified 50 children who had HS (level IV). They found that 28% of the children in the HS group were obese versus 15% of nonsnoring children (significance not reported). They reported that HS had no impact on BP, but that age, gender, and BMI were significant covariates in predicting systolic BP; inclusion of HS in this analysis did not affect these relationships. Similar findings were identified for diastolic BP, with the exception that age had no effect. This study compared absolute BP measurements rather than the variance from normal values on the basis of race, age, gender, and body size. Because children from 4 to 14 years of age were included, this may have affected the results and conclusions. Kohyama et al[175] examined 32 Asian subjects referred for PSG and measured overnight BP every 15 minutes. In this study, obstructive apneas and hypopneas were identified indirectly and, thus, could have been underestimated or overestimated compared with studies with more direct measurements of airflow (level IV). Subjects were divided into low (<10 obstructive events per hour; 16 subjects) and high AHI (>10 obstructive events per hour; 7 subjects). Of the total, 23 subjects tolerated the BP measurements. Three subjects were obese. BMI predicted the systolic BP during rapid eye movement sleep ($P < .001$) but did not predict any of the diastolic BP indices. Li et al[176] performed a population-based study of 306 Asian children 6 to 13 years of age who had overnight PSG and ambulatory day and night BP measurements (level III). Children who had primary snoring were excluded, and those who had OSAS were divided into normal, mild, and moderate (AHI >5) groups. Multiple linear regression analysis revealed significant associations for the severity of hypoxemia and AHI with day and night BP, respectively, independent of obesity. Although BP levels both awake and asleep increased with the severity of OSAS, obesity and waist circumference partially accounted for elevations in sleep systolic BP and sleep mean arterial pressure but not for diastolic BP measurements. Amin et al[177] studied 88 children who had OSAS ranging in severity from mild to severe and 52 controls matched for age and gender. They used PSG, ambulatory BP measurements, and actigraphy (level III). The obese SDB group, compared with the nonobese SDB group, had higher

waking systolic BP ($P < .001$) and sleeping systolic BP ($P = .02$) after adjusting for severity of SDB. They concluded that there was no difference between the effects of SDB and obesity on waking systolic or diastolic BP or sleeping systolic BP but did find that SDB had a greater contribution to sleeping diastolic BP than did obesity.

In summary, this group of articles demonstrates that both obesity and SDB are associated with increased day and night BP in children, although hypertension per se is rare (aggregate evidence level III). It seems that after controlling for obesity, significant independent effects of SDB remain and that hypoxemia and the frequency of obstructive events, perhaps via sleep disruption or intrathoracic fluid shifts, are important. Practitioners should be aware that children and adolescents who have OSAS are at increased risk of elevated BP. Future studies would benefit from a treatment arm to determine whether BP improves with resolution of sleep apnea, as well as longitudinal studies to determine the impact of pediatric obesity related–SDB on adult hypertension.

Metabolic

Obesity is a risk factor for impaired glucose tolerance, liver disease, abnormal lipid profiles, and other metabolic derangements. OSAS has been explored as a possible contributor to these metabolic abnormalities. Ten articles were reviewed. Verhulst et al[178] studied 104 overweight/obese children and adolescents with Tanner staging, overnight PSG, oral glucose tolerance testing, lipid profile, and BP measurements (level IV). The subjects were divided into normal, mild, and moderate/severe SDB groups. Findings consistent with the metabolic syndrome were present in 37%. Those who had a moderate degree of SDB had a higher BMI *z* score than the normal group, and the waist-to-hip circumference ratio increased across the 3 SDB groups. The severity of SDB was independently correlated with impaired glucose homeostasis and worse lipid profile. Mean $Sp0_2$ and $Sp0_2$ nadir during sleep were significant predictors of the metabolic syndrome ($P = .04$ for both). A community-based cohort of 270 adolescents was studied by Redline et al[179] using PSG, oral glucose tolerance testing, homeostatic model assessment (HOMA [a measure of insulin sensitivity]), BMI, waist circumference, BP measurements, Tanner stage, sleep diary, SES, and birth history (level II). Metabolic syndrome was defined as having at least 3 of the following 5 features: (1) waist circumference >75% of normal; (2) mean BP or diastolic BP >90% of normal or receiving current therapy for hypertension; (3) elevated triglycerides; (4) low high-density lipoprotein; or (5) abnormal oral glucose tolerance or fasting glucose test results. Twenty-five percent of the sample was overweight, and 19% were deemed to have metabolic syndrome. The authors found that children who had metabolic syndrome had more severe hypoxemia and decreased sleep efficiency and that as AHI severity increased, there was a progressive increase in the number of children who had metabolic syndrome ($P < .001$). Both overweight children and those who had metabolic syndrome were more prevalent in the SDB group ($P < .001$) and more were male. Age, race, birth history, and SES did not vary with SDB. With adjustment for BMI, the SDB group had higher BP, fasting insulin, and more abnormal HOMA and lipid profile. They concluded that adolescents who experience SDB are at a sevenfold increased risk of metabolic syndrome and that the relationship is not explained by gender, race, or SES and, furthermore, persists with adjustment for BMI percentile.

A study by Kaditis et al[180] of 110 children (2–13 years of age) referred for snoring did not find an impact of SDB on glucose homeostasis in nonobese children. The subjects were divided into AHI ≥5/h and <5/h; the authors found no difference in HOMA, insulin, glucose, or lipid concentrations between the 2 groups (level III). There was no relationship identified between PSG indices and HOMA or fasting insulin. BMI, age, and gender were significant predictors for fasting insulin and HOMA in multiple linear regression analysis. They speculated that OSAS may have more detrimental effects in obese than in nonobese young subjects. Similarly, Tauman et al[181] studied 116 subjects referred for PSG, one-half of whom were obese, and 19 nonsnoring controls. The authors found no impact of SDB indices on metabolic parameters (level III). Only BMI and age were important, and there was no relationship between SDB and surrogate measures of insulin resistance. They concluded that obesity was the major determinant of insulin resistance and dyslipidemia. In obese children, data from de la Eva et al[182] demonstrated that the severity of OSAS correlated with fasting insulin levels, independent of BMI (level III). Of note, the study by Redline et al[179] included children older than those in the studies by Kaditis et al[180] and Tauman et al[181]; thus, the variation in the findings may be a function of the length of time SDB had been present or perhaps attributable to the strong influence puberty has on glucose homeostasis. Kelly et al[183] compared 37 prepubertal and 98 pubertal children in a study by using PSG, HOMA, adiponectin (an insulin-sensitizing hormone secreted by adipose tissue) measurements, as well as urinary catecholamine metabolites (level III).

Tanner stage was determined by self-attestation. In the prepubertal children, they found no association between polysomnographic parameters and metabolic measurements after correcting for BMI. Elevated fasting insulin (≥20 μU/mL) was significantly more common in the OSAS group (P = .03), even when corrected for BMI. When pubertal obese subjects were considered separately, the risk of elevated fasting insulin (P = .04) and impaired HOMA was greater in the OSAS group (P = .05). Pubertal children who had OSAS also had lower adiponectin and higher urinary catecholamine levels, even when controlled for BMI. Kelly et al concluded that OSAS further predisposes obese children to metabolic syndrome, likely through multiple mechanisms involving adipose tissue and the sympathetic nervous system.

In a study that included pretreatment and posttreatment measurements in 62 prepubertal children who had moderate to severe OSAS, Gozal et al[184] found that although nonobese children had no change in measures of glucose homeostasis after treatment of OSAS, obese children had a significant improvement even while BMI remained stable ($P < .001$) (level II). Similar effects were not seen in nonobese children. Treatment (AT) improved the lipid profile and inflammatory markers in both obese and nonobese children.

Other studies have examined different aspects of altered metabolism in obesity-related OSAS. Kheirandish-Gozal et al[185] found elevated alanine transaminase (a marker for fatty liver) in a large sample of obese children who had OSAS (level IV). Verhulst et al[186] found elevated serum uric acid (a marker of oxidative stress) in 62 overweight children who had OSAS, with a significant relationship between the severity of OSAS and serum uric acid independent of abdominal adiposity (P = .01) (level IV). Verhulst et al[187] demonstrated that, in a group of 95 obese and overweight children, total white blood cell and neutrophil counts increased with hypoxemia, and they speculated that inflammation may contribute to cardiovascular morbidity in obesity-related SDB (level IV).

In summary, as expected, this group of studies confirms that obesity increases the risk of insulin resistance, dyslipidemia, and other metabolic abnormalities in children. The role that OSAS plays in altering glucose metabolism is still not entirely clear but is likely less important in younger children and in lean children. Conflicting studies exist regarding the independent effect of OSAS on metabolic measures when it coexists with obesity in children. Puberty has an important role in this relationship. Screening of obese children who have OSAS for markers of metabolic syndrome should be considered, especially in the adolescent age group. Individual studies were level II through IV, with an aggregate level of III.

Neurobehavioral

The neurobehavioral complications of OSAS are discussed in detail elsewhere in this technical report. However, 6 studies have explored the potential contribution of obesity to behavior and cognition in children with OSAS and will be discussed in this section. A subanalysis of the Tucson Children's Assessment of Sleep Apnea Study evaluating parent-rated behavioral problems in overweight children before and after controlling for OSAS was performed by Mulvaney et al (level II).[188] They analyzed data from 402 subjects, 15% of whom were overweight; data were derived from home overnight PSG, the Conners scale, and the Child Behavior Checklist (CBCL). They found that, after controlling for OSAS, behaviors such as withdrawal and social problems were higher in obese children compared with nonobese children. This finding emphasizes the need to control for obesity when designing studies evaluating neurobehavioral issues in children with OSAS. Chervin et al[42] evaluated students in the second and fifth grades in 6 elementary schools (level IV). Only 146 of 806 surveys were returned. Parental survey of health, race, BMI, Pediatric Sleep Questionnaire, teacher-rated performance, and SES were collected. SDB was associated with African American race, SES, and poor teacher ratings ($P < .01$), but only SES was independently associated with school performance. Low SES was not associated with SDB when controlled for BMI. The authors concluded that future studies evaluating the relationship between school performance and SDB should incorporate direct measurements of SES and obesity. Owens et al[189] examined all children evaluated at a tertiary center for sleep problems between 1999 and 2005; they used PSG, BMI, the Children's Sleep Health Questionnaire, and a mental health history, including the CBCL (level IV). In this study of 235 participants, 56% had a BMI >85th percentile and were thus considered overweight. They found modest correlations between measures of SDB and both somatic complaints and social problems but not with other behavioral complaints. Increased BMI was associated with total CBCL score, internalizing, social, thought, withdrawn, anxious, somatic, and aggressive behavior domains in a dose-response fashion (P = .03), thus emphasizing the need to control for obesity in future studies. Short sleep also correlated with a number of subscales on the CBCL ($P < .001$). Additional sleep disorders added to the risk of behavior

problems ($P < .001$). BMI predicted both total and internalizing CBCL scores, and sleep duration predicted externalizing scores. The presence of an additional sleep diagnosis was the strongest predictor of all 3 CBCL scores. They concluded that overweight, insufficient sleep, and other sleep disorders should be considered when evaluating and treating behavioral problems associated with SDB. Beebe et al[21] studied 60 obese subjects recruited from a weight-management program compared with 22 controls; tools used included BMI; parent- and self-reported validated sleep, behavior, and mood questionnaires; actigraphy; and PSG (level IV). They reported that the obese group had later bedtimes ($P < .05$), shorter ($P < .01$) and more disrupted sleep ($P < .05$), more symptoms of OSAS ($P < .001$), sleepiness ($P = .009$), parasomnias ($P = .007$), higher AHI ($P < .01$), and poorer school performance. Another study by Beebe et al[190] of 263 overweight subjects enrolled in a hospital-based weight-management program found a negative relationship between the severity of OSAS and school performance and parent- and teacher-reported behaviors that persisted with adjustment for gender, race, SES, sleep duration, and BMI (level IV). Interestingly, Roemmich et al[191] found a relationship between a decrease in motor activity and increasing weight in overweight children after surgical treatment of OSAS by using AT ($P = .03$) (level IV). They hypothesized that a decrease in physical activity and "fidgeting" energy expenditure were responsible for the weight gain. However, because obese controls without surgery were not studied, it is unclear whether the degree of weight gain was greater than typically seen in obese children.

In summary, these studies point to obesity as a potential important factor in childhood performance, mood, and behavior (aggregate level III). Clinicians should be aware that children who are obese and have OSAS might continue to have difficulties in these domains after treatment of OSAS. It is recommended that sleep habits and nonrespiratory sleep complaints be included in the evaluation and treatment of obesity-related OSAS. The relationship between SES, obesity, and OSAS is complex and adds further emphasis to the premise that studies of behavior and cognition must be carefully designed and controlled.

QoL

Both obesity and OSAS can affect health-related QoL. Two studies have examined measures of QoL in children who are obese and have OSAS. In a study of 151 overweight children by Carno et al[192] that used surveys of QoL and SDB and PSG, overweight youth who have OSAS were found to have lower self- and parent-related QoL (level IV). Neither objective measures of OSAS by PSG nor BMI correlated with QoL, whereas reported symptoms of OSAS did ($P < .05$). Similarly, Crabtree et al[193] compared 85 children 8 to 12 years of age who had been referred for OSAS and who underwent PSG, BMI, QoL ascertainment, and the Children's Depression Inventory with a control group with previously documented normal PSG (level IV). They found that OSAS did not differ between obese and nonobese children and that there was no difference in QoL between children who snore and have OSAS. The referred SDB group had lower QoL scores than the control group ($P < .001$), but the authors found no difference between obese and nonobese SDB subjects or in those with OSAS versus snoring. They concluded that children who snore have a lower QoL than nonsnoring controls, and that this finding was not related to obesity of the severity of SDB.

In summary, QoL is an important outcome measure that may be more related to perceived symptoms of OSAS than measured physiologic disturbances of sleep and breathing, even in the obese patient (aggregate level IV). The impact of obesity on QoL in children with SDB is yet to be determined by using population-based studies and is an important outcome measure to be included in longitudinal and treatment studies.

Surgical Treatment of OSAS in the Obese Child

Surgical treatment of OSAS in general is discussed in detail in the technical report, but 5 studies have examined this area in obesity-related OSAS and are discussed here. Shine et al[194] evaluated 19 obese patients treated with AT (level IV). Although OSAS improved significantly ($P < .01$), only 37% of patients were deemed cured (defined as a postoperative AHI <5/hour), and 10 (53%) subjects needed CPAP postoperatively. A level IV retrospective review by Spector et al[195] included 14 patients who were morbidly obese who were electively sent to the ICU after AT (per policy). One patient needed intubation, and 2 patients required BPAP. Another retrospective review of 26 morbidly obese patients, all of whom were sent to the ICU after AT as per routine, found that 14 patients (54%) had an uncomplicated postoperative course, and 12 (45%) required respiratory intervention, including 1 requiring intubation and 2 requiring BPAP.[196] Costa and Mitchell[131] evaluated the response to AT in a meta-analysis of 4 studies that included 110 obese children who had OSAS (level III). They found that OSAS improved but did not resolve after AT, with 88% of children having an AHI >1/hour and 51% of

children having an AHI >5/hour postoperatively. Apostolidou et al[138] reported on 70 snoring children with a mean age of 5.8 ± 1.8 years who underwent AT; 22 (31%) were obese (level IV). PSG was performed both preoperatively and postoperatively. They found no difference in cure rates between obese and nonobese subjects who had OSAS, by using an AHI <1/hour as the definition of cure. However, there was an improvement in AHI in both groups, and approximately 90% of all subjects had an AHI <5/hour postoperatively.

In summary, few studies have evaluated the effects of AT in the obese child who has OSAS, and studies have been of a low level of evidence (aggregate level IV). Studies suggest that the AHI may improve significantly after AT, even in obese children, supporting the idea that surgery may be a reasonable first-line treatment, even in obese patients. However, better-level studies are needed to assess the effects of AT in obese children and adolescents, including evaluation of subgroups such as adolescents and the morbidly obese. A significant number of children required intubation or CPAP postoperatively, which reinforces the need for inpatient observation in obese children postoperatively. Studies have not been performed to determine whether children at high risk who are obese and have OSAS, such as those with pulmonary or systemic hypertension, waking hypoventilation, or pathologic daytime sleepiness, may benefit from stabilization with BPAP therapy before undergoing AT to decrease the risk of postoperative complications.

Weight Loss and Other Nonsurgical Treatments

There is a paucity of data regarding the effects of weight loss on OSAS in children and adolescents. Verhulst et al[197] found that weight loss was a successful treatment of OSAS in a group of 61 adolescents being cared for in a residential weight loss treatment program (level IV). Davis et al[49] studied the effects of exercise in 100 overweight children by administering the Pediatric Sleep Questionnaire before and after enrollment in a no-exercise group, a low-dose aerobic exercise program, or a high-dose aerobic exercise program for 3 months (level IV). They found no change in BMI, but 50% of children who screened positive for SDB improved to a negative screening result after intervention. They found their results to be consistent with a dose-response effect of exercise on improvement in SDB ($P < .001$). Academic achievement did not improve in concert with changes in the Pediatric Sleep Questionnaire. Kalra et al[198] showed a significant improvement in OSAS after bariatric surgery, in association with a mean weight loss of 58 kg (level IV). In summary, along with many other health-related benefits, achieving weight loss and increasing exercise seem to be beneficial for OSAS and should be recommended along with other interventions for OSAS in obese children and adolescents (aggregate level IV). However, it should be noted that the 2 weight loss studies involved treatment regimens that are not commonly available to the majority of obese children. The effects of more modest weight loss regimens require further evaluation.

Pulmonary Disease and Obesity-Related SDB

Two studies addressed the relationship between obesity-related SDB and pulmonary disease. This has been described in adults as the "overlap syndrome," when chronic obstructive pulmonary disease and OSAS are present in the same individual. As part of the Cleveland Children's Sleep and Health Study, Sulit et al[199] evaluated parent-reported wheeze and asthma, history of snoring, and PSG in 788 participants (level III). They found that children who experienced wheeze and asthma were more likely to be obese ($P = .0097$) and concluded that SDB may partially explain this finding. They speculated that obesity changes airway mechanics and that SDB may increase gastroesophageal reflux, leptin levels, and cytokines and, thus, increase lower airways inflammation. Dubern et al[200] studied 54 children who had BMI *z* scores >3, 74% of whom were pubertal, by using history, physical examination, assessment of body fat mass, Tanner stage, HOMA, lipid profile, leptin, pulmonary function tests, and PSG (level IV). They confirmed the presence of OSAS, lower functional residual capacity, increased airways resistance, lower airways obstruction, and insulin resistance in this group of morbidly obese children. Snoring and AHI correlated with BMI ($P = .01$) and neck/height ratio ($P = .03$) (adjusted for age, gender, Tanner stage, and ethnicity). Airways resistance correlated with snoring index and AHI after adjustment. These studies remind us that the upper airway is part of the respiratory system and that its function is affected by lung mechanics. Abnormalities of pulmonary mechanics related to obesity affect OSAS and may add to abnormalities of gas exchange during sleep. It is suggested that evaluation of the child who is obese and has OSAS should include a history and physical examination directed at the entire respiratory system, and pulmonary function testing may be indicated.

Areas for Future Research

- What threshold of easily obtained anthropomorphic measurements predicts a significant risk of OSAS?

Overweight as well as obese children should be included in future studies.

- Are there additive or multiplicative effects of OSAS and obesity on BP? How do these relationships evolve over time, and what is the impact of genetic and racial background? Does treatment of OSAS improve hypertension in obese children and adolescents?
- The effect of OSAS on metabolic syndrome in children and adolescents remains controversial. Future research should include treatment arms with careful measurements before and after interventions. Longitudinal studies that track changes during puberty and into adulthood would be of interest.
- Further research is needed to clarify the effects of AT on OSAS, including evaluation of subgroups such as adolescents and morbidly obese patients. There should also be studies evaluating the use of CPAP or BPAP before surgery in the obese population, as a way of stabilizing the cardiopulmonary system and reducing operative risk.
- What is the effect of modest weight loss on OSAS in children and adolescents? Research should be directed at identifying strategies to effectively implement weight loss and exercise programs in this population.

SUBCOMMITTEE ON OBSTRUCTIVE SLEEP APNEA SYNDROME*

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OVERSIGHT FROM THE STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT, 2009--2011

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Sleep Apnea Clinical Practice Guideline Quick Reference Tools

- Action Statement Summary
  — Diagnosis and Management of Childhood Obstructive Sleep Apnea
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Sleep Apnea
- AAP Patient Education Handout
  — *Sleep Apnea and Your Child*

Action Statement Summary

Diagnosis and Management of Childhood Obstructive Sleep Apnea

Key Action Statement 1: Screening for OSAS

As part of routine health maintenance visits, clinicians should inquire whether the child or adolescent snores. If the answer is affirmative or if a child or adolescent presents with signs or symptoms of OSAS (Table 2), clinicians should perform a more focused evaluation. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Key Action Statement 2A: Polysomnography

If a child or adolescent snores on a regular basis and has any of the complaints or findings shown in Table 2, clinicians should either (1) obtain a polysomnogram (Evidence Quality A, Key Action strength: Recommendation) OR (2) refer the patient to a sleep specialist or otolaryngologist for a more extensive evaluation (Evidence quality D, Key Action strength: Option). (Evidence Quality: Grade A for polysomnography; Grade D for specialist referral, Recommendation Strength: Recommendation.)

Key Action Statement 2B: Alternative Testing

If polysomnography is not available, then clinicians may order alternative diagnostic tests, such as nocturnal video recording, nocturnal oximetry, daytime nap polysomnography, or ambulatory polysomnography. (Evidence Quality: Grade C, Recommendation Strength: Option.)

Key Action Statement 3: Adenotonsillectomy

If a child is determined to have OSAS, has a clinical examination consistent with adenotonsillar hypertrophy, and does not have a contraindication to surgery (see Table 3), the clinician should recommend adenotonsillectomy as the first line of treatment. If the child has OSAS but does not have adenotonsillar hypertrophy, other treatment should be considered (see Key Action Statement 6). Clinical judgment is required to determine the benefits of adenotonsillectomy compared with other treatments in obese children with varying degrees of adenotonsillar hypertrophy. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Key Action Statement 4: High-Risk Patients Undergoing Adenotonsillectomy

Clinicians should monitor high-risk patients (Table 5) undergoing adenotonsillectomy as inpatients postoperatively. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Key Action Statement 5: Reevaluation

Clinicians should clinically reassess all patients with OSAS for persisting signs and symptoms after therapy to determine whether further treatment is required. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Key Action Statement 5B: Reevaluation of High-Risk Patients

Clinicians should reevaluate high-risk patients for persistent OSAS after adenotonsillectomy, including those who had a significantly abnormal baseline polysomnogram, have sequelae of OSAS, are obese, or remain symptomatic after treatment, with an objective test (see Key Action Statement 2) or refer such patients to a sleep specialist. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Key Action Statement 6: CPAP

Clinicians should refer patients for CPAP management if symptoms/signs (Table 2) or objective evidence of OSAS persists after adenotonsillectomy or if adenotonsillectomy is not performed. (Evidence Quality: Grade B, Recommendation Strength: Recommendation.)

Key Action Statement 7: Weight Loss

Clinicians should recommend weight loss in addition to other therapy if a child/adolescent with OSAS is overweight or obese. (Evidence Quality: Grade C, Recommendation Strength: Recommendation.)

Key Action Statement 8: Intranasal Corticosteroids

Clinicians may prescribe topical intranasal corticosteroids for children with mild OSAS in whom adenotonsillectomy is contraindicated or for children with mild postoperative OSAS. (Evidence Quality: Grade B, Recommendation Strength: Option.)

Coding Quick Reference for Sleep Apnea	
ICD-9-CM	***ICD-10-CM***
327.20 Sleep apnea, organic, unspecified	**G47.30** Sleep apnea, unspecified
327.21 Sleep apnea, primary central	**G47.31** Primary central sleep apnea
327.23 Sleep apnea, obstructive	**G47.33** Obstructive sleep apnea (adult) (pediatric) (Code additional underlying conditions.)
	J35.3 Hypertrophy of tonsils with hypertrophy of adenoids
	E66.01 Morbid (severe) obesity due to excess calories **E66.09** Other obesity due to excess calories **E66.3** Overweight **E66.8** Other obesity **E66.9** Obesity, unspecified

Sleep Apnea and Your Child

Does your child snore a lot? Does he sleep restlessly? Does he have difficulty breathing, or does he gasp or choke, while he sleeps?

If your child has these symptoms, he may have a condition known as sleep apnea.

Sleep apnea is a common problem that affects an estimated 2% of all children, including many who are undiagnosed.

If not treated, sleep apnea can lead to a variety of problems. These include heart, behavior, learning, and growth problems.

How do I know if my child has sleep apnea?

Symptoms of sleep apnea include

- Frequent snoring
- Problems breathing during the night
- Sleepiness during the day
- Difficulty paying attention
- Behavior problems

If you notice any of these symptoms, let your pediatrician know as soon as possible. Your pediatrician may recommend an overnight sleep study called a *polysomnogram.* Overnight polysomnograms are conducted at hospitals and major medical centers. During the study, medical staff will watch your child sleep. Several sensors will be attached to your child to monitor breathing, oxygenation, and brain waves. An electroencephalogram (EEG) is a test that measures brain waves.

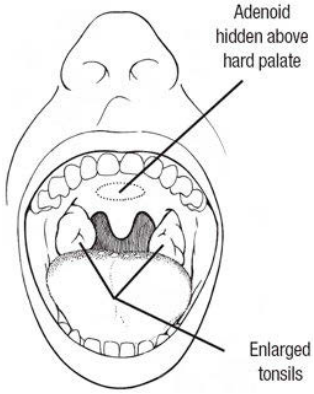
The results of the study will show whether your child suffers from sleep apnea. Other specialists, such as pediatric pulmonologists, otolaryngologists, neurologists, and pediatricians with specialty training in sleep disorders, may help your pediatrician make the diagnosis.

What causes sleep apnea?

Many children with sleep apnea have larger tonsils and adenoids.

Tonsils are the round, reddish masses on each side of your child's throat. They help fight infections in the body. You can only see the adenoid with an x-ray or special mirror. It lies in the space between the nose and throat.

Large tonsils and adenoid may block a child's airway while she sleeps. This causes her to snore and wake up often during the night. However, not every child with large tonsils and adenoid has sleep apnea. A sleep study can tell your doctor whether your child has sleep apnea or if she is simply snoring.



Children born with other medical conditions, such as Down syndrome, cerebral palsy, or craniofacial (skull and face) abnormalities, are at higher risk for sleep apnea. Overweight children are also more likely to suffer from sleep apnea.

How is sleep apnea treated?

The most common way to treat sleep apnea is to remove your child's tonsils and adenoid. This surgery is called a tonsillectomy and adenoidectomy. It is highly effective in treating sleep apnea.

Another effective treatment is nasal continuous positive airway pressure (CPAP), which requires the child to wear a mask while he sleeps. The mask delivers steady air pressure through the child's nose, allowing him to breathe comfortably. Continuous positive airway pressure is usually used in children who do not improve after tonsillectomy and adenoidectomy, or who are not candidates for tonsillectomy and adenoidectomy.

Children who may need additional treatment include children who are overweight or suffering from another complicating condition. Overweight children will improve if they lose weight, but may need to use CPAP until the weight is lost.

Remember

A good night's sleep is important to good health. If your child suffers from the symptoms of sleep apnea, talk with your pediatrician. A proper diagnosis and treatment can mean restful nights and restful days for your child and your family.

From your doctor

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

The American Academy of Pediatrics is an organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of infants, children, adolescents, and young adults.

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Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months

- *Clinical Practice Guideline*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 2 for more information.

- *Technical Report*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 2 for more information.

- *2011 Commentary*

Readers of this clinical practice guideline are urged to review the technical report to enhance the evidence-based decision-making process. The full technical report is available following the clinical practice guideline and on the companion CD-ROM.

CLINICAL PRACTICE GUIDELINE

Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months

SUBCOMMITTEE ON URINARY TRACT INFECTION, STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT

KEY WORDS
urinary tract infection, infants, children, vesicoureteral reflux, voiding cystourethrography

ABBREVIATIONS
SPA—suprapubic aspiration
AAP—American Academy of Pediatrics
UTI—urinary tract infection
RCT—randomized controlled trial
CFU—colony-forming unit
VUR—vesicoureteral reflux
WBC—white blood cell
RBUS—renal and bladder ultrasonography
VCUG—voiding cystourethrography

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abstract

FREE

OBJECTIVE: To revise the American Academy of Pediatrics practice parameter regarding the diagnosis and management of initial urinary tract infections (UTIs) in febrile infants and young children.

METHODS: Analysis of the medical literature published since the last version of the guideline was supplemented by analysis of data provided by authors of recent publications. The strength of evidence supporting each recommendation and the strength of the recommendation were assessed and graded.

RESULTS: Diagnosis is made on the basis of the presence of both pyuria and at least 50 000 colonies per mL of a single uropathogenic organism in an appropriately collected specimen of urine. After 7 to 14 days of antimicrobial treatment, close clinical follow-up monitoring should be maintained to permit prompt diagnosis and treatment of recurrent infections. Ultrasonography of the kidneys and bladder should be performed to detect anatomic abnormalities. Data from the most recent 6 studies do not support the use of antimicrobial prophylaxis to prevent febrile recurrent UTI in infants without vesicoureteral reflux (VUR) or with grade I to IV VUR. Therefore, a voiding cystourethrography (VCUG) is not recommended routinely after the first UTI; VCUG is indicated if renal and bladder ultrasonography reveals hydronephrosis, scarring, or other findings that would suggest either high-grade VUR or obstructive uropathy and in other atypical or complex clinical circumstances. VCUG should also be performed if there is a recurrence of a febrile UTI. The recommendations in this guideline do not indicate an exclusive course of treatment or serve as a standard of care; variations may be appropriate. Recommendations about antimicrobial prophylaxis and implications for performance of VCUG are based on currently available evidence. As with all American Academy of Pediatrics clinical guidelines, the recommendations will be reviewed routinely and incorporate new evidence, such as data from the Randomized Intervention for Children With Vesicoureteral Reflux (RIVUR) study.

CONCLUSIONS: Changes in this revision include criteria for the diagnosis of UTI and recommendations for imaging. *Pediatrics* 2011;128:595–610

INTRODUCTION

Since the early 1970s, occult bacteremia has been the major focus of concern for clinicians evaluating febrile infants who have no recognizable source of infection. With the introduction of effective conjugate vaccines against *Haemophilus influenzae* type b and *Streptococcus pneumoniae* (which have resulted in dramatic decreases in bacteremia and meningitis), there has been increasing appreciation of the urinary tract as the most frequent site of occult and serious bacterial infections. Because the clinical presentation tends to be nonspecific in infants and reliable urine specimens for culture cannot be obtained without invasive methods (urethral catheterization or suprapubic aspiration [SPA]), diagnosis and treatment may be delayed. Most experimental and clinical data support the concept that delays in the institution of appropriate treatment of pyelonephritis increase the risk of renal damage.[1,2]

This clinical practice guideline is a revision of the practice parameter published by the American Academy of Pediatrics (AAP) in 1999.[3] It was developed by a subcommittee of the Steering Committee on Quality Improvement and Management that included physicians with expertise in the fields of academic general pediatrics, epidemiology and informatics, pediatric infectious diseases, pediatric nephrology, pediatric practice, pediatric radiology, and pediatric urology. The AAP funded the development of this guideline; none of the participants had any financial conflicts of interest. The guideline was reviewed by multiple groups within the AAP (7 committees, 1 council, and 9 sections) and 5 external organizations in the United States and Canada. The guideline will be reviewed and/or revised in 5 years, unless new evidence emerges that warrants revision sooner. The guideline is intended for use in a variety of clinical settings (eg, office, emergency department, or hospital) by clinicians who treat infants and young children. This text is a summary of the analysis. The data on which the recommendations are based are included in a companion technical report.[4]

Like the 1999 practice parameter, this revision focuses on the diagnosis and management of initial urinary tract infections (UTIs) in febrile infants and young children (2–24 months of age) who have no obvious neurologic or anatomic abnormalities known to be associated with recurrent UTI or renal damage. (For simplicity, in the remainder of this guideline the phrase "febrile infants" is used to indicate febrile infants and young children 2–24 months of age.) The lower and upper age limits were selected because studies on infants with unexplained fever generally have used these age limits and have documented that the prevalence of UTI is high (~5%) in this age group. In those studies, fever was defined as temperature of at least 38.0°C (≥100.4°F); accordingly, this definition of fever is used in this guideline. Neonates and infants less than 2 months of age are excluded, because there are special considerations in this age group that may limit the application of evidence derived from the studies of 2- to 24-month-old children. Data are insufficient to determine whether the evidence generated from studies of infants 2 to 24 months of age applies to children more than 24 months of age.

METHODS

To provide evidence for the guideline, 2 literature searches were conducted, that is, a surveillance of Medline-listed literature over the past 10 years for significant changes since the guideline was published and a systematic review of the literature on the effectiveness of prophylactic antimicrobial therapy to prevent recurrence of febrile UTI/pyelonephritis in children with vesicoureteral reflux (VUR). The latter was based on the new and growing body of evidence questioning the effectiveness of antimicrobial prophylaxis to prevent recurrent febrile UTI in children with VUR. To explore this particular issue, the literature search was expanded to include trials published since 1993 in which antimicrobial prophylaxis was compared with no treatment or placebo treatment for children with VUR. Because all except 1 of the recent randomized controlled trials (RCTs) of the effectiveness of prophylaxis included children more than 24 months of age and some did not provide specific data according to grade of VUR, the authors of the 6 RCTs were contacted; all provided raw data from their studies specifically addressing infants 2 to 24 months of age, according to grade of VUR. Meta-analysis of these data was performed.

Results from the literature searches and meta-analyses were provided to committee members. Issues were raised and discussed until consensus was reached regarding recommendations. The quality of evidence supporting each recommendation and the strength of the recommendation were assessed by the committee member most experienced in informatics and epidemiology and were graded according to AAP policy[5] (Fig 1).

The subcommittee formulated 7 recommendations, which are presented in the text in the order in which a clinician would use them when evaluating and treating a febrile infant, as well as in algorithm form in the Appendix. This clinical practice guideline is not intended to be a sole source of guidance for the treatment of febrile infants with UTIs. Rather, it is intended to assist clinicians in decision-making. It is not intended to replace clinical judgment or to

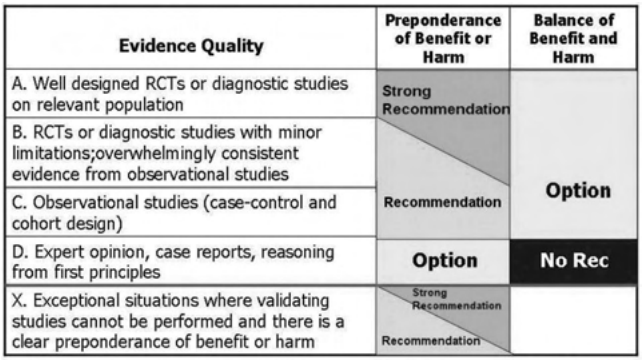

FIGURE 1
AAP evidence strengths.

establish an exclusive protocol for the care of all children with this condition.

DIAGNOSIS

Action Statement 1

If a clinician decides that a febrile infant with no apparent source for the fever requires antimicrobial therapy to be administered because of ill appearance or another pressing reason, the clinician should ensure that a urine specimen is obtained for both culture and urinalysis before an antimicrobial agent is administered; the specimen needs to be obtained through catheterization or SPA, because the diagnosis of UTI cannot be established reliably through culture of urine collected in a bag (evidence quality: A; strong recommendation).

When evaluating febrile infants, clinicians make a subjective assessment of the degree of illness or toxicity, in addition to seeking an explanation for the fever. This clinical assessment determines whether antimicrobial therapy should be initiated promptly and affects the diagnostic process regarding UTI. If the clinician determines that the degree of illness warrants immediate antimicrobial therapy, then a urine specimen suitable for culture should be obtained through catheterization or SPA before antimicrobial agents are administered, because the antimicrobial agents commonly prescribed in such situations would almost certainly obscure the diagnosis of UTI.

SPA has been considered the standard method for obtaining urine that is uncontaminated by perineal flora. Variable success rates for obtaining urine have been reported (23%–90%).[6–8] When ultrasonographic guidance is used, success rates improve.[9,10] The technique has limited risks, but technical expertise and experience are required, and many parents and physicians perceive the procedure as unacceptably invasive, compared with catheterization. However, there may be no acceptable alternative to SPA for boys with moderate or severe phimosis or girls with tight labial adhesions.

Urine obtained through catheterization for culture has a sensitivity of 95% and a specificity of 99%, compared with that obtained through SPA.[7,11,12] The techniques required for catheterization and SPA are well described.[13] When catheterization or SPA is being attempted, the clinician should have a sterile container ready to collect a urine specimen, because the preparation for the procedure may stimulate the child to void. Whether the urine is obtained through catheterization or is voided, the first few drops should be allowed to fall outside the sterile container, because they may be contaminated by bacteria in the distal urethra.

Cultures of urine specimens collected in a bag applied to the perineum have an unacceptably high false-positive rate and are valid only when they yield negative results.[6,14–16] With a prevalence of UTI of 5% and a high rate of false-positive results (specificity: ~63%), a "positive" culture result for urine collected in a bag would be a false-positive result 88% of the time. For febrile boys, with a prevalence of UTI of 2%, the rate of false-positive results is 95%; for circumcised boys, with a prevalence of UTI of 0.2%, the rate of false-positive results is 99%. Therefore, in cases in which antimicrobial therapy will be initiated, catheterization or SPA is required to establish the diagnosis of UTI.

- Aggregate quality of evidence: A (diagnostic studies on relevant populations).
- Benefits: A missed diagnosis of UTI can lead to renal scarring if left untreated; overdiagnosis of UTI can lead to overtreatment and unnecessary and expensive imaging. Once antimicrobial therapy is initiated, the opportunity to make a definitive diagnosis is lost; multiple studies of antimicrobial therapy have shown that the urine may be rapidly sterilized.
- Harms/risks/costs: Catheterization is invasive.
- Benefit-harms assessment: Preponderance of benefit over harm.
- Value judgments: Once antimicrobial therapy has begun, the opportunity to make a definitive diagnosis is lost. Therefore, it is important to have the most-accurate test for UTI performed initially.
- Role of patient preferences: There is no evidence regarding patient preferences for bag versus catheterized urine. However, bladder tap has

been shown to be more painful than urethral catheterization.

- Exclusions: None.
- Intentional vagueness: The basis of the determination that antimicrobial therapy is needed urgently is not specified, because variability in clinical judgment is expected; considerations for individual patients, such as availability of follow-up care, may enter into the decision, and the literature provides only general guidance.
- Policy level: Strong recommendation.

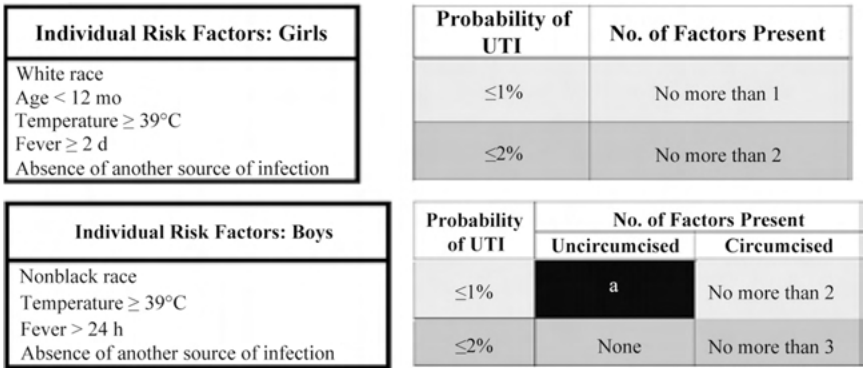

FIGURE 2

Probability of UTI Among Febrile Infant Girls[28] and Infant Boys[30] According to Number of Findings Present. [a]Probability of UTI exceeds 1% even with no risk factors other than being uncircumcised.

Action Statement 2

If a clinician assesses a febrile infant with no apparent source for the fever as not being so ill as to require immediate antimicrobial therapy, then the clinician should assess the likelihood of UTI (see below for how to assess likelihood).

Action Statement 2a

If the clinician determines the febrile infant to have a low likelihood of UTI (see text), then clinical follow-up monitoring without testing is sufficient (evidence quality: A; strong recommendation).

Action Statement 2b

If the clinician determines that the febrile infant is not in a low-risk group (see below), then there are 2 choices (evidence quality: A; strong recommendation). Option 1 is to obtain a urine specimen through catheterization or SPA for culture and urinalysis. Option 2 is to obtain a urine specimen through the most convenient means and to perform a urinalysis. If the urinalysis results suggest a UTI (positive leukocyte esterase test results or nitrite test or microscopic analysis results positive for leukocytes or bacteria), then a urine specimen should be obtained through catheterization or SPA and cultured; if urinalysis of fresh (<1 hour since void) urine yields negative leukocyte esterase and nitrite test results, then it is reasonable to monitor the clinical course without initiating antimicrobial therapy, recognizing that negative urinalysis results do not rule out a UTI with certainty.

If the clinician determines that the degree of illness does not require immediate antimicrobial therapy, then the likelihood of UTI should be assessed. As noted previously, the overall prevalence of UTI in febrile infants who have no source for their fever evident on the basis of history or physical examination results is approximately 5%,[17,18] but it is possible to identify groups with higher-than-average likelihood and some with lower-than-average likelihood. The prevalence of UTI among febrile infant girls is more than twice that among febrile infant boys (relative risk: 2.27). The rate for uncircumcised boys is 4 to 20 times higher than that for circumcised boys, whose rate of UTI is only 0.2% to 0.4%.[19–24] The presence of another, clinically obvious source of infection reduces the likelihood of UTI by one-half.[25]

In a survey asking, "What yield is required to warrant urine culture in febrile infants?," the threshold was less than 1% for 10.4% of academicians and 11.7% for practitioners[26]; when the threshold was increased to 1% to 3%, 67.5% of academicians and 45.7% of practitioners considered the yield sufficiently high to warrant urine culture. Therefore, attempting to operationalize "low likelihood" (ie, below a threshold that warrants a urine culture) does not produce an absolute percentage; clinicians will choose a threshold depending on factors such as their confidence that contact will be maintained through the illness (so that a specimen can be obtained at a later time) and comfort with diagnostic uncertainty. Fig 2 indicates the number of risk factors associated with threshold probabilities of UTI of at least 1% and at least 2%.

In a series of studies, Gorelick, Shaw, and colleagues[27–29] derived and validated a prediction rule for febrile infant girls on the basis of 5 risk factors, namely, white race, age less than 12 months, temperature of at least 39°C, fever for at least 2 days, and absence of another source of infection. This prediction rule, with sensitivity of 88% and specificity of 30%, permits some infant girls to be considered in a low-likelihood group (Fig 2). For example, of girls with no identifiable source of infection, those who are nonwhite and more than 12 months of age with a recent onset (<2 days) of low-

grade fever (<39°C) have less than a 1% probability of UTI; each additional risk factor increases the probability. It should be noted, however, that some of the factors (eg, duration of fever) may change during the course of the illness, excluding the infant from a low-likelihood designation and prompting testing as described in action statement 2a.

As demonstrated in Fig 2, the major risk factor for febrile infant boys is whether they are circumcised. The probability of UTI can be estimated on the basis of 4 risk factors, namely, nonblack race, temperature of at least 39°C, fever for more than 24 hours, and absence of another source of infection.[4,30]

If the clinician determines that the infant does not require immediate antimicrobial therapy and a urine specimen is desired, then often a urine collection bag affixed to the perineum is used. Many clinicians think that this collection technique has a low contamination rate under the following circumstances: the patient's perineum is properly cleansed and rinsed before application of the collection bag, the urine bag is removed promptly after urine is voided into the bag, and the specimen is refrigerated or processed immediately. Even if contamination from the perineal skin is minimized, however, there may be significant contamination from the vagina in girls or the prepuce in uncircumcised boys, the 2 groups at highest risk of UTI. A "positive" culture result from a specimen collected in a bag cannot be used to document a UTI; confirmation requires culture of a specimen collected through catheterization or SPA. Because there may be substantial delay waiting for the infant to void and a second specimen, obtained through catheterization, may be necessary if the urinalysis suggests the possibility of UTI, many clinicians prefer to obtain a definitive urine specimen through catheterization initially.

- Aggregate quality of evidence: A (diagnostic studies on relevant populations).
- Benefits: Accurate diagnosis of UTI can prevent the spread of infection and renal scarring; avoiding overdiagnosis of UTI can prevent overtreatment and unnecessary and expensive imaging.
- Harms/risks/costs: A small proportion of febrile infants, considered at low likelihood of UTI, will not receive timely identification and treatment of their UTIs.
- Benefit-harms assessment: Preponderance of benefit over harm.
- Value judgments: There is a risk of UTI sufficiently low to forestall further evaluation.
- Role of patient preferences: The choice of option 1 or option 2 and the threshold risk of UTI warranting obtaining a urine specimen may be influenced by parents' preference to avoid urethral catheterization (if a bag urine sample yields negative urinalysis results) versus timely evaluation (obtaining a definitive specimen through catheterization).
- Exclusions: Because it depends on a range of patient- and physician-specific considerations, the precise threshold risk of UTI warranting obtaining a urine specimen is left to the clinician but is below 3%.
- Intentional vagueness: None.
- Policy level: Strong recommendation.

TABLE 1 Sensitivity and Specificity of Components of Urinalysis, Alone and in Combination

Test	Sensitivity (Range), %	Specificity (Range), %
Leukocyte esterase test	83 (67–94)	78 (64–92)
Nitrite test	53 (15–82)	98 (90–100)
Leukocyte esterase or nitrite test positive	93 (90–100)	72 (58–91)
Microscopy, WBCs	73 (32–100)	81 (45–98)
Microscopy, bacteria	81 (16–99)	83 (11–100)
Leukocyte esterase test, nitrite test, or microscopy positive	99.8 (99–100)	70 (60–92)

Action Statement 3

To establish the diagnosis of UTI, clinicians should require *both* urinalysis results that suggest infection (pyuria and/or bacteriuria) *and* the presence of at least 50 000 colony-forming units (CFUs) per mL of a uropathogen cultured from a urine specimen obtained through catheterization or SPA (evidence quality: C; recommendation).

Urinalysis

General Considerations

Urinalysis cannot substitute for urine culture to document the presence of UTI but needs to be used in conjunction with culture. Because urine culture results are not available for at least 24 hours, there is considerable interest in tests that may predict the results of the urine culture and enable presumptive therapy to be initiated at the first encounter. Urinalysis can be performed on any specimen, including one collected from a bag applied to the perineum. However, the specimen must be fresh (<1 hour after voiding with maintenance at room temperature or <4 hours after voiding with refrigeration), to ensure sensitivity and specificity of the urinalysis. The tests that have received the most attention are biochemical analyses of leukocyte esterase and nitrite through a rapid dipstick method and urine microscopic examination for white blood cells (WBCs) and bacteria (Table 1).

Urine dipsticks are appealing, because they provide rapid results, do not require microscopy, and are eligible for a waiver under the Clinical Laboratory Improvement Amendments. They indicate the presence of leukocyte esterase (as a surrogate marker for pyuria) and urinary nitrite (which is converted from dietary nitrates in the presence of most Gram-negative enteric bacteria in the urine). The conversion of dietary nitrates to nitrites by bacteria requires approximately 4 hours in the bladder.[31] The performance characteristics of both leukocyte esterase and nitrite tests vary according to the definition used for positive urine culture results, the age and symptoms of the population being studied, and the method of urine collection.

Nitrite Test

A nitrite test is not a sensitive marker for children, particularly infants, who empty their bladders frequently. Therefore, negative nitrite test results have little value in ruling out UTI. Moreover, not all urinary pathogens reduce nitrate to nitrite. The test is helpful when the result is positive, however, because it is highly specific (ie, there are few false-positive results).[32]

Leukocyte Esterase Test

The sensitivity of the leukocyte esterase test is 94% when it used in the context of clinically suspected UTI. Overall, the reported sensitivity in various studies is lower (83%), because the results of leukocyte esterase tests were related to culture results without exclusion of individuals with asymptomatic bacteriuria. The absence of leukocyte esterase in the urine of individuals with asymptomatic bacteriuria is an advantage of the test, rather than a limitation, because it distinguishes individuals with asymptomatic bacteriuria from those with true UTI.

The specificity of the leukocyte esterase test (average: 72% [range: 64%–92%]) generally is not as good as the sensitivity, which reflects the nonspecificity of pyuria in general. Accordingly, positive leukocyte esterase test results should be interpreted with caution, because false-positive results are common. With numerous conditions other than UTI, including fever resulting from other conditions (eg, streptococcal infections or Kawasaki disease), and after vigorous exercise, WBCs may be found in the urine. Therefore, a finding of pyuria by no means confirms that an infection of the urinary tract is present.

The absence of pyuria in children with true UTIs is rare, however. It is theoretically possible if a febrile child is assessed before the inflammatory response has developed, but the inflammatory response to a UTI produces both fever and pyuria; therefore, children who are being evaluated because of fever should already have WBCs in their urine. More likely explanations for significant bacteriuria in culture in the absence of pyuria include contaminated specimens, insensitive criteria for pyuria, and asymptomatic bacteriuria. In most cases, when true UTI has been reported to occur in the absence of pyuria, the definition of pyuria has been at fault. The standard method of assessing pyuria has been centrifugation of the urine and microscopic analysis, with a threshold of 5 WBCs per high-power field (~25 WBCs per μL). If a counting chamber is used, however, the finding of at least 10 WBCs per μL in uncentrifuged urine has been demonstrated to be more sensitive[33] and performs well in clinical situations in which the standard method does not, such as with very young infants.[34]

An important cause of bacteriuria in the absence of pyuria is asymptomatic bacteriuria. Asymptomatic bacteriuria often is associated with school-aged and older girls,[35] but it can be present during infancy. In a study of infants 2 to 24 months of age, 0.7% of afebrile girls had 3 successive urine cultures with 10^5 CFUs per mL of a single uropathogen.[26] Asymptomatic bacteriuria can be easily confused with true UTI in a febrile infant but needs to be distinguished, because studies suggest that antimicrobial treatment may do more harm than good.[36] The key to distinguishing true UTI from asymptomatic bacteriuria is the presence of pyuria.

Microscopic Analysis for Bacteriuria

The presence of bacteria in a fresh, Gram-stained specimen of uncentrifuged urine correlates with 10^5 CFUs per mL in culture.[37] An "enhanced urinalysis," combining the counting chamber assessment of pyuria noted previously with Gram staining of drops of uncentrifuged urine, with a threshold of at least 1 Gram-negative rod in 10 oil immersion fields, has greater sensitivity, specificity, and positive predictive value than does the standard urinalysis[33] and is the preferred method of urinalysis when appropriate equipment and personnel are available.

Automated Urinalysis

Automated methods to perform urinalysis are now being used in many hospitals and laboratories. Image-based systems use flow imaging analysis technology and software to classify particles in uncentrifuged urine specimens rapidly.[38] Results correlate well with manual methods, especially for red blood cells, WBCs, and squamous epithelial cells. In the future, this may be the most common method by which urinalysis is performed in laboratories.

Culture

The diagnosis of UTI is made on the basis of quantitative urine culture results in addition to evidence of pyuria and/or bacteriuria. Urine specimens should be processed as expediently as

possible. If the specimen is not processed promptly, then it should be refrigerated to prevent the growth of organisms that can occur in urine at room temperature; for the same reason, specimens that require transportation to another site for processing should be transported on ice. A properly collected urine specimen should be inoculated on culture medium that will allow identification of urinary tract pathogens.

Urine culture results are considered positive or negative on the basis of the number of CFUs that grow on the culture medium.[36] Definition of significant colony counts with regard to the method of collection considers that the distal urethra and periurethral area are commonly colonized by the same bacteria that may cause UTI; therefore, a low colony count may be present in a specimen obtained through voiding or catheterization when bacteria are not present in bladder urine. Definitions of positive and negative culture results are operational and not absolute. The time the urine resides in the bladder (bladder incubation time) is an important determinant of the magnitude of the colony count. The concept that more than 100 000 CFUs per mL indicates a UTI was based on morning collections of urine from adult women, with comparison of specimens from women without symptoms and women considered clinically to have pyelonephritis; the transition range, in which the proportion of women with pyelonephritis exceeded the proportion of women without symptoms, was 10 000 to 100 000 CFUs per mL.[39] In most instances, an appropriate threshold to consider bacteriuria "significant" in infants and children is the presence of at least 50 000 CFUs per mL of a single urinary pathogen.[40] (Organisms such as *Lactobacillus* spp, coagulase-negative staphylococci, and *Corynebacterium* spp are not considered clinically relevant urine isolates for otherwise healthy, 2- to 24-month-old children.) Reducing the threshold from 100 000 CFUs per mL to 50 000 CFUs per mL would seem to increase the sensitivity of culture at the expense of decreased specificity; however, because the proposed criteria for UTI now include evidence of pyuria in addition to positive culture results, infants with "positive" culture results alone will be recognized as having asymptomatic bacteriuria rather than a true UTI. Some laboratories report growth only in the following categories: 0 to 1000, 1000 to 10 000, 10 000 to 100 000, and more than 100 000 CFUs per mL. In such cases, results in the 10 000 to 100 000 CFUs per mL range need to be evaluated in context, such as whether the urinalysis findings support the diagnosis of UTI and whether the organism is a recognized uropathogen.

Alternative culture methods, such as dipslides, may have a place in the office setting; sensitivity is reported to be in the range of 87% to 100%, and specificity is reported to be 92% to 98%, but dipslides cannot specify the organism or antimicrobial sensitivities.[41] Practices that use dipslides should do so in collaboration with a certified laboratory for identification and sensitivity testing or, in the absence of such results, may need to perform "test of cure" cultures after 24 hours of treatment.

- Aggregate quality of evidence: C (observational studies).
- Benefits: Accurate diagnosis of UTI can prevent the spread of infection and renal scarring; avoiding overdiagnosis of UTI can prevent overtreatment and unnecessary and expensive imaging. These criteria reduce the likelihood of overdiagnosis of UTI in infants with asymptomatic bacteriuria or contaminated specimens.
- Harms/risks/costs: Stringent diagnostic criteria may miss a small number of UTIs.
- Benefit-harms assessment: Preponderance of benefit over harm.
- Value judgments: Treatment of asymptomatic bacteriuria may be harmful.
- Role of patient preferences: We assume that parents prefer no action in the absence of a UTI (avoiding false-positive results) over a very small chance of missing a UTI.
- Exclusions: None.
- Intentional vagueness: None.
- Policy level: Recommendation.

MANAGEMENT

Action Statement 4

Action Statement 4a

When initiating treatment, the clinician should base the choice of route of administration on practical considerations. Initiating treatment orally or parenterally is equally efficacious. The clinician should base the choice of agent on local antimicrobial sensitivity patterns (if available) and should adjust the choice according to sensitivity testing of the isolated uropathogen (evidence quality: A; strong recommendation).

Action Statement 4b

The clinician should choose 7 to 14 days as the duration of antimicrobial therapy (evidence quality: B; recommendation).

The goals of treatment of acute UTI are to eliminate the acute infection, to prevent complications, and to reduce the likelihood of renal damage. Most children can be treated orally.[42–44] Patients whom clinicians judge to be "toxic" or who are unable to retain oral intake (including medications) should receive an antimicrobial agent parenter-

TABLE 2 Some Empiric Antimicrobial Agents for Parenteral Treatment of UTI

Antimicrobial Agent	Dosage
Ceftriaxone	75 mg/kg, every 24 h
Cefotaxime	150 mg/kg per d, divided every 6–8 h
Ceftazidime	100–150 mg/kg per d, divided every 8 h
Gentamicin	7.5 mg/kg per d, divided every 8 h
Tobramycin	5 mg/kg per d, divided every 8 h
Piperacillin	300 mg/kg per d, divided every 6–8 h

TABLE 3 Some Empiric Antimicrobial Agents for Oral Treatment of UTI

Antimicrobial Agent	Dosage
Amoxicillin-clavulanate	20–40 mg/kg per d in 3 doses
Sulfonamide	
Trimethoprim-sulfamethoxazole	6–12 mg/kg trimethoprim and 30-60 mg/kg sulfamethoxazole per d in 2 doses
Sulfisoxazole	120–150 mg/kg per d in 4 doses
Cephalosporin	
Cefixime	8 mg/kg per d in 1 dose
Cefpodoxime	10 mg/kg per d in 2 doses
Cefprozil	30 mg/kg per d in 2 doses
Cefuroxime axetil	20–30 mg/kg per d in 2 doses
Cephalexin	50–100 mg/kg per d in 4 doses

ally (Table 2) until they exhibit clinical improvement, generally within 24 to 48 hours, and are able to retain orally administered fluids and medications. In a study of 309 febrile infants with UTIs, only 3 (1%) were deemed too ill to be assigned randomly to either parenteral or oral treatment.[42] Parenteral administration of an antimicrobial agent also should be considered when compliance with obtaining an antimicrobial agent and/or administering it orally is uncertain. The usual choices for oral treatment of UTIs include a cephalosporin, amoxicillin plus clavulanic acid, or trimethoprim-sulfamethoxazole (Table 3). It is essential to know local patterns of susceptibility of coliforms to antimicrobial agents, particularly trimethoprim-sulfamethoxazole and cephalexin, because there is substantial geographic variability that needs to be taken into account during selection of an antimicrobial agent before sensitivity results are available. Agents that are excreted in the urine but do not achieve therapeutic concentrations in the bloodstream, such as nitrofurantoin, should not be used to treat febrile infants with UTIs, because parenchymal and serum antimicrobial concentrations may be insufficient to treat pyelonephritis or urosepsis.

Whether the initial route of administration of the antimicrobial agent is oral or parenteral (then changed to oral), the total course of therapy should be 7 to 14 days. The committee attempted to identify a single, preferred, evidence-based duration, rather than a range, but data comparing 7, 10, and 14 days directly were not found. There is evidence that 1- to 3-day courses for febrile UTIs are inferior to courses in the recommended range; therefore, the minimal duration selected should be 7 days.

- Aggregate quality of evidence: A/B (RCTs).
- Benefits: Adequate treatment of UTI can prevent the spread of infection and renal scarring. Outcomes of short courses (1–3 d) are inferior to those of 7- to 14-d courses.
- Harms/risks/costs: There are minimal harm and minor cost effects of antimicrobial choice and duration of therapy.
- Benefit-harms assessment: Preponderance of benefit over harm.
- Value judgments: Adjusting antimicrobial choice on the basis of available data and treating according to best evidence will minimize cost and consequences of failed or unnecessary treatment.
- Role of patient preferences: It is assumed that parents prefer the most-effective treatment and the least amount of medication that ensures effective treatment.
- Exclusions: None.
- Intentional vagueness: No evidence distinguishes the benefit of treating 7 vs 10 vs 14 days, and the range is allowable.
- Policy level: Strong recommendation/recommendation.

Action Statement 5

Febrile infants with UTIs should undergo renal and bladder ultrasonography (RBUS) (evidence quality: C; recommendation).

The purpose of RBUS is to detect anatomic abnormalities that require further evaluation, such as additional imaging or urologic consultation. RBUS also provides an evaluation of the renal parenchyma and an assessment of renal size that can be used to monitor renal growth. The yield of actionable findings is relatively low.[45,46] Widespread application of prenatal ultrasonography clearly has reduced the prevalence of previously unsuspected obstructive uropathy in infants, but the consequences of prenatal screening with respect to the risk of renal abnormalities in infants with UTIs have not yet been well defined. There is considerable variability in the timing and quality of prenatal ultrasonograms, and the report of "normal" ultrasonographic results cannot necessarily be relied on to dismiss completely the possibility of a structural abnormality unless the study was a detailed anatomic survey (with measurements), was performed during the third tri-

mester, and was performed and interpreted by qualified individuals.[47]

The timing of RBUS depends on the clinical situation. RBUS is recommended during the first 2 days of treatment to identify serious complications, such as renal or perirenal abscesses or pyonephrosis associated with obstructive uropathy when the clinical illness is unusually severe or substantial clinical improvement is not occurring. For febrile infants with UTIs who demonstrate substantial clinical improvement, however, imaging does not need to occur early during the acute infection and can even be misleading; animal studies demonstrate that *Escherichia coli* endotoxin can produce dilation during acute infection, which could be confused with hydronephrosis, pyonephrosis, or obstruction.[48] Changes in the size and shape of the kidneys and the echogenicity of renal parenchyma attributable to edema also are common during acute infection. The presence of these abnormalities makes it inappropriate to consider RBUS performed early during acute infection to be a true baseline study for later comparisons in the assessment of renal growth.

Nuclear scanning with technetium-labeled dimercaptosuccinic acid has greater sensitivity for detection of acute pyelonephritis and later scarring than does either RBUS or voiding cystourethrography (VCUG). The scanning is useful in research, because it ensures that all subjects in a study have pyelonephritis to start with and it permits assessment of later renal scarring as an outcome measure. The findings on nuclear scans rarely affect acute clinical management, however, and are not recommended as part of routine evaluation of infants with their first febrile UTI. The radiation dose to the patient during dimercaptosuccinic acid scanning is generally low (~1 mSv),[49] although it may be increased in children with reduced renal function. The radiation dose from dimercaptosuccinic acid is additive with that of VCUG when both studies are performed.[50] The radiation dose from VCUG depends on the equipment that is used (conventional versus pulsed digital fluoroscopy) and is related directly to the total fluoroscopy time. Moreover, the total exposure for the child will be increased when both acute and follow-up studies are obtained. The lack of exposure to radiation is a major advantage of RBUS, even with recognition of the limitations of this modality that were described previously.

- Aggregate quality of evidence: C (observational studies).
- Benefits: RBUS in this population will yield abnormal results in ~15% of cases, and 1% to 2% will have abnormalities that would lead to action (eg, additional evaluation, referral, or surgery).
- Harms/risks/costs: Between 2% and 3% will be false-positive results, leading to unnecessary and invasive evaluations.
- Benefit-harms assessment: Preponderance of benefit over harm.
- Value judgments: The seriousness of the potentially correctable abnormalities in 1% to 2%, coupled with the absence of physical harm, was judged sufficiently important to tip the scales in favor of testing.
- Role of patient preferences: Because ultrasonography is noninvasive and poses minimal risk, we assume that parents will prefer RBUS over taking even a small risk of missing a serious and correctable condition.
- Exclusions: None.
- Intentional vagueness: None.
- Policy level: Recommendation.

Action Statement 6

Action Statement 6a

VCUG should not be performed routinely after the first febrile UTI; VCUG is indicated if RBUS reveals hydronephrosis, scarring, or other findings that would suggest either high-grade VUR or obstructive uropathy, as well as in other atypical or complex clinical circumstances (evidence quality B; recommendation).

Action Statement 6b

Further evaluation should be conducted if there is a recurrence of febrile UTI (evidence quality: X; recommendation).

For the past 4 decades, the strategy to protect the kidneys from further damage after an initial UTI has been to detect childhood genitourinary abnormalities in which recurrent UTI could increase renal damage. The most common of these is VUR, and VCUG is used to detect this. Management included continuous antimicrobial administration as prophylaxis and surgical intervention if VUR was persistent or recurrences of infection were not prevented with an antimicrobial prophylaxis regimen; some have advocated surgical intervention to correct high-grade reflux even when infection has not recurred. However, it is clear that there are a significant number of infants who develop pyelonephritis in whom VUR cannot be demonstrated, and the effectiveness of antimicrobial prophylaxis for patients who have VUR has been challenged in the past decade. Several studies have suggested that prophylaxis does not confer the desired benefit of preventing recurrent febrile UTI.[51–55] If prophylaxis is, in fact, not beneficial and VUR is not required for development of pyelonephritis, then the rationale for performing VCUG routinely after an initial febrile UTI must be questioned.

RCTs of the effectiveness of prophylaxis performed to date generally included children more than 24 months of age, and some did not provide complete data according to grade of VUR. These 2 factors have compromised meta-analyses. To ensure direct comparisons, the committee contacted the 6 researchers who had conducted the most recent RCTs and requested raw data from their studies.[51–56] All complied, which permitted the creation of a data set with data for 1091 infants 2 to 24 months of age according to grade of VUR. A χ^2 analysis (2-tailed) and a formal meta-analysis did not detect a statistically significant benefit of prophylaxis in preventing recurrence of febrile UTI/pyelonephritis in infants without reflux or those with grades I, II, III, or IV VUR (Table 4 and Fig 3). Only 5 infants with grade V VUR were included in the RCTs; therefore, data for those infants are not included in Table 4 or Fig 3.

The proportion of infants with high-grade VUR among all infants with febrile UTIs is small. Data adapted from current studies (Table 5) indicate that, of a hypothetical cohort of 100 infants with febrile UTIs, only 1 has grade V VUR; 99 do not. With a practice of waiting for a second UTI to perform VCUG, only 10 of the 100 would need to undergo the procedure and the 1 with grade V VUR would be identified. (It also is possible that the 1 infant with grade V VUR might have been identified after the first UTI on the basis of abnormal RBUS results that prompted VCUG to be performed.) Data to quantify additional potential harm to an infant who is not revealed to have high-grade VUR until a second UTI are not precise but suggest that the increment is insufficient to justify routinely subjecting all infants with an initial febrile UTI to VCUG (Fig 4). To minimize any harm incurred by that infant, attempts have been made to identify, at the time of the initial UTI, those who have the greatest likelihood of having high-grade VUR. Unfortunately, there are no clinical or laboratory indicators that have been demonstrated to identify infants with high-grade VUR. Indications for VCUG have been proposed on the basis of consensus in the absence of data[57]; the predictive value of any of the indications for VCUG proposed in this manner is not known.

TABLE 4 Recurrences of Febrile UTI/Pyelonephritis in Infants 2 to 24 Months of Age With and Without Antimicrobial Prophylaxis, According to Grade of VUR

Reflux Grade	Prophylaxis		No Prophylaxis		*P*
	No. of Recurrences	Total *N*	No. of Recurrences	Total *N*	
None	7	210	11	163	.15
I	2	37	2	35	1.00
II	11	133	10	124	.95
III	31	140	40	145	.29
IV	16	55	21	49	.14

The level of evidence supporting routine imaging with VCUG was deemed insufficient at the time of the 1999 practice parameter to receive a recommendation, but the consensus of the subcommittee was to "strongly encourage" imaging studies. The position of the current subcommittee reflects the new evidence demonstrating antimicrobial prophylaxis not to be effective as presumed previously. Moreover, prompt diagnosis and effective treatment of a febrile UTI recurrence may be of greater importance regardless of whether VUR is present or the child is receiving antimicrobial prophylaxis. A national study (the Randomized Intervention for Children With Vesicoureteral Reflux study) is currently in progress to identify the effects of a prophylactic antimicrobial regimen for children 2 months to 6 years of age who have experienced a UTI, and it is anticipated to provide additional important data[58] (see Areas for Research).

Action Statement 6a

- Aggregate quality of evidence: B (RCTs).
- Benefits: This avoids, for the vast majority of febrile infants with UTIs, radiation exposure (of particular concern near the ovaries in girls), expense, and discomfort.
- Harms/risks/costs: Detection of a small number of cases of high-grade reflux and correctable abnormalities is delayed.
- Benefit-harms assessment: Preponderance of benefit over harm.
- Value judgments: The risks associated with radiation (plus the expense and discomfort of the procedure) for the vast majority of infants outweigh the risk of delaying the detection of the few with correctable abnormalities until their second UTI.
- Role of patient preferences: The judgment of parents may come into play, because VCUG is an uncomfortable procedure involving radiation exposure. In some cases, parents may prefer to subject their children to the procedure even when the chance of benefit is both small and uncertain. Antimicrobial prophylaxis seems to be ineffective in preventing recurrence of febrile UTI/pyelonephritis for the vast majority of infants. Some parents may want to avoid VCUG even after the second UTI. Because the benefit of identifying high-grade reflux is still in some doubt, these preferences should be considered. It is the judgment of the committee that VCUG is indicated after the second UTI.
- Exclusions: None.

TABLE 5 Rates of VUR According to Grade in Hypothetical Cohort of Infants After First UTI and After Recurrence

	Rate, %	
	After First UTI ($N = 100$)	After Recurrence ($N = 10$)
No VUR	65	26
Grades I–III VUR	29	56
Grade IV VUR	5	12
Grade V VUR	1	6

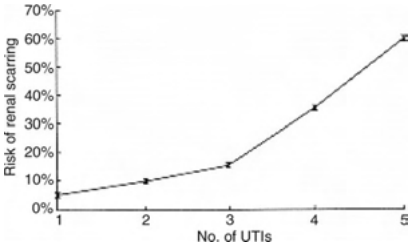

FIGURE 4
Relationship between renal scarring and number of bouts of pyelonephritis. Adapted from Jodal.[59]

- Intentional vagueness: None.
- Policy level: Recommendation.

Action Statement 6b

- Aggregate quality of evidence: X (exceptional situation).
- Benefits: VCUG after a second UTI should identify infants with very high-grade reflux.
- Harms/risks/costs: VCUG is an uncomfortable, costly procedure that involves radiation, including to the ovaries of girls.
- Benefit-harms assessment: Preponderance of benefit over harm.
- Value judgments: The committee judged that patients with high-grade reflux and other abnormalities may benefit from interventions to prevent further scarring. Further studies of treatment for grade V VUR are not underway and are unlikely in the near future, because the condition is uncommon and randomization of treatment in this group generally has been considered unethical.

FIGURE 3
A, Recurrences of febrile UTI/pyelonephritis in 373 infants 2 to 24 months of age without VUR, with and without antimicrobial prophylaxis (based on 3 studies; data provided by Drs Craig, Garin, and Montini). B, Recurrences of febrile UTI/pyelonephritis in 72 infants 2 to 24 months of age with grade I VUR, with and without antimicrobial prophylaxis (based on 4 studies; data provided by Drs Craig, Garin, Montini, and Roussey-Kesler). C, Recurrences of febrile UTI/pyelonephritis in 257 infants 2 to 24 months of age with grade II VUR, with and without antimicrobial prophylaxis (based on 5 studies; data provided by Drs Craig, Garin, Montini, Pennesi, and Roussey-Kesler). D, Recurrences of febrile UTI/pyelonephritis in 285 infants 2 to 24 months of age with grade III VUR, with and without antimicrobial prophylaxis (based on 6 studies; data provided by Drs Brandström, Craig, Garin, Montini, Pennesi, and Roussey-Kesler). E, Recurrences of febrile UTI/pyelonephritis in 104 infants 2 to 24 months of age with grade IV VUR, with and without antimicrobial prophylaxis (based on 3 studies; data provided by Drs Brandström, Craig, and Pennesi). M-H indicates Mantel-Haenszel; CI, confidence interval.

- Role of patient preferences: As mentioned previously, the judgment of parents may come into play, because VCUG is an uncomfortable procedure involving radiation exposure. In some cases, parents may prefer to subject their children to the procedure even when the chance of benefit is both small and uncertain. The benefits of treatment of VUR remain unproven, but the point estimates suggest a small potential benefit. Similarly, parents may want to avoid VCUG even after the second UTI. Because the benefit of identifying high-grade reflux is still in some doubt, these preferences should be considered. It is the judgment of the committee that VCUG is indicated after the second UTI.
- Exclusions: None.
- Intentional vagueness: Further evaluation will likely start with VCUG but may entail additional studies depending on the findings. The details of further evaluation are beyond the scope of this guideline.
- Policy level: Recommendation.

Action Statement 7

After confirmation of UTI, the clinician should instruct parents or guardians to seek prompt medical evaluation (ideally within 48 hours) for future febrile illnesses, to ensure that recurrent infections can be detected and treated promptly (evidence quality: C; recommendation).

Early treatment limits renal damage better than late treatment,[1,2] and the risk of renal scarring increases as the number of recurrences increase (Fig 4).[59] For these reasons, all infants who have sustained a febrile UTI should have a urine specimen obtained at the onset of subsequent febrile illnesses, so that a UTI can be diagnosed and treated promptly.

- Aggregate quality of evidence: C (observational studies).
- Benefits: Studies suggest that early treatment of UTI reduces the risk of renal scarring.
- Harms/risks/costs: There may be additional costs and inconvenience to parents with more-frequent visits to the clinician for evaluation of fever.
- Benefit-harms assessment: Preponderance of benefit over harm.
- Value judgments: None.
- Role of patient preferences: Parents will ultimately make the judgment to seek medical care.
- Exclusions: None.
- Intentional vagueness: None.
- Policy level: Recommendation.

CONCLUSIONS

The committee formulated 7 key action statements for the diagnosis and treatment of infants and young children 2 to 24 months of age with UTI and unexplained fever. Strategies for diagnosis and treatment depend on whether the clinician determines that antimicrobial therapy is warranted immediately or can be delayed safely until urine culture and urinalysis results are available. Diagnosis is based on the presence of pyuria and at least 50 000 CFUs per mL of a single uropathogen in an appropriately collected specimen of urine; urinalysis alone does not provide a definitive diagnosis. After 7 to 14 days of antimicrobial treatment, close clinical follow-up monitoring should be maintained, with evaluation of the urine during subsequent febrile episodes to permit prompt diagnosis and treatment of recurrent infections. Ultrasonography of the kidneys and bladder should be performed to detect anatomic abnormalities that require further evaluation (eg, additional imaging or urologic consultation). Routine VCUG after the first UTI is not recommended; VCUG is indicated if RBUS reveals hydronephrosis, scarring, or other findings that would suggest either high-grade VUR or obstructive uropathy, as well as in other atypical or complex clinical circumstances. VCUG also should be performed if there is a recurrence of febrile UTI.

AREAS FOR RESEARCH

One of the major values of a comprehensive literature review is the identification of areas in which evidence is lacking. The following 8 areas are presented in an order that parallels the previous discussion.

1. The relationship between UTIs in infants and young children and reduced renal function in adults has been established but is not well characterized in quantitative terms. The ideal prospective cohort study from birth to 40 to 50 years of age has not been conducted and is unlikely to be conducted. Therefore, estimates of undesirable outcomes in adulthood, such as hypertension and end-stage renal disease, are based on the mathematical product of probabilities at several steps, each of which is subject to bias and error. Other attempts at decision analysis and thoughtful literature review have recognized the same limitations. Until recently, imaging tools available for assessment of the effects of UTIs have been insensitive. With the imaging techniques now available, it may be possible to identify the relationship of scarring to renal impairment and hypertension.
2. The development of techniques that would permit an alternative to invasive sampling and culture would be valuable for general use. Special attention should be given to infant girls and uncircumcised boys, because urethral catheterization may

be difficult and can produce contaminated specimens and SPA now is not commonly performed. Incubation time, which is inherent in the culture process, results in delayed treatment or presumptive treatment on the basis of tests that lack the desired sensitivity and specificity to replace culture.

3. The role of VUR (and therefore of VCUG) is incompletely understood. It is recognized that pyelonephritis (defined through cortical scintigraphy) can occur in the absence of VUR (defined through VCUG) and that progressive renal scarring (defined through cortical scintigraphy) can occur in the absence of demonstrated VUR.[52,53] The presumption that antimicrobial prophylaxis is of benefit for individuals with VUR to prevent recurrences of UTI or the development of renal scars is not supported by the aggregate of data from recent studies and currently is the subject of the Randomized Intervention for Children With Vesicoureteral Reflux study.[58]
4. Although the effectiveness of antimicrobial prophylaxis for the prevention of UTI has not been demonstrated, the concept has biological plausibility. Virtually all antimicrobial agents used to treat or to prevent infections of the urinary tract are excreted in the urine in high concentrations. Barriers to the effectiveness of antimicrobial prophylaxis are adherence to a daily regimen, adverse effects associated with the various agents, and the potential for emergence of antimicrobial resistance. To overcome these issues, evidence of effectiveness with a well-tolerated, safe product would be required, and parents would need sufficient education to understand the value and importance of adherence. A urinary antiseptic, rather than an antimicrobial agent, would be particularly desirable, because it could be taken indefinitely without concern that bacteria would develop resistance. Another possible strategy might be the use of probiotics.
5. Better understanding of the genome (human and bacterial) may provide insight into risk factors (VUR and others) that lead to increased scarring. Blood specimens will be retained from children enrolled in the Randomized Intervention for Children With Vesicoureteral Reflux study, for future examination of genetic determinants of VUR, recurrent UTI, and renal scarring.[58] VUR is recognized to "run in families,"[60,61] and multiple investigators are currently engaged in research to identify a genetic basis for VUR. Studies may also be able to distinguish the contribution of congenital dysplasia from acquired scarring attributable to UTI.
6. One of the factors used to assess the likelihood of UTI in febrile infants is race. Data regarding rates among Hispanic individuals are limited and would be useful for prediction rules.
7. This guideline is limited to the initial management of the first UTI in febrile infants 2 to 24 months of age. Some of the infants will have recurrent UTIs; some will be identified as having VUR or other abnormalities. Further research addressing the optimal course of management in specific situations would be valuable.
8. The optimal duration of antimicrobial treatment has not been determined. RCTs of head-to-head comparisons of various duration would be valuable, enabling clinicians to limit antimicrobial exposure to what is needed to eradicate the offending uropathogen.

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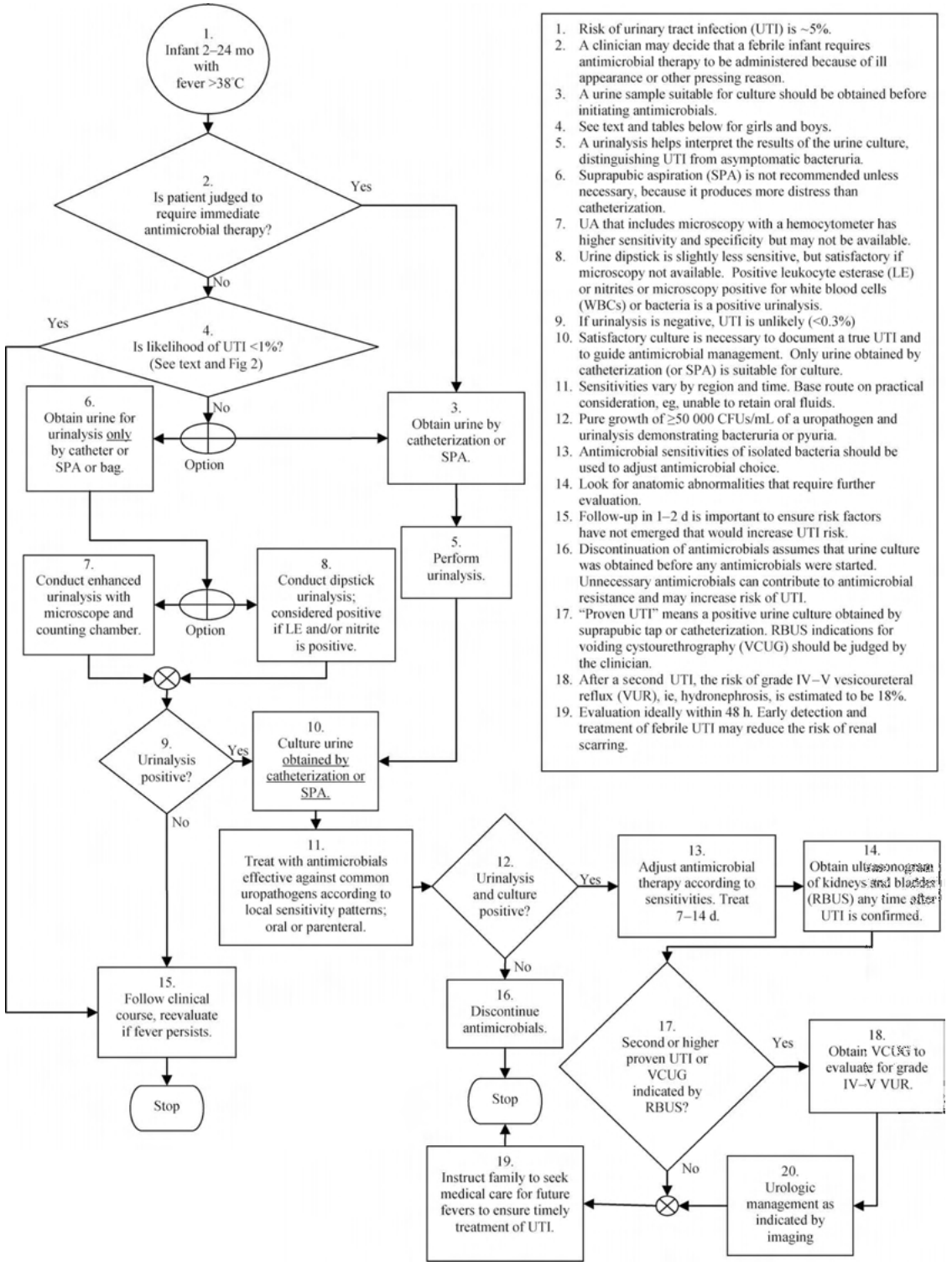

APPENDIX
Clinical practice guideline algorithm.

Technical Report—Diagnosis and Management of an Initial UTI in Febrile Infants and Young Children

S. Maria E. Finnell, MD, MS, Aaron E. Carroll, MD, MS, Stephen M. Downs, MD, MS, and the Subcommittee on Urinary Tract Infection

KEY WORDS
urinary tract infection, infants, children, vesicoureteral reflux, voiding cystourethrography, antimicrobial, prophylaxis, antibiotic prophylaxis, pyelonephritis

ABBREVIATIONS
UTI—urinary tract infection
VUR—vesicoureteral reflux
VCUG—voiding cystourethrography
CI—confidence interval
RR—risk ratio
RCT—randomized controlled trial
LR—likelihood ratio
SPA—suprapubic aspiration

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abstract

FREE

OBJECTIVES: The diagnosis and management of urinary tract infections (UTIs) in young children are clinically challenging. This report was developed to inform the revised, evidence-based, clinical guideline regarding the diagnosis and management of initial UTIs in febrile infants and young children, 2 to 24 months of age, from the American Academy of Pediatrics Subcommittee on Urinary Tract Infection.

METHODS: The conceptual model presented in the 1999 technical report was updated after a comprehensive review of published literature. Studies with potentially new information or with evidence that reinforced the 1999 technical report were retained. Meta-analyses on the effectiveness of antimicrobial prophylaxis to prevent recurrent UTI were performed.

RESULTS: Review of recent literature revealed new evidence in the following areas. Certain clinical findings and new urinalysis methods can help clinicians identify febrile children at very low risk of UTI. Oral antimicrobial therapy is as effective as parenteral therapy in treating UTI. Data from published, randomized controlled trials do not support antimicrobial prophylaxis to prevent febrile UTI when vesicoureteral reflux is found through voiding cystourethrography. Ultrasonography of the urinary tract after the first UTI has poor sensitivity. Early antimicrobial treatment may decrease the risk of renal damage from UTI.

CONCLUSIONS: Recent literature agrees with most of the evidence presented in the 1999 technical report, but meta-analyses of data from recent, randomized controlled trials do not support antimicrobial prophylaxis to prevent febrile UTI. This finding argues against voiding cystourethrography after the first UTI. *Pediatrics* 2011;128:e749–e770

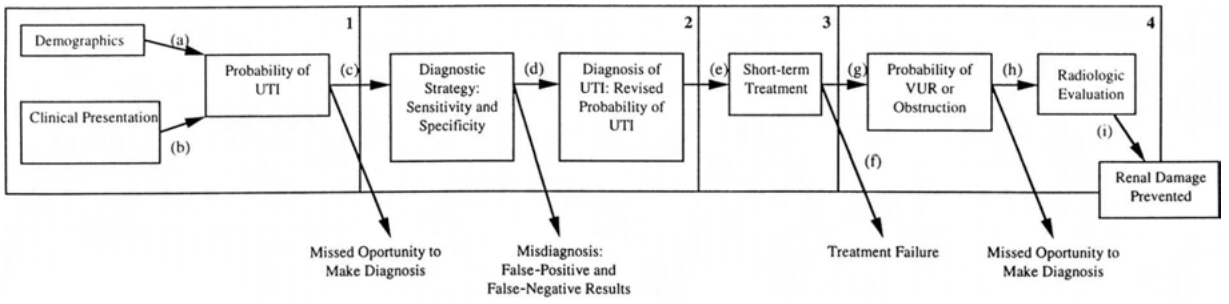

FIGURE 1
Evidence model from the 1999 technical report on the diagnosis and treatment of infants and children with UTIs.

In 1999, the Subcommittee on Urinary Tract Infection of the American Academy of Pediatrics released its guideline on detection, diagnosis, and management for children between 2 and 24 months of age with febrile urinary tract infections (UTIs).[1] The guideline was supported by a technical report[2] that included a critical review of the relevant literature and a cost-effectiveness analysis. Consistent with the policies of the American Academy of Pediatrics, the subcommittee has undertaken a revision of the guideline. This technical report was developed to support the guideline.[3]

The revised technical report was to be based on a selective review of the literature, focusing on changes in the evidence regarding detection, diagnosis, and management of UTIs in these children. The original technical report was designed around an evidence model (Fig 1). Each cell (numbered 1–4) corresponded to a stage in the recognition, diagnosis, or management of UTI. The boxes represented steps the clinician must follow, and the arrows represented the process of moving from one step to the next. Downward arrows represented undesirable consequences in management.[4]

In cell 1, the clinician must combine patient demographic data and other presenting clinical data to arrive at an assessment of the risk of UTI. Failure to do so results in a missed opportunity to make the diagnosis. In cell 2, the clinician must undertake a diagnostic strategy, primarily involving laboratory testing, to arrive at a posterior (posttest) probability of UTI, ruling the diagnosis in or out. Poor test choices or interpretation of results can lead to misdiagnosis. In cell 3, the clinician must choose a treatment for acute UTI; in cell 4, the clinician must consider the possibility of structural or functional anomalies of the urinary tract and diagnose them appropriately to avoid ongoing renal damage.

Implicit in cell 4 is the idea that anomalies of the urinary tract, such as vesicoureteral reflux (VUR) and obstructions, may, if left untreated, lead to significant renal damage, resulting in hypertension or end-stage renal disease. Furthermore, it is assumed that treatment with medical or surgical therapies can prevent these consequences successfully.

The conclusions of the 1999 technical report were that there were high-quality data regarding the prevalence of UTI among febrile infants, the performance of standard diagnostic tests for UTI, and the prevalence of urinary tract abnormalities among children with UTI. The evidence indicating that certain patient characteristics (age, gender, and circumcision status) affected the probability of UTI was weaker. The evidence supporting the relationship between urinary tract abnormalities and future complications, such as hypertension or renal failure, was considered very poor, and the effectiveness of treatments to prevent these complications was not addressed directly but was assumed.

The cost-effectiveness analysis using these data led to the conclusion that diagnosis and treatment of UTI and evaluation for urinary tract anomalies had borderline cost-effectiveness, costing approximately $700 000 per case of hypertension or end-stage renal disease prevented. On the basis of these results, the subcommittee recommended testing all children between 2 and 24 months of age with fever with no obvious source for UTI, by culturing urine obtained through bladder tap or catheterization. As an option for children who were not going to receive immediate antimicrobial treatment, the committee recommended ruling out UTI through urinalysis of urine obtained with any convenient method. The committee concluded that children found to have a UTI should undergo renal ultrasonography and voiding cystourethrography (VCUG) for evaluation for urinary tract abnormalities, most frequently VUR.

Ten years later, the subcommittee has undertaken a review of the technical analysis for a revised guideline. The strategy for this technical report was to survey the medical literature published in the past 10 years for studies of UTIs in young children. The literature was examined for any data that varied significantly from those analyzed in the

first technical report. This survey found an emerging body of literature addressing the effectiveness of antimicrobial agents to prevent recurrent UTI. Therefore, the authors conducted a critical literature review and meta-analysis focused on that specific issue.

METHODS

Surveillance of Recent Literature

The authors searched Medline for articles published in the past 10 years with the medical subject headings "urinary tract infection" and "child (all)." The original search was conducted in 2007, but searches were repeated at intervals (approximately every 3 months) to identify new reports as the guideline was being developed. Titles were reviewed by 2 authors (Drs Downs and Carroll) to identify all articles that were potentially relevant and seemed to contain original data. All titles that were considered potentially relevant by either reviewer were retained. Abstracts of selected articles were reviewed, again to identify articles that were relevant to the guideline and that seemed to contain original data. Review articles that were relevant also were retained for review. Again, all abstracts that were considered potentially relevant by either reviewer were retained. In addition, members of the subcommittee submitted articles that they thought were relevant to be included in the review.

Selected articles were reviewed and summarized by 2 reviewers (Drs Finnell and Downs). The summaries were reviewed, and articles presenting potentially new information were retained. In addition, representative articles reinforcing evidence in the 1999 technical report were retained.

The most significant area of change in the UTI landscape was a new and growing body of evidence regarding the effectiveness of antimicrobial prophylaxis to prevent recurrent infections in children with VUR. To explore this particular issue, a second, systematic, targeted literature search and formal meta-analysis were conducted to estimate the effectiveness of antimicrobial prophylaxis to prevent renal damage in children with VUR. In addition, 1 author (Dr Finnell) and the chairperson of the guideline committee (Dr Roberts) contacted the authors of those studies to obtain original data permitting subgroup analyses.

Targeted Literature Search and Meta-analysis

To examine specifically the effectiveness of antimicrobial prophylaxis to prevent recurrent UTI and pyelonephritis in children with VUR, a formal meta-analysis of randomized controlled trials (RCTs) was conducted. First, a systematic literature review focused on RCTs, including studies in press, was performed.

Inclusion Criteria

RCTs published in the past 15 years (1993–2009) that compared antimicrobial treatment versus no treatment or placebo treatment for the prevention of recurrent UTI and included a minimum of 6 months of follow-up monitoring were included. Published articles, articles in press, and published abstracts were included. There were no language restrictions. To be included, studies needed to enroll children who had undergone VCUG for determination of the presence and grade of VUR. Studies that examined antibiotic prophylaxis versus no treatment or placebo treatment were included.

Outcome Measures

The primary outcome was the number of episodes of pyelonephritis or febrile UTI diagnosed on the basis of the presence of fever and bacterial growth in urine cultures. A secondary outcome was an episode of any type of UTI, including cystitis, nonfebrile UTI, and asymptomatic bacteriuria in addition to the cases of pyelonephritis or febrile UTI.

Search Methods

The initial literature search was conducted on June 24, 2008, and the search was repeated on April 14, 2009. Studies were obtained from the following databases: Medline (1993 to June 2008), Embase (1993 to June 2008), Cochrane Central Register for Controlled Trials, bibliographies of identified relevant articles and reviews, and the Web site www.ClinicalTrials.gov.

The search terms "vesico-ureteral reflux," "VUR," "vesicoureter*," "vesico ureter*," "vesicourethral," or "vesico urethral" and "antibiotic," "anti biotic," "antibacterial," "anti bacterial," "antimicrobial," "anti microbial," "antiinfective," or "anti infective" were used. The asterisk represents the truncation or wild card symbol, which indicates that all suffixes and variants were included. The search was limited to the publication types and subject headings for all clinical trials and included all keyword variants for "random" in Medline and Embase.[5] In addition, the Web site www.ClinicalTrials.gov was searched on May 20, 2010.

The search strategy and the screening of the titles for selection of potentially relevant abstracts were completed by 1 reviewer (Dr Finnell). Two reviewers (Drs Finnell and Downs) screened selected abstracts to identify appropriate articles. Published articles and abstracts that met the inclusion criteria were included in the meta-analysis. Additional information was sought from authors whose articles or abstracts did not contain the information needed for a decision regarding inclusion. The selection process is summarized in Fig 2.

Assessment of Studies

The quality of selected articles and abstracts was assessed with the scoring

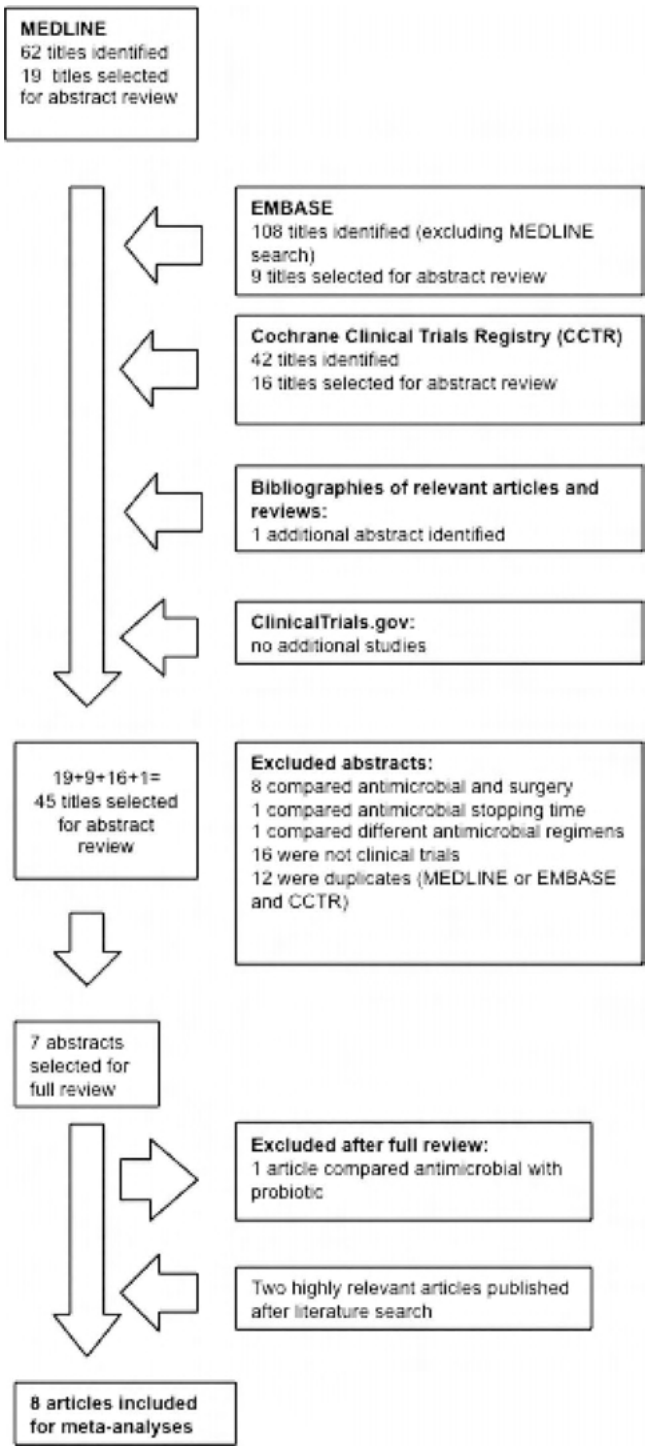

FIGURE 2
Study selection for meta-analyses.

system described by Downs and Black in 1998.[6] Each study received scores (from 2 assessors) on a scale from 0 to 32. Six of the articles and abstracts were included in a first meta-analysis, which evaluated febrile UTI or pyelonephritis as the outcome. A second meta-analysis, which included all studies with the outcome "all UTI," also was conducted.

Meta-analyses

All statistical tests were performed by using Review Manager 5.1 (Nordic Cochrane Centre, Copenhagen, Denmark). The following settings were used for the analyses: dichotomous outcome and Mantel-Haenzel statistical method. Data were analyzed with a random-effects model. When no statistically significant effect and no statistical heterogeneity were detected, data also were analyzed with a fixed-effects model, because that type of analysis is more likely to detect a difference. The effect measure was presented as a risk ratio (RR). The results for the primary outcome (pyelonephritis or febrile UTI) and the secondary outcome (any type of UTI, including cystitis, nonfebrile UTI, and asymptomatic bacteriuria) were calculated as point estimates with corresponding 95% confidence intervals (CIs). Heterogeneity was analyzed by using the Q statistic with a threshold of $P < .05$. The number of studies was insufficient for assessment of publication bias with a funnel plot.

Meta-analyses of Data According to VUR Grade and for Children 2 to 24 Months of Age

The published data on which the meta-analyses were based did not contain subgroup data relevant to the practice guideline. Specifically, some studies did not report outcomes according to the severity of VUR, and some did not report outcomes specific to the age range of interest (2–24 months). Therefore, the committee chairperson contacted the authors of the reports included in the meta-analysis, to obtain original data. Data on recurrence according to VUR grade and for the subgroup of children 2 to 24 months of age were received from the authors, and these data were analyzed in separate meta-analyses.

RESULTS

Surveillance of Recent Literature

The surveillance of recent literature yielded 1308 titles. Of those, 297 abstracts were selected for review. From among the abstracts, 159 articles were selected for full review. The results of this surveillance, as well as the full review and meta-analyses, are organized according to the evidence diagram in Fig 1.

Box 1: Prevalence and Risk Factors for UTI

The Presence of UTI Should Be Considered for Any Child 2 Months to 2 Years of Age With Unexplained Fever

The previous technical report described a very consistent UTI prevalence of 5% among children 2 to 24 months of age with a fever without obvious source. In 1996, Hoberman et al[7] conducted a study of urine diagnostic tests with a cohort of 4253 infants with fever and found a prevalence of 5%. Similarly, in a 1999 cohort study of 534 children 3 to 36 months of age with a temperature of more than 39°C and no apparent source of fever, UTI prevalence was determined to be 5%.[8] In a 1998 cohort study of 2411 children (boys and girls <12 months of age and girls 12–24 months of age) seen in the emergency department with a temperature of more than 38.5°C, Shaw et al[9] determined the prevalence of UTI to be 3.3%. Because 84% of those children were black, this estimate may be low for the general population (see below). In a meta-analysis of 14 studies, the pooled prevalence of UTI was 7% (95% CI: 5.5%–8.4%) among febrile children 0 to 24 months of age, of both genders, with or without additional symptoms of UTI.[10] In the 6- to 12-month age group, however, the prevalence was 5.4%; in the 12- to 24-month age group, the prevalence was 4.5%. Taken together, these estimates are consistent with a pooled prevalence of 5% determined in earlier studies.

TABLE 1 LRs and Posttest Probabilities of UTI for Infant Boys According to Number of Findings Present

Finding	LR		Posttest Probability, %					
			All Boys		Circumcised Boys		Uncircumcised Boys	
	Positive	Negative	After Positive Results	After Negative Results	After Positive Results	After Negative Results	After Positive Results	After Negative Results
Uncircumcised	2.8	0.33	5.9	0.7	—	—	—	—
History of UTI	2.6	0.96	5.5	2.1	1.8	0.7	14.0	5.7
Temperature of >39°C	1.4	0.76	3.1	1.7	1.0	0.5	8.1	4.5
Fever without apparent source	1.4	0.69	3.1	1.5	1.0	0.5	8.1	4.1
Ill appearance	1.9	0.68	4.1	1.5	1.3	0.5	10.6	4.1
Fever for >24 h	2.0	0.9	4.3	2.0	1.4	0.6	11.1	5.3
Nonblack race	1.4	0.52	3.1	1.2	1.0	0.4	8.1	3.2

The previous technical report examined the effects of age, gender, and circumcision status on the prevalence of UTI. The conclusion was that boys more than 1 year of age who had been circumcised were at sufficiently low risk of UTI (<1%) that evaluation of this subpopulation would not be cost-effective. New work confirms an approximately threefold to fourfold decreased risk of UTI among circumcised boys.[10] The difference seems to be greater for younger children.[11] Additional clinical characteristics were shown more recently to affect the risk of UTI among febrile infants and children. From a study by Shaikh et al,[12] a set of likelihood ratios (LRs) for various risk factors for UTI was derived (Table 1).

A simplified way to examine the data on boys from Shaikh et al[12] is first to exclude boys with a history of UTI, because the guideline addresses only first-time UTIs, and to exclude those with ill appearance, because they are likely to require antimicrobial agents, in which case a urine specimen would be required. Finally, boys with and without circumcision should be considered separately. This leaves 4 risk factors for boys who present with fever, namely, temperature above 39°C, fever for more than 24 hours, no apparent fever source, and nonblack race. All 4 have similar LRs. If 2 assumptions are made, then the decision rule can be simplified. The first assumption is that, as a first approximation, each risk factor has a positive LR of 1.4 and a negative LR of 0.7. The second assumption is that the presence of each risk factor is conditionally independent of the others, given the presence or absence of UTI. With these reasonable assumptions, Table 2 applies to boys with no previous history of UTI

TABLE 2 LRs and Posttest Probabilities of UTI for Febrile Infant Boys According to Number of Findings Present

No. of Risk Factors	LR	Posttest Probability, %		
		All Boys	Uncircumcised	Circumcised
0	0.34	0.8	2.1	0.2
1	0.69	1.5	4.1	0.5
2	1.37	3.0	7.9	1.0
3	2.74	5.8	14.7	1.9
4	5.49	11.0	25.6	3.7

Risk factors: temperature above 39°C, fever for more than 24 hours, no apparent fever source, and nonblack race.

TABLE 3 LRs and Posttest Probabilities of UTI for Febrile Infant Girls According to Number of Findings Present (Prospective Original Study)

Cutoff Value, No. of Factors	LR		Posttest Probability, %	
	Positive	Negative (Approximate)	Below Cutoff Value	At or Above Cutoff Value
1	1.04	0.20	0.8	5.1
2	1.35	0.17	0.8	6.5
3	2.5	0.42	2.1	11.4
4	9.4	0.79	3.9	33.0
5	15.8	0.95	4.7	45.0

Risk factors: less than 12 months of age, white race, temperature > 39°C, fever for at least 2 days, and absence of another source of infection.

TABLE 4 LRs and Posttest Probabilities of UTI for Febrile Infant Girls According to Number of Findings Present (Retrospective Validation Study)

No. of Findings	LR	Posttest Probability, %
0 or 1	1.02	0.8
2	1.10	0.9
3	1.26	1.0
4	3.04	2.4
5	2.13	1.7

Risk factors: less than 12 months of age, white race, temperature > 39°C, fever for at least 2 days, and absence of another source of infection.

and do not appear ill. The LR is calculated as LR = $(1.4)^p \times (0.7)^n$, where p is the number of positive findings and n is the number of negative findings. This assumes that the clinician has assessed all 4 risk factors. It should be noted that, for uncircumcised boys, the risk of UTI never decreases below 2%. For circumcised boys, the probability exceeds 1% if there are 2 or more risk factors.

Other studies have shown that the presence of another, clinically obvious source of infection,[13] particularly documented viral infections,[14] such as respiratory syncytial virus infections,[15] reduces the risk of UTI by one-half. In a series of studies conducted by Gorelick, Shaw, and others,[9,16,17] male gender, black race, and no history of UTI were all found to reduce the risk. The authors derived a prediction rule specifically for girls, with 95% sensitivity and 31% specificity. In a subsequent validation study, they confirmed that these findings had predictive power, but the validation study used a weaker, retrospective, case-control design, compared with the more-robust, prospective, cohort design of the original derivation study. On the basis of the earlier cohort study and starting with a baseline risk of 5%, a child scoring low on the prediction rule would have a slightly less than 1% risk of UTI. To score this low on the prediction rule, a young girl would have to exhibit no more than 1 of the following features: less than 12 months of age, white race, temperature of more than 39°C, fever for at least 2 days, or absence of another source of infection.

However, those authors evaluated their decision rule with several different cutoff points, to determine the score below which the risk of UTI decreased below a test threshold of 1%. Unfortunately, the published article did not include the set of negative LRs needed to reproduce the posterior probabilities.[17] However, it was possible to approximate them through extrapolation from the receiver operating characteristic curve presented. On the basis of these estimated negative LRs and the positive LRs provided in the article,[17] Table 3 was derived. For each cutoff value in the number of risk factors, Table 3 shows the posterior probability for children with fewer than that number of risk factors (below the cutoff value) and for those with that number of risk factors *or more*. Therefore, the posttest probability is not the risk of UTI for children with exactly that number of risk factors. Similar results could be derived from the validation study and are shown in Table 4. However, because the second study had a weaker design, the values in Table 3 are more reliable.

These studies provide criteria for practical decision rules that clinicians can use to select patients who need urine samples for analysis and/or culture. They do not establish a threshold or maximal risk of UTI above which a urine sample is needed. However, in surveys of pediatricians, Roberts et al[18] found that only 10% of clinicians thought that a urine culture is indicated if the probability of UTI is less than 1%. In addition, the cost-effectiveness analysis published in the 1999 technical report set a threshold of 1%. However, circumstances such as risk of loss to follow-up monitoring or other clinician concerns may shift this threshold up or down.

TABLE 5 List of Test Characteristics of Diagnostic Tests for UTI Reported in 1999 Technical Report[2]

Test	Sensitivity, %			Specificity, %		
	Range	Median	Mean	Range	Median	Mean
Leukocyte esterase test	67–94	84	83	64–92	77	78
Nitrite test	15–82	58	53	90–100	99	98
Blood assessment	25–64	53	47	60–89	85	78
Protein assessment	40–55	53	50	67–84	77	76
Microscopy, leukocytes	32–100	*78*	73	45–98	87	81
Microscopy, bacteria	16–99	88	81	11–100	93	83
Leukocyte esterase or nitrite test	90–100	92	93	58–91	70	72
Any positive test results in urinalysis	99–100	100	99.8	60–92	63	70

TABLE 6 Test Characteristics of Laboratory Tests for UTI in Children

Study	Test	Population	*n*	Sensitivity, %	Specificity, %
Lockhart et al[19] (1995)	Leukocyte esterase or nitrite test results positive	Prospective sample, <6 mo of age, ED	207	67	79
	Any bacteria with Gram-staining				
Hoberman et al[7] (1996)	>10 white blood cells per counting chamber or any bacteria per 10 oil emersion fields	<2 y of age, 95% febrile, ED	4253	96	93
Shaw et al[9] (1998)	Enhanced urinalysis	Infants <12 mo of age and girls <2 y of age, ≥38.5°C, ED	3873	94	84
	Dipslide or standard urinalysis			83	87
Lin et al[20] (2000)	Hemocytometer, ≥10 cells per μL	Systematic review, febrile infants hospitalized, febrile UTI	NA	83	89

ED indicates emergency department; NA, not applicable.

Box 2: Diagnostic Tests for UTI

The 1999 technical report reviewed a large number of studies that described diagnostic tests for UTI. The results are summarized in Table 5. This updated review of the literature largely reinforced the findings of the original technical report.

More-recent work compared microscopy, including the use of hemocytometers and counting chambers (enhanced urinalysis), with routine urinalysis or dipslide reagents (Table 6). Lockhart et al[19] found that the observation of any visible bacteria in an uncentrifuged, Gram-stained, urine sample had better sensitivity and specificity than did combined dipslide leukocyte esterase and nitrite test results. Hoberman et al[7] in 1996 and Shaw et al[20] in 1998 both evaluated enhanced urinalysis, consisting of more than 10 white blood cells in a counting chamber or any bacteria seen in 10 oil emersion fields; they found sensitivity of 94% to 96% and specificity of 84% to 93%. In 2000, Lin et al[21] found that a count of at least 10 white blood cells per μL in a hemocytometer was less sensitive (83%) but quite specific (89%). Given the sensitivity of enhanced urinalysis, the probability of UTI for a typical febrile infant with a previous likelihood of UTI of 5% would be reduced to 0.2% to 0.4% with negative enhanced urinalysis results.

Obtaining a Urine Sample

In the UTI practice parameters from 1999, the subcommittee defined the gold standard of a UTI to be growth of bacteria on a culture of urine obtained through suprapubic aspiration (SPA). In the previous technical report, SPA was reported to have success rates ranging from 23% to 90%,[22–24] although higher success rates have been achieved when SPA is conducted under ultrasonographic guidance.[25,26] SPA is considered more invasive than catheterization and, in RCTs from 2006[27] and 2010,[28] pain scores associated with SPA were significantly higher than those associated with catheterization. This result was found for both boys and girls. Similar to previous studies, these RCTs also revealed lower success rates for SPA (66% and 60%), compared with catheterization (83% and 78%).[27,28] In comparison with SPA results, cultures of urine specimens obtained through catheterization are 95% sensitive and 99% specific.[7,11,12]

Cultures of bag specimens are difficult to interpret. In the original technical report, sensitivity was assumed to be 100% but the specificity of bag cultures was shown to range between 14% and 84%.[2] Our updated surveillance of the literature did not show that these numbers have improved.[29–33] One article suggested that a new type of collection bag may result in improved specificity,[34] but that study was not controlled. With a prevalence of 5% and specificity of 70%, the positive predictive value of a positive culture result for urine obtained in a bag would be 15%. This means that, of all positive culture results for urine obtained in a bag, 85% would be false-positive results.

Box 3: Short-term Treatment of UTIs

General Principles of Treatment

Published evidence regarding the short-term treatment of UTIs supports 4 main points. First, complications, such as bacteremia or renal scarring, are sufficiently common to necessitate early, thorough treatment of febrile UTIs in infants.[35] Second, treatment with orally administered antimicrobial agents is as effective as parenteral therapy.[36,37] Third, bacterial sensitivity to antimicrobial agents is highly variable across time and geographic areas, which suggests that therapy should be guided initially by local sensitivity patterns and should be adjusted on the basis of sensitivities of isolated pathogens.[38,39] Fourth, meta-analyses have suggested that shorter durations of oral therapy may not have a disadvantage over longer courses for UTIs. However, those studies largely excluded febrile UTI and pyelonephritis.[40]

Experimental and Clinical Data Support the Concept That Delays in the Institution of Appropriate Treatment for Pyelonephritis Increase the Risk of Renal Damage

The 1999 technical report cited evidence that febrile UTIs in children less

TABLE 7 Recent Studies Documenting the Prevalence of VUR Among Children With UTI

Study	Description	*n*	Prevalence, %
Sargent and Stringer[50] (1995)	Retrospective study of first VCUG for UTI in children 1 wk to 15 y of age	309	30
Craig et al[51] (1997)	Cross-sectional study of children <5 y of age with first UTI	272	28
McDonald et al[52] (2000)	Retrospective chart review of children with VCUG after UTI	176	19
Oostenbrink et al[53] (2000)	Cross-sectional study of children <5 y of age with first UTI	140	26
Mahant et al[54] (2001)	Retrospective chart review of children with VCUG after UTI	162	22
Mahant et al[55] (2002)	Retrospective review of VCUG in children <5 y of age admitted with first UTI	162	22
Chand et al[56] (2003)	Retrospective review of VCUG or radionuclide cystogram in children <7 y of age	15 504	35
Fernandez-Menendez et al[44] (2003)	Prospective cohort study of 158 children <5 y of age (85% < 2 y) with first UTI	158	22
Camacho et al[41] (2004)	Prospective cohort study of children 1 mo to 12 y of age (mean age: 20 mo) with first febrile UTI	152	21
Hansson et al[57] (2004)	Retrospective cross-sectional study of children <2 y of age with first UTI	303	26
Pinto[58] (2004)	Retrospective chart review of first VCUG for UTI in children 1 mo to 14 y of age	341	30
Zamir et al[59] (2004)	Cohort study of children 0–5 y of age hospitalized with first UTI	255	18

than 2 years of age are associated with bacterial sepsis in 10% of cases.[35] Furthermore, renal scarring is common among children who have febrile UTIs. The risk is higher among those with higher grades of VUR[41] but occurs with all grades, even when there is no VUR. Although it was not confirmed in all studies,[42,43] older work[2] and newer studies[44] demonstrated an increased risk of scarring with delayed treatment. Children whose treatment is delayed more than 48 hours after onset of fever may have a more than 50% higher risk of acquiring a renal scar.

Oral Versus Intravenous Therapy

In a RCT from 1999, Hoberman et al[36] studied children 1 to 24 months of age with febrile UTIs. They compared 14 days of oral cefixime treatment with 3 days of intravenous cefotaxime treatment followed by oral cefixime treatment to complete a 14-day course. The investigators found no difference in outcomes between children who were treated with an orally administered, third-generation cephalosporin alone and those who received intravenous treatment.

In a Cochrane review, Hodson et al[37] evaluated studies with children 0 to 18 years of age, examining oral versus intravenous therapy. No significant differences were found in duration of fever (2 studies; mean difference: 2.05 hours [95% CI: −0.84 to 4.94 hours]) or renal parenchymal damage at 6 to 12 months (3 studies; RR: 0.80 [95% CI: 0.50–1.26]) between oral antimicrobial therapy (10–14 days) and intravenous antimicrobial treatment (3 days) followed by oral antimicrobial treatment (11 days).

Duration of Therapy

In the 1999 technical report, data slightly favoring longer-duration (7–10 days) over shorter-duration (1 dose to 3 days) antimicrobial therapy for pediatric patients with UTIs were presented.[2] Since then, several meta-analyses with different conclusions have been published on this topic.[40,45,46] A 2003 Cochrane review addressing the question analyzed studies that examined the difference in rates of recurrence for positive urine cultures after treatment.[40] It compared short (2–4 days) and standard (7–14 days) duration of treatment for UTIs and found no significant difference in the frequency of bacteriuria after completion of treatment (8 studies; RR: 1.06 [95% CI: 0.64–1.76]). Although the authors of the review did not exclude studies of children with febrile UTIs or pyelonephritis, each individual study included in the meta-analysis had already excluded such children. To date, there are no conclusive data on the duration of therapy for children with febrile UTIs or pyelonephritis.

Proof of Cure

Data supporting routine repeat cultures of urine during or after completion of antimicrobial therapy were not available for the 1999 technical report. Retrospective studies did not show "proof of bacteriologic cure" cultures to be beneficial.[47,48] Studies demonstrating that clinical response alone *ensures* bacteriologic cure are not available.

Box 4: Evaluation and Management of Urinary Tract Abnormalities

Prevalence of VUR

Several cohort studies published since the 1999 technical report provide estimates of the prevalence of VUR of various grades among infants and children with UTIs (Table 7). Overall, these estimates are reasonably consistent with those reported in earlier studies, although the grades of reflux are now reported more consistently, by using the international system of radiographic grading of VUR.[49]

The prevalence of VUR among children in these studies varies between 18% and 35%. The weighted average prevalence is 34%, but this is largely driven by the enormous retrospective study by Chand et al.[56] Most studies report a rate of 24% or less, which is less than the estimate of VUR prevalence in the 1999 technical report.

Data on the prevalence of VUR among children *without* a history of UTI do not

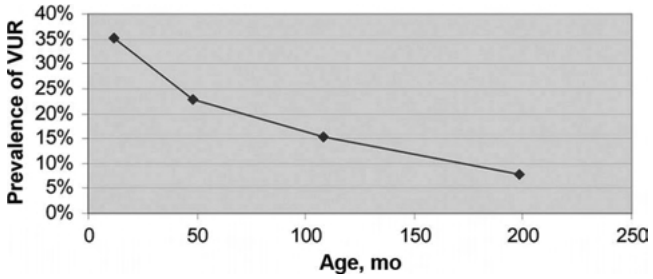

FIGURE 3
Prevalence of VUR as a function of the midpoint of each age stratum, as reported by Chand et al.[56]

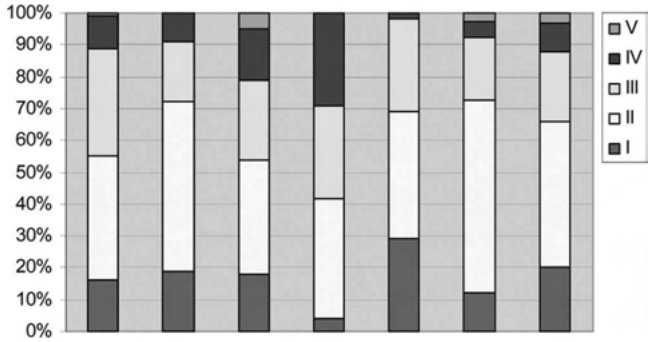

FIGURE 4
Distribution of reflux grades among children with VUR.[41,44,51,56,57,62,63]

exist. Using a retrospective approach and existing urine culture data, Hannula and Ventola and colleagues,[60,61] in 2 separate publications, found similar rates of prevalence of any grade of VUR among children with proven (37.4%) or certain (36%) UTI versus false (34.8%) or improbable (36%) UTI. These results suggest that VUR is prevalent even among children without a history of UTI.

The prevalence of VUR decreases with age. This was approximated by analysis across studies in the 1999 technical report. Since then, Chand et al[56] reported the prevalence VUR within age substrata of their cohort. Figure 3 shows the prevalence of VUR plotted as a function of the midpoint of each age stratum.

Seven studies reported the prevalence of different grades of reflux, by using the international grading system.[41,44,51,56,57,62,63] The distributions of different reflux grades among children who had VUR are shown in Fig 4. There is significant variability in the relative predominance of each reflux grade, but grades II and III consistently are the most common. With the exception of the study by Camacho et al,[41] all studies showed grades IV and V to be the least frequent, and grade V accounted for 0% to 5% (weighted average: 3%) of reflux. With that value multiplied by the prevalence of VUR among young children with a first UTI, we would expect grade V reflux to be present in <1% of children with a first UTI.

It has been suggested that the risk of VUR and, more specifically, high-grade VUR may be higher for children with recurrent UTI than for children with a first UTI. Although it was not tested directly in the studies reviewed, this idea can be tested and the magnitude of the effect can be estimated from the data found in the literature search for this meta-analysis.[64–70] These data clearly demonstrate that the risk of UTI recurrence is associated with VUR (Fig 5). Furthermore, this relationship allows the likelihood of each grade of reflux (given that a UTI recurrence has occurred) to be estimated by using Bayes' theorem, as follows:

$$p(\mathrm{VUR}_i|\mathrm{UTI}) = \frac{p(\mathrm{UTI}|\mathrm{VUR}_i) \times p(\mathrm{VUR}_i)}{\sum_{i=0}^{V} p(\mathrm{UTI}|\mathrm{VUR}_i) \times p(\mathrm{VUR}_i)},$$

where $p(\mathrm{UTI}|\mathrm{VUR}_i)$ refers to the probability of VUR of grade i given the recurrence of UTI. If it is assumed that the conditional probabilities remain the same with second or third UTIs, then Bayes' theorem can be reapplied for a third UTI as well.

By using estimates of p(UTI VUR) (Fig 5) and the previously determined distri-

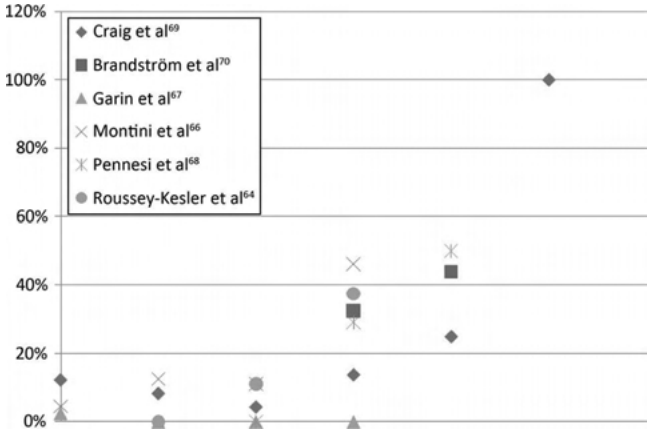

FIGURE 5
Probability of a recurrent febrile UTI as a function of VUR grade among infants 2 to 24 months of age in the control groups of the studies included in meta-analyses.[64,66–70]

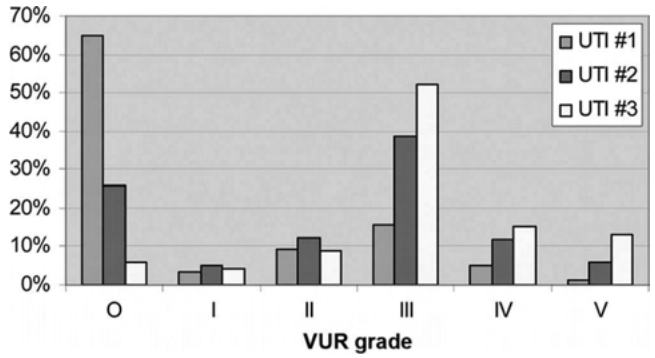

FIGURE 6
Distribution of VUR grades after different numbers of UTIs.

butions of VUR grades (Fig 4), a very approximate estimate of the distribution of VUR grades after the first, second, and third UTI can be made (Fig 6). The likelihood that there is no VUR decreases rapidly. Conversely, the likelihood of VUR grades III to V increases rapidly. The risk of grades I and II changes little.

Ultrasonography

Ultrasonography is used as a noninvasive technique to identify renal abnormalities in children after UTI. The sensitivity of the test varies greatly and has been reported to be as low as 5% for detection of renal scarring[71–73] and 10% for detection of VUR.[74] However, most studies report moderate specificity.

One possible reason for a decrease in specificity is that, in animal models, *Escherichia coli* endotoxin has been shown to produce temporary dilation of the urinary tract during acute infection.[75] Therefore, use of routine ultrasonography for children with UTIs during acute infection may increase the false-positive rate. However, no human data are available to confirm this hypothesis.

Ultrasonography is used during acute infection to identify renal or perirenal abscesses or pyonephrosis in children who fail to experience clinical improvement despite antimicrobial therapy. The sensitivity of ultrasonography for such complications is thought to be very high, approaching 100%.[76] Therefore, ultrasonography in the case of a child with a UTI who is not responding to therapy as expected can be very helpful in ruling out these infectious complications.

Ultrasonography also is advocated for screening for renal abnormalities such as hydronephrosis, suggesting posterior urethral valves, ureteropelvic junction obstruction, or ureteroceles. The evidence model illustrates the expected outcomes from routine ultrasonography of the kidneys, ureters, and bladder after the first febrile UTI in infants and young children (Fig 7). The model is based on the study results documented in Tables 8 and 9 and a strategy of performing kidney and bladder ultrasonography for all infants with UTIs. The numbers are not exact for 2 reasons, namely, (1) study populations vary and do not always precisely meet the definitions of 2 to 24 months of age and febrile without another fever source and, (2) even within similar populations, reported rates vary widely.

Ultrasonography yields ~15% positive results. However, it has a ~70% false-negative rate for reflux, scarring, and other abnormalities. Limited data exist regarding the false-negative rate for high-grade VUR (grade IV and V), but the studies reviewed presented 0% to 40% false-negative rates for detection of grade IV reflux through ultrasonography.[59,74] Among the 15% of results that are positive, between 1% and 24% are false-positive results. Of the true-positive results, ~40% represent some dilation of the collecting system, such as would be found on a VCUG; 10% represent abnormalities that are potentially surgically correctable (eg, ureteroceles or ureteropelvic junction obstruction). Approximately one-half represent findings such as horseshoe kidneys or renal scarring, for which there is no intervention but which might lead to further evaluations, such as technetium-99m–labeled dimercaptosuccinic acid renal scintigraphy. The 40% with dilation of the collecting system are problematic. This represents only a small fraction of children (15% × 88% × 40% = 5%) with first UTIs who would be expected to have VUR before ultrasonography. Ultrasonography does not seem to be enriching for this population (although ultrasonography might identify a population with higher-grade VUR).

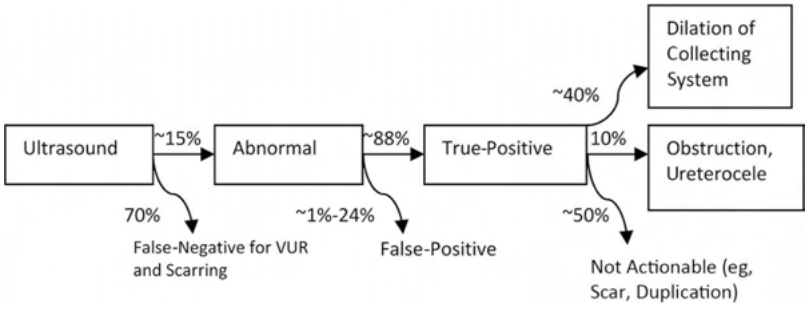

FIGURE 7
Evidence model for ultrasonography after a first UTI.

TABLE 8 Summary of Ultrasonography Literature

Study	*n*/*N* (%)	Comments
False-negative rate		
Scarring		
Smellie et al[73] (1995)	7/20 (35)	
Barry et al[77] (1998)	23/170 (14)	
Moorthy et al[71] (2004)	219/231 (95)	
Sinha et al[78] (2007)	61/79 (77)	Reported as renal units
Montini et al[79] (2009)	33/45 (73)	
VUR		
Smellie et al[73] (1995)	21/36 (58)	
Mahant et al[55] (2002)	14/35 (40)	
Hoberman et al[74] (2003)	104/117 (90)	
Zamir et al[59] (2004)	38/47 (81)	
Montini et al[79] (2009)	48/66 (73)	
Other		
Smellie et al[74] (1995)	5/5 (100)	Duplex kidney
False-positive rate		
Scarring		
Barry et al[77] (1998)	11/478 (2)	
Moorthy et al[71] (2004)	12/699 (1.7)	
Sinha et al[78] (2007)	9/870 (1)	
Monitini et al[79] (2009)	26/255 (10)	
VUR		
Smellie et al[73] (1995)	2/12 (17)	Normal VCUG, DMSA, and IVU results
Mahant et al[55] (2002)	30/127 (24)	
Hoberman et al[74] (2003)	17/185 (10)	
Zamir et al[59] (2004)	27/208 (13)	
Other		
Giorgi et al[80] (2005)	21/203 (10)	

IVU indicates intravenous urography; DMSA, dimercaptosuccinic acid.

Prenatal Ultrasonography

Urinary tract abnormalities also may be identified during prenatal ultrasonography,[85–87] which theoretically would decrease the number of new abnormalities found through later ultrasonography.[81] However, the extent to which normal prenatal ultrasonographic findings decrease the need for later studies remains in doubt.

Miron et al[88] studied 209 children who underwent ultrasonography prenatally and again after a UTI. They found that, among 9 children with abnormal ultrasonographic results after UTI, 7 had normal prenatal ultrasonographic results. These cases included 3 cases of hydronephrosis, 3 cases of moderate dilation, and 1 case of double collecting system. Similarly, in a study by Lakhoo et al[89] in 1996, 22 of 39 children with UTIs had normal prenatal ultrasonographic results but "abnormal" post-UTI ultrasonographic results; the abnormalities were not described. These studies suggest that normal prenatal ultrasonographic findings may not be sufficient to obviate the need for additional studies if a UTI occurs in infancy.

Results of Targeted Literature Review and Meta-analysis on Prophylaxis to Prevent Recurrent UTI

Study Identification

For the meta-analysis of studies on the effectiveness of antimicrobial agents to prevent recurrent UTI in children with VUR, we reviewed a total of 213 titles from our primary literature search. Of those, 45 were retained for abstract review on the basis of the title, of which 7 were selected for full review. Six of the studies met the inclusion criteria. Figure 2 summarizes the selection process.

Thirty-eight abstracts were excluded before full review (Fig 2). Eight of those studies were RCTs comparing prophylactic antimicrobial agent use with some type of surgical intervention. None of those studies included a placebo arm.[90–97] One study compared different lengths of antimicrobial prophylaxis.[98] Another study compared different antimicrobial regimens but did not include a placebo arm.[99] Sixteen studies were determined, on closer inspection, to be not clinical trials but prospective cohort studies, reviews, systematic reviews, or meta-analyses. Twelve studies were found twice, either in Medline or Embase and the Cochrane Clinical Trials Registry.

One article was excluded after full review (Fig 2). That study compared prophylactic antimicrobial agent use with probiotic use.[65] The study was not included in the meta-analysis, but the results are described separately.

There are RCTs of antimicrobial prophylaxis that are older than 15 years. In 4 studies from the 1970s, a total of 179 children were enrolled.[100–103] Less than 20% of those children had VUR. Because of limited reporting of results in that subgroup, those older studies were not included in the analyses.

Two additional RCTs comparing antimicrobial prophylaxis and placebo treatment for children were published in October 2009.[69,70] The first trial enrolled children 0 to 18 years of age after a first UTI, with 2% of enrolled children (12 of 576 children) being more than 10 years of age. The second trial enrolled children diagnosed as having VUR after a first UTI (194 [96%] of 203 children) or after prenatal ultrasonography (9 [4%] of 203 children), who were then assigned randomly to receive antimicrobial prophylaxis, surveillance, or endoscopic therapy, at 1 to 2 years of age. The majority of these children (132 children [65%]) had been diagnosed as having VUR before 1

TABLE 9 Distribution of Positive Ultrasonographic Findings

Study	*n*/*N* (%)
Alon and Ganapathy[62] (1999)	19/124 (15)
Minimal unilateral changes	
VUR	2 (1.6)
Normal VCUG findings	2 (1.6)
Resolved on repeat study	2 (1.6)
Not monitored further	3 (2.4)
Major changes	8 (6.5)
VUR	1 (1.6)
Normal findings	1 (1.6)
Posterior urethral valve	1 (1.6)
Hydroureternephrosis	1 (1.6)
Gelfand et al[81] (2000)	141/844 (16.7)
Bladder wall thickening	31 (3.7)
Hydroureter	6 (0.7)
Parenchymal abnormalities	42 (5.0)
Pelvocalyceal dilation	27 (3.2)
Renal calculus	1 (0.1)
Simple renal cyst	1 (0.1)
Urethelial thickening	31 (3.7)
Jothilakshmi et al[82] (2001)	42/262 (16)
Duplex kidney	3 (1)
Crossed renal ectopia	1 (0.38)
Horseshoe kidney	1 (0.38)
Hydronephrosis	5 (1.9)
Megaureter	6 (2.3)
Polycystic kidney	1 (0.38)
Pelviureteric junction obstruction	1 (0.38)
Posterior urethral valve	2 (0.76)
Renal calculus	3 (0.01)
Rotated kidney	2 (0.76)
Ureterocele	2 (0.76)
VUR	7 (2.7)
Hoberman et al[74] (2003)	37/309 (12)
Dilated pelvis	13 (4.2)
Pelvocaliectasis	12 (3.9)
Hydronephrosis	2 (0.6)
Dilated ureter	9 (2.9)
Double collecting system	3 (1.0)
Extrarenal pelvis	1 (0.3)
Calculus	1 (0.3)
Zamir et al[59] (2004)	36/255 (14.1)
Mild unilateral pelvis dilation	32 (12.5)
Moderate unilateral pelvis dilation	1 (0.04)
Enlargement kidney	1 (0.04)
Small renal cyst	1 (0.04)
Double collecting system and severe hydronephrosis	1 (0.04)
Jahnukainen et al[83] (2006)[a]	23/155 (14.8)
Hydronephrosis	8 (5)
Double collecting system	11 (7)
Multicystic dysplasia	1 (0.6)
Renal hypoplasia	1 (0.6)
Solitary kidney	1 (0.6)
Horseshoe kidney	1 (0.6)
Huang et al[84] (2008)	112/390 (28.7)
Nephromegaly	46 (11.8)
Isolated hydronephrosis	20 (5.1)
Intermittent hydronephrosis	3 (0.8)
Hydroureter	8 (2.1)
Hydroureter and hydronephrosis	3 (0.8)
Thickened bladder wall	11 (2.8)
Small kidneys	8 (2.1)
Simple ureterocele	5 (1.3)
Double collecting systems	4 (1.0)
Increased echogenicity	3 (0.8)
Horseshoe kidney	1 (0.3)
Montini et al[79] (2009)	38/300 (13)
Dilated pelvis, ureter, or pelvis and calyces	12 (4)
Renal swelling or local parenchymal changes	10 (3.3)
Increased bladder wall or pelvic mucosa, thickness	6 (2)
Other	10 (3.3)

[a] Hospitalized children with UTI.

year of age and thus had been receiving prophylaxis before random assignment. These studies were included in the meta-analysis.

Description of Included Studies

Table 10 presents characteristics of the 8 included studies.[64,66–70,104,105] Four studies enrolled children after diagnosis of a first episode of pyelonephritis.[64,66–68] In those 4 studies, pyelonephritis was described as fever of more than 38°C or 38.5°C and positive urine culture results. In 1 of those studies,[67] dimercaptosuccinic acid scanning results consistent with acute pyelonephritis represented an additional requirement for inclusion. The remaining studies had slightly different inclusion criteria. In the study by Craig et al[71] from 2009, symptoms consistent with UTI and positive urine culture results were required for inclusion. Fever was documented for 79% of enrolled children (454 of 576 children). In the study by Brandström et al,[70] 96% of enrolled children (194 of 203 children) had pyelonephritis, defined in a similar manner as in the 6 initial studies. The remaining patients were enrolled after prenatal diagnosis of VUR. The 2 included abstracts described studies that enrolled any child with VUR and not only children who had had pyelonephritis.[104,105] Seven of the 8 studies (all except the study by Reddy et al[108]) reported a gender ratio. Among those studies, there were 67% girls and 33% boys. Six studies compared antimicrobial treatment with no treatment. Only 2 studies were placebo controlled, and those 2 were the only blinded studies.[69,105] The grade of VUR among the enrolled children varied from 0 to V, but few of the children had grade V VUR.

The ages of children included in the initial meta-analyses were 0 to 18 years; therefore, some children were included who were outside the target

TABLE 10 Studies Included in Meta-analysis

Study	Study Sites	*n*		Age	VUR Grade	Antimicrobial Agents	Control	Follow-up Period, mo	Outcome
		VUR	No VUR						
Craig et al[105] (2002)	Australia	46	0	0–3 mo	I–V	TMP-SMX	Placebo	36	UTI and renal damage
Craig et al[69] (2009)	Australia	243	234	0–18 y	I–V	TMP-SMX	Placebo	12	Symptomatic UTI, febrile UTI, hospitalization, and renal scarring
Garin et al[67] (2006)	Chile, Spain, United States	113	105	3 mo to 18 y	0–III	TMP-SMX/ nitrofurantoin	No treatment	12	Asymptomatic UTI, cystitis, pyelonephritis, and renal scarring
Brandström et al[70] (2010)	Sweden	203	0	1–2 y	III–IV	TMP-SMX/cefadroxil, nitrofurantoin	No treatment	48	Febrile UTI, reflux status, and renal scarring
Montini et al[66] (2008)	Italy	128	210	2 mo to 7 y	0–III	TMP-SMX/amoxicillin-clavulanate	No treatment	12	Febrile UTI and renal scarring
Pennesi et al[68] (2008)	Italy	100	0	0–30 mo	II–IV	TMP-SMX	No treatment	48	UTI and renal scarring
Reddy et al[104] (1997)	United States	29	0	1–10 y	I–V	TMP-SMX/ nitrofurantoin	No treatment	24	UTI, progression of disease, need for surgery, parental compliance
Roussey-Kesler et al[64] (2008)	France	225	0	1–36 m	I–III	TMP-SMX	No treatment	18	Febrile and afebrile UTI

TMP-SMX indicates trimethoprim-sulfamethoxazole.

age range for this report and for whom other factors (eg, voiding and bowel habits) might have played a role. The median age of the included children, however, was not above 3 years in any of the included studies in which it was reported. Separate meta-analyses were subsequently performed for the subgroup of children who were 2 to 24 months of age. The duration of antimicrobial treatment and follow-up monitoring ranged from 12 to 48 months. The antimicrobial agents used were trimethoprim-sulfamethoxazole (1–2 or 5–10 mg/kg),[64,68,69,105] trimethoprim-sulfamethoxazole or amoxicillin-clavulanic acid (15 mg/kg),[66] trimethoprim-sulfamethoxazole or nitrofurantoin,[67,104] or trimethoprim-sulfamethoxazole, cefadroxil, or nitrofurantoin.[70] Urine collection methods differed among studies. Bag specimens were reported for 3 studies.[64,66,70] In an additional 4 studies, the description of the urine collection methods did not exclude the use of bag specimens.[67,68,104,105] Recurrent UTI was described as (1) asymptomatic bacteriuria (diagnosed through screening cultures), (2) cystitis, (3) febrile UTI, and (4) pyelonephritis (diagnosed on the basis of focal or diffuse uptake on dimercaptosuccinic acid scans) in the different articles.

Quality Assessment

The included studies received scores (from 2 assessors) from 7 to 26 (scale range: 0–32) with the scoring system described by Downs and Black,[6] with a median score of 16. Score deductions resulted from lack of blinding of patients (all except 2 studies[69,105]), lack of blinding of assessors (all except 2 studies[69,105]), limited or no information about patients lost to follow-up monitoring (3 studies[64,67,104]), lack of reporting of adverse effects (all except 2 studies[66,69]), and small sample sizes. The lowest scores, 7 and 12, were received by the 2 abstracts because of lack of details in the descriptions of the methods.[104,105]

Antimicrobial Therapy Versus No Treatment

Overview of Findings

Described here are the results of several meta-analyses, subdivided according to type of recurrence (pyelonephritis versus UTI), degree of VUR (none to grade V), and patient age. In summary, antimicrobial prophylaxis does not seem to reduce significantly the rates of recurrence of pyelonephritis, regardless of age or degree of reflux. Although prophylaxis seems to reduce significantly but only slightly the risk of UTI when all forms are included, most of this effect is attributable to reductions in rates of cystitis or asymptomatic bacteriuria, which would not be expected to lead to ongoing renal damage.

Recurrence of Pyelonephritis/Febrile UTI Among All Studied Children With VUR of Any Grade

Recurrence of pyelonephritis was reported in 6 of the 8 studies. The study by Pennesi et al[68] presented the results as recurrence of pyelonephritis, but recurrence was defined as episodes of fever *or* "symptoms of UTI." When contacted, this author confirmed that all reported recurrences were characterized by fever above 38.5°C. Therefore, the article was included in the meta-analysis. With a random-effects model, there was no significant difference in rates of recurrence of pyelonephritis for children who received antimicrobial therapy and those who did not. This meta-analysis yielded a RR of 0.77 (95% CI: 0.47–1.24) (Fig 8). Heterogeneity test-

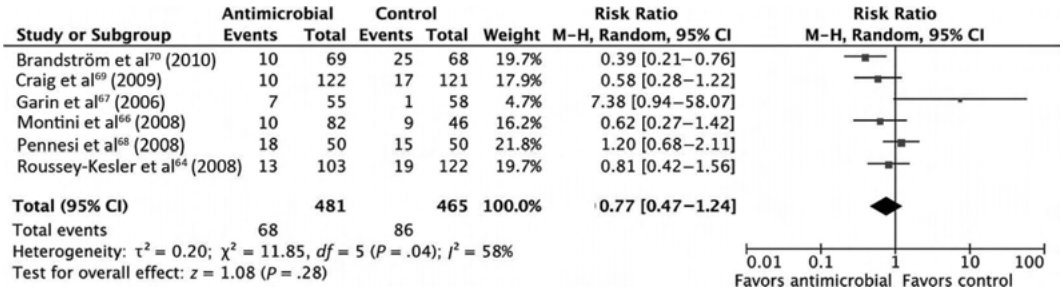

FIGURE 8
Combined estimates of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children with VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

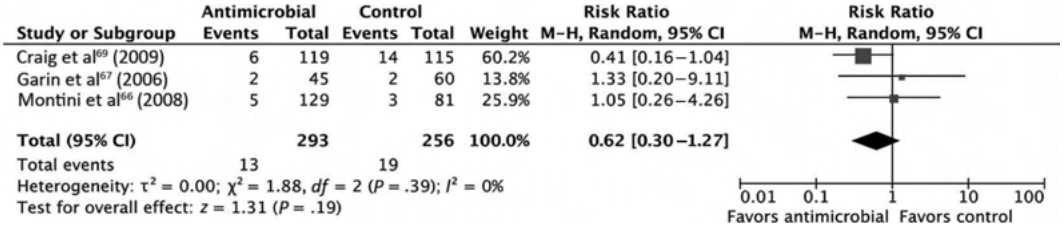

FIGURE 9
Combined estimates of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children without VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

ing results were significant ($P = .04$), which indicated statistical heterogeneity between studies.

Recurrence of Pyelonephritis/ Febrile UTI Among Children of All Ages Without VUR

There was no significant difference in rates of recurrence of pyelonephritis for children without VUR who received antimicrobial therapy and those who did not. With random-effects modeling, the meta-analysis yielded a RR of 0.62 (95% CI: 0.30–1.27) (Fig 9). Heterogeneity testing results were not significant ($P = .39$). Because no difference was detected with a random-effects model and there was no statistical heterogeneity in this analysis, analysis also was conducted with a fixed-effects model. With fixed-effects modeling, the meta-analysis yielded a RR of 0.61 (95% CI: 0.31–1.23).

Recurrence of Pyelonephritis/Febrile UTI Among Children of All Ages With VUR, According to Grade

Table 11 summarizes the results of separate meta-analyses of subpopulations from each study with different grades of VUR. None of those analyses showed a statistically significant difference in rates of recurrence with random- or fixed-effects modeling. Random-effects modeling results are presented.

TABLE 11 Combined Estimates of Effect of Antimicrobial Prophylaxis on Prevention of Pyelonephritis for All Children According to Grade of VUR

VUR Grade	No. of Children	No. of Studies	RR (95% CI)[a]
0	549	3	0.62 (0.30–1.27)
I–II	455	5	0.94 (0.49–1.80)
III	347	6	0.74 (0.42–1.29)
IV	122	3	0.69 (0.39–1.20)
V	5	1	0.40 (0.08–1.90)

[a] From random-effects model.

Recurrence of Pyelonephritis/Febrile UTI Among Children 2 to 24 Months of Age With VUR of Any Grade

There was no significant difference in rates of recurrence of pyelonephritis for children 2 to 24 months of age with VUR who received antimicrobial agents and those who did not. With random-effects modeling, the meta-analysis yielded a RR of 0.78 (95% CI: 0.48–1.26) (Fig 10). Heterogeneity testing results were not significant ($P = .07$). With fixed-effects modeling, the meta-analysis yielded a RR of 0.79 (95% CI: 0.58–1.07). Heterogeneity testing results were not significant ($P = .07$).

Recurrence of Pyelonephritis/Febrile UTI Among Children 2 to 24 Months of Age With No VUR

There was no significant difference in rates of recurrence of pyelonephritis for children 2 to 24 months of age without VUR who received antimicrobial agents and those who did not. With random-effects modeling, the meta-analysis yielded a RR of 0.55 (95% CI:

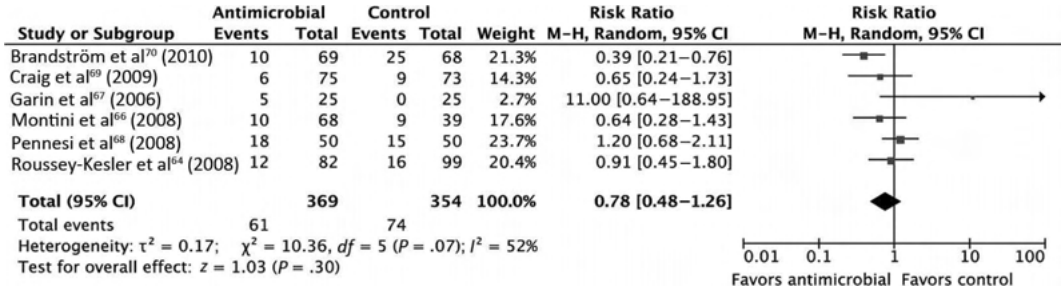

FIGURE 10

Combined estimates of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children 2 to 24 months of age with any grade of VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

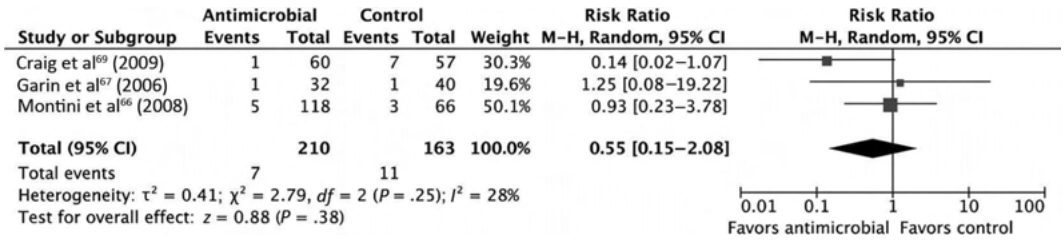

FIGURE 11

Combined estimates of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children 2 to 24 months of age without VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

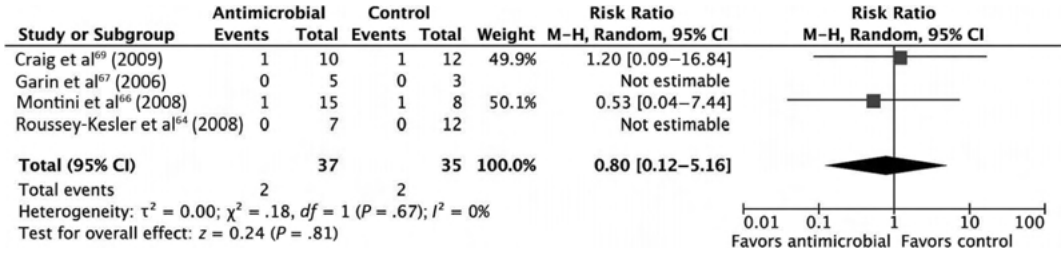

FIGURE 12

Combined estimates of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children 2 to 24 months of age with grade I VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

0.15–2.08) (Fig 11). Heterogeneity testing results were not significant (P = .25). With fixed-effects modeling, the meta-analysis yielded a RR of 0.48 (95% CI: 0.18–1.27). Heterogeneity testing results were not significant (P = .25).

Recurrence of Pyelonephritis/Febrile UTI Among Children 2 to 24 Months of Age According to Grade of VUR

When results were analyzed according to VUR grade, there was no significant difference in rates of recurrence of pyelonephritis for children 2 to 24 months of age who received antimicrobial agents and those who did not in any of the analyses, with random- or fixed-effects modeling. Results of random-effects modeling are presented in Figs 12 through 16. Heterogeneity testing results were not significant in any of the analyses.

Recurrence of Any Type of UTI Among Children of All Ages With VUR of Any Grade

In this meta-analysis, in which the 2 published abstracts that never resulted in published articles were included, there was a statistically significant difference in rates of recurrence of any type of UTI for children with VUR who received antimicrobial agents and those who did not. With random-effects modeling, the meta-analysis yielded a RR of 0.70 (95% CI: 0.51–0.96) (Fig 17). Heterogeneity testing results were not significant (P = .20).

The inclusion of the published abstracts[104,105] in these meta-analyses can be criticized, because the investigators in those studies enrolled all children with VUR and not just those who had been diagnosed as having UTI; therefore, *recurrent* UTIs were not measured. With exclusion of the 2 abstracts from the meta-analyses for prevention of any UTI, the RR with random-effects modeling would be 0.73 (95% CI: 0.53–1.01). Heterogeneity testing results were not significant (P = .16).

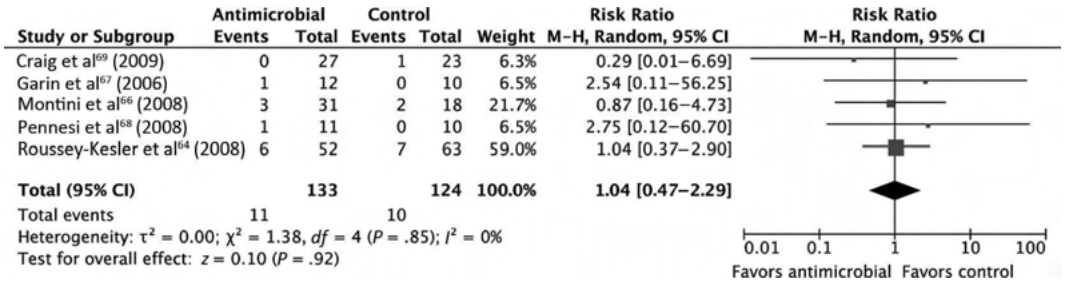

FIGURE 13
Combined estimates of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children 2 to 24 months of age with grade II VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

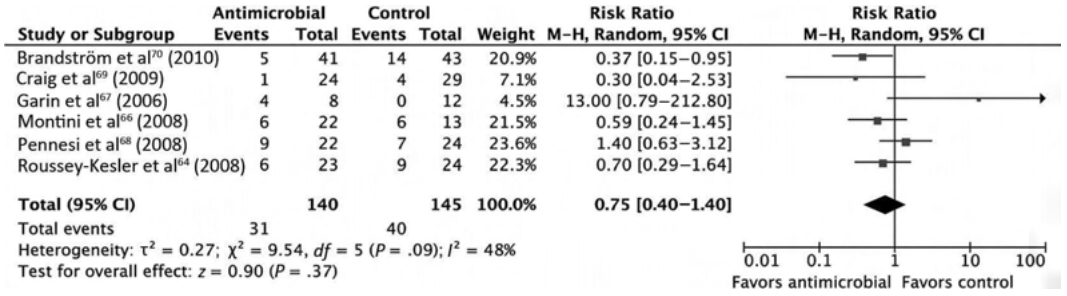

FIGURE 14
Combined estimates of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children 2 to 24 months of age with grade III VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

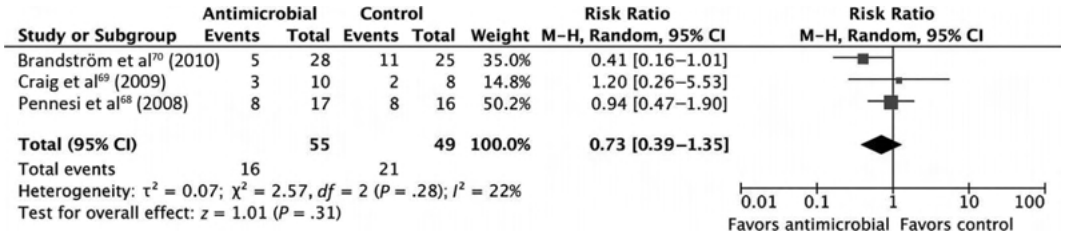

FIGURE 15
Combined estimates of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children 2 to 24 months of age with grade IV VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

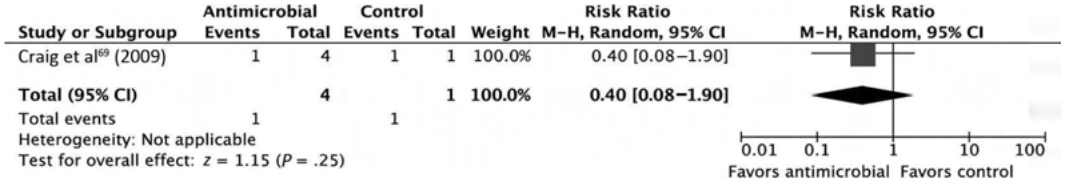

FIGURE 16
Estimate of the effect of antimicrobial prophylaxis on prevention of pyelonephritis in children 2 to 24 months of age with grade V VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

Recurrence of Any Type of UTI Among Children of All Ages Without VUR

There was no significant difference in rates of recurrence of any type of UTI for children without VUR who received antimicrobial agents and those who did not. With random-effects modeling, the meta-analysis yielded a RR of 0.72 (95% CI: 0.43–1.20) (Fig 18). Heterogeneity testing results were not significant ($P = .37$).

Effect on Studies of Inclusion of Bag Specimens

With the exception of the study by Craig et al,[69] no studies reported that bag urine specimens were excluded. The inclusion of such specimens might

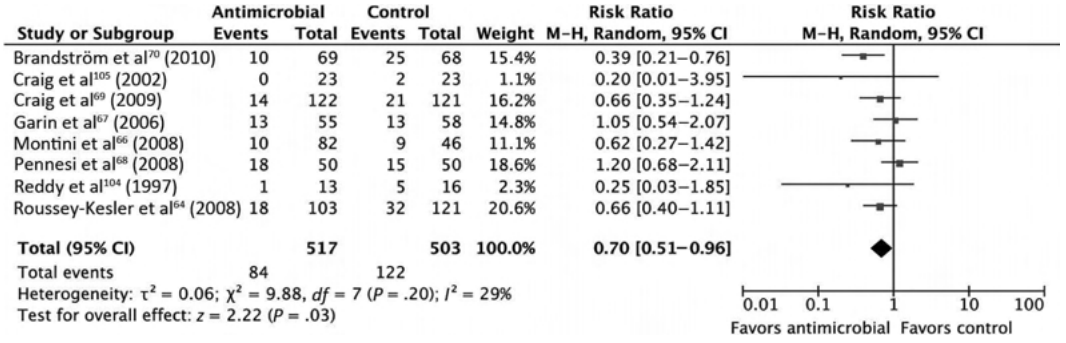

FIGURE 17

Combined estimates of the effect of antimicrobial prophylaxis on prevention of any UTI in children with any grade of VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

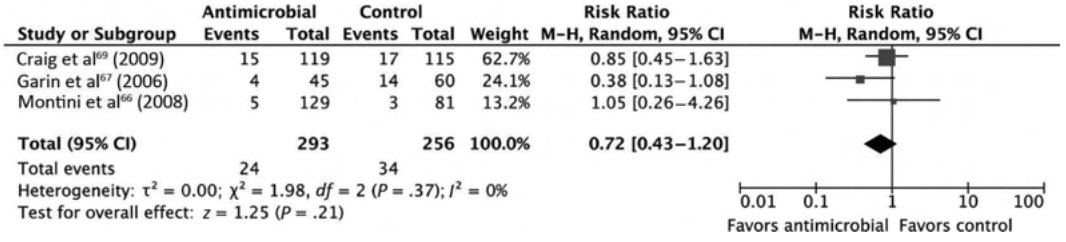

FIGURE 18

Combined estimates of the effect of antimicrobial prophylaxis on prevention of any UTI in children without VUR, from random-effects modeling. RRs and 95% CIs are shown. M-H indicates Mantel-Haenszel.

have resulted in increased numbers of false-positive urine culture results in both the antimicrobial prophylaxis and control groups, yielding a bias toward the null hypothesis in those studies.

Results of Excluded Study

The study by Lee et al[65] was excluded from the meta-analysis because it compared antimicrobial prophylaxis with probiotic treatment. A total of 120 children 13 to 36 months of age with a history of UTI and VUR of grade I to V who had been receiving trimethoprim-sulfamethoxazole once daily for 1 year were again assessed for VUR; if VUR persisted, then children were assigned randomly either to continue to receive trimethoprim-sulfamethoxazole or to receive *Lactobacillus acidophilus* twice daily for 1 additional year. The study showed no statistical difference in recurrent UTI rates between the 2 groups during the second year of follow-up monitoring.

Antimicrobial Prophylaxis and Antimicrobial Resistance

The antimicrobial resistance patterns of the pathogens isolated during UTI recurrences were assessed in 5 of the RCTs included in the meta-analyses.[64,66,68–70] All authors concluded that UTI recurrences with antimicrobial-resistant bacteria were more common in the groups of children assigned randomly to receive antimicrobial prophylaxis. In the placebo/surveillance groups, the proportions of resistant bacteria ranged from 0% to 39%; in the antimicrobial prophylaxis groups, the proportions of resistant bacteria ranged from 53% to 100%. These results are supported by other studies in which antimicrobial prophylaxis has been shown to promote resistant organisms.[106,107]

Surgical Intervention Versus Antimicrobial Prophylaxis

Data on the effectiveness of surgical interventions for VUR are quite limited. To date, only 1 RCT has compared surgical intervention (only endoscopic therapy) for VUR with placebo treatment.[70] In that study, there was a statistically significant difference in the rates of recurrence of febrile UTI for girls treated with endoscopic therapy and those under surveillance (10 of 43 vs 24 of 42 girls; $P = .0014$). No such difference was noted among boys, for whom the results trended in the opposite direction (4 of 23 vs 1 of 26 boys). A meta-analysis examined the outcomes of UTIs and febrile UTIs in children assigned randomly to either reflux correction plus antimicrobial therapy or antimicrobial therapy alone.[108] By 2 years, the authors found no significant reduction in the risk of UTI in the surgery plus antimicrobial therapy group, compared with the antimicrobial therapy-only group (4 studies; RR: 1.07 [95% CI: 0.55–2.09]). The frequency of febrile UTIs was reported in only 2 studies. Children in the surgery plus

antimicrobial therapy group had significantly fewer febrile UTIs than did children in the antimicrobial therapy-only group between 0 and 5 years after intervention (RR: 0.43 [95% CI: 0.27–0.70]). Although there may be some promise in endoscopic interventions for children with VUR, to date there are insufficient data to show whether and for whom such interventions may be helpful.

Long-term Consequences of VUR

The link between VUR discovered after the first UTI and subsequent hypertension and end-stage renal disease remains tenuous at best. There have been no longitudinal studies monitoring children long enough to quantify these outcomes. Retrospective studies evaluated highly selected populations, and their findings might not apply to otherwise healthy children with a first UTI.[109–112] Ecologic data from Australia demonstrated no changes in the rates of hypertension and renal failure since the widespread introduction of antimicrobial prophylaxis and ureteric reimplantation surgery for VUR in the 1960s.[113]

DISCUSSION

Review of the evidence regarding diagnosis and management of UTIs in 2- to 24-month-old children yields the following. First, the prevalence of UTI in febrile infants remains about the same, at ~5%. Studies have provided demographic features (age, race, and gender) and clinical characteristics (height and duration of fever, other causes of fever, and circumcision) that can help clinicians identify febrile infants whose low risk of UTI obviates the need for further evaluation.

Among children who do not receive immediate antimicrobial therapy, UTI can be ruled out on the basis of completely negative urinalysis results. For this purpose, enhanced urinalysis is preferable. However, facilities for urine microscopy with counting chambers and Gram staining may not be available in all settings. A urine reagent strip with negative nitrite and leukocyte esterase reaction results is sufficient to rule out UTI if the pretest risk is moderate (~5%). Diagnosis of UTI is best achieved with a combination of culture and urinalysis. Cultures of urine collected through catheterization, compared with SPA, are nearly as sensitive and specific but have higher success rates and the process is less painful. Cultures of urine collected in bags have unacceptably high false-positive rates.

The previous guideline recommended VCUG after the first UTI for children between 2 and 24 months of age. The rationale for this recommendation was that antimicrobial prophylaxis among children with VUR could reduce subsequent episodes of pyelonephritis and additional renal scarring. However, evidence does not support antimicrobial prophylaxis to prevent UTI when VUR is found through VCUG. The only statistically significant effect of antimicrobial prophylaxis was in preventing UTI that included cystitis and asymptomatic bacteriuria. Statistically significant differences in the rates of febrile UTI or pyelonephritis were not seen. Moreover, VCUG is one of the most uncomfortable radiologic procedures performed with children.[114–116]

Even if additional studies were to show a statistically significant effect of prophylaxis in preventing pyelonephritis, our point estimates suggest that the RR would be ~0.80, corresponding to a reduction in RR of 20%. If we take into account the prevalence of VUR, the risk of recurrent UTI in those children, and this modest *potential* effect, we can determine that ~100 children would need to undergo VCUG for prevention of 1 UTI in the first year. Even more striking is the fact that the evidence of benefit is the same (or better) for children with *no* VUR, which makes the benefit of VCUG more dubious. Taken in light of the marginal cost-effectiveness of the procedure found under the more-optimistic assumptions in the 1999 technical report, these data argue against VCUG after the first UTI. VCUG after a second or third UTI would have a higher yield of higher grades of reflux, but the optimal care for infants with higher-grade reflux is still not clear. Ultrasonography of the kidneys, ureters, and bladder after a first UTI has poor sensitivity and only a modest yield of "actionable" findings. However, the procedure is less invasive, less uncomfortable, and less risky (in terms of radiation) than is VCUG.

There is a significant risk of renal scarring among children with febrile UTI, and some evidence suggests that early antimicrobial treatment mitigates that risk. It seems prudent to recommend early evaluation (in the 24- to 48-hour time frame) of subsequent fevers and prompt treatment of UTI to minimize subsequent renal scarring.

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OVERSIGHT BY THE STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT, 2009–2011

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The New American Academy of Pediatrics Urinary Tract Infection Guideline

This issue of *Pediatrics* includes a long-awaited update[1] of the American Academy of Pediatrics (AAP) 1999 urinary tract infection (UTI) practice parameter.[2] The new guideline is accompanied by a technical report[3] that provides a comprehensive literature review and also a new meta-analysis, for which the authors obtained individual-level data from investigators. The result is an exceptionally evidence-based guideline that differs in important ways from the 1999 guideline and sets a high standard for transparency and scholarship.

The guideline and technical report address a logical sequence of questions that arise clinically, including (1) Which children should have their urine tested? (2) How should the sample be obtained? (3) How should UTIs be treated? (4) What imaging and follow-up are recommended after a diagnosis of UTI? and (5) How should children be followed after a UTI has been diagnosed? I will follow that same sequence in this commentary. I will mention some important areas of agreement and make other suggestions when I believe alternative recommendations are supported by available evidence.

WHICH CHILDREN SHOULD HAVE THEIR URINE TESTED?

Unlike the 1999 practice parameter, which recommended urine testing for all children aged 2 months to 2 years with unexplained fever,[2] the new guideline recommends selective urine testing based on the prior probability of UTI, which is an important improvement. The guideline and technical report do an admirable job summarizing the main factors that determine that prior probability (summarized in Table 1 in the clinical report). This table will help clinicians estimate whether the probability of UTI is ≥1% or ≥2%, values that the authors suggest are reasonable thresholds for urine testing.

The guideline appropriately states that the threshold probability for urine testing is not known and that "clinicians will choose a threshold depending on factors such as their confidence that contact will be maintained through the illness. . . and comfort with diagnostic uncertainty." However, the authors assert that this threshold is below 3%, which indicates that it is worth performing urine tests on more than 33 febrile children to identify a single UTI. This is puzzling, because the only study cited to support a specific testing threshold found that 33% of academicians and 54% of practitioners had a urine culture threshold higher than 3%.[4]

An evidence-based urine-testing threshold probability would be based on the risks and costs of urine testing compared with the benefits of diagnosing a UTI. These benefits are not known and probably are not uniform; the younger and sicker an infant is and the longer he or she has been febrile, the greater the likely benefit of diagnosing and treating a UTI. Because acute symptoms of most UTIs seem to resolve un-

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ABBREVIATIONS
AAP—American Academy of Pediatrics
UTI—urinary tract infection
VCUG—voiding cystourethrogram
VUR—vesicoureteral reflux

Opinions expressed in these commentaries are those of the author and not necessarily those of the American Academy of Pediatrics or its Committees.

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FREE

eventfully, even without treatment,[5,6] some of the impetus for diagnosing UTIs rests on the belief that doing so will reduce the risk of renal scarring and associated sequelae.[7] This belief needs to be proven, and the benefit quantified, if a urine-testing threshold is to be evidence-based. Until then, rather than automatically testing urine on the basis of the risk factors and the 1% or 2% threshold suggested in Table 1, clinicians should continue to individualize. It seems reasonable, for example, to defer urine tests on the large number of febrile infants for whom, if their parents had called for advice, we would have estimated their probability of UTI or other serious illness to be low enough that they could be safely initially watched at home.

A potential source of confusion is that Table 1 lists "absence of another source of infection" as a risk factor, and the technical report indicates that this factor has a likelihood ratio of ~1.4 for UTI. However, the inclusion of this risk factor in the table is inconsistent with the text of the guideline, which directs clinicians to assess the likelihood of UTI in febrile infants with no apparent source for the fever. If children with an apparent source for their fever are included, the use of Table 1 could lead to excessive urine testing (eg, among infants with colds). For example, even using the 2% testing threshold, according to Table 1 all nonblack uncircumcised boys younger than 24 months with any fever of any duration, even with an apparent source, would need their urine tested. I doubt that this level of urine testing is necessary or was intended by the authors of the guideline.

HOW SHOULD THE SAMPLE BE OBTAINED?

I am glad the new guideline continues to offer the option of obtaining urine for urinalyses noninvasively, but I am not convinced that the bag urine can never be used for culture. If the urinalysis is used to select urine for culture, the prior probability may sometimes be in a range where the bag culture will be useful. For example, the technical report calculates that "with a prevalence of 5% and specificity of 70%, the positive predictive value of a positive culture obtained by bag would be 15%." However, with the same 5% pretest probability, a positive nitrite test would raise the probability of UTI to ~75% (using the median sensitivity [58%] and specificity [99%] in the technical report). This is high enough to make the positive culture on bag urine convincing (and perhaps unnecessary).

Although bag urine cultures can lead to errors, catheterized urine cultures are not perfect[1] and urethral catheterization is painful,[8] frightening,[9] and risks introducing infection.[10] Fortunately, if other recommendations in the guideline are followed (including the elimination of routine voiding cystourethrograms [VCUGs] and outpatient rather than inpatient antimicrobial therapy; see below), the adverse consequences of falsely positive bag cultures will be markedly attenuated.

HOW SHOULD UTIs BE TREATED?

The guideline recognizes regional variation in antimicrobial susceptibility patterns and appropriately suggests that they dictate the choice of initial treatment. However, I would adjust the choice on the basis of the clinical course rather than on sensitivity testing of the isolated uropathogen, as recommended in the guideline. At the University of California at San Francisco we have the option of a "screening" urine culture, which provides only the colony count and Gram-stain results for positive cultures (eg, "10^5 Gram-negative rods"). We can later add identification and sensitivities of the organism in the rare instances in which obtaining them is clinically indicated. Use of screening cultures can lead to considerable savings, because identification of organisms and antimicrobial susceptibility testing are expensive and unnecessary in the majority of cases in which patients are better within 24 hours of starting treatment.

The guideline and technical report cite good evidence that oral antimicrobial treatment is as effective as parenteral treatment and state that the choice of route of administration should be based on "practical considerations." However, the examples they cite for when parenteral antibiotics are reasonable (eg, toxic appearance and inability to retain oral medications) seem more like clinical than practical considerations. Given equivalent estimates of efficacy and the dramatic differences in cost, the guideline could have more forcefully recommended oral treatment in the absence of clinical contraindications.

WHAT IMAGING IS INDICATED AFTER UTI?

As in the 1999 AAP guideline, the current guideline recommends a renal/bladder ultrasound examination after a first febrile UTI to rule out anatomic abnormalities (particularly obstruction) that warrant further evaluation. Although the yield of this test is low, particularly if there has been a normal third-trimester prenatal ultrasound scan, the estimated 1% to 2% yield of actionable abnormalities was believed to be sufficient to justify this noninvasive test. This may be so, but it is important to note that it is not just the yield of abnormalities but also the evidence of an advantage of early detection and cost-effectiveness that must be considered when deciding whether an ultrasound scan is indicated after the first febrile UTI, and this evidence was not reviewed.

The recommendation most dramatically different from the 1999 guideline

is that a VCUG not be routinely performed after a first febrile UTI. The main reason for this change is the accumulation of evidence casting doubt on the benefit of making a diagnosis of vesicoureteral reflux (VUR). To put these data in historical perspective, operative ureteral reimplantation was standard treatment for VUR until randomized trials found it to be no better than prophylactic antibiotics at preventing renal scarring.[11–13] Although, as one commentator put it, "It is psychologically difficult to accept results that suggest that time-honored methods that are generally recommended and applied are of no or doubtful value,"[14] ureteral reimplantation was gradually replaced with prophylactic antibiotics as standard treatment for VUR. This was not because of evidence of benefit of antibiotics but because their use was easier and less invasive than ureteral reimplantation. Finally, in the last few years, several randomized trials have investigated the efficacy of prophylactic antibiotics for children with reflux and have found little, if any, benefit.[1,3] Thus, the risks, costs, and discomfort of the VCUG are hard to justify, because there is no evidence that patients benefit from having their VUR diagnosed.[15–18]

The recommendation not to perform a VCUG after the first UTI is consistent with a guideline published by the United Kingdom's National Institute for Health and Clinical Excellence (NICE).[19] However, unlike the AAP, the NICE does not recommend that VCUGs be performed routinely for recurrent UTIs in infants older than 6 months, which makes sense; the arguments against VCUGs after a first UTI still hold after a second UTI. The AAP recommendation to perform a VCUG after the second UTI is based on the increasing likelihood of detecting higher grades of reflux in children with recurrent UTIs and the belief that detecting grade V reflux is beneficial. However, the guideline appropriately recognizes that grade V reflux is rare and that the benefits of diagnosing it are still in some doubt. Therefore, the guideline suggests that parent preferences be considered in making these imaging decisions.

HOW SHOULD CHILDREN BE FOLLOWED AFTER A UTI HAS BEEN DIAGNOSED?

The guideline recommends that parents or guardians of children with confirmed UTI "seek prompt (ideally within 48 hours) medical evaluation for future febrile illnesses to ensure that recurrent infections can be detected and treated promptly." As pointed out in the guideline, parents will ultimately make the judgment to seek medical care, and there is room for judgment here. After-hours or weekend visits would not generally be required for infants who appear well, and the necessity and urgency of the visit would be expected to increase with the discomfort of the child, the height and duration of the fever, the absence of an alternative source, and the number of previous UTIs.

It should be noted that the guideline does not recommend prophylactic antibiotics to prevent UTI recurrences. This was a good decision; meta-analyses[3,20] have revealed no significant reduction in symptomatic UTI from such prophylaxis regardless of whether VUR was present. Even in the study that showed a benefit,[21] the absolute risk reduction for symptomatic UTI over the 1-year follow-up period was only ~6%, and there was no reduction in hospitalizations for UTI or in renal scarring. Thus, as one colleague put it, if UTI prophylaxis worked, it would offer the opportunity to "treat 16 children with antibiotics for a year to prevent treating one child with antibiotics for a week." (A. R. Schroeder, MD, written communication, June 24, 2011).

CONCLUSIONS

I salute the authors of the new AAP UTI guideline and the accompanying technical report. Both publications represent a significant advance that should be helpful to clinicians and families dealing with this common problem.

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Urinary Tract Infection Clinical Practice Guideline Quick Reference Tools

- Action Statement Summary
  — Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months
- *ICD-9-CM/ICD-10-CM* Coding Quick Reference for Urinary Tract Infection
- AAP Patient Education Handout
  — *Urinary Tract Infections in Young Children*

Action Statement Summary

Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months

Action Statement 1

If a clinician decides that a febrile infant with no apparent source for the fever requires antimicrobial therapy to be administered because of ill appearance or another pressing reason, the clinician should ensure that a urine specimen is obtained for both culture and urinalysis before an antimicrobial agent is administered; the specimen needs to be obtained through catheterization or SPA, because the diagnosis of UTI cannot be established reliably through culture of urine collected in a bag (evidence quality: A; strong recommendation).

Action Statement 2

If a clinician assesses a febrile infant with no apparent source for the fever as not being so ill as to require immediate antimicrobial therapy, then the clinician should assess the likelihood of UTI (see below for how to assess likelihood).

Action Statement 2a

If the clinician determines the febrile infant to have a low likelihood of UTI (see text), then clinical follow-up monitoring without testing is sufficient (evidence quality: A; strong recommendation).

Action Statement 2b

If the clinician determines that the febrile infant is not in a low-risk group (see below), then there are 2 choices (evidence quality: A; strong recommendation). Option 1 is to obtain a urine specimen through catheterization or SPA for culture and urinalysis. Option 2 is to obtain a urine specimen through the most convenient means and to perform a urinalysis. If the urinalysis results suggest a UTI (positive leukocyte esterase test results or nitrite test or microscopic analysis results positive for leukocytes or bacteria), then a urine specimen should be obtained through catheterization or SPA and cultured; if urinalysis of fresh (<1 hour since void) urine yields negative leukocyte esterase and nitrite test results, then it is reasonable to monitor the clinical course without initiating antimicrobial therapy, recognizing that negative urinalysis results do not rule out a UTI with certainty.

Action Statement 3

To establish the diagnosis of UTI, clinicians should require *both* urinalysis results that suggest infection (pyuria and/or bacteriuria) *and* the presence of at least 50 000 colony-forming units (CFUs) per mL of a uropathogen cultured from a urine specimen obtained through catheterization or SPA (evidence quality: C; recommendation).

Action Statement 4a

When initiating treatment, the clinician should base the choice of route of administration on practical considerations. Initiating treatment orally or parenterally is equally efficacious. The clinician should base the choice of agent on local antimicrobial sensitivity patterns (if available) and should adjust the choice according to sensitivity testing of the isolated uropathogen (evidence quality: A; strong recommendation).

Action Statement 4b

The clinician should choose 7 to 14 days as the duration of antimicrobial therapy (evidence quality: B; recommendation).

Action Statement 5

Febrile infants with UTIs should undergo renal and bladder ultrasonography (RBUS) (evidence quality: C; recommendation).

Action Statement 6a

VCUG should not be performed routinely after the first febrile UTI; VCUG is indicated if RBUS reveals hydronephrosis, scarring, or other findings that would suggest either high-grade VUR or obstructive uropathy, as well as in other atypical or complex clinical circumstances (evidence quality B; recommendation).

Action Statement 6b

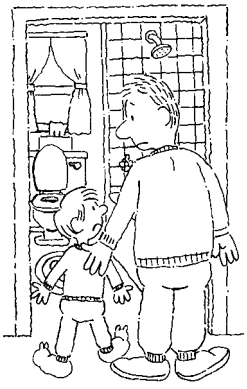
Further evaluation should be conducted if there is a recurrence of febrile UTI (evidence quality: X; recommendation).

Action Statement 7

After confirmation of UTI, the clinician should instruct parents or guardians to seek prompt medical evaluation (ideally within 48 hours) for future febrile illnesses, to ensure that recurrent infections can be detected and treated promptly (evidence quality: C; recommendation).

Coding Quick Reference for Urinary Tract Infection	
ICD-9-CM	***ICD-10-CM***
599.0 Urinary tract infection, site not specified	**N39.0** Urinary tract infection, site not specified
771.82 Urinary tract infection, newborn	**P39.3** Neonatal urinary tract infection

Urinary Tract Infections in Young Children



Urinary tract infections (UTIs) are common in young children. These infections can lead to serious health problems. UTIs may go untreated because the symptoms may not be obvious to the child or the parents. The following is information from the American Academy of Pediatrics about UTIs—what they are, how children get them, and how they are treated.

The urinary tract

The urinary tract makes and stores urine. It is made up of the kidneys, ureters, bladder, and urethra (see illustration on the next page). The kidneys produce urine. Urine travels from the kidneys down 2 narrow tubes called the ureters to the bladder. The bladder is a thin muscular bag that stores urine until it is time to empty urine out of the body. When it is time to empty the bladder, a muscle at the bottom of the bladder relaxes. Urine then flows out of the body through a tube called the urethra. The opening of the urethra is at the end of the penis in boys and above the vaginal opening in girls.

Urinary tract infections

Normal urine has no germs (bacteria). However, bacteria can get into the urinary tract from 2 sources: (1) the skin around the rectum and genitals and (2) the bloodstream from other parts of the body. Bacteria may cause infections in any or all parts of the urinary tract, including the following:

- Urethra (called urethritis)
- Bladder (called cystitis)
- Kidneys (called pyelonephritis)

UTIs are common in infants and young children. The frequency of UTIs in girls is much greater than in boys. About 3% of girls and 1% of boys will have a UTI by 11 years of age. A young child with a high fever and no other symptoms has a 1 in 20 chance of having a UTI. Uncircumcised boys have more UTIs than those who have been circumcised.

Symptoms

Symptoms of UTIs may include the following:

- Fever
- Pain or burning during urination
- Need to urinate more often, or difficulty getting urine out
- Urgent need to urinate, or wetting of underwear or bedding by a child who knows how to use the toilet
- Vomiting, refusal to eat
- Abdominal pain
- Side or back pain
- Foul-smelling urine
- Cloudy or bloody urine
- Unexplained and persistent irritability in an infant
- Poor growth in an infant

Diagnosis

If your child has symptoms of a UTI, your child's doctor will do the following:

- Ask about your child's symptoms.
- Ask about any family history of urinary tract problems.
- Ask about what your child has been eating and drinking.
- Examine your child.
- Get a urine sample from your child.

Your child's doctor will need to test your child's urine to see if there are bacteria or other abnormalities.

Ways urine is collected

Urine must be collected and analyzed to determine if there is a bacterial infection. Older children are asked to urinate into a container.

There are 3 ways to collect urine from a young child:

1. The preferred method is to place a small tube, called a catheter, through the urethra into the bladder. Urine flows through the tube into a special urine container.
2. Another method is to insert a needle through the skin of the lower abdomen to draw urine from the bladder. This is called needle aspiration.
3. If your child is very young or not yet toilet trained, the child's doctor may place a plastic bag over the genitals to collect the urine. Since bacteria on the skin can contaminate the urine and give a false test result, this method is used only to screen for infection. If an infection seems to be present, the doctor will need to collect urine through 1 of the first 2 methods in order to determine if bacteria are present.

Your child's doctor will discuss with you the best way to collect your child's urine.

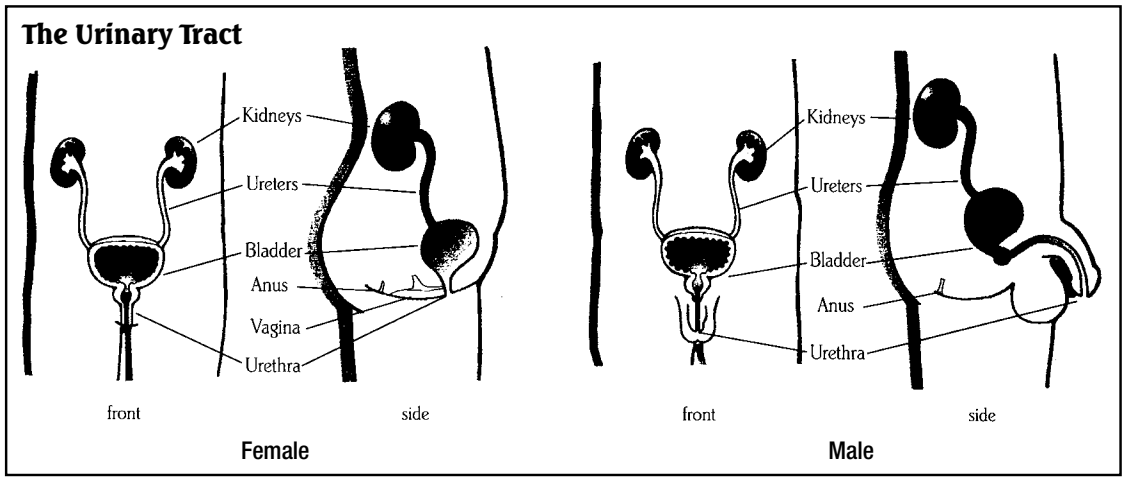
Treatment

UTIs are treated with antibiotics. The way your child receives the antibiotic depends on the severity and type of infection. Antibiotics are usually given by mouth, as liquid or pills. If your child has a fever or is vomiting and is unable to keep fluids down, the antibiotics may be put directly into a vein or injected into a muscle.

UTIs need to be treated right away to

- Get rid of the infection.
- Prevent the spread of the infection outside of the urinary tract.
- Reduce the chances of kidney damage.

Infants and young children with UTIs usually need to take antibiotics for 7 to 14 days, sometimes longer. Make sure your child takes all the medicine your child's doctor prescribes. Do not stop giving your child the medicine until the child's doctor says the treatment is finished, even if your child feels better. UTIs can return if not fully treated.



Follow-up

If the UTI occurs early in life, your child's doctor will probably want to make sure the urinary tract is normal with a kidney and bladder ultrasound. This test uses sound waves to examine the bladder and kidneys.

In addition, your child's doctor may want to make sure that the urinary tract is functioning normally and is free of any damage. Several tests are available to do this, including the following:

Voiding cystourethrogram (VCUG). A catheter is placed into the urethra and the bladder is filled with a liquid that can be seen on x-rays. This test shows whether the urine is flowing back from the bladder toward the kidneys instead of all of it coming out through the urethra as it should.

Nuclear scans. Radioactive material is injected into a vein to see if the kidneys are normal. There are many kinds of nuclear scans, each giving different information about the kidneys and bladder. The radioactive material gives no more radiation than any other kind of x-ray.

Remember

UTIs are common and most are easy to treat. Early diagnosis and prompt treatment are important because untreated or repeated infections can cause long-term medical problems. Children who have had one UTI are more likely to have another. Be sure to see your child's doctor early if your child has had a UTI in the past and has fever. Talk with your child's doctor if you suspect that your child might have a UTI.

From your doctor

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

The American Academy of Pediatrics is an organization of 60,000 primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists dedicated to the health, safety, and well-being of infants, children, adolescents, and young adults.

American Academy of Pediatrics
Web site — www.aap.org

Section 2

Endorsed Clinical Practice Guidelines

The American Academy of Pediatrics endorses and accepts as its policy the following guidelines from other organizations.

AUTISM

Screening and Diagnosis of Autism

Quality Standards Subcommittee of the American Academy of Neurology and the Child Neurology Society

ABSTRACT. Autism is a common disorder of childhood, affecting 1 in 500 children. Yet, it often remains unrecognized and undiagnosed until or after late preschool age because appropriate tools for routine developmental screening and screening specifically for autism have not been available. Early identification of children with autism and intensive, early intervention during the toddler and preschool years improves outcome for most young children with autism. This practice parameter reviews the available empirical evidence and gives specific recommendations for the identification of children with autism. This approach requires a dual process: 1) routine developmental surveillance and screening specifically for autism to be performed on all children to first identify those at risk for any type of atypical development, and to identify those specifically at risk for autism; and 2) to diagnose and evaluate autism, to differentiate autism from other developmental disorders. (8/00)

CEREBRAL PALSY

Diagnostic Assessment of the Child With Cerebral Palsy

Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society

ABSTRACT. ***Objective***. The Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society develop practice parameters as strategies for patient management based on analysis of evidence. For this parameter the authors reviewed available evidence on the assessment of a child suspected of having cerebral palsy (CP), a nonprogressive disorder of posture or movement due to a lesion of the developing brain.

Methods. Relevant literature was reviewed, abstracted, and classified. Recommendations were based on a four-tiered scheme of evidence classification.

Results. CP is a common problem, occurring in about 2 to 2.5 per 1,000 live births. In order to establish that a brain abnormality exists in children with CP that may, in turn, suggest an etiology and prognosis, neuroimaging is recommended with MRI preferred to CT (Level A). Metabolic and genetic studies should not be routinely obtained in the evaluation of the child with CP (Level B). If the clinical history or findings on neuroimaging do not determine a specific structural abnormality or if there are additional and atypical features in the history or clinical examination, metabolic and genetic testing should be considered (Level C). Detection of a brain malformation in a child with CP warrants consideration of an underlying genetic or metabolic etiology. Because the incidence of cerebral infarction is high in children with hemiplegic CP, diagnostic testing for coagulation disorders should be considered (Level B). However, there is insufficient evidence at present to be precise as to what studies should be ordered. An EEG is not recommended unless there are features suggestive of epilepsy or a specific epileptic syndrome (Level A). Because children with CP may have associated deficits of mental retardation, ophthalmologic and hearing impairments, speech and language disorders, and oral-motor dysfunction, screening for these conditions should be part of the initial assessment (Level A).

Conclusions. Neuroimaging results in children with CP are commonly abnormal and may help determine the etiology. Screening for associated conditions is warranted as part of the initial evaluation. (3/04)

COMMUNITY-ACQUIRED PNEUMONIA

The Management of Community-Acquired Pneumonia (CAP) in Infants and Children Older Than 3 Months of Age

Pediatric Infectious Diseases Society and Infectious Diseases Society of America

ABSTRACT. Evidenced-based guidelines for management of infants and children with community-acquired pneumonia (CAP) were prepared by an expert panel comprising clinicians and investigators representing community pediatrics, public health, and the pediatric specialties of critical care, emergency medicine, hospital medicine, infectious diseases, pulmonology, and surgery. These guidelines are intended for use by primary care and subspecialty providers responsible for the management of otherwise healthy infants and children with CAP in both outpatient and inpatient settings. Site-of-care management, diagnosis, antimicrobial and adjunctive surgical therapy, and prevention are discussed. Areas that warrant future investigations are also highlighted. (10/11)

CONGENITAL ADRENAL HYPERPLASIA

Congenital Adrenal Hyperplasia Due to Steroid 21-hydroxylase Deficiency: An Endocrine Society Clinical Practice Guideline

The Endocrine Society

CONCLUSIONS. We recommend universal newborn screening for severe steroid 21-hydroxylase deficiency followed by confirmatory tests. We recommend that prenatal treatment of CAH continue to be regarded as experimental. The diagnosis rests on clinical and hormonal data; genotyping is reserved for equivocal cases and genetic counseling. Glucocorticoid dosage should be minimized to avoid iatrogenic Cushing's syndrome. Mineralocorticoids and, in infants, supplemental sodium are recommended in classic CAH patients. We recommend against the routine use of experimental therapies to promote growth and delay puberty; we suggest patients avoid adrenalectomy. Surgical guidelines emphasize early single-stage genital repair for severely virilized girls, performed by experienced surgeons. Clinicians should consider patients' quality of life, consulting mental health professionals as appropriate. At the transition to adulthood, we recommend monitoring for potential complications of CAH. Finally, we recommend judicious use of medication during pregnancy and in symptomatic patients with nonclassic CAH. (9/10)

DEPRESSION

Guidelines for Adolescent Depression in Primary Care (GLAD-PC): I. Identification, Assessment, and Initial Management

Rachel A. Zuckerbrot, MD; Amy H. Cheung, MD; Peter S. Jensen, MD; Ruth E. K. Stein, MD; Danielle Laraque, MD; and the GLAD-PC Steering Group

ABSTRACT. ***Objectives.*** To develop clinical practice guidelines to assist primary care clinicians in the management of adolescent depression. This first part of the guidelines addresses identification, assessment, and initial management of adolescent depression in primary care settings.

Methods. By using a combination of evidence- and consensus-based methodologies, guidelines were developed by an expert steering committee in 5 phases, as informed by (1) current scientific evidence (published and unpublished), (2) a series of focus groups, (3) a formal survey, (4) an expert consensus workshop, and (5) draft revision and iteration among members of the steering committee.

Results. Guidelines were developed for youth aged 10 to 21 years and correspond to initial phases of adolescent depression management in primary care, including identification of at-risk youth, assessment and diagnosis, and initial management. The strength of each recommendation and its evidence base are summarized. The identification, assessment, and initial management section of the guidelines includes recommendations for (1) identification of depression in youth at high risk, (2) systematic assessment procedures using reliable depression scales, patient and caregiver interviews, and Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition criteria, (3) patient and family psychoeducation, (4) establishing relevant links in the community, and (5) the establishment of a safety plan.

Conclusions. This part of the guidelines is intended to assist primary care clinicians in the identification and initial management of depressed adolescents in an era of great clinical need and a shortage of mental health specialists but cannot replace clinical judgment; these guidelines are not meant to be the sole source of guidance for adolescent depression management. Additional research that addresses the identification and initial management of depressed youth in primary care is needed, including empirical testing of these guidelines. (11/07)

Guidelines for Adolescent Depression in Primary Care (GLAD-PC): II. Treatment and Ongoing Management

Amy H. Cheung, MD; Rachel A. Zuckerbrot, MD; Peter S. Jensen, MD; Kareem Ghalib, MD; Danielle Laraque, MD; Ruth E. K. Stein, MD; and the GLAD-PC Steering Group

ABSTRACT. ***Objectives.*** To develop clinical practice guidelines to assist primary care clinicians in the management of adolescent depression. This second part of the guidelines addresses treatment and ongoing management of adolescent depression in the primary care setting.

Methods. Using a combination of evidence- and consensus-based methodologies, guidelines were developed in 5 phases as informed by (1) current scientific evidence (published and unpublished), (2) a series of focus groups, (3) a formal survey, (4) an expert consensus workshop, and (5) revision and iteration among members of the steering committee.

Results. These guidelines are targeted for youth aged 10 to 21 years and offer recommendations for the management of adolescent depression in primary care, including (1) active monitoring of mildly depressed youth, (2) details for the specific application of evidence-based medication and psychotherapeutic approaches in cases of moderate-to-severe depression, (3) careful monitoring of adverse effects, (4) consultation and coordination of care with mental health specialists, (5) ongoing tracking of outcomes, and (6) specific steps to be taken in instances of partial or no improvement after an initial treatment has begun. The strength of each recommendation and its evidence base are summarized.

Conclusions. These guidelines cannot replace clinical judgment, and they should not be the sole source of guidance for adolescent depression management. Nonetheless, the guidelines may assist primary care clinicians in the management of depressed adolescents in an era of great clinical need and a shortage of mental health specialists. Additional research concerning the management of youth with depression in primary care is needed, including the usability, feasibility, and sustainability of guidelines and determination of the extent to which the guidelines actually improve outcomes of youth with depression. (11/07)

DIALYSIS

Shared Decision-Making in the Appropriate Initiation of and Withdrawal from Dialysis, 2nd Edition

Renal Physicians Association (10/10)

ENDOCARDITIS

Prevention of Infective Endocarditis: Guidelines From the American Heart Association

Walter Wilson, MD, Chair; Kathryn A. Taubert, PhD, FAHA; Michael Gewitz, MD, FAHA; Peter B. Lockhart, DDS; Larry M. Baddour, MD; Matthew Levison, MD; Ann Bolger, MD, FAHA; Christopher H. Cabell, MD, MHS; Masato Takahashi, MD, FAHA; Robert S. Baltimore, MD; Jane W. Newburger, MD, MPH, FAHA; Brian L. Strom, MD; Lloyd Y. Tani, MD; Michael Gerber, MD; Robert O. Bonow, MD, FAHA; Thomas Pallasch, DDS, MS; Stanford T. Shulman, MD, FAHA; Anne H. Rowley, MD; Jane C. Burns, MD; Patricia Ferrieri, MD; Timothy Gardner, MD, FAHA; David Goff, MD, PhD, FAHA; David T. Durack, MD, PhD

ABSTRACT. ***Background.*** The purpose of this statement is to update the recommendations by the American Heart Association (AHA) for the prevention of infective endocarditis that were last published in 1997.

Methods and Results. A writing group was appointed by the AHA for their expertise in prevention and treatment of infective endocarditis, with liaison members representing the American Dental Association, the Infectious Diseases Society of America, and the American Academy of Pediatrics. The writing group reviewed input from

national and international experts on infective endocarditis. The recommendations in this document reflect analyses of relevant literature regarding procedure-related bacteremia and infective endocarditis, in vitro susceptibility data of the most common microorganisms that cause infective endocarditis, results of prophylactic studies in animal models of experimental endocarditis, and retrospective and prospective studies of prevention of infective endocarditis. MEDLINE database searches from 1950 to 2006 were done for English-language papers using the following search terms: endocarditis, infective endocarditis, prophylaxis, prevention, antibiotic, antimicrobial, pathogens, organisms, dental, gastrointestinal, genitourinary, streptococcus, enterococcus, staphylococcus, respiratory, dental surgery, pathogenesis, vaccine, immunization, and bacteremia. The reference lists of the identified papers were also searched. We also searched the AHA online library. The American College of Cardiology/AHA classification of recommendations and levels of evidence for practice guidelines were used. The paper was subsequently reviewed by outside experts not affiliated with the writing group and by the AHA Science Advisory and Coordinating Committee.

Conclusions. The major changes in the updated recommendations include the following: (1) The Committee concluded that only an extremely small number of cases of infective endocarditis might be prevented by antibiotic prophylaxis for dental procedures even if such prophylactic therapy were 100% effective. (2) Infective endocarditis prophylaxis for dental procedures should be recommended only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from infective endocarditis. (3) For patients with these underlying cardiac conditions, prophylaxis is recommended for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa. (4) Prophylaxis is not recommended based solely on an increased lifetime risk of acquisition of infective endocarditis. (5) Administration of antibiotics solely to prevent endocarditis is not recommended for patients who undergo a genitourinary or gastrointestinal tract procedure. These changes are intended to define more clearly when infective endocarditis prophylaxis is or is not recommended and to provide more uniform and consistent global recommendations. (*Circulation.* 2007;116:1736–1754.) (5/07)

FLUORIDE

Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States
Centers for Disease Control and Prevention (8/01)

FOOD ALLERGY

Guidelines for the Diagnosis and Management of Food Allergy in the United States: Report of the NIAID-Sponsored Expert Panel
National Institute of Allergy and Infectious Diseases

ABSTRACT. Food allergy is an important public health problem that affects children and adults and may be increasing in prevalence. Despite the risk of severe allergic reactions and even death, there is no current treatment for food allergy: the disease can only be managed by allergen avoidance or treatment of symptoms. The diagnosis and management of food allergy also may vary from one clinical practice setting to another. Finally, because patients frequently confuse nonallergic food reactions, such as food intolerance, with food allergies, there is an unfounded belief among the public that food allergy prevalence is higher than it truly is. In response to these concerns, the National Institute of Allergy and Infectious Diseases, working with 34 professional organizations, federal agencies, and patient advocacy groups, led the development of clinical guidelines for the diagnosis and management of food allergy. These Guidelines are intended for use by a wide variety of health care professionals, including family practice physicians, clinical specialists, and nurse practitioners. The Guidelines include a consensus definition for food allergy, discuss comorbid conditions often associated with food allergy, and focus on both IgE-mediated and non-IgE-mediated reactions to food. Topics addressed include the epidemiology, natural history, diagnosis, and management of food allergy, as well as the management of severe symptoms and anaphylaxis. These Guidelines provide 43 concise clinical recommendations and additional guidance on points of current controversy in patient management. They also identify gaps in the current scientific knowledge to be addressed through future research. (12/10)

GASTROENTERITIS

Managing Acute Gastroenteritis Among Children: Oral Rehydration, Maintenance, and Nutritional Therapy
Centers for Disease Control and Prevention (11/03)

GASTROESOPHAGEAL REFLUX

Guidelines for Evaluation and Treatment of Gastroesophageal Reflux in Infants and Children
North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition

ABSTRACT. Gastroesophageal reflux (GER), defined as passage of gastric contents into the esophagus, and GER disease (GERD), defined as symptoms or complications of GER, are common pediatric problems encountered by both primary and specialty medical providers. Clinical manifestations of GERD in children include vomiting, poor weight gain, dysphagia, abdominal or substernal pain, esophagitis and respiratory disorders. The GER Guideline Committee of the North American Society for Pediatric Gastroenterology and Nutrition has formulated a clinical practice guideline for the management of pediatric GER. The GER Guideline Committee, consisting of a primary care pediatrician, two clinical epidemiologists (who also practice primary care pediatrics) and five pediatric gastroenterologists, based its recommendations on an integration of a comprehensive and systematic review of the medical literature combined with expert opinion. Consensus was achieved through Nominal Group Technique, a structured quantitative method.

The Committee examined the value of diagnostic tests and treatment modalities commonly used for the management of GERD, and how those interventions can be applied to clinical situations in the infant and older child.

The guideline provides recommendations for management by the primary care provider, including evaluation, initial treatment, follow-up management and indications for consultation by a specialist. The guideline also provides recommendations for management by the pediatric gastroenterologist.

This document represents the official recommendations of the North American Society for Pediatric Gastroenterology and Nutrition on the evaluation and treatment of gastroesophageal reflux in infants and children. The American Academy of Pediatrics has also endorsed these recommendations. The recommendations are summarized in a synopsis within the article. This review and recommendations are a general guideline and are not intended as a substitute for clinical judgment or as a protocol for the management of all patients with this problem. (2001)

GROUP B STREPTOCOCCAL DISEASE

Prevention of Perinatal Group B Streptococcal Disease: Revised Guidelines from CDC, 2010

Centers for Disease Control and Prevention

SUMMARY. Despite substantial progress in prevention of perinatal group B streptococcal (GBS) disease since the 1990s, GBS remains the leading cause of early-onset neonatal sepsis in the United States. In 1996, CDC, in collaboration with relevant professional societies, published guidelines for the prevention of perinatal group B streptococcal disease (CDC. Prevention of perinatal group B streptococcal disease: a public health perspective. *MMWR* 1996;45[No. RR-7]); those guidelines were updated and republished in 2002 (CDC. Prevention of perinatal group B streptococcal disease: revised guidelines from CDC. *MMWR* 2002;51[No. RR-11]). In June 2009, a meeting of clinical and public health representatives was held to reevaluate prevention strategies on the basis of data collected after the issuance of the 2002 guidelines. This report presents CDC's updated guidelines, which have been endorsed by the American College of Obstetricians and Gynecologists, the American Academy of Pediatrics, the American College of Nurse-Midwives, the American Academy of Family Physicians, and the American Society for Microbiology. The recommendations were made on the basis of available evidence when such evidence was sufficient and on expert opinion when available evidence was insufficient. The key changes in the 2010 guidelines include the following:

- expanded recommendations on laboratory methods for the identification of GBS,
- clarification of the colony-count threshold required for reporting GBS detected in the urine of pregnant women,
- updated algorithms for GBS screening and intrapartum chemoprophylaxis for women with preterm labor or preterm premature rupture of membranes,
- a change in the recommended dose of penicillin-G for chemoprophylaxis,
- updated prophylaxis regimens for women with penicillin allergy, and
- a revised algorithm for management of newborns with respect to risk for early-onset GBS disease.

Universal screening at 35–37 weeks' gestation for maternal GBS colonization and use of intrapartum antibiotic prophylaxis has resulted in substantial reductions in the burden of early-onset GBS disease among newborns. Although early-onset GBS disease has become relatively uncommon in recent years, the rates of maternal GBS colonization (and therefore the risk for early-onset GBS disease in the absence of intrapartum antibiotic prophylaxis) remain unchanged since the 1970s. Continued efforts are needed to sustain and improve on the progress achieved in the prevention of GBS disease. There also is a need to monitor for potential adverse consequences of intrapartum antibiotic prophylaxis (e.g., emergence of bacterial antimicrobial resistance or increased incidence or severity of non-GBS neonatal pathogens). In the absence of a licensed GBS vaccine, universal screening and intrapartum antibiotic prophylaxis continue to be the cornerstones of early-onset GBS disease prevention. (11/10)

***HELICOBACTER PYLORI* INFECTION**

Helicobacter pylori Infection in Children: Recommendations for Diagnosis and Treatment

North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (11/00)

HEMATOPOIETIC STEM CELL TRANSPLANT

Guidelines for Preventing Opportunistic Infections Among Hematopoietic Stem Cell Transplant Recipients

Centers for Disease Control and Prevention, Infectious Diseases Society of America, and the American Society of Blood and Marrow Transplantation (10/00)

HUMAN IMMUNODEFICIENCY VIRUS

Guidelines for the Prevention and Treatment of Opportunistic Infections in HIV-Exposed and HIV-Infected Children

US Department of Health and Human Services

SUMMARY. This report updates the last version of the Guidelines for the Prevention and Treatment of Opportunistic Infections (OIs) in HIV-Exposed and HIV-Infected Children, published in 2009. These guidelines are intended for use by clinicians and other health-care workers providing medical care for HIV-exposed and HIV-infected children in the United States. The guidelines discuss opportunistic pathogens that occur in the United States and ones that might be acquired during international travel, such as malaria. Topic areas covered for each OI include a brief description of the epidemiology, clinical presentation, and diagnosis of the OI in children; prevention of exposure; prevention of first episode of disease; discontinuation of primary prophylaxis after immune reconstitution; treatment of disease; monitoring for adverse effects during treatment, including immune reconstitution inflammatory syndrome (IRIS); management of treatment failure; prevention of disease recurrence; and discontinuation of secondary prophylaxis after immune reconstitution. A separate document providing recommendations for prevention and treatment of OIs among HIV-infected adults and post-pubertal adolescents (*Guidelines for the Prevention and Treatment of Opportunistic*

Infections in HIV-Infected Adults and Adolescents) was prepared by a panel of adult HIV and infectious disease specialists (see http://aidsinfo.nih.gov/guidelines).

These guidelines were developed by a panel of specialists in pediatric HIV infection and infectious diseases (the Panel on Opportunistic Infections in HIV-Exposed and HIV-Infected Children) from the U.S. government and academic institutions. For each OI, one or more pediatric specialists with subject-matter expertise reviewed the literature for new information since the last guidelines were published and then proposed revised recommendations for review by the full Panel. After these reviews and discussions, the guidelines underwent further revision, with review and approval by the Panel, and final endorsement by the National Institutes of Health (NIH), Centers for Disease Control and Prevention (CDC), the HIV Medicine Association (HIVMA) of the Infectious Diseases Society of America (IDSA), the Pediatric Infectious Disease Society (PIDS), and the American Academy of Pediatrics (AAP). So that readers can ascertain how best to apply the recommendations in their practice environments, the recommendations are rated by a letter that indicates the strength of the recommendation, a Roman numeral that indicates the quality of the evidence supporting the recommendation, and where applicable, a * notation that signifies a hybrid of higher-quality adult study evidence and consistent but lower-quality pediatric study evidence.

More detailed methodologic considerations are listed in Appendix 1 (Important Guidelines Considerations), including a description of the make-up and organizational structure of the Panel, definition of financial disclosure and management of conflict of interest, funding sources for the guidelines, methods of collecting and synthesizing evidence and formulating recommendations, public commentary, and plans for updating the guidelines. The names and financial disclosures for each of the Panel members are listed in Appendices 2 and 3, respectively.

An important mode of childhood acquisition of OIs and HIV infection is from infected mothers. HIV-infected women may be more likely to have coinfections with opportunistic pathogens (e.g., hepatitis C) and more likely than women who are not HIV-infected to transmit these infections to their infants. In addition, HIV-infected women or HIV-infected family members coinfected with certain opportunistic pathogens may be more likely to transmit these infections horizontally to their children, resulting in increased likelihood of primary acquisition of such infections in young children. Furthermore, transplacental transfer of antibodies that protect infants against serious infections may be lower in HIV-infected women than in women who are HIV-uninfected. Therefore, infections with opportunistic pathogens may affect not just HIV-infected infants but also HIV-exposed, uninfected infants. These guidelines for treating OIs in children, therefore, consider treatment of infections in all children—HIV-infected and HIV-uninfected—born to HIV-infected women.

In addition, HIV infection increasingly is seen in adolescents with perinatal infection who are now surviving into their teens and in youth with behaviorally acquired HIV infection. Guidelines for postpubertal adolescents can be found in the adult OI guidelines, but drug pharmacokinetics (PK) and response to treatment may differ in younger prepubertal or pubertal adolescents. Therefore, these guidelines also apply to treatment of HIV-infected youth who have not yet completed pubertal development.

Major changes in the guidelines from the previous version in 2009 include:

- Greater emphasis on the importance of antiretroviral therapy (ART) for prevention and treatment of OIs, especially those OIs for which no specific therapy exists;
- Increased information about diagnosis and management of IRIS;
- Information about managing ART in children with OIs, including potential drug-drug interactions;
- Updated immunization recommendations for HIV-exposed and HIV-infected children, including pneumococcal, human papillomavirus, meningococcal, and rotavirus vaccines;
- Addition of sections on influenza, giardiasis, and isosporiasis;
- Elimination of sections on aspergillosis, bartonellosis, and HHV-6 and HHV-7 infections; and
- Updated recommendations on discontinuation of OI prophylaxis after immune reconstitution in children.

The most important recommendations are highlighted in boxed major recommendations preceding each section, and a table of dosing recommendations appears at the end of each section. The guidelines conclude with summary tables that display dosing recommendations for all of the conditions, drug toxicities and drug interactions, and 2 figures describing immunization recommendations for children aged 0 to 6 years and 7 to 18 years.

The terminology for describing use of antiretroviral (ARV) drugs for treatment of HIV infection has been standardized to ensure consistency within the sections of these guidelines and with the *Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection*. Combination antiretroviral therapy (cART) indicates use of multiple (generally 3 or more) ARV drugs as part of an HIV treatment regimen that is designed to achieve virologic suppression; highly active antiretroviral therapy (HAART), synonymous with cART, is no longer used and has been replaced by cART; the term ART has been used when referring to use of ARV drugs for HIV treatment more generally, including (mostly historical) use of one- or two-agent ARV regimens that do not meet criteria for cART.

Because treatment of OIs is an evolving science, and availability of new agents or clinical data on existing agents may change therapeutic options and preferences, these recommendations will be periodically updated and will be available at http://AIDSinfo.nih.gov. (11/13)

INFLUENZA

Seasonal Influenza in Adults and Children—Diagnosis, Treatment, Chemoprophylaxis, and Institutional Outbreak Management: Clinical Practice Guidelines of the Infectious Diseases Society of America

Infectious Diseases Society of America

EXECUTIVE SUMMARY. ***Background.*** Influenza virus infection causes significant morbidity and mortality in the United States each year. The majority of persons infected with influenza virus exhibit self-limited, uncomplicated, acute febrile respiratory symptoms or are asymptomatic. However, severe disease and complications due to infection, including hospitalization and death, may occur in elderly persons, in very young persons, in persons with underlying medical conditions (including pulmonary and cardiac disease, diabetes, and immunosuppression), and in previously healthy persons. Early treatment with antiviral medications may reduce the severity and duration of symptoms, hospitalizations, and complications (otitis media, bronchitis, pneumonia), and may reduce the use of outpatient services and antibiotics, extent and quantity of viral shedding, and possibly mortality in certain populations. Vaccination is the best method for preventing influenza, but antivirals may also be used as primary or secondary means of preventing influenza transmission in certain settings.

The Centers for Disease Control and Prevention's (CDC's) Advisory Committee on Immunization Practices and the American Academy of Pediatrics provide recommendations on the appropriate use of trivalent inactivated and live, attenuated influenza vaccines, as well as information on diagnostics and antiviral use for treatment and chemoprophylaxis. The CDC's influenza Web site (http://www.cdc.gov/flu) also summarizes up-to-date information on current recommendations for influenza diagnostic testing and antiviral use. The Infectious Diseases Society of America's (IDSA's) influenza guideline provides an evidence-based set of recommendations and background on influenza with contributions from many sources, including the CDC, the American Academy of Pediatrics, the American College of Physicians, the American Academy of Family Physicians, the Pediatric Infectious Diseases Society, the Society for Healthcare Epidemiology of America, practicing clinicians, and the IDSA, to guide decision-making on these issues. The current guideline development process included a systematic weighting of the quality of the evidence and the grade of recommendation (table 1). These guidelines apply to seasonal (interpandemic) influenza and not to avian or pandemic disease. Clinical management guidelines for sporadic human infections due to avian A (H5N1) viruses have been published by the World Health Organization. (4/09)

INTRAVASCULAR CATHETER-RELATED INFECTIONS

Guidelines for the Prevention of Intravascular Catheter-Related Infections

Society of Critical Care Medicine, Infectious Diseases Society of America, Society for Healthcare Epidemiology of America, Surgical Infection Society, American College of Chest Physicians, American Thoracic Society, American Society of Critical Care Anesthesiologists, Association for Professionals in Infection Control and Epidemiology, Infusion Nurses Society, Oncology Nursing Society, Society of Cardiovascular and Interventional Radiology, American Academy of Pediatrics, and the Healthcare Infection Control Practices Advisory Committee of the Centers for Disease Control and Prevention

ABSTRACT. These guidelines have been developed for practitioners who insert catheters and for persons responsible for surveillance and control of infections in hospital, outpatient, and home health-care settings. This report was prepared by a working group comprising members from professional organizations representing the disciplines of critical care medicine, infectious diseases, health-care infection control, surgery, anesthesiology, interventional radiology, pulmonary medicine, pediatric medicine, and nursing. The working group was led by the Society of Critical Care Medicine (SCCM), in collaboration with the Infectious Disease Society of America (IDSA), Society for Healthcare Epidemiology of America (SHEA), Surgical Infection Society (SIS), American College of Chest Physicians (ACCP), American Thoracic Society (ATS), American Society of Critical Care Anesthesiologists (ASCCA), Association for Professionals in Infection Control and Epidemiology (APIC), Infusion Nurses Society (INS), Oncology Nursing Society (ONS), Society of Cardiovascular and Interventional Radiology (SCVIR), American Academy of Pediatrics (AAP), and the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC) and is intended to replace the *Guideline for Prevention of Intravascular Device-Related Infections* published in 1996. These guidelines are intended to provide evidence-based recommendations for preventing catheter-related infections. Major areas of emphasis include 1) educating and training health-care providers who insert and maintain catheters; 2) using maximal sterile barrier precautions during central venous catheter insertion; 3) using a 2% chlorhexidine preparation for skin antisepsis; 4) avoiding routine replacement of central venous catheters as a strategy to prevent infection; and 5) using antiseptic/antibiotic impregnated short-term central venous catheters if the rate of infection is high despite adherence to other strategies (ie, education and training, maximal sterile barrier precautions, and 2% chlorhexidine for skin antisepsis). These guidelines also identify performance indicators that can be used locally by health-care institutions or organizations to monitor their success in implementing these evidence-based recommendations. (11/02)

JAUNDICE

Guideline for the Evaluation of Cholestatic Jaundice in Infants

North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition

ABSTRACT. For the primary care provider, cholestatic jaundice in infancy, defined as jaundice caused by an elevated conjugated bilirubin, is an uncommon but potentially serious problem that indicates hepatobiliary dysfunction. Early detection of cholestatic jaundice by the primary care physician and timely, accurate diagnosis by the pediatric gastroenterologist are important for successful treatment and a favorable prognosis. The Cholestasis Guideline Committee of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition has formulated a clinical practice guideline for the diagnostic evaluation of cholestatic jaundice in the infant. The Cholestasis Guideline Committee, consisting of a primary care pediatrician, a clinical epidemiologist (who also practices primary care pediatrics), and five pediatric gastroenterologists, based its recommendations on a comprehensive and systematic review of the medical literature integrated with expert opinion. Consensus was achieved through the Nominal Group Technique, a structured quantitative method.

The Committee examined the value of diagnostic tests commonly used for the evaluation of cholestatic jaundice and how those interventions can be applied to clinical situations in the infant. The guideline provides recommendations for management by the primary care provider, indications for consultation by a pediatric gastroenterologist, and recommendations for management by the pediatric gastroenterologist.

The Cholestasis Guideline Committee recommends that any infant noted to be jaundiced at 2 weeks of age be evaluated for cholestasis with measurement of total and direct serum bilirubin. However, breast-fed infants who can be reliably monitored and who have an otherwise normal history (no dark urine or light stools) and physical examination may be asked to return at 3 weeks of age and, if jaundice persists, have measurement of total and direct serum bilirubin at that time.

This document represents the official recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition on the evaluation of cholestatic jaundice in infants. The American Academy of Pediatrics has also endorsed these recommendations. These recommendations are a general guideline and are not intended as a substitute for clinical judgment or as a protocol for the care of all patients with this problem. (8/04)

METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS*

Clinical Practice Guidelines by the Infectious Diseases Society of America for the Treatment of Methicillin-Resistant *Staphylococcus aureus* Infections in Adults and Children

Infectious Diseases Society of America

ABSTRACT. Evidence-based guidelines for the management of patients with methicillin-resistant Staphylococcus aureus (MRSA) infections were prepared by an Expert Panel of the Infectious Diseases Society of America (IDSA). The guidelines are intended for use by health care providers who care for adult and pediatric patients with MRSA infections. The guidelines discuss the management of a variety of clinical syndromes associated with MRSA disease, including skin and soft tissue infections (SSTI), bacteremia and endocarditis, pneumonia, bone and joint infections, and central nervous system (CNS) infections. Recommendations are provided regarding vancomycin dosing and monitoring, management of infections due to MRSA strains with reduced susceptibility to vancomycin, and vancomycin treatment failures. (2/11)

MIGRAINE HEADACHE

Pharmacological Treatment of Migraine Headache in Children and Adolescents

Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society (12/04)

RADIOLOGY

Neuroimaging of the Neonate

Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society

ABSTRACT. ***Objective.*** The authors reviewed available evidence on neonatal neuroimaging strategies for evaluating both very low birth weight preterm infants and encephalopathic term neonates.

Imaging for the preterm neonate. Routine screening cranial ultrasonography (US) should be performed on all infants of <30 weeks' gestation once between 7 and 14 days of age and should be optimally repeated between 36 and 40 weeks' postmenstrual age. This strategy detects lesions such as intraventricular hemorrhage, which influences clinical care, and those such as periventricular leukomalacia and low-pressure ventriculomegaly, which provide information about long-term neurodevelopmental outcome. There is insufficient evidence for routine MRI of all very low birth weight preterm infants with abnormal results of cranial US.

Imaging for the term infant. Noncontrast CT should be performed to detect hemorrhagic lesions in the encephalopathic term infant with a history of birth trauma, low hematocrit, or coagulopathy. If CT findings are inconclusive, MRI should be performed between days 2 and 8 to assess the location and extent of injury. The pattern of injury identified with conventional MRI may provide diagnostic and prognostic information for term infants with evidence of encephalopathy. In particular, basal ganglia and thalamic lesions detected by conventional MRI are associated with poor neurodevelopmental outcome. Diffusion-weighted imaging may allow earlier detection of these cerebral injuries.

Recommendations. US plays an established role in the management of preterm neonates of <30 weeks' gestation. US also provides valuable prognostic information when the infant reaches 40 weeks' postmenstrual age. For

encephalopathic term infants, early CT should be used to exclude hemorrhage; MRI should be performed later in the first postnatal week to establish the pattern of injury and predict neurologic outcome. (6/02)

SEDATION AND ANALGESIA

Clinical Policy: Evidence-Based Approach to Pharmacologic Agents Used in Pediatric Sedation and Analgesia in the Emergency Department
American College of Emergency Physicians (10/04)

SEIZURE

Evaluating a First Nonfebrile Seizure in Children
Quality Standards Subcommittee of the American Academy of Neurology, the Child Neurology Society, and the American Epilepsy Society

ABSTRACT. ***Objective.*** The Quality Standards Subcommittee of the American Academy of Neurology develops practice parameters as strategies for patient management based on analysis of evidence. For this practice parameter, the authors reviewed available evidence on evaluation of the first nonfebrile seizure in children in order to make practice recommendations based on this available evidence. Methods: Multiple searches revealed relevant literature and each article was reviewed, abstracted, and classified. Recommendations were based on a three-tiered scheme of classification of the evidence. Results: Routine EEG as part of the diagnostic evaluation was recommended; other studies such as laboratory evaluations and neuroimaging studies were recommended as based on specific clinical circumstances. Conclusions: Further studies are needed using large, well-characterized samples and standardized data collection instruments. Collection of data regarding appropriate timing of evaluations would be important. (8/00)

Treatment of the Child With a First Unprovoked Seizure
Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society

ABSTRACT. The Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society develop practice parameters as strategies for patient management based on analysis of evidence regarding risks and benefits. This parameter reviews published literature relevant to the decision to begin treatment after a child or adolescent experiences a first unprovoked seizure and presents evidence-based practice recommendations. Reasons why treatment may be considered are discussed. Evidence is reviewed concerning risk of recurrence as well as effect of treatment on prevention of recurrence and development of chronic epilepsy. Studies of side effects of anticonvulsants commonly used to treat seizures in children are also reviewed. Relevant articles are classified according to the Quality Standards Subcommittee classification scheme. Treatment after a first unprovoked seizure appears to decrease the risk of a second seizure, but there are few data from studies involving only children. There appears to be no benefit of treatment with regard to the prognosis for long-term seizure remission. Antiepileptic drugs (AED) carry risks of side effects that are particularly important in children. The decision as to whether or not to treat children and adolescents who have experienced a first unprovoked seizure must be based on a risk–benefit assessment that weighs the risk of having another seizure against the risk of chronic AED therapy. The decision should be individualized and take into account both medical issues and patient and family preference. (1/03)

STATUS EPILEPTICUS

Diagnostic Assessment of the Child With Status Epilepticus (An Evidence-based Review)
Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society

ABSTRACT. ***Objective***. To review evidence on the assessment of the child with status epilepticus (SE).

Methods. Relevant literature were reviewed, abstracted, and classified. When data were missing, a minimum diagnostic yield was calculated. Recommendations were based on a four-tiered scheme of evidence classification.

Results. Laboratory studies (Na^{++} or other electrolytes, Ca^{++}, glucose) were abnormal in approximately 6% and are generally ordered as routine practice. When blood or spinal fluid cultures were done on these children, blood cultures were abnormal in at least 2.5% and a CNS infection was found in at least 12.8%. When antiepileptic drug (AED) levels were ordered in known epileptic children already taking AEDs, the levels were low in 32%. A total of 3.6% of children had evidence of ingestion. When studies for inborn errors of metabolism were done, an abnormality was found in 4.2%. Epileptiform abnormalities occurred in 43% of EEGs of children with SE and helped determine the nature and location of precipitating electroconvulsive events (8% generalized, 16% focal, and 19% both). Abnormalities on neuroimaging studies that may explain the etiology of SE were found in at least 8% of children.

Recommendations. Although common clinical practice is that blood cultures and lumbar puncture are obtained if there is a clinical suspicion of a systemic or CNS infection, there are insufficient data to support or refute recommendations as to whether blood cultures or lumbar puncture should be done on a routine basis in children in whom there is no clinical suspicion of a systemic or CNS infection (Level U). AED levels should be considered when a child with treated epilepsy develops SE (Level B). Toxicology studies and metabolic studies for inborn errors of metabolism may be considered in children with SE when there are clinical indicators for concern or when the initial evaluation reveals no etiology (Level C). An EEG may be considered in a child with SE as it may be helpful in determining whether there are focal or generalized epileptiform abnormalities that may guide further testing for the etiology of SE, when there is a suspicion of pseudostatus epilepticus (nonepileptic SE), or nonconvulsive SE, and may guide treatment (Level C). Neuroimaging may be considered after the child with SE has been stabilized if there are clinical indications or if the etiology is unknown (Level C). There is insufficient evidence to support or refute routine neuroimaging in a child presenting with SE (Level U). (11/06)

TOBACCO USE

Treating Tobacco Use and Dependence: 2008 Update
US Department of Health and Human Services

ABSTRACT. *Treating Tobacco Use and Dependence: 2008 Update,* a Public Health Service-sponsored Clinical Practice Guideline, is a product of the Tobacco Use and Dependence Guideline Panel ("the Panel"), consortium representatives, consultants, and staff. These 37 individuals were charged with the responsibility of identifying effective, experimentally validated tobacco dependence treatments and practices. The updated Guideline was sponsored by a consortium of eight Federal Government and nonprofit organizations: the Agency for Healthcare Research and Quality (AHRQ); Centers for Disease Control and Prevention (CDC); National Cancer Institute (NCI); National Heart, Lung, and Blood Institute (NHLBI); National Institute on Drug Abuse (NIDA); American Legacy Foundation; Robert Wood Johnson Foundation (RWJF); and University of Wisconsin School of Medicine and Public Health's Center for Tobacco Research and Intervention (UW-CTRI). This Guideline is an updated version of the 2000 *Treating Tobacco Use and Dependence: Clinical Practice Guideline* that was sponsored by the U.S. Public Health Service, U. S. Department of Health and Human Services.

An impetus for this Guideline update was the expanding literature on tobacco dependence and its treatment. The original 1996 Guideline was based on some 3,000 articles on tobacco treatment published between 1975 and 1994. The 2000 Guideline entailed the collection and screening of an additional 3,000 articles published between 1995 and 1999. The 2008 Guideline update screened an additional 2,700 articles; thus, the present Guideline update reflects the distillation of a literature base of more than 8,700 research articles. Of course, this body of research was further reviewed to identify a much smaller group of articles that served as the basis for focused Guideline data analyses and review.

This Guideline contains strategies and recommendations designed to assist clinicians; tobacco dependence treatment specialists; and health care administrators, insurers, and purchasers in delivering and supporting effective treatments for tobacco use and dependence. The recommendations were made as a result of a systematic review and meta-analysis of 11 specific topics identified by the Panel (proactive quitlines; combining counseling and medication relative to either counseling or medication alone; varenicline; various medication combinations; long-term medications; cessation interventions for individuals with low socioeconomic status/limited formal education; cessation interventions for adolescent smokers; cessation interventions for pregnant smokers; cessation interventions for individuals with psychiatric disorders, including substance use disorders; providing cessation interventions as a health benefit; and systems interventions, including provider training and the combination of training and systems interventions). The strength of evidence that served as the basis for each recommendation is indicated clearly in the Guideline update. A draft of the Guideline update was peer reviewed prior to publication, and the input of 81 external reviewers was considered by the Panel prior to preparing the final document. In addition, the public had an opportunity to comment through a *Federal Register* review process. The key recommendations of the updated Guideline, *Treating Tobacco Use and Dependence: 2008 Update,* based on the literature review and expert Panel opinion, are as follows:

Ten Key Guideline Recommendations

The overarching goal of these recommendations is that clinicians strongly recommend the use of effective tobacco dependence counseling and medication treatments to their patients who use tobacco, and that health systems, insurers, and purchasers assist clinicians in making such effective treatments available.

1. Tobacco dependence is a chronic disease that often requires repeated intervention and multiple attempts to quit. Effective treatments exist, however, that can significantly increase rates of long-term abstinence.
2. It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting.
3. Tobacco dependence treatments are effective across a broad range of populations. Clinicians should encourage every patient willing to make a quit attempt to use the counseling treatments and medications recommended in this Guideline.
4. Brief tobacco dependence treatment is effective. Clinicians should offer every patient who uses tobacco at least the brief treatments shown to be effective in this Guideline.
5. Individual, group, and telephone counseling are effective, and their effectiveness increases with treatment intensity. Two components of counseling are especially effective, and clinicians should use these when counseling patients making a quit attempt:
   - Practical counseling (problemsolving/skills training)
   - Social support delivered as part of treatment
6. Numerous effective medications are available for tobacco dependence, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents).
   - Seven first-line medications (5 nicotine and 2 nonnicotine) reliably increase long-term smoking abstinence rates:
     – Bupropion SR
     – Nicotine gum
     – Nicotine inhaler
     – Nicotine lozenge
     – Nicotine nasal spray
     – Nicotine patch
     – Varenicline

- Clinicians also should consider the use of certain combinations of medications identified as effective in this Guideline.

7. Counseling and medication are effective when used by themselves for treating tobacco dependence. The combination of counseling and medication, however, is more effective than either alone. Thus, clinicians should encourage all individuals making a quit attempt to use both counseling and medication.
8. Telephone quitline counseling is effective with diverse populations and has broad reach. Therefore, both clinicians and health care delivery systems should ensure patient access to quitlines and promote quitline use.
9. If a tobacco user currently is unwilling to make a quit attempt, clinicians should use the motivational treatments shown in this Guideline to be effective in increasing future quit attempts.
10. Tobacco dependence treatments are both clinically effective and highly cost-effective relative to interventions for other clinical disorders. Providing coverage for these treatments increases quit rates. Insurers and purchasers should ensure that all insurance plans include the counseling and medication identified as effective in this Guideline as covered benefits.

The updated Guideline is divided into seven chapters that provide an overview, including methods (Chapter 1); information on the assessment of tobacco use (Chapter 2); clinical interventions, both for patients willing and unwilling to make a quit attempt at this time (Chapter 3); intensive interventions (Chapter 4); systems interventions for health care administrators, insurers, and purchasers (Chapter 5); the scientific evidence supporting the Guideline recommendations (Chapter 6); and information relevant to specific populations and other topics (Chapter 7).

A comparison of the findings of the updated Guideline with the 2000 Guideline reveals the considerable progress made in tobacco research over the brief period separating these two publications. Tobacco dependence increasingly is recognized as a chronic disease, one that typically requires ongoing assessment and repeated intervention. In addition, the updated Guideline offers the clinician many more effective treatment strategies than were identified in the original Guideline. There now are seven different first-line effective agents in the smoking cessation pharmacopoeia, allowing the clinician and patient many different medication options. In addition, recent evidence provides even stronger support for counseling (both when used alone and with other treatments) as an effective tobacco cessation strategy; counseling adds to the effectiveness of tobacco cessation medications, quitline counseling is an effective intervention with a broad reach, and counseling increases tobacco cessation among adolescent smokers.

Finally, there is increasing evidence that the success of any tobacco dependence treatment strategy cannot be divorced from the health care system in which it is embedded. The updated Guideline contains new evidence that health care policies significantly affect the likelihood that smokers will receive effective tobacco dependence treatment and successfully stop tobacco use. For instance, making tobacco dependence treatment a covered benefit of insurance plans increases the likelihood that a tobacco user will receive treatment and quit successfully. Data strongly indicate that effective tobacco interventions require coordinated interventions. Just as the clinician must intervene with his or her patient, so must the health care administrator, insurer, and purchaser foster and support tobacco intervention as an integral element of health care delivery. Health care administrators and insurers should ensure that clinicians have the training and support to deliver consistent, effective intervention to tobacco users.

One important conclusion of this Guideline update is that the most effective way to move clinicians to intervene is to provide them with information regarding multiple effective treatment options and to ensure that they have ample institutional support to use these options. Joint actions by clinicians, administrators, insurers, and purchasers can encourage a culture of health care in which failure to intervene with a tobacco user is inconsistent with standards of care. (5/08)

VESICOURETERAL REFLUX

Report on the Management of Primary Vesicoureteral Reflux in Children
American Urological Association (5/97)

Section 3

Affirmation of Value Clinical Practice Guidelines

These guidelines are not endorsed as policy of the American Academy of Pediatrics (AAP). Documents that lack a clear description of the process for identifying, assessing, and incorporating research evidence are not eligible for AAP endorsement as practice guidelines. However, such documents may be of educational value to members of the AAP.

ASTHMA

Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers
National Environmental Education Foundation

INTRODUCTION (EXCERPT). These guidelines are the product of a new Pediatric Asthma Initiative aimed at integrating environmental management of asthma into pediatric health care. This document outlines competencies in environmental health relevant to pediatric asthma that should be mastered by primary health care providers, and outlines the environmental interventions that should be communicated to patients.

These environmental management guidelines were developed for pediatricians, family physicians, internists, pediatric nurse practitioners, pediatric nurses, and physician assistants. In addition, these guidelines should be integrated into respiratory therapists' and licensed case/care (LICSW) management professionals' education and training.

The guidelines contain three components:

- Competencies: An outline of the knowledge and skills that health care providers and health professional students should master and demonstrate in order to incorporate management of environmental asthma triggers into pediatric practice.
- Environmental History Form: A quick, easy, user-friendly document that can be utilized as an intake tool by the health care provider to help determine pediatric patients' environmental asthma triggers.
- Environmental Intervention Guidelines: Follow-up questions and intervention solutions to environmental asthma triggers. (8/05)

PALLIATIVE CARE AND HOSPICE

Standards of Practice for Pediatric Palliative Care and Hospice
National Hospice and Palliative Care Organization (2/09)

SLEEP APNEA

Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea
American Society of Anesthesiologists (5/06)

TURNER SYNDROME

Care of Girls and Women With Turner Syndrome: A Guideline of the Turner Syndrome Study Group
Turner Syndrome Consensus Study Group

ABSTRACT. ***Objectives.*** The objective of this work is to provide updated guidelines for the evaluation and treatment of girls and women with Turner syndrome (TS).

Participants. The Turner Syndrome Consensus Study Group is a multidisciplinary panel of experts with relevant clinical and research experience with TS that met in Bethesda, Maryland, April 2006. The meeting was supported by the National Institute of Child Health and unrestricted educational grants from pharmaceutical companies.

Evidence. The study group used peer-reviewed published information to form its principal recommendations. Expert opinion was used where good evidence was lacking.

Consensus. The study group met for 3 d to discuss key issues. Breakout groups focused on genetic, cardiological, auxological, psychological, gynecological, and general medical concerns and drafted recommendations for presentation to the whole group. Draft reports were available for additional comment on the meeting web site. Synthesis of the section reports and final revisions were reviewed by e-mail and approved by whole-group consensus.

Conclusions. We suggest that parents receiving a prenatal diagnosis of TS be advised of the broad phenotypic spectrum and the good quality of life observed in TS in recent years. We recommend that magnetic resonance angiography be used in addition to echocardiography to evaluate the cardiovascular system and suggest that patients with defined cardiovascular defects be cautioned in regard to pregnancy and certain types of exercise. We recommend that puberty should not be delayed to promote statural growth. We suggest a comprehensive educational evaluation in early childhood to identify potential attention-deficit or nonverbal learning disorders. We suggest that caregivers address the prospect of premature ovarian failure in an open and sensitive manner and emphasize the critical importance of estrogen treatment for feminization and for bone health during the adult years. All individuals with TS require continued monitoring of hearing and thyroid function throughout the lifespan. We suggest that adults with TS be monitored for aortic enlargement, hypertension, diabetes, and dyslipidemia. (1/07)

Section 4

2013 Policies

From the American Academy of Pediatrics

- *Policy Statements*
  ORGANIZATIONAL PRINCIPLES TO GUIDE AND DEFINE THE CHILD HEALTH CARE SYSTEM AND TO IMPROVE THE HEALTH OF ALL CHILDREN

- *Clinical Reports*
  GUIDANCE FOR THE CLINICIAN IN RENDERING PEDIATRIC CARE

- *Technical Reports*
  BACKGROUND INFORMATION TO SUPPORT AMERICAN ACADEMY OF PEDIATRICS POLICY

Includes policy statements, clinical reports, and technical reports published between January 1, 2013, and January 1, 2014.

INTRODUCTION

This section of the ***Pediatric Clinical Practice Guidelines & Policies: A Compendium of Evidence-based Research for Pediatric Practice*** manual is composed of policy statements, clinical reports, and technical reports issued by the American Academy of Pediatrics (AAP) and is designed as a quick reference tool for AAP members, staff, and other interested parties. Section 4 includes the full text of all AAP policies published in 2013. Section 5 is a compilation of all active AAP statements (through January 1, 2014) arranged alphabetically, with abstracts where applicable. A committee index (Appendix 1) and subject index are also available. The companion CD-ROM contains the full text of all current policy statements, clinical reports, and technical reports (through January 1, 2014). These materials should help answer questions that arise about the AAP position on child health care issues. **However, it should be remembered that AAP policy statements, clinical reports, and technical reports do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.**

The policy statements have been written by AAP committees, councils, task forces, or sections and approved by the AAP Board of Directors. Most of these statements have appeared previously in ***Pediatrics***, ***AAP News***, or ***News & Comments*** (the forerunner of ***AAP News***).

This section does not contain all AAP policies. It does not include

- Press releases.
- Motions and resolutions that were approved by the Board of Directors. These can be found in the Board of Directors' minutes.
- Policies in manuals, pamphlets, booklets, or other AAP publications. These items can be ordered through the AAP. To order, visit our online Bookstore at www.aap.org/bookstore or call toll-free 888/227-1770.
- Testimony before Congress or government agencies.

All policy statements, clinical reports, and technical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time. Please check the American Academy of Pediatrics Web site at www.aap.org for up-to-date reaffirmations, revisions, and retirements.

Calcium and Vitamin D Requirements of Enterally Fed Preterm Infants

- *Clinical Report*

CLINICAL REPORT

Calcium and Vitamin D Requirements of Enterally Fed Preterm Infants

abstract

FREE

Bone health is a critical concern in managing preterm infants. Key nutrients of importance are calcium, vitamin D, and phosphorus. Although human milk is critical for the health of preterm infants, it is low in these nutrients relative to the needs of the infants during growth. Strategies should be in place to fortify human milk for preterm infants with birth weight <1800 to 2000 g and to ensure adequate mineral intake during hospitalization and after hospital discharge. Biochemical monitoring of very low birth weight infants should be performed during their hospitalization. Vitamin D should be provided at 200 to 400 IU/day both during hospitalization and after discharge from the hospital. Infants with radiologic evidence of rickets should have efforts made to maximize calcium and phosphorus intake by using available commercial products and, if needed, direct supplementation with these minerals. *Pediatrics* 2013;131:e1676–e1683

In 2011, the Institute of Medicine (IOM) released dietary guidelines for calcium and vitamin D intakes for all age groups.[1] However, no intake recommendations were made specifically for preterm infants, because they were considered a special population and did not fit within the guidelines for dietary reference intakes developed by the IOM. Preterm infants have unique bone mineral requirements that may not be assumed to be similar to those of full-term newborn infants. Previous statements in the United States have limited their recommendations to full-term infants.[2,3] However, The European Society for Pediatric Gastroenterology, Hepatology, and Nutrition has recently described enteral nutrition recommendations for preterm infants.[4,5]

Data on in utero bone mineralization rates are limited. Cadaver studies, beginning with the classic work of Widdowson et al,[6] generally support an in utero accretion of calcium during the third trimester of 100 to 130 mg/kg per day, peaking between 32 and 36 weeks' gestation. Phosphorus accretion is approximately half the accretion of calcium throughout gestation. Remarkably, more recent reevaluation of these data by using modern body composition techniques[7] provided values similar to those developed by Widdowson et al.[6]

In full-term infants, there is a strong correlation between maternal and infant cord blood 25-hydroxyvitamin D (25-OH-D) concentrations, although the cord blood concentration is less than the maternal concentration.[8] A substantial proportion of pregnant women, especially

Steven A. Abrams, MD and the COMMITTEE ON NUTRITION

KEY WORDS
preterm infants, human milk, vitamin D, calcium, phosphorous, nutrient intake

ABBREVIATIONS
25-OH-D—25-hydroxyvitamin D
APA—alkaline phosphatase activity
IOM—Institute of Medicine
VLBW—very low birth weight

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doi:10.1542/peds.2013-0420

All clinical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

African American and Hispanic women in the United States and Europe, have 25-OH-D concentrations <20 ng/mL (50 nmol/L),[9] a value set for the basis of the Recommended Dietary Allowance.[1] However, in utero, skeletal mineralization is primarily independent of maternal vitamin D status, making the clinical significance of 25-OH-D concentrations during pregnancy unclear.[10,11]

EFFECTS OF PRETERM BIRTH ON MINERAL METABOLISM

Population-based studies of rickets among preterm infants are lacking; therefore, the frequency is not known or reliably estimated. Approximately 10% to 20% of hospitalized infants with birth weight <1000 g have radiographically defined rickets (metaphyseal changes) despite current nutritional practices.[12] This frequency is much lower than the 50% incidence in this population described before fortification of human milk and the use of preterm high mineral containing formulas were routine.[13] One challenge in identifying the prevalence of rickets is the confusion related to terminology. Rickets is defined by radiographic findings, not by any biochemical findings. Standard radiographic definitions of rickets are used. Poorly defined terms, such as osteopenia or biochemical rickets, are often used in the literature interchangeably with radiographically defined rickets. Rickets is not widely reported in preterm infants with birth weight >1500 g unless there are health issues severely limiting enteral nutrition.

Limited long-term studies of bone mineralization exist in former preterm infants. In general, these studies do not demonstrate significant long-term negative effects on bone health in preterm infants who demonstrate catch-up growth occurring during the first 2 years after birth.[14] A single study demonstrated a small decrease in young adolescent height when the alkaline phosphatase concentration exceeded 1200 IU/L.[15] That study was limited because of the use of formulas containing relatively low amounts of energy and protein. The preterm infants had reduced adult height and low lumbar spine bone mineral density compared with population reference data, and the deficits were greatest in those with birth weight <1200 g and those born small for gestational age.[16]

One study indicated a significant decrease in height during the prepubertal years of former very low birth weight (VLBW) infants exposed to dexamethasone for the treatment of bronchopulmonary dysplasia.[17] In addition, Dalziel et al[18] demonstrated that prenatal steroid use did not affect peak bone mass. It appeared that slower fetal growth, rather than preterm birth, predicted lower peak bone mass. The lower peak bone mass in those born small for gestational age was appropriate for their adult height.

IN-HOSPITAL ASSESSMENT AND MANAGEMENT

A summary of high-risk factors for the development of rickets is shown in Table 1. It is common medical practice to assess VLBW infants biochemically for evidence of abnormalities of bone-related parameters, especially the serum alkaline phosphatase activity (APA) and serum phosphorus concentration, and subsequently to evaluate them radiographically if these evaluations suggest a high risk of developing rickets. No absolute values for a low serum phosphorus concentration exist, with values below ~4 mg/dL often, but not always, being considered associated with low phosphorus status. On the other hand, there is little, if any, evidence supporting measuring bone mineral-related laboratory values in infants with birth weight >1500 g unless infants are unable to achieve full feeds or have other conditions, such as severe cholestasis or renal disease, placing them at risk for bone loss.

Typically, a very high serum APA (>1000 IU/L) is suggestive, but not proof, of rickets. In 1 study, values >1000 IU/L were associated with an incidence of radiologic rickets of ~50% to 60%,[12] although some cases were also seen with serum APA in the range of 800 to 1000 IU/L. Elevations of serum APA and clinical rickets are uncommon in the first 4 weeks after birth at any gestational age. Therefore, screening the serum APA and serum phosphorus at 4 to 6 weeks after birth in VLBW infants followed by biweekly monitoring is appropriate. Typically, the APA will peak at 400 to 800 IU/L and then decrease in VLBW infants who do not develop rickets. In this circumstance, clinical experience indicates that if the infant has APA values in this range and has achieved full feeds of human milk with a mineral-containing fortifier or formula designed for preterm infants, there is minimal, if any, risk of developing rickets, and measurement of APA can usually be stopped.

TABLE 1 High-Risk Criteria for Rickets in Preterm Infants

Born at <27 weeks' gestation
Birth weight <1000 g
Long-term parenteral nutrition (eg, >4 to 5 weeks)
Severe bronchopulmonary dysplasia with use of loop diuretics (eg, furosemide) and fluid restriction
Long-term steroid use
History of necrotizing enterocolitis
Failure to tolerate formulas or human milk fortifiers with high mineral content

Other markers of bone status include serum osteocalcin concentration and bone-specific APA; the latter has been considered of value in cases of cholestasis to help identify the bone-related fraction from total APA. At present, there are no data demonstrating clinical utility of measuring serum osteocalcin concentration and bone-specific APA in neonates, and normal values do not exist for preterm infants. Backstrom et al[19] found no additional information gained from measurement of bone-specific APA compared with total APA in preterm infants. It is, therefore, unlikely that these laboratory values, which are poorly standardized in neonates and expensive to obtain, will be a substantial aspect of clinical decision-making in an individual infant.

The ultimate diagnosis of rickets requires a radiographic evaluation, usually of either the wrist or the knee. Chest radiographs revealing abnormalities of the ribs may be suggestive of rickets, but a confirmatory long-bone film of the wrist or knee should be obtained to confirm the diagnosis. The radiologist should categorize the infant as likely having or not having rickets. Nonspecific terms, such as "osteopenia" or "washed out bones," have little clinical meaning. Rickets in preterm infants appears radiographically similar to rickets in older infants and should be characterized as such. The use of either bone ultrasonography or, before discharge, dual energy radiographic absorptiometry to evaluate bone status may be considered. However, the lack of data related to normal values in former preterm infants indicate that these are performed primarily for research purposes. Current data do not support routine use of any of these techniques for preterm infants, including those with abnormal radiographic findings.

CALCIUM AND PHOSPHORUS INTAKE AND ABSORPTION

Rickets in preterm infants is almost always attributable to decreased total absorbed calcium and phosphorus. Decreases in absorption can result from either low intake or low absorption efficiency.[20] Several studies have revealed that, in healthy preterm infants, calcium absorption averages ~50% to 60% of intake,[21–24] which is similar to that of breastfed full-term infants.[1] In contrast, phosphorus absorption is typically 80% to 90% of dietary intake.[23]

Unfortified human milk, parenteral nutrition, and infant formulas designed for full-term infants, including amino acid-based and soy-based formulas, do not contain enough calcium and phosphorus to fully meet the needs for bone mineralization in preterm infants. Even at very high rates of absorption (eg, 80% or more), the calcium and phosphorus intakes from unfortified human milk or formulas not intended for preterm infants would be a limiting factor in bone growth.[20] Table 2 provides sample numbers for the intake, absorption, and retention of calcium in a VLBW infant fed fortified human milk or a formula for preterm infants typically used in the United States compared with unfortified human milk.

Although most attention is focused on calcium intake, the very high urinary calcium concentrations found in preterm infants fed unfortified human milk suggests that phosphorus deficiency is at least as important, if not more important, than calcium deficiency in the etiology of this disease.[4,25,26] Some cases of hypercalcemia have been reported in preterm infants fed unfortified human milk as a result of the very low phosphorus content and resultant relative excess of calcium.[27]

VITAMIN D IN PRETERM INFANTS

Vitamin D enhances the absorption of calcium, and in general, calcium absorption efficiency is greater in people whose calcium intake is low and in whom vitamin D-dependent absorption increases. However, in preterm infants, the calcium absorption fraction appears to be relatively constant across a wide range of intakes. It has been suggested[21] that most calcium absorption may not be vitamin D dependent in preterm infants in the first month after birth but rather occurs primarily via a passive, paracellular absorption. This hypothesis is unproven, however, and the exact timing and proportion of vitamin D-dependent absorption of calcium and phosphorus in preterm infants is unknown. Some older data suggest an effect of high-dose vitamin D on calcium absorption, but these data have not been verified by using isotopic techniques nor performed on groups of infants using currently available high mineral-containing diets.[5]

TABLE 2 Approximate Calcium Balance in a Typical Infant Receiving 120 kcal/kg Per Day Intake

	Calcium Concentration (mg/dL)	Intake (mg/kg per day)	Absorption %	Total Absorption (mg/kg per day)	Approximate Retention (mg/kg per day)
Human milk[a]	25	38	60	25	15–20
Preterm formula/fortified human milk	145	220	50–60	120–130	100–120

[a] Human milk assumed to be 20 kcal/oz, and preterm formula and fortified human milk assumed to be 24 kcal/oz.

TABLE 3 Intakes of Calcium, Phosphorus, and Vitamin D From Various Enteral Nutrition Feedings at 160 mL/kg Per Day Used in the United States

	Unfortified Human Milk[a] (20 kcal/oz)	Fortified Human Milk[a] (24 kcal/oz)	Preterm Formula (24 kcal/oz)	Transitional Formula (22 kcal/oz)
Calcium (mg/kg)	37	184–218	210–234	125–144
Phosphorus (mg/kg)	21	102–125	107–130	74–80
Vitamin D (IU/day)[b]	2.4	283–379	290–468	125–127

[a] Human milk data based on mature human milk.[38]
[b] Based on an infant weighing 1500 g.

It is accepted that the best available marker of vitamin D exposure and vitamin D status is the serum 25-OH-D concentration.[1] Although the active form of vitamin D is 1,25 dihydroxyvitamin D, its serum value is not closely associated with overall outcomes or vitamin D exposure.[1] Therefore, excluding rare cases of severe renal disease or suspicion of vitamin D-resistant rickets, vitamin D status in preterm infants as well as older infants should be monitored exclusively by measuring the serum 25-OH-D concentration, not the 1,25 dihydroxyvitamin D concentration.

Data on the relationship between vitamin D intake and serum 25-OH-D in preterm infants are extremely limited. Backstrom et al[28] found that an intake of 200 IU/kg in the first 6 weeks after birth led to mean 25-OH-D concentrations of ~50 nmol/L and 80 nmol/L by 12 weeks of age (to convert from nmol/L to ng/mL, divide by 2.5). Similar results were found by Koo et al.[29] Most full-term infants achieve 25-OH-D concentrations of more than 50 nmol/L with vitamin D intakes of 400 IU/day.[1] However, it is difficult to extrapolate data from full-term infants to preterm infants, especially those who are hospitalized, in whom UV B-mediated vitamin D formation is likely to be minimal and in whom fat mass, in which vitamin D and its metabolites are stored, is minimal. A recent study revealed a high incidence of very low 25-OH-D concentrations in the cord blood of Arab preterm infants in the Middle East, likely attributable to very low maternal vitamin D status.[30]

CARE OF VLBW INFANTS RELATED TO BONE HEALTH

Calcium, Phosphorus, and Vitamin D

The basic approach to prevention of rickets in preterm infants is the use of diets containing high amounts of minerals. In almost all infants with birth weight <1800 to 2000 g, regardless of gestational age, it is recommended to use formulas designed for preterm infants or human milk supplemented with fortifiers designed for use in this population. Bone mineral content is low in infants who are small for gestational age, leading to the recommendation to use these products on the basis of weight rather than gestational age.[31] Further research is needed, however, to clarify whether this is appropriate practice for all preterm infants with birth weight <2000 g.

In the United States, fortified human milk and formulas designed for preterm infants provide calcium intakes of ~180 to 220 mg/kg per day and approximately half that amount of phosphorus (Table 3). Two widely used sets of recommendations in the United States from Tsang et al[32] and Klein et al[33] (Table 4) are consistent with these intakes, and for calcium, it is reasonable to adopt the lower value and the higher value of the 2 as a range for recommended intakes (ie, 150 to 220 mg/kg per day). For phosphorus, the lower value of 60 mg/kg per day would lead to a 2:1 ratio or higher with the recommended calcium intakes, and thus, a minimum lower intake level of 75 mg/kg per day is recommended to provide a calcium-to-phosphorous ratio less than 2:1. Although no optimal calcium-to-phosphorous ratio is identified, generally a 1.5 to 1.7:1 ratio may be optimal for preterm infants.[34] For an upper intake recommendation for phosphorous, the higher value of 140 mg/kg per day is suggested. As noted later, phosphorus deficiency may occur in some preterm infants, and thus, a higher upper level recommendation is provided.

Pending further research, using the full-term infant vitamin D intake recommendation of 400 IU/day is appropriate for preterm infants born with birth weight >1500 g. Potential risks related to high 25-OH-D concentrations are unknown, and the established upper tolerable intake of 1000 IU/day for healthy full-term infants may be considered an upper intake for preterm infants as well.

TABLE 4 Recommendations for Enteral Nutrition for VLBW Infants

	Calcium, mg/kg per day	Phosphorus, mg/kg per day	Vitamin D, IU/day
Tsang et al (2005)[32]	100–220	60–140	150–400[a]
Klein (2002)[33]	150–220	100–130	135–338[b]
Agostoni[c] (2010)[5]	120–140	65–90	800–1000
This AAP clinical report	150–220	75–140	200–400

[a] Text says "aim to deliver 400 IU/daily."
[b] 90–125 IU/kg (total amount shown is for 1.5-kg infant).
[c] Reflects European recommendations.

For VLBW infants, few data are available. Their smaller size may lead to a lower need for vitamin D to achieve adequate 25-OH-D concentrations,[28,29] but further data are needed on this relationship. On the basis of limited data, a vitamin D intake of 200 to 400 IU/day for VLBW infants is recommended. This intake should be increased to 400 IU/day when weight exceeds ~1500 g and the infant is tolerating full enteral nutrition. Because this would require supplemental vitamins being added in addition to available human milk fortifiers, some may wish to wait until weight is closer to 2000 g to provide a full 400 IU/day because of concern about the osmolarity of vitamin supplements. These intake recommendations should be subject to clinical trials with rickets and fractures as clinical outcomes.

Comparisons With Other Recommendations

In Europe, a considerably lower target for calcium and phosphorus intake is common (Table 4). European guidelines generally suggest higher intakes of vitamin D of 800 to 1000 IU/day,[4,5] but there is no direct comparison of this approach compared with the approach used in the United States. Although this vitamin D intake is likely safe and is within the tolerable upper intake limit of the IOM for full-term infants,[1] no data are available for groups of VLBW infants and especially infants with birth weight <1000 g to assess the safety of providing these vitamin D intakes, which, on a bodyweight basis may be 5 to 10 times the amount recommended for full-term neonates.

As noted by the IOM report,[1] there are no clinical outcome data to support routine measurement of vitamin D concentrations in preterm infants. Infants with cholestasis, other malabsorptive disorders, or renal disease should be considered for assessment, targeting a 25-OH-D concentration >50 ng/mL.[1,3] Preterm infants with radiologic evidence of rickets or high APA (>800 IU/L) are often provided the tolerable upper intake total of 1000 IU/day of vitamin D; however, no evidence-based data are available to support any specific benefit to this practice.

Research in a small number of preterm infants has suggested improvement in bone mineral content with an exercise or physical therapy program for preterm infants. No studies have demonstrated a decrease in rickets or fractures with such a program. Care would need to be taken because of the fragile nature of the preterm infants' bones. At present, this therapy requires further clinical investigation before it can be recommended for routine use.[35]

OTHER MANAGEMENT ISSUES

Despite the use of feedings with high mineral content, some infants may develop rickets. The management of infants who have rickets and remain dependent on intravenous nutrition is beyond the scope of this review, but in general, maximizing calcium and phosphorus intake from intravenous nutrition while minimizing factors that lead to mineral loss (steroids, some diuretics) is advised. Management approaches for infants who are fed enterally are described in Table 5. These principles have not been tested in controlled trials but reflect expert opinion related to mineral intake and metabolism.

Whether minerals should be added directly to human milk separate from the use of human milk fortifiers is controversial. This practice has been advocated, combined with monitoring of urinary calcium and phosphorus.[36] Although shown to be effective in some small studies, adding minerals directly to human milk, especially in the absence of using human milk fortifiers, is not widely performed in the United States for routine management of VLWB infants, because individually supplementing these minerals does not also provide the extra protein and other nutrients needed for growth.

However, in some infants who have evidence of rickets, the need for fluid restriction or inability to tolerate formula designed for preterm infants or human milk fortifier may lead to the need to directly supplement calcium and phosphorus. Optimal or safest forms and doses of calcium and phosphorus to add directly to the diet of preterm infants are unknown. In general, most widely used is calcium glubionate, a liquid form of calcium

TABLE 5 Management Approach for Enterally Fed Preterm Infants With Radiologic Evidence of Rickets

1. Maximize nutrient intake. Consider increasing human milk fortifier and/or feeding volume of preterm formula, as clinically indicated. If unable to tolerate human milk fortifier or preterm formula, then will likely need elemental minerals added as described below.
2. If no further increases in these can be made, add elemental calcium and phosphorus as tolerated. Usually beginning at 20 mg/kg per day of elemental calcium and 10–20 mg/kg per day elemental phosphorus and increasing, as tolerated, usually to a maximum of 70–80 mg/kg per day of elemental calcium and 40–50 mg/kg per day elemental phosphorus.
3. Evaluate cholestasis and vitamin D status. May consider measuring 25-OH-D concentration, targeting serum 25-OH-D concentration of >20 ng/mL (50 nmol/L).
4. Follow serum phosphorus concentration and serum APA weekly or biweekly.
5. Recheck radiographs for evidence of rickets at 5- to 6-week intervals until resolved.
6. Advise caregiving team to be cautious in handling of infant.
7. Limit use of steroids and furosemide, as clinically feasible.

containing 23 mg/mL of elemental calcium for oral supplementation. When needed, starting doses of 20 mg/kg per day of elemental calcium may be used, increasing slowly to a maximum of approximately 60 to 70 mg/kg per day of elemental calcium. Data specific to the use of calcium carbonate are not available, but the high pH of the neonatal intestine may make calcium carbonate less than ideal. Calcium gluconate (9.3 mg/mL elemental calcium) may also be used. Salts that contain both calcium and phosphorus are also used.[23] For example, calcium tribasic phosphate contains 0.39 mg calcium and 0.28 mg of phosphorus per milligram of powder, although calcium tribasic phosphate must be compounded as a liquid for administration to infants.

A special population is older preterm infants who develop a low serum phosphorus concentration, often in conjunction with a serum APA <500 IU/L. The specific cause of this low serum phosphorus concentration is unknown, but it is likely partly related to the use of phosphorus in nonbone tissue, such as muscle. The exact serum phosphorus concentration for which evidence demonstrates a need to supplement phosphorus without calcium is not known, but a serum concentration below ~4.0 mg/dL, especially if present for more than 1 to 2 weeks, suggests consideration of adding phosphorus directly.

An ideal oral form of phosphorus for use in preterm infants does not exist. Administering the intravenous preparations orally can be considered, because they are lower in osmolarity than are commercially available phosphorus-containing liquids. For example, potassium phosphate provides 31 mg of elemental phosphorus per millimole, and a dose of 10 to 20 mg/kg per day of elemental phosphorus is reasonable and will likely resolve hypophosphatemia in most preterm infants.

Transitioning Off High-Mineral Containing Products

Decreasing mineral intake, by either using less human milk fortifier or discontinuing the use of formulas for preterm infants, is often begun at a body weight of ~2000 g. Delaying the switch to transitional formulas and continuing the use of formula designed for preterm infants or human milk fortifier should be considered for infants on fluid restriction, especially <150 mL/kg per day, or for infants with a prolonged course of parenteral nutrition and a persistent elevation of serum APA (ie, >800 IU/L). Use of formula designed for preterm infants would likely be safe until body weight of at least 3000 g is reached, after which some concern might be present about vitamins or minerals (especially vitamin A) exceeding the established tolerable upper intake levels.[37] No clinical evidence of vitamin A toxicity exists, although for intakes slightly above the upper level, a risk-benefit assessment may need to be performed regarding use of formulas designed for preterm infants in some larger infants.

Preterm infants who do not tolerate cow milk protein or lactose-containing products represent a special circumstance. Amino acid-based, soy-based, and other specialized infant formulas generally have higher levels of minerals than do routine infant formulas, but the bioavailability of these minerals, especially in high-risk infants such as those with a history of feeding intolerance or intestinal failure, is uncertain. As such, biochemical monitoring may need to be continued for an extended period of time, and in some cases, direct supplementation with added minerals should be considered.

POSTDISCHARGE MANAGEMENT OF PRETERM INFANTS

VLBW infants who are discharged exclusively breastfeeding will often do well from a bone mineral perspective; however, they may be at risk for a very high serum APA after discharge. No specific research or clinical studies have addressed this issue. A measurement of serum APA 2 to 4 weeks after discharge is appropriate in exclusively breastfed former VLBW infants, with careful follow-up for values >800 IU/L and consideration of direct mineral supplementation if serum APA exceeds 1000 IU/L. Parents may also choose to provide some feedings per day of a higher mineral-containing formula (such as transitional formulas at 22 kcal/oz) to infants with birth weight <1500 g after hospital discharge. Transitional formulas contain 22 kcal/oz, and their nutrient contents are between those used for full-term infants and those used for preterm infants.

No data are available to define the length of time exclusively breastfed infants receiving such formula supplements or transitional formula need to continue them. This decision is often driven by growth in weight, head circumference, and length, not by bone mineral concerns. Infants consuming less than ~800 mL of currently marketed transitional formula daily after discharge from the hospital will receive <400 IU/day of vitamin D for several weeks to several months. It is reasonable to supplement these infants with a small amount of vitamin D (often 200 to 400 IU/day) to ensure a total intake of at least 400 IU/day.

From a bone mineral perspective, infants with birth weight 1500 to 2000 g will generally do well with exclusive breastfeeding or routine infant formula after discharge from the hospital. Some pediatricians choose to use a transitional infant formula after

infants reach ~34 weeks' postmenstrual age or ~1800 to 2000 g body weight.

There are no specific studies related to the bone mineral needs of infants who are "late preterm" (ie, 34–36 weeks' gestation and >2000 g at birth). However, there are no clinical reports of mineral deficiency or rickets in this population whether breastfed exclusively or fed formula designed for preterm infants, as long as long-term vitamin D status is adequate. Therefore, it is likely that late preterm infants do not generally need special management related to bone minerals after discharge from the hospital. Breastfed preterm infants who are at home should receive 400 IU/day of vitamin D. Formula-fed preterm infants receiving formulas designed for full-term infants would generally not achieve an intake of 400 IU/day of vitamin D until consuming ~800 mL of formula daily, depending on the formula. Providing these infants with an additional 200 to 400 IU/day may be considered, but there are no data indicating any clinical benefit to this practice.

Small-for-gestational-age infants at or near term, such as is common in many global settings, may usually be provided minerals in the same way as larger infants of the same gestational age. Such infants should be monitored carefully for growth, and an adequate intake of vitamin D should be ensured.

SUMMARY

1. Preterm infants, especially those <27 weeks' gestation or with birth weight <1000 g with a history of multiple medical problems, are at high-risk of rickets.
2. Routine evaluation of bone mineral status by using biochemical testing is indicated for infants with birth weight <1500 g but not those with birth weight >1500 g. Biochemical testing should usually be started 4 to 5 weeks after birth.
3. Serum APA >800 to 1000 IU/L or clinical evidence of fractures should lead to a radiographic evaluation for rickets and management focusing on maximizing calcium and phosphorus intake and minimizing factors leading to bone mineral loss.
4. A persistent serum phosphorus concentration less than ~4.0 mg/dL should be followed, and consideration should be given for phosphorus supplementation.
5. Routine management of preterm infants, especially those with birth weight <1800 to 2000 g, should include human milk fortified with minerals or formulas designed for preterm infants (see Table 4 for details).
6. At the time of discharge from the hospital, VLBW infants will often be provided higher intakes of minerals than are provided by human milk or formulas intended for term infants through the use of transitional formulas. If exclusively breastfed, a follow-up serum APA at 2 to 4 weeks after discharge from the hospital may be considered.
7. When infants reach a body weight >1500 g and tolerate full enteral feeds, vitamin D intake should generally be ~400 IU/day, up to a maximum of 1000 IU/day.

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Caregiver-Fabricated Illness in a Child: A Manifestation of Child Maltreatment

• *Clinical Report*

CLINICAL REPORT

Caregiver-Fabricated Illness in a Child: A Manifestation of Child Maltreatment

abstract

FREE

Caregiver-fabricated illness in a child is a form of child maltreatment caused by a caregiver who falsifies and/or induces a child's illness, leading to unnecessary and potentially harmful medical investigations and/or treatment. This condition can result in significant morbidity and mortality. Although caregiver-fabricated illness in a child has been widely known as Munchausen syndrome by proxy, there is ongoing discussion about alternative names, including pediatric condition falsification, factitious disorder (illness) by proxy, child abuse in the medical setting, and medical child abuse. Because it is a relatively uncommon form of maltreatment, pediatricians need to have a high index of suspicion when faced with a persistent or recurrent illness that cannot be explained and that results in multiple medical procedures or when there are discrepancies between the history, physical examination, and health of a child. This report updates the previous clinical report "Beyond Munchausen Syndrome by Proxy: Identification and Treatment of Child Abuse in the Medical Setting." The authors discuss the need to agree on appropriate terminology, provide an update on published reports of new manifestations of fabricated medical conditions, and discuss approaches to assessment, diagnosis, and management, including how best to protect the child from further harm. *Pediatrics* 2013;132:590–597

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KEY WORDS

Munchausen syndrome by proxy, pediatric condition falsification, factitious disorder by proxy, medical child abuse, child maltreatment, Child Protective Services, covert video surveillance, multidisciplinary child protection team, Munchausen syndrome

ABBREVIATION

CVS—covert video surveillance

INTRODUCTION

Few conditions are as difficult to diagnose and manage as illness induced or falsified by caregivers. Although this condition has been widely known as Munchausen syndrome by proxy, there is ongoing debate about alternative names, including pediatric condition falsification, factitious disorder (illness) by proxy, child abuse in the medical setting, and medical child abuse. The previous clinical report from the American Academy of Pediatrics called this form of maltreatment "child abuse in a medical setting," noting that it can include physical abuse, medical neglect, and psychological maltreatment.[1] This term was used to focus attention on the harm caused to the child. Roesler and Jenny[2] concurred that pediatricians should focus on the maltreatment that happened to the child rather than the offender's motivation. They coined the term "medical child abuse," which they defined as "a child receiving unnecessary and harmful or potentially harmful medical care at the instigation of a caretaker." Despite the

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variability in terms, there is general agreement that this condition causes serious harm and is associated with significant morbidity and mortality.[3] The sections that follow provide an overview of the spectrum of the condition, the epidemiology, and an approach to assessment, diagnosis, and management.

DESCRIPTION

The essential feature of the condition that will be referred to in this report as fabricated illness in a child is the caregiver's falsification and/or inducement of physical or psychological symptoms or signs in a child.[4] The term "fabricated illness in a child" has been used in this report to reflect the emphasis on the child as the victim of the abuse rather than on the mental status or motivation of the caregiver who has caused the signs and/or symptoms.

Just as the name has been under debate, the definition has been controversial, partly because early definitions often included the offender's motivation. To be consistent with the approach to diagnosing other forms of child maltreatment, the definition and diagnosis of caregiver-fabricated illness in a child should focus on the child's exposure to risk and harm and associated injuries or impairment rather than the motivation of the offender.[1,2,5,6] Caregiver-fabricated illness in a child is best defined as maltreatment that occurs when a child has received unnecessary and harmful or potentially harmful medical care because of the caregiver's fabricated claims or signs and symptoms induced by the caregiver.[2]

SPECTRUM OF PRESENTATIONS

This type of maltreatment has no typical presentation, but a broad range of manifestations has been described, as shown in Table 1. In separate literature reviews, Rosenberg[7] and Feldman and Brown[8] determined that bleeding, seizures, central nervous system depression, apnea, diarrhea, vomiting, fever, and rash were the most common presentations. Approximately one-quarter of children present with renal and urologic manifestations, including urinary tract infections and hematuria.[9] Illnesses commonly are reported to involve multiple organs, and the children are frequently seen by numerous subspecialists. Apnea and anorexia/feeding problems are the 2 most commonly reported symptoms.[10] Emotional and behavioral conditions, such as attention-deficit/hyperactivity disorder, learning disabilities, dissociative disorders, and psychosis, have all been fabricated by caregivers.[11–13] Allegations of sexual abuse have also been fabricated.[14–16]

Some of the forms of fabricated illness reported in more recent literature include hypernatremic dehydration,[17] immunodeficiency,[18] celiac disease,[19] and Gaucher disease.[20] A retrospective review of calls to the National Poison Data System from 2000 to 2008 for pharmaceutical exposures that were coded as "malicious" and occurred in a child younger than 7 years revealed 1437 cases (average of 160 cases/year).[21] Ethanol, laxatives, and benzodiazepines, in that order, were the most common pharmaceutical categories. The pharmaceutical exposure may have been an intentional poisoning, drug-facilitated sexual abuse, or fabricated illness. Eighteen children (1.2%) died, and 2.2% suffered some major signs or symptoms related to the exposure. Most of the deaths were related to exposure to a sedating agent, including antihistamines and opioids.

The offending caregiver may fabricate or invent a history of illness, exaggerate a real disease, or underreport signs and symptoms. The caregiver may actually produce the signs and symptoms of illness or may both fabricate the

TABLE 1 Symptoms and Signs by System Involved

Allergic: food allergy, rash
Dermatologic: erythema, vesiculations from burns, lacerations, scratches, puncture wounds, eczema
Developmental: learning disabilities, attention-deficit/ hyperactivity disorders, neuromotor dysfunctions, pervasive developmental delay, psychosis
Endocrine: polydipsia, polyuria, hypoglycemia, diabetes, glycosuria
Gastrointestinal: abdominal pain, anorexia, diarrhea, dehydration, esophageal burns, vomiting, weight loss, bowel obstruction, gut dyskinesias, bleeding including hematemesis and hematochezia or melena, bleeding from nasogastric tube, bleeding from ileostomy, disorders leading to a need for parenteral nutrition
Hematologic: bleeding, easy bruising, anemia
Infection: fever, leukopenia, sepsis, septic arthritis, osteomyelitis; failure to resolve infections with antibiotics to which bacteria are susceptible; onset of new infection while the child is receiving antibiotics to which the bacteria are susceptible; unusual bacteria from the site of infection or infection with multiple simultaneous organisms of low pathogenicity
Metabolic: mitochondrial disorders, without positive testing
Neurologic: seizures, headaches, weakness, disorder of consciousness
Oncologic: leukemia, other cancers
Ophthalmic: recurrent hemorrhagic conjunctivitis, keratitis, eyelid swelling, unequal pupils, nystagmus, periorbital cellulitis
Orthopedic: limping
Otic: otorrhea, recurrent infections
Renal: hematuria, proteinuria, renal calculi, bacteriuria, renal insufficiency, hypertension, nocturia, hypernatremia, hyponatremia, hypokalemia, pyuria, renal failure
Respiratory: presentation with an acute life-threatening event, apnea including sleep apnea, cystic fibrosis, bleeding from the upper respiratory tract, intractable asthma, hemoptysis, cyanosis, hypoxia
Rheumatologic: arthritis, arthralgia, morning stiffness

Data are from refs 2, 3, and 7.

clinical picture and cause the signs and symptoms. There is a spectrum of severity of fabricated illness, and 1 form may evolve into another: for example, a caregiver may begin by fabricating a history and move on to actually cause signs and symptoms of illness.

The caregiver's fabrications may lead physicians to cause chronic medical complications or disabilities through their treatments, for example, by inserting an unnecessary gastric tube for feeding. Caregivers' actions may induce emotional or psychiatric disease in their children. The caregiver may coach the victim or others into misrepresenting the victim as ill. The child and family members may be convinced of the child's illness. There is often a significant delay from months to years between when the child presents with initial symptoms to the time of diagnosis.[7,22]

EPIDEMIOLOGY

Although fabricated illness in a child is relatively rare, best estimates suggest that health professionals will likely encounter at least 1 case during their career.[23] This form of maltreatment often goes unrecognized and unreported even when it is recognized. The reported incidence is approximately 0.5 to 2.0 per 100 000 children younger than 16 years.[7,24,25] Inappropriate invasive investigations or treatments, including drug therapy, were inflicted on 93% of the children in the cases reported over 2 years in the United Kingdom.[24] In this prospective surveillance study conducted in the United Kingdom and the Republic of Ireland, 85% of the notifying pediatricians estimated the certainty of their diagnosis as greater than 90%. In this study, it appears that pediatricians needed to have a strong degree of certainty before reporting, suggesting that many cases go unreported when a physician is less sure of the diagnosis. A diagnosis of fabricated illness in a child may also not be made because of the inconsistency in diagnostic criteria. Failure to consider the possibility in the differential diagnosis is the most common reason for the missed diagnosis.[7,26]

Males and females are victimized equally.[7,10] The median age at diagnosis is between 14 months and 2.7 years.[10] Most of the victims are infants and toddlers, although approximately 25% of cases occur in children older than 6 years.[10,22,24] Illness fabricated by a caregiver has been described in many other countries and cultures.[8] Siblings of children who are victims of fabricated illness are also frequently abused.[24,27,28] In 1 large series, 25% of the siblings had died and 61.3% of the siblings had illnesses similar to those of the victims of fabricated illness.[10]

Although mothers are most commonly the offenders, fathers, grandparents, boyfriends, and child care providers have been found responsible.[24,29] Cases in which parents have colluded to fabricate illness have been reported as well.[11] There are reports of children who appear to actively collude with the offender in producing the fabricated illness and who later independently fabricate their own illness as they become older.[30] In addition, older children have been reported to fabricate illness, both by falsifying symptoms and/or signs of illness, without adult collusion.[18,25,31,32]

Although a discussion of the etiology for such behavior by caregivers is beyond the scope of this report, it is important for clinicians to be aware of some of the caregiver risk indicators for fabricating illness in a child. These include caregivers who (1) appear to need or thrive on attention from physicians,[13] (2) insist that the child cannot cope without the parent's ongoing attention,[13] (3) are either directly involved in professions related to health care[3] or at least are very knowledgeable medically and have a familiarity with medical terminology, and (4) have a history of factitious disorder or somatoform disorder.[33,34] Although such indicators are useful in raising awareness about the possibility of fabricated illness among children of otherwise apparently caring families, such features are quite nonspecific and should not be used to make the diagnosis.[35] These characteristics overlap considerably with those of caregivers who are advocates for their children with genuine illnesses, and some parents who fabricate illness in their children do not show such features.[35] It is important to underscore that there is no consistent psychological presentation or psychiatric diagnosis among caregivers who have fabricated illness in a child.[36]

Children who are victims of fabricated illness can suffer significant morbidity and mortality.[21,24,27,28,37] Mortality rates of 6% to 9% have been reported, and approximately the same percentage suffer long-term disability or permanent injury.[7,10,24] By definition, all victims suffer some short-term morbidity related to unnecessary procedures or treatments. The abuse often continues in the hospital[38] and has even occurred in the ICU.[17,39] Approximately 75% of the morbidity experienced by children has been precipitated by caregivers' behaviors while the children are hospitalized.[7]

DIAGNOSIS

The diagnosis of fabricated illness in a child can be especially difficult, because the signs and symptoms reported by a caregiver may not actually be present during the physician's evaluation. When illness is induced or fabricated, the signs and symptoms may fluctuate and be inconsistent with normal physiology. Indicators that should cause the pediatrician to consider

fabricated illness in a child are shown in Table 2. A caregiver who seeks another medical opinion when told that the child does not have illness or who resists reassurance that the child is healthy should raise concern about possible fabricated illness. Other potential areas for concern include a caregiver who perseverates about borderline abnormal results of no clinical relevance, despite repeated reassurance, or who refutes the validity of normal results. In the previous clinical report, it was suggested that the physician consider the following 3 questions in the diagnostic assessment of suspected fabricated illness:

1. Are the history, signs, and symptoms of disease credible?
2. Is the child receiving unnecessary and harmful or potentially harmful medical care?
3. If so, who is instigating the evaluations and treatment?

A multidisciplinary evaluation involving medical, psychosocial, child protective services, and legal professionals is important.[40] Because of the complexity of the diagnosis of fabricated illness in a child, the physician may want to consult with a specialist in child abuse pediatrics. A physician with expertise in child abuse and fabricated illness in a child may be able to provide a more objective opinion than a physician more closely involved with the family.[41,42] A complete review of the medical record, although potentially daunting, is imperative.[35] Because medical records are generally extensive and usually involve multiple medical sites, identification of the condition as fabricated may be missed if the complete medical records are not reviewed. The complete medical record may not be readily available if care has been sought at different clinical settings.

It is important to understand that as many as 30% of children with fabricated illness have an underlying medical illness.[7] Eventually, most of the victims will have iatrogenic signs and symptoms of illness.

When reviewing medical records, it is useful to make a chronological summary of medical contacts. This summary may reveal one or more of the following: (1) use of multiple medical facilities; (2) excessive and/or inappropriate pattern of utilization, including procedures, medications, tests, hospitalizations, and surgeries; (3) a pattern of missed appointments and discharge of the child against medical advice; and (4) a history of the opinions of physicians about the child's medical problems, illnesses, and treatments being misrepresented to other physicians. It is essential to review the entire record, including daily notes by all health care professionals, rather than simply focusing on summary reports, such as discharge summaries. When a child is hospitalized, it is important that all staff attribute the source of medical information in their notes: for example, nurses should document whether they witnessed that a child was apneic or that the caregiver told them the child was apneic. As shown in Table 3, it is useful to create a table that includes the following elements for each health contact: name of patient, date, location, reason for contact, reported signs/symptoms as stated by the caregiver, objective observations documented by the physician, conclusions/diagnosis made, treatment provided, efficacy of treatment, and other comments or observations. The veracity of the claims made by the caregiver can then be assessed for each symptom and sign.[35] An important overall issue to consider is whether the medical history provided by the caregiver matches the history in the medical record and whether the diagnosis reported by the caregiver matches the diagnosis made by the physician. Because fabricating caregivers can misrepresent medical information provided by various medical professionals, it is helpful to have all involved physicians conference and develop a consensus management plan.

Because physicians may be reluctant to identify possible concerns about induced illness in the record, it is also important to contact the individual physicians to discuss whether they have any concerns about possible fabrication of illness. A physician directly involved in the ongoing assessment or treatment of a child who may be the victim of fabricated illness can legally contact other physicians involved in the current or past care of the patient to obtain information relevant to the ongoing assessment or treatment of the child. If there is any aspect of that physician contact

TABLE 2 Indicators of Possible Fabricated Illness in a Child

- Diagnosis does not match the objective findings
- Signs or symptoms are bizarre
- Caregiver or suspected offender does not express relief or pleasure when told that child is improving or that child does not have a particular illness
- Inconsistent histories of symptoms from different observers
- Caregiver insists on invasive or painful procedures and hospitalizations
- Caregiver's behavior does not match expressed distress or report of symptoms (eg, unusually calm)
- Signs and symptoms begin only in the presence of 1 caregiver
- Sibling has or had an unusual or unexplained illness or death
- Sensitivity to multiple environmental substances or medicines
- Failure of the child's illness to respond to its normal treatments or unusual intolerance to those treatments
- Caregiver publicly solicits sympathy or donations or benefits because of the child's rare illness
- Extensive unusual illness history in the caregiver or caregivers' family; caregiver's history of somatization disorders

TABLE 3 Sample Table for Chart Review

Date	Location	Reason for Contact	Reported Signs/Symptoms per Caregiver	Objective Observations by Physician	Conclusions/ Diagnosis Made	Treatment Provided	Efficacy of Treatments	Other Comments or Observations

that may be for forensic purposes or done in consultation with child protective services, consider obtaining the caregiver's consent and/or obtaining legal advice before making such contact. The medical record of the siblings should be reviewed in the same thorough fashion.

If a child with the possible fabricated illness is verbal, the child should be interviewed separately from the caregiver for his or her recollection of any symptoms, including where and when they occurred. It is also important to take a careful family and social history, including information about any unusual or frequent illnesses in the extended family and siblings.

Fabricated illness in a child, like other forms of child maltreatment, is not a diagnosis of exclusion. The pediatrician should evaluate the child for illness fabrication while simultaneously searching for other medical explanations for the illness: for example, unusual and rare medical problems, such as cyclic vomiting or mitochondrial disease. Some parents are overanxious or difficult, and others perceive their child as vulnerable because of some earlier traumatic event, such as extreme prematurity, and may "shop around" for a physician.[43] When parental behaviors result in harm to the child, the child has been maltreated, whatever the caregiver's motivation.[37]

The specific features of an evaluation for fabricated illness in a child depend on the type of fabrication suspected. The pediatrician may need to perform toxicology tests if poisoning is suspected or may need to request blood group typing or subtyping if blood contamination is a concern. If testing is needed to confirm the diagnosis, the child must be protected from any additional or ongoing harm while the evaluation is underway. Although the hospital is generally considered an appropriate setting to complete this testing, the offending caregiver often continues the illness fabrication in the hospital.[7] Consequently, the caregiver's contact with the child may need to be supervised to protect the child from further harm.

If there are concerns that a child may be a victim of fabricated illness, physicians should defer procedures and prescriptions. The physician's responsibility is to protect the child.

COVERT VIDEO SURVEILLANCE

Covert video surveillance (CVS) has been proposed as a method of ensuring the child's safety during the hospitalization, as well as to expose and document the offending caregiver's fabricating behavior toward the child while in the hospital.[44,45] The use of CVS has been controversial.[46] Some argue that it is an invasion of the parent's right to privacy or that it represents entrapment.[47] Others respond that privacy is not guaranteed in a hospital setting, because health care providers, such as nurses, may walk into patient rooms at any time unannounced. Also, for some conditions, monitors are attached to a child and sound at the nurses' station. Some consider CVS to be a diagnostic tool,[48] but others argue that the recordings can be difficult to interpret and that a caregiver may be falsely accused of harm.[47] Because it can be difficult to prove to child protective services and in legal proceedings that illness has been fabricated, some children will not be protected from further harm without the use of CVS to document the abuse. Some of the disadvantages of the use of CVS include its cost, the need for real-time monitoring to interrupt any harm to a child, and the risk of additional harm to the child even with close monitoring.[44,45]

In 1 series, CVS was required to make the diagnosis of fabricated illness in a child in more than half of the cases. In 10% of the cases, however, it proved helpful because it showed that the child had a medical problem.[45] CVS has been used to detect caregivers suffocating infants, intentionally causing fractures, administering poison, and injecting harmful substances into intravenous lines. Some offending caregivers, who were previously thought to be very attentive to the child, were shown to ignore the child when no one was watching. CVS can also disprove a caregiver's falsified claim, such as showing that apnea did not occur when a caregiver has reported it. Furthermore, CVS has the potential to show that the abuse was premeditated and occurred without provocation.

If CVS is to be implemented, the hospital should develop protocols that guide its use. The protocols should include provision for continuous monitoring, training for the observers or monitors, and a plan that ensures rapid intervention if the child is observed to be at risk.

An approach that can be considered instead of CVS is separation of the child from the suspected offending caregiver and subsequent observation of the child's condition. The child must be separated for sufficient time to determine whether there is any change in the child's condition while, as much as possible, maintaining constant all other management, such as medication use. During this trial period, the suspected offending caregiver must not be allowed any contact with the child unless strict third-party supervision is maintained. Intervention by child protective services will likely be required to establish and maintain this separation. If symptoms do not disappear, this is strong indication that the symptoms were not fabricated, providing the child has been adequately protected during the separation. The association between the trial separation and any improvement in a child's condition may be difficult to prove in a legal setting, especially because improvement in a child's condition may be attributed to a spontaneous remission or resolution of the underlying medical problem.

MANAGEMENT AND PROGNOSIS

Reporting Suspected Maltreatment

Physicians should report any reasonable suspicions of child abuse promptly to child protective services authorities. All states have laws that mandate physicians report suspected child maltreatment if they have reasonable cause to suspect. In a review by Sheridan,[10] only approximately one-third of the cases of suspected fabricated illness in a child had been reported. Another study found that pediatricians do not report unless they are almost certain of the diagnosis of fabricated illness. In this study, the pediatricians estimated the probability that their diagnosis was correct as greater than 90%.[24] Although the laws do not require this level of certainty for reporting, physicians may be concerned that a caregiver will escalate the illness induction to "prove" the child's illness. Also, pediatricians may be reluctant to report suspicions of illness fabrication because of previous experience with child protective services and the legal system failing to protect a child without additional corroborating evidence.

Many state child protective services systems do not list fabricated illness or any of its various names as a specific form of child maltreatment. When reporting suspected fabricated illness in these states, the pediatrician should focus on how the child was affected: for example, the pediatrician may report suspected physical abuse, emotional abuse, risk of harm, and all the categories that apply to the particular situation. Pediatricians should collaborate with child protective services and law enforcement to ensure the best outcome for the child.

Outcome if Reported

Even when fabricated illness is reported to child protective services, many children are not protected from further harm. In the 2-year surveillance study in the United Kingdom and the Republic of Ireland referred to previously,[24] approximately one-third of the children (46 of 119) were allowed to return home.[28] Approximately one-quarter of the children (27) still had signs or symptoms of abuse at follow-up. Only one-third of the children were placed in caregiving arrangements outside the control of the alleged offending parent. Child protective services and the courts were more likely to intervene and protect children who were young and who had been physically abused as opposed to older children who suffered other harm.

If children who have been victims of fabricated illness are returned home to the care of the offending caregiver, reabuse is common.[28,49] Approximately 40% suffer further abuse, including other forms of maltreatment, such as physical and emotional abuse.[49] On the basis of Rosenberg's review,[7] in 20% of the fatal cases the child had been returned home after the parents had been confronted about the suspicion of fabricated illness, and the child subsequently died. In a study in 54 children with a diagnosis of fabricated illness followed for 1 to 14 years, many of the children manifested other problems, including emotional and behavioral conditions, such as conduct disorders. Criminal conviction of the offending caregiver was found in only 8% of the cases in the Rosenberg series.[7]

In a cohort study that had several methodologic limitations, including follow-up of only approximately 50% of the original sample identified, the factors associated with better outcomes for children who had been victimized included the following: (1) continuous positive input from the spouse and/or grandparents, (2) successful short-term foster care before returning to live with the offending caregiver, (3) the offender's long-term therapeutic relationship with a social worker, (4) successful remarriage for the offending caregiver, (5) early adoption of the victim, and (6) long-term foster care placement.[49] It was not possible to determine the relative benefits for children of remaining with the abusing caregiver versus being separated. Among those children who were with the fabricator of the illness at the time of this study, children placed away from their mother, even temporarily, appeared to have a better outcome than those who did not experience this separation.

Caregiver Treatment and Reunification

When confronted with the suspicion that the illness has been fabricated,

15% to 45% of offenders admitted to causing or fabricating the child's illness, although many denied any deception.[7,45] In general, the prognosis has been poor for offenders, but there are some reports of apparent successful treatment.[50] Identifying an offender's motivation may not be critical to making a diagnosis of fabricated illness in a child, but understanding the motivation is important for determining the course of treatment.[34,51] Schreier[11] outlines the following indicators of successful treatment: (1) the abuser admits to the abuse and has been able to describe specifically how he or she abused the child, (2) the abuser has experienced an appropriate emotional response to his or her behaviors and the harm he or she has caused the child, (3) the abuser has developed strategies to better identify and manage his or her needs to avoid abusing the child in the future, and (4) the abuser has demonstrated these skills, with monitoring, over a significant period of time. Schreier also asserts that the partners of offending caregivers should participate in treatment, because they have frequently colluded in the abuse of the child. The partner's lack of nurture for the offending caregiver may also be 1 motivation for the child's abuse.

SUMMARY

Caregiver-fabricated illness in a child is a relatively rare but very serious form of child maltreatment. The pediatrician who suspects that signs or symptoms of a disease are being fabricated should focus on the harm or potential harm to the child caused by the actions of that caregiver and by the efforts of medical personnel to diagnose and treat a nonexistent disease. Pediatricians need to have a high index of suspicion and be alert to the possibility when signs and symptoms do not fit a particular illness, when they appear resistant to treatment, or when they evolve into another or additional illnesses. Proper diagnosis of fabricated disease involves a thorough evaluation of medical records, clear communication among medical professionals, and often, a multidisciplinary approach. If the child protective services system's response seems inadequate, the pediatrician should ask a local specialist in child abuse pediatrics for advice and assistance. A focus on the motives of the caregiver, although useful in therapy, is not necessary for a diagnosis of this form of child maltreatment.

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Children, Adolescents, and the Media

- *Policy Statement*

POLICY STATEMENT

Children, Adolescents, and the Media

abstract

FREE

Media, from television to the "new media" (including cell phones, iPads, and social media), are a dominant force in children's lives. Although television is still the predominant medium for children and adolescents, new technologies are increasingly popular. The American Academy of Pediatrics continues to be concerned by evidence about the potential harmful effects of media messages and images; however, important positive and prosocial effects of media use should also be recognized. Pediatricians are encouraged to take a media history and ask 2 media questions at every well-child visit: How much recreational screen time does your child or teenager consume daily? Is there a television set or Internet-connected device in the child's bedroom? Parents are encouraged to establish a family home use plan for all media. Media influences on children and teenagers should be recognized by schools, policymakers, product advertisers, and entertainment producers. *Pediatrics* 2013;132:958–961

COUNCIL ON COMMUNICATIONS AND MEDIA

KEY WORDS

media, television, new technology, family media use plan, media history, media education

ABBREVIATION

AAP—American Academy of Pediatrics

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INTRODUCTION

Media, from traditional television to the "new media" (including cell phones, iPads, and social media), are a dominant force in children's lives. Although media are not the leading cause of any major health problem in the United States, the evidence is now clear that they can and do contribute substantially to many different risks and health problems and that children and teenagers learn from, and may be negatively influenced by, the media. However, media literacy and prosocial uses of media may enhance knowledge, connectedness, and health. The overwhelming penetration of media into children's and teenagers' lives necessitates a renewed commitment to changing the way pediatricians, parents, teachers, and society address the use of media to mitigate potential health risks and foster appropriate media use.

According to a recent study, the average 8- to 10-year-old spends nearly 8 hours a day with a variety of different media, and older children and teenagers spend >11 hours per day.[1] Presence of a television (TV) set in a child's bedroom increases these figures even more, and 71% of children and teenagers report having a TV in their bedroom.[1] Young people now spend more time with media than they do in school—it is the leading activity for children and teenagers other than sleeping.[1,2]

In addition to time spent with media, what has changed dramatically is the media landscape.[3,4] TV remains the predominant medium (>4 hours per day) but nearly one-third of TV programming is viewed on alternative platforms (computers, iPads, or cell phones). Nearly all children and teenagers have Internet access (84%), often high-speed, and one-third have

access in their own bedroom. Computer time accounts for up to 1.5 hours per day; half of this is spent in social networking, playing games, or viewing videos. New technology has arrived in a big way: some 75% of 12- to 17-year-olds now own cell phones, up from 45% in 2004. Nearly all teenagers (88%) use text messaging. Teenagers actually talk less on their phones than any other age group except for senior citizens,[5,6] but in the first 3 months of 2011, teenagers 13 through 17 years of age sent an average of 3364 texts per month.[5] Half of teenagers send 50 or more text messages per day, and one-third send more than 100 per day.[5] Teenagers access social media sites from cell phones,[6] and as reviewed in a recent clinical report from the American Academy of Pediatrics (AAP), social media, mainly Facebook, offers opportunities and potential risks to young wired users.[7] They are also avid multitaskers, often using several technologies simultaneously,[1] but multitasking teenagers are inefficient.[8] For example, using a mobile phone while driving may result in both poor communication and dangerous driving.[9]

Despite all of this media time and new technology, many parents seem to have few rules about use of media by their children and adolescents. In a recent study, two-thirds of children and teenagers report that their parents have "no rules" about time spent with media.[1] Many young children see PG-13 and R-rated movies—either online, on TV, or in movie theaters—that contain problematic content and are clearly inappropriate for them.[10,11] Few parents have rules about cell phone use for their children or adolescents. More than 60% of teenagers send and/or receive text messages after "lights out," and they report increased levels of tiredness, including at school.[12] One study found that 20% of adolescents either sent or received a sexually explicit image by cell phone or Internet.[13]

For nearly 3 decades, the AAP has expressed concerns about the amount of time that children and teenagers spend with media and about some of the content they view. In a series of policy statements, the AAP has delineated its concerns about media violence,[14] sex in the media,[10] substance use,[11] music and music videos,[15] obesity and the media,[16] and infant media use.[17] At the same time, existing AAP policy discusses the positive, prosocial uses of media and the need for media education in schools and at home.[18] Shows like "Sesame Street" can help children learn numbers and letters, and the media can also teach empathy, racial and ethnic tolerance, and a whole variety of interpersonal skills.[19] Prosocial media may also influence teenagers. Helping behaviors can increase after listening to prosocial (rather than neutral) song lyrics, and positive information about adolescent health is increasingly available through new media, including YouTube videos and campaigns that incorporate cell phone text messages.[20]

RECOMMENDATIONS FOR PEDIATRICIANS AND OTHER HEALTH CARE PROVIDERS

- Become educated about critical media topics (media use, violence, sex, obesity, substance use, new technology) via continuing medical education programs.
- Ask 2 media questions and provide age-appropriate counseling for families at every well-child visit: How much recreational screen time does your child or teenager consume daily? Is there a TV set or an Internet-connected electronic device (computer, iPad, cell phone) in the child's or teenager's bedroom? In a busy clinic or office, these 2 targeted questions are key. There is considerable evidence that a bedroom TV increases the risk for obesity, substance use, and exposure to sexual content.[1,21–26]
- Take a more detailed media history with children or teenagers who demonstrate aggressive behavior; are overweight or obese; use tobacco, alcohol, or other drugs; or have difficulties in school.
- Examine your own media use habits; pediatricians who watch more TV are less likely to advise families to follow AAP recommendations.[27]

PEDIATRICIANS SHOULD RECOMMEND THE FOLLOWING TO PARENTS

- Limit the amount of total entertainment screen time to <1 to 2 hours per day.
- Discourage screen media exposure for children <2 years of age.
- Keep the TV set and Internet-connected electronic devices out of the child's bedroom.
- Monitor what media their children are using and accessing, including any Web sites they are visiting and social media sites they may be using.
- Coview TV, movies, and videos with children and teenagers, and use this as a way of discussing important family values.
- Model active parenting by establishing a family home use plan for all media. As part of the plan, enforce a mealtime and bedtime "curfew" for media devices, including cell phones. Establish reasonable but firm rules about cell phones, texting, Internet, and social media use.

RECOMMENDATIONS FOR SCHOOLS

Community-based pediatricians, especially those serving in an advisory role to schools, are influential voices in school and neighborhood forums and can work to encourage a team approach among the medical home, the school home, and the family home. So pediatricians, especially

those serving as school physicians or school medical advisors should:

- Educate school boards and school administrators about evidence-based health risks associated with unsupervised, unlimited media access and use by children and adolescents, as well as ways to mitigate those risks, such as violence prevention, sex education, and drug use-prevention programs.
- Encourage the continuation and expansion of media education programs, or initiate implementation of media education programs in settings where they are currently lacking.
- Encourage innovative use of technology where it is not already being used, such as online education programs for children with extended but medically justified school absences.
- Work collaboratively with parent-teacher associations to encourage parental guidance in limiting or monitoring age-appropriate screen times. In addition, schools that do use new technology like iPads need to have strict rules about what students can access.

PEDIATRICIANS SHOULD WORK WITH THE AAP AND LOCAL CHAPTERS TO CHALLENGE THE ENTERTAINMENT INDUSTRY TO DO THE FOLLOWING

- Establish an ongoing dialogue with health organizations like the AAP, the American Medical Association, the American Psychological Association, and the American Public Health Association to maximize prosocial content in media and minimize harmful effects (eg, portrayals of smoking, violence, etc).
- Make movies smoke-free, without characters smoking or product placement.[11]

PEDIATRICIANS SHOULD WORK WITH THE AAP AND LOCAL CHAPTERS TO CHALLENGE MANUFACTURERS OF PRODUCTS WITH PUBLIC HEALTH IMPLICATIONS (TOBACCO, ALCOHOL, FOOD) TO DO THE FOLLOWING

- Make socially responsible decisions on marketing products to youth; betterment of their health is the ultimate goal.

PEDIATRICIANS SHOULD WORK WITH THE AAP AND LOCAL CHAPTERS TO CHALLENGE THE FEDERAL GOVERNMENT TO DO THE FOLLOWING

- Advocate for a federal report within either the National Institutes of Health or the Institute of Medicine on the impact of media on children and adolescents that would establish a baseline of what is currently known and what new research needs to be conducted.
- Encourage the entertainment industry and the advertising industry to create more prosocial programming and to reassess the effects of their current programming.
- Issue strong regulations—self-regulation is not likely to work—that would restrict the advertising of junk food and fast food to children and adolescents.
- Establish an ongoing funding mechanism for new media research.
- Initiate legislation and rules that would ban alcohol advertising from television.[11]
- Work with the Department of Education to support the creation and implementation of media education curricula for schoolchildren and teenagers.

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Community Pediatrics: Navigating the Intersection of Medicine, Public Health, and Social Determinants of Children's Health

- *Policy Statement*

POLICY STATEMENT

Community Pediatrics: Navigating the Intersection of Medicine, Public Health, and Social Determinants of Children's Health

COUNCIL ON COMMUNITY PEDIATRICS

KEY WORDS
community pediatrics, child advocacy, public health, social determinants of health

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abstract

FREE

This policy statement provides a framework for the pediatrician's role in promoting the health and well-being of all children in the context of their families and communities. It offers pediatricians a definition of community pediatrics, emphasizes the importance of recognizing social determinants of health, and delineates the need to partner with public health to address population-based child health issues. It also recognizes the importance of pediatric involvement in child advocacy at local, state, and federal levels to ensure all children have access to a high-quality medical home and to eliminate child health disparities. This statement provides a set of specific recommendations that underscore the critical nature of this dimension of pediatric practice, teaching, and research. *Pediatrics* 2013;131:623–628

Environmental and social factors contribute significantly to the health and well-being of children in the contexts of families, schools, and communities. Over the past decade, the Institute of Medicine recognized and quantified the effects of external factors on early brain development and the health of children in 2 seminal reports, *Neurons to Neighborhoods*[1] in 2000 and *Children's Health, the Nation's Wealth*[2] in 2004. As understanding of the mechanisms and impact of biological, behavioral, cultural, social, and physical environments on healthy development deepens and expands, the long-standing role of pediatricians in promoting the physical, mental, and social health and well-being of all children must also evolve.[3] The field of pediatrics must address the problems facing children in the 21st century by influencing these critical determinants of child health and well-being.[4] To do so, pediatricians must successfully merge their traditional clinical skills with public health, population-based approaches to practice, and advocacy.

DEFINITION OF COMMUNITY PEDIATRICS

The American Academy of Pediatrics (AAP) offers a definition of community pediatrics to remind all pediatricians, pediatric medical subspecialists, and pediatric surgical specialists alike of the profound importance of the community dimension in pediatric practice. Community pediatrics is the practice of promoting and integrating the

positive social, cultural, and environmental influences on children's health as well as addressing potential negative effects that deter optimal child health and development within a community. Community pediatrics includes all of the following:

- A perspective that expands the pediatrician's focus from one child to the well-being of all children in the community;
- A recognition that family, educational, social, cultural, spiritual, economic, environmental, and political forces affect the health and functioning of children;
- A synthesis of clinical practice and public health principles to promote the health of all children within the context of the family, school, and community[5]; and
- A commitment to collaborate with community partners to advocate for and provide quality services equitably for all children.[6,7]

Participating in community activities to improve the health and welfare of all children is considered an integral part of the professional role and ethical obligation of all pediatricians. For many pediatricians, efforts to promote the health of children have been directed at attending to the needs of particular children in a practice setting, on an individual basis, and providing them with a medical home[8] in concert with pediatricians' own community interests and commitments. Increasingly, however, the major threats to the healthy development of America's children stem from problems that cannot be addressed adequately by the practice model alone.[9] These problems include infant mortality; preventable infectious diseases; dental caries; sedentary lifestyles; chronic health care needs; obesity, metabolic syndrome, and other historically adult-onset chronic diseases; high levels of intentional and unintentional injuries; exposure to violence in all forms; risks of neurodevelopmental disabilities and illnesses from exposure to environmental tobacco smoke, lead, and other environmental hazards; substance abuse; mental health conditions; poor school readiness[10]; family dysfunction; sexual health, unwanted pregnancies, and sexually transmitted diseases; relatively low rates of breastfeeding; social, medical, behavioral, economic, and environmental effects of disasters[11]; and inequitable access to medical homes[12] and basic material resources and poverty.[13] Whether the pediatrician is communicating with patients and families or with a community, it is critical to remember that this must be done in a culturally and linguistically effective manner to be successful. On the part of pediatricians, culturally effective communication includes behaviors and attitudes that are appropriate to care for patients and families with a wide variety of cultural attributes.

SOCIAL DETERMINANTS OF HEALTH

In the past decade, increasing attention has been paid toward recognizing the social determinants of children's physical, mental, and behavioral health. Briefly, social determinants are the economic and social conditions that shape the health of individuals and communities. In 2005, the World Health Organization established a Commission on the Social Determinants of Health to examine the evidence of the effects of social determinants on health outcomes, specifically for the purpose of promoting health equity globally. With the description of the life course health development model[14] and the recognition of the life course health development perspective by agencies serving children and families, including the US Maternal and Child Health Bureau, the effects of poor social and economic factors in childhood on the quality of adult health have become increasingly clear. For example, authors of studies have examined the link between childhood obesity and cardiovascular disease in adulthood, lack of adequate calcium and vitamin D intake in childhood on adult osteoporosis, and childhood maltreatment and family dysfunction on adult mental and physical health problems.[13,15,16]

Childhood obesity, dental caries, asthma, and early mental health issues are prevalent in today's child population and interact reciprocally with family dysfunction or school stress. Pediatricians must have the knowledge, skills, and willingness to address these issues in addition to more traditional clinical solutions. An integral approach to doing so incorporates interdisciplinary practice. As former AAP president Robert Haggerty, MD, reminded us in 1995, "we must become partners with others, or we will become increasingly irrelevant to the health of children."[17] Pediatricians should recognize that health care is merely 1 influential component of overall health and well-being for children and families, and children often move through other systems, such as education, child welfare, mental health/social services, and juvenile justice. Interdisciplinary communication and coordination are crucial for successfully addressing all factors that contribute to a child's health and well-being.

THE NATURAL AND BUILT ENVIRONMENTS

The physical environment is an important part of a community. Health hazards from toxic environmental exposures (such as mold, heavy metals, and fluorocarbons) are routinely recognized and brought to the attention of pediatricians. Less consideration has been given to the potential for adverse effects on health from "built environments," such as poor-quality housing, lack of access to

opportunities for safe gross motor play, inadequate transportation, especially for children with limited mobility, and lack of coordinated community planning, although awareness has grown over the past decade of the effects of the built environment on the childhood obesity epidemic.[18] Accessible housing and transportation options that meet the needs of all children and families, including those with mobility, sensory, and health impairments, to travel safely and making all community and leisure environments accessible to all children, especially those with special needs, has the potential to decrease the risk of obesity and metabolic syndrome.

Because the design of a child's physical environment can cause or prevent illness or injury, a high-quality environment is essential for children to achieve optimal health and development. Community planning and building and land-use policies can either undermine or promote safety, health, and optimal development while simultaneously preserving future resources. Children in low-income families are more likely to be exposed to structural hazards in the home and are more likely to have diseases such as lead poisoning and asthma. Although environmental risks are more prevalent in low-income families, children from any income level may be exposed. For all children, examining the quality of a child's physical environment is crucial when assessing children's health. Pediatrician advocates are needed to speak out for children's needs in the physical environment.

PARTNERING WITH PUBLIC HEALTH

One could argue that pediatricians have always been a part of the public health system. As trusted sources of information for parents and front-line providers of preventive health care for children, pediatricians have fulfilled the role of addressing the needs of populations of children, whether they are in an early education and child care setting, school, or local community. Pediatricians often contribute to the public health system by recognizing and reporting illnesses, hazards, and trends to public health departments.

Because of this responsibility, pediatricians should know where to get accurate information regarding the latest public and school health issues facing children in their communities, as well as how to communicate this information effectively either individually to families or to groups in public forums or through the media. The Institute of Medicine has recently provided a framework for primary care and public health professions to work together.[19] Pediatricians should partner with local health departments and school districts and child welfare agencies to be aware of programs for children and families that address certain needs, such as injury prevention, child maltreatment prevention, lead poisoning, environmental tobacco smoke control, breastfeeding promotion, overweight/obesity prevention, asthma, perinatal care, trauma, child abuse prevention, and disaster preparedness.[20–23] One example of a pediatric/public health approach would be to ensure that children's issues are addressed in disaster planning/response.

LOCAL, STATE, AND FEDERAL ADVOCACY

The passage of the Patient Protection and Affordable Care Act in 2010 was a milestone in health care in the United States that could not have been achieved without advocacy on multiple levels by many groups of people, including pediatricians. Pediatricians have always advocated on behalf of the nation's youngest citizens, whether on the individual level for necessary services or more widely at the community, state, or federal level in legislative avenues. Because children do not have a voice in government, others must speak up on behalf of the nation's most vulnerable population of citizens.

In recent years, pediatric medical education has promoted the formal training of residents in legislative advocacy. The AAP Community Pediatrics Training Initiative has developed advocacy training modules for use in pediatric residency training programs and is supporting individual programs to implement advocacy rotations in their curricula. Statewide collaboratives, such as in California and more recently in New Jersey, have been established to serve as networks for residency programs to share advocacy curricula and support implementation of new curricular experiences in legislative advocacy. These efforts are in direct response to the recognition that, to influence policies and laws affecting children and families, pediatricians need specialized skill sets to be effective advocates on multiple levels.

With the passage of the 2010 Patient Protection and Affordable Care Act, pediatric leadership and advocacy will be crucial to ensure some just reward for the activities described in this policy statement. To counter the growing financial and productivity pressures on practicing pediatricians, some recognition of the importance of addressing the social determinants of children's health will be necessary in the financing models for accountable care organizations.[24]

RECOMMENDATIONS

With the shifting epidemiology of problems facing children and growing recognition that social determinants play a major role in children's health, pediatricians must have a second

"bag of tools" in addition to the clinical "doctor's bag" that addresses more traditional agents of childhood disease. This second bag of tools includes skills such as being able to function in an interdisciplinary fashion; partnering with public health and child welfare entities; recognizing root sources of health and pathology from children's social, economic, physical, and educational environments; and advocating on multiple levels. The following recommendations offer guidelines for pediatricians to optimize their effectiveness as clinical practitioners and advocates in the community. To accomplish these recommendations, payment and financing systems must be appropriately aligned and recognize clinicians who provide population-based prevention.[25]

1. Pediatricians should use community data (epidemiologic, demographic, and economic) to increase their understanding of the effects that social determinants have on child health outcomes.
2. Pediatricians should work together with public health departments, school districts,[21–23] child welfare agencies, community and children's hospitals, and colleagues in related professions to identify and decrease barriers to the health and well-being of children in the communities they serve.[26,27] In addition, pediatricians should have access to information about community programs and resources that could affect the health and well-being of the children in their community.
3. Pediatricians should routinely, and in a culturally effective manner, promote preventive health strategies for common childhood issues (ie, immunization, injury prevention, oral health, sexual health, nutrition, obesity prevention, breastfeeding, positive parenting, and abuse and neglect) in both individual well-child visits as well as on a population level within a community. Pediatricians can play an important role in coordinating and focusing new and existing services to realize maximum benefit for all children.[28,29]
4. Pediatricians and other members of the community should interact with and advocate to improve all settings and organizations in which children spend time (eg, early education and child care facilities, schools, school-based health centers, family support and resource centers, youth programs, recreation venues, and transportation systems). Together with families, schools and community resources should be considered as primary assets in promoting children's health, safety, and development.
5. Pediatricians should advocate for universal access to health care in a medical home and for the social, economic, educational, and environmental resources essential for every child's healthy development, including those in foster care who may have no other natural advocates.
6. Pediatricians should be able to interface with the media and be able to be trusted sources of information for parents and the general public about public health issues pertaining to children, such as vaccine safety and emergency/disaster/crisis medical issues.
7. Pediatric medical education (both undergraduate and graduate) should include specific curricula on community and public health topics pertaining to child health, including social determinants of health, how to identify and access community resources, school health, health care systems and financing, and child advocacy, including interactions with the public child welfare system and legislative advocacy skills.
8. Continuing medical education programs should consider and periodically review basic community pediatric competencies to be included in maintenance of certification efforts for pediatricians.[30] Maintenance of certification and quality improvement activities should include options to address child health issues in community settings.
9. AAP chapters and their members should provide leadership for further understanding of community pediatrics and encourage participation in creative, community-based, integrated models such as those supported through the Community Access to Child Health program and the Healthy Tomorrows Partnership for Children program.
10. The AAP is committed to continued recognition and provision of leadership and support to pediatricians to develop and exercise advocacy skills at the local, state, and national levels to ensure that children have access to care, to resources, and to conditions that promote healthy development. This includes support for the following:
    - Federal and state programs that reduce the burden of debt on medical students in pediatric primary care and pediatric medical subspecialty and surgical specialty fellowships, including but not limited to the National Health Service Corps.
    - Incorporation into the curricula for residency programs and for young physicians' discussion of different strategies

for engaging in community activities no matter the practice setting.

- Expectation of community engagement as an explicit part of comprehensive clinical payment models currently under development, including the patient-centered medical home and accountable care organizations.

11. The AAP is committed to continuing to strategically address the lack of payment for the work pediatricians do in the community, which addresses social determinants of health and population-based health issues, much of which is currently uncompensated. Not only should these services be recognized as a crucial part of child health, but also, payment for these services should be at a reasonable and fair level so that pediatricians can afford to pursue these activities in their communities.

By caring for children in the context of their families and communities, pediatricians play an important role in promoting the health and well-being of the nation's youngest citizens. Pediatricians who work with schools, early education and child care programs, community agencies and organizations, and local public health departments and child welfare agencies equip themselves to be effective child advocates in the community. Pediatricians can also play a crucial role in public health by communicating important facts about issues facing children's health; ensuring children's issues are addressed in disaster planning and response efforts[11]; and advocating at the local, state, and federal legislative levels for universal access for all children to high-quality medical homes and for social policies that promote equal opportunities for the development of children, families, and communities. The recommendations in this policy statement are meant to provide a framework for guiding the development of relevant curricula in pediatric medical education and supporting the practice of high-quality and effective pediatric care.

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Condom Use by Adolescents

- *Policy Statement*

POLICY STATEMENT

Condom Use by Adolescents

COMMITTEE ON ADOLESCENCE

ABBREVIATIONS

CDC—Centers for Disease Control and Prevention
FC—female condom
FDA—Food and Drug Administration
HIV—human immunodeficiency virus
HPV—human papillomavirus
MSM—men who have sex with men
STI—sexually transmitted infection
YRBS—Youth Risk Behavior Survey

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abstract

FREE

Rates of sexual activity, pregnancies, and births among adolescents have continued to decline during the past decade to historic lows. Despite these positive trends, many adolescents remain at risk for unintended pregnancy and sexually transmitted infections (STIs). This policy statement has been developed to assist the pediatrician in understanding and supporting the use of condoms by their patients to prevent unintended pregnancies and STIs and address barriers to their use. When used consistently and correctly, male latex condoms reduce the risk of pregnancy and many STIs, including HIV. Since the last policy statement published 12 years ago, there is an increased evidence base supporting the protection provided by condoms against STIs. Rates of acquisition of STIs/HIV among adolescents remain unacceptably high. Interventions that increase availability or accessibility to condoms are most efficacious when combined with additional individual, small-group, or community-level activities that include messages about safer sex. Continued research is needed to inform public health interventions for adolescents that increase the consistent and correct use of condoms and promote dual protection of condoms for STI prevention with other effective methods of contraception. *Pediatrics* 2013;132:973–981

INTRODUCTION

This policy statement updates a previous statement from the American Academy of Pediatrics published in 2001.[1] The medical and societal consequences of adolescent sexual activity, including sexually transmitted infections (STIs) and unintended pregnancies, remain a significant public health problem. Although abstinence of sexual activity is the most effective method for prevention of pregnancy and STIs, young people should be prepared for the time when they will become sexually active. Prevention of STIs in adolescents involves safer sexual practices by those who are sexually active or who no longer plan to be abstinent. Since publication of the previous statement, there has been increasing evidence supporting the effectiveness of condoms to prevent many STIs, including HIV. Increased availability of condoms has been shown to increase use, and widespread distribution programs have been recommended by the Centers for Disease Control and Prevention (CDC).[2]

In this policy statement, the use of condoms as a method of preventing STIs, including HIV and pregnancy will be reviewed including effectiveness, factors that influence use, and the roles that schools, communities,

and parents can play in improving use of condoms and increased availability of condoms.

TRENDS IN ADOLESCENT SEXUAL ACTIVITY AND CONSEQUENCES

Despite recent data indicating that sexual activity has declined among adolescents, the current rates of sexual activity and health consequences of STIs and pregnancy remain a significant public health concern. The CDC, through its Youth Risk Behavior Survey (YRBS), reports sexual risk behaviors in a nationally representative sample of high school students surveyed biannually. In the most recently available YRBS (2011), 47.4% of students reported that they had ever had sexual intercourse, 33.7% reported that they were currently sexually active, and 15.3% had had sexual intercourse with four or more partners in their lifetime. Among sexually active students, 60.2% reported condom use during their last sexual encounter. Of additional concern, by 12th grade, nearly two-thirds (63.1%) of students reported ever being sexually active but reported lower use of condoms than did sexually active 9th- and 10th-graders.[3]

In 2011, approximately 330 000 teenagers gave birth,[4] and in 2008, the most recently available estimates are that 750 000 teenagers became pregnant.[5] Despite the fact that US teen birth rates are at the lowest level in the past 70 years,[6] the birth rate for US teenagers remains higher than other developed nations, and marked disparities by race/ethnicity and geographic area persist.[7]

Rates of STIs remain highest among adolescents and young adults, with estimates suggesting that 15- to 24-year-olds, who represent 25% of the sexually experienced population, acquire nearly half of all new STIs.[8] Rates of *Chlamydia*, gonorrhea, and syphilis have all continued to increase in adolescent and young adults.[9] A study that examined the prevalence of STIs among female adolescents 14 to 19 years of age in the United States from the 2003–2004 NHANES reported a 24.1% prevalence of any of 5 STIs (*Neisseria gonorrhea, Chlamydia trachomatis*, *Trichomonas vaginalis*, herpes simplex virus type 2, and human papilloma virus [HPV] infections) among all female adolescents and a prevalence of 37.7% among sexually experienced females. Importantly, even among those whose sexual partner was the same age or 1 year older, the prevalence was high (25.6%), and among those with only 1 lifetime partner, the prevalence was 19.7%.[10]

For specific infections, in 2011 the highest *Chlamydia* rates were seen in 15- to 19-year-old (3.4%) and 20- to 24-year-old women (3.7%). Of concern, during 2010–2011, rates increased 4% for those aged 15 to 19 years and 11% for those aged 20 to 24 years. Reported rates of *Chlamydia* are lower among young men, likely because of decreased screening efforts, but have increased 6% for those 15 to 19 years of age and 12% for those 20 to 24 years of age between 2010 and 2011. In studies of higher-risk populations (for example, the National Job Training Program, an educational program for disadvantaged youth) at entry, rates of *Chlamydia* for women and men 16 to 24 years of age were 10.3% and 8%, respectively. Similarly, in juvenile correctional facilities, 13.5% of women and 6.5% of men screened positively for *Chlamydia*.[9]

Adolescent and young adult women also have the highest rates of gonorrhea compared with any other age and gender group and increased 1.4% in 15- to 19-year-old women during 2009–2010 (unchanged in 2011), and increased 5.4% in 20- to 24-year-old women during 2010–2011. Adolescent and young adult men have also had increasing rates of gonorrhea, increasing 6% in those aged 20 to 24 years during 2010–2011.[9]

Syphilis rates in both men and women are highest in the 15- to 24-year old age group and increased most dramatically during 2010–2011 in 20- to 24-year-old men (5.2–21.9 cases/100 000), particularly in men who have sex with men (MSM).[9]

An estimated 10 065 young people aged 13 to 24 years received a diagnosis of HIV infection in 2011, accounting for 20% of all new infections in the United States. Among adolescent/young adult males living with and diagnosed with HIV, 77% acquired infection from MSM, 4% from heterosexual transmission, and 13% were perinatally acquired. Among females, 56% acquired infection by heterosexual transmission, and 34% were perinatally acquired.[11,12] Anonymous HIV screening in locations where youth 12 to 24 years of age congregate in communities surrounding the Adolescent Trials Network for HIV/AIDS interventions found a prevalence of HIV of 15.3% in 611 MSM tested, 60% of whom did not know they were infected.[13] In addition to patients with behaviorally acquired HIV infections, an estimated 9038 people with perinatally acquired HIV are now in adolescence and young adulthood. These youth are generally receiving highly active antiretroviral therapy, and concern exists for extensive drug-resistant strains.[14] In a prospective cohort study of the reproductive health of sexually active adolescent girls perinatally infected with HIV, the cumulative incidence of pregnancy at 19 years of age was 24%, and incidence of STIs was 26%, stressing the need for comprehensive HIV/STI-prevention strategies.[15]

CONDOM USE

Recent Trends in Adolescent Condom Use

The condom remains the most popularly used contraceptive method among teenagers.[3] An increased proportion of sexually active adolescents report using a condom at last intercourse, according to 2 CDC surveys. In the YRBS, condom use increased from 46.2% in 1991 to 60.2% in 2011.[3] The prevalence of condom use was higher among male (68.6%) than female (53.9%) students and higher among white (63.3%) and African American (62.4%) than Hispanic students (54.9%).[3] In the National Survey of Family Growth, condom use at last intercourse increased among females from 31% in 1988 to 52% in 2006–2010 and males from 53% to 75%.[16] Rates of actual condom use in both surveys may also be lower than thought because of the uncertain/questionable validity of self-report of this and other sexual behaviors that are prone to bias. For example, in a clinic-based sample of African American females 15 to 21 years of age in Atlanta, Georgia, 186 young women reported 100% condom use via an audio computer-assisted self-interviewing technique. In these young women, 34% had a positive biologic marker for unprotected vaginal sex in the past 14 days (a Y-chromosome polymerase chain reaction assay). As a possible explanation of these findings, condoms may have been used inconsistently or incorrectly, or youth might have provided socially desirable answers.[17]

Factors That Influence Condom Use

A number of factors, including individual, family, sociodemographic, attitude, education, relationship, and partner-related factors, influence condom use. For example, in a national study of adolescent males,[18] factors associated with greater consistency of condom use included African American race/ethnicity, more positive condom attitudes, and more discussion of health topics with parents. Adolescents who did not have formal sex education were half as likely to use a condom at first intercourse and even less likely to use condoms consistently. Lower condom use at first sex was associated with older age, an older or casual first sexual partner, and a partner using another method of contraception. These factors were also associated with lower condom use at last sex, except for having a casual sexual partner, which was associated with higher condom use.[18]

Higher rates of condom use are noted in youth who perceive their partners as wanting to use condoms and in those able to communicate their desire to use condoms with their partners.[19] Motivations for young people to have sex include the pursuit of fulfilling sexual experiences in addition to other motivations such as intimacy, procreation, or in response to peer or partner pressure. However, adolescents' lack of condom use is associated with perceptions that condoms reduce sexual pleasure and/or that partners disapprove of condom use.[20] Condom-promotion campaigns that include linking condom use to enhanced sensitivity and sensuality, and, thus, a more positive experience as a motivating factor, have found increased uptake of condoms and safer sex behaviors.[21–23]

The influence of social networks that encourage condom use is becoming increasingly recognized.[24,25] However, increased relationship intimacy and closeness to the partner's family can be associated with less condom use.[26] Condom use rates are higher in new relationships compared with established relationships.[27] Other factors associated with increased condom use include receiving comprehensive sex and HIV education programs,[28] attending schools where condoms are available,[29] and perceiving a risk of STIs.[30]

The effect of the media on adolescent sexual behavior has been reviewed in a recent American Academy of Pediatrics policy statement.[31] Adolescents are exposed to an increasing amount of sexual content in music, movies, magazines, television, and the Internet, and this exposure plays an important role in adolescent initiation of sexual activity. Despite the increasingly sexually explicit material in media and programming, there are rare messages promoting responsible sexual activity, such as contraception, including condom use.[31] On primetime television, 77% of programs have sexual content but only 14% reference risks or responsibility of sexual behavior.[32]

Adults, especially parents, play an important role in promoting the sexual health of adolescents. Bright Futures outlines how pediatricians and other health care providers can support parents in promoting healthy sexual development and sexuality, including the use of condoms to protect against STIs including HIV.[33] A number of studies have examined the role of parent-adolescent communication about sexual risk and association with increased adolescent use of condoms.[34–38] Parental communication about sexual risk and condom use are associated with increases in adolescents' use of condoms.[34–36,38] Timing of the discussion is important; in 1 study, the highest rates of condom use at first and last sex, as well as for regular use, were found among adolescent girls who communicated with their mothers about condom use before onset of sexual activity compared with after initiation.[34] In a recent longitudinal study of parents and their

children regarding the timing of parent and child communication about sexual behaviors, more than 40% of the children had intercourse before there were discussions about STI symptoms, condom use, birth control, or partner condom refusal.[39] This suggests increased efforts are needed by pediatricians, educators, and those in public health to encourage parents to talk about these issues.

In a large study of African American and Puerto Rican teens aged 14 to 17 years, separate face-to-face interviews were conducted with 907 mother-adolescent pairs to examine factors that predicted mother-adolescent discussions about condoms. Those mothers who communicated effectively about condoms had greater knowledge of sexuality and HIV, perceived that they had enough information to discuss condoms, had received information from a health-related source, were comfortable in discussing condoms and sexuality, and believed that condom use prevents HIV. The implication for pediatricians is that providing parents with accurate information about adolescent sexual behavior, risks, and use and effectiveness of condoms can improve communication with their adolescents.[40]

Other opportunities for parents to become comfortable speaking with their adolescents about sexual health was demonstrated in a novel work site–based trial. In weekly small-group sessions, parent training with a standardized prevention curriculum, designed to help parents of 11- to 16-year-old children communicate about sexual health, found significant differences compared with a control group in discussions of these topics, including condom education. At baseline, 4% of adolescents reported that a parent had discussed with them how to use a condom, and by the 9-month follow-up survey, 36% reported receipt of instruction.[41]

EFFECTIVENESS OF CONDOM USE

Materials used for male condoms are of 3 types: most (>80%) are composed of latex (natural rubber), and a small proportion (<5%) are natural membrane (lamb cecum) or synthetic (eg, polyurethane; approximately 15%).[42] Only latex and synthetic condoms are recommended for prevention of STIs and HIV because natural membrane condoms contain small pores that may allow passage of viruses, including HIV, hepatitis B virus, and herpes simplex virus.[43,44] Synthetic condoms, when compared with latex condoms, are generally more resistant to deterioration and are compatible with both oil- and water-based lubricants. Synthetic condoms have similar failure rates to latex condoms in prevention of pregnancy.[45] Although not extensively studied, synthetic condoms are believed to provide STI protection similar to male latex condoms; however, US Food and Drug Administration (FDA) labeling currently restricts their recommended use for latex-sensitive or -allergic people.[42,45] Condoms lubricated with the spermicide nonoxynol-9 are no longer recommended, because they have a shorter shelf life, increased cost, and lack of added benefit compared with other lubricated condoms[46] and may increase likelihood of HIV transmission as a result of increased genital mucosal irritation.[47] In the United States, condoms are regulated as medical devices by the FDA, and stringent manufacturing standards exist such that each condom is tested for holes or weak spots before sale.[48]

Condoms can be highly effective against unintended pregnancy when used consistently and correctly. Method failure of the male condom for unintended pregnancy is estimated to be 2% in 12 months of use (ie, 2 pregnancies per 100 woman-years with perfect use), although with typical use, the failure rate (accounting for inconsistent and incorrect use) is 18%.[49] The most important noncontraceptive benefit of condom use is the additional protection against acquisition and transmission of STIs, including HIV. Evidence supporting the protection provided by condoms against acquisition of most STIs, including HIV, has increased markedly over the past decade.[50] If placed on the penis before genital contact and used throughout intercourse, condoms should prevent contact with semen, genital lesions, and infectious discharges in both males and females. Condoms greatly reduce the risk of STIs that are transmitted to or from the penile urethra, including gonorrhea, *Chlamydia*, trichomoniasis, hepatitis B virus, and HIV. Condoms also provide protection against STIs transmitted via skin-to-skin contact or contact with mucosal surfaces, including genital herpes simplex virus, HPV, syphilis, and chancroid in those affected areas covered by the condom.[51–54] Passage of the smallest sexually transmitted pathogen, hepatitis B virus, is effectively blocked by latex condoms, according to in vitro studies.[55–59] Most of the studies on condom effectiveness evaluate vaginal penile sexual activity. Latex and synthetic condoms also can be used during anogenital and orogenital intercourse to reduce the risk of STI.[42]

Well-designed epidemiologic studies and those of discordant couples have shown that condoms are highly effective against heterosexual transmission of HIV infection.[60] The most recent Cochrane review estimated the effectiveness of condom use at 80%.[61]

Inconsistency of the estimates of the effectiveness of condoms against

other STIs can be attributed to limitations in study design, because the quality of studies historically tended to be weaker than for studies of HIV.[54] Recent studies have empirically documented that the effectiveness of condom use against many STIs is underestimated because of limitations of study design.[62–68] Even with these limitations, these and more recent studies with improved methodologies have found that condoms provide protection against a variety of STIs, including gonorrhea, *Chlamydia*, trichomoniasis, genital herpes, and HPV.[53,54,65,69–74]

Given the coital-dependent nature of condoms, effectiveness against both unintended pregnancy and STIs is closely tied to the degree of consistency or correctness of use. Factors associated with decreased condom effectiveness include failure to use a condom with every act of intercourse; failure to use condoms throughout intercourse, such as placing condoms on after initiating intercourse or removing before ejaculation; condom breakage and slippage; and improper lubricant use with latex condoms (oil-based lubricants, such as petroleum jelly, baby oil, hand lotions, and some vaginal medications), which can reduce condom integrity and may result in breakage.[51]

Five key condom instructions reached by consensus at a World Health Organization Experts Meeting[51] are as follows:

1. Use a new condom for each act of sexual intercourse.
2. Before any genital contact, place the condom on the tip of the erect penis with the rolled side out.
3. Unroll the condom all the way to the base of the erect penis.
4. Immediately after ejaculation, hold the rim of the condom and withdraw the penis while it is still erect.
5. Throw away the used condom safely.

FEMALE CONDOM

The female condom 1 (FC1; Reality, Femy, Care Contraceptive Sheath, Femidom), a loose-fitting polyurethane sheath with 2 flexible polyurethane rings, introduced in 1994, was the first condom marketed to women but is no longer in production in the United States. The FC2 (similarly designed to the FC1 but made of nitrile and without a seam) was approved for use in 2009 by the US FDA and is the only female-initiated barrier method for STI prevention currently available in the United States. Data regarding contraceptive effectiveness of female condoms suggest estimated rates of pregnancy during the first 12 months of perfect use and typical use for FC1 were 5% and 21%; these pregnancy rates are slightly higher than those associated with use of the male condom.[75]

Although laboratory and clinical studies suggest that the female condom might be as effective as the male condom in preventing STIs, data are much more limited. Continued research is needed to evaluate the effectiveness and acceptability of female condoms, which currently account for less than 1% of US condom use overall.[75,76]

DUAL PROTECTION

Hormonal contraceptives and intrauterine devices offer pregnancy protection but no protection against STIs. Use of "dual methods" (the combined use of condoms and hormonal contraceptives or an intrauterine device) may be the optimal approach for protection against both pregnancy and STIs for adolescents. Although dual method use has been increasing over time, studies find that fewer than 25% of adolescents use dual methods[77–79] According to data from the National Survey of Family Growth, condom use is lower in women who use "highly effective user-independent methods of contraception" defined as injectables, intrauterine devices, and implants, even lower than those who use oral contraceptives.[80]

Adolescents with main and regular partners tend to discontinue condom use quickly, especially if other pregnancy prevention methods are used.[27] Studies that have examined dual method use among adolescents have found that increased use is associated with perceived risks of pregnancy and STIs, communication with parents about sexual risk, parental approval of birth control, positive attitudes toward condoms, increased use with casual partners versus main partners, partner support for condom use, and self-efficacy of condom negotiation.[77,78,81–84] In 1 clinic-based study of African American and Hispanic female adolescents who received counseling and watched a video incorporating themes of condom use and nonuse, researchers found that at 3-month follow-up, those who had the intervention were more than twice as likely to have used a condom at last intercourse than in the usual care group. However, differences did not persist at the 12-month follow-up.[85]

EFFORTS AIMED AT INCREASING CONDOM USE

Eighty-three studies of curriculum-based sex- and HIV-education programs among people younger than 25 years from all countries were reviewed, finding that two-thirds of the programs significantly improved one or more sexual behaviors. Of the 54 studies that evaluated effects on condom use, nearly half (48%) demonstrated an increase in condom use, and no studies found decreased condom use. Concern that these programs might hasten the initiation of sex appears unfounded. In the 52 studies that measured timing of initiation of

sex, 42% found that sexual initiation was significantly delayed for at least 6 months, and 55% found no effect.[28]

Condom availability programs have been evaluated in a variety of settings. In a study of programs in Massachusetts high schools, adolescents in schools where condoms were available were more likely to receive condom use instruction and less likely to report lifetime or recent sexual intercourse, and adolescents who were sexually active were twice as likely to use condoms at most recent sexual encounter.[29] Likewise, clinic-based interventions have been shown to be effective in increasing condom use and decreasing STIs.[86,87] Clinic-based safer sex interventions are endorsed by the CDC.[88]

A recent meta-analysis of high-quality US and international studies of structural-level condom distribution interventions found significant effects on increased condom use, condom acquisition, condom carrying, delayed sexual initiation of youth, and reduced incidence of STIs. The interventions that increase availability or accessibility to condoms are most efficacious when combined with additional individual, small-group, or community-level activities. The intervention effects were significant across target participant characteristics (youth, adults, commercial sex workers, STI clinic populations, or males).[89]

RECOMMENDATIONS

1. Abstaining from sexual intercourse should be encouraged for adolescents as the most effective way to prevent STIs, including HIV infection, and unintended pregnancy.
2. Pediatricians and other clinicians should actively support and encourage the consistent and correct use of condoms as well as other reliable contraception as part of anticipatory guidance with adolescents who are sexually active or contemplating sexual activity. The responsibility of males as well as females in preventing unintended pregnancies and STIs should be emphasized.
3. Pediatricians and other clinicians are encouraged to implement the recommendations in Bright Futures promoting communication between parents and adolescents about healthy sexual development and sexuality including the use and effectiveness of condoms.
4. Restrictions and barriers to condom availability should be removed, given the research that demonstrates that increased availability of condoms facilitates use. Beyond retail distribution of condoms, sexually active adolescents should have ready access to condoms at free or low cost where possible. Pediatricians and other clinicians are encouraged to provide condoms within their offices and to support availability within their communities.
5. Condom availability programs should be developed through a collaborative community process and accompanied by comprehensive sequential sexuality education to be most effective. This is ideally part of a K–12 health education program, with parental involvement, counseling, and positive peer support.
6. Schools should be considered appropriate sites for the availability of condoms because they contain large adolescent populations and may potentially provide a comprehensive array of related educational and health care resources. Training of youth to improve communication skills around condom negotiation with partners can occur in school-based settings.
7. Pediatricians and other clinicians should actively help raise awareness among parents and communities that making condoms available to adolescents does not increase the onset or frequency of adolescent sexual activity and that use of condoms can help decrease rates of unintended pregnancy and acquisition of STIs.
8. Pediatricians and other clinicians should provide and support parental education programs that help parents develop communications skills with their adolescent children around prevention of STIs and proper use of condoms.
9. The American Academy of Pediatrics should encourage additional research to identify strategies to increase continued condom use in established relationships and strategies for use of dual protection with condoms aimed at prevention of STIs and a second contraceptive method for the most effective prevention of pregnancy.

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Conflicts Between Religious or Spiritual Beliefs and Pediatric Care: Informed Refusal, Exemptions, and Public Funding

- *Policy Statement*

POLICY STATEMENT

Conflicts Between Religious or Spiritual Beliefs and Pediatric Care: Informed Refusal, Exemptions, and Public Funding

abstract

FREE

Although respect for parents' decision-making authority is an important principle, pediatricians should report suspected cases of medical neglect, and the state should, at times, intervene to require medical treatment of children. Some parents' reasons for refusing medical treatment are based on their religious or spiritual beliefs. In cases in which treatment is likely to prevent death or serious disability or relieve severe pain, children's health and future autonomy should be protected. Because religious exemptions to child abuse and neglect laws do not equally protect all children and may harm some children by causing confusion about the duty to provide medical treatment, these exemptions should be repealed. Furthermore, public health care funds should not cover alternative unproven religious or spiritual healing practices. Such payments may inappropriately legitimize these practices as appropriate medical treatment. *Pediatrics* 2013;132:962–965

INTRODUCTION

Religion plays an important role in the lives of many individuals. Fifty-eight percent of respondents to a recent poll reported that religion is very important in their lives, and 23% reported that it is fairly important.[1] The relationship between religion and medicine is complex. Some studies suggest "greater involvement in religion conveys more health-related benefits."[2] There are, however, times when religion and medicine conflict. The current policy statement addresses 3 related issues: (1) parents' refusal of medical treatment of their children; (2) religious exemptions to child abuse and neglect laws; and (3) public funding of alternative unproven religious or spiritual healing practices. The statement situates religious refusals within the scope of parental authority and argues that children's future autonomy should be protected. Religious exemption statutes do not protect all children equally and create uncertainty and, to protect children's health, should be repealed. Public health care funding should focus on established, effective therapies, and paying for spiritual healing practices may inadvertently engender medical neglect. The discussion of these specific topics should not be interpreted as a broader criticism of the interaction between religion and medicine.

COMMITTEE ON BIOETHICS

KEY WORDS

exemption, informed refusal, medical neglect, pediatrics, religion

ABBREVIATIONS

AAP—American Academy of Pediatrics

HHS—US Department of Health and Human Services

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RELIGIOUS OBJECTIONS TO MEDICAL CARE

Although parents have broad authority, they have less discretion in making medical decisions for their children than for themselves. On the basis of the ethical principles of autonomy and respect for persons, capacitated adults should have wide license in making medical decisions for themselves, including the refusal of potentially life-saving medical treatment. Their liberty should only be limited in cases of direct harm to third parties, such as the risk of transmitting serious infectious diseases. Infants and children lack the ability to make autonomous medical decisions; therefore, the law generally authorizes their parents or guardians to make such decisions on their behalf. These decisions should primarily focus on the child's best interests.[3,4] Clinicians should afford parents and guardians significant discretion in their interpretation of these interests and collaborate with them to develop treatment plans that promote their children's health. Although family autonomy and privacy are important social values, parents' choices may be limited when they rise to the level of abuse or neglect.[5]

Failure to provide children with essential medical care has been increasingly recognized as a form of neglect. In 1983, the US Department of Health and Human Services (HHS) amended its definition of negligent treatment to include failure to provide adequate medical care.[6] A number of factors are relevant to the evaluation of suspected medical neglect, including likelihood and magnitude of the harm of foregoing medical treatment and the benefits, risks, and burdens of the proposed treatment.[7–9] For example, the risk of an individual unimmunized child contracting a communicable vaccine-preventable disease may be low if immunization rates in the community are high and disease prevalence is low.[10] Serious harms include death, severe disability, or severe pain. The American Academy of Pediatrics (AAP) Committee on Child Abuse and Neglect identifies a variety of factors that can lead to children not receiving appropriate medical care and corresponding graduated management options for pediatricians. For example, lack of awareness, knowledge, or skills can be addressed by counseling and education.[7] Ethics consultation is an additional management option.[7,11] If less-restrictive alternatives are not available or successful, pediatricians should refer families to child protective services agencies. In emergencies, providers may be ethically justified in administering treatment immediately necessary to preserve life, prevent serious disability, or treat severe pain. They should notify child protective services as soon as possible.

The basis for some parents' rejection of medical treatment is religious or spiritual. Traditions vary in the scope of medical treatments they refuse. For example, members of the Followers of Christ refuse all medical treatment in favor of prayer, anointing with oil, and the laying on of hands.[12] Christian Scientists may use dentists and physicians for "mechanical" procedures, such as setting bones or childbirth, but consider most illnesses to be the result of the individual's mental attitude and seek healing through spiritual means, such as prayer. They consider these healing practices incompatible with concurrent medical treatment.[13] Other religious groups prohibit only specific medical interventions. On the basis of their interpretation of scripture, Jehovah's Witnesses only prohibit the use of blood and its major fractions.[14] Understanding these differences is important in identifying whether there are mutually acceptable alternatives.

Some religious refusals have, tragically, led to children's deaths from readily treatable conditions, such as pneumonia, appendicitis, or diabetes.[12,15] Although the free exercise of religion, including parents teaching their children their religious beliefs, is an important societal value, it must be balanced against other important societal values, such as protecting children from serious harm.[16] In some situations, the issue is primarily an empirical one —the relative efficacy of medical and spiritual interventions. Although systematic empirical evidence of the efficacy of religious interventions is often lacking, the courts can judge efficacy by using criteria generally accepted by both parents and health care providers. In other situations, the issue involves differing conceptions of benefit and harm. Parents and guardians should have significant discretion in weighing the risks and benefits of a proposed treatment. At times, the primary benefit of refusing medical treatment or seeking alternative nonmedical treatment is religious or spiritual, such as the implications of the treatment on the patient's eternal salvation. In such cases, the potential benefit cannot be evaluated by using generally accepted criteria. In such situations, the child's future ability to decide this contested issue for himself or herself should be protected.[17] Some adolescents may possess adequate decision-making capacity to comprehend and evaluate the risks and benefits of medical treatment. The possibility of coercion should also be considered in the evaluation of whether a capacitated adolescent's dissent is autonomous.[18]

The courts have consistently ordered life-saving medical treatment over parental religious objections.[8,9] In passages frequently quoted in subsequent rulings, the US Supreme Court famously stated, "The right to practice religion freely does not include liberty to expose the community or the child to communicable disease or the latter to

ill health or death" and "Parents may be free to become martyrs themselves. But it does not follow they are free, in identical circumstances, to make martyrs of their children before they have reached the age of full and legal discretion when they can make that choice for themselves."[19] There is less unanimity in judicial decisions if the condition is not life-threatening, the treatment has significant adverse effects, or the treatment has limited efficacy.[7–9] Courts may also consider the negative psychological effects of court-ordered treatment or medical foster care in their decisions.

RELIGIOUS EXEMPTIONS TO CHILD ABUSE AND NEGLECT LAWS

Most states have "religious exemptions" to their child abuse and neglect laws. These exemptions proliferated in response to the Child Abuse Prevention and Treatment Act of 1974. The act stated, "Provided, however, that a parent or guardian legitimately practicing his religious beliefs who thereby does not provide specified medical treatment for a child, for that reason alone shall not be considered a negligent parent or guardian."[20] Enacting exemptions was a condition for states to receive federal child abuse grants. More than 40 states adopted exemptions, which vary in their location within each state's code and wording.[8] Some apply to child protective services agencies' ability to intervene, and others apply to parents' criminal liability. The HHS revised its position, taking a neutral stance, when the act was reauthorized in 1983: "Nothing in this part should be construed as requiring or prohibiting a finding of negligent treatment or maltreatment when a parent practicing his or her religious beliefs does not, for that reason alone, provide medical treatment for a child."[21] After reauthorization of the act in 1987, HHS clarified that reports of medical neglect should only be made if there is harm or a substantial risk of harm, and religious exemptions should be a matter of state discretion rather than federal imposition.[18] A number of states subsequently amended or repealed their religious exemption statutes.[8,16] Most recently, after the deaths of 2 children, Oregon repealed its exemption.[22]

The AAP believes that religious exemptions to state child abuse and neglect laws should be repealed. These exemptions fail to provide an equivalent level of protection to children whose parents practice spiritual healing and children whose parents do not.[16] In addition, they may create confusion that results in harm to children; parents may be unclear about their duty to provide medical treatment, child protective services agencies may falsely believe that they cannot intervene until after a child suffers serious injury or dies, and prosecutors and courts may be uncertain whether parents are subject to criminal liability if their child dies of medical neglect.[5,16] Although the exemptions could be revised to make it explicit that seeking medical care is required when a child is seriously ill,[5,8] repeal is preferable because it provides greater clarity.[16] For example, parents and spiritual healers who are members of groups that refuse all medical treatment may not be able to differentiate moderate from severe illnesses and, therefore, fail to seek medical attention in a timely manner.[14,16]

PUBLIC FUNDING OF SPIRITUAL HEALING PRACTICES

In addition to efforts to create religious exemptions, some churches and legislators have sought to provide public funds to pay for religious or spiritual healing practices. For example, Medicare and Medicaid cover care provided at Christian Science sanatoria and other religious nonmedical health care institutions and exempt these institutions from medical oversight requirements.[23] In addition, there were unsuccessful efforts to include coverage of Christian Science practitioners in the 2009 federal health care reform bills[24] and ongoing efforts to include their services in the essential health benefits package. These efforts should be distinguished from both health care services provided by religious organizations, such as Roman Catholic and Seventh-day Adventist hospitals, and pastoral care provided as a bundled service.

Coverage for unproven care by unlicensed practitioners is poor public policy for several reasons. Fundamentally, public funds should be spent on established, effective therapies.[25] In addition, religious nonmedical health care institutions provide custodial rather than skilled nursing care, a benefit not covered in other institutions. Given patients' exemptions from undergoing medical examinations, it is not possible to determine whether patients of religious nonmedical health care institutions would otherwise qualify for benefits.[23,26] Because providing public funding for unproven alternative spiritual healing practices may be perceived as legitimating these services, parents may not believe that they have an obligation to seek medical treatment. Although the AAP recognizes the importance of addressing children's spiritual needs as part of the comprehensive care of children, it opposes public funding of religious or spiritual healing practices.

RECOMMENDATIONS

1. Pediatricians, pediatric medical subspecialists, and pediatric surgical specialists should respect families and their religious or spiritual beliefs and collaborate with them to develop treatment plans to promote their children's health.
2. Pediatricians, pediatric medical subspecialists, and pediatric surgical specialists should report

suspected cases of medical neglect to state child protective services agencies, regardless of whether the parents' decision is based on religious beliefs.

3. Pediatricians, pediatric medical subspecialists, pediatric surgical specialists, and the AAP and its chapters should work to repeal religious exemptions to child abuse and neglect laws and to prevent public payment for religious or spiritual healing practices.

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Consumption of Raw or Unpasteurized Milk and Milk Products by Pregnant Women and Children

- *Policy Statement*

POLICY STATEMENT

Consumption of Raw or Unpasteurized Milk and Milk Products by Pregnant Women and Children

COMMITTEE ON INFECTIOUS DISEASES and COMMITTEE ON NUTRITION

KEY WORDS
raw milk/milk products, unpasteurized milk/milk products, pregnant women, children

ABBREVIATIONS
AAP—American Academy of Pediatrics
FDA—Food and Drug Administration

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abstract

FREE

Sales of raw or unpasteurized milk and milk products are still legal in at least 30 states in the United States. Raw milk and milk products from cows, goats, and sheep continue to be a source of bacterial infections attributable to a number of virulent pathogens, including *Listeria monocytogenes, Campylobacter jejuni, Salmonella* species, *Brucella* species, and *Escherichia coli* 0157. These infections can occur in both healthy and immunocompromised individuals, including older adults, infants, young children, and pregnant women and their unborn fetuses, in whom life-threatening infections and fetal miscarriage can occur. Efforts to limit the sale of raw milk products have met with opposition from those who are proponents of the purported health benefits of consuming raw milk products, which contain natural or unprocessed factors not inactivated by pasteurization. However, the benefits of these natural factors have not been clearly demonstrated in evidence-based studies and, therefore, do not outweigh the risks of raw milk consumption. Substantial data suggest that pasteurized milk confers equivalent health benefits compared with raw milk, without the additional risk of bacterial infections. The purpose of this policy statement was to review the risks of raw milk consumption in the United States and to provide evidence of the risks of infectious complications associated with consumption of unpasteurized milk and milk products, especially among pregnant women, infants, and children. *Pediatrics* 2014;133:175–179

INTRODUCTION

Foodborne illness accounts for substantial morbidity and mortality in the United States. Estimates suggest that each year, as many as 48 million Americans experience foodborne illness, accounting for 128 000 hospitalizations and 3000 deaths.[1] In addition, surveillance estimates by the Centers for Disease Control and Prevention demonstrated no overall improvement in the incidence of foodborne illness in the United States from 2006 to 2009.[2] Among the most preventable of these foodborne illnesses are infections related to ingestion of raw or unpasteurized milk and milk products because of ubiquitous access to healthy, pasteurized milk and milk products, as well as legislation prohibiting the sale of raw dairy products in much of the United States. Reasons for the continued burden of disease related to raw or unpasteurized milk or milk products are primarily related to

misinformation regarding the purported benefits of these raw dairy products. Consumption of raw dairy products is especially risky among populations such as pregnant women, infants, the elderly, and immunocompromised individuals, who are most susceptible to infection with pathogens ingested in raw milk or milk products. Evidence demonstrates the overwhelming benefits to food safety conferred by pasteurization and consumption of pasteurized dairy products.

EPIDEMIOLOGY OF DISEASES CAUSED BY RAW OR UNPASTEURIZED MILK AND MILK PRODUCTS IN THE UNITED STATES

Before pasteurization of milk began in the United States in the 1920s, consumption of raw dairy products accounted for a significant proportion of foodborne illnesses among Americans and resulted in hundreds of outbreaks of tuberculosis and infections caused by bacteria, such as *Brucella abortus*, streptococcal species, and enteric pathogens.[3] Although most milk and milk products consumed today in the United States are pasteurized, an estimated 1% to 3% of all dairy products consumed are not pasteurized. From 1998 through 2009 alone, consumption of raw milk or milk products in the United States resulted in 93 illness outbreaks, 1837 illnesses, 195 hospitalizations, and 2 deaths.[4] These foodborne illnesses were caused primarily by ingestion of raw milk or milk products contaminated with *Escherichia coli* 0157, *Campylobacter* species, or *Salmonella* species. Seventy-nine percent of the outbreaks involved at least 1 person younger than 20 years.[4] In a second study, 121 dairy-associated foodborne illness outbreaks were identified in the United States from 1993 to 2006. Of these, 73 (60%) were associated with unpasteurized dairy products, resulting in 1571 cases, 202 hospitalizations, and 2 deaths; 60% of the patients were younger than 20 years. Thirteen percent of patients involved in raw milk or milk product foodborne illness outbreaks were hospitalized, compared with 1% of patients involved in outbreaks associated with pasteurized products. In addition, 55 (75%) of all 121 outbreaks occurred in 21 states that permitted the sale of unpasteurized dairy products.[5] Immigrant groups are another population at risk for illness from consumption of traditional foods made with raw milk.[6,7]

A number of pathogenic and opportunistic bacteria, parasites, and viruses (see Organisms Detected in Raw or Unpasteurized Milk or Milk Products) have been detected in raw milk or milk products.[4–22] In addition, patterns of dairy consumption appear to have affected the prevalence of illnesses associated with different dairy products. Among milk- or milk product–associated foodborne illness outbreaks reported to the Centers for Disease Control and Prevention between 1973 and 2009, 82% were attributable to raw milk or cheese. However, increasingly, recent illnesses associated with raw or unpasteurized cheese have been reported. This underscores the importance of all raw milk products as potential sources of illness.

Populations at highest risk of morbidity and mortality from foodborne illnesses include older adults, immunocompromised individuals, young infants, and children. The risks involved with infections attributable to consumption of raw milk and milk products are particularly high among pregnant women and their fetuses, as well as young children. For example, consumption of raw milk or milk products has been associated with a fivefold increase in toxoplasmosis among pregnant women[23]; listeriosis associated with high rates of stillbirths, preterm delivery, and neonatal infections, such as sepsis and meningitis[6]; and *E coli* 0157–associated diarrheal disease and hemolytic-uremic syndrome, primarily among young children.[24] Between 17% and 33% of all cases of invasive disease attributable to *Listeria monocytogenes* in the United States occur among pregnant women, unborn fetuses, or newborn infants, a 13- to 17-fold increase compared with the general population.[25–27] Complications include a 20% risk of spontaneous abortion or stillbirth, with two-thirds of infants developing neonatal infection, including pneumonia, sepsis, or meningitis.[28]

GUIDELINES FOR SALES OF RAW OR UNPASTEURIZED MILK AND MILK PRODUCTS BY THE FOOD AND DRUG ADMINISTRATION AND INDIVIDUAL STATES

The modern pasteurization process consists of raising the temperature of milk to at least 161°F for more than 15 seconds, followed by rapid cooling. Since 1924, the Food and Drug Administration (FDA) has regulated the production, handling, transportation, processing, testing, and sale of milk in all 50 states in the United States. In 1987, the FDA prohibited the interstate shipment of raw milk for human consumption, effectively banning interstate commerce of raw milk or milk products. No federal agencies, however, including the FDA, have jurisdiction in the regulation and enforcement of milk sanitation within individual states. In 2011, the National Association of State Departments of Agriculture conducted a review demonstrating that 30 states allow raw milk sales, but only a few of these allow sales in grocery stores. In addition, the 1987 FDA ban on interstate raw dairy transport allows for an exception of cheese made from raw milk, provided the cheese has been aged a minimum of 60 days and is clearly labeled as unpasteurized. However, there is evidence that *E coli* can survive in cheese products even

after a 60-day aging period,[29] and recent outbreaks of *E coli* O157 illness associated with such unpasteurized, aged cheese have been documented in Arizona, California, Colorado, and New Mexico.[30]

RISKS AND BENEFITS OF RAW VERSUS PASTEURIZED MILK AND MILK PRODUCTS

Infections associated with consumption of raw and unpasteurized milk and milk products are related to contamination with pathogenic and opportunistic organisms from a variety of sources. Contamination of raw milk occurs by a number of mechanisms, including direct contact with bovine fecal matter; transmission of organisms from bovine skin or hide; clinical or subclinical mastitis; primary bovine diseases, such as tuberculosis; environmental contamination; and contact with insects, animals, and humans, for example, by contamination from soiled clothing.

Proponents of the health benefits of raw or unpasteurized milk and milk products claim that pasteurization destroys or neutralizes important nutrients in milks, such as proteins, carbohydrates, calcium, vitamins, and enzymes.[31–33] For example, claims that consumption of raw milk is not associated with lactose intolerance and that destruction of lactase by pasteurization of milk leads to lactose intolerance have not been substantiated by independent studies.[34–37] Other claims purporting links between pasteurized milk and autism, allergic reactions, and asthma have largely been based on testimonials or anecdotes and have not been demonstrated based on scientific data. In contrast, numerous scientific analyses have demonstrated that pasteurized milk and milk products contain equivalent levels of such nutrients compared with raw, unpasteurized milk and milk products.[31–39]

RECOMMENDATIONS FROM NATIONAL AND INTERNATIONAL ORGANIZATIONS REGARDING CONSUMPTION OF RAW OR UNPASTEURIZED MILK AND MILK PRODUCTS

Virtually all national and international advisory and regulatory committees related to food safety have strongly endorsed the principles of consuming only pasteurized milk and milk products. These include the American Medical Association, the American Veterinary Medical Association, the International Association for Food Protection, the National Environmental Health Association, the FDA, and the World Health Association. In January 2012, the US federal government denied a petition requesting federal-level legalization of all raw milk sales on the basis of its analysis of the scientific basis for the food safety benefits of pasteurization.[40]

The American Academy of Pediatrics (AAP) has strongly endorsed the use of pasteurized milk in its 2012 *Red Book*.[41]

CONCLUSIONS

In summary, the AAP strongly supports the position of the FDA and other national and international associations in endorsing the consumption of only pasteurized milk and milk products for pregnant women, infants, and children. The AAP also endorses a ban on the sale of raw or unpasteurized milk and milk products throughout the United States, including the sale of certain raw milk cheeses, such as fresh cheeses, soft cheeses, and soft-ripened cheeses. This recommendation is based on the multiplicity of data regarding the burden of illness associated with consumption of raw and unpasteurized milk and milk products, especially among pregnant women, fetuses and newborn infants, and infants and young children, as well as the strong scientific evidence that pasteurization does not alter the nutritional value of milk. The AAP also encourages pediatricians to contact their state representatives to support a ban on sale of raw milk and milk products. Additional resources containing information regarding the safety of pasteurization and the risks of consuming raw or unpasteurized milk or milk products are provided in this statement.

ORGANISMS DETECTED IN RAW OR UNPASTEURIZED MILK OR MILK PRODUCTS

Bacteria

Brucella species
Campylobacter jejuni
Coxiella burnetii
Cryptosporidium species
Enterotoxigenic *Staphylococcus aureus*
Listeria monocytogenes
Mycobacterium bovis
Salmonella species
Escherichia coli
- Shiga toxin-producing *E coli* (STEC [eg, *E coli* O157])
- Enterohemorrhagic *E coli* (EHEC)
- Enterotoxigenic *E coli* (ETEC)

Shigella species
Yersinia entercolitica

Parasites

Giardia species

Viruses

Norovirus
Rabies
Vaccinia

RESOURCES

- http://www.realrawmilkfacts.com/
- www.cdc.gov/foodsafety/rawmilk/raw-milk-index.html
- http://www.fda.gov/Food/FoodborneIllnessContaminants/BuyStoreServeSafeFood/ucm277854.htm
- FDA "Grade 'A' Pasteurized Milk Ordinance." 2011 Revision: http://www.fda.gov/downloads/Food/GuidanceRegulation/UCM291757.pdf
- FoodSafety.gov "Myths About Raw Milk": www.foodsafety.gov/keep/types/milk
- www.nationaldairycouncil.org/sitecollectiondocuments/research/dairy_council_digests/2011/dcd11-1w.pdf

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Early Intervention, IDEA Part C Services, and the Medical Home: Collaboration for Best Practice and Best Outcomes

- *Clinical Report*

CLINICAL REPORT

Early Intervention, IDEA Part C Services, and the Medical Home: Collaboration for Best Practice and Best Outcomes

Richard C. Adams, MD, Carl Tapia, MD, and THE COUNCIL ON CHILDREN WITH DISABILITIES

KEY WORDS
Part C, IDEA, medical home, children with special health care needs, CSHCN, collaboration, comanagement, coaching, learning in the natural environment

ABBREVIATIONS
AAP—American Academy of Pediatrics
EI—early intervention
IDEA—Individuals With Disabilities Education Act

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abstract

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The medical home and the Individuals With Disabilities Education Act Part C Early Intervention Program share many common purposes for infants and children ages 0 to 3 years, not the least of which is a family-centered focus. Professionals in pediatric medical home practices see substantial numbers of infants and toddlers with developmental delays and/or complex chronic conditions. Economic, health, and family-focused data each underscore the critical role of timely referral for relationship-based, individualized, accessible early intervention services and the need for collaborative partnerships in care. The medical home process and Individuals With Disabilities Education Act Part C policy both support nurturing relationships and family-centered care; both offer clear value in terms of economic and health outcomes. Best practice models for early intervention services incorporate learning in the natural environment and coaching models. Proactive medical homes provide strategies for effective developmental surveillance, family-centered resources, and tools to support high-risk groups, and comanagement of infants with special health care needs, including the monitoring of services provided and outcomes achieved. *Pediatrics* 2013;132:e1073–e1088

In decades past, debate centered on the question: "does early childhood intervention work?" Time and extensive research clearly reveal an affirmative answer.[1] In the new millennium, the focus of discussion has turned to distinct conceptual matters and specific questions:

- What roles and actions are best assumed by collaborative professionals in providing a system of early intervention (EI) shared by pediatricians in the medical home and EI programs?
- What models of intervention are optimal when considering infants/toddlers, families, agencies, pediatricians, and best use of resources for optimal outcomes?
- What systematic barriers to optimal intervention are present and what supports are available to overcome them?

Given the ever-growing body of evidence demonstrating the value of EI services for infants with special needs and their families, there remains a necessity for close collaboration between the infants'

medical home and their respective Individuals With Disabilities Education Act (IDEA) Part C state programs. This clinical report, reflecting the work of diverse stakeholders (clinicians, policy makers, academicians, family members, and governmental staffs), will:

1. Review the common core components of IDEA Part C and the medical home;
2. Review evidence of the value of medical home and EI programs for infants/toddlers with special needs;
3. Provide pediatricians with information on evidence-based best-practice models for effective EI;
4. Highlight systematic barriers to identification/integration of infants in EI services; and
5. Offer resources for medical home personnel and families to support this collaboration.

CORE COMPONENTS OF IDEA PART C AND THE MEDICAL HOME

IDEA Part C Programs

For more than half a century, the field of early childhood intervention has emphasized factors impacting an infant's overall function. These encompass both biologic (epigenetic, infectious, etc) and experiential variables (quality of relationships; exposure to, or lack of, opportunities for exploration and learning).[2] The importance of these early experiences was a compelling concept in the 1975 creation of the Education for All Handicapped Children Act (Pub L No. 94-142), which provided "special education" services for children 5 to 21 years of age. Eleven years later, the law was extended and broadened to incorporate the concept of support to infants 0 to 3 years old and their families. This 0 to 3 component, now called Part C of IDEA, addressed "an urgent and substantial need" in several areas: (1) enhancing the development of infants and toddlers with special needs; (2) reducing downstream governmental costs of special education and/or institutionalization by intervening earlier; and (3) supporting the ability of families to interact with and meet the needs of the infant/toddler.[3–6]

The long-standing charge to each state's Part C program is to create and sustain a statewide, comprehensive, coordinated, family-centered, multidisciplinary, and interagency system of EI services for delivery in the local or regional area. In doing so, each state is required to establish eligibility criteria for serving, at a minimum, 2 cohorts of children: (1) those with a diagnosed physical or mental condition with a high likelihood of developmental delays; or (2) a developmental delay in 1 or more of 5 domains (cognitive, motor, communication, social/emotional, adaptive).[3,5] States may also elect to serve infants at risk for delay because of biological or environment risk factors and/or children who have been in Part C but are now eligible for preschool education (if the family desires to stay in the Part C system).

Because each state is charged with developing these eligibility criteria and is subject to legislative and budgetary constraints, notable variations in eligibility and services occur from state to state. Historically, federal monies for Part C are relatively small. Thus, states rely on systems of coordination with state, local, other public, and private funding sources, serving as payers of last resort rather than as primary payers for intervention services.

This model has demonstrated success on several levels. By 1992, 143 000 children and their families were receiving services via Part C. In 2009, that number had risen to 349 000, or 2.67% of the US population 3 years or younger. With variables related to eligibility criteria and budgets, the percentage of the 0- to 3-year-old population being served in 2009 ranged from 1.24% (Georgia) to 6.5% (Massachusetts). Despite fiscal challenges at the federal and state level, at the time of this publication, all 50 states continue to participate in the Part C program.[3,7]

The most recent reauthorization of IDEA Part C in 2004 placed increasing importance on quality measures of outcome, provision of services in the child's natural environment, and identification efforts for eligible infants ("child find"). There was also a strengthening of the relationship between EI and services being rendered in each state according to the Child Abuse Prevention and Treatment Act Reauthorization Act of 2010 (Pub L No. 111-320).[8]

Because of state-to-state variations regarding eligibility criteria, definitions of "developmental delay," and state budgetary priorities, the nature of EI services can seem heterogeneous when viewed through a national lens. Nonetheless, 2 core concepts remain stable across Part C programs across the country:

- Nurturing relationships are the fundamental elements for optimal early development; and
- IDEA Part C is dedicated to helping families better understand their infants and to coordinating the various regional systems and services available to the family and child.

The Medical Home

By definition, a "medical home" for children is a process of care. The American Academy of Pediatrics (AAP) has described the medical home as

the provision of primary care to children that is accessible, family-centered, continuous, comprehensive, coordinated, compassionate, and culturally effective. Historically, the medical home was commonly discussed in the context of children with special health care needs, but increasingly, its value has been seen across the full spectrum of infants, children, and adolescents.[9–11]

Clearly, the core components of care that define a medical home match closely those specified legislatively in IDEA Part C. As child find is mandated in Part C, there is recognition that the pediatric medical home is an integral part of that process.[11] Emerging evidence supports the medical home process regarding its value to children's ultimate development and well-being.[12–18] The Healthy People 2020 goals and those of the Patient Protection and Affordable Care Act cite the promotion of the patient-centered medical home.[19,20] When considering the intersection of EI and the medical home, a key component of the medical home process is that of identifying infants and toddlers with developmental disorders.[21–25] A natural next step is timely and appropriate referral to EI services for coordinated, culturally effective, and family-centered developmental intervention.

Over the past decade, the medical home concept has extended beyond pediatric practices into those of family/community physicians and internal medicine. A recent workforce study by the AAP described a robust pediatric workforce for the population of US children but noted a significant problem of distribution (regional shortages and oversupplies).[26] Family physicians provide a medical home opportunity for approximately one-third of the US pediatric population. Historically, these services have been in rural communities; estimates suggest up to 5 million children/adolescents live in counties with no pediatrician. Supporting both family physician medical homes and Part C agencies serving rural and/or frontier areas of the country should be a focus at both the preservice and in-service levels.[27]

As the model of the pediatric medical home has gained support over recent years, the number of recommended or expected tasks/screening procedures for the primary pediatrician has also increased.[14] Acknowledging potential time and budgetary constraints within pediatric practices, methods to streamline identification of infant developmental delays have been developed and are critical to meeting family needs and successful referral to EI services for the child.[4,28]

EVIDENCE-BASED OUTCOMES AND BEST PRACTICE CONSIDERATIONS

Over the past half century, research in the neurosciences and in child development have placed an increasing priority on the support needed in the first few years of life as brain growth and function are being shaped for future "scaffolding" of skills and knowledge. Program development and methods of program evaluation have since been generated and demonstrated to assist in this neurodevelopmental process. From this body of work have emerged several global principles related to early childhood development and intervention for optimal development.[29] Brains are built over time and are modulated by the interactive influences of genes and experience that literally affect the architecture of the developing brain.

- Access to basic medical care (prenatal and during early childhood) prevents threats to healthy development through early diagnosis/identification of problems with subsequent EI and ongoing care management.
- When parents, community programs, and professionals who provide early childhood services (including the pediatrician in the medical home) promote supportive relationships and rich learning experiences for infants and young children, a stronger foundation is created for higher achievement in school and, eventually, the community.
- The economic cost of creating and applying supportive conditions for early childhood development is less than the alternative "down the road" costs of addressing problems later in childhood or adolescence.
- From a legislative and policy perspective, a strong investment in early childhood intervention is foundational for community and economic development on multiple levels.

Although these global incentives derive from studies across various medical and nonmedical fields, it is instructive to consider, more specifically, the benefits stemming from the 2 entities being considered: the medical home and EI services for infants and toddlers.

Benefits From Participation in a Medical Home

The primary care medical home, with core attributes including being family centered; community based; and accessible, coordinated, and continuous in support, has increasingly been endorsed by the AAP and other child-oriented agencies as highly valuable.[30] The core concepts of these processes of care seem intuitive for physicians charged with providing preventive and timely care to infants/toddlers.

The benefits of a medical home in providing efficient, high-quality, comprehensive primary care are well documented. For example, the medical home has been linked to improved health status, more timely care, increased family-centeredness, improved family functioning, and more appropriate health-care utilization.[9,10,13,17,31,32] The National Survey of Early Childhood Health reports that nearly half of parents have concerns about their child's development,[33] yet few parents report that their concerns are elicited during outpatient clinic visits.[34] In addition, children at high-risk of developmental delay have been associated with lower odds of having a medical home compared with children at low or no developmental risk.[35] Thus, a growing consensus recognizes the ability of a medical home process to provide developmental health services and promote a comprehensive system of community services for early childhood development,[33,36,37] a process altogether consistent with and supportive of the core elements of EI services under IDEA Part C.

Benefits From EI

When evaluating benefits derived from early identification and intervention, there are 2 major streams for measuring outcomes: (1) benefits to the child and the family; and (2) economic advantages derived from EI programs.[38]

An increasing number of well-constructed longitudinal studies have emerged over the past decade. The indicators measured reflect positive and sustainable outcomes. The Infant Health and Development Program tracked outcomes in low birth weight and preterm infants who received EI services. At 8 years of age, improvements were noted in verbal abilities, receptive language scores, and overall cognitive performance.[39] At the 18-year follow-up, there were notable improvements in academic performance and endorsement of less risky behaviors, fewer arrests, and a lower dropout rate.[40] Other studies have generated similar positive data as long as 15 to 40 years beyond early childhood.[41,42]

Equally important to communities and agencies are the studies demonstrating the fiscal advantages of providing quality EI services. A 2003 report from the Federal Reserve Bank of Minneapolis reveals EI programs as "economic development initiatives" that should be at the top of economic lists for local and state governments. The authors found that 1 program demonstrated an $8 return for every dollar invested in EI and estimated that 80% of the benefits were directly applicable to society in general (because of more efficient use of school services and less use of criminal justice and other public systems).[43–46] In the 2008 study, The Economics of Early Childhood Policy,[47–49] Kilburn and Karoly provide the foundation for support of EI from strictly an economic perspective and conclude: "The costs savings for government could be large enough to not only repay the initial costs of the program but also to possibly generate savings to government or society as a whole multiple times greater than the costs."

The benefits reflected in these studies and other studies expand the concept of EI from one of solely a social-service/educational policy to one of critical economic-development and conservative fiscal responsibility.[50] Availability of these data should support advocacy efforts of the medical home on behalf of infants (Fig 1).

MEDICAL HOMES, EI PROGRAMS, AND BEST PRACTICE MODELS

Given the evidence-based data regarding the value of medical homes and EI services, the continuing challenge is to identify which models of intervention are consistent with best practice consensus, and which demonstrate greatest outcomes with best stewardship of professional and fiscal resources. The medical home can be essential in helping families and

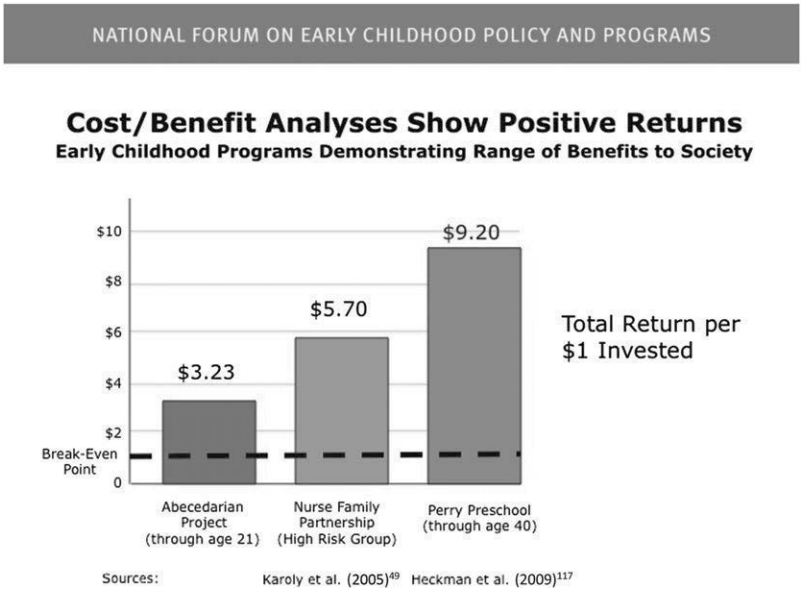

FIGURE 1
Cost/benefit analysis of benefits to society of early childhood programs. (Reprinted with permission from the Center on the Developing Child at Harvard University, www.developingchild.harvard.edu.).

diverse providers better understand the roles played by professionals involved in the infant's overall intervention program.

Two concepts are increasingly prioritized when translating evidence-based neuroscience into functional application for "best practice" provision of EI services:

1. Creating frequent opportunities that allow for "learning in the natural environment" rather than in simulated "treatment" situations; and
2. Utilizing methods of "coaching" as a model for families, medical homes, and EI programs providing services to infants.

The concept of providing intervention services within the context of a natural learning environment has been a legal and conceptual component of IDEA Part C intervention since its inception. Part C considers "natural environments" as meaning settings that are natural or typical for similarly aged and nondisabled peers. The broader concept of learning in the natural environment encompasses several key elements:

- There is base acknowledgment that learning takes place in the context of relationships, and as such, intervention strategies should enhance rather than disrupt typical activities unique to a family.
- There is endorsement of parents, siblings, extended family, and others as key agents for the infant's developmental learning.
- Thus, emphasis is on supporting those change agents and their abilities during everyday activities, rather than attempting to teach new skills outside of natural contexts.
- Focus is on function and development of personal-social skills in the infant while promoting awareness and confidence in parents to guide their infant with special needs.

Rather than a "medical model" wherein a specific treatment is applied directly to the child for a specific malady, the paradigm is shifted to a contextual and consultation-based delivery of supports and services to the family and the infant.[51,52] Similar to the concept of the medical home being a process, rather than an address, the concept of natural environment describes process rather than a physical address.[53] These concepts have been endorsed by national stakeholder organizations, including those of speech, physical, and occupational therapies.[54–56]

Increasingly, a best practice method, endorsed across diverse disciplines, provides coaching strategies to families for use in the child's natural learning environments. This method has been shown to build the capacities of a parent or other caretaker as new skills (both in the family member and the child) are acquired.[57,58] Coaching techniques to support parents are used by therapists in the natural learning environment and can be modified and applied by the pediatrician in the medical home process.[59–62] Key elements in the coaching process are shown in Table 1.

There is a more complex subset of infants who might benefit periodically from adjunctive traditional "hands-on" (direct) medical therapy. This is generally for specific goals and often for limited periods of time. These complex health care needs may include severe visual or hearing impairments, tracheotomies, and congenital malformations with inherent limitations to daily activities or needs, etc. Referrals for supportive direct services should be based on specific and measurable outcome goals. Preferably, such goals should be written in concert with the global goals of the family (also reflected in the individualized family service plan as a component of "care coordination").

Unfortunately, confusion is too often experienced by families when the infant is dually served by therapists applying direct medical therapy and professionals in the medical home and/or EI program by using transdisciplinary coaching within the natural learning environment. Unless these services are explained and

TABLE 1 Elements in the Coaching Process

Element	Examples for Application
Joint planning	Agreement by coach and parent on actions assumed by coach and subsequent opportunities for the parent to practice between coaching visits.
Observations	Consider the family's actions/practices/routines to better develop new skill sets, strategies, and ideas for use in the natural learning environment.
Action	Spontaneous or scheduled events, occurring in real-life situations, that allow the family member to practice, refine, or analyze new skills.
Reflections	The coach revisits the existing strategies to ensure they are in keeping with evidence-based practices and consider if/when modifications are needed.
Feedback	After the family member is allowed to reflect on strategies employed, actions being applied, and opportunities to practice new skills in the natural learning environment, the coach provides information affirming the parent's understanding or adds information to deepen the parent's understanding.

Modified from Rush DD, Shelden ML. *Evidence-Based Definition of Coaching Practices*. Morganton, NC: Center for the Advanced Study of Excellence in Early Childhood; 2005.[114]

closely coordinated, a mistrust of one professional or the other can develop.[57]

FOUR DEVELOPMENTALLY HIGH-RISK GROUPS COMMON TO MEDICAL HOMES AND EI PROGRAMS

Among all the children seen in the medical home, several subgroups involve particularly high risks, specific opportunities for EI services, and ongoing collaboration with the pediatrician:

Infants and Toddlers From Environments of Abuse or Neglect

Data from the US Department of Health and Human Services (2011) revealed ~825 000 substantiated cases of abuse/neglect resulting in 1770 child deaths.[63] Infants younger than 1 year remained the highest risk group for fatalities. Among children 0 to 3 years of age who are maltreated but survive, negative effects (social/emotional, cognitive, and/or physical) have been described in up to 47%.[64] Given the astounding cost of child protective services (provision of educational, judicial, and health-related services are estimated at $94 to $103 billion per year), the ability to identify and prevent conditions leading to maltreatment warrant serious consideration and action.[15]

A gap exists in the provision of EI services to maltreated infants and toddlers. Of the ~35% with a need, only 12.7% actually receive services.[65] The Child Abuse and Prevention Treatment Act of 2010 acknowledged this and sought to advance "effective practices and programs to improve activities that promote collaboration between the child protective services system and the medical community, including providers of mental health and developmental disability services, and providers of early childhood intervention services."

Social and emotional development is most vulnerable to previous maltreatment, with attachment issues, severe feeding differences, and sleep disorders being especially prominent among infants.[66] Given research evidence that (1) early brain development affects lifelong capacity to regulate emotions and learn; (2) the "active ingredient" for brain development is the quality of relationships between the infant and those providing care and nurturing; and (3) infants/toddlers exposed to persistent multiple risk factors are in need of EI as early as possible, the close, collaborative interaction of the medical home and the regional Part C program is vital to infant outcome and community cost containment.[67,68]

Infants and Toddlers With Mental Health Issues

Closely related to the issues of maltreatment, but by no means limited to this group, are infants and toddlers experiencing mental health issues (either primary to the child or among their caregivers).[69] Coexisting conditions can act as "red flags" for developing infant mental health concerns (Table 2).[70,71] Likewise, mental health issues affecting the infant/toddler can result in additional developmental delay or dysfunction.[15] As awareness of infant mental health issues increases and as more focus is placed on providing needed services for this group, the medical home and the Part C programs together remain at the forefront of identification, intervention, and surveillance over time.[72–75]

Elements of support for infant mental health include: (1) easy accessibility for diverse families; (2) a system for early identification of concerns and timely application of screening/referral; (3) provision of full access to an array of supportive resources; (4) promotion of family knowledge of conditions and of service delivery systems; and (5) ensuring family-centered care with family satisfaction as an outcome of interventions.[76,77] These elements are provided when the medical home process and the regional Part C program perform collaboratively. The focus of intervention to support infant mental health remains on the infant-caregiver relationship rather than on solely the child or adult.[78] Instruments such as the Ages and Stages, Third Edition,[79,80] the Ages and Stages: Social/Emotional screener,[81] Mental Health Screening Tool Zero to 5 Years,[82] and the AAP "Addressing Mental Health Concerns in Primary Care: A Clinician's Toolkit,"[83] among others, offer functional options for use with families.

TABLE 2 Risk Factors Potentially Impacting Infant Mental Health

Family and Associated Environmental Factors	Child Factors
Low socioeconomic status/poverty	Premature birth
Low maternal education	Low birth weight
History of domestic violence	"Difficult" temperament and/or poor "goodness of fit" with primary caregivers
Maternal/paternal depression	Exposure to "toxic stressors" (alcohol, illicit drugs, traumatic events, environmental exposures, such as lead, etc)
History of parental criminality	Cognitive dysfunction
Parental health problems	Genetic conditions with associated behavioral disorders
Parental mental health disorders	
Family history of mental health disorders	

Modified from Brauner CB, Stephens BC. Estimating the prevalence of early childhood serious emotional/behavioral disorders: challenges and recommendations. *Public Health Rep.* 2006;121(3):303–310.[70]

Infants and Toddlers From Culturally Diverse Backgrounds

Linguistic and/or cultural differences between families and professionals in the medical home or EI program create barriers to both appropriate screening and, potentially, to enrollment and provision of services. Families' beliefs and understanding of child development and differences in developmental progression reflect cultural perspectives. Their views of "community" and the child may differ from a professional's "deficit-oriented" interpretation of the child's functioning capacity.[84]

Numerous factors and variables affect the process of screening, referral, and service provision, including: socioeconomic status, religious differences, regional demographics, English proficiency or literacy, immigration status, family support systems, and access to services. When 1 or more of these potential barriers exist, the results may include families' feelings of being insulted or treated rudely, fear of the medical community in general, confusion about appointments/referrals, or being discounted in the decision process.[85–89]

The disparities noted previously can negatively affect the processes of care in the medical home and the regional Part C program.[90] Feinberg et al[91] discussed the effect of race on effective participation in EI programs. African American children with developmental delay(s) were 5 times less likely than were white children to receive EI services. Garcia and Ortiz[84] have described similar differences in the Latino population and have offered suggestions for prereferral interventions to support culturally and linguistically different populations. As medical home personnel consider quality improvement efforts, areas for consideration might include lack of awareness of racial privilege, assumptions of the value of science over spirituality (in reference to developmental differences), importance of individual over the family group, and logistics required for higher frequency interactions with the developmental or medical community[91,92] (Table 3).

Infants and Toddlers From Economically Deprived Backgrounds

Robust data from economically at-risk populations describe (1) disparities in referral and provision of services for EI and developmental support; and (2) variations in policy commitment to low-income young children and families. Some of these disparities remain at the institutional/policy level within each state (eligibility criteria, coordination efforts, etc). For example, among states with narrow EI eligibility criteria, poor children are 18% less likely to receive EI services.[93] Some are the result of barriers discussed above relative to cultural differences and to mental health issues.[94–98]

The effects of poverty and comorbid conditions, such as food insecurity, have been linked not only to health and ultimate educational performance but also to mental health and behavior in young children and their mothers.[99,100] It is critical for professionals in both medical homes and Part C programs to integrate quick and effective methods of surveillance for poverty-related issues, such as food insecurity, as a component of early childhood intervention[101] (Table 4).

TOOLS FOR THE MEDICAL HOME: MEETING THE CHALLENGES OF COLLABORATION

The medical home process is highly valued by families as they perceive "added value" benefits of more predictable care and less unplanned emergent care, especially among families of children with special needs.[12] As the value placed on the medical home continues to rise, so too are the seemingly unending expectations. But as screening procedures and protocols are encouraged, time and reimbursements remain significant limiting factors.[102,103] Thus, it is imperative that the professionals in the medical home have ready access to tools to provide efficient screening, surveillance, referral, and ongoing collaboration in support of infants/toddlers and EI services.[104]

In 2006, the AAP published a policy statement, "Identifying infants and

TABLE 3 Cultural Barriers to Medical Home Screening and Referral for EI Services

Families
Limited proficiency in English (parent and/or child); differences in speech or dialect
Limited reading skills
Acculturation level and knowledge of/comfort with agencies
Attitudes toward child development and disabilities
Conflicts: work, child care, transportation, or financial
Extended family expectations different from parents/professionals
Medical homes
Sensitivity to cultural diversity within medical home staff
Sensitivity to religious preferences and differing family traditions
Paternalistic approaches to parents of infants from different cultures
Use of medical jargon
EI programs
Lack of language-appropriate information materials
Shortage of available bilingual personnel
Inflexible scheduling practices
Sensitivity to cultural diversity among families served

Modified from Zhang C, Bennett T. Facilitating the meaningful participation of culturally and linguistically diverse families in the IFSP and IEP process. *Focus Autism Other Dev Disabil.* 2003;18(1):51–59.[115]

TABLE 4 Potential Questions for Social History in Families of Infants/Toddlers by Using the *IHELLP* Mnemonic

Area of Interest	Example Questions
Income	
General	Do you have fear of running short of money by the end of the month?
Food security	Do you or anyone in the family ever skip meals because there is not enough money for food? Do you receive assistance (food stamps, etc)?
Housing	Is housing or payment for housing a problem for you?
Associated utilities	Do you have trouble or concern about paying electric/gas/water bills?
Education and development	Do you have concerns about how your infant is developing?
Early childhood programs	Is your child in a program to assist you in supporting her development?
	Do you feel the need for such a program?
Legal status	Do you have questions about your immigration status or about benefits/services for you and your infant/toddler?
Literacy	Do you have trouble reading forms given from our office or agencies?
	Do have difficulty in reading generally?
	Do you read to your child each day? (Based on above answers)
Personal safety	Do you feel that you and your infant/toddler are safe in your present situation/relationship?
	Have you or your spouse ever been the subject of domestic violence?

Modified from Kenyon C, Sandel M, Silverstein M, Shakir A, Zuckerman B. Revisiting the social history for child health. *Pediatrics*. 2007;120(3). Available at: www.pediatrics.org/cgi/content/full/120/3/e734.[101]

young children with developmental disorders in the medical home: an algorithm for developmental surveillance and screening"[105] (http://pediatrics.aappublications.org/content/118/1/405.full.html), which offers a roadmap and valuable resources to the pediatrician seeking to identify and refer eligible infants for EI services. Since its publication, Earls et al[23] reported a longitudinal study of developmental and behavioral screening in a North Carolina project containing insightful ideas and suggestions for practical applications in practice.

King et al[24] conducted a quality improvement follow-up study on developmental screening and surveillance. Attempting to apply the algorithm suggested in the 2006 AAP policy statement, clear gains were made in identifying and referring young children to EI programs. But many practices described struggles in implementing the processes in particularly busy seasons, with staff turnover, and regarding certain time-sensitive screens. Tracking of referrals made was difficult. King et al's[24] review (http://pediatrics.aappublications.org/content/125/2/350.full.html) offers insights for other medical homes attempting to optimize identification and referrals for EI.

Marks et al[106] in 2011 published suggestions for enhancing the algorithm for developmental and behavioral surveillance in children ages 0 to 5 years (http://cpj.sagepub.com/content/50/9/853). In addition to further data supporting the use of specific screening tools, the review offers practitioners specific guidance in the following components of care:

- Eliciting and addressing parents' concerns;
- Milestone and behavioral skill monitoring;
- Identifying developmental/behavioral risk and protective factors;
- Making accurate and informed observations about child-parent interactions; and
- Child referral resources.

Three other resources available to the medical home offer guidance and efficiency in approaching at-risk infants/toddler who have potential need for EI services. The 2006 clinical report from the AAP,[107] "Clinical genetic evaluation of the child with mental retardation or developmental delays," remains a useful tool for the practitioner in which decision trees, clinical guidelines, and resources for clinical application are outlined (http://pediatrics.aappublications.org/content/117/6/2304.full.html). Michaud's[108] overview of prescribing therapy services for children with motor disabilities (http://pediatrics.aappublications.org/content/113/6/1836.full.html) and Sneed et al's[109] review of the differences in prescribing therapies and medical equipment in medical versus educational settings (http://pediatrics.aappublications.org/content/114/5/e612.full.html) are both practical and insightful guides for the busy medical home.

Once the practitioner has identified an eligible infant/toddler in need of services, the family benefits from open and effective lines of collaboration between the medical home and the Part C program. A summary of suggestions for better communication between medical homes and EI programs is provided in Table 5.[110,111] A representative sample of the numerous resources available to the medical home and to families is outlined in Table 6.

Despite the barriers and challenges inherent to practitioners and programs, there remains strong potential for collaboration between medical homes and EI programs at the policy

and programmatic levels.[89,112] Kozlowski et al[113] described an investigation comparing parents of toddlers with autism to those of children with other developmental disorders. The data, generated through the Louisiana Part C Program, described time delays between when parents first perceived differences in their children's communication styles and when referrals from physicians were made to the EI program. Collaborative model ventures such as this will continue to inform families, medical home professionals, EI service programs, and state agencies.

SUGGESTIONS FOR COLLABORATION BETWEEN THE MEDICAL HOME AND EI PROGRAMS

- Improving child-find and optimizing the referral process

Practitioners should incorporate the AAP recommendations for developmental surveillance, which allows for enhanced identification and timely referral for EI services.

The referral should set the stage for collaboration with EI programs. The AAP referral form is available (http://www.medicalhomeinfo.org/downloads/pdfs/EIReferralForm_1.pdf) and can help streamline the process, and individual states may have referral forms that are specific for the individual state Part C program. Such forms can be used in referrals to adjunctive service programs.

The referral provides an opportunity for education about appropriate developmental milestones, as well as eliciting family goals and expectations, which should inform supervision of the individualized family service plan and clinical approval for EI and other developmental services.

The medical home should incorporate a system for referral tracking. An example referral form (Appendix) provides a template to obtain family permission at the time of the referral so that EI programs can communicate the results of the initial evaluation with the medical home. Modifications for individual states/programs may be needed (Appendix).

- Efficient evaluation and coordination of services

Practitioners should not wait for a specific diagnosis before initiating an appropriate referral to EI. Early referral should request:

- assistance with multidisciplinary assessment;
- provision of support to parents in addition to the child;
- provision of knowledge about and integration with community resources; and
- a preferred mechanism for information return from the intervention program.

Various protocols are available to guide a stepwise developmental evaluation of infants and young children (see above). Included among these resources is the AAP "Caring for Children With Autism Spectrum Disorders: A Resource Toolkit for Clinicians."

As practices enhance their capacity for care coordination, consideration should be given to develop mechanisms for identifying families who need assistance with the referral process or who have complex psychosocial or medical issues. These strategies might include:

- closer follow-up;
- linkage to a care coordinator; and
- incorporation of health information technology to assist in identification, clinical decision support, and tracking.

Families should be encouraged to partner with the professionals in the medical home to recognize and monitor appropriate consultation and service options. These may include:

- monitoring of the child's progress being made related to services being purchased;
- informing families of appropriate treatment models;
- being available to programs and school systems for clarification of medical issues that affect development and learning; and
- proactively planning the transition from Part C (birth to 3 years) to Part B of IDEA, and the 3- to 5-year-old programs in their local school system.
- Advocacy roles for physicians in the medical home

TABLE 5 Ideas for Communication/Collaboration Between Medical Homes and Part C

Channels for concise bidirectional, "minimum effort" communication needs to be in place and familiar to both the medical home and the regional Part C Program. Tools such as the AAP Referral Form for Early Intervention should be deemed acceptable (with modifications as needed) and readily available (http://www.medicalhomeinfo.org/downloads/pdfs/EIReferralForm_1.pdf).[113]

Professionals at both the medical home and the Part C program need continual update in medical records as the child is seen and changes are noted.

To best sustain the process of information sharing, the individuals at each program should know who one another are and how to contact directly when needed.

Information from the medical home should be available to the Part C assessment team before its evaluation and information, and recommendations on intervention should be forwarded to the medical home as the individualized family service plan is developed and modified.

When the child is seen by subspecialists, their input to both the medical home and the Part C program is valuable.

Timely and ongoing flow of information between the medical home and the Part C program reassures the family of coordinated, family-centered care; it relieves the family of the burden of having to interpret and transport the information.

Modified from Stille CJ. Communication, comanagement, and collaborative care for children and youth with special healthcare needs. *Pediatr Ann.* 2009;38(9):498–504.[110]

TABLE 6 Resources for Medical Homes and Families

Resource	Comments
American Academy of Pediatrics www.HealthyChildren.org	At the American Academy of Pediatrics Web site. Includes developmental milestones for infants/toddlers 0–5 y of age. Information about infants born preterm and about early childhood delays in all areas, including language and social skills, is available.
Zero To Three www.zerotothree.org	Includes information and resources on a number of topics, including early development, language, and behavior.
Learn the Sign, Act Early Center for Disease Control and Prevention, The National Center on Birth Defects and Developmental Disabilities www.cdc.gov/actearly	Provides an array of checklists, fact sheets, positive parenting tip sheets, and links to useful sites for specific issues.
National Dissemination Center for Children With Disabilities http://nichcy.org/babies 1-800-695-0285	Funded by the US Office of Special Education and Rehabilitative Services. This site provides information about services in one's state and local region. Information is guided for families, medical professionals, and school personnel.
Family Voices www.familyvoices.org	Family Voices aims to achieve family-centered care for all children and youth with special health care needs and/or disabilities. The site provides families with tools to make informed decisions, advocate for improved public and private policies, build partnerships among professionals and families, and serve as a partner in the child's health care. National and state sites and organizations are available.
Child and Family WebGuide: Expert Reviewed Sites on Children and Families www.cfw.tufts.edu	The WebGuide is a directory that evaluates, describes, and provides links to hundreds of sites containing information about child development research and practical advice for professionals and families.
Your Child: Development and Behavior Resources: A Guide to Information and Support for Parents www.med.umich.edu/yourchild/index.htm	The site provides: evidence-based information for families and professionals; links to support groups, agencies, and organizations; recommended books and other tools; links to sites for "timely topics"; and a guide for families on using the Internet to find reliable parenting information.
National Association for the Education of Young Children (NAEYC) http://www.naeyc.org/	Founded in 1926, NAEYC is the world's largest organization (80 000 members) working on behalf of young children. Resources and publications for medical homes, families, and agency programs for infants and toddlers are available.

Realize state-to-state differences in eligibility criteria, assessment policies, and services provided under Part C; be aware of updated changes in aspects of service for your state.

Be aware of potential costs to the family (public funding, private insurance, private pay).

Be cognizant of resources (fiscal and professional) available within the state and their local Part C programs and support efforts to optimize services to infants/toddlers.

Maintain an updated resource list of local and regional services/resources, including both subspecialty consultants and supportive programs.

Assign time to meet with staff from local and regional programs (in office, over telephone, or through local continuing education or hospital staff meetings).

Work within AAP Chapter structures to monitor and encourage state governmental services to infants and children; interaction at the legislative and the agency levels is critical to support fiscal, policy, and quality assurances of outcomes. Fiscal considerations include both monies to operate quality programs and a system of proper reimbursements for primary physicians and specialists caring for children with special needs. Policy considerations include ensuring that families have timely access to primary and subspecialty services.

Explore opportunities to participate on statewide or regional boards tasked with oversight of the early childhood programs.

CONCLUSIONS

The positive economic effect of front-end EI services has been clearly demonstrated. Short-term and longitudinal data (even into young adulthood) demonstrate the value of early childhood intervention focusing on family-centered, coordinated services that support parent-child relationships as the core element of intervention. Likewise, the economic and health-related values (long-term) derived from being a child supported by the medical home process continue to emerge.

Seeking to enhance collaboration between the sister systems and to minimize systematic barriers is clearly in the best interest of infants, toddlers, their families, and the larger community. Such collaboration serves families in their critical roles as coaches to their children (living, playing, and growing in the infant's natural learning environment).

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Electronic Prescribing in Pediatrics: Toward Safer and More Effective Medication Management

- *Policy Statement*

POLICY STATEMENT

Electronic Prescribing in Pediatrics: Toward Safer and More Effective Medication Management

abstract

FREE

This policy statement identifies the potential value of electronic prescribing (e-prescribing) systems in improving quality and reducing harm in pediatric health care. On the basis of limited but positive pediatric data and on the basis of federal statutes that provide incentives for the use of e-prescribing systems, the American Academy of Pediatrics recommends the adoption of e-prescribing systems with pediatric functionality. The American Academy of Pediatrics also recommends a set of functions that technology vendors should provide when e-prescribing systems are used in environments in which children receive care. *Pediatrics* 2013;131:824–826

COUNCIL ON CLINICAL INFORMATION TECHNOLOGY EXECUTIVE COMMITTEE, 2011–2012

KEY WORDS

electronic prescribing, health information technology, medication, pediatrics, prescription, quality improvement

BACKGROUND

The American Academy of Pediatrics (AAP) is committed to providing the best and safest health care system possible for children.

Medication prescribing or ordering in pediatrics is an error-prone process that can lead to adverse medication events and patient harm.[1,2] Electronic prescribing (e-prescribing) is widely recognized as a component of the care process that improves quality and reduces costs by facilitating handoffs, improving clinical decision-making, and potentially improving medication adherence.

NEW INFORMATION

Prescribing error rates in children were estimated to be between 5% and 27% in a recent systematic review.[3] Prescribing errors are most prevalent with antibiotic agents but may occur even with medications that do not require weight-based dosing.[4] Medication errors in children may lead to more severe complications because of narrow therapeutic profiles and the inability of some children to communicate adverse effects. Many existing e-prescribing systems are not well designed for use in pediatric patients and lack the required features outlined in this statement. Parental health and English literacy have been shown to play important roles in the correct medication administration in children.[5,6]

From a legislative viewpoint, the past decade has been an active one for the national medication-prescribing landscape. In particular, 2 major statutes specifically addressed the goal of 100% adoption of e-prescribing through both time-dependent incentives and penalties.

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The Medicare Improvements for Patients and Providers Act (Pub L No. 110-275 [2008]) provided for incentive payments to Medicare-participating providers that use e-prescribing software to generate prescriptions. The Health Information Technology for Economic and Clinical Health Act (Pub L No. 111-5 [2009]) established a program of incentive payments for Medicare and Medicaid providers who adopt, implement, and demonstrate meaningful use of health information technology. One of the key requirements of meaningful use is to generate and transmit prescriptions electronically to the pharmacy. The meaningful use requirements also encourage the routine use of medication lists, medication allergy lists, drug–drug interaction and drug-allergy checking, and drug formulary checking.

CONCLUSIONS

E-prescribing systems can improve the quality and safety of medication administration by reducing preventable adverse drug events,[7–9] reducing dosing errors,[10] improving communication,[11,12] avoiding adverse effects,[13,14] and improving efficiency.[15] The benefits of e-prescribing systems in pediatrics can only be achieved by systems with appropriate functionality and may be hampered by poorly developed systems[16] or implementation strategies.[17] At present, many e-prescribing systems fall short of providing expert-recommended functional characteristics.[18] Specific challenges in pediatric e-prescribing include age- and indication-specific, weight-based dosing requirements, rounding based on formulary (liquid or solid), the conversion of doses from an ingredient amount to a volume for liquids, the desire to provide easily administered home doses, and, when necessary, extemporaneously compounded dosage forms. Although these systems already confer numerous advantages over the paper-based alternative, they will need to evolve to be an ideal platform for safe and effective pediatric medication prescribing. The features listed in Table 1, derived in part from previous work by the AAP,[19] will help address these challenges to safe and effective pediatric prescribing.

RECOMMENDATIONS

1. Because safety for children is paramount, e-prescribing systems used for the care of children should include, at a minimum, pediatric-specific medication catalogs; pediatric-specific decision support, such as weight-based dose calculations and individual and daily dose alerts; rounding; ingredient amount-to-volume conversions for liquid medications; metric-only labeling instructions; and pediatric drug information and formulation options. This recommendation may be implemented by sharing reports, such as the accompanying technical report,[20] with standards development organizations and the Office of the National Coordinator for Health Information Technology–Authorized Testing and Certification Bodies to encourage the inclusion of minimum requirements into the development of standards and certification criteria.
2. When possible, e-prescribing systems should be implemented as part of a robust electronic health record and include drug–drug interaction and allergy checking. When implementing a stand-alone e-prescribing system, consideration should be given to a solid design (including correct field length and standard vocabulary) and the potential future need to generate reports with, transfer data to, or interface the e-prescribing system with an electronic health record. E-prescribing systems must be

TABLE 1 Pediatric Requirements for Safe and Effective e-Prescribing

Category	Pediatric Requirements
Patient information	Date of birth or age in units more specific than years
	Weight in kilograms
	Height in centimeters
	Any history of intolerable adverse effects or allergy to medications
Medication information	Indication-based dosing and individual and daily dose alerts, using a mg/kg per day or mg/m^2 per day formula, unless inappropriate
	Weight-based dosing calculations
	All available formulations, including liquid formulations that may be specific brands
	Common formulations requiring extemporaneous compounding or combinations of active ingredients
Cognitive support	Dose-range checking (minimum and maximum amount per dose, amount per day based on weight, surface area, and total dose)
	Automatic strength-to-volume conversions for liquid medications
	Adverse effect warnings specific to pediatric populations
	Alternative therapies based on ameliorable adverse effects
	Tall Man lettering to reduce medication selection errors
	Medication-specific indications to reduce ordering of sound-alike drugs
Pharmacy information	Pharmacies that will create extemporaneous compounds
Data transmission	Use of messaging standards for data transmission to pharmacies that include the patient's weight and notes pertaining to weight-based calculations
	Transmission of strength, concentration, and dose volume labeled in metric units for liquid medications

efficient for use in pediatric offices and must integrate well with existing office workflow. Recommendation 2 may be implemented by educating providers on the required elements of pediatric-appropriate e-prescribing systems through published reports, such as the accompanying technical report.[20]

3. E-prescribing systems should be able to provide patients and their parents with administration instructions based on their level of health literacy and their preferred language. Recommendation 3 may be implemented by educating e-prescribing vendors and providers of the need for this feature.
4. Pharmacies should work to enhance their technology infrastructure and workflows to enable efficient acceptance and processing of electronic prescriptions generated and transmitted by certified health information technology. Furthermore, pharmacies should be capable of performing the dose-range checks to provide independent redundancy.
5. Private and public insurers and other third-party payers should offer financial incentives to health care providers and pharmacies to use e-prescribing systems with appropriate decision support.
6. States should work to harmonize their respective legislation to the US Drug Enforcement Agency's interim final rule on e-prescribing of controlled substances. Recommendations 4, 5, and 6 may be implemented by continued advocacy activities at the local, state, and national levels.

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ERRATA

An error occurred in this AAP Policy Statement titled "Electronic Prescribing in Pediatrics: Toward Safer and More Effective Medication Management" published in the April 2013 issue of *Pediatrics* (2013;131[4]:824–826; doi:10.1542/peds.2013-0192). The Policy Statement should have included a note that author Kevin Johnson's work was funded by the Agency for Healthcare Research and Quality.

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Electronic Prescribing in Pediatrics: Toward Safer and More Effective Medication Management

- *Technical Report*

TECHNICAL REPORT

Electronic Prescribing in Pediatrics: Toward Safer and More Effective Medication Management

abstract

FREE

This technical report discusses recent advances in electronic prescribing (e-prescribing) systems, including the evidence base supporting their limitations and potential benefits. Specifically, this report acknowledges that there are limited but positive pediatric data supporting the role of e-prescribing in mitigating medication errors, improving communication with dispensing pharmacists, and improving medication adherence. On the basis of these data and on the basis of federal statutes that provide incentives for the use of e-prescribing systems, the American Academy of Pediatrics recommends the adoption of e-prescribing systems with pediatric functionality. This report supports the accompanying policy statement from the American Academy of Pediatrics recommending the adoption of e-prescribing by pediatric health care providers. *Pediatrics* 2013;131:e1350–e1356

The US health care system has the distinction of being the world's most expensive delivery system while also having among the lowest levels of quality, as judged by many metrics, including infant mortality, life expectancy, and potential years of life lost.[1,2] More specifically, despite US leadership in establishing many standards of care that correlate with improved quality, the US health care system is able to deliver, at best, 60% of the recommended care in most practices.[3,4] Reasons for this inefficiency include the voluminous information resources to consult and the experts' parallel processing and modeling skills (including integrating considerations of the patient's other illnesses, lifestyle, and genome) required to make an optimal decision.[5] Other challenges include the health care system's existing methods of payment, which lead to fragmented care.[6] Difficult-to-resolve health disparities also occur when there are suboptimal interactions between a person's preferences, the regulatory/operational health care system, and internalized biases, stereotypes, or knowledge deficits. All of these challenges to information management affect the delivery of care.[7] For these reasons, health information technology (HIT) has become recognized as a set of tools that complement the provision of care.[8] Electronic prescribing (e-prescribing) is widely recognized as a component of the prescribing process that facilitates handoffs, improves clinical decision-making, and may improve medication adherence. E-prescribing was defined in 2008 by the Centers for Medicare and Medicaid Services as a system providing prescribers with

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KEY WORDS

health information technology, electronic prescribing, quality improvement, pediatrics, medication, prescription

ABBREVIATIONS

CBO—Congressional Budget Office
EHR—electronic health record
HIT—health information technology
HITECH—Health Information Technology for Economic and Clinical Health
MIPPA—Medicare Improvements for Patients and Providers Act

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the ability to generate and "electronically send an accurate, error-free and understandable prescription directly to a pharmacy from the point-of-care."

RATIONALE FOR ADOPTING E-PRESCRIBING

Adoption of e-prescribing has been strongly endorsed by a variety of professional societies and federal agencies for more than a decade.[9-13] The reason for almost unanimous support for e-prescribing tools is the mounting evidence in adult populations that e-prescribing can improve prescribing quality and provide better pharmacovigilance. Monitoring pharmaceuticals requires collecting, observing, researching, assessing, and evaluating data and derivative information related to safe, effective, and consistent medication use. Pharmacy data management successes reveal a path for transforming medication communication throughout the health care system. The Institute of Medicine summarized this literature in its publication *Preventing Medication Errors*[14] and recommended national mandates for this technology. There is less literature specific to pediatric populations; however, the literature that is specific to this population has been encouraging.

Quality Challenges for E-Prescribing in Pediatrics

By far, the strongest rationale for adopting e-prescribing recognizes the inherent challenges with pediatric prescribing, which are responsible for an error rate in children of between 5% and 27% in a recent systematic review.[15] Physiologic factors, such as the nearly universal need for weight or body surface area considerations in dosing, make medication ordering more prone to errors in children than in adults.[14,16,17] In addition to these physiologic factors, the therapeutic window for many drugs is smaller for children than adults. Pharmacologic factors, including age-based variability in absorption, metabolism, and excretion of drugs in children as compared with adults, as well as the age-specific contraindications of certain medications, pose special vulnerabilities to the adverse effects of overdosing. The conversion of doses from ingredient amounts to volumes for liquids labeled for home use is also problematic.[18-20] Prescribing errors are most prevalent with antibiotic agents but may occur even in medications that do not require weight-based dosing or ingredient-to-volume conversion.[21] Medication errors in children may lead to more severe complications because of the inability of children to communicate some adverse effects.

Decreased Preventable Adverse Drug Events

Adverse drug events are defined as injuries "resulting from medical intervention related to a drug" and are the leading cause of iatrogenic harm to patients.[22] The Institute of Medicine conservatively estimated that each year, more than 1.5 million preventable adverse drug events occur in the United States.[14] In an ambulatory study in adults, 25% of patients experienced 1 or more adverse drug events (27 events per 100 patients).[23] Estimates in 1995 placed the cost of drug related morbidity and mortality between $20 billion and $130 billion, with most of the cost stemming from drug-related hospital admissions.[24]

The rate of adverse drug events attributable to ambulatory drug administration has been estimated at 3% to 4% in 1 study.[25] This rate is highest in children taking multiple prescription medications.[26] Pediatric patients, although less likely to suffer harm from an adverse event, are susceptible to more types of adverse events, but the quality of the evidence is variable.[27,28] Studies evaluating e-prescribing systems reveal consistent reductions in potential adverse drug events in systems that organize and coherently report medication summaries.[29-31]

Reducing Dosing Errors

Dosing errors represent the most common medication error in pediatrics.[32] Although seemingly easy to catch, dosing error-checking is complicated by the fact that children's weights vary from as little as 500 g for micro premature infants to well over 100 kg for some obese adolescents, differing by a factor of more than 200. To illustrate the challenge, 2 patients (1 weighing 2 kg and the other 100 kg) discharged with a prescription for 5 mg/kg per day of ranitidine could receive a dose of between 10 mg and 300 mg a day and still not catch the attention of a pharmacist, because all doses between these amounts are reasonable for children, depending on their weight.

E-prescribing systems are able to present standardized dosing formulae, to use the patient's weight to calculate a dose, to convert that dose to a volume for liquids, and to present that dose in a format that is least likely to be confusing to the prescriber, pharmacist, nurse, or parent. Truly sophisticated prescribing systems use individual dose limits and total daily dose limits, compared with weight- or body surface area-based normal values.[33] Some particularly sophisticated systems write out the final dose (ie, "ten [10]") to further improve clarity and to reduce the risk of prescription tampering.[34] Finally, a recent article demonstrated the power of annotating electronic prescriptions with the actual calculation leading up to the dose.[35]

Improved Communication

After dosing errors, missing information and illegible prescriptions cause

the majority of prescribing errors in children[36] and significantly impede the ability for these errors to be caught by pharmacists or other health care providers. Illegible handwriting may be at fault for at least 20% of all errors.[26,37] Groups such as the Pediatric Pharmacy Advocacy Group, the Institute for Safe Medication Practices, and the American Society of Health System Pharmacists[38] have espoused requirements for safe pediatric prescribing, recognizing that these prescriptions should include information about the child's age, weight, and indication for therapy and should adhere to a format (eg, no trailing zero) that minimizes miscommunication. The Institute for Safe Medication Practices, the American Academy of Pediatrics, and other groups support the labeling of all prescriptions for liquid medication with volume in milliliters (mL).[39-41]

Parental health and English literacy has been shown to play an important role in the correct medication administration in children.[42,43] E-prescribing systems may provide administration instructions that are appropriate for the parents' or child's health literacy and can be provided in the patient's or her family's primary language.

Software can default or force entry of specific information. For example, a date may be automatically populated, a weight may be pulled from an existing electronic health record (EHR), and a user may be prevented from completing the prescription until essential information has been completed. Pharmacists view the net effect of e-prescribing as positive in the areas of patient safety, effectiveness of care, and efficiency of care.[44,45] In pediatrics, e-prescribing can improve communication through both improving clarity of prescriptions and providing standardized information about indications for therapy, rationales for overriding allergy alerts, and the weight-based calculations leading to a specific dose.[35] For all patients, e-prescribing systems can improve communication about provider willingness to allow generic substitution,[46-48] which, by avoiding higher copayments, can improve medication adherence.[49]

A study on prescriptions[35] demonstrated the value of including body weight and the process associated with calculating a dose. In this study, pharmacies stated that prescribing safety was improved by "showing your work" related to the cognitive processes associated with prescribing and found it especially beneficial in pediatric prescribing.

Avoiding Adverse Effects

Medication adverse effects may be related to interactions between a medication and the host (allergies or unintended effects) or may be related to other patient medications, dietary choices, or other diagnoses. These unintended consequences may be life-threatening or, more commonly, may lead to poor therapeutic adherence by children and families. Often, these consequences can be ameliorated by choosing an equally efficacious alternative therapy at the time of the initial prescription or after onset of the unintended effect. E-prescribing systems can display results of past therapy and help avoid prescribing medications that may not be tolerated. Systems that are more sophisticated warn about potential unintended effects, thereby decreasing the burden on the family and potentially having a beneficial effect on the economics of health care.[50,51]

Improving Efficiency

The process of prescribing and ensuring adherence is 1 of the most time consuming in practice settings. Both new and refilled prescriptions require attention to the 5 rights: making sure the right patient receives the right medication in the right dose, using the right route, and at the right time. E-prescribing is able to help with many of these issues by providing early warnings for duplicate therapies, contraindications for use (such as in pregnancy or for lactating mothers), and other prescribing risks mentioned previously.

As a component of an efficient practice, e-prescribing may decrease delays in renewing chronic medications or in flagging renewals as inappropriate. In pediatrics, there is an additional challenge of modifying a dose for some medication refills as the child grows, which can be facilitated by information technology. Perhaps the most pervasive way that e-prescribing can boost practice efficiency is by recognizing the distributed nature of work in the ambulatory setting. For example, a well-designed e-prescribing system might allow a refill or new prescription to be drafted by 1 provider or designee and completed by an authorized prescriber either in the office or any location by using Web-enabled information technology.[34]

E-PRESCRIBING SYSTEM FUNCTIONAL REQUIREMENTS

The theoretical benefits of e-prescribing systems in pediatrics can only be achieved by systems with appropriate functionality and may be hampered by poorly developed systems[52] or implementation strategies.[49] At present, many e-prescribing systems fall short of providing expert recommended functional characteristics.[53] These features broadly cover patient identification and data access, current medication/medication history availability, medication selection, alerts and reminders, medication information, data transmission/storage, monitoring and renewals, prescribing practice feedback, and system security/confidentiality.

The use of e-prescribing systems in children will require overcoming some unique challenges inherent in pediatrics. Paramount among these challenges is the question about the relevance and sensitivity of drug interaction or adverse-effect alerts.[54,55] The existing insensitivity results in many false-positive alerts and subsequently in override rates ranging from 89% to 91%.[25,56-58] Although few studies have been published that assess this phenomenon in children, children tend to be on fewer chronic medications and, because of generally good renal and hepatic function, may be less at risk for severe adverse reactions,[59] thereby magnifying this concern in pediatrics.

Age- and indication-specific weight-based dosing requirements, coupled with the fact that home administration may be associated with a high potential for errors,[21] place additional requirements on the pediatric e-prescribing system (dose rounding, minimum/maximum dosing checks, etc) that may not be as important for adult prescribing. E-prescribing systems need to modify both dosing guidelines and dose-screening parameters to support pediatric dosing for every indication that warrants modified dosing regimens. Furthermore, they need to support the desire to provide easily administered home doses (in mL for liquids) and, when necessary, extemporaneously compounded dosage forms. In short, these systems will need to evolve to be an ideal platform for safe and effective pediatric medication prescribing, although they already confer numerous advantages over the paper-based alternative. The features listed in Table 1, derived in part from previous work by the American Academy of Pediatrics,[16] will help address these challenges to safe and effective pediatric e-prescribing.

TABLE 1 Pediatric Requirements for Safe and Effective Electronic Prescribing

Category	Pediatric Requirements
Patient information	Date of birth or age in units more specific than years
	Weight in kg
	Height in cm
	Any history of intolerable adverse effects or allergy to medications
Medication information	Indication-based dosing and individual and daily dose alerts, using mg/kg per day or mg/m^2 per day formula, unless inappropriate
	Weight-based dosing calculations
	All available formulations, including liquid formulations that may be specific brands
	Common formulations requiring extemporaneous compounding or combinations of active ingredients
Cognitive support	Dose range checking (minimum and maximum amount per dose, amount per day based on weight, surface area, and total dose)
	Automatic strength to volume conversions for liquid medications
	Adverse-effect warnings specific to pediatric populations
	Alternative therapies based on ameliorable adverse effects
	Tall-man lettering to reduce medication selection errors
	Medication-specific indications to reduce ordering of sound-alike drugs
Pharmacy information	Pharmacies that will create extemporaneous compounds
Data transmission	Use of messaging standards for data transmission to pharmacies that include the patient's weight and notes pertaining to weight-based calculations
	Transmission of strength, concentration, and dose volume labeled in metric units for liquid medications

FEDERAL INITIATIVES TO IMPROVE E-PRESCRIBING ADOPTION

The past decade has been an active one for the national medication prescribing landscape. In particular, 2 major statutes specifically address the goal of 100% e-prescribing adoption through both time-dependent incentives and penalties. Each of these statutes will be described below.

Medicare Improvements for Patients and Providers Act

The Medicare Improvements for Patients and Providers Act (MIPPA) became law on July 15, 2008 (Pub L No. 110-275). MIPPA was designed to avert a statutory Medicare reduction in payments for physicians and implement other changes. In addition to its effect on physician fees, MIPPA addressed the chasm between literature describing improved quality of care related to e-prescribing and the current state of poor adoption (especially among health care providers caring for older and sicker populations). It addressed this chasm by incentivizing the adoption of e-prescribing by authorized prescribers. MIPPA created new financial incentives to encourage physicians who provide services to Medicare patients to adopt technology that will allow them to order prescriptions electronically. Use of this technology is meant to reduce medical errors and help physicians consider cost issues as they make prescribing decisions. Under MIPPA, beginning in 2009, physicians received a 2% increase in payments, phasing down to 0.5% in 2013. However, in 2014 and afterward, physicians who have not implemented the technology will lose 2% of their payments. The incentives and penalties under MIPPA may have less of an effect on pediatric patients, because not all pediatricians see a sufficient number of Medicare-eligible patients.

The Health Information Technology for Economic and Clinical Health Act

The Health Information Technology for Economic and Clinical Health (HITECH) Act was incorporated as part of the American Recovery and Reinvestment Act of 2009 (H.R. 1), the economic stimulus bill signed into law on February 17, 2009 (Pub L No. 111-5). The HITECH Act is intended to promote the widespread adoption of HIT to support the electronic sharing of clinical data among hospitals, physicians, and other health care stakeholders. According to a 2009 report by Surescripts (http://www.surescripts.com/downloads/npr/national-progress-report.pdf), the number of prescribers sending prescriptions electronically more than doubled from 2008 to the end of 2009 to 156 000, which corresponds to only 25% of all office-based prescribers. The same report stated that 85% of community pharmacies, as well as the 6 largest mail-order pharmacies, were able to receive electronic prescriptions. Therefore, the infrastructure for e-prescribing is nearly ready, but prescribers have not yet fully adopted this technology. The HITECH Act builds on existing federal efforts to encourage e-prescribing/HIT adoption and use. The Congressional Budget Office (CBO) estimates that Medicare and Medicaid spending under the HITECH Act will total $32.7 billion over the 2009–2019 period. CBO hypothesizes, however, that widespread HIT adoption will reduce total spending on health care. Through 2019, CBO estimates that the HITECH Act will save the Medicare and Medicaid programs a total of approximately $12.5 billion. Under current law, CBO predicts that approximately 45% of hospitals and 65% of physicians will have adopted HIT by 2019. CBO estimates that the incentive mechanisms in the HITECH Act will boost those adoption rates to approximately 70% for hospitals and 90% for physicians.

The HITECH Act provides financial incentives for HIT use among health care practitioners. It establishes several grant programs to provide funding for investing in HIT infrastructure, purchasing certified EHRs, training, and the dissemination of best practices. E-prescribing functionality is a required component of these EHRs. Important to pediatricians, the legislation further authorizes a 100% federal match for payments to certain qualifying Medicaid service providers who acquire and use certified EHR technology.

E-Prescribing of Controlled Substances

In March 2010, the US Drug Enforcement Agency published the interim final rule on e-prescribing of controlled substances. Before the interim final rule, controlled substances were excluded from e-prescribing through a prohibition by the Drug Enforcement Agency. Even though this ruling will close the gap in e-prescribing, the rules require recertification of systems by outside auditors, new credentialing and auditing processes for prescribers, and a new level of authentication by prescribers before prescriptions are able to be routed electronically. Physicians must apply to federally approved credential service providers or certification authorities to verify their identity and obtain the necessary credentials to engage in e-prescribing of controlled substances. Once a provider is authorized by a third person in the practice to prescribe controlled substances, providers must provide 2 modes of identification, including a user identification/password, a token (like a smart card), or a biometric factor (like a thumbprint) (http://www.deadiversion.usdoj.gov/fed_regs/rules/2010/fr0331.htm). Because of the complexity required to prevent drug diversion (forgeries), vendor compliance and provider adoption is expected to take 1 to 2 years.

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ERRATA

An error occurred in this AAP Technical Report titled "Electronic Prescribing in Pediatrics: Toward Safer and More Effective Medication Management" published in the April 2013 issue of *Pediatrics* (2013;131[4]:e1350–e1356; originally published online March 25, 2013; doi:10.1542/peds.2013-0193). The Technical Report should have included a note that author Kevin Johnson's work was funded by the Agency for Healthcare Research and Quality.

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Enhancing Pediatric Workforce Diversity and Providing Culturally Effective Pediatric Care: Implications for Practice, Education, and Policy Making

- *Policy Statement*

POLICY STATEMENT

Enhancing Pediatric Workforce Diversity and Providing Culturally Effective Pediatric Care: Implications for Practice, Education, and Policy Making

COMMITTEE ON PEDIATRIC WORKFORCE

KEY WORDS
pediatrician, workforce, diversity, health disparities, culturally effective care, education

ABBREVIATIONS
AAP—American Academy of Pediatrics
CEHC—culturally effective health care
CME—continuing medical education
LGBT—lesbian, gay, bisexual, and transgender
URM—underrepresented in medicine

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abstract

FREE

This policy statement serves to combine and update 2 previously independent but overlapping statements from the American Academy of Pediatrics (AAP) on culturally effective health care (CEHC) and workforce diversity. The AAP has long recognized that with the ever-increasing diversity of the pediatric population in the United States, the health of all children depends on the ability of all pediatricians to practice culturally effective care. CEHC can be defined as the delivery of care within the context of appropriate physician knowledge, understanding, and appreciation of all cultural distinctions, leading to optimal health outcomes. The AAP believes that CEHC is a critical social value and that the knowledge and skills necessary for providing CEHC can be taught and acquired through focused curricula across the spectrum of lifelong learning.

This statement also addresses workforce diversity, health disparities, and affirmative action. The discussion of diversity is broadened to include not only race, ethnicity, and language but also cultural attributes such as gender, religious beliefs, sexual orientation, and disability, which may affect the quality of health care. The AAP believes that efforts must be supported through health policy and advocacy initiatives to promote the delivery of CEHC and to overcome educational, organizational, and other barriers to improving workforce diversity. *Pediatrics* 2013;132:e1105–e1116

INTRODUCTION

This policy statement serves to combine and update 2 previous statements from the American Academy of Pediatrics (AAP) on culturally effective health care (CEHC)[1] and workforce diversity.[2] The impetus to combine these independent policy statements comes from the recognition that the provision of culturally effective care and enhancing the diversity of the pediatrician workforce represent parallel and often overlapping initiatives to improve care for pediatric patients. This policy statement provides guidance for policy makers, advocacy groups, medical educators, and physicians on the provision of CEHC and enhancing the diversity of the pediatrician workforce.

CEHC can be defined as the delivery of care within the context of appropriate physician knowledge, understanding, and appreciation of all cultural distinctions, leading to optimal health outcomes, quality of life,

and family satisfaction.[1] For the purposes of this policy statement, the term "culture" is used to signify the full spectrum of values, behaviors, customs, language, race, ethnicity, gender, sexual orientation, religious beliefs, disabilities, and other distinct attributes of population groups. The AAP believes that "culturally effective care" is a more inclusive term than "cultural competence" because it encompasses the values of competence and, more important, focuses on the outcomes of the physician-patient or physician-family interaction.

The AAP has a distinguished history of promoting diversity within the pediatrician workforce. Of particular note is the 1994 *Report of the AAP Task Force on Minority Children's Access to Pediatric Care*,[3] which promulgated 66 recommendations covering a wide range of topics, from the health status of minority children, to barriers to accessing pediatric care, to workforce needs. Racial and ethnic diversity was also a major issue addressed by the report of the Task Force on the Future of Pediatric Education II,[4] which called for increases in the percentage of underrepresented in medicine (URM) pediatricians in practice and academic medicine to meet the needs of the ever-growing population of children from racial/ethnic minority groups.

Over the past decade, the discussion of patient diversity by the medical community has increasingly expanded beyond the traditional attributes of race and ethnicity to include cultural characteristics such as language, race, ethnicity, ancestry, national origin, immigration status, religion, age, marital status, gender, sexual orientation, gender identity or expression, and disability.[5] A broader and more inclusive definition of patient diversity consequently requires an expansion of diversity beyond race and ethnicity within the pediatrician workforce as well. The AAP believes that it has an important leading role in applying this expanded definition of patient diversity to improve the provision of CEHC for all populations.

This statement makes the case for a diverse pediatrician workforce; explores the impact that patient attributes have on their health care; investigates CEHC education and training; and addresses health policy and implementation. These issues are complex and nuanced, and a forceful commitment from an educated leadership will be needed to fully achieve the statement's recommendations.

CASE FOR A DIVERSE WORKFORCE

The Association of American Medical Colleges' description of URM encompasses "those racial and ethnic populations that are underrepresented in the medical profession relative to their numbers in the general population."[6] URM groups in the United States currently include black and African American, American Indian and Alaska Native, Native Hawaiian and other Pacific Islander, Hispanic and Latino, as well as any Asian other than Chinese, Filipino, Japanese, Korean, Asian Indian, Thai, or Vietnamese/Southeast Asian.[7] Some of the most compelling evidence in support of increased workforce diversity is that physicians from URM groups disproportionately practice in underserved communities and treat a greater number of underrepresented minority, Medicaid, and uninsured patients.[5,8–10] Whatever the reason for these practice patterns, the contributions of the minority physician workforce to the care of these groups of patients are therefore significant.

Numerous studies have demonstrated that minority patients suffer from significant health disparities and experience more barriers to accessing health care services than do other nonminority patients, but access to care for minority patients is improved when the physician and the patient are racially or ethnically consentient.[5,11,12] Such congruence between patient and physician is, however, relatively infrequent.[12] This is perhaps why a 2006 study by the Health Resources and Services Administration noted that "although studies in our review suggested that interpersonal care was on balance better in race concordant patient-practitioner relationships, and that patients tended to prefer practitioners of their own race, these findings did not apply to all patients and practitioners."[13]

A study examining patient-physician social concordance using 4 social characteristics (race, gender, age, and education) showed that lower patient-physician social correspondence was associated with less favorable patient perceptions of care and lower global satisfaction ratings; conversely, stepwise patient-physician similarities were shown to improve patient perceptions of care in an additive fashion.[14] A large study looking at patient-physician congruence in adult patients with diabetes mellitus who were at high risk of cardiovascular disease concluded that African American patients who received treatment from African American physicians were significantly more adherent to taking their medications and that Spanish-speaking patients were significantly more adherent to taking their medications when their physicians were linguistically concordant.[15] Consequently, there is an ongoing need to increase racial and ethnic diversity among the pediatrician workforce in part because minority pediatricians continue to be more likely to provide care to minority children and their families in a disproportionate manner.[2]

PATIENT ATTRIBUTES AND IMPACT ON HEALTH CARE

Data from the US Census Bureau project that by 2020, 44.5% of American

children 0 to 19 years of age will belong to a racial or ethnic minority group.[16] Consideration of cultural attributes in addition to race and ethnicity would greatly increase this projection of diversity. For example, in 2010, there were 646 000 same-sex unmarried couple households in the United States, and a number of these households reported having children.[17] Data from 2008 indicate that 23% of US citizens were living in rural locations, 12% of US citizens who were living outside of residential facilities or nursing homes had a disability, and 4% identified themselves as lesbian, gay, bisexual, or transgender.[18]

According to the US Census Bureau, approximately 20% of the US population older than 5 years speaks a language other than English at home. Although the majority of these people report that they also speak English well, it is estimated that approximately 24.5 million people in the United States need some assistance with English. Approximately 62% of these people speak Spanish at home.[19]

Census data confirm the growing numbers of foreign-born immigrants residing in the United States. The US Census Bureau uses this term to refer to anyone who is not a US citizen at birth. This includes naturalized US citizens, lawful permanent residents (immigrants), temporary migrants (such as foreign students), humanitarian migrants (such as refugees and asylees), and persons illegally present in the United States.[16,20] However, obtaining accurate estimates of numbers of US foreign-born immigrants is difficult because of respondents' concerns regarding potential legal difficulties arising from participating in census activities. In addition, census data may not accurately provide information on migrant workers' children and the growing numbers of homeless children.

The pool of foreign-born immigrant children includes both legal and undocumented children as well as international adoptees. Foreign-born immigrant children often face multiple challenges, including language barriers, and in addition to the common illnesses typical of other US children, they may suffer from other diseases rarely diagnosed in the United States. Furthermore, the diversity of the US foreign-born immigrant population, manifested even in individuals from the same country of origin, is such that health needs and health literacy are extremely varied, making the delivery of care for this population still more challenging. Homeless children face higher rates of trauma-related injuries, developmental delays, neurologic problems, and asthma, among other conditions.[21] Migrant workers' children face similar health and linguistic challenges and, because of unstable living conditions, poverty, and other social constraints, are often unable to access comprehensive health care.[21]

Significant and pervasive racial and ethnic health and health care inequities persist among children with chronic health conditions, such as attention-deficit/hyperactivity disorder, asthma, autism spectrum disorder, Down syndrome, cerebral palsy, cystic fibrosis, diabetes, sickle cell anemia, obesity, traumatic brain injury, and HIV/AIDS.[22] Black and Hispanic parents of children with special health care needs report higher dissatisfaction with care and more difficulties navigating services for their children compared with their white counterparts.[23] Although *Healthy People 2020* has listed "cultural sensitivity in health care provision" as 1 of 7 key determinants of health under the heading of health disparities,[18] addressing disparities in cultural attributes and attitudes between physicians and their patients, patients' families, and/or guardians requires educational interventions to ensure that pediatricians and other health care professionals are able to provide CEHC to a diverse patient population.[24] To better understand and overcome long-standing and minimally improving health care disparities, the Institute of Medicine in 2009 formed a Subcommittee on Standardized Collection of Race/Ethnicity Data for Healthcare Quality Improvement.[25]

Certain patient populations and communities suffer from poorer health compared with other populations. Reliable data have shown that patients who belong to racial, ethnic, linguistic, or other minority groups tend to have greater morbidity than do white, English-speaking patients.[12,26–32] Research has shown that early life events influence one's health over an entire lifetime and that there is a stepwise health gradient that is defined distinctly by socioeconomic status.[33,34] *Healthy People 2020* has outlined much broader examples of health disparities beyond race and ethnicity, with disparate health outcomes noted to be associated with gender, sexual identity and orientation, age, disability, socioeconomic status, and geographic location.[18] Although some studies have suggested that, compared with heterosexual people, lesbian, gay, bisexual, and transgender (LGBT)*[35] people face greater mental health challenges,[36] other studies have not found such mental health differences but instead simply disparities in accessing routine health care services.[37,38] LGBT patients may be reticent

*Some support groups, community organizations, and researchers are now using the acronym LGBTQ or GLBTQ instead of LGBT. The "Q" may represent questioning or queer (in a nonpejorative way) and includes individuals who are uncertain of their sexual orientation but may still be considered a sexual minority or who self-identify as queer. However, according to the Gay & Lesbian Alliance Against Defamation, the use of the term "queer" is not universally accepted within the LGBT community, and care should be taken to avoid its use unless quoting or describing someone who self-identifies as queer.

to disclose their sexual or gender identity in a medical encounter for fear of being judged and also may believe that their physician is unfamiliar with LGBT health concerns.[39] LGBT youth face additional challenges as they navigate middle school and high school, where they may experience varying degrees of harassment, discrimination, exclusion, and isolation,[40] which may lead to increased depressive symptomatology as well as increased risk of suicidal ideation and self-harm compared with their heterosexual peers.[41,42]

CEHC: EDUCATION AND TRAINING

The AAP maintains that CEHC should be promoted through health policy and education at all levels, from premedical education and medical school through residency training and continuing medical education (CME). This task is complex; multiple languages and dialects must be addressed, requiring significant resources ranging from translation services to community linkages as well as commitment from both the learner and the educator. Nevertheless, the AAP maintains that at every level of education, pediatricians must be able to interact effectively and respectfully with patients and their families regardless of the cultural differences that may exist between them. These educational efforts should enhance the knowledge and understanding of pediatricians and other child health care professionals about the cultures of their patients and their families and increase their ability to provide care in a manner that is responsive to the individual needs of each patient. Educational programs must focus on the enhancement of interpersonal and communication skills, which are essential to nurturing the pediatrician-patient or pediatrician-family relationship and optimizing the health status of patients.

In addition, programs to enhance student, trainee, and physician awareness about their own preconceptions and cultural attributes will likely translate into more open communication with and greater appreciation of the cultural backgrounds of all patients.[43] Educational programs such as those developed through the National Center for Cultural Competence can be effective in training of students, house officers, and faculty.[44]

The literature pertaining to teaching multicultural issues to medical students is robust. Many medical educators believe that training physicians to provide CEHC should begin earlier, as part of undergraduate premedical curricula. Some medical educators have suggested that these educational endeavors should focus less on individual attitudes and the characteristics of minority groups and more on discussions pertaining to social barriers and inequities at the institutional or systems level.[45,46] Others have raised concerns about the model of addressing multiculturalism and cultural competence through lectures and occasional workshops and have argued for the incorporation of these topics as a continuum throughout medical school. Some medical schools, in an effort to better integrate these skills, have opted to identify space for these activities within existing courses on patient-physician relationships and medical interviewing and develop "thoughtfully prepared instructional material throughout the four-year curriculum."[46,47] Efforts to weave CEHC education into core pediatric clerkships in the third year of medical school have demonstrated success in increasing knowledge, enhancing attitudes, and improving clinical skills.[48]

Medical schools should choose to focus at least some of their recruitment efforts on encouraging students from underserved areas, including rural locations, to apply, and should also consider proficiency in a second language an asset in evaluating prospective medical students. Educational endeavors that merit institutional and program support are instructional sessions for students and residents on how to use to their best advantage (and how to evaluate) professional medical interpreters and translation services. At a minimum, medical school curricula and pediatric residency education programs should include educational components that elucidate the impact of low English proficiency, low literacy, and low health literacy on pediatric health care and offer strategies for remediating these problems. Furthermore, increasing the number of bilingual educational opportunities in the US at all educational levels would increase the likelihood that future physicians would be more likely to speak the same language as their patients.

Program requirements for residency education in pediatrics developed by the Pediatric Residency Review Committee call for structured educational experiences that prepare residents for the role of child health advocate within the community and inclusion of the multicultural dimensions of health care in the curriculum.[49] The Residency Review and Redesign in Pediatrics (R^3P) Committee of the American Board of Pediatrics recognizes that there is a need for some flexibility in training to allow for a variety of career choices, acknowledging that residency education is merely a segment of an educational continuum that starts in medical school and is sustained throughout the years of clinical practice.[50] Immersion experiences for pediatric trainees have used community-academic partnerships to move CEHC training into underserved communities, enhancing educational experiences and creating classrooms without walls.[51,52] A curriculum designed to foster cultural humility asks physicians to engage in self-reflection and self-critique as lifelong learners and requires the physician to

bring humility to the power balance in the physician-patient relationship.[53] This curriculum, piloted by 1 family practice program, resulted in increased patient engagement during the office visits as well as high levels of satisfaction reported by participating residents.[54] Such a curriculum could be adapted for appropriate pediatric resident outpatient practices.

Beyond residency training, pediatricians and other child health care professionals can benefit from CME to enhance the provision of CEHC. The AAP regularly incorporates CEHC into its CME programming. Other resources exist that may be helpful in identifying important components for educational activities. For example, the Culturally Effective Care Toolkit on the AAP Web site can provide guidance and resources for enhancing CEHC in practice.[55]

Educational programs may include a component that allows individual participants to analyze personal beliefs and values. Programs may focus on the communication aspects of providing CEHC by exploring how assumptions and stereotypes influence interactions between physicians and patients or their families, as well as between physicians and other clinicians. Because people are influenced by their own personal experiences and may or may not subscribe to group-assumed norms, people who share the same cultural background may think and act differently. For this reason, it is important that programs intended to address the cultural values and practices of specific groups not perpetuate stereotypes. Physicians must also be aware that the culture of medicine itself promotes certain attitudes and biases that may interfere at times with the physician-patient or physician-parent relationship.

Culture is not static; changes can and do occur over time. An appreciation of cultural change and the significance of intracultural diversity (variation among individuals within the same culture) can help to prevent cultural stereotyping.[56] Programs aimed at enhancing the provision of CEHC should be tailored to the demographics of the pediatric population or community where the pediatrician serves.

CEHC: BARRIERS AND OPPORTUNITIES

Cultural variations in verbal and nonverbal communication can be a major barrier to effective pediatric care. Although the role of culturally linked behaviors that may influence the physician-patient interaction, including eye contact, body language, and communication styles, has not been fully explored,[57] language barriers have been shown to have a major effect on health care. Parents and their children in the United States increasingly speak a language other than English at home and/or have limited English proficiency. When the pediatrician and his or her patient and the patient's family do not speak the same language with fluency, there is a potential for problems to occur, such as obtaining an inaccurate history, misunderstanding of therapies, and/or deferred medical visits.[58,59]

Pediatricians continue to struggle with recommendations to use trained interpreters and provision of appropriate language services.[60] These barriers could be addressed through the use of certified medical interpreters (or bilingual pediatricians and other pediatric health care professionals) to meet the needs of pediatric patients whose parents are not proficient enough in English to interact with members of the health care system.[61] These services, however, remain beyond the reach of many pediatricians because of their cost. In 2009, Medicaid or State Children's Health Insurance Programs in only 13 states and the District of Columbia provided reimbursement for language services, and many insurance carriers do not reimburse for such services because they expect medical practices to absorb the cost as part of their overall business expense.[62] Despite the difficulties associated with identifying and accessing appropriate language services, however, the AAP opposes the use of children and adolescents as medical interpreters for their parents and family members.

Another facet of the relationship between language and CEHC is health literacy. The Institute of Medicine defined health literacy as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions."[63] Although this is a particular problem for individuals with low or marginal literacy skills, health literacy can also affect patients and families with adequate language literacy. Many individuals, even those with high health literacy and for whom English is their native language, find the complex wording of insurance statements, benefits coverage, hospital admissions forms, prescription drug information sheets, and similar documents to be confusing. Low health literacy for pediatric patients and their families, similar to limited English proficiency, is a barrier to the provision of optimal pediatric health care. Whereas health literacy may not be a distinct cultural attribute, language and health literacy are greatly affected by cultural distinctions and, if low, directly contribute to unfavorable patient outcomes. A provision in the Patient Protection and Affordable Care Act of 2010 now requires that any summary of benefits and coverage be presented "in a culturally and linguistically appropriate manner."[64] Commonsense innovations such as these may alleviate some of the challenging implications of low health literacy across the patient population.

At the level of the individual pediatrician, CEHC requires acquisition of knowledge, development of skills, and demonstration of behaviors and attitudes that are appropriate to care for patients and families with a wide variety of cultural attributes. Physician demographics, gender, and religious beliefs are but a few of the factors that influence (often subconsciously) medical recommendations for patients from all backgrounds.[43] As such, physician self-reflection, self-knowledge, and self-critique have been identified as critical components of competence, which can be expanded further to encompass the concept of cultural humility. Practiced over time, these specific skills, in addition to conscious realignment of inherent imbalances in power that often undermine provider-patient communications and fostering of mutually respectful and dynamic partnerships within the community in which one practices, form the foundation for practicing with cultural humility.[53] Although using these knowledge bases, skills, behaviors, and attitudes is commonly referred to as cultural competence and cultural sensitivity, these terms focus on process. CEHC focuses on outcomes and emphasizes the need for continued monitoring and documentation.

Clearly, reasons for health disparities are numerous and may also include patients' cultural beliefs about health care and healing, dietary deficiencies, insufficient exercise, barriers to access to health care resources, financial indigence, inadequate insurance coverage, and inability to communicate with English-speaking physicians and other health care professionals. Trying to communicate effectively with parents who are deaf or hard of hearing also can pose significant barriers and may lead to suboptimal health care even when the child/patient is able to hear; this may direct the pediatrician to seek creative solutions to provide family-centered care.[65] One study evaluated 3 community-based, culturally and linguistically sensitive initiatives that demonstrated that it is possible to reduce or eliminate racial/ethnic disparities in the child health arena by engaging patients and reinforcing participant collaboration.[66] A paper on quality improvement initiatives highlighted how a patient-centered medical home serves to reduce disparities and demonstrated that family involvement and partnering with others in the community not directly involved in patient care are key components of a successful program.[67] The National Committee for Quality Assurance's Patient-Centered Medical Home 2011 Standards ask practices to assess the language needs and characteristics of their patient populations; the standards also expect practice-based care teams to be trained on effective patient communication, particularly with vulnerable populations.[68] The growing number of practices achieving Patient-Centered Medical Home recognition translates into a greater number of pediatricians who understand and appreciate the importance of CEHC.

Pediatricians should become knowledgeable about the resources available to their patients and families within their institutions (offices, hospitals), health maintenance organizations, and communities. Pediatricians who seek out opportunities to partner with institutions, such as third-party payers, hospitals, health departments, and education departments, will be better able to advocate for the specific cultural needs of their patients and thereby increase patient satisfaction and quality of health care.

WORKFORCE DIVERSITY: BARRIERS AND OPPORTUNITIES

The ethnic and racial gap between pediatricians (as well as other physicians) and their patients persists despite efforts to increase the diversity of the pediatrician workforce. Data from the AAP Annual Survey of Graduating Residents show that the percentage of underrepresented minorities (African American, Hispanic, and Native American) who graduated from US medical schools increased from 9% in 2003 to 15% in 2009, but this increase but was not statistically significant. Approximately a third of graduating residents report having grown up in a bilingual or multilingual family (34% in 2009; 29% in 2010).[69] Although these levels of URM pediatric trainees are encouraging, the percentages are far below the current estimates of the pediatric population, and these trends are unlikely to change drastically in the near future. Also, unlike most other medical specialties (except perhaps obstetrics and gynecology), the numbers of women entering pediatric training continue to increase and currently exceed the numbers of men in pediatric training.[70] Over time, it will be important to evaluate how this trend affects the availability of male pediatricians to treat patients who have this preference, which could, among other factors, be influenced by patient gender and specific cultural norms.

Literature in support of the Supreme Court decisions related to the University of Michigan's affirmative action policies has strongly stated the case for diversity at all levels of medical education. A more diverse faculty and student body is viewed as an indispensable component of quality medical education. Nevertheless, gains in enhancing diversity may be derailed by legislative actions, such as the passage of proposition 209 in 1996 in the state of California, which eliminated race-conscious admissions at public institutions. Since then, there has been a decline in the percentage of in-state minority students accepted

to and matriculating in California medical schools, with no appreciable rebound over time.[71] Institutional diversity will increase the cultural exposure of all faculty and students, which will help to dispel stereotypes and improve cultural competence by virtue of everyday interactions. A more diverse workforce will likely lead to a more diverse medical research agenda for improving health and the delivery of health care services among racial, ethnic, and cultural minority patients. Creating such a workforce, it is argued, begins with the diversity of those admitted to doctor of medicine and doctor of philosophy educational programs. Indeed, in a modern multicultural society, promoting diversity within the medical profession to better reflect the diversity of the patient population while maintaining the high quality of the health care workforce is in keeping with the societal obligation of medical schools to produce well-trained professionals to meet the future health care needs of the country.[8,13,72] The Association of American Medical Colleges published its flagship statement in 2008 to serve as a tool for medical schools for the development of diversity-related policies and, in doing so, implored those in academic medicine to be "serious about creating and sustaining diversity in medical education, biomedical research, and the physician workforce."[73]

Financial incentives to encourage URM students to enter medical training continue to grow nationally through organizations such as the National Institute on Minority Health and Health Disparities, and through state and regional programs. These incentives, including loan forgiveness/repayment and tuition reimbursement, may help to address many financial barriers such as low family income and educational debt. Institutional programs, such as the Center of Excellence in Diversity at Stanford University, reach out to promising premedical students to help prepare them for careers in medicine.[74] Diversity programs, along with educational institutions, acknowledge the importance of minority faculty concomitantly serving as mentors to minority students, serving on admissions committees, overseeing diversity initiatives, and serving in leadership positions at all levels. To support all of these activities, there must be a simultaneous commitment to increase diversity at the highest organizational and institutional levels.

Another approach to increasing the recruitment of minority students into the health professions is to focus on reaching out to individuals in earlier educational stages, such as elementary and high school. To maximize the effectiveness of these programs, appropriate support structures for these individuals within their communities, schools, postsecondary institutions, health care organizations, medical societies, and other entities need to be established. These support structures include financial incentives, mentoring and shadowing programs, adequate staffing for diversity programs, and educational and other initiatives related to cultural effectiveness and diversity. Holistic review of college and medical school applications may further bolster the numbers of URM students admitted to institutions of higher learning. Giving weight not only to the applicant's academic credentials but also to leadership potential, ability to work within a team, and interpersonal and communications skills, while taking into account personal circumstances, may provide more opportunities for outstanding students with essential nonacademic qualifications to succeed. There is clearly a need to pursue active recruitment of minority candidates for health-professions education programs. To increase the small number of minority individuals entering pediatrics without negatively affecting the number entering other specialties, the total number of minority individuals entering medical school must first be increased.

Workforce diversity and CEHC may also be enhanced by increasing minority representation in hospital governance and leadership positions, which can heighten the institution's efforts to reduce health care disparities and promote diversity in management and leadership. For example, minorities comprise 29% of the patient population nationally, yet they represent only 14% of hospital board members, 14% of executive leadership positions, and 15% of first- and mid-level management positions.[75] Such data illustrate an opportunity to foster programs that promote minority representation in hospital decision-making roles.

HEALTH POLICY AND IMPLEMENTATION

Although mandates from government agencies and regulatory bodies have served as important policy leverage or motivation to promote the provision of CEHC, these mandates have been largely unfunded, implying that academic institutions, hospitals, pediatricians, and other physicians must defray the costs of their implementation.[76] Decreasing payment to physician practices for clinical care and decreasing hospital operating margins have rendered these mandates largely impractical. Additionally, financial and other incentives from insurers, government agencies, and other payers to reward physicians and hospitals for delivering CEHC have been meager and, hence, have not supplied the impetus and support to encourage fundamental systemic changes, which are often costly.

In an era when cost containment is an urgent priority for the health care

community, research plays a pivotal role in changing the societal value of CEHC. The AAP regards CEHC as vital and a critical social value. However, many health care payers, employers, institutions, and others fear exacerbating current financial pressures and hardship when trying to provide such care. Many estimates of costs associated with poor child health do not take into account lifetime costs resulting from loss of productivity and earning potential; those who would contend that improving eligibility for health insurance will adequately address child health disparities need also to consider barriers such as insurance enrollment and access to care while recognizing the burden of certain chronic health conditions that disproportionately impact underserved children.[77] Reliable and timely data to demonstrate long-term decreases in health care costs, appropriate use of health care services, and improved patient health outcome measures would provide a solid foundation for addressing valid concerns about the financial implications of providing CEHC. To this end, culturally effective knowledge and skills need to be applied to research development and implementation. From a quality-of-care perspective, moreover, this research would allow policy makers to identify at-risk patient populations and to develop strategies to address health disparities on national, regional, state, and local levels.

Although Medicaid and other public insurers are placing increased emphasis on "cultural competence" and quality care,[78] few tools exist for health care payers to measure the outcomes of processes implemented to ensure CEHC. The use of patient-satisfaction scoring systems that assess shared decision-making, mutual respect, trust, and other culturally sensitive parameters should be encouraged. Survey instruments should use quality measures that are within the scope of responsibility of the health care professional, and the results of these surveys should be used to identify priorities for continuing education. When carefully designed to reflect the health and wellness values of the specific community being surveyed, such outcomes-driven efforts will allow greater focus on the effectiveness of interventions designed to monitor and ensure quality care.

Sponsors of diversity initiatives must likewise be able to track their progress in reaching specific targets and goals through research and data-driven outcome measures. For instance, institutional goals and metrics that are established for the purpose of recruiting and retaining minority trainees and faculty could be used to assess effectiveness. It is difficult to improve what we cannot measure. Limited data on cultural minorities in medicine hamper the ability of the profession to evaluate the current status of diversity, implement activities to enhance it, and measure the outcomes of these activities. The AAP has begun to address this concern by compiling more data regarding better tracking of attributes other than race and ethnicity through research generated by its Annual Survey of Graduating Residents, its new Pediatrician Life and Career Experience Study, its membership surveys, and collaborations with external organizations. However, more must be done to measure progress in improving diversity within medicine and pediatrics.

CONCLUSIONS

Since adoption of the *Report of the AAP Task Force on Minority Children's Access to Pediatric Care*,[3] the AAP has strengthened its commitment to ensure that all infants, children, adolescents, and young adults have access to optimal CEHC, ideally through a medical home.[80] Additionally, the AAP acknowledges that CEHC is multifaceted, complex, and often costly. The AAP believes that the education of pediatricians about cultural attributes and about the importance of implementing culturally effective practices and policies is essential. Because pediatricians are committed to lifelong learning, education that will enhance the provision of such care must be available at all levels, from premedical education and medical school through residency training and CME.

The medical community has made insufficient progress in diversifying its workforce. Improving diversity within the pediatrician workforce will require proactive leadership from the medical community in a number of areas, including recruitment, mentoring, education, organizational support systems, and financial incentives. Success will also depend on the collaboration and cooperation of many stakeholders, including the AAP, with respect to initiatives designed to promote diversity within the health professions. Pediatricians are not alone in seeking solutions to improve the delivery of pediatric health care to the neediest patients. Pediatricians, other health care professionals, hospitals, universities, community groups, health care payers and insurers, regulatory and accrediting bodies, legislators, and others have significant roles to play in ensuring CEHC and will have to participate in health policy deliberations on this topic. Broad-based participation will ensure that a pediatric focus and perspective are brought to bear on decisions that have a direct effect on the quality of care that is delivered to children. In particular, stakeholders will have to advocate for necessary financial, regulatory, and other support among decision-makers to implement appropriate changes to the US health care delivery system.

Individual pediatricians need educational tools; the pediatric community needs the results of outcomes research to bolster, validate, and sustain its effort; institutions need support and encouragement to provide appropriate and effective education and training; foundations and other organizations need to have a pediatric perspective in all health care and policy development considerations; and legislative bodies, including federal and state agencies, need to provide the funding and infrastructure necessary to implement and evaluate mandates. The AAP has played, and must continue to play, a pivotal role in all of these important health policy deliberations.

RECOMMENDATIONS

The AAP believes that increasing the diversity of the pediatrician workforce and enhancing the provision of culturally effective care to the pediatric population will help achieve the AAP mission of promoting optimal physical, mental, and social health and well-being for all infants, children, adolescents, and young adults. Thus, the AAP is committed to working in collaboration with AAP chapters and other groups, including but not limited to medical societies, hospitals, universities, health care payers and insurers, federal agencies, and policy makers, to achieve greater workforce diversity and promote the provision of culturally effective pediatric care and recommends the following:

1. Pediatricians should assume a leadership role in advocating for a diverse workforce. Diversity in this context includes a wide spectrum of racial, ethnic, and cultural attributes, which include values, behaviors, customs, language, sexual orientation, religious beliefs, socioeconomic status, and other distinct population attributes. Many individuals exhibiting such a broad range of perspectives and attributes are URM compared with their presence in the general population.
2. The AAP should support the development of sequentially staged programs that prepare URM students to pursue careers in health professions, including pediatrics. URM medical student, resident, or physician groups would encompass those individuals from ethnic and racial populations that are underrepresented in the medical profession relative to their numbers in the general population as a whole.
3. Medical student, resident, and faculty recruitment activities should support and advocate for the full spectrum of diversity as described in Recommendation 1.
4. Affirmative-action programs should be supported because they promote the entry of URM students into medical school.
5. Financial assistance should be broadened for URM students, including federal funding for diversity programs, Title VII funding, loan-forgiveness/repayment programs, and tuition reimbursement.
6. Educational and health care institutions and organizations must employ individuals who are primarily responsible for the implementation, management, and evaluation of diversity programs that address the full spectrum of diversity as described in Recommendation 1.
7. Institutional commitment to improve workforce diversity must include formal programs or mechanisms to ensure that individuals of diverse backgrounds can rise to leadership positions. Furthermore, commitment from a number of groups (including institutions, the AAP, AAP chapters, medical societies, federal agencies, and policy makers) is necessary to ensure the provision of CEHC.
8. Pediatricians should assume a leadership role in advocating for CEHC for all infants, children, adolescents, and young adults.
9. The AAP, along with health care organizations at all levels, should continue to participate in the development and assessment of effectiveness of educational programs that promote CEHC. The curricula should address issues including but not limited to the patient's and one's own cultural beliefs, values, behaviors, customs, language, sexual orientation, religious beliefs, disabilities, and other distinct attributes.
10. Pediatricians must continue to work locally with hospitals, offices, and managed care organizations as well as commercial and government insurance payers to develop policies and programs that address health care needs specific to their communities.
11. Mandates from both the government and insurers to improve the provision of CEHC must be accompanied by funding or payment to support the infrastructure necessary to implement these programs and assess their effectiveness.
12. Public and private incentive programs must be established to encourage the implementation of national, regional, state, and community-based initiatives to improve the delivery of CEHC.

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Essential Contractual Language for Medical Necessity in Children

- *Policy Statement*

POLICY STATEMENT

Essential Contractual Language for Medical Necessity in Children

abstract

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The previous policy statement from the American Academy of Pediatrics, "Model Language for Medical Necessity in Children," was published in July 2005. Since that time, there have been new and emerging delivery and payment models. The relationship established between health care providers and health plans should promote arrangements that are beneficial to all who are affected by these contractual arrangements. Pediatricians play an important role in ensuring that the needs of children are addressed in these emerging systems. It is important to recognize that health care plans designed for adults may not meet the needs of children. Language in health care contracts should reflect the health care needs of children and families. Informed pediatricians can make a difference in the care of children and influence the role of primary care physicians in the new paradigms. This policy highlights many of the important elements pediatricians should assess as providers develop a role in emerging care models. *Pediatrics* 2013;132:398–401

The American Academy of Pediatrics (AAP) published the policy statement "Model Contractual Language for Medical Necessity in Children" in July 2005.[1] The chief principles articulated in that statement are still relevant, but given the structural shifts in the health care delivery system, they no longer adequately address the unique needs of children. This revised policy statement is an update of the 2005 statement.

In light of the passage and ongoing implementation of the Patient Protection and Affordable Care Act (ACA [Pub L No. 111-148]) in 2010, contractual obligations, as expressed in health plan-provider and health plan-beneficiary agreements, have a new significance with respect to the array of health care benefits made available to children and families. In particular, a much used term—"medical necessity"—is, in fact, generally ill defined. As stated in the previous policy statement, "The term 'medical necessity' is used by Medicaid and Medicare and in insurance contracts to refer to medical services that are generally recognized as appropriate for the diagnosis, prevention, or treatment of disease and injury." The term is found in insurance contractual language, and, as stated in the 2005 policy statement, "… an intervention will be covered if it is an otherwise covered category of service, not specifically excluded, and medically necessary." It

COMMITTEE ON CHILD HEALTH FINANCING

KEY WORDS

medical necessity, contractual language, pediatric care, children, insurance, health plans, payment

ABBREVIATIONS

AAP—American Academy of Pediatrics
ACA—Patient Protection and Affordable Care Act

This article was written by members of the American Academy of Pediatrics. It does not represent the views of the US government or any US government agency.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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would appear that this statement provides a straightforward presentation of medical necessity. However, health insurance coverage is moderated by a host of federal regulations and statutes, state mandates, and other rules. Provider agreements are usually written to incorporate these rules and regulations. As the US Department of Health and Human Services moves to implement the provisions of the ACA, essential health care benefits are not guaranteed to be the same in every state. Consequently, benefits for children may vary from state to state or plan to plan and may contain specific exclusions. The AAP advocates for quality health care for children that promotes optimal growth and development with measures intended to prevent, diagnose, detect, ameliorate, or palliate the effects of physical, genetic, congenital, mental, or behavioral conditions, injuries, or disabilities.

Individuals with health insurance coverage, whether it be Medicaid, Medicare, or commercial insurance coverage, may be unaware of payment or benefit restrictions for the medical services they seek. In addition, services ordered by a physician might only be covered if conditions of medical necessity are met. Medical necessity means that a decision is needed about appropriateness for a specific treatment of a specific individual. The 2005 AAP statement drew on model language developed by Stanford University[2]; however, more specific considerations are needed for children because of their unique needs. Now, as the US Department of Health and Human Services is charged with implementation of the ACA, it is time to address medical necessity and the needs of children. Although Medicare has become the de facto standard of health care benefits and directly influences commercial health care benefit plans, it is important to realize that health care standards designed for adult care often will not meet the needs of children. By and large, the Medicaid program provides coverage for a significant number of children, and it, too, can be influenced by health care standards designed for adults.

A definition of medical necessity for children must recognize that the needs of children differ from those of adults. The foundation for medical necessity for children should be based on the comprehensive, fully inclusive set of services provided by the Early and Periodic Screening, Diagnosis, and Treatment regimen embodied in Medicaid as well as the preventive care recommendations in *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents,* as stipulated in Section 2713 of the ACA.[3] The language in the Stanford statement considered the scope of health problems, evidence of effectiveness, and value of the intervention. Medical necessity should be guided by these criteria, but health plan and even Medicare language generalizes across populations, as opposed to focusing on specific individuals or groups, including children, often in a manner that is blind to their particular needs. A definition of medical necessity is needed that is more functional or operational and specific to meet the needs of children. Informed pediatricians can help advance such a definition.

Variability in "Essential Health Benefits," as intended by the ACA, is also cause for concern. There are 10 categories of Essential Health Benefits, including item 10—pediatric services including vision and oral care. The states are allowed individually to define the benefits for each of these 10 categories. Therefore, there is a great likelihood of significant variation in pediatric benefits throughout the nation. States are likely to use different methods of determining medical necessity.

Some examples may help to illustrate the unique needs of children. One such example is the nuance between rehabilitative and habilitative services. Rehabilitative and habilitative services and devices are specifically addressed as 1 of 10 necessary categories of Essential Health Benefits in the ACA. Currently, in many instances, health care coverage is limited to rehabilitative services, referring to the need to restore a lost function. Habilitation suggests a function or skill not yet acquired or attained. More specifically, the National Association of Insurance Commissioners defines habilitation as "health care services that help a person keep, *learn,* or improve skills and functioning for daily living." With today's medical knowledge, conditions poorly understood in the past may now be subject to significant improvement, even functions that have not yet been acquired. Habilitation and rehabilitation services are usually provided by the same professionals, the only difference being the indication for therapeutic intervention. The case is also illustrated when one considers speech therapy for a child with autism or physical therapy for a child with hypotonia—motor skills and developmental milestones not yet achieved. Every newborn infant is a well of unknown potential. The terms habilitative and rehabilitative should be interchangeable where children are concerned. Developmental milestones represent standards achieved by most children in a given time frame, but not all children follow the same trajectory. A primary focus needs to be on the potential for functional gain—hence, habilitative services.

Evidence of effectiveness is a cornerstone of medical necessity, yet such data for children may not be readily available. It would be beneficial if medical necessity was governed by traditional evidence grading, and if not available, a hierarchy or algorithm of standards should be applied. The AAP has published 2 policy statements to aid decision makers in classifying clinical recommendations and ensuring transparency in issuing clinical guidelines.[4,5] If patient-centered or scientific evidence for children is insufficient, then professional standards of care for children must be considered. The AAP, other pediatric medical specialty societies, and consensus expert pediatric opinion could serve as references for defining essential pediatric care in the context of medically necessary services. **Hence, the pediatric definition of medical necessity should be as follows: health care interventions that are evidence based, evidence informed, or based on consensus advisory opinion and that are recommended by recognized health care professionals, such as the AAP, to promote optimal growth and development in a child and to prevent, detect, diagnose, treat, ameliorate, or palliate the effects of physical, genetic, congenital, developmental, behavioral, or mental conditions, injuries, or disabilities.**

Value is another parameter in the consideration of medical necessity. Value is not simply a cost-benefit assumption. Value, in fact, may be a subjective consideration. The recipient may have an entirely different perception of value than the provider or payer. Value implies quality (ie, access to age-appropriate care, in an appropriate setting, by appropriate personnel) plus desired outcome at a reasonable cost. Pediatricians recognize the so-called marginal effect of some services—extensive interventions for limited or no essential benefit. However, children deserve the intent embedded in the Medicaid provision of the Early and Periodic Screening, Diagnosis, and Treatment regimen, specifically treatment. Given a pediatric definition of medical necessity as mentioned previously, the value of services might also be considered. Examples in which this is particularly true include children with autism spectrum disorders, neurodevelopmental disorders, or expressive speech delay, conditions for which needs are unique and improvement may be slow. Similarly, services that have been provided for an appropriate period of time by an appropriate provider could be discontinued if there is no measureable benefit. In short, services should be provided to children, but continuity is only ensured if there is evidence of a significant measureable benefit. It may be that the only therapeutic benefit is maintenance at a given level of function. If this facilitates more manageable daily living, then the service has value. This might best be exemplified by the continuation of occupational or physical therapy for a child with neurologic damage if only to facilitate safe transfers or to minimize the usual contractures. The goal is to achieve value for both the recipient and the provider. Resources are limited, but every child, with or without disability, deserves the opportunity to declare his or her potential for improvement in his or her daily life. Difficult decisions are part of medical necessity. Cost should not be the basis for denial of services, but the delivery of care in a setting that demonstrates lower cost could be acceptable if quality is not compromised.

Transparency in today's health care delivery system is essential to credibility. Health plans need to be clear with respect to the evaluation and determinations of medical necessity. The decision pathway, authority credentials of decision makers, and timeliness in the process should feature identifiable criteria or benchmarks in rendering decisions relevant to medical necessity. The expectations of all health plans, including Medicaid and Medicare, should be clear in anticipation of medical necessity requirements, and similarly, the decision-making process should be equally transparent. Consideration might be given to the role of a family advocate or ombudsmen in protecting children and families and intervening to aid in solving their problems related to medical necessity decisions.

As health care reform advances, contracts between providers of care and health care organizations, whether they are medical group practices, accountable care organizations, or health plans, will define expectations and obligations. Essential language should exist to address the unique needs of children in the context of medical necessity. The right of a child to optimal growth and development should be a universal expectation limited only by the restraints of physical or genetic conditions. New and emerging health care delivery models, including accountable care organizations, bundled payments covering hospital and physician services, disease-management models, and others, will influence how health care services are managed for beneficiaries. There will also be contractual arrangements with providers of primary and specialty care, and federal and/or state regulations will influence these contractual relationships. This time of transition affords pediatricians

an opportunity to affect not only overall health care benefits but also the medical necessity decisions that affect pediatric care. All of these agreements should feature essential language that recognizes the unique needs of children and ensures more equitable care for all children. The AAP and its member pediatricians are the informed advocates who can advance a better understanding of medical necessity decisions on behalf of children.

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Ethical Controversies in Organ Donation After Circulatory Death

- *Policy Statement*

POLICY STATEMENT

Ethical Controversies in Organ Donation After Circulatory Death

COMMITTEE ON BIOETHICS

KEY WORDS
bioethics, children, circulatory death, ethics, organ donation, organ procurement

ABBREVIATIONS
DCD—donation after circulatory death
ECMO—extracorporeal membrane oxygenation

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The persistent mismatch between the supply of and need for transplantable organs has led to efforts to increase the supply, including controlled donation after circulatory death (DCD). Controlled DCD involves organ recovery after the planned withdrawal of life-sustaining treatment and the declaration of death according to the cardiorespiratory criteria. Two central ethical issues in DCD are when organ recovery can begin and how to manage conflicts of interests. The "dead donor rule" should be maintained, and donors in cases of DCD should only be declared dead after the permanent cessation of circulatory function. Permanence is generally established by a 2- to 5-minute waiting period. Given ongoing controversy over whether the cessation must also be irreversible, physicians should not be required to participate in DCD. Because the preparation for organ recovery in DCD begins before the declaration of death, there are potential conflicts between the donor's and recipient's interests. These conflicts can be managed in a variety of ways, including informed consent and separating the various participants' roles. For example, informed consent should be sought for premortem interventions to improve organ viability, and organ procurement organization personnel and members of the transplant team should not be involved in the discontinuation of life-sustaining treatment or the declaration of death. It is also important to emphasize that potential donors in cases of DCD should receive integrated interdisciplinary palliative care, including sedation and analgesia. *Pediatrics* 2013;131:1021–1026

INTRODUCTION

The persistent mismatch between the supply of and need for transplantable organs and the resulting deaths of individuals on the waiting list have led to a variety of efforts to increase the supply. As of May 17, 2012, there were 878 individuals aged <18 years awaiting a kidney transplant and 513 awaiting a liver transplant. In 2011, 10 individuals aged <18 years died while waiting for a kidney transplant, and 20 children and adolescents died while waiting for a liver transplant.[1] One effort to increase the supply of transplantable organs has been renewed interest in donation after circulatory death (DCD), which is the retrieval of organs from individuals declared dead after the irreversible cessation of circulatory and respiratory functions. (This

process was initially referred to as "nonheartbeating organ donation" and then as "donation after cardiac death." The most recent change in terminology emphasizes that the determination of death is based on the cessation of circulatory, not cardiac, functions.[2]) There are several forms of DCD, and the current statement focuses on "controlled" DCD: the recovery of organs after the planned withdrawal of life-sustaining medical treatment.[3]

Although DCD was the initial form of deceased organ donation, it was eclipsed by recovery of organs from individuals declared dead according to neurologic criteria after these criteria were established and evidence showed improved graft function from such donors. There was renewed interest in DCD in the 1990s, including the publication of the so-called Pittsburgh Protocol,[4,5] given the persistent shortage of transplantable organs. Recent estimates suggest that DCD could increase the supply of transplantable organs by 20%.[6] A number of subsequent reports and consensus statements have addressed points of controversy, such as the waiting period before the declaration of death and the use of premortem interventions to improve graft function.[7–10] More recent pediatric studies reporting similar graft survival in kidneys and livers from donors declared dead according to neurologic and cardiovascular criteria have further increased interest in DCD.[11]

Increased acceptance of DCD has resulted in regulatory oversight. The Joint Commission mandates that, although hospitals need not perform DCD, their policies must address it.[12] The United Network for Organ Sharing has articulated Model Elements for Controlled DCD Recovery Protocols[13] and requires its member hospitals that perform solid organ transplants to develop protocols which address the required elements to facilitate the recovery of organs from donors in cases of DCD.[14] The Organ Donation Breakthrough Collaborative has also established the goal of having donors in DCD cases represent 10% of all organ donors.[15]

The current policy statement addresses the 2 major conceptual and ethical issues related to DCD: when can organ recovery begin, and how should conflicts of interests be managed? It provides greater detail than the American Academy of Pediatrics' policy statement "Pediatric Organ Donation and Transplantation,"[16] but it does not address general issues, such as medical examiner release of organs. Discussing these issues is particularly important given the variation among DCD policies at children's hospitals.[17] Standards must be met to maintain the integrity of and public confidence in the organ transplantation system.

DECLARATION OF DEATH

Whether and when donors in DCD cases are dead is important because cadaveric organ transplantation operates under the "dead donor rule." This rule can be characterized in 2 different ways, each with its own ethical justification. One version is that organ recovery must not cause the donor's death. This version is justified by the prohibition against the direct killing of innocent persons. The other version is that the donor must be dead before the recovery of vital organs. This version is based on preventing potential negative outcomes, such as the mistreatment of potential donors and the erosion of public confidence in transplantation.[18]

Some commentators have recommended abandoning the dead donor rule. Miller and Truog,[19] for example, argue that withdrawing life-sustaining treatment causes patients' death and that there is no ethical bright line between withdrawing life-sustaining treatment and active euthanasia. They contend that patients or their surrogates, who have previously decided to have life-sustaining medical treatment withdrawn, should be permitted to consent to the premortem recovery of vital organs. Although they do not discuss the implications of their position for pediatrics, it would, in principle, extend to parents or guardians and capacitated adolescents or their proxies. Miller and Troug's arguments are not, however, compelling. For example, they conflate patients' right to refuse treatment with the distinction between killing and letting die. They also ignore well-developed arguments that the intentional killing of innocent persons is unethical and that the ethically relevant distinction is between different forms of letting die. The dead donor rule should, therefore, be retained, not only because the reasons supporting it are compelling but also because the reasons for abandoning it are insufficient.

The discussion of death commonly distinguishes definition, criteria, and tests. The predominant definition of death is "the cessation of functioning of the organism as a whole."[20] This definition focuses on the functions possessed by the whole organism, such as consciousness and control of circulation, respiration, and temperature, rather than the functions of its constituent parts. Although the definition states the necessary and jointly sufficient conditions for correctly applying the concept of death, the criteria specify measurable conditions, and physicians use the tests to evaluate the criteria at the bedside. The 2 criteria for death are the neurologic and the cardiorespiratory.

Drawing an analogy to the declaration of death in other clinical contexts,

proponents of DCD argue that the cessation of circulatory function must be permanent but not irreversible. The cessation is permanent if it will not resume on its own through autoresuscitation or as a result of external action, such as cardiopulmonary resuscitation. Once sufficient time has elapsed to preclude the spontaneous recovery of circulatory function, it is permanent, because, as part of the decision to withdraw life-sustaining treatment, the parents or guardians previously decided to forego cardiopulmonary resuscitation. Irreversibility further requires that the function is incapable, within the limits of current technology, of being restored. Proponents of DCD contend that irreversibility is not necessary for the declaration of death.[21] Numerous professional organizations and consensus groups support this argument.[8–10]

Within this framework, how much time must elapse to preclude autoresuscitation sufficiently is a significant concern. Despite calls for additional research, data are limited on this topic. On the basis of narrative reviews, commentators have recommended waiting at least 2 minutes and not more than 5 minutes.[8–10] The authors of the most recent systematic review, noting the low quality and limited scope of reports, concluded there are no cases of autoresuscitation without cardiopulmonary resuscitation.[22] Until a large observational study that provides narrow confidence intervals around the duration of autoresuscitation is conducted, this timing remains a prudential judgment. Once death is declared, there is no need for an additional waiting period before the initiation of organ recovery efforts.

Declaring death requires tests in addition to definitions and criteria. It would be prudent to use more sensitive and/or objective tests when they are available. For example, using indwelling arterial catheters, Doppler ultrasonography, or echocardiography may be preferable to palpating pulses or auscultating heartbeats.[2]

There are, however, 2 significant criticisms of the proponents of DCD's arguments. One objection is that irreversibility is a necessary criterion for the declaration of death. Although permanence and irreversibility are causally related (ie, without intervention, permanent cessation will become irreversible), they are not contemporaneous. During the time between when circulatory function is permanently lost and when it is irreversibly lost, critics argue, individuals are dying but not yet dead.[23] This objection can also be stated in terms of the relationship between the cardiorespiratory and neurologic criteria of death. Rather than being independent criteria, the neurologic criteria are arguably fundamental. Although individuals who fulfill the cardiorespiratory criteria inevitably fulfill the neurologic criteria, if resuscitation is withheld, additional time must elapse.

A second criticism is that replacing irreversibility with permanence inappropriately makes the declaration of death contingent on the intent and action of others rather than an intrinsic condition of the organism.[23] Nevertheless, the criticism that retrieving vital organs from donors in DCD cases is the proximate cause of death is not sound. If sufficient time passes to preclude autoresuscitation, progressive hypoxia-ischemia of the central nervous system is the proximate cause of death.[24]

Although the need to increase the supply of transplantable organs is compelling and the arguments for the sufficiency of permanence for declaring death are widely accepted, the criticisms of these arguments are sufficient that physicians should not be required to retrieve organs from donors in cases of DCD.[25] Institutions have an obligation to provide patients and their families access to DCD. Whether institutions themselves should be able to refuse to perform DCD is ethically controversial because of burdens placed on patients and their families by alternatives, such as the transfer of patients to other institutions.[26] The American Academy of Pediatrics could not reach consensus on whether institutions may refuse to participate.

Recent publications have highlighted related conceptual and practical issues. In 2008, Boucek et al[27] reported successfully transplanting hearts from 3 infant donors in cases of DCD. Some criticized the waiting period of 75 seconds in 2 of the transplants as being too short. Shortening the waiting period is particularly problematic in infants because they were not part of the population in which autoresuscitation was studied, and their organs may be more resilient.[2] Others contended that the resumption of cardiac activity in the recipient negates the determination of death.[28] The current definition of death focuses on the loss of integrated functioning of the organism that is demonstrated by the absence of autoresuscitation. Residual function of individual organs and tissues is consistent with death of the organism as a whole.

Others have reported on the use of extracorporeal membrane oxygenation (ECMO) in donors to support organ perfusion between the declaration of death and organ recovery and, thereby, improve outcomes in the transplanted organs.[29,30] ECMO was originally designed to provide cardiorespiratory support to individuals with reversible cardiorespiratory failure. The use of ECMO in DCD is problematic because it artificially replaces circulatory function analogous to a

ventilator in patients with severe brainstem or spinal cord injuries. The additional concern is that reperfusion of the brain could restore consciousness. A potential modification is to prevent perfusion of the brain or organs above the diaphragm.[2] It is not clear whether these measures are sufficient to permit donors to be declared dead according to the cardiorespiratory criteria or whether donors receiving ECMO should be evaluated by using the neurologic criteria.

CONFLICTS OF INTERESTS

In addition to conceptual and practical issues regarding the declaration of death, DCD involves a variety of conflicts of interests.[31] In contrast to donors declared dead according to the neurologic criteria, preparation for organ recovery efforts in DCD begins before the declaration of death. This preparation may include premortem interventions, such as placing lines or administering heparin, and modifications of the usual process of withdrawing life-sustaining treatment. These actions create the potential for conflicts between the interests of the donor and of the recipients.

These potential conflicts are exacerbated by the need to limit warm, and to a lesser extent cold, ischemic time. Organs tolerate oxygen deprivation better at colder temperatures than at warm ones. In "brain-dead" donors, the organs are relatively normally perfused before recovery and then rapidly cooled. In donors in cases of DCD, organs may experience hypoperfusion during the time between stopping life-sustaining treatment and recovering and cooling the organs. This hypoperfusion may damage the organs and impair their function. Premortem practices are altered in DCD to diminish warm ischemia times, and the maximum duration of organ recovery efforts is frequently stipulated. (The fact that donation efforts will cease if the potential donor does not die within the specified time period should be disclosed as part of the informed consent process.)

The donor's informed consent is a potential way to manage the conflicts of interests. Capacitated adults can accept the risks involved in the donation process to benefit potential recipients. Informed consent by the donor is, however, unlikely in DCD. Most potential donors in cases of DCD have suffered serious, irreversible neurologic injuries and are incapacitated. Expressing one's interest in donation (eg, by signing a donor card) does not currently constitute informed consent for the modifications in premortem management required by DCD.[32]

Parents or guardians "consenting" for their children further complicate the issue. In contrast to surrogate decision makers for previously capacitated adults who should make decisions on the basis of substituted judgment, parents or guardians should make decisions based on their child's and family's interests. Giving permission for their child to become an organ donor may permit families to create meaning or value in a tragic circumstance. Changes in premortem treatment may create conflicts between the interests of the recipient and/or the family and the interests of the donor. Minimally, changes in premortem treatment should not be contrary to the donor's interests.

The potential for conflicts arises at multiple points in the donation process, including consent to organ donation, premortem interventions to promote organ viability, palliative care, and declaration of death.

- The decision to withdraw life-sustaining medical treatment should be separate or decoupled from the decision to attempt to donate organs.[7–10] The conceptual separation of the issues can be reinforced by separating when the decisions are discussed and who participates in the discussions. This separation should be maintained, to the extent possible, if parents or guardians raise the issue of organ donation before deciding to withdraw life-sustaining medical treatment.
- Premortem interventions to improve organ viability should not harm the donor and require informed consent.[7,9,10] Premortem interventions may include medications, such as anticoagulants or vasodilators, and procedures, such as line placement. Most of these interventions are neutral to patients' interests. There is legitimate disagreement about whether anticoagulants may, in uncommon situations, contribute to the potential donor's death and whether the pain of line placement constitutes a relevant harm.[7] Parental permission is necessary for any premortem intervention to improve organ viability.
- Potential donors in cases of DCD should receive integrated interdisciplinary palliative care,[33] including sedation and analgesia.[8,9] In DCD, palliative care occurs concurrently with preliminary organ donation efforts. Efforts should be made to limit alterations in the process of withdrawing life-sustaining treatment, such as its location. Alterations in the process of withdrawing life-sustaining treatment to reduce warm ischemia times should also be disclosed as part of the informed consent process. Medications should not be used with the direct intention of controlling the time of death.[7,8,10]
- Although organ procurement organization personnel may be involved in evaluating potential donors and scheduling, they and members of the transplant team should not be

involved in the decision to withdraw life-sustaining treatment or its actual discontinuation. Programs should consider whether physicians caring for potential recipients should also be excluded from involvement in premortem management. If there are no alternatives to members of the transplant team participating in premortem interventions, such as prepping and draping and/or line placement, they should physically leave the patient care area before the withdrawal of life-sustaining treatment.[7,10]

- As discussed previously, death should be declared by using relatively sensitive and objective tests. Organ procurement organization and transplant personnel should not be involved in the declaration of death. Programs should consider the appropriate role, if any, of those caring for potential recipients.[7–10]

Institutions should have policies regarding these issues and periodically review performance to promote adherence. Ethics committees can contribute to the development of policies and the resolution of dilemmas or conflicts in their implementation.

RECOMMENDATIONS

- The American Academy of Pediatrics considers DCD an ethically acceptable option when practiced within appropriate constraints, such as waiting a reasonable amount of time after the initial fulfillment of the cardiorespiratory criteria for death to preclude autoresuscitation before declaring death. On the basis of current evidence, the recommendation to wait between 2 and 5 minutes is reasonable.
- Additional research to better understand the phenomenon of autoresuscitation in infants and children should be conducted.
- Given legitimate ethical disagreement regarding the interpretation of the cardiorespiratory criteria for death, individual physicians should not be required to participate in DCD. Institutions should, nonetheless, provide access to DCD.
- Physicians should help institutions develop policies to manage the conflicts of interests inherent in the DCD process. Such policies should include:
  - the separation or decoupling of the decision to withdraw life-sustaining treatment from the decision to donate;
  - the prohibition of premortem interventions to improve organ viability that harm the patient;
  - the requirement of parental permission for acceptable premortem interventions;
  - the provision of integrated interdisciplinary palliative care; and
  - the prohibition of organ procurement organization staff and transplant team members from participating in the discontinuation of life-sustaining treatment or the declaration of death.

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Ethical and Policy Issues in Genetic Testing and Screening of Children

- *Policy Statement*

POLICY STATEMENT

Ethical and Policy Issues in Genetic Testing and Screening of Children

abstract

FREE

The genetic testing and genetic screening of children are commonplace. Decisions about whether to offer genetic testing and screening should be driven by the best interest of the child. The growing literature on the psychosocial and clinical effects of such testing and screening can help inform best practices. This policy statement represents recommendations developed collaboratively by the American Academy of Pediatrics and the American College of Medical Genetics and Genomics with respect to many of the scenarios in which genetic testing and screening can occur. *Pediatrics* 2013;131:620–622

BACKGROUND

In 1953, Watson and Crick described the DNA double helix. Fifty years later, the full sequence of the human genome was published. Our knowledge of genetics grows rapidly, as does consumer interest in undergoing genetic testing. Statements about genetic testing of children in the United States written in the past 2 decades need to be updated to consider the ethical issues arising with new technologies and expanded uses of genetic testing and screening.[1,2] The growing literature on the psychosocial and clinical effects of such testing and screening can help inform us about best practices.

Genetic testing and screening of minors are commonplace. Every year, ~4 million infants in the United States undergo newborn screening for metabolic, hematologic, and endocrine abnormalities for which early treatment may prevent or reduce morbidity or mortality.

Outside of newborn screening, genetic testing of children is less commonly performed. Diagnostic genetic testing may be performed on a child with signs or symptoms of a potential genetic condition or for treatment decisions made on the basis of results of pharmacogenetic assays. Genetic testing may also be performed on an asymptomatic child with a positive family history for a specific genetic condition, particularly if early treatment may affect morbidity or mortality. The American Academy of Pediatrics (AAP) and the American College of Medical Genetics and Genomics (ACMG) provide the following recommendations regarding genetic testing and screening of minors. An accompanying technical report provides ethical explanations and empirical data in support of these recommendations (http://www.nature.com/gim/journal/vaop/ncurrent/full/gim2012176a.html).[3]

COMMITTEE ON BIOETHICS, COMMITTEE ON GENETICS, AND THE AMERICAN COLLEGE OF MEDICAL GENETICS AND GENOMICS SOCIAL, ETHICAL, AND LEGAL ISSUES COMMITTEE

KEY WORDS

genetic testing, genetic screening, newborn screening, predictive testing, disclosure, carrier identification

ABBREVIATIONS

AAP—American Academy of Pediatrics

ACMG—American College of Medical Genetics and Genomics

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GENERAL RECOMMENDATIONS

1. Decisions about whether to offer genetic testing and screening should be driven by the best interest of the child.
2. Genetic testing is best offered in the context of genetic counseling. Genetic counseling can be performed by clinical geneticists, genetic counselors, or any other health care provider with appropriate training and expertise. The AAP and ACMG support the expansion of educational opportunities in human genomics and genetics for medical students, residents, and practicing pediatric primary care providers.

DIAGNOSTIC TESTING

3. In a child with symptoms of a genetic condition, the rationale for genetic testing is similar to that of other medical diagnostic evaluations. Parents or guardians should be informed about the risks and benefits of testing, and their permission should be obtained. Ideally and when appropriate, the assent of the child should be obtained.[4]
4. When performed for therapeutic purposes, pharmacogenetic testing of children is acceptable, with permission of parents or guardians and, when appropriate, the child's assent. If a pharmacogenetic test result carries implications beyond drug targeting or dose-responsiveness, the broader implications should be discussed before testing.

NEWBORN SCREENING

5. The AAP and ACMG support the mandatory offering of newborn screening for all children. After education and counseling about the substantial benefits of newborn screening, its remote risks, and the next steps in the event of a positive screening result, parents should have the option of refusing the procedure, and an informed refusal should be respected.

CARRIER TESTING

6. The AAP and ACMG do not support routine carrier testing in minors when such testing does not provide health benefits in childhood. The AAP and ACMG advise against school-based testing or screening programs, because the school environment is unlikely to be conducive to voluntary participation, thoughtful consent, privacy, confidentiality, or appropriate counseling about test results.
7. For pregnant adolescents or for adolescents considering reproduction, genetic testing and screening should be offered as clinically indicated, and the risks and benefits should be explained clearly.

PREDICTIVE GENETIC TESTING

8. Parents or guardians may authorize predictive genetic testing for asymptomatic children at risk of childhood-onset conditions. Ideally, the assent of the child should be obtained.
9. Predictive genetic testing for adult-onset conditions generally should be deferred unless an intervention initiated in childhood may reduce morbidity or mortality. An exception might be made for families for whom diagnostic uncertainty poses a significant psychosocial burden, particularly when an adolescent and his or her parents concur in their interest in predictive testing.
10. For ethical and legal reasons, health care providers should be cautious about providing predictive genetic testing to minors without the involvement of their parents or guardians, even if a minor is mature. Results of such tests may have significant medical, psychological, and social implications, not only for the minor but also for other family members.

HISTOCOMPATIBILITY TESTING

11. Tissue compatibility testing of minors of all ages is permissible to benefit immediate family members but should be conducted only after thorough exploration of the psychosocial, emotional, and physical implications of the minor serving as a potential stem cell donor. A donor advocate or similar mechanism should be in place from the outset to avert coercion and safeguard the interests of the child.[5]

ADOPTION

12. The rationale for genetic testing of children in biological families should apply for adopted children and children awaiting placement for adoption. If a child has a known genetic risk, prospective adoptive parents must be made aware of this possibility. In rare cases, it may be in a child's best interest to undergo predictive genetic testing for a known risk before adoption to ensure the child's placement with a family capable of and willing to accept the child's potential medical and developmental challenges. In the absence of such indications, genetic testing should not be performed as a condition of adoption.

DISCLOSURE

13. At the time of genetic testing, parents or guardians should be encouraged to inform their child of the test results at an appropriate age. Parents or guardians should be advised that, under most circumstances, a request by a mature adolescent for test results should be honored.
14. Results from genetic testing of a child may have implications for the parents and other family

members. Health care providers have an obligation to inform parents and the child, when appropriate, about these potential implications. Health care providers should encourage patients and families to share this information and offer to help explain the results to the extended family or refer them for genetic counseling.

15. Misattributed paternity, use of donor gametes, adoption, or other questions about family relationships may be uncovered "incidentally" whenever genetic testing is performed, particularly when testing multiple family members. This risk should be discussed, and a plan about disclosure or nondisclosure should be in place before testing.

DIRECT-TO-CONSUMER TESTING

16. The AAP and ACMG strongly discourage the use of direct-to-consumer and home kit genetic testing of children because of the lack of oversight on test content, accuracy, and interpretation.

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Evaluating for Suspected Child Abuse: Conditions That Predispose to Bleeding

- *Technical Report*

TECHNICAL REPORT

Evaluating for Suspected Child Abuse: Conditions That Predispose to Bleeding

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KEY WORDS
intracranial hemorrhage, inherited coagulation disorders, bruising, nonaccidental trauma

ABBREVIATIONS
AP—α-2 antiplasmin
aPTT—activated partial thromboplastin time
BSS—Bernard-Soulier syndrome
CNS—central nervous system
EDS—Ehlers-Danlos syndrome
FFP—fresh-frozen plasma
GT—Glanzmann thrombasthenia
ICH—intracranial hemorrhage
ITP—immune thrombocytopenia
NARBDR—North American Rare Bleeding Disorders Registry
OI—osteogenesis imperfecta
PAI-1—plasminogen activator inhibitor type 1
PFA-100—platelet function analyzer
PT—prothrombin time
VKDB—vitamin K deficiency bleeding
VWAg—von Willebrand antigen
VWD—von Willebrand disease
VWF—von Willebrand factor

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abstract

FREE

Child abuse might be suspected when children present with cutaneous bruising, intracranial hemorrhage, or other manifestations of bleeding. In these cases, it is necessary to consider medical conditions that predispose to easy bleeding/bruising. When evaluating for the possibility of bleeding disorders and other conditions that predispose to hemorrhage, the pediatrician must consider the child's presenting history, medical history, and physical examination findings before initiating a laboratory investigation. Many medical conditions can predispose to easy bleeding. Before ordering laboratory tests for a disease, it is useful to understand the biochemical basis and clinical presentation of the disorder, condition prevalence, and test characteristics. This technical report reviews the major medical conditions that predispose to bruising/bleeding and should be considered when evaluating for abusive injury. *Pediatrics* 2013;131:e1357–e1373

INTRODUCTION

In the absence of known accidental mechanisms or medical causes, children with intracranial hemorrhage (ICH), cutaneous bruises, or other symptoms of bleeding might be suspected victims of child abuse. In such situations, physicians must often carefully evaluate for the possibility of a bleeding disorder or another medical condition as a possible cause. In addition, because of the legal proceedings associated with cases of potential abuse, physicians might feel compelled to rule out any theoretical possibility of a medical explanation for the child's findings despite clinical improbability. This can result in an expensive and, in the case of young children with limited total blood volume, potentially harmful laboratory investigation of diminished clinical value.

The list of congenital and acquired bleeding disorders that could potentially be confused with abusive injury is extensive: hemophilia, von Willebrand disease (VWD), disorders of fibrinogen, vitamin K deficiency, factor XIII and other factor deficiencies, thrombocytopenia, leukemia, aplastic anemia and other bone marrow infiltrative or failure syndromes, and platelet function abnormalities, among others. Most of these conditions can present with mucosal bleeding, such as epistaxis and cutaneous bruising, but some (especially factor deficiencies) have been noted to present with isolated ICH, or can increase susceptibility to severe ICH after minor trauma. Collagen disorders can also

predispose to easy bruising/bleeding in some circumstances. This report reviews the rationale for the consideration of bleeding disorders and collagen disorders as a cause of or as contributing to ICH, bruising, or bleeding when child abuse is suspected, and addresses several unsupported hypotheses related to these issues.

CLINICAL APPROACH TO THE EVALUATION OF CONDITIONS THAT PREDISPOSE TO BLEEDING IN THE SETTING OF POSSIBLE ABUSE

In many children with bruising/bleeding concerning for abuse, the evaluation for medical conditions causing or contributing to the findings noted on the physical examination can be completed by assessing the child's presenting symptoms, trauma history, medical history, family history, and medications. Before engaging in a laboratory evaluation, physicians should consider the following:

1. The specific clinical characteristics of the child's findings, along with a previous history of bleeding or bruising. Family history of bleeding or bruising or a history of specific coagulopathies and other conditions should be addressed.
2. The known presentations and prevalence of the various bleeding disorders, collagen disorders, or other medical conditions under consideration.
3. The medical probability that a specific medical condition might cause or contribute to the child's bleeding or bruising.
4. The statistical characteristics of the proposed laboratory testing.
5. The history of the use of blood products or other factor replacement products that might alter test results.
6. The associated costs of testing, both financial and medical, such as the blood volume needed for testing.
7. The anticipated benefit of identifying conditions that might cause bleeding or bruising.

CLINICAL CHARACTERISTICS

Nonintracranial Bleeding

The age and developmental capabilities of the child, history of trauma, and the location and pattern of bruising often provide significant evidence in determining the presence of abusive injury.[1–5] In many cases, the constellation of findings, taken in conjunction with the clinical history, can be so strongly consistent with abusive injury that a further laboratory investigation for medical conditions is not warranted. For instance, in a verbal child with a patterned slap mark who describes being hit with an open hand at the location of the slap mark, obtaining tests to rule out a bleeding disorder is unlikely to provide useful information. However, because few data exist comparing the specific clinical presentations of bleeding disorders and abuse, in some cases, a laboratory evaluation might be necessary to minimize the chances of a misdiagnosis. It also must be considered that the presence of a bleeding disorder or other medical condition does not rule out abuse as the etiology for bruising or bleeding.[6]

Other symptoms, such as hematemesis,[7] hematochezia,[8] and oronasal bleeding, can be caused by abuse or a bleeding disorder.[9–13] The relative frequencies of abuse or coagulopathies presenting with these symptoms should be considered, along with the patient's history and any other medical findings, such as fractures, neglect, and other manifestations of bleeding/bruising, before ordering laboratory tests. An increasing number of findings unrelated to bleeding disorders and consistent with abuse decrease the overall likelihood of a coagulopathy or other medical condition contributing to or causing bleeding or bruising. However, it is prudent to evaluate for bleeding disorders or other medical causes in children who have presenting symptoms that are not typical of inflicted injury.

ICH

Multiple studies have assessed the roles of history,[14] clinical and radiographic findings,[15–22] and outcomes[18,21,23,24] in making the diagnosis of abusive head trauma. In a recent study of ICH in bleeding disorders, ICH was the presenting event in 19.2%.[25] However, no studies have addressed how to differentiate whether patients who present with ICH in the absence of trauma or with a history of minimal trauma have a bleeding disorder either causing or contributing to the clinical findings. No studies have systematically compared the presentation, clinical findings, patterns of ICH, or presence of retinal hemorrhages between bleeding disorders and/or collagen disorders and abusive head trauma. Therefore, for children presenting with ICH but without other findings strongly suggestive of abuse, such as fractures,[26] significant abdominal trauma, burns, or patterned bruising, an evaluation for other medical conditions causing or contributing to the findings is necessary. Additionally, physicians must recognize that although evidence of old inflicted injury, such as healing fractures, could support the diagnosis of abuse, healing injuries may be unrelated to recent bruising or ICH. Physicians must assess their own comfort in making and supporting the diagnosis of abuse in the absence of an extensive laboratory evaluation.

REVIEW OF BLEEDING DISORDERS

This section describes the significant bleeding disorders that may require

further evaluation in cases of suspected abuse, including their common presentations, incidence of ICH, and the method of diagnosis (Table 1).

Deficiency of Factor VIII or IX

Hemophilia A and B are attributable to deficiencies of factors VIII and IX, respectively. Factor VIII deficiency occurs in approximately 1 in 5000 live male births. Factor IX deficiency is rarer, occurring in 1 in 20 000 live male births. Because of the X-linked recessive inheritance pattern of these diseases, most patients affected with hemophilia are male. However, girls who are carriers can have low enough factor VIII or IX levels to present with bleeding as a result of homozygous mutations or extreme inactivation of the normal X chromosome. Rarely, a phenotypic female can have only 1 X chromosome and be affected with the disease (ie, testicular feminization, Turner syndrome).[27,28]

Major bleeding sequelae of hemophilia include bleeding into joints and soft tissues and ICH. The most common sites of the initial bleeding episode in one series were post-circumcision and intracranial.[29] ICH in a child with hemophilia can occur as a result of birth trauma, in response to mild head trauma, or spontaneously. ICH is estimated to occur in 5% to 12% of patients with hemophilia throughout their lives.[25,30,31] A review of 57 episodes of ICH in 52 patients with congenital factor deficiencies showed intraparenchymal and/or intraventricular bleeding in 39 patients, subdural in 15, subarachnoid in 2, and cerebellar in 1. Most of these patients (38) had severe hemophilia. The median age of presentation was 8 years (range, 1 month to 22 years). The overall prevalence of ICH in patients with hemophilia in this study was 9.1%.[25] The largest series to date of ICH in hemophilia reported a rate of 2.7% over 5 years in a cohort of 3629 patients with hemophilia, or 0.0054 cases per year. Most of the cases in this series were not the result of trauma (78.4%). Most (69%) occurred in patients with severe hemophilia, and 18% occurred in those with mild hemophilia. Sites of hemorrhage were intracerebral, subdural, subarachnoid, epidural, or unspecified. Trauma was implicated in all of the epidural hemorrhages, 36% of the subarachnoid hemorrhages, 10% of subdural hemorrhages, and 3% of intracerebral hemorrhages.[31] In a recent review of 97 patients with hemophilia who underwent a total of 295 computed tomography scans for head trauma, 9 (3%) were identified as having intracranial bleeding. The mean age of these patients was 3.7 $\pm$ 4.1 years. Most of the bleeding in these patients was subdural, although in 2 patients, bleeding was intraparenchymal.[32] A recent study of hemophilia in the first 2 years of life revealed 19.0% of first bleeding episodes (n = 404) were head bleeding, of which 36.4% were ICH. Seventy-five percent of the ICH occurred in infants younger than 1 month of age, and most of these were associated with delivery. In contrast to the aforementioned studies, the occurrence of ICH was distributed across all severities of the disease.[29]

Approximately two-thirds of patients who present with a diagnosis of hemophilia have a positive family history for the disease. The one-third of patients without a family history of hemophilia might represent new germ-line mutations.[29,33] Diagnosis of hemophilia requires measuring factor VIII or IX activity level. Hemophilia is categorized as severe if the factor level is $<$1%, moderate if the factor level is between 1% and 5%, and mild if the factor level is $\geq$5%. Spontaneous bleeding is more common in severe hemophilia. The activated partial thromboplastin time (aPTT) is prolonged in moderate and severe cases, but can be normal in patients with mild disease, depending on the laboratory's emphasis on detecting mild factor deficiencies. Factor VIII is also an acute phase reactant and can be elevated into the normal range in patients with mild disease in response to trauma or inflammation.[34]

VWD

VWD is the most common heritable bleeding disorder, and typically presents with mild to moderate mucocutaneous bleeding. Low von Willebrand factor (VWF) levels may occur in up to 1% of the population, but fewer people may present with symptoms (0.01% to 0.1%). The current prevalence of VWD can be difficult to ascertain because recent changes in consensus have resulted in more specific diagnostic criteria. The new criteria for diagnosis requires VWF $<$30% (normal range, 50% to 150%), resulting in fewer people with levels below the normal range meeting diagnostic criteria. Individuals with bleeding symptoms and VWF levels between 30% and 50% create a diagnostic dilemma.[35] In addition, because the bleeding symptoms of VWD are generally mild, there are likely to be patients who have not come to medical attention. On the basis of the number of symptomatic cases seen by hematology specialists, the prevalence has been estimated to be even lower than previously suggested (23 to 110 per million, or 0.0023% to 0.01%), meaning that many individuals with low VWF levels might never manifest bleeding symptoms.[36]

The laboratory evaluation for, and common presentations of, the various types of VWD are variable (Tables 2 and 3). Type 1 VWD is the most common form (approximately 80%) and is characterized by a normally

TABLE 1 Common Testing Strategies for Bleeding Disorders

Condition	Frequency	Inheritance	Screening Tests	Sn and Sp, %	PPV and NPV, %	Confirmatory Test
Factor abnormalities/deficiencies						
VWD type 1	1 per 1000	AD	PFA-100	Sn = 79–96[a]	PPV = 93.3	VWAg[b] VWF activity
				Sp = 88–96[a]	NPV = 98.2	VW multimer analysis Factor VIII activity
VWD type 2A	Uncommon	AD or AR	PFA-100	Sn = 94–100[a]	PPV = 93.3	VWAg[b] VWF activity
				Sp = 88–96[a]	NPV = 98.2	VW multimer analysis Factor VIII activity
VWD type 2B	Uncommon	AD	PFA-100	Sn = 93–96[a]	PPV = 93.3	VWAg[b] VWF activity
				Sp = 88–96[a]	NPV = 98.2	VW multimer analysis Factor VIII activity
VWD type 2M	Uncommon	AD or AR	PFA-100	Sn = 94–97[a]	PPV = 93.3	VWAg[b] VWF activity
				Sp = 88–96[a]	NPV = 98.2	VW multimer analysis Factor VIII activity
VWD type 2N	Uncommon	AR, or compound heterozygote	aPTT	NA	NA	VWF-Factor VIII binding assay
VWD type 3	1 per 300 000–1 000 000	AR, or compound heterozygote	PFA-100	Sn = 94–100[a]	PPV = 93.3	VWAg[b] Ristocetin cofactor
				Sp = 88–96[a]	NPV = 98.2	VWF multimer analysis Factor VIII activity
Factor II deficiency (prothrombin)	26 reported cases, estimated 1 per 1–2 million		aPTT, PT (may be normal)	Sn = variable	NA	Factor II activity +/− antigen levels
Factor V deficiency	1 per 1 million	AR	aPTT, PT	Sn = variable	NA	Factor V activity
Combined factor V/factor VIII deficiency	1 per 1 million	AR	aPTT>PT	Sn = variable	NA	Factor V and factor VIII activities
Factor VII deficiency	1 per 300 000–500 000	AR	PT	Sn = variable	NA	Factor VII activity
Factor VIII deficiency	1 per 5000 male births	X-linked	aPTT	Sn = variable	NA	Factor VIII activity
Factor IX deficiency	1 per 20 000 male births	X-linked	aPTT	Sn = variable	NA	Factor IX activity
Factor X deficiency	1 per 1 million	AR	aPTT, PT, RVV	Sn = variable	NA	Factor X activity
Factor XI deficiency	1 per 100 000	AR	aPTT	Sn = variable	NA	Factor XI activity
Factor XIII deficiency	1 per 2–5 million	AR	Clot solubility	Sn = variable	NA	Factor XIII activity
Fibrinolytic defects						
AP deficiency	~40 reported cases	AR	Euglobin lysis test	Sn = variable	NA	AP activity
PAI-1 deficiency	Very rare	AR		Sn = variable	NA	PAI-1 antigen and activity
Defects of fibrinogen						
Afibrinogenemia	1 per 500 000	AR	PT, aPTT	Sn = high	NA	Fibrinogen level
Hypofibrinogenemia	Less than afibrinogenemia		PT, aPTT	Sn = variable	NA	Thrombin time, fibrinogen activity
Dysfibrinogenemia	1 per million		Thrombin time, fibrinogen level	Sn = variable	NA	Thrombin time, fibrinogen antigen and activity level comparison, reptilase time
Platelet disorders						
ITP	Age-related	NA	CBC	Sn = high	NA	Antiplatelet Ab (rarely needed)

TABLE 1 Continued

Condition	Frequency	Inheritance	Screening Tests	Sn and Sp, %	PPV and NPV, %	Confirmatory Test
GT	Very rare	AR	PFA-100	Sn = 97–100	NA	Platelet aggregation testing Flow cytometry
BSS	Rare	AR	PFA-100	Sn = 100	NA	Platelet aggregation testing Flow cytometry
Platelet release/ storage disorders	Unknown, more common than other platelet function disorders	variable	PFA-100	Sn = 27–50	NA	Platelet aggregation and secretion Electron microscopy Molecular and cytogenetic testing

AD, autosomal dominant; AR, autosomal recessive; CBC, complete blood cell (count); NA, not available or not applicable; NPV, negative predictive value; PPV, positive predictive value; RVV, Russell viper venom (test); Sn, sensitivity; Sp, specificity; VW, von Willebrand; Ab, antibody.

[a] Values derived from data before 2008 National Institutes of Health Consensus guidelines. Sn and Sp using current diagnostic cutoffs unknown but would be expected to have higher Sp with lower Sn.

[b] May be reasonable to proceed directly to diagnostic testing depending on availability. See accompanying technical report for detailed discussion.[25]

functioning but decreased von Willebrand antigen (VWAg), resulting in low levels of both VWAg and VWF activity. Type 1 VWD has a wide range of bleeding severity and variable penetration among members of the same family. Type 2 VWD subtypes are characterized by abnormally functioning von Willebrand molecules and variable bleeding severity. Type 3 VWD presents with absence of VWF and a very low but detectable factor VIII level. The bleeding in type 3 VWD can be quite severe and can also include hemarthroses resulting from low factor VIII levels (Table 3).[35]

ICH has very rarely been reported in association with VWD. A single case series detailed 4 episodes of ICH thought to have occurred spontaneously in patients with no previous history of VWD. Patient ages ranged from 18 to 65 years of age.[37] There was an additional report of ICH in a newborn child with type 3 VWD and simultaneous sinovenous thrombosis.[38] One case report implicated type 1 VWD as a possible cause of subdural hematoma and retinal hemorrhages[39]; however, the laboratory findings in that case report did not meet the diagnostic criteria for definitive VWD,[40] and child abuse was not completely investigated, because no repeat skeletal survey was performed. Large mass-effect ICH associated with minor trauma in children with VWD outside of the typical age range for abusive head injury has been reported.[41,42] The extreme rarity of this presentation and the questions surrounding the validity of VWD causing ICH in some cases, indicate that VWD is not a typical cause of ICH.

The platelet function analyzer (PFA-100 [Siemens Healthcare Diagnostics, Tarrytown, NY]) has been proposed as a screening test for VWD, and results are often abnormal in patients who are known to have the disorder and have VWF levels <30%. It is superior to the bleeding time because of ease of testing but does not test for blood vessel integrity and is affected by medications, platelet count, and hematocrit. The bleeding time is not recommended for bleeding disorder screening because of poor test characteristics and the invasive nature of the test.[43] The utility of the PFA-100 as a screening tool for VWD has not been established with population studies. It can be a useful tool as a preliminary screen for VWD or a platelet function defect, but if the result is normal and clinical suspicion remains high, other specific testing for these disorders should be obtained. Abnormal results of the PFA-100 test should also prompt further testing as well.[35,40,44,45] It is important to realize that the PFA-100 is not a diagnostic test for bleeding disorders but rather acts as a quick screen in situations in which more specific testing is unavailable or will be delayed. If access to specific testing is available, it might be rational to skip the PFA-100. Specific testing consists of VWAg, VW activity (also referred to as ristocetin cofactor by some laboratories), factor VIII activity, and often, von Willebrand multimer analysis. Some practitioners also include ristocetin-induced platelet agglutination and/or a collagen-binding assay. Contributing to the difficulty of diagnosis, particularly for type 1 VWD, VWF levels increase in response to stress, pregnancy, and inflammation and exhibit significant variability within an individual. In addition, some patients' test results will fall below the lower limits of normal but above the current upper diagnostic cutoff (31% to 50%), creating a diagnostic dilemma.[35] Because of these issues and the lack of a single diagnostic test, the diagnosis of VWD might require repeated testing and is best accomplished by a pediatric hematologist.

TABLE 2 VWD Variants

Test	Type 1	Type 2A	Type 2B	PT-VWD	Type 2N	Type 2M	Type 3
VWF:Ag	Low	Low	Low	Low	Low	Low	Absent
VWF:Act	Low	VWF:Act/VWF:Ag <0.5	Low	Low	Low	VWF:Act/VWF:Ag <0.5	Absent
FVIII	Low	NI	NI	NI	Low	NI	Absent
RIPA	NI	Low	NI	NI	NI	Low	Absent
RIPA-LD	Absent	Absent	Increased	Increased	Absent	Absent	Absent
Frequency	70%–80%	10%–12%	3%–5%	0%–1%	1%–2%	1%–2%	1%–3%
Multimers	NI	Small	Small	Small	NI	NI	Absent

FVIII, factor VIII activity; NI, normal; PT-VWD, platelet-type pseudo VWD; RIPA, ristocetin-induced platelet aggregation; RIPA-LD, low-dose ristocetin-induced platelet aggregation; VWF:Act, VWF activity; VWF:Ag, VWF antigen. Reprinted with permission from Nichols WL, Hultin MB, James AH, et al. von Willebrand disease (VWD): evidence-based diagnosis and management guidelines, the National Heart, Lung, and Blood Institute (NHLBI) Expert Panel Reports (USA). *Haemophilia.* 2008;14(2):191.

TABLE 3 Common Bleeding Symptoms of Healthy Individuals and Patients With VWD

Symptoms	Healthy Individuals (n = 500; n = 341; n = 88; n = 60), %	All Types of VWD (n = 264; n = 1885),%	Type 1 VWD (n = 42; n = 671), %	Type 2 VWD (n = 497), %	Type 3 VWD (n = 66; n = 385), %
Epistaxis	4.6–22.7	38.1–62.5	53–61	63	66–77
Menorrhagia	23.0–68.4	47–60	32	32	56–69
Bleeding after dental extraction	4.8–41.9	28.6–51.5	17–31	39	53–70
Ecchymoses	11.8–50.0	49.2–50.4	50	NR	NR
Bleeding from minor cuts and abrasions	0.2–33.3	36	36	40	50
Gingival bleeding	7.4–47.1	26.1–34.8	29–31	35	56
Postoperative bleeding	1.4–28.2	19.5–28	20–47	23	41
Hemarthrosis	0–14.9	6.3–8.3	2–3	4	37–45
Gastrointestinal tract bleeding	0.6–27.7	14	5	8	20

NR, not reported. Reprinted with permission from Nichols WL, Hultin MB, James AH, et al. von Willebrand disease (VWD): evidence-based diagnosis and management guidelines, the National Heart, Lung, and Blood Institute (NHLBI) Expert Panel Reports (USA). *Haemophilia.* 2008;14(2):186.

Acquired von Willebrand syndrome is a rare phenomenon in pediatrics that can be associated with a number of clinical disorders, such as vascular anomalies, Wilms tumor and other cancers, cardiovascular lesions, hypothyroidism, lymphoproliferative or myeloproliferative disorders, storage disorders, autoimmune illnesses, monoclonal gammopathies, and certain medications. It has been estimated to occur at a prevalence of 0.04% to 0.13% in the general population, although the rate in pediatrics may be lower.[46] It is usually caused by autoimmune clearance or inhibition of VWF, increased shear stress causing consumption of VWF, or adsorption of VWF to cell surfaces. Laboratory tests used to diagnose acquired VWD are the same as those used to diagnose the congenital disorder. The addition of the von Willebrand propeptide can help to distinguish between the 2 entities.[46]

Factor VII Deficiency

Factor VII deficiency is the only plasma coagulation factor deficiency in which the prothrombin time (PT) alone is prolonged. The incidence is estimated as 1 in 300 000 to 1 in 500 000. To date, more than 150 cases have been reported. A quantitative factor VII determination by standard factor assay methods provides a definitive diagnosis. Homozygous patients usually have less than 10 U/dL of factor VII. Heterozygous patients have factor VII levels between 40 and 60 U/dL and might represent single or double heterozygous abnormalities. It is very important to use age and gestational-related normal ranges, because factor VII is naturally low at birth.[47]

ICH has been reported in 4.0% to 6.5% of patients with factor VII deficiency and usually occurs in those with severe disease (<1% factor activity), both spontaneously and as a result of trauma.[48,49] Central nervous system (CNS) bleeding was reported in 4.4% of factor VII–deficient patients as a presenting symptom in 1 registry and was found to occur in subjects younger than 6 months.[49] Bleeding symptoms can be extremely variable, and individuals can have minimal bleeding despite very low levels of factor VII. Using the most recent severity grading system, all patients with CNS bleeding have severe disease by definition.[50] Intracranial bleeding in these patients has been recorded as intraparenchymal, intraventricular, subdural, and tentorial, often accompanied with overlying cephalohematoma and usually occurring soon after birth.[48,51,52]

It is also important to rule out acquired factor VII deficiency as a result of vitamin K deficiency, liver disease, or consumptive coagulopathy. Although in these conditions, one would expect

more extensive coagulopathy, prolongation of the PT is often the only finding in the early stages of these disorders because of the short half-life of factor VII.

Factor XI Deficiency

Factor XI deficiency (also termed hemophilia C) has an estimated frequency in the general population of 1 in 100 000.[53,54] Factor XI deficiency occurs more frequently in the Ashkenazi Jewish population; approximately 0.2% of Ashkenazi Jewish people are homozygous and 11.0% are heterozygous for this disorder.[55]

Bleeding in factor XI deficiency tends to be mild and associated with trauma or surgery. Bleeding symptoms often cannot be predicted by the factor level. Serious spontaneous hemorrhage is uncommon, even in individuals with very low factor levels.[56] There was 1 report of subarachnoid hemorrhage in a 53-year-old man with previously undiagnosed factor XI deficiency. This patient was also found to have cerebral aneurysms.[57]

Laboratory screening tests reveal a prolonged aPTT and normal PT, though the aPTT can be normal in heterozygous patients with mild deficiency. Other screening test results are normal. The specific assay for factor XI is the definitive test for this deficiency. In homozygous individuals, factor XI activity ranges from <1 U/dL up to 10 U/dL. Severe deficiency is defined as <15 U/dL.[58] It is important to compare results with age-matched norms, because healthy ranges in infants are lower than those in adults.[59]

Factor XIII Deficiency

Factor XIII acts to covalently cross-link and stabilize fibrin. Because the PT and aPTT measure the production of fibrin from fibrinogen and the action of factor XIII is subsequent to the formation of fibrin, these tests are normal in factor XIII deficiency and therefore cannot be used to screen for this disorder. The clot solubility test, which is the most commonly used test to screen for factor XIII deficiency, is abnormal only in very severe deficiencies of factor XIII, typically with factor XIII activities <3% of normal. This is the level most experts believe is necessary to cause spontaneous bleeding. A quantitative test for factor XIII exists.[60,61]

Deficiency of factor XIII is rare, occurring in only approximately 1 in 2 to 5 million people. However, intracranial bleeding is a common manifestation of this disorder, occurring in up to one-third of those with the deficiency.[60,62] Bleeding has been reported in subdural, intraparenchymal, and epidural locations, although because most registries and case reports have not specified the location of ICH, it is likely that it has occurred in more disparate sites. ICH has been reported to occur occasionally in patients with factor levels >3%, and therefore, the diagnosis can be missed if only the clot solubility test is used.[63–65] Other manifestations of factor XIII deficiency are umbilical cord bleeding, muscle hematomas, and postoperative bleeding.[62]

Other Factor Deficiencies (Factors II, V, Combined V and VIII, and X)

Prothrombin (Factor II) Deficiency

Homozygous prothrombin deficiency occurs at an estimated prevalence of 1 in 1 to 2 million. The most common bleeding presentation in homozygous and heterozygous patients is bleeding involving the skin and mucous membranes. In the North American Rare Bleeding Disorders Registry (NARBDR), 11% of the subjects with factor II deficiency suffered a CNS complication (which included both ICH and ischemic stroke). In subjects with factor II levels <0.01 U/mL, the rate of ICH was 20%.[66] Little description of these hemorrhages exists, although case reports have described subdural and epidural hematomas.[67–69] Homozygous patients can also present with surgical or trauma-induced bleeding.[70] Hemarthroses occurred in 42%, and gastrointestinal bleeding in 12% of homozygous subjects in one registry.[71] Acquired prothrombin deficiency can occur with vitamin K deficiency, liver disease, warfarin therapy, or overdose or in the setting of connective tissue disorders with accompanying lupus anticoagulant.[70]

The degree to which the PT and aPTT are prolonged varies from patient to patient, from a few seconds in some patients to more than 60 seconds in others, and occasionally, these screening results can be in the normal range.[47,71] The diagnosis is established with a factor assay for functional prothrombin (FII), along with immunologic tests for antigen levels if necessary.

Factor V Deficiency

Factor V deficiency is estimated to occur in 1 in 1 million people. Both homozygous and heterozygous patients with factor V deficiency typically have bleeding symptoms. Bleeding in homozygous patients tends to be spontaneous and occurs in the skin and mucous membranes, joints and muscles, genitourinary tract, gastrointestinal tract, and CNS. In the NARBDR, 8% of homozygous patients presented with intracranial bleeding.[66] Intrauterine subdural hematomas have been reported, as have spontaneous intraparenchymal hemorrhages.[72,73] Fifty-percent of heterozygous patients also had bleeding. Skin and mucous membrane bleeding were the most common manifestations, and none experienced ICH.[66]

Factor V can also be low in some platelet disorders, because it is also

present in platelet α granules. In addition, acquired factor V deficiency can occur in patients with rheumatologic disorders or malignancies, patients using antimicrobial agents, or patients using topical bovine thrombin because of antibodies to factor V.[74]

In factor V deficiency, the PT and aPTT are both prolonged. Abnormal bleeding time or positive PFA-100 result is reported in approximately one-third of patients, perhaps related to a deficiency of factor V in platelet α granules.[53] Other screening test results are normal. Definitive diagnosis requires a factor V assay.

Combined Factor V and Factor VIII Deficiency

Combined deficiency of factor V and factor VIII is rare, occurring in 1 in 1 million people, with higher frequency in populations in which consanguinity is more common. In this syndrome, factor V and factor VIII levels (both antigen and activity) range from 5% to 30% of normal.[47,75] Bleeding is usually mild to moderate. Patients typically have easy bruising, epistaxis, and gum bleeding, as well as bleeding after trauma or surgery. Menorrhagia and postpartum bleeding in affected women have also been reported. Hemarthrosis can also occur. Intracranial bleeding is rare but has been reported in 1 patient of 46 reported in the 2 largest registries of this disorder (27 and 19 subjects, respectively).[76,77]

Combined deficiency of factor V and factor VIII is passed down in an autosomal-recessive fashion and is attributable to a mutation of a protein of the endoplasmic reticulum–Golgi intermediate compartment (ERGIC 53) encoded by the *LMAN1* gene. This protein has been shown to be important in facilitating protein transport from the endoplasmic reticulum to the Golgi apparatus. The decrease in factors V and VIII is, thus, attributable to defective intracellular transport and secretion unique to these 2 coagulation factors.[47] The PT and aPTT are prolonged in this disorder, with the prolongation of aPTT out of proportion to that of the PT.

Factor X Deficiency

The prevalence of factor X deficiency is 1 in 1 million in the general population and more common in populations with higher rates of consanguinity.[47] It is passed down in an autosomal-recessive pattern. As many as 1 in 500 people might be carriers of the disorder.[78] More severe deficiency would be expected to present earlier in life. Heterozygous cases might be identified incidentally by laboratory tests performed preoperatively or for another purpose.[79]

In the NARBDR, most bleeding symptoms in factor X deficiency were mucocutaneous, including easy bruising, followed by musculoskeletal bleeding. Intracranial bleeding occurred in 15% of the homozygous cohort, of which 54% had a factor X level <0.01 U/ mL. This cohort had the highest rate of ICH in the study, compared with other rare bleeding disorders. No heterozygous subjects experienced ICH.[66] Severely affected patients also present in the neonatal period with bleeding at circumcision, umbilical stump bleeding, or gastrointestinal hemorrhage.[78] The Greifswald factor X deficiency registry, which enrolls patients from Europe and Latin America, showed ICH in 21% of its cohort. ICH was reported only in patients who were homozygous and compound heterozygous.[80]

Severe liver disease can result in deficiency of all liver-produced factors, including factor X. Acquired factor X deficiency can also occur with amyloidosis, cancer, myeloma, infection, and use of sodium valproate. Acquired inhibitors to factor X have also been reported in association with upper respiratory infections and burns and usually present with active bleeding from multiple body sites.[78,80] Because of the frequency of the associated diseases, acquired factor X deficiency is actually fairly common. Although the overall rate is unknown, this disorder has been reported in up to 5% of patients with amyloidosis.[78] Therefore, diagnosis of inherited factor X deficiency in the face of concomitant medical diagnoses should be made carefully and ideally with the assistance of a pediatric hematologist.

Both the PT and aPTT are usually prolonged and correct with a 1:1 mix with normal plasma; however, with 2 types of mutations, the PT is prolonged and the aPTT is normal, whereas the opposite is true in another variant.[81] The Russell viper venom test is usually prolonged, although it can be normal in some variants.[53] A factor X assay is the definitive test, although it is important to compare results with normal levels for age and exclude vitamin K deficiency before confirming the diagnosis.

Vitamin K Deficiency

Vitamin K is required to complete the posttranslational alteration of factors II, VII, IX, and X and proteins C and S. In the absence of vitamin K, precursor proteins are synthesized by hepatic cells, but because γ-carboxyglutamic acid residues are absent, the calcium-binding sites are nonfunctional. Deficiency of vitamin K results in induced functional deficiencies of all of these proteins. If the level of functional proteins falls below 30 U/dL, bleeding symptoms can result, and the PT and/or the aPTT will be prolonged.[82]

Vitamin K deficiency bleeding (VKDB) is most often seen in newborn infants in the first days of life (in infants who do

not receive vitamin K at birth). Because their livers are still immature, synthesis of the vitamin K–dependent factors in newborn infants is 30% to 50% of adult levels. Almost all neonates are vitamin K deficient as a result of poor placental transmission of maternal vitamin K and the lack of colonization of the colon by vitamin K–producing bacteria in the neonate, although not all infants will go on to have VKDB without prophylaxis.

VKDB is divided into 3 subtypes: early, classic, and late. Early VKDB occurs primarily in infants of mothers who have been on a vitamin K–blocking medication, such as anticonvulsants, and usually occurs within hours to the first week of life. Classic-onset VKDB occurs between the first week and first month of life and is largely prevented by prophylactic vitamin K administration at birth. Late VKDB occurs from the first month to 3 months after birth.[83] This deficiency is more prevalent in breastfed babies, because human milk contains less vitamin K than does cow milk. It can be precipitated by acquired or inherited gastrointestinal tract disease. Infants with liver disease might also be susceptible.

Manifestations of VKDB are bleeding in the skin or from mucosal surfaces, bleeding from circumcision, generalized ecchymoses, large intramuscular hemorrhages, and ICH. Although VKDB is rare in countries that provide prophylaxis, more than 50% of infants with late VKDB will present with ICH.[82] VKDB is prevented in the United States by encouraging administration of vitamin K to all newborn infants. Although most states have laws that require administration, some do not. Administration of oral vitamin K prophylaxis reduces the incidence of late VKDB from 4.4 to 10.5/100 000 live births to 1.5 to 6.4/100 000 live births.[83] Intramuscular vitamin K prophylaxis prevents almost all cases of late VKDB; however, these can still occur, particularly if there is an unrecognized underlying cause of vitamin K deficiency. Secondary VKDB can occur in the setting of hepatobiliary disease, antimicrobial therapy, coumarol poisoning/rat poison ingestion, biliary atresia, and chronic diarrhea. ICH in this setting is rare but does occur.[84]

Diagnosis of VKDB is the same regardless of underlying cause. Laboratory tests show prolonged PT and possibly aPTT for age. Specific factor assays for factors II, VII, IX, and X are markedly decreased. In patients who have already received vitamin K as treatment or transfusion of plasma, measurement of proteins induced by vitamin K absence can confirm the diagnosis.[82,84]

Inherited combined deficiencies of vitamin K–dependent proteins occur when there is a mutation in the γ-glutamyl carboxylase gene or the vitamin K epoxide reductase complex. Fewer than 30 cases have been reported. Bleeding symptoms range from mild to severe, and ICH has been reported. Some patients also have dysmorphic features or skeletal defects.[85]

Defects of Fibrinogen

Abnormalities of fibrinogen can result in complete lack of the protein (afibrinogenemia), decreased levels (hypofibrinogenemia), or an abnormally functioning molecule (dysfibrinogenemia). Clinical presentations range from mild to severe bleeding, and some patients have an increased risk of thrombosis as well, depending on the causative mutation.[86,87] Fibrinogen deficiencies can also be acquired in other medical disorders, such as liver disease or consumptive coagulopathy.[87]

Severe disorders of fibrinogen result in prolongation of PT and aPTT, but milder disorders might be missed by these screening tests. Thrombin time tests conversion of fibrinogen to fibrin and is more sensitive to both deficiencies and abnormalities of fibrinogen than are PT and aPTT. Reptilase time is similar to thrombin time, except that it is not affected by heparin and might help distinguish hypofibrinogenemia from dysfibrinogenemia because of its slightly different mechanism of action. One can also measure the amount of fibrinogen antigen through a variety of methods.[87]

Most patients with dysfibrinogenemia are asymptomatic. Bleeding, when it is present, is typically mild and triggered by surgery or trauma, and thrombosis can occur. The presence of a bleeding or thrombotic phenotype is dependent on the underlying mutation.[88] One case report of ICH and cephalhematomas in a child with suspected dysfibrinogenemia has been published. The case in that report was unique in that the patient had a long history of bleeding and almost undetectable fibrinogen levels. In addition, the patient appeared to inherit his disease in a double heterozygous-recessive manner from consanguineous parents, in contrast to most cases, which are autosomal dominant in nature.[89]

Overall, bleeding symptoms in afibrinogenemia are variable and can range from mild to life threatening. ICH has been reported in patients with afibrinogenemia (5% to 10% of patients).[90,91] Up to 85% of patients present in the neonatal period with umbilical cord bleeding.[92]

Defects of Fibrinolysis

Fibrinolysis refers to the breakdown of the fibrin clot and is directed by plasmin. Plasmin is generated from plasminogen by the actions of plasminogen activators. The inhibitors of this action are α-2 antiplasmin (AP, also known as α-2 plasmin inhibitor

and plasmin inhibitor), thrombin-activatable fibrinolysis inhibitor, and plasminogen activator inhibitor type 1 (PAI-1). Deficiencies in AP and PAI-1 have been described, although both are rare.[93,94]

Patients with PAI-1 deficiency have been described as having mild to moderate bleeding symptoms, such as epistaxis, menorrhagia, and delayed bleeding after surgery or trauma. Spontaneous bleeding is rare. Diagnosis of PAI-1 deficiency can be problematic in that the laboratory assay used for diagnosis is inaccurate at low levels. Normal ranges often are reported beginning at 0, creating a large crossover between those patients with an abnormality in PAI-1 and healthy individuals. Only 2 of the reported deficiencies of PAI-1 have been correlated with an underlying genetic defect.[94] In 1 large kindred in whom a null mutation was identified, ICH and bleeding into joints were reported after mild trauma.[95] ICH has been reported in 2 adults in whom the only underlying coagulation abnormality identified was a low PAI-1 level. One adult also had osteogenesis imperfecta (OI).[96,97]

There have been approximately 40 cases of AP deficiency reported in the literature. AP deficiency is inherited in an autosomal-recessive pattern, although heterozygous patients can also present with bleeding. Acquired deficiency has also been reported in patients with liver disease, disseminated intravascular coagulation, and acute promyelocytic leukemia. Homozygous patients tend to have severe bleeding similar to that seen in factor XIII deficiency, although ICH has not been reported. Heterozygous patients can have bleeding in response to trauma, surgery, or dental procedures or can be asymptomatic.[93,98] Intramedullary hematomas of long bones, which can occur without a history of trauma, are an unusual feature of homozygous AP deficiency.[99,100] Similar lesions have been seen in patients with afibrinogenemia. A shortened euglobulin lysis time can be used as a screening test for AP deficiency. Definitive diagnosis requires measurement of AP antigen and activity.[101]

Congenital Platelet Abnormalities

Platelets interact with VWF to adhere to sites of vessel wall injury. Subsequent activation and aggregation of platelets, which includes the release of granular contents, leads to formation of a platelet plug. Congenital platelet disorders can result in fewer platelets, abnormal function of platelets, or a combination of the two. There is a wide range in the presenting symptoms of these disorders, from mild mucocutaneous bleeding to severe life-threatening hemorrhage.[102]

The most severe and best-characterized platelet function disorders are also the rarest. These are the autosomal recessive disorders Bernard-Soulier syndrome (BSS) and Glanzmann thrombasthenia (GT). BSS results from absence or abnormal function of the GP Ib-IX-V receptor, which is responsible for platelet adhesion to VWF. Patients with BSS also commonly have mild thrombocytopenia with enlarged platelet size. In GT, the $\alpha IIb\beta 3$ platelet integrin is abnormal or missing, leading to impaired platelet aggregation, but the platelet count is normal. In both of these disorders, significant mucocutaneous bleeding and ICH have been reported, although ICH is rare, occurring in only 0.3% to 2.0% of patients with GT and even less in those with BSS.[103,104] The PFA-100 is a fairly reliable screening mechanism for these diagnoses (Table 1).[102,103]

Less well characterized but more common, the disorders of platelet signaling and secretion result from a variety of defects. Platelet activation leads to a conformational change in the platelet and normally results in secretion of platelet granule contents, which recruits other platelets to the site of injury. Without this response, platelets are unable to recruit other platelets. This group of disorders includes Quebec platelet disorder, the MYH9-related disorders, Scott syndrome, Hermansky-Pudlak syndrome, Chediak-Higashi syndrome, and Wiskott-Aldrich syndrome. Most bleeding with these disorders is mild and manifests as excessive bruising or menorrhagia. The PFA-100 does not reliably screen for these disorders.[105] More specific platelet aggregation and secretion testing is required, and occasionally, electron microscopic examination or genetic mutation testing is necessary to confirm the diagnosis.[102] All forms of genetic inheritance have been reported. Most patients with these disorders present with mucocutaneous bleeding manifestations or bleeding after surgery or trauma. Bleeding symptoms are variable and dependent on the specific defect. Joint bleeding can occur in some disorders. ICH has been reported after childbirth in neonates and trauma in older individuals. Some platelet function disorders are part of syndromes with associated physical findings. Individual review of these entities is outside of the scope of this report.[106,107] Of note, a variety of medications can lead to platelet dysfunction (eg, nonsteroidal antiinflammatory drugs, sodium valproate); therefore, a careful medication history should be obtained before diagnosing a congenital platelet abnormality.[108] Acquired thrombocytopenia, whether from medication, immune thrombocytopenia (ITP), maternal ITP, or neonatal alloimmune thrombocytopenia, should be readily diagnosed on the basis of a complete

blood cell count. The rate of ICH in patients with idiopathic ITP is <1%.[109]

Vascular Disorders

Certain vascular disorders can present with bruising or bleeding. Two disorders that might be confused for abuse are outlined. Discussion of all vascular disorders is outside of the scope of this report but can be found elsewhere.[110]

Ehlers-Danlos

Ehlers-Danlos syndrome (EDS) consists of a group of genetically and clinically heterogeneous connective tissue diseases that might be mistaken for child abuse.[111,112] The exact prevalence of EDS is unknown but is estimated to be 1 in 5000.[113] There are 6 genetic subtypes, which differ in the underlying biochemical defect, inheritance pattern, and clinical symptoms[114]; however, prominent bruising and bleeding are seen in all subtypes.[115] Mutations in collagen type I, type III, type V, or the genes involved in processing type I collagen result in most EDS subtypes. The tendency to bleed and/or bruise in EDS is caused by an abnormal capillary structure with deficiency of normal perivascular collagen. Cutaneous blood vessels are poorly supported and can rupture when subject to shearing forces. Tests for bleeding disorders are generally normal, except for the Hess test, which can be abnormal, indicating capillary fragility.[115] Clinically, the disorder manifests itself with easy bruising, bleeding gums, prolonged bleeding after surgical procedures, and menorrhagia. When evaluating children with possible abusive findings, pediatricians should assess for the typical signs of EDS. Skin hyperextensibility describes skin that extends easily and snaps back after release and is best tested at the volar surface of the forearm.[115] Widened, thin scarring often occurs at knees, shins, elbows, and the forehead.[115] Joint hypermobility is also often seen.

The vascular type of EDS, also known as EDS type IV, particularly might be confused with child abuse.[111] The precise prevalence is not known but has been estimated to be 1 in 250 000.[116,117] Both autosomal-recessive and -dominant inheritance patterns, as well as sporadic mutations, have been described.[118] The clinical diagnosis is made on the basis of 4 criteria: easy bruising; skin with visible veins; characteristic facial features; and rupture of arteries, uterus, or intestines.[114] The diagnosis is confirmed by the demonstration that cultured fibroblasts synthesize abnormal type III procollagen molecules or by the identification of a mutation in the gene for type III procollagen (*COL3A1*).[119] Excessive bruising is the most common presentation, but other severe complications, such as spontaneous rupture of the bowel and hemorrhagic pneumothorax, can occur. Vascular ruptures, including renal or splenic arteries, aneurysmal rupture, or stroke can also occur. ICH, including subdural hemorrhage, has only very rarely been described, and findings would likely not be confused with those commonly seen in inflicted head injury.[118,120] Severe complications are rare in childhood.[116] Joint hypermobility is often limited to the small joints of the hands. Skin hypermobility is typically not present, but the skin is often translucent, showing a visible venous pattern.[121,122] The characteristic facial appearance includes prominent eyes, pinched nose, small lips, hollow cheeks, and lobeless ears.[117,121]

If clinical suspicion exists, the diagnosis of most subtypes of EDS can be evaluated with biochemical and molecular analysis. Cultured skin fibroblasts can be used for gel electrophoresis of collagen types I, III, and V. For the vascular subtype (EDS type IV), biochemical analysis of type III procollagen identifies more than 95% of patients, whereas molecular screening of the *COL3A1* gene identifies up to 99% of mutations.[117,119]

OI

OI is a heterogeneous group of diseases characterized by bone fragility, dentinogenesis imperfecta, and adult hearing loss.[123] OI has been associated with easy bruising and ICH after minimal or no trauma.[124,125] Bleeding diathesis in OI is thought to occur as a result of platelet dysfunction and capillary fragility.[126,127]

Inheritance is generally autosomal-dominant, but autosomal-recessive inheritance and new mutations are known to occur. Most cases are the result of mutations in *COL1A1* and *COL1A2*. At least 8 types of OI are known to exist, and the prevalence is approximated at 1 in 15 000 to 1 in 20 000.[128,129]

Testing for OI by using DNA sequencing or collagen analysis is available. Sensitivities and specificities vary depending on the type of OI, but approximately 90% of individuals with OI types I, II, III, and IV (but none with OI types V, VI, VII, or VIII) have an identifiable mutation in either *COL1A1* or *COL1A2*.[125] Rare case reports have attributed multiple varieties of ICH, including subdural hematomas in children, to OI.[130–134] Additionally, 3 cases of relatively minor retinal hemorrhages coupled with subdural hematomas have been reported after trivial trauma in patients with OI type 1.[124] Despite these case reports, OI is a rare condition, and the occurrence of subdural hematomas and/or retinal hemorrhages attributable to OI is exceedingly rare.

Despite the reported associations of OI with easy bruising, no large-scale studies have characterized the

frequency and nature of bruising in children with OI or compared these patterns to nonabused children without OI or abused children. In children with bruises only, in the absence of other clinical indicators of OI, such as short stature, blue sclera, wormian or demineralized bones, or family history, it is generally not necessary to rule out OI via collagen or DNA testing.

Unsupported Hypotheses

Many alternative hypotheses have been proposed to explain bruising or bleeding concerning for abuse that are not supported by scientific evidence. It is outside of the scope of this report to discuss all hypotheses of this nature. Two of the more common are intracranial findings concerning for abuse caused by the effects of vaccines or by intracranial thrombosis.

Vaccines Mimicking Abusive Head Trauma

Some have proposed that vaccines cause findings that might be confused with abusive head trauma.[135–137] The hypothesized mechanism is a combination of ascorbate (vitamin C) depletion and foreign protein in vaccines causing a high histamine level, which then leads to capillary fragility and venous bleeding. No scientific evidence exists to support the hypothesis that immunizations cause findings that might be confused with inflicted trauma.

Intracranial Venous Thrombosis Mimicking Abusive Head Trauma

The incidence of intracranial venous thrombosis in children is estimated to be 0.67 cases per 100 000 children per year.[138] Of these, approximately 28% involve hemorrhagic venous infarction; thus, the incidence of hemorrhagic venous infarction is 0.19 cases per 100 000 children per year.[138] Common congenital associations include factor V Leiden, prothrombin gene mutation, protein C or S deficiency, and antithrombin deficiency. Other causes include infections (eg, otitis media, mastoiditis, sinusitis), dehydration, and trauma. Affected infants typically present with seizures and diffuse neurologic signs.[138] No studies have systematically compared characteristics of ICH resulting from intracranial thrombosis with characteristics of ICH resulting from trauma. A single study evaluating nontraumatic intracranial venous thrombosis detected no subdural hematoma in the study population (n = 36).[139] Additionally, bleeding from intracranial thrombosis has a typical appearance on magnetic resonance imaging, including localized bleeding near the thrombus, typically in an intraparenchymal distribution. This appearance is in contrast to the typical presenting features of deceleration head trauma, including thin-film subdural hemorrhages involving the interhemispheric region and the cerebral convexities.[22] If there is concern for intracranial thrombosis, magnetic resonance venography is the test of choice. Given the significant difference in appearance of ICH as a result of intracranial venous thrombosis in comparison with ICH from deceleration trauma, confusion between the 2 conditions should not exist.

INTERPRETATION OF TESTS

It should be noted that aPTT can be falsely prolonged in certain conditions, such as in the presence of a lupus anticoagulant, or can be prolonged and not indicate a true bleeding disorder, such as in factor XII deficiency or other contact factor deficiencies. In addition, patients who suffer a traumatic brain injury often have a transient coagulopathy that does not reflect an underlying congenital disorder.[140,141] It should also be noted that coagulation tests are very sensitive to specimen handling and should be performed in laboratories experienced with these assays. Inappropriate handling commonly leads to false-positive results.

Patients who have sustained significant trauma also might receive transfusions of blood products. Fresh-frozen plasma (FFP) is prepared by separating the liquid portion of blood from the cellular portion after the collection of whole blood or by collecting the liquid portion of blood by using apheresis technique. By definition, each milliliter of FFP contains 1 unit of all normal coagulation factors and inhibitors of coagulation, but in general, 10 to 20 mL/kg will raise factor levels only by 15% to 25%.[142]

Cryoprecipitate is prepared by thawing FFP and refreezing the precipitate. It contains high concentrations of fibrinogen, factor VIII, VWF, and factor XIII. Each coagulation factor has a different half-life (Table 4). Therefore, the administration of FFP or cryoprecipitate will affect the investigation for a coagulation factor deficiency differently depending on the factor being measured.

FREQUENCY OF THE CONDITION AND MEDICAL PROBABILITY

Specific data regarding the prevalence of bleeding disorders within the population of children with ICH or subdural hemorrhage are not available; however, there are data on the frequency of ICH as a result of specific bleeding disorders. If the prevalence of a condition and the frequency of a particular presentation of that condition are known, a physician can construct the probability of that specific condition (bleeding disorder) resulting in the specific presentation (ICH):

$$P(B) = \text{Prev}(A) \times \text{Prev}(B|A),$$

where B is ICH attributable to condition A, P is probability, and Prev is prevalence. For example, factor XIII deficiency is extremely rare, occurring at an

TABLE 4 Half-Lives of Coagulation Factors

Factor	Half-Life Postinfusion, h
Fibrinogen	96–150
II	60
V	24
VII	4–6
VIII	11–12
IX	22
X	35
XI	60
XIII	144–300
VWF	8–12

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upper limit estimated population prevalence of 1 in 2 million; however, it can present with isolated intracranial bleeding in up to one-third of cases.[59] The estimated probability that factor XIII deficiency will cause an ICH in a person in the population at large is:

(Prevalence of factor XIII deficiency)
× (Prevalence of ICH in factor XIII deficiency)
$(1/2 \text{ million}) \times (1/3) = 1/6 \text{ million}$

Table 5 contains probabilities for congenital bleeding disorders to cause ICHs in the population at large. No calculation was made in situations in which no reliable estimates of prevalence of the condition or frequency of ICH exist. The most liberal prevalence and frequency numbers were used, so as to provide the upper limits of probability.

CONCLUSIONS

In cases of suspected abuse involving bruising and/or bleeding, physicians must consider the possibility of coagulopathies causing or contributing to the findings. In many cases, the possible coagulopathies can be effectively evaluated by a thorough history and physical examination, and possibly by the specific nature of the child's findings; however, in some cases, a laboratory evaluation for coagulopathies might be necessary. The diagnosis of a bleeding disorder does not automatically rule out the presence of nonaccidental trauma. Because of the chronic nature of their disease, children with bleeding disorders may be at higher risk of abuse.[143]

Limited evidence exists comparing bruising and bleeding in children with coagulopathies with child victims of abuse. Conducting such studies would be difficult, given the overall rarity of coagulopathies; however, large databases exist for rare hematologic conditions, and modification of these databases to include factors, such as location of bruising or location/character of ICH, which would assist in discriminating between bleeding disorders and abuse, would be beneficial. In the absence of such data, physicians must use existing data, including epidemiologic and clinical factors, in their decision-making process.

TABLE 5 Probabilities for Congenital Coagulopathies to Cause ICH[a]

Condition	Prevalence of Condition, Upper Limits	Prevalence of ICH, Upper Limits	Probability[b]
VWD	1/1000	Extremely rare	Low
Factor II deficiency	1/1 million	11%	1/10 million
Factor V deficiency	1/1 million	8% of homozygotes	1/10 million homozygotes
Combined factors V and VIII deficiency	1/1 million	2%	1/50 million
Factor VII deficiency	1/300 000	4%–6.5%	1/5 million
Factor VIII deficiency	1/5000 males	5%–12%	1/50 000 males
Factor IX deficiency	1/20 000 males	5%–12%	1/200 000 males
Factor X deficiency	1/1 million	21%	1/5 million
Factor XI deficiency	1/100 000	Extremely rare	Low
Factor XIII deficiency	1/2 million	33%	1/6 million
AP deficiency	40 cases reported	Not reported	Low
PAI-1 deficiency	Extremely rare	Common	Low
Afibrinogenemia	1/500 000	10%	1/5 million
Dysfibrinogenemia	1/1 million	Single case report	Low

[a] The probability of having a specific bleeding disorder increases in the setting of a family history of that specific named bleeding disorder or if the patient is from an ethnicity in which a specific bleeding disorder is more common (eg, Ashkenazi Jewish people and factor XI deficiency).

[b] "Probability" indicates the probability that an individual in the general population would have the following specific coagulopathy causing an ICH.

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Evaluation for Bleeding Disorders in Suspected Child Abuse

• *Clinical Report*

CLINICAL REPORT

Evaluation for Bleeding Disorders in Suspected Child Abuse

abstract

FREE

Bruising or bleeding in a child can raise the concern for child abuse. Assessing whether the findings are the result of trauma and/or whether the child has a bleeding disorder is critical. Many bleeding disorders are rare, and not every child with bruising/bleeding concerning for abuse requires an evaluation for bleeding disorders. In some instances, however, bleeding disorders can present in a manner similar to child abuse. The history and clinical evaluation can be used to determine the necessity of an evaluation for a possible bleeding disorder, and prevalence and known clinical presentations of individual bleeding disorders can be used to guide the extent of the laboratory testing. This clinical report provides guidance to pediatricians and other clinicians regarding the evaluation for bleeding disorders when child abuse is suspected. *Pediatrics* 2013;131:e1314–e1322

INTRODUCTION

Children often present for medical care with bleeding or bruising that can raise a concern for child abuse. Most commonly, this occurs with cutaneous bruises and intracranial hemorrhage (ICH), but other presentations, such as hematemesis,[1] hematochezia,[2] and oronasal bleeding can be caused by child abuse and/or bleeding disorders.[3–7] When bleeding or bruising is suspicious for child abuse, careful consideration of medical and other causes is warranted. The inappropriate diagnosis of child abuse could occur,[8–10] potentially resulting in the removal of a child from a home and/or the potential prosecution of an innocent person. Conversely, attributing an abusive injury to medical causes or accidental injury puts a child at risk for future abuse and possible death.[11] Laboratory evaluations should be conducted with the understanding that the presence of a bleeding disorder does not rule out abuse as the etiology for bruising or bleeding.[9] Similarly, the presence of a history of trauma (accidental or nonaccidental) does not exclude the presence of a bleeding disorder or other medical condition. This clinical report provides guidance to pediatricians and other clinicians regarding the evaluation for bleeding disorders when child abuse is suspected (Fig 1).

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KEY WORDS

intracranial hemorrhage, inherited coagulation disorders, bruising, nonaccidental trauma

ABBREVIATIONS

aPTT—activated partial thromboplastin time
DIC—disseminated intravascular coagulation
ICH—intracranial hemorrhage
ITP—immune thrombocytopenia
PFA-100—platelet function analyzer
PT—prothrombin time
VKDB—vitamin K deficiency bleeding
VWD—von Willebrand disease

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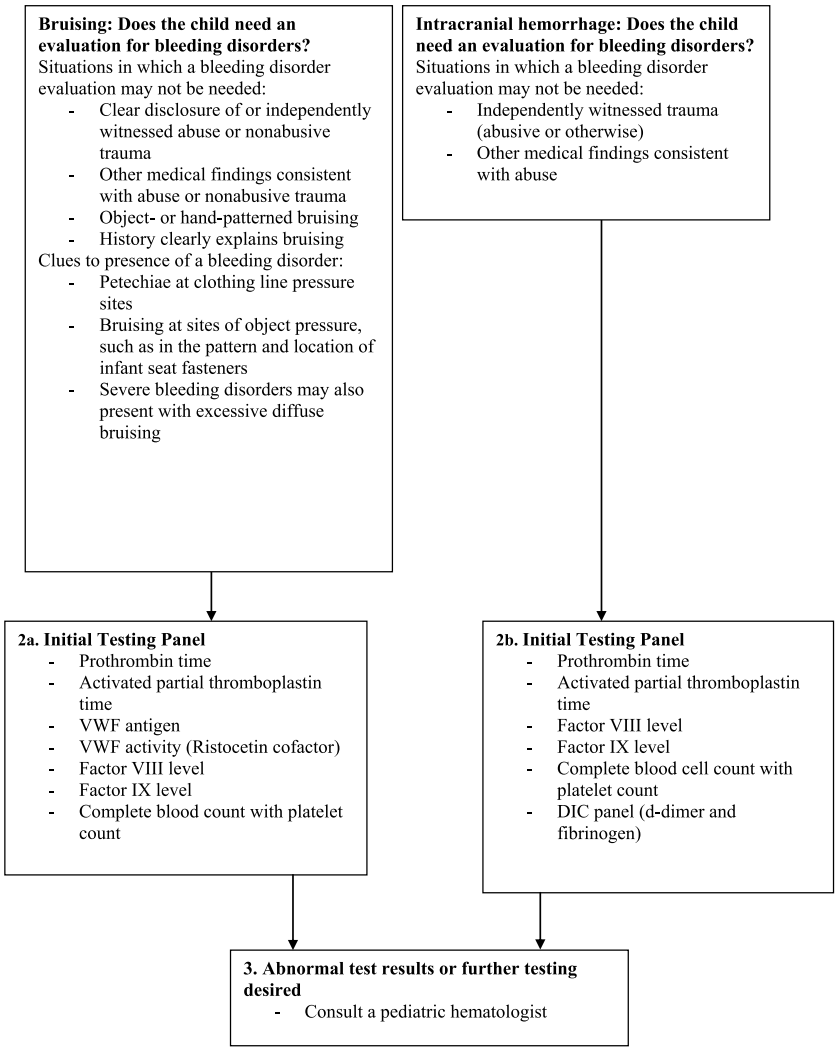

FIGURE 1
Recommended pathway for evaluation of possible bleeding disorders when child abuse is suspected. VWF, von Willebrand factor.

ASSESSING THE NEED FOR A LABORATORY EVALUATION FOR BLEEDING DISORDERS

The age and developmental capabilities of the child, history of trauma, the location and pattern of bruising, and, in the case of ICH, findings on neuroimaging should be considered when assessing children with bruising/bleeding for possible abuse.[12–18] Additionally, a medical history of symptoms suggestive of a bleeding disorder, such as significant bleeding after a circumcision or other surgery, epistaxis, bleeding from the umbilical stump, or excessive bleeding after dental procedures, increases the possibility of a bleeding disorder. Family history of a specific bleeding disorder or ethnicity of a population with higher rates of a certain bleeding disorder (eg, Amish) might necessitate testing for that condition. The child's medications should be documented, because certain drugs can affect the results of some tests that might be used to detect bleeding disorders, such as the platelet function analyzer (PFA-100; Siemens Healthcare Diagnostics, Tarrytown, NY) and platelet aggregation testing. Caregivers might state that their child "bruises easily." These statements are difficult to assess during an evaluation for possible abuse, as they can be a sign of a bleeding disorder, a reflection of the child's (fair) skin tone, or a fabrication to mask abuse. Children who are verbal and capable of providing a history should be interviewed away from potential offending caregivers, if possible. A thorough physical examination should include an evaluation of areas of bruising that have higher specificity for abuse,[14] such as the buttocks, ears, and genitals.

Any bleeding disorder can cause cutaneous bruising, and sometimes this bruising can be mild, can appear in locations that are considered suspicious for abuse,[19] and can appear at any age. Given the extreme rarity of some bleeding disorders, it is not reasonable to perform extensive laboratory testing for bleeding disorders in every child. In some cases, the constellation of findings, taken in conjunction with the clinical history and physical examination, can be so strongly consistent with an abusive injury that further laboratory investigation for medical conditions is not warranted. For instance, a child with a patterned slap mark who describes being hit with an open hand does not require a laboratory evaluation for a bleeding disorder.

In addition to bleeding disorders, the possibility of other medical causes of easy bruising or bleeding, such as Ehlers-Danlos syndrome, scurvy, cancer and other infiltrative disorders, glutaric aciduria, and arteriovenous malformations, should be assessed, as should a history of use of any medications or alternative therapies that may increase bleeding/bruising. Comprehensive descriptions of medical conditions that could be confused with child abuse and alternative therapies that may predispose to

bleeding/bruising are beyond the scope of this report and can be found elsewhere.[20,21] Results of the history, review of systems, physical examination, and, in the case of ICH, neuroimaging are generally adequate to exclude these conditions. When there are concerns that a medical condition might be the cause of bruising or bleeding, the evaluation for the conditions in question should occur simultaneously with the evaluation for abuse.

Bruising

In the absence of independently witnessed accidental trauma or a known medical cause, any bruising in a nonmobile child is highly concerning for abuse and necessitates an evaluation for child abuse.[12–15] Additionally, bruising in a young infant could also be the first presentation of a bleeding disorder.[19] As such, a simultaneous evaluation for bleeding disorders is recommended in these cases. In mobile children, the locations and patterns of the bruising can be used to assess for the possibility of abuse (Table 1).

TABLE 1 Suspicion of Child Abuse in Ambulatory Children on the Basis of Characteristics of Bruises[14,15,17]

Less Suspicious for Child Abuse	More Suspicious for Child Abuse
Forehead	Location
Under chin	Face
Elbows	Ears
Lower arms	Neck
Hips	Upper arms
Shins	Trunk
Ankles	Hands
	Genitalia
	Buttocks
	Anterior, medial thighs
	Pattern
	Slap or hand marks
	Object marks
	Bite marks
	Bruises in clusters
	Multiple bruises of uniform shape
	Large cumulative size of bruising

In cases of bruising, the assessment of the need for an evaluation for bleeding disorders should focus on the following:

- the specific history offered to explain the bruising;
- the nature and location of bruising; and
- mobility and developmental status of the child.

The following factors generally exclude the need for an evaluation for a bleeding disorder:

- the caregivers' description of trauma sufficiently explains the bruising;
- the child or an independent witness is able to provide a history of abuse or nonabusive trauma that explains the bruising; or
- abusive object or hand-patterned bruising is present.

The injury history offered by caregivers might be purposefully misleading if the caregivers have caused the bruising by abusive means.

In nonmobile infants, bleeding disorders can present with bruising or petechiae in sites of normal handling or pressure. Examples of this include the following:

- petechiae at clothing line pressure sites;
- bruising at sites of object pressure, such as in the pattern and location of infant seat fasteners; and
- excessive diffuse bleeding if the child has a severe bleeding disorder.

Absence of these examples does not rule out a bleeding disorder; however, their presence might increase the probability of a bleeding disorder.

ICH

Excepting obvious known trauma, ICH in a nonmobile child is highly concerning for child abuse. Children can suffer ICH, such as a small subdural or an epidural hematoma underlying a site of impact, from a short fall; however, short falls rarely result in significant brain injury.[16] Birth trauma and some medical conditions can also result in ICH in infants. Consultation with a child abuse pediatrician should be considered in complex or concerning cases.

No studies have systematically compared the presentation, clinical findings, patterns of ICH, or presence of retinal hemorrhages found in children with bleeding disorders with those found in children in whom abusive head trauma is diagnosed. However, bleeding disorders can cause ICH in any part of the cranial contents, and up to 12% of children and young adults with bleeding disorders have had ICH at some time.[22,23] Children with ICH concerning for abuse require an evaluation for bleeding disorders. Exceptions to required evaluation can include the following:

- Independently witnessed or verifiable trauma (abusive or nonabusive),
- Other findings consistent with abuse, such as fractures, burns, or internal abdominal trauma.

Other Bleeding Symptoms

Children with conditions such as hematemesis, hematochezia, or oronasal bleeding as presenting symptoms should be evaluated on a case-by-case basis for possible abuse, particularly child abuse in a medical setting. Medical conditions and/or child abuse can cause these findings.

BLEEDING DISORDERS AND EXTENT OF EVALUATION

Bleeding disorders that can produce patterns of bruising or bleeding that mimic abuse include coagulation factor deficiencies/abnormalities, fibrinolytic

defects, defects of fibrinogen, and platelet disorders. Table 2 contains a listing of the most common bleeding disorders in children and characteristics of potential testing strategies for each disorder. Most factor deficiencies can be detected by the prothrombin time (PT) and activated partial thromboplastin time (aPTT); however, von Willebrand disease (VWD) and factor XIII deficiency are not reliably detected by these screening tests. Additionally, mild deficiencies in factor VIII or factor IX (mild hemophilia) might not cause abnormalities in the aPTT but might still result in significant bleeding, including ICH, particularly after mild trauma. Fibrinolytic defects can cause significant bleeding/bruising but are extremely rare and require specific testing. Defects of fibrinogen are also rare and can be detected by the fibrinogen concentration and thrombin time.

The prevalence of mild platelet disorders is unknown, and testing for mild platelet disorders is challenging. The most common clinical presentations include bruising and mucocutaneous bleeding. The prevalence of ICH in mild platelet disorders is unknown but is likely to be low. Platelet aggregation testing, best performed by a pediatric hematologist, requires a relatively large volume of blood, and interpretation of the test result requires a specialist.[25] A PFA-100 can screen for many platelet function disorders, including more severe types, such as Bernard Soulier syndrome and Glanzmann thrombasthenia, as well as many types of VWD. However, the PFA-100 is not an effective screen for some types of VWD and milder platelet abnormalities. Individual patient characteristics, such as hematocrit, platelet count, pregnancy, age, multisystem trauma, sepsis, and medications, can affect the results of the PFA-100. Accurate diagnosis often requires additional testing, such as specific von Willebrand testing or platelet aggregation; therefore, many centers have decreased or ceased use of the PFA-100.[25,26] Assessment of the results of a PFA-100 and the need for further testing are best accomplished in consultation with a pediatric hematologist.

Vitamin K Deficiency

Vitamin K deficiency in infants can result in bleeding in the skin or from mucosal surfaces from circumcision, generalized ecchymoses, large intramuscular hemorrhages, or ICH. Because of the widespread provision of vitamin K at birth, vitamin K deficiency bleeding (VKDB) is rare; however, not all states require vitamin K to be administered at birth, and some medical conditions predispose to VKDB.[24] In VKDB, there is a prolonged PT and possibly aPTT for age. In patients who have already received vitamin K, fresh-frozen plasma, or specific factor replacement as treatment, measurement of proteins induced by vitamin K absence can confirm the diagnosis.[27,28]

Coagulation Tests in Cases of Bruising

The initial screening panel in a patient who presents with bruising evaluates for conditions with a known prevalence more common than 1 per 500 000 people, including idiopathic thrombocytopenic purpura, all factor deficiencies (except factor XIII deficiency), and VWD (Fig 1). It does not evaluate for extremely rare conditions, including factor XIII deficiency, defects of fibrinogen, and fibrinolytic defects. This strategy also does not screen for extremely rare platelet disorders, such as Glanzmann thrombasthenia, and more common but relatively more difficult to detect platelet disorders, such as platelet storage pool disorders. If test results are abnormal or expanded/detailed testing is necessary or preferred, consultation with a pediatric hematologist is recommended.

In many circumstances, children with bruising that is suspicious for abuse may be removed from a potentially dangerous setting where the abuse likely occurred. A thorough physical examination performed in the weeks after removal that reveals minimal bruising and/or bruising only in locations of common accidental bruises is supportive of abuse as the cause of the original suspicious bruising. Each case must be evaluated individually, however, considering the totality of findings, and with the understanding that the need for safety must be balanced with the emotional trauma of removing a child from his or her home. Bleeding disorders are generally permanent conditions that do not result in abatement after a change in caregivers. One exception to this is immune thrombocytopenia (ITP), which is a transient, often self-resolving bleeding disorder. Screening for ITP (platelet count) is necessary at the time of presentation with bruises.

Determining the Need for a Test: The Medical Probability

Specific data regarding the prevalence of bleeding disorders in the population of children with ICH or subdural hematoma is not available. However, there are data regarding the probability of specific bleeding disorders to cause ICH. If the prevalence of a condition and the frequency of a particular presentation of that condition are known, a physician can construct the probability of that specific condition (bleeding disorder) resulting in the specific presentation (ICH). The presence of "classic" bleeding symptoms, such as bleeding after circumcision,

TABLE 2 Common Testing Strategies for Bleeding Disorders

Condition	Frequency	Inheritance	Screening Tests	Sn and Sp, %	PPV and NPV,%	Confirmatory Test
Factor abnormalities/deficiencies						
VWD type 1	1/1000	AD	PFA-100	Sn = 79–96[a]	PPV = 93.3	VWAg[b] VWF activity
				Sp = 88–96[a]	NPV = 98.2	VW multimer analysis Factor VIII activity
VWD type 2A	Uncommon	AD or AR	PFA-100	Sn = 94–100[a]	PPV = 93.3	VWAg[b] VWF activity
				Sp = 88–96[a]	NPV = 98.2	VW multimer analysis Factor VIII activity
VWD type 2B	Uncommon	AD	PFA-100	Sn = 93–96[a]	PPV = 93.3	VWAg[b] VWF activity
				Sp = 88–96[a]	NPV = 98.2	VW multimer analysis Factor VIII activity
VWD type 2M	Uncommon	AD or AR	PFA-100	Sn = 94–97[a]	PPV = 93.3	VWAg[b] VWF activity
				Sp = 88–96[a]	NPV = 98.2	VW multimer analysis Factor VIII activity
VWD type 2N	Uncommon	AR, or compound heterozygote	aPTT	NA	NA	VWF-Factor VIII binding assay
VWD type 3	1/300 000–1 000 000	AR, or compound heterozygote	PFA-100	Sn = 94–100[a]	PPV = 93.3	VWAg[b] Ristocetin cofactor
				Sp = 88–96[a]	NPV = 98.2	VWF multimer analysis Factor VIII activity
Factor II deficiency (prothrombin)	26 reported cases, estimated 1/1–2 million		aPTT, PT (may be normal)	Sn = variable	NA	Factor II activity ± antigen levels
Factor V deficiency	1/1 million	AR	aPTT, PT	Sn = variable	NA	Factor V activity
Combined Factor V/Factor VIII deficiency	1/1 million	AR	aPTT>PT	Sn = variable	NA	Factor V and factor VIII activities
Factor VII deficiency	1/300 000–500 000	AR	PT	Sn = variable	NA	Factor VII activity
Factor VIII deficiency	1/5000 male births	X-linked	aPTT	Sn = variable	NA	Factor VIII activity
Factor IX deficiency	1/20 000 male births	X-linked	aPTT	Sn = variable	NA	Factor IX activity
Factor X deficiency	1/1 million	AR	aPTT, PT, RVV	Sn = variable	NA	Factor X activity
Factor XI deficiency	1/100 000	AR	aPTT	Sn = variable	NA	Factor XI activity
Factor XIII deficiency	1/2–5 million	AR	Clot solubility	Sn = variable	NA	Factor XIII activity
Fibrinolytic defects						
α-2 antiplasmin deficiency	~40 reported cases	AR	Euglobin lysis test	Sn = variable	NA	α-2 antiplasmin activity
PAI-1 deficiency	Very rare	AR		Sn = variable	NA	PAI -1 antigen and activity
Defects of fibrinogen						
Afibrinogenemia	1/500 000	AR	PT, aPTT	Sn = high	NA	Fibrinogen level
Hypofibrinogenemia	Less than afibrinogenemia		PT, aPTT	Sn = variable	NA	Thrombin time, fibrinogen activity
Dysfibrinogenemia	1/million		Thrombin time, fibrinogen level	Sn = variable	NA	Thrombin time, fibrinogen antigen and activity level comparison, reptilase time
Platelet disorders						
ITP	Age-related	NA	CBC	Sn = high	NA	Antiplatelet Ab (rarely needed)
Glanzmann thrombasthenia	Very rare	AR	PFA-100	Sn = 97–100	NA	Platelet aggregation testing Flow cytometry

TABLE 2 Continued

Condition	Frequency	Inheritance	Screening Tests	Sn and Sp, %	PPV and NPV,%	Confirmatory Test
Bernard Soulier syndrome	Rare	AR	PFA-100	Sn = 100	NA	Platelet aggregation testing Flow cytometry
Platelet release/storage disorders	Unknown, more common than other platelet function disorders	variable	PFA-100	Sn = 27–50	NA	Platelet aggregation and secretion Electron microscopy Molecular and cytogenetic testing

AD, autosomal dominant; AR, autosomal recessive; CBC, complete blood cell (count); NA, not available or not applicable; NPV, negative predictive value; PAI-1, plasminogen activator inhibitor-1; PPV, positive predictive value; RVV, Russell viper venom (test); Sn, sensitivity; Sp, specificity; VW, von Willebrand; VWAg, von Willebrand antigen; VWF, von Willebrand factor Ab, antibody.

[a] Values derived from data before 2008 National Institutes of Health Consensus guidelines. Sn and Sp using current diagnostic cutoffs unknown but would be expected to have higher Sp with lower Sn.

[b] May be reasonable to proceed directly to diagnostic testing depending on availability. See accompanying technical report for detailed discussion.[24]

umbilical stump bleeding, joint hemorrhage, and excessive soft tissue bleeding, increase the probability for a bleeding disorder; however, these findings are neither sensitive nor specific for bleeding disorders.

Coagulation Tests in the Setting of ICH

For bleeding disorders that cause ICH, the prevalence of the bleeding disorder and the prevalence of ICH in patients with each specific bleeding disorder can be used to construct the probability of the specific bleeding disorder to cause ICH (Table 3). Some probabilities are so low as to preclude calculation. Testing for these conditions is likely not useful. Mild hemophilia, which might be missed if only an aPTT test is ordered, can be detected by measuring specific levels of factor VIII and factor IX. Mild hemophilia can result in ICH, particularly after mild trauma, and because of the relatively high prevalence of the condition, the probability of mild factor VIII deficiency causing or contributing to ICH is 1 in 280 000 males. In populations with a high prevalence of factor XI deficiency, such as the Ashkenazi Jewish population, it might be reasonable to measure factor XI level.

Clinical and historical information can be used to determine the need for testing in children with isolated ICH concerning for abuse (Fig 1). The initial testing panel for ICH evaluates for conditions for which the probability for the condition resulting in ICH is greater than 1 per 5 million. The panel includes testing for most factor deficiencies and afibrinogenemia. This screening panel does not test for factor XIII deficiency, VWD, fibrinolytic defects, hypofibrinogenemia, and dysfibrinogenemia. These conditions either have not been associated with ICH or they are so rarely the cause of ICH that testing for the conditions is not reasonable. Additionally, the initial screening panel evaluates for disseminated intravascular coagulation (DIC). Because DIC can cause any type of bruising/bleeding, including ICH, the finding of DIC in the context of suspected child abuse could significantly change the clinical approach to a patient. In children with DIC and bleeding symptoms as the only finding concerning for abuse, consideration must be given to the multitude of primary causes of DIC, including trauma, sepsis, and primary bleeding disorders, among many others.

Many children with ICH suspicious for abuse, if they survive, are placed in safe settings after hospital discharge. In these cases, testing for bleeding disorders can be deferred to a later date, with the exception of ITP. If blood products have been given to the patient, as can happen in severe ICH, the definitive evaluation for bleeding disorders should be postponed until the transfused blood components are no longer in the patient's system (Table 4). Assistance from a pediatric hematologist should be considered in addressing the possibility of factor deficiencies after a transfusion has occurred.

Many aspects of bleeding disorders are under investigation, and thus, changes in the understanding of the prevalence and severity of certain bleeding symptoms related to these disorders should be expected. For example, although hemophilia A and B are X-linked diseases and, therefore, typically thought to affect only male individuals, 25% to 50% of female carriers of hemophilia report excess bleeding; therefore, measurement of factor VIII and IX levels in female patients should be considered.[29] In addition, the population prevalence and/or clinical effects of mild platelet function disorders continue to be studied. In a patient with mucocutaneous symptoms, particularly if petechiae are

TABLE 3 Probabilities for Congenital Coagulopathies Causing ICH[a]

Condition	Prevalence of Condition, Upper Limits	Prevalence of ICH, Upper Limits	Probability[b]
VWD	1/1000	Extremely rare	Low
Factor II deficiency	1/1 million	11%	1/10 million
Factor V deficiency	1/1 million	8% of homozygotes	1/10 million homozygotes
Combined factors V and VIII deficiencies	1/1 million	2%	1/50 million
Factor VII deficiency	1/300 000	4%–6.5%	1/5 million
Factor VIII deficiency	1/5000 males	5%–12%	1/50 000 males
Factor IX deficiency	1/20 000 males	5%–12%	1/200 000 males
Factor X deficiency	1/1 million	21%	1/5 million
Factor XI deficiency	1/100 000	Extremely rare	Low
Factor XIII deficiency	1/2 million	33%	1/6 million
α-2 antiplasmin deficiency	40 cases reported	Not reported	Low
Plasminogen activator inhibitor-1 deficiency	Extremely rare	Common	Low
Afibrinogenemia	1/500 000	10%	1/5 million
Dysfibrinogenemia	1/1 million	Single case report	Low

[a] The probability of having a specific bleeding disorder increases in the setting of a family history of that specific named bleeding disorder or if the patient is from an ethnicity in which a specific bleeding disorder is more common (eg, Ashkenazi Jewish people and factor XI deficiency).
[b] "Probability" indicates the probability that an individual in the general population would have the following specific coagulopathy causing an ICH.

present, platelet aggregation testing should be considered.[25] Finally, because von Willebrand factor is an acute phase reactant, its levels can vary in response to clinical status, resulting in falsely elevated results. Many times, testing must be repeated up to 3 times to ensure reliable results.[30] If significant concern for VWD exists, consultation with a pediatric hematologist is suggested.

When Testing Indicates a Possible Bleeding Disorder in the Context of an Abuse Evaluation

Positive laboratory test results require further evaluation for the possibility of false-positive results and/or the necessity for further testing. Prolongation of the PT and aPTT because of parenchymal damage has been noted in abusive head trauma and should not automatically be interpreted as evidence of a primary bleeding disorder.[31] Additionally, consideration must be given to the likelihood of a preexisting bleeding disorder as the primary cause of a child's bleeding/bruising. For example, given the relatively high prevalence of VWD, it is inevitable that some children with VWD will be abused and present with bleeding/bruising symptoms. Determining the causative factor in these situations is challenging. Bruising is a common finding in VWD. If a child has test results consistent with VWD and bruising concerning for abuse, a short-term change in home setting may be considered, understanding the cautions needed when using this approach. Only a few case reports have attributed ICH to VWD. Most reported ICH in children with VWD would not be confused with typical abusive ICH.[32–34] Given the rarity of ICH in VWD, particularly spontaneous ICH, testing consistent with VWD does not mean that ICH is definitively attributable to VWD, and abuse must still be considered.

TABLE 4 Half-Lives of Coagulation Factors

Factor	Half-Life Postinfusion, h
Fibrinogen	96–150
II	60
V	24
VII	4–6
VIII	11–12
IX	22
X	35
XI	60
XIII	144–300
VWF	8–12

VWF, von Willebrand factor.
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Interpretation of Tests

It should be noted that the aPTT can be falsely prolonged in certain circumstances, such as in the presence of a lupus anticoagulant, or can be prolonged and might not indicate a true bleeding disorder, such as in factor XII deficiency or other contact factor deficiencies. In addition, patients who experience a traumatic brain injury often have a transient coagulopathy that does not reflect an underlying congenital disorder.[31,35] Coagulation tests are very sensitive to specimen handling and should be performed in laboratories experienced with these assays. Inappropriate handling commonly leads to false-positive results.

CONCLUSIONS

Children who present with bleeding and bruising symptoms that are concerning for abuse require careful evaluation for the potential of bleeding disorders as a cause. No single panel of tests rules out every possible bleeding disorder. Given the rarity of most bleeding disorders and the possible presence of specific clinical factors that decrease the likelihood of a bleeding disorder causing a child's findings, in many situations, extensive laboratory evaluation is not

necessary. If a laboratory evaluation is conducted, tests should be chosen on the basis of the prevalence of the condition, patient and family history, ease of testing, blood volume required for testing, and, in the case of ICH, probability of a bleeding disorder causing ICH. Further consultation with a pediatric hematologist is recommended if specific, expanded testing is necessary, if preliminary testing suggests the presence of a bleeding disorder, if testing to rule out a specific bleeding disorder is needed, or if testing for very rare conditions is preferred.

GUIDANCE FOR PEDIATRICIANS

In children who have bruising or bleeding that is suspicious for abuse,

1. Complete medical, trauma, and family histories and a thorough physical examination are critical tools in evaluating for the possibility of abuse or medical conditions that predispose to bleeding/bruising.
2. In each case, careful consideration of the possibility of a medical condition causing the bleeding/bruising is essential. Specific elements of the history and characteristics of the bleeding/bruising can be used to determine the need for a laboratory evaluation for bleeding disorders.
3. If the evaluation indicates a need for laboratory testing for bleeding disorders, initial testing is focused on the prevalence of the condition and potential of each specific condition to cause the specific findings in a given child (Fig 1).
4. Laboratory testing suggestive or indicating the presence of a bleeding disorder does not eliminate abuse from consideration. In children with bruising and laboratory testing suggestive of a bleeding disorder, a follow-up evaluation after a change in home setting can provide valuable information regarding the likelihood of a bleeding disorder causing the concerning findings.
5. Children with ICH often receive blood product transfusions. It is suggested that screening for bleeding disorders in these patients be delayed until elimination of the transfused blood clotting elements.
6. The discovery of new information regarding condition prevalence, laboratory testing, and clinical presentations of bleeding disorders is to be expected. Close collaboration with a pediatric hematologist is necessary to ensure the most current evaluation and testing methods.

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The Evaluation of Children in the Primary Care Setting When Sexual Abuse Is Suspected

• *Clinical Report*

CLINICAL REPORT

The Evaluation of Children in the Primary Care Setting When Sexual Abuse Is Suspected

abstract

FREE

This clinical report updates a 2005 report from the American Academy of Pediatrics on the evaluation of sexual abuse in children. The medical assessment of suspected child sexual abuse should include obtaining a history, performing a physical examination, and obtaining appropriate laboratory tests. The role of the physician includes determining the need to report suspected sexual abuse; assessing the physical, emotional, and behavioral consequences of sexual abuse; providing information to parents about how to support their child; and coordinating with other professionals to provide comprehensive treatment and follow-up of children exposed to child sexual abuse. *Pediatrics* 2013;132:e558–e567

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KEY WORD
sexual abuse

ABBREVIATIONS
AAP—American Academy of Pediatrics
HIV—human immunodeficiency virus
NAAT—nucleic acid amplification test
STI—sexually transmitted infection

INTRODUCTION

Sexual abuse of children and adolescents is a common problem that is potentially damaging to their long-term physical and psychological health. The Fourth National Incidence Study on Child Abuse and Neglect[1] estimated that in 2006, 1.8 children per 1000 (or a total of 135 300 children) were victims of sexual abuse. Other national studies have found that 5% to 25% of adults reported being sexually abused as children, depending on the population studied and the methods used to define sexual abuse.[2–7] Pediatricians are likely to care for sexually abused children in their practices, even though many victims wait years before telling anyone about their abuse.[8,9] More than half of sexually abused children do not disclose their abuse until they are adults.[10]

A history of childhood sexual abuse can have lifelong deleterious effects on a child's physical and mental health. Sexual abuse increases the risk of developing posttraumatic stress disorder, anxiety disorder, depression,[11,12] low self-esteem,[13] and social phobias.[14] Children exposed to sexual abuse are more likely to need hospitalization for mental illness.[15] Adult survivors of child sexual abuse are more likely to become victims of intimate partner violence and sexual assault.[16,17] They are at higher risk of developing obesity,[18] sexual problems,[19] irritable bowel syndrome,[20] fibromyalgia,[21] and sexually transmitted infections (STIs), including infection with the human immunodeficiency virus (HIV).[22,23] They use more medical services as adults than those without a history of child sexual abuse[21,24] and are more likely to develop addictions to tobacco, drugs, and alcohol.[25–27]

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In summary, child sexual abuse occurs commonly and can have lifelong effects on victims' physical and mental health. When the issue of possible sexual abuse is raised in the clinical setting, it is important for pediatricians to know how to respond to and evaluate the child, when to refer the child for evaluation by other professionals, when to report the case to the appropriate investigative agency, and how to counsel parents to decrease the long-term deleterious effects of the abuse. This clinical report updates an American Academy of Pediatrics (AAP) report from 2005 titled "The Evaluation of Sexual Abuse in Children."[28]

RESPONDING TO A PARENT'S CONCERN ABOUT POSSIBLE SEXUAL ABUSE

When a parent brings up the possibility of sexual abuse of his or her child, the pediatrician should immediately exclude the child from the discussion. Children (particularly young children) might be influenced by hearing their parents' concerns about abuse. Sometimes parents are overconcerned about normal childhood sexual behavior.[29] In those cases, reassuring and educating the parents will probably assuage their fears. Parents' overconcern could be related to their own adverse experiences in childhood, and in such cases, a more in-depth assessment to assist the parent is needed. Occasionally, parents might have concerns about possible sexual abuse because of relationship issues that arise between caregivers. Many of these concerns are raised in good faith but ultimately unfounded. Notwithstanding these caveats, every concern about possible sexual abuse should be approached objectively, thoughtfully, and with an open mind.

The pediatrician faces many challenges in evaluating possible sexual abuse to determine which cases warrant an immediate intervention in the office and which cases warrant reporting to investigative agencies or referral for evaluation by other professionals. In all these cases, the pediatrician should carefully document the parent's concerns, take a detailed history of the nature of the child's disclosure from the parents' perspective, ask what questions the parent used in eliciting the disclosure, and document a complete medical history, social history, and review of systems for urogenital and behavioral problems. It is important to note in the record the source of the information documented in the medical record. For example, be sure to say, "Mother tells me that the child said . . .," rather than writing, "The child said. . . ."

Often, a child will present to the pediatrician after direct disclosure to another person regarding sexual abuse. Less commonly, a child presents to the pediatrician with an abnormal genital or anal examination, pregnancy, an STI, or sexual abuse witnessed by a third party or by discovery of sexually graphic images or videos in the possession of a potential perpetrator. The general pediatrician's response depends on what resources are available in the community. Many communities and regions have specialized clinics or child advocacy centers where children can be referred when concerns of sexual abuse arise. In areas without these resources, the general pediatrician is often the most knowledgeable professional in the community regarding the evaluation and interviewing of children. If pediatricians find that their regions do not offer specialized abuse-related services (eg, child advocacy centers or hospital-based child protection programs), it is important for them to educate themselves about childhood genital and anal examinations and about how to interview children to get enough information to make appropriate decisions about reporting to child protective service agencies, referring to counseling facilities, or referring to pediatric clinics specializing in abuse evaluations. The AAP offers a variety of educational materials on child abuse to physicians, including a comprehensive CD-ROM,[30] textbooks on child abuse,[31,32] and educational offerings at the National Conference and Exhibition.

Whenever the issue of possible child sexual abuse arises in the office setting, 5 important issues should be addressed.

1. **The child's safety.** Is the child safe to go home? Is the child at imminent risk of additional harm if sent back to an environment where a possible perpetrator has access to the child? Is the child likely to be harmed or punished for disclosing abuse? Is there concern that the child might be coerced or intimidated to recant the disclosure? If any of these questions are answered "yes" or "maybe," this is a child protection emergency, and the appropriate authorities (child protective services or law enforcement) should be contacted immediately.
2. **Reporting to child protection authorities.** If the child is not at imminent risk, the pediatrician should decide whether child protective services should be contacted about the allegation. It is important to remember that in every state, and in all provinces and territories in Canada, it is mandated that professionals report *suspected* child abuse and neglect to the appropriate government agency (child protective services or police agencies, including tribal agencies). Studies have shown that some pediatricians are hesitant to involve outside agencies,

even if they strongly suspect abuse has occurred.[33] Pediatricians worry about the intrusion of agencies into family life, the risk of the child being separated from the parents, or the possibility that the family will leave the practice if reported to a child protection agency. Some pediatricians have experienced negative interactions with child protection agencies, which could make them distrustful of an agency's response and its effect on the family.[34] Some physicians might overestimate their ability to manage the situation within their practice. Physicians should not let these concerns act as barriers to protecting a child. In the United States, physicians are protected against liability for reporting a reasonable suspicion of child abuse and neglect if the report is made in good faith. This is also the case in many other jurisdictions, but because laws can vary, it is important for physicians to be familiar with the laws that pertain to their practice. Still, the safety of the child should take precedence over the physician's fear of lawsuits.

One problem lies in the definition of *suspected.* If a parent is going through a contentious divorce and the child is having symptoms of anxiety and depression, should abuse be suspected? If a child is sexually acting out with peers, should abuse be suspected? Each pediatrician will need to consider the facts of the individual case when making the decision to report suspected child abuse while bearing in mind the statutory requirements for reporting suspected abuse in his or her state. The threshold for reporting is low. The pediatrician should report when there is a reasonable suspicion that the child was abused. The child protective services agency then has the responsibility to conduct a thorough investigation to determine whether abuse has occurred.

3. **The child's mental health.** In every case, the patient should be assessed for possible mental health problems, and if any are identified, appropriate emergency mental health care should be sought. The initial disclosure of abuse can be extremely stressful for a young person. It is important to consider the possibility that symptoms of depression and posttraumatic stress disorder might already have developed. The family might be angry at the child because the disclosure has introduced stress into the family or because the threatened loss of a family member could result in financial insecurity. A disclosure of sexual abuse is perhaps one of the most explosive events that can occur in a family.
4. **The need for a physical examination.** If sexual abuse is suspected, a thorough examination should be performed to rule out injury, particularly if a child is reporting genital or anal pain or bleeding. If the abuse occurred in the distant past and the asymptomatic child is going to be referred to a specialty center for medical evaluation, examination might be deferred. If the child reports dysuria, a urinalysis is indicated. Rarely, acute sexual assault can cause severe genital or anal injury that can lead to excessive blood loss (a medical emergency).
5. **The need for forensic evidence collection.** Children who have had recent sexual contact involving the exchange of bodily fluids should be immediately referred to a specialized clinic or emergency department capable of collecting evidence using a forensic evidence kit.[35] Many states recommend that forensic evidence be collected if less than 72 hours have passed since the assault. Some states require evidence kits to be performed as late as 96 hours after assault. Some evidence supports limiting collection of forensic evidence in prepubertal children to those who present within 24 hours after assault.[36,37] As more laboratories use DNA testing to analyze forensic specimens, however, the time for collection of useful forensic evidence might be extended beyond the current 72-hour standard.[38,39] Pediatricians should familiarize themselves with the relevant policies of the jurisdiction in which they practice. The referral center also should be capable of evaluating the child for the appropriateness of antiretroviral HIV prophylaxis,[40] postexposure prophylaxis for STIs,[41] and pregnancy prophylaxis. HIV and pregnancy prophylaxis should be given as soon after the sexual contact as possible and are not recommended more than 72 hours after contact.

INTERVIEWING CHILDREN ABOUT POSSIBLE SEXUAL ABUSE

Depending on the community services available, the pediatrician should be prepared to conduct a basic interview with a verbal child about an abuse experience. Often, this is necessary to make the appropriate decision about referral to another facility or to report to child protective services. Several fundamental guidelines inform this process.

1. If the child spontaneously discloses abuse, it is important that the person hearing the disclosure respond by telling the child it is okay to talk about it with adults. If the child begins to make a disclosure and the physician says, "I'm

not the person you should tell this to," the child might be hesitant to disclose at another time.

2. The child should be separated from the parent for the interview if at all possible. Parents can subtly or not-so-subtly influence the child's statements. Separation from the parent is particularly important if the parent is a suspected perpetrator or is supportive of the suspected perpetrator, to prevent the child from feeling intimidated or threatened. The parent will later be present for the examination if that is the child's preference.
3. If the pediatrician has not already established a relationship with the patient, some time should be spent talking about nonthreatening issues, such as school, friends, or pets. It is difficult for a child to be asked painful or embarrassing questions without first feeling safe and supported by the adult asking the questions.
4. Pediatricians should tell children that it is their job as doctors to keep children healthy and that it is okay for children to talk about difficult or uncomfortable subjects with their doctors.
5. The pediatrician should not ask leading or suggestive questions. It is important to begin with open-ended, general questions about the child's likes and dislikes or about the people in the child's family. Then ask about things the child is worried or confused about, or about things that have happened to the child that have been unpleasant or stressful. A question should never suggest an answer. Examples of open-ended questions include the following:

"Is anything bothering you?"

"Tell me why you're here today."

"Do you think he would want you to tell me what happened?"

Examples of incorrect questions are as follows:

"Who touched your privates?"

"I know that Uncle Joe hurt you; tell me about it."

6. Developmentally appropriate language should be used with the child. The terms and concepts understood by a 12-year-old are very different from those understood by a 4-year-old. Be aware of the terms the child uses for the genitalia and anus. The parents should be asked in advance which terms the family uses for private parts and bathroom activities.
7. Any descriptions of abuse given by the child should be recorded word for word (using quotation marks) in the medical record, using the child's own language, and should be attributed to the child. When practical, the response should be recorded together with the question. For example, "When asked why she was not wearing underwear, the patient answered that . . ." or "Without my asking, the child stated that. . . ." Careful notes should be taken during the interview. Video or audio recording of the interview is not needed unless this is part of the pediatrician's regular practice.
8. The child should not be urged or coerced to talk about abuse. The child should be allowed to talk about it if he or she wants to, but there should never be an expectation that the child must disclose to the professional. The child should not be rewarded after a disclosure. (For example, "Tell me what happened with Uncle Joe, and then you can go back to your mom" is not an appropriate statement.) Forcing a child who has been abused to give a disclosure can be experienced by the child as revictimization and loss of control and can make an already painful experience worse.
9. The pediatrician should remember that this is a *medical* interview and that he or she is obtaining information needed to make the appropriate diagnostic and treatment decisions. If the child makes an initial disclosure to the pediatrician, it is likely that the child will be interviewed again by another adult professional. Parents and children can be told this before the interview begins. Professionals with advanced training in forensic interviewing conduct a very different type of interview than the medical interview conducted in the clinical setting. Although it is important to avoid multiple interviews of the child, in many situations the interview will be a 2-stage process in which the initial evaluator obtains minimal facts to evaluate the need to report to the authorities, and a forensic evaluator conducts a more detailed interview.
10. The pediatrician should be supportive and empathic. Treat the patient with the same respect and caring given to all your patients. If the child tells you about abuse, show appropriate concern; do not act shocked, outraged, or dismissive.
11. Appropriate language should be used to interview children. Translators should be used if necessary, and the child's use of words to describe body parts should be understood.
12. If the pediatrician records his or her impression of the child's emotions during the examination or interview, these subjective impressions should be identified as such (eg, "It was my impression

that the child seemed agitated."). Similarly, if an observation is made that may bear on the truthfulness of the history, it should be clearly identified as separate from fact (eg, "I noted that the child and her mother used identical words when answering this same question. I therefore considered the possibility that the answers may have been rehearsed.").

THE PHYSICAL EXAMINATION WHEN SEXUAL ABUSE IS SUSPECTED

Studies have shown that pediatricians often have not been properly trained to examine the genitals and anuses of children when abuse is suspected.[42] Some of the most basic knowledge, such as the appropriate identification of anatomic structures, has not always been part of pediatric residencies or physicians' continuing education.[43,44] Appropriate techniques for evaluating children's anogenital regions are an important part of pediatric education.

When the question of sexual abuse arises in the medical setting, the pediatrician might want to consider whether the child should be triaged to another facility for evaluation, such as a child advocacy center or a specialized abuse assessment clinic at a children's hospital (after considering the safety questions discussed previously). If the pediatrician does not think that the situation constitutes an emergency, he or she should consider referring the child for evaluation if he or she is not confident that he or she has the necessary examination skills. Unnecessary multiple anogenital examinations should be avoided because they can be upsetting to a sexually abused child. On the other hand, routine examination of the genitals and anus (appropriately chaperoned)[45] during well child examinations can help patients and parents understand that anogenital health is as important as the health of other parts of the body and will familiarize pediatricians with normal anatomic structures.

The anogenital examination should be preceded by a thorough general physical examination. Children who have experienced one type of abuse also are at risk for other types of abuse or neglect. In addition, the general physical examination establishes the physician's role and is likely to be an event the child has previously experienced at a physician's office.

The nature and process of the examination should be explained to the child in age-appropriate language before the examination takes place. An appropriate chaperone must be present. Most children will want a same-gender parent in the room during the examination. If a parent is not available, a second medical professional should be in the room to reassure the child, to assist the examining physician, and to act as a chaperone. A parent or caring professional at the head of the examination table can provide support for the child as well as reasonable assurance and distraction during the examination. Use of appropriate gowns and drapes can protect the child's modesty and make the child feel less vulnerable.

The examination of the genitalia and anus does not require the use of instruments in most cases. For girls, separation of the labia and gentle labial traction while the child is supine with the knees bent and hips abducted (frog-leg position) will adequately expose the genital structures. Speculum examinations are contraindicated in prepubertal children in the office setting. If intravaginal trauma is suspected, vaginoscopy should be performed under anesthesia.

In an adolescent, an examination for sexual abuse should follow the recommendations of the AAP regarding intravaginal examination using a speculum.[46] In many cases, a speculum examination is not needed in the absence of signs or symptoms of genital disease but is usually indicated after acute vaginal sexual assault to document injuries and to collect forensic specimens.[47] Girls should receive their first cervical cytologic examination (Papanicolaou test) at 21 years of age unless there are special circumstances, such as immune suppression or infection with HIV.[46,48]

For boys, the examination of the genitals consists of inspection of the penis and scrotum, documenting any noted trauma or scarring and any other abnormalities.

Examination of the anus is performed in most cases by external inspection with gentle traction of the buttocks to expose the anal sphincter while the child is supine with the knees pulled up to the chest (cannon-ball position). Anoscopy or a digital rectal examination is not routinely indicated.

Documenting the findings of the anogenital examination is important. In specialty centers, the examination is usually documented with photographs or videos. In the pediatric office, a detailed description of the structures will suffice. If photographs are taken, however, they should be treated as a confidential part of the medical record, and care should be taken to label them for proper identification.

An expert committee that has written practice standards for medical examinations in child advocacy centers recommends that all examinations be reviewed by an expert clinician.[49] This usually entails a secondary review of photographs or videos to verify the physical findings. If the examination findings are deemed to be abnormal

or consistent with trauma, pediatricians also should have a secondary review of physical findings, either by having a clinician experienced in forensic anogenital examinations review the photographs or by referring the child to a center specializing in child abuse. Studies have shown there to be better agreement on interpretation of examination findings when clinicians have had extensive experience and education in the evaluation of child sexual abuse.[50]

All pediatricians should gain experience in the anogenital examination of children and adolescents. Many conditions can mimic trauma. It is important to recognize these findings and to distinguish them from lesions caused by child abuse.[51] The Supplemental Appendix reviews genital and anal conditions that can be confused with sexual abuse.

Most sexually abused children have normal anogenital examinations.[52,53] Many types of molestation (eg, oral genital contact or fondling) leave no permanent scars or marks. Even children who have been sexually penetrated often have normal examinations.[53,54] Anogenital tissues heal quickly and completely after many types of anal or genital trauma.[55,56] A normal examination of the genitals and anus neither confirms nor rules out sexual abuse. This fact should be mentioned in the assessment portion of the record. After the examination, it is important to reassure the child that he or she is healthy.

TESTING FOR STIs

STIs occur infrequently in prepubertal sexually abused children. A recent multisite prospective study of 536 children evaluated for suspected sexual abuse revealed that 8.2% of the female children younger than 14 years had an STI.[57] *Chlamydia trachomatis* infections were found in 3.1% of the girls, and *Neisseria gonorrhoeae* infections were found in 3.3%. Only 1 girl tested positive for syphilis (0.3%), and none tested positive for HIV. Five of 12 girls with genital lesions tested positive for herpes simplex virus. Five of 85 symptomatic girls (5.9%) had *Trichomonas vaginalis* identified on a wet mount. Girls with vaginal discharge were more likely to have an STI.

Because STIs are not common in prepubertal children evaluated for abuse, culturing all sites for all organisms is not recommended if the child is asymptomatic. Each case should be evaluated individually for STI risk. Factors that should lead the physician to consider screening for STI include the following[41]:

1. Child has experienced penetration of the genitalia or anus.
2. Child has been abused by a stranger.
3. Child has been abused by a perpetrator known to be infected with an STI or at high risk of STIs (intravenous drug abusers, men who have sex with men, or people with multiple sexual partners).
4. Child has a sibling or other relative in the household with an STI.
5. Child lives in an area with a high rate of STI in the community.
6. Child has signs or symptoms of STIs.
7. Child has already been diagnosed with 1 STI.

Sexually abused adolescents are at higher risk of STIs and should be screened for all STIs, as would any sexually active adolescent presenting for routine care.

Genital and anal infections with *N gonorrhoeae* are rarely acquired perinatally, and outside the newborn period they are considered likely to be caused by sexual abuse.[58] *C trachomatis* infections in children older than 3 years also are likely to be sexually transmitted.[59] *T vaginalis* infection also should raise a concern of possible abuse.[60] Herpes simplex virus and genital warts (human papillomavirus) can be sexually transmitted in children, but these infections are not diagnostic of abuse by themselves.[61] HIV infections in children who have not been exposed to the virus perinatally, through blood products, or by needle sticks are also highly likely to be caused by abuse.[62] In any case of an STI in a child, a careful investigation into risk factors and contacts should be conducted, a thorough medical and social history should be obtained, and the child should be evaluated for possible sexual abuse.

The recommendations for laboratory methods best used to detect infection with *C trachomatis* and *N gonorrhoeae* in abused children are evolving. Current standards require these organisms to be confirmed by culture in cases of suspected sexual abuse that involve the legal system.[41] However, a recent multicenter study found that commercially available nucleic acid amplification tests (NAATs) are highly sensitive and specific for these organisms and that these tests provide "a better alternative than culture as a forensic standard."[63] The study also found that NAATs performed on urine specimens worked as well as vaginal swabs to detect infection in both prepubertal and postpubertal girls, obviating more invasive tests. All positive NAAT results in this study were confirmed by genotypic and sequence analysis tests, leading to a high positive predictive value for *C trachomatis* and *N gonorrhoeae*.

In medicolegal cases, culture-based tests have been preferred because of their high specificity (nearing 100%). This would make the possibility of a false-positive result highly unlikely. Unfortunately, culture-based tests for *C trachomatis* and *N gonorrhoeae* are

very insensitive. In addition, many laboratories no longer offer culture-based tests, making it impossible to screen victims for infection using culture methods. If laboratories do maintain limited culture facilities, they would be more likely to provide false results, given limited experience with cultures. Because NAATs provide highly sensitive detection of organisms and their specificity approaches that of culture, the AAP recommends the use of NAATs when evaluating children and adolescents for genital infections with *C trachomatis* and *N gonorrhoeae*.

All positive test results should be considered presumptive evidence of infection and, if used, should be interpreted with caution. Positive results should be confirmed using additional tests in populations with a low prevalence of the infection or when a false-positive test could have an adverse outcome. When establishing a protocol to evaluate positive NAAT results for *N gonorrhoeae* or *C trachomatis,* experts in laboratory medicine and pediatric infectious diseases should be consulted to determine appropriate secondary tests. All positive specimens in suspected abuse cases should be retained by the laboratory for additional testing.

Recently, various rapid antigen tests, DNA hybridization tests, and NAATs have been developed for *Candida* species, *Gardnerella vaginalis,* and *T vaginalis*.[64] These tests have not been extensively studied in children and should not be used at this time. Bacterial vaginosis (the vaginosis associated with *G vaginalis*) and genital candidiasis are not specific indicators of sexual abuse.

By recommending the use of NAATs for *N gonorrhoeae* and *C trachomatis* in cases of suspected sexual abuse of children, the AAP recognizes that pediatricians' first priority should be protecting the health of children. The pediatrician should be considered primarily a provider of health care for children and should prioritize ensuring the health and well-being of their patients rather than focusing on the legal outcome of criminal cases. In practice, rarely have cases of suspected sexual abuse been adjudicated on the basis of a positive test result for an STI alone in the absence of a history, physical finding, or other confirmatory evidence of abuse. Although properly collected, tested, and confirmed laboratory specimens can aid in the prosecution of sex offenders, the pediatrician's main responsibility lies in protecting the child's health.

The Food and Drug Administration has not approved NAATs for the diagnosis of *C trachomatis* or *N gonorrhoeae* infections of the throat or anus. The Food and Drug Administration does allow laboratories to use NAATs for testing nongenital specimens if the individual laboratory undergoes internal validation of the method used in a method verification study. In verification studies, positive and negative specimens are compared with reference standards or with results from a second laboratory.[65] No studies have been published evaluating the use of nongenital-site NAATs in prepubertal children. However, studies in adults have had promising results when using some NAATs to test for rectal or pharyngeal *N gonorrhoeae* and *Chlamydia* infections in high-risk populations.[66–68] At this point, the use of NAATs in children for rectal or pharyngeal specimens is not warranted until more research is available. If used, they should be interpreted with caution.

If diagnosed with an STI, the child should be treated promptly. When there is a possibility that the child has been exposed to HIV, proper follow-up or prophylaxis is needed. When appropriate, consideration should be given to treating the patient with emergency contraception.

WORKING WITH FAMILIES TO MITIGATE THE ADVERSE EFFECTS OF SEXUAL ABUSE

When children disclose sexual abuse, people close to them are usually deeply affected. Parents often have feelings of guilt for not protecting their children[68,69] and might experience intense anger at the abusers. A child's disclosure can exacerbate a parent's own feelings about his or her adverse childhood experiences. Previous family conflict (eg, marital conflict, substance abuse issues) can be aggravated. Some parents want to sweep the disclosure under the rug to avoid dealing with the painful reality. Family members can feel protective of the accused abuser, especially if that person is another family member. Families should be given the following guidance about how to respond to children who disclose abuse.

1. Parents should understand that medical professionals are required to report suspected abuse to the proper authorities for investigation. It is not an option for the pediatrician to keep the disclosure secret.
2. It is important for families to cooperate with agencies investigating the alleged abuse.
3. Studies have shown that the long-term outcomes of children who have experienced sexual abuse are better if they are believed and supported after a disclosure.[11,70] The parents' initial response to the disclosure is important. If the parents show extreme distress and become nonfunctional, the child will feel less secure and less protected. If the parents are openly emotional and weeping, the child might feel that he or she has to recant or minimize the abuse to decrease the parents' distress.

Parents should respond in a calm and protective manner, assuring the child that the abuse was not his or her fault and that they will do all they can to protect the child and keep him or her safe.

4. Parents should not independently try to question the child or accuse the child of lying. If the child wants to talk about the abuse experience, the parent should listen and be supportive, but it is not helpful to repeatedly question the child or force the child to describe the abuse in detail. This type of questioning can be damaging to the legal adjudication of the case.
5. Pediatricians can provide guidance to families by recognizing the importance of mental health assessment after childhood trauma and by familiarizing themselves with mental health treatments that have been shown to be effective in ameliorating the effects of abuse.[71] Children should be treated by therapists with proper training and experience in dealing with child trauma. Options are available to facilitate the delivery of psychological services to abused children through child advocacy centers, community mental health centers, and victims' compensation programs.

GUIDANCE FOR PEDIATRICIANS

1. Pediatricians should understand the mandatory child abuse reporting laws in their states and should know how to make a report to the responsible agency in their jurisdiction that investigates cases of alleged child sexual abuse.
2. Pediatricians should recognize that sexual abuse of children occurs commonly, and they should be prepared to respond appropriately in their clinical practices.
3. Pediatricians should be aware of normal, developmentally appropriate variations in children's sexual behaviors.[29]
4. Pediatricians should be aware of community resources available to assist in the evaluation of alleged child abuse.
5. Pediatricians should be educated about normal and abnormal genital and anal anatomy in children.
6. Pediatricians should seek a second expert opinion in cases of child sexual abuse when the child's anal or genital examination is thought to be abnormal.
7. Pediatricians should know when and where to refer cases of acute alleged sexual abuse or assault that require forensic testing, prophylaxis for STIs and HIV, and emergency contraception.
8. Pediatricians should know the importance of using nonleading, open-ended questions if they are asking questions about possible abuse.
9. Pediatricians should understand how to support children and families when child sexual abuse is suspected.
10. Pediatricians should be aware of the effects of sexual abuse on children's mental health and be able to refer abused children to mental health professionals who have expertise in treating child trauma.
11. Advice on protection of children from sexual abuse should be part of the anticipatory guidance given to parents in the medical home. The AAP Web site provides guidance for pediatricians (http://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Medical-Home-for-Children-and-Adolescents-Exposed-to-Violence/Pages/Sexual-Abuse.aspx) and for parents (http://www.aap.org/en-us/about-the-aap/aap-press-room/news-features-and-safety-tips/Pages/Parent-Tips-for-Preventing-and-Identifying-Child-Sexual-Abuse.aspx) about preventing child sexual abuse. In addition, the AAP developed an educational toolkit for "Preventing Sexual Violence" (https://www2.aap.org/pubserv/PSVpreview/pages/main.html).

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Gastroesophageal Reflux: Management Guidance for the Pediatrician

- *Clinical Report*

CLINICAL REPORT

Gastroesophageal Reflux: Management Guidance for the Pediatrician

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abstract

FREE

Recent comprehensive guidelines developed by the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition define the common entities of gastroesophageal reflux (GER) as the physiologic passage of gastric contents into the esophagus and gastroesophageal reflux disease (GERD) as reflux associated with troublesome symptoms or complications. The ability to distinguish between GER and GERD is increasingly important to implement best practices in the management of acid reflux in patients across all pediatric age groups, as children with GERD may benefit from further evaluation and treatment, whereas conservative recommendations are the only indicated therapy in those with uncomplicated physiologic reflux. This clinical report endorses the rigorously developed, well-referenced North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition guidelines and likewise emphasizes important concepts for the general pediatrician. A key issue is distinguishing between clinical manifestations of GER and GERD in term infants, children, and adolescents to identify patients who can be managed with conservative treatment by the pediatrician and to refer patients who require consultation with the gastroenterologist. Accordingly, the evidence basis presented by the guidelines for diagnostic approaches as well as treatments is discussed. Lifestyle changes are emphasized as first-line therapy in both GER and GERD, whereas medications are explicitly indicated only for patients with GERD. Surgical therapies are reserved for children with intractable symptoms or who are at risk for life-threatening complications of GERD. Recent black box warnings from the US Food and Drug Administration are discussed, and caution is underlined when using promoters of gastric emptying and motility. Finally, attention is paid to increasing evidence of inappropriate prescriptions for proton pump inhibitors in the pediatric population. *Pediatrics* 2013;131:e1684–e1695

KEY WORDS

gastroesophageal reflux, gastroesophageal reflux disease, pediatrics, guidelines, review, global consensus, reflux-related disease, vomiting, regurgitation, rumination, extraesophageal symptoms, Barrett esophagus, proton pump inhibitors, diagnostic imaging, impedance monitoring, gastrointestinal endoscopy, lifestyle changes

ABBREVIATIONS

GER—gastroesophageal reflux
GERD—gastroesophageal reflux disease
GI—gastrointestinal
H2RA—histamine-$_2$ receptor antagonist
MII—multiple intraluminal impedance
PPI—proton pump inhibitor

INTRODUCTION

Gastroesophageal reflux (GER) occurs in more than two-thirds of otherwise healthy infants and is the topic of discussion with pediatricians at one-quarter of all routine 6-month infant visits.[1,2] In addition to seeking guidance from their pediatricians, parents often request evaluation by pediatric medical subspecialists.[3] It is, therefore, not surprising that strongly evidence-based guidelines incorporating

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state-of-the-art approaches to the evaluation and management of pediatric GER have been welcomed by both general pediatricians and pediatric medical subspecialists and surgical specialists. GER, defined as the passage of gastric contents into the esophagus, is distinguished from gastroesophageal reflux disease (GERD), which includes troublesome symptoms or complications associated with GER.[4] Differentiating between GER and GERD lies at the crux of the guidelines jointly developed by the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition.[4] These definitions have further been recognized as representing a global consensus.[5] Therefore, it is important that all practitioners who treat children with reflux-related disorders are able to identify and distinguish those children with GERD, who may benefit from further evaluation and treatment, from those with simple GER, in whom conservative recommendations are more appropriate.

GER is considered a normal physiologic process that occurs several times a day in healthy infants, children, and adults. GER is generally associated with transient relaxations of the lower esophageal sphincter independent of swallowing, which permits gastric contents to enter the esophagus. Episodes of GER in healthy adults tend to occur after meals, last less than 3 minutes, and cause few or no symptoms.[6] Less is known about the normal physiology of GER in infants and children, but regurgitation or spitting up, as the most visible symptom, is reported to occur daily in 50% of all infants.[7,8]

In both infants and children, reflux can also be associated with vomiting, defined as a forceful expulsion of gastric contents via a coordinated autonomic and voluntary motor response. Regurgitation and vomiting can be further differentiated from rumination, in which recently ingested food is effortlessly regurgitated into the mouth, masticated, and reswallowed. Rumination syndrome has been identified as a relatively rare clinical entity that involves the voluntary contraction of abdominal muscles.[9] In contrast, both regurgitation and vomiting can be considered common and often nonpathologic manifestations of GER.

Symptoms or conditions associated with GERD are classified by the practice guidelines as being either esophageal or extraesophageal.[4] Both classifications can be used to define the disease, which can be further characterized by findings of mucosal injury on upper endoscopy. Esophageal conditions include vomiting, poor weight gain, dysphagia, abdominal or substernal/retrosternal pain, and esophagitis. Extraesophageal conditions have been subclassified according to both established and proposed associations; established extraesophageal manifestations of GERD can include respiratory symptoms, including cough and laryngitis, as well as wheezing in infancy.[10,11] Although older studies from the 1990s suggested that GERD may aggravate asthma, recent publications have suggested that the impact of GERD on asthma control is considerably less than previously thought.[10,12–18] Other extraesophageal manifestations include dental erosions, and proposed associations include pharyngitis, sinusitis, and recurrent otitis media. Patients can be described clinically by their symptoms or by the endoscopic description of their esophageal mucosa. GERD-associated esophageal injuries and complications found on endoscopy include reflux esophagitis, less commonly peptic stricture, and rarely Barrett esophagus and adenocarcinoma.

Although the reported prevalence of GERD in patients of all ages worldwide is increasing,[5] GERD is nevertheless far less common than GER. Population-based studies suggest reflux disorders are not as common in Eastern Asia, where the prevalence is 8.5%,[19] compared with Western Europe and North America, where the current prevalence of GERD is estimated to be 10% to 20%.[20] New epidemiologic and genetic evidence suggests some heritability of GERD and its complications, including erosive esophagitis, Barrett esophagus, and esophageal adenocarcinoma.[21–23] A few pediatric populations at high risk of GERD have also been identified, including children with neurologic impairment, certain genetic disorders, and esophageal atresia[24,25] (Table 1). The prevalence of severe, chronic GERD is much higher in pediatric patients with these "GERD-promoting" conditions. These patients may be more prone to experiencing complications of severe GERD than patients who are otherwise healthy.[26]

Population trends hypothesized to contribute to a general increase in the prevalence of GERD include global epidemics of both obesity and asthma. In some instances, GERD can be implicated as either the underlying etiology (ie, recurrent pneumonia in

TABLE 1 Pediatric Populations at High Risk for GERD and Its Complications

Neurologic impairment
Obese
History of esophageal atresia (repaired)
Hiatal hernia
Achalasia
Chronic respiratory disorders
Bronchopulmonary dysplasia
Idiopathic interstitial fibrosis
Cystic fibrosis
History of lung transplantation
Preterm infants

the premature infant exacerbated by GERD) or a direct repercussion (ie, obesity leading to GERD) of such conditions. In the great majority of cases, however, GERD and comorbidities are known to occur simultaneously in patients without a clear causal relationship.

CLINICAL FEATURES OF GERD

Troublesome symptoms or complications of pediatric GERD are associated with a number of typical clinical presentations in infants and children, depending on patient age[5] (Table 2). Reflux may occur commonly in preterm newborn infants but is generally nonacidic and improves with maturation. A full discussion of reflux in neonates and preterm infants is beyond the scope of this report.

Guidelines have distinguished between manifestations of GERD in full-term infants (younger than 1 year) from those in children older than 1 year and adolescents. Common symptoms of GERD in infants include regurgitation or vomiting associated with irritability, anorexia or feeding refusal, poor weight gain, dysphagia, presumably painful swallowing, and arching of the back during feedings. Relying on a symptom-based diagnosis of GERD can be difficult in the first year of life, especially because symptoms of GERD in infants do not always resolve with acid-suppression therapy.[5,27] GERD in infants can also be associated with extraesophageal symptoms of coughing, choking, wheezing, or upper respiratory symptoms.[7] The incidence of GERD is reportedly lower in breastfed infants than in formula-fed infants.[27] In line with the natural history of regurgitation, GERD in infants is considered to have a peak incidence of approximately 50% at 4 months of age and then to decline to affect only 5% to 10% of infants at 12 months of age.[7,8]

TABLE 2 Common Presenting Symptoms of GERD in Pediatric Patients

Infant	Older Child/Adolescent
Feeding refusal	Abdominal pain/ heartburn
Recurrent vomiting	Recurrent vomiting
Poor weight gain	Dysphagia
Irritability	Asthma
Sleep disturbance	Recurrent pneumonia
Respiratory symptoms	Upper airway symptoms (chronic cough, hoarse voice)

Common symptoms of GERD in children 1 to 5 years of age include regurgitation, vomiting, abdominal pain, anorexia, and feeding refusal.[28] Generally, GERD causes troublesome symptoms without necessarily interfering with growth; however, children with clinically significant GERD or endoscopically diagnosed esophagitis may also develop an aversion to food, presumably because of a stimulus-response association of eating with pain. This aversion, combined with feeding difficulties associated with repeated episodes of regurgitation, as well as potential and substantial nutrient losses resulting from emesis, may lead to poor weight gain or even malnutrition.

Older children and adolescents are most likely to resemble adults in their clinical presentation with GERD and to complain of heartburn, epigastric pain, chest pain, nocturnal pain, dysphagia, and sour burps. When eliciting a history in school-aged children with suspected GERD, it may be important to directly ask patients themselves about their symptoms rather than relying strongly on parent report. In 1 study, adolescents were significantly more likely than their parents to report themselves to be experiencing symptoms of sour burps or nausea.[1] Extraesophageal symptoms in older children and adolescents can include nocturnal cough, wheezing, recurrent pneumonia, sore throat, hoarseness, chronic sinusitis, laryngitis, or dental erosions. In a pediatric patient with GERD and dental erosions, the progression of tooth structure loss may be indicative that existing therapy for GERD is not effective. Conversely, stability of dental erosions is 1 measure of adequacy of GERD management.

DIAGNOSTIC STUDIES

For most pediatric patients, a history and physical examination in the absence of warning signs are sufficient to reliably diagnose uncomplicated GER and initiate treatment strategies. Generally speaking, diagnostic testing is not necessary. The reliability of symptoms to make the clinical diagnosis of GERD is particularly high in adolescents, who often present with heartburn typical of adults.[29–31] Nevertheless, dedicating at least part of a clinical visit to obtaining a clinical history and performing a physical examination are also essential to exclude more worrisome diagnoses that can present with reflux or vomiting (Table 3).

To date, no single symptom or cluster of symptoms can reliably be used to diagnose esophagitis or other complications of GERD in children or to predict which patients are most likely

TABLE 3 Concerning Symptoms and Signs ("Warning Signs" in Figures) for Primary Etiologies Presenting With Vomiting

Bilious vomiting
GI tract bleeding
Hematemesis
Hematochezia
Consistently forceful vomiting
Fever
Lethargy
Hepatosplenomegaly
Bulging fontanelle
Macro/microcephaly
Seizures
Abdominal tenderness or distension
Documented or suspected genetic/metabolic syndrome
Associated chronic disease

to respond to therapy.[21] Nonetheless, a number of GERD symptom questionnaires have been validated and may be useful in the detection and surveillance of GERD in affected children of all ages. Kleinman et al developed a questionnaire for infants that was validated for documentation and monitoring of parent-reported GERD symptoms.[30] Another questionnaire by Størdal et al[32] for pediatric patients 7 to 16 years of age compared favorably with results of pH monitoring. As yet another example, the GERD Symptom Questionnaire developed by Deal et al[33] appears valid for differentiating children with GERD from healthy controls but has not been compared with objective standards, such as pH monitoring or endoscopic findings.

The strategy of using diagnostic testing to diagnose GERD may also be fraught with complexity, because there is no single test that can rule it in or out. Instead, diagnostic tests must be used in a thoughtful and serial manner to document the presence of reflux of gastric contents in the esophagus, to detect complications, to establish a causal relationship between reflux and symptoms, to evaluate the efficacy of therapies, and to exclude other conditions. The diagnostic methods most commonly used to evaluate pediatric patients with GERD symptoms are upper gastrointestinal (GI) tract contrast radiography, esophageal pH and/or impedance monitoring, and upper endoscopy with esophageal biopsy. Upper GI tract series are useful to delineate anatomy and to occasionally document a motility disorder, whereas esophageal pH monitoring and intraluminal esophageal impedance represent tools to quantify GER. Upper endoscopy with esophageal biopsy represents the primary method to investigate the esophageal mucosa to both exclude other conditions that can cause GERD-like symptoms and evaluate for esophageal injury attributable to GERD.[4]

Upper GI Tract Series

Upper GI tract contrast radiography generally involves obtaining a series of fluoroscopic images of swallowed barium until the ligament of Treitz is visualized. According to the new guidelines, the routine performance of upper GI tract radiographic imaging to diagnose GER or GERD is not justified,[4] because upper GI tract series are too brief in duration to adequately rule out the occurrence of pathologic reflux, and the high frequency of nonpathologic reflux during the examination can encourage false-positive diagnoses. Additionally, observation of the reflux of a barium column into the esophagus during GI tract contrast studies may not correlate with the severity of GERD or the degree of esophageal mucosal inflammation in patients with reflux esophagitis. It is recognized that upper GI tract series are useful in the evaluation of vomiting to screen for possible anatomic abnormalities of the upper GI tract.[4] For example, in infants with bilious vomiting, an upper GI tract series may be useful for evaluating for possible malrotation or duodenal web. Persistent, forceful vomiting in the first few months of life should be evaluated with pyloric ultrasonography to evaluate for possible pyloric stenosis. An upper GI tract series should be reserved if the results of the pyloric ultrasound are equivocal.

Esophageal pH Monitoring

Continuous intraluminal esophageal pH monitoring can be used to quantify the frequency and duration of esophageal acid exposure during a study period. The conventional definition of acid exposure in the esophagus is a pH <4.0, the pH most associated with a complaint of heartburn in adults. Esophageal pH metrics generally include an absolute number of reflux episodes detected during monitoring, the duration of reflux episodes detected, and the reflux index, which is calculated as the percentage of a study period during which esophageal pH is <4.0. Although esophageal pH monitoring may be useful for associating a temporal relationship between a symptom and acid reflux and to evaluate the efficacy of pharmacologic therapy on acid suppression, mounting evidence suggests poor reproducibility of pH testing, as well as a clear continuum between pH findings in physiologic GER and pathologic GERD. In turn, esophageal pH monitoring is losing value as a primary modality for diagnosing or managing pediatric GERD.[34]

Multichannel Intraluminal Impedance Monitoring

Multiple intraluminal impedance (MII) is an emerging technology for detecting the movement of both acidic and nonacidic fluids, solids, and air in the esophagus, thereby providing a more detailed picture of esophageal events than pH monitoring.[34] MII can be used to measure volume, speed, and physical length of both anterograde and retrograde esophageal boluses. Combined pH/MII testing is evolving into the test of choice to detect temporal relationships between specific symptoms and the reflux of both acid and nonacid gastric contents. In particular, MII has been used in recent years to investigate how GER and GERD correlate with apnea, cough, and behavioral symptoms.[35] According to the new guidelines, MII and pH electrodes can and should be combined on a single catheter.[4]

Gastroesophageal Scintigraphy

Gastroesophageal scintigraphy scans for reflux of ^{99m}Tc-labeled solids or liquids into the esophagus or lungs after administration of the test

material into the stomach. This nuclear scan evaluates postprandial reflux and can also quantitate gastric emptying; however, the lack of standardized techniques and age-specific normal values limits the usefulness of this test. Therefore, gastroesophageal scintigraphy is not recommended in the routine evaluation of pediatric patients with GER.[4]

Endoscopy and Esophageal Biopsy

It is certainly preferable to pursue conservative measures for treating GERD in children before considering the use of more invasive testing. In particular, any diagnostic benefits of pursuing upper endoscopy in pediatric patients suspected of having GERD must also be weighed against minimal, but not entirely negligible, procedural and sedation risks.[36] Nevertheless, the performance of upper endoscopy allows direct visualization of the esophageal mucosa to determine the presence and severity of injury from the reflux of gastric contents into the esophagus.[26] Esophageal biopsies allow evaluation of the microscopic anatomy.[24] Upper endoscopy with esophageal biopsy may be useful to evaluate inflammation in the esophageal mucosa attributable to GERD and to exclude other associated conditions with symptoms that can mimic GERD, such as eosinophilic esophagitis. Recent data confirm that approximately 25% of infants younger than 1 year will have histologic evidence of esophageal inflammation.[37] This test is indicated in patients with GERD who fail to respond to pharmacologic therapy or as part of the initial management if symptoms of poor weight gain, unexplained anemia or fecal occult blood, recurrent pneumonia, or hematemesis exist.

Upper endoscopy may also be helpful in the assessment of other causes of abdominal pain and vomiting in pediatric patients, such as esophageal or antral webs, Crohn esophagitis, peptic ulcer, *Helicobacter pylori* infection, and infectious esophagitis. Erosive esophagitis is reported less often in infants and children with GERD than in adults with GERD; however, a normal endoscopic appearance of the esophageal mucosa in pediatric patients does not exclude histologic evidence of reflux esophagitis.[5,8] Esophageal biopsy is beneficial in evaluating for conditions that may mimic symptoms of GERD, such as eosinophilic esophagitis, infectious esophagitis (*Candida* esophagitis or herpetic esophagitis), Crohn disease, or Barrett esophagus.[24] Because endoscopic findings correlate poorly with histologic testing in infants and children, performing esophageal biopsies during endoscopy is recommended for the evaluation of GERD in children.[4]

MANAGEMENT

The new guidelines describe several treatment options for treating children with GER and GERD. In particular, lifestyle changes are emphasized, because they can effectively minimize symptoms of both in infants and children. For patients who require medication, options include buffering agents, acid secretion suppressants, and promoters of gastric emptying and motility. Finally, surgical approaches are reserved for children who have intractable symptoms unresponsive to medical therapy or who are at risk for life-threatening complications of GERD.

LIFESTYLE CHANGES

Lifestyle Modifications for Infants

Lifestyle changes to treat GERD in infants may involve a combination of feeding changes and positioning therapy. Modifying maternal diet if infants are breastfed, changing formulas, and reducing the feeding volume while increasing the frequency of feedings may be effective strategies to address GERD in many patients. In particular, the guidelines emphasize that milk protein allergy can cause a clinical presentation that mimics GERD in infants. Therefore, a 2- to 4-week trial of a maternal exclusion diet that restricts at least milk and egg is recommended in breastfeeding infants with GERD symptoms, whereas an extensively hydrolyzed protein or amino acid–based formula may be appropriate in formula-fed infants.[4,30] It is important to note that this recommendation applies to the subset of infants with complications of GER, and not "happy spitters."

In 1 study of formula-fed infants, GERD symptoms resolved in 24% of infants after a 2-week trial of changing to a protein hydrolysate formula thickened with 1 tablespoon rice cereal per ounce, avoiding overfeeding, avoiding seated and supine positions, and avoiding environmental tobacco smoke.[3] Feeding changes can also be recommended in breastfed infants, because it is well known that small amounts of cow milk protein ingested by the mother may be expressed in human milk. Indeed, several studies have found that breastfed infants may benefit from a maternal diet that restricts cow milk and eggs.[38,39]

The feeding management strategy that involves the use of thickened feedings, either by adding up to 1 tablespoon of dry rice cereal per 1 oz of formula[30] or changing to commercially thickened (added rice) formulas for full-term infants who are not cow milk protein intolerant, is recognized as a reasonable management strategy for otherwise healthy infants with both GER and GERD.[4] On the other hand, all pediatric clinicians should be aware of a possible association between thickened feedings and necrotizing enterocolitis in preterm infants.[40] The Food and Drug Administration issued a warning regarding a

common commercially available thickening agent in 2011, suggesting that "parents, caregivers and health care providers not…feed 'SimplyThick' to infants born before 37 weeks gestation who are currently receiving hospital care or have been discharged from the hospital in the past 30 days."

Thickened feedings appear to decrease observed regurgitation rather than the actual number of reflux episodes. Little is known about the effect of thickening formula on the natural history of infantile reflux or the potential allergenicity of commercial thickening agents. Excessive energy intake may occur with long-term use of feedings thickened with rice cereal or corn. To this point, it is important to realize that thickening a 20-kcal/oz infant formula with 1 tablespoon of rice cereal per ounce increases the energy density to 34 kcal/oz. Commercially available antiregurgitant formulae contain processed rice, corn, or potato starch; guar gum; or locust bean gum and may present an option that does not involve excess energy intake by infants when consumed in normal volumes. To date, there has been little investigation into any relationship between use of added rice cereal or antiregurgitant formulae and childhood obesity.

Lifestyle changes that may also benefit infants with GERD include keeping them in the completely upright position or even placing them prone. Indeed, a number of recent studies that used impedance and pH monitoring have confirmed older studies that used pH monitoring to demonstrate significantly less GER in infants in the flat prone position compared with the flat supine position.[41,42] However, the guidelines are unequivocal that the risk of sudden infant death syndrome in sleeping infants outweighs the benefits of prone positioning in the management of GERD and, therefore, that prone positioning should be considered acceptable only if the infant is observed and awake.[4] Prone positioning is suggested to be beneficial in children older than 1 year with either GER or GERD, because the risk of sudden infant death syndrome is greatly decreased in older age groups.

Perceived and actual benefits of seated or semisupine positioning are also explored in the new guidelines. Semisupine positioning, particularly in an infant carrier or car seat, may exacerbate GER and should be avoided when possible, especially after feeding.[43] More recent data obtained with esophageal impedance–pH monitoring have confirmed that postprandial reflux occurs similarly when infants are in car seats as when they are supine but also suggests that being in a car seat for 2 hours after a feeding reduces reflux-related respiratory events.[44]

Lifestyle Modifications for Children and Adolescents

Lifestyle changes that may benefit GERD in older children and adolescents are more akin to recommendations made for adult patients, including the importance of weight loss in overweight patients, cessation of smoking, and avoiding alcohol use. Recommendations for conservatively managing GERD in older children and adolescents, likewise, may involve dietary modification and positioning changes, although the effectiveness of the latter as a treatment of GERD in older children has not been as well studied as in infants. In terms of dietary changes, older children and adolescents are advised to avoid caffeine, chocolate, alcohol, and spicy foods as potential symptom triggers. The guidelines also point out that 3 independent studies have demonstrated decreased reflux episodes with postprandial chewing of sugarless gum.[45–47]

PHARMACOTHERAPEUTIC AGENTS FOR PEDIATRIC GERD

Several medications may be used to treat GERD in infants and children. The 2 major classes of pharmacologic agents for treatment of GERD are acid suppressants and prokinetic agents (Table 4). Growing evidence that demonstrates the former to be more effective than the latter has led to an increased use of acid suppressants to manage suspected GERD in pediatric patients[4,39]; however, there is also significant concern for the overprescription of acid suppressants, particularly proton pump inhibitors (PPIs), and it is important to understand the new guidelines for medication indications.

Acid Suppressants

The main classes of acid suppressants are antacids, histamine-$_2$ receptor antagonists (H2RAs), and PPIs. The principles of using these medications in the treatment of pediatric GERD are similar to those in adults, other than the need to prescribe weight-adjusted doses and the need to consider the form of the drug prescribed (ie, for ease of ingestion in infants and children). Dosage ranges for drugs commonly prescribed for pediatric patients with GERD are listed in Table 4.

Antacids

Antacids are a class of medications that can be used to directly buffer gastric acid in the esophagus or stomach to reduce heartburn and ideally allow mucosal healing of esophagitis. There is limited historical evidence that on-demand use of antacids can lead to symptom relief in infants and children.[48] Instead, although antacids are generally seen as a relatively benign approach to treating pediatric

TABLE 4 Pediatric Doses of Medications Prescribed for GERD

Medications	Doses	Formulations	Ages Indicated by the Food and Drug Administration
Cimetidine	30–40 mg/kg/d, divided in 4 doses	Syrup	≥16 y
Ranitidine	5–10 mg/kg/d, divided in 2 to 3 doses	Peppermint-flavored syrup; Effervescent tablet	1 mo–16 y
Famotidine	1 mg/kg/d, divided in 2 doses	Cherry-banana-mint–flavored oral suspension	1–16 y
Nizatidine	10 mg/kg/d, divided in 2 doses	Bubble gum–flavored solution	≥12 y
Omeprazole	0.7–3.3 mg/kg/d	Sprinkle contents of capsule onto soft foods	2–16 y
Lansoprazole	0.7–3 mg/kg/d	Sprinkle contents of capsule onto soft foods or select juices Administer capsule contents in juice through nasogastric tube Strawberry-flavored disintegrating tablet Orally disintegrating tablet via oral syringe or nasogastric tube (≥8 French)	1–17 y
Esomeprazole	0.7–3.3 mg/kg/d	Sprinkle contents of capsule onto soft foods Administer capsule contents in juice through nasogastric tube	1–17 y
Rabeprazole	20 mg daily	Oral tablet	12–17 y
Dexlansoprazole	30–60 mg daily	Oral tablet	No pediatric indication
Pantoprazole	40 mg daily (adult dose)	Oral tablet	No pediatric indication

GERD, it is important to recognize that they are not entirely without risk. Indeed, several studies link aluminum-containing preparations with aluminum toxicity and its complications in children.[49–51] Similarly, milk-alkali syndrome, a triad of hypercalcemia, alkalosis, and renal failure, has been described in children receiving calcium-containing preparations and adds to a note of caution. According to the new guidelines, chronic antacid therapy is generally not recommended in pediatrics for the treatment of GERD.[4] In addition, the safety and efficacy of surface protective agents, such as alginates or sucralfate, an aluminum-containing preparation, have not been adequately studied in the pediatric population. As such, no surface agent is currently recommended as independent treatment of severe symptoms of GERD or erosive esophagitis in children.[4]

H2RAs

H2RAs represent a major class of medications that has completely revolutionized the treatment of GERD in children. H2RAs decrease the secretion of acid by inhibiting the histamine-$_2$ receptor on the gastric parietal cell. Expert opinion suggests little clinical difference between the various formulations of H2RAs. Randomized placebo-controlled pediatric clinical trials have shown that cimetidine and nizatidine are superior to placebo for the treatment of erosive esophagitis in children.[52,53] Pharmacokinetic studies in school-aged children suggest that gastric pH begins to increase within 30 minutes of administration of an H2RA and reaches peak plasma concentrations 2.5 hours after dosing. The acid-inhibiting effects of H2RAs last for approximately 6 hours, so H2RAs are quite effective if administered 2 or 3 times a day.

However, H2RAs inherently have some limitations. In particular, a fairly rapid tachyphylaxis can develop within 6 weeks of initiation of treatment, limiting its potential for long-term use. In addition, H2RAs have been shown to be less effective than PPIs in symptom relief and healing rates of erosive esophagitis. Although most of these downsides have been demonstrated most clearly in adults, they are also believed to affect children. It is also important to recognize that cimetidine has specifically been linked to an increased risk of liver disease and gynecomastia, and that these associations may be generalizable to other H2RAs.

PPIs

Most recently, PPIs have emerged as the most potent class of acid suppressants by repeatedly demonstrating superior efficacy compared with H2RAs. PPIs decrease acid secretion by inhibition of H^+, K^+-ATPase in the gastric parietal cell canaliculus. PPIs are uniquely able to inhibit meal-induced acid secretion and have a capacity to maintain gastric pH >4 for a longer period of time than H2RAs. These properties contribute to higher and faster healing rates for erosive esophagitis with PPI therapy compared with H2RA therapy. Finally, unlike H2RAs, the acid suppression ability of PPIs has not been observed to diminish with chronic use.

The timing of dosing most PPIs is important for maximum efficacy. Both pediatricians and pediatric medical subspecialists must be diligent at educating their patients to administer PPIs, ideally, approximately 30 minutes before meals.[7] All clinicians should also recognize that the metabolism of PPIs is known to differ in children compared with adults, with a trend toward a shorter half-life, necessitating a higher per-kilogram dose to achieve a peak serum concentration

and area under the curve similar to those in adults.[45] A fairly wide range of effective doses is evident in children. For example, an open-label study of omeprazole in children revealed an effective dosage range of 0.7 to 3.3 mg/kg daily, on the basis of improvement in clinical symptoms and the results of esophageal pH monitoring.[47] Lansoprazole, 0.7 to 3.0 mg/kg daily, improved GERD symptoms and healed all cases of erosive esophagitis in the treatment of 1- to 12-year-old children with GERD.[48] Other trials of PPI therapy support the efficacy of treatment of severe esophagitis and esophagitis refractory to H2RAs in children.[4,45]

As in adults, PPIs are considered safe and generally well tolerated with relatively few adverse effects. In terms of their long-term use, published studies have reported PPI use for up to 11 years in small numbers of children.[16] The Food and Drug Administration has approved a number of PPIs for use in pediatric patients in recent years, including omeprazole, lansoprazole, and esomeprazole for people 1 year and older and rabeprazole for people 12 years and older. Nonetheless, the new guidelines strike a note of caution when discussing the dramatic increase in past years in the number of PPI prescriptions written for pediatric patients, particularly infants, who may be at increased risk of lower respiratory tract infections.[54–56]

Overuse or misuse of PPIs in infants with reflux is a matter for great concern. Placebo-controlled trials in infants have not demonstrated superiority of PPIs over placebo for reduction in irritability.[57] Headaches, diarrhea, constipation, and nausea have been described as occurring in up to 14% of older children and adults prescribed PPIs.[25,58] Although considered a benign histologic change, enterochromaffin cell hyperplasia has

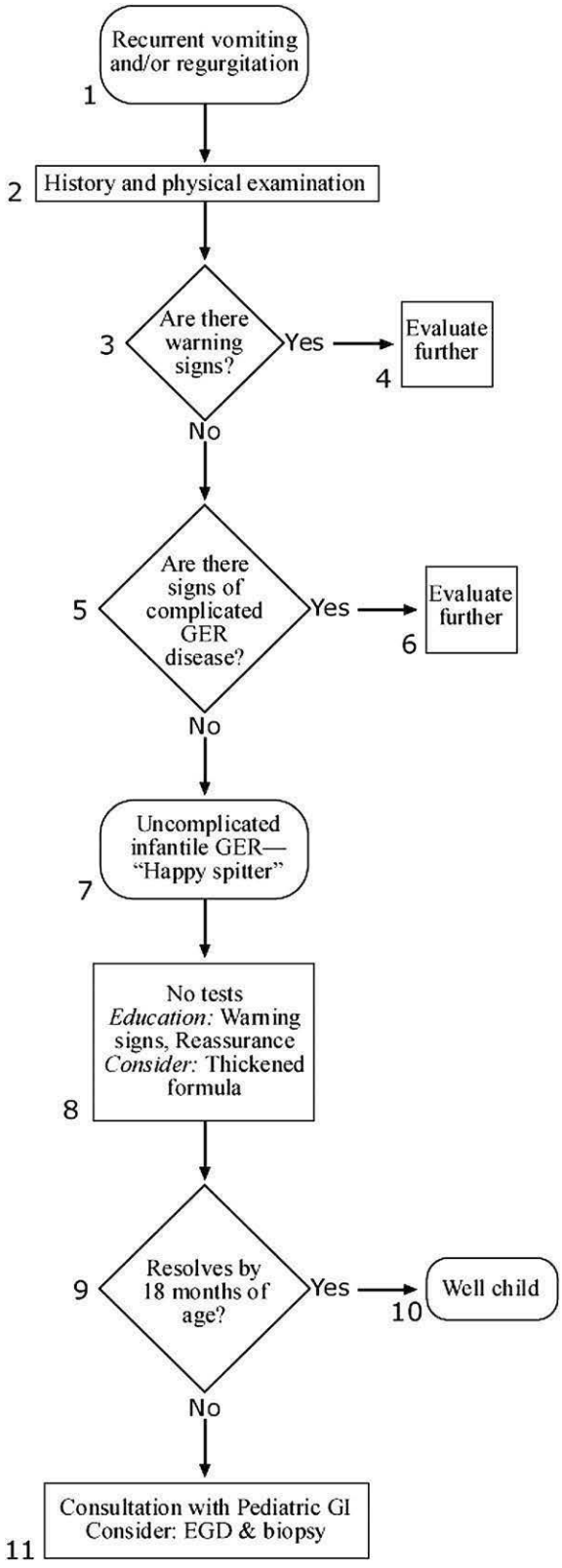

FIGURE 1
Approach to the infant with recurrent regurgitation and vomiting.

recently been demonstrated in up to 50% of children receiving PPIs for more than 2.5 years.[25] Finally, a growing body of evidence suggests that acid suppression, in general, with either H2RAs or PPIs, may be a risk factor for pediatric community-acquired pneumonia, gastroenteritis, candidemia, and necrotizing enterocolitis in preterm infants.[59,60]

Prokinetic Agents

Desired pharmacologic effects of prokinetic agents include improving contractility of the body of the esophagus, increasing lower esophageal sphincter pressure, and increasing the rate of gastric emptying. To date, efforts to design a prokinetic agent with benefits that outweigh adverse effects has proven difficult. Even metoclopramide, the most common prokinetic agent still available, recently received a black box warning regarding its adverse effects. Indeed, adverse effects have been reported in 11% to 34% of patients treated with metoclopramide, including drowsiness, restlessness, and extrapyramidal reactions. Although a meta-analysis of 7 randomized controlled trials of metoclopramide in patients younger than 2 years with GERD confirmed a decrease in GERD symptoms, it was clearly at the cost of such significant adverse effects.[61] Other drugs in this category include bethanechol, cisapride (no longer available commercially in the United States), baclofen, and erythromycin. Each works as a prokinetic by using a different mechanism. Nevertheless, after careful review, guidelines unequivocally state that there is insufficient evidence to support the routine use of any prokinetic agent for the treatment of GERD in infants or older children.[4]

Surgery for Pediatric GERD

Several surgical procedures can be used to decrease GER disorders in children. Fundoplication, whereby the gastric fundus is wrapped around the distal esophagus, is most common and can be performed to prevent reflux by increasing baseline pressure of the lower esophageal sphincter, decreasing the number of transient lower esophageal sphincter relaxations, and increasing the length of the esophagus that is intra-abdominal to accentuate the angle of His and reduce a hiatal hernia, if indicated.[17,56,57] Total esophagogastric dissociation is another operative procedure that is rarely used after failed fundoplication. Both procedures are associated with significant morbidity and do not reduce the risk of direct aspiration of oral contents. Careful patient selection is one of the keys to successful outcome.[17] Children who have failed pharmacologic treatment may be candidates for surgical therapy, as are children at severe risk of aspiration of their gastric contents. In most patients, if acid suppression with PPIs is ineffective, the accuracy of the diagnosis of GERD should be reassessed, because fundoplication may not produce optimum clinical results. Clinical conditions, such as cyclic vomiting, rumination, gastroparesis, and eosinophilic esophagitis, should

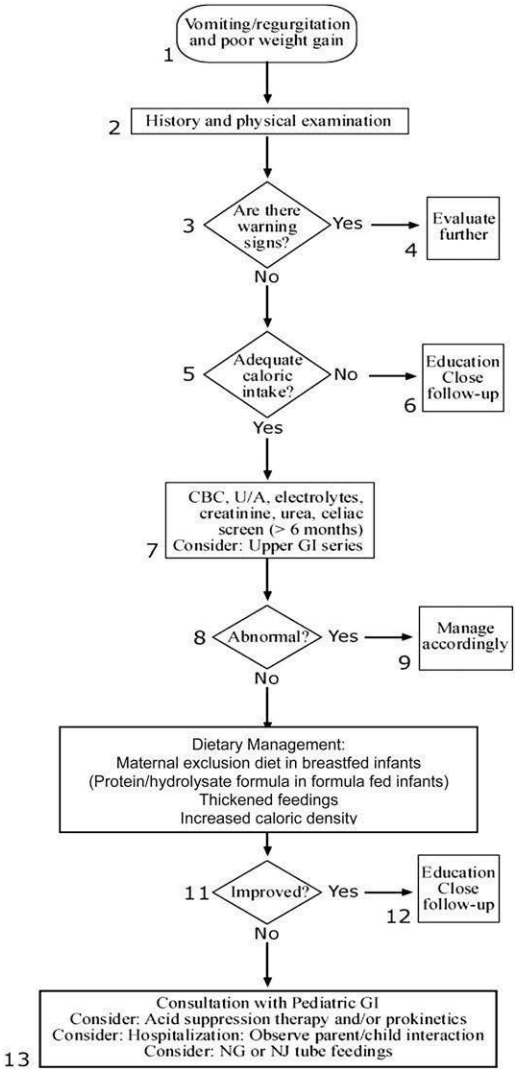

FIGURE 2
Approach to the infant with recurrent regurgitation and weight loss.

be carefully ruled out before surgery, because they are likely to still cause symptoms after surgery. If antireflux surgery is pursued, the new guidelines also stress the importance of providing families with adequate counseling and education before the procedure so that they have a "realistic understanding of the potential complications…including symptom recurrence."[4]

SUMMARY

The updated guidelines published in 2009 are particularly rich with descriptions of typical presentations of GERD across all pediatric age groups.[4] With an emphasis on evidence-based, best practice, they present a number of algorithms that can be of great use to both general pediatricians and pediatric medical subspecialists. The guidelines discuss the evaluation and management of recurrent regurgitation and vomiting in both infants and older children and the importance of distinguishing GERD from numerous other disorders. The figures shown demonstrate the recommended approaches for commonly encountered presentations of GERD in pediatric patients and are summarized here.

In the infant with uncomplicated recurrent regurgitation, it may be important to recognize physiologic GER that is effortless, painless, and not affecting growth (Fig 1). In this situation, pediatricians should focus on minimal testing and conservative management. Overuse of medications in the so-called "happy spitter" should be avoided by all pediatric physicians. Instead, pediatricians are well served to diagnose GER and provide significant parental education, anticipatory guidance, and reassurance. In turn, they will provide high-value, high-quality care without risk to their patients or unnecessary direct and indirect costs.

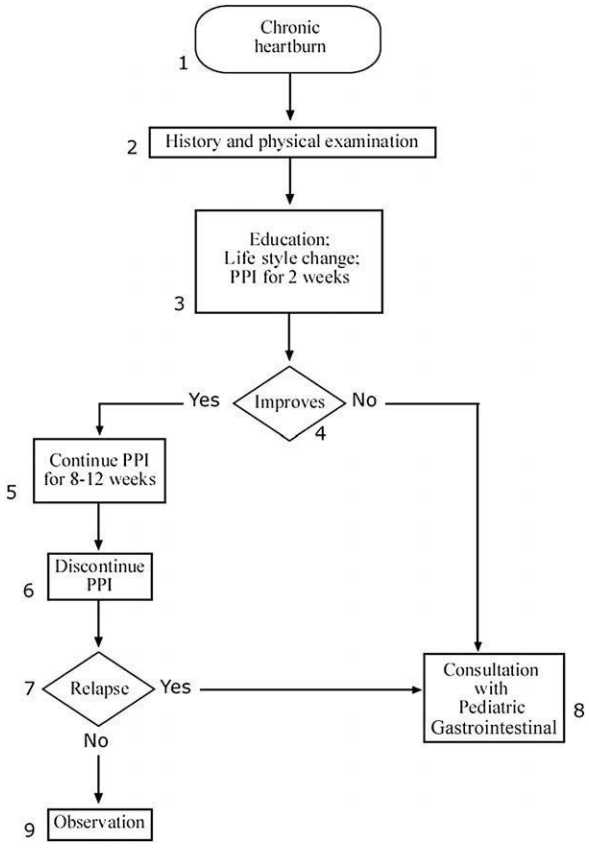

FIGURE 3
Approach to the older child or adolescent with heartburn.

Pediatricians must also be able to recognize infants with recurrent regurgitation and troublesome symptoms of GERD (Fig 2). The new guidelines emphasize weight loss as a crucial warning sign that should alter clinical management. Older children with heartburn may benefit from empirical treatment with PPIs (Fig 3). In general, there is a paucity of studies in pediatrics that demonstrate the effectiveness of this approach. Instead, it is essential to carefully follow all patients empirically treated for GERD to ensure that they are improving, because there are many clinical conditions that may mimic its symptoms. It cannot be overemphasized that pediatric best practice involves both identifying children at risk for complications of GERD and reassuring parents of patients with physiologic GER who are not at risk for complications to avoid unnecessary diagnostic procedures or pharmacologic therapy.[62–64]

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Guidance on Management of Asymptomatic Neonates Born to Women With Active Genital Herpes Lesions

• *Clinical Report*

CLINICAL REPORT

Guidance on Management of Asymptomatic Neonates Born to Women With Active Genital Herpes Lesions

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KEY WORDS
newborn, herpes simplex virus, acyclovir, pregnancy

ABBREVIATIONS
CNS—central nervous system
CSF—cerebrospinal fluid
HSV—herpes simplex virus
HSV-1—herpes simplex virus type 1
HSV-2—herpes simplex virus type 2
IgG—immunoglobulin G
PCR—polymerase chain reaction
SEM—skin, eye, mouth

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abstract

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Herpes simplex virus (HSV) infection of the neonate is uncommon, but genital herpes infections in adults are very common. Thus, although treating an infant with neonatal herpes is a relatively rare occurrence, managing infants potentially exposed to HSV at the time of delivery occurs more frequently. The risk of transmitting HSV to an infant during delivery is determined in part by the mother's previous immunity to HSV. Women with primary genital HSV infections who are shedding HSV at delivery are 10 to 30 times more likely to transmit the virus to their newborn infants than are women with recurrent HSV infection who are shedding virus at delivery. With the availability of commercial serological tests that reliably can distinguish type-specific HSV antibodies, it is now possible to determine the type of maternal infection and, thus, further refine management of infants delivered to women who have active genital HSV lesions. The management algorithm presented herein uses both serological and virological studies to determine the risk of HSV transmission to the neonate who is delivered to a mother with active herpetic genital lesions and tailors management accordingly. The algorithm does not address the approach to asymptomatic neonates delivered to women with a history of genital herpes but no active lesions at delivery. *Pediatrics* 2013;131:e635–e646

INTRODUCTION

Herpes simplex virus (HSV) infection of the neonate is an uncommon occurrence, with an estimated 1500 cases diagnosed annually in the United States from a birth cohort of more than 4 000 000. In contrast, genital herpes infections in adults are very common. Between 1 in 4 and 1 in 5 adults in the United States has genital herpes caused by HSV type 2 (HSV-2).[1,2] In addition, HSV type 1 (HSV-1) now accounts for at least 20% and, in some locales, more than 50% of cases of genital herpes in the United States.[3,4] Therefore, managing infants potentially exposed to HSV at the time of delivery is not uncommon, and prevention of the devastating outcomes of neonatal HSV disease is paramount.

Current recommendations for the management of infants after intrapartum exposure are based on expert opinion, because a randomized controlled trial to determine whether an exposed neonate should be treated would be unethical. However, the existing recommendations do

not take into account recent information correlating risk of transmission with type of maternal infection (primary versus recurrent) at the time of delivery.[5] The algorithm contained within this American Academy of Pediatrics (AAP) clinical report for the diagnostic and therapeutic approach to the neonate with known potential exposure to HSV during the perinatal period incorporates the most current scientific understanding of the biology, epidemiology, and pathology of HSV infection and disease.

TERMINOLOGY OF HSV INFECTION AND DISEASE

When an individual with no HSV-1 or HSV-2 antibody acquires either virus in the genital tract, a first-episode primary infection results. If a person with preexisting HSV-1 antibody acquires HSV-2 genital infection (or vice versa), a first-episode nonprimary infection ensues. Viral reactivation from latency and subsequent antegrade translocation of virus back to skin and mucosal surfaces produces a recurrent infection.

Genital HSV infection can be either clinically apparent (eg, genital lesions) or inapparent (asymptomatic, or subclinical). Transmission to the neonate at the time of birth can occur with either presentation.

The distinction between neonatal HSV infection and neonatal HSV disease warrants discussion. Infection occurs when viral replication has been established, but the virus is not causing illness. Disease occurs when viral replication produces clinical signs of illness (eg, skin lesions, encephalitis, hepatitis). Once an infant is infected with HSV, progression to neonatal HSV disease is virtually certain. In an effort to prevent this progression from neonatal infection to neonatal disease, experts have recommended for many years that parenteral acyclovir be administered preemptively to HSV-infected neonates.[6]

RISK OF MATERNAL INFECTION DURING PREGNANCY

Recurrent infections are the most common form of genital HSV during pregnancy.[7] Approximately 10% of HSV-2–seronegative pregnant women have an HSV-2–seropositive sexual partner and, thus, are at risk for contracting a primary HSV-2 infection during the pregnancy[8] and transmitting the virus to their infants during delivery. Approximately one-fifth to one-third of women of childbearing age are seronegative for both HSV-1 and HSV-2,[9,10] and, among discordant couples, the chance that a woman will acquire either virus during pregnancy is estimated to be 3.7%.[11] For women who are already seropositive for HSV-1, the estimated chance of HSV-2 acquisition during the pregnancy is 1.7%.[11] Approximately two-thirds of women who acquire genital herpes during pregnancy remain asymptomatic and have no symptoms to suggest a genital HSV infection.[11] This is consistent with the finding that 60% to 80% of women who deliver an HSV-infected infant have a clinically unapparent genital HSV infection at the time of delivery and have neither a past history of genital herpes nor a sexual partner reporting a history of genital HSV.[12–14]

RISK OF NEONATAL HSV INFECTION

HSV infection of the newborn infant is acquired during 1 of 3 distinct times: intrauterine (in utero), intrapartum (perinatal), and postpartum (postnatal). The time of transmission of HSV-1 or HSV-2 for the overwhelming majority of infected infants (~85%) is in the intrapartum period. An additional 10% of infected neonates acquire HSV-1 postnatally from either a maternal or nonmaternal source, and the final 5% are infected with HSV-2 or HSV-1 in utero. Five factors known to influence transmission of HSV from mother to neonate are:

1. Type of maternal infection (primary versus recurrent)[5,15–18];
2. Maternal HSV antibody status[5,14,19,20];
3. Duration of rupture of membranes[18];
4. Integrity of mucocutaneous barriers (eg, use of fetal scalp electrodes)[5,21,22]; and
5. Mode of delivery (cesarean versus vaginal delivery).[5]

Infants born to mothers who have a first episode of genital HSV infection near term and are shedding virus at delivery are at much greater risk of developing neonatal herpes than are infants whose mothers have recurrent genital herpes (Fig 1).[5,15–18]

The largest assessment of the influence of type of maternal infection on likelihood of neonatal transmission is a landmark study involving almost 60 000 women in labor who did not have clinical evidence of genital HSV disease, approximately 40 000 of whom had cultures performed within 48 hours of delivery (Fig 1).[5] Of these, 121 women were identified who were asymptomatically shedding HSV and who had sera available for analysis. In this large trial, 57% of infants delivered to women with first-episode primary HSV infection developed neonatal HSV disease, compared with 25% of infants delivered to women with first-episode nonprimary infection and 2% of infants delivered to women with recurrent HSV disease (Fig 1).[5]

CLINICAL MANIFESTATIONS OF NEONATAL HSV DISEASE

HSV infections acquired either intrapartum or postpartum can be classified as: (1) disease involving multiple visceral organs, including lung, liver, adrenal glands, skin, eye, and/or brain (disseminated disease); (2) central nervous system (CNS) disease, with or without skin lesions (CNS disease); and (3) disease limited to the skin, eyes, and/or mouth (skin, eye, mouth [SEM]

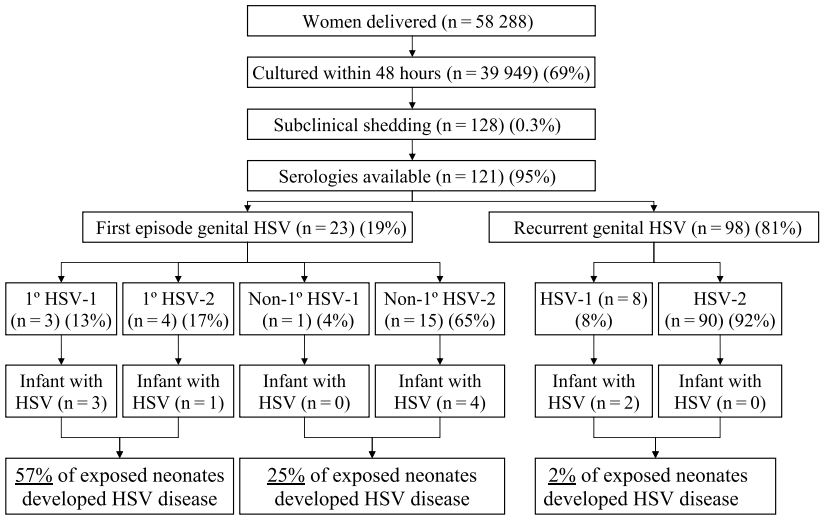


FIGURE 1
Type of maternal infection and risk of HSV transmission to the neonate.[5]

disease). This classification system is predictive of both morbidity and mortality.[23–27] Neonates with disseminated and SEM HSV disease typically present for medical attention at 10 to 12 days of age, whereas infants with CNS disease typically present at 17 to 19 days of age.[24] Overall, approximately half of all infants with neonatal HSV disease will have CNS involvement (CNS disease or disseminated disease with CNS involvement), and approximately 70% will have characteristic vesicular skin lesions (SEM disease, 83%; CNS disease, 63%; disseminated disease, 58%).[24]

DIAGNOSIS OF GENITAL HSV DISEASE

HSV can be detected from genital lesions by polymerase chain reaction (PCR) assay, viral culture, or antigen detection. Of these, PCR assay or viral culture are the testing modalities recommended by the Centers for Disease Control and Prevention for the diagnosis of genital HSV lesions.[28] The sensitivity of viral culture from genital lesions is low, especially for recurrent infection, and declines rapidly as lesions begin to heal. PCR assays for HSV DNA are more sensitive and are increasingly used for the diagnosis of genital HSV.[28,29] A potential limitation of the PCR assay at the current time relates to its availability in all clinical settings; some smaller or more remote medical facilities have limited or no access to laboratories offering this technology. At many tertiary care centers, PCR assay results may be available within a day, whereas it takes 2 to 5 days for HSV to grow in viral culture. Typing of an HSV culture isolate or PCR assay product to determine if it is HSV-1 or HSV-2 can be accomplished by one of several techniques. The reliability of viral culture depends on the stage of the episode, with higher quantities of virus being present during the prodromal and vesicular stages than during crusting.[30] Antigen detection methods are available commercially but may not distinguish HSV-1 from HSV-2 and are not recommended by the Centers for Disease Control and Prevention for the diagnosis of genital herpes.

Before the year 2000, commercially available serological assays were unable to distinguish between HSV-1 and HSV-2 antibodies, severely limiting their utility. Over the past decade, a number of type-specific serological assays that reliably distinguish between immunoglobulin G (IgG) directed against HSV-1 and HSV-2 have been approved by the US Food and Drug Administration (Table 1). Many of these products are sold in kits that are used by clinical laboratories throughout the United States. Several additional tests that claim to distinguish between HSV-1 and HSV-2 antibody are available commercially, but high cross-reactivity rates attributable to their use of crude antigen preparations limit their utility,[31] and their use is not recommended.

DIAGNOSIS OF NEONATAL HSV DISEASE

Isolation of HSV by culture remains the definitive diagnostic method of establishing neonatal HSV disease. If skin lesions are present, a scraping of the vesicles should be transferred in appropriate viral transport media on ice to a diagnostic virology laboratory.[6] Other sites from which specimens should be obtained for culture of HSV include the conjunctivae, mouth, nasopharynx, and rectum ("surface cultures").[6] Specimens for viral culture from mucosal body sites may be combined before inoculating in cell culture to decrease costs, because the important information gathered from such cultures is the presence or absence of replicating virus rather than its precise body site. The sensitivity of PCR assay on surface specimens has not been studied; if used, surface PCR assay should be performed in addition to (and not instead of) the gold-standard surface culture. Rapid diagnostic techniques also are available, such as direct fluorescent antibody staining of vesicle scrapings or enzyme immunoassay detection of HSV antigens. These techniques are as specific but slightly less sensitive than culture.

The diagnosis of neonatal HSV CNS disease has been greatly enhanced by PCR testing of cerebrospinal fluid (CSF) specimens,[32–38] and PCR assay is now the method of choice for documenting CNS involvement in an infant

TABLE 1 Quick Reference Guide for Blood Tests to Accurately Detect Type-Specific HSV Antibodies

	Biokit HSV-2 Rapid Test (also sold as SureVue HSV-2 Rapid Test by Fisher HealthCare)	BioPlex HSV	Captia ELISA	Euroimmun Anti-HSV-1 and Anti-HSV-2 ELISA	HerpeSelect HSV-1 ELISA and HerpeSelect HSV-2 ELISA	HerpeSelect 1 and 2 Differentiation Immunoblot	Liaison HSV-2	AtheNA MultiLyte
Supplier	Biokit USA	Bio-Rad Laboratories	Trinity Biotech USA	Euroimmun US LLC	Focus Diagnostics	Focus Diagnostics	DiaSorin Inc.	Inverness Medical
FDA approved	1999	2009	2004	2007	2000/2002	2000	2008	2008
Antibodies detected	HSV-2 only	HSV-1 or HSV-2 or both	HSV-1 or HSV-2 or both	HSV-1 or HSV-2	HSV-1 or HSV-2 or both	HSV-1 and/or HSV-2	HSV-1 or HSV-2	HSV-1 and/or HSV-2
Best use of test	POC test to screen or test individuals >3 mo postexposure	Screening or testing (high volume)	Screening or testing pregnant women or STD clinic patients (moderate volume)	Moderate volume	Screening or testing STD patients or pregnant women (moderate volume)	Low volume	High volume	Screening or testing (moderate to high volume)
Collection method	Finger stick, whole blood, or serum in clinic	Blood draw (sent to laboratory)	Blood draw (sent to laboratory)	Blood draw (sent to laboratory)	Blood draw (sent to laboratory)	Blood draw (sent to laboratory)	Blood draw (sent to laboratory)	Blood draw (sent to laboratory)
Test time	10 min	45 min	~2 h	~2 h	~2 h	~2 h	35 min	~2 h
FDA approved for use during pregnancy		Yes	Yes		Yes	Yes		
Test availability	Limited	Limited	Widely available		Widely available			
Web site	www.biokitusa.com	www.bio-rad.com	www.trinitybiotech.com	www.euroimmunus.com	www.herpeselect.com	www.herpeselect.com	www.diasorin.com	www.invernessmedicalpd.com
For more information	800-926-3353	800-224-6723	800-325-3424	800-913-2022			800-328-5669	877-546-8633

FDA, US Food and Drug Administration; POC, point of care; STD, sexually transmitted disease. Adapted from http://www.ashastd.org/. Accessed August 5, 2010.

suspected of having HSV disease. However, PCR assay of CSF should only be performed in conjunction with HSV surface cultures, given that up to 40% of infants with disseminated disease will not have CNS involvement, and, by definition, no infants with SEM disease will have CNS involvement. The sensitivity of CSF PCR testing in neonatal HSV disease ranges from 75% to 100%.[33,36,38] PCR analysis of CSF also should play a role in determining the duration of antiviral therapy, because available data suggest that having HSV DNA detected in CSF at or after completion of intravenous therapy is associated with poor outcomes.[36,37] All infants with a positive CSF PCR assay result for HSV DNA at the beginning of antiviral therapy should have a repeat lumbar puncture near the end of treatment to determine that HSV DNA has been cleared from the CNS.[24] Infants whose PCR assay result remains positive should continue to receive intravenous antiviral therapy until the CSF PCR assay result is negative.[24,36]

Application of PCR testing to blood specimens from infants with suspected HSV disease appears promising,[37–42] and, in the 2012 *Red Book*,[6] PCR assay of blood has been added to the laboratory evaluation for neonatal HSV disease. Data are insufficient at the current time to allow the use of serial PCR assays of blood to establish response to antiviral therapy or to guide decisions about the duration of therapy.

Serological testing is not helpful in the diagnosis of neonatal HSV infection, because transplacentally acquired maternal HSV IgG is present in most infants, given the substantial proportions of the adult American population who are HSV-1 and/or HSV-2 seropositive.

PREVENTION OF NEONATAL HSV DISEASE

Cesarean delivery in a woman with active genital lesions can reduce the infant's risk of acquiring HSV.[5,18] In

1999, the American College of Obstetricians and Gynecologists updated its management guidelines for genital herpes in pregnancy.[43] To reduce the risk of neonatal HSV disease, cesarean delivery should be performed if genital HSV lesions or prodromal symptoms are present at the time of delivery. Neonatal HSV infection has occurred despite cesarean delivery performed before the rupture of membranes.[12,44]

In women with a previous diagnosis of genital herpes, cesarean delivery to prevent neonatal HSV infection is not indicated if there are no genital lesions at the time of labor. In an effort to reduce cesarean deliveries performed for the indication of genital herpes, the use of oral acyclovir or valacyclovir near the end of pregnancy to suppress genital HSV recurrences has become increasingly common in obstetric practice. Several studies with small sample sizes suggest that suppressive acyclovir therapy during the last weeks of pregnancy decreases the occurrence of clinically apparent genital HSV disease at the time of delivery,[45–48] with an associated decrease in cesarean delivery rates for the indication of genital HSV.[45,46,49,50] However, because viral shedding still occurs (albeit with reduced frequency),[47,51] the potential for neonatal infection is not avoided completely, and cases of neonatal HSV disease in newborn infants of women who were receiving antiviral suppression recently have been reported.[52,53]

ALGORITHM FOR MANAGEMENT OF ASYMPTOMATIC NEONATES BORN VAGINALLY OR BY CESAREAN DELIVERY TO WOMEN WITH ACTIVE GENITAL HSV LESIONS (FIGS 2 AND 3)

The risk of transmitting HSV to the newborn infant during delivery is influenced directly by the mother's previous immunity to HSV; women who have primary genital HSV infections who are shedding HSV at delivery are 10 to 30 times more likely to transmit the virus to their newborn infants than women with a recurrent infection.[5] The increased risk is attributable both to lower concentrations of transplacental HSV-specific antibodies (which also are less reactive to expressed polypeptides) in women with primary infection[19] and to the higher quantities of HSV that are shed for a longer period of time in the maternal genital tract in comparison with women who have recurrent genital HSV infection.[54] However, a substantial percentage of women with first clinical episodes of symptomatic genital herpes actually are experiencing reactivation of a previously unrecognized genital herpetic infection.[55] Thus, to tailor management of exposed neonates according to their degree of risk, one must distinguish primary versus recurrent maternal HSV infection in a manner that relies on more than just the history, or lack thereof, of genital herpes in the woman or her partner (s). Ideally, detection of HSV DNA from genital swabs obtained from women in labor would identify both symptomatic and asymptomatic HSV shedding, allowing for focused management of only those infants who are exposed; however, the technology to accomplish this on a broad scale is not readily available commercially at this time.

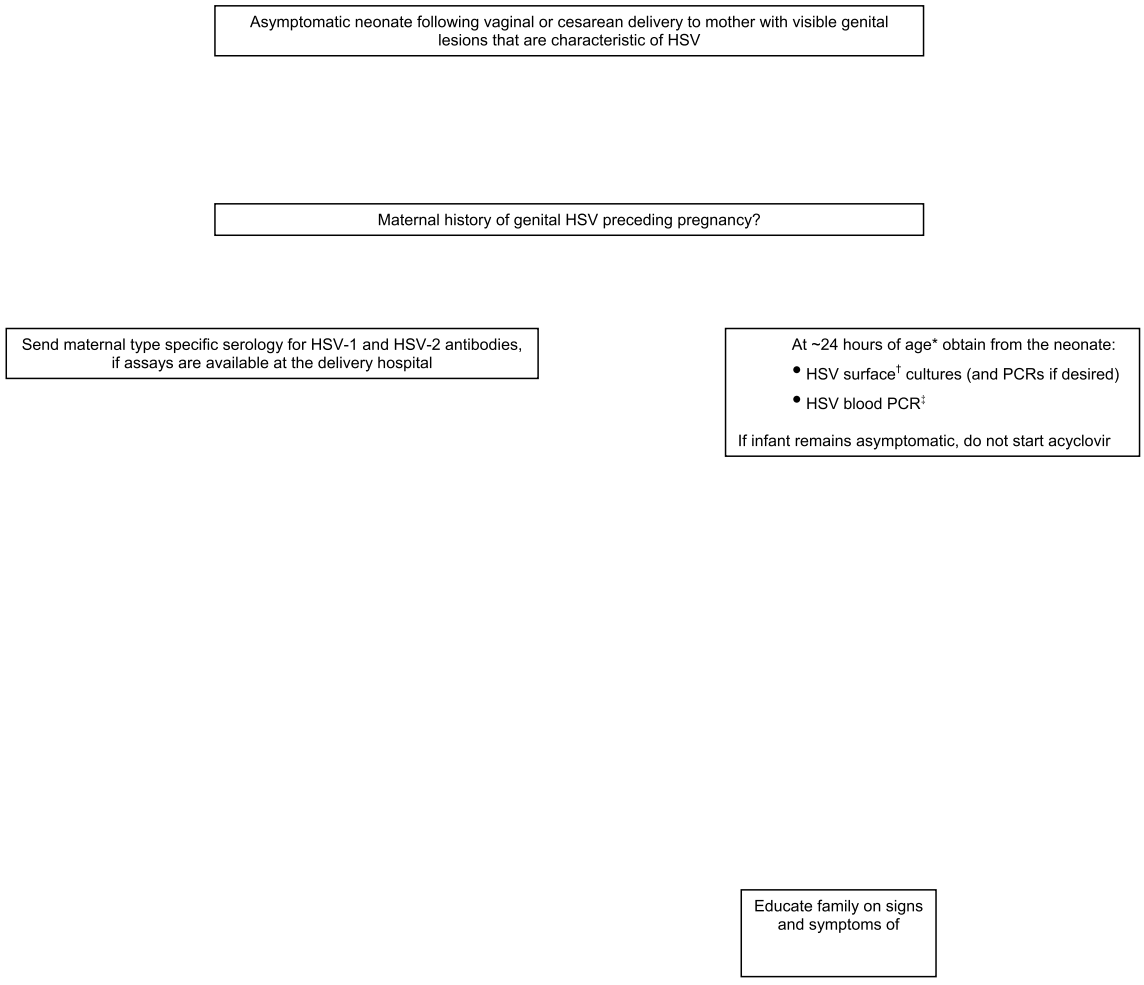
With the approval of commercially available serological tests that can reliably distinguish type-specific HSV antibodies (Table 1), the means to further refine management of asymptomatic neonates delivered to women with active genital HSV lesions is now possible. The algorithm detailed in Figs 2 and 3 applies only to asymptomatic neonates after vaginal or cesarean (because cesarean delivery reduces but does not eliminate the risk of neonatal HSV disease) delivery to women with active genital HSV lesions. It is intended to outline 1 approach to the management of these infants and may not be feasible in settings with limited access to PCR assays for HSV DNA or to the newer type-specific serological tests. If, at any point during the evaluation outlined in the algorithm, an infant develops symptoms that could possibly indicate neonatal HSV disease (fever, hypothermia, lethargy, irritability, vesicular rash, seizures, etc), a full diagnostic evaluation should be undertaken, and intravenous acyclovir therapy should be initiated. In applying this algorithm, obstetric providers and pediatricians likely will need to work closely with their diagnostic laboratories to ensure that serological and virological testing is available and turnaround times are acceptable. In situations in which this is not possible, the approach detailed in the algorithm will have limited, and perhaps no, applicability.

TESTING OF WOMEN IN LABOR

Women in labor with visible genital lesions that are characteristic of HSV should have the lesions swabbed for HSV PCR and culture (AI). Any positive test result then requires further analysis to determine if the virus is HSV-1 or HSV-2. Correlation of viral type with serological status allows for determination of maternal infection classification (Table 2).

Management of Asymptomatic Neonates After Vaginal or Cesarean Delivery to Women With Lesions at Delivery and History of Genital HSV Preceding Pregnancy

For women with a history of genital herpes preceding the pregnancy, the likelihood that the current outbreak represents reactivation of latent HSV is high, and, therefore, the likelihood of transmission to the infant is low (2%). Skin and mucosal specimens (conjunctivae, mouth, nasopharynx, and rectum, and scalp electrode site, if present) should be obtained from the



neonate for culture (and PCR assay, if desired) at approximately 24 hours after delivery (BII), and blood should be sent for HSV DNA PCR assay. Acyclovir need not be started as long as the infant remains asymptomatic (BIII). The importance of waiting until approximately 24 hours after delivery to obtain virological studies is based on the fact that a positive virological test result at that point represents actively replicating virus on the infant's mucosa, whereas a positive test result shortly after birth could reflect only transient maternal contamination that may not lead to replication with resulting neonatal HSV disease.[56] It is permissible to discharge an asymptomatic infant after

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Principles of Judicious Antibiotic Prescribing for Upper Respiratory Tract Infections in Pediatrics

- *Clinical Report*

CLINICAL REPORT

Principles of Judicious Antibiotic Prescribing for Upper Respiratory Tract Infections in Pediatrics

abstract

FREE

Most upper respiratory tract infections are caused by viruses and require no antibiotics. This clinical report focuses on antibiotic prescribing strategies for bacterial upper respiratory tract infections, including acute otitis media, acute bacterial sinusitis, and streptococcal pharyngitis. The principles for judicious antibiotic prescribing that are outlined focus on applying stringent diagnostic criteria, weighing the benefits and harms of antibiotic therapy, and understanding situations when antibiotics may not be indicated. The principles can be used to amplify messages from recent clinical guidelines for local guideline development and for patient communication; they are broadly applicable to antibiotic prescribing in general. *Pediatrics* 2013;132:1146–1154

INTRODUCTION

More than 1 in 5 pediatric ambulatory visits to a physician result in an antibiotic prescription, which accounts for nearly 50 million antibiotic prescriptions annually in the United States.[1] It is widely documented that inappropriate antibiotic prescribing, especially for upper respiratory tract infections (URIs) of viral origin, is common in ambulatory care.[1–3] As many as 10 million antibiotic prescriptions per year are directed toward respiratory conditions for which they are unlikely to provide benefit.[1] Recent evidence shows that broad-spectrum antibiotic prescribing has increased and frequently occurs when either no therapy is necessary or when narrower-spectrum alternatives are appropriate.[1,2] Such overuse of antibiotics causes avoidable drug-related adverse events,[4–6] contributes to antibiotic resistance,[7,8] and adds unnecessary medical costs. This is compounded by the fact that few new antibiotics to treat antibiotic-resistant infections are under development.[9] The growing health and economic threats of antibiotic resistance make promoting judicious antibiotic prescribing, which encompasses both reducing overuse and ensuring that appropriate agents are prescribed, an urgent public health and patient safety priority (http://www.cdc.gov/drugresistance/threat-report-2013).

Clinical decision-making about whether to prescribe antibiotics for a patient with URI symptoms is a daily occurrence for ambulatory-care physicians and other health care professionals who provide care for children. Although antibiotic prescribing is a routine part of clinical

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KEY WORDS

respiratory tract infections, antibacterial agents

ABBREVIATIONS

AAP—American Academy of Pediatrics
AOM—acute otitis media
GAS—group A *Streptococcus*
NNT—number needed to treat
PTA—peritonsillar abscess
TM—tympanic membrane
URI—upper respiratory tract infection

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care, judicious antibiotic prescribing is challenging because it is difficult to distinguish between viral and bacterial URIs. A major objective of this clinical report is to provide a framework for clinical decision-making regarding antibiotic use for pediatric URIs. A point of emphasis is the importance of using stringent and validated clinical criteria when diagnosing acute otitis media (AOM), acute bacterial sinusitis, and pharyngitis caused by group A *Streptococcus* (GAS), as established through clinical guidelines. Additionally, this document emphasizes situations in which the use of antibiotics is not indicated, in particular for viral respiratory infections. Considering the frequency of URIs and the large proportion of antibiotic prescribing attributable to URI visits, these conditions represent a high-impact target for guidelines and other interventions designed to optimize antibiotic prescribing. The careful application of these criteria has the potential to mitigate overuse of antibiotics for pediatric URIs.

The first "Principles of Judicious Use of Antimicrobial Agents for Pediatric Upper Respiratory Tract Infections" were published in 1998 in response to concerns over the emergence and spread of antibiotic-resistant organisms.[10] The Centers for Disease Control and Prevention, in collaboration with the American Academy of Pediatrics (AAP), sought to update these principles in a current context. Antibiotic resistance remains a major public health concern, and appropriate antibiotic use is an important health care quality goal. Although the introduction of a 7-valent pneumococcal polysaccharide-protein conjugate vaccine (PCV7) in 2000 led to large declines in the incidence of invasive pneumococcal infections,[11] an increase in the prevalence of nonvaccine serotypes, most notably serotype 19A, a commonly antibiotic-resistant serotype,[12,13] prompted the 2010 introduction of a 13-valent pneumococcal polysaccharide-protein conjugate vaccine (PCV13). Provider concerns about antibiotic resistance may be 1 factor leading to increasing use of broad-spectrum antibiotics. In recent years, several high-quality randomized controlled trials, meta-analyses, and new and updated clinical guidelines have been published that better define the effectiveness of antibiotic use for selected URIs, including AOM and acute bacterial sinusitis.[14–23] At the same time, new evidence highlighting the extent to which antibiotics lead to adverse events requiring medical attention[4–6] or potentially life-threatening events[24,25] has emerged.

This clinical report focuses on antibiotic prescribing for key pediatric URIs that, in certain instances, may benefit from antibiotic therapy: AOM, acute bacterial sinusitis, and pharyngitis. The specific recommendations are applicable to healthy children who do not have underlying medical conditions (eg, immunosuppression) placing them at increased risk of developing serious complications. The purpose of this report is to provide practitioners specific context using the most current recommendations and guidelines while applying 3 principles of judicious antibiotic use: (1) determination of the likelihood of a bacterial infection, (2) weighing the benefits and harms of antibiotics, and (3) implementing judicious prescribing strategies (Table 1).

PRINCIPLE 1: DETERMINE THE LIKELIHOOD OF A BACTERIAL INFECTION

Many aspects of the clinical history, symptoms, and signs of bacterial URIs overlap with or mirror those of viral infections or noninfectious conditions. To make a judicious decision about antibiotic use, it is essential first to determine the likelihood of a bacterial infection. When a practitioner has made the diagnosis of viral infection and has reasonably excluded the presence of concurrent bacterial infection, antibiotics should not be used because the potential for harm outweighs the potential benefit. In the specific cases of AOM, acute bacterial sinusitis, and pharyngitis, there are well-established stringent criteria that aid in distinguishing bacterial from nonbacterial causes.

AOM

The AAP and American Academy of Family Physicians released updated clinical practice guidelines for the diagnosis and treatment of AOM in 2013.[22] AOM may be defined as "the rapid onset of signs and symptoms of inflammation in the middle ear." The signs include bulging with or without erythema of the tympanic membrane (TM), and the symptoms may include otalgia, irritability, otorrhea, and fever. The diagnosis of AOM always requires a careful otoscopic examination to confirm the presence of inflammatory changes in the TM. The AAP guideline recommends that physicians diagnose AOM definitively under either of 2 conditions: (1) evidence of middle-ear effusion, as demonstrated by moderate to severe bulging of the TM, or (2) new onset of otorrhea that is not attributable to otitis externa. AOM may also be diagnosed when a child presents with only mild bulging of the TM but with additional symptoms of recent onset of ear pain or with intense erythema of the TM. Although clear visualization of the TM at times is difficult and because AOM is typically a self-limiting disease, a high degree of diagnostic certainty is essential to minimize antibiotic overuse. After AOM is diagnosed, judicious antibiotic use can be enhanced by further categorizing patients on the basis of illness severity (severe otalgia, otalgia lasting

TABLE 1 Application of Judicious Antibiotic Principles for Pediatric URIs

Principles	AOM	Acute Bacterial Sinusitis	Acute Pharyngitis
Principle 1: Determine the likelihood of a bacterial infection	Requires middle ear effusion and signs of inflammation:	URI symptoms that are either worsening, severe, or persistent	Diagnosis of GAS pharyngitis requires confirmation by rapid testing or culture
	• moderate or severe bulging of TM; or	• Worsening symptoms: worsening or new onset fever, daytime cough, or nasal discharge after improvement of viral URI	• Only test if 2 of the following are present: fever, tonsillar exudate/ swelling, swollen/tender anterior cervical nodes, absence of cough
	• otorrhea not due to otitis externa; or	• Severe symptoms: fever ≥39°C, purulent nasal discharge	• Do not treat empirically
	• mild bulging of TM with ear pain or erythema of TM	• Persistent symptoms without improvement: nasal discharge or daytime cough >10 d	
		No role for routine imaging	
Principle 2: Weigh benefits versus harms of antibiotics	Benefits: for strictly defined AOM, NNT of as few as 4 patients to achieve improvements in symptoms	Benefits: for strictly defined bacterial sinusitis, antibiotics improve symptoms at 3 and 14 d	Benefits: for confirmed GAS, antibiotics shorten symptom duration, prevent rheumatic fever and may limit secondary transmission.
	• no significant benefits in preventing complications such as mastoiditis	• no evidence that antibiotic therapy prevents complications such as brain abscess	• Limited evidence that therapy prevents complications such as PTA
First-line therapy	Amoxicillin with or without clavulanate	Amoxicillin with or without clavulanate	Amoxicillin or penicillin
	Harms: for all conditions, no benefits to therapy when bacterial infection is not likely. Increased risk of adverse events including diarrhea, dermatitis, *C difficile* colitis, antibiotic resistance		
Principle 3: Implement judicious prescribing strategies	• Consider watchful waiting for older patients (>2 y), those with unilateral disease and without severe symptoms	• Consider watchful waiting for patients with persistent symptoms only	• Once daily dosing of amoxicillin
	• Shorter-duration therapy (7 d)		
	Not recommended: azithromycin and oral third-generation cephalosporins are generally not recommended for these conditions attributable to *S pneumoniae* resistance.		

>48 hours, or temperature ≥39°C), laterality of infection (bilateral versus unilateral), and age (≤23 months vs ≥24 months). Patients with more severe symptoms, bilateral involvement, and younger age are more likely to benefit from antibiotics. Watchful waiting is reasonable for patients who are older and have nonsevere, unilateral disease.

Acute Bacterial Sinusitis

The AAP[23] and the Infectious Diseases Society of America[21] recently developed evidence-based clinical guidelines for the diagnosis and treatment of acute bacterial sinusitis. These guidelines support use of strict diagnostic criteria to distinguish bacterial from viral URIs. In particular, acute bacterial sinusitis is diagnosed on the basis of symptoms that are (1) persistent and not improving, (2) worsening, or (3) severe. Persistent symptoms are most common and include nasal discharge (of any quality) or daytime cough not improving by 10 days. Worsening symptoms include a worsening or new onset of fever, daytime cough, or nasal discharge after improvement of a typical viral URI. Severe symptoms include persistent fever (temperature ≥39°C) and purulent nasal discharge for at least 3 days. These clinical criteria are the basis for the diagnosis of acute bacterial sinusitis. Because many children with viral URI will have radiographic abnormalities, imaging should not be performed routinely.

Acute Pharyngitis

Pharyngitis, or sore throat, may be accompanied by other nonspecific symptoms including cough, congestion, and fever. The most important diagnostic consideration is whether β-hemolytic GAS is the cause. Unlike AOM and acute bacterial sinusitis, the diagnosis of GAS infection can be confirmed with laboratory testing (either a rapid-antigen detection test or culture).[26,27] Scoring systems (Modified Centor or McIsaac Scores[28]) can assist in identifying candidates for testing. Patients with 2 or more of the following features should undergo testing: (1) absence of cough, (2) presence of tonsillar exudates or swelling, (3) history of fever, (4) presence of swollen and tender anterior cervical lymph nodes, and (5) age younger than 15 years. Children with URI signs and symptoms, including cough, nasal congestion, conjunctivitis, hoarseness, diarrhea, or oropharyngeal lesions (ulcers, vesicles) more likely have viral illnesses and not GAS infection and should not be tested for GAS. Testing should generally not be performed in children younger than 3 years in whom GAS rarely causes pharyngitis and in whom rheumatic fever is uncommon. GAS should not be diagnosed in the

absence of testing, even among patients with all of the aforementioned clinical criteria, with rare exceptions (eg, symptomatic and household contact with confirmed GAS pharyngitis). The importance of limiting testing to children with appropriate clinical criteria is further supported by the fact that colonization rates can reach 15% to 20% even among asymptomatic children.

Common Cold, Nonspecific URI, Acute Cough Illness, and Acute Bronchitis

Symptoms of the common cold, nonspecific URI, and bronchitis may overlap with or mirror those of bacterial URIs and can include cough, congestion, and sore throat. Collectively, these viral conditions account for millions of office visits per year. Acute bronchitis, in particular, is a cough illness that is diagnosed during more than 2 million pediatric office visits annually, and antibiotics are prescribed more than 70% of the time.[1] Application of diagnostic clinical criteria for AOM, sinusitis, and pharyngitis should aid clinicians in excluding these conditions. Management of the common cold, nonspecific URI, acute cough illness, and acute bronchitis should focus on symptomatic relief. Antibiotics should not be prescribed for these conditions.

PRINCIPLE 2: WEIGH BENEFITS VERSUS HARMS OF ANTIBIOTICS

If a bacterial infection is determined to be likely, the next step is to compare the evidence about the benefits of antibiotic therapy for each condition to the potential for harms. Relevant outcomes to consider for benefits include the cure rate, symptom reduction, prevention of complications, and secondary cases. Outcomes for harms include antibiotic-related adverse events (eg, abdominal pain, diarrhea, rash), *Clostridium difficile* colitis, development of resistance, and cost.

AOM

Benefits

Several high-quality randomized controlled trials and meta-analyses have been published since the publication of the first principles of judicious use of antibiotics.[18–20,29–33] Collectively, these have emphasized the following: (1) at least half of patients with AOM will recover without antibiotic therapy; (2) recovery is more likely and is hastened for children who receive antibiotic therapy compared with placebo; and (3) recovery without antibiotic therapy is less likely for younger children, those with bilateral versus unilateral disease, and those with more severe signs and symptoms. These observations underlie the rationale for treatment recommendations for AOM.

Multiple meta-analyses indicate that children receiving antibiotic therapy are more likely to achieve clinical success in terms of symptom resolution compared with placebo with a number needed to treat (NNT) of 7 or 8 patients.[18,33] Two recent randomized controlled trials among younger children that used even more stringent diagnostic criteria demonstrated that children who received antibiotics had more favorable symptom scores than those who received placebo, achieved faster symptom recovery, and had significantly lower rates of clinical failure as measured by otoscopic examination and persistence of symptoms, with an NNT closer to 4.[19,20] Nonetheless, it is important to note that in numerous studies of antibiotic efficacy for AOM, the majority of patients have symptoms that ultimately resolve spontaneously regardless of therapy and without complications. The potential for preventing complications, such as mastoiditis, may contribute, in part, to the clinical decision to use antibiotics for AOM. However, across the aforementioned controlled studies and meta-analyses, antibiotics have not demonstrated significant benefit in preventing these rare but serious complications. Observational data from the United Kingdom including more than 1 million AOM episodes indicates that when mastoiditis occurs, it typically is present at time of initial clinical presentation to care.[34] The estimated NNT to prevent 1 episode of mastoiditis is nearly 5000.[34]

The AAP recommends antibiotic therapy for children diagnosed with AOM on the basis of presence of established clinical criteria. Observation can be considered for selected children, particularly children older than 2 years with nonsevere symptoms and unilateral disease.

Acute Bacterial Sinusitis

Benefits

The evidence base evaluating the effectiveness of antibiotics for treatment of acute bacterial sinusitis in children is limited and mixed. Three randomized controlled trials have assessed the effectiveness of antibiotics versus placebo for clinically diagnosed acute bacterial sinusitis in children, 2 of which have been published since the 1998 principles of judicious use of antibiotics.[14,17,35] Two trials concluded that antibiotics significantly improved the likelihood of symptom resolution after both 3 and 14 days,[14,35] but 1 study revealed no benefit of antibiotics over placebo.[17] Key differences in the study design between these studies likely contributed to the differences in outcomes; the trials showing benefit included patients with more severe symptoms and applied more strict diagnostic criteria. This emphasizes the importance of careful attention to clinical diagnosis because antibiotics confer no clinical benefit for patients

without diagnostic criteria suggesting acute bacterial sinusitis.

The benefit of antibiotic therapy in preventing suppurative complications, such as orbital cellulitis or intracranial abscess, is unproven. Individual efficacy trials lack the statistical power to demonstrate effectiveness against these rare complications, and a meta-analysis of randomized controlled trials in children and adults found no significant association between antibiotic use and the rate of complications.[36]

The AAP recommends antibiotic therapy for children with clinical features of acute bacterial sinusitis, especially those with symptoms that are worsening or severe. Observation with close follow-up or antibiotic therapy can be considered for those with persistent symptoms (>10 days).

GAS Pharyngitis

Benefits

Antibiotic treatment of acute pharyngitis has been studied with respect to the effects on symptom resolution, transmission, and prevention of complications, including rheumatic fever. Five randomized controlled studies and 1 meta-analysis have examined the effect of immediate antibiotics on resolution of symptoms, 1 of which was completed since publication of the first principles of judicious use of antibiotics.[37–41] These studies provide strong evidence that antibiotic therapy for children with pharyngitis and confirmation of GAS shortens the duration of symptoms, including sore throat and headache, by approximately 1 day. These benefits are apparent within as few as 3 days. However, the benefits of antibiotic therapy on shortening duration of fever are uncertain. Although data are somewhat limited, antibiotic therapy for index cases of GAS may reduce horizontal transmission and thereby prevent secondary cases.[40,42] These benefits are especially relevant in large households, child care settings, schools, and military settings.

Historically, the primary motivation for prescribing antibiotics for GAS pharyngitis was prevention of rheumatic fever. Randomized controlled trials in children before 1975 showed a fourfold benefit in preventing the onset of rheumatic fever, which occurred in approximately 3% of untreated patients.[43] Although localized outbreaks have occurred in recent decades, the incidence of rheumatic fever in most developed countries has declined dramatically.[44] Some of this decline might be attributable to better recognition and antibiotic treatment,[45] but more likely this relates to a decline in the prevalence of rheumatogenic strains of GAS.[46]

Antibiotics may also have a role in preventing suppurative complications associated with GAS pharyngitis, such as peritonsillar abscess (PTA), AOM, and acute sinusitis. One meta-analysis suggested that antibiotic treatment prevents PTA; however, the majority of cases were derived from a single study conducted in 1951.[43] Data from a large observational cohort conducted in the United Kingdom suggest that antibiotic treatment may prevent development of PTA, but with an NNT >4000.[47]

The AAP recommends antibiotic therapy for children with pharyngitis confirmed to be caused by GAS.

Common Cold, Nonspecific URI, Acute Cough Illness, and Acute Bronchitis

Because the predominant etiologies for these conditions are viruses, antibiotic therapy is not indicated. Because of uncertainty about the relevance of the diagnosis of acute bronchitis for children, data are limited. Nonetheless, a large meta-analysis concluded that there was no benefit to antibiotic therapy (including for delayed prescriptions) for patients with nonspecific cough and cold.[48]

Harms of Antibiotic Therapy

It is crucial to account for the potential for antibiotics to cause harm when used for treatment of URIs. The significance of potential harms should be directly balanced against the potential for benefit on a case-by-case basis. The importance of harms associated with antibiotic use is directly related to (1) an assessment of the magnitude of potential benefit (eg, greater benefit achieved for young children with bilateral AOM than unilateral) and (2) the extent to which uncertainty remains in the diagnosis. The preponderance of evidence for benefits of antibiotic therapy in treatment of bacterial URIs relates to attenuation of symptoms. When it is unclear whether the URI represents an acute bacterial infection, in general, the harms of antibiotic use have the potential to outweigh benefits. The importance of applying stringent clinical criteria to establish the diagnosis of a bacterial infection aids in differentiating children with nonspecific URI and common cold. Prescribing antibiotics for nonspecific URI and colds generally does not provide benefit and only exposes these children to potential harm.

Antibiotics are responsible for the largest number of unplanned medical visits for medication-related adverse events among children, which exceeds 150 000 per year and incurs substantial potential morbidity and cost.[4] Antibiotic-associated adverse events can range from mild (diarrhea and rash), to more severe (Stevens-Johnson syndrome), to life-threatening (anaphylaxis or sudden cardiac death) reactions. Most clinical trials conducted to assess the treatment of AOM, sinusitis, and pharyngitis have used amoxicillin or amoxicillin-clavulanate,

and these remain the first-line recommended agents for antibiotic therapy for these conditions. Studies comparing antibiotic treatment to placebo for AOM suggest a modestly increased rate of adverse events among treated patients, particularly diarrhea and rash. Two meta-analyses estimated rate differences of approximately 5% for adverse events.[18,32] Not included in these are the results from 2 recent trials using amoxicillin-clavulanate (older studies frequently used amoxicillin), which demonstrated even higher rates of diarrhea and dermatitis among patients receiving antibiotic therapy.[19,20] Among studies of sinusitis, in the most recent trial that demonstrated a benefit of antibiotic therapy, adverse events (defined as rash, diarrhea, vomiting, and abdominal pain) occurred in 44% of patients treated with high-dose amoxicillin-clavulanate compared with 14% in the placebo group.[14]

The adverse events described previously occur relatively frequently, although are relatively mild in most cases. Antibiotics can produce serious allergic reactions such as Stevens-Johnson syndrome.[25] There is rapidly growing evidence that antibiotic exposures early in life may disrupt the microbial balance of the intestines and other parts of the body in such a way as to contribute to long-term adverse health effects, such as inflammatory bowel disease, obesity, eczema, and asthma.[49–51] A recent study highlighted risk of sudden death in adults treated with azithromycin, likely related to drug-associated prolongation of the QT interval.[24] Azithromycin is not a first-line antibiotic for any pediatric URI and is the antibiotic most likely to be used inappropriately (inadequate coverage for the most common pathogens causing AOM and sinusitis).[1] The incidence of *C difficile* colitis in hospitalized children has increased substantially during the past decade.[52] Although children with comorbid conditions are at greatest risk, community-onset infections occur,[53] with recent antibiotic exposure as an important risk factor.

The relationship between antibiotic exposure and development of antibiotic resistance at the level of the individual patient and at the level of the community is well established.[7,8] Because of limited therapeutic options, antibiotic-resistant infections are difficult to treat and, in some cases, are associated with poor clinical outcomes.[54] Application of stringent diagnostic criteria and use of therapy only when the diagnosis and potential benefits are well established is essential to minimizing the impact of antibiotic overuse on resistance in individuals and within communities.

PRINCIPLE 3: IMPLEMENT JUDICIOUS PRESCRIBING STRATEGIES

When evidence suggests that antibiotics may provide benefit, several aspects of judicious prescribing should be considered. These include selecting an appropriate antibiotic agent that treats the most likely pathogens (including accounting for local resistance patterns), selecting the appropriate dose, and treating for the shortest duration required. Additionally, physicians may consider the role of observation and use of delayed prescribing strategies.

The treatment of AOM and acute bacterial sinusitis illustrates several key aspects of judicious antibiotic use. Amoxicillin has traditionally been the recommended first-line agent for these conditions because *Streptococcus pneumoniae* is the most important cause. However, in some communities, the prevalence of amoxicillin-resistant β-lactamase-producing *Haemophilus influenzae* among bacterial URIs has increased significantly.[55] This underlies (in part) the recommendation to consider amoxicillin-clavulanate in certain instances (eg, severe symptoms, recent [<6 weeks] antibiotic exposure, known high local prevalence of amoxicillin-resistant *H influenzae*). It is important to note, however, that the benefits of antibiotic therapy appear to be greatest for patients with *S pneumonia*e infection, compared with other bacterial causes of URI, including *H influenzae* and *Moraxella* species, which may have higher rates of spontaneous resolution.[16] In recognition of the possibility of a higher rate of adverse events caused by amoxicillin-clavulanate compared with amoxicillin, some physicians may choose to use amoxicillin as the first-line agent in most instances.

An understanding of local epidemiology and resistance patterns is especially important for understanding appropriate antibiotic selection. The rates of pneumococcal resistance to macrolides[56] and oral third-generation cephalosporins[57,58] make these agents poor choices for treating most children with suspected bacterial URIs. Emergence of macrolide resistance to GAS is also an important problem, although susceptibility testing is not routinely performed.

The role of observation (also termed "wait and see" or "delayed prescribing") instead of immediate antibiotic therapy is an important consideration for children with AOM and acute bacterial sinusitis. Studies among patients with AOM have shown that this approach reduces antibiotic use, is well accepted by families, and, when supported by close follow-up, does not result in worse clinical outcomes.[22] Observation therapy may be considered as an alternative strategy to immediate therapy for AOM and sinusitis for older patients without severe symptoms.[22,23] The use of this approach is an opportunity to engage in shared decision-making with patients and families to include a discussion

about the potential benefits and risks associated with immediate antibiotic therapy.

Another important consideration for judicious antibiotic use is overall magnitude of exposure. Relatively short courses of therapy may achieve the same clinical benefits as longer courses while minimizing the risks of adverse events and development of resistance and lead to better compliance. Important examples are the use of once-daily amoxicillin for GAS pharyngitis[26] (vs 2 or 3 times daily dosing but the same daily dose of 50 mg/kg) and short-course therapy (eg, 7 days vs 10 days) for older children with AOM.[22]

CONCLUSIONS

This clinical report discusses principles of judicious antibiotic use for pediatric URIs. There is a strong emphasis on appropriate diagnosis, which is the foundation for making judicious decisions about prescribing antibiotics. Although focused on specific URIs, the main message has broader application for antibiotic use in general. These principles can be used to promote educational efforts for physicians, amplify the messages from recent clinical guidelines, assist with communication about appropriate antibiotic use to patients and families, and support local guideline development for judicious antibiotic use.

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Promoting the Well-Being of Children Whose Parents are Gay or Lesbian

- *Policy Statement*

POLICY STATEMENT

Promoting the Well-Being of Children Whose Parents Are Gay or Lesbian

COMMITTEE ON PSYCHOSOCIAL ASPECTS OF CHILD AND FAMILY HEALTH

KEY WORDS
civil marriage, adoption, foster care, nurturing children, children of gay and lesbian parents, marriage equality

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abstract

FREE

To promote optimal health and well-being of all children, the American Academy of Pediatrics (AAP) supports access for all children to (1) civil marriage rights for their parents and (2) willing and capable foster and adoptive parents, regardless of the parents' sexual orientation. The AAP has always been an advocate for, and has developed policies to support, the optimal physical, mental, and social health and well-being of all infants, children, adolescents, and young adults. In so doing, the AAP has supported families in all their diversity, because the family has always been the basic social unit in which children develop the supporting and nurturing relationships with adults that they need to thrive. Children may be born to, adopted by, or cared for temporarily by married couples, nonmarried couples, single parents, grandparents, or legal guardians, and any of these may be heterosexual, gay or lesbian, or of another orientation. Children need secure and enduring relationships with committed and nurturing adults to enhance their life experiences for optimal social-emotional and cognitive development. Scientific evidence affirms that children have similar developmental and emotional needs and receive similar parenting whether they are raised by parents of the same or different genders. If a child has 2 living and capable parents who choose to create a permanent bond by way of civil marriage, it is in the best interests of their child(ren) that legal and social institutions allow and support them to do so, irrespective of their sexual orientation. If 2 parents are not available to the child, adoption or foster parenting remain acceptable options to provide a loving home for a child and should be available without regard to the sexual orientation of the parent(s). *Pediatrics* 2013;131:827–830

INTRODUCTION

All children need support and nurturing from stable, healthy, and well-functioning adults to become resilient and effective adults. On the basis of a review of extensive scientific literature, the American Academy of Pediatrics (AAP) affirms that "children's well-being is affected much more by their relationships with their parents, their parents' sense of competence and security, and the presence of social and economic support for the family than by the gender or the sexual orientation of their parents."[1]

Families' structural forms are varied. In 2010, married adults were raising 65.3% of all children in this country.[2] The other 34.7% of children (25.9 million of 74.63 million children) were living in a variety of situations. Many were being raised by parents who were single or cohabiting, either by choice or by circumstance. Growing numbers of grandparents are stepping in as parents to 2.5 million children when necessary.[2] When none of a child's biological relatives is available or able to provide necessary nurturing and support, other arrangements exist to nurture children. Foster parenting and adoption are substitute arrangements that can provide financial, emotional, social, and legal support for children. In 2007, >400 000 children were in foster care, and 130 000 children were adopted by unrelated adults.[3,4]

Increasing numbers of same-gender couples are raising children today, and the numbers are likely to increase in the future. The US 2010 Census reported that 646 464 households included 2 adults of the same gender.[5,6] These same-gender couples are raising ~115 000 children aged ≤18 years and are living in essentially all counties of the United States.[5,6] When these children are combined with single gay and lesbian parents who are raising children, almost 2 million children are being raised by gay and lesbian parents in the United States.[7]

Civil marriage is the legal and social institution in modern society that serves as the basic building block for family structure and child-rearing. Marriage is generally considered the optimal relationship between 2 adults who share responsibility for children. Marriage brings 2 extended families together to provide long-term security and social and emotional support to all members of the newly formed family. Marriage offers many legal rights and responsibilities, including the joint responsibility to care for children and to make decisions (including medical decisions) for them. A report from the AAP Task Force on the Family noted that married couples have more financial and social resources to nurture and raise children.[8] Additionally, "married men and women are physically and emotionally healthier and are less likely to engage in health risk behaviors . . . than are unmarried adults."[8] A number of studies have documented "a positive relationship between the quality of marital life and family functioning."[9] The Task Force report emphasized: "As we move forward, the Academy and pediatricians stand ready to serve all children in all families, regardless of the family structure in which they live."[8]

There are few social or legal restrictions limiting the ability of 2 unrelated adults to marry in the United States. These include (1) age: states have different age limits before which parental permission is required for marriage; (2) numerosity: there is a long-standing prohibition on bigamy/polygamy; (3) the existence of blood relationships; and (4) cognitive capacity to consent. The only other exception applies to adults seeking same-gender relationships (in most states).

There is extensive research documenting that there is no causal relationship between parents' sexual orientation and children's emotional, psychosocial, and behavioral development.[1,10–19] Many studies attest to the normal development of children of same-gender couples when the child is wanted, the parents have a commitment to shared parenting, and the parents have strong social and economic supports. Indeed, current research has concluded that "In all, it is now well-established that the adjustment of children and adolescents is best accounted for by variations in the quality of the relationships with their parents, the quality of the relationship between the parents or significant adults in the children's and adolescents' lives, and the availability of economic and socio-economic resources."[19]

Therefore, the AAP has endorsed, for more than a decade, a policy supporting the benefits of both parents in a same-gender couple having legal rights and responsibilities for their child(ren), for example, through second-parent or coparent adoption.[20] A special article in *Pediatrics* in 2006 reviewed the legal issues associated with civil marriage, civil union, and domestic partnership and noted a number of disparities for children growing up in various legal arrangements.[10] The American Medical Association has recently noted the disparities that exist for parents of the same gender who lack marriage equality as well as for their children.[21] Many other professional organizations have adopted policies urging legislative changes and legal mechanisms, including adoption, foster parenting, and civil marriage, for gay and lesbian adults who wish to be parents.* Civil unions and domestic partnerships do not confer the same legal rights, protections, and benefits to children that civil marriage provides.[10]

Public policy related to marriage and family is largely a state function. Consequently, the laws across the country that regulate marriage, adoption, and foster parenting by gay men and lesbians are an inconsistent patchwork. Even civil marriage in a state that

*National organizations that support marriage equality: American Civil Liberties Union (June 1998), National Association of Social Workers (June 2004), American Psychological Association (July 2004), American Psychiatric Association (May 2005), American Psychoanalytic Association (January 2008), American Bar Association (August 2010), American College of Nursing (July 2012), and American Academy of Family Physicians (October 2012). National organizations that support gay and lesbian parenting and the nurturing of children: American Academy of Child and Adolescent Psychiatry, American College of Obstetrics and Gynecology, American Medical Association, Child Welfare League of America, National Adoption Center, National Education Association, North American Council on Adoptable Children, and Voice for Adoption.

permits it does not ensure access to federal benefits. The federal Defense of Marriage Act (1996; Pub. L. No. 104-199) denies members of married same-gender households access and benefits equivalent to those available to households headed by married parents of different genders, such as (1) Social Security and related programs, (2) housing and food stamps, (3) federal civilian and military service benefits, (4) employment benefits, (5) immigration and nationality status, (6) remedies and protections for crimes and family violence, and (7) certain loans and financial guarantees.[10,21] For this reason, the AAP has joined with other national organizations in support of the position that the Defense of Marriage Act is unconstitutional.[†]

A core mission of the AAP is to support the best interests of all children, regardless of their home or family structure, on the basis of the common principles of justice. If a child has 2 living and capable parents who choose to create a permanent bond by way of civil marriage, it is in the best interests of their child(ren) that legal and social institutions allow and support them to do so. If 2 parents are not available to the child, adoption or foster parenting remain acceptable options to provide a loving home for a child and should be available without regard to the sexual orientation of the parent(s).

RECOMMENDATIONS

The AAP works to ensure that public policies help all parents, regardless of sexual orientation and other characteristics, to build and maintain strong, stable, and healthy families that are able to meet the needs of their children. In particular, the AAP supports:

1. Marriage equality for all capable and consenting couples, including those who are of the same gender, as a means of guaranteeing all federal and state rights and benefits, and long-term security for their children.
2. Adoption by single parents, coparents adopting together, or a second parent when 1 parent is already a legal parent by birth or adoption, without regard to the sexual orientation of the adoptive parent(s).
3. Foster care placement for eligible children to qualified adults without regard to their sexual orientation.

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Promoting the Well-Being of Children Whose Parents are Gay or Lesbian

- *Technical Report*

TECHNICAL REPORT

Promoting the Well-Being of Children Whose Parents Are Gay or Lesbian

abstract

FREE

Extensive data available from more than 30 years of research reveal that children raised by gay and lesbian parents have demonstrated resilience with regard to social, psychological, and sexual health despite economic and legal disparities and social stigma. Many studies have demonstrated that children's well-being is affected much more by their relationships with their parents, their parents' sense of competence and security, and the presence of social and economic support for the family than by the gender or the sexual orientation of their parents. Lack of opportunity for same-gender couples to marry adds to families' stress, which affects the health and welfare of all household members. Because marriage strengthens families and, in so doing, benefits children's development, children should not be deprived of the opportunity for their parents to be married. Paths to parenthood that include assisted reproductive techniques, adoption, and foster parenting should focus on competency of the parents rather than their sexual orientation. *Pediatrics* 2013;131: e1374–e1383

Ellen C. Perrin, MD, MA, Benjamin S. Siegel, MD, and the COMMITTEE ON PSYCHOSOCIAL ASPECTS OF CHILD AND FAMILY HEALTH

KEY WORDS

civil marriage, adoption, foster care, nurturing children, gay parents, lesbian parents, health disparities, legal disparities, same sex, same gender, marriage equality

INTRODUCTION

The mission of the American Academy of Pediatrics (AAP) is to promote optimal physical, mental, and social health and well-being for all infants, children, adolescents, and young adults. Historically, the AAP has worked, through its educational, research, advocacy, and policy efforts, to highlight the powerful connection between children's well-being and the functioning of their most enduring source of support and influence—their parents. It is vital that pediatricians understand the unique and complex characteristics of their patients' families and support them to ensure optimal development of children.

All children have the same needs for, and the right to, nurturing, security, and social stability. Children whose parents are gay and lesbian have historically been subjected to laws, social policies, and disapproving attitudes that create social distance and ostracism and challenge the stability of their families as well as their optimal social and psychological development. This technical report provides the scientific rationale, based on the current available evidence, to support the recommendations outlined in the policy statement "Promoting the Well-Being of Children Whose Parents are Gay or Lesbian"[1]: support for marriage equality, including repeal of the federal Defense of

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Marriage Act and similar public policies that limit access to federal benefits associated with civil marriage for gay and lesbian couples, and the right of gay and lesbian adults to adopt and provide foster care for eligible children.

Children depend on their parents for guidance, nurturing, protection, support, and love. Their resiliency derives from their sense of permanence, security, and unconditional attachment. As a consequence of this central value to their children, modern societies have developed the legal and social contract of marriage to ensure the permanent commitment of parents to each other and to their children, and thus to provide an optimal environment for children to thrive. The value of children to society is reflected also in the many public policies and programs that are designed to ensure adequate resources and support to parents who are raising a child alone, by choice or circumstance, and to families that because of physical or mental illness, abuse, neglect, and/or financial difficulty, cannot function successfully in their capacity as parents. Families created by gay and lesbian adults are no exception to these broad social policies.

Because of the value of marriage to the society, there are few legal restrictions on who can marry. The only legal limitations to marriage equality for consenting adults in the United States are for adults who are certified as mentally/emotionally incompetent, for whom marriage would lead to a polygamous relationship, who are of minor age, who are related by blood, or who are the same gender (in a majority of the states). Even a history of child abuse, domestic violence, or other criminal activity does not disqualify adults from civil marriage. Despite conflicts based on individuals' political and religious beliefs, it is important to recognize that laws restricting competent adults of the same gender from codifying their commitment to each other and their children via civil marriage may result not only in pain and hardship for their children but also in legal, economic, psychological, social, and health disparities that can no longer be justified.

DIVERSE FAMILIES

The 2003 report of the AAP Task Force on the Family stated that: "No particular family constellation makes poor or good outcomes for children inevitable."[2] The report continued: "A stable, well-functioning family that consists of 2 parents and children is potentially the most secure, supportive, and nurturing environment in which children may be raised. That children can be successfully brought to adulthood without this basic functioning unit is a tribute to those involved who have developed the skill and resiliency to overcome a difficult and fundamental challenge."[2]

Families are diverse, complex, and changing. Most US public policy is built on the presumption that the majority of families are composed of a married mother and father raising their biological children. In contrast, the 2010 US Census revealed that the proportion of children living with 2 married biological parents had declined to 65.3%, down from 69.2% in 2001.[3] See Table 1 for further elucidation of family types based on the 2010 Census.

Determining the number of children being raised by lesbian and gay parents is challenging, because most surveys do not ask about parents' sexual orientation. Starting with the 2000 Census, gay and lesbian couples have had the option to identify themselves as spouses.[4] The 2010 Census identified 131 729 self-reported married same-gender households and 514 735 same-gender unmarried partner households located in essentially all counties of the United States.[4–6]

Thirty-one percent of same-gender couples who identified as spouses and 14% of those who identified as unmarried partners indicated that they were raising children, more than 111 000 in all.[5] In addition to these parents, many single gay men and lesbians are also raising children. Combined, current estimates suggest that almost 2 million children younger than 18 years are being raised by at least 1 gay or lesbian parent in the United States.[6,7]

Families with a gay or lesbian parent (or parents) are, themselves, a diverse group.[8,9] For example, 55% to 59% of same-gender couples with children identify as white compared with 70% to 73% of married heterosexual couples with children.[7] Same-gender couples, like heterosexual couples, may become parents by having children in previous heterosexual relationships or through fostering, adoption, donor insemination, and/or surrogacy.[10]

LEGAL DISPARITIES CREATED BY STATE LAWS

Regulations and laws about the rights and responsibilities of parenthood are primarily state specific, resulting in

TABLE 1 Children in the United States 2010: Family Status

Family Status	Number of Children (Millions)[a]	Children in the United States, %
Children in 2-parent households	51.456	73.0
Children with married parents living together	48.516	65.3
Children with unmarried parents	2.940	3.9
Children with single/separated parents	20.263	27.1
Children being raised by 1 or more grandparents	2.595	3.5

[a] Total number of children in the United States: 74.630 million.

great variability among the states. Many legal and social disparities exist for same-gender couples and their children.[11]

- A critical disparity for children of unmarried parents is the absence of the protections reflected in divorce law. Thus, in the event of the dissolution of the couple's relationship, these families lack the protections that exist for children whose parents are married, such as:
  1. Access to the courts for a legally structured arrangement for dissolution of the relationship;
  2. A court-approved legal arrangement for visitation rights and/or custody of children; and
  3. Entitlement for children to financial support from and ongoing relationships with both parents.
- The majority of states prohibit, by statute or state constitutional amendment, recognition of same-gender marriage.[12] A few states extend other forms of relationship recognition, such as civil union or domestic partnership.
- A few states, either by statute, regulation, or legal interpretation, restrict or prohibit foster parenting by same-gender couples and/or lesbians and gay men.
- Laws regarding joint adoption by same gender couples, wherein both individuals become the legal parents of a biologically unrelated child, vary from state to state.[13] Joint adoption by lesbian and gay couples is expressly prohibited in a few states, granted by law in fewer than half, and not addressed by statutes in most states.
- Only in states that recognize civil marriage or other forms of domestic relationships can a lesbian or gay spouse or partner be recognized as a legal parent or step-parent to the child(ren) she or he is helping raise. In the majority of states, this is not a legal option.
- In the United States (but not in much of Europe), sperm and egg donors may choose to remain anonymous and take on no legal responsibility for any children born. In a few states, a donor may be considered a legally recognized parent and have related responsibilities. A few states have laws ensuring that both parents are legally recognized as "presumed parents" of the child.
- Most states lack a formal mechanism to ensure basic rights and responsibilities to nonbiological, nonadoptive coparents. Such laws are important to children when adult couple relationships are in dissolution and appropriate custody is under consideration.
- Legal arrangements with a surrogate carrier are available in only a few states to gay men who wish to have a biologically related child.
- In the event of death of a spouse, partner, or parent, state laws do not provide for Social Security or veteran's survivor benefits for the surviving spouse/partner and children.

LEGAL DISPARITIES CREATED BY FEDERAL LAWS AND REGULATIONS

Restrictions against civil marriage for same-gender couples, such as the federal Defense of Marriage Act (Pub L No. 104-199 [1996]) and replications of it in state statutes and constitutions, deny these couples and their children numerous other protections and benefits deemed valuable by society and government to which heterosexual married couples and their children have access. Under the Defense of Marriage Act, these benefits are not available to couples of the same gender even if they are legally married in a state that recognizes same-gender marriage. The US Government Accountability Office has identified a total of 1138 federal statutory provisions in which marital status was a factor in determining or receiving rights, benefits, and protections. These have been outlined elsewhere in detail[14]; a few examples are presented here:

- Legal recognition of a couple's commitment to and responsibility for one another and legal recognition of a child's relationship to both parents and joint parenting rights;
- Tax-exempt employer-sponsored health and other insurance benefits for spouse/partner and nonbiological/not jointly adopted children;
- Ability to consent to medical care or authorize emergency medical treatment of nonbiological/not jointly adopted children;
- The ability to travel with a child if it will require proof of being a legal parent;
- The ability to file joint income tax returns and take advantage of family-related deductions, including the ability to use the child tax credit, child and dependent care tax credit, dependency exemption, earned income tax credit, and gift and estate tax exemption; and
- A surviving parent's right to the custody of and care for, and children's right to maintain a relationship with, a nonbiological or not legally recognized parent in the event of the death of the other parent.

HEALTH DISPARITIES

- Because children cannot legally consent to medical treatment, the lack of uniform legal recognition of

lesbian and gay parents results in parents being prohibited from accompanying their child(ren) and making medical decisions for them in routine and even emergency situations. Parents may even be barred from visiting their child in the hospital if their parental status is ambiguous.

- Another challenge for same-gender couples and their families is obtaining health insurance. As a result of the federal Defense of Marriage Act, employers are not required to, although some choose to, offer health benefits to same-gender spouses or partners or children of lesbian and gay employees, even if those workers are legally married in their state. As a result, same-gender couples are 2 to 3 times less likely to have health insurance than are heterosexual couples.[7,15] This disparity affects children directly, because the vast majority of children (more than 84%) have the same health insurance status as their parents (public or private insurance or uninsured[16]). Evidence that health insurance coverage is directly associated with health status is undeniable.[17]
- Even when employers do make health insurance benefits available to same-gender spouses, partners, and related children, these families are faced with an economic disadvantage compared with their heterosexual counterparts. Such benefits are considered by the Internal Revenue Code to be taxable or "imputed" income to the employee unless the spouse or partner or child qualifies as a legal dependent. In addition, employers must also pay taxes on this imputed income for their share of the employee's payroll tax.
- Lesbian- and gay-headed families are at greater peril than heterosexual-headed families when a parent loses a job or takes a cut in pay. The Consolidated Omnibus Budget Reconciliation Act of 1995 (COBRA [Pub L No. 99-272]) provides workers and their families who lose their health benefits the capacity to continue group health benefits provided by their employer group health plan for limited periods of time. However, the COBRA, as federal legislation, does not require employers, even those who provide benefits for same-gender spouses/partners and their dependents, to offer lesbian and gay employees the opportunity to enroll their spouses, partners, or children.
- Additional challenges exist in the provision of health care. Physicians, hospitals, and other health care professionals and environments may not offer a welcoming environment for same-gender parents and their children. The reaction a family may encounter ranges from acceptance to disdain: sometimes pediatricians and others encountered in health care settings or institutions may express stigmatizing attitudes or refuse to recognize an unmarried parent, especially when that parent is part of a gay or lesbian couple. Among respondents in a survey of gay and lesbian parents in New York, 42% reported that dislike of lesbian and gay people was a barrier to accessing health care and reported a lack of appropriately trained, competent professionals to deliver health care to lesbian and gay people.[18] According to the October 2011 report, *All Children Matter: How Legal and Social Inequalities Hurt LGBT Children*, "a family may shy away from scheduling a child's doctor's visit in an effort to shield him or her from hostile questions or misunderstandings. For parents who must rely on medical professionals with unknown attitudes toward lesbian and gay patients, concerns linger about treatment of them and their children, which can make care more difficult to obtain."[7] Some parents report worries about being blamed for their child's physical or emotional disorders because of their sexual orientation or family constellation.[19]

CHILDREN'S DEVELOPMENTAL TRAJECTORY AND PSYCHOLOGICAL OUTCOMES

Many factors confer risk to children's healthy development and adult outcomes, such as poverty, parental depression, parental substance abuse, divorce, and domestic violence, but the sexual orientation of their parents is not among them. Many studies have assessed the developmental and psychosocial outcomes of children whose parents are gay or lesbian and note that a family's social and economic resources and the strength of the relationships among members of the family are far more important variables than parental gender or sexual orientation in affecting children's development and well-being.[20] A large body of scientific literature demonstrates that children and adolescents who grow up with gay and/or lesbian parents fare as well in emotional, cognitive, social, and sexual functioning as do children whose parents are heterosexual.[21–37] Although the methodologic challenges are daunting in addressing phenomena as complex and multifactorial as children's long-term developmental and psychosocial outcomes, the literature accumulated over more than 30 years, taken together, provides robust, reliable, and valid assurance about the well-being

of children raised by parents of the same gender.[28,29]

The first review of available data regarding the well-being of children living with lesbian or gay parents concluded that "While research on these topics is relatively new….there is no evidence that the development of children with lesbian and gay parents is compromised in any significant respect relative to that among children of heterosexual parents in otherwise comparable circumstances."[30]

Another early review summarized 23 articles published before 2000 that, together, described 615 offspring of lesbian mothers and gay fathers and 387 controls by using a variety of psychological tests and interviews. The conclusion drawn from these studies was that children raised by gay and lesbian parents did not systematically differ from other children in emotional/behavioral functioning, sexual orientation, experiences of stigmatization, gender role behavior, or cognitive functioning.[31]

A more recent comprehensive review of the experiences of gay and lesbian parents and their children reaffirmed that most children raised by lesbian and gay parents are developmentally and socially well-adjusted and that the societal presence of stigma, heterosexism, family circumstance, structure, and process are more important influences on children's developmental trajectory than is the gender or sexual orientation of their parents.[32]

Much of this early research about children with gay and lesbian parents was, by necessity, based on relatively small convenience samples. Nevertheless, more than 100 scientific publications over 30 years, taken together, have demonstrated that children's well-being is affected much more by their relationships with their parents, their parents' sense of competence and security, and the presence of social and economic support for the family than by the gender or the sexual orientation of their parents.[20,33,34]

Increasing recognition and acceptance of lesbian and gay parents has allowed for larger, community-based and national studies in the United States and Europe. Three studies are of particular note. Using data obtained in a large US population-based survey, the National Longitudinal Study of Adolescent Health, the 44 adolescents who reported being raised by 2 women in a "marriage-like" family arrangement were compared with a random sample of 44 adolescents raised by heterosexual parents.[35,36] There were no differences noted in measures of self-esteem, depression, anxiety, school connectedness, and school success. The authors concluded that "adolescents were functioning well and their adjustment was not associated with family type." In both groups of adolescents, those who described a "closer relationship with their parents" reported less delinquent behavior and substance abuse; that is, the quality of parent-adolescent relationships better predicted adolescent outcomes than did family type.

Another community-wide study was based on data from a cohort of 14 000 mothers of children born within a particular county in England during 1 year.[37] The study examined the quality of parent-child relationships and socioemotional and gender development in a community sample of 5- to 7-year-old children with lesbian mothers. Thirty-nine lesbian mother families were compared with 74 two-parent heterosexual families and 60 families headed by single heterosexual mothers. No differences were found in maternal warmth, emotional involvement, enjoyment of motherhood, frequency of conflicts, supervision of the child, abnormal behaviors reported by parents or teachers in the child, children's self-esteem, or psychiatric disorders. Both mothers and teachers reported more behavioral problems among children in single-parent families than among children who had 2 parents in the home, irrespective of their sexual orientation.

A recent publication was based on a large national sample of US adults who were asked whether their parents had ever had a relationship with a person of the same gender while they were growing up and whether they had ever lived with that parent while the parent was involved in such a relationship.[38] Parents who were said to have had a same-gender relationship were categorized as lesbian or gay parents, although their sexual orientation was not directly determined. In comparison with those who did not report that a parent had had a same-gender relationship, a number of adverse outcomes were identified, including being on public assistance, being unemployed, and having poorer educational attainment. Extensive critique of this study[39–44] has pointed out that:

- It is well known that family instability, and in particular divorce, is a risk factor for children,[45,46] and almost all of the respondents whose parent had had a same-gender relationship had also experienced the divorce of their parents.
- These data reflect an era when stigmatization and discrimination toward same-gender couples and their children were strong and were likely to have contributed to less-than-optimal child-rearing environments.[40]
- Respondents were certainly not children "raised by" lesbian or gay parents, because only half were living with these parents,

and the sexual orientation of the parents was not determined.[41,42]

- The great variability in the form and characteristics of both same-gender and heterosexual relationships, combined with the small number of those relationships, even in a large data set like this one, makes it impossible to sort out true evidence of causality.[43]

A longstanding longitudinal study of children born to lesbian parents in the United States provides further insight into the well-being of children raised from birth by lesbian parents. The National Longitudinal Lesbian Family Study began in 1986, enrolling 154 lesbian mothers who became pregnant through donor insemination (70 birth mothers, 70 comothers, and 14 single mothers). These mothers have been enrolled in the study for more than 17 years, maintaining a retention rate of 92%. Recent publications describe the outcome of 78 adolescent offspring at age 17 (39 girls and 39 boys) on the basis of mothers' and adolescents' reports and comparing them with national standardization samples. The mothers' reports about their 17-year-old sons and daughters indicated that they had high levels of social, school/academic, and total competence and fewer social problems, rule breaking, and aggressive and externalizing behavior compared with their age-matched counterparts in the Achenbach Child Behavior Checklist's standardization sample. There were no differences between offspring who were conceived by known or anonymous donors or between offspring whose parents were still together and those whose mothers had separated.[47] An accompanying editorial noted, "Can these data reassure those who fear that homosexual relationships with or without children will herald the end of the family as we know it? Our experience tells us of the resilience of children who are loved and know that love. … And when we see these moms or dads with their kids in our practice, we call them families."[48]

The self-reported quality of life of the adolescents in this sample was similar to that reported by a comparable sample of adolescents with heterosexual parents.[49] Lesbian parents reported that they planned to expose their children to male role models as an important child-rearing strategy. Half of both the girls and the boys had identified a male role model in their lives. There were no significant associations between gender role traits, adolescent psychological adjustment, gender of the adolescent, and the presence or absence of male role models.[50]

More data are available to document the well-being of children whose parents are lesbian than of those whose parents are gay men, because the numbers of gay men parenting have, until recently, been small. Recent studies affirm that families created by gay men resemble closely those created by lesbians.[51] For example, a recent study assessed child development and parenting among 27 lesbian, 29 gay, and 50 heterosexual couples who had adopted a child.[52] Lesbian and gay parents were similar in a variety of parenting characteristics to their heterosexual counterparts. Children in all family types were functioning similarly and had few behavior problems. Average scores for internalizing, externalizing, and total behavior problems reported by parents and teachers were similar to population averages for the child development instruments. In particular, there were no differences among the family types in children's adjustment, parenting stress, parent discipline techniques, and couple adjustment. As in previous studies, teachers' ratings of behavior noted that behavior problems were more likely in children with single parents than with 2 parents, irrespective of their sexual orientation. Instead, "parents who reported less parenting stress, use of more effective disciplinary techniques and who had greater happiness in their couple relationships had children who were described as well off."[51]

Some authors have investigated children's academic performance as an indicator of their well-being. Two articles compared the academic achievement of children whose parents were gay or lesbian with children whose parents were heterosexual. Although the studies were performed with different methodologies and in different population groups, both revealed similar academic achievement in the 2 groups. Using an analysis of US Census data to perform the first large-sample, nationally representative analysis of educational outcomes, the author concluded that "children of same-sex couples are as likely to make normal progress through school as the children of most other family structures."[53] Another study demonstrated that lower academic achievement was related more to the number of family transitions experienced by children than to the sexual orientation of their parents.[54]

A few publications have suggested less positive outcomes for children raised by same-gender parents. For example, a small study from Australia[55] has sometimes been cited in support of the proposition that children raised by lesbians and gay men are less well-adjusted than those raised by heterosexual couples. The study was based on a comparison of teachers' reports about 58 children in each of 3 groups of parents: married, heterosexual cohabiting, and gay or lesbian cohabiting. A primary goal of the

study was to understand possible disadvantages to children's school and social performance on the basis of the marriage versus cohabitation of their parents. It is critical to note that:

- At the time of the research, marriage was available only to heterosexual parents, and therefore, all gay or lesbian couples were, by definition, cohabiting.
- There is strong evidence provided in the article that the children with gay or lesbian parents were severely stigmatized in their schools and communities.
- Most of the children with gay or lesbian parents had experienced the divorce of their heterosexual birth parents, in many cases shortly before the time of study, thus potentially adding to the children's stress.[45,46]

The study's findings included considerable variation in the ratings given by teachers with regard to the children's school behavior and performance. For example, children with gay or lesbian parents were rated as performing less well in language and math but better in social studies and as having a better attitude toward learning, compared with the children being raised by cohabiting or married heterosexual parents. The deleterious effects of divorce and of stigmatization on children's development are described by the author as likely contributors to the areas of poorer performance of the children with gay or lesbian parents. Overall, the author's conclusions emphasized the benefits of marriage: "married couples seem to offer the best environment for a child's social and educational development."[55] In another article, the same author reported a comparison of cohabiting adults of the same and of different genders and concluded that, in substantial ways, the relationships of cohabiting adults are similar, whether the partners are of the same or different genders.[56]

A 2012 commentary has described various shortcomings of the aforementioned research in support of adoption rights and marriage equality for same-gender couples.[57] In general, this critique pointed out that most studies have included small and selective samples; have rarely reported longitudinal data and, therefore, have reported only short-term outcomes; and often have not included a comparison group. While agreeing with the imperfections of past research in this area, others have pointed out the intrinsic complexities of this research agenda[40] and commented that, despite these imperfections, it is likely that the extensive research efforts that have been carried out would have documented serious and significant damages if they existed. In addition, it is important to note that all past research about children growing up with gay or lesbian parents has taken place in the context of pervasive social stigma and includes a majority of children whose parents were either single or divorced, each of which can be expected to contribute to poor outcomes for children.[39]

Although studies of uncommon and varied phenomena are difficult to perform and yield incomplete and imperfect results, there is an emerging consensus, based on an extensive review of the scientific literature, that children growing up in households headed by gay men or lesbians are not disadvantaged in any significant respect relative to children of heterosexual parents. Indeed, the fact that most data suggest that children grow up successfully in families created by gay and lesbian parents despite the almost-universal family disruption and social stigma they have experienced attests to the resilience of these families. Greater acceptance and support of these families will provide an environment even more conducive to successful social and emotional development.

Over the past decade, 11 countries have recognized marriage equality and, thus, allow marriage between 2 partners of the same gender: Argentina, Belgium, Canada, Denmark, Iceland, Netherlands, Norway, Portugal, Spain, South Africa, and Sweden. There has been no evidence that children in these countries have experienced difficulties as a result of these social changes.

WHEN MARRIAGE IS NOT AN OPTION

The AAP recognizes that some children are members of families headed by a single parent or by 2 parents who do not choose to be legally married and that it is possible for these parents to overcome the challenges involved in raising children in these circumstances. The AAP also acknowledges that some children have been removed from severely challenged families and are in temporary custody of a state agency or a related adult. There is no evidence that restricting these children's access to loving and nurturing adoptive or foster care homes on the basis of gender or sexual orientation of the parents is in their best interests.[52,58]

MARRIAGE MATTERS

The AAP Task Force on the Family reported that "married men and women are physically and emotionally healthier and are less likely to engage in health risk behaviors, such as alcohol or drug abuse, than are unmarried adults."[2] Both men and women live longer when married, presumably in part because they have healthier lifestyles, eat better, and

monitor each other's health.[2] They tend to have relationships with more people and social institutions, which increases their level of social support. It has been well established that permanently married parents can create the best environment for children's development.[2,59]

Marriage supports permanence and security (the basic ingredients for the healthy development of children). Marriage is also the official societal mechanism for conferring rights, benefits, and protections that support couples as spouses and parents and their children financially and legally. In a survey of married same-gender couples in Massachusetts, the first state to allow civil marriage for same-gender couples, 24% of the respondents noted that their children had previously been explicitly teased or taunted about having a gay or lesbian parent, but 93% of respondents stated that marriage has made their children happier and better off.[60] Eighty-four percent of parents stated that their being married made them feel more comfortable working with their child (ren)'s teachers at school.

CONCLUSIONS

On the basis of this comprehensive review of the literature regarding the development and adjustment of children whose parents are the same gender, as well as the existing evidence for the legal, social, and health benefits of marriage to children, the AAP concludes that it is in the best interests of children that they be able to partake in the security of permanent nurturing and care that comes with the civil marriage of their parents, without regard to their parents' gender or sexual orientation.

Marriage equality can help reduce social stigma faced by lesbian and gay parents and their children, thereby enhancing social stability, acceptance, and support. Children who are raised by married parents benefit from the social and legal status that civil marriage conveys to their parents.

When marriage of their parents is not a viable option, children should not be deprived of the opportunity for temporary foster care or adoption by single parents or couples, irrespective of their sexual orientation. Public policy and community support are vital to the success of children in these circumstances.

Pediatricians working to eliminate disparities and establish support, stability, and security of all families through marriage equality and legal parental recognition honor the AAP mission to promote the optimal physical, mental, and social health and well-being of all infants, children, adolescents, and young adults.

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Providing Care for Children and Adolescents Facing Homelessness and Housing Insecurity

- *Policy Statement*

POLICY STATEMENT

Providing Care for Children and Adolescents Facing Homelessness and Housing Insecurity

abstract

FREE

Child health and housing security are closely intertwined, and children without homes are more likely to suffer from chronic disease, hunger, and malnutrition than are children with homes. Homeless children and youth often have significant psychosocial development issues, and their education is frequently interrupted. Given the overall effects that homelessness can have on a child's health and potential, it is important for pediatricians to recognize the factors that lead to homelessness, understand the ways that homelessness and its causes can lead to poor health outcomes, and when possible, help children and families mitigate some of the effects of homelessness. Through practice change, partnership with community resources, awareness, and advocacy, pediatricians can help optimize the health and well-being of children affected by homelessness. *Pediatrics* 2013;131:1206–1210

INTRODUCTION

An estimated 1.6 million children, or nearly 1 in 45 American children, experienced homelessness in 2010.[1] Although a national economic downturn and an increase in housing foreclosures contribute to family homelessness, additional adversity and risk factors often contribute to this complex problem. Children affected by homelessness may experience a variety of challenges to their health because of difficulty accessing health care, inadequate nutrition, education interruptions, trauma, and family dynamics. By recognizing these challenges, pediatricians can help improve the care of these children in practices and communities.

DEFINING AND MEASURING HOMELESSNESS

The US Department of Education defines a homeless individual as "(A) an individual who lacks a fixed, regular, and adequate nighttime residence . . . and (B) includes (i) children and youths who are sharing the housing of other persons due to loss of housing, economic hardship, or a similar reason; are living in motels, hotels, trailer parks, or camping grounds due to the lack of alternative accommodations; are living in emergency or transitional shelters; are abandoned in hospitals; or are awaiting foster care placement; (ii) children and youths who have a primary nighttime residence that is a public or private place not designed for or ordinarily used as

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KEY WORDS

homelessness, housing insecurity, children, adolescents, pediatrician, health, poverty, toxic stress

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a regular sleeping accommodation for human beings …; (iii) children and youths who are living in cars, parks, public spaces, abandoned buildings, substandard housing, bus or train stations, or similar settings; and (iv) migratory children who qualify as homeless for the purposes of this subtitle because the children are living in circumstances described in clauses (i) through (iii)."[2]

Measuring the homeless population is difficult, and there are no definitive counts of homeless persons in the United States. The US Census Bureau does not currently attempt to estimate the total homeless population; however, the US Department of Housing and Urban Development collects data on shelter usage and makes point-in-time estimates of homelessness. The 2011 Annual Homeless Assessment Report to Congress estimates that approximately 1.5 million homeless people used an emergency shelter or transitional housing during 2010–2011, and on a single night in January 2011, 636 017 people were homeless. From 2007 to 2011, the number of children in shelters increased by 1.9% and families with children comprised 35.8% of the total sheltered population in 2011. In addition, from 2007 to 2011, the number of families that moved from stable housing arrangements to the shelter system increased by 38.5%.[3] These estimates did not include homeless persons who were unsheltered or living temporarily with other families. The incidence of homelessness in the United States in a given year is thought to be much higher.

RISK FACTORS

Although all populations experience homelessness, some populations are disproportionately affected. Major risk factors for homelessness among parents include unemployment, substance abuse, mental illness, previous military service, and a previous history of domestic violence or physical or sexual abuse.[4] An analysis of homelessness in a national cohort of US adolescents revealed that poor family relationship quality, school adjustment problems, and victimization during adolescence were each independent predictors of homelessness in adulthood.[5] Among homeless youth, a sexual orientation other than heterosexual and a history of foster care placement and school expulsion are all potential predictors of homelessness as well.[6,7] Racial and ethnic minorities are significantly overrepresented in the sheltered homeless population. In 2011, 71.9% of sheltered families were racial minorities.[3] Recognition of these risk factors is an important part of understanding and supporting homeless children and families.

Homeless children and families often experience a number of negative exposures and life events that create a cumulative risk for poor health outcomes. For example, children who live in poverty, are exposed to violence, or experience food insecurity also have poor health care service attainment, increased emergency department utilization, and overall poor health outcomes, independent of housing status.[8,9] However, these risks can be additionally compounded by homelessness. A series of studies on adverse childhood experiences has shown that multiple toxic stressors that begin in childhood can have long-term adverse effects on a child's neurobiological make-up, cognitive ability, mental health, and ability to manage stressors as an adult.[10,11] It is therefore important to understand and address these stressors both separately and in totality.

HEALTH EFFECTS OF HOMELESSNESS

Homelessness and housing insecurity negatively impact child health and development in many ways. Homeless children have shown higher rates of acute and chronic health problems than low-income children with homes. Cross-sectional surveys conducted in the 1990s reveal increased rates of multiple infectious, respiratory, gastrointestinal, and dermatologic diseases and otitis media, diarrhea, bronchitis, scabies, lice, and dental caries.[12,13] Both the prevalence and severity of asthma are markedly increased among homeless children, and homeless children suffer from higher rates of accidents and injuries than low-income children with homes.[12,14] In an evaluation completed in a school-based health center, homeless children were 2.5 times more likely to have health problems and 3 times more likely to have severe health problems than children with homes.[15] Children without a stable home are more likely to skip meals, worry about the availability of food, and consume foods with low nutritional quality and high fat content.[16,17] As a result, they suffer from high rates of malnutrition, stunting, and obesity.[8,18] Homeless children are at an increased risk of abuse, exposure to violence, and psychological trauma. Emotional distress, developmental delays, and decreased academic achievement are all more common in this population.[19–21] Speech and language deficits lead to significantly decreased literacy rates in school-aged children.[19,21] Homeless children may experience frequent moves that interrupt their education and impact school performance. In a study in elementary school students, homeless children scored lower on math and reading achievement tests than low-income students living in homes.[21] A study in homeless adolescents who received crisis services at a homeless shelter revealed just 34% of those students attained a high school diploma or general equivalency diploma (GED) by 18 years of age.[22]

Unaccompanied homeless and runaway youth differ from homeless children in families. They are more often separated from their families and more frequently exposed to violence and exploitation. Unaccompanied homeless youth are more likely to engage in high-risk sexual behaviors, have teenage pregnancies, engage in drug use, experience mood and anxiety disorders, and face violence than youth with homes.[23,24]

ACCESS TO HOUSING

Homeless families face many barriers to accessing appropriate housing. In the 2012 Hunger and Homelessness Survey conducted by the US Conference of Mayors, 64% of the surveyed cities reported that shelters turn away families with children experiencing homelessness because of lack of available beds.[25] Access to shelters is challenging in urban settings and rural communities. Although homeless families are more likely to be sheltered than individuals, age and gender restrictions in many shelters often lead to family separations. Homeless mothers are also more likely than housed mothers to have their children separated from them by the child welfare system.[26]

ACCESS TO HEALTH CARE

Children and families in unstable housing often receive fragmented health care and rely on the emergency department as a primary source of care.[27] Some of the barriers that prevent homeless children and families from accessing optimal care include the following:

- difficulty obtaining affordable, accessible, and coordinated health care services;
- frequent and unpredictable changes in living circumstances that prevent timely presentation for care, follow-up, and communications with health care providers;
- inadequate access to storage places for medication and medical supplies; and
- potential exposure to violence or fear of violence that limits freedom.

Despite these barriers, pediatricians can support homeless children. By partnering with community resources and making changes in practice, pediatricians have the opportunity to help families establish a stable source of quality health care, improve family dynamics, and obtain housing and needed services. Addressing these barriers has been shown to have a positive effect on the health outcomes of those who have experienced homelessness.[21,22,28,29]

RECOMMENDATIONS

The following recommendations address how pediatricians can help improve the health of homeless children through practice strategies.

1. Pediatricians should help homeless children increase access to health care services by promoting and, when possible, facilitating Medicaid enrollment to eligible children and families.
2. Pediatricians should familiarize themselves with best practices for care of homeless populations and the management of chronic diseases in homeless populations.
3. Pediatricians should optimize acute care visits to best resolve patient concerns and provide comprehensive care when possible. For example, pediatricians can update immunizations if a patient is significantly behind rather than having him or her schedule a separate appointment.
4. Pediatricians should seek to identify the issues of homelessness and housing insecurity in their patient populations. Pediatricians can use methods such as routine screening on intake and making note of frequent address changes or a history of scattered care provision.
5. Pediatricians should seek to identify underlying causes of homelessness in specific families and help facilitate connection to appropriate resources. This may include asking sensitive questions about unemployment, intimate partner violence, substance abuse, and sexual and gender identity issues. Supporting families to address these difficult issues in addition to their housing needs is critical to improving child health and development.
6. Pediatricians should partner with families to develop care plans that acknowledge barriers posed by homelessness. This can involve a variety of innovations, such as making a communications plan that takes into consideration patient access to telephone and mail services, assisting with transportation through vouchers, offering more flexible office visit scheduling, and prescribing the most affordable treatments available. Pediatricians can also learn about the availability of mobile health services in communities to facilitate care that is convenient for homeless children and families.
7. Pediatricians should become familiar with government and community-based services that assist families with unmet social and economic needs. These include such programs as Temporary Assistance for Needy Families (TANF), Special Nutrition Assistance for Nutrition (SNAP), and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Medical-legal partnerships and local departments of health

and human services are also helpful resources.

8. Pediatricians should support and assist in the development of shelter-based care, including partnering with mental health, dental, and other health programs when possible.
9. Pediatricians can learn about the causes and prevalence of homelessness in their communities. The State Report Card on Child Homelessness (www.homelesschildrenameric.org) issued by the National Coalition on Family Homelessness (www.familyhomelessness.org) is one of many good resources.

Pediatricians and the American Academy of Pediatrics can advocate for the needs of homeless children and families in the following ways:

1. Support local, state, and federal policies that lead to increased availability of low-income, transitional, and permanent housing.
2. Support policies and programs, such as the "Homelessness Prevention and Rapid Re-Housing Program," that aim to quickly place families in stable, permanent housing rather than a continuum of emergency and temporary housing. Permanent housing has been demonstrated to be more cost-effective and more stabilizing for families, who can be exposed to significant trauma while experiencing homelessness.
3. Support violence protection policies such as the Family Violence Prevention and Services Act and Child Abuse Prevention and Treatment Act, which provide substantial funding for shelter in addition to social services and legal aid for victims of family violence.
4. Support creative approaches to providing stable health insurance to homeless and unemployed populations, and promote strategies that enable homeless families to enroll and maintain health coverage without requiring a permanent address.
5. Support policies to eliminate any barriers for children without addresses to enroll in school.
6. Support local, state, and federal policies that provide child care vouchers for homeless families.
7. Support reformation of the foster care system to allow longer time in foster care, increased resources for maintaining families when children are aging out of foster care, and greater resources toward training/supporting foster children as they transition into independent adulthood.

Homelessness is a complex issue that presents a number of challenges for children and families. Pediatricians can support all children who are impacted, by implementing practice-level strategies and engaging in advocacy to promote their health and well-being.

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Providing Care for Immigrant, Migrant, and Border Children

- *Policy Statement*

POLICY STATEMENT

Providing Care for Immigrant, Migrant, and Border Children

abstract

FREE

This policy statement, which recognizes the large changes in immigrant status since publication of the 2005 statement "Providing Care for Immigrant, Homeless, and Migrant Children," focuses on strategies to support the health of immigrant children, infants, adolescents, and young adults. Homeless children will be addressed in a forthcoming separate statement ("Providing Care for Children and Adolescents Facing Homelessness and Housing Insecurity"). While recognizing the diversity across and within immigrant, migrant, and border populations, this statement provides a basic framework for serving and advocating for all immigrant children, with a particular focus on low-income and vulnerable populations. Recommendations include actions needed within and outside the health care system, including expansion of access to high-quality medical homes with culturally and linguistically effective care as well as education and literacy programs. The statement recognizes the unique and special role that pediatricians can play in the lives of immigrant children and families. Recommendations for policies that support immigrant child health are included. *Pediatrics* 2013;131:e2028–e2034

COUNCIL ON COMMUNITY PEDIATRICS

KEY WORDS

immigrant, migrant, border, underserved communities

ABBREVIATIONS

CHIP—Children's Health Insurance Program

INTRODUCTION

Many children in immigrant communities face multiple barriers to accessing comprehensive, affordable, and culturally and linguistically effective health care services. Some of these barriers include poverty, fear and stigma, high mobility, limited English proficiency, little information or misunderstandings about how the US health care system works, and lack of insurance and/or access to care. Many children of immigrant families belong to racial and ethnic minority groups that face health status disparities resulting from complex determinants that are exacerbated by children's living circumstances. Inadequate availability of basic necessities, such as housing, and lack of information regarding previous medical care are among the persistent challenges faced by these vulnerable families. For some, the fear of violence or harassment because of their immigrant status compounds their already fragile living conditions. For many within this population, care can be episodic, fragmented, and oriented to care of acute conditions.[1] Although many children in these circumstances face similar challenges, there are some differences of experiences among migrant and border immigrant subgroups (see Fig 1).

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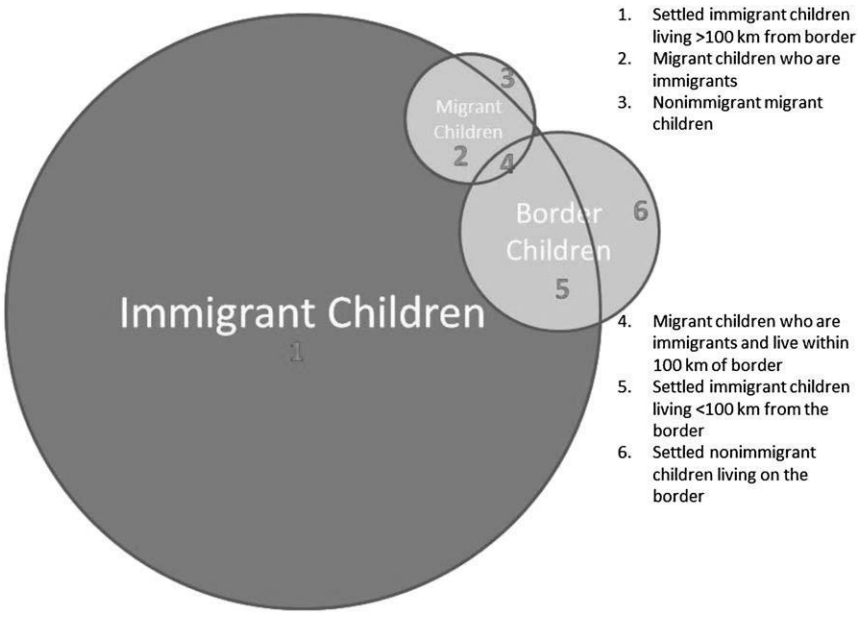

FIGURE 1
Representation of the populations of immigrant, border, and migrant children: separate and overlapping groups.

DEFINITIONS

"Immigrant children" are defined as children who are foreign-born or children born in the United States who live with at least 1 parent who is foreign-born.[2]

Many immigrant children are in migrant families that move across the country seeking seasonal or temporary employment in a variety of industries. "Migrant children" may work in the industries in which their family members are employed and move frequently because of changes in their parents' employment. Migrant families are often located in areas that have many agricultural workers and/or where rapid growth is occurring.

"Border children" are those who live within 100 km of the US-Mexico border.[3] Immigrant children have a significant presence in the border states of Arizona, California, New Mexico, and Texas. Many border children are of Mexican origin, and a significant number are US citizens whose ancestors have been US citizens for generations. For the purposes of this discussion, only children living north of the Mexican border are described, although many children south of the border share similar characteristics. Children living along the Canadian border are not discussed in this statement, because there is far less immigration across that border and discrete immigrant communities there have been rare.

DEMOGRAPHICS

Immigrant children represent the fastest growing segment of the US population. One in every 4 children in the United States, approximately 18.4 million children, live in an immigrant family. Eighty-nine percent of these children are born in the United States and are US citizens.[4] Immigrant children accounted for most of the US child population growth over the past decade. Although 64% of all children of immigrants live in 6 states (California, Texas, New York, Florida, Illinois, and New Jersey), immigrant children are dispersed throughout the country. Since 1990, the largest growth in percentage of immigrant children has occurred in North Carolina, Nevada, Georgia, and Arkansas.[5] Families immigrate for a variety of reasons that may include seeking opportunity, fleeing war/chaos, or escaping persecution.

Pediatricians may be surprised by the high degree of diversity of the immigrant population and by the variety of immigrant communities within their midst, such as Haitians in Florida and eastern Virginia or Somali families in Seattle and Minneapolis. Hmong families are present in the Central Valley of California.[6] In response to the growth of these immigrant communities, some health care and social/community service providers have begun providing culturally appropriate care and services.

Approximately 43% of immigrant children have parents of Mexican origin, and 20% are of Central American descent. An estimated 22% of immigrant children have parents of Asian or Middle Eastern origin. Fifteen percent of children have parents with origins in Africa, Central and Eastern Europe, Western Europe, Canada, and Australia.[7] Given this rapid demographic growth, most pediatricians will provide care for immigrant children in their practices.

COMMON CHALLENGES FOR IMMIGRANT, MIGRANT, AND BORDER CHILDREN

All 3 groups of children face a variety of challenges to their health and well-being, including poverty, lack of health insurance, low educational attainment, substandard housing, and language barriers.

Poverty is a strong determinant of child well-being and is very common among immigrant children. Poverty is closely linked to negative physical, developmental, and mental health–related outcomes.[8] A family's socioeconomic status has a direct effect on its ability to access high-quality health

care services and to achieve good health, social, and emotional outcomes. In 2010, 30% of children in immigrant families lived below the federal poverty level, compared with 19% of children with US-born parents.[4] This is despite the fact that immigrant children are more likely to live in 2-parent families and have parents who work and work more hours compared with parents of US-born children.[9] Immigrant children tend to live in larger families, with 19% having 4 or more siblings, compared with 14% of US-born families.[10] Housing is often substandard and/or overcrowded for these families.

Lack of health care coverage is more common among children in each of these groups than for nonimmigrant children. Children of immigrants are nearly twice as likely to be uninsured (15%) as are children of nonimmigrant families (8%).[4] Many of the immigrant children who are uninsured are eligible for Medicaid or the Children's Health Insurance Program (CHIP) but are not enrolled. Many immigrant parents fear that accessing services for their eligible children will lead them to be considered a "public charge" (a person dependent on the government for the expenses of living[11]) and worry about how that may negatively affect their immigration status and prospects. They may also fear that agencies offering assistance will share information with immigration enforcement agencies. Other families may not be aware of their children's eligibility for coverage. These same reasons may affect parents' ability and willingness to access other programs and benefits that their children may be eligible for, such as the Special Supplemental Nutrition Program for Women, Infants, and Children; Supplemental Nutrition Assistance Program; the Temporary Assistance for Needy Families program; and Supplemental Security Income. Current federal law allows states to apply waiting periods for up to 5 years for legal permanent residents to become eligible for Medicaid coverage. Medicaid also excludes undocumented children from all but emergency health care. Although states may choose to cover children sooner, waiting periods can exacerbate the lack of health insurance coverage for immigrant children. The Affordable Care Act of 2010 (Pub L No. 111-148) also restricts the access to health insurance exchanges of children and adults who are undocumented immigrants.[12]

Language and communication barriers may impede medical care for many children in each of these 3 groups. Although many immigrant children speak English, their parents may not, creating a barrier that can prevent families from accessing health services and/or causing inadequate communication with health care providers. Without access to qualified medical interpreters in health care settings, language barriers can place English-speaking children in the difficult position of interpreting between health care providers and their family members. Use of children and other family members as untrained interpreters should be avoided. These challenges can result in major barriers to accessing health care and decreased satisfaction with services received. Providing care to families with limited English proficiency without appropriate medical interpretation services can ultimately lead to a higher incidence of medical errors when delivering care.[13]

Educational levels and health literacy are often lower among parents of immigrant, border, and migrant families than among native-born US families. Thirty-one percent of immigrant children have a mother without a high school education; the proportion of fathers without a high school education is similar.[4] It is important to note that the level of maternal education is an important determinant of child health. Lower education levels are associated with lower health literacy. Low health literacy creates a barrier for patients in understanding medical information and is associated with poor health outcomes.

Health Status and Health Disparities

Although immigrant children may be vulnerable to many risk factors for poorer health outcomes, some groups of immigrant children enjoy a healthier infancy than expected. For example, Latino families have a relatively low incidence of low birth weight, preterm birth, and infant mortality compared with children of US-born parents.[4] This phenomenon has been called the "healthy immigrant phenomenon."[9] Immigrant mothers are more likely to breastfeed their infants than mothers born in the United States.[14] Immigrant children also seem to benefit from some additional protective factors, such as growing up in 2-parent or extended families,[9] as well as close identification with the cultural and spiritual practices of their family and community. In addition, as they grow up, immigrant children may also display relatively better adjustment and behavior in school compared with nonimmigrant peers. This phenomenon has been shown to fade with increased length of stay in the United States and is, therefore, an infrequent protective factor for health outcomes.

On the other hand, the health of immigrant children as a group is, in some respects, worse than US-born children. For example, they are less likely to be perceived by their parents to be in excellent/good health and are less likely to have a usual source of medical care and to obtain specialty care when needed.[15] They also have less access to dental care, despite the fact that

they have a higher prevalence of dental caries.[16] The Affordable Care Act excluded undocumented immigrants from health care coverage made available through the Act, leaving that group of adults and children as the largest group who still will not have health insurance after the changes of 2014.[12]

Immigrant children who are foreign-born may not have been screened at birth for congenital syphilis, hemoglobinopathies, hearing deficits, and inborn errors of metabolism. In comparison with US-born children, they also have lower immunization rates, especially for vaccines that are not routinely administered in their countries of origin. Some children may lack immunization records. Foreign-born immigrant children have a higher incidence or prevalence of some infectious diseases, such as tuberculosis, hepatitis A, amebiasis, and parasitosis.[17] Immigrant children with asthma are less likely to be prescribed the recommended preventive medications.[18] Immigrant families may be uniquely vulnerable to mental health problems and experience high levels of stress, depression, grief, and traumatic events compared with nonimmigrant families.[19] Additionally, many experience the stress of family separation, in which some of the siblings or, in some cases, 1 or both of the parents do not reside in this country with them.

Development, Early Education, and School Success

Many immigrant, migrant, and border children also experience educational disparities compared with US-born children. As noted, immigrant children may enjoy a healthy start as infants but may experience developmental stagnation as toddlers compared with nonimmigrant children.[20]

In general, children who grow up in bilingual homes should attain major language developmental milestones at the normally expected times. At the same time, children raised in homes with impoverished language have a greater chance of being delayed in language acquisition, whether their families are monolingual or bilingual. When language delays are suspected in children growing up in limited English proficiency households, they present complex evaluation and intervention issues. When in doubt about a suspected language delay in a bilingual child, timely referral to a knowledgeable, bilingual speech and language pathologist is ideal.

Many immigrant children have less access to quality early education programs and are less likely to be enrolled in preschool programs, such as Head Start.[4] Once enrolled in school, cultural and linguistic barriers between parents and schools can lead to decreased family interaction and involvement. As they advance in their schooling, children in immigrant families are less likely to graduate from high school than are their nonimmigrant peers.[4]

Fear and Discrimination

Immigrant children and families may face discrimination and be fearful of attitudes and behaviors of the people they interact with outside their communities, including health care providers, which can reduce access to health care and lead to negative child health outcomes. Families may face anti-immigrant sentiment. Fear and discrimination can exacerbate a feeling of isolation and contribute to mental health problems, such as child and family depression, leaving these populations vulnerable.

Family Separation

Immigrant children may have 1 or more undocumented family members. An undocumented immigrant lacks the proper records and identification to live in the United States.[21] Immigration enforcement and related policies can lead to the sudden removal of an undocumented parent or other key family member without notice or preparation. Children whose parents are taken into custody and/or deported have been shown to experience mental and emotional health problems, including sleeping and eating disturbances, anxiety, depression, poor school performance, and other types of distress. Forced separations because of immigration enforcement can also result in the loss of family income and have been shown to result in family housing and food instability.[22] This can negatively affect a child's safety, health, and development.

FACTORS SPECIFIC TO MIGRANT CHILDREN

A large number of migrant children are also immigrants. For that reason, virtually all of the points made earlier about immigrant children may also apply to those who are migrants. Because of their migration patterns, migrant children are even more likely to lack medical coverage and a medical home than other immigrant children. They are also more likely to be socially, culturally, and linguistically isolated because of their mobile lifestyle.

Many migrant children face a panoply of health problems related to their living and working conditions, including workplace injuries, substandard housing, and unreliable transportation.[23] These factors can contribute to higher rates of respiratory tract and ear infections, bacterial and viral gastroenteritis, tuberculosis, nutritional deficiencies, intestinal parasites, skin infections, dental problems, lead and pesticide exposure, and undiagnosed congenital anomalies.[24] Additionally, at times, migrant adolescents travel

on their own from 1 job site to another, putting them at increased risk of many health-related problems.

FACTORS SPECIFIC TO BORDER CHILDREN

Immigrant children living at the US-Mexico border share almost all of the characteristics of other immigrant children but may experience additional challenges. Children who have crossed the border to enter the United States may have experienced trauma in the form of threat of death, abuse, and exploitation that leave serious psychological scars. Once in the United States, these children may experience an enhanced fear of a family member's deportation, imprisonment, or abuse because of documentation status. Children and families who have recently crossed the border can also experience difficulty adapting to the new cultural environment of the United States and experience stress from the absence of an extended family (including a parent or head of household) that is located in another country. Border children may be even more stigmatized or mistreated by the nonimmigrant populations living nearby, as their families are falsely presumed to take advantage of scarce resources and not pay taxes.

Many border communities are poor and lacking in resources, including medical care. In general, border communities lack sufficient numbers of primary care pediatricians, and those present may lack appropriate cultural and linguistic capacity to serve minority border children. In addition, primary care providers bear an especially high proportion of Medicaid, CHIP, and self-pay patients, with few privately insured patients to whom costs may be shifted. As a consequence of these deficiencies and because of high costs of medical care in the United States, families living close to the border may use medical care and pharmaceutical resources south of the border.

RECOMMENDATIONS

Immigrant children represent a considerable part of the economic and social future of the nation. It is in the national interest that we work to ensure that all children within the United States, including immigrant, border, and migrant children, grow up physically and developmentally healthy. The future prosperity and well-being of the United States depends on the health and vitality of all of its children, without exception. The following recommendations address how pediatricians can help support immigrant child health in practice.

1. Pediatricians and the American Academy of Pediatrics should advocate for health insurance coverage for every child and every individual living in the United States, as lack of coverage for any family member affects the health of the entire family.[25] This advocacy should focus on expanding access to quality health care within a medical home. Barriers to enrollment must be addressed, including the removal of any waiting periods for documented immigrant children to enroll into coverage. Efforts must also address barriers to enrollment for children who are potentially eligible for Medicaid and CHIP but not enrolled. Simplified enrollment for both programs and federal or state funding for those who are not currently eligible for Medicaid or CHIP is also essential.
2. The provision of comprehensive, coordinated, culturally and linguistically effective care, and continuous health services provided in a quality medical home should be integral to all efforts on behalf of immigrant children.[26] This is especially critical for children with chronic health care needs and emotional or behavioral health problems. Private and public insurance payers should pay for qualified medical interpretation services.
3. Pediatricians caring for immigrant children should evaluate immunization adequacy and should conduct careful developmental surveillance and screening at regular intervals as recommended by the American Academy of Pediatrics.[27] Appropriate referral for early intervention services or psychoeducational evaluation should be initiated as soon as a concern is identified.
4. Pediatricians should recognize the barriers to health that are faced by immigrant children and take these barriers into account while providing care. They should inquire about beliefs and practices related to health, illness, and disability, as well as traditional healing practices and medication use while obtaining a patient's medical history. Knowledge, attitude, and skill development in culturally and linguistically effective practices and cross-cultural communication should be part of every pediatrician's professional agenda.
5. Pediatricians should be knowledgeable about the unique emotional, behavioral, mental, and physical health advantages and problems that may be faced by immigrant children, including those related to family separation. Appropriate screening to identify family, environmental, and social circumstances, as well as biological factors, should be incorporated into routine pediatric assessments, such as in Bright Futures history forms.

6. Pediatricians should have access to information regarding federal, state, and community programs that can serve as resources to at-risk children and families. Culturally relevant programs that address social and economic challenges, such as food and housing security, English literacy, and legal services, are particularly important. Medical-legal partnerships should be supported to help immigrant families with these issues.
7. Pediatricians should play a key role in helping immigrant parents assess and review the educational progress of the child and encouraging parents to become involved in and interact with teachers and the school community. If a child exhibits difficulty or academic underachievement, pediatricians are in a unique position to advocate for the child and encourage and help parents to obtain appropriate evaluation and intervention from the school system.
8. Pediatricians should routinely use available screening and diagnostic protocols for evaluating foreign-born children for infectious diseases and other medical conditions when providing care for newly arrived immigrant children.[28] Additional screenings, including lead, vision, and hearing screenings, should be considered whether required for school entry or not.
9. Pediatricians should advocate for an array of culturally effective early intervention services, including the establishment of evidence-based early literacy promotion programs, such as Reach Out and Read, in immigrant, border, and migrant communities. Because reading is such an important skill, these programs are important tools for improving the school readiness of all children, just as fostering health literacy in parents is important to the well-being of their children.
10. Pediatricians should use their positions of respect in communities to promote the value of diversity and inclusion and to advocate for children and families of all backgrounds.

Given the challenging circumstances many immigrant children face because of their family's immigration status, the following recommendations address how immigration policies can support child health and well-being.

11. The health, well-being, and safety of children should be prioritized in all immigration proceedings. Whenever possible, the separation of a child from his or her family and home environment should be prevented, and family reunions should be expedited.
12. In no circumstances should a child have to represent himself or herself in an immigration proceeding.
13. Health care facilities should be safe settings for immigrant children and families to access health care. Medical records and health care facilities should not be used in any immigration enforcement action.

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Recognition and Management of Iatrogenically Induced Opioid Dependence and Withdrawal in Children

• *Clinical Report*

CLINICAL REPORT

Recognition and Management of Iatrogenically Induced Opioid Dependence and Withdrawal in Children

abstract

FREE

Opioids are often prescribed to children for pain relief related to procedures, acute injuries, and chronic conditions. Round-the-clock dosing of opioids can produce opioid dependence within 5 days. According to a 2001 Consensus Paper from the American Academy of Pain Medicine, American Pain Society, and American Society of Addiction Medicine, dependence is defined as "a state of adaptation that is manifested by a drug class specific withdrawal syndrome that can be produced by abrupt cessation, rapid dose reduction, decreasing blood level of the drug, and/or administration of an antagonist." Although the experience of many children undergoing iatrogenically induced withdrawal may be mild or goes unreported, there is currently no guidance for recognition or management of withdrawal for this population. Guidance on this subject is available only for adults and primarily for adults with substance use disorders. The guideline will summarize existing literature and provide readers with information currently not available in any single source specific for this vulnerable pediatric population. *Pediatrics* 2014;133:152–155

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KEY WORDS

opioids, dependence, withdrawal, sedation, analgesia

INTRODUCTION

Opioids are commonly prescribed to children of all ages.[1] Primarily, they are used in short duration for pain related to either a procedure or an acute injury. Utilization of opioids in these circumstances is widely accepted and generally considered low risk. Even in this circumstance, it is important to realize that children prescribed opioids for as little as 7 days can develop opioid dependence and exhibit drug-specific withdrawal symptoms on abrupt discontinuation of medications. Children in ICU settings are especially prone to these issues, because they are often exposed to opioids for longer periods of time when they have ongoing pain or require long-term sedation/analgesia as part of their care.

To understand the consequences of opioid use, it is important that one understands some basic definitions related to opioid use and adaptation to this use. The most commonly accepted definitions for these behaviors are based on a 2001 Consensus Paper from the American Academy of Pain Medicine, American Pain Society, and American Society of Addiction Medicine.[2] The definitions are as follows:

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

- Addiction is a primary, chronic, neurobiological disease with genetic, psychosocial, and environmental factors influencing its development and manifestations. It is characterized by behaviors that include one or more of the following: impaired control over drug use, compulsive use, continued use despite harm, and craving.
- Physical dependence is a state of adaptation that is manifested by a drug class–specific withdrawal syndrome that can be produced by abrupt cessation, rapid dose reduction, decreasing blood level of the drug, and/or administration of an antagonist.
- Tolerance is a state of adaptation in which exposure to a drug induces changes that result in a diminution of one or more of the drug's effects over time.

The consensus paper also noted, "most specialists in pain medicine and addiction agree that patients treated with prolonged opioid therapy do develop physical dependence and sometimes tolerance, but do not usually develop addictive disorders."

Although the experience of many children undergoing iatrogenically induced withdrawal may be mild or go unreported, there is currently no guidance for recognition or management of withdrawal for this population. (Guidance for newborn infants is available from the American Academy of Pediatrics.[3]) Guidance available on this subject is mostly from adults and primarily from literature on adults with substance use disorders. This clinical report summarizes existing literature on this subject and provides readers with information currently not available in any single source specific for this vulnerable pediatric population. The scope of this document is limited to children who received opioid medications outside the neonatal and infant period.

EPIDEMIOLOGY OF OPIOID USE IN THE PEDIATRIC POPULATION

In 2009, approximately 7.2 million outpatient opioid prescriptions were dispensed for children in the United States.[1] The frequency of opioid prescriptions to children has doubled in the past decade.[4] The vast majority of these prescriptions were written for children between the ages of 10 and 17 years, with many of these prescriptions for postprocedural and postoperative use.

BEHAVIORAL AND PHYSIOLOGIC CHARACTERISTICS OF OPIOID DEPENDENCE AND WITHDRAWAL

In most clinical situations, opioid dependence does not manifest any symptoms until opioid administration is abruptly decreased or discontinued (sometimes in favor of nonopioid analgesics), resulting in symptoms of withdrawal. Withdrawal also occurs when an alteration in gastrointestinal absorption leads to decreased absorption of oral opioid and a subsequent decrease in opioid blood concentration. Finally, transition from intravenous to oral administration is not always a predictable conversion, and withdrawal symptoms can occur when oral dosing results in a significantly lower blood concentration of opioid than the previous intravenous dosing. The signs and symptoms associated with withdrawal in the pediatric population can vary somewhat by age but are relatively consistent overall.[5,6]

Behavioral changes are often the primary manifestation of withdrawal and include anxiety, agitation, insomnia, and tremors. In addition to behavioral symptoms, physiologic changes commonly seen in withdrawal include increased muscle tone, nausea, vomiting, diarrhea, decreased appetite, tachypnea, tachycardia, fever, sweating, and hypertension. Care must be taken to rule out other causes of these symptoms, such as infection and sepsis.

Many of these symptoms are assessed in tools used to monitor children undergoing potential opioid withdrawal.[5] Specific scales for children include the Modified Narcotic Abstinence Scale, the Sedation Withdrawal Score, the Sophia Observation Withdrawal Symptoms Scale, and the Opioid Benzodiazepine Withdrawal Scale. Of these pediatric-specific scales, only the Sophia Observation Withdrawal Symptoms Scale has been validated.[7] The only validated scales to measure withdrawal in adults are the Clinical Opiate Withdrawal Scale (an 11-item clinician-administered scale assessing opioid withdrawal) and the Clinical Institute Narcotic Assessment scale, but these are not specific for children.[8] Consistently using and becoming familiar with any of these scales (adult or pediatric) will allow a clinician a means of detecting early signs of withdrawal so a treatment strategy can be implemented. Clinicians should also interpret results from the use of these scales within the clinical context of each individual patient, because there may be reasons other than opioid withdrawal that could explain certain behaviors being scored.

MANAGEMENT STRATEGIES FOR APPROPRIATE WEANING OF OPIOIDS AND TREATMENT OF WITHDRAWAL SYMPTOMS

Prevention is the preferred approach to management of opioid withdrawal symptoms and is achieved by decreasing the dose of opioid over time rather than abruptly discontinuing the medication, commonly referred to as "weaning." When discontinuing an opioid, the first step is to decide whether a patient is at risk for opioid withdrawal. Opioid withdrawal symptoms have been reported in as little as 5 days,[6] but there seems to be

considerable interpatient variability. Most patients who have received an opioid for less than 7 days do not suffer from withdrawal and can have their medication discontinued quickly. Patients who have been exposed to an opioid for longer than 14 days will usually need to follow a weaning protocol to prevent withdrawal symptoms. Those patients with opioid exposure lasting between 7 and 14 days may need to be weaned off their opioid but usually can be weaned more quickly than those with exposure longer than 14 days. It is critical to assess a patient's pain status at the time of anticipated weaning. A patient should not have ongoing painful stimuli or a condition that requires continuation or escalation of opioid dose to adequately manage pain before weaning.

After it is determined that a patient should be weaned from an opioid, a weaning protocol is developed taking into account the length of opioid exposure and total daily opioid dose. Unfortunately, there is no clear outcome-based evidence to support an ideal weaning protocol, but it does seem logical that individual patient response to weaning is more important than following a rigid schedule. It is beyond the scope of this article to prescribe specific guidelines; the generally accepted approach involves transition to a longer-acting opioid formulation, such as methadone, extended-release morphine, or extended-release oxycodone (this is an off-label use for these drugs). Once the patient is stabilized on the long-acting opioid, weaning is usually accomplished by steps of a 10% to 20% decrease in the original dose every 24 to 48 hours.[6] During opioid weaning, parents and care providers should carefully monitor for signs of withdrawal. If withdrawal symptoms are observed, the planned dose of opioid, from the weaning schedule, should be administered, and administration of additional rescue opioid should be considered if withdrawal symptoms are severe. A shorter-acting opioid should be available for signs of withdrawal, painful procedures, or for breakthrough pain. Adjunctive medications, such as clonidine, gabapentin, and dexmedetomidine, have been used[6] to decrease withdrawal symptoms and to help in the opioid-weaning process. These drugs are not labeled for this indication, and there is little information, other than the articles referenced in this clinical report, to provide guidance on their use.

Another common clinical scenario in patients with opioid dependence is concomitant long-term benzodiazepine exposure. Again, there are no clear guidelines for the concurrent weaning of benzodiazepines and opioids. It would seem prudent to have patients wean from 1 medication at a time rather than attempt to wean from both at the same time. This way, any signs of withdrawal can be more clearly attributed to 1 medication.

There is little in the literature describing the use of behavioral strategies for management of iatrogenic opioid withdrawal symptoms in children and adolescents. However, there are reports of the successful use of these interventions for the management of benzodiazepine withdrawal in adult patients with insomnia.[9,10] Behavioral intervention has also been used as part of treatment programs in adolescents who are dependent on either prescription opioids or heroin.[11] Given the success of multidisciplinary pain management interventions that include some form of behavioral therapy, it would seem logical that behavioral intervention would be a useful part of any weaning program to help with sleep hygiene, anxiety/mood symptoms, and pain-related symptoms that may occur during the weaning period.

Overall, the management of opioid dependence and tolerance can be managed safely and comfortably for most patients. The most common difficulties in the process are using a weaning schedule that is too rapid or not understanding that the patient's weaning protocol may not provide adequate analgesia if there are ongoing (or new) painful stimuli.

CONCLUSIONS

There is a high prevalence in the use of prescription opioids in the pediatric population (see the earlier section "Epidemiology of Opioid Use in the Pediatric Population") for durations exceeding 1 week. It is essential to realize that abrupt discontinuation of opioids can lead to drug-specific withdrawal symptoms. For patients receiving prolonged opioid therapy, it is best to develop strategies in conjunction with the patient's care team and family to minimize withdrawal symptoms while following a set opioid-weaning strategy. Understanding opioid withdrawal is key to its prevention. Research in this field is just beginning and should be looked at as a priority, because the frequency of prescribed opioid use in children has doubled in the past decade.[4]

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Recommendations for Prevention and Control of Influenza in Children, 2013–2014

- *Policy Statement*
  - *PPI: AAP Partnership for Policy Implementation*
    See Appendix 2 for more information.

POLICY STATEMENT

Recommendations for Prevention and Control of Influenza in Children, 2013–2014

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS
influenza, immunization, live-attenuated influenza vaccine, inactivated influenza vaccine, vaccine, children, pediatrics

ABBREVIATIONS
AAP—American Academy of Pediatrics
ccIIV3—trivalent cell culture-based inactivated influenza vaccine
CDC—Centers for Disease Control and Prevention
FDA—US Food and Drug Administration
ID—intradermal
IIV—inactivated influenza vaccine
IIV3—trivalent inactivated influenza vaccine
IIV4—quadrivalent inactivated influenza vaccine
IM—intramuscular
HCP—health care personnel
LAIV—live-attenuated influenza vaccine
LAIV3—trivalent live-attenuated influenza vaccine
LAIV4—quadrivalent live-attenuated influenza vaccine
PCV13—13-valent pneumococcal conjugate vaccine
pH1N1—influenza A (H1N1) pdm09 pandemic virus
RIV3—trivalent recombinant influenza vaccine

(Continued on last page)

abstract

FREE

The purpose of this statement is to update recommendations for routine use of seasonal influenza vaccine and antiviral medications for the prevention and treatment of influenza in children. Highlights for the upcoming 2013–2014 season include (1) this year's trivalent influenza vaccine contains an A/California/7/2009 (H1N1) pdm09-like virus (same as 2012–2013); an A/Texas/50/2012 (H3N2) virus (antigenically like the 2012–2013 strain); and a B/Massachusetts/2/2012-like virus (a B/Yamagata lineage like 2012–2013 but a different virus); (2) new quadrivalent influenza vaccines with an additional B virus (B/Brisbane/60/2008-like virus [B/Victoria lineage]) have been licensed by the US Food and Drug Administration; (3) annual universal influenza immunization is indicated with either a trivalent or quadrivalent vaccine (no preference); and (4) the dosing algorithm for administration of influenza vaccine to children 6 months through 8 years of age is unchanged from 2012–2013. As always, pediatricians, nurses, and all health care personnel should promote influenza vaccine use and infection control measures. In addition, pediatricians should promptly identify influenza infections to enable rapid antiviral treatment, when indicated, to reduce morbidity and mortality. *Pediatrics* 2013;132:e1089–e1104

INTRODUCTION

The American Academy of Pediatrics (AAP) recommends annual seasonal influenza immunization for all people, including *all* children and adolescents, 6 months of age and older during the 2013–2014 influenza season. In addition, special effort should be made to vaccinate people in the following groups:

- All children, including infants born preterm, who are 6 months of age and older with conditions that increase the risk of complications from influenza (eg, children with chronic medical conditions, such as asthma, diabetes mellitus, hemodynamically significant cardiac disease, immunosuppression, or neurologic and neurodevelopmental disorders)
- Children of American Indian/Alaskan Native heritage
- All household contacts and out-of-home care providers of
  - children with high-risk conditions; and
  - children younger than 5 years, especially infants younger than 6 months

- All health care personnel (HCP)
- All women who are pregnant, are considering pregnancy, have recently delivered, or are breastfeeding during the influenza season

KEY POINTS RELEVANT FOR THE 2013–2014 INFLUENZA SEASON

1. **Annual seasonal influenza vaccine is recommended for *all* people, including all children and adolescents, 6 months of age and older during the 2013–2014 influenza season.** It is important that household contacts and out-of-home care providers of children younger than 5 years, especially infants younger than 6 months and children of any age at high risk of complications of influenza (eg, children with chronic medical conditions, such as asthma, diabetes mellitus, hemodynamically significant cardiac disease, immunosuppression, or neurologic and neurodevelopmental disorders) receive annual influenza vaccine. In the United States, more than two-thirds of children younger than 6 years and almost all children 6 years and older spend significant time in child care and school settings outside the home. Exposure to groups of children increases the risk of contracting infectious diseases. Children younger than 2 years are at an increased risk of hospitalization and complications attributable to influenza. School-age children bear a large influenza disease burden and have a significantly higher chance of seeking influenza-related medical care compared with healthy adults. Therefore, reducing influenza virus transmission among children who attend child care or school has been shown to decrease the burden of childhood influenza and transmission of influenza virus to household contacts and community members of all ages.
2. The 2012–2013 influenza season was moderately severe, with a higher percentage of outpatient visits for influenza-like illness, higher rates of hospitalization, and more deaths attributed to pneumonia and influenza compared with the 2011–2012 influenza season. As of August 10, 2013, 158 laboratory-confirmed influenza-associated pediatric deaths were reported to the Centers for Disease Control and Prevention (CDC) during the 2012–2013 influenza season. Influenza A (H3N2) viruses predominated overall, but influenza B viruses and, to a lesser extent, A (H1N1) pdm09 (pH1N1) viruses also were reported in the United States. Eighty-two of the 158 deaths were associated with influenza B viruses, 32 deaths were associated with influenza A (H3) viruses, and 4 deaths were associated with pH1N1 viruses. Thirty-seven deaths were associated with an influenza A virus for which the subtype was not determined, 1 death was associated with an undetermined type of influenza virus, and 2 deaths were associated with both influenza A and B viruses. The majority of pediatric deaths were among children who had not been immunized against influenza. Among children hospitalized with influenza and for whom medical chart data were available, approximately 44% did not have any recorded underlying condition, whereas 23% had underlying asthma or reactive airway disease (Fig 1). Although children with certain conditions are at higher risk of complications, substantial proportions of seasonal influenza morbidity and mortality occur among healthy children.
3. Both trivalent and quadrivalent influenza vaccines are licensed and available in the United States for the 2013–2014 season. Neither vaccine formulation is preferred over the other. The trivalent vaccine contains an A/California/7/2009 (H1N1) pdm09-like virus (same as 2012–2013), an A/Texas/50/2012 (H3N2) virus (antigenically like the 2012–2013 strain), and a B/Massachusetts/2/2012-like virus (a B/Yamagata lineage like 2012-2013 but a different virus). The new quadrivalent influenza vaccines include an additional B virus (B/Brisbane/60/2008-like virus [B/Victoria lineage]). In addition, 2 trivalent influenza vaccines manufactured using new technologies that do not use eggs will also be available during the 2013–2014 season: cell culture-based inactivated influenza vaccine (ccIIV3) and recombinant influenza vaccine (RIV3).
4. The number of seasonal influenza vaccine doses to be administered in the 2013–2014 influenza season depends on the child's age at the time of the first administered dose and his or her vaccine history (Fig 2):
   - Influenza vaccines are not licensed for administration to infants younger than 6 months of age.
   - Children 9 years and older need only 1 dose.
   - Children 6 months through 8 years of age receiving the seasonal influenza vaccine for the first time should receive a second dose this season at least 4 weeks after the first dose.
   - Children 6 months through 8 years of age who received seasonal influenza vaccine before the 2013–2014 influenza season
     - need only 1 dose of vaccine, if they previously received 2 or more doses of seasonal vaccine since July 1, 2010.
     - need 2 doses of vaccine, if they have not previously received 2 or more doses of seasonal vaccine since July 1, 2010.

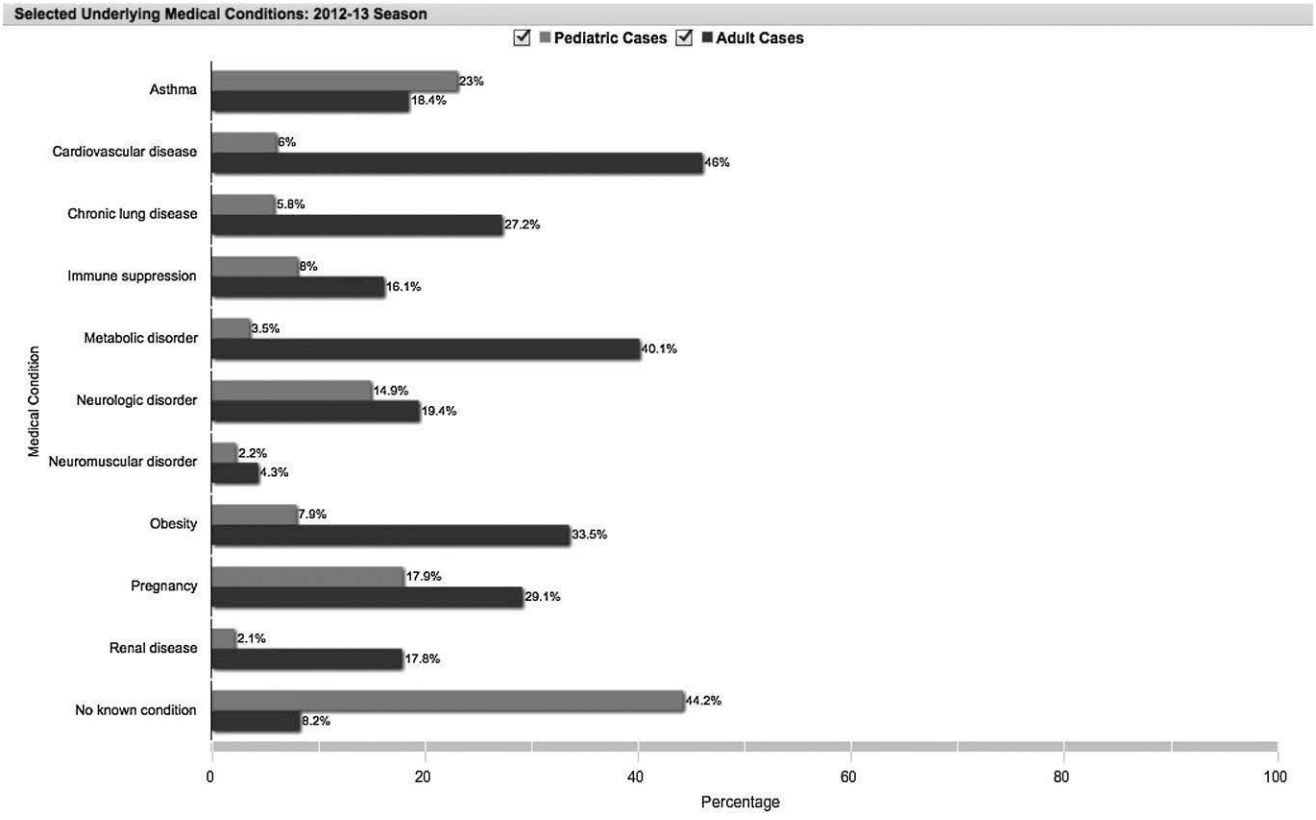

FIGURE 1

Selected underlying medical conditions in patients hospitalized with influenza, FluSurv-NET 2012–2013. Source: Centers for Disease Control and Prevention. FluView 2012–2013 Preliminary Data as of August 10, 2013. Available at: http://gis.cdc.gov/grasp/fluview/FluHospChars.html. FluSurv-NET data are preliminary and displayed as they become available. Therefore, figures are based on varying denominators because some variables represent information that may require more time to be collected. Data are refreshed and updated weekly. Asthma includes a medical diagnosis of asthma or reactive airway disease. Cardiovascular disease includes include conditions such as coronary heart disease, cardiac valve disorders, congestive heart failure, pulmonary hypertension, and aortic stenosis. It does not include hypertension disease only. Chronic lung disease includes conditions such as bronchitis obliterans, chronic aspiration pneumonia, and interstitial lung disease. Immune suppression includes conditions such as immunoglobulin deficiency, leukemia, lymphoma, HIV/AIDS, and individuals taking immunosuppression medications. Metabolic disorder includes conditions such as diabetes mellitus, thyroid dysfunction, adrenal insufficiency, and liver disease. Neurologic disorder includes conditions such as seizure disorders, cerebral palsy, and cognitive dysfunction. Neuromuscular disorder includes conditions such as multiple sclerosis and muscular dystrophy. Obesity was assigned if indicated in patients' medical chart or if BMI was >30. Pregnancy percentage was calculated using number of female cases aged between 15 and 44 years as the denominator. Renal disease includes conditions such as acute or chronic renal failure, nephrotic syndrome, glomerulonephritis, and impaired creatinine clearance. No known condition indicates that the case did not have any known underlying medical condition indicated in the medical chart at the time of hospitalization.

- need only 1 dose of influenza vaccine if there is clear documentation of having received at least 2 seasonal influenza vaccines from any previous season and at least 1 dose of a pH1N1-containing vaccine, which could have been in 1 of the seasonal vaccines (2010–2011, 2011–2012, or 2012–2013) or as the monovalent pH1N1 vaccine from 2009–2010.

Vaccination should not be delayed to obtain a specific product for either dose. Any available, age-appropriate trivalent or quadrivalent vaccine can be used. A child who receives only 1 of the 2 doses as a quadrivalent formulation is likely to be less primed against the additional B virus.

5. Pediatric offices should consider serving as alternate venues for providing influenza immunization to parents and other adults who care for children, if this approach is acceptable to both the pediatrician and the adult to be immunized.[1] There are important medical liability issues and medical record documentation requirements that need to be addressed before a pediatrician begins immunizing adults (see details at www.aapredbook.org/implementation). Pediatricians are reminded to document the recommendation for adult immunization in the vulnerable child's medical record. In addition, adults should still be encouraged to have a medical home and communicate their immunization status to their primary care provider. Immunization of close contacts of children at high risk of influenza-related complications is

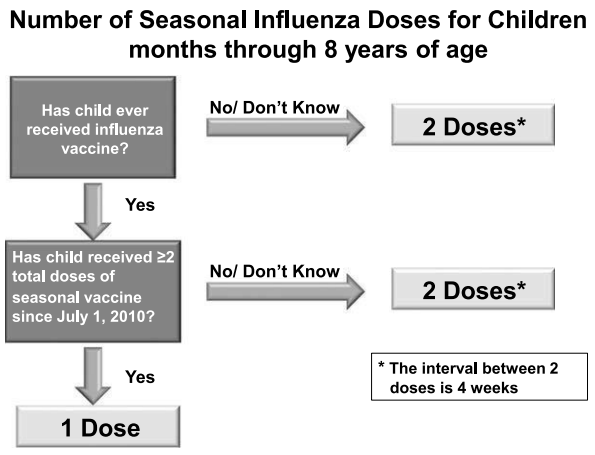

FIGURE 2
Number of 2013–2014 seasonal influenza vaccine doses for children 6 months through 8 years of age.

intended to reduce their risk of contagion (ie, "cocooning"). The concept of cocooning is particularly important to help protect infants younger than 6 months, because they are too young to be immunized with influenza vaccine. Infants younger than 6 months of age can also be protected through vaccination of their mothers during pregnancy with transplacental transfer of antibodies. The risk of influenza-associated hospitalization in healthy children aged younger than 24 months has been shown to be greater than the risk of hospitalization in previously recognized high-risk groups, such as the elderly, during influenza season. Children 24 through 59 months of age have shown increased rates of outpatient visits and antimicrobial use associated with influenza-like illnesses.

6. As soon as the seasonal influenza vaccine is available locally, HCP should be immunized, parents and caregivers should be notified about vaccine availability, and immunization of all children 6 months and older, especially children at high risk of complications from influenza, should begin. HCP endorsement plays a major role in vaccine uptake. A strong correlation exists between HCP endorsement of influenza vaccine and patient acceptance.[2] Prompt initiation of influenza immunization and continuance of immunization throughout the influenza season, whether or not influenza is circulating (or has circulated) in the community, are critical components of an effective immunization strategy. Giving the vaccine promptly and early during the influenza season is not felt to pose a significant risk that immunity might wane before the end of the season. The seasonal vaccine is not perfect, but it still is the best strategy available for preventing illness from influenza. It is moderately effective in reducing the risk for outpatient medical visits caused by circulating influenza viruses by approximately one-half to two-thirds in most people. Even a moderately effective influenza vaccine has been shown to reduce illness, antibiotic use, doctor visits, time lost from work, hospitalizations, and deaths.
7. Providers should continue to offer vaccine until the vaccine expiration date because influenza is unpredictable. Protective immune responses persist throughout the influenza season, which can have >1 disease peak and often extends into March or later. Although most influenza activity in the United States tends to occur in January through March, influenza activity can occur in early fall (ie, October and November) or late spring (eg, influenza circulated through the third week in May during the 2012–2013 season). This approach also provides ample opportunity to administer a second dose of vaccine because children aged <9 years may require 2 doses to confer optimal protection. In addition, with international travel so common, there is potential exposure to influenza at virtually all times of the year.
8. HCP, influenza campaign organizers, and public health agencies should collaborate to develop improved strategies for planning, communication, and administration of vaccines.
   - Plan to make seasonal influenza vaccine easily accessible for all children. Examples include creating walk-in influenza clinics; extending hours beyond routine times during peak vaccination periods; administering influenza vaccine during both well and sick visits; considering how to immunize parents, adult caregivers, and siblings at the same time in the same office setting as children[1]; and working with other institutions (eg, schools, child-care centers, and religious organizations) or alternative care sites, such as emergency departments, to expand venues for administering vaccine. If a child or adult receives influenza vaccine outside of his or her medical home, such as at a pharmacy or other retail-based clinic, appropriate documentation of immunization

must be provided to the medical home.

- Concerted efforts among the aforementioned groups, plus vaccine manufacturers, distributors, and payers, also are necessary to prioritize distribution appropriately to the primary care office setting and patient-centered medical home before other venues, especially when vaccine supplies are delayed or limited.
- Vaccine safety, effectiveness, and indications must be properly communicated to the public. HCP should act as role models by receiving influenza immunization annually as well as recommending annual immunizations to both colleagues and patients. Influenza immunization programs for HCP benefit the health of employees, their patients, and members of the community.[2] Beginning in 2012, as an immunization core measure, the Centers for Medicare and Medicaid Services, the US federal agency that administers Medicare, Medicaid, and the State Children's Health Insurance Program, began requiring hospitals and certain other inpatient facilities to screen for a history of influenza vaccination and to administer influence vaccine to all unimmunized hospitalized patients 6 months and older between October and March unless contraindicated or the patient or family refuses.

9. Antiviral medications also are important in the control of influenza but are not a substitute for influenza immunization. The neuraminidase inhibitors oral oseltamivir (Tamiflu; Roche Laboratories, Nutley, NJ) and inhaled zanamivir (Relenza; GlaxoSmithKline, Research Triangle Park, NC) are the only antiviral medications routinely recommended for chemoprophylaxis or treatment of influenza during the 2013–2014 season. Intravenous preparations of oseltamivir, zanamivir, and peramivir are not currently approved by the US Food and Drug Administration (FDA) and are not routinely available. However, with consultation with infectious diseases specialists, experimental intravenous antiviral medications could be considered for some critically ill children, especially those who are immunocompromised. Recent viral surveillance and resistance data indicate that the majority of currently circulating influenza viruses likely to cause 2013–2014 seasonal influenza in North America continue to be sensitive to oseltamivir and zanamivir. In contrast, amantadine and rimantadine should not be used because circulating influenza A viruses have sustained high levels of resistance to these drugs, and they are not effective against influenza B viruses. Resistance characteristics may change rapidly; pediatricians should verify susceptibility data at the start of the influenza season and monitor it during the season. Up-to-date information can be found on the AAP Web site (www.aap.org or www.aapredbook.org/flu), through state-specific AAP chapter Web sites, or on the CDC Web site (www.cdc.gov/flu/index.htm).

SEASONAL INFLUENZA VACCINES

During previous influenza seasons, only trivalent influenza vaccines that included antigen from 1 influenza B virus were available. However, since 1985, 2 antigenically distinct lineages (ie, Victoria or Yamagata) of influenza B viruses have circulated globally. In most years, vaccination against a B virus of 1 lineage confers little cross-protection against a B virus strain from the other lineage. Thus, trivalent vaccines offer limited immunity against circulating influenza B strains of the lineage not present in the vaccine. Furthermore, in recent years, it has proven difficult to consistently predict which B lineage will predominate during a given influenza season. Therefore, a quadrivalent influenza vaccine with influenza B strains of both lineages may offer improved protection. Postmarketing safety and vaccine effectiveness data are not yet available, prohibiting a full risk-benefit analysis of newer versus previously available products.

For the 2013–2014 season, the inactivated influenza vaccines (IIVs) will be available for intramuscular (IM) injection in both trivalent (IIV3) and quadrivalent (IIV4) formulations. Note that the abbreviation IIV has replaced TIV (trivalent inactivated influenza vaccine) because inactivated influenza vaccines now contain either 3 or 4 virus strains. The intranasally administered live-attenuated influenza vaccine (LAIV) will be available only in a quadrivalent formulation (LAIV4). IIV4 and LAIV4 will contain the identical influenza strains anticipated to circulate during the 2013–2014 influenza season.

IIVs contain no live virus. IIV3 formulations are now available for IM and intradermal (ID) use. The IM formulation of IIV3 is licensed and recommended for children 6 months of age and older and adults, including people with and without chronic medical conditions. The most common adverse events after IIV administration are local injection site pain and tenderness. Fever may occur within 24 hours after immunization in approximately 10% to 35% of children younger than 2 years but rarely in older children and adults. Mild systemic symptoms, such as nausea, lethargy, headache, muscle

aches, and chills, may occur after administration of IIV3.

An ID formulation of IIV3 is licensed for use in people 18 through 64 years of age. ID vaccine administration involves a microinjection with a shorter needle than needles used for IM administration. The most common adverse events are redness, induration, swelling, pain, and itching, which occur at the site of administration; although all adverse events occur at a slightly higher rate with the IM formulation of IIV3, the rate of pain was similar between ID and IM. Headache, myalgia, and malaise may occur and tend to occur at the same rate as that with the IM formulation of IIV3. There is no preference for IM or ID immunization with IIV3 in people 18 years or older. Therefore, pediatricians may choose to use either the IM or ID product in their late adolescent and young adult patients as well as for any adults they may be vaccinating (ie, as part of a cocooning strategy).

IIV4 is available in IM but not ID formulations. One formulation is licensed for use in children as young as 6 months of age. In children, the most common injection site adverse reactions were pain, redness, and swelling. The most common systemic adverse events were drowsiness, irritability, loss of appetite, fatigue, muscle aches, headache, arthralgia, and gastrointestinal tract symptoms. These events were reported with comparable frequency among participants receiving the licensed comparator trivalent vaccines. IIV4 is an acceptable alternative to other approved vaccines indicated for persons 6 months or older when otherwise appropriate and may offer greater protection than IIV3. The relative quantity of doses of IIV4 that will be available is not certain and likely to be limited.

During the 2010–2011 and 2011–2012 influenza seasons, increased reports of febrile seizures in the United States were noted by the Vaccine Adverse Event Reporting System and were associated with IIV3 manufactured by Sanofi Pasteur (Fluzone), mainly in children in the 12- through 23-month age group (the peak age for febrile seizures). The most common vaccine administered concomitantly with IIV3 when a febrile seizure was reported was the 13-valent pneumococcal conjugate vaccine (PCV13). This disproportionate reporting of febrile seizures did not persist through the most recent 2012–2013 influenza season. On the basis of these data, simultaneous administration of IIV and PCV13 for the 2013–2014 influenza season continues to be recommended when both vaccines are indicated.

LAIV4 is a quadrivalent live-attenuated influenza vaccine that is administered intranasally and replaces the previous trivalent formulation of LAIV (LAIV3). It is licensed by the FDA for previously healthy people aged 2 through 49 years. It is not recommended for people with a history of asthma, diabetes mellitus, or other high-risk medical conditions associated with an increased risk of complications from influenza (see Contraindications and Precautions). LAIV4 has a similar safety profile to that of LAIV3. The most commonly reported reactions in children were runny nose/nasal congestion, headache, decreased activity/lethargy, and sore throat. LAIV should not be administered to people with notable nasal congestion that would impede vaccine delivery.

Two trivalent influenza vaccines manufactured using new technologies that do not use eggs will also be available for people 18 years or older during the 2013–2014 season: ccIIV3 and recombinant influenza vaccine (RIV3). These manufacturing methods are beneficial because they would be expected to permit a more rapid scale up of vaccine production when needed, such as during a pandemic.

ccIIV3 is a trivalent cell culture–based inactivated influenza vaccine indicated for people 18 years or older, administered as an IM injection. ccIIV3 has comparable immunogenicity to US-licensed comparator vaccines. Although ccIIV3 is manufactured from virus propagated in Madin Darby Canine Kidney cells rather than embryonated eggs, before production, seed virus is created using the World Health Organization reference virus strains that have been passaged in eggs. However, egg protein is not detectable in the final vaccine, and egg allergy is not mentioned in the package insert. Contraindications are similar to those for other IIVs. The most common solicited adverse reactions included injection site pain, erythema at the injection site, headache, fatigue, myalgia, and malaise.

RIV3 is a recombinant hemagglutinin vaccine. It is indicated for people 18 through 49 years of age and is administered via IM injection. The most frequently reported adverse events were pain, headache, myalgia, and fatigue.

Tables 1 and 2 summarize information on the types of 2013–2014 seasonal influenza vaccines licensed for immunization of children and adults. With the addition of 5 newly licensed vaccines, it is likely that more than 1 type or brand of vaccine may be appropriate for vaccine recipients. However, no preferential recommendation is made for use of any influenza vaccine product over another. Vaccination should not be delayed to obtain a specific product.

A large body of scientific evidence demonstrates that thimerosal-containing vaccines are not associated with increased risk of autism spectrum disorders in children. As such, the AAP extends its strongest support to the recent World Health Organization recommendations to retain the use of thimerosal in the global vaccine supply.

Some people may still raise concerns about the minute amounts of thimerosal in IIV vaccines, and in some states, there is a legislated restriction on the use of thimerosal-containing vaccines. The benefits of protecting children against the known risks of influenza are clear. Therefore, children should receive any available formulation of IIV rather than delaying immunization while waiting for vaccines with reduced-thimerosal content or thimerosal-free vaccine. Although some formulations of IIV contain only a trace amount of thimerosal, certain types can be obtained thimerosal free. LAIV does not contain thimerosal. Vaccine manufacturers are delivering increasing amounts of thimerosal-free influenza vaccine each year.

INFLUENZA VACCINES AND EGG ALLERGY

Almost all IIV and LAIV are produced in eggs and contain measurable amounts of egg protein, expressed as the concentration of ovalbumin per dose. However, recent data have shown that IIV administered in a single, age-appropriate dose is well tolerated by virtually all recipients who have egg allergy. More conservative approaches, such as skin testing or a 2-step graded challenge, are no longer recommended. No data exist on the safety of administering LAIV to egg-allergic recipients.

As a precaution, pediatricians should continue to determine whether the presumed egg allergy is based on a mild (ie, hives alone) or severe (ie, anaphylaxis involving cardiovascular changes, respiratory and/or gastrointestinal tract symptoms, or reactions that required the use of epinephrine) reaction. Pediatricians should consult with an allergist for children with a history of severe reaction. Most vaccine administration to individuals with egg allergy can happen without the need for referral. Data indicate that approximately 1% of children have immunoglobulin E-mediated sensitivity to egg, and of those, a rare minority has a severe allergy.

Standard immunization practice should include the ability to respond to acute hypersensitivity reactions. Therefore, influenza vaccine should be given to people with egg allergy with the following preconditions (Fig 3):

TABLE 1 Recommended Seasonal Influenza Vaccines for Different Age Groups: United States, 2013–2014 Influenza Season

Vaccine	Trade Name	Manufacturer	Presentation	Thimerosal Mercury Content[a]	Age Group
Inactivated					
IIV3	Fluzone	Sanofi Pasteur	0.25-mL prefilled syringe	0	6–35 mo
			0.5-mL prefilled syringe	0	≥36 mo
			0.5-mL vial	0	≥36 mo
			5.0-mL multidose vial	25	≥6 mo
IIV3	Fluzone Intradermal	Sanofi Pasteur	0.1-mL prefilled microinjection	0	18–64 y
IIV3	Fluzone HD	Sanofi Pasteur	0.5-mL prefilled syringe	0	≥65 y
IIV3	Fluvirin	Novartis	0.5-mL prefilled syringe	≤1.0	≥4 y
			5.0-mL multidose vial	25	≥4 y
IIV3	Agriflu	Novartis	0.5-mL prefilled syringe	0	≥18 y
IIV3	Fluarix	GlaxoSmithKline	0.5-mL prefilled syringe	0	≥36 mo
IIV3	FluLaval	ID Biomedical Corporation of Quebec (distributed by GlaxoSmithKline)	5.0-mL multidose vial	25	≥3 y
IIV3	Afluria	CSL Biotherapies (distributed by Merck)	0.5-mL prefilled syringe	0	≥9 y[b]
			5-mL multidose vial	24.5	≥9 y[b]
ccIIV3	Flucelvax	Novartis Vaccines	0.5-mL prefilled syringe	0	≥18 y
IIV4	Fluzone Quadrivalent	Sanofi Pasteur	0.25-mL prefilled syringe	0	6-35 mo
			0.5-mL prefilled syringe	0	≥36 mo
			0.5-mL vial	0	≥36 mo
IIV4	Fluarix Quadrivalent	GlaxoSmithKline	0.5-mL prefilled syringe	0	≥36 mo
IIV4	FluLaval Quadrivalent	ID Biomedical Corporation of Quebec (distributed by GlaxoSmithKline)	5.0-mL multidose vial	25	≥3 y
Recombinant					
RIV3	FluBlok	Protein Sciences	0.5-mL vial	0	18–49 y
Live-attenuated					
LAIV4	FluMist Quadrivalent	MedImmune	0.2-mL sprayer	0	2–49 y

Data sources: American Academy of Pediatrics, Committee on Infectious Diseases. Recommendations for prevention and control of influenza in children, 2012–2013. *Pediatrics.* 2012;130(4):780–792; Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP)—United States, 2012–13 influenza season. *MMWR Morb Mortal Wkly Rep.* 2012;61(32):613–618; and Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines: interim recommendations of the Advisory Committee on Immunization Practices (ACIP), 2013. *MMWR Morb Mortal Wkly Rep.* 2013;62(18):356.

[a] Microgram of Hg/0.5-mL dose.

[b] Age indication per package insert is ≥5 y; however, the Advisory Committee on Immunization Practices recommends Afluria not be used in children 6 months through 8 years of age because of increased reports of febrile reactions noted in this age group. If no other age-appropriate, licensed, inactivated seasonal influenza vaccine is available for a child 5 through 8 years of age who has a medical condition that increases the child's risk of influenza complications, Afluria can be used; however, pediatricians should discuss with the parents or caregivers the benefits and risks of influenza vaccination with Afluria before administering this vaccine.

TABLE 2 LAIV4 Compared With IIV3 and IIV4

Vaccine Characteristic	LAIV4	IIV3	IIV4
Route of administration	Intranasal spray	IM or ID injection[a]	IM injection[a]
Type of vaccine	Live virus	Killed virus	Killed virus
Product	Attenuated, cold-adapted	Inactivated subvirion or surface antigen	Inactivated subvirion or surface antigen
No. of included virus strains	4 (2 influenza A, 2 influenza B)	3 (2 influenza A, 1 influenza B)	4 (2 influenza A, 2 influenza B)
Vaccine virus strains updated	Annually	Annually	Annually
Frequency of administration[b]	Annually	Annually	Annually
Approved age groups	All healthy people aged 2–49 y	All people aged ≥6 mo (ID 18–64 y)	All people aged ≥6 mo
Interval between 2 doses in children	4 wk	4 wk	4 wk
Can be given to people with medical risk factors for influenza-related complications?	No	Yes	Yes
Can be given to children with asthma or children aged 2–4 y with wheezing in the previous year?	No[c]	Yes	Yes
Can be simultaneously administered with other vaccines?	Yes[d]	Yes[d]	Yes[d]
If not simultaneously administered, can be administered within 4 wk of another live vaccine?	No, prudent to space 4 wk apart	Yes	Yes
Can be administered within 4 wk of an inactivated vaccine?	Yes	Yes	Yes

Data sources: American Academy of Pediatrics, Committee on Infectious Diseases. Recommendations for prevention and control of influenza in children, 2012–2013. *Pediatrics.* 2012;130 (4):780–792; Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP)—United States, 2012–13 influenza season. *MMWR Morb Mortal Wkly Rep.* 2012;61(32):613–618; and Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines: interim recommendations of the Advisory Committee on Immunization Practices (ACIP), 2013. *MMWR Morb Mortal Wkly Rep.* 2013;62(18):356.

[a] The preferred site of IIV intramuscular injection for infants and young children is the anterolateral aspect of the thigh.

[b] See Fig 2 for decision algorithm to determine number of doses of seasonal influenza vaccine recommended for children during the 2013–2014 influenza season.

[c] LAIV4 is not recommended for children with a history of asthma. In the 2- through 4-year age group, there are children who have a history of wheezing with respiratory illnesses in whom reactive airways disease is diagnosed and in whom asthma may later be diagnosed. Therefore, because of the potential for increased wheezing after immunization, children 2 through 4 years of age with recurrent wheezing or a wheezing episode in the previous 12 months should not receive LAIV4. When offering LAIV4 to children in this age group, a pediatrician should screen those who might be at higher risk of asthma by asking the parents/guardians of 2-, 3-, and 4-year-olds (24- through 59-month-olds) the question: "In the previous 12 months, has a health care professional ever told you that your child had wheezing?" If the parents answer yes to this question, LAIV4 is not recommended for these children.

[d] LAIV4 coadministration has been evaluated systematically only among children 12 to 15 months of age with measles-mumps-rubella and varicella vaccines. IIV coadministration has been evaluated systematically only among adults with pneumococcal polysaccharide and zoster vaccines.

- Appropriate resuscitative equipment must be readily available.[3]
- The vaccine recipient should be observed in the office for 30 minutes after immunization, the standard observation time for receiving immunotherapy.

Providers may consider use of ccIIV3 or RIV3 vaccines produced via non-egg-based technologies for adults with egg allergy in settings in which these vaccines are available and otherwise age appropriate. Because there is no known safe threshold for ovalbumin content in vaccines, ccIIV3, which does contain trace amounts of ovalbumin, should be administered according to the guidance for other IIVs (Fig 3). In contrast, RIV3, which contains no ovalbumin, may be administered to people with egg allergy of any severity who are 18 through 49 years of age and do not have other contraindications. However, vaccination of individuals with mild egg allergy should not be delayed if RIV3 or ccIIV3 are not available. Instead, any licensed, age-appropriate IIV should be used.

VACCINE STORAGE AND ADMINISTRATION

The AAP Storage and Handling Tip Sheet provides resources for practices to develop comprehensive vaccine management protocols to keep their vaccine supply safe during a power failure or other disaster (www2.aap.org/immunization/pediatricians/pdf/DisasterPlanning.pdf). Any of the influenza vaccines can be administered at the same visit with all other recommended routine vaccines.

IM Vaccine

The IM formulation of IIV is shipped and stored at 2°C to 8°C (35°F–46°F). It is administered intramuscularly into the anterolateral thigh of infants and young children and into the deltoid muscle of older children and adults. The volume of vaccine is age dependent; infants and toddlers 6 months through 35 months of age should receive a dose of 0.25 mL, and all people 3 years (36 months) and older should receive 0.5 mL/dose.

ID Vaccine

The ID formulation of IIV is also shipped and stored at 2°C to 8°C (35°F–46°F). It is administered intradermally only to people 18 through 64 years of age, preferably over the deltoid muscle, and only using the device included in the vaccine package. Vaccine is supplied in a single-dose, prefilled microinjection system (0.1 mL) for adults. The package insert should be reviewed for full administration details of this product.

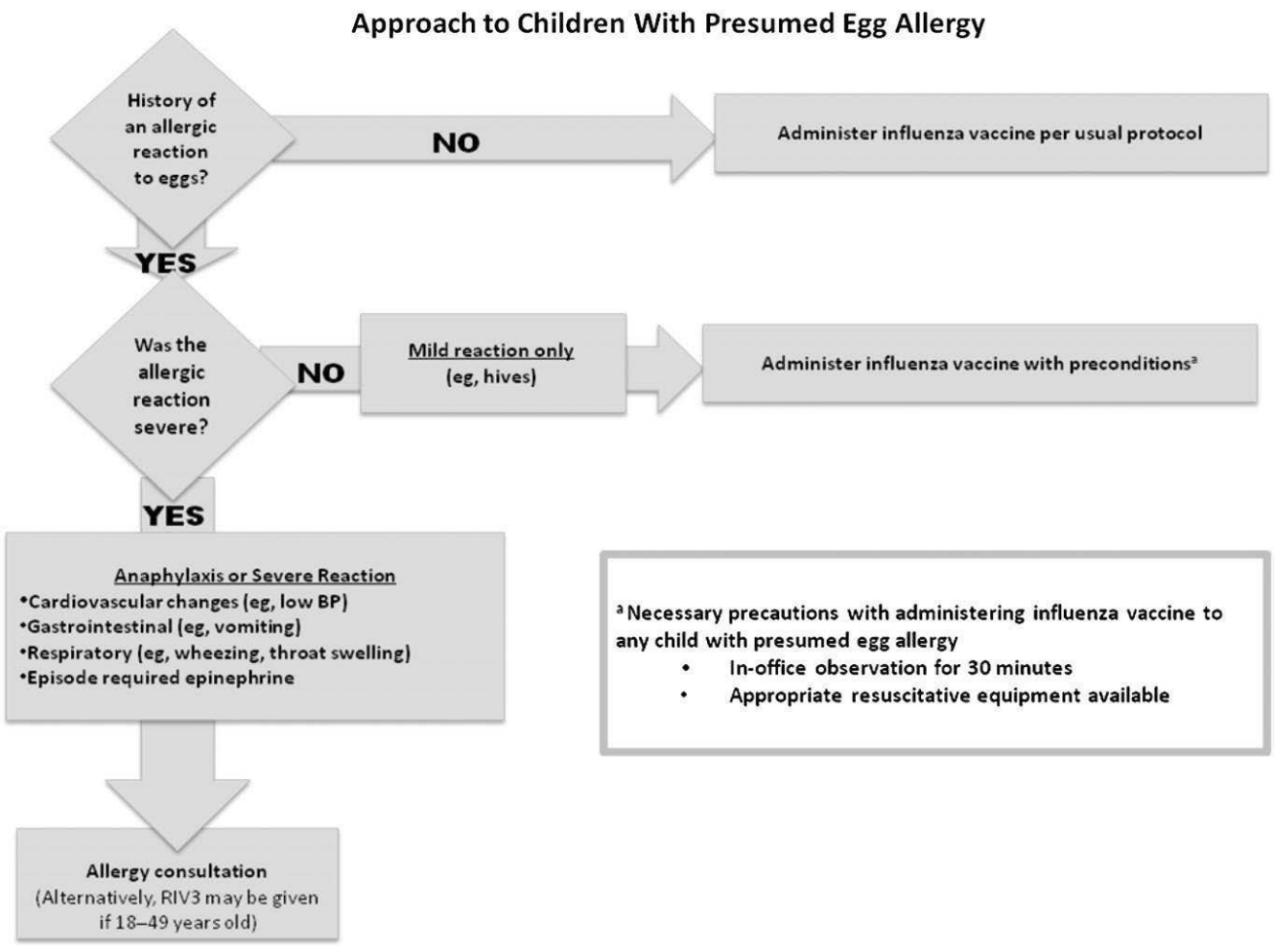

FIGURE 3
Precautions for administering IIV to presumed egg-allergic individuals. BP, blood pressure.

Live-Attenuated (Intranasal) Vaccine

The cold-adapted, temperature sensitive LAIV formulation currently licensed in the United States must be shipped and stored at 2°C to 8°C (35°F–46°F) and administered intranasally in a prefilled, single-use sprayer containing 0.2 mL of vaccine. A removable dose-divider clip is attached to the sprayer to administer 0.1 mL separately into each nostril. After administration of any live-virus vaccine, at least 4 weeks should pass before another live-virus vaccine is administered.

CURRENT RECOMMENDATIONS

Seasonal influenza immunization is recommended for all children 6 months and older. Healthy children 2 years and older can receive either IIV or LAIV. Particular focus should be on the administration of IIV for all children and adolescents with underlying medical conditions associated with an increased risk of complications from influenza, including the following:

- Asthma or other chronic pulmonary diseases, including cystic fibrosis.
- Hemodynamically significant cardiac disease.
- Immunosuppressive disorders or therapy.
- HIV infection.
- Sickle cell anemia and other hemoglobinopathies.
- Diseases that require long-term aspirin therapy, including juvenile idiopathic arthritis or Kawasaki disease.
- Chronic renal dysfunction.
- Chronic metabolic disease, including diabetes mellitus
- Any condition that can compromise respiratory function or handling of secretions or can increase the risk of aspiration, such as neurodevelopmental disorders, spinal cord injuries, seizure disorders, or neuromuscular abnormalities.

Although universal immunization for all people 6 months and older is recommended for the 2013–2014 influenza season, particular immunization

efforts with either IIV or LAIV should be made for the following groups to prevent transmission of influenza to those at risk, unless contraindicated:

- Household contacts and out-of-home care providers of children younger than 5 years of age and at-risk children of all ages (healthy contacts 2 through 49 years of age can receive either IIV or LAIV).
- Any woman who is pregnant, is considering pregnancy, has recently delivered, or is breastfeeding during the influenza season (IIV only). Studies have shown that infants born to immunized women have better influenza-related health outcomes. However, according to Internet panel surveys conducted by the CDC, only 47% of pregnant women reported receiving an influenza vaccine during the 2011–2012 season, even though both pregnant women and their infants are at higher risk of complications. In addition, data from some studies suggest that influenza vaccination in pregnancy may decrease the risk of preterm birth as well as giving birth to infants who are small for gestational age. Pregnant women can safely receive the influenza vaccine during any trimester.
- Children and adolescents of American Indian/Alaskan Native heritage.
- HCP or health care volunteers. Despite the recent AAP recommendation for mandatory influenza immunization for all HCP,[2] many HCP remain unvaccinated. As of November 2012, the CDC estimated that only 62.9% of HCP received the seasonal influenza vaccine. The AAP recommends mandatory vaccination of HCP, because they frequently come into contact with patients at high risk of influenza illness in their clinical settings.
- Close contacts of immunosuppressed people.

CONTRAINDICATIONS AND PRECAUTIONS

Minor illnesses, with or without fever, are not contraindications to the use of influenza vaccines, particularly among children with mild upper respiratory infection symptoms or allergic rhinitis.

Children Who Should Not Be Vaccinated With IIV

- Infants younger than 6 months.
- Children who have a moderate-to-severe febrile illness on the basis of clinical judgment of the clinician.

Children Who Should Not Be Vaccinated With LAIV

- Children younger than 2 years.
- Children who have a moderate-to-severe febrile illness.
- Children with an amount of nasal congestion that would notably impede vaccine delivery.
- Children with chronic underlying medical conditions, including metabolic disease, diabetes mellitus, asthma, other chronic disorders of the pulmonary or cardiovascular systems, renal dysfunction, or hemoglobinopathies.
- Children 2 through 4 years of age with a history of recurrent wheezing or a medically attended wheezing episode in the previous 12 months because of the potential for increased wheezing after immunization. In this age range, many children have a history of wheezing with respiratory tract illnesses and are eventually diagnosed with asthma. Therefore, when offering LAIV to children 24 through 59 months of age, the pediatrician should screen them by asking the parent/guardian the question, "In the previous 12 months, has a health care professional ever told you that your child had wheezing?" If a parent answers yes to this question, LAIV is not recommended for the child. IIV would be recommended for the child to whom LAIV is not given.
- Children who have received other live-virus vaccines within the past 4 weeks; however, other live-virus vaccines can be given on the same day as LAIV.
- Children who have known or suspected immunodeficiency disease or who are receiving immunosuppressive or immunomodulatory therapies.
- Children who are receiving aspirin or other salicylates.
- Any woman who is pregnant or considering pregnancy.
- Children with any condition that can compromise respiratory function or handling of secretions or can increase the risk for aspiration, such as neurodevelopmental disorders, spinal cord injuries, seizure disorders, or neuromuscular abnormalities.
- Children taking an influenza antiviral medication should not receive LAIV until 48 hours after stopping the influenza antiviral therapy. If a child recently received LAIV but has an influenza illness for which antiviral agents are appropriate, the antiviral agents should be given. Reimmunization may be indicated because of the potential effects of antiviral medications on LAIV replication and immunogenicity.

IIV is the vaccine of choice for anyone in close contact with a subset of severely immunocompromised people (ie, individuals in a protected environment). IIV is preferred over LAIV for contacts of severely immunocompromised people (ie, in a protected environment) because of the theoretical risk of infection in an immunocompromised contact of a LAIV-immunized person. Available data indicate a low risk of transmission of the virus in both children and adults vaccinated

with LAIV. HCP immunized with LAIV may continue to work in most units of a hospital, including the NICU and general oncology wards, using standard infection-control techniques. As a precautionary measure, people recently vaccinated with LAIV should restrict contact with severely immunocompromised patients (eg, hematopoietic stem cell transplant recipients during periods that require a protected environment) for 7 days after immunization, although there have been no reports of LAIV transmission from a vaccinated person to an immunocompromised person. In the theoretical scenario in which symptomatic LAIV infection develops in an immunocompromised host, oseltamivir or zanamivir could be prescribed because LAIV strains are susceptible to these antiviral medications.

SURVEILLANCE

Information about influenza surveillance is available through the CDC Voice Information System (influenza update, 888-232-3228) or at www.cdc.gov/flu/index.htm. Although current influenza season data on circulating strains do not necessarily predict which and in what proportion strains will circulate in the subsequent season, it is instructive to be aware of 2012–2013 influenza surveillance data and use them as a guide to empirical therapy until current seasonal data are available from the CDC. Information is posted weekly on the CDC Web site (www.cdc.gov/flu/weekly/fluactivity.htm).

VACCINE IMPLEMENTATION

These updated recommendations for prevention and control of influenza in children will have considerable operational and fiscal effects on pediatric practice. Therefore, the AAP has developed implementation guidance on supply, payment, coding, and liability issues; these documents can be found at www.aapredbook.org/implementation.

In addition, the AAP's Partnership for Policy Implementation has developed a series of definitions using accepted health information technology standards to assist in the implementation of this guideline in computer systems and quality measurement efforts. This document is available at www2.aap.org/informatics/PPI.html.

USE OF ANTIVIRAL MEDICATIONS

Oseltamivir remains the antiviral drug of choice for the management of influenza infections. Zanamivir is an acceptable alternative but is more difficult to administer. Antiviral resistance can emerge quickly from one season to the next. If local or national influenza surveillance data indicate a predominance of a particular influenza strain with known antiviral susceptibility profile, then empirical treatment can be directed toward that strain. For example, among 2123 influenza A (H3N2) viruses tested, 1 (0.05%) was found to be resistant to oseltamivir alone and 1 (0.05%) to both oseltamivir and zanamivir. Among the 542 pH1N1 viruses tested for resistance to oseltamivir, 2 (0.4%) were resistant, and all of the 258 viruses tested for resistance to zanamivir were sensitive. In contrast, high levels of resistance to amantadine and rimantadine exist, so these drugs should not be used in the upcoming season unless resistance patterns change significantly.

- Current treatment guidelines for antiviral medications (Table 3) are applicable to both infants and children with suspected influenza when known virus strains are circulating in the community or when infants or children are confirmed to have seasonal influenza.
- Oseltamivir is available in capsule and oral-suspension formulations. The commercially manufactured liquid formulation has a concentration of 6 mg/mL. If the commercially manufactured oral suspension is not available, the capsule may be opened and the contents mixed with simple syrup or Oral-Sweet SF (sugar-free) by retail pharmacies to a final concentration of 6 mg/mL (Table 3, footnote a).
- Continuous monitoring of the epidemiology, change in severity, and resistance patterns of influenza strains may lead to new guidance.

Treatment should be offered for the following:

- Any child hospitalized with presumed influenza or with severe, complicated, or progressive illness attributable to influenza, regardless of influenza immunization status.
- Influenza infection of any severity in children at high risk of complications of influenza infection (Table 4).

Treatment should be considered for the following:

- Any otherwise healthy child with influenza infection for whom a decrease in duration of clinical symptoms is felt to be warranted by his or her pediatrician; the greatest impact on outcome will occur if treatment can be initiated within 48 hours of illness onset.

Reviews of available studies by the CDC, the World Health Organization, and independent investigators have consistently found that timely oseltamivir treatment can reduce the risks of complications, including those resulting in hospitalization and death. Although a 2012 Cochrane review suggested that oseltamivir may not be effective in preventing complications or hospitalizations from influenza, its authors correctly pointed out that the data reviewed were not always complete, were analyzed in a variety of treated populations, and used a number of clinical trial designs. Regardless, treatment with oseltamivir for children with presumed serious, complicated, or progressive disease, irrespective of

influenza immunization status and/or even if illness began > 48 hours before admission, continues to be recommended. Earlier treatment provides optimal clinical responses. However, treatment after 48 hours of symptoms in adults and children with moderate-to-severe disease or with progressive disease has been shown to provide some benefit and should be strongly considered.

Dosages for antiviral agents for both treatment and chemoprophylaxis in children can be found in Table 3 and on the CDC Web site (http://www.cdc.gov/flu/professionals/antivirals/index.htm). Children younger than 2 years are at an increased risk of hospitalization and complications attributable to influenza. The FDA recently licensed oseltamivir down to 2 weeks of age. Given its known safety profile, oseltamivir can be used to treat influenza in both term and preterm infants from birth.

Clinical judgment (on the basis of underlying conditions, disease severity, time since symptom onset, and local influenza activity) is an important factor in treatment decisions for pediatric patients who present with influenza-like illness. Antiviral treatment should be started as soon as possible after illness onset and should not be delayed while waiting for a definitive influenza test result. Currently available rapid antigen tests have low sensitivity, particularly for the pH1N1 virus strain, and should not be used to exclude influenza infection. Although negative results from rapid antigen tests should not be used to make treatment or infection-control decisions, positive results are helpful because they may reduce additional testing to identify the cause of the child's influenza-like illness. Nucleic-acid-based molecular diagnostic techniques (eg, polymerase chain reaction–based) are more widely available and have greater sensitivity than antigen tests for influenza infection.

People with suspected influenza who present with an uncomplicated febrile illness typically do not require treatment with antiviral medications unless they are at higher risk of influenza complications (eg, children with chronic medical conditions such as asthma, diabetes mellitus, hemodynamically significant

TABLE 3 Recommended Dosage and Schedule of Influenza Antiviral Medications for Treatment and Chemoprophylaxis for the 2013–2014 Influenza Season: United States

Medication	Treatment (5 d)	Chemoprophylaxis (10 d)
Oseltamivir[a]		
Adults	75 mg twice daily	75 mg once daily
Children ≥12 mo		
≤15 kg (≤33 lb)	30 mg twice daily	30 mg once daily
>15–23 kg (33–51 lb)	45 mg twice daily	45 mg once daily
>23–40 kg (>51–88 lb)	60 mg twice daily	60 mg once daily
>40 kg (>88 lb)	75 mg twice daily	75 mg once daily
Infants 9 through 11 mo[b]	3.5 mg/kg/dose twice daily	3.5 mg/kg/dose once per day
Term Infants 0 through 8 mo[b]	3 mg/kg/dose twice daily[c]	3 mg/kg/dose once daily for infants 3 through 8 mo; not recommended for infants younger than 3 mo, unless situation judged critical, because of limited safety and efficacy data in this age group
Zanamivir[d]		
Adults	10 mg (two 5-mg inhalations) twice daily	10 mg (two 5-mg inhalations) once daily
Children (≥7 y for treatment, ≥5 y for chemoprophylaxis)	10 mg (two 5-mg inhalations) twice daily	10 mg (two 5-mg inhalations) once daily

Sources: Centers for Disease Control and Prevention. Antiviral agents for the treatment and chemoprophylaxis of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2011;60(RR-1):1–24; Kimberlin DW, Acosta EP, Prichard MN, et al. National Institute of Allergy and Infectious Diseases Collaborative Antiviral Study Group. Oseltamivir pharmacokinetics, dosing, and resistance among children aged <2 y with influenza. *J Infect Dis.* 2013;207(5):709–720.

[a] Oseltamivir is administered orally without regard to meals, although administration with meals may improve gastrointestinal tolerability. Oseltamivir is available as Tamiflu in 30-mg, 45-mg, and 75-mg capsules and as a powder for oral suspension that is reconstituted to provide a final concentration of 6 mg/mL. For the 6-mg/mL suspension, a 30-mg dose is given with 5 mL of oral suspension, a 45-mg dose is given with 7.5 mL oral suspension; a 60-mg dose is given with 10 mL oral suspension, and a 75-mg dose is given with 12.5 mL oral suspension. If the commercially manufactured oral suspension is not available, a suspension can be compounded by retail pharmacies (final concentration also 6 mg/mL), based on instructions on the package label. In patients with renal insufficiency, the dose should be adjusted on the basis of creatinine clearance. For treatment of patients with creatinine clearance 10 to 30 mL/min: 75 mg once daily for 5 days. For chemoprophylaxis of patients with creatinine clearance 10 to 30 mL/min: 30 mg, once daily, for 10 days after exposure or 75 mg, once every other day, for 10 days after exposure (5 doses). See http://www.cdc.gov/flu/professionals/antivirals/antiviral-drug-resistance.htm.

[b] Approved by the FDA down to 2 weeks of age. Given its known safety profile, oseltamivir can be used to treat influenza in both term and preterm infants from birth.

[c] Oseltamivir dosing for preterm infants. The weight-based dosing recommendation for preterm infants is lower than for term infants. Preterm infants may have lower clearance of oseltamivir because of immature renal function, and doses recommended for full-term infants may lead to high drug concentrations in this age group. Limited data from the National Institute of Allergy and Infectious Diseases Collaborative Antiviral Study Group provide the basis for dosing preterm infants using their postmenstrual age (gestational age + chronological age): 1.0 mg/kg/dose, orally, twice daily, for those <38 weeks' postmenstrual age; 1.5 mg/kg/dose, orally, twice daily, for those 38 through 40 weeks' postmenstrual age; 3.0 mg/kg/dose, orally, twice daily, for those >40 weeks' postmenstrual age.

[d] Zanamivir is administered by inhalation using a proprietary "Diskhaler" device distributed together with the medication. Zanamivir is a dry powder, not an aerosol, and should not be administered using nebulizers, ventilators, or other devices typically used for administering medications in aerosolized solutions. Zanamivir is not recommended for people with chronic respiratory diseases, such as asthma or chronic obstructive pulmonary disease, which increase the risk of bronchospasm.

TABLE 4 People at Higher Risk of Influenza Complications Recommended for Antiviral Treatment of Suspected or Confirmed Influenza

Children <2 y
Adults ≥65 y
People with chronic pulmonary (including asthma), cardiovascular (except hypertension alone), renal, hepatic, hematologic (including sickle cell disease), or metabolic disorders (including diabetes mellitus) or neurologic and neurodevelopment conditions (including disorders of the brain, spinal cord, peripheral nerve, and muscle such as cerebral palsy, epilepsy [seizure disorders], stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, or spinal cord injury)
People with immunosuppression, including that caused by medications or by HIV infection
Women who are pregnant or postpartum (within 2 wk after delivery)
People <19 y who are receiving long-term aspirin therapy
American Indian/Alaska Native people
People who are morbidly obese (ie, BMI ≥40)
Residents of nursing homes and other chronic-care facilities

Source: Centers for Disease Control and Prevention. Antiviral agents for the treatment and chemoprophylaxis of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2011;60(RR-1):1–24

cardiac disease, immunosuppression, or neurologic and neurodevelopmental disorders), especially in situations with limited antiviral medication availability. Should there be a shortage of antiviral medications, local public health authorities will provide additional guidance about testing and treatment.

Randomized placebo-controlled studies showed that oseltamivir and zanamivir were efficacious when administered as chemoprophylaxis to household contacts after a family member had laboratory confirmed influenza. During the 2009 pandemic, the emergence of oseltamivir resistance was observed among people receiving postexposure prophylaxis. Decisions on whether to administer antiviral agents for chemoprophylaxis should take into account the exposed person's risk of influenza complications, vaccination status, the type and duration of contact, recommendations from local or public health authorities, and clinical judgment. Optimally, postexposure chemoprophylaxis should only be used when antiviral agents can be started within 48 hours of exposure. Early treatment of high-risk patients without waiting for laboratory confirmation is an alternative strategy.

Although immunization is the preferred approach to prevention of infection, chemoprophylaxis during an influenza outbreak, as defined by the CDC, is recommended:

- For children at high risk of complications from influenza for whom influenza vaccine is contraindicated.
- For children at high risk during the 2 weeks after influenza immunization.
- For family members or HCP who are unimmunized and are likely to have ongoing, close exposure to
  - unimmunized children at high risk; or
  - unimmunized infants and toddlers who are younger than 24 months.
- For control of influenza outbreaks for unimmunized staff and children in a closed institutional setting with children at high risk (eg, extended-care facilities).
- As a supplement to immunization among children at high risk, including children who are immunocompromised and may not respond to vaccine.
- As postexposure prophylaxis for family members and close contacts of an infected person if those people are at high risk of complications from influenza.
- For children at high risk and their family members and close contacts, as well as HCP, when circulating strains of influenza virus in the community are not matched with seasonal influenza vaccine strains, on the basis of current data from the CDC and local health departments.

These recommendations apply to routine circumstances, but it should be noted that guidance may change on the basis of updated recommendations from the CDC in concert with antiviral availability, local resources, clinical judgment, recommendations from local or public health authorities, risk of influenza complications, type and duration of exposure contact, and change in epidemiology or severity of influenza. Chemoprophylaxis is not recommended for infants younger than 3 months, unless the situation is judged critical, because of limited safety and efficacy data in this age group.

Chemoprophylaxis should not be considered a substitute for immunization.

Influenza vaccine should always be offered when not contraindicated, even when influenza virus is circulating in the community. Antiviral medications currently licensed are important adjuncts to influenza immunization for control and prevention of influenza disease, but there are toxicities associated with antiviral agents, and indiscriminate use might limit availability. Pediatricians should inform recipients of antiviral chemoprophylaxis that risk of influenza is lowered but remains while taking the medication, and susceptibility to influenza returns when medication is discontinued. For recommendations about treatment and chemoprophylaxis against influenza, see Table 3. Updates will be available at www.aapredbook.org/flu and http://www.cdc.gov/flu/professionals/antivirals/index.htm.

FUTURE NEEDS

Currently, within the approved indications and recommendations, no preferential recommendation is made for any type or brand of influenza vaccine over another. This is partly because the supply of newer vaccines may be limited during the 2013–2014 season. Moreover, postmarketing safety and vaccine effectiveness data are not yet available, prohibiting a full risk-benefit analysis of newer versus previously available products. However, such analyses will be performed as the data become available and, in the future, specific vaccines may be preferentially recommended for particular groups.

A large body of evidence indicates that even children with severe (anaphylactic) allergic reactions to the ingestion of eggs tolerate IIV in a single, age-appropriate dose. Examination of Vaccine Adverse Event Reporting System data after new Advisory Committee on Immunization Practices guidelines recommending influenza vaccine for egg-allergic recipients indicated no disproportionate reporting of allergy or anaphylaxis. Studies are also underway examining the safety of LAIV in egg-allergic recipients. If, as expected, additional safety monitoring continues to show no increased risk for anaphylactic reactions in egg-allergic recipients of influenza vaccine, special precautions regarding allergy referral and waiting periods after administration to egg-allergic recipients beyond those recommended for any vaccine may no longer be recommended.

Efforts should be made to create adequate outreach and infrastructure to ensure an optimal distribution of vaccine so that more people are immunized. Pediatricians should also become more involved in pandemic preparedness or disaster planning efforts. A bidirectional partner dialogue between pediatricians and public health decision makers ensures that children's issues are addressed during the initial state, regional, and local plan development stages. Further information concerning disaster preparedness can be found at www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/children-and-disasters/Pages/Pediatric-Preparedness-Resource-Kit.aspx.

Health care for children should be provided in the child's medical home. However, medical homes may have limited capacity to accommodate all patients (and their families) seeking influenza immunization. Because of the increased demand for immunization during each influenza season, the AAP and the CDC recommend vaccine administration at any visit to the medical home during influenza season when it is not contraindicated, at specially arranged "vaccine-only" sessions, and through cooperation with community sites, schools, and child care centers to provide influenza vaccine. If alternate venues are used, including pharmacies and other retail-based clinics, a system of patient record transfer is beneficial to ensuring maintenance of accurate immunization records. Immunization information systems should be used whenever available. The use of 2-dimensional barcodes may help facilitate more efficient and accurate documentation of vaccine administration. Multiple barriers appear to have an impact on influenza vaccination coverage for children in foster care, refugee and immigrant children, and homeless children. Access to care issues, lack of immunization records, and questions regarding who can provide consent may be addressed by linking children with a medical home, using all health care encounters as vaccination opportunities, and more consistently using immunization registry data.

Cost-effectiveness and logistic feasibility of vaccinating everyone continue to be concerns. With universal immunization, particular attention is being paid to vaccine supply, distribution, implementation, and financing. Potential benefits of more widespread childhood immunization among recipients, their contacts, and the community include fewer influenza cases, fewer outpatient visits and hospitalizations for influenza infection, and a decrease in the use of antimicrobial agents, absenteeism from school, and lost parent work time. To optimally administer antiviral therapy in hospitalized patients with influenza who cannot tolerate oral or inhaled antiviral agents, FDA-approved intravenous neuraminidase inhibitors for children also are needed.

Continued evaluation of the safety, immunogenicity, and effectiveness of influenza vaccine, especially for children younger than 2 years, is important. The potential role of previous influenza vaccination on overall vaccine effectiveness by virus strain and subject age in preventing outpatient medical visits, hospitalizations, and deaths continues to be explored. There is also a need for more systematic health services research on influenza vaccine uptake and refusal as well as identification of methods to enhance uptake. In addition, development of a safe, immunogenic vaccine for infants younger than 6 months is essential. Until such a vaccine is available for infants younger than 6 months, vaccination of their mothers while pregnant is the best way to protect them. Breastfeeding is also recommended to protect against influenza viruses by activating innate antiviral mechanisms, specifically type 1 interferons, in the host. Mandatory annual influenza immunization of all HCP has been implemented successfully at an increasing number of pediatric institutions. Future efforts should include broader implementation of mandatory immunization programs. Optimal prevention of influenza in the health care setting depends on the vaccination of at least 90% of HCP.

Additional studies are needed to investigate the extent of offering to immunize parents and adult child care providers in the pediatric office setting; the level of family contact satisfaction with this practice; how practices handle the logistic, liability, legal, and financial barriers that limit or complicate this service; and, most important, how this practice will affect disease rates in children and adults. In addition, adjuvants have been shown to enhance immune responses to influenza vaccines, but certain adjuvants have been associated with the development of narcolepsy in some studies. Additional studies on the effectiveness and safety of influenza vaccines containing adjuvants are needed. Finally, as mentioned earlier, efforts to improve the vaccine-development process to allow for a shorter interval between identification of vaccine strains and vaccine production continue.

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Recommended Childhood and Adolescent Immunization Schedule—United States, 2014

- *Policy Statement*

POLICY STATEMENT

Recommended Childhood and Adolescent Immunization Schedule—United States, 2014

COMMITTEE ON INFECTIOUS DISEASES

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FREE

The 2014 recommended childhood and adolescent immunization schedules have been approved by the American Academy of Pediatrics, the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention, the American Academy of Family Physicians, and the American College of Obstetricians and Gynecologists. The 2014 format is similar to last year and includes a single schedule for persons 0 through 18 years of age (Fig 1). The yellow bars indicate the recommended age range for all children and contain a notation indicating the recommended dose number by age. The green bars indicate the recommended catch-up age. The purple bars designate the range for immunization for certain groups at high risk. The combined green and purple bar indicates the recommended age when hepatitis A vaccine catch-up is recommended. The white boxes show the ages when a vaccine is not recommended routinely. The catch-up schedule offers recommendations for children and adolescents who start late or are >1 month behind (Fig 2).

Footnotes contain recommendations for routine vaccination, for catch-up vaccination, and for vaccination of children and adolescents with high-risk conditions or in special circumstances. Numerous changes have been made to improve the clarity and readability of the footnotes. A parent-friendly vaccine schedule for children and adolescents is available at http://www.cdc.gov/vaccines/schedules/index.html. An adult immunization schedule also is published in February of each year and is available at www.cdc.gov/vaccines. These schedules are revised annually to reflect current recommendations for the use of vaccines licensed by the US Food and Drug Administration and include the following specific changes from last year:

- Both generic names and trade names are referenced in the title of each vaccine footnote; thereafter, only the trade name is used, as in the rotavirus footnote.
- The Tdap footnote includes information on vaccination of persons 7 years and older with a single lifetime dose of Tdap, except for pregnant adolescents, who should be vaccinated with each pregnancy. For pregnant adolescents, administration is preferred during week 27 through week 36 of gestation, regardless of time since previous Td or Tdap.
- The *Haemophilus influenzae* type b footnote clarifies vaccination of children 12 through 59 months of age who are at increased risk because of incomplete vaccination, asplenia, HIV infection, receipt of hematopoietic stem cell transplant, or receipt of chemotherapy or radiation treatment.

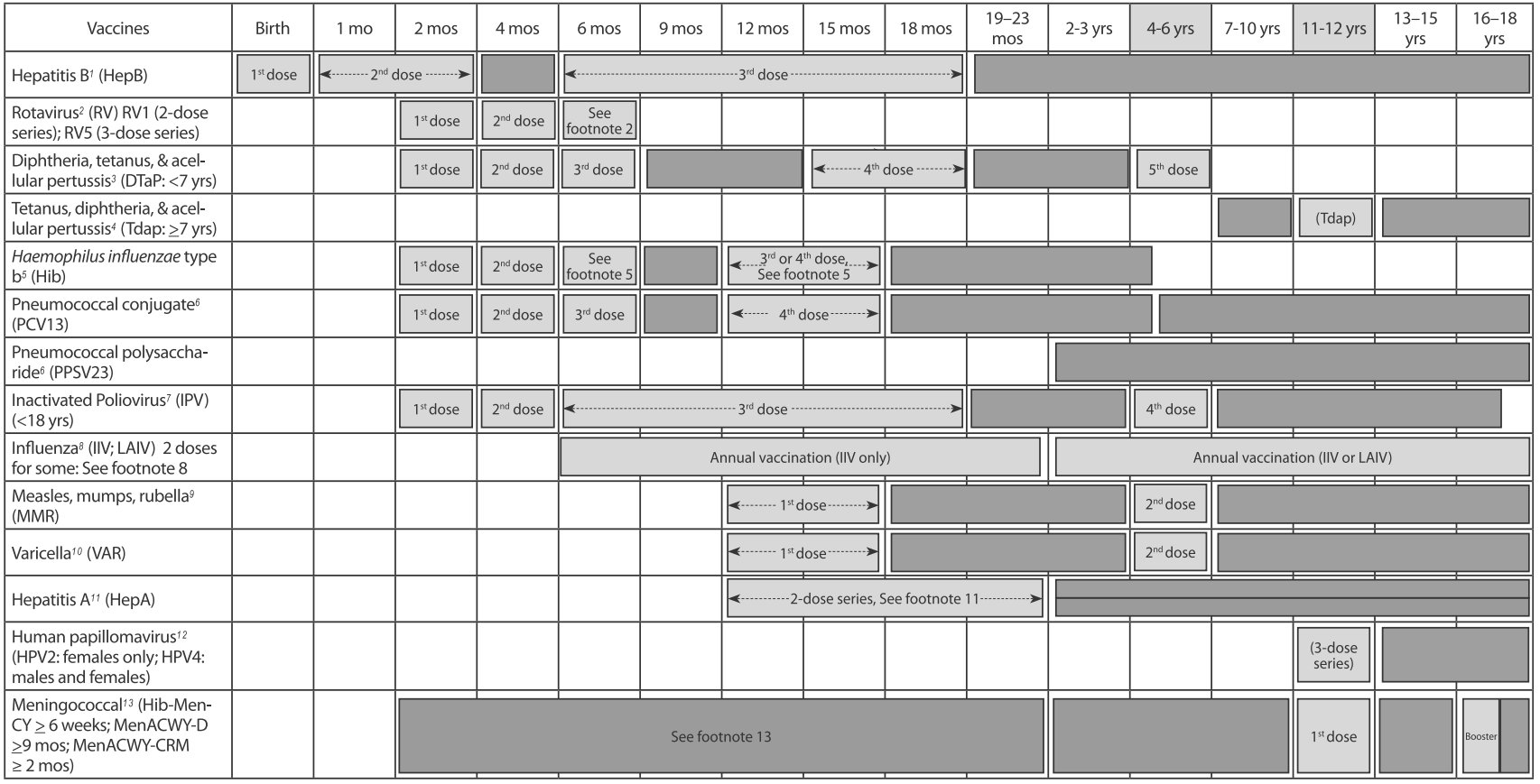
- The pneumococcal vaccine footnote itemizes recommendations for PCV13 and PPSV23 use in children and adolescents at increased risk on the basis of age and degree of risk.
- The influenza vaccine footnote describes vaccine dosing for children 6 months through 8 years of age and for those 9 years of age and older for the 2013–2014 season.
- The hepatitis A vaccine footnote includes the list of persons at increased risk of hepatitis A disease.
- The HPV footnote clarifies the intervals between vaccine doses.
- The meningococcal footnote includes guidance for use of Menveo (Novartis, Cambridge, MA) starting at 2 months of age for certain persons at increased risk. Clarification is added regarding immunization of children with sickle cell disease or persistent complement component deficiency, travelers to areas where meningococcal disease is hyperendemic/epidemic, and children at risk during a community outbreak. Catch-up recommendations for persons at high risk are addressed.

Clinically significant adverse events that follow immunization should be reported to the Vaccine Adverse Event Reporting System (VAERS). Guidance about how to obtain and complete a VAERS form can be obtained at www.vaers.hhs.gov or by calling 800-822-7967. Additional information can be found in the *Red Book* and at *Red Book* Online (http://aapredbook.aappublications.org/). Statements from the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention that contain details of recommendations for individual vaccines, including recommendations for children with high-risk conditions, are available at www.cdc.gov/vaccines/pubs/ACIP-list.htm. Information on new vaccine releases, vaccine supplies, and interim recommendations resulting from vaccine shortages and statements on specific vaccines can be found at www.aapredbook.org/news/vaccstatus.shtml and www.cdc.gov/vaccines/pubs/ACIP-list.htm.

FIGURE 1

Recommended immunization schedule for persons aged 0 through 18 years—2014. (For those who fall behind or start late, see the catch-up schedule [Fig 2].)

These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are in bold.



This schedule includes recommendations in effect as of January 1, 2014. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement for detailed recommendations, available online at http://www.cdc.gov/vaccines/hcp/acip-recs/index.html. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://www.vaers.hhs.gov) or by telephone (800-822-7967).Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including precautions and contraindications for vaccination, is available from CDC online (http://www.cdc.gov/vaccines) or by telephone (800-CDC-INFO [800-232-4636]).

This schedule is approved by the Advisory Committee on Immunization Practices (http//www.cdc.gov/vaccines/acip), the American Academy of Pediatrics (http://www.aap.org), the American Academy of Family Physicians (http://www.aafp.org), and the American College of Obstetricians and Gynecologists (http://www.acog.org).

NOTE: The above recommendations must be read along with the footnotes of this schedule.

FIGURE 2

Catch-up immunization schedule for persons aged 4 months through 18 years who start late or who are >1 month behind—United States, 2014.

The figure below provides catch-up schedules and minimum intervals between doses for children whose vaccinations have been delayed. A vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Use the section appropriate for the child's age. Always use this table in conjunction with Figure 1 and the footnotes that follow.

Persons aged 4 months through 6 years					
Vaccine	Minimum Age for Dose 1	Minimum Interval Between Doses			
		Dose 1 to dose 2	Dose 2 to dose 3	Dose 3 to dose 4	Dose 4 to dose 5
Hepatitis B[1]	Birth	4 weeks	8 weeks and at least 16 weeks after first dose; minimum age for the final dose is 24 weeks		
Rotavirus[2]	6 weeks	4 weeks	4 weeks		
Diphtheria, tetanus, & acellular pertussis [3]	6 weeks	4 weeks	4 weeks	6 months	6 months[3]
Haemophilus influenzae type b[5]	6 weeks	4 weeks if first dose administered at younger than age 12 months 8 weeks (as final dose) if first dose administered at age 12 through 14 months No further doses needed if first dose administered at age 15 months or older	4 weeks[5] if current age is younger than 12 months and first dose administered at < 7 months old 8 weeks and age 12 months through 59 months (as final dose)[5] if current age is younger than 12 months and first dose administered between 7 through 11 months (regardless of Hib vaccine [PRP-T or PRP-OMP] used for first dose); OR if current age is 12 through 59 months and first dose administered at younger than age 12 months; OR first 2 doses were PRP-OMP and administered at younger than 12 months. No further doses needed if previous dose administered at age 15 months or older	8 weeks (as final dose) This dose only necessary for children aged 12 through 59 months who received 3 (PRP-T) doses before age 12 months and started the primary series before age 7 months	
Pneumococcal[6]	6 weeks	4 weeks if first dose administered at younger than age 12 months 8 weeks (as final dose for healthy children) if first dose administered at age 12 months or older No further doses needed for healthy children if first dose administered at age 24 months or older	4 weeks if current age is younger than 12 months 8 weeks (as final dose for healthy children) if current age is 12 months or older No further doses needed for healthy children if previous dose administered at age 24 months or older	8 weeks (as final dose) This dose only necessary for children aged 12 through 59 months who received 3 doses before age 12 months or for children at high risk who received 3 doses at any age	
Inactivated poliovirus[7]	6 weeks	4 weeks[7]	4 weeks[7]	6 months[7] minimum age 4 years for final dose	
Meningococcal[13]	6 weeks	8 weeks[13]	See footnote 13	See footnote 13	
Measles, mumps, rubella[9]	12 months	4 weeks			
Varicella[10]	12 months	3 months			
Hepatitis A[11]	12 months	6 months			
Persons aged 7 through 18 years					
Tetanus, diphtheria; tetanus, diphtheria, & acellular pertussis[4]	7 years[4]	4 weeks	4 weeks if first dose of DTaP/DT administered at younger than age 12 months 6 months if first dose of DTaP/DT administered at age 12 months or older and then no further doses needed for catch-up	6 months if first dose of DTaP/DT administered at younger than age 12 months	
Human papillomavirus[12]	9 years	Routine dosing intervals are recommended[12]			
Hepatitis A[11]	12 months	6 months			
Hepatitis B[1]	Birth	4 weeks	8 weeks (and at least 16 weeks after first dose)		
Inactivated poliovirus[7]	6 weeks	4 weeks	4 weeks[7]	6 months[7]	
Meningococcal[13]	6 weeks	8 weeks[13]			
Measles, mumps, rubella[9]	12 months	4 weeks			
Varicella[10]	12 months	3 months if person is younger than age 13 years 4 weeks if person is aged 13 years or older			

NOTE: The above recommendations must be read along with the footnotes of this schedule.

Footnotes — Recommended immunization schedule for persons aged 0 through 18 years—United States, 2014

For further guidance on the use of the vaccines mentioned below, see: http://www.cdc.gov/vaccines/hcp/acip-recs/index.html.
For vaccine recommendations for persons 19 years of age and older, see the adult immunization schedule.

Additional information

- For contraindications and precautions to use of a vaccine and for additional information regarding that vaccine, vaccination providers should consult the relevant ACIP statement available online at http://www.cdc.gov/vaccines/hcp/acip-recs/index.html.
- For purposes of calculating intervals between doses, 4 weeks = 28 days. Intervals of 4 months or greater are determined by calendar months.
- Vaccine doses administered 4 days or less before the minimum interval are considered valid. Doses of any vaccine administered ≥5 days earlier than the minimum interval or minimum age should not be counted as valid doses and should be repeated as age-appropriate. The repeat dose should be spaced after the invalid dose by the recommended minimum interval. For further details, see *MMWR, General Recommendations on Immunization and Reports* / Vol. 60 / No. 2; Table 2. *Recommended and minimum ages and intervals between vaccine doses* available online at http://www.cdc.gov/mmwr/pdf/rr/rr6002.pdf.
- Information on travel vaccine requirements and recommendations is available at http://wwwnc.cdc.gov/travel/page/vaccinations.htm.
- For vaccination of persons with primary and secondary immunodeficiencies, see Table 13, "*Vaccination of persons with primary and secondary immunodeficiencies*," in General Recommendations on Immunization (ACIP), available at http://www.cdc.gov/mmwr/pdf/rr/rr6002.pdf.; and American Academy of Pediatrics. Immunization in Special Clinical Circumstances, in Pickering LK, Baker CJ, Kimberlin DW, Long SS eds. *Red Book: 2012 report of the Committee on Infectious Diseases. 29th ed.* Elk Grove Village, IL: American Academy of Pediatrics.

1. Hepatitis B (HepB) vaccine. (Minimum age: birth)

Routine vaccination:

At birth

- Administer monovalent HepB vaccine to all newborns before hospital discharge.
- For infants born to hepatitis B surface antigen (HBsAg)-positive mothers, administer HepB vaccine and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth. These infants should be tested for HBsAg and antibody to HBsAg (anti-HBs) 1 to 2 months after completion of the HepB series, at age 9 through 18 months (preferably at the next well-child visit).
- If mother's HBsAg status is unknown, within 12 hours of birth administer HepB vaccine regardless of birth weight. For infants weighing less than 2,000 grams, administer HBIG in addition to HepB vaccine within 12 hours of birth. Determine mother's HBsAg status as soon as possible and, if mother is HBsAg-positive, also administer HBIG for infants weighing 2,000 grams or more as soon as possible, but no later than age 7 days.

Doses following the birth dose

- The second dose should be administered at age 1 or 2 months. Monovalent HepB vaccine should be used for doses administered before age 6 weeks.
- Infants who did not receive a birth dose should receive 3 doses of a HepB-containing vaccine on a schedule of 0, 1 to 2 months, and 6 months starting as soon as feasible. See Figure 2.
- Administer the second dose 1 to 2 months after the first dose (minimum interval of 4 weeks), administer the third dose at least 8 weeks after the second dose AND at least 16 weeks after the **first** dose. The final (third or fourth) dose in the HepB vaccine series should be administered no earlier than age 24 weeks.
- Administration of a total of 4 doses of HepB vaccine is permitted when a combination vaccine containing HepB is administered after the birth dose.

Catch-up vaccination:

- Unvaccinated persons should complete a 3-dose series.
- A 2-dose series (doses separated by at least 4 months) of adult formulation Recombivax HB is licensed for use in children aged 11 through 15 years.
- For other catch-up guidance, see Figure 2.

2. Rotavirus (RV) vaccines. (Minimum age: 6 weeks for both RV1 [Rotarix] and RV5 [RotaTeq])

Routine vaccination:

Administer a series of RV vaccine to all infants as follows:

1. If Rotarix is used, administer a 2-dose series at 2 and 4 months of age.
2. If RotaTeq is used, administer a 3-dose series at ages 2, 4, and 6 months.
3. If any dose in the series was RotaTeq or vaccine product is unknown for any dose in the series, a total of 3 doses of RV vaccine should be administered.

Catch-up vaccination:

- The maximum age for the first dose in the series is 14 weeks, 6 days; vaccination should not be initiated for infants aged 15 weeks, 0 days or older.
- The maximum age for the final dose in the series is 8 months, 0 days.
- For other catch-up guidance, see Figure 2.

3. Diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine. (Minimum age: 6 weeks. Exception: DTaP-IPV [Kinrix]: 4 years)

Routine vaccination:

- Administer a 5-dose series of DTaP vaccine at ages 2, 4, 6, 15 through 18 months, and 4 through 6 years. The fourth dose may be administered as early as age 12 months, provided at least 6 months have elapsed since the third dose.

Catch-up vaccination:

- The fifth dose of DTaP vaccine is not necessary if the fourth dose was administered at age 4 years or older.
- For other catch-up guidance, see Figure 2.

4. Tetanus and diphtheria toxoids and acellular pertussis (Tdap) vaccine. (Minimum age: 10 years for Boostrix, 11 years for Adacel)

Routine vaccination:

- Administer 1 dose of Tdap vaccine to all adolescents aged 11 through 12 years.
- Tdap may be administered regardless of the interval since the last tetanus and diphtheria toxoid-containing vaccine.
- Administer 1 dose of Tdap vaccine to pregnant adolescents during each pregnancy (preferred during 27 through 36 weeks gestation) regardless of time since prior Td or Tdap vaccination.

Catch-up vaccination:

- Persons aged 7 years and older who are not fully immunized with DTaP vaccine should receive Tdap vaccine as 1 (preferably the first) dose in the catch-up series; if additional doses are needed, use Td vaccine. For children 7 through 10 years who receive a dose of Tdap as part of the catch-up series, an adolescent Tdap vaccine dose at age 11 through 12 years should NOT be administered. Td should be administered instead 10 years after the Tdap dose.
- Persons aged 11 through 18 years who have not received Tdap vaccine should receive a dose followed by tetanus and diphtheria toxoids (Td) booster doses every 10 years thereafter.
- Inadvertent doses of DTaP vaccine:
  - If administered inadvertently to a child aged 7 through 10 years may count as part of the catch-up series. This dose may count as the adolescent Tdap dose, or the child can later receive a Tdap booster dose at age 11 through 12 years.
  - If administered inadvertently to an adolescent aged 11 through 18 years, the dose should be counted as the adolescent Tdap booster.
- For other catch-up guidance, see Figure 2.

5. *Haemophilus influenzae* type b (Hib) conjugate vaccine. (Minimum age: 6 weeks for PRP-T [ACTHIB, DTaP-IPV/Hib (Pentacel) and Hib-MenCY (MenHibrix)], PRP-OMP [PedvaxHIB or COMVAX], 12 months for PRP-T [Hiberix])

Routine vaccination:

- Administer a 2- or 3-dose Hib vaccine primary series and a booster dose (dose 3 or 4 depending on vaccine used in primary series) at age 12 through 15 months to complete a full Hib vaccine series.
- The primary series with ActHIB, MenHibrix, or Pentacel consists of 3 doses and should be administered at 2, 4, and 6 months of age. The primary series with PedvaxHib or COMVAX consists of 2 doses and should be administered at 2 and 4 months of age; a dose at age 6 months is not indicated.
- One booster dose (dose 3 or 4 depending on vaccine used in primary series) of any Hib vaccine should be administered at age 12 through 15 months. An exception is Hiberix vaccine. Hiberix should only be used for the booster (final) dose in children aged 12 months through 4 years who have received at least 1 prior dose of Hib-containing vaccine.

For further guidance on the use of the vaccines mentioned below, see: http://www.cdc.gov/vaccines/hcp/acip-recs/index.html.

5. ***Haemophilus influenzae* type b (Hib) conjugate vaccine (cont'd)**
   - For recommendations on the use of MenHibrix in patients at increased risk for meningococcal disease, please refer to the meningococcal vaccine footnotes and also to *MMWR* March 22, 2013 / 62(RR02); 1-22, available at http://www.cdc.gov/mmwr/pdf/rr/rr6202.pdf.

   Catch-up vaccination:
   - If dose 1 was administered at ages 12 through 14 months, administer a second (final) dose at least 8 weeks after dose 1, regardless of Hib vaccine used in the primary series.
   - If the first 2 doses were PRP-OMP (PedvaxHIB or COMVAX), and were administered at age 11 months or younger, the third (and final) dose should be administered at age 12 through 15 months and at least 8 weeks after the second dose.
   - If the first dose was administered at age 7 through 11 months, administer the second dose at least 4 weeks later and a third (and final) dose at age 12 through 15 months or 8 weeks after second dose, whichever is later, regardless of Hib vaccine used for first dose.
   - If first dose is administered at younger than 12 months of age and second dose is given between 12 through 14 months of age, a third (and final) dose should be given 8 weeks later.
   - For unvaccinated children aged 15 months or older, administer only 1 dose.
   - For other catch-up guidance, see Figure 2. For catch-up guidance related to MenHibrix, please see the meningococcal vaccine footnotes and also *MMWR* March 22, 2013 / 62(RR02); 1-22, available at http://www.cdc.gov/mmwr/pdf/rr/rr6202.pdf.

   Vaccination of persons with high-risk conditions:
   - Children aged 12 through 59 months who are at increased risk for Hib disease, including chemotherapy recipients and those with anatomic or functional asplenia (including sickle cell disease), human immunodeficiency virus (HIV) infection, immunoglobulin deficiency, or early component complement deficiency, who have received either no doses or only 1 dose of Hib vaccine before 12 months of age, should receive 2 additional doses of Hib vaccine 8 weeks apart; children who received 2 or more doses of Hib vaccine before 12 months of age should receive 1 additional dose.
   - For patients younger than 5 years of age undergoing chemotherapy or radiation treatment who received a Hib vaccine dose(s) within 14 days of starting therapy or during therapy, repeat the dose(s) at least 3 months following therapy completion.
   - Recipients of hematopoietic stem cell transplant (HSCT) should be revaccinated with a 3-dose regimen of Hib vaccine starting 6 to 12 months after successful transplant, regardless of vaccination history; doses should be administered at least 4 weeks apart.
   - A single dose of any Hib-containing vaccine should be administered to unimmunized* children and adolescents 15 months of age and older undergoing an elective splenectomy; if possible, vaccine should be administered at least 14 days before procedure.
   - Hib vaccine is not routinely recommended for patients 5 years or older. However, 1 dose of Hib vaccine should be administered to unimmunized* persons aged 5 years or older who have anatomic or functional asplenia (including sickle cell disease) and unvaccinated persons 5 through 18 years of age with human immunodeficiency virus (HIV) infection.

   ** Patients who have not received a primary series and booster dose or at least 1 dose of Hib vaccine after 14 months of age are considered unimmunized.*

6. **Pneumococcal vaccines. (Minimum age: 6 weeks for PCV13, 2 years for PPSV23)**

   Routine vaccination with PCV13:
   - Administer a 4-dose series of PCV13 vaccine at ages 2, 4, and 6 months and at age 12 through 15 months.
   - For children aged 14 through 59 months who have received an age-appropriate series of 7-valent PCV (PCV7), administer a single supplemental dose of 13-valent PCV (PCV13).

   Catch-up vaccination with PCV13:
   - Administer 1 dose of PCV13 to all healthy children aged 24 through 59 months who are not completely vaccinated for their age.
   - For other catch-up guidance, see Figure 2.

   Vaccination of persons with high-risk conditions with PCV13 and PPSV23:
   - All recommended PCV13 doses should be administered prior to PPSV23 vaccination if possible.
   - For children 2 through 5 years of age with any of the following conditions: chronic heart disease (particularly cyanotic congenital heart disease and cardiac failure); chronic lung disease (including asthma if treated with high-dose oral corticosteroid therapy); diabetes mellitus; cerebrospinal fluid leak; cochlear implant; sickle cell disease and other hemoglobinopathies; anatomic or functional asplenia; HIV infection; chronic renal failure; nephrotic syndrome; diseases associated with treatment with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; solid organ transplantation; or congenital immunodeficiency:
     1. Administer 1 dose of PCV13 if 3 doses of PCV (PCV7 and/or PCV13) were received previously.
     2. Administer 2 doses of PCV13 at least 8 weeks apart if fewer than 3 doses of PCV (PCV7 and/or PCV13) were received previously.
     3. Administer 1 supplemental dose of PCV13 if 4 doses of PCV7 or other age-appropriate complete PCV7 series was received previously.
     4. The minimum interval between doses of PCV (PCV7 or PCV13) is 8 weeks.
     5. For children with no history of PPSV23 vaccination, administer PPSV23 at least 8 weeks after the most recent dose of PCV13.
   - For children aged 6 through 18 years who have cerebrospinal fluid leak; cochlear implant; sickle cell disease and other hemoglobinopathies; anatomic or functional asplenia; congenital or acquired immunodeficiencies; HIV infection; chronic renal failure; nephrotic syndrome; diseases associated with treatment with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; generalized malignancy; solid organ transplantation; or multiple myeloma:
     1. If neither PCV13 nor PPSV23 has been received previously, administer 1 dose of PCV13 now and 1 dose of PPSV23 at least 8 weeks later.
     2. If PCV13 has been received previously but PPSV23 has not, administer 1 dose of PPSV23 at least 8 weeks after the most recent dose of PCV13.
     3. If PPSV23 has been received but PCV13 has not, administer 1 dose of PCV13 at least 8 weeks after the most recent dose of PPSV23.
   - For children aged 6 through 18 years with chronic heart disease (particularly cyanotic congenital heart disease and cardiac failure), chronic lung disease (including asthma if treated with high-dose oral corticosteroid therapy), diabetes mellitus, alcoholism, or chronic liver disease, who have not received PPSV23, administer 1 dose of PPSV23. If PCV13 has been received previously, then PPSV23 should be administered at least 8 weeks after any prior PCV13 dose.
   - A single revaccination with PPSV23 should be administered 5 years after the first dose to children with sickle cell disease or other hemoglobinopathies; anatomic or functional asplenia; congenital or acquired immunodeficiencies; HIV infection; chronic renal failure; nephrotic syndrome; diseases associated with treatment with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; generalized malignancy; solid organ transplantation; or multiple myeloma.

7. **Inactivated poliovirus vaccine (IPV). (Minimum age: 6 weeks)**

   Routine vaccination:
   - Administer a 4-dose series of IPV at ages 2, 4, 6 through 18 months, and 4 through 6 years. The final dose in the series should be administered on or after the fourth birthday and at least 6 months after the previous dose.

   Catch-up vaccination:
   - In the first 6 months of life, minimum age and minimum intervals are only recommended if the person is at risk for imminent exposure to circulating poliovirus (i.e., travel to a polio-endemic region or during an outbreak).
   - If 4 or more doses are administered before age 4 years, an additional dose should be administered at age 4 through 6 years and at least 6 months after the previous dose.
   - A fourth dose is not necessary if the third dose was administered at age 4 years or older and at least 6 months after the previous dose.
   - If both OPV and IPV were administered as part of a series, a total of 4 doses should be administered, regardless of the child's current age. IPV is not routinely recommended for U.S. residents aged 18 years or older.
   - For other catch-up guidance, see Figure 2.

8. **Influenza vaccines. (Minimum age: 6 months for inactivated influenza vaccine [IIV], 2 years for live, attenuated influenza vaccine [LAIV])**

   Routine vaccination:
   - Administer influenza vaccine annually to all children beginning at age 6 months. For most healthy, nonpregnant persons aged 2 through 49 years, either LAIV or IIV may be used. However, LAIV should NOT be administered to some persons, including 1) those with asthma, 2) children 2 through 4 years who had wheezing in the past 12 months, or 3) those who have any other underlying medical conditions that predispose them to influenza complications. For all other contraindications to use of LAIV, see *MMWR* 2013; 62 (No. RR-7):1-43, available at http://www.cdc.gov/mmwr/pdf/rr/rr6207.pdf.

   For children aged 6 months through 8 years:
   - For the 2013–14 season, administer 2 doses (separated by at least 4 weeks) to children who are receiving influenza vaccine for the first time. Some children in this age group who have been vaccinated previously will also need 2 doses. For additional guidance, follow dosing guidelines in the 2013-14 ACIP influenza vaccine recommendations, *MMWR* 2013; 62 (No. RR-7):1-43, available at http://www.cdc.gov/mmwr/pdf/rr/rr6207.pdf.
   - For the 2014–15 season, follow dosing guidelines in the 2014 ACIP influenza vaccine recommendations.

   For persons aged 9 years and older:
   - Administer 1 dose.

For further guidance on the use of the vaccines mentioned below, see: http://www.cdc.gov/vaccines/hcp/acip-recs/index.html.

9. Measles, mumps, and rubella (MMR) vaccine. (Minimum age: 12 months for routine vaccination)

Routine vaccination:

- Administer a 2-dose series of MMR vaccine at ages12 through 15 months and 4 through 6 years. The second dose may be administered before age 4 years, provided at least 4 weeks have elapsed since the first dose.
- Administer 1 dose of MMR vaccine to infants aged 6 through 11 months before departure from the United States for international travel. These children should be revaccinated with 2 doses of MMR vaccine, the first at age 12 through 15 months (12 months if the child remains in an area where disease risk is high), and the second dose at least 4 weeks later.
- Administer 2 doses of MMR vaccine to children aged 12 months and older before departure from the United States for international travel. The first dose should be administered on or after age 12 months and the second dose at least 4 weeks later.

Catch-up vaccination:

- Ensure that all school-aged children and adolescents have had 2 doses of MMR vaccine; the minimum interval between the 2 doses is 4 weeks.

10. Varicella (VAR) vaccine. (Minimum age: 12 months)

Routine vaccination:

- Administer a 2-dose series of VAR vaccine at ages 12 through 15 months and 4 through 6 years. The second dose may be administered before age 4 years, provided at least 3 months have elapsed since the first dose. If the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid.

Catch-up vaccination:

- Ensure that all persons aged 7 through 18 years without evidence of immunity (see *MMWR* 2007; 56 [No. RR-4], available at http://www.cdc.gov/mmwr/pdf/rr/rr5604.pdf) have 2 doses of varicella vaccine. For children aged 7 through 12 years, the recommended minimum interval between doses is 3 months (if the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid); for persons aged 13 years and older, the minimum interval between doses is 4 weeks.

11. Hepatitis A (HepA) vaccine. (Minimum age: 12 months)

Routine vaccination:

- Initiate the 2-dose HepA vaccine series at 12 through 23 months; separate the 2 doses by 6 to 18 months.
- Children who have received 1 dose of HepA vaccine before age 24 months should receive a second dose 6 to 18 months after the first dose.
- For any person aged 2 years and older who has not already received the HepA vaccine series, 2 doses of HepA vaccine separated by 6 to 18 months may be administered if immunity against hepatitis A virus infection is desired.

Catch-up vaccination:

- The minimum interval between the two doses is 6 months.

Special populations:

- Administer 2 doses of HepA vaccine at least 6 months apart to previously unvaccinated persons who live in areas where vaccination programs target older children, or who are at increased risk for infection. This includes persons traveling to or working in countries that have high or intermediate endemicity of infection; men having sex with men; users of injection and non-injection illicit drugs; persons who work with HAV-infected primates or with HAV in a research laboratory; persons with clotting-factor disorders; persons with chronic liver disease; and persons who anticipate close, personal contact (e.g., household or regular babysitting) with an international adoptee during the first 60 days after arrival in the United States from a country with high or intermediate endemicity. The first dose should be administered as soon as the adoption is planned, ideally 2 or more weeks before the arrival of the adoptee.

12. Human papillomavirus (HPV) vaccines. (Minimum age: 9 years for HPV2 [Cervarix] and HPV4 [Gardisil])

Routine vaccination:

- Administer a 3-dose series of HPV vaccine on a schedule of 0, 1-2, and 6 months to all adolescents aged 11 through 12 years. Either HPV4 or HPV2 may be used for females, and only HPV4 may be used for males.
- The vaccine series may be started at age 9 years.
- Administer the second dose 1 to 2 months after the first dose (minimum interval of 4 weeks), administer the third dose 24 weeks after the first dose and 16 weeks after the second dose (minimum interval of 12 weeks).

Catch-up vaccination:

- Administer the vaccine series to females (either HPV2 or HPV4) and males (HPV4) at age 13 through 18 years if not previously vaccinated.
- Use recommended routine dosing intervals (see above) for vaccine series catch-up.

13. Meningococcal conjugate vaccines. (Minimum age: 6 weeks for Hib-MenCY [MenHibrix], 9 months for MenACWY-D [Menactra], 2 months for MenACWY-CRM [Menveo])

Routine vaccination:

- Administer a single dose of Menactra or Menveo vaccine at age 11 through 12 years, with a booster dose at age 16 years.
- Adolescents aged 11 through 18 years with human immunodeficiency virus (HIV) infection should receive a 2-dose primary series of Menactra or Menveo with at least 8 weeks between doses.
- For children aged 2 months through 18 years with high-risk conditions, see below.

Catch-up vaccination:

- Administer Menactra or Menveo vaccine at age 13 through 18 years if not previously vaccinated.
- If the first dose is administered at age 13 through 15 years, a booster dose should be administered at age 16 through 18 years with a minimum interval of at least 8 weeks between doses.
- If the first dose is administered at age 16 years or older, a booster dose is not needed.
- For other catch-up guidance, see Figure 2.

Vaccination of persons with high-risk conditions and other persons at increased risk of disease:

- Children with anatomic or functional asplenia (including sickle cell disease):
  1. For children younger than 19 months of age, administer a 4-dose infant series of MenHibrix or Menveo at 2, 4, 6, and 12 through 15 months of age.
  2. For children aged 19 through 23 months who have not completed a series of MenHibrix or Menveo, administer 2 primary doses of Menveo at least 3 months apart.
  3. For children aged 24 months and older who have not received a complete series of MenHibrix or Menveo or Menactra, administer 2 primary doses of either Menactra or Menveo at least 2 months apart. If Menactra is administered to a child with asplenia (including sickle cell disease), do not administer Menactra until 2 years of age and at least 4 weeks after the completion of all PCV13 doses.
- Children with persistent complement component deficiency:
  1. For children younger than 19 months of age, administer a 4-dose infant series of either MenHibrix or Menveo at 2, 4, 6, and 12 through 15 months of age.
  2. For children 7 through 23 months who have not initiated vaccination, two options exist depending on age and vaccine brand:
     a. For children who initiate vaccination with Menveo at 7 months through 23 months of age, a 2-dose series should be administered with the second dose after 12 months of age and at least 3 months after the first dose.
     b. For children who initiate vaccination with Menactra at 9 months through 23 months of age, a 2-dose series of Menactra should be administered at least 3 months apart.
     c. For children aged 24 months and older who have not received a complete series of MenHibrix, Menveo, or Menactra, administer 2 primary doses of either Menactra or Menveo at least 2 months apart.
- For children who travel to or reside in countries in which meningococcal disease is hyperendemic or epidemic, including countries in the African meningitis belt or the Hajj, administer an age-appropriate formulation and series of Menactra or Menveo for protection against serogroups A and W meningococcal disease. Prior receipt of MenHibrix is not sufficient for children traveling to the meningitis belt or the Hajj because it does not contain serogroups A or W.
- For children at risk during a community outbreak attributable to a vaccine serogroup, administer or complete an age- and formulation-appropriate series of MenHibrix, Menactra, or Menveo.
- For booster doses among persons with high-risk conditions, refer to *MMWR* 2013 62(RR02); 1-22, available at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6202a1.htm.

Catch-up recommendations for persons with high-risk conditions:

1. If MenHibrix is administered to achieve protection against meningococcal disease, a complete age-appropriate series of MenHibrix should be administered.
2. If the first dose of MenHibrix is given at or after 12 months of age, a total of 2 doses should be given at least 8 weeks apart to ensure protection against serogroups C and Y meningococcal disease.
3. For children who initiate vaccination with Menveo at 7 months through 9 months of age, a 2-dose series should be administered with the second dose after 12 months of age and at least 3 months after the first dose.
4. For other catch-up recommendations for these persons, refer to *MMWR* 2013 62(RR02); 1-22, available at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6202a1.htm.

For complete information on use of meningococcal vaccines, including guidance related to vaccination of persons at increased risk of infection, see *MMWR* March 22, 2013 / 62(RR02);1-22, available at http://www.cdc.gov/mmwr/pdf/rr/rr6202.pdf.

Respiratory Support in Preterm Infants at Birth

- *Policy Statement*

POLICY STATEMENT

Respiratory Support in Preterm Infants at Birth

COMMITTEE ON FETUS AND NEWBORN

KEY WORDS
respiratory distress syndrome, preterm infant, neonate, surfactant, continuous positive airway pressure, bronchopulmonary dysplasia

ABBREVIATIONS
BPD—bronchopulmonary dysplasia
CI—confidence interval
CPAP—continuous positive airway pressure
INSURE—intubation, surfactant, and extubation
RDS—respiratory distress syndrome
RR—relative risk

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abstract

FREE

Current practice guidelines recommend administration of surfactant at or soon after birth in preterm infants with respiratory distress syndrome. However, recent multicenter randomized controlled trials indicate that early use of continuous positive airway pressure with subsequent selective surfactant administration in extremely preterm infants results in lower rates of bronchopulmonary dysplasia/death when compared with treatment with prophylactic or early surfactant therapy. Continuous positive airway pressure started at or soon after birth with subsequent selective surfactant administration may be considered as an alternative to routine intubation with prophylactic or early surfactant administration in preterm infants. *Pediatrics* 2014;133:171–174

BACKGROUND

Current practice guidelines in neonatology recommend administration of surfactant at or soon after birth in preterm infants with respiratory distress syndrome (RDS).[1] However, recent multicenter randomized controlled trials indicate that nasal continuous positive airway pressure (CPAP) may be an effective alternative to prophylactic or early surfactant administration.[2–8] Respiratory support is being achieved more frequently with CPAP and other less invasive approaches, such as the technique of intubation, surfactant, and extubation (INSURE).[9]

Experimental evidence documents that mechanical ventilation, particularly in the presence of surfactant deficiency, results in lung injury. Early randomized clinical trials demonstrated that surfactant administration in infants with established RDS decreased mortality, bronchopulmonary dysplasia (BPD), and pneumothorax.[10] Subsequent trials indicated that early selective administration of surfactant results in fewer pneumothoraces, less pulmonary interstitial emphysema, less BPD, and lower mortality compared with delayed selective surfactant therapy.[11] Trials of prophylactic administration of surfactant demonstrated decreased air leaks and mortality compared with selective surfactant therapy.[12] However, infants enrolled in these trials did not consistently receive early CPAP, an alternative therapy for the maintenance of functional residual capacity. Furthermore, control infants were intubated and mechanically ventilated without exogenous surfactant.

The INSURE strategy also resulted in fewer air leaks and shorter duration of ventilation when compared with later selective surfactant administration with continued ventilation. However, oxygen need and survival at 36 weeks' postmenstrual age or longer-term outcomes were not assessed in these trials.[13] It is also worth noting that the INSURE studies did not consistently use early CPAP in the control group. In fact, a recent large trial not included in this meta-analysis did not show a benefit of the INSURE strategy when compared with early CPAP.[7] The INSURE strategy may be more efficacious if an infant can be rapidly extubated. Studies in baboons have demonstrated an increase in the severity of pulmonary injury when extubation to CPAP is delayed, thus reducing the benefits of surfactant administration.[14] Decisions on extubation may have to be individualized, because some critically ill infants may not benefit from rapid extubation. Further research is needed to test the potential benefits of the INSURE strategy on important long-term outcomes. However, rapid extubation after surfactant administration may not be achievable or desirable in the most immature infants, and decisions to extubate should be individualized.

CPAP can be delivered by several noninvasive techniques such as nasal prongs, nasopharyngeal tube, or mask by using a water-bubbling system (bubble CPAP) or a ventilator. Although physician preference for bubble or ventilator CPAP is common, physiologic and clinical studies have been inconclusive. It is feasible to provide noninvasive nasal CPAP starting in the delivery room, even in extremely preterm infants (24–27 weeks' gestation), but the most immature infants had the highest risk of failure.[6] Noninvasive modes of ventilation, such as nasal intermittent ventilation, do not appear to provide further benefits compared with CPAP.[15]

RANDOMIZED CONTROLLED TRIALS OF NASAL CPAP STARTING AT BIRTH

Recently published large, multicenter randomized controlled trials of prophylactic or early CPAP have enrolled very immature infants, a group that, in previous trials, benefited from surfactant treatment. The COIN (CPAP or INtubation) Trial of the Australasian Trial Network compared the effectiveness of nasal CPAP (8 cm of water pressure) to intubation and mechanical ventilation in preterm infants who were breathing spontaneously at 5 minutes after birth.[4] There was a trend for a lower rate of death or BPD in infants who received CPAP and used fewer corticosteroids postnatally. The mean duration of ventilation was shorter in the CPAP group (3 days in the CPAP group and 4 days in the ventilator group). However, the CPAP group had a higher rate of pneumothorax than the ventilator group (9% vs 3%; $P < .001$). Although surfactant therapy was not required for intubated infants, three-quarters of the intubation cohort received surfactant. Similarly, 46% of infants in the CPAP group required ventilator support, and 50% received surfactant. Therefore, the comparison was between early CPAP (with 50% of infants ultimately receiving surfactant) and intubation and ventilation, mostly but not always with surfactant administration.

The largest CPAP trial ($N = 1310$), the Surfactant Positive Pressure and Pulse Oximetry Randomized Trial (SUPPORT) conducted by the *Eunice Kennedy Shriver* National Institutes of Health and Human Development Neonatal Research Network investigators, was designed to evaluate nasal CPAP started immediately after birth by using a limited-ventilation strategy compared with prophylactic surfactant therapy and ventilator support started within 60 minutes after birth by using a limited ventilation strategy in infants born at 24 to 27 weeks' gestation.[5] This trial used prospectively defined criteria for intubation and extubation. The rate of death or BPD in the CPAP group was 48% compared with 51% in the surfactant group (relative risk [RR]: 0.91; 95% confidence interval [CI]: 0.83–1.01; $P = .07$). Among infants born at 24 and 25 weeks' gestation, the death rate was lower in the CPAP group than in the surfactant group (20% vs 29%; RR: 0.68; 95% CI: 0.5–0.92; $P = .01$). Two-thirds of the infants in the CPAP group ultimately received surfactant. In addition, duration of mechanical ventilation was shorter (25 vs 28 days), and use of postnatal corticosteroid therapy was reduced in the CPAP group (7% vs 13%). The rate of air leaks did not differ between the groups, and there were no adverse effects of the CPAP strategy despite a reduction in the use of surfactant. This trial demonstrated that nasal CPAP started immediately after birth is an effective and safe alternative to prophylactic or early surfactant administration and may be superior. A follow-up study at 18 to 22 months' corrected age showed that death or neurodevelopmental impairment occurred in 28% of the infants in the CPAP group compared with 30% of those in the surfactant/ventilation group (RR: 0.93; 95% CI: 0.78–1.10; $P = .38$).[16] CPAP and the limited-ventilation strategy, rather than intubation and surfactant, resulted in less respiratory morbidity by 18 to 22 months' corrected age.[17]

The Vermont Oxford Network Delivery Room Management Trial randomly assigned infants born at 26 to 29 weeks' gestation to 1 of 3 treatment groups: prophylactic surfactant and

continued ventilation, prophylactic surfactant and extubation to CPAP, or CPAP (without surfactant).[7] There were no statistically significant differences between the 3 groups, but when compared with the prophylactic surfactant group, the RR of BPD or death was 0.83 (95% CI: 0.64–1.09) for the CPAP group and 0.78 (95% CI: 0.59–1.03) for the INSURE group.

Other trials have compared early CPAP with prophylactic or early surfactant administration. The CURPAP[2] and Colombian Network[3] trials did not demonstrate a difference in the rate of BPD between the 2 treatment strategies. Moreover, in the Columbian Network trial,[3] infants randomly assigned to prophylactic CPAP had a higher risk of pneumothorax (9%) than infants randomly assigned to INSURE (2%). Infants in the South American Neocosur Network trial were randomly assigned to early CPAP (with rescue using an INSURE strategy) or oxygen hood (with rescue using mechanical ventilation).[8] The early CPAP strategy (and selective of INSURE, if needed) reduced the need for mechanical ventilation and surfactant.

Standard but diverse CPAP systems have been used in these and other large randomized controlled trials reviewed, including bubble CPAP and ventilator CPAP. A detailed description of the practical aspects of using CPAP systems are beyond the scope of this statement but are available in the published literature.[18,19]

Preterm infants are frequently born precipitously in hospitals without the capability of CPAP. CPAP can be provided with a bag and mask or other comparable devices in these circumstances. However, special expertise is necessary because CPAP may not be easy to use without specific training. Safe transport before delivery may be preferable depending on clinical circumstances. Thus, care should be individualized on the basis of the capabilities of health workers in addition to the patient's condition.

A meta-analysis of prophylactic surfactant versus prophylactic stabilization with CPAP and subsequent selective surfactant administration in preterm infants showed that prophylactic administration of surfactant compared with stabilization with CPAP and selective surfactant administration was associated with a higher risk of death or BPD (RR: 1.12; 95% CI: 1.02–1.24; $P < .05$).[11] The previously reported benefits of prophylactic surfactant could no longer be demonstrated.

It is notable that infants as immature as 24 weeks' gestational age were enrolled in many of the trials. In a subgroup analysis in the SUPPORT trial, the most immature infants (born at 24 and 25 weeks' gestation) benefited the most from the CPAP strategy. Many extremely preterm infants can be managed with CPAP only; early application of nasal CPAP (without surfactant administration) was successful in 50% of infants weighing ≤750 g at birth in 1 retrospective review.[20]

Surfactant administration can be expensive, particularly in low-resource settings. Additionally, intubation and mechanical ventilation may not be possible or desirable in institutions with limited resources. CPAP provides an alternative for early respiratory support in resource-limited settings. Emerging evidence indicates that early CPAP is an effective strategy for respiratory support in extremely preterm infants, including very immature infants. CPAP appears to be at least as safe and effective as early surfactant therapy with mechanical ventilation.[9]

CONCLUSIONS

1. Based on a meta-analysis of prophylactic surfactant versus CPAP as well as on other trials of more selective early use of surfactant versus CPAP not included in the meta-analysis, the early use of CPAP with subsequent selective surfactant administration in extremely preterm infants results in lower rates of BPD/death when compared with treatment with prophylactic or early surfactant therapy (Level of Evidence: 1).
2. Preterm infants treated with early CPAP alone are not at increased risk of adverse outcomes if treatment with surfactant is delayed or not given (Level of Evidence: 1).
3. Early initiation of CPAP may lead to a reduction in duration of mechanical ventilation and postnatal corticosteroid therapy (Level of Evidence: 1).
4. Infants with RDS may vary markedly in the severity of the respiratory disease, maturity, and presence of other complications, and thus it is necessary to individualize patient care. Care for these infants is provided in a variety of care settings, and thus the capabilities of the health care team need to be considered.

RECOMMENDATION

1. Using CPAP immediately after birth with subsequent selective surfactant administration may be considered as an alternative to routine intubation with prophylactic or early surfactant administration in preterm infants (Level of Evidence: 1, Strong Recommendation).[21] If it is likely that respiratory support with a ventilator will be needed, early administration of surfactant followed by rapid extubation is preferable to prolonged ventilation (Level of Evidence: 1, Strong Recommendation).[21]

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Returning to Learning Following a Concussion

- *Clinical Report*

CLINICAL REPORT

Returning to Learning Following a Concussion

abstract

FREE

Following a concussion, it is common for children and adolescents to experience difficulties in the school setting. Cognitive difficulties, such as learning new tasks or remembering previously learned material, may pose challenges in the classroom. The school environment may also increase symptoms with exposure to bright lights and screens or noisy cafeterias and hallways. Unfortunately, because most children and adolescents look physically normal after a concussion, school officials often fail to recognize the need for academic or environmental adjustments. Appropriate guidance and recommendations from the pediatrician may ease the transition back to the school environment and facilitate the recovery of the child or adolescent. This report serves to provide a better understanding of possible factors that may contribute to difficulties in a school environment after a concussion and serves as a framework for the medical home, the educational home, and the family home to guide the student to a successful and safe return to learning. *Pediatrics* 2013;132:948–957

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KEY WORDS

head injury, mild traumatic brain injury, pediatrics, return to school, academics, return to learn, cognitive deficits

ABBREVIATIONS

AT—certified athletic trainer
FERPA—Family Educational Rights and Privacy Act
HIPAA—Health Insurance Portability and Accountability Act
IEP—individualized education plan
IDEA—Individuals with Disabilities Education Act
RTL—return to learn

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DEFINITIONS

- Individualized education plan (IEP): a formalized educational plan protected under the Individuals with Disabilities Education Act (IDEA; Pub L No. 101-476, 1990), known commonly as special education, that provides for classification or coding of a student under 1 of 13 federally designated categories and allowances for modification of regular education without penalty to the student.
- 504 plan: under Section 504 of the Rehabilitation Act (Pub L No. 93-112, 1973) and the Americans with Disabilities Act (Pub L No. 101-336, 1990), provides for a student who is not eligible for special education under an IEP but who requires accommodations in regular education on the basis of bona fide medical need, as documented by a physician and validation by the educational home.
- Individualized health care plan: a written document created by a school nurse on the basis of information provided by the student's pediatrician to document specific health care needs in the school setting with a plan for addressing each documented need.
- Family Educational Rights and Privacy Act (FERPA): a federal law established in 1974 (Pub L No. 93-380) that protects the privacy of students' "education records," including school health records, and applies to educational agencies and institutions that receive funds under any program administered by the US Department of

Education. Schools require FERPA permission from parents to release any information to any entity, including physicians. FERPA does not cover requirements of the Health Insurance Portability and Accountability Act (HIPAA). Other details can be found at: http://www.ed.gov/policy/gen/guid/fpco/index.html.

- Health Insurance Portability and Accountability Act (HIPAA): the Privacy Rule of HIPAA (Pub L No. 104-191, 1996) requires "covered entities," including physicians, to protect individuals' health records and other identifiable health information with appropriate safeguards to protect privacy and sets limits and conditions on the uses and disclosures that may be made of such information without patient authorization. HIPAA covers FERPA requirements. More information is available at http://www.hhs.gov/ocr/privacy.
- Child Find: Child Find is a continuous process of public awareness activities, screening, and evaluation designed to locate, identify, and refer as early as possible all young children with disabilities and their families who are in need of Early Intervention Program (Part C) or Preschool Special Education (Part B/619) services of the IDEA.

INTRODUCTION

Much attention has been paid to concussions in children and adolescents, particularly concussions resulting from sports. The majority of the focus on concussions has been centered on diagnosis, education of key stakeholders regarding the problem, and the timing of safe return to play (that is, to sports and other physical activity). Unfortunately, little attention has been given to academics and learning and how a concussion may affect the young student learner. Developing appropriate guidance and evidence-based recommendations for a "return to learn" (RTL) for a student following a concussion is a challenge, given the limited research that exists in this area of concussion and its management. Because of this shortage of research, the guidance provided in this clinical report is based primarily on expert opinion and adapted from a program developed in Colorado to address the issue of RTL.[1] Data are currently insufficient to advocate the ideal way to manage the RTL in the pediatric population.

Pediatricians report that inadequate training on concussion management is among the most significant barriers to effectively counseling patients on returning to school following a concussion.[2] There are many published statements that discuss the importance of "cognitive rest" following a concussion.[3–5] Cognitive rest refers to avoiding potential cognitive stressors, such as texting, video games, TV exposure, and schoolwork, as examples. However, to date, there is no research documenting the benefits or harm of these methods in either the prolongation of symptoms or the ultimate outcome for the student following a concussion. Given the disruptive nature that concussion symptoms may pose for the student and his or her family, adding additional restrictions that may not be needed has the potential to create further emotional stress during the recovery. This calls for an individualized approach for the student when a pediatrician is making recommendations for cognitive rest and the student's RTL in the school setting.

BACKGROUND

With an estimated 1.7 million traumatic brain injuries occurring annually, many of them concussions, the need for specific recommendations for returning a student to learning after concussion is necessary.[6] Given that students typically appear well physically after a concussion, it may be difficult for educators, school administrators, and peers of the student to fully understand the extent of deficits experienced by a student with a concussion. This lack of outward physical appearance of illness may also make it difficult for school officials to accept the need for adjustments for a student with a concussion.

Cognitive difficulties following a concussion have long been recognized and can clearly affect a student's learning capabilities. With recent increased attention to concussions, more focus has been placed on appropriate management for this specific injury. Neurocognitive testing, particularly the commercially available computerized versions, and its use after concussion has become more widespread, but the focus has been primarily on sports-related concussions. Although these neurocognitive tests may be helpful as a tool in assessing a student after a concussion, they have not been applied systematically to determine when and how a student is ready to take on the typical cognitive demands in a school setting.

Although a concussion can have obvious direct effects on learning, there is also increasing evidence that using a concussed brain to learn may worsen concussion symptoms and perhaps even prolong recovery.[7,8] Increasing cognitive activities are hypothesized to add additional stress to an energy-deprived brain, which may worsen symptoms. The goal during concussion recovery is to avoid overexerting the brain to the level of worsening or reproducing symptoms. Determining the appropriate balance between how much cognitive exertion and rest is needed is the hallmark of the management plan during cognitive recovery.

There is insufficient research on the role of cognitive rest, although recent research suggests benefit to the concept of cognitive rest both early and late in the recovery of the student.[9]

SIGNS AND SYMPTOMS OF CONCUSSION AFFECTING STUDENTS

Many aspects of a concussion can affect the student in the classroom. The common signs and symptoms the student may experience can be physical, cognitive, emotional, or related to sleep. Fortunately, research has demonstrated that recovery for the school-age student occurs usually within 3 weeks from the injury, but school adjustments during this recovery period may be necessary.[10]

When evaluating the student, recognizing the common signs and symptoms of a concussion and how they may affect the student in the school setting is important (Table 1). A thorough understanding of potential problems the student can encounter will help the pediatrician make appropriate recommendations to the school, the student, and the student's family. Allowing adequate cognitive rest may help minimize a worsening of symptoms and potentially facilitate a quicker recovery without significant disruption to the student's life.

Use of symptom checklists may help not only in evaluating what symptoms the student may be experiencing but also in rating them in severity (Figs 1 and 2). These checklists can also be used serially to follow the student through his or her recovery and identify areas that may need more targeted interventions.[11] Because the diagnosis of concussion is largely symptom driven, it is important not only to recognize but also to inquire further about the specific nature of the symptoms reported by the student or observed by the parent because many of the symptoms reported after a concussion may not be unique to a concussion. For example, some students may have preexisting depression, chronic daily or intermittent headaches, learning disabilities, or attention-deficit/hyperactivity disorder, which can affect reporting on a symptom checklist.

TABLE 1 Signs and Symptoms of a Concussion and the Potential Problems They May Pose to the Student

Sign/Symptom	Potential Implications in School
Headache	Most common symptom reported in concussions
	Can distract the student from concentration
	Can vary throughout the day and may be triggered by various exposures, such as fluorescent lighting, loud noises, and focusing on tasks
Dizziness/lightheadedness	May be an indication of injury to vestibular system
	May make standing quickly or walking in crowded environment challenging
	Often provoked by visual stimulus (rapid movements, videos, etc)
Visual symptoms: light sensitivity, double vision, blurry vision	Troubles with various aspects of the school building
	Slide presentations
	Movies
	Smart boards
	Computers
	Handheld computers (tablets)
	Artificial lighting
	Difficulty reading and copying
	Difficulty paying attention to visual tasks
Noise sensitivity	Troubles with various aspects of the school building
	Lunchroom
	Shop classes
	Music classes (band/choir)
	Physical education classes
	Hallways
	Organized sports practices
Difficulty concentrating or remembering	Challenges learning new tasks and comprehending new materials
	Difficulty with recalling and applying previously learned material
	Lack of focus in the classroom
	Troubles with test taking
	Troubles with standardized testing
	Reduced ability to take drivers education classes safely
Sleep disturbances	Excessive fatigue can hamper memory for new or past learning or ability to attend and focus
	Insufficient sleep can lead to tardiness or excessive absences
	Difficulty getting to sleep or frequent waking at night may lead to sleeping in class
	Excessive napping due to fatigue may lead to further disruptions of the sleep cycle

Careful history taking to account for any possible preinjury conditions is useful in assessing the student with concussion, especially one with protracted postconcussive symptoms. The pediatrician should account for these preexisting conditions and continue to manage the concussion and as well as the preexisting problems concurrently. It is also worthwhile to discuss other potential stressors that may affect symptom reporting, such as family or relationship problems, pressures from coaches and teammates if the child is involved in organized sports, and the restriction from participation in important upcoming life events. Symptom checklists and their scores may help in determining what symptoms may need to be addressed when returning to the school environment but should not be the sole determining factor in deciding when to return a child to school after a concussion.

THE RETURN TO LEARNING TEAM

A student returning to school after a concussion may benefit from a multidisciplinary team to maximize his or her recovery (Table 2).[1] Because state laws differ, the accessibility for some

CIRCLE ONE FOR EACH LISTED	NONE	MILD		MODERATE		SEVERE	
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred or double vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitive to light	0	1	2	3	4	5	6
Sensitive to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or anxious	0	1	2	3	4	5	6

FIGURE 1
Example postconcussion symptom score checklist (recommended for seventh grade and up).[5] Use of the postconcussion symptom scale: the student should complete the form, on his or her own, by circling a subjective value for each symptom. This form can be used with each encounter to track progress toward symptom resolution. Many students may have some of these reported symptoms at a baseline, such as concentration difficulties in the patient with attention-deficit disorder or sadness in a student with underlying depression. This must be taken into consideration when interpreting the score. Students do not need a total score of 0 to return to play if they had symptoms before their concussion. This scale has not been validated to determine concussion severity.

CIRCLE ONE FOR EACH LISTED	NONE	RARELY	SOMETIMES	OFTEN
I have trouble paying attention	0	1	2	3
I get distracted easily	0	1	2	3
I have a hard time concentrating	0	1	2	3
I have problems remembering what people tell me	0	1	2	3
I have problems following directions	0	1	2	3
I daydream too much	0	1	2	3
I get confused	0	1	2	3
I forget things	0	1	2	3
I have problems finishing things	0	1	2	3
I have trouble figuring things out	0	1	2	3
It's hard for me to learn new things	0	1	2	3
I have headaches	0	1	2	3
I feel dizzy	0	1	2	3
I feel like the room is spinning	0	1	2	3
I feel like I'm going to faint	0	1	2	3
Things are blurry when I look at them	0	1	2	3
I see double/two of things	0	1	2	3
I feel sick to my stomach	0	1	2	3
I get tired a lot	0	1	2	3
I get tired easily	0	1	2	3

FIGURE 2
Example of postconcussion symptom score checklist (recommended for kindergarten to sixth grade).[5]

students to a school physician or a school nurse may be less likely in some communities. It remains essential that all schools recognize the importance of team management for a student after concussion and ensure that all students recovering from concussion have assigned staff who will be responsible for smooth reentry to school. Yet in the ideal situation, there is a school physician in every district and a school nurse in every school, so that a medical team in the educational home can readily work with the student's medical home toward a child or adolescent's optimal benefit and outcome.[12,13]

Even though a student may be having symptoms, ultimately, the goal is to keep disruptions to the student's life to a minimum and to return the recovering student to school as soon as possible. The challenge of the multidisciplinary team is to balance the need for the student to be at school with the appropriate adjustments for the cognitive demands at school that have the potential for increasing symptoms. To reach the right balance at home and school, the multidisciplinary teams should be well versed in their roles and responsibilities in concussion management and keep communication open among all parties regarding decisions to progress, regress, or hold steady during the RTL process.

After a concussion, the student already has individuals in place for each of the teams described (Table 2). Ideally, at least 1 person from each team is involved in the concussion management and communicating with each other to help facilitate the recovery. The pediatrician does not need to create the teams or roles, but it will help to understand what roles and responsibilities each team has in the recovery of the student.

The role and responsibility of the family team is to enforce rest and to reduce stimulation to the student during recovery. In the early phases of a concussion,

TABLE 2 Multidisciplinary Team to Facilitate "Return to Learning"[1]

Team	Members of the Team
Family team	Student, parents, guardians, grandparents, peers, teammates, and family friends
Medical team	Emergency department, primary care provider, concussion specialist (primary care sports medicine physicians, neurologists, neurosurgeons, as examples), clinical psychologist, neuropsychologist, team and/or school physician
School academic team	Teacher, school counselor, school psychologist, social worker, school nurse, school administrator, school physician
School physical activity team	School nurse, athletic trainer, coach, physical education teacher, playground supervisor, school physician

All members listed for a team do not need to be involved for successful concussion management. An individual, such as an emergency department physician, may only be involved in the initial assessment and suggestion for initiating academic adjustments. Some members may serve roles on various teams. Some schools may have access to only certain individuals suggested for a team. This list is meant to serve as a framework to help pediatricians and others involved with concussion management, possible roles they can serve for a student with a concussion.

TABLE 3 Sample Approach for Determining a Students' Readiness to Return to Learning Following a Concussion[17]

If a student/athlete experiences symptoms enough to affect his or her ability to concentrate or tolerate stimulation for even up to 30 minutes, the student should likely remain at home. The student may consider light mental activities, such as watching TV, light reading, and interaction with the family, until they provoke symptoms. Computer use, texting, and video games should remain at a minimum.

When the student/athlete is able to tolerate symptoms comfortably for up to 30 to 45 minutes, the parent may consider returning him or her back to learning, either through home tutoring or in-school instruction with programming adjustment as needed. However, it is the parent who should communicate with the school about the concussion and sign a release of information for school personnel to coordinate adjustments that may be needed as recommended by the primary care provider. The level of adjustments are decided collectively by the parent, school, and primary care provider based on severity, type, and duration of symptoms present.

symptoms may be so severe that they may prevent the student from attending school or even accepting home tutoring. However, as symptoms become tolerable, short-lived, and/or amenable to rest and intervention, the student may return to school, often with the use of supplemental academic adjustments. Therefore, it is the parent who will ultimately make the decision when the student should return to school. It is not unusual for a student to be extremely symptomatic in the doctor's office initially but minimally symptomatic at home within several days. Some guidance to help decision making for return to school can be found in Table 3.

The role and responsibility of the medical team is to evaluate the concussion, assess for a more serious structural or neurologic injury, and prescribe physical and cognitive rest, as appropriate, until symptoms improve. As recovery continues, the medical team should gather data from the family and from the school teams to aid in the decision of when to start to allow safe progression back to increasing physical activity.

Two school teams are involved in the recovery process for the student with a concussion, the school physical activity team and the school academic team. The roles and responsibilities of the 2 school teams are extensive and varied. In the early stages of the concussion, the primary goal of the school physical activity team is to safeguard the student from any further potential injury to the brain. If a concussion has been suspected, it is recommended that the student be removed from physical activity and be evaluated by his or her pediatrician or other appropriate health care professionals for further diagnosis and management before returning to physical activity. Pediatricians should counsel patients on the current recommended return to activity progressions, as outlined in the clinical report from the American Academy of Pediatrics titled "Sport-Related Concussion in Children and Adolescents," which may be applied to both athletes and nonathletes.[3]

Similarly, in the early phases of a concussion, the school academic team must coordinate the return of the student to cognitive exertion and help to facilitate the appropriate level of academic adjustments necessary to reduce or eliminate symptoms. Whether communication occurs directly with a single teacher or is coordinated across all teachers via the designated case manager, such as the school nurse, counselor, or school psychologist, it is essential for all adults working with the student to understand the effects of a concussion on learning and how best to reduce cognitive demands during this period of recovery. The parent is encouraged to return the student to school, even if the day is shortened, when the student can tolerate cognitive activity or stimulation for approximately 30 to 45 minutes. This arbitrary cutoff is based on the observation that a good amount of learning takes place in 30- to 45-minute increments. High schools with 7 to 8 consecutive classes often schedule periods at 30- to 45-minute intervals. A student with a concussion can benefit from 30 minutes of instruction and a 15-minute "rest period" before changing classes. High schools on a "block schedule" usually run 90-minute blocks (two 45-minute periods), which may require allowances for a planned rest midway through the block. The concussed student may maximize learning in 30- to 45-minute increments before needing to take a rest (Table 3). Missing instruction, however, may necessitate the need for the provision of class notes, supplemental tutoring, or an easing of assignments or course expectations.

When the student returns to school, observing which classes exacerbate

symptoms will allow for further adjustments to be made to help reduce symptom provocation. Students may be able to tolerate some classes better than others, and consideration should be given for reduced exposure for those classes that the student cannot tolerate as well by substituting a study hall period, allowing for rest periods, or making adjustments to class schedules.

As the concussion symptoms improve, the school academic team and the family team should feel comfortable increasing mental and social activities, as tolerated by the student, and involving the medical team only as needed, apart from preplanned follow-up visits. This may translate into parents allowing their child to attend a social gathering, watch a game, or return to driving. At school, this should translate into a teacher requiring more work from a student who is obviously feeling better and able to tolerate longer periods of time of mental exertion without provoking symptoms.

Pediatricians should encourage teachers to pick and choose the academic adjustments most amenable to their class teaching style and content and most appropriate for the phase of recovery of the concussion on the basis of a child's tolerance. Teachers and those on the school academic team should reassess progress at weekly intervals to determine the effectiveness and continued need of adjustments. Direct communication and attention to symptoms with the student is helpful, because the student may not be willing to mention problems specifically to the teacher. Communication with a student should be conducted in a private setting, because many students prefer not to be singled out or draw additional attention to themselves following the injury. Younger students may be apprehensive or not know how to effectively express their academic struggles. High-achieving students may also be unwilling to "give in" to adjustments that are offered.

STRATEGIES TO RETURN TO LEARN IN THE CLASSROOM

Returning a student to the classroom while symptomatic from a concussion requires an individualized approach. Most students will likely return to the classroom while symptomatic from their concussion. Each concussion is unique and may encompass a different constellation and severity of symptoms. Concussion symptoms may vary from student to student and even from concussion to concussion in the same individual who may sustain more than one concussion. Therefore, a "cookie-cutter" approach to managing a concussion and a return to the classroom cannot be applied. However, most of the difficulties that arise in students can be handled with similar adjustments, depending on the signs or symptoms they are experiencing.

In the first few weeks after a concussion, most interventions can be made in the general education classroom, by the general education teacher, with minimal support and check-ins with the school physician, school nurse, school counselor, school psychologist, school social worker, or certified athletic trainer (AT).[14,15] Parents should be encouraged to follow up with the school and student to assess whether academic adjustments are occurring to minimize worsening of students' symptoms during their early recovery.

Physicians should learn educational terminology to assist them in being precise in what they are requesting of schools. The term "academic adjustment" is used intentionally to refer to nonformalized adjustments made to the student's environment during the typical 1- to 3-week recovery period that do not jeopardize the curriculum or require alterations in standardized testing. The term "academic accommodations" is used to address longer-term needs, beyond 3 weeks, which may include standardized testing arrangement, extra time on work, changes in class schedule, for example, and access to the grade-level curriculum but still within the context of regular education and may be formalized in a 504 plan. The term "academic modification" is used when considering more prolonged and more permanent changes to an educational plan, necessitating special education with needs specified in an IEP. Teachers' understanding and putting a few reasonable adjustments in place in the early stages of the concussion will often help bring the student through recovery in the typical, expected timeframe of 1 to 3 weeks. The type of academic adjustments put in place should depend on the severity of the symptoms, the type of symptom, specific teaching styles used by a teacher in the classroom, and pattern of the symptoms (Table 4).

Concussion education can be conducted by the pediatrician via direct communication with school personnel on a case-by-case basis to facilitate better understanding among appropriate school personnel during the RTL process; restrictions and adjustments should be specifically listed on a school note at each visit and during the interim, if needed. Unfortunately, simply requesting this in written form does not guarantee the school can or will comply. It would be helpful for the pediatrician if the school could identify a "point person" or case manager to contact at the school and likewise for the school to be given a "point person" in the pediatrician's office who will communicate with each other during the RTL process. FERPA permission is needed by educational agencies, and HIPAA permission is required by medical personnel; therefore, a signed parent permission on a document that satisfies both is required for communication among team members. The school point person is often a member of the school academic team. The

medical home point person is someone with enough knowledge of the situation and of the child to communicate concerns back to the pediatrician. Parents should also be involved with this communication.

The team approach between the medical home and a school staff member is helpful in assisting the school with problems it encounters in the process and identifying solutions to these problems. A team approach also can reduce the likelihood of a pediatrician's office from receiving frequent phone calls from many individuals about the same situation. For many schools, the point person would be a guidance counselor, school psychologist, school physician, or school nurse. In schools in which a AT is present, the AT can help reinforce communication of any school or sports restrictions to safeguard against the student-athlete beginning a return to play protocol but still having academic adjustments.[15] For this reason, communication with the AT by the treating physician or a representative of the school who has been communicating with the physician is also encouraged.[16] In some circumstances, the AT may be limited to support only the students in organized sports for the school rather than the student body as a whole. It would be helpful to the pediatrician to understand how ATs can assist the pediatrician with the management of their patients.

Encouraging parents to communicate with the school, especially the designated case manager, about how recommended adjustments are being applied can be helpful. Pediatricians should also encourage parents to communicate with their child to make sure any adjustments that are being offered are also being used, as needed, and are helping.

TABLE 4 Signs and Symptoms of a Concussion and the Strategies to Help in the School Setting

Sign/Symptom	Potential Adjustments in School Setting
Headache	Frequent breaks
	Identifying aggravators and reducing exposure to them
	Rests, planned or as needed, in nurses office or quiet area
Dizziness	Allow student to put head down if symptoms worsen
	Give student early dismissal from class and extra time to get from class to class to avoid crowded hallways
Visual symptoms: light sensitivity, double vision, blurry vision	Reduce exposure to computers, smart boards, videos
	Reduce brightness on the screens
	Allow the student to wear a hat or sunglasses in school
	Consider use of audiotapes of books
	Turn off fluorescent lights as needed
	Seat student closer to the center of classroom activities (blurry vision)
	Cover 1 eye with patch/tape 1 lens if glasses are worn (double vision)
Noise sensitivity	Allow the student to have lunch in quiet area with a classmate
	Limit or avoid band, choir, or shop classes
	Avoid noisy gyms and organized sports practices/games
	Consideration of the use of earplugs
	Give student early dismissal from class and extra time to get from class to class to avoid crowded hallways during pass time
Difficulty concentrating or remembering	Avoid testing or completion of major projects during recovery when possible
	Provide extra time to complete nonstandardized tests
	Postpone standardized testing (may require that 504 plan is in place)
	Consider 1 test per day during exam periods
	Consider the use of preprinted notes, notetaker, scribe, or reader for oral test taking
Sleep disturbances	Allow for late start or shortened school day to catch up on sleep
	Allow rest breaks

PROLONGED SYMPTOMS

Fortunately, most students with a concussion will recover within the first 3 weeks from their injury.[10] For students with symptoms lasting longer than 3 weeks, further medical management considerations and accommodations, rather than academic adjustments, may be needed. Schools currently have in place a system for accommodations (504 plan) for students expected to have temporary interference with learning or modifications (IEP) for students with a classifiable chronic condition. However, applying these systems to concussions, in some schools, may be a newer concept. Although healing may be considered "protracted" with some concussions, the expectation is still for a full recovery that no longer would require academic adjustments, accommodations, or modifications. Referral to a concussion specialist (licensed physician, such as a pediatrician, neurologist, primary care sports medicine specialist, or neurosurgeon with expanded knowledge and experience in pediatric concussion management) should also be considered, if not already initiated, for the student with prolonged symptoms.

Because laws, regulations, policies, and practices vary among states, districts, and schools, it is important that the pediatrician be familiar with the level of flexibility and creativity that a particular school will provide or permit. Differences also exist among long-term modifications, midterm accommodations, and short-term adjustments. Pediatricians should understand that the IDEA provides for longer-term accommodations. For example, there are provisions for school-based problem-solving teams to determine the appropriateness of an IEP for a child in need of long-term modifications through special education on the basis of a given classification.

In addition, a 504 plan is available through the Rehabilitation Act of 1973 and Americans with Disabilities Act of 1990 for a child who needs longer-term academic accommodations in regular education but does not qualify for special education through 1 of the 13 classifications available via an IEP. Most adjustments can and should be short term and through the child's educational team, with guidance from the medical home and approval by the principal and family team. The key to this process is that the pediatrician provides the school with medical documentation based on persisting signs and symptoms that might significantly limit a child's ability to access full instruction. It is also helpful for the pediatrician to realize that, often, schools will not allow a child to participate in extracurricular activities until he or she is fully participating in curricular activities.

Early in the recovery, a student may need simple academic adjustments in the classroom. Students who do not respond in the first few months may need a more targeted level of intervention. At this level, school teams may need to brainstorm and problem solve what other interventions may be helpful and decide whether more formalized assessments need to occur. Often, the family team is a critical part of the problem-solving process, as is the medical team. All 3 teams must be actively involved in managing the concussion on behalf of the recovering student. At this level, some of the interventions can no longer be easily applied in the general education classroom without formal intervention. For example, students may require some amount of pullout from the regular classroom for a small-group intervention, tutoring, or 1-on-1 instruction. Customized plans at this point may be more formalized into an Individualized Health Plan, a learning plan, or a 504 plan. Interventions at this level are usually accommodations to the environment (ie, large-print books, extra set of books at home, audio books, extended time on tests, note takers).

If symptoms remain severe or prolonged, typically longer than 5 to 6 months, more intensive intervention may be needed. In these cases, a potentially more permanent disability is considered, necessitating most school districts to trigger their Child Find (a component of IDEA) obligations, provide appropriate testing, and develop an IEP. The family team and medical team should continue to be involved and consulted during the development of the IEP. Interventions at this level are often considered modifications of the curriculum, implying that the student may not be held responsible for the regular education curriculum required of all other same-age peers. Instead, the student may be taught without penalty on a level appropriate for him or her, often at a level lower than peers, and will only be held accountable for his or her own personal academic growth rather than being compared with typical grade-level peers.[17,18] In addition, the concussion would be so severe at this level as to potentially necessitate specialized instruction and/or specialized programming. It is uncommon, however, for the student with a concussion to need an IEP.

When considering the implementation of a 504 plan or IEP, involving the school academic teams or special education teams is beneficial and necessary. The school academic team, including the school psychologist, can provide formal recommendations to the school to make the creation of the 504 plan or IEP that is most relevant to the particular student's greatest needs in the academic setting. Regardless of the problems, it is essential the medical team, the school team, and the family team work together, if further testing seems indicated to help in the development of an educational program through an IEP or 504 plan. In the majority of these assessments, the recommendations and development of an IEP or 504 plan will be developed by the schools. A medical diagnosis of concussion can prompt the school academic team to collect other sources of information and consider developing a 504 plan or IEP. Importantly, 504 plans and IEPs are governed by different laws. A 504 plan can be provided when a school determines the concussion to substantially limit one or more major life activities, such as learning. On the other hand, an IEP can be provided if it is determined that the concussion results in total or partial impairment that adversely affects educational performance such that a student cannot benefit from regular education alone and requires modification of curriculum, specialized instruction, programming, and/or placement.

Although not expected or common after a concussion, a student with prolonged symptoms who does not seem to be responding to various interventions should also be evaluated for issues related to anxiety about school or school avoidance. This may be more likely in the child who sustained a concussion from an incidence of bullying or assault. Keeping a child out of school and away from friends for extended periods also may risk development of fear and isolation in a child or adolescent on attempting to return to school and might require the assistance of a mental health specialist in extreme cases.

EDUCATION

Given the large number of concussions occurring each year, both in and out of formal sport activities, most schools will encounter a child who is dealing with symptoms from a concussion. Education of all individuals involved is paramount to helping students who may need assistance in the school setting.

Education regarding concussion, generally, and the role of cognitive and

physical rest and return to school, specifically, is essential for the teams of individuals helping a student with concussion during assessment, management, and recovery. This education should extend to both school personnel (eg, administrators, athletic directors, teachers, guidance counselors, school psychologists, coaches, school physicians, school nurses, ATs) and individuals likely not employed by the school (eg, primary physicians, sports/team physicians, emergency department physicians, parents, and other caregivers). Even in states with legislation for concussion education and management, nonathletic personnel in schools are often left out of concussion education efforts. However, a comprehensive team approach to care may help reduce mistakes in management, which could potentially risk reinjury during the healing phase, lengthen recovery, or result in untoward long-term outcomes.

Education, on a larger scale, should be conducted to instruct school groups on the concepts of concussion management, particularly when introducing models of cognitive rest. Education can be tailored to various school personnel as needed. Education sessions are especially helpful as sport seasons begin in the fall, winter, and spring. Several groups have developed educational materials, such as online tutorials, relevant to this topic and provide excellent resources for schools, parents, students, and health care providers (see Resources).

FUTURE DIRECTIONS

Given the paucity of studies that have been conducted thus far regarding the effects and role of cognitive rest after concussion, further research is needed. Future research is also needed to clarify best practices for RTL. Developing a better understanding of the best methods to assist a student in the school environment, determining whether cognitive rest can assist in speed of recovery, and evaluating written and educational resources on this topic are all areas that require additional research and review. Studies comparing outcomes in school settings that have concussion management teams with case management versus those that do not would also be of value.

Continued education of all individuals involved with a student with a concussion should help facilitate better outcomes and less resistance to developing appropriate concussion management guidelines and programs.

CONCLUSIONS AND GUIDANCE FOR PHYSICIANS

1. Students with a concussion may need academic adjustments in school to help minimize a worsening of symptoms.
2. Given that most concussions resolve within 3 weeks of the injury, adjustments may often be made in the individual classroom setting without formal written plans, such as a 504 plan or IEP.
3. Students with symptoms lasting longer than 3 to 4 weeks may benefit from a more detailed assessment by a concussion specialist (licensed physician, such as a pediatrician, neurologist, primary care sports medicine specialist, or neurosurgeon with expanded knowledge and experience in pediatric concussion management) and recommendations specific to the educational environment. Considerations should be given to developing a 504 plan or, subsequently, but unlikely, an IEP, in the student with a lengthy recovery.
4. A team approach consisting of the medical team, the school team, and the family team to assist the student in his or her return to learning is ideal.
5. Students should be performing at their academic "baseline" before returning to sports, full physical activity, or other extracurricular activities following a concussion.
6. Education of all individuals involved with students who sustain a concussion is necessary to provide adequate adjustments, accommodations, and long-term program modifications for the students.
7. Additional research is necessary to strengthen and provide more evidence-based recommendations for appropriate adjustments for students following a concussion.

RESOURCES

- Brain 101: Concussion Handbook: http://brain101.orcasinc.com/1000
- REAP (Reduce/Educate/Accommodate/Pace) Program: a community-based concussion management program: http://www.rockymountainhospitalforchildren.com/sports-medicine/concussion-management/reap-guidelines.htm
- CDC Foundation Online Training for Clinicians: http://preventingconcussions.org/
- Centers for Disease Control and Prevention: Fact Sheet for School Professionals on Returning to School after a Concussion: http://www.cdc.gov/concussion/pdf/TBI_Returning_to_School-a.pdf
- Centers for Disease Control and Prevention: Heads Up for Schools: http://www.cdc.gov/concussion/HeadsUp/schools.html
- Centers for Disease Control and Prevention: Online Coaches Training: http://www.cdc.gov/concussion/HeadsUp/online_training.html
- Dr. Mike Evans Concussions 101 Video: http://www.myfavouritemedicine.com/concussions-101/
- Frequently Asked Questions about 504 Plans: http://www2.ed.gov/about/offices/list/ocr/504faq.html
- Sample Return to Learning Note for Physicians: http://www.aap.org/en-us/

about-the-aap/Committees-Councils-Sections/Council-on-sports-medicine-and-fitness/Documents/returntoschool.pdf and http://www2.aap.org/sections/schoolhealth/returntoschool.pdf

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Scope of Practice Issues in the Delivery of Pediatric Health Care

- *Policy Statement*

POLICY STATEMENT

Scope of Practice Issues in the Delivery of Pediatric Health Care

COMMITTEE ON PEDIATRIC WORKFORCE

KEY WORDS
delegate, family physician, independent practice, medical home, pediatric nurse practitioner, pediatrician, physician assistant, nonphysician clinician, team-based care

ABBREVIATIONS
AAP—American Academy of Pediatrics
NP—nurse practitioner
PA—physician assistant

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abstract

FREE

The American Academy of Pediatrics (AAP) believes that optimal pediatric health care depends on a team-based approach with supervision by a physician leader, preferably a pediatrician. The pediatrician, here defined to include not only pediatric generalists but all pediatric medical subspecialists, all surgical specialists, and internal medicine/pediatric physicians, is uniquely qualified to manage, coordinate, and supervise the entire spectrum of pediatric care, from diagnosis through all stages of treatment, in all practice settings. The AAP recognizes the valuable contributions of nonphysician clinicians, including nurse practitioners and physician assistants, in delivering optimal pediatric care. However, the expansion of the scope of practice of nonphysician pediatric clinicians raises critical public policy and child health advocacy concerns. Pediatricians should serve as advocates for optimal pediatric care in state legislatures, public policy forums, and the media and should pursue opportunities to resolve scope of practice conflicts outside state legislatures. The AAP affirms the importance of appropriate documentation and standards in pediatric education, training, skills, clinical competencies, examination, regulation, and patient care to ensure safety and quality health care for all infants, children, adolescents, and young adults. *Pediatrics* 2013;131:1211–1216

INTRODUCTION

The American Academy of Pediatrics (AAP) advocates that every child receive high-quality, accessible, family-centered, continuous, coordinated, comprehensive care in a medical home. To this end, optimal pediatric care is best delivered in a team-based approach that is led by a primary physician, ideally a pediatrician, who assumes responsibility for managing the patient's care. All professionals who provide pediatric care must hold to the highest standards of education and training and continually demonstrate their skills and competencies.

COMPREHENSIVE TEAM-BASED CARE WITH PHYSICIAN LEADERSHIP

The provision of optimal pediatric care depends on a team-based approach to health care that is ideally led by a pediatrician. In this team-based model of pediatric care, the physician assumes overall responsibility for the care of the patient. As leader of the pediatric

health care team, the physician oversees the delivery of care and, when appropriate, delegates patient care responsibilities to nurse practitioners (NPs), physician assistants (PAs), and other valued members of the heath care team. The pediatrician who leads the health care team also determines when referral to other physicians is warranted. When patient care responsibilities must be shared by multiple providers, the pediatrician should assume primary responsibility for managing the full range of health care services to ensure continuity of care within the child's medical home.[1] For some children, a general pediatrician and a pediatric medical subspecialist or surgical specialist may decide to comanage care. The medical home's team-based model of pediatric care provides high-quality, cost-effective care by minimizing duplication of clinical effort, promoting the appropriate and timely use of all health care providers on the team, and ensuring that the care provided is accessible, continuous, comprehensive, family-centered, coordinated, compassionate, and culturally effective.[2]

UNIQUE QUALIFICATIONS OF PEDIATRICIANS

As a direct result of their extensive training and experience, pediatricians possess the broad range of competencies required to best assess and manage health issues in children. Pediatric illness runs the gamut from basic to complex, from common behavioral disorders to rare metabolic and genetic diseases. In addition, diseases that present initially as a common condition such as a cold may sometimes progress to a severe and complex illness such as pneumonia or respiratory failure. The pediatrician is the clinician most extensively educated in pediatric health care and has the depth and breadth of knowledge, skills, and experience to deliver optimal care to children.

PROFESSIONAL STANDARDS TO ENSURE SAFETY AND QUALITY CARE

The AAP supports safe, quality care for all children and their families and believes that any health care professional who wishes to actively participate in the care of children must demonstrate appropriate education, training, skills, and ongoing competencies in pediatric health within his or her scope of practice to ensure the highest standards of care. All members of the health care team should provide care consistent with their education, training, and licensure.

In recent years, the health care market has seen a significant increase in the number of nonphysician clinicians who seek to care for children. Professional associations for psychologists, pharmacists, massage therapists, physical therapists, occupational therapists, optometrists, acupuncturists, naturopaths, homeopaths, and chiropractors have actively sought expanded scopes of practice in the care of children. In an evergrowing and more complicated health care delivery system, patients and families need to know what services these clinicians are licensed and trained to provide and understand the differences in education and skills among them.

Support for such transparency is increasing and resulting in requirements that medical and health professionals be required to display or advertise their degrees, credential(s), or licenses according to a standard that is easier for consumers to understand. In addition, truth-in-advertising laws help patients distinguish between medical doctors and other health professions with doctoral degrees who are licensed to provide care.

KEY MEMBERS OF THE PEDIATRIC HEALTH CARE TEAM

For many years, pediatricians have worked closely with physicians in disciplines across the field of medicine to optimize the care of children. The AAP specifically acknowledges the key role that family physicians have played in providing care to children and the importance of their continuing collaboration with pediatricians. Pediatricians need to collaborate closely with family physicians in practice to provide pediatric support and consultation.

Nonphysician clinicians play an invaluable role in the provision of health care to infants, children, adolescents, and young adults as part of the physician-led team that provides pediatric health care. Learning to work in teams should begin in pediatric residency training, where collaborative learning with nonphysician clinicians can expose future pediatricians to the benefits of team-based care. In particular, the AAP also affirms that these nonphysician clinicians have been important participants in the care of children in the United States for many years.

PAs are educated in the medical model to provide medical care specifically under the direction and supervision of a physician. PAs must graduate from an accredited master's-level educational program that includes didactic education and clinical rotations in pediatrics and must also pass the national certifying examination administered by the National Commission on Certification of Physician Assistants. The AAP is involved in the development of educational standards and national certification for PAs through appointed representatives on the boards of the Accreditation Review Commission on Education for the Physician Assistant and the National Commission on Certification of Physician Assistants. PAs support the

concept of physician-directed, team-based care.

NPs are educated in graduate-level training programs, and the majority of NPs are certified by either the American Nurses Credentialing Center or the American Academy of Nurse Practitioners. In 7 states, national board certification is not required for licensing. The care provided by NPs can vary considerably on the basis of the laws in the state in which they practice. States may limit or deny NPs the authority to prescribe medications, to admit patients to the hospital, or to practice independently. As of 2012, more than half of the states required physician involvement (eg, collaborative practice agreement, physician delegation and supervision) for NPs to practice diagnosis and treatment and for prescriptive authority (for information on current state laws, please contact the AAP Division of State Government Affairs at stgov@aap.org).[3] Full admitting privileges for NPs would allow them to admit, provide care for, and discharge patients without physician supervision. Although NPs are rarely granted full admitting privileges, it is not uncommon for them to obtain associate privileges that permit them to admit a patient to a supervising physician. NPs can play an important role in the inpatient setting, but the AAP believes that a pediatrician should lead the health care team that is providing pediatric inpatient care.

In states that do not allow independent practice, a structured agreement with a physician is required. Recent studies have shown that even in states which allow independent practice for NPs, fewer than 15% of pediatric NPs actually choose to practice independently.[4] Regardless of the state in which they practice, the vast majority of pediatric NPs choose to practice under the supervision of general pediatricians, pediatric medical subspecialists, or pediatric surgical specialists. The AAP endorses this collaborative and structured relationship and believes this choice reflects both a shared commitment to patient safety and the positive nature of current pediatrician–NP relationships in US health care.

Of note, some reports have called for changes in the education of NPs so that they might spend additional time in clinical training and increase their likelihood of independent practice. These reports have also called for changes in the scope of practice for NPs in efforts to meet a workforce demand in areas with physician shortages.[5–7]

Considering the educational aspect, NPs generally receive a master's degree or postmaster's certificate. These NP training programs provide 500 to 720 hours of clinical training.[8] However, in 2004, the American Association of Colleges of Nursing endorsed a position statement calling for NP training programs to move the current level of preparation necessary for advanced nursing practice from a master's-level to a doctorate-level degree (eg, Doctor of Nursing Practice [DNP] or Doctor of Philosophy [PhD] in Nursing) by 2015.[9] The American Association of Colleges of Nursing's *The Essentials of Doctoral Education for Advanced Nursing Practice* (2006) recommends that programs—designed for individuals who have already acquired the competencies in *The Essentials of Baccalaureate Education for Professional Nursing Practice* (1998)—be "three calendar years, or 36 months of full-time study (including summers) or four years on a traditional academic calendar."[10] This requirement is equivalent to the currently required 3 years of graduate training for the master's degree program. Subsequently, the number of doctorate-level nursing programs in the United States has grown from 20 in 2006 to 182 in 2011.[9]

Increases in the duration of education or the final degree (eg, a DNP or PhD in Nursing) will not achieve educational parity with physicians. In comparison, with 4 years of medical school and 3 years of pediatric residency at a minimum, the pediatrician has invested between 12 000 and 14 000 clinical hours at the completion of basic pediatric training alone. Therefore, the AAP believes that pediatricians and NPs are not interchangeable in the delivery of pediatric health care.

A recent study of the geographic distribution of pediatric NPs found that the majority of states have fewer than 25 pediatric NPs per 100 000 children and that a state's independent practice laws are not related to its density of pediatric NPs.[11] In 2010, almost 85% of all NPs reported practicing in urban areas.[12] Furthermore, a recent study from the University of Washington Rural Health Research Center found no statistically significant link between states that allow NPs greater practice autonomy and higher rates of NP practice in rural areas.

Because a greater supply of NPs in a state does not necessarily lead to an equitable distribution to areas that are underserved, the AAP does not support changes in scope of practice for NPs in these areas and believes it is ill-advised to create a system of care based on independent practice without any supervision or oversight by a physician. Rather, the AAP recommends incentives for physician relocation, including loan forgiveness, payment reform, and expanded health insurance coverage for children.[13]

Some have called for an expansion of retail-based clinics as a means to increase the provision of care for children in underserved areas. However, retail-based clinics are not staffed by

physicians, and the nonphysician clinicians that are staffing these clinics often work without supervision or oversight by a physician (ie, independent practice). Also, a recent study of more than 900 retail clinics throughout the United States found that "retail clinics are currently located in more advantaged neighborhoods, which may make them less accessible for those most in need."[14] In light of its commitment to comprehensive team-based care, the AAP does not support the use of retail-based clinics for the medical care of infants, children, and adolescents.[15] Because retail-based clinics are not founded on a medical home model, use of these clinics as a source of care for children poses a significant risk for fragmentation of care, limited follow-up, missed diagnoses, and decreased quality of care overall.

SCOPE OF PRACTICE LEGISLATION

Scope of practice legislation falls under the jurisdiction of individual states. State legislatures are therefore the loci of deliberations on these issues. The competing political agendas and perspectives expressed during these deliberations often generate highly charged debates. To bring a uniformity of approach and an essential level of civility to this discourse, the AAP endorses the 2005 recommendations of the Federation of State Medical Boards regarding the approach to scope of practice legislation.[16] A portion of the Federation of State Medical Boards statement follows:

> "Changing or creating a new scope of practice for a health profession necessitates establishment of a legitimate need for the change, along with a systematic review of the impact of the proposed change on public health, safety, and welfare. Patient safety and public protection must be the primary objectives in making decisions on scope of practice. It is important for boards and legislatures to recognize that there are often significant differences in the prerequisites, the scope, and the duration of education provided to other health care practitioners when compared with that provided to physicians. Policy makers must ensure that all practitioners are prepared, by virtue of education and training, to provide the services authorized in their scope of practice in a safe, effective, and economical manner."

LIABILITY

The expansion of the scope of practice of NPs, PAs, and other nonphysician clinicians has created new challenges for physicians in all specialties in addressing professional and medical liability issues. Specific areas of risk for physicians when supervising nonphysician clinicians include improper delegation of authority, vicarious liability for medical care provided by nonphysician clinicians, and liability for nonmedical acts committed by nonphysician clinicians in which the physician is responsible for the negligent hiring, training, supervising, or retaining of the nonphysician clinicians. When delegating authority to nonphysician clinicians, physicians should consider the proper method of delegation and their oversight responsibilities for the delegated duties.

It is important that lawmakers and regulators remain attentive to the fact that a physician's ability to delegate authority is often governed by contractual limitations as well as by statutes that govern health care facilities. Moreover, health care entities, such as hospitals or managed care organizations, may not authorize the delegation of more authority than is permitted by state statutes or regulations, but they may impose limitations on the delegation of authority that are more restrictive than state laws. These policies may also be admissible in a medical liability lawsuit as evidence of the standard of care. Physicians violating such policies may risk loss of employment or revocation of privileges. Physicians and health care entities must therefore be knowledgeable about the terms of these state statutes and regulations, as well as health care entity policies, and should seek advice from a qualified attorney.

For nonphysician clinicians who practice independently of a physician, public policy should require both exclusive professional responsibility for the care they provide and adequate liability insurance to allow for appropriate financial remedy for adverse settlements or decisions. States that license nonphysician clinicians should therefore require that these nonphysician clinicians abide by the same rules regarding liability insurance as do physicians. Because physicians can be held accountable for clinicians acting under their supervision, a pediatrician should consider potential professional or medical liability issues before establishing a supervisory relationship.

CONCLUSIONS

The AAP believes that optimal pediatric care is best rendered by using a team-based approach led by a pediatrician. As the clinician most extensively educated in pediatric health care, the pediatrician has the depth and breadth of knowledge, skills, and experience to assume this role and should be held to the highest standards. Collaboration with family physicians is an important component of pediatric health care delivery, as are partnerships with nonphysician clinicians in an effort to provide safe and effective quality health care for all infants, children, adolescents, and young adults in the United States. The AAP recognizes the importance of team-based education and training. Furthermore, the AAP maintains that to ensure safe and effective care, all members of the health care team must be required to demonstrate

adequate education, training, skills, and competencies in pediatric health within their scope of practice, and all members of the health care team must provide care that is consistent with their education, training, and licensure. Patient safety and public protection must be the primary benchmarks in making any decision on changes involving the scope of practice of those who care for children.

The AAP affirms the following policy recommendations:

1. A pediatrician should serve as the leader of the pediatric health care team. This leadership role is based on the pediatrician's ability to manage, coordinate, and supervise the entire spectrum of pediatric care, from diagnosis through all stages of treatment and in all practice settings.
2. Pediatricians must assume responsibility for educating patients, families, health care purchasers, policy makers, the media, and the public about scope of practice issues.
3. Pediatricians should participate in the training and educational experiences of nonphysician pediatric clinicians, using evidenced-based and best-practice sources whenever possible. Similarly, training of pediatricians should include collaborative learning experiences in team care.
4. The AAP supports limitations on the scope of practice of nonphysician clinicians and opposes legislation that expands their scope of practice, including independent practice, hospital admitting privileges, and independent prescriptive authority.
5. Although the AAP opposes independent practice for nonphysician clinicians, in states that do allow independent practice, nonphysician clinicians acting independently of physicians should be held to the equivalent degree of professional and medical liability and abide by the same rules regarding liability insurance as would physicians.
6. To promote the highest standards of care in each state, scope of practice issues should be resolved according to the current guidelines developed by the Federation of State Medical Boards. These guidelines were designed to assist policy makers in ensuring that all practitioners are prepared, by virtue of education, training, and ongoing evaluation of competency, to provide services authorized in their scopes of practice in a safe, effective, and cost-efficient manner.
7. AAP chapters should encourage, recruit, and train their members to serve as advocates of optimal pediatric health care in state-level policy initiatives concerning nonphysician scope of practice. Such activities depend on physicians who are knowledgeable about lawmaking and policy-making processes and who have the skills necessary to be effective advocates in legislative deliberations.
8. AAP chapters and state medical and specialty societies, as well as national medical and specialty societies, should be proactive in scope of practice advocacy and should partner in informing policy makers, health care purchasers, the media, and the public about the differences in the education, skills, and knowledge of various health care professionals.

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Surfactant Replacement Therapy for Preterm and Term Neonates With Respiratory Distress

- *Clinical Report*

CLINICAL REPORT

Surfactant Replacement Therapy for Preterm and Term Neonates With Respiratory Distress

abstract

FREE

Respiratory failure secondary to surfactant deficiency is a major cause of morbidity and mortality in preterm infants. Surfactant therapy substantially reduces mortality and respiratory morbidity for this population. Secondary surfactant deficiency also contributes to acute respiratory morbidity in late-preterm and term neonates with meconium aspiration syndrome, pneumonia/sepsis, and perhaps pulmonary hemorrhage; surfactant replacement may be beneficial for these infants. This statement summarizes the evidence regarding indications, administration, formulations, and outcomes for surfactant-replacement therapy. The clinical strategy of intubation, surfactant administration, and extubation to continuous positive airway pressure and the effect of continuous positive airway pressure on outcomes and surfactant use in preterm infants are also reviewed. *Pediatrics* 2014;133:156–163

INTRODUCTION

Surfactant replacement was established as an effective and safe therapy for immaturity-related surfactant deficiency by the early 1990s.[1] Systematic reviews of randomized, controlled trials confirmed that surfactant administration in preterm infants with established respiratory distress syndrome (RDS) reduces mortality, decreases the incidence of pulmonary air leak (pneumothoraces and pulmonary interstitial emphysema), and lowers the risk of chronic lung disease or death at 28 days of age (Table 1).[2–11] Subsequent trials indicated that prophylactic or early administration of surfactant resulted in fewer pneumothoraces, less pulmonary interstitial emphysema, and improved survival without bronchopulmonary dysplasia (BPD). However, recent randomized clinical trials indicate that the benefits of prophylactic surfactant are no longer evident in groups of infants when continuous positive airway pressure (CPAP) is used routinely.[5]

This clinical report updates a 2008 report from the American Academy of Pediatrics.[1] As in the previous report, a number of clinically important topics are reviewed surrounding use of surfactant, including prophylactic versus rescue replacement, preparations and administration techniques, the synergistic effects of surfactant and antenatal steroids, and surfactant therapy for respiratory disorders other than RDS. In addition, the effect of CPAP on RDS and surfactant replacement and the

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KEY WORDS

surfactant, antenatal steroids, respiratory distress syndrome, meconium aspiration syndrome, neonatal pneumonia, neonatal sepsis, congenital diaphragmatic hernia, pulmonary hemorrhage, persistent pulmonary hypertension, preterm, term

ABBREVIATIONS

BPD—bronchopulmonary dysplasia
CI—confidence interval
CPAP—continuous positive airway pressure
ECMO—extracorporeal membrane oxygenation
INSURE—intubation, surfactant administration, and extubation
LOE—level of evidence
NNTB—number needed to benefit
RDS—respiratory distress syndrome
RR—relative risk
SP-B—surfactant protein B

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TABLE 1 Meta-analyses of Surfactant Replacement: Prophylaxis and Rescue Treatment With Animal-Derived and Synthetic Surfactant[2,3,8,11]

Outcome	Prophylactic Surfactant		Rescue Surfactant	
	Animal Derived	Synthetic	Animal Derived	Synthetic
	N RR (95% CI)	N RR (95% CI)	N RR (95% CI)	N RR (95% CI)
Neonatal mortality	8 0.60 (0.47–0.77)	7 0.70 (0.58–0.85)	10 0.68 (0.57–0.82)	6 0.73 (0.61–0.88)
Pneumothorax	9 0.40 (0.29–0.54)	6 0.67 (0.50–0.90)	12 0.42 (0.34–0.52)	5 0.64 (0.55–0.76)
PIE	6 0.46 (0.36–0.59)	2 0.68 (0.50–0.93)	8 0.45 (0.37–0.55)	4 0.62 (0.54–0.71)
BPD[a]	8 0.91 (0.79–1.05)	4 1.06 (0.83–1.36)	12 0.95 (0.84–1.08)	5 0.75 (0.61–0.92)
BPD/death[a]	8 0.80 (0.72–0.88)	4 0.89 (0.77–1.03)	12 0.83 (0.77–0.90)	4 0.73 (0.65–0.83)

N, number; PIE, pulmonary interstitial emphysema.
[a] Defined at 28 d.

efficacy of the INSURE approach (intubation, surfactant administration, and extubation to CPAP) are reviewed.

PRETERM INFANTS AND SURFACTANT EFFECTIVENESS IN CLINICAL TRIALS

Surfactant trials have included infants born between 23 and 34 weeks' gestation and/or with birth weight between 500 and 2000 g.[1–12] The results of subgroup analyses from such studies indicated that surfactant therapy decreased mortality rates most effectively in infants born at less than 30 weeks' gestation or with birth weight <1250 g.[12] In addition, surfactant replacement reduced the incidence of pneumothorax, pulmonary interstitial emphysema, and the combined outcome of death or BPD, compared with no surfactant replacement[12]; these findings suggest that lung injury is mitigated after surfactant replacement. The incidence of other medical morbidities, such as BPD, intraventricular hemorrhage, necrotizing enterocolitis, health care–associated infections, retinopathy of prematurity, and patent ductus arteriosus, has not changed with surfactant replacement, but this may be attributable, in part, to the large reduction in mortality with surfactant replacement therapy.[13] The onset of clinical signs of patent ductus arteriosus may occur earlier, and the incidence of pulmonary hemorrhage, especially in infants born at less than 27 weeks' gestation, may be increased with surfactant therapy. Surfactant replacement is effective for larger and more mature preterm infants with established RDS.

PROPHYLACTIC VERSUS RESCUE SURFACTANT

A prophylactic, or preventive, surfactant strategy is defined as intubation and surfactant administration to infants at high risk of developing RDS for the primary purpose of preventing worsening RDS rather than treatment of established RDS; this has been operationalized in clinical studies as surfactant administration in the delivery room before initial resuscitation efforts or the onset of respiratory distress or, most commonly, after initial resuscitation but within 10 to 30 minutes after birth. This contrasts with a rescue or treatment surfactant strategy, in which surfactant is given only to preterm infants with established RDS. Rescue surfactant is most often administered within the first 12 hours after birth, when specified threshold criteria of severity of RDS are met.

The meta-analysis of studies conducted before routine application of CPAP demonstrated a lower mortality rate (relative risk [RR] 0.69; 95% confidence interval [CI] 0.56–0.85; number needed to benefit [NNTB] 20) and a decrease in the risk of air leak (RR 0.79; 95% CI 0.63–0.98) in preterm infants receiving prophylactic surfactant versus rescue surfactant.[14] However, when the studies that allowed for routine application of CPAP were included in the meta-analysis (National Institute of Child Health and Human Development SUPPORT Trial and Vermont Oxford Network Delivery Room Management Trial), the benefits of prophylactic surfactant on mortality (RR 0.89; 95% CI 0.76–1.04) and air leak (RR 0.86; 95% CI 0.71–1.04) could no longer be demonstrated.[5] Furthermore, infants receiving prophylactic surfactant had a higher incidence of BPD or death than did infants stabilized on CPAP (RR 1.12; 95% CI 1.02–1.24). Secondary analyses of studies that did or did not use CPAP to stabilize infants demonstrated a trend to a lower risk of intraventricular hemorrhage (RR 0.91; 95% CI 0.82–1.00) and severe intraventricular hemorrhage (RR 0.87; 95% CI 0.70–1.04) with prophylactic surfactant. That finding cannot be explained; however, there was considerable heterogeneity in the trials included in the meta-analysis. The risks of developing other complications of prematurity, such as retinopathy of prematurity, patent ductus arteriosus, and periventricular leukomalacia, were not significantly different.

When studies investigating infants born at <30 weeks' gestation were analyzed separately,[5] similar findings were noted. However, there was a trend for an increased risk of chronic lung disease in infants born at <30 weeks' gestation who received prophylactic surfactant (RR 1.13; 95% CI 1.00–1.28) and a significant increase in death or chronic lung disease (RR 1.13; 95% CI 1.02–1.25) with use of prophylactic surfactant.

EARLY VERSUS DELAYED SELECTIVE SURFACTANT TREATMENT OF RDS

Although there are no statistically significant benefits to prophylactic use of surfactant when compared with

prophylactic CPAP, several studies have investigated whether administration of surfactant early in the course of respiratory insufficiency improves clinical outcomes. Early rescue is defined as surfactant treatment within 1 to 2 hours of birth, and late rescue is defined as surfactant treatment 2 or more hours after birth. A recent meta-analysis of early (within 2 hours) versus delayed surfactant treatment concluded that the risks of mortality (RR 0.84; 95% CI 0.74–0.95), air leak (RR 0.61; 95% CI 0.48–0.78), chronic lung disease (RR 0.69; 95% CI 0.55–0.86), and chronic lung disease or death (RR 0.83; 95% CI 0.75–0.91) were significantly decreased. There were no differences in other complications of prematurity.[7]

EARLY ADMINISTRATION OF SURFACTANT FOLLOWED BY BRIEF VENTILATION AND EXTUBATION TO CPAP (INSURE STRATEGY)

The INSURE strategy is widely used throughout the world. In randomized clinical trials performed before 2008, the INSURE approach, compared with rescue surfactant administration in infants with RDS, was associated with a significantly reduced need for mechanical ventilation (RR 0.67; 95% CI 0.57–0.79) and a reduced need for oxygen at 28 days.[6] In an analysis stratified by fraction of inspired oxygen requirement at study entry, a significantly higher frequency of patent ductus arteriosus was observed among infants in the rescue surfactant group, who required a fraction of inspired oxygen greater than 0.45 (RR 2.15; 95% CI 1.09–4.23). The Vermont Oxford Network Delivery Room Management Trial (n = 648) randomly assigned infants born at 26 to 29 weeks' gestation to 1 of 3 treatment groups: prophylactic surfactant and continued ventilation, prophylactic surfactant and rapid extubation to CPAP (INSURE), or nasal CPAP without surfactant.[15] When compared with the group of infants receiving prophylactic surfactant and continued ventilation, the RR of death or BPD was 0.78 (95% CI 0.59–1.03) for the INSURE group and 0.83 (95% CI 0.64–1.09) for the CPAP group. However, in the nasal CPAP group, 48% were managed without intubation and 54% without surfactant treatment. A recent meta-analysis demonstrated that prophylactic surfactant (with rapid extubation to CPAP) was associated with a higher risk of death or BPD (RR 1.12; 95% CI 1.02–1.24; number needed to harm of 17) when compared with early stabilization with CPAP and selective surfactant administration.[5] In infants with birth weight ≥1250 g and mild to moderate RDS, elective intubation and administration of surfactant decreased the need for mechanical ventilation but had no effect on the duration of oxygen therapy, ventilator therapy, or hospital stay.[16]

ANIMAL-DERIVED VERSUS SYNTHETIC SURFACTANT

A wide variety of animal-derived and synthetic surfactants are available commercially (Table 2); both are beneficial as therapy for RDS in preterm infants. Animal-derived surfactants are modified or purified from bovine or porcine lungs. Treatment with animal-derived surfactants (beractant [Survanta; Abbvie Inc, North Chicago, IL], calfactant [Infasurf; ONY Inc, Amherst, NY], and poractant [Curosurf; Chiesi Farmaceutici, Parma, Italy]) has several advantages over first-generation, protein-free synthetic surfactants (eg, colfosceril palmitate [Exosurf; GlaxoSmithKline, Middlesex, UK]).[3] These include lower mortality rates (RR 0.86; 95% CI 0.76–0.98; number needed to harm of 40) and fewer pneumothoraces (RR 0.63; 95% CI 0.53–0.75; NNTB 22).[4] Animal-derived surfactants contain variable amounts of surfactant protein B (SP-B). SP-B enhances the rate of adsorption of phospholipids at the air-water interface, is involved in the formation of tubular myelin, and has antiinflammatory properties. However, it is unclear whether significant differences in clinical outcomes exist among the available animal-derived products.

A synthetic surfactant (lucinactant) that contains a 21-amino acid peptide that mimics SP-B activity has recently been approved for the prevention and treatment of RDS in preterm infants.[18,19] When compared with animal-derived surfactant (beractant or poractant), lucinactant was shown to be equivalent.[18,19] Neonatal morbidities (intraventricular hemorrhage, periventricular leukomalacia, pulmonary hemorrhage, sepsis, patent ductus arteriosus, retinopathy of prematurity, necrotizing enterocolitis, and BPD) were not significantly different between preterm infants treated with animal-derived surfactants and those treated with synthetic surfactants.

SURFACTANT ADMINISTRATION

Surfactant administration strategies have been based on manufacturer guidelines for individual surfactants.[1] The dose of surfactant, frequency of administration, and treatment procedures have been modeled after research protocols. Furthermore, repeated doses of surfactants given at intervals for predetermined indications have decreased mortality and morbidity compared with placebo or single surfactant doses.[10] However, given the long half-life for surfactant in preterm infants with RDS,[20] redosing should not be needed more often than every 12 hours, unless surfactant is being inactivated by an infectious process, meconium, or blood. Dosing intervals shorter than 12 hours recommended by some manufacturers are not based on human pharmacokinetic data.

TABLE 2 Composition and Dosage of Surfactants[17]

Surfactant	Main Phospholipids	Proteins	Phospholipid Concentration	Suggested Dose	Phospholipid per Dose
Animal-derived					
Beractant (Survanta[a]) minced bovine lung extract	DPPC and PG	(<0.1%) SP-B and (1%) SP-C	25 mg/mL	4 mL/kg	100 mg/kg
Calfactant (Infasurf[b]) bovine calf lung lavage	DPPC and PG	(0.7%) SP-B and (1%) SP-C	35 mg/mL	3 mL/kg	105 mg/kg
Poractant (Curosurf[c]) minced porcine lung extract	DPPC and PG	(0.6%)SP-B and (1%) SP-C	80 mg/mL	2.5 mL/kg and	100-200 mg/kg
				1.25 mL/kg	100 mg/kg
Synthetic					
Colfosceril (Exosurf[d])	DPPC (100%)	None	13.5 mg/mL	5 mL/kg	67.5 mg/kg
Synthetic, protein analog					
Lucinactant (Surfaxin[e])	DPPC and POPG	KL4 peptide as SP-B	30 mg/mL	5.8 mL/kg	175 mg/kg

DPPC, dipalmitoyl phosphatidylcholine; PG, phosphatidylglycerol; POPG, palmitoyloleyl phosphatidylglycerol; SP-C, surfactant protein C.
[a] Abbvie Inc, North Chicago, IL.
[b] ONY Inc, Amherst, NY.
[c] Chiesi Farmaceutici, Parma, Italy.
[d] GlaxoSmithKline, Middlesex, UK.
[e] Discovery Laboratories, Warrington, PA.

Surfactant administration procedures may be complicated by transient airway obstruction, oxygen desaturation, bradycardia, and alterations in cerebral blood flow and brain electrical activity. The delivery of surfactant can also result in rapid improvement in lung volume, functional residual capacity, and compliance. Thus, expeditious changes in mechanical ventilator settings may be necessary to minimize the risks of lung injury and air leak. Clinicians with expertise in these procedures should be responsible for surfactant administration whenever surfactant is given.

Surfactant has traditionally been administered through an endotracheal tube either as bolus, in smaller aliquots,[21] or by infusion through an adaptor port on the proximal end of the endotracheal tube.[19] In an animal model, administration of surfactant as an intratracheal bolus while disconnected from the mechanical ventilator resulted in more uniform distribution than an infusion administered over 30 minutes through a side-hole adapter.[22] However, a small clinical trial of human preterm infants showed no significant differences in clinical outcomes between methods.[23] During surfactant administration, reflux into the endotracheal tube occurred more often when the infusion technique was used. Similar clinical outcomes were also found when surfactant was administered as a bolus or as a 1-minute infusion through a side-hole adapter.[24] Because data are conflicting and limited, the optimal method of surfactant administration in preterm infants has yet to be clearly proven. Additionally, there is insufficient evidence to recommend the optimal number of fractional doses of surfactant or what body position is best when surfactant is administered.

A number of alternatives to intratracheal administration of surfactant have been evaluated in clinical trials.[25–32] These include use of aerosolized surfactant preparations, laryngeal mask airway-aided delivery of surfactant, instillation of pharyngeal surfactant, and administration of surfactant using thin intratracheal catheters. Theoretically, each of these methods could allow administration of surfactant without intubation in spontaneously breathing infants. In a recent study, Göpel et al[25] randomized 220 preterm infants born at 26 to 28 weeks' gestation to receive either surfactant administered via a thin plastic catheter (using laryngoscopy) or surfactant administered as a rescue therapy. All infants were maintained on CPAP. The administration of surfactant through a thin plastic catheter significantly reduced the need for mechanical ventilation and decreased the need for oxygen therapy at 28 days. More data are needed to recommend any of the alternative techniques for surfactant administration.

SURFACTANT REPLACEMENT THERAPY FOR RESPIRATORY DISORDERS OTHER THAN RDS

Surfactant inactivation and secondary dysfunction may occur with conditions such as meconium aspiration syndrome, persistent pulmonary hypertension of the newborn, neonatal pneumonia, and pulmonary hemorrhage.[33,34] Surfactant administration techniques, surfactant dosage, patient populations, entry criteria, and study outcomes in the small randomized trials and case series of surfactant replacement in neonates with secondary surfactant deficiency vary considerably.[35–42]

Meconium aspiration syndrome with severe respiratory failure and persistent pulmonary hypertension may be complicated by surfactant inactivation. Surfactant replacement by bolus or slow infusion in infants with severe

meconium aspiration syndrome improved oxygenation and reduced the need for extracorporeal membrane oxygenation (ECMO) (RR 0.64; 95% CI 0.46–0.91; NNTB 6).[35] Surfactant did not reduce mortality or decrease the frequency of air leaks (pneumothoraces or pulmonary interstitial emphysema). In a blinded randomized clinical trial of infants receiving ECMO, administration of surfactant shortened the duration of the ECMO. Notably, there were no infants with congenital diaphragmatic hernia in that study.[36]

Surfactant inactivation may be associated with pneumonia.[37,38] In a small randomized trial of surfactant rescue therapy, the subgroup of infants with sepsis showed improved oxygenation and a reduced need for ECMO compared with a similar group of control infants.[37] Newborn infants with pneumonia or sepsis receiving rescue surfactant also demonstrated improved gas exchange compared with infants without surfactant treatment. The number of neonates who received surfactant for sepsis and pneumonia in these clinical reports is small, and no recommendation can be made.

Surfactant treatment of pulmonary hemorrhage is plausible, because blood inhibits surfactant function. However, only a few retrospective and observational reports have documented the benefits of such therapy, and the magnitude of benefit remains to be established.[39]

Congenital diaphragmatic hernia may be associated with surfactant insufficiency.[40] Although measurements of disaturated phosphatidylcholine from lungs of infants with congenital diaphragmatic hernia show synthetic rates similar to those from infants without diaphragmatic hernia, pool sizes and kinetics are altered.[40] However, surfactant treatment of a large series of infants with congenital diaphragmatic hernia did not improve outcomes. In fact, the need for ECMO, the incidence of chronic lung disease, and mortality rate were increased with surfactant administration.[41,42]

ANTENATAL STEROIDS AND SURFACTANT REPLACEMENT

Surfactant trials that proved efficacy were performed at a time when antenatal steroid therapy was given infrequently.[43] By the late 1990s, most mothers of preterm infants born at less than 30 weeks' gestation had received antenatal steroids (58% to 92%).[44–46] Antenatal steroids significantly reduce mortality (RR 0.62; 95% CI 0.51–0.77; NNTB 23), RDS (RR 0.65; 95% CI 0.47–0.75; NNTB 12), and surfactant use in preterm infants (RR 0.45; 95% CI 0.22–0.93; NNTB 9),[47] most consistently in those born between 28 and 34 weeks' gestation.

Results of observational studies and clinical trials have inferred that antenatal steroids may reduce the need for prophylactic and early rescue surfactant replacement in infants born after 27 to 28 weeks' gestation,[16,48] but no randomized, controlled trials have addressed this issue. In infants born at or earlier than 27 weeks' gestation, the incidence of RDS is not reduced after exposure to antenatal steroids; however, in a recently published study, death or neurodevelopment impairment at 18 to 22 months was significantly lower for infants who had been exposed to antenatal steroids at 23 to 25 weeks' gestation.[49] Infants born before 32 weeks' gestation who received both antenatal steroids and postnatal surfactant were found on subgroup analyses to have significant reductions in mortality, severity of respiratory distress, and air leaks when compared with subgroups that received neither steroids nor surfactant, antenatal steroids only, or surfactant only.[50–52] This finding corroborates evidence from animal models of RDS that the combination of antenatal steroids and postnatal surfactant improves lung function more than either treatment alone.[53–55]

An important additional benefit of antenatal steroids is a reduction in risk of intraventricular hemorrhage, an advantage not found with surfactant replacement alone.[56] The effects of antenatal steroids on other neonatal morbidities, such as necrotizing enterocolitis and patent ductus arteriosus, have been inconsistent. However, antenatal steroids have not significantly decreased the incidence of BPD.[50,51]

CPAP AND SURFACTANT

Randomized clinical trials suggest that nasal CPAP is acceptable as an alternative to surfactant administration in preterm infants with RDS. A clinical report from the American Academy of Pediatrics, "Respiratory Support of the Preterm Infant," is forthcoming.[57]

TABLE 3 Levels of Evidence[59]

Recommendation LOE	LOE	Grade of Recommendation
Preterm infants born at <30 wk of gestation who need mechanical ventilation because of severe RDS should be given surfactant after initial stabilization.	1	Strong Recommendation
Using CPAP immediately after birth with subsequent selective surfactant administration should be considered as an alternative to routine intubation with prophylactic or early surfactant administration in preterm infants.	1	Strong Recommendation
Rescue surfactant may be considered for infants with hypoxic respiratory failure attributable to secondary surfactant deficiency (eg, meconium aspiration syndrome or sepsis/pneumonia).	2	Recommendation

SUMMARY OF SCIENCE

1. Surfactant replacement, given as prophylaxis or rescue treatment, reduces the incidence of RDS, air leaks, and mortality in preterm infants with RDS (level of evidence [LOE] 1).
2. Both animal-derived and newer synthetic surfactants with SP-B–like activity decrease acute respiratory morbidity and mortality in preterm infants with RDS (LOE 1).
3. Early rescue surfactant treatment (<2 hours of age) in infants with RDS decreases the risk of mortality, air leak, and chronic lung disease in preterm infants (LOE 1).
4. Early initiation of CPAP with subsequent selective surfactant administration in extremely preterm infants results in lower rates of BPD/death when compared with treatment with prophylactic surfactant therapy (LOE 1).
5. Surfactant replacement has not been shown to affect the incidence of neurologic, developmental, behavioral, medical, or educational outcomes in preterm infants (LOE 2).
6. Surfactant treatment improves oxygenation and reduces the need for ECMO without an increase in morbidity in neonates with meconium aspiration syndrome (LOE 2).
7. Surfactant treatment of infants with congenital diaphragmatic hernia does not improve clinical outcomes (LOE 2).
8. Antenatal steroids and postnatal surfactant replacement independently and additively reduce mortality, the severity of RDS, and air leaks in preterm infants (LOE 2).

CLINICAL IMPLICATIONS (TABLE 3)

1. Preterm infants born at <30 weeks' gestation who need mechanical ventilation because of severe RDS should be given surfactant after initial stabilization (Strong Recommendation).
2. Using CPAP immediately after birth with subsequent selective surfactant administration should be considered as an alternative to routine intubation with prophylactic or early surfactant administration in preterm infants (Strong Recommendation).
3. Rescue surfactant may be considered for infants with hypoxic respiratory failure attributable to secondary surfactant deficiency (eg, pulmonary hemorrhage, meconium aspiration syndrome, or sepsis/pneumonia) (Recommendation).
4. Preterm and term neonates who are receiving surfactant should be managed by nursery and transport personnel with the technical and clinical expertise to administer surfactant safely and deal with multisystem illness. Therefore, pediatric providers who are without expertise, or who are inexperienced or uncomfortable with surfactant administration or managing an infant who has received surfactant should wait for the transport team to arrive.

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DISCLOSURES

Dr Carlo is on the Mednax Board of Directors. Dr Polin is a consultant for Discovery Laboratories.

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The Transfer of Drugs and Therapeutics Into Human Breast Milk: An Update on Selected Topics

• *Clinical Report*

CLINICAL REPORT

The Transfer of Drugs and Therapeutics Into Human Breast Milk: An Update on Selected Topics

abstract

FREE

Many mothers are inappropriately advised to discontinue breastfeeding or avoid taking essential medications because of fears of adverse effects on their infants. This cautious approach may be unnecessary in many cases, because only a small proportion of medications are contraindicated in breastfeeding mothers or associated with adverse effects on their infants. Information to inform physicians about the extent of excretion for a particular drug into human milk is needed but may not be available. Previous statements on this topic from the American Academy of Pediatrics provided physicians with data concerning the known excretion of specific medications into breast milk. More current and comprehensive information is now available on the Internet, as well as an application for mobile devices, at LactMed (http://toxnet.nlm.nih.gov). Therefore, with the exception of radioactive compounds requiring temporary cessation of breastfeeding, the reader will be referred to LactMed to obtain the most current data on an individual medication. This report discusses several topics of interest surrounding lactation, such as the use of psychotropic therapies, drugs to treat substance abuse, narcotics, galactagogues, and herbal products, as well as immunization of breastfeeding women. A discussion regarding the global implications of maternal medications and lactation in the developing world is beyond the scope of this report. The World Health Organization offers several programs and resources that address the importance of breastfeeding (see http://www.who.int/topics/breastfeeding/en/). *Pediatrics* 2013;132:e796–e809

Hari Cheryl Sachs, MD, FAAP* and COMMITTEE ON DRUGS

KEY WORD
human milk

ABBREVIATIONS
AAP—American Academy of Pediatrics
FDA—Food and Drug Administration
HBV—hepatitis B vaccine
HPV—human papillomavirus vaccine
NSAID—nonsteroidal antiinflammatory drug

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

*The recommendations in this review are those of the authors and do not represent the views of the US Food and Drug Administration.

INTRODUCTION

Lactating women can be exposed to medications or other therapeutics, either on a limited or long-term basis, depending on the need to treat acute or chronic conditions. Many women are advised to discontinue nursing or avoid taking necessary medications because of concerns about possible adverse effects in their infants.[1] Such advice is often not based on evidence, because information about the extent of drug excretion into human milk may be unavailable, and for many drugs, information is limited to data from animal studies, which may not correlate with human experience. In addition, not all drugs are excreted in clinically significant amounts into human milk, and the presence of a drug in human milk may not pose a risk for the infant. To weigh the risks and benefits of breastfeeding, physicians need to consider multiple factors. These factors include the need for the drug by the mother, the potential effects of

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the drug on milk production, the amount of the drug excreted into human milk, the extent of oral absorption by the breastfeeding infant, and potential adverse effects on the breastfeeding infant. The age of the infant is also an important factor in the decision-making process, because adverse events associated with drug exposure via lactation occur most often in neonates younger than 2 months and rarely in infants older than 6 months.[2] In the near future, pharmacogenetics may also provide important guidance for individualized decisions.

In large part because of efforts by Cheston Berlin, Jr, MD, a statement by the American Academy of Pediatrics (AAP) on the transfer of drugs and chemicals into human milk was first published in 1983[3] and underwent several subsequent revisions,[4,5] the most recent of which was published in 2001.[6] Previous editions were intended to list drugs potentially used during lactation and to describe possible effects on the infant and/or on lactation. Revisions for the statement can no longer keep pace with the rapidly changing information available via the Internet, published studies, and new drug approvals. A more comprehensive and current database is available at LactMed (http://toxnet.nlm.nih.gov). LactMed includes up-to-date information on drug levels in human milk and infant serum, possible adverse effects on breastfeeding infants, potential effects on lactation, and recommendations for possible alternative drugs to consider. Common herbal products are also included. For this reason, with the exception of radioactive compounds that require temporary or permanent cessation of breastfeeding, the reader will be referred to LactMed to obtain the most current data on an individual medication.

This statement reviews proposed changes in US Food and Drug Administration (FDA) labeling that are designed to provide useful information to the physician and to outline general

LactMed is part of the National Library of Medicine's Toxicology Data Network (TOXNET)

Each record includes the following information:

- Generic name: refers to US-adopted name of active portion of the drug
- Scientific name: genus and species of botanical products (when applicable)
- Summary of use during lactation (includes discussion of conflicting recommendations and citations)
- Drug levels
  - Maternal levels: based on studies that measure concentration in breast milk; includes relative infant dose (weight-adjusted percentage of maternal dose) when possible
  - Infant levels: serum or urine concentrations from the literature
- Effects in breastfed infants: adverse events with Naranjo* assessment of causality (definite, probably, possibly, unlikely)
- Possible effects on lactation: if known, including effects on infants that may interfere with nursing (eg, sedation)
- Alternative drugs to consider: may not be comprehensive
- References
- Chemical Abstracts Service Registry Number
- Drug class
- LactMed record number
- Last revision date

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* The Naranjo probability scale is a method used to estimate the probability that an adverse event is caused by a drug.[7]

considerations for individual risk/benefit counseling. An update regarding the use of antidepressants, anxiolytics, and antipsychotics in the lactating woman is also provided, because the use of psychotropic agents during lactation is still debated. Since publication of the last statement, numerous questions have been raised regarding the use of methadone in the lactating woman. For this reason, therapies for substance abuse and smoking cessation are discussed. Given the finding that codeine use may be associated with toxicity in patients, including neonates with ultrarapid metabolism, a brief review of alternative agents to treat pain in the lactating woman is provided. The use of galactagogues is also reviewed because more women now endeavor to breastfeed adopted infants or preterm neonates. The increasing use of herbal products has invited a discussion of the merits of these alternative therapies in the nursing woman. Finally, immunization of breastfeeding women and their infants will be reviewed to assist pediatricians in encouraging immunization when needed in lactating women and addressing parental reluctance to immunize breastfed infants.

GENERAL CONSIDERATIONS

Several factors should be considered when advising a woman regarding a decision to breastfeed her infant while she is on drug therapy. The benefits of breastfeeding for both the infant and mother need to be weighed against the risks of drug exposure to the infant (or to the mother, in the case of agents intended to induce lactation). Many factors affect the individual risk/benefit decision, including specific information about chemical and pharmacologic properties of the drug, which may be available from resources such as LactMed and in product labeling. In general, chemical properties of a drug, such as lack of ionization, small molecular weight, low volume of distribution, low maternal serum protein binding, and high lipid solubility, facilitate drug excretion into human milk. Drugs with long half-lives are more likely to accumulate in human milk, and drugs with high oral bioavailability are more easily absorbed by the infant.[8] The adverse event profile of the drug is another property that affects the individual risk/benefit ratio. Use of a drug with a significant adverse effect in a lactating woman (such as an arrhythmia) may be acceptable to treat a serious illness in the mother; however, use of the same drug to increase milk production would not be acceptable. For drugs with an adverse event profile that correlates with increasing dosage, higher maternal doses may be associated with greater neonatal toxicity. In addition, the timing of exposure and the duration of therapy are other important considerations. A decision to breastfeed when continuing treatment with an agent for which in utero exposure also has occurred differs from a decision to initiate a novel therapy in the early postpartum period. Similarly, the risks of a single-dose therapy or short-term treatment may differ from those of a chronic therapy.

In addition to pharmacokinetic or chemical properties of the drug, the infant's expected drug exposure is influenced by infant and maternal factors beyond basic known pharmacokinetic and chemical properties of the drug itself. For example, the risk of adverse reactions in a preterm infant or an infant with underlying chronic medical conditions may be higher than that for a more mature or healthier infant. Certain drugs may accumulate in the breastfed infant because of reduced clearance or immaturity of metabolic pathways. However, for other drugs (eg, acetaminophen), the immaturity of these same pathways may protect an infant from toxic drug metabolites. Similarly, patients with specific genotypes may experience drug toxicity, as evidenced by fatalities observed in individuals who demonstrate ultrarapid metabolism of codeine.[9] Finally, certain infant conditions, such as metabolic diseases, and maternal health conditions may preclude nursing (eg, HIV) or require multiple therapies that are particularly toxic (eg, cancer treatment).

CHANGES IN DRUG LABELING

In the past, the lactation section in FDA-approved labeling was often limited to statements that advise caution or contain an admonition to discontinue breastfeeding or discontinue therapy, depending on the importance to the mother. In 2008, the FDA published a proposed revision to the regulations, which affects the pregnancy and lactation sections of labeling. The agency is currently working on the final rule, which is intended to provide a clinically oriented framework for placement of pregnancy and lactation information into drug labeling and to permit the patient and physician to explore the risk/benefit on the basis of the best available data. Under the proposed rule, the current Nursing Mothers section is replaced by a section called Lactation. The Lactation section of labeling will contain 3 subsections: Risk Summary, Clinical Considerations, and Data. The Risk Summary section will include a summary of what is known about the excretion of the drug into human milk and potential effects on the breastfed infant, as well as maternal milk production. The Clinical Considerations section will include methods to minimize exposure of the breastfed infant to the drug when applicable, as well as information about monitoring for

expected adverse drug effects on the infant. The Data component will provide a detailed overview of the existing data that forms the evidence base for the other 2 sections.

In addition to the proposed rule, the FDA published "Guidance for Industry: Clinical Lactation Studies: Study Design, Data Analysis, and Recommendations for Labeling."[10]

Along with outlining recommendations regarding lactation study design as well as the timing and indications for these studies, this draft guidance includes advice on parameters (several of which are used in LactMed) that can be used to inform physicians about the extent of drug exposure. Using these parameters, drug exposure to the infant may be measured directly in infant serum or estimated on the basis of pharmacokinetic parameters. These estimates of infant exposure (for example, relative infant dose) can be expressed as a percent of weight-adjusted maternal or, when known, weight-adjusted pediatric dose.

ESTIMATES OF DRUG EXPOSURE

Daily Infant Dosage (mg/day)=

$\sum$(drug concentration in each milk collection × expreesed volume in each milk collection)

OR

C_{milk}[average drug concentration in milk(mg/mL)] × V_{milk}(volume in mL of milk ingested in 24 hours)

Note: V_{milk} is typically estimated to be 150 mL/kg/day

Relative Infant Dose

% Maternal Dose= [Daily Infant Dosage (mg/kg/day) ÷ Maternal Dose (mg/kg/day)] × 100

% Infant or Pediatric Dose= [Daily Infant Dosage (mg/kg/day) ÷ Infant or Pediatric dose(mg/kg/day)] × 100

ANTIDEPRESSANTS, ANXIOLYTICS, AND ANTIPSYCHOTICS

Previous statements from the AAP categorized the effect of psychoactive drugs on the nursing infant as "unknown but may be of concern." Although new data have been published since 2001, information on the long-term effects of these compounds is still limited. Most publications regarding psychoactive drugs describe the pharmacokinetics in small numbers of lactating women with short-term observational studies of their infants. In addition, interpretation of the effects on the infant from the small number of longer-term studies is confounded by prenatal treatment or exposure to multiple therapies. For these reasons, the long-term effect on the developing infant is still largely unknown.[11,12]

Many antianxiety drugs, antidepressants, and mood stabilizers appear in low concentrations in human milk, with estimated relative infant doses less than 2% of weight-adjusted maternal dose and/or milk-plasma ratios less than 1.[13] However, the percentage of maternal doses that approach clinically significant levels (10% or more) have been reported for bupropion,[14] diazepam,[13] fluoxetine,[15] citalopram,[16] lithium,[17] lamotrigine,[18] and venlafaxine.[19] Data on drug excretion in human milk are not available for up to one-third of psychoactive therapies.[13]

Because of the long half-life of some of these compounds and/or their metabolites, coupled with an infant's immature hepatic and renal function, nursing infants may have measurable amounts of the drug or its metabolites in plasma and potentially in neural tissue. Infant plasma concentrations that exceed 10% of therapeutic maternal plasma concentrations have been reported for a number of selective serotonin reuptake inhibitors, antipsychotics, anxiolytics, and mood stabilizers (see Table 1).

TABLE 1 Psychoactive Drugs With Infant Serum Concentrations Exceeding 10% of Maternal Plasma Concentrations[a]

Agent	Reference
Citalopram	Weissman 2004[20]
Clomipramine	Schimmell 1991[21]
Diazepam	Wesson 1985[22]
Doxepin	Moretti 2009[16]
Fluoxetine	Weissman 2004,[20] product labeling
Fluvoxamine	Weissman 2004[20]
Lamotrigine	Newport 2008,[18] Fotopoulou 2009[23]
Lithium	Viguerra 2007,[24] Grandjean 2009,[25] Bogen 2012[26]
Mirtazapine	Tonn 2009[27]
Nortriptyline	Weissman 2004[20]
Olanzapine	Whitworth 2008[28]
Sertraline	Hendrick 2001,[29] Stowe 2003[30]
Venlafaxine	Newport 2009[19]

[a] Based on individual maternal-infant pair(s); may include active metabolites.

Mothers who desire to breastfeed their infant(s) while taking these agents should be counseled about the benefits of breastfeeding as well as the potential risk that the infant may be exposed to clinically significant levels and that the long-term effects of this exposure are unknown. Consideration should be given to monitoring growth and neurodevelopment of the infant.

DRUGS FOR SMOKING CESSATION OR TO TREAT SUBSTANCE ABUSE/ ALCOHOL DEPENDENCE

Although many women are appropriately advised to refrain from smoking, drinking, and using recreational drugs during and after pregnancy, in part because of adverse effects on their infants (see Table 2), some are unable to do so and may seek assistance after delivery. Maternal smoking is not an absolute contraindication to breastfeeding.[31] Nonetheless, for multiple reasons, including the association of sudden infant death syndrome with

TABLE 2 Drugs of Abuse for Which Adverse Effects on the Breastfeeding Infant Have Been Reported[a]

Drug	Reported Effect or Reason for Concern	Reference
Alcohol	Impaired motor development or postnatal growth, decreased milk consumption, sleep disturbances.	Koren 2002,[34] Backstrand 2004,[35] Mennella 2007[36]
	Note: Although binge drinking should be avoided, occasional, limited ingestion (0.5 g of alcohol/kg/d; equivalent to 8 oz wine or 2 cans of beer per day) may be acceptable.	National Academy of Sciences 1991[37]
Amphetamines	Hypertension, tachycardia, and seizures.	Product labeling
	In animal studies of postnatal exposure, long-term behavioral effects, including learning and memory deficits and altered locomotor activity, were observed.	
Benzodiazepines	Accumulation of metabolite, prolonged half-life in neonate or preterm infant is noted; chronic use not recommended.	Jain 2005,[38] Malone 2004[39]
	Apnea, cyanosis, withdrawal, sedation, cyanosis, and seizures.	
Cocaine	Intoxication, seizures, irritability, vomiting, diarrhea, tremulousness.	Chasnoff 1987,[40] Winecker 2001[41]
Heroin	Withdrawal symptoms, tremors, restlessness, vomiting, poor feeding.	vandeVelde 2007[42]
LSD	Potent hallucinogen.	
Methamphetamine	Fatality, persists in breast milk for 48 h.	Ariagno 1995,[43] Bartu 2009[44]
Methylene dioxy-methamphetamine (ecstasy)	Closely related products (amphetamines) are concentrated in human milk.	
Marijuana (cannabis)	Neurodevelopmental effects, delayed motor development at 1 y, lethargy, less frequent and shorter feedings, high milk-plasma ratios in heavy users.	Djulus 2005,[45] Campolongo 2009,[46] Garry 2010[47]
Phencyclidine	Potent hallucinogen, infant intoxication.	AAP 2001,[6] Academy of Breastfeeding Medicine[48]

[a] Effect on maternal judgment or mood may affect ability to care for infant.

tobacco exposure,[32,33] lactating women should be strongly encouraged to stop smoking and to minimize secondhand exposure. Exposure to alcohol or recreational drugs may impair a mother's judgment and interfere with her care of the infant and can cause toxicity to the breastfeeding infant (see Table 2).

Limited information is available regarding the use of medications in lactating women to treat substance abuse or alcohol dependence or for smoking cessation. However, the presence of behaviors, such as continued ingestion of illicit drugs or alcohol, and underlying conditions, such as HIV infection, are not compatible with breastfeeding.[49,50] Patients also require ongoing psychosocial support to maintain abstinence.[48]

Methadone, buprenorphine, and naltrexone are 3 agents approved by the FDA for use in the treatment of opioid dependence. Continued breastfeeding by women undergoing such treatment presumes that the patient remains abstinent, is HIV negative, and is enrolled in and closely monitored by an appropriate drug treatment program with significant social support.[48,51]

Potential adverse effects on breastfeeding infants from methadone (according to product labeling) and buprenorphine include lethargy, respiratory difficulty, and poor weight gain.[52] The long-term effects of methadone in humans are unknown. Nonetheless, methadone levels in human milk are low, with calculated infant exposures less than 3% of the maternal weight-adjusted dose.[53,54] Plasma concentrations in infants are also low (less than 3% of maternal trough concentrations) during the neonatal period and up to 6 months postpartum.[55,56] For these reasons, guidelines from the Academy of Breastfeeding Medicine encourage breastfeeding for women treated with methadone who are enrolled in methadone-maintenance programs.[48]

Buprenorphine is excreted into human milk and achieves a level similar to that in maternal plasma.[57] Infant exposure appears to be up to 2.4% of the maternal weight-adjusted dose.[55,56,58] However, buprenorphine can be abused, and although the significance in humans is unknown, labeling for buprenorphine and buprenorphine/naloxone combinations states that use is not advised by lactating women, because animal lactation studies have shown decreased milk production and viability of the offspring. FDA labeling also advises caution for use of naltrexone in nursing infants of opioid-dependent women. Of note, published information on naltrexone is limited to 1 case report that estimates infant exposure to be low (7 μg/kg/d, or 0.86% of the maternal weight-adjusted dose).[59]

Transferred amounts of methadone or buprenorphine are insufficient to prevent symptoms of neonatal abstinence syndrome.[49,60] Neonatal abstinence syndrome can occur after abrupt discontinuation of methadone.[51,61] Thus, breastfeeding should not be stopped abruptly, and gradual

weaning is advised if a decision is made to discontinue breastfeeding.

Limited information is available for disulfiram and naltrexone, agents that are used to treat alcohol dependence. As noted previously, a low relative infant dose (<1%) was observed in a single case report of naltrexone exposure in a 6-week-old breastfed infant.[59] FDA labeling discourages use of disulfiram and both the injectable and oral form of naltrexone in lactating women.

Only one-third of women successfully discontinue smoking without pharmacologic aids.[62] Nicotine replacement therapy, bupropion, and varenicline are agents indicated for use as aids to smoking cessation treatment. Nicotine replacement therapy is compatible with breastfeeding as long as the dose (assuming a cigarette delivers ~1 mg of nicotine) is less than the number of cigarettes typically smoked, because nicotine passes freely into human milk and is orally absorbed as nicotine. Cotinine concentrations are lower than those related to tobacco use. Short-acting products (eg, gum or lozenges) are recommended.[62] Infant exposure decreases proportionally with maternal patch doses.[63]

In contrast, bupropion is excreted into human milk with exposures that may exceed 10% (range, 1.4%–10.6%) of the maternal dose.[14] Although infant levels were not measured, there is a case report of a seizure in a 6-month-old breastfed infant potentially related to bupropion.[64] Limited published information is available for varenicline, but the varenicline label includes a boxed warning for serious neuropsychiatric adverse events, including suicidal ideation or behavior. FDA labeling discourages use of both these agents in lactating women.

PAIN MEDICATIONS

Rarely, normal doses of codeine given to lactating women may result in dangerously high levels of its active metabolite morphine in breastfeeding infants. A fatality has been noted in an infant of a mother with ultrarapid metabolism.[65] In this infant, the postmortem level of morphine (87 ng/mL) greatly exceeded a typical level in a breastfeeding infant (2.2 ng/mL), as well as the therapeutic range for neonates (10–12 ng/mL). In addition, unexplained apnea, bradycardia, cyanosis, and sedation have been reported in nursing infants of mothers receiving codeine.[2,66] Hydrocodone is also metabolized via the CYP2D6 pathway. On the basis of pharmacokinetic data, infants exposed to hydrocodone through human milk may receive up to 9% of the relative maternal dose.[67] Given the reduced clearance of hydrocodone in neonates and the adverse events observed in ultrarapid metabolizers of codeine, caution is advised for use of codeine and hydrocodone in both the mother and nursing infant. Close monitoring for signs and symptoms of neonatal as well as maternal toxicity is recommended. A commercial test to identify ultrarapid metabolizers is not yet widely available. The incidence of this specific CYP2D6 genotype varies with racial and ethnic group as follows: Chinese, Japanese, or Hispanic, 0.5% to 1.0%; Caucasian, 1.0% to 10.0%; African American, 3.0%; and North African, Ethiopian, and Saudi Arabian, 16.0% to 28.0%.[68]

For these reasons, when narcotic agents are needed to treat pain in the breastfeeding woman, agents other than codeine (eg, butorphanol, morphine, or hydromorphone) are preferred. Clinically insignificant levels of butorphanol are excreted into human milk. Morphine appears to be tolerated by the breastfeeding infant, although there is 1 case report of an infant with plasma concentrations within the therapeutic range.[69] Clearance of morphine is decreased in infants younger than 1 month and approaches 80% of adult values by 6 months of age.[70] Limited data suggest that use of hydromorphone for brief periods may be compatible with breastfeeding[71,72]; however, FDA labeling discourages use. Regardless of the choice of therapy, to minimize adverse events for both the mother and her nursing infant, the lowest dose and shortest duration of therapy should be prescribed. Drug delivery via patient-controlled anesthesia or administration by the epidural route may also minimize infant exposure.

Other narcotic agents, such as oxycodone, pentazocine, propoxyphene, and meperidine, are not recommended in the lactating mother. Relatively high amounts of oxycodone are excreted into human milk, and therapeutic concentrations have been detected in the plasma of a nursing infant.[73] Central nervous system depression was noted in 20% of infants exposed to oxycodone during breastfeeding.[74] Thus, use of oxycodone should be discouraged. Limited published data are available about pentazocine. However, respiratory depression and apnea occur frequently in infants, particularly in neonates or in preterm infants, who are treated with pentazocine. Propoxyphene has been associated with unexplained apnea, bradycardia, and cyanosis, as well as hypotonia in nursing infants.[75,76] Moreover, propoxyphene was withdrawn from the market because significant QT prolongation occurred at therapeutic doses.[77] Meperidine use is associated with decreased alertness of the infant and is likely to interfere with breastfeeding.[71] Although estimates of meperidine exposure are low (approximately 2% to 3% of the maternal weight-adjusted dose), the half-life of the active metabolite for meperidine is prolonged, and it may accumulate in infant blood or tissue.[71,72]

When narcotics are not required to relieve mild to moderate pain, other analgesic agents can be used. Presuming that pain relief is adequate, short-acting agents, such as ibuprofen and acetaminophen, are acceptable.[78] Although the half-life of ibuprofen may be prolonged in neonates, particularly in preterm infants (according to product labeling), minimal amounts of ibuprofen are excreted into human milk.[72] Despite reduced clearance of acetaminophen,[79] hepatotoxicity is less common in neonates than in older infants, in part because of low levels of certain cytochrome P-450 enzymes, which convert acetaminophen into toxic metabolites.[80] Acetaminophen is available for both oral and intravenous administration.

Although all nonsteroidal antiinflammatory drugs (NSAIDs) carry a boxed warning regarding gastrointestinal bleeding and potential long-term cardiac toxicity, according to their product labeling and Gardiner et al,[81] celecoxib, flurbiprofen, and naproxen are considered to be compatible with breastfeeding, because less than 1% is excreted into human milk. In addition, a breastfeeding infant would receive less than 1% of the relative pediatric dose of celecoxib prescribed for a 2-year-old (according to product labeling). However, long-term use of naproxen is not recommended because of the drug's long half-life and case reports of gastrointestinal tract bleeding and emesis. Avoiding NSAIDs in breastfeeding infants with ductal-dependent cardiac lesions may be prudent.

Limited published data on other NSAIDs (etodolac, fenoprofen, meloxicam, oxaprozin, piroxicam, sulindac, and tolmetin) are available, and FDA labeling discourages their use for a variety of reasons. Although the implications for humans are unknown, meloxicam concentrations in milk of lactating animals exceed plasma concentrations. Diflunisal has a long half-life and is not recommended because of potential adverse events, including cataracts and fatality, in neonatal animals. Similarly, mefenamic acid has a prolonged half-life in preterm infants. Injectable and oral forms of ketorolac are contraindicated in nursing women, according to product labeling, because of potential adverse effects related to closure of the ductus arteriosus in neonates. Less than 1% of ketorolac nasal spray is excreted into human milk, and unlike the oral and intravenous forms of ketorolac, use is not contraindicated (product labeling).

Carisoprodol and its active metabolite, meprobamate, are concentrated in human milk (2–4 times maternal plasma concentrations). Impaired milk production has been observed, and animal studies suggest maternal use may lead to less effective infant feeding (because of sedation) and/or decreased milk production (according to product labeling).

Low doses (75–162 mg/d) of aspirin may be acceptable[82]; however, use of high-dose aspirin therapy during breastfeeding is not advised, because the serum concentration of salicylate in breastfeeding infants has been reported to reach approximately 40% of therapeutic concentrations. Adverse events, such as rash, platelet abnormalities, bleeding, and metabolic acidosis have also been reported.[71]

GALACTAGOGUES

Galactagogues, or agents to stimulate lactation, are often used to facilitate lactation, particularly for mothers of preterm infants. They also may be used to induce lactation in an adoptive mother. However, evidence to support these agents, including use of dopamine antagonists, such as domperidone and metoclopramide; herbal treatments; and hormonal manipulation, is lacking.[83]

Although a placebo-controlled study (n = 42) suggested that domperidone may increase milk volume in mothers of preterm infants,[84] maternal safety has not been established. The FDA issued a warning in June 2004 regarding use of domperidone in breastfeeding women because of safety concerns based on published reports of arrhythmia, cardiac arrest, and sudden death associated with intravenous therapy. Furthermore, treatment with oral domperidone is associated with QT prolongation in children and infants.[85,86] Domperidone is not an approved product in the United States, and labeling for oral formulations marketed outside the United States do not recommend use during lactation.

Several small trials (each with fewer than 25 subjects) published before 1990 suggested that metoclopramide increases prolactin concentrations and/or milk production in mothers of both term and preterm infants.[87] However, more recent controlled studies do not replicate this finding.[88,89] Human milk concentrations of metoclopramide are similar to therapeutic concentrations in adult plasma,[88] and measurable amounts can be detected in breastfeeding infants.[90] Clearance of metoclopramide in neonates is prolonged, which may result in excessive serum concentrations and the risk of conditions associated with overdose, such as methemoglobinemia. Of concern, prolactin concentrations were increased in 4 of 7 infants exposed to metoclopramide via human milk.[90] The safety profile for metoclopramide includes adverse reactions, such as dystonia, depression, suicidal ideation, and gastrointestinal tract disturbances, as well as a boxed warning about the risk of tardive dyskinesia. These risks to the mother limit the usefulness of this therapy.

Although a pilot study in 8 lactating women performed decades ago suggested that oxytocin nasal spray

increased human milk production, a larger placebo-controlled trial in 51 women has not confirmed that observation.[91] Oxytocin nasal spray is no longer marketed in the United States. Similarly, anecdotal reports supporting the use of the herb fenugreek to facilitate lactation have not been confirmed by controlled studies.[92,93] Fenugreek contains coumarin, which may interact with NSAIDs.[94] Use of fenugreek in lactating women also is associated with maple-syrup odor in infants.[95] Available data do not support the routine use of other herbal products, such as fennel, to facilitate lactation.[96]

In summary, galactagogues have a limited role in facilitating lactation and have not been subject to full assessments of safety for the nursing infant. Nursing mothers should seek consultation with a lactation specialist and use nonpharmacologic measures to increase milk supply, such as ensuring proper technique, using massage therapy, increasing the frequency of milk expression, prolonging the duration of pumping, and maximizing emotional support.

COMMONLY USED HERBAL PRODUCTS

Despite the frequent use of herbal products in breastfeeding women (up to 43% of lactating mothers in a 2004 survey),[97] reliable information on the safety of many herbal products is lacking. Herbal products are not subject to the same standards for manufacturing and proven effectiveness and safety as are drug products before they are marketed.[98] In fact, the use of several herbal products may be harmful, including kava and yohimbe. For example, the FDA has issued a warning that links kava supplementation to severe liver damage.[99] Breastfeeding mothers should not use yohimbe because of reports of associated fatalities in children.[100] In addition, from 2008 through 2010, the FDA recalled 10 or more dietary supplements each year because of the presence of potentially toxic undeclared ingredients in the supplement.[101] Similarly, the US Government Accountability Office found that 16 of 40 common herbal dietary supplements obtained from retail stores contained pesticide residues.[102]

Safety data are lacking for many herbs commonly used during breastfeeding, such as chamomile,[103] black cohosh,[104] blue cohosh,[105] chastetree,[106] echinacea,[107] ginseng,[108] gingko,[109] *Hypericum* (St John's wort),[110,111] and valerian.[112] Adverse events have been reported in both breastfeeding infants and mothers. For example, St John's wort may cause colic, drowsiness, or lethargy in the breastfed infant even though milk production and infant weight do not appear to be adversely affected[110] and relative maternal dose and infant plasma concentrations are low.[113] Prolonged use of fenugreek may require monitoring of coagulation status and serum glucose concentrations.[114] For these reasons, these aforementioned herbal products are not recommended for use by nursing women.

Although supplementation of nursing mothers with iron and vitamins is safe as long as recommended daily allowances are not exceeded, the use of other nutritional supplements may not be. For instance, L-tryptophan has been associated with eosinophilic myositis.[115] Therefore, physicians should inquire about the use of herbal products and dietary supplements in lactating women and discuss the need for caution because of the paucity of data available.

DIAGNOSTIC IMAGING

When feasible, elective imaging procedures should be delayed until a woman is no longer breastfeeding. For most radiopharmaceuticals, breastfeeding should be interrupted for a time period based on the rate of decline of the agent and dosimetry to avoid infant exposures greater than 1 mSv (100 mrem). For agents that may be concentrated in breast tissue, close contact of the mother with the infant and, consequently, nursing may need to be avoided for a period of time, although expressed milk that has been refrigerated until the radioactivity has decayed may be safe. General guidelines based on Nuclear Regulatory Commission regulations and International Commission on Radiologic Protection guidelines[116] are cited in Tables 3 and 4. However, because there is considerable variability in milk radioactivity, and close contact with an infant may result in additional exposure, consultation with a radiologist should be sought. If deemed necessary, individualized testing of expressed milk may be performed to ensure that radioactivity has reached background levels before breastfeeding is resumed.[117]

Notably, because radiolabeled iodinated products are concentrated in the developing thyroid and radioactivity persists after imaging with most ^{131}I and ^{125}I radiopharmaceuticals (with the exception of ^{125}I- hippurate), breastfeeding should be interrupted for a minimum of 3 weeks. Similarly, ^{22}Na and ^{67}Ga (gallium) administration also require a prolonged (3-week) interruption in breastfeeding. Because the lactating breast has a greater ^{131}I affinity than does the nonlactating breast, women should cease breastfeeding at least 4 weeks before whole-body procedures with ^{131}I and should discontinue breastfeeding thereafter. Doing so will reduce the radiation dose and potential cancer risk to maternal breast tissue.

Traditionally, lactating women receiving intravascular gadolinium or iodinated contrast (as opposed to radiolabeled iodine) are advised to discontinue nursing for 24 hours. However, a minimal amount (0.04%) of the intravenous dose reaches human milk, and, of that, less than 1% to

TABLE 3 Radioactive Compounds That May Require Temporary Cessation of Breastfeeding: Recommendations of the International Commission on Radiologic Protection

Compound	Examples	Example of Procedures	Recommended Time for Cessation of Breastfeeding	Comments
^{14}C-labeled	Triolein, glycocholic acid, urea	*Helicobacter pylori* breath test	None	No approved US products
^{99m}Tc-labeled	DMSA, DTPA, phosphonates (MDP), PYP, tetrofosmin	Multiple: imaging of kidney, bone, lung, heart, tumors	0 to 4 h, as long as no free pertechnetate	Consider discarding at least 1 meal after procedure
	Microspheres, pertechnetate, WBC		12–24 h	Range depends on dose
	Sulfur-colloids, RBC in vivo		6 h	
I-labeled	^{123}I, ^{125}I or ^{131}I-iodo hippurate	Thyroid imaging	12 h	Note: whole-body irradiation with ^{131}I requires prolonged cessation
Others	^{11}C- ^{11}N or ^{11}O-labeled	PET scans	None	Short physical half-life
	^{57}Co-labeled vitamin B_{12}	Schilling test	24 h	Pomeroy 2005[119]
	^{18}F-FDG	PET scans	None, first feeding should be expressed breast milk to avoid direct contact[120]	Use alternatives for 10 half-lives (10×109 min= 18 h)[a]
	^{51}Cr-EDTA	Renal imaging	None	
	^{81m}Kr-gas	Pulmonary imaging	None	No approved US products
	^{82}Rb chloride	PET scan of myocardium	May resume 1 h after last infusion	Half-life 75 s[a]
	^{111}In-octreotide	SPECT, neuroendocrine tumors	None	
	^{111}In -WBC		1 wk	Depends on dose
	^{133}Xe	Cardiac, pulmonary, and cerebral imaging	None	Half-life 5 d[a]

DMSA, dimercaptosuccinic acid; DTPA, diethylenetriaminepentaacetate; EDTA, ethylenediaminetetraacetic acid; FDG, fludeoxyglucose; PET, positron emission tomography; PYP, pyrophosphate; RBC, red blood cell; SPECT, single-photon emission computed tomography; WBC, white blood cell.
[a] FDA-approved drug labeling.

TABLE 4 Radioactive Compounds Requiring Prolonged Cessation of Breastfeeding

Compound	Examples	Example of Procedures	Recommended Time for Cessation of Breastfeeding	Comments
I-labled	^{123}I- BMIPP, -HSA, -IPPA, -MIBG, -NaI, or -HSA	Imaging of tumors	Greater than 3 wk	Essentially need to stop breastfeeding
	^{131}I-MIBG or -NaI			
Others	^{201}Tl-chloride	Cardiac imaging	48 h to 2 wk	Half-life 73 h[a]
	^{67}Ga-citrate	Imaging of tumors	1 wk to 1 mo	Depends on dose
	^{22}Na, ^{75}Se		Greater than 3 wk	Essentially need to stop breastfeeding

Use of expressed human milk recommended because of exposure via direct contact.[120] BMIPP, β-methyl-p-iodophenyl-pentadecanoic acid; HSA, human serum albumin; IPPA, iodophenylpentadecanoic; MIBG, metaiodobenzylguanidine; NaI, sodium iodide.
[a] FDA-approved drug labeling.

2% is absorbed by the infant. Therefore, breastfeeding can be continued without interruption after the use of iodinated contrast or gadolinium.[118]

BREASTFEEDING AND VACCINES

With rare exceptions, maternal immunization does not create any problems for breastfeeding infants, although questions concerning 2 topics often arise regarding lactation and immunization: the effect of lactation on the infant's immune response to a vaccine and a potential adverse effect on the infant from maternal immunization. Breastfeeding does not interfere with the infant's immune response to most routine immunizations (eg, diphtheria and tetanus toxoids and acellular pertussis vaccine, inactivated poliovirus vaccine, and hepatitis B vaccine [HBV]),[121] despite the presence of maternal antibodies in human milk. Seroconversion rates are also similar between breastfed and formula-fed infants receiving rotavirus vaccine; however, vaccine efficacy for severe rotavirus gastroenteritis appears to be higher in formula-fed infants compared with exclusively breastfed infants, particularly during the second season (98% vs 88%) when breastfeeding has been discontinued.[122] Nonetheless, protection during the first year is similar. Moreover, breastfeeding enhances the antibody response to pneumococcal and *Haemophilus influenzae* type b vaccines.[123] Breastfeeding may also decrease the incidence of fever after infant immunization.[124] Therefore, the timing of infant feeding (including human milk) relative to immunization is not restricted, even for live vaccines, such as rotavirus.

Lactating women may need to be immunized. Inactivated vaccines (such as tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine; inactivated poliovirus vaccine; influenza; hepatitis A vaccine; HBV; or human papillomavirus vaccine [HPV]) given to

a nursing mother do not pose a risk to the breastfeeding infant. Several vaccines, such as tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine and influenza vaccine, are recommended for the mother during the postpartum period to protect the infant as well as the mother. Other routine or catch-up vaccines, such as HPV, hepatitis A vaccine, and HBV, can be given to the lactating mother. HPV immunization is recommended for women younger than 27 years. The incidence of adverse reactions in nursing infants within 30 days of maternal immunization with HPV was similar to nursing infants of women receiving the control except for acute respiratory illness (according to Gardasil labeling). Hence, caution is warranted when immunizing mothers of infants who are vulnerable to respiratory illnesses (eg, preterm infants, infants with congenital heart disease or chronic respiratory problems).

Most live vaccines are not associated with virus secretion in human milk. For example, despite maternal seroconversion, neither the varicella virus nor antibody to varicella DNA has been detected in breastfeeding infants.[125] Although attenuated rubella can be secreted into human milk and transmitted to breastfed infants, infections are usually asymptomatic or mild. Consequently, postpartum immunization with measles-mumps-rubella vaccine is recommended for women who lack immunity, especially to rubella.[126] In contrast, infants are considered to be at high risk of developing vaccinia after exposure to smallpox vaccine or encephalitis after yellow fever vaccine. Two cases of meningoencephalitis in nursing infants whose mothers had been immunized against yellow fever are documented in the literature.[127,128] Therefore, most vaccines, with the exception of smallpox or yellow-fever vaccine, which are contraindicated in nonemergency situations, may be administered during lactation.

SUMMARY

The benefits of breastfeeding outweigh the risk of exposure to most therapeutic agents via human milk. Although most drugs and therapeutic agents do not pose a risk to the mother or nursing infant, careful consideration of the individual risk/benefit ratio is necessary for certain agents, particularly those that are concentrated in human milk or result in exposures in the infant that may be clinically significant on the basis of relative infant dose or detectable serum concentrations. Caution is also advised for drugs and agents with unproven benefits, with long half-lives that may lead to drug accumulation, or with known toxicity to the mother or infant. In addition, specific infants may be more vulnerable to adverse events because of immature organ function (eg, preterm infants or neonates) or underlying medical conditions. Several excellent resources are available for the pediatrician, including product labeling and the peer-reviewed database, LactMed. Consultation with a specialist may be indicated, particularly when the use of radiopharmaceuticals, oncologic drugs, or other therapies not addressed by LactMed is contemplated. Additional information about topics outside the scope of this report, such as environmental agents, can be obtained from the third edition of the AAP textbook *Pediatric Environmental Health*.[129]

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Transitioning HIV-Infected Youth Into Adult Health Care

- *Policy Statement*

POLICY STATEMENT

Transitioning HIV-Infected Youth Into Adult Health Care

abstract

FREE

With advances in antiretroviral therapy, most HIV-infected children survive into adulthood. Optimal health care for these youth includes a formal plan for the transition of care from primary and/or subspecialty pediatric/adolescent/family medicine health care providers (medical home) to adult health care provider(s). Successful transition involves the early engagement and participation of the youth and his or her family with the pediatric medical home and adult health care teams in developing a formal plan. Referring providers should have a written policy for the transfer of HIV-infected youth to adult care, which will guide in the development of an individualized plan for each youth. The plan should be introduced to the youth in early adolescence and modified as the youth approaches transition. Assessment of developmental milestones is important to define the readiness of the youth in assuming responsibility for his or her own care before initiating the transfer. Communication among all providers is essential and should include both personal contact and a written medical summary. Progress toward the transition should be tracked and, once completed, should be documented and assessed. *Pediatrics* 2013;132:192–197

COMMITTEE ON PEDIATRIC AIDS

KEY WORDS

adolescents, adults, HIV, transition, young adults

ABBREVIATIONS

AAP—American Academy of Pediatrics
ART—antiretroviral treatment
EHR—electronic health record
MSM—males who have sex with men

INTRODUCTION

In the United States, the prevalence of HIV infection in adolescents and young adults continues to increase as a result of the improved survival of perinatally infected youth as well as those horizontally infected through adult risk behaviors.[1] The Centers for Disease Control and Prevention estimated that in 2009, there were approximately 77 000 HIV-infected youth between 13 and 24 years of age in the United States. Currently, HIV infection is the seventh leading cause of death in this age group. Youths accounted for 12 200 (25.7%) of all new HIV infections in 2010. More than one-half (59.5%) were unaware of their infection, the highest for any age group.[2]

The rate of new HIV infections is highest in African-American youth, including males who have sex with men (MSM) and females with heterosexual contact. HIV infection rates are sevenfold higher among non-Hispanic African Americans and 2.5-fold higher among Hispanic Americans than among non-Hispanic white Americans.[3] AIDS rates nearly doubled from 1997 to 2006 in male subjects between 15 and 19 years of age, largely because of the dramatic increase in HIV infection among MSM from lower socioeconomic classes.[4] In addition, female subjects between 10 and 14 years of age are at a higher risk of

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infection than similarly aged male subjects.[2] The disease disproportionately affects minorities and individuals residing in the South and the Northeast regions of the United States. Risk factors include sex with older men, lack of access to HIV prevention services, and lack of perceived personal risk despite frequent anonymous sexual encounters and unprotected anal intercourse. The HIV incidence rate for African-American women is nearly 15 times that of white women and nearly 4 times that of Hispanic/Latina women.[5] Risk factors among these groups include poverty, stigma, limited access to health care, higher rates of concurrent sexually transmitted infections, and drug use.[2]

Adolescence is a developmental stage characterized by immature concrete reasoning often manifested by denial of illness, a sense of invulnerability reflected by risk taking, and behaviors that are strongly influenced by peer norms. These characteristics all have a direct negative effect on the ability to adhere to complex medical regimens. With the dramatic improvement in HIV care over the past 3 decades, the infected adolescent and his or her caregivers are now faced with managing a chronic illness. In addition to caring for the physical needs of the HIV-infected adolescent, it is important to recognize and address the psychosocial barriers to optimal health and enable delivery of uninterrupted, high-quality medically and developmentally appropriate health care as the individual transitions from adolescence to adulthood.[6]

The increasing incidence and prevalence of HIV infection affect the nation's youth at an age when individual psychosocial and physical developmental processes are evolving and maturing. Physically, the pubertal growth spurt is associated with hormonal and bodily changes reflected in secondary sexual characteristics that influence adolescents' long-term self-image and self-esteem. Furthermore, the social environment and responses of peers and significant others have to be constantly integrated into an evolving identity. Among HIV-infected adolescents and young adults, these changes often occur on a background of denial, depression, marginalization and stigmatization, and medical comorbidities associated with HIV infection.[6] Accompanying psychosocial stressors include parental loss, placement in foster care, poverty, homelessness, unemployment, discrimination, and abuse. HIV-infected youth may have less social support because of stigmatization associated with their infection and/or their sexual orientation. Planning for the transition to adult health care should consider potential cultural differences in different populations of infected youth.

HIV-infected youth consist of 2 distinct populations: those who acquired HIV infection perinatally and those infected horizontally through risk behaviors including consensual or nonconsensual sex. Although the course of the infections in these populations may differ, the challenges faced can be similar, including the stigma of HIV infection and the resulting need for confidentiality, which conflicts with the need for disclosure of their infection status to sexual partners.[7] Youth with horizontal acquisition of HIV may be reluctant to disclose an abusive relationship or sexual exploitation to parents and authorities. Differences between the clinical and psychosocial presentations of youth with perinatally and horizontally acquired HIV infection influence the acceptance of illness, self-efficacy, and antiretroviral treatment (ART) adherence. Among young MSM, unique stressors include homophobia and discrimination, which can lead to a cascade of adverse outcomes, including homelessness and unemployment, and directly affect clinical follow-up and adherence to life-saving medications. Adolescents with newly diagnosed infection may present with an opportunistic and/or sexually transmitted infection associated with advanced immunosuppression. The development of individual disease management skills may be essential for adherence to ART and treatment of associated comorbidities. However, these expectations may be incongruous with the developmental stage of the individual newly diagnosed with HIV along with the complex social situations in which these teenagers may find themselves. Many perinatally infected children have survived into adolescence with multiple courses of combination ART not infrequently associated with periods of poor adherence, often reflecting treatment fatigue, leading to viral resistance.[8] With HIV resistance, therapeutic options become limited, necessitating increasingly more complex treatment regimens. Such regimens can be particularly difficult to implement in treatment-weary adolescents with challenges such as stunted growth, delayed puberty, and physical disabilities arising from earlier complications of perinatal HIV infection or from long-term ART.

Adolescents who have chronic health conditions are often followed up in pediatric or adolescent clinics through adolescence or into young adulthood, although the upper age limit varies. Seamless and successful transition from pediatric- to adult-oriented health care is dependent on these youth acquiring skills to allow them to be responsible for the management of their own health care.[9–12] In situations in which youth have both a primary care provider (medical home) and a subspecialty HIV care provider, both primary care and HIV care will need to be transitioned to adult providers. This situation could allow for the transition of

primary care and subspecialty care at different times. With good communication and careful planning, this strategy could help smooth the transition and improve retention in care.

HIV-infected youth face many of the same challenges in transitioning to adult health care as do individuals with other chronic health conditions.[10] These include the loss of close and supportive relationships with their individual pediatric/adolescent/family medicine providers. The neurocognitive delay and behavioral problems commonly experienced by HIV-infected youth may pose additional challenges for the adult health care provider.[6,13,14] The adult care site may not provide the level of support and encouragement to which the youth is accustomed in his or her pediatric medical home. At 1 site, HIV-infected youth aged 17 to 24 years who received care in an adult health clinic had poorer outcomes than did older adults in the same clinic, with lower rates of viral suppression and nearly 4 times the rate of loss to follow-up.[15] However, increases in CD4+ T-lymphocyte counts were similar in the 2 groups. High rates of substance use and mental health problems, difficulties in adjustment, and reduced emotional support may lead to loss to follow-up and disease progression.[15,16] In addition, in many states, youth who have received public health insurance coverage become ineligible at 18 to 21 years of age, limiting their access to care and medications. Among HIV-infected youth older than 18 years who transitioned from National Institutes of Health clinical research protocols to adult care, 15% reported not having health insurance.[16] Protocols and linkages to care in anticipation of the transition can help avert such consequences.

Several models of transition to adult health care have been proposed, with considerable variability among institutions and individual providers. This variability is reflected in differences in addressing comprehensive care needs as part of the transition, including medical, psychosocial, and financial aspects of transitioning.[17–21] In a survey of providers of pediatric HIV care in the United States, 81% had designated a transition coordinator, but few had established policies to define the details of the transition.[22] One university-based program elected to begin the process at 23 years of age because of a high failure rate when initiated at 21 years of age.[20] Results of this strategy are not yet available. Most models are characterized by flexibility, allowing youth to move back and forth between stages of the transition with the anticipation of completing the process by 25 years of age.

Data are limited regarding the outcomes of HIV-infected youth after transition to adult health care.[23,24] Fewer than one-half of children with congenital heart disease at 1 large pediatric center successfully transitioned to adult health care.[25] Qualitative studies emphasize the importance of an adult-based case manager and mental health providers to assist in the transition as well as an individualized approach to the transition process, including addressing health insurance, alcohol and drug treatment, housing, transportation, education, training, and employment needs.[16,26] Predictors of a successful transition included good adherence to care[24] and effective management of psychiatric comorbidities[6,27] before transition. Further studies to define the outcome of transition and identify the determinants of a successful transfer of care are urgently needed.

RECOMMENDATIONS

Guidelines for transitioning youth with chronic diseases to adult health care have been published by the Society for Adolescent Health and Medicine (formerly known as the Society for Adolescent Medicine)[28] and the American Academy of Pediatrics (AAP [with endorsement by the American Academy of Family Physicians and the American College of Physicians]).[10,29] Broad recommendations include the development of a formal, multidisciplinary, transitional program that involves individual youths and their families and the identification of an adult health care provider before the transition. These guidelines provide guidance on care planning and the transfer of medical information. Their conclusions remain widely accepted as a gold standard that can serve as a framework for the transition of HIV-infected youth. However, a national survey of AAP members revealed that pediatricians remain poorly informed about the conclusions of the AAP consensus statement and that most pediatric practices neither initiate transition planning early in adolescence nor offer transition support services.[30] Identified gaps included limited personnel and training of staff, limited time and workforce shortages, inadequate reimbursement, and anxiety on the part of treating clinicians, adolescents, and their parents about planning for future health care. Guidelines specific to transitioning HIV-infected youth are also available.[20,21]

There are 4 major steps in the transition process:

1. The primary and/or subspecialty pediatric, adolescent, or family medicine HIV care team, in collaboration with adult HIV care providers, develops a formal written policy for transition of youth to adult health care. Written supporting documents, such as brochures and Web-based information, can be helpful in implementing the policy. The transition policy should describe the goals and timeline of transition and explain how the practice evaluates this process.

The policy should be shared with all members of the health care team and implemented with appropriate staff training. An important component of the plan is to establish a system, such as a registry, to identify and track youth as they approach and progress through the transition process because these youth may frequently change where they are living.

2. The patient and his or her family should be introduced to the concept of transition to adult health care early in adolescence, well in anticipation of the actual transfer of care. Although opinions differ regarding the appropriate age to first introduce the transition process, early adolescence is generally regarded as the most appropriate time. Many recommend beginning the discussion of transition by 12 years of age or at an appropriate time after the initial diagnosis, if it occurs at an older age.[10] HIV infection status must be fully disclosed to the patient and explained before introducing the plan. Factors to consider in choosing the age to introduce the plan include individual developmental stage and neurocognitive abilities. Providers may use a readiness assessment tool to reveal areas of strength and weakness to which patient education can be focused to achieve self-management. Specific tools are available for downloading from the Internet, such as the New York State guidelines.[21] It is important to encourage independence through personal ownership and management of health care. Particular attention should be paid to identifying and addressing behavioral, emotional, and mental health problems. In conjunction with the patient and family, the referring provider develops an individualized written transition plan with realistic goals to delineate the process of transition to adult health care. The plan should emphasize education of all involved parties and empowerment of the HIV-infected youth to assume responsibility for his or her own health care. The plan should anticipate and address challenges that patients, parents, and caregivers encounter during transition, including the loss of an established provider. Patient education during office visits and peer group sessions can reinforce the value of independence and decision-making as part of the transition. The creation of a portable medical summary and an emergency care plan is an important component of the plan.

   Ongoing discussions of the transition plan should occur at least annually at subsequent visits, with modification of the plan as appropriate. The health care coverage of the youth should be evaluated regularly to ensure that health care coverage and access to medications remains uninterrupted during the transition. The 2010 Patient Protection and Affordable Care Act health care reform legislation includes provision for children to remain on their parents' insurance until 26 years of age and eliminates insurers' ability to exclude coverage on the basis of preexisting conditions.
3. The actual transition to adult health care is initiated. The age at which this transition is initiated is generally between 18 and 25 years and can be influenced by the upper age at which health care is provided by the referring team and the comfort of the adult health care provider in caring for younger adults. Once a suitable adult HIV medicine provider is identified, a pretransfer visit to meet the adult health care provider can help to establish a successful long-term relationship. The pediatric, adolescent, or family medicine provider should communicate directly with the adult health care provider and supply appropriate documentation, including a transfer letter, the portable medical summary, and/or electronic health record (EHR), before the initial encounter between the adult health care provider and the patient. The portable medical summary and/or EHR should address all medical and psychosocial needs, including advance directives. Ideally, the youth would be introduced to the adult health care provider personally by the pediatric, adolescent, or family medicine provider, either in the referring or adult clinic. It is likely that most youth will need ongoing support from the pediatric adolescent or family medicine health care team during the process for transition to be successful. This support could consist of periodic contact by a member of the referring health care team, such as a nurse or social worker. A peer support group may assist youth with dealing with anxiety resulting from the transition process.
4. The final step in the transition process is to document the completion of the transition and evaluate the outcome of the process. The referring health care provider should document that the young adult has established his or her care in the adult clinic and should be available to provide ongoing encouragement to maintain the youth in adult health care. The referring team should be available to the adult health care provider to serve as a resource during the immediate posttransfer period. However, once the youth has established ongoing care with the adult health care provider, it is appropriate for the

pediatric, adolescent, or family medicine provider to withdraw from providing care to prevent confusion in the patient and to reinforce the role of the adult health care provider.

CONCLUSIONS

A well-planned transition of HIV-infected youth from pediatric, adolescent, or family medicine clinics, often from a medical home to adult health care, enables them to optimize their ability to assume adult roles and activities. Transition planning should be a standard part of providing health care for all HIV-infected youth. Pediatricians and adolescent and family medicine providers have a pivotal role in facilitating seamless and effective transition at a very vulnerable and anxious time of life for both HIV-infected youth and their families. These essential transitional activities can improve health outcomes for HIV-infected adolescents.

Specific Recommendations

1. Pediatric, adolescent, and family medicine HIV care providers, in collaboration with suitable adult HIV care providers, should develop a formal process for transition of youth to adult health care.
2. The patient and his or her family should be introduced to the concept of transition to adult health care early in adolescence well in anticipation of the actual transfer of care. The youth should be informed of his or her HIV status before initiating the process.
3. There are 4 key steps in the transition process:
   a. The referring provider should develop written policies to define the process of transition of HIV-infected youth to adult health care. The plan should be shared with all pediatric/adolescent or family medicine providers, staff, and patients and their families with appropriate staff training. Written documents, such as brochures and Web-based information, can be helpful in implementing the policy. Providers should establish a system to identify and track youth as they progress through the transition process.
   b. The provider, the youth, and the family should jointly create an individualized transition plan well in anticipation of transition, which should include creation of a portable medical summary and/or EHR and an emergency care plan. Providers may use a readiness assessment tool, and the transition plan should be revised on the basis of these assessments.
   c. Transition to the adult HIV care provider should be initiated with appropriate communication, including a transfer letter and portable medical summary. A pretransfer visit by the patient to meet the adult health care provider can assist in establishing a successful long-term relationship.
   d. Completion of the transition should be documented, and the outcome of the process should be evaluated. The referring health care team should be available to the adult health care provider to serve as a resource during the immediate posttransfer period.
4. The health care coverage of the youth should be evaluated regularly to ensure that health care coverage and access to medications remains uninterrupted during transition.
5. The transition process should ensure that the youth's health care, educational, vocational, and social service needs are discussed and addressed.

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Use of Inhaled Nitric Oxide in Preterm Infants

- *Clinical Report*

CLINICAL REPORT

Use of Inhaled Nitric Oxide in Preterm Infants

Praveen Kumar MD, FAAP, and COMMITTEE ON FETUS AND NEWBORN

abstract

FREE

Nitric oxide, an important signaling molecule with multiple regulatory effects throughout the body, is an important tool for the treatment of full-term and late-preterm infants with persistent pulmonary hypertension of the newborn and hypoxemic respiratory failure. Several randomized controlled trials have evaluated its role in the management of preterm infants ≤34 weeks' gestational age with varying results. The purpose of this clinical report is to summarize the existing evidence for the use of inhaled nitric oxide in preterm infants and provide guidance regarding its use in this population. *Pediatrics* 2014;133:164–170

KEY WORDS

inhaled nitric oxide, preterm infants, hypoxic respiratory failure, bronchopulmonary dysplasia

ABBREVIATIONS

BPD—bronchopulmonary dysplasia
iNO—inhaled nitric oxide
NO—nitric oxide
NOCLD—Nitric Oxide Chronic Lung Disease study group

INTRODUCTION

Nitric oxide (NO) is an important signaling molecule with multiple regulatory effects throughout the body. In perinatal medicine, inhaled nitric oxide (iNO) was initially studied for its pulmonary vasodilating effects in infants with pulmonary hypertension and has since become an important tool for the treatment of full-term and late-preterm infants with persistent pulmonary hypertension of the newborn and hypoxemic respiratory failure.[1] Inhaled NO also has multiple and complex systemic and pulmonary effects. In animal models of neonatal chronic lung disease, iNO stimulates angiogenesis, augments alveolarization, improves surfactant function, and inhibits proliferation of smooth muscle cells and abnormal elastin deposition.[2–6] Although the evidence for similar benefits in preterm infants is lacking, the off-label use of iNO in this population has escalated.[7] A study published in 2010 reported a sixfold increase (from 0.3% to 1.8%) in the use of iNO among infants born at less than 34 weeks' gestation between 2000 and 2008.[7] The greatest increase occurred among infants who were born at 23 to 26 weeks' gestation (0.8% to 6.6%). The National Institutes of Health convened a consensus panel in October 2010 to evaluate the evidence for safety and efficacy of iNO therapy in preterm infants. After reviewing the published evidence, the panel concluded that the available evidence does not support the use of iNO in early routine, early rescue, or later rescue regimens in the care of infants born at less than 34 weeks' gestation and that hospitals, clinicians, and the pharmaceutical industry should avoid marketing iNO for this group of infants.[8] An individual-patient data meta-analysis of 14 randomized controlled trials reached similar conclusions.[9] The purpose of this clinical report is to summarize the

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existing evidence for the use of iNO in preterm infants and provide guidance regarding its use in this population.

LITERATURE REVIEW

Use of iNO in Preterm Infants With Respiratory Failure

The benefits associated with iNO therapy in full-term and late-preterm infants with persistent pulmonary hypertension of the newborn and hypoxemic respiratory failure initiated interest in exploring whether iNO could reduce the rates of death and neonatal morbidities in more immature infants. Pilot studies reported short-term improvement in oxygenation with iNO, but no significant benefit was observed in mortality or other morbidities.[10–15] Subsequently, several randomized clinical trials were undertaken.[16–23] Table 1 outlines the study population, entry criteria, and dose and duration of iNO treatment and summarizes the outcomes for all published randomized controlled trials. Only 1 small trial of 40 patients reported a beneficial effect on survival (Table 1). Subgroup analyses of secondary outcomes have provided conflicting results. Post hoc analysis of the Neonatal Research Network study suggested that iNO therapy was associated with reduced rates of death and bronchopulmonary dysplasia (BPD) in infants with a birth weight greater than 1000 g, but higher mortality and increased risk of severe intracranial hemorrhage in infants weighing 1000 g or less at birth.[17] In contrast, another large multicenter US trial reported no significant difference in the primary outcome of death or BPD between treated and control groups; however, infants treated with iNO had fewer brain lesions (eg, grade 3 or 4 intracranial hemorrhage, periventricular leukomalacia, and/or ventriculomegaly) noted on cranial ultrasonography.[20] A European multicenter study reported that infants randomized to iNO treatment had longer duration of ventilation, time on oxygen therapy, and length of hospital stay compared with the placebo group, although none of these results were statistically significant.[19]

Use of iNO in Preterm Infants to Improve the Rate of Survival Without BPD

Lung pathology in preterm infants with BPD is characterized by reduced numbers of large alveoli and abnormal pulmonary vasculature development. Surfactant deficiency, ventilator-induced lung injury, oxygen toxicity, and inflammation appear to play important roles in its pathogenesis.[26,27] In animal models of neonatal lung injury, iNO promotes angiogenesis, decreases apoptosis, and reduces lung inflammation and oxidant injury.[28–30] In an early study of iNO use in preterm infants, the incidence of BPD was reduced in treated infants who required ventilator support.[16] Of 3 subsequent large randomized trials designed to evaluate the effect of iNO therapy on survival without BPD,[20,24,25] 2 found no significant benefit[20,25] (Table 1). A third trial, which featured late treatment (7–21 days of age), a longer duration of drug exposure (25 days), and a higher cumulative dose, demonstrated a modest but statistically significant beneficial effect (44% iNO vs 37% placebo; P = .042).[24] A subgroup analysis showed that the beneficial effect was seen in infants enrolled between 7 and 14 days of age but not those enrolled between the ages of 15 and 21 days.[24]

EFFECTS OF INO THERAPY ON NEURODEVELOPMENTAL OUTCOME

Studies in animal models suggest that iNO may have direct beneficial effects on the brain through mechanisms involving the cerebral vasculature and/or neuronal maturation.[31,32] Other investigators have described a possible role for intravascular NO-derived molecules in conserving and stabilizing NO bioactivity that may contribute to the regulation of regional blood flow and oxygen delivery.[33,34] Neurodevelopmental outcome has been reported for 6 clinical trials,[35–40] and of these, 1 noted a more favorable neurodevelopmental outcome at 1 year of age among the preterm cohort treated with iNO but no difference in the rate of cerebral palsy.[36]

EFFECTS OF INO THERAPY ON LONG-TERM PULMONARY OUTCOME OF SURVIVORS

In animal models, iNO decreases baseline airway resistance and may increase the rate of alveolarization.[2–6] To date, only 2 studies have reported respiratory outcomes of preterm infants treated with iNO.[41,42] In a telephone survey that included 456 infants in the Nitric Oxide Chronic Lung Disease (NOCLD) study group, the use of bronchodilators, inhaled steroids, systemic steroids, diuretics, and supplemental oxygen during the first year of life was less in the iNO-treated group, but there were no significant differences in the frequency of wheezing or the rate of rehospitalization. In the Inhaled Nitric Oxide Versus Ventilatory Support Without Inhaled Nitric Oxide multicenter trial, follow-up at 1 year of age showed no difference in maximal expiratory flow at functional residual capacity, wheezing, readmission rate, or use of respiratory medications.[42]

RESULTS OF META-ANALYSES OF STUDIES EVALUATING THE USE OF INO IN PRETERM INFANTS

Two published meta-analyses found no overall significant effect of iNO on the rate of mortality, BPD, intraventricular hemorrhage, or neurodevelopmental impairment.[43,44] In view of the limitations

TABLE 1 Randomized Controlled Trials of iNO in Preterm Infants

Author, Year	*n*	Gestational Age, wk	Birth Weight, g	Age at Enrollment	Entry Criteria	iNO Protocol	Primary Outcome	Study Results
Subhedar, 1997[11]	42	<32	—	96 h	Need for mechanical ventilation and high risk of developing CLD	20 ppm for at least first 2 h and then 5 ppm for 3–4 d	Death and/or CLD before discharge	No difference in primary outcome
Kinsella, 1999[12]	80	≤34	—	≤7 d	aAO_2 ratio <0.1 on 2 consecutive blood gases in first 7 d of life	5 ppm for 7–14 d	Survival	No difference in primary outcome; no difference in rate of IVH or CLD
The French-Belgian iNO Trial, 1999[13]	85	<33	—	<7 d	OI between 12.5 and 30.0 on 2 consecutive blood gases at least 1 h apart	10–20 ppm for a minimum of 2 h	OI reduction of ≥33% or at least 10 points	More treated infants achieved primary outcome; no difference in median OI at 2 h; no difference in survival or other outcomes
Srisuparp, 2002[15]	34	—	<2000	<72 h	OI ranging from >4 to >12 based on birth wt	20 ppm for 24–48 h and then 5 ppm for maximum of 7 d	Change in oxygenation	Improved oxygenation with treatment but no difference in survival or IVH
Schreiber, 2003[16]	207	<34	<2000	<72 h	Need for mechanical ventilation	10 ppm for first day then 5 ppm for 6 d	Death and survival without BPD at 36 wk postmenstrual age	Treatment associated with a decrease in the combined incidence of BPD and death; no difference in mortality alone
Van Meurs, 2005[17]	420	<34	401–1500	4–120 h; mean 26–28 h	OI ≥10 on 2 consecutive blood gases between 30 min and 12 h apart	5–10 ppm for maximum of 14 d	Incidence of death or BPD	No difference in primary outcome; no difference in rate of BPD, severe IVH, or PVL. Post hoc analyses: Decrease in primary outcome in cohort with birth weight >1000 g; higher rate of mortality and severe IVH in cohort with birth wt <1000 g
Hascoet, 2005[18]	145	<32	—	6–48 h	aAO_2 ratio <0.22	5 ppm for first h of treatment and further dosage were adjusted based on response; total duration of treatment not clearly defined but varied from 4 h in nonresponders to few days in responders	Intact survival at 28 d	No difference in primary outcome; iNO was an independent risk factor for the combined risk of death or brain lesion
Field, 2005[19]	108	<34	—	<28 d; median 1 d	Severe respiratory failure requiring assisted ventilation	5–40 ppm depending on patient response; total duration of treatment not clearly defined	Death or severe disability at 1 y corrected age; death or CLD	No difference in primary outcome
Kinsella, 2006[20]	793	≤34	500–1250	<48 h	Need for mechanical ventilation	5 ppm for maximum of 21 d	Death or BPD at 36 wk postmenstrual age	No difference in primary outcome but had a decreased risk of brain injury; decreased incidence of BPD in cohort with birth weight ≤1000 g
Dani, 2006[21]	40	<30	—	≤7 d	aAO_2 ratio <0.15	10 ppm for 4 h then 6 ppm until extubation	Death and BPD	Primary outcome less with iNO treatment

TABLE 1 Continued

Author, Year	*n*	Gestational Age, wk	Birth Weight, g	Age at Enrollment	Entry Criteria	iNO Protocol	Primary Outcome	Study Results
Ballard, 2006[24]	582	≤32	500–1250	7–21 d	Need for mechanical ventilation for lung disease between 7 and 21 d; infants with birth weight 500–799 g were eligible if requiring nasal CPAP	20 ppm for 48–96 h followed by 10, 5, and 2 ppm at weekly intervals, with a minimum treatment duration of 24 d	Survival without BPD at 36 wk of postmenstrual age	Improved survival without BPD at 36 wk postmenstrual age; post hoc analysis showed most benefit when iNO treatment was started between 7–14 d of age
Van Meurs, 2007[23]	29	<34	>1500	4–120 h; mean 24–25 h	OI ≥15 on 2 consecutive blood gases between 30 min and 12 h apart	5–10 ppm for maximum of 14 d	Incidence of death or BPD	No difference in primary outcome
Su and Chen, 2008[22]	65	<32	≤1500	Mean 2.5 d	OI ≥25	5–20 ppm based on patient response; treatment duration at physician discretion (mean duration 4.9 ± 2.3 d)	OI at 24 h after randomization	Improved oxygenation with iNO treatment; no difference in survival, CLD, IVH, PDA, ROP, or duration of intubation
Mercier, 2010[25]	800	<29	>500	First day of life	Need for surfactant or CPAP within 24 h of birth	5 ppm for minimum of 7 d and maximum of 21 d	Survival without BPD at 36 wk postmenstrual age	No difference in primary outcome; no difference in survival alone; no difference in BPD; no difference in brain injury

Dash indicates not part of enrollment criteria.
aAO_2, arterial-alveolar oxygen ratio; CLD, chronic lung disease; CPAP, continuous positive airway pressure; IVH, intraventricular hemorrhage; OI, oxygenation index; PDA, patent ductus arteriosus; PVL, periventricular leukomalacia; ROP, retinopathy of prematurity.

of meta-analysis using aggregate data from different trials and to identify any patient or treatment characteristics that might predict benefit, Askie et al[9] conducted an individual-patient data meta-analysis. Data from 3298 infants in 11 trials that included 96% of published data showed no statistically significant effect of iNO on the rate of death or chronic lung disease (relative risk 0.96; 95% confidence interval 0.92–1.01) or severe brain lesions on cranial imaging (relative risk 1.12; 95% confidence interval 0.98–1.28). There were no statistically significant differences in iNO effect according to any of the patient-level characteristics tested; however, the authors cautioned that they could not exclude the possibility of a small reduction in the combined outcome of death or chronic lung disease if a higher dose of iNO (20 ppm) was used after >7 days of age, as observed in the NOCLD study.[9,24]

COST-BENEFIT ANALYSES OF ROUTINE USE OF INO IN PRETERM INFANTS

Treatment with iNO is expensive and can add significantly to health care costs.[8] A retrospective economic evaluation using patient-level data from the NOCLD trial (the only trial showing clinical benefit) reported that the overall mean cost per infant for the initial hospitalization was similar in the treated and placebo groups; however, when iNO therapy was initiated between 7 and 14 days of age, there was a 71% probability that the treatment decreased costs and improved outcomes.[45] Cost-benefit analysis from 2 other studies failed to show any cost-benefit.[37,39] Among preterm infants in the Inhaled Nitric Oxide Versus Ventilatory Support Without Inhaled Nitric Oxide trial, there was no difference in resource use and cost of care through the 4-year assessment.[37] Using more robust research methodology, including

data on postdischarge resource utilization and health-related quality of life evaluations, Watson et al[39] found that costs of care did not vary significantly by treatment arm through 1 year of age. Although quality-adjusted survival was slightly better with iNO therapy, the estimated incremental cost-effectiveness ratio was $2.25 million per quality-adjusted life year, with only a 12.9% probability that the incremental cost-effectiveness ratio would be less than $500 000 per quality-adjusted life year. Additionally, in subgroup analysis, total costs were significantly higher for the iNO-treated group in the smallest birth weight stratum (500–749 g).

SAFETY OF INO USE IN PRETERM INFANTS

The only information regarding the safety of iNO use in preterm infants is derived from the NOCLD trial.[46–49] The limited data suggest that iNO is safe and does not increase lung inflammation or oxidative stress.[46,48]

SUMMARY

1. The results of randomized controlled trials, traditional meta-analyses, and an individualized patient data meta-analysis study indicate that neither rescue nor routine use of iNO improves survival in preterm infants with respiratory failure (Evidence quality, A; Grade of recommendation, strong).[50]
2. The preponderance of evidence does not support treating preterm infants who have respiratory failure with iNO for the purpose of preventing/ameliorating BPD, severe intraventricular hemorrhage, or other neonatal morbidities (Evidence quality, A; Grade of recommendation, strong).
3. The incidence of cerebral palsy, neurodevelopmental impairment, or cognitive impairment in preterm infants treated with iNO is similar to that of control infants (Evidence quality, A).
4. The results of 1 multicenter, randomized controlled trial suggest that treatment with a high dose of iNO (20 ppm) beginning in the second postnatal week may provide a small reduction in the rate of BPD. However, these results need to be confirmed by other trials.
5. An individual-patient data meta-analysis that included 96% of preterm infants enrolled in all published iNO trials found no statistically significant differences in iNO effect according to any of the patient-level characteristics, including gestational age, race, oxygenation index, postnatal age at enrollment, evidence of pulmonary hypertension, and mode of ventilation.
6. There are limited data and inconsistent results regarding the effects of iNO treatment on pulmonary outcomes of preterm infants in early childhood.

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SECTION 5

Current Policies

From the American Academy of Pediatrics

(Through January 1, 2014)

- *Policy Statements*
  ORGANIZATIONAL PRINCIPLES TO GUIDE AND DEFINE THE CHILD HEALTH CARE SYSTEM AND TO IMPROVE THE HEALTH OF ALL CHILDREN

- *Clinical Reports*
  GUIDANCE FOR THE CLINICIAN IN RENDERING PEDIATRIC CARE

- *Technical Reports*
  BACKGROUND INFORMATION TO SUPPORT AMERICAN ACADEMY OF PEDIATRICS POLICY

AMERICAN ACADEMY OF PEDIATRICS

Policy Statements, Clinical Reports, Technical Reports

Current through January 1, 2014

Full text of all titles listed below is available on the *Pediatric Clinical Practice Guidelines & Policies* CD-ROM included with this manual.

AAP PRINCIPLES CONCERNING RETAIL-BASED CLINICS

Retail-Based Clinic Policy Work Group (12/06, reaffirmed 1/11)

ABUSIVE HEAD TRAUMA IN INFANTS AND CHILDREN

Cindy W. Christian, MD; Robert Block, MD; and Committee on Child Abuse and Neglect

ABSTRACT. Shaken baby syndrome is a term often used by physicians and the public to describe abusive head trauma inflicted on infants and young children. Although the term is well known and has been used for a number of decades, advances in the understanding of the mechanisms and clinical spectrum of injury associated with abusive head trauma compel us to modify our terminology to keep pace with our understanding of pathologic mechanisms. Although shaking an infant has the potential to cause neurologic injury, blunt impact or a combination of shaking and blunt impact cause injury as well. Spinal cord injury and secondary hypoxic ischemic injury can contribute to poor outcomes of victims. The use of broad medical terminology that is inclusive of all mechanisms of injury, including shaking, is required. The American Academy of Pediatrics recommends that pediatricians develop skills in the recognition of signs and symptoms of abusive head injury, including those caused by both shaking and blunt impact, consult with pediatric subspecialists when necessary, and embrace a less mechanistic term, abusive head trauma, when describing an inflicted injury to the head and its contents. (4/09, reaffirmed 3/13)

ACCESS TO OPTIMAL EMERGENCY CARE FOR CHILDREN

Committee on Pediatric Emergency Medicine

ABSTRACT. Millions of pediatric patients require some level of emergency care annually, and significant barriers limit access to appropriate services for large numbers of children. The American Academy of Pediatrics has a strong commitment to identifying barriers to access to emergency care, working to surmount these obstacles, and encouraging, through education and system changes, improved levels of emergency care available to all children. (1/07, reaffirmed 8/10)

ACCF/AHA/AAP RECOMMENDATIONS FOR TRAINING IN PEDIATRIC CARDIOLOGY

American College of Cardiology Foundation, American Heart Association, and American Academy of Pediatrics (12/05, reaffirmed 1/09)

ACHIEVING QUALITY HEALTH SERVICES FOR ADOLESCENTS

Committee on Adolescence

ABSTRACT. In recent years, there has been an increased national focus on assessing and improving the quality of health care. This statement provides recommendations and criteria for assessment of the quality of primary care delivered to adolescents in the United States. Consistent implementation of American Academy of Pediatrics recommendations (periodicity of visits and confidentiality issues), renewed attention to professional quality-improvement activities (access and immunizations) and public education, and modification of existing quality-measurement activities to ensure that quality is delivered are proposed as strategies that would lead to improved care for youth. (6/08, reaffirmed 3/13)

ACTIVE HEALTHY LIVING: PREVENTION OF CHILDHOOD OBESITY THROUGH INCREASED PHYSICAL ACTIVITY

Council on Sports Medicine and Fitness and Council on School Health

ABSTRACT. The current epidemic of inactivity and the associated epidemic of obesity are being driven by multiple factors (societal, technologic, industrial, commercial, financial) and must be addressed likewise on several fronts. Foremost among these are the expansion of school physical education, dissuading children from pursuing sedentary activities, providing suitable role models for physical activity, and making activity-promoting changes in the environment. This statement outlines ways that pediatric health care providers and public health officials can encourage, monitor, and advocate for increased physical activity for children and teenagers. (5/06, reaffirmed 5/09, 8/12)

ADDITIONAL RECOMMENDATIONS FOR USE OF TETANUS TOXOID, REDUCED-CONTENT DIPHTHERIA TOXOID, AND ACELLULAR PERTUSSIS VACCINE (TDAP)

Committee on Infectious Diseases

ABSTRACT. The American Academy of Pediatrics and the Centers for Disease Control and Prevention are amending previous recommendations and making additional recommendations for the use of tetanus toxoid, reduced-content diphtheria toxoid, and acellular pertussis vaccine (Tdap). Review of the results from clinical trials and other studies has revealed no excess reactogenicity when Tdap is given within a short interval after other tetanus- or diphtheria-containing toxoid products, and accrual of postmarketing adverse-events reports reveals an excellent safety record for Tdap. Thus, the recommendation for caution regarding Tdap use within any interval after a tetanus- or

diphtheria-containing toxoid product is removed. Tdap should be given when it is indicated and when no contraindication exists. In further efforts to protect people who are susceptible to pertussis, the American Academy of Pediatrics and Centers for Disease Control and Prevention recommend a single dose of Tdap for children 7 through 10 years of age who were underimmunized with diphtheria-tetanus-acellular pertussis (DTaP). Also, the age for recommendation for Tdap is extended to those aged 65 years and older who have or are likely to have contact with an infant younger than 12 months (eg, health care personnel, grandparents, and other caregivers). (9/11)

ADMISSION AND DISCHARGE GUIDELINES FOR THE PEDIATRIC PATIENT REQUIRING INTERMEDIATE CARE (CLINICAL REPORT)

Committee on Hospital Care and Section on Critical Care (joint with Society of Critical Care Medicine)

ABSTRACT. During the past 3 decades, the specialty of pediatric critical care medicine has grown rapidly, leading to a number of pediatric intensive care units opening across the country. Many patients who are admitted to the hospital require a higher level of care than routine inpatient general pediatric care, yet not to the degree of intensity of pediatric critical care; therefore, an intermediate care level has been developed in institutions providing multidisciplinary subspecialty pediatric care. These patients may require frequent monitoring of vital signs and nursing interventions, but usually they do not require invasive monitoring. The admission of the pediatric intermediate care patient is guided by physiologic parameters depending on the respective organ system involved relative to an institution's resources and capacity to care for a patient in a general care environment. This report provides admission and discharge guidelines for intermediate pediatric care. Intermediate care promotes greater flexibility in patient triage and provides a cost-effective alternative to admission to a pediatric intensive care unit. This level of care may enhance the efficiency of care and make health care more affordable for patients receiving intermediate care. (5/04, reaffirmed 2/08, 1/13)

ADOLESCENT PREGNANCY: CURRENT TRENDS AND ISSUES (CLINICAL REPORT)

Jonathan D. Klein, MD, MPH, and Committee on Adolescence

ABSTRACT. The prevention of unintended adolescent pregnancy is an important goal of the American Academy of Pediatrics and our society. Although adolescent pregnancy and birth rates have been steadily decreasing, many adolescents still become pregnant. Since the last statement on adolescent pregnancy was issued by the Academy in 1998, efforts to prevent adolescent pregnancy have increased, and new observations, technologies, and prevention effectiveness data have emerged. The purpose of this clinical report is to review current trends and issues related to adolescent pregnancy, update practitioners on this topic, and review legal and policy implications of concern to pediatricians. (7/05)

ADOLESCENTS AND HIV INFECTION: THE PEDIATRICIAN'S ROLE IN PROMOTING ROUTINE TESTING

Committee on Pediatric AIDS

ABSTRACT. Pediatricians can play a key role in preventing and controlling HIV infection by promoting risk-reduction counseling and offering routine HIV testing to adolescent and young adult patients. Most sexually active youth do not feel that they are at risk of contracting HIV and have never been tested. Obtaining a sexual history and creating an atmosphere that promotes nonjudgmental risk counseling is a key component of the adolescent visit. In light of increasing numbers of people with HIV/AIDS and missed opportunities for HIV testing, the Centers for Disease Control and Prevention recommends universal and routine HIV testing for all patients seen in health care settings who are 13 to 64 years of age. There are advances in diagnostics and treatment that help support this recommendation. This policy statement reviews the epidemiologic data and recommends that routine screening be offered to all adolescents at least once by 16 to 18 years of age in health care settings when the prevalence of HIV in the patient population is more than 0.1%. In areas of lower community HIV prevalence, routine HIV testing is encouraged for all sexually active adolescents and those with other risk factors for HIV. This statement addresses many of the real and perceived barriers that pediatricians face in promoting routine HIV testing for their patients. (10/11)

ADOLESCENTS AND HUMAN IMMUNODEFICIENCY VIRUS INFECTION: THE ROLE OF THE PEDIATRICIAN IN PREVENTION AND INTERVENTION

Committee on Pediatric AIDS and Committee on Adolescence

ABSTRACT. Half of all new human immunodeficiency virus (HIV) infections in the United States occur among young people between the ages of 13 and 24. Sexual transmission accounts for most cases of HIV during adolescence. Pediatricians can play an important role in educating adolescents about HIV prevention, transmission, and testing, with an emphasis on risk reduction, and in advocating for the special needs of adolescents for access to information about HIV. (1/01, reaffirmed 10/03, 1/05)

THE ADOLESCENT'S RIGHT TO CONFIDENTIAL CARE WHEN CONSIDERING ABORTION

Committee on Adolescence

ABSTRACT. In this statement, the American Academy of Pediatrics (AAP) reaffirms its position that the rights of adolescents to confidential care when considering abortion should be protected. The AAP supports the recommendations presented in the report on mandatory parental consent to abortion by the Council on Ethical and Judicial Affairs of the American Medical Association. Adolescents should be strongly encouraged to involve their parents and other trusted adults in decisions regarding pregnancy termination, and the majority of them voluntarily do so. Legislation mandating parental involvement does not achieve the intended benefit of promoting family communication, but it does increase the risk of harm to the adolescent by delaying access to appropriate medical care.

The statement presents a summary of pertinent current information related to the benefits and risks of legislation requiring mandatory parental involvement in an adolescent's decision to obtain an abortion. The AAP acknowledges and respects the diversity of beliefs about abortion and affirms the value of voluntary parental involvement in decision making by adolescents. (5/96, reaffirmed 5/99, 11/02)

ADVANCED PRACTICE IN NEONATAL NURSING

Committee on Fetus and Newborn

ABSTRACT. The participation of advanced practice registered nurses in neonatal care continues to be accepted and supported by the American Academy of Pediatrics. Recognized categories of advanced practice neonatal nursing are the neonatal clinical nurse specialist and the neonatal nurse practitioner. (5/09)

AGE LIMITS OF PEDIATRICS

Child and Adolescent Health Action Group (5/88, reaffirmed 9/92, 1/97, 3/02, 1/06, 10/11)

AGE TERMINOLOGY DURING THE PERINATAL PERIOD

Committee on Fetus and Newborn

ABSTRACT. Consistent definitions to describe the length of gestation and age in neonates are needed to compare neurodevelopmental, medical, and growth outcomes. The purposes of this policy statement are to review conventional definitions of age during the perinatal period and to recommend use of standard terminology including gestational age, postmenstrual age, chronological age, corrected age, adjusted age, and estimated date of delivery. (11/04, reaffirmed 10/07, 11/08, 1/09)

ALCOHOL USE BY YOUTH AND ADOLESCENTS: A PEDIATRIC CONCERN

Committee on Substance Abuse

ABSTRACT. Alcohol use continues to be a major problem from preadolescence through young adulthood in the United States. Results of recent neuroscience research have substantiated the deleterious effects of alcohol on adolescent brain development and added even more evidence to support the call to prevent and reduce underaged drinking. Pediatricians should be knowledgeable about substance abuse to be able to recognize risk factors for alcohol and other substance abuse among youth, screen for use, provide appropriate brief interventions, and refer to treatment. The integration of alcohol use prevention programs in the community and our educational system from elementary school through college should be promoted by pediatricians and the health care community. Promotion of media responsibility to connect alcohol consumption with realistic consequences should be supported by pediatricians. Additional research into the prevention, screening and identification, brief intervention, and management and treatment of alcohol and other substance use by adolescents continues to be needed to improve evidence-based practices. (4/10)

ALLERGY TESTING IN CHILDHOOD: USING ALLERGEN-SPECIFIC IGE TESTS (CLINICAL REPORT)

Scott H. Sicherer, MD; Robert A. Wood, MD; and Section on Allergy and Immunology

ABSTRACT. A variety of triggers can induce common pediatric allergic diseases which include asthma, allergic rhinitis, atopic dermatitis, food allergy, and anaphylaxis. Allergy testing serves to confirm an allergic trigger suspected on the basis of history. Tests for allergen-specific immunoglobulin E (IgE) are performed by in vitro assays or skin tests. The tests are excellent for identifying a sensitized state in which allergen-specific IgE is present, and may identify triggers to be eliminated and help guide immunotherapy treatment. However, a positive test result does not always equate with clinical allergy. Newer enzymatic assays based on anti-IgE antibodies have supplanted the radioallergosorbent test (RAST). This clinical report focuses on allergen-specific IgE testing, emphasizing that the medical history and knowledge of disease characteristics are crucial for rational test selection and interpretation. (12/11)

ALL-TERRAIN VEHICLE INJURY PREVENTION: TWO-, THREE-, AND FOUR-WHEELED UNLICENSED MOTOR VEHICLES

Committee on Injury and Poison Prevention

ABSTRACT. Since 1987, the American Academy of Pediatrics (AAP) has had a policy about the use of motorized cycles and all-terrain vehicles (ATVs) by children. The purpose of this policy statement is to update and strengthen previous policy. This statement describes the various kinds of motorized cycles and ATVs and outlines the epidemiologic characteristics of deaths and injuries related to their use by children in light of the 1987 consent decrees entered into by the US Consumer Product Safety Commission and the manufacturers of ATVs. Recommendations are made for public, patient, and parent education by pediatricians; equipment modifications; the use of safety equipment; and the development and improvement of safer off-road trails and responsive emergency medical systems. In addition, the AAP strengthens its recommendation for passage of legislation in all states prohibiting the use of 2- and 4-wheeled off-road vehicles by children younger than 16 years, as well as a ban on the sale of new and used 3-wheeled ATVs, with a recall of all used 3-wheeled ATVs. (6/00, reaffirmed 5/04, 1/07)

AMBIENT AIR POLLUTION: HEALTH HAZARDS TO CHILDREN

Committee on Environmental Health

ABSTRACT. Ambient (outdoor) air pollution is now recognized as an important problem, both nationally and worldwide. Our scientific understanding of the spectrum of health effects of air pollution has increased, and numerous studies are finding important health effects from air pollution at levels once considered safe. Children and infants are among the most susceptible to many of the air pollutants. In addition to associations between air pollution and respiratory symptoms, asthma exacerbations, and asthma hospitalizations, recent studies have found links between air pollution and preterm birth, infant mortality, deficits in lung growth, and possibly, develop-

ment of asthma. This policy statement summarizes the recent literature linking ambient air pollution to adverse health outcomes in children and includes a perspective on the current regulatory process. The statement provides advice to pediatricians on how to integrate issues regarding air quality and health into patient education and children's environmental health advocacy and concludes with recommendations to the government on promotion of effective air-pollution policies to ensure protection of children's health. (12/04, reaffirmed 4/09)

ANTENATAL COUNSELING REGARDING RESUSCITATION AT AN EXTREMELY LOW GESTATIONAL AGE (CLINICAL REPORT)

Daniel G. Batton, MD, and Committee on Fetus and Newborn

ABSTRACT. The anticipated delivery of an extremely low gestational age infant raises difficult questions for all involved, including whether to initiate resuscitation after delivery. Each institution caring for women at risk of delivering extremely preterm infants should provide comprehensive and consistent guidelines for antenatal counseling. Parents should be provided the most accurate prognosis possible on the basis of all the factors known to affect outcome for a particular case. Although it is not feasible to have specific criteria for when the initiation of resuscitation should or should not be offered, the following general guidelines are suggested. If the physicians involved believe there is no chance for survival, resuscitation is not indicated and should not be initiated. When a good outcome is considered very unlikely, the parents should be given the choice of whether resuscitation should be initiated, and clinicians should respect their preference. Finally, if a good outcome is considered reasonably likely, clinicians should initiate resuscitation and, together with the parents, continually reevaluate whether intensive care should be continued. Whenever resuscitation is considered an option, a qualified individual, preferably a neonatologist, should be involved and should be present in the delivery room to manage this complex situation. Comfort care should be provided for all infants for whom resuscitation is not initiated or is not successful. (6/09)

ANTIVIRAL THERAPY AND PROPHYLAXIS FOR INFLUENZA IN CHILDREN (CLINICAL REPORT)

Committee on Infectious Diseases

ABSTRACT. Antiviral agents are available that are safe and effective for the treatment and prophylaxis of influenza virus infections in children. The neuraminidase inhibitors (oseltamivir [Tamiflu] and zanamivir [Relenza]) are preferred agents because of current widespread resistance to the adamantanes (amantadine [Symmetrel] and rimantadine [Flumadine]). Therapy should be provided to children with influenza infection who are at high risk of severe infection and to children with moderate-to-severe influenza infection who may benefit from a decrease in the duration of symptoms. Prophylaxis should be provided (1) to high-risk children who have not yet received immunization and during the 2 weeks after immunization, (2) to unimmunized family members and health care professionals with close contact with high-risk unimmunized children or infants who are younger than 6 months, and (3) for control of influenza outbreaks in unimmunized staff and children in an institutional setting. Testing of current H5N1 avian influenza virus isolates, the potential agents of pandemic influenza, suggests susceptibility to oseltamivir and zanamivir. Because no prospective data exist on the efficacy of these agents in humans for H5N1 strains, the dosage and duration of therapy in adults and children may differ from those documented to be effective for epidemic influenza strains. (4/07, reaffirmed 7/10)

THE APGAR SCORE

Committee on Fetus and Newborn (joint with American College of Obstetricians and Gynecologists)

ABSTRACT. The Apgar score provides a convenient shorthand for reporting the status of the newborn infant and the response to resuscitation. The Apgar score has been used inappropriately to predict specific neurologic outcome in the term infant. There are no consistent data on the significance of the Apgar score in preterm infants. The Apgar score has limitations, and it is inappropriate to use it alone to establish the diagnosis of asphyxia. An Apgar score assigned during resuscitation is not equivalent to a score assigned to a spontaneously breathing infant. An expanded Apgar score reporting form will account for concurrent resuscitative interventions and provide information to improve systems of perinatal and neonatal care. (4/06, reaffirmed 1/09)

APPLICATION OF THE RESOURCE-BASED RELATIVE VALUE SCALE SYSTEM TO PEDIATRICS

Committee on Coding and Nomenclature

ABSTRACT. With an increased focus on payment and productivity measurement in health care, it is essential to understand the genesis and principles behind the Medicare Resource-Based Relative Value Scale (RBRVS) physician fee schedule. The majority of third-party payers, including a growing number of Medicaid programs and commercial payers, use variations of the Medicare RBRVS as their basis for physician payment. Many group practices have also adopted this system to benchmark physician productivity and determine variable compensation and bonus payments. Because pediatric care is underrepresented in any Medicare-based payment system analysis, unique aspects of physician work and practice expense may not be accurately reflected in the total relative value units (RVUs) for certain pediatric services. Despite this potential limitation, the American Academy of Pediatrics supports the use of *Current Procedural Terminology* (CPT) codes to report unique physician work and the RBRVS physician fee schedule as a uniform payment system. The American Academy of Pediatrics will continue to work to rectify perceived inequities of the RBRVS system as they pertain to pediatrics. (12/08)

ASSESSMENT AND MANAGEMENT OF INGUINAL HERNIA IN INFANTS (CLINICAL REPORT)

Kasper S. Wang, MD; Committee on Fetus and Newborn; and Section on Surgery

ABSTRACT. Inguinal hernia repair in infants is a routine surgical procedure. However, numerous issues, including timing of the repair, the need to explore the contralateral groin, use of laparoscopy, and anesthetic approach, remain unsettled. Given the lack of compelling data, con-

sideration should be given to large, prospective, randomized controlled trials to determine best practices for the management of inguinal hernias in infants. (9/12)

ATHLETIC PARTICIPATION BY CHILDREN AND ADOLESCENTS WHO HAVE SYSTEMIC HYPERTENSION

Rebecca A. Demorest, MD; Reginald L. Washington, MD; and Council on Sports Medicine and Fitness

ABSTRACT. Children and adolescents who have hypertension may be at risk for complications when exercise causes their blood pressure to rise even higher. The purpose of this statement is to update recommendations concerning the athletic participation of individuals with hypertension, including special populations such as those with spinal cord injuries or obesity, by using the guidelines from "The 36th Bethesda Conference: Eligibility Recommendations for Competitive Athletes with Cardiovascular Abnormalities"; "The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents"; and "The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure." (5/10, reaffirmed 5/13)

AUDITORY INTEGRATION TRAINING AND FACILITATED COMMUNICATION FOR AUTISM

Committee on Children With Disabilities

ABSTRACT. This statement reviews the basis for two new therapies for autism—auditory integration training and facilitative communication. Both therapies seek to improve communication skills. Currently available information does not support the claims of proponents that these treatments are efficacious. Their use does not appear warranted at this time, except within research protocols. (8/98, reaffirmed 5/02, 1/06, 12/09)

BASEBALL AND SOFTBALL

Council on Sports Medicine and Fitness

ABSTRACT. Baseball and softball are among the most popular and safest sports in which children and adolescents participate. Nevertheless, traumatic and overuse injuries occur regularly, including occasional catastrophic injury and even death. Safety of the athlete is a constant focus of attention among those responsible for modifying rules. Understanding the stresses placed on the arm, especially while pitching, led to the institution of rules controlling the quantity of pitches thrown in youth baseball and established rest periods between pitching assignments. Similarly, field maintenance and awareness of environmental conditions as well as equipment maintenance and creative prevention strategies are critically important in minimizing the risk of injury. This statement serves as a basis for encouraging safe participation in baseball and softball. This statement has been endorsed by the Canadian Paediatric Society. (2/12)

BICYCLE HELMETS

Committee on Injury and Poison Prevention

ABSTRACT. Bicycling remains one of the most popular recreational sports among children in America and is the leading cause of recreational sports injuries treated in emergency departments. An estimated 23 000 children younger than 21 years sustained head injuries (excluding the face) while bicycling in 1998. The bicycle helmet is a very effective device that can prevent the occurrence of up to 88% of serious brain injuries. Despite this, most children do not wear a helmet each time they ride a bicycle, and adolescents are particularly resistant to helmet use. Recently, a group of national experts and government agencies renewed the call for all bicyclists to wear helmets. This policy statement describes the role of the pediatrician in helping attain universal helmet use among children and teens for each bicycle ride. (10/01, reaffirmed 1/05, 2/08, 11/11)

BONE DENSITOMETRY IN CHILDREN AND ADOLESCENTS (CLINICAL REPORT)

Laura K. Bachrach, MD; Irene N. Sills, MD; and Section on Endocrinology

ABSTRACT. Concern for bone fragility in children and adolescents has led to increased interest in bone densitometry. Pediatric patients with genetic and acquired chronic diseases, immobility, and inadequate nutrition may fail to achieve the expected gains in bone size, mass, and strength, which leaves them vulnerable to fracture. In older adults, bone densitometry has been shown to predict fracture risk and reflect response to therapy. The role of densitometry in the management of children at risk of bone fragility is less certain. This clinical report summarizes the current knowledge about bone densitometry in the pediatric population, including indications for its use, interpretation of results, and its risks and costs. This report emphasizes consensus statements generated at the 2007 Pediatric Position Development Conference of the International Society of Clinical Densitometry by an international panel of bone experts. Some of these recommendations are evidence-based, and others reflect expert opinion, because the available data are inadequate. The statements from this and other expert panels have provided general guidance to the pediatrician, but decisions about ordering and interpreting bone densitometry still require clinical judgment. Ongoing studies will help to better define the indications and best methods for assessing bone strength in children and the clinical factors that contribute to fracture risk. (12/10)

BOXING PARTICIPATION BY CHILDREN AND ADOLESCENTS

Council on Sports Medicine and Fitness (joint with Canadian Paediatric Society Healthy Active Living and Sports Medicine Committee)

ABSTRACT. Thousands of boys and girls younger than 19 years participate in boxing in North America. Although boxing provides benefits for participants, including exercise, self-discipline, and self-confidence, the sport of boxing encourages and rewards deliberate blows to the head and face. Participants in boxing are at risk of head, face, and neck injuries, including chronic and even fatal neurologic injuries. Concussions are one of the most common injuries that occur with boxing. Because of the risk of head and facial injuries, the American Academy of Pediatrics and the Canadian Paediatric Society oppose boxing as a sport for children and adolescents. These organizations recommend that physicians vigorously oppose boxing in youth and encourage patients to participate in

alternative sports in which intentional head blows are not central to the sport. (8/11)

BREASTFEEDING AND THE USE OF HUMAN MILK

Section on Breastfeeding

ABSTRACT. Breastfeeding and human milk are the normative standards for infant feeding and nutrition. Given the documented short- and long-term medical and neurodevelopmental advantages of breastfeeding, infant nutrition should be considered a public health issue and not only a lifestyle choice. The American Academy of Pediatrics reaffirms its recommendation of exclusive breastfeeding for about 6 months, followed by continued breastfeeding as complementary foods are introduced, with continuation of breastfeeding for 1 year or longer as mutually desired by mother and infant. Medical contraindications to breastfeeding are rare. Infant growth should be monitored with the World Health Organization (WHO) Growth Curve Standards to avoid mislabeling infants as underweight or failing to thrive. Hospital routines to encourage and support the initiation and sustaining of exclusive breastfeeding should be based on the American Academy of Pediatrics-endorsed WHO/UNICEF "Ten Steps to Successful Breastfeeding." National strategies supported by the US Surgeon General's Call to Action, the Centers for Disease Control and Prevention, and The Joint Commission are involved to facilitate breastfeeding practices in US hospitals and communities. Pediatricians play a critical role in their practices and communities as advocates of breastfeeding and thus should be knowledgeable about the health risks of not breastfeeding, the economic benefits to society of breastfeeding, and the techniques for managing and supporting the breastfeeding dyad. The "Business Case for Breastfeeding" details how mothers can maintain lactation in the workplace and the benefits to employers who facilitate this practice. (2/12)

THE BUILT ENVIRONMENT: DESIGNING COMMUNITIES TO PROMOTE PHYSICAL ACTIVITY IN CHILDREN

Committee on Environmental Health

ABSTRACT. An estimated 32% of American children are overweight, and physical inactivity contributes to this high prevalence of overweight. This policy statement highlights how the built environment of a community affects children's opportunities for physical activity. Neighborhoods and communities can provide opportunities for recreational physical activity with parks and open spaces, and policies must support this capacity. Children can engage in physical activity as a part of their daily lives, such as on their travel to school. Factors such as school location have played a significant role in the decreased rates of walking to school, and changes in policy may help to increase the number of children who are able to walk to school. Environment modification that addresses risks associated with automobile traffic is likely to be conducive to more walking and biking among children. Actions that reduce parental perception and fear of crime may promote outdoor physical activity. Policies that promote more active lifestyles among children and adolescents will enable them to achieve the recommended 60 minutes of daily physical activity. By working with community partners, pediatricians can participate in establishing communities designed for activity and health. (5/09, reaffirmed 1/13)

CALCIUM AND VITAMIN D REQUIREMENTS OF ENTERALLY FED PRETERM INFANTS (CLINICAL REPORT)

Steven A. Abrams, MD, and Committee on Nutrition

ABSTRACT. Bone health is a critical concern in managing preterm infants. Key nutrients of importance are calcium, vitamin D, and phosphorus. Although human milk is critical for the health of preterm infants, it is low in these nutrients relative to the needs of the infants during growth. Strategies should be in place to fortify human milk for preterm infants with birth weight <1800 to 2000 g and to ensure adequate mineral intake during hospitalization and after hospital discharge. Biochemical monitoring of very low birth weight infants should be performed during their hospitalization. Vitamin D should be provided at 200 to 400 IU/day both during hospitalization and after discharge from the hospital. Infants with radiologic evidence of rickets should have efforts made to maximize calcium and phosphorus intake by using available commercial products and, if needed, direct supplementation with these minerals. (4/13)

See full text on page 461.

CARDIOVASCULAR HEALTH SUPERVISION FOR INDIVIDUALS AFFECTED BY DUCHENNE OR BECKER MUSCULAR DYSTROPHY (CLINICAL REPORT)

Section on Cardiology and Cardiac Surgery

ABSTRACT. Duchenne muscular dystrophy is the most common and severe form of the childhood muscular dystrophies. The disease is typically diagnosed between 3 and 7 years of age and follows a predictable clinical course marked by progressive skeletal muscle weakness with loss of ambulation by 12 years of age. Death occurs in early adulthood secondary to respiratory or cardiac failure. Becker muscular dystrophy is less common and has a milder clinical course but also results in respiratory and cardiac failure. The natural history of the cardiomyopathy in these diseases has not been well established. As a result, patients traditionally present for cardiac evaluation only after clinical symptoms become evident. The purpose of this policy statement is to provide recommendations for optimal cardiovascular evaluation to health care specialists caring for individuals in whom the diagnosis of Duchenne or Becker muscular dystrophy has been confirmed. (12/05, reaffirmed 1/09)

CARDIOVASCULAR MONITORING AND STIMULANT DRUGS FOR ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

James M. Perrin, MD; Richard A. Friedman, MD; Timothy K. Knilans, MD; Black Box Working Group; and Section on Cardiology and Cardiac Surgery

ABSTRACT. A recent American Heart Association (AHA) statement recommended electrocardiograms (ECGs) routinely for children before they start medications to treat attention-deficit/hyperactivity disorder (ADHD). The AHA statement reflected the thoughtful work of a group committed to improving the health of children with heart disease. However, the recommendation to obtain

an ECG before starting medications for treating ADHD contradicts the carefully considered and evidence-based recommendations of the American Academy of Child and Adolescent Psychiatry and the American Academy of Pediatrics (AAP). These organizations have concluded that sudden cardiac death (SCD) in persons taking medications for ADHD is a very rare event, occurring at rates no higher than those in the general population of children and adolescents. Both of these groups also noted the lack of any evidence that the routine use of ECG screening before beginning medication for ADHD treatment would prevent sudden death. The AHA statement pointed out the importance of detecting silent but clinically important cardiac conditions in children and adolescents, which is a goal that the AAP shares. The primary purpose of the AHA statement is to prevent cases of SCD that may be related to stimulant medications. The recommendations of the AAP and the rationale for these recommendations are the subject of this statement. (8/08)

CARE OF ADOLESCENT PARENTS AND THEIR CHILDREN (CLINICAL REPORT)

Jorge L. Pinzon, MD; Veronnie F. Jones, MD; Committee on Adolescence; and Committee on Early Childhood

ABSTRACT. Teen pregnancy and parenting remain an important public health issue in the United States and the world, and many children live with their adolescent parents alone or as part of an extended family. A significant proportion of teen parents reside with their family of origin, significantly affecting the multigenerational family structure. Repeated births to teen parents are also common. This clinical report updates a previous policy statement on care of the adolescent parent and their children and addresses medical and psychosocial risks specific to this population. Challenges unique to teen parents and their children are reviewed, along with suggestions for the pediatrician on models for intervention and care. (11/12)

CARE OF THE ADOLESCENT SEXUAL ASSAULT VICTIM (CLINICAL REPORT)

Miriam Kaufman, MD, and Committee on Adolescence

ABSTRACT. Sexual assault is a broad-based term that encompasses a wide range of sexual victimizations including rape. Since the American Academy of Pediatrics published its last policy statement on sexual assault in 2001, additional information and data have emerged about sexual assault and rape in adolescents and the treatment and management of the adolescent who has been a victim of sexual assault. This report provides new information to update physicians and focuses on assessment and care of sexual assault victims in the adolescent population. (8/08)

CARE COORDINATION IN THE MEDICAL HOME: INTEGRATING HEALTH AND RELATED SYSTEMS OF CARE FOR CHILDREN WITH SPECIAL HEALTH CARE NEEDS

Council on Children With Disabilities

ABSTRACT. Care coordination is a process that facilitates the linkage of children and their families with appropriate services and resources in a coordinated effort to achieve good health. Care coordination for children with special health care needs often is complicated because there is no single point of entry into the multiple systems of care, and complex criteria frequently determine the availability of funding and services among public and private payers. Economic and sociocultural barriers to coordination of care exist and affect families and health care professionals. In their important role of providing a medical home for all children, primary care physicians have a vital role in the process of care coordination, in concert with the family. (11/05)

CAREGIVER-FABRICATED ILLNESS IN A CHILD: A MANIFESTATION OF CHILD MALTREATMENT (CLINICAL REPORT)

Emalee G. Flaherty, MD; Harriet L. MacMillan, MD; and Committee on Child Abuse and Neglect

ABSTRACT. Caregiver-fabricated illness in a child is a form of child maltreatment caused by a caregiver who falsifies and/or induces a child's illness, leading to unnecessary and potentially harmful medical investigations and/or treatment. This condition can result in significant morbidity and mortality. Although caregiver-fabricated illness in a child has been widely known as Munchausen syndrome by proxy, there is ongoing discussion about alternative names, including pediatric condition falsification, factitious disorder (illness) by proxy, child abuse in the medical setting, and medical child abuse. Because it is a relatively uncommon form of maltreatment, pediatricians need to have a high index of suspicion when faced with a persistent or recurrent illness that cannot be explained and that results in multiple medical procedures or when there are discrepancies between the history, physical examination, and health of a child. This report updates the previous clinical report "Beyond Munchausen Syndrome by Proxy: Identification and Treatment of Child Abuse in the Medical Setting." The authors discuss the need to agree on appropriate terminology, provide an update on published reports of new manifestations of fabricated medical conditions, and discuss approaches to assessment, diagnosis, and management, including how best to protect the child from further harm. (8/13)

See full text on page 471.

THE CHANGING CONCEPT OF SUDDEN INFANT DEATH SYNDROME: DIAGNOSTIC CODING SHIFTS, CONTROVERSIES REGARDING THE SLEEPING ENVIRONMENT, AND NEW VARIABLES TO CONSIDER IN REDUCING RISK

Task Force on Sudden Infant Death Syndrome

ABSTRACT. There has been a major decrease in the incidence of sudden infant death syndrome (SIDS) since the American Academy of Pediatrics (AAP) released its recommendation in 1992 that infants be placed down for sleep in a nonprone position. Although the SIDS rate continues to fall, some of the recent decrease of the last several years may be a result of coding shifts to other causes of unexpected infant deaths. Since the AAP published its last statement on SIDS in 2000, several issues have become relevant, including the significant risk of side sleeping position; the AAP no longer recognizes side sleeping as a reasonable alternative to fully supine sleeping. The AAP also stresses the need to avoid redundant soft bedding and soft objects in the infant's sleeping environment, the hazards of adults sleeping with an infant in the same bed, the SIDS risk reduction associated with having infants sleep

in the same room as adults and with using pacifiers at the time of sleep, the importance of educating secondary caregivers and neonatology practitioners on the importance of "back to sleep," and strategies to reduce the incidence of positional plagiocephaly associated with supine positioning. This statement reviews the evidence associated with these and other SIDS-related issues and proposes new recommendations for further reducing SIDS risk. (11/05, reaffirmed 5/08)

CHEERLEADING INJURIES: EPIDEMIOLOGY AND RECOMMENDATIONS FOR PREVENTION

Council on Sports Medicine and Fitness

ABSTRACT. Over the last 30 years, cheerleading has increased dramatically in popularity and has evolved from leading the crowd in cheers at sporting events into a competitive, year-round sport involving complex acrobatic stunts and tumbling. Consequently, cheerleading injuries have steadily increased over the years in both number and severity. Sprains and strains to the lower extremities are the most common injuries. Although the overall injury rate remains relatively low, cheerleading has accounted for approximately 66% of all catastrophic injuries in high school girl athletes over the past 25 years. Risk factors for injuries in cheerleading include higher BMI, previous injury, cheering on harder surfaces, performing stunts, and supervision by a coach with low level of training and experience. This policy statement describes the epidemiology of cheerleading injuries and provides recommendations for injury prevention. (10/12)

CHEMICAL-BIOLOGICAL TERRORISM AND ITS IMPACT ON CHILDREN

Committee on Environmental Health and Committee on Infectious Diseases

ABSTRACT. Children remain potential victims of chemical or biological terrorism. In recent years, children have even been specific targets of terrorist acts. Consequently, it is necessary to address the needs that children would face after a terrorist incident. A broad range of public health initiatives have occurred since September 11, 2001. Although the needs of children have been addressed in many of them, in many cases, these initiatives have been inadequate in ensuring the protection of children. In addition, public health and health care system preparedness for terrorism has been broadened to the so-called all-hazards approach, in which response plans for terrorism are blended with plans for a public health or health care system response to unintentional disasters (eg, natural events such as earthquakes or pandemic flu or manmade catastrophes such as a hazardous-materials spill). In response to new principles and programs that have appeared over the last 5 years, this policy statement provides an update of the 2000 policy statement. The roles of both the pediatrician and public health agencies continue to be emphasized; only a coordinated effort by pediatricians and public health can ensure that the needs of children, including emergency protocols in schools or child care centers, decontamination protocols, and mental health interventions, will be successful. (9/06, reaffirmed 1/11)

CHEMICAL-MANAGEMENT POLICY: PRIORITIZING CHILDREN'S HEALTH

Council on Environmental Health

ABSTRACT. The American Academy of Pediatrics recommends that chemical-management policy in the United States be revised to protect children and pregnant women and to better protect other populations. The Toxic Substance Control Act (TSCA) was passed in 1976. It is widely recognized to have been ineffective in protecting children, pregnant women, and the general population from hazardous chemicals in the marketplace. It does not take into account the special vulnerabilities of children in attempting to protect the population from chemical hazards. Its processes are so cumbersome that in its more than 30 years of existence, the TSCA has been used to regulate only 5 chemicals or chemical classes of the tens of thousands of chemicals that are in commerce. Under the TSCA, chemical companies have no responsibility to perform premarket testing or postmarket follow-up of the products that they produce; in fact, the TSCA contains disincentives for the companies to produce such data. Voluntary programs have been inadequate in resolving problems. Therefore, chemical-management policy needs to be rewritten in the United States. Manufacturers must be responsible for developing information about chemicals before marketing. The US Environmental Protection Agency must have the authority to demand additional safety data about a chemical and to limit or stop the marketing of a chemical when there is a high degree of suspicion that the chemical might be harmful to children, pregnant women, or other populations. (4/11)

CHILD ABUSE, CONFIDENTIALITY, AND THE HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT

Committee on Child Abuse and Neglect

ABSTRACT. The federal Health Insurance Portability and Accountability Act (HIPAA) of 1996 has significantly affected clinical practice, particularly with regard to how patient information is shared. HIPAA addresses the security and privacy of patient health data, ensuring that information is released appropriately with patient or guardian consent and knowledge. However, when child abuse or neglect is suspected in a clinical setting, the physician may determine that release of information without consent is necessary to ensure the health and safety of the child. This policy statement provides an overview of HIPAA regulations with regard to the role of the pediatrician in releasing or reviewing patient health information when the patient is a child who is a suspected victim of abuse or neglect. This statement is based on the most current regulations provided by the US Department of Health and Human Services and is subject to future changes and clarifications as updates are provided. (12/09)

THE CHILD IN COURT: A SUBJECT REVIEW (CLINICAL REPORT)

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. When children come to court as witnesses, or when their needs are decided in a courtroom, they face unique stressors from the legal proceeding and from the social predicament that resulted in court action. Effective

pediatric support and intervention requires an understanding of the situations that bring children to court and the issues that will confront children and child advocates in different court settings. (11/99, reaffirmed 11/02)

CHILD FATALITY REVIEW

Cindy W. Christian, MD; Robert D. Sege, MD, PhD; Committee on Child Abuse and Neglect; Committee on Injury, Violence, and Poison Prevention; and Council on Community Pediatrics

ABSTRACT. Injury remains the leading cause of pediatric mortality and requires public health approaches to reduce preventable deaths. Child fatality review teams, first established to review suspicious child deaths involving abuse or neglect, have expanded toward a public health model of prevention of child fatality through systematic review of child deaths from birth through adolescence. Approximately half of all states report reviewing child deaths from all causes, and the process of fatality review has identified effective local and state prevention strategies for reducing child deaths. This expanded approach can be a powerful tool in understanding the epidemiology and preventability of child death locally, regionally, and nationally; improving accuracy of vital statistics data; and identifying public health and legislative strategies for reducing preventable child fatalities. The American Academy of Pediatrics supports the development of federal and state legislation to enhance the child fatality review process and recommends that pediatricians become involved in local and state child death reviews. (8/10)

CHILD LIFE SERVICES

Committee on Hospital Care and Child Life Council

ABSTRACT. Child life programs have become standard in most large pediatric centers and even on some smaller pediatric inpatient units to address the psychosocial concerns that accompany hospitalization and other health care experiences. The child life specialist focuses on the strengths and sense of well-being of children while promoting their optimal development and minimizing the adverse effects of children's experiences in health care or other potentially stressful settings. Using play and psychological preparation as primary tools, child life interventions facilitate coping and adjustment at times and under circumstances that might prove overwhelming otherwise. Play and age-appropriate communication may be used to (1) promote optimal development, (2) present information, (3) plan and rehearse useful coping strategies for medical events or procedures, (4) work through feelings about past or impending experiences, and (5) establish therapeutic relationships with children and parents to support family involvement in each child's care, with continuity across the care continuum. The benefits of this collaborative work with the family and health care team are not limited to the health care setting; it may also optimize reintegration into schools and the community. (10/06, reaffirmed 2/12)

CHILD PASSENGER SAFETY

Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Child passenger safety has dramatically evolved over the past decade; however, motor vehicle crashes continue to be the leading cause of death of children 4 years and older. This policy statement provides 4 evidence-based recommendations for best practices in the choice of a child restraint system to optimize safety in passenger vehicles for children from birth through adolescence: (1) rear-facing car safety seats for most infants up to 2 years of age; (2) forward-facing car safety seats for most children through 4 years of age; (3) belt-positioning booster seats for most children through 8 years of age; and (4) lap-and-shoulder seat belts for all who have outgrown booster seats. In addition, a fifth evidence-based recommendation is for all children younger than 13 years to ride in the rear seats of vehicles. It is important to note that every transition is associated with some decrease in protection; therefore, parents should be encouraged to delay these transitions for as long as possible. These recommendations are presented in the form of an algorithm that is intended to facilitate implementation of the recommendations by pediatricians to their patients and families and should cover most situations that pediatricians will encounter in practice. The American Academy of Pediatrics urges all pediatricians to know and promote these recommendations as part of child passenger safety anticipatory guidance at every health-supervision visit. (3/11)

CHILD PASSENGER SAFETY (TECHNICAL REPORT)

Dennis R. Durbin, MD, MSCE, and Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Despite significant reductions in the number of children killed in motor vehicle crashes over the past decade, crashes continue to be the leading cause of death for children 4 years and older. Therefore, the American Academy of Pediatrics continues to recommend inclusion of child passenger safety anticipatory guidance at every health-supervision visit. This technical report provides a summary of the evidence in support of 5 recommendations for best practices to optimize safety in passenger vehicles for children from birth through adolescence that all pediatricians should know and promote in their routine practice. These recommendations are presented in the revised policy statement on child passenger safety in the form of an algorithm that is intended to facilitate their implementation by pediatricians with their patients and families. The algorithm is designed to cover the majority of situations that pediatricians will encounter in practice. In addition, a summary of evidence on a number of additional issues that affect the safety of children in motor vehicles, including the proper use and installation of child restraints, exposure to air bags, travel in pickup trucks, children left in or around vehicles, and the importance of restraint laws, is provided. Finally, this technical report provides pediatricians with a number of resources for additional information to use when providing anticipatory guidance to families. (3/11)

CHILDREN, ADOLESCENTS, AND ADVERTISING
Committee on Communications
ABSTRACT. Advertising is a pervasive influence on children and adolescents. Young people view more than 40 000 ads per year on television alone and increasingly are being exposed to advertising on the Internet, in magazines, and in schools. This exposure may contribute significantly to childhood and adolescent obesity, poor nutrition, and cigarette and alcohol use. Media education has been shown to be effective in mitigating some of the negative effects of advertising on children and adolescents. (12/06, reaffirmed 3/10)

CHILDREN, ADOLESCENTS, AND THE MEDIA
Council on Communications and Media
ABSTRACT. Media, from television to the "new media" (including cell phones, iPads, and social media), are a dominant force in children's lives. Although television is still the predominant medium for children and adolescents, new technologies are increasingly popular. The American Academy of Pediatrics continues to be concerned by evidence about the potential harmful effects of media messages and images; however, important positive and prosocial effects of media use should also be recognized. Pediatricians are encouraged to take a media history and ask 2 media questions at every well-child visit: How much recreational screen time does your child or teenager consume daily? Is there a television set or Internet-connected device in the child's bedroom? Parents are encouraged to establish a family home use plan for all media. Media influences on children and teenagers should be recognized by schools, policymakers, product advertisers, and entertainment producers. (10/13)
See full text on page 481.

CHILDREN, ADOLESCENTS, OBESITY, AND THE MEDIA
Council on Communications and Media
ABSTRACT. Obesity has become a worldwide public health problem. Considerable research has shown that the media contribute to the development of child and adolescent obesity, although the exact mechanism remains unclear. Screen time may displace more active pursuits, advertising of junk food and fast food increases children's requests for those particular foods and products, snacking increases while watching TV or movies, and late-night screen time may interfere with getting adequate amounts of sleep, which is a known risk factor for obesity. Sufficient evidence exists to warrant a ban on junk-food or fast-food advertising in children's TV programming. Pediatricians need to ask 2 questions about media use at every well-child or well-adolescent visit: (1) How much screen time is being spent per day? and (2) Is there a TV set or Internet connection in the child's bedroom? (7/11)

CHILDREN, ADOLESCENTS, SUBSTANCE ABUSE, AND THE MEDIA
Victor C. Strasburger, MD, and Council on Communications and Media
ABSTRACT. The causes of adolescent substance use are multifactorial, but the media can play a key role. Tobacco and alcohol represent the 2 most significant drug threats to adolescents. More than $25 billion per year is spent on advertising for tobacco, alcohol, and prescription drugs, and such advertising has been shown to be effective. Digital media are increasingly being used to advertise drugs. In addition, exposure to PG-13– and R-rated movies at an early age may be a major factor in the onset of adolescent tobacco and alcohol use. The American Academy of Pediatrics recommends a ban on all tobacco advertising in all media, limitations on alcohol advertising, avoiding exposure of young children to substance-related (tobacco, alcohol, prescription drugs, illegal drugs) content on television and in PG-13– and R-rated movies, incorporating the topic of advertising and media into all substance abuse–prevention programs, and implementing media education programs in the classroom. (9/10)

CHILDREN, ADOLESCENTS, AND TELEVISION
Committee on Public Education
ABSTRACT. This statement describes the possible negative health effects of television viewing on children and adolescents, such as violent or aggressive behavior, substance use, sexual activity, obesity, poor body image, and decreased school performance. In addition to the television ratings system and the v-chip (electronic device to block programming), media education is an effective approach to mitigating these potential problems. The American Academy of Pediatrics offers a list of recommendations on this issue for pediatricians and for parents, the federal government, and the entertainment industry. (2/01)

CHILDREN AS HEMATOPOIETIC STEM CELL DONORS
Committee on Bioethics
ABSTRACT. In the past half-century, hematopoietic stem cell transplantation has become standard treatment for a variety of diseases in children and adults, including selected hematologic malignancies, immunodeficiencies, hemoglobinopathies, bone marrow failure syndromes, and congenital metabolic disorders. There are 3 sources of allogeneic hematopoietic stem cells: bone marrow, peripheral blood, and umbilical cord blood; each has its own benefits and risks. Children often serve as hematopoietic stem cell donors, most commonly for their siblings. HLA-matched biological siblings are generally preferred as donors because of reduced risks of transplant-related complications as compared with unrelated donors. This statement includes a discussion of the ethical considerations regarding minors serving as stem cell donors, using the traditional benefit/burden calculation from the perspectives of both the donor and the recipient. The statement also includes an examination of the circumstances under which a minor may ethically participate as a hematopoietic stem cell donor, how the risks can be minimized, what the informed-consent process should entail, the role for a donor advocate (or some similar mechanism), and other ethical concerns. The American Academy of Pediatrics holds that minors can ethically serve as stem cell donors when specific criteria are fulfilled. (1/10)

CHILDREN IN PICKUP TRUCKS

Committee on Injury and Poison Prevention

ABSTRACT. Pickup trucks have become increasingly popular in the United States. A recent study found that in crashes involving fatalities, cargo area passengers were 3 times more likely to die than were occupants in the cab. Compared with restrained cab occupants, the risk of death for those in the cargo area was 8 times higher. Furthermore, the increased use of extended-cab pickup trucks and air bag-equipped front passenger compartments creates concerns about the safe transport of children. The most effective preventive strategies are the legislative prohibition of travel in the cargo area and requirements for age-appropriate restraint use and seat selection in the cab. Parents should select vehicles that are appropriate for the safe transportation needs of the family. Physicians have an important role in counseling families and advocating public policy measures to reduce the number of deaths and injuries to occupants of pickup trucks. (10/00, reaffirmed 5/04, 1/07)

CHRONIC ABDOMINAL PAIN IN CHILDREN (CLINICAL REPORT)

Subcommittee on Chronic Abdominal Pain (joint with North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition)

ABSTRACT. Children and adolescents with chronic abdominal pain pose unique challenges to their caregivers. Affected children and their families experience distress and anxiety that can interfere with their ability to perform regular daily activities. Although chronic abdominal pain in children is usually attributable to a functional disorder rather than organic disease, numerous misconceptions, insufficient knowledge among health care professionals, and inadequate application of knowledge may contribute to a lack of effective management. This clinical report accompanies a technical report (see page e370 in this issue) on childhood chronic abdominal pain and provides guidance for the clinician in the evaluation and treatment of children with chronic abdominal pain. The recommendations are based on the evidence reviewed in the technical report and on consensus achieved among subcommittee members. (3/05)

CHRONIC ABDOMINAL PAIN IN CHILDREN (TECHNICAL REPORT)

Subcommittee on Chronic Abdominal Pain (joint with North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition)

ABSTRACT. Chronic abdominal pain, defined as long-lasting intermittent or constant abdominal pain, is a common pediatric problem encountered by primary care physicians, medical subspecialists, and surgical specialists. Chronic abdominal pain in children is usually functional, that is, without objective evidence of an underlying organic disorder. The Subcommittee on Chronic Abdominal Pain of the American Academy of Pediatrics and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition has prepared this report based on a comprehensive, systematic review and rating of the medical literature. This report accompanies a clinical report based on the literature review and expert opinion.

The subcommittee examined the diagnostic and therapeutic value of a medical and psychological history, diagnostic tests, and pharmacologic and behavioral therapy. The presence of alarm symptoms or signs (such as weight loss, gastrointestinal bleeding, persistent fever, chronic severe diarrhea, and significant vomiting) is associated with a higher prevalence of organic disease. There was insufficient evidence to state that the nature of the abdominal pain or the presence of associated symptoms (such as anorexia, nausea, headache, and joint pain) can discriminate between functional and organic disorders. Although children with chronic abdominal pain and their parents are more often anxious or depressed, the presence of anxiety, depression, behavior problems, or recent negative life events does not distinguish between functional and organic abdominal pain. Most children who are brought to the primary care physician's office for chronic abdominal pain are unlikely to require diagnostic testing. Pediatric studies of therapeutic interventions were examined and found to be limited or inconclusive. (3/05)

CIRCUMCISION POLICY STATEMENT

Task Force on Circumcision

ABSTRACT. Male circumcision is a common procedure, generally performed during the newborn period in the United States. In 2007, the American Academy of Pediatrics (AAP) formed a multidisciplinary task force of AAP members and other stakeholders to evaluate the recent evidence on male circumcision and update the Academy's 1999 recommendations in this area. Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks and that the procedure's benefits justify access to this procedure for families who choose it. Specific benefits identified included prevention of urinary tract infections, penile cancer, and transmission of some sexually transmitted infections, including HIV. The American College of Obstetricians and Gynecologists has endorsed this statement. (8/12)

CLASSIFYING RECOMMENDATIONS FOR CLINICAL PRACTICE GUIDELINES

Steering Committee on Quality Improvement and Management

ABSTRACT. Clinical practice guidelines are intended to improve the quality of clinical care by reducing inappropriate variations, producing optimal outcomes for patients, minimizing harm, and promoting cost-effective practices. This statement proposes an explicit classification of recommendations for clinical practice guidelines of the American Academy of Pediatrics (AAP) to promote communication among guideline developers, implementers, and other users of guideline knowledge, to improve consistency, and to facilitate user understanding. The statement describes 3 sequential activities in developing evidence-based clinical practice guidelines and related policies: 1) determination of the aggregate evidence quality in support of a proposed recommendation; 2) evaluation of the anticipated balance between benefits and harms when the recommendation is carried out; and

3) designation of recommendation strength. An individual policy can be reported as a "strong recommendation," "recommendation," "option," or "no recommendation." Use of this classification is intended to improve consistency and increase the transparency of the guideline-development process, facilitate understanding of AAP clinical practice guidelines, and enhance both the utility and credibility of AAP clinical practice guidelines. (9/04)

CLIMATIC HEAT STRESS AND EXERCISING CHILDREN AND ADOLESCENTS

Council on Sports Medicine and Fitness and Council on School Health

ABSTRACT. Results of new research indicate that, contrary to previous thinking, youth do not have less effective thermoregulatory ability, insufficient cardiovascular capacity, or lower physical exertion tolerance compared with adults during exercise in the heat when adequate hydration is maintained. Accordingly, besides poor hydration status, the primary determinants of reduced performance and exertional heat-illness risk in youth during sports and other physical activities in a hot environment include undue physical exertion, insufficient recovery between repeated exercise bouts or closely scheduled same-day training sessions or rounds of sports competition, and inappropriately wearing clothing, uniforms, and protective equipment that play a role in excessive heat retention. Because these known contributing risk factors are modifiable, exertional heat illness is usually preventable. With appropriate preparation, modifications, and monitoring, most healthy children and adolescents can safely participate in outdoor sports and other physical activities through a wide range of challenging warm to hot climatic conditions. (8/11)

CLINICAL GENETIC EVALUATION OF THE CHILD WITH MENTAL RETARDATION OR DEVELOPMENTAL DELAYS (CLINICAL REPORT)

John B. Moeschler, MD; Michael Shevell, MD; and Committee on Genetics

ABSTRACT. This clinical report describes the clinical genetic evaluation of the child with developmental delays or mental retardation. The purpose of this report is to describe the optimal clinical genetics diagnostic evaluation to assist pediatricians in providing a medical home for children with developmental delays or mental retardation and their families. The literature supports the benefit of expert clinical judgment by a consulting clinical geneticist in the diagnostic evaluation. However, it is recognized that local factors may preclude this particular option. No single approach to the diagnostic process is supported by the literature. This report addresses the diagnostic importance of clinical history, 3-generation family history, dysmorphologic examination, neurologic examination, chromosome analysis (≥650 bands), fragile X molecular genetic testing, fluorescence in situ hybridization studies for subtelomere chromosome rearrangements, molecular genetic testing for typical and atypical presentations of known syndromes, computed tomography and/or magnetic resonance brain imaging, and targeted studies for metabolic disorders. (6/06, reaffirmed 5/12)

***CLOSTRIDIUM DIFFICILE* INFECTION IN INFANTS AND CHILDREN**

Committee on Infectious Diseases

ABSTRACT. Infections caused by *Clostridium difficile* in hospitalized children are increasing. The recent publication of clinical practice guidelines for *C difficile* infection in adults did not address issues that are specific to children. The purpose of this policy statement is to provide the pediatrician with updated information and recommendations about *C difficile* infections affecting pediatric patients. (12/12)

COCHLEAR IMPLANTS IN CHILDREN: SURGICAL SITE INFECTIONS AND PREVENTION AND TREATMENT OF ACUTE OTITIS MEDIA AND MENINGITIS

Lorry G. Rubin, MD; Blake Papsin, MD; Committee on Infectious Diseases; and Section on Otolaryngology–Head and Neck Surgery

ABSTRACT. The use of cochlear implants is increasingly common, particularly in children younger than 3 years. Bacterial meningitis, often with associated acute otitis media, is more common in children with cochlear implants than in groups of control children. Children with profound deafness who are candidates for cochlear implants should receive all age-appropriate doses of pneumococcal conjugate and *Haemophilus influenzae* type b conjugate vaccines and appropriate annual immunization against influenza. In addition, starting at 24 months of age, a single dose of 23-valent pneumococcal polysaccharide vaccine should be administered. Before implant surgery, primary care providers and cochlear implant teams should ensure that immunizations are up-to-date, preferably with completion of indicated vaccines at least 2 weeks before implant surgery. Imaging of the temporal bone/inner ear should be performed before cochlear implantation in all children with congenital deafness and all patients with profound hearing impairment and a history of bacterial meningitis to identify those with inner-ear malformations/cerebrospinal fluid fistulas or ossification of the cochlea. During the initial months after cochlear implantation, the risk of complications of acute otitis media may be higher than during subsequent time periods. Therefore, it is recommended that acute otitis media diagnosed during the first 2 months after implantation be initially treated with a parenteral antibiotic (eg, ceftriaxone or cefotaxime). Episodes occurring 2 months or longer after implantation can be treated with a trial of an oral antimicrobial agent (eg, amoxicillin or amoxicillin/clavulanate at a dose of approximately 90 mg/kg per day of amoxicillin component), provided the child does not appear toxic and the implant does not have a spacer/positioner, a wedge that rests in the cochlea next to the electrodes present in certain implant models available between 1999 and 2002. "Watchful waiting" without antimicrobial therapy is inappropriate for children with implants with acute otitis media. If feasible, tympanocentesis should be performed for acute otitis media, and the material should be sent for culture, but performance of this procedure should not result in an undue delay in initiating antimicrobial therapy. For patients with suspected meningitis, cerebrospinal fluid as well as middle-ear fluid, if present, should be sent for culture. Empiric antimicrobial therapy for meningitis

occurring within 2 months of implantation should include an agent with broad activity against Gram-negative bacilli (eg, meropenem) plus vancomycin. For meningitis occurring 2 months or longer after implantation, standard empiric antimicrobial therapy for meningitis (eg, ceftriaxone plus vancomycin) is indicated. For patients with meningitis, urgent evaluation by an otolaryngologist is indicated for consideration of imaging and surgical exploration. (7/10)

COLLABORATIVE ROLE OF THE PEDIATRICIAN IN THE DIAGNOSIS AND MANAGEMENT OF BIPOLAR DISORDER IN ADOLESCENTS (CLINICAL REPORT)

Benjamin N. Shain, MD, PhD, and Committee on Adolescence

ABSTRACT. Despite the complexity of diagnosis and management, pediatricians have an important collaborative role in referring and partnering in the management of adolescents with bipolar disorder. This report presents the classification of bipolar disorder as well as interviewing and diagnostic guidelines. Treatment options are described, particularly focusing on medication management and rationale for the common practice of multiple, simultaneous medications. Medication adverse effects may be problematic and better managed with collaboration between mental health professionals and pediatricians. Case examples illustrate a number of common diagnostic and management issues. (11/12)

COMMUNICATING WITH CHILDREN AND FAMILIES: FROM EVERYDAY INTERACTIONS TO SKILL IN CONVEYING DISTRESSING INFORMATION (TECHNICAL REPORT)

Marcia Levetown, MD, and Committee on Bioethics

ABSTRACT. Health care communication is a skill that is critical to safe and effective medical practice; it can and must be taught. Communication skill influences patient disclosure, treatment adherence and outcome, adaptation to illness, and bereavement. This article provides a review of the evidence regarding clinical communication in the pediatric setting, covering the spectrum from outpatient primary care consultation to death notification, and provides practical suggestions to improve communication with patients and families, enabling more effective, efficient, and empathic pediatric health care. (5/08, reaffirmed 5/11)

COMMUNITY PEDIATRICS: NAVIGATING THE INTERSECTION OF MEDICINE, PUBLIC HEALTH, AND SOCIAL DETERMINANTS OF CHILDREN'S HEALTH

Council on Community Pediatrics

ABSTRACT. This policy statement provides a framework for the pediatrician's role in promoting the health and well-being of all children in the context of their families and communities. It offers pediatricians a definition of community pediatrics, emphasizes the importance of recognizing social determinants of health, and delineates the need to partner with public health to address population-based child health issues. It also recognizes the importance of pediatric involvement in child advocacy at local, state, and federal levels to ensure all children have access to a high-quality medical home and to eliminate child health disparities. This statement provides a set of specific recommendations that underscore the critical nature of this dimension of pediatric practice, teaching, and research. (2/13)

See full text on page 487.

COMPREHENSIVE HEALTH EVALUATION OF THE NEWLY ADOPTED CHILD (CLINICAL REPORT)

Veronnie F. Jones, MD, PhD, MSPH, and Committee on Early Childhood, Adoption, and Dependent Care

ABSTRACT. Children who join families through the process of adoption often have multiple health care needs. After placement in an adoptive home, it is essential that these children have a timely comprehensive health evaluation. This evaluation should include a review of all available medical records and a complete physical examination. Evaluation should also include diagnostic testing based on the findings from the history and physical examination as well as the risks presented by the child's previous living conditions. Age-appropriate screens should be performed, including, for example, newborn screening panels, hearing, vision, dental, and formal behavioral/developmental screens. The comprehensive assessment can occur at the time of the initial visit to the physician after adoptive placement or can take place over several visits. Adopted children should be referred to other medical specialists as deemed appropriate. The Section on Adoption and Foster Care is a resource within the American Academy of Pediatrics for physicians providing care for children who are being adopted. (12/11)

CONDOM USE BY ADOLESCENTS

Committee on Adolescence

ABSTRACT. Rates of sexual activity, pregnancies, and births among adolescents have continued to decline during the past decade to historic lows. Despite these positive trends, many adolescents remain at risk for unintended pregnancy and sexually transmitted infections (STIs). This policy statement has been developed to assist the pediatrician in understanding and supporting the use of condoms by their patients to prevent unintended pregnancies and STIs and address barriers to their use. When used consistently and correctly, male latex condoms reduce the risk of pregnancy and many STIs, including HIV. Since the last policy statement published 12 years ago, there is an increased evidence base supporting the protection provided by condoms against STIs. Rates of acquisition of STIs/HIV among adolescents remain unacceptably high. Interventions that increase availability or accessibility to condoms are most efficacious when combined with additional individual, small-group, or community-level activities that include messages about safer sex. Continued research is needed to inform public health interventions for adolescents that increase the consistent and correct use of condoms and promote dual protection of condoms for STI prevention with other effective methods of contraception. (10/13)

See full text on page 495.

CONFIDENTIALITY IN ADOLESCENT HEALTH CARE
Committee on Adolescence (4/89, reaffirmed 1/93, 11/97, 5/00, 5/04)

CONFLICTS BETWEEN RELIGIOUS OR SPIRITUAL BELIEFS AND PEDIATRIC CARE: INFORMED REFUSAL, EXEMPTIONS, AND PUBLIC FUNDING
Committee on Bioethics
ABSTRACT. Although respect for parents' decision-making authority is an important principle, pediatricians should report suspected cases of medical neglect, and the state should, at times, intervene to require medical treatment of children. Some parents' reasons for refusing medical treatment are based on their religious or spiritual beliefs. In cases in which treatment is likely to prevent death or serious disability or relieve severe pain, children's health and future autonomy should be protected. Because religious exemptions to child abuse and neglect laws do not equally protect all children and may harm some children by causing confusion about the duty to provide medical treatment, these exemptions should be repealed. Furthermore, public health care funds should not cover alternative unproven religious or spiritual healing practices. Such payments may inappropriately legitimize these practices as appropriate medical treatment. (10/13)
See full text on page 507.

CONGENITAL ADRENAL HYPERPLASIA (TECHNICAL REPORT)
Section on Endocrinology and Committee on Genetics
ABSTRACT. The Section on Endocrinology and the Committee on Genetics of the American Academy of Pediatrics, in collaboration with experts from the field of pediatric endocrinology and genetics, developed this policy statement as a means of providing up-to-date information for the practicing pediatrician about current practice and controversial issues in congenital adrenal hyperplasia (CAH), including the current status of prenatal diagnosis and treatment, the benefits and problem areas of neonatal screening programs, and the management of children with nonclassic CAH. The reference list is designed to allow physicians who wish more information to research the topic more thoroughly. (12/00, reaffirmed 10/04)

A CONSENSUS STATEMENT ON HEALTH CARE TRANSITIONS FOR YOUNG ADULTS WITH SPECIAL HEALTH CARE NEEDS
American Academy of Pediatrics, American Academy of Family Physicians, and American College of Physicians-American Society of Internal Medicine
ABSTRACT. This policy statement represents a consensus on the critical first steps that the medical profession needs to take to realize the vision of a family-centered, continuous, comprehensive, coordinated, compassionate, and culturally competent health care system that is as developmentally appropriate as it is technically sophisticated. The goal of transition in health care for young adults with special health care needs is to maximize lifelong functioning and potential through the provision of high-quality, developmentally appropriate health care services that continue uninterrupted as the individual moves from adolescence to adulthood. This consensus document has now been approved as policy by the boards of the American Academy of Pediatrics, the American Academy of Family Physicians, and the American College of Physicians-American Society of Internal Medicine. (12/02)

CONSENT FOR EMERGENCY MEDICAL SERVICES FOR CHILDREN AND ADOLESCENTS
Committee on Pediatric Emergency Medicine and Committee on Bioethics
ABSTRACT. Parental consent generally is required for the medical evaluation and treatment of minor children. However, children and adolescents might require evaluation of and treatment for emergency medical conditions in situations in which a parent or legal guardian is not available to provide consent or conditions under which an adolescent patient might possess the legal authority to provide consent. In general, a medical screening examination and any medical care necessary and likely to prevent imminent and significant harm to the pediatric patient with an emergency medical condition should not be withheld or delayed because of problems obtaining consent. The purpose of this policy statement is to provide guidance in those situations in which parental consent is not readily available, in which parental consent is not necessary, or in which parental refusal of consent places a child at risk of significant harm. (7/11)

CONSENT BY PROXY FOR NONURGENT PEDIATRIC CARE (CLINICAL REPORT)
Gary N. McAbee, DO, JD, and Committee on Medical Liability and Risk Management
ABSTRACT. Minor-aged patients are often brought to the pediatrician for nonurgent acute medical care, physical examinations, or health supervision visits by someone other than their legally authorized representative, which, in most situations, is a parent. These surrogates or proxies can be members of the child's extended family, such as a grandparent, adult sibling, or aunt/uncle; a noncustodial parent or stepparent in cases of divorce and remarriage; an adult who lives in the home but is not biologically or legally related to the child; or even a child care professional (eg, au pair, nanny). This report identifies common situations in which pediatricians may encounter "consent by proxy" for nonurgent medical care for minors, including physical examinations, and explains the potential for liability exposure associated with these circumstances. The report suggests practical steps that balance the need to minimize the physician's liability exposure with the patient's access to health care. Key issues to be considered when creating or updating office policies for obtaining and documenting consent by proxy are offered. (10/10)

CONSUMPTION OF RAW OR UNPASTEURIZED MILK AND MILK PRODUCTS BY PREGNANT WOMEN AND CHILDREN
Committee on Infectious Diseases and Committee on Nutrition
ABSTRACT. Sales of raw or unpasteurized milk and milk products are still legal in at least 30 states in the United States. Raw milk and milk products from cows, goats, and sheep continue to be a source of bacterial infections

attributable to a number of virulent pathogens, including *Listeria monocytogenes, Campylobacter jejuni, Salmonella* species, *Brucella* species, and *Escherichia coli* O157. These infections can occur in both healthy and immunocompromised individuals, including older adults, infants, young children, and pregnant women and their unborn fetuses, in whom life-threatening infections and fetal miscarriage can occur. Efforts to limit the sale of raw milk products have met with opposition from those who are proponents of the purported health benefits of consuming raw milk products, which contain natural or unprocessed factors not inactivated by pasteurization. However, the benefits of these natural factors have not been clearly demonstrated in evidence-based studies and, therefore, do not outweigh the risks of raw milk consumption. Substantial data suggest that pasteurized milk confers equivalent health benefits compared with raw milk, without the additional risk of bacterial infections. The purpose of this policy statement was to review the risks of raw milk consumption in the United States and to provide evidence of the risks of infectious complications associated with consumption of unpasteurized milk and milk products, especially among pregnant women, infants, and children. (12/13)

See full text on page 513.

CONTRACEPTION AND ADOLESCENTS

Committee on Adolescence

ABSTRACT. Although adolescent pregnancy rates in the United States have decreased significantly over the past decade, births to adolescents remain both an individual and public health issue. As advocates for the health and well-being of all young people, the American Academy of Pediatrics strongly supports the recommendation that adolescents postpone consensual sexual activity until they are fully ready for the emotional, physical, and financial consequences of sex. The academy recognizes, however, that some young people will choose not to postpone sexual activity, and as health care providers, the responsibility of pediatricians includes helping teens reduce risks and negative health consequences associated with adolescent sexual behaviors, including unintended pregnancies and sexually transmitted infections. This policy statement provides the pediatrician with updated information on contraception methods and guidelines for counseling adolescents. (11/07)

CONTROVERSIES CONCERNING VITAMIN K AND THE NEWBORN

Committee on Fetus and Newborn

ABSTRACT. Prevention of early vitamin K deficiency bleeding (VKDB) of the newborn, with onset at birth to 2 weeks of age (formerly known as classic hemorrhagic disease of the newborn), by oral or parenteral administration of vitamin K is accepted practice. In contrast, late VKDB, with onset from 2 to 12 weeks of age, is most effectively prevented by parenteral administration of vitamin K. Earlier concern regarding a possible causal association between parenteral vitamin K and childhood cancer has not been substantiated. This revised statement presents updated recommendations for the use of vitamin K in the prevention of early and late VKDB. (7/03, reaffirmed 5/06, 5/09)

COPARENT OR SECOND-PARENT ADOPTION BY SAME-SEX PARENTS

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. Children who are born to or adopted by 1 member of a same-sex couple deserve the security of 2 legally recognized parents. Therefore, the American Academy of Pediatrics supports legislative and legal efforts to provide the possibility of adoption of the child by the second parent or coparent in these families. (2/02, reaffirmed 5/09)

COPARENT OR SECOND-PARENT ADOPTION BY SAME-SEX PARENTS (TECHNICAL REPORT)

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. A growing body of scientific literature demonstrates that children who grow up with 1 or 2 gay and/or lesbian parents fare as well in emotional, cognitive, social, and sexual functioning as do children whose parents are heterosexual. Children's optimal development seems to be influenced more by the nature of the relationships and interactions within the family unit than by the particular structural form it takes. (2/02, reaffirmed 5/09)

CORPORAL PUNISHMENT IN SCHOOLS

Committee on School Health

ABSTRACT. The American Academy of Pediatrics recommends that corporal punishment in schools be abolished in all states by law and that alternative forms of student behavior management be used. (8/00, reaffirmed 6/03, 5/06, 2/12)

COUNSELING THE ADOLESCENT ABOUT PREGNANCY OPTIONS

Committee on Adolescence

ABSTRACT. When consulted by a pregnant adolescent, pediatricians should be able to make a timely diagnosis and to help the adolescent understand her options and act on her decision to continue or terminate her pregnancy. Pediatricians may not impose their values on the decision-making process and should be prepared to support the adolescent in her decision or refer her to a physician who can. (5/98, reaffirmed 1/01, 1/06)

COUNSELING FAMILIES WHO CHOOSE COMPLEMENTARY AND ALTERNATIVE MEDICINE FOR THEIR CHILD WITH CHRONIC ILLNESS OR DISABILITY

Committee on Children With Disabilities

ABSTRACT. The use of complementary and alternative medicine (CAM) to treat chronic illness or disability is increasing in the United States. This is especially evident among children with autism and related disorders. It may be challenging to the practicing pediatrician to distinguish among accepted biomedical treatments, unproven therapies, and alternative therapies. Moreover, there are no published guidelines regarding the use of CAM in the care of children with chronic illness or disability. To best serve the interests of children, it is important to maintain a scientific perspective, to provide balanced advice about therapeutic options, to guard against bias, and to establish and maintain a trusting relationship with families. This

statement provides information and guidance for pediatricians when counseling families about CAM. (3/01, reaffirmed 1/05, 5/10)

CREATING HEALTHY CAMP EXPERIENCES
Council on School Health
ABSTRACT. The American Academy of Pediatrics has created recommendations for health appraisal and preparation of young people before participation in day or resident camps and to guide health and safety practices for children at camp. These recommendations are intended for parents, primary health care providers, and camp administration and health center staff. Although camps have diverse environments, there are general guidelines that apply to all situations and specific recommendations that are appropriate under special conditions. This policy statement has been reviewed and is supported by the American Camp Association. (3/11)

THE CRUCIAL ROLE OF RECESS IN SCHOOL
Council on School Health
ABSTRACT. Recess is at the heart of a vigorous debate over the role of schools in promoting the optimal development of the whole child. A growing trend toward reallocating time in school to accentuate the more academic subjects has put this important facet of a child's school day at risk. Recess serves as a necessary break from the rigors of concentrated, academic challenges in the classroom. But equally important is the fact that safe and well-supervised recess offers cognitive, social, emotional, and physical benefits that may not be fully appreciated when a decision is made to diminish it. Recess is unique from, and a complement to, physical education—not a substitute for it. The American Academy of Pediatrics believes that recess is a crucial and necessary component of a child's development and, as such, it should not be withheld for punitive or academic reasons. (12/12)

DEALING WITH THE PARENT WHOSE JUDGMENT IS IMPAIRED BY ALCOHOL OR DRUGS: LEGAL AND ETHICAL CONSIDERATIONS (CLINICAL REPORT)
Committee on Medical Liability
ABSTRACT. An estimated 11 to 17.5 million children are being raised by a substance-abusing parent or guardian. The importance of this statistic is undeniable, particularly when a patient is brought to a pediatric office by a parent or guardian exhibiting symptoms of judgment impairment. Although the physician-patient relationship exists between the pediatrician and the minor patient, other obligations (some perceived and some real) should be considered as well. In managing encounters with impaired parents who may become disruptive or dangerous, pediatricians should be aware of their responsibilities before acting. In addition to fulfilling the duty involved with an established physician-patient relationship, the pediatrician should take reasonable care to safeguard patient confidentiality; protect the safety of the patient and other patients, visitors, and employees; and comply with reporting mandates. This clinical report identifies and discusses the legal and ethical concepts related to these circumstances. The report offers implementation suggestions when establishing anticipatory office procedures and training programs for staff on what to do (and not do) in such situations to maximize the patient's well-being and safety and minimize the liability of the pediatrician. (9/04, reaffirmed 9/10)

DEATH OF A CHILD IN THE EMERGENCY DEPARTMENT (TECHNICAL REPORT)
Jane Knapp, MD; Deborah Mulligan-Smith, MD; and Committee on Pediatric Emergency Medicine
ABSTRACT. Of the estimated 40000 American children ≤14 years old who die each year, approximately 20% die or are pronounced dead in outpatient sites, primarily the emergency department (ED). The ED is distinguishable from other sites at which children die, because the death is often sudden, unexpected, and without a previously established physician-patient care relationship. Despite these difficult circumstances and potentially limited professional experience with the death of a child, the emergency physician must be prepared to respond to the emotional, cultural, procedural, and legal issues that are an inevitable part of caring for ill and injured children who die. All of this must be accomplished while supporting a grieving family. There is also a responsibility to inform the child's pediatrician of the death, who in turn also must be prepared to counsel and support bereaved families. The American Academy of Pediatrics and American College of Emergency Physicians collaborated on the joint policy statement, "Death of a Child in the Emergency Department," agreeing on recommendations on the principles of care after the death of a child in the ED. This technical report provides the background information, consensus opinion, and evidence, where available, used to support the recommendations found in the policy statement. Important among these are the pediatrician's role as an advocate to advise in the formulation of ED policy and procedure that facilitate identification and management of medical examiners' cases, identification and reporting of child maltreatment, requests for postmortem examinations, and procurement of organ donations. (5/05, reaffirmed 8/13)

DEATH OF A CHILD IN THE EMERGENCY DEPARTMENT: JOINT STATEMENT OF THE AMERICAN ACADEMY OF PEDIATRICS AND THE AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
Committee on Pediatric Emergency Medicine (joint with American College of Emergency Physicians) (10/02, reaffirmed 1/06, 1/09, 8/13)

DEVELOPMENTAL DYSPLASIA OF THE HIP PRACTICE GUIDELINE (TECHNICAL REPORT)
Harold P. Lehmann, MD, PhD; Richard Hinton, MD, MPH; Paola Morello, MD; Jeanne Santoli, MD; in conjunction with Committee on Quality Improvement and Subcommittee on Developmental Dysplasia of the Hip
ABSTRACT. *Objective.* To create a recommendation for pediatricians and other primary care providers about their role as screeners for detecting developmental dysplasia of the hip (DDH) in children.

Patients. Theoretical cohorts of newborns.

Method. Model-based approach using decision analysis as the foundation. Components of the approach include the following:

Perspective: Primary care provider.

Outcomes: DDH, avascular necrosis of the hip (AVN).

Options: Newborn screening by pediatric examination; orthopaedic examination; ultrasonographic examination; orthopaedic or ultrasonographic examination by risk factors. Intercurrent health supervision-based screening.

Preferences: 0 for bad outcomes, 1 for best outcomes.

Model: Influence diagram assessed by the Subcommittee and by the methodology team, with critical feedback from the Subcommittee.

Evidence Sources: Medline and EMBASE search of the research literature through June 1996. Hand search of sentinel journals from June 1996 through March 1997. Ancestor search of accepted articles.

Evidence Quality: Assessed on a custom subjective scale, based primarily on the fit of the evidence to the decision model.

Results. After discussion, explicit modeling, and critique, an influence diagram of 31 nodes was created. The computer-based and the hand literature searches found 534 articles, 101 of which were reviewed by 2 or more readers. Ancestor searches of these yielded a further 17 articles for evidence abstraction. Articles came from around the globe, although primarily Europe, British Isles, Scandinavia, and their descendants. There were 5 controlled trials, each with a sample size less than 40. The remainder were case series. Evidence was available for 17 of the desired 30 probabilities. Evidence quality ranged primarily between one third and two thirds of the maximum attainable score (median: 10–21; interquartile range: 8–14).Based on the raw evidence and Bayesian hierarchical meta-analyses, our estimate for the incidence of DDH revealed by physical examination performed by pediatricians is 8.6 per 1000; for orthopaedic screening, 11.5; for ultrasonography, 25. The odds ratio for DDH, given breech delivery, is 5.5; for female sex, 4.1; for positive family history, 1.7, although this last factor is not statistically significant. Postneonatal cases of DDH were divided into mid-term (younger than 6 months of age) and late-term (older than 6 months of age). Our estimates for the mid-term rate for screening by pediatricians is 0.34/1000 children screened; for orthopaedists, 0.1; and for ultrasonography, 0.28. Our estimates for late-term DDH rates are 0.21/1000 newborns screened by pediatricians; 0.08, by orthopaedists; and 0.2 for ultrasonography. The rates of AVN for children referred before 6 months of age is estimated at 2.5/1000 infants referred. For those referred after 6 months of age, our estimate is 109/1000 referred infants. The decision model (reduced, based on available evidence) suggests that orthopaedic screening is optimal, but because orthopaedists in the published studies and in practice would differ, the supply of orthopaedists is relatively limited, and the difference between orthopaedists and pediatricians is statistically insignificant, we conclude that pediatric screening is to be recommended. The place of ultrasonography in the screening process remains to be defined because there are too few data about postneonatal diagnosis by ultrasonographic screening to permit definitive recommendations. These data could be used by others to refine the conclusions based on costs, parental preferences, or physician style. Areas for research are well defined by our model-based approach. (4/00)

DIAGNOSIS OF HIV-1 INFECTION IN CHILDREN YOUNGER THAN 18 MONTHS IN THE UNITED STATES (TECHNICAL REPORT)

Jennifer S. Read, MD, MS, MPH, DTM&H, and Committee on Pediatric AIDS

ABSTRACT. The objectives of this technical report are to describe methods of diagnosis of HIV-1 infection in children younger than 18 months in the United States and to review important issues that must be considered by clinicians who care for infants and young children born to HIV-1–infected women. Appropriate HIV-1 diagnostic testing for infants and children younger than 18 months differs from that for older children, adolescents, and adults because of passively transferred maternal HIV-1 antibodies, which may be detectable in the child's bloodstream until 18 months of age. Therefore, routine serologic testing of these infants and young children is generally only informative before the age of 18 months if the test result is negative. Virologic assays, including HIV-1 DNA or RNA assays, represent the gold standard for diagnostic testing of infants and children younger than 18 months. With such testing, the diagnosis of HIV-1 infection (as well as the presumptive exclusion of HIV-1 infection) can be established within the first several weeks of life among nonbreastfed infants. Important factors that must be considered when selecting HIV-1 diagnostic assays for pediatric patients and when choosing the timing of such assays include the age of the child, potential timing of infection of the child, whether the infection status of the child's mother is known or unknown, the antiretroviral exposure history of the mother and of the child, and characteristics of the virus. If the mother's HIV-1 serostatus is unknown, rapid HIV-1 antibody testing of the newborn infant to identify HIV-1 exposure is essential so that antiretroviral prophylaxis can be initiated within the first 12 hours of life if test results are positive. For HIV-1–exposed infants (identified by positive maternal test results or positive antibody results for the infant shortly after birth), it has been recommended that diagnostic testing with HIV-1 DNA or RNA assays be performed within the first 14 days of life, at 1 to 2 months of age, and at 3 to 6 months of age. If any of these test results are positive, repeat testing is recommended to confirm the diagnosis of HIV-1 infection. A diagnosis of HIV-1 infection can be made on the basis of 2 positive HIV-1 DNA or RNA assay results. In nonbreastfeeding children younger than 18 months with no positive HIV-1 virologic test results, presumptive exclusion of HIV-1 infection can be based on 2 negative virologic test results (1 obtained at ≥2 weeks and 1 obtained at ≥4 weeks of age); 1 negative virologic test result obtained at ≥8 weeks of age; or 1 negative HIV-1 antibody test result obtained at ≥6 months of age. Alternatively, presumptive exclusion of HIV-1 infection can be based on 1 positive HIV-1 virologic test with at least 2 subsequent negative virologic test results (at least 1 of which is performed at ≥8 weeks of age) or negative HIV-1 antibody test results (at least 1 of

which is performed at ≥6 months of age). Definitive exclusion of HIV-1 infection is based on 2 negative virologic test results, 1 obtained at ≥1 month of age and 1 obtained at ≥4 months of age, or 2 negative HIV-1 antibody test results from separate specimens obtained at ≥6 months of age. For both presumptive and definitive exclusion of infection, the child should have no other laboratory (eg, no positive virologic test results) or clinical (eg, no AIDS-defining conditions) evidence of HIV-1 infection. Many clinicians confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay result at 12 to 18 months of age. For breastfeeding infants, a similar testing algorithm can be followed, with timing of testing starting from the date of complete cessation of breastfeeding instead of the date of birth. (12/07, reaffirmed 4/10)

DIAGNOSIS AND MANAGEMENT OF CHILDHOOD OBSTRUCTIVE SLEEP APNEA SYNDROME (TECHNICAL REPORT)

Carole L. Marcus, MBBCh; Lee J. Brooks, MD; Sally Davidson Ward, MD; Kari A. Draper, MD; David Gozal, MD; Ann C. Halbower, MD; Jacqueline Jones, MD; Christopher Lehmann, MD; Michael S. Schechter, MD, MPH; Stephen Sheldon, MD; Richard N. Shiffman, MD, MCIS; and Karen Spruyt, PhD

ABSTRACT. *Objective.* This technical report describes the procedures involved in developing recommendations on the management of childhood obstructive sleep apnea syndrome (OSAS).

Methods. The literature from 1999 through 2011 was evaluated.

Results and Conclusions. A total of 3166 titles were reviewed, of which 350 provided relevant data. Most articles were level II through IV. The prevalence of OSAS ranged from 0% to 5.7%, with obesity being an independent risk factor. OSAS was associated with cardiovascular, growth, and neurobehavioral abnormalities and possibly inflammation. Most diagnostic screening tests had low sensitivity and specificity. Treatment of OSAS resulted in improvements in behavior and attention and likely improvement in cognitive abilities. Primary treatment is adenotonsillectomy (AT). Data were insufficient to recommend specific surgical techniques; however, children undergoing partial tonsillectomy should be monitored for possible recurrence of OSAS. Although OSAS improved postoperatively, the proportion of patients who had residual OSAS ranged from 13% to 29% in low-risk populations to 73% when obese children were included and stricter polysomnographic criteria were used. Nevertheless, OSAS may improve after AT even in obese children, thus supporting surgery as a reasonable initial treatment. A significant number of obese patients required intubation or continuous positive airway pressure (CPAP) postoperatively, which reinforces the need for inpatient observation. CPAP was effective in the treatment of OSAS, but adherence is a major barrier. For this reason, CPAP is not recommended as first-line therapy for OSAS when AT is an option. Intranasal steroids may ameliorate mild OSAS, but follow-up is needed. Data were insufficient to recommend rapid maxillary expansion. (8/12)

DIAGNOSIS AND MANAGEMEN OF AN INITIAL UTI IN FEBRILE INFANTS AND YOUNG CHILDREN (TECHNICAL REPORT)

S. Maria E. Finnell, MD, MS; Aaron E. Carroll, MD, MS; Stephen M. Downs, MD, MS; and Subcommittee on Urinary Tract Infection

ABSTRACT. *Objectives.* The diagnosis and management of urinary tract infections (UTIs) in young children are clinically challenging. This report was developed to inform the revised, evidence-based, clinical guideline regarding the diagnosis and management of initial UTIs in febrile infants and young children, 2 to 24 months of age, from the American Academy of Pediatrics Subcommittee on Urinary Tract Infection.

Methods. The conceptual model presented in the 1999 technical report was updated after a comprehensive review of published literature. Studies with potentially new information or with evidence that reinforced the 1999 technical report were retained. Meta-analyses on the effectiveness of antimicrobial prophylaxis to prevent recurrent UTI were performed.

Results. Review of recent literature revealed new evidence in the following areas. Certain clinical findings and new urinalysis methods can help clinicians identify febrile children at very low risk of UTI. Oral antimicrobial therapy is as effective as parenteral therapy in treating UTI. Data from published, randomized controlled trials do not support antimicrobial prophylaxis to prevent febrile UTI when vesicoureteral reflux is found through voiding cystourethrography. Ultrasonography of the urinary tract after the first UTI has poor sensitivity. Early antimicrobial treatment may decrease the risk of renal damage from UTI.

Conclusions. Recent literature agrees with most of the evidence presented in the 1999 technical report, but meta-analyses of data from recent, randomized controlled trials do not support antimicrobial prophylaxis to prevent febrile UTI. This finding argues against voiding cystourethrography after the first UTI. (8/11)

DIAGNOSIS AND PREVENTION OF IRON DEFICIENCY AND IRON-DEFICIENCY ANEMIA IN INFANTS AND YOUNG CHILDREN (0–3 YEARS OF AGE) (CLINICAL REPORT)

Robert D. Baker, MD, PhD; Frank R. Greer, MD; and Committee on Nutrition

ABSTRACT. This clinical report covers diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants (both breastfed and formula fed) and toddlers from birth through 3 years of age. Results of recent basic research support the concerns that iron-deficiency anemia and iron deficiency without anemia during infancy and childhood can have long-lasting detrimental effects on neurodevelopment. Therefore, pediatricians and other health care providers should strive to eliminate iron deficiency and iron-deficiency anemia. Appropriate iron intakes for infants and toddlers as well as methods for screening for iron deficiency and iron-deficiency anemia are presented. (10/10)

DIAGNOSTIC IMAGING OF CHILD ABUSE
Section on Radiology
ABSTRACT. The role of imaging in cases of child abuse is to identify the extent of physical injury when abuse is present and to elucidate all imaging findings that point to alternative diagnoses. Effective diagnostic imaging of child abuse rests on high-quality technology as well as a full appreciation of the clinical and pathologic alterations occurring in abused children. This statement is a revision of the previous policy published in 2000. (4/09)

DISASTER PLANNING FOR SCHOOLS
Council on School Health
ABSTRACT. Community awareness of the school district's disaster plan will optimize a community's capacity to maintain the safety of its school-aged population in the event of a school-based or greater community crisis. This statement is intended to stimulate awareness of the disaster-preparedness process in schools as a part of a global, community-wide preparedness plan. Pediatricians, other health care professionals, first responders, public health officials, the media, school nurses, school staff, and parents all need to be unified in their efforts to support schools in the prevention of, preparedness for, response to, and recovery from a disaster. (10/08, reaffirmed 9/11)

DISCLOSURE OF ILLNESS STATUS TO CHILDREN AND ADOLESCENTS WITH HIV INFECTION
Committee on Pediatric AIDS
ABSTRACT. Many children with human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome are surviving to middle childhood and adolescence. Studies suggest that children who know their HIV status have higher self-esteem than children who are unaware of their status. Parents who have disclosed the status to their children experience less depression than those who do not. This statement addresses our current knowledge and recommendations for disclosure of HIV infection status to children and adolescents. (1/99, reaffirmed 2/02, 5/05, 1/09, 1/12)

DISPENSING MEDICATIONS AT THE HOSPITAL UPON DISCHARGE FROM AN EMERGENCY DEPARTMENT (TECHNICAL REPORT)
Loren G. Yamamoto, MD, MPH, MBA; Shannon Manzi, PharmD; and Committee on Pediatric Emergency Medicine
ABSTRACT. Although most health care services can and should be provided by their medical home, children will be referred or require visits to the emergency department (ED) for emergent clinical conditions or injuries. Continuation of medical care after discharge from an ED is dependent on parents or caregivers' understanding of and compliance with follow-up instructions and on adherence to medication recommendations. ED visits often occur at times when the majority of pharmacies are not open and caregivers are concerned with getting their ill or injured child directly home. Approximately one-third of patients fail to obtain priority medications from a pharmacy after discharge from an ED. The option of judiciously dispensing ED discharge medications from the ED's outpatient pharmacy within the facility is a major convenience that overcomes this obstacle, improving the likelihood of medication adherence. Emergency care encounters should be routinely followed up with primary care provider medical homes to ensure complete and comprehensive care. (1/12)

DISTINGUISHING SUDDEN INFANT DEATH SYNDROME FROM CHILD ABUSE FATALITIES (CLINICAL REPORT)
Kent P. Hymel, MD, and Committee on Child Abuse and Neglect (joint with National Association of Medical Examiners)
ABSTRACT. Fatal child abuse has been mistaken for sudden infant death syndrome. When a healthy infant younger than 1 year dies suddenly and unexpectedly, the cause of death may be certified as sudden infant death syndrome. Sudden infant death syndrome is more common than infanticide. Parents of sudden infant death syndrome victims typically are anxious to provide unlimited information to professionals involved in death investigation or research. They also want and deserve to be approached in a nonaccusatory manner. This clinical report provides professionals with information and suggestions for procedures to help avoid stigmatizing families of sudden infant death syndrome victims while allowing accumulation of appropriate evidence in potential cases of infanticide. This clinical report addresses deficiencies and updates recommendations in the 2001 American Academy of Pediatrics policy statement of the same name. (7/06, reaffirmed 4/09, 3/13)

DO-NOT-RESUSCITATE ORDERS FOR PEDIATRIC PATIENTS WHO REQUIRE ANESTHESIA AND SURGERY (CLINICAL REPORT)
Section on Surgery, Section on Anesthesia and Pain Medicine, and Committee on Bioethics
ABSTRACT. This clinical report addresses the topic of preexisting do-not-resuscitate (DNR) orders for children undergoing anesthesia and surgery. Pertinent issues addressed include the rights of children, surrogate decision-making, the process of informed consent, and the roles of surgeons and anesthesiologists. The reevaluation process of DNR orders called "required reconsideration" can be incorporated into the process of informed consent for surgery and anesthesia. Care should be taken to distinguish between goal-directed and procedure-directed approaches to DNR orders. By giving parents or other surrogates and clinicians the option of deciding from among full resuscitation, limitations based on procedures, or limitations based on goals, the child's needs are individualized and better served. (12/04, reaffirmed 1/09, 10/12)

DRINKING WATER FROM PRIVATE WELLS AND RISKS TO CHILDREN
Committee on Environmental Health and Committee on Infectious Diseases
ABSTRACT. Drinking water for approximately one sixth of US households is obtained from private wells. These wells can become contaminated by pollutant chemicals or pathogenic organisms and cause illness. Although the US Environmental Protection Agency and all states offer guidance for construction, maintenance, and testing of private wells, there is little regulation. With few exceptions, well owners are responsible for their own wells. Children may also drink well water at child care or when

traveling. Illness resulting from children's ingestion of contaminated water can be severe. This policy statement provides recommendations for inspection, testing, and remediation for wells providing drinking water for children. (5/09, reaffirmed 1/13)

DRINKING WATER FROM PRIVATE WELLS AND RISKS TO CHILDREN (TECHNICAL REPORT)

Walter J. Rogan, MD; Michael T. Brady, MD; Committee on Environmental Health; and Committee on Infectious Diseases

ABSTRACT. Drinking water for approximately one sixth of US households is obtained from private wells. These wells can become contaminated by pollutant chemicals or pathogenic organisms, leading to significant illness. Although the US Environmental Protection Agency and all states offer guidance for construction, maintenance, and testing of private wells, there is little regulation, and with few exceptions, well owners are responsible for their own wells. Children may also drink well water at child care or when traveling. Illness resulting from children's ingestion of contaminated water can be severe. This report reviews relevant aspects of groundwater and wells; describes the common chemical and microbiologic contaminants; gives an algorithm with recommendations for inspection, testing, and remediation for wells providing drinking water for children; reviews the definitions and uses of various bottled waters; provides current estimates of costs for well testing; and provides federal, national, state, and, where appropriate, tribal contacts for more information. (5/09, reaffirmed 1/13)

EARLY CHILDHOOD ADVERSITY, TOXIC STRESS, AND THE ROLE OF THE PEDIATRICIAN: TRANSLATING DEVELOPMENTAL SCIENCE INTO LIFELONG HEALTH

Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, and Dependent Care; and Section on Developmental and Behavioral Pediatrics

ABSTRACT. Advances in a wide range of biological, behavioral, and social sciences are expanding our understanding of how early environmental influences (the ecology) and genetic predispositions (the biologic program) affect learning capacities, adaptive behaviors, lifelong physical and mental health, and adult productivity. A supporting technical report from the American Academy of Pediatrics (AAP) presents an integrated ecobiodevelopmental framework to assist in translating these dramatic advances in developmental science into improved health across the life span. Pediatricians are now armed with new information about the adverse effects of toxic stress on brain development, as well as a deeper understanding of the early life origins of many adult diseases. As trusted authorities in child health and development, pediatric providers must now complement the early identification of developmental concerns with a greater focus on those interventions and community investments that reduce external threats to healthy brain growth. To this end, AAP endorses a developing leadership role for the entire pediatric community—one that mobilizes the scientific expertise of both basic and clinical researchers, the family-centered care of the pediatric medical home, and the public influence of AAP and its state chapters—to catalyze fundamental change in early childhood policy and services. AAP is committed to leveraging science to inform the development of innovative strategies to reduce the precipitants of toxic stress in young children and to mitigate their negative effects on the course of development and health across the life span. (12/11)

EARLY CHILDHOOD CARIES IN INDIGENOUS COMMUNITIES

Committee on Native American Child Health (joint with Canadian Paediatric Society First Nations, Inuit, and Métis Committee)

ABSTRACT. The oral health of Indigenous children of Canada (First Nations, Inuit, and Métis) and the United States (American Indian, Alaska Native) is a major child health issue: there is a high prevalence of early childhood caries (ECC) and resulting adverse health effects in this community, as well as high rates and costs of restorative and surgical treatments under general anesthesia. ECC is an infectious disease that is influenced by multiple factors, including socioeconomic determinants, and requires a combination of approaches for improvement. This statement includes recommendations for preventive oral health and clinical care for young infants and pregnant women by primary health care providers, community-based health-promotion initiatives, oral health workforce and access issues, and advocacy for community water fluoridation and fluoride-varnish program access. Further community-based research on the epidemiology, prevention, management, and microbiology of ECC in Indigenous communities would be beneficial. (5/11)

EARLY INTERVENTION, IDEA PART C SERVICES, AND THE MEDICAL HOME: COLLABORATION FOR BEST PRACTICE AND BEST OUTCOMES (CLINICAL REPORT)

Richard C. Adams, MD; Carl Tapia, MD; and Council on Children With Disabilities

ABSTRACT. The medical home and the Individuals With Disabilities Education Act Part C Early Intervention Program share many common purposes for infants and children ages 0 to 3 years, not the least of which is a family-centered focus. Professionals in pediatric medical home practices see substantial numbers of infants and toddlers with developmental delays and/or complex chronic conditions. Economic, health, and family-focused data each underscore the critical role of timely referral for relationship-based, individualized, accessible early intervention services and the need for collaborative partnerships in care. The medical home process and Individuals With Disabilities Education Act Part C policy both support nurturing relationships and family-centered care; both offer clear value in terms of economic and health outcomes. Best practice models for early intervention services incorporate learning in the natural environment and coaching models. Proactive medical homes provide strategies for effective developmental surveillance, family-centered resources, and tools to support high-risk groups, and comanagement of infants with special health care needs, including the monitoring of services provided and outcomes achieved. (9/13)

See full text on page 521.

ECHOCARDIOGRAPHY IN INFANTS AND CHILDREN
Section on Cardiology
ABSTRACT. It is the intent of this statement to inform pediatric providers on the appropriate use of echocardiography. Although on-site consultation may be impossible, methods should be established to ensure timely review of echocardiograms by a pediatric cardiologist. With advances in data transmission, echocardiography information can be exchanged, in some cases eliminating the need for a costly patient transfer. By cooperating through training, education, and referral, complete and cost-effective echocardiographic services can be provided to all children. (6/97, reaffirmed 3/03, 3/07)

EDUCATION OF CHILDREN WITH HUMAN IMMUNODEFICIENCY VIRUS INFECTION
Committee on Pediatric AIDS
ABSTRACT. Treatment for human immunodeficiency virus (HIV) infection has enabled more children and youths to attend school and participate in school activities. Children and youths with HIV infection should receive the same education as those with other chronic illnesses. They may require special services, including home instruction, to provide continuity of education. Confidentiality about HIV infection status should be maintained with parental consent required for disclosure. Youths also should assent or consent as is appropriate for disclosure of their diagnosis. (6/00, reaffirmed 3/03, 10/06, 4/10, 3/13)

EFFECTS OF EARLY NUTRITIONAL INTERVENTIONS ON THE DEVELOPMENT OF ATOPIC DISEASE IN INFANTS AND CHILDREN: THE ROLE OF MATERNAL DIETARY RESTRICTION, BREASTFEEDING, TIMING OF INTRODUCTION OF COMPLEMENTARY FOODS, AND HYDROLYZED FORMULAS (CLINICAL REPORT)
Frank R. Greer, MD; Scott H. Sicherer, MD; A. Wesley Burks, MD; Committee on Nutrition; and Section on Allergy and Immunology
ABSTRACT. This clinical report reviews the nutritional options during pregnancy, lactation, and the first year of life that may affect the development of atopic disease (atopic dermatitis, asthma, food allergy) in early life. It replaces an earlier policy statement from the American Academy of Pediatrics that addressed the use of hypoallergenic infant formulas and included provisional recommendations for dietary management for the prevention of atopic disease. The documented benefits of nutritional intervention that may prevent or delay the onset of atopic disease are largely limited to infants at high risk of developing allergy (ie, infants with at least 1 first-degree relative [parent or sibling] with allergic disease). Current evidence does not support a major role for maternal dietary restrictions during pregnancy or lactation. There is evidence that breastfeeding for at least 4 months, compared with feeding formula made with intact cow milk protein, prevents or delays the occurrence of atopic dermatitis, cow milk allergy, and wheezing in early childhood. In studies of infants at high risk of atopy and who are not exclusively breastfed for 4 to 6 months, there is modest evidence that the onset of atopic disease may be delayed or prevented by the use of hydrolyzed formulas compared with formula made with intact cow milk protein, particularly for atopic dermatitis. Comparative studies of the various hydrolyzed formulas also indicate that not all formulas have the same protective benefit. There is also little evidence that delaying the timing of the introduction of complementary foods beyond 4 to 6 months of age prevents the occurrence of atopic disease. At present, there are insufficient data to document a protective effect of any dietary intervention beyond 4 to 6 months of age for the development of atopic disease. (1/08)

ELECTRONIC PRESCRIBING IN PEDIATRICS: TOWARD SAFER AND MORE EFFECTIVE MEDICATION MANAGEMENT
Council on Clinical Information Technology
ABSTRACT. This policy statement identifies the potential value of electronic prescribing (e-prescribing) systems in improving quality and reducing harm in pediatric health care. On the basis of limited but positive pediatric data and on the basis of federal statutes that provide incentives for the use of e-prescribing systems, the American Academy of Pediatrics recommends the adoption of e-prescribing systems with pediatric functionality. The American Academy of Pediatrics also recommends a set of functions that technology vendors should provide when e-prescribing systems are used in environments in which children receive care. (3/13)
See full text on page 537.

ELECTRONIC PRESCRIBING IN PEDIATRICS: TOWARD SAFER AND MORE EFFECTIVE MEDICATION MANAGEMENT (TECHNICAL REPORT)
Kevin B. Johnson, MD, MS; Christoph U. Lehmann, MD; and Council on Clinical Information Technology
ABSRACT. This technical report discusses recent advances in electronic prescribing (e-prescribing) systems, including the evidence base supporting their limitations and potential benefits. Specifically, this report acknowledges that there are limited but positive pediatric data supporting the role of e-prescribing in mitigating medication errors, improving communication with dispensing pharmacists, and improving medication adherence. On the basis of these data and on the basis of federal statutes that provide incentives for the use of e-prescribing systems, the American Academy of Pediatrics recommends the adoption of e-prescribing systems with pediatric functionality. This report supports the accompanying policy statement from the American Academy of Pediatrics recommending the adoption of e-prescribing by pediatric health care providers. (3/13)
See full text on page 537.

ELECTRONIC PRESCRIBING SYSTEMS IN PEDIATRICS: THE RATIONALE AND FUNCTIONALITY REQUIREMENTS
Council on Clinical Information Technology
ABSTRACT. The use of electronic prescribing applications in pediatric practice, as recommended by the federal government and other national health care improvement organizations, should be encouraged. Legislation and policies that foster adoption of electronic prescribing systems by pediatricians should recognize both specific pediatric requirements and general economic incentives required to speed the adoption of these systems. Continued research into improving the effectiveness of these systems,

recognizing the unique challenges of providing care to the pediatric population, should be promoted. (6/07)

ELECTRONIC PRESCRIBING SYSTEMS IN PEDIATRICS: THE RATIONALE AND FUNCTIONALITY REQUIREMENTS (TECHNICAL REPORT)

Robert S. Gerstle, MD; Christoph U. Lehmann, MD; and Council on Clinical Information Technology

ABSTRACT. This technical report discusses electronic prescribing systems and their limitations and potential benefits, particularly to the pediatrician in the ambulatory setting. In the report we acknowledge the benefits of integrating these systems with electronic health records and practice-management systems and recommend that the adoption of electronic prescribing systems be done in the context of ultimately moving toward an electronic health record. This technical report supports the accompanying American Academy of Pediatrics policy-statement recommendations on the adoption of electronic prescribing systems by pediatricians. (6/07)

E-MAIL COMMUNICATION BETWEEN PEDIATRICIANS AND THEIR PATIENTS (CLINICAL REPORT)

Steering Committee on Clinical Information Technology

ABSTRACT. This report addresses specific e-mail patient communication issues relevant to pediatricians and their appropriate use of e-mail in the office setting. The report briefly reviews: 1) e-mail privacy and security concerns; 2) e-mail in the office environment; 3) the legal status of e-mail; and 4) available e-mail technologic solutions. (7/04, reaffirmed 2/08)

EMERGENCY CONTRACEPTION

Committee on Adolescence

ABSTRACT. Despite significant declines over the past 2 decades, the United States continues to have teen birth rates that are significantly higher than other industrialized nations. Use of emergency contraception can reduce the risk of pregnancy if used up to 120 hours after unprotected intercourse or contraceptive failure and is most effective if used in the first 24 hours. Indications for the use of emergency contraception include sexual assault, unprotected intercourse, condom breakage or slippage, and missed or late doses of hormonal contraceptives, including the oral contraceptive pill, contraceptive patch, contraceptive ring (ie, improper placement or loss/expulsion), and injectable contraception. Adolescents younger than 17 years must obtain a prescription from a physician to access emergency contraception in most states. In all states, both males and females 17 years or older can obtain emergency contraception without a prescription. Adolescents are more likely to use emergency contraception if it has been prescribed in advance of need. The aim of this updated policy statement is to (1) educate pediatricians and other physicians on available emergency contraceptive methods; (2) provide current data on safety, efficacy, and use of emergency contraception in teenagers; and (3) encourage routine counseling and advance emergency-contraception prescription as 1 part of a public health strategy to reduce teen pregnancy. This policy focuses on pharmacologic methods of emergency contraception used within 120 hours of unprotected or underprotected coitus for the prevention of unintended pregnancy. Emergency contraceptive medications include products labeled and dedicated for use as emergency contraception by the US Food and Drug Administration (levonorgestrel and ulipristal) and the "off-label" use of combination oral contraceptives. (11/12)

EMERGENCY INFORMATION FORMS AND EMERGENCY PREPAREDNESS FOR CHILDREN WITH SPECIAL HEALTH CARE NEEDS

*Committee on Pediatric Emergency Medicine and Council on Clinical Information Technology (*joint with American College of Emergency Physicians Pediatric Emergency Medicine Committee)

ABSTRACT. Children with chronic medical conditions rely on complex management plans for problems that cause them to be at increased risk for suboptimal outcomes in emergency situations. The emergency information form (EIF) is a medical summary that describes medical condition(s), medications, and special health care needs to inform health care providers of a child's special health conditions and needs so that optimal emergency medical care can be provided. This statement describes updates to EIFs, including computerization of the EIF, expanding the potential benefits of the EIF, quality-improvement programs using the EIF, the EIF as a central repository, and facilitating emergency preparedness in disaster management and drills by using the EIF. (3/10)

ENDORSEMENT OF HEALTH AND HUMAN SERVICES RECOMMENDATION FOR PULSE OXIMETRY SCREENING FOR CRITICAL CONGENITAL HEART DISEASE

Section on Cardiology and Cardiac Surgery Executive Committee

ABSTRACT. Incorporation of pulse oximetry to the assessment of the newborn infant can enhance detection of critical congenital heart disease (CCHD). Recently, the Secretary of Health and Human Services (HHS) recommended that screening for CCHD be added to the uniform screening panel. The American Academy of Pediatrics (AAP) has been a strong advocate of early detection of CCHD and fully supports the decision of the Secretary of HHS.

The AAP has published strategies for the implementation of pulse oximetry screening, which addressed critical issues such as necessary equipment, personnel, and training, and also provided specific recommendations for assessment of saturation by using pulse oximetry as well as appropriate management of a positive screening result. The AAP is committed to the safe and effective implementation of pulse oximetry screening and is working with other advocacy groups and governmental agencies to promote pulse oximetry and to support widespread surveillance for CCHD.

Going forward, AAP chapters will partner with state health departments to implement the new screening strategy for CCHD and will work to ensure that there is an adequate system for referral for echocardiographic/pediatric cardiac evaluation after a positive screening result. It is imperative that AAP members engage their respective

policy makers in adopting and funding the recommendations made by the Secretary of HHS. (12/11)

ENHANCING PEDIATRIC WORKFORCE DIVERSITY AND PROVIDING CULTURALLY EFFECTIVE PEDIATRIC CARE: IMPLICATIONS FOR PRACTICE, EDUCATION, AND POLICY MAKING

Committee on Pediatric Workforce

ABSTRACT. This policy statement serves to combine and update 2 previously independent but overlapping statements from the American Academy of Pediatrics (AAP) on culturally effective health care (CEHC) and workforce diversity. The AAP has long recognized that with the ever-increasing diversity of the pediatric population in the United States, the health of all children depends on the ability of all pediatricians to practice culturally effective care. CEHC can be defined as the delivery of care within the context of appropriate physician knowledge, understanding, and appreciation of all cultural distinctions, leading to optimal health outcomes. The AAP believes that CEHC is a critical social value and that the knowledge and skills necessary for providing CEHC can be taught and acquired through focused curricula across the spectrum of lifelong learning.

This statement also addresses workforce diversity, health disparities, and affirmative action. The discussion of diversity is broadened to include not only race, ethnicity, and language but also cultural attributes such as gender, religious beliefs, sexual orientation, and disability, which may affect the quality of health care. The AAP believes that efforts must be supported through health policy and advocacy initiatives to promote the delivery of CEHC and to overcome educational, organizational, and other barriers to improving workforce diversity. (9/13)

See full text on page 553.

EPIDEMIOLOGY AND DIAGNOSIS OF HEALTH CARE–ASSOCIATED INFECTIONS IN THE NICU (TECHNICAL REPORT)

Committee on Fetus and Newborn and Committee on Infectious Diseases

ABSTRACT. Health care–associated infections in the NICU are a major clinical problem resulting in increased morbidity and mortality, prolonged length of hospital stays, and increased medical costs. Neonates are at high risk for health care–associated infections because of impaired host defense mechanisms, limited amounts of protective endogenous flora on skin and mucosal surfaces at time of birth, reduced barrier function of neonatal skin, the use of invasive procedures and devices, and frequent exposure to broad-spectrum antibiotics. This statement will review the epidemiology and diagnosis of health care–associated infections in newborn infants. (3/12)

EQUIPMENT FOR AMBULANCES

American College of Surgeons Committee on Trauma, American College of Emergency Physicians, National Association of EMS Physicians, Pediatric Equipment Guidelines Committee—Emergency Medical Services for Children (EMSC) Partnership for Children Stakeholder Group, and American Academy of Pediatrics

INTRODUCTION (EXCERPT). Almost 4 decades ago, the Committee on Trauma of the American College of Surgeons (ACS) developed a list of standardized equipment for ambulances. Beginning in 1988, the American College of Emergency Physicians (ACEP) published a similar list. The 2 organizations collaborated on a joint document published in 2000, and the National Association of EMS Physicians (NAEMSP) participated in the 2005 revision. The 2005 revision included resources needed on ambulances for appropriate homeland security. All 3 organizations adhere to the principle that emergency medical services (EMS) providers at all levels must have the appropriate equipment and supplies to optimize prehospital delivery of care. The document was written to serve as a standard for the equipment needs of emergency ambulance services in both the United States and Canada.

EMS providers care for patients of all ages, who have a wide variety of medical and traumatic conditions. With permission from the ACS Committee on Trauma, ACEP, and NAEMSP, the current revision includes updated pediatric recommendations developed by members of the federal Emergency Medical Services for Children (EMSC) Stakeholder Group. The EMSC Program has developed several performance measures for the program's state partnership grantees. One of the performance measures evaluates the availability of essential pediatric equipment and supplies for basic life support (BLS) and advanced life support (ALS) patient care units. This document will be used as the standard for this performance measure. The American Academy of Pediatrics (AAP) has also officially endorsed this list. (6/09)

ESSENTIAL CONTRACTUAL LANGUAGE FOR MEDICAL NECESSITY IN CHILDREN

Committee on Child Health Financing

ABSTRACT. The previous policy statement from the American Academy of Pediatrics, "Model Language for Medical Necessity in Children," was published in July 2005. Since that time, there have been new and emerging delivery and payment models. The relationship established between health care providers and health plans should promote arrangements that are beneficial to all who are affected by these contractual arrangements. Pediatricians play an important role in ensuring that the needs of children are addressed in these emerging systems. It is important to recognize that health care plans designed for adults may not meet the needs of children. Language in health care contracts should reflect the health care needs of children and families. Informed pediatricians can make a difference in the care of children and influence the role of primary care physicians in the new paradigms. This policy highlights many of the important elements pediatricians should assess as providers develop a role in emerging care models. (7/13)

See full text on page 567.

ETHICAL CONSIDERATIONS IN RESEARCH WITH SOCIALLY IDENTIFIABLE POPULATIONS

Committee on Native American Child Health and Committee on Community Health Services

ABSTRACT. Community-based research raises ethical issues not normally encountered in research conducted in academic settings. In particular, conventional risk-benefits assessments frequently fail to recognize harms that can occur in socially identifiable populations as a result of research participation. Furthermore, many such communities require more stringent measures of beneficence that must be applied directly to the participating communities. In this statement, the American Academy of Pediatrics sets forth recommendations for minimizing harms that may result from community-based research by emphasizing community involvement in the research process. (1/04, reaffirmed 10/07, 1/13)

ETHICAL CONTROVERSIES IN ORGAN DONATION AFTER CIRCULATORY DEATH

Committee on Bioethics

ABSTRACT. The persistent mismatch between the supply of and need for transplantable organs has led to efforts to increase the supply, including controlled donation after circulatory death (DCD). Controlled DCD involves organ recovery after the planned withdrawal of life-sustaining treatment and the declaration of death according to the cardiorespiratory criteria. Two central ethical issues in DCD are when organ recovery can begin and how to manage conflicts of interests. The "dead donor rule" should be maintained, and donors in cases of DCD should only be declared dead after the permanent cessation of circulatory function. Permanence is generally established by a 2- to 5-minute waiting period. Given ongoing controversy over whether the cessation must also be irreversible, physicians should not be required to participate in DCD. Because the preparation for organ recovery in DCD begins before the declaration of death, there are potential conflicts between the donor's and recipient's interests. These conflicts can be managed in a variety of ways, including informed consent and separating the various participants' roles. For example, informed consent should be sought for premortem interventions to improve organ viability, and organ procurement organization personnel and members of the transplant team should not be involved in the discontinuation of life-sustaining treatment or the declaration of death. It is also important to emphasize that potential donors in cases of DCD should receive integrated interdisciplinary palliative care, including sedation and analgesia. (4/13)

See full text on page 573.

ETHICAL ISSUES WITH GENETIC TESTING IN PEDIATRICS

Committee on Bioethics

ABSTRACT. Advances in genetic research promise great strides in the diagnosis and treatment of many childhood diseases. However, emerging genetic technology often enables testing and screening before the development of definitive treatment or preventive measures. In these circumstances, careful consideration must be given to testing and screening of children to ensure that use of this technology promotes the best interest of the child. This statement reviews considerations for the use of genetic technology for newborn screening, carrier testing, and testing for susceptibility to late-onset conditions. Recommendations are made promoting informed participation by parents for newborn screening and limited use of carrier testing and testing for late-onset conditions in the pediatric population. Additional research and education in this developing area of medicine are encouraged. (6/01, reaffirmed 1/05, 1/09)

ETHICAL AND POLICY ISSUES IN GENETIC TESTING AND SCREENING OF CHILDREN

Committee on Bioethics and Committee on Genetics (joint with American College of Medical Genetics and Genomics)

ABSTRACT. The genetic testing and genetic screening of children are commonplace. Decisions about whether to offer genetic testing and screening should be driven by the best interest of the child. The growing literature on the psychosocial and clinical effects of such testing and screening can help inform best practices. This policy statement represents recommendations developed collaboratively by the American Academy of Pediatrics and the American College of Medical Genetics and Genomics with respect to many of the scenarios in which genetic testing and screening can occur. (2/13)

See full text on page 581.

ETHICS AND THE CARE OF CRITICALLY ILL INFANTS AND CHILDREN

Committee on Bioethics

ABSTRACT. The ability to provide life support to ill children who, not long ago, would have died despite medicine's best efforts challenges pediatricians and families to address profound moral questions. Our society has been divided about extending the life of some patients, especially newborns and older infants with severe disabilities. The American Academy of Pediatrics (AAP) supports individualized decision making about life-sustaining medical treatment for all children, regardless of age. These decisions should be jointly made by physicians and parents, unless good reasons require invoking established child protective services to contravene parental authority. At this time, resource allocation (rationing) decisions about which children should receive intensive care resources should be made clear and explicit in public policy, rather than be made at the bedside. (7/96, reaffirmed 10/99, 6/03)

EVALUATING INFANTS AND YOUNG CHILDREN WITH MULTIPLE FRACTURES (CLINICAL REPORT)

Carole Jenny, MD, MBA, FAAP, for Committee on Child Abuse and Neglect

ABSTRACT. Infants and toddlers with multiple unexplained fractures are often victims of inflicted injury. However, several medical conditions can also cause multiple fractures in children in this age group. In this report, the differential diagnosis of multiple fractures is presented, and diagnostic testing available to the clinician is discussed. The hypothetical entity "temporary brittle-bone disease" is examined also. Although frequently offered in

court cases as a cause of multiple infant fractures, there is no evidence that this condition actually exists. (9/06)

EVALUATING FOR SUSPECTED CHILD ABUSE: CONDITIONS THAT PREDISPOSE TO BLEEDING (TECHNICAL REPORT)

Shannon L. Carpenter, MD, MS; Thomas C. Abshire, MD; James D. Anderst, MD, MS; Section on Hematology/Oncology; and Committee on Child Abuse and Neglect

ABSTRACT. Child abuse might be suspected when children present with cutaneous bruising, intracranial hemorrhage, or other manifestations of bleeding. In these cases, it is necessary to consider medical conditions that predispose to easy bleeding/bruising. When evaluating for the possibility of bleeding disorders and other conditions that predispose to hemorrhage, the pediatrician must consider the child's presenting history, medical history, and physical examination findings before initiating a laboratory investigation. Many medical conditions can predispose to easy bleeding. Before ordering laboratory tests for a disease, it is useful to understand the biochemical basis and clinical presentation of the disorder, condition prevalence, and test characteristics. This technical report reviews the major medical conditions that predispose to bruising/bleeding and should be considered when evaluating for abusive injury. (3/13)

See full text on page 587.

EVALUATION FOR BLEEDING DISORDERS IN SUSPECTED CHILD ABUSE (CLINICAL REPORT)

James D. Anderst, MD, MS; Shannon L. Carpenter, MD, MS; Thomas C. Abshire, MD; Section on Hematology/Oncology; and Committee on Child Abuse and Neglect

ABSTRACT. Bruising or bleeding in a child can raise the concern for child abuse. Assessing whether the findings are the result of trauma and/or whether the child has a bleeding disorder is critical. Many bleeding disorders are rare, and not every child with bruising/bleeding concerning for abuse requires an evaluation for bleeding disorders. In some instances, however, bleeding disorders can present in a manner similar to child abuse. The history and clinical evaluation can be used to determine the necessity of an evaluation for a possible bleeding disorder, and prevalence and known clinical presentations of individual bleeding disorders can be used to guide the extent of the laboratory testing. This clinical report provides guidance to pediatricians and other clinicians regarding the evaluation for bleeding disorders when child abuse is suspected. (3/13)

See full text on page 607.

THE EVALUATION OF CHILDREN IN THE PRIMARY CARE SETTING WHEN SEXUAL ABUSE IS SUSPECTED (CLINICAL REPORT)

Carole Jenny, MD, MBA; James E. Crawford-Jakubiak, MD; and Committee on Child Abuse and Neglect

ABSTRACT. This clinical report updates a 2005 report from the American Academy of Pediatrics on the evaluation of sexual abuse in children. The medical assessment of suspected child sexual abuse should include obtaining a history, performing a physical examination, and obtaining appropriate laboratory tests. The role of the physician includes determining the need to report suspected sexual abuse; assessing the physical, emotional, and behavioral consequences of sexual abuse; providing information to parents about how to support their child; and coordinating with other professionals to provide comprehensive treatment and follow-up of children exposed to child sexual abuse. (7/13)

See full text on page 619.

EVALUATION AND MANAGEMENT OF THE INFANT EXPOSED TO HIV-1 IN THE UNITED STATES (CLINICAL REPORT)

Peter L. Havens, MD; Lynne M. Mofenson, MD; and Committee on Pediatric AIDS

ABSTRACT. The pediatrician plays a key role in the prevention of mother-to-child transmission of HIV-1 infection. For infants born to women with HIV-1 infection identified during pregnancy, the pediatrician ensures that antiretroviral prophylaxis is provided to the infant to decrease the risk of acquiring HIV-1 infection and promotes avoidance of postnatal HIV-1 transmission by advising HIV-1–infected women not to breastfeed. The pediatrician should perform HIV-1 antibody testing for infants born to women whose HIV-1 infection status was not determined during pregnancy or labor. For HIV-1–exposed infants, the pediatrician monitors the infant for early determination of HIV-1 infection status and for possible short- and long-term toxicity from antiretroviral exposures. Provision of chemoprophylaxis for *Pneumocystis jiroveci* pneumonia and support of families living with HIV-1 by providing counseling to parents or caregivers are also important components of care. (12/08)

THE EVALUATION OF SEXUAL BEHAVIORS IN CHILDREN (CLINICAL REPORT)

Nancy D. Kellogg, MD, and Committee on Child Abuse and Neglect

ABSTRACT. Most children will engage in sexual behaviors at some time during childhood. These behaviors may be normal but can be confusing and concerning to parents or disruptive or intrusive to others. Knowledge of age-appropriate sexual behaviors that vary with situational and environmental factors can assist the clinician in differentiating normal sexual behaviors from sexual behavior problems. Most situations that involve sexual behaviors in young children do not require child protective services intervention; for behaviors that are age-appropriate and transient, the pediatrician may provide guidance in supervision and monitoring of the behavior. If the behavior is intrusive, hurtful, and/or age-inappropriate, a more comprehensive assessment is warranted. Some children with sexual behavior problems may reside or have resided in homes characterized by inconsistent parenting, violence, abuse, or neglect and may require more immediate intervention and referrals. (8/09, reaffirmed 3/13)

EVALUATION OF SUSPECTED CHILD PHYSICAL ABUSE (CLINICAL REPORT)

Nancy D. Kellogg, MD, and Committee on Child Abuse and Neglect

ABSTRACT. This report provides guidance in the clinical approach to the evaluation of suspected physical abuse in children. The medical assessment is outlined with respect to obtaining a history, physical examination, and

appropriate ancillary testing. The role of the physician may encompass reporting suspected abuse; assessing the consistency of the explanation, the child's developmental capabilities, and the characteristics of the injury or injuries; and coordination with other professionals to provide immediate and long-term treatment and follow-up for victims. Accurate and timely diagnosis of children who are suspected victims of abuse can ensure appropriate evaluation, investigation, and outcomes for these children and their families. (6/07, reaffirmed 5/12)

EVIDENCE FOR THE DIAGNOSIS AND TREATMENT OF ACUTE UNCOMPLICATED SINUSITIS IN CHILDREN: A SYSTEMATIC REVIEW (TECHNICAL REPORT)

Michael J. Smith, MD, MSCE

In 2001, the American Academy of Pediatrics published clinical practice guidelines for the management of acute bacterial sinusitis (ABS) in children. The technical report accompanying those guidelines included 21 studies that assessed the diagnosis and management of ABS in children. This update to that report incorporates studies of pediatric ABS that have been performed since 2001. Overall, 17 randomized controlled trials of the treatment of sinusitis in children were identified and analyzed. Four randomized, double-blind, placebo-controlled trials of antimicrobial therapy have been published. The results of these studies varied, likely due to differences in inclusion and exclusion criteria. Because of this heterogeneity, formal meta-analyses were not performed. However, qualitative analysis of these studies suggests that children with greater severity of illness at presentation are more likely to benefit from antimicrobial therapy. An additional 5 trials compared different antimicrobial therapies but did not include placebo groups. Six trials assessed a variety of ancillary treatments for ABS in children, and 3 focused on subacute sinusitis. Although the number of pediatric trials has increased since 2001, there are still limited data to guide the diagnosis and management of ABS in children. Diagnostic and treatment guidelines focusing on severity of illness at the time of presentation have the potential to identify those children most likely to benefit from antimicrobial therapy and at the same time minimize unnecessary use of antibiotics. (6/13)

See full text on page 317.

AN EVIDENCE-BASED REVIEW OF IMPORTANT ISSUES CONCERNING NEONATAL HYPERBILIRUBINEMIA (TECHNICAL REPORT)

Stanley Ip, MD; Mei Chung, MPH; John Kulig, MD, MPH; Rebecca O'Brien, MD; Robert Sege, MD, PhD; Stephan Glicken, MD; M. Jeffrey Maisels, MB, BCh; Joseph Lau, MD; and Subcommittee on Hyperbilirubinemia

ABSTRACT. This article is adapted from a published evidence report concerning neonatal hyperbilirubinemia with an added section on the risk of blood exchange transfusion (BET). Based on a summary of multiple case reports that spanned more than 30 years, we conclude that kernicterus, although infrequent, has at least 10% mortality and at least 70% long-term morbidity. It is evident that the preponderance of kernicterus cases occurred in infants with a bilirubin level higher than 20 mg/dL. Given the diversity of conclusions on the relationship between peak bilirubin levels and behavioral and neurodevelopmental outcomes, it is apparent that the use of a single total serum bilirubin level to predict long-term outcomes is inadequate and will lead to conflicting results. Evidence for efficacy of treatments for neonatal hyperbilirubinemia was limited. Overall, the 4 qualifying studies showed that phototherapy had an absolute risk-reduction rate of 10% to 17% for prevention of serum bilirubin levels higher than 20 mg/dL in healthy infants with jaundice. There is no evidence to suggest that phototherapy for neonatal hyperbilirubinemia has any long-term adverse neurodevelopmental effects. Transcutaneous measurements of bilirubin have a linear correlation to total serum bilirubin and may be useful as screening devices to detect clinically significant jaundice and decrease the need for serum bilirubin determinations. Based on our review of the risks associated with BETs from 15 studies consisting mainly of infants born before 1970, we conclude that the mortality within 6 hours of BET ranged from 3 per 1000 to 4 per 1000 exchanged infants who were term and without serious hemolytic diseases. Regardless of the definitions and rates of BET-associated morbidity and the various pre-exchange clinical states of the exchanged infants, in many cases the morbidity was minor (eg, postexchange anemia). Based on the results from the most recent study to report BET morbidity, the overall risk of permanent sequelae in 25 sick infants who survived BET was from 5% to 10%. (7/04)

EXCESSIVE SLEEPINESS IN ADOLESCENTS AND YOUNG ADULTS: CAUSES, CONSEQUENCES, AND TREATMENT STRATEGIES (TECHNICAL REPORT)

Richard P. Millman, MD; Working Group on Sleepiness in Adolescents/Young Adults; and Committee on Adolescence

ABSTRACT. Adolescents and young adults are often excessively sleepy. This excessive sleepiness can have a profound negative effect on school performance, cognitive function, and mood and has been associated with other serious consequences such as increased incidence of automobile crashes. In this article we review available scientific knowledge about normal sleep changes in adolescents (13–22 years of age), the factors associated with chronic insufficient sleep, the effect of insufficient sleep on a variety of systems and functions, and the primary sleep disorders or organic dysfunctions that, if untreated, can cause excessive daytime sleepiness in this population. (6/05)

EXPERT WITNESS PARTICIPATION IN CIVIL AND CRIMINAL PROCEEDINGS

Committee on Medical Liability and Risk Management

ABSTRACT. The interests of the public and both the medical and legal professions are best served when scientifically sound and unbiased expert witness testimony is readily available in civil and criminal proceedings. As members of the medical community, patient advocates, and private citizens, pediatricians have ethical and professional obligations to assist in the administration of justice. The American Academy of Pediatrics believes that the adoption of the recommendations outlined in this statement will improve the quality of medical expert witness testimony in legal proceedings and, thereby, increase

the probability of achieving outcomes that are fair, honest, and equitable. Strategies for enforcing guidance and promoting oversight of expert witnesses are proposed. (6/09)

EXPOSURE TO NONTRADITIONAL PETS AT HOME AND TO ANIMALS IN PUBLIC SETTINGS: RISKS TO CHILDREN (CLINICAL REPORT)

Larry K. Pickering, MD; Nina Marano, DVM, MPH; Joseph A. Bocchini, MD; Frederick J. Angulo, DVM, PhD; and Committee on Infectious Diseases

ABSTRACT. Exposure to animals can provide many benefits during the growth and development of children. However, there are potential risks associated with animal exposures, including exposure to nontraditional pets in the home and animals in public settings. Educational materials, regulations, and guidelines have been developed to minimize these risks. Pediatricians, veterinarians, and other health care professionals can provide advice on selection of appropriate pets as well as prevention of disease transmission from nontraditional pets and when children contact animals in public settings. (10/08, reaffirmed 12/11)

THE EYE EXAMINATION IN THE EVALUATION OF CHILD ABUSE (CLINICAL REPORT)

Alex V. Levin, MD, MHSc; Cindy W. Christian, MD; Committee on Child Abuse and Neglect; and Section on Ophthalmology

ABSTRACT. Retinal hemorrhage is an important indicator of possible abusive head trauma, but it is also found in a number of other conditions. Distinguishing the type, number, and pattern of retinal hemorrhages may be helpful in establishing a differential diagnosis. Identification of ocular abnormalities requires a full retinal examination by an ophthalmologist using indirect ophthalmoscopy through a pupil that has been pharmacologically dilated. At autopsy, removal of the eyes and orbital tissues may also reveal abnormalities not discovered before death. In previously well young children who experience unexpected apparent life-threatening events with no obvious cause, children with head trauma that results in significant intracranial hemorrhage and brain injury, victims of abusive head trauma, and children with unexplained death, premortem clinical eye examination and postmortem examination of the eyes and orbits may be helpful in detecting abnormalities that can help establish the underlying etiology. (7/10)

EYE EXAMINATION IN INFANTS, CHILDREN, AND YOUNG ADULTS BY PEDIATRICIANS

Committee on Practice and Ambulatory Medicine and Section on Ophthalmology (joint with American Association of Certified Orthoptists, American Association for Pediatric Ophthalmology and Strabismus, and American Academy of Ophthalmology)

ABSTRACT. Early detection and prompt treatment of ocular disorders in children is important to avoid lifelong visual impairment. Examination of the eyes should be performed beginning in the newborn period and at all well-child visits. Newborns should be examined for ocular structural abnormalities, such as cataract, corneal opacity, and ptosis, which are known to result in visual problems. Vision assessment beginning at birth has been endorsed by the American Academy of Pediatrics, the American Association for Pediatric Ophthalmology and Strabismus, and the American Academy of Ophthalmology. All children who are found to have an ocular abnormality or who fail vision assessment should be referred to a pediatric ophthalmologist or an eye care specialist appropriately trained to treat pediatric patients. (4/03, reaffirmed 5/07)

FACILITIES AND EQUIPMENT FOR THE CARE OF PEDIATRIC PATIENTS IN A COMMUNITY HOSPITAL (CLINICAL REPORT)

Committee on Hospital Care

ABSTRACT. Many children who require hospitalization are admitted to community hospitals that are more accessible for families and their primary care physicians but vary substantially in their pediatric resources. The intent of this clinical report is to provide basic guidelines for furnishing and equipping a pediatric area in a community hospital. (5/03, reaffirmed 5/07, reaffirmed 8/13)

FAILURE TO THRIVE AS A MANIFESTATION OF CHILD NEGLECT (CLINICAL REPORT)

Robert W. Block, MD; Nancy F. Krebs, MD; Committee on Child Abuse and Neglect; and Committee on Nutrition

ABSTRACT. Failure to thrive is a common problem in infancy and childhood. It is most often multifactorial in origin. Inadequate nutrition and disturbed social interactions contribute to poor weight gain, delayed development, and abnormal behavior. The syndrome develops in a significant number of children as a consequence of child neglect. This clinical report is intended to focus the pediatrician on the consideration, evaluation, and management of failure to thrive when child neglect may be present. Child protective services agencies should be notified when the evaluation leads to a suspicion of abuse or neglect. (11/05, reaffirmed 1/09)

FALLS FROM HEIGHTS: WINDOWS, ROOFS, AND BALCONIES

Committee on Injury and Poison Prevention

ABSTRACT. Falls of all kinds represent an important cause of child injury and death. In the United States, approximately 140 deaths from falls occur annually in children younger than 15 years. Three million children require emergency department care for fall-related injuries. This policy statement examines the epidemiology of falls from heights and recommends preventive strategies for pediatricians and other child health care professionals. Such strategies involve parent counseling, community programs, building code changes, legislation, and environmental modification, such as the installation of window guards and balcony railings. (5/01, reaffirmed 10/04, 5/07, 6/10)

FAMILIES AND ADOPTION: THE PEDIATRICIAN'S ROLE IN SUPPORTING COMMUNICATION (CLINICAL REPORT)

Committee on Early Childhood, Adoption, and Dependent Care

ABSTRACT. Each year, more children join families through adoption. Pediatricians have an important role in assisting adoptive families in the various challenges they may face with respect to adoption. The acceptance of the differences between families formed through birth and

those formed through adoption is essential in promoting positive emotional growth within the family. It is important for pediatricians to be informed about adoption and to share this knowledge with adoptive families. Parents need ongoing advice with respect to adoption issues and need to be supported in their communication with their adopted children. (12/03)

FATHERS AND PEDIATRICIANS: ENHANCING MEN'S ROLES IN THE CARE AND DEVELOPMENT OF THEIR CHILDREN (CLINICAL REPORT)

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. Research substantiates that fathers' interactions with their children can exert a positive influence on their children's development. This report suggests ways pediatricians can enhance fathers' caregiving involvement by offering specific, culturally sensitive advice and how pediatricians might change their office practices to support and increase fathers' active involvement in their children's care and development. (5/04, reaffirmed 8/13)

FEVER AND ANTIPYRETIC USE IN CHILDREN (CLINICAL REPORT)

Janice E. Sullivan, MD; Henry C. Farrar, MD; Section on Clinical Pharmacology and Therapeutics; and Committee on Drugs

ABSTRACT. Fever in a child is one of the most common clinical symptoms managed by pediatricians and other health care providers and a frequent cause of parental concern. Many parents administer antipyretics even when there is minimal or no fever, because they are concerned that the child must maintain a "normal" temperature. Fever, however, is not the primary illness but is a physiologic mechanism that has beneficial effects in fighting infection. There is no evidence that fever itself worsens the course of an illness or that it causes long-term neurologic complications. Thus, the primary goal of treating the febrile child should be to improve the child's overall comfort rather than focus on the normalization of body temperature. When counseling the parents or caregivers of a febrile child, the general well-being of the child, the importance of monitoring activity, observing for signs of serious illness, encouraging appropriate fluid intake, and the safe storage of antipyretics should be emphasized. Current evidence suggests that there is no substantial difference in the safety and effectiveness of acetaminophen and ibuprofen in the care of a generally healthy child with fever. There is evidence that combining these 2 products is more effective than the use of a single agent alone; however, there are concerns that combined treatment may be more complicated and contribute to the unsafe use of these drugs. Pediatricians should also promote patient safety by advocating for simplified formulations, dosing instructions, and dosing devices. (2/11)

FINANCING GRADUATE MEDICAL EDUCATION TO MEET THE NEEDS OF CHILDREN AND THE FUTURE PEDIATRICIAN WORKFORCE

Committee on Pediatric Workforce

ABSTRACT. This policy statement articulates the positions of the American Academy of Pediatrics on graduate medical education and the associated costs and funding mechanisms. It reaffirms the policy of the American Academy of Pediatrics that graduate medical education is a public good and is an essential part of maintaining a high-quality physician workforce. The American Academy of Pediatrics advocates for lifelong learning across the continuum of medical education. This policy statement focuses on the financing of one component of this continuum, namely residency education. The statement calls on federal and state governments to continue their support of residency education and advocates for stable means of funding such as the establishment of an all-payer graduate medical education trust fund. It further proposes a portable authorization system that would allocate graduate medical education funds for direct medical education costs to accredited residency programs on the basis of the selection of the program by qualified student or residents. This system allows the funding to follow the residents to their program. Recognizing the critical workforce needs of many pediatric medical subspecialties, pediatric surgical specialties, and other pediatric specialty disciplines, this statement maintains that subspecialty fellowship training and general pediatrics research fellowship training should receive adequate support from the graduate medical education financing system, including funding from the National Institutes of Health and other federal agencies, as appropriate. Furthermore, residency education that is provided in freestanding children's hospitals should receive a level of support equivalent to that of other teaching hospitals. The financing of graduate medical education is an important and effective tool to ensure that the future pediatrician workforce can provide optimal heath care for infants, children, adolescents, and young adults. (4/08, reaffirmed 1/12)

FINANCING OF PEDIATRIC HOME HEALTH CARE

Committee on Child Health Financing and Section on Home Care

ABSTRACT. In certain situations, home health care has been shown to be a cost-effective alternative to inpatient hospital care. National health expenditures reveal that pediatric home health costs totaled $5.3 billion in 2000. Medicaid is the major payer for pediatric home health care (77%), followed by other public sources (22%). Private health insurance and families each paid less than 1% of pediatric home health expenses. The most important factors affecting access to home health care are the inadequate supply of clinicians and ancillary personnel, shortages of home health nurses with pediatric expertise, inadequate payment, and restrictive insurance and managed care policies. Many children must stay in the NICU, PICU, and other pediatric wards and intermediate care areas at a much higher cost because of inadequate pediatric home health care services. The main financing problem pertaining to Medicaid is low payment to home health agencies at rates that are insufficient to provide beneficiaries access to home health services. Although home care services may be a covered benefit under private health plans, most do not cover private-duty nursing (83%), home health aides (45%), or home physical, occupational, or speech therapy (33%) and/or impose visit or monetary limits or caps. To advocate for improvements in financing of pediatric home health care, the American Academy of Pediatrics has developed several recommendations for

public policy makers, federal and state Medicaid offices, private insurers, managed care plans, Title V officials, and home health care professionals. These recommendations will improve licensing, payment, coverage, and research related to pediatric home health services. (8/06)

FIREARM-RELATED INJURIES AFFECTING THE PEDIATRIC POPULATION

Council on Injury, Violence, and Poison Prevention Executive Committee

ABSTRACT. The absence of guns from children's homes and communities is the most reliable and effective measure to prevent firearm-related injuries in children and adolescents. Adolescent suicide risk is strongly associated with firearm availability. Safe gun storage (guns unloaded and locked, ammunition locked separately) reduces children's risk of injury. Physician counseling of parents about firearm safety appears to be effective, but firearm safety education programs directed at children are ineffective. The American Academy of Pediatrics continues to support a number of specific measures to reduce the destructive effects of guns in the lives of children and adolescents, including the regulation of the manufacture, sale, purchase, ownership, and use of firearms; a ban on semiautomatic assault weapons; and the strongest possible regulations of handguns for civilian use. (10/12)

FIREWORKS-RELATED INJURIES TO CHILDREN

Committee on Injury and Poison Prevention

ABSTRACT. An estimated 8500 individuals, approximately 45% of them children younger than 15 years, were treated in US hospital emergency departments during 1999 for fireworks-related injuries. The hands (40%), eyes (20%), and head and face (20%) are the body areas most often involved. Approximately one third of eye injuries from fireworks result in permanent blindness. During 1999, 16 people died as a result of injuries associated with fireworks. Every type of legally available consumer (so-called "safe and sane") firework has been associated with serious injury or death. In 1997, 20 100 fires were caused by fireworks, resulting in $22.7 million in direct property damage. Fireworks typically cause more fires in the United States on the Fourth of July than all other causes of fire combined on that day. Pediatricians should educate parents, children, community leaders, and others about the dangers of fireworks. Fireworks for individual private use should be banned. Children and their families should be encouraged to enjoy fireworks at public fireworks displays conducted by professionals rather than purchase fireworks for home or private use. (7/01, reaffirmed 1/05, 2/08, 10/11)

FOLIC ACID FOR THE PREVENTION OF NEURAL TUBE DEFECTS

Committee on Genetics

ABSTRACT. The American Academy of Pediatrics endorses the US Public Health Service (USPHS) recommendation that all women capable of becoming pregnant consume 400 μg of folic acid daily to prevent neural tube defects (NTDs). Studies have demonstrated that periconceptional folic acid supplementation can prevent 50% or more of NTDs such as spina bifida and anencephaly. For women who have previously had an NTD-affected pregnancy, the Centers for Disease Control and Prevention (CDC) recommends increasing the intake of folic acid to 4000 μg per day beginning at least 1 month before conception and continuing through the first trimester. Implementation of these recommendations is essential for the primary prevention of these serious and disabling birth defects. Because fewer than 1 in 3 women consume the amount of folic acid recommended by the USPHS, the Academy notes that the prevention of NTDs depends on an urgent and effective campaign to close this prevention gap. (8/99, reaffirmed 11/02, 1/07, 5/12)

FOLLOW-UP MANAGEMENT OF CHILDREN WITH TYMPANOSTOMY TUBES

Section on Otolaryngology and Bronchoesophagology

ABSTRACT. The follow-up care of children in whom tympanostomy tubes have been placed is shared by the pediatrician and the otolaryngologist. Guidelines are provided for routine follow-up evaluation, perioperative hearing assessment, and the identification of specific conditions and complications that warrant urgent otolaryngologic consultation. These guidelines have been developed by a consensus of expert opinions. (2/02)

FORGOING LIFE-SUSTAINING MEDICAL TREATMENT IN ABUSED CHILDREN

Committee on Child Abuse and Neglect and Committee on Bioethics

ABSTRACT. A decision to forgo life-sustaining medical treatment (LSMT) for a critically ill child injured as the result of abuse should be made using the same criteria as those used for any critically ill child. The parent or guardian of an abused child may have a conflict of interest when a decision to forgo LSMT risks changing the legal charge faced by a parent, guardian, relative, or acquaintance from assault to manslaughter or homicide. If a physician suspects that a parent or guardian is not acting in a child's best interest, further review and consultation should be sought in hopes of resolving the conflict. A guardian ad litem who will represent the child's interests regarding LSMT should be appointed in all cases in which a parent or guardian may have a conflict of interest. (11/00, reaffirmed 6/03, 10/06, 4/09)

FORGOING MEDICALLY PROVIDED NUTRITION AND HYDRATION IN CHILDREN (CLINICAL REPORT)

Douglas S. Diekema, MD, MPH; Jeffrey R. Botkin, MD, MPH; and Committee on Bioethics

ABSTRACT. There is broad consensus that withholding or withdrawing medical interventions is morally permissible when requested by competent patients or, in the case of patients without decision-making capacity, when the interventions no longer confer a benefit to the patient or when the burdens associated with the interventions outweigh the benefits received. The withdrawal or withholding of measures such as attempted resuscitation, ventilators, and critical care medications is common in the terminal care of adults and children. In the case of adults, a consensus has emerged in law and ethics that the medical administration of fluid and nutrition is not fundamentally different from other medical interventions such

as use of ventilators; therefore, it can be forgone or withdrawn when a competent adult or legally authorized surrogate requests withdrawal or when the intervention no longer provides a net benefit to the patient. In pediatrics, forgoing or withdrawing medically administered fluids and nutrition has been more controversial because of the inability of children to make autonomous decisions and the emotional power of feeding as a basic element of the care of children. This statement reviews the medical, ethical, and legal issues relevant to the withholding or withdrawing of medically provided fluids and nutrition in children. The American Academy of Pediatrics concludes that the withdrawal of medically administered fluids and nutrition for pediatric patients is ethically acceptable in limited circumstances. Ethics consultation is strongly recommended when particularly difficult or controversial decisions are being considered. (7/09)

THE FUTURE OF PEDIATRICS: MENTAL HEALTH COMPETENCIES FOR PEDIATRIC PRIMARY CARE

Committee on Psychosocial Aspects of Child and Family Health and Task Force on Mental Health

ABSTRACT. Pediatric primary care clinicians have unique opportunities and a growing sense of responsibility to prevent and address mental health and substance abuse problems in the medical home. In this report, the American Academy of Pediatrics proposes competencies requisite for providing mental health and substance abuse services in pediatric primary care settings and recommends steps toward achieving them. Achievement of the competencies proposed in this statement is a goal, not a current expectation. It will require innovations in residency training and continuing medical education, as well as a commitment by the individual clinician to pursue, over time, educational strategies suited to his or her learning style and skill level. System enhancements, such as collaborative relationships with mental health specialists and changes in the financing of mental health care, must precede enhancements in clinical practice. For this reason, the proposed competencies begin with knowledge and skills for systems-based practice. The proposed competencies overlap those of mental health specialists in some areas; for example, they include the knowledge and skills to care for children with attention-deficit/hyperactivity disorder, anxiety, depression, and substance abuse and to recognize psychiatric and social emergencies. In other areas, the competencies reflect the uniqueness of the primary care clinician's role: building resilience in all children; promoting healthy lifestyles; preventing or mitigating mental health and substance abuse problems; identifying risk factors and emerging mental health problems in children and their families; and partnering with families, schools, agencies, and mental health specialists to plan assessment and care. Proposed interpersonal and communication skills reflect the primary care clinician's critical role in overcoming barriers (perceived and/or experienced by children and families) to seeking help for mental health and substance abuse concerns. (6/09, reaffirmed 8/13)

GASTROESOPHAGEAL REFLUX: MANAGEMENT GUIDANCE FOR THE PEDIATRICIAN (CLINICAL REPORT)

Jenifer R. Lightdale, MD, MPH; David A. Gremse, MD; and Section on Gastroenterology, Hepatology, and Nutrition

ABSTRACT. Recent comprehensive guidelines developed by the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition define the common entities of gastroesophageal reflux (GER) as the physiologic passage of gastric contents into the esophagus and gastroesophageal reflux disease (GERD) as reflux associated with troublesome symptoms or complications. The ability to distinguish between GER and GERD is increasingly important to implement best practices in the management of acid reflux in patients across all pediatric age groups, as children with GERD may benefit from further evaluation and treatment, whereas conservative recommendations are the only indicated therapy in those with uncomplicated physiologic reflux. This clinical report endorses the rigorously developed, well-referenced North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition guidelines and likewise emphasizes important concepts for the general pediatrician. A key issue is distinguishing between clinical manifestations of GER and GERD in term infants, children, and adolescents to identify patients who can be managed with conservative treatment by the pediatrician and to refer patients who require consultation with the gastroenterologist. Accordingly, the evidence basis presented by the guidelines for diagnostic approaches as well as treatments is discussed. Lifestyle changes are emphasized as first-line therapy in both GER and GERD, whereas medications are explicitly indicated only for patients with GERD. Surgical therapies are reserved for children with intractable symptoms or who are at risk for life-threatening complications of GERD. Recent black box warnings from the US Food and Drug Administration are discussed, and caution is underlined when using promoters of gastric emptying and motility. Finally, attention is paid to increasing evidence of inappropriate prescriptions for proton pump inhibitors in the pediatric population. (4/13)

See full text on page 631.

GENERIC PRESCRIBING, GENERIC SUBSTITUTION, AND THERAPEUTIC SUBSTITUTION

Committee on Drugs (5/87, reaffirmed 6/93, 5/96, 6/99, 5/01, 5/05, 10/08, 10/12)

GLOBAL CLIMATE CHANGE AND CHILDREN'S HEALTH

Committee on Environmental Health

ABSTRACT. There is broad scientific consensus that Earth's climate is warming rapidly and at an accelerating rate. Human activities, primarily the burning of fossil fuels, are very likely (>90% probability) to be the main cause of this warming. Climate-sensitive changes in ecosystems are already being observed, and fundamental, potentially irreversible, ecological changes may occur in the coming decades. Conservative environmental estimates of the impact of climate changes that are already in process indicate that they will result in numerous health

effects to children. The nature and extent of these changes will be greatly affected by actions taken or not taken now at the global level.

Physicians have written on the projected effects of climate change on public health, but little has been written specifically on anticipated effects of climate change on children's health. Children represent a particularly vulnerable group that is likely to suffer disproportionately from both direct and indirect adverse health effects of climate change. Pediatric health care professionals should understand these threats, anticipate their effects on children's health, and participate as children's advocates for strong mitigation and adaptation strategies now. Any solutions that address climate change must be developed within the context of overall sustainability (the use of resources by the current generation to meet current needs while ensuring that future generations will be able to meet their needs). Pediatric health care professionals can be leaders in a move away from a traditional focus on disease prevention to a broad, integrated focus on sustainability as synonymous with health.

This policy statement is supported by a technical report that examines in some depth the nature of the problem of climate change, likely effects on children's health as a result of climate change, and the critical importance of responding promptly and aggressively to reduce activities that are contributing to this change. (11/07, reaffirmed 5/12)

GLOBAL CLIMATE CHANGE AND CHILDREN'S HEALTH (TECHNICAL REPORT)

Katherine M. Shea, MD, MPH, and Committee on Environmental Health

ABSTRACT. There is a broad scientific consensus that the global climate is warming, the process is accelerating, and that human activities are very likely (>90% probability) the main cause. This warming will have effects on ecosystems and human health, many of them adverse. Children will experience both the direct and indirect effects of climate change. Actions taken by individuals, communities, businesses, and governments will affect the magnitude and rate of global climate change and resultant health impacts. This technical report reviews the nature of the global problem and anticipated health effects on children and supports the recommendations in the accompanying policy statement on climate change and children's health. (11/07, reaffirmed 5/12)

GRADUATE MEDICAL EDUCATION AND PEDIATRIC WORKFORCE ISSUES AND PRINCIPLES

Task Force on Graduate Medical Education Reform (6/94)

GUIDANCE FOR THE ADMINISTRATION OF MEDICATION IN SCHOOL

Council on School Health

ABSTRACT. Many children who take medications require them during the school day. This policy statement is designed to guide prescribing health care professionals, school physicians, and school health councils on the administration of medications to children at school. All districts and schools need to have policies and plans in place for safe, effective, and efficient administration of medications at school. Having full-time licensed registered nurses administering all routine and emergency medications in schools is the best situation. When a licensed registered nurse is not available, a licensed practical nurse may administer medications. When a nurse cannot administer medication in school, the American Academy of Pediatrics supports appropriate delegation of nursing services in the school setting. Delegation is a tool that may be used by the licensed registered school nurse to allow unlicensed assistive personnel to provide standardized, routine health services under the supervision of the nurse and on the basis of physician guidance and school nursing assessment of the unique needs of the individual child and the suitability of delegation of specific nursing tasks. Any delegation of nursing duties must be consistent with the requirements of state nurse practice acts, state regulations, and guidelines provided by professional nursing organizations. Long-term, emergency, and short-term medications; over-the-counter medications; alternative medications; and experimental drugs that are administered as part of a clinical trial are discussed in this statement. This statement has been endorsed by the American School Health Association. (9/09, reaffirmed 2/13)

GUIDANCE FOR EFFECTIVE DISCIPLINE

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. When advising families about discipline strategies, pediatricians should use a comprehensive approach that includes consideration of the parent-child relationship, reinforcement of desired behaviors, and consequences for negative behaviors. Corporal punishment is of limited effectiveness and has potentially deleterious side effects. The American Academy of Pediatrics recommends that parents be encouraged and assisted in the development of methods other than spanking for managing undesired behavior. (4/98, reaffirmed 3/01, 1/05, 5/12)

GUIDANCE ON MANAGEMENT OF ASYMPTOMATIC NEONATES BORN TO WOMEN WITH ACTIVE GENITAL HERPES LESIONS (CLINICAL REPORT)

Committee on Infectious Diseases and Committee on Fetus and Newborn

ABSTRACT. Herpes simplex virus (HSV) infection of the neonate is uncommon, but genital herpes infections in adults are very common. Thus, although treating an infant with neonatal herpes is a relatively rare occurrence, managing infants potentially exposed to HSV at the time of delivery occurs more frequently. The risk of transmitting HSV to an infant during delivery is determined in part by the mother's previous immunity to HSV. Women with primary genital HSV infections who are shedding HSV at delivery are 10 to 30 times more likely to transmit the virus to their newborn infants than are women with recurrent HSV infection who are shedding virus at delivery. With the availability of commercial serological tests that reliably can distinguish type-specific HSV antibodies, it is now possible to determine the type of maternal infection and, thus, further refine management of infants delivered to women who have active genital HSV lesions. The management algorithm presented herein uses both serologi-

cal and virological studies to determine the risk of HSV transmission to the neonate who is delivered to a mother with active herpetic genital lesions and tailors management accordingly. The algorithm does not address the approach to asymptomatic neonates delivered to women with a history of genital herpes but no active lesions at delivery. (1/13)

See full text on page 645.

GUIDELINES FOR CARE OF CHILDREN IN THE EMERGENCY DEPARTMENT

Committee on Pediatric Emergency Medicine (joint with American College of Emergency Physicians Pediatric Committee and Emergency Nurses Association Pediatric Committee)

ABSTRACT. Children who require emergency care have unique needs, especially when emergencies are serious or life-threatening. The majority of ill and injured children are brought to community hospital emergency departments (EDs) by virtue of their geography within communities. Similarly, emergency medical services (EMS) agencies provide the bulk of out-of-hospital emergency care to children. It is imperative, therefore, that all hospital EDs have the appropriate resources (medications, equipment, policies, and education) and staff to provide effective emergency care for children. This statement outlines resources necessary to ensure that hospital EDs stand ready to care for children of all ages, from neonates to adolescents. These guidelines are consistent with the recommendations of the Institute of Medicine's report on the future of emergency care in the United States health system. Although resources within emergency and trauma care systems vary locally, regionally, and nationally, it is essential that hospital ED staff and administrators and EMS systems' administrators and medical directors seek to meet or exceed these guidelines in efforts to optimize the emergency care of children they serve. This statement has been endorsed by the Academic Pediatric Association, American Academy of Family Physicians, American Academy of Physician Assistants, American College of Osteopathic Emergency Physicians, American College of Surgeons, American Heart Association, American Medical Association, American Pediatric Surgical Association, Brain Injury Association of America, Child Health Corporation of America, Children's National Medical Center, Family Voices, National Association of Children's Hospitals and Related Institutions, National Association of EMS Physicians, National Association of Emergency Medical Technicians, National Association of State EMS Officials, National Committee for Quality Assurance, National PTA, Safe Kids USA, Society of Trauma Nurses, Society for Academic Emergency Medicine, and The Joint Commission. (9/09, reaffirmed 4/13)

GUIDELINES FOR THE DETERMINATION OF BRAIN DEATH IN INFANTS AND CHILDREN: AN UPDATE OF THE 1987 TASK FORCE RECOMMENDATIONS (CLINICAL REPORT)

Thomas A. Nakagawa, MD; Stephen Ashwal, MD; Mudit Mathur, MD; and Mohan Mysore, MD (joint with Society of Critical Care Medicine Section on Critical Care and Section on Neurology and Child Neurology Society)

ABSTRACT. *Objective.* To review and revise the 1987 pediatric brain death guidelines.

Methods. Relevant literature was reviewed. Recommendations were developed using the GRADE system.

Conclusions and Recommendations.

(1) Determination of brain death in term newborns, infants and children is a clinical diagnosis based on the absence of neurologic function with a known irreversible cause of coma. Because of insufficient data in the literature, recommendations for preterm infants less than 37 weeks gestational age are not included in this guideline.

(2) Hypotension, hypothermia, and metabolic disturbances should be treated and corrected and medications that can interfere with the neurologic examination and apnea testing should be discontinued allowing for adequate clearance before proceeding with these evaluations.

(3) Two examinations including apnea testing with each examination separated by an observation period are required. Examinations should be performed by different attending physicians. Apnea testing may be performed by the same physician. An observation period of 24 hours for term newborns (37 weeks gestational age) to 30 days of age, and 12 hours for infants and chi (> 30 days to 18 years) is recommended. The first examination determines the child has met the accepted neurologic examination criteria for brain death. The second examination confirms brain death based on an unchanged and irreversible condition. Assessment of neurologic function following cardiopulmonary resuscitation or other severe acute brain injuries should be deferred for 24 hours or longer if there are concerns or inconsistencies in the examination.

(4) Apnea testing to support the diagnosis of brain death must be performed safely and requires documentation of an arterial PaCO2 20 mm Hg above the baseline and 60 mm Hg with no respiratory effort during the testing period. If the apnea test cannot be safely completed, an ancillary study should be performed.

(5) Ancillary studies (electroencephalogram and radionuclide cerebral blood flow) are not required to establish brain death and are not a substitute for the neurologic examination. Ancillary studies may be us d to assist the clinician in making the diagnosis of brain death (i) when components of the examination or apnea testing cannot be completed safely due to the underlying medical condition of the patient; (ii) if there is uncertainty about the results of the neurologic examination; (iii) if a medication effect may be present; or (iv) to reduce the inter-examination observation period. When ancillary studies are used, a second clinical examination and apnea test should be performed and components that can be completed must remain consistent with brain death. In this instance the observation interval may be shortened and the second

neurologic examination and apnea test (or all components that are able to be completed safely) can be performed at any time thereafter.

(6) Death is declared when the above criteria are fulfilled. (8/11)

GUIDELINES FOR DEVELOPING ADMISSION AND DISCHARGE POLICIES FOR THE PEDIATRIC INTENSIVE CARE UNIT (CLINICAL REPORT)

Committee on Hospital Care and Section on Critical Care (joint with Society of Critical Care Medicine Pediatric Section Admission Criteria Task Force)

ABSTRACT. These guidelines were developed to provide a reference for preparing policies on admission to and discharge from pediatric intensive care units. They represent a consensus opinion of physicians, nurses, and allied health care professionals. By using this document as a framework for developing multidisciplinary admission and discharge policies, use of pediatric intensive care units can be optimized and patients can receive the level of care appropriate for their condition. (4/99, reaffirmed 5/05, 2/08, 1/13)

GUIDELINES FOR THE ETHICAL CONDUCT OF STUDIES TO EVALUATE DRUGS IN PEDIATRIC POPULATIONS (CLINICAL REPORT)

Robert E. Shaddy, MD; Scott C. Denne, MD; Committee on Drugs; and Committee on Pediatric Research

ABSTRACT. The proper ethical conduct of studies to evaluate drugs in children is of paramount importance to all those involved in these types of studies. This report is an updated revision to the previously published guidelines from the American Academy of Pediatrics in 1995. Since the previous publication, there have been great strides made in the science and ethics of studying drugs in children. There have also been numerous legislative and regulatory advancements that have promoted the study of drugs in children while simultaneously allowing for the protection of this particularly vulnerable group. This report summarizes these changes and advances and provides a framework from which to guide and monitor the ethical conduct of studies to evaluate drugs in children. (3/10)

GUIDELINES ON FORGOING LIFE-SUSTAINING MEDICAL TREATMENT

Committee on Bioethics (3/94, reaffirmed 11/97, 10/00, 1/04, 1/09, 10/12)

GUIDELINES FOR HOME CARE OF INFANTS, CHILDREN, AND ADOLESCENTS WITH CHRONIC DISEASE

Committee on Children With Disabilities (7/95, reaffirmed 4/00, 1/06)

GUIDELINES FOR MONITORING AND MANAGEMENT OF PEDIATRIC PATIENTS DURING AND AFTER SEDATION FOR DIAGNOSTIC AND THERAPEUTIC PROCEDURES: AN UPDATE (CLINICAL REPORT)

American Academy of Pediatrics; American Academy of Pediatric Dentistry; Charles J. Coté, MD; Stephen Wilson, DMD, MA, PhD; and Work Group on Sedation

ABSTRACT. The safe sedation of children for procedures requires a systematic approach that includes the following: no administration of sedating medication without the safety net of medical supervision; careful presedation evaluation for underlying medical or surgical conditions that would place the child at increased risk from sedating medications; appropriate fasting for elective procedures and a balance between depth of sedation and risk for those who are unable to fast because of the urgent nature of the procedure; a focused airway examination for large tonsils or anatomic airway abnormalities that might increase the potential for airway obstruction; a clear understanding of the pharmacokinetic and pharmacodynamic effects of the medications used for sedation, as well as an appreciation for drug interactions; appropriate training and skills in airway management to allow rescue of the patient; age- and size-appropriate equipment for airway management and venous access; appropriate medications and reversal agents; sufficient numbers of people to carry out the procedure and monitor the patient; appropriate physiologic monitoring during and after the procedure; a properly equipped and staffed recovery area; recovery to presedation level of consciousness before discharge from medical supervision; and appropriate discharge instructions. This report was developed through a collaborative effort of the American Academy of Pediatrics and the American Academy of Pediatric Dentistry to offer pediatric providers updated information and guidance in delivering safe sedation to children. (12/06, reaffirmed 3/11)

GUIDELINES FOR PEDIATRIC CANCER CENTERS

Section on Hematology/Oncology

ABSTRACT. Since the American Academy of Pediatrics published guidelines for pediatric cancer centers in 1986 and 1997, significant changes in the delivery of health care have prompted a review of the role of tertiary medical centers in the care of pediatric patients. The potential effect of these changes on the treatment and survival rates of children with cancer led to this revision. The intent of this statement is to delineate personnel and facilities that are essential to provide state-of-the-art care for children and adolescents with cancer. This statement emphasizes the importance of board-certified pediatric hematologists/oncologists, pediatric subspecialty consultants, and appropriately qualified pediatric medical subspecialists and pediatric surgical specialists overseeing the care of all pediatric and adolescent cancer patients and the need for facilities available only at a tertiary center as essential for the initial management and much of the follow-up for pediatric and adolescent cancer patients. (6/04, reaffirmed 10/08)

GUIDELINES FOR PEDIATRIC CARDIOVASCULAR CENTERS

Section on Cardiology and Cardiac Surgery

ABSTRACT. Pediatric cardiovascular centers should aim to provide high-quality therapeutic outcomes for infants and children with congenital and acquired heart diseases. This policy statement describes critical elements and organizational features of centers in which high-quality outcomes have the greatest likelihood of occurring. Center elements include noninvasive diagnostic modalities, cardiac catheterization, cardiovascular surgery, and cardiovascular intensive care. These elements should

be organizationally united in centers in which pediatric cardiac physician specialists and specialized pediatric staff work together to achieve and surpass existing quality-of-care benchmarks. (3/02, reaffirmed 10/07)

GUIDELINES FOR REFERRAL TO PEDIATRIC SURGICAL SPECIALISTS
Surgical Advisory Panel (7/02, reaffirmed 1/07)

GUIDING PRINCIPLES FOR MANAGED CARE ARRANGEMENTS FOR THE HEALTH CARE OF NEWBORNS, INFANTS, CHILDREN, ADOLESCENTS, AND YOUNG ADULTS
Committee on Child Health Financing
ABSTRACT. By including the precepts of primary care and the medical home in the delivery of services, managed care can be effective in increasing access to a full range of health care services and clinicians. A carefully designed and administered managed care plan can minimize patient under- and overutilization of services, as well as enhance quality of care. Therefore, the American Academy of Pediatrics urges the use of the key principles outlined in this statement in designing and implementing managed care programs for newborns, infants, children, adolescents, and young adults to maximize the positive potential of managed care for pediatrics. (10/13)
See full text on page 659.

GUIDING PRINCIPLES FOR PEDIATRIC HOSPITAL MEDICINE PROGRAMS
Section on Hospital Medicine
ABSTRACT. Pediatric hospital medicine programs have an established place in pediatric medicine. This statement speaks to the expanded roles and responsibilities of pediatric hospitalists and their integrated role among the community of pediatricians who care for children within and outside of the hospital setting. (9/13)
See full text on page 673.

GYNECOLOGIC EXAMINATION FOR ADOLESCENTS IN THE PEDIATRIC OFFICE SETTING (CLINICAL REPORT)
Paula K. Braverman, MD; Lesley Breech, MD; and Committee on Adolescence
ABSTRACT. The American Academy of Pediatrics promotes the inclusion of the gynecologic examination in the primary care setting within the medical home. Gynecologic issues are commonly seen by clinicians who provide primary care to adolescents. Some of the most common concerns include questions related to pubertal development; menstrual disorders such as dysmenorrhea, amenorrhea, oligomenorrhea, and abnormal uterine bleeding; contraception; and sexually transmitted and non–sexually transmitted infections. The gynecologic examination is a key element in assessing pubertal status and documenting physical findings. Most adolescents do not need an internal examination involving a speculum or bimanual examination. However, for cases in which more extensive examination is needed, the primary care office with the primary care clinician who has established rapport and trust with the patient is often the best setting for pelvic examination. This report reviews the gynecologic examination, including indications for the pelvic examination in adolescents and the approach to this examination in the office setting. Indications for referral to a gynecologist are included. The pelvic examination may be successfully completed when conducted without pressure and approached as a normal part of routine young women's health care. (8/10, reaffirmed 5/13)

HEAD LICE (CLINICAL REPORT)
Barbara L. Frankowski, MD, MPH; Joseph A. Bocchini, Jr, MD; Council on School Health; and Committee on Infectious Diseases
ABSTRACT. Head lice infestation is associated with limited morbidity but causes a high level of anxiety among parents of school-aged children. Since the 2002 clinical report on head lice was published by the American Academy of Pediatrics, patterns of resistance to products available over-the-counter and by prescription have changed, and additional mechanical means of removing head lice have been explored. This revised clinical report clarifies current diagnosis and treatment protocols and provides guidance for the management of children with head lice in the school setting. (7/10)

HEALTH CARE SUPERVISION FOR CHILDREN WITH WILLIAMS SYNDROME
Committee on Genetics
ABSTRACT. This set of guidelines is designed to assist the pediatrician to care for children with Williams syndrome diagnosed by clinical features and with regional chromosomal microdeletion confirmed by fluorescence in situ hybridization. (5/01, reaffirmed 5/05, 1/09)

HEALTH CARE OF YOUTH AGING OUT OF FOSTER CARE
Council on Foster Care, Adoption, and Kinship Care and Committee on Early Childhood
ABSTRACT. Youth transitioning out of foster care face significant medical and mental health care needs. Unfortunately, these youth rarely receive the services they need because of lack of health insurance. Through many policies and programs, the federal government has taken steps to support older youth in foster care and those aging out. The Fostering Connections to Success and Increasing Adoptions Act of 2008 (Pub L No. 110-354) requires states to work with youth to develop a transition plan that addresses issues such as health insurance. In addition, beginning in 2014, the Patient Protection and Affordable Care Act of 2010 (Pub L No. 111-148) makes youth aging out of foster care eligible for Medicaid coverage until age 26 years, regardless of income. Pediatricians can support youth aging out of foster care by working collaboratively with the child welfare agency in their state to ensure that the ongoing health needs of transitioning youth are met. (11/12)

HEALTH CARE FOR YOUTH IN THE JUVENILE JUSTICE SYSTEM
Committee on Adolescence
ABSTRACT. Youth in the juvenile correctional system are a high-risk population who, in many cases, have unmet physical, developmental, and mental health needs. Multiple studies have found that some of these health issues occur at higher rates than in the general adolescent population. Although some youth in the juvenile

justice system have interfaced with health care providers in their community on a regular basis, others have had inconsistent or nonexistent care. The health needs of these youth are commonly identified when they are admitted to a juvenile custodial facility. Pediatricians and other health care providers play an important role in the care of these youth, and continuity between the community and the correctional facility is crucial. This policy statement provides an overview of the health needs of youth in the juvenile correctional system, including existing resources and standards for care, financing of health care within correctional facilities, and evidence-based interventions. Recommendations are provided for the provision of health care services to youth in the juvenile correctional system as well as specific areas for advocacy efforts. (11/11)

HEALTH EQUITY AND CHILDREN'S RIGHTS

Council on Community Pediatrics and Committee on Native American Child Health

ABSTRACT. Many children in the United States fail to reach their full health and developmental potential. Disparities in their health and well-being result from the complex interplay of multiple social and environmental determinants that are not adequately addressed by current standards of pediatric practice or public policy. Integrating the principles and practice of child health equity—children's rights, social justice, human capital investment, and health equity ethics—into pediatrics will address the root causes of child health disparities.

Promoting the principles and practice of equity-based clinical care, child advocacy, and child- and family-centered public policy will help to ensure that social and environmental determinants contribute positively to the health and well-being of children. The American Academy of Pediatrics and pediatricians can move the national focus from documenting child health disparities to advancing the principles and practice of child health equity and, in so doing, influence the worldwide practice of pediatrics and child health. All pediatricians, including primary care practitioners and medical and surgical subspecialists, can incorporate these principles into their practice of pediatrics and child health. Integration of these principles into competency-based training and board certification will secure their assimilation into all levels of pediatric practice. (3/10, reaffirmed 10/13)

HEALTH INFORMATION TECHNOLOGY AND THE MEDICAL HOME

Council on Clinical Information Technology

ABSTRACT. The American Academy of Pediatrics (AAP) supports development and universal implementation of a comprehensive electronic infrastructure to support pediatric information functions of the medical home. These functions include (1) timely and continuous management and tracking of health data and services over a patient's lifetime for all providers, patients, families, and guardians, (2) comprehensive organization and secure transfer of health data during patient-care transitions between providers, institutions, and practices, (3) establishment and maintenance of central coordination of a patient's health information among multiple repositories (including personal health records and information exchanges), (4) translation of evidence into actionable clinical decision support, and (5) reuse of archived clinical data for continuous quality improvement. The AAP supports universal, secure, and vendor-neutral portability of health information for all patients contained within the medical home across all care settings (ambulatory practices, inpatient settings, emergency departments, pharmacies, consultants, support service providers, and therapists) for multiple purposes including direct care, personal health records, public health, and registries. The AAP also supports financial incentives that promote the development of information tools that meet the needs of pediatric workflows and that appropriately recognize the added value of medical homes to pediatric care. (4/11)

HEALTH AND MENTAL HEALTH NEEDS OF CHILDREN IN US MILITARY FAMILIES (CLINICAL REPORT)

Benjamin S. Siegel, MD; Beth Ellen Davis, MD, MPH; Committee on Psychosocial Aspects of Child and Family Health; and Section on Uniformed Services

ABSTRACT. The wars in Afghanistan and Iraq have been challenging for US uniformed service families and their children. Almost 60% of US service members have family responsibilities. Approximately 2.3 million active duty, National Guard, and Reserve service members have been deployed since the beginning of the wars in Afghanistan and Iraq (2001 and 2003, respectively), and almost half have deployed more than once, some for up to 18 months' duration. Up to 2 million US children have been exposed to a wartime deployment of a loved one in the past 10 years. Many service members have returned from combat deployments with symptoms of posttraumatic stress disorder, depression, anxiety, substance abuse, and traumatic brain injury. The mental health and well-being of spouses, significant others, children (and their friends), and extended family members of deployed service members continues to be significantly challenged by the experiences of wartime deployment as well as by combat mortality and morbidity. The medical system of the Department of Defense provides health and mental health services for active duty service members and their families as well as activated National Guard and Reserve service members and their families. In addition to military pediatricians and civilian pediatricians employed by military treatment facilities, nonmilitary general pediatricians care for >50% of children and family members before, during, and after wartime deployments. This clinical report is for all pediatricians, both active duty and civilian, to aid in caring for children whose loved ones have been, are, or will be deployed. (5/13)

See full text on page 681.

HEALTH SUPERVISION FOR CHILDREN WITH ACHONDROPLASIA (CLINICAL REPORT)

Tracy L. Trotter, MD; Judith G. Hall, OC, MD; and Committee on Genetics

ABSTRACT. Achondroplasia is the most common condition associated with disproportionate short stature. Substantial information is available concerning the natural history and anticipatory health supervision needs in children with this dwarfing disorder. Most children with achondroplasia have delayed motor milestones, problems

with persistent or recurrent middle-ear dysfunction, and bowing of the lower legs. Less often, infants and children may have serious health consequences related to hydrocephalus, craniocervical junction compression, upper-airway obstruction, or thoracolumbar kyphosis. Anticipatory care should be directed at identifying children who are at high risk and intervening to prevent serious sequelae. This report is designed to help the pediatrician care for children with achondroplasia and their families. (9/05, reaffirmed 5/12)

HEALTH SUPERVISION FOR CHILDREN WITH DOWN SYNDROME (CLINICAL REPORT)

Marilyn J. Bull, MD, and Committee on Genetics

ABSTRACT. These guidelines are designed to assist the pediatrician in caring for the child in whom a diagnosis of Down syndrome has been confirmed by chromosome analysis. Although a pediatrician's initial contact with the child is usually during infancy, occasionally the pregnant woman who has been given a prenatal diagnosis of Down syndrome will be referred for review of the condition and the genetic counseling provided. Therefore, this report offers guidance for this situation as well. (7/11)

HEALTH SUPERVISION FOR CHILDREN WITH FRAGILE X SYNDROME (CLINICAL REPORT)

Joseph H. Hersh, MD; Robert A. Saul, MD; and Committee on Genetics

ABSTRACT. Fragile X syndrome (an FMR1–related disorder) is the most commonly inherited form of mental retardation. Early physical recognition is difficult, so boys with developmental delay should be strongly considered for molecular testing. The characteristic adult phenotype usually does not develop until the second decade of life. Girls can also be affected with developmental delay. Because multiple family members can be affected with mental retardation and other conditions (premature ovarian failure and tremor/ataxia), family history information is of critical importance for the diagnosis and management of affected patients and their families. This report summarizes issues for fragile X syndrome regarding clinical diagnosis, laboratory diagnosis, genetic counseling, related health problems, behavior management, and age-related health supervision guidelines. The diagnosis of fragile X syndrome not only involves the affected children but also potentially has significant health consequences for multiple generations in each family. (4/11)

HEALTH SUPERVISION FOR CHILDREN WITH MARFAN SYNDROME (CLINICAL REPORT)

Brad T. Tinkle, MD, PhD; Howard M. Saal, MD; and Committee on Genetics

ABSTRACT. Marfan syndrome is a systemic, heritable connective tissue disorder that affects many different organ systems and is best managed by using a multidisciplinary approach. The guidance in this report is designed to assist the pediatrician in recognizing the features of Marfan syndrome as well as caring for the individual with this disorder. (9/13)

See full text on page 697.

HEALTH SUPERVISION FOR CHILDREN WITH NEUROFIBROMATOSIS (CLINICAL REPORT)

Joseph H. Hersh, MD, and Committee on Genetics

ABSTRACT. Neurofibromatosis 1 is a multisystem disorder that primarily involves the skin and nervous system. Its population prevalence is 1 in 3500. The condition usually is recognized in early childhood, when cutaneous manifestations are apparent. Although neurofibromatosis 1 is associated with marked clinical variability, most affected children do well from the standpoint of their growth and development. Some features of neurofibromatosis 1 are present at birth, and others are age-related abnormalities of tissue proliferation, which necessitate periodic monitoring to address ongoing health and developmental needs and to minimize the risk of serious medical complications. This clinical report provides a review of the clinical criteria needed to establish a diagnosis, the inheritance pattern of neurofibromatosis 1, its major clinical and developmental manifestations, and guidelines for monitoring and providing intervention to maximize the growth, development, and health of an affected child. (3/08)

HEALTH SUPERVISION FOR CHILDREN WITH PRADER-WILLI SYNDROME (CLINICAL REPORT)

Shawn E. McCandless, MD, and Committee on Genetics

ABSTRACT. This set of guidelines was designed to assist the pediatrician in caring for children with Prader-Willi syndrome diagnosed by clinical features and confirmed by molecular testing. Prader-Willi syndrome provides an excellent example of how early diagnosis and management can improve the long-term outcome for some genetic disorders. (12/10)

HEALTH SUPERVISION FOR CHILDREN WITH SICKLE CELL DISEASE

Section on Hematology/Oncology and Committee on Genetics

ABSTRACT. Sickle cell disease (SCD) is a group of complex genetic disorders with multisystem manifestations. This statement provides pediatricians in primary care and subspecialty practice with an overview of the genetics, diagnosis, clinical manifestations, and treatment of SCD. Specialized comprehensive medical care decreases morbidity and mortality during childhood. The provision of comprehensive care is a time-intensive endeavor that includes ongoing patient and family education, periodic comprehensive evaluations and other disease-specific health maintenance services, psychosocial care, and genetic counseling. Timely and appropriate treatment of acute illness is critical, because life-threatening complications develop rapidly. It is essential that every child with SCD receive comprehensive care that is coordinated through a medical home with appropriate expertise. (3/02, reaffirmed 1/06, 1/11)

HEARING ASSESSMENT IN INFANTS AND CHILDREN: RECOMMENDATIONS BEYOND NEONATAL SCREENING (CLINICAL REPORT)

Allen D. "Buz" Harlor Jr, MD; Charles Bower, MD; Committee on Practice and Ambulatory Medicine; and Section on Otolaryngology–Head and Neck Surgery

ABSTRACT. Congenital or acquired hearing loss in infants and children has been linked with lifelong deficits in speech and language acquisition, poor academic performance, personal-social maladjustments, and emotional difficulties. Identification of hearing loss through neonatal hearing screening, regular surveillance of developmental milestones, auditory skills, parental concerns, and middle-ear status and objective hearing screening of all infants and children at critical developmental stages can prevent or reduce many of these adverse consequences. This report promotes a proactive, consistent, and explicit process for the early identification of children with hearing loss in the medical home. An algorithm of the recommended approach has been developed to assist in the detection and documentation of, and intervention for, hearing loss. (9/09)

HELPING CHILDREN AND FAMILIES DEAL WITH DIVORCE AND SEPARATION (CLINICAL REPORT)

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. More than 1 million children each year experience their parents' divorce. For these children and their parents, this process can be emotionally traumatic from the beginning of parental disagreement and rancor, through the divorce, and often for many years thereafter. Pediatricians are encouraged to be aware of behavioral changes in their patients that might be signals of family dysfunction so they can help parents and children understand and deal more positively with the issue. Age-appropriate explanation and counseling is important so children realize that they are not the cause of, and cannot be the cure for, the divorce. Pediatricians can offer families guidance in dealing with their children through the troubled time as well as appropriate lists of reading material and, if indicated, can refer them to professionals with expertise in the emotional, social, and legal aspects of divorce and its aftermath. (11/02, reaffirmed 1/06)

HIGH-DEDUCTIBLE HEALTH PLANS AND THE NEW RISKS OF CONSUMER-DRIVEN HEALTH INSURANCE PRODUCTS

Committee on Child Health Financing

ABSTRACT. Consumer-driven health care is the most noteworthy development in health insurance since the widespread adoption of health maintenance organizations and preferred provider organizations in the 1980s. The most common consumer-driven health plan is the high-deductible health plan, which is essentially a catastrophic health insurance plan, often linked with tax-advantaged spending accounts, with very high deductibles, fewer benefits, and higher cost-sharing than conventional health maintenance organization or preferred provider organization plans. The financial risks are significant under high-deductible health plans, especially for low- to moderate-income families and for families whose children have special health care needs. Of concern for pediatricians are the potential quality risks that are predictable in high-deductible health plans, in which families are likely to delay or avoid seeking care, especially preventive care (if it is not exempted from the deductible), when they are faced with paying for care before the deductible is met. This policy statement provides background information on the most common consumer-driven health plan model, discusses the implications for pediatricians and families, and offers recommendations pertaining to health plan product design, education, practice administration, and research. (3/07)

HIV TESTING AND PROPHYLAXIS TO PREVENT MOTHER-TO-CHILD TRANSMISSION IN THE UNITED STATES

Committee on Pediatric AIDS

ABSTRACT. Universal HIV testing of pregnant women in the United States is the key to prevention of mother-to-child transmission of HIV. Repeat testing in the third trimester and rapid HIV testing at labor and delivery are additional strategies to further reduce the rate of perinatal HIV transmission. Prevention of mother-to-child transmission of HIV is most effective when antiretroviral drugs are received by the mother during her pregnancy and continued through delivery and then administered to the infant after birth. Antiretroviral drugs are effective in reducing the risk of mother-to-child transmission of HIV even when prophylaxis is started for the infant soon after birth. New rapid testing methods allow identification of HIV-infected women or HIV-exposed infants in 20 to 60 minutes. The American Academy of Pediatrics recommends documented, routine HIV testing for all pregnant women in the United States after notifying the patient that testing will be performed, unless the patient declines HIV testing ("opt-out" consent or "right of refusal"). For women in labor with undocumented HIV-infection status during the current pregnancy, immediate maternal HIV testing with opt-out consent, using a rapid HIV antibody test, is recommended. Positive HIV antibody screening test results should be confirmed with immunofluorescent antibody or Western blot assay. For women with a positive rapid HIV antibody test result, antiretroviral prophylaxis should be administered promptly to the mother and newborn infant on the basis of the positive result of the rapid antibody test without waiting for results of confirmatory HIV testing. If the confirmatory test result is negative, then prophylaxis should be discontinued. For a newborn infant whose mother's HIV serostatus is unknown, the health care professional should perform rapid HIV antibody testing on the mother or on the newborn infant, with results reported to the health care professional no later than 12 hours after the infant's birth. If the rapid HIV antibody test result is positive, antiretroviral prophylaxis should be instituted as soon as possible after birth but certainly by 12 hours after delivery, pending completion of confirmatory HIV testing. The mother should be counseled not to breastfeed the infant. Assistance with immediate initiation of hand and pump expression to stimulate milk production should be offered to the mother, given the possibility that the confirmatory test result may be negative. If the confirmatory test result is negative, then prophylaxis should be stopped and breastfeeding may be initiated. If the confirmatory

test result is positive, infants should receive antiretroviral prophylaxis for 6 weeks after birth, and the mother should not breastfeed the infant. (11/08, reaffirmed 6/11)

HOME CARE OF CHILDREN AND YOUTH WITH COMPLEX HEALTH CARE NEEDS AND TECHNOLOGY DEPENDENCIES (CLINICAL REPORT)

Ellen Roy Elias, MD; Nancy A. Murphy, MD; and Council on Children With Disabilities

ABSTRACT. Children and youth with complex medical issues, especially those with technology dependencies, experience frequent and often lengthy hospitalizations. Hospital discharges for these children can be a complicated process that requires a deliberate, multistep approach. In addition to successful discharges to home, it is essential that pediatric providers develop and implement an interdisciplinary and coordinated plan of care that addresses the child's ongoing health care needs. The goal is to ensure that each child remains healthy, thrives, and obtains optimal medical home and developmental supports that promote ongoing care at home and minimize recurrent hospitalizations. This clinical report presents an approach to discharging the child with complex medical needs with technology dependencies from hospital to home and then continually addressing the needs of the child and family in the home environment. (4/12)

HOME, HOSPITAL, AND OTHER NON–SCHOOL-BASED INSTRUCTION FOR CHILDREN AND ADOLESCENTS WHO ARE MEDICALLY UNABLE TO ATTEND SCHOOL

Committee on School Health

ABSTRACT. The American Academy of Pediatrics recommends that school-aged children and adolescents obtain their education in school in the least restrictive setting, that is, the setting most conducive to learning for the particular student. However, at times, acute illness or injury and chronic medical conditions preclude school attendance. This statement is meant to assist evaluation and planning for children to receive non–school-based instruction and to return to school at the earliest possible date. (11/00, reaffirmed 6/03, 5/06)

HONORING DO-NOT-ATTEMPT-RESUSCITATION REQUESTS IN SCHOOLS

Council on School Health and Committee on Bioethics

ABSTRACT. Increasingly, children and adolescents with complex chronic conditions are living in the community. Federal legislation and regulations facilitate their participation in school. Some of these children and adolescents and their families may wish to forego life-sustaining medical treatment, including cardiopulmonary resuscitation, because they would be ineffective or because the risks outweigh the benefits. Honoring these requests in the school environment is complex because of the limited availability of school nurses and the frequent lack of supporting state legislation and regulations. Understanding and collaboration on the part of all parties is essential. Pediatricians have an important role in helping school nurses incorporate a specific action plan into the student's individualized health care plan. The action plan should include both communication and comfort-care plans. Pediatricians who work directly with schools can also help implement policies, and professional organizations can advocate for regulations and legislation that enable students and their families to effectuate their preferences. (4/10, reaffirmed 7/13)

HOSPITAL DISCHARGE OF THE HIGH-RISK NEONATE

Committee on Fetus and Newborn

ABSTRACT. This policy statement updates the guidelines on discharge of the high-risk neonate first published by the American Academy of Pediatrics in 1998. As with the earlier document, this statement is based, insofar as possible, on published, scientifically derived information. This updated statement incorporates new knowledge about risks and medical care of the high-risk neonate, the timing of discharge, and planning for care after discharge. It also refers to other American Academy of Pediatrics publications that are relevant to these issues. This statement draws on the previous classification of high-risk infants into 4 categories: (1) the preterm infant; (2) the infant with special health care needs or dependence on technology; (3) the infant at risk because of family issues; and (4) the infant with anticipated early death. The issues of deciding when discharge is appropriate, defining the specific needs for follow-up care, and the process of detailed discharge planning are addressed as they apply in general to all 4 categories; in addition, special attention is directed to the particular issues presented by the 4 individual categories. Recommendations are given to aid in deciding when discharge is appropriate and to ensure that all necessary care will be available and well coordinated after discharge. The need for individualized planning and physician judgment is emphasized. (11/08, reaffirmed 5/11)

THE HOSPITAL RECORD OF THE INJURED CHILD AND THE NEED FOR EXTERNAL CAUSE-OF-INJURY CODES

Committee on Injury and Poison Prevention

ABSTRACT. Proper record-keeping of emergency department visits and hospitalizations of injured children is vital for appropriate patient management. Determination and documentation of the circumstances surrounding the injury event are essential. This information not only is the basis for preventive counseling, but also provides clues about how similar injuries in other youth can be avoided. The hospital records have an important secondary purpose; namely, if sufficient information about the cause and mechanism of injury is documented, it can be subsequently coded, electronically compiled, and retrieved later to provide an epidemiologic profile of the injury, the first step in prevention at the population level. To be of greatest use, hospital records should indicate the "who, what, when, where, why, and how" of the injury occurrence and whether protective equipment (eg, a seat belt) was used. The pediatrician has two important roles in this area: to document fully the injury event and to advocate the use of standardized external cause-of-injury codes, which allow such data to be compiled and analyzed. (2/99, reaffirmed 5/02, 5/05, 10/08)

HOSPITAL STAY FOR HEALTHY TERM NEWBORNS

Committee on Fetus and Newborn

ABSTRACT. The hospital stay of the mother and her healthy term newborn infant should be long enough to allow identification of early problems and to ensure that

the family is able and prepared to care for the infant at home. The length of stay should also accommodate the unique characteristics of each mother-infant dyad, including the health of the mother, the health and stability of the infant, the ability and confidence of the mother to care for her infant, the adequacy of support systems at home, and access to appropriate follow-up care. Input from the mother and her obstetrician should be considered before a decision to discharge a newborn is made, and all efforts should be made to keep mothers and infants together to promote simultaneous discharge. (1/10)

HPV VACCINE RECOMMENDATIONS
Committee on Infectious Diseases
ABSTRACT. On October 25, 2011, the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention recommended that the quadrivalent human papillomavirus vaccine (Gardasil; Merck & Co, Inc, Whitehouse Station, NJ) be used routinely in males. The American Academy of Pediatrics has reviewed updated data provided by the Advisory Committee on Immunization Practices on vaccine efficacy, safety, and cost-effectiveness as well as programmatic considerations and supports this recommendation. This revised statement updates recommendations for human papillomavirus immunization of both males and females. (2/12)

HUMAN EMBRYONIC STEM CELL (HESC) AND HUMAN EMBRYO RESEARCH
Committee on Pediatric Research and Committee on Bioethics
ABSTRACT. Human embryonic stem cell research has emerged as an important platform for the understanding and treatment of pediatric diseases. From its inception, however, it has raised ethical concerns based not on the use of stem cells themselves but on objections to the source of the cells—specifically, the destruction of preimplantation human embryos. Despite differences in public opinion on this issue, a large majority of the public supports continued research using embryonic stem cells. Given the possible substantial benefit of stem cell research on child health and development, the American Academy of Pediatrics believes that funding and oversight for human embryo and embryonic stem cell research should continue. (10/12)

HUMAN IMMUNODEFICIENCY VIRUS AND OTHER BLOOD-BORNE VIRAL PATHOGENS IN THE ATHLETIC SETTING
Committee on Sports Medicine and Fitness
ABSTRACT. Because athletes and the staff of athletic programs can be exposed to blood during athletic activity, they have a very small risk of becoming infected with human immunodeficiency virus, hepatitis B virus, or hepatitis C virus. This statement, which updates a previous position statement of the American Academy of Pediatrics, discusses sports participation for athletes infected with these pathogens and the precautions needed to reduce the risk of infection to others in the athletic setting. Each of the recommendations in this statement is dependent upon and intended to be considered with reference to the other recommendations in this statement and not in isolation. (12/99, reaffirmed 1/05, 1/09, 11/11)

HUMAN IMMUNODEFICIENCY VIRUS SCREENING
Committee on Fetus and Newborn and Committee on Pediatric AIDS (joint with American College of Obstetricians and Gynecologists) (7/99, reaffirmed 6/02, 5/05, 10/08, 5/12)

HUMAN MILK, BREASTFEEDING, AND TRANSMISSION OF HUMAN IMMUNODEFICIENCY VIRUS IN THE UNITED STATES
Committee on Pediatric AIDS (*11/95, reaffirmed 11/99, 11/03, 2/08)*

HUMAN MILK, BREASTFEEDING, AND TRANSMISSION OF HUMAN IMMUNODEFICIENCY VIRUS TYPE 1 IN THE UNITED STATES (TECHNICAL REPORT)
Committee on Pediatric AIDS
ABSTRACT. Transmission of human immunodeficiency virus type 1 (HIV-1) through breastfeeding has been conclusively demonstrated. The risk of such transmission has been quantified, the timing has been clarified, and certain risk factors for breastfeeding transmission have been identified. In areas where infant formula is accessible, affordable, safe, and sustainable, avoidance of breastfeeding has represented one of the main components of mother-to-child HIV-1 transmission prevention efforts for many years. In areas where affordable and safe alternatives to breastfeeding may not be available, interventions to prevent breastfeeding transmission are being investigated. Complete avoidance of breastfeeding by HIV-1-infected women has been recommended by the American Academy of Pediatrics and the Centers for Disease Control and Prevention and remains the only means by which prevention of breastfeeding transmission of HIV-1 can be absolutely ensured. This technical report summarizes the information available regarding breastfeeding transmission of HIV-1. (11/03, reaffirmed 1/07)

IDENTIFICATION AND CARE OF HIV-EXPOSED AND HIV-INFECTED INFANTS, CHILDREN, AND ADOLESCENTS IN FOSTER CARE
Committee on Pediatric AIDS
ABSTRACT. As a consequence of the expanding human immunodeficiency virus (HIV) epidemic and major advances in medical management of HIV-exposed and HIV-infected persons, revised recommendations are provided for HIV testing of infants, children, and adolescents in foster care. Updated recommendations also are provided for the care of HIV-exposed and HIV-infected persons who are in foster care. (7/00, reaffirmed 3/03, 2/08, 6/11)

IDENTIFICATION AND EVALUATION OF CHILDREN WITH AUTISM SPECTRUM DISORDERS (CLINICAL REPORT)
Chris Plauché Johnson, MD, MEd; Scott M. Myers, MD; and Council on Children With Disabilities
ABSTRACT. Autism spectrum disorders are not rare; many primary care pediatricians care for several children with autism spectrum disorders. Pediatricians play an important role in early recognition of autism spectrum disorders, because they usually are the first point of contact for parents. Parents are now much more aware of

the early signs of autism spectrum disorders because of frequent coverage in the media; if their child demonstrates any of the published signs, they will most likely raise their concerns to their child's pediatrician. It is important that pediatricians be able to recognize the signs and symptoms of autism spectrum disorders and have a strategy for assessing them systematically. Pediatricians also must be aware of local resources that can assist in making a definitive diagnosis of, and in managing, autism spectrum disorders. The pediatrician must be familiar with developmental, educational, and community resources as well as medical subspecialty clinics. This clinical report is 1 of 2 documents that replace the original American Academy of Pediatrics policy statement and technical report published in 2001. This report addresses background information, including definition, history, epidemiology, diagnostic criteria, early signs, neuropathologic aspects, and etiologic possibilities in autism spectrum disorders. In addition, this report provides an algorithm to help the pediatrician develop a strategy for early identification of children with autism spectrum disorders. The accompanying clinical report addresses the management of children with autism spectrum disorders and follows this report on page 1162 [available at www.pediatrics.org/cgi/content/full/120/5/1162]. Both clinical reports are complemented by the toolkit titled *"Autism: Caring for Children With Autism Spectrum Disorders: A Resource Toolkit for Clinicians,"* which contains screening and surveillance tools, practical forms, tables, and parent handouts to assist the pediatrician in the identification, evaluation, and management of autism spectrum disorders in children. (11/07, reaffirmed 9/10)

IDENTIFICATION AND MANAGEMENT OF EATING DISORDERS IN CHILDREN AND ADOLESCENTS (CLINICAL REPORT)

David S. Rosen, MD, MPH, and Committee on Adolescence

ABSTRACT. The incidence and prevalence of eating disorders in children and adolescents has increased significantly in recent decades, making it essential for pediatricians to consider these disorders in appropriate clinical settings, to evaluate patients suspected of having these disorders, and to manage (or refer) patients in whom eating disorders are diagnosed. This clinical report includes a discussion of diagnostic criteria and outlines the initial evaluation of the patient with disordered eating. Medical complications of eating disorders may affect any organ system, and careful monitoring for these complications is required. The range of treatment options, including pharmacotherapy, is described in this report. Pediatricians are encouraged to advocate for legislation and policies that ensure appropriate services for patients with eating disorders, including medical care, nutritional intervention, mental health treatment, and care coordination. (11/10)

IDENTIFYING INFANTS AND YOUNG CHILDREN WITH DEVELOPMENTAL DISORDERS IN THE MEDICAL HOME: AN ALGORITHM FOR DEVELOPMENTAL SURVEILLANCE AND SCREENING

Council on Children With Disabilities, Section on Developmental and Behavioral Pediatrics, Bright Futures Steering Committee, and Medical Home Initiatives for Children With Special Needs Project Advisory Committee

ABSTRACT. Early identification of developmental disorders is critical to the well-being of children and their families. It is an integral function of the primary care medical home and an appropriate responsibility of all pediatric health care professionals. This statement provides an algorithm as a strategy to support health care professionals in developing a pattern and practice for addressing developmental concerns in children from birth through 3 years of age. The authors recommend that developmental surveillance be incorporated at every well-child preventive care visit. Any concerns raised during surveillance should be promptly addressed with standardized developmental screening tests. In addition, screening tests should be administered regularly at the 9-, 18-, and 30-month visits. (Because the 30-month visit is not yet a part of the preventive care system and is often not reimbursable by third-party payers at this time, developmental screening can be performed at 24 months of age. In addition, because the frequency of regular pediatric visits decreases after 24 months of age, a pediatrician who expects that his or her patients will have difficulty attending a 30-month visit should conduct screening during the 24-month visit.) The early identification of developmental problems should lead to further developmental and medical evaluation, diagnosis, and treatment, including early developmental intervention. Children diagnosed with developmental disorders should be identified as children with special health care needs, and chronic-condition management should be initiated. Identification of a developmental disorder and its underlying etiology may also drive a range of treatment planning, from medical treatment of the child to family planning for his or her parents. (7/06, reaffirmed 12/09)

IMMUNIZATION INFORMATION SYSTEMS

Committee on Practice and Ambulatory Medicine

ABSTRACT. The American Academy of Pediatrics continues to support the development and implementation of immunization information systems, previously referred to as immunization registries, and other systems for the benefit of children, pediatricians, and their communities. Pediatricians and others must be aware of the value that immunization information systems have for society, the potential fiscal influences on their practice, the costs and benefits, and areas for future improvement. (9/06, reaffirmed 10/11)

IMMUNIZING PARENTS AND OTHER CLOSE FAMILY CONTACTS IN THE PEDIATRIC OFFICE SETTING (TECHNICAL REPORT)

Herschel R. Lessin, MD; Kathryn M. Edwards, MD; Committee on Practice and Ambulatory Medicine; and Committee on Infectious Diseases

ABSTRACT. Additional strategies are needed to protect children from vaccine-preventable diseases. In particular, very young infants, as well as children who are immunocompromised, are at especially high risk for developing the serious consequences of vaccine-preventable diseases and cannot be immunized completely. There is some evidence that children who become infected with these diseases are exposed to pathogens through household contacts, particularly from parents or other close family contacts. Such infections likely are attributable to adults who are not fully protected from these diseases, either because their immunity to vaccine-preventable diseases has waned over time or because they have not received a vaccine. There are many challenges that have added to low adult immunization rates in the United States. One option to increase immunization coverage for parents and close family contacts of infants and vulnerable children is to provide alternative locations for these adults to be immunized, such as the pediatric office setting. Ideally, adults should receive immunizations in their medical homes; however, to provide greater protection to these adults and reduce the exposure of children to pathogens, immunizing parents or other adult family contacts in the pediatric office setting could increase immunization coverage for this population to protect themselves as well as children to whom they provide care. (12/11)

IMPACT OF MUSIC, MUSIC LYRICS, AND MUSIC VIDEOS ON CHILDREN AND YOUTH

Council on Communications and Media

ABSTRACT. Music plays an important role in the socialization of children and adolescents. Popular music is present almost everywhere, and it is easily available through the radio, various recordings, the Internet, and new technologies, allowing adolescents to hear it in diverse settings and situations, alone or shared with friends. Parents often are unaware of the lyrics to which their children are listening because of the increasing use of downloaded music and headphones. Research on popular music has explored its effects on schoolwork, social interactions, mood and affect, and particularly behavior. The effect that popular music has on children's and adolescents' behavior and emotions is of paramount concern. Lyrics have become more explicit in their references to drugs, sex, and violence over the years, particularly in certain genres. A teenager's preference for certain types of music could be correlated or associated with certain behaviors. As with popular music, the perception and the effect of music-video messages are important, because research has reported that exposure to violence, sexual messages, sexual stereotypes, and use of substances of abuse in music videos might produce significant changes in behaviors and attitudes of young viewers. Pediatricians and parents should be aware of this information. Furthermore, with the evidence portrayed in these studies, it is essential for pediatricians and parents to take a stand regarding music lyrics. (10/09)

THE IMPACT OF SOCIAL MEDIA ON CHILDREN, ADOLESCENTS, AND FAMILIES (CLINICAL REPORT)

Gwenn Schurgin O'Keeffe, MD; Kathleen Clarke-Pearson, MD; and Council on Communications and Media

ABSTRACT. Using social media Web sites is among the most common activity of today's children and adolescents. Any Web site that allows social interaction is considered a social media site, including social networking sites such as Facebook, MySpace, and Twitter; gaming sites and virtual worlds such as Club Penguin, Second Life, and the Sims; video sites such as YouTube; and blogs. Such sites offer today's youth a portal for entertainment and communication and have grown exponentially in recent years. For this reason, it is important that parents become aware of the nature of social media sites, given that not all of them are healthy environments for children and adolescents. Pediatricians are in a unique position to help families understand these sites and to encourage healthy use and urge parents to monitor for potential problems with cyberbullying, "Facebook depression," sexting, and exposure to inappropriate content. (3/11)

IMPLEMENTATION PRINCIPLES AND STRATEGIES FOR THE STATE CHILDREN'S HEALTH INSURANCE PROGRAM

Committee on Child Health Financing

ABSTRACT. This policy statement presents principles and implementation and evaluation strategies recommended for the State Children's Health Insurance Program (SCHIP). The statement summarizes the current status of SCHIP, the needs of uninsured children, and the potential benefits of SCHIP programs. Principles and recommended strategies include expanding eligibility, maximizing funding, providing comprehensive benefits, including pediatricians in program design and evaluation, providing adequate reimbursement and access to pediatricians, ensuring choices for families and pediatricians, and establishing simple administrative procedures. (5/01)

THE IMPORTANCE OF PLAY IN PROMOTING HEALTHY CHILD DEVELOPMENT AND MAINTAINING STRONG PARENT-CHILD BONDS (CLINICAL REPORT)

Kenneth R. Ginsburg, MD, MSEd; Committee on Communications; and Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. Play is essential to development because it contributes to the cognitive, physical, social, and emotional well-being of children and youth. Play also offers an ideal opportunity for parents to engage fully with their children. Despite the benefits derived from play for both children and parents, time for free play has been markedly reduced for some children. This report addresses a variety of factors that have reduced play, including a hurried lifestyle, changes in family structure, and increased attention to academics and enrichment activities at the expense of recess or free child-centered play. This report offers guidelines on how pediatricians can advocate for children by helping families, school systems, and communities consider how best to ensure that play is protected as they seek the balance in children's lives to create the optimal developmental milieu. (1/07)

THE IMPORTANCE OF PLAY IN PROMOTING HEALTHY CHILD DEVELOPMENT AND MAINTAINING STRONG PARENT-CHILD BOND: FOCUS ON CHILDREN IN POVERTY (CLINICAL REPORT)

Regina M. Milteer, MD; Kenneth R. Ginsburg, MD, MSEd; Council on Communications and Media; and Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. Play is essential to the social, emotional, cognitive, and physical well-being of children beginning in early childhood. It is a natural tool for children to develop resiliency as they learn to cooperate, overcome challenges, and negotiate with others. Play also allows children to be creative. It provides time for parents to be fully engaged with their children, to bond with their children, and to see the world from the perspective of their child. However, children who live in poverty often face socioeconomic obstacles that impede their rights to have playtime, thus affecting their healthy social-emotional development. For children who are underresourced to reach their highest potential, it is essential that parents, educators, and pediatricians recognize the importance of lifelong benefits that children gain from play. (12/11)

IMPROVING SUBSTANCE ABUSE PREVENTION, ASSESSMENT, AND TREATMENT FINANCING FOR CHILDREN AND ADOLESCENTS

Committee on Child Health Financing and Committee on Substance Abuse

ABSTRACT. The numbers of children, adolescents, and families affected by substance abuse have sharply increased since the early 1990s. The American Academy of Pediatrics recognizes the scope and urgency of this problem and has developed this policy statement for consideration by Congress, federal and state agencies, employers, national organizations, health care professionals, health insurers, managed care organizations, advocacy groups, and families. (10/01)

THE INAPPROPRIATE USE OF SCHOOL "READINESS" TESTS

Committee on Early Childhood, Adoption, and Dependent Care and Committee on School Health (3/95, reaffirmed 4/98, 1/04, 4/10)

INCORPORATING RECOGNITION AND MANAGEMENT OF PERINATAL AND POSTPARTUM DEPRESSION INTO PEDIATRIC PRACTICE (CLINICAL REPORT)

Marian F. Earls, MD, and Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. Every year, more than 400 000 infants are born to mothers who are depressed, which makes perinatal depression the most underdiagnosed obstetric complication in America. Postpartum depression leads to increased costs of medical care, inappropriate medical care, child abuse and neglect, discontinuation of breastfeeding, and family dysfunction and adversely affects early brain development. Pediatric practices, as medical homes, can establish a system to implement postpartum depression screening and to identify and use community resources for the treatment and referral of the depressed mother and support for the mother-child (dyad) relationship. This system would have a positive effect on the health and well-being of the infant and family. State chapters of the American Academy of Pediatrics, working with state Early Periodic Screening, Diagnosis, and Treatment (EPSDT) and maternal and child health programs, can increase awareness of the need for perinatal depression screening in the obstetric and pediatric periodicity of care schedules and ensure payment. Pediatricians must advocate for workforce development for professionals who care for very young children and for promotion of evidence-based interventions focused on healthy attachment and parent-child relationships. (10/10)

INCREASING ANTIRETROVIRAL DRUG ACCESS FOR CHILDREN WITH HIV INFECTION

Committee on Pediatric AIDS and Section on International Child Health

ABSTRACT. Although there have been great gains in the prevention of pediatric HIV infection and provision of antiretroviral therapy for children with HIV infection in resource-rich countries, many barriers remain to scaling up HIV prevention and treatment for children in resource-limited areas of the world. Appropriate testing technologies need to be made more widely available to identify HIV infection in infants. Training of practitioners in the skills required to care for children with HIV infection is required to increase the number of children receiving antiretroviral therapy. Lack of availability of appropriate antiretroviral drug formulations that are easily usable and inexpensive is a major impediment to optimal care for children with HIV. The time and energy spent trying to develop liquid antiretroviral formulations might be better used in the manufacture of smaller pill sizes or crushable tablets, which are easier to dispense, transport, store, and administer to children. (4/07, reaffirmed 4/10)

INCREASING IMMUNIZATION COVERAGE

Committee on Practice and Ambulatory Medicine and Council on Community Pediatrics

ABSTRACT. In 1977, the American Academy of Pediatrics issued a statement calling for universal immunization of all children for whom vaccines are not contraindicated. In 1995, the policy statement "Implementation of the Immunization Policy" was published by the American Academy of Pediatrics, followed in 2003 with publication of the first version of this statement, "Increasing Immunization Coverage." Since 2003, there have continued to be improvements in immunization coverage, with progress toward meeting the goals set forth in *Healthy People 2010.* Data from the 2007 National Immunization Survey showed that 90% of children 19 to 35 months of age have received recommended doses of each of the following vaccines: inactivated poliovirus (IPV), measles-mumps-rubella (MMR), varicella-zoster virus (VZB), hepatitis B virus (HBV), and *Haemophilus influenzae* type b (Hib). For diphtheria and tetanus and acellular pertussis (DTaP) vaccine, 84.5% have received the recommended 4 doses by 35 months of age. Nevertheless, the *Healthy People 2010* goal of at least 80% coverage for the full series (at least 4 doses of DTaP, 3 doses of IPV, 1 dose of MMR, 3 doses of Hib, 3 doses of HBV, and 1 dose of varicella-zoster virus vaccine) has not yet been met, and immunization coverage of adolescents continues to lag behind the goals set forth in *Healthy People 2010.* Despite these

encouraging data, a vast number of new challenges that threaten continued success toward the goal of universal immunization coverage have emerged. These challenges include an increase in new vaccines and new vaccine combinations as well as a significant number of vaccines currently under development; a dramatic increase in the acquisition cost of vaccines, coupled with a lack of adequate payment to practitioners to buy and administer vaccines; unanticipated manufacturing and delivery problems that have caused significant shortages of various vaccine products; and the rise of a public antivaccination movement that uses the Internet as well as standard media outlets to advance a position, wholly unsupported by any scientific evidence, linking vaccines with various childhood conditions, particularly autism. Much remains to be accomplished by physician organizations; vaccine manufacturers; third-party payers; the media; and local, state, and federal governments to ensure dependable vaccine supply and payments that are sufficient to continue to provide immunizations in public and private settings and to promote effective strategies to combat unjustified misstatements by the antivaccination movement.

Pediatricians should work individually and collectively at the local, state, and national levels to ensure that all children without a valid contraindication receive all childhood immunizations on time. Pediatricians and pediatric organizations, in conjunction with government agencies such as the Centers for Disease Control and Prevention, must communicate effectively with parents to maximize their understanding of the overall safety and efficacy of vaccines. Most parents and children have not experienced many of the vaccine-preventable diseases, and the general public is not well informed about the risks and sequelae of these conditions. A number of recommendations are included for pediatricians, individually and collectively, to support further progress toward the goal of universal immunization coverage of all children for whom vaccines are not contraindicated. (5/10)

INDICATIONS FOR MANAGEMENT AND REFERRAL OF PATIENTS INVOLVED IN SUBSTANCE ABUSE

Committee on Substance Abuse

ABSTRACT. This statement addresses the challenge of evaluating and managing the various stages of substance use by children and adolescents in the context of pediatric practice. Approaches are suggested that would assist the pediatrician in differentiating highly prevalent experimental and occasional use from more severe use with adverse consequences that affect emotional, behavioral, educational, or physical health. Comorbid psychiatric conditions are common and should be evaluated and treated simultaneously by child and adolescent mental health specialists. Guidelines for referral based on severity of involvement using established patient treatment-matching criteria are outlined. Pediatricians need to become familiar with treatment professionals and facilities in their communities and to ensure that treatment for adolescent patients is appropriate based on their developmental, psychosocial, medical, and mental health needs. The family should be encouraged to participate actively in the treatment process. (7/00)

INFANT FEEDING AND TRANSMISSION OF HUMAN IMMUNODEFICIENCY VIRUS IN THE UNITED STATES

Committee on Pediatric AIDS

ABSTRACT. Physicians caring for infants born to women infected with HIV are likely to be involved in providing guidance to HIV-infected mothers on appropriate infant feeding practices. It is critical that physicians are aware of the HIV transmission risk from human milk and the current recommendations for feeding HIV-exposed infants in the United States. Because the only intervention to completely prevent HIV transmission via human milk is not to breastfeed, in the United States, where clean water and affordable replacement feeding are available, the American Academy of Pediatrics recommends that HIV-infected mothers not breastfeed their infants, regardless of maternal viral load and antiretroviral therapy. (1/13)

See full text on page 713.

INFANT METHEMOGLOBINEMIA: THE ROLE OF DIETARY NITRATE IN FOOD AND WATER (CLINICAL REPORT)

Frank R. Greer, MD; Michael Shannon, MD; Committee on Nutrition; and Committee on Environmental Health

ABSTRACT. Infants for whom formula may be prepared with well water remain a high-risk group for nitrate poisoning. This clinical report reinforces the need for testing of well water for nitrate content. There seems to be little or no risk of nitrate poisoning from commercially prepared infant foods in the United States. However, reports of nitrate poisoning from home-prepared vegetable foods for infants continue to occur. Breastfeeding infants are not at risk of methemoglobinemia even when mothers ingest water with very high concentrations of nitrate nitrogen (100 ppm). (9/05, reaffirmed 4/09)

INFECTION PREVENTION AND CONTROL IN PEDIATRIC AMBULATORY SETTINGS

Committee on Infectious Diseases

ABSTRACT. Since the American Academy of Pediatrics published a statement titled "Infection Control in Physicians' Offices" (*Pediatrics.* 2000;105[6]:1361–1369), there have been significant changes that prompted this updated statement. Infection prevention and control is an integral part of pediatric practice in ambulatory medical settings as well as in hospitals. Infection prevention and control practices should begin at the time the ambulatory visit is scheduled. All health care personnel should be educated regarding the routes of transmission and techniques used to prevent transmission of infectious agents. Policies for infection prevention and control should be written, readily available, updated annually, and enforced. The standard precautions for hospitalized patients from the Centers for Disease Control and Prevention, with a modification from the American Academy of Pediatrics exempting the use of gloves for routine diaper changes and wiping a well child's nose or tears, are appropriate for most patient encounters. As employers, pediatricians are required by the Occupational Safety and Health Administration to take precautions to identify and protect employees who are likely to be exposed to blood or other potentially infectious materials while on the job. Key principles of standard precautions include hand hygiene

(ie, use of alcohol-based hand rub or hand-washing with soap [plain or antimicrobial] and water) before and after every patient contact; implementation of respiratory hygiene and cough-etiquette strategies for patients with suspected influenza or infection with another respiratory tract pathogen to the extent feasible; separation of infected, contagious children from uninfected children when feasible; safe handling and disposal of needles and other sharp medical devices and evaluation and implementation of needle-safety devices; appropriate use of personal protective equipment such as gloves, gowns, masks, and eye protection; and appropriate sterilization, disinfection, and antisepsis. (9/07, reaffirmed 8/10)

INFORMED CONSENT, PARENTAL PERMISSION, AND ASSENT IN PEDIATRIC PRACTICE
Committee on Bioethics (2/95, reaffirmed 11/98, 11/02, 10/06, 5/11)

INHALANT ABUSE (CLINICAL REPORT)
Janet F. Williams, MD; Michael Storck, MD; Committee on Substance Abuse; and Committee on Native American Child Health
ABSTRACT. Inhalant abuse is the intentional inhalation of a volatile substance for the purpose of achieving an altered mental state. As an important, yet-underrecognized form of substance abuse, inhalant abuse crosses all demographic, ethnic, and socioeconomic boundaries, causing significant morbidity and mortality in school-aged and older children. This clinical report reviews key aspects of inhalant abuse, emphasizes the need for greater awareness, and offers advice regarding the pediatrician's role in the prevention and management of this substance abuse problem. (5/07)

INJURIES ASSOCIATED WITH INFANT WALKERS
Committee on Injury and Poison Prevention
ABSTRACT. In 1999, an estimated 8800 children younger than 15 months were treated in hospital emergency departments in the United States for injuries associated with infant walkers. Thirty-four infant walker-related deaths were reported from 1973 through 1998. The vast majority of injuries occur from falls down stairs, and head injuries are common. Walkers do not help a child learn to walk; indeed, they can delay normal motor and mental development. The use of warning labels, public education, adult supervision during walker use, and stair gates have all been demonstrated to be insufficient strategies to prevent injuries associated with infant walkers. To comply with the revised voluntary standard (ASTM F977-96), walkers manufactured after June 30, 1997, must be wider than a 36-in doorway or must have a braking mechanism designed to stop the walker if 1 or more wheels drop off the riding surface, such as at the top of a stairway. Because data indicate a considerable risk of major and minor injury and even death from the use of infant walkers, and because there is no clear benefit from their use, the American Academy of Pediatrics recommends a ban on the manufacture and sale of mobile infant walkers. If a parent insists on using a mobile infant walker, it is vital that they choose a walker that meets the performance standards of ASTM F977-96 to prevent falls down stairs. Stationary activity centers should be promoted as a safer alternative to mobile infant walkers. (9/01, reaffirmed 1/05, 2/08, 10/11)

INJURIES IN YOUTH SOCCER (CLINICAL REPORT)
Chris G. Koutures, MD; Andrew J. M. Gregory, MD; and Council on Sports Medicine and Fitness
ABSTRACT. Injury rates in youth soccer, known as football outside the United States, are higher than in many other contact/collision sports and have greater relative numbers in younger, preadolescent players. With regard to musculoskeletal injuries, young females tend to suffer more knee injuries, and young males suffer more ankle injuries. Concussions are fairly prevalent in soccer as a result of contact/collision rather than purposeful attempts at heading the ball. Appropriate rule enforcement and emphasis on safe play can reduce the risk of soccer-related injuries. This report serves as a basis for encouraging safe participation in soccer for children and adolescents. (1/10, reaffirmed 5/13)

INJURY RISK OF NONPOWDER GUNS (TECHNICAL REPORT)
Committee on Injury, Violence, and Poison Prevention
ABSTRACT. Nonpowder guns (ball-bearing [BB] guns, pellet guns, air rifles, paintball guns) continue to cause serious injuries to children and adolescents. The muzzle velocity of these guns can range from approximately 150 ft/second to 1200 ft/second (the muzzle velocities of traditional firearm pistols are 750 ft/second to 1450 ft/second). Both low- and high-velocity nonpowder guns are associated with serious injuries, and fatalities can result from high-velocity guns. A persisting problem is the lack of medical recognition of the severity of injuries that can result from these guns, including penetration of the eye, skin, internal organs, and bone. Nationally, in 2000, there were an estimated 21840 (coefficient of variation: 0.0821) injuries related to nonpowder guns, with approximately 4% resulting in hospitalization. Between 1990 and 2000, the US Consumer Product Safety Commission reported 39 nonpowder gun–related deaths, of which 32 were children younger than 15 years. The introduction of high-powered air rifles in the 1970s has been associated with approximately 4 deaths per year. The advent of war games and the use of paintball guns have resulted in a number of reports of injuries, especially to the eye. Injuries associated with nonpowder guns should receive prompt medical management similar to the management of firearm-related injuries, and nonpowder guns should never be characterized as toys. (11/04, reaffirmed 2/08, 10/11)

IN-LINE SKATING INJURIES IN CHILDREN AND ADOLESCENTS
Committee on Injury and Poison Prevention and Committee on Sports Medicine and Fitness
ABSTRACT. In-line skating has become one of the fastest-growing recreational sports in the United States. Recent studies emphasize the value of protective gear in reducing the incidence of injuries. Recommendations are provided for parents and pediatricians, with special emphasis on the novice or inexperienced skater. (4/98, reaffirmed 1/02, 1/06, 1/09, 11/11)

INSTITUTIONAL ETHICS COMMITTEES
Committee on Bioethics
ABSTRACT. In hospitals throughout the United States, institutional ethics committees (IECs) have become a standard vehicle for the education of health professionals about biomedical ethics, for the drafting and review of hospital policy, and for clinical ethics case consultation. In addition, there is increasing interest in a role for the IEC in organizational ethics. Recommendations are made about the membership and structure of an IEC, and guidelines are provided for those serving on an ethics committee. (1/01, reaffirmed 1/04, 1/09, 10/12)

INSTRUMENT-BASED PEDIATRIC VISION SCREENING POLICY STATEMENT
Section on Ophthalmology and Committee on Practice and Ambulatory Medicine (joint with American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists)
ABSTRACT. A policy statement describing the use of automated vision screening technology (instrument-based vision screening) is presented. Screening for amblyogenic refractive error with instrument-based screening is not dependent on behavioral responses of children, as when visual acuity is measured. Instrument-based screening is quick, requires minimal cooperation of the child, and is especially useful in the preverbal, preliterate, or developmentally delayed child. Children younger than 4 years can benefit from instrument-based screening, and visual acuity testing can be used reliably in older children. Adoption of this new technology is highly dependent on third-party payment policies, which could present a significant barrier to adoption. (10/12)

INSURANCE COVERAGE OF MENTAL HEALTH AND SUBSTANCE ABUSE SERVICES FOR CHILDREN AND ADOLESCENTS: A CONSENSUS STATEMENT
Joint Statement (10/00)

INTENSIVE TRAINING AND SPORTS SPECIALIZATION IN YOUNG ATHLETES
Committee on Sports Medicine and Fitness
ABSTRACT. Children involved in sports should be encouraged to participate in a variety of different activities and develop a wide range of skills. Young athletes who specialize in just one sport may be denied the benefits of varied activity while facing additional physical, physiologic, and psychologic demands from intense training and competition.

This statement reviews the potential risks of high-intensity training and sports specialization in young athletes. Pediatricians who recognize these risks can have a key role in monitoring the health of these young athletes and helping reduce risks associated with high-level sports participation. (7/00, reaffirmed 11/04, 1/06, 5/09)

INTIMATE PARTNER VIOLENCE: THE ROLE OF THE PEDIATRICIAN (CLINICAL REPORT)
Jonathan D. Thackeray, MD; Roberta Hibbard, MD; M. Denise Dowd, MD, MPH; Committee on Child Abuse and Neglect; and Committee on Injury, Violence, and Poison Prevention
ABSTRACT. The American Academy of Pediatrics and its members recognize the importance of improving the physician's ability to recognize intimate partner violence (IPV) and understand its effects on child health and development and its role in the continuum of family violence. Pediatricians are in a unique position to identify abused caregivers in pediatric settings and to evaluate and treat children raised in homes in which IPV may occur. Children exposed to IPV are at increased risk of being abused and neglected and are more likely to develop adverse health, behavioral, psychological, and social disorders later in life. Identifying IPV, therefore, may be one of the most effective means of preventing child abuse and identifying caregivers and children who may be in need of treatment and/or therapy. Pediatricians should be aware of the profound effects of exposure to IPV on children. (4/10)

KNEE BRACE USE IN THE YOUNG ATHLETE (TECHNICAL REPORT)
Committee on Sports Medicine and Fitness
ABSTRACT. This statement is a revision of a previous statement on prophylactic knee bracing and provides information for pediatricians regarding the use of various types of knee braces, indications for the use of knee braces, and the background knowledge necessary to prescribe the use of knee braces for children. (8/01, reaffirmed 1/07, 4/10, 5/13)

LACTOSE INTOLERANCE IN INFANTS, CHILDREN, AND ADOLESCENTS (CLINICAL REPORT)
Melvin B. Heyman, MD, MPH, for Committee on Nutrition
ABSTRACT. The American Academy of Pediatrics Committee on Nutrition presents an updated review of lactose intolerance in infants, children, and adolescents. Differences between primary, secondary, congenital, and developmental lactase deficiency that may result in lactose intolerance are discussed. Children with suspected lactose intolerance can be assessed clinically by dietary lactose elimination or by tests including noninvasive hydrogen breath testing or invasive intestinal biopsy determination of lactase (and other disaccharidase) concentrations. Treatment consists of use of lactase-treated dairy products or oral lactase supplementation, limitation of lactose-containing foods, or dairy elimination. The American Academy of Pediatrics supports use of dairy foods as an important source of calcium for bone mineral health and of other nutrients that facilitate growth in children and adolescents. If dairy products are eliminated, other dietary sources of calcium or calcium supplements need to be provided. (9/06, reaffirmed 8/12)

"LATE-PRETERM" INFANTS: A POPULATION AT RISK (CLINICAL REPORT)

William A. Engle, MD; Kay M. Tomashek, MD; Carol Wallman, MSN; and Committee on Fetus and Newborn

ABSTRACT. Late-preterm infants, defined by birth at 34$^{6}/_{7}$ through 36$^{6}/_{7}$ weeks' gestation, are less physiologically and metabolically mature than term infants. Thus, they are at higher risk of morbidity and mortality than term infants. The purpose of this report is to define "late preterm," recommend a change in terminology from "near term" to "late preterm," present the characteristics of late-preterm infants that predispose them to a higher risk of morbidity and mortality than term infants, and propose guidelines for the evaluation and management of these infants after birth. (12/07, reaffirmed 5/10)

LAWN MOWER-RELATED INJURIES TO CHILDREN

Committee on Injury and Poison Prevention

ABSTRACT. Lawn mower-related injuries to children are relatively common and can result in severe injury or death. Many amputations during childhood are caused by power mowers. Pediatricians have an important role as advocates and educators to promote the prevention of these injuries. (6/01, reaffirmed 10/04, 5/07, 6/10)

LAWN MOWER-RELATED INJURIES TO CHILDREN (TECHNICAL REPORT)

Committee on Injury and Poison Prevention

ABSTRACT. In the United States, approximately 9400 children younger than 18 years receive emergency treatment annually for lawn mower-related injuries. More than 7% of these children require hospitalization, and power mowers cause a large proportion of the amputations during childhood. Prevention of lawn mower-related injuries can be achieved by design changes of lawn mowers, guidelines for mower operation, and education of parents, child caregivers, and children. Pediatricians have an important role as advocates and educators to promote the prevention of these injuries. (6/01, reaffirmed 10/04, 5/07, 6/10)

LEARNING DISABILITIES, DYSLEXIA, AND VISION

Section on Ophthalmology and Council on Children With Disabilities (joint with American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists)

ABSTRACT. Learning disabilities, including reading disabilities, are commonly diagnosed in children. Their etiologies are multifactorial, reflecting genetic influences and dysfunction of brain systems. Learning disabilities are complex problems that require complex solutions. Early recognition and referral to qualified educational professionals for evidence-based evaluations and treatments seem necessary to achieve the best possible outcome. Most experts believe that dyslexia is a language-based disorder. Vision problems can interfere with the process of learning; however, vision problems are not the cause of primary dyslexia or learning disabilities. Scientific evidence does not support the efficacy of eye exercises, behavioral vision therapy, or special tinted filters or lenses for improving the long-term educational performance in these complex pediatric neurocognitive conditions. Diagnostic and treatment approaches that lack scientific evidence of efficacy, including eye exercises, behavioral vision therapy, or special tinted filters or lenses, are not endorsed and should not be recommended. (7/09)

LEARNING DISABILITIES, DYSLEXIA, AND VISION (TECHNICAL REPORT)

Sheryl M. Handler, MD; Walter M. Fierson, MD; and Section on Ophthalmology and Council on Children With Disabilities (joint with American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists)

ABSTRACT. Learning disabilities constitute a diverse group of disorders in which children who generally possess at least average intelligence have problems processing information or generating output. Their etiologies are multifactorial and reflect genetic influences and dysfunction of brain systems. Reading disability, or dyslexia, is the most common learning disability. It is a receptive language-based learning disability that is characterized by difficulties with decoding, fluent word recognition, rapid automatic naming, and/or reading-comprehension skills. These difficulties typically result from a deficit in the phonologic component of language that makes it difficult to use the alphabetic code to decode the written word. Early recognition and referral to qualified professionals for evidence-based evaluations and treatments are necessary to achieve the best possible outcome. Because dyslexia is a language-based disorder, treatment should be directed at this etiology. Remedial programs should include specific instruction in decoding, fluency training, vocabulary, and comprehension. Most programs include daily intensive individualized instruction that explicitly teaches phonemic awareness and the application of phonics. Vision problems can interfere with the process of reading, but children with dyslexia or related learning disabilities have the same visual function and ocular health as children without such conditions. Currently, there is inadequate scientific evidence to support the view that subtle eye or visual problems cause or increase the severity of learning disabilities. Because they are difficult for the public to understand and for educators to treat, learning disabilities have spawned a wide variety of scientifically unsupported vision-based diagnostic and treatment procedures. Scientific evidence does not support the claims that visual training, muscle exercises, ocular pursuit-and-tracking exercises, behavioral/perceptual vision therapy, "training" glasses, prisms, and colored lenses and filters are effective direct or indirect treatments for learning disabilities. There is no valid evidence that children who participate in vision therapy are more responsive to educational instruction than children who do not participate. (3/11)

LEGALIZATION OF MARIJUANA: POTENTIAL IMPACT ON YOUTH

Committee on Substance Abuse and Committee on Adolescence

ABSTRACT. As experts in the health care of children and adolescents, pediatricians may be called on to advise legislators concerning the potential impact of changes in the legal status of marijuana on adolescents. Parents, too, may look to pediatricians for advice as they consider whether

to support state-level initiatives that propose to legalize the use of marijuana for medical purposes or to decriminalize possession of small amounts of marijuana. This policy statement provides the position of the American Academy of Pediatrics on the issue of marijuana legalization, and the accompanying technical report (available online) reviews what is currently known about the relationship between adolescents' use of marijuana and its legal status to better understand how change might influence the degree of marijuana use by adolescents in the future. (6/04)

LEGALIZATION OF MARIJUANA: POTENTIAL IMPACT ON YOUTH (TECHNICAL REPORT)

Committee on Substance Abuse and Committee on Adolescence

ABSTRACT. This technical report provides historical perspectives and comparisons of various approaches to the legal status of marijuana to aid in forming public policy. Information on the impact that decriminalization and legalization of marijuana could have on adolescents, in addition to concerns surrounding medicinal use of marijuana, are also addressed in this report. Recommendations are included in the accompanying policy statement. (6/04)

LEVELS OF NEONATAL CARE

Committee on Fetus and Newborn

ABSTRACT. Provision of risk-appropriate care for newborn infants and mothers was first proposed in 1976. This updated policy statement provides a review of data supporting evidence for a tiered provision of care and reaffirms the need for uniform, nationally applicable definitions and consistent standards of service for public health to improve neonatal outcomes. Facilities that provide hospital care for newborn infants should be classified on the basis of functional capabilities, and these facilities should be organized within a regionalized system of perinatal care. (8/12)

THE LIFELONG EFFECTS OF EARLY CHILDHOOD ADVERSITY AND TOXIC STRESS (TECHNICAL REPORT)

Jack P. Shonkoff, MD; Andrew S. Garner, MD, PhD; Committee on Psychosocial Aspects of Child and Family Health; Committee on Early Childhood, Adoption, and Dependent Care; and Section on Developmental and Behavioral Pediatrics

ABSTRACT. Advances in fields of inquiry as diverse as neuroscience, molecular biology, genomics, developmental psychology, epidemiology, sociology, and economics are catalyzing an important paradigm shift in our understanding of health and disease across the lifespan. This converging, multidisciplinary science of human development has profound implications for our ability to enhance the life prospects of children and to strengthen the social and economic fabric of society. Drawing on these multiple streams of investigation, this report presents an ecobiodevelopmental framework that illustrates how early experiences and environmental influences can leave a lasting signature on the genetic predispositions that affect emerging brain architecture and long-term health. The report also examines extensive evidence of the disruptive impacts of toxic stress, offering intriguing insights into causal mechanisms that link early adversity to later impairments in learning, behavior, and both physical and mental well-being. The implications of this framework for the practice of medicine, in general, and pediatrics, specifically, are potentially transformational. They suggest that many adult diseases should be viewed as developmental disorders that begin early in life and that persistent health disparities associated with poverty, discrimination, or maltreatment could be reduced by the alleviation of toxic stress in childhood. An ecobiodevelopmental framework also underscores the need for new thinking about the focus and boundaries of pediatric practice. It calls for pediatricians to serve as both front-line guardians of healthy child development and strategically positioned, community leaders to inform new science-based strategies that build strong foundations for educational achievement, economic productivity, responsible citizenship, and lifelong health. (12/11)

LONG-TERM FOLLOW-UP CARE FOR PEDIATRIC CANCER SURVIVORS (CLINICAL REPORT)

Section on Hematology/Oncology (joint with Children's Oncology Group)

ABSTRACT. Progress in therapy has made survival into adulthood a reality for most children, adolescents, and young adults diagnosed with cancer today. Notably, this growing population remains vulnerable to a variety of long-term therapy-related sequelae. Systematic ongoing follow-up of these patients, therefore, is important for providing for early detection of and intervention for potentially serious late-onset complications. In addition, health counseling and promotion of healthy lifestyles are important aspects of long-term follow-up care to promote risk reduction for health problems that commonly present during adulthood. Both general and subspecialty pediatric health care providers are playing an increasingly important role in the ongoing care of childhood cancer survivors, beyond the routine preventive care, health supervision, and anticipatory guidance provided to all patients. This report is based on the guidelines that have been developed by the Children's Oncology Group to facilitate comprehensive long-term follow-up of childhood cancer survivors (www.survivorshipguidelines.org). (3/09, reaffirmed 4/13)

MALE ADOLESCENT SEXUAL AND REPRODUCTIVE HEALTH CARE (CLINICAL REPORT)

Arik V. Marcell, MD, MPH; Charles Wibbelsman, MD; Warren M. Seigel, MD; and Committee on Adolescence

ABSTRACT. Male adolescents' sexual and reproductive health needs often go unmet in the primary care setting. This report discusses specific issues related to male adolescents' sexual and reproductive health care in the context of primary care, including pubertal and sexual development, sexual behavior, consequences of sexual behavior, and methods of preventing sexually transmitted infections (including HIV) and pregnancy. Pediatricians are encouraged to address male adolescent sexual and reproductive health on a regular basis, including taking a sexual history, performing an appropriate examination, providing patient-centered and age-appropriate anticipatory guidance, and delivering appropriate vaccinations. Pediatricians should provide these services to male ado-

lescent patients in a confidential and culturally appropriate manner, promote healthy sexual relationships and responsibility, and involve parents in age-appropriate discussions about sexual health with their sons. (11/11)

MALE CIRCUMCISION (TECHNICAL REPORT)

Task Force on Circumcision

ABSTRACT. Male circumcision consists of the surgical removal of some, or all, of the foreskin (or prepuce) from the penis. It is one of the most common procedures in the world. In the United States, the procedure is commonly performed during the newborn period. In 2007, the American Academy of Pediatrics (AAP) convened a multidisciplinary workgroup of AAP members and other stakeholders to evaluate the evidence regarding male circumcision and update the AAP's 1999 recommendations in this area. The Task Force included AAP representatives from specialty areas as well as members of the AAP Board of Directors and liaisons representing the American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, and the Centers for Disease Control and Prevention. The Task Force members identified selected topics relevant to male circumcision and conducted a critical review of peer-reviewed literature by using the American Heart Association's template for evidence evaluation.

Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks; furthermore, the benefits of newborn male circumcision justify access to this procedure for families who choose it. Specific benefits from male circumcision were identified for the prevention of urinary tract infections, acquisition of HIV, transmission of some sexually transmitted infections, and penile cancer. Male circumcision does not appear to adversely affect penile sexual function/sensitivity or sexual satisfaction. It is imperative that those providing circumcision are adequately trained and that both sterile techniques and effective pain management are used. Significant acute complications are rare. In general, untrained providers who perform circumcisions have more complications than well-trained providers who perform the procedure, regardless of whether the former are physicians, nurses, or traditional religious providers.

Parents are entitled to factually correct, nonbiased information about circumcision and should receive this information from clinicians before conception or early in pregnancy, which is when parents typically make circumcision decisions. Parents should determine what is in the best interest of their child. Physicians who counsel families about this decision should provide assistance by explaining the potential benefits and risks and ensuring that parents understand that circumcision is an elective procedure. The Task Force strongly recommends the creation, revision, and enhancement of educational materials to assist parents of male infants with the care of circumcised and uncircumcised penises. The Task Force also strongly recommends the development of educational materials for providers to enhance practitioners' competency in discussing circumcision's benefits and risks with parents.

The Task Force made the following recommendations:

- Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks, and the benefits of newborn male circumcision justify access to this procedure for those families who choose it.
- Parents are entitled to factually correct, nonbiased information about circumcision that should be provided before conception and early in pregnancy, when parents are most likely to be weighing the option of circumcision of a male child.
- Physicians counseling families about elective male circumcision should assist parents by explaining, in a nonbiased manner, the potential benefits and risks and by ensuring that they understand the elective nature of the procedure.
- Parents should weigh the health benefits and risks in light of their own religious, cultural, and personal preferences, as the medical benefits alone may not outweigh these other considerations for individual families.
- Parents of newborn boys should be instructed in the care of the penis, regardless of whether the newborn has been circumcised or not.
- Elective circumcision should be performed only if the infant's condition is stable and healthy.
- Male circumcision should be performed by trained and competent practitioners, by using sterile techniques and effective pain management.
- Analgesia is safe and effective in reducing the procedural pain associated with newborn circumcision; thus, adequate analgesia should be provided whenever newborn circumcision is performed.
  - — Nonpharmacologic techniques (eg, positioning, sucrose pacifiers) alone are insufficient to prevent procedural and postprocedural pain and are not recommended as the sole method of analgesia. They should be used only as analgesic adjuncts to improve infant comfort during circumcision.
  - — If used, topical creams may cause a higher incidence of skin irritation in low birth weight infants, compared with infants of normal weight; penile nerve block techniques should therefore be chosen for this group of newborns.
- Key professional organizations (AAP, the American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, the American Society of Anesthesiologists, the American College of Nurse Midwives, and other midlevel clinicians such as nurse practitioners) should work collaboratively to:
  - — Develop standards of trainee proficiency in the performance of anesthetic and procedure techniques, including suturing;
  - — Teach the procedure and analgesic techniques during postgraduate training programs;
  - — Develop educational materials for clinicians to enhance their own competency in discussing the benefits and risks of circumcision with parents;
  - — Offer educational materials to assist parents of male infants with the care of both circumcised and uncircumcised penises.

- The preventive and public health benefits associated with newborn male circumcision warrant third-party reimbursement of the procedure.

The American College of Obstetricians and Gynecologists has endorsed this technical report. (8/12)

MALTREATMENT OF CHILDREN WITH DISABILITIES (CLINICAL REPORT)

Roberta A. Hibbard, MD; Larry W. Desch, MD; Committee on Child Abuse and Neglect; and Council on Children With Disabilities

ABSTRACT. Widespread efforts are being made to increase awareness and provide education to pediatricians regarding risk factors of child abuse and neglect. The purpose of this clinical report is to ensure that children with disabilities are recognized as a population that is also at risk of maltreatment. Some conditions related to a disability can be confused with maltreatment. The need for early recognition and intervention of child abuse and neglect in this population, as well as the ways that a medical home can facilitate the prevention and early detection of child maltreatment, are the subject of this report. (5/07, reaffirmed 1/11)

MANAGEMENT OF CHILDREN WITH AUTISM SPECTRUM DISORDERS (CLINICAL REPORT)

Scott M. Myers, MD; Chris Plauché Johnson, MD, MEd; and Council on Children With Disabilities

ABSTRACT. Pediatricians have an important role not only in early recognition and evaluation of autism spectrum disorders but also in chronic management of these disorders. The primary goals of treatment are to maximize the child's ultimate functional independence and quality of life by minimizing the core autism spectrum disorder features, facilitating development and learning, promoting socialization, reducing maladaptive behaviors, and educating and supporting families. To assist pediatricians in educating families and guiding them toward empirically supported interventions for their children, this report reviews the educational strategies and associated therapies that are the primary treatments for children with autism spectrum disorders. Optimization of health care is likely to have a positive effect on habilitative progress, functional outcome, and quality of life; therefore, important issues, such as management of associated medical problems, pharmacologic and nonpharmacologic intervention for challenging behaviors or coexisting mental health conditions, and use of complementary and alternative medical treatments, are also addressed. (11/07, reaffirmed 9/10)

MANAGEMENT OF FOOD ALLERGY IN THE SCHOOL SETTING (CLINICAL REPORT)

Scott H. Sicherer, MD; Todd Mahr, MD; and Section on Allergy and Immunology

ABSTRACT. Food allergy is estimated to affect approximately 1 in 25 school-aged children and is the most common trigger of anaphylaxis in this age group. School food-allergy management requires strategies to reduce the risk of ingestion of the allergen as well as procedures to recognize and treat allergic reactions and anaphylaxis. The role of the pediatrician or pediatric health care provider may include diagnosing and documenting a potentially life-threatening food allergy, prescribing self-injectable epinephrine, helping the child learn how to store and use the medication in a responsible manner, educating the parents of their responsibility to implement prevention strategies within and outside the home environment, and working with families, schools, and students in developing written plans to reduce the risk of anaphylaxis and to implement emergency treatment in the event of a reaction. This clinical report highlights the role of the pediatrician and pediatric health care provider in managing students with food allergies. (11/10)

MANAGEMENT OF NEONATES WITH SUSPECTED OR PROVEN EARLY-ONSET BACTERIAL SEPSIS (CLINICAL REPORT)

Richard A. Polin, MD, and Committee on Fetus and Newborn

ABSTRACT. With improved obstetrical management and evidence-based use of intrapartum antimicrobial therapy, early-onset neonatal sepsis is becoming less frequent. However, early-onset sepsis remains one of the most common causes of neonatal morbidity and mortality in the preterm population. The identification of neonates at risk for early-onset sepsis is frequently based on a constellation of perinatal risk factors that are neither sensitive nor specific. Furthermore, diagnostic tests for neonatal sepsis have a poor positive predictive accuracy. As a result, clinicians often treat well-appearing infants for extended periods of time, even when bacterial cultures are negative. The optimal treatment of infants with suspected early-onset sepsis is broad-spectrum antimicrobial agents (ampicillin and an aminoglycoside). Once a pathogen is identified, antimicrobial therapy should be narrowed (unless synergism is needed). Recent data suggest an association between prolonged empirical treatment of preterm infants (≥5 days) with broad-spectrum antibiotics and higher risks of late onset sepsis, necrotizing enterocolitis, and mortality. To reduce these risks, antimicrobial therapy should be discontinued at 48 hours in clinical situations in which the probability of sepsis is low. The purpose of this clinical report is to provide a practical and, when possible, evidence-based approach to the management of infants with suspected or proven early-onset sepsis. (4/12)

MANAGEMENT OF PEDIATRIC TRAUMA

Section on Orthopaedics, Committee on Pediatric Emergency Medicine, Section on Critical Care, Section on Surgery, and Section on Transport Medicine (joint with Pediatric Orthopaedic Society of North America)

ABSTRACT. Injury is the number 1 killer of children in the United States. In 2004, injury accounted for 59.5% of all deaths in children younger than 18 years. The financial burden to society of children who survive childhood injury with disability continues to be enormous. The entire process of managing childhood injury is complex and varies by region. Only the comprehensive cooperation of a broadly diverse group of people will have a significant effect on improving the care and outcome of injured children. (4/08, reaffirmed 4/13)

MANAGEMENT OF TYPE 2 DIABETES MELLITUS IN CHILDREN AND ADOLESCENTS (TECHNICAL REPORT)

Shelley C. Springer, MD, MBA, MSc, JD; Janet Silverstein, MD; Kenneth Copeland, MD; Kelly R. Moore, MD; Greg E. Prazar, MD; Terry Raymer, MD, CDE; Richard N. Shiffman, MD; Vidhu V. Thaker, MD; Meaghan Anderson, MS, RD, LD, CDE; Stephen J. Spann, MD, MBA; and Susan K. Flinn, MA

ABSTRACT. *Objective.* Over the last 3 decades, the prevalence of childhood obesity has increased dramatically in North America, ushering in a variety of health problems, including type 2 diabetes mellitus (T2DM), which previously was not typically seen until much later in life. This technical report describes, in detail, the procedures undertaken to develop the recommendations given in the accompanying clinical practice guideline, "Management of Type 2 Diabetes Mellitus in Children and Adolescents," and provides in-depth information about the rationale for the recommendations and the studies used to make the clinical practice guideline's recommendations.

Methods. A primary literature search was conducted relating to the treatment of T2DM in children and adolescents, and a secondary literature search was conducted relating to the screening and treatment of T2DM's comorbidities in children and adolescents. Inclusion criteria were prospectively and unanimously agreed on by members of the committee. An article was eligible for inclusion if it addressed treatment (primary search) or 1 of 4 comorbidities (secondary search) of T2DM, was published in 1990 or later, was written in English, and included an abstract. Only primary research inquiries were considered; review articles were considered if they included primary data or opinion. The research population had to constitute children and/or adolescents with an existing diagnosis of T2DM; studies of adult patients were considered if at least 10% of the study population was younger than 35 years. All retrieved titles, abstracts, and articles were reviewed by the consulting epidemiologist.

Results. Thousands of articles were retrieved and considered in both searches on the basis of the aforementioned criteria. From those, in the primary search, 199 abstracts were identified for possible inclusion, 58 of which were retained for systematic review. Five of these studies were classified as grade A studies, 1 as grade B, 20 as grade C, and 32 as grade D. Articles regarding treatment of T2DM selected for inclusion were divided into 4 major subcategories on the basis of type of treatment being discussed: (1) medical treatments (32 studies); (2) nonmedical treatments (9 studies); (3) provider behaviors (8 studies); and (4) social issues (9 studies). From the secondary search, an additional 336 abstracts relating to comorbidities were identified for possible inclusion, of which 26 were retained for systematic review. These articles included the following: 1 systematic review of literature regarding comorbidities of T2DM in adolescents; 5 expert opinions presenting global recommendations not based on evidence; 5 cohort studies reporting natural history of disease and comorbidities; 3 with specific attention to comorbidity patterns in specific ethnic groups (case-control, cohort, and clinical report using adult literature); 3 reporting an association between microalbuminuria and retinopathy (2 case-control, 1 cohort); 3 reporting the prevalence of nephropathy (cohort); 1 reporting peripheral vascular disease (case series); 2 discussing retinopathy (1 case-control, 1 position statement); and 3 addressing hyperlipidemia (American Heart Association position statement on cardiovascular risks; American Diabetes Association consensus statement; case series). A breakdown of grade of recommendation shows no grade A studies, 10 grade B studies, 6 grade C studies, and 10 grade D studies. With regard to screening and treatment recommendations for comorbidities, data in children are scarce, and the available literature is conflicting. Therapeutic recommendations for hypertension, dyslipidemia, retinopathy, microalbuminuria, and depression were summarized from expert guideline documents and are presented in detail in the guideline. The references are provided, but the committee did not independently assess the supporting evidence. Screening tools are provided in the Supplemental Information. (1/13)

See full text on page 97.

MARIJUANA: A CONTINUING CONCERN FOR PEDIATRICIANS

Committee on Substance Abuse

ABSTRACT. Marijuana, the common name for products derived from the plant *Cannabis sativa,* is the most common illicit drug used by children and adolescents in the United States. Despite growing concerns by the medical profession about the physical and psychological effects of its active ingredient, Æ-9-tetrahydrocannabinol, survey data continue to show that increasing numbers of young people are using the drug as they become less concerned about its dangers. (10/99, reaffirmed 4/03)

MATERNAL-FETAL INTERVENTION AND FETAL CARE CENTERS (CLINICAL REPORT)

Committee on Bioethics (joint with American College of Obstetricians and Gynecologists Committee on Ethics)

ABSTRACT. The past 2 decades have yielded profound advances in the fields of prenatal diagnosis and fetal intervention. Although fetal interventions are driven by a beneficence-based motivation to improve fetal and neonatal outcomes, advancement in fetal therapies raises ethical issues surrounding maternal autonomy and decision-making, concepts of innovation versus research, and organizational aspects within institutions in the development of fetal care centers. To safeguard the interests of both the pregnant woman and the fetus, the American College of Obstetricians and Gynecologists and the American Academy of Pediatrics make recommendations regarding informed consent, the role of research subject advocates and other independent advocates, the availability of support services, the multidisciplinary nature of fetal intervention teams, the oversight of centers, and the need to accumulate maternal and fetal outcome data. (7/11)

MATERNAL PHENYLKETONURIA

Committee on Genetics

ABSTRACT. Elevated maternal phenylalanine concentrations during pregnancy are teratogenic and may result in growth retardation, microcephaly, significant developmental delays, and birth defects in the offspring of

women with poorly controlled phenylketonuria during pregnancy. Women of childbearing age with all forms of phenylketonuria, including mild variants such as mild hyperphenylalaninemia, should receive counseling concerning their risks for adverse fetal effects, optimally before conceiving. The best outcomes occur when strict control of maternal phenylalanine concentration is achieved before conception and continued throughout pregnancy. Included are brief descriptions of novel treatments for phenylketonuria. (8/08, reaffirmed 1/13)

MEDIA EDUCATION
Committee on Communications and Media
ABSTRACT. The American Academy of Pediatrics recognizes that exposure to mass media (eg, television, movies, video and computer games, the Internet, music lyrics and videos, newspapers, magazines, books, advertising) presents health risks for children and adolescents but can provide benefits as well. Media education has the potential to reduce the harmful effects of media and accentuate the positive effects. By understanding and supporting media education, pediatricians can play an important role in reducing harmful effects of media on children and adolescents. (9/10)

MEDIA USE BY CHILDREN YOUNGER THAN 2 YEARS
Council on Communications and Media
ABSTRACT. In 1999, the American Academy of Pediatrics (AAP) issued a policy statement addressing media use in children. The purpose of that statement was to educate parents about the effects that media—both the amount and the content—may have on children. In one part of that statement, the AAP recommended that "pediatricians should urge parents to avoid television viewing for children under the age of two years." The wording of the policy specifically discouraged media use in this age group, although it is frequently misquoted by media outlets as no media exposure in this age group. The AAP believed that there were significantly more potential negative effects of media than positive ones for this age group and, thus, advised families to thoughtfully consider media use for infants. This policy statement reaffirms the 1999 statement with respect to media use in infants and children younger than 2 years and provides updated research findings to support it. This statement addresses (1) the lack of evidence supporting educational or developmental benefits for media use by children younger than 2 years, (2) the potential adverse health and developmental effects of media use by children younger than 2 years, and (3) adverse effects of parental media use (background media) on children younger than 2 years. (10/11)

MEDIA VIOLENCE
Council on Communications and Media
ABSTRACT. Exposure to violence in media, including television, movies, music, and video games, represents a significant risk to the health of children and adolescents. Extensive research evidence indicates that media violence can contribute to aggressive behavior, desensitization to violence, nightmares, and fear of being harmed. Pediatricians should assess their patients' level of media exposure and intervene on media-related health risks. Pediatricians and other child health care providers can advocate for a safer media environment for children by encouraging media literacy, more thoughtful and proactive use of media by children and their parents, more responsible portrayal of violence by media producers, and more useful and effective media ratings. Office counseling has been shown to be effective. (10/09)

MEDICAID POLICY STATEMENT
Committee on Child Health Financing
ABSTRACT. Medicaid insures 39% of the children in the United States. This revision of the 2005 Medicaid Policy Statement of the American Academy of Pediatrics reflects opportunities for changes in state Medicaid programs resulting from the 2010 Patient Protection and Affordable Care Act as upheld in 2012 by the Supreme Court. Policy recommendations focus on the areas of benefit coverage, financing and payment, eligibility, outreach and enrollment, managed care, and quality improvement. (4/13)
See full text on page 721.

MEDICAL CONCERNS IN THE FEMALE ATHLETE
Committee on Sports Medicine and Fitness
ABSTRACT. Female children and adolescents who participate regularly in sports may develop certain medical conditions, including disordered eating, menstrual dysfunction, and decreased bone mineral density. The pediatrician can play an important role in monitoring the health of young female athletes. This revised policy statement provides updated and expanded information for pediatricians on these health concerns as well as recommendations for evaluation, treatment, and ongoing assessments of female athletes. (9/00, reaffirmed 5/05, 5/08)

MEDICAL CONDITIONS AFFECTING SPORTS PARTICIPATION (CLINICAL REPORT)
Stephen G. Rice, MD, PhD, MPH, and Council on Sports Medicine and Fitness
ABSTRACT. Children and adolescents with medical conditions present special issues with respect to participation in athletic activities. The pediatrician can play an important role in determining whether a child with a health condition should participate in certain sports by assessing the child's health status, suggesting appropriate equipment or modifications of sports to decrease the risk of injury, and educating the athlete, parent(s) or guardian, and coach regarding the risks of injury as they relate to the child's condition. This report updates a previous policy statement and provides information for pediatricians on sports participation for children and adolescents with medical conditions. (4/08, reaffirmed 5/11)

MEDICAL EMERGENCIES OCCURRING AT SCHOOL
Council on School Health
ABSTRACT. Children and adults might experience medical emergency situations because of injuries, complications of chronic health conditions, or unexpected major illnesses that occur in schools. In February 2001, the American Academy of Pediatrics issued a policy statement titled "Guidelines for Emergency Medical Care in Schools" (available at: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;107/2/435). Since the

release of that statement, the spectrum of potential individual student emergencies has changed significantly. The increase in the number of children with special health care needs and chronic medical conditions attending schools and the challenges associated with ensuring that schools have access to on-site licensed health care professionals on an ongoing basis have added to increasing the risks of medical emergencies in schools. The goal of this statement is to increase pediatricians' awareness of schools' roles in preparing for individual student emergencies and to provide recommendations for primary care and school physicians on how to assist and support school personnel. (10/08, reaffirmed 9/11)

THE MEDICAL HOME

Medical Home Initiatives for Children With Special Needs Project Advisory Committee (7/02, reaffirmed 5/08)

MEDICAL STAFF APPOINTMENT AND DELINEATION OF PEDIATRIC PRIVILEGES IN HOSPITALS (CLINICAL REPORT)

Daniel A. Rauch, MD; Committee on Hospital Care; and Section on Hospital Medicine

ABSTRACT. The review and verification of credentials and the granting of clinical privileges are required of every hospital to ensure that members of the medical staff are competent and qualified to provide specified levels of patient care. The credentialing process involves the following: (1) assessment of the professional and personal background of each practitioner seeking privileges; (2) assignment of privileges appropriate for the clinician's training and experience; (3) ongoing monitoring of the professional activities of each staff member; and (4) periodic reappointment to the medical staff on the basis of objectively measured performance. We examine the essential elements of a credentials review for initial and renewed medical staff appointments along with suggested criteria for the delineation of clinical privileges. Sample forms for the delineation of privileges can be found on the American Academy of Pediatrics Committee on Hospital Care Web site (http://www.aap.org/visit/cmte19.htm). Because of differences among individual hospitals, no 1 method for credentialing is universally applicable. The medical staff of each hospital must, therefore, establish its own process based on the general principles reviewed in this report. The issues of medical staff membership and credentialing have become very complex, and institutions and medical staffs are vulnerable to legal action. Consequently, it is advisable for hospitals and medical staffs to obtain expert legal advice when medical staff bylaws are constructed or revised. (3/12)

MENINGOCOCCAL CONJUGATE VACCINES POLICY UPDATE: BOOSTER DOSE RECOMMENDATIONS

Committee on Infectious Diseases

ABSTRACT. The Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention and the American Academy of Pediatrics approved updated recommendations for the use of quadravalent (serogroups A, C, W-135, and Y) meningococcal conjugate vaccines (Menactra [Sanofi Pasteur, Swiftwater, PA] and Menveo [Novartis, Basel, Switzerland]) in adolescents and in people at persistent high risk of meningococcal disease. The recommendations supplement previous Advisory Committee on Immunization Practices and American Academy of Pediatrics recommendations for meningococcal vaccinations. Data were reviewed pertaining to immunogenicity in high-risk groups, bactericidal antibody persistence after immunization, current epidemiology of meningococcal disease, meningococcal conjugate vaccine effectiveness, and cost-effectiveness of different strategies for vaccination of adolescents. This review prompted the following recommendations: (1) adolescents should be routinely immunized at 11 through 12 years of age and given a booster dose at 16 years of age; (2) adolescents who received their first dose at age 13 through 15 years should receive a booster at age 16 through 18 years or up to 5 years after their first dose; (3) adolescents who receive their first dose of meningococcal conjugate vaccine at or after 16 years of age do not need a booster dose; (4) a 2-dose primary series should be administered 2 months apart for those who are at increased risk of invasive meningococcal disease because of persistent complement component (eg, C5–C9, properdin, factor H, or factor D) deficiency (9 months through 54 years of age) or functional or anatomic asplenia (2–54 years of age) and for adolescents with HIV infection; and (5) a booster dose should be given 3 years after the primary series if the primary 2-dose series was given from 2 through 6 years of age and every 5 years for persons whose 2-dose primary series or booster dose was given at 7 years of age or older who are at risk of invasive meningococcal disease because of persistent component (eg, C5–C9, properdin, factor H, or factor D) deficiency or functional or anatomic asplenia. (11/11)

MENSTRUATION IN GIRLS AND ADOLESCENTS: USING THE MENSTRUAL CYCLE AS A VITAL SIGN (CLINICAL REPORT)

Committee on Adolescence (joint with American College of Obstetricians and Gynecologists Committee on Adolescent Health Care)

ABSTRACT. Young patients and their parents often are unsure about what represents normal menstrual patterns, and clinicians also may be unsure about normal ranges for menstrual cycle length and amount and duration of flow through adolescence. It is important to be able to educate young patients and their parents regarding what to expect of a first period and about the range for normal cycle length of subsequent menses. It is equally important for clinicians to have an understanding of bleeding patterns in girls and adolescents, the ability to differentiate between normal and abnormal menstruation, and the skill to know how to evaluate young patients' conditions appropriately. Using the menstrual cycle as an additional vital sign adds a powerful tool to the assessment of normal development and the exclusion of pathological conditions. (11/06)

MINORS AS LIVING SOLID-ORGAN DONORS (CLINICAL REPORT)

Lainie Friedman Ross, MD, PhD; J. Richard Thistlethwaite Jr, MD, PhD; and Committee on Bioethics

ABSTRACT. In the past half-century, solid-organ transplantation has become standard treatment for a variety of diseases in children and adults. The major limitation

for all transplantation is the availability of donors, and the gap between demand and supply continues to grow despite the increase in living donors. Although rare, children do serve as living donors, and these donations raise serious ethical issues. This clinical report includes a discussion of the ethical considerations regarding minors serving as living donors, using the traditional benefit/burden calculus from the perspectives of both the donor and the recipient. The report also includes an examination of the circumstances under which a minor may morally participate as a living donor, how to minimize risks, and what the informed-consent process should entail. The American Academy of Pediatrics holds that minors can morally serve as living organ donors but only in exceptional circumstances when specific criteria are fulfilled. (8/08, reaffirmed 5/11)

MODEL CONTRACTUAL LANGUAGE FOR MEDICAL NECESSITY FOR CHILDREN

Committee on Child Health Financing

ABSTRACT. The term "medical necessity" is used by Medicare and Medicaid and in insurance contracts to refer to medical services that are generally recognized as appropriate for the diagnosis, prevention, or treatment of disease and injury. There is no consensus on how to define and apply the term and the accompanying rules and regulations, and as a result there has been substantial variation in medical-necessity definitions and interpretations. With this policy statement, the American Academy of Pediatrics hopes to encourage insurers to adopt more consistent medical-necessity definitions that take into account the needs of children. (7/05, reaffirmed 10/11)

MOLECULAR GENETIC TESTING IN PEDIATRIC PRACTICE: A SUBJECT REVIEW (CLINICAL REPORT)

Committee on Genetics

ABSTRACT. Although many types of diagnostic and carrier testing for genetic disorders have been available for decades, the use of molecular methods is a relatively recent phenomenon. Such testing has expanded the range of disorders that can be diagnosed and has enhanced the ability of clinicians to provide accurate prognostic information and institute appropriate health supervision measures. However, the proper application of these tests may be difficult because of their scientific complexity and the potential for negative, sometimes unexpected, consequences for many patients. The purposes of this subject review are to provide background information on molecular genetic tests, to describe specific testing modalities, and to discuss some of the benefits and risks specific to the pediatric population. It is likely that pediatricians will use these testing methods increasingly for their patients and will need to evaluate critically their diagnostic and prognostic implications. (12/00, reaffirmed 5/07)

MOTOR DELAYS: EARLY IDENTIFICATION AND EVALUATION (CLINICAL REPORT)

Garey H. Noritz, MD; Nancy A. Murphy, MD; and Neuromotor Screening Expert Panel

ABSTRACT. Pediatricians often encounter children with delays of motor development in their clinical practices. Earlier identification of motor delays allows for timely referral for developmental interventions as well as diagnostic evaluations and treatment planning. A multidisciplinary expert panel developed an algorithm for the surveillance and screening of children for motor delays within the medical home, offering guidance for the initial workup and referral of the child with possible delays in motor development. Highlights of this clinical report include suggestions for formal developmental screening at the 9-, 18-, 30-, and 48-month well-child visits; approaches to the neurologic examination, with emphasis on the assessment of muscle tone; and initial diagnostic approaches for medical home providers. Use of diagnostic tests to evaluate children with motor delays are described, including brain MRI for children with high muscle tone, and measuring serum creatine kinase concentration of those with decreased muscle tone. The importance of pursuing diagnostic tests while concurrently referring patients to early intervention programs is emphasized. (5/13)

See full text on page 733.

NEONATAL DRUG WITHDRAWAL (CLINICAL REPORT)

Mark L. Hudak, MD; Rosemarie C. Tan, MD, PhD; Committee on Drugs; and Committee on Fetus and Newborn

ABSTRACT. Maternal use of certain drugs during pregnancy can result in transient neonatal signs consistent with withdrawal or acute toxicity or cause sustained signs consistent with a lasting drug effect. In addition, hospitalized infants who are treated with opioids or benzodiazepines to provide analgesia or sedation may be at risk for manifesting signs of withdrawal. This statement updates information about the clinical presentation of infants exposed to intrauterine drugs and the therapeutic options for treatment of withdrawal and is expanded to include evidence-based approaches to the management of the hospitalized infant who requires weaning from analgesics or sedatives. (1/12)

THE NEW MORBIDITY REVISITED: A RENEWED COMMITMENT TO THE PSYCHOSOCIAL ASPECTS OF PEDIATRIC CARE

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. In 1993, the American Academy of Pediatrics adopted the policy statement "The Pediatrician and the 'New Morbidity.'" Since then, social difficulties, behavioral problems, and developmental difficulties have become a main part of the scope of pediatric practice, and recognition of the importance of these areas has increased. This statement reaffirms the Academy's commitment to prevention, early detection, and management of behavioral, developmental, and social problems as a focus in pediatric practice. (11/01)

NEWBORN SCREENING EXPANDS: RECOMMENDATIONS FOR PEDIATRICIANS AND MEDICAL HOMES—IMPLICATIONS FOR THE SYSTEM (CLINICAL REPORT)

Newborn Screening Authoring Committee

ABSTRACT. Advances in newborn screening technology, coupled with recent advances in the diagnosis and treatment of rare but serious congenital conditions that affect newborn infants, provide increased opportunities for positively affecting the lives of children and their families. These advantages also pose new challenges to primary care pediatricians, both educationally and in response to the management of affected infants. Primary care pediatricians require immediate access to clinical and diagnostic information and guidance and have a proactive role to play in supporting the performance of the newborn screening system. Primary care pediatricians must develop office policies and procedures to ensure that newborn screening is conducted and that results are transmitted to them in a timely fashion; they must also develop strategies to use should these systems fail. In addition, collaboration with local, state, and national partners is essential for promoting actions and policies that will optimize the function of the newborn screening systems and ensure that families receive the full benefit of them. (1/08)

NEWBORN SCREENING FACT SHEETS, INTRODUCTION TO THE (TECHNICAL REPORT)

Celia I. Kaye, MD, PhD, and Committee on Genetics

ABSTRACT. Newborn screening fact sheets were last revised in 1996 by the Committee on Genetics of the American Academy of Pediatrics. These fact sheets have been revised again because of advances in the field, including technologic innovations such as tandem mass spectrometry, as well as greater appreciation of ethical issues such as informed consent. The fact sheets provide information to assist pediatricians and other professionals who care for children in performing their essential role within the newborn screening public health system. The newborn screening system consists of 5 parts: (1) newborn testing; (2) follow-up of abnormal screening results to facilitate timely diagnostic testing and management; (3) diagnostic testing; (4) disease management, which requires coordination with the medical home and genetic counseling; and (5) continuous evaluation and improvement of the newborn screening system. The following disorders are reviewed in the newborn screening fact sheets (which are available at www.pediatrics.org/cgi/content/full/118/3/e934): biotinidase deficiency, congenital adrenal hyperplasia, congenital hearing loss, congenital hypothyroidism, cystic fibrosis, galactosemia, homocystinuria, maple syrup urine disease, medium-chain acyl-coenzyme A dehydrogenase deficiency, phenylketonuria, sickle cell disease and other hemoglobinopathies, and tyrosinemia. (9/06, reaffirmed 1/11)

NEWBORN SCREENING FACT SHEETS (TECHNICAL REPORT)

Celia I. Kaye, MD, PhD, and Committee on Genetics

ABSTRACT. Newborn screening fact sheets were last revised in 1996 by the American Academy of Pediatrics Committee on Genetics. This revision was prompted by advances in the field since 1996, including technologic innovations, as well as greater appreciation of ethical issues such as those surrounding informed consent. The following disorders are discussed in this revision of the newborn screening fact sheets: biotinidase deficiency, congenital adrenal hyperplasia, congenital hearing loss, congenital hypothyroidism, cystic fibrosis, galactosemia, homocystinuria, maple syrup urine disease, medium-chain acyl-coenzyme A dehydrogenase deficiency, phenylketonuria, sickle cell disease and other hemoglobinopathies, and tyrosinemia. A series of topics related to newborn screening is discussed in a companion publication to this electronic publication of the fact sheets (available at: www.pediatrics.org/cgi/content/full/118/3/1304). These topics are newborn screening as a public health system; factors contributing to the need for review of the newborn screening system; informed consent; tandem mass spectrometry; DNA analysis in newborn screening; status of newborn screening in the United States; and the effect of sample timing, preterm birth, diet, transfusion, and total parenteral nutrition on newborn screening results. (9/06, reaffirmed 1/11)

NONDISCRIMINATION IN PEDIATRIC HEALTH CARE

Committee on Pediatric Workforce

ABSTRACT. This policy statement is a revision of a 2001 statement and articulates the positions of the American Academy of Pediatrics on nondiscrimination in pediatric health care. It addresses both pediatricians who provide health care and the infants, children, adolescents, and young adults whom they serve. (10/07, reaffirmed 6/11)

NONINITIATION OR WITHDRAWAL OF INTENSIVE CARE FOR HIGH-RISK NEWBORNS

Committee on Fetus and Newborn

ABSTRACT. Advances in medical technology have led to dilemmas in initiation and withdrawal of intensive care of newborn infants with a very poor prognosis. Physicians and parents together must make difficult decisions guided by their understanding of the child's best interest. The foundation for these decisions consists of several key elements: (1) direct and open communication between the health care team and the parents of the child with regard to the medical status, prognosis, and treatment options; (2) inclusion of the parents as active participants in the decision process; (3) continuation of comfort care even when intensive care is not being provided; and (4) treatment decisions that are guided primarily by the best interest of the child. (2/07, reaffirmed 5/10)

NONTHERAPEUTIC USE OF ANTIMICROBIAL AGENTS IN ANIMAL AGRICULTURE: IMPLICATIONS FOR PEDIATRICS (TECHNICAL REPORT)

Committee on Environmental Health and Committee on Infectious Diseases

ABSTRACT. Antimicrobial resistance is widespread. Overuse or misuse of antimicrobial agents in veterinary and human medicine is responsible for increasing the crisis of resistance to antimicrobial agents. The American Academy of Pediatrics, in conjunction with the US Public Health Service, has begun to address this problem by disseminating policies on the judicious use of antimicrobial

agents in humans. Between 40% and 80% of the antimicrobial agents used in the United States each year are used in food animals; many are identical or very similar to drugs used in humans. Most of this use involves the addition of low doses of antimicrobial agents to the feed of healthy animals over prolonged periods to promote growth and increase feed efficiency or at a range of doses to prevent disease. These nontherapeutic uses contribute to resistance and create health dangers for humans. This report will describe how antimicrobial agents are used in animal agriculture and review the mechanisms by which such uses contribute to resistance in human pathogens. Although therapeutic use of antimicrobial agents in agriculture clearly contributes to the development of resistance, this report will concentrate on nontherapeutic uses in healthy animals. (9/04, reaffirmed 10/08, 4/13)

OFFICE-BASED CARE FOR LESBIAN, GAY, BISEXUAL, TRANSGENDER, AND QUESTIONING YOUTH

Committee on Adolescence

ABSTRACT. The American Academy of Pediatrics issued its last statement on homosexuality and adolescents in 2004. Although most lesbian, gay, bisexual, transgender, and questioning (LGBTQ) youth are quite resilient and emerge from adolescence as healthy adults, the effects of homophobia and heterosexism can contribute to health disparities in mental health with higher rates of depression and suicidal ideation, higher rates of substance abuse, and more sexually transmitted and HIV infections. Pediatricians should have offices that are teen-friendly and welcoming to sexual minority youth. Obtaining a comprehensive, confidential, developmentally appropriate adolescent psychosocial history allows for the discovery of strengths and assets as well as risks. Referrals for mental health or substance abuse may be warranted. Sexually active LGBTQ youth should have sexually transmitted infection/HIV testing according to recommendations of the Sexually Transmitted Diseases Treatment Guidelines of the Centers for Disease Control and Prevention based on sexual behaviors. With appropriate assistance and care, sexual minority youth should live healthy, productive lives while transitioning through adolescence and young adulthood. (6/13)

See full text on page 747.

OFFICE-BASED CARE FOR LESBIAN, GAY, BISEXUAL, TRANSGENDER, AND QUESTIONING YOUTH (TECHNICAL REPORT)

David A. Levine, MD, and Committee on Adolescence

ABSTRACT. The American Academy of Pediatrics issued its last statement on homosexuality and adolescents in 2004.This technical report reflects the rapidly expanding medical and psychosocial literature about sexual minority youth. Pediatricians should be aware that some youth in their care may have concerns or questions about their sexual orientation or that of siblings, friends, parents, relatives, or others and should provide factual, current, nonjudgmental information in a confidential manner. Although most lesbian, gay, bisexual, transgender, and questioning (LGBTQ) youth are quite resilient and emerge from adolescence as healthy adults, the effects of homophobia and heterosexism can contribute to increased mental health issues for sexual minority youth. LGBTQ and MSM/WSW (men having sex with men and women having sex with women) adolescents, in comparison with heterosexual adolescents, have higher rates of depression and suicidal ideation, higher rates of substance abuse, and more risky sexual behaviors. Obtaining a comprehensive, confidential, developmentally appropriate adolescent psychosocial history allows for the discovery of strengths and assets as well as risks. Pediatricians should have offices that are teen-friendly and welcoming to sexual minority youth. This includes having supportive, engaging office staff members who ensure that there are no barriers to care. For transgender youth, pediatricians should provide the opportunity to acknowledge and affirm their feelings of gender dysphoria and desires to transition to the opposite gender. Referral of transgender youth to a qualified mental health professional is critical to assist with the dysphoria, to educate them, and to assess their readiness for transition. With appropriate assistance and care, sexual minority youth should live healthy, productive lives while transitioning through adolescence and young adulthood. (6/13)

See full text on page 755.

OFFICE-BASED COUNSELING FOR UNINTENTIONAL INJURY PREVENTION (CLINICAL REPORT)

H. Garry Gardner, MD, and Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Unintentional injuries are the leading cause of death for children older than 1 year. Pediatricians should include unintentional injury prevention as a major component of anticipatory guidance for infants, children, and adolescents. The content of injury-prevention counseling varies for infants, preschool-aged children, school-aged children, and adolescents. This report provides guidance on the content of unintentional injury-prevention counseling for each of those age groups. (1/07)

OPHTHALMOLOGIC EXAMINATIONS IN CHILDREN WITH JUVENILE RHEUMATOID ARTHRITIS (CLINICAL REPORT)

James Cassidy, MD; Jane Kivlin, MD; Carol Lindsley, MD; James Nocton, MD; Section on Rheumatology; and Section on Ophthalmology

ABSTRACT. Unlike the joints, ocular involvement with juvenile rheumatoid arthritis is most often asymptomatic; yet, the inflammation can cause serious morbidity with loss of vision. Scheduled slit-lamp examinations by an ophthalmologist at specific intervals can detect ocular disease early, and prompt treatment can prevent vision loss. (5/06)

ORAL AND DENTAL ASPECTS OF CHILD ABUSE AND NEGLECT (CLINICAL REPORT)

Nancy Kellogg, MD, and Committee on Child Abuse and Neglect (joint with American Academy of Pediatric Dentistry)

ABSTRACT. In all 50 states, physicians and dentists are required to report suspected cases of abuse and neglect to social service or law enforcement agencies. The purpose of this report is to review the oral and dental aspects of physical and sexual abuse and dental neglect and the role of physicians and dentists in evaluating such condi-

tions. This report addresses the evaluation of bite marks as well as perioral and intraoral injuries, infections, and diseases that may cause suspicion for child abuse or neglect. Physicians receive minimal training in oral health and dental injury and disease and, thus, may not detect dental aspects of abuse or neglect as readily as they do child abuse and neglect involving other areas of the body. Therefore, physicians and dentists are encouraged to collaborate to increase the prevention, detection, and treatment of these conditions. (12/05, reaffirmed 1/09)

ORAL HEALTH CARE FOR CHILDREN WITH DEVELOPMENTAL DISABILITIES (CLINICAL REPORT)

Kenneth W. Norwood Jr, MD; Rebecca L. Slayton, DDS, PhD; Council on Children With Disabilities; and Section on Oral Health

ABSTRACT. Children with developmental disabilities often have unmet complex health care needs as well as significant physical and cognitive limitations. Children with more severe conditions and from low-income families are particularly at risk with high dental needs and poor access to care. In addition, children with developmental disabilities are living longer, requiring continued oral health care. This clinical report describes the effect that poor oral health has on children with developmental disabilities as well as the importance of partnerships between the pediatric medical and dental homes. Basic knowledge of the oral health risk factors affecting children with developmental disabilities is provided. Pediatricians may use the report to guide their incorporation of oral health assessments and education into their well-child examinations for children with developmental disabilities. This report has medical, legal, educational, and operational implications for practicing pediatricians. (2/13)

See full text on page 775.

ORAL HEALTH RISK ASSESSMENT TIMING AND ESTABLISHMENT OF THE DENTAL HOME

Section on Pediatric Dentistry

ABSTRACT. Early childhood dental caries has been reported by the Centers for Disease Control and Prevention to be perhaps the most prevalent infectious disease of our nation's children. Early childhood dental caries occurs in all racial and socioeconomic groups; however, it tends to be more prevalent in low-income children, in whom it occurs in epidemic proportions. Dental caries results from an overgrowth of specific organisms that are a part of normally occurring human flora. Human dental flora is site specific, and an infant is not colonized until the eruption of the primary dentition at approximately 6 to 30 months of age. The most likely source of inoculation of an infant's dental flora is the mother or another intimate care provider, through shared utensils, etc. Decreasing the level of cariogenic organisms in the mother's dental flora at the time of colonization can significantly impact the child's predisposition to caries. To prevent caries in children, high-risk individuals must be identified at an early age (preferably high-risk mothers during prenatal care), and aggressive strategies should be adopted, including anticipatory guidance, behavior modifications (oral hygiene and feeding practices), and establishment of a dental home by 1 year of age for children deemed at risk. (5/03, reaffirmed 5/09)

ORGANIC FOODS: HEALTH AND ENVIRONMENTAL ADVANTAGES AND DISADVANTAGES (CLINICAL REPORT)

Joel Forman, MD; Janet Silverstein, MD; Committee on Nutrition; and Council on Environmental Health

ABSTRACT. The US market for organic foods has grown from $3.5 billion in 1996 to $28.6 billion in 2010, according to the Organic Trade Association. Organic products are now sold in specialty stores and conventional supermarkets. Organic products contain numerous marketing claims and terms, only some of which are standardized and regulated.

In terms of health advantages, organic diets have been convincingly demonstrated to expose consumers to fewer pesticides associated with human disease. Organic farming has been demonstrated to have less environmental impact than conventional approaches. However, current evidence does not support any meaningful nutritional benefits or deficits from eating organic compared with conventionally grown foods, and there are no well-powered human studies that directly demonstrate health benefits or disease protection as a result of consuming an organic diet. Studies also have not demonstrated any detrimental or disease-promoting effects from an organic diet. Although organic foods regularly command a significant price premium, well-designed farming studies demonstrate that costs can be competitive and yields comparable to those of conventional farming techniques. Pediatricians should incorporate this evidence when discussing the health and environmental impact of organic foods and organic farming while continuing to encourage all patients and their families to attain optimal nutrition and dietary variety consistent with the US Department of Agriculture's MyPlate recommendations.

This clinical report reviews the health and environmental issues related to organic food production and consumption. It defines the term "organic," reviews organic food-labeling standards, describes organic and conventional farming practices, and explores the cost and environmental implications of organic production techniques. It examines the evidence available on nutritional quality and production contaminants in conventionally produced and organic foods. Finally, this report provides guidance for pediatricians to assist them in advising their patients regarding organic and conventionally produced food choices. (10/12)

ORGANIZED SPORTS FOR CHILDREN AND PREADOLESCENTS

Committee on Sports Medicine and Fitness and Committee on School Health

ABSTRACT. Participation in organized sports provides an opportunity for young people to increase their physical activity and develop physical and social skills. However, when the demands and expectations of organized sports exceed the maturation and readiness of the participant, the positive aspects of participation can be negated. The nature of parental or adult involvement can also influence the degree to which participation in organized sports is

a positive experience for preadolescents. This updates a previous policy statement on athletics for preadolescents and incorporates guidelines for sports participation for preschool children. Recommendations are offered on how pediatricians can help determine a child's readiness to participate, how risks can be minimized, and how child-oriented goals can be maximized. (6/01, reaffirmed 1/05, 6/11)

OUT-OF-SCHOOL SUSPENSION AND EXPULSION

Council on School Health

ABSTRACT. The primary mission of any school system is to educate students. To achieve this goal, the school district must maintain a culture and environment where all students feel safe, nurtured, and valued and where order and civility are expected standards of behavior. Schools cannot allow unacceptable behavior to interfere with the school district's primary mission. To this end, school districts adopt codes of conduct for expected behaviors and policies to address unacceptable behavior. In developing these policies, school boards must weigh the severity of the offense and the consequences of the punishment and the balance between individual and institutional rights and responsibilities. Out-of-school suspension and expulsion are the most severe consequences that a school district can impose for unacceptable behavior. Traditionally, these consequences have been reserved for offenses deemed especially severe or dangerous and/or for recalcitrant offenders. However, the implications and consequences of out-of-school suspension and expulsion and "zero-tolerance" are of such severity that their application and appropriateness for a developing child require periodic review. The indications and effectiveness of exclusionary discipline policies that demand automatic or rigorous application are increasingly questionable. The impact of these policies on offenders, other children, school districts, and communities is broad. Periodic scrutiny of policies should be placed not only on the need for a better understanding of the educational, emotional, and social impact of out-of-school suspension and expulsion on the individual student but also on the greater societal costs of such rigid policies. Pediatricians should be prepared to assist students and families affected by out-of-school suspension and expulsion and should be willing to guide school districts in their communities to find more effective and appropriate alternatives to exclusionary discipline policies for the developing child. A discussion of preventive strategies and alternatives to out-of-school suspension and expulsion, as well as recommendations for the role of the physician in matters of out-of-school suspension and expulsion are included. School-wide positive behavior support/positive behavior intervention and support is discussed as an effective alternative. (2/13)

See full text on page 783.

OVERCROWDING CRISIS IN OUR NATION'S EMERGENCY DEPARTMENTS: IS OUR SAFETY NET UNRAVELING?

Committee on Pediatric Emergency Medicine

ABSTRACT. Emergency departments (EDs) are a vital component in our health care safety net, available 24 hours a day, 7 days a week, for all who require care. There has been a steady increase in the volume and acuity of patient visits to EDs, now with well over 100 million Americans (30 million children) receiving emergency care annually. This rise in ED utilization has effectively saturated the capacity of EDs and emergency medical services in many communities. The resulting phenomenon, commonly referred to as ED overcrowding, now threatens access to emergency services for those who need them the most. As managers of the pediatric medical home and advocates for children and optimal pediatric health care, there is a very important role for pediatricians and the American Academy of Pediatrics in guiding health policy decision-makers toward effective solutions that promote the medical home and timely access to emergency care. (9/04, reaffirmed 5/07, 6/11)

OVERUSE INJURIES, OVERTRAINING, AND BURNOUT IN CHILD AND ADOLESCENT ATHLETES (CLINICAL REPORT)

Joel S. Brenner, MD, MPH, and Council on Sports Medicine and Fitness

ABSTRACT. Overuse is one of the most common etiologic factors that lead to injuries in the pediatric and adolescent athlete. As more children are becoming involved in organized and recreational athletics, the incidence of overuse injuries is increasing. Many children are participating in sports year-round and sometimes on multiple teams simultaneously. This overtraining can lead to burnout, which may have a detrimental effect on the child participating in sports as a lifelong healthy activity. One contributing factor to overtraining may be parental pressure to compete and succeed. The purpose of this clinical report is to assist pediatricians in identifying and counseling at-risk children and their families. This report supports the American Academy of Pediatrics policy statement on intensive training and sport specialization. (6/07, reaffirmed 3/11)

PALLIATIVE CARE FOR CHILDREN

Committee on Bioethics and Committee on Hospital Care

ABSTRACT. This statement presents an integrated model for providing palliative care for children living with a life-threatening or terminal condition. Advice on the development of a palliative care plan and on working with parents and children is also provided. Barriers to the provision of effective pediatric palliative care and potential solutions are identified. The American Academy of Pediatrics recommends the development and broad availability of pediatric palliative care services based on child-specific guidelines and standards. Such services will require widely distributed and effective palliative care education of pediatric health care professionals. The Academy offers guidance on responding to requests for hastening death, but does not support the practice of physician-assisted suicide or euthanasia for children. (8/00, reaffirmed 6/03, 10/06, 2/12)

PARENT-PROVIDER-COMMUNITY PARTNERSHIPS: OPTIMIZING OUTCOMES FOR CHILDREN WITH DISABILITIES (CLINICAL REPORT)

Nancy A. Murphy, MD; Paul S. Carbone, MD; and Council on Children With Disabilities

ABSTRACT. Children with disabilities and their families have multifaceted medical, developmental, educational, and habilitative needs that are best addressed through strong partnerships among parents, providers, and communities. However, traditional health care systems are designed to address acute rather than chronic conditions. Children with disabilities require high-quality medical homes that provide care coordination and transitional care, and their families require social and financial supports. Integrated community systems of care that promote participation of all children are needed. The purpose of this clinical report is to explore the challenges of developing effective community-based systems of care and to offer suggestions to pediatricians and policy-makers regarding the development of partnerships among children with disabilities, their families, and health care and other providers to maximize health and well-being of these children and their families. (9/11)

PARENTAL LEAVE FOR RESIDENTS AND PEDIATRIC TRAINING PROGRAMS

Section on Medical Students, Residents, and Fellowship Trainees and Committee on Early Childhood

ABSTRACT. The American Academy of Pediatrics (AAP) is committed to the development of rational, equitable, and effective parental leave policies that are sensitive to the needs of pediatric residents, families, and developing infants and that enable parents to spend adequate and good-quality time with their young children. It is important for each residency program to have a policy for parental leave that is written, that is accessible to residents, and that clearly delineates program practices regarding parental leave. At a minimum, a parental leave policy for residents and fellows should conform legally with the Family Medical Leave Act as well as with respective state laws and should meet institutional requirements of the Accreditation Council for Graduate Medical Education for accredited programs. Policies should be well formulated and communicated in a culturally sensitive manner. The AAP advocates for extension of benefits consistent with the Family Medical Leave Act to all residents and interns beginning at the time that pediatric residency training begins. The AAP recommends that regardless of gender, residents who become parents should be guaranteed 6 to 8 weeks, at a minimum, of parental leave with pay after the infant's birth. In addition, in conformance with federal law, the resident should be allowed to extend the leave time when necessary by using paid vacation time or leave without pay. Coparenting, adopting, or fostering of a child should entitle the resident, regardless of gender, to the same amount of paid leave (6–8 weeks) as a person who takes maternity/paternity leave. Flexibility, creativity, and advanced planning are necessary to arrange schedules that optimize resident education and experience, cultivate equity in sharing workloads, and protect pregnant residents from overly strenuous work experiences at critical times of their pregnancies. (1/13)

See full text on page 793.

PATIENT- AND FAMILY-CENTERED CARE OF CHILDREN IN THE EMERGENCY DEPARTMENT (TECHNICAL REPORT)

Patricia J. O'Malley, MD; Kathleen Brown, MD; Steven E. Krug, MD; and Committee on Pediatric Emergency Medicine

ABSTRACT. Patient- and family-centered care is an innovative approach to the planning, delivery, and evaluation of health care that is grounded in a mutually beneficial partnership among patients, families, and health care professionals. Providing patient- and family-centered care to children in the emergency department setting presents many opportunities and challenges. This technical report draws on previously published policy statements and reports, reviews the current literature, and describes the present state of practice and research regarding patient- and family-centered care for children in the emergency department setting as well as some of the complexities of providing such care. This technical report has been endorsed by the Academic Pediatric Association (formerly the Ambulatory Pediatric Association), the American College of Osteopathic Emergency Physicians, the National Association of Emergency Medical Technicians, the Institute for Family-Centered Care, and the American College of Emergency Physicians. This report is also supported by the Emergency Nurses Association. (8/08)

PATIENT- AND FAMILY-CENTERED CARE AND THE PEDIATRICIAN'S ROLE

Committee on Hospital Care and Institute for Patient- and Family-Centered Care

ABSTRACT. Drawing on several decades of work with families, pediatricians, other health care professionals, and policy makers, the American Academy of Pediatrics provides a definition of patient- and family-centered care. In pediatrics, patient- and family-centered care is based on the understanding that the family is the child's primary source of strength and support. Further, this approach to care recognizes that the perspectives and information provided by families, children, and young adults are essential components of high-quality clinical decision-making, and that patients and family are integral partners with the health care team. This policy statement outlines the core principles of patient- and family-centered care, summarizes some of the recent literature linking patient- and family-centered care to improved health outcomes, and lists various other benefits to be expected when engaging in patient- and family-centered pediatric practice. The statement concludes with specific recommendations for how pediatricians can integrate patient- and family-centered care in hospitals, clinics, and community settings, and in broader systems of care, as well. (1/12)

PATIENT- AND FAMILY-CENTERED CARE AND THE ROLE OF THE EMERGENCY PHYSICIAN PROVIDING CARE TO A CHILD IN THE EMERGENCY DEPARTMENT

Committee on Pediatric Emergency Medicine (joint with American College of Emergency Physicians)

ABSTRACT. Patient- and family-centered care is an approach to health care that recognizes the role of the family in providing medical care; encourages collaboration between the patient, family, and health care professionals; and honors individual and family strengths, cultures, traditions, and expertise. Although there are many opportunities for providing patient- and family-centered care in the emergency department, there are also challenges to doing so. The American Academy of Pediatrics and the American College of Emergency Physicians support promoting patient dignity, comfort, and autonomy; recognizing the patient and family as key decision-makers in the patient's medical care; recognizing the patient's experience and perspective in a culturally sensitive manner; acknowledging the interdependence of child and parent as well as the pediatric patient's evolving independence; encouraging family-member presence; providing information to the family during interventions; encouraging collaboration with other health care professionals; acknowledging the importance of the patient's medical home; and encouraging institutional policies for patient- and family-centered care. (11/06, reaffirmed 6/09, 10/11)

PATIENT SAFETY IN THE PEDIATRIC EMERGENCY CARE SETTING

Committee on Pediatric Emergency Medicine

ABSTRACT. Patient safety is a priority for all health care professionals, including those who work in emergency care. Unique aspects of pediatric care may increase the risk of medical error and harm to patients, especially in the emergency care setting. Although errors can happen despite the best human efforts, given the right set of circumstances, health care professionals must work proactively to improve safety in the pediatric emergency care system. Specific recommendations to improve pediatric patient safety in the emergency department are provided in this policy statement. (12/07, reaffirmed 6/11)

PAYMENT FOR TELEPHONE CARE

Section on Telephone Care and Committee on Child Health Financing

ABSTRACT. Telephone care in pediatrics requires medical judgment, is associated with practice expense and medical liability risk, and can often substitute for more costly face-to-face care. Despite this, physicians are infrequently paid by patients or third-party payors for medical services provided by telephone. As the costs of maintaining a practice continue to increase, pediatricians are increasingly seeking payment for the time and work involved in telephone care. This statement reviews the role of telephone care in pediatric practice, the current state of payment for telephone care, and the practical issues associated with charging for telephone care services, a service traditionally provided gratis to patients and families. Specific recommendations are presented for appropriate documenting, reporting, and billing for telephone care services. (10/06)

PEDESTRIAN SAFETY

Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Each year, approximately 900 pediatric pedestrians younger than 19 years are killed. In addition, 51000 children are injured as pedestrians, and 5300 of them are hospitalized because of their injuries. Parents should be warned that young children often do not have the cognitive, perceptual, and behavioral abilities to negotiate traffic independently. Parents should also be informed about the danger of vehicle back-over injuries to toddlers playing in driveways. Because posttraumatic stress syndrome commonly follows even minor pedestrian injury, pediatricians should screen and refer for this condition as necessary. The American Academy of Pediatrics supports community- and school-based strategies that minimize a child's exposure to traffic, especially to high-speed, high-volume traffic. Furthermore, the American Academy of Pediatrics supports governmental and industry action that would lead to improvements in vehicle design, driver manuals, driver education, and data collection for the purpose of reducing pediatric pedestrian injury. (7/09, reaffirmed 8/13)

PEDIATRIC AND ADOLESCENT MENTAL HEALTH EMERGENCIES IN THE EMERGENCY MEDICAL SERVICES SYSTEM (TECHNICAL REPORT)

Margaret A. Dolan, MD; Joel A. Fein, MD, MPH; and Committee on Pediatric Emergency Medicine

ABSTRACT. Emergency department (ED) health care professionals often care for patients with previously diagnosed psychiatric illnesses who are ill, injured, or having a behavioral crisis. In addition, ED personnel encounter children with psychiatric illnesses who may not present to the ED with overt mental health symptoms. Staff education and training regarding identification and management of pediatric mental health illness can help EDs overcome the perceived limitations of the setting that influence timely and comprehensive evaluation. In addition, ED physicians can inform and advocate for policy changes at local, state, and national levels that are needed to ensure comprehensive care of children with mental health illnesses. This report addresses the roles that the ED and ED health care professionals play in emergency mental health care of children and adolescents in the United States, which includes the stabilization and management of patients in mental health crisis, the discovery of mental illnesses and suicidal ideation in ED patients, and approaches to advocating for improved recognition and treatment of mental illnesses in children. The report also addresses special issues related to mental illness in the ED, such as minority populations, children with special health care needs, and children's mental health during and after disasters and trauma. (4/11)

PEDIATRIC ASPECTS OF INPATIENT HEALTH INFORMATION TECHNOLOGY SYSTEMS (TECHNICAL REPORT)

George R. Kim; Christoph U. Lehmann, MD; and Council on Clinical Information Technology

ABSTRACT. US adoption of health information technology as a path to improved quality of patient care (effectiveness, safety, timeliness, patient-centeredness,

efficiency, and equity) has been promoted by the medical community. Children and infants (especially those with special health care needs) are at higher risk than are adults for medical errors and their consequences (particularly in environments in which children are not the primary patient population). However, development and adoption of health information technology tools and practices that promote pediatric quality and patient safety are lagging. Two inpatient clinical processes—medication delivery and patient care transitions—are discussed in terms of health information technology applications that support them and functions that are important to pediatric quality and safety. Pediatricians and their partners (pediatric nurses, pharmacists, etc) must develop awareness of technical and adaptive issues in adopting these tools and collaborate with organizational leaders and developers as advocates for the best interests and safety of pediatric patients. Pediatric health information technology adoption cannot be considered in terms of applications (such as electronic health records or computerized physician order entry) alone but must be considered globally in terms of technical (health information technology applications), organizational (structures and workflows of care), and cultural (stakeholders) aspects of what is best. (12/08)

PEDIATRIC CARE RECOMMENDATIONS FOR FREESTANDING URGENT CARE FACILITIES

Committee on Pediatric Emergency Medicine

ABSTRACT. Freestanding urgent care centers are not emergency departments or medical homes, yet they are sometimes used as a source of pediatric care. The purpose of this policy statement is to provide updated and expanded recommendations for ensuring appropriate stabilization in pediatric emergency situations and timely and appropriate transfer to a hospital for definitive care when necessary. (7/05, reaffirmed 1/09, 6/11)

PEDIATRIC FELLOWSHIP TRAINING

Federation of Pediatric Organizations (7/04)

PEDIATRIC MENTAL HEALTH EMERGENCIES IN THE EMERGENCY MEDICAL SERVICES SYSTEM

Committee on Pediatric Emergency Medicine (joint with American College of Emergency Physicians)

ABSTRACT. Emergency departments are vital in the management of pediatric patients with mental health emergencies. Pediatric mental health emergencies are an increasing part of emergency medical practice because emergency departments have become the safety net for a fragmented mental health infrastructure that is experiencing critical shortages in services in all sectors. Emergency departments must safely, humanely, and in a culturally and developmentally appropriate manner manage pediatric patients with undiagnosed and known mental illnesses, including those with mental retardation, autistic spectrum disorders, and attention-deficit/hyperactivity disorder and those experiencing a behavioral crisis. Emergency departments also manage patients with suicidal ideation, depression, escalating aggression, substance abuse, posttraumatic stress disorder, and maltreatment and those exposed to violence and unexpected deaths. Emergency departments must address not only the physical but also the mental health needs of patients during and after mass-casualty incidents and disasters. The American Academy of Pediatrics and the American College of Emergency Physicians support advocacy for increased mental health resources, including improved pediatric mental health tools for the emergency department, increased mental health insurance coverage, and adequate reimbursement at all levels; acknowledgment of the importance of the child's medical home; and promotion of education and research for mental health emergencies. (10/06, reaffirmed 6/09, 4/13)

PEDIATRIC OBSERVATION UNITS (CLINICAL REPORT)

Gregory P. Conners, MD, MPH, MBA; Sanford M. Melzer, MD, MBA; Committee on Hospital Care; and Committee on Pediatric Emergency Medicine

ABSTRACT. Pediatric observation units (OUs) are hospital areas used to provide medical evaluation and/or management for health-related conditions in children, typically for a well-defined, brief period. Pediatric OUs represent an emerging alternative site of care for selected groups of children who historically may have received their treatment in an ambulatory setting, emergency department, or hospital-based inpatient unit. This clinical report provides an overview of pediatric OUs, including the definitions and operating characteristics of different types of OUs, quality considerations and coding for observation services, and the effect of OUs on inpatient hospital utilization. (6/12)

PEDIATRIC ORGAN DONATION AND TRANSPLANTATION

Committee on Hospital Care, Section on Surgery, and Section on Critical Care

ABSTRACT. Pediatric organ donation and organ transplantation can have a significant life-extending benefit to the young recipients of these organs and a high emotional impact on donor and recipient families. Pediatricians, pediatric medical specialists, and pediatric transplant surgeons need to be better acquainted with evolving national strategies that involve organ procurement and organ transplantation to help acquaint families with the benefits and risks of organ donation and transplantation. Efforts of pediatric professionals are needed to shape public policies to provide a system in which procurement, distribution, and cost are fair and equitable to children and adults. Major issues of concern are availability of and access to donor organs; oversight and control of the process; pediatric medical and surgical consultation and continued care throughout the organ-donation and transplantation process; ethical, social, financial, and follow-up issues; insurance-coverage issues; and public awareness of the need for organ donors of all ages. (3/10)

PEDIATRIC PALLIATIVE CARE AND HOSPICE CARE COMMITMENTS, GUIDELINES, AND RECOMMENDATIONS

Section on Hospice and Palliative Medicine and Committee on Hospital Care

ABSTRACT. Pediatric palliative care and pediatric hospice care (PPC-PHC) are often essential aspects of medical care for patients who have life-threatening conditions or

need end-of-life care. PPC-PHC aims to relieve suffering, improve quality of life, facilitate informed decision-making, and assist in care coordination between clinicians and across sites of care. Core commitments of PPC-PHC include being patient centered and family engaged; respecting and partnering with patients and families; pursuing care that is high quality, readily accessible, and equitable; providing care across the age spectrum and life span, integrated into the continuum of care; ensuring that all clinicians can provide basic palliative care and consult PPC-PHC specialists in a timely manner; and improving care through research and quality improvement efforts. PPC-PHC guidelines and recommendations include ensuring that all large health care organizations serving children with life-threatening conditions have dedicated interdisciplinary PPC-PHC teams, which should develop collaborative relationships between hospital- and community-based teams; that PPC-PHC be provided as integrated multimodal care and practiced as a cornerstone of patient safety and quality for patients with life-threatening conditions; that PPC-PHC teams should facilitate clear, compassionate, and forthright discussions about medical issues and the goals of care and support families, siblings, and health care staff; that PPC-PHC be part of all pediatric education and training curricula, be an active area of research and quality improvement, and exemplify the highest ethical standards; and that PPC-PHC services be supported by financial and regulatory arrangements to ensure access to high-quality PPC-PHC by all patients with life-threatening and life-shortening diseases. (10/13)

See full text on page 799.

PEDIATRIC PRIMARY HEALTH CARE

Committee on Pediatric Workforce (11/93, reaffirmed 6/01 *AAP News,* 1/05, 10/07, 9/10)

PEDIATRIC SUDDEN CARDIAC ARREST

Section on Cardiology and Cardiac Surgery

ABSTRACT. Pediatric sudden cardiac arrest (SCA), which can cause sudden cardiac death if not treated within minutes, has a profound effect on everyone: children, parents, family members, communities, and health care providers. Preventing the tragedy of pediatric SCA, defined as the abrupt and unexpected loss of heart function, remains a concern to all. The goal of this statement is to increase the knowledge of pediatricians (including primary care providers and specialists) of the incidence of pediatric SCA, the spectrum of causes of pediatric SCA, disease-specific presentations, the role of patient and family screening, the rapidly evolving role of genetic testing, and finally, important aspects of secondary SCA prevention. This statement is not intended to address sudden infant death syndrome or sudden unexplained death syndrome, nor will specific treatment of individual cardiac conditions be discussed. This statement has been endorsed by the American College of Cardiology, the American Heart Association, and the Heart Rhythm Society. (3/12)

THE PEDIATRICIAN AND CHILDHOOD BEREAVEMENT

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. Pediatricians should understand and evaluate children's reactions to the death of a person important to them by using age-appropriate and culturally sensitive guidance while being alert for normal and complicated grief responses. Pediatricians also should advise and assist families in responding to the child's needs. Sharing, family support, and communication have been associated with positive long-term bereavement adjustment. (2/00, reaffirmed 1/04, 3/13)

THE PEDIATRICIAN AND DISASTER PREPAREDNESS

Committee on Pediatric Emergency Medicine, Committee on Medical Liability, and Task Force on Terrorism

ABSTRACT. Recent natural disasters and events of terrorism and war have heightened society's recognition of the need for emergency preparedness. In addition to the unique pediatric issues involved in general emergency preparedness, several additional issues related to terrorism preparedness must be considered, including the unique vulnerabilities of children to various agents as well as the limited availability of age- and weight-appropriate antidotes and treatments. Although children may respond more rapidly to therapeutic intervention, they are at the same time more susceptible to various agents and conditions and more likely to deteriorate if not monitored carefully.

The challenge of dealing with the threat of terrorism, natural disasters, and public health emergencies in the United States is daunting not only for disaster planners but also for our medical system and health professionals of all types, including pediatricians. As part of the network of health responders, pediatricians need to be able to answer concerns of patients and families, recognize signs of possible exposure to a weapon of terror, understand first-line response to such attacks, and sufficiently participate in disaster planning to ensure that the unique needs of children are addressed satisfactorily in the overall process. Pediatricians play a central role in disaster and terrorism preparedness with families, children, and their communities. This applies not only to the general pediatrician but also to the pediatric medical subspecialist and pediatric surgical specialist. Families view pediatricians as their expert resource, and most of them expect the pediatrician to be knowledgeable in areas of concern. Providing expert guidance entails educating families in anticipation of events and responding to questions during and after actual events. It is essential that pediatricians educate themselves regarding these issues of emergency preparedness.

For pediatricians, some information is currently available on virtually all of these issues in recently produced printed materials, at special conferences, in broadcasts of various types, and on the Internet. However, selecting appropriate, accurate sources of information and determining how much information is sufficient remain difficult challenges. Similarly, guidance is needed with respect to developing relevant curricula for medical students and postdoctoral clinical trainees. (2/06, reaffirmed 6/09, 9/13)

PEDIATRICIAN-FAMILY-PATIENT RELATIONSHIPS: MANAGING THE BOUNDARIES

Committee on Bioethics

ABSTRACT. All professionals are concerned about maintaining the appropriate limits in their relationships with those they serve. Pediatricians should be aware that, under normal circumstances, caring for one's own children presents significant ethical issues. Pediatricians also must strive to maintain appropriate professional boundaries in their relationships with the family members of their patients. Pediatricians should avoid behavior that patients and parents might misunderstand as having sexual or inappropriate social meaning. Romantic and sexual involvement between physicians and patients is unacceptable. The acceptance of gifts or nonmonetary compensation for medical services has the potential to affect the professional relationship adversely. (11/09)

THE PEDIATRICIAN WORKFORCE: CURRENT STATUS AND FUTURE PROSPECTS (TECHNICAL REPORT)

David C. Goodman, MD, MS, and Committee on Pediatric Workforce

ABSTRACT. The effective and efficient delivery of children's health care depends on the pediatrician workforce. The number, composition, and distribution of pediatricians necessary to deliver this care have been the subject of long-standing policy and professional debate. This technical report reviews current characteristics and recent trends in the pediatric workforce and couples the workforce to a conceptual model of improvement in children's health and well-being. Important recent changes in the workforce include (1) the growth in the number of pediatricians in relation to the child population, (2) increased numbers of female pediatricians and their attainment of majority gender status in the specialty, (3) the persistence of a large number of international medical graduates entering training programs, (4) a lack of ethnic and racial diversity in pediatricians compared with children, and (5) the persistence of marked regional variation in pediatrician supply. Supply models projecting the pediatric workforce are reviewed and generally indicate that the number of pediatricians per child will increase by 50% over the next 20 years. The differing methods of assessing workforce requirements are presented and critiqued. The report finds that the pediatric workforce is undergoing fundamental changes that will have important effects on the professional lives of pediatricians and children's health care delivery. (7/05)

PEDIATRICIAN WORKFORCE POLICY STATEMENT

Committee on Pediatric Workforce

ABSTRACT. This policy statement reviews important trends and other factors that affect the pediatrician workforce and the provision of pediatric health care, including changes in the pediatric patient population, pediatrician workforce, and nature of pediatric practice. The effect of these changes on pediatricians and the demand for pediatric care are discussed. The American Academy of Pediatrics (AAP) concludes that there is currently a shortage of pediatric medical subspecialists in many fields, as well as a shortage of pediatric surgical specialists. In addition, the AAP believes that the current distribution of primary care pediatricians is inadequate to meet the needs of children living in rural and other underserved areas, and more primary care pediatricians will be needed in the future because of the increasing number of children who have significant chronic health problems, changes in physician work hours, and implementation of current health reform efforts that seek to improve access to comprehensive patient- and family-centered care for all children in a medical home. The AAP is committed to being an active participant in physician workforce policy development with both professional organizations and governmental bodies to ensure a pediatric perspective on health care workforce issues. The overall purpose of this statement is to summarize policy recommendations and serve as a resource for the AAP and other stakeholders as they address pediatrician workforce issues that ultimately influence the quality of pediatric health care provided to children in the United States. (7/13)

See full text on page 809.

THE PEDIATRICIAN'S ROLE IN CHILD MALTREATMENT PREVENTION (CLINICAL REPORT)

Emalee G. Flaherty, MD; John Stirling Jr, MD; and Committee on Child Abuse and Neglect

ABSTRACT. It is the pediatrician's role to promote the child's well-being and to help parents raise healthy, well-adjusted children. Pediatricians, therefore, can play an important role in the prevention of child maltreatment. Previous clinical reports and policy statements from the American Academy of Pediatrics have focused on improving the identification and management of child maltreatment. This clinical report outlines how the pediatrician can help to strengthen families and promote safe, stable, nurturing relationships with the aim of preventing maltreatment. After describing some of the triggers and factors that place children at risk for maltreatment, the report describes how pediatricians can identify family strengths, recognize risk factors, provide helpful guidance, and refer families to programs and other resources with the goal of strengthening families, preventing child maltreatment, and enhancing child development. (9/10)

THE PEDIATRICIAN'S ROLE IN COMMUNITY PEDIATRICS

Committee on Community Health Services

ABSTRACT. This policy statement reaffirms the pediatrician's role in community pediatrics. It offers pediatricians a definition of community pediatrics and provides a set of specific recommendations that underscore the critical nature of this important dimension of the profession. (4/05, reaffirmed 1/10)

THE PEDIATRICIAN'S ROLE IN DEVELOPMENT AND IMPLEMENTATION OF AN INDIVIDUAL EDUCATION PLAN (IEP) AND/OR AN INDIVIDUAL FAMILY SERVICE PLAN (IFSP)

Committee on Children With Disabilities

ABSTRACT. The Individual Education Plan and Individual Family Service Plan are legally mandated documents developed by a multidisciplinary team assessment that specifies goals and services for each child eligible for special educational services or early intervention services.

Pediatricians need to be knowledgeable of federal, state, and local requirements; establish linkages with early intervention, educational professionals, and parent support groups; and collaborate with the team working with individual children. (7/99, reaffirmed 11/02, 1/06)

THE PEDIATRICIAN'S ROLE IN FAMILY SUPPORT AND FAMILY SUPPORT PROGRAMS

Committee on Early Childhood, Adoption, and Dependent Care

ABSTRACT. Children's social, emotional, and physical health; their developmental trajectory; and the neurocircuits that are being created and reinforced in their developing brains are all directly influenced by their relationships during early childhood. The stresses associated with contemporary American life can challenge families' abilities to promote successful developmental outcomes and emotional health for their children. Pediatricians are positioned to serve as partners with families and other community providers in supporting the well-being of children and their families. The structure and support of families involve forces that are often outside the agenda of the usual pediatric health supervision visits. Pediatricians must ensure that their medical home efforts promote a holistically healthy family environment for all children. This statement recommends opportunities for pediatricians to develop their expertise in assessing the strengths and stresses in families, in counseling families about strategies and resources, and in collaborating with others in their communities to support family relationships. (11/11)

THE PEDIATRICIAN'S ROLE IN THE PREVENTION OF MISSING CHILDREN (CLINICAL REPORT)

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. In 2002, the *Second National Incidence Studies of Missing, Abducted, Runaway, and Thrownaway Children* report was released by the US Department of Justice, providing new data on a problem that our nation continues to face. This clinical report describes the categories of missing children, the prevalence of each, and prevention strategies that primary care pediatricians can share with parents to increase awareness and education about the safety of their children. (10/04)

THE PEDIATRICIAN'S ROLE IN SUPPORTING ADOPTIVE FAMILIES (CLINICAL REPORT)

Veronnie F. Jones, MD, PhD; Elaine E. Schulte, MD, MPH; Committee on Early Childhood; and Council on Foster Care, Adoption, and Kinship Care

ABSTRACT. Each year, more children join families through adoption. Pediatricians have an important role in assisting adoptive families in the various challenges they may face with respect to adoption. The acceptance of the differences between families formed through birth and those formed through adoption is essential in promoting positive emotional growth within the family. It is important for pediatricians to be aware of the adoptive parents' need to be supported in their communication with their adopted children. (9/12)

PERSONAL WATERCRAFT USE BY CHILDREN AND ADOLESCENTS

Committee on Injury and Poison Prevention

ABSTRACT. The use of personal watercraft (PWC) has increased dramatically during the past decade as have the speed and mobility of the watercraft. A similar dramatic increase in PWC-related injury and death has occurred simultaneously. No one younger than 16 years should operate a PWC. The operator and all passengers must wear US Coast Guard-approved personal flotation devices. Other safety recommendations are suggested for parents and pediatricians. (2/00, reaffirmed 5/04, 1/07, 6/10)

PESTICIDE EXPOSURE IN CHILDREN

Council on Environmental Health

ABSTRACT. This statement presents the position of the American Academy of Pediatrics on pesticides. Pesticides are a collective term for chemicals intended to kill unwanted insects, plants, molds, and rodents. Children encounter pesticides daily and have unique susceptibilities to their potential toxicity. Acute poisoning risks are clear, and understanding of chronic health implications from both acute and chronic exposure are emerging. Epidemiologic evidence demonstrates associations between early life exposure to pesticides and pediatric cancers, decreased cognitive function, and behavioral problems. Related animal toxicology studies provide supportive biological plausibility for these findings. Recognizing and reducing problematic exposures will require attention to current inadequacies in medical training, public health tracking, and regulatory action on pesticides. Ongoing research describing toxicologic vulnerabilities and exposure factors across the life span are needed to inform regulatory needs and appropriate interventions. Policies that promote integrated pest management, comprehensive pesticide labeling, and marketing practices that incorporate child health considerations will enhance safe use. (11/12)

PESTICIDE EXPOSURE IN CHILDREN (TECHNICAL REPORT)

James R. Roberts, MD, MPH; Catherine J. Karr, MD, PhD; and Council on Environmental Health

ABSTRACT. Pesticides are a collective term for a wide array of chemicals intended to kill unwanted insects, plants, molds, and rodents. Food, water, and treatment in the home, yard, and school are all potential sources of children's exposure. Exposures to pesticides may be overt or subacute, and effects range from acute to chronic toxicity. In 2008, pesticides were the ninth most common substance reported to poison control centers, and approximately 45% of all reports of pesticide poisoning were for children. Organophosphate and carbamate poisoning are perhaps the most widely known acute poisoning syndromes, can be diagnosed by depressed red blood cell cholinesterase levels, and have available antidotal therapy. However, numerous other pesticides that may cause acute toxicity, such as pyrethroid and neonicotinoid insecticides, herbicides, fungicides, and rodenticides, also have specific toxic effects; recognition of these effects may help identify acute exposures. Evidence is increasingly

emerging about chronic health implications from both acute and chronic exposure. A growing body of epidemiological evidence demonstrates associations between parental use of pesticides, particularly insecticides, with acute lymphocytic leukemia and brain tumors. Prenatal, household, and occupational exposures (maternal and paternal) appear to be the largest risks. Prospective cohort studies link early-life exposure to organophosphates and organochlorine pesticides (primarily DDT) with adverse effects on neurodevelopment and behavior. Among the findings associated with increased pesticide levels are poorer mental development by using the Bayley index and increased scores on measures assessing pervasive developmental disorder, inattention, and attention-deficit/hyperactivity disorder. Related animal toxicology studies provide supportive biological plausibility for these findings. Additional data suggest that there may also be an association between parental pesticide use and adverse birth outcomes including physical birth defects, low birth weight, and fetal death, although the data are less robust than for cancer and neurodevelopmental effects. Children's exposures to pesticides should be limited as much as possible. (11/12)

PHOTOTHERAPY TO PREVENT SEVERE NEONATAL HYPERBILIRUBINEMIA IN THE NEWBORN INFANT 35 OR MORE WEEKS OF GESTATION (TECHNICAL REPORT)

Vinod K. Bhutani, MD, and Committee on Fetus and Newborn

ABSTRACT. *Objective.* To standardize the use of phototherapy consistent with the American Academy of Pediatrics clinical practice guideline for the management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation.

Methods. Relevant literature was reviewed. Phototherapy devices currently marketed in the United States that incorporate fluorescent, halogen, fiber-optic, or blue light-emitting diode light sources were assessed in the laboratory.

Results. The efficacy of phototherapy units varies widely because of differences in light source and configuration. The following characteristics of a device contribute to its effectiveness: (1) emission of light in the blue-to-green range that overlaps the in vivo plasma bilirubin absorption spectrum (~460–490 nm); (2) irradiance of at least 30 $\mu W \cdot cm^{-2} \cdot nm^{-1}$ (confirmed with an appropriate irradiance meter calibrated over the appropriate wavelength range); (3) illumination of maximal body surface; and (4) demonstration of a decrease in total bilirubin concentrations during the first 4 to 6 hours of exposure.

Recommendations. The intensity and spectral output of phototherapy devices is useful in predicting potential effectiveness in treating hyperbilirubinemia (group B recommendation). Clinical effectiveness should be evaluated before and monitored during use (group B recommendation). Blocking the light source or reducing exposed body surface should be avoided (group B recommendation). Standardization of irradiance meters, improvements in device design, and lower-upper limits of light intensity for phototherapy units merit further study. Comparing the in vivo performance of devices is not practical, in general, and alternative procedures need to be explored. (9/11)

PHYSICIAN REFUSAL TO PROVIDE INFORMATION OR TREATMENT ON THE BASIS OF CLAIMS OF CONSCIENCE

Committee on Bioethics

ABSTRACT. Health care professionals may have moral objections to particular medical interventions. They may refuse to provide or cooperate in the provision of these interventions. Such objections are referred to as conscientious objections. Although it may be difficult to characterize or validate claims of conscience, respecting the individual physician's moral integrity is important. Conflicts arise when claims of conscience impede a patient's access to medical information or care. A physician's conscientious objection to certain interventions or treatments may be constrained in some situations. Physicians have a duty to disclose to prospective patients treatments they refuse to perform. As part of informed consent, physicians also have a duty to inform their patients of all relevant and legally available treatment options, including options to which they object. They have a moral obligation to refer patients to other health care professionals who are willing to provide those services when failing to do so would cause harm to the patient, and they have a duty to treat patients in emergencies when referral would significantly increase the probability of mortality or serious morbidity. Conversely, the health care system should make reasonable accommodations for physicians with conscientious objections. (11/09)

PHYSICIANS' ROLES IN COORDINATING CARE OF HOSPITALIZED CHILDREN (CLINICAL REPORT)

Patricia S. Lye, MD; Committee on Hospital Care; and Section on Hospital Medicine

ABSTRACT. The care of hospitalized children and adolescents has become increasingly complex and often involves multiple physicians beyond the traditional primary care pediatrician. Hospitalists, medical subspecialists, surgical specialists, and hospital attending physicians may all participate in the care of hospitalized children and youth. This report summarizes the responsibilities of the pediatrician and other involved physicians in ensuring that children receive coordinated and comprehensive medical care delivered within the context of their medical homes as inpatients, and that care is appropriately continued on an outpatient basis. (9/10)

PLANNED HOME BIRTH

Committee on Fetus and Newborn

ABSTRACT. The American Academy of Pediatrics concurs with the recent statement of the American College of Obstetricians and Gynecologists affirming that hospitals and birthing centers are the safest settings for birth in the United States while respecting the right of women to make a medically informed decision about delivery. This statement is intended to help pediatricians provide supportive, informed counsel to women considering home birth while retaining their role as child advocates and to summarize the standards of care for newborn infants born at home, which are consistent with standards for infants born in a medical care facility. Regardless of the circumstances of his or her birth, including location, every newborn infant deserves health care that adheres to the standards

highlighted in this statement, more completely described in other publications from the American Academy of Pediatrics, including *Guidelines for Perinatal Care.* The goal of providing high-quality care to all newborn infants can best be achieved through continuing efforts by all participating health care providers and institutions to develop and sustain communications and understanding on the basis of professional interaction and mutual respect throughout the health care system. (4/13)

See full text on page 819.

POLIOVIRUS

Committee on Infectious Diseases

ABSTRACT. Despite marked progress in global polio eradication, the threat of polio importation into the United States remains; therefore, all children should be protected against the disease. The standard schedule for poliovirus immunization remains 4 doses of inactivated poliovirus vaccine at 2, 4, and 6 through 18 months and 4 through 6 years of age. The minimum interval between doses 1 and 2 and between doses 2 and 3 is 4 weeks, and the minimum interval between doses 3 and 4 is 6 months. The minimum age for dose 1 is 6 weeks. Minimal age and intervals should be used when there is imminent threat of exposure, such as travel to an area in which polio is endemic or epidemic. The final dose in the inactivated poliovirus vaccine series should be administered at 4 through 6 years of age, regardless of the previous number of doses administered before the fourth birthday, and at least 6 months since the last dose was received. (9/11)

POSTDISCHARGE FOLLOW-UP OF INFANTS WITH CONGENITAL DIAPHRAGMATIC HERNIA (CLINICAL REPORT)

Section on Surgery and Committee on Fetus and Newborn

ABSTRACT. Infants with congenital diaphragmatic hernia often require intensive treatment after birth, have prolonged hospitalizations, and have other congenital anomalies. After discharge from the hospital, they may have long-term sequelae such as respiratory insufficiency, gastroesophageal reflux, poor growth, neurodevelopmental delay, behavior problems, hearing loss, hernia recurrence, and orthopedic deformities. Structured follow-up for these patients facilitates early recognition and treatment of these complications. In this report, follow-up of infants with congenital diaphragmatic hernia is outlined. (3/08, reaffirmed 5/11)

POSTEXPOSURE PROPHYLAXIS IN CHILDREN AND ADOLESCENTS FOR NONOCCUPATIONAL EXPOSURE TO HUMAN IMMUNODEFICIENCY VIRUS (CLINICAL REPORT)

Committee on Pediatric AIDS

ABSTRACT. Exposure to human immunodeficiency virus (HIV) can occur in a number of situations unique to, or more common among, children and adolescents. Guidelines for postexposure prophylaxis (PEP) for occupational and nonoccupational (eg, sexual, needle-sharing) exposures to HIV have been published by the US Public Health Service, but they do not directly address nonoccupational HIV exposures unique to children (such as accidental exposure to human milk from a woman infected with HIV or a puncture wound from a discarded needle on a playground), and they do not provide antiretroviral drug information relevant to PEP in children.

This clinical report reviews issues of potential exposure of children and adolescents to HIV and gives recommendations for PEP in those situations. The risk of HIV transmission from nonoccupational, nonperinatal exposure is generally low. Transmission risk is modified by factors related to the source and extent of exposure. Determination of the HIV infection status of the exposure source may not be possible, and data on transmission risk by exposure type may not exist. Except in the setting of perinatal transmission, no studies have demonstrated the safety and efficacy of postexposure use of antiretroviral drugs for the prevention of HIV transmission in nonoccupational settings. Antiretroviral therapy used for PEP is associated with significant toxicity. The decision to initiate prophylaxis needs to be made in consultation with the patient, the family, and a clinician with experience in treatment of persons with HIV infection. If instituted, therapy should be started as soon as possible after an exposure—no later than 72 hours—and continued for 28 days. Many clinicians would use 3 drugs for PEP regimens, although 2 drugs may be considered in certain circumstances. Instruction for avoiding secondary transmission should be given. Careful follow-up is needed for psychologic support, encouragement of medication adherence, toxicity monitoring, and serial HIV antibody testing. (6/03, reaffirmed 1/07, 10/08)

POSTNATAL CORTICOSTEROIDS TO PREVENT OR TREAT BRONCHOPULMONARY DYSPLASIA

Kristi L. Watterberg, MD, and Committee on Fetus and Newborn

ABSTRACT. The purpose of this revised statement is to review current information on the use of postnatal glucocorticoids to prevent or treat bronchopulmonary dysplasia in the preterm infant and to make updated recommendations regarding their use. High-dose dexamethasone (0.5 mg/kg per day) does not seem to confer additional therapeutic benefit over lower doses and is not recommended. Evidence is insufficient to make a recommendation regarding other glucocorticoid doses and preparations. The clinician must use clinical judgment when attempting to balance the potential adverse effects of glucocorticoid treatment with those of bronchopulmonary dysplasia. (9/10)

POSTNATAL GLUCOSE HOMEOSTASIS IN LATE-PRETERM AND TERM INFANTS (CLINICAL REPORT)

David H. Adamkin, MD, and Committee on Fetus and Newborn

ABSTRACT. This report provides a practical guide and algorithm for the screening and subsequent management of neonatal hypoglycemia. Current evidence does not support a specific concentration of glucose that can discriminate normal from abnormal or can potentially result in acute or chronic irreversible neurologic damage. Early identification of the at-risk infant and institution of prophylactic measures to prevent neonatal hypoglycemia are recommended as a pragmatic approach despite the absence of a consistent definition of hypoglycemia in the literature. (3/11)

PRECERTIFICATION PROCESS
Committee on Hospital Care
ABSTRACT. Precertification is a process still used by health insurance companies to control health care costs. Although we believe precertification is unnecessary and not cost-effective, in those instances where precertification is still being utilized, we suggest that the following procedures be adopted. This statement suggests guidelines that should help achieve this goal while allowing optimal access to care for children. (8/00, reaffirmed 5/05, 11/08)

PREMEDICATION FOR NONEMERGENCY ENDOTRACHEAL INTUBATION IN THE NEONATE (CLINICAL REPORT)
Praveen Kumar, MD; Susan E. Denson, MD; Thomas J. Mancuso, MD; Committee on Fetus and Newborn; and Section on Anesthesiology and Pain Medicine
ABSTRACT. Endotracheal intubation is a common procedure in newborn care. The purpose of this clinical report is to review currently available evidence on use of premedication for intubation, identify gaps in knowledge, and provide guidance for making decisions about the use of premedication. (2/10, reaffirmed 8/13)

PRENATAL SUBSTANCE ABUSE: SHORT- AND LONG-TERM EFFECTS ON THE EXPOSED FETUS (TECHNICAL REPORT)
Marylou Behnke, MD; Vincent C. Smith, MD; Committee on Substance Abuse; and Committee on Fetus and Newborn
ABSTRACT. Prenatal substance abuse continues to be a significant problem in this country and poses important health risks for the developing fetus. The primary care pediatrician's role in addressing prenatal substance exposure includes prevention, identification of exposure, recognition of medical issues for the exposed newborn infant, protection of the infant, and follow-up of the exposed infant. This report will provide information for the most common drugs involved in prenatal exposure: nicotine, alcohol, marijuana, opiates, cocaine, and methamphetamine. (2/13)
See full text on page 827.

THE PRENATAL VISIT (CLINICAL REPORT)
George J. Cohen, MD, and Committee on Psychosocial Aspects of Child and Family Health
ABSTRACT. As advocates for children and their families, pediatricians can support and guide expectant parents in the prenatal period. Prenatal visits allow the pediatrician to gather basic information from expectant parents, offer them information and advice, and identify high-risk conditions that may require special care. In addition, a prenatal visit is the first step in establishing a relationship between the family and the pediatrician (the infant's medical home) and in helping the parents develop parenting skills and confidence. There are several possible formats for this first visit. The one used depends on the experience and preference of the parents, the style of the pediatrician's practice, and pragmatic issues of reimbursement. (9/09)

PREPARATION FOR EMERGENCIES IN THE OFFICES OF PEDIATRICIANS AND PEDIATRIC PRIMARY CARE PROVIDERS
Committee on Pediatric Emergency Medicine
ABSTRACT. High-quality pediatric emergency care can be provided only through the collaborative efforts of many health care professionals and child advocates working together throughout a continuum of care that extends from prevention and the medical home to prehospital care, to emergency department stabilization, to critical care and rehabilitation, and finally to a return to care in the medical home. At times, the office of the pediatric primary care provider will serve as the entry site into the emergency care system, which comprises out-of-hospital emergency medical services personnel, emergency department nurses and physicians, and other emergency and critical care providers. Recognizing the important role of pediatric primary care providers in the emergency care system for children and understanding the capabilities and limitations of that system are essential if pediatric primary care providers are to offer the best chance at intact survival for every child who is brought to the office with an emergency. Optimizing pediatric primary care provider office readiness for emergencies requires consideration of the unique aspects of each office practice, the types of patients and emergencies that might be seen, the resources on site, and the resources of the larger emergency care system of which the pediatric primary care provider's office is a part. Parent education regarding prevention, recognition, and response to emergencies, patient triage, early recognition and stabilization of pediatric emergencies in the office, and timely transfer to an appropriate facility for definitive care are important responsibilities of every pediatric primary care provider. In addition, pediatric primary care providers can collaborate with out-of-hospital and hospital-based providers and advocate for the best-quality emergency care for their patients. (7/07, reaffirmed 6/11)

PREPARING FOR PEDIATRIC EMERGENCIES: DRUGS TO CONSIDER (CLINICAL REPORT)
Mary A. Hegenbarth, MD, and Committee on Drugs
ABSTRACT. This clinical report provides current recommendations regarding the selection and use of drugs in preparation for pediatric emergencies. It is not intended to be a comprehensive list of all medications that may be used in all emergencies. When possible, dosage recommendations are consistent with those used in current emergency references such as the *Advanced Pediatric Life Support and Pediatric Advanced Life Support* textbooks and the recently revised American Heart Association resuscitation guidelines. (2/08, reaffirmed 10/11)

PRESCRIBING ASSISTIVE-TECHNOLOGY SYSTEMS: FOCUS ON CHILDREN WITH IMPAIRED COMMUNICATION (CLINICAL REPORT)
Larry W. Desch, MD; Deborah Gaebler-Spira, MD; and Council on Children With Disabilities
ABSTRACT. This clinical report defines common terms of use and provides information on current practice, research, and limitations of assistive technology that can be used in systems for communication. The assessment

process to determine the best devices for use with a particular child (ie, the best fit of a device) is also reviewed. The primary care pediatrician, as part of the medical home, plays an important role in the interdisciplinary effort to provide appropriate assistive technology and may be asked to make a referral for assessment or prescribe a particular device. This report provides resources to assist pediatricians in this role and reviews the interdisciplinary team functional evaluation using standardized assessments; the multiple funding opportunities available for obtaining devices and ways in which pediatricians can assist families with obtaining them; the training necessary to use these systems once the devices are procured; the follow-up evaluation to ensure that the systems are meeting their goals; and the leadership skills needed to advocate for this technology. The American Academy of Pediatrics acknowledges the need for key resources to be identified in the community and recognizes that these resources are a shared medical, educational, therapeutic, and family responsibility. Although this report primarily deals with assistive technology specific for communication impairments, many of the details in this report also can aid in the acquisition and use of other types of assistive technology. (6/08, reaffirmed 1/12)

PRESCRIBING THERAPY SERVICES FOR CHILDREN WITH MOTOR DISABILITIES (CLINICAL REPORT)

Committee on Children With Disabilities

ABSTRACT. Pediatricians often are called on to prescribe physical, occupational, and speech-language therapy services for children with motor disabilities. This report defines the context in which rehabilitation therapies should be prescribed, emphasizing the evaluation and enhancement of the child's function and abilities and participation in age-appropriate life roles. The report encourages pediatricians to work with teams including the parents, child, teachers, therapists, and other physicians to ensure that their patients receive appropriate therapy services. (6/04, reaffirmed 5/07, 5/11)

PRESERVATION OF FERTILITY IN PEDIATRIC AND ADOLESCENT PATIENTS WITH CANCER (TECHNICAL REPORT)

Mary E. Fallat, MD; John Hutter, MD; Committee on Bioethics; Section on Hematology/Oncology; and Section on Surgery

ABSTRACT. Many cancers that present in children and adolescents are curable with surgery, chemotherapy, and/or radiation therapy. Potential adverse consequences of treatment include sterility, infertility, or subfertility as a result of either gonad removal or damage to germ cells from adjuvant therapy. In recent years, treatment of solid tumors and hematologic malignancies has been modified in an attempt to reduce damage to the gonads. Simultaneously, advances in assisted reproductive techniques have led to new possibilities for the prevention and treatment of infertility. This technical report reviews the topic of fertility preservation in pediatric and adolescent patients with cancer, including ethical considerations. (5/08, reaffirmed 2/12)

PREVENTING AND TREATING HOMESICKNESS (CLINICAL REPORT)

Christopher A. Thurber, PhD; Edward Walton, MD; and Council on School Health

ABSTRACT. Homesickness is the distress and functional impairment caused by an actual or anticipated separation from home and attachment objects such as parents. It is characterized by acute longing and preoccupying thoughts of home. Almost all children, adolescents, and adults experience some degree of homesickness when they are apart from familiar people and environments. Pediatricians and other health care professionals are in a unique position to assist families in understanding the etiology, prevention, and treatment of homesickness. In the case of planned separations, such as summer camp, techniques are provided that may aid in prevention. In the case of unanticipated or traumatic separations, such as hospitalization, effective treatment strategies are available. (1/07, reaffirmed 5/12)

PREVENTION OF AGRICULTURAL INJURIES AMONG CHILDREN AND ADOLESCENTS

Committee on Injury and Poison Prevention and Committee on Community Health Services

ABSTRACT. Although the annual number of farm deaths to children and adolescents has decreased since publication of the 1988 American Academy of Pediatrics statement, "Rural Injuries," the rate of nonfatal farm injuries has increased. Approximately 100 unintentional injury deaths occur annually to children and adolescents on US farms, and an additional 22 000 injuries to children younger than 20 years occur on farms. Relatively few adolescents are employed on farms compared with other types of industry, yet the proportion of fatalities in agriculture is higher than that for any other type of adolescent employment. The high mortality and severe morbidity associated with farm injuries require continuing and improved injury-control strategies. This statement provides recommendations for pediatricians regarding patient and community education as well as public advocacy related to agricultural injury prevention in childhood and adolescence. (10/01, reaffirmed 1/07, 11/11)

PREVENTION OF CHOKING AMONG CHILDREN

Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Choking is a leading cause of morbidity and mortality among children, especially those aged 3 years or younger. Food, coins, and toys are the primary causes of choking-related injury and death. Certain characteristics, including shape, size, and consistency, of certain toys and foods increase their potential to cause choking among children. Childhood choking hazards should be addressed through comprehensive and coordinated prevention activities. The US Consumer Product Safety Commission (CPSC) should increase efforts to ensure that toys that are sold in retail store bins, vending machines, or on the Internet have appropriate choking-hazard warnings; work with manufacturers to improve the effectiveness of recalls of products that pose a choking risk to children; and increase efforts to prevent the resale of these recalled products via online auction sites. Current gaps in choking-prevention standards for children's toys should

be reevaluated and addressed, as appropriate, via revisions to the standards established under the Child Safety Protection Act, the Consumer Product Safety Improvement Act, or regulation by the CPSC. Prevention of food-related choking among children in the United States has been inadequately addressed at the federal level. The US Food and Drug Administration should establish a systematic, institutionalized process for examining and addressing the hazards of food-related choking. This process should include the establishment of the necessary surveillance, hazard evaluation, enforcement, and public education activities to prevent food-related choking among children. While maintaining its highly cooperative arrangements with the CPSC and the US Department of Agriculture, the Food and Drug Administration should have the authority to address choking-related risks of all food products, including meat products that fall under the jurisdiction of the US Department of Agriculture. The existing National Electronic Injury Surveillance System–All Injury Program of the CPSC should be modified to conduct more-detailed surveillance of choking on food among children. Food manufacturers should design new foods and redesign existing foods to avoid shapes, sizes, textures, and other characteristics that increase choking risk to children, to the extent possible. Pediatricians, dentists, and other infant and child health care providers should provide choking-prevention counseling to parents as an integral part of anticipatory guidance activities. (2/10)

PREVENTION OF DROWNING

Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Drowning is a leading cause of injury-related death in children. In 2006, fatal drowning claimed the lives of approximately 1100 US children younger than 20 years. A number of strategies are available to prevent these tragedies. As educators and advocates, pediatricians can play an important role in the prevention of drowning. (5/10)

PREVENTION OF DROWNING (TECHNICAL REPORT)

Committee on Injury, Violence, and Poison Prevention and Jeffrey Weiss, MD

ABSTRACT. Drowning is a leading cause of injury-related death in children. In 2006, approximately 1100 US children younger than 20 years died from drowning. A number of strategies are available to prevent these tragedies. As educators and advocates, pediatricians can play an important role in the prevention of drowning. (5/10)

PREVENTION AND MANAGEMENT OF PAIN IN THE NEONATE: AN UPDATE

Committee on Fetus and Newborn and Section on Surgery (joint with Canadian Paediatric Society)

ABSTRACT. The prevention of pain in neonates should be the goal of all caregivers, because repeated painful exposures have the potential for deleterious consequences. Neonates at greatest risk of neurodevelopmental impairment as a result of preterm birth (ie, the smallest and sickest) are also those most likely to be exposed to the greatest number of painful stimuli in the NICU. Although there are major gaps in our knowledge regarding the most effective way to prevent and relieve pain in neonates, proven and safe therapies are currently underused for routine minor yet painful procedures. Every health care facility caring for neonates should implement an effective pain-prevention program, which includes strategies for routinely assessing pain, minimizing the number of painful procedures performed, effectively using pharmacologic and nonpharmacologic therapies for the prevention of pain associated with routine minor procedures, and eliminating pain associated with surgery and other major procedures. (11/06, reaffirmed 5/10)

PREVENTION AND MANAGEMENT OF POSITIONAL SKULL DEFORMITIES IN INFANTS (CLINICAL REPORT)

James Laughlin, MD; Thomas G. Luerssen, MD; Mark S. Dias, MD; Committee on Practice and Ambulatory Medicine; and Section on Neurological Surgery

ABSTRACT. Positional skull deformities may be present at birth or may develop during the first few months of life. Since the early 1990s, US pediatricians have seen an increase in the number of children with cranial asymmetry, particularly unilateral flattening of the occiput, likely attributable to parents following the American Academy of Pediatrics "Back to Sleep" positioning recommendations aimed at decreasing the risk of sudden infant death syndrome. Positional skull deformities are generally benign, reversible head-shape anomalies that do not require surgical intervention, as opposed to craniosynostosis, which can result in neurologic damage and progressive craniofacial distortion. Although associated with some risk of positional skull deformity, healthy young infants should be placed down for sleep on their backs. The practice of putting infants to sleep on their backs has been associated with a drastic decrease in the incidence of sudden infant death syndrome. Pediatricians need to be able to properly differentiate infants with benign skull deformities from those with craniosynostosis, educate parents on methods of proactively decreasing the likelihood of the development of occipital flattening, initiate appropriate management, and make referrals when necessary. This report provides guidance for the prevention, diagnosis, and management of positional skull deformity in an otherwise normal infant without evidence of associated anomalies, syndromes, or spinal disease. (11/11)

PREVENTION OF PEDIATRIC OVERWEIGHT AND OBESITY

Committee on Nutrition

ABSTRACT. The dramatic increase in the prevalence of childhood overweight and its resultant comorbidities are associated with significant health and financial burdens, warranting strong and comprehensive prevention efforts. This statement proposes strategies for early identification of excessive weight gain by using body mass index, for dietary and physical activity interventions during health supervision encounters, and for advocacy and research. (8/03, reaffirmed 10/06)

PREVENTION OF ROTAVIRUS DISEASE: UPDATED GUIDELINES FOR USE OF ROTAVIRUS VACCINE

Committee on Infectious Diseases

ABSTRACT. This statement updates and replaces the 2007 American Academy of Pediatrics statement for prevention of rotavirus gastroenteritis. In February 2006, a live oral human-bovine reassortant rotavirus vaccine (RV5 [RotaTeq]) was licensed as a 3-dose series for use in infants in the United States. The American Academy of Pediatrics recommended routine use of RV5 in infants in the United States. In April 2008, a live, oral, human attenuated rotavirus vaccine (RV1 [Rotarix]) was licensed as a 2-dose series for use in infants in the United States. The American Academy of Pediatrics recommends routine immunization of infants in the United States with rotavirus vaccine. The American Academy of Pediatrics does not express a preference for either RV5 or RV1. RV5 is to be administered orally in a 3-dose series with doses administered at 2, 4, and 6 months of age; RV1 is to be administered orally in a 2-dose series with doses administered at 2 and 4 months of age. The first dose of rotavirus vaccine should be administered from 6 weeks through 14 weeks, 6 days of age. The minimum interval between doses of rotavirus vaccine is 4 weeks. All doses should be administered by 8 months, 0 days of age. Recommendations in this statement also address the maximum ages for doses, contraindications, precautions, and special situations for administration of rotavirus vaccine. (3/09)

PREVENTION OF SEXUAL HARASSMENT IN THE WORKPLACE AND EDUCATIONAL SETTINGS

Committee on Pediatric Workforce

ABSTRACT. The American Academy of Pediatrics is committed to working to ensure that workplaces and educational settings in which pediatricians spend time are free of sexual harassment. The purpose of this statement is to heighten awareness and sensitivity to this important issue, recognizing that institutions, clinics, and office-based practices may have existing policies. (10/06, reaffirmed 5/09, 1/12)

PREVENTION AND TREATMENT OF TYPE 2 DIABETES MELLITUS IN CHILDREN, WITH SPECIAL EMPHASIS ON AMERICAN INDIAN AND ALASKA NATIVE CHILDREN (CLINICAL REPORT)

Committee on Native American Child Health and Section on Endocrinology

ABSTRACT. The emergence of type 2 diabetes mellitus in the American Indian/Alaska Native pediatric population presents a new challenge for pediatricians and other health care professionals. This chronic disease requires preventive efforts, early diagnosis, and collaborative care of the patient and family within the context of a medical home. (10/03, reaffirmed 10/08)

THE PREVENTION OF UNINTENTIONAL INJURY AMONG AMERICAN INDIAN AND ALASKA NATIVE CHILDREN: A SUBJECT REVIEW (CLINICAL REPORT)

Committee on Native American Child Health and Committee on Injury and Poison Prevention

ABSTRACT. Among ethnic groups in the United States, American Indian and Alaska Native (AI/AN) children experience the highest rates of injury mortality and morbidity. Injury mortality rates for AI/AN children have decreased during the past quarter century, but remain almost double the rate for all children in the United States. The Indian Health Service (IHS), the federal agency with the primary responsibility for the health care of AI/AN people, has sponsored an internationally recognized injury prevention program designed to reduce the risk of injury death by addressing community-specific risk factors. Model programs developed by the IHS and tribal governments have led to successful outcomes in motor vehicle occupant safety, drowning prevention, and fire safety. Injury prevention programs in tribal communities require special attention to the sovereignty of tribal governments and the unique cultural aspects of health care and communication. Pediatricians working with AI/AN children on reservations or in urban environments are strongly urged to collaborate with tribes and the IHS to create community-based coalitions and develop programs to address highly preventable injury-related mortality and morbidity. Strong advocacy also is needed to promote childhood injury prevention as an important priority for federal agencies and tribes. (12/99, reaffirmed 12/02 COIVPP, 5/03 CONACH, 1/06, 1/09)

PREVENTION OF VARICELLA: UPDATE OF RECOMMENDATIONS FOR USE OF QUADRIVALENT AND MONOVALENT VARICELLA VACCINES IN CHILDREN

Committee on Infectious Diseases

ABSTRACT. Two varicella-containing vaccines are licensed for use in the United States: monovalent varicella vaccine (Varivax [Merck & Co, Inc, West Point, PA]) and quadrivalent measles-mumps-rubella-varicella vaccine (MMRV) (ProQuad [Merck & Co, Inc]). It is estimated from postlicensure data that after vaccination at 12 through 23 months of age, 7 to 9 febrile seizures occur per 10 000 children who receive the MMRV, and 3 to 4 febrile seizures occur per 10 000 children who receive the measles-mumps-rubella (MMR) and varicella vaccines administered concurrently but at separate sites. Thus, 1 additional febrile seizure is expected to occur per approximately 2300 to 2600 children 12 to 23 months old vaccinated with the MMRV, when compared with separate MMR and varicella vaccine administration. The period of risk for febrile seizures is from 5 through 12 days after receipt of the vaccine(s). No increased risk of febrile seizures is seen among patients 4 to 6 years of age receiving MMRV. Febrile seizures do not predispose to epilepsy or neurodevelopmental delays later in life and are not associated with long-term health impairment. The American Academy of Pediatrics recommends that either MMR and varicella vaccines separately or the MMRV be used for the first dose of measles, mumps, rubella, and varicella vac-

cines administered at 12 through 47 months of age. For the first dose of measles, mumps, rubella, and varicella vaccines administered at ages 48 months and older, and for dose 2 at any age (15 months to 12 years), use of MMRV generally is preferred over separate injections of MMR and varicella vaccines. (8/11)

PREVENTIVE ORAL HEALTH INTERVENTION FOR PEDIATRICIANS

Section on Pediatric Dentistry and Oral Health

ABSTRACT. This policy is a compilation of current concepts and scientific evidence required to understand and implement practice-based preventive oral health programs designed to improve oral health outcomes for all children and especially children at significant risk of dental decay. In addition, it reviews cariology and caries risk assessment and defines, through available evidence, appropriate recommendations for preventive oral health intervention by primary care pediatric practitioners. (12/08)

PRINCIPLES FOR THE DEVELOPMENT AND USE OF QUALITY MEASURES

Steering Committee on Quality Improvement and Management and Committee on Practice and Ambulatory Medicine

ABSTRACT. The American Academy of Pediatrics and its members are committed to improving the health care system to provide the highest-quality and safest health care for infants, children, adolescents, and young adults. This statement is intended as a guide for pediatricians and pediatric leadership on the appropriate uses of quality measures and the criteria on which they should be based. The statement summarizes the current national efforts on quality measurement and provides a set of principles for the development, use, and evaluation of quality measures for improving children's health and health care. The American Academy of Pediatrics recommends that these measures address important issues for children; be appropriate for children's health and health care, scientifically valid, and feasible; and focus on what can be improved. In addition, the American Academy of Pediatrics supports reasonable principles for the oversight and implementation of pay-for-performance programs. (2/08)

PRINCIPLES OF HEALTH CARE FINANCING

Committee on Child Health Financing

ABSTRACT. The American Academy of Pediatrics advocates that all children must have health insurance coverage that ensures them access to affordable and comprehensive quality care. Access to care depends on the design and implementation of payment systems that ensure the economic viability of the medical home; support and grow the professional pediatric workforce; promote the adoption and implementation of health information technology; enhance medical education, training, and research; and encourage and reward quality-improvement programs that advance and strengthen the medical home. Health insurance plans must be portable from state to state, with administrative procedures to eliminate breaks and gaps in coverage to ensure continuous coverage from year to year. Plans should ensure free choice of clinicians and foster coordination with public and private community-based programs for infants, children, and adolescents through the age of 26. The scope of services provided by all health plans must include preventive, acute and chronic illness, behavioral, inpatient, emergency, and home health care. These plans must be affordable and have cost-sharing policies that protect patients and families from financial strain and are without risk of loss of benefits because of plan design, current illness, or preexisting condition. (10/10, reaffirmed 4/13)

PRINCIPLES OF JUDICIOUS ANTIBIOTIC PRESCRIBING FOR UPPER RESPIRATORY TRACT INFECTIONS IN PEDIATRICS (CLINICAL REPORT)

Committee on Infectious Diseases

ABSTRACT. Most upper respiratory tract infections are caused by viruses and require no antibiotics. This clinical report focuses on antibiotic prescribing strategies for bacterial upper respiratory tract infections, including acute otitis media, acute bacterial sinusitis, and streptococcal pharyngitis. The principles for judicious antibiotic prescribing that are outlined focus on applying stringent diagnostic criteria, weighing the benefits and harms of antibiotic therapy, and understanding situations when antibiotics may not be indicated. The principles can be used to amplify messages from recent clinical guidelines for local guideline development and for patient communication; they are broadly applicable to antibiotic prescribing in general. (11/13)

See full text on page 845.

PRINCIPLES OF PEDIATRIC PATIENT SAFETY: REDUCING HARM DUE TO MEDICAL CARE

Steering Committee on Quality Improvement and Management and Committee on Hospital Care

ABSTRACT. Pediatricians are rendering care in an environment that is increasingly complex, which results in multiple opportunities to cause unintended harm. National awareness of patient safety risks has grown in the 10 years since the Institute of Medicine published its report *To Err Is Human,* and patients and society as a whole continue to challenge health care providers to examine their practices and implement safety solutions. The depth and breadth of harm incurred by the practice of medicine is still being defined as reports continue to uncover a variety of avoidable errors, from those that involve specific high-risk medications to those that are more generalizable, such as patient misidentification. Pediatricians in all venues must have a working knowledge of patient-safety language, advocate for best practices that attend to risks that are unique to children, identify and support a culture of safety, and lead efforts to eliminate avoidable harm in any setting in which medical care is rendered to children. (5/11)

PROBIOTICS AND PREBIOTICS IN PEDIATRICS (CLINICAL REPORT)

Dan W. Thomas, MD; Frank R. Greer, MD; Committee on Nutrition; and Section on Gastroenterology, Hepatology, and Nutrition

ABSTRACT. This clinical report reviews the currently known health benefits of probiotic and prebiotic products, including those added to commercially available infant formula and other food products for use in children. Probiotics are supplements or foods that contain viable microorganisms that cause alterations of the microflora of the host. Use of probiotics has been shown to be modestly effective in randomized clinical trials (RCTs) in (1) treating acute viral gastroenteritis in healthy children; and (2) preventing antibiotic-associated diarrhea in healthy children. There is some evidence that probiotics prevent necrotizing enterocolitis in very low birth weight infants (birth weight between 1000 and 1500 g), but more studies are needed. The results of RCTs in which probiotics were used to treat childhood *Helicobacter pylori* gastritis, irritable bowel syndrome, chronic ulcerative colitis, and infantile colic, as well as in preventing childhood atopy, although encouraging, are preliminary and require further confirmation. Probiotics have not been proven to be beneficial in treating or preventing human cancers or in treating children with Crohn disease. There are also safety concerns with the use of probiotics in infants and children who are immunocompromised, chronically debilitated, or seriously ill with indwelling medical devices.

Prebiotics are supplements or foods that contain a nondigestible food ingredient that selectively stimulates the favorable growth and/or activity of indigenous probiotic bacteria. Human milk contains substantial quantities of prebiotics. There is a paucity of RCTs examining prebiotics in children, although there may be some long-term benefit of prebiotics for the prevention of atopic eczema and common infections in healthy infants. Confirmatory well-designed clinical research studies are necessary. (11/10)

PROFESSIONAL LIABILITY INSURANCE AND MEDICOLEGAL EDUCATION FOR PEDIATRIC RESIDENTS AND FELLOWS

Committee on Medical Liability and Risk Management

ABSTRACT. The American Academy of Pediatrics believes that pediatric residents and fellows should be fully informed of the scope and limitations of their professional liability insurance coverage while in training. The academy states that residents and fellows should be educated by their training institutions on matters relating to medical liability and the importance of maintaining adequate and continuous professional liability insurance coverage throughout their careers in medicine. (8/11)

PROFESSIONALISM IN PEDIATRICS: STATEMENT OF PRINCIPLES

Committee on Bioethics

ABSTRACT. The purpose of this statement is to delineate the concept of professionalism within the context of pediatrics and to provide a brief statement of principles to guide the behavior and professional practice of pediatricians. (10/07, reaffirmed 5/11)

PROFESSIONALISM IN PEDIATRICS (TECHNICAL REPORT)

Mary E. Fallat, MD; Jacqueline Glover, PhD; and Committee on Bioethics

ABSTRACT. The purpose of this report is to provide a concrete overview of the ideal standards of behavior and professional practice to which pediatricians should aspire and by which students and residents can be evaluated. Recognizing that the ideal is not always achievable in the practical sense, this document details the key components of professionalism in pediatric practice with an emphasis on core professional values for which pediatricians should strive and that will serve as a moral compass needed to provide quality care for children and their families. (10/07, reaffirmed 5/11)

PROMOTING EDUCATION, MENTORSHIP, AND SUPPORT FOR PEDIATRIC RESEARCH

Committee on Pediatric Research

ABSTRACT. Pediatricians have an important role to play in the advancement of child health research and should be encouraged and supported to pursue research activities. Education and training in child health research should be part of every level of pediatric training. Continuing education and access to research advisors should be available to practitioners and academic faculty. Recommendations to promote additional research education and support at all levels of pediatric training, from premedical to continuing medical education, as well as suggestions for means to increase support and mentorship for research activities, are outlined in this statement. (6/01, reaffirmed 1/05, 5/08, 10/11)

PROMOTING THE PARTICIPATION OF CHILDREN WITH DISABILITIES IN SPORTS, RECREATION, AND PHYSICAL ACTIVITIES (CLINICAL REPORT)

Nancy A. Murphy, MD; Paul S. Carbone, MD; and Council on Children With Disabilities

ABSTRACT. The benefits of physical activity are universal for all children, including those with disabilities. The participation of children with disabilities in sports and recreational activities promotes inclusion, minimizes deconditioning, optimizes physical functioning, and enhances overall well-being. Despite these benefits, children with disabilities are more restricted in their participation, have lower levels of fitness, and have higher levels of obesity than their peers without disabilities. Pediatricians and parents may overestimate the risks or overlook the benefits of physical activity in children with disabilities. Well-informed decisions regarding each child's participation must consider overall health status, individual activity preferences, safety precautions, and availability of appropriate programs and equipment. Health supervision visits afford pediatricians, children with disabilities, and parents opportunities to collaboratively generate goal-directed activity "prescriptions." Child, family, financial, and societal barriers to participation need to be directly identified and addressed in the context of local, state, and federal laws. The goal is inclusion for all children with disabilities in appropriate activities. This clinical report discusses the importance of physical activity, recreation, and sports participation for children with disabilities

and offers practical suggestions to pediatric health care professionals for the promotion of participation. (5/08, reaffirmed 1/12)

PROMOTING THE WELL-BEING OF CHILDREN WHOSE PARENTS ARE GAY OR LESBIAN

Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. To promote optimal health and well-being of all children, the American Academy of Pediatrics (AAP) supports access for all children to (1) civil marriage rights for their parents and (2) willing and capable foster and adoptive parents, regardless of the parents' sexual orientation. The AAP has always been an advocate for, and has developed policies to support, the optimal physical, mental, and social health and well-being of all infants, children, adolescents, and young adults. In so doing, the AAP has supported families in all their diversity, because the family has always been the basic social unit in which children develop the supporting and nurturing relationships with adults that they need to thrive. Children may be born to, adopted by, or cared for temporarily by married couples, nonmarried couples, single parents, grandparents, or legal guardians, and any of these may be heterosexual, gay or lesbian, or of another orientation. Children need secure and enduring relationships with committed and nurturing adults to enhance their life experiences for optimal social-emotional and cognitive development. Scientific evidence affirms that children have similar developmental and emotional needs and receive similar parenting whether they are raised by parents of the same or different genders. If a child has 2 living and capable parents who choose to create a permanent bond by way of civil marriage, it is in the best interests of their child(ren) that legal and social institutions allow and support them to do so, irrespective of their sexual orientation. If 2 parents are not available to the child, adoption or foster parenting remain acceptable options to provide a loving home for a child and should be available without regard to the sexual orientation of the parent(s). (3/13)

See full text on page 857.

PROMOTING THE WELL-BEING OF CHILDREN WHOSE PARENTS ARE GAY OR LESBIAN (TECHNICAL REPORT)

Ellen C. Perrin, MD, MA; Benjamin S. Siegel, MD; and Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. Extensive data available from more than 30 years of research reveal that children raised by gay and lesbian parents have demonstrated resilience with regard to social, psychological, and sexual health despite economic and legal disparities and social stigma. Many studies have demonstrated that children's well-being is affected much more by their relationships with their parents, their parents' sense of competence and security, and the presence of social and economic support for the family than by the gender or the sexual orientation of their parents. Lack of opportunity for same-gender couples to marry adds to families' stress, which affects the health and welfare of all household members. Because marriage strengthens families and, in so doing, benefits children's development, children should not be deprived of the opportunity for their parents to be married. Paths to parenthood that include assisted reproductive techniques, adoption, and foster parenting should focus on competency of the parents rather than their sexual orientation. (3/13)

See full text on page 863.

PROMOTION OF HEALTHY WEIGHT-CONTROL PRACTICES IN YOUNG ATHLETES

Committee on Sports Medicine and Fitness

ABSTRACT. Children and adolescents are often involved in sports in which weight loss or weight gain is perceived as an advantage. This policy statement describes unhealthy weight-control practices that may be harmful to the health and/or performance of athletes. Healthy methods of weight loss and weight gain are discussed, and physicians are given resources and recommendations that can be used to counsel athletes, parents, coaches, and school administrators in discouraging inappropriate weight-control behaviors and encouraging healthy methods of weight gain or loss, when needed. (12/05)

PROTECTING CHILDREN FROM SEXUAL ABUSE BY HEALTH CARE PROVIDERS

Committee on Child Abuse and Neglect

ABSTRACT. Sexual abuse or exploitation of children is never acceptable. Such behavior by health care providers is particularly concerning because of the trust that children and their families place on adults in the health care profession. The American Academy of Pediatrics strongly endorses the social and moral prohibition against sexual abuse or exploitation of children by health care providers. The academy opposes any such sexual abuse or exploitation by providers, particularly by the academy's members. Health care providers should be trained to recognize and abide by appropriate provider-patient boundaries. Medical institutions should screen staff members for a history of child abuse issues, train them to respect and maintain appropriate boundaries, and establish policies and procedures to receive and investigate concerns about patient abuse. Each person has a responsibility to ensure the safety of children in health care settings and to scrupulously follow appropriate legal and ethical reporting and investigation procedures. (6/11)

PROTECTIVE EYEWEAR FOR YOUNG ATHLETES

*Committee on Sports Medicine and Fitness (*joint with American Academy of Ophthalmology)

ABSTRACT. The American Academy of Pediatrics and American Academy of Ophthalmology strongly recommend protective eyewear for all participants in sports in which there is risk of eye injury. Protective eyewear should be mandatory for athletes who are functionally 1-eyed and for athletes whose ophthalmologists recommend eye protection after eye surgery or trauma. (3/04, reaffirmed 2/08, 6/11)

PROVIDING CARE FOR CHILDREN AND ADOLESCENTS FACING HOMELESSNESS AND HOUSING INSECURITY

Council on Community Pediatrics

ABSTRACT. Child health and housing security are closely intertwined, and children without homes are more likely to suffer from chronic disease, hunger, and malnutrition than are children with homes. Homeless children and

youth often have significant psychosocial development issues, and their education is frequently interrupted. Given the overall effects that homelessness can have on a child's health and potential, it is important for pediatricians to recognize the factors that lead to homelessness, understand the ways that homelessness and its causes can lead to poor health outcomes, and when possible, help children and families mitigate some of the effects of homelessness. Through practice change, partnership with community resources, awareness, and advocacy, pediatricians can help optimize the health and well-being of children affected by homelessness. (5/13)

See full text on page 875.

PROVIDING CARE FOR IMMIGRANT, MIGRANT, AND BORDER CHILDREN

Council on Community Pediatrics

ABSTRACT. This policy statement, which recognizes the large changes in immigrant status since publication of the 2005 statement "Providing Care for Immigrant, Homeless, and Migrant Children," focuses on strategies to support the health of immigrant children, infants, adolescents, and young adults. Homeless children will be addressed in a forthcoming separate statement ("Providing Care for Children and Adolescents Facing Homelessness and Housing Insecurity"). While recognizing the diversity across and within immigrant, migrant, and border populations, this statement provides a basic framework for serving and advocating for all immigrant children, with a particular focus on low-income and vulnerable populations. Recommendations include actions needed within and outside the health care system, including expansion of access to high-quality medical homes with culturally and linguistically effective care as well as education and literacy programs. The statement recognizes the unique and special role that pediatricians can play in the lives of immigrant children and families. Recommendations for policies that support immigrant child health are included. (5/13)

See full text on page 883.

PROVIDING A PRIMARY CARE MEDICAL HOME FOR CHILDREN AND YOUTH WITH CEREBRAL PALSY (CLINICAL REPORT)

Gregory S. Liptak, MD, MPH; Nancy A. Murphy, MD; and Council on Children With Disabilities

ABSTRACT. All primary care providers will care for children with cerebral palsy in their practice. In addition to well-child and acute illness care, the role of the medical home in the management of these children includes diagnosis, planning for interventions, authorizing treatments, and follow-up. Optimizing health and well-being for children with cerebral palsy and their families entails family-centered care provided in the medical home; comanagement is the most common model. This report reviews the aspects of care specific to cerebral palsy that a medical home should provide beyond the routine health care needed by all children. (10/11)

PROVIDING A PRIMARY CARE MEDICAL HOME FOR CHILDREN AND YOUTH WITH SPINA BIFIDA (CLINICAL REPORT)

Robert Burke, MD, MPH; Gregory S. Liptak, MD, MPH; and Council on Children With Disabilities

ABSTRACT. The pediatric primary care provider in the medical home has a central and unique role in the care of children with spina bifida. The primary care provider addresses not only the typical issues of preventive and acute health care but also the needs specific to these children. Optimal care requires communication and comanagement with pediatric medical and developmental subspecialists, surgical specialists, therapists, and community providers. The medical home provider is essential in supporting the family and advocating for the child from the time of entry into the practice through adolescence, which includes transition and transfer to adult health care. This report reviews aspects of care specific to the infant with spina bifida (particularly myelomeningocele) that will facilitate optimal medical, functional, and developmental outcomes. (11/11)

PROVISION OF EDUCATIONALLY RELATED SERVICES FOR CHILDREN AND ADOLESCENTS WITH CHRONIC DISEASES AND DISABLING CONDITIONS

Council on Children With Disabilities

ABSTRACT. Children and adolescents with chronic diseases and disabling conditions often need educationally related services. As medical home providers, physicians and other health care professionals can assist children, adolescents, and their families with the complex federal, state, and local laws, regulations, and systems associated with these services. Expanded roles for physicians and other health care professionals in individualized family service plan, individualized education plan, and Section 504 plan development and implementation are recommended. Recent updates to the Individuals With Disabilities Education Act will also affect these services. Funding for these services by private and nonprivate sources also continue to affect the availability of these educationally related services.

The complex range of federal, state, and local laws, regulations, and systems for special education and related services for children and adolescents in public schools is beyond the scope of this statement. Readers are referred to the American Academy of Pediatrics policy statement "The Pediatrician's Role in Development and Implementation of an Individual Education Plan (IEP) and/or an Individual Family Service Plan (IFSP)" for additional background materials. The focus of this statement is the role that health care professionals have in determining and managing educationally related services in the school setting.

This policy statement is a revision of a previous statement, "Provision of Educationally Related Services for Children and Adolescents With Chronic Diseases and Disabling Conditions," published in February 2000 by the Committee on Children With Disabilities (http://aappolicy.aappublications.org/cgi/content/full/pediatrics;105/2/448). (6/07)

PSYCHOLOGICAL MALTREATMENT (CLINICAL REPORT)

Roberta Hibbard, MD; Jane Barlow, Dphil; Harriet MacMillan, MD; Committee on Child Abuse and Neglect (joint with American Academy of Child and Adolescent Psychiatry Child Maltreatment and Violence Committee)

ABSTRACT. Psychological or emotional maltreatment of children may be the most challenging and prevalent form of child abuse and neglect. Caregiver behaviors include acts of omission (ignoring need for social interactions) or commission (spurning, terrorizing); may be verbal or nonverbal, active or passive, and with or without intent to harm; and negatively affect the child's cognitive, social, emotional, and/or physical development. Psychological maltreatment has been linked with disorders of attachment, developmental and educational problems, socialization problems, disruptive behavior, and later psychopathology. Although no evidence-based interventions that can prevent psychological maltreatment have been identified to date, it is possible that interventions shown to be effective in reducing overall types of child maltreatment, such as the Nurse Family Partnership, may have a role to play. Furthermore, prevention before occurrence will require both the use of universal interventions aimed at promoting the type of parenting that is now recognized to be necessary for optimal child development, alongside the use of targeted interventions directed at improving parental sensitivity to a child's cues during infancy and later parent-child interactions. Intervention should, first and foremost, focus on a thorough assessment and ensuring the child's safety. Potentially effective treatments include cognitive behavioral parenting programs and other psychotherapeutic interventions. The high prevalence of psychological abuse in advanced Western societies, along with the serious consequences, point to the importance of effective management. Pediatricians should be alert to the occurrence of psychological maltreatment and identify ways to support families who have risk indicators for, or evidence of, this problem. (7/12)

PSYCHOSOCIAL IMPLICATIONS OF DISASTER OR TERRORISM ON CHILDREN: A GUIDE FOR THE PEDIATRICIAN (CLINICAL REPORT)

Joseph F. Hagan Jr, MD; Committee on Psychosocial Aspects of Child and Family Health; and Task Force on Terrorism

ABSTRACT. During and after disasters, pediatricians can assist parents and community leaders not only by accommodating the unique needs of children but also by being cognizant of the psychological responses of children to reduce the possibility of long-term psychological morbidity. The effects of disaster on children are mediated by many factors including personal experience, parental reaction, developmental competency, gender, and the stage of disaster response. Pediatricians can be effective advocates for the child and family and at the community level and can affect national policy in support of families. In this report, specific children's responses are delineated, risk factors for adverse reactions are discussed, and advice is given for pediatricians to ameliorate the effects of disaster on children. (9/05)

PSYCHOSOCIAL RISKS OF CHRONIC HEALTH CONDITIONS IN CHILDHOOD AND ADOLESCENCE

Committee on Children With Disabilities and Committee on Psychosocial Aspects of Child and Family Health (12/93, reaffirmed 10/96)

QUALITY EARLY EDUCATION AND CHILD CARE FROM BIRTH TO KINDERGARTEN

Committee on Early Childhood, Adoption, and Dependent Care

ABSTRACT. High-quality early education and child care for young children improves their health and promotes their development and learning. Early education includes all of a child's experiences at home, in child care, and in other preschool settings. Pediatricians have a role in promoting access to quality early education and child care beginning at birth for all children. The American Academy of Pediatrics affords pediatricians the opportunity to promote the educational and socioemotional needs of young children with other advocacy groups. (1/05, reaffirmed 12/09)

RABIES-PREVENTION POLICY UPDATE: NEW REDUCED-DOSE SCHEDULE

Committee on Infectious Diseases

ABSTRACT. The Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention recommends reducing the number of doses from 5 to 4 of human diploid cell vaccine or purified chick embryo cell vaccine required for postexposure prophylaxis to prevent rabies in humans. The vaccine doses should be given on day 0 (first day of prophylaxis) and days 3, 7, and 14 after the first dose. For persons with immune suppression, the 5-dose regimen should continue to be used. Recommendations for the use of human rabies immunoglobulin remain unchanged. The American Academy of Pediatrics endorses these recommendations. (3/11)

RACE/ETHNICITY, GENDER, SOCIOECONOMIC STATUS—RESEARCH EXPLORING THEIR EFFECTS ON CHILD HEALTH: A SUBJECT REVIEW (CLINICAL REPORT)

Committee on Pediatric Research

ABSTRACT. Data on research participants and populations frequently include race, ethnicity, and gender as categorical variables, with the assumption that these variables exert their effects through innate or genetically determined biologic mechanisms. There is a growing body of research that suggests, however, that these variables have strong social dimensions that influence health. Socioeconomic status, a complicated construct in its own right, interacts with and confounds analyses of race/ethnicity and gender. The Academy recommends that research studies include race/ethnicity, gender, and socioeconomic status as explanatory variables only when data relevant to the underlying social mechanisms have been collected and included in the analyses. (6/00, reaffirmed 10/05, 1/09)

RACIAL AND ETHNIC DISPARITIES IN THE HEALTH AND HEALTH CARE OF CHILDREN (TECHNICAL REPORT)

Glenn Flores, MD, and Committee on Pediatric Research

ABSTRACT. *Objective.* This technical report reviews and synthesizes the published literature on racial/ethnic disparities in children's health and health care.

Methods. A systematic review of the literature was conducted for articles published between 1950 and March 2007. Inclusion criteria were peer-reviewed, original research articles in English on racial/ethnic disparities in the health and health care of US children. Search terms used included "child," "disparities," and the Index Medicus terms for each racial/ethnic minority group.

Results. Of 781 articles initially reviewed, 111 met inclusion criteria and constituted the final database. Review of the literature revealed that racial/ethnic disparities in children's health and health care are quite extensive, pervasive, and persistent. Disparities were noted across the spectrum of health and health care, including in mortality rates, access to care and use of services, prevention and population health, health status, adolescent health, chronic diseases, special health care needs, quality of care, and organ transplantation. Mortality-rate disparities were noted for children in all 4 major US racial/ethnic minority groups, including substantially greater risks than white children of all-cause mortality; death from drowning, from acute lymphoblastic leukemia, and after congenital heart defect surgery; and an earlier median age at death for those with Down syndrome and congenital heart defects. Certain methodologic flaws were commonly observed among excluded studies, including failure to evaluate children separately from adults (22%), combining all nonwhite children into 1 group (9%), and failure to provide a white comparison group (8%). Among studies in the final database, 22% did not perform multivariable or stratified analyses to ensure that disparities persisted after adjustment for potential confounders.

Conclusions. Racial/ethnic disparities in children's healthand health care are extensive, pervasive, and persistent, and occur across the spectrum of health and health care. Methodologic flaws were identified in how such disparities are sometimes documented and analyzed. Optimal health and health care for all children will require recognition of disparities as pervasive problems, methodologically sound disparities studies, and rigorous evaluation of disparities interventions. (3/10, reaffirmed 5/13)

RADIATION DISASTERS AND CHILDREN

Committee on Environmental Health

ABSTRACT. The special medical needs of children make it essential that pediatricians be prepared for radiation disasters, including 1) the detonation of a nuclear weapon; 2) a nuclear power plant event that unleashes a radioactive cloud; and 3) the dispersal of radionuclides by conventional explosive or the crash of a transport vehicle. Any of these events could occur unintentionally or as an act of terrorism. Nuclear facilities (eg, power plants, fuel processing centers, and food irradiation facilities) are often located in highly populated areas, and as they age, the risk of mechanical failure increases. The short- and long-term consequences of a radiation disaster are significantly greater in children for several reasons. First, children have a disproportionately higher minute ventilation, leading to greater internal exposure to radioactive gases. Children have a significantly greater risk of developing cancer even when they are exposed to radiation in utero. Finally, children and the parents of young children are more likely than are adults to develop enduring psychologic injury after a radiation disaster. The pediatrician has a critical role in planning for radiation disasters. For example, potassium iodide is of proven value for thyroid protection but must be given before or soon after exposure to radioiodines, requiring its placement in homes, schools, and child care centers. Pediatricians should work with public health authorities to ensure that children receive full consideration in local planning for a radiation disaster. (6/03, reaffirmed 1/07)

RADIATION RISK TO CHILDREN FROM COMPUTED TOMOGRAPHY (CLINICAL REPORT)

Alan S. Brody, MD; Donald P. Frush, MD; Walter Huda, PhD; Robert L. Brent, MD, PhD; and Section on Radiology

ABSTRACT. Imaging studies that use ionizing radiation are an essential tool for the evaluation of many disorders of childhood. Ionizing radiation is used in radiography, fluoroscopy, angiography, and computed tomography scanning. Computed tomography is of particular interest because of its relatively high radiation dose and wide use. Consensus statements on radiation risk suggest that it is reasonable to act on the assumption that low-level radiation may have a small risk of causing cancer. The medical community should seek ways to decrease radiation exposure by using radiation doses as low as reasonably achievable and by performing these studies only when necessary. There is wide agreement that the benefits of an indicated computed tomography scan far outweigh the risks. Pediatric health care professionals' roles in the use of computed tomography on children include deciding when a computed tomography scan is necessary and discussing the risk with patients and families. Radiologists should be a source of consultation when forming imaging strategies and should create specific protocols with scanning techniques optimized for pediatric patients. Families and patients should be encouraged to ask questions about the risks and benefits of computed tomography scanning. The information in this report is provided to aid in decision-making and discussions with the health care team, patients, and families. (9/07)

RECOGNITION AND MANAGEMENT OF IATROGENICALLY INDUCED OPIOID DEPENDENCE AND WITHDRAWAL IN CHILDREN (CLINICAL REPORT)

Jeffrey Galinkin, MD, FAAP; Jeffrey Lee Koh, MD, FAAP; Committee on Drugs; and Section on Anesthesiology and Pain Medicine

ABSTRACT. Opioids are often prescribed to children for pain relief related to procedures, acute injuries, and chronic conditions. Round-the-clock dosing of opioids can produce opioid dependence within 5 days. According to a 2001 consensus paper from the American Academy of Pain Medicine, American Pain Society, and American Society of Addiction Medicine, dependence is defined as "a state of adaptation that is manifested by a drug class

specific withdrawal syndrome that can be produced by abrupt cessation, rapid dose reduction, decreasing blood level of the drug, and/or administration of an antagonist." Although the experience of many children undergoing iatrogenically induced withdrawal may be mild or goes unreported, there is currently no guidance for recognition or management of withdrawal for this population. Guidance on this subject is available only for adults and primarily for adults with substance use disorders. The guideline will summarize existing literature and provide readers with information currently not available in any single source specific for this vulnerable pediatric population. (12/13)

See full text on page 893.

RECOGNIZING AND RESPONDING TO MEDICAL NEGLECT (CLINICAL REPORT)

Carole Jenny, MD, MBA, and Committee on Child Abuse and Neglect

ABSTRACT. A caregiver may fail to recognize or respond to a child's medical needs for a variety of reasons. An effective response by a health care professional to medical neglect requires a comprehensive assessment of the child's needs, the parents' resources, the parents' efforts to provide for the needs of the child, and options for ensuring optimal health for the child. Such an assessment requires clear, 2-way communication between the family and the health care professional. Physicians should consider the least intrusive options for managing cases of medical neglect that ensure the health and safety of the child. (12/07, reaffirmed 1/11)

RECOMMENDATION FOR MANDATORY INFLUENZA IMMUNIZATION OF ALL HEALTH CARE PERSONNEL

Henry H. Bernstein, DO; Jeffrey R. Starke, MD; and Committee on Infectious Diseases

ABSTRACT. The purpose of this statement is to recommend implementation of a mandatory influenza immunization policy for all health care personnel. Immunization of health care personnel is a critically important step to substantially reduce health care–associated influenza infections. Despite the efforts of many organizations to improve influenza immunization rates with the use of voluntary campaigns, influenza coverage among health care personnel remains unacceptably low. Mandatory influenza immunization for all health care personnel is ethically justified, necessary, and long overdue to ensure patient safety. (9/10)

RECOMMENDATIONS FOR ADMINISTERING HEPATITIS A VACCINE TO CONTACTS OF INTERNATIONAL ADOPTEES

Committee on Infectious Diseases

ABSTRACT. The Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention and the American Academy of Pediatrics (AAP) recommend routine administration of hepatitis A vaccine for household members and close contacts, including baby-sitters, when children are adopted from countries with high or intermediate rates of hepatitis A infection. This policy expands previous AAP recommendations to immunize travelers to countries who are seeking to adopt a child in countries with high or medium hepatitis A endemicity. All previously nonimmune unvaccinated people who anticipate close exposure to international adoptees during the 60 days after their arrival should receive hepatitis A immunization, ideally 2 or more weeks before the arrival of the adopted child. (9/11)

RECOMMENDATIONS FOR PREVENTION AND CONTROL OF INFLUENZA IN CHILDREN, 2013–2014

Committee on Infectious Diseases

ABSTRACT. The purpose of this statement is to update recommendations for routine use of seasonal influenza vaccine and antiviral medications for the prevention and treatment of influenza in children. Highlights for the upcoming 2013–2014 season include (1) this year's trivalent influenza vaccine contains an A/California/7/2009 (H1N1) pdm09-like virus (same as 2012–2013); an A/Texas/50/2012 (H3N2) virus (antigenically like the 2012–2013 strain); and a B/Massachusetts/2/2012-like virus (a B/Yamagata lineage like 2012–2013 but a different virus); (2) new quadrivalent influenza vaccines with an additional B virus (B/Brisbane/60/2008-like virus [B/Victoria lineage]) have been licensed by the US Food and Drug Administration; (3) annual universal influenza immunization is indicated with either a trivalent or quadrivalent vaccine (no preference); and (4) the dosing algorithm for administration of influenza vaccine to children 6 months through 8 years of age is unchanged from 2012–2013. As always, pediatricians, nurses, and all health care personnel should promote influenza vaccine use and infection control measures. In addition, pediatricians should promptly identify influenza infections to enable rapid antiviral treatment, when indicated, to reduce morbidity and mortality. (9/13)

See full text on page 899.

RECOMMENDATIONS FOR THE PREVENTION OF PERINATAL GROUP B STREPTOCOCCAL (GBS) DISEASE

Committee on Infectious Diseases and Committee on Fetus and Newborn

ABSTRACT. The Centers for Disease Control and Prevention (CDC) guidelines for the prevention of perinatal group B streptococcal (GBS) disease were initially published in 1996. The American Academy of Pediatrics (AAP) also published a policy statement on this topic in 1997. In 2002, the CDC published revised guidelines that recommended universal antenatal GBS screening; the AAP endorsed these guidelines and published recommendations based on them in the 2003 *Red Book.* Since then, the incidence of early-onset GBS disease in neonates has decreased by an estimated 80%. However, in 2010, GBS disease remained the leading cause of early-onset neonatal sepsis. The CDC issued revised guidelines in 2010 based on evaluation of data generated after 2002. These revised and comprehensive guidelines, which have been endorsed by the AAP, reaffirm the major prevention strategy—universal antenatal GBS screening and intrapartum antibiotic prophylaxis for culture-positive and high-risk women—and include new recommendations for laboratory methods for identification of GBS colonization during pregnancy, algorithms for screening and intrapartum prophylaxis for women with preterm labor and premature

rupture of membranes, updated prophylaxis recommendations for women with a penicillin allergy, and a revised algorithm for the care of newborn infants. The purpose of this policy statement is to review and discuss the differences between the 2002 and 2010 CDC guidelines that are most relevant for the practice of pediatrics. (8/11)

RECOMMENDATIONS FOR THE PREVENTION OF *STREPTOCOCCUS PNEUMONIAE* INFECTIONS IN INFANTS AND CHILDREN: USE OF 13-VALENT PNEUMOCOCCAL CONJUGATE VACCINE (PCV13) AND PNEUMOCOCCAL POLYSACCHARIDE VACCINE (PPSV23)

Committee on Infectious Diseases

ABSTRACT. Routine use of the 7-valent pneumococcal conjugate vaccine (PCV7), available since 2000, has resulted in a dramatic reduction in the incidence of invasive pneumococcal disease (IPD) attributable to serotypes of Streptococcus pneumoniae contained in the vaccine. However, IPD caused by nonvaccine pneumococcal serotypes has increased, and nonvaccine serotypes are now responsible for the majority of the remaining cases of IPD occurring in children. A 13-valent pneumococcal conjugate vaccine has been licensed by the US Food and Drug Administration, which, in addition to the 7 serotypes included in the original PCV7, contains the 6 pneumococcal serotypes responsible for 63% of IPD cases now occurring in children younger than 5 years. Because of the expanded coverage provided by PCV13, it will replace PCV7. This statement provides recommendations for (1) the transition from PCV7 to PCV13; (2) the routine use of PCV13 for healthy children and children with an underlying medical condition that increases the risk of IPD; (3) a supplemental dose of PCV13 for (a) healthy children 14 through 59 months of age who have completed the PCV7 series and (b) children 14 through 71 months of age with an underlying medical condition that increases the risk of IPD who have completed the PCV7 series; (4) "catch-up" immunization for children behind schedule; and (5) PCV13 for certain children at high risk from 6 through 18 years of age. In addition, recommendations for the use of pneumococcal polysaccharide vaccine for children at high risk of IPD are also updated. (5/10)

RECOMMENDATIONS FOR PREVENTIVE PEDIATRIC HEALTH CARE

Committee on Practice and Ambulatory Medicine and Bright Futures Steering Committee

ABSTRACT. Each child and family is unique; therefore, these Recommendations for Preventive Pediatric Health Care are designed for the care of children who are receiving competent parenting, have no manifestations of any important health problems, and are growing and developing in satisfactory fashion. Additional visits may become necessary if circumstances suggest variations from normal.

Developmental, psychosocial, and chronic disease issues for children and adolescents may require frequent counseling and treatment visits separate from preventive care visits.

These guidelines represent a consensus by the American Academy of Pediatrics (AAP) and Bright Futures. The AAP continues to emphasize the great importance of continuity of care in comprehensive health supervision and the need to avoid fragmentation of care. (12/07, reaffirmed 1/11)

RECOMMENDED CHILDHOOD AND ADOLESCENT IMMUNIZATION SCHEDULE—UNITED STATES, 2014

Committee on Infectious Diseases (1/14)

See full text on page 917.

RED REFLEX EXAMINATION IN NEONATES, INFANTS, AND CHILDREN

*Section on Ophthalmology (*joint with American Association for Pediatric Ophthalmology and Strabismus, American Academy of Ophthalmology, and American Association of Certified Orthoptists)

ABSTRACT. Red reflex testing is an essential component of the neonatal, infant, and child physical examination. This statement, which is a revision of the previous policy statement published in 2002, describes the rationale for testing, the technique used to perform this examination, and the indications for referral to an ophthalmologist experienced in the examination of children. (12/08)

REDUCING THE NUMBER OF DEATHS AND INJURIES FROM RESIDENTIAL FIRES

Committee on Injury and Poison Prevention

ABSTRACT. Smoke inhalation, severe burns, and death from residential fires are devastating events, most of which are preventable. In 1998, approximately 381 500 residential structure fires resulted in 3250 non-firefighter deaths, 17 175 injuries, and approximately $4.4 billion in property loss. This statement reviews important prevention messages and intervention strategies related to residential fires. It also includes recommendations for pediatricians regarding office anticipatory guidance, work in the community, and support of regulation and legislation that could result in a decrease in the number of fire-related injuries and deaths to children. (6/00)

REDUCING THE RISK OF HIV INFECTION ASSOCIATED WITH ILLICIT DRUG USE

Committee on Pediatric AIDS

ABSTRACT. Substance abuse, specifically the use of illicit drugs that are administered intravenously, continues to play a role in the transmission of human immunodeficiency virus type 1 (HIV-1) among adolescents and young adults (youth). Risks of HIV-1 infection may result from direct exposure to contaminated blood through sharing of injection drug equipment and from unsafe sexual practices (while under the influence of drugs and/or in exchange for drugs). Reducing the risk of HIV-1 infection that is associated with illicit drug use requires prevention education and prompt engagement in treatment. Providing patients with education, instruction on decontamination of used injection drug equipment, improved access to sterile syringes and needles, and postexposure prophylaxis may decrease their risk of acquiring HIV-1 infection. Pediatricians should assess risk behaviors as part of every health care encounter, including queries about tobacco, alcohol, and marijuana use. The risks and benefits of postexposure prophylaxis with antiretroviral drugs should be considered for youth with a single recent (within 72 hours) high-risk exposure to HIV-1 through

sharing needles/syringes with an HIV-1–infected individual or having unprotected intercourse with an individual who engages in injection drug use. Such prophylaxis must be accompanied by risk-reduction counseling, appropriate referrals for treatment, and evaluation for pregnancy and associated sexually transmitted infections. There is an urgent need for more substance-abuse prevention and treatment programs, legislation that facilitates unencumbered access to sterile syringes, and expedient availability of reproductive health care services for sexually active youth, including voluntary HIV-1 counseling and testing. (2/06, reaffirmed 5/09, 5/12)

REIMBURSEMENT FOR FOODS FOR SPECIAL DIETARY USE

Committee on Nutrition

ABSTRACT. Foods for special dietary use are recommended by physicians for chronic diseases or conditions of childhood, including inherited metabolic diseases. Although many states have created legislation requiring reimbursement for foods for special dietary use, legislation is now needed to mandate consistent coverage and reimbursement for foods for special dietary use and related support services with accepted medical benefit for children with designated medical conditions. (5/03, reaffirmed 1/06)

RELIEF OF PAIN AND ANXIETY IN PEDIATRIC PATIENTS IN EMERGENCY MEDICAL SYSTEMS (CLINICAL REPORT)

Joel A. Fein, MD, MPH; William T. Zempsky, MD, MPH; Joseph P. Cravero, MD; Committee on Pediatric Emergency Medicine; and Section on Anesthesiology and Pain Medicine

ABSTRACT. Control of pain and stress for children is a vital component of emergency medical care. Timely administration of analgesia affects the entire emergency medical experience and can have a lasting effect on a child's and family's reaction to current and future medical care. A systematic approach to pain management and anxiolysis, including staff education and protocol development, can provide comfort to children in the emergency setting and improve staff and family satisfaction. (10/12)

RELIGIOUS OBJECTIONS TO MEDICAL CARE

Committee on Bioethics

ABSTRACT. Parents sometimes deny their children the benefits of medical care because of religious beliefs. In some jurisdictions, exemptions to child abuse and neglect laws restrict government action to protect children or seek legal redress when the alleged abuse or neglect has occurred in the name of religion. The American Academy of Pediatrics (AAP) believes that all children deserve effective medical treatment that is likely to prevent substantial harm or suffering or death. In addition, the AAP advocates that all legal interventions apply equally whenever children are endangered or harmed, without exemptions based on parental religious beliefs. To these ends, the AAP calls for the repeal of religious exemption laws and supports additional efforts to educate the public about the medical needs of children. (2/97, reaffirmed 10/00, 6/03, 10/06, 5/09)

RESPIRATORY SUPPORT IN PRETERM INFANTS AT BIRTH

Committee on Fetus and Newborn

ABSTRACT. Current practice guidelines recommend administration of surfactant at or soon after birth in preterm infants with respiratory distress syndrome. However, recent multicenter randomized controlled trials indicate that early use of continuous positive airway pressure with subsequent selective surfactant administration in extremely preterm infants results in lower rates of bronchopulmonary dysplasia/death when compared with treatment with prophylactic or early surfactant therapy. Continuous positive airway pressure started at or soon after birth with subsequent selective surfactant administration may be considered as an alternative to routine intubation with prophylactic or early surfactant administration in preterm infants. (12/13)

See full text on page 927.

RESPONDING TO PARENTAL REFUSALS OF IMMUNIZATION OF CHILDREN (CLINICAL REPORT)

Douglas S. Diekema, MD, MPH, and Committee on Bioethics

ABSTRACT. The American Academy of Pediatrics strongly endorses universal immunization. However, for childhood immunization programs to be successful, parents must comply with immunization recommendations. The problem of parental refusal of immunization for children is an important one for pediatricians. The goal of this report is to assist pediatricians in understanding the reasons parents may have for refusing to immunize their children, review the limited circumstances under which parental refusals should be referred to child protective services agencies or public health authorities, and provide practical guidance to assist the pediatrician faced with a parent who is reluctant to allow immunization of his or her child. (5/05, reaffirmed 1/09, 11/12)

RESTRAINT USE ON AIRCRAFT

Committee on Injury and Poison Prevention

ABSTRACT. Occupant protection policies for children younger than 2 years on aircraft are inconsistent with all other national policies on safe transportation. Children younger than 2 years are not required to be restrained or secured on aircraft during takeoff, landing, and conditions of turbulence. They are permitted to be held on the lap of an adult. Preventable injuries and deaths have occurred in children younger than 2 years who were unrestrained in aircraft during survivable crashes and conditions of turbulence. The American Academy of Pediatrics recommends a mandatory federal requirement for restraint use for children on aircraft. The Academy further recommends that parents ensure that a seat is available for all children during aircraft transport and follow current recommendations for restraint use for all children. Physicians play a significant role in counseling families, advocating for public policy mandates, and encouraging technologic research that will improve protection of children in aircraft. (11/01, reaffirmed 5/05, 10/08)

RETURNING TO LEARNING FOLLOWING A CONCUSSION (CLINICAL REPORT)

Mark E. Halstead, MD, FAAP; Karen McAvoy, PsyD; Cynthia D. Devore, MD, FAAP; Rebecca Carl, MD, FAAP; Michael Lee, MD, FAAP; Kelsey Logan, MD, FAAP; Council on Sports Medicine and Fitness; and Council on School Health

ABSTRACT. Following a concussion, it is common for children and adolescents to experience difficulties in the school setting. Cognitive difficulties, such as learning new tasks or remembering previously learned material, may pose challenges in the classroom. The school environment may also increase symptoms with exposure to bright lights and screens or noisy cafeterias and hallways. Unfortunately, because most children and adolescents look physically normal after a concussion, school officials often fail to recognize the need for academic or environmental adjustments. Appropriate guidance and recommendations from the pediatrician may ease the transition back to the school environment and facilitate the recovery of the child or adolescent. This report serves to provide a better understanding of possible factors that may contribute to difficulties in a school environment after a concussion and serves as a framework for the medical home, the educational home, and the family home to guide the student to a successful and safe return to learning. (10/13)

See full text on page 933.

RITUAL GENITAL CUTTING OF FEMALE MINORS

Board of Directors (6/10)

THE ROLE OF HOME-VISITATION PROGRAMS IN IMPROVING HEALTH OUTCOMES FOR CHILDREN AND FAMILIES

Council on Child and Adolescent Health

ABSTRACT. Traditional pediatric care is often based on the assumption that parents have the basic knowledge and resources to provide a nurturing, safe environment and to provide for the emotional, physical, developmental, and health care needs of their infants and young children. Unfortunately, many families have insufficient knowledge of parenting skills and an inadequate support system of friends, extended family, or professionals to help with these vital tasks. Home-visitation programs offer an effective mechanism to ensure ongoing parental education, social support, and linkage with public and private community services. This statement reviews the history and current research on home-visitation programs and provides recommendations about the pediatrician's role in supporting and using home visitation. (3/98, reaffirmed 5/01)

ROLE OF THE MEDICAL HOME IN FAMILY-CENTERED EARLY INTERVENTION SERVICES

Council on Children With Disabilities

ABSTRACT. There is growing evidence that early intervention services have a positive influence on the developmental outcome of children with established disabilities as well as those who are considered to be "at risk" of disabilities. Various federal and state laws now mandate the establishment of community-based, coordinated, multidisciplinary, family-centered programs that are accessible to children and families. The medical home, in close collaboration with the family and the early intervention team, can play a critical role in ensuring that at-risk children receive appropriate clinical and developmental early intervention services. The purpose of this statement is to assist the pediatric health care professional in assuming a proactive role with the interdisciplinary team that provides early intervention services. (11/07)

THE ROLE OF THE PEDIATRICIAN IN RURAL EMERGENCY MEDICAL SERVICES FOR CHILDREN

Committee on Pediatric Emergency Medicine

ABSTRACT. In rural America, pediatricians can play a key role in the development, implementation, and ongoing supervision of emergency medical services for children (EMSC). Pediatricians may represent the only source of pediatric expertise for a large region and are a vital resource for rural physicians (eg, general and family practice, emergency medicine) and other rural health care professionals (physician assistants, nurse practitioners, and emergency medical technicians), providing education about management and prevention of pediatric illness and injury; appropriate equipment for the acutely ill or injured child; and acute, chronic, and rehabilitative care. In addition to providing clinical expertise, the pediatrician may be involved in quality assurance, clinical protocol development, and advocacy, and may serve as a liaison between emergency medical services and other entities working with children (eg, school nurses, child care centers, athletic programs, and programs for children with special health care needs). (10/12)

ROLE OF THE PEDIATRICIAN IN YOUTH VIOLENCE PREVENTION

Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Youth violence continues to be a serious threat to the health of children and adolescents in the United States. It is crucial that pediatricians clearly define their role and develop the appropriate skills to address this threat effectively. From a clinical perspective, pediatricians should become familiar with *Connected Kids: Safe, Strong, Secure,* the American Academy of Pediatrics' primary care violence prevention protocol. Using this material, practices can incorporate preventive education, screening for risk, and linkages to community-based counseling and treatment resources. As advocates, pediatricians may bring newly developed information regarding key risk factors such as exposure to firearms, teen dating violence, and bullying to the attention of local and national policy makers. This policy statement refines the developing role of pediatricians in youth violence prevention and emphasizes the importance of this issue in the strategic agenda of the American Academy of Pediatrics. (6/09)

ROLE OF PEDIATRICIANS IN ADVOCATING LIFE SUPPORT TRAINING COURSES FOR PARENTS AND THE PUBLIC

Committee on Pediatric Emergency Medicine

ABSTRACT. Available literature suggests a need for both initial cardiopulmonary resuscitation basic life support training and refresher courses for parents and the public as well as health care professionals. The promotion of basic life support training courses that establish a pediat-

ric chain of survival spanning from prevention of cardiac arrest and trauma to rehabilitative and follow-up care for victims of cardiopulmonary arrest is advocated in this policy statement and is the focus of an accompanying technical report. Immediate bystander cardiopulmonary resuscitation for victims of cardiac arrest improves survival for out-of-hospital cardiac arrest. Pediatricians will improve the chance of survival of children and adults who experience cardiac arrest by advocating for cardiopulmonary resuscitation training and participating in basic life support training courses as participants and instructors. (12/04, reaffirmed 5/07, 8/10, 8/13)

ROLE OF PEDIATRICIANS IN ADVOCATING LIFE SUPPORT TRAINING COURSES FOR PARENTS AND THE PUBLIC (TECHNICAL REPORT)

Lee A. Pyles, MD; Jane Knapp, MD; and Committee on Pediatric Emergency Medicine

ABSTRACT. Available literature suggests a need for both initial cardiopulmonary resuscitation training and refresher courses. The establishment of a pediatric chain of survival for victims of cardiopulmonary arrest is the focus of this technical report and is advocated in the accompanying policy statement. Immediate bystander cardiopulmonary resuscitation for victims of cardiac arrest improves survival for out-of-hospital cardiac arrest. Pediatricians will improve the chance of survival of children and adults who experience cardiac arrest by advocating for basic life support training and participating in basic life support courses as participants and teachers. (12/04, reaffirmed 5/07, 8/10)

THE ROLE OF PRESCHOOL HOME-VISITING PROGRAMS IN IMPROVING CHILDREN'S DEVELOPMENTAL AND HEALTH OUTCOMES

Council on Community Pediatrics

ABSTRACT. Child health and developmental outcomes depend to a large extent on the capabilities of families to provide a nurturing, safe environment for their infants and young children. Unfortunately, many families have insufficient knowledge about parenting skills and an inadequate support system of friends, extended family, or professionals to help with or advise them regarding child rearing. Home-visiting programs offer a mechanism for ensuring that at-risk families have social support, linkage with public and private community services, and ongoing health, developmental, and safety education. When these services are part of a system of high-quality well-child care linked or integrated with the pediatric medical home, they have the potential to mitigate health and developmental outcome disparities. This statement reviews the history of home visiting in the United States and reaffirms the support of the American Academy of Pediatrics for home-based parenting education and support. (1/09)

ROLE OF PULSE OXIMETRY IN EXAMINING NEWBORNS FOR CONGENITAL HEART DISEASE: A SCIENTIFIC STATEMENT FROM THE AHA AND AAP

William T. Mahle, MD; Jane W. Newburger, MD, MPH; G. Paul Matherne, MD; Frank C. Smith, MD; Tracey R. Hoke, MD; Robert Koppel, MD; Samuel S. Gidding, MD; Robert H. Beekman, III, MD; Scott D. Grosse, PhD; on behalf of American Heart Association Congenital Heart Defects Committee of the Council on Cardiovascular Disease in the Young, Council on Cardiovascular Nursing, and Interdisciplinary Council on Quality of Care and Outcomes Research; and American Academy of Pediatrics Section on Cardiology and Cardiac Surgery and Committee on Fetus and Newborn

ABSTRACT. *Background.* The purpose of this statement is to address the state of evidence on the routine use of pulse oximetry in newborns to detect critical congenital heart disease (CCHD).

Methods and Results. A writing group appointed by the American Heart Association and the American Academy of Pediatrics reviewed the available literature addressing current detection methods for CCHD, burden of missed and/or delayed diagnosis of CCHD, rationale of oximetry screening, and clinical studies of oximetry in otherwise asymptomatic newborns. MEDLINE database searches from 1966 to 2008 were done for English-language papers using the following search terms: congenital heart disease, pulse oximetry, physical examination, murmur, echocardiography, fetal echocardiography, and newborn screening. The reference lists of identified papers were also searched. Published abstracts from major pediatric scientific meetings in 2006 to 2008 were also reviewed. The American Heart Association classification of recommendations and levels of evidence for practice guidelines were used. In an analysis of pooled studies of oximetry assessment performed after 24 hours of life, the estimated sensitivity for detecting CCHD was 69.6%, and the positive predictive value was 47.0%; however, sensitivity varied dramatically among studies from 0% to 100%. False-positive screens that required further evaluation occurred in only 0.035% of infants screened after 24 hours.

Conclusions. Currently, CCHD is not detected in some newborns until after their hospital discharge, which results in significant morbidity and occasional mortality. Furthermore, routine pulse oximetry performed on asymptomatic newborns after 24 hours of life, but before hospital discharge, may detect CCHD. Routine pulse oximetry performed after 24 hours in hospitals that have on-site pediatric cardiovascular services incurs very low cost and risk of harm. Future studies in larger populations and across a broad range of newborn delivery systems are needed to determine whether this practice should become standard of care in the routine assessment of the neonate. (8/09)

ROLE OF THE SCHOOL NURSE IN PROVIDING SCHOOL HEALTH SERVICES

Council on School Health

ABSTRACT. The school nurse has a crucial role in the seamless provision of comprehensive health services to children and youth. Increasing numbers of students enter schools with chronic health conditions that require management during the school day. This policy statement describes for pediatricians the role of the school nurse in serving as a team member in providing preventive services, early identification of problems, interventions, and referrals to foster health and educational success. To optimally care for children, preparation, ongoing education, and appropriate staffing levels of school nurses are important factors for success. Recommendations are

offered to facilitate the working relationship between the school nurse and the child's medical home. This statement has been endorsed by the National Association of School Nurses. (5/08)

ROLE OF THE SCHOOL PHYSICIAN
Council on School Health
ABSTRACT. The American Academy of Pediatrics recognizes the important role physicians play in promoting the optimal biopsychosocial well-being of children in the school setting. Although the concept of a school physician has existed for more than a century, uniformity among states and school districts regarding physicians in schools and the laws governing it are lacking. By understanding the roles and contributions physicians can make to schools, pediatricians can support and promote school physicians in their communities and improve health and safety for children. (12/12)

THE ROLE OF SCHOOLS IN COMBATING ILLICIT SUBSTANCE ABUSE
Council on School Health and Committee on Substance Abuse
ABSTRACT. Disturbingly high levels of illicit drug use remain a problem among American teenagers. As the physical, social, and psychological "home away from home" for most youth, schools naturally assume a primary role in substance abuse education, prevention, and early identification. However, the use of random drug testing on students as a component of drug prevention programs requires additional, more rigorous scientific evaluation. Widespread implementation should await the result of ongoing studies to address the effectiveness of testing and evaluate possible inadvertent harm. If drug testing on students is conducted, it should never be implemented in isolation. A comprehensive assessment and therapeutic management program for the student who tests positive should be in place before any testing is performed. Schools have the opportunity to work with parents, health care professionals, and community officials to use programs with proven effectiveness, to identify students who show behavioral risks for drug-related problems, and to make referrals to a student's medical home. When use of an illicit substance is detected, schools can foster relationships with established health care experts to assist them. A student undergoing individualized intervention for using illicit substances merits privacy. This requires that awareness of the student's situation be limited to parents, the student's physician, and only those designated school health officials with a need to know. For the purposes of this statement, alcohol, tobacco, and inhalants are not addressed. (12/07)

SAFE TRANSPORTATION OF NEWBORNS AT HOSPITAL DISCHARGE
Committee on Injury and Poison Prevention
ABSTRACT. All hospitals should set policies that require the discharge of every newborn in a car safety seat that is appropriate for the infant's maturity and medical condition. Discharge policies for newborns should include a parent education component, regular review of educational materials, and periodic in-service education for responsible staff. Appropriate child restraint systems should become a benefit of coverage by Medicaid, managed care organizations, and other third-party insurers. (10/99, reaffirmed 1/03, 1/06, 10/08)

SAFE TRANSPORTATION OF PRETERM AND LOW BIRTH WEIGHT INFANTS AT HOSPITAL DISCHARGE (CLINICAL REPORT)
Marilyn J. Bull, MD; William A. Engle, MD; Committee on Injury, Violence, and Poison Prevention; and Committee on Fetus and Newborn
ABSTRACT. Safe transportation of preterm and low birth weight infants requires special considerations. Both physiologic immaturity and low birth weight must be taken into account to properly position such infants. This clinical report provides guidelines for pediatricians and other caregivers who counsel parents of preterm and low birth weight infants about car safety seats. (4/09, reaffirmed 8/13)

SAFETY IN YOUTH ICE HOCKEY: THE EFFECTS OF BODY CHECKING
Committee on Sports Medicine and Fitness
ABSTRACT. Ice hockey is a sport enjoyed by many young people. The occurrence of injury can offset what may otherwise be a positive experience. A high proportion of injuries in hockey appear to result from intentional body contact or the practice of checking. The American Academy of Pediatrics recommends limiting checking in hockey players 15 years of age and younger as a means to reduce injuries. Strategies such as the fair play concept can also help decrease injuries that result from penalties or unnecessary contact. (3/00, reaffirmed 1/06, 5/09)

SCHOOL BUS TRANSPORTATION OF CHILDREN WITH SPECIAL HEALTH CARE NEEDS
Committee on Injury and Poison Prevention (8/01, reaffirmed 1/05, 2/08)

SCHOOL HEALTH ASSESSMENTS
Committee on School Health
ABSTRACT. Comprehensive health assessments often are performed in school-based clinics or public health clinics by health professionals other than pediatricians. Pediatricians or other physicians skilled in child health care should participate in such evaluations. This statement provides guidance on the scope of in-school health assessments and the roles of the pediatrician, school nurse, school, and community. (4/00, reaffirmed 6/03, 5/06, 10/11)

SCHOOL HEALTH CENTERS AND OTHER INTEGRATED SCHOOL HEALTH SERVICES
Committee on School Health
ABSTRACT. This statement offers guidelines on the integration of expanded school health services, including school-based and school-linked health centers, into community-based health care systems. Expanded school health services should be integrated so that they enhance accessibility, provide high-quality health care, link children to a medical home, are financially sustainable, and address both long- and short-term needs of children and adolescents. (1/01)

SCHOOL READINESS (TECHNICAL REPORT)

Pamela C. High, MD; Committee on Early Childhood, Adoption, and Dependent Care; and Council on School Health

ABSTRACT. School readiness includes the readiness of the individual child, the school's readiness for children, and the ability of the family and community to support optimal early child development. It is the responsibility of schools to be ready for all children at all levels of readiness. Children's readiness for kindergarten should become an outcome measure for community-based programs, rather than an exclusion criterion at the beginning of the formal educational experience. Our new knowledge of early brain and child development has revealed that modifiable factors in a child's early experience can greatly affect that child's learning trajectory. Many US children enter kindergarten with limitations in their social, emotional, cognitive, and physical development that might have been significantly diminished or eliminated through early identification of and attention to child and family needs. Pediatricians have a role in promoting school readiness for all children, beginning at birth, through their practices and advocacy. The American Academy of Pediatrics affords pediatricians many opportunities to promote the physical, social-emotional, and educational health of young children, with other advocacy groups. This technical report supports American Academy of Pediatrics policy statements "Quality Early Education and Child Care From Birth to Kindergarten" and "The Inappropriate Use of School 'Readiness' Tests." (4/08, reaffirmed 9/13)

SCHOOL TRANSPORTATION SAFETY

Committee on Injury, Violence, and Poison Prevention and Council on School Health

ABSTRACT. This policy statement replaces the previous version published in 1996. It provides new information, studies, regulations, and recommendations related to the safe transportation of children to and from school and school-related activities. Pediatricians can play an important role at the patient/family, community, state, and national levels as child advocates and consultants to schools and early education programs about transportation safety. (7/07, reaffirmed 10/11)

SCHOOL-BASED HEALTH CENTERS AND PEDIATRIC PRACTICE

Council on School Health

ABSTRACT. School-based health centers (SBHCs) have become an important method of health care delivery for the youth of our nation. Although they only represent 1 aspect of a coordinated school health program approach, SBHCs have provided access to health care services for youth confronted with age, financial, cultural, and geographic barriers. A fundamental principle of SBHCs is to create an environment of service coordination and collaboration that addresses the health needs and well-being of youth with health disparities or poor access to health care services. Some pediatricians have concerns that these centers are in conflict with the primary care provider's medical home. This policy provides an overview of SBHCs and some of their documented benefits, addresses the issue of potential conflict with the medical home, and provides recommendations that support the integration and coordination of SBHCs and the pediatric medical home practice. (1/12)

SCHOOL-BASED MENTAL HEALTH SERVICES

Committee on School Health

ABSTRACT. More than 20% of children and adolescents have mental health problems. Health care professionals for children and adolescents must educate key stakeholders about the extent of these problems and work together with them to increase access to mental health resources. School-based programs offer the promise of improving access to diagnosis of and treatment for the mental health problems of children and adolescents. Pediatric health care professionals, educators, and mental health specialists should work in collaboration to develop and implement effective school-based mental health services. (6/04, reaffirmed 5/09)

SCOPE OF HEALTH CARE BENEFITS FOR CHILDREN FROM BIRTH THROUGH AGE 26

Committee on Child Health Financing

ABSTRACT. The optimal health of all children is best achieved with access to appropriate and comprehensive health care benefits. This policy statement outlines and defines the recommended set of health insurance benefits for children through age 26. The American Academy of Pediatrics developed a set of recommendations concerning preventive care services for children, adolescents, and young adults. These recommendations are compiled in the publication *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents,* third edition. The Bright Futures recommendations were referenced as a standard for access and design of age-appropriate health insurance benefits for infants, children, adolescents, and young adults in the Patient Protection and Affordable Care Act of 2010 (Pub L No. 114–148). (11/11)

SCOPE OF PRACTICE ISSUES IN THE DELIVERY OF PEDIATRIC HEALTH CARE

Committee on Pediatric Workforce

ABSTRACT. The American Academy of Pediatrics (AAP) believes that optimal pediatric health care depends on a team-based approach with supervision by a physician leader, preferably a pediatrician. The pediatrician, here defined to include not only pediatric generalists but all pediatric medical subspecialists, all surgical specialists, and internal medicine/pediatric physicians, is uniquely qualified to manage, coordinate, and supervise the entire spectrum of pediatric care, from diagnosis through all stages of treatment, in all practice settings. The AAP recognizes the valuable contributions of nonphysician clinicians, including nurse practitioners and physician assistants, in delivering optimal pediatric care. However, the expansion of the scope of practice of nonphysician pediatric clinicians raises critical public policy and child health advocacy concerns. Pediatricians should serve as advocates for optimal pediatric care in state legislatures, public policy forums, and the media and should pursue opportunities to resolve scope of practice conflicts outside state legislatures. The AAP affirms the importance

of appropriate documentation and standards in pediatric education, training, skills, clinical competencies, examination, regulation, and patient care to ensure safety and quality health care for all infants, children, adolescents, and young adults. (5/13)

See full text on page 945.

SCREENING EXAMINATION OF PREMATURE INFANTS FOR RETINOPATHY OF PREMATURITY

Section on Ophthalmology (joint with American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists)

ABSTRACT. This statement revises a previous statement on screening of preterm infants for retinopathy of prematurity (ROP) that was published in 2006. ROP is a pathologic process that occurs only in immature retinal tissue and can progress to a tractional retinal detachment, which can result in functional or complete blindness. Use of peripheral retinal ablative therapy by using laser photocoagulation for nearly 2 decades has resulted in a high probability of markedly decreasing the incidence of this poor visual outcome, but the sequential nature of ROP creates a requirement that at-risk preterm infants be examined at proper times and intervals to detect the changes of ROP before they become permanently destructive. This statement presents the attributes on which an effective program for detecting and treating ROP could be based, including the timing of initial examination and subsequent reexamination intervals. (12/12)

SCREENING FOR RETINOPATHY IN THE PEDIATRIC PATIENT WITH TYPE 1 DIABETES MELLITUS (CLINICAL REPORT)

Gregg T. Lueder, MD; Janet Silverstein, MD; Section on Ophthalmology; and Section on Endocrinology (joint with American Association for Pediatric Ophthalmology and Strabismus)

ABSTRACT. Diabetic retinopathy (DR) is the leading cause of blindness in young adults in the United States. Early identification and treatment of DR can decrease the risk of vision loss in affected patients. This clinical report reviews the risk factors for the development of DR and screening guidance for pediatric patients with type 1 diabetes mellitus. (7/05, reaffirmed 1/09)

SECONDHAND AND PRENATAL TOBACCO SMOKE EXPOSURE (TECHNICAL REPORT)

Dana Best, MD, MPH; Committee on Environmental Health; Committee on Native American Child Health; and Committee on Adolescence

ABSTRACT. Secondhand tobacco smoke (SHS) exposure of children and their families causes significant morbidity and mortality. In their personal and professional roles, pediatricians have many opportunities to advocate for elimination of SHS exposure of children, to counsel tobacco users to quit, and to counsel children never to start. This report discusses the harms of tobacco use and SHS exposure, the extent and costs of tobacco use and SHS exposure, and the evidence that supports counseling and other clinical interventions in the cycle of tobacco use. Recommendations for future research, policy, and clinical practice change are discussed. To improve understanding and provide support for these activities, the harms of SHS exposure are discussed, effective ways to eliminate or reduce SHS exposure are presented, and policies that support a smoke-free environment are outlined. (10/09)

SELECTING APPROPRIATE TOYS FOR YOUNG CHILDREN: THE PEDIATRICIAN'S ROLE (CLINICAL REPORT)

Committee on Early Childhood, Adoption, and Dependent Care

ABSTRACT. Play is essential for learning in children. Toys are the tools of play. Which play materials are provided and how they are used are equally important. Adults caring for children can be reminded that toys facilitate but do not substitute for the most important aspect of nurture—warm, loving, dependable relationships. Toys should be safe, affordable, and developmentally appropriate. Children do not need expensive toys. Toys should be appealing to engage the child over a period of time. Information and resources are provided in this report so pediatricians can give parents advice about selecting toys. (4/03, reaffirmed 10/06, 5/11)

SELF-INJECTABLE EPINEPHRINE FOR FIRST-AID MANAGEMENT OF ANAPHYLAXIS (CLINICAL REPORT)

Scott H. Sicherer, MD; F. Estelle R. Simons, MD; and Section on Allergy and Immunology

ABSTRACT. Anaphylaxis is a severe, potentially fatal systemic allergic reaction that is rapid in onset and may cause death. Epinephrine is the primary medical therapy, and it must be administered promptly. This clinical report focuses on practical issues concerning the administration of self-injectable epinephrine for first-aid treatment of anaphylaxis in the community. The recommended epinephrine dose for anaphylaxis in children, based primarily on anecdotal evidence, is 0.01 mg/kg, up to 0.30 mg. Intramuscular injection of epinephrine into the lateral thigh (vastus lateralis) is the preferred route for therapy in first-aid treatment. Epinephrine autoinjectors are currently available in only 2 fixed doses: 0.15 and 0.30 mg. On the basis of current, albeit limited, data, it seems reasonable to recommend autoinjectors with 0.15 mg of epinephrine for otherwise healthy young children who weigh 10 to 25 kg (22–55 lb) and autoinjectors with 0.30 mg of epinephrine for those who weigh approximately 25 kg (55 lb) or more; however, specific clinical circumstances must be considered in these decisions. This report also describes several quandaries in regard to management, including the selection of dose, indications for prescribing an autoinjector, and decisions regarding when to inject epinephrine. Effective care for individuals at risk of anaphylaxis requires a comprehensive management approach involving families, allergic children, schools, camps, and other youth organizations. Risk reduction entails confirmation of the trigger, discussion of avoidance of the relevant allergen, a written individualized emergency anaphylaxis action plan, and education of supervising adults with regard to recognition and treatment of anaphylaxis. (3/07)

SENSORY INTEGRATION THERAPIES FOR CHILDREN WITH DEVELOPMENTAL AND BEHAVIORAL DISORDERS

Section on Complementary and Integrative Medicine and Council on Children With Disabilities

ABSTRACT. Sensory-based therapies are increasingly used by occupational therapists and sometimes by other types of therapists in treatment of children with developmental and behavioral disorders. Sensory-based therapies involve activities that are believed to organize the sensory system by providing vestibular, proprioceptive, auditory, and tactile inputs. Brushes, swings, balls, and other specially designed therapeutic or recreational equipment are used to provide these inputs. However, it is unclear whether children who present with sensory-based problems have an actual "disorder" of the sensory pathways of the brain or whether these deficits are characteristics associated with other developmental and behavioral disorders. Because there is no universally accepted framework for diagnosis, sensory processing disorder generally should not be diagnosed. Other developmental and behavioral disorders must always be considered, and a thorough evaluation should be completed. Difficulty tolerating or processing sensory information is a characteristic that may be seen in many developmental behavioral disorders, including autism spectrum disorders, attention-deficit/hyperactivity disorder, developmental coordination disorders, and childhood anxiety disorders.

Occupational therapy with the use of sensory-based therapies may be acceptable as one of the components of a comprehensive treatment plan. However, parents should be informed that the amount of research regarding the effectiveness of sensory integration therapy is limited and inconclusive. Important roles for pediatricians and other clinicians may include discussing these limitations with parents, talking with families about a trial period of sensory integration therapy, and teaching families how to evaluate the effectiveness of a therapy. (5/12)

SEXUAL ORIENTATION AND ADOLESCENTS (CLINICAL REPORT)

Committee on Adolescence

ABSTRACT. The American Academy of Pediatrics issued its first statement on homosexuality and adolescents in 1983, with a revision in 1993. This report reflects the growing understanding of youth of differing sexual orientations. Young people are recognizing their sexual orientation earlier than in the past, making this a topic of importance to pediatricians. Pediatricians should be aware that some youths in their care may have concerns about their sexual orientation or that of siblings, friends, parents, relatives, or others. Health care professionals should provide factual, current, nonjudgmental information in a confidential manner. All youths, including those who know or wonder whether they are not heterosexual, may seek information from physicians about sexual orientation, sexually transmitted diseases, substance abuse, or various psychosocial difficulties. The pediatrician should be attentive to various potential psychosocial difficulties, offer counseling or refer for counseling when necessary and ensure that every sexually active youth receives a thorough medical history, physical examination, immunizations, appropriate laboratory tests, and counseling about sexually transmitted diseases (including human immunodeficiency virus infection) and appropriate treatment if necessary.

Not all pediatricians may feel able to provide the type of care described in this report. Any pediatrician who is unable to care for and counsel nonheterosexual youth should refer these patients to an appropriate colleague. (6/04)

SEXUALITY OF CHILDREN AND ADOLESCENTS WITH DEVELOPMENTAL DISABILITIES (CLINICAL REPORT)

Nancy A. Murphy, MD; Ellen Roy Elias, MD; for Council on Children With Disabilities

ABSTRACT. Children and adolescents with developmental disabilities, like all children, are sexual persons. However, attention to their complex medical and functional issues often consumes time that might otherwise be invested in addressing the anatomic, physiologic, emotional, and social aspects of their developing sexuality. This report discusses issues of puberty, contraception, psychosexual development, sexual abuse, and sexuality education specific to children and adolescents with disabilities and their families. Pediatricians, in the context of the medical home, are encouraged to discuss issues of sexuality on a regular basis, ensure the privacy of each child and adolescent, promote self-care and social independence among persons with disabilities, advocate for appropriate sexuality education, and provide ongoing education for children and adolescents with developmental disabilities and their families. (7/06, reaffirmed 12/09, 7/13)

SEXUALITY, CONTRACEPTION, AND THE MEDIA

Victor C. Strasburger, MD, and Council on Communications and Media

ABSTRACT. From a health viewpoint, early sexual activity among US adolescents is a potential problem because of the risk of pregnancy and sexually transmitted infections. New evidence points to the media adolescents use frequently (television, music, movies, magazines, and the Internet) as important factors in the initiation of sexual intercourse. There is a major disconnect between what mainstream media portray—casual sex and sexuality with no consequences—and what children and teenagers need—straightforward information about human sexuality and the need for contraception when having sex. Television, film, music, and the Internet are all becoming increasingly sexually explicit, yet information on abstinence, sexual responsibility, and birth control remains rare. It is unwise to promote "abstinence-only" sex education when it has been shown to be ineffective and when the media have become such an important source of information about "nonabstinence." Recommendations are presented to help pediatricians address this important issue. (8/10)

SEXUALITY EDUCATION FOR CHILDREN AND ADOLESCENTS

Committee on Psychosocial Aspects of Child and Family Health and Committee on Adolescence

ABSTRACT. Children and adolescents need accurate and comprehensive education about sexuality to practice healthy sexual behavior as adults. Early, exploitative, or risky sexual activity may lead to health and social problems, such as unintended pregnancy and sexually transmitted diseases, including human immunodeficiency virus infection and acquired immunodeficiency syndrome. This statement reviews the role of the pediatrician in providing sexuality education to children, adolescents, and their families. Pediatricians should integrate sexuality education into the confidential and longitudinal relationship they develop with children, adolescents, and families to complement the education children obtain at school and at home. Pediatricians must be aware of their own attitudes, beliefs, and values so their effectiveness in discussing sexuality in the clinical setting is not limited. (8/01, reaffirmed 10/04)

SHOPPING CART–RELATED INJURIES TO CHILDREN

Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Shopping cart–related injuries to children are common and can result in severe injury or even death. Most injuries result from falls from carts or cart tip-overs, and injuries to the head and neck represent three fourths of cases. The current US standard for shopping carts should be revised to include clear and effective performance criteria to prevent falls from carts and cart tipovers. Pediatricians have an important role as educators, researchers, and advocates to promote the prevention of these injuries. (8/06, reaffirmed 4/09, 8/13)

SHOPPING CART–RELATED INJURIES TO CHILDREN (TECHNICAL REPORT)

Gary A. Smith, MD, DrPH, for Committee on Injury, Violence, and Poison Prevention

ABSTRACT. An estimated 24 200 children younger than 15 years, 20 700 (85%) of whom were younger than 5 years, were treated in US hospital emergency departments in 2005 for shopping cart–related injuries. Approximately 4% of shopping cart–related injuries to children younger than 15 years require admission to the hospital. Injuries to the head and neck represent three fourths of all injuries. Fractures account for 45% of all hospitalizations. Deaths have occurred from falls from shopping carts and cart tip-overs. Falls are the most common mechanism of injury and account for more than half of injuries associated with shopping carts. Cart tip-overs are the second most common mechanism, responsible for up to one fourth of injuries and almost 40% of shopping cart–related injuries among children younger than 2 years. Public-awareness initiatives, education programs, and parental supervision, although important, are not enough to prevent these injuries effectively. European Standard EN 1929-1:1998 and joint Australian/New Zealand Standard AS/NZS 3847.1:1999 specify requirements for the construction, performance, testing, and safety of shopping carts and have been implemented as national standards in 21 countries. A US performance standard for shopping carts (ASTM [American Society for Testing and Materials] F2372-04) was established in July 2004; however, it does not adequately address falls and cart tip-overs, which are the leading mechanisms of shopping cart–related injuries to children. The current US standard for shopping carts should be revised to include clear and effective performance criteria for shopping cart child-restraint systems and cart stability to prevent falls from carts and cart tip-overs. This is imperative to decrease the number and severity of shopping cart–related injuries to children. Recommendations from the American Academy of Pediatrics regarding prevention of shopping cart–related injuries are included in the accompanying policy statement. (8/06, reaffirmed 4/09, 8/13)

SIDS AND OTHER SLEEP-RELATED INFANT DEATHS: EXPANSION OF RECOMMENDATIONS FOR A SAFE INFANT SLEEPING ENVIRONMENT

Task Force on Sudden Infant Death Syndrome

ABSTRACT. Despite a major decrease in the incidence of sudden infant death syndrome (SIDS) since the American Academy of Pediatrics (AAP) released its recommendation in 1992 that infants be placed for sleep in a nonprone position, this decline has plateaued in recent years. Concurrently, other causes of sudden unexpected infant death that occur during sleep (sleep-related deaths), including suffocation, asphyxia, and entrapment, and ill-defined or unspecified causes of death have increased in incidence, particularly since the AAP published its last statement on SIDS in 2005. It has become increasingly important to address these other causes of sleep-related infant death. Many of the modifiable and nonmodifiable risk factors for SIDS and suffocation are strikingly similar. The AAP, therefore, is expanding its recommendations from focusing only on SIDS to focusing on a safe sleep environment that can reduce the risk of all sleep-related infant deaths, including SIDS. The recommendations described in this policy statement include supine positioning, use of a firm sleep surface, breastfeeding, room-sharing without bed-sharing, routine immunizations, consideration of using a pacifier, and avoidance of soft bedding, overheating, and exposure to tobacco smoke, alcohol, and illicit drugs. The rationale for these recommendations is discussed in detail in the accompanying "Technical Report—SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment." (10/11)

SIDS AND OTHER SLEEP-RELATED INFANT DEATHS: EXPANSION OF RECOMMENDATIONS FOR A SAFE INFANT SLEEPING ENVIRONMENT (TECHNICAL REPORT)

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statement on SIDS in 2005. It has become increasingly important to address these other causes of sleep-related infant death. Many of the modifiable and nonmodifiable risk factors for SIDS and suffocation are strikingly similar. The AAP, therefore, is expanding its recommendations from being only SIDS-focused to focusing on a safe sleep environment that can reduce the risk of all sleep-related infant deaths including SIDS. The recommendations described in this report include supine positioning, use of a firm sleep surface, breastfeeding, room-sharing without bed-sharing, routine immunization, consideration of a pacifier, and avoidance of soft bedding, overheating, and exposure to tobacco smoke, alcohol, and illicit drugs. The rationale for these recommendations is discussed in detail in this technical report. The recommendations are published in the accompanying "Policy Statement—Sudden Infant Death Syndrome and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment." (10/11)

SKATEBOARD AND SCOOTER INJURIES

Committee on Injury, Violence, and Poison Prevention

ABSTRACT. Skateboard-related injuries account for an estimated 50 000 emergency department visits and 1500 hospitalizations among children and adolescents in the United States each year. Nonpowered scooter-related injuries accounted for an estimated 9400 emergency department visits between January and August 2000, and 90% of these patients were children younger than 15 years. Many such injuries can be avoided if children and youth do not ride in traffic, if proper protective gear is worn, and if, in the absence of close adult supervision, skateboards and scooters are not used by children younger than 10 and 8 years, respectively. (3/02, reaffirmed 5/05, 10/08)

SNOWMOBILING HAZARDS

Committee on Injury and Poison Prevention

ABSTRACT. Snowmobiles continue to pose a significant risk to children younger than 15 years and adolescents and young adults 15 through 24 years of age. Head injuries remain the leading cause of mortality and serious morbidity, arising largely from snowmobilers colliding, falling, or overturning during operation. Children also were injured while being towed in a variety of conveyances by snowmobiles. No uniform code of state laws governs the use of snowmobiles by children and youth. Because evidence is lacking to support the effectiveness of operator safety certification and because many children and adolescents do not have the required strength and skills to operate a snowmobile safely, the recreational operation of snowmobiles by persons younger than 16 years is not recommended. Snowmobiles should not be used to tow persons on a tube, tire, sled, or saucer. Furthermore, a graduated licensing program is advised for snowmobilers 16 years and older. Both active and passive snowmobile injury prevention strategies are suggested, as well as recommendations for manufacturers to make safer equipment for snowmobilers of all ages. (11/00, reaffirmed 5/04, 1/07, 6/10)

SOFT DRINKS IN SCHOOLS

Committee on School Health

ABSTRACT. This statement is intended to inform pediatricians and other health care professionals, parents, superintendents, and school board members about nutritional concerns regarding soft drink consumption in schools. Potential health problems associated with high intake of sweetened drinks are 1) overweight or obesity attributable to additional calories in the diet; 2) displacement of milk consumption, resulting in calcium deficiency with an attendant risk of osteoporosis and fractures; and 3) dental caries and potential enamel erosion. Contracts with school districts for exclusive soft drink rights encourage consumption directly and indirectly. School officials and parents need to become well informed about the health implications of vended drinks in school before making a decision about student access to them. A clearly defined, district-wide policy that restricts the sale of soft drinks will safeguard against health problems as a result of overconsumption. (1/04, reaffirmed 1/09)

SPECIAL REQUIREMENTS OF ELECTRONIC HEALTH RECORD SYSTEMS IN PEDIATRICS (CLINICAL REPORT)

S. Andrew Spooner, MD, MS, and Council on Clinical Information Technology

ABSTRACT. Some functions of an electronic health record system are much more important in providing pediatric care than in adult care. Pediatricians commonly complain about the absence of these "pediatric functions" when they are not available in electronic health record systems. To stimulate electronic health record system vendors to recognize and incorporate pediatric functionality into pediatric electronic health record systems, this clinical report reviews the major functions of importance to child health care providers. Also reviewed are important but less critical functions, any of which might be of major importance in a particular clinical context. The major areas described here are immunization management, growth tracking, medication dosing, data norms, and privacy in special pediatric populations. The American Academy of Pediatrics believes that if the functions described in this document are supported in all electronic health record systems, these systems will be more useful for patients of all ages. (3/07, reaffirmed 5/12)

SPECTRUM OF NONINFECTIOUS HEALTH EFFECTS FROM MOLDS

Committee on Environmental Health

ABSTRACT. Molds are eukaryotic (possessing a true nucleus) nonphotosynthetic organisms that flourish both indoors and outdoors. For humans, the link between mold exposure and asthma exacerbations, allergic rhinitis, infections, and toxicities from ingestion of mycotoxin-contaminated foods are well known. However, the cause-and-effect relationship between inhalational exposure to mold and other untoward health effects (eg, acute idiopathic pulmonary hemorrhage in infants and other illnesses and health complaints) requires additional investigation. Pediatricians play an important role in the education of families about mold, its adverse health effects, exposure prevention, and remediation procedures. (12/06, reaffirmed 1/11)

SPECTRUM OF NONINFECTIOUS HEALTH EFFECTS FROM MOLDS (TECHNICAL REPORT)

Lynnette J. Mazur, MD, MPH; Janice Kim, MD, PhD, MPH; and Committee on Environmental Health

ABSTRACT. Molds are multicellular fungi that are ubiquitous in outdoor and indoor environments. For humans, they are both beneficial (for the production of antimicrobial agents, chemotherapeutic agents, and vitamins) and detrimental. Exposure to mold can occur through inhalation, ingestion, and touching moldy surfaces. Adverse health effects may occur through allergic, infectious, irritant, or toxic processes. The cause-and-effect relationship between mold exposure and allergic and infectious illnesses is well known. Exposures to toxins via the gastrointestinal tract also are well described. However, the cause-and-effect relationship between inhalational exposure to mold toxins and other untoward health effects (eg, acute idiopathic pulmonary hemorrhage in infants and other illnesses and health complaints) is controversial and requires additional investigation. In this report we examine evidence of fungal-related illnesses and the unique aspects of mold exposure to children. Mold-remediation procedures are also discussed. (12/06, reaffirmed 1/11)

SPORT-RELATED CONCUSSION IN CHILDREN AND ADOLESCENTS (CLINICAL REPORT)

Mark E. Halstead, MD; Kevin D. Walter, MD; and Council on Sports Medicine and Fitness

ABSTRACT. Sport-related concussion is a "hot topic" in the media and in medicine. It is a common injury that is likely underreported by pediatric and adolescent athletes. Football has the highest incidence of concussion, but girls have higher concussion rates than boys do in similar sports. A clear understanding of the definition, signs, and symptoms of concussion is necessary to recognize it and rule out more severe intracranial injury. Concussion can cause symptoms that interfere with school, social and family relationships, and participation in sports. Recognition and education are paramount, because although proper equipment, sport technique, and adherence to rules of the sport may decrease the incidence or severity of concussions, nothing has been shown to prevent them. Appropriate management is essential for reducing the risk of long-term symptoms and complications. Cognitive and physical rest is the mainstay of management after diagnosis, and neuropsychological testing is a helpful tool in the management of concussion. Return to sport should be accomplished by using a progressive exercise program while evaluating for any return of signs or symptoms. This report serves as a basis for understanding the diagnosis and management of concussion in children and adolescent athletes. (8/10)

SPORTS DRINKS AND ENERGY DRINKS FOR CHILDREN AND ADOLESCENTS: ARE THEY APPROPRIATE? (CLINICAL REPORT)

Committee on Nutrition and Council on Sports Medicine and Fitness

ABSTRACT. Sports and energy drinks are being marketed to children and adolescents for a wide variety of inappropriate uses. Sports drinks and energy drinks are significantly different products, and the terms should not be used interchangeably. The primary objectives of this clinical report are to define the ingredients of sports and energy drinks, categorize the similarities and differences between the products, and discuss misuses and abuses. Secondary objectives are to encourage screening during annual physical examinations for sports and energy drink use, to understand the reasons why youth consumption is widespread, and to improve education aimed at decreasing or eliminating the inappropriate use of these beverages by children and adolescents. Rigorous review and analysis of the literature reveal that caffeine and other stimulant substances contained in energy drinks have no place in the diet of children and adolescents. Furthermore, frequent or excessive intake of caloric sports drinks can substantially increase the risk for overweight or obesity in children and adolescents. Discussion regarding the appropriate use of sports drinks in the youth athlete who participates regularly in endurance or high-intensity sports and vigorous physical activity is beyond the scope of this report. (5/11)

STANDARD TERMINOLOGY FOR FETAL, INFANT, AND PERINATAL DEATHS (CLINICAL REPORT)

CAPT Wanda Denise Barfield, MD, MPH, and Committee on Fetus and Newborn

ABSTRACT. Accurately defining and reporting perinatal deaths (ie, fetal and infant deaths) is a critical first step in understanding the magnitude and causes of these important events. In addition to obstetric health care providers, neonatologists and pediatricians should know the current US definitions and reporting requirements for live births, fetal deaths, and infant deaths. Correct identification of these vital events will improve our local, state, and national data so that these deaths can be better addressed and reduced. (6/11)

STANDARDS FOR HEALTH INFORMATION TECHNOLOGY TO ENSURE ADOLESCENT PRIVACY

Committee on Adolescence and Council on Clinical Information Technology

ABSTRACT. Privacy and security of health information is a basic expectation of patients. Despite the existence of federal and state laws safeguarding the privacy of health information, health information systems currently lack the capability to allow for protection of this information for minors. This policy statement reviews the challenges to privacy for adolescents posed by commercial health information technology systems and recommends basic principles for ideal electronic health record systems. This policy statement has been endorsed by the Society for Adolescent Health and Medicine. (10/12)

STATE CHILDREN'S HEALTH INSURANCE PROGRAM ACHIEVEMENTS, CHALLENGES, AND POLICY RECOMMENDATIONS

Committee on Child Health Financing

ABSTRACT. This policy statement reviews the impressive progress of the State Children's Health Insurance Program since its enactment in 1997 and identifies outstanding challenges and state and federal policy recommendations. The American Academy of Pediatrics urges Congress to reauthorize SCHIP to strengthen its historic gains. The following set of recommended strategies for reauthorization

pertain to funding, eligibility and enrollment, coverage, cost sharing, payment and provider-network capacity, and quality performance. (6/07)

STRATEGIES FOR PREVENTION OF HEALTH CARE–ASSOCIATED INFECTIONS IN THE NICU (CLINICAL REPORT)

Richard A. Polin, MD; Susan Denson, MD; Michael T. Brady, MD; Committee on Fetus and Newborn; and Committee on Infectious Diseases

ABSTRACT. Health care–associated infections in the NICU result in increased morbidity and mortality, prolonged lengths of stay, and increased medical costs. Neonates are at high risk of acquiring health care–associated infections because of impaired host-defense mechanisms, limited amounts of protective endogenous flora on skin and mucosal surfaces at time of birth, reduced barrier function of their skin, use of invasive procedures and devices, and frequent exposure to broad-spectrum antibiotic agents. This clinical report reviews management and prevention of health care–associated infections in newborn infants. (3/12)

STRENGTH TRAINING BY CHILDREN AND ADOLESCENTS

Council on Sports Medicine and Fitness

ABSTRACT. Pediatricians are often asked to give advice on the safety and efficacy of strength-training programs for children and adolescents. This statement, which is a revision of a previous American Academy of Pediatrics policy statement, defines relevant terminology and provides current information on risks and benefits of strength training for children and adolescents. (4/08, reaffirmed 6/11)

SUBSTANCE USE SCREENING, BRIEF INTERVENTION, AND REFERRAL TO TREATMENT FOR PEDIATRICIANS

Committee on Substance Abuse

ABSTRACT. As a component of comprehensive pediatric care, adolescents should receive appropriate guidance regarding substance use during routine clinical care. This statement addresses practitioner challenges posed by the spectrum of pediatric substance use and presents an algorithm-based approach to augment the pediatrician's confidence and abilities related to substance use screening, brief intervention, and referral to treatment in the primary care setting. Adolescents with addictions should be managed collaboratively (or comanaged) with child and adolescent mental health or addiction specialists. This statement reviews recommended referral guidelines that are based on established patient-treatment–matching criteria and the risk level for substance abuse. (10/11)

SUICIDE AND SUICIDE ATTEMPTS IN ADOLESCENTS (CLINICAL REPORT)

Benjamin N. Shain, MD, PhD, and Committee on Adolescence

ABSTRACT. Suicide is the third-leading cause of death for adolescents 15 to 19 years old. Pediatricians can take steps to help reduce the incidence of adolescent suicide by screening for depression and suicidal ideation and behavior. This report updates the previous statement of the American Academy of Pediatrics and is intended to assist the pediatrician in the identification and management of the adolescent at risk of suicide. The extent to which pediatricians provide appropriate care for suicidal adolescents depends on their knowledge, skill, comfort with the topic, and ready access to appropriate community resources. All teenagers with suicidal thoughts or behaviors should know that their pleas for assistance are heard and that pediatricians are willing to serve as advocates to help resolve the crisis. (9/07)

SUPPLEMENTAL SECURITY INCOME (SSI) FOR CHILDREN AND YOUTH WITH DISABILITIES

Council on Children With Disabilities

ABSTRACT. The Supplemental Security Income (SSI) program remains an important source of financial support for low-income families of children with special health care needs and disabling conditions. In most states, SSI eligibility also qualifies children for the state Medicaid program, providing access to health care services. The Social Security Administration (SSA), which administers the SSI program, considers a child disabled under SSI if there is a medically determinable physical or mental impairment or combination of impairments that results in marked and severe functional limitations. The impairment(s) must be expected to result in death or have lasted or be expected to last for a continuous period of at least 12 months. The income and assets of families of children with disabilities are also considered when determining financial eligibility. When an individual with a disability becomes an adult at 18 years of age, the SSA considers only the individual's income and assets. The SSA considers an adult to be disabled if there is a medically determinable impairment (or combination of impairments) that prevents substantial gainful activity for at least 12 continuous months. SSI benefits are important for youth with chronic conditions who are transitioning to adulthood. The purpose of this statement is to provide updated information about the SSI medical and financial eligibility criteria and the disability-determination process. This statement also discusses how pediatricians can help children and youth when they apply for SSI benefits. (11/09)

SUPPORTING THE FAMILY AFTER THE DEATH OF A CHILD (CLINICAL REPORT)

Esther Wender, MD, and Committee on Psychosocial Aspects of Child and Family Health

ABSTRACT. The death of a child can have a devastating effect on the family. The pediatrician has an important role to play in supporting the parents and any siblings still in his or her practice after such a death. Pediatricians may be poorly prepared to provide this support. Also, because of the pain of confronting the grief of family members, they may be reluctant to become involved. This statement gives guidelines to help the pediatrician provide such support. It describes the grief reactions that can be expected in family members after the death of a child. Ways of supporting family members are suggested, and other helpful resources in the community are described. The goal of this guidance is to prevent outcomes that may impair the health and development of affected parents and children. (11/12)

SUPPORTING THE HEALTH CARE TRANSITION FROM ADOLESCENCE TO ADULTHOOD IN THE MEDICAL HOME (CLINICAL REPORT)

American Academy of Pediatrics, American Academy of Family Physicians, and American College of Physicians Transitions Clinical Report Authoring Group

ABSTRACT. Optimal health care is achieved when each person, at every age, receives medically and developmentally appropriate care. The goal of a planned health care transition is to maximize lifelong functioning and well-being for all youth, including those who have special health care needs and those who do not. This process includes ensuring that high-quality, developmentally appropriate health care services are available in an uninterrupted manner as the person moves from adolescence to adulthood. A well-timed transition from child- to adult-oriented health care is specific to each person and ideally occurs between the ages of 18 and 21 years. Coordination of patient, family, and provider responsibilities enables youth to optimize their ability to assume adult roles and activities. This clinical report represents expert opinion and consensus on the practice-based implementation of transition for all youth beginning in early adolescence. It provides a structure for training and continuing education to further understanding of the nature of adolescent transition and how best to support it. Primary care physicians, nurse practitioners, and physician assistants, as well as medical subspecialists, are encouraged to adopt these materials and make this process specific to their settings and populations. (7/11)

SURFACTANT REPLACEMENT THERAPY FOR PRETERM AND TERM NEONATES WITH RESPIRATORY DISTRESS (CLINICAL REPORT)

Richard A. Polin, MD, FAAP; Waldemar A. Carlo, MD, FAAP; and Committee on Fetus and Newborn

ABSTRACT. Respiratory failure secondary to surfactant deficiency is a major cause of morbidity and mortality in preterm infants. Surfactant therapy substantially reduces mortality and respiratory morbidity for this population. Secondary surfactant deficiency also contributes to acute respiratory morbidity in late-preterm and term neonates with meconium aspiration syndrome, pneumonia/sepsis, and perhaps pulmonary hemorrhage; surfactant replacement may be beneficial for these infants. This statement summarizes the evidence regarding indications, administration, formulations, and outcomes for surfactant-replacement therapy. The clinical strategy of intubation, surfactant administration, and extubation to continuous positive airway pressure and the effect of continuous positive airway pressure on outcomes and surfactant use in preterm infants are also reviewed. (12/13)

See full text on page 953.

SURVEILLANCE OF PEDIATRIC HIV INFECTION

Committee on Pediatric AIDS

ABSTRACT. Pediatric human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) surveillance should expand to include perinatal HIV exposure and HIV infection as well as AIDS to delineate completely the extent and impact of HIV infection on children and families, accurately assess the resources necessary to provide services to this population, evaluate the efficacy of public health recommendations, and determine any potential long-term consequences of interventions to prevent perinatal transmission to children ultimately determined to be uninfected as well as for those who become infected. Ensuring the confidentiality of information collected in the process of surveillance is critical. In addition, expansion of surveillance must not compromise the established, ongoing surveillance system for pediatric AIDS. An expanded pediatric HIV surveillance program provides an important counterpart to existing American Academy of Pediatrics and American College of Obstetricians and Gynecologists recommendations for HIV counseling and testing in the prenatal setting. (2/98, reaffirmed 2/02, 1/06, 1/11)

SWIMMING PROGRAMS FOR INFANTS AND TODDLERS

Committee on Sports Medicine and Fitness and Committee on Injury and Poison Prevention

ABSTRACT. Infant and toddler aquatic programs provide an opportunity to introduce young children to the joy and risks of being in or around water. Generally, children are not developmentally ready for swimming lessons until after their fourth birthday. Aquatic programs for infants and toddlers have not been shown to decrease the risk of drowning, and parents should not feel secure that their child is safe in water or safe from drowning after participating in such programs. Young children should receive constant, close supervision by an adult while in and around water. (4/00, reaffirmed 5/04)

THE TEEN DRIVER

Committee on Injury, Violence, and Poison Prevention and Committee on Adolescence

ABSTRACT. Motor vehicle–related injuries to adolescents continue to be of paramount importance to society. Since the original policy statement on the teenaged driver was published in 1996, there have been substantial changes in many state laws and much new research on this topic. There is a need to provide pediatricians with up-to-date information and materials to facilitate appropriate counseling and anticipatory guidance. This statement describes why teenagers are at greater risk of motor vehicle–related injuries, suggests topics suitable for office-based counseling, describes innovative programs, and proposes preventive interventions for pediatricians, parents, legislators, educators, and other child advocates. (12/06, reaffirmed 6/10)

TESTING FOR DRUGS OF ABUSE IN CHILDREN AND ADOLESCENTS

Committee on Substance Abuse

ABSTRACT. The American Academy of Pediatrics (AAP) recognizes the abuse of psychoactive drugs as one of the greatest problems facing children and adolescents and condemns all such use. Diagnostic testing for drugs of abuse is frequently an integral part of the pediatrician's evaluation and management of those suspected of such use. "Voluntary screening" is the term applied to many mass non–suspicion-based screening programs, yet such programs may not be truly voluntary as there are often negative consequences for those who choose not to take

part. Participation in such programs should not be a prerequisite to participation in school activities. Involuntary testing is not appropriate in adolescents with decisional capacity—even with parental consent—and should be performed only if there are strong medical or legal reasons to do so. The AAP reaffirms its position that the appropriate response to the suspicion of drug abuse in a young person is the referral to a qualified health care professional for comprehensive evaluation. (8/96, reaffirmed 5/99, 5/06)

TESTING FOR DRUGS OF ABUSE IN CHILDREN AND ADOLESCENTS: ADDENDUM—TESTING IN SCHOOLS AND AT HOME

Committee on Substance Abuse and Council on School Health

ABSTRACT. The American Academy of Pediatrics continues to believe that adolescents should not be drug tested without their knowledge and consent. Recent US Supreme Court decisions and market forces have resulted in recommendations for drug testing of adolescents at school and products for parents to use to test adolescents at home. The American Academy of Pediatrics has strong reservations about testing adolescents at school or at home and believes that more research is needed on both safety and efficacy before school-based testing programs are implemented. The American Academy of Pediatrics also believes that more adolescent-specific substance abuse treatment resources are needed to ensure that testing leads to early rehabilitation rather than to punitive measures only. (3/07)

TOBACCO, ALCOHOL, AND OTHER DRUGS: THE ROLE OF THE PEDIATRICIAN IN PREVENTION, IDENTIFICATION, AND MANAGEMENT OF SUBSTANCE ABUSE (CLINICAL REPORT)

John W. Kulig, MD, MPH, and Committee on Substance Abuse

ABSTRACT. Substance abuse remains a major public health concern, and pediatricians are uniquely positioned to assist their patients and families with its prevention, detection, and treatment. The American Academy of Pediatrics has highlighted the importance of such issues in a variety of ways, including its guidelines for preventive services. The harmful consequences of tobacco, alcohol, and other drug use are a concern of medical professionals who care for infants, children, adolescents, and young adults. Thus, pediatricians should include discussion of substance abuse as a part of routine health care, starting with the prenatal visit, and as part of ongoing anticipatory guidance. Knowledge of the nature and extent of the consequences of tobacco, alcohol, and other drug use as well as the physical, psychological, and social consequences is essential for pediatricians. Pediatricians should incorporate substance-abuse prevention into daily practice, acquire the skills necessary to identify young people at risk of substance abuse, and provide or facilitate assessment, intervention, and treatment as necessary. (3/05, reaffirmed 3/13)

TOBACCO AS A SUBSTANCE OF ABUSE (TECHNICAL REPORT)

Tammy H. Sims, MD, MS, and Committee on Substance Abuse

ABSTRACT. Tobacco use is the leading preventable cause of morbidity and death in the United States. Because 80% to 90% of adult smokers began during adolescence, and two thirds became regular, daily smokers before they reached 19 years of age, tobacco use may be viewed as a pediatric disease. Every year in the United States, approximately 1.4 million children younger than 18 years start smoking, and many of them will die prematurely from a smoking-related disease. Moreover, there is recent evidence that adolescents report symptoms of tobacco dependence early in the smoking process, even before becoming daily smokers. The prevalence of tobacco use is higher among teenagers and young adults than among older adult populations. The critical role of pediatricians in helping to reduce tobacco use and addiction and secondhand tobacco-smoke exposure in the pediatric population includes education and prevention, screening and detection, and treatment and referral. (10/09)

TOBACCO USE: A PEDIATRIC DISEASE

Committee on Environmental Health, Committee on Substance Abuse, Committee on Adolescence, and Committee on Native American Child Health

ABSTRACT. Tobacco use and secondhand tobacco-smoke (SHS) exposure are major national and international health concerns. Pediatricians and other clinicians who care for children are uniquely positioned to assist patients and families with tobacco-use prevention and treatment. Understanding the nature and extent of tobacco use and SHS exposure is an essential first step toward the goal of eliminating tobacco use and its consequences in the pediatric population. The next steps include counseling patients and family members to avoid SHS exposures or cease tobacco use; advocacy for policies that protect children from SHS exposure; and elimination of tobacco use in the media, public places, and homes. Three overarching principles of this policy can be identified: (1) there is no safe way to use tobacco; (2) there is no safe level or duration of exposure to SHS; and (3) the financial and political power of individuals, organizations, and government should be used to support tobacco control. Pediatricians are advised not to smoke or use tobacco; to make their homes, cars, and workplaces tobacco free; to consider tobacco control when making personal and professional decisions; to support and advocate for comprehensive tobacco control; and to advise parents and patients not to start using tobacco or to quit if they are already using tobacco. Prohibiting both tobacco advertising and the use of tobacco products in the media is recommended. Recommendations for eliminating SHS exposure and reducing tobacco use include attaining universal (1) smoke-free home, car, school, work, and play environments, both inside and outside, (2) treatment of tobacco use and dependence through employer, insurance, state, and federal supports, (3) implementation

and enforcement of evidence-based tobacco-control measures in local, state, national, and international jurisdictions, and (4) financial and systems support for training in and research of effective ways to prevent and treat tobacco use and SHS exposure. Pediatricians, their staff and colleagues, and the American Academy of Pediatrics have key responsibilities in tobacco control to promote the health of children, adolescents, and young adults. (10/09)

TOWARD TRANSPARENT CLINICAL POLICIES

Steering Committee on Quality Improvement and Management

ABSTRACT. Clinical policies of professional societies such as the American Academy of Pediatrics are valued highly, not only by clinicians who provide direct health care to children but also by many others who rely on the professional expertise of these organizations, including parents, employers, insurers, and legislators. The utility of a policy depends, in large part, on the degree to which its purpose and basis are clear to policy users, an attribute known as the policy's transparency. This statement describes the critical importance and special value of transparency in clinical policies, guidelines, and recommendations; helps identify obstacles to achieving transparency; and suggests several approaches to overcome these obstacles. (3/08)

TRAMPOLINE SAFETY IN CHILDHOOD AND ADOLESCENCE

Council on Sports Medicine and Fitness

ABSTRACT. Despite previous recommendations from the American Academy of Pediatrics discouraging home use of trampolines, recreational use of trampolines in the home setting continues to be a popular activity among children and adolescents. This policy statement is an update to previous statements, reflecting the current literature on prevalence, patterns, and mechanisms of trampoline-related injuries. Most trampoline injuries occur with multiple simultaneous users on the mat. Cervical spine injuries often occur with falls off the trampoline or with attempts at somersaults or flips. Studies on the efficacy of trampoline safety measures are reviewed, and although there is a paucity of data, current implementation of safety measures have not appeared to mitigate risk substantially. Therefore, the home use of trampolines is strongly discouraged. The role of trampoline as a competitive sport and in structured training settings is reviewed, and recommendations for enhancing safety in these environments are made. (9/12)

THE TRANSFER OF DRUGS AND THERAPEUTICS INTO HUMAN BREAST MILK: AN UPDATE ON SELECTED TOPICS (CLINICAL REPORT)

Hari Cheryl Sachs, MD, FAAP, and Committee on Drugs

ABSTRACT. Many mothers are inappropriately advised to discontinue breastfeeding or avoid taking essential medications because of fears of adverse effects on their infants. This cautious approach may be unnecessary in many cases, because only a small proportion of medications are contraindicated in breastfeeding mothers or associated with adverse effects on their infants. Information to inform physicians about the extent of excretion for a particular drug into human milk is needed but may not be available. Previous statements on this topic from the American Academy of Pediatrics provided physicians with data concerning the known excretion of specific medications into breast milk. More current and comprehensive information is now available on the Internet, as well as an application for mobile devices, at LactMed (http://toxnet.nlm.nih.gov). Therefore, with the exception of radioactive compounds requiring temporary cessation of breastfeeding, the reader will be referred to LactMed to obtain the most current data on an individual medication. This report discusses several topics of interest surrounding lactation, such as the use of psychotropic therapies, drugs to treat substance abuse, narcotics, galactagogues, and herbal products, as well as immunization of breastfeeding women. A discussion regarding the global implications of maternal medications and lactation in the developing world is beyond the scope of this report. The World Health Organization offers several programs and resources that address the importance of breastfeeding (see http://www.who.int/topics/breastfeeding/en/). (8/13)

See full text on page 963.

TRANSITIONING HIV-INFECTED YOUTH INTO ADULT HEALTH CARE

Committee on Pediatric AIDS

ABSTRACT. With advances in antiretroviral therapy, most HIV-infected children survive into adulthood. Optimal health care for these youth includes a formal plan for the transition of care from primary and/or subspecialty pediatric/adolescent/family medicine health care providers (medical home) to adult health care provider(s). Successful transition involves the early engagement and participation of the youth and his or her family with the pediatric medical home and adult health care teams in developing a formal plan. Referring providers should have a written policy for the transfer of HIV-infected youth to adult care, which will guide in the development of an individualized plan for each youth. The plan should be introduced to the youth in early adolescence and modified as the youth approaches transition. Assessment of developmental milestones is important to define the readiness of the youth in assuming responsibility for his or her own care before initiating the transfer. Communication among all providers is essential and should include both personal contact and a written medical summary. Progress toward the transition should be tracked and, once completed, should be documented and assessed. (6/13)

See full text on page 979.

TRANSPORTING CHILDREN WITH SPECIAL HEALTH CARE NEEDS

Committee on Injury and Poison Prevention

ABSTRACT. Children with special health care needs should have access to proper resources for safe transportation. This statement reviews important considerations for transporting children with special health care needs and provides current guidelines for the protection of children with specific health care needs, including those with a tracheostomy, a spica cast, challenging behaviors, or muscle tone abnormalities as well as those transported in wheelchairs. (10/99, reaffirmed 1/03, 1/06, 3/13)

THE TREATMENT OF NEUROLOGICALLY IMPAIRED CHILDREN USING PATTERNING

Committee on Children With Disabilities

ABSTRACT. This statement reviews patterning as a treatment for children with neurologic impairments. This treatment is based on an outmoded and oversimplified theory of brain development. Current information does not support the claims of proponents that this treatment is efficacious, and its use continues to be unwarranted. (11/99, reaffirmed 11/02, 1/06, 8/10)

ULTRAVIOLET RADIATION: A HAZARD TO CHILDREN AND ADOLESCENTS

Council on Environmental Health and Section on Dermatology

ABSTRACT. Ultraviolet radiation (UVR) causes the 3 major forms of skin cancer: basal cell carcinoma; squamous cell carcinoma; and cutaneous malignant melanoma. Public awareness of the risk is not optimal, overall compliance with sun protection is inconsistent, and melanoma rates continue to rise. The risk of skin cancer increases when people overexpose themselves to sun and intentionally expose themselves to artificial sources of UVR. Yet, people continue to sunburn, and teenagers and adults alike remain frequent visitors to tanning parlors. Pediatricians should provide advice about UVR exposure during health-supervision visits and at other relevant times. Advice includes avoiding sunburning, wearing clothing and hats, timing activities (when possible) before or after periods of peak sun exposure, wearing protective sunglasses, and applying and reapplying sunscreen. Advice should be framed in the context of promoting outdoor physical activity. Adolescents should be strongly discouraged from visiting tanning parlors. Sun exposure and vitamin D status are intertwined. Cutaneous vitamin D production requires sunlight exposure, and many factors, such as skin pigmentation, season, and time of day, complicate efficiency of cutaneous vitamin D production that results from sun exposure. Adequate vitamin D is needed for bone health. Accumulating information suggests a beneficial influence of vitamin D on many health conditions. Although vitamin D is available through the diet, supplements, and incidental sun exposure, many children have low vitamin D concentrations. Ensuring vitamin D adequacy while promoting sun-protection strategies will require renewed attention to children's use of dietary and supplemental vitamin D. (2/11)

ULTRAVIOLET RADIATION: A HAZARD TO CHILDREN AND ADOLESCENTS (TECHNICAL REPORT)

Sophie J. Balk, MD; Council on Environmental Health; and Section on Dermatology

ABSTRACT. Sunlight sustains life on earth. Sunlight is essential for vitamin D synthesis in the skin. The sun's ultraviolet rays can be hazardous, however, because excessive exposure causes skin cancer and other adverse health effects. Skin cancer is a major public health problem; more than 2 million new cases are diagnosed in the United States each year. Ultraviolet radiation (UVR) causes the 3 major forms of skin cancer: basal cell carcinoma; squamous cell carcinoma; and cutaneous malignant melanoma. Exposure to UVR from sunlight and artificial sources early in life elevates the risk of developing skin cancer. Approximately 25% of sun exposure occurs before 18 years of age. The risk of skin cancer is increased when people overexpose themselves to sun and intentionally expose themselves to artificial sources of UVR. Public awareness of the risk is not optimal, compliance with sun protection is inconsistent, and skin-cancer rates continue to rise in all age groups including the younger population. People continue to sunburn, and teenagers and adults are frequent visitors to tanning parlors. Sun exposure and vitamin D status are intertwined. Adequate vitamin D is needed for bone health in children and adults. In addition, there is accumulating information suggesting a beneficial influence of vitamin D on various health conditions. Cutaneous vitamin D production requires sunlight, and many factors complicate the efficiency of vitamin D production that results from sunlight exposure. Ensuring vitamin D adequacy while promoting sun-protection strategies, therefore, requires renewed attention to evaluating the adequacy of dietary and supplemental vitamin D. Daily intake of 400 IU of vitamin D will prevent vitamin D deficiency rickets in infants. The vitamin D supplementation amounts necessary to support optimal health in older children and adolescents are less clear. This report updates information on the relationship of sun exposure to skin cancer and other adverse health effects, the relationship of exposure to artificial sources of UVR and skin cancer, sun-protection methods, vitamin D, community skin-cancer–prevention efforts, and the pediatrician's role in preventing skin cancer. In addition to pediatricians' efforts, a sustained public health effort is needed to change attitudes and behaviors regarding UVR exposure. (3/11)

UNDERINSURANCE OF ADOLESCENTS: RECOMMENDATIONS FOR IMPROVED COVERAGE OF PREVENTIVE, REPRODUCTIVE, AND BEHAVIORAL HEALTH CARE SERVICES

Committee on Adolescence and Committee on Child Health Financing

ABSTRACT. The purpose of this policy statement is to address the serious underinsurance (ie, insurance that exists but is inadequate) problems affecting insured adolescents' access to needed preventive, reproductive, and behavioral health care. In addition, the statement addresses provider payment problems that disproportionately affect clinicians who care for adolescents.

Among adolescents with insurance, particularly private health insurance, coverage of needed services is often inadequate. Benefits are typically limited in scope and amount; certain diagnoses are often excluded; and cost-sharing requirements are often too high. As a result, underinsurance represents a substantial problem among adolescents and adversely affects their health and well-being.

In addition to underinsurance problems, payment problems in the form of inadequate payment, uncompensated care for confidential reproductive services, and the failure of insurers to recognize and pay for certain billing and diagnostic codes are widespread among both private and public insurers. Payment problems negatively affect clinicians' ability to offer needed services to adolescents, especially publicly insured adolescents. (12/08)

UNDERSTANDING THE BEHAVIORAL AND EMOTIONAL CONSEQUENCES OF CHILD ABUSE (CLINICAL REPORT)

John Stirling Jr, MD; Committee on Child Abuse and Neglect; and Section on Adoption and Foster Care (joint with Lisa Amaya-Jackson, MD, MPH; American Academy of Child and Adolescent Psychiatry; and National Center for Child Traumatic Stress)

ABSTRACT. Children who have suffered early abuse or neglect may later present with significant behavior problems including emotional instability, depression, and a tendency to be aggressive or violent with others. Troublesome behaviors may persist long after the abusive or neglectful environment has changed or the child has been in foster care placement. Neurobiological research has shown that early abuse results in an altered physiological response to stressful stimuli, a response that deleteriously affects the child's subsequent socialization. Pediatricians can assist caregivers by helping them recognize the abused or neglected child's altered responses, formulate more effective coping strategies, and mobilize available community resources. (9/08)

UPDATE OF NEWBORN SCREENING AND THERAPY FOR CONGENITAL HYPOTHYROIDISM (CLINICAL REPORT)

Susan R. Rose, MD; Section on Endocrinology; and Committee on Genetics (joint with American Thyroid Association; Rosalind S. Brown, MD; and Lawson Wilkins Pediatric Endocrine Society)

ABSTRACT. Unrecognized congenital hypothyroidism leads to mental retardation. Newborn screening and thyroid therapy started within 2 weeks of age can normalize cognitive development. The primary thyroid-stimulating hormone screening has become standard in many parts of the world. However, newborn thyroid screening is not yet universal in some countries. Initial dosage of 10 to 15 μg/kg levothyroxine is recommended. The goals of thyroid hormone therapy should be to maintain frequent evaluations of total thyroxine or free thyroxine in the upper half of the reference range during the first 3 years of life and to normalize the serum thyroid-stimulating hormone concentration to ensure optimal thyroid hormone dosage and compliance.

Improvements in screening and therapy have led to improved developmental outcomes in adults with congenital hypothyroidism who are now in their 20s and 30s. Thyroid hormone regimens used today are more aggressive in targeting early correction of thyroid-stimulating hormone than were those used 20 or even 10 years ago. Thus, newborn infants with congenital hypothyroidism today may have an even better intellectual and neurologic prognosis. Efforts are ongoing to establish the optimal therapy that leads to maximum potential for normal development for infants with congenital hypothyroidism.

Remaining controversy centers on infants whose abnormality in neonatal thyroid function is transient or mild and on optimal care of very low birth weight or preterm infants. Of note, thyroid-stimulating hormone is not elevated in central hypothyroidism. An algorithm is proposed for diagnosis and management.

Physicians must not relinquish their clinical judgment and experience in the face of normal newborn thyroid test results. Hypothyroidism can be acquired after the newborn screening. When clinical symptoms and signs suggest hypothyroidism, regardless of newborn screening results, serum free thyroxine and thyroid-stimulating hormone determinations should be performed. (6/06, reaffirmed 12/11)

USE OF CHAPERONES DURING THE PHYSICAL EXAMINATION OF THE PEDIATRIC PATIENT

Committee on Practice and Ambulatory Medicine

ABSTRACT. Physicians should always communicate the scope and nature of the physical examination to be performed to the pediatric patient and his or her parent. This statement addresses the use of chaperones and issues of patient comfort, confidentiality, and privacy. The use of a chaperone should be a shared decision between the patient and physician. In some states, the use of a chaperone is mandated by state regulations. (4/11)

USE OF CODEINE- AND DEXTROMETHORPHAN-CONTAINING COUGH REMEDIES IN CHILDREN

Committee on Drugs

ABSTRACT. Numerous prescription and nonprescription medications are currently available for suppression of cough, a common symptom in children. Because adverse effects and overdosage associated with the administration of cough and cold preparations in children have been reported, education of patients and parents about the lack of proven antitussive effects and the potential risks of these products is needed. (6/97, reaffirmed 5/00, 6/03, 10/06)

THE USE OF COMPLEMENTARY AND ALTERNATIVE MEDICINE IN PEDIATRICS (CLINICAL REPORT)

Kathi J. Kemper, MD, MPH; Sunita Vohra, MD; Richard Walls, MD, PhD; Task Force on Complementary and Alternative Medicine; and Provisional Section on Complementary, Holistic, and Integrative Medicine

ABSTRACT. The American Academy of Pediatrics is dedicated to optimizing the well-being of children and advancing family-centered health care. Related to these goals, the American Academy of Pediatrics recognizes the increasing use of complementary and alternative medicine in children and, as a result, the need to provide information and support for pediatricians. From 2000 to 2002, the American Academy of Pediatrics convened and charged the Task Force on Complementary and Alternative Medicine to address issues related to the use of complementary and alternative medicine in children and to develop resources to educate physicians, patients, and families. One of these resources is this report describing complementary and alternative medicine services, current levels of utilization and financial expenditures, and associated legal and ethical considerations. The subject of complementary and alternative medicine is large and diverse, and consequently, an in-depth discussion of each method of complementary and alternative medicine is beyond the scope of this report. Instead, this report will define terms; describe epidemiology; outline common types of complementary and alternative medicine therapies; review medicolegal, ethical, and research implications; review education and training for complementary

and alternative medicine providers; provide resources for learning more about complementary and alternative medicine; and suggest communication strategies to use when discussing complementary and alternative medicine with patients and families. (12/08, reaffirmed 10/12, 1/13)

USE OF INHALED NITRIC OXIDE
Committee on Fetus and Newborn
ABSTRACT. Approval of inhaled nitric oxide by the US Food and Drug Administration for hypoxic respiratory failure of the term and near-term newborn provides an important new therapy for this serious condition. This statement addresses the conditions under which inhaled nitric oxide should be administered to the neonate with hypoxic respiratory failure. (8/00, reaffirmed 4/03, 12/09)

USE OF INHALED NITRIC OXIDE IN PRETERM INFANTS (CLINICAL REPORT)
Praveen Kumar, MD, FAAP, and Committee on Fetus and Newborn
ABSTRACT. Nitric oxide, an important signaling molecule with multiple regulatory effects throughout the body, is an important tool for the treatment of full-term and late-preterm infants with persistent pulmonary hypertension of the newborn and hypoxemic respiratory failure. Several randomized controlled trials have evaluated its role in the management of preterm infants ≤34 weeks' gestational age with varying results. The purpose of this clinical report is to summarize the existing evidence for the use of inhaled nitric oxide in preterm infants and provide guidance regarding its use in this population. (12/13)
See full text on page 987.

THE USE AND MISUSE OF FRUIT JUICE IN PEDIATRICS
Committee on Nutrition
ABSTRACT. Historically, fruit juice was recommended by pediatricians as a source of vitamin C and an extra source of water for healthy infants and young children as their diets expanded to include solid foods with higher renal solute. Fruit juice is marketed as a healthy, natural source of vitamins and, in some instances, calcium. Because juice tastes good, children readily accept it. Although juice consumption has some benefits, it also has potential detrimental effects. Pediatricians need to be knowledgeable about juice to inform parents and patients on its appropriate uses. (5/01, reaffirmed 10/06, 8/13)

USE OF PERFORMANCE-ENHANCING SUBSTANCES
Committee on Sports Medicine and Fitness
ABSTRACT. Performance-enhancing substances include dietary supplements, prescription medications, and illicit drugs. Virtually no data are available on the efficacy and safety in children and adolescents of widely used performance-enhancing substances. This statement is intended to provide a generalized but functional definition of performance-enhancing substances. The American Academy of Pediatrics strongly condemns the use of performance-enhancing substances and vigorously endorses efforts to eliminate their use among children and adolescents. (4/05, reaffirmed 5/08)

USE OF SOY PROTEIN-BASED FORMULAS IN INFANT FEEDING (CLINICAL REPORT)
Jatinder Bhatia, MD; Frank Greer, MD; and Committee on Nutrition
ABSTRACT. Soy protein-based formulas have been available for almost 100 years. Since the first use of soy formula as a milk substitute for an infant unable to tolerate a cow milk protein-based formula, the formulation has changed to the current soy protein isolate. Despite very limited indications for its use, soy protein-based formulas in the United States may account for nearly 25% of the formula market. This report reviews the limited indications and contraindications of soy formulas. It will also review the potential harmful effects of soy protein-based formulas and the phytoestrogens contained in these formulas. (5/08)

THE USE OF SYSTEMIC AND TOPICAL FLUOROQUINOLONES (CLINICAL REPORT)
John S. Bradley, MD; Mary Anne Jackson, MD; and Committee on Infectious Diseases
ABSTRACT. Appropriate prescribing practices for fluoroquinolones are essential as evolving resistance patterns are considered, additional treatment indications are identified, and the toxicity profile of fluoroquinolones in children becomes better defined. Earlier recommendations for systemic therapy remain; expanded uses of fluoroquinolones for the treatment of certain infections are outlined in this report. Although fluoroquinolones are reasonably safe in children, clinicians should be aware of the specific adverse reactions. Use of fluoroquinolones in children should continue to be limited to treatment of infections for which no safe and effective alternative exists. (9/11)

USES OF DRUGS NOT DESCRIBED IN THE PACKAGE INSERT (OFF-LABEL USES)
Committee on Drugs
ABSTRACT. New regulatory initiatives have been designed to ensure that new drugs and biologicals include adequate pediatric labeling for the claimed indications at the time of, or soon after, approval. However, because such labeling may not immediately be available, off-label use (or use that is not included in the approved label) of therapeutic agents is likely to remain common in the practice of pediatrics. This policy statement was written to address questions practitioners have regarding off-label use. The purpose of off-label use is to benefit the individual patient. Practitioners may use their professional judgment to determine these uses. Practitioners should understand that the Food and Drug Administration does not regulate off-label use. (7/02, reaffirmed 10/05)

USING PERSONAL HEALTH RECORDS TO IMPROVE THE QUALITY OF HEALTH CARE FOR CHILDREN
Council on Clinical Information Technology
ABSTRACT. A personal health record (PHR) is a repository of information from multiple contributors (eg, patient, family, guardians, physicians, and other health care professionals) regarding the health of an individual. The development of electronic PHRs presents new opportunities and challenges to the practice of pediatrics. This policy statement provides recommendations for actions

that pediatricians can take to support the development and use of PHRs for children.

Pediatric health care professionals must become actively involved in developing and adopting PHRs and PHR systems. The American Academy of Pediatrics supports development of:

- educational programs for families and clinicians on effective and efficient use of PHRs;
- incentives to facilitate PHR use and maintenance; and
- child- and adolescent-friendly standards for PHR content, portability, security, and privacy.

Properly designed PHR systems for pediatric care can empower patients. PHRs can improve access to health information, improve coordination of preventive health and health maintenance activities, and support emergency and disaster management activities. PHRs provide support for the medical home for all children, including those with special health care needs and those in foster care. PHRs can also provide information to serve as the basis for pediatric quality improvement efforts.

For PHRs to be adopted sufficiently to realize these benefits, we must determine how best to support their development and adoption. Privacy and security issues, especially with regard to children and adolescents, must be addressed. (6/09)

VENTRICULAR FIBRILLATION AND THE USE OF AUTOMATED EXTERNAL DEFIBRILLATORS ON CHILDREN

Committee on Pediatric Emergency Medicine and Section on Cardiology and Cardiac Surgery

ABSTRACT. The use of automated external defibrillators (AEDs) has been advocated in recent years as one part of the chain of survival to improve outcomes for adult cardiac arrest victims. When AEDs first entered the market, they had not been tested for pediatric usage and rhythm interpretation. In addition, the presumption was that children do not experience ventricular fibrillation, so they would not benefit from the use of AEDs. Recent literature has shown that children do experience ventricular fibrillation, which has a better outcome than do other cardiac arrest rhythms. At the same time, the arrhythmia software on AEDs has become more extensive and validated for children, and attenuation devices have become available to downregulate the energy delivered by AEDs to allow their use on children. Pediatricians are now being asked whether AED programs should be implemented, and where they are being implemented, pediatricians are being asked to provide guidance on the use of them on children. As AED programs expand, pediatricians must advocate on behalf of children so that their needs are accounted for. For pediatricians to be able to provide guidance and ensure that children are included in AED programs, it is important for pediatricians to know how AEDs work, be up-to-date on the literature regarding pediatric fibrillation and energy delivery, and understand the role of AEDs as life-saving interventions for children. (11/07, reaffirmed 6/11)

WHEN IS LACK OF SUPERVISION NEGLECT? (CLINICAL REPORT)

Kent P. Hymel, MD, and Committee on Child Abuse and Neglect

ABSTRACT. Occasionally, pediatricians become aware of children who are inadequately supervised. More frequently, pediatricians treat children for traumatic injuries or ingestions that they suspect could have been prevented with better supervision. This clinical report contains guidance for pediatricians considering a referral to a child protective services agency on the basis of suspicion of supervisory neglect. (9/06)

WIC PROGRAM

Provisional Section on Breastfeeding

ABSTRACT. This policy statement highlights the important collaboration between pediatricians and local Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) programs to ensure that infants and children receive high-quality, cost-effective health care and nutrition services. Specific recommendations are provided for pediatricians and WIC personnel to help children and their families receive optimum services through a medical home. (11/01)

YEAR 2007 POSITION STATEMENT: PRINCIPLES AND GUIDELINES FOR EARLY HEARING DETECTION AND INTERVENTION PROGRAMS

Joint Committee on Infant Hearing

ABSTRACT. The Joint Committee on Infant Hearing (JCIH) endorses early detection of and intervention for infants with hearing loss. The goal of early hearing detection and intervention (EHDI) is to maximize linguistic competence and literacy development for children who are deaf or hard of hearing. Without appropriate opportunities to learn language, these children will fall behind their hearing peers in communication, cognition, reading, and social-emotional development. Such delays may result in lower educational and employment levels in adulthood. To maximize the outcome for infants who are deaf or hard of hearing, the hearing of all infants should be screened at no later than 1 month of age. Those who do not pass screening should have a comprehensive audiological evaluation at no later than 3 months of age. Infants with confirmed hearing loss should receive appropriate intervention at no later than 6 months of age from health care and education professionals with expertise in hearing loss and deafness in infants and young children. Regardless of previous hearing-screening outcomes, all infants with or without risk factors should receive ongoing surveillance of communicative development beginning at 2 months of age during well-child visits in the medical home. EHDI systems should guarantee seamless transitions for infants and their families through this process. (10/07)

SECTION 6

Endorsed Policies

The American Academy of Pediatrics endorses and accepts as its policy the following documents from other organizations.

AMERICAN ACADEMY OF PEDIATRICS

Endorsed Policies

APPROPRIATE MEDICAL CARE FOR THE SECONDARY SCHOOL-AGE ATHLETE COMMUNICATION
National Athletic Trainers' Association (2004)

BEST PRACTICE FOR INFANT SURGERY: A POSITION STATEMENT FROM THE AMERICAN PEDIATRIC SURGICAL ASSOCIATION
American Pediatric Surgical Association (9/08)

CARDIOVASCULAR RISK REDUCTION IN HIGH-RISK PEDIATRIC POPULATIONS
American Heart Association
ABSTRACT. Although for most children the process of atherosclerosis is subclinical, dramatically accelerated atherosclerosis occurs in some pediatric disease states, with clinical coronary events occurring in childhood and very early adult life. As with most scientific statements about children and the future risk for cardiovascular disease, there are no randomized trials documenting the effects of risk reduction on hard clinical outcomes. A growing body of literature, however, identifies the importance of premature cardiovascular disease in the course of certain pediatric diagnoses and addresses the response to risk factor reduction. For this scientific statement, a panel of experts reviewed what is known about very premature cardiovascular disease in 8 high-risk pediatric diagnoses and, from the science base, developed practical recommendations for management of cardiovascular risk. (*Circulation.* 2006;114:000-000.) (12/06)

A COMPREHENSIVE IMMUNIZATION STRATEGY TO ELIMINATE TRANSMISSION OF HEPATITIS B VIRUS INFECTION IN THE UNITED STATES
Advisory Committee on Immunization Practices and Centers for Disease Control and Prevention
SUMMARY. This report is the first of a two-part statement from the Advisory Committee on Immunization Practices (ACIP) that updates the strategy to eliminate hepatitis B virus (HBV) transmission in the United States. The report provides updated recommendations to improve prevention of perinatal and early childhood HBV transmission, including implementation of universal infant vaccination beginning at birth, and to increase vaccine coverage among previously unvaccinated children and adolescents. Strategies to enhance implementation of the recommendations include 1) establishing standing orders for administration of hepatitis B vaccination beginning at birth; 2) instituting delivery hospital policies and procedures and case management programs to improve identification of and administration of immunoprophylaxis to infants born to mothers who are hepatitis B surface antigen (HBsAg) positive and to mothers with unknown HBsAg status at the time of delivery; and 3) implementing vaccination record reviews for all children aged 11–12 years and children and adolescents aged <19 years who were born in countries with intermediate and high levels of HBV endemicity, adopting hepatitis B vaccine requirements for school entry, and integrating hepatitis B vaccination services into settings that serve adolescents. The second part of the ACIP statement, which will include updated recommendations and strategies to increase hepatitis B vaccination of adults, will be published separately. (7/06)

CONSENSUS STATEMENT: DEFINITIONS FOR CONSISTENT EMERGENCY DEPARTMENT METRICS
American Academy of Emergency Medicine, American Association of Critical Care Nurses, American College of Emergency Physicians, Association of periOperative Registered Nurses, Emergency Department Practice Management Association, Emergency Nurses Association, and National Association of EMS Physicians (2/10)

CONSENSUS STATEMENT ON MANAGEMENT OF INTERSEX DISORDERS
International Consensus Conference on Intersex (Lawson Wilkins Pediatric Endocrine Society and European Society for Paediatric Endocrinology)
INTRODUCTION. The birth of an intersex child prompts a long-term management strategy that involves myriad professionals working with the family. There has been progress in diagnosis, surgical techniques, understanding psychosocial issues, and recognizing and accepting the place of patient advocacy. The Lawson Wilkins Pediatric Endocrine Society and the European Society for Paediatric Endocrinology considered it timely to review the management of intersex disorders from a broad perspective, review data on longer-term outcome, and formulate proposals for future studies. The methodology comprised establishing a number of working groups, the membership of which was drawn from 50 international experts in the field. The groups prepared previous written responses to a defined set of questions resulting from evidence-based review of the literature. At a subsequent gathering of participants, a framework for a consensus document was agreed. This article constitutes its final form. (8/06)

DEFINING PEDIATRIC MALNUTRITION: A PARADIGM SHIFT TOWARD ETIOLOGY-RELATED DEFINITIONS
American Society for Parenteral and Enteral Nutrition
ABSTRACT. Lack of a uniform definition is responsible for underrecognition of the prevalence of malnutrition and its impact on outcomes in children. A pediatric malnutrition definitions workgroup reviewed existing pediatric age group English-language literature from 1955 to 2011, for relevant references related to 5 domains of the definition of *malnutrition* that were a *priori* identified: anthropometric parameters, growth, chronicity of malnutrition, etiology and pathogenesis, and developmental/functional outcomes. Based on available evidence and an iterative process to arrive at multidisciplinary consensus in the group, these domains were included in the overall construct of a new definition. Pediatric malnutrition

(undernutrition) is defined as an imbalance between nutrient requirements and intake that results in cumulative deficits of energy, protein, or micronutrients that may negatively affect growth, development, and other relevant outcomes. A summary of the literature is presented and a new classification scheme is proposed that incorporates chronicity, etiology, mechanisms of nutrient imbalance, severity of malnutrition, and its impact on outcomes. Based on its etiology, malnutrition is either *illness related* (secondary to 1 or more diseases/injury) or *non–illness related,* (caused by environmental/behavioral factors), or both. Future research must focus on the relationship between inflammation and illness-related malnutrition. We anticipate that the definition of malnutrition will continue to evolve with improved understanding of the processes that lead to and complicate the treatment of this condition. A uniform definition should permit future research to focus on the impact of pediatric malnutrition on functional outcomes and help solidify the scientific basis for evidence-based nutrition practices. (3/13)

DIABETES CARE FOR EMERGING ADULTS: RECOMMENDATIONS FOR TRANSITION FROM PEDIATRIC TO ADULT DIABETES CARE SYSTEMS
American Diabetes Association (11/11)

DIAGNOSIS, TREATMENT, AND LONG-TERM MANAGEMENT OF KAWASAKI DISEASE: A STATEMENT FOR HEALTH PROFESSIONALS
American Heart Association (12/04)

DIETARY RECOMMENDATIONS FOR CHILDREN AND ADOLESCENTS: A GUIDE FOR PRACTITIONERS
American Heart Association (9/05)

DIETARY REFERENCE INTAKES FOR CALCIUM AND VITAMIN D
Institute of Medicine (2011)

EMERGENCY EQUIPMENT AND SUPPLIES IN THE SCHOOL SETTING
National Association of School Nurses (1/12)

EVIDENCE REPORT: GENETIC AND METABOLIC TESTING ON CHILDREN WITH GLOBAL DEVELOPMENTAL DELAY
American Academy of Neurology and Child Neurology Society
ABSTRACT. *Objective.* To systematically review the evidence concerning the diagnostic yield of genetic and metabolic evaluation of children with global developmental delay or intellectual disability (GDD/ID).

Methods. Relevant literature was reviewed, abstracted, and classified according to the 4-tiered American Academy of Neurology classification of evidence scheme.

Results and Conclusions. In patients with GDD/ID, microarray testing is diagnostic on average in 7.8% (Class III), G-banded karyotyping is abnormal in at least 4% (Class II and III), and subtelomeric fluorescence in situ hybridization is positive in 3.5% (Class I, II, and III). Testing for X-linked ID genes has a yield of up to 42% in males with an appropriate family history (Class III). *FMR1* testing shows full expansion in at least 2% of patients with mild to moderate GDD/ID (Class II and III), and *MeCP2* testing is diagnostic in 1.5% of females with moderate to severe GDD/ID (Class III). Tests for metabolic disorders have a yield of up to 5%, and tests for congenital disorders of glycosylation and cerebral creatine disorders have yields of up to 2.8% (Class III). Several genetic and metabolic screening tests have been shown to have a better than 1% diagnostic yield in selected populations of children with GDD/ID. These values should be among the many factors considered in planning the laboratory evaluation of such children. (9/11)

EVIDENCE-BASED GUIDELINE UPDATE: MEDICAL TREATMENT OF INFANTILE SPASMS
American Academy of Neurology and Child Neurology Society
ABSTRACT. *Objective.* To update the 2004 American Academy of Neurology/Child Neurology Society practice parameter on treatment of infantile spasms in children.

Methods. MEDLINE and EMBASE were searched from 2002 to 2011 and searches of reference lists of retrieved articles were performed. Sixty-eight articles were selected for detailed review; 26 were included in the analysis. Recommendations were based on a 4-tiered classification scheme combining pre-2002 evidence and more recent evidence.

Results. There is insufficient evidence to determine whether other forms of corticosteroids are as effective as adrenocorticotropic hormone (ACTH) for short-term treatment of infantile spasms. However, low-dose ACTH is probably as effective as high-dose ACTH. ACTH is more effective than vigabatrin (VGB) for short-term treatment of children with infantile spasms (excluding those with tuberous sclerosis complex). There is insufficient evidence to show that other agents and combination therapy are effective for short-term treatment of infantile spasms. Short lag time to treatment leads to better long-term developmental outcome. Successful short-term treatment of cryptogenic infantile spasms with ACTH or prednisolone leads to better long-term developmental outcome than treatment with VGB.

Recommendations. Low-dose ACTH should be considered for treatment of infantile spasms. ACTH or VGB may be useful for short-term treatment of infantile spasms, with ACTH considered preferentially over VGB. Hormonal therapy (ACTH or prednisolone) may be considered for use in preference to VGB in infants with cryptogenic infantile spasms, to possibly improve developmental outcome. A shorter lag time to treatment of infantile spasms with either hormonal therapy or VGB possibly improves long-term developmental outcomes. (6/12)

EXECUTING JUVENILE OFFENDERS: A FUNDAMENTAL FAILURE OF SOCIETY
Society for Adolescent Medicine (10/04)

EXPEDITED PARTNER THERAPY FOR ADOLESCENTS DIAGNOSED WITH CHLAMYDIA OR GONORRHEA: A POSITION PAPER OF THE SOCIETY FOR ADOLESCENT MEDICINE

Society for Adolescent Medicine

ABSTRACT. Chlamydia and gonorrhea, the most frequently reported sexually transmitted infections (STIs), present substantial public health challenges among adolescents. Although these infections are easily treated with antibiotics, many adolescents are reinfected within 3–6 months, usually because their partners remain untreated. The standard approaches to notifying and treating a partner of an STI-infected patient are patient referral, whereby the patient notifies his/her partners to seek care, and provider referral, whereby the provider or public health disease intervention specialist notifies the partner and directs him/her toward treatment. These methods rely on the accuracy of the disclosed partner information as well as other limitations, such as compliance and staffing resources. Another approach to partner notification is expedited partner therapy (EPT), treating sex partners without requiring a prior clinical evaluation. In randomized trials, EPT has reduced the rates of persistent or recurrent gonorrhea and chlamydia infection; however, its routine use is limited by concerns related to liability, cost, compliance, and missed opportunities for prevention counseling. The Society for Adolescent Medicine (SAM) recommends that providers who care for adolescents should do the following: use EPT as an option for STI care among chlamydia- or gonorrhea-infected heterosexual males and females who are unlikely or unable to otherwise receive treatment; through SAM and AAP chapters, collaborate with policy makers to remove EPT legal barriers and facilitate reimbursement; and collaborate with health departments for implementation assistance. (9/09)

EXPERT PANEL ON INTEGRATED GUIDELINES FOR CARDIOVASCULAR HEALTH AND RISK REDUCTION IN CHILDREN AND ADOLESCENTS: SUMMARY REPORT

National Heart, Lung and Blood Institute

INTRODUCTION (EXCERPT). Atherosclerotic cardiovascular disease (CVD) remains the leading cause of death in North Americans, but manifest disease in childhood and adolescence is rare. By contrast, risk factors and risk behaviors that accelerate the development of atherosclerosis begin in childhood, and there is increasing evidence that risk reduction delays progression toward clinical disease. In response, the former director of the National Heart, Lung, and Blood Institute (NHLBI), Dr Elizabeth Nabel, initiated development of cardiovascular health guidelines for pediatric care providers based on a formal evidence review of the science with an integrated format addressing all the major cardiovascular risk factors simultaneously. An expert panel was appointed to develop the guidelines in the fall of 2006. (3/12)

FOSTER CARE MENTAL HEALTH VALUES

American Academy of Child and Adolescent Psychiatry and Child Welfare League of America (2002)

GENERAL RECOMMENDATIONS ON IMMUNIZATION: RECOMMENDATIONS OF THE ADVISORY COMMITTEE ON IMMUNIZATION PRACTICES (ACIP)

Advisory Committee on Immunization Practices

SUMMARY. This report is a revision of General Recommendations on Immunization and updates the 2002 statement by the Advisory Committee on Immunization Practices (ACIP) (CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices and the American Academy of Family Physicians. MMWR 2002;51[No. RR-2]). This report is intended to serve as a general reference on vaccines and immunization. The principal changes include 1) expansion of the discussion of vaccination spacing and timing; 2) an increased emphasis on the importance of injection technique/age/body mass in determining appropriate needle length; 3) expansion of the discussion of storage and handling of vaccines, with a table defining the appropriate storage temperature range for inactivated and live vaccines; 4) expansion of the discussion of altered immunocompetence, including new recommendations about use of live-attenuated vaccines with therapeutic monoclonal antibodies; and 5) minor changes to the recommendations about vaccination during pregnancy and vaccination of internationally adopted children, in accordance with new ACIP vaccine-specific recommendations for use of inactivated influenza vaccine and hepatitis B vaccine. The most recent ACIP recommendations for each specific vaccine should be consulted for comprehensive discussion. This report, ACIP recommendations for each vaccine, and other information about vaccination can be accessed at CDC's National Center for Immunization and Respiratory Diseases (proposed) (formerly known as the National Immunization Program) website at http//:www.cdc.gov/nip. (12/06)

GENETIC BASIS FOR CONGENITAL HEART DEFECTS: CURRENT KNOWLEDGE

American Heart Association

ABSTRACT. The intent of this review is to provide the clinician with a summary of what is currently known about the contribution of genetics to the origin of congenital heart disease. Techniques are discussed to evaluate children with heart disease for genetic alterations. Many of these techniques are now available on a clinical basis. Information on the genetic and clinical evaluation of children with cardiac disease is presented, and several tables have been constructed to aid the clinician in the assessment of children with different types of heart disease. Genetic algorithms for cardiac defects have been constructed and are available in an appendix. It is anticipated that this summary will update a wide range of medical personnel, including pediatric cardiologists and pediatricians, adult cardiologists, internists, obstetricians, nurses, and thoracic surgeons, about the genetic aspects of congenital heart disease and will encourage an interdisciplinary approach to the child and adult with congenital heart disease. (*Circulation.* 2007;115:3015-3038.) (6/07)

GIFTS TO PHYSICIANS FROM INDUSTRY

American Medical Association (8/01)

GUIDELINES FOR FIELD TRIAGE OF INJURED PATIENTS
Centers for Disease Control and Prevention (1/12)

GUIDELINES FOR THE PREVENTION AND TREATMENT OF OPPORTUNISTIC INFECTIONS IN HIV-EXPOSED AND HIV-INFECTED CHILDREN
National Institutes of Health, Centers for Disease Control and Prevention, HIV Medicine Association of Infectious Diseases Society of America, and Pediatric Infectious Diseases Society (11/13)

GUIDELINES FOR REFERRAL OF CHILDREN AND ADOLESCENTS TO PEDIATRIC RHEUMATOLOGISTS
American College of Rheumatology (6/02, reaffirmed 5/07)

HELPING THE STUDENT WITH DIABETES SUCCEED: A GUIDE FOR SCHOOL PERSONNEL
National Diabetes Education Program (6/03)

IDENTIFYING AND RESPONDING TO DOMESTIC VIOLENCE: CONSENSUS RECOMMENDATIONS FOR CHILD AND ADOLESCENT HEALTH
Family Violence Prevention Fund (9/02)

IMPORTANCE AND IMPLEMENTATION OF TRAINING IN CARDIOPULMONARY RESUSCITATION AND AUTOMATED EXTERNAL DEFIBRILLATION IN SCHOOLS
American Heart Association Emergency Cardiovascular Care Committee, Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation, Council on Cardiovascular Diseases in the Young, Council on Cardiovascular Nursing, Council on Clinical Cardiology, and Advocacy Coordinating Committee

ABSTRACT. In 2003, the International Liaison Committee on Resuscitation published a consensus document on education in resuscitation that strongly recommended that "…instruction in CPR [cardiopulmonary resuscitation] be incorporated as a standard part of the school curriculum."[1] The next year the American Heart Association (AHA) recommended that schools "…establish a goal to train every teacher in CPR and first aid and train all students in CPR" as part of their preparation for a response to medical emergencies on campus.[2]

Since that time, there has been an increased interest in legislation that would mandate that school curricula include training in CPR or CPR and automated external defibrillation. Laws or curriculum content standards in 36 states (as of the 2009–2010 school year) now encourage the inclusion of CPR training programs in school curricula. The language in those laws and standards varies greatly, ranging from a suggestion that students "recognize" the steps of CPR to a requirement for certification in CPR. Not surprisingly, then, implementation is not uniform among states, even those whose laws or standards encourage CPR training in schools in the strongest language. This statement recommends that training in CPR and familiarization with automated external defibrillators (AEDs) should be required elements of secondary school curricula and provides the rationale for implementation of CPR training, as well as guidance in overcoming barriers to implementation. (2/11)

INTER-ASSOCIATION CONSENSUS STATEMENT ON BEST PRACTICES FOR SPORTS MEDICINE MANAGEMENT FOR SECONDARY SCHOOLS AND COLLEGES
National Athletic Trainers Association, National Interscholastic Athletic Administrators Association, College Athletic Trainers' Society, National Federation of State High School Associations, American College Health Association, American Orthopaedic Society for Sports Medicine, National Collegiate Athletic Association, American Medical Society for Sports Medicine, National Association of Collegiate Directors of Athletics, and National Association of Intercollegiate Athletics (7/13)

LIGHTNING SAFETY FOR ATHLETICS AND RECREATION
National Athletic Trainers' Association

Abstract. *Objective.* To educate athletic trainers and others about the dangers of lightning, provide lightning-safety guidelines, define safe structures and locations, and advocate prehospital care for lightning-strike victims.
Background. Lightning may be the most frequently encountered severe-storm hazard endangering physically active people each year. Millions of lightning flashes strike the ground annually in the United States, causing nearly 100 deaths and 400 injuries. Three quarters of all lightning casualties occur between May and September, and nearly four fifths occur between 10:00 AM and 7:00 PM, which coincides with the hours for most athletic or recreational activities. Additionally, lightning casualties from sports and recreational activities have risen alarmingly in recent decades.
Recommendations. The National Athletic Trainers' Association recommends a proactive approach to lightning safety, including the implementation of a lightning-safety policy that identifies safe locations for shelter from the lightning hazard. Further components of this policy are monitoring local weather forecasts, designating a weather watcher, and establishing a chain of command. Additionally, a flash-to-bang count of 30 seconds or more should be used as a minimal determinant of when to suspend activities. Waiting 30 minutes or longer after the last flash of lightning or sound of thunder is recommended before athletic or recreational activities are resumed. Lightning safety strategies include avoiding shelter under trees, avoiding open fields and spaces, and suspending the use of land-line telephones during thunderstorms. Also outlined in this document are the prehospital care guidelines for triaging and treating lightning-strike victims. It is important to evaluate victims quickly for apnea, asystole, hypothermia, shock, fractures, and burns. Cardiopulmonary resuscitation is effective in resuscitating pulseless victims of lightning strike. Maintenance of cardiopulmonary resuscitation and first-aid certification should be required of all persons involved in sports and recreational activities. (12/00)

LONG-TERM CARDIOVASCULAR TOXICITY IN CHILDREN, ADOLESCENTS, AND YOUNG ADULTS WHO RECEIVE CANCER THERAPY: PATHOPHYSIOLOGY, COURSE, MONITORING, MANAGEMENT, PREVENTION, AND RESEARCH DIRECTIONS: A SCIENTIFIC STATEMENT FROM THE AMERICAN HEART ASSOCIATION
*American Heart Association (*9/13)

THE MANAGEMENT OF HYPOTENSION IN THE VERY-LOW-BIRTH-WEIGHT INFANT: GUIDELINE FOR PRACTICE
National Association of Neonatal Nurses
ABSTRACT. This guideline, released in 2011, focuses on the clinical management of systemic hypotension in the very-low-birth-weight (VLBW) infant during the first 3 days of postnatal life. (2011)

MEETING OF THE STRATEGIC ADVISORY GROUP OF EXPERTS ON IMMUNIZATION, APRIL 2012– CONCLUSIONS AND RECOMMENDATIONS
World Health Organization (5/12) (*The AAP endorses the recommendation pertaining to the use of thimerosal in vaccines.)*

MENTAL HEALTH AND SUBSTANCE USE SCREENING AND ASSESSMENT OF CHILDREN IN FOSTER CARE
*American Academy of Child and Adolescent Psychiatry and Child Welfare League of America (*2003)

NEURODEVELOPMENTAL OUTCOMES IN CHILDREN WITH CONGENITAL HEART DISEASE: EVALUATION AND MANAGEMENT: A SCIENTIFIC STATEMENT FROM THE AMERICAN HEART ASSOCIATION
*American Heart Association (*7/12)

NONINHERITED RISK FACTORS AND CONGENITAL CARDIOVASCULAR DEFECTS: CURRENT KNOWLEDGE
American Heart Association
ABSTRACT. Prevention of congenital cardiovascular defects has been hampered by a lack of information about modifiable risk factors for abnormalities in cardiac development. Over the past decade, there have been major breakthroughs in the understanding of inherited causes of congenital heart disease, including the identification of specific genetic abnormalities for some types of malformations. Although relatively less information has been available on noninherited modifiable factors that may have an adverse effect on the fetal heart, there is a growing body of epidemiological literature on this topic. This statement summarizes the currently available literature on potential fetal exposures that might alter risk for cardiovascular defects. Information is summarized for periconceptional multivitamin or folic acid intake, which may reduce the risk of cardiac disease in the fetus, and for additional types of potential exposures that may increase the risk, including maternal illnesses, maternal therapeutic and nontherapeutic drug exposures, environmental exposures, and paternal exposures. Information is highlighted regarding definitive risk factors such as maternal rubella; phenylketonuria; pregestational diabetes; exposure to thalidomide, vitamin A cogeners, or retinoids; and indomethacin tocolysis. Caveats regarding interpretation of possible exposure-outcome relationships from case-control studies are given because this type of study has provided most of the available information. Guidelines for prospective parents that could reduce the likelihood that their child will have a major cardiac malformation are given. Issues related to pregnancy monitoring are discussed. Knowledge gaps and future sources of new information on risk factors are described. (*Circulation.* 2007;115:2995-3014.) (6/07)

PEDIATRIC CARE IN THE EMERGENCY DEPARTMENT
Society for Academic Emergency Medicine
ABSTRACT. Physicians who have successfully completed an accredited Emergency Medicine residency and are certified in emergency medicine by the American Board of Emergency Medicine (ABEM) or the American Osteopathic Board of Emergency Medicine (AOBEM) ABEM/AOBEM or those who are certified in pediatric emergency medicine by ABEM or the American Board of Pediatrics (ABP) possess the knowledge and skills required to provide quality emergency medical care to children of all ages for a wide variety of illnesses, injuries or poisonings. To provide quality care, the emergency physician must have all necessary and age-appropriate medical equipment readily available. The emergency physician must also have access via consultation, admission, or transfer, to appropriate specialty and sub-specialty physicians, to who will provide any needed patient care after emergency department treatment. Physically separated care areas for children are not mandatory in order to provide high-quality care to patients of all ages. Although physically separate care areas for children are ideal, they are not mandatory to provide high-quality care. (11/03)

PREVENTION AND CONTROL OF MENINGOCOCCAL DISEASE: RECOMMENDATIONS OF THE ADVISORY COMMITTEE ON IMMUNIZATION PRACTICES (ACIP)
Centers for Disease Control and Prevention
SUMMARY. Meningococcal disease describes the spectrum of infections caused by Neisseria meningiditis, including meningitdis, bacteremia, and bacteremic pneumonia. Two quadrivalent meningococcal polysaccharide-protein conjugate vaccines that provide protection against meningococcal serogroups A, C, W, and Y (MenACWY-D [Menactra, manufactured by Sanofi Pasteur, Inc., Swiftwater, Pennsylvania] and MenACWY-CRM [Menveo, manufactured by Novartis Vaccines, Cambridge, Massachusetts]) are licensed in the United States for use among persons aged 2 through 55 years. MenACWY-D also is licensed for use among infants and toddlers aged 9 through 23 months. Quadrivalent meningococcal polysaccharide vaccine (MPSV4 [Menommune, manufactured by sanofi pasteur, Inc., Swiftwater, Pennsylvania]) is the only vaccine licensed for use among persons aged ≥56 years. A bivalent meningococcal polysaccharide protein conjugate vaccine that provides protection against meningococcal serogroups C and Y along with Haemophilus influenzae type b (Hib) (Hib-MenCY-TT [MenHibrix, manufactured by GlaxoSmithKline Biologicals, Rixensart, Belgium]) is licensed for use in children aged 6 weeks through 18 months.

This report compiles and summarizes all recommendations from CDC's Advisory Committee on Immunization

Practices (ACIP) regarding prevention and control of meningococcal disease in the United States, specifically the changes in the recommendations published since 2005 (CDC. Prevention and control of meningococcal disease: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 2005;54 Adobe PDF file [No. RR-7]). As a comprehensive summary of previously published recommendations, this report does not contain any new recommendations; it is intended for use by clinicians as a resource. ACIP recommends routine vaccination with a quadrivalent meningococcal conjugate vaccine (MenACWY) for adolescents aged 11 or 12 years, with a booster dose at age 16 years. ACIP also recommends routine vaccination for persons at increased risk for meningococcal disease (i.e., persons who have persistent complement component deficiencies, persons who have anatomic or functional asplenia, microbiologists who routinely are exposed to isolates of N. meningitidis, military recruits, and persons who travel to or reside in areas in which meningococcal disease is hyperendemic or epidemic). Guidelines for antimicrobial chemoprophylaxis and for evaluation and management of suspected outbreaks of meningococcal disease also are provided. (3/13)

PREVENTION OF RHEUMATIC FEVER AND DIAGNOSIS AND TREATMENT OF ACUTE STREPTOCOCCAL PHARYNGITIS

American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee of the Council on Cardiovascular Disease in the Young, Interdisciplinary Council on Functional Genomics and Translational Biology, and Interdisciplinary Council on Quality of Care and Outcomes Research

ABSTRACT. Primary prevention of acute rheumatic fever is accomplished by proper identification and adequate antibiotic treatment of group A â-hemolytic streptococcal (GAS) tonsillopharyngitis. Diagnosis of GAS pharyngitis is best accomplished by combining clinical judgment with diagnostic test results, the criterion standard of which is the throat culture. Penicillin (either oral penicillin V or injectable benzathine penicillin) is the treatment of choice, because it is cost-effective, has a narrow spectrum of activity, and has long-standing proven efficacy, and GAS resistant to penicillin have not been documented. For penicillin-allergic individuals, acceptable alternatives include a narrow-spectrum oral cephalosporin, oral clindamycin, or various oral macrolides or azalides. The individual who has had an attack of rheumatic fever is at very high risk of developing recurrences after subsequent GAS pharyngitis and needs continuous antimicrobial prophylaxis to prevent such recurrences (secondary prevention). The recommended duration of prophylaxis depends on the number of previous attacks, the time elapsed since the last attack, the risk of exposure to GAS infections, the age of the patient, and the presence or absence of cardiac involvement. Penicillin is again the agent of choice for secondary prophylaxis, but sulfadiazine or a macrolide or azalide are acceptable alternatives in penicillin-allergic individuals. This report updates the 1995 statement by the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee. It includes new recommendations for the diagnosis and treatment of GAS pharyngitis, as well as for the secondary prevention of rheumatic fever, and classifies the strength of the recommendations and level of evidence supporting them. (2/09)

PROTECTING ADOLESCENTS: ENSURING ACCESS TO CARE AND REPORTING SEXUAL ACTIVITY AND ABUSE

Society for Adolescent Medicine (11/04)

RECOMMENDATION OF WHO STRATEGIC ADVISORY GROUP OF EXPERTS (SAGE) ON IMMUNIZATION

World Health Organization's Strategic Advisory Group of Experts (SAGE) on Immunization (5/12)

REPORT OF THE NATIONAL CONSENSUS CONFERENCE ON FAMILY PRESENCE DURING PEDIATRIC CARDIOPULMONARY RESUSCITATION AND PROCEDURES

Ambulatory Pediatric Association

INTRODUCTION. The National Consensus Conference on Family Presence during Pediatric Cardiopulmonary Resuscitation and Procedures was held in Washington, DC, on September 7–8, 2003. The concept, funding, planning and organization for the conference were the Ambulatory Pediatric Association (APA) Presidential Project of James Seidel, M.D., Ph.D. Dr. Seidel was in the final stages of preparation for chairing the conference when he died on July 25, 2003. In Dr. Seidel's absence, the conference was chaired by Deborah Parkman Henderson R.N., PhD, his co-investigator, and Jane F. Knapp, M.D, a colleague.

The National Consensus Conference on Family Presence during Pediatric Procedures and Cardiopulmonary Resuscitation was funded by a grant to the APA from the Maternal Child Health Bureau (MCHB) Partnership for Children. This meeting brought together a panel of over 20 appointed representatives from a multidisciplinary, diverse group of national organizations interested in the emergency care of children. The conference was part of a multiphase process designed with the goal of publishing consensus guidelines useful for defining policy regarding family presence (FP) during pediatric procedures and CPR in the Emergency Department (ED). It is also possible that the consensus panel recommendations could be applied to other settings.

Panel members completed a review of the literature prior to attending the conference. This review, along with results of a pre-conference questionnaire, formed the basis of the discussion during the conference. During the two day conference the participants completed the outline of the guidelines presented here. We believe these recommendations are a powerful testimony to Dr. Seidel's vision for promoting FP through multidisciplinary consensus building. Beyond that vision, however, we hope that the guidelines will make a difference in improving the quality of children's health care. (9/03)

RESPONSE TO CARDIAC ARREST AND SELECTED LIFE-THREATENING MEDICAL EMERGENCIES: THE MEDICAL EMERGENCY RESPONSE PLAN FOR SCHOOLS. A STATEMENT FOR HEALTHCARE PROVIDERS, POLICYMAKERS, SCHOOL ADMINISTRATORS, AND COMMUNITY LEADERS

American Heart Association (1/04)

SAFE AT SCHOOL CAMPAIGN STATEMENT OF PRINCIPLES
American Diabetes Association (endorsed 2/06)

SCREENING FOR IDIOPATHIC SCOLIOSIS IN ADOLESCENTS
Pediatric Orthopaedic Society of North America, American Academy of Orthopaedic Surgeons, and Scoliosis Research Society
EXECUTIVE SUMMARY. Many states mandate school screening to identify children at risk for scoliosis, though recent studies have cast some controversy on the effectiveness of routine scoliosis screening. Previous studies have both supported and discouraged routine screening.

Prevention of severe scoliosis is a major commitment of physicians caring for children with spinal deformities. For this reason, the American Academy of Orthopaedic Surgeons (AAOS), the Scoliosis Research Society (SRS), the Pediatric Orthopaedic Society of North America (POSNA), and the American Academy of Pediatrics (AAP) convened a task force to examine issues related to scoliosis screening and to put forth the present information statement. The societies acknowledge the important role of a systematic review of the literature as well as the role of consensus expert opinion in the common situation where the available evidence does not yet exist to speak definitely for, or against, an evaluation or intervention.

Costs involved with scoliosis screening are relatively low on a societal level and may justify the possibility of preventing surgery in adolescents with scoliosis. Adolescents without significant spinal deformity who are referred to a specialist for evaluation often do not require radiographs. For those who do need radiographic evaluation, it is important to know that the radiation exposure using current-day radiographic techniques, including digital radiography, is significantly smaller than in the past.

Opponents to scoliosis screening have focused on concerns about a low predictive value of screening and the cost-effectiveness of referral. There have also been concerns about the possibility of unnecessary treatment, including brace use, and the effect of exposure to radiation when radiographs are obtained.

With regard to early treatment in those adolescents detected with moderate scoliosis, the available data neither definitively support nor refute the efficacy of bracing. To most effectively answer this, a well-organized level I study is needed. Such a study, a five-year multicenter randomized controlled trial of bracing sponsored by the National Institutes of Health/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIH/NIAMS), is currently under way.

In 1996, the United States Preventive Services Task Force (USPSTF) concluded that there was insufficient evidence to make a recommendation for, or against, screening. However, in 2004, the USPSTF changed their position and recommended against the routine screening of asymptomatic adolescents for idiopathic scoliosis. The AAOS, SRS, POSNA, and AAP have concerns that this change in position by the USPSTF came in the absence of any significant change in the available literature, in the absence of any change in position statements by the AAOS, SRS, POSNA, and AAP, and in the absence of any significant input from specialists who commonly care for children with scoliosis.

As the primary care providers for adolescents with idiopathic scoliosis, the AAOS, SRS, POSNA, and AAP do not support any recommendation against scoliosis screening, given the available literature. (1/08)

SELECTED ISSUES FOR THE ADOLESCENT ATHLETE AND THE TEAM PHYSICIAN: A CONSENSUS STATEMENT
American Academy of Family Physicians, American Academy of Orthopaedic Surgeons, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine
GOAL. The goal of this document is to help the team physician improve the care of the adolescent athlete by understanding the medical, musculoskeletal and psychological factors common in this age group. To accomplish this goal, the team physician should have knowledge of and be involved with:

- Musculoskeletal injuries of the adolescent athlete, specifically those to the shoulder, knee, elbow and spine
- Medical conditions of the adolescent athlete, especially those pertaining to infectious diseases, concussion, and nutrition and supplementation
- Psychological issues related to sports specialization and overtraining. (11/08)

SKIING AND SNOWBOARDING INJURY PREVENTION
Canadian Paediatric Society
ABSTRACT. Skiing and snowboarding are popular recreational and competitive sport activities for children and youth. Injuries associated with both activities are frequent and can be serious. There is new evidence documenting the benefit of wearing helmets while skiing and snowboarding, as well as data refuting suggestions that helmet use may increase the risk of neck injury. There is also evidence to support using wrist guards while snowboarding. There is poor uptake of effective preventive measures such as protective equipment use and related policy. Physicians should have the information required to counsel children, youth and families regarding safer snow sport participation, including helmet use, wearing wrist guards for snowboarding, training and supervision, the importance of proper equipment fitting and binding adjustment, sun safety and avoiding substance use while on the slopes. (1/12)

SUPPLEMENT TO THE JCIH 2007 POSITION STATEMENT: PRINCIPLES AND GUIDELINES FOR EARLY INTERVENTION AFTER CONFIRMATION THAT A CHILD IS DEAF OR HARD OF HEARING
Joint Committee on Infant Hearing
PREFACE. This document is a supplement to the recommendations in the year 2007 position statement of the Joint Committee on Infant Hearing (JCIH) and provides comprehensive guidelines for early hearing detection and intervention (EHDI) programs on establishing strong early intervention (EI) systems with appropriate expertise to meet the needs of children who are deaf or hard of hearing (D/HH).

EI services represent the purpose and goal of the entire EHDI process. Screening and confirmation that a child is D/HH are largely meaningless without appropriate, individualized, targeted and high-quality intervention. For the infant or young child who is D/HH to reach his or her full potential, carefully designed individualized intervention must be implemented promptly, utilizing service providers with optimal knowledge and skill levels and providing services on the basis of research, best practices, and proven models.

The delivery of EI services is complex and requires individualization to meet the identified needs of the child and family. Because of the diverse needs of the population of children who are D/HH and their families, well-controlled intervention studies are challenging. At this time, few comparative effectiveness studies have been conducted. Randomized controlled trials are particularly difficult for ethical reasons, making it challenging to establish causal links between interventions and outcomes. EI systems must partner with colleagues in research to document what works for children and families and to strengthen the evidence base supporting practices.

Despite limitations and gaps in the evidence, the literature does contain research studies in which all children who were D/HH had access to the same well-defined EI service. These studies indicate that positive outcomes are possible, and they provide guidance about key program components that appear to promote these outcomes. This EI services document, drafted by teams of professionals with extensive expertise in EI programs for children who are D/HH and their families, relied on literature searches, existing systematic reviews, and recent professional consensus statements in developing this set of guidelines.

Terminology presented a challenge throughout document development. The committee noted that many of the frequently occurring terms necessary within the supplement may not reflect the most contemporary understanding and/or could convey inaccurate meaning. Rather than add to the lack of clarity or consensus and to avoid introducing new terminology to stakeholders, the committee opted to use currently recognized terms consistently herein and will monitor the emergence and/or development of new descriptors before the next JCIH consensus statement.

For purposes of this supplement:

- Language refers to all spoken and signed languages.
- Early intervention (EI), according to part C of the Individuals with Disabilities Education Improvement Act (IDEA) of 2004, is the process of providing services, education, and support to young children who are deemed to have an established condition, those who are evaluated and deemed to have a diagnosed physical or mental condition (with a high probability of resulting in a developmental delay), those who have an existing delay, or those who are at risk of developing a delay or special need that may affect their development or impede their education.
- Communication is used in lieu of terms such as communication options, methods, opportunities, approaches, etc.
- Deaf or hard of hearing (D/HH) is intended to be inclusive of all children with congenital and acquired hearing loss, unilateral and bilateral hearing loss, all degrees of hearing loss from minimal to profound, and all types of hearing loss (sensorineural, auditory neuropathy spectrum disorder, permanent conductive, and mixed).
- Core knowledge and skills is used to describe the expertise needed to provide appropriate EI that will optimize the development and well-being of infants/children and their families. Core knowledge and skills will differ according to the roles of individuals within the EI system (eg, service coordinator or EI provider).

This supplement to JCIH 2007 focuses on the practices of EI providers outside of the primary medical care and specialty medical care realms, rather than including the full spectrum of necessary medical, audiologic, and educational interventions. For more information about the recommendations for medical follow-up, primary care surveillance for related medical conditions, and specialty medical care and monitoring, the reader is encouraged to reference the year 2007 position statement of the JCIH as well as any subsequent revision. When an infant is confirmed to be D/HH, the importance of ongoing medical and audiologic management and surveillance both in the medical home and with the hearing health professionals, the otolaryngologist and the audiologist, cannot be overstated. A comprehensive discussion of those services is beyond the scope of this document. (3/13)

TARGETED TUBERCULIN TESTING AND TREATMENT OF LATENT TUBERCULOSIS INFECTION

American Thoracic Society and Centers for Disease Control and Prevention (4/00) *(The AAP endorses and accepts as its policy the sections of this statement as they relate to infants and children.)*

TIMING OF UMBILICAL CORD CLAMPING AFTER BIRTH

American College of Obstetricians and Gynecologists Committee on Obstetric Practice (12/12)

TYPE 2 DIABETES IN CHILDREN AND ADOLESCENTS

American Diabetes Association (3/00)

UPDATE ON JAPANESE ENCEPHALITIS VACCINE FOR CHILDREN—UNITED STATES, MAY 2011

Centers for Disease Control and Prevention

Inactivated mouse brain-derived Japanese encephalitis (JE) vaccine (JE-MB [manufactured as JE-Vax]), the only JE vaccine that is licensed for use in children in the United States, is no longer available. This notice provides updated information regarding options for obtaining JE vaccine for U.S. children. (8/11)

WEIGHING PEDIATRIC PATIENTS IN KILOGRAMS

Emergency Nurses Association (3/12)

Appendix 1

Policies by Committee

AMERICAN ACADEMY OF PEDIATRICS

Policies by Committee

BLACK BOX WORKING GROUP

Cardiovascular Monitoring and Stimulant Drugs for Attention-Deficit/Hyperactivity Disorder (joint with Section on Cardiology and Cardiac Surgery), 8/08

BOARD OF DIRECTORS

Ritual Genital Cutting of Female Minors, 6/10

BRIGHT FUTURES STEERING COMMITTEE

Identifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening (joint with Council on Children With Disabilities, Section on Developmental and Behavioral Pediatrics, and Medical Home Initiatives for Children With Special Needs Project Advisory Committee), 7/06, reaffirmed 12/09

Recommendations for Preventive Pediatric Health Care (joint with Committee on Practice and Ambulatory Medicine), 12/07, reaffirmed 1/11

CHILD AND ADOLESCENT HEALTH ACTION GROUP (FORMERLY COUNCIL ON CHILD AND ADOLESCENT HEALTH)

Age Limits of Pediatrics, 5/88, reaffirmed 9/92, 1/97, 3/02, 1/06, 10/11

The Role of Home-Visitation Programs in Improving Health Outcomes for Children and Families, 3/98, reaffirmed 5/01

COMMITTEE ON ADOLESCENCE

Achieving Quality Health Services for Adolescents, 6/08, reaffirmed 3/13

Adolescent Pregnancy: Current Trends and Issues (Clinical Report), 7/05

Adolescents and Human Immunodeficiency Virus Infection: The Role of the Pediatrician in Prevention and Intervention (joint with Committee on Pediatric AIDS), 1/01, reaffirmed 10/03, 1/05

The Adolescent's Right to Confidential Care When Considering Abortion, 5/96, reaffirmed 5/99, 11/02

Care of Adolescent Parents and Their Children (Clinical Report) (joint with Committee on Early Childhood), 11/12

Care of the Adolescent Sexual Assault Victim (Clinical Report), 8/08

Collaborative Role of the Pediatrician in the Diagnosis and Management of Bipolar Disorder in Adolescents (Clinical Report), 11/12

Condom Use by Adolescents, 10/13

Confidentiality in Adolescent Health Care, 4/89, reaffirmed 1/93, 11/97, 5/00, 5/04

Contraception and Adolescents, 11/07

Counseling the Adolescent About Pregnancy Options, 5/98, reaffirmed 1/01, 1/06

Emergency Contraception, 11/12

Excessive Sleepiness in Adolescents and Young Adults: Causes, Consequences, and Treatment Strategies (Technical Report) (joint with Working Group on Sleepiness in Adolescents/Young Adults), 6/05

Gynecologic Examination for Adolescents in the Pediatric Office Setting (Clinical Report), 8/10, reaffirmed 5/13

Health Care for Youth in the Juvenile Justice System, 11/11

Identification and Management of Eating Disorders in Children and Adolescents (Clinical Report), 11/10

Legalization of Marijuana: Potential Impact on Youth (joint with Committee on Substance Abuse), 6/04

Legalization of Marijuana: Potential Impact on Youth (Technical Report) (joint with Committee on Substance Abuse), 6/04

Male Adolescent Sexual and Reproductive Health Care (Clinical Report), 11/11

Menstruation in Girls and Adolescents: Using the Menstrual Cycle as a Vital Sign (Clinical Report) (joint with American College of Obstetricians and Gynecologists), 11/06

Office-Based Care for Lesbian, Gay, Bisexual, Transgender, and Questioning Youth, 6/13

Office-Based Care for Lesbian, Gay, Bisexual, Transgender, and Questioning Youth (Technical Report), 6/13

Secondhand and Prenatal Tobacco Smoke Exposure (Technical Report) (joint with Committee on Environmental Health and Committee on Native American Child Health), 10/09

Sexual Orientation and Adolescents (Clinical Report), 6/04

Sexuality Education for Children and Adolescents (joint with Committee on Psychosocial Aspects of Child and Family Health), 8/01, reaffirmed 10/04

Standards for Health Information Technology to Ensure Adolescent Privacy (joint with Council on Clinical Information Technology), 10/12

Suicide and Suicide Attempts in Adolescents (Clinical Report), 9/07

The Teen Driver (joint with Committee on Injury, Violence, and Poison Prevention), 12/06, reaffirmed 6/10

Tobacco Use: A Pediatric Disease (joint with Committee on Environmental Health, Committee on Substance Abuse, and Committee on Native American Child Health), 10/09

Underinsurance of Adolescents: Recommendations for Improved Coverage of Preventive, Reproductive, and Behavioral Health Care Services (joint with Committee on Child Health Financing), 12/08

COMMITTEE ON BIOETHICS

Children as Hematopoietic Stem Cell Donors, 1/10

Communicating With Children and Families: From Everyday Interactions to Skill in Conveying Distressing Information (Technical Report), 5/08, reaffirmed 5/11

Conflicts Between Religious or Spiritual Beliefs and Pediatric Care: Informed Refusal, Exemptions, and Public Funding, 10/13

Consent for Emergency Medical Services for Children and Adolescents (joint with Committee on Pediatric Emergency Medicine), 7/11

Do-Not-Resuscitate Orders for Pediatric Patients Who Require Anesthesia and Surgery (Clinical Report) (joint with Section on Surgery and Section on Anesthesia and Pain Medicine), 12/04, reaffirmed 1/09, 10/12

Ethical Controversies in Organ Donation After Circulatory Death, 4/13

Ethical Issues With Genetic Testing in Pediatrics, 6/01, reaffirmed 1/05, 1/09

Ethical and Policy Issues in Genetic Testing and Screening of Children (joint with Committee on Genetics and American College of Medical Genetics and Genomics), 2/13

Ethics and the Care of Critically Ill Infants and Children, 7/96, reaffirmed 10/99, 6/03

Forgoing Life-Sustaining Medical Treatment in Abused Children (joint with Committee on Child Abuse and Neglect), 11/00, reaffirmed 6/03, 10/06, 4/09

Forgoing Medically Provided Nutrition and Hydration in Children (Clinical Report), 7/09

Guidelines on Forgoing Life-Sustaining Medical Treatment, 3/94, reaffirmed 11/97, 10/00, 1/04, 1/09, 10/12

Honoring Do-Not-Attempt-Resuscitation Requests in Schools (joint with Council on School Health), 4/10, reaffirmed 7/13

Human Embryonic Stem Cell (hESC) and Human Embryo Research (joint with Committee on Pediatric Research), 10/12

Informed Consent, Parental Permission, and Assent in Pediatric Practice, 2/95, reaffirmed 11/98, 11/02, 10/06, 5/11

Institutional Ethics Committees, 1/01, reaffirmed 1/04, 1/09, 10/12

Maternal-Fetal Intervention and Fetal Care Centers (Clinical Report) (joint with American College of Obstetricians and Gynecologists), 7/11

Minors as Living Solid-Organ Donors (Clinical Report), 8/08, reaffirmed 5/11

Palliative Care for Children (joint with Committee on Hospital Care), 8/00, reaffirmed 6/03, 10/06, 2/12

Pediatrician-Family-Patient Relationships: Managing the Boundaries, 11/09

Physician Refusal to Provide Information or Treatment on the Basis of Claims of Conscience, 11/09

Preservation of Fertility in Pediatric and Adolescent Patients With Cancer (Technical Report) (joint with Section on Hematology/Oncology and Section on Surgery), 5/08, reaffirmed 2/12

Professionalism in Pediatrics: Statement of Principles, 10/07, reaffirmed 5/11

Professionalism in Pediatrics (Technical Report), 10/07, reaffirmed 5/11

Religious Objections to Medical Care, 2/97, reaffirmed 10/00, 6/03, 10/06, 5/09

Responding to Parental Refusals of Immunization of Children (Clinical Report), 5/05, reaffirmed 1/09

COMMITTEE ON CHILD ABUSE AND NEGLECT

Abusive Head Trauma in Infants and Children, 4/09, reaffirmed 3/13

Caregiver-Fabricated Illness in a Child: A Manifestation of Child Maltreatment (Clinical Report), 8/13

Child Abuse, Confidentiality, and the Health Insurance Portability and Accountability Act, 12/09

Child Fatality Review (joint with Committee on Injury, Violence, and Poison Prevention and Council on Community Pediatrics), 8/10

Distinguishing Sudden Infant Death Syndrome From Child Abuse Fatalities (Clinical Report) (joint with National Association of Medical Examiners), 7/06, reaffirmed 4/09, 3/13

Evaluating Infants and Young Children With Multiple Fractures (Clinical Report), 9/06

Evaluating for Suspected Child Abuse: Conditions That Predispose to Bleeding (Technical Report) (joint with Section on Hematology/Oncology), 3/13

Evaluation for Bleeding Disorders in Suspected Child Abuse (Clinical Report) (joint with Section on Hematology/Oncology), 3/13

The Evaluation of Children in the Primary Care Setting When Sexual Abuse Is Suspected (Clinical Report), 7/13

The Evaluation of Sexual Behaviors in Children (Clinical Report), 8/09, reaffirmed 3/13

Evaluation of Suspected Child Physical Abuse (Clinical Report), 6/07, reaffirmed 5/12

The Eye Examination in the Evaluation of Child Abuse (Clinical Report) (joint with Section on Ophthalmology), 7/10

Failure to Thrive as a Manifestation of Child Neglect (Clinical Report) (joint with Committee on Nutrition), 11/05, reaffirmed 1/09

Forgoing Life-Sustaining Medical Treatment in Abused Children (joint with Committee on Bioethics), 11/00, reaffirmed 6/03, 10/06, 4/09

Intimate Partner Violence: The Role of the Pediatrician (Clinical Report) (joint with Committee on Injury, Violence, and Poison Prevention), 4/10

Maltreatment of Children With Disabilities (Clinical Report) (joint with Council on Children With Disabilities), 5/07, reaffirmed 1/11

Oral and Dental Aspects of Child Abuse and Neglect (Clinical Report) (joint with American Academy of Pediatric Dentistry), 12/05, reaffirmed 1/09

The Pediatrician's Role in Child Maltreatment Prevention (Clinical Report), 9/10

Protecting Children From Sexual Abuse by Health Care Providers, 6/11

Psychological Maltreatment (Clinical Report) (joint with American Academy of Child and Adolescent Psychiatry), 7/12

Recognizing and Responding to Medical Neglect (Clinical Report), 12/07, reaffirmed 1/11

Understanding the Behavioral and Emotional Consequences of Child Abuse (Clinical Report) (joint with Section on Adoption and Foster Care, American Academy of Child and Adolescent Psychiatry, and National Center for Child Traumatic Stress), 9/08

When Is Lack of Supervision Neglect? (Clinical Report), 9/06

COMMITTEE ON CHILD HEALTH FINANCING

Essential Contractual Language for Medical Necessity in Children, 7/13

Financing of Pediatric Home Health Care (joint with Section on Home Care), 8/06

Guiding Principles for Managed Care Arrangements for the Health Care of Newborns, Infants, Children, Adolescents, and Young Adults, 10/13

High-Deductible Health Plans and the New Risks of Consumer-Driven Health Insurance Products, 3/07

Implementation Principles and Strategies for the State Children's Health Insurance Program, 5/01

Improving Substance Abuse Prevention, Assessment, and Treatment Financing for Children and Adolescents (joint with Committee on Substance Abuse), 10/01

Medicaid Policy Statement, 4/13

Model Contractual Language for Medical Necessity for Children, 7/05, reaffirmed 10/11

Payment for Telephone Care (joint with Section on Telephone Care), 10/06

Principles of Health Care Financing, 10/10, reaffirmed 4/13

Scope of Health Care Benefits for Children From Birth Through Age 26, 11/11

State Children's Health Insurance Program Achievements, Challenges, and Policy Recommendations, 6/07

Underinsurance of Adolescents: Recommendations for Improved Coverage of Preventive, Reproductive, and Behavioral Health Care Services (joint with Committee on Adolescence), 12/08

COMMITTEE ON CODING AND NOMENCLATURE

Application of the Resource-Based Relative Value Scale System to Pediatrics, 12/08

COMMITTEE ON DRUGS

Fever and Antipyretic Use in Children (Clinical Report) (joint with Section on Clinical Pharmacology and Therapeutics), 2/11

Generic Prescribing, Generic Substitution, and Therapeutic Substitution, 5/87, reaffirmed 6/93, 5/96, 6/99, 5/01, 5/05, 10/08, 10/12

Guidelines for the Ethical Conduct of Studies to Evaluate Drugs in Pediatric Populations (Clinical Report) (joint with Committee on Pediatric Research), 3/10

Neonatal Drug Withdrawal (Clinical Report) (joint with Committee on Fetus and Newborn), 1/12

Preparing for Pediatric Emergencies: Drugs to Consider (Clinical Report), 2/08, reaffirmed 10/11

Recognition and Management of Iatrogenically Induced Opioid Dependence and Withdrawal in Children (Clinical Report) (joint with Section on Anesthesiology and Pain Medicine), 12/13

The Transfer of Drugs and Therapeutics Into Human Breast Milk: An Update on Selected Topics (Clinical Report), 8/13

Use of Codeine- and Dextromethorphan-Containing Cough Remedies in Children, 6/97, reaffirmed 5/00, 6/03, 10/06

Uses of Drugs Not Described in the Package Insert (Off-Label Uses), 7/02, reaffirmed 10/05

COMMITTEE ON FETUS AND NEWBORN

Advanced Practice in Neonatal Nursing, 5/09

Age Terminology During the Perinatal Period, 11/04, reaffirmed 10/07, 11/08, 1/09

Antenatal Counseling Regarding Resuscitation at an Extremely Low Gestational Age (Clinical Report), 6/09

The Apgar Score (joint with American College of Obstetricians and Gynecologists), 4/06, reaffirmed 1/09

Assessment and Management of Inguinal Hernia in Infants (Clinical Report) (joint with Section on Surgery), 9/12

Controversies Concerning Vitamin K and the Newborn, 7/03, reaffirmed 5/06, 5/09

Epidemiology and Diagnosis of Health Care–Associated Infections in the NICU (Technical Report) (joint with Committee on Infectious Diseases), 3/12

Guidance on Management of Asymptomatic Neonates Born to Women With Active Genital Herpes Lesions (Clinical Report) (joint with Committee on Infectious Diseases), 1/13

Hospital Discharge of the High-Risk Neonate, 11/08, reaffirmed 5/11

Hospital Stay for Healthy Term Newborns, 1/10

Human Immunodeficiency Virus Screening (joint with Committee on Pediatric AIDS and American College of Obstetricians and Gynecologists), 7/99, reaffirmed 6/02, 5/05, 10/08, 5/12

"Late-Preterm" Infants: A Population at Risk (Clinical Report), 12/07, reaffirmed 5/10

Levels of Neonatal Care, 8/12

Management of Neonates With Suspected or Proven Early-Onset Bacterial Sepsis (Clinical Report), 4/12

Neonatal Drug Withdrawal (Clinical Report) (joint with Committee on Drugs), 1/12

Noninitiation or Withdrawal of Intensive Care for High-Risk Newborns, 2/07, reaffirmed 5/10

Phototherapy to Prevent Severe Neonatal Hyperbilirubinemia in the Neonate Infant 35 or More Weeks of Gestation (Technical Report), 9/11

Planned Home Birth, 4/13

Postdischarge Follow-up of Infants With Congenital Diaphragmatic Hernia (Clinical Report) (joint with Section on Surgery), 3/08, reaffirmed 5/11

Postnatal Corticosteroids to Prevent or Treat Bronchopulmonary Dysplasia, 9/10

Postnatal Glucose Homeostasis in Late-Preterm and Term Infants (Clinical Report), 3/11

Premedication for Nonemergency Endotracheal Intubation in the Neonate (Clinical Report) (joint with Section on Anesthesiology and Pain Medicine), 2/10, reaffirmed 8/13

Prenatal Substance Abuse: Short- and Long-term Effects on the Exposed Fetus (Technical Report) (joint with Committee on Substance Abuse), 2/13

Prevention and Management of Pain in the Neonate: An Update (joint with Section on Surgery and Canadian Paediatric Society), 11/06, reaffirmed 5/10

Recommendations for the Prevention of Perinatal Group B Streptococcal (GBS) Disease (joint with Committee on Infectious Diseases), 8/11

Respiratory Support in Preterm Infants at Birth, 12/13

Role of Pulse Oximetry in Examining Newborns for Congenital Heart Disease: A Scientific Statement from the AHA and AAP (joint with Section on Cardiology and Cardiac Surgery and American Heart Association Congenital Heart Defects Committee of the Council on Cardiovascular Disease in the Young, Council on Cardiovascular Nursing, and Interdisciplinary Council on Quality of Care and Outcomes Research), 8/09

Safe Transportation of Preterm and Low Birth Weight Infants at Hospital Discharge (Clinical Report) (joint with Committee on Injury, Violence, and Poison Prevention), 4/09, reaffirmed 8/13

Standard Terminology for Fetal, Infant, and Perinatal Deaths (Clinical Report), 6/11

Strategies for Prevention of Health Care–Associated Infections in the NICU (Clinical Report) (joint with Committee on Infectious Diseases), 3/12

Surfactant Replacement Therapy for Preterm and Term Neonates With Respiratory Distress (Clinical Report), 12/13

Use of Inhaled Nitric Oxide, 8/00, reaffirmed 4/03, 12/09

Use of Inhaled Nitric Oxide in Preterm Infants (Clinical Report), 12/13

COMMITTEE ON GENETICS

Clinical Genetic Evaluation of the Child With Mental Retardation or Developmental Delays (Clinical Report), 6/06, reaffirmed 5/12

Congenital Adrenal Hyperplasia (Technical Report) (joint with Section on Endocrinology), 12/00, reaffirmed 10/04

Ethical and Policy Issues in Genetic Testing and Screening of Children (joint with Committee on Bioethics and American College of Medical Genetics and Genomics), 2/13

Folic Acid for the Prevention of Neural Tube Defects, 8/99, reaffirmed 11/02, 1/07, 5/12

Health Care Supervision for Children With Williams Syndrome, 5/01, reaffirmed 5/05, 1/09

Health Supervision for Children With Achondroplasia (Clinical Report), 9/05, reaffirmed 5/12

Health Supervision for Children With Down Syndrome (Clinical Report), 7/11

Health Supervision for Children With Fragile X Syndrome (Clinical Report), 4/11

Health Supervision for Children With Marfan Syndrome (Clinical Report), 9/13

Health Supervision for Children With Neurofibromatosis (Clinical Report), 3/08

Health Supervision for Children With Prader-Willi Syndrome (Clinical Report), 12/10

Health Supervision for Children With Sickle Cell Disease (joint with Section on Hematology/Oncology), 3/02, reaffirmed 1/06, 1/11

Maternal Phenylketonuria, 8/08, reaffirmed 1/13

Molecular Genetic Testing in Pediatric Practice: A Subject Review (Clinical Report), 12/00, reaffirmed 5/07

Newborn Screening Fact Sheets, Introduction to the (Technical Report), 9/06, reaffirmed 1/11

Newborn Screening Fact Sheets (Technical Report), 9/06, reaffirmed 1/11

Update of Newborn Screening and Therapy for Congenital Hypothyroidism (Clinical Report) (joint with Section on Endocrinology, American Thyroid Association, and Lawson Wilkins Pediatric Endocrine Society), 6/06, reaffirmed 12/11

COMMITTEE ON HOSPITAL CARE

Admission and Discharge Guidelines for the Pediatric Patient Requiring Intermediate Care (Clinical Report) (joint with Section on Critical Care and Society of Critical Care Medicine), 5/04, reaffirmed 2/08, 1/13

Child Life Services (joint with Child Life Council), 10/06, reaffirmed 2/12

Facilities and Equipment for the Care of Pediatric Patients in a Community Hospital (Clinical Report), 5/03, reaffirmed 5/07, 8/13

Guidelines for Developing Admission and Discharge Policies for the Pediatric Intensive Care Unit (Clinical Report) (joint with Section on Critical Care and Society of Critical Care Medicine), 4/99, reaffirmed 5/05, 2/08, 1/13

Medical Staff Appointment and Delineation of Pediatric Privileges in Hospitals (Clinical Report) (joint with Section on Hospital Medicine), 3/12

Palliative Care for Children (joint with Committee on Bioethics), 8/00, reaffirmed 6/03, 10/06, 2/12

Patient- and Family-Centered Care and the Pediatrician's Role (joint with Institute for Patient- and Family-Centered Care), 1/12

Pediatric Observation Units (Clinical Report) (joint with Committee on Pediatric Emergency Medicine), 6/12

Pediatric Organ Donation and Transplantation (joint with Section on Surgery and Section on Critical Care), 3/10

Pediatric Palliative Care and Hospice Care Commitments, Guidelines, and Recommendations (joint with Section on Hospice and Palliative Medicine), 10/13

Physicians' Roles in Coordinating Care of Hospitalized Children (Clinical Report) (joint with Section on Hospital Medicine), 9/10

Precertification Process, 8/00, reaffirmed 5/05, 11/08

Principles of Pediatric Patient Safety: Reducing Harm Due to Medical Care (joint with Steering Committee on Quality Improvement and Management), 5/11

COMMITTEE ON INFECTIOUS DISEASES

Additional Recommendations for Use of Tetanus Toxoid, Reduced Content Diphtheria Toxoid, and Acellular Pertussis Vaccine (Tdap), 9/11

Antiviral Therapy and Prophylaxis for Influenza in Children (Clinical Report), 4/07, reaffirmed 7/10

Chemical-Biological Terrorism and Its Impact on Children (joint with Committee on Environmental Health), 9/06, reaffirmed 1/11

Clostridium difficile Infection in Infants and Children, 12/12

Cochlear Implants in Children: Surgical Site Infections and Prevention and Treatment of Acute Otitis Media and Meningitis (joint with Section on Otolaryngology–Head and Neck Surgery), 7/10

Consumption of Raw or Unpasteurized Milk and Milk Products by Pregnant Women and Children (joint with Committee on Nutrition), 12/13

Drinking Water From Private Wells and Risks to Children (joint with Committee on Environmental Health), 5/09, reaffirmed 1/13

Drinking Water From Private Wells and Risks to Children (Technical Report) (joint with Committee on Environmental Health), 5/09, reaffirmed 1/13

Epidemiology and Diagnosis of Health Care–Associated Infections in the NICU (Technical Report) (joint with Committee on Fetus and Newborn), 3/12

Exposure to Nontraditional Pets at Home and to Animals in Public Settings: Risks to Children (Clinical Report), 10/08, reaffirmed 12/11

Guidance on Management of Asymptomatic Neonates Born to Women With Active Genital Herpes Lesions (Clinical Report) (joint with Committee on Fetus and Newborn), 1/13

Head Lice (Clinical Report) (joint with Council on School Health), 7/10

HPV Vaccine Recommendations, 2/12

Immunizing Parents and Other Close Family Contacts in the Pediatric Office Setting (Technical Report) (joint with Committee on Practice and Ambulatory Medicine), 12/11

Infection Prevention and Control in Pediatric Ambulatory Settings, 9/07, reaffirmed 8/10

Meningococcal Conjugate Vaccines Policy Update: Booster Dose Recommendations, 11/11

Nontherapeutic Use of Antimicrobial Agents in Animal Agriculture: Implications for Pediatrics (Technical Report) (joint with Committee on Environmental Health), 9/04, reaffirmed 10/08, 4/13

Poliovirus, 9/11

Prevention of Rotavirus Disease: Updated Guidelines for Use of Rotavirus Vaccine, 3/09

Prevention of Varicella: Update of Recommendations for Use of Quadrivalent and Monovalent Varicella Vaccines in Children, 8/11

Principles of Judicious Antibiotic Prescribing for Upper Respiratory Tract Infections in Pediatrics (Clinical Report), 11/13

Rabies-Prevention Policy Update: New Reduced-Dose Schedule, 3/11

Recommendation for Mandatory Influenza Immunization of All Health Care Personnel, 9/10

Recommendations for Administering Hepatitis A Vaccine to Contacts of International Adoptees, 9/11

Recommendations for Prevention and Control of Influenza in Children, 2013–2014, 9/13

Recommendations for the Prevention of Perinatal Group B Streptococcal (GBS) Disease (joint with Committee on Fetus and Newborn), 8/11

Recommendations for the Prevention of *Streptococcus pneumoniae* Infections in Infants and Children: Use of 13-Valent Pneumococcal Conjugate Vaccine (PCV13) and Pneumococcal Polysaccharide Vaccine (PPSV23), 5/10

Recommended Childhood and Adolescent Immunization Schedule—United States, 2014, 1/14

Strategies for Prevention of Health Care–Associated Infections in the NICU (Clinical Report) (joint with Committee on Fetus and Newborn), 3/12

The Use of Systemic and Topical Fluoroquinolones (Clinical Report), 9/11

COMMITTEE ON MEDICAL LIABILITY AND RISK MANAGEMENT

Consent by Proxy for Nonurgent Pediatric Care (Clinical Report), 10/10

Dealing With the Parent Whose Judgment Is Impaired by Alcohol or Drugs: Legal and Ethical Considerations (Clinical Report), 9/04, reaffirmed 9/10

Expert Witness Participation in Civil and Criminal Proceedings, 6/09

The Pediatrician and Disaster Preparedness (joint with Committee on Pediatric Emergency Medicine and Task Force on Terrorism), 2/06, reaffirmed 6/09, 9/13

Professional Liability Insurance and Medicolegal Education for Pediatric Residents and Fellows, 8/11

COMMITTEE ON NATIVE AMERICAN CHILD HEALTH

Early Childhood Caries in Indigenous Communities (joint with Canadian Paediatric Society), 5/11

Ethical Considerations in Research With Socially Identifiable Populations (joint with Committee on Community Health Services), 1/04, reaffirmed 10/07, 1/13

Health Equity and Children's Rights (joint with Council on Community Pediatrics), 3/10, reaffirmed 10/13

Inhalant Abuse (Clinical Report) (joint with Committee on Substance Abuse), 5/07

Prevention and Treatment of Type 2 Diabetes Mellitus in Children, With Special Emphasis on American Indian and Alaska Native Children (Clinical Report) (joint with Section on Endocrinology), 10/03, reaffirmed 10/08

The Prevention of Unintentional Injury Among American Indian and Alaska Native Children: A Subject Review (Clinical Report) (joint with Committee on Injury and Poison Prevention), 12/99, reaffirmed 5/03, 1/06, 1/09

Secondhand and Prenatal Tobacco Smoke Exposure (Technical Report) (joint with Committee on Environmental Health and Committee on Adolescence), 10/09

Tobacco Use: A Pediatric Disease (joint with Committee on Environmental Health, Committee on Substance Abuse, and Committee on Adolescence), 10/09

COMMITTEE ON NUTRITION

Calcium and Vitamin D Requirements of Enterally Fed Preterm Infants (Clinical Report), 4/13

Consumption of Raw or Unpasteurized Milk and Milk Products by Pregnant Women and Children (joint with Committee on Infectious Diseases), 12/13

Diagnosis and Prevention of Iron Deficiency and Iron-Deficiency Anemia in Infants and Young Children (0–3 Years of Age) (Clinical Report), 10/10

Effects of Early Nutritional Interventions on the Development of Atopic Disease in Infants and Children: The Role of Maternal Dietary Restriction, Breastfeeding, Timing of Introduction of Complementary Foods, and Hydrolyzed Formulas (Clinical Report) (joint with Section on Allergy and Immunology), 1/08

Failure to Thrive as a Manifestation of Child Neglect (Clinical Report) (joint with Committee on Child Abuse and Neglect), 11/05, reaffirmed 1/09

Infant Methemoglobinemia: The Role of Dietary Nitrate in Food and Water (Clinical Report) (joint with Committee on Environmental Health), 9/05, reaffirmed 4/09

Lactose Intolerance in Infants, Children, and Adolescents (Clinical Report), 9/06, reaffirmed 8/12

Organic Foods: Health and Environmental Advantages and Disadvantages (Clinical Report) (joint with Council on Environmental Health), 10/12

Prevention of Pediatric Overweight and Obesity, 8/03, reaffirmed 10/06

Probiotics and Prebiotics in Pediatrics (Clinical Report) (joint with Section on Gastroenterology, Hepatology, and Nutrition), 11/10

Reimbursement for Foods for Special Dietary Use, 5/03, reaffirmed 1/06

Sports Drinks and Energy Drinks for Children and Adolescents: Are They Appropriate? (Clinical Report) (joint with Council on Sports Medicine and Fitness), 5/11

The Use and Misuse of Fruit Juice in Pediatrics, 5/01, reaffirmed 10/06, 8/13

Use of Soy Protein-Based Formulas in Infant Feeding (Clinical Report), 5/08

COMMITTEE ON PEDIATRIC AIDS

Adolescents and HIV Infection: The Pediatrician's Role in Promoting Routine Testing, 10/11

Adolescents and Human Immunodeficiency Virus Infection: The Role of the Pediatrician in Prevention and Intervention (joint with Committee on Adolescence), 1/01, reaffirmed 10/03, 1/05

Diagnosis of HIV-1 Infection in Children Younger Than 18 Months in the United States (Technical Report), 12/07, reaffirmed 4/10

Disclosure of Illness Status to Children and Adolescents With HIV Infection, 1/99, reaffirmed 2/02, 5/05, 1/09, 1/12

Education of Children With Human Immunodeficiency Virus Infection, 6/00, reaffirmed 3/03, 10/06, 4/10, 3/13

Evaluation and Management of the Infant Exposed to HIV-1 in the United States (Clinical Report), 12/08

HIV Testing and Prophylaxis to Prevent Mother-to-Child Transmission in the United States, 11/08, reaffirmed 6/11

Human Immunodeficiency Virus Screening (joint with Committee on Fetus and Newborn and American College of Obstetricians and Gynecologists), 7/99, reaffirmed 6/02, 5/05, 10/08, 5/12

Human Milk, Breastfeeding, and Transmission of Human Immunodeficiency Virus in the United States, 11/95, reaffirmed 11/99, 11/03, 2/08

Human Milk, Breastfeeding, and Transmission of Human Immunodeficiency Virus Type 1 in the United States (Technical Report), 11/03, reaffirmed 1/07

Identification and Care of HIV-Exposed and HIV-Infected Infants, Children, and Adolescents in Foster Care, 7/00, reaffirmed 3/03, 2/08, 6/11

Increasing Antiretroviral Drug Access for Children With HIV Infection (joint with Section on International Child Health), 4/07, reaffirmed 4/10

Infant Feeding and Transmission of Human Immunodeficiency Virus in the United States, 1/13

Postexposure Prophylaxis in Children and Adolescents for Nonoccupational Exposure to Human Immunodeficiency Virus (Clinical Report), 6/03, reaffirmed 1/07, 10/08

Reducing the Risk of HIV Infection Associated With Illicit Drug Use, 2/06, reaffirmed 5/09, 5/12

Surveillance of Pediatric HIV Infection, 2/98, reaffirmed 2/02, 1/06, 1/11

Transitioning HIV-Infected Youth Into Adult Health Care, 6/13

COMMITTEE ON PEDIATRIC EMERGENCY MEDICINE

Access to Optimal Emergency Care for Children, 1/07, reaffirmed 8/10

Consent for Emergency Medical Services for Children and Adolescents (joint with Committee on Bioethics), 7/11

Death of a Child in the Emergency Department (Technical Report), 5/05, reaffirmed 8/13

Death of a Child in the Emergency Department: Joint Statement of the American Academy of Pediatrics and the American College of Emergency Physicians (joint with American College of Emergency Physicians), 10/02, reaffirmed 1/06, 1/09, 8/13

Dispensing Medications at the Hospital Upon Discharge From an Emergency Department (Technical Report), 1/12

Emergency Information Forms and Emergency Preparedness for Children With Special Health Care Needs (joint with Council on Clinical Information Technology and American College of Emergency Physicians Pediatric Emergency Medicine Committee), 3/10

Guidelines for Care of Children in the Emergency Department (joint with American College of Emergency Physicians and Emergency Nurses Association), 9/09, reaffirmed 4/13

Management of Pediatric Trauma (joint with Section on Orthopaedics, Section on Critical Care, Section on Surgery, Section on Transport Medicine, and Pediatric Orthopaedic Society of North America), 4/08, reaffirmed 4/13

Overcrowding Crisis in Our Nation's Emergency Departments: Is Our Safety Net Unraveling?, 9/04, reaffirmed 5/07, 6/11

Patient- and Family-Centered Care of Children in the Emergency Department (Technical Report), 8/08

Patient- and Family-Centered Care and the Role of the Emergency Physician Providing Care to a Child in the Emergency Department (joint with American College of Emergency Physicians), 11/06, reaffirmed 6/09, 10/11

Patient Safety in the Pediatric Emergency Care Setting, 12/07, reaffirmed 6/11

Pediatric and Adolescent Mental Health Emergencies in the Emergency Medical Services System (Technical Report), 4/11

Pediatric Care Recommendations for Freestanding Urgent Care Facilities, 7/05, reaffirmed 1/09, 6/11

Pediatric Mental Health Emergencies in the Emergency Medical Services System (joint with American College of Emergency Physicians), 10/06, reaffirmed 6/09, 4/13

Pediatric Observation Units (Clinical Report) (joint with Committee on Hospital Care), 6/12

The Pediatrician and Disaster Preparedness (joint with Committee on Medical Liability and Task Force on Terrorism), 2/06, reaffirmed 6/09, 9/13

Preparation for Emergencies in the Offices of Pediatricians and Pediatric Primary Care Providers, 7/07, reaffirmed 6/11

Relief of Pain and Anxiety in Pediatric Patients in Emergency Medical Systems (Clinical Report) (joint with Section on Anesthesiology and Pain Medicine), 10/12

The Role of the Pediatrician in Rural Emergency Medical Services for Children, 10/12

Role of Pediatricians in Advocating Life Support Training Courses for Parents and the Public, 12/04, reaffirmed 5/07, 8/10, 8/13

Role of Pediatricians in Advocating Life Support Training Courses for Parents and the Public (Technical Report), 12/04, reaffirmed 5/07, 8/10

Ventricular Fibrillation and the Use of Automated External Defibrillators on Children (joint with Section on Cardiology and Cardiac Surgery), 11/07, reaffirmed 6/11

COMMITTEE ON PEDIATRIC RESEARCH

Guidelines for the Ethical Conduct of Studies to Evaluate Drugs in Pediatric Populations (Clinical Report) (joint with Committee on Drugs), 3/10

Human Embryonic Stem Cell (hESC) and Human Embryo Research (joint with Committee on Bioethics), 10/12

Promoting Education, Mentorship, and Support for Pediatric Research, 6/01, reaffirmed 1/05, 5/08, 10/11

Race/Ethnicity, Gender, Socioeconomic Status—Research Exploring Their Effects on Child Health: A Subject Review (Clinical Report), 6/00, reaffirmed 10/05, 1/09

Racial and Ethnic Disparities in the Health and Health Care of Children (Technical Report), 3/10, reaffirmed 5/13

COMMITTEE ON PEDIATRIC WORKFORCE

Enhancing Pediatric Workforce Diversity and Providing Culturally Effective Pediatric Care: Implications for Practice, Education, and Policy Making, 9/13

Financing Graduate Medical Education to Meet the Needs of Children and the Future Pediatrician Workforce, 4/08, reaffirmed 1/12

Nondiscrimination in Pediatric Health Care, 10/07, reaffirmed 6/11

Pediatric Primary Health Care, 11/93, reaffirmed 6/01, 1/05, 10/07, 9/10

The Pediatrician Workforce: Current Status and Future Prospects (Technical Report), 7/05

Pediatrician Workforce Policy Statement, 7/13

Prevention of Sexual Harassment in the Workplace and Educational Settings, 10/06, reaffirmed 5/09, 1/12

Scope of Practice Issues in the Delivery of Pediatric Health Care, 5/13

COMMITTEE ON PRACTICE AND AMBULATORY MEDICINE

Eye Examination in Infants, Children, and Young Adults by Pediatricians (joint with Section on Ophthalmology, American Association of Certified Orthoptists, American Association for Pediatric Ophthalmology and Strabismus, and American Academy of Ophthalmology), 4/03, reaffirmed 5/07

Hearing Assessment in Infants and Children: Recommendations Beyond Neonatal Screening (Clinical Report) (joint with Section on Otolaryngology–Head and Neck Surgery), 9/09

Immunization Information Systems, 9/06, reaffirmed 10/11

Immunizing Parents and Other Close Family Contacts in the Pediatric Office Setting (Technical Report) (joint with Committee on Infectious Diseases), 12/11

Increasing Immunization Coverage (joint with Council on Community Pediatrics), 5/10

Instrument-Based Pediatric Vision Screening Policy Statement (joint with Section on Ophthalmology, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists), 10/12

Prevention and Management of Positional Skull Deformities in Infants (Clinical Report) (joint with Section on Neurological Surgery), 11/11

Principles for the Development and Use of Quality Measures (joint with Steering Committee on Quality Improvement and Management), 2/08

Recommendations for Preventive Pediatric Health Care (joint with Bright Futures Steering Committee), 12/07, reaffirmed 1/11

Use of Chaperones During the Physical Examination of the Pediatric Patient, 4/11

COMMITTEE ON PSYCHOSOCIAL ASPECTS OF CHILD AND FAMILY HEALTH

The Child in Court: A Subject Review (Clinical Report), 11/99, reaffirmed 11/02

Coparent or Second-Parent Adoption by Same-Sex Parents, 2/02, reaffirmed 5/09

Coparent or Second-Parent Adoption by Same-Sex Parents (Technical Report), 2/02, reaffirmed 5/09

Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science Into Lifelong Health (joint with Committee on Early Childhood, Adoption, and Dependent Care and Section on Developmental and Behavioral Pediatrics), 12/11

Fathers and Pediatricians: Enhancing Men's Roles in the Care and Development of Their Children (Clinical Report), 5/04, reaffirmed 8/13

The Future of Pediatrics: Mental Health Competencies for Pediatric Primary Care (joint with Task Force on Mental Health), 6/09, reaffirmed 8/13

Guidance for Effective Discipline, 4/98, reaffirmed 3/01, 1/05, 5/12

Health and Mental Health Needs of Children in US Military Families (Clinical Report) (joint with Section on Uniformed Services), 5/13

Helping Children and Families Deal With Divorce and Separation (Clinical Report), 11/02, reaffirmed 1/06

The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds (Clinical Report) (joint with Committee on Communications), 1/07

The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bond: Focus on Children in Poverty (Clinical Report) (joint with Council on Communications and Media), 12/11

Incorporating Recognition and Management of Perinatal and Postpartum Depression Into Pediatric Practice (Clinical Report), 10/10

The Lifelong Effects of Early Childhood Adversity and Toxic Stress (Technical Report) (joint with Committee on Early Childhood, Adoption, and Dependent Care and Section on Developmental and Behavioral Pediatrics), 12/11

The New Morbidity Revisited: A Renewed Commitment to the Psychosocial Aspects of Pediatric Care, 11/01

The Pediatrician and Childhood Bereavement, 2/00, reaffirmed 1/04, 3/13

The Pediatrician's Role in the Prevention of Missing Children (Clinical Report), 10/04

The Prenatal Visit (Clinical Report), 9/09

Promoting the Well-Being of Children Whose Parents Are Gay or Lesbian, 3/13

Promoting the Well-Being of Children Whose Parents Are Gay or Lesbian (Technical Report), 3/13

Psychosocial Implications of Disaster or Terrorism on Children: A Guide for the Pediatrician (Clinical Report) (joint with Task Force on Terrorism), 9/05

Psychosocial Risks of Chronic Health Conditions in Childhood and Adolescence (joint with Committee on Children With Disabilities), 12/93, reaffirmed 10/96

Sexuality Education for Children and Adolescents (joint with Committee on Adolescence), 8/01, reaffirmed 10/04

Supporting the Family After the Death of a Child (Clinical Report), 11/12

COMMITTEE ON SUBSTANCE ABUSE

Alcohol Use by Youth and Adolescents: A Pediatric Concern, 4/10

Improving Substance Abuse Prevention, Assessment, and Treatment Financing for Children and Adolescents (joint with Committee on Child Health Financing), 10/01

Indications for Management and Referral of Patients Involved in Substance Abuse, 7/00

Inhalant Abuse (Clinical Report) (joint with Committee on Native American Child Health), 5/07

Legalization of Marijuana: Potential Impact on Youth (joint with Committee on Adolescence), 6/04

Legalization of Marijuana: Potential Impact on Youth (Technical Report) (joint with Committee on Adolescence), 6/04

Marijuana: A Continuing Concern for Pediatricians, 10/99, reaffirmed 4/03

Prenatal Substance Abuse: Short- and Long-term Effects on the Exposed Fetus (Technical Report) (joint with Committee on Fetus and Newborn), 2/13

The Role of Schools in Combating Illicit Substance Abuse (joint with Council on School Health), 12/07

Substance Use Screening, Brief Intervention, and Referral to Treatment for Pediatricians, 10/11

Testing for Drugs of Abuse in Children and Adolescents, 8/96, reaffirmed 5/99, 5/06

Testing for Drugs of Abuse in Children and Adolescents: Addendum—Testing in Schools and at Home (joint with Council on School Health), 3/07

Tobacco, Alcohol, and Other Drugs: The Role of the Pediatrician in Prevention, Identification, and Management of Substance Abuse (Clinical Report), 3/05, reaffirmed 3/13

Tobacco as a Substance of Abuse (Technical Report), 10/09

Tobacco Use: A Pediatric Disease (joint with Committee on Environmental Health, Committee on Adolescence, and Committee on Native American Child Health), 10/09

COUNCIL ON CHILDREN WITH DISABILITIES (FORMERLY COMMITTEE ON CHILDREN WITH DISABILITIES AND SECTION ON CHILDREN WITH DISABILITIES)

Auditory Integration Training and Facilitated Communication for Autism, 8/98, reaffirmed 5/02, 1/06, 12/09

Care Coordination in the Medical Home: Integrating Health and Related Systems of Care for Children With Special Health Care Needs, 11/05

Counseling Families Who Choose Complementary and Alternative Medicine for Their Child With Chronic Illness or Disability, 3/01, reaffirmed 1/05, 5/10

Early Intervention, IDEA Part C Services, and the Medical Home: Collaboration for Best Practice and Best Outcomes (Clinical Report), 9/13

Guidelines for Home Care of Infants, Children, and Adolescents With Chronic Disease, 7/95, reaffirmed 4/00, 1/06

Home Care of Children and Youth With Complex Health Care Needs and Technology Dependencies (Clinical Report), 4/12

Identification and Evaluation of Children With Autism Spectrum Disorders (Clinical Report), 11/07, reaffirmed 9/10

Identifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening (joint with Section on Developmental and Behavioral Pediatrics, Bright Futures Steering Committee, and Medical Home Initiatives for Children With Special Needs Project Advisory Committee), 7/06, reaffirmed 12/09

Learning Disabilities, Dyslexia, and Vision (joint with Section on Ophthalmology, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists), 7/09

Learning Disabilities, Dyslexia, and Vision (Technical Report) (joint with Section on Ophthalmology, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists), 3/11

Maltreatment of Children With Disabilities (Clinical Report) (joint with Committee on Child Abuse and Neglect), 5/07, reaffirmed 1/11

Management of Children With Autism Spectrum Disorders (Clinical Report), 11/07, reaffirmed 9/10

Oral Health Care for Children With Developmental Disabilities (Clinical Report) (joint with Section on Oral Health), 2/13

Parent-Provider-Community Partnerships: Optimizing Outcomes for Children With Disabilities (Clinical Report), 9/11

The Pediatrician's Role in Development and Implementation of an Individual Education Plan (IEP) and/or an Individual Family Service Plan (IFSP), 7/99, reaffirmed 11/02, 1/06

Prescribing Assistive-Technology Systems: Focus on Children With Impaired Communication (Clinical Report), 6/08, reaffirmed 1/12

Prescribing Therapy Services for Children With Motor Disabilities (Clinical Report), 6/04, reaffirmed 5/07, 5/11

Promoting the Participation of Children With Disabilities in Sports, Recreation, and Physical Activities (Clinical Report), 5/08, reaffirmed 1/12

Providing a Primary Care Medical Home for Children and Youth With Cerebral Palsy (Clinical Report), 10/11

Providing a Primary Care Medical Home for Children and Youth With Spina Bifida (Clinical Report), 11/11

Provision of Educationally Related Services for Children and Adolescents With Chronic Diseases and Disabling Conditions, 6/07

Psychosocial Risks of Chronic Health Conditions in Childhood and Adolescence (joint with Committee on Psychosocial Aspects of Child and Family Health), 12/93, reaffirmed 10/96

Role of the Medical Home in Family-Centered Early Intervention Services, 11/07

Sensory Integration Therapies for Children With Developmental and Behavioral Disorders (joint with Section on Complementary and Integrative Medicine), 5/12

Sexuality of Children and Adolescents With Developmental Disabilities (Clinical Report), 7/06, reaffirmed 12/09, 7/13

Supplemental Security Income (SSI) for Children and Youth With Disabilities, 11/09

The Treatment of Neurologically Impaired Children Using Patterning, 11/99, reaffirmed 11/02, 1/06, 8/10

COUNCIL ON CLINICAL INFORMATION TECHNOLOGY (FORMERLY STEERING COMMITTEE ON CLINICAL INFORMATION TECHNOLOGY, SECTION ON COMPUTERS AND OTHER TECHNOLOGIES, AND TASK FORCE ON MEDICAL INFORMATICS)

Electronic Prescribing in Pediatrics: Toward Safer and More Effective Medication Management, 3/13

Electronic Prescribing in Pediatrics: Toward Safer and More Effective Medication Management (Technical Report), 3/13

Electronic Prescribing Systems in Pediatrics: The Rationale and Functionality Requirements, 6/07

Electronic Prescribing Systems in Pediatrics: The Rationale and Functionality Requirements (Technical Report), 6/07

E-mail Communication Between Pediatricians and Their Patients (Clinical Report), 7/04, reaffirmed 2/08

Emergency Information Forms and Emergency Preparedness for Children With Special Health Care Needs (joint with Committee on Pediatric Emergency Medicine and American College of Emergency Physicians Pediatric Emergency Medicine Committee), 3/10

Health Information Technology and the Medical Home, 4/11

Pediatric Aspects of Inpatient Health Information Technology Systems (Technical Report), 12/08

Special Requirements of Electronic Health Record Systems in Pediatrics (Clinical Report), 3/07, reaffirmed 5/12

Standards for Health Information Technology to Ensure Adolescent Privacy (joint with Committee on Adolescence), 10/12

Using Personal Health Records to Improve the Quality of Health Care for Children, 6/09

COUNCIL ON COMMUNICATIONS AND MEDIA (FORMERLY COMMITTEE ON COMMUNICATIONS AND COMMITTEE ON PUBLIC EDUCATION)

Children, Adolescents, and Advertising, 12/06, reaffirmed 3/10

Children, Adolescents, and the Media, 10/13

Children, Adolescents, Obesity, and the Media, 7/11

Children, Adolescents, Substance Abuse, and the Media, 9/10

Children, Adolescents, and Television, 2/01

Impact of Music, Music Lyrics, and Music Videos on Children and Youth, 10/09

The Impact of Social Media on Children, Adolescents, and Families (Clinical Report), 3/11

The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds (Clinical Report) (joint with Committee on Psychosocial Aspects of Child and Family Health), 1/07

The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bond: Focus on Children in Poverty (Clinical Report) (joint with Committee on Psychosocial Aspects of Child and Family Health), 12/11

Media Education, 9/10

Media Use by Children Younger Than 2 Years, 10/11

Media Violence, 10/09

Sexuality, Contraception, and the Media, 8/10

COUNCIL ON COMMUNITY PEDIATRICS (FORMERLY COMMITTEE ON COMMUNITY HEALTH SERVICES)

Child Fatality Review (joint with Committee on Child Abuse and Neglect and Committee on Injury, Violence, and Poison Prevention), 8/10

Community Pediatrics: Navigating the Intersection of Medicine, Public Health, and Social Determinants of Children's Health, 2/13

Ethical Considerations in Research With Socially Identifiable Populations (joint with Committee on Native American Child Health), 1/04, reaffirmed 10/07, 1/13

Health Equity and Children's Rights (joint with Committee on Native American Child Health), 3/10, reaffirmed 10/13

Increasing Immunization Coverage (joint with Committee on Practice and Ambulatory Medicine), 5/10

The Pediatrician's Role in Community Pediatrics, 4/05, reaffirmed 1/10

Prevention of Agricultural Injuries Among Children and Adolescents (joint with Committee on Injury and Poison Prevention), 10/01, reaffirmed 1/07, 11/11

Providing Care for Children and Adolescents Facing Homelessness and Housing Insecurity, 5/13

Providing Care for Immigrant, Migrant, and Border Children, 5/13

The Role of Preschool Home-Visiting Programs in Improving Children's Developmental and Health Outcomes, 1/09

COUNCIL ON EARLY CHILDHOOD (FORMERLY COMMITTEE ON EARLY CHILDHOOD, ADOPTION, AND DEPENDENT CARE AND COMMITTEE ON EARLY CHILDHOOD)

Care of Adolescent Parents and Their Children (Clinical Report) (joint with Committee on Adolescence), 11/12

Comprehensive Health Evaluation of the Newly Adopted Child (Clinical Report), 12/11

Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science Into Lifelong Health (joint with Committee on Psychosocial Aspects of Child and Family Health and Section on Developmental and Behavioral Pediatrics), 12/11

Families and Adoption: The Pediatrician's Role in Supporting Communication (Clinical Report), 12/03

Health Care of Youth Aging Out of Foster Care (joint with Council on Foster Care, Adoption, and Kinship Care), 11/12

The Inappropriate Use of School "Readiness" Tests (joint with Committee on School Health), 3/95, reaffirmed 4/98, 1/04, 4/10

The Lifelong Effects of Early Childhood Adversity and Toxic Stress (Technical Report) (joint with Committee on Psychosocial Aspects of Child and Family Health and Section on Developmental and Behavioral Pediatrics), 12/11

Parental Leave for Residents and Pediatric Training Programs (joint with Section on Medical Students, Residents, and Fellowship Trainees), 1/13

The Pediatrician's Role in Family Support and Family Support Programs, 11/11

The Pediatrician's Role in Supporting Adoptive Families (Clinical Report) (joint with Council on Foster Care, Adoption, and Kinship Care), 9/12

Quality Early Education and Child Care From Birth to Kindergarten, 1/05, reaffirmed 12/09

School Readiness (Technical Report) (joint with Council on School Health), 4/08, reaffirmed 9/13

Selecting Appropriate Toys for Young Children: The Pediatrician's Role (Clinical Report), 4/03, reaffirmed 10/06, 5/11

COUNCIL ON ENVIRONMENTAL HEALTH (FORMERLY COMMITTEE ON ENVIRONMENTAL HEALTH)

Ambient Air Pollution: Health Hazards to Children, 12/04, reaffirmed 4/09

The Built Environment: Designing Communities to Promote Physical Activity in Children, 5/09, reaffirmed 1/13

Chemical-Biological Terrorism and Its Impact on Children (joint with Committee on Infectious Diseases), 9/06, reaffirmed 1/11

Chemical-Management Policy: Prioritizing Children's Health, 4/11

Drinking Water From Private Wells and Risks to Children (joint with Committee on Infectious Diseases), 5/09, reaffirmed 1/13

Drinking Water From Private Wells and Risks to Children (Technical Report) (joint with Committee on Infectious Diseases), 5/09, reaffirmed 1/13

Global Climate Change and Children's Health, 11/07, reaffirmed 5/12

Global Climate Change and Children's Health (Technical Report), 11/07, reaffirmed 5/12

Infant Methemoglobinemia: The Role of Dietary Nitrate in Food and Water (Clinical Report) (joint with Committee on Nutrition), 9/05, reaffirmed 4/09

Nontherapeutic Use of Antimicrobial Agents in Animal Agriculture: Implications for Pediatrics (Technical Report) (joint with Committee on Infectious Diseases), 9/04, reaffirmed 10/08, 4/13

Organic Foods: Health and Environmental Advantages and Disadvantages (Clinical Report) (joint with Committee on Nutrition), 10/12

Pesticide Exposure in Children, 11/12

Pesticide Exposure in Children (Technical Report), 11/12

Radiation Disasters and Children, 6/03, reaffirmed 1/07

Secondhand and Prenatal Tobacco Smoke Exposure (Technical Report) (joint with Committee on Native American Child Health and Committee on Adolescence), 10/09

Spectrum of Noninfectious Health Effects From Molds, 12/06, reaffirmed 1/11

Spectrum of Noninfectious Health Effects From Molds (Technical Report), 12/06, reaffirmed 1/11

Tobacco Use: A Pediatric Disease (joint with Committee on Substance Abuse, Committee on Adolescence, and Committee on Native American Child Health), 10/09

Ultraviolet Radiation: A Hazard to Children and Adolescents (joint with Section on Dermatology), 2/11

Ultraviolet Radiation: A Hazard to Children and Adolescents (Technical Report) (joint with Section on Dermatology), 3/11

COUNCIL ON FOSTER CARE, ADOPTION, AND KINSHIP CARE (FORMALLY SECTION ON ADOPTION AND FOSTER CARE, TASK FORCE ON FOSTER CARE, AND COMMITTEE ON EARLY CHILDHOOD, ADOPTION, AND DEPENDENT CARE)

Families and Adoption: The Pediatrician's Role in Supporting Communication (Clinical Report), 12/03

Health Care of Youth Aging Out of Foster Care (joint with Committee on Early Childhood), 11/12

The Inappropriate Use of School "Readiness" Tests (joint with Committee on School Health), 3/95, reaffirmed 4/98, 1/04, 4/10

The Pediatrician's Role in Family Support and Family Support Programs, 11/11

The Pediatrician's Role in Supporting Adoptive Families (Clinical Report) (joint with Committee on Early Childhood), 9/12

Quality Early Education and Child Care From Birth to Kindergarten, 1/05, reaffirmed 12/09

School Readiness (Technical Report) (joint with Council on School Health), 4/08, reaffirmed 9/13

Selecting Appropriate Toys for Young Children: The Pediatrician's Role (Clinical Report), 4/03, reaffirmed 10/06, 5/11

Understanding the Behavioral and Emotional Consequences of Child Abuse (Clinical Report) (joint with Committee on Child Abuse and Neglect, American Academy of Child and Adolescent Psychiatry, and National Center for Child Traumatic Stress), 9/08

COUNCIL ON INJURY, VIOLENCE, AND POISON PREVENTION (FORMALLY COMMITTEE ON INJURY, VIOLENCE, AND POISON PREVENTION)

All-Terrain Vehicle Injury Prevention: Two-, Three-, and Four-Wheeled Unlicensed Motor Vehicles, 6/00, reaffirmed 5/04, 1/07

Bicycle Helmets, 10/01, reaffirmed 1/05, 2/08, 11/11

Child Fatality Review (joint with Committee on Child Abuse and Neglect and Council on Community Pediatrics), 8/10

Child Passenger Safety, 3/11

Child Passenger Safety (Technical Report), 3/11

Children in Pickup Trucks, 10/00, reaffirmed 5/04, 1/07

Falls From Heights: Windows, Roofs, and Balconies, 5/01, reaffirmed 10/04, 5/07, 6/10

Firearm-Related Injuries Affecting the Pediatric Population, 10/12

Fireworks-Related Injuries to Children, 7/01, reaffirmed 1/05, 2/08, 10/11

The Hospital Record of the Injured Child and the Need for External Cause-of-Injury Codes, 2/99, reaffirmed 5/02, 5/05, 10/08

Injuries Associated With Infant Walkers, 9/01, reaffirmed 1/05, 2/08, 10/11

Injury Risk of Nonpowder Guns (Technical Report), 11/04, reaffirmed 2/08, 10/11

In-line Skating Injuries in Children and Adolescents (joint with Committee on Sports Medicine and Fitness), 4/98, reaffirmed 1/02, 1/06, 1/09, 11/11

Intimate Partner Violence: The Role of the Pediatrician (Clinical Report) (joint with Committee on Child Abuse and Neglect), 4/10

Lawn Mower-Related Injuries to Children, 6/01, reaffirmed 10/04, 5/07, 6/10

Lawn Mower-Related Injuries to Children (Technical Report), 6/01, reaffirmed 10/04, 5/07, 6/10

Office-Based Counseling for Unintentional Injury Prevention (Clinical Report), 1/07

Pedestrian Safety, 7/09, reaffirmed 8/13

Personal Watercraft Use by Children and Adolescents, 2/00, reaffirmed 5/04, 1/07, 6/10

Prevention of Agricultural Injuries Among Children and Adolescents (joint with Committee on Community Health Services), 10/01, reaffirmed 1/07, 11/11

Prevention of Choking Among Children, 2/10

Prevention of Drowning, 5/10

Prevention of Drowning (Technical Report), 5/10

The Prevention of Unintentional Injury Among American Indian and Alaska Native Children: A Subject Review (Clinical Report) (joint with Committee on Native American Child Health), 12/99, reaffirmed 12/02, 1/06, 1/09

Reducing the Number of Deaths and Injuries From Residential Fires, 6/00

Restraint Use on Aircraft, 11/01, reaffirmed 5/05, 10/08

Role of the Pediatrician in Youth Violence Prevention, 6/09

Safe Transportation of Newborns at Hospital Discharge, 10/99, reaffirmed 1/03, 1/06, 10/08

Safe Transportation of Preterm and Low Birth Weight Infants at Hospital Discharge (Clinical Report) (joint with Committee on Fetus and Newborn), 4/09, reaffirmed 8/13

School Bus Transportation of Children With Special Health Care Needs, 8/01, reaffirmed 1/05, 2/08

School Transportation Safety (joint with Council on School Health), 7/07, reaffirmed 10/11

Shopping Cart–Related Injuries to Children, 8/06, reaffirmed 4/09, 8/13

Shopping Cart–Related Injuries to Children (Technical Report), 8/06, reaffirmed 4/09, 8/13

Skateboard and Scooter Injuries, 3/02, reaffirmed 5/05, 10/08

Snowmobiling Hazards, 11/00, reaffirmed 5/04, 1/07, 6/10

Swimming Programs for Infants and Toddlers (joint with Committee on Sports Medicine and Fitness), 4/00, reaffirmed 5/04

The Teen Driver (joint with Committee on Adolescence), 12/06, reaffirmed 6/10

Transporting Children With Special Health Care Needs, 10/99, reaffirmed 1/03, 1/06, 3/13

COUNCIL ON SCHOOL HEALTH (FORMERLY COMMITTEE ON SCHOOL HEALTH AND SECTION ON SCHOOL HEALTH)

Active Healthy Living: Prevention of Childhood Obesity Through Increased Physical Activity (joint with Council on Sports Medicine and Fitness), 5/06, reaffirmed 5/09, 8/12

Climatic Heat Stress and Exercising Children and Adolescents (joint with Council on Sports Medicine and Fitness), 8/11

Corporal Punishment in Schools, 8/00, reaffirmed 6/03, 5/06, 2/12

Creating Healthy Camp Experiences, 3/11

The Crucial Role of Recess in School, 12/12

Disaster Planning for Schools, 10/08, reaffirmed 9/11

Guidance for the Administration of Medication in School, 9/09, reaffirmed 2/13

Head Lice (Clinical Report) (joint with Committee on Infectious Diseases), 7/10

Home, Hospital, and Other Non–School-based Instruction for Children and Adolescents Who Are Medically Unable to Attend School, 11/00, reaffirmed 6/03, 5/06

Honoring Do-Not-Attempt-Resuscitation Requests in Schools (joint with Committee on Bioethics), 4/10, reaffirmed 7/13

The Inappropriate Use of School "Readiness" Tests (joint with Committee on Early Childhood, Adoption, and Dependent Care), 3/95, reaffirmed 4/98, 1/04, 4/10

Medical Emergencies Occurring at School, 10/08, reaffirmed 9/11

Organized Sports for Children and Preadolescents (joint with Committee on Sports Medicine and Fitness), 6/01, reaffirmed 1/05, 6/11

Out-of-School Suspension and Expulsion, 2/13

Preventing and Treating Homesickness (Clinical Report), 1/07, reaffirmed 5/12

Returning to Learning Following a Concussion (Clinical Report) (joint with Council on Sports Medicine and Fitness), 10/13

Role of the School Nurse in Providing School Health Services, 5/08

Role of the School Physician, 12/12

The Role of Schools in Combating Illicit Substance Abuse (joint with Committee on Substance Abuse), 12/07

School-Based Health Centers and Pediatric Practice, 1/12

School Health Assessments, 4/00, reaffirmed 6/03, 5/06, 10/11

School Health Centers and Other Integrated School Health Services, 1/01

School Readiness (Technical Report) (joint with Committee on Early Childhood, Adoption, and Dependent Care), 4/08, reaffirmed 9/13

School Transportation Safety (joint with Committee on Injury, Violence, and Poison Prevention), 7/07, reaffirmed 10/11

School-Based Mental Health Services, 6/04, reaffirmed 5/09

Soft Drinks in Schools, 1/04, reaffirmed 1/09

Testing for Drugs of Abuse in Children and Adolescents: Addendum—Testing in Schools and at Home (joint with Committee on Substance Abuse), 3/07

COUNCIL ON SPORTS MEDICINE AND FITNESS (FORMERLY COMMITTEE ON SPORTS MEDICINE AND FITNESS AND SECTION ON SPORTS MEDICINE AND FITNESS)

Active Healthy Living: Prevention of Childhood Obesity Through Increased Physical Activity (joint with Council on School Health), 5/06, reaffirmed 5/09, 8/12

Athletic Participation by Children and Adolescents Who Have Systemic Hypertension, 5/10, reaffirmed 5/13

Baseball and Softball, 2/12

Boxing Participation by Children and Adolescents (joint with Canadian Paediatric Society), 8/11

Cheerleading Injuries: Epidemiology and Recommendations for Prevention, 10/12

Climatic Heat Stress and Exercising Children and Adolescents (joint with Council on School Health), 8/11

Human Immunodeficiency Virus and Other Blood-borne Viral Pathogens in the Athletic Setting, 12/99, reaffirmed 1/05, 1/09, 11/11

Injuries in Youth Soccer (Clinical Report), 1/10, reaffirmed 5/13

In-line Skating Injuries in Children and Adolescents (joint with Committee on Injury and Poison Prevention), 4/98, reaffirmed 1/02, 1/06, 1/09, 11/11

Intensive Training and Sports Specialization in Young Athletes, 7/00, reaffirmed 11/04, 1/06, 5/09

Knee Brace Use in the Young Athlete (Technical Report), 8/01, reaffirmed 1/07, 4/10, 5/13

Medical Concerns in the Female Athlete, 9/00, reaffirmed 5/05, 5/08

Medical Conditions Affecting Sports Participation (Clinical Report), 4/08, reaffirmed 5/11

Organized Sports for Children and Preadolescents (joint with Committee on School Health), 6/01, reaffirmed 1/05, 6/11

Overuse Injuries, Overtraining, and Burnout in Child and Adolescent Athletes (Clinical Report), 6/07, reaffirmed 3/11

Promotion of Healthy Weight-Control Practices in Young Athletes, 12/05

Protective Eyewear for Young Athletes (joint with American Academy of Ophthalmology), 3/04, reaffirmed 2/08, 6/11

Returning to Learning Following a Concussion (Clinical Report) (joint with Council on School Health), 10/13

Safety in Youth Ice Hockey: The Effects of Body Checking, 3/00, reaffirmed 1/06, 5/09

Sport-Related Concussion in Children and Adolescents (Clinical Report), 8/10

Sports Drinks and Energy Drinks for Children and Adolescents: Are They Appropriate? (Clinical Report) (joint with Committee on Nutrition), 5/11

Strength Training by Children and Adolescents, 4/08, reaffirmed 6/11

Swimming Programs for Infants and Toddlers (joint with Committee on Injury and Poison Prevention), 4/00, reaffirmed 5/04

Trampoline Safety in Childhood and Adolescence, 9/12

Use of Performance-Enhancing Substances, 4/05, reaffirmed 5/08

JOINT COMMITTEE ON INFANT HEARING

Supplement to the JCIH 2007 Position Statement: Principles and Guidelines for Early Intervention After Confirmation That a Child Is Deaf or Hard of Hearing, 3/13

Year 2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs, 10/07

MEDICAL HOME INITIATIVES FOR CHILDREN WITH SPECIAL NEEDS PROJECT ADVISORY COMMITTEE

Identifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening (joint with Council on Children With Disabilities, Section on Developmental and Behavioral Pediatrics, and Bright Futures Steering Committee), 7/06, reaffirmed 12/09

The Medical Home, 7/02, reaffirmed 5/08

NEUROMOTOR SCREENING EXPERT PANEL

Motor Delays: Early Identification and Evaluation (Clinical Report), 5/13

NEWBORN SCREENING AUTHORING COMMITTEE

Newborn Screening Expands: Recommendations for Pediatricians and Medical Homes—Implications for the System (Clinical Report), 1/08

RETAIL-BASED CLINIC POLICY WORK GROUP

AAP Principles Concerning Retail-Based Clinics, 12/06, reaffirmed 1/11

SECTION ON ALLERGY AND IMMUNOLOGY

Allergy Testing in Childhood: Using Allergen-Specific IgE Tests (Clinical Report), 12/11

Effects of Early Nutritional Interventions on the Development of Atopic Disease in Infants and Children: The Role of Maternal Dietary Restriction, Breastfeeding, Timing of Introduction of Complementary Foods, and Hydrolyzed Formulas (Clinical Report) (joint with Committee on Nutrition), 1/08

Management of Food Allergy in the School Setting (Clinical Report), 11/10

Self-injectable Epinephrine for First-Aid Management of Anaphylaxis (Clinical Report), 3/07

SECTION ON ANESTHESIOLOGY AND PAIN MEDICINE

Premedication for Nonemergency Endotracheal Intubation in the Neonate (Clinical Report) (joint with Committee on Fetus and Newborn), 2/10, reaffirmed 8/13

Recognition and Management of Iatrogenically Induced Opioid Dependence and Withdrawal in Children (Clinical Report) (joint with Committee on Drugs), 12/13

Relief of Pain and Anxiety in Pediatric Patients in Emergency Medical Systems (Clinical Report) (joint with Committee on Pediatric Emergency Medicine), 10/12

SECTION ON BREASTFEEDING

Breastfeeding and the Use of Human Milk, 2/12

WIC Program, 11/01

SECTION ON CARDIOLOGY AND CARDIAC SURGERY

ACCF/AHA/AAP Recommendations for Training in Pediatric Cardiology (joint with American College of Cardiology Foundation and American Heart Association), 12/05, reaffirmed 1/09

Cardiovascular Health Supervision for Individuals Affected by Duchenne or Becker Muscular Dystrophy (Clinical Report), 12/05, reaffirmed 1/09

Cardiovascular Monitoring and Stimulant Drugs for Attention-Deficit/Hyperactivity Disorder (joint with Black Box Working Group), 8/08

Echocardiography in Infants and Children, 6/97, reaffirmed 3/03, 3/07

Endorsement of Health and Human Services Recommendation for Pulse Oximetry Screening for Critical Congenital Heart Disease, 12/11

Guidelines for Pediatric Cardiovascular Centers, 3/02, reaffirmed 10/07

Pediatric Sudden Cardiac Arrest, 3/12

Role of Pulse Oximetry in Examining Newborns for Congenital Heart Disease: A Scientific Statement from the AHA and AAP (joint with Committee on Fetus and Newborn and American Heart Association Congenital Heart Defects Committee of the Council on Cardiovascular Disease in the Young, Council on Cardiovascular Nursing, and Interdisciplinary Council on Quality of Care and Outcomes Research), 8/09

Ventricular Fibrillation and the Use of Automated External Defibrillators on Children (joint with Committee on Pediatric Emergency Medicine), 11/07, reaffirmed 6/11

SECTION ON CLINICAL PHARMACOLOGY AND THERAPEUTICS

Fever and Antipyretic Use in Children (Clinical Report) (joint with Committee on Drugs), 2/11

SECTION ON COMPLEMENTARY AND INTEGRATIVE MEDICINE (FORMERLY PROVISIONAL SECTION ON COMPLEMENTARY, HOLISTIC, AND INTEGRATIVE MEDICINE)

Sensory Integration Therapies for Children With Developmental and Behavioral Disorders (joint with Council on Children With Disabilities), 5/12

The Use of Complementary and Alternative Medicine in Pediatrics (Clinical Report) (joint with Task Force on Complementary and Alternative Medicine), 12/08, reaffirmed 10/12, 1/13

SECTION ON CRITICAL CARE

Admission and Discharge Guidelines for the Pediatric Patient Requiring Intermediate Care (Clinical Report) (joint with Committee on Hospital Care and Society of Critical Care Medicine), 5/04, reaffirmed 2/08, 1/13

Guidelines for the Determination of Brain Death in Infants and Children: An Update of the 1987 Task Force Recommendations (Clinical Report) (joint with Section on Neurology, Society of Critical Care Medicine, and Child Neurology Society), 8/11

Guidelines for Developing Admission and Discharge Policies for the Pediatric Intensive Care Unit (joint with Committee on Hospital Care and Society of Critical Care Medicine), 4/99, reaffirmed 5/05, 2/08, 1/13

Management of Pediatric Trauma (joint with Section on Orthopaedics, Committee on Pediatric Emergency Medicine, Section on Surgery, Section on Transport Medicine, and Pediatric Orthopaedic Society of North America), 4/08, reaffirmed 4/13

Pediatric Organ Donation and Transplantation (joint with Committee on Hospital Care and Section on Surgery), 3/10

SECTION ON DERMATOLOGY

Ultraviolet Radiation: A Hazard to Children and Adolescents (joint with Council on Environmental Health), 2/11

Ultraviolet Radiation: A Hazard to Children and Adolescents (Technical Report) (joint with Council on Environmental Health), 3/11

SECTION ON DEVELOPMENTAL AND BEHAVIORAL PEDIATRICS

Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science Into Lifelong Health (joint with Committee on Psychosocial Aspects of Child and Family Health and Committee on Early Childhood, Adoption, and Dependent Care), 12/11

Identifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening (joint with Council on Children With Disabilities, Bright Futures Steering Committee, and Medical Home Initiatives for Children With Special Needs Project Advisory Committee), 7/06, reaffirmed 12/09

The Lifelong Effects of Early Childhood Adversity and Toxic Stress (Technical Report) (joint with Committee on Psychosocial Aspects of Child and Family Health and Committee on Early Childhood, Adoption, and Dependent Care), 12/11

SECTION ON ENDOCRINOLOGY

Bone Densitometry in Children and Adolescents (Clinical Report), 12/10

Congenital Adrenal Hyperplasia (Technical Report) (joint with Committee on Genetics), 12/00, reaffirmed 10/04

Prevention and Treatment of Type 2 Diabetes Mellitus in Children, With Special Emphasis on American Indian and Alaska Native Children (Clinical Report) (joint with Committee on Native American Child Health), 10/03, reaffirmed 10/08

Screening for Retinopathy in the Pediatric Patient With Type 1 Diabetes Mellitus (Clinical Report) (joint with Section on Ophthalmology and American Association for Pediatric Ophthalmology and Strabismus), 7/05, reaffirmed 1/09

Update of Newborn Screening and Therapy for Congenital Hypothyroidism (Clinical Report) (joint with Committee on Genetics, American Thyroid Association, and Lawson Wilkins Pediatric Endocrine Society), 6/06, reaffirmed 12/11

SECTION ON GASTROENTEROLOGY, HEPATOLOGY, AND NUTRITION

Gastroesophageal Reflux: Management Guidance for the Pediatrician (Clinical Report), 4/13

Probiotics and Prebiotics in Pediatrics (Clinical Report) (joint with Committee on Nutrition), 11/10

SECTION ON HEMATOLOGY/ONCOLOGY

Evaluating for Suspected Child Abuse: Conditions That Predispose to Bleeding (Technical Report) (joint with Committee on Child Abuse and Neglect), 3/13

Evaluation for Bleeding Disorders in Suspected Child Abuse (Clinical Report) (joint with Committee on Child Abuse and Neglect), 3/13

Guidelines for Pediatric Cancer Centers, 6/04, reaffirmed 10/08

Health Supervision for Children With Sickle Cell Disease (joint with Committee on Genetics), 3/02, reaffirmed 1/06, 1/11

Long-term Follow-up Care for Pediatric Cancer Survivors (Clinical Report) (joint with Children's Oncology Group), 3/09, reaffirmed 4/13

Preservation of Fertility in Pediatric and Adolescent Patients With Cancer (Technical Report) (joint with Committee on Bioethics and Section on Surgery), 5/08, reaffirmed 2/12

SECTION ON HOME CARE

Financing of Pediatric Home Health Care (joint with Committee on Child Health Financing), 8/06

SECTION ON HOSPICE AND PALLIATIVE MEDICINE

Pediatric Palliative Care and Hospice Care Commitments, Guidelines, and Recommendations (joint with Committee on Hospital Care), 10/13

SECTION ON HOSPITAL MEDICINE

Guiding Principles for Pediatric Hospital Medicine Programs, 9/13

Medical Staff Appointment and Delineation of Pediatric Privileges in Hospitals (Clinical Report) (joint with Committee on Hospital Care), 3/12

Physicians' Roles in Coordinating Care of Hospitalized Children (Clinical Report) (joint with Committee on Hospital Care), 9/10

SECTION ON INTERNATIONAL CHILD HEALTH

Increasing Antiretroviral Drug Access for Children With HIV Infection (joint with Committee on Pediatric AIDS), 4/07, reaffirmed 4/10

SECTION ON MEDICAL STUDENTS, RESIDENTS, AND FELLOWSHIP TRAINEES

Parental Leave for Residents and Pediatric Training Programs (joint with Committee on Early Childhood), 1/13

SECTION ON NEUROLOGICAL SURGERY

Prevention and Management of Positional Skull Deformities in Infants (Clinical Report) (joint with Committee on Practice and Ambulatory Medicine), 11/11

SECTION ON NEUROLOGY

Guidelines for the Determination of Brain Death in Infants and Children: An Update of the 1987 Task Force Recommendations (Clinical Report) (joint with Section on Critical Care, Society of Critical Care Medicine, and Child Neurology Society), 8/11

SECTION ON OPHTHALMOLOGY

The Eye Examination in the Evaluation of Child Abuse (Clinical Report) (joint with Committee on Child Abuse and Neglect), 7/10

Eye Examination in Infants, Children, and Young Adults by Pediatricians (joint with Committee on Practice and Ambulatory Medicine, American Association of Certified Orthoptists, American Association for Pediatric Ophthalmology and Strabismus, and American Academy of Ophthalmology), 4/03, reaffirmed 5/07

Instrument-Based Pediatric Vision Screening Policy Statement (joint with Committee on Practice and Ambulatory Medicine, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists), 10/12

Learning Disabilities, Dyslexia, and Vision (joint with Council on Children With Disabilities, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists), 7/09

Learning Disabilities, Dyslexia, and Vision (Technical Report) (joint with Council on Children With Disabilities, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists), 3/11

Ophthalmologic Examinations in Children With Juvenile Rheumatoid Arthritis (Clinical Report) (joint with Section on Rheumatology), 5/06

Red Reflex Examination in Neonates, Infants, and Children (joint with American Association for Pediatric Ophthalmology and Strabismus, American Academy of Ophthalmology, and American Association of Certified Orthoptists), 12/08

Screening Examination of Premature Infants for Retinopathy of Prematurity (joint with American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists), 12/12

Screening for Retinopathy in the Pediatric Patient With Type 1 Diabetes Mellitus (Clinical Report) (joint with Section on Endocrinology and American Association for Pediatric Ophthalmology and Strabismus), 7/05, reaffirmed 1/09

SECTION ON ORAL HEALTH (FORMERLY SECTION ON PEDIATRIC DENTISTRY AND SECTION ON PEDIATRIC DENTISTRY AND ORAL HEALTH)

Oral Health Care for Children With Developmental Disabilities (Clinical Report) (joint with Council on Children With Disabilities), 2/13

Oral Health Risk Assessment Timing and Establishment of the Dental Home, 5/03, reaffirmed 5/09

Preventive Oral Health Intervention for Pediatricians, 12/08

SECTION ON ORTHOPAEDICS

Management of Pediatric Trauma (joint with Committee on Pediatric Emergency Medicine, Section on Critical Care, Section on Surgery, Section on Transport Medicine, and Pediatric Orthopaedic Society of North America), 4/08, reaffirmed 4/13

SECTION ON OTOLARYNGOLOGY—HEAD & NECK SURGERY

Cochlear Implants in Children: Surgical Site Infections and Prevention and Treatment of Acute Otitis Media and Meningitis (joint with Committee on Infectious Diseases), 7/10

Follow-up Management of Children With Tympanostomy Tubes, 2/02

Hearing Assessment in Infants and Children: Recommendations Beyond Neonatal Screening (Clinical Report) (joint with Committee on Practice and Ambulatory Medicine), 9/09

SECTION ON RADIOLOGY

Diagnostic Imaging of Child Abuse, 4/09

Radiation Risk to Children From Computed Tomography (Clinical Report), 9/07

SECTION ON RHEUMATOLOGY

Ophthalmologic Examinations in Children With Juvenile Rheumatoid Arthritis (Clinical Report) (joint with Section on Ophthalmology), 5/06

SECTION ON SURGERY

Assessment and Management of Inguinal Hernia in Infants (Clinical Report) (joint with Committee on Fetus and Newborn), 9/12

Do-Not-Resuscitate Orders for Pediatric Patients Who Require Anesthesia and Surgery (Clinical Report) (joint with Section on Anesthesia and Pain Medicine and Committee on Bioethics), 12/04, reaffirmed 1/09, 10/12

Management of Pediatric Trauma (joint with Section on Orthopaedics, Committee on Pediatric Emergency Medicine, Section on Critical Care, Section on Transport Medicine, and Pediatric Orthopaedic Society of North America), 4/08, reaffirmed 4/13

Pediatric Organ Donation and Transplantation (joint with Committee on Hospital Care and Section on Critical Care), 3/10

Postdischarge Follow-up of Infants With Congenital Diaphragmatic Hernia (Clinical Report) (joint with Committee on Fetus and Newborn), 3/08, reaffirmed 5/11

Preservation of Fertility in Pediatric and Adolescent Patients With Cancer (Technical Report) (joint with Committee on Bioethics and Section on Hematology/Oncology), 5/08, reaffirmed 2/12

Prevention and Management of Pain in the Neonate: An Update (joint with Committee on Fetus and Newborn and Canadian Paediatric Society), 11/06, reaffirmed 5/10

SECTION ON TELEHEALTH CARE (FORMERLY SECTION ON TELEPHONE CARE)

Payment for Telephone Care (joint with Committee on Child Health Financing), 10/06

SECTION ON TRANSPORT MEDICINE

Management of Pediatric Trauma (joint with Section on Orthopaedics, Committee on Pediatric Emergency Medicine, Section on Critical Care, Section on Surgery, and Pediatric Orthopaedic Society of North America), 4/08, reaffirmed 4/13

SECTION ON UNIFORMED SERVICES

Health and Mental Health Needs of Children in US Military Families (Clinical Report) (join with Committee on Psychosocial Aspects of Child and Family Health), 5/13

STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT

ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents (Clinical Practice Guideline) (joint with Subcommittee on Attention-Deficit/Hyperactivity Disorder), 10/11

Classifying Recommendations for Clinical Practice Guidelines, 9/04

Developmental Dysplasia of the Hip Practice Guideline (Technical Report), 4/00

Diagnosis and Management of Acute Otitis Media (Clinical Practice Guideline) (joint with American Academy of Family Physicians), 5/04

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome (Clinical Practice Guideline) (joint with Subcommittee on Obstructive Sleep Apnea Syndrome), 8/12

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome (Technical Report) (joint with Subcommittee on Obstructive Sleep Apnea Syndrome), 8/12

Early Detection of Developmental Dysplasia of the Hip (Clinical Practice Guideline), 4/00

An Evidence-Based Review of Important Issues Concerning Neonatal Hyperbilirubinemia (Technical Report), 7/04

Febrile Seizures: Clinical Practice Guideline for the Long-term Management of the Child With Simple Febrile Seizures (Clinical Practice Guideline) (joint with Subcommittee on Febrile Seizures), 6/08

Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation (Clinical Practice Guideline), 7/04

Management of Sinusitis (Clinical Practice Guideline), 9/01

Otitis Media With Effusion (Clinical Practice Guideline), 5/04

Principles for the Development and Use of Quality Measures (joint with Committee on Practice and Ambulatory Medicine), 2/08

Principles of Pediatric Patient Safety: Reducing Harm Due to Medical Care (joint with Committee on Hospital Care), 5/11

Toward Transparent Clinical Policies, 3/08

Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months (Clinical Practice Guideline) (joint with Subcommittee on Urinary Tract Infection), 8/11

SUBCOMMITTEE ON ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents (Clinical Practice Guideline) (joint with Steering Committee on Quality Improvement and Management), 10/11

SUBCOMMITTEE ON CHRONIC ABDOMINAL PAIN

Chronic Abdominal Pain in Children (Clinical Report) (joint with North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition), 3/05

Chronic Abdominal Pain in Children (Technical Report) (joint with North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition), 3/05

SUBCOMMITTEE ON DIAGNOSIS AND MANAGEMENT OF BRONCHIOLITIS

Diagnosis and Management of Bronchiolitis (Clinical Practice Guideline), 10/06

SUBCOMMITTEE ON FEBRILE SEIZURES

Febrile Seizures: Clinical Practice Guideline for the Long-term Management of the Child With Simple Febrile Seizures (Clinical Practice Guideline) (joint with Steering Committee on Quality Improvement and Management), 6/08

Febrile Seizures: Guideline for the Neurodiagnostic Evaluation of the Child With a Simple Febrile Seizure (Clinical Practice Guideline), 2/11

SUBCOMMITTEE ON OBSTRUCTIVE SLEEP APNEA SYNDROME

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome (Clinical Practice Guideline) (joint with Steering Committee on Quality Improvement and Management), 8/12

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome (Technical Report) (joint with Steering Committee on Quality Improvement and Management), 8/12

SUBCOMMITTEE ON URINARY TRACT INFECTION

Diagnosis and Management of an Initial UTI in Febrile Infants and Young Children (Technical Report), 8/11

Urinary Tract Infection: Clinical Practice Guideline for the Diagnosis and Management of the Initial UTI in Febrile Infants and Children 2 to 24 Months (Clinical Practice Guideline) (joint with Steering Committee on Quality Improvement and Management), 8/11

SURGICAL ADVISORY PANEL

Guidelines for Referral to Pediatric Surgical Specialists, 7/02, reaffirmed 1/07

TASK FORCE ON CIRCUMCISION

Circumcision Policy Statement, 8/12

Male Circumcision (Technical Report), 8/12

TASK FORCE ON COMPLEMENTARY AND ALTERNATIVE MEDICINE

The Use of Complementary and Alternative Medicine in Pediatrics (Clinical Report) (joint with Provisional Section on Complementary, Holistic, and Integrative Medicine), 12/08, reaffirmed 10/12, 1/13

TASK FORCE ON GRADUATE MEDICAL EDUCATION REFORM

Graduate Medical Education and Pediatric Workforce Issues and Principles, 6/94

TASK FORCE ON MENTAL HEALTH

The Future of Pediatrics: Mental Health Competencies for Pediatric Primary Care (joint with Committee on Psychosocial Aspects of Child and Family Health), 6/09, reaffirmed 8/13

TASK FORCE ON SUDDEN INFANT DEATH SYNDROME

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk, 11/05, reaffirmed 5/08

SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment, 10/11

SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment (Technical Report), 10/11

TASK FORCE ON TERRORISM

The Pediatrician and Disaster Preparedness (joint with Committee on Pediatric Emergency Medicine and Committee on Medical Liability), 2/06, reaffirmed 6/09, 9/13

Psychosocial Implications of Disaster or Terrorism on Children: A Guide for the Pediatrician (Clinical Report) (joint with Committee on Psychosocial Aspects of Child and Family Health), 9/05

WORK GROUP ON SEDATION

Guidelines for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures: An Update (Clinical Report) (joint with American Academy of Pediatric Dentistry), 12/06, reaffirmed 3/11

WORKING GROUP ON SLEEPINESS IN ADOLESCENTS/ YOUNG ADULTS

Excessive Sleepiness in Adolescents and Young Adults: Causes, Consequences, and Treatment Strategies (Technical Report) (joint with Committee on Adolescence), 6/05

JOINT STATEMENTS

Joint Statement of the American Academy of Pediatrics and the American Academy of Child and Adolescent Psychiatry

Psychological Maltreatment (Clinical Report), 7/12

Joint Statement of the American Academy of Pediatrics, the American Academy of Child and Adolescent Psychiatry, and the National Center for Child Traumatic Stress

Understanding the Behavioral and Emotional Consequences of Child Abuse (Clinical Report), 9/08

Joint Statement of the American Academy of Pediatrics and the American Academy of Family Physicians

Diagnosis and Management of Acute Otitis Media (Clinical Practice Guideline), 5/04

Joint Statement of the American Academy of Pediatrics, the American Academy of Family Physicians, and the American College of Physicians

Supporting the Health Care Transition From Adolescence to Adulthood in the Medical Home (Clinical Report), 7/11

Joint Statement of the American Academy of Pediatrics, the American Academy of Family Physicians, and the American College of Physicians-American Society of Internal Medicine

A Consensus Statement on Health Care Transitions for Young Adults With Special Health Care Needs, 12/02

Joint Statement of the American Academy of Pediatrics and the American Academy of Ophthalmology

Protective Eyewear for Young Athletes, 3/04, reaffirmed 2/08, 6/11

Joint Statement of the American Academy of Pediatrics, the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus, and the American Association of Certified Orthoptists

Instrument-Based Pediatric Vision Screening Policy Statement, 10/12

Screening Examination of Premature Infants for Retinopathy of Prematurity, 12/12

Joint Statement of the American Academy of Pediatrics and the American Academy of Pediatric Dentistry

Guidelines for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures: An Update (Clinical Report), 12/06, reaffirmed 3/11

Oral and Dental Aspects of Child Abuse and Neglect (Clinical Report), 12/05, reaffirmed 1/09

Joint Statement of the American Academy of Pediatrics, the American Association of Certified Orthoptists, the American Association for Pediatric Ophthalmology and Strabismus, and the American Academy of Ophthalmology

Eye Examination in Infants, Children, and Young Adults by Pediatricians, 4/03, reaffirmed 5/07

Learning Disabilities, Dyslexia, and Vision, 7/09

Learning Disabilities, Dyslexia, and Vision (Technical Report), 3/11

Red Reflex Examination in Neonates, Infants, and Children, 12/08

Joint Statement of the American Academy of Pediatrics and the American Association for Pediatric Ophthalmology and Strabismus

Screening for Retinopathy in the Pediatric Patient With Type 1 Diabetes Mellitus (Clinical Report), 7/05, reaffirmed 1/09

Joint Statement of the American Academy of Pediatrics, the American College of Cardiology Foundation, and the American Heart Association

ACCF/AHA/AAP Recommendations for Training in Pediatric Cardiology, 12/05, reaffirmed 1/09

Joint Statement of the American Academy of Pediatrics and the American College of Emergency Physicians

Death of a Child in the Emergency Department: Joint Statement of the American Academy of Pediatrics and the American College of Emergency Physicians, 10/02, reaffirmed 1/06, 1/09, 8/13

Emergency Information Forms and Emergency Preparedness for Children With Special Health Care Needs, 3/10

Patient- and Family-Centered Care and the Role of the Emergency Physician Providing Care to a Child in the Emergency Department, 11/06, reaffirmed 6/09, 10/11

Pediatric Mental Health Emergencies in the Emergency Medical Services System, 10/06, reaffirmed 6/09, 4/13

Joint Statement of the American Academy of Pediatrics, the American College of Emergency Physicians, and the Emergency Nurses Association

Guidelines for Care of Children in the Emergency Department, 9/09, reaffirmed 4/13

Joint Statement of the American Academy of Pediatrics and the American College of Medical Genetics and Genomics

Ethical and Policy Issues in Genetic Testing and Screening of Children, 2/13

Joint Statement of the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists

The Apgar Score, 4/06, reaffirmed 1/09

Human Immunodeficiency Virus Screening, 7/99, reaffirmed 6/02, 5/05, 10/08, 5/12

Maternal-Fetal Intervention and Fetal Care Centers (Clinical Report), 7/11

Menstruation in Girls and Adolescents: Using the Menstrual Cycle as a Vital Sign (Clinical Report), 11/06

Joint Statement of the American Academy of Pediatrics, the American College of Surgeons Committee on Trauma, the American College of Emergency Physicians, the National Association of EMS Physicians, and the Pediatric Equipment Guidelines Committee—Emergency Medical Services for Children (EMSC) Partnership for Children Stakeholder Group

Equipment for Ambulances, 6/09

Joint Statement of the American Academy of Pediatrics and the American Heart Association

Role of Pulse Oximetry in Examining Newborns for Congenital Heart Disease: A Scientific Statement from the AHA and AAP, 8/09

Joint Statement of the American Academy of Pediatrics, the American Thyroid Association, and the Lawson Wilkins Pediatric Endocrine Society

Update of Newborn Screening and Therapy for Congenital Hypothyroidism (Clinical Report), 6/06, reaffirmed 12/11

Joint Statement of the American Academy of Pediatrics and the Canadian Paediatric Society

Boxing Participation by Children and Adolescents, 8/11

Early Childhood Caries in Indigenous Communities, 5/11

Prevention and Management of Pain in the Neonate: An Update, 11/06, reaffirmed 5/10

Joint Statement of the American Academy of Pediatrics and the Child Life Council

Child Life Services, 10/06, reaffirmed 2/12

Joint Statement of the American Academy of Pediatrics and the Children's Oncology Group

Long-term Follow-up Care for Pediatric Cancer Survivors (Clinical Report), 3/09, reaffirmed 4/13

Joint Statement of the American Academy of Pediatrics and the Institute for Patient- and Family-Centered Care

Patient- and Family-Centered Care and the Pediatrician's Role, 1/12

Joint Statement of the American Academy of Pediatrics and the National Association of Medical Examiners

Distinguishing Sudden Infant Death Syndrome From Child Abuse Fatalities (Clinical Report), 7/06, reaffirmed 4/09, 3/13

Joint Statement of the American Academy of Pediatrics and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition

Chronic Abdominal Pain in Children (Clinical Report), 3/05

Chronic Abdominal Pain in Children (Technical Report), 3/05

Joint Statement of the American Academy of Pediatrics and Others

Insurance Coverage of Mental Health and Substance Abuse Services for Children and Adolescents: A Consensus Statement, 10/00

Joint Statement of the American Academy of Pediatrics and the Pediatric Orthopaedic Society of North America

Management of Pediatric Trauma, 4/08, reaffirmed 4/13

Joint Statement of the American Academy of Pediatrics and the Society of Critical Care Medicine

Admission and Discharge Guidelines for the Pediatric Patient Requiring Intermediate Care (Clinical Report), 5/04, reaffirmed 2/08, 1/13

Guidelines for Developing Admission and Discharge Policies for the Pediatric Intensive Care Unit (Clinical Report), 4/99, reaffirmed 5/05, 2/08, 1/13

Joint Statement of the American Academy of Pediatrics, the Society of Critical Care Medicine, and the Child Neurology Society
Guidelines for the Determination of Brain Death in Infants and Children: An Update of the 1987 Task Force Recommendations (Clinical Report), 8/11

Joint Statement of the Federation of Pediatric Organizations
Pediatric Fellowship Training, 7/04

ENDORSED CLINICAL PRACTICE GUIDELINES AND POLICIES
(*The AAP endorses and accepts as its policy the following clinical practice guidelines and policies that have been published by other organizations.)*

Advisory Committee on Immunization Practices
General Recommendations on Immunization: Recommendations of the Advisory Committee on Immunization Practices (ACIP), 12/06

Advisory Committee on Immunization Practices and Centers for Disease Control and Prevention
A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States, 7/06

Ambulatory Pediatric Association
Report of the National Consensus Conference on Family Presence during Pediatric Cardiopulmonary Resuscitation and Procedures, 9/03

American Academy of Child and Adolescent Psychiatry and Child Welfare League of America
Foster Care Mental Health Values, 2002
Mental Health and Substance Use Screening and Assessment of Children in Foster Care, 2003

American Academy of Emergency Medicine, American Association of Critical Care Nurses, American College of Emergency Physicians, Association of periOperative Registered Nurses, Emergency Department Practice Management Association, Emergencies Nurses Association, and National Association of EMS Physicians
Consensus Statement: Definitions for Consistent Emergency Department Metrics (2/10)

American Academy of Family Physicians, American Academy of Orthopaedic Surgeons, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine
Selected Issues for the Adolescent Athlete and the Team Physician: A Consensus Statement, 11/08

American Academy of Neurology and Child Neurology Society
Evidence Report: Genetic and Metabolic Testing on Children With Global Developmental Delay, 9/11
Evidence-Based Guidelines Update: Medical Treatment of Infantile Spasms, 6/12

American College of Emergency Physicians
Clinical Policy: Evidence-Based Approach to Pharmacologic Agents Used in Pediatric Sedation and Analgesia in the Emergency Department (Clinical Practice Guideline), 10/04

American College of Obstetricians and Gynecologists
Timing of Umbilical Cord Clamping After Birth, 12/12

American College of Rheumatology
Guidelines for Referral of Children and Adolescents to Pediatric Rheumatologists, 6/02, reaffirmed 5/07

American Diabetes Association
Diabetes Care for Emerging Adults: Recommendations for Transition From Pediatric to Adult Diabetes Care Systems, 11/11
Safe at School Campaign Statement of Principles, endorsed 2/06
Type 2 Diabetes in Children and Adolescents, 3/00

American Heart Association
Cardiovascular Risk Reduction in High-Risk Pediatric Populations, 12/06
Diagnosis, Treatment, and Long-Term Management of Kawasaki Disease: A Statement for Health Professionals (Clinical Report), 12/04
Dietary Recommendations for Children and Adolescents: A Guide for Practitioners, 9/05
Genetic Basis for Congenital Heart Defects: Current Knowledge, 6/07
Importance and Implementation of Training in Cardiopulmonary Resuscitation and Automated External Defibrillation in Schools, 2/11
Long-term Cardiovascular Toxicity in Children, Adolescents, and Young Adults Who Receive Cancer Therapy: Pathophysiology, Course, Monitoring, Management, Prevention, and Research Directions: A Scientific Statement From the American Heart Association, 9/13
Neurodevelopmental Outcomes in Children With Congenital Heart Disease: Evaluation and Management: A Scientific Statement From the American Heart Association, 7/12
Noninherited Risk Factors and Congenital Cardiovascular Defects: Current Knowledge, 6/07
Prevention of Infective Endocarditis: Guidelines From the American Heart Association (Clinical Practice Guideline), 5/07
Prevention of Rheumatic Fever and Diagnosis and Treatment of Acute Streptococcal Pharyngitis, 2/09
Response to Cardiac Arrest and Selected Life-Threatening Medical Emergencies: The Medical Emergency Response Plan for Schools. A Statement for Healthcare Providers, Policymakers, School Administrators, and Community Leaders, 1/04

American Medical Association
Gifts to Physicians From Industry, 8/01

American Pediatric Surgical Association
Best Practice for Infant Surgery: A Position Statement From the American Pediatric Surgical Association, 9/08

American Society for Parenteral and Enteral Nutrition
Defining Pediatric Malnutrition: A Paradigm Shift Toward Etiology-Related Definitions, 3/13

American Thoracic Society and Centers for Disease Control and Prevention
(*The AAP endorses and accepts as its policy the sections of this statement as they relate to infants and children.)*
Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection, 4/00

American Urological Association
Report on the Management of Primary Vesicoureteral Reflux in Children (Clinical Practice Guideline), 5/97

Canadian Paediatric Society
Skiing and Snowboarding Injury Prevention, 1/12

Centers for Disease Control and Prevention
Guidelines for Field Triage of Injured Patients, 1/12
Managing Acute Gastroenteritis Among Children: Oral Rehydration, Maintenance, and Nutritional Therapy (Clinical Practice Guideline), 11/03
Prevention and Control of Meningococcal Disease: Recommendations of the Advisory Committee on Immunization Practices (ACIP), 3/13
Prevention of Perinatal Group B Streptococcal Disease: Revised Guidelines from CDC, 2010 (Clinical Practice Guideline), 11/10
Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States (Clinical Practice Guideline), 8/01
Update on Japanese Encephalitis Vaccine for Children—United States, May 2011, 8/11

Centers for Disease Control and Prevention, Infectious Diseases Society of America, and American Society of Blood and Marrow Transplantation
Guidelines for Preventing Opportunistic Infections Among Hematopoietic Stem Cell Transplant Recipients (Clinical Practice Guideline), 10/00

Emergency Nurses Association
Weighing Pediatric Patients in Kilograms, 3/12

The Endocrine Society
Congenital Adrenal Hyperplasia Due to Steroid 21-hydroxylase Deficiency: An Endocrine Society Clinical Practice Guideline (Clinical Practice Guideline), 9/10

Family Violence Prevention Fund
Identifying and Responding to Domestic Violence: Consensus Recommendations for Child and Adolescent Health, 9/02

Guidelines for the Management of Adolescent Depression in Primary Care Steering Group
Guidelines for Adolescent Depression in Primary Care (GLAD-PC): I. Identification, Assessment, and Initial Management (Clinical Practice Guideline), 11/07
Guidelines for Adolescent Depression in Primary Care (GLAD-PC): II. Treatment and Ongoing Management (Clinical Practice Guideline), 11/07

Infectious Diseases Society of America
Clinical Practice Guidelines by the Infectious Diseases Society of America for the Treatment of Methicillin-Resistant *Staphylococcus aureus* Infections in Adults and Children (Clinical Practice Guideline), 2/11
Seasonal Influenza in Adults and Children—Diagnosis, Treatment, Chemoprophylaxis, and Institutional Outbreak Management: Clinical Practice Guidelines of the Infectious Diseases Society of America (Clinical Practice Guideline), 4/09

Institute of Medicine
Dietary Reference Intakes for Calcium and Vitamin D, 2011

International Consensus Conference on Intersex (Lawson Wilkins Pediatric Endocrine Society and the European Society for Paediatric Endocrinology)
Consensus Statement on Management of Intersex Disorders, 8/06

Joint Committee on Infant Hearing
Supplement to the JCIH 2007 Position Statement: Principles and Guidelines for Early Intervention After Confirmation That a Child Is Deaf or Hard of Hearing, 3/13

National Association of Neonatal Nurses
The Management of Hypotension in the Very-Low-Birth-Weight Infant: Guideline for Practice, 2011

National Association of School Nurses
Emergency Equipment and Supplies in the School Setting, 1/12

National Athletic Trainers' Association
Appropriate Medical Care for the Secondary School-Age Athlete Communication, 2004
Lightning Safety for Athletics and Recreation (Position Statement), 12/00

National Athletic Trainers' Association, National Interscholastic Athletic Administrators Association, College Athletic Trainers' Society, National Federation of State High School Associations, American College Health Association, American Orthopaedic Society for Sports Medicine, National Collegiate Athletic Association, American Medical Society for Sports Medicine, National Association of Collegiate Directors of Athletics, and National Association of Intercollegiate Athletics
Inter-Association Consensus Statement on Best Practices for Sports Medicine Management for Secondary Schools and Colleges, 7/13

National Diabetes Education Program
Helping the Student with Diabetes Succeed: A Guide for School Personnel, 6/03

National Heart, Lung and Blood Institute
Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents: Summary Report, 3/12

National Institute of Allergy and Infectious Diseases
Guidelines for the Diagnosis and Management of Food Allergy in the United States: Report of the NIAID-Sponsored Expert Panel (Clinical Practice Guideline), 12/10

National Institutes of Health, Centers for Disease Control and Prevention, HIV Medicine Association of Infectious Diseases Society of America, and Pediatric Infectious Diseases Society
Guidelines for the Prevention and Treatment of Opportunistic Infections in HIV-Exposed and HIV-Infected Children (Clinical Practice Guideline), 11/13

North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition
Guideline for the Evaluation of Cholestatic Jaundice in Infants (Clinical Practice Guideline), 8/04
Guidelines for Evaluation and Treatment of Gastroesophageal Reflux in Infants and Children (Clinical Practice Guideline), 2001
Helicobacter pylori Infection in Children: Recommendations for Diagnosis and Treatment (Clinical Practice Guideline), 11/00

Pediatric Infectious Diseases Society and Infectious Diseases Society of America
The Management of Community-Acquired Pneumonia (CAP) in Infants and Children Older Than 3 Months of Age (Clinical Practice Guideline), 10/11

Pediatric Orthopaedic Society of North America/ American Academy of Orthopaedic Surgeons/ Scoliosis Research Society
Screening for Idiopathic Scoliosis in Adolescents, 1/08

Quality Standards Subcommittee of the American Academy of Neurology and Child Neurology Society
Diagnostic Assessment of the Child with Cerebral Palsy (Clinical Practice Guideline), 3/04
Diagnostic Assessment of the Child With Status Epilepticus (An Evidence-based Review) (Clinical Practice Guideline), 11/06
Neuroimaging of the Neonate (Clinical Practice Guideline), 6/02
Pharmacological Treatment of Migraine Headache in Children and Adolescents (Clinical Practice Guideline), 12/04
Screening and Diagnosis of Autism (Clinical Practice Guideline), 8/00
Treatment of the Child With a First Unprovoked Seizure (Clinical Practice Guideline), 1/03

Quality Standards Subcommittee of the American Academy of Neurology, Child Neurology Society, and American Epilepsy Society
Evaluating a First Nonfebrile Seizure in Children (Clinical Practice Guideline), 8/00

Renal Physicians Association
Shared Decision-Making in the Appropriate Initiation of and Withdrawal from Dialysis, 2nd Edition (Clinical Practice Guideline), 10/10
Society for Academic Emergency Medicine
Pediatric Care in the Emergency Department, 11/03

Society for Adolescent Medicine
Executing Juvenile Offenders: A Fundamental Failure of Society, 10/04
Expedited Partner Therapy for Adolescents Diagnosed With Chlamydia or Gonorrhea: A Position Paper of the Society for Adolescent Medicine, 9/09
Protecting Adolescents: Ensuring Access to Care and Reporting Sexual Activity and Abuse, 11/04

Society of Critical Care Medicine, Infectious Diseases Society of America, Society for Healthcare Epidemiology of America, Surgical Infection Society, American College of Chest Physicians, American Thoracic Society, American Society of Critical Care Anesthesiologists, Association for Professionals in Infection Control and Epidemiology, Infusion Nurses Society, Oncology Nursing Society, Society of Cardiovascular and Interventional Radiology, American Academy of Pediatrics, and Healthcare Infection Control Practices Advisory Committee of the Centers for Disease Control and Prevention
Guidelines for the Prevention of Intravascular Catheter-Related Infections (Clinical Practice Guideline), 2002

US Department of Health and Human Services
Guidelines for the Prevention and Treatment of Opportunistic Infections in HIV-Exposed and HIV-Infected Children (Clinical Practice Guideline), 11/13
Treating Tobacco Use and Dependence: 2008 Update (Clinical Practice Guideline), 5/08

World Health Organization
(*The AAP endorses the recommendation pertaining to the use of thimerosal in vaccines.)*
Meeting of the Strategic Advisory Group of Experts on Immunizations, April 2012–Conclusions and Recommendations, 5/12

AFFIRMATION OF VALUE CLINICAL PRACTICE GUIDELINES AND POLICIES

(*These guidelines are not endorsed as policy of the American Academy of Pediatrics [AAP]. Documents that lack a clear description of the process for identifying, assessing, and incorporating research evidence are not eligible for AAP endorsement as practice guidelines. However, such documents may be of educational value to members of the AAP.)*

American Society of Anesthesiologists
Practice Guidelines for the Perioperative Management of Patients with Obstructive Sleep Apnea (Clinical Practice Guideline), 5/06

National Environmental Education Foundation
Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers (Clinical Practice Guideline), 8/05

National Hospice and Palliative Care Organization
Standards of Practice for Pediatric Palliative Care and Hospice (Clinical Practice Guideline), 2/09

Turner Syndrome Consensus Study Group
Care of Girls and Women With Turner Syndrome: A Guideline of the Turner Syndrome Study Group (Clinical Practice Guideline), 1/07

APPENDIX 2

PPI: AAP Partnership for Policy Implementation

BACKGROUND

The American Academy of Pediatrics (AAP) develops policies that promote the attainment of optimal physical, mental, and social health and well-being for all infants, children, adolescents, and young adults. These documents are valued highly not only by clinicians who provide direct health care to children, but by members of other organizations that share similar goals, and also by parents, payers, and legislators. Unfortunately, AAP policy documents vary widely in terms of how they are written, and some find these documents difficult to implement. Pediatricians who have expertise in medical informatics found AAP policy documents particularly challenging when they tried to convert policy recommendations into items that could be easily programmed into an electronic system. In June 2005, with initial funding support from the federal Maternal and Child Health Bureau, the AAP launched the Partnership for Policy Implementation (PPI), a pilot program to create changes in the development of policy statements, clinical reports, technical reports, and clinical practice guidelines—specifically, how they are written. Unofficially, collaboration began that resulted in this project to demonstrate the feasibility of integrating health information technology (HIT) functionalities into AAP policy. The PPI is currently funded by the AAP Child Health Informatics Center (CHIC).

VISION

The vision of the PPI is for all AAP policy statements, clinical reports, technical reports, and clinical practice guidelines to have medically sound content, a transparent evidence base, and clearly stated, actionable recommendations that can be implemented in practice and incorporated into electronic systems to support the delivery of high-quality care for children and youth and their families.

MISSION

The mission of the PPI is to facilitate implementation of AAP recommendations at the point of care by ensuring that AAP documents are written in a practical, action-oriented fashion with unambiguous recommendations.

WHAT IS THE PPI?

It is a network of pediatric informaticians who work with AAP authors and guideline subcommittees throughout the writing process.

Contributions of the PPI to the AAP writing process include disambiguation and specification; development of clear definitions; clearly defined logic; implementation techniques; action-oriented recommendations, including clinical algorithms; transparency of evidence basis for recommendations; and health information technology (HIT) standard development.

WHAT HAS THE PPI ACCOMPLISHED?

Since its inception, over 20 statements have been published using the PPI process covering child health topics as diverse as identifying developmental disorders through surveillance and screening (*Pediatrics.* 2006;118:405–420); diagnosis and management of bronchiolitis (*Pediatrics.* 2006;118:1774–1793); prevention of influenza (*Pediatrics.* 2007;119:846–851 and subsequent annual updates); identification, evaluation, and management of autism (*Pediatrics.* 2007;120:1162–1182 and *Pediatrics.* 2007;120:1183–1215); recommendations for and implications of newborn screening (*Pediatrics.* 2008;121:192–217); hearing assessment (*Pediatrics.* 2009; 124:1252–1263); enhancing pediatric mental health care (*Pediatrics.* 2010;125:S109–S125); and the diagnosis and management of childhood obstructive sleep apnea syndrome (Pediatrics. 2012; 130: e714–-e755).

One example of how a statement developed using the PPI process has gained broader acceptance is the influenza statement published in April 2007. The Centers for Disease Control and Prevention chose to adopt components of the PPI statement (specifically, the clinical algorithm) within its own statement on the same topic. In addition, the Childhood Influenza Immunization Coalition posted an interactive version of the influenza algorithm on its Web site (www.preventchildhoodinfluenza.org/resource/algorithm.swf).

WHAT IS THE PPI DOING NOW?

In addition to creating practical, action-oriented documents that pediatricians can use, the PPI is also working to make it easier for these documents to be incorporated into electronic systems. To date, the PPI has focused its involvement on the statement development process. The involvement of the PPI during the writing process helps to produce a clear, more concise document. As these standards of care become well documented, the PPI can begin to focus on building or mapping pediatric vocabulary; once solidified, this vocabulary can be built into electronic health record (EHR) systems. The standards of care can also be matched to the various logical and functional HIT standards that already exist today. Through this work, the PPI hopes to improve AAP policy documents by providing specific guidance to pediatricians at the point of care, to help ensure that EHRs are designed to assist pediatricians in providing optimal care for children.

For more information about the PPI, please visit the Web site (http://www2.aap.org/informatics/PPI.html) or contact Lisa Krams (lkrams@aap.org or 847/434-7663).

APPENDIX 3

American Academy of Pediatrics Acronyms

AMERICAN ACADEMY OF PEDIATRICS

Acronyms

AACAP	American Academy of Child and Adolescent Psychiatry
AAFP	American Academy of Family Physicians
AAMC	Association of American Medical Colleges
AAOS	American Academy of Orthopaedic Surgeons
AAP	American Academy of Pediatrics
AAPD	American Academy of Pediatric Dentistry
ABMS	American Board of Medical Specialties
ABP	American Board of Pediatrics
ACBOCCSA	Advisory Committee to the Board on Community, Chapter, and State Affairs
ACBOCSP	Advisory Committee to the Board on Community and Specialty Pediatrics
ACBOE	Advisory Committee to the Board on Education
ACBOF	Advisory Committee to the Board on Finance
ACBOFA	Advisory Committee to the Board on Federal Affairs
ACBOGCH	Advisory Committee to the Board on Global Child Health
ACBOIT	Advisory Committee to the Board on Information Technology
ACBOM	Advisory Committee to the Board on Membership
ACBOMP	Advisory Committee to the Board on Marketing and Publications
ACBOP	Advisory Committee to the Board on Practice
ACBOR	Advisory Committee to the Board on Research
ACBOSP	Advisory Committee to the Board on Strategic Planning
ACBOSPe	Advisory Committee to the Board on Specialty Pediatrics
ACCME	Accreditation Council for Continuing Medical Education
ACEP	American College of Emergency Physicians
ACGME	Accreditation Council for Graduate Medical Education
ACIP	Advisory Committee on Immunization Practices
ACMG	American College of Medical Genetics
ACO	Accountable Care Organization
ACOG	American Congress of Obstetricians and Gynecologists
ACOP	American College of Osteopathic Pediatricians
ACP	American College of Physicians
ADAMHA	Alcohol, Drug Abuse, and Mental Health Administration
AG-M	Action Group—Multidisciplinary (Section Forum)
AG-M1	Action Group—Medical 1 (Section Forum)
AG-M2	Action Group—Medical 2 (Section Forum)
AG-S	Action Group—Surgical (Section Forum)
AHA	American Heart Association
AHA	American Hospital Association
AHRQ	Agency for Healthcare Research and Quality
ALF	Annual Leadership Forum
AMA	American Medical Association
AMCHP	Association of Maternal and Child Health Programs
AMSA	American Medical Student Association
AMSPDC	Association of Medical School Pediatric Department Chairs
AMWA	American Medical Women's Association
APA	Academic Pediatric Association
APHA	American Public Health Association
APLS	Advanced Pediatric Life Support
APPD	Association of Pediatric Program Directors
APQ	Alliance for Pediatric Quality
APS/SPR	American Pediatric Society/Society for Pediatric Research
AQA	Ambulatory Care Quality Alliance
ASHG	American Society of Human Genetics
ASTM	American Society of Testing and Materials
BHP	Bureau of Health Professions
BIA	Bureau of Indian Affairs
BLAST	Babysitter Lessons and Safety Training
BOD	Board of Directors
BPC	Breastfeeding Promotion Consortium
CAG	Corporate Advisory Group
CAMLWG	Children, Adolescents, and Media Leadership Workgroup
CAP	College of American Pathologists
CAQI	Chapter Alliance for Quality Improvement
CATCH	Community Access to Child Health
CDC	Centers for Disease Control and Prevention
CESP	Confederation of European Specialty Pediatrics
CFMC	Chapter Forum Management Committee
CFT	Cross Functional Team
CHA	Children's Hospital Association
CHCA	Child Health Corporation of America

CMC	Council Management Committee
CME	Continuing Medical Education
CMS	Centers for Medicare & Medicaid Services
CMSS	Council of Medical Specialty Societies
CnF	Council Forum
COA	Committee on Adolescence
COB	Committee on Bioethics
COCAN	Committee on Child Abuse and Neglect
COCHF	Committee on Child Health Financing
COCIT	Council on Clinical Information Technology
COCM	Council on Communications and Media
COCME	Committee on Continuing Medical Education
COCN	Committee on Coding and Nomenclature
COCP	Council on Community Pediatrics
COCWD	Council on Children With Disabilities
COD	Committee on Drugs
CODe	Committee on Development
COEC	Council on Early Childhood
COEH	Council on Environmental Health
CoF	Committee Forum
COFCAKC	Council on Foster Care, Adoption, and Kinship Care
COFGA	Committee on Federal Government Affairs
CoFMC	Committee Forum Management Committee
COFN	Committee on Fetus and Newborn
COG	Committee on Genetics
COGME	Council on Graduate Medical Education (DHHS/HRSA)
COHC	Committee on Hospital Care
COID	Committee on Infectious Diseases
COIVPP	Committee on Injury, Violence, and Poison Prevention
COM	Committee on Membership
COMLRM	Committee on Medical Liability and Risk Management
COMSEP	Council on Medical Student Education in Pediatrics (AMSPDC)
CON	Committee on Nutrition
CONACH	Committee on Native American Child Health
COPA	Committee on Pediatric AIDS
COPACFH	Committee on Psychosocial Aspects of Child and Family Health
COPAM	Committee on Practice and Ambulatory Medicine
COPE	Committee on Pediatric Education
COPEM	Committee on Pediatric Emergency Medicine
COPR	Committee on Pediatric Research
COPW	Committee on Pediatric Workforce
COQIPS	Council on Quality Improvement and Patient Safety
CORS	Committee on Residency Scholarships
COSA	Committee on Substance Abuse
COSGA	Committee on State Government Affairs
COSH	Council on School Health
COSMF	Council on Sports Medicine and Fitness
CPS	Canadian Paediatric Society
CPTI	Community Pediatrics Training Initiative
CQN	Chapter Quality Network
CSHCN	Children With Special Health Care Needs
DHHS	Department of Health and Human Services
DOD	Department of Defense
DVC	District Vice Chairperson
EBCDLW	Early Brain and Child Development Leadership Workgroup
EC	Executive Committee
EMSC	Emergency Medical Services for Children
EPA	Environmental Protection Agency
eQIPP	Education in Quality Improvement for Pediatric Practice
eTACC	Electronic Translation of Academy Clinical Content
FCF	Friends of Children Fund
FDA	Food and Drug Administration
FOPE II	Future of Pediatric Education II Project
FOPO	Federation of Pediatric Organizations
FTC	Federal Trade Commission
GME	Graduate Medical Education
HAAC	Historical Archives Advisory Committee
HBB	Helping Babies Breathe
HCCA	Healthy Child Care America
HEDIS	Health Plan Employer Data and Information Set
HHS	Health and Human Services
HIPAA	Health Insurance Portability and Accountability Act of 1996
HMO	Health Maintenance Organization
HQA	Hospital Quality Alliance
HRSA	Health Resources and Services Administration
HTC	Helping the Children
HTPCP	Healthy Tomorrows Partnership for Children Program
IHS	Indian Health Service
IMG	International Medical Graduate
IOM	Institute of Medicine
IPA	International Pediatric Association
IPC	International Pediatric Congress
IRB	Institutional Review Board
JCAHO	Joint Commission on Accreditation of Healthcare Organizations
LLLI	La Leche League International
MCAN	Merck Childhood Asthma Network
MCH	Maternal and Child Health
MCHB	Maternal and Child Health Bureau
MCN	Migrant Clinicians Network
MHICSN-PAC	Medical Home Initiatives for Children With Special Needs Project Advisory Committee
MHLWG	Mental Health Leadership Work Group
MRT	Media Resource Team
NACH	National Association of Children's Hospitals
NACHC	National Association of Community Health Centers

NACHRI	National Association of Children's Hospitals and Related Institutions
NAEMSP	National Association of Emergency Medical Physicians
NAEPP	National Asthma Education and Prevention Program
NAPNAP	National Association of Pediatric Nurse Practitioners
NASPGHAN	North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition
NAWD	National Association of WIC Directors
NBME	National Board of Medical Examiners
NCE	National Conference & Exhibition
NCEPG	National Conference & Exhibition Planning Group
NCQA	National Committee for Quality Assurance
NHLBI	National Heart, Lung, and Blood Institute
NHMA	National Hispanic Medical Association
NHTSA	National Highway Traffic Safety Administration
NIAAA	National Institute on Alcohol Abuse and Alcoholism
NICHD	National Institute of Child Health and Human Development
NICHQ	National Initiative for Children's Healthcare Quality
NIDA	National Institute on Drug Abuse
NIH	National Institutes of Health
NIMH	National Institute of Mental Health
NMA	National Medical Association
NMS	Neuromotor Screening Expert Panel
NNC	National Nominating Committee
NQF	National Quality Forum
NRHA	National Rural Health Association
NRMP	National Resident Matching Program
NRP	Neonatal Resuscitation Program
NSC	National Safety Council
NVAC	National Vaccine Advisory Committee
ODPHP	Office of Disease Prevention and Health Promotion
OED	Office of the Executive Director
OHISC	Oral Health Initiative Steering Committee
OLW	Obesity Leadership Workgroup
P4P	Pay for Performance
PAC	Project Advisory Committee
PAHO	Pan American Health Organization
PALS	Pediatric Advanced Life Support
PAS	Pediatric Academic Societies
PCO	*Pediatric Care Online*™
PCOC	Primary Care Organizations Consortium
PCPCC	Patient-Centered Primary Care Collaborative
PCPI	Physician Consortium on Performance Improvement
PEAC	Practice Expense Advisory Committee
PECOS	Pediatric Education in Community and Office Settings
PECS	Pediatric Education in Community Settings
PEPP	Pediatric Education for Prehospital Professionals
PIR	*Pediatrics in Review*
PLA	Pediatric Leadership Alliance
PMO	*Practice Management Online*
PPAAC	Private Payer Advocacy Advisory Committee (COCHF Subcommittee)
PPAC	Past President's Advisory Committee
PPAC	Practicing Physicians' Advisory Council
PPC-PCMH	Physician Practice Connections—Patient-Centered Medical Home (NCQA)
PPI	Partnership for Policy Implementation
PREP	Pediatric Review and Education Program
PROS	Pediatric Research in Office Settings
PSOLGBTHW	Provisional Section on Lesbian, Gay, Bisexual, and Transgender Health and Wellness
PSOTCo	Provisional Section on Tobacco Control
PUPVS	Project Universal Preschool Vision Screening
QA	Quality Assurance
QI	Quality Improvement
QuIIN	Quality Improvement Innovation Network
RBPE	Resource-Based Practice Expense
RBRVS	Resource-Based Relative Value Scale
RCE	Richmond Center of Excellence
RRC	Residency Review Committee (ACGME)
RUC	AMA/Specialty Society Relative Value Scale Update Committee
RVU	Relative Value Unit
SAM	Society for Adolescent Medicine
SAMHSA	Substance Abuse and Mental Health Services Administration
SCHIP	State Children's Health Insurance Program
SDBP	Society for Developmental and Behavioral Pediatrics
SF	Section Forum
SFMC	Section Forum Management Committee
SOA	Section on Anesthesiology and Pain Medicine
SOAC	Subcommittee on Access to Care
SOAH	Section on Adolescent Health
SOAI	Section on Allergy and Immunology
SOAPM	Section on Administration and Practice Management
SOATT	Section on Advances in Therapeutics and Technology
SOB	Section on Bioethics
SOBr	Section on Breastfeeding
SOCAN	Section on Child Abuse and Neglect
SOCC	Section on Critical Care
SOCCS	Section on Cardiology and Cardiac Surgery
SOCPT	Section on Clinical Pharmacology and Therapeutics
SOD	Section on Dermatology
SODBP	Section on Developmental and Behavioral Pediatrics

SOEM	Section on Emergency Medicine
SOEn	Section on Endocrinology
SOEp	Section on Epidemiology
SOGBD	Section on Genetics and Birth Defects
SOGHN	Section on Gastroenterology, Hepatology, and Nutrition
SOHC	Section on Home Care
SOHM	Section on Hospital Medicine
SOHO	Section on Hematology/Oncology
SOHPM	Section on Hospice and Palliative Medicine
SOICH	Section on International Child Health
SOID	Section on Infectious Diseases
SOIM	Section on Integrative Medicine
SOIMP	Section on Internal Medicine/Pediatrics
SOMP	Section on Medicine-Pediatrics
SOMSRFT	Section on Medical Students, Residents, and Fellowship Trainees
SONp	Section on Nephrology
SONS	Section on Neurological Surgery
SONu	Section on Neurology
SOOb	Section on Obesity
SOOH	Section on Oral Health
SOOHNS	Section on Otolaryngology/Head & Neck Surgery
SOOp	Section on Ophthalmology
SOOPe	Section on Osteopathic Pediatricians
SOOr	Section on Orthopaedics
SOPPe	Section on Perinatal Pediatrics
SOPPSM	Section on Pediatric Pulmonology and Sleep Medicine
SOPS	Section on Plastic Surgery
SORa	Section on Radiology
SORh	Section on Rheumatology
SOSM	Section on Senior Members
SOSu	Section on Surgery
SOTC	Section on Telehealth Care
SOTM	Section on Transport Medicine
SOU	Section on Urology
SOUS	Section on Uniformed Services
SOYP	Section on Young Physicians
SPR	Society for Pediatric Research
SPWG	Strategic Planning Work Group
TA	Technical Assistance
TA	Technology Assessment
TFOA	Task Force on Access (also known as Task Force on Health Insurance Coverage and Access to Care)
TFOC	Task Force on Circumcision
TFOI	Task Force on Immunization
TIPP	The Injury Prevention Program
TJC	The Joint Commission
UNICEF	United Nations Children's Fund
UNOS	United Network for Organ Sharing
USDA	US Department of Agriculture
WHO	World Health Organization
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children

Subject Index

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

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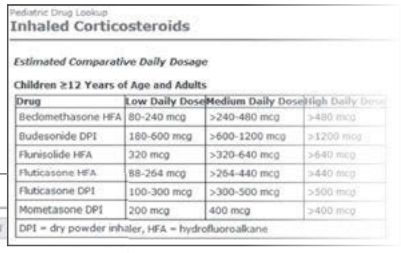

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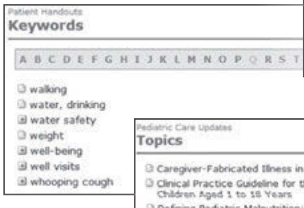

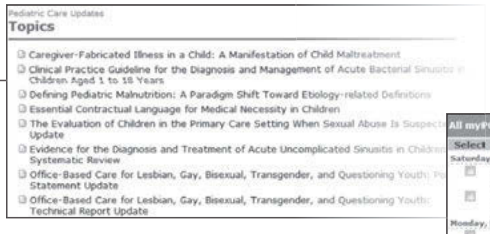

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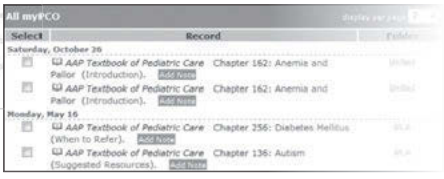

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Section 3:	Affirmation of Value Clinical Practice Guidelines
Section 4:	2013 Policies From the American Academy of Pediatrics
Section 5:	Current Policies From the American Academy of Pediatrics
Section 6:	Endorsed Policies
Appendix 1:	Policies by Committee
Appendix 2:	PPI: AAP Partnership for Policy Implementation
Appendix 3:	American Academy of Pediatrics Acronyms

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CLINICAL REPORT

Assessment and Management of Inguinal Hernia in Infants

abstract

FREE

Inguinal hernia repair in infants is a routine surgical procedure. However, numerous issues, including timing of the repair, the need to explore the contralateral groin, use of laparoscopy, and anesthetic approach, remain unsettled. Given the lack of compelling data, consideration should be given to large, prospective, randomized controlled trials to determine best practices for the management of inguinal hernias in infants. *Pediatrics* 2012;130:768–773

Kasper S. Wang, MD, and the COMMITTEE ON FETUS AND NEWBORN AND SECTION ON SURGERY

KEY WORDS

inguinal hernia, infants, surgery, anesthesia, laparoscopy

ABBREVIATION

PPV—patent processus vaginalis

INTRODUCTION

Inguinal hernia is a common condition requiring surgical repair in the pediatric age group. The incidence of inguinal hernias is approximately 3% to 5% in term infants and 13% in infants born at less than 33 weeks of gestational age.[1] Inguinal hernias in both term and preterm infants are commonly repaired shortly after diagnosis to avoid incarceration of the hernia. Given the lack of definitive data, optimal timing for repair of inguinal hernias in infants remains debatable. This report reviews the embryology and natural history of inguinal hernias as well as published data regarding the timing and approach to inguinal hernia repair in infants.

EMBRYOLOGY AND NATURAL HISTORY OF THE PATENT PROCESSUS VAGINALIS

Complete understanding of the issues related to surgical repair of an inguinal hernia requires an understanding of the embryology of descent of the testes and the formation of the processus vaginalis.

Testicular descent involves 2 phases: intra-abdominal and extra-abdominal.[2] During the intra-abdominal phase, the testis, which derives from the bipotential gonad originating at the urogenital ridge, is attached to the diaphragm by the craniosuspensory ligament. In the male fetus, regression of the craniosuspensory ligament results in transabdominal migration of the testis between 8 and 15 weeks postconception. Simultaneously, there is thickening of the gubernaculum, which attaches the testis to the scrotum through the external and internal rings of the inguinal canal. As the male fetus grows and the abdomen elongates, the testis is essentially anchored by the thickened gubernaculum.[3] In the female fetus, the craniosuspensory ligament is maintained; hence, the ovary retains its dorsal (retrocoelomic or retroperitoneal)

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intra-abdominal location. In addition, the gubernaculum does not thicken but persists as the ovarian round ligament.

The second phase occurs between 25 and 35 weeks of gestation.[4] The testis descends from its retroperitoneal, intra-abdominal location through the inguinal canal, drawing with it an extension of the peritoneal lining, which defines the processus vaginalis. Normally, the processus vaginalis obliterates and involutes, leaving no communication between the intra-abdominal peritoneal cavity and the extra-abdominal inguinal canal and scrotum. This enveloping involuted layer is the tunica vaginalis. Both human in vitro tissue culture and rodent model studies implicate genitofemoral nerve innervation as critical for regulation of gubernacular length as well as obliteration of the processus vaginalis.[5–7] Incomplete involution results in a patent processus vaginalis (PPV), through which fluid can travel and accumulate extra-abdominally as a hydrocele. If the communication is large, intra-abdominal structures such as bowel may herniate, resulting in an indirect inguinal hernia. The relation of the processus vaginalis with testicular descent is thought to explain why more than 90% of pediatric inguinal hernias are diagnosed in boys.[1] Involution of the left processus vaginalis precedes that of right, which is consistent with the observation that 60% of indirect inguinal hernias occur on the right side.[8]

The prevalence of PPV is highest during infancy and declines with age. Congenital hydroceles, which are essentially clinically apparent PPV, usually resolve spontaneously within 18 to 24 months.[9,10] The reported prevalence of PPV is as high as 80% in term male infants.[11] However, this prevalence is generally extrapolated from findings at time of exploration of the contralateral internal ring during time of inguinal hernia repair. Thus, most reported rates of bilateral PPV are derived from observations in patients with symptomatic unilateral inguinal hernias and likely overestimate the true prevalence of PPV in the general population. Rowe et al reported a 64% rate of contralateral PPV identified at the time of inguinal hernia repair in infants younger than 2 months. Reported rates of contralateral PPV decrease to between 33% and 50% in children younger than 1 year of age and are as low as 15% by 5 years of age.[12–16] Not all cases of PPV result in inguinal hernias. The estimated childhood risk of developing an inguinal hernia if there is a PPV is between 25% and 50%.[17,18] Even though the true prevalence of a PPV in the general pediatric population is likely lower than contralateral PPV reported at the time of hernia repair, it is clearly greatest at birth and declines with increasing age.

RATIONALE AND TIMING FOR ELECTIVE INGUINAL HERNIA REPAIR IN INFANTS

All inguinal hernias in infants are repaired to avoid the risk of incarceration of bowel and gonadal infarction and atrophy.[19–22] However, these risks must be balanced against the risk of potential operative and anesthetic complications. Unfortunately, data regarding these risks are not definitive.

Many investigators have sought to define the risk of inguinal hernia incarceration in young children. However, the physical features of hernia, such as the size of the abdominal wall defect, the amount of the herniating intestine, and the ease with which it can be reduced, do not consistently predict the risk of incarceration. Attempts have been made to correlate the age at diagnosis, the duration between diagnosis and hernia repair, and infants' gestational age with risk of inguinal hernia incarceration. Notably, in an analysis of a Canadian administrative database containing more than 1000 children with inguinal hernia, Zamakshary et al showed that children younger than 1 year had a twofold greater risk of inguinal hernia incarceration when repair was performed $\geq$14 days after diagnosis compared with children who had repair performed between 1 and 2 years of age.[23] Vaos et al reported a retrospective analysis of preterm infants undergoing inguinal hernia repair at 1 of 2 institutions.[24] They noted that infants undergoing repair later than 1 week after diagnosis were at significantly greater risk of inguinal hernia incarceration, postoperative hernia recurrence, and testicular atrophy, compared with infants undergoing earlier repair. Lautz et al analyzed the risk of inguinal hernia incarceration in approximately 49 000 preterm infants using the 2003 and 2006 Kids' Inpatient Databases.[25] They determined that the overall rate of inguinal hernia incarceration was approximately 16% and that the risk was greatest in infants in whom surgery was delayed beyond 40 weeks' corrected gestational age (21%) compared with those repaired between 36 and 39 weeks (9%) corrected age or less than 36 weeks corrected gestational age (11%). Furthermore, 28% of former preterm infants undergoing repair during a subsequent hospitalization were noted to have inguinal hernia incarceration, suggesting an even greater risk with further delay. Although fraught with limitations inherent to administrative databases, the conclusions of this study are compelling.

Conversely, other data indicate that delay in inguinal hernia repair is associated with low rates of inguinal hernia incarceration. Lee et al reported a 4.6% rate of hernia incarceration in 172 former preterm infants within a single Kaiser system hospital. Of the 127 infants who were discharged from

the hospital with known inguinal hernias and scheduled for a planned elective outpatient repair, there were no episodes of inguinal hernia incarceration while awaiting repair.[26] Uemura et al reported comparable inguinal hernia incarceration rates in 19 preterm infants (birth weight range 492–2401 g) who underwent repair at more than 2 weeks after diagnosis, compared with 21 preterm infants who underwent more urgent repair.[27] Although these studies suggest that inguinal hernia repair can be delayed, the data are not as compelling as those suggesting repair on a more urgent basis.

Inguinal hernia repair is associated with operative complications, including hernia recurrence, vas deferens injury, and testicular atrophy, the rates of which vary from 1% to 8%.[28–31] Long-term complications include chronic pain and infertility in adulthood.[32] In a single-institution, retrospective analysis, Moss et al observed low recurrence and complication rates up to 5 years after surgical repair in infants younger than 2 months of age.[33] Conversely, a retrospective analysis by Baird et al revealed a higher rate of complications in infants who were 43 weeks' corrected gestational age or younger, compared with those who underwent repair at an older age.[34] They speculated that the greater friability of the hernia sac in former preterm infants predisposes to repair failure.

Early repair of inguinal hernias in preterm infants must be further balanced against the risk of postoperative apnea after general anesthesia. Historically, the rate of postoperative apnea in preterm infants has been reported to be as high as 49%.[35,36] The risk of postoperative apnea is associated with perioperative anemia and a history of preoperative apnea as well as associated comorbidities.[35,37] Vaos et al noted that preterm infants undergoing inguinal hernia repair within 1 week of diagnosis experienced a significantly greater rate of apnea compared with those undergoing repair later.[24] Melone et al reported on a cohort of 127 former preterm infants (mean gestational age, 32.7 weeks) who underwent outpatient inguinal hernia repair at a mean corrected gestational age of 45.3 weeks. The authors identified only 2 infants who experienced episodes of apnea: 1 in the operating room, the other postdischarge. They concluded that because the apnea rate is so low, elective outpatient inguinal hernia repair is a feasible option for preterm infants. Lee et al reported no episodes of apnea in a cohort of preterm infants (30.7 weeks' gestation at birth) undergoing outpatient elective hernia repair.[26] However, the authors noted that 13 of 45 former preterm infants who underwent elective inguinal hernia repair before discharge from the NICU remained intubated for longer than 2 days postoperatively.

Younger corrected gestational age is associated with a greater risk of apnea.[38] Allen et al noted a nearly 9% rate of postoperative apnea in their cohort of 57 preterm infants undergoing inguinal hernia repair.[39] In a subset analysis, infants who experienced apnea episodes tended to be younger (41 weeks' corrected gestational age compared with 47 weeks' corrected gestational age); had significantly higher perioperative risk, as measured by American Society of Anesthesia scores (2.6 compared with 1.8); and were more likely to have received intraoperative narcotic and muscle relaxation compared with infants who were not apneic. A recent meta-analysis concluded that former preterm infants undergoing general anesthesia who are less than 46 weeks' corrected gestational age should be observed for at least 12 hours postoperatively and that those who are between 46 and 60 weeks' corrected gestational age should receive more individualized care on the basis of the presence or absence of associated comorbidities.[40]

To reduce the incidence of postoperative apnea, spinal, rather than general, anesthesia has been used for inguinal hernia repair in preterm infants.[41–43] Although some studies have been encouraging, none have been adequately powered. Indeed, Craven et al published a Cochrane Collaboration analysis in which only 108 patients from 4 small randomized or quasi-randomized studies comparing spinal and general anesthesia were identified.[44] The authors concluded that there was no evidence that spinal anesthesia was associated with a reduction in postoperative apnea, bradycardia, or oxygen desaturation. Furthermore, the authors concluded that a large, randomized controlled trial was necessary to determine whether spinal anesthesia reduces postoperative cardiorespiratory complications; to date, no such study has been reported.

Over the past decade, studies performed in rodents and nonhuman primates have shown a dose-dependent association of neuronal apoptosis with general anesthetic agents, including ketamine, propofol, and isoflurane.[45–47] Importantly, there is emerging evidence that the use of general anesthesia in infancy may be associated with long-term neurocognitive and developmental problems, specifically after multiple exposures to general anesthesia before 3 years of age.[48] DiMaggio et al, using a New York State Medicaid database, showed that children younger than 3 years who were given general anesthesia for inguinal hernia repair had a greater than twofold risk of developmental or behavioral disorders than did age-matched control children.[49] A potential bias of this study is that children undergoing surgery at a young age may

also be predisposed to learning or cognitive disorders. Bartels et al attempted to address this issue by using the Netherlands Twin Registry to evaluate monozygotic concordant-discordant twins. In a study of 1143 monozygotic twin pairs, exposure to anesthesia before 3 years of age was associated with reduced educational achievement.[50] However, there was no difference in outcome between twin pairs when one twin had undergone anesthesia and the other had not. The authors concluded that there is no causal relationship between anesthesia exposure and learning disabilities. Hansen et al recently compared ninth-grade test scores of nearly 2700 Swedish children who had undergone inguinal hernia repair as infants with those of randomly selected age-matched controls and found no difference in test performance.[51] Clearly, the issue of whether anesthetic exposure as an infant affects long-term neurodevelopment is unsettled. Two large clinical studies are under way to address this issue.[52]

Ultimately, the timing of preterm infant inguinal hernia repair varies widely in practice. In a 2005 survey of members of the American Academy of Pediatrics Section on Surgery, 63% reported routinely performing hernia repairs just before discharge from the NICU, 18% performed repairs at a specific corrected gestational age, and 5% performed repairs when it was convenient.[53] If a hernia was discovered after discharge, 53% of respondents would repair the hernia when it was convenient, and 27% of respondents would wait to repair until the infant was between 38 and 60 weeks' corrected gestational age (mean, 53.1 weeks' corrected gestational age). In a previous survey performed in 1993, surgeons were more likely to repair an inguinal hernia when convenient.[54]

Timing of inguinal hernia repair in preterm and term infants represents a balance of the risks of inguinal hernia incarceration and of postoperative respiratory complications. At present, the literature does not clearly define what these risks are and how they should be balanced.

CONTRALATERAL INGUINAL EXPLORATION

The utility of contralateral inguinal exploration in children is an area of active debate. The rationale for attempting to diagnose a contralateral PPV is that repair can be performed to prevent any potential contralateral incarceration with no additive anesthetic risk. Historically, surgeons performed routine open contralateral inguinal explorations to identify PPV in either all children or in selected populations (ie, former preterm infants or children younger than 2 years). Marulaiah et al suggested that routine contralateral exploration is not indicated, given the risks associated with such exploration, such as spermatic cord injury.[55] Alternatively, given the high incidence of subsequent hernias if a contralateral PPV is encountered, others support routine exploration.[13,56,57] Lee et al indicated that it is cost-effective to perform routine contralateral groin explorations.[58] Results from the aforementioned 2005 survey of American Academy of Pediatrics Section on Surgery members revealed a variety of practices; 15% of respondents indicated that they never explore the contralateral side in a male patient, 12% responded that they always do, and 73% responded that they had an age cutoff beyond which they would not explore.[53] Respondents also had a wide variation of practices when caring for a girl with a unilateral hernia. For both male and female patients with hernias, however, results of the survey revealed that there were significant reductions in the routine explorations of the contralateral side compared with results from the same survey performed in 1996.[54] Various diagnostic modalities, such as the physical examination, herniography, or ultrasonographic examination are not particularly sensitive or specific, thus making these efforts unreliable.[56,59] With the advent of laparoscopic techniques, inspection of the contralateral internal ring has become increasingly popular as the method of choice for evaluating for a PPV. According to survey responses, use of laparoscopy as the modality with which to explore the contralateral ring has increased from 6% in 1996 to 37% in 2005.[53,54] Use of laparoscopy to explore the contralateral groin has likely increased since then.

LAPAROSCOPIC APPROACH TO INGUINAL HERNIA REPAIR IN INFANTS

Laparoscopic repair has been used effectively in preterm infants. Various techniques have been described, but all routinely use a port placed in the umbilicus to visualize the internal ring. Reported hernia recurrence rates are comparable to those associated with open repair.[60,61] However, data regarding the risk of testicular atrophy are not available.[62,63] A prospective, randomized, single-blinded trial comparing laparoscopic to open repair of inguinal hernias showed that children who were older than 3 months of age when laparoscopic repair was performed required significantly fewer doses of pain medication.[64] The utility of laparoscopic repair of inguinal hernias in younger infants remains undetermined to date.

CONCLUSIONS

- Inguinal hernias are common in the infant population. The risk of hernia incarceration drives the preference to pursue surgical repair.
- Data regarding optimal timing of repair are conflicting and inadequate.

- There is no consensus on when or if contralateral inguinal exploration is necessary.
- Data regarding a laparoscopic approach to inguinal hernia repairs suggest that it is comparable to the standard open technique.
- Given the lack of data supporting evidence-based approaches to inguinal hernias in infants, consideration should be given to large, prospective, randomized, controlled trials to answer these important questions.

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POLICY STATEMENT

Baseball and Softball

abstract

FREE

Baseball and softball are among the most popular and safest sports in which children and adolescents participate. Nevertheless, traumatic and overuse injuries occur regularly, including occasional catastrophic injury and even death. Safety of the athlete is a constant focus of attention among those responsible for modifying rules. Understanding the stresses placed on the arm, especially while pitching, led to the institution of rules controlling the quantity of pitches thrown in youth baseball and established rest periods between pitching assignments. Similarly, field maintenance and awareness of environmental conditions as well as equipment maintenance and creative prevention strategies are critically important in minimizing the risk of injury. This statement serves as a basis for encouraging safe participation in baseball and softball. This statement has been endorsed by the Canadian Paediatric Society. *Pediatrics* 2012;129:e842–e856

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KEY WORDS

balls, bats, commotio cordis, elbow, equipment, helmets, injury, pitch count, safety, shoulder

ABBREVIATIONS

AED—automated external defibrillator
CPSC—Consumer Protection Safety Commission
NEISS—National Electronic Injury Surveillance System
NOCSAE—National Operating Committee on Standard for Athletic Equipment
UCL—ulnar collateral ligament

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INTRODUCTION

The pediatrician needs to have an understanding of baseball and softball. This will allow the pediatrician to offer appropriate counseling and guidance to the many boys and girls, their parents, and members of the sporting community who participate in baseball and softball each year.

Baseball is one of the most popular sports in the United States, with an estimated 8.6 million children ages 6 to 17 participating annually in organized and recreational baseball.[1] Although baseball is a relatively safe sport in comparison with many other athletic activities, highly publicized catastrophic impact injuries from contact with a ball or a bat frequently raise safety concerns.[2,3] These incidents, as well as the high frequency of shoulder and elbow injuries resulting from overload and overuse, provide the impetus for this review and new guidance to reduce injury risk and improve safety in baseball for 5- to 18-year-old participants. This policy statement replaces the previous statement written in 2001.[4] This statement has been endorsed by the Canadian Paediatric Society.

Beginning in the early 1990s, epidemiological and injury surveillance research in baseball and softball intensified. Data from these scientific efforts paved the way for organized baseball to create medical advisory committees, which generated policies designed to reduce the risks of injury in baseball and softball. Advances in equipment also continue to offer new opportunities to make the game safer for youth athletes; similarly, the dissemination and use of automatic lightning detectors (which produce a clear and loud warning signal) and automated external defibrillators (AEDs) provide additional means of reducing catastrophic events on the baseball field.[5,6] Moreover, organized youth baseball coaches, officials, and administrators must remain knowledgeable and

sensitive to the developmental and skill levels of young baseball players and continue to modify the rules, when necessary, for the safety of the players. This policy statement focuses principally on baseball, but softball will also be considered where relevant literature is available.

PARTICIPATION

There are over a dozen youth baseball organizations whose combined annual participation is nearly 5 million. Little League Baseball reports baseball participation at approximately 2.3 million annually and softball participation at 400 000 per year[7]; the Babe Ruth League (and its 12-and-under Cal Ripken Baseball division) has more than 1 million youth participants annually.[8] Over 2 million girls between the ages of 12 and 18 compete in fast pitch softball annually. The National Federation of State High School Associations 2009–2010 participation data counted 473 503 baseball players (ages 14–18) and 393 578 softball athletes.[9]

INJURY DATA

There are a variety of sources of data for injuries in youth baseball, which include hospital emergency departments, insurance claims, national catastrophic injury reporting system, and independent researchers.[1,10–13] Each of these sources captures a limited view of total injuries. Taken together, however, a fairly consistent pattern emerges on the overall injury incidence and relative frequency (prevalence) of baseball injuries compared with other sports. Comprehensive data also come from the high school level reporting systems using certified athletic trainers to record the key injury-related information on this 14- to 18-year-old population.[14–16]

Prevalence

The US Consumer Product Safety Commission (CPSC) maintains the National Electronic Injury Surveillance System (NEISS) through a network of approximately 100 participating US emergency departments. From the data collected from this cross section of national emergency departments, the CPSC extrapolates national estimates of injury prevalence in various age groups. The overall prevalence of all sports-related injuries in children younger than 15 years seen in an emergency department is just under a million per year; in 2007, the CPSC estimated that 109 202 baseball- and softball-related injuries among 5- to 14-year-old children were treated in US emergency departments nationally.[17] More specifically, in 2007, the CPSC/NEISS recorded exactly 3343 baseball injuries among 5- to 18-year-old children from the participating US emergency departments (T.J. Schroeder, MS, personal communication, 2009). The frequency distribution of injuries by age followed a bell-shaped curve for ages 5 to 18 years, with the highest number of injuries clustered in children from 11 to 14 years of age (more than 300 injuries per year of age).[17] Because 11- to 14-year-old children represent the majority of participants, valid injury risk comparisons with other age groups cannot be directly determined from these raw numbers alone. Nearly half of the 3343 injuries (44%) involved the head (25% to the face, including eyes and nose; 14% to the head and neck; and 5% to the mouth), with the highest frequency in children 9 to 11 years of age.[17] According to several years of annual NEISS reports, approximately one-fourth to one-third of all youth baseball injuries are to the upper extremities, including the fingers (10%–13%), wrists (4%–5%), and hands (4%–5%). Just under 20% of injuries were to the lower extremities, with knees (5%) and ankles (6%–7%) almost equally affected. Injuries to the trunk and pubic area accounted for approximately 6% to 10% of all injuries.[1,11,17]

Also in 2007, the NEISS recorded exactly 1188 youth softball injuries in the same 100 participating emergency departments. Girls accounted for 1062 injuries, and boys accounted for 126.[17] For girls, the frequency of injuries by age also followed a bell-shaped curve for ages 5 to 18 years, with the highest numbers of injuries clustered in children from 13 to 16 years of age (more than 130 injuries per year of age). The distribution of injuries by body region was more evenly distributed for girls playing softball compared with boys playing baseball, with 28% of girls' softball injuries involving the head and neck, 35% involving the upper extremities, 31% involving the lower extremities, and 5% involving the trunk and pubic area. The 5 most common areas for injury were the face (14%), ankle (14%), finger (13%), knee (11%), and head and neck (11%).[17] Thirty-nine percent of injuries were classified as contusions, abrasions, lacerations, or hematomas/hemorrhages; 31% were classified as sprains or strains; 21% were classified as fractures, dislocations, or avulsions; 4% were classified as internal organ injuries; and 4% were classified as concussions.[17]

Baseball is one of the safest high school sports in the United States with a reported injury rate of 1.26 injuries per 1000 athletic exposures.[14] Baseball athletes have the third lowest rates of injury lasting longer than 1 week among 18 different sports played in high school. However, although the overall injury rate is low, the degree of injury severity is relatively high. In baseball, fractures represent a larger percentage of total injuries than in other sports. Baseball also ranks second highest for the percentage of injuries resulting in a time loss from sport participation longer than 7 days.[14,15] In high school baseball and softball, as in youth baseball, most injuries to the head and face (48%) and mouth

and teeth (16.0%) are attributed to being hit by a batted ball.[14] More of these head and facial injuries also required surgery (18.0%), compared with other baseball-related injuries (6.8%).

USA Baseball, through its Medical and Safety Advisory Committee, sponsored injury-surveillance research and produced a report on injury patterns in youth baseball in 2008 which concluded that, in younger players, injuries are more often associated with lack of skill, whereas in older players, the greater skill, muscle power, and body size become injurious forces.[13] More detailed study findings were as follows:

1. Across all age groups, pitchers, catchers, and fielders have a relative frequency of injury in a season comparable to batters and base runners, with one exception: as age increases, the proportion of injuries to catchers increases, whereas the proportion of injuries to fielders decreases.
2. The younger the age group, the more frequently injuries occur during practice sessions, not games. Also, in younger age groups, relatively higher frequencies of injuries came from "before/after" baseball play, such as warm-ups or postgame horseplay.
3. Pitcher injuries are also age-related, with noncontact overuse injuries increasing in each older age group. Younger pitchers are more likely to be hit by a batted or thrown ball.
4. Catchers principally are injured in catching a pitch, getting hit by a foul tip, or tagging a base runner. Younger catchers are more frequently injured trying to catch the pitched ball, whereas older catchers are more likely to be injured by foul tips. Although home-plate collisions during a tag play generate a modest but constant pattern of injury for catchers of all ages, these collisions produce a greater injury risk to the older catcher.
5. Batters are most frequently injured by a pitched ball (and by a foul ball as they get older). The younger the batter, the more likely they are to be injured by a swung bat of another player while getting into position. Approximately 10% of batting injuries among older batters are of a noncontact nature, indicating some form of overswinging resulting in an injury to the muscles, bones, or connective tissues of the rib cage.
6. Injuries to base runners occurred almost equally at all bases, with slightly more injuries at home plate than at first base. Two-thirds of these injuries occurred from sliding, and one-third occurred from base running. Base running injuries are not related to age, occurring almost equally from collisions, being hit by a thrown ball, or simply running (such as falling, stepping wrong on the base, or straining a muscle).
7. Fielder injuries occur at the base (33%), in foul territory (10%), and in the field (57%). Younger fielders are more likely to be hit by a batted ball, whereas older fielders are more likely to be injured by colliding with a sliding opponent.

Catastrophic Injuries

Research from the National Amateur Baseball Catastrophic Injury Surveillance Program places the rate of catastrophic injury very low, at approximately 1 injury per 1 million participants annually. Such injuries may be caused by trauma related to participating in the skills of the sport, such as contact with a bat, baseball, or softball (direct catastrophic injury), by a body system failure resulting from exertion while participating in a sport or activity (eg, cardiac collapse or heat stroke) or by a complication that resulted from a nonfatal injury (indirect catastrophic injury). Catastrophic injuries are further classified according to outcome as fatal (athlete died), nonfatal (athlete left with permanent disability), and serious (athlete experienced severe injury but recovered, to be left with no permanent functional disability).[12] The National Amateur Baseball Catastrophic Injury Surveillance Program data revealed an annual fatality rate of 0.05 per 100 000 participants, 0.03 for nonfatal catastrophic injuries and 0.04 for serious catastrophic injuries.[18] Between 1996 and 2006, deaths in youth baseball averaged just over 2 per year.[18] These deaths occurred from impact to the head resulting in intracranial bleeding and from blunt chest impact, likely prompting ventricular fibrillation or asystole (commotio cordis).[11,12]

Another study based on statistics compiled by the CPSC[11] indicated that there were 88 baseball-related deaths (approximately 4 per year) to children 5 to 18 years old between 1973 and 1995.[11,19] The injury causing death in 38 cases (43%) was direct-ball impact with the chest (commotio cordis); in 21 cases (24%), the injury causing death was direct-ball contact with the head; in 13 cases (15%), the injury causing death was from impact from bat contact; in 9 cases (10%), the injury causing death was from direct contact with a ball impacting the neck, ears, or throat; and in 7 (8%), the injury causing death was unknown.[11,19]

Among high school baseball athletes (with approximately 475 000 participating annually), there have been 10 "direct" deaths, 14 "indirect" deaths, 17 nonfatal catastrophic injuries, and 22 serious catastrophic injuries between 1982 and 2008.[12] Direct injury rates are between 2 and 5 times greater in high school than in youth baseball (5–14 years of age) and 4 times greater in college than high school baseball (but still less than 1/100 000 participants annually in any of the 3 categories).

Among high school softball athletes (371 000 annual participants), there has been 1 direct death, no indirect deaths, 2 nonfatal catastrophic injuries, and 1 serious catastrophic injury in the 15 seasons from 1993 and 2008; these rates are approximately one-tenth of those for high school baseball.[12]

Commotio Cordis

Young baseball and softball players who receive direct ball impact to the anterior chest wall over the cardiac silhouette may develop cardiac arrest. Commotio cordis is the second highest cause of death in athletes younger than 14 years and is considered to be only a pediatric problem because of its unique occurrence in children, usually younger than 16 years.[20–22] Children 5 to 14 years of age may be uniquely vulnerable to this blunt chest impact, because their chest walls are more elastic and more easily compressed.[20–24]

Although protective gear can be a key preventive measure, it is not always effective. Research has shown that even with protective gear, the fatality rate for commotio cordis is alarmingly high at 90%.[19–24,25,26] Proper coaching and execution can augment protective equipment. Batters who learn to avoid the ball and turn away from an inside pitch can greatly reduce their risk. This is particularly difficult, however, while bunting and, thus, requires special attention and instruction. The risk to pitchers can also be reduced by teaching proper fielding position after ball release as well as ball avoidance when necessary.[19] The capacity to recognize that a batted ball is coming at you quickly and the ability to react to that event before the ball arrives are crucial traits for protecting these athletes. Speed of processing and reaction time are commonly measured during the computer-based neuropsychological tests given to high school athletes as a baseline in concussion management programs. Presumably, these are skills that can be improved marginally with proper training and sufficient repetitions. It is estimated that 400 milliseconds is required for a pitcher to complete a protective movement, such as lifting a hand to the chest or face; this corresponds to a batted ball speed of 42 m/second.[27] Because balls hit from some metal bats may exceed 42 m/second, performance standards for composite metal bats were developed in 2003 to limit their capacity to transfer force (velocity) to the batted ball.

It is noteworthy that cardiac death caused by commotio cordis is potentially preventable. If cardiac arrest occurs, an immediate and appropriate response may, in many cases, save a young player's life. AEDs are becoming more prevalent in the sports world at athletic complexes and certainly in patrol cars and emergency medical vehicles. The use of these devices, along with cardiopulmonary resuscitation, has become a standard first step in treating cardiac arrest.[6,28] If no AED is available near the affected child, the emergency medical care system should be activated by using 911 to get an AED to the athlete's side as soon as possible (ideally within 3 minutes). Baseball coaches should be routinely reminded to have a local cellular phone and emergency medical numbers at every youth baseball and softball game and practice in the event of a medical emergency.

Concussion

Concussion in sports continues to garner ever-increasing public attention and concern. Data on high school concussion rates in baseball and softball were generated through the Reporting Information Online system, developed from the National High School Sports-Related Injury Surveillance Study, over the 5-year period from the 2005–2006 to 2009–2010 school years. The rate of concussions for baseball was 0.2 per 1000 athletic exposures, and for softball the rate of concussions was 0.5 per 1000 athletic exposures. Of the 9 sports surveyed (including football, wrestling, soccer, and basketball), baseball had the lowest rate, and softball was seventh. The top 2 activities associated with concussion in high school boys playing baseball were batting (36.7%) and running the bases (21.5%), whereas for girls playing softball, the top 2 activities were catching (33.3%) and fielding (25.0%).[29] The most recent concussion recommendations, including the AAP Clinical Report published in 2010, stress removing an athlete suspected of sustaining a concussion from play immediately with no return to play on the day of injury. Resting the brain is the key to the most rapid resolution of the concussion; such rest includes no physical activity, with minimal cognitive and social activity. The concussed athlete should seek prompt medical attention from an appropriate health professional. Once the athlete is fully free of symptoms and cleared by a physician knowledgeable in the treatment and management of concussion, the athlete should enter a graduated return-to-play protocol to ensure a safe return to sporting activity.[30]

Summary of Acute Injuries

Although the rates of injury for baseball and softball are low in comparison with other sports, the combination of relatively high severity of injuries that do occur and the very large number of participants in these sports produces a substantial number of individuals with significant injuries each year. Focused media attention on these cases often produces a groundswell for action, even when the scientific evidence for change is lacking.

OVERLOAD CAUSING OVERUSE INJURY OF THE SHOULDER AND ELBOW IN BASEBALL

Overuse arm injuries in youth baseball primarily affect pitchers. The repetitive stress of throwing can lead to muscle fatigue and then to muscle, tendon, and ligament damage. To control the number of these injuries, it is critical that pediatricians, coaches, athletes, and parents understand the anatomy, biomechanics, and kinetics of throwing a baseball pitch.[31–33]

In throwing, especially pitching, the arm force and speed generated during the full windup motion is astonishingly high (7200 degrees, or 20 revolutions of a circle, per second for professional pitchers). At ball release, the rotator cuff muscles and long head of the biceps contract to decelerate arm motion and prevent the arm from following the ball ("throwing one's arm out").[34]

The shoulder girdle (including the clavicle [collarbone], scapula [shoulder blade], glenohumeral joint, humerus, and all of the various muscular attachments to the thorax and scapula) permits the arm to enjoy remarkable freedom of movement. Greater joint range of motion sacrifices the inherent joint stability that is usually provided by bony articulation or ligamentous limitation. Unlike other joints, such as the knee and ankle, the glenohumeral joint of the shoulder acquires nearly all of its stability during activity from the muscles of the shoulder with little or no assistance from bones or ligaments. Therefore, when the muscles become fatigued (and cannot do their job properly), the shoulder becomes an unstable joint. Pitchers who continue to throw when the arm is fatigued risk serious and possibly permanent injury to their muscles, ligaments, capsules, labra, and bones.[35]

The scapula plays a critical role in the functioning kinetic chain of the upper extremity. The scapula is attached to the distal end of the clavicle by the broad acromioclavicular ligament and the 2 coracoclavicular ligaments that arise from the hooklike coracoid. The clavicle attaches proximally to the sternum at the sternoclavicular joint; the sternoclavicular joint is the only joint connection of the entire upper extremity to the main skeleton of the body. The scapula rests on the thorax (chest wall) and is connected through numerous muscles (scapulothoracic joint) that permit the shoulder blade to rise (shrugging shoulders), to glide around the body (protraction), and to glide back toward the spinal column (retraction). Strength and endurance of these extrinsic shoulder girdle muscles, especially the serratus anterior, are essential to ensure safe pitching. These muscles must move the scapula to its appropriate position and stabilize its base before the acceleration phase of the throwing motion can proceed. With excellent scapular muscular control, the athlete can then use the long lever of the upper extremity to throw with power, speed, and accuracy.[36]

It also has long been recognized, however, that the source of power (velocity) in throwing is part of a larger kinetic chain, which begins in the legs, travels through the pelvis into the torso ("the core"), and finally comes out through the scapula into the upper extremity. Strong legs and especially a strong core help generate a majority of the force behind a pitched ball.[37]

Relative weakness of the serratus anterior muscle is often responsible for injuries to the rotator cuff muscles, biceps, and elbow (farther down the kinetic chain). Scapular winging (being able to slide one's hand under the medial or inferior edge of the scapula when relaxed), scapular depression (inferior pole sits lower than the other side or below T-7), and protraction (sits farther away from the vertebral spines than the opposite side) are noted on inspection. Observing an athlete (from behind) performing the arm component of a "jumping jack" approximately a dozen times will demonstrate poor movement patterns, or scapulothoracic dyskinesis. A second test entails forward flexing the arm to the fully overhead position and slowly lowering the arm 180 degrees to its natural position. Scapulothoracic dyskinesis consists of unsmooth or uncontrolled scapular motion while bringing the arms up or down, including marked scapular winging during descent. Although the athlete may perform the first few repetitions well, scapulothoracic dyskinesis may become evident toward the end of the set, when fatigue sets in.[36,38]

The scapula also forms part of the glenohumeral joint (true shoulder joint). The scapula's glenoid is a shallow socket surrounded by a cuplike rim called the labrum, which provides additional stability. The 2 main ligaments of the glenohumeral joint perform most of their stabilizing function when the shoulder is not being used dynamically. During sporting activity and especially during throwing, the 4 rotator cuff muscles and the long head of the biceps are responsible for keeping the humeral head in the glenoid socket. The larger muscles (deltoids, trapezius, pectorals, latissimus dorsi, short head of the biceps, and triceps) provide the powerful dynamic forces to move the arm and generate ball velocity.

The term "Little League shoulder" refers to the widening of the proximal humeral physis resulting from chronic recurrent traction stress across the growth plate. This lesion is felt to be primarily the result of throwing a large number of pitches or maximum-effort throws or insufficient rest between pitching assignments, but can also be related to improper mechanics or premature attempts with certain pitch

types. When unrecognized, or when recognized in an advanced stage of overuse, Little League shoulder can lead to chronic pain with throwing, early shoulder instability, or degenerative arthritis.[39]

The term "Little League elbow" refers to medial elbow pain in skeletally immature athletes resulting from throwing issues similar to those mentioned in the description of "Little League shoulder." Pitchers are most likely to be affected by this condition, but it can also occur in other players at positions requiring frequent and forceful throwing. Traction forces occur on the medial elbow and compression forces laterally. The medial traction forces can cause separation or avulsion of the humeral medial epicondyle apophysis and overuse injury to the common flexor tendon. The compression forces laterally can cause collapse and deformity of the distal humerus (capitulum), also known as osteochondritis dissecans in adolescents and Panner disease in children younger than 10 years. Early recognition of symptoms is important to avoid chronic elbow pain, instability, and arthritis.[35] The inability to fully straighten the elbow is usually an indication of an overuse elbow injury. Complete tears of the ulnar collateral ligament (UCL) are repaired by "Tommy John" surgery, which is followed by nearly a year of rehabilitation before return to pitching is allowed. UCL tears have risen to nearly epidemic proportions in the past 5 years among youth and high school pitchers, increasing almost 20-fold from the previous decade.[35,40] When the pitch velocity exceeds 80 miles per hour, the forces experienced at the UCL are near the point of failure (32 Newton meters).[35,41]

Prevention of Shoulder and Elbow Overuse Injuries in Baseball

In 2006, the Medical and Safety Advisory Committee of USA Baseball set pitching limits for a season and a calendar year, based on age.[42] In 2007 and 2008, on the basis of extensive research, Little League Baseball released its pitch count regulation guide in an attempt to reduce the risk of overuse injuries to elbows and shoulders.[43,44] This guide for parents, coaches, and league officials sets a maximum number of pitches to be thrown in a day on the basis of age as well as the number of rest days between pitching assignments on the basis of number of pitches thrown and age. It replaces the previous regulations, which set a maximum number of innings pitched in a calendar week. Beginning in 2010, Little League tournament pitching regulations became the same as for regular season play, as shown in Tables 1 and 2.[44,45] It is the responsibility of the coach to know when an athlete has reached his or her pitch count limit. When pitchers exceed recommended pitch count maximums for age for an entire season or a full year, the injury rates for shoulders and elbows increase dramatically.[41]

Young pitchers should avoid pitching on multiple teams with overlapping seasons; the guidelines for rest requirements must be enforced across all teams. Youth pitchers should not pitch competitively in more than 8 months in any 12-month period; 3 consecutive months of complete rest from pitching each year is recommended. A pitcher should also not be a catcher for his or her team. Catchers throw even more frequently than pitchers, and although the return throws are only moderately stressful, catchers also make many hard throws to the bases during a game. Thus, playing both positions greatly increases the repetitive stress to the arm.[35,46]

A preseason conditioning program that includes strengthening the core, the rotator cuff, and the shoulder-stabilizing muscles (scapular stabilizers) also may help reduce throwing injuries. A prospective epidemiological research study among asymptomatic adolescent and preadolescent tennis athletes found those with decreased scapula stabilizing muscular strength (noted by scapula winging, protraction, and depression) demonstrated a higher rate of shoulder injury during the subsequent season.[47]

Teaching proper pitching mechanics may also prevent serious overuse injuries.[35,42,43,48] Allowing sufficient time during the early part of the season to gradually increase the amount and intensity of throwing may provide young arms an opportunity to adapt to the stresses of throwing. During the off-season and preseason, after allowing for a period of several months of complete rest from throwing, daily throwing of a strictly limited number of pitches may enhance strength development (as regular strength training does for other muscle regions) with little risk of overuse injury or fatigue.[35,49] A core-stabilizing exercise program will improve strength and should also be adopted for pitchers and hitters.[35,37,47]

Four keys to successful pitching within the 5- to 14-year age group are (1) the development of a fastball; (2) accuracy of locating pitches (control); (3) development of an off-speed pitch (change-up); and (4) changing pitch speeds and plate locations to keep batters guessing. Conventional wisdom has long considered the curve ball and slider to be stressful to the young elbow, and recommendations to delay their introduction until later years (when the skeletal maturity is more significantly advanced) were common.[43] Recent studies challenge those theories and indicate that, when properly thrown, the curve ball may not overly stress the elbow.[35,50,51] Nevertheless, on the basis of those

TABLE 1 Little League Baseball 2010 Pitching Guidelines: Maximum Pitches per Game

10 y and younger	75 pitches per d
11–12 y	85 pitcher per d
13–16 y	95 pitches per d
17–18 y	105 pitches per d

Source: Little League (http://www.littleleague.org/media/newsarchive/2009/Sep-Dec/LLTournamentRegularSeasonPitchingRulesMadeSame.htm).

studies that show increased injury among those who throw curve balls and sliders at early ages, researchers currently continue to recommend delaying introduction of the curve ball until after age 14 or when pubertal development has advanced to the stage when the athlete has started to shave (sliders should be delayed until age 16).[41] The American Academy of Pediatrics endorses this recommendation. Finally, on the basis of the increasing number of elbow ligament surgeries in younger and younger pitchers, it is clear that players, parents, and coaches require more respect for the limits of the developing child's arm to withstand the forces incurred while pitching and should understand that the consequence of overload causing overuse injuries which can permanently damage anatomic structures.[35]

OVERUSE INJURY FROM SOFTBALL PITCHING

Data on softball injuries were included in the previous sections; in general, these demonstrate injury patterns similar to baseball with several minor variations. One unique feature of softball, however, is the nature of pitching; pitchers throw underhand from a flat mound. Although the softball windmill pitching motion may be less stressful to the pitcher's shoulder and elbow than throwing a hardball overhand, there are still significant forces placed on various body structures to cause overuse injury.

The same concerns exist for arm safety: do not throw when fatigued. As of 2011, inning limitations and rest days for softball windmill pitchers in the various age divisions of Little League apply to tournament play only. Many softball teams rely on fewer pitchers per team than baseball. Before such inning limitations, some pitchers pitched in multiple games during weekend tournaments, running up pitch counts between 1500 and 2000 pitches in a 3-day period.[52]

The driving force of the windmill softball pitch is in the lower body[53]; 1 study reported more than 50% of the total kinetic energy of upper extremity during overhead movements is supplied by the trunk and legs.[54] The softball pitcher engages the gluteal muscles to achieve stabilization of the pelvis, which in turn helps the scapula achieve adequate control.

The lower extremity supports the mechanics of the upper body during the softball windmill pitch, especially during the single-leg support component; however, the site of failure (injury) may not be located where the problem originates, but at a more remote site (the weakest link). This kinetic chain theory produces "culprits" and "victims" in describing injuries. For example, although 70% of 131 injuries to collegiate softball pitchers were from overuse, only 13% were reported in the lower extremity.[55] The majority occurred in the shoulder or elbow. Thus, although the "culprit" may be weak gluteal muscles and lack of pelvic stabilization, the athlete may present with shoulder pain, because the "victim" shoulder is inherently "the weakest link."

The pelvis and torso work to accelerate the segments of the upper extremity in a sequential manner. Scapular retraction is stimulated by ipsilateral hip extension and trunk extension. A stable scapula is vital for optimal rotator cuff function that helps to keep the humerus in the glenoid fossa (thus avoiding impingement).

Accordingly, examination and treatment of shoulder pain in softball windmill pitchers should include an assessment of and rehabilitation for pelvic stability and gluteal strength. Scapular stabilization must also be evaluated and treated as well as the affected shoulder or elbow. Off-season and preseason conditioning programs for softball windmill pitchers should include gluteal strengthening and pelvic stabilization exercises.

TABLE 2 Little League Baseball 2010 Pitching Guidelines: Rest Requirements for Pitchers

Pitchers 14 y and younger	
66 or more pitches in a day	Four (4) calendar days
51–65 pitches in a day	Three (3) calendar days
36–50 pitches in a day	Two (2) calendar days of rest must be observed
21–35 pitches in a day	One (1) calendar day of rest must be observed
1–20 pitches in a day	NO (0) calendar day of rest must be observed
Pitchers 15–18 y	
76 or more pitches in a day	Four (4) calendar days
61–75 pitches in a day	Three (3) calendar days
46–60 pitches in a day	Two (2) calendar days of rest must be observed
31–45 pitches in a day	One (1) calendar day of rest must be observed
1–30 pitches in a day	NO (0) calendar day of rest must be observed

Source: Little League (http://www.littleleague.org/media/newsarchive/2009/Sep-Dec/LLTournamentRegularSeasonPitchingRulesMadeSame.htm).

ROLE OF EQUIPMENT IN INJURY RISK AND PREVENTION

Playing Equipment

The game of baseball requires playing equipment (ball, bat, gloves, bases), as well as equipment to dress and protect the athlete. Although there are overarching concerns about equipment

performance and safety that apply to every athlete who plays baseball, some concerns typically apply to only a small segment of players depending on age, developmental level, and skill.[56,57]

The ball is the cause of most baseball injuries, through being hit by a pitched ball, being struck while attempting to field a batted ball, trying to catch a thrown ball, or being hit by a thrown or batted ball while running the bases. Accordingly, modifications in the hardness and compressibility of baseballs (and softballs) were developed by equipment manufacturers several decades ago for use by children of different ages with the intent of reducing the force of impact by the ball while maintaining adequate performance characteristics; they were known as reduction-in-force balls. These softer balls, however, are alleged to possess a more "lively" bounce than traditional baseballs.[56–58] The National Operating Committee on Standard for Athletic Equipment (NOCSAE) has developed standards for these softer baseballs (levels 1, 2, and 3),[59,60] and an expert review panel and other researchers have indicated that softer balls meeting the NOCSAE standard are less likely to cause injury, specifically serious head injury or commotio cordis by impact.[22–24,60,61] Children with the lowest skill level (in general, those younger than 10 years) should use the lowest-impact NOCSAE-approved balls (level 1). Level 2 low-impact balls are designed for children 10 to 12 years of age with moderate skill levels. Children younger than 10 years of age with moderate skills may use either level 1 or level 2 balls. Level 3 balls are designated for youths older than 12 years and those 10 to 12 years of age with advanced skills.[61]

Baseball has the highest number of sports-related eye injuries in children, with the highest incidence in 5- to 14-year-olds (T.J. Schroeder, MS, personal communication, 2009).[11,13] Approximately one-third of baseball-related eye injuries result from being struck by a pitched ball; other common causes of eye injuries are attempting to field a batted ball or catch a thrown ball.

The composition of the bat has provoked much discussion in recent years, especially for baseball players older than 15 years. Composite (metal) bats have largely replaced wooden bats.[62] Initially, the introduction of metal bats led to an increased velocity of the batted ball, putting fielders at greater risk of injury, especially pitchers and third basemen.[62] Considerable research has been conducted comparing both types of bats, but no consensus exists regarding safety of composite metal bats compared with wooden bats in youth baseball.[62,63] All bats, wooden or metal, are momentarily deformed upon contact with the baseball; the recoil or restitution characteristics of the bat to its usual shape result in imparting additional velocity to the batted ball. Industry performance standards for composite metal bats were developed in 2003 through the leadership of the National Collegiate Athletic Association and National Federation of State High School Associations. These standards limit the dimensions of the bat and its capacity to transfer force (velocity) to the batted ball (ball exit speed ratio). Bat composition for National Collegiate Athletic Association baseball was required to meet the Batted Ball Coefficient of Restitution guidelines in 2011, and high school baseball will follow suit in 2012.[64] For Little League Baseball, the maximum bat length is 33 inches and maximum barrel diameter may not exceed 2 1/4 inches. Since 2009, all Little League bats must be labeled with a bat performance factor of 1.15 or lower.[65,66] Bat performance factor is a measure of a nonwood bat's performance relative to wood bats. For 2011, Little League International has imposed a moratorium on the use of composite bats for all baseball divisions citing research that found that "composite bats, while they meet the standard when new, can exceed that standard after a break-in process."[67] Although the media continue to report anecdotal stories of significant head and facial injuries associated with metal bats, epidemiological injury surveillance studies do not show an increase in the rate of such injuries since metal bats were introduced.[62]

Equipment-related injuries also include those caused by bases and cleats. Foot and ankle injuries occur regularly in baseball and softball, especially during sliding. Early studies showed that at least 35% of all injuries in softball occurred while sliding feet first into a base, and, in one study, 82% of those injuries resulted in ankle fractures or dislocations.[68,69] Subsequently, a 2-year study comparing traditional stationary bases and bases capable of disengaging noted a greater than 95% reduction in foot and ankle injuries with breakaway bases.[70–74] In 2008, Little League baseball and softball mandated the use of breakaway bases.[74] Youth softball leagues have also incorporated the use of a separate "runner's base" at first base to avoid collisions; the orange "runner's base" sits adjacent to the white regular base, but in foul territory, providing the runner and fielder separate, equal-size bases. Metal spikes are dangerous to basemen covering bases; rubber spikes are preferred for youth baseball.

Protective Equipment

Protective equipment should always be properly fitted, well maintained, and clean; equipment hygiene is important to prevent infections, such as methicillin-resistant *Staphylococcus aureus*. Although not all equipment adaptations have been tested scientifically for

efficacy, experts believe those mentioned in this article will help reduce injuries in softball and baseball players.[24]

Padded sliding pants worn underneath the baseball pants provide good protection against contusions and abrasions to the hips and thigh when athletes slide feet first into a base. For athletes who slide head and hands first, wearing gloves can reduce hand abrasions; similarly, use of batting gloves improves the grip on the bat and reduces the risk of blisters. Head-first sliding creates the risk of head injuries from collisions with the fielder or from being hit by a thrown ball; upper-extremity injuries can occur from the contact and deceleration forces that occur when the hands of the diving body encounter the stationary base. According to current Little League Baseball rules, a runner may not slide head-first except when retreating to a previously held base.[75]

Chest protectors for batters were introduced in the 1990s to protect the heart from ball impact, which can cause commotio cordis.[19] However, this protective barrier has not been shown to be reliable in either the human experience or in animal laboratory studies.[22–25,28,63] More study is required to develop and target equipment that will better prevent commotio cordis.[24] Recent design modifications indicate that progress is being made, but these advances have not been validated in evidence-based peer-reviewed scientific journal articles or abstracts presented at professional meetings.[76] Even the chest protectors for catchers, which are effective for blunting the usual forces encountered from pitches, foul tips, throws, and collisions do not reliably prevent commotio cordis.[24,77]

Hard plastic shell batting helmets have long been an integral part of protecting baseball and softball players from head injuries while batting and running the bases. The NOCSAE developed standards for helmets and their testing decades ago.[59] Their design and characteristics have been modified over the years to better protect the eyes, ears, face, mouth, and nose.[78] In 2009, a new batting helmet was introduced with the capacity to withstand the impact of a 100-mph fastball; it has a layer of expanded polypropylene, the hard, foamlike material used in bicycle helmets.[79,80]

Face and eye protection can be achieved by securing additional protection to the batting helmet, such as a polycarbonate plastic face guard, metal cage, or a polycarbonate full-face shield. Although full plastic face shields have been demonstrated to reduce injury risk significantly, their acceptance by players and league officials has been mixed, primarily because of compromised visibility through the shield over time.[56] More recent epidemiological research among high school baseball athletes has led to a call for infielders and pitchers to wear face shields.[14]

Eye protection may be worn to reduce the risk for eye injury.[81–84] This protection may be particularly important for young athletes who have undergone eye surgery or experienced a previous serious eye injury.[85] Polycarbonate face guards and shields must meet the F910 standard of the American Society of Testing and Materials.[84,86] Face guards cover the lower part of the face from the tip of the nose to below the chin, directly protecting the teeth and facial bones; the space between the top of the guard and the brim of the helmet is less than the diameter of a baseball, thereby indirectly protecting the eyes without impairing vision. Functionally one-eyed athletes (best corrected vision in the worse eye of less than 20/50) must use one of these protectors when batting and also must protect their good eye when fielding the ball by using polycarbonate sports goggles that meet American Society of Testing and Materials standard F803.[86] Some parents may also prefer the use of a face guard or eye goggles when their children are in the field. All athletes who wear glasses or sunglasses while playing baseball or softball should make sure that the lenses and frames meet appropriate safety standards, thus minimizing the risk of breaking or shattering on contact with a baseball or softball.[86]

An essential piece of equipment for all boys playing baseball or softball is use of a hard plastic athletic cup to protect the testicles. Although catchers, pitchers, and infielders are at the greatest risk, testicular injuries can occur to any player while in the field, batting, or running the bases.

The development of triangular-shaped foam pads ("knee savers") for catchers is another advance in safety equipment that has enjoyed widespread use since its introduction.[87] These pads fit into the popliteal fossa behind the knee and are designed to minimize the strain on the knee joint while the catcher is in the crouched position. Some batters opt for shin guards to protect their medial distal tibia; another innovation gaining notice is the elbow protective pad for batters.

ENVIRONMENTAL RISKS

Environmental risks include weather-related concerns and field conditions and boundaries (perimeters).

Baseball and softball players are at risk for injury from weather-related factors, including lightning, sun, and heat. Recreational facilities managers, coaches, and umpires need to be well-versed in lightning safety guidelines[5,88] and prepare an emergency action prevention plan in advance. In particular, lightning presents a unique challenge because of the difficulty in

predicting and appreciating the presence of electrical storms. More and more facilities are installing automatic lightning detectors and alarm systems to ensure that everyone responds appropriately to the presence of lightning. In the absence of an automated warning system, estimating the distance of the storm from the fields can be accomplished by counting the number of seconds between seeing lightning and hearing thunder. Divide the number of seconds by 5 to estimate the distance in miles. A "flash-to-bang" of 30 seconds or less is an indication to move athletes and spectators to a safe area. A preassigned individual should be responsible for the decision to evacuate. In general, a period of 30 minutes should elapse from the last sound of thunder and from the last visible lightning flash before play should be resumed.

Hot and/or humid weather conditions pose significant risk for heat-related illness in children and adolescents. Ambient temperature, relative humidity, wind speed, and solar radiant heat all affect risk for heat illness.[89,90] The ability to dissipate body heat into the surrounding environment decreases as the ambient temperature rises closer to body temperature. Similarly, as the humidity rises and the air becomes more saturated with water, the ability to cool oneself through evaporation decreases. Wind and sun exposure can damage the skin and eyes. Being acclimatized to the environment, ensuring adequate hydration, wearing a baseball cap, and having a covered dugout are important features of minimizing the risk of sun- and heat-related illness. Recommendations regarding sunscreen, sunglasses, and proper uniforms for practice and games are appropriate for players of all ages. Similarly, in cold weather, athletes need to be properly dressed. When necessary, games should be postponed or game times altered when weather conditions are extreme.

Fields need to be inspected regularly for hazards, including problems with sprinkler heads, gopher holes in the outfield, or rocky infields. A warning track (usually 15 feet wide) should surround the entire grass or artificial turf playing surface and should meet all recommended specifications; the change in surface texture serves to alert fielders that they are nearing the perimeter barriers, such as when outfielders are going back on long hits to the fence. All fences should be in good repair, especially the backstop and the fence along both foul lines. If a chain-link fence is curled up and the grass becomes high, an athlete may receive a laceration when reaching down to pick up the ball (not noticing the hazard produced by the defective fencing).

Elimination of the on-deck circle, placing dugouts behind a fence, and the wearing of batting helmets by the first-base and third-base coaches have further reduced the risk of injury on the playing field.

DEVELOPMENTAL CONSIDERATIONS

The pediatrician needs to have an understanding of developmental considerations as they apply to baseball and softball participation at various ages. This will allow the pediatrician to offer appropriate counseling and guidance to the many boys and girls, their parents, and members of the sporting community who participate in baseball and softball each year.

Compared with older players, children between 5 and 10 years often have less coordination, slower reaction times, a reduced ability to pitch accurately, and a greater fear of being struck by the ball.[91,92] Some developmentally appropriate rule modifications, therefore, are advisable for this age group, including the use of batting tee, a pitching machine, or an adult pitcher. The avoidance of head-first sliding for children younger than 10 years is especially important, because there have been anecdotal reports of rare but serious cervical spine injuries occurring when a young player slides head-first, hitting an opponent with the top of the helmet. This injury is similar to that caused by "spearing" (using the head as the lead object) in football. Feet-first sliding should be taught consistently (as players become developmentally ready) so that all players become comfortable with this key technique of the game. The use of softer balls, as described in a previous section of this statement, is also recommended in this age group to reduce serious impact injury.

Youth baseball has long recognized that the game must be modified to meet the developmental level and skills of its players. The distance between bases begins at 45 feet for Tee Ball, moves to 60 feet for Minor League and Little League (Majors) for ages 10 to 12 years, goes to 70 to 75 feet for ages 13 to 15 years, and eventually advances to 90 feet for boys 16 to 18 years of age; similarly, the pitcher's mound increases from 46 feet, to 50 feet, to 60.5 feet from home plate, respectively. The distances of the outfield fences also grow as the field enlarges. The length and weight of bats is another variable that changes as the youth grow in size, strength, and ability.

Some children are able to track ball movement at early ages and can accurately move to and catch a fly ball or hit live pitching as early as 5 years old; most children, however, do not achieve these capabilities until ages 8 or 9.[91] Therefore, it is appropriate to begin introduction to baseball batting for 5- to 7-year-olds using a ball that is not moving but placed on a tee. For

children who are capable of hitting a thrown pitched ball, however, being forced to hit the tee ball may not enhance their skill development.

Coaches who are not knowledgeable in child development may become frustrated trying to teach basic skills to young boys and girls who are simply not ready to acquire these skills, no matter how many balls are pitched to them or how many fly balls they are asked to catch during practice. For these reasons, Little League baseball tracks its athletes into the minors and the majors for boys 10 through 12, separating those children who are developmentally advanced from those who are developing at the typical rate. It must be remembered, however, that "late bloomers" may ultimately turn out to be the finest athletes of all, despite their slower beginning. Proper instruction and persistent repetition in the fundamentals of baseball are essential for youth to develop the talent and skills required to perform proficiently at a high level during late adolescence and adulthood.

RECOMMENDATIONS

The American Academy of Pediatrics recommends the following:

1. Because baseball and softball for children 5 through 18 years of age are relatively safe sports, participation should be encouraged by pediatricians.
2. Preventive measures should be used to protect young baseball pitchers from throwing injuries. Adequate core strength and scapular muscle strength provide a critical foundation; proper instruction in throwing mechanics, conditioning, and training is another essential component. Delay introduction of the curve ball until after age 14 and the slider until age 16. Three key elements in preventing overuse injuries in pitchers include: (a) age guidelines regarding the number of pitches thrown daily; (b) rest requirements between pitching assignments; and (c) season and yearly total pitch limits.[38,42,44] Young pitchers should avoid pitching on multiple teams with overlapping seasons; the guidelines for rest requirements must be enforced across all teams. Youth pitchers should not pitch competitively in more than 8 months in any 12-month period; 3 months of rest from pitching are recommended each year. A pitcher should also not be a catcher for his or her team.
3. Parents, coaches, and players should be educated about the early warning signs of elbow and shoulder overuse injuries as well as the importance of parascapular muscle strength. Athletes should cease pitching immediately when signs of arm fatigue or pain occur; they should be encouraged to seek timely and appropriate treatment of significant or persistent pain.[35]
4. Serious and potentially catastrophic baseball injuries can be minimized by the proper use of available safety equipment. This safety equipment includes: (a) for hitters, approved batting helmets with face protection; (b) for catchers, helmets, masks with throat guards, chest protectors, and shin guards; (c) for all male players, hard plastic athletic cup; and (d) for all baseball and softball players, rubber-spiked soles. In light of the relatively high percentage and severity of head, face, and mouth injuries in baseball, strong consideration should be given to head and facial protection for pitchers and infielders, especially in younger age groups and for less-skilled players. Protective equipment should always be properly fitted, well maintained, and clean.
5. Current data show that chest barriers or protection are not sufficiently effective in preventing commotio cordis; thus, the routine use of these heart protectors is not recommended for baseball players at this time. Catchers must continue to wear approved chest protectors.
6. Coaches and officials must be prepared to activate the emergency response system (call 911) and to obtain rapid access to an AED, ideally in less than 3 minutes, to assist young baseball or softball players who are experiencing cardiac arrest or another medical emergency. Coaches should have a local cellular phone and emergency medical phone numbers available for use at all times.
7. Coaches, parents, umpires, and league officials need to be knowledgeable regarding the cause, prevention, recognition, and response to concussion. New policies exist with excellent free educational and prevention materials, especially from the Centers for Disease Control and Prevention. Furthermore, free on-line trainings are available through the Centers for Disease Control and Prevention (http://www.cdc.gov/concussion/) and the National Federation of State High School Associations (www.nfhs.org).
8. Youth baseball and softball players should wear polycarbonate eye protection guards or shields or metal cages on their batting helmets to reduce the risk of eye injury. For functionally one-eyed athletes (best corrected vision in the worse eye of less than 20/50) and those who have undergone eye surgery or experienced previous severe eye injuries, eye protection (one of the 3 types of

face shields or polycarbonate sports goggles) should be required at all times while the athlete is batting or fielding.

9. Children with the lowest skill level (in general, those younger than 10 years of age) should use the lowest-impact NOCSAE-approved balls (level 1). Level 2 low-impact balls are recommended for children 10 to 12 years of age with moderate skill levels. Children younger than 10 years with moderate skills may use either level 1 or level 2 balls. Level 3 balls are designated for youths older than 12 years and those 10 to 12 years of age with advanced skills.
10. Continued research into the relative safety of composite metal versus wooden bats is appropriate and necessary.
11. Awareness of heat and lightning safety is essential for all coaches and officials of Little League baseball and softball. The Web site http://www.lightningsafety.noaa.gov/outdoors.htm[88] and weather forecasts are critical resources for prevention of lightning injuries. When necessary, games or practices should be postponed or game times altered when weather conditions are extreme.
12. Protective fencing of dugouts and benches and the elimination of the on-deck circle are recommended during games and practices in organized and informal participation. Proper field maintenance is required to minimize injury risks.
13. New developmentally appropriate rule modifications should continue to be implemented when indicated.
14. Surveillance of baseball and softball injuries should be continued. Continual strong support of research is essential to develop other new, improved, and efficacious safety equipment and rule modifications.

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POLICY STATEMENT

Breastfeeding and the Use of Human Milk

SECTION ON BREASTFEEDING

KEY WORDS
breastfeeding, complementary foods, infant nutrition, lactation, human milk, nursing

ABBREVIATIONS
AAP—American Academy of Pediatrics
AHRQ—Agency for Healthcare Research and Quality
CDC—Centers for Disease Control and Prevention
CI—confidence interval
CMV—cytomegalovirus
DHA—docosahexaenoic acid
NEC—necrotizing enterocolitis
OR—odds ratio
SIDS—sudden infant death syndrome
WHO—World Health Organization

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abstract

FREE

Breastfeeding and human milk are the normative standards for infant feeding and nutrition. Given the documented short- and long-term medical and neurodevelopmental advantages of breastfeeding, infant nutrition should be considered a public health issue and not only a lifestyle choice. The American Academy of Pediatrics reaffirms its recommendation of exclusive breastfeeding for about 6 months, followed by continued breastfeeding as complementary foods are introduced, with continuation of breastfeeding for 1 year or longer as mutually desired by mother and infant. Medical contraindications to breastfeeding are rare. Infant growth should be monitored with the World Health Organization (WHO) Growth Curve Standards to avoid mislabeling infants as underweight or failing to thrive. Hospital routines to encourage and support the initiation and sustaining of exclusive breastfeeding should be based on the American Academy of Pediatrics-endorsed WHO/UNICEF "Ten Steps to Successful Breastfeeding." National strategies supported by the US Surgeon General's Call to Action, the Centers for Disease Control and Prevention, and The Joint Commission are involved to facilitate breastfeeding practices in US hospitals and communities. Pediatricians play a critical role in their practices and communities as advocates of breastfeeding and thus should be knowledgeable about the health risks of not breastfeeding, the economic benefits to society of breastfeeding, and the techniques for managing and supporting the breastfeeding dyad. The "Business Case for Breastfeeding" details how mothers can maintain lactation in the workplace and the benefits to employers who facilitate this practice. *Pediatrics* 2012;129:e827–e841

INTRODUCTION

Six years have transpired since publication of the last policy statement of the American Academy of Pediatrics (AAP) regarding breastfeeding.[1] Recently published research and systematic reviews have reinforced the conclusion that breastfeeding and human milk are the reference normative standards for infant feeding and nutrition. The current statement updates the evidence for this conclusion and serves as a basis for AAP publications that detail breastfeeding management and infant nutrition, including the *AAP Breastfeeding Handbook for Physicians*,[2] *AAP Sample Hospital Breastfeeding Policy for Newborns*,[3] *AAP Breastfeeding Residency Curriculum*,[4] and the *AAP Safe and Healthy Beginnings Toolkit*.[5] The AAP reaffirms its recommendation of exclusive breastfeeding for about 6 months, followed by continued breastfeeding as complementary foods are introduced, with continuation

of breastfeeding for 1 year or longer as mutually desired by mother and infant.

EPIDEMIOLOGY

Information regarding breastfeeding rates and practices in the United States is available from a variety of government data sets, including the Centers for Disease Control and Prevention (CDC) National Immunization Survey,[6] the NHANES,[7] and Maternity Practices and Infant Nutrition and Care.[8] Drawing on these data and others, the CDC has published the "Breastfeeding Report Card," which highlights the degree of progress in achieving the breastfeeding goals of the Healthy People 2010 targets as well as the 2020 targets (Table 1).[9–11]

The rate of initiation of breastfeeding for the total US population based on the latest National Immunization Survey data are 75%.[11] This overall rate, however, obscures clinically significant sociodemographic and cultural differences. For example, the breastfeeding initiation rate for the Hispanic or Latino population was 80.6%, but for the non-Hispanic black or African American population, it was 58.1%. Among low-income mothers (participants in the Special Supplemental Nutrition Program for Women, Infants, and Children [WIC]), the breastfeeding initiation rate was 67.5%, but in those with a higher income ineligible for WIC, it was 84.6%.[12] Breastfeeding initiation rate was 37% for low-income non-Hispanic black mothers.[7] Similar disparities are age-related; mothers younger than 20 years initiated breastfeeding at a rate of 59.7% compared with the rate of 79.3% in mothers older than 30 years. The lowest rates of initiation were seen among non-Hispanic black mothers younger than 20 years, in whom the breastfeeding initiation rate was 30%.[7]

Although over the past decade, there has been a modest increase in the rate of "any breastfeeding" at 3 and 6 months, in none of the subgroups have the Healthy People 2010 targets been reached. For example, the 6-month "any breastfeeding" rate for the total US population was 43%, the rate for the Hispanic or Latino subgroup was 46%, and the rate for the non-Hispanic black or African American subgroup was only 27.5%. Rates of exclusive breastfeeding are further from Healthy People 2010 targets, with only 13% of the US population meeting the recommendation to breastfeed exclusively for 6 months. Thus, it appears that although the breastfeeding initiation rates have approached the 2010 Healthy People targets, the targets for duration of any breastfeeding and exclusive breastfeeding have not been met.

Furthermore, 24% of maternity services provide supplements of commercial infant formula as a general practice in the first 48 hours after birth. These observations have led to the conclusion that the disparities in breastfeeding rates are also associated with variations in hospital routines, independent of the populations served. As such, it is clear that greater emphasis needs to be placed on improving and standardizing hospital-based practices to realize the newer 2020 targets (Table 1).

TABLE 1 Healthy People Targets 2010 and 2020(%)

	2007[a]	2010 Target	2020 Target
Any breastfeeding			
Ever	75.0	75	81.9
6 mo	43.8	50	60.5
1 y	22.4	25	34.1
Exclusive breastfeeding			
To 3 mo	33.5	40	44.3
To 6 mo	13.8	17	23.7
Worksite lactation support	25	—	38.0
Formula use in first 2 d	25.6	—	15.6

[a] 2007 data reported in 2011.[10]

INFANT OUTCOMES

Methodologic Issues

Breastfeeding results in improved infant and maternal health outcomes in both the industrialized and developing world. Major methodologic issues have been raised as to the quality of some of these studies, especially as to the size of the study populations, quality of the data set, inadequate adjustment for confounders, absence of distinguishing between "any" or "exclusive" breastfeeding, and lack of a defined causal relationship between breastfeeding and the specific outcome. In addition, there are inherent practical and ethical issues that have precluded prospective randomized interventional trials of different feeding regimens. As such, the majority of published reports are observational cohort studies and systematic reviews/meta-analyses.

To date, the most comprehensive publication that reviews and analyzes the published scientific literature that compares breastfeeding and commercial infant formula feeding as to health outcomes is the report prepared by the Evidence-based Practice Centers of the Agency for Healthcare Research and Quality (AHRQ) of the US Department of Health Human Services titled *Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries*.[13] The following sections summarize and update the AHRQ meta-analyses and provide an expanded analysis regarding health outcomes. Table 2 summarizes the dose-response relationship between the duration of breastfeeding and its protective effect.

Respiratory Tract Infections and Otitis Media

The risk of hospitalization for lower respiratory tract infections in the first year is reduced 72% if infants breastfed exclusively for more than 4 months.[13,14] Infants who exclusively breastfed for 4

TABLE 2 Dose-Response Benefits of Breastfeeding[a]

Condition	% Lower Risk[b]	Breastfeeding	Comments	OR[c]	95% CI
Otitis media[13]	23	Any	—	0.77	0.64–0.91
Otitis media[13]	50	≥3 or 6 mo	Exclusive BF	0.50	0.36–0.70
Recurrent otitis media[15]	77	Exclusive BF ≥6 mo[d]	Compared with BF 4 to <6 mo[d]	1.95	1.06–3.59
Upper respiratory tract infection[17]	63	>6 mo	Exclusive BF	0.30	0.18–0.74
Lower respiratory tract infection[13]	72	≥4 mo	Exclusive BF	0.28	0.14–0.54
Lower respiratory tract infection[15]	77	Exclusive BF ≥6 mo[d]	Compared with BF 4 to <6 mo[d]	4.27	1.27–14.35
Asthma[13]	40	≥3 mo	Atopic family history	0.60	0.43–0.82
Asthma[13]	26	≥3 mo	No atopic family history	0.74	0.6–0.92
RSV bronchiolitis[16]	74	>4 mo	—	0.26	0.074–0.9
NEC[19]	77	NICU stay	Preterm infants Exclusive HM	0.23	0.51–0.94
Atopic dermatitis[27]	27	>3 mo	Exclusive BFnegative family history	0.84	0.59–1.19
Atopic dermatitis[27]	42	>3 mo	Exclusive BFpositive family history	0.58	0.41–0.92
Gastroenteritis[13,14]	64	Any	—	0.36	0.32–0.40
Inflammatory bowel disease[32]	31	Any	—	0.69	0.51–0.94
Obesity[13]	24	Any	—	0.76	0.67–0.86
Celiac disease[31]	52	>2 mo	Gluten exposure when BF	0.48	0.40–0.89
Type 1 diabetes[13,42]	30	>3 mo	Exclusive BF	0.71	0.54–0.93
Type 2 diabetes[13,43]	40	Any	—	0.61	0.44–0.85
Leukemia (ALL)[13,46]	20	>6 mo	—	0.80	0.71–0.91
Leukemia (AML)[13,45]	15	>6 mo	—	0.85	0.73–0.98
SIDS[13]	36	Any >1 mo	—	0.64	0.57–0.81

ALL, acute lymphocytic leukemia; AML, acute myelogenous leukemia; BF, breastfeeding; HM, human milk; RSV, respiratory syncytial virus.

[a] Pooled data.

[b] % lower risk refers to lower risk while BF compared with feeding commercial infant formula or referent group specified.

[c] OR expressed as increase risk for commercial formula feeding.

[d] Referent group is exclusive BF ≥6 months.

to 6 months had a fourfold increase in the risk of pneumonia compared with infants who exclusively breastfed for more than 6 months.[15] The severity (duration of hospitalization and oxygen requirements) of respiratory syncytial virus bronchiolitis is reduced by 74% in infants who breastfed exclusively for 4 months compared with infants who never or only partially breastfed.[16]

Any breastfeeding compared with exclusive commercial infant formula feeding will reduce the incidence of otitis media (OM) by 23%.[13] Exclusive breastfeeding for more than 3 months reduces the risk of otitis media by 50%. Serious colds and ear and throat infections were reduced by 63% in infants who exclusively breastfed for 6 months.[17]

Gastrointestinal Tract Infections

Any breastfeeding is associated with a 64% reduction in the incidence of nonspecific gastrointestinal tract infections, and this effect lasts for 2 months after cessation of breastfeeding.[13,14,17,18]

Necrotizing Enterocolitis

Meta-analyses of 4 randomized clinical trials performed over the period 1983 to 2005 support the conclusion that feeding preterm infants human milk is associated with a significant reduction (58%) in the incidence of necrotizing enterocolitis (NEC).[13] A more recent study of preterm infants fed an exclusive human milk diet compared with those fed human milk supplemented with cow-milk-based infant formula products noted a 77% reduction in NEC.[19] One case of NEC could be prevented if 10 infants received an exclusive human milk diet, and 1 case of NEC requiring surgery or resulting in death could be prevented if 8 infants received an exclusive human milk diet.[19]

Sudden Infant Death Syndrome and Infant Mortality

Meta-analyses with a clear definition of degree of breastfeeding and adjusted for confounders and other known risks for sudden infant death syndrome (SIDS) note that breastfeeding is associated with a 36% reduced risk of SIDS.[13] Latest data comparing any versus exclusive breastfeeding reveal that for any breastfeeding, the multivariate odds ratio (OR) is 0.55 (95% confidence interval [CI], 0.44–0.69). When computed for exclusive breastfeeding, the OR is 0.27 (95% CI, 0.27–0.31).[20] A proportion (21%) of the US infant mortality has been attributed, in part, to the increased rate of SIDS in infants who were never breastfed.[21] That the positive effect of breastfeeding on SIDS rates is independent of sleep position was confirmed in a large case-control study of supine-sleeping infants.[22,23]

It has been calculated that more than 900 infant lives per year may be saved in the United States if 90% of mothers exclusively breastfed for 6 months.[24] In the 42 developing countries in which 90% of the world's childhood deaths occur, exclusive breastfeeding for 6 months and weaning after 1 year is the most effective intervention, with the potential of preventing more than 1 million infant deaths per year, equal to preventing 13% of the world's childhood mortality.[25]

Allergic Disease

There is a protective effect of exclusive breastfeeding for 3 to 4 months in

reducing the incidence of clinical asthma, atopic dermatitis, and eczema by 27% in a low-risk population and up to 42% in infants with positive family history.[13,26] There are conflicting studies that examine the timing of adding complementary foods after 4 months and the risk of allergy, including food allergies, atopic dermatitis, and asthma, in either the allergy-prone or nonatopic individual.[26] Similarly, there are no convincing data that delaying introduction of potentially allergenic foods after 6 months has any protective effect.[27–30] One problem in analyzing this research is the low prevalence of exclusive breastfeeding at 6 months in the study populations. Thus, research outcomes in studies that examine the development of atopy and the timing of introducing solid foods in partially breastfed infants may not be applicable to exclusively breastfed infants.

Celiac Disease

There is a reduction of 52% in the risk of developing celiac disease in infants who were breastfed at the time of gluten exposure.[31] Overall, there is an association between increased duration of breastfeeding and reduced risk of celiac disease when measured as the presence of celiac antibodies. The critical protective factor appears to be not the timing of the gluten exposure but the overlap of breastfeeding at the time of the initial gluten ingestion. Thus, gluten-containing foods should be introduced while the infant is receiving only breast milk and not infant formula or other bovine milk products.

Inflammatory Bowel Disease

Breastfeeding is associated with a 31% reduction in the risk of childhood inflammatory bowel disease.[32] The protective effect is hypothesized to result from the interaction of the immunomodulating effect of human milk and the underlying genetic susceptibility of the infant. Different patterns of intestinal colonization in breastfed versus commercial infant formula–fed infants may add to the preventive effect of human milk.[33]

Obesity

Because rates of obesity are significantly lower in breastfed infants, national campaigns to prevent obesity begin with breastfeeding support.[34,35] Although complex factors confound studies of obesity, there is a 15% to 30% reduction in adolescent and adult obesity rates if any breastfeeding occurred in infancy compared with no breastfeeding.[13,36] The Framingham Offspring study noted a relationship of breastfeeding and a lower BMI and higher high-density lipoprotein concentration in adults.[37] A sibling difference model study noted that the breastfed sibling weighed 14 pounds less than the sibling fed commercial infant formula and was less likely to reach BMI obesity threshold.[38] The duration of breastfeeding also is inversely related to the risk of overweight; each month of breastfeeding being associated with a 4% reduction in risk.[14]

The interpretation of these data is confounded by the lack of a definition in many studies of whether human milk was given by breastfeeding or by bottle. This is of particular importance, because breastfed infants self-regulate intake volume irrespective of maneuvers that increase available milk volume, and the early programming of self-regulation, in turn, affects adult weight gain.[39] This concept is further supported by the observations that infants who are fed by bottle, formula, or expressed breast milk will have increased bottle emptying, poorer self-regulation, and excessive weight gain in late infancy (older than 6 months) compared with infants who only nurse from the breast.[40,41]

Diabetes

Up to a 30% reduction in the incidence of type 1 diabetes mellitus is reported for infants who exclusively breastfed for at least 3 months, thus avoiding exposure to cow milk protein.[13,42] It has been postulated that the putative mechanism in the development of type 1 diabetes mellitus is the infant's exposure to cow milk β-lactoglobulin, which stimulates an immune-mediated process cross-reacting with pancreatic β cells. A reduction of 40% in the incidence of type 2 diabetes mellitus is reported, possibly reflecting the long-term positive effect of breastfeeding on weight control and feeding self-regulation.[43]

Childhood Leukemia and Lymphoma

There is a reduction in leukemia that is correlated with the duration of breastfeeding.[14,44] A reduction of 20% in the risk of acute lymphocytic leukemia and 15% in the risk of acute myeloid leukemia in infants breastfed for 6 months or longer.[45,46] Breastfeeding for less than 6 months is protective but of less magnitude (approximately 12% and 10%, respectively). The question of whether the protective effect of breastfeeding is a direct mechanism of human milk on malignancies or secondarily mediated by its reduction of early childhood infections has yet to be answered.

Neurodevelopmental Outcomes

Consistent differences in neurodevelopmental outcome between breastfed and commercial infant formula–fed infants have been reported, but the outcomes are confounded by differences in parental education, intelligence, home environment, and socioeconomic status.[13,47] The large, randomized Promotion of Breastfeeding Intervention Trial provided evidence that adjusted outcomes of intelligence scores and teacher's ratings are significantly greater in breastfed infants.[48–50] In

addition, higher intelligence scores are noted in infants who exclusively breastfed for 3 months or longer, and higher teacher ratings were observed if exclusive breastfeeding was practiced for 3 months or longer. Significantly positive effects of human milk feeding on long-term neurodevelopment are observed in preterm infants, the population more at risk for these adverse neurodevelopmental outcomes.[51–54]

PRETERM INFANTS

There are several significant short- and long-term beneficial effects of feeding preterm infants human milk. Lower rates of sepsis and NEC indicate that human milk contributes to the development of the preterm infant's immature host defense.[19,55–59] The benefits of feeding human milk to preterm infants are realized not only in the NICU but also in the fewer hospital readmissions for illness in the year after NICU discharge.[51,52] Furthermore, the implications for a reduction in incidence of NEC include not only lower mortality rates but also lower long-term growth failure and neurodevelopmental disabilities.[60,61] Clinical feeding tolerance is improved, and the attainment of full enteral feeding is hastened by a diet of human milk.[51,52,59]

Neurodevelopmental outcomes are improved by the feeding of human milk. Long-term studies at 8 years of age through adolescence suggest that intelligence test results and white matter and total brain volumes are greater in subjects who had received human milk as infants in the NICU.[53,54] Extremely preterm infants receiving the greatest proportion of human milk in the NICU had significantly greater scores for mental, motor, and behavior ratings at ages 18 months and 30 months.[51,52] These data remain significant after adjustment for confounding factors, such as maternal age, education, marital status, race, and infant morbidities. These neurodevelopmental outcomes are associated with predominant and not necessarily exclusive human milk feeding. Human milk feeding in the NICU also is associated with lower rates of severe retinopathy of prematurity.[62,63] Long-term studies of preterm infants also suggest that human milk feeding is associated with lower rates of metabolic syndrome, and in adolescents, it is associated with lower blood pressures and low-density lipoprotein concentrations and improved leptin and insulin metabolism.[64,65]

The potent benefits of human milk are such that all preterm infants should receive human milk (Table 3). Mother's own milk, fresh or frozen, should be the primary diet, and it should be fortified appropriately for the infant born weighing less than 1.5 kg. If mother's own milk is unavailable despite significant lactation support, pasteurized donor milk should be used.[19,66] Quality control of pasteurized donor milk is important and should be monitored. New data suggest that mother's own milk can be stored at refrigerator temperature (4°C) in the NICU for as long as 96 hours.[67] Data on thawing, warming, and prolonged storage need updating. Practices should involve protocols that prevent misadministration of milk.

TABLE 3 Recommendations on Breastfeeding Management for Preterm Infants

1. All preterm infants should receive human milk.
   - Human milk should be fortified, with protein, minerals, and vitamins to ensure optimal nutrient intake for infants weighing <1500 g at birth.
   - Pasteurized donor human milk, appropriately fortified, should be used if mother's own milk is unavailable or its use is contraindicated.
2. Methods and training protocols for manual and mechanical milk expression must be available to mothers.
3. Neonatal intensive care units should possess evidence-based protocols for collection, storage, and labeling of human milk.[150]
4. Neonatal intensive care units should prevent the misadministration of human milk (http://www.cdc.gov/breastfeeding/recommendations/other_mothers_milk.htm).
5. There are no data to support routinely culturing human milk for bacterial or other organisms.[151]

MATERNAL OUTCOMES

Both short- and long-term health benefits accrue to mothers who breastfeed. Such mothers have decreased postpartum blood loss and more rapid involution of the uterus. Continued breastfeeding leads to increased child spacing secondary to lactational amenorrhea. Prospective cohort studies have noted an increase in postpartum depression in mothers who do not breastfeed or who wean early.[68] A large prospective study on child abuse and neglect perpetuated by mothers found, after correcting for potential confounders, that the rate of abuse/neglect was significantly increased for mothers who did not breastfeed as opposed to those who did (OR: 2.6; 95% CI: 1.7–3.9).[69]

Studies of the overall effect of breastfeeding on the return of the mothers to their pre-pregnancy weight are inconclusive, given the large numbers of confounding factors on weight loss (diet, activity, baseline BMI, ethnicity).[13] In a covariate-adjusted study of more than 14 000 women postpartum, mothers who exclusively breastfed for longer than 6 months weighed 1.38 kg less than those who did not breastfeed.[70] In mothers without a history of gestational diabetes, breastfeeding duration was associated with a decreased risk of type 2 diabetes mellitus; for each year of breastfeeding, there was a decreased risk of 4% to 12%.[71,72] No beneficial effect for breastfeeding was noted in mothers who were diagnosed with gestational diabetes.

The longitudinal Nurses Health Study noted an inverse relationship between the cumulative lifetime duration of breastfeeding and the development of rheumatoid arthritis.[73] If cumulative duration of breastfeeding exceeded 12

months, the relative risk of rheumatoid arthritis was 0.8 (95% CI: 0.8–1.0), and if the cumulative duration of breastfeeding was longer than 24 months, the relative risk of rheumatoid arthritis was 0.5 (95% CI: 0.3–0.8).[73] An association between cumulative lactation experience and the incidence of adult cardiovascular disease was reported by the Women's Health Initiative in a longitudinal study of more than 139 000 postmenopausal women.[74] Women with a cumulative lactation history of 12 to 23 months had a significant reduction in hypertension (OR: 0.89; 95% CI: 0.84–0.93), hyperlipidemia (OR: 0.81; 95% CI: 0.76–0.87), cardiovascular disease (OR: 0.90; 95% CI: 0.85–0.96), and diabetes (OR: 0.74; 95% CI: 0.65–0.84).

Cumulative lactation experience also correlates with a reduction in both breast (primarily premenopausal) and ovarian cancer.[13,14,75] Cumulative duration of breastfeeding of longer than 12 months is associated with a 28% decrease in breast cancer (OR: 0.72; 95% CI: 0.65–0.8) and ovarian cancer (OR: 0.72; 95% CI: 0.54–0.97).[76] Each year of breastfeeding has been calculated to result in a 4.3% reduction in breast cancer.[76,77]

ECONOMIC BENEFITS

A detailed pediatric cost analysis based on the AHRQ report concluded that if 90% of US mothers would comply with the recommendation to breastfeed exclusively for 6 months, there would be a savings of $13 billion per year.[24] The savings do not include those related to a reduction in parental absenteeism from work or adult deaths from diseases acquired in childhood, such as asthma, type 1 diabetes mellitus, or obesity-related conditions. Strategies that increase the number of mothers who breastfeed exclusively for about 6 months would be of great economic benefit on a national level.

DURATION OF EXCLUSIVE BREASTFEEDING

The AAP recommends exclusive breastfeeding for about 6 months, with continuation of breastfeeding for 1 year or longer as mutually desired by mother and infant, a recommendation concurred to by the WHO[78] and the Institute of Medicine.[79]

Support for this recommendation of exclusive breastfeeding is found in the differences in health outcomes of infants breastfed exclusively for 4 vs 6 months, for gastrointestinal disease, otitis media, respiratory illnesses, and atopic disease, as well as differences in maternal outcomes of delayed menses and postpartum weight loss.[15,18,80]

Compared with infants who never breastfed, infants who were exclusively breastfed for 4 months had significantly greater incidence of lower respiratory tract illnesses, otitis media, and diarrheal disease than infants exclusively breastfed for 6 months or longer.[15,18] When compared with infants who exclusively breastfed for longer than 6 months, those exclusively breastfed for 4 to 6 months had a fourfold increase in the risk of pneumonia.[15] Furthermore, exclusively breastfeeding for 6 months extends the period of lactational amenorrhea and thus improves child spacing, which reduces the risk of birth of a preterm infant.[81]

The AAP is cognizant that for some infants, because of family and medical history, individual developmental status, and/or social and cultural dynamics, complementary feeding, including gluten-containing grains, begins earlier than 6 months of age.[82,83] Because breastfeeding is immunoprotective, when such complementary foods are introduced, it is advised that this be done while the infant is feeding only breastmilk.[82] Mothers should be encouraged to continue breastfeeding through the first year and beyond as more and varied complementary foods are introduced.

CONTRAINDICATIONS TO BREASTFEEDING

There are a limited number of medical conditions in which breastfeeding is contraindicated, including an infant with the metabolic disorder of classic galactosemia. Alternating breastfeeding with special protein-free or modified formulas can be used in feeding infants with other metabolic diseases (such as phenylketonuria), provided that appropriate blood monitoring is available. Mothers who are positive for human T-cell lymphotrophic virus type I or II[84] or untreated brucellosis[85] should not breastfeed nor provide expressed milk to their infants Breastfeeding should not occur if the mother has active (infectious) untreated tuberculosis or has active herpes simplex lesions on her breast; however, expressed milk can be used because there is no concern about these infectious organisms passing through the milk. Breastfeeding can be resumed when a mother with tuberculosis is treated for a minimum of 2 weeks and is documented that she is no longer infectious.[86] Mothers who develop varicella 5 days before through 2 days after delivery should be separated from their infants, but their expressed milk can be used for feeding.[87] In 2009, the CDC recommended that mothers acutely infected with H1N1 influenza should temporarily be isolated from their infants until they are afebrile, but they can provide expressed milk for feeding.[88]

In the industrialized world, it is not recommended that HIV-positive mothers breastfeed. However, in the developing world, where mortality is increased in non-breastfeeding infants from a combination of malnutrition and infectious diseases, breastfeeding may outweigh the risk of the acquiring HIV infection

from human milk. Infants in areas with endemic HIV who are exclusively breastfed for the first 3 months are at a lower risk of acquiring HIV infection than are those who received a mixed diet of human milk and other foods and/or commercial infant formula.[89] Recent studies document that combining exclusive breastfeeding for 6 months with 6 months of antiretroviral therapy significantly decreases the postnatal acquisition of HIV-1.[90,91]

There is no contraindication to breastfeeding for a full-term infant whose mother is seropositive for cytomegalovirus (CMV). There is a possibility that CMV acquired from mother's milk may be associated with a late-onset sepsis-like syndrome in the extremely low birth weight (birth weight <1500 g) preterm infant. Although not associated with long-term abnormalities, such a syndrome may warrant antiviral therapy.[92] The value of routinely feeding human milk from seropositive mothers to preterm infants outweighs the risks of clinical disease, especially because no long-term neurodevelopmental abnormalities have been reported.[93] Freezing of milk reduces but does not eliminate CMV.[94] Heating, either as Holder pasteurization (heating at 62.5°C for 30 minutes) or high-temperature short pasteurization (72°C for 5–10 seconds) eliminates the viral load from the milk but also affects bioactive factors and nutrients.[95] Thus, fresh mother's own milk is preferable for routinely feeding all preterm infants.

Maternal substance abuse is not a categorical contraindication to breastfeeding. Adequately nourished narcotic-dependent mothers can be encouraged to breastfeed if they are enrolled in a supervised methadone maintenance program and have negative screening for HIV and illicit drugs.[96] Street drugs such as PCP (phencyclidine), cocaine, and cannabis can be detected in human milk, and their use by breastfeeding mothers is of concern, particularly with regard to the infant's long-term neurobehavioral development and thus are contraindicated.[97] Alcohol is not a galactogogue; it may blunt prolactin response to suckling and negatively affects infant motor development.[98,99] Thus, ingestion of alcoholic beverages should be minimized and limited to an occasional intake but no more than 0.5 g alcohol per kg body weight, which for a 60 kg mother is approximately 2 oz liquor, 8 oz wine, or 2 beers.[100] Nursing should take place 2 hours or longer after the alcohol intake to minimize its concentration in the ingested milk.[101] Maternal smoking is not an absolute contraindication to breastfeeding but should be strongly discouraged, because it is associated with an increased incidence in infant respiratory allergy[102] and SIDS.[103] Smoking should not occur in the presence of the infant so as to minimize the negative effect of secondary passive smoke inhalation.[104] Smoking is also a risk factor for low milk supply and poor weight gain.[105,106]

MATERNAL DIET

Well-nourished lactating mothers have an increased daily energy need of 450 to 500 kcal/day that can be met by a modest increase in a normally balanced varied diet.[107–109] Although dietary reference intakes for breastfeeding mothers are similar to or greater than those during pregnancy, there is no routine recommendation for maternal supplements during lactation.[108,109,110] Many clinicians recommend the continued use of prenatal vitamin supplements during lactation.[109]

The mother's diet should include an average daily intake of 200 to 300 mg of the ω-3 long-chain polyunsaturated fatty acids (docosahexaenoic acid [DHA]) to guarantee a sufficient concentration of preformed DHA in the milk.[111,112] Consumption of 1 to 2 portions of fish (eg, herring, canned light tuna, salmon) per week will meet this need. The concern regarding the possible risk from intake of excessive mercury or other contaminants is offset by the neurobehavioral benefits of an adequate DHA intake and can be minimized by avoiding the intake of predatory fish (eg, pike, marlin, mackerel, tile fish, swordfish).[113] Poorly nourished mothers or those on selective vegan diets may require a supplement of DHA as well as multivitamins.

MATERNAL MEDICATIONS

Recommendations regarding breastfeeding in situations in which the mother is undergoing either diagnostic procedures or pharmacologic therapy must balance the benefits to the infant and the mother against the potential risk of drug exposure to the infant. There are only a limited number of agents that are contraindicated, and an appropriate substitute usually can be found. The most comprehensive, up-to-date source of information regarding the safety of maternal medications when the mother is breastfeeding is LactMed, an Internet-accessed source published by the National Library of Medicine/National Institutes of Health.[114] A forthcoming AAP policy statement on the transfer of drugs and other chemicals into human milk will provide additional recommendations, with particular focus on psychotropic drugs, herbal products, galactagogues, narcotics, and pain medications.[115] In general, breastfeeding is not recommended when mothers are receiving medication from the following classes of drugs: amphetamines, chemotherapy agents, ergotamines, and statins.

There are a wide variety of maternally administered psychotropic agents for which there are inadequate pharmacologic data with regard to human milk and/or nursing infant's blood

concentrations. In addition, data regarding the long-term neurobehavioral effects from exposure to these agents during the critical developmental period of early infancy are lacking. A recent comprehensive review noted that of the 96 psychotropic drugs available, pharmacologic and clinical information was only available for 62 (65%) of the drugs.[116] In only 19 was there adequate information to allow for defining a safety protocol and thus qualifying to be compatible for use by lactating mothers. Among the agents considered to be least problematic were the tricyclic antidepressants amitriptyline and clomipramine and the selective serotonin-reuptake inhibitors paroxetine and sertraline.

Detailed guidelines regarding the necessity for and duration of temporary cessation of breastfeeding after maternal exposure to diagnostic radioactive compounds are provided by the US Nuclear Regulatory Commission and in medical reviews.[117–119] Special precaution should be followed in the situation of breastfeeding infants with glucose-6-phosphate-dehydrogenase deficiency. Fava beans, nitrofurantoin, primaquine, and phenazopyridine should be avoided by the mother to minimize the risk of hemolysis in the infant.[120]

HOSPITAL ROUTINES

The Sections on Breastfeeding and Perinatal Pediatrics have published the Sample Hospital Breastfeeding Policy that is available from the AAP Safe and Healthy Beginnings Web site.[3,5] This sample hospital policy is based on the detailed recommendations of the previous AAP policy statement "Breastfeeding and the Use of Human Milk"[1] as well as the principles of the 1991 WHO/UNICEF publication "Tens Steps to Successful Breastfeeding" (Table 4)[121] and provides a template for developing a uniform hospital policy for support of breastfeeding.[122] In particular, emphasis is placed on the need to revise or discontinue disruptive hospital policies that interfere with early skin-to-skin contact, that provide water, glucose water, or commercial infant formula without a medical indication, that restrict the amount of time the infant can be with the mother, that limit feeding duration, or that provide unlimited pacifier use.

In 2009, the AAP endorsed the Ten Steps program (see Table 4). Adherence to these 10 steps has been demonstrated to increase rates of breastfeeding initiation, duration, and exclusivity.[122,123] Implementation of the following 5 postpartum hospital practices has been demonstrated to increase breastfeeding duration, irrespective of socioeconomic status: breastfeeding in the first hour after birth, exclusive breastfeeding, rooming-in, avoidance of pacifiers, and receipt of telephone number for support after discharge from the hospital.[124]

The CDC National Survey of Maternity Practices in Infant Nutrition and Care has assessed the lactation practices in more than 80% of US hospitals and noted that the mean score for implementation of the Ten Steps was only 65%.[34,125] Fifty-eight percent of hospitals erroneously advised mothers to limit suckling at the breast to a specified length of time, and 41% of the hospitals gave pacifiers to more than some of their newborns—both practices that have been documented to lower breastfeeding rates and duration.[126] The survey noted that in 30% of all birth centers, more than half of all newborns received supplementation commercial infant formula, a practice associated with shorter duration of breastfeeding and less exclusivity.[34,125] As indicated in the benefits section, this early supplementation may affect morbidity outcomes in this population. The survey also reported that 66% of hospitals reported that they distributed to breastfeeding mothers discharge packs that contained commercial infant formula, a practice that has been documented to negatively affect exclusivity and duration of breastfeeding.[127] Few birth centers have model hospital policies (14%) and support breastfeeding mothers after hospital discharge (27%). Only 37% of centers practice more than 5 of the 10 Steps and only 3.5% practice 9 to 10 Steps.[34]

There is, thus, a need for a major conceptual change in the organization of the hospital services for the mother and infant dyad (Table 5). This requires that medical and nursing routines and practices adjust to the principle that breastfeeding should begin within the first hour after birth (even for Cesarean deliveries) and that infants must be continuously accessible to the mother by rooming-in

TABLE 4 WHO/UNICEF Ten Steps to Successful Breastfeeding

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in the skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within the first hour of birth.
5. Show mothers how to breastfeed and how to maintain lactation even if they are separated from their infants.
6. Give newborn infants no food or drink other than breast milk, unless medically indicated.
7. Practice rooming-in (allow mothers and infants to remain together) 24 h a day.
8. Encourage breastfeeding on demand.
9. Give no artificial nipples or pacifiers to breastfeeding infants.[a]
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from hospital.

[a] The AAP does not support a categorical ban on pacifiers because of their role in SIDS risk reduction and their analgesic benefit during painful procedures when breastfeeding cannot provide the analgesia. Pacifier use in the hospital in the neonatal period should be limited to specific medical indications such as pain reduction and calming in a drug-exposed infant, for example. Mothers of healthy term breastfed infants should be instructed to delay pacifier use until breastfeeding is well-established, usually about 3 to 4 wk after birth.

arrangements that facilitate around-the-clock, on-demand feeding for the healthy infant. Formal staff training should not only focus on updating knowledge and techniques for breastfeeding support but also should acknowledge the need to change attitudes and eradicate unsubstantiated beliefs about the supposed equivalency of breastfeeding and commercial infant formula feeding. Emphasis should be placed on the numerous benefits of exclusive breastfeeding. The importance of addressing the issue of the impact of hospital practices and policies on breastfeeding outcomes is highlighted by the decision of The Joint Commission to adopt the rate of exclusive breast milk feeding as a Perinatal Care Core Measure.[127] As such, the rate of exclusive breastfeeding during the hospital stay has been confirmed as a critical variable when measuring the quality of care provided by a medical facility.

Pacifier Use

Given the documentation that early use of pacifiers may be associated with less successful breastfeeding, pacifier use in the neonatal period should be limited to specific medical situations.[128] These include uses for pain relief, as a calming agent, or as part of structured program for enhancing oral motor function. Because pacifier use has been associated with a reduction in SIDS incidence, mothers of healthy term infants should be instructed to use pacifiers at infant nap or sleep time after breastfeeding is well established, at approximately 3 to 4 weeks of age.[129–131]

Vitamins and Mineral Supplements

Intramuscular vitamin K_1 (phytonadione) at a dose of 0.5 to 1.0 mg should routinely be administered to all infants on the first day to reduce the risk of hemorrhagic disease of the newborn.[132] A delay of administration until after the first feeding at the breast but not later than 6 hours of age is recommended. A single oral dose of vitamin K should not be used, because the oral dose is variably absorbed and does not provide adequate concentrations or stores for the breastfed infant.[132]

Vitamin D deficiency/insufficiency and rickets has increased in all infants as a result of decreased sunlight exposure secondary to changes in lifestyle, dress habits, and use of topical sunscreen preparations. To maintain an adequate serum vitamin D concentration, all breastfed infants routinely should receive an oral supplement of vitamin D, 400 U per day, beginning at hospital discharge.[133]

Supplementary fluoride should not be provided during the first 6 months. From age 6 months to 3 years, fluoride supplementation should be limited to infants residing in communities where the fluoride concentration in the water is <0.3 ppm.[134] Complementary food rich in iron and zinc should be introduced at about 6 months of age. Supplementation of oral iron drops before 6 months may be needed to support iron stores.

Premature infants should receive both a multivitamin preparation and an oral iron supplement until they are ingesting a completely mixed diet and their growth and hematologic status are normalized.

GROWTH

The growth pattern of healthy term breastfed infants differs from the existing CDC "reference" growth curves, which are primarily based on data from few breastfeeding infants. The WHO multicenter curves are based on combined longitudinal data from healthy breastfed infants from birth to 24 months and cross-sectional data from 2 to 5 years of the same children from 6 diverse geographical areas

TABLE 5 Recommendations on Breastfeeding Management for Healthy Term Infants

1. Exclusive breastfeeding for about 6 mo
   - Breastfeeding preferred; alternatively expressed mother's milk, or donor milk
   - To continue for at least the first year and beyond for as long as mutually desired by mother and child
   - Complementary foods rich in iron and other micronutrients should be introduced at about 6 mo of age
2. Peripartum policies and practices that optimize breastfeeding initiation and maintenance should be compatible with the AAP and Academy of Breastfeeding Medicine Model Hospital Policy and include the following:
   - Direct skin-to-skin contact with mothers immediately after delivery until the first feeding is accomplished and encouraged throughout the postpartum period
   - Delay in routine procedures (weighing, measuring, bathing, blood tests, vaccines, and eye prophylaxis) until after the first feeding is completed
   - Delay in administration of intramuscular vitamin K until after the first feeding is completed but within 6 h of birth
   - Ensure 8 to 12 feedings at the breast every 24 h
   - Ensure formal evaluation and documentation of breastfeeding by trained caregivers (including position, latch, milk transfer, examination) at least for each nursing shift
   - Give no supplements (water, glucose water, commercial infant formula, or other fluids) to breastfeeding newborn infants unless medically indicated using standard evidence-based guidelines for the management of hyperbilirubinemia and hypoglycemia
   - Avoid routine pacifier use in the postpartum period
   - Begin daily oral vitamin D drops (400 IU) at hospital discharge
3. All breastfeeding newborn infants should be seen by a pediatrician at 3 to 5 d of age, which is within 48 to 72 h after discharge from the hospital
   - Evaluate hydration (elimination patterns)
   - Evaluate body wt gain (body wt loss no more than 7%
   from birth and no further wt loss by day 5: assess feeding and consider more frequent follow-up)
   - Discuss maternal/infant issues
   - Observe feeding
4. Mother and infant should sleep in proximity to each other to facilitate breastfeeding
5. Pacifier should be offered, while placing infant in back-to-sleep-position, no earlier than 3 to 4 wk of age and after breastfeeding has been established

(Brazil, Ghana, India, Norway, Oman, and the United States).[135] As such, the WHO curves are "standards" and are the normative model for growth and development irrespective of infant ethnicity or geography reflecting the optimal growth of the breastfed infant.[136] Use of the WHO curves for the first 2 years allows for more accurate monitoring of weight and height for age and, in comparison with use of the CDC reference curves, results in more accurate (lower) rates of undernutrition and short stature and (higher) rates of overweight. Furthermore, birth to 6-month growth charts are available where the curves are magnified to permit monitoring of weight trajectories. As such, the WHO curves serve as the best guide for assessing lactation performance because they minimize mislabeling clinical situations as inadequate breastfeeding and identify more accurately and promptly overweight and obese infants. As of September 2010, the CDC, with the concurrence of the AAP, recommended the use of the WHO curves for all children younger than 24 months.[137,138]

ROLE OF THE PEDIATRICIAN

Pediatricians have a critical role in their individual practices, communities, and society at large to serve as advocates and supporters of successful breastfeeding (Table 6).[139] Despite this critical role, studies have demonstrated lack of preparation and knowledge and declining attitudes regarding the feasibility of breastfeeding.[140] The AAP Web site[141] provides a wealth of breastfeeding-related material and resources to assist and support pediatricians in their critical role as advocates of infant well-being. This includes the Safe and Healthy Beginnings toolkit,[5] which includes resources for physician's office for promotion of breastfeeding in a busy pediatric practice setting, a pocket guide for coding to facilitate appropriate payment, suggested guidelines for telephone triage of maternal breastfeeding concerns, and information regarding employer support for breastfeeding in the workplace. Evidence-based protocols from organizations such as the Academy of Breastfeeding Medicine provide detailed clinical guidance for management of specific issues, including the recommendations for frequent and unrestricted time for breastfeeding so as to minimize hyperbilirubinemia and hypoglycemia.[4,142,143] The critical role that pediatricians play is highlighted by the recommended health supervision visit at 3 to 5 days of age, which is within 48 to 72 hours after discharge from the hospital, as well as pediatricians support of practices that avoid non–medically indicated supplementation with commercial infant formula.[144]

Pediatricians also should serve as breastfeeding advocates and educators and not solely delegate this role to staff or nonmedical/lay volunteers. Communicating with families that breastfeeding is a medical priority that is enthusiastically recommended by their personal pediatrician will build support for mothers in the early weeks postpartum. To assist in the education of future physicians, the AAP recommends using the evidence-based Breastfeeding Residency Curriculum,[4] which has been demonstrated to improve knowledge, confidence, practice patterns, and breastfeeding rates. The pediatrician's own office-based practice should serve as a model for how to support breastfeeding in the workplace. The pediatrician should also take the lead in encouraging the hospitals with which he or she is affiliated to provide proper support and facilities for their employees who choose to continue to breastfeed.

TABLE 6 Role of the Pediatrician

1. Promote breastfeeding as the norm for infant feeding.
2. Become knowledgeable in the principles and management of lactation and breastfeeding.
3. Develop skills necessary for assessing the adequacy of breastfeeding.
4. Support training and education for medical students, residents and postgraduate physicians in breastfeeding and lactation.
5. Promote hospital policies that are compatible with the AAP and Academy of Breastfeeding Medicine Model Hospital Policy and the WHO/UNICEF "Ten Steps to Successful Breastfeeding."
6. Collaborate with the obstetric community to develop optimal breastfeeding support programs.
7. Coordinate with community-based health care professionals and certified breastfeeding counselors to ensure uniform and comprehensive breastfeeding support.

BUSINESS CASE FOR BREASTFEEDING

A mother/baby-friendly worksite provides benefits to employers, including a reduction in company health care costs, lower employee absenteeism, reduction in employee turnover, and increased employee morale and productivity.[145,146] The return on investment has been calculated that for every $1 invested in creating and supporting a lactation support program (including a designated pump site that guarantees privacy, availability of refrigeration and a handwashing facility, and appropriate mother break time) there is a $2 to $3 dollar return.[147] The Maternal and Child Health Bureau of the US Department of Health and Human Services, with support from the Office of Women's Health, has created a program, "The Business Case for Breastfeeding," that provides details of economic benefits to the employer and toolkits for the creation of such programs.[148] The Patient Protection and Affordable Care Act passed by Congress in March 2010 mandates that employers provide "reasonable break time" for nursing mothers and private non-bathroom areas to express

breast milk during their workday.[149] The establishment of these initiatives as the standard workplace environment will support mothers in their goal of supplying only breast milk to their infants beyond the immediate postpartum period.

CONCLUSIONS

Research and practice in the 5 years since publication of the last AAP policy statement have reinforced the conclusion that breastfeeding and the use of human milk confer unique nutritional and nonnutritional benefits to the infant and the mother and, in turn, optimize infant, child, and adult health as well as child growth and development. Recently, published evidence-based studies have confirmed and quantitated the risks of not breastfeeding. Thus, infant feeding should not be considered as a lifestyle choice but rather as a basic health issue. As such, the pediatrician's role in advocating and supporting proper breastfeeding practices is essential and vital for the achievement of this preferred public health goal.[35]

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CLINICAL REPORT

Care of Adolescent Parents and Their Children

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KEY WORDS
teen pregnancy, adolescent parent, teen parents

ABBREVIATIONS
CI—confidence interval
IPV—intimate partner violence
OR—odds ratio

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abstract

FREE

Teen pregnancy and parenting remain an important public health issue in the United States and the world, and many children live with their adolescent parents alone or as part of an extended family. A significant proportion of teen parents reside with their family of origin, significantly affecting the multigenerational family structure. Repeated births to teen parents are also common. This clinical report updates a previous policy statement on care of the adolescent parent and their children and addresses medical and psychosocial risks specific to this population. Challenges unique to teen parents and their children are reviewed, along with suggestions for the pediatrician on models for intervention and care. *Pediatrics* 2012;130:e1743–e1756

INTRODUCTION

Adolescent parents and their children represent populations at increased risk for medical, psychological, developmental, and social problems. This clinical report updates an American Academy of Pediatrics policy statement published in 2001.[1] Although the most recent birth rate data from 2009 indicate historic low birth rates for infants of 15- to 19-year-old females in the United States, the rate remains higher than a number of other developed countries.[2] Further, between 2005 and 2007, there was an interruption in a 15-year decline that occurred from 1991 through 2005, emphasizing the need to continue to address prevention of unplanned pregnancy in this age group.[2–5] Additionally, factors that improve outcomes for parenting adolescents and their offspring must be identified as the numbers of younger adolescents at risk for becoming teen parents is increasing.[6]

ADOLESCENT PREGNANCY AND THE CHANGING LANDSCAPE DURING THE PAST DECADE

After a 15-year decline between 1991 and 2005, there was a 5% increase in rates of births to 15- to 19-year-olds in the United States from 2005 to 2007. However, the rate has consistently declined since 2007, such that in 2009, the teen birth rates in the United States reached a low of 37.9 births per 1000 females 15 through 19 years of age accounting for 409 802 births. It decreased further in 2010 to 34.3 births per 1000 females, or 367 752 births.[7] Birth rates fell for other age groups as well.[7] The rate for 10- to 14-year-olds declined from 0.5 per 1000 (5029 births) in 2009 to 0.4 per 1000 (4500 births) in 2010. The birth rate for teenagers 15 to 17 years old was 17.3 per 1000 in 2010 (109 193 births), down from 19.6 in 2009

(124 247 births), which represents a 12% decline from 2009. A similar decrease in birth rates was seen for older teenagers, aged 18 to 19 years. In 2010, birth rates were 58.3 per 1000 (258 559 births) in 2010 compared with 64.0 (285 555 births) in 2009.

With regard to ethnic background, American Indian/Alaska Native teenagers' birth rates increased 7% during 2006–2007, to 59.0 per 1000 in females 15 through 19 years of age but declined to 43.8 per 1000 in 2009, with a continued downward trend in preliminary 2010 data reaching a low of 38.7.[3–7] Birth rates in the same age group for non-Hispanic white and black teenagers and Asian or Pacific Islander teenagers have steadily decreased to a low of 23.5 and 51.5 per 1000, respectively, in 2010.[3,7] Birth rates for Hispanic teenagers decreased to 75.3 per 1000 in 2007, with an additional decrease to 63.6 per 1000 in 2009 and preliminary rates of 55.7 per 1000 in 2010 in the same age group.[3,7]

Although it is encouraging to see a downward trend in teen birth rates, there continues to be important issues to consider. Health care providers should not assume that the teenager has made an autonomous decision whether to engage in sexual activity.[8] Older age of the teenager's partner is a risk factor for initiation of sexual behavior.[8–10] Young adolescent girls, particularly those aged 13 or younger with a partner at least 4 years older, are much more likely than their peers to have sex with their partner, which exposes them to the risks of pregnancy and other health problems. The power dynamic between the adolescent and her partner may be coercive in nature and needs to be addressed. Also, it is especially important to ensure that the pregnant adolescent is not a victim of nonconsensual sex, particularly in younger children. The pediatrician needs to explore these issues and should be familiar with the legal nuances of their specific state. If needed, teenagers should be connected to the appropriate source for additional services.

MEDICAL AND PSYCHOSOCIAL RISKS TO THE ADOLESCENT MOTHER

Medical complications associated with adolescent pregnancy include poor maternal weight gain, anemia, and pregnancy-induced hypertension. These complications seem to be the greatest for the youngest adolescents. Poverty, lower educational level, and inadequate family support seem to contribute to a lack of adequate prenatal care, which may account for the majority of negative health outcomes for both the adolescent mother and her child.[11] The long-term socioeconomic consequences of adolescent childbearing were evaluated longitudinally in Sweden from 1941 to 1970, but no such data are available for the United States. On the basis of this homogeneous sample of 140 000 teen mothers, the Swedish study is one of the largest to date and showed increased likelihood of low educational attainment (odds ratio [OR], 1.7–1.9), single living arrangements (OR, 1.5–2.3), and welfare dependency (OR, 1.9–2.6), supporting the view that childbearing during adolescence is a risk factor for poverty in later life.[12]

Violence during pregnancy is recognized as a serious public health concern, particularly for those of younger age (12–24 years). Intimate partner violence (IPV), which can include verbal abuse, assault by a partner or family member, being in a fight or being hurt, or witnessing violence, may be increased during pregnancy, with 3% to 19% of women identified as victims of IPV.[13] It is more common among pregnant adolescents than among nonpregnant adolescents. Reported rates of domestic violence to pregnant teenagers have ranged from 20% to 31.6%.[14] One study reported a rate of abuse during pregnancy of 20.6% in a diverse population of women in Texas and Maryland of lower socioeconomic status. Of the 1203 pregnant women enrolled in the study, 29.6% (356) were teenagers between 13 and 19 years of age. Abused teenagers were at greater risk of poor weight gain, first- or second-trimester bleeding, and substance use. Other studies have indicated that 1 in 5 teenagers experience abuse during pregnancy, which was also associated with late entry into prenatal care (third trimester) and low birth weight.[15,16] Harrykissoon et al[17] examined the prevalence of IPV prospectively during a 24-month period in adolescent mothers and found that 41% of young mothers reported being victims of abuse. Similarly, Mylant and Mann[18] reported in 2008 that 61% of the subjects in their study cohort experienced IPV, with 37.5% reporting having experienced it during pregnancy and 22.5% reporting current sexual trauma at the time of the study.

An extremely concerning statistic relates to the cause of death for all women of childbearing age and 1 year postpartum. Consistent with other maternal mortality studies conducted in urban areas, homicide was shown to be the leading cause of death for women of reproductive age. Risk of death by homicide was 2.63 times greater for teenagers 15 to 19 years of age who had recently given birth compared with teenagers who were not pregnant or had not recently given birth in the same age group, stratified by age, race, and urban/rural residence (95% confidence interval [CI], 1.17–5.95), but the reason for this increased risk is not known.[19–21] In 1987, the Division of Reproductive Health of the National Center for Chronic Disease

Prevention and Health Promotion at the Centers for Disease Control and Prevention, the American College of Obstetricians and Gynecologists, and state health departments established the Pregnancy Mortality Surveillance System to collect data on all reported deaths during pregnancy and within 1 year of pregnancy. The pregnancy-associated homicide rate reported was 1.7 per 100 000 live births; risk factors included being younger than 20 years, being black, and having later or no prenatal care.[22–24] To date, younger age during pregnancy remains a risk factor of dying by homicide, particularly for the 15- to 19-year-old group.[25,26]

In terms of psychosocial risk factors for early motherhood, a number of studies have suggested that being a teen mother may be related to poorer mental health outcomes, such as mood disorders. Birkeland et al in 2005[27] studied 149 adolescent mothers with a mean age of 17 years (range, 15–19 years) in 2 school systems (Tampa Bay, FL, and Twin Cities, MN). The participants took part in a school-based teen parent program and completed mental health assessments, which included symptoms of depression. Overall, the results suggested that the first year postpartum is difficult for adolescent mothers, regardless of ethnic background, with 29% of the sample reporting symptoms consistent with clinical depression. More recently and on the basis of longitudinal primary care data from 87 000 dyads of parents in the United Kingdom, a higher incidence of depression of mothers compared with fathers was shown. Younger parental age (15–24 years) at the time of the birth of the child was associated with a higher risk of maternal depression; similarly, depression affected fathers with no history of mood disorders.[28] These 2 studies support efforts to detect depression in parents, particularly younger ones, because parental depression is associated with adverse outcomes for children.

Other studies have suggested that early motherhood may also be related to poorer educational outcomes and future economic difficulties. Boden and colleagues[29] studied a birth cohort of New Zealand children over a 25-year span and found that 16.8% of the children were born to mothers who were younger than 21 years, with 86% reporting that their pregnancy was unplanned. The authors concluded that younger mothers are less likely to finish high school and have poorer future economic circumstances. In the United States, on the basis of longitudinal data from almost 2000 adolescents who took part in the National Longitudinal Study of Adolescent Health (1995–2001), the study showed that, for black and American Indian adolescents, pregnancy carried a significant risk (4.2 and 19 times, respectively) of the teenager being more likely to have received public assistance. In addition, American Indian and non-Hispanic black young women, respectively, were 2.6 and 2.7 times more likely if ever pregnant than white young women to have received public assistance.[30]

Although pregnant adolescents have been shown to decrease or limit their use of alcohol, cigarettes, marijuana, and other substances during gestation, the use of cigarettes and alcohol, in particular, has been shown to increase steadily during the first 6 months postpartum.[31–33] Daily smoking of cigarettes and alcohol and drug problems are known to be associated with adolescent parenthood. The tendency of the adolescent mother to reduce substance use during pregnancy provides a window of opportunity in the immediate postpartum period for the pediatrician to emphasize and encourage healthy choices by the mother.[34]

RISK OF REPEAT ADOLESCENT PREGNANCY

Repeat births in adolescents have been linked to decreased educational achievement, increased dependence on governmental support by the adolescent mother, increased infant mortality, and low birth weight.[35] These negative outcomes result in increased societal expense and contribute to the continuation of the adolescent pregnancy cycle. In contrast to adult women experiencing a second pregnancy, adolescents with a repeat pregnancy tend to delay prenatal care.[36] A second adolescent birth may be more deleterious to the teen mother and her offspring by compounding negative socioeconomic impact and the influence of a short interpregnancy interval. A study by Partington et al[37] conducted with Milwaukee teen mothers examined rates of pregnancy and childbearing from 1993 to 2002. The authors found that the second births tended to be preterm in 15% of the cases, particularly if the mother smoked during pregnancy, had inadequate prenatal weight gain, or had an interpregnancy interval of less than 18 months; also, teenagers younger than 16 years had increased odds of having an infant with low birth weight with their second pregnancy. Data from the National Youth Risk Behavior Survey from 1999 to 2003 revealed that multiple pregnancies during adolescence were associated with risk behaviors. A dose-response relationship was evident between multiple adolescent pregnancies and earlier sexual initiation and more lifetime sexual partners. Even though causation cannot be determined because of the cross-sectional nature of the survey, multiple adolescent pregnancies may be part of a broad profile of risk behaviors.[38]

An extensive review of the literature in 2005 revealed that a repeat or second

pregnancy occurs in 19% of adolescent mothers within 1 year after delivery and in 38% within 2 years of the first birth, with the highest rates documented for non-Hispanic black teenagers with reported lower socioeconomic status.[39] Raneri and Wiemann[40] conducted a 48-month follow-up study in a diverse population of adolescent mothers in Texas and found that 42% of mothers were pregnant within 2 years after delivery, with 73% of those going on to deliver a second child.

Several factors are associated with repeat adolescent pregnancy occurring in less than 2 years: not returning to school within 6 months after delivery, being married or living with a male partner, receiving major child care assistance from the adolescent's mother, not using a long-acting contraceptive within 3 months of delivery, experiencing IPV,[41] and having peers who were adolescent parents.[40]

Another significant factor that influences rapid subsequent pregnancies in adolescent mothers is mood disorders. In a study of 269 non-Hispanic black teenagers attending 5 prenatal clinics in Maryland, Barnet and colleagues[42] determined that depressive symptoms may be an independent risk factor for subsequent pregnancy. The authors found that of the 49% of the teenagers experiencing a second pregnancy within 2 years postpartum within their study, 46% had reported symptoms of depression at baseline.

An adolescent who drops out of school may choose to remain at home in a parenting role, reflecting a conscious decision not to return to school in the near future, if at all.[43] A study by Brosh et al[44] with 54 female students who were either pregnant or had 1 child showed that the majority of students wanted to obtain a high school diploma or a general equivalency diploma. Teenagers found relatives to be the most helpful source of support; in contrast, government assistance programs were rated the least helpful.

Because adolescents themselves often report that their second pregnancies are intentional, repeat pregnancy-prevention programs need to focus on defining and supporting an adolescent's educational goals and on providing motivations for delaying a second pregnancy. Knowledge and access to contraceptive services alone will not decrease repeat pregnancy rates. The use of long-acting contraceptive methods, such as subdermal progestin implants or injectable progestins or intrauterine devices, is associated with significantly lower rates of pregnancy than is the use of oral contraceptives.[1,4] Programs that help adolescent mothers return to school combined with intensive psychosocial postpartum care tend to successfully prevent early repeat pregnancies.[45] Cultural norms for extended family roles in child-rearing or for early parenting may vary. Not all ethnic or cultural subpopulations in the United States share the dominant cultural assumptions about adolescent childbearing, thus increasing the need for cultural sensitivity when dealing with diverse populations.

FACTORS ASSOCIATED WITH IMPROVED OUTCOMES FOR ADOLESCENT MOTHERS

Several studies in the literature address outcomes of adolescent parenting. A 20-year follow-up study of pregnant adolescents from the late 1960s defined "long-term success" as high school completion and employment or support by a spouse at the time of follow-up. The study population ranged from 32 to 38 years of age, with 68% of the women being unmarried. Factors positively associated with this definition of long-term success included having completed school before becoming pregnant, actively participating in a program for pregnant adolescents, remaining in school with no subsequent pregnancy at 26 months postpartum, having a sense of control over one's life, experiencing little social isolation, and having only 1 or 2 subsequent lifetime children after the first adolescent pregnancy.[46]

Another study involving a 17-year follow-up of black adolescent mothers documented that the universally negative outcomes described for teen parents previously suggested in the literature were not substantiated.[47] More than two-thirds of the women in that study had completed high school, had regular employment, and were not dependent on the government for income. In contrast, however, their offspring displayed greater rates of difficulties at school and behavioral problems at home than did the offspring of adult mothers.[47]

Family factors associated with improved outcomes for the adolescent mothers and their children include early child care for the infant of the young adolescent mother provided by the infant's family of origin, support that also allows the adolescent to finish school, playful interaction between infant and father, and stability of marital status for the teen mothers.[48] Unfortunately, common problems encountered in this type of research include small sample size, lack of control groups, attrition, and outcome measurement heterogeneity; furthermore, no research studies have addressed how best to enhance the typical sources of support to adolescent parents (family, parents, peer support) that positively affect the adolescent's own psychosocial growth as both a teenager and a parent while meeting the developmental needs of the infant.[49]

FATHERS OF INFANTS BORN TO ADOLESCENT MOTHERS

The literature defines paternal involvement in terms of a father's engagement, accessibility to the child,

and responsibility to the child—in other words, the amount of support from the father to his partner and offspring. A number of factors play a role in this dynamic, including the type of romantic involvement the couple had during the pregnancy and after birth; paternal ability to provide and support their family; father's level of education and socioeconomic status; father's relationship with his family of origin; and father's ethnic background, cultural values, and beliefs, including moral values and spirituality. Evidence supports the concept that fathers who are romantically involved with their partner and cohabitate are more involved with their children.[50] Most of the literature on adolescent pregnancy and parenting includes only mothers; furthermore, adolescent pregnancy-prevention programs are targeted at young females, and the positive contributions of adolescent fathers have not been well studied. A long-standing gender bias as it relates to adolescent males' perspectives on and attitudes toward pregnancy and pregnancy outcomes exists.[51] Of all pregnancies to adolescent mothers, estimates include that 18% to 35% of the pregnancies involve fathers younger than 20 years at the time of the children's births.[52] Adult men who father a child with an adolescent girl tend to be more socioeconomically and psychologically similar to adolescent fathers than to other adult fathers.[53] In evaluating the cost and consequences for young fathers, Brien et al[54] used data from the National Longitudinal Survey of Youth in which participants were 14 to 21 years of age in 1979. The authors reported that 8 of 10 young fathers do not marry the mother of their first child; furthermore, these fathers pay less than $800 annually for child support—probably related to being poor themselves.

Adolescent fathers are more likely to live in poverty, with adolescent fatherhood, like adolescent motherhood, often repeated from 1 generation to the next.[55] Young adult men who father children with adolescent mothers are also more likely to be impoverished. One study found that 64% of unwed fathers 19 to 26 years of age lived with a parent or close relative, most likely reflecting low socioeconomic status.[1,56] Although more than 80% of unwed fathers in their late teens and early 20s live away from their children, one-third to one-half of these fathers visit their children weekly.[56] Some fathers may be incarcerated and, therefore, unavailable or unable to be involved. One study found that at least 30% of fathers of children born to adolescent mothers were in prison.[20] Although social support, in general, correlates positively with improved outcomes for adolescent mothers, support by the father has been linked with increased maternal risk of not completing school.[57] However, partner support has been related to decreased distress and depression in the adolescent mother, along with improved self-esteem.[58] Marital status may transiently improve socioeconomic status for adolescent mothers, but a paucity of long-term marriages exists in this population, because most marriages precipitated by pregnancy in the adolescent age group end in divorce. Single status for the mother at 5 years postpartum has been associated with a threefold increased risk of receiving governmental assistance, at least in the short-term.[57]

The father's role in family functioning may also play an important role in the initiation, continuation, and ultimate success of breastfeeding. Although the positive benefits of breastfeeding have been well documented, few teenage mothers even initiate breastfeeding, and of those, few sustain the practice for at least 6 months. Harner and McCarter-Spaulding[59] studied the impact of paternal age on infant feeding method initiated by teen mothers during their hospital stay after giving birth by interviewing 86 teen mothers younger than 18 years in Philadelphia. The authors found that 30% of the teen mothers had an adult partner (defined as being 4 years older than the mother), and 24% (21) reported breastfeeding while in the hospital. Of the total sample, 40% of teen mothers reported that the father of the baby had an influence on their decision to breastfeed or not, regardless of the age of the father.

As the child matures, fathers are important for teaching life-survival skills, in general, and in the school setting for helping with homework, coaching, and social skills and encouraging a healthy lifestyle. Moore et al[60] studied a convenience sample of 104 English-speaking, urban fathers looking at the support to their families in attending well-child visits, and concluded that all health care providers should encourage early involvement of fathers, particularly for those younger than 25 years. Strengthening the father-child bond will benefit family functioning and ultimately may improve the child's health and well-being.[61,62] In a study to evaluate the interaction between adolescent fathers and health care professionals, Dallas[63] interviewed 111 participants. The sample included 25 sets of unmarried, low-income, black adolescent fathers and mothers and 50 grandmothers and 11 grandfathers; the interviews were conducted in their place of residence at 1, 6, 12, 18, and 24 months after birth. The authors concluded that treating adolescent fathers as if peripheral in their parenting role risks "marginalizing" an already alienated group and negatively affects the ability of the

father to seek future advice and education.

Children of adolescent mothers who continue to have close ties with the child's biological father have better outcomes in employment and education, are less depressed, and are at less risk of adolescent parenting themselves. However, children of adolescent parents in general, with or without paternal involvement, remain a group at risk, with a 33% rate of school dropout, 31% incidence of depression, 16% incidence of incarceration, and 25% risk of adolescent parenthood.[47] Fathers' engagement positively affects the psychosocial, cognitive, and behavioral outcomes of children, with evidence that cohabitation of the mother and father is associated with less externalizing behavioral problems in their children.[64]

Adolescent or adult fathers who maintain active participation in the prenatal, neonatal, and immediate postpartum processes with an adolescent mother have a greater likelihood of ongoing involvement with their children.[65] Such interactions include playing with their children, giving them gifts, or feeding them but are less likely to involve diapering, bathing, and caring for the child alone. Parenting interventions can help teach such skills to adolescent fathers as well as to adolescent mothers. Several successful father programs exist, and all adolescent parenting programs should make a more concerted effort to engage the fathers.[66–68]

MEDICAL AND PSYCHOSOCIAL RISKS TO THE INFANT

Infants of adolescent mothers have an increased risk of adverse health outcomes, including higher incidences of perinatal mortality, low birth weight, preterm birth, developmental disabilities, and poorer developmental outcomes compared with offspring of older mothers.[69] Markovitz and associates investigated the relationships between infant mortality, socioeconomic status, and maternal age in a large, retrospective study.[70] The researchers compared the risk of neonatal and infant mortality in a cohort of adolescent mothers 12 to 19 years of age in Missouri compared with those 20 to 35 years of age. After adjusting for socioeconomic factors, they concluded that the risk of postnatal mortality (OR, 1.73; 95% CI, 1.14–2.64) but not neonatal mortality (OR, 1.43; 95% CI, 0.98–2.08) was significantly higher in infants born to adolescent mothers 17 years or younger, compared with infants born to mothers between 18 and 25 years of age. This study corroborated the findings of Phipps et al, who evaluated the risk of infant mortality (defined as death within the first year after live birth) in a US birth cohort from the National Center for Health Statistics from 1995 to 1996.[71] The analysis included more than 700 000 single births. Of these births to women 12 through 19 years of age, there were 4631 infant deaths. The risk of infant mortality was 1.6 (95% CI, 1.4–1.7) times greater for those with teen mothers younger than 15 years than for those with mothers 18 through 19 years old—a 56% greater risk.[71]

Another study by Gilbert and associates[74] reported an increased risk of negative health outcomes for infants and adolescent parents. They examined birth and death certificates by using maternal and neonatal hospital discharge records of primiparous women (11–29 years of age) in California who delivered between January 1, 1992, and December 31, 1997. Pregnancy outcomes of early (11- to 15-year-old) and late (16- to 19-year-old) adolescents were compared with those of a control group of women 20 to 29 years of age. When compared with older women, all teen pregnancies were associated with higher rates of poor obstetric outcomes, including infant and neonatal deaths, preterm birth, and low birth weight. Even more striking, non-Hispanic black mothers and infants of all ages had worse outcomes than did white mothers and infants.[72]

Not all adverse health outcomes of children are directly associated with maternal age. Maternal age alone has not been shown to be a risk factor in sudden infant death syndrome, injuries, child abuse, or infections; factors such as substance abuse and socioeconomic status do appear to have a role. However, 1 study found that the rare occurrence of infant homicide, which tends to occur during the first 4 months of life, was associated with having an adolescent parent, especially one who had given birth previously.[73]

NEURODEVELOPMENTAL PERSPECTIVE

Longitudinal neuroimaging studies on subjects from 3 through 30 years of age conducted by the child psychiatry branch of the National Institute of Mental Health have shown significant changes in brain development throughout the adolescent developmental period. The dorsolateral frontal cortex is one of the latest regions to mature and is the one associated with "executive brain functions," such as planning, foresight, evaluating risk and reward ratios, and the capacity to balance decision-making with emotional demands. Substantial neurobiological, behavioral, and emotional changes take place in the adolescent and young adult brain, making it a time of risk but also a time of significant opportunity.[74] Therefore, any interventions put into place need to take into account the adolescent's

developing brain function to enhance these executive brain functions.

Studies have shown that children born to adolescent mothers are at risk for deficits in cognitive and social development. These deficits may persist into adolescence.[69,75] During the first 3 to 4 years of life, the anatomic brain structures and physiologic response patterns that determine a child's learning processes, coping skills, and personality traits become established, encoded, and strengthened.[76,77] These neuronal structures have the potential to atrophy if unused.[78] Negative environmental conditions, including lack of stimulation or close and affectionate interaction with primary caregivers, child abuse, violence within the family, or even repeated threats of physical and verbal abuse during these critical years can have a profound influence on these nerve connections and neurotransmitter networks, potentially resulting in impaired brain development.[79] Childhood negative life experiences may have long-term consequences in the developing brain of children; toxic stress has been defined as "an excessive or prolonged activation of the physiological stress response system in the absence of the buffering protection afforded by stable, responsive relationships." The American Academy of Pediatrics is committed to mitigate the negative effects of toxic stress in children; therefore, identifying children at risk for toxic stress must be a priority for pediatricians.[80] Maternal substance use before and after delivery may further affect infant development as a result of physiologic or anatomic changes in the infant's brain or the parents' ability to nurture appropriately.[72]

A study by the National Institute of Child Health and Human Development found that one of the most important predictors of child development was the quality of the parent-child interaction.[81] An adolescent mother's attitude toward parenting influences her parenting style; mothers who place inappropriate expectations on the child are likely to use harsh and rejecting discipline strategies.[82] Such strategies are linked with child anger, low self-esteem, and social withdrawal. Furthermore, mothers with intense feelings of inadequacy and failure in the parenting role tend to withdraw emotionally and physically from the infant. This withdrawal has been linked to angry and resistant infant behaviors and troubled mother-child relationships.[19]

Compared with older mothers of similar parity and socioeconomic status, adolescent mothers may vocalize, touch, and smile at their infants less and may be less sensitive to and accepting of their infants' behavior.[83] Teen mothers tend to hold less realistic developmental expectations of their children. They may underestimate or not be knowledgeable about the importance of simple interactions within the home. Parent-child relationship focused interventions have been shown to moderate maternal behaviors and child developmental outcomes. Educating mothers on interaction styles may improve maternal responsiveness and lead to less directive parenting styles and more engaging interactions, which promote child development.[83] Also, adolescent mothers who have more social support exhibit less anger and use less punitive methods of parenting than do adolescent mothers with fewer social supports.[84]

Another factor that contributes to child development is the home literacy environment. Research has shown that teen mothers provide fewer literacy experiences than do older mothers.[85] The consequences of an impoverished literacy environment on early brain development and later child development may manifest as a delay in oral language skills and later have a negative effect on early reading skills.[85] Teen mothers need instruction on how to incorporate literacy activities in the home and why it is important for their child's development. Because adolescent mothers may not be trained in appropriate stimulation techniques and may be coping with stress in their own lives, ongoing education and support by the pediatrician and other nurturing adults are imperative to help prevent negative sequelae in them and in their offspring.

MODELS OF INTERVENTION FOR ADOLESCENT PARENTS

A number of models of intervention and support for adolescent parents exist. These programs, which may be individual and/or group based, predominantly have focused on adolescent mothers and their children. Not all programs have been evaluated rigorously. These types of interventions are aimed to improve parenting knowledge, practices, attitudes, and skills for the adolescents and may be part of prenatal or postpartum care. Coren and Barlow reviewed 23 studies of parenting programs for teen parenting. Positive outcomes were shown in maternal-child interaction, communication at mealtimes, and offspring cognition; methodological limitations included the small number of studies reviewed, with a small number of outcome measures. Despite these limitations, the findings suggested that parenting programs may be effective in improved outcomes for teen parents and their children.[86] Similar conclusions were reached in a recent Cochrane update of parenting programs.[87] Successful teen programs were highlighted in a study from New Mexico, a state with

one of the highest teen birth rates in the United States. These parenting programs of predominantly Latino-Hispanic youth resulted in lower rates of late entry into prenatal care and decreased birth rates. Participants in the program were more likely to have higher rates of education attainment and employment postpartum. One of the specific program recommendations was the inclusion of teen fathers within the program.[88] Another important model has been the nurse-family partnership —in particular, the home-visit model focusing on high-risk, first-time single mothers.[89] Programs like Health Access Nurturing Development Services in Kentucky have been successful in achieving goals related to infant health and well-being, subsequent child health and development, risk reduction and home safety, and maternal well-being.[90] The Nurse–Family Partnership, a program of prenatal and postpartum home visitation by nurses for low-income mothers and their first child across the United States, currently serves more than 20 000 families. A focus on family planning for the mother has decreased the rapid-succession second pregnancy effectively within the 2-year postpartum period, with encouraging results in rural locations and younger mothers.[91]

School-Based Programs

Specialized school-based programs can provide a means of providing multidisciplinary services to pregnant and parenting adolescents while keeping them in school. A student's prepregnancy academic achievement affects the outcome of such interventions; low-achieving students require longer and more intensive interventions than do students who are doing well academically before pregnancy.[9] For the marginally achieving student, specialized educational programs with a small student-to-teacher ratio can foster a sense of achievement and help the adolescent feel capable of completing school. The concept of a "school-within-a-school," or consistent peer group placement within a larger school, has been useful for academically challenged pregnant and nonpregnant adolescents.[92] Quality school-based child care programs facilitate the participation of the adolescent in school, provide support and parenting education to the parent, and can assist in improved health and development in their children.

Positive results for a school-based "children of teen parents" program were shown in a study by Crean et al[93] in Rochester, New York. Eighty-one teen mothers and their children received free on-site child care, the service most frequently requested by adolescent mothers; 89 wait-listed teen mothers served as a control group. The study included those mothers born between 1969 and 1976 and included those whose children were born in the 1986–1987 academic year. Participant mothers were found to have better school attendance, with 70% graduating from high school. Letourneau et al[49] conducted a review of studies published between 1982 and 2003 that evaluated resources and support or education interventions for teen mothers and found that small sample size, significant attrition, lack of suitable comparison groups, and inconsistency among measures used were significant limitations in validity and reliability for the data.

Multidisciplinary and Non–School-Based Programs

Multidisciplinary programs provide medical care, psychological support, and a comprehensive life-skills approach to adolescent parents. These programs have shown that participating female adolescents are more likely to be employed, work more hours, earn more money, and report a better home environment 5 years after the intervention began than are socioeconomically matched adolescents in cities without this comprehensive approach.[94] Adolescents receiving these interventions were also less likely to be receiving Aid to Families With Dependent Children (now relabeled as Temporary Assistance to Needy Families).

Teen Tot programs (in which adolescent parents and their children receive care simultaneously) have been developed in many medical centers and ambulatory clinic settings to provide structured medical visits and support. Such use of time and space creates access to multidisciplinary services. When all visits are scheduled in a clinic on a consistent day each week, teaching sessions specifically addressing adolescent parenting issues can be timed with clinic visits. This model for care often provides the adolescent with a peer support group; however, these social support and parenting interventions appear to improve maternal-child interactions but do not seem to reduce low birth weight or neonatal deaths.[95] One such model program at Children's Hospital in Boston evaluated 142 young mothers (average age, 17.3 $\pm$ 1.2 years) and their offspring (average age, 8.3 $\pm$ 5 months); the sample was racially diverse and had 91 young mothers in the intervention group and 54 controls. The program included 12 sessions of a once-a-week parenting group with a comprehensive curriculum geared toward improving teen parenting skills and reducing life stress, with pregroup and postgroup measures. The authors reported positive effects with this type of intervention, but no longer-term follow-

up data were available to evaluate sustainability of the changes.[96] Although the arrangement of a joint visit has its advantages, the pediatrician needs to focus the visits on each of the individuals separately to ensure that the adolescent's concerns of her own health and her infant's health are not overlooked.

Peer Group and Role Model Programs

Using adolescent parents as role models may enhance self-efficacy in the adolescents serving as instructors as well as in the adolescents being instructed about parenting. Innovative approaches using technology and the media have shown promise in enhancing parenting skills of adolescent mothers.[97] From a developmental perspective, use of peer groups makes sense in getting a message across. Unfortunately, there is no evidence that peer group and role model programs effectively reduce adolescent pregnancy or improve adolescent parenting skills. Many programs still use this technique. In the future, positive outcome data may become available.

When possible, all caregivers involved in the care of the infant should be given practical, evidenced based information that support early brain development for the infant. The pediatrician should provide encouragement and support to the adolescent parent to make decisions for her infant even when other adults are involved in the child's care. When the adolescent needs more support, the pediatrician can facilitate a co-decision model that ensures the optimal welfare of the infant.

Programs such as Head Start and Early Head Start are designed to address the needs of both parents and children. Prenatal and early childhood home visitation has been associated with reduction in the number of subsequent pregnancies, use of governmental assistance, child abuse and neglect, and criminal behavior in adolescent mothers. These visitations also have been associated with reduced risk of serious antisocial behavior and substance abuse by adolescent offspring followed up during the first 15 years of life.[98–101] Multidimensional family and peer support with positive role models and concrete examples of how to overcome challenges has also been shown to help teenagers initiate and continue breastfeeding.[102]

Special Education Initiatives

Female adolescents in some special education programs become pregnant in disproportionate numbers and drop out of school at earlier ages than do adolescents in regular education.[103] School-based care for these adolescents should include sexuality education[8] and discussions on safety for the adolescent mother and her child. These discussions should focus on self-efficacy and should help the mother acquire decision-making and concrete, task-oriented skills. This task-centered approach also can be used to strengthen the adolescent's ability to access external support systems and to develop supportive family relationships, which directly and indirectly can improve the adolescent's self-esteem.

GUIDANCE FOR THE PEDIATRICIAN

1. Continuity of care and a "medical home" for adolescent parents, as well as for their children, is important in caring for this population. Specific attention needs to be directed toward anticipatory guidance, the critical importance of nurturing relationships and positive parenting on their young child's development, and the teaching of basic caregiving skills involving the adolescent mother and the infant's father, when possible. Pediatricians and other health care providers can build on their established relationship with adolescent parents and their children to provide developmentally appropriate care to both.
2. A multidisciplinary and comprehensive approach to caring for parenting adolescents is encouraged, by using community resources with the needed funding for programs, such as social services, nurse visitations programs, and the Special Supplemental Nutrition Program for Women, Infants, and Children. Early and Periodic Screening, Diagnosis, and Treatment and Title XXI should be used to include medical and developmental services to low-income adolescent parents and their children. Pediatricians and their staff are ideal for facilitating coordination of these services.
3. The pediatrician can help promote breastfeeding to all adolescent mothers, realizing the importance of educating the teen father when available. Opportunities to discuss the benefits and management of breastfeeding may be available for the pediatrician and staff in the school setting where pregnant teenagers attend. Continued support is necessary for adolescents who choose to breastfeed so that they may overcome barriers typically encountered in their environment. Pediatricians can help by working with schools to dedicate an area for breastfeeding and/or milk expression that provides privacy and access to a hand-washing sink and a refrigerator.

4. A good time to initiate contraceptive counseling is during pregnancy; such discussion should include an emphasis on long-acting methods, such as DMPA, Nexplanon, and the IUD, coupled with condom use during every visit for the teenager and may be part of the anticipatory guidance offered at visits for the teen parent's infant. Pediatricians should not assume that all adolescent parents are open to discussing their needs while having their infant visit; when appropriate, the pediatrician can negotiate the use of this time for the adolescent's needs. The 2- or 4-week infant visit follow-up visit is a good time to remind the adolescent to have a visit with her gynecologist or adolescent specialist and initiate contraception.
5. Pediatricians can be important advocates for youth development programs that have proven, evidence-based strategies to prevent unwanted, or to delay, teen pregnancies.
6. Pediatricians can play an important role to the adolescent parent in emphasizing the importance of completing high school, pursuing higher education or vocational training, and being knowledgeable about community resources and programs that may better support adolescents and their infants.
7. Pediatricians can encourage the continuation of healthy lifestyles that may have been initiated during pregnancy. Information on the effect of maternal substance use and cigarette smoking on infant and child health and development is important to provide at mother and infant visits.
8. Assessment by the pediatrician for risk of domestic violence and mental health issues, particularly depression, is encouraged both during and after pregnancy. IPV is a significant problem among young mothers and is not restricted to a particular sociocultural group. Screening to assess IPV can include asking the adolescent if she has been hit, kicked, or punched by a partner or ex-partner. Pediatricians and health care providers caring for pregnant adolescents are in a unique position to identify and help prevent violence in adolescents' lives.
9. In the preadolescent and young adolescent age group, it is of particular importance to ensure that the pregnant adolescent is not a victim of sexual abuse and/or exploitation. Pediatricians and other health care providers should not assume that sexual activity during adolescence, particularly for younger adolescents, is voluntary. Pediatricians should advocate and help develop protocols that elicit information from adolescents about whether their sexual activity was voluntary; this can be accomplished with the help of social workers or psychologists.
10. Pediatricians are encouraged to stress the importance of the adolescent parent caring for the child even if other adults are involved in the caregiving (eg, grandparents and great-grandparents). These other caregivers need support and education to allow optimal infant development while helping the adolescent to achieve her own developmental milestones. From the ethical point of view, pediatricians should question whether the adolescent parent is capable of making decisions on behalf of her offspring; when in doubt, consideration should be given to a co-decision maker in support of the adolescent parent and the best interest of the child. Pediatricians can provide positive reinforcement for success by praising adolescents who are successful (eg, graduating from high school or college; abstaining from use of drugs, alcohol, and nicotine; continuing breastfeeding; keeping the child's immunizations current; and attending all well-child visits).
11. Counseling by pediatricians includes adapting their counseling approach to the developmental level of the adolescent, by using office-based and school-based interventions that incorporate intensive instruction on infant care and development, positive parenting techniques, and coping with the stress associated with parenting. Use of support groups in the office, clinic, or school setting; home visits; and creative use of videos and media can improve parenting skills.
12. A heightened sense of awareness by pediatricians to attend to the developmental needs of both the infant and the adolescent parent is important. The pediatrician can advocate for quality community resources, such as competent, culturally sensitive, effective preterm and infant classes, postpartum home visits, nurse home visitations, quality child care programs, and well-managed programs supported by Head Start and Individuals with Disabilities Education Act–Part C (for children ages 0–3 years with disabilities or at risk), and encourage adolescent parents to use these resources when available and appropriate.
13. In the nursery and early on, efforts should be made that

target young fathers, supporting their involvement in their children's care. Pediatricians and other professionals working with children and their families can actively encourage fathers' involvement with their offspring from an early age.

14. Further studies are needed on outcomes of teen parents and their infants when interventions specifically involve fathers of infants born to adolescents and on the involvement of grandparents assisting in child-rearing or as primary caregivers. Short- and long-term outcome evaluations on adolescent parenting programs are vitally needed to better understand the effects that teen pregnancy has within heterogeneous groups within the United States.
15. Although rates of teen pregnancy are declining, the pediatrician can continue to advocate for longitudinal, comprehensive solutions, including advocacy, which focuses on primary prevention strategies to continue this downward trend.

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POLICY STATEMENT

Cheerleading Injuries: Epidemiology and Recommendations for Prevention

abstract

FREE

Over the last 30 years, cheerleading has increased dramatically in popularity and has evolved from leading the crowd in cheers at sporting events into a competitive, year-round sport involving complex acrobatic stunts and tumbling. Consequently, cheerleading injuries have steadily increased over the years in both number and severity. Sprains and strains to the lower extremities are the most common injuries. Although the overall injury rate remains relatively low, cheerleading has accounted for approximately 66% of all catastrophic injuries in high school girl athletes over the past 25 years. Risk factors for injuries in cheerleading include higher BMI, previous injury, cheering on harder surfaces, performing stunts, and supervision by a coach with low level of training and experience. This policy statement describes the epidemiology of cheerleading injuries and provides recommendations for injury prevention. *Pediatrics* 2012;130:966–971

INTRODUCTION

When cheerleading originated in the late 1800s,[1] the primary purpose was to lead the crowd in cheering on sports teams through the use of pompoms, toe-touch jumps, splits, and clapping. However, over the last century, cheerleading has evolved dramatically into a competitive, physically demanding, year-round activity consisting of fast-paced floor routines with leaps and jumps, gymnastics-style tumbling, and complex stunts, such as pyramid building and tossing athletes in the air (see Appendix for definitions of cheerleading terminology). Cheerleading has also become much more popular. From 1990 to 2003, the number of US cheerleaders 6 years and older increased by approximately 600 000 from 3.0 to 3.6 million.[2] This number includes traditional school-based cheerleading squads as well as "all-star" cheerleading squads, which are not associated with a school or sports league and whose main objective is competition. In 2009, the National Federation of State High School Associations (NFHS) reported that there were approximately 400 000 participants in high school cheerleading, with approximately 123 000 on competitive cheer teams.[3,4] Girls represent the majority (96%) of participants.[5] With this growth in participation and the more physically demanding routines comes a greater number of injuries and, subsequently, an increase in the number of cheerleaders presenting to the pediatrician for treatment and advice about prevention.

COUNCIL ON SPORTS MEDICINE AND FITNESS

KEY WORDS

cheer, athletes, sports, adolescents, females

ABBREVIATIONS

AACCA—American Association of Cheerleading Coaches and Advisors

NCAA—National Collegiate Athletic Association

NFHS—National Federation of State High School Associations

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EPIDEMIOLOGY OF INJURIES

Although most high schools and colleges have cheerleaders, only 29 state high school athletic associations recognize cheerleading as a sport,[3] and the National Collegiate Athletic Association (NCAA) does not include competitive cheerleading in its list of sponsored sports. This has important implications on injury rates and prevention, because being classified as a sport affords valuable safety resources and regulations, such as qualified coaches, adequate and well-maintained practice facilities, preseason conditioning, access to certified athletic trainers and team physicians, and mandated preparticipation physical examinations. It also means injury data for cheerleaders are not uniformly captured in the sports injury surveillance systems of state high school athletic associations, the NFHS, and the NCAA. Fortunately, a few epidemiologic studies completed in recent years have provided some data on cheerleading injuries. The data presented here do not include dance teams, baton, or color guard.

Cheerleading injuries in the United States have been increasing steadily over the past few decades. The US Consumer Product Safety Commission reported 4954 hospital emergency department visits for cheerleading injuries in 1980.[6] By 2007, the Consumer Product Safety Commission reported this number had climbed more than 400% to 26 786. Although 98% of injured cheerleaders were treated and released, 221 were hospitalized.

The number of catastrophic injuries related to cheerleading has increased from 1.5 per year from 1982 to 1992 to 4.8 per year from 2003 to 2009.[7] This rising incidence of injury is likely attributable to a combination of (1) larger numbers of children, as young as 3 years of age, participating in cheerleading classes and teams; (2) incorporation of more complex skills, including tumbling, pyramids of 15 ft or higher, and partner stunts with athletes lifting, tossing, and catching each other; and (3) better reporting of cheerleading injuries through a few recent epidemiologic studies and a case report.

The overall injury rate in cheerleading across all age groups is 1.0 per 1000 athletic exposures. An athletic exposure is defined as 1 athlete participating in 1 practice or competition session. College cheerleaders have the highest injury rate (2.4), followed by elementary school (1.5), high school (0.9), all-star (0.8), middle school (0.5), and recreational (0.5) cheerleaders. The overall injury rate in high school cheerleading is lower than in other girls' high school sports (Table 1).[5,8]

As in other sports, cheerleading injury rates increase with age and competitive level.[5,9] Middle and high school cheerleaders have lower overall rates of injury than do collegiate cheerleaders (0.5 and 0.9 vs 2.4 per 1000 athletic exposures, respectively).[5] This is probably because older, better-skilled cheerleaders perform more complex gymnastics and height-based stunts. Rates of stunt-related injuries are higher for collegiate versus high school and middle school cheerleaders (1.59 vs 0.59 and 0.23 per 1000 athlete exposures, respectively).[10]

TABLE 1 Overall Injury Rates in Girls' High School Sports[5,7,8]

Sport	Overall Injury Rate (per 1000 Exposures)	Catastrophic Injury Rate (per 100 000 Exposures)
Cheerleading	0.9	0.50–1.62[a]
Gymnastics	8.5	0.44
Soccer	5.3	0.03
Basketball	4.4	0.03
Field hockey	3.7	0.00
Softball	3.5	0.02
Volleyball	1.7	0.00

[a] Injury rate is 1.62 when based on 123 644 actual exposures reported by the NFHS for competitive cheer squads. Injury rate is 0.50 when based on 400 000 exposures estimated by the NFHS for all types of cheer teams (competitive and noncompetitive).

INJURY MECHANISMS

The most common mechanisms of injury are basing/spotting (23%), tumbling (14%–26%), and falls from heights (14%–25%).[5,11] Stunting accounts for 42% to 60% of all cheerleading injuries and 96% of concussions and closed-head injuries.[10,12,13] Pyramid stunts are responsible for the majority of head/neck injuries (50%–66%).[14,15]

TYPES OF INJURIES

When all age groups are considered together, lower-extremity injuries are most common (30%–37% of all cheerleading injuries), followed by injuries to the upper extremities (21%–26%), head/neck (16%–19%), and trunk (7%–17%).[5,7,9,15] Younger cheerleaders are more likely to experience upper-extremity injuries (41% vs 25% of all injuries for 6- to 11-year-olds vs 12- to 17-year-olds, respectively), and older cheerleaders are more likely to have lower-extremity injuries (38% vs 29% of all injuries for 12- to 17-year-olds vs 6- to 11-year-olds).[9]

Overall, sprains and strains are the most common types of injuries (53% of all cheerleading injuries), followed by abrasions/contusions/hematomas (13%–18%), fractures/dislocations (10%–16%), lacerations/punctures (4%), and concussion/head injuries (3.5%–4%).[5,9] A single case report reveals a cheerleader with a splenic rupture after being thrown in the air and caught by a fellow cheerleader in a cradle.[16]

Younger cheerleaders (5- to 11-year-olds) are 1.6 times more likely to suffer a fracture or dislocation compared with older cheerleaders (12- to 18-year-olds), and older cheerleaders are 1.2 times more likely to suffer

a sprain or strain than are younger cheerleaders.[9]

Head Injuries

Concussions and other closed-head injuries account for 4% to 6% of all cheerleading injuries,[5,9,11] and head and neck injuries account for approximately 15% of all cheerleading injuries seen in US emergency departments.[6] Concussion rates in cheerleading (0.06 per 1000 exposures) are relatively low compared with other girls' high school sports, such as soccer (0.36), basketball (0.16–0.21), lacrosse (0.20), softball (0.07–0.11), and field hockey (0.10).[17,18] However, from 1998 to 2008, concussion rates in cheerleading increased by 26% each year, a rate greater than any of the other girls' sports studied.[18] Concussion rates increase with age and competitive level, likely because of the increasing difficulty of stunts.[5]

Catastrophic Injuries

Catastrophic injuries are classified as direct (trauma related to participating in the skills of the sport) or indirect (body system failure resulting from exertion while participating in a sport [eg, cardiac collapse or heat stroke] or a complication from a nonfatal injury). Direct catastrophic injuries include closed-head injury, skull fractures, and cervical spine injuries resulting in permanent brain injury, paralysis, or death. From 1982 to 2009, the National Center for Catastrophic Sports Injury Research recorded 76 direct catastrophic injuries in high school cheerleaders and 34 in collegiate cheerleaders.[7] However, because of the much larger number of high school cheerleaders, the rate of catastrophic injuries was 5 times higher for collegiate versus high school cheerleaders (2.0 vs 0.4 per 100 000 participants, respectively).[1] Although the overall risk of injury is lower in cheerleading than in most other sports, the risk of direct catastrophic injury is considerably higher for cheerleading. From 1982 to 2009, cheerleading accounted for 65.0% of all direct catastrophic injuries to girl athletes at the high school level and 70.8% at the college level.[7]

RISK FACTORS FOR INJURY

Risk factors for cheerleading injuries include higher BMI,[11] previous injury,[11] cheering on harder surfaces,[19] performing stunts, and supervision by a coach with low level of training and experience.[11] Critical height is defined as the approximate fall height below which a life-threatening injury would not be expected to occur. Critical height is much higher for a landing mat on a foam floor (11 ft) and for a spring floor (10.5 ft) than for concrete or vinyl tile floor (0.5 ft).[19] Critical heights for natural grass, artificial turf, and wood gym floor are 3.5 ft, 4 ft, and 4.5 ft, respectively (Fig 1). The most serious cheerleading injuries occur at or above the critical height for the surface on which the cheerleader is performing at the time of injury.[20] Some data[11] indicate that bases and flyers are at similar risk for injury during stunts, but others suggest that bases are at higher risk.[10]

INJURY PREVENTION

To increase safety, the American Association of Cheerleading Coaches and Advisors (AACCA)[21] and the NFHS[22] have enacted rules and recommendations, including requiring coach training and certification, proper strength and conditioning for all cheerleaders, avoiding stunts and tumbling on hard surfaces, and specific rules for execution of technical skills. Examples include the following: (1) pyramid height limited to no more than 2 persons; (2) top cheerleader must be supported by 1 or more bases in direct weight-bearing contact with performing surface; (3) bases must be stationary and maintain constant contact with suspended cheerleaders; (4) basket toss should be limited to 4 throwers, the toss should start from ground level, and 1 thrower must be behind the flyer during the toss; (5) spotters must be present for every

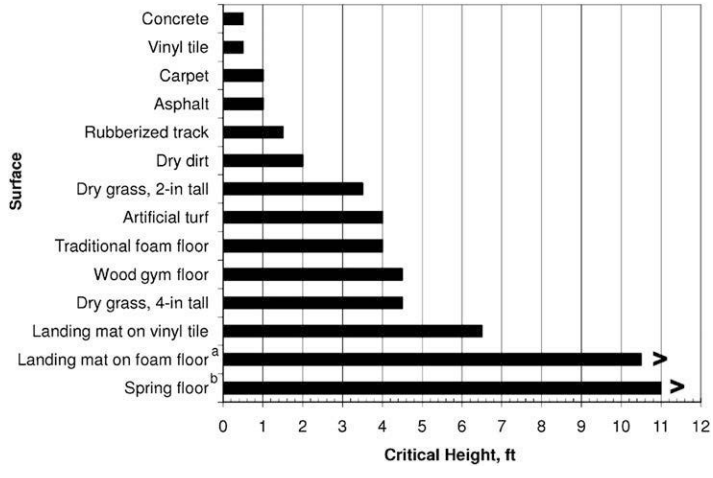

FIGURE 1

Critical height for cheerleading surfaces. [a]Landing mat on traditional foam floor. Limits of Triax 2000 were reached before critical height was attained. [b]Limits of Triax 2000 were reached before critical height was attained. Reprinted with permission from Shields BJ, Smith GA. The potential for brain injury on selected surfaces used by cheerleaders. *J Athl Train.* 2009;44(6):573.

person extended above shoulder level; and (6) suspended persons are not to be inverted or rotated on dismount.

Although spotters are commonly used during more difficult skills, active spotting of a maneuver does not significantly decrease the number of serious injuries sustained.[20] This could be because spotters may not have had appropriate training or lack sufficient core and upper body strength and balance to spot effectively.

One study revealed cheerleaders supervised by coaches with the most education, qualifications, and training had a nearly 50% reduction in injury risk compared with cheerleaders supervised by coaches with the lowest amount of education, qualifications, and training.[11] However, another study revealed that injury rates were not associated with the number of cheerleading safety training or certification programs completed by the coach or years of coaching experience.[5] Still, most agree that requiring coaches to obtain certification in a standardized training program that focuses on safe practices is a logical step in decreasing risk of injury among cheerleaders.

RECOMMENDATIONS

The American Academy of Pediatrics recommends that its chapters and individual pediatricians, especially those serving as school physicians, advisors, or consultants, work with their interscholastic athletic associations and other state and local cheerleading regulating bodies to ensure that the following guidelines are followed to reduce cheerleading injuries.

1. Cheerleading should be designated a sport so that it is subject to rules and regulations set forth by sports governing bodies (eg, NCAA, NFHS) and school athletic departments. Designation of cheerleading as a sport will afford it the same benefits as other sports, such as availability of athletic trainers, improved access to medical care, limits on practice time, better facilities, certified/qualified coaches, and inclusion in injury surveillance data.
2. Cheerleaders should have a preparticipation physical examination before participating in a cheerleading program and should have access to appropriate strength and conditioning programs.
3. Cheerleaders should be supervised by qualified coaches who have been trained and certified in proper spotting for gymnastics and partner stunts, safety measures, and basic injury management.
4. Cheerleaders should be trained in proper spotting techniques and should only attempt stunts after they have demonstrated appropriate skill progression and proficiency required to complete the stunt. Spotters and bases should have adequate upper body and core strength and balance to support flyers.
5. Technical skills, such as pyramids, mounts, tosses, and tumbling, should not be performed on hard (eg, concrete, asphalt), wet, or uneven surfaces or surfaces with obstructions. No cheer events should take place on dirt, vinyl floors, concrete, or asphalt.
6. Pyramids and partner stunts should only be performed on a spring floor or with a landing mat on either a traditional foam floor or grass/turf.
7. Pyramids should not be more than 2 people high and should only be performed with spotters.
8. Coaches should follow rules for execution of technical skills set forth in the most recent version of the NFHS *Spirit Rules Handbook* (http://www.nfhs.com/c-229-spirit.aspx) and the AACCA *Cheerleading Safety Manual* (http://aacca.org/content.aspx?item=Safety/2011-12SchoolCheerleadingRules.xml).
9. Coaches, parents, and athletes should have access to a written emergency plan, designed by school administrators in conjunction with the team physician and/or certified athletic trainer. Whenever possible, a certified athletic trainer or physician should be present at practices and competitions.
10. Cheer competitions should be held in venues that are compliant with guidelines of the National Cheer Safety Foundation and the AACCA.
11. Any cheerleader showing signs of a head injury should be removed from practice or competition and not allowed to return until he or she has received written clearance from a physician or qualified health care provider. Coaches, parents, and officials should be knowledgeable regarding the cause, prevention, recognition, and response to concussion. Free online educational materials are available through the Centers for Disease Control and Prevention (http://www.cdc.gov/concussion/) and the NFHS (http://www.nfhs.org).
12. Surveillance of cheerleading injuries should continue. All catastrophic injuries should be reported to the National Center for Catastrophic Sports Injury Research at Mueller@e-mail.unc.edu or National Cheer Safety Foundation at http://nationalcheersafety.com or by calling their Injury Reporting Hotline at 1-800-596-7860 ext 201. Research regarding injury epidemiology, mechanisms, and effectiveness of safety measures is necessary to guide new rules

and recommendations for improving safety.

APPENDIX: CHEERLEADING TERMINOLOGY

Tumbling

Any gymnastic or acrobatic skill executed on the performing surface. Examples include the following:

Round-off

A skill similar to a cartwheel but with both feet landing at the same time. It is almost always the beginning skill for all back tumbling passes.

Handspring/Flip-Flop

A front or back tumbling skill that takes off from the feet onto the hands and back onto the feet. It is commonly a set-up for a front or back tuck (flip).

Somersault/Salto/Flip/Somie

An acrobatic movement where the body makes a complete aerial turn (360 degrees) in the transverse axis. Can be performed forward, backward, or sideways.

Base

Person with at least 1 foot on the floor who is in direct, weight-bearing contact with the performing surface and who provides primary support for another person (flyer).

Flyer

Person who is elevated and/or tossed in the air by a base and may perform twists and/or flips before being caught by 1 or more bases.

Spotter

Person who remains in contact with the performing surface, is responsible for watching for hazards, and must be prepared to catch the flyer if he or she falls.

Stunts

Maneuvers in which 1 or more bases supports 1 or more flyers off the ground, such as the following:

Basket Toss

A stunt in which a flyer is tossed by bases whose hands are interlocked.

Cradle

A dismount from a stunt in which the flyer is caught in a face-up, piked position in the arms of 1 or more bases.

Pyramid

A stunt in which 2 or more bases support 1 or more flyers off the ground.

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Council on Sports Medicine and Fitness. Policy Statement: Cheerleading Injuries: Epidemiology and Recommendations for Prevention. *Pediatrics.* 2012;130(5):966–971

An error occurred in the American Academy of Pediatrics policy statement, titled "Cheerleading Injuries: Epidemiology and Recommendations for Prevention" published in the November 2012 issue of *Pediatrics* (2012;130[5]:966–971; originally published online October 22, 2012; doi:10.1542/peds.2012-2480). In Table 1, the third column heading should read Catastrophic Injury Rate (per 100 000 Participants). We regret the error.

doi:10.1542/peds.2012-3544

POLICY STATEMENT

Circumcision Policy Statement

TASK FORCE ON CIRCUMCISION

KEY WORDS
male circumcision, penis, prepuce, phimosis, sexually transmitted infections, HIV, urinary tract infection, analgesia, parental decision-making, ethics

ABBREVIATION
AAP—American Academy of Pediatrics

www.pediatrics.org/cgi/doi/10.1542/peds.2012-1989

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

abstract

FREE

Male circumcision is a common procedure, generally performed during the newborn period in the United States. In 2007, the American Academy of Pediatrics (AAP) formed a multidisciplinary task force of AAP members and other stakeholders to evaluate the recent evidence on male circumcision and update the Academy's 1999 recommendations in this area. Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks and that the procedure's benefits justify access to this procedure for families who choose it. Specific benefits identified included prevention of urinary tract infections, penile cancer, and transmission of some sexually transmitted infections, including HIV. The American College of Obstetricians and Gynecologists has endorsed this statement. *Pediatrics* 2012;130:585–586

POLICY STATEMENT

Systematic evaluation of English-language peer-reviewed literature from 1995 through 2010 indicates that preventive health benefits of elective circumcision of male newborns outweigh the risks of the procedure. Benefits include significant reductions in the risk of urinary tract infection in the first year of life and, subsequently, in the risk of heterosexual acquisition of HIV and the transmission of other sexually transmitted infections.

The procedure is well tolerated when performed by trained professionals under sterile conditions with appropriate pain management. Complications are infrequent; most are minor, and severe complications are rare. Male circumcision performed during the newborn period has considerably lower complication rates than when performed later in life.

Although health benefits are not great enough to recommend routine circumcision for all male newborns, the benefits of circumcision are sufficient to justify access to this procedure for families choosing it and to warrant third-party payment for circumcision of male newborns. It is important that clinicians routinely inform parents of the health benefits and risks of male newborn circumcision in an unbiased and accurate manner.

Parents ultimately should decide whether circumcision is in the best interests of their male child. They will need to weigh medical information in the context of their own religious, ethical, and

cultural beliefs and practices. The medical benefits alone may not outweigh these other considerations for individual families.

Findings from the systematic evaluation are available in the accompanying technical report. The American College of Obstetricians and Gynecologists has endorsed this statement.

POLICY STATEMENT

Clostridium difficile Infection in Infants and Children

abstract

FREE

Infections caused by *Clostridium difficile* in hospitalized children are increasing. The recent publication of clinical practice guidelines for *C difficile* infection in adults did not address issues that are specific to children. The purpose of this policy statement is to provide the pediatrician with updated information and recommendations about *C difficile* infections affecting pediatric patients. *Pediatrics* 2013;131:196–200

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS

Clostridium difficile, *Clostridium difficile* infections, antibiotic-associated diarrhea

ABBREVIATIONS

CCCA—cell culture cytotoxicity assay
CDI—*Clostridium difficile* infection
EIA—enzyme immunoassay
FDA—Food and Drug Administration
NAAT—nucleic acid amplification test
NAP1—North American pulsed field type 1
PCR—polymerase chain reaction

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

INTRODUCTION

Clostridium difficile is a spore-forming, obligate anaerobic, Gram-positive bacillus and is acquired from the environment or by the fecal-oral route. Toxins A and B are responsible for intestinal disease. *C difficile* is the most common cause of antimicrobial-associated diarrhea and is a common health care-associated pathogen. Clinical symptoms vary widely, from asymptomatic colonization to pseudomembranous colitis with bloody diarrhea, fever, and severe abdominal pain.

The incidence of *C difficile* infections (CDIs) among hospitalized children has been increasing across the United States since 1997.[1–3] Kim et al evaluated the annual incidence of *C difficile*–associated disease from 2001 to 2006 at 22 freestanding children's hospitals and found increases in the number of admissions (2.4 to 4.0/1000 admissions; $P = .04$) as well as the number of cases per patient-days in the hospital (4.4 to 6.5 cases/10 000 patient-days; $P = .06$).[1] Nylund et al evaluated data from 1997, 2000, 2003, and 2006 and demonstrated an increase in the number of CDIs, from 3565 cases in 1997 to 7779 cases in 2006 (total cases, 21 274; $P < .01$).[2] Zilberberg et al also demonstrated an increase of hospitalizations attributable to *C difficile*, from 7.24 to 12.80/10 000 hospitalizations.[3] The emergence of the epidemic strain of toxin-producing *C difficile* (North American pulsed field type 1 [NAP1]) in recent years may have changed the epidemiology in children. Published guidelines for managing CDI in adults affirm that there are gaps in the knowledge surrounding CDIs in infants and children.[4]

Disease in the Neonate/Infant/Young Child 0 to 3 Years of Age

Although testing of infants is not recommended, recent data have shown that 26% of children hospitalized with CDIs were infants younger than 1 year, and 5% were neonates.[1] What cannot be determined from these data are whether the rates of hospitalization for CDIs represent true disease or asymptomatic carriage.

The intestine of the newborn infant is sterile, but by 12 months of age, an infant's intestine has flora similar to that of an adult.[5] *C difficile* carriage rates average 37% for infants 0 to 1 month of age and 30% between 1 and 6 months of age.[5] Vaginal delivery, premature rupture of membranes, and previous administration of antimicrobial agents have little effect on carriage rates, but exposure to environments where *C difficile* is present (eg, ICUs) is important.[6–8] The organism has been recovered from the hands of hospital personnel, baby baths, oximeters, electronic thermometers, and hospital floors. Breastfed infants have lower carriage rates than do formula-fed infants (14% vs 30%, respectively).[9] At 6 to 12 months of age, approximately 14% of children are colonized with *C difficile*, and by 3 years of age, the rate is similar to that of nonhospitalized adults (0% to 3%).[5] Recognized risk factors for older children acquiring CDI included antimicrobial therapy, use of proton pump inhibitors, repeated enemas, use of diapers, prolonged nasogastric tube insertion, gastrostomy and jejunostomy tubes, underlying bowel disease, gastrointestinal tract surgery, renal insufficiency, and impaired humoral immunity. Carriage rates in hospitalized children and adults approximate 20%.[4] Many of these risk factors are common among hospitalized children; the presence of risk factors does not necessarily prove causation of CDI in an individual patient.

Clinical illness is rarely reported before 12 to 24 months of age. It is possible that neonates/infants may lack the cellular machinery to bind and process the toxins of *Clostridium* species.[10] There have been relatively few studies of *C difficile* with diarrhea that include control groups. In an emergency department treating children, 7% of patients with diarrhea and 15% of controls were colonized with *C difficile*.[11] In 2 studies of inpatients 0 to 2 years of age, 11% to 59% of patients with diarrhea and 24% to 33% of controls were colonized with *C difficile*.[12,13] Among inpatients 0 to 34 months of age, 21% of those with diarrhea and 33% of controls carried *C difficile*.[14] Among patients 0 to 12 years of age, 2.9% of outpatients, 4.6% of inpatients, and 6.6% of controls were colonized with *C difficile*.[15] In the setting of a high prevalence of asymptomatic carriage, detection of *C difficile* toxin cannot be assumed to be the causative agent for diarrhea in children before adolescence, particularly young children.[16]

The NAP1 Isolate of *C difficile*

The NAP1 strain of *C difficile* has been described as causing severe disease, including an increased incidence of symptomatic infection relative to colonization, recurrent disease, sepsis, toxic megacolon, bowel perforation, and mortality.[17] The NAP1 strain has entered the pediatric population at lower rates (10%–19% of *C difficile* isolates) than reported for adults (>50%).[18,19] NAP1-associated CDIs occur in children without exposure to health care facilities and/or to antimicrobial agents.[20,21] Whether the NAP1 strain is truly responsible for more severe disease in children requires further investigation. Newer strains of *C difficile* have also been isolated (eg, NAP7, NAP8), and their role in human disease has yet to be elucidated completely.[22] Detection of the NAP1 strain of *C difficile* is not possible in most laboratories and, in most situations, would not influence the clinical care of an individual patient.

DIAGNOSTIC TESTING

The diagnosis of *C difficile* disease is based on the presence of diarrhea and of *C difficile* toxins in a diarrheal stool specimen. Diarrhea is often defined as 3 or more stools that take the shape of their container in a 24-hour period. Because of a slow turnaround time, isolation of the organism from stool is not a clinically useful diagnostic test, nor is testing of stool from asymptomatic patients. The cell culture cytotoxicity assay (CCCA) has been replaced by more sensitive diagnostics. The most common testing method used today for *C difficile* toxins is the commercially available enzyme immunoassay (EIA), which detects toxins A and/or B. Mean test sensitivities range from 72% to 82%, with mean specificities of 97% to 98%, compared with the CCCA.[23] With low prevalence rates of disease in children, sensitivities and specificities such as these lead to an unacceptably low positive predictive value, thus limiting the usefulness of such testing.[11–15] Testing for glutamine dehydrogenase produced by *C difficile* should only be used as part of a 2-step algorithm with a confirmation of positive results by using either a toxin assay A/B EIA or a CCCA.[4]

Molecular assays using nucleic acid amplification tests (NAATs) are approved by the US Food and Drug Administration (FDA) and are now preferred by many laboratories. NAATs combine good sensitivity and specificity, have turnaround times comparable to EIAs, and are not required to be part of a 2- or 3-step algorithm.[24] In a recent study, the sensitivities of the real-time polymerase chain reaction (PCR) assay for toxin A/B compared with EIA for toxin A/B were superior (95% vs 35%, respectively), and the specificity was equal (100%).[25] With the use of the PCR, the positivity rates for stool samples doubled, from 7.9% to 8.3% with EIA to 14.9% to 18.1% with PCR, and the numbers of repeated samples decreased. Many children's hospitals are converting to NAAT technology to diagnose CDIs, but more data are needed before NAATs can be used routinely.[4]

Because carriage is so common, it is prudent to avoid routine testing for *C difficile* in children younger than 1 year. Testing for *C difficile* can be considered in children 1 to 3 years of age with diarrhea, but testing for other causes of diarrhea, particularly viral, is recommended first.[19] For children older than 3 years, testing can be performed in the same manner as for older children and adults. Endoscopic findings of pseudomembranes and hyperemic, friable rectal mucosa suggest pseudomembranous colitis and are sufficient to diagnose a CDI at any age.

A common mistake is to use EIAs and NAATs as tests of cure after treatment of CDIs. *C difficile*, its toxins, and genome are shed for long periods after resolution of diarrheal symptoms. None of the assays are licensed or recommended for tests of cure. Excretion of toxin approximates 13% to 24% at 2 weeks and 6% at 4 weeks after therapy.[26,27] Given that NAAT testing is more sensitive than toxin assays, an interval greater than 4 weeks since last testing should be used for testing with a recurrence.

TREATMENT

Discontinuation of antimicrobial agents is the first step in treating CDI and may suffice in most instances. For patients with moderate or severe disease, proper empirical antibiotic treatment should be started as soon as the diagnosis is suspected. Antiperistaltic medications should be avoided because they may obscure symptoms and precipitate complications, such as toxic megacolon. Although orally administered vancomycin is still the only agent approved by the US FDA for the treatment of CDI in children, it was replaced as the drug of choice in the 1990s in response to concerns over the emergence of vancomycin-resistant enterococcus. Metronidazole is currently the drug of choice for the initial treatment of children and adolescents with mild to moderate disease on the basis of efficacy, cost, and antimicrobial stewardship. Oral vancomycin or vancomycin administered by enema with or without intravenous metronidazole is indicated as initial therapy for patients with severe disease and for patients who do not respond to oral metronidazole.[4] Severe or fatal disease is more likely to occur in neutropenic children with leukemia, in children with intestinal stasis (eg, Hirschsprung disease), and in patients with inflammatory bowel disease. Prospective trials for therapy longer than 10 days have not been performed for either drug. Historically, metronidazole resistance in *C difficile* was rare, and there is no evidence that the new epidemic isolates, NAP1, is more resistant to metronidazole compared with the nonepidemic isolates. A recent randomized controlled trial evaluating a subgroup of patients with severe disease suggested that vancomycin treatment was superior to metronidazole even in patients infected with the NAP1 isolate.[28] Extrapolating these data to treatment with infants and children is difficult, and more data are required.

Up to 30% of patients treated for CDIs experience a recurrence after discontinuing therapy. Recurrences represent either relapse with the original isolate or reinfection with a new isolate. In clinical practice, the distinction cannot be made. Patients with a recurrence will usually respond to a second course of the same treatment. Metronidazole should not be used for the treatment of the second recurrence (third episode) or for chronic therapy (because of possible neurotoxicity[4]), and tapered or pulsed regimens of vancomycin are recommended for this situation. Vancomycin therapy is recommended in adults with the first recurrence if the patient has a white blood cell count of 15 000/μL or higher or has an increasing serum creatinine concentration, because they are at a higher risk of developing complications from CDI. No data exist for children. Other antimicrobial agents with activity against *C difficile* include nitazoxanide, fidaxomicin (FDA approved for treatment of CDI in adults in 2011), and rifaximin; criteria for optimal use of these drugs in children are unknown. Because there is a lack of controlled studies in children, probiotics are not recommended for either the prevention or the treatment of CDI. In rare instances, severely ill patients may require cecostomy for irrigation or a colectomy. Fecal transplantation (enteric administration of donor stool flora) is used anecdotally.[29]

CONTROL

Transmission is via the fecal-oral route, and CDI is transmitted to others by contact with the patient or the patients' contaminated environment. Control of *C difficile* in the environment is essential to the control of CDIs in health care facilities. People with *C difficile*–associated diarrhea should be placed in standard plus contact precautions for the duration of their diarrhea. Test of cure is not recommended; the patient may be removed from isolation once the diarrhea has resolved. Use of gloves is the best proven method for preventing patient-to-patient transmission via the hands of health care personnel. Hand-washing with soap and water is more effective for the removal of spores than is alcohol-based hand sanitizer. Germicidal wipes with 10% sodium hypochlorite are good adjuncts for cleaning the environment, especially in an outbreak situation.

RECOMMENDATIONS

1. Testing for *C difficile* colonization or toxin should only be performed in

children with diarrhea who meet the clinical and age-related conditions listed in the following recommendations.

2. Testing in infants (younger than 12 months of age) is complicated by a high rate of asymptomatic colonization. Testing of these infants should be limited to those with Hirschsprung disease or other severe motility disorders or in an outbreak situation. Alternative etiologies should be sought even in those with a positive test result for *C difficile*.
3. Testing in the second and third year of life is difficult to interpret; alternative etiologies should be sought. A positive test result indicates possible CDI.
4. A positive test result after the third year of life indicates probable CDI. Risk factors increasing the probability of CDI include antimicrobial therapy, use of proton pump inhibitors, underlying bowel disease, renal insufficiency, or impaired humoral immunity.
5. Endoscopic or histologic test results positive for pseudomembranous colitis indicate definite CDI.
6. Test of cure is not recommended. Testing for recurrences less than 4 weeks after initial testing is only useful when the results of repeat testing are negative.
7. Discontinuation of antimicrobial agents is the first step in treating CDI and may suffice in most instances. Antiperistaltic medications should be avoided.
8. When antimicrobial treatment is indicated for moderate disease, metronidazole (30 mg/kg/day in 4 divided doses, orally; maximum, 2 g/day) is the drug of choice for initial treatment of first episode of CDI and for first recurrence.
9. Oral vancomycin (40 mg/kg/day in 4 divided doses; maximum, 2 g/day), with or without metronidazole, is recommended for severe disease and second recurrence.
10. Use of gloves with symptomatic patients, washing of hands with soap and water, and environmental decontamination using chlorine products are key control measures. Contact isolation may be removed once the diarrhea has resolved.

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CLINICAL REPORT

Collaborative Role of the Pediatrician in the Diagnosis and Management of Bipolar Disorder in Adolescents

Benjamin N. Shain, MD, PhD and COMMITTEE ON ADOLESCENCE

KEY WORDS
adolescent bipolar disorder, interview guidelines, psychiatric diagnosis, psychotropic medication, collaboration

ABBREVIATIONS
ADHD—attention-deficit/hyperactivity disorder
DSM-IV-TR—*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*
FDA—US Food and Drug Administration
OCD—obsessive-compulsive disorder
SMD—severe mood dysregulation

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abstract

FREE

Despite the complexity of diagnosis and management, pediatricians have an important collaborative role in referring and partnering in the management of adolescents with bipolar disorder. This report presents the classification of bipolar disorder as well as interviewing and diagnostic guidelines. Treatment options are described, particularly focusing on medication management and rationale for the common practice of multiple, simultaneous medications. Medication adverse effects may be problematic and better managed with collaboration between mental health professionals and pediatricians. Case examples illustrate a number of common diagnostic and management issues. *Pediatrics* 2012;130:e1725–e1742

Pediatricians are faced with increasing numbers of patients diagnosed with bipolar disorder and taking multiple psychotropic medications. In addition, pediatricians may be seeing these patients long before they are diagnosed and treated by a child and adolescent psychiatrist or other mental health professional. Pediatric bipolar disorder, once thought to be rare in adolescents and nearly nonexistent in younger children, has been diagnosed increasingly over the past decade.[1–3] In 2004, bipolar disorder accounted for 26% of primary discharge diagnoses among psychiatrically hospitalized adolescents in the United States.[3] Bipolar spectrum disorders,[4] encompassing the several types of bipolar disorder, have an estimated prevalence of 4% of children and adolescents in the general population.[5] The diagnosis remains controversial, and there has been a shift in how the diagnosis has been defined in youth.[1]

Associated impairments may include severe depression, high risk of suicide, psychosis, impulsive and dangerous behaviors, social and cognitive deficits, and frequent comorbidity with other psychiatric disorders, including substance use disorders, attention-deficit/hyperactivity disorder (ADHD), anxiety disorders, oppositional defiant disorder, and conduct disorder. Insight is frequently diminished, with youth vehemently blaming others for their difficulties and having little recognition of their own disruptive symptoms.[1] Management of these youth is additionally complicated by medication limitations, including troublesome adverse effects, lack of full response and the resultant common prescription of multiple medications, and incomplete prevention of relapse.[1] Not surprisingly, poor adherence to prescribed dosing is common.[6]

This report is not expected to give general pediatricians the tools necessary to diagnose and manage these complex cases independently. Some specific techniques are described with the intent of facilitating partnerships between pediatricians and child and adolescent psychiatrists and other mental health professionals. Additional goals include improved understanding of diagnosis and treatment; earlier referral of new, suspected cases, and patients with symptom relapse or worsening; and assistance in recognizing and managing medication adverse effects.

The focus of this report is diagnosis and management of adolescents with bipolar disorder. Children are mentioned as well when the subject matter applies to them.

CLASSIFICATION

The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)[7] describes 4 types of bipolar disorders, all without age limitations: bipolar I disorder, bipolar II disorder, cyclothymic disorder, and bipolar disorder not otherwise specified. Manic symptoms are the key feature of these diagnoses; Tables 1, 2, and 3 provide criteria for mania, hypomania, and mixed episodes.[7] A key criterion is duration: the minimum duration for mania and mixed episodes is 7 days and for hypomania is 4 days.

Bipolar I Disorder

Bipolar I disorder is the "classic" form of the disorder and requires a current or past manic or mixed episode. At any given time, the patient may be in a manic, hypomanic, mixed, or major depressive episode or may have fully or partially recovered from the last mood episode. Notably, this is a historical diagnosis because the patient may be in any current mood state and still meet this criterion. History of a depressive episode is common but not required. Other criteria are that the mood symptoms cause significant distress or impaired functioning; are not better accounted for by schizoaffective disorder or superimposed on schizophrenia, schizophreniform disorder, delusional disorder, or psychotic disorder not otherwise specified; and are not the effect of a substance (including medications) or general medical condition.

TABLE 1 Diagnostic Criteria for a Manic Episode

A. A distinct period of abnormally and persistently elevated, expansive, or irritable mood, lasting at least 1 wk (or for any duration if hospitalization is necessary)
B. During the period of mood disturbance, 3 (or more) of the following symptoms have persisted (4 if the mood is only irritable) and have been present to a significant degree
   1. Inflated self-esteem or grandiosity
   2. Decreased need for sleep (eg, feels rested after only 3 h)
   3. More talkative than usual or pressure to keep talking
   4. Flight of ideas or subjective experience that thoughts are racing
   5. Distractibility (ie, attention too easily drawn to unimportant or irrelevant external stimuli)
   6. Increase in goal-directed activity (either socially, at work or school, or sexually) or psychomotor agitation
   7. Excessive involvement in pleasurable activities that have a high potential for painful consequences (eg, engaging in unrestrained buying sprees, sexual indiscretions, or foolish business investments)
C. The symptoms do not meet criteria for a mixed episode
D. The mood disturbance is sufficiently severe to cause marked impairment in occupational functioning or in usual social activities or relationships with others or to necessitate hospitalization to prevent harm to self or others, or there are psychotic features
E. The symptoms are not due to the direct physiologic effects of a substance (eg, a drug of abuse, a medication, or other treatment) or a general medical condition (eg, hyperthyroidism)

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TABLE 2 Diagnostic Criteria for a Hypomanic Episode

A. A distinct period of persistently elevated, expansive, or irritable mood, lasting throughout at least 4 d, that is clearly different from the usual nondepressed mood
B. Same as manic episode "B" (Table 1)
C. The episode is associated with an unequivocal change in functioning that is uncharacteristic of the person when not symptomatic
D. The disturbance in mood and the change in functioning are observable by others
E. The episode is not severe enough to cause marked impairment in social or occupational functioning or to necessitate hospitalization, and there are no psychotic features
F. Same as manic episode "E" (Table 1)

DSM-IV-TR asks for specification of certain patterns, including longitudinal course as with or without full interepisode recovery and/or rapid cycling. Rapid cycling is defined as more than 4 mood changes in a year. Researchers have defined patterns that commonly apply to pediatric bipolar disorder, including ultrarapid cycling, episodes lasting a few days to a few weeks, and ultradian cycling, variation occurring within a 24-hour period.[8,9]

Bipolar II Disorder

Depression typically is the major problem in bipolar II disorder. A current or at least 1 past major depressive episode is required, and the patient must have a current or past episode of hypomania with no manic or mixed episodes at any time. That is, currently or historically, a patient with bipolar I disorder has big "ups" (mania) and may or may not have "downs" (depression). A patient with bipolar II disorder has little "ups" (hypomania) plus big "downs" (major depression).

Cyclothymic Disorder

Cyclothymic disorder is characterized by relatively mild but chronic symptoms (hypomanic and depressive symptoms) that last at least 2 years (1 year with children and adolescents) before any full manic, mixed, or major depressive

TABLE 3 Diagnostic Criteria for a Mixed Episode

A. The criteria are met for both a manic episode and a major depressive episode (except for duration) nearly every day during at least a 1-wk period
B. Same as manic episode "D" (Table 1)
C. Same as manic episode "E" (Table 1)

episodes. These patients have little "ups" (hypomania) and little "downs" (dysthymia), but the disorder is chronic.

Bipolar Disorder Not Otherwise Specified

DSM-IV-TR describes the category of bipolar disorder not otherwise specified as including, "disorders with bipolar features that do not meet criteria for any specific bipolar disorder."[7] The American Academy of Child and Adolescent Psychiatry recommends using this diagnosis for youth with manic symptoms lasting hours to days or for those with chronic manic-like symptoms.[1] These youth may be significantly impaired and constitute the majority of those referred to mental health professionals.[10] Emerging evidence suggests that this disorder is on a continuum with bipolar I disorder,[11,12] and 45% of patients converted to bipolar I or bipolar II disorder at follow-up an average of 5 years later, particularly patients with a family history of bipolar disorder.[13]

Beyond DSM-IV-TR

Akiskal and Pinto described a bipolar spectrum in adults, ranging from bipolar I disorder to hyperthymic temperament.[4] The disorders and conditions on the spectrum share symptom characteristics that generally responded better to mood-stabilizing medication than to antidepressant medication.

Leibenluft et al suggested research diagnostic criteria for 3 clinical phenotypes of pediatric bipolar disorder: narrow, intermediate, and broad[14] (Tables 4, 5, and 6). These criteria are included in this report to illustrate important features of diagnosis that are not present in DSM-IV-TR; they should not be construed as generally accepted by physicians or researchers. Narrow phenotype refers to a disorder in which, for at least 1 episode, full DSM-IV-TR criteria are met, including duration criteria, and elation and/or grandiosity also is present. Elation and grandiosity were argued by Geller et al[9] to be core bipolar features. Intermediate phenotype refers to patients with episodes that met full DSM-IV-TR criteria but lacked duration criteria (episodes too short) or had mania/hypomania that was irritable rather than euphoric. This phenotype still includes mood cycling as a required feature. Broad phenotype refers to a disorder characterized by chronic irritability and hyperarousal and does not include mood cycling. Compared with their peers, children and adolescents who have the broad phenotype show markedly increased reactivity to negative emotional stimuli. The broad phenotype has been referred to as severe mood dysregulation (SMD).

TABLE 4 Research Criteria for the Narrow Phenotype of Juvenile Mania

A. Modification to the DSM-IV-TR criteria for manic episode
a. The child must exhibit either elevated/expansive mood or grandiosity while also meeting the other DSM-IV-TR criteria for a (hypo)manic episode
B. Guidelines for applying the DSM-IV-TR criteria
a. Episodes must meet the full duration criteria (ie, at least 7 d for mania and at least 4 d for hypomania) and be demarcated by switches from other mood states (depression, mixed state, euthymic).
b. Episodes are characterized by a change from baseline in the patient's mood and, simultaneously, by the presence of the associated symptoms.
c. Decreased need for sleep should be distinguished from insomnia.
d. Poor judgment is not a diagnostic criterion unless it is in the context of "increased goal-directed activity" or "excessive involvement in pleasurable activities that have a high potential for painful consequences."

TABLE 5 Research Criteria for the Intermediate Phenotypes of Juvenile Mania

A. The child meets the criteria for the narrow phenotype except:
a. (Hypo)manic episodes are 1to 3 d in duration OR
b. The (hypo)manic episodes include exclusively irritable, not elevated or expansive, mood, and DSM-IV-TR duration criteria are met

SMD among children 9 to 19 years of age has a lifetime prevalence of 3.3%, with most affected children having comorbid psychiatric disorders, most frequently disruptive behavior disorders (ADHD, conduct disorder, and oppositional defiant disorder).[15] Children with SMD were 7 times more likely to develop depression as young adults compared with those without SMD. Compared with children with narrow phenotype bipolar disorder, subjects with SMD had different psychopathological measures and were less likely to have parents with bipolar disorder,[16] suggesting that SMD is a disorder distinct from narrow phenotype bipolar disorder.

Mood diagnoses continue to evolve. The development web site for the forthcoming *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition,* lists an additional proposed mood diagnosis of "disruptive mood dysregulation disorder,"[17] characterized by severe recurrent temper outbursts in response to common stressors and similar to the broad phenotype. Characteristics for this diagnosis as well as others on the development Web site have been changing in response to public feedback. The *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, is expected to be published in May 2013. Because the final version may be fairly different, this report

TABLE 6 Research Criteria for Broad Phenotype of Juvenile Mania: Severe Mood and Behavioral Dysregulation

A. Inclusion criteria
  a. Age 7–17 y, with onset of symptoms before age 12
  b. Abnormal mood present at least half of the day most days and of sufficient severity to be noticeable by people in the child's environment
  c. Hyperarousal, as defined by at least 3 of the following symptoms: insomnia, agitation, distractibility, racing thoughts or flight of ideas, pressured speech, intrusiveness
  d. Compared with his/her peers, the child exhibits markedly increased reactivity to negative emotional stimuli that is manifest verbally or behaviorally
  e. The symptoms noted in the previous 3 items are currently present and have been present for at least 12 mo without any symptom-free periods exceeding 2 mo in duration
  f. The symptoms are severe in at least 1 setting and at least mild symptoms in a second setting
B. Exclusion criteria
  a. The individual exhibits any of the cardinal bipolar symptoms: elevated or expansive mood, grandiosity or inflated self-esteem, episodically decreased need for sleep
  b. The symptoms occur in distinct periods lasting more than 4 d
  c. The individual meets criteria for schizophrenia, schizoaffective illness, pervasive developmental disorder, or posttraumatic stress disorder
  d. The individual has met the criteria for substance abuse disorder in the past 3 mo
  e. IQ <80
  f. The symptoms are attributable to the direct physiologic effects of a drug of abuse or to a general medical or neurologic condition

does not include additional mention of diagnoses listed on the development web site.

The balance of this report refers to *DSM-IV-TR* as well as proposed research diagnoses. Pediatricians should be aware, however, of the changing classification of bipolar and related disorders.

INTERVIEWING FOR MANIA

The presence or history of mania of some sort is the determining factor for a diagnosis of bipolar disorder. Typically, depressive symptoms are also present at some point in the illness and may be the major concern, but depression is not required to be present either currently or historically for a bipolar diagnosis. Depressed patients with bipolar disorder, particularly those with the narrow or intermediate phenotype, may require different medication from those with depression alone, so it is important for the pediatrician or mental health professional to attempt to make this differentiation before initiating pharmacotherapy.

Challenges in Diagnosing Mania

At a minimum, a full psychiatric evaluation should be performed to determine diagnosis.[1] A significant problem is that the diagnosis of mania typically is historical. Even with a patient who demonstrates manic symptoms during the interview, the interviewer still needs to determine that the symptoms represent a change, interfere with functioning, and are associated with less evident manic symptoms. Much more often, however, the patient presents as depressed or euthymic, leaving it for the interviewer to tease out groups of symptoms that occur together in episodes and are different from "normal adolescence." Adolescents and parents may tend to minimize these symptoms, wanting the trouble to be something less serious or, conversely, may tend to exaggerate, grasping at a bipolar diagnosis as a means of explaining a range of difficulties. Much of the public now has some education about bipolar disorder, often just enough to produce misconceptions about the diagnosis and associated symptoms, thus complicating the job of the interviewer.

Simplifications

Without specific training in this area, the general pediatrician should not attempt initiation of treatment in newly diagnosed cases. The goal for the pediatrician in identification, therefore, should be reasonable suspicion rather than diagnosis, followed by referral or seeking an appropriate mental health professional as partner. The balance of this section discusses several historical symptoms that may be considered red flags for the diagnosis. The clear presence of any of these should be considered sufficient for reasonable suspicion.

Red Flag Symptoms

Rage Outbursts or Verbal or Physical Aggression

Rage is not a bipolar symptom per se but is common with adolescents experiencing episodic irritable mania or chronic severe mood dysregulation. In both cases, the adolescent is edgy and easily frustrated and provoked. Questions the interviewer may ask include, "Do you lose your temper?" If so, the adolescent should be asked about frequency, duration, what happens, and what the triggers are (see Table 7 for a summary of examples of interview questions).

Episodes of Requiring Little Sleep

Requiring little sleep needs to be distinguished from going to bed late and getting up late and from receiving less sleep and consequently being tired the next day. Staying up late for 1 night during a sleepover or for a concert also does not count. Adolescents with this symptom have the experience of having high energy, receiving at least 2 hours less sleep per night, and remaining full of energy often after several nights of this.[18] Questions include, "Do you ever have nights when you have lots of energy, do not need to sleep much, and do lots of things?" If so, "Are you tired the next day?"

TABLE 7 Examples of Interview Questions

Symptom	Question examples
Rage outbursts	"Do you lose your temper?" If so, ask about frequency, duration, what happens, what the triggers are.
Episodes of requiring little sleep	"Do you ever have nights when you have lots of energy, do not need to sleep much, and do lots of things?" If so, "Are you tired the next day?"
Spontaneous mood shifts	"Do you find yourself suddenly angry or extremely happy for no apparent reason?" If so, ask about frequency and duration of the moods.
Running away, sneaking out at night, spending money, hypersexuality	"Have you even run away or snuck out of the house at night?" "Do you have time when you spend a lot of money or when you feel that you cannot control your sexual urges?"
Grandiosity	"Do you have times when you feel that nothing can happen to you?" "Do you have times when you greatly overestimate your talents or abilities?"
Agitation or mania with antidepressant	"Have you ever taken medication for depression?" If so, "Did you have any side effects?" "Did you ever become very edgy or much more happy or angry than is typical for you?"

Spontaneous Mood Shifts

The adolescent experiences sudden mood shifts between euthymic, giddy, depressed, or angry, with no evident circumstantial trigger. The giddy, depressed, or angry mood state should significantly interfere with functioning, such as making concentration in school or appropriate behavior with friends much more difficult. A mood shift may happen multiple times per day. Questions include, "Do you find yourself suddenly angry or extremely happy for no apparent reason?" If so, ask about frequency and duration of the moods.

Running Away, Sneaking Out at Night, Spending Money, Hypersexuality

These activities may be categorized as "excessive involvement in pleasurable activities that have a high potential for painful consequences" (Table 1).[7] Running away also may be an example of an impulsive activity related to severe irritability. Questions include, "Have you ever run away or snuck out of the house at night?" "Do you have times when you spend a lot of money or when you feel that you cannot control your sexual urges?"

Grandiosity

Grandiosity is a grossly inflated belief in oneself having special talents or abilities, such as never being in danger regardless of the activity or being the best at a certain sport, or endless talk about a real talent. This must be a change from baseline and does not include a consistent picture of boastfulness or failure to appreciate consequences. Questions include, "Do you have times when you feel that nothing can happen to you?" "Do you have times when you greatly overestimate your talents or abilities?"

Agitation or Mania With Antidepressant

Adverse effects for a patient under the influence of antidepressant medication may be edginess, agitation, or less commonly, frank mania. By definition, a cluster of manic symptoms resulting from a medication or substance is not mania. It is, however, a risk factor for mania either continuing once the medication is withdrawn or mania at another time. Questions include, "Have you ever taken medication for depression?" If so, "Did you have any side effects?" "Did you ever become very edgy or much more happy or angry than is typical for you?"

Any or all of these symptoms may be present currently, recently, or in the more distant past.

TREATMENT

Psychotherapy

Psychotherapeutic interventions are an important component of an overall treatment plan.[1] Interventions should be targeted to the following areas.

Psychoeducation

Information is provided to patient and family on the illness, treatment options, impact on functioning, and heritability. Relapse prevention typically is an important issue. Education is provided regarding importance of treatment adherence, avoidance of precipitating factors, and early recognition of symptoms. The illness may result in a dramatic tendency to blame others and minimize one's own symptoms and limitations, making engagement in the treatment plan difficult. For some individuals and families, education regarding relapse prevention is the key intervention.

Individual Psychotherapy

Cognitive-behavioral psychotherapy and interpersonal therapy support emotional and cognitive development, coping, and symptom monitoring.

Social and Family Functioning

Interventions aimed at communication and problem solving are needed to address disruptions in family and social relationships.

Academic and Occupational Functioning

Educational planning, specialized educational programs, and occupational training and support may be needed to address disruption of functioning in

school or work from ongoing or intermittent symptoms.

Treatment of Comorbidities

Psychosocial interventions should be aimed at treatment of pre- or coexisting substance abuse disorders, behavioral disorders, anxiety disorders, learning problems, and confounding social issues.

Inpatient Psychiatric Hospitalization

Inpatient care typically is aimed at preventing imminent harm to self and others as well as allowing for treatment that could not be accomplished in a less restrictive setting.[19] A common reason for admission is suicidality, including suicidal ideation or a recent attempt. To be at high risk of suicide, the patient need not be thinking of suicide at the time of admission. Mood and behavior may have considerable day-to-day or even minute-to-minute variation; therefore, judgment as to safety should be based on recent thoughts, moods, and behaviors rather than just the current ones and on near-future projection on the basis of possible and sudden occurrence of common adolescent stressors. For example, in an adolescent with recent suicidal behavior and a history of grossly overreacting to negative circumstances, a romantic breakup could be lethal.

Other common reasons for psychiatric hospitalization for harm prevention are recent episodes of severe rage, agitation, or aggression attributable to mood symptoms or manic symptoms accompanied by severe impulsivity in areas that could inadvertently result in self-harm, such as running away or sexual activity with multiple partners. Patients with florid mania or acute psychosis typically require hospitalization even in the absence of overtly dangerous behaviors or ideation because of the high unpredictability of the behavior of afflicted individuals as well as difficulty with treatment adherence at a time when vigorous treatment is indicated.

Partial hospitalization[20] or hospital day treatment is used as a less restrictive, step-down treatment from inpatient care or as step-up treatment from mental health office services. Partial hospitalization does not afford the 24-hour monitoring and harm prevention provided with inpatient services but is less disruptive to the patient's life, less expensive, and gives the patient and family more responsibility for the patient's care while still providing intensive psychotherapeutic and medical management.

Residential treatment[21] is longer-term, 24-hour-a-day care in a less intensive, typically nonhospital setting, and may be a month to a year or more in duration. Residential care is designed for patients who cannot be safely managed otherwise despite adequate treatment or who have symptoms that require long-term behavioral intervention to effect improvement.

Psychopharmacology

Medication management is an important component of treatment of youth with bipolar disorder and is the primary treatment in cases of well-defined mania.[1,5] The primary medications used to treat patients with bipolar disorder are mood stabilizers, such as lithium; certain anticonvulsant medications, including divalproex, lamotrigine, carbamazepine, oxcarbazepine, gabapentin, and topiramate; and atypical antipsychotics, including aripiprazole, olanzapine, quetiapine, risperidone, ziprasidone, paliperidone, clozapine, asenapine, and iloperidone. Adjunctive medications include antidepressant medications and "typical" antipsychotics, as well as medications for ADHD, anxiety, and insomnia; more information is available from the American Academy of Child and Adolescent practice parameters.[1,22–25]

The American Academy of Child and Adolescent Psychiatry[1] recommends basing the medication choice on the following: evidence of efficacy, phase of illness, type of presentation (eg, with psychotic symptoms), safety and adverse effect profile, history of medication response, and patient or family preference. Medication combinations are common, with some patients on 5 or more drugs. See Kowatch et al[5] for a suggested prescribing algorithm.

Efficacy Studies

Currently, lithium, aripiprazole, risperidone, olanzapine, and quetiapine are approved by the US Food and Drug Administration (FDA) for use in adolescents with bipolar disorder (Table 8).[26] In addition, divalproex, lamotrigine, carbamazepine, oxcarbazepine, gabapentin, and topiramate have nonmental health pediatric indications, and divalproex, lamotrigine, ziprasidone, and asenapine have indications for treatment of adults with bipolar disorder. Published studies have had mixed results (Tables 9, 10, and 11). Not all studies are available, because pharmaceutical companies are not required to publish their studies even when submitted to the FDA as part of an application for an indication. Lithium, aripiprazole, and olanzapine showed efficacy in published, double-blind, placebo-controlled studies, with open-label, chart review, and comparison studies giving support for use of divalproex, lamotrigine, clozapine, risperidone, quetiapine, and carbamazepine. Notably, divalproex and oxcarbazepine each failed to show efficacy in a double-blind, placebo-controlled study, but given the heterogeneity of this disorder, 1 negative study is not conclusive. Divalproex, lamotrigine, lithium, aripiprazole,

TABLE 8 FDA Indications for Oral Formulations of Mood Stabilizers and Atypical Antipsychotics

Medication	Bipolar disorder	Schizophrenia	Irritability associated with autism	Nonmental health	All adult mental health
Mood stabilizer					
Lithium (Eskalith)	Mania, ages 12–17				Mania
Divalproex (Depakote)				Seizures, ages 0–17	Mania
Lamotrigine (Lamictal)				Seizures, ages 2–17	Bipolar maintenance
Carbamazepine (Tegretol)				Seizures, ages 0–17; trigeminal neuralgia	
Oxcarbazepine (Trileptal)				Seizures, ages 2–17	
Gabapentin (Neurontin)				Seizures, ages 3–17	
Topiramate (Topamax)				Seizures, ages 2–17	
Atypical antipsychotics					
Aripiprazole (Abilify)	Manic and mixed episodes, ages 10–17	Ages 13–17	Ages 6–17		Bipolar mania, schizophrenia, adjunctive for major depression
Risperidone (Risperdal)	Manic and mixed episodes, ages 10–17	Ages 13–17	Ages 5–16		Schizophrenia, bipolar manic and mixed episodes
Olanzapine (Zyprexa)	Manic and mixed episodes, ages 13–17	Ages 13–17			Schizophrenia, bipolar manic and mixed episodes, bipolar and resistant depression (in combination with fluoxetine)
Quetiapine (Seroquel)	Manic episodes, ages 10–17	Ages 13–17			Schizophrenia, bipolar mania, bipolar depression
Ziprasidone (Geodon)					Schizophrenia, bipolar manic and mixed episodes, bipolar maintenance
Paliperidone (Invega)					Schizophrenia, schizoaffective disorder
Clozapine (Clozaril)					Schizophrenia, schizoaffective disorder
Asenapine (Saphris)					Schizophrenia, bipolar manic and mixed episodes
Iloperidone (Fanapt)					Schizophrenia
Lurasidone (Latuda)					Schizophrenia

quetiapine, risperidone, and topiramate have shown efficacy in medication combination studies. Kowatch et al[27] found a medication combination response rate of 80% among patients who did not respond to monotherapy with a mood stabilizer.

Adverse Effects

Mood stabilizer (Table 12)[5] and atypical antipsychotic (Table 13)[28,29] medications have a variety of adverse effects, interactions, and safety concerns. Pediatricians probably need to be most aware of weight gain and metabolic effects common with the atypical antipsychotics, although weight gain is also commonly associated with valproate and, to a lesser extent, lithium. Prescription of atypical antipsychotics in youth for bipolar disorder as well as for psychosis, disruptive behavior disorders, and other mood disorders has increased drastically in recent years.[30] Children and adolescents may be more vulnerable than adults to weight gain from these medications and, thus, likely to be at higher risk of glucose and lipid abnormalities.[31] Weight management potentially can be addressed with suggestions of diet and exercise as well as changing the dose and/or type of medication. Use of metformin may be of some help.[32,33] Stable patients should be seen by their pediatrician every 4 to 6 months, with more frequent visits when there are active adverse effects, interactions, or safety issues.

The American Diabetes Association[34] published a protocol for use in monitoring for weight gain and metabolic changes in adults treated with atypical antipsychotics, including obtaining personal and family history of related disorders, determining weight and height, determining waist circumference, taking blood pressure, and measuring fasting plasma glucose and fasting lipid profile. Weight should

TABLE 9 Published Studies of Efficacy of Mood Stabilizers With Pediatric Bipolar Disorder[a]

Medication	Study	Ages	Type	Results	Comments
Divalproex	Wagner et al (2002)[41]	7–19; *n* = 40	Open-label trial	Response rate 61% with manic symptoms	Manic, mixed, or hypomanic
Divalproex	Henry et al (2003)[42]	4–18; *n* = 15	Records review	Response rate 53% after 1 y	Divalproex alone and as add-on
Divalproex	Wagner et al (2009)[43]	10–17; *n* = 150	Double-blind	No significant difference from placebo	Manic or mixed
Lamotrigine	Chang et al (2006)[44]	12–17; *n* = 20	Open-label trial	Significant decreases in depression, mania, and aggression	Lamotrigine alone and in combination with other medication
Lamotrigine	Pavuluri et al (2009)[45]	8–18; *n* = 46	Open-label trial	Response rate 72% with manic symptoms and 82% with depressive symptoms	Monotherapy
Lithium	Strober et al (1990)[46]	13–17, *n* = 37	Naturalistic prospective follow-up	Relapse rate 3 times higher when lithium discontinued	Lithium alone and in combination with other medication
Lithium	Geller et al (1998)[47]	12–18; *n* = 25	Double-blind	Significant response rate difference, 46% versus 8% of placebo group	Bipolar disorder with secondary substance dependence
Lithium	Kafantaris et al (2003)[48]	12–18; *n* = 100	Open-label trial	Response rate 63% with manic symptoms	Acute mania
Lithium	Kafantaris, et al (2004)[49]	12–18; *n* = 40	Double-blind discontinuation	No significant difference from placebo	Mania with or without psychosis or aggression
Lithium	Patel et al (2006)[50]	12–18; *n* = 27	Open-label trial	Response rate 48% with depressive symptoms	Acute bipolar depression
Oxcarbazepine	Wagner et al (2006)[51]	7–18; *n* = 116	Double-blind	No significant difference from placebo	Manic or mixed
Topiramate	Del Bello et al (2002)[52]	5–20; *n* = 26	Chart review	Response rate 73% for mania and 62% for overall illness	Outpatient with acute manic, mixed, or depressive episode; adjunctive or monotherapy
Topiramate	Barzman et al (2005)[53]	7–20; *n* = 25	Chart review	Response rate 64%	Hospitalized with acute manic, mixed, or depressive episode; adjunctive or monotherapy
Topiramate	DelBello, et al (2005)[54]	6–17; *n* = 56	Double-blind	Mixed results	Inconclusive; study stopped early when early adult studies failed to show efficacy

[a] Includes only the most recent studies of divalproex and lithium.

TABLE 10 Published Studies of Efficacy of Atypical Antipsychotics for Pediatric Bipolar Disorder

Medication	Study	Ages	Type	Results	Comments
Aripiprazole	Barzman et al (2004)[55]	5–19; *n* = 30	Chart review	Response rate 67%	Bipolar or schizoaffective; adjunctive or monotherapy
Aripiprazole	Biederman et al (2005)[56]	4–17; *n* = 41	Records review	71% improvement of manic symptoms	Aripiprazole alone and as add-on
Aripiprazole	Biederman et al (2007)[57]	6–17; *n* = 19	Open-label trial	Significant improvement	Mania
Aripiprazole	Tramontina et al (2007)[58]	8–17; *n* = 10	Open-label trial	Significant improvement	Comorbid bipolar and ADHD; improved both mania and ADHD symptoms
Aripiprazole	Findling et al (2009)[59]	10–17; *n* = 296	Double-blind	Significant response rate difference, 44% (10 mg), 64% (30 mg), 26% (placebo)	Manic or mixed
Aripiprazole	Tramontina et al (2009)[60]	8–17; *n* = 43	Double-blind	Significant response rate difference, 89% vs 52% of placebo group	Manic or mixed comorbid with ADHD
Clozapine	Masi et al (2002)[61]	12–17; *n* = 10	Open-label trial	Significant improvement	Severe treatment-resistant manic or mixed
Olanzapine	Frazier et al (2001)[62]	5–14; *n* = 23	Open-label trial	Response rate 61%	Acute mania
Olanzapine	Tohen et al (2007)[63]	13–17; *n* = 161	Double-blind	Significant response rate difference, 45% vs 19% of placebo group	Acute manic or mixed
Olanzapine	Joshi et al (2010)[64]	4–17; *n* = 52	Open-label trial; secondary analysis of 2 trials	Significantly less antimanic response with comorbid OCD	Bipolar disorder
Quetiapine	Del Bello et al (2007)[65]	12–18; *n* = 20	Single-blind, open label	Response rate 87% with mood symptoms	Patients at high risk for bipolar I
Quetiapine	Del Bello et al (2009)[66]	12–18; *n* = 32	Double-blind	No significant difference from placebo	Bipolar depression
Quetiapine	Scheffer et al (2010)[67]	6–16; *n* = 75	Open-label trial	94% much improved at 8 wk; rapid loading tolerated well	Bipolar disorder
Risperidone	Frazier et al (1999)[68]	4–17; *n* = 28	Records review	Response rate 82% with manic and aggressive symptoms	Mixed or hypomanic
Risperidone	Biederman et al (2005)[69]	6–17; *n* = 30	Open-label trial	Response rate 70% with manic symptoms	Manic, mixed, or hypomanic
Risperidone	Haas et al (2009)[70]	10–17; *n* = 169	Double-blind	Significant response rate difference, 59% (0.5–2.5 mg), 63% (3–6 mg), 26% (placebo)	Acute manic or mixed
Risperidone	Carlson et al (2010)[71]	5–12; *n* = 151	Chart review	Reduced duration or rages	Hospitalized children with possible bipolar disorder
Risperidone	Krieger et al (2011)[72]	7–17; *n* = 21	Open-label trial	Significant reduction of irritability, depression, ADHD symptoms, and global functioning	Severe mood dysregulation
Ziprasidone	Biederman et al (2007)[73]	6–17; *n* = 21	Open-label trial	Response rate 71% with manic symptoms	Mania

be reassessed monthly for 3 months and then quarterly. Lipids and fasting plasma glucose may be measured after 3 months and then every 6 months. There is no a protocol currently for children and adolescents.[28]

When medications are prescribed by a physician other than the pediatrician, the decision of which physician monitors the patient's weight and metabolic consequences of the medication may be a matter of practicality. Certain measurements, such as vital signs, height, weight, and waist size, are easily and routinely obtained in a pediatrician's office but much more difficult to obtain in a psychiatrist's office, because it typically is not set up with the proper equipment and usually does not have a nurse on staff. In addition, at times, the patients may perceive these measurements to be physically intrusive when obtained by the psychiatrist. The pediatrician should collaborate with the prescribing physician in monitoring for and managing these medication adverse effects.

Other Medication Caution

A number of medications should be used with care because they may increase mood cycling (Table 14).[18] In particular, antidepressant medications are commonly prescribed, because bipolar disorder usually includes depression, and depression is the most common reason for the initial referral for treatment. Antidepressant induction of mania may be less frequent than once thought,[35] but common practice is to start with a mood stabilizer or atypical antipsychotic (or combination) and add an antidepressant to the mix only if there is insufficient response.

Few studies have addressed the use of mood stabilizers and atypical antipsychotics with pediatric bipolar depression. Lithium and lamotrigine

TABLE 11 Published Comparison Studies of Efficacy of Mood Stabilizers and Atypical Antipsychotics With Pediatric Bipolar Disorder

Medication	Study	Ages	Type	Results	Comments
Lithium, Divalproex, Carbamazepine	Kowatch et al (2000)[74]	6–18; *n* = 42	Open-label trial	Large effect size for all 3 medications; response rate with manic symptoms of divalproex 53%, lithium 38%, and carbamazepine 38%	Manic or mixed
Quetiapine, Divalproex	Del Bello et al (2002)[75]	12–18; *n* = 30	Double-blind	Significant response rate difference, 87% vs 53% of placebo group	Manic or mixed; divalproex plus quetiapine versus divalproex plus placebo
Risperidone, Lithium, Divalproex	Pavuluri et al (2004)[76]	5–18; *n* = 37	Open-label trial	Response rate 80% for risperidone plus divalproex and 82% for risperidone plus lithium	Manic or mixed
Lithium, Divalproex	Findling et al (2005)[77]	5–17; *n* = 60	Double-blind; no placebo group	No significant difference between the groups	Stabilized on lithium plus divalproex and then compared maintenance monotherapy with one or the other
Quetiapine, Divalproex	Del Bello et al (2006)[78]	12–18; *n* = 50	Double-blind, no placebo group	Significant improvement in both groups; no significant difference in amount of improvement but significantly faster improvement in quetiapine group	Manic or mixed; compared quetiapine and divalproex
Risperidone, Divalproex	MacMillan et al (2008)[79]	5–14; *n* = 28	Records review	Risperidone group showed significantly faster decrease of symptoms than divalproex group	More wt gain with risperidone
Risperidone, Divalproex	Pavuluri et al (2010)[80]	8–18; *n* = 66	Double-blind, no placebo group	More rapid improvement in risperidone group but no difference in final scores	No significant wt gain in either group; better retention of subjects in risperidone group

have shown efficacy in open-label trials (Table 9) and quetiapine was not significantly better than placebo (Table 10).

Medication Combinations

Adolescents with bipolar disorder may have a range of symptoms within the disorder, including symptoms of mania or hypomania, depression, and psychosis, and commonly have comorbidities with a variety of other psychiatric disorders, including ADHD, generalized anxiety disorder, obsessive-compulsive disorder (OCD), posttraumatic stress disorder, and others.[5] These comorbidities can lead to a complexity of symptoms and often difficult choices for medication management. As a result, use of multiple medications is common in treating adolescents with bipolar disorder, who often are prescribed 2 to 5, or more, simultaneous medications. Even in a research setting using algorithms designed to limit the number of medications, only 28% of patients were able to remain on monotherapy for >6 months.[36]

Reasons for combining medications include the following:

- Partial response. A group of symptoms, such as expansive mood, grandiosity, and pleasure-seeking behaviors, may have improved with a particular medication (with adequate dose and time), but symptoms continue sufficiently to cause distress and/or impairment of functioning. A second (or sometimes third) medication is then added as an "augmentation agent" to improve response. Another type of partial response is when some symptoms improve and others do not (eg, symptoms of mania improve but the patient still suffers from intermittent or persistent depression).
- Target specific symptom. There may be a particular troublesome and/or easily treated symptom, such as

TABLE 12 Adverse Effects and Possible Monitoring of Mood Stabilizers

Medication	Summary of adverse effects	Suggested monitoring
Lithium	Reduced renal function, hypothyroidism, nausea, diarrhea, abdominal distress, sedation, tremor, polyuria, wt gain, acne, cardiac conduction problems, hypoparathyroidism	Baseline: serum electrolytes, creatinine, BUN, calcium, CBC count, TFTs, EKG, pregnancy test (sexually active female patients)
	Wt gain may be additive when combined with an atypical antipsychotic[28]	Ongoing: lithium level, renal function, thyroid function, calcium
	Toxic levels may produce confusion, ataxia, dysarthria, seizures, coma, death	
Divalproex	Polycystic ovaries, nausea, increased appetite, wt gain, sedation, thrombocytopenia, hair loss, tremor, vomiting, rare pancreatitis or liver failure	Baseline: height and wt, pregnancy test (sexually active female patients), liver function tests, CBC
	Wt gain may be additive when combined with an atypical antipsychotic[28]	Every 6 mo: divalproex level, liver function tests, CBC
Carbamazepine	Multiple medication interactions (decrease or increase the other medication levels including oral contraceptive failure), sedation, ataxia, dizziness, blurred vision, nausea, vomiting, aplastic anemia, hyponatremia, Stevens-Johnson	Baseline: CBC Every 6 mo: carbamazepine level, CBC
Lamotrigine	Severe cutaneous reactions (risk 3 times greater <16), dizziness, tremor, sedation, asthenia, headache, interactions with oral contraceptives; case reports of leucopenia, agranulocytosis, hepatic failure, multiorgan failure	Baseline: CBC and liver function tests
Oxcarbazepine	Hyponatremia, oral contraceptive failure, cutaneous reactions, cognitive symptoms, sedation, coordination difficulties, nausea, vomiting, asthenia, headache, dizziness[26]	Baseline and periodic: serum sodium
Gabapentin	Mostly benign; most common are sedation, dizziness, tremor, headache, ataxia, fatigue, wt gain	None
Topiramate	Oral contraceptive failure, sedation, fatigue, impaired concentration, psychomotor slowing, word-finding difficulties, nephrolithiasis	Baseline and periodic: serum bicarbonate

BUN, blood urea nitrogen; CBC, complete blood cell (count); EKG, electrocardiogram; TFT, thyroid function test.

insomnia, that is treated with a medication just for that symptom.

- Cross-taper. When a medication is thought to be working poorly or not at all, a decision may be to replace it with another medication. The cleanest way to do so is to taper down the dose of the first medication, wait for a period of time for medication "wash out," and then start the second medication at a low dose with subsequent appropriate increases. This approach may be problematic at times if, in retrospect, the first medication is discovered to have been more effective than previously thought, but regardless, the patient goes longer without an effective medication. The likelihood of a relapse is higher, and depending on the patient's history, relapse may be debilitating or life-threatening or may interfere with a planned transition, such as starting school or leaving the hospital. The way to decrease the likelihood of relapse and treat current symptoms more quickly is to "cross-taper," for example, starting the second medication with the full dose of the first medication, and then, if the second medication is tolerated and appears to be adding incremental benefit, the second medication gradually is increased while the first medication is decreased.
- Treat comorbid disorders. Additional medications may be used to treat symptoms of comorbid disorders, such as inattentiveness with ADHD or worrying with an anxiety disorder.

PRESCRIBING GUIDELINES

The process of medicating is stepwise, with few patients having a full, lasting response to all symptoms with the first dose of the first medication. Each step is the opportunity for the physician to make a change (add or stop a medication or change a dose) or continue the current regimen as is (eg, the patient is stable or improving or needs a longer amount of time for a medication to work or for an adverse effect to resolve). Each patient becomes an individual study, with the result sometimes being good efficacy with odd-appearing or counterintuitive medication combinations. A number of issues may guide the decision at each step:

- **One Change at a Time.** With multiple medications, knowing which medication is causing positive effects or adverse effects may be difficult. Making 1 change at a time and then observing the effect can help deal with this problem, although this guideline may be discontinued at times for the sake of urgency or when there is little expected overlap in effects and

TABLE 13 Adverse Effects and Possible Monitoring of Atypical Antipsychotics

Adverse effect	Time course	Suggested monitoring	Medications most likely to cause
Anticholinergic	Early		Clozapine, olanzapine
Acute parkinsonism	Early	During titration, at 3 mo and annually	Paliperidone, risperidone
Akathisia	Early/intermediate	During titration, at 3 mo and annually	Aripiprazole
Cardiovascular events	Not known	EKG at baseline if taking ziprasidone or clozapine and during titration if taking ziprasidone	
Diabetes	Late	Fasting blood glucose at 3 mo and then every 6 mo	Clozapine, olanzapine (but problem for all)
Increased lipids	Early?	Lipids at 3 mo and then every 6 mo	Clozapine, olanzapine (but problem for all)
Neutropenia	Most likely within first 6 mo	Clozapine registry recommended CBC monitoring	Clozapine
Orthostasis	Early	Orthostatic blood pressure and pulse if symptomatic; blood pressure and pulse at 3 mo and annually	Clozapine, olanzapine, quetiapine
Increased prolactin and sexual dysfunction	Early	Sexual history during titration and then every 3 mo; prolactin level only if symptomatic	Paliperidone, risperidone, olanzapine
Decreased prolactin	Early	Prolactin level only if symptomatic	Aripiprazole
Increased QTc interval	Not known	EKG at baseline if taking ziprasidone or clozapine and during titration if taking ziprasidone	Ziprasidone
Sedation	Early	Each visit	Clozapine, olanzapine, quetiapine (but problem for all)
Seizures	During titration		Clozapine
Tardive dyskinesia	Late	At 3 mo and annually (abnormal involuntary movement scale)	Lower risk compared with first generation antipsychotics
Withdrawal dyskinesia	Early during fast switch	During titration	Aripiprazole, paliperidone
Wt gain	First 3–6 mo	Height, wt, BMI percentile, BMI *z* score each visit	All, but clozapine and olanzapine highest and aripiprazole and ziprasidone least
Other laboratories		Electrolytes, CBC, renal function test annually, and liver function tests at 3 mo and annually	

TABLE 14 Medications That May Increase Mood Cycling in Children and Adolescents

Antidepressants
Tricyclic antidepressants
Selective serotonin reuptake inhibitors
Serotonin-norepinephrine reuptake inhibitors
Aminophylline
Oral or intravenous corticosteroids
Sympathomimetic amines (eg, pseudoephedrine)
Antibiotics (eg, clarithromycin, erythromycin, and amoxicillin)

adverse effects of medications in a particular combination.

- **Important Cluster of Symptoms.** When a group of symptoms is causing severe impairment and distress, such as full-fledged mania or acute psychosis, it must be addressed first.
- **Treat the Most Troublesome Symptoms First.** A more common situation is that there is no group of symptoms that is overwhelming. In that case, first treat the group of symptoms that is causing the most distress or impairment. For example, moderate depression is treated before mild to moderate inattentiveness.
- **Opportunity to Reduce the Number of Medications That Eventually Will Be Needed.** A medication may be used that may not be the best for any particular group of symptoms but has the potential to treat ≥2 groups of symptoms.
- **Manage an Adverse Effect.** Depending on the urgency of the need for clinical effect and the troublesomeness of the adverse effect, an adverse effect may temporarily halt the search for an effective regimen until it can be resolved or reduced to an acceptable level.
- **Treat a "Lynchpin" Symptom.** At times, a symptom seems to be the basis for other symptoms, for example, an anxious and inattentive adolescent who goes into a rage

attempting to complete homework. As an alternative to using a medication that works to reduce rage, using a medication to reduce anxiety or to increase attentiveness may be at least as effective (of course, the prescriber may choose to do both to potentially increase the effect).

- **Preference for a Medication That Works Quickly.** At times, a medication is chosen over another one for a particular effect because it works quickly. The thinking is that if it then does not work, less time is lost in pursuing the other medication, thus increasing the chance of finding an effective medication in a given period of time.

An example that illustrates the use of several of these guidelines is a patient with insomnia in the context of depression. Choices for the first medication(s) include (1) a mood agent to treat the depression (the more impairing symptom) while waiting for the insomnia to resolve as the depression improves, (2) a hypnotic to treat the insomnia because the response is likely to be quick and the patient's mood may improve once he or she no longer is sleep deprived, (3) combination of a hypnotic with an optimal mood agent for this patient, or (4) a sedating mood agent that may treat both the depression and the insomnia. For a particular patient, these may all be reasonable options, or there may be other factors, such as treatment history, that favor one option over others.

CONCURRENT MEDICAL CONDITIONS

Scheffer and Linden[37] divided medical conditions concurrent with pediatric bipolar disorder into 4 types: (1) conditions related to bipolar disorder or its treatment, (2) conditions that mimic mania, (3) conditions that occur more commonly in patients with bipolar disorder that appear unrelated to its treatment, and (4) conditions related to risk behaviors associated with bipolar disorder. The authors noted that little has been published specifically with regard to pediatric bipolar disorder and concurrent medical conditions, but a number of reports that focused on adults included pediatric subjects.

Tables 12 and 13 summarize medical adverse effects from medications commonly used to treat bipolar disorder. Pediatricians should familiarize themselves with these and monitor for them. Lithium treatment can result in hypothyroidism and, regardless of the cause, hypothyroidism can make bipolar disorder more difficult to treat.[37] Elevated prolactin levels, typically from certain atypical antipsychotics, are associated with low bone mass for chronologic age, sexual dysfunction, menstrual irregularities, gynecomastia, galactorrhea, and retrograde ejaculation. Cardiovascular disease[38] and type 2 diabetes mellitus[39] may be associated with the illness itself. Conditions that may mimic mania are listed in Table 15.[5,37] Unrelated conditions more common in patients with bipolar disorder[37] include migraine headaches, epilepsy, and at least in 1 large family, autosomal dominant medullary cystic kidney disease. Conditions associated with bipolar risk behaviors[37] include complications of substance use and abuse, sexually transmitted diseases, and traumatic brain injury.

CASE VIGNETTES

The following fictitious cases are conglomerates based on the authors' clinical experience and are designed to illustrate common diagnostic and treatment issues.

Case 1

Mary is a 16-year-old girl who presents for admission to psychiatry inpatient after sudden onset 1 week previously of euphoric and giddy mood, talking rapidly and jumping from topic to topic, and little sleep with almost none over the past 3 days. She has spent most of her time since then at her health club trying to "pick up" male patrons, a behavior very out of character for her. Before age 14, she was high achieving and well adjusted, earning mostly A's in school, socially active, and described by her parents as a "model daughter." At age 14, she broke up with a boyfriend and became severely depressed, responding after 2 months to a combination of sertraline and psychotherapy. She discontinued both treatments 4 months later because she had been doing well. She continued to do well until 1 year ago, when she developed an episode similar to the current one, but her behavior was controlled, and she was managed outside the hospital, responding after 2 weeks to a combination of lithium and psychotherapy. She had difficulty with moodiness and functioning in school for the next 6 months and again stopped the treatments. She then continued about the same until this current episode.

Mary is diagnosed with bipolar I disorder, current episode manic, severe, and without psychotic features. She has the narrow phenotype. She is restarted on lithium and also is started on quetiapine for sleeping, calming, and additional mood stabilization. Lithium is chosen because of her past response to this medication. Her psychiatrist decides to combine this with quetiapine immediately, despite treatment algorithms suggesting starting with monotherapy,[5,18] for 2 reasons: (1) previous treatment with lithium yielded a good acute response but only a partial response long-term, even before she stopped the medication and (2)

TABLE 15 Medical Conditions That May Mimic Mania

Hyperthyroidism
Closed or open head injury
Temporal lobe epilepsy
Multiple sclerosis
Systemic lupus erythematosus
Fetal alcohol spectrum disorder/alcohol-related neurodevelopmental disorder
Wilson disease
HIV
Lyme disease
Dementia
Fibromyalgia
Niemann-Pick disease
Familial leukoencephalopathy

lithium can easily take 1 week or more to be effective, and Mary needs something with more immediate effect for calming and sleeping.

Mary is in a relatively consistent (abnormal) mood state. The primary treatment goals are, therefore, to help her out of this state, return her to a euthymic mood, and prevent the next mood episode. If her current mood state were depression instead of mania, mood-stabilizing medication would still be the first choice, but often, antidepressant medication is cautiously added should the depression prove resistant to the mood stabilizing medication alone. The caution is related to the possibility that the antidepressant could make it easier for her to go into a manic episode, even when combined with the mood-stabilizing medication. In addition, during the time she is in a manic state, an antidepressant is generally not recommended.

Case 2

Charles is a 15-year-old boy who presents to the psychiatrist's office for his first mental health visit with the complaint of increasing, severe depression over the past month. He feels that the depression started 3 years ago when his parents divorced and he moved with his mother and siblings to a new city and new school. Additional questions reveal that depression probably existed on and off for quite some time before the divorce. Furthermore, the depression is not continuous. Even over the past week, he reports having 1 or 2 days at a time of feeling great and "energized," spending most of the night playing an online game with little fatigue the next day, talking more, having racing thoughts, and having a more difficult time focusing on school work. He has other times, up to 2 days at a time, of being easily angered, punching a wall at times, ruminating about slights from peers and parents, and generally feeling "edgy."

Charles is diagnosed with bipolar disorder not otherwise specified and the intermediate phenotype. He does not meet duration criteria for mania (7 days) or hypomania (4 days). Key features are the spontaneous and frequent changes of mood symptoms, unrelated or only very loosely related to environmental circumstances, and the lack of distinct, continuous manic or hypomanic states for even 4 days.

Medication management for Charles is similar to that for Mary in case 1; the primary initial objective is mood stabilization with $\geq$1 mood stabilizers and/or atypical antipsychotics. A difference is that Charles's mood symptoms are not stable. He only has to wait a few days or less to switch to a different group of symptoms. Despite depression being the primary concern, antidepressants may make his condition worse by increasing the frequency or intensity of mood changes or undermining the effects of the mood-stabilizing medication. Even for treating the depression symptoms, the preference is typically to find more effective mood stabilizing medication rather than add an antidepressant. Exceptions are common, however, with the treatment of bipolar illness.

Cases 1 and 2 illustrate the findings of a recent study showing that in 90% of cases the first mood episode in pediatric bipolar disorder is depression.[40]

Case 3

Dan is a 17-year-old boy who presents for psychiatric inpatient admission after damaging his father's car with a crow bar and threatening to kill his parents and then himself after parents took away his cell phone. The patient reports having had difficulty with temper outbursts for years. This is the worst such episode, but the patient commonly yells or leaves the house when upset and tends to overreact to his parents' attempts to set limits. Both patient and parents report that he does "fine" most of the time and just overreacts to frustration. He was diagnosed with ADHD in the third grade and has been on and off treatment for that (currently off). He has had mild to moderate depression at times but not recently. On interview, the patient reports that the incident with the car was "not a big deal" and says that he currently feels "fine," although he appears quite edgy and becomes frustrated with the interviewer for "asking too many questions."

The patient is diagnosed with mood disorder not otherwise specified and meets criteria for bipolar spectrum broad phenotype or severe mood dysregulation. He shows no evidence for mood cycling, except for the history of depression, but his mood changes quickly with minor provocation, and he is highly sensitive to frustrating circumstances.

Common practice is to treat the rage symptoms and edginess with mood stabilizers and/or atypical antipsychotics. Treatment of rage and edginess in this population has been poorly studied, but risperidone and aripiprazole are approved by the FDA for the treatment of irritability associated with autism (Table 8). With some patients, these symptoms may respond to $\geq$1

medications for depression, anxiety, or ADHD.

Case 4

Claire is a 13-year-old girl who presents to the psychiatrist's office because of daily episodes of rage, which have been present for years but increasing over the past year. She has the rage only at home and does well academically and socially. She denies any history of significant depression, although she does report a strong tendency to worry and has had this for most of her life. With further questioning, she reports multiple different ritualistic behaviors, such as needing to touch the doorframe in a certain way before going through it and needing to do household tasks in groups of 3. She becomes enraged when parents inadvertently interfere with her ability to complete a behavior.

Claire is diagnosed with OCD as well as generalized anxiety disorder. She does not have a mood disorder despite the rage outbursts. The rage would probably diminish with a mood stabilizer or atypical antipsychotic, but a better treatment is medication and psychotherapy for OCD and anxiety.

Case 5

George is a 14-year-old boy who presents to the pediatrician having recently moved from another state. According to his mother, he has been doing fairly well for the past 6 months and has been diagnosed with bipolar disorder and ADHD. He is currently taking lithium, methylphenidate, quetiapine, aripiprazole, sertraline, and clonazepam. He last saw his previous psychiatrist 2 months ago, and the mother requests a refill for his medications, because he does not have a psychiatrist currently. George's mother said that he has been in general good health but gained 40 pounds over the past year. George's mother attributes this to the medication. In addition to her routine for a new patient visit, the pediatrician does the following:

- Asks more questions to confirm clinical stability, such as potential adverse effects of the medications and clinical course, including depression, suicidality, and behavioral problems.
- Asks about medication dosing adherence.
- Contacts the previous psychiatrist to confirm medications and doses, obtain history, and obtain the psychiatrist's opinion on recent stability.
- Orders laboratory studies, including lithium concentration 12 hours after last dose, electrolytes, thyroid studies, calcium, lipids, and glucose (a fasting glucose may be ordered later if the random one is abnormal).
- Performs physical examination, including vital signs, height, and weight, and calculates BMI percentile.
- Refers George to a local child and adolescent psychiatrist for ongoing mental health care and arranges to partner with the out-of-state psychiatrist for care in the meantime.
- Renews the current medications unless there is a compelling reason otherwise. Given 6 months of stability, a slow medication taper may be safe, but this should be conducted under psychiatric supervision. Not renewing the medications is dangerous, because it may precipitate a major relapse as well as withdrawal symptoms.
- Refers George to a dietitian, recommends an exercise program, and plans to work with the psychiatrist on adjusting medications to reduce weight.

If it were determined that George may not be stable in some respect, resources include phone consultations with the out-of-state psychiatrist (and the out-of-state therapist, if there was one), urgent referral to a local child and adolescent psychiatrist, urgent referral to a local psychologist or other therapist for psychotherapy, and evaluation at a local hospital emergency department.

SUMMARY

Pediatricians have a collaborative role in diagnosis and management of adolescents with bipolar disorder, a common and often debilitating illness. Interviewing for current or past mania or hypomania, the defining feature of bipolar disorder, may be challenging but may be simplified by asking about red flag symptoms that, when present in the history, signal reasonable suspicion of bipolar disorder. In suspected or previously diagnosed cases of bipolar disorder, patients with current or recent symptoms or impairments should be referred for treatment. Pediatricians can actively monitor for and manage medication adverse effects, particularly weight gain, hyperlipidemia, and diabetes mellitus.

ADVICE FOR PEDIATRICIANS

1. Have some familiarity with diagnostic criteria and different types of bipolar disorder.
2. Maintain communication with child and adolescent psychiatrists and other mental health professionals.
3. Maintain familiarity with adverse effects and suggested monitoring protocols for mood-stabilizing and atypical antipsychotic medications.
4. Assist in monitoring for and managing medication adverse effects, particularly weight gain, hyperlipidemia, and diabetes mellitus.
5. Carefully and thoroughly document all recommendations, including referrals, medications prescribed, and instructions for observing and reporting adverse reactions.

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POLICY STATEMENT

The Crucial Role of Recess in School

COUNCIL ON SCHOOL HEALTH

KEY WORDS
play, recess, school

ABBREVIATION
AAP—American Academy of Pediatrics

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abstract

FREE

Recess is at the heart of a vigorous debate over the role of schools in promoting the optimal development of the whole child. A growing trend toward reallocating time in school to accentuate the more academic subjects has put this important facet of a child's school day at risk. Recess serves as a necessary break from the rigors of concentrated, academic challenges in the classroom. But equally important is the fact that safe and well-supervised recess offers cognitive, social, emotional, and physical benefits that may not be fully appreciated when a decision is made to diminish it. Recess is unique from, and a complement to, physical education—not a substitute for it. The American Academy of Pediatrics believes that recess is a crucial and necessary component of a child's development and, as such, it should not be withheld for punitive or academic reasons. *Pediatrics* 2013;131:183–188

THE BENEFITS OF RECESS FOR THE WHOLE CHILD

The Centers for Disease Control and Prevention defines recess as "regularly scheduled periods within the elementary school day for unstructured physical activity and play."[1] The literature examining the global benefits of recess for a child's cognitive, emotional, physical, and social well-being has recently been reviewed.[2] Yet, recent surveys and studies have indicated a trend toward reducing recess to accommodate additional time for academic subjects in addition to its withdrawal for punitive or behavioral reasons.[3–6] Furthermore, the period allotted to recess decreases as the child ages and is less abundant among children of lower socioeconomic status and in the urban setting.[4,7]

Just as physical education and physical fitness have well-recognized benefits for personal and academic performance, recess offers its own, unique benefits. Recess represents an essential, planned respite from rigorous cognitive tasks. It affords a time to rest, play, imagine, think, move, and socialize.[8–11] After recess, for children or after a corresponding break time for adolescents, students are more attentive and better able to perform cognitively.[12–16] In addition, recess helps young children to develop social skills that are otherwise not acquired in the more structured classroom environment.[8,11,17]

COGNITIVE/ACADEMIC BENEFITS

Children develop intellectual constructs and cognitive understanding through interactive, manipulative experiences. This type of exploratory

experience is a feature of play in an unstructured social environment.[8,18] Optimal cognitive processing in a child necessitates a period of interruption after a period of concentrated instruction.[19,20] The benefits of these interruptions are best served by unstructured breaks rather than by merely shifting from 1 cognitive task to another to diminish stresses and distractions that interfere with cognitive processing.[9,11,15,20] Several studies demonstrated that recess, whether performed indoors or outdoors, made children more attentive and more productive in the classroom.[11–13,16,19,21] This finding was true even though, in many cases, the students spent much of their recess time socializing. In fact, a student's ability to refocus cognitively was shown to be stimulated more by the break from the classroom than by the mode of activity that occurred during that break; any type of activity at recess benefited cognitive performance afterward.[14] Although specified time afforded for recess diminishes with age, the benefits of periodic breaks in the academic day to optimize cognitive processing applies equally to adolescents and to younger children.

SOCIAL AND EMOTIONAL BENEFITS

Recess promotes social and emotional learning and development for children by offering them a time to engage in peer interactions in which they practice and role play essential social skills.[8,17,18,22,23] This type of activity, under adult supervision, extends teaching in the classroom to augment the school's social climate. Through play at recess, children learn valuable communication skills, including negotiation, cooperation, sharing, and problem solving as well as coping skills, such as perseverance and self-control.[8–11,15,17,22] These skills become fundamental, lifelong personal tools. Recess offers a child a necessary, socially structured means for managing stress. By adapting and adjusting to the complex school environment, children augment and extend their cognitive development in the classroom.[15,17]

PHYSICAL BENEFITS

There is a wealth of literature published on the need for and benefit of physical activity and fitness, not only for a child's physical well-being but also for academic and social maturation.[5,12,22–33] Although not all children play vigorously at recess, it does provide the opportunity for children to be active in the mode of their choosing and to practice movement and motor skills. Importantly, recess affords young children free activity for the sheer joy of it.[34] Even minor movement during recess counterbalances sedentary time at school and at home and helps the child achieve the recommended 60 minutes of moderate to vigorous activity per day, a standard strongly supported by the American Academy of Pediatrics (AAP) policy, which can help lower risk of obesity.[5,12,30–35]

SAFETY AND SUPERVISION

A child's safety during recess is a concern for many parents, teachers, and administrators. Some schools even have chosen to ban games or activities deemed unsafe and, in some cases, to discontinue recess altogether in light of the many issues connected with child safety.[10,36] Although schools should ban games and activities that are unsafe, they should not discontinue recess altogether just because of concerns connected with child safety. There are measures schools can take to address these concerns and protect children while still preserving play during recess.[5,11,24,28,34,37,38] Compliance with the Consumer Product Safety Commission's Playground Safety Handbook (http://www.cpsc.gov/CPSCPUB/PUBS/325.pdf) will help to ensure proper maintenance of playground equipment that meets all of the following applicable federal guidelines:

1. Provision of adequate safe spaces and facilities.
2. Maintenance of developmentally appropriate equipment with regular inspections.
3. Establishment and enforcement of safety rules.
4. Implementation of recess curriculum in physical education classes to teach games, rules, and conflict resolution.
5. Establishment of a school-wide, clear policy to prevent bullying or aggressive behavior.
6. Provision of adequate supervision by qualified adults who can intervene in the event a child's physical or emotional safety is in jeopardy.

Some playgrounds in areas with a high risk of violence may require additional protective measures to ensure the safety of children.

THE EMERGING ISSUE OF STRUCTURED RECESS

Structured recess is a recess based on structured play, during which games and physical activities are taught and led by a trained adult (teachers, school staff, or volunteers). Proponents for structured recess note that children often need help in developing games and require suggestions and encouragement to participate in physical activities. Recently, policy makers and funding organizations have called for more opportunities for daily activity as a means to address childhood obesity. These statements have strengthened the argument to maintain or reinstate recess as an integral component of the school day.[12,25,30,34] Although this new dimension to the recess debate has

increased attention on its role, it also has created tension. Some have promoted recess time as a solution for increasing children's physical activity and combating obesity. If recess assumes such a role, then, like physical education, it will need to be planned and directed to ensure that all children are participating in moderately vigorous physical activity.[4,7,12,31,33,38] Pediatric health care providers, parents, and school officials should be cognizant, however, that in designing a structured recess, they will sacrifice the notion of recess as an unstructured but supervised break that belongs to the child; that is, a time for the child to make a personal choice between sedentary, physical, creative, or social options.[2,8–10,18,22–24,30,34,37,39] However, there are many cited benefits of structured recess to consider, including[12]:

- Older elementary children may benefit from game instruction and encouragement for total class inclusion.
- Children can be coached to develop interpersonal skills for appropriate conflict resolution.
- More children can actively participate in regular activity, irrespective of skill level.
- Anecdotally, teachers have reported improved behavior and attention in the classroom after vigorous structured recess.

To be effective, structured recess requires that school personnel (or volunteers) receive adequate training so that they are able to address and encourage the diverse needs of all students.[12,38] One aspect of supervision should be to facilitate social relationships among children by encouraging inclusiveness in games. A problem arises when the structured activities of recess are promoted as a replacement for the child's physical education requirement. The replacement of physical education by recess threatens students' instruction in and acquisition of new motor skills, exploration of sports and rules, and a concept of lifelong physical fitness.[24,30,34]

There are ways to encourage a physically active recess without necessarily adding structured, planned, adult-led games, such as offering attractive, safe playground equipment to stimulate free play; establishing games/boundaries painted on the playground; or instructing children in games, such as four square or hopscotch.[37,38,40] These types of activities can range from fully structured (with the adult directing and requiring participation) to partly unstructured (with adults providing supervision and initial instruction) to fully unstructured (supervision and social guidance). In structured, partly structured, or unstructured environments, activity levels vary widely on the basis of school policy, equipment provided, encouragement, age group, gender, and race.[4,7,30,38,40] Consequently, the potential benefits of mandatory participation of all children in a purely structured recess must be weighed against the potential social and emotional trade-off of limiting acquisition of important developmental skills. Whichever style is chosen, recess should be viewed as a supplement to motor skill acquisition in physical education class.[5,23,24,33,34]

DURATION AND TIMING OF RECESS

In the United States, the duration and timing of recess periods vary by age, grade, school district, and sometimes by building.[4,7] The majority of elementary schools that offer lunch-time recess do so after the students eat lunch.[4,37,41–44] Many school wellness councils have adopted the "Recess Before Lunch" concept which stems from studies that examined food waste by students in relation to the timing of their recess.[42–44] When students have recess before lunch, more time is taken for lunch and less food is wasted. In addition, teachers and researchers noted an improvement in the student behavior at meal time, which carried into the classroom in the afternoon. The Centers for Disease Control and Prevention and the US Department of Agriculture support the concept of scheduling recess before lunch as part of a school's wellness policy.[2,45]

Peer-reviewed research has examined the timing and type of activity during recess and chronicled the many benefits of recess for children, without establishing an optimal required duration.[2,8,12,13,18,19,21] There is consensus about the need for regularly scheduled recess based on national guidelines, even though the length of the recess period has not been firmly established. In schools, the length specified for recess ranges widely, from 20 to 60 minutes per day.[24,30] In other countries, such as Japan, primary school-aged children have a 10- to 15-minute break every hour, and this is thought to reflect the fact that attention spans begin to wane after 40 to 50 minutes of intense instruction.[46] On the basis of this premise, to maximize cognitive benefits, recess should be scheduled at regular intervals, providing children sufficient time to regain their focus before instruction continues.

CONCLUSIONS

School attendance represents a unique opportunity to address nutrition and physical fitness. Each day, 55 million US students attend school, which constitutes nearly one-half of their waking hours.[47] In light of rising rates of overweight and obesity, schools have come under increased scrutiny. Within the school environment, there are competing calls for stricter standards and greater academic achievement as

well as calls for schools to provide greater opportunities for nonsedentary daily activity. Even with ample evidence of a whole-child benefit from recess, significant external pressures, such as standardized cognitive testing mandated by educational reforms, have led some to view recess as time that would be better spent on academics.[4] Time previously dedicated to daily activity in school, such as physical education and recess, is being reallocated to make way for additional academic instruction.

Ironically, minimizing or eliminating recess may be counterproductive to academic achievement, as a growing body of evidence suggests that recess promotes not only physical health and social development but also cognitive performance.[10,37] Although recess and physical education both promote activity and a healthy lifestyle, it is only supervised but unstructured recess that offers children the opportunity to actually play creatively. In this sense, then, pediatricians' support of recess is an extension of the AAP's policy statement supporting free play as a fundamental component of a child's normal growth and development.[16] On the basis of an abundance of scientific studies, withholding recess for punitive or academic reasons would seem to be counterproductive to the intended outcomes and may have unintended consequences in relation to a child's acquisition of important life skills.

RECOMMENDATIONS

In their role as child health experts, the pediatricians of the AAP stress the following perspective to parents, teachers, school administrators, and policy makers:

1. Recess is a necessary break in the day for optimizing a child's social, emotional, physical, and cognitive development. In essence, recess should be considered a child's personal time, and it should not be withheld for academic or punitive reasons.
2. Cognitive processing and academic performance depend on regular breaks from concentrated classroom work. This applies equally to adolescents and to younger children. To be effective, the frequency and duration of breaks should be sufficient to allow the student to mentally decompress.
3. Recess is a complement to, but not a replacement for, physical education. Physical education is an academic discipline. Whereas both have the potential to promote activity and a healthy lifestyle, only recess (particularly unstructured recess) provides the creative, social, and emotional benefits of play.
4. Recess can serve as a counterbalance to sedentary time and contribute to the recommended 60 minutes of moderate to vigorous activity per day, a standard strongly supported by AAP policy as a means to lessen risk of overweight.
5. Whether structured or unstructured, recess should be safe and well supervised. Although schools should ban games and activities that are unsafe, they should not discontinue recess altogether just because of concerns connected with child safety. Environmental conditions, well-maintained playground equipment, and well-trained supervisors are the critical components of safe recess.
6. Peer interactions during recess are a unique complement to the classroom. The lifelong skills acquired for communication, negotiation, cooperation, sharing, problem solving, and coping are not only foundations for healthy development but also fundamental measures of the school experience.

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TECHNICAL REPORT

Dispensing Medications at the Hospital Upon Discharge From an Emergency Department

abstract

FREE

Although most health care services can and should be provided by their medical home, children will be referred or require visits to the emergency department (ED) for emergent clinical conditions or injuries. Continuation of medical care after discharge from an ED is dependent on parents or caregivers' understanding of and compliance with follow-up instructions and on adherence to medication recommendations. ED visits often occur at times when the majority of pharmacies are not open and caregivers are concerned with getting their ill or injured child directly home. Approximately one-third of patients fail to obtain priority medications from a pharmacy after discharge from an ED. The option of judiciously dispensing ED discharge medications from the ED's outpatient pharmacy within the facility is a major convenience that overcomes this obstacle, improving the likelihood of medication adherence. Emergency care encounters should be routinely followed up with primary care provider medical homes to ensure complete and comprehensive care. *Pediatrics* 2012;129:e562–e566

INTRODUCTION

The purpose of this report is provide information to support judicious dispensing of medications to improve compliance with discharge instructions and adherence to medication recommendations after a visit to the emergency department (ED). Unlike scheduled or sick visits to the medical home, most ED visits are unplanned and occur during "off hours." Families may be limited in their ability to get prescriptions filled immediately for treatment of these acute conditions. Although the primary site of health care should be in the medical home, the ED plays an important role as a safety net for children requiring emergent medical care.[1–4] Medical care provided in EDs often requires the treatment of acute clinical conditions, with a high priority placed on the timely administration of medications such as analgesics, antibiotics, bronchodilators, and corticosteroids. Prompt initiation and maintenance of therapy are important factors in achieving an optimal therapeutic effect. Relapses or exacerbations of chronic conditions (eg, epilepsy, diabetes) are often attributable to medication nonavailability or nonadherence. Because emergency care is provided around the clock, the lack of available pharmacy services to dispense outpatient medications can be a significant therapeutic barrier. Community-based pharmacies that are open 24 hours a day are valuable community resources in providing these medications at all hours. However, the nearest 24-hour pharmacy may be quite far

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KEY WORDS

emergency department, medication, pharmacy, hospital, discharge

ABBREVIATIONS

ED—emergency department

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from the ED, and then the patient or parent must wait for the medication to be dispensed. Most patients and families have already spent a considerable amount of time in the ED receiving diagnostic tests and treatment, and some families do not have the resources to easily travel to an offsite pharmacy. These factors may impede adherence to essential discharge medications and instructions.

Several studies have demonstrated low medication adherence rates after ED visits.[5–14] In one of the more recent studies, one-third of insured pediatric patients who were prescribed "priority medications" (defined as new medications for an acute condition that excluded over-the-counter medications, refills, and continuation of therapy that was previously initiated) did not pick them up.[5] In examining the Medicaid subgroup separately, half did not pick up their "priority medications,"[5] despite the absence of financial barriers. The resources spent on emergency care will not result in optimal outcomes unless prompt medication adherence is achieved. Knowing that medication adherence rates are likely to be low, many emergency physicians choose to err on the side of caution and administer more medications (eg, corticosteroids, long-acting intramuscular antibiotics) before discharging patients from the ED, further increasing cost and lengthening ED stays, or they may choose to hospitalize the patient to avoid the risks associated with nonadherence, adding additional cost.

Although pharmacy access is not the only factor determining medication adherence, it has been demonstrated to be a significant one.[9] Most studies of medication adherence have been conducted in adult populations, but pediatric studies have demonstrated similar nonadherence rates.[5,11,12]

The short duration of action of some medications (eg, albuterol) makes it potentially risky not to provide additional doses on discharge from the ED for home use. Even families who adhere to medication regimens might have difficulty getting such prescriptions filled in time for the patient's next dose. During epidemics when there may be medication shortages, EDs can be prepared to dispense medication to those most a risk. Parents frequently request that medications be dispensed from the ED, because it is perceived to be faster, more convenient, and a logical patient expectation. Many families may be unfamiliar with the location of local pharmacies, especially a particular pharmacy providing late night service. Dispensing medications for the acute illness or injury from the ED is a means to both improve service to the patient and provide better care. The medical home should be notified of the ED visit and medications prescribed. Renewal of medications or refills of these medications after the acute illness or injury should be done by the primary physician in the medical home.

PRACTICES THAT HAVE BEEN PROPOSED AS POTENTIAL SOLUTIONS

Prescriptions May Be Called In, Faxed, or Submitted Electronically to the Community Pharmacy

Although this has the potential to save time, pharmacists will typically give priority to patients who are physically present and waiting over a patient who may or may not show up. Some antibiotic suspensions are expensive, and if the patient does not pick it up, the pharmacy might have to discard the medication. Thus, suspensions are frequently not reconstituted until the patient is physically present.

The First Antibiotic Dose Can Be Administered in the ED

This works well for patients who are able to take pills. For children, first-dose administration of antibiotic suspensions requires that unit doses be created. Pharmacies at larger hospitals can efficiently dispense multiple unit doses, but smaller hospitals are more likely to use fewer doses, resulting in more wastage of the remaining reconstituted antibiotic suspension. First-dose administration practice can at least guarantee that the first dose is given, and if the patient is observed briefly, it improves the likelihood that an immediate adverse reaction can be recognized and addressed. This practice can also reduce the need for initial parenteral antibiotic dosing, although long-duration parenteral antibiotics have some advantages over oral antibiotics. Administering a single oral dose in the ED does not necessarily ensure adherence, because the remainder of the medication course must be obtained from an outpatient pharmacy, but it does permit the patient's family to return home to get some rest so that they can obtain the remainder of the medication course at a more convenient time. Although administering the first antibiotic dose in the ED has significant advantages, dispensing the entire course from the ED is more convenient and is more in line with patient expectations. Factors that improve full adherence are less likely to result in complications from treatment failure and induction of antibiotic resistance.

A Few Days' Supply of Medication Can Be Dispensed to Allow the Patient Enough Time to Get to a Neighborhood Pharmacy

This solution also works better for medications in pill or capsule formulations but not as well for suspensions. A potential pitfall of this method is the failure of the caregiver to fill the remainder of the prescription because the child appears to be feeling better. This would also require a second prescription to be written for the

outpatient pharmacy and a second pharmacist to be involved in dispensing a single course of therapy. Both are potential sources of error. Electronic health record and order entry systems would need to generate 2 "prescriptions" with coordinated start and stop dates, making the process of ordering a single course of therapy twice as complicated and time-consuming.

Drug Company Samples Can Be Used

Samples dispensed in a private office setting are severely restricted in hospital-based EDs, essentially making them infeasible. All medications dispensed within a hospital (including samples) must be managed and regulated by the pharmacy. Additionally, samples are only available for a small proportion of medications used in children, and the appropriate formulation is often not available, making this option difficult to manage and unreliable. Electronic health records that maintain a patient's medication record would have difficulty keeping track of medication samples, because it is possible that no prescription would be generated, resulting in a lack of records in the patient's prescription history.

BARRIERS TO DISPENSING HOME MEDICATIONS FROM THE ED

Staffing of a 24-Hour Outpatient Pharmacy Is Not Likely to Be Cost-Effective

Transferring all the home prescriptions from the ED to the pharmacist(s) increases their workload substantially, such that it might compromise the other duties of the pharmacist(s) and create the potential for medication errors. Staffing of additional pharmacists may be difficult to achieve, because they are in short supply in many areas or the expense may not be supported by the revenue gained from filling home medication prescriptions. Many patient care improvements are not cost-neutral, but the overall systematic improvement in patient care may justify these expenses. Competing demands for pharmacist resources would need to be addressed in most health systems. Expecting that patient satisfaction improvements will be without cost is unreasonable. In this case, patient satisfaction and medication adherence can both potentially improve.

There Is Concern That This Prescribing Practice Might Be Illegal

Some states have regulations limiting outpatient dispensing by an inpatient facility. For example, the state of Massachusetts allows hospital inpatient pharmacies to dispense up to 14 days of medication, whereas the state of Washington only allows hospital inpatient pharmacies to dispense a 24-hour supply, except in extraordinary circumstances. Many hospital pharmacies have created programs to dispense to outpatients when confronted with extraordinary circumstances, such as free-care patients or medications that cannot be obtained in the community. Regulations cited typically apply to medications dispensed by the ED (not a pharmacy), medications dispensed by the hospital inpatient pharmacy, medications dispensed by the hospital, or a limited subset of medications (eg, controlled substances or "dangerous" medications). Note that these special regulations apply to hospital units or inpatient pharmacies but not to outpatient pharmacies, therefore the most efficient solution with the fewest regulatory obstacles is to have a 24-hour outpatient pharmacy available to service the needs of the ED.

Insurance Companies Might Choose to Deny Payment for Outpatient Medications Dispensed by an Inpatient Pharmacy

This is difficult to confirm or refute, because insurance company reimbursement practices may vary within a given state or region or health plan. In theory, there should be no reason why an insurance company would reimburse a community outpatient pharmacy but not a hospital pharmacy, as long as the costs and the regulatory requirements are the same. If this practice becomes more common, then insurance company reimbursement practices for this are likely to become more consistent. Having a 24-hour outpatient pharmacy available to service the needs of the ED would address this concern as well.

Hospitals Might Have an Economic Advantage (Because of Size and/or Nonprofit Status) Over Small Community Pharmacies, Because Hospitals Purchase Medications in Larger Bulk and Under Different Contract Agreements

This may be true relative to smaller community pharmacies; however, it is less common that a 24-hour pharmacy is a small community pharmacy. The current 24-hour pharmacies are generally part of larger pharmacy chains that have similar purchasing strength. Federal case law has been established in this issue, and the only restriction is that hospital-based pharmacies are limited in the total day supply that can be dispensed.[14]

POTENTIAL ADVERSE EFFECTS OF DISPENSING MEDICATIONS FROM THE ED OR HOSPITAL PHARMACY

Dispensing Home Medications From the ED or Hospital Pharmacy Simplifies and Increases the Convenience of Obtaining Medications, Which Might Further

Encourage the Inappropriate Use of the ED (Versus the Medical Home) for Minor Acute Care

The medical home is the preferred site of care for most common illnesses and minor injuries. Most EDs will triage patients with minor acute conditions to lower-priority categories, resulting in longer waiting times in most cases. It is a rare family that would wait hours in an ED just for the convenience of also getting their discharge medications. Perceived abuse of the emergency care system is more likely to be a symptom of community primary care availability rather than the desire to get a convenient medication. Not dispensing medications from the ED does not fix this problem. On the contrary, providing medications from the ED under these circumstances helps patients receive necessary treatment, providing the beneficial safety net of emergency care.

Obligating Hospital Pharmacies to Dispense Medications to Uninsured Patients Increases Financial Expenses

Community pharmacies are unlikely to dispense medications at no charge if the patient lacks financial resources to cover the expense of the medications. Dispensing the medications at no charge from a hospital pharmacy represents an expense, but this expense is often less than the overall health care costs of not treating the condition. Small rural hospital EDs should not be expected to have the same resources as larger hospitals; however, there should be an available option for patients to obtain their medications.

Both of These Potential Adverse Effects of Dispensing Medications on Discharge From the ED Can Be Reduced by Requiring the Physician to Confirm That the Need for the Medication Is a High Priority

For example, refilling a prescription that will run out in 1 week is not the role of an ED pharmacy. A standardized set of indications for dispensing discharge medications from the ED outpatient pharmacy (including a no-charge compassionate care provision) can be agreed on in advance to facilitate this process. Creation of such a system also permits physicians to appreciate cost and efficacy factors that are assessed to a lesser degree during conventional medication prescribing decisions. Special circumstances that cannot be anticipated in advance can be considered on a case-by-case basis with the ED physician and the pharmacist on duty.

Dispensing Medications May Further Slow ED Throughput

Turnaround time, or "throughput," is a critical focus in most EDs. By providing medications for discharge, a system must be set up so that dispensing of these medications does not impede patient flow. Such systems can be accomplished through a predetermined list of high-use medications that can be dispensed, which would facilitate the availability of templated paper orders or computerized order sets, preprinted labels, and appropriate stock and supplies. These preparations can significantly improve turnaround time for prescription dispensing in the ED environment.

SUMMARY

Clinical outcomes for many acute conditions are highly dependent on timely access to medications. Optimal care is compromised if it is accompanied by lack of ready access to such medications. Although most health care should be sought from the medical home, unanticipated and off-hour visits to an ED for an acute illness or injury occur. Access to quality emergency care should be available to all, including access to the essential components of "after care" following an ED visit.

Failing to provide access to appropriate medications to treat conditions identified by emergency care encounters compromises the emergency care safety net. Children and families with no insurance and no ability to pay for medications at a retail pharmacy are not likely to be given medications at no charge. Some parents will not disclose inability to pay at the time of the ED encounter. By dispensing medications at the site of service, inability to pay can be identified promptly so that less costly therapeutic options can be offered or a no-charge compassionate care provision can be used to dispense the medications under a predetermined protocol. Federal regulations require that that emergency care be provided regardless of ability to pay. The benefit of this first step is not fully realized until treatment is initiated and completed.

Providing important and necessary medications from the ED outpatient pharmacy in selected instances reduces the risk of nonadherence by providing the medications more conveniently, reliably, and in a manner more proximate to the encounter, giving providers additional opportunities to reinforce medication instructions and their importance. This results in a more optimal therapeutic approach in conjunction with primary care follow-up and communication to maximize the likelihood of a good outcome.

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POLICY STATEMENT

Emergency Contraception

abstract

FREE

Despite significant declines over the past 2 decades, the United States continues to have teen birth rates that are significantly higher than other industrialized nations. Use of emergency contraception can reduce the risk of pregnancy if used up to 120 hours after unprotected intercourse or contraceptive failure and is most effective if used in the first 24 hours. Indications for the use of emergency contraception include sexual assault, unprotected intercourse, condom breakage or slippage, and missed or late doses of hormonal contraceptives, including the oral contraceptive pill, contraceptive patch, contraceptive ring (ie, improper placement or loss/expulsion), and injectable contraception. Adolescents younger than 17 years must obtain a prescription from a physician to access emergency contraception in most states. In all states, both males and females 17 years or older can obtain emergency contraception without a prescription. Adolescents are more likely to use emergency contraception if it has been prescribed in advance of need. The aim of this updated policy statement is to (1) educate pediatricians and other physicians on available emergency contraceptive methods; (2) provide current data on safety, efficacy, and use of emergency contraception in teenagers; and (3) encourage routine counseling and advance emergency-contraception prescription as 1 part of a public health strategy to reduce teen pregnancy. This policy focuses on pharmacologic methods of emergency contraception used within 120 hours of unprotected or underprotected coitus for the prevention of unintended pregnancy. Emergency contraceptive medications include products labeled and dedicated for use as emergency contraception by the US Food and Drug Administration (levonorgestrel and ulipristal) and the "off-label" use of combination oral contraceptives. *Pediatrics* 2012;130:1174–1182

COMMITTEE ON ADOLESCENCE

KEY WORDS

emergency contraception, adolescents, teen pregnancy, birth control, oral contraceptives

ABBREVIATIONS

FDA—US Food and Drug Administration

STI—sexually transmitted infection

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BACKGROUND

Despite significant declines over the past 2 decades, the United States continues to have teen birth rates that are significantly higher than other industrialized nations.[1,2] The most recent birth data available indicate a birth rate of 34.3 per 1000 among 15- to 19-year-olds.[3] The most current pregnancy outcomes data indicate that 57% of teen pregnancies ended in live births, 27% ended in induced abortion, and 16% ended in miscarriage or stillbirth.[4,5] Pediatricians have an important role, through their interactions with adolescents, to address the major public health objective of continuing to reduce adolescent pregnancy in the United States.[6]

The current decrease in teen pregnancies since the 1990s has resulted from both increased abstinence and increased use of contraception,[7,8] but large numbers of teenagers continue to engage in unprotected sexual activity. The rate of "ever having intercourse" among 15- to 19-year-old females is 43%, and, among males of the same age range, this rate is 42%.[9] The rate increases between early and late adolescence, from 13% of 15-year-olds to 70% of 19-year-olds. Although most teenagers report first intercourse with a steady partner and consensual sex, approximately 10% report being forced to have sex. Rates of sexual assault among teenagers and young adults are higher than in any other group,[10] another factor increasing the risk of unintended pregnancy.[11]

Nearly 80% of pregnancies in adolescents are unintended[12] and result from contraceptive failure or nonuse. The most commonly used method of contraception reported by teenagers who have had intercourse is the condom, followed by withdrawal and the oral contraceptive pill.[9] Research has shown, however, that many teenagers use contraceptive methods inconsistently.[13] In addition to the risk of sexually transmitted infections (STIs), the pregnancy rate for withdrawal is particularly high (27% of women who use the withdrawal method will have an unintended pregnancy in the first year of using this method).[14] Although condoms are important for protection against STIs as well as pregnancy and the pill can be a very effective method for pregnancy prevention, both methods require strict adherence by the user to be maximally effective.

Emergency contraception can reduce the risk of pregnancy if used up to 120 hours after unprotected intercourse[15,16] or contraceptive failure and is most effective if used in the first 24 hours.[17,18]

In August 2007, the US Food and Drug Administration (FDA) authorized nonprescription access to Plan B (levonorgestrel, manufactured by Teva Women's Health, Woodcliff Lake, NJ) for women 18 years of age and older and then in 2009 changed the age limit to females 17 years of age and older. Prescription for emergency contraception is required for teenagers younger than 17 years in most states.[19] As of the date of publication, males 17 years or older can also access Plan B with or without a prescription.

Studies have shown that adolescents are more likely to use emergency contraception if it has been prescribed in advance of need.[20] However, a majority of practicing pediatricians and pediatric residents do not routinely counsel patients about emergency contraception and have not prescribed it.[21–24] This policy statement will focus on pharmacologic methods of emergency contraception used within 120 hours of unprotected or underprotected coitus for the prevention of unintended pregnancy (Table 1).

DEFINITION OF EMERGENCY CONTRACEPTION

Emergency contraception is the only contraceptive method designed to prevent pregnancy after intercourse. Indications for use of emergency contraception include sexual assault, unprotected vaginal sexual intercourse, and contraceptive failures, such as broken condoms and missed or late doses of other hormonal methods (ie, missing 3 consecutive doses of active birth control pills, patch off for more than 24 hours during 'patch-on' week, or vaginal ring out for more than 3 hours during 'ring-in' week). Emergency contraceptive medications include products labeled and approved for use as emergency contraception by the FDA (levonorgestrel and ulipristal acetate) and the "off-label" use of combination oral contraceptives—the Yuzpe method—described in the literature since 1974.[25] Pediatricians should also be aware that insertion of a copper intrauterine device within 5 days of unprotected intercourse is an additional method of emergency contraception available in the United States. This statement does not cover the intrauterine device method in more detail, because it is not an option available to most pediatricians in their offices.

EMERGENCY-CONTRACEPTION METHODS

Progestin-Only Regimens

Levonorgestrel emergency contraception was approved by the FDA in 1999 under the brand name Plan B and is currently marketed as Plan B, Plan B One Step (Teva Women's Health, Woodcliff Lake, NJ), and Next Choice (Watson Pharma Inc, Corona, CA). Plan B and Next Choice consist of 2 pills containing 0.75 mg of levonorgestrel each. Although prescribing directions indicate that patients should take each of the 2 pills 12 hours apart, recent data suggest that both pills taken together as a single dose (total treatment dose of 1.5 mg levonorgestrel) is equally effective and without increased adverse effect.[15] To this effect, the next generation of emergency contraception, Plan B One Step, is packaged as a single pill with 1.5 mg levonorgestrel to be taken 1 time.[26] Pharmacies may stock both 0.75-mg and 1.5-mg levonorgestrel versions. Package labeling indicates that all 3 brands of levonorgestrel emergency contraception should be taken within 72 hours of unprotected intercourse; however, data support that use up to 120 hours after intercourse may prevent pregnancy.[15,16]

TABLE 1 Selected Regimens for Emergency Contraception Available in the United States[14,72]

Brand	First Dose	Second Dose	Ethinyl Estradiol per Dose, μg	Levonorgestrel per Dose, mg
Progestin-only pills				
Next Choice or Plan B	2 pills	None	0	1.5
Plan B One-Step	1 pill	None	0	1.5
Ovrette	20 pills	20 pill	0	0.75
Other emergency contraception				
ella	30 mg of ulipristal acetate			
Combined estrogen and progestin pills				
Ovral	2 white pills	2 white pills	100	0.5
Levora	4 white pills	4 white pills	120	0.6
Nordette	4 light orange pills	4 light orange pills	120	0.6
Seasonale	4 pink pills	4 pink pills	120	0.6
Triphasil	4 yellow pills	4 yellow pills	120	0.5
Alesse	5 pink pills	5 pink pills	120	0.5

Additional combinations are available at: http://ec.princeton.edu.

The FDA-labeled levonorgestrel methods are currently the preferred emergency contraception for teenagers because of their improved adverse effect profile and increased effectiveness in comparison with combination oral contraceptive methods. Adolescents should be instructed to take 1.5 mg of levonorgestrel as soon as possible and up to 120 hours after unprotected intercourse. No physical examination or pregnancy testing is required before use. Adolescents are advised to have a pregnancy test done if they do not have a normal period within 3 weeks of emergency-contraception use.

Ulipristal Acetate Progesterone Agonist/Antagonist

In August 2010, the FDA approved a progesterone agonist/antagonist ulipristal acetate (ella, Watson Pharma Inc, Corona, CA) for use as an emergency contraceptive.[27] Ulipristal binds to the human progesterone receptor, thereby preventing the binding of progesterone. Ulipristal is a single pill containing 30 mg of ulipristal acetate and is indicated up to 120 hours after unprotected intercourse.[28] Unlike with hormonal emergency contraception, existing pregnancy must be excluded before prescribing ulipristal because of the risk of fetal loss if used in the first trimester of pregnancy.[28] Patients should be counseled that a pregnancy test is indicated if their period is more than 7 days later than expected after taking ulipristal. Patients should also be instructed to return for evaluation of the rare but possible occurrence of ectopic pregnancy if severe abdominal pain occurs 3 to 5 weeks after the dose. Ulipristal is available only by prescription regardless of age.

Combined Hormonal Regimens (Yuzpe Method)

The use of combination oral contraceptives for emergency contraception is commonly referred to as the "Yuzpe method."[25] Commonly used since 1974, its acceptability and efficacy was limited by adverse effects of nausea and vomiting. The Yuzpe method involves taking 2 doses of pills, each containing a minimum of 100 μg of ethinyl estradiol and a minimum of 500 μg of levonorgestrel. Levonorgestrel is the active isomer of norgestrel, so equivalent dosing of any pill containing norgestrel requires doubling the dose of progestin. Other pill formulations used for emergency contraception are included in Table 1. Similar information is available from the Office of Population Research at Princeton University, which maintains a comprehensive source of information on emergency contraception (http://ec.princeton.edu/). The availability of many combination oral contraceptives with norgestrel or levonorgestrel makes this alternative particularly helpful when there is no or limited access to an emergency-contraception product. Although combination oral contraceptives have not been labeled specifically for emergency contraception, the FDA Reproductive Health Advisory Committee and professional organizations such as the American College of Obstetricians and Gynecologists have declared the use of combination oral contraceptives safe and effective for emergency contraception.[29,30]

MECHANISM OF ACTION

Hormonal emergency contraception, including combined and progestin-only methods, inhibits ovulation, disrupts follicular development, and interferes with the maturation of the corpus luteum.[31–37] These are the same mechanisms by which other hormonal methods of contraception prevent pregnancy. Results of studies evaluating the effect of hormonal emergency contraception on the endometrium are conflicting. Some studies suggest that endometrial histologic or biochemical alterations occur after emergency contraception by which endometrial receptivity to the implantation of a fertilized egg is impaired.[31,38,39] Other studies demonstrate little to no effect on the endometrium.[32,33,35,37,40,41] Suggested mechanisms, including alteration of sperm or egg transport, interference with the fertilization process, and/or cervical mucus changes, have not been verified by clinical data.[42,43] Hormonal emergency

contraception does not interrupt established pregnancies and has not been linked to teratogenic effects.[44–47]

Ulipristal acetate inhibits follicular development and rupture, so its primary mechanism of action as an emergency contraceptive is considered to be inhibition or delay of ovulation.[28] It also decreases endometrial thickness and may have a direct effect on implantation. Ulipristal is in pregnancy category X, because data from animal studies suggest that fetal loss is a risk of use during the first trimester. Therefore, pregnancy should be excluded before a dose is given.

EFFICACY

The efficacy of combined hormonal or progestin-only emergency contraception depends on the timing of use within the menstrual cycle.[48,49] A randomized controlled trial has shown that the progestin-only method, Plan B, is more effective at preventing pregnancy than combination hormone methods. When the 2 regimens were started within 72 hours, the overall pregnancy rate was 1.1% in the levonorgestrel-only group in comparison with 3.2% in the combination oral contraceptive (Yuzpe method) group.[17] The proportion of pregnancies prevented in this study was 85% with levonorgestrel and 57% with the combination oral contraceptive (Yuzpe) method in comparison with the expected number when no treatment was given. The effectiveness of emergency contraception might be summarized as follows: if 100 female adolescents have unprotected coitus in the middle of their menstrual cycles, estimates suggest that approximately 8 will become pregnant. Appropriate use of emergency contraception would reduce this number to approximately 2 pregnancies.[14]

Compared with 1.5 mg of levonorgestrel, ulipristal acetate has been shown to be equally efficacious when taken within 72 hours of unprotected intercourse. Glasier and colleagues[50] observed no statistically significant difference in pregnancy rates between women taking 30 mg of ulipristal (1.8%) or 1.5 mg of levonorgestrel (2.6%) within 72 hours of unprotected intercourse (odds ratio, 0.69%; 95% confidence interval, 0.35–1.31). This finding was consistent with a previous study.[51] Between 72 and 120 hours, the Glasier study showed some evidence that ulipristal may be more effective at preventing pregnancy.

ADVERSE EFFECTS AND CONTRAINDICATIONS

Levonorgestrel-Only Methods (Plan B, Plan B One Step, and Next Choice)

The only contraindication to use of levonorgestrel emergency contraception is known pregnancy because of lack of utility, not concern for teratogenicity or fetal loss. Young women with contraindications to estrogen may use levonorgestrel. The rate of nausea and vomiting with levonorgestrel emergency contraception is approximately half that with the combination oral contraceptive (Yuzpe) method, and routine use of antiemetics is not indicated.[17] Package labeling for the newest levonorgestrel emergency-contraception product, Plan B One Step, indicates that the most common adverse effect reported after use was heavier menstrual bleeding.[26]

Repeated use of levonorgestrel emergency contraception is associated with the same adverse effects as 1-time use. A recent Cochrane review of the subject found no serious adverse effects in trials of repeated use.[52]

Ulipristal

The most common adverse effects reported by users of ulipristal include headache (18%), nausea (12%), and abdominal pain (12%).[28] As previously noted, animal studies suggest that fetal loss is a risk of use during the first trimester. No fetal malformations have been reported.[28] It is recommended to redose ulipristal if vomiting occurs within 3 hours of the initial dose.

Yuzpe/Estrogen-Containing Methods

The most common adverse effects that occur during the first 24 to 48 hours of using estrogen-containing emergency-contraception methods are nausea (approximately 50%) and vomiting (approximately 20%), which seem unaffected by food intake.[53–55] Other adverse effects might include fatigue, breast tenderness, headache, abdominal pain, and dizziness.[14] The severity and incidence of nausea and vomiting can be decreased significantly by using an antiemetic 1 hour before an estrogen-containing regimen.[55] Antiemetics are ineffective if taken after nausea is present.[55] Effective oral antiemetics include meclizine, 25 to 50 mg, and metoclopramide, 10 mg by mouth, taken once before combination-hormone methods.[55,56] Patients with contraindications to estrogen use such as history of thromboembolism should not use the combination oral contraceptive (Yuzpe) method.

OTHER CLINICAL CONSIDERATIONS

The discussion of emergency-contraception methods with patients must also include the fact that none of these methods will protect from STIs. Patients should be encouraged to contact their physician after use to schedule follow-up visits for STI testing or treatment, as indicated. In addition, these follow-up visits are an important time to discuss options for ongoing contraception, abstinence, and consensual intercourse. It should be emphasized to patients that emergency contraception is intended for emergency use and that routine use of

emergency contraception to prevent pregnancy is not as effective as the regular use of other forms of contraception. Although emergency contraception is exclusively for use by females, young men should be counseled on this method so that they may also suggest use to their female partners if needed.

ADOLESCENTS AND EMERGENCY CONTRACEPTION: AWARENESS AND ACCESS

The regulatory changes and public discourse surrounding emergency contraception have increased the public's awareness of the methods; however, large numbers of teenagers still do not have much knowledge about correct use. In 2002, Aiken and colleagues[57] reassessed the awareness and knowledge of emergency contraception among 13- to 21-year-old females recruited from the same Pittsburgh clinic and drug treatment center from which they recruited participants for a 1996 study of emergency-contraception knowledge. Their study showed that, in 2002, 73% of teenagers were aware of emergency contraception, an increase from 44% in 1996. Although 95% of teenagers who were aware also knew where to get emergency contraception in 2002, up from 78% in 1996, only 52% were aware of the correct time frame for use (up from only 20% in 1996). Recent studies conducted in New York City and Hawaii found the percentage of teenagers aware of emergency contraception was closer to 50%.[58,59]

Data from the most recent 2006–2008 National Survey of Family Growth indicate that 14% of sexually experienced adolescent girls have ever used emergency contraception,[9] up from 8% in the 2002 survey. Reasons for use of emergency contraception by teenagers were examined by Alford et al[60] in a retrospective cohort study published in 2010. The most common reason for use was condom failure. Importantly, 13% of adolescents' use of emergency contraception during the study period was for nonconsensual penetration. A qualitative study conducted in Philadelphia aimed to explore teenagers' attitudes about the use of emergency contraception in more detail. Themes that emerged as barriers to emergency contraception use among the teenagers included worries about confidentiality, ability to get emergency contraception depending on age, worries about adverse effects, and lack of transportation to obtain the medication.[61] In a recent study of college-aged students, fewer than 16% knew that emergency contraception was available in their college health center.[62]

One important strategy to increase timely access to emergency contraception for adolescent girls is advanced prescribing. Advanced prescription for emergency contraception means providing a teenager with a supply or a prescription for emergency contraception before it is needed. Advanced prescribing facilitates access for teenagers in states that require prescriptions and also reduces the cost of obtaining emergency contraception for adolescents of all ages whose insurance provides coverage for emergency contraception with a prescription. In a 2010 review of 7 randomized trials of emergency contraception that included teenagers, it was shown that advanced prescription increased the use of emergency contraception and decreased time to use.[20] None of the studies showed an increase in sexual activity or decrease in ongoing contraceptive use in adolescents given advanced access to emergency contraception.

Despite evidence that improved access to emergency contraception (through advanced prescribing and allowing nonprescription access) increases the likelihood of use, no studies have demonstrated that improved access to emergency contraception reduces the pregnancy rate in a population.[63,64] There may be statistical reasons for this related to sample size of the studies, but it also may be that pregnancy rates remain unchanged overall because unprotected intercourse remains more frequent than emergency contraceptive use, despite increased access. The lack of demonstrated population level impact does not negate the potential for the method to reduce the risk of unintended pregnancy for an individual woman, however.

ETHICAL DILEMMAS FOR PHYSICIANS AND PHARMACISTS

Despite multiple studies showing no increased risk behavior and evidence that hormonal emergency contraception will not disrupt an established pregnancy, public and medical discourse reflects that personal values of physicians and pharmacists continue to affect emergency-contraception access, particularly for adolescents.[65–70] Some physicians refuse to provide emergency contraception to teenagers, regardless of the circumstance, and others may provide emergency contraception only if nonconsensual penetration has occurred. Both of these choices by physicians have important adverse consequences for adolescents in their ability to access emergency contraception.

A study published in 2009 demonstrated that the decision to provide emergency contraception at a time of need but not in advance of need may be related to the physician's beliefs about whether it is okay for teenagers to have sex.[24] Often, physicians hold conflicting values when approaching reproductive health issues with teenagers. Physicians may object to

unprotected intercourse or intercourse outside of marriage, but they may also feel the need to prevent teen pregnancy. Pediatricians should strive to be aware of the ways in which the underlying beliefs they bring to their clinical practice affect the care that they provide.

The American Academy of Pediatrics has issued a policy statement on refusal to provide information or treatment on the basis of conscience.[71] According to the policy, pediatricians have a duty to inform their patients about relevant, legally available treatment options to which they object and have a moral obligation to refer patients to other physicians who will provide and educate about those services. Failure to inform/educate about availability and access to emergency-contraception services violates this duty to their adolescent and young adult patients.

SUMMARY AND RECOMMENDATIONS

1. Pediatricians should be aware that sexual behavior is prevalent among teenagers and that as many as 10% of sexually active teenagers may be the victims of sexual assault.
2. Effective contraceptive use with dual methods (condoms in addition to hormonal contraception/intrauterine device) or abstinence are the best ways for teenagers to avoid pregnancy. Many teenagers are at high risk of contraceptive failure, however, and emergency contraception is an important backup method for all teenagers. Emergency contraception is most effective in decreasing risk of pregnancy when used as soon as possible, but it may be used 120 hours after unprotected or underprotected intercourse.
3. Indications for use of emergency contraception include sexual assault, -unprotected intercourse, condom breakage or slippage, and missed or late doses of hormonal contraceptives, including the oral contraceptive pill, contraceptive patch, contraceptive ring, and injectable contraception.
4. Pediatricians should provide levonorgestrel 1.5 mg (Plan B, Plan B One Step, or Next Choice) for teenagers in immediate need of emergency contraception and provide prescriptions/supply for teenagers to have on hand in case of future need (ie, advanced provision). No pregnancy test is required before the use of levonorgestrel.
5. The levonorgestrel method has an improved adverse effect profile and increased effectiveness compared with combined hormonal emergency-contraception methods. The rate of nausea and vomiting with levonorgestrel emergency contraception is approximately half that with the combination oral contraceptive (Yuzpe) method, and routine use of antiemetics is not indicated. Advanced provision increases the likelihood that teenagers will use emergency contraception when needed, reduces the time to use, and does not decrease condom or other contraceptive use. Both males and females 17 years or older may obtain levonorgestrel without a prescription, but must show proof of age.
6. Other emergency-contraception methods include ulipristal (ella) and estrogen-containing (Yuzpe) emergency-contraception methods. Adverse effects of ulipristal include headache, nausea, and abdominal pain. Existing pregnancy must be excluded before prescribing ulipristal. The adverse effects of the estrogen-containing emergency contraception (Yuzpe) method include nausea, vomiting, and abdominal pain. Patients with contraindications to estrogen use, such as history of thromboembolism, should not use the combination oral contraceptive (Yuzpe) method.
7. All adolescents, males and females, and families of disabled adolescents should be counseled on emergency contraception as part of routine anticipatory guidance in the context of a discussion on sexual safety and family planning regardless of current intentions for sexual behavior. All contraceptive and STI counseling for adolescents should include education and counseling regarding the use and availability and advance prescription of emergency contraception wherever these visits occur, including emergency departments, clinics, and hospitals. Adolescents should be instructed to use emergency contraception as soon as possible after unprotected intercourse and to then schedule a follow-up appointment with their primary provider to address the need for STI testing and ongoing contraception.
8. At the policy level, pediatricians should advocate for increased nonprescription access to emergency contraception for teenagers regardless of age and for insurance coverage of emergency contraception to reduce cost barriers.

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TECHNICAL REPORT

Epidemiology and Diagnosis of Health Care–Associated Infections in the NICU

abstract

FREE

Health care–associated infections in the NICU are a major clinical problem resulting in increased morbidity and mortality, prolonged length of hospital stays, and increased medical costs. Neonates are at high risk for health care–associated infections because of impaired host defense mechanisms, limited amounts of protective endogenous flora on skin and mucosal surfaces at time of birth, reduced barrier function of neonatal skin, the use of invasive procedures and devices, and frequent exposure to broad-spectrum antibiotics. This statement will review the epidemiology and diagnosis of health care–associated infections in newborn infants. *Pediatrics* 2012;129:e1104–e1109

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KEY WORDS

antibiotics, health care–associated infection, neonate, newborn, NICU, nosocomial infection

ABBREVIATIONS

CDC—Centers for Disease Control and Prevention
CPAP—continuous positive airway pressure

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INTRODUCTION

Health care–associated infections are infections acquired in the hospital while receiving treatment of other conditions. They are common occurrences in patients of all ages and are estimated to result in 2 million infections, 90 000 deaths, and $28 to $45 billion in excess health care costs annually.[1,2] In the Pediatric Prevention Network national point prevalence survey, 11.2% of NICU patients had a health care–associated infection on the day of the survey.[3] Although there are no recent estimates of the cost of health care–associated infections in the NICU, Payne et al[4] estimated that health care–associated bloodstream infections added almost $100 million to the cost of treating infants with birth weights from 500 to 1499 g in 1999 dollars. Because this finding represented the excess costs associated with only one type of infection in one gestational age cohort, it provides just a glimpse of the financial impact of health care–associated infections in the NICU. This financial estimate does not include the potential morbidity and mortality concerns for the infant and the effect that the prolonged hospital stay has on the family and resource utilization within the hospital. Reducing health care–associated infections in the NICU would have benefits to infants, families, and the health care delivery system. The purpose of this technical report was to review the epidemiology and diagnosis of health care–associated infections in the NICU. A companion policy statement addresses strategies for the prevention of health care–associated infections.

EPIDEMIOLOGY

Newborn infants hospitalized in a NICU have host factors that not only make them more vulnerable to acquisition of health care–associated

infections but also increase their risk of developing more serious illnesses. Whether an infant is born preterm or at term, many components of their innate and adaptive immune systems exhibit diminished function when compared with older children and adults. Infants with birth weights less than1500 g (very low birth weight) have rates of health care–associated infections 3 times higher than those who weigh greater than 1500 g at birth. However, the increased susceptibility to infection in infants of very low birth weight is multifactorial and related to both the developmental deficiencies in the innate and adaptive immune systems and a greater likelihood of a critical illness requiring invasive monitoring and procedures. Furthermore, the immunologic deficiencies can be exacerbated by the critical nature of many of the illnesses affecting newborn infants.[5]

Colonization of mucous membranes and the skin occurs rapidly after birth. Newborn infants delivered vaginally are colonized with maternal bacteria acquired from the birth canal. In most instances, those organisms do not cause invasive disease; however, in critically ill newborn infants, this colonization can potentially lead to systemic infection when skin or mucosal surfaces are compromised. The stratum corneum of the skin is poorly developed before 26 weeks' gestation, and ill neonates are at increased risk of developing skin and mucosal injury (eg, by suctioning or invasive procedures), allowing invasive bacteria access to deeper tissues or vascular spaces. Furthermore, mucosal surfaces and skin of infants in the NICU are more likely to be colonized with Gram-negative enteric rods, staphylococci, enterococci, and *Candida* species. NICU-acquired microbes are more likely to be pathogenic and resistant because of frequent exposure of hospitalized infants to antibiotic agents.

Data describing the epidemiology and incidence of health care–associated infections in NICUs can be obtained from 4 sources: (1) the National Healthcare Safety Network (previously known as the National Nosocomial Infections Surveillance system) at the Centers for Disease Control and Prevention (CDC); (2) the Pediatric Prevention Network at the National Association of Children's Hospitals and Related Institutions; (3) the Vermont Oxford Network; and (4) the National Institute for Child Health and Human Development Neonatal Research Network.

In addition to preterm birth,[6,7] risk factors associated with an increased rate of health care–associated infections include the presence of invasive devices (intravascular catheters, endotracheal tubes, orogastric tubes, urinary catheters, and drains), exposure to broad-spectrum antibiotic agents, parenteral nutrition,[8] overcrowding and poor staffing ratios, administration of steroids and histamine$_2$-receptor antagonists, and acuity of underlying illness. Furthermore, the lower the birth weight, the more invasive technology is used.[6,7]

Parenteral nutrition is commonly administered to the sickest infants through central venous catheters or peripherally inserted central catheters. The relationship between central line use and increased risk of infection has been demonstrated in multiple studies[9–11]; administration of lipids may be an independent risk factor for bacterial or fungal sepsis.[10]

The most common type of health care–associated infection within the NICU is a catheter-associated bloodstream infection.[3] Within the first 30 days after birth, coagulase-negative *Staphylococcus* species, *Staphylococcus aureus*, *Enterococcus* species, and Gram-negative enteric bacteria are the most common etiologic agents. After 30 days of age, coagulase-negative *Staphylococcus* species remain the most common pathogens; however, fungi, particularly *Candida* species and *Malassezia furfur*, have been noted with increasing frequency.[3] Central-line–related infections are, in large part, a result of problems with poor technique at the time of placement and ongoing care of the catheter site. Data suggest that the hub is a common source of contamination and subsequent infection.[12] Not surprisingly, the occurrence of catheter-associated bloodstream infections is highly related to the duration of catheter use and the number of times the catheter or hub is entered or opened.

Health care–associated lower respiratory tract infections and ventilator-associated pneumonia are of extreme importance for hospitalized infants because of their frequency and potential severity. Health care–associated pneumonia represents 6.8% to 32.3% of health care–associated infections in the NICU and is the second most frequent hospital-acquired infection in critically ill neonates.[7,13,14] The most recent National Healthcare Safety Network data indicate a pooled mean rate of ventilator-associated pneumonia from 0.7 to 2.2 per 1000 ventilator days.[7] However, rates varied among NICUs, with 90% of NICUs reporting rates between 2.1 and 7.3 per 1000 ventilator days. Variations in incidence likely reflect, in part, difficulty in making this diagnosis in infants with chronic lung disease. As with most health care–associated infections, birth weight and gestational age correlate inversely with the incidence of ventilator-associated pneumonia. Many of the risk factors for the development of health care–associated pneumonia in NICU patients are similar to those previously identified in adult patients, such as prolonged duration of mechanical ventilation, severe underlying cardiopulmonary disease, prolonged intravenous alimentation, and previous thoracoabdominal surgery.

Most bacterial health care–associated lower respiratory tract infections occur by aspiration of bacteria that colonize the oropharynx or the upper gastrointestinal tract. On rare occasions, health care–associated pneumonias may result from contiguous spread or a primary infection at a distant site. Under normal circumstances, the filtration system of the upper airway and the mucociliary clearance system of the large airways protect the lower respiratory tract from bacteria that may be present in the patient's environment or that reside in the upper respiratory tract. Endotracheal tubes bypass these initial host barrier defense mechanisms, providing direct access of bacteria and other pathogens to the lower respiratory tract. Uncuffed endotracheal tubes provide even easier access of microorganisms to the lower respiratory tract.[15–17] The aspiration of contaminated materials may be obvious or, more commonly, may be subclinical.[15–18] By using pepsin as a marker for aspiration, microaspiration has been detected in up to 92.8% of ventilated neonates.[18,19] Methylxanthines and bronchopulmonary dysplasia increase the frequency of microaspiration. Microaspiration is also more frequent in infants with severe bronchopulmonary dysplasia compared with those with moderate bronchopulmonary dysplasia.[18,19] Neonates who have either impaired swallowing mechanisms or anatomic abnormalities that prevent adequate protection of their airway are also at increased risk of aspiration.[15,16,20]

Dense bacterial polysaccharide biofilm can coat the endotracheal tubes, and polymicrobial flora become embedded into this film. Endotracheal suctioning can dislodge these aggregates of bacteria, providing a large bacterial inoculum directly into lower airways. Nasal continuous positive airway pressure (CPAP) does not bypass many of the protective barriers, does not require endotracheal suctioning, and reduces mechanical disruption of respiratory mucosa. This likely explains the lower risk of health care–associated pneumonia in neonates using nasal CPAP versus those treated with endotracheal intubation (1.8 vs 12.8 per 1000 nasal CPAP or ventilator days).[21] However, CPAP has been associated with an increased risk of Gram-negative infections.[22]

Skin and soft tissue infections are commonly observed in NICU patients. Neonates, especially those born preterm, have fragile skin, which is easily traumatized. Cellulitis, abscesses, and skin abrasions are frequently noted at sites of percutaneous puncture (lancets and scalp electrodes), in diaper or bandage areas, and at surgical incision sites. *S aureus* is by far the most common microorganism responsible for all skin and soft tissue infections in the NICU. The recent emergence of methicillin-resistant *S aureus*, both endemic health care–associated and community-associated strains, has made management of these infections complicated. Gram-negative enteric rods and yeasts are less commonly associated with skin and soft tissue infections than *S aureus*, but they are associated with surgical procedures, particularly those affecting the gastrointestinal tract.

DIAGNOSIS OF CENTRAL LINE–ASSOCIATED BLOODSTREAM INFECTIONS

The presence of a central venous catheter is a major risk factor for bloodstream infection. Coagulase-negative staphylococci are responsible for nearly 50% of catheter-related bloodstream infections. Other pathogens include Gram-negative organisms (~20%), *S aureus* (4% to 9%), *Enterococcus* species (3% to 5%), and *Candida* species (~10%).[23] Coagulase-negative staphylococci are skin commensals; therefore, interpretation of a blood culture result positive for this organism is difficult. The diagnosis is made even more problematic by the nonspecific signs of sepsis in the neonate. It is noteworthy that the databases of the National Healthcare Safety Network, Vermont Oxford Network, and the National Institute for Child Health and Human Development Network include infants with a single positive blood culture and clinical signs as "proven cases" of central line–associated bloodstream infection. Although many experts recommend obtaining both central line and peripheral blood cultures when evaluating neonatal patients for central line–associated bloodstream infection, a single blood culture sample is commonly obtained. In those situations, it may be difficult to determine whether the coagulase-negative *Staphylococcus* is the responsible pathogen or a contaminant, and the clinician will need to make a judgment on the basis of the laboratory data and response to treatment. The Infectious Diseases Society of America recommends that paired samples be drawn from the catheter and a peripheral vein (level of evidence: A-II).[24] Although this action may not be possible for all neonates, paired samples should be obtained whenever feasible. Neonates with a suspected central line–associated bloodstream infection should be treated with broad-spectrum antibiotic agents to cover both Gram-positive and Gram-negative pathogens. An algorithm for interpreting a positive blood culture result for coagulase-negative staphylococci is shown in Fig 1.

DIAGNOSIS OF HEALTH CARE–ASSOCIATED PNEUMONIA

Health care–associated pneumonia can have adverse clinical consequences, both from the infection itself and from

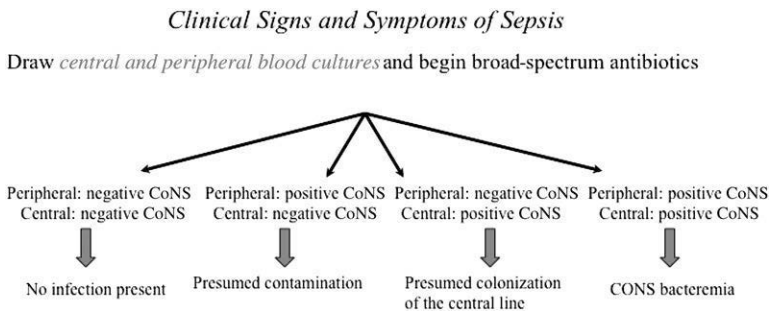

FIGURE 1
Algorithm for interpreting a positive blood culture result for coagulase-negative staphylococci (CONS).

its therapies. Health care–associated pneumonias in infants may result in increased exposure to broad-spectrum antibiotic agents, need for reintubation, increased duration of assisted ventilation, increased length and cost of hospitalization, secondary infections including sepsis, and even death.

The optimal method of diagnosing health care–associated pneumonia in neonates remains to be established. In neonates with underlying pulmonary disease, it may be difficult to differentiate between preexisting lung disease and health care–associated pneumonia or tracheitis. In general, the diagnosis of health care–associated pneumonia is made on the basis of evidence of respiratory decompensation with new and persistent infiltrates on a chest radiograph. Clinical signs suggesting that a health care–associated bacterial pneumonia has developed in an infant receiving mechanical ventilation include changes in the patient's respiratory status that are unexplained by other events and a significant increase in the quantity and quality of respiratory secretions. However, signs such as fever, leukocytosis, and changes in the quality and quantity of tracheobronchial secretions may occur for reasons other than the development of a health care–associated lower respiratory tract infection. Unfortunately, relying on clinical changes and chest radiographic findings for the diagnosis in a NICU setting may overestimate the true incidence of health care–associated pneumonia. Infants with atelectasis, congenital heart disease, bronchopulmonary dysplasia, pulmonary hemorrhage, pulmonary edema, and surgical procedures affecting the chest may have radiographic changes that are similar to changes seen with pneumonia. The National Healthcare Safety Network and CDC definition requires at least 48 hours of mechanical ventilation accompanied by new and persistent radiographic infiltrates after the initiation of mechanical ventilation. In addition to these criteria, infants younger than 1 year old must exhibit worsening gas exchange and at least 3 of the following: (1) temperature instability with no other recognized cause; (2) leukopenia (white blood cell count $<4000/mm^3$); (3) change in the character of sputum or increased respiratory secretions or suctioning requirements; (4) apnea, tachypnea, nasal flaring, or grunting; (5) wheezing, rales, rhonchi, or cough; or (6) bradycardia (<100 beats/min) or tachycardia (>170 beats/min).[25] Baltimore,[26] however, has pointed out that the CDC definitions were developed for epidemiologic surveillance and have not been validated for clinical diagnosis.

Laboratory tests, such as Gram stain or bacterial culture, documenting the presence of inflammation and pathogenic microorganisms in lower respiratory tract secretions may be helpful in establishing the presence of a health care–associated lower respiratory tract infection. However, in most cases, presence of bacteria in specimens obtained by suctioning the endotracheal tube represents colonization rather than an invasive infection, even when the culture is obtained immediately after intubation. In addition, the correlation between culture results obtained from endotracheal suction specimens and those from samples obtained directly from the lungs, pleural cavity, or blood is poor.[27,28]

When it is likely that a health care–associated bacterial pneumonia is present, a number of procedures can assist in establishing the etiologic agent. A Gram stain of a specimen obtained by suctioning through the endotracheal tube can provide evidence of an inflammatory (and potentially infectious) process in the lower respiratory tract.[29] The presence of an abundance of polymorphonuclear neutrophils or a significant increase in polymorphonuclear neutrophils from a previous Gram stain of the same secretions, regardless of the presence of a predominant bacterial organism, is supportive evidence that pneumonia is present but also may represent tracheitis. The presence of a single organism obtained by culture that is consistent with an organism identified on the Gram stain increases the likelihood that this agent is causally related to the health care–associated bacterial pneumonia.[29]

Numerous efforts have been made to develop techniques for obtaining specimens from the lower respiratory tract that can identify the bacteria responsible for the health care–associated pneumonia without interference by upper airway contamination. Transtracheal aspiration, transthoracic needle aspiration and biopsy, and bronchoscopy have been used in older children and

adults to obtain samples directly from the lower respiratory tract, but these procedures are generally contraindicated in neonates. Moreover, there is a high rate of false-positive results in children who have underlying pulmonary conditions that might be confused with pneumonia by their clinical and radiographic appearances.

Bronchoalveolar lavage is a reliable method for obtaining lower respiratory tract secretion samples in older children and adults.[30–32] However, its role in diagnosing ventilator-associated pneumonia in older children and adults has not been established, and experience in preterm infants is limited. In intubated neonates, tracheal aspirates may provide information similar to that which can be obtained by bronchoalveolar lavage. However, for neonates with rapidly progressing lower respiratory tract disease or in whom a diagnosis is not established with routine tracheal aspirate, a bronchoalveolar lavage may be indicated (if technically feasible).[33–35] The aspirated fluid can be centrifuged, and the pellet can be examined immediately for bacteria (Gram stain or acridine orange) and fungi (KOH or Calcofluor). Cultures and other molecular diagnostic testing (eg, direct fluorescent antibody assay, polymerase chain reaction assay) can be performed for aerobic bacteria, fungi, and viruses. The differential count of white blood cells from bronchoalveolar lavage fluid may also be helpful. Infants with bacterial or fungal infections are more likely to have a high proportion of granulocytes in bronchoalveolar lavage fluid.[33,36]

Isolation of the same bacterial pathogen from the blood and the lower respiratory tract usually confirms that this organism is the agent responsible for the health care–associated pneumonia. However, only approximately 2% to 5% of patients with health care–associated bacterial pneumonia have positive blood cultures.[36]

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POLICY STATEMENT

Firearm-Related Injuries Affecting the Pediatric Population

The absence of guns from children's homes and communities is the most reliable and effective measure to prevent firearm-related injuries in children and adolescents. Adolescent suicide risk is strongly associated with firearm availability. Safe gun storage (guns unloaded and locked, ammunition locked separately) reduces children's risk of injury. Physician counseling of parents about firearm safety appears to be effective, but firearm safety education programs directed at children are ineffective. The American Academy of Pediatrics continues to support a number of specific measures to reduce the destructive effects of guns in the lives of children and adolescents, including the regulation of the manufacture, sale, purchase, ownership, and use of firearms; a ban on semiautomatic assault weapons; and the strongest possible regulations of handguns for civilian use.

SCOPE OF THE PROBLEM

Although rates have declined since the American Academy of Pediatrics (AAP) issued the original policy statement in 1992, firearm-related deaths continue as 1 of the top 3 causes of death in American youth.[1] As shown in Fig 1, the firearm-associated death rate among youth ages 15 to 19 has fallen from its peak of 27.8 deaths per 100 000 in 1994 to 11.4 per 100 000 in 2009, driven by a decline in firearm homicide rates.[1] No single study has adequately explained the decline in firearm-related homicide rates. Postulated reasons include improved socioeconomic conditions, violence prevention programs, decline in the crack/cocaine market, changes in legislation, declines in firearms availability for other reasons, and community policing. Nevertheless, firearm-associated death and disability rates remain unacceptably high.

Of all injury deaths of individuals 15 through 19 years of age in the United States in 2009, more than 1 (28.7%) in 4 were firearm related, and of those younger than 20 years, nearly 1 (19.5%) in 5 were firearm related.[1] These firearm deaths result from homicide, suicide, and unintentional injury (Fig 2). Black Americans are particularly affected; injuries from firearms were the leading cause of death among black males 15 through 34 years of age in 2009.[2] Although national data cannot fully document urban and rural differences in the patterns of injuries from firearms that involve children, local data indicate that children in rural areas as well as in urban areas are at risk for firearm-related mortality.[3–5]

COUNCIL ON INJURY, VIOLENCE, AND POISON PREVENTION EXECUTIVE COMMITTEE

KEY WORDS
child, adolescent, violence, homicide, suicide, injury, epidemiology, policy

ABBREVIATIONS
AAP—American Academy of Pediatrics
NVDRS—National Violent Death Reporting System

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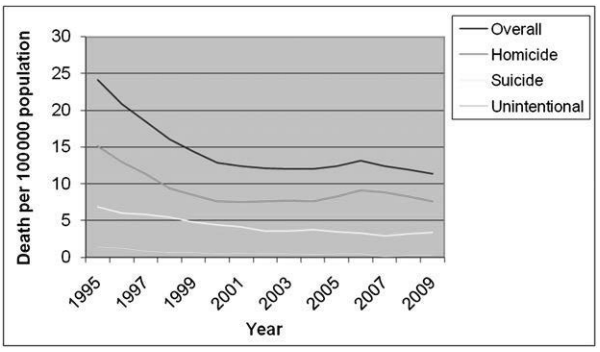

FIGURE 1
Firearm-related death rates per 100 000 people 15 through 19 years of age in the United States, 1995–2009. (Adapted from National Center for Injury Prevention and Control, US Centers for Disease Control and Prevention. Web-Based Injury Statistics Query & Reporting System (WISQARS) Injury Mortality Reports, 1999–2009, for national, regional, and states [May, 2012]. Available at: http://webappa.cdc.gov/sasweb/ncipc/. Accessed June 8, 2012).

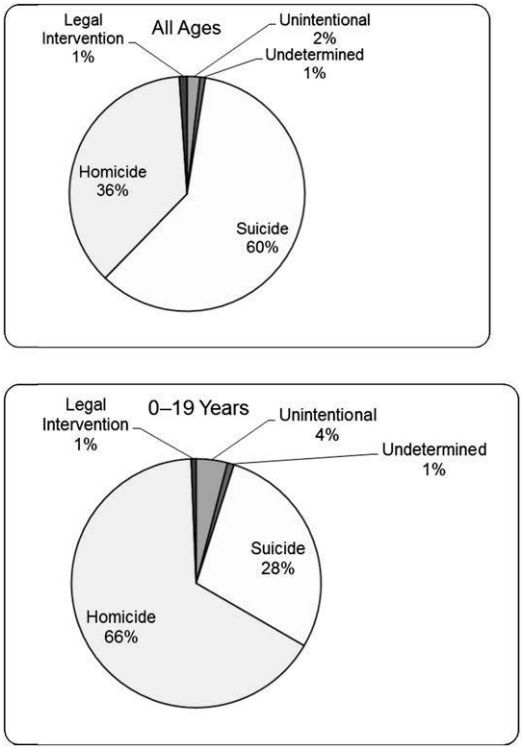

FIGURE 2
Injury intent: US 2009 firearm-related deaths, for all ages (*n* = 31 593) and in children from birth through 19 years of age (*n* = 2966). (Adapted from National Center for Injury Prevention and Control, US Centers for Disease Control and Prevention. Web-Based Injury Statistics Query & Reporting System (WISQARS) Injury Mortality Reports, 1999–2009, for national, regional, and states [May, 2012]. Available at: http://webappa.cdc.gov/sasweb/ncipc/. Accessed June 8, 2012).

The National Violent Death Reporting System (NVDRS), administered by the Centers for Disease Control and Prevention, provides detailed surveillance of all violent deaths in participating states. The NVDRS system uses sources of data to allow analysis of each death (homicides, suicides, and others), including the detailed history and circumstances of the fatal incident. Data concerning mental health, substance abuse, race, age group, previous history, method of injury, and relationship of suspect to victim are included. Suspects and multiple victims can be studied together, allowing for comparisons of victim and perpetrator characteristics.[6–8] The NVDRS can provide useful information concerning childhood mortality from firearms; limited raw data from this system are now available online.[1]

INTERNATIONAL COMPARISONS

The United States has the highest rates of firearm-related deaths (including homicide, suicide, and unintentional deaths) among high-income countries.[9] For youth 15 to 24 years of age, firearm homicide rates, as documented by Richardson and Hemenway,[9] were 35.7 times higher than in other countries. For children 5 to 14 years of age, firearm suicide rates were 8 times higher, and death rates from unintentional firearm injuries were 10 times higher in the United States than other high-income countries. The difference in rates may be related to the ease of availability of guns in the United States compared with other high-income countries. This is particularly true for suicides, as guns carry a high case-fatality rate.[10] Suicides among the young are typically impulsive,[11] and easy access to lethal weapons largely determines outcome.

ECONOMIC COSTS OF FIREARM-RELATED INJURY

Corso and colleagues[12] calculated the financial cost to society resulting from gun-related assaults and homicides in 2000. The amount totaled $17.4 billion, including $0.8 billion in direct medical costs and $16.6 billion in lost productivity. In the same year, self-inflicted firearm injuries and suicides cost society $16.4 billion, including

$16.3 billion in lost productivity and $0.1 billion in direct medical costs. The analysis found that average direct medical cost per case for nonfatal firearm assaults and self-inflicted injuries resulting in hospitalization were $24 353 and $7234 respectively.[12] The method for calculating the medical costs includes ambulance transport costs, coroner/medical examiner costs, emergency department costs, hospital readmission costs, and inpatient hospitalization and/or nursing home costs.[12] Work loss costs were calculated by the net present value of future wage earning and losses in household productivity.

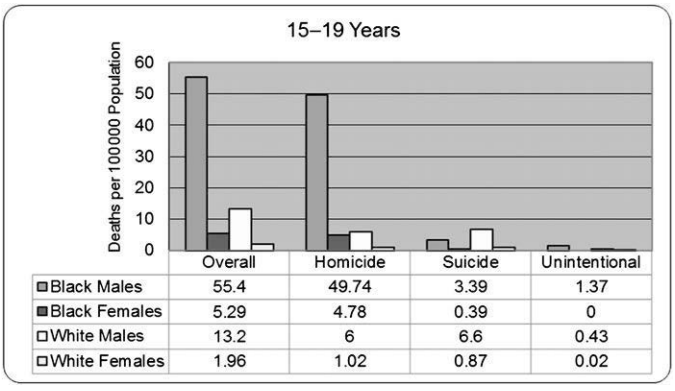

FIGURE 3

Firearm-related death rates per 100 000 black and white people 15 through 19 years of age in the United States, 2009. (Adapted from National Center for Injury Prevention and Control, US Centers for Disease Control and Prevention. Web-Based Injury Statistics Query & Reporting System (WISQARS) Injury Mortality Reports, 1999–2009, for national, regional, and states [May, 2012]. Available at: http://webappa.cdc.gov/sasweb/ncipc/. Accessed June 8, 2012).

HOMICIDE

In 2009, 84.5% of all homicides of people 15 through 19 years of age were firearm-related.[1] Deaths of male individuals outnumber deaths of female individuals (Fig 3). Young black men from 15 through 34 years of age have the highest rates of firearm-related homicide.[1] In 2010 in the United States, 67.5% of all homicides were committed with a firearm, and in 68.5% of those cases, a handgun was used as the murder weapon.[13] Firearm homicide rates were higher in major urban areas than in the nation as a whole (5.2 per 100 000 vs 4.2 per 100 000). Within the 50 largest metropolitan areas, they were highest in the central cities (9.7 per 100 000).[3]

An understanding of the characteristics of firearm-related homicides is important when interventions are being planned. Most homicides occur during interpersonal conflict, typically between relatives, friends, or acquaintances.[13] Recognized risk factors for violence involving children and adolescents include exposure to family violence, history of antisocial behavior, depression, suicidal ideation, drug/alcohol use, poor school performance, bullying, and isolation from peer groups.[14] The occurrence of shootings in schools, although rare, deserves serious study and calls for local and national responses.

SUICIDE

Suicide Risk Among Adolescents and Firearm Availability

In 2009, suicide was the third leading cause of death for American youth 15 to 19 years of age. Firearms remained the most common method used for suicide in this age group, accounting for 736 deaths (3.4 per 100 000).[1] Of all common methods used for attempting suicide, firearms are the most lethal, with approximately a 90% mortality rate.[15] Adolescents are at a relatively high risk of attempting suicide as a consequence of their often impulsive behavior. Choosing a highly lethal method such as a firearm to attempt suicide leads to higher suicide fatality rates overall, in part because most survivors of serious suicide attempts do not die of renewed attempts.[16] Thus, easy access to firearms contributes to an increased risk of suicide among youth this age. Although handguns are used in most youth firearm suicides, long guns (shotguns and rifles) are also used in a large percentage of suicides in rural areas, where they are more widely available.[17,18] Strong evidence suggests that the presence of firearms in the home increases the risk of suicide among adolescents. A review of existing data from case-control studies and ecological data found that firearm availability plays a large role in increasing the risk of youth suicide.[19] Several individual-level and ecologic studies, including nationally representative studies, have corroborated these earlier findings.[20–24] The association of a gun in the home and increased risk of suicide among adolescents has been well documented. From a clinical perspective, it is important to note that this association is significant even in those teens without a previous psychiatric diagnosis.[25,26] The odds of suicide are particularly high if the gun is kept loaded.[25,26]

Data concerning the effects of laws restricting firearm ownership show varying results.[27–29] Interestingly, laws reducing child access, which primarily requires safe storage, appear to be associated with lower overall adolescent suicide rates, whereas purchase restrictions did not result in this reduction.[29] Other studies have

established the finding that safe storage of firearms reduces the risk of adolescent suicide.[30]

UNINTENTIONAL FIREARM-RELATED DEATHS

In 2009, 114 children and adolescents younger than 20 years died as a result of unintentional firearm-related injuries.[1] Perhaps surprisingly, 66 of these 114 unintentional deaths occurred in the 15- to 19-year age group. Fatal shootings are usually inflicted by other children or youth, typically friends or siblings.[31,32] There are few recent systemically collected data concerning the precise circumstances of unintentional firearm injury deaths among these 114 children.

NONFATAL FIREARM-RELATED INJURIES

According to data from emergency departments in the 66 hospitals in the National Electronic Injury Surveillance System All-Injury Program, an estimated 73 505 people of all ages were treated for nonfatal firearm-related injuries in US hospital emergency departments in 2010, among them 15 576 children and adolescents younger than 20 years.[1] Of those, 6236 (40%) required hospitalization for their injuries. Adolescents 15 to 19 years of age had nonfatal firearm injury rates nearly 3 times that of the general population (62.9 vs 23.9 per 100 000).[1] Most (79%) of the nonfatal injuries to adolescents were attributable to assault, and assault-related injuries were responsible for 84.5% of hospitalizations.[1]

ADOLESCENT CHARACTERISTICS AND ACCESS TO GUNS

The 2011 *National Youth Risk Behavior Surveillance* reported that 5.1% of students in grades 9 through 12 had carried guns during the past month, with boys more likely to report carrying guns than girls (8.6% vs 1.4%).[33] Well-established behavioral risk factors for carrying guns include gang membership, use of alcohol and other drugs, victimization by violence, and perpetration of violence.[34–36] As with other risk behaviors, adolescents substantially overestimate the percentage of their peers who carry guns, and interestingly, gun carrying is highly associated with that normative perception.[35] Adolescence is marked by a search for identity, independence, and autonomy. Accompanying characteristics may be curiosity, the strong influence of the peer group, rites of passage, belief in invincibility, impulsiveness, immaturity, mood swings, and substance abuse. The perception of danger by adolescents may be influenced by many factors, including the media, as well as the reality of their own lives. A view of the world as a dangerous place during this particularly vulnerable developmental period may lead to conflict, injury, and death, especially when access to guns is easy.

GUNS AND GUN OWNERSHIP

It is estimated that 57 million Americans owned 283 million firearms in 2004, representing 38% of all households and 26% of all adults having or owning at least 1 gun. Of these, 60% were long guns and the remaining 40% were handguns.[37] Of the handguns, 50% were revolvers, 35% were semiautomatic pistols, and 15% were other types.[37] More recently, there has been a troubling increase in serious and disabling injuries resulting from high-velocity nonpowder guns.[38]

Prevalence of gun ownership by household varies significantly geographically, with an estimated low of 5.2% in the District of Columbia to 62.8% of all households in Wyoming.[39] In a study of gun-owning Americans with children under 18 years of age, 21.7% stored a gun loaded, 31.5% stored a gun unlocked, and 8.3% stored at least 1 gun unlocked and loaded.[40] Household firearm owners with adolescents 13 through 17 years of age report leaving their firearms unlocked 41.7% of the time, compared with only 28.8% of household firearm owners with children 0 through 12 years of age.[40]

Most gun owners report the leading motivation for ownership is recreational; however, nearly three-quarters of handgun owners said self-protection was the primary reason for owning a gun.[41] Research in several US urban areas indicates that a gun stored in the home is associated with a threefold increase in the risk of homicide and a fivefold increase in the risk of suicide.[42–44] Evidence from Philadelphia suggests that firearm possession increases the risk of being shot in an assault. In a carefully conducted case-control study, Branas and colleagues found that people possessing a gun were more than 4 times more likely to be shot in an assault than those not in possession of a firearm.[45]

LEGAL ISSUES

A 2008 Supreme Court decision struck down the handgun ban in the District of Columbia, concluding that the second amendment to the US Constitution establishes individual rights to gun ownership.[46] In the subsequent 2010 Supreme Court case of *McDonald v the City of Chicago*, the Court ruled that the 14th Amendment extends the 2nd Amendment protections of the federal government to states and localities against laws that infringe on "the right to keep and bear arms."[47]

Because Chicago was the only locality in the country to possess an outright handgun ban, the *McDonald* ruling did not have an immediate effect on state and local gun laws outside the Chicago area. The ruling set the stage

for Second Amendment legal challenges to local and state gun laws, however, including laws requiring the safe storage of firearms and trigger locks, as well as laws aimed at protecting children from firearms. There have been and will likely continue to be a number of state and local legal challenges to restrictions on firearm acquisition and use in the United States. These include challenges to measures specifically pertaining to access to firearms by children. Pediatricians should, nonetheless, continue to provide anticipatory guidance to children and their families regarding keeping children safe from injury, including restriction of access to guns.

IMPLICATIONS OF DATA FOR PREVENTION STRATEGIES

The following summary of data suggests a number of intervention strategies:

- Firearm-related injuries are often fatal; primary prevention is essential.
- Suicide fatality rates increase if guns are present in the home.
- Access to guns increases the number of conflict-related deaths and injuries.
- Access to guns and unsafe storage practices creates risk of serious unintentional injury and death.
- Most firearm-related injuries and deaths of children and adolescents involve a handgun, but long guns are involved a large number of unintentional injuries and suicides, especially in rural areas.

Preventing Firearm Injuries in Children

A number of design options have been proposed to decrease the likelihood of unintentional injury by a firearm, as well as limiting access by unauthorized users. These include trigger locks, lock boxes, personalized safety mechanisms, and trigger pressures that are too high for young children.[48] A multisite study found that keeping a gun locked and keeping a gun unloaded have protective effects of 73% and 70%, respectively, with regard to risk of both unintentional injury and suicide for children and teenagers. These findings were consistent for both handguns and long guns (rifles and shotguns).[30]

Gun avoidance programs are designed to educate children as a way of reducing firearm injury (eg, Eddie Eagle, STAR); however, several evaluation studies have demonstrated that such programs do not prevent risk behaviors[49–51] and may even increase gun handling among children.[45] In contrast, results of a large national randomized controlled trial demonstrated that brief physician counseling directed at parents, combined with distribution of gunlocks, may be effective in promoting safer storage of guns in homes with children.[52] A recent randomized controlled trial found that a safe storage campaign with gun safe distribution was both feasible and effective at limiting household exposure to unlocked and loaded guns.[53]

A number of factors may be important in reducing exposure to violence and the results of that exposure in children and adolescents. Some curricula targeting younger children and those at low risk of violence have been evaluated and have shown positive results.[54] Resiliency-based violence-prevention strategies in preschool children have shown improvement in teacher interactional skills supporting children's resiliency and improvement in children's prosocial behaviors.[55] Other studies have shown that both family support and early childhood education result in reductions in delinquency[56]; however, one study has shown that, for seventh-grade children exposed to high levels of violence as victims or witnesses, a conflict-resolution class produced more anxiety, depression, and aggression.[57] School curricula aimed at reducing violence should be specific to the population and include evaluation components to determine their effectiveness.[58]

The AAP statement on youth violence prevention suggests many ways in which pediatricians and communities can respond to violence.[59] This policy endorses use of the *Connected Kids: Safe, Strong, Secure* violence-prevention program. This program provides counseling suggestions concerning a number of violence-related topics and parent information brochures specifically related to reducing unintentional injuries to young children and suicide risk among adolescents. The *Connected Kids* program was developed on the basis of expert opinion and focus groups of parents around the United States.[60–62] The clinical guide and parent information material provides parents with factual information from which they can make their own decisions. For parents of young children, handgun storage is placed in the context of preventing child access to other dangerous household products. Parents of adolescents have counseling and written materials that describe the relationship between the availability of lethal weapons and fatal teen suicide attempts. These concepts have been incorporated in the new *Bright Futures* toolkit, and pediatricians will find items concerning gun safety incorporated into relevant previsit questionnaires.[63] The AAP also advocates for reduction of television viewing by children, because media exposure results in increases in childhood and youth violence. In particular, media tends to romanticize the

use of firearms as a means of resolving conflicts. The AAP policy statement on media violence provides specific background information and recommendations for pediatricians.[64]

Pediatricians can benefit from knowing local community resources that assist with guidance when patients and families are at high risk of firearm-related injury. Pediatricians may partner with other community members and community-based organizations to identify and publicize these resources.

SUMMARY AND RECOMMENDATIONS

Firearm-related injury to children is associated with death and severe morbidity and is a significant public health problem. Child health care professionals can and should provide effective leadership in efforts to prevent gun violence, injury, and death. The AAP recognizes the importance of a variety of countermeasures (educational, environmental, engineering, enactment, enforcement, economic incentives, and evaluation) to dramatically curb the number of firearm-related injuries to children. The AAP makes the following recommendations, which reaffirm and expand on the 1992 and 2000 policy statements[65,66]:

1. The AAP affirms that the most effective measure to prevent suicide, homicide, and unintentional firearm-related injuries to children and adolescents is the absence of guns from homes and communities. Although the US Supreme Court ruling in the case of *McDonald v City of Chicago* struck down comprehensive local and statewide firearm bans, pediatricians should continue to advocate for the strongest possible legislative and regulatory approaches to prevent firearm injuries and deaths.
2. Health information for parents:
   a. Pediatricians and other child health care professionals are urged to counsel parents about the dangers of allowing children and adolescents to have access to guns inside and outside the home. The AAP recommends that pediatricians incorporate questions about the presence and availability of firearms into their patient history taking and urge parents who possess guns to prevent access to these guns by children. Safer storage of guns reduces injuries, and physician counseling linked with distribution of cable locks appear to increase safer storage. Nevertheless, the safest home for a child or adolescent is one without firearms.
   b. The presence of guns in the home increases the risk of lethal suicidal acts among adolescents. Health care professionals should counsel the parents of all adolescents to remove guns from the home or restrict access to them. This advice should be reiterated and reinforced for patients with mood disorders, substance abuse problems (including alcohol), or a history of suicide attempts.
3. The AAP urges that guns be subject to consumer product regulations regarding child access, safety, and design. In addition, the AAP continues to support law enforcement activities that trace the origins of firearms used in the commission of crimes and that these data be used to enforce regulations aimed at preventing illegal sales to minors.
   a. Evidence supports the effectiveness of regulation that limits child access to firearms.
   b. The AAP supports efforts to reduce the destructive power of handguns and handgun ammunition via regulation of the manufacture and importation of classes of guns. Engineering efforts (eg, personalized safety mechanisms and trigger locks) may be of benefit and need further study. Trigger locks, lock boxes, gun safes, and safe storage legislation are encouraged by the AAP. Other measures aimed at regulating access of guns should include legislative actions, such as mandatory waiting periods, closure of the gun show loophole, mental health restrictions for gun purchases, and background checks.
   c. The AAP recommends restoration of the ban on the sale of assault weapons to the general public.
4. The AAP supports the funding of research related to the prevention of firearm injury, including surveillance through the NVDRS; accurate evaluation of health care–based screening and intervention; and local, regional, and national efforts to identify and disseminate violence prevention resources.
5. The AAP supports the education of physicians and other professionals interested in understanding the effects of firearms and how to reduce the morbidity and mortality associated with their use.

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POLICY STATEMENT

Health Care of Youth Aging Out of Foster Care

abstract

FREE

Youth transitioning out of foster care face significant medical and mental health care needs. Unfortunately, these youth rarely receive the services they need because of lack of health insurance. Through many policies and programs, the federal government has taken steps to support older youth in foster care and those aging out. The Fostering Connections to Success and Increasing Adoptions Act of 2008 (Pub L No. 110-354) requires states to work with youth to develop a transition plan that addresses issues such as health insurance. In addition, beginning in 2014, the Patient Protection and Affordable Care Act of 2010 (Pub L No. 111-148) makes youth aging out of foster care eligible for Medicaid coverage until age 26 years, regardless of income. Pediatricians can support youth aging out of foster care by working collaboratively with the child welfare agency in their state to ensure that the ongoing health needs of transitioning youth are met. *Pediatrics* 2012;130:1170–1173

COUNCIL ON FOSTER CARE, ADOPTION, AND KINSHIP CARE AND COMMITTEE ON EARLY CHILDHOOD

KEY WORDS

foster care, aging out, emancipation, adolescents, health care

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BACKGROUND

Children and youth in the child welfare system in the United States frequently face multiple obstacles in accessing needed health care services. All adolescents face challenges as they move into adulthood, but most have nurturing families to provide stability and emotional and economic support. Approximately 66 000 individuals in foster care (16% of the foster care population) are aged 16 and 17 years of age, and another 17 000 are 18 through 20 years of age.[1] As youth in foster care mature into adulthood, they face enormous challenges, including lack of family support; educational deficiencies; employment and income problems; inadequate or inappropriate living arrangements; medical, dental, and mental health problems; and lack of health insurance.

HEALTH CHALLENGES FACED BY YOUTH IN FOSTER CARE

Youth in foster care face medical and mental health challenges at significantly higher rates than other children, often as a consequence of the circumstances that led to their removal from their home and sometimes exacerbated by their experiences in foster care.[2] These health issues include developmental delays, mental retardation, emotional adjustment problems, chronic medical problems, birth defects, substance abuse, and pregnancy. In the foster care population, more than 60% of youth will have mental health problems during their lifetime; 30% to 40% of adolescents are coping with mental health issues, including posttraumatic stress disorder; and

more than one-third of older adolescents have a chronic illness or disability.[3–5]

LACK OF HEALTH COVERAGE AMONG YOUTH AGING OUT OF FOSTER CARE

High rates of physical and emotional health needs mean that youth aging out of foster care require comprehensive health coverage that recognizes and addresses their unique needs. Unfortunately, research has shown that they rarely receive such services. The Northwest Foster Care Alumni Study, one of the most comprehensive studies to date of the status of youth aging out of foster care, revealed that only 47% of foster care alumni said they had health insurance when they exited foster care.[6] The Midwest Evaluation of the Adult Functioning of Former Foster Youth Study, which examined the progress of youth in 3 states where they received foster care for at least 18 months, found that 51% stated they had no health insurance coverage.[7] The third wave of Midwest Evaluation interviews, conducted when subjects were aged 21 years, revealed that only half of the young adults who had aged out of foster care had medical insurance, and only 39% had dental insurance. Approximately 20% had not received any medical or dental care in the past year, citing their lack of health insurance as the main reason.[8] Another study found that 55% of young adults who had exited the foster care system had no health insurance.[9] The percentage of young adults (average age, 20.2 years) who had exited foster care with no health insurance was double that of young adults who had not been in foster care. According to the US Census Bureau, 30% of all young adults 18 through 24 years of age do not have health insurance.[10] Multiple studies and surveys over the years show clearly that youth in foster care have 3 to 7 times as many chronic health conditions and behavior/mental health problems as do those who have not been in foster care; however, they are only about half as likely to have health insurance.

LAWS ON HEALTH CARE FOR YOUTH AGING OUT OF FOSTER CARE

Historically, the child welfare system has been a responsibility of states. Each state designs and administers its child welfare and foster care programs as well as other human service programs that support children, both in and out of foster care, at various stages along the path to adulthood. Although the federal government's role in the child welfare system has expanded over the years, states provide the care for children within their child welfare system. The primary responsibilities of state child welfare agencies are to ensure the safety of children who have been maltreated, find permanent homes for such children, and promote the health and well-being of children in foster care. Another primary responsibility is to prepare teenagers in foster care for independent living.

Through many policies and programs, the federal government has taken steps to support older youth in foster care. Beginning in 1986 with an amendment to Title IV-E of the Social Security Act, the Independent Living Initiative provided states with funds to prepare foster youth for independent living. The Adoption and Safe Families Act of 1997 (Pub L No. 105-89) promoted adoption and permanent homes for children, including older children and youth. The Foster Care Independence Act of 1999 (Pub L No. 106-169, John Chafee Foster Care Independence Program), which replaced the Independent Living Initiative, increased funding to states for the purpose of preparing older youth for independent living and gave states the option of extending Medicaid coverage for youth aging out of foster care through 20 years of age. The "Chafee option" also allows states to use some independent living funds for housing and requires that states provide some level of services and supports to young people 18 to 21 years of age who have left foster care.

The Chafee option was a turning point in its recognition of the need to better serve older youth during a critical transition in their lives. Previously, all states were responsible for ensuring that services, including health care services, were provided to youths in foster care until 18 years of age. Over the past decade, several states have exercised the "Chafee option" to extend Medicaid services to 21 years of age for children who age out of foster care. Of those that have not yet used the "Chafee option," many states provide health care coverage to children who leave foster care through a number of mechanisms, including state Medicaid waivers, Children's Health Insurance Program (CHIP) coverage, medically needy Medicaid coverage, and other sources.[11] Beginning in 2014, as a result of a provision in the Patient Protection and Affordable Care Act of 2010 (Pub L No. 111–148), all youth aging out of foster care will be eligible for Medicaid coverage until they reach 26 years of age, regardless of their income.

Beyond the concerns of continued health coverage, the federal government has also prioritized the need for states to more actively coordinate the health care and services that youth in foster care are receiving. The Fostering Connections to Success and Increasing Adoptions Act (Pub L No. 110-354) of 2008 requires states to work with youth to develop a transition plan within the 90 days before a youth ages out of foster care. The plan

should contain as much detail as the youth chooses and should address issues including housing, health insurance, education, mentoring, continuing support services, workforce supports, and employment services. With regard to health care, this transition plan should include arranging for enrollment in Medicaid if the youth meets eligibility criteria to maintain the medical home and ensure continuity of care.

In addition, the Fostering Connections to Success Act requires states to develop, in coordination and collaboration with the state Medicaid agency and in consultation with pediatricians and other experts, a plan for the ongoing oversight and coordination of health care services for all youth in foster care. The state health plan must ensure that, among other provisions, every child receives appropriate health screenings and follow-up, continuity of care using the medical home model, and oversight of medications for each child.*

FUTURE CHALLENGES

Although strengthened provisions on health care coverage and coordination of care have represented important progress on behalf of older youth in foster care, they have also created new challenges for the future. In the short term, extended coverage to 26 years of age will not begin until 2014, leaving a cohort of exiting youth until that time at risk for not seeing the same benefits as those who will follow them. Additionally, access to care will continue to be a concern, particularly if Medicaid payment rates do not improve. Of paramount concern is that adult medicine physicians and other clinicians will be reluctant to care for or may even close their practices to young adults aging out of foster care because of low payment rates. This may place greater pressure on pediatricians or family physicians to fill this service need, but it is likely that service gaps will remain.

RECOMMENDATIONS FOR PEDIATRICIANS AND OTHER PHYSICIANS

1. Pediatricians should continue to provide medical homes for youth in foster care.
2. Pediatricians should work collaboratively with child welfare workers to ensure youth in foster care receive the health care services they need.
3. Pediatricians and other physicians are encouraged be informed about their state's programs to provide health care coverage for older youth both in foster care and aging out of the foster care system.
4. Pediatricians should work with child welfare and other community partners to educate youth who are aging out of care before 2014 that they will become eligible for Medicaid coverage effective January 1, 2014.
5. Pediatricians and other physicians are encouraged to learn more about the health needs of youth aging out of foster care and to learn about resources of the American Academy of Pediatrics available to assist in meeting these needs (see Healthy Foster Care America Web site: www.aap.org/fostercare).
6. Pediatricians have a unique opportunity, as the primary source of health care for children in foster care, to teach youth at transition the skills needed to navigate the adult health care system. Pediatricians should help their young adult patients transfer their health records, understand their health issues, and link them with a new adult primary care physician as well as needed mental health, reproductive health, and dental services.[12] Adolescents often feel invulnerable at this stage of development, so youth leaving foster care may need help understanding why their ongoing health care should be a priority.
7. Especially for youth with special health care needs, pediatricians should work collaboratively with child welfare workers to help plan for transition from child welfare. The pediatrician brings a "whole child" perspective of health care for these youth. Working together ensures that these youth receive comprehensive health services.

RECOMMENDATIONS FOR PUBLIC POLICY

1. Pediatricians play a vital role in advocating on behalf of children and adolescents. Working in concert with the national American Academy of Pediatrics (AAP) on federal efforts and AAP chapters and districts on regional, state, and local efforts, pediatrician advocacy can ensure that the physical, mental, social, and emotional health needs of adolescents and young adults are appropriately represented when the issue of health care for youths aging out of foster care is addressed. States have made a large investment in ensuring that these children arrive at the doors of adulthood safely, and it is prudent to ensure that this investment is protected by making sound transition plans.
2. The AAP supports pediatrician and AAP chapter efforts at the state level to extend foster care eligibility

*For more information, please contact the American Academy of Pediatrics Division of State Government Affairs at stgov@aap.org or visit www.aap.org/fostercare.

for older youths from 18 to 21 years of age.

3. The AAP supports pediatrician and AAP chapter efforts at the state level to extend health care coverage for youths in foster care from 18 to 26 years of age, in advance of Medicaid coverage becoming mandatory for these youths in 2014.
4. The AAP supports pediatrician and AAP chapter efforts at the state level to improve Medicaid payment to ensure all youth have continuous access to health care in a medical home. In addition to providing appropriate and adequate Medicaid payment, states should consider implementing financial and other incentive programs (eg, expedited payment processing, performance payments, etc) to encourage more pediatricians to provide medical care to children and youth in foster care.
5. The AAP additionally supports federal, state, and local efforts that recognize the health care coverage needs of young adults who have exited foster care and who are engaged in education or training programs.

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CLINICAL REPORT

Home Care of Children and Youth With Complex Health Care Needs and Technology Dependencies

abstract

FREE

Children and youth with complex medical issues, especially those with technology dependencies, experience frequent and often lengthy hospitalizations. Hospital discharges for these children can be a complicated process that requires a deliberate, multistep approach. In addition to successful discharges to home, it is essential that pediatric providers develop and implement an interdisciplinary and coordinated plan of care that addresses the child's ongoing health care needs. The goal is to ensure that each child remains healthy, thrives, and obtains optimal medical home and developmental supports that promote ongoing care at home and minimize recurrent hospitalizations. This clinical report presents an approach to discharging the child with complex medical needs with technology dependencies from hospital to home and then continually addressing the needs of the child and family in the home environment. *Pediatrics* 2012;129:996–1005

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KEY WORDS

children and youth with special health care needs, discharge planning, habilitative services, home care, medical home, technology dependency, tube feedings

ABBREVIATIONS

DME—durable medical equipment
PCP—primary care provider

INTRODUCTION

Enormous advances in neonatal, pediatric, and surgical care have led to the survival of a greater number of children and youth with special health care needs who are cared for at home.[1] The issues faced by these children and their families are often complex and include significant feeding and respiratory problems, often associated with technology dependencies. Many children and youth with special health care needs have intellectual disabilities, physical impairments, and sensory deficits that require specialized therapeutic and educational interventions. The overarching goal of home health care is to optimize each child's health and function while minimizing recurrent or prolonged hospitalizations through the provision of comprehensive, cost-effective, family-centered health care rendered in a nurturing home environment.[2] Caring for children with chronic conditions at home can be challenging to pediatricians but successful and rewarding when provided in the context of a coordinated, family-centered, and complete medical home.

Children and youth with special health care needs are defined as those who "have or are at increased risk of having a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally."[3] More than 10 million children in the United States meet this definition.[4] Diagnoses common to children and youth with special health care needs are numerous and include

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preterm birth, congenital genetic and metabolic disorders, neurologic disorders, sequelae of severe infections, or trauma and malignancies. A subset of children with special health care needs has been recently termed "children with medical complexity," as defined by substantial health care needs, 1 or more chronic conditions, functional limitations often associated with technology assistance, and health care use. Technology dependency refers to the use of medical devices without which—if they were to fail or be discontinued—adverse health consequences and hospitalization would likely follow.[5] Examples include mechanical ventilators, intravenous catheters, tracheostomy tubes, enteral feeding devices, colostomy bags, and urinary catheters. The multifaceted medical, developmental, and psychosocial needs of children with such a diverse group of diagnoses typically require the expertise of many pediatric subspecialists and related health care providers in a coordinated system of care.[6]

Most children and youth with medical complexity are discharged to home after birth or hospital admissions for acute exacerbations or conditions because long-term hospitalization of such children is no longer a preferred option in our society.[7] As the acuity of hospitalized children has increased over time, so too has the severity and complexity of the unresolved medical conditions present on discharge.[8] Children are now frequently sent home to complete or continue interventions that formerly would have occurred in hospitals. They are discharged with complex medical interventions, including oxygen, tracheostomies with or without ventilators, enteral feeding tubes, intravenous infusions, dialysis, and complex medication regimens.

Part I of this report offers guidance on the hospital discharge of children and youth with medical complexity issues to home. Part II discusses how to optimally care for children with complex, chronic conditions at home after hospital discharge. The focus of this report is on the medical rather than the financial aspects of pediatric home care and is intended to provide an easily accessible resource for pediatricians. A more detailed resource from the American Academy of Pediatrics (*Guidelines for Pediatric Home Health Care*) is available for those who seek more comprehensive guidance on this subject.[9] Another resource discussing insurance changes helpful to families caring for children with special health care needs is the American Academy of Pediatrics clinical report "Parent-Provider-Community Partnerships: Optimizing Outcomes for Children With Disabilities."[10] This report addressed some of the changes mandated by the Affordable Care Act of 2009, the goal of which was to improve access to home care services for children with special health care needs.

PART I: TRANSITIONING FROM HOSPITAL TO HOME CARE

The primary care provider (PCP) should be intimately involved with discharge planning for children and youth with special health care needs. The 6 main issues to be addressed during this process are outlined in Table 1 and include the following: (1) establishing a partnership with the family and acute care providers to identify family and community resources available to support the transition process and ensure success at home; (2) defining, locating, and engaging a medical home; (3) ensuring adequate training of family and other care providers; (4) assisting in the selection of a home nursing agency and/or providers of supplies and equipment; (5) identifying respite care providers; and (6) opening communication with the school district so that the Individualized Education Plan process for school services can be initiated. Discharge planning should commence in a timely way, preferably as soon as the child is admitted.

Evaluating the Child, Family, Home, and Community

Not every child with medical complexity can be cared for at home. Instead, some children and families opt for out-of-home care, including care in foster homes, extended specialty hospitals (long-term acute care), or pediatric skilled nursing facilities.[11] Although the number and availability of congregate care options have decreased in recent years and may not be geographically feasible in some cases, out-of-home care continues to play an important role for children with severe disabilities who cannot be cared for at home. Each child should be evaluated to ensure that he or she is medically stable for home care. Although there is no clear definition of "stability" given the numerous underlying and complex issues involved, the child should have had no major changes made to the medical regimen for at least several days before discharge and should be tolerating feedings and current medications and have no new fevers or worrisome respiratory problems noted. At the time of hospital discharge, the child's care needs should be stable and predictable.

The needs, preferences, and resources of families of children with disabilities should be evaluated well in advance of hospital discharge.[12] A candid appraisal of the family's desire to provide complex care at home and of their skills, time, and energies is essential. The home should be evaluated to ensure that it is an adequate, safe, and accessible environment. Architectural barriers, including the ability to accommodate equipment such as wheelchairs, lift systems, hospital beds, or medical equipment, must be considered. Local emergency medical services, as well

TABLE 1 Issues Related to Planning for Home Care Before Discharge From the Hospital

A. Evaluating child, child's family, home, and community
  1. Child
    a. Child is medically stable for home care
  2. Family
    a. Family desires to have child at home
    b. Family has learned the necessary skills
    c. Family has the resources (time, energy, and finances) to provide care
    d. Family has considered palliative care and end-of-life care options
  3. Home
    a. The home environment is adequate, safe, and accessible
      (1) Structure
      (2) Electrical (eg, 3-pronged plugs, 220-V line)[a]
      (3) Access (eg, bathroom and ramps)
      (4) Heat, hot water, clean water supply
      (5) Air conditioning
      (6) Driveway/road accessibility
      (7) Other (eg, snow removal)
      (8) Telephone access[b]
  4. Community
    a. Community health nurse
    b. Home care nurses
    c. Therapists (eg, physical and occupational therapy)
    d. Ambulance/emergency medical services
    e. Specialty care
    f. Medical supply vendors
    g. Pharmacist
    h. School/early intervention program
    i. Counseling
    j. Support group(s)
    k. Palliative and hospice care where indicated
B. Finding a medical home
  1. PCP
  2. Roles and communication network
  3. Patient summary
    a. Plan for emergency care
    b. Medications
    c. Equipment
    d. Disposable supplies
    e. Advance care plan, out of hospital do-not-resuscitate order, where appropriate
C. Training the home caregivers
  1. Training schedule
  2. Actual care with supervision (trial home care)
D. Arranging home care nursing and developmental/educational services
  1. Nursing care coverage is outlined
  2. Alternative plans are made if nursing care is not available
  3. Arrangements with school or preschool programs for ongoing educational needs
E. Finding home care agencies for supplies and equipment
F. Insurance coverage
  1. Verify that adequate coverage will be provided
  2. Pursue alternative or additional coverage and benefits such as Medicaid waiver program and SSI
  3. Evaluate ability of family to pay for uncovered care (eg, transportation, electricity)

[a] Secondary power generators may be necessary; local power companies and emergency providers should be alerted on hospital discharge, to help prioritize responsiveness to emergencies.
[b] Arrangements should be made with telephone companies to ensure uninterrupted services. Internet services may also be required, especially for those parents who are hearing impaired and cannot easily communicate via telephone.

as heating and electrical providers, should be alerted to the specialized needs in homes of children with high medical complexity and fragility. Safe, accessible, and predictable means of transporting the child and essential equipment and supplies should be established. The community should be evaluated to ensure that it can provide the resources and support necessary to care for the child at home and support the family.

Finding a Medical Home

It is critical to identify a PCP who accepts the care of the child on hospital discharge and is willing to provide a medical home for the child with medical complexity as well as his or her family. Not every provider is proficient in managing children with complex, chronic conditions or willing to invest the time and energy that this responsibility demands.[13] The PCP should be knowledgeable about the child's conditions and treatments as well as community support services. A detailed and immediately accessible care plan should be developed jointly by the family, the PCP, and other care providers, with continuous updates as indicated. The PCP for children with complex conditions and disabilities who receive home care support should be provided with a comprehensive discharge summary that includes details of all the issues and events of the hospitalization and an accurate list of medications, therapies, equipment, and services that have been arranged before the discharge. The PCP should also know how communication will take place with other subspecialists involved in the child's care and how frequently the child will need visits with other providers and therapists.[14]

Training the Home Caregivers

Before the child's discharge, the caregivers (usually the parents but occasionally the grandparents or other family and friends) will require appropriate training to be able to render care for the child at home. Caregivers should be taught and should demonstrate competency in the care and use of enteral feeding tubes, tracheostomy care, respiratory treatments and supports (eg, nebulizers, ventilators), wound care, intravenous line care, and medication management. Cardiopulmonary resuscitation training is generally advisable. In addition to teaching the home

caregivers how to render care, teaching assessment skills is also essential. For example, it is important to know not only how to suction or change a tracheostomy tube but also when a child needs this intervention. Home caregivers should also have a clear understanding of when and how to call the PCP or specialist, should problems arise. Family preferences should be considered when developing care regimens, including timings for feeding and medication administration. Hospital schedules of administering enteral feedings every 2 hours around the clock indefinitely are generally unsustainable expectations that families are expected to adhere to at home. After a prolonged hospitalization, it is strongly recommended that the parents stay overnight for 1 to 2 days before discharge, allowing them to render all the child's care independently but with the support of hospital staff for questions and problem solving before the discharge.[12] Parents must demonstrate competency in the use of monitors that may be used in the home in preparation of transitioning from hospital to home. Standardized criteria for caregiver competencies and ongoing demonstration of skills are much needed.

Arranging Home Care Nursing and Developmental/Educational Services

Some children and youth with special health care needs have requirements that are so time-consuming and complex that parents alone cannot meet those needs without home nursing support.[12] Children who require intensive respiratory supports, such as those with tracheostomy and ventilator dependencies associated with high suctioning requirements, are likely to require private duty home nursing rather than brief and periodic skilled nursing visits. A nationwide shortage of qualified pediatric registered nurses and licensed practical nurses often complicates and delays discharge, as does ensuring coverage by insurance for such support.[15] The unique needs of children with complex, chronic conditions and their families who reside in rural areas with limited nursing and community resources should be anticipated and addressed. Parents should be actively involved in determining the child's care plan to ensure that the plan is feasible from their perspective in the context of their community. For example, parents who must work outside the home often elect to have home nursing during the day, whereas other families elect to have nighttime nursing so that they can sleep. However, some nursing agencies will not allow the nurse to be the only adult in the home and require that a family caregiver be present as well. In some limited areas, providers specially trained in the care of children with medical complexity may offer an additional care option for parents who are employed outside the home or who are full-time students themselves. Families and providers should have well-established contingency plans that are responsive to unanticipated interruptions in caregiving (family or home nursing care).

Children from birth to 3 years of age should be referred to local early intervention programs for developmental services.[16] Children with sensory deficits may require specialized referrals to programs that address visual and/or hearing impairments. Frequent and consistent communication between PCPs and early intervention providers is essential to optimize each child's medical, developmental, and functional outcomes. For school-aged children, it is often important to meet with the school, including the school nurse, to plan for appropriate educational, therapeutic, and medical services before discharge from the hospital.[17] For children requiring care for their tracheostomy or enteral feedings in school, training of the school personnel by hospital personnel should be considered before patient discharge.

Arranging Providers for Supplies and Durable Medical Equipment

Many large pediatric centers now have care coordinators/discharge planners (usually registered nurses) who arrange for home equipment such as oxygen, respiratory technologies, enteral feeding supplies, intravenous medications, specialized enemas, urinary catheters, and other durable medical equipment (DME) before discharge. The prescription of DME that supports safe and effective mobility, such as specialized beds, bath seats, lift systems, and adapted car seats, should also be completed collaboratively with interdisciplinary providers before hospital discharge.[18] The child's insurance coverage usually dictates which DME providers may be accessed, further influenced by geographic considerations. Early and meticulous discharge planning is essential to ensure that the appropriate supplies are ordered and delivered in a timely way so that they can be readily available for training of caregivers and use on discharge.

Insurance Coverage for Care at Home

At times, third-party payers fail to cover the costs of specialized pediatric private duty home care, leading to delayed or even canceled hospital discharges for children with complex, chronic conditions and technology dependencies.[19] Lack of coverage for home nursing or extended therapeutic services are not uncommon. Families may seek secondary insurance coverage through Medicaid to cover costs denied by primary commercial payers. Families often face financial hardship related to extensive medical bills from lengthy hospitalizations as well as lost revenue related to the need to reduce

employment outside of the home.[20] Some children with disabilities are eligible for Supplemental Security Income benefits, which may help meet the financial demands.[21] The financial implications of caring for children with special health care needs is further discussed in the American Academy of Pediatrics clinical report on parent-provider-community partnerships.[10]

PART II: CARING FOR CHILDREN AND YOUTH WITH MEDICAL COMPLEXITY AT HOME

As complicated as sending a child home from the hospital may be, sustaining the child and family at home can be an even greater challenge. The most common reasons for failure of home care are the lack of community and family resources, lack of financial resources, and emotional depletion of the family.[22] For simplicity, an approach to caring for children with complex, chronic conditions at home can be divided into 7 main areas: (1) defining the basic medical issues; (2) defining the developmental issues; (3) understanding the underlying diagnoses; (4) the role of the PCP and the medical home; (5) the needs of the family; (6) the ongoing home care agencies and services required; and (7) assessment of the community and educational services.

Defining the Basic Medical Issues

Nutrition is 1 of the most basic medical needs of every child. Many children with disabilities are unable to meet their nutritional requirements orally and rely on enteral or parenteral supports. At every visit, it is important to assess each child's growth by using readily available standardized growth curves.[23] It is important to consider the route of feeding as well as its safety and efficacy. For example, does the child who eats orally cough, choke, or demonstrate respiratory distress during or after meals? If so, obtaining a specialized feeding and swallowing evaluation, including videofluoroscopic studies, may be indicated. Alternatives to oral intake include feeding via gastrostomy tube (ie, g-tube), nasogastric tube, nasojejunal or jejunal tubes, or via intravenous catheter, such as total parenteral nutrition. Feedings via gastrostomy tube may be given as boluses or continuous infusions by using feeding pumps. Jejunal tube feedings must be administered continuously because bolus feedings are associated with abdominal pain, diarrhea, and dumping syndrome. Some children require specialized formulas, such as elemental or higher-calorie formulas, or supplements to increase the caloric or nutritional density of the diet. Because enteral feedings and delivery systems are medically necessary, they are generally covered by third-party payers.[24] A balanced intake of fiber and fluid is recommended for optimal bowel motility and evacuations. The need for consultations with dietitians and gastroenterologists should be determined by the child's feeding tolerance, nutritional status, and related concerns (eg, gastroesophageal reflux disease, dysmotility, constipation).

Respiratory issues can be frequent and often life-limiting challenges for children and youth with special health care needs.[25] Chronic lung disease may follow preterm delivery or result from chronic aspiration of feedings and secretions in children with neurologic disabilities. Children with neuromuscular conditions, such as muscular dystrophy, may need ventilator assistance (via continuous positive airway pressure, bilevel positive airway pressure, and tracheostomies with ventilators). Oxygen supplementation is frequently indicated for children with neurologic impairments as well as for those with complex congenital heart disease. Airway issues related to severe chronic airway obstruction in children with craniofacial anomalies or severe neuromuscular disorders may necessitate placement of a tracheostomy, often with continuous or intermittent ventilator support. Children may frequently require bronchodilators or long-term inhaled or systemic steroids, which can compromise growth and bone density. Other interventions such as regular pulmonary toilet, often with high-frequency chest wall oscillation (eg, the Vest Airway Clearance System [Hill-Rom, Minneapolis, MN] or Smartvest [Electromed Inc, New Prague, MN]) or mechanical insufflator-exsufflator (eg, CoughAssist [Phillips Respironics, Pittsburgh, PA]) devices, may be necessary. Typically, children with moderate to severe respiratory impairments benefit from ongoing input from pediatric pulmonologists. Preventive care should be a priority, including the provision of pneumococcal and annual influenza vaccines for at-risk children and their families.

Children with special health care needs receive 5 times the number of medications than do typical children.[26] These may include protein pump inhibitors for gastroesophageal reflux disease; prokinetic agents for dysmotility and remedies for chronic constipation; and bronchodilators, antiepileptics, spasmolytics, and behavioral medications such as stimulant, antipsychotic, or anxiolytic agents. All medications have the potential for adverse effects, and the use of multiple medications increases the risk of drug–drug interactions.[27] Maintaining current medication lists for the caregivers with clear dosing regimens is essential, and updated lists must be maintained in the medical home. This action facilitates timely refills, reduces risks of medication errors, and allows health care providers to regularly monitor for and address potential drug interactions. This is a critical role of the PCP in the care of children with complex conditions.

Complications of immobility can lead to secondary conditions in children

who are on bed rest or have decreased mobility.[28] Pediatricians and home care providers need to vigilantly avoid and otherwise identify and address early threats to skin integrity, such as decubitus ulcers[29] over pressure points, particularly the posterior occiput, sacrum, ischium, and heels. Immobility and lack of weight bearing also contributes to osteoporosis and increases the risk of pathologic fractures.[30] Musculoskeletal contractures and deformities can progress quickly; range-of-motion exercises should be routinely implemented in children who are nonambulatory, which may require input from the pediatric physical medicine specialist. Elimination disorders can be managed with careful attention to regular bowel and bladder emptying, facilitated with regular bowel programs, enemas, bladder irrigations, and intermittent catheterization as needed. Regulation of sleep-wake cycles is another strategy to minimize secondary conditions. Children may benefit from early intervention services and home occupational and physical therapy for the establishment of exercise regimens and to ensure that appropriate equipment is available to optimize mobility and minimize complications (eg, hospital beds, commodes, wheelchairs).

Pain in children with complex, chronic conditions may be caused by orthopedic, gastrointestinal, or neurologic issues. Their irritability and discomfort can be distressing to families and home care providers. It may be challenging to determine whether there is an underlying medical issue causing pain that requires intervention, particularly in a child with limited communication abilities.[31] Validated and reliable measures can be useful in assessing pain in children with cognitive impairments, such as the FLACC (Face, Legs, Activity, Cry and Consolability) Scale and the Pediatric Pain Profile (http://www.ppprofile.org.uk). Medical home providers may be called on to evaluate the child to rule out simple problems, such as otitis media, which may be easily treatable. Less obvious problems, such as urinary tract infections, dental abscesses, or pathologic fractures, may be contributing to discomfort and should be identified and treated. Consultations with palliative care providers might further benefit children with chronic pain and the families who care for them.[32]

Defining Developmental Issues

Many children with special health care needs have intellectual and physical disabilities that affect their overall health and development. If developmental disabilities are suspected on the basis of history, underlying diagnosis, or developmental screening results, it is critical to ensure that children receive appropriate educational and related services through an early intervention or adapted preschool program, often in collaboration with medically based habilitative therapies. Referrals for individualized habilitative services often require prescriptions from PCPs, particularly when coverage is requested for medically based (as opposed to educationally based) therapeutic services, and pediatricians may need to advocate for these services.[17] Lastly, barriers to development, such as impairments of vision and hearing, should be identified and managed promptly to maximize outcomes.

Understanding the Underlying Etiology of the Child's Conditions

Children and youth with special health care needs should be discharged from the hospital to home with a plan of care that clearly addresses the acute medical issues, any temporary or long-term changes to the chronic condition care plan, and family adaptation and training.[33] In addition, ongoing attention to the underlying chronic issues should not be overlooked. For some children, home care may be defined by a course of antibiotics and wound care, with discharge on resolution of the primary concern. For other children, an episode of acute pneumonia will resolve, but long-term respiratory failure and ventilator dependency will persist and require ventilation titration. Children with dependency on medical devices (including pacemakers, ventriculoperitoneal shunts, intravascular catheters, colostomies, and other devices) warrant close monitoring for device-related complications.

There are multiple etiologies of chronic pediatric conditions associated with special health care needs and disabilities. Sometimes, the underlying diagnosis is straightforward, and the child's needs are well understood. However, some children are discharged to home without a clearly established diagnosis, and the medical workup may still be in progress at discharge. Differentiating among time-limited acute conditions, chronic but stable conditions, and progressive and life-limiting conditions in children receiving home care ensures that the care rendered is appropriate to the needs of each individual.[33]

The Role of the Medical Home

Although pediatricians cannot be experts in every chronic condition of childhood, it is important that they update their knowledge regarding the individual children and youth with special health care needs in their practices. By reviewing the literature and consulting with specialists, pediatricians can quickly gain the needed expertise to manage and coordinate care, whether it is with interdisciplinary spina bifida or craniofacial teams or with individual specialists. Depending on the unique medical needs or community resources of a child, medical home providers may be either PCPs or pediatric subspecialists. An awareness of the recommended

frequency of follow-up visits with consultants further facilitates care coordination. Pediatric residency programs may need to reassess the training experiences for their residents so that future pediatricians have the needed expertise and comfort in providing medical homes for all children, including those with chronic conditions, disabilities, and complex home care needs. Medical homes should ensure coordination of care associated with technology dependencies among families of children and youth with special health care needs, home care providers, and community systems, including emergency medical services and utility companies.[34] Arrangements for uninterrupted power in homes of children with technology dependencies may include the provision of generators and prioritization by utility companies for immediate restoration of services in the event of disruptions.

The medical home office visit for children and youth with special health care needs, particularly with technology dependencies, needs to be carefully orchestrated, in terms of the frequency, duration, and content of visits. It can be useful to provide separate chronic condition management visits and well-child visits or schedule longer-than-routine visits, because acute issues too often crowd out much-needed time for routine pediatric care. A large examination room that accommodates the child, family, and caregiver (s) as well as wheelchairs and ventilators, as needed, should be available. Providers need to consider their own access to dietitians, care managers, social workers, and other support staff members who contribute substantially to the care of children and youth with special health care needs. A systematic method of communication among all providers should be established so that critical information is available during office visits. Electronic health records are increasingly used for this purpose. A detailed problem list and care plan, including the names and contact information for consulting specialists, should be regularly updated in the medical record. The medical home should also maintain a record of medications and refills, the preferred pharmacy, home care orders, referrals, and letters of medical necessity.[5] Home visits by pediatricians can offer a safe and efficient alternative to traditional office visits.

Each individual medical home needs to address payment for direct and indirect services rendered. A major disincentive in the current system of care is the lack of physician compensation for time invested in phone management, care coordination, completion of home care orders and recertifications, management of medication refills, and letters of medical necessity, although some insurance companies are starting to cover care coordination.[35] Children with chronic conditions and disabilities may be insured by Medicaid rather than by private insurance companies, and the effect of this policy on individual practices needs to be considered.

The Needs of the Family

Family-centered care is a critical component of the medical home for children and youth with special health care needs. Providers should periodically assess family caregiver skill and comfort in rendering care, particularly when technology dependencies are present, and offer opportunities to refresh or extend skills to grandparents and other close relatives or caregivers. The primary coordinator of care should be explicitly identified and may often be a parent. Providers should have regular conversations with the families regarding met and unmet home care staffing, equipment, and transportation needs.

The needs of parents in their roles as long-term caregivers as well as the unique needs of siblings of children with complex, chronic conditions and disabilities should be recognized, with appropriate referrals to community agencies (eg, Supplemental Security Income, Family Voices, disease-specific organizations, adapted sports and recreational programs). Families and providers should partner in care planning and proactive discussions regarding their child's prognosis, including explicit statement of family preferences regarding resuscitation status and end-of-life care. Referrals to palliative or hospice care providers and wish-granting organizations may be arranged according to family preferences. Formal and informal opportunities for respite care should be identified and accessed whenever possible.

The presence of a child with complex medical and developmental needs associated with technology dependencies and long-term home care most certainly affects the physical and emotional health and well-being of the parents, siblings, and other family members.[22,36] Siblings of children with disabilities may demonstrate behavioral problems or academic failures, as they often assume caregiving responsibilities and may have unmet needs for parental attention and support.[37] Family vacations may be canceled or postponed, parental attendance at important school or sports events may not occur, and sometimes even serious medical symptoms in the well sibling may go unattended. Siblings may sometimes be called on to assume caregiving roles for which they have not been appropriately trained or are not developmentally prepared. Pediatricians can assist these children and their families by being cognizant of these issues, seeing the well siblings for separate appointments where they can receive individualized attention, and sometimes meeting privately with the siblings to allow them to express their feelings. Because children

with disabilities are at increased risk of abuse and neglect, pediatricians should also be particularly attentive to child–family interactions and sensitive to early indications of maltreatment. In some instances, family support services and counseling are indicated.[38]

Ongoing Home Health Care Needs

Some children and youth with special health care needs have chronic conditions associated with complete and irreversible dependence on technology. As a consequence, they may require lifelong private duty nursing care. The provision of uninterrupted home care is threatened by national nursing shortages, limitations in the availability of skilled pediatric nurses in rural areas, and lack of funding.[19] Pediatric equipment is not universally available. Physicians need to provide frequent updates on orders, with an associated flurry of paperwork. Thus, home care services must be carefully monitored and maintained to ensure that the requirements of the children and youth with special health care needs and their families are safely and effectively met without interruption. Transitioning from pediatric to adult care providers also requires careful planning.

Community and Educational Services

Most children and youth with special health care needs are cared for by their families, with support from their medical homes, pediatric subspecialists, and communities. Community services should not be underestimated, as they offer developmental programs (eg, early intervention programs),[16] educational services,[39] and recreational opportunities.[10,40] Individualized education plans should include the provision of the nursing care (eg, enteral feedings, airway suctioning, medication administration) necessary during school hours so that each child can participate fully in school programs. Programs of adapted sports and recreation, specialized vacation camps, and community-based religious or cultural services offer additional opportunities for child and family participation in their communities. Table 2 lists issues that are important to monitor for children who are receiving home care.

CONCLUSIONS

Children with complex medical and developmental issues comprise a significant percentage of hospitalized pediatric patients and are being discharged to home with an ever-expanding range of complex medical and technology dependencies. Medical homes for children with complex home care needs must coordinate a team of providers toward the overarching goal of optimizing each child's health, development, and well-being. Pediatricians must understand the complexities of the child's underlying conditions, including ongoing medical needs, prognosis and end-of-life care, family needs, and available community resources. Medical homes may need to adapt routine practices and individualize their approaches to best orchestrate the multifaceted needs of children and youth with special health care needs, their parents and families, and health care systems. A systematic approach[10] to pediatric care with explicit care coordination, family-centered care, and advanced planning ensures the best outcomes and most rewarding experiences for children and youth with special health care needs, their families, and providers.

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TABLE 2 Issues Related to Ongoing Monitoring of Home Care

1. Regular review of home care discharge plan to determine whether goals are being met or have changed
2. Child assessment
   a. Physical condition
   b. Appropriateness of current nursing care
   c. Developmental issues
   d. Advance care planning
3. Family assessment
   a. Strengths
   b. Problem identification
   c. Changes
   d. Family–provider communications
   e. Adequacy of current services
4. Financial
   a. Paperwork
   b. Policy benefit changes
   c. Family financial changes
   d. Adequate coverage
5. Equipment/supplies/medications
   a. Identification and tracking of current needs
   b. Prescriptions written
   c. Justification letters
6. Diagnostics ordered with appropriate interventions made, and referrals to specialists as needed
7. Follow-up appointments made
   a. To PCP
   b. To specialists
   c. Coordination of appointments and procedures whenever possible
   d. Communication with subspecialists in a timely way so that the child's changing needs are being addressed

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POLICY STATEMENT

HPV Vaccine Recommendations

abstract

FREE

On October 25, 2011, the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention recommended that the quadrivalent human papillomavirus vaccine (Gardasil; Merck & Co, Inc, Whitehouse Station, NJ) be used routinely in males. The American Academy of Pediatrics has reviewed updated data provided by the Advisory Committee on Immunization Practices on vaccine efficacy, safety, and cost-effectiveness as well as programmatic considerations and supports this recommendation. This revised statement updates recommendations for human papillomavirus immunization of both males and females. *Pediatrics* 2012;129:602–605

INTRODUCTION

The American Academy of Pediatrics (AAP) recommends immunization against human papillomavirus (HPV) for all 11- through 12-year-old children as part of the adolescent immunization platform. Quadrivalent HPV vaccine (HPV4; Gardasil; Merck & Co, Inc, Whitehouse Station, NJ) is the only vaccine approved for males, and either HPV4 or bivalent HPV vaccine (HPV2; Cervarix; GlaxoSmithKline, Middlesex, UK) may be used in females. This brief policy statement supersedes the previous AAP "permissive recommendation" for use of HPV4 in males[1] and the retired 2007 policy statement.[2] A complete rationale is available in the statement from the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention.[3]

BRIEF BACKGROUND AND RATIONALE

HPVs are the most common sexually transmitted viruses in the United States. The highest prevalence of HPV infection is found in sexually active adolescents and young adults. Most HPV infections are asymptomatic and resolve without complications within 2 years. However, persistent infection with high-risk HPV types is responsible for most cervical and anal cancers in females. In males, high-risk HPV types are responsible for a large proportion of cancers of the mouth and pharynx, which are increasing in recent years, and of anal and penile cancers. Each year in the United States, approximately 15 000 cases of cancer in females and 7000 cases of cancer in males are caused by HPV types 16 and 18. Of the cancers in males, the great majority are cancers of the oropharynx (approximately 5400), followed by anal cancer (approximately 1400) and penile cancer (approximately 300).

The rationale for routine HPV immunization at 11 through 12 years of age is twofold. First, optimal vaccine efficacy is derived if the vaccine is

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KEY WORDS

human papillomavirus, HPV, vaccine, males, females, adolescents, immunization, cancer

ABBREVIATIONS

AAP—American Academy of Pediatrics
HPV—human papillomavirus
HPV2—bivalent human papillomavirus vaccine
HPV4—quadrivalent human papillomavirus vaccine

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administered before onset of sexual activity. The vaccine is inactive against HPV types previously acquired by the vaccine recipient. Second, antibody responses are highest at ages 9 through 15 years. Immunization of males provides direct benefit to males, including prevention of genital warts and anal cancer. Prevention of oropharyngeal cancer has not been studied but is biologically plausible. In addition, immunization of males is expected to provide indirect benefit for females through herd immunity. Four years after the initial recommendation for immunization of females, uptake of the HPV vaccine lags behind other vaccines offered in adolescence; results of the 2010 National Immunization Survey indicated 32% of females 13 through 17 years have completed the 3-dose series. The cost-effectiveness of male immunization is sensitive to a range of assumptions, such as vaccine efficacy, vaccine coverage of females, and the effect of HPV-associated diseases on quality of life. Recognizing low vaccine uptake among females and the preponderance of heterosexual transmission in the epidemiology of HPV, immunization of males becomes a cost-effective intervention for preventing disease caused by vaccine types of HPV in both genders.

Other interventions to reduce HPV infection and HPV-associated genital warts and malignancies include counseling of adolescents regarding sexuality, including abstinence and proper use of condoms, and circumcision of males. HPV is transmitted skin to skin, so protection by condoms is imperfect.[4–6]

As a sidebar, there is precedent for vaccines recommended by the AAP and the Advisory Committee on Immunization Practices for prevention of sexually transmitted infections and cancer and for immunization of all children to minimize infectious complications disproportionately affecting females during their reproductive years. Rubella vaccine (a component of the measles-mumps-rubella vaccine) is intended primarily to prevent fetal miscarriages and malformations after rubella infection during pregnancy, and hepatitis B virus vaccine prevents cirrhosis of the liver and hepatocellular carcinoma caused by hepatitis B virus acquired at time of birth or through later sexual exposure.

HPV VACCINES

HPV4 contains no viral DNA and is not infectious. It consists of bioengineered viruslike particles produced from the major capsid protein of HPV types 16 and 18, which are responsible for 70% of cases of cervical, 87% of anal, 60% of oropharyngeal, and 31% of penile cancers. In addition, the vaccine includes capsid proteins of types 6 and 11, which are responsible for 90% of genital warts and almost all cases of juvenile recurrent respiratory papillomatosis. Clinical trials have revealed the vaccine to be highly immunogenic, safe, and well tolerated in males and females 9 through 26 years of age. Antibody responses are at least twice as high in individuals of both genders 9 through 15 years of age as in those 16 through 26 years of age. HPV4 was licensed for use in females in 2006; antibodies have been shown to persist for at least 9 years. HPV4 was licensed for use in males in 2009; the duration of vaccine-induced antibodies is still under investigation but is known to be at least 5 years.

In sexually active female subjects 16 through 26 years of age, protection has been demonstrated against persistent infection; precancerous lesions of the cervix, vulva, and vagina; and genital warts caused by HPV types contained in the vaccine. The vaccine was recommended for females in 2007. In sexually active male subjects 16 through 26 years of age, vaccine efficacy was demonstrated against genital warts caused by vaccine types. HPV4 was permitted in males in 2010. Also in 2010, the US Food and Drug Administration added a new indication of prevention of anal cancer in males and females on the basis of data from an efficacy study in males. In new data from a substudy of high-risk sexually active young men (men who have sex with men), protection has been demonstrated against precancerous lesions of the anus. These data contribute to the current recommendation. The study did not have adequate power (too few penile or perineal precancerous lesions) to support benefit in preventing these precancerous conditions. No studies of HPV4 vaccine protection against oropharyngeal cancers or recurrent respiratory papillomatosis have been conducted.

HPV2, directed at HPV types 16 and 18, was licensed for use in females in 2009. This vaccine is highly immunogenic, safe, and well tolerated in females 9 through 26 years of age. Antibody responses are highest in girls 9 through 15 years of age. HPV2 is not licensed for use in males.

The safety of HPV4 was evaluated in 2 large phase III clinical trials in females, 1 phase III clinical trial in males, and several immunogenicity studies in adolescents. There is continued surveillance of potential adverse effects of HPV vaccine through the Vaccine Adverse Effect Reporting System as well as real-time surveillance of large health maintenance organization practices via the Vaccine Safety Datalink. Several other countries or communities conduct similar surveillance for adverse effects of HPV vaccines. The Food and Drug Administration requires postmarketing surveillance by vaccine manufacturers. After more than 40 million doses have been administered in the first 5 years of routine

administration in American girls, no discernible, vaccine-specific adverse effect, with the exception of rare anaphylaxis to vaccine components, has been detected.

RECOMMENDATIONS

1. Girls 11 through 12 years of age should be immunized routinely with 3 doses of HPV4 or HPV2, administered intramuscularly at 0, 1 to 2, and 6 months. The vaccines can be administered starting at 9 years of age at the discretion of the physician.
2. All girls and women 13 through 26 years of age who have not been immunized previously or have not completed the full vaccine series should complete the series.
3. Boys 11 through 12 years of age should be immunized routinely with 3 doses of HPV4, administered intramuscularly at 0, 1 to 2, and 6 months. The vaccine can be given starting at 9 years of age at the discretion of the physician.
4. All boys and men 13 through 21 years of age who have not been immunized previously or have not completed the full vaccine series should receive HPV4 vaccine.
5. Men 22 through 26 years of age who have not been immunized previously or have not completed the full vaccine series may receive HPV4 vaccine. Cost-efficacy models do not justify a stronger recommendation in this age group.
6. Special effort should be given to immunizing men who have sex with men up to 26 years of age who have not been immunized previously or have not completed the full vaccine series.
7. Previous sexual activity is not a contraindication to HPV immunization or completion of the immunization series. Patients infected with 1 HPV type may still benefit from protection against remaining HPV types in the vaccine. Testing for previous exposure to HPV is not recommended. HPV vaccine can be administered when a female patient has an abnormal or equivocal Papanicolaou test result. There is no known therapeutic (as opposed to prophylactic) benefit from the HPV vaccines.
8. HIV-infected people of either gender, 9 through 26 years of age, who have not been immunized previously or have not completed the full vaccine series should receive or complete their series with HPV4.
9. HPV vaccines can be administered at the same visit as all other recommended vaccines.
10. HPV vaccine can be administered in these special circumstances:
    a. when a patient is immunocompromised because of disease or medication
    b. when a female patient is breastfeeding
11. HPV vaccine is not recommended during pregnancy. The practitioner should inquire about pregnancy in sexually active female patients, but a pregnancy test is not required before starting the immunization series. If a vaccine recipient becomes pregnant, subsequent doses should be postponed until completion of the pregnancy. It is recommended that women who become pregnant while receiving HPV vaccine be reported to registries that have been developed to record data on outcomes (HPV2: 1-888-452-9622; HPV4: 1-800-986-8999).
12. Because HPV vaccine will not prevent infection attributable to all high-risk HPV types, cervical cancer screening recommendations (ie, Papanicolaou testing) should continue to be conducted in women who have received HPV vaccine.
13. Administration of HPV vaccine does not change current counseling recommendations for use of barrier methods for the prevention of HPV and other sexually transmitted infections as well as discussion about healthy choices about sexual activity, including condoms and abstinence.
14. HPV immunization of children 9 years of age and older should be covered by all public and private health insurers.

CONTRAINDICATIONS

HPV4 should not be given to people with a history of immediate hypersensitivity to yeast or to pregnant women.

PRECAUTIONS

Immunizations should be deferred for people with moderate or severe acute illness. Because syncope can occur in adolescents after injections and has been reported after HPV vaccine, vaccine recipients should sit or lie down for 15 minutes after administration.

IMPLEMENTATION

These updated recommendations for HPV immunization will have considerable operational and fiscal effect on pediatric practice. Therefore, the AAP has developed implementation guidance on supply, payment, coding, and liability issues; these documents can be found at www.aapredbook.org/implementation.

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POLICY STATEMENT

Human Embryonic Stem Cell (hESC) and Human Embryo Research

abstract

FREE

Human embryonic stem cell research has emerged as an important platform for the understanding and treatment of pediatric diseases. From its inception, however, it has raised ethical concerns based not on the use of stem cells themselves but on objections to the source of the cells—specifically, the destruction of preimplantation human embryos. Despite differences in public opinion on this issue, a large majority of the public supports continued research using embryonic stem cells. Given the possible substantial benefit of stem cell research on child health and development, the American Academy of Pediatrics believes that funding and oversight for human embryo and embryonic stem cell research should continue. *Pediatrics* 2012;130:972–977

COMMITTEE FOR PEDIATRIC RESEARCH and COMMITTEE ON BIOETHICS

KEY WORDS

human embryonic stem cell, stem cell research, embryo, ethics

ABBREVIATIONS

hESC—human embryonic stem cell
iPSC—inducible pluripotent stem cell
IVF—in vitro fertilization

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INTRODUCTION

In the past 10 years, significant progress has been made in basic and translational research using human embryonic stem cells (hESCs), with specific implications for pediatric diseases such as hypoxic-ischemic encephalopathy,[1] bone marrow failure syndromes,[2] leukemia,[3] and congenital heart disease.[4] Although the fundamental principle of stem cell research remains the same (ie, the development of undifferentiated cells into committed cell lineages for the purpose of tissue renewal and repair), the science has evolved to encompass many new applications, including cell-based therapies[5] and drug screening.[6,7] Although these new applications are intriguing, they remain in the early stages of development, and additional research is needed to make the transition from bench to therapeutics. It is anticipated that continued advances will have a substantial impact on the understanding and treatment of pediatric diseases.

hESCS

Three unique properties of hESCs are as follows: (1) they are unspecialized or undifferentiated; (2) they can differentiate into more specialized cell types, such as brain, bone marrow, or heart, depending on the developmental signals they receive (referred to as pluripotency); and (3) they can continue to divide and renew themselves for longer periods than differentiated cells.[8]

Current sources of hESCs include excess embryos that would have been discarded after a successful in vitro fertilization (IVF) process, from previously frozen embryos created as part of an earlier IVF

process, and from de novo synthesis. In addition, hESCs may be generated from embryos with arrested[9] or otherwise abnormal growth that would render them unsuitable for implantation. In these cases, the removal of the cells to form the stem cell line results in the destruction of the embryo. There is some recent evidence that hESC lines can be generated from 1 to 2 cells obtained by a biopsy procedure that does not require destruction of the embryo, but this procedure has not obviated the need to continue to derive stem cells in the traditional manner, which results in the destruction of an embryo.[10] Traditionally created embryonic stem cell lines are needed to serve as a comparison with the newly developed lines to establish whether they are indeed equivalent to traditionally developed lines. Moreover, although a single cell biopsy may be performed in IVF cases to test for genetic diseases, it is unclear whether it would be appropriate to transfer to a uterus an embryo that underwent such biopsy for the creation of stem cell lines. It is not known whether the biopsy makes the embryo less likely to implant. Women undergoing IVF typically choose to transfer to their uterus embryos with the highest likelihood of implantation and, eventually, healthy birth. If embryos that have undergone a biopsy for purposes unrelated to health are not going to be chosen for implantation and will be eventually discarded, then the single biopsy procedure does not result in "sparing" embryos (although it may result in a delay in destruction). Research is ongoing to identify novel and more efficient methods of obtaining stem cells from human embryos, and it is anticipated that this area will continue to evolve.

Once small numbers of embryonic stem cells have been isolated from human embryos, they are cultured in the laboratory to generate an ongoing source of cells, referred to as a cell line. Because of the unique self-renewing capacity of stem cells, the lines can often be maintained indefinitely. Because of constraints on the use of federal funds for research that results in the destruction of a human embryo, federal research grants involving hESCs entail the experimental manipulation of existing hESC lines and do not directly fund the acquisition of stem cells from the embryo. To maximize collaboration and access to hESC lines available nationally and internationally, the National Institutes of Health Office of Extramural Research maintains a publicly accessible registry that investigators may access to apply for funds pertaining to a particular cell line. State and private funding of stem cell research may not be similarly constrained.

ADULT STEM CELLS AND INDUCIBLE PLURIPOTENT STEM CELLS

In an attempt to find alternative sources for stem cells, several additional methods have been developed over the past 15 years. These include the isolation and genetic reprogramming of specific adult cells (usually skin fibroblasts) into inducible pluripotent stem cells (iPSCs). The development of these methods has not replaced the use of hESCs but has offered additional insight into the biology of cell differentiation, dedifferentiation, and aging in new biological models.

Most mature tissues have small populations of stem cells that facilitate continued tissue growth and repair. These were first recognized in bone marrow, and advances in their isolation and expansion have revolutionized the treatment of hematologic and other malignancies. Bone marrow transplantation with hematopoietic stem cells is now the standard of care for pediatric high-risk leukemia as well as for certain solid tumors, immune deficiencies, and metabolic disorders. Stem cells have also been identified in the brain, cardiac muscle, connective tissue, and bone. Most evidence suggests that these cells are not pluripotent, as are hESCs, but could be induced to accelerate their repair mechanism in cell-based regenerative therapy, such as the use of native neural stem cells to repair spinal cord injury.[11,12] Traditionally, this technology has been limited by the fact that adult stem cells are more differentiated, are harder to isolate from tissue, exist in relatively small numbers, and are more difficult to maintain in long-term culture when compared with hESCs.

The generation of iPSCs from adult cells represents a major advancement in the understanding of the molecular mechanisms of cell differentiation. In 2007, iPSCs were successfully generated from human fibroblasts by engineering them to express genes implicated in dedifferentiation and the maintenance of "stemness."[13] These cells were capable of differentiating into all 3 embryonic germ layers (endoderm, mesoderm, and ectoderm). It is anticipated that, as the technology evolves, iPSCs will have important implications for pediatric diseases, including the study of tumor differentiation,[14,15] hematopoiesis,[16,17] neurodegenerative disorders,[18] and damaged tissue regeneration.[19,20]

Opponents of funding for hESC research believe that advances in the use of iPSCs obviate the need for cells derived directly from the human embryo. Although the use of iPSCs appears to hold great promise, there is evidence that, when compared with embryonic cells, iPSCs tend to retain their "molecular identity" and may, therefore, be less stable and efficient

when programmed to develop into a particular cell line.[21] Their cellular growth parameters may also be altered and have an increased susceptibility to unregulated growth similar to a neoplastic process, raising cancer concerns. In addition, some iPSCs may be susceptible to silencing of genes required for fetal development and differentiation.[22] This concept of lineage bias will continue to be an active area of research requiring ongoing comparison of the pluripotency of iPSCs and hESCs. For example, the gene involved in fragile X syndrome, the most common inherited form of mental retardation in children, produces a protein vital to normal brain development in normal patients but acquires a silencing mutation in those with the disease. Researchers have shown that this gene functions normally in human embryonic cells and becomes silenced as the cells differentiate. In iPSCs, however, the gene is already silenced before the cells begin to differentiate.[23] The use of iPSCs in human trials is problematic, given the high level of manipulation of these cells and the resulting concerns about how they will function in vivo. Whether iPSCs will prove a useful substitute for hESCs has yet to be determined. At this time, comparative studies using iPSCs will require an ongoing source of hESCs, which are still considered the scientific gold standard for embryonic cell lines.[24]

hESC RESEARCH AND PEDIATRIC DISEASE

The American Academy of Pediatrics supports hESC research because current research reveals it may positively affect the treatment of pediatric diseases. In the past decade, several promising advances have been made with specific applications in pediatrics. hESCs have been programmed to differentiate into type II alveolar lung cells[25] capable of producing surfactant, optimizing gas exchange, and protecting against pathogen invasion. Continued developments in this area could enhance the treatment of neonatal lung disease, a leading cause of morbidity and mortality in preterm infants. Insulin-secreting populations of pancreatic islet cells have been developed.[26] Additional research is needed to stimulate these cells to produce enough insulin to be physiologically functional. If achieved, this could serve as a powerful therapy for children facing lifelong insulin replacement and morbidity associated with type I diabetes mellitus. A new technique for culturing hESCs has allowed for their differentiation into skin cells that expand rapidly and may serve as a replacement for autologous skin grafts[27] and their long-term cosmetic sequelae. A direct comparison of the tumor-killing capacity of natural killer cells derived from hESCs versus umbilical cord blood stem cells found hESCs to be more efficient at killing leukemias and solid tumors as well as protecting against metastasis and recurrence in an in vivo model.[28] Further work in this area will be particularly beneficial to children, in whom the late effects of cancer chemotherapy have been of increasing concern.

ETHICAL ISSUES

There are few ethical concerns raised about the use of isolated hESCs. Rather, concerns focus on the sources of the cells and, particularly, on the need to destroy a human embryo to derive the cell lines.[29] If the destruction of a human embryo is a morally wrong act, then the use of stem cells derived from the destruction of the embryo may also be morally problematic. Some people who object to the destruction of embryos do not similarly object to the use of stem cells derived from those embryos but see the 2 acts as separate. People who do object argue that the use of such stem cells is morally complicit.[30] In some ways, this concern may be time-limited (eventually, an alternative mechanism for deriving cell lines that does not result in the destruction of an embryo may be discovered). But, as pointed out earlier, even as new mechanisms are developed, traditionally derived stem cells must be used to set the standard against which to compare the newly derived lines.[24]

The moral status* of preimplantation ex utero human embryos may never be truly settled, and debates about the ethics of stem cell research are ongoing. Despite differences in public opinion on this issue, a majority of the public supports continued research using embryonic stem cells.[31] Those people who disagree may argue that preimplantation ex utero human embryos should be accorded equal moral status to fully developed humans, but others counter that they have lesser moral status. Those in the latter category may argue that preimplantation ex utero embryos have no moral status (because they lack relevant characteristics, such as sentience or ability to feel pain), or instead they may attempt to place embryos along a moral status hierarchy with other biologically alive entities, such as nonhuman animals. Even those who believe these embryos have little or no moral status may still believe they should be treated with respect or that there are certain limits to what may be done with a human embryo. Alternatively, those who believe that the preimplantation

*Moral status refers to the determination that an entity "counts" or that its interests must be taken into account, from a moral (as opposed to legal) point of view. Not all entities with moral status will have legal status (eg, nonhuman animals). Not all entities with legal status will have moral status (eg, corporations).

ex utero embryo has some moral status may determine that the interests of those who could benefit from future developed treatments weigh in favor of their use. In particular, they may find benefit in the use of embryos that are already destined for disposal. For the purposes of this policy statement, it is important to recognize that the moral status of preimplantation ex utero embryos is a point of debate and that any policy or regulatory oversight system should be sensitive to differing moral positions.

The American Academy of Pediatrics recognizes the ethical considerations inherent in hESC research but also recognizes the potential benefit to children of future discoveries, particularly children for whom successful treatment of their diseases is currently limited. At this time, research with hESCs offers a promising line of inquiry for many of these diseases. Because of the continued ethical debates in this context, a regulatory oversight framework should strive to find as much common ground as possible, although widespread agreement on all issues may be impossible. In a pluralistic society, minority views should be respected but should not necessarily determine policy. The development of stem cell lines through the destruction of preimplantation ex utero embryos and research on stem cell lines should be permitted. Public funding for such work should also be permitted. Although some may argue that their taxes should not be used to fund research to which they object, this is no different than the use of taxes to support other activities some taxpayers object to, such as military spending. Minority views can be respected, in part, by the promotion of research into ways to obtain hESCs without destroying embryos.

In addition to the debate about destruction of embryos, there are a number of other ethical issues that arise in this context. For example, there are ethical concerns regarding acquisition of embryos from different sources. The most common source is excess embryos from the IVF process. But embryos may also be created specifically for stem cell research. For those who believe that embryos have some moral status (whether it is equivalent to that of fully developed humans), the creation of embryos for research purposes may be more ethically problematic than the use of excess embryos that would otherwise be destroyed. Even those who believe the embryo has no moral status may be uneasy about creating them for purely research uses. Because there are fewer objections to the use of embryos already created, research in this area may be limited to cells derived from excess IVF embryos. This would be congruent with the view that embryos have some moral status as well as the view that embryos have little or no moral status but should nonetheless be treated with respect.

The use of excess IVF embryos creates other ethical issues. Couples undergoing IVF may be both emotionally and financially vulnerable. Care must be taken to ensure that the informed consent process for research donation has adequate protections. Under no circumstances should couples feel obligated to donate, and they should be fully informed about the relevant issues, including other choices they can make regarding their excess embryos. Moreover, couples should not feel that their IVF care is in any way dependent on their decision to donate. Finally, it would be improper to offer financial incentives to couples in exchange for donating their embryos for the creation of stem cells because such incentives raise concerns about undue inducement. In addition, for some, payment for embryos may seem to commodify children or even demonstrate disrespect for the embryo (although payment of money can also be viewed as a way of demonstrating respect). Because of the varying positions on this issue and the absence of a need to pay donors for any time, effort, or risk involved in creating the excess embryos, the American Academy of Pediatrics finds financial incentives to be inappropriate in this context. Payment for the time, effort, and risks involved in gamete donation raises different issues and is beyond the scope of this statement.

If embryos are created by using genetic material from multiple individuals, it may be unclear who should provide the consent for research. Most IVF clinics do not look to gamete donors specifically, but rather to the individuals (or individual) who are planning to use the embryos for reproductive purpose to make decisions about disposition, including research. Consent forms for gamete donation should make clear that the recipients will have this dispositional authority. Similarly, agreements between parties who are creating embryos should set forth terms of disposition at the outset of the process, including what to do in cases of disagreement, separation/divorce, or death. hESCs should only be derived from embryos donated for research under either a previous agreement or current consent from parties with dispositional authority.

CONCLUSIONS

In a pluralistic society, substantive disagreements may be addressed through the legislative or regulatory process. The National Institutes of Health has issued guidelines on human stem cell research that identify eligibility for federal funding (setting standards for donation, consent, and the use of cells derived before the guidelines took effect). The guidelines

serve as an important roadmap for using hESCs in research and attempt to strike an acceptable balance between the potential scientific benefits, the ethical issues and concerns surrounding this research, and the need for proper protection of human subjects. In addition to guidelines developed at the national or state level, it may be useful to create institutional stem cell oversight bodies which could ensure the application of legal restrictions and evaluate ethical issues that may arise in specific research proposals.

RECOMMENDATIONS

1. Given the substantial potential benefit on child health and development, the American Academy of Pediatrics believes that public funding and oversight for human embryo and embryonic stem cell research should continue. Funding for research that seeks to identify mechanisms to derive embryonic stem cells without resulting in the destruction of an embryo is also appropriate.
2. The American Academy of Pediatrics endorses the National Institutes of Health Guidelines on Human Stem Cell Research (http://stemcells.nih.gov/policy/2009guidelines.html), which identify eligibility for federal funding (setting standards for donation, consent, and the use of cells derived before the guidelines took effect). The guidelines serve as an important roadmap for using hESCs in research and strike an acceptable balance between the potential scientific benefits, the ethical issues and concerns surrounding this research, and the need for proper protection of human subjects. In particular, the American Academy of Pediatrics supports the following restrictions on hESC research:
   a. hESCs should be derived from embryos that were created by using IVF for reproductive purposes and are no longer needed for this purpose.
   b. The individuals who sought reproductive treatment must give voluntary written informed consent for the human embryos to be used for research purposes.
   c. No payments, cash or in kind, should be offered for donated embryos used for hESC derivation.
   d. There is a clear separation between the prospective embryo donor(s)'s decision to create human embryos for reproductive purposes and the prospective embryo donor(s)'s decision to donate human embryos for research purposes.

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POLICY STATEMENT

Instrument-Based Pediatric Vision Screening Policy Statement

AMERICAN ACADEMY OF PEDIATRICS Section on Ophthalmology and Committee on Practice and Ambulatory Medicine; AMERICAN ACADEMY OF OPHTHALMOLOGY; AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS; and AMERICAN ASSOCIATION OF CERTIFIED ORTHOPTISTS

KEY WORDS
vision screening, young children, instrument-based screening, visual acuity, automated technology

ABBREVIATION
RVU—relative value unit

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abstract

FREE

A policy statement describing the use of automated vision screening technology (instrument-based vision screening) is presented. Screening for amblyogenic refractive error with instrument-based screening is not dependent on behavioral responses of children, as when visual acuity is measured. Instrument-based screening is quick, requires minimal cooperation of the child, and is especially useful in the preverbal, preliterate, or developmentally delayed child. Children younger than 4 years can benefit from instrument-based screening, and visual acuity testing can be used reliably in older children. Adoption of this new technology is highly dependent on third-party payment policies, which could present a significant barrier to adoption. *Pediatrics* 2012;130:983–986

INTRODUCTION

With recent research and development of improved screening and refractive devices, this policy statement supplants the 2002 position paper[1] and is in accord with the overall vision screening policy of the American Academy of Pediatrics.[2] This statement is cosponsored by the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus, and the American Association of Certified Orthoptists.

The goal of vision screening is to detect subnormal vision or risk factors that threaten visual development, preferably at a time when treatment can be initiated to yield the highest benefit.[3] A primary goal of vision screening in young children is the detection of amblyopia or the risk factors for development of amblyopia, a neural deficit in vision that is estimated to be present in 1% to 4% of children.[4] Amblyopia can be caused by obscured images (eg, from infantile cataracts), misaligned images (eg, from constant strabismus), or defocused images (eg, from different refractive errors between the eyes, termed anisometropia). The hallmark of amblyopia is decreased visual acuity, typically monocular, for which no ocular structural disorder fully accounts. However, successful visual acuity testing by using a vision chart is highly dependent on patient age and screener experience. In children younger than 3 years, few professionals can reliably determine acuity in each eye by using a vision chart.[5] Therefore, for younger children, the preferred methodology is instrument-based detection of risk factors for amblyopia—primarily photoscreening and autorefraction.

PHOTOSCREENERS, AUTOREFRACTORS, AND OTHER INSTRUMENTS

Instrument-based screening, if performed and interpreted correctly by appropriately trained individuals, usually identifies the presence and magnitude of optical and physical abnormalities of the eyes; it is quick and requires minimal cooperation from the child. Instrument-based screening systems typically produce a hard copy or digital record for inclusion in the patient record to document that screening was performed and, in some cases, provide an interpretation of the data.

Photoscreening uses optical images of the eye's red reflex to estimate refractive error, media opacity, ocular alignment, and other factors, such as ocular adnexal deformities (eg, ptosis), all of which put a child at risk for developing amblyopia. Photoscreening instruments, which assess both eyes simultaneously, have been found to be useful for screening children,[6–10] and their output is interpreted by operators, by a central reading center, or by computer.

Autorefraction involves optically automated skiascopy methods or wavefront technology (Shack-Hartmann) to evaluate the refractive error of each eye. The National Institutes of Health–sponsored Vision in Preschoolers Study[7] systematically evaluated instrument-based screening methods and compared them with visual acuity–based screening when administered by licensed eye-care professionals. For the conditions most important to detect and treat early and for a specificity of 90%, autorefraction had sensitivity of 81% to 88%, with the use of specified referral criteria. For these conditions, visual acuity testing had 77% sensitivity at 90% specificity. A disadvantage of autorefractors is that they typically measure only 1 eye at a time, limiting their ability to detect strabismus in the absence of abnormal refractive error. However, in contrast to tabletop autorefractors, which are difficult to use with very young children, portable, handheld autorefractors are useful for screening young children.[7,11–15] Autorefraction data yield numeric results that are analyzed by the evaluator or by the instrument itself to determine if a child passes or fails the screening.

Other instruments have been or are being developed to objectively evaluate the eye or visual system for the presence of risk factors for amblyopia. These instruments are, at present, without a sufficient evidence base for recommendation.

As with any screening device, the sensitivity and specificity will depend on the referral criteria used. Alterations in referral criteria result in an inverse relationship between sensitivity and specificity, such that high detection of at-risk children (ie, high sensitivity) risks excessive overreferrals (ie, low specificity), and minimization of overreferrals (ie, high specificity) reduces detection of at-risk children (ie, low sensitivity).

Both photoscreening and autorefraction offer hope in improving vision-screening rates in preverbal children, preliterate children, and those with developmental delays, who are the most difficult to screen. Children younger than 4 years can benefit from instrument-based screenings. For children 4 to 5 years of age, photoscreening and autorefraction have not been shown to be superior or inferior to visual acuity testing with the use of vision charts.[7] In children older than 5 years, visual acuity testing by using vision charts can be used reliably and should be performed every 1 to 2 years.[2]

BARRIERS TO THE USE OF INSTRUMENT-BASED VISUAL SCREENING

Although all of the aforementioned instruments are available for use in a primary care setting, all of them involve substantial costs to the primary care practice. The instruments themselves often cost thousands of dollars, in addition to the costs of printers and supplies for each test performed. There are additional indirect costs, including space and staff time required to perform these tests, as well as physician time to interpret them. High initial capital investments for these instruments may be reduced if suppliers offer a leasing option as an alternative to purchasing equipment, but these costs must still be calculated into the total costs of performing the test. Although *Current Procedural Terminology* codes are available for such devices, there is never a guarantee of payment from third-party payers, even if the appropriate code is used. Historically, when such codes increase in frequency, third-party payers simply cease paying them. Additionally, visual screening is often inappropriately bundled into a global fee for the health maintenance visit, despite the fact that this is a separately identifiable service with real costs and established relative value units (RVUs). The adoption of any such technology will be highly dependent on the payment decisions of third-party payers. Primary care physicians will likely be slow to adopt these new technologies, despite their merit, if they are expected to absorb the cost without adequate payment for their up-front costs and their time. A level-1 *Current Procedural Terminology* code, 99174 with RVU 0.69, has been assigned to photoscreening. The adequacy of such an RVU depends on the cost of the screening device.

RECOMMENDATIONS

- Vision screening should be performed at an early age and at regular intervals with age-appropriate, valid methods, ideally within the

medical home. The goal remains to identify and treat preventable visual impairment at the earliest feasible age.

- Photoscreening and handheld autorefraction may be electively performed in children 6 months to 3 years of age, allowing earlier detection of conditions that may lead to amblyopia, as well as in older children who are unable or unwilling to cooperate with routine acuity screening.
- Photoscreening and handheld autorefraction are recommended as an alternative to visual acuity screening with vision charts from 3 through 5 years of age, after which visual acuity screening with vision charts becomes more efficient and less costly in the medical home. Adequate payment for instrument-based vision-screening services must be ensured if there is to be widespread adoption of this recommendation.
- Alternatively, the use of vision charts and standard physical examination techniques to assess amblyopia in children 3 to 5 years of age in the medical home remains a viable practice at the present time.
- There is no recommendation for mass screening at this time.
- Vision screening is a separately identifiable service and should not be bundled into the global code of well-child care. Adequate payment for photoscreening and handheld autorefraction must be ensured if there is to be widespread adoption of this recommendation.
- Regardless of the type of photoscreening or autorefraction system used, it is recommended that the evaluator know how to apply the technology properly and understand the limitations of the test in relation to the population being tested.
- The American Academy of Pediatrics, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists advocate additional research of photoscreening and handheld autorefraction devices and other vision screening methods to elucidate the validity of results, efficacy, cost-effectiveness, and payment policies for identifying amblyogenic factors in different age groups and subgroups of children. The goal remains to eliminate preventable childhood visual impairment.

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POLICY STATEMENT

Levels of Neonatal Care

COMMITTEE ON FETUS AND NEWBORN

KEY WORDS
neonatal intensive care, high-risk infant, regionalization, maternal and child health, health policy, very low birth weight infant, hospital newborn care services, nurseries

ABBREVIATIONS
AAP—American Academy of Pediatrics
aOR—adjusted odds ratio
CI—confidence interval
CON—certificate of need
ELBW—extremely low birth weight
TIOP—"Toward Improving the Outcome of Pregnancy"
VLBW—very low birth weight

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abstract

FREE

Provision of risk-appropriate care for newborn infants and mothers was first proposed in 1976. This updated policy statement provides a review of data supporting evidence for a tiered provision of care and reaffirms the need for uniform, nationally applicable definitions and consistent standards of service for public health to improve neonatal outcomes. Facilities that provide hospital care for newborn infants should be classified on the basis of functional capabilities, and these facilities should be organized within a regionalized system of perinatal care. *Pediatrics* 2012;130:587–597

OBJECTIVE

This revised policy statement reviews the current status of the designation of levels of newborn care definitions in the United States, which were delineated in a 2004 policy statement by the American Academy of Pediatrics (AAP).[1] Since publication of the 2004 policy statement, new data, both nationally and internationally, have reinforced the importance of well-defined regionalized systems of perinatal care, population-based assessment of outcomes, and appropriate epidemiologic methods to adjust for risk. This revised statement updates the designations to provide (1) a basis for comparison of health outcomes, resource use, and health care costs, (2) standardized nomenclature for public health, (3) uniform definitions for pediatricians and other health care professionals providing neonatal care, and (4) a foundation for consistent standards of service by institutions; state health departments; and state, regional, and national organizations focused on the improvement of perinatal care.

BACKGROUND

The availability of neonatal intensive care has improved the outcomes of high-risk infants born either preterm or with serious medical or surgical conditions.[2–4] Many of these improvements can be attributed to the concept and implementation of regionalized systems of perinatal care, broadly articulated in the 1976 March of Dimes report "Toward Improving the Outcome of Pregnancy" (TIOP I).[5] The TIOP I report included criteria that stratified maternal and neonatal care into 3 levels of complexity and recommended referral of high-risk patients to higher-level centers with the appropriate resources and personnel to address the required increased complexity of care. However, since the initial TIOP I report was published more than 3 decades ago, there have been signs of deregionalization, including (1)

an increase in the number of NICUs and neonatologists, without a consistent relationship to the percentage of high-risk infants, (2) a proliferation of small NICUs in the same regions as large NICUs,[6–11] and (3) failure of states to reach the Healthy People 2010 goal that 90% of deliveries of very low birth weight (VLBW; <1500 g) infants occur at level III facilities.[12,13]

In the environment of deregionalization, preterm birth rates have increased 13% overall from 1990 to 2010 (10.6%–12.0%) as a result of a variety of factors, including increases in elective early cesarean deliveries, multiple births, advanced maternal age, and complications of pregnancy.[14–20] The majority of the increase in the preterm birth rate (>70%) is attributable to late preterm births.[21] Infants born late preterm can experience significant morbidity that may result in the need for specialized care and advanced neonatal services.[22,23] An increase in the supply of specialty staff[24,25] and availability of new neonatal therapies (eg, bubble continuous positive airway pressure), have expanded the scope of care in level II facilities.[26] Some have expressed concern that level II hospitals have expanded their scope of care without sufficient evidence of favorable outcome. Because most infant deaths in the United States occur among the most immature infants in the first few days after birth,[27,28] improvements in regionalized systems may reduce mortality among the most preterm newborn infants.

REVIEW OF THE LITERATURE ON NEONATAL LEVELS OF CARE SINCE THE 2004 AAP POLICY STATEMENT

In 2004, the AAP defined neonatal levels of care, including 3 distinct levels with subdivisions in 2 of the levels.[1] Level I centers provided basic care; level II centers provided specialty care, with further subdivisions of IIA and IIB centers; and level III centers provided subspecialty care for critically ill newborn infants with subdivisions of level IIIA, IIIB, and IIIC facilities. Data published since the 2004 statement have informed the development of the levels of care in this new policy statement.

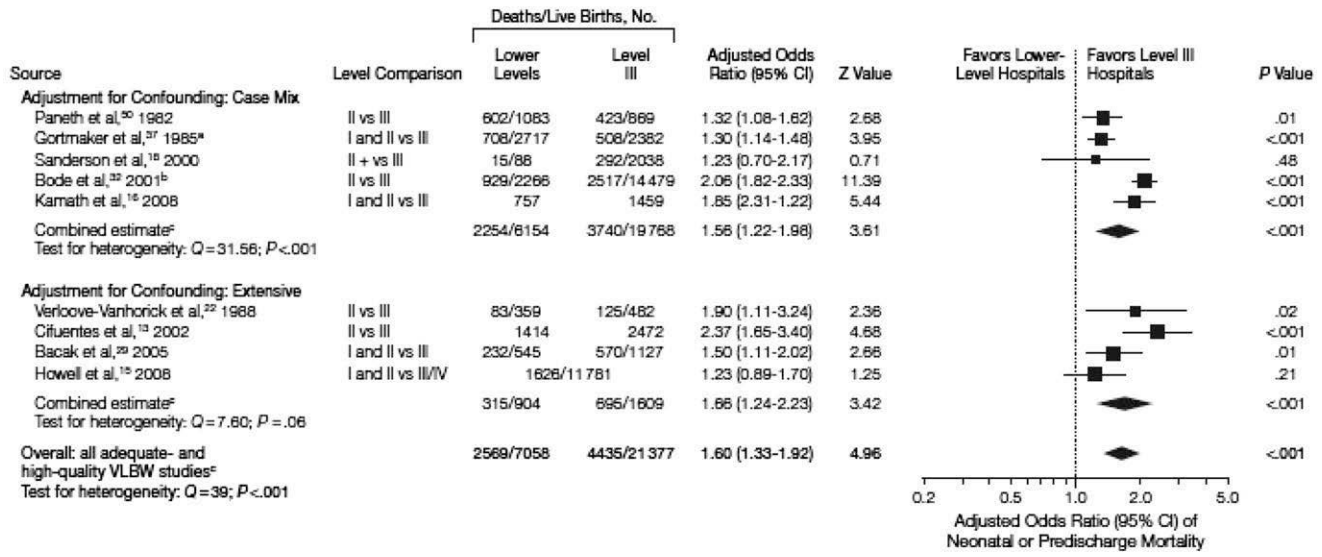
A meta-analysis of the published literature from 1978 to 2010 clearly demonstrates improved outcomes for VLBW infants and infants <32 weeks' gestational age born in level III centers. Lasswell et al reviewed 41 English-language US and international studies, which included >113 000 VLBW infants and found that VLBW infants born at non–level III hospitals had a 62% increase in odds of neonatal or predischarge mortality compared with those born at level III hospitals (adjusted odds ratio [aOR], 1.62; 95% confidence interval [CI], 1.44–1.83). Subset comparisons of studies identifying infants <32 weeks' gestation and extremely low birth weight (ELBW) infants (<1000 g) demonstrated similar effects (aOR, 1.55; 95% CI, 1.21–1.98; aOR, 1.64; 95% CI, 1.14–2.36, respectively). When only higher-quality studies were included, the findings were consistent (VLBW aOR, 1.60; 95% CI, 1.33–1.92; <32 weeks' gestation aOR, 1.42; 95% CI, 1.06–1.88; ELBW aOR, 1.80; 95% CI, 1.31–2.36). The effect of level of care on VLBW mortality did not vary by decade of publication[29]; hence, the risk of death for VLBW infants born in level I or II facilities remained higher than those born within a level III facility. Figures 1, 2, and 3 summarize the findings of these studies.

As Lasswell and colleagues found, part of the difficulty in collecting evidence to provide accurate assessments of VLBW outcomes has been in obtaining appropriate standardized measures. Heterogeneity among studies on neonatal levels of care suggests the need for a quality standard for comparison which includes the following elements: (1) population-based studies within well-defined geographic regions, (2) clear definitions of the "intervention" or hospital level of care, and (3) appropriate adjustment for confounding factors to include maternal social and demographic risk factors, pregnancy and perinatal risks, and severity of illness at delivery.

Current Controversies in Levels of Care Designation

Although little debate exists on the need for advanced neonatal services for the most immature and surgically complex neonates, ongoing controversies exist regarding which facilities are qualified to provide these services and what is the most appropriate measure for such qualification. These issues are, in general, based on the need for comparison of facility experience (measured by patient volume or census), location (inborn/outborn deliveries, regional perinatal center, or children's hospital), or case mix (including stillbirths, delivery room deaths, and complex congenital anomalies).

Several studies have explored the topic of center experience as measured by volume or census of VLBW infants.[30–35] Phibbs et al conducted a population-based retrospective cohort study of 48 237 California VLBW infants to examine differences in neonatal mortality among NICUs with various levels of care and patient volumes. When compared with high-volume, high-level centers, the odds ratio of death was 1.19 (range, 1.04–1.37) for level IIIB, IIIC, or IIID centers with <100 annual admissions, 1.78 (range, 1.35–2.34) for level IIIA centers with 26 to 50 annual admissions, and 2.72 (range, 2.37–3.12) for level I centers with <10 annual admissions. The authors also found that the percentage of VLBW infants delivered in level IIIB, IIIC, or IIID centers decreased from 36% in 1991 to 22% in



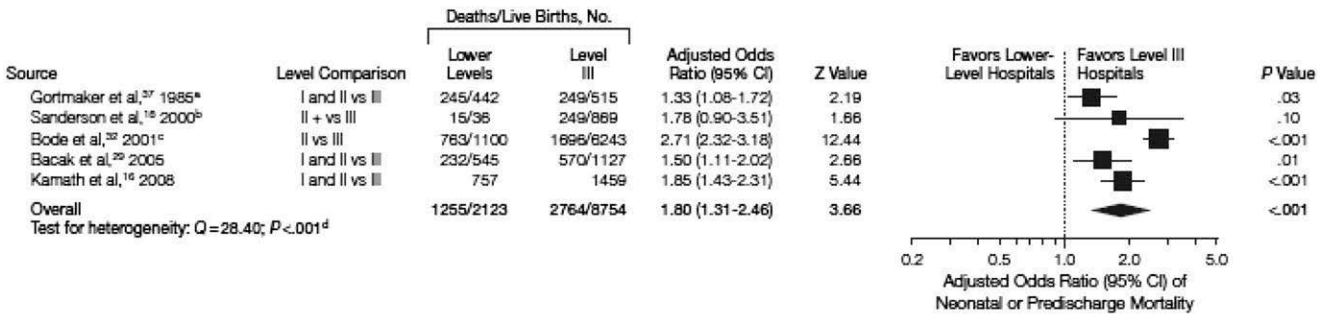
Case mix indicates adjustment for demographic and/or socioeconomic status variables; extensive indicates adjustment for case mix plus maternal/perinatal risk factors and infant illness severity. CI indicates confidence interval. Size of data markers indicates size of study population.
[a] Included data are for urban populations and combine reported black/white race strata and birth weight strata (750-1000 g and 1001-1500 g).
[b] Included data combine reported birth date interval strata (1980-1984, 1985-1989, and 1990-1994) and birth weight strata (500-1000 g and 1001-1500 g).
[c] Raw death counts are not reported in Cifuentes et al[13] and Kamath et al[16] and are not stratified by hospital level in Howell et al.[15] These studies are not included in combined death/birth counts.

FIGURE 1

Meta-analysis of adequate- and high-quality publications on VLBW infants, stratified by level of adjustment for confounding. (Reprinted with permission from Lasswell S, Barfield WD, Rochat R, Blackmon L. Perinatal regionalization for very low birth weight and very preterm infants: a meta-analysis. *JAMA.* 2010;304[9]:992–1000.[29])

2000 and estimated that shifting VLBW births in urban areas (92% of VLBW births) to level IIIC or IIID centers with >100 annual admissions would have prevented 21% of VLBW deaths in 2000.[30] In a secondary data analysis, Chung et al found that deregionalization of California perinatal services resulted in 20% of VLBW deliveries occurring in level I and level II hospitals, with lower-volume hospitals having the highest odds of mortality.[31]

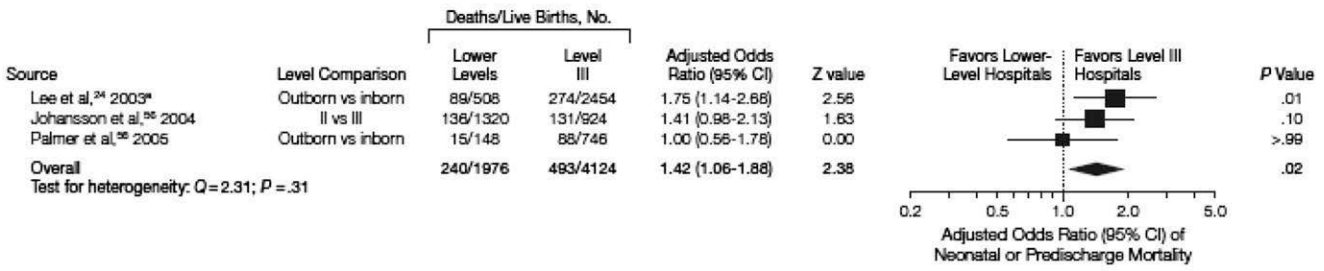
A population-based study of 4379 VLBW infants who were born between 1991 and 1999 in Lower Saxony, Germany, evaluated neonatal mortality in relation to both the annual volume of births and NICU volume.[32] There was an increased odds of mortality in centers with annual NICU admissions of fewer than 36 VLBW infants; the largest



CI indicates confidence interval. Size of data markers indicates size of study population.
[a] Included data are for urban populations and combine reported black/white race strata.
[b] Included data combine reported birth weight strata (500-749 g and 750-1000 g).
[c] Included data combine reported birth date interval strata (1980-1984, 1985-1989, and 1990-1994).
[d] The study by Kamath et al[16] does not report raw death count data and is not included in combined death/birth counts.

FIGURE 2

Meta-analysis of adequate- and high-quality publications on ELBW infants. (Reprinted with permission from Lasswell S, Barfield WD, Rochat R, Blackmon L. Perinatal regionalization for very low birth weight and very preterm infants: a meta-analysis. *JAMA.* 2010;304[9]:992–1000.[29])



CI indicates confidence interval. Size of data markers indicates size of study population. Inborn infants are those born in a level III hospital; outborn infants are those born in a lower-level hospital then transferred to a level III hospital.
[a] Included data combine reported gestational age strata (<26 weeks, 27-29 weeks, and 30-31 weeks).

FIGURE 3

Meta-analysis of adequate- and high-quality publications on very preterm infants (<32 weeks' gestation). (Reprinted with permission from Lasswell S, Barfield WD, Rochat R, Blackmon L. Perinatal regionalization for very low birth weight and very preterm infants: a meta-analysis. *JAMA.* 2010;304[9]:992–1000.[29])

effect on mortality was for infants born at less than 29 weeks' gestation.

Other studies assessing NICU volume suggest caution in using this measure as an effective indicator of quality of care. Rogowski and colleagues assessed the potential usefulness of NICU volume as a quality indicator among 94 110 VLBW infants entered into the Vermont Oxford Network database between 1995 and 2000 and compared NICU volume with other indicators based on hospital characteristics and patient outcomes.[33] They found that although annual volume explained 9% of the variation in hospital mortality rates, other hospital characteristics explained another 7%. They suggested that direct measures based on patient outcomes are more useful quality indicators than volume for the purpose of selective referral.

Several studies assessed the effects of level of care, patient volume, and racial disparities on mortality of VLBW infants based on births in minority-serving hospitals. Morales[34] and Howell[35] evaluated mortality of VLBW infants born in minority-serving hospitals. In both studies, neonatal level of care and patient volume were each independently associated with mortality, suggesting that delivery of all VLBW infants at high-volume hospitals would reduce black-white disparities in VLBW mortality rates. Rogowski and colleagues further suggest that the quality of care in poor-outcome hospitals could be improved through collaborative quality improvement, and evidence-based selective referral.[36]

Several studies have compared the short-term outcome of VLBW infants born in centers with level III units (inborn) compared with those born at lower level centers and soon transferred to a higher level (level III or children's hospital; outborn). Many of these studies are retrospective and may be subject to selection bias because infants who were transferred most likely had the highest chance of survival and thus gave the impression of lower mortality.[24] In a secondary analysis of a randomized placebo-controlled study of preemptive morphine analgesia on neonatal outcomes, Palmer et al compared neonatal mortality as related to place of birth for 894 infants who were born at 23 to 32 weeks' gestation. Outborn babies were more likely to have severe intraventricular hemorrhage ($P = .0005$), and this increased risk persisted after controlling for severity of illness. However, when adjusted for antenatal steroids, the effect of birth center was no longer significant.[37]

Evaluating and controlling for confounding variables and "case-mix" presents another set of challenges because these factors vary by population. For example, race and insurance status may have more of an effect on birth outcomes in the United States[34–36,38] than in countries with a more homogenous population and universal national health care.[39] There are also potential confounding factors for which measurement is frequently lacking, such as parental wishes regarding aggressive resuscitation of an infant. Arad et al noted that parental wishes varied by religious affiliation in their 2-hospital study. Because religious affiliation was unequally distributed between the 2 hospitals, fewer attempts at resuscitation may have been made at the level III hospital, with a result of improved survival at the level II facility.[40] More comprehensive studies controlling for confounding factors are needed.

Measured outcomes other than VLBW mortality (notably, fetal mortality, postdischarge mortality, and long-term physical and neurodevelopmental outcomes) may offer important information in assessing the evidence for newborn levels of care and perinatal regionalization. Studies measuring the effect of hospital level of birth on fetal

and neonatal outcomes stratified by gestational age, as well as by birth weight, are also helpful, because gestational age is a better gauge of fetal maturity.[41–44] Although some studies include stillbirths and intrapartum fetal deaths, measurement and surveillance of fetal death varies widely.[3] Congenital anomalies are often excluded from studies of perinatal regionalization but should be considered in the provision of risk appropriate care.[45]

Additional studies are also needed to assess the effectiveness and potential cost savings of centralizing expensive technologies and provider expertise for relatively rare conditions at a few locations and to assess the effectiveness, including costs, of antenatal transport.

IMPORTANCE OF NEONATAL LEVELS OF CARE

Provision of Standardized Nomenclature for Public Health

Since 2004, efforts have been made to improve the comparison of health outcomes by hospital facility through the use of standardized nomenclature on the US birth certificate. The National Center for Health Statistics at the Centers for Disease Control and Prevention has worked with states to use the newly revised US Standard Certificate of Birth.[46] This 2003 revised certificate defines a NICU as a "hospital facility or unit staffed and equipped to provide continuous mechanical ventilatory support for a newborn infant." It also includes information on the use of antenatal therapies and postpartum surfactant, which may be useful in monitoring population-based utilization of technologies at birth.[47] In an analysis of 16 states using the revised certificate of birth, Barfield et al found that overall, 77.3% of VLBW infants were admitted to NICUs; this estimate varied by state and ranged from 63.7% in California to 93.4% in North Dakota. Among VLBW infants of Hispanic mothers, 71.8% were admitted to NICUs, compared with 79.5% of VLBW infants of non-Hispanic black mothers and 80.5% of VLBW infants of non-Hispanic white mothers. In multivariable analysis, preterm delivery, multiple gestation, and cesarean delivery were associated with higher prevalence of NICU admission among VLBW infants.[13] State variations in the receipt of intensive care for VLBW infants may explain, in part, variation in VLBW outcomes across the country.

Use of Uniform Definitions of Levels of Care for Pediatricians and Other Health Care Professionals

Variation in definition, criteria, and state enforcement still occurs despite the TIOP I guidelines. Blackmon et al conducted an extensive review of all 50 states and the District of Columbia governmental Web sites to assess state definitions and levels terminology, functional and utilization criteria, regulatory compliance and funding measures, and citation of AAP documents on levels of neonatal care. The authors found that state definitions, criteria, compliance, and regulatory mechanisms for the specific type of care neonatal centers provide varied considerably, and they suggested a consistent national approach.[48] Lorch et al assessed all 50 states and the District of Columbia to identify state certificate of need (CON) legislation, a mechanism that regulates the expansion of NICU facilities and NICU beds. Thirty states regulated the construction of NICUs through CON programs, and non-CON program states were associated with more NICU facilities and more NICU beds (relative risk, 2.06; 95% CI, 1.74–2.45; and relative risk, 1.96; 95% CI, 1.89–2.03, respectively). In large metropolitan areas, non-CON states had higher infant mortality for all birth weight groups.[49]

The Maternal and Child Health Bureau of the Health Resources and Services Administration has worked with state Title V agencies to document the percentage of VLBW infants delivered in level III hospitals or subspecialty perinatal clinics. In 2009, only 5 states met the goal of at least 90% of VLBW infants delivered at high-risk facilities.[12] Yet, the interpretation and reporting of these facilities may be inconsistent as some states had unclear facility definitions or included level II facilities in their reporting. Recently, several states, in partnership with national organizations, have taken more definitive action in defining and regulating organization of perinatal care.[50]

Development of Consistent Standards of Service

Efforts by quality-improvement collaboratives, health services researchers, and public health officials will continue to improve the standards by which to measure quality of care.[51,52] Quality-improvement activities have begun to flourish at all levels to improve maternal and perinatal health and ideally prevent preterm births; this includes provider-level quality-improvement activities, hospital-level performance measures, and regional, state, and national performance measures.[53] Organizations such as the March of Dimes have promoted standard definitions of levels of care since the introduction of perinatal regionalization in the 1970s, reaffirmed its importance in 1993 (TIOP II),[54] and included the concept of quality care for the prevention of preterm birth with a new TIOP (TIOP III) in 2010.[53]

DEFINITIONS OF LEVELS OF NEONATAL CARE

The updated classification consists of basic care (level I), specialty care (level II), and subspecialty intensive care (level III, level IV; Table 1). These definitions reflect the overall evidence for risk-appropriate care through the availability of appropriate personnel, physical space, equipment, technology, and

TABLE 1 Definitions, Capabilities, and Provider Types: Neonatal Levels of Care

Level of Care	Capabilities	Provider Types[a]
Level I Well newborn nursery	• Provide neonatal resuscitation at every delivery • Evaluate and provide postnatal care to stable term newborn infants • Stabilize and provide care for infants born 35–37 wk gestation who remain physiologically stable • Stabilize newborn infants who are ill and those born at <35 wk gestation until transfer to a higher level of care	Pediatricians, family physicians, nurse practitioners, and other advanced practice registered nurses
Level II Special care nursery	Level I capabilities plus: • Provide care for infants born ≥32 wk gestation and weighing ≥1500 g who have physiologic immaturity or who are moderately ill with problems that are expected to resolve rapidly and are not anticipated to need subspecialty services on an urgent basis • Provide care for infants convalescing after intensive care • Provide mechanical ventilation for brief duration (<24 h) or continuous positive airway pressure or both • Stabilize infants born before 32 wk gestation and weighing less than 1500 g until transfer to a neonatal intensive care facility	Level I health care providers plus: Pediatric hospitalists, neonatologist, and neonatal nurse practitioners.
Level III NICU	Level II capabilities plus: • Provide sustained life support • Provide comprehensive care for infants born <32 wks gestation and weighing <1500 g and infants born at all gestational ages and birth weights with critical illness • Provide prompt and readily available access to a full range of pediatric medical subspecialists, pediatric surgical specialists, pediatric anesthesiologists, and pediatric opthalmologists • Provide a full range of respiratory support that may include conventional and/or high-frequency ventilation and inhaled nitric oxide • Perform advanced imaging, with interpretation on an urgent basis, including computed tomography, MRI, and echocardiography	Level II health care providers plus: Pediatric medical subspecialists[b], pediatric anesthesiologists[b], pediatric surgeons, and pediatric opthalmologists[b].
Level IV Regional NICU	Level III capabilities plus: • Located within an institution with the capability to provide surgical repair of complex congenital or acquired conditions • Maintain a full range of pediatric medical subspecialists, pediatric surgical subspecialists, and pediatric anesthesiologists at the site • Facilitate transport and provide outreach education	Level III health care providers plus: Pediatric surgical subspecialists

[a] Includes all providers with relevant experience, training, and demonstrated competence.
[b] At the site or at a closely related institution by prearranged consultative agreement.

organization.[55] Each level reflects the minimal capabilities, functional criteria, and provider type required. Currently, there are 148 specialty care units and 809 subspecialty care units self-identified in the 2009 AAP perinatal section directory.

Level I

Level I facilities (well newborn nurseries) provide a basic level of care to neonates who are low risk. They have the capability to perform neonatal resuscitation at every delivery and to evaluate and provide routine postnatal care for healthy newborn infants. In addition, they can care for preterm infants at 35 to 37 weeks' gestation who are physiologically stable and can stabilize newborn infants who are less than 35 weeks of gestation or who are ill until they can be transferred to a facility at which specialty neonatal care is provided. Because late preterm infants (34–36 weeks' gestation) are at risk for increased neonatal morbidity and mortality, more evidence is needed to determine their outcomes by level of care.

Level II

Care in a specialty-level facility (level II) should be reserved for stable or

moderately ill newborn infants who are born at ≥32 weeks' gestation or who weigh ≥1500 g at birth with problems that are expected to resolve rapidly and who would not be anticipated to need subspecialty-level services on an urgent basis. These situations usually occur as a result of relatively uncomplicated preterm labor or preterm rupture of membranes. There is limited evidence to support the specific subdivision of level II care, in part because of the lack of studies with well-defined subdivisions. Level II facilities should take into consideration geographic constraints and population size when assessing the staffing resources needed to care appropriately for moderately ill newborn infants.

Level II nurseries may provide assisted ventilation on an interim basis until the infant's condition either soon improves or the infant can be transferred to a higher-level facility. Delivery of continuous positive airway pressure should be readily available by experienced personnel, and mechanical ventilation can be provided for a brief duration (less than 24 hours). Level II nurseries must have equipment (eg, portable x-ray machine, blood gas analyzer) and personnel (eg, physicians, specialized nurses, respiratory therapists, radiology technicians, laboratory technicians) continuously available to provide ongoing care as well as to address emergencies. Referral to a higher level of care should occur for all infants when needed for pediatric surgical or medical subspecialty intervention.

Level III

Evidence suggests that infants who are born at <32 weeks' gestation, weigh <1500 g at birth, or have medical or surgical conditions, regardless of gestational age, should be cared for at a level III facility. Designation of level III care should be based on clinical experience, as demonstrated by large patient volume, increasing complexity of care, and availability of pediatric medical subspecialists and pediatric surgical specialists. Subspecialty care services should include expertise in neonatology and also ideally maternal-fetal medicine, if mothers are referred for the management of potential preterm birth. Level III NICUs are defined by having continuously available personnel (neonatologists, neonatal nurses, respiratory therapists) and equipment to provide life support for as long as necessary. Facilities should have advanced respiratory support and physiologic monitoring equipment, laboratory and imaging facilities, nutrition and pharmacy support with pediatric expertise, social services, and pastoral care.

Level III facilities should be able to provide ongoing assisted ventilation for 24 hours or more, which may include conventional ventilation, high-frequency ventilation, and inhaled nitric oxide. Level III facility capabilities should also be based on a region's consideration of geographic constraints, population size, and personnel resources. If geographic constraints for land transportation exist, the level III facility should ensure availability of rotor and fixed-wing transport services to quickly and safely transfer infants requiring subspecialty intervention.[56] Potential transfer to higher-level facilities or children's hospitals, as well as back-transport of recovering infants to lower-level facilities, should be considered as clinically indicated.

A broad range of pediatric medical subspecialists and pediatric surgical specialists should be readily accessible on site or by prearranged consultative agreements. Prearranged consultative agreements can be performed by using telemedicine technology and/or telephone consultation, for example, from a distant location.[50] Pediatric ophthalmology services and an organized program for the monitoring, treatment, and follow-up of retinopathy of prematurity should be readily available in level III facilities.[57] Level III units should have the capability to perform major surgery on site or at a closely related institution, ideally in close geographic proximity. Because the outcomes of less complex surgical procedures in children, such as appendectomy or pyloromyotomy, are better when performed by pediatric surgeons compared with general surgeons, it is recommended that pediatric surgical specialists (including anesthesiologists with pediatric expertise) perform all procedures in newborn infants.[58]

Level III facilities should have the capability to perform advanced imaging with interpretation on an urgent basis, including CT, MRI, and echocardiography. Level III facilities should collect data to assess outcomes within their facility and to compare with other levels.

Level IV

Level IV units include the capabilities of level III with additional capabilities and considerable experience in the care of the most complex and critically ill newborn infants and should have pediatric medical and pediatric surgical specialty consultants continuously available 24 hours a day. Level IV facilities would also include the capability for surgical repair of complex conditions (eg, congenital cardiac malformations that require cardiopulmonary bypass with or without extracorporeal membrane oxygenation). More evidence is needed to assess the risk of morbidity and mortality by level of care for newborn infants with complex congenital cardiac malformations. A recent study by Burstein et al[59] was not able to note a difference in postoperative morbidity or mortality

associated with dedicated pediatric cardiac ICUs versus NICUs and PICUs but did not separately assess the newborn and postneonatal periods. Although specific supporting data are not currently available, it is thought that concentrating the care of such infants at designated level IV centers will allow these centers to develop the expertise needed to achieve optimal outcomes.

Not all level IV hospitals need to act as regional centers; however, regional organization of perinatal health care services requires that there be coordination in the development of specialized services, professional continuing education to maintain competency, facilitation of opportunities for transport and back-transport,[60] and collection of data on long-term outcomes to evaluate both the effectiveness of delivery of perinatal health care services and the safety and efficacy of new therapies. These functions usually are best achieved when responsibility is concentrated in a single regional center with both perinatal and neonatal subspecialty services. In some cases, regional coordination may be provided adequately by the collaboration of a children's hospital with a subspecialty perinatal facility that is in close geographic proximity.[61]

STANDARDS OF SERVICE FOR HOSPITALS PROVIDING NEONATAL CARE

Current evidence indicates that family and cultural considerations are important for care of sick neonates.[62–65] These considerations include family- and patient-centered care, culturally effective care, family-based education, and opportunities for back-transport to level II facilities or transfer to the family's local community facility when medically and socially indicated.[64–67]

SUMMARY AND RECOMMENDATIONS

1. Regionalized systems of perinatal care are recommended to ensure that each newborn infant is delivered and cared for in a facility most appropriate for his or her health care needs, when possible, and to facilitate the achievement of optimal health outcomes.
    - Because VLBW and/or very preterm infants are at increased risk of predischarge mortality when born outside of a level III center, they should be delivered at a level III facility unless this is precluded by the mother's medical condition or geographic constraints.
2. The functional capabilities of facilities that provide inpatient care for newborn infants should be classified uniformly on the basis of geographic and population parameters in collaboration with state health departments, as follows:
    - Level I: a hospital nursery organized with the personnel and equipment to perform neonatal resuscitation, evaluate and provide postnatal care of healthy newborn infants, provide care for infants born at 35 to 37 weeks' gestation who remain physiologically stable, and stabilize ill newborn infants or infants born at less than 35 weeks' gestational age until transfer to a facility that can provide the appropriate level of neonatal care.
    - Level II: a hospital special care nursery organized with the personnel and equipment to provide care to infants born at 32 weeks' gestation or more and weighing 1500 g or more at birth who have physiologic immaturity, such as apnea of prematurity, inability to maintain body temperature, or inability to take oral feedings; who are moderately ill with problems that are expected to resolve rapidly and are not anticipated to need subspecialty services on an urgent basis; or who are convalescing from a higher level of intensive care. A level II center has the capability to provide continuous positive airway pressure and may provide mechanical ventilation for brief durations (less than 24 hours).
    - Level III: a hospital NICU organized with personnel and equipment to provide continuous life support and comprehensive care for extremely high-risk newborn infants and those with critical illness. This includes infants born weighing <1500 g or at <32 weeks' gestation. Level III units have the capability to provide critical medical and surgical care. Level III units routinely provide ongoing assisted ventilation; have ready access to a full range of pediatric medical subspecialists; have advanced imaging with interpretation on an urgent basis, including CT, MRI, and echocardiography; have access to pediatric ophthalmologic services with an organized program for the monitoring, treatment, and follow-up of retinopathy of prematurity; and have pediatric surgical specialists and pediatric anesthesiologists on site or at a closely related institution to perform major surgery. Level III units can facilitate transfer to higher-level facilities or children's hospitals, as well as back-transport recovering infants to lower-level facilities, as clinically indicated.
    - Level IV units have the capabilities of a level III NICU and

are located within institutions that can provide on-site surgical repair of serious congenital or acquired malformations. Level IV units can facilitate transport systems and provide outreach education within their catchment area.

3. The functional capabilities of facilities that provide inpatient care for newborn infants should be classified uniformly and with clear definitions that include requirements for equipment, personnel, facilities, ancillary services, training, and the organization of services (including transport) for the capabilities of each level of care.
4. Population-based data on patient outcomes, including mortality, morbidity, and long-term outcomes, should be obtained to provide level-specific standards for patients requiring various categories of specialized care, including surgery.

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TECHNICAL REPORT

Male Circumcision

abstract

FREE

Male circumcision consists of the surgical removal of some, or all, of the foreskin (or prepuce) from the penis. It is one of the most common procedures in the world. In the United States, the procedure is commonly performed during the newborn period. In 2007, the American Academy of Pediatrics (AAP) convened a multidisciplinary workgroup of AAP members and other stakeholders to evaluate the evidence regarding male circumcision and update the AAP's 1999 recommendations in this area. The Task Force included AAP representatives from specialty areas as well as members of the AAP Board of Directors and liaisons representing the American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, and the Centers for Disease Control and Prevention. The Task Force members identified selected topics relevant to male circumcision and conducted a critical review of peer-reviewed literature by using the American Heart Association's template for evidence evaluation.

Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks; furthermore, the benefits of newborn male circumcision justify access to this procedure for families who choose it. Specific benefits from male circumcision were identified for the prevention of urinary tract infections, acquisition of HIV, transmission of some sexually transmitted infections, and penile cancer. Male circumcision does not appear to adversely affect penile sexual function/sensitivity or sexual satisfaction. It is imperative that those providing circumcision are adequately trained and that both sterile techniques and effective pain management are used. Significant acute complications are rare. In general, untrained providers who perform circumcisions have more complications than well-trained providers who perform the procedure, regardless of whether the former are physicians, nurses, or traditional religious providers.

Parents are entitled to factually correct, nonbiased information about circumcision and should receive this information from clinicians before conception or early in pregnancy, which is when parents typically make circumcision decisions. Parents should determine what is in the best interest of their child. Physicians who counsel families about this decision should provide assistance by explaining the potential benefits and risks and ensuring that parents understand that circumcision is an elective procedure. The Task Force strongly recommends the creation, revision, and enhancement of educational materials to assist parents of male infants with the care of circumcised and uncircumcised penises. The Task Force also strongly recommends the development of educational materials for providers to enhance practitioners' competency in discussing circumcision's benefits and risks with parents.

The Task Force made the following recommendations:

TASK FORCE ON CIRCUMCISION

KEY WORD

circumcision

ABBREVIATIONS

AAFP—American Academy of Family Physicians
AAP—American Academy of Pediatrics
ACOG—American College of Obstetricians and Gynecologists
BV—bacterial vaginosis
CB—caudal block
CDC—Centers for Disease Control and Prevention
CDM—Charge Data Master
CI—confidence interval
DPNB—dorsal penile nerve block
HPV—human papillomavirus
HSV—herpes simplex virus
IELT—Intravaginal Ejaculatory Latency Times
MSM—men who have sex with men
NHDS—National Hospital Discharge Survey
NIS—National Inpatient Sample
OR—odds ratio
RCT—randomized controlled trial
STI—sexually transmitted infection
UTI—urinary tract infection

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- Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks, and the benefits of newborn male circumcision justify access to this procedure for those families who choose it.
- Parents are entitled to factually correct, nonbiased information about circumcision that should be provided before conception and early in pregnancy, when parents are most likely to be weighing the option of circumcision of a male child.
- Physicians counseling families about elective male circumcision should assist parents by explaining, in a nonbiased manner, the potential benefits and risks and by ensuring that they understand the elective nature of the procedure.
- Parents should weigh the health benefits and risks in light of their own religious, cultural, and personal preferences, as the medical benefits alone may not outweigh these other considerations for individual families.
- Parents of newborn boys should be instructed in the care of the penis, regardless of whether the newborn has been circumcised or not.
- Elective circumcision should be performed only if the infant's condition is stable and healthy.
- Male circumcision should be performed by trained and competent practitioners, by using sterile techniques and effective pain management.
- Analgesia is safe and effective in reducing the procedural pain associated with newborn circumcision; thus, adequate analgesia should be provided whenever newborn circumcision is performed.
    - Nonpharmacologic techniques (eg, positioning, sucrose pacifiers) alone are insufficient to prevent procedural and postprocedural pain and are not recommended as the sole method of analgesia. They should be used only as analgesic adjuncts to improve infant comfort during circumcision.
    - If used, topical creams may cause a higher incidence of skin irritation in low birth weight infants, compared with infants of normal weight; penile nerve block techniques should therefore be chosen for this group of newborns.
- Key professional organizations (AAP, the American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, the American Society of Anesthesiologists, the American College of Nurse Midwives, and other midlevel clinicians such as nurse practitioners) should work collaboratively to:
    - Develop standards of trainee proficiency in the performance of anesthetic and procedure techniques, including suturing;
    - Teach the procedure and analgesic techniques during postgraduate training programs;
    - Develop educational materials for clinicians to enhance their own competency in discussing the benefits and risks of circumcision with parents;
    - Offer educational materials to assist parents of male infants with the care of both circumcised and uncircumcised penises.
- The preventive and public health benefits associated with newborn male circumcision warrant third-party reimbursement of the procedure.

The American College of Obstetricians and Gynecologists has endorsed this technical report. *Pediatrics* 2012;130: e756–e785

INTRODUCTION AND BACKGROUND

Statement of the Issue

The American Academy of Pediatrics' (AAP) statement on circumcision of the newborn penis was last issued in May 1999.[1] The *Circumcision Policy Statement* recognized the health benefits of circumcision but did not deem the procedure to be a medical necessity for the well-being of the child. Since that time, substantial contributions have been made to the peer-reviewed literature concerning circumcision of males and its possible benefits. For this reason, in 2007, the AAP formed a Task Force charged with reviewing current evidence on male circumcision and updating the policy on this procedure to provide guidance to AAP membership regarding the circumcision of newborn males.

The American College of Obstetricians and Gynecologists has endorsed this technical report.

Background

Male circumcision consists of the surgical removal of some, or all, of the foreskin (or prepuce) from the penis. It is one of the most common procedures in the world. In the United States, the procedure is most frequently performed during the newborn period. Elective circumcision performed soon after the newborn period is generally a result of deferral because of low birth weight or illness in the newborn. Circumcision after the newborn period is most commonly performed because of the infant's low birth weight or illness precluded newborn circumcision. Other infants are circumcised later in life because of the occurrence of tight phimosis and/or urinary tract infection (UTI).

The 3 most common operative methods of circumcision for the newborn male include: the Gomco clamp, the Plastibell device, and the Mogen clamp (or variations derived from the same

principle on which each of these devices is based). The elements that are common to the use of each of these devices to accomplish circumcision include the following: estimation of the amount of external skin to be removed; dilation of the preputial orifice so that the glans can be visualized to ensure that the glans itself is normal; bluntly freeing the inner preputial epithelium from the epithelium of the glans; placing the device (at times a dorsal slit is necessary to do so); leaving the device in situ long enough to produce hemostasis; and removal of the foreskin.

The extent of this practice in the United States has been estimated by various federally sponsored national surveys, each of which has its strengths and limitations; thus, multiple measures of circumcision prevalence and incidence are presented. There are large population measures of male circumcision in the United States, measuring either the occurrence (ie, incidence) of male circumcision among newborns or the existence of the circumcised state among representative samples of males in the United States at a particular period in time (ie, prevalence). The findings of these studies are qualitatively similar and consistently estimate the rate of male circumcision to range from 42% to 80% among various populations.[2–6]

A recent Centers for Disease Control and Prevention (CDC) study assessed trends in the incidence of in-hospital newborn male circumcision from 1999 to 2010 using 3 independent sources of discharge data on in-patient hospitalizations: the National Center for Health Statistics' National Hospital Discharge Survey (NHDS), the Agency for Healthcare Research and Quality's National Inpatient Sample (NIS), and the SDI Health's Charge Data Master (CDM).[2,3] These sources were used to estimate the incidence of newborn male circumcision in the first month of life. Overall from 1999 to 2010, the CDC's weighted analysis found that the approximate percentage of newborn US males who were circumcised was approximately 59.1% according to the NHDS, 57.8% according to the NIS, and 55.8% according to the CDM. The incidence of newborn male circumcision decreased over time in all 3 data sources: from 62.5% in 1999 to 56.9% in 2008 according to the NHDS; from 63.5% in 1999 to 56.3% in 2008 according to the NIS; and from 58.4% in 2001 to 54.7% in 2010 according to the CDM (Fig 1). A key limitation is that these incidence rates were derived from hospital-based surveys and do not include out-of-hospital circumcisions; thus, these data sources underestimate the actual rate of newborn male circumcision in the first month of life.

NIS

The NIS is a database of 5 to 8 million hospital inpatient stays drawn from states that participate in the Healthcare Cost and Utilization Project (HCUP). In 2008, these states comprised 95% of the US population. The NIS is used to track and analyze national trends in health care utilization, delivery, and outcomes via a 20% stratified sample of 1000 community hospitals. Weights are provided to calculate national estimates.[4]

The NIS indicates that circumcision was performed in 57% of male newborn hospitalizations between 1998 and 2005. NIS data from 1988 to 2008 indicate that the rate of circumcision performed during newborn male delivery hospitalizations increased significantly from 48% in 1988–1991, to 61% in 1997–2000,[5] then declined from 61% to 56% in 2000–2008[6] (Fig 1). Circumcision rates were highest in the Midwestern states (74%), followed by the Northeastern (67%) and Southern states (61%). The lowest circumcision rates were found in the Western states (30%) (Table 1).[3]

NHANES

The NHANES provides a snapshot of the health and nutritional status of the US population aged 14 to 59 years at the time of the survey, by using a probability sample of persons aged 0 to over 60 years. Prevalence of male circumcision is derived from participant self-report and is thus subject to misclassification. From 1999 to 2004, NHANES found that, of the 6174 men surveyed, 79% of men reported being circumcised, including 88% of non-Hispanic white men, 73% of non-Hispanic black men, 42% of Mexican-American men, and 50% of men of other races/ethnicities[6] (Fig 2).

However, prevalence rates are limited by the accuracy of the examiner and/or the self-report.[7,8] These findings underscore the necessity of using a standardized clinical examination for establishing circumcision status for the purpose of research on circumcision. It also highlights the potential difficulty of advising on care of the circumcised and uncircumcised penis when an individual and/or clinician may not know which condition is present.

Ethical Issues

The practice of medicine has long respected an adult's right to self-determination in health care decision-making. This principle has been operationalized through the doctrine of informed consent. The process of informed consent obligates the clinician to explain any procedure or treatment and to enumerate the risks, benefits, and alternatives so the patient can make an informed choice. As a general rule, minors in the United States are not considered competent to provide legally binding consent regarding their health care, and parents

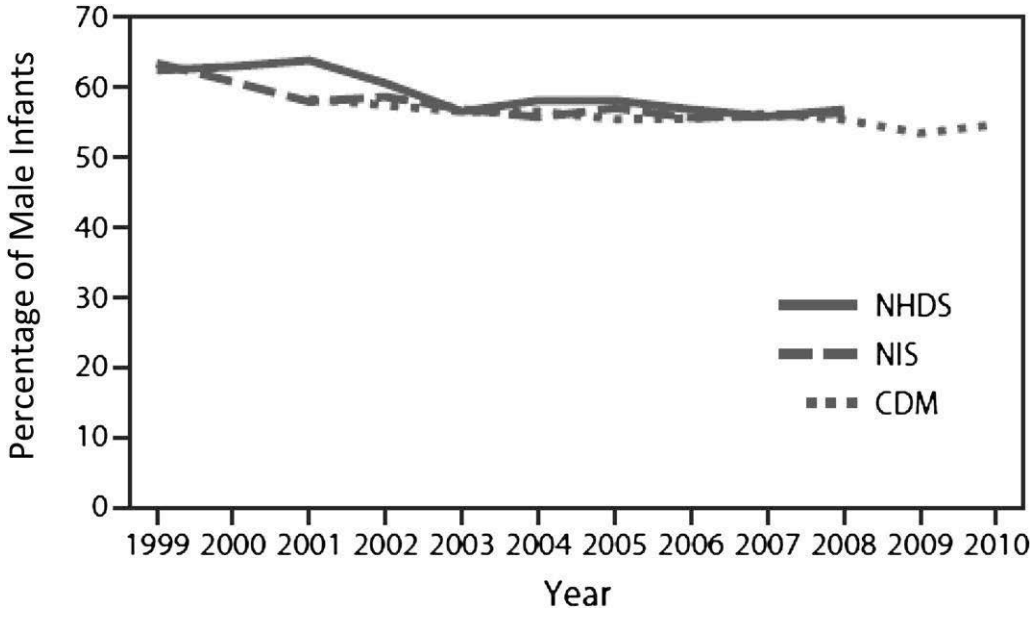

FIGURE 1
Incidence of in-hospital newborn male circumcision, according to data source; United States, 1999–2010.[2,3]

or guardians are empowered to make health care decisions on their behalf.[9] In most situations, parents are granted wide latitude in terms of the decisions they make on behalf of their children, and the law has respected those decisions except where they are clearly contrary to the best interests of the child or place the child's health, well-being, or life at significant risk of serious harm.[10]

Parents and physicians each have an ethical duty to the child to attempt to secure the child's best interest and well-being.[11] Reasonable people may disagree, however, as to what is in the best interest of any individual patient or how the potential medical benefits and potential medical harms of circumcision should be weighed against each other. This situation is further complicated by the fact that there are social, cultural, religious, and familial benefits and harms to be considered as well.[12] It is reasonable to take these nonmedical benefits and harms for an individual into consideration when making a decision about circumcision.[13]

TABLE 1 Multivariate Cox Proportional Hazards Regression of Selected Factors Associated With Circumcision Among Male Newborn Delivery Hospitalizations, United States, 1998–2005[2]

Characteristic	Weighted % of Male Infant Circumcisions	Adjusted Prevalence Rate Ratios (95% CI)
Hospital region		
Midwest	74	3.53 (3.23–3.87)
Northeast	67	2.90 (2.64–3.18)
South	61	2.80 (2.56–3.07)
West	30	1.00
Payer		
Private	67	1.76 (1.70–1.82)
Public	45	1.00
Hospital location		
Urban	66	1.29 (1.24–1.34)
Rural	56	1.00
Newborn health status		
Term, healthy	61	1.22 (1.20–1.23)
Not term, healthy	54	1.00

In cases such as the decision to perform a circumcision in the newborn period (where there is reasonable disagreement about the balance between medical benefits and harms, where there are nonmedical benefits and harms that can result from a decision on whether to perform the procedure, and where the procedure is not essential to the child's immediate well-being), the parents should determine what is in the best interest of the child. In the pluralistic society of the United States, where parents are afforded wide authority for determining what constitutes appropriate child-rearing and child welfare, it is legitimate for the parents to take into account their own cultural, religious, and ethnic traditions, in addition to medical factors, when making this choice.[11]

Physicians who counsel families about this decision should assist parents by objectively explaining the potential benefits and risks of circumcising their infant.[10] Because some families may opt to circumcise as part of religious or traditional practice, discussion should also encompass risks and benefits of

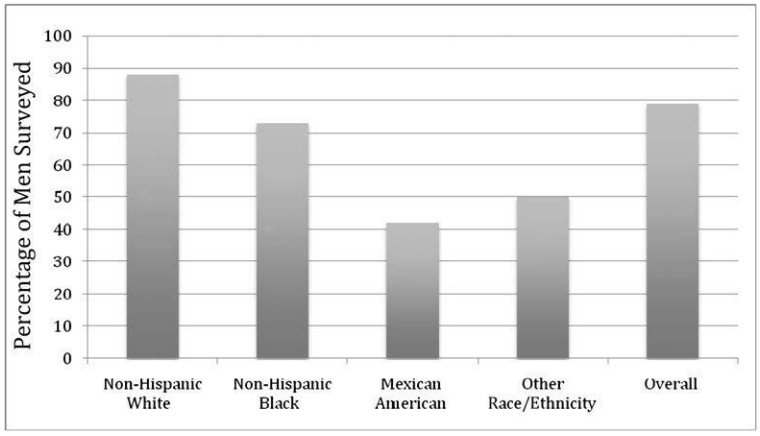

FIGURE 2
Prevalence of male circumcision, according to self-report; United States, 1999–2004.[5]

having a medical professional perform this procedure in a clinical setting versus having it performed by a traditional/religious provider in a nonmedical environment.

Parents may wish to consider whether the benefits of the procedure can be attained in equal measure if the procedure is delayed until the child is of sufficient age to provide his own informed consent. These interests include the medical benefits; the cultural and religious implications of being circumcised; and the fact that the procedure has the least surgical risk and the greatest accumulated health benefits if performed during the newborn period. Newborn males who are not circumcised at birth are much less likely to elect circumcision in adolescence or early adulthood. Parents who are considering deferring circumcision should be explicitly informed that circumcision performed later in life has increased risks and costs. Furthermore, deferral of the procedure also requires longer healing time than if performed during the newborn period and requires sexual abstinence during healing. Those who are already sexually active by the time they have the procedure lose some opportunities for the protective benefit against sexually transmitted infection (STI) acquisition, including HIV; moreover, there is the risk of acquiring an STI if the individual is sexually active during the healing process. (See the section entitled Sexually Transmitted Diseases, Including HIV.)

Finally, there is a moral obligation to take reasonable steps to reduce the risk of harm associated with the performance of any surgical intervention. These include ensuring that the providers who perform circumcision have adequate training and demonstrate competence in performing the procedure; the provision of adequate procedural analgesia and postprocedural pain control; and that the risks of infection are minimized through appropriate infection control measures, such as a sterile environment and sterilized instruments.[14] The Task Force advises against the practice of mouth-to-penis contact during circumcision, which is part of some religious practices, because it poses serious infectious risk to the child.

TASK FORCE ON MALE CIRCUMCISION

Committee Membership and Research Questions

In December 2007, the AAP formed a multidisciplinary workgroup of AAP members and other stakeholders to evaluate the evidence on male circumcision and update the AAP's recommendations in this area. The Task Force included AAP representatives from specialty areas, including anesthesiology/pain management, bioethics, child health care financing, epidemiology, fetus and newborn medicine, infectious diseases (including pediatric AIDS), and urology. The Task Force also included members of the AAP Board of Directors and liaisons representing the American Academy of Family Physicians (AAFP), the American College of Obstetricians and Gynecologists (ACOG), and the CDC. The Task Force's evidence review was supplemented by an independent, AAP-contracted, physician and doctoral-level epidemiologist who was also part of the entire evidence review process.

Literature Search Overview

The Task Force members identified the following topics and questions as relevant to male circumcision and to be addressed through a critical review of the peer-reviewed literature:

- What is the current epidemiology of male circumcision in the United States?
- What are the most common procedures and techniques for newborn male circumcision?
- What best supports the parental decision-making process regarding circumcision?
- What is the association between male circumcision and both morbidity and sexual function/satisfaction?
- What is the impact of anesthesia and analgesia?
- What are the common complications and the complication rates associated with male circumcision?
- What workforce issues affect newborn male circumcision?

- What are the trends in financing and payment for elective circumcision?

The group agreed on parameters for reviewing the literature on associations between male circumcision and other outcomes. The literature review comprised analytic studies (including meta-analyses) in the topic areas in English-language, peer-reviewed, scientific literature. The Task Force evaluated studies that addressed the identified clinical questions, including all meta-analyses; all randomized controlled trials; and all case-control, prospective and retrospective cohort, and cross-sectional studies based on the American Heart Association's template for evidence evaluation (see the following section). Case reports, case series, ecological studies, reviews, and opinions were excluded from the review. Although case reports and case series are important for generating hypotheses, the Task Force limited itself to reviewing analytic studies. The Task Force compiled and vetted Medical Subject Headings, which are defined by the National Library of Medicine.

Searches were conducted in Medline, Cochrane Database, and Embase for the period 1995 through 2010. The literature search produced 1388 abstracts that were reviewed by both the epidemiologist and the Task Force chair, and those citations meeting the established criteria were included; ultimately, 1014 articles were included in the review (Table 2). A second search was conducted in April 2010, which yielded 42 additional citations, of which 17 were included. All 1031 accepted articles were reviewed by the contracted physician epidemiologist and at least 1 Task Force member; any differences were resolved by consensus. In 2011, individual Task Force members also identified other key articles that appeared in the peer-reviewed literature; these articles were consulted in the preparation of the current report and cited accordingly. These additional articles did not affect the findings of the Task Force. Areas in which there were no analytic studies available for the time period of interest are noted as such within this document.

Evidence Quality and Use in Forming Recommendations

Articles were reviewed by using the American Heart Association's template for evidence evaluation.[15] The articles were also assigned a level of evidence (Table 3) based on the methodology used. Among those with evidence levels 1 through 4, the reviewers assessed the quality of the evidence as "excellent," "good," "fair," or "poor" depending on how well the methodology was applied. Articles with an evidence level of 5 or higher were not included in this review. A critical assessment was made of each article/source in terms of the research design and methods, by using the American Heart Association's template (Table 4).

RESULTS

As a result of these findings, the Task Force made the following recommendations, which are described further in the following text:

- Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks, and the benefits of newborn male circumcision justify access to this procedure for those families who choose it.
- Parents are entitled to factually correct, nonbiased information about circumcision that should be provided before conception and early in pregnancy, when parents are most likely to be weighing the option of circumcision of a male child.
- Physicians counseling families about elective male circumcision should assist parents by explaining, in a nonbiased manner, the potential benefits and risks, and by ensuring that they understand the elective nature of the procedure.
- Parents should weigh the health benefits and risks in light of their own religious, cultural, and personal preferences, as the medical benefits alone may not outweigh these other considerations for individual families.
- Parents of newborn boys should be instructed in the care of the penis at the time of discharge from the newborn hospital stay, regardless of whether the newborn has been circumcised or not.
- Elective circumcision should be performed only if the infant's condition is stable and healthy.
- Male circumcision should be performed by trained and competent practitioners, by using sterile techniques and effective pain management.
- Analgesia is safe and effective in reducing the procedural pain associated with newborn circumcision; thus, adequate analgesia should be provided whenever newborn circumcision is performed.
    - Nonpharmacologic techniques (eg, positioning, sucrose pacifiers) alone are insufficient to prevent procedural and postprocedural pain and are not recommended as the sole method of analgesia. They should be used only as analgesic adjuncts to improve infant comfort during circumcision.
    - If used, topical creams may cause a higher incidence of skin irritation in low birth weight infants, compared with infants of normal weight; penile nerve block techniques should therefore be chosen for this group of newborns.

TABLE 2 Results from Medline, Cochrane Database, and Embase Search for 1995–2010

Clinical Topic Area[a]	No. of Articles Included
HIV/STI	231
Procedure and complications	219
UTI	53
Pain management	159
Penile dermatoses	107
Penile hygiene	76
Phimosis	64
Parental decision-making	60
Carcinoma (penile)	58
Carcinoma (cervical)	3
Sexual satisfaction	1

[a] Does not include nonclinical areas such as ethics and financing.

- Key professional organizations (AAP, AAFP, ACOG, the American Society of Anesthesiologists, the American College of Nurse Midwives, and other midlevel clinicians such as nurse practitioners) should work collaboratively to:
  - Develop standards of trainee proficiency in the performance of anesthetic and procedure techniques, including suturing;
  - Teach the procedure and analgesic techniques during postgraduate training programs;
  - Develop educational materials for clinicians to enhance practitioners' competency in discussing the benefits and risks of circumcision with parents;
  - Offer educational materials to assist parents of male infants with the care of both circumcised and uncircumcised penises.
- The preventive and public health benefits associated with newborn male circumcision warrant third-party reimbursement of the procedure.

TABLE 3 Evidence Levels

Level	Definition
1	RCTs or meta-analyses of multiple clinical trials with substantial treatment effects
2	RCTs with smaller or less significant treatment effects
3	Prospective, controlled, nonrandomized, cohort studies
4	Historic, nonrandomized, cohort or case-control studies
5	Case series: patients compiled in serial fashion, lacking a control group (excluded from review)
6	Animal studies or mechanical model studies (excluded from review)
7	Extrapolations from existing data collected for other purposes, theoretical analyses (excluded from review)
8	Rational conjecture (common sense); common practices accepted before evidence-based guidelines (excluded from review)

Parental Decision-Making

- Task Force Recommendations:
  - Parents are entitled to factually correct, nonbiased information about circumcision that should be provided before conception and early in pregnancy, when parents are most likely to be weighing the option of circumcision of a male child.
  - Physicians counseling families about elective male circumcision should assist parents by explaining, in a nonbiased manner, the potential benefits and risks, and by ensuring that they understand the elective nature of the procedure.
  - Parents should weigh the health benefits and risks in light of their own religious, cultural, and personal preferences, as the medical benefits alone may not outweigh these other considerations for individual families.

The decision of whether to circumcise a male newborn is frequently made early in the pregnancy and even before conception.[16–18] In a cross-sectional study of parents of 55 male infants presenting to a family practice clinic for a well-child visit, 80% of parents reported that the circumcision decision was made before a discussion occurred with the clinician about this issue. Only 4% of parents reportedly discussed circumcision with their clinician before the pregnancy.[16] This finding is substantiated by the 2009 AAP survey of 1620 members with a response rate of 57%, in which most respondents reported that parents of newborn male patients generally do not seek their pediatrician's recommendation regarding circumcision; only 5% reported that "all" or "most" parents "are uncertain about circumcision and seek their recommendation" about the procedure.[19] There is fair evidence that parental decisions about circumcision are shaped more by family and sociocultural influences than by discussion with medical clinicians or by parental education.[16,20]

In 4 cross-sectional studies with fair evidence, US parents most often reported that they chose to have their newborn son circumcised for health/medical benefits, including hygiene and cleanliness of the penis (reported by 39.6%, 46%, 53%, and 67%, respectively).[16,17,21,22] Social concerns (such as having a father or brother who was circumcised) were also an important reason given for newborn male circumcision (22.8%, 23.5%, 28%, and 37%). Religious requirements for circumcision, such as those of the Jewish and Islamic faiths, were ranked less highly in importance (11%, 12.1%, 13%, and 19%). Although one of these studies was small and included only 55 patients drawn from a homogeneous population,[16] the findings coincide with the 3 larger and more diverse studies.

For parents to receive nonbiased information about male circumcision in time to inform their decisions, clinicians need to provide this information at least before conception and/or early in the pregnancy, probably as a

TABLE 4 Assessment of Research Design and Methods

Component of Study and Rating	Excellent	Good	Fair	Poor	Unsatisfactory
Design and Methods	Highly appropriate sample or model, randomized, proper controls AND outstanding accuracy, precision, and data collection in its class	Highly appropriate sample or model, randomized, proper controls OR outstanding accuracy, precision, and data collection in its class	Adequate design but possibly biased OR adequate under the circumstances	Small or clearly biased population or model OR weakly defensible in its class, limited data or measures	Anecdotal, no controls, off target end points OR not defensible in its class, insufficient data or measures

curriculum item in childbirth classes. Information to assist in parental decision-making should be made available as early as possible. For this reason, obstetrician-gynecologists and family physicians who manage prenatal care probably have a more pivotal role in this decision than do pediatricians. *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*, Third Edition, supports prenatal pediatric visits, at which time pediatricians can provide counseling about male circumcision (http://brightfutures.aap.org). Medical benefits and risks need to be presented accurately and in a nonbiased fashion so families can make a decision in light of their own cultural, religious, and personal preferences.

There is fair evidence that there are financial barriers to the circumcision decision in the United States; when the procedure is not covered by insurance, parents are less likely to choose to have their child circumcised.[21] This finding does not seem to be true in Canada, where the prevalence of circumcision did not change after circumcision for ritual, religious, cultural, or cosmetic reasons was delisted from insurance benefits in 1994.[17,23]

Care of the Circumcised Versus Uncircumcised Penis

- Task Force Recommendations:
  - Parents of newborn boys should be instructed in the care of the penis at the time of discharge from the newborn hospital stay, regardless of whether the newborn has been circumcised or not.

This review found no systematic studies in infants and children on the care of the uncircumcised versus circumcised penis.

Parents of newborn boys should be instructed in the care of the penis at the time of discharge from the newborn hospital stay, regardless of whether they choose circumcision or not. The circumcised penis should be washed gently without any aggressive pulling back of the skin.[24] The noncircumcised penis should be washed with soap and water. Most adhesions present at birth spontaneously resolve by age 2 to 4 months, and the foreskin should not be forcibly retracted. When these adhesions disappear physiologically (which occurs at an individual pace), the foreskin can be easily retracted, and the whole penis washed with soap and water.[25]

Circumcision reduces the bacteria that accumulate under the prepuce which can cause UTIs and, in the adult male, can be a reservoir for bacteria that cause STIs. In an internally controlled study with fair evidence, researchers cultured the periurethral and glandular sulcus of 50 children aged 1 to 12 weeks before and 4 weeks after circumcision and found the pathogenic bacteria largely disappeared after circumcision (33 children had pathogenic bacteria before circumcision and 4 had pathogenic bacteria after circumcision).[26]

In adults and children, there is fair evidence that periurethral flora contains fewer pathogens after circumcision than before circumcision.[26,27] Because these studies looked at cultures 1 time (4 weeks after the circumcision), the long-term significance of the findings is unclear.

Penile wetness (defined as the observation of a diffuse homogeneous film of moisture on the surface of the glans and coronal sulcus) is considered a marker for poor penile hygiene and is more prevalent in uncircumcised than in circumcised men.[28] Penile wetness has been associated with HIV infection in 1 cross-sectional study, although the temporal relationship is unclear and the evidence level is fair.[29] A related study with fair evidence assessed the frequency of washing the whole penis (including retracting the foreskin for uncircumcised men) and found that not always washing the whole penis was approximately 10 times more common in uncircumcised than in circumcised men.[30] The relationship between penile wetness and thorough washing of the penis is unclear and, because the studies were conducted in STI clinics, the findings may not be generalizable to the population at large.

Male Circumcision and Diseases, Morbidities, and Sexual Function/ Satisfaction

STIs, Including HIV

- Task Force Recommendation:
  - Evaluation of the current evidence indicates that the health benefits of newborn male circumcision outweigh the risks, and the benefits of newborn male circumcision justify access to this procedure for those families who choose it.

The most notable research contributions to the literature since 1995 are studies of male circumcision and the acquisition of HIV and the transmission of other STIs. Review of the literature revealed a consistently reported protective effect of 40% to 60% for male circumcision in reducing the risk of HIV acquisition among heterosexual males in areas with high HIV prevalence due to heterosexual transmission (ie, Africa).

There is also good evidence from randomized controlled trials that male circumcision is associated with a lower prevalence of human papillomavirus (HPV) infection[31,32] and herpes simplex virus type 2 (HSV-2) transmission,[31,33] as well as a decreased likelihood of bacterial vaginosis (BV) in female partners.[80] The evidence for male circumcision being protective against syphilis is less strong,[65–68] however, and male circumcision was not found to be associated with decreased risk of gonorrhea[84,85,91–93] or chlamydia.[84–89]

It is biologically plausible that the circumcised state may confer protection against STIs (including HIV). Possible mechanisms for the protective effect of circumcision include the fact that the foreskin's thin inner surface is susceptible to microtears and abrasions (especially during sexual activity), which provides a port of entry for pathogens. The foreskin also contains a high density of HIV target cells (ie, Langerhans cells, CD4 T cells, macrophages), which facilitates HIV infection of host cells. The preputial space provides an environment that is thought to "trap" pathogens and bodily secretions and favor their survival and replication.[26,27,34] The circumcised male has no foreskin and may likely provide a less welcoming environment for such substances. In addition, STI-containing secretions have increased contact time in the prospective uncircumcised male host, which may increase the likelihood of transmission and infection. The exposed surfaces of the uncircumcised penis do not offer the same physical barrier to resist infection that the highly keratinized surface of a circumcised penis does. Finally, the higher rates of sexually transmitted genital ulcerative disease (eg, HSV-2) observed in uncircumcised men may also increase susceptibility to HIV infection, as the presence of genital ulcers, irrespective of circumcision status, increases the likelihood of HIV acquisition.[35–37]

HIV

The CDC estimates that 1.2 million people in the United States are living with HIV, the virus that causes AIDS, which is incurable. Approximately 50 000 Americans are newly infected with HIV each year; more than 619 000 people in the United States have died of AIDS since the epidemic began.[38] In the United States, HIV/AIDS predominantly affects men who have sex with men (MSM), who account for almost two-thirds (61%) of all new infections. Heterosexual exposure accounts for 27% of new HIV infections, and injection drug use accounts for 9% of new HIV cases. In other parts of the world (eg, Africa), heterosexual transmission is far more common.[39]

Fourteen studies provide fair evidence that circumcision is protective against heterosexually acquired HIV infection in men.[40–53] One study with fair evidence found that male circumcision before puberty (specifically before 12 years of age) is more protective than circumcision occurring at a later age.[50] Three large randomized controlled trials provide good evidence of such protection.[54–56] A cross-sectional study with fair evidence is neutral regarding the relationship between circumcision and HIV infection.[57] Two other studies with a cross-sectional design provide fair evidence that circumcision increases the risk of HIV infection, although one of these studies highlights the HIV risks associated with circumcision performed outside the hospital setting and without sterile equipment and medically trained personnel.[58,59]

A recently published study from the CDC provides good evidence that, in the United States, male circumcision before the age of sexual debut would reduce HIV acquisition among heterosexual males.[60] Although individual sexual practices are difficult to predict in the newborn period, the majority of US males are heterosexual and could benefit from male circumcision. Mathematical modeling by the CDC shows that, taking an average efficacy of 60% from the African trials, and assuming the protective effect of circumcision applies only to heterosexually acquired HIV, there would be a 15.7% reduction in lifetime HIV risk for all males. This is taking into account the proportion of HIV that is acquired through heterosexual sex and reducing that by 60%. The percent reduction in HIV cases was determined by assessing the proportion of new cases of HIV infection that could be prevented by analyzing which infections would be presumed to occur in uncircumcised males and what the reduction would be if those who would not already be circumcised

would be circumcised. The proportions of transmissions prevented are lower than in Africa because a higher proportion of US HIV transmission occurs between MSM. In addition, a portion of the population would be circumcised without any policy change, and the prevented cases would only occur in the additional circumcised males. This ranges from an estimated 8% reduction in non-Hispanic white males to an estimated 21% reduction among non-Hispanic black males. The CDC study suggests that newborn circumcision performed in the United States to prevent HIV infection is cost-effective without consideration of other health benefits. The CDC recommendations state that all parents of newborn males should be given the choice of circumcision.

Specific HIV Risk Populations

MSM

The association of circumcision and the decreased likelihood of HIV acquisition applies to heterosexual males. Circumcision seems to be less likely to protect MSM, however, and has not been associated with decreased acquisition of HIV among MSM.[61] There is fair evidence from 1 study that there is a protective effect of circumcision from HIV infection in MSM; however, this study used self-report to establish circumcision status.[62] One study with fair evidence is neutral regarding the relationship between circumcision and HIV infection in MSM.[61] It is probable that the differences found in the level of protection (or lack of protection) by studies of MSM are confounded by the fact that MSM commonly perform both receptive and insertive sex. It is not known to what extent circumcision may be protective against HIV transmission for MSM who practice insertive sex versus for those who engage in receptive sex.

Heterosexual Women

Women account for 23% of new HIV infections in the United States; HIV infection in women is primarily attributed either to heterosexual contact or injection drug use.[38] Two prospective cohort studies with fair evidence looked at the relationship between a woman's risk of HIV infection and whether her primary male partner is circumcised. The first study describes a protective effect but had considerable loss-to-follow-up and possible misclassification of the partners' circumcision status.[63] The other study showed nonsignificant protection in the high-risk group (ie, women who were more likely to have ever engaged in sex work; to have reported 2 or more partners in the last 3 months; and/or to have had a higher median lifetime number of sex partners) but neither protection nor increased risk in the study population as a whole.[64] A meta-analysis with good evidence of data from 1 randomized controlled trial (RCT) and 6 longitudinal analyses found little evidence that male circumcision directly reduces their female partner's risk of acquiring HIV (summary relative risk: 0.8 [95% confidence interval (CI): 0.53–1.36]); however, male circumcision's protective effect did not reach a level of statistical significance.[65] One Ugandan RCT study with good evidence found that, at 24 months, the risk of HIV infection among women whose male partners were circumcised was 21.7% compared with 13.4% for female partners of uncircumcised men.[66]

Ulcerative STIs

Genital ulcers are notable both because of the morbidity and mortality associated with the causative organism and because the presence of the ulcer itself facilitates the transmission of HIV.

Syphilis

From 2009 to 2010, there were 13 604 cases of early latent syphilis reported to the CDC and 18 079 cases of late and late latent syphilis. The rate of primary and secondary syphilis in 2010 was 4.5 cases per 100 000 individuals, 2.2% lower than the 2009 rate. "The total number of cases of syphilis (primary and secondary, early latent, late, late latent, and congenital) reported to CDC increased 2.2% (from 44,830 to 45,834 cases) during 2009–2010."[67] A large percentage of syphilis cases occur in MSM; in 2010, 67% of the reported primary and secondary syphilis cases were among MSM.[67]

The balance of evidence suggests that male circumcision is protective against syphilis.[68–70] One meta-analysis with good evidence describes a protective effect (relative risk: 0.67 [95% CI: 0.54–0.83]), but there is considerable heterogeneity among the studies included.[68] An additional cohort study with fair evidence found that circumcised men were significantly less likely to have active syphilis at the point of study recruitment; when the men were followed up prospectively for 2 years, a protective effect was also observed but was nonsignificant.[69] Good evidence from a large RCT reported no reduction or trend toward reduction for male circumcision and the incidence of syphilis[71]; however, the extent to which protection might be afforded, and among which specific populations, is difficult to determine.

Genital Herpes

Genital herpes is an STI commonly manifested by recurrent genital ulcers caused by HSV-1 or HSV-2. HSV may not be clinically evident despite infection. Approximately 16.2% of US individuals aged 14 to 49 years have HSV-2.[31,72] Case reporting data for genital HSV are not available, but 2005–2008 NHANES data indicate that the percentage of NHANES participants aged 20 to 49 years who reported having

been diagnosed with genital herpes at some point was 18.9%.[72]

One meta-analysis with good evidence found some protective effect of circumcision against HSV-2 of borderline statistical significance.[68] Good evidence of the protective effect of male circumcision is available from two of the large randomized controlled trials in Africa. In the South African study, the incidence of HSV-2 was 34% lower in circumcised men.[73] In the Uganda study, the risk of HSV-2 infection (adjusted for other factors) was 28% lower in circumcised men.[71] There is fair evidence from 1 study that male circumcision protects female partners against HSV-2 infection.[33] Two studies with fair evidence found that there is no effect of circumcision on the risk of HSV-2 acquisition.[6,74]

Chancroid

Chancroid is a bacterial disease spread through sexual contact. It is rare in the United States, with a total of 24 cases reported in 2010 (a rate of 0.08 case per 100 000 individuals).[75]

The literature search produced no individual studies since 1995 exploring the relationship between male circumcision and chancroid. One meta-analysis with good evidence found that 6 of 7 older studies (85%) described circumcision as having a protective effect against chancroid. This meta-analysis did not provide a summary value for the relationship due to differences in the definition and ascertainment of outcomes and variability among the comparison groups.[68] One methodologically poor meta-analysis found no effect of male circumcision on chancroid.[76]

Lymphogranuloma Venereum and Granuloma Inguinale (Donovanosis)

The CDC reports that the frequency of lymphogranuloma venereum infection is thought to be rare in industrialized countries, although its identification is not always obvious; the number of cases of this infection in the United States is unknown.[77] Granuloma inguinale is a genital ulcerative disease that is rare in the United States but endemic in some tropical and developing areas. The lesions might develop secondary bacterial infection or can coexist with other sexually transmitted pathogens.

The literature search produced no studies since 1995 exploring the relationship between male circumcision and lymphogranuloma venereum or granuloma inguinale. One meta-analysis provided fair evidence that genital ulcerative disease was more common in uncircumcised men but not to a statistically significant degree.[78] One cross-sectional study with fair evidence found that male circumcision was protective against genital ulcers, but the findings were based on respondents self-reporting a history of genital ulcerative disease and may not be accurate.[79]

Nonulcerative STIs

Nonulcerative STIs generally cause inflammation and scarring along the reproductive tract. Untreated infection can cause cancer, can interfere with reproduction, and can negatively impact newborn health. Additionally, these infections can facilitate the transmission of HIV.

BV

BV is a condition "in women where the normal balance of bacteria in the vagina is disrupted and replaced by an overgrowth of certain bacteria."[80] BV is common among pregnant women; an estimated 1 080 000 pregnant women have BV annually.

There is good evidence from 1 large randomized controlled trial that male circumcision is protective against BV in female partners.[81] A small prospective cohort study with good evidence also found that male circumcision, among other factors, was protective against BV in female partners.[82] A cross-sectional study with fair evidence found no effect but may have lacked the power to detect an effect.[83]

Chlamydia

Chlamydia is the most commonly reported notifiable disease in the United States and the most common STI reported to the CDC, with 1 307 893 chlamydial infections (426.0 cases per 100 000 individuals) reported to the CDC in 2010.[84]

The balance of evidence does not reveal any relationship between circumcision and chlamydia infection.[85–87] The 1 prospective cohort study with fair evidence showed a protective effect, but the study had a composite end point with several STIs combined and used self-report of STI as the outcome (increasing the possibility of misclassification).[88] Two studies with fair evidence explored the effect of male circumcision on chlamydia infection in female partners. The first, a prospective cohort study, found a nonsignificant increased risk in the female partners of circumcised men.[89] The second, a cross-sectional study, found a significantly decreased risk of chlamydia infection among women with circumcised male sexual partners, but a possible selection bias may have affected results because only 51.8% of subjects had specimens for analysis.[90]

Gonorrhea

Gonorrhea is the second most commonly reported STI in the United States, with 309 341 cases reported to the CDC (a rate of 100.8 cases per 100 000 individuals) in 2010.[91]

The evidence does not demonstrate any relationship between circumcision and gonorrheal infection.[85,86,92–94] The

studies that show a protective effect are either barely significant or have poorly defined or self-reported outcomes, thus offering only a fair level of evidence.[79,88]

HPV

HPV is among the most commonly occurring STIs in the United States and can lead to the development of cancers, including cervical cancer. The population-based data from NHANES 2003–2006 indicate that the overall prevalence of high- and low-oncogenic risk HPV types was 42.5% among US women aged 14 to 59 years. The prevalence of infection was lower for the 2 viral types with the highest risk of causing cancer, however, at 4.7% for HPV type 16 and 1.9% for HPV type 18.[95]

There is good evidence that male circumcision is protective against all types of HPV infection (nononcogenic and oncogenic). Two prevalence studies with good evidence found a 30% to 40% reduction in risk of infection among circumcised men.[96,97] These studies fail to provide information on the risk of acquiring HPV and may reflect persistence of HPV rather than acquisition of infection. Four studies provide fair evidence that male circumcision protects against HPV.[98–101] The selection of anatomic sites sampled may influence the results.[98]

Good evidence of the protective effect of male circumcision against HPV is available from two of the large randomized controlled trials in Africa. In the South African study, the prevalence of high-risk HPV was 32% lower in circumcised men.[102] In the Uganda study, the risk of oncogenic HPV infection (adjusted for other factors) was 35% lower in circumcised men.[71]

There is also good evidence that male circumcision reduces the risk of male-to-female transmission of high-risk HPV from HIV-uninfected men. In the Uganda randomized controlled trial, the prevalence of high-risk HPV infection was 28% lower in female partners of circumcised HIV-uninfected men, while the incidence was 23% lower.[32] Good evidence from another Uganda randomized controlled trial of male circumcision in HIV-infected men indicates that a circumcision did not reduce the risk of male-to-female transmission of high-risk HPV from HIV-infected men.[103]

Male Circumcision and UTIs

According to the CDC, "A urinary tract infection (UTI) is an infection involving any part of the urinary system, including urethra, bladder, ureters, and kidney."[104] UTIs are the most common type of health care–associated infection reported to the National Healthcare Safety Network among US individuals. The majority of UTIs in males occur during the first year of life. In children, UTIs usually necessitate a physician visit and may involve the possibility of an invasive procedure and hospitalization.

Most available data were published before 1995 and consistently show an association between the lack of circumcision and increased risk of UTI. Studies published since 1995 have similar findings. There is good evidence from 2 well-conducted meta-analyses[105,106] and a cohort study[107] that UTI incidence among boys under age 2 years is reduced in those who were circumcised compared with uncircumcised boys. The data from randomized controlled trials are limited. However, there are large cohort and case-controlled studies with similar findings. Given that the risk of UTI among this population is approximately 1%, the number needed to circumcise to prevent UTI is approximately 100. The benefits of male circumcision are, therefore, likely to be greater in boys at higher risk of UTI, such as male infants with underlying anatomic defects such as reflux or recurrent UTIs.

There is fair evidence from 5 observational studies that UTI incidence among boys under age 2 years is reduced in circumcised infant boys, compared with uncircumcised boys under the age of 2.[108–112] The degree of reduction is between threefold and 10-fold in all studies.

There is fair evidence from a prospective study that there is a decreased prevalence of uropathogens in the periurethral area 3 weeks after circumcision, compared with similar cultures taken at the time of circumcision.[113] By using these rates and the increased risks suggested from the literature, it is estimated that 7 to 14 of 1000 uncircumcised male infants will develop a UTI during the first year of life, compared with 1 to 2 infants among 1000 circumcised male infants.

There is a biologically plausible explanation for the relationship between an intact foreskin and an increased association of UTI during infancy. Increased periurethral bacterial colonization may be a risk factor for UTI.[114] During the first 6 months of life, there are more uropathogenic organisms around the urethral meatus of uncircumcised male infants than around those of circumcised male infants (this colonization decreases in both groups after the first 6 months).[115] In addition, an experimental preparation found that uropathogenic bacteria adhered to, and readily colonized, the mucosal surface of the foreskin but did not adhere to the keratinized skin surface of the foreskin.[116]

Cancer

Penile Cancer

Penile cancer is rare, and rates seem to be declining. In the United States, Surveillance, Epidemiology, and End

Results data indicate that the incidence of primary, malignant penile cancer was 0.58 case per 100 000 individuals for 1993 to 2002, a decline from 0.84 case per 100 000 individuals from 1973 to 1982.[117] An analysis of the Danish Cancer Registry found that the incidence of epidermoid cancer of the penis (excluding scrotal, epididymal, and nonepidermoid) declined from a rate of 1.15 cases per 100 000 individuals from 1943 to 1947 to 0.82 case per 100 000 individuals in 1988 to 1990.[118]

Thus, declines have been noted in nations with both low and high circumcision rates (Denmark and the United States, respectively). Declines are not explained by changing patterns in circumcision utilization; it is thought that socioeconomic and economic development factors (including effects on hygiene habits) may have an important role.

The literature review yielded 2 case-control studies; although the studies were well designed, the evidence level for case-control studies is only deemed to be fair.[119,120] These studies show an association between circumcision and a decreased likelihood of invasive penile cancer. For all men with penile cancer (carcinoma in situ and squamous cell carcinoma), the absence of circumcision confers an increased risk with an odds ratio (OR) of 1.5, although this finding was not significant (P = .07), with a CI of 1.1–2.2.[119] An OR indicates the odds of an event happening in 1 group divided by the odds of an event happening in another group. An OR of 1 thus means that there is an equal chance for the event to occur in each group. When separated into squamous cell carcinoma and carcinoma in situ, the absence of circumcision was a risk factor for invasive squamous cell carcinoma (OR: 2.3 [CI: 1.3–4.1]) but not for carcinoma in situ (OR: 1.1 [CI not provided]).

Phimosis is a condition in which the foreskin cannot be fully retracted from the penis. A history of phimosis alone confers a significantly elevated risk of invasive cancer (OR: 11.4). In fact, in men with an intact prepuce and no phimosis, there is a decreased risk of invasive penile cancer (OR: 0.5). When excluding phimosis, the risk disappears, which suggests that the benefit of circumcision is conferred by reducing the risk of phimosis and that the phimosis is responsible for the increased risk. Other forms of penile injury or irritation likewise can pose a significant risk factor for cancer. There is accumulating evidence that circumcised men have a lower prevalence of oncogenic (high-risk) and nononcogenic (low-risk) HPV when compared with uncircumcised men, and this may be another means by which circumcision has a protective effect against invasive penile cancer (as discussed in the earlier STI section).

It is difficult to establish how many male circumcisions it would take to prevent a case of penile cancer, and at what cost economically and physically. One study with good evidence estimates that based on having to do 909 circumcisions to prevent 1 penile cancer event, 2 complications would be expected for every penile cancer event avoided.[121] However, another study with fair evidence estimates that more than 322 000 newborn circumcisions are required to prevent 1 penile cancer event per year.[122] This would translate into 644 complications per cancer event, by using the most favorable rate of complications, including rare but significant complications.[123] The clinical value of the modest risk reduction from circumcision for a rare cancer is difficult to measure against the potential for complications from the procedure. In addition, these findings are likely to decrease with increasing rates of HPV vaccination in the United States.

Cervical Cancer

Up to 12 000 new cases of cervical cancer are diagnosed in the United States annually. Cervical cancer is a leading cause of death for women in developing countries; more than 80% of all cervical cancer deaths occur in developing countries.[124] Persistent HPV infection with high-risk (ie, oncogenic) types (HPV types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 73, and 82) is the main prerequisite to developing cervical squamous carcinoma.

The association of cervical cancer, penile HPV infection, and circumcision was studied in an article of fair quality that found a protective effect of male circumcision against cervical cancer in the female partner(s) of men who have multiple female partners.[100] There was a lower incidence of HPV detection in circumcised men compared with uncircumcised men (5.5% and 19.6%, respectively). The OR for men who self-reported having been circumcised and who had penile HPV was 0.37 (95% CI: 0.16–0.85). In women whose partner had more than 6 lifetime sexual partners, male circumcision lowered her odds of cervical cancer significantly (OR: 0.42). The overall rate of cervical cancer for women who currently had circumcised male partners was not significantly decreased. Thus, the contribution of male circumcision to prevention of cervical cancer is likely to be small.

Penile Dermatoses and Phimosis

Penile dermatoses encompass a wide range of genital skin diseases, some of which are rarer than others. These diseases can include psoriasis, inflammation (ie, balanitis, balanoposthitis), infections (ie, superficial skin and soft tissue infections such as cellulitis), lichen sclerosis, lichen planus, lichen simplex, seborrheic dermatitis, atopic

eczema, and irritant dermatitis, among others.

From 1995 to 2011, all publications addressing this concern were case series and were therefore excluded from the literature forming the current analysis. Before 1995, a New Zealand prospective cohort study with good evidence explored rates of penile problems for 635 boys from birth to 8 years of age.[125] Four types of penile problems were defined: first was the number of episodes of inflammation of the penis experienced by the child. Penile inflammation included balanitis, meatitis, inflammation of the prepuce, and conditions in which the penis was described as sore or inflamed without any further diagnostic elaboration. The second type was the number of episodes of phimosis experienced by the child. These episodes included every time medical attention was sought for phimosis and associated symptoms. Episodes in which the child was brought to medical attention for "tight" or "non-retractable" foreskin but was not treated were not classified as phimosis, due to the likelihood that most of these attendances resulted from parental anxiety or uncertainty about the development of the foreskin rather than any pathologic condition in the child. The third type was inadequate circumcision requiring repair or recircumcision. Fourth was postoperative infection after circumcision from birth to 8 years of age by circumcision status. Findings were inconclusive for the first year of life; the adjusted rate of problems experienced was 5.2 penile problems per 100 circumcised boys over the study period, compared with 1.2 penile problems in uncircumcised boys at risk. From ages 1 through 8 years, the rates were 6.5 penile problems per 100 circumcised boys over the study period, compared with 17.2 penile problems per 100 uncircumcised boys.

Sexual Function and Penile Sexual Sensitivity

The literature review does not support the belief that male circumcision adversely affects penile sexual function or sensitivity, or sexual satisfaction, regardless of how these factors are defined.

Sexual Satisfaction and Sensitivity

Literature since 1995 includes 2 good-quality randomized controlled trials that evaluated the effect of adult circumcision on sexual satisfaction and sensitivity in Uganda and Kenya, respectively.[126,127] Among 5000 Ugandan participants, circumcised men reported significantly less pain on intercourse than uncircumcised men.[126] At 2 years' postcircumcision, sexual satisfaction had increased significantly from baseline measures in the control group (from 98% at baseline to 99.9%); satisfaction levels remained stable among the circumcised men (98.5% at baseline, 98.4% 2 years after the procedure). This study included no measures of time to ejaculation or sensory changes on the penis. In the Kenyan study (which had a nearly identical design and similar results), 64% of circumcised men reported much greater penile sensitivity postcircumcision.[127] At the 2-year follow-up, 55% of circumcised men reported having an easier time reaching orgasm than they had precircumcision, although the findings did not reach statistical significance. The studies' limitation is that the outcomes of interest were subjective, self-reported measures rather than objective measures.

Other studies in the area of function, sensation, and satisfaction have been less rigorous in design, and they fail to provide evidence that the circumcised penis has decreased sensitivity compared with the uncircumcised penis. There is both good and fair evidence that no statistically significant differences exist between circumcised and uncircumcised men in terms of sexual sensation and satisfaction.[128–131] Sensation end points in these studies included subjective touch and pain sensation, response to the International Index of Erectile Function, the Brief Male Sexual Function Inventory, pudendal nerve evoked potentials, and Intravaginal Ejaculatory Latency Times (IELTs).

There is fair evidence that men circumcised as adults demonstrate a higher threshold for light touch sensitivity with a static monofilament compared with uncircumcised men; these findings failed to attain statistical significance for most locations on the penis, however, and it is unclear that sensitivity to static monofilament (as opposed to dynamic stimulus) has any relevance to sexual satisfaction.[132] There is fair evidence from a cross-sectional study of Korean men of decreased masturbatory pleasure after adult circumcision.[133]

Sexual Function

There is both good and fair evidence that sexual function is not adversely affected in circumcised men compared with uncircumcised men.[131,134–136] There is fair evidence that no significant difference exists between circumcised and uncircumcised men in terms of sexual function, as assessed by using the IELT.[129]

Limitations to consider with respect to this issue include the timing of IELT studies after circumcision, because studies of sexual function at 12 weeks postcircumcision by using IELT measures may not accurately reflect sexual function at a later period. Also, the self-report of circumcision status may impact study validity. This could be in an unpredictable direction, although it is most likely that the effect would be to cause an underestimation of the association. Other biases include

participants' ages and any coexisting medical conditions.

Analgesia and Anesthesia

- Task Force Recommendation:
  - Trained and competent practitioners, by using sterile techniques and effective pain management, should perform male circumcision. Analgesia is safe and effective in reducing the procedural pain associated with newborn circumcision; thus, adequate analgesia should be provided whenever newborn circumcision is performed.
  - Nonpharmacologic techniques (eg, positioning, sucrose pacifiers) alone are insufficient to prevent procedural and postprocedural pain and are not recommended as the sole method of analgesia. They should be used only as analgesic adjuncts to improve infant comfort during circumcision.
  - If used, topical creams may cause a higher incidence of skin irritation in low birth weight infants, compared with infants of normal weight, so penile nerve block techniques should be chosen for this group of newborns.

The analgesics used for newborn circumcision include nonpharmacologic and pharmacologic (topical and nerve blocks) techniques. The Task Force's review included nonnutritive sucking, a pacifier dipped in sucrose, acetaminophen, topical 4% lidocaine (ie, LMX4 cream), a eutectic mixture of lidocaine-prilocaine local anesthetic (EMLA), subcutaneous ring block, and the dorsal penile nerve block (DPNB). These methods, which reduce the pain and stress of newborn circumcision, are representative of the principles discussed in the AAP *Policy Statement on Prevention and Management of Pain in the Neonate*, which was updated in 2006.[137,138] There are no evidence-based recommendations that state there is persistent pain that must be treated after the local preprocedure anesthetic wears off.

Analgesia is safe and effective in reducing the procedural pain associated with newborn circumcision, as indicated by changes in heart rate, oxygen saturation, facial action, crying, and other measures.[139–145] Therefore, adequate analgesia should be provided when newborn circumcision is performed. Topical 4% lidocaine, DPNB, and a subcutaneous ring block are all effective options, although the latter may provide the most effective analgesia. In addition there is good evidence that infants circumcised without analgesia exhibit a stronger behavioral pain response to subsequent routine immunization at 4 to 6 months of age, compared with both infants circumcised with analgesia and with uncircumcised infants.[145]

The literature search did not produce any reports of local anesthetic toxicity, such as seizures or cardiovascular instability, among the newborns receiving either local anesthetic injections or topical applications (ie, topical 4% lidocaine).

Nonpharmacologic Techniques

There is good evidence that oral sucrose and oral analgesics are not different from placebo or environmental modification in their ability to control pain.[141,142,144] There is good evidence that a more physiologic positioning of the infant in a padded environment may decrease distress during the procedure.[146] There is fair evidence that sucrose on a pacifier has been demonstrated to be more effective than water alone for decreasing crying during circumcision.[147–149] Nonpharmacologic techniques alone are insufficient to prevent procedural pain, however. Positioning and a sucrose pacifier should be used as analgesic adjuncts to improve infant comfort during circumcision but are not recommended as the sole method of analgesia.

Topical Local Anesthesia Techniques

There is good evidence that topical anesthesia with lidocaine-prilocaine (which contains 2.5% lidocaine and 2.5% prilocaine) or 4% lidocaine is superior to no anesthesia in preventing pain during male circumcision.[150]

There is good evidence from a prospective cohort study that lidocaine-prilocaine cream attenuates the pain response to circumcision (as measured by using heart rate, oxygen saturation, facial actions, and time and characteristics of crying) when applied 60 to 90 minutes before the procedure.[150,151] There is fair evidence from an RCT that lidocaine-prilocaine cream attenuates the pain response to circumcision, although it was less effective in doing so than DPNB or ring block.[152] There is good evidence that topical 4% lidocaine is as effective as lidocaine-prilocaine at preventing pain.[140,153] Topical 4% lidocaine has the advantage of having a faster onset of action (2 g applied 30 minutes before circumcision, compared with 1 to 2 hours before circumcision for lidocaine-prilocaine). Both topical preparations require coverage with plastic wrap to keep the cream in place. Topical 4% lidocaine is the preferred topical local anesthetic (over lidocaine-prilocaine) because there is no risk of methemoglobinemia.

The most common complications reported with analgesic techniques were an 8% to 14% incidence of erythema, swelling, and blistering associated with topical analgesia.[142,150,153,154] There is fair evidence that adverse effects of topical anesthetic creams are

infrequent and include only either minor skin reactions (ie, erythema, swelling) or, more rarely, blistering (especially in low birth weight infants).[154] For this reason, penile nerve block techniques should be chosen for low birth weight infants. There is good and fair evidence that both reactions are less common with 4% lidocaine than with lidocaine-prilocaine cream.[142,150,153–155]

There is a theoretical risk of methemoglobinemia with lidocaine-prilocaine.[152] However, when methemoglobin has been measured after lidocaine-prilocaine application, the level, although elevated, was not clinically significant.[150] Nevertheless, there have been isolated case reports of clinically significant methemoglobinemia involving prolonged application time or use in premature infants.[156,157,158]

DPNB

Most commonly, DPNB consists of injections of 0.4 mL of 1% lidocaine without epinephrine on both sides of the base of the penis. Systemic lidocaine levels obtained with use of this technique reached peak concentrations at 60 minutes after injection and were well below toxic ranges.[159]

There is good evidence that DPNB is effective in reducing the behavioral and physiologic indicators of pain caused by circumcision, regardless of the device used.[144] There is good evidence that DPNB is superior to lidocaine-prilocaine in relieving pain during and after circumcision in newborns.[142,160–162] One good-quality prospective cohort study of 491 newborn circumcisions measured complications of DPNB analgesia; it reported an 11% incidence of bruising and a 0.2% incidence of hematoma, none of which required any change in management.[163] Another good-quality, blinded, randomized controlled trial found a 43% incidence of small hematomas in preterm and term newborns circumcised by using DPNB.[142]

Subcutaneous Ring Block

Two studies with fair evidence found that the subcutaneous circumferential ring block (0.8 mL of 1% lidocaine without epinephrine injected at the base or midshaft of the penis) is effective in mitigating pain and its consequences during circumcision of newborns.[164]

One study presented fair evidence that the ring block was superior to using no anesthesia but found a 5% failure rate with the technique (1 in 20 ring block infants had heart rate and behavioral pain scores that were above the control mean during at least 50% of the measured intervals, while 19 of 20 had heart rate and pain scores less than the control mean). There were no hematomas in the infants receiving ring blocks. A second ring block study had fair evidence that the method was superior to either DPNB or lidocaine-prilocaine cream for pain relief in newborn circumcision, as the ring block seemed to prevent crying and increases in heart rate during all phases of the circumcision, with less crying and lower heart rates during foreskin separation and incision than seen with DPNB or lidocaine-prilocaine.[152] No complications have been reported in the use of this simple and highly effective technique.

Analgesia and Anesthesia for a Circumcision After the Newborn Period

In the United States, after the newborn period, general anesthesia is used during male circumcision because the surgical procedure takes longer and involves hemostasis and the suturing of skin edges. Use of adjuvant local anesthetic techniques in addition to general anesthesia provides longer-lasting postoperative analgesia, minimizes the need for intraoperative or postoperative opioid administration, reduces adverse postoperative events such as nausea and vomiting, and decreases recovery time. Long-lasting analgesia is achieved with either penile nerve block, by using any of the methods mentioned earlier, or caudal epidural analgesia in infants and children up to 3 years of age.

General anesthesia carries a low risk of mortality (1 death per 400 000 instances of general anesthesia). The risk of adverse events (especially respiratory events) during general anesthesia remains higher in infants under 1 year of age.[165] These risks are minimized when the procedure is performed in infants in their optimal state of health (no active reactive airway disease or upper respiratory infection) and in a facility familiar with the anesthesia care of infants.[166] Additional concerns associated with surgical circumcision in older infants include time lost by parents and patients from work and/or school.

Caudal Block

Caudal block (CB) with bupivacaine is an anesthetic technique used for postoperative analgesia for circumcision in infants and older children up to 3 years of age, as an alternative to ring block and DPNB techniques. There is good and fair evidence that there is a longer time to first postoperative urination after CB without adverse clinical consequences.[167,168] There is good evidence for a high incidence of mild postoperative motor block and delay in walking after the CB procedure (21% to 44%) in older children.[167,169,170] Caudal analgesia may be less available in facilities that do not treat many pediatric patients.

DPNB

The reported failure rate of DPNB is 1% to 10%.[171–175] When DPNB is used

without general anesthesia in boys 3 to 5 years of age, the technique has a failure rate of 15%; for boys aged 6 and older, the failure rate is 1.5%.[175] There is good and fair evidence that incidence of hematoma with DPNB ranges from 0.001% to 24%; several studies report rates of approximately 6%.[174–177] One study with fair evidence reports a 0.001% rate of "improper needle position with bleeding" and a similar number of "medication errors."[176] Studies with good and fair evidence report a 12% to 83% rate of edema in the area of injection of the local anesthetic after DPNB.[174,175,177]

Subcutaneous Ring Block

There is good evidence for the reported 8% failure rate using the ring block.[168] In children, edema and distortion of tissue layers after the ring block make surgery more difficult, compared with using a CB to prevent postoperative pain.[178]

Comparison of Methods

DPNB, subcutaneous ring block, and CB techniques may be used in conjunction with general anesthesia depending on the age of the child and are also used to provide postcircumcision analgesia. There is good evidence that there is no difference in the quality of postoperative analgesia or parent satisfaction between DPNB and CB using bupivacaine.[169] A comparison of CB with or without a subcutaneous ring block with bupivacaine showed good evidence that CB with a subcutaneous ring block had significantly longer duration of postoperative analgesia.[168] A technique describing ultrasound guidance for correct needle placement for DPNB in children under general anesthesia describes lower pain scores in the first postoperative hour and a longer interval until rescue analgesia was required.[179,180]

Complications and Adverse Events

- Task Force Recommendation:
  - Elective circumcision should be performed only if the infant's condition is stable and healthy.
  - Male circumcision should be performed by trained and competent practitioners, by using sterile techniques and effective pain management.

The true incidence of complications after newborn circumcision is unknown, in part due to differing definitions of "complication" and differing standards for determining the timing of when a complication has occurred (ie, early or late). Adding to the confusion is the comingling of "early" complications, such as bleeding or infection, with "late" complications such as adhesions and meatal stenosis. Also, complication rates after an in-hospital procedure with trained personnel may be far different from those of the developing world and/or by untrained ritual providers. For the purposes of this document, complications are grouped in terms of the timing of the procedure. (Citations for the following statements below are provided in the section after this summary.)

Significant acute complications are rare, occurring in approximately 1 in 500 newborn male circumcisions. Acute complications are usually minor and most commonly involve bleeding, infection, or an imperfect amount of tissue removed. Late complications do occur, most commonly adhesions, skin bridges, and meatal stenosis. There are 2 schools of thought regarding the cause of penile adhesions, which are common after circumcision. One is that fine adhesions represent incomplete lysis of physiologic adhesions at the time of circumcision; the other is that the fine adhesions occur because of raw serosa surfaces. It is unknown how often these late complications require surgical repair; this area requires further study.

In general, the specific technique used does not afford a significant difference in risk of complications. However, boys undergoing circumcisions in medical facilities in industrialized settings performed by trained practitioners have fewer complications than boys in nonindustrialized nations who have circumcisions performed by poorly trained (or untrained) practitioners in nonmedical surroundings. If circumcision is performed, it is imperative that those providing the service have adequate training in the method used and resources for and practice of adequate analgesia and infection control.

Contraindications to newborn circumcision include significantly premature infants, those with blood dyscrasias, individuals who have a family history of bleeding disorders, and those who have congenital abnormalities such as hypospadias, congenital chordee, or deficient shaft skin such as penoscrotal fusion or congenital buried penis. In addition, before performing newborn male circumcision, the clinician should confirm that vitamin K has been administered, in accordance with standard practice of newborn care.[181]

Newborn Elective Circumcision

Two large US hospital-based studies with good evidence estimate the risk of significant acute circumcision complications in the United States to be between 0.19% and 0.22%.[121,123] Bleeding was the most common complication (0.08% to 0.18%), followed by infection (0.06%) and penile injury (0.04%). For comparison, an audit of 33 921 tonsillectomies found an incidence of hemorrhage of 1.9% among children aged 0 to 4 years.[182] An Israeli prospective cohort study with fair evidence examined 19 478 male infants born in 2001 who were

circumcised primarily by trained, ritual providers in nonmedical settings, and reported similarly low complication rates. The overall complication rate was 0.34%, including bleeding in 0.08% and infection in 0.01%.[183] Approximately one-third of the identified complications were immediate (ie, bleeding, infection, penile injury), whereas two-thirds occurred later (ie, excess foreskin, penile torsion, shortage of skin, phimosis, inclusion cyst).

There is fair evidence of a more frequent complication rate of 3.1% in a study based on abstraction of 1951 hospital medical (rather than billing) records on newborn circumcision in Atlanta.[184] In this study, complications were found to be much more common, with bleeding occurring in 2.1%, although most reports of bleeding were mild in nature. Likewise, a review with fair evidence of 1000 newborn circumcisions by using the Gomco clamp in a hospital setting in Saudi Arabia found an overall complication rate of 1.9%.[185] Bleeding occurred in 0.6%, infection in 0.4%, and redundant prepuce in 0.3%.

Late complications of newborn circumcision include excessive residual skin (incomplete circumcision), excessive skin removal, adhesions (natural and vascularized skin bridges), meatal stenosis, phimosis, and epithelial inclusion cysts. These complications are considered "late," as opposed to "acute" (or immediate) complications such as bleeding or infection, which may still present during infancy but not during the immediate postprocedural time frame. In 1 outpatient-based study of 214 boys with poor evidence, the complications seen included adhesions (observed in 55 boys [25.6%]), redundant residual prepuce (44 boys [20.1%]), balanitis (34 boys [15.5%]), skin bridge (9 boys [4.1%]), and meatal stenosis (1 boy [0.5%]).[76]

Outside the United States, a cross-sectional study from Nigeria of 370 consecutive male infants (322 of whom had been circumcised) attending an infant welfare clinic for immunization with fair evidence reported an overall complication rate of 20.2%.[186] Complications included redundant prepuce (12.9%), excessive skin removal (5.9%), skin bridge (4.1%), and buried penis (0.4%). The majority of the procedures (81%) were performed in the hospital; 19% were performed at home. Nurses performed 56% of procedures (n = 180), physicians performed 35% (n = 113), and traditional circumcisers performed 9% (n = 29). The Israeli study noted earlier with fair evidence reported a late complication of redundant prepuce in 0.2% of the 19 478 male infants studied.[183]

There is good evidence that circumcision of a premature infant is associated with an increased risk of later-occurring complications (ie, poor cosmesis, increased risk of trapped penis, adhesions). There is also good evidence that circumcision of a newborn who has a prominent suprapubic fat pad or penoscrotal webbing has a higher risk for the same long-term complications.[187] One prospective study with fair evidence examined the natural course of penile adhesions after circumcision and found that adhesions disappeared at some point 6 months postcircumcision without intervention, except for thick adhesions (called "bridging adhesions"). The authors recommended lysis for skin bridges.[188]

Post-newborn Circumcision

There have been few reports of acute complications after non-newborn circumcision in the United States. Furthermore, there are no adequate studies of late complications in boys undergoing circumcision in the post-newborn period; this area requires more study.

Although adverse outcomes are rare among non-newborn circumcisions, the incidence tends to be orders of magnitude greater for boys circumcised between 1 and 10 years of age, compared with those circumcised as newborns.[189] As noted, general anesthesia, which is used for procedures performed after the newborn period, confers additional risk.

The most common surgical complication is excessive bleeding (eg, bleeding that did not stop with local pressure, perhaps requiring a suture), reported in 0.6% of 1742 male infants.[184] Contact burns were reported with electrocautery when used with metal, and it should not be used with the Gomco clamp in newborn circumcisions because it can cause devastating burns.[184,190,191] A study with fair evidence reviewed the records of 476 boys undergoing circumcision during childhood and found that complications occurred in 8 records (1.7%), of which 3 were related to anesthesia.[192] The most common surgical complication was excessive bleeding in 0.6%. In another report with fair evidence, which examined 267 patients who had circumcision by using topical glue rather than skin sutures, excessive bleeding occurred in 0.75% of cases.[193]

European centers report an overall complication rate of 1.2% to 3.8% for circumcisions performed in boys during the newborn or non-newborn period.[194–196] In a study with fair evidence of trained medical personnel in the United Kingdom, the rate of bleeding was 0.8% and of infection was 0.3%. In this study of a historical cohort of over 75 boys aged 0 to 14 years, 0.5% required surgical repair.[195]

In a Turkish prospective cohort study of 700 boys with fair evidence, bleeding

was reported in 2.2% of cases and infection in 1.3% of boys circumcised in a hospital, versus a bleeding rate of 3.6% and an infection rate of 2.7% in boys undergoing a nonhospital-based mass religious procedure, despite the latter procedure being performed by trained personnel.[196]

There are no adequate analytic studies of late complications in boys undergoing circumcision in the post-newborn period. An Iranian cross-sectional study with good evidence reported a late complication rate of 7.4%, including redundant skin in 3.6%, excessive skin removal in 1.3%, and meatal stenosis in 0.9%.[197]

Major Complications

The majority of severe or even catastrophic injuries are so infrequent as to be reported as case reports (and were therefore excluded from this literature review). These rare complications include glans or penile amputation,[198–206] transmission of herpes simplex after mouth-to-penis contact by a mohel (Jewish ritual circumcisers) after circumcision,[207–209] methicillin-resistant *Staphylococcus aureus* infection,[210] urethral cutaneous fistula,[211] glans ischemia,[212] and death.[213]

Medical Versus Traditional Providers

In general, untrained providers create more complications when performing male circumcision than do well-trained providers, regardless of whether they are physicians, nurses, or traditional religious providers. Physicians in a hospital setting generally have fewer complications than traditional providers in the community setting.

A prospective study in Kenya with good evidence found an overall complication rate of 35% in 443 children and young men aged 5 to 21 years who had traditional circumcision performed in a village or household setting, compared with an overall complication rate of 17% in those whose circumcision was performed by trained providers in a medical setting such as a hospital, health center, or physician's office.[214] The most common complications were bleeding and infection; excessive pain, lacerations, torsion, and erectile dysfunction were also observed. A study in Turkey with fair evidence studied a historical cohort and found a significantly higher rate of complications when male circumcision was performed by traditional circumcisers, compared with those performed by physicians; complication rates were 85% for traditional providers versus 2.6% for physicians.[215]

A study in Israel with fair evidence found there was no difference in the rate of complications in newborn circumcision between hospital-based physicians and well-trained, home-based ritual circumcisers (mohels).[183]

Complications With Different Methods of Male Circumcision

There have been few studies comparing the 3 most commonly used techniques for male circumcision in the United States (the Gomco clamp, the Plastibell device, and the Mogen clamp). Steps common to all 3 include estimation of the amount of external skin to be removed; dilation of the preputial orifice so the glans can be visualized to ensure that the glans itself is normal; bluntly freeing the inner preputial epithelium from the epithelium of the glans; placing the device; leaving the device in place long enough to produce hemostasis; and surgically removing the foreskin.

Gomco Clamp

The Gomco clamp was specifically designed for performing circumcisions. In this procedure, "the foreskin is cut lengthwise through the stretched tissue (dorsal slit) to allow space to insert the circumcision device. The bell of the Gomco clamp is placed over the glans, and the foreskin is pulled over the bell. The base of the Gomco clamp is placed over the bell, and the Gomco clamp's arm is fitted. After the surgeon confirms correct fitting and placement (and the amount of foreskin to be excised), the nut on the Gomco clamp is tightened and left in place for 3 to 5 minutes to allow hemostasis to occur, then the foreskin is removed using a scalpel. The Gomco's base and bell are then removed."[216]

One study of the Gomco clamp with fair evidence reviewed 1000 newborn circumcisions in a hospital setting in Saudi Arabia and found an overall complication rate of 1.9%.[185] Bleeding occurred in 0.6% of cases, infection in 0.4%, and redundant prepuce in 0.3%. Another study of 521 newborn male circumcisions performed at a Houston outpatient clinic with fair evidence reported a 2.9% incidence of phimosis (trapped penis) after newborn circumcision using the Gomco clamp.[217]

Plastibell Device

Plastibell circumcision involves a surgical procedure in which a plastic ring is inserted under the foreskin, and a tie is placed over the ring to provide hemostasis. The ring remains on the penis for several days until the tissue necroses and the ring falls off spontaneously. Bleeding ranged from 0.8% to 3% of cases; infection occurred in 2.1% of cases.[218] Urinary retention[219,220] and problems with the Plastibell ring have been reported in 3.6% of cases.[221] Studies of the Plastibell device with fair and good evidence found, overall, that complications range from 2.4% to 5%.[218,221–223]

Mogen Clamp

The Mogen clamp is a device consisting of 2 flat blades that have a limited

(slit-like) space between them and a mechanism that draws the blades together and locks them in place. The slit is limited to 3 mm to allow the foreskin, but not the glans, to cross the opening. The preputial adhesions are gently taken down by a probe and the glans pushed downward, thereby protecting it from the blades. The prepuce distal to the glans is drawn into the slit between the blades and positioned. The blades are locked together, crushing the skin and creating hemostasis. The skin is excised from above the clamp. The clamp is removed and the skin pushed proximally into proper position.

There were no specific studies of complications of the Mogen because complications are rare; thus, one can only rely on available case reports of amputation.[201,202,222–228]

Comparison

A study with fair evidence evaluated the use of the Gomco versus the Plastibell device in 350 newborn infants.[229] The incidence of infection was higher with the Gomco clamp (2%) versus a lower complication rate (1.3%) with the Plastibell device. Adhesions were also more common with the Gomco clamp, at a rate of 20% vs 6.6% for the Plastibell device.

Stratification of Risks

Based on the data reviewed, it is difficult, if not impossible, to adequately assess the total impact of complications, because the data are scant and inconsistent regarding the severity of complications. For example, studies that report bleeding as a complication do not uniformly report how frequently the bleeding was controlled with local measures versus requiring a transfusion or surgical intervention. Similarly, infection is rarely further divided into local tissue infection versus bacteremia or sepsis. Financial costs of care, emotional tolls, or the need for future corrective surgery (with the attendant anesthetic risks, family stress, and expense) are unknown.

Some reports have attempted to compare potential benefits of circumcision with reported complication rates. One study with good evidence attempted to estimate complication rates compared with benefits from male circumcision. Based on an estimate that 100 circumcisions must be performed to prevent 1 UTI, and 909 circumcisions must be performed to prevent 1 case of penile cancer, the study yields an estimate of 1 complication for every 5 UTIs prevented and 2 complications for every 1 case of penile cancer prevented.[121] Assuming an overall minor adverse event rate for newborn circumcision of 0.2%, and a severe adverse event rate of 0.005%, another study with fair evidence estimated that over 322 000 newborn male circumcisions are required to prevent 1 case of penile cancer per year.[122] Similar modeling for HIV, herpes, and HPV in the United States is not available.

A recently published CDC study found that male circumcision before the age of sexual debut was cost-effective for the prevention of HIV.[60] The study did not take into account the positive benefits of newborn circumcision for other conditions such as costs of caring for UTIs.[106,107,110,112,230–233] It also did not include recent evidence that circumcision (either as an infant or later in life) is associated with reduced risk for other STIs, penile and cervical cancers, phimosis, and penile dermatoses.[36,88,234,235] The authors did not include adverse effects that make newborn circumcision less cost-effective, such as bleeding, infection, and revision. Considering all these factors, however, the authors concluded that male circumcision was a cost-effective strategy for HIV prevention in the United States.[60]

Workforce Development and Male Circumcision

- Task Force Recommendations:
  - Physicians counseling families about elective male circumcision should assist parents by explaining, in a nonbiased manner, the potential benefits and risks, and by ensuring that they understand the elective nature of the procedure.
  - Parents are entitled to factually correct, nonbiased information about circumcision that should be provided before conception and early in pregnancy, when parents are most likely to be weighing the option of circumcision of a male child.
  - Parents of newborn boys should be instructed in the care of the penis at the time of discharge from the newborn hospital stay, regardless of whether the newborn is circumcised or not.
  - Male circumcision should be performed by trained and competent practitioners, by using sterile techniques and effective pain management. Analgesia is safe and effective in reducing the procedural pain associated with newborn circumcision; thus, adequate analgesia should be provided whenever newborn circumcision is performed.
  - Key professional organizations (AAP, AAFP, ACOG, the American Society of Anesthesiologists, the American College of Nurse Midwives, and other midlevel clinicians such as

nurse practitioners) should work collaboratively to:

- Develop standards of trainee proficiency in performance of anesthetic and procedure techniques, including suturing;
- Teach the procedure and analgesic techniques during postgraduate training programs;
- Develop educational materials for clinicians to enhance practitioners' competency in discussing the benefits and risks of circumcision with parents;
- Offer educational materials to assist parents of male infants with the care of both circumcised and uncircumcised penises.

Workforce Development and Parental Decision-making

There is fair evidence that some clinicians do not convey current or medically accurate information about circumcision to parents, either verbally or in written materials.[18] Providing information about the risks and benefits of circumcision does not seem to lead to lower circumcision rates.[236]

Parents are entitled to factually correct, nonbiased information about circumcision and should receive this information from clinicians before conception and/or early in pregnancy, which is when they are making choices about circumcision. As noted, in 2009, the AAP surveyed members on their attitudes and practices around circumcision.[19] According to the responses, 67% of pediatricians reported discussing the pros and cons of circumcision with parents. Almost two-thirds (62%) reported that they made no recommendation regarding circumcision to the majority of their patients; 18% responded recommending to all or most of their patients' parents that circumcision be performed; 7% reported recommending to all or nearly all of the parents of newborn males that circumcision not be performed.

As described earlier, there is fair evidence that parental decision-making about circumcision tends to occur well before the child's birth. Thus, information to assist in parental decision-making should be made available as early as possible, even as part of guidance to parents before conception occurs. For this reason, obstetrician-gynecologists and family physicians who manage women's health and prenatal care probably have a more pivotal role in this decision than do pediatricians. Public health authorities have an important role in educating the public on the role of newborn male circumcision in disease prevention.

Workforce Development and Provision of Circumcision

In the United States, obstetricians, family physicians, and pediatricians are the principal clinicians who perform newborn circumcisions in medical settings; there is no single system of training or credentialing for circumcision in use nationwide.[237] There is good and fair evidence of considerable variation in provider type by region and by hospital,[238–240] with midwives performing circumcision in some locations.[18,241]

Training curricula for teaching newborn circumcision in departments of pediatrics[237,242] and family medicine[243] have been described but do not provide information on how widely used they are or the trainings' results and/or effectiveness. One pediatric program's training consisted of the resident performing 3 to 5 circumcisions with assistance from a faculty instructor, 3 to 5 circumcisions under direct observation but without hands-on faculty involvement, and 2 test circumcisions for grading and departmental credentialing.[242] The other 2 programs did not describe actual resident experience performing a circumcision.

Most residency training programs in the respective specialties teach techniques, including the Gomco clamp, Mogen clamp, and Plastibell device.[238] As of 2006, 97% of programs that included training in performance of circumcision taught the use of either local or topical anesthetics for circumcision analgesia, an increase from 45% to 74% in 1998.[238–240] Although case studies were excluded from this review, it was noted that 2 record reviews with fair evidence addressed the need for circumcision revision based on the medical discipline of the physician who performed the original procedure.[241,244]

None of the articles reviewed addressed current or future workforce needs, which seems to depend on the number of surgeries being performed, the future demand, and reimbursement for the procedure. Sustaining a workforce that is capable of counseling families and performing the newborn male circumcision procedure safely is increasingly important, as the number of clinicians who are able to perform this procedure is likely to decline with curtailment of Medicaid coverage for it in various states.

The Task Force strongly recommends the creation, revision, and enhancement of educational materials to assist parents of male infants with the care of both circumcised and uncircumcised penises. The Task Force also strongly recommends the development of educational materials for clinicians to enhance practitioners' competency in discussing the benefits and risks of circumcision with parents. A structured decision-making tool that clinicians can use to help

parents complete would assist in the decision of whether to circumcise or not. To this end, the Task Force recommends that key professional organizations (AAP, ACOG, AAFP, American Society of Anesthesiologists, American College of Nurse Midwives, and other entities supporting midlevel clinicians) work together to develop a consensus plan about which groups are best suited to perform circumcisions in newborn males; teach the procedure and analgesic techniques during postgraduate training programs; and develop standards of trainee proficiency. In addition, health departments should be involved in the dissemination of educational materials and coordinating educational efforts with professional organizations.

Financing Newborn Male Circumcision

- Task Force recommendation:
    1. The preventive and public health benefits associated with newborn male circumcision warrant third-party reimbursement of the procedure.

The CDC estimates that, from 2005 to 2006, the average cost of providing newborn male circumcision (including physician- and facility-related costs) ranged from $216 to $601 across the nation.[60] Hospitals in states where Medicaid covers routine newborn male circumcision have circumcision rates that are 24% higher than hospitals in states without such coverage.[23] As of 2009, 15 states did not cover newborn male circumcision in their Medicaid programs; 2 additional states had variable coverage dependent on the enrollment plan.[245] There seems to be a relationship between circumcision incidence and third-party payment.

Circumcised newborns are more likely to be privately insured than publicly insured infants.[246] The weighted rates of circumcision over the 13-year period from 1991 to 2005 were 40.8% for Medicaid clients versus 43.3% for the uninsured and 64.4% for insured newborns.[5] The associations with insurance status were independent of race/ethnicity and socioeconomic status in this study.[246]

As noted, a recent cost-effectiveness analysis by the CDC concluded that newborn circumcision is a societal cost-saving HIV prevention intervention.[60] African-American and Hispanic males in the United States are disproportionately affected by HIV and other STIs, and thus would derive the greatest benefit from circumcision; the HIV prevention evidence for non-Hispanic white males was not as strong as for African-American and Hispanic males. However, the African-American and Hispanic populations are the most likely to have Medicaid coverage.[247] In 2010, 50% of Hispanic children (up to age 18 years) and 54% of African-American children were covered by Medicaid, compared with 23% of white children.[248] Thus, recent efforts by state Medicaid programs to curb payment for newborn male circumcision affect those populations that could benefit the most from the procedure.[60] The CDC authors recommended that: "Financial barriers that prevent parents from having the choice to circumcise their male newborns should be reduced or eliminated."

AREAS FOR FUTURE RESEARCH

In the course of its work, the Task Force identified important gaps in our knowledge of male circumcision and urges the research community to seriously consider these gaps as future research agendas are developed. Although it is clear that there is good evidence on the risks and benefits of male circumcision, it will be useful for this benefit to be more precisely defined in a US setting and to monitor adverse events. Specifically, the Task Force recommends additional studies to better understand:

- The performance of elective male circumcisions in the United States, including those that are hospital-based and nonhospital-based, in infancy and subsequently in life.
- Parental decision-making to develop useful tools for communication between providers and parents on the issue of male circumcision.
- The impact of male circumcision on transmission of HIV and other STIs in the United States because key studies to date have been performed in African populations with HIV burdens that are epidemiologically different from HIV in the United States.
- The risk of acquisition of HIV and other STIs in 0- to 18-year-olds, to help inform the acceptance of the procedure during infancy versus deferring the decision to perform circumcision (and thus the procedure's benefits) until the child can provide his own assent/consent. Because newborn male circumcision is less expensive and more widely available, a delay often means that circumcision does not occur. It will be useful to more precisely define the prevention benefits conferred by male circumcision to inform parental decision-making and to evaluate cost-effectiveness and benefits of circumcision, especially in terms of numbers needed to treat to prevent specific outcomes.
- The population-based incidence of complications of newborn male circumcision (including stratifications according to timing of procedure, type of procedure, provider type, setting, and timing of complications [especially severe and nonacute complications]).
- The impact of the AAP Male Circumcision policy on newborn male

circumcision practices in the United States and elsewhere.

- The extent and level of training of the workforce to sustain the availability of safe circumcision practices for newborn males and their families.

CONCLUSIONS

This technical report provides recommendations regarding the practice of male circumcision, particularly in the newborn period. It emphasizes the primacy of parental decision-making and the imperative for those who perform male circumcisions to be adequately trained and use both effective sterile techniques and pain management. The report evaluated current evidence regarding the effect of male circumcision on the prevention of STIs (including HIV), UTIs, cancer, and other morbidities. Evidence about complications resulting from male circumcision and the use of analgesia and anesthesia were also discussed.

The Task Force concluded that the health benefits of newborn male circumcision outweigh the risks and justify access to this procedure for families who choose it.

The Task Force also made the following recommendations:

- Evaluation of current evidence indicates that the health benefits of newborn male circumcision outweigh the risks, and the benefits of newborn male circumcision justify access to this procedure for those families who choose it.
- Parents are entitled to factually correct, nonbiased information about circumcision that should be provided before conception and early in pregnancy, when parents are most likely to be weighing the option of circumcision of a male child.
- Physicians counseling families about elective male circumcision should assist parents by explaining, in a nonbiased manner, the potential benefits and risks, and by ensuring that they understand the elective nature of the procedure.
- Parents should weigh the health benefits and risks in light of their own religious, cultural, and personal preferences, as the medical benefits alone may not outweigh these other considerations for individual families.
- Parents of newborn boys should be instructed in the care of the penis at the time of discharge from the newborn hospital stay, whether the newborn is circumcised or not.
- Elective circumcision should be performed only if the infant's condition is stable and healthy.
- Trained and competent practitioners, by using sterile techniques and effective pain management, should perform male circumcision.
- Analgesia is safe and effective in reducing the procedural pain associated with newborn circumcision; thus, adequate analgesia should be provided whenever newborn circumcision is performed.
    - Nonpharmacologic techniques (such as positioning and sucrose pacifiers) alone are insufficient to prevent procedural and postprocedural pain and are not recommended as the sole method of analgesia. They should be used only as analgesic adjuncts to improve infant comfort during circumcision.
    - If used, topical creams may cause a higher incidence of skin irritation in low birth weight infants, compared with infants of normal weight, so penile nerve block techniques should be chosen for this group of newborns.
- Key professional organizations (AAP, AAFP, ACOG, the American Society of Anesthesiologists, the American College of Nurse Midwives, and other midlevel clinicians such as nurse practitioners) should work collaboratively to:
    - Develop standards of trainee proficiency in performance of anesthetic and procedure techniques, including suturing;
    - Teach the procedure and analgesic techniques during postgraduate training programs;
    - Develop educational materials for clinicians to enhance practitioners' competency in discussing the benefits and risks of circumcision with parents;
    - Offer educational materials to assist parents of male infants with the care of both circumcised and uncircumcised penises.
- The preventive and public health benefits associated with newborn male circumcision warrant third-party reimbursement of the procedure.

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CLINICAL REPORT

Management of Neonates With Suspected or Proven Early-Onset Bacterial Sepsis

abstract

FREE

With improved obstetrical management and evidence-based use of intrapartum antimicrobial therapy, early-onset neonatal sepsis is becoming less frequent. However, early-onset sepsis remains one of the most common causes of neonatal morbidity and mortality in the preterm population. The identification of neonates at risk for early-onset sepsis is frequently based on a constellation of perinatal risk factors that are neither sensitive nor specific. Furthermore, diagnostic tests for neonatal sepsis have a poor positive predictive accuracy. As a result, clinicians often treat well-appearing infants for extended periods of time, even when bacterial cultures are negative. The optimal treatment of infants with suspected early-onset sepsis is broad-spectrum antimicrobial agents (ampicillin and an aminoglycoside). Once a pathogen is identified, antimicrobial therapy should be narrowed (unless synergism is needed). Recent data suggest an association between prolonged empirical treatment of preterm infants (≥5 days) with broad-spectrum antibiotics and higher risks of late onset sepsis, necrotizing enterocolitis, and mortality. To reduce these risks, antimicrobial therapy should be discontinued at 48 hours in clinical situations in which the probability of sepsis is low. The purpose of this clinical report is to provide a practical and, when possible, evidence-based approach to the management of infants with suspected or proven early-onset sepsis. *Pediatrics* 2012;129:1006–1015

Richard A. Polin, MD and the COMMITTEE ON FETUS AND NEWBORN

KEY WORDS

early-onset sepsis, antimicrobial therapy, group B streptococcus, meningitis, gastric aspirate, tracheal aspirate, chorioamnionitis, sepsis screen, blood culture, lumbar puncture, urine culture, body surface cultures, white blood count, acute phase reactants, prevention strategies

ABBREVIATIONS

CFU—colony-forming units
CRP—C-reactive protein
CSF—cerebrospinal fluid
GBS—group B streptococci
I/T—immature to total neutrophil (ratio)
PMN—polymorphonuclear leukocyte
PPROM—preterm premature rupture of membranes

INTRODUCTION

"Suspected sepsis" is one of the most common diagnoses made in the NICU.[1] However, the signs of sepsis are nonspecific, and inflammatory syndromes of noninfectious origin mimic those of neonatal sepsis. Most infants with suspected sepsis recover with supportive care (with or without initiation of antimicrobial therapy). The challenges for clinicians are threefold: (1) identifying neonates with a high likelihood of sepsis promptly and initiating antimicrobial therapy; (2) distinguishing "high-risk" healthy-appearing infants or infants with clinical signs who do not require treatment; and (3) discontinuing antimicrobial therapy once sepsis is deemed unlikely. The purpose of this clinical report is to provide a practical and, when possible, evidence-based approach to the diagnosis and management of early-onset sepsis, defined by the National Institute of Child Health and Human Development and Vermont Oxford Networks as sepsis with onset at ≤3 days of age.

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PATHOGENESIS AND EPIDEMIOLOGY OF EARLY-ONSET SEPSIS

Before birth, the fetus optimally is maintained in a sterile environment. Organisms causing early-onset sepsis ascend from the birth canal either when the amniotic membranes rupture or leak before or during the course of labor, resulting in intra-amniotic infection.[2] Commonly referred to as "chorioamnionitis," intra-amniotic infection indicates infection of the amniotic fluid, membranes, placenta, and/or decidua.

Group B streptococci (GBS) can also enter the amniotic fluid through occult tears. Chorioamnionitis is a major risk factor for neonatal sepsis. Sepsis can begin in utero when the fetus inhales or swallows infected amniotic fluid. The neonate can also develop sepsis in the hours or days after birth when colonized skin or mucosal surfaces are compromised. The essential criterion for the clinical diagnosis of chorioamnionitis is maternal fever. Other criteria are relatively insensitive. When defining intra-amniotic infection (chorioamnionitis) for clinical research studies, the diagnosis is typically based on the presence of maternal fever of greater than 38°C (100.4°F) and at least two of the following criteria: maternal leukocytosis (greater than 15 000 cells/mm^3), maternal tachycardia (greater than 100 beats/minute), fetal tachycardia (greater than 160 beats/minute), uterine tenderness, and/or foul odor of the amniotic fluid. These thresholds are associated with higher rates of neonatal and maternal morbidity.

Nonetheless, the diagnosis of chorioamnionitis must be considered even when maternal fever is the sole abnormal finding. Although fever is common in women who receive epidural anesthesia (15%–20%), histologic evidence of acute chorioamnionitis is very common in women who become febrile after an epidural (70.6%).[3] Furthermore, most of these women with histologic chorioamnionitis do not have a positive placental culture.[3] The incidence of clinical chorioamnionitis varies inversely with gestational age. In the National Institute of Child Health and Human Development Neonatal Research Network, 14% to 28% of women delivering preterm infants at 22 through 28 weeks' gestation exhibited signs compatible with chorioamnionitis.[4] The major risk factors for chorioamnionitis include low parity, spontaneous labor, longer length of labor and membrane rupture, multiple digital vaginal examinations (especially with ruptured membranes), meconium-stained amniotic fluid, internal fetal or uterine monitoring, and presence of genital tract microorganisms (eg, *Mycoplasma hominis*).[5]

At term gestation, less than 1% of women with intact membranes will have organisms cultured from amniotic fluid.[6] The rate can be higher if the integrity of the amniotic cavity is compromised by procedures before birth (eg, placement of a cerclage or amniocentesis).[6] In women with preterm labor and intact membranes, the rate of microbial invasion of the amniotic cavity is 32%, and if there is preterm premature rupture of membranes (PPROM), the rate may be as high as 75%.[7] Many of the pathogens recovered from amniotic fluid in women with preterm labor or PPROM (eg, *Ureaplasma* species or *Mycoplasma* species) do not cause early-onset sepsis.[8–10] However, both *Ureaplasma* and *Mycoplasma* organisms can be recovered from the bloodstream of infants whose birth weight is less than 1500 g.[11] When a pathogen (eg, GBS) is recovered from amniotic fluid, the attack rate of neonatal sepsis can be as high as 20%.[12] Infants born to women with PPROM who are colonized with GBS have an estimated attack rate of 33% to 50% when intrapartum prophylaxis is not given.[13]

The major risk factors for early-onset neonatal sepsis are preterm birth, maternal colonization with GBS, rupture of membranes >18 hours, and maternal signs or symptoms of intra-amniotic infection.[14–16] Other variables include ethnicity (ie, black women are at higher risk of being colonized with GBS), low socioeconomic status, male sex, and low Apgar scores. Preterm birth/low birth weight is the risk factor most closely associated with early-onset sepsis.[17] Infant birth weight is inversely related to risk of early-onset sepsis. The increased risk of early-onset sepsis in preterm infants is also related to complications of labor and delivery and immaturity of innate and adaptive immunity.[18]

DIAGNOSTIC TESTING FOR SEPSIS

The clinical diagnosis of sepsis in the neonate is difficult, because many of the signs of sepsis are nonspecific and are observed with other noninfectious conditions. Although a normal physical examination is evidence that sepsis is not present,[19,20] bacteremia can occur in the absence of clinical signs.[21] Available diagnostic testing is not helpful in deciding which neonate requires empirical antimicrobial therapy but can assist with the decision to discontinue treatment.[22]

Blood Culture

A single blood culture in a sufficient volume is required for all neonates with suspected sepsis. Data suggest that 1.0 mL of blood should be the minimum volume drawn for culture when a single pediatric blood culture bottle is used. Dividing the specimen in half and inoculating aerobic and anaerobic bottles is likely to decrease the sensitivity. Although 0.5 mL of blood has previously been considered acceptable, in vitro data from Schelonka et al demonstrated that 0.5 mL would not reliably detect low-level bacteremia

(4 colony-forming units [CFU]/mL or less).[23] Furthermore, up to 25% of infants with sepsis have low colony count bacteremia (≤4 CFU/mL), and two-thirds of infants younger than 2 months of age have colony counts <10 CFU/mL.[24,25] Neal et al demonstrated that more than half of blood specimens inoculated into the aerobic bottle were less than 0.5 mL.[26] A study by Connell et al indicated that blood cultures with an adequate volume were twice as likely to yield a positive result.[27] A blood culture obtained through an umbilical artery catheter shortly after placement for other clinical indications is an acceptable alternative to a culture drawn from a peripheral vein.[28] The risk of recovering a contaminant is greater with a blood culture drawn from an umbilical vein.[29] There are, however, data to suggest that a blood culture drawn from the umbilical vein at the time of delivery using a doubly clamped and adequately prepared segment of the cord is a reliable alternative to a culture obtained peripherally.[30]

Urine Culture

A urine culture should not be part of the sepsis workup in an infant with suspected early-onset sepsis.[31] Unlike urinary tract infections in older infants (which are usually ascending infections), urinary tract infections in newborn infants are attributable to seeding of the kidney during an episode of bacteremia.

Gastric Aspirates

The fetus swallows 500 to 1000 mL of amniotic fluid each day. Therefore, if there are white blood cells present in amniotic fluid, they will be present in gastric aspirate specimens at birth. However, these cells represent the maternal response to inflammation and have a poor correlation with neonatal sepsis.[32] Gram stains of gastric aspirates to identify bacteria are of limited value and are not routinely recommended.[33]

Body Surface Cultures

Bacterial cultures of the axilla, groin, and the external ear canal have a poor positive predictive accuracy. They are expensive and add little to the evaluation of an infant with possible bacterial sepsis.[34,35]

Tracheal Aspirates

Cultures and Gram stains of tracheal aspirate specimens may be of value if obtained immediately after endotracheal tube placement.[36] Once an infant has been intubated for several days, tracheal aspirates are of no value in the evaluation of sepsis.[37]

Lumbar Puncture

The decision to perform a lumbar puncture in a neonate with suspected early-onset sepsis remains controversial. In the high-risk, healthy-appearing infant, data suggest that the likelihood of meningitis is extremely low.[38] In the infant with clinical signs that are thought to be attributable to a noninfectious condition, such as respiratory distress syndrome, the likelihood of meningitis is also low.[39] However, in bacteremic infants, the incidence of meningitis may be as high as 23%.[40,41] Blood culture alone cannot be used to decide who needs a lumbar puncture, because blood cultures can be negative in up to 38% of infants with meningitis.[42,43] The lumbar puncture should be performed in any infant with a positive blood culture, infants whose clinical course or laboratory data strongly suggest bacterial sepsis, and infants who initially worsen with antimicrobial therapy. For any infant who is critically ill and likely to have cardiovascular or respiratory compromise from the procedure, the lumbar puncture can be deferred until the infant is more stable.

Cerebrospinal fluid (CSF) values indicative of neonatal meningitis are controversial. In studies that have excluded infants with "traumatic taps" (or nonbacterial illnesses), the mean number of white blood cells in uninfected preterm or term infants was consistently <10 cells/mm^3.[44–50] Cell counts 2 standard deviations from the mean were generally less than 20 cells/mm^3.[46] In a study by Garges et al, the median number of white blood cells in infants who were born at greater than 34 weeks' gestation and had bacterial meningitis was 477/mm^3.[43] In contrast, the median number of white blood cells in infants who were born at less than 34 weeks' gestation and had meningitis was 110/mm^3.[51] Infants with meningitis attributable to Gram-negative pathogens typically have higher CSF white blood cell counts than do infants with meningitis attributable to Gram-positive pathogens.[52] Adjusting the CSF white blood cell count for the number of red blood cells does not improve the diagnostic utility (loss of sensitivity with marginal gain in specificity).[53] In addition, the number of bands in a CSF specimen does not predict meningitis.[54] With a delay in analysis (>2 hours), white blood cell counts and glucose concentrations decrease significantly.[55]

Protein concentrations in uninfected, term newborn infants are <100 mg/dL.[44–50] Preterm infants have CSF protein concentrations that vary inversely with gestational age. In the normoglycemic newborn infant, glucose concentrations in CSF are similar to those in older infants and children (70%–80% of a simultaneously obtained blood specimen). A low glucose concentration is the CSF variable with the greatest specificity for the diagnosis of meningitis.[43,51] Protein concentrations are higher and glucose concentrations are lower in term than in preterm infants with meningitis. However, meningitis occurs in infants with normal CSF values, and some of these infants have high bacterial inocula.[43,51]

Peripheral White Blood Cell Count and Differential Count

Total white blood cell counts have little value in the diagnosis of early-onset sepsis and have a poor positive predictive accuracy.[56,57] Many investigators have analyzed subcomponents of the white blood cell count (neutrophil indices)—absolute neutrophil count, absolute band count, and immature to total neutrophil (I/T)ratio—to identify infected infants. Like most diagnostic tests for neonatal sepsis, neutrophil indices have proven most useful for excluding infants without infection rather than identifying infected neonates. Neutropenia may be a better marker for neonatal sepsis and has better specificity than an elevated neutrophil count, because few conditions besides sepsis (maternal pregnancy-induced hypertension, asphyxia, and hemolytic disease) depress the neutrophil count of neonates.[58] The definitions for neutropenia vary with gestational age,[58–61] type of delivery (infants born by cesarean delivery without labor have lower counts than infants delivered vaginally),[61] site of sampling (neutrophil counts are lower in samples from arterial blood),[62] and altitude (infants born at elevated altitudes have higher total neutrophil counts).[63] In late preterm and term infants, the definition for neutropenia most commonly used is that suggested by Manroe et al ($<1800/mm^3$ at birth and $<7800/mm^3$ at 12–14 hours of age).[58] Schmutz et al reinvestigated these reference ranges using modern cell-counting instrumentation in 30 254 infants born at 23 to 42 weeks' gestation.[61] Infants with diagnoses known to affect neutrophil counts (eg, those born to women with pregnancy-induced hypertension or those with early-onset sepsis) were excluded. In this study, the lower limits of normal for neutrophil values at birth were $3500/mm^3$ in infants born at >36 weeks' gestation, $1000/mm^3$ in infants born at 28 through 36 weeks' gestation, and $500/mm^3$ in infants born at <28 weeks' gestation. Peak values occurred at 6 to 8 hours after birth; the lower limits of normal at that time were $7500/mm^3$, $3500/mm^3$, and $1500/mm^3$ for infants born at >36 weeks' gestation, 28 to 36 weeks' gestation, and <28 weeks' gestation, respectively.[61] It is noteworthy that the study by Schmutz et al was performed at 4800 feet above sea level, whereas that of Manroe et al was performed at 500 feet above sea level.

The absolute immature neutrophil count follows a similar pattern to the absolute neutrophil count and peaks at approximately 12 hours of life. The number of immature neutrophils increases from a maximal value of 1100 cells/mm^3 at birth to 1500 cells/mm^3 at 12 hours of age.[58] Absolute immature counts have a poor sensitivity and positive predictive accuracy for early-onset sepsis.[22] Furthermore, if exhaustion of bone marrow reserves occurs, the number of immature forms will remain depressed.[64]

The I/T ratio has the best sensitivity of any of the neutrophil indices. However, with manual counts, there are wide interreader differences in band neutrophil identification.[65] The I/T ratio is <0.22 in 96% of healthy preterm infants born at <32 weeks' gestational age.[66] Unlike the absolute neutrophil count and the absolute band count, maximum normal values for the I/T ratio occur at birth (0.16) and decline with increasing postnatal age to a minimum value of 0.12.[58] In healthy term infants, the 90th percentile for the I/T ratio is 0.27.[59] A single determination of the I/T ratio has a poor positive predictive accuracy (approximately 25%) but a very high negative predictive accuracy (99%).[66] The I/T ratio may be elevated in 25% to 50% of uninfected infants.[67]

Exhaustion of bone marrow reserves will result in low band counts and lead to falsely low ratios. The timing of the white blood cell count is critical.[68] Counts obtained 6 to 12 hours after birth are more likely to be abnormal than are counts obtained at birth, because alterations in the numbers (and ratios) of mature and immature neutrophils require an established inflammatory response. Therefore, once the decision is made to start antimicrobial therapy soon after birth, it is worth waiting 6 to 12 hours before ordering a white blood cell count and differential count.[68,69]

Platelet Counts

Despite the frequency of low platelet counts in infected infants, they are a nonspecific, insensitive, and late indicator of sepsis.[70,71] Moreover, platelet counts are not useful to follow clinical response to antimicrobial agents, because they often remain depressed for days to weeks after a sepsis episode.

Acute-Phase Reactants

A wide variety of acute-phase reactants have been evaluated in neonates with suspected bacterial sepsis. However, only C-reactive protein (CRP) and procalcitonin concentrations have been investigated in sufficiently large studies.[72,73] CRP concentration increases within 6 to 8 hours of an infectious episode in neonates and peaks at 24 hours.[74,75] The sensitivity of a CRP determination is low at birth, because it requires an inflammatory response (with release of interleukin-6) to increase CRP concentrations.[76] The sensitivity improves dramatically if the first determination is made 6 to 12 hours after birth. Benitz et al have demonstrated that excluding a value at birth, 2 normal CRP determinations (8–24 hours after birth and 24 hours later) have a negative predictive accuracy of 99.7% and a negative likelihood ratio of 0.15 for proven neonatal sepsis.[76] If CRP determinations remain persistently normal, it is strong evidence that bacterial sepsis is unlikely, and antimicrobial agents can be safely discontinued. Data are insufficient to recommend following sequential CRP

concentrations to determine the duration of antimicrobial therapy in an infant with an elevated value (≥1.0 mg/dL).

Procalcitonin concentrations increase within 2 hours of an infectious episode, peak at 12 hours, and normalize within 2 to 3 days in healthy adult volunteers.[77] A physiologic increase in procalcitonin concentration occurs within the first 24 hours of birth, and an increase in serum concentrations can occur with noninfectious conditions (eg, respiratory distress syndrome).[78] Procalcitonin concentration has a modestly better sensitivity than does CRP concentration but is less specific.[73] Chiesa and colleagues have published normal values for procalcitonin concentrations in term and preterm infants.[79] There is evidence from studies conducted in adult populations, the majority of which focused on patients with sepsis in the ICU, that significant reductions in use of antimicrobial agents can be achieved in patients whose treatment is guided by procalcitonin concentration.[80]

Sepsis Screening Panels

Hematologic scoring systems using multiple laboratory values (eg, white blood cell count, differential count, and platelet count) have been recommended as useful diagnostic aids. No matter what combination of tests is used, the positive predictive accuracy of scoring systems is poor unless the score is very high. Rodwell et al described a scoring system in which a score of 1 was assigned to 1 of 7 findings, including abnormalities of leukocyte count, total neutrophil count, increased immature polymorphonuclear leukocyte (PMN) count, increased I/T ratio, immature to mature PMN ratio >0.3, platelet count ≤150 000/mm^3, and pronounced degenerative changes (ie, toxic granulations) in PMNs.[81] In this study, two-thirds of preterm infants and 90% of term infants with a hematologic score ≥3 did not have proven sepsis.[81] Furthermore, scores obtained in the first several hours after birth have been shown to have poorer sensitivity and negative predictive value than scores obtained at 24 hours of age.[67] Sepsis screening panels commonly include neutrophil indices and acute-phase reactants (usually CRP concentration). The positive predictive value of the sepsis screen in neonates is poor (<30%); however, the negative predictive accuracy has been high (>99%) in small clinical studies.[22] Sepsis screening tests might be of value in deciding which "high-risk" healthy-appearing neonates do not need antimicrobial agents or whether therapy can be safely discontinued.

TREATMENT OF INFANTS WITH SUSPECTED EARLY-ONSET SEPSIS

In the United States, the most common pathogens responsible for early-onset neonatal sepsis are GBS and *Escherichia coli*.[17] A combination of ampicillin and an aminoglycoside (usually gentamicin) is generally used as initial therapy, and this combination of antimicrobial agents also has synergistic activity against GBS and *Listeria monocytogenes*.[82,83] Third-generation cephalosporins (eg, cefotaxime) represent a reasonable alternative to an aminoglycoside. However, several studies have reported rapid development of resistance when cefotaxime has been used routinely for the treatment of early-onset neonatal sepsis,[84] and extensive/prolonged use of third-generation cephalosporins is a risk factor for invasive candidiasis.[85] Because of its excellent CSF penetration, empirical or therapeutic use of cefotaxime should be restricted for use in infants with meningitis attributable to Gram-negative organisms.[86] Ceftriaxone is contraindicated in neonates because it is highly protein bound and may displace bilirubin, leading to a risk of kernicterus. Bacteremia without an identifiable focus of infection is generally treated for 10 days.[87] Uncomplicated meningitis attributable to GBS is treated for a minimum of 14 days.[88] Other focal infections secondary to GBS (eg, cerebritis, osteomyelitis, endocarditis) are treated for longer durations.[88] Gram-negative meningitis is treated for minimum of 21 days or 14 days after obtaining a negative culture, whichever is longer.[88] Treatment of Gram-negative meningitis should include cefotaxime and an aminoglycoside until the results of susceptibility testing are known.[87,88]

The duration of antimicrobial therapy in infants with negative blood cultures is controversial. Many women receive antimicrobial agents during labor as prophylaxis to prevent early-onset GBS infections or for management of suspected intra-amniontic infection or PPROM. In those instances, postnatal blood cultures may be sterile (false negative). When considering the duration of therapy in infants with negative blood cultures, the decision should include consideration of the clinical course as well as the risks associated with longer courses of antimicrobial agents. In a retrospective study by Cordero and Ayers, the average duration of treatment in 695 infants (<1000 g) with negative blood cultures was 5 ± 3 days.[89] Cotten et al have suggested an association with prolonged administration of antimicrobial agents (>5 days) in infants with suspected early-onset sepsis (and negative blood cultures) with death and necrotizing enterocolitis.[90] Two recent papers also support this association.[91,92]

PREVENTION STRATEGIES FOR EARLY-ONSET SEPSIS

The only intervention proven to decrease the incidence of early-onset neonatal sepsis is maternal treatment with intrapartum intravenous antimicrobial agents for the prevention of GBS infections.[93] Adequate prophylaxis is defined as penicillin (the preferred agent), ampicillin, or cefazolin given for

≥4 hours before delivery. Erythromycin is no longer recommended for prophylaxis because of high resistance rates. In parturients who have a nonserious penicillin allergy, cefazolin is the drug of choice. For parturients with a history of serious penicillin allergy (anaphylaxis, angioedema, respiratory compromise, or urticaria), clindamycin is an acceptable alternative agent, but only if the woman's rectovaginal GBS screening isolate has been tested and documented to be susceptible. If the clindamycin susceptibility is unknown or the GBS isolate is resistant to clindamycin, vancomycin is an alternative agent for prophylaxis. However, neither clindamycin nor vancomycin has been evaluated for efficacy in preventing early-onset GBS sepsis in neonates. Intrapartum antimicrobial agents are indicated for the following situations[93]:

1. Positive antenatal cultures or molecular test at admission for GBS (except for women who have a cesarean delivery without labor or membrane rupture)
2. Unknown maternal colonization status with gestation <37 weeks, rupture of membranes >18 hours, or temperature >100.4°F (>38°C)
3. GBS bacteriuria during the current pregnancy
4. Previous infant with invasive GBS disease

Management guidelines for the newborn infant have been published[93] and are available online (http://www.cdc.gov/groupbstrep/guidelines/index.html).

CLINICAL CHALLENGES

Challenge 1: Identifying Neonates With Clinical Signs of Sepsis With a "High Likelihood" of Early-Onset Sepsis Who Require Antimicrobial Agents Soon After Birth

Most infants with early-onset sepsis exhibit abnormal signs in the first 24 hours of life. Approximately 1% of infants will appear healthy at birth and then develop signs of infection after a variable time period.[21] Every critically ill infant should be evaluated and receive empirical broad-spectrum antimicrobial therapy after cultures, even when there are no obvious risk factors for sepsis. The greatest difficulty faced by clinicians is distinguishing neonates with early signs of sepsis from neonates with noninfectious conditions with relatively mild findings (eg, tachypnea with or without an oxygen requirement). In this situation, data are insufficient to guide management. In more mature neonates without risk factors for infection who clinically improve over the first 6 hours of life (eg, need for oxygen is decreasing and respiratory distress is resolving), it is reasonable to withhold antimicrobial therapy and monitor the neonates closely. The 6-hour window should not be considered absolute; however, most infants without infection demonstrate some improvement over that time period. Any worsening of the infant's condition should prompt starting antimicrobial agents after cultures have been obtained.

Challenge 2: Identifying Healthy-Appearing Neonates With a "High Likelihood" of Early-Onset Sepsis Who Require Antimicrobial Agents Soon After Birth

This category includes infants with 1 of the risk factors for sepsis noted previously (colonization with GBS, prolonged rupture of membranes >18 hours, or maternal chorioamnionitis). GBS is not a risk factor if the mother has received adequate intrapartum therapy (penicillin, ampicillin, or cefazolin for at least 4 hours before delivery) or has a cesarean delivery with intact membranes in the absence of labor.[93] The risk of infection in the newborn infant varies considerably with the risk factor present. The greatest risk of early-onset sepsis occurs in infants born to women with chorioamnionitis who are also colonized with GBS and did not receive intrapartum antimicrobial agents. Early-onset sepsis does occur in infants who appear healthy at birth.[21] Therefore,

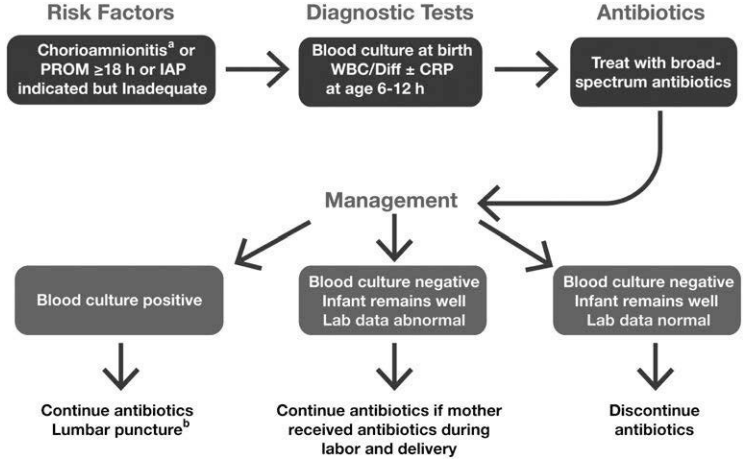

FIGURE 1

Evaluation of asymptomatic infants <37 weeks' gestation with risk factors for sepsis. [a]The diagnosis of chorioamnionitis is problematic and has important implications for the management of the newborn infant. Therefore, pediatric providers are encouraged to speak with their obstetrical colleagues whenever the diagnosis is made. [b]Lumbar puncture is indicated in any infant with a positive blood culture or in whom sepsis is highly suspected on the basis of clinical signs, response to treatment, and laboratory results. IAP, intrapartum antimicrobial prophylaxis; WBC, white blood cell; Diff, differential white blood cell count.

some clinicians use diagnostic tests with a high negative predictive accuracy as reassurance that infection is not present (allowing them to withhold antimicrobial agents). The decision of whether to treat a high-risk infant depends on the risk factors present, the frequency of observations, and gestational age. The threshold for initiating antimicrobial treatment generally decreases with increasing numbers of risk factors for infection and greater degrees of prematurity. Suggested algorithms for management of healthy-appearing, high-risk infants are shown in Figs 1, 2, and 3. Screening blood cultures have not been shown to be of value.[21]

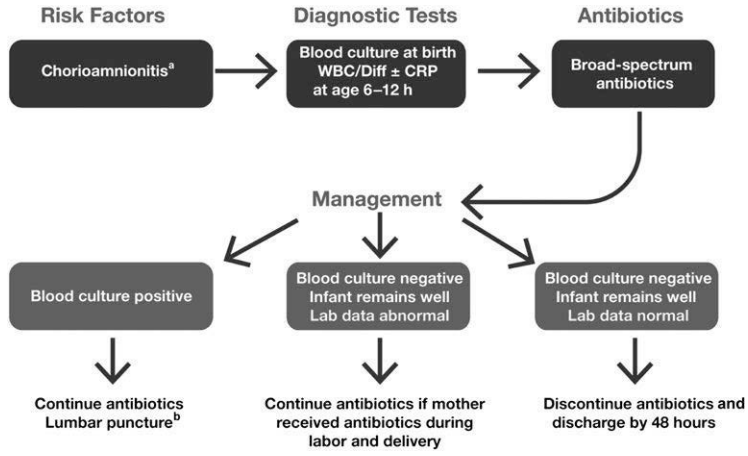

FIGURE 2

Evaluation of asymptomatic infants ≥37 weeks' gestation with risk factors for sepsis. [a]The diagnosis of chorioamnionitis is problematic and has important implications for the management of the newborn infant. Therefore, pediatric providers are encouraged to speak with their obstetrical colleagues whenever the diagnosis is made. [b]Lumbar puncture is indicated in any infant with a positive blood culture or in whom sepsis is highly suspected on the basis of clinical signs, response to treatment, and laboratory results. WBC, white blood cell; Diff, differential white blood cell count.

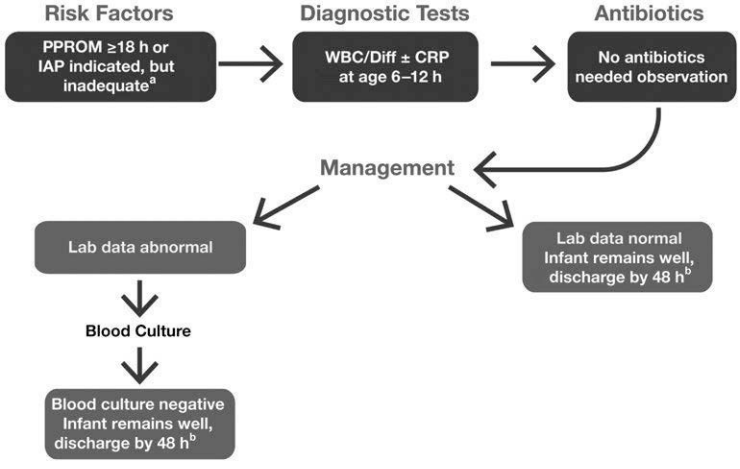

FIGURE 3

Evaluation of asymptomatic infants ≥37 weeks' gestation with risk factors for sepsis (no chorioamnionitis). [a]Inadequate treatment: Defined as the use of an antibiotic other than penicillin, ampicillin, or cefazolin or if the duration of antibiotics before delivery was <4 h. [b]Discharge at 24 h is acceptable if other discharge criteria have been met, access to medical care is readily accessible, and a person who is able to comply fully with instructions for home observation will be present. If any of these conditions is not met, the infant should be observed in the hospital for at least 48 h and until discharge criteria are achieved. IAP, intrapartum antimicrobial prophylaxis; WBC, white blood cell; Diff, differential white blood cell count.

CONCLUSIONS

The diagnosis and management of neonates with suspected early-onset sepsis are based on scientific principles modified by the "art and experience" of the practitioner. The following are well-established concepts related to neonatal sepsis:

1. Neonatal sepsis is a major cause of morbidity and mortality.
2. Diagnostic tests for early-onset sepsis (other than blood or CSF cultures) are useful for identifying infants with a low probability of sepsis but not at identifying infants likely to be infected.
3. One milliliter of blood drawn before initiating antimicrobial therapy is needed to adequately detect bacteremia if a pediatric blood culture bottle is used.
4. Cultures of superficial body sites, gastric aspirates, and urine are of no value in the diagnosis of early-onset sepsis.
5. Lumbar puncture is not needed in all infants with suspected sepsis (especially those who appear healthy) but should be performed for infants with signs of sepsis who can safely undergo the procedure, for infants with a positive blood culture, for infants likely to be bacteremic (on the basis of laboratory data), and infants who do not respond to antimicrobial therapy in the expected manner.
6. The optimal treatment of infants with suspected early-onset sepsis is broad-spectrum antimicrobial agents (ampicillin and an aminoglycoside). Once the pathogen is identified, antimicrobial therapy should be narrowed (unless synergism is needed).
7. Antimicrobial therapy should be discontinued at 48 hours in clinical situations in which the probability of sepsis is low.

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CLINICAL REPORT

Medical Staff Appointment and Delineation of Pediatric Privileges in Hospitals

abstract

FREE

The review and verification of credentials and the granting of clinical privileges are required of every hospital to ensure that members of the medical staff are competent and qualified to provide specified levels of patient care. The credentialing process involves the following: (1) assessment of the professional and personal background of each practitioner seeking privileges; (2) assignment of privileges appropriate for the clinician's training and experience; (3) ongoing monitoring of the professional activities of each staff member; and (4) periodic reappointment to the medical staff on the basis of objectively measured performance. We examine the essential elements of a credentials review for initial and renewed medical staff appointments along with suggested criteria for the delineation of clinical privileges. Sample forms for the delineation of privileges can be found on the American Academy of Pediatrics Committee on Hospital Care Web site (http://www.aap.org/visit/cmte19.htm). Because of differences among individual hospitals, no 1 method for credentialing is universally applicable. The medical staff of each hospital must, therefore, establish its own process based on the general principles reviewed in this report. The issues of medical staff membership and credentialing have become very complex, and institutions and medical staffs are vulnerable to legal action. Consequently, it is advisable for hospitals and medical staffs to obtain expert legal advice when medical staff bylaws are constructed or revised. *Pediatrics* 2012;129:782–787

INTRODUCTION

Credentialing is the formal recognition of professional and technical competence. The process involves 2 distinct elements: it establishes what information is necessary to confirm professional and technical competence including mechanisms for the verification of the information received by the hospital, and it evaluates the information received with reference to an applicant.[1]

"The delineation of clinical privileges is the process whereby the medical staff evaluates and recommends that an individual practitioner be allowed to provide specific patient care services in the institution. A clinical privilege is a specific grant or permission by a hospital for an individual practitioner to perform diagnostic or therapeutic procedures or other patient care services within well-defined limits."[1]

Daniel A. Rauch, MD, THE COMMITTEE ON HOSPITAL CARE, and SECTION ON HOSPITAL MEDICINE

ABBREVIATIONS

ADA—Americans With Disabilities Act
NPDB—National Practitioners Data Bank

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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The role of the hospital in credentialing its staff was first laid out by The Joint Commission on the Accreditation of Hospitals (later renamed The Joint Commission) in 1953 and has been regularly updated since then. This process is distinct from the recognition of competence within a specialty, which is the purview of the various members of the American Board of Medical Specialties.

Medical staff membership is not synonymous with clinical privileges. Medical staff membership involves the practitioner's organizational rights and responsibilities. A member of the medical staff is not entitled to perform procedures or treat patients simply by virtue of being a member of the medical staff.[1]

CREDENTIALING PRINCIPLES

The medical staff of each hospital is responsible for establishing its own procedures for credentialing.[2] These procedures must be reviewed by a lawyer who is familiar with these issues.[3] The authority of the hospital to grant, change, or revoke clinical privileges is based on several principles:

1. The practice of medicine, including pediatrics, within a hospital is not a right of every physician but rather a privilege extended by the hospital in accordance with applicable law.
2. The hospital and its governing board are responsible for the safety of its patients and the quality of care provided by its staff.
3. The hospital must ensure that all members of its health care team are competent and qualified to provide the services for which they have been granted privileges.
4. The organized medical staff of the hospital is entrusted by the governing board with the responsibility of recommending that only competent practitioners treat patients in the hospital.

Certain elements are required in every hospital's credentialing process:

1. The credentialing process must be thorough, fair, and timely and must involve unbiased and good-faith review by peers within or outside the hospital as appropriate to the individual candidate. Any possible malicious use of the peer-review process is not acceptable.
2. The entire credentialing process must be clearly described in the medical staff bylaws. This must include a description of mechanisms for appeal and guaranteed due process for disputes concerning disciplinary actions and for changes or revocation of privileges. The medical staff bylaws should incorporate provisions of the Health Care Quality Improvement Act of 1986,[4] requirements of state laws that define immunities and protections for the hospital and peer-review committee members from various legal liabilities, and other related legislation.[2]
3. Criteria for specific clinical privileges must be well defined and based on up-to-date national and local standards.
4. Confidentiality and protection of the information used in credentialing and peer review, subject to applicable law, must be incorporated into the process.
5. The credentialing process should take into account the standards recommended by The Joint Commission, the Hospital Medical Staff Section of the American Medical Association, state and federal agencies, or other appropriate accrediting organizations.[2]

Credentialing standards have been updated to include 3 new concepts. Credentialing should be informed by the 6 areas of "general competencies" developed by the Accreditation Council for Graduate Medical Education. Focused professional practice evaluation allows the medical staff to focus on a specific aspect of a practitioner's performance, such as when competence is suggested but additional information is needed for confirmation. Examples of this are proctoring or peer review of cases. Lastly, ongoing professional practice evaluation provides for continuous evaluation rather than the traditional biannual renewal process.[2,5] Examples of this are direct observation and monitoring patient outcomes. The credentialing process must not allow conflicts of interest (economic or otherwise) to impair due process.

In some communities, the credentialing process for medical staffs of area hospitals, surgical centers, and health insurance companies has been consolidated and standardized under a centralized data collection and storage agency, such as the state or local medical society. This allows only 1 application and data verification for applications to more than 1 hospital. However, each hospital is still required to determine the applicant's qualifications for clinical privileges. The American Academy of Pediatrics approves of this model as a method that simplifies the process yet maintains its rigor. Although credentialing standards have been used as a method of quality assurance, a recent study reveals no correlation between stringency of hospital credentialing policies and clinical outcomes.[5]

INITIAL APPOINTMENT

When a practitioner applies for medical staff membership the first time, the medical staff must verify the practitioner's training, experience, and qualifications. This involves verifying the following documents from primary sources or approved secondary sources if applicable:

1. Medical staff category requested
2. Current license in the state of practice
3. Other active state licenses
4. Drug Enforcement Administration certificate
5. Medical school education
6. Residency and fellowship training
7. Practice experience
8. Board certification, recertification, or other measure of ongoing competency
9. Basic life support or other lifesaving course (eg, pediatric advanced life support, neonatal resuscitation program) documentation of completion
10. Settled or pending litigation
11. Felony convictions and criminal background checks
12. Involuntary license or medical staff resignations, suspensions, disciplinary actions, or denials
13. Sanctions received from professional organizations
14. National Practitioners Data Bank (NPDB) and Federation of State Medical Boards Physician information
15. Disciplinary Data Bank information
16. Malpractice coverage verification, if required
17. Current physical, mental, or substance abuse issues that may affect patient care, as allowed by the Americans With Disabilities Act (ADA)[6]; this information can be obtained after the applicant is determined to meet all other qualifications for medical staff membership[7]
18. Signed release of liability form from the practitioner
19. Other information, as determined by the individual hospital or department[2]

The NPDB serves as a central repository of information about health care practitioners' malpractice payments, professional membership restrictions, and adverse actions regarding licenses or hospital privileges. Hospitals are required to check with the NPDB for all new medical staff appointments. They are also required to report any actions that affect the clinical privileges such as reduction, restriction, suspension, or revocation of clinical privileges for at least 31 days; voluntary resignation while peer review is taking place or instead of peer review; and the denial of clinical privileges to a new or existing medical staff member when a peer review judgment is involved. Between 5% and 30% of privileging and licensure applications involving an NPDB report were not granted "as requested," suggesting the NPDB data are important to the process. Unfortunately, underreporting was also evident: 60% to 75% of reportable actions were not reported, limiting the information to which health care entities have access.[8]

In addition to concrete data about the applicant's accomplishments, information from peers should be obtained regarding the practitioner's ability to work with other staff, patients, and students, if applicable. Hospitals may require that each applicant be covered by a minimum limit of medical liability insurance as a condition of membership on the medical staff. This may be waived for practitioners not participating in patient care (eg, retired physicians). For the hospital to verify the information, the applicant must sign a statement allowing the hospital to collect the information and releasing the hospital and references or sources from liability. Hospitals must ensure that all information collected and decisions regarding credentialing are kept confidential.

Depending on state law and hospital or medical staff bylaws, medical staff membership may include nonphysician licensed independent practitioners, such as psychologists, podiatrists, physician assistants, nurse practitioners, midwives, optometrists, dentists, and others who provide direct patient care. Advanced practice nurses also must be credentialed by the department of nursing. Advanced practice nurses who do not provide direct patient care are not credentialed through the medical staff.[9] Guidelines for the practice and requirements for the supervision of nonphysician independent licensed practitioners and residents-in-training must be defined clearly in the medical staff bylaws and include the same level of fairness and rigor as those applied to physicians.[2,10] A physician providing telemedicine services must be credentialed by the hospital receiving the telemedicine services (ie, where the patient is receiving care).[2]

Criteria for granting or restricting medical staff appointment cannot be based on gender; race or ethnic group; creed; national origin; sexual orientation; membership in professional societies; membership in a prepaid, closed-panel group practice; or solely economic factors. Criteria for medical staff appointment should relate to standards of patient care and to the objectives, purposes, and resources of the institution.

The ADA covers hospital employees and may cover physicians with staff privileges. The ADA prohibits discrimination against qualified job applicants and traditional employees who, with or without reasonable accommodation, can perform the essential functions of their job. It may apply to hospital medical staff matters involving independent contractor physicians. As a result of the ADA, questions regarding personal health issues and alcohol and illegal drug use cannot be asked at the time of initial staff application. A conditional offer of medical staff membership can be made contingent on the

applicant providing personal health information meeting certain criteria. In all issues when accommodations are requested for disabilities, the most important factor is the safety of the patient.[7]

Economic credentialing has been defined by the American Medical Association as "the use of economic criteria in determining an individual's qualification for initial and continuing hospital medical staff membership or privileges that is unrelated to the quality of care or professional competency." Measures that have an economic component in addition to improving quality, such as length of stay and ICU days, may be used in credentialing decisions. Several states have laws that prohibit use of economic credentialing,[11,12] although in most states, it is still legal and physicians need to be aware of the ramifications of participating in potentially competing entities.[13] In this regard, the American Academy of Pediatrics states that pediatricians should not be excluded from patient care panels solely on an economic basis.[14]

Initial medical staff membership starts with a provisional or temporary appointment for a defined period of time. This allows direct observation of the practitioner's clinical skills, patient management style, and manner of care. The need for proctoring and mentoring for new medical staff members should be established by each department. Appointments must be renewed at a minimum of every 2 years, but processes must also allow for interval evaluation as needed.[2] Medical staff membership is awarded in several categories on the basis of the amount and type of patient care the practitioner delivers. There may be categories for hospital-based ambulatory care only, for full staff including ambulatory and inpatient care, and for those who no longer provide direct patient care in the hospital setting. Nonphysician licensed independent practitioners or residents-in-training may form other categories.

If a hospital medical staff decides to deny initial appointment or reappointment or deny, limit, or suspend privileges, due process and protection must be provided in accordance with customary legal principles and hospital bylaws. This must include procedural due process, which is defined as whether the rules are administered properly and applied equally to all staff members, and substantive due process. The latter is concerned with whether the rules and criteria stated in the bylaws are reasonable, fair, and not arbitrary and whether the decision made by the medical staff or hearing panel is based on the weight of relevant and reliable evidence and only on that evidence presented to the medical staff or hearing panel. Nonphysician licensed independent practitioners also must have similar due process and protection.[2]

DELINEATION OF CLINICAL PRIVILEGES

A major portion of the credentialing process is the delineation of clinical privileges. By this process, the medical staff evaluates and recommends that an individual practitioner is allowed to provide specific patient care services in the hospital on the basis of the mission and needs of the hospital and the practitioner's training, experience, and skills. Privileges may be denied to an applicant if the hospital does not have the facilities for the requested procedure (eg, a pediatric cardiologist who requests privileges for cardiac catheterization from a hospital that does not have catheterization facilities).[15]

Departments within the hospital are responsible for defining the minimum education, training, and experience that a practitioner must possess to deliver care of varying complexity or perform specific procedures. Experience may be defined as cumulative or as a certain volume in a period of time. This definition may be applied across departments when patients are cared for by practitioners of different disciplines (such as pediatrics and nursing for nurse practitioners). Once criteria are established, these must be written and applied equitably across practitioners from different specialties (such as pediatrics, family practice, and surgery). Criteria for clinical privileges are based on the complexity of care needed by the patient, such as routine inpatient care, routine newborn care, subspecialty care, or intensive care. Criteria for privileges for procedures can be based on the levels of care, documentation of training, and continued competence in the procedures. Research has revealed that skills in some procedures, such as laparoscopy or surgical procedures, improve with repeated use until a set number is reached.[16,17] Other data have revealed that patient outcomes are improved for some procedures when a minimum number is performed in a hospital.[16,18] Competency for procedures also can be determined by evaluation of performance under clinical conditions (proctorship). Checklists may be used by the practitioner requesting privileges to document levels of care and procedures requested.

Questions are often raised on how one determines that an applicant is competent to care for children in the hospital if the applicant is not a pediatrician or pediatric-trained specialist or subspecialist. Skill levels for individual practitioners caring for children can be determined by reviewing training and experience. Experience in procedures performed on children should also be documented. Standards for assessing competencies of nonpediatric physicians should be defined

and rigorous and meet uniformed standards of care for children regardless of the physician's training.

As new procedures and treatment modalities develop, guidelines for clinical privileges must also develop. New procedures and treatment modalities can be divided into major new procedures, such as endoscopy or laparoscopic surgery, or minor changes, such as a new way to perform laparoscopic surgery. Practitioners wishing to be granted privileges in a major new procedure or treatment modality not inherent in their residency or fellowship training (such as use of ultrasonography or providing sedation) must document sufficient hands-on-training to be deemed competent. Physicians may gain this training through supervised training programs. A practitioner may also gain provisional privileges allowing him or her to perform the procedure under the supervision of another practitioner skilled in the procedure (proctoring).[19,20] Data from some new procedures have revealed that the complication rate decreases significantly and competency increases significantly after a certain number of the procedures are performed.[17,21] Guidelines for competency in new procedures or treatment modalities must be developed on the basis of a review of the literature and the technical aspects of the procedure. Once the guidelines are successfully met by the practitioner, full privileges are granted.

REAPPOINTMENT

Standards from The Joint Commission state that reappointment must occur at least every 2 years. This reappointment is based on ongoing monitoring of information concerning the practitioner's professional performance, judgment, and clinical or technical skills.[2] The content of the reappointment request must be defined in the medical staff bylaws. The minimum information required from the practitioner includes:

1. Medical staff category requested
2. Current license in the state of practice
3. Other active state licenses
4. Drug Enforcement Administration certificate
5. Continuing medical education credit, as required
6. Original certification date and certification renewal dates
7. Current cardiopulmonary resuscitation or other lifesaving course (eg, pediatric advanced life support, neonatal resuscitation program) documentation of completion
8. Settled or pending litigation
9. Felony convictions
10. Involuntary license or medical staff resignations, suspensions, disciplinary actions, or denials
11. Sanctions received from professional organizations
12. NPDB and Federation of State Medical Boards Physician Disciplinary Data Bank information
13. Malpractice coverage verification, if required
14. Quality assurance or continuing quality improvement activities and results
15. Listing of all hospitals where the practitioner holds privileges and any changes in this status
16. Signed release of liability form from the practitioner
17. Current physical, mental, or substance abuse issues that may affect patient care, as allowed by ADA

In most cases, information should be reviewed in a similar manner to that occurring for initial appointment. If an applicant for reappointment rarely cares for patients in the hospital facility, the medical staff office may need to request information from another hospital where the applicant is more active to help delineate appropriate clinical privileges or consider modifying the appointment to that of ambulatory-care only. If concerns are raised about reappointment or granting initial clinical privileges because of irregularities in clinical activity profile or quality assurance, this information needs to be reviewed by peers and the department head in a confidential manner, as defined in medical staff bylaws. If concerns persist, the review committee or medical staff must communicate these concerns to the applicant in a confidential manner, as defined by the medical staff bylaws. Due process, as defined in the medical staff bylaws, must be followed.

It is the responsibility of each member of the medical staff to raise any concerns about physician performance because of waning skills, mental or physical health problems, or substance abuse that affects patient care. These must be investigated in a confidential and fair manner, as defined in the medical staff bylaws, without waiting for the next reappointment.

The process of credentialing and granting of privileges must be seen as 1 way for hospitals to help ensure that their patients receive quality care. Pediatricians or pediatric-trained specialists and subspecialists must be involved in defining guidelines to ensure that children receive optimal care.

SPECIAL CIRCUMSTANCES

Hospitals should have an established policy on emergency privileges that allow current medical staff members to practice beyond their existing privileges to save a life, limb, or organ. Likewise, there should be a policy for disaster privileges that enable practitioners outside the current medical staff to treat patients in the case of a disaster in the community.[2]

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CLINICAL REPORT

Neonatal Drug Withdrawal

Mark L. Hudak, MD, Rosemarie C. Tan, MD,, PhD, THE COMMITTEE ON DRUGS, and THE COMMITTEE ON FETUS AND NEWBORN

abstract

Maternal use of certain drugs during pregnancy can result in transient neonatal signs consistent with withdrawal or acute toxicity or cause sustained signs consistent with a lasting drug effect. In addition, hospitalized infants who are treated with opioids or benzodiazepines to provide analgesia or sedation may be at risk for manifesting signs of withdrawal. This statement updates information about the clinical presentation of infants exposed to intrauterine drugs and the therapeutic options for treatment of withdrawal and is expanded to include evidence-based approaches to the management of the hospitalized infant who requires weaning from analgesics or sedatives. *Pediatrics* 2012;129:e540–e560

KEY WORDS

opioid, methadone, heroin, fentanyl, benzodiazepine, cocaine, methamphetamine, SSRI, drug withdrawal, neonate, abstinence syndrome

ABBREVIATIONS

CNS—central nervous system
DTO—diluted tincture of opium
ECMO—extracorporeal membrane oxygenation
FDA—Food and Drug Administration
5-HIAA—5-hydroxyindoleacetic acid
ICD-9—International Classification of Diseases, Ninth Revision
NAS—neonatal abstinence syndrome
SSRI—selective serotonin reuptake inhibitor

INTRODUCTION

Use and abuse of drugs, alcohol, and tobacco contribute significantly to the health burden of society. The 2009 National Survey on Drug Use and Health reported that recent (within the past month) use of illicit drugs, binge or heavy alcohol ingestion, and use of tobacco products occurred in 8.7%, 23.7%, and 27.7%, respectively, of the population 12 years or older.[1] Numerous case reports have documented the use of a variety of drugs by women of childbearing age (Table 1). Intrauterine exposure to certain drugs may cause congenital anomalies and/or fetal growth restriction, increase the risk of preterm birth, produce signs of withdrawal or toxicity in the neonate, or impair normal neurodevelopment.[2] Fetal exposure to marijuana, the illicit drug most commonly used by pregnant women, does not cause clinically important neonatal withdrawal signs but may have subtle effects on long-term neurobehavioral outcomes.[3] With the use of computer-assisted interviewing techniques that preserved confidentiality, the 2009 National Survey on Drug Use and Health noted that 4.5% of pregnant women 15 to 44 years of age reported recent use of illicit drugs (eg, marijuana, cocaine, hallucinogens, heroin, methamphetamines, and nonmedical use of prescription drugs). Binge or heavy drinking in the first trimester was reported by 11.9%, and recent tobacco use was reported by 15.3%. Rates of recent illicit drug use and smoking were lower among pregnant compared with nonpregnant women across all age groups, except for those 15 to 17 years of age. In the latter age group, the rates of illicit drug use and smoking were higher among those who were pregnant compared with those who were not pregnant (15.8% vs 13.0% and 20.6% vs 13.9%, respectively). The reported rates of illicit drug use most likely underestimate true rates, because the percentage of pregnant women who report the recent use of illicit drugs on screening interviews can

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FREE

TABLE 1 Major Drugs of Abuse[a]

Opioids	CNS Stimulants	CNS Depressants	Hallucinogens
Agonists	Amphetamines	Alcohol	Indolealkylamines (LSD, psilocin, psilocybin, DMT, DET)
Morphine	Dextroamphetamine (Dexedrine)	Barbiturates	Phenylethylamines (mescaline, peyote)
Codeine	Methamphetamine	Benzodiazepines	Phenylisopropylamines (MDA, MMDA, MDMA, MDEA)
Methadone	Amphetamine sulfate	Other sedative-hypnotics	Inhalants
Meperidine (Demerol)	Amphetamine congeners	Methaqualone (Quaalude)	Solvents and aerosols (glues, gasoline, paint thinner, cleaning solutions, nail polish remover, Freon)
Oxycodone (Percodan, OxylR, Percolone, Roxicodone, Percocet, OxyContin)	Benzphetamine (Didrex)	Glutethimide (Doriden)	Nitrites
Propoxyphene (Darvon)	Diethylpropion (Tenuate)	Chloral hydrate	Nitrous oxide
Hydromorphone (Dilaudid)	Fenfluramine	Cannabinoids	
Hydrocodone (Lortab, Vicodin)	Phendimetrazine (Adipost, Bontril, Prelu-2)	Marijuana	
Fentanyl (Sublimaze)	Phentermine (Adipex-P, Zantryl)	Hashish	
Tramadol (Ultram, Ultracet)	Cocaine		
Heroin	Methylphenidate (Ritalin, Concerta)		
Antagonists	Pemoline (Cylert)		
Naloxone (Narcan)	Phenylpropanolamine		
Naltrexone (ReVia)	Phencyclidines		
Mixed Agonist-Antagonists	Nicotine		
Pentazocine (Talwin)			
Buprenorphine (Buprenex)			

DET, diethyltryptamine; DMT, dimethyltryptamine; LSD, lysergic acid diethylamide; MDA, methylenedioxyamphetamine; MDEA, 3,4-methylenedioxyethamphetamine; MDMA, 3,4-methylenedioxymethamphetamine (ecstasy); and MMDA, 3-methoxy-4,5-methylenedioxyamphetamine.

[a] Adapted from Milhorn.[160]

be substantially lower than that determined by drug screening using biological samples. For infants, the use of *International Classification of Diseases, Ninth Revision* (*ICD-9*)-based hospital discharge databases to determine the incidence of neonatal drug withdrawal secondary to intrauterine exposure has in the past underestimated the incidence of this condition.[4] Data compiled by the Agency for Healthcare Research and Quality and by the Florida Department of Health attest to an increased incidence and/or recognition of neonatal withdrawal syndrome (ICD-9 code 779.5). Nationally, the number of infants coded at discharge with neonatal withdrawal increased from 7653 in 1995 to 11 937 in 2008. In Florida, the number of newborns discharged with ICD-9 code 779.5 climbed by more than 10-fold, from 0.4 to 4.4 discharges per 1000 live births, from 1995 to 2009. An indeterminate part of these observed increases has resulted from more liberal use of prescription opiates in pregnant women to palliate a wide variety of etiologies of acute or chronic pain. In a recent report, chronic use of narcotic prescriptions (use for $\geq$1 intrapartum month) among pregnant women cared for at a single clinic increased fivefold from 1998 to 2008, and 5.6% of infants delivered to these women manifested signs of neonatal withdrawal.[5]

Signs characteristic of neonatal withdrawal have been attributed to intrauterine exposure to a variety of drugs (Table 2). Other drugs cause signs in neonates because of acute toxicity. Chronic in utero exposure to a drug (eg, alcohol) can lead to permanent phenotypical and/or neurodevelopmental-behavioral abnormalities consistent with drug effect. Signs and symptoms of withdrawal worsen as drug levels decrease, whereas signs and symptoms of acute toxicity abate with drug elimination. Clinically important neonatal withdrawal most commonly results from intrauterine opioid exposure. The constellation of clinical findings associated with opioid withdrawal has been termed the neonatal abstinence syndrome (NAS). Among neonates exposed to opioids in utero, withdrawal signs will develop in 55% to 94%.[6–9] Neonatal withdrawal signs have also been described in infants exposed antenatally to benzodiazepines,[10,11] barbiturates,[12,13] and alcohol.[14,15]

COCAINE AND OTHER STIMULANTS

An abstinence syndrome after intrauterine exposure to central nervous system (CNS) stimulants such as cocaine and amphetamine has not been clearly defined. Many studies that have assessed behavior and neurologic signs in cocaine-exposed infants have used scoring systems that were designed to evaluate opioid withdrawal. Neurobehavioral abnormalities[16,17] frequently occur in neonates with intrauterine cocaine exposure, most frequently on the second or third postnatal days.[18] These abnormalities may include irritability, hyperactivity, tremors, high-pitched cry, and excessive sucking. Because cocaine or its metabolites may be detected in neonatal urine

TABLE 2 Maternal Nonnarcotic Drugs That Cause Neonatal Psychomotor Behavior Consistent With Withdrawal

Drug	Signs	Onset of Signs	Duration of Signs[a]	Ref. No.
Alcohol	Hyperactivity, crying, irritability, poor suck, tremors, seizures; onset of signs at birth, poor sleeping pattern, hyperphagia, diaphoresis	3–12 h	18 mo	14,15
Barbiturates	Irritability, severe tremors, hyperacusis, excessive crying, vasomotor instability, diarrhea, restlessness, increased tone, hyperphagia, vomiting, disturbed sleep; onset first 24 h of life or as late as 10–14 d of age	1–14 d	4-6 mo with prescription	12,13
Caffeine	Jitteriness, vomiting, bradycardia, tachypnea	At birth	1-7 d	161
Chlordiazepoxide	Irritability, tremors; signs may start at 21 d	Days–weeks	9 mo; 11/2 mo with prescription	11
Clomipramine	Hypothermia, cyanosis, tremors; onset 12 h of age		4 d with prescription	162
Diazepam	Hypotonia, poor suck, hypothermia, apnea, hypertonia, hyperreflexia, tremors, vomiting, hyperactivity, tachypnea (mother receiving multiple drug therapy)	Hours–weeks	8 mo; 10–66 d with prescription	10
Ethchlorvynol	Lethargy, jitteriness, hyperphagia, irritability, poor suck, hypotonia (mother receiving multiple drug therapy)		Possibly 10 d with prescription	163
Glutethimide	Increased tone, tremors, opisthotonos, high-pitched cry, hyperactivity, irritability, colic		6 mo	164
Hydroxyzine	Tremors, irritability, hyperactivity, jitteriness, shrill cry, myoclonic jerks, hypotonia, increased respiratory and heart rates, feeding problems, clonic movements (mother receiving multiple drug therapy)		5 wk with prescription	58
Meprobamate	Irritability, tremors, poor sleep patterns, abdominal pain		9 mo; 3 mo with prescription	165
SSRIs	Crying, irritability, tremors, poor suck, feeding difficulty, hypertonia, tachypnea, sleep disturbance, hypoglycemia, seizures	Hours–days	1–4 wk	31–33,35

[a] Prescription indicates the infant was treated with pharmacologic agents, and the natural course of the signs may have been shortened.

for as long as 7 days after delivery,[18] observed abnormalities in exposed infants may reflect drug effect rather than withdrawal. In an unmasked study, 6%, 14%, and 35% of infants exposed to cocaine only, heroin only, or cocaine plus heroin, respectively, qualified for treatment on the basis of scoring.[19] Several studies that used masked evaluators found that cocaine-exposed infants had either no[20,21] or minimal[22] withdrawal signs compared with cocaine-naïve infants (ie, those never exposed). Eyler et al[16] conducted a prospective controlled study of 3 groups of infants: 1 group had no documented exposure to cocaine by history or by maternal and infant urine testing; a second group was cocaine exposed but had negative urine screening at birth; and a third group had cocaine metabolites detected in neonatal urine. Observers masked to infant status performed assessments using the Brazelton Neonatal Behavioral Assessment Scale.[23] Infants who were positive for cocaine metabolites did not differ significantly from metabolite-negative infants with a history of exposure nor from cocaine-naïve infants. These findings supported neither a withdrawal nor a drug toxicity syndrome. Cocaine-exposed infants have been described as having a higher incidence of abnormal auditory brainstem responses and EEGs, compared with nonexposed infants.[24,25] In another study, infants with heavy exposure to cocaine had similar Brazelton findings at 2 to 3 days of age as did infants with light or no exposure; however, by 17 days of age, heavily exposed infants were more excitable and demonstrated poorer state regulation.[26] No published studies have carefully evaluated pharmacologic treatment of infants with signs attributable to prenatal cocaine exposure.

Methamphetamine abuse has been reported among pregnant women,[27] although overall rates are low compared with cocaine and appear to have decreased in the general population between 2006 and 2008.[1] Methamphetamine is an extremely potent sympathomimetic agent that induces euphoria and increases alertness and self-confidence, because it produces a massive efflux of dopamine in the CNS. Pregnant women who abuse methamphetamine are at increased risk of preterm birth, placental abruption, fetal distress, and intrauterine growth restriction at rates similar to those for pregnant women who use cocaine. In 1 study, only 4% of infants exposed to methamphetamine were treated for drug withdrawal, but it was not possible to exclude concomitant abuse of other drugs as contributory in all cases.[27] There are reports of long-term adverse neurotoxic effects of in utero methamphetamine exposure on behavior, cognitive skills, and physical dexterity.[28,29]

SELECTIVE SEROTONIN REUPTAKE INHIBITORS

Selective serotonin reuptake inhibitors (SSRIs) are a class of antidepressant medications that became available for widespread clinical use in 1988. SSRIs

(eg, fluoxetine [Prozac], paroxetine [Paxil], sertraline [Zoloft], citalopram [Celexa], escitalopram [Lexapro], and fluvoxamine [Luvox]) are now the most frequently used drugs to treat depression both in the general population and in pregnant women.[30] Case reports,[31] adverse drug reaction reports,[32] and prospective studies[33,34] linked third-trimester use of SSRIs in pregnant women to a constellation of neonatal signs that include continuous crying, irritability, jitteriness, and/or restlessness; shivering; fever; tremors; hypertonia or rigidity; tachypnea or respiratory distress; feeding difficulty; sleep disturbance; hypoglycemia; and seizures.[35] The onset of these signs ranged from several hours to several days after birth and usually resolved within 1 to 2 weeks. In 1 infant exposed to paroxetine, signs persisted through 4 weeks of age.[36] In severely affected infants, a short-term course of chlorpromazine provided measurable relief of symptoms.[36]

Several authors have discussed whether these signs are better explained by serotonin syndrome (attributable to increased serotonin concentration in the intersynaptic cleft) or by SSRI withdrawal (attributable to a relative hyposerotonergic state).[30,32,35,37–40] In adults, treatment with a single SSRI may cause mild to moderate serotonin syndrome, but severe signs are more likely to occur when 2 or more drugs that increase serotonin concentration by different mechanisms are prescribed.[35] In adults, serotonin syndrome is characterized by the following triad of clinical signs: changes in mental status (agitation, confusion); autonomic hyperactivity (fever, tachycardia, tachypnea, diaphoresis, mydriasis); and neuromuscular abnormalities (tremor, clonus, hyperreflexia, hypertonia). On the other hand, serotonin withdrawal in adults manifests with subjective symptoms that include anxiety, headache, nausea, fatigue, low mood, and, rarely, extrapyramidal signs such as dystonia. Hence, in most cases, the clinical syndrome reported among neonates born to mothers on SSRI treatment is consistent with a gradual resolution of a hyperserotonergic condition rather than with the evolution of a hyposerotonergic state. Still, in a few cases, drug withdrawal may be a better explanation.[35]

Biochemical studies that correlate serial serum SSRI (or active metabolite) concentrations and markers of CNS serotonin activity (eg, 5-hydroxyindoleacetic acid [5-HIAA], a metabolite of serotonin) with changes in clinical signs could be helpful in differentiating toxicity from withdrawal. In adults, cerebrospinal fluid concentrations of 5-HIAA (but not serum concentrations of serotonin) correlate inversely with increased CNS serotonin activity that results from SSRI treatment. One prospective study compared concentrations of SSRI and active metabolites at birth, 2 days of life, and 2 weeks of life; cord blood monoamine and metabolite; and serial serotonergic scores in infants born to mothers on treatment with SSRIs and those of SSRI-naïve control infants.[39] The infants born to mothers on SSRIs had an average serotonergic score fourfold greater than SSRI-naïve infants. Cord blood 5-HIAA concentrations were inversely related to the initial serotonergic score, and the resolution of neonatal signs correlated with rapid declines in serially measured serum SSRI and metabolite concentrations.[39] These results do support drug toxicity rather than drug withdrawal as the cause of clinical signs. Recent authors have suggested the terms "serotonin discontinuation syndrome"[34] or "prenatal antidepressant exposure syndrome."[41]

Although 1 study reported decreased pain reactivity at 2 months of age in infants with prenatal exposure to SSRIs,[42] several recent reviews have not identified adverse neurodevelopmental outcomes among infants born to women treated with SSRIs during pregnancy.[30,34,43,44] SSRI treatment should be continued during pregnancy at the lowest effective dose, because withdrawal of medication may have harmful effects on the mother-infant dyad. Clinicians should be aware that infants are at risk for manifesting clinical signs of drug toxicity or withdrawal over the first week of life and arrange for early follow-up after the initial hospital discharge. Ideally, recommendations about lactation and breastfeeding should be made in consideration of what is known about the differences among drugs in a therapeutic class vis-à-vis the ratio of human milk to maternal plasma drug concentration, the likely total daily infant drug dose (as a fraction of the daily maternal drug dose normalized for weight), and the ratio of infant to maternal plasma drug concentration. However, in the absence of known adverse effects (eg, diminished suck, sleep disturbances, decreased growth), what constitutes an acceptable fractional drug dose or ratio of plasma concentrations is arbitrary—is 0.10 acceptable but 0.20 not? Paroxetine is the only SSRI for which the ratio of infant to maternal plasma concentrations is low and uniformly <0.10.[45] Fortinguerra et al[46] documented that paroxetine, sertraline, and fluvoxamine are minimally excreted in human milk and provide the infant <10% of the maternal daily dose (normalized for weight). Yet, Weissman et al[45] cite studies in which 6% and 33% of the reported paired infant to maternal plasma concentration ratios for sertraline and fluvoxamine, respectively, are >0.10. A mother on treatment with an SSRI who desires to nurse her infant should be counseled about the

benefits of breastfeeding as well as the potential risk that her infant may continue to be exposed to a measureable level of the SSRI with unknown long-term effects.

OPIOIDS

Opioids are a class of natural, endogenous, and synthetic compounds that activate primarily μ-opioid (but also κ- and δ-opioid) receptors in the CNS to produce supraspinal analgesia. Other acute effects include sedation, euphoria, miosis, respiratory depression, and decreased gastrointestinal motility. Prolonged use results in physical and psychological dependence. As a class, opioids demonstrate a narrow therapeutic index. On the other hand, the interpatient range of dose necessary to achieve a similar therapeutic effect is fairly wide because of genetic differences in pharmacokinetics and pharmacodynamics.[47] Morphine is 1 of many natural opioids that can be extracted from the opium poppy. Codeine, heroin (diacetylmorphine), hydromorphone (Dilaudid), fentanyl (Sublimaze), and methadone are examples of synthetic opioids. Endogenous opioids include enkephalins, endorphins, and endomorphins. The term opiate refers to a subclass of alkaloid opioids. Methadone exerts secondary effects by acting as an *N*-methyl-D-aspartate receptor antagonist, blocking the actions of glutamate, the primary excitatory neurotransmitter in the CNS. Opioids acutely inhibit the release of noradrenaline at synaptic terminals. With chronic opioid exposure, tolerance develops as the rate of noradrenaline release over time increases toward normal. Abrupt discontinuation of exogenous opioids results in supranormal release of noradrenaline and produces the autonomic and behavioral signs and symptoms characteristic of withdrawal.

Opioid abuse in pregnant women presents additional risks for the fetus and newborn. Opioids are small lipophilic molecular weight compounds that cross placental and blood-brain barriers. Active or passive maternal detoxification is associated with increased risk of fetal distress and fetal loss. Maintenance programs with methadone (a full μ-opioid agonist and a Food and Drug Administration [FDA] schedule II controlled substance) for pregnant women can sustain opioid concentrations in the mother and fetus in ranges that minimize opioid craving, suppress abstinence symptomatology, block heroin-induced euphoria, and prevent fetal stress. Other benefits from this once controversial treatment are optimization of prenatal care and general maternal physical and mental health, as well as anticipation of potential withdrawal signs in the newborn infant. Disadvantages of methadone include the extremely unlikely achievement of successful detoxification after delivery and a more severe and prolonged course of NAS compared with heroin exposure. These issues have encouraged the development of other synthetic opioids as alternative treatments to methadone.

Subsequent to the Drug Addiction Treatment Act of 2000 that allowed office-based treatment of addiction by using FDA schedule III to V drugs, the synthetic opioid buprenorphine (a partial μ-opioid agonist) was approved by the FDA in 2002 as a schedule III controlled substance for the treatment of opioid dependence. Neither methadone nor buprenorphine is approved for use in pregnant women, and both are categorized by the FDA as class C pregnancy drugs. Nonetheless, buprenorphine, either alone (Subutex) or in combination with naloxone (Suboxone), has been used both as a first-line treatment of heroin addiction and as a replacement drug for methadone. Recent results from the Maternal Opioid Treatment: Human Experimental Research study suggest that buprenorphine has some advantages to methadone as a treatment of opioid addiction in pregnant women. Infants born to mothers treated with buprenorphine had shorter hospital stays (10 vs 17.5 days), had shorter treatment durations for NAS (4.1 vs 9.9 days), and required a lower cumulative dose of morphine (1.1 vs 10.4 mg) compared with infants born to mothers on methadone maintenance.[48]

CLINICAL PRESENTATION OF OPIOID WITHDRAWAL

The clinical presentation of NAS varies with the opioid, the maternal drug history (including timing of the most recent use of drug before delivery), maternal metabolism, net transfer of drug across the placenta, placental metabolism (W. Snodgrass, MD, PhD, personal communication, 2008), infant metabolism and excretion, and other factors. In addition, maternal use of other drugs and substances such as cocaine, barbiturates, hypnotics-sedatives, and cigarettes may influence the severity and duration of NAS. Because opioid receptors are concentrated in the CNS and the gastrointestinal tract, the predominant signs and symptoms of pure opioid withdrawal reflect CNS irritability, autonomic overreactivity, and gastrointestinal tract dysfunction (Table 3). Excess environmental stimuli and hunger will exacerbate the perceived severity of NAS.

Onset of signs attributable to neonatal withdrawal from heroin often begins within 24 hours of birth, whereas withdrawal from methadone usually commences around 24 to 72 hours of age.[49] For both opioids, evidence of withdrawal may be delayed until 5 to 7 days of age or later, which is typically after hospital discharge.[50] For

TABLE 3 Clinical Features of the Neonatal Narcotic Abstinence Syndrome

Neurologic Excitability	Gastrointestinal Dysfunction
Tremors	Poor feeding
Irritability	Uncoordinated and constant sucking
Increased wakefulness	Vomiting
High-pitched crying	Diarrhea
Increased muscle tone	Dehydration
Hyperactive deep tendon reflexes	Poor wt gain
Exaggerated Moro reflex	Autonomic signs
Seizures	Increased sweating
Frequent yawning and sneezing	Nasal stuffiness
	Fever
	Mottling
	Temperature instability

infants exposed to buprenorphine, 1 study found that onset of withdrawal peaked at 40 hours and that signs were most severe at 70 hours of age.[51] The different time courses reflect variations in the half-lives of drug elimination. However, if 1 week or longer has elapsed between the last maternal opioid use and delivery of the infant, the incidence of neonatal withdrawal is relatively low.[52] The incidence and severity of NAS are greater in infants exposed to methadone compared with those exposed to buprenorphine[48] or heroin. Still, severe withdrawal has been described in 0 to 50% of buprenorphine-exposed infants.[53–55] In the acute phase, seizures have occurred in 2% to 11% of infants withdrawing from opioids[49,50,56]; however, abnormal EEG results without overt seizure activity have been reported in >30% of neonates.[57,58] Subacute signs of opioid withdrawal may last up to 6 months.[59]

Seizures also may be associated with withdrawal from a variety of nonnarcotic drugs (eg, barbiturates,[12,14] alcohol,[14] and sedative-hypnotics[60,61]). The mechanism and significance of seizures associated with withdrawal are unclear. Withdrawal from ethanol begins early, in general, during the first 3 to 12 hours after delivery.[12,15] Diagnosis of sedative withdrawal is more difficult, because classically it appears after the first few days of life. Barbiturate withdrawal has a median onset of 4 to 7 days, but a wide range from days 1 through 14.[12,13] Other sedative-hypnotics have exhibited even later onset, including as late as day 12 for diazepam[10] and day 21 for chlordiazepoxide.[11]

Studies of the relationship between maternal methadone dose and the incidence and severity of NAS have provided contradictory findings. Some studies demonstrated that larger maternal methadone dosages in late pregnancy were associated with greater neonatal concentrations and increased risk of withdrawal,[8,9,62–68] but others refuted a correlation.[69–74] This lack of consensus is explained in part by different approaches to the management of antenatal methadone maintenance therapy. There were substantial variations in the mean and range of daily methadone dose in the populations studied. Studies that found no correlation tended to enroll infants born to mothers who had been prescribed higher doses of methadone (50–200 mg/day), whereas those that did note a relationship between maternal dose and NAS sequelae reported lower maternal doses (eg, <50 mg/day) or included women undergoing partial detoxification.[67] Another potential explanatory factor is the significant interindividual variability in maternal methadone metabolism.[75] As a result, cumulative fetal exposure can be expected to vary among infants born to mothers on equivalent methadone regimens.

Methadone concentrations in cord blood and at 48 hours of age,[72] as well as the rate of decline in neonatal serum concentration,[65] appear to correlate with NAS signs. Kuschel et al[72] found that infants who required rescue treatment had lower cord blood methadone concentrations and that, in all but 1 infant, methadone concentrations were undetectable in the serum at 48 hours. Doberczak[65] noted that faster declines in postnatal blood methadone concentrations were associated with more severe CNS withdrawal.

Preterm Infants

Preterm infants have been described as being at lower risk of drug withdrawal with less severe and/or prolonged courses. Infants born at <35 weeks' gestation whose mothers received methadone maintenance had significantly lower total and CNS abstinence scores than did term infants of mothers receiving similar methadone dosages.[64] In a more recent study, lower gestational age correlated with a lower risk of neonatal withdrawal.[68] The apparent decreased severity of signs in preterm infants may relate to developmental immaturity of the CNS, differences in total drug exposure, or lower fat depots of drug. Alternatively, the clinical evaluation of the severity of abstinence may be more difficult in preterm infants, because scoring tools to describe withdrawal were largely developed in term or late preterm infants.[76,77] In a retrospective study, Dysart et al[78] compared the length of hospital stay, duration of medication, and cumulative medication exposure for preterm and term infants born to mothers enrolled in a methadone maintenance program. Infants were evaluated by using an abstinence scoring system[77] and treated uniformly

with a neonatal opiate solution. All adverse outcomes were reduced in the preterm cohort.

Abuse of Multiple Drugs

The abuse of multiple drugs during pregnancy is not uncommon,[79] but its effect on the occurrence and severity of neonatal abstinence is controversial. In 1 study, abstinence scores of infants whose mothers abused cocaine and methadone were similar to the scores of infants whose mothers received high-dose maintenance methadone.[64] In another study, the neurobehavioral scores of infants exposed to intrauterine cocaine were similar to those of infants exposed to both cocaine and methadone.[80] Conversely, an unmasked study reported higher abstinence scores in infants exposed to both cocaine and heroin in comparison with those exposed to heroin or cocaine alone.[19] Infants born to mothers maintained on methadone who were also heavy smokers (>20 cigarettes per day) demonstrated higher withdrawal scores that peaked later than infants born to light smokers.[81]

A 1989 case report linked the administration of naloxone for the treatment of apnea in a baby born to a mother with recent methadone ingestion to the onset of seizures. The seizures resolved after morphine treatment but did not respond to administration of phenobarbital or diazepam.[82] For this reason, maternal use of opiates during pregnancy has remained a relative contraindication to the use of naloxone for the treatment of apnea or hypoventilation during the transition period after birth.

DIFFERENTIAL DIAGNOSIS

The presence of maternal characteristics known to be associated with drug abuse during pregnancy can be considered an indication to screen for intrauterine drug exposure. These characteristics include absent, late, or inadequate prenatal care; a previously documented or admitted history of drug abuse; a previous unexplained late fetal demise; precipitous labor; abruptio placentae; hypertensive episodes; severe mood swings; cerebrovascular accidents; myocardial infarction; and repeated spontaneous abortions.[80,83–88] The legal implications of testing and the need for consent from the mother may vary among the states.[89] Each hospital should consider adopting a policy for maternal and newborn screening to avoid discriminatory practices and to comply with local laws.

Withdrawal signs in the newborn may mimic other conditions, such as infection, hypoglycemia, hypocalcemia, hyperthyroidism, intracranial hemorrhage, hypoxic-ischemic encephalopathy, and hyperviscosity.[90] If none of these diagnoses is readily apparent, a detailed maternal drug history should be obtained that includes interviewing the mother about drug use and abuse by her partner, friends, and parents, in addition to queries about the mother's prescription and nonprescription drug use.[90,91] Because maternal self-reporting underestimates drug exposure and maternal urine screening during pregnancy fails to identify many cases of drug use,[83] appropriate neonatal drug screening should be performed. Conversely, no clinical signs should be attributed solely to drug withdrawal on the basis of a positive maternal history without a careful assessment to exclude other causes.

Screening is most commonly accomplished by using neonatal urine specimens. A urine sample must be collected as soon as possible after birth, because many drugs are rapidly metabolized and eliminated.[90,92,93] Even so, a positive urine screening result may only reflect recent drug use. Alcohol is detectable in neonatal urine for 6 to 16 hours after the last maternal ingestion. Amphetamines, benzodiazepines, cocaine metabolites, and opioids are usually cleared within 1 to 3 days after birth. Marijuana and cocaine metabolites may be detectable for weeks, depending on maternal usage.[94]

Drugs that are excreted in the hepatobiliary system as well as drugs excreted by the fetal kidneys into the amniotic fluid are concentrated in meconium. Hence, meconium analysis is most useful when the history and clinical presentation strongly suggest neonatal withdrawal, but the maternal and neonatal urine screening results are negative. Drawbacks of testing for drugs in meconium are that it is not typically performed by hospitals and that results are often not available for days to weeks. Meconium must be collected before it is contaminated by transitional, human milk, or formula stools—otherwise, the assay may not be valid or the reference laboratory may reject the sample. Assay of meconium, although not conclusive if the results are negative, is more likely to identify infants of drug-abusing mothers than is the testing of infant or maternal urine.[95,96] Other specimens that have been tested in research laboratories are maternal and neonatal hair.[97,98] Recently, testing of umbilical cord tissue by using drug class-specific immunoassays was shown to be in concordance with testing of paired meconium specimens at rates of 97%, 95%, 99%, and 91% for the detection of amphetamines, opiates, cocaine, and cannabinoids, respectively.[99] The availability of this tissue from the moment of birth (in contrast to the inherent delay in collecting urine or meconium) may foster the adoption of this method of testing.

ASSESSMENT AND NONPHARMACOLOGIC TREATMENT

Several semiobjective tools are available for quantifying the severity of

neonatal withdrawal signs. Clinicians have used discrete or serial scores to assist with therapeutic decisions. The Lipsitz tool, also known as the Neonatal Drug Withdrawal Scoring System,[76] was recommended in the 1998 American Academy of Pediatrics statement "Neonatal Drug Withdrawal,"[100] probably because it is a relatively simple metric with good sensitivity for identifying clinically important withdrawal. The modified Neonatal Abstinence Scoring System (Fig 1),[101] is the predominant tool used in the United States.[102] This more comprehensive instrument assigns a cumulative score based on the interval observation of 21 items relating to signs of neonatal withdrawal.[103] In 1 study, administration of this scoring system with infants verified not to have been exposed to prenatal opiates by meconium analysis resulted in a stable median score of 2 during each of the first 3 days of life, with 95th percentile scores of 5.5 and 7 on days 1 and 2, respectively.[104] Infants at risk for NAS should be carefully monitored in the hospital for the development of signs consistent with withdrawal. The appropriate duration of hospital observation is variable and depends on a careful assessment of the maternal drug history. An infant born to a mother on a low-dose prescription opiate with a short half-life (eg, hydrocodone; average half-life, 4 hours) may be safely discharged if there are no signs of withdrawal by 3 days of age, whereas an infant born to a mother on an opiate with a prolonged half-life (eg, methadone) should be observed for a minimum of 5 to 7 days. Initial treatment of infants who develop early signs of withdrawal is directed at minimizing environmental stimuli (both light and sound) by placing the infant in a dark, quiet environment; avoiding autostimulation by careful swaddling; responding early to an infant's signals;

NEONATAL ABSTINENCE SCORING SYSTEM

SYSTEM	SIGNS AND SYMPTOMS	SCORE		AM						PM						COMMENTS
CENTRAL NERVOUS SYSTEM DISTURBANCES	Continuous High Pitched (or other) Cry	2														Daily Weight:
	Continuous High Pitched (or other) Cry	3														
	Sleeps <1 Hour After Feeding	3														
	Sleeps <2 Hours After Feeding	2														
	Sleeps <3 Hours After Feeding	1														
	Hyperactive Moro Reflex	2														
	Markedly Hyperactive Moro Reflex	3														
	Mild Tremors Disturbed	1														
	Moderate-Severe Tremors Disturbed	2														
	Mild Tremors Undisturbed	3														
	Moderate-Severe Tremors Undisturbed	4														
	Increased Muscle Tone	2														
	Excoriation (Specific Area)	1														
	Myoclonic Jerks	3														
	Generalized Convulsions	5														
METABOLIC/VASOMOTOR/RESPIRATORY DISTURBANCES	Sweating	1														
	Fever 100.4°-101°F (38°-38.3°C)	1														
	Fever > 101°F (38.3°C)	2														
	Frequent Yawning (>3-4 times/interval)	1														
	Mottling	1														
	Nasal Stuffiness	1														
	Sneezing (>3-4 times/interval)	1														
	Nasal Flaring	2														
	Respiratory Rate >60/min	1														
	Respiratory Rate > 60/min with Retractions	2														
GASTROINTESTIONAL DISTURBANCES	Excessive Sucking	1														
	Poor Feeding	2														
	Regurgitation	2														
	Projectile Vomiting	3														
	Loose Stools	2														
	Watery Stools	3														
	TOTAL SCORE															
	INITIALS OF SCORER															

FIGURE 1
Modified Finnegan's Neonatal Abstinence Scoring Tool. Adapted from ref 101.

adopting appropriate infant positioning and comforting techniques (swaying, rocking); and providing frequent small volumes of hypercaloric formula or human milk to minimize hunger and allow for adequate growth. Caloric needs may be as high as 150 to 250 cal/kg per day because of increased energy expenditure and loss of calories from regurgitation, vomiting, and/or loose stools.[105,106] The infant needs to be carefully observed to recognize fever, dehydration, or weight loss promptly. The goals of therapy are to ensure that the infant achieves adequate sleep and nutrition to establish a consistent pattern of weight gain and begins to integrate into a social environment. Maternal screening for comorbidities, such as HIV or hepatitis C virus infections and polydrug abuse, needs to be performed. Additional supportive care in the form of intravenous fluids, replacement electrolytes, and gavage feedings may be necessary to stabilize the infant's condition in the acute phase and obviate the need for pharmacologic intervention. When possible, and if not otherwise contraindicated, mothers who adhere to a supervised drug treatment program should be encouraged to breastfeed so long as the infant continues to gain weight. Breastfeeding or the feeding of human milk has been associated with less severe NAS that presents later and less frequently requires pharmacologic intervention.[107,108] Methadone is present in very low concentrations in human milk. Cumulative daily intake of methadone in fully breastfed infants has been estimated to range from 0.01 to 0.15 mg/day in the first 30 days of life[109] and 0.15 to 0.30 mg/day between 30 and 180 days of age.[110] Similarly, the amount of buprenorphine excreted in human milk is small. Although more information is needed to evaluate long-term neurodevelopmental outcome of infants exposed to small quantities of buprenorphine, there is no clear reason to discourage breastfeeding in mothers who adhere to methadone or buprenorphine maintenance treatment.[111]

Each nursery should adopt a protocol for the evaluation and management of neonatal withdrawal, and staff should be trained in the correct use of an abstinence assessment tool. In a recent survey of accredited US neonatology fellowship programs, only 55% had implemented a written NAS protocol, and only 69% used a published abstinence scoring system.[102]

RATIONALE AND COMPARATIVE EVIDENCE FOR PHARMACOLOGIC TREATMENT

Drug therapy is indicated to relieve moderate to severe signs of NAS and to prevent complications such as fever, weight loss, and seizures if an infant does not respond to a committed program of nonpharmacologic support. Since the introduction of the abstinence scales in 1975, published reports have documented that the decision to initiate pharmacologic treatment has been based on single or serial withdrawal scores. However, no studies to date have compared the use of different withdrawal score thresholds for initiating pharmacologic intervention on short-term outcomes (eg, severity and duration of withdrawal signs, weight gain, duration of hospitalization, need for pharmacologic treatment, or cumulative drug exposure). Withdrawal from opioids or sedative-hypnotic drugs may be life-threatening, but ultimately, drug withdrawal is a self-limited process. Unnecessary pharmacologic treatment will prolong drug exposure and the duration of hospitalization to the possible detriment of maternal-infant bonding. The only clearly defined benefit of pharmacologic treatment is the short-term amelioration of clinical signs. Studies have not addressed whether long-term morbidity related to neonatal drug withdrawal is decreased by pharmacologic management of affected infants, or whether continued postnatal drug exposure augments the risk of neurobehavioral and other morbidities. It is possible that pharmacologic therapy of the infant may introduce or reinforce a maternal disposition to rely on drugs for the treatment of infant discomfort or annoying behavior.[112]

Clinicians have treated NAS with a variety of drug preparations, including opioids (tincture of opium, neonatal morphine solution, methadone, and paregoric), barbiturates (phenobarbital), benzodiazepines (diazepam, lorazepam), clonidine, and phenothiazines (chlorpromazine). Information pertinent to the use of these drug preparations in infants is well summarized in the previous American Academy of Pediatrics statement.[100] Recent surveys have documented that, in accord with the recommendations of that statement, 94% of UK and 83% of US clinicians use an opioid (morphine or methadone) as the drug of first choice. The majority of practitioners use phenobarbital as a second drug if the opiate does not adequately control withdrawal signs.[102,113] Daily doses of morphine ranged from 0.24 mg/kg per day to 1.3 mg/kg per day.[113] Paregoric is no longer used, because it contains variable concentrations of other opioids, as well as toxic ingredients such as camphor, anise oil, alcohol, and benzoic acid.[100] The use of diazepam has also fallen into disfavor because of a documented lack of efficacy compared with other agents and because of its adverse effects on infant suck and swallow reflexes.[114–116]

Meta-analyses of published trials regarding the pharmacologic treatment of neonatal withdrawal are available.[117,118] In 2 Cochrane meta-analyses, either an opioid[117] or a sedative[118] drug treatment

was compared with a control treatment that could include a nonpharmacologic intervention, a placebo treatment, or another opioid and/or sedative drug. The authors prospectively designated 4 primary outcomes (failure of treatment to control withdrawal signs; incidence of seizures; survival; and neurodevelopmental outcome) for meta-analysis. Treatment failure was defined variously as the inability of the treatment to maintain abstinence scores within a preset "safe" level and/or the need to add another drug therapy. Some studies did not report primary outcomes and instead quantified secondary outcomes (eg, duration of treatment, duration of hospitalization, rate of weight gain, etc).

Seven studies of opioid treatment that enrolled a total of 585 infants were identified between 1983 and 2004. Methodologic flaws were common and included quasirandom patient allocation; substantial and often unexplained differences in allocation of patients to treatment groups; imbalances in group characteristics after randomization; failure to mask study treatments; and failure to mask outcome measurements. In the single study that assessed oral morphine treatment versus supportive therapy only, 3 consecutive Finnegan scores $\geq$8 prompted institution of the intervention.[119] No significant effect of morphine was found on the rate of treatment failure. Oral morphine significantly increased the duration of treatment and the length of hospital stay, but it did reduce the number of days required to regain birth weight and duration of supportive care. Four studies compared treatment failures of opioids (paregoric, oral morphine, or methadone) with phenobarbitone.[8,119–121] Neither the meta-analysis nor any individual study identified a significant difference in treatment failure. One study reported a lower incidence of seizures in the opioid (paregoric) treatment group.[122] No consistent trends in secondary outcomes were observed, although 1 study reported a shorter duration of therapy in the phenobarbitone compared with the paregoric treatment group,[123] and another made the opposite observation when the opioid used was oral morphine.[121] Three studies individually and in combination reported significantly lower rates of treatment failure in infants assigned to opioid (paregoric or methadone) compared with diazepam therapy[8,114,120] but did not define differences in secondary outcomes. No studies reported mortality or neurodevelopmental outcomes.

A second Cochrane review analyzed 6 trials involving 305 infants published between 1969 and 2002 in which sedative treatment of NAS was compared with a nonopioid therapy. Methodologic concerns were similar to the opioid treatment trials. In the sole study of phenobarbitone versus supportive care, no difference in treatment failure was found, but treatment significantly increased the duration of therapy and hospital stay.[119] A small study that allocated infants already treated with diluted tincture of opium (DTO) to phenobarbitone as a second drug versus no additional treatment identified no infants in either group with treatment failure but observed significant reductions in the duration of hospitalization (38 vs 79 days) and the maximal daily dose of opioid in the phenobarbitone-treated infants.[124] Infants were discharged from the hospital once they were no longer taking opioids. However, the mean duration of phenobarbitone treatment was 3.5 months. Of 3 studies that compared phenobarbitone and diazepam treatment, 1 found a significantly lower rate of treatment failure in the phenobarbitone group.[8,114,120] One study of phenobarbitone versus chlorpromazine[125] found no differences in primary or secondary outcomes.

Since 2004, a number of small studies of varying methodologic quality have compared pharmacologic treatments. In a prospective randomized double-masked study, Langenfeld et al[126] could not identify differences in duration of treatment, duration of hospitalization, or in weight gain (g/day) in infants treated with either DTO or oral morphine drops. A retrospective study found no difference in length of hospitalization in infants with NAS who were treated with methadone or oral morphine solution, but did correlate higher maternal methadone doses with longer lengths of stay.[127] Ebner et al[128] examined the incidence of NAS in infants born to mothers maintained with methadone, morphine, or buprenorphine and compared phenobarbital and oral morphine treatments in affected infants. Sixty-eight percent of infants born to mothers maintained on methadone required pharmacologic treatment at a mean age of 58 hours, compared with 82% of infants at a mean age of 33 hours in the morphine group and 21% of infants at a mean age of 34 hours in the buprenorphine group. The duration of treatment was significantly shorter for infants who received morphine compared with infants who were treated with phenobarbital. A randomized comparison trial of sublingual buprenorphine versus neonatal opium solution for the treatment of NAS showed a nonsignificant reduction in length of treatment and duration of hospitalization in the buprenorphine group.[129] Buprenorphine therapy was well tolerated.

Clonidine is an α_2-adrenergic receptor agonist that has been used in combination with an opioid or other drug in older children and adults to reduce withdrawal symptoms.[130,131] Via a negative feedback mechanism, clonidine

reduces CNS sympathetic outflow and palliates symptoms of autonomic overactivity such as tachycardia, hypertension, diaphoresis, restlessness, and diarrhea. Cessation of clonidine treatment can result in a rebound of autonomic activity. Reported experience with clonidine as a primary or adjunctive treatment of NAS is limited but promising. In a small case series, 6 of 7 infants with NAS showed significant resolution of signs when treated with oral clonidine.[132] In a randomized double-masked controlled trial, Agthe et al[133] compared the efficacy and safety of treating NAS with DTO plus oral clonidine (1 μg/kg every 3 hours) versus DTO plus placebo in 80 infants with prenatal exposure to methadone and/or heroin. The combination therapy significantly reduced the median length of treatment of all infants and for infants exposed to methadone, but more infants in the DTO/clonidine group required resumption of DTO after initial discontinuation. The mean total dose of morphine over the treatment course was ~60% lower in the combination therapy group. No clinically significant differences in feeding, weight gain or loss, heart rate, or blood pressure were observed. In another case series, oral clonidine was administered either as a primary or adjunctive therapy for the prevention or treatment of narcotic withdrawal in infants on intravenous fentanyl or infants with antenatal exposure to opiates.[134] In all cases, treatment was successful and clonidine was discontinued without sequelae after a mean duration of 7 days. In a retrospective case series, infants who had evidence of NAS attributable to antenatal methadone exposure had lower severity scores and required fewer days of drug therapy and hospitalization if they had been treated with a combination of clonidine and chloral hydrate rather than a combination of morphine and phenobarbital.[135]

A recently published case series from France that used a historical cohort for a comparison has suggested that the treatment of NAS with the phenothiazine, chlorpromazine, as a single drug may be more effective than treatment with morphine.[136] Infants treated with oral morphine had significantly longer median durations of treatment and hospitalization in comparison with infants treated with chlorpromazine. No adverse affects were reported.

OUTCOME

Assessment of potential long-term morbidity specifically attributable to neonatal drug withdrawal and its treatment is difficult to evaluate. Few studies have followed drug-exposed children beyond the first few years of life. Confounding variables, such as environment and dysfunctional caregivers, complicates the interpretation of outcomes. In a small study, developmental scores on the mental index on the Bayley Scales of Infant Development were not affected by the severity of withdrawal or the treatment chosen.[114] Mean scores on the Bayley Scales of Infant Development were similar for all infants treated for withdrawal, including those receiving phenobarbital, paregoric, or a combination therapy. Scores of infants whose withdrawal was too mild to qualify for pharmacologic intervention were also similar.

Fourteen drug-exposed infants with withdrawal-associated seizures were reported by Doberczak et al.[25] The abstinence scores for 5 of these infants were <7 (the cutoff for treatment); hence, they received no pharmacologic therapy before the onset of seizures. Thirteen of the 14 infants were offspring of mothers enrolled in a methadone treatment program; however, the success of maternal treatment was not described. Of the 14 infants with seizures, 12 were available for evaluation at 1 year of age; results of neurologic examinations were normal in 9 of the 12 infants evaluated. EEG results were abnormal in 9 neonates; however, subsequent EEGs for 7 of 8 of these infants normalized during follow-up. Mean scores on the Bayley Scales of Infant Development were also normal by 1 year of age, similar to matched controls that were drug exposed, but in whom withdrawal-associated seizures did not develop.[24] Withdrawal-associated seizures seem to be primarily myoclonic, to respond to opiates, and to carry no increased risk of poor outcome. Withdrawal-associated seizures in neonates are different from those associated with other causes. Based on the depression of norepinephrine and dopamine observed with methadone exposure in animal models, withdrawal seizures are speculated to be attributable to lowered levels of neurotransmitters.[137,138] The normalization of the EEG and normal neurologic development are believed to reflect recovery of normal neurotransmitter concentrations during early infancy. Bandstra et al[139] have comprehensively reviewed outcomes of infants and toddlers who were exposed prenatally to opioids and cocaine.

MANAGEMENT OF ACQUIRED OPIOID AND BENZODIAZEPINE DEPENDENCY

One of the cornerstones in caring for critically ill children is to provide adequate and safe analgesia, sedation, amnesia, and anxiolysis by using both pharmacologic and nonpharmacologic measures. Pharmacologic treatment typically includes medications in the opioid and benzodiazepine drug classes. However, if these drugs cannot safely be discontinued within a few days, physical dependence on 1 or both of these classes of medication can develop and manifest with signs

and symptoms of withdrawal on acute dosage reduction or cessation of therapy. Infants who undergo complex surgery, who require prolonged medical intensive care for conditions such as respiratory failure or persistent pulmonary hypertension, or who are supported with extracorporeal membrane oxygenation (ECMO) therapy are among those at greatest risk of acquired drug dependency.

Extended treatment with opioids via continuous intravenous infusion results in drug tolerance. Even short-term opioid exposure alters the number and affinity of receptors in key neuronal centers so that an escalation of the opioid infusion rate (which produces an increase in opioid plasma concentrations) becomes necessary to achieve the same physiologic effect.[140] By itself, the development of tolerance does not predict physical dependency or withdrawal.[141] Cumulative exposure to fentanyl, quantified by the total dose in milligrams per kilogram or the number of consecutive days of treatment, correlated with the likelihood of withdrawal.[140,142,143] By using a multiple logistic regression analysis, Arnold et al[140] found that the duration of ECMO therapy was an even more powerful predictor of withdrawal than was cumulative fentanyl exposure. Katz et al[142] reported that among 23 mechanically ventilated children aged 1 week to 22 months (mean, 6 months) who were treated for >24 hours with a continuous fentanyl infusion, 13 of 23 children (57%) developed withdrawal as defined by a Finnegan score ≥8. In this prospective study, a cumulative fentanyl exposure in excess of 2.5 mg/kg or 9 days of therapy was 100% predictive of withdrawal. More recently, in a prospective study of 19 neonates treated with fentanyl for a minimum of 24 hours, Dominquez et al[143] documented that a cumulative fentanyl dose ≥415 μg/kg predicted withdrawal with 70% sensitivity and 78% specificity and that an infusion duration ≥8 days was 90% sensitive and 67% specific for withdrawal. In adults, concomitant treatment with neuromuscular paralytic agents or propofol for >24 hours also increased the likelihood of withdrawal.[144] Signs and symptoms of withdrawal from fentanyl commence within 24 hours of cessation of therapy.

The refinement of pain management in children over the past 2 decades has witnessed an expansion of the use of opioids in the intensive care setting. As a result, more children have been treated for actual or potential withdrawal symptoms as a comorbidity of hospitalization. Fentanyl, a pure μ-opioid receptor antagonist, has become the opioid of choice because of its rapid onset of action, short duration of effect (half-life of 0.5–1 hour), excellent potency, and minimal acute adverse effects. However, fentanyl has not been demonstrated to be safer or more effective than morphine for the provision of long-term analgesia. Indeed, 1 study has reported that patients who were treated prospectively with a continuous morphine infusion during ECMO experienced a significantly lower need for supplemental analgesia, a lower rate of dependency, and a shorter hospital stay compared with a previous group of patients treated with fentanyl during ECMO.[145]

Practitioners have employed a variety of strategies to treat or, in high-risk patients, to prevent signs and symptoms of opioid withdrawal in infants and children. Carr and Todres[146] reported success with a gradual taper of the opioid infusion rate. Children who had received continuous opioid infusions for more than a week required 2 to 3 weeks for complete weaning. One disadvantage of this approach was that intravenous access had to be maintained for the entire course of treatment. Tobias et al[147] were among the first investigators to describe treatment of opioid withdrawal by conversion to enteral methadone. Methadone was chosen as the opioid of choice because of its excellent oral bioavailability (70%–100%) and long half-life (19–41 hours), which allowed for long intervals between doses.[148] In this initial report, 3 symptomatic patients who had been exposed to continuous or bolus opioids for up to 7 weeks were transitioned to a methadone regimen of 0.1 mg/kg, orally, every 12 hours. Dose reduction by 10% to 20% of the initial dose per week resulted in successful weaning in 4 to 6 weeks.

In 2000, Robertson and et al[149] reported the outcomes of 10 children 6 months to 18 years of age who had received >7 days of opioids (range, 7–53 days). An amount of methadone, equipotent to the existing daily fentanyl or morphine dose, was determined. This amount was reduced by a factor of 6 because of the longer half-life of methadone to calculate the initial total daily methadone dose. Protocols specified 2 different weaning schedules, depending on whether the patient had been treated with opioids (fentanyl or morphine) for either 7 to 14 days or for >14 days. Treatment intervals were gradually lengthened from every 6 hours to every 24 hours when methadone was discontinued. Outcomes of these patients were compared with recent control patients who had also been treated with enteral methadone but not under a standard protocol. Among the protocol patients, there were no treatment failures. Weaning was accomplished in a median of 9 days (range, 5–10 days), which was significantly less than the median of 20 days (range, 9–31 days) observed in the nonprotocol children. Concurrent use of benzodiazepines occurred in 6 of the protocol children, compared

with 3 of the nonprotocol group, so that the decreased taper time on protocol was unlikely to have been confounded by other drug therapy. Weaning and discontinuation from benzodiazepines were successful during the methadone taper in all protocol patients.

Meyer et al[150] described a protocol for rescue therapy in 29 patients 1 day to 20 years of age on admission who developed withdrawal during the course of nonstandardized tapers of prolonged continuous fentanyl infusion. Withdrawal was defined as the observation of 3 consecutive Finnegan scores $\geq$8 obtained at 2-hour intervals. The daily fentanyl dose for the period 24 to 48 hours before withdrawal symptoms was used to calculate an equipotent dose of morphine sulfate. Morphine was administered as a bolus dose every 4 hours and titrated to effect (Finnegan score consistently <8) over 12 to 24 hours. An equipotent amount of methadone was then determined by using the effective morphine dose. Three loading doses of methadone at 12-hour intervals were administered. Afterward, doses were given every 24 hours and weaned by 10% per day. Ten patients were receiving concomitant treatment with a benzodiazepine or chloral hydrate, but these medications were not weaned during the methadone taper. Twenty-five of 29 patients successfully completed this taper over 10 days. Three patients required 21 days, and 1 patient died of sepsis. Sixteen of the patients were discharged from the hospital and completed methadone tapers on an outpatient basis. Nine of the patients had been started on clonidine during the phase of nonstandardized opioid weaning in unsuccessful attempts to prevent withdrawal. A subsequent randomized double-blind follow-up study by the same group of investigators[151] found that in a group of 37 fentanyl-treated patients, a 5-day methadone taper was as successful as the longer 10-day course (13 of 16 vs 17 of 21 [not significant]) in discontinuing opioid infusions without causing withdrawal. In contrast to their previous study, a standardized taper of lorazepam was allowed in 17 of the 37 patients while on the methadone protocol. Only 1 of these 17 patients who underwent dual tapers required rescue treatment with an increased dose of opioids.

Several factors potentially complicate the adoption of the protocols reported by Robertson, Meyer, and Berens (see Table 4) into routine neonatal clinical practices. Most obvious is that these studies were conducted in a PICU setting; few neonates were included, and their outcomes were not separately analyzed. Other investigators have emphasized that the Finnegan instrument common to all 3 studies has been validated only in term infants undergoing withdrawal secondary to in utero opioid exposure.[152,153] Therefore, the use of this tool may have underestimated withdrawal symptomatology in an older pediatric population. A third concern is that opioids and benzodiazepines are often used concurrently in the same patient, yet symptoms of opioid and benzodiazepine withdrawal overlap to a great extent. Hence, current instruments will not reliably differentiate whether withdrawal symptoms stem from relative opioid or benzodiazepine abstinence.[153] Other scales have been proposed for children and are in various stages of evaluation, including the Opioid and Benzodiazepine Withdrawal Scale,[151] the Sedation Withdrawal Score,[154] and the Sophia Benzodiazepine and Opioid Withdrawal Checklist.[155]

At this time, no optimal pharmacologic regimen for the prevention or treatment of acquired opioid and/or benzodiazepine dependency can be recommended, because the necessary comparative studies of safety and efficacy are not available.[156] Hence, it is even more incumbent on the practitioner to prescribe pharmacologic interventions with the goal of achieving the desired therapeutic effect by using the fewest drugs at the lowest doses and for the shortest durations possible.

Nonetheless, because many critically ill infants and children do receive treatment with prolonged courses of opioids and benzodiazepines, the following practices are reasonable based on the available evidence:

1. Each clinical unit can establish a threshold level of cumulative exposure to opioids and benzodiazepines above which drug dependency can be expected to occur with a likelihood that justifies anticipatory initiation of a weaning protocol. For example, setting a threshold at a cumulative fentanyl exposure of >2 mg/kg or >7 days' duration would predict a likelihood of dependency >50% but <100%.[141,142]
2. Infants with a cumulative exposure to opioids or benzodiazepines below the thresholds for initiation of weaning protocols can undergo a rapid taper of these medications over a 24- to 48-hour period. Many such children will not subsequently exhibit drug dependency.
3. Signs and symptoms of withdrawal will develop within 24 hours of discontinuation or during the course of a rapid taper of an opioid. If this occurs, 1 of the rescue approaches in Table 4 can be chosen as a guide to facilitate conversion to enteral methadone management and to initiate a weaning strategy, with 2 caveats. Infants on very high daily doses of continuous intravenous opioid may require less than the

TABLE 4 Weaning Protocols by Using Conversion of Continuous Opioid Infusions to Enteral Methadone and for Conversion of Midazolam (Versed) Infusion to Enteral Lorazepam (Ativan)

Robertson et al[149]
Conversion of continuous intravenous fentanyl of 7–14 d duration to enteral methadone: 1. By using the current hourly infusion rate, calculate the 24-h fentanyl dose. 2. Multiply the daily fentanyl dose by a factor of 100 to calculate the equipotent amount of methadone (ratio of potencies assumed to be fentanyl: methadone = 100:1). 3. Divide this amount of methadone by 6 (a correction for the longer half-life of methadone) to calculate an initial total daily dose of methadone, and on day 1 provide this amount orally in 4 divided doses every 6 h for 24 h. 4. Day 2: Provide 80% of original daily dose in 3 divided oral doses every 8 h for 24 h. 5. Day 3: Provide 60% of original daily dose in 3 divided oral doses every 8 h for 24 h. 6. Day 4: Provide 40% of original daily dose in 2 divided oral doses every 12 h for 24 h. 7. Day 5: Provide 20% of original daily dose × 1. 8. Day 6: Discontinue methadone. Conversion of continuous intravenous fentanyl greater than 14 d duration to enteral methadone: 1. Repeat steps 1–2 above. 2. Days 1–2: Divide the dose of methadone by 6 (a correction for the longer half-life of methadone) and on day 1 provide this amount orally in 4 divided doses every 6 h for 48 h. 3. Days 3–4: Provide 80% of original daily dose in 3 divided oral doses every 8 h for 48 h. 4. Days 5–6: Provide 60% of original daily dose in 3 divided oral doses every 8 h for 48 h. 5. Days 7–8: Provide 40% of original daily dose in 2 divided oral doses every 12 h for 48 h. 6. Days 9–10: Provide 20% of original daily dose once per day for 48 h. 7. Day 11: Discontinue methadone. For patients on continuous intravenous morphine, proceed as above but do not multiply the daily fentanyl dose by 100, because morphine and methadone are nearly equipotent.
Meyer and Berens[150]
Conversion of continuous intravenous fentanyl to intermittent intravenous morphine: 1. By using the target hourly infusion rate of fentanyl, calculate the 24-h fentanyl dose. 2. Multiply the daily fentanyl dose by a factor of 60 to calculate the equipotent dose of morphine (ratio of potencies assumed to be fentanyl: morphine = 60:1). 3. Divide the dose of morphine by 4 (correcting for the longer half-life of morphine) and on day 1 administer this amount intravenously in 6 divided doses every 4 h. 4. Titrate the morphine dose for adequate effect over 12 to 24 h. Conversion of intermittent intravenous morphine to enteral methadone: 1. Multiply the dose of morphine given every 4 h by 2 (ratio of potencies assumed to be morphine: methadone = 2:1) to determine an equipotent amount of methadone. 2. Provide this amount of methadone as an oral dose every 12 h for 3 doses. 3. Double this amount of methadone and provide as a single oral dose per day at bedtime. 4. Provide 90% of the initial dose on day 2, 80% on day 3, etc, so that the last dose of methadone (10% of the original dose) is given on day 10.
Protocols at Wolfson Children's Hospital, Jacksonville, Florida
Conversion of continuous intravenous fentanyl >7 d duration to enteral methadone: 1. By using the current hourly infusion rate, calculate the 24-h fentanyl dose. 2. Multiply the daily fentanyl dose by a factor of 100 to calculate the equipotent amount of methadone (ratio of potencies assumed to be fentanyl: methadone = 100:1). 3. Divide this amount of methadone by 8–12 (a correction for the longer half-life of methadone) to calculate an initial total daily dose of methadone (not to exceed 40 mg/day). 4. Days 1–2: Provide the total daily dose of methadone orally in 4 divided doses every 6 h for 48 h. At the time of the second methadone dose, reduce the fentanyl infusion rate to 50%; at the time of the third dose, reduce the fentanyl infusion rate to 25%; and after the fourth methadone dose, discontinue the fentanyl infusion. 5. Days 3–4: Provide 80% of original daily dose in 3 divided oral doses every 8 h for 48 h. 6. Days 5–6: Provide 60% of original daily dose in 3 divided oral doses every 8 h for 48 h. 7. Days 7–8: Provide 40% of original daily dose in 2 divided oral doses every 12 h for 48 h. 8. Days 9–10: Provide 20% of original daily dose once per day for 48 h. 9. Day 11: Discontinue methadone. Conversion of continuous intravenous midazolam >7 d duration to enteral lorazepam: 1. By using the current hourly infusion rate, calculate the 24-h midazolam dose. 2. Because lorazepam is twice as potent as midazolam and has a sixfold longer half-life, divide the 24 h midazolam dose by 12 to determine the daily lorazepam dose. 3. Divide the calculated lorazepam dose by 4 and initiate every 6 h oral treatments with the intravenous product or an aliquot of a crushed tablet. 4. Wean lorazepam by 10% to 20% per day. The dosage interval can also be increased gradually to every 8 h, then every 12 h, then every 24 h, and then every other day before lorazepam is discontinued.

TABLE 4 Continued

Robertson et al[149]
Summary of Conversion Of Intravenous Opioids to Enteral Methadone

1. Tobias et al[147]: Converted 2 patients on morphine (0.1–0.15 mg/kg q3h) and 1 patient on fentanyl (1–2 μg/kg every 1–2 h) to methadone at a starting dose of 0.2 mg/kg per day.
2. Robertson et al[149]: 1 μg/kg per h fentanyl = 0.4 mg/kg per day methadone.
3. Meyer and Berens[150]: 1 μg/kg per h fentanyl = 0.24 mg/kg per day methadone.
4. Wolfson Children's Hospital: 1 μg/kg per h fentanyl = 0.2–0.3 mg/kg per day methadone.

calculated methadone equivalent to achieve a successful conversion. Also, the rate of weaning should be adjusted on the basis of careful continuing clinical assessment. Eighty percent of children can be successfully weaned from methadone completely within 5 to 10 days.

4. Signs and symptoms of withdrawal from benzodiazepine therapy can be delayed. Intravenous benzodiazepines can be converted to oral lorazepam (Table 4). The required time for weaning can be expected to be proportional to the duration of intravenous benzodiazepine treatment.
5. Infants and children at risk for withdrawal are prudently observed in the hospital for signs and symptoms. Each clinical unit can choose 1 assessment tool and train staff to minimize individual variability in scoring.
6. Discharge from the hospital for infants and very young children is prudently delayed until they are free of withdrawal signs and symptoms for a period of 24 to 48 hours after complete cessation of opioids. Earlier discharge of an older child can be individualized in consideration of the child's overall clinical status, the home environment, and the availability of adequate and prompt follow-up.
7. No clinical studies to date support the premise that initiation of clonidine, chloral hydrate, or continuous intravenous low-dose naloxone[157,158] during the course of continuous opioid infusions will reduce the likelihood or severity of opioid dependency.

CLINICAL HIGHLIGHTS

1) Each nursery that cares for infants with neonatal withdrawal should develop a protocol that defines indications and procedures for screening for maternal substance abuse. In addition, each nursery should develop and adhere to a standardized plan for the evaluation and comprehensive treatment of infants at risk for or showing signs of withdrawal.
2) Screening for maternal substance abuse is best accomplished by using multiple methods, including maternal history, maternal urine testing, and testing of newborn urine and/or meconium specimens that are in compliance with local laws. The screening of biological samples is an adjunct to provide additional information helpful in the ongoing medical care of the infant. The duration of urinary excretion of most drugs is relatively short, and maternal or neonatal urinary screening only addresses drug exposure in the hours immediately before urine collection. Thus, false-negative urine results may occur in the presence of significant intrauterine drug exposure. Although newborn meconium screening also may yield false-negative results, the likelihood is lower than with urinary screening. The more recent availability of testing of umbilical cord samples may be considered a viable screening tool, because it appears to reflect in utero exposures comparable to meconium screening.
3) Drug withdrawal should be considered in the differential diagnosis for infants in whom compatible signs develop. Physicians should be aware of other potential diagnoses that need to be evaluated and, if confirmed, treated appropriately.
4) Nonpharmacologic supportive measures that include minimizing environmental stimuli, promoting adequate rest and sleep, and providing sufficient caloric intake to establish weight gain should constitute the initial approach to therapy.
5) Signs of drug withdrawal can be scored by using a published abstinence assessment tool. Infants with confirmed drug exposure who are unaffected or demonstrating minimal signs of withdrawal do not require pharmacologic therapy. Caution should be exercised before instituting pharmacologic therapy that could lengthen the duration of hospitalization and interfere with maternal-infant bonding.

Together with individualized clinical assessment, the serial and accurate use of a withdrawal assessment tool may facilitate a decision about the institution of pharmacologic therapy and thereafter can provide a quantitative measurement that can be used to adjust drug dosing.

6) The optimal threshold score for the institution of pharmacologic therapy by using any of the published abstinence assessment instruments is unknown.

7) Breastfeeding and the provision of expressed human milk should be encouraged if not contraindicated for other reasons.[111,159]

8) Pharmacologic therapy for withdrawal-associated seizures is indicated. Other causes of neonatal seizures must also be evaluated.

9) Vomiting, diarrhea, or both associated with dehydration and poor weight gain in the absence of other diagnoses are relative indications for treatment, even in the absence of high total withdrawal scores.

10) The limited available evidence from controlled trials of neonatal opioid withdrawal supports the use of oral morphine solution and methadone when pharmacologic treatment is indicated. Growing evidence suggests that oral clonidine is also effective either as a primary or adjunctive therapy, but further prospective trials are warranted. Dosing regimens are listed in Table 5. With respect to other drug treatments and clinical situations, a number of important caveats apply. Treatment with paregoric is contraindicated, because this preparation contains multiple opiates in addition to morphine, as well as other potentially harmful compounds (alcohol, anise). Morphine prescriptions should be written as milligrams of morphine per kilogram and not as milliliters of DTO per kilogram. Tincture of opium contains a 25-fold higher concentration of morphine than do available oral morphine solutions; hence, it increases the likelihood of drug error and morphine overdose. The relative efficacy and safety of buprenorphine for the treatment of NAS require additional comparative study. The optimal pharmacologic treatment of infants who are withdrawing from sedatives or hypnotics is unknown. Finally, there is also insufficient evidence to state whether an infant born to a mother with multiple drug abuse who meets criteria for pharmacologic therapy of withdrawal signs is best treated with an opioid, a barbiturate, a medication from another drug class, or a combination of drugs from different classes.

11) Physicians need to be aware that the severity of withdrawal signs, including seizures, has not been proven to be associated with differences in long-term outcome after intrauterine drug exposure. Furthermore, treatment of drug withdrawal may not alter the long-term outcome.

12) Given the natural history of withdrawal, it is reasonable for neonates with known antenatal exposure to opioids and benzodiazepines to be observed in the hospital for 4 to 7 days. After discharge, outpatient follow-up should occur early and include reinforcement of the education of the caregiver about the risk of late withdrawal signs.

13) Neonates cared for in ICUs who have developed tolerance to opioids and benzodiazepines as a result of an extended duration of treatment can be converted to an equivalent regimen of oral methadone and lorazepam. Doses may be increased as necessary to achieve patient comfort. These medications can then be reduced by 10% to 20% of the initial dose every 1 to 2 days on the basis of clinical response and serial assessments by using a standardized neonatal abstinence instrument.

14) Significant gaps in knowledge concerning the optimal treatment strategy (including the criteria for instituting pharmacologic therapy, the drug of first choice, and the strategy for weaning) of infants with neonatal withdrawal should be addressed in well-designed randomized controlled studies that are adequately powered to assess short-term outcomes and to provide for long-term follow-up.

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TABLE 5 Drugs Used in the Treatment of Neonatal Narcotic Withdrawal

Drug	Initial Dose	Increment	Maximum Dose	Ref. No.
Oral morphine	0.04 mg/kg every 3–4 h	0.04 mg/kg per dose	0.2 mg/kg per dose	119,121,126,133
Oral methadone	0.05–0.1 mg/kg every 6 h	0.05 mg/kg per dose	To effect	127
Oral clonidine	0.5–1 μg/kg every 3–6 h	Not studied	1 μg/kg every 3 h	132–135

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CLINICAL REPORT

Organic Foods: Health and Environmental Advantages and Disadvantages

abstract

FREE

The US market for organic foods has grown from $3.5 billion in 1996 to $28.6 billion in 2010, according to the Organic Trade Association. Organic products are now sold in specialty stores and conventional supermarkets. Organic products contain numerous marketing claims and terms, only some of which are standardized and regulated.

In terms of health advantages, organic diets have been convincingly demonstrated to expose consumers to fewer pesticides associated with human disease. Organic farming has been demonstrated to have less environmental impact than conventional approaches. However, current evidence does not support any meaningful nutritional benefits or deficits from eating organic compared with conventionally grown foods, and there are no well-powered human studies that directly demonstrate health benefits or disease protection as a result of consuming an organic diet. Studies also have not demonstrated any detrimental or disease-promoting effects from an organic diet. Although organic foods regularly command a significant price premium, well-designed farming studies demonstrate that costs can be competitive and yields comparable to those of conventional farming techniques. Pediatricians should incorporate this evidence when discussing the health and environmental impact of organic foods and organic farming while continuing to encourage all patients and their families to attain optimal nutrition and dietary variety consistent with the US Department of Agriculture's MyPlate recommendations.

This clinical report reviews the health and environmental issues related to organic food production and consumption. It defines the term "organic," reviews organic food-labeling standards, describes organic and conventional farming practices, and explores the cost and environmental implications of organic production techniques. It examines the evidence available on nutritional quality and production contaminants in conventionally produced and organic foods. Finally, this report provides guidance for pediatricians to assist them in advising their patients regarding organic and conventionally produced food choices. *Pediatrics* 2012;130:e1406–e1415

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KEY WORDS

organic food, produce, meat, dairy, growth hormone, antibiotic, farming, diet

ABBREVIATIONS

GH—growth hormone
NOP—National Organic Program
USDA—US Department of Agriculture

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DEFINITION AND REGULATION OF ORGANIC FOODS

Definition

Organic farming uses an approach to growing crops and raising livestock that avoids synthetic chemicals, hormones, antibiotic agents, genetic engineering, and irradiation. In the United States, the US Department of Agriculture (USDA) has implemented the National Organic Program (NOP)[1] in response to the Organic Foods Production Act of 1990.[2] The NOP set labeling standards that have been in effect since October 2002. NOP standards for organic food production include many specific requirements for both crops and livestock. To qualify as organic, crops must be produced on farms that have not used most synthetic pesticides, herbicides, and fertilizer for 3 years before harvest and have a sufficient buffer zone to decrease contamination from adjacent lands. Genetic engineering, ionizing radiation, and sewage sludge is prohibited. Soil fertility and nutrient content is managed primarily with cultivation practices, crop rotations, and cover crops supplemented with animal and crop waste fertilizers. Pests, weeds, and diseases are managed primarily by physical, mechanical, and biological controls instead of with synthetic pesticides and herbicides. Exceptions are allowed if substances are on a national approved list. Organic livestock must be reared without the routine use of antibiotic agents or growth hormones (GHs) and must be provided with access to the outdoors. If an animal is treated for disease with antibiotic agents, it cannot be sold as organic. Preventive health practices include vaccination and vitamin and mineral supplementation. The USDA certifies organic products according to these guidelines. Organic farmers must apply for certification, pass a test, and pay a fee. The NOP requires annual inspections to ensure ongoing compliance with these standards.

Labeling

Consumers are confronted with a wide range of food product marketing terms, some regulated and some not (Table 1). The labeling requirements of the NOP apply to raw, fresh products and processed products that contain organic agricultural ingredients. These labeling requirements are based on the percentage of organic ingredients in a product.[3] Products labeled "100% organic" must contain only organically produced ingredients and processing aids (excluding water and salt). Products labeled "organic" must consist of at least 95% organically processed ingredients (excluding water and salt); the remaining 5% of ingredients may be conventional or synthetic but must be on the USDA's approved list. Processed products that contain at least 70% organic ingredients can use the phrase "made with organic ingredients" and list up to 3 of the organic ingredients or food groups on the principal display panel. For example, soup made with at least 70% organic ingredients and only organic vegetables may be labeled either "soup made with organic peas, potatoes, and carrots" or "soup made with organic vegetables."

Related Terms

The NOP places no restrictions on the use of truthful labeling claims, such as "no drugs or growth hormones used," "free range," or "sustainably harvested."[3] The USDA regulates the term "free range" for poultry products; to use this term, producers must demonstrate that the poultry has been allowed "access to the outside."[4] According to Consumers Union's evaluation, this means that a poultry product comes from a bird that had at least 5 minutes of access to the outdoors each day.[4,5] No standard definition exists for all other products

TABLE 1 Commonly Used Food Product Marketing Terms

Term	Definition
100% organic	Must contain only organically produced ingredients and processing aids (excluding water and salt).
Organic	Must consist of at least 95% organically produced ingredients (excluding water and salt). Any remaining product ingredients must consist of nonagricultural substances approved on the National List.
Made with organic ingredients	Must contain at least 70% organic ingredients.
Natural	A product containing no artificial ingredient or added color and that is only minimally processed (a process that does not fundamentally alter the raw product). The label must explain the use of the term.
Free range	Producers must demonstrate to the USDA that the poultry has been allowed access to the outside.
No hormones (pork or poultry)	Hormones are not allowed in raising hogs or poultry. Therefore, the claim "no hormones added" cannot be used on the labels of pork or poultry unless it is followed by a statement that says "Federal regulations prohibit the use of hormones."
No hormones (beef)	The term "no hormones administered" may be approved for use on the label of beef products if sufficient documentation is provided to the USDA by the producer showing no hormones have been used in raising the animals.
No antibiotics (red meat and poultry)	The terms "no antibiotics added" may be used on labels for meat or poultry products if sufficient documentation is provided by the producer to the USDA demonstrating that the animals were raised without antibiotics.
Certified	"Certified" implies that the USDA's Food Safety and Inspection Service and the Agriculture Marketing Service have officially evaluated a meat product.
Chemical free	This term is not allowed to be used on a label.

There are no restrictions on use of other truthful labeling claims, such as "no drugs or growth hormones used," or "sustainably harvested."

carrying the "free range" label, such as beef, pork, or eggs; the use of the term, however, is allowed.

The term "natural" or "all natural" is defined by the USDA for meat and poultry and means that the products contain no artificial flavoring, color ingredients, chemical preservatives, or artificial or synthetic ingredients and are "minimally processed." Minimally processed means that the raw product was not fundamentally altered. Additional USDA definitions of other labeling terms can be found in publicly available USDA fact sheets.[4]

The term "raw" milk refers to unpasteurized milk. All milk certified as organic by the USDA is pasteurized. Raw milk can contain harmful bacteria, such as *Salmonella* species, *Escherichia coli* O157:H7, *Listeria* species, *Campylobacter* species, and *Brucella* species, and has been repeatedly associated with outbreaks of disease caused by these pathogens. The American Academy of Pediatrics, US Food and Drug Administration, and Centers for Disease Control and Prevention advise consumers not to consume raw milk.[6–8]

SCOPE OF CONSUMER USE, PRICES, AND TRENDS IN ORGANIC FOOD

In 2008, more than two-thirds of US consumers bought some organic products, and more than one-quarter bought organic at least weekly. The amount of US acreage dedicated to organic crops has doubled since 1997.[9] Consumers choose organic food in the belief that organic foods are more nutritious, have fewer additives and contaminants, and are grown more sustainably.[10] Some studies[11,12] suggest that families with children and adolescents or younger consumers in general are more likely to buy organic fruits and vegetables than are other consumers.[13] The factor most consistently associated with the increased propensity to purchase organic food is the level of consumer education.[14–21] Organic products, however, cost up to 40% more.

NUTRITIONAL QUALITY OF ORGANIC VERSUS CONVENTIONAL FOOD

Produce

Consumers believe that organic produce is more nutritious than conventionally grown produce, but the research to support that belief is not definitive. Many studies have demonstrated no important differences in carbohydrate or vitamin and mineral content.[22] Some studies have found lower nitrate content in organic foods versus conventionally grown foods, which is potentially desirable because of the association of nitrates with increased risk of gastrointestinal cancer and, in infants, methemoglobinemia. Higher vitamin C concentrations were found in organic leafy vegetables, such as spinach, lettuce, and chard versus the same conventionally produced vegetables in 21 of 36 (58%) studies.[22] Other studies have found higher total phenols in organic produce versus conventionally grown produce and have postulated health benefits from antioxidant effects.[23]

Several attempts have been made to review the relevant literature and draw conclusions on organic versus conventional foods, but the results are conflicting.[24–28] A large systematic review published in 2009 found that fewer than 20% of 292 articles with potentially relevant titles met criteria for quality, leaving only 55 studies to assess. The authors highlighted the fact that the nutrient content of produce is affected by numerous factors, including the geographic location of the farm, local soil characteristics, climactic conditions that can vary by season, maturity at time of harvest, and storage and time to testing after harvest. Because of the large number of nutrients reported in various articles, the authors grouped the nutrients into large categories. They found no significant differences in most nutrients, with the exception of higher nitrogen content in conventional produce and higher titratable acidity and phosphorus in organic produce.[29] Better-quality research that accounts for the many confounding variables is needed to elucidate potential differences in nutrients and the clinical importance of nutrients that may be different. At this time, however, there does not appear to be convincing evidence of a substantial difference in nutritional quality of organic versus conventional produce.

Milk

The composition of dairy products, including milk, is affected by many factors, including differences caused by genetic variability and cattle breed; thus, the results of studies assessing milk composition must be interpreted with caution. In general, milk has the same protein, vitamin, trace mineral content, and lipids from both organically and conventionally reared cows. Fat-soluble antioxidants and vitamins present in milk come primarily from the natural components of the diet or from the synthetic compounds used to supplement the feed ingested by lactating cows.[30]

One recent study examined antibiotic and microorganism content, hormone concentrations, and nutritional values of milk in 334 samples from 48 states labeled as organic, not treated with bovine GH (referred to as "GH-free"), or conventional. This study found that milk labeled "conventional" had lower bacterial counts than milk that was organic or GH-free, although this was not clinically significant. Estradiol and progesterone concentrations were lower in conventional milk than in organic milk, but GH-free milk had progesterone concentrations similar to conventional

milk and estradiol concentrations similar to organic milk. Macronutrient composition was similar, although organic milk had 0.1% more protein than the other 2 milk types.[31]

Several studies have demonstrated that organic milk has higher concentrations of antioxidants and polyunsaturated fatty acids. However, it is important to recognize that the composition of milk is strongly related to what the cows eat. This differs by time of year (outdoors in the summer, indoor forage in the winter) and whether the farms are high or low input. High-input farms supplement the diets of cattle with proprietary minerals and vitamins. Low-input farms use methods similar to those used in organic farming but do not follow all the restrictions prescribed by organic farming standards; they use mineral fertilizers but at lower levels than used by conventional high-input systems. One study comparing milk from all 3 production systems found milk from both the low-input organic and low-input nonorganic systems generally had significantly higher concentrations of nutritionally desirable unsaturated fatty acids (conjugated linoleic acid and omega-3 fatty acids) and fat-soluble antioxidants compared with milk from the high-input systems; milk derived from cows in both organic certified and nonorganic low-input systems was significantly higher in conjugated linoleic acid content than was milk from conventional high-input systems.[32]

HORMONES

GH

Hormone supplementation of farm animals, especially with GH, is one of the major reasons consumers state they prefer to buy organic foods. Bovine GH (ie, recombinant bovine somatotropin) increases milk yield by 10% to 15% and is lipotropic in cows. Because GH is degraded in the acidic stomach environment, it must be given by injection. GH is species-specific, and bovine GH is biologically inactive in humans. Because of this, any bovine GH in food products has no physiologic effect on humans, even if it were absorbed intact from the gastrointestinal tract. In addition, 90% of bovine GH in milk is destroyed during the pasteurization process. There is no evidence that the gross composition of milk (fat, protein, and lactose) is altered by treatment with bovine GH, nor is there any evidence that the vitamin and mineral contents of milk are changed by GH treatment.[31]

GH treatment of cows may actually have environmental benefits. GH increases milk production per cow, which could theoretically decrease the number of cows needed to produce a given amount of milk, with resultant need for fewer cows and, thus, less cultivated land needed to feed the cows. In addition, fewer cows would result in the production of less manure with resultant reduced methane production and less carbon dioxide production, with a resultant salutary effect on global warming.[33]

Sex Steroids

Treatment of cattle with sex steroids increases lean muscle mass, accelerates the rate of growth, and is an efficient way to increase meat yield. Estrogens are usually given by implantation of estrogen pellets into the skin on the underside of the ear, and the ear is discarded during slaughter. Unlike GH, sex steroids are not species-specific and may be given orally without degradation in the stomach. In 1998, the Food and Agriculture Organization of the United Nations and World Health Organization jointly concluded that meat from estradiol-treated animals was safe on the basis of data obtained from residue levels in meat from studies performed in the 1970s and 1980s using radioimmunoassay methods. One study demonstrated concentrations of estrogens found in meat residues were low and overlapped with concentrations found in untreated cows.[34] Gas chromatography measurements of sex steroids progesterone, testosterone, 17β estradiol, and estrone and their metabolites in meat products, fish, poultry, milk, and eggs revealed insignificant amounts compared with daily production of these steroids in adults and children.[35] Furthermore, 98% to 99% of endogenous sex steroids are bound by sex-hormone-binding globulin, rendering them metabolically inactive as only the unbound (free) forms of sex steroids are metabolically active. Synthetic sex steroids (zeranol, melengestrol, and trenbolone) commonly used in animals have lower affinities to sex-hormone-binding globulin and, therefore, are potentially more metabolically active unbound sex steroids. These hormones do not occur naturally in humans, and although the concentrations of these hormones are low in cattle, the biological effects in humans, if any, are unknown.

Ingestion of milk from estrogen-treated cows appears to be safe for children. Estradiol and estrone concentrations in organic and conventional 1%, 2%, and whole milk were the same, although the concentrations of sex steroids were higher as the fat content of the milk increased and were lower than endogenous production rates in humans. Estradiol concentrations in milk ranged from 0.4 to 1.1 pg/mL, and estrone concentrations ranged from 2.9 to 7.9 pg/mL, with the lowest concentrations in skim milk and the highest in whole milk.[36]

Endogenous estradiol concentrations are as high as 80 pg/mL in 2- to 4-month-old female infants and 40 pg/mL in 2- to 4-month-old male infants. Human milk has estradiol concentrations

as high as 39 pg/mL and estrone (which has approximately half the potency of estradiol) concentrations as high as 1177 pg/mL. Human colostrum has even higher estrogen concentrations of 500 pg/mL and 4000 to 5000 pg/mL for estradiol and estrone, respectively. Cow milk, by comparison, has estradiol concentrations of 4 to 14 pg/mL and estrone concentrations of 34 to 55 pg/mL.[37,38]

It has been postulated that ingested estrogen in food derived from sex-hormone-treated animals may play a role in earlier development of puberty and increasing risk of breast cancer. However, no studies have supported this hypothesis in humans. Studies in animals demonstrating carcinogenic and teratogenic effects of estrogens used high doses of estradiol and cannot be extrapolated to the low doses of sex steroids found in the food supply. Estrogen concentrations in the myometrium, breast, and vagina of postmenopausal women, although still low, are higher than those found in serum, and additional studies are needed to determine the significance of these low concentrations of sex steroids in estrogen-sensitive tissues.[39]

An association has been found between red meat consumption in high school girls and the development of breast cancer later in life. A 7-year prospective longitudinal study of 39 268 premenopausal women 33 to 53 years of age who filled out a comprehensive diet history of foods eaten while in high school in the 1960s and 1970s revealed a linear association between each additional 100 g of red meat consumed in high school per day with the risk of developing hormone-receptor-positive premenopausal tumors (relative risk, 1.36; 95% confidence interval, 1.08–1.70; $P = .008$). Red meat ingestion did not increase the risk of hormone-receptor-negative tumors. Although this intriguing study, which suggested that higher red meat consumption in adolescence may increase breast cancer risk, tracked cases of cancer prospectively after the dietary history was obtained, it was limited by a number of factors, including the dependence on subjects' long-term memory of amount of food eaten decades previously, the likelihood that hormone concentrations in meat were higher in that period, and the lack of direct measurement of hormonal exposure.[40] Longitudinal prospective studies are needed to compare the risk of breast cancer in women who eat meat from hormone-treated animals with the risk in women who eat meat from untreated animals.

Endocrine disrupters, chemicals that interfere with hormone signaling systems, are pervasive in our environment. Among the most commonly found endocrine disrupters are bisphenol A, found in industrial chemicals and plastics; phthalates, found in personal care items such as cosmetics; and lavender and tea tree oil, found in many hair products, soaps, and lotions; all have estrogenic properties. Endocrine disrupters are postulated to be involved in the increased occurrence of genital abnormalities among newborn boys and precocious puberty in girls. Recent literature on sex steroid concentrations and their physiologic roles during childhood indicate that concentrations of estradiol in prepubertal children are lower than originally thought and that children are extremely sensitive to estradiol and may respond with increased growth and/or breast development even at serum concentrations below the current detection limits.[41] No threshold has been established below which there are no hormonal effects on exposed children. Furthermore, the daily endogenous production rates of sex steroids in children estimated by the Food and Drug Administration in 1999 and still used in risk assessments are highly overestimated and should be reevaluated by using current assays.[41] It is therefore important to determine the relative importance of hormone treatment of animals in the context of other environmental endocrine disrupters through long-term longitudinal studies in children.

NONTHERAPEUTIC USE OF ANTIBIOTIC AGENTS

Conventional animal husbandry frequently includes the administration of antibiotic agents in nontherapeutic doses to livestock to promote growth and increase yields. Between 40% and 80% of the antimicrobial agents used in the United States each year are used in food animals, three-quarters of which is nontherapeutic. Many of these agents are identical or similar to drugs used in humans.[42] Evidence is clear that such nontherapeutic use promotes the development of drug-resistant organisms in the animals and that these organisms then colonize the intestines of people living on farms where this practice occurs.[43] Evidence is also ample that human disease caused by antibiotic-resistant organisms spread through the food chain.[44] Because organic farming prohibits the nontherapeutic use of antibiotic agents, it could contribute to a reduction in the threat of human disease caused by drug-resistant organisms.

SYNTHETIC CHEMICAL EXPOSURE

Pesticides

Pesticides have a host of toxic effects that range from acute poisonings to subtle subclinical effects from long-term, low-dose exposure.[45] Organophosphate pesticides are commonly used in agriculture, and poisoning is a persistent problem in the agricultural setting. From 1998 to 2005, 3271 cases of agricultural occupational acute pesticide poisoning were

reported to the California Department of Pesticide Regulation and the National Institute of Occupational Health's SENSOR-Pesticides program. This constitutes a rate of 56 cases per 100 000 full-time equivalents, 38 times the rate observed in nonagricultural occupations.[46] Chronic exposure among farm workers has been associated with numerous adult health problems, including respiratory problems, memory disorders, dermatologic conditions, depression, neurologic deficits including Parkinson disease, miscarriages, birth defects, and cancer.[47–50] Prenatal organophosphate pesticide exposure has been associated with adverse birth outcomes, such as decreased birth weight and length[51] and smaller head circumference.[52] A large prospective birth cohort study that measured pesticide exposure in pregnant farm workers in California and followed their offspring found lower mental development index scores at 24 months of age[53] and attentional problems at 3.5 and 5 years of age.[54] An analysis of cross-sectional data from the NHANES has demonstrated that within the range of exposure in the general US population, the odds of attention-deficit/hyperactivity disorder for 8- to 15-year-old children were increased 55% with a 10-fold increase in urinary concentrations of the organophosphate metabolite dimethyl alkylphosphate.[55]

The National Research Council reported in 1993 that the primary form of exposure to pesticides in children is through dietary intake.[56] Organic produce consistently has lower levels of pesticide residues than does conventionally grown produce,[57] and a diet of organic produce reduces human exposure. Several studies have clearly demonstrated that an organic diet reduces children's exposure to pesticides commonly used in conventional agricultural production. A small longitudinal cohort of children who regularly consumed conventional produce demonstrated that urinary pesticide residues were reduced to almost nondetectable levels (below 0.3 μg/L for malathion dicarboxylic acid, for example) when they were changed to an organic produce diet for 5 days.[58] In addition, residues varied with seasonal intake of produce, suggesting that dietary intake of organophosphate pesticides represented the major source of exposure in these young children.[59]

Although a common practice, rinsing conventionally farmed produce reduces some but not all pesticide residues on produce to varying degrees but has not been proven to decrease human exposure.[60]

Pesticide metabolite concentrations observed in studies that examined exposure in farming communities as well as in residential settings were in the same range as those observed in subjects consuming conventional produce in studies of biological exposure measures for organic versus conventional produce diets. For instance, the median concentration observed for malathion urinary metabolites in female farm workers whose offspring had significantly lower mental development index scores at 24 months of age was 0.82 μg/L,[53] which is close to the median concentration found in children in the initial conventional diet phase of the organic diet study of 1.5 μg/L, discussed previously.[58] Ranges for other pesticide metabolites were similar.

Although chronic pesticide exposure and measurable pesticide metabolite concentrations seem undesirable and potentially unhealthy, no studies to date have experimentally examined the causal relationship between exposure to pesticides directly from conventionally grown foods and adverse neurodevelopmental health outcomes. Most of the research implicating pesticides in these adverse health outcomes is from case-control or cross-sectional studies. These studies are limited by a number of factors, including difficulties measuring past exposures and the lack of a positive temporal relationship between exposure and outcome. It is difficult to directly extrapolate from these studies and draw conclusions about potential toxicity at the levels of pesticide exposure documented from dietary intake of conventional produce. Data derived from large prospective cohort studies may address some of these shortcomings.

ENVIRONMENTAL IMPACT AND PRODUCTION EFFICIENCY OF ORGANIC VERSUS CONVENTIONAL FARMING METHODS

Environmental Impact

A major subject in the organic debate is whether organic farming methods have less impact on the environment, can be equally as productive, and can be no more expensive than conventional approaches. A variety of surveys and studies have attempted to compare these issues for organic and conventional farming methods. Many believe that organic farming is less damaging to the environment because organic farms do not use or release synthetic pesticides into the environment, some of which have the potential to harm soil, water, and local terrestrial and aquatic wildlife.[61] In addition, it is thought that organic farms are better than conventional farms at sustaining diverse ecosystems, including populations of plants, insects, and animals, because of practices such as crop rotation. When calculated either per unit area or per unit of yield, organic farms use less energy and produce less waste.[62,63] Organically managed soil has been demonstrated to be of higher quality and have higher water retention, which may increase yields for organic farms in drought years.[64]

Production Efficiency

Critics of organic farming methods believe that organic farms require more land to produce the same amount of food as conventional farms. One study found a 20% smaller yield from organic farms.[65] Another study from the Danish Environmental Protection Agency found that, area for area, organic farms of potatoes, sugar beets, and seed grass produce as little as half the output as their conventional farm counterparts.[66]

It remains controversial whether organic farming is able to provide adequate food supply to sustain the world population. Norman Borlaug, considered to be the father of the "green revolution" and winner of the Nobel Peace Prize, believes that organic farming alone is incapable of feeding the world population and needs to be used in conjunction with genetically modified food.[67] On the other hand, a meta-analysis of 292 studies designed to assess the efficiency of both organic and conventional farming concluded that organic methods could produce enough food on a global per-capita basis to sustain the current human population and potentially an even larger population without increasing the agricultural land base.[68]

The largest prospective farming study to date is a comparative trial of more than 20 years' duration conducted by researchers from Cornell University. This study, conducted in Pennsylvania, compared various conventional and organic farming approaches in a controlled prospective design in which confounding influences such as weather and moisture were similar in the different systems. Over 20 years of observation, the organic fields had productivity that was generally comparable to the conventional fields, while avoiding environmental pollution with herbicides and pesticides and reducing fossil fuel consumption by 30%. Although costs were higher primarily because of increased labor costs (15%), the return for the organic plots was higher because of the higher prices commanded at the marketplace.[64]

THE DIFFERENCE IN PRICE OF ORGANIC VERSUS CONVENTIONAL FOODS

One major concern with organic food is its higher price to consumers. Organic products typically cost 10% to 40% more than similar conventionally produced products.[69] A number of factors contribute to these higher costs, including higher-priced organic animal feed, lower productivity, and higher labor costs because of the increased reliance on hand weeding. Of potential concern is that the higher price of organically produced fruits and vegetables might lead consumers to eat less of these foods, despite the well-established literature documenting the health benefits of eating fruits and vegetables, including lower rates of obesity, cardiovascular disease, and certain types of cancer. Fifty-five percent of children born in the United States are eligible for food packages under the Special Supplemental Nutrition Program for Women, Infants, and Children, and these food packages are currently giving families approximately $10 a month to spend on fruits and vegetables, so the money must be used wisely to maximize spending capacity for healthy foods.

SUMMARY

To demonstrate superiority of 1 food production method over another, it is important to show an advantage in terms of improved individual health or an important societal advantage. Organic diets have been convincingly demonstrated to expose consumers to fewer pesticides associated with human disease. Nontherapeutic use of antibiotic agents in livestock contributes to the emergence of resistant bacteria; thus, organic animal husbandry may reduce the risk of human disease attributable to resistant organisms. There is sound evidence that organic foods contain more vitamin C (ascorbic acid) and phosphorus than do conventional foods, but there is no direct evidence that this provides meaningful nutritional benefits to children eating organic foods compared with those who eat conventionally grown food products. Well-designed farming studies demonstrate that comparable yields can be achieved with organic farming techniques and that organic farming has a lower environmental impact than do conventional approaches. However, no well-powered human studies have directly demonstrated health benefits or disease protection as a result of consuming an organic diet. Such studies would be difficult to perform and require large prospective cohort populations or, better, randomly assigning subjects to interventions that increase organic versus conventional food intakes. Additional data are needed to identify relationships between diet and pesticide exposure and individual health outcomes. Pediatricians should incorporate this evidence when discussing the health and environmental impact of organic foods and organic farming while continuing to encourage all patients and their families to attain optimal nutrition and dietary variety by choosing a diet high in fresh fruits and vegetables, consistent with the USDA's MyPlate recommendations.

Key Points

1. Nutritional differences between organic and conventional produce appear minimal, but studies examining this have been limited by inadequate controls for the many subtle potential confounders, such as moisture, maturity of the produce, and measurement techniques.

No direct evidence of a clinically relevant nutritional difference between organic and conventional produce exists.

2. Organic produce contains fewer pesticide residues than does conventional produce, and consuming a diet of organic produce reduces human exposure to pesticides. It remains unclear whether such a reduction in exposure is clinically relevant.
3. Organic animal husbandry that prohibits the nontherapeutic use of antibiotic agents has the potential to reduce human disease caused by drug-resistant organisms.
4. There is no evidence of clinically relevant differences in organic and conventional milk.
   a. There are few, if any, nutritional differences between organic and conventional milk. There is no evidence that any differences that may exist are clinically relevant.
   b. There is no evidence that organic milk has clinically significant higher bacterial contamination levels than does conventional milk.
   c. There is no evidence that conventional milk contains significantly increased amounts of bovine GH. Any bovine GH that might remain in conventional milk is not biologically active in humans because of structural differences and susceptibility to digestion in the stomach.
5. Organic farming approaches in practice are usually more expensive than conventional approaches, but in carefully designed experimental farms, the cost difference can be mitigated.
6. The price differential between organic and conventional food might be reduced or eliminated as organic farming techniques advance and as the prices of petroleum products, such as pesticides and herbicides, as well as the price of energy, increase.
7. Organic farming reduces fossil fuel consumption and reduces environmental contamination with pesticides and herbicides.
8. Large prospective cohort studies that record dietary intake accurately and measure environmental exposures directly will likely greatly enhance understanding of the relationship between pesticide exposure from conventional foods and human disease and between consumption of meat from hormone-treated animals and the risk of breast cancer in women.

Advice for Pediatricians

1. Encourage patients and their families to eat an optimally health-promoting diet rich in fruits, vegetables, whole grains, and low-fat or fat-free milk and dairy products.
2. When approached by families interested in consuming organic foods, review key facts presented in this report to address the full range of relevant nutrition, human health, environmental, and cost issues. Be explicit about areas in which scientific evidence is strong as well as those in which it is uncertain.
3. When advice is sought by families concerned with the potential health impact of pesticide residues in food, direct them toward reliable resources that provide information on the relative pesticide content of various fruits and vegetables. Two such examples include:
   a. *Consumer Reports* article (September 2008) "Fruits and Vegetables, When to Buy Organic" (http://www.consumerreports.org/health/healthy-living/diet-nutrition/healthy-foods/organic-foods/overview/when-to-buy-organic.htm) and
   b. Environmental Working Group's "Shopper's Guide to Pesticides" (http://www.foodnews.org).

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POLICY STATEMENT

Patient- and Family-Centered Care and the Pediatrician's Role

abstract

Drawing on several decades of work with families, pediatricians, other health care professionals, and policy makers, the American Academy of Pediatrics provides a definition of patient- and family-centered care. In pediatrics, patient- and family-centered care is based on the understanding that the family is the child's primary source of strength and support. Further, this approach to care recognizes that the perspectives and information provided by families, children, and young adults are essential components of high-quality clinical decision-making, and that patients and family are integral partners with the health care team. This policy statement outlines the core principles of patient- and family-centered care, summarizes some of the recent literature linking patient- and family-centered care to improved health outcomes, and lists various other benefits to be expected when engaging in patient- and family-centered pediatric practice. The statement concludes with specific recommendations for how pediatricians can integrate patient- and family-centered care in hospitals, clinics, and community settings, and in broader systems of care, as well. *Pediatrics* 2012;129:394–404

COMMITTEE ON HOSPITAL CARE and INSTITUTE FOR PATIENT- AND FAMILY-CENTERED CARE

KEY WORD

patient care

ABBREVIATIONS

AAP—American Academy of Pediatrics
IHI—Institute for Healthcare Improvement
IOM—Institute of Medicine
NICHQ—National Institute for Children's Healthcare Quality

INTRODUCTION

Patient- and family-centered care is an innovative approach to the planning, delivery, and evaluation of health care that is grounded in a mutually beneficial partnership among patients, families, and providers that recognizes the importance of the family* in the patient's life. When patient- and family-centered care is practiced it shapes health care policies, programs, facility design, evaluation of health care, and day-to-day interactions among patients, families, physicians, and other health care professionals. Health care professionals who practice patient- and family-centered care recognize the vital role that

*Family is broadly defined. The following serves as an example of such a definition: "We all come from families. Families are big, small, extended, nuclear, multigenerational, with one parent, two parents and grandparents. We live under one roof or many. A family can be as temporary as a few weeks, as permanent as forever. We become part of a family by birth, adoption, marriage, or from a desire for mutual support. As family members, we nurture, protect, and influence one another. Families are dynamic and are cultures unto themselves, with different values and unique ways of realizing dreams. Together, our families become the source of our rich cultural heritage and spiritual diversity. Each family has strengths and qualities that flow from individual members and from the family as a unit. Our families create neighborhoods, communities, states, and nations." (New Mexico's Memorial Task Force on Children and Families and the Coalition for Children, 1990)

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families play in ensuring the health and well-being of children† and family members of all ages. These practitioners acknowledge that emotional, social, and developmental support are integral components of health care. They respect each child and family's innate strengths and cultural values and view the health care experience as an opportunity to build on these strengths and support families in their caregiving and decision-making roles. Patient- and family-centered approaches lead to better health outcomes and wiser allocation of resources as well as to greater patient and family satisfaction. It should be noted that the term "family-centered care," is replaced with the term "patient- and family-centered care," to more explicitly capture the importance of engaging the family and the patient in a developmentally supportive manner as essential members of the health care team. Patient- and family-centered care in pediatrics is based on the understanding that the family is the child's primary source of strength and support and that the child's and family's perspectives and information are important in clinical decision-making. Practitioners of patient- and family-centered care are keenly aware that positive health care experiences in provider/family partnerships can enhance parents' confidence in their roles and, over time, increase the competence of children and young adults to take responsibility for their own health care, particularly in anticipation of the transition to adult service systems.

"During the past decade, family advocates have promoted family-centered care, 'the philosophies, principles and practices that put the family at the heart or center of services; the family is the driving force.'"[1] This is in harmony with, but different from, "…family pediatrics [family-oriented care]" as outlined in the American Academy of Pediatrics (AAP) Task Force on Family, which "…extends the responsibilities of the pediatrician to include screening, assessment, and referral of parents for physical, emotional, or social problems or health risk behaviors that can adversely affect the health and emotional or social well-being of their child."[1] This policy statement specifically defines the expectations of patient- and family-centered care.

CORE PRINCIPLES OF PATIENT- AND FAMILY-CENTERED CARE

Patient- and family-centered care is grounded in collaboration among patients, families, physicians, nurses, and other professionals in clinical care as well as for the planning, delivery, and evaluation of health care, and in the education of health care professionals and in research, as well. These collaborative relationships are guided by the following principles:

1. Listening to and respecting each child and his or her family. Honoring racial, ethnic, cultural, and socioeconomic background and patient and family experiences and incorporating them in accordance with patient and family preference into the planning and delivery of health care.
2. Ensuring flexibility in organizational policies, procedures, and provider practices so services can be tailored to the needs, beliefs, and cultural values of each child and family and facilitating choice for the child and family about approaches to care.[2]
3. Sharing complete, honest, and unbiased information with patients and their families on an ongoing basis and in ways they find useful and affirming, so that they may effectively participate in care and decision-making to the level they choose. Health information for children and families should be available in the range of cultural and linguistic diversity in the community and take into account health literacy. In hospitals, conducting physician rounds in the patients' rooms with nursing staff and family present can enhance the exchange of information and encourage the involvement of the family in decision-making.[3–6]
4. Providing and/or ensuring formal and informal support (eg, peer-to-peer support) for the child and family during each phase of the child's life. Such support is provided so that Health Insurance Portability and Accountability Act and other relevant ethical and legal guidelines are followed.
5. Collaborating with patients and families at all levels of health care: in the delivery of care to the individual child; in professional education, policy making, program development, implementation, and evaluation; and in health care facility design. As part of this collaboration, patients and families can serve as members of child or family advisory councils, committees, and task forces dealing, for example, with operational issues in health care facilities; as collaborators in improving patient safety; as participants in quality-improvement initiatives; and as leaders or coleaders of peer-support programs.[7,8] In the area of medical research, patients and families should have voices at all levels in shaping the research agenda, in determining how children and families participate in research, and in deciding how research findings will be shared with children and families.[9]
6. Recognizing and building on the strengths of individual children and families and empowering them to discover their own strengths, build confidence, and participate in making

†In accordance with the policies of the AAP, references to "child" and "children" in this document includes infants, children, adolescents, and young adults up to age 21.

choices and decisions about their health care.[7,10–12]

A self-assessment tool is available for families to evaluate whether the care they are receiving fits into the realm of family-centered care and also can be used by pediatricians to evaluate the care they deliver.[13]

HISTORY OF PATIENT- AND FAMILY-CENTERED CARE

Patient- and family-centered care emerged as an important concept in health care during the second half of the 20th century, at a time of increasing awareness of the importance of meeting the psychosocial and developmental needs of children and of the role of families in promoting the health and well-being of their children.[14–24] Much of the early work focused on hospitals; for example, as research emerged about the effects of separating hospitalized children from their families, many institutions adopted policies that welcomed family members to be with their child around the clock and also encouraged their presence during medical procedures. The Maternal and Child Health Bureau of the Health Resources and Service Administration played an active role in furthering the involvement of families and the support of family issues and service needs. Federal legislation of the late 1980s and 1990s,‡ much of it targeted at children with special needs, provided additional validation of the importance of family-centered principles.[7,10] Family-centered care has long been a characteristic of an effective medical home.[25] Family Voices, founded in 1992, advocates for family-centered, community-based services for children with special health care needs.[26] Building on the work begun in the previous decade, the Institute for Family-Centered Care (now the Institute for Patient- and Family-Centered Care) was also founded in 1992 to foster the development of partnerships among patients, families, and health care professionals and to provide leadership for advancing the practice of family-centered care in all settings.[7,10]

Patient- and family-centered care is supported by a growing body of research and by prestigious organizations, such as the Institute of Medicine (IOM), which in its 2001 report "Crossing the Quality Chasm: A New Health System for the 21st Century," emphasized the need to ensure the involvement of patients in their own health care decisions, to better inform patients of treatment options, and to improve patients' and families' access to information.[27] It specifies 6 domains for improving patient safety, one of which is patient centeredness. The IOM's recommendations are intrinsic to patient- and family-centered practice. In 2006, the Institute for Family-Centered Care and the Institute for Healthcare Improvement (IHI) brought together leadership organizations and patient and family advisors to advance the practice of patient- and family-centered care and ensure that there are sustained, effective partnerships with patients and families in all aspects of the health care system.[7,8]

The AAP has incorporated many of the principles of patient- and family-centered care into several policy statements and manuals.[25,28–37] In 2006, the AAP Board of Directors approved a Parent Advisory Group pilot program under the Section on Home Care.[38] Members of the Parent Advisory Group all share a special interest in patient- and family-centered care, have personal experience with children with special health care needs, and serve as advisors and leaders for patient- and family-centered pediatric care within their own communities and at the national level.

The IHI, founded in 1991, is an independent organization founded to improve health care throughout the world. Among its core values is patient and family centeredness.[39] The National Institute for Children's Healthcare Quality (NICHQ) was launched as an IHI program in 1999. The NICHQ is dedicated to improving the quality of health care provided to children. One component of its 4-part improvement agenda is promoting evidence-based patient- and family-centered care for children with chronic conditions. A strong focus of the NICHQ is the participation of family advisors.[40]

The value of patient- and family-centered care in health care quality is recognized by the American Hospital Association–McKesson Quest for Quality Prize, which raises awareness of patient- and family-centered care and rewards successful efforts to develop and promote improvements in the safety and quality of care.[41] As a result of improved outcomes when patient- and family-centered care is delivered in hospitals, the American Hospital Association partnered with the Institute for Patient- and Family-Centered Care to produce and distribute a toolkit, Strategies for Leadership: Patient- and Family-Centered Care, to the chief executive officer of every hospital in the United States to assist administration and medical leadership in advancing patient- and family-centered practice and to complement other

‡Among the legislation advancing the practice of family-centered care are such statutes as: the Education of the Handicapped Act Amendments of 1986 (Public Law 99-457), Part H—Early Intervention Programs for Handicapped Infants and Toddlers; Maternal and Child Health block grant amendments contained in the Omnibus Budget Reconciliation Act of 1989 (Public Law 101-239); Individuals With Disabilities Education Act of 1990 (Public Law 101-476); the Developmental Disabilities Assistance and Bill of Rights Act of 1990 (Public Law 101-496); Mental Health Amendments of 1990 (Public Law 101-639); and Families of Children With Disabilities Support Act of 1994 (Public Law 103-382).

efforts to improve patient safety and the quality of patient care.[8,42–44]

The National Patient Safety Foundation, with patients and families serving on its Board of Directors and on a Patient and Family Committee of the Board, is working to ensure that all health care organizations meaningfully involve patients and families in enhancing patient safety and redesigning health care systems and processes.[45] The Joint Commission, likewise, promotes patient- and family-centered care in their efforts to improve patient safety practices.[46]

The National Survey of Children with Special Health Care Needs in 2005 to 2006 demonstrated that, although most families of children with special health care needs feel they are partners in the care of their child, approximately one-third do not, particularly families with incomes below the poverty level, families without health care insurance, and Hispanic or black families.[47]

OUTCOMES OF PATIENT- AND FAMILY-CENTERED CARE: BRIEF SUMMARY OF RECENT LITERATURE

Patient- and family-centered care can improve patient and family outcomes, improve the patient's and family's experience, increase patient and family satisfaction, build on child and family strengths, increase professional satisfaction, decrease health care costs, and lead to more effective use of health care resources, as shown in the following examples from the literature.

Patient and Family Outcomes

High-quality, patient- and family-centered primary care is associated with a significant reduction in nonurgent emergency department visits in children.[48] Family presence during health care procedures decreases anxiety for the child and the parents. Research indicates that when parents are prepared, they do not prolong the procedure or make the provider more anxious.[49–53] Children whose mothers were involved in their posttonsillectomy care recovered faster and were discharged earlier than were children whose mothers did not participate in their care.[12]

A series of quality-improvement studies found that children who had undergone surgery cried less, were less restless, and required less medication when their parents were present and assisted in pain assessment and management.[54] Children and parents who received care from child life specialists[29] did significantly better than did control children and parents on measures of emotional distress, coping during procedures, and adjustment during hospitalization, posthospital adjustment, and recovery, including recovery from surgery.[55]

A multisite evaluation of the efficacy of parent-to-parent support found that 1-to-1 support increased parents' confidence and problem-solving capacity. Interviewees noted that this type of support could not be provided through any other means.[56,57] Family-to-family support can have beneficial effects on the mental health status of mothers of children with chronic illness.[58]

Since 1993, patient- and family-centered care has been a strategic priority at 1 children's hospital. Families participated in design planning for the new hospital, and they have been involved in program planning, staff education, and other key hospital committees and task forces. In recent years, this children's hospital has consistently received among the highest patient and family satisfaction scores in a nationwide survey of comparable pediatric facilities.[59] And more recently, it has demonstrated decreased length of stay, reduced medical errors, and improved staff satisfaction.[60,61] This children's hospital is part of a larger academic medical center and health system, recognized nationally for its commitment to patient- and family-centered practice. This health system is among the most cost-efficient organizations in the University Health System Consortium database and, for the past 5 years, has reported a decrease in malpractice claims and litigation, whereas many other academic medical centers, as measured by the University Health System Consortium, have reported annual increases in these expenditures.[8,62]

A different children's hospital has also been integrating patient- and family-centered care throughout its hospital and outpatient facilities since the late 1990s. In 2001, in response to the IOM report, "To Err is Human,"[63] and its outcome data, this hospital implemented an ambitious plan to improve safety and quality. Critical to its efforts and its subsequent success in improving safety and quality, improvement teams have consistently involved families as active members.[64] Because of the hospital's excellence in quality, safety, and patient experience, it has been the recipient of many honors, including the Leapfrog Group Top Hospital Award, the American Hospital Association's McKesson Quest for Quality Prize, and the Picker Award for Excellence in the Advancement of Patient-Centered Care.

In a federally funded medical home project using a quality-improvement model, families served by 13 community-based pediatric practices are collaborating with pediatricians and office staff to enhance the practices' capacity to provide care to children with special health care needs and to be more responsive to the priorities and needs of these children and their families. These practices have permanently integrated family input into decisions about their processes of care and have demonstrated a 34% improvement on a standardized measure of medical

home implementation.[65] A review of the emerging literature on medical homes reported that there are favorable outcomes associated with medical home including better health status, timeliness of care, family perception of family centeredness, and family functioning.[66] Clear communication between physicians, patients, and parents leads to improved satisfaction with acute inpatient pediatric and NICU care.[67] Patient and family satisfaction are linked to hospital safety and communication.[68]

Parents of infants who received more patient- and family-centered care while in the NICU and in discharge planning were more satisfied with the care they received, demonstrated increased competence and confidence in infant caregiving, and were more willing to seek help from health care providers.[69–72]

Use of a patient- and family-centered care map to identify opportunities for and implement patient- and family-centered practices resulted in significant improvement in growth parameters and earlier discharge of very low birth weight newborn infants.[73] This care map was designed for the NICU to promote family-centered care throughout daily interventions with infants and families to deliver care in a holistic fashion to meet the developmental, physical, and psychosocial needs of the infants and their families.

Staff Satisfaction

Staff members at another children's hospital who participate in education programs with families as teachers believe that these experiences are highly valuable.[74] A different program has shown that a family faculty program, combined with home visits, produces positive changes in medical students' perceptions of children and adolescents with cognitive disabilities.[75]

When patient- and family-centered care is the cornerstone of culture in a pediatric emergency department, staff members have more positive feelings about their work than do staff members in an emergency department that does not emphasize emotional support. This may lead to improved job performance, less staff turnover, and a decrease in costs.[76]

Cost-Effectiveness

Coordination of prenatal care in a manner consistent with patient- and family-centered principles for pregnant women at risk of poor birth outcomes at 1 medical center resulted in more prenatal visits, decreased rates of tobacco and alcohol use during pregnancy, higher infant birth weights and gestational ages, and fewer NICU days. All of these factors decrease health care costs and the need for additional services.[77]

After redesigning their transitional care center in a way supportive of families, creating 24-hour open visiting for families, and making a commitment to information sharing, another children's hospital experienced a 30% to 50% decrease in the infants' length of hospital stay. Other outcomes included fewer rehospitalizations, decreased use of the emergency department, greater parent satisfaction, and a decrease in maternal anxiety.[78]

In 1 community program a family support service for children with HIV infection hired family support workers whose backgrounds and life experiences were similar to those of families served by that program. This approach resulted in decreases in HIV-related hospital stays, missed clinic appointments, and foster care placements.[79]

One county program has a children's managed-care plan based on a family-participation service model. Families decide for themselves how dollars are spent for their children with special mental health needs, as long as the services are developed by a collaborative team created by the family. In the 5 years since the program's inception, the proportion of children living in community homes instead of institutions has increased from 24% to 91%; the number of children attending community schools has grown from 48% to 95%; and the average cost of care per child or family per month has decreased from ~$6000 to $4100.[80–82]

The risk-management literature indicates that patients and families are significantly less likely to initiate lawsuits, even when mistakes have been made, if there is open and effective communication and there are trusting relationships between the practitioner and patient and family. Communication problems that can lead to malpractice, by contrast, include the failure to understand patients' or families' perspectives, poor delivery of information, devaluation of patient or family views, and provider unavailability.[83–86]

The pediatrician who appropriately incorporates patient- and family-centered care concepts in patient encounters will, by necessity, spend additional time with the child and the supporting family. This time has value because it will eventually improve care and prevent unnecessary costs in the future. Consequently, payment for the time spent with a family should be adequate, and paid to the physician without undue administrative complexities.

BENEFITS OF PATIENT- AND FAMILY-CENTERED CARE FOR PEDIATRICIANS

Given the documented benefits, pediatricians who practice patient- and family-centered care may experience the following benefits:

- A stronger alliance with the family in promoting each child's health and development.[87]
- Improved clinical decision-making based on better information and collaborative processes.

- Improved follow-through when the plan of care is developed collaboratively with families.
- Greater understanding of the family's strengths and caregiving capacities.
- More efficient and effective use of professional time, including the use of patient- and family-centered rounds.
- More efficient use of health care resources (eg, more care managed at home, decrease in unnecessary hospitalizations and emergency department visits, more effective use of preventive care).
- Improved communication among members of the health care team.
- A more competitive position in the health care marketplace.
- An enhanced learning environment for future pediatricians and other professionals in training.[88]
- A practice environment that enhances professional satisfaction in both inpatient and outpatient practice.
- Greater child and family satisfaction with their health care.
- Improved patient safety from collaboration with informed and engaged patients and families.
- An opportunity to learn from families how care systems really work and not just how they are intended to work.
- A possible decrease in the number of legal claims, claim severity, and legal expenses.[62,85]

RECOMMENDATIONS

1. As leaders of the child's medical home, pediatricians should ensure that true collaborative relationships with patients and families as defined in the core concepts of patient- and family-centered care are incorporated into all aspects of their professional practice.[89] The patient and family are integral members of the health care team. They should participate in the development of the health care plan and have ownership of it.
2. Pediatricians should unequivocally convey respect for families' unique insights into and understanding of their child's behavior and needs, should actively seek out their observations, and should appropriately incorporate family preferences into the care plan.§
3. In hospitals, conducting attending physician rounds (ie, patient presentations and discussions) in the patients' rooms with nursing staff and the family present should be standard practice.[3–6]
4. Parents or guardians should be offered the option to be present with their child during medical procedures and offered support before, during, and after the procedure.
5. Families should be strongly encouraged to be present during hospitalization of their child, and pediatricians should advocate for improved employer recognition of the importance of family presence during a child's illness.
6. Pediatricians should share information with and promote the active participation of all children, including children with disabilities, if capable, in the management and direction of their own health care. The adolescent's and young adult's capacity for independent decision-making and right to privacy should be respected.
7. In collaboration with patients, families, and other health care professionals, pediatricians should modify systems of care, processes of care, and patient flow as needed to improve the patient's and family's experience of care.
8. Pediatricians should share medical information with children and families in ways that are useful and affirming. This information should be complete, honest, and unbiased.
9. Pediatricians should encourage and facilitate peer-to-peer support and networking, particularly with children and families of similar cultural and linguistic backgrounds or with the same type of medical condition.
10. Pediatricians should collaborate with patients and families and other health care providers to ensure a transition to good-quality, developmentally appropriate, patient- and family-centered adult health care services.
11. In developing job descriptions, hiring staff, and designing performance-appraisal processes, pediatricians should make explicit the expectation of collaboration with patients and families and other patient- and family-centered behaviors.
12. Pediatricians should create a variety of ways for children and families to serve as advisors for and leaders of office, clinic, hospital, institutional, and community organizations involved with pediatric health care.[7,8]

§It is the responsibility of the physician to make medical care decisions, but they should be made after such consultation has been made with the patient and the family. It is the patient's and family's responsibility to comply with the agreed upon medical care decisions. If there are major differences of opinion between physicians and families in the care of the child that cannot be resolved with consultation and further medical opinions, consultation with an ethics committee would be prudent. In rare and extreme circumstances, when the health and the life of the child is in jeopardy, appropriate legal action may need to be taken.

13. The design of health care facilities should promote the philosophy of patient- and family-centered care, such as including single-room care, family sleeping areas, and availability of kitchen and laundry areas and other areas supportive of families. Pediatricians should advocate for children and families to participate in design planning of health care facilities.[90–93]
14. Education and training in patient- and family-centered care should be provided to all trainees, students, and residents as well as staff members.
15. Patients and families should have a voice in shaping the research agenda, and they should be invited to collaborate in pediatric research programs. This should include determining how children and families participate in research and deciding how research findings will be shared with children and families.[9]
16. Pediatricians should advocate for and participate in research on outcomes and implementation of patient- and family-centered care in all venues of care.
17. Incorporating the patient- and family-centered care concepts described in this statement into patient encounters requires additional face-to-face and coordination time by pediatricians. This time has value and is an investment in improved care, leading to better outcomes and prevention of unnecessary costs in the future. Payment for time spent with the family should be appropriate and paid without undue administrative complexities.

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CLINICAL REPORT

Pediatric Observation Units

abstract

FREE

Pediatric observation units (OUs) are hospital areas used to provide medical evaluation and/or management for health-related conditions in children, typically for a well-defined, brief period. Pediatric OUs represent an emerging alternative site of care for selected groups of children who historically may have received their treatment in an ambulatory setting, emergency department, or hospital-based inpatient unit. This clinical report provides an overview of pediatric OUs, including the definitions and operating characteristics of different types of OUs, quality considerations and coding for observation services, and the effect of OUs on inpatient hospital utilization. *Pediatrics* 2012;130:172–179

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KEY WORDS

pediatric, observation unit, observation status, emergency department, inpatient

ABBREVIATIONS

CPT—*Current Procedural Terminology*
ED—emergency department
OU—observation unit

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BACKGROUND INFORMATION

Across the United States, hospitals providing care for children are facing the challenges of limited inpatient and emergency department (ED) bed capacity and pressures to decrease health care costs and improve efficiencies, quality, and patient safety. One approach has been the establishment of pediatric observation units (OUs). OUs have become widely used in adult medicine to provide hospital-level patient care on a short-term basis, providing efficient care of adults with chest pain, asthma, congestive heart failure, overdose, and many other diagnoses.[1–4] Although the numbers of pediatric OUs and of children treated in them are not tracked or reported on a national basis, a growing body of literature and interest in these units accompanying health care reform support the notion that the number of OUs may increase in the near future. In this context, it is important that pediatricians be familiar with the clinical and operating characteristics of OUs.

DEFINITIONS

Efforts to categorize different OU models are hampered by a lack of universally accepted terminology and definitions. Nonetheless, OUs may be described on the basis of location, scope of clinical activity, or intended function. A recent Institute of Medicine report[5] described OUs as "separate areas that allow for observation of patients to determine whether admission is necessary"; this is a common perspective. OUs may also serve as an alternate site for treatment of selected conditions. And in some hospitals, the OU may serve both functions. In a recent study from a children's hospital with extensive OU experience,

the OU was described both as "dedicated areas where patients may be treated or observed for a defined time period to determine the need for inpatient admission" and as a "disposition option for children who are judged to be too ill for home management."[6] This range of descriptions demonstrates that there may be considerable overlap between different types and functions of OUs, even within a single institution.

The following are definitions related to OUs and observation care from recent literature, acknowledging that terminology varies widely. As the pediatric OU management and research literature evolves, it will be important to have standardized terminology for accurate comparison and referencing purposes.

- Traditional inpatient care: Admission of a patient to a hospital inpatient setting for management or diagnosis of a health-related condition, typically for more than 24 hours.
- Observation unit (OU): A hospital area used to manage and/or diagnose a health-related condition, typically for a well-defined, brief period (typically under 24 or 48 hours). Use of the word "observation" suggests that patients will be frequently reassessed to monitor progression of illness or response to therapy.
- Observation services: Services furnished by a hospital on its premises, including the use of a bed, periodic monitoring by nursing and other staff, and other reasonable and necessary services to evaluate a patient's condition or determine the need for a possible (inpatient) admission to the hospital.
- Observation status: Observation status is a level of care determination that is often assigned to patients who present to an ED (or a private office or clinic) and require a period of monitoring before a decision is made concerning admission or discharge. Observation status generally results in a decision to continue observation care (*Current Procedural Terminology* [CPT] codes 99224–99226 for subsequent observation care [Table 1]), admit the patient (ie, change them to inpatient status with the reporting of CPT codes 99221–99223 for initial hospital care), or discharge the patient (CPT code 99217 for observation care discharge). A patient need not be in a designated OU to be considered in observation status, and likewise, placing a patient in an OU does not constitute initiation of observation-status care.
- Clinical decision unit: Often used synonymously with OU, this is a more descriptive term for an area designated for assessment of patients for whom more time is needed to make a decision whether to admit for traditional inpatient care.[5]
- Rapid (or extended) treatment unit, short-stay unit, 23-hour unit: These and similar terms are sometimes used synonymously with OU. Their time-specific nature suggests a special emphasis on expeditious patient disposition as a key element of their operation, although observation stays can be longer than 24 hours.
- Hybrid OU: Hybrid OUs provide both the short-term diagnostic and management work performed in the typical OU and hospital-level care for scheduled, brief, elective admissions, typically for diagnostic or therapeutic procedures. The most common of these pediatric procedures is provision of sedation for a painful diagnostic procedure such as lumbar puncture or bone marrow aspirate,[6] admissions for infusions, pH probe studies, or recovery from anesthesia.[6,7] Hybrid units may enhance operating efficiencies in that they use a unit's resources for different activities at different times, leading to smoother bed and staffing demands.[6,8–10] The term "hybrid unit," as described here, is not consistently applied. The author of a 2001 review defined the dual mission of a "hybrid or combined unit" differently, calling it "an OU where both pediatric and adult patients can be treated or observed."[11]
- Holding unit, overflow unit, delayed admission unit: Because hospital overcrowding has led to significant numbers of admitted patients being kept in EDs and other areas of hospitals that have not previously provided traditional inpatient care, some hospitals have designated 1 or more specific areas to provide

TABLE 1 Observation-Related CPT Codes

Code	Description
99217	Hospital observation discharge
99218	Initial observation care, low complexity/severity
99219	Initial observation care, moderate complexity/severity
99220	Initial observation care, high complexity/severity
99224	Subsequent observation care, low complexity
99225	Subsequent observation care, moderate complexity
99226	Subsequent observation care, high complexity
99234	Hospital observation and discharge, same day, low complexity/severity
99235	Hospital observation and discharge, same day, moderate complexity/severity
99236	Hospital observation and discharge, same day, high complexity/severity

short-term care of these "overflow" inpatients. These may or may not overlap with the mission of an OU, depending on individual hospital requirements.[12] It is important to be aware that, just as is the case with EDs, holding inpatients in OUs that are designed for rapid patient turnover will impinge on their ability to perform their primary missions.

OPERATING CHARACTERISTICS OF PEDIATRIC OUs

Clinical Staffing

Optimal management of an OU requires a team approach, with all involved being focused on the goal of efficient yet safe patient management. Although management of OUs is typically led by physicians, including emergency physicians, hospitalists,[13,14] or a small-but growing group of dedicated "observationalists," nurse practitioners and/or physician assistants often play integral roles as well.[15,16] Using a hospital-based provider staff allows for the frequent rounding and decision-making usually associated with observation status. However, treatment of children in an OU or coding for such services is not limited to hospital-based physicians. The quality of pediatric OU care can be enhanced with dedicated, experienced nursing staff with specific pediatric experience. To enhance efficiency and decrease OU length of stay and waiting time, a well-organized system to schedule and interpret laboratory, imaging, and other test results is also important.

The role of residents and other trainees in the operation of OUs located in academic training centers is variable, and the literature on this topic is scant. A survey of interns during a rotation on a short-stay unit indicated that their educational experience was favorable.[17] The authors suggested that the unit's clustering of patients with symptoms suggestive of straightforward diagnoses enhanced the intern's educational experience. Exposing residents to patients in the OU also provides them with experience with lower-acuity patients than they would obtain in caring for those on hospital wards alone.

Clinical Care Provided in OUs

Studies describing the diagnoses of children cared for in OUs have revealed that these units may provide effective care for a wide range of common pediatric illnesses and conditions.[18] The most frequent pediatric observation diagnoses include the following: respiratory conditions, such as asthma, bronchiolitis, and croup; gastroenteritis/dehydration and abdominal pain; and prolonged observation of patients with head or other injuries, potential appendicitis, or toxic ingestions. OUs can also be used by day surgery or ambulatory procedure patients who have a delayed recovery time from sedation or anesthesia or whose postoperative/procedure pain is not well controlled. These conditions lend themselves to specific guidelines of care, and for this reason, diagnostic dilemmas are typically not well suited for the OU. Admission criteria to the OU are typically based on age, degree of illness, diagnosis, and the patient's then-current location (ED, clinic, primary care, etc). Although specific guidelines governing patient admission to OUs are universally recognized as critical to OU operations, it is also important to maintain flexibility in patient selection. Reconciling the intensity of expected OU care with available unit staffing is also important, because physician and nursing availability may vary with time of day or at time of peak volumes.

Location of Observation Care

Although traditional pediatric inpatient care is predominantly provided on a hospital floor setting, pediatric observation services may be provided in a variety of settings. This may include a geographic location (or locations) specifically designated as a pediatric OU or a mixed adult-pediatric OU. These units are most commonly found adjacent to or contiguous with an ED; however, others are distinct units in a hospital setting.[6,12,19,20] In either case, a patient is physically transferred to an OU, often after an initial period as an ED patient. Alternatively, observation services may be provided to patients who physically remain in an ED or who are on a hospital floor or other setting, such as a postanesthesia care unit. Observation services may be provided to patients who do not meet the specific admission criteria of a defined OU, who are at hospitals that have chosen not to dedicate space to a discrete OU,[21] or who may simply not fit in an already-full OU.

OUs, uniquely positioned at the interface of inpatient and outpatient care, present certain unique compliance, regulatory, and risk-management issues. In some states, OU beds may not count against a hospital's quota of licensed, inpatient beds and/or be subject to certificate of need determinations. An area of regulatory uncertainty relates to obligations created under the Emergency Medical Treatment and Labor Act for patients in observation status. In addition, OU care, with its unique billing codes and hospital requirements, requires careful attention to clinical protocols as well as documentation and management of medical records.

MEASURING AND ENSURING QUALITY OF CARE IN OUs

A well-functioning OU staff may commonly admit, manage, and discharge its entire census of patients in the course of a day. Safe and efficient operation of these high-volume, high-turnover units requires particular

attention to developing policies and procedures addressing administration, staffing, quality assurance, patient safety, equipment, clinical protocols for treatment, and quality measures. Macy et al[18] have suggested components of a performance metrics "dashboard" for pediatric OUs. Although some of the most commonly cited OU-specific quality measures include return visit rates, length of stay, and financial performance, consistent and comparative measures of operational and clinical performance have been hampered by a lack of standard definitions.[18]

As an example, return visit rates will vary depending on the follow-up time period, the type of return visits being tracked, and how closely the initial and subsequent medical conditions are related. Similarly, OU length of stay determination will vary depending on the definition of the starting and ending points of care. In addition, variability in accounting methods to report and allocate OU revenue and costs creates challenges in describing the economic outcomes of OU care.

The rate of admission for traditional inpatient care after observation services is also frequently tracked as a quality marker. Although sometimes characterized as "failed observation,"[18] progress to traditional hospital admission should be expected of a substantial portion of patients receiving observation services, especially those being observed to determine whether hospital admission will be required. The frequency of inpatient admission among children initially treated in OUs varies widely and may be impacted by medical condition or admission and discharge criteria for individual units. Reported admission rates range from 4% for diagnoses such as croup and seizures to, in some cases, more than 50% for respiratory conditions such as bronchiolitis.[6,16,18,20,22,23] An overall rate of 15% to 25% conversion from observation to full inpatient status is commonly reported.[18] Rates higher or lower than these suggest a need for reevaluation of admission criteria.

Attempts to identify the clinical features that differentiate which specific patients will go on to require an inpatient admission from those who will be discharged have had only marginal success. The clinical characteristics of patients more likely to require admission from an OU vary widely by diagnosis and care provided. Studies of children with asthma treated in an OU did not find meaningful differences in clinical characteristics of patients who were successfully discharged from the OU and those who required hospital admission, except for a persistent need for oxygen supplementation.[24,25] Hypoxia also predicts hospital admission for children with bronchiolitis.[23] Among children with dehydration caused by gastroenteritis and treated in an OU, unplanned admission was required in 19%, although there were no significant associations between specific historical, physical examination, or laboratory characteristics and the need for admission.[26] Young age (<30 days) has been shown to be associated with a risk of inpatient admission, along with diagnoses of hematochezia, viral pneumonia, and bronchiolitis.[18] Among patients with closed head injuries treated in an OU in a pediatric level 1 trauma center, patients with basilar skull fracture, head laceration, or the need for intravenous fluids were more likely to need inpatient admission after OU management.[27] A recent study at a major children's hospital revealed use of certain resources, including intravenous fluids and medications, cardiorespiratory monitoring, respiratory therapy, subspecialty consultation, and oxygen, were associated with hospitalization.[28] The diagnoses most commonly leading to hospitalization included asthma, adenitis, cellulitis, bronchiolitis, and the presence of esophageal foreign bodies.[28]

In addition to return visit and hospital admission rates, best practices in OUs generally include tracking other clinical quality metrics. Examples include the following: adverse events, patient outcomes, satisfaction (of patients, parents,[29] staff, and referring or primary care physicians[30]), and compliance with clinical protocols.[18]

The clinical characteristics of patients who are receiving observation services support the use of standardized clinical pathways for common diagnoses such as croup[31] and dehydration.[15] Although the quality effect of these pathways can be difficult to measure, standardized care has been shown to reduce the length of stay for patients in an OU compared with patients with equivalent conditions in an inpatient unit[32] by reducing unnecessary variations in care. The nature of OU care also requires clear indications as to when patients are moved out of observation status, either to inpatient hospital admission or discharge, providing additional opportunities to standardize care.

In addition to standard care protocols, safety and family-centered care may be enhanced through effective communication in the OU. Medical control responsibilities should be clearly delineated for all patients to ensure smooth transitions from the ED, operating room, or procedure area to inpatient or off-unit testing areas to reduce the risks associated with "handovers" or transfers of care from 1 site to another. After an episode of OU care, a discharge summary and follow-up plan provided to the family and primary provider is important to support the child's family and medical home.[33]

EFFECT OF OUs ON INPATIENT HOSPITAL UTILIZATION

A benefit of OUs is that they may reduce the rate of admissions to inpatient units. Although there are limited data to support this claim, OUs may have an especially important effect on pediatric inpatient admissions, in part because a significant number of inpatient admissions among children are of relatively short duration. An analysis of the Nationwide Inpatient Sample database, an all-payer nationally representative data set of hospital discharges compiled by the Agency for Healthcare Research and Quality, revealed that since 1999, nearly one-third of children hospitalized in the United States have stayed fewer than 2 nights.[34] Furthermore, the proportion of short-stay patients (0 or 1 night) increased from 25% to 30% between 1993 and 2003. Many of these patients are likely eligible for care in OUs.

Several studies support the notion that observation services can substitute for traditional inpatient admission. In a study of inpatient pediatric admissions for asthma in Rochester, NY, more than 70% of admissions could either have been avoided entirely or patients could have been treated in an observation setting.[35] In another study of emergency asthma care in a pediatric ED before and after implementation of an OU, the admission rate for asthma decreased 23%, although there was a modest increase in asthma-related return visits to the ED.[36] In a retrospective review of admissions for croup to a children's hospital after introduction of an OU, the rate of hospitalization among "nondischargeable" children with croup decreased from 9.5% to 4.2%, and median charges and length of stay were also decreased in the OU group.[37] A study of an ED-based OU in France revealed that among 509 admissions to an OU, the decision in the absence of the OU would have been hospital admission in nearly 80%.[15] The authors concluded that having an OU reduced patient hospitalizations while generating few inappropriate short-stay hospitalizations. A recent study of a British pediatric OU had similar findings.[12]

In published studies comparing observation care to inpatient care for selected diagnoses and cases, OU length of stay has been described as shorter than the inpatient alternative.[32,37–40] Because the care model in the OU may involve fewer handovers, more protocol-driven care, and more frequent patient assessment when compared with traditional inpatient care, reduction in length of stay in these units may be achieved by reducing the time from when the patient is clinically ready for discharge until actual departure from the unit. A chart review of 220 patients admitted to an Australian teaching hospital revealed that 65% of patients were medically ready for discharge within 12 hours.[41] The authors also found that the actual length of stay was closer to 17 hours, and they postulated that unnecessary delays caused by administrative aspects of hospital admission and the relatively infrequent evaluation of patients in inpatient settings may lengthen the period of admission. They suggested that many short-stay patients who are admitted to hospitals may be eligible for care in OUs. McConnochie et al[42] have shown similar results in a US study of pediatric patients admitted for gastroenteritis. Despite a growing body of evidence supporting the concept that observation services can substitute for inpatient admissions, however, there are insufficient data to assess the overall effect of OUs on pediatric inpatient use rates across the United States.[18]

Another potential effect of OUs is on the problem of ED overcrowding and patient flow. Patients in EDs may experience long delays when ED rooms are being used by patients needing ongoing treatment or awaiting an inpatient bed. A computer simulation study at the Children's Hospital in Vancouver British Columbia[43] revealed that an OU would reduce wait times in the pediatric ED by creating additional capacity and improving patient flow. Although it is plausible that establishing an OU could lead to increased hospitalization, because some patients who would previously have been discharged after ED evaluation might instead be admitted to the OU, this was not found in a recent, large, prospective pediatric study.[28]

CODING FOR OBSERVATION CARE

Historically, observation care has been clinically defined as care provided in less than 48 hours. However, for the purposes of coding and reporting of clinical services provided to observation patients, many payers, including Medicaid, have defined observation status by using clinical criteria that do not depend on time. Rather, observation status is more typically characterized as a set of clinically appropriate specific services that include ongoing short-term treatment, assessment, and reassessment before deciding whether a patient requires further treatment as a hospital inpatient or discharge from the outpatient hospital, independent of the time required for treatment.

Pediatricians who provide observation services for children need to be aware that there are specific, nuanced rules that govern the reporting and payment for professional services associated with observation care. The American Medical Association's CPT manual, the standard reference for coding medical encounters with patients, categorizes hospital observation services

under "evaluation and management" services.[44] The observation codes represent an unusual set of CPT codes. They represent physician services that lie between ambulatory and outpatient care and inpatient admission services. These codes may be reported by physicians practicing any specialty, including emergency physicians, hospitalists, and office, clinic, or hospital-based general pediatricians or pediatric medical subspecialists. The coding rules governing the reporting of professional fee codes for observation services are not the same as the reporting rules that health plans or state Medicaid agencies use to determine observation or inpatient status, which in turn determines facility payments. In general, the attending physician makes the determination as to whether the care provided is at the level of observation or inpatient. However, hospitals or payers including Medicaid frequently define observation care by using clinical characteristics developed by companies such as InterQual,[45] and these characteristics may vary depending on payer and geographic area.

The use of observation codes is based on the level, rather than the location, of care provided and, like all evaluation and management coding, requires careful documentation of the history, examination, and medical decision-making. Observation services may be reported by physicians for patients treated in an ED, OU, or an inpatient or other hospital unit. These codes are divided into those used when the child is both placed on observation status and discharged on the same date of service versus those used when the child is placed on observation status 1 day and sent home on another. When the child's observation services are begun and completed on the same date of service, the code set 99234–99236 is used. One or more physicians practicing the same specialty may not bill the same patient for the same complaint or illness on the same day. Thus, for example, an emergency physician or 2 emergency physicians may not submit professional bills for both emergency care and observation care on the same day. If the child is seen for the same complaint or illness in a number of different sites of service by a single physician (eg, office, ED, observation, and inpatient admission), only 1 code representing the final disposition of the patient is reported for that date. However, practitioners of different specialties, such as an emergency physician who first evaluates a patient and another physician practicing pediatrics in an OU, may submit separate professional bills on the first calendar day of admission, even if they are evaluating the same complaint or illness. When the child is placed on observation care on 1 date and discharged from the hospital on another calendar day, the 99218–99220 code set is used for the initial date of service, the code set 99226–99226 is used for subsequent days, and 99217 is used on the discharge day.[46] Children meeting clinical criteria may be transferred to inpatient status with the use of initial and subsequent inpatient care codes as determined by history, physical examination, and medical decision-making. An order reflecting the status change should be written. Code 99217 should not be used when a patient is transferred from observation to inpatient status.

CONCLUSIONS

With continued financial pressures to reduce costs of care as well as greater emphasis on efficiency and patient-centered care, it is likely that many hospitals providing care for children will offer observation services to children and that pediatricians will be increasingly likely to work in an OU or refer patients for OU care. Many children previously cared for in a traditional inpatient hospital setting may be safely and efficiently cared for in an OU. However, the operation of pediatric OUs presents distinct challenges, including a lack of uniform definitions for the types of OU care, the selection of patients for OU services, and the unique requirements to deliver care that may end with either admission or discharge. Pediatricians, managers, and other care providers should be aware of the unique coding and reporting requirements for observation services and ensure that the documentation provided supports the selection of specific observation care codes. Quality of care in OUs may be enhanced with defined criteria for admission and discharge, use of standardized clinical protocols, and clearly defined policies and procedures defining responsibility for the patient's care while in observation status. A growing research base, largely descriptive to date, suggests that OUs enhance the care of children; further research is necessary to better describe the contributions of OUs to overall pediatric health.

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POLICY STATEMENT

Pediatric Sudden Cardiac Arrest

abstract

FREE

Pediatric sudden cardiac arrest (SCA), which can cause sudden cardiac death if not treated within minutes, has a profound effect on everyone: children, parents, family members, communities, and health care providers. Preventing the tragedy of pediatric SCA, defined as the abrupt and unexpected loss of heart function, remains a concern to all. The goal of this statement is to increase the knowledge of pediatricians (including primary care providers and specialists) of the incidence of pediatric SCA, the spectrum of causes of pediatric SCA, disease-specific presentations, the role of patient and family screening, the rapidly evolving role of genetic testing, and finally, important aspects of secondary SCA prevention. This statement is not intended to address sudden infant death syndrome or sudden unexplained death syndrome, nor will specific treatment of individual cardiac conditions be discussed. This statement has been endorsed by the American College of Cardiology, the American Heart Association, and the Heart Rhythm Society. *Pediatrics* 2012;129:e1094–e1102

INCIDENCE OF PEDIATRIC SUDDEN CARDIAC ARREST

In the United States, there is no centralized or mandatory registry for pediatric sudden cardiac arrest (SCA). Available data generally are collected through media reports, from lay SCA advocacy groups, or from peer-reviewed publications, often from major referral medical centers. Episodes of resuscitated cardiac arrest (aborted cardiac death) are even more difficult to document retrospectively. The Centers for Disease Control and Prevention has estimated that every year in the United States, approximately 2000 patients younger than 25 years will die of SCA.[1] Other older reports estimate the frequency of SCA in children and adolescents to be between 0.8 and 6.2 per 100 000 per year.[2–6] Two studies suggest that the frequency of SCA in adolescents and young adults actually may be increasing.[7,8] Although SCA occurs even at young ages and at rest, the likelihood of child and young adult SCA for those with underlying cardiovascular disease is increased by athletic participation.[9] Nonetheless, 2 studies from Maron et al[10,11] estimate fewer than 100 cases of SCA in young US competitive athletes each year. An Italian study reported a baseline incidence of SCA in young competitive athletes at 1:25 000 before implementing a national screening program.[12] Corrado et al identified a 2.5 times relative risk for SCA attributable to sports activity in adolescent and young adult athletes versus an age-matched nonathletic population,[13] related to underlying cardiac disorders.

SECTION ON CARDIOLOGY AND CARDIAC SURGERY

KEY WORDS

syncope, cardiovascular disease, long QT, cardiomyopathy, athlete, heart disease

ABBREVIATIONS

AAP—American Academy of Pediatrics
AED—automated external defibrillator
AHA—American Heart Association
CPR—cardiopulmonary resuscitation
CPVT—catecholaminergic polymorphic ventricular tachycardia
ECG—electrocardiography
EMS—emergency medical services
HCM—hypertrophic cardiomyopathy
LQTS—long QT syndrome
PPE—preparticipation evaluation
SCA—sudden cardiac arrest
SIDS—sudden infant death syndrome
VF—ventricular fibrillation

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Reporting and referral biases affect our knowledge of SCA incidence. The difficulty in determining cause of death in patients with primary cardiac electrical disorders (so-called "autopsy negative") must be acknowledged. Many of these now recognized electrical disorders have been described only recently, confounding older literature that details the cause of pediatric SCA identified at autopsy.

CARDIAC DISORDERS PREDISPOSING YOUTH TO SCA

Underlying cardiac disorders associated with pediatric and young adult SCA are listed in Table 1. In general, causes can be considered (1) structural or functional (expected to be identified with echocardiography or at autopsy); (2) primary electrical (most commonly associated with structurally and functionally normal hearts); or (3) other, including use of illicit drugs and stimulants (eg, cocaine, ephedra) or prescription medications (eg, erythromycin, ketoconazole, carbamazepine). The reader is directed to reference texts and previous publications for more detail about each of these individual conditions.[14,15]

TABLE 1 Cardiac Disorders Predisposing to Pediatric and Young Adult SCA

Structural/functional
1. Hypertrophic cardiomyopathy[a]
2. Coronary artery anomalies
3. Aortic rupture/Marfan syndrome[a]
4. Dilated cardiomyopathy or restrictive cardiomyopathy[a]
5. Myocarditis
6. Left ventricular outflow tract obstruction
7. Mitral valve prolapse
8. Coronary artery atherosclerotic disease
9. Arrhythmogenic right ventricular cardiomyopathy[a]
10. Postoperative congenital heart disease
Electrical
11. LQTS[a]
12. Wolff-Parkinson-White syndrome
13. Brugada syndrome[a]
14. Catecholaminergic polymorphic ventricular tachycardia[a]
15. Short QT syndrome[a]
16. Complete heart block
Other
17. Drugs and stimulants; some prescription medications
18. Primary pulmonary hypertension[a]
19. Commotio cordis

[a] Familial/genetic.

GENETICS OF PEDIATRIC SCA

The identification of disease-causing genetic mutations is progressing rapidly in all areas of medicine. Evaluation of large cohorts of ostensibly healthy individuals has begun to catalog the common polymorphisms and the background rate of rare genetic variants of uncertain significance within the general population. For cardiac disease, the science of genotypic evaluation has not yet advanced to the point at which genotype alone (isolated from clinical phenotypic description) can routinely and accurately risk stratify for clinical outcome. Many cardiac disorders, including hypertrophic cardiomyopathy (HCM) and the cardiac ion channelopathies, are known to be genetic.[16,17] Several studies have documented the efficacy of genetic testing of first-degree relatives of persons who have died of SCA. A 2003 study[18] reported cardiac symptoms in 27% of surviving relatives, with a 22% incidence of unexpected premature sudden death in addition to the proband in any relative and a 6% incidence of sudden death in a first-degree relative. After evaluating 49 cases of young autopsy-negative SCA, Tester and Ackerman[19] reported 17 cases with genetic/molecular evidence for long QT syndrome (LQTS) or catecholaminergic polymorphic ventricular tachycardia (CPVT) disease–causing mutations; 9 (53%) of these cases had a family history of SCA or syncope documented by the medical examiner. A personal history of syncope, seizure, or previous cardiac arrest was detailed for 7 individuals whose deaths were attributable to SCA. In a 2005 report, genetic testing established a likely cause of death in 17 of 43 autopsy-negative persons (40%). Genetic testing of family members revealed an additional 151 presymptomatic and undiagnosed disease carriers (average of 8.9 per family).[20]

Recognizing the genetic nature of many of the disorders listed in Table 1, the role of a detailed, comprehensive family history (and considering consultation with an expert in cardiac genetics) is readily apparent. The primary goal is prospective identification of any family member, even if asymptomatic, who is genotypically or phenotypically affected by a disease entity predisposing a person to SCA. A 2008 publication discusses the role of family history for evaluating cardiomyopathy and ion channelopathies predisposing people to SCA.[21] A 3-generation pedigree as a family history tool is highly effective for clinical evaluation; a family history template suggested by the US Surgeon General's Family History Initiative is available free at www.hhs.gov/familyhistory.

WARNING SIGNS AND SYMPTOMS

Although SCA may be the sentinel event, symptoms in patients with structural-functional or primary electrical disorders may, in fact, be relatively common before SCA. Often, these warning signs or symptoms may be misinterpreted or disregarded by both family members and medical personnel. These points were emphasized in a 1996 publication[22] that summarized 9 previous studies. Preceding symptoms of dizziness, chest pain, syncope, palpitations, or dyspnea and a family history of premature, unexpected sudden death were noted in 25% to 61% of the study population. Deaths were exertion-related in 8% to 33% of cases. A study of 162 young persons (15–34 years of age)[23] undergoing autopsy evaluation after SCA found 92

cases with a history of syncope/presyncope, chest pain, palpitations, or dyspnea; 26 of these subjects had a family history of SCA. In a study of natural death in people 5 to 35 years of age,[24] the most common cause of sudden death was presumed arrhythmia in those with no or minimal heart disease (29%). Eleven percent of cases were exercise-associated. A history of SCA was reported in 4.5% of first-degree relatives of the descendents. Importantly, symptoms may be nonspecific and confusing in athletes, who may overexert until physical exhaustion.

In most cases, the immediate cause of SCA is a lethal ventricular tachyarrhythmia (ventricular fibrillation [VF] or pulseless ventricular tachycardia) causing cardiac collapse. Some of these arrhythmias (eg, torsades de pointes, the characteristic tachyarrhythmia associated with LQTS) may be short lived and self-terminating, causing episodes of syncope/presyncope or episodes of seizure-like activity.[19,22–25] These neurologic signs and symptoms may direct referral to a neurologist, inadvertently misdirecting the patient away from cardiac evaluation and, thus, delaying correct diagnosis and treatment. These tachyarrhythmia-associated SCA events must be distinguished from the well-recognized but poorly understood entity called sudden unexpected death in epilepsy.[26,27] In the latter, this primary neurologic event may cause a cardiac death, mediated through abnormalities of cardiovascular autonomic function.[28] Chest pain is almost never present in patients with primary electrical disorders but is more likely in patients with cardiomyopathies,[29,30] congenital coronary artery abnormalities,[31] or aortic disease (eg, dissection or rupture associated with Marfan syndrome[32]). Other nontypical cardiac presentations also may misdirect patients to other consulting medical subspecialties. Symptoms suggestive of exercise-induced bronchospasm may be present in patients with HCM and dilated or restrictive cardiomyopathy. Cardiomyopathy-associated wheezing is attributable to decreased left ventricular compliance, mitral insufficiency, or pulmonary venous hypertension with pulmonary edema. Failure of empirical exercise-induced bronchospasm medication or normal pulmonary function testing should prompt cardiovascular evaluation. Drowning or near-drowning has been associated with LQTS and CPVT.[33,34] Approximately 5% to 10% of sudden infant death syndrome (SIDS) cases may stem from channelopathic mutations in genes associated with LQTS, Brugada syndrome, and CPVT.[35–38] Congenital deafness has been noted in some types of LQTS.[39] Patients with congenital deafness should be evaluated for LQTS if the deafness is not otherwise associated with another recognized syndrome or anomaly. Febrile seizures may be a presenting sign of children affected with Brugada syndrome.[40]

SCREENING TECHNIQUES

The role of any screening effort is to identify individuals at risk; unaffected or low-risk individuals should be cleared, and conversely, those affected should be appropriately restricted counseled, and treated. Not all SCAs can be foreseen, even in the best of circumstances. No screening protocol has yet proven to be effective in this role or validated as highly effective.

Sports Preparticipation Evaluation and Cardiovascular Risk Assessment

As noted by aforementioned studies, it is estimated that as many as half of pediatric SCA cases exhibited a personal/familial sudden death warning sign or symptom (such as previous exercise-triggered faint or family history of premature unexplained sudden death). Thus, there is an opportunity to identify individuals at risk for pediatric SCA without technology-based screening programs, such as the 12-lead electrocardiography (ECG) and echocardiography; however, despite the aforementioned data supporting the fact that preceding warning signs and symptoms may be present in many patients and families at risk for SCA, most published studies have not substantiated the efficacy of current athletic preparticipation evaluation (PPE) processes. Only 3% of 158 athletes with SCA were suspected of having cardiovascular disease using a PPE screen, leading the authors of a 1996 study to conclude that "pre-participation screening appeared to be of limited value for identification of underlying cardiovascular abnormalities."[41] The 1996 study was retrospective, and the details of the PPE questionnaire used and the adequacy of PPE were not reported. This report also predated description of some of the disease entities now known to cause pediatric SCA. More recently, an investigation from the United Kingdom concluded that family history and personal symptom questionnaire alone were inadequate for identification of at-risk patients and families.[42] The 2008 UK study used a comprehensive PPE format and trained examiners, with little reported benefit, which reveals the potential failure of a single PPE at 1 point in time.

In contrast to a single PPE initiated only before athletic participation, a more thorough cardiovascular risk-assessment process, applied throughout childhood and adolescence (the continuum of well-child care), can be provided for any patient, of any age, by any care provider (Table 2). Patient and family histories can and do change over time, necessitating an update of information for the care provider. Families should be encouraged to provide complete and

TABLE 2 Pediatric Sudden Cardiac Death Risk Assessment Form

Patient history questions: Tell me about any of these in your child…	Yes	No
Has your child fainted or passed out during or after exercise, emotion, or startle?		
Has your child ever had extreme shortness of breath and/or discomfort, pain, or pressure in his or her chest during exercise?		
Has your child had extreme fatigue associated with exercise (different from other children)?		
Has a doctor ever ordered a test for your child's heart?		
Has your child ever been diagnosed with an unexplained seizure disorder? Or exercise-induced asthma not well controlled with medication?		
Family history questions: Tell me about any of these in your family…		
Are there any family members who had a sudden, unexpected, unexplained death before age 50 (including SIDS, car crash, drowning, others) or near-drowning?		
Are there any family members who died suddenly of "heart problems" before age 50?		
Are there any family members who have had unexplained fainting or seizures?		
Are there any relatives with certain conditions, such as:		
Enlarged heart: HCM		
Dilated cardiomyopathy		
Heart rhythm problems: LQTS		
Short QT syndrome		
Brugada syndrome		
Catecholaminergic ventricular tachycardia		
Arrhythmogenic right ventricular cardiomyopathy		
Marfan syndrome (aortic rupture)		
Heart attack, age 50 or younger		
Pacemaker or implanted defibrillator		
Deaf at birth (congenital deafness)		
Please explain more about any "yes" answers here:		
Parent signature:		
Physician signature:		
Date:		

Ask these questions (or have parents complete for your review) at periodic times during well-child visits (neonatal, preschool, before or during middle school, and before or during high school).

accurate responses concerning history. PPE screening of athletes exclusively omits >25 million US schoolchildren who do not participate in sports. Postponing cardiovascular risk assessment until a more formal high school or collegiate athletic PPE screen also will delay detection of patients and families at risk for SCA before high school. For any PPE or cardiovascular risk assessment to succeed, medical providers must be aware of sudden death warning signs and symptoms and respond appropriately with comprehensive cardiovascular evaluation, referral, treatment, and activity restrictions as appropriate. The use of competent and qualified examiners is still a necessity, but recent data reveal that 35% of states allow nonphysicians with little cardiovascular training to perform the screening evaluations.[43]

The American Heart Association (AHA) has documented a 12-element recommendation for preparticipation screening of competitive athletes.[44] Another PPE, sponsored and endorsed by the American Academy of Pediatrics (AAP) and 5 other agencies, is now widely used throughout the United States for childhood and adolescent athletic PPE.[45] This document acknowledges the wide variation in physician competencies and documentation for PPE examinations. Many states have endorsed the use of this PPE to eliminate unnecessary variability and to more effectively screen for cardiovascular risk. The updated fourth edition of this PPE form became available in April 2010.

None of the aforementioned PPEs or cardiovascular risk-assessment tools have been validated but serve as standard templates for more comprehensive screening. Likewise, no true sensitivity or specificity data exist for prediction of risk of SCA by PPE. Among the many warning signs and symptoms, the following 4 appear to represent more ominous positive responses (based on expert opinion):

1. Have you ever fainted, passed out, or had a seizure suddenly and without warning, especially during exercise or in response to auditory triggers such as doorbells, alarm clocks, and ringing telephones?
2. Have you ever had exercise-induced chest pain or shortness of breath?
3. Are you related to anyone with sudden, unexplained, and unexpected death before the age of 50?
4. Are you related to anyone who has been diagnosed with a sudden death–predisposing heart condition such as HCM, LQTS, Brugada syndrome, and so forth? (See Table 1.)

Once a cardiovascular disorder listed on Table 1 is suspected or diagnosed, referral to and management by pediatric/adult cardiologists or heart rhythm specialists experienced with the particular sudden death–predisposing heart condition is crucial.

Another important time, resource, and cost-benefit issue centers around obtaining the detailed and accurate cardiovascular risk assessment or PPE forms in the primary care office setting. This time-consuming process is currently poorly reimbursed and difficult to prioritize and validate in a busy practice.

ECG Screening

Although some data suggest that SCA screening may be enhanced with the addition of ECG, broad-scale ECG screening has not been tested or implemented in the United States. Mandatory screening of Japanese schoolchildren since 1973[46,47] has demonstrated a greater sensitivity of ECG versus history and physical examination. Competitive Italian athletes undergo required PPE and ECG, with ECG reportedly demonstrating 77% greater power to detect HCM

than history and physical examination alone.[2] Italy also has reported a newborn ECG screening program to identify infants at risk for SIDS secondary to abnormal cardiac repolarization.[48] For Olympic athletes, the International Olympic Medical Committee issued a screening protocol including ECG in 2004.[49] A 2005 European Society of Cardiology consensus statement on cardiovascular preparticipation screening of young competitive athletes recommends 12-lead ECG in addition to focused history and physical examination.[50] Some US studies have suggested that ECG screening may be cost-effective on the basis of estimated cost per year of lives saved.[51,52]

The 2007 AHA scientific statement/screening guidelines[44] (coauthored by S.B. and M.J.A.) did not recommend standard ECG assessment, however, citing false-positive and false-negative results, cost-effectiveness, feasibility, and medicolegal concerns. Wide-scale ECG screening would require a major infrastructure enhancement not currently available in the United States. Recent reassessment of ECG "normal" values has helped to decrease false-positive findings.[53] Competitive athletes are known to have unusual but occasionally benign ECG findings, consistent with "athlete's heart," that must be differentiated from ECG findings attributable to pathologic conditions.[54]

The role of routine ECG screening in the United States to prevent SCA is not settled and will require more data and debate. Readers are referred to recently published debates of the subject for further details.[55,56]

Molecular Autopsy

The genetic nature of many cardiac ion channelopathies predisposing youth to pediatric SCA is being defined rapidly.[17] When children die suddenly, there may be no previous evaluation or diagnosis. Conventional autopsies often fail to identify a condition responsible for sudden death. These autopsy-negative cardiac conditions have previously defied complete definition. As already described, complete evaluation of a child who died of SCA through detailed clinical and targeted genetic testing of immediate family members may identify specifically the cause of SCA and direct appropriate care and genetic counseling to surviving family members. The cardiac channel postmortem genetic analysis (also known as "molecular autopsy")[57] remains a research test but soon may evolve into a standard clinical practice. Unfortunately, current standards of care for autopsy do not yet ensure that a postmortem sample suitable for DNA analysis is retained. Further, despite the evidence that approximately 25% to 35% of autopsy-negative sudden unexplained death is channelopathic, health insurance companies currently do not accept responsibility for molecular autopsy of the deceased in the United States. The cost would befall the medical examiner and, ultimately, the community; however, far more expensive testing of all first-degree surviving family members currently is used clinically and reimbursed. An important next step will be the development of guidelines at a public health level for postmortem genetic testing.

PRIMARY PREVENTION OF SCA

Primary prevention of SCA depends on patient diagnosis, specific etiology, and etiology-specific treatment. Treatment options include but are not limited to medical therapy, device therapy (eg, pacemakers, internal cardioverter defibrillators), activity-restriction guidelines, avoidance of certain classes of medications, and family emergency preparedness. The details of primary prevention, given that they are etiology specific and prescribed by a consulting cardiologist, are beyond the scope of this policy statement.

SECONDARY PREVENTION OF SCA

When SCA primary prevention strategies (ie, patient identification, treatment, activity restriction, and counseling) have failed, SCA still may occur, and secondary prevention (resuscitative) efforts are required. The AHA has proposed a "chain-of-survival"[58] beginning with early symptom recognition and 911 emergency medical services (EMS) contact, followed by effective bystander cardiopulmonary resuscitation (CPR), early defibrillation, and finally, advanced hospital care. The published outcomes for out-of-hospital pediatric cardiac arrest are dismal; survival to hospital discharge occurs in approximately <10% of children, and many have severe neurologic sequelae.[59–63] Poor outcomes may be related to prolonged periods of no cardiac output, in part because many out-of-hospital arrests are unwitnessed, and only approximately 30% of children received bystander CPR[61] (note also that bystander CPR more than doubles patient survival rates[64]).

Bystanders report that they do not perform CPR because of panic or fear of failure[65] and unwillingness to perform mouth-to-mouth rescue breathing. Recent studies suggest that "compression-only" CPR may be more effective than standard CPR with ventilation,[66,67] by using faster (approximately 100 per minute) and deeper compressions, in adults for witnessed nonasphyxial arrest (arrest not secondary to, for example, drowning, hanging, or carbon monoxide poisoning). To date, there are no pediatric studies with respect to compression-only CPR. Because pediatric patients are more likely to experience respiratory arrests, compression only may not be suitable. Two studies report VF as the initial rhythm in 19% to 24% of out-of-hospital pediatric cardiac arrests, excluding deaths attributable to SIDS.[68,69] VF and ventricular tachycardia generally have been considered more favorable initial SCA rhythms than

either asystole or pulseless electrical activity, with a higher rate of survival to hospital discharge, when prompt defibrillation (termination of VF) and return of an organized perfusing rhythm is achieved. As part of the chain of survival, public access defibrillation using automated external defibrillators (AEDs) has a prominent role.[70] Data from witnessed VF arrest in adults show that appropriate use of AEDs can lead to long-term survival rates >70%.[71,72] AEDs have now been recommended for children younger than 8 years,[73,74] with still insufficient scientific evidence to warrant official recommendation for or against AED use in children aged 1 year or younger. A 2007 AAP policy statement addressed current pathophysiology of VF and recommendations for AED use in children; readers are referred to this publication for further detail.[75]

SCHOOL AED PROGRAMS

The average school-aged child spends 28% of the day and 14% of his or her total annual hours in school.[76] In addition, adults (parents, grandparents, teachers, staff, and visitors) crowd our schools. As an area of higher traffic, schools have become sites for implementation of AED programs. In 1 report, 67% of schools activate EMS for an emergency involving a student, and 37% activate EMS for an emergency involving an adult.[76] A 2007 report detailed a 16-year history of SCA in Seattle city and King county schools, providing a framework for reasonable and rational school-based emergency programs.[77]

A growing number of states have mandated school AED programs. The cost-effectiveness of school AED programs has been reported by Berger et al.[78] Key components for a comprehensive school-preparedness program include education and all-staff awareness, knowledge and application of effective bystander CPR techniques, implementation of a lay-rescuer AED program, and written emergency action plans,[79] with all steps reinforced with effective communication throughout the school campus and periodic practice drills. Current principles guiding this recommendation for schools, primary clinicians, and school physicians have been detailed in the AAP policy statement "Medical Emergencies Occurring at School."[80] At this time, there are no published data to support the efficacy of home AEDs.[81]

RECOMMENDATIONS FOR PEDIATRIC CARE PROVIDERS

Evidence-based recommendations frequently are designated as class I, II, or III, indicating the supporting level of evidence. For pediatric SCA, the level of evidence does not permit a meaningful use of this terminology. This statement has been endorsed by the American College of Cardiology, the American Heart Association, and the Heart Rhythm Society.

All steps in the primary and secondary SCA-prevention strategies should be optimized if pediatric SCA is to be prevented.

RECOMMENDATIONS

Important steps for consideration include:

1. Recognize the warning signs and symptoms of SCA, including those that may "misdirect" initial evaluation to noncardiac specialties and, thus, delay correct diagnosis.
2. Understand the role of comprehensive and accurate family history and pedigree for preventing SCA stemming from inherited cardiac genetic disorders.
3. Use standardized PPE forms and processes to minimize unnecessary variation.
4. Ensure that identified patients and/or families with known or suspected cardiac disorders are referred to a pediatric cardiac center for further comprehensive evaluation and management. Appropriate secondary testing may include ECG, echocardiography, exercise testing, or genetic testing, as indicated.
5. Advocate for autopsy evaluation by a medical examiner familiar with rarely encountered heritable cardiac diseases causing SCA when pediatric SCA occurs. Procurement of and retention of DNA-bearing tissue for subsequent molecular autopsy should be encouraged for autopsy-negative cases.
6. Support education programs for effective bystander CPR and appropriate AED use.
7. Support development of effective school emergency response programs.
8. Consider participation in school emergency response programs as a medical director.
9. Support efforts to mandate a central registry for pediatric SCA as a reportable event.
10. Support recommendation for evidence-based evaluation of national screening processes and programs.

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* Significant (greater than $10 000) relationship.

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CLINICAL REPORT

The Pediatrician's Role in Supporting Adoptive Families

abstract

FREE

Each year, more children join families through adoption. Pediatricians have an important role in assisting adoptive families in the various challenges they may face with respect to adoption. The acceptance of the differences between families formed through birth and those formed through adoption is essential in promoting positive emotional growth within the family. It is important for pediatricians to be aware of the adoptive parents' need to be supported in their communication with their adopted children. *Pediatrics* 2012;130:e1040–e1049

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adoption, kinship care, adoption by same sex parents, transracial adoption, communication

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CHANGING PICTURE OF ADOPTION

According to the 2007 National Survey of Adopted Children, approximately 2% of the child population in the United States was adopted, accounting for 1.8 million children.[1,2] Approximately 38% of these children were adopted from foster care, another 38% joined families through private domestic adoption, and 25% were adopted internationally. Furthermore, approximately 24% of adopted children were adopted by relatives, including 17% from foster care, and 37% of children were adopted privately in the United States.[1,2] Overall, 49% of adopted children were male; 39% of children adopted internationally and 57% adopted through the foster care system were male. Adopted children tended to be older than the general population, with only 14% younger than 5 years, compared with 27% in the general population. Adopted children were less likely to be white or Hispanic, but this varied by the type of adoption. Children adopted through the foster care system tended to have the highest percentage of black children, at 35%, whereas children adopted internationally had the least number of black children, at 3%. Children adopted privately in the United States were more likely to be white, at 50%, whereas children adopted internationally were least likely to be white, at 19%. The majority of children adopted internationally were of Asian descent (59%), with 33% originating from China. Adopted children were less likely to live in households with incomes below the poverty level than the general population (12% vs 18%, respectively). Conversely, 46% of adopted children live in households with incomes no higher than 2 times the poverty level. Similar to the general population, 69% of adopted children lived with 2 married parents. Eighty-five percent of adopted children were reported by parents to be in excellent or very good health, and 78% reportedly had adequate health insurance.[1] Knowing the current picture of adopted children, pediatricians can play a significant role in the adoption process by providing counseling

to parents during the preadoption phase and subsequently providing support for the adoptive family.[3] Additionally, by understanding the unique medical, developmental, mental health, and behavioral needs of the adopted child, pediatricians can provide optimal health care for these patients.

Adoption can be domestic or international. Domestic adoption involves adopting a child from within the United States. International adoption involves adopting a child who was born outside the country, with the intention of bringing the child to live in the United States. Regardless of the type of adoption, the biological family may have continued contact of varying degrees with the child for whom an adoption plan has been chosen, ranging from complete confidentiality to unlimited direct contact.[1,4,5] In fact, more than one-third of children in nonrelative adoptions have had some contact with their birth parents. Private domestic adoptions account for the majority of contact, with 68% of adoptive families reporting communication with birth parents, whereas 39% of families of children adopted from foster care and 6% of families of children adopted internationally acknowledge some degree of contact with birth parents.

Adoptive families are changing.[6–15] It is estimated that every year, approximately 120 000 children, representing 2% of the US population, are adopted.[1,7,8] The source of adoptees has undergone a transition. The number of adoptions from domestic sources, including foster care, has been increasing, and international adoptions have declined.[1,7] Blended families, families with gay or lesbian parents, and families with older parents are providing more homes to children through adoption, although exact numbers are difficult to obtain.[6] Single-parent adoptions have become increasingly more common.[9–11] Research from the 1970s found that an estimated 0.5% to 4% of people completing adoptions were single, compared with 8% to 34% of adopters in the 1980s. This percentage remained relatively stable in the 2000s.[9] Additionally, more children are being placed long-term with relatives, who may or may not formalize the relationship through adoption.[4,12–15] Twenty-three percent of children adopted from the foster care system were adopted by relatives, and an additional 22% were adopted by nonrelatives who knew the child before the adoptive process. In other domestic adoptions through the private sector, 41% were adopted by relatives, and an additional 7% were adopted by previously known nonrelatives.[1] Children may have had multiple sets of foster parents before their adoption, some of whom may maintain contact with the child after the adoption.[1,2] Others may be adopted by the only foster parent they have encountered. There were fewer newborn infants and more older children being placed for adoption. Sibling groups were often placed together. A child may be adopted into a family of the same ethnicity and/or race or into a family with members of different groups.[1,4,6,14] Four of 10 adopted children were in transracial adoptions.[1] Kinship care showed an increase.[1,12]

The number of adoptions of children with special needs has increased markedly in the past 2 decades.[11,16] Many adopted children have complex medical, developmental, behavioral, educational, and psychological challenges.[1,2,7,16,17] In fact, 39% of adopted children were classified as having special health care needs, compared with 19% in the general population.[1] Furthermore, more than half of children adopted from foster care (54%) were considered to have special health care needs.[1,7,17] Adopted children were more likely than nonadopted children to have asthma and to have moderate or severe health problems. Also, adoptive parents were more likely than nonadoptive parents to be told that their child had a learning disability, developmental delay, and/or physical impairment. Mental health issues, such as attention-deficit/hyperactivity disorder, autism, mental retardation, and emotional problems were more commonly reported in adopted children with special health care needs. These conditions may be the result of biological and/or environmental stressors experienced while the child was living with the biological family or may have been initiated or exacerbated while the child was in temporary care.[14] Despite the reported issues, most adoptive parents rated their children's health as "excellent" or "very good."[1]

Modern technology has contributed to the changing face of adoption. The Internet has led to wider dissemination of information about children waiting for permanent families and has established a new system of support among adoptive families. Information about adoption on the Internet may not always be reliable, however, and the broad and instant reach of the World Wide Web also allows great potential for unethical practices in adoption.[18]

PEDIATRIC ISSUES

Pediatricians may be asked to review preadoption health records to help families understand the current and potential future medical, developmental, and mental health needs of children they plan to adopt.[3,19] Pediatricians may be able to use health records to help parents determine additional questions that could clarify a particular health issue or diagnosis and help parents

elucidate what special needs they are prepared to accept. When reviewing medical records, the Privacy and Security Rules of the Health Insurance Portability and Accountability Act must be considered.[20] The Privacy and Security Rules define how covered entities use individually identifiable health information, or personal health information. If a covered entity is not involved, then adherence to Health Insurance Portability and Accountability Act rules may not be required, but other regulations may come into play.

Specific issues to address in the health records may include conditions related to complications of pregnancy, poor nutrition, preterm birth, lack of prenatal care, genetic diseases, alcohol use, substance abuse, early brain cognitive development, and growth trends of the child. In counseling families, all attempts should be made to obtain a complete medical and psychological history of the child, particularly in assessing potential special needs of a child. Through comprehensive preplacement assessment, parents should assess their resources and abilities to meet a particular child's needs. Pediatricians without expertise in this area may seek out and refer hopeful adoptive parents to pediatricians listed on the Council on Foster Care, Adoption, and Kinship Care Web page who have experience in preadoptive evaluations.[21]

Children who join their families through adoption must have a comprehensive medical evaluation to identify medical needs.[22–24] This should be completed soon after placement in an adoptive home to confirm and clarify existing medical diagnoses, assess for any previously unrecognized medical issues, discuss developmental and behavioral concerns, and make appropriate referrals. It is recommended that pediatricians review the standards for medical care of adopted children that have been published by the American Academy of Pediatrics (AAP).[22,25] For children adopted internationally, this evaluation includes but is not limited to screening tests and assessment of immunization status, as recommended in the *Red Book*.[22] Acute and chronic medical problems, vision and hearing loss, and developmental delays should be identified and addressed. Behavioral, emotional, learning, and developmental concerns need to be evaluated, with appropriate therapy initiated as needed.

The pediatrician can provide information to parents concerning issues of transition and adjustment of the child into the adoptive family.[25] For many, this may be an easy transition, but others may experience varying degrees of difficulty during this phase in their lives. The child may experience symptoms of anxiety, display signs of depression, or withdraw from his or her environment. The child may demonstrate misbehaviors that are atypical and may also experience school difficulties. Sleep and feeding problems may be prominent during this period. The following AAP resources are available to guide the pediatrician in management: *Addressing Mental Health Concerns in Primary Care: A Clinician's Toolkit*,[26] *AAP Developmental and Behavioral Pediatrics*,[27] and *Guide to Learning Disabilities for Primary Care: How to Screen, Identify, Manage, and Advocate for Children with Learning Disabilities*.[28]

After completion of the comprehensive evaluation, pediatricians can help families that have not finalized the adoption to be more prepared to negotiate adequate adoption subsidies. Adoption assistance may involve access to medical care, counseling or therapy, special equipment, tutoring programs, and other support services that may help children who have special needs. The type and amount of assistance vary by state.[29] Finally, providing information about available community services, such as early child intervention programs and support groups, may ease the transition for the expected family. The Child Welfare League of America also may be a valuable resource for pediatricians and adoptive families.[30]

DEVELOPMENTAL UNDERSTANDING OF ADOPTION

Just as a child's thinking and self-concept changes at various stages of development, so does a child's understanding of the meaning of adoption.[31–33] It is generally agreed that the child should be told of the adoption, but there is disagreement on when the information should be given. Until 3 years of age, most adopted children do not realize there is a difference between their family and families in which children are reared by their biological parents.[32] From the time a child is adopted, it is appropriate for families to use adoption language, as described later in this statement, on a routine basis. Using adoption language early helps to lay the groundwork for children to later understand these abstract concepts. It also provides the time that may be needed for the parents to become comfortable sharing their child's adoption with family and friends.[34] The pediatrician can facilitate the parents' comfort level by introducing the adoptive parents to available resources, such as support groups. The pediatrician can also suggest books on adoption for the parent and even young children.[29,35] Through the use of available resources, as well as any pictures that may help describe a child's own adoption story, parents should relate to children the story of how their family came to be. These

foundations are important in the later development of positive attitudes about adoption, a child's birth parents, and himself or herself.[34,36] It is also important for the pediatrician to remind parents that adoption issues come in and out of focus for children over time and may be dormant for periods. During nodal points in development, specific issues may become more relevant for the child. The pediatrician can counsel adoptive parents about the need to understand the child's questions surrounding the adoption in the context of the child's current development and answer questions in a way that promotes self-esteem.

By approximately 3 years of age, however, children become self-absorbed and may believe that they magically cause all things that have happened to them.[33–35] Three-year-old children often love to hear their adoption stories. At this age, most children begin to ask questions about what adoption means, yet children adopted at a very young age do not understand that they have another family besides the family with whom they live. Separation issues may be more pronounced than they are in peers, especially with children who remember the loss of biological or foster parents, siblings, or other relatives. Children at this age may feel responsible for the loss of their first family, as well as for the repeated losses through moves in and out of foster care. They may fear that their adoptive parents will abandon them in the same way once their hidden flaws are discovered. Some children may express yearnings to have been "in the belly" of their adoptive mother.[32] By the time children enter kindergarten, they realize that most of their peers are not adopted. They also may learn that some children may be living with biological parents in circumstances that are similar to those experienced by their own biological parents (eg, single-parent families or conditions of poverty). This, once again, may lead children to feel responsible for their biological parents' decision not to raise them.

School-aged children continue to face issues associated with adoption, although often they deal with them by going "underground." Although children in this stage may not ask questions or initiate discussion of issues related to adoption, they are most likely thinking about them.[33,36] When children are 6 to 12 years of age, they realize that, in gaining an adoptive family, they have also lost a biological family.[33,37] Realization of this loss may be one of the underlying issues in the emotional adjustment of adopted individuals giving rise to the appearance of increased adjustment difficulties during this period.[33] At the same time, school-aged children may identify with their imagined biological families, fantasizing about what life would have been like if an adoption plan had not been made for them. During middle childhood, children (particularly children adopted across racial and/or cultural lines) may become upset by the differences they notice in comparison with other children and other family members. They may experience denial of these differences as well as of the adoption itself.[36] Self-esteem issues may also complicate emotions and the thinking process during these years, because some children may wonder what flaw in them resulted in their biological parents making an adoption plan—particularly if the biological parent(s) chose to rear a sibling.

During preschool and elementary school years, peer and school problems may or may not be the manifestation for underlying adoption issues. Although internationally adopted children are more likely to have attention-deficit/hyperactivity disorder and learning concerns,[38] these do not exist in isolation and may be a result of posttraumatic stress disorder or reactive attachment disorder. When children well adapted to a high-threat environment, such as an institution, attempt to integrate into a new world, as at school or on the playground, they may find themselves ill prepared.[39] Some school assignments may be problematic for children who have joined their family through adoption. Children who have lived in foster care or in another country may not have pictures of themselves from birth or at an early age. Family tree assignments may be difficult, because children may be unsure of how to demonstrate their relationship to their biological family, adoptive family, or foster families. Information about biological ancestors also may be unavailable to the child for such a project. Tracing genetic traits through generations may be difficult even for children who have an ongoing relationship with their biological families. For children adopted by an extended family member, these simple learning assignments may create anxiety by highlighting family differences.[4,36] Communication with educators about adoption issues at this age, as at other ages, may be necessary to help children deal with some of these difficult school assignments and insensitive comments about adoption, family circumstances, culture, race, and ethnicity.

As adolescence approaches, physical and mental changes are rapidly occurring.[40] Teenagers are developing the ability to do abstract thinking. Concepts like adoption may be internalized and could have gray areas instead of black or white. Adolescents might go through an intense period of self-reflection in an attempt to define

their identities, but as adolescents develop and begin the task of separation and individuation, adoption issues commonly become very important. This may widen the gap between the adoptee and the adoptive family. It is important for pediatricians to recognize that the consolidation of identity is not the same as an identity crisis, and pediatricians should neither over- nor underpathologize children and adolescents. Also, it is important to remember that identity development is not unique to adopted children, but it can add to its complexity. At 12 to 16 years of age, many adolescents become angry over the differences between their own life experiences and society's norm of an intact family. Adolescents may continue to fantasize about their "perfect" biological family and may look to identify with their perceived biological families even more. The teenager may try identities similar to those of their biological families, whether known or imagined, which may include changes in physical appearance, religion, and customs.[36] The adolescent may question parental views and authority of the adoptive parents and may partake in behaviors that may be out of character, such as engaging in risk-taking activities similar to those that may have led to their conception, including participating in unprotected sex. The adolescent may also take on other activities that played a part in the biological parent's (or parents') decision to make an adoption plan, such as substance abuse. These actions may be the teen's way of connecting to his perceived birth family; however, the adolescent may wish to avoid making similar mistakes as the biological parents. Although the adolescent may be fully committed to the adoptive family, he or she may have a heightened curiosity about the past and his or her biological family, creating a feeling of ambivalence. The teenager may feel a sense of betrayal to his or her adoptive family if this avenue is explored, but he or she needs to develop his or her own sense of belonging as well as a sense of autonomy. The adoptive family may fear the loss of the teen to the biological family, ultimately resulting in increased conflict. The conflicting emotions may be exacerbated as adolescents head toward emancipation from their family and as separation comes to the forefront. Both the child and the family may experience increased emotional uncertainty at the thought of moving away from the adoptive family and home.[36] The pediatrician can play a role in helping the adolescent and family by stressing the need to keep the lines of communication open. The pediatrician should be aware of available community resources, such as support groups and counselors, to help the family explore their feelings in a safe environment.

LOSSES IN ADOPTION

Although parents and children gain so much in becoming a part of an adoptive family, children who join their families through adoption often experience issues of loss relevant to adoption.[41] Although these feelings of loss may be more rooted in societal expectations of genetically based attachments rather than in any inherent biological loss, they nonetheless are experienced by many adopted people.[42]

All members of the adoption triad—the child, the adoptive family, and the biological family—are affected by the losses. Children in closed adoptions may lose the sense of their own original identity as well as ties to those with whom they share genetic links. Even children in open and kinship adoptions are aware of the way in which their families are different and will process their knowledge in different ways at different ages. Adoption may also represent loss to adoptive parents. Some adoptive parents have faced infertility, so they too may grieve the loss of genetic links to their child. In confidential adoptions, biological parents have an obvious loss of a relationship with the child they have conceived. Through understanding and acknowledgment of these losses, adoptive families, children, and biological families are able to adapt better and build healthier families.[43]

COMMUNICATING ABOUT ADOPTION WITH CHILDREN

Even before a child understands the words "adoption," "adopted," and "biological family" or "birth family," it is important that these words be a part of a family's natural conversation, whether the adoption is open or confidential, kinship, or foster-adoptive placement.[35,44] Families should be discouraged from "waiting until just the right minute" to tell children that they were adopted, because this may leave children feeling betrayed and wondering what else their parents may have hidden from them.[36] Children may also learn information from peers or neighbors, which may impair the trust between parent(s) and child. It is important to share with even young children their adoption story, starting with their birth, not the adoptive family's initiation of the adoption process.[36] An honest approach in the discussion of a child's biological family and the adoption process will give a child permission to ask questions or to make statements about adoption and, at the same time, will take away the veil of secrecy that often implies that being adopted is a negative condition.[32]

Some information in a child's past may be private or difficult for the parent to share with the child. The pediatrician,

potentially with the collaboration of a mental health specialist, may help the family decide how and when to disclose this information. Open discussion with a child is essential in building bridges of trust and security within a family, but it is also important that the discussion be framed with developmentally appropriate language. The family can be encouraged to present the information without judgmental comments or criticism. Even the most difficult information, such as previous sexual or physical abuse or having been conceived in the context of rape or incest, eventually may be shared with a child at a developmentally appropriate age.[36]

Some parents who have dealt with infertility may be uncomfortable with the reality that their child has another family—another set of parents.[37] Thus, issues of loss in the adoptive family may continue after the child is adopted into the family.[32] Avoidance of discussion about the biological family will deprive children of the opportunity to ask questions, openly fantasize, or understand having a family outside the one in which they live and may give children the perception that their thoughts and questions about adoption are bad.[36] It is important to tell a child that he or she was not "given up" but rather that the biological parents made an adoption plan in the best interest of the child's future and to the best of their abilities at the time. As children grow in their understanding of the relationship with their biological family, they may become concerned that just as they were "rejected" by their biological family, their adoptive family may also reject them.[32,36] Adoptive parents may need to verbalize their commitment to their child frequently. A "life book," a compilation of all (difficult and happy) that is known about a child's history, can be an effective tool for parents to use in helping a child to process all the thoughts and feelings about his or her adoption story. There may be an opportunity for the pediatrician to encourage families to develop rituals with their child to honor the birth parents, which may take the form of a celebration during holidays or the designation of a particular ornament or saying a special prayer to commensurate the birth family. Rituals like these allow adoptive children to acknowledge and remember their past but also to honor their adoption.

RACIAL, ETHNIC, AND CULTURAL DIFFERENCES

Children adopted by parents of a different race, ethnicity, or cultural background may have other concerns specific to their identities. Even children as young as 3 or 4 years of age will be aware of the physical differences between themselves and members of other racial groups.[45] When adopted children live in communities where they are members of an ethnic minority, the differences in racial identity will be easily apparent to classmates, other parents, and strangers. As these children enter preschool and elementary school, peers may ask questions about their biological and cultural heritage. As children reach the developmental stage of wanting to be just like their peers, these questions may provoke a variety of responses. Some of these responses might seem to the casual observer to be out of proportion for the information requested. Some remarks may be taunting or intrusive.[36] Children may encounter racist remarks for the first time, particularly in situations in which they are not physically or emotionally safeguarded by their parents.

Families need to acknowledge openly the racial differences that exist between their child and themselves. Relationships with others of the same race or ethnic group, including adults and children, may be very helpful to a child.[45] Whenever possible, an adopted child should be given the opportunity to learn more about the heritage of the country of his or her birth or of his or her ethnic group.[36,45] Role-playing with children with respect to stereotypes and racist statements may help them to feel in control when they encounter inevitable comments from strangers, friends, or extended family members.[43] Parents who have not experienced racism personally may need to pay extra attention to teaching their children effective ways to respond to racism.

ADOPTION BY SAME-SEX PARENTS

Although accurate statistics are unavailable, it is estimated that gay and lesbian parents are raising approximately 4% of all adopted children in the United States, accounting for approximately 65 500 adopted children.[46] Demographically, same-sex couples raising adopted children are typically older, more educated, and have more economic resources compared with other adoptive parents. Adopted children in this family composition are generally younger and more likely to be born outside the United States. Research on the subject of children raised by same-sex couples continues, primarily focusing on developmental outcomes, such as psychological adjustment, peer relationships, family relationships, and progress through school.[47] The AAP published a policy statement[48] and technical report[49] supporting coparent or second-parent adoption in 2002 and reaffirmed the policy statement in May 2009. The basis for the policy statement was to ensure the best interest of children living in this family structure, allowing legal stability for the child. The statement pointed out that children fare

better in a home in which parents, regardless of sexual identity, provided a caring, supportive, and secure home environment. After review of the literature, the AAP concluded that children who grow up with gay or lesbian parents do as well in emotional, cognitive, social, and sexual functioning as children who grow up with heterosexual parents. The pediatrician should be familiar with the existing professional literature and support families in their desire to parent children.

OPEN ADOPTION

Open adoption describes a continuum of communication between birth parents and the adoptive family. It may be restricted to the birth parents providing input into the selection of the adoptive parents, or it may describe regular communication between or face-to-face meetings with the adoptive parents, adopted child, or both.[5] Pediatricians should discuss with families the extent of communication between the adoptive family and the biological family and provide needed support by identifying potential and real benefits and drawbacks to the relationship. The adoptive parents may fear birth parents will interfere in the adoptive family's life. They may have concerns of their child's ability to bond within the adoptive family. Anxiety may arise about the parental authority for the child. These and other issues should be part of the routine visit, allowing parents an opportunity to express their concerns. Pediatricians should be knowledgeable about resources, including support groups, available within the community.

SPECIAL ISSUES IN KINSHIP ADOPTION

For children who are placed for adoption within their biological family, separation issues are lessened. At the same time, these relationships present particular challenges for a family. There may be a reluctance of other family members to confirm the adoptive parents as the child's actual parents, and reference may be made within the family setting to the child's "real" parents. Boundaries must be set regarding the type of contact, timing, and granting of parental responsibility to the biological parents. All family members may need to be reminded that the adoptive parent is the responsible parent. Family gatherings may provide particular challenges, especially in cases in which the biological parents' rights have been involuntarily terminated. Many kinship adopters have limited contact with support groups, and there may be a tendency to "keep it in the family," especially with respect to the open discussion of family secrets that led to the placement of the child with a family member. Grandparents who become adoptive parents may grieve the loss of the vision of their own children as parents, coping with the stresses of raising children again and dealing with the circumstances of the reason the child was placed with them.

It is important that pediatricians provide support to these families, particularly in the area of validating the adoptive parents' rights to make decisions for the child. Kinship adoptive parents may be reluctant to share with the child painful information involved in the circumstances leading to the separation from the biological parents. Failing to share the truth may increase the anxiety for the child. The biological parents and kinship adoptive parents must communicate about the sharing of information and what language will be used, keeping in mind the child's developmental stage. Support services and resources for families with a kinship adoptive placement, whether formal or informal, may be available, including local child welfare agencies, the Department on Aging's "Grandparents Raising Grandchildren," and other community resources, financial assistance, respite care, and services.[35]

DIFFICULT TIMES

"Anniversary reactions" often occur in adopted children at certain times of the year.[36] On Mother's Day, children may think about the many mothers they have had, including their adoptive mother, biological mother, and foster mothers. On birthdays and adoption days, children may seem depressed and withdrawn instead of joyful. These anniversaries may trigger thoughts of the biological family, and children may wonder whether their biological parents still love them or even think about them. Sensitivity, particularly at these significant times, may help a child in dealing with difficult adoption issues.

SEARCHING FOR BIOLOGICAL FAMILY AND CULTURAL TIES

As adopted children age into adolescence and adulthood, they may wish to seek out more information about their biological families.[41] Individuals who joined their families through international adoption may choose to make a trip to the country of their birth. Domestic adoptees may pursue reunification with biological relatives through a reunion registry, may choose to reestablish ties in a lapsed open adoption, or may develop a stronger interest in understanding kinship ties. Although some adoptive parents may view their child's searching for his or her biological family as a sign of rejection, it is actually a sign of healthy emotional growth in the search for an identity.[37] The experience of a reunion

with the biological family may be rewarding, but there may also be some pitfalls. In preparing for contact and reunion, adopted people (and birth parents) should prepare for a whole range of realities, including rejection by the biological parent(s) and family members. Pediatricians need to be aware of the feelings the adopted child may have after meeting a sibling—either one who is older and remained with the biological parent(s) or one who was born after the adopted child was placed. All members of the adoption triad may need the help of mental health professionals to work through these situations. Pediatricians are encouraged to become aware of local community resources for adoptive families, including resources for locating information about biological families, support groups, adoption conferences and services, and mental health professionals.

MODELING POSITIVE ADOPTION LANGUAGE

Pediatricians are encouraged to model positive adoption language for all families.[44] Adoptive families are "real" families; siblings who joined a family through adoption are "real siblings." Biological parents do not "give up a child for adoption," which might imply to the child that he or she was of less worth and was given away. Rather, they "make an adoption plan for a child." A biological mother should not be identified as a "natural parent," because this implies that adoptive families are "unnatural." A child's racial identity, adoption, or birth in another country should never be the identifying characteristics for any child. It is never appropriate to ask how much a child "cost." In modeling positive adoption language, pediatricians can use vocabulary that reflects respect and permanency about children and their families.[36]

As more children each year become part of permanent families through adoption, it is becoming increasingly important for pediatricians to be aware of and knowledgeable about adoption. Pediatricians play an important role in helping families deal with the differences, the losses, and the many other issues surrounding the adoption of a child. Pediatricians are encouraged to have a greater understanding about adoption to be able to advise and support parents as they communicate about adoption with their children. It is also important for pediatricians to remind families of the importance of forthright communication about adoption. Open acknowledgment of the adoptive relationship helps to nurture a child's self-esteem as he or she grows in the understanding of what it means to join a family through adoption. Effective communication about adoption is important for the long-term mental and physical health and well-being of each child and family.

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POLICY STATEMENT

Pesticide Exposure in Children

COUNCIL ON ENVIRONMENTAL HEALTH

KEY WORDS
pesticides, toxicity, children, pest control, integrated pest management

ABBREVIATIONS
EPA—Environmental Protection Agency
IPM—integrated pest management

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abstract

FREE

This statement presents the position of the American Academy of Pediatrics on pesticides. Pesticides are a collective term for chemicals intended to kill unwanted insects, plants, molds, and rodents. Children encounter pesticides daily and have unique susceptibilities to their potential toxicity. Acute poisoning risks are clear, and understanding of chronic health implications from both acute and chronic exposure are emerging. Epidemiologic evidence demonstrates associations between early life exposure to pesticides and pediatric cancers, decreased cognitive function, and behavioral problems. Related animal toxicology studies provide supportive biological plausibility for these findings. Recognizing and reducing problematic exposures will require attention to current inadequacies in medical training, public health tracking, and regulatory action on pesticides. Ongoing research describing toxicologic vulnerabilities and exposure factors across the life span are needed to inform regulatory needs and appropriate interventions. Policies that promote integrated pest management, comprehensive pesticide labeling, and marketing practices that incorporate child health considerations will enhance safe use. *Pediatrics* 2012;130:e1757–e1763

INTRODUCTION

Pesticides represent a large group of products designed to kill or harm living organisms from insects to rodents to unwanted plants or animals (eg, rodents), making them inherently toxic (Table 1). Beyond acute poisoning, the influences of low-level exposures on child health are of increasing concern. This policy statement presents the position of the American Academy of Pediatrics on exposure to these products. It was developed in conjunction with a technical report that provides a thorough review of topics presented here: steps that pediatricians should take to identify pesticide poisoning, evaluate patients for pesticide-related illness, provide appropriate treatment, and prevent unnecessary exposure and poisoning.[1] Recommendations for a regulatory agenda are provided as well, recognizing the role of federal agencies in ensuring the safety of children while balancing the positive attributes of pesticides. Repellents reviewed previously (eg, N,N-diethyl-meta-toluamide, commonly known as DEET; picaridin) are not discussed.[2]

SOURCES AND MECHANISMS OF EXPOSURE

Children encounter pesticides daily in air, food, dust, and soil and on surfaces through home and public lawn or garden application, household insecticide use, application to pets, and agricultural product

TABLE 1 Categories of Pesticides and Major Classes

Pesticide category	Major Classes	Examples
Insecticides	Organophosphates	Malathion, methyl parathion, acephate
	Carbamates	Aldicarb, carbaryl, methomyl, propoxur
	Pyrethroids/pyrethrins	Cypermethrin, fenvalerate, permethrin
	Organochlorines	Lindane
	Neonicotinoids	Imidacloprid
	N-phenylpyrazoles	Fipronil
Herbicides	Phosphonates	Glyphosate
	Chlorophenoxy herbicides	2,4-D, mecoprop
	Dipyridyl herbicides	Diquat, paraquat
	Nonselective	Sodium chlorate
Rodenticides	Anticoagulants	Warfarin, brodifacoum
	Convulsants	Strychnine
	Metabolic poison	Sodium fluoroacetate
	Inorganic compounds	Aluminum phosphide
Fungicides	Thiocarbamates	Metam-sodium
	Triazoles	Fluconazole, myclobutanil, triadimefon
	Strobilurins	Pyraclostrobin, picoxystrobin
Fumigants	Halogenated organic	Methyl bromide, Chloropicrin
	Organic	Carbon disulfide, Hydrogen cyanide, Naphthalene
	Inorganic	Phosphine
Miscellaneous	Arsenicals	Lead arsenate, chromated copper arsenate, arsenic trioxide
	Pyridine	4-aminopyridine

residues.[3–9] For many children, diet may be the most influential source, as illustrated by an intervention study that placed children on an organic diet (produced without pesticide) and observed drastic and immediate decrease in urinary excretion of pesticide metabolites.[10] In agricultural settings, pesticide spray drift is important for residences near treated crops or by take-home exposure on clothing and footwear of agricultural workers.[9,11,12] Teen workers may have occupational exposures on the farm or in lawn care.[13–15] Heavy use of pesticides may also occur in urban pest control.[16]

Most serious acute poisoning occurs after unintentional ingestion, although poisoning may also follow inhalational exposure (particularly from fumigants) or significant dermal exposure.[17]

ACUTE PESTICIDE TOXICITY

Clinical Signs and Symptoms

High-dose pesticide exposure may result in immediate, devastating, even lethal consequences. Table 2 summarizes features of clinical toxicity for the major pesticides classes. It highlights the similarities of common classes of pesticides (eg, organophosphates, carbamates, and pyrethroids) and underscores the importance of discriminating among them because treatment modalities differ. Having an index of suspicion based on familiarity with toxic mechanisms and taking an environmental history provides the opportunity for discerning a pesticide's role in clinical decision-making.[18] Pediatric care providers have a poor track record for recognition of acute pesticide poisoning.[19–21] This reflects their self-reported lack of medical education and self-efficacy on the topic.[22–26] More in-depth review of acute toxicity and management can be found in the accompanying technical report or recommended resources in Table 3.

The local or regional poison control center plays an important role as a resource for any suspected pesticide poisoning.

There is no current reliable way to determine the incidence of pesticide exposure and illness in US children. Existing data systems, such as the American Association of Poison Control Centers' National Poison Data System or the National Institute for Occupational Safety and Health's Sentinel Event Notification System for Occupational Risks,[27,28] capture limited information about acute poisoning and trends over time.

There is also no national systematic reporting on the use of pesticides by consumers or licensed professionals. The last national survey of consumer pesticide use in homes and gardens was in 1993 (Research Triangle Institute study).[29]

Improved physician education, accessible and reliable biomarkers, and better diagnostic testing methods to readily identify suspected pesticide illness would significantly improve reporting and surveillance. Such tools would be equally important in improving clinical decision-making and reassuring families if pesticides can be eliminated from the differential diagnosis.

The Pesticide Label

The pesticide label contains information for understanding and preventing acute health consequences: the active ingredient; signal words identifying acute toxicity potential; US Environmental Protection Agency (EPA) registration number; directions for use, including protective equipment recommendations, storage, and disposal; and manufacturer's contact information.[30] Basic first aid advice is provided, and some labels contain a "note for physicians" with specific relevant medical information. The label does not specify the pesticide class or "other"/"inert" ingredients that may have significant toxicity and can account for up to 99% of the product.

Chronic toxicity information is not included, and labels are predominantly available in English. There is significant use of illegal pesticides (especially in immigrant communities), off-label use, and overuse, underscoring the importance of education, monitoring, and enforcement.[31]

TABLE 2 Common Pesticides: Signs, Symptoms, and Management Considerations[a]

Class	Acute Signs and Symptoms	Clinical Considerations
Organophosphate and N-methyl carbamate insecticides	• Headache, nausea, vomiting, abdominal pain, and dizziness • Hypersecretion: sweating, salivation, lacrimation, rhinorrhea, diarrhea, and bronchorrhea • Muscle fasciculation and weakness, and respiratory symptoms (bronchospasm, cough, wheezing, and respiratory depression) • Bradycardia, although early on, tachycardia may be present • Miosis • Central nervous system: respiratory depression, lethargy, coma, and seizures	• Obtain red blood cell and plasma cholinesterase levels • Atropine is primary antidote • Pralidoxime is also an antidote for organophosphate and acts as a cholinesterase reactivator • Because carbamates generally produce a reversible cholinesterase inhibition, pralidoxime is not indicated in these poisonings
Pyrethroid insecticides	• Similar findings found in organophosphates including the hypersecretion, muscle fasciculation, respiratory symptoms, and seizures • Headache, fatigue, vomiting, diarrhea, and irritability • Dermal: skin irritation and paresthesia	• At times have been mistaken for acute organophosphate or carbamate poisoning • Symptomatic treatment • Treatment with high doses of atropine may yield significant adverse results • Vitamin E oil for dermal symptoms
Neonicotinoid insecticides	• Disorientation, severe agitation, drowsiness, dizziness, weakness, and in some situations, loss of consciousness • Vomiting, sore throat, abdominal pain • Ulcerations in upper gastrointestinal tract	• Supportive care • Consider sedation for severe agitation • No available antidote • No available diagnostic test
Fipronil (N-phenylpyrazole insecticides)	• Nausea and vomiting • Aphthous ulcers • Altered mental status and coma • Seizures	• Supportive care • No available antidote • No available diagnostic test
Lindane (organochlorine insecticide)	• Central nervous system: mental status changes and seizures • Paresthesia, tremor, ataxia and hyperreflexia	• Control acute seizures with lorazepam • Lindane blood level available as send out
Glyphosate (phosphonate herbicides)	• Nausea and vomiting • Aspiration pneumonia type syndrome • Hypotension, altered mental status, and oliguria in severe cases • Pulmonary effects may in fact be secondary to organic solvent	• Supportive care • Pulmonary effects may be secondary to organic solvent
Chlorophenoxy herbicides	• Skin and mucous membrane irritation • Vomiting, diarrhea, headache, confusion • Metabolic acidosis is the hallmark • Renal failure, hyperkalemia, and hypocalcemia • Probable carcinogen	• Consider urine alkalinization with sodium bicarbonate in IV fluids
Rodenticides (long-acting anticoagulants)	• Bleeding: gums, nose, and other mucous membrane sites • Bruising	• Consider PT (international normalized ratio) • Observation may be appropriate for some clinical scenarios in which it is not clear a child even ingested the agent • Vitamin K indicated for active bleeding (IV vitamin K) or for elevated PT (oral vitamin K)

IV, intravenous; PT, prothrombin time.

[a] Expanded version of this table is available in the accompanying technical report.[1]

CHRONIC EFFECTS

Dosing experiments in animals clearly demonstrate the acute and chronic toxicity potential of multiple pesticides. Many pesticide chemicals are classified by the US EPA as carcinogens. The past decade has seen an expansion of the epidemiologic evidence base supporting adverse effects after acute and chronic pesticide exposure in children. This includes increasingly sophisticated studies addressing combined exposures and genetic susceptibility.[1]

Chronic toxicity end points identified in epidemiologic studies include adverse birth outcomes including preterm birth, low birth weight, and congenital

TABLE 3 Pesticide and Child Health Resources for the Pediatrician

Topic/Resource	Additional Information	Contact Information
Management of acute pesticide poisoning		
Recognition and Management of Pesticide Poisonings	Print: fifth (1999) is available in Spanish, English; 6th edition available 2013	http://www.epa.gov/pesticides/safety/healthcare/handbook/handbook.htm
Regional Poison Control Centers		1 (800) 222-1222
Chronic exposure information and specialty consultation		
The National Pesticide Medical Monitoring Program (NPMMP)	Cooperative agreement between Oregon State University and the US EPA. NPMMP provides informational assistance by E-mail in the assessment of human exposure to pesticides	npmmp@oregonstate.edu or by fax at (541) 737-9047
Pediatric Environmental Health Specialty Units (PEHSUs)	Coordinated by the Association of Occupational and Environmental Clinics to provide regional academically based free consultation for health care providers	www.aoec.org/PEHSU.htm; toll-free telephone number (888) 347-AOEC (extension 2632)
Resources for safer approaches to pest control		
US EPA	Consumer information documents	www.epa.gov/oppfead1/Publications/Cit_Guide/citguide.pdf
Citizens Guide to Pest Control and Pesticide Safety	• Household pest control • Alternatives to chemical pesticides • How to choose pesticides • How to use, store, and dispose of them safely • How to prevent pesticide poisoning • How to choose a pest-control company	
Controlling pests	Recommended safest approaches and examples of programs	www.epa.gov/pesticides/controlling/index.htm
The University of California Integrative Pest Management Program	Information on IPM approaches for common home and garden pests	www.ipm.ucdavis.edu
Other resources		
National research programs addressing children's health and pesticides	• NIEHS/EPA Centers for Children's Environmental Health & Disease Prevention Research • The National Children's Study	www.niehs.nih.gov/research/supported/centers/prevention www.nationalchildrensstudy.gov/Pages/default.aspx
US EPA	Pesticide product labels	www.epa.gov/pesticides/regulating/labels/product-labels.htm#projects
The National Library of Medicine "Tox Town"	Section on pesticides that includes a comprehensive and well-organized list of web link resources on pesticides	http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=23

anomalies, pediatric cancers, neurobehavioral and cognitive deficits, and asthma. These are reviewed in the accompanying technical report. The evidence base is most robust for associations to pediatric cancer and adverse neurodevelopment. Multiple case-control studies and evidence reviews support a role for insecticides in risk of brain tumors and acute lymphocytic leukemia. Prospective contemporary birth cohort studies in the United States link early-life exposure to organophosphate insecticides with reductions in IQ and abnormal behaviors associated with attention-deficit/hyperactivity disorder and autism. The need to better understand the health implications of ongoing pesticide use practices on child health has benefited from these observational epidemiologic data.[32]

EXPOSURE PREVENTION APPROACHES

The concerning and expanding evidence base of chronic health consequences of pesticide exposure underscores the importance of efforts aimed at decreasing exposure.

Integrated pest management (IPM) is an established but undersupported approach to pest control designed to minimize and, in some cases, replace the use of pesticide chemicals while achieving acceptable control of pest populations.[33] IPM programs and knowledge have been implemented in agriculture and to address weeds and pest control in residential settings and schools, commercial structures, lawn and turf, and community gardens. Reliable resources are available from the US EPA and University of California—Davis (Table 3). Other local policy approaches in use are posting warning signs of pesticide use, restricting spray zone buffers at schools, or restricting specific types of pesticide products in schools. Pediatricians can

play a role in promotion of development of model programs and practices in the communities and schools of their patients.

RECOMMENDATIONS

Three overarching principles can be identified: (1) pesticide exposures are common and cause both acute and chronic effects; (2) pediatricians need to be knowledgeable in pesticide identification, counseling, and management; and (3) governmental actions to improve pesticide safety are needed. Whenever new public policy is developed or existing policy is revised, the wide range of consequences of pesticide use on children and their families should be considered. The American Academy of Pediatrics, through its chapters, committees, councils, sections, and staff, can provide information and support for public policy advocacy efforts. See http://www.aap.org/advocacy.html for additional information or contact chapter leadership.

Recommendations to Pediatricians

1. Acute exposures: become familiar with the clinical signs and symptoms of acute intoxication from the major types of pesticides. Be able to translate clinical knowledge about pesticide hazards into an appropriate exposure history for pesticide poisoning.
2. Chronic exposures: become familiar with the subclinical effects of chronic exposures and routes of exposures from the major types of pesticides.
3. Resource identification: know locally available resources for acute toxicity management and chronic low-dose exposure (see Table 3).
4. Pesticide labeling knowledge: Understand the usefulness and limitations of pesticide chemical information on pesticide product labels.
5. Counseling: Ask parents about pesticide use in or around the home to help determine the need for providing targeted anticipatory guidance. Recommend use of minimal-risk products, safe storage practices, and application of IPM (least toxic methods), whenever possible.
6. Advocacy: work with schools and governmental agencies to advocate for application of least toxic pesticides by using IPM principles. Promote community right-to-know procedures when pesticide spraying occurs in public areas.

Recommendations to Government

1. Marketing: ensure that pesticide products as marketed are not attractive to children.
2. Labeling: include chemical ingredient identity on the label and/or the manufacturer's Web site for all product constituents, including inert ingredients, carriers, and solvents. Include a label section specific to "Risks to children," which informs users whether there is evidence that the active or inert ingredients have any known chronic or developmental health concerns for children. Enforce labeling practices that ensure users have adequate information on product contents, acute and chronic toxicity potential, and emergency information. Consider printing or making available labels in Spanish in addition to English.
3. Exposure reduction: set goal to reduce exposure overall. Promote application methods and practices that minimize children's exposure, such as using bait stations and gels, advising against overuse of pediculicides. Promote education regarding proper storage of product.
4. Reporting: make pesticide-related suspected poisoning universally reportable and support a systematic central repository of such incidents to optimize national surveillance.
5. Exportation: aid in identification of least toxic alternatives to pesticide use internationally, and unless safer alternatives are not available or are impossible to implement, ban export of products that are banned or restricted for toxicity concerns in the United States.
6. Safety: continue to evaluate pesticide safety. Enforce community right-to-know procedures when pesticide spraying occurs in public areas. Develop, strengthen, and enforce standards of removal of concerning products for home or child product use. Require development of a human biomarker, such as a urinary or blood measure, that can be used to identify exposure and/or early health implications with new pesticide chemical registration or reregistration of existing products. Developmental toxicity, including endocrine disruption, should be a priority when evaluating new chemicals for licensing or reregistration of existing products.
7. Advance less toxic pesticide alternatives: increase economic incentives for growers who adopt IPM, including less toxic pesticides. Support research to expand and improve IPM in agriculture and nonagricultural pest control.
8. Research: support toxicologic and epidemiologic research to better identify and understand health risks associated with children's exposure to pesticides. Consider supporting another national study of pesticide use in the home and garden setting of US households as a targeted initiative or through cooperation with existing research opportunities (eg, National Children's Study, NHANES).
9. Health provider education and support: support educational efforts to increase the capacity of pediatric health care providers to diagnose and manage acute pesticide

poisoning and reduce pesticide exposure and potential chronic pesticide effects in children. Provide support to systems such as Poison Control Centers to provide timely, expert advice on exposures. Require the development of diagnostic tests to assist providers with diagnosing (and ruling out) pesticide poisoning.

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TECHNICAL REPORT

Pesticide Exposure in Children

James R. Roberts, MD, MPH, Catherine J. Karr, MD, PhD, and COUNCIL ON ENVIRONMENTAL HEALTH

KEY WORDS
pesticides, toxicity, children, pest control, integrated pest management

ABBREVIATIONS
CDC—Centers for Disease Control and Prevention
CI—confidence interval
2,4-D—2,4-dichlorophenoxyacetic acid
DDE—*p,p′*-dichlorodiphenyldichloroethylene
EPA—Environmental Protection Agency
ES—Ewing sarcoma
GI—gastrointestinal
INR—international normalized ratio
IPM—integrated pest management
NPDS—National Poison Data System
OP—organophosphate
OR—odds ratio
PT—prothrombin time
RR—relative risk
SGA—small for gestational age
Th2—T helper 2

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abstract

FREE

Pesticides are a collective term for a wide array of chemicals intended to kill unwanted insects, plants, molds, and rodents. Food, water, and treatment in the home, yard, and school are all potential sources of children's exposure. Exposures to pesticides may be overt or subacute, and effects range from acute to chronic toxicity. In 2008, pesticides were the ninth most common substance reported to poison control centers, and approximately 45% of all reports of pesticide poisoning were for children. Organophosphate and carbamate poisoning are perhaps the most widely known acute poisoning syndromes, can be diagnosed by depressed red blood cell cholinesterase levels, and have available antidotal therapy. However, numerous other pesticides that may cause acute toxicity, such as pyrethroid and neonicotinoid insecticides, herbicides, fungicides, and rodenticides, also have specific toxic effects; recognition of these effects may help identify acute exposures. Evidence is increasingly emerging about chronic health implications from both acute and chronic exposure. A growing body of epidemiological evidence demonstrates associations between parental use of pesticides, particularly insecticides, with acute lymphocytic leukemia and brain tumors. Prenatal, household, and occupational exposures (maternal and paternal) appear to be the largest risks. Prospective cohort studies link early-life exposure to organophosphates and organochlorine pesticides (primarily DDT) with adverse effects on neurodevelopment and behavior. Among the findings associated with increased pesticide levels are poorer mental development by using the Bayley index and increased scores on measures assessing pervasive developmental disorder, inattention, and attention-deficit/hyperactivity disorder. Related animal toxicology studies provide supportive biological plausibility for these findings. Additional data suggest that there may also be an association between parental pesticide use and adverse birth outcomes including physical birth defects, low birth weight, and fetal death, although the data are less robust than for cancer and neurodevelopmental effects. Children's exposures to pesticides should be limited as much as possible. *Pediatrics* 2012;130:e1765–e1788

INTRODUCTION

Pesticides represent a broad classification of chemicals that are applied to kill or control insects, unwanted plants, molds, or unwanted animals (eg, rodents). "Pesticide" is a collective term for a wide array of products but is often inappropriately used in reference to only insecticides. The universe of pesticide types and products is broad, and

a comprehensive review of all active ingredients is beyond the scope of this report. This review focuses on select insecticides, herbicides, and rodenticides and specific chemical classes within these groups that have the greatest acute and chronic toxicity for children on the basis of historical experience and/or emerging evidence (Table 1).

Several types of pesticides are not discussed in this report. Fumigants and fungicides, although potentially toxic, are less commonly involved in acute childhood exposure and poisoning, in general, so these are not included. Wood preservatives containing arsenic are also not included in this report. The specific compound containing arsenic, copper chromium arsenate, has been removed from the market since January 2004. Older wood structures treated with copper chromium arsenate may still be found in homes, on playgrounds, and in yards and should be treated yearly with a waterproof sealant.[1] Insect repellents, including *N, N*-diethyl-meta-toluamide and picaridin, are different from most pesticides in that they are a product purposefully applied to human skin to prevent insect bites and are, in fact, not insecticides. These compounds are unique and have been reviewed recently.[2]

Although the severity of pesticide exposures and toxicity may be greater in developing countries where regulatory oversight and information is limited, the content of this technical report is oriented toward exposures most relevant to children residing in the United States. Commonly used insecticides, including the organophosphates (OPs), carbamate, and pyrethroid classes, are discussed, as are the relatively new neonicotinoids. Other pesticides that will be discussed in some detail include the phosphonate herbicides (eg, glyphosate), chlorophenoxy herbicides, and long-acting anticoagulants (rodenticides). For a more comprehensive survey of the acute toxicity from the spectrum of pesticide active ingredients and products, see other sources.[1,3]

CHILDREN'S EXPOSURE: VULNERABILITY, MECHANISMS, AND SOURCES OF EXPOSURE

Children's Unique Vulnerabilities

Children are uniquely vulnerable to uptake and adverse effects of pesticides because of developmental, dietary, and physiologic factors. Exposure occurs through ingestion, inhalation, or dermal contact. Unintentional ingestion by children may be at a considerably higher dose than an adult because of the greater intake of food or fluids per pound of body weight. Children exhibit frequent hand-to-mouth activity, and this is an important source of increased exposure in comparison with adults.[4,5]

Residential Factors

Fortunately, acute toxicity attributable to pesticide poisoning is relatively uncommon in US children, and a pediatrician in general practice may not encounter such an event. However, subacute and chronic low-level exposure is common. Residential factors that influence chronic exposure include the use of insecticides and rodenticides in the home, and herbicide and fungicide use on lawns, as well. Indoors, broadcast applications including sprays, "flea bombs," and foggers can leave lingering residues in the air, carpet, toys, and house dust.[6–9] Typical exploratory behavior, including playing on and crawling across the floor, increases the risk of dermal, inhalation, and oral exposure to residues on surfaces or the air as it settles.[10] Repeated and cumulative incidental exposure can also occur. Pesticides can be measured in indoor air samples and persist in dust vacuumed from carpeted areas, upholstered objects, and children's toys, such as stuffed animals, and can also be brought home from the workplace.[11–14] Herbicides applied on the lawn or garden can be tracked into the home, with residues building up over time.[15] Applications of diazinon to lawns have been demonstrated to be carried indoors via the paws of pet dogs.[16] Residential pesticide residue levels also vary geographically according to the specific pesticide needs in the area. In Los Angeles, high levels of chlorpyrifos and other insecticides were found because of the large numbers of crawling insects, fleas, and termites. Conversely, in Iowa, there were high levels of the herbicides 2,4-dichlorophenoxyacetic acid (2,4-D) and dicamba because of weed-control applications.[17]

Residentially related sources may be relevant in other settings where children spend time, including school, child care, a relative's home, etc, depending on indoor and outdoor pesticide use patterns and proximity to pesticide use. In a North Carolina study of 142 urban homes and preschools, chlorpyrifos was detected in all indoor air and dust samples.[18]

Biomonitoring Data for Exposure Assessment

The Centers for Disease Control and Prevention (CDC) conducts a population-based biomonitoring program associated with the NHANES.[19] The most recent report includes biomarker data for many organochlorine, OP, and carbamate insecticides; herbicides; pyrethroid insecticides; and some other pesticides. Testing of 44 pesticide metabolites revealed that 29 were detectable in most people from whom samples were analyzed (ages 6–59 years), with OP and organochlorine insecticides reported to be most prevalent in the US population.[19] Although the health implications of these "snapshot" sampling data are largely unknown, they do

TABLE 1 Major Pesticide Classes and Selected Examples

Pesticide Class	Examples	Toxicity	Comment, Uses
Organochlorines	DDT, endrin, aldrin, chlordane, lindane	• High toxicity	• Many organochlorines now banned in the United States • Lindane has been banned in California, elsewhere used for control of lice and scabies • DDT and other organochlorines have long metabolic disposition and are stored in fatty tissues and can persist in the environment
Organophosphates	Parathion, chlorpyrifos, dichlorvos, acephate, methyl-parathion, malathion, phorate	• Most OPs are highly toxic • Malathion is considered relatively less toxic than other OPs	• Parathion is banned for use in the United States • Chlorpyrifos is no longer approved for residential use • Most others are used for insect control in both agricultural and home settings • Malathion is an approved treatment of head lice
N-Methyl carbamates	Aldicarb, carbaryl, carbofuran, pirimicarb, propoxur	• Aldicarb and carbaryl are both highly toxic • Other carbamates have a relatively moderate toxicity	• Insect control in agricultural and home settings
Pyrethrins and pyrethroids	Permethrin, cyano-pyrethroids: deltamethrin, cypermethrin, fenvalerate	• Permethrin has relatively low toxicity • Other pyrethroids have moderate toxicity	• Permethrin is a common pediculicide • Most other pyrethroids are commonly used to control insects, often used in home and garden
Neonicotinoids	Imidacloprid	• Relatively newer class of insecticides	• Selective affinity toward insect nicotinic acetylcholine receptors compared with mammalian nicotinic acetylcholine receptors
		• Have relatively lower toxicity than OPs and carbamates	• Often used as spot-on flea control for domestic animals
N-Phenylpyrazole insecticides	Fipronil	• Relatively newer class of insecticides	• Often used as spot-on flea control for domestic animals • Yard treatments for insect control
Phosphonate herbicides	Glyphosate	• Because of primary mechanism of action, has relatively low toxicity from active ingredient. • Toxicity often due to the accompanying organic solvent	• Acts on plant cell wall • Commercially available in many products
Chlorophenoxy herbicides	2,4-D, 2,4,5-T	• Moderate toxicity	• Weed control
Dipyridyl herbicides	Paraquat, diquat	• Highly toxic	• Infrequently used • Paraquat toxicity often requires lung transplant
Long-acting anticoagulants	Brodifacoum (superwarfarins)		• Rodenticides • Longer-acting than warfarin • Recently eliminated packaging as loose pellets

2,4,5-T, 2,4,5-trichlorophenoxy acetic acid.

provide a reference point on pesticide metabolite distributions. Periodic reassessment also allows for evaluations of population-level exposure trends.

As noted previously, children's unique behaviors and metabolic rate often place them at risk for absorption of higher doses from contaminated environments in comparison with adults. One example evident from the biomonitoring data is chlorpyrifos, a nonpersistent OP insecticide. Although banned in 2000 for use inside the home, it continues to be used in agriculture, including orchard fruits, such as apples and pears, and other dietary staples of children. In the CDC biomonitoring data, chlorpyrifos-specific urinary metabolites were highest for the youngest age group assessed (6–11 years) compared with older children and adults.[19] In contrast, biomonitoring of serum markers of organochlorine insecticides and their metabolites, such as DDT, dieldrin, and chlordane, many of which were banned from use in the United States in the 1970s and 1980s, revealed lower concentrations in the youngest age group monitored (12–19 years). Despite relatively lower concentrations, the ongoing detection and the higher levels with increasing age likely reflect the influence of the accumulation of these fat-soluble, persistent compounds over a lifetime.

Exposures From the Food Supply

In the general population, the food supply represents the most important source of exposure for organochlorines and OPs. For pyrethroids, both food residues and household pest control products are important sources.[20] The US Environmental Protection Agency (EPA) regulates exposure to pesticides in food by setting "tolerances," which are the maximum amount of pesticides that may legally remain in or on food

and animal feed. The US Food and Drug Administration is responsible for enforcement of these tolerances, which includes a modest monitoring program, which analyzed 7234 total samples in 2003. Among the domestically produced samples, 49% of fruit, 29% of vegetables, 26% of grain products, 24% of fish/shellfish, and 0% of milk/dairy tested had detectable but legally allowable pesticide residues. Only fruit and vegetables had residues above the legal tolerance (approximately 2% each). Overall, the detection of residues in the samples from imported fruits and vegetables tested were less, but the exceedances of legal tolerances were greater (5%–7% of imported fruits/vegetables sampled).[21] Consumption of organic food may lower pesticide exposure, as demonstrated by a study in which children were placed on an organic diet for a period of 5 consecutive days. A rapid and dramatic drop in their urinary excretion of metabolites of malathion and chlorpyrifos OP insecticides during the organic diet phase was observed.[22]

Agriculturally Related Exposures

Proximity to pesticide-treated agricultural areas or household members that work with pesticides presents another opportunity for contamination of the residential environment for some children. In a Washington State study of children of agricultural workers and nonagricultural workers in an agricultural setting, pesticide levels in carpet dust and pesticide metabolites in urine of residents increased with self-reported proximity of homes to orchard fields and during the pesticide application season.[9,23] Similarly, in an agriculture center in California, pesticide residues of 3 chemicals used recently on crops were significantly correlated with house dust samples in nearby homes and urine samples among their inhabitants. The findings were noted in both farmworkers and nonfarmworkers.[24] The presence of an agricultural worker in the home also increases pesticide levels through "take-home" exposures.[23] Children living on a farm had higher urinary pesticide metabolite levels than children not living on a farm.[25] Children themselves may participate in agricultural work that involves the use of pesticides or contact with pesticide-treated foliage.[26–28]

Exposures From Drinking Water

Contamination of drinking water presents another potential source of exposure, particularly for herbicides. A 10-year study (1992–2001) by the US Geological Survey's National Water-Quality Assessment program provided a national-scale view of pesticide occurrence in streams and groundwater. Overall, pesticides were detected in more than 50% of sampled wells from shallow groundwater tapped beneath agricultural and urban areas as well as in 33% of the deeper wells that tap major aquifers used for water supply. The concentrations associated with these detections rarely exceeded water quality health reference levels (approximately 1% of the 2356 domestic and 364 public-supply wells that were sampled). Herbicides, particularly the triazine class, were the most frequently detected pesticide group in agricultural areas. (It should be noted that atrazine and other triazine herbicides were monitored from surface water.) In urban areas, both herbicides and insecticides (particularly diazinon and carbaryl) were frequently detected. The greatest proportion of wells exceeding a health reference level was for those tapping shallow groundwater beneath urban areas. It is noteworthy that the detection of pesticides usually occurred as mixtures, and health reference levels reflected exposure to a single agent.[29]

NATIONAL DATA ON ACUTE EXPOSURE, MORBIDITY, AND MORTALITY

Although some states (eg, California and Washington) mandate the reporting of pesticide-related illness, there is no national surveillance system for pesticide exposure and poisoning. The American Association of Poison Control Centers' National Poison Data System (NPDS [formerly known as the Toxic Exposure Surveillance System]) compiles annual data on pesticide exposures. Incidents reported by the NPDS are categorized by age (<6 years, 6–19 years, and >19 years), reason (unintentional, intentional, other, adverse reaction), and outcome (none [no morbidity], minor, moderate, major, or death). However, these data represent self-reports from patients and/or family members and calls from medical treatment facilities. Although they are useful to describe trends, they do not indicate true prevalence or incidence. Data are reported annually and, since 2005, have been published in *Clinical Toxicology*.[30]

In 2009, pesticides were the tenth most frequently involved substance in human exposure (3.9% of all NPDS reports) and the ninth most common substance encountered in children (3.3% of pediatric NPDS reports). Nearly 55.8% of all single-substance pesticide exposures involved children ≤19 years of age, and 94% of all pesticide ingestions were unintentional. Twenty-one of the reports from pesticide exposure resulted in death; however, these were not categorized by age.[30] Rates (calculated by using US census data for the catchment area served by the poison control center as the denominator) of reported pesticide poisonings described as moderate, major, and fatal declined from 1995 to 2004 by approximately 42%. The sharpest declines in poisonings were from OP and carbamate insecticides,

likely reflecting EPA regulatory action to discontinue residential use of several previously widely available OP and carbamate insecticides on the basis of child health concerns.[31]

ACUTE TOXICITY MECHANISMS AND CLINICAL MANIFESTATIONS

OP and Carbamate Insecticides

OP and carbamates insecticides have been widely used for insect control in the home and in agriculture since the 1960s. During this period, OP and carbamates usage largely replaced the use of organochlorines because of environmental and human health concerns of the latter class. In the past 10 years, chemical products in the OP and carbamate group have come under scrutiny, with subsequent regulatory action based on human health concerns. Examples include 2 commonly used OPs with high acute toxicity: parathion (banned) and chlorpyrifos (no longer allowed for residential use). Other OPs that remain widely used include dichlorvos, acephate, methyl-parathion, and malathion. Malathion has relatively lower acute toxicity among the OPs and is registered for the treatment of head lice (Ovide). A well-known example of a carbamate is aldicarb, although use has largely been curtailed by regulatory action because of its high toxicity. Commonly used carbamates include carbaryl and pirimicarb.[1,3]

Toxicity, Clinical Signs, and Symptoms

OPs and carbamates exert a common mechanism of action by inhibiting the acetylcholinesterase enzyme, thereby producing accumulation of acetylcholine at the synapses, neuromuscular junction, and end organs, which results in excessive stimulation at those sites. The reaction is generally an irreversible binding by OPs and a reversible binding by carbamates, and it influences treatment approaches for each class of insecticides. Consequently, acute poisoning by OPs tends to be more severe and refractory than that of carbamates; however, variations are observed in each class. There are some notable carbamates (such as aldicarb) that have equal if not greater toxicity than some OPs.[1,3]

Acute clinical manifestations reflect the development of cholinergic crisis and can arise from stimulation of muscarinic, nicotinic, and/or central nervous system receptors (Table 2). Early findings can often mimic a flu-like illness and include hypersecretion. Miosis is a helpful diagnostic sign. The classic cardiovascular sign is bradycardia, although early on, tachycardia may be present initially because of nicotinic stimulation. Progressive symptoms lead to muscle and respiratory problems. The central nervous system may also be affected, signifying severe poisoning, particularly in children.[1,3,32–34] Reviews of case series indicate that between 20% and 30% will have seizures, and between 50% and 100% of children will have lethargy, stupor, or coma.[32–34] A high clinical suspicion plus directed and persistent environmental history taking to identify potential exposures are necessary to identify these poisonings. Reviews of pediatric poisonings note that, historically, most children were transferred to a referral center with the wrong preliminary diagnosis and parents initially denied any exposure history.[33,34]

Laboratory Evaluation and Treatment

Poisoning with OPs and carbamates can be detected on the basis of clinical findings and history of exposure. Laboratory confirmation can assist in the diagnosis by using red blood cell and plasma cholinesterase levels; both are typically depressed with acute poisoning, although there is some variation among active ingredients as well as variation in levels by severity of poisoning.[35] Measurement techniques and resultant levels vary among laboratories; therefore, clinicians will need to check with their own laboratory for reference values. Red blood cell cholinesterase levels typically are more specific for acute poisoning and will be depressed longer than plasma cholinesterase levels (often 1–3 months) until enzyme is replaced.[3] Interpretation of results can be discussed with a pediatric environmental health specialist or clinical toxicologist.

The parent active ingredient cannot typically be measured in biological specimens. These compounds undergo metabolic transformation in the liver and are excreted in the urine mostly in their metabolized form, most of which are nonspecific metabolites for all OPs.[19] Exceptions include parathion, methyl-parathion, and chlorpyrifos, all of which have their own specific metabolite in addition to the nonspecific metabolites. Urinary metabolites can be measured, and human data are available from the CDC on a nationally representative sample.[19] However, an evidence base to support clinical interpretation of urinary concentrations is lacking.

Treatment of OP poisoning (and this applies to the acute treatment of any other pesticide as well) begins with the basics of advanced life support, with any necessary airway or breathing support as needed. Gastrointestinal (GI) decontamination is controversial. The American Academy of Clinical Toxicology and the European Association of Poisons Centres and Clinical Toxicologists issued a joint statement on the use of single-dose charcoal for poisoned patients (inclusive of all types of poisonings). They stated that activated charcoal is most effective when given within 1 hour after the ingestion of a poison, but routine administration in all poisonings is not recommended.

TABLE 2 Clinical Signs and Symptoms

Class of Compounds	Signs and Symptoms	Special Notes, Laboratory Evaluations, Specific Treatments, or Antidote
Organophosphate and carbamate insecticides	• Nonspecific early symptoms: headache, nausea, vomiting, abdominal pain, and dizziness	• Red blood cell and plasma cholinesterase levels
	• Sometimes hypersecretion: sweating, salivation, lacrimation, rhinorrhea, diarrhea, and bronchorrhea	• Measure nonspecific metabolites for most OPs
	• Progressive symptoms: muscle fasciculation, muscle weakness, and respiratory symptoms (bronchospasm, cough, wheezing, and respiratory depression)	• Specific metabolites can be measured for chlorpyrifos and parathion
	• Bradycardia is typical, although early in acute poisoning, tachycardia may be present	• Atropine is primary antidote
	• Miosis	• Pralidoxime is also an antidote for OP and acts as a cholinesterase reactivator
	• Central nervous system: respiratory depression, lethargy, coma, and seizures	• Because carbamates generally produce a reversible cholinesterase inhibition, pralidoxime is not indicated in these poisonings
Pyrethroids	• Dermal: skin irritation and paresthesia	• At times have been mistaken for acute OP or carbamate poisoning and treated with atropine with potentially adverse or disastrous results
	• Nonspecific symptoms including headache, fatigue, vomiting, diarrhea, and irritability	• Symptomatic treatment
	• Similar findings found in OPs, including hypersecretion, muscle fasciculation, pulmonary symptoms and seizures	• Vitamin E oil for dermal symptoms
Neonicotinoids	• Disorientation, agitation—severe enough to require sedation, drowsiness, dizziness, weakness, and, in some situations, loss of consciousness	• Supportive care
	• Vomiting, sore throat, abdominal pain	• No available antidote
	• Ulcerations in upper GI tract	• No available diagnostic test
Fipronil (*N*-phenylpyrazole insecticides)	• Nausea and vomiting	• Supportive care
	• Aphthous ulcers	• No available antidote
	• Altered mental status and coma	• No available diagnostic test
	• Seizures	
Organochlorines	• Central nervous system: mental status changes and seizures	• Control acute seizures with lorazepam
	• Paresthesia, tremor, ataxia, and hyperreflexia	
Glyphosate (phosphonate herbicides)	• Nausea and vomiting	• Supportive care
	• Aspiration pneumonia type syndrome	
	• Hypotension, altered mental status, and oliguria in severe cases	
	• Aspiration pneumonia type syndrome	
	• Pulmonary effects may in fact be secondary to organic solvent	
Chlorophenoxy herbicides	• Skin and mucous membrane irritation	• Consider forced alkaline diuresis with sodium bicarbonate in IV fluids
	• Vomiting, diarrhea, headache, confusion	
	• Metabolic acidosis is the hallmark	
	• Renal failure, hyperkalemia, and hypocalcemia	
Long-acting anticoagulants (rodenticides)	• Bleeding: gums, nose, and other mucous membrane sites	• Consider PT (INR) or observation
	• Bruising	• Vitamin K indicated for bleeding (IV vitamin K) or for elevated PT (INR) (oral vitamin K)

IV, intravenous.

Activated charcoal is contraindicated if the patient does not have a protected or intact airway.[36] A randomized controlled trial evaluating the effect of multiple-dose charcoal for pesticide-poisoned patients in Asia found no benefit, as measured by a reduction in mortality.[37] Skin decontamination also is critically important, and clothing should be removed. Medical personnel should take measures to protect themselves from contaminated skin and clothing, because numerous cases of hospital-acquired OP poisoning have been documented.[38] Parents or other family caregivers may also be at risk for skin contamination. Seizures should be controlled with intravenous lorazepam.[3]

Atropine can be given as a nonspecific antidote in both OP and carbamate poisoning. It will reverse the muscarinic effects of the poisoning; however, it is less effective on central nervous system effects. It is given as a dose of

0.05 to 0.1 mg/kg per dose and may be given as often as every 15 minutes until respiratory secretions are controlled.[3] Notably, this dose is 10 times the usual dose given during a resuscitation situation, because the purpose is to overcome complete blockade of the muscarinic channel. Pralidoxime is also given as a specific antidote to reverse the acetylcholinesterase inhibitor complex. The use of pralidoxime continues to be of interest, particularly in developing countries, although most studies have been performed with adult patients.[39,40] The World Health Organization recommends its use for all patients who require atropine.[41] Its use is indicated for OP poisoning, because cholinesterase inhibition usually is permanent in OP poisoning. Use of pralidoxime usually is not necessary or recommended for carbamate poisoning, because this inhibition is reversible.[3]

Pyrethrins and Pyrethroid Insecticides

Pyrethrins and pyrethroids are a relatively more recent class of insecticides that have been largely replacing the use of cholinesterase-inhibiting insecticides, especially in the consumer market. These insecticides are used for structural pest control in urban areas, in gardening or agriculture for row crops and orchards, and in the home for pet sprays and shampoo.

The pyrethrins are botanically derived from pyrethrum, an extract of the chrysanthemum plant. For these consumer products, pyrethrins are usually combined with another active ingredient: either a longer-acting synthetically derived pyrethroid or one of the cholinesterase inhibitors. Pyrethrins are not stable in heat or sunlight and, therefore, are usually used more for indoor application. Permethrin is the most widely known example of a pyrethrin and is one of the few products licensed for use to apply to human skin, because it is commonly used as a pediculicide.[3,42,43]

Pyrethroids are synthetically derived compounds that have been modified to be more stable in sunlight and heat and are, therefore, used more widely for insect control, especially outdoors. Toxicity varies widely among pyrethrins and pyrethroids, and, although they are less acutely toxic as a class than the cholinesterase insecticides, there is a subgroup of these compounds that has been modified with a cyano side chain. This modification creates a compound that is significantly more resistant to degradation and potentially more acutely toxic than other pyrethroids. Commonly used chemicals in this subgroup include deltamethrin, cypermethrin, and fenvalerate—these are the insecticides to which the majority of toxic signs and symptoms in the next section apply.[43]

Toxicology, Clinical Signs, and Symptoms

Pyrethroids exert their toxic effect by blocking the sodium channel at the level of the cell membrane. Most clinical reports of poisoning occur either through excessive skin contact or through ingestion or inhalation. The result is continued hyperpolarization, effectively inhibiting cell function. Some types of pyrethroids also work at other sites, including voltage-dependent chloride channels and γ-aminobutyric acid–gated chloride channels. This appears to be one of the reasons for a variety of toxicity found among pyrethroid insecticides.[42,43] Pyrethroids with a cyano group, also known as type II pyrethroids, constitute most cases of human poisoning.[42,43] Pyrethroids are well absorbed across the GI tract, but limited penetration occurs across the skin barrier, which can limit acute toxicity.[42,44] Some pyrethroids have a high acute toxicity, usually after ingestion.[42,45] Pyrethroids are metabolized by the liver and excreted in their metabolic forms.

Pyrethroids have adverse effects on the nervous system, GI tract, and skin. Specific signs and symptoms are found in Table 2. Similar to OPs, muscle fasciculation, weakness, an altered level of consciousness, and seizures can develop after exposures to some pyrethroids.[42–45] Of note, paresthesias, including burning, tingling, stinging, and eventually numbness, are characteristic of pyrethroid exposure.[46,47] The paresthesias appear to be dose-dependent and occur at pyrethroid dosages lower than what would cause systemic toxicity, thereby acting as a warning of exposure. The paresthesias are self-limiting once exposure is eliminated.[48]

Laboratory Evaluation and Treatment

Pyrethroid toxicity is identified through clinical history and knowledge of exposure to the agent. There are no rapidly available diagnostic laboratory tests. Most pyrethroids are metabolized to 3-phenoxybenzoic acid, which can be recovered in the urine. CDC national surveys provide biomonitoring information on pyrethroid urinary metabolites and can act as comparison for background measures of exposure in the general population. However, in the clinical setting, results of metabolite levels are usually obtained from specialty laboratories and are not immediately available; therefore, these results not useful in acute clinical management.

Paresthesias are generally self-limiting and resolve within 24 hours.[46,48] If exposure is interrupted after the onset of paresthesias and other dermal findings, no additional treatment is necessary. Vitamin E oil or cream has been shown to improve the

symptoms associated with the paresthesias.[47] The mechanism is not completely clear; however, in experimental studies, vitamin E (α-tocopherol) blocked tetramethrin-modified sodium channels.[49]

Treatment of systemic pyrethroid poisoning is supportive, in general, and there are no specific antidotes. Because of the similar features of cholinesterase inhibitor poisoning, some patients have been treated erroneously with high atropine, sometimes with disastrous results.[45] Efforts have been aimed at antagonizing the sodium current resulting from the pyrethroid blockade. Several medications have been tested in the animal model, but, to date, none have been considered effective antidotes for systemic pyrethroid poisoning in humans. For significant neurologic effects, patients should have standard decontamination, including GI tract decontamination, supportive respiratory care, seizure control with diazepam or lorazepam, and careful dosing of atropine for excessive salivation.[42] Proper identification of the offending agent is imperative to distinguish these poisonings from OPs and often requires a high index of suspicion and a thorough exposure history.

Organochlorine Insecticide (Lindane)

The discussion of acute toxicity for organochlorines is focused on lindane, because most other organochlorine compounds have been banned for use in the United States. Other organochlorines, including DDT and some of the cyclodienes, including chlordane and dieldrin, are important compounds, because they can still persist in human and environmental samples. These chronic exposures are of continuing concern for developmental health effects, including immunotoxicity, endocrine disruption, and neurodevelopmental insults (see Chronic Health Effects of Pesticide Exposure).

Lindane, also known technically as the γ-isomer of hexachlorocyclohexane, is still approved in some states for control of lice and scabies. However, in a comparison of in vitro activity against lice with other pediculicides, it was the least effective.[50] It is efficiently absorbed across the skin (approximately 9%) and even more so across abraded skin, such as with severe excoriations from scabies.[51,52] Signs and symptoms are noted in Table 2. Treatment is supportive and includes decontamination and the control of seizures with lorazepam. There is no specific antidote. Lindane has been banned in California because of high levels found in the water supply.[53]

Neonicotinoids

Neonicotinoids are a new class of insecticides based on metabolic alterations of nicotine. They are used primarily in agriculture and are gaining widespread use for flea control on domestic animals. They act on the nicotinic *N*-acetylcholine receptors and selectively displace acetylcholine. They do have a relatively selective affinity for insects as opposed to mammals, although there have been a few reports of human poisoning.[54–56] The most commonly used neonicotinoid in the United States is imidacloprid. Information about toxicity and signs and symptoms can be found in Tables 1 and 2.

N-Phenylpyrazoles

Fipronil is the primary representative of this class and was developed in the mid-1990s. It is widely used in flea control on domestic pets. It is also used in ant and roach bait stations, agriculture crops, and lawn treatments. It acts by inhibiting γ-aminobutyric acid–gated chlorine channels. The inhibition will block chloride passage and result in hyperexcitability of the cell.[57–59] Signs and symptoms are reported in Table 2.

HERBICIDES

Chlorophenoxy Herbicides

Chlorophenoxy herbicide compounds are often mixed with fertilizers and are used both in agriculture and on residential lawns. These compounds are well absorbed from the GI tract but are not well absorbed after inhalational or dermal exposure.[60] Examples of commonly used chlorophenoxy herbicides are 2,4-D and 2,4,5-trichlorophenoxy acetic acid. The half-lives of these compounds range between 13 and 39 hours. They are mostly excreted unchanged in the urine; excretion can be greatly enhanced in an alkaline environment.[3,61,62] More toxic substances that can be produced during the manufacture of these herbicides include dioxins, which were contaminants of the herbicide Agent Orange and were found in the Love Canal chemical dump site.[63]

Primary initial effects are on the skin and mucous membranes. Severe poisoning will result in metabolic acidosis and possibly renal failure.[3,61,64] Specific symptoms are discussed in Tables 1 and 2. The compounds can be measured in the urine, although similar to pyrethroid insecticides, analyses are generally performed at specialty laboratories, so results are usually not immediately available to clinicians. Treatment is primarily supportive and may also include forced alkaline diuresis by adding sodium bicarbonate to the fluids and establishing a high urine pH and high urine flow.[3,61,65]

Phosphonate Herbicides (Glyphosate)

Glyphosate is a commonly used herbicide and is commercially available in

many products. Glyphosate acts on the cell wall of plants, so, theoretically, it should have no effect on human cells, at least by way of its primary mechanism of action. Despite this, there are numerous reports in the medical literature of adverse events after human exposure, particularly unintentional ingestions. Patients have presented with signs and symptoms consistent with an aspiration pneumonia–like syndrome, and the offending agent may be the hydrocarbon solvent with which the glyphosate is mixed. Treatment is primarily supportive, and providers should be vigilant for aspiration pneumonia.

RODENTICIDES (LONG-ACTING ANTICOAGULANTS)

Most currently used rodenticides belong to the class of warfarin-type anticoagulants. Unlike warfarin, the superwarfarin agents, such as brodifacoum, have a much longer half-life. Although they have traditionally been available as pellets that can be spread around or in a box that the rat can consume, the EPA has recently changed the type of products that are available to consumers. Since 2008, superwarfarins can only be sold as a child-resistant bait station instead of loose pellets.[66]

The mechanism of action is inhibition of the synthesis of vitamin K–dependent clotting factors. As such, the primary manifestations of toxicity are bleeding and easy bruisability. In severe cases, bleeding may be life-threatening. Clinicians who suspect that their patients may have ingested a superwarfarin should consider obtaining a prothrombin time (PT; also known as the international normalized ratio [INR]).[3] However, several studies that have analyzed cohorts of exposed children have found very few subjects with an elevated PT (INR) or active bleeding. Therefore, in situations in which it is unclear whether a child ingested more than a few pellets, it is reasonable to simply observe the child.[67–70] Most patients can be managed in the outpatient setting as long as the ingestion has been recognized early.[71]

Treatment is vitamin K and should be reserved for patients with elevated PT (INR) levels or active bleeding. With severe bleeding or shock, a transfusion of blood or plasma is indicated as well.[3]

CHRONIC HEALTH EFFECTS OF PESTICIDE EXPOSURE

The health implications of the nonacute, relatively low, but often repetitive and combined exposures encountered routinely by children are an ongoing focus of concern and inquiry for scientists, regulators, and parents.[72,73] Pediatricians are well placed to provide guidance to parents about potential long-term or subtle health effects from pesticide residues on food, in water, or used in homes or schools and on exposure-reduction strategies. However, surveys suggest pediatricians often feel ill-prepared with training in this topic, underscoring the importance of improving educational opportunities for clinical providers.[74–76]

The associated health effects of chronic pesticide exposure in children vary, reflecting the diversity of toxicological properties of this broad group of differing chemicals. Some of the important end points of concern include an increased risk of cancer, abnormal neurodevelopment, asthma, perturbation of gestational growth, and endocrine-mimicking effects. Health effects of pesticides and the current relative strength of the evidence base are reviewed in subsequent sections for each of these health outcomes.

Childhood Cancer

All pesticides undergo in vitro and animal testing to determine their likelihood of causing cancer. The EPA maintains a list and classification of all active ingredients in pesticides and their potential for carcinogenicity. The method of identifying potential carcinogenicity has changed. Before 1996, pesticides were assigned a letter classification (eg, pesticides with the "C" classification were considered "possibly carcinogenic"). Subsequently, pesticides have been assigned a category such as "likely to be carcinogenic to humans," "suggestive evidence of carcinogenic potential," "inadequate evidence," and "not likely." These categories are not directly comparable, so both classifications (before 1996) and categories (after 1996) continue to exist.

The pesticides that are categorized as "possibly carcinogenic" or "likely to be carcinogenic to humans" are available from the EPA via an e-mailed report.[77] Included in this report are some well-known and widely used OPs, carbamates, pyrethroids, and fungicides. Within classes of pesticides, variation in carcinogenicity potential exists. Note that a pesticide, such as cypermethrin, that has "replaced" use of cancer-causing OPs has cancer-causing potential.

A substantial amount of observational epidemiological data demonstrate a link between pesticide exposure and childhood cancers.[78–87] However, the evidence base includes studies that found no association between childhood cancers and pesticides or few associations that cannot be ruled out as a chance finding.[88,89] Overall, the most comprehensive reviews of the existing literature implicate an association of pesticides with leukemia and brain tumors.[78,79]

Leukemia

In 1998, Zahm and Ward[79] reviewed 18 studies assessing the relationship between pesticide exposure and leukemia; 13 studies found an elevated risk, and,

for 6 of those studies, the association was statistically significant. The most frequently occurring associations among the studies were between pesticide exposure and acute lymphocytic leukemia.

A 2007 review by Infante-Rivard and Weichenthal[78] summarized the 1998 review of Zahm and Ward and updated findings from recent studies. Although it was previously postulated that childhood exposure to agricultural products or proximity to an agricultural setting would present the highest risks, the most commonly associated pesticide exposure in childhood acute lymphocytic leukemia studies was household insecticide use. Cases were more likely to have had preconception exposure and/or exposures in utero in most studies. The main limitations with the studies in the 1998 review included crude exposure assessment, concern for recall bias, small numbers of exposed cases, and mixing of different leukemia types.[78]

In the updated review, 5 of 6 recent case-control studies found a statistically significant relationship between pesticide exposure and leukemia.[84,85,90–92] In particular, 2 studies included the most detailed exposure assessment to date and reported findings related to a dose/exposure–response gradient.[84,85] The primary risk factors were maternal exposure to pesticide between the periods of preconception through pregnancy. The largest of the 2 studies had 491 cases and an equal number of controls, focused only on acute lymphocytic leukemia, included a measure of frequency of use, and considered genetic susceptibility. For maternal use of herbicides, plant insecticides, and pesticides for trees during pregnancy, the odds ratio (OR) was 1.84 (95% confidence interval [CI], 1.32–2.57), 1.97 (95% CI, 1.32–2.94), and 1.70 (95% CI, 1.12–3.59), respectively. For parental use during the child's postnatal life, OR was 1.41 (95% CI, 1.06–1.86), 1.82 (95% CI, 1.31–2.52), and 1.41 (95% CI, 1.01–1.97) after exposure to herbicides, plant insecticides, and pesticides for trees, respectively.[84]

To further explore associations between pesticides and leukemia, a group of authors conducted 2 meta-analyses. They provided similar and additional support to the associations described previously. One examined studies that included parental occupational exposure (prenatally and in early childhood) and leukemia in their offspring. Maternal occupational exposure, but not paternal occupational exposure, was found to be associated with leukemia. The reported OR was 2.09 (95% CI, 1.51–2.88) for overall pesticide exposure, 2.38 (95% CI, 1.56–3.62) for insecticide exposure, and 3.62 (95% CI, 1.28–10.3) for herbicide exposure.[93] The second meta-analysis assessed pesticide exposure in the home and garden setting. In this meta-analysis, 15 studies were included, and exposures during pregnancy to unspecified pesticides, insecticides, and herbicides were all associated with leukemia (OR, 1.54 [95% CI, 1.13–2.11], 2.05 [95% CI, 1.80–2.32], and 1.61 [95% CI, 1.2–2.16], respectively).[94]

Brain Tumors

Zahm and Ward's 1998 review included 16 case-control studies examining associations between brain tumors and pesticide exposures. Of these, 12 found an increased risk estimate of brain tumors after pesticide exposure; 7 of these findings reached statistical significance. Associated exposures were most often from parental use of pesticides in the home, in the garden, and on pets. Interpretation of these studies is difficult given the inadequate exposure assessments, small numbers because of a relatively rare childhood outcome, and a mixture of brain tumor types among cases.[79]

Since 1998, 10 additional studies have been published, all but one of which demonstrated an increased risk estimate of cancer with maternal and/or paternal exposure, although not all studies demonstrated statistical significance. Some of the more robust findings come from a case-control study with 321 cases of astrocytomas. The risk estimate from maternal occupational exposure to insecticides before or during pregnancy was 1.9 (95% CI, 1.1–3.3). The risk estimates for paternal exposure for insecticides, herbicides, and fungicides were 1.5, 1.6, and 1.6, respectively. These risk estimates were just short of reaching statistical significance.[87] In a cohort study of more than 200 000 patients, paternal exposure in any occupation and in agricultural/forestry preceding conception was associated with an increased risk of central nervous system tumors (relative risk [RR], 2.36 [95% CI, 1.27–4.39] and RR, 2.12 [95% CI, 1.08–4.39], respectively).[83] For all studies, it appears that prenatal exposure to insecticides, particularly in the household, as well as both maternal and paternal occupational exposure before conception through birth represent the most consistent risk factors.[83,86,87,95–100]

Ewing Sarcoma

Two case-control studies were performed to evaluate potential parental occupational exposures and the development of Ewing sarcoma (ES). One study of 196 cases and matched controls found an association between ES in boys age 15 years or younger and household pesticide extermination (OR, 3.0; 95% CI, 1.1–9.2). There was no association between parental occupational exposure to pesticides and ES.[101] A study in Australia compared 106 cases of either ES or peripheral primitive neuroectodermal tumor with 344 population-based controls. Exposures

included prenatal exposure from conception through pregnancy and also included parental exposures through the time of the child's diagnosis. Notable elevated risks were observed for mothers who worked on farms (OR, 2.3; 95% CI, 0.5–12.0), mothers who handled pesticides (OR, 2.3; 95% CI, 0.6–8.5), patients who ever lived on a farm (OR, 2.0; 95% CI, 1.0–3.9), and farming fathers at the time of conception and/or pregnancy (OR, 3.5; 95% CI, 1.0–11.9).[102] Of note in this study, all 95% CIs include 1.0, so they did not reach statistical significance, although some ORs approached it.

In summary, there is some evidence of increased risk of developing several childhood cancers after preconception and/or prenatal exposure to pesticides. The strongest evidence appears to be for leukemia, which is a relatively more common type of childhood cancer than brain tumors. Maternal exposure to insecticides and paternal occupational exposure appear to carry the greatest risk.

Neurodevelopment/ Neurobehavioral Effects

Many pesticides have well-described acute neurotoxicant properties that have been described previously in this report in relation to human poisoning episodes and acute toxic mechanisms. However, information on the potential neurodevelopmental toxicity arising from chronic, low-level exposure in gestational or postnatal life is inadequate or lacking for most pesticides in use. There is a growing available evidence base supporting an adverse effect on neurodevelopment from 2 classes of insecticides, the organochlorines (specifically DDT and its metabolite *p,p'*-dichlorodiphenyldichloroethylene [DDE]) and, most recently, OPs. Several recent reviews of the evidence base are now available.[103–105]

Although chronic neurologic sequelae after acute OP poisoning have been observed in multiple adult studies, the epidemiological data on children are limited.[106,107] A recent neuropsychological evaluation of healthy school-aged children who had experienced hospitalization for acute OP poisoning before the age of 3 years found subtle but significant deficits in their ability to restrain and control their motor behaviors compared with both children who had no history of poisoning and children who had a history of early life poisoning with kerosene.[108]

Of greater public health concern is the potential neurotoxicity from routinely encountered chronic exposures. This is the subject of study in ongoing, large National Institutes of Health/EPA-sponsored prospective birth cohorts. Studies in 2 urban settings and a rural farmworker community have enrolled women during pregnancy with an objective assessment of exposure by the use of environmental measurements and biological monitoring.[104,109,110] Follow-up assessment of neurodevelopment and neurobehavior in their children with the use of validated tools such as the Brazelton Neonatal Assessment Scales, the Bayley Scales of Infant Development, the Child Behavior Checklist, and IQ testing at comparable intervals is being conducted. To date, remarkably similar findings relating adverse neurodevelopmental and neurobehavioral outcomes associated with prenatal OP exposure have been made in these distinct cohort studies. For example, in 2 cohorts, the Brazelton Neonatal Behavioral Assessment Scale was administered in the first weeks of life. In both, deficits in the primitive reflex domain were noted with the other 6 of 7 Brazelton Neonatal Behavioral Assessment Scale domains not associated with prenatal OP exposure.[111,112] Two of the cohorts have published their Bayley Mental and Psychomotor Developmental Index results conducted during the toddler years (ages 2–3).[113,114] Significantly poorer mental development was associated with higher OP exposure in both, whereas one of the cohorts also observed OP-associated deficits in the motor scale at 3 years of age. Results of Child Behavior Checklist assessments are also available for 2 cohorts, conducted at 2 years of age in one and 3 to 4 years of age in the other. Significantly increased scores representative of pervasive developmental disorder were associated with higher OP exposure in both.[113,114] One cohort also had increased scores for inattention and attention-deficit/hyperactivity disorder subscales.[114] All 3 cohorts have found decrements in IQ testing associated with higher prenatal exposures at the time of follow-up at 7 years of age.[115–117]

In one of the cohorts, postnatal exposure effects in the child have been investigated and reported. Interestingly, improved mental development based on Bayley's Index at 12 and 24 months of age is associated with higher contemporary child excretion of OP urinary metabolites. Explanations for this are debated but include theories that children with higher cognitive abilities may explore their environments more thoroughly and, as such, experience higher exposure.

Recently, a US-based cross-sectional analysis demonstrated that children with high urinary concentrations of OP metabolites were more likely to have a diagnosis of attention-deficit/hyperactivity disorder. This study used data from a representative sample of 8- to 15-year-old children collected as part of the NHANES conducted by the CDC.[118]

One study based in Ecuador has examined the relationship of OP exposure on neurodevelopment in school-aged children.[119] Prenatal exposure (based

on mother occupational history questionnaire) was associated with a decrease on the Stanford-Binet copying test among the study subjects at 7 years of age. Their concurrent exposure (on the basis of OP urinary metabolites) was associated with an increase in simple reaction time.

The toxicological mechanisms that underlie the adverse neurodevelopmental observations are also under investigation. Interestingly, noncholinergic mechanisms are being deciphered in animal models and in vitro studies, distinct from the well-described mechanism of acute OP toxicity (cholinesterase inhibition) and occurring at doses much lower than required to inhibit cholinesterase.[120]

Well-designed recent cohort studies and previous work including animal models suggest that OP exposures that are being experienced by US children may have adverse neurodevelopmental consequences. The plasticity of these effects and clinical implications are as yet unclear, although continued assessments as these cohorts age and enter school age are planned and may add clarity. The potential modification of these effects on the basis of genetic factors, specifically metabolic enzymes involved in pesticide detoxification pathways, are also being explored in these cohorts. For example, preliminary analyses indicate that children with a particular variant of the paraoxonase I gene, which is associated with lower levels of this OP-metabolizing enzyme, may be at higher risk of health consequences from OP exposure.[121,122]

Although DDT has not been used since the early 1970s, its persistence in the environment and fat solubility results in ongoing detection of the parent compound and breakdown product (DDE) in contemporary US populations.[19] The potential adverse neurodevelopmental consequences of prenatal DDT (2 studies) and DDE (several studies) was studied in one of the recent cohorts described previously in this report, which was a predominately Mexican American farmworker population. In this cohort, maternal serum DDT levels were negatively associated with mental development and psychomotor development at 12 and 24 months.[123] Maternal serum DDE was associated with reduced psychomotor development at 6 months and mental development at 24 months. A review of the overall evidence base reveals that studies of in utero DDE exposure and neurodevelopment are mixed, with at least 2 studies showing decrements in psychomotor function. Both of the 2 studies that have evaluated effects of DDT exposure observed cognitive deficits.[103]

In summary, the existing and recently emerging evidence base suggests that organochlorine and OP exposure in early life, particularly prenatally, may have adverse consequences on child neurodevelopment.

Physical Developmental Effects

In addition to neurodevelopmental toxicity, there is also considerable concern of physical developmental toxicity to the embryo and fetus from pesticide exposure. These concerns arise from multiple epidemiological studies that have investigated their relationship to adverse pregnancy outcomes including intrauterine growth retardation, preterm birth, fetal death, and congenital anomalies. The available studies are heterogeneous in design, are conflicting in results, and often have an insufficient exposure assessment. Nonetheless, pesticides remain one of the most common environmental exposures of concern cited in relation to adverse pregnancy outcomes and have been the focus of recent reviews on the topic, which include weight of the evidence evaluations.[124–126]

Among studies that are able to address specific types of pesticide exposures, there are more data focused on the organochlorine and OP insecticides or phenoxy or triazine herbicides. These represent the currently or historically (eg, organochlorine) most heavily used pesticides. This review summarizes the highlights of the existing evidence base with a focus on studies that incorporate direct measures of exposure for individual study subjects.

Fetal Death and Birth Defects

A California-based case-control study found an increased risk of fetal death attributable to congenital anomalies when OP application occurred in the residential area of the mother during weeks 3 through 8 of pregnancy—consistent with organogenesis.[127] One other study found an elevated risk of spontaneous abortion associated with chlorophenoxy herbicides. However, as with some studies of birth defects discussed previously, this study also relied on self-report and less reliable means of exposure assessment.[128] Results are not consistent, because other studies have not found association of parental exposure to OPs with spontaneous abortion or stillbirth.[129–131]

Birth defects will be discussed first, followed by other adverse birth outcomes. The more common birth defects include orofacial clefts, limb defects, and neural tube defects, which are generally the defects studied in relationship to pesticide exposures. Although several studies have found associations of maternal or paternal exposures with a wide variety of birth defect categories, all of the studies used indirect measures of exposure and most were ecological study designs, making interpretation of the adverse birth outcome evidence base inadequate and unreliable.[125]

A 1995 review article discussed the available evidence for associations between birth defects and potential

pesticide exposure.[132] Five studies were included that assessed various birth defects (central nervous system, oral cleft, limb defects) compared with maternal agricultural occupation. Four of those 5 reported an elevated RR or an OR ranging from 1.6 to 5.0; however, only 2 were statistically significant.[133–137] Of note, in these studies, there was not an assessment to any single pesticide; rather, the "exposure" was maternal occupation.

Six additional studies from this period evaluated maternal pesticide exposure at work and the development of birth defects. Of the 5 studies with an elevated OR or RR, ranging from 1.3 to 7.5,[138–142] 3 were statistically significant. Unfortunately, some of these studies included small numbers of cases, and others were likely to have significant exposure misclassification. The conclusion of this review was that there are some indications of elevated risk but no clearly convincing evidence.[143]

Two studies from Minnesota have reported a relationship between physical defects in children and paternal occupation of pesticide applicator. The first study compared data from a birth registry between 1989 and 1992. A geographic section of Minnesota that had the highest agriculture activity and highest frequency of use of chlorophenoxy herbicides and fungicides was also found to have the highest rate of birth defects (30.0/1000). By comparison, the general population in this same region had a birth defect rate of 26.9/1000. Interestingly, there was a seasonal effect, with the highest frequency occurring in infants who were conceived in the spring, the same time as most herbicide and some fungicide application (OR, 1.36; CI, 1.10–1.69).[144] The second study is a cross-sectional study that used a survey of licensed applicators and subsequently more in-depth interviews of either/both the applicator and female partners of licensed applicators when possible. The study eventually included live births fathered by 536 applicators. The birth defect rate in this study was 31.3/1000, which is statistically significantly higher than what the previous study found for the general population. Again, there was a significant difference in season of conception (7.6% in spring versus 3.7% in other seasons).[145]

Studies of birth defects often include all types within the analysis because of insufficient numbers of individual defects to allow adequate power of statistical analyses. A meta-analysis used 19 studies that had sufficient data to be included to estimate the effects of pesticides on orofacial clefting. Maternal occupational exposure to pesticides was associated with orofacial clefts (OR, 1.37; 95% CI, 1.04–1.81). There was a weaker association for paternal occupation (OR, 1.16; 95% CI, 0.94–1.44).[146] Studies on 3 other birth defects—cryptorchidism, hypospadias, and polythelia—will be discussed in the section on endocrine effects.

In summary, a small risk elevation is noted for birth defects and pesticide exposure, but the findings are not robust, and the data specific to pesticide subtypes are not adequate.

Adverse Birth Outcomes (Low Birth Weight, Decreased Gestational Age)

DDT (and its major metabolite DDE) is the organochlorine that has been most extensively examined in relation to birth defects, fetal death, and fetal growth, with mixed findings. Fetal exposures, as determined by maternal serum or umbilical cord blood levels, have been associated with preterm birth, decreased birth weight, and intrauterine growth retardation.[147–151] However, not all studies reported significant associations between exposure with infant birth weight or preterm birth, including a relatively recent study of Mexican American farmworking women in the United States with higher exposures in comparison with a similar group of a national sample of nonfarmworking Mexican American women.[142,152] In the largest cohort study to date (a US cohort of births between 1959 and 1966), DDE concentrations in maternal serum during pregnancy demonstrated a dose–response relationship to risk of preterm delivery and delivering small for gestational age (SGA) infants.[147]

Exposure to pesticides is associated with risk of decreased birth weight. In a study conducted before recent regulatory actions that reduced their residential use, exposure to the OPs chlorpyrifos and diazinon were associated with decreased birth weight in a New York City cohort.[110] In another New York City cohort, birth weight was reduced among mothers with higher OP exposure levels in pregnancy, but only among those with a genetic polymorphism of an OP detoxification enzyme (paraoxonase 1 or PON1).[150] In a similar longitudinal pregnancy cohort conducted among Latina farmworkers in agricultural California, no association of maternal pregnancy exposure to OPs and birth weight was determined, but a reduction in gestational age was associated.[153]

An ecological study determined that women in a rural region of Iowa with increased levels of triazine, metolachlor, and cyanazine herbicides in the drinking water had an elevated risk of delivering an infant with intrauterine growth retardation compared with women in other parts of the state.[154] A study based in France reported that atrazine levels in municipal drinking water throughout pregnancy were not associated with increased risk of delivering an SGA infant but that the

risk of delivering an SGA infant increased when the third trimester occurred in whole or in part during the period of May through September, when atrazine levels typically peak.[155]

Summary: Physical Developmental Defects

In summary, the true extent and nature of pesticide exposure on adverse fetal growth and birth outcomes is unknown despite suggestive epidemiological studies that link some of the most widely used pesticides to reduced intrauterine growth, fetal death, preterm birth, and congenital anomalies. Very little is known about many pesticide types in current use, including synthetic pyrethroids and carbamate insecticides, rodenticides, and fungicides. Studies that examine the timing and extent of exposure to pesticides and exposure to pesticide mixtures with validated exposure assessment techniques including biological markers are needed. The potential for differential vulnerabilities because of genetic polymorphisms that influence the toxicological properties of these exposures must also be explored.

ENDOCRINE EFFECTS

An emerging concern, although less well studied in humans, is the potential effects that some chemicals including pesticides may have on the endocrine system. Some of the most notable pesticides thought to have such effects are the organochlorine pesticides, such as DDT, endosulfan, methoxychlor, chlordecone, chlordane, and dieldrin. Other herbicides (atrazine, 2,4-D, and glyphosate) and fungicides (vinclozolin) also have some endocrine activity.[156–159] The associations are very complex and are primarily based on in vitro and animal studies. Estrogen-mimicking properties tend to be the most commonly reported, although effects on androgen and thyroid hormones, among others, are also reported. Feminization has been noted in alligators found in lakes highly contaminated by organochlorine pesticides.[160] Hayes et al[161] have studied the effects of atrazine on amphibians and have noted a 10-fold decrease in testosterone from exposure to 25 ppb of atrazine in mature male frogs. The mechanism of the latter appears to be activation of the enzyme aromatase, which promotes conversion of testosterone to estrogen.[162]

The human epidemiology literature is limited on endocrine effects from pesticides. One report from Macedonia noted some degree of early pubertal findings, primarily premature thelarche, which was hypothesized to be related to organochlorine pesticide exposure.[163] A study in 2000 with 48 patients, 18 of which had cryptorchidism, first raised the hypothesis about an association with organochlorine pesticides. An association between cryptorchidism and organochlorine pesticide levels has been hypothesized.[164] Since then, additional case-control studies have been conducted to examine the effects of organochlorines on endocrine-related birth outcomes, cryptorchidism, hypospadias, and/or polythelia. Two focused on fetal exposures from maternal levels of DDE alone and development of cryptorchidism and hypospadias.[165,166] Bhatia et al[165] calculated an OR of 1.34 (95% CI, 0.51–3.48) for the association of cryptorchidism and DDE and 1.18 (95% CI, 0.46–3.02) for the association of hypospadias and DDE. Longnecker et al[166] estimated an OR of 1.3 (95% CI, 0.6–2.4) for the association between DDE and cryptorchidism and an OR of 1.2 (95% CI, 0.6–2.4) the association between DDE and hypospadias. The modest association is felt to be inconclusive with the imprecision in risk estimates and suggests that a larger sample size may be needed. A third case-control study found inconclusive results on the effect of heptachlor and β-hexachlorocyclohexane levels in pregnant women on cryptorchidism. For heptachlor, the OR was 1.2 (95% CI, 0.6–2.6), and for β-hexachlorocyclohexane, the OR was 1.6 (95% CI, 0.7–3.6). The sample size in this study was 219 cases, compared with 564 controls.[167]

Two nested case-control studies have examined the possibility that multiple organochlorine compounds will have a cumulative effect on the development of urogenital abnormalities in boys.[168,169] Fernandez et al[168] reported that total xenoestrogens as well as detectable pesticide levels were associated with cryptorchidism and/or hypospadias. They found elevated ORs in the range of 2.19 for endosulfan to 3.38 for lindane. All 95% CIs were noted to be statistically significant. The study in Finland and Denmark reported a significant relationship between chlordane and cryptorchidism but no other relationships between 7 other individual organochlorines. However, combined analysis of the 8 persistent pesticides did demonstrate a statistically significant increase in cryptorchidism in exposed boys.[169]

Testing chemicals is an important and necessary step for the EPA to determine potential long-term risks from pesticide during the registration or re-registration process. There has been progress in the development of appropriate biomarkers to evaluate chemicals for the presence of endocrine-disruption qualities. The ability to measure DDE and dioxins from human milk has been developed.[170] More recently, a biomarker for xenoestrogen mixtures was developed in Spain.[171]

In summary, there is compelling basic science evidence for endocrine-mimicking effects of several pesticide chemicals that is sound and scientifically plausible. Human data

are slowly emerging but not yet conclusive.[172]

Asthma

Given the widespread use of pesticides and the high morbidity of asthma in children, questions have been raised regarding pesticides as triggers as well as risk factors for incident disease. Concern is raised by a mounting adult occupational literature associating pesticides with asthma or other measures of respiratory health. In addition, preliminary toxicological data provide mechanisms that link pesticides and asthma. An important limitation of most epidemiological studies to date is the lack of exposure specificity regarding pesticide chemicals or chemical classes. In addition, studies regarding children are few.

There is indirect evidence that pesticides skew the immune response toward the T helper 2 (Th2) phenotype associated with atopic disease. The National Institutes of Health/EPA-sponsored rural birth cohort described above regarding evaluation of neurodevelopmental effects has also observed that maternal agricultural work was associated with a 26% increase in proportion of Th2 cells in their 24-month-old infants' blood samples.[173] The percentage of Th2 cells was associated with both physician-diagnosed asthma and maternal report of wheeze in these infants. This population of largely Mexican American farmworkers was selected for study on the basis of the relatively high use of OP pesticides in this agricultural area.

Animal-based toxicological mechanistic models include OP-induced airway hyperreactivity via alteration in muscarinic receptor function in airway smooth muscle and oxidative stress induced by OP-related lipid peroxidation.[174–177]

The few epidemiological data on pesticides and respiratory health in children have mixed results. In a cohort of rural Iowan children, any pesticide use indoors or any outdoor use in the previous year was not significantly associated with asthma symptoms and prevalence.[178] Contrarily, a cross-sectional analysis of Lebanese children identified increased risk of chronic respiratory symptoms, including wheeze, among those with any pesticide exposure in the home, exposure related to parent's occupation, and use outside the home. The highest risk was observed for children whose parents had occupational exposure to pesticides (OR, 4.61; 95% CI, 2.06–10.29).[179] However, given this study's cross-sectional design, it is not possible to discern whether the pesticide exposure preceded the diagnosis of asthma.

Among exposures in the first year of life explored in a nested case-control study of the Southern California Children's Health Study, both herbicides and pesticides/insecticides had a strong association with asthma diagnosis before 5 years of age (OR, 4.58 [95% CI, 1.36–15.43] and OR, 2.39 [95% CI, 1.17–4.89], respectively).[180]

More published data are available regarding adult farmers and adult rural residents. These studies more consistently support a link between pesticides and respiratory symptoms or chronic respiratory disease, such as asthma.[181,182] For example, use of multiple individual pesticides was evaluated in relation to self-reported episodes of wheeze in the previous year in a large cohort of commercial pesticide applicators (adults) and farmers enrolled in the Agricultural Health Study.[182] Among the pesticides classes, several OPs showed associations with wheeze, including several that demonstrated a dose–response trend. Chlorpyrifos, malathion, and parathion were positively associated with wheeze among the farmers; for the commercial applicators, the OPs chlorpyrifos, dichlorvos, and phorate were positively associated with wheeze. Among commercial applicators, the strongest OR was for applying chlorpyrifos on more than 40 days per year (OR, 2.40; 95% CI, 1.24–4.65). Elevated risk for wheeze related to herbicide use was almost exclusively associated with chlorimuron-ethyl (urea-derivative class).

Similar studies addressing the respiratory health implications for children for specific pesticide chemical types or groups are rare. However, for DDT, there is some emerging evidence for a link between metabolites of DDT and asthma risk.[183,184] In a prospective cohort study of children in Spain, wheezing at 4 years of age increased with increasing levels of DDE at birth. The adjusted RR for the children with exposure in the highest quartile was 2.63 (95% CI, 1.19–4.69). The use of physician-diagnosed asthma (occurring in 1.9% of children) instead of wheezing as the outcome variable also resulted in a positive association, although it was not statistically significant.[184]

In summary, the available data regarding chronic exposure to pesticides and children's respiratory health remain limited. Studies that incorporate pesticide-specific exposure assessment and markers of biological mechanisms and consider the influence of timing of exposure across the life span are needed.

THE PESTICIDE LABEL

Pesticides for sale or use in the United States must be registered with the EPA, and this includes approval of the product label, which contains the EPA registration number. The pesticide label contains several types of information that may be important in understanding and preventing acute health consequences associated with their use.[185]

The product label identifies the active ingredient and provides the manufacturer's

contact information. The label does not specify the particular class of pesticide for the active ingredient, which may make it difficult for a physician to identify potential toxic effects. Information about "other" or "inert" ingredients, which may account for up to 99% of the product, is not required to be disclosed on the label. These constituents include chemicals with known toxicity. The physician treating a patient may request this from the manufacturer; however, delay in information may compromise optimal clinical care. The local or regional poison control center plays an important role as a resource for any suspected pesticide poisoning. The EPA is currently considering rulemaking changes that would expand the disclosure of information on inert ingredients. One of the options under consideration includes labeling 100% of the ingredients.[186]

The "directions for use" section on the label explains when, how, and where the pesticide may be applied. The label is considered the law; therefore, any use of the product in a manner inconsistent with the label is a violation of the Federal Insecticide, Fungicide, and Rodenticide Act (Pub L No. 80-104).[187] Information on recommended storage of the product and disposal of the container is also printed on the label.

The label will contain a signal word and symbol to identify acute toxicity potential: "danger" along with the word poison and the skull and crossbones symbol signifies high acute toxicity; "warning" signifies moderate acute toxicity; and "caution" represents slight acute toxicity. There is a section for precautionary statements regarding the potential hazards to people or pets and the actions that can be taken to reduce these hazards, such as wearing gloves or other protective equipment. Basic first aid advice for responding to dermal, inhalational, and/or oral exposure is provided. Some labels contain a "note for physicians" that includes specific medical information. The label does not provide any information or warnings about the potential for chronic toxicity arising from normal use or misuse of the pesticide. An example of an interactive pesticide label can be found at the EPA Web site.[188] It includes "pop-up" features that define each of the components on the pesticide label.

STATE OF PESTICIDE KNOWLEDGE AMONG PEDIATRICIANS

Self-reported medical education and self-efficacy suggests pediatricians are not well prepared to identify pesticide exposure and illness, including taking a relevant environmental history or discussing pesticide risks with their patients.[189–191] Even in agricultural areas of the Pacific Northwest, where pesticide use is heavy, a survey of health care providers who serve high volumes of agricultural farmworkers and their families found that 61% did not feel comfortable responding to patient/client questions regarding pesticides on the basis of their training, background, and experience.[75] Among academic pediatricians with an interest in pediatric environmental health, pesticides were among the topics they felt least prepared to teach to their trainees.[192] Given the widespread use of pesticides and concerns for child health, opportunities to increase pesticide competency in pediatric medical education are likely to prevent missed diagnoses and reduce exposure because of improved anticipatory guidance.

Clinicians must have a high index of suspicion to identify pesticide poisoning. Identification and treatment of acute pesticide poisoning requires familiarity with the toxic mechanisms and related signs and symptoms of the pesticide classes. For example, when evaluating a patient with status epilepticus or mental status changes, certain insecticides belong in the differential among the numerous and more common etiologies. Eliciting an environmental history will help decipher the relative importance of pesticides in further clinical decision-making. The environmental history is a general tool for addressing potentially hazardous environmental exposures and is discussed in detail in the Pediatric Environmental Health manual from the AAP.[193]

EFFORTS TO REDUCE PESTICIDE EXPOSURE

Dietary Considerations

Dietary modifications can help reduce pesticide exposure. As mentioned previously, consuming organic produce has shown a reduced amount of urinary pesticide levels in comparison with a conventional diet.[22] Because many food-based pesticide residues occur on the surface of food crops, other practical approaches may be used to reduce exposures by washing produce, peeling off outer layers of leafy vegetables, and removing peels from fruits and vegetables. Trimming fat from meat and fat and skin from poultry and fish may reduce residues of persistent pesticides, such as the organochlorines, that concentrate in animal fat.

Efforts to address and reduce chronic pesticide exposure via the food supply in children have included regulatory approaches that consider the unique vulnerability of the developing child in policy decision-making. For example, the 1996 Food Quality Protection Act (Pub L No. 104-170, Section 405) required that the EPA use an additional 10-fold margin of safety regarding limits of pesticide residues on food (unless there are data that show a less stringent residue level is safe for

prenatal and postnatal development; for description, see http://www.epa.gov/opp00001/factsheets/riskassess.htm).

Integrated Pest Management

In addition to food residues, use of pesticides in and around the home and other settings where children spend time (child care, school, and playgrounds and sports fields) is an important influence on the chronic and cumulative exposure to pesticides among US children. Most of the pest problems that occur indoors as well as control of lawn and garden pests can be addressed with least toxic approaches, including integrated pest management (IPM) techniques. IPM focuses on nontoxic and least toxic control methods to address pest problems have been promoted and adopted for residential, school, and agricultural settings (fact sheets available at http://www.epa.gov/opp00001/factsheets/ipm.htm).

"Integrated" refers to employment of complementary strategies of pest control, which may include mechanical devices; physical devices; genetic, biological, and cultural management; and chemical management. For example, to control cockroaches, a family could be counseled to keep garbage and trash in containers with well-fitted lids, eliminate plumbing leaks or other sources of moisture, store food in insect-proof containers, vacuum cracks and crevices, clean up spills immediately, and use the least-toxic insecticides, such as boric acid, in cracks and crevices or bait stations. The goal is to target the pest and limit the effect on other organisms and the environment. Although developed with a focus on agricultural insect pests, IPM programs and knowledge have extended to address weeds and pest control in residential settings and schools, commercial structures, lawn and turf, and community gardens.

Within agriculture, IPM has been recognized and promoted for decades; however, inadequate leadership, coordination, and management of US Department of Agriculture IPM programs were identified as impediments to adequate progress in a 2001 report.[194] The report provided the basis for an ongoing national roadmap effort to improve ongoing development of increased IPM in agriculture.

To protect children, IPM in schools has been recommended by the US Department of Agriculture, EPA, American Public Health Association, and National Parent Teacher Association. Many states and local municipalities have adopted programs and resources to encourage IPM in public places, in addition to homes and schools (see Table 3). IPM strategies seek to minimize insecticide use by applying strategies such as cleaning up food and water, sealing cracks and crevices, and using pesticides that are contained in baits or traps, which are far less likely to pose a health concern compared with any type of broadcast spray application. Avoiding combination products with pesticides and fertilizers (ie, "weed and feed" preparations) is advised for lawn maintenance, because these tend to result in overapplication of pesticides. Hand weeding is always a reasonable alternative to herbicides. However, if an herbicide is to be used, some (such as glyphosate) have better acute human toxicity profiles than others (such as 2,4-D). Even so, glyphosate is not without its risks. Most cases of moderate to severe toxicity have occurred after intentional (suicidal) ingestion.[195] Using safe storage practices (in a locked cabinet or building) and not reusing pesticide containers are important components toward the prevention of acute poisonings after unintentional ingestion by small children. Reliable resources for useful information on pest-control alternatives and safe use of pesticides are available from the EPA and University of California-Davis (Table 3).

Spraying in the Community: Right to Know

Although there is no federal mandate for notification of pesticide use in communities, many states, locales, or schools have implemented requirements for posting warning signs or developing registries to alert individuals of planned pesticide application (see Table 3). These are designed to allow the public to make decisions to avoid exposures during application or soon after from residues. Other local policies that have been developed include restricting spray zones that create buffers from schools or other areas or restrict specific types of pesticide products in schools. Pediatricians can play a role in the promotion of development of model programs and practices in the communities and schools of their patients. For example, in some communities, pediatricians have participated in local organizations that have successfully advocated for no pesticide application in schools.

SUMMARY

Pesticides are a complex group of chemicals with a wide range of acute and chronic toxicity. Poison control centers report lower rates of more severe poisonings but continue to report similar total numbers of acute exposures among children. There is a growing body of literature that suggests that pesticides may induce chronic health complications in children, including neurodevelopmental or behavioral problems, birth defects, asthma, and cancer. Pediatricians are a trusted source of information for families and communities, although current training focused on pesticide toxicity and environmental health, in

TABLE 3 Pesticide and Child Health Resources for the Pediatrician

Management of Acute Pesticide Poisoning		
Recognition and Management of Pesticide Poisonings		Print: fifth (1999) is available in Spanish, English (6th edition available 2013) http://www.epa.gov/pesticides/safety/healthcare/handbook/handbook.htm
Regional Poison Control Centers		1-800-222-1222
Chronic Exposure Information/Specialty Consultation		
The National Pesticide Medical Monitoring Program (NPMMP)	Cooperative agreement between Oregon State University and the EPA NPMMP provides informational assistance by e-mail in the assessment of human exposure to pesticides	npmmp@oregonstate.edu or by fax at 541-737-9047
Pediatric Environmental Health Specialty Units (PEHSUs)	Coordinated by the Association of Occupational and Environmental Clinics to provide regional academically based free consultation for health care providers	http://www.aoec.org/PEHSU.htm Toll-free telephone number 888-347-AOEC (2632)
Resources for Safer Approaches to Pest Control		
EPA	Consumer information documents	http://www.epa.gov/oppfead1/Publications/Cit_Guide/citguide.pdf
Citizens Guide to Pest Control and Pesticide Safety	• Household pest control • Alternatives to chemical pesticides • How to choose pesticides • How to use, store, and dispose of them safely • How to prevent pesticide poisoning • How to choose a pest-control company	
Controlling pests	Recommended safest approaches and examples of programs	http://www.epa.gov/pesticides/controlling/index.htm
The University of California Integrative Pest Management Program	Information on IPM approaches for common home and garden pests	http://www.ipm.ucdavis.edu
Other Resources		
National research programs addressing children's health and pesticides	NIEHS/EPA Centers for Children's Environmental Health & Disease Prevention Research The National Children's Study	www.niehs.nih.gov/research/supported/centers/prevention www.nationalchildrensstudy.gov/Pages/default.aspx
EPA	Pesticide product labels	www.epa.gov/pesticides/regulating/labels/product-labels.htm#projects
The National Library of Medicine "Tox Town"	Section on pesticides that includes a comprehensive and well-organized list of Web link resources on pesticides	http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=23

NIEHS, National Institute of Environmental Health Sciences.

general, is limited. Pediatricians should be familiar with the common pesticide types, signs and symptoms of acute toxicity, and chronic health implications. Efforts should be made to limit children's exposure as much as possible and to ensure that products released to the marketplace have been appropriately tested for safety to protect fetuses, infants, and children from adverse effects.

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CLINICAL REPORT

Psychological Maltreatment

abstract

FREE

Psychological or emotional maltreatment of children may be the most challenging and prevalent form of child abuse and neglect. Caregiver behaviors include acts of omission (ignoring need for social interactions) or commission (spurning, terrorizing); may be verbal or nonverbal, active or passive, and with or without intent to harm; and negatively affect the child's cognitive, social, emotional, and/or physical development. Psychological maltreatment has been linked with disorders of attachment, developmental and educational problems, socialization problems, disruptive behavior, and later psychopathology. Although no evidence-based interventions that can prevent psychological maltreatment have been identified to date, it is possible that interventions shown to be effective in reducing overall types of child maltreatment, such as the Nurse Family Partnership, may have a role to play. Furthermore, prevention before occurrence will require both the use of universal interventions aimed at promoting the type of parenting that is now recognized to be necessary for optimal child development, alongside the use of targeted interventions directed at improving parental sensitivity to a child's cues during infancy and later parent-child interactions. Intervention should, first and foremost, focus on a thorough assessment and ensuring the child's safety. Potentially effective treatments include cognitive behavioral parenting programs and other psychotherapeutic interventions. The high prevalence of psychological abuse in advanced Western societies, along with the serious consequences, point to the importance of effective management. Pediatricians should be alert to the occurrence of psychological maltreatment and identify ways to support families who have risk indicators for, or evidence of, this problem. *Pediatrics* 2012;130:372–378

INTRODUCTION

Psychological or emotional maltreatment of children and adolescents may be the most challenging and prevalent form of child abuse and neglect, but until recently, it has received relatively little attention. The American Academy of Pediatrics (AAP) reviewed the topic in a technical report in 2002.[1] This clinical report updates the pediatrician on current knowledge and approaches to psychological maltreatment, with guidance on its identification and effective methods of prevention and treatments/intervention.

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KEY WORDS

psychological maltreatment, child abuse, emotional maltreatment, neglect, verbal abuse, development

ABBREVIATIONS

AAP—American Academy of Pediatrics
NFP—nurse family partnership

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DEFINITION

There is no universally agreed definition of psychological maltreatment or emotional maltreatment, terms that are often used interchangeably. Psychological maltreatment encompasses both the cognitive and affective components of maltreatment.[2] One of the difficulties in clearly defining what such maltreatment comprises involves the absence of a strong societal consensus on the distinction between psychological maltreatment and suboptimal parenting.[3] Exposure to psychological maltreatment is considered when acts of omission or commission inflict harm on the child's well-being, which may then be manifested as emotional distress or maladaptive behavior in the child. Psychological maltreatment is difficult to identify, in part because such maltreatment involves "a relationship between the parent and the child rather than an event or a series of repeated events occurring within the parent-child relationship."[4] Isolated incidents of behaviors identified in Table 1 do not necessarily constitute psychological abuse. Psychological maltreatment refers to a repeated pattern of parental behavior that is likely to be interpreted by a child that he or she is unloved, unwanted, or serves only instrumental purposes and/or that severely undermines the child's development and socialization.[4] Recent conceptualization[5] of psychological maltreatment focuses on the caregiver's behaviors as opposed to the disturbed behaviors in the child. Such behaviors of the caregiver include acts of omission (ignoring the need for social interaction) or commission (spurning, terrorizing); may be verbal or nonverbal, active or passive, and with or without intent to harm; and negatively affect the child's cognitive, social, emotional, and/or physical development. Table 1 summarizes the different types of psychologically abusive caregivers' behaviors across 6 main categories.[2,5]

Although the psychological components of any form of child maltreatment are key to understanding its effects, psychological maltreatment is often not recognized when other forms of maltreatment coexist.[3] When psychological maltreatment occurs alone, it can be even harder to identify, and opportunities for intervention may be missed. This form of child maltreatment is possibly the most underreported to authorities.[3,6]

TABLE 1 Types of Psychologically Abusive Behaviors by Caregivers

Spurning	• Belittling, denigrating, or other rejecting • Ridiculing for showing normal emotions • Singling out or humiliating in public
Terrorizing	• Placing in unpredictable/chaotic circumstances • Placing in recognizably dangerous situations • Having rigid/unrealistic expectations accompanied by threats if not met • Threatening/perpetrating violence against child or child's loved ones/objects
Isolating	• Confining within environment • Restricting social interactions in community
Exploiting/Corrupting	• Modeling, permitting, or encouraging antisocial or developmentally inappropriate behavior • Restricting/undermining psychological autonomy • Restricting/interfering with cognitive development
Denying emotional responsiveness	• Being detached or uninvolved; interacting only when necessary • Providing little or no warmth, nurturing, praise during any developmental period in childhood
Mental health/medical/educational neglect	• Limiting a child's access to necessary health care because of reasons other than inadequate resources • Refusing to provide for serious emotional/behavioral, physical health, or educational needs

Adapted from Hart et al[2] and Brassard et al.[5]

DISTRIBUTION OF PSYCHOLOGICAL MALTREATMENT

A recent review of the burden and consequences of psychological abuse concluded that, although there were few studies reporting its prevalence, a number of large population-based, self-report studies in the United Kingdom and United States found that approximately 8% to 9% of women and 4% of men reported exposure to severe psychological abuse during childhood.[7] This review found even higher rates reported in Eastern Europe. A number of US surveys found that psychological and emotional maltreatment were the most frequently self-reported forms of victimization.[8]

DETERMINANTS OF PSYCHOLOGICAL MALTREATMENT

Although it is recognized that psychological maltreatment occurs in a wide range of families, it is more often associated with multiple family stresses[9] and, in particular, with factors such as family conflict, adult mental health problems, and parental substance abuse[10] that may be co-occurring.[11] For example, some parental mental health problems are associated with unpredictable and frightening behaviors, and others (particularly depression) are linked with parental withdrawal and neglect.[12,13] Similarly, in terms of family conflict, attacks on a parent almost always frighten a child, even if the child is not the direct target. Threats or actual violence as part of a pattern of aggression against one parent will sometimes exploit the other parent's or child's fears.[14,15] Children exposed to violence in the home are at disproportionate risk of injury,

eating disorders, and self-harm,[16] even when they are not themselves victims of physical violence. The AAP statement "Intimate Partner Violence: The Role of the Pediatrician" deals with how such issues should be addressed.[17] Although there is a paucity of literature specifically addressing the issue of parental substance abuse and psychological maltreatment,[18] substance abuse on the part of one or both parents is associated with high rates of child maltreatment.[19,20]

ASSOCIATED IMPAIRMENT

Precisely because it interferes with a child's developmental trajectory, psychological maltreatment has been linked with disorders of attachment, developmental and educational problems, socialization problems, and disruptive behavior.[21,22] Research involving institutionalized Romanian orphans demonstrated the effects of severe emotional and sensory deprivation on later IQ, executive function and memory, psychological processing, attachment, and psychiatric disorders.[23,24] The effects of psychological maltreatment during the first 3 years of life can be particularly profound, because rapid and extensive growth of the brain and biological systems takes place during this period, and this growth is significantly influenced by the young child's environment and, in particular, the early parenting that he or she receives.[25] Psychological maltreatment also negatively affects the organization of the child's attachment to important adults in his or her life.[26,27] Longitudinal studies have shown that impairment in security of attachment is associated with a range of later problems,[27] because early parenting plays a significant role in influencing children's beliefs about themselves (ie, in terms of the extent to which they are lovable) and about themselves in relation to other people (ie, when they have needs, people will respond appropriately to them). The research suggests that these internalized beliefs can affect children's later cognitive schemas and, thereby, their psychological adjustment.[28]

Psychological maltreatment in early childhood is also associated with insecure attachment in adulthood.[29] A recent overview of the evidence found that as the child grows older, such attachment problems interfere with a number of aspects of later functioning, including peer relations, intimacy, caregiving and caretaking, sexual functioning, conflict resolution, and relational aggression.[29] The findings from longitudinal[30] and retrospective[28] studies also suggest a strong association with psychiatric morbidity. For example, one longitudinal study found that psychological unavailability and neglect in early childhood were associated with increased social problems, delinquency, aggression, and attempted suicide in adolescents and also that most psychologically abused children received at least 1 diagnosis of mental illness, with three-quarters having comorbid conditions for 2 or more disorders. Factors that may influence the effects of the abuse include early caregiving experiences; frequency, intensity, and duration of the abuse; factors intrinsic to the child, such as behavioral and coping strategies, self-esteem, and disposition; and the availability of supportive relationships.[31] For example, although the evidence does not relate specifically to psychological maltreatment, 1 study found that boys who experienced abuse that started before 12 years of age had more serious problems (eg, arrests and severity of delinquency) compared with boys who were abused after 12 years of age.[32] Without intervention, the cycle of abuse is often repeated in the next generation.[29]

Psychological maltreatment carries a significant burden for society, as can be seen in its effects on the health and social care systems,[33] such as the costs of educational failure, crime, and health services as a result of poor mental health.

ASSESSMENT

Psychological maltreatment poses a real challenge to pediatricians dedicated to ensuring the health and well-being of children. Pediatricians need to be alert to the possibility of psychological maltreatment and consider such exposure in any assessment of psychological and behavioral conditions in childhood. Just as history about a psychological or behavioral problem should be obtained from multiple informants whenever possible, this is also the case when considering whether a child is being exposed to psychological maltreatment. Much emphasis has been placed on appropriate skills for interviewing children about sexual abuse, but it is also important to develop approaches for asking children about their relationships with caregivers, experiences of discipline (some psychological maltreatment occurs in this context), and feelings of self-worth, safety, and being loved. Once it is possible to interview a child from a developmental standpoint and the pediatrician is comfortable doing so, an individual interview with the child becomes important for assessment of any concerns of major psychological or behavioral problems. Even very young children, once they are speaking in sentences, can often provide this information. It is important to interview children alone, away from their caregivers, because they may be experiencing maltreatment from the very caregivers who accompanied them to an appointment. The AAP resources, Bright Futures[34] and Addressing Mental Health Concerns in Primary Care, A Clinician's Toolkit[35] provide guidance

that may be helpful in approaching these issues. The pediatrician needs to be aware of risk indicators for psychological maltreatment, such as parental psychiatric illness, including depression and substance abuse, among others. It is also important to be aware of the psychological maltreatment that can accompany exposure to intimate partner violence, although this is considered a separate type of maltreatment and is the focus of a previous AAP report as outlined above.[17] For children of all ages, major caregivers need to be interviewed (this should be performed individually to ensure the parent's safety when asking about such issues as intimate partner violence), and information should be gathered from teachers or child care personnel. Even brief telephone contact with school or child care personnel can be helpful in assessing a child's exposure to psychological maltreatment. Because this can be time consuming, ideally, the task of obtaining this information can be shared with another member of the pediatrician's office staff. Consultation with a pediatrician who has expertise in assessing child maltreatment or a mental health professional may assist the pediatrician in completing an assessment and plan.

Although there are no specific physical indicators for psychological maltreatment, it is essential to assess a child's growth and development, because these can be impaired in association with exposure to psychological maltreatment. The extent of impairment can vary; severe forms of psychological deprivation can be associated with psychosocial short stature, a condition of short stature or growth failure formerly known as psychosocial dwarfism.[36] Observing a child and parent(s) together can provide valuable information about the quality of their relationship and ability of a parent to respond to a child, although appropriate behavior by a parent in the context of a brief office visit does not rule out the possibility that a child is experiencing psychological maltreatment. Conversely, a single interaction that is of concern between a parent and child is generally not diagnostic of psychological maltreatment. Close clinical follow-up may be needed to clarify any issues of concern.

As outlined in the earlier technical report on this topic,[1] reporting of psychological maltreatment can be difficult. In some jurisdictions, clear indication of impairment in growth and/or development may be necessary for a child protective services agency to accept a report; detailed documentation is essential in such situations. It is important that the pediatrician record specific statements from the child, the family, and other sources and that the pediatrician is systematic in assessing the child's behavioral, psychological, and physical status in relation to the baseline assessment. For example, the pediatrician who has been providing general pediatric care to a child whose parents become involved in an extremely contentious custody/access dispute can alert the parents to the potential for the child to experience psychological trauma and can be aware of early indicators of impairment in the child. If identification for the parents of a child being exposed to potential psychological maltreatment does not lead to improvement in parenting behavior, the pediatrician can then make referrals to such services as mediation, mental health services, or child protective services. Careful follow-up is very important, because parents who are psychologically abusive may not be reliable in providing information about their child's functioning or their own response to intervention.

PREVENTION

The potential for major impairment associated with psychological maltreatment during the early years of life underscores the importance of identifying approach to intervention in infancy and toddlerhood. Prevention before occurrence involves both the use of universal interventions aimed at promoting the type of parenting that is now recognized to be necessary for optimal child development, alongside the use of targeted interventions directed at improving parental sensitivity to infant cues. This would include, for example, the recommendation that all routine contact between professionals and parents be used as an opportunity to promote sensitive and attuned parenting using a range of approaches (including media-based strategies, such as leaflets, books, and videos, among others) and to observe and identify parent-child interactions that require further intervention using targeted approaches. Although it is unknown whether these strategies actually prevent psychological maltreatment, there is preliminary evidence to suggest that the use of population strategies of this nature show promise in the prevention of child maltreatment generally.[37]

Targeted programs aimed at preventing early indicators of psychological abuse often focus on infants and younger children.[38] Much less is known about approaches to preventing psychological maltreatment in the older age groups. Specifically, maternal insensitivity to infant cues,[39] which is associated with insecure attachment, is a significant predictor of socioemotional maladaptation.[27] A meta-analysis of attachment-based interventions that ranged from home-visiting programs to parent-infant psychotherapy, found significant improvements in maternal sensitivity ($d = 0.33$) and infant attachment insecurity ($d = 0.22$).[40]

Greater effectiveness was associated with programs that included several sessions and had a clear behavioral focus. Maternal insensitivity is an important element of psychologically harmful parent-child relationships; brief focused interventions, such as those involving video feedback and attachment discussion, might improve insensitive parenting, but there is no direct evidence at this time that these interventions prevent psychological maltreatment. Furthermore, interventions to date have focused on maternal-child interactions; it is important to address paternal-child interactions as well as other significant caregiving relationships.

One targeted program that has been shown effective in preventing child maltreatment generally is the Nurse Family Partnership (NFP), an intensive home-visitation program provided by nurses to low-income first-time mothers beginning prenatally and during infancy.[41] Because the goals of the NFP include assisting women to promote healthy prenatal behaviors and parents' competent care of their children, it is possible that the NFP could prevent psychological maltreatment as part of the overall reduction in maltreatment, but its effectiveness in preventing this specific type of maltreatment has not been assessed.

TREATMENT

Despite ongoing debate about the role of formal child protection processes for dealing with psychological maltreatment,[42] there is agreement about the need to intervene early to minimize poor outcomes. It is important to consider what is known about approaches to prevent recurrence of psychological maltreatment and treat associated impairment, once it has been identified. There is a paucity of studies evaluating the effectiveness of approaches specifically designed for parents or caregivers who psychologically abuse their children. One randomized trial compared 2 group-based cognitive-behavioral therapy parenting programs (standard and enhanced models of the Triple-P Program) aimed at psychologically abusive parents.[43] The standard program focused on child-management strategies, and the enhanced model included components to alter parental anger and misattributions. Both groups made gains, there was no actual control group, and many parents had self-referred, reducing the generalizability of the results. Parents who are psychologically abusive may not be able to recognize their own behavior and self-refer.[44] Results of another trial suggest that a preschool child-parent psychotherapy program may be beneficial in improving specific aspects of the mother-child relationship, but further research is necessary.[45] A number of innovative methods of working with parents with mental health[46] and substance misuse problems have recently been developed and evaluated.[47]

There is major need for research to develop and test effective treatments for children who have experienced psychological maltreatment, either alone or in combination with other forms of maltreatment.

GUIDANCE FOR THE PEDIATRICIAN

Psychological maltreatment is just as harmful as other types of maltreatment. Although little is known about approaches to its prevention or treatment, it is important for pediatricians to be alert to its occurrence and consider ways to support families who have risk indicators for this problem. Pediatricians should develop approaches for asking children about their relationships with caregivers, experiences of discipline and feelings of self-worth, safety, and being loved. Bright Futures[34] and the Addressing Mental Health Concerns in Primary Care toolkit[35] are resources that can assist the pediatrician in the evaluation; however, they are not specific to psychological maltreatment.

The pediatrician should encourage parents who are experiencing mental health problems, intimate partner violence, or substance misuse to consider the effects of such conditions on their parenting and assist them in accessing appropriate resources, such as referrals to mental health professionals and substance misuse treatment programs. With respect to identification of psychological maltreatment, Rees[48] suggests that pediatricians need to be "as confident in assessing inadequate emotional care as physical and sexual abuse." This might include an assessment of parent-child interactions through the use of interviews or consultation with other clinicians, such as mental health providers, to assess the child's feelings and understanding about the situation. As with other types of child maltreatment, children showing signs of behavioral and psychological problems should be assessed to identify specific conditions, such as depression or posttraumatic stress disorder, for which there are evidence-based treatments, such as cognitive-behavioral therapy. Several trauma-specific interviews have been developed to determine whether children and adolescents presenting with mental health problems have been exposed to maltreatment.[49] To date, such instruments have been used mainly in research settings, but studies are increasingly examining their clinical applicability.

Although the evidence is limited with regard to interventions for psychological maltreatment, it is important for pediatricians to refer families for additional assessment and treatment if psychological abuse or neglect is

suspected, in addition to referring to child protective services in accordance with individual state laws, and follow-up appointments should be made so that the progress of the situation can be monitored.

Another equally important aspect of responding to psychological maltreatment is professional communication; collaboration among pediatric, psychiatric, and child protective services professionals is essential in formulating a management plan for a child at risk for or experiencing psychological maltreatment. Specific goals need to be put in place, and in cases where exposure to psychological maltreatment persists, the pediatrician should advocate for the needs of the child to remain paramount. Although efforts should focus on ways to assist the family with the child remaining in the home, it is important for the pediatrician to be alert to situations in which a child's needs are better met outside the home, either on a temporary or permanent basis. Consideration of out-of-home care interventions should not be restricted to cases of physical or sexual abuse; children exposed to psychological maltreatment may also require a level of protection that necessitates removal from the parental home.

Pediatricians are uniquely positioned to educate those working in child welfare, child health care, and the judicial system about the complex needs of children exposed to psychological maltreatment. Because determination of and response to psychological maltreatment by child protective services can vary considerably across regions, pediatricians can assist child protective services workers in understanding the effects of exposure to maltreatment on the child as well as possible resources for intervention. Because less is known about psychological maltreatment and it has been recognized relatively recently compared with other subtypes of abuse and neglect, there is even less standardization of approaches to investigation and intervention by child protective services agencies. The pediatrician is well situated to advocate on behalf of the child and can take on an important liaison role with professionals in the child welfare system.

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Hibbard et al. Clinical Report: Psychological Maltreatment. *Pediatrics*. 2012;130(2):372–378

Two errors occurred in the print version of the article by Hibbard R; Barlow J; MacMillan H; American Academy of Pediatrics, Committee on Child Abuse and Neglect; and American Academy of Child and Adolescent Psychiatry, Child Maltreatment and Violence Committee, titled "Clinical Report: Psychological Maltreatment" published in the August 2012 issue of *Pediatrics* (2012;130[2]:372–378; doi:10.1542/peds.2012-1552). The name of the American Academy of Child and Adolescent Psychiatry was incorrectly printed as Association, rather than Academy. The online version is correct.

On page 372, under Introduction, second sentence, the date given for the technical report (reference 1) should have been 2002, not 2000. The online version is correct.

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CLINICAL REPORT

Relief of Pain and Anxiety in Pediatric Patients in Emergency Medical Systems

Joel A. Fein, MD, MPH, William T. Zempsky, MD, MPH, Joseph P. Cravero, MD, and THE COMMITTEE ON PEDIATRIC EMERGENCY MEDICINE AND SECTION ON ANESTHESIOLOGY AND PAIN MEDICINE

KEY WORDS
pain, stress, anxiety, analgesia, opiates, topical anesthesia

ABBREVIATIONS
ED—emergency department
EMS—emergency medical services
IV—intravenous
NPO—nil per os

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abstract

FREE

Control of pain and stress for children is a vital component of emergency medical care. Timely administration of analgesia affects the entire emergency medical experience and can have a lasting effect on a child's and family's reaction to current and future medical care. A systematic approach to pain management and anxiolysis, including staff education and protocol development, can provide comfort to children in the emergency setting and improve staff and family satisfaction. *Pediatrics* 2012;130:e1391–e1405

BACKGROUND

A systematic approach to pain management is required to ensure relief of pain and anxiety for children who enter into the emergency medical system, which includes all emergency medical services (EMS) agencies, interfacility critical care transport teams, and the emergency department (ED).[1] The administration of appropriate analgesia in children varies by age as well as by training of the ED team (which includes physicians, nurses, physician assistants, and nurse practitioners), however, and still lags behind analgesia provided for adults in similar situations.[2] Furthermore, neonates are at highest risk of receiving inadequate analgesia.[3,4]

Encouragingly, improvements in the recognition and treatment of pain in children have led to changes in the approach to pain management for acutely ill and injured pediatric patients.[5] Studies have shown an increase in opiate use in children with fractures.[6–8] Recent advances in the approach and support for pediatric analgesia and sedation, as well as new products and devices, have improved the overall climate of the ED for patients and families in search of the "ouchless" ED.[5,9] Increased parental education regarding pain and sedation, physician comfort and desire to enhance patient satisfaction, and a quest to satisfy accreditation regulations have appropriately driven this effort. System-wide approaches for pain management awareness and strategies work best if they are woven into the fabric of the emergency medical system through education and protocol development. The purpose of this report was to provide information to optimize the comfort and minimize the distress of children and families as they are cared for in the emergency setting.

STATEMENT OF THE PROBLEM

Barriers to adequate pain control for children in the ED and in out-of-hospital emergency care settings include difficulty in assessing pain in

young patients, unfamiliarity with new products and techniques, fear of medication adverse effects, staffing limitations, and time constraints.[10–15] Children's pain is underestimated because of the underuse of appropriate assessment tools and the failure to account for the wide range of children's developmental stages. Analgesic agents typically used for pain in other settings might not be used in the ED because of concerns regarding masking of symptoms and prevention of appropriate diagnoses as well as misconceptions or personal biases by physicians or parents against using stigmatized medications like opiates. Topical anesthetics may be underused because of concerns regarding delay in definitive treatment, cost, or lack of availability. In addition to the child's developmental level, culture, ethnicity, and race affect pain management from both a patient and physician perspective. It is clear that cultural differences can contribute to how an individual or family manifests behavioral distress and anxiety[16–19]; however, no predictable patterns have emerged with regard to a consistent pain experience within ethnic groups.[20] Studies have noted that Hispanic and black individuals with long-bone fractures were less likely to receive analgesics than were non-Hispanic white individuals.[21–23] A review of the National Hospital Ambulatory Medical Care Survey from 1992 to 1997 demonstrated that among patients with fractures, black children covered by Medicaid were least likely to receive parenteral sedation and analgesia.[24] Opioid prescribing for painful conditions has increased for all patients, but white patients continue to be more likely to receive an opioid prescription than black, Hispanic, or Asian patients.[25]

Although few physicians still believe that children do not feel pain the same way adults do and that pain has no untoward consequences,[15] there is a growing recognition of how even minor painful procedures, such as needle sticks, can affect a child's longer-term emotional well-being.[26] Inadequate sedation and pain control can worsen a child's reaction to subsequent, possibly even nonpainful procedures. Neonates who undergo procedures with inadequate analgesia have long-standing alterations in their response to and perceptions of painful experiences.[27–32] Inadequate pain control as well as invalidation of the child's pain during oncology procedures leads to significantly increased pain scores for subsequent painful procedures.[33,34] Posttraumatic stress symptoms can occur after procedures or stressful medical experiences that are not accompanied by appropriate pain control or sedation, and this can lead to adverse reactions to subsequent procedures.[35–37]

In the ED, children often present with a constellation of symptoms but no final diagnosis; they are usually unknown to the treating physician, have a wide range of medical or surgical problems, and are unlikely to be fasting on arrival.[11] These factors make their assessment and the selection of appropriate analgesic intervention more complicated. As well, the emergency setting can be a busy, fast-paced environment in which heightened patient and parental anxiety increases the perception of pain and makes its treatment more difficult.[12]

Optimal pain management requires a thorough understanding of pain assessment and management strategies.[12,13] Education in pain management is a recent emphasis for hospitals as well as regulatory agencies, such as The Joint Commission: "Each and every patient has a right to the assessment and management of pain."[38,39]

NEW INFORMATION

Setting the Stage for Relief of Pain and Anxiety

Physicians can begin to address pain and anxiety as soon as a child comes in contact with the EMS system. Prehospital EMS providers typically receive relatively little pain management instruction.[40,41] The development of pain assessment and management protocols specifically for prehospital EMS providers, along with educational initiatives, can improve pain management in the field.[40,42–44] Several adult studies and 1 pediatric trial show that analgesics, such as opiates and tramadol hydrochloride, can be used in prehospital protocols to decrease pain scores without causing respiratory depression.[45–48] Alternative delivery systems, such as transmucosal medications or inhaled nitrous oxide, could offer pain control without requiring intravenous (IV) access, providing advantages in the field as well as in the hospital setting.[49–53] Some EMS systems have implemented a "toolbox" of distraction equipment on units as an adjunct to providing pain relief in the anxious, uncomfortable child.

Assessment and Management of Pain, Stress, and Anxiety in the ED

The Environment

It is clear that there is a relationship between anxiety and perceived pain in children and adults.[54] The creation of an appropriate environment is essential to minimize the pain and distress of a child's ED visit.[12] Ideally, each child should be placed in a private room. Even in a general ED, there can be a dedicated pediatric area that provides a child-friendly, calming environment.[11] Colorful walls, pictures on the ceiling, and a collection of toys and games will minimize fear induced by this strange setting.[12]

Stress management and emotional support are essential to providing a comfortable environment for the child and have been shown to reduce anxiety in older children as well as parental perception of pain in younger children.[55] Adequate preparation has been shown to decrease anxiety and increase a child's coping before a minor procedure or surgery.[56–58] Distraction can range from simple techniques, such as a bubble blower or pinwheel used by the child during a painful injection, to techniques that require more time and training, such as hypnosis.[59–61] Structural changes, such as outfitting each procedure room with equipment that can provide videos and music, and distraction stations equipped with bubble columns, light wands, and imagery projectors, can be helpful in engendering a feeling of safety and comfort in young children.[62–67] A child life specialist based in the ED has the ability to (1) decrease anxiety and pain perception using developmentally appropriate education and preparation to patients and families; (2) teach the child and staff simple distraction techniques, deep breathing, progressive relaxation, or guided imagery; (3) help the child to develop and execute coping plans during difficult events in the ED; (4) educate the child about the ED environment and his or her diagnosis; and (5) support family involvement in the child's care.[68–70] The child life specialist has an important role. He or she is one of a few professionals in the emergency setting who is not in a position to cause emotional or physical pain to the child[71,72]; however, nurses, physicians, and ancillary staff also share in this responsibility and can learn from and teach each other these techniques. Optimally, the treatment plan for each child should be communicated to the entire medical care team with specific regard to the environmental and behavioral management of anxiety in the emergency medical setting. This includes teaching children what to expect during a procedure or during their visit, showing them specific medical supplies they will be using, offering them choices when appropriate, giving them a role or a job during a procedure or hospital visit, and using distractions. Creating a relaxing environment can help a child to feel more comfortable and less stressed.

Allowing (but not requiring) family presence during painful procedures also may be of benefit. Although there is no evidence that family presence decreases pain, their presence for procedures can decrease child distress.[73–76] Family presence does not usually increase anxiety of the child or decrease the procedure success rate of experienced physicians; however, it is important to monitor parental responses to limit the adverse effects on all parties.[73,74,77] In addition, involving the parent as a coach for the child during the procedure is useful in reducing anxiety and distress.[78–82]

Pain Assessment in the ED

The Joint Commission standards include mandatory pain assessments for all hospital patients.[39] Pain is, by nature, a subjective experience and is influenced by social, psychological, and experiential factors. For example, patients who experience chronic pain may not report the same pain level or exhibit the same facial cues and vocalizations as those who are new to the pain experience. Pain assessment, which is obviously the first step toward appropriate treatment, can, therefore, be more complex than just obtaining a single pain score; it is also essential to pay attention to changes in pain scores in response to treatment. The current clinical standard for pain assessment is a self-report scale. Simple numerical scales, such as verbally grading pain from 0 to 10, are often used in adults; although there is evidence that this technique may be accurate in older children with moderate to severe pain, it may be less accurate for those with abdominal pain.[83,84] Several well-validated scales exist for children as young as 3 years to report their own pain level.[85–88] The revised FACES pain scale, the Wong-Baker Faces scale, and the 10-cm Visual Analog Scale have been used successfully in many EDs caring for children.[86,88–92] Other dimensions can be added to the visual analog scale, such as height, width, and color, and are valid methods for assessment of acute pain in children.[93] For those who are unable to use self-report scales, behavioral scales can be combined with an evaluation of the patient's history and physical findings to assess the level of a child's pain.[94–96] Pain in a neonate can be evaluated using the Neonatal Infant Pain Scale,[97] and pain in infants, young children, and those with cognitive impairment can be assessed using the FLACC (face, legs, activity, crying and consolability) scale.[98–104] It must be noted that few, if any, scales have been validated in the prehospital setting.

Pain Management in the ED

Pain assessment should occur routinely at the triage desk along with vital signs; however, reassessment during the ED stay is imperative to determine treatment effect.[12,13,105] In addition, physicians should take into account the possibility that combining multiple minor procedures may produce as much stress and discomfort as a single major procedure.[106]

Controlling Pain Related to Needle Sticks and Other Minor Procedures

Patients with less acute conditions also may require analgesia.[107] Protocols should be developed to facilitate the delivery of appropriate medications, such as acetaminophen, ibuprofen, or oral opiates, to these patients (Table 1).

TABLE 1 Triage Oral Analgesic Administration Guidelines

Purpose
To provide analgesic therapy to patients presenting to triage with a complaint of pain
Procedure
1. Assess pain score using a validated tool
2. Immediately triage to a treatment room all patients with severe pain as assessed by triage nurse and consideration of pain score
3. For those not requiring immediate evaluation with pain score >3 (0–10 scale) or chief complaint consistent with pain, consider administration of oral analgesic
4. Assess recent analgesic use
Contraindications
1. Allergy to analgesic (consider alternative)
Medications
1. Ibuprofen (avoid if the patient has aspirin allergy, anticipated surgery, bleeding disorder, hemorrhage, or renal disease)
2. Acetaminophen (avoid if the patient has hepatic disease or dysfunction)
3. Oral oxycodone

TABLE 2 Guidelines for Use of Topical Lidocaine in the ED

Topical anesthetics should be considered in any patient who has a high likelihood of undergoing a non-emergent invasive procedure on intact skin in the ED. These include the following:
• Intravenous line placement or venipuncture
• Lumbar puncture
• Abscess drainage
• Joint aspiration
Discussion with parents should bring up the following issues:
• Topical lidocaine does not provide complete pain relief
• Some patients may require a procedure before topical lidocaine reaches its full effectiveness (see below)
• Discuss with the parents how they feel the patient will tolerate the topical lidocaine application, in terms of anticipation of the procedure as well as sensory integration disorders
Contraindications:
• Emergent need for IV access
• Allergy to amide anesthetics
• Nonintact skin
• EMLA only: Recent sulfonamide antibiotic use (trimethoprim-sulfamethoxazole, erythromycin-sulfisoxazole); congenital or idiopathic methemoglobinemia
The topical anesthetic dose should be lower for patients <12 mo old or weighing <10 kg
Placement of topical lidocaine:
• Intravenous line placement
Topical lidocaine should be placed in at least 2 sites over veins amenable to placement of an IV line, preferably judged by the nurse placing the IV line.
Care should be taken to avoid mucous membrane contact or ingestion
• Lumbar puncture
Placement of topical lidocaine for lumbar puncture should be considered as soon as the decision is made to perform a lumbar puncture; accurate placement may require consultation with the clinician performing the procedure
Liposomal topical lidocaine reaches full effectiveness in 30 min, heated topical lidocaine in 20 min, EMLA reaches full effectiveness in 60 min.

Topical anesthetics can be placed proactively to control the pain associated with placement of IV catheters and other minor procedures. For example, in 1 inner-city pediatric ED, 90% of patients requiring IV access did not undergo this procedure until at least 60 minutes after triage.[108] A prediction model was developed whereby the patient's chief complaint and medical history, combined with an experienced triage nurse assessment, determined with some accuracy which patients had a high probability of requiring IV access.[109] These findings could be adapted to develop topical anesthetic protocols for painful procedures in other EDs, taking into account their patient volume, acuity, and flow characteristics (Table 2). Some topical anesthetics have been developed that produce anesthesia more rapidly than eutectic mixture of local anesthetics (EMLA; AstraZeneca, Wilmington, DE). A topical liposomal 4% lidocaine cream (LMX_4; Ferndale Laboratories, Ferndale, MI) provides anesthesia in approximately 30 minutes.[110,111] Heat-activated systems have shortened the time required to as low as 10 to 20 minutes for IV insertion pain relief.[112] Topical anesthetics also have been reported to improve procedural success rates, likely because of decreased movement leading to better accuracy.[113,114] When the procedure cannot be delayed or needs to take place in the prehospital setting, other techniques can be used; intradermal lidocaine injection as well as intradermal saline with benzyl alcohol preservative decreases the pain of venous cannulation without affecting procedural success rate.[115–119] Needle-free injection systems using either powder or liquid jet injection reduce the onset time even more.[106,120–123] Vapocoolant sprays that have immediate onset of action have been found to be effective in reducing venipuncture pain in adults; however, they are less effective in children, likely because of their intolerance of the unpleasant cold feeling resulting from the required administration time.[124,125] Recent innovations include a vibrating device that, when applied to the proximal extremity over a cold pack, may decrease the pain of venipuncture and immunizations by taking advantage of the "gate" theory of pain. However, further study is required to determine the comparative efficacy of this technique.

Similar protocols should be developed for topical anesthetic placement for laceration repair at triage (Table 3). Laceration repair should be completed with an emphasis on minimizing pain and anxiety. Several topical anesthetic/vasoconstrictor combinations, such as lidocaine, epinephrine, and tetracaine, which can be made by the in-hospital pharmacy as a liquid or gel preparation, provide excellent wound anesthesia in 20 to 30 minutes.[126,127] EMLA cream also provides topical anesthesia for laceration repair, although it is not approved by the US Food and Drug Administration for this purpose.[128,129] Tissue adhesives, such as octyl cyanoacrylate, provide essentially painless closure for low-tension wounds.[130,131] Steri-Strips (3M, St Paul, MN) provide similar painless closure and are less expensive than currently available tissue adhesives.[132] Absorbable sutures should be considered for facial wounds that must be sutured to avoid the pain and anxiety produced by suture removal.[133,134]

TABLE 3 Guidelines for Use of LET (a Topical Anesthetic for Open Wounds)

Eligibility
- LET can be applied to simple lacerations and may be applied to complex or deeper lacerations that may require supplemental subcutaneous anesthetic administration.

Contraindications
- Allergy to amide anesthetics
- Gross contamination of wound

Procedure
- LET should be placed according to standard ED procedure; time of placement should be documented on triage sheet
- Dose: 3 mL for children >17 kg; 0.175 mL/kg in children <17 kg[a]
  (1) Place LET on open wound and cover with occlusive dressing or place cotton ball soaked with LET solution into wound
  (2) Allow LET to soak into wound for 10–20 min or until wound edges appear blanched.

LET, lidocaine, epinephrine, and tetracaine.
[a] Based on maximum dose of 5 mg/kg of lidocaine.

Lidocaine can be used alone in urgent situations or after topical anesthetics have been applied. Lidocaine can be injected in an almost painless manner.[115] This technique includes buffering the anesthetic with bicarbonate, warming the lidocaine before injection, and injecting slowly with a small-gauge needle.[135–139] Lidocaine buffered with bicarbonate made in advance can be stocked in the ED and will remain stable for up to 30 days.[140,141]

The pain of intramuscular injection can be reduced using the shortest needle length possible to reach the intramuscular tissue, and applying concurrent manual pressure to the injection site.[142–145]

Neonatal Pain Management in the ED

Simple changes in practice can minimize painful stimuli for infants. Protocols for topical anesthetic placement should include neonates. Topical anesthetics for procedures ranging from circumcision to venipuncture are safe in newborn infants and even preterm infants, with appropriate dosing and short administration times.[146–148]

Recent studies have suggested methods by which neonatal distress during painful procedures can be minimized. Sucrose has been found to decrease the response to noxious stimuli, such as heel sticks and injections, in neonates and has even been demonstrated to reduce subsequent crying episodes during routine care, such as diaper changes.[149–161] This effect seems to be strongest in the newborn infant and decreases gradually over the first 6 months of life. Nursing protocols that allow for the use of sucrose before painful procedures are in place at many hospitals (Table 4). A 12% to 25% sucrose solution that is made by the pharmacy or is available commercially can be used (Sweet-Ease, Children's Medical Ventures, Norwell, MA). The use of a pacifier alone or in conjunction with sucrose also has been shown to have analgesic effects in neonates undergoing routine venipuncture.[162] Skin-to-skin contact of an infant with his or her mother and breastfeeding during a procedure decrease pain behaviors associated with painful stimuli.[163,164]

Available evidence supports the use of local and topical anesthetic for lumbar puncture in neonates.[165,166] Protocols can allow for the timely placement of topical anesthetic, or injected buffered lidocaine can be used at the site of needle insertion before the procedure. Concerns over the increased difficulty of lumbar puncture after local anesthetic use have proved to be unfounded, and one study even demonstrated improved success with the use of topical anesthetic.[113,165,167]

Pain can be decreased in neonates by the elimination of heel sticks and intramuscular injections. Venipuncture seems to be less painful than heel lancing for obtaining blood for diagnostic testing.[168] When the intramuscular route is necessary, topical anesthetic should be used.[169] Use of distraction techniques discussed previously,

TABLE 4 Guidelines for Use of Sucrose in the ED

Indications
- Use as an adjunct for limiting the pain associated with procedures such as heel sticks, venipuncture, IV line insertion, arterial puncture, insertion of a Foley catheter, and lumbar puncture in neonates and infants younger than 6 mo

Procedure
1. Administer 2 mL of 25% sucrose solution by syringe into the infant's mouth (1 mL in each cheek) or allow infant to suck solution from a nipple (pacifier) no more than 2 min before the start of the painful procedure
2. Sucrose seems to be more effective when given in combination with a pacifier; nonnutritive suck also contributes to calming the infant and decreasing pain-elicited distress

Contraindications: None

ice, and less painful injection techniques can also be efficacious.[170–173] The use of lidocaine as the diluent for ceftriaxone can decrease the pain of intramuscular injection.[174]

Does the Appropriate Use of Analgesics Make Evaluation More Difficult?

There is no evidence that pain management masks symptoms or clouds mental status, preventing adequate assessment and diagnosis. For patients with abdominal pain, several adult studies have shown that pain medications such as morphine can be used without affecting diagnostic accuracy.[175–179] Pediatric studies have demonstrated similar findings.[179,180] Clinical experience suggests that the use of pain medication makes children more comfortable and makes the examination of the patient's abdomen and diagnostic testing (such as ultrasonography) easier, thus aiding in diagnosis. In the child who has suffered multisystem trauma, small titrated doses of opiates can be used to provide pain relief without affecting the clinical examination or the ability to perform neurologic assessments.[181,182] The development of pain protocols can improve the management of children

who suffer major trauma.[183] Regional anesthesia should also be considered for patients who have injuries that are amenable to these techniques.[184,185] Additional studies evaluating these practices in pediatric patients are necessary but should not delay the development of protocols for the use of analgesics in patients with acute abdominal pain and multisystem trauma in the ED and even the prehospital setting.

Analgesia in the ED and EMS Setting

Optimal pain management requires expeditious pain assessment and rapid administration of systemic opioid pain medication to patients in severe pain. This may occur through various routes of administration, including transmucosal or IV routes. The IV route allows for rapid relief of pain and drug titration; the intramuscular route is less preferred, because it does not allow for medication titration and is painful at the time of delivery and for days afterward. Adjunctive pain medications, such as nonsteroidal antiinflammatory drugs, can be used judiciously in children with pain; antiplatelet activity and gastrointestinal tract and renal toxicity are rare but recognized adverse effects. Oral opiates and nonsteroidal antiinflammatory drugs are appropriate for mild to moderate pain if the patient has no contraindications to receiving oral medications. Alternative routes of medication administration, including oral, intranasal, transdermal, and inhaled routes, should be used when appropriate and may offer rapid relief of pain.[186] Studies of transmucosal, aerosolized, and inhaled fentanyl show analgesic action commensurate with IV opioids.[187–189] Transmucosal administration may be appropriate and useful in the prehospital setting as well.[190] Intranasal delivery, despite demonstrating more rapid onset of action, also may be less tolerated because of burning of the nasal mucosa during administration.[54,191] Drug delivery into the central nervous system is greatly enhanced with the use of an atomizer that distributes the medication more evenly to the mucous membranes.[192–194] Because adverse events are still possible when this mode of opiate administration is used, care should be taken when using adjunctive medications, such as benzodiazepines. In addition, if there is no IV access, it is prudent to prepare for alternative methods of administration for reversal agents. Pain medication should be provided in the ED as well as on discharge, even for those with mild to moderate pain. Patients and families should get specific instructions regarding dose and duration of use. Clear, written instructions should be provided for families regarding the after care of children who have received procedural sedation. Pain medication should be recommended on an around-the-clock basis for anyone in whom moderate pain is anticipated.

The use of sedative hypnotic medication may be required to reduce pain and distress for children undergoing procedures in the ED. Unfortunately, pain and anxiety are often difficult to differentiate in infants and toddlers and even in school-aged children. Although many procedures can be performed relatively painlessly with the use of a topical or local anesthetic, this does not obviate the use of pharmacologic agents to decrease the anxiety and stress in children undergoing procedures in the ED, especially when the child needs to remain still to ensure the success of the procedure. When the procedure is expected to be painful, the agents used should have analgesic properties as well. Emergency physicians are increasingly using short-acting medications such as propofol, alone or in combination with ketamine, for procedural sedation in children.[195,196] Published reports involving adult patients and recently published experiences with children demonstrate that, when applied using careful protocols and in a setting of experienced sedation teams, propofol, either alone or in combination with ketamine, can be used safely and effectively for sedation in children.[195,197–205] Benzodiazepines, particularly rapidly effective but relatively short-acting ones, such as midazolam, are also helpful in the prehospital and ED settings. Nitrous oxide is a potent analgesic that does not require venous access and is available in some EDs.[49–53] Nitrous oxide should be used in conjunction with appropriate sedation guidelines and avoided in patients with pneumothorax, bowel obstruction, intracranial injury, and cardiovascular compromise.[52,53] Nitrous oxide has many potential applications, including anxiolysis for procedures such as IV catheter insertion and laceration repair, pain control for burn débridement, and fracture and dislocation reduction; care should be taken if opiates are used concurrently so as not to reduce respiratory drive.[206] The most important part of providing safe sedation for children is the establishment of appropriate sedation systems and sedation training programs with credentialing guidelines for sedation providers that specifically address the core competencies required for the care of pediatric patients.[207,208]

Pain Considerations for Children With Developmental Disabilities

Children with developmental disabilities, particularly those with severe neurologic involvement, provide additional challenges to parents and EMS and ED personnel in management of acute pain and its associated anxiety. For many children, previous painful experiences in similar settings add to stress of the acute incident. Learning about the child's anticipated response

and previous experiences from parents, primary care physicians, and specialists informs the emergency physician and staff of useful supportive technique.[209–211] Parental understanding and awareness of subtle indirect behaviors or emotional shifts are often critical adjuncts in the assessment process of the child's sense of comfort and well-being. Child life specialists, as previously mentioned, are knowledgeable of distinct coping strategies to assist children with developmental disabilities and children who are more sensitive to sights and sounds. Myths of pain insensitivity or indifference must be actively avoided.[212–214] Pain modulation can vary widely, related to neurotransmitter function differences within the brain or along the injured spinal cord, thereby altering the perception and response to pain in children with previous injuries.[213–215] Cognitive impairments can affect both understanding and coping mechanisms, making self-report particularly challenging in young people with motor and/or cognitive differences. Maladaptive behaviors, heightened anxiety, and uncommon coping styles can add further complexity to the assessment process. The Non-communicating Children's Pain Checklist–Revised offers a validated visual method for staff members to assess and reassess children 3 to 18 years of age.[216–218] In addition, the Individual Numeric Rating Scale has been shown to be effective in children with developmental disabilities. In general, the approaches to medication use for pain and anxiety should hold true for children with developmental disabilities; some children, however, show altered sensitivity to medications and may be taking medications that interact with common pain medications.[219]

Sedation Policies and Protocols in the ED

Physicians, physician assistants, and nurse practitioners who administer sedation and analgesia should have proven training and skills and ongoing education in the management of pediatric airways and resuscitation, especially in the use of face mask ventilation and laryngeal mask airways. Emergency physicians and other nonanesthesiologist physicians with appropriate training have demonstrated the ability to safely and effectively provide moderate and deep sedation and dissociative anesthesia, allowing for the timely performance of procedures and rapid relief of pain and anxiety.[202,207,208,220,221] A recent large prospective study of 131 751 elective pediatric sedation encounters demonstrated no differences in serious adverse outcomes (ie, death, ICU admissions, aspiration events) between those performed by anesthesiologists and those performed by other pediatric medical subspecialists practicing in highly organized sedation systems.[222] Although the reported incidence of serious complications is low, it is imperative to develop ongoing policies that establish informed consent and close monitoring of these patients. A critical component of any sedation protocol is to require a trained observer to be solely responsible for monitoring the patient while the procedure is being performed.[223,224] Techniques such as noninvasive end-tidal carbon dioxide monitoring allow for more consistent detection of bradypnea, hypopnea, and apnea in sedated children and are being recognized increasingly as an essential part of the sedation armamentarium[225,226]; however, this is not a replacement for direct visualization of respiratory effort. Current guidelines from the American Academy of Pediatrics, American Society of Anesthesiologists, and American College of Emergency Physicians recommend a structured evaluation of children that allows risk stratification before beginning sedation, thereby reducing the risk of complications in the pediatric age group.[223,227–235] This evaluation should include issues such as preexisting medical conditions, focused airway examination, and consideration of nil per os (NPO) status. NPO guidelines for children receiving sedation in the ED are controversial. Many children who have received procedural sedation for emergencies have not fasted in accordance with published guidelines for elective procedures, and this variation was not associated with adverse outcomes.[236–239] Current data are insufficient to determine the length of time that constitutes safety with regard to NPO status.[237–243] Recently published guidelines recommend that the physician consider the urgency of the procedure, targeted depth of sedation, risk level of the patient, and timing of most recent solid food intake to determine the safety profile for each patient.[244]

Discharge criteria also are critically important for children undergoing sedation in the ED. Patients who receive sedatives with long half-lives, such as chloral hydrate or pentobarbital, are at particular risk of adverse events after discharge, either during transportation or in their homes after the procedure.[224] Strict adherence to criteria that require a child to be "back to baseline" in terms of consciousness, or adaptation of newer "maintenance of wakefulness" criteria, are critical to optimize safety surrounding the sedation process.[245]

Quality Improvement Programs

Any ED that provides treatment of children should have a quality improvement program that reviews, at regular intervals, sedation and pain management practices in pediatric patients. Transport team and prehospital EMS providers are essential partners in this ongoing review and should consider establishing internal review policies as well. Many hospitals use a multidisciplinary committee to

help interpret the data emanating from these reviews and then suggest system-wide protocol and educational initiatives. Indicators that should be evaluated include the use of validated pain scores; appropriate analgesics for specific disease states (whether severe or mild to moderate pain); topical anesthetics and other non-noxious routes of analgesia and sedation; monitoring for adverse outcomes; and the use of discharge instructions that outline the indications, dose, and duration of analgesic to be used.[246–248] Discharge instruction also should include any possible adverse effects of sedative/analgesic medications used in the ED. Adverse events that lead to respiratory depression or other life-threatening conditions should be fully reviewed by a committee charged with understanding if systemic care issues or provider-specific issues were root causes of these outcomes.

Implementation

A systematic approach to pain management in the EMS requires an implementation strategy, promoted and advocated by leadership, that includes the following: (1) a comprehensive evaluation of current pain and distress management practices; (2) an educational and credentialing program regarding pain assessment and management techniques for all clinical staff, preferably overseen by a hospital-wide sedation committee[249]; (3) development of protocols to allow the universal and efficient application of pain management strategies and medications; and (4) a quality improvement process to evaluate the ongoing success of the program.[11,13] EMS agencies should establish policies and protocols that make available pertinent provider education and ensure quality improvement processes are in place for pediatric pain management protocols appropriate for their practice setting.

CONCLUSIONS

Management of a child's distress during illness or after an injury is an important yet complex aspect of emergency medical care for children. Physicians and prehospital EMS providers should be aware of all the available analgesic and sedative options. Adequate pain assessment is essential for pain relief and should begin on entry into the EMS and continue through discharge of the child from the ED. Multiple modalities are now available that allow pain and anxiety control for all age groups. Future research should concentrate on pharmacologic, nonpharmacologic, and device-related technology that can assist in reducing the pain and distress associated with medical procedures.

SUMMARY OF KEY POINTS

1. Training and education in pediatric pain assessment and management should be provided to all participants in the EMS for children; EMS medical directors should formally include pediatric pain management measures within the protocols provided to EMS providers.
2. Incorporation of child life specialists and others trained in nonpharmacologic stress reduction can alleviate the anxiety and perceived pain related to pediatric procedures.
3. Family presence during painful procedures can be a viable and useful practice in the acute care setting.
4. Pain assessment for children should begin at admission to EMS, including prehospital management, and continue until discharge from the ED. When discharged, patients should receive detailed instructions regarding analgesic administration.
5. Administration of analgesics and anesthetics should be painless or as pain free as possible.
6. Neonates and young infants should receive adequate pain prophylaxis for procedures and pain relief as appropriate.
7. Administration of pain medication has been demonstrated to preserve the ability to assess patients with abdominal pain and should not be withheld.
8. Sedation or dissociative anesthesia should be provided appropriately for patients undergoing painful or stressful procedures in the ED.
9. Pain management and sedation, including deep sedation and dissociative anesthesia, are fully within the monitoring and management capabilities of appropriately trained emergency medicine and pediatric emergency medicine physicians. Each emergency department that provides sedation and analgesia to children should include sedation competencies in recredentialing procedures and develop protocols, policies, and quality improvement programs as part of the systematic approach to pain management in the EMS.

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POLICY STATEMENT

The Role of the Pediatrician in Rural Emergency Medical Services for Children

abstract

FREE

In rural America, pediatricians can play a key role in the development, implementation, and ongoing supervision of emergency medical services for children (EMSC). Pediatricians may represent the only source of pediatric expertise for a large region and are a vital resource for rural physicians (eg, general and family practice, emergency medicine) and other rural health care professionals (physician assistants, nurse practitioners, and emergency medical technicians), providing education about management and prevention of pediatric illness and injury; appropriate equipment for the acutely ill or injured child; and acute, chronic, and rehabilitative care. In addition to providing clinical expertise, the pediatrician may be involved in quality assurance, clinical protocol development, and advocacy, and may serve as a liaison between emergency medical services and other entities working with children (eg, school nurses, child care centers, athletic programs, and programs for children with special health care needs). *Pediatrics* 2012;130:978–982

COMMITTEE ON PEDIATRIC EMERGENCY MEDICINE

KEY WORDS

rural health, pediatric emergency, EMSC, rural pediatrician

ABBREVIATIONS

AAP—American Academy of Pediatrics
ED—emergency department
EMS—emergency medical services
EMSC—emergency medical services for children
IOM—Institute of Medicine

INTRODUCTION

Ten percent of prehospital emergency responses[1] and 37% of emergency department (ED) visits are for patients 24 years and younger.[2] Children, in general, have been shown to use emergency medical services (EMS) less frequently than adults. When children younger than 5 years are cared for in the EMS system, they are less likely to receive appropriate interventions, such as splinting or cervical spine immobilization.[3]

According to the 2000 US Census,* 42% of the population lives in nonmetropolitan areas, 25% of which are rural[4]; 41% of community hospitals are considered rural by the *American Hospital Guide*.[5] Additionally, certain populations such as Native Americans disproportionately live in rural areas. Depending on the state, one-fourth to one-third of the population resides in rural or frontier areas[6]; rural is defined as fewer than 1000 people per square mile, and frontier is defined as 6 to 8 people per square mile. Rural areas vary widely, however, by environment, terrain, resources, and needs. Additionally, rural and frontier areas are common vacation destinations, with

*US Census data on urban and rural populations for 2010 are scheduled to be released in October 2012.

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seasonal increases in population. A study of rural EMS reported the following: (1) 70% of prehospital health care professionals practice in rural areas; (2) rural EMS medical directors are more likely to be nonpediatric primary care physicians; and (3) 20% of states cross-train prehospital health care professionals in an expanded hospital role to address the national nursing shortage.[7]

Because of occupational and lifestyle exposure to work- and play-related vehicles, hazardous structures, and animals (eg, farm machinery, pickup trucks, all-terrain vehicles, grain silos, and horses) and environmental threats (eg, weather, terrain, and toxins), children in rural areas have unique medical and surgical emergency needs. Children in rural areas have increased risk of disability and death from injury, trauma and medical diseases largely because of long transport times to definitive care.[7] It has also been reported that the quality of care rendered to children in rural EDs is not of a level equal to the quality of care in urban facilities.[8] Additionally, there may be a higher risk of medication errors for children treated in rural EDs.[9,10] Finally, in a survey study, remote and rural EDs were not as well prepared as urban EDs were to care for children.[11] Because definitive pediatric emergency and critical care usually are located far from rural children, any inadequacy of EMS education and intervention or lack of appropriate pediatric equipment may be even more detrimental in a rural setting.

Lack of access to all levels of care, with particular effects on vulnerable populations, is a major difference between emergency medical services for children (EMSC) systems in rural and urban areas. Decreased access to medical care increases the morbidity and mortality of rural children.[12,13] Vital access issues include:

- Communication (eg, 911 access [especially enhanced 911 access], the use of telemedicine in EMS consultation, and limited availability of cellular wireless telephone systems and high-speed and wireless Internet access)
- Transport method and availability (ground versus air; fixed wing versus rotor wing; weather, terrain, and distance)
- Appropriate emergency care equipment for children from infancy through adolescence
- Level of responding prehospital personnel (emergency medical technicians—basic versus paramedic, paid versus volunteer EMS services)
- Pediatric skills of prehospital health care professionals
- Pediatric expertise at the immediate receiving facility (general, community hospitals)
- Rural-to-urban hospital pediatric transport
- Referral center care
- Rehabilitation
- Local follow-up care
- Repatriation to local facilities
- Pediatric-specific primary and subspecialty care
- Preparation for emergencies involving children with special health care needs—specifically, technology-assisted children, including awareness and utilization of the Emergency Information Form [14]
- Public health emergency, disaster, and terrorism response plans applicable to rural settings (recognition of risk and familiarity with rural systems in preparation)

Pediatricians can play valuable roles in ensuring access to high-quality and comprehensive care for children in rural communities. Their leadership and advocacy, often organized through state American Academy of Pediatrics (AAP) chapters and state/territorial EMSC programs, can aid local and regional EMS organizations in the establishment of pediatric-specific protocols and policies, data collection, and pediatric-specific quality management and support for the development of enhanced pediatric capabilities via the legislative and regulatory process. They can also advocate for addressing the unique needs of children, including children with special health care needs, in local preparedness efforts around public health emergency and disaster planning. Through their expertise in the care of children, pediatricians can support efforts in pediatric emergency care education.

Local health care professional training (prehospital, emergency, and school nurses) in pediatrics would be enhanced by rural pediatricians' input and participation. Because skill retention is an issue in rural settings, periodic updates for rural health care professionals is necessary. Many pediatric-specific enhanced training courses (eg, Pediatric Advanced Life Support, Pediatric Education for Prehospital Professionals, Neonatal Resuscitation Program, Emergency Nursing Pediatric Course, Advanced Pediatric Life Support) are applicable. Promoting telehealth initiatives and Web-based education could also help increase access to training in the rural setting.[15–21] In fact, a study of rural education reports that rural prehospital providers accessed pediatric Web-based training more commonly than did urban providers.[21] In addition to health care professional education, pediatricians can provide patient and parent education about injury prevention, recognition of childhood emergencies, and accessing 911 and

poison control centers. Anticipatory guidance should also include first aid and preparation of the home for public health emergencies and disasters.

Office preparation for emergency response is crucial in rural areas and builds confidence in providers.[22] Pediatricians must recognize that rural areas, like urban areas, are subject to terrorist attacks, and it is prudent to address the needs of children in rural areas in preparation plans. Pediatric offices should be prepared to care for the acutely ill or injured child, arrange for definitive care, and participate in a community public health emergency or disaster response. The AAP provides information on office preparation in *Childhood Emergencies in the Office, Hospital, and Community*.[23] Additionally, a policy statement on the role of the pediatrician in disasters and bioterrorism preparedness has been published by the Committee on Pediatric Emergency Medicine and Committee on Medical Liability of the AAP.[24]

Finally, involvement in legislator and public education about children's health care by collecting and reporting EMSC data may improve the system locally and statewide. Data collection and research are particularly needed for EMSC in rural areas, where certain problems are more prevalent than in urban settings (eg, skills retention, transport mechanisms, volunteer responder's education and responsibilities, and delayed access issues). Interested pediatricians can find many opportunities to promote studies generating outcome-based information to improve local and national EMSC, with support from sources such as the Community Access to Child Health program, the Practice Research in Office Settings network, other AAP programs and support staff, and the Centers for Disease Control and Prevention and other federal agencies. Legislative input can be presented by pediatricians knowledgeable about statewide EMSC issues. Building local, statewide, and regional coalitions is a sound approach to generating legislative responsiveness and awakening the community to the importance of a sophisticated and competent EMSC program. In many rural areas, limited resources have led to the development of interstate coalitions to pursue EMSC agendas (eg, Intermountain Regional EMS for Children Coordinating Council).

In the 2006 Institute of Medicine (IOM) Future of Emergency Care Series entitled *Emergency Care for Children: Growing Pains*, regionalization, accountability, and coordination are the 3 goals set by the IOM Committee on the Future of Emergency Care in the United States Health System for developing an emergency and trauma care system of the future.[25] According to the IOM report, "critically ill and injured children should not be directed simply to the closest facility, but to the nearest facility with the pediatric expertise and resources needed to deliver high level care. The goal of regionalization is to improve patient outcomes by directing patients to facilities with the optimal capabilities and best outcomes for any given type of illness or injury."[25] To aid in regionalization efforts, rural issues that may need distinct legislative assistance include establishment of universal 911 (preferably "enhanced") service, communications technology, educational processes, advisory councils, coding standards, and data collection resources to assess areas for improvement in EMSC. Guidelines[26,27] are available to provide a framework for continued development of state EMSC; amendments specific to the rural locales may be necessary.

RECOMMENDATIONS

Development of quality EMSC in rural America requires motivated pediatric advocates to commit their expertise to prevention, education, legislation, and facilitation of these services. As highly trained child health professionals and leaders of the child health care team, rural pediatricians are encouraged to be aware of activities that would benefit from their involvement.

1. Advocate for legislative initiatives supportive of EMSC that meet the needs of children and pediatricians, including equity in funding for EMSC, especially trauma services. This will be a step toward ensuring that all children—whether they live in a rural or urban area; or are insured, underinsured, or uninsured—have unhindered access to care.
2. Participate in and work cooperatively with local EMS agencies responsible for local system design and development, including educational programs, simulations, structured protocols, communication (from dispatchers to ED physicians), hospital care and transport (with special focus on long transport time and distance issues), and quality improvement. This system should address children's needs, including those of children with special health care needs, and integrate well with the state EMS system. Key participants in this system include representatives from the state office of rural health, department of health, state EMSC programs, and AAP chapters.
3. Provide guidance in recruiting and retaining community EMS providers (prehospital and ED) and primary health care professionals (family practitioners, nurse practitioners, and physician assistants) who have pediatric training. This

includes helping them maintain skills and comfort with pediatric emergencies by providing continuing medical education, pediatric office rotations, and sensitive quality assurance review.

4. Develop a personal awareness of rural EMSC issues for American Indian/Alaska Native communities. For information, contact the Indian Health Services EMSC liaison or the Health Resources and Services Administration.

Pediatricians can develop strategies for community-sensitive outreach to rural areas and assist in the organization of regionalized pediatric emergency care, using available rural expertise and assets to optimize outcomes of seriously ill or injured rural children. Several resources are available for implementation and continuation of such an EMSC agenda.

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SUGGESTED READING

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POLICY STATEMENT

Role of the School Physician

abstract

FREE

The American Academy of Pediatrics recognizes the important role physicians play in promoting the optimal biopsychosocial well-being of children in the school setting. Although the concept of a school physician has existed for more than a century, uniformity among states and school districts regarding physicians in schools and the laws governing it are lacking. By understanding the roles and contributions physicians can make to schools, pediatricians can support and promote school physicians in their communities and improve health and safety for children. *Pediatrics* 2013;131:178–182

COUNCIL ON SCHOOL HEALTH

KEY WORDS

coordinated school health, school, school health, school physician

ABBREVIATION

AAP—American Academy of Pediatrics

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HISTORY OF PHYSICIANS IN THE SCHOOL SETTING

Physicians associated with schools have held a variety of titles over the years. For the purpose of this article, a school physician is any physician who serves in any capacity for a school district, such as, but not limited to, an advisor, consultant, medical director, volunteer, team physician, medical inspector, or district physician.[1] This statement does not address the role of physicians in school-based health centers[2] or the role of community pediatricians as private providers to school-aged children. Information on these topics is available on the American Academy of Pediatrics (AAP) Council on School Health Web site (http://www.aap.org/sections/schoolhealth/).

The tradition of a school physician dates back to the late 1800s, as parents and public officials recognized that public school facilities needed national systematic medical inspection.[3] Over time, the role of the school medical inspector expanded to include containment of prevalent infectious diseases of childhood[3,4] and eventually as an important vehicle to manage universal immunization.[5] Modern school physicians focus on the needs of individual children as well as the public health of the school community.[3,6,7] They often assist schools in accommodating students who have special health care needs, manage acute and chronic illness, and oversee emergency response, environmental health and safety, health promotion, and education.[8,9]

Millions of children spend roughly 7 hours per day, 180 days per year, in school[10] and may only visit their medical home once annually. In 1999, Dr Joycelyn Elders acknowledged the interdependence of health and education when she said, "You cannot educate a child who is not healthy, and you cannot keep a child healthy who is not educated."[11] In addition, Bright Futures, a national health care promotion initiative, encourages public schools and public health communities to become partners in prevention efforts.[12] Despite the value of coordinating

health and education, physicians are not effectively and consistently involved in schools across the nation. As a result, US children have varying levels of medical support and safety, depending on the community in which they live. Well-placed school physician expertise can contribute to the creation of policies and practices that provide sound, evidence-based structure to coordinated school health teams.

CURRENT LAWS PERTAINING TO THE PHYSICIAN IN SCHOOLS

Currently, there is no single national set of school health laws. School health services are primarily regulated by state or local governments or individual school districts, and these regulations vary.[13–15] Some states mandate school physicians; most do not.[16,17] However, "no one has systematically identified the full range of relevant legal authorities pertinent to schools that may help shape the health of children and adolescents."[15]

Federal law guarantees antidiscrimination and equal protection to individuals who have disabilities.[18–20] These laws require federally funded states to provide "related services," such as school nursing, as part of a child's Individualized Education Plan. However, the US Supreme Court ruled that school districts are not required to provide physician services for individual students, except for diagnostic or evaluative purposes for special education services.[13–15] This ruling's broad interpretation has limited funding to schools for physician services, despite the fact that many states, and the AAP, established basic minimal health services schools should provide without established guidance for pediatrician involvement.[21,22]

The AAP recommends that all schools have a registered professional school nurse, hereafter referred to as school nurse, to provide health services in schools.[23] The American Medical Association not only recommends that school health be provided by "a professionally prepared school nurse" but also that "health services in schools must be supervised by a physician, preferably one who is experienced in the care of children and adolescents. Additionally, a physician should be accessible to administer care on a regular basis."[24]

Despite a scarcity of laws addressing school physicians, pediatricians remain leaders in child health care and are integral members of the school health team.[22,25–29] Certainly, pediatricians need to know the laws that apply to their patients and themselves and will benefit from collaboration with their AAP chapter, state and local health departments, and school district to understand the laws specific to their role in the schools. However, the lack of uniformity of laws or standards of best practice for school physicians complicates the role physicians have in schools and results in a difference of health care for children based on the schools they attend.

CRITICAL KNOWLEDGE BASE FOR PHYSICIANS WORKING IN THE SCHOOL SETTING

Ideally, school physicians should be board-certified pediatricians or physicians with expertise in pediatrics.[24] In addition to basic training in child growth and development, disease processes, and well-child maintenance including adolescent and reproductive health and sports medicine, physicians who work with schools need additional expertise in key school health topics.[30–32] The degree of mastery required depends on the extent of the physician's role with the schools. Overall, a school physician can become a positive liaison between the medical home, the family, and the school.[8] Table 1 contains a nonexclusive list of essential areas of expertise required of a school physician.

TABLE 1 Critical Knowledge Base for School Physicians

Infectious diseases (eg, outbreak control)
Public health (eg, risk assessment and management, resources)
Immunizations (eg, school requirements and medical contraindications)
Medical-legal issues
State and district school and public health laws, regulations, and policies
IDEA, Section 504, and ADA
FERPA and HIPAA and how they intersect in the school setting
Adolescent health (eg, brain development and reproductive health)
Sports medicine[a]
The value of physical education and physical activity at school
Injury prevention
Conditioning
Disqualifying conditions
Hydration
The effects of climate extremes on athletes
Concussion management
Adaptive physical education
Emergency preparedness (eg, children with special health care needs)
Environmental and occupational health (eg, indoor air quality)
Health and learning (eg, medical, emotional, attentional, and learning problems that affect learning)
Social services resources (eg, access to health insurance and assistance programs)
A coordinated school health model (eg, health services, health education, healthy and safe environment, physical education and activity, nutrition services, counseling/psychology/social services, staff health promotion and family/community involvement)

ADA, Americans With Disabilities Act; FERPA, Family Education Rights and Privacy Act; HIPAA, Health Insurance Portability and Accountability Act; IDEA, Individuals With Disabilities Act.

[a] Unless there is a separate team physician.

CURRENT ROLES AND RELATIONSHIPS FOR SCHOOL PHYSICIANS

The roles and types of relationships for physicians working in schools are broad. Involvement can range from fulfilling mandated services, serving as an advisor to a school health advisory group, or being the leader of a coordinated school health program. School physicians function based on the medical and social needs or demands of the community, the school district's priorities, and state laws. School physicians not only bring value to the quality of health services but also may provide a cost savings to districts, with decreased liability from physician oversight of sound school health programs. For example, school physician–coordinated concussion management programs, established climate standards for outdoor activity, or guided anaphylaxis management protocols can potentially save lives, reduce morbidity, improve outcomes, and prevent potential costly litigation against school districts.[33–36] Because states fund schools on the basis of student attendance, a school physician can potentially save schools money by decreasing absenteeism through advocacy and education, such as in improved asthma or diabetes management.[37–40] The Council on School Health Web site (http://www.aap.org/sections/schoolhealth/) provides guidance on these activities and how pediatricians can work with schools (Table 2).

TABLE 2 Roles for School Physicians

- Mandated Services
  - Physical exams (grade mandated, special education, work permits, sports participation)
  - Oversight of return to sports (eg, concussion management programs)
  - Active member on teams/committees (eg, special education, wellness, health education)
- Consultation
  - Write standing nursing orders/protocols
  - Athletic advisor/team physician
    - Oversee health aspects of athletic programs and best practice standards
      - Infectious diseases esp. for close contact sports
      - Participation of athletes with serious medical conditions
    - Adaptive physical education for acutely injured or chronically disabled youngsters
    - Mixed gender competition
  - Develop policies
    - Contagious diseases/pandemics
    - Restraint, suspension, expulsion
    - Bullying
    - Reproductive health
    - Chronic school absenteeism
  - Develop protocols
    - Delivery of medications
    - Seizure management
    - Diabetes care
    - Anaphylaxis management
    - Asthma education and management
  - Assist in the management of specific medical emergencies or immediacies
  - Participate at the building level in comprehensive, multidisciplinary teams and wellness councils
- Programmatic leadership
  - Health program evaluation and quality improvement
    - Health education
    - Mental health promotion programs
    - Nutrition and food services
    - Physical activity and education
    - Staff wellness
    - Family and community education
  - Liaison with primary care physicians regarding specific concerns
  - Professional performance development
  - Evaluation and collaborative oversight of nursing staff and other health service providers, including one-on-one nurses and door-to-door transportation
  - Reviews of emergency care plans for children with life-threatening conditions.
  - Classroom observations of children with special needs
  - Health education curriculum development
- Direct consultation with principals or the superintendent
  - Medical-legal issues
  - Parent attorneys or advocates in accommodation disputes and hearings
  - Building and playground health and safety
  - Bloodborne pathogen incidents
  - School closure related to illness or weather extremes, or infections that affect public health

Physicians can have a professional relationship with schools in many ways, such as a full- or part-time employee, an independent contractor, or a volunteer on a school health advisory group. Where feasible, a school physician does not serve as a private physician for a child in that school district, however, because it can create a potential conflict of interest between the physician as representative/advocate for a patient versus the school.

Whatever the relationship, once a school district asks a physician to participate in hands-on medical practice for compensation in exchange for services, a clear definition of district expectations of the physician is essential. An agreement, accounting for laws governing the relationship of the physician to the public school district, should define indemnification and liability. It is critical that physicians understand the specifics of their relationship and that the legal implications are articulated clearly in a written agreement renewed periodically. Although community volunteerism is attractive, physicians should take some precautions before volunteering to serve as a school or team physician. It is essential that he or she knows and understands state laws that address whether a district has an obligation to

hire a medical director. Regardless of the type of relationship, the physician should notify his or her professional liability insurance company of involvement in school health activities and determine whether the insurance covers such activities. If covered, this decision should be noted in writing. If a district has an obligation to provide compensation for physician services, this will allow the physician to schedule time for the school district and to improve the quality and consistency of service.

RECOMMENDATIONS

Given the contribution a school physician can make to the overall well-being of a child within the context of the school setting, the AAP recommends the following:

1. Pediatricians should advocate that all school districts have a school physician to oversee health services. The school physician's roles and responsibilities should be well defined, fairly compensated, and outlined within a written contract.
2. Pediatricians should support their patients and local school health programs by working closely with the school health services team. In districts without school physicians, pediatricians should educate these districts about the benefits of having a school physician and work to foster private-public partnerships for school physicians.
3. School physicians should be experts in key school health topics and be educated about the medical-legal environment in which they practice. They need to provide proper notification of their role and responsibility to their medical liability insurer and should collaborate with their AAP chapter, state and local health departments, and school district to understand the laws specific to their role in the schools.
4. Community pediatricians should be knowledgeable about key school health topics and how to work effectively with schools their patients attend.
5. Pediatricians should consider becoming a school physician or serving on school boards or school health advisory groups to develop sound school health policies and community programs.
6. All physicians who work with school-aged children should recognize the value to the child when there is a comprehensive, coordinated team effort among the child's medical home, the school, and family.
7. Pediatric medical investigators should consider further research to determine how comprehensive coordinated school health programs under the direction of a school physician can improve health care in schools and enhance the goals of the medical home without attempting to replace it.
8. AAP districts and chapters should support school health and school physicians and use the school physician's expertise to advocate for important changes to state and local school health policy. In addition, AAP districts and chapters should advocate to develop and promote school health policies that benefit children by advocating for additional research on the benefits of school physicians in school health services.

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POLICY STATEMENT

School-Based Health Centers and Pediatric Practice

COUNCIL ON SCHOOL HEALTH

KEY WORDS
school-based health centers, school health services, medical home

ABBREVIATIONS
SBHCs—school-based health centers

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abstract

FREE

School-based health centers (SBHCs) have become an important method of health care delivery for the youth of our nation. Although they only represent 1 aspect of a coordinated school health program approach, SBHCs have provided access to health care services for youth confronted with age, financial, cultural, and geographic barriers. A fundamental principle of SBHCs is to create an environment of service coordination and collaboration that addresses the health needs and well-being of youth with health disparities or poor access to health care services. Some pediatricians have concerns that these centers are in conflict with the primary care provider's medical home. This policy provides an overview of SBHCs and some of their documented benefits, addresses the issue of potential conflict with the medical home, and provides recommendations that support the integration and coordination of SBHCs and the pediatric medical home practice. *Pediatrics* 2012;129:387–393

BACKGROUND

According to the most recent national census of school-based health centers (SBHCs) conducted by the National Assembly on School-Based Health Care,[1] almost 2000 SBHCs are operating in 48 states and territories of the United States, with 57% located in urban communities, 16% in suburban communities, and 27% in rural communities. Approximately 33% of SBHCs are located in high schools, 24% are located in elementary or middle schools, and 43% are located in alternative schools or schools with a combination of grade levels. As SBHCs become more prevalent, pediatricians and other health care providers should be familiar with the role of SBHCs in providing primary care and preventive services to school-aged youth. In addition, it is critical that health care providers working in SBHCs are aware of the importance of supporting the medical home and coordinating care with other primary care providers in the community.

The provision of health services in schools is not a new concept; rather, it was pioneered by pediatric and nursing health professionals to address common pediatric health challenges.[2,3] Schools already provide several critical health services, including triage and management of medical emergencies; medication delivery; services for youth with special health care needs; referral of common health problems, such as injury, asthma, and behavioral and emotional difficulties; and health screenings (such as vision and hearing screenings).[4–7] SBHCs are an expansion of these school health services. SBHCs evolved during the 1970s and 1980s and were promoted by the Robert Wood Johnson Foundation, which continues its support by funding The Center for

Health and Health Care in Schools.[8,9] Over time, guidelines regarding best practices for SBHCs have been developed. These include performing a community needs assessment; coordinating care with the medical community, hospitals, and public health providers; and documenting the effect of SBHC services on students' health and educational outcomes.[10–14] Another best practice of SBHCs is to establish a business plan to generate grants, contracts, and billings to match SBHC expenses. Although state funding of SBHCs has almost quadrupled over the past 20 years, finding adequate resources and income remains a challenge for most SBHCs.[15]

By the early 1990s, some pediatricians expressed concern that SBHCs might fragment children's health care because schools are closed on the afternoons and during weekends and holidays.[4] Although this concern was warranted, most SBHCs have avoided fragmentation of health care delivery by conducting needs assessments and finding a health care "sponsor" to address the community's documented needs. Sponsors can include pediatricians who provide care to underserved children in their communities by establishing SBHCs as satellites of their practices with financial support from grants and contracts. In addition, local hospitals often provide after-hours and school vacation coverage and financial support for SBHCs. Local hospitals benefit from this arrangement because SBHCs can reduce hospitals' costs by preventing unnecessary emergency or urgent care visits and hospitalizations and enrolling students in public health insurance. As the medical home concept has evolved, SBHCs fit into the model just as satellite offices and practice networks do for private practice.[12] A recent national survey of SBHCs revealed that 35% of managed care organizations recognize SBHCs as reimbursable primary care providers.[1]

THE ROLE OF THE SBHC IN INCREASING ACCESS TO HEALTH CARE

SBHCs address many of the barriers to health care access for school-aged children.[16–21] Because SBHCs are located where children spend a significant amount of their time, scheduling and transportation barriers are minimized. SBHCs address financial barriers by helping enroll eligible students in Medicaid or the Children's Health Insurance Program and offering free services for uninsured students. Many adolescents, especially boys, are reluctant to use traditional medical care.[22] SBHCs increase adolescents' health care use, particularly for sexual health issues, drug or alcohol problems, and mental health problems, by providing convenient and confidential care in a familiar setting.[23–27]

Surveys of students, parents, and pediatricians indicate that the majority are supportive of SBHCs and believe SBHCs can increase access to health care for underserved children.[18,27–30] In addition, the authors of several studies have documented that children and adolescents who use SBHCs have more primary care visits and fewer emergency department visits when compared with those who do not use SBHCs.[18,31–35] A national multisite study by the Robert Wood Johnson Foundation revealed that 71% of students enrolled in SBHCs reported having a health care visit compared with 59% who were not enrolled.[20] Studies conducted in Denver revealed that adolescents who used SBHCs, the majority of whom were uninsured, had higher visit rates and a higher proportion of visits for preventive care or screening for high-risk behaviors compared with those who did not use SBHCs.[24,35] Although colocation and integration of medical with oral health services are not common in pediatric practices, SBHCs can offer integration along with improved access for oral health services.[36] Three reports have documented improved access to dental care, which is a particularly difficult access issue for uninsured and publicly insured adolescents with many dental health needs.[37–39]

SERVICES PROVIDED BY SBHCs

SBHCs can deliver a variety of services, including medical, oral, nutritional, case management, and mental health services. Because the types of providers and range of services offered by SBHCs vary, pediatricians should be knowledgeable about what their local SBHCs offer. SBHCs usually use 1 of 3 primary staffing models. The primary care model, used by 25% of SBHCs, comprises a nurse practitioner or physician assistant who provides basic health services, with supervision by a physician. The primary care–mental health model (40%) also includes a mental health professional, such as a licensed clinical social worker or psychologist. Finally, the primary care–mental health plus model (35%) comprises primary care and mental health providers and other professionals, such as health educators, case managers, and nutritionists.[1,36] According to the recent census of SBHCs, the most common services provided are comprehensive health assessments (offered by 97% of SBHCs), treatment of acute illness (96%), prescriptions for medications (96%), vision and hearing screenings (92%), sports participation examinations (92%), nutrition counseling (91%), and anticipatory guidance (90%).[1]

The provision of reproductive health services in SBHCs has resulted in community controversy, despite the fact that parents have been found to support these services.[40,41] Currently, ~68% of SBHCs provide screening and treatment of sexually transmitted infections, 70% provide counseling about

birth control methods, 39% dispense contraception, and 59% provide follow-up regarding contraception use.[1] Many SBHCs are prohibited from dispensing contraception by school district policy (57%), health center policy (13%), and state law (10%).[1]

In addition to providing services for individual students, SBHCs can provide prevention, early intervention, and harm-reduction services for the entire school community by following the 8 components of the Coordinated School Health Program model, as described by the Division of Adolescent and School Health of the Centers for Disease Control and Prevention.[42] These 8 components are as follows: (1) health education; (2) physical education; (3) health services; (4) mental health and social services; (5) nutrition services; (6) healthy and safe environment; (7) family and community involvement; and (8) staff wellness. A literature review conducted by the Division of Adolescent and School Health of the Centers for Disease Control and Prevention identified school-based health promotional interventions that not only improved health attitudes and behaviors but also improved academic performance.[43] A New York comparison study revealed that students in schools with SBHCs had greater satisfaction with their learning environment, compared with students in schools without SBHCs.[44] Thus, in addition to addressing health promotion by using *Bright Futures* guidelines for health examinations, SBHCs are increasingly using small group, classroom, and schoolwide evidence-based curricula and interventions to better reach *Bright Futures* goals for health.

EFFECTIVENESS OF SBHCs IN IMPROVING HEALTH OUTCOMES

SBHCs have been shown to improve children and adolescents' health for several outcomes while also reducing health care costs.[32,33,45–48] Students who use SBHCs are more likely to have received recommended vaccines and screening for high-risk behaviors, compared with those who do not use SBHCs.[24,35,49] Students who use SBHCs have also been shown to have higher satisfaction with their health status and have healthier behaviors, such as more physical activity and greater consumption of healthier foods.[47] Two studies using Medicaid claims data to compare health care costs for students who did and did not use SBHCs revealed that those who used SBHCs had lower Medicaid expenses.[32,48]

Asthma is 1 chronic disease for which SBHCs have improved outcomes. Children with asthma have better outcomes with management and coordination by the SBHC with the children's medical homes and pediatric subspecialists. A study by Webber et al[46] revealed that access to SBHCs was associated with a reduction in the rate of hospitalization and a gain of 3 days of school for school children who have asthma. Another study revealed that students with asthma who accessed SBHCs had lower hospitalization rates and improved self-care, such as use of peak flow meters and metered-dose inhalers.[45] Guo et al[50] investigated rates of hospitalization and emergency department visits for school-aged children with asthma and found that children with asthma attending a school with an SBHC had fewer hospitalizations and emergency department visits compared with children without SBHC access. They estimated the potential cost savings to be $970 per child.

Integration of medical health and mental health screening and services in SBHCs benefit school performance.[27,51–53] When mental health services are offered in SBHCs, students' access to mental health services is improved and communication is facilitated between students, school personnel, SBHC staff, and parents.[24,54,55] In Dallas, medical services decreased school absences by 50% among students who had 3 or more absences in a 6-week period, and students who received mental health services had an 85% decline in school discipline referrals.[55] In North Carolina, students who used SBHCs were significantly more likely to stay in school and to graduate or be promoted than did students who did not use SBHC services. This was especially true for African American male students, who were 3 times more likely to stay in school.[51] Another study conducted in a northeastern city revealed that SBHC users had a 50% decrease in absenteeism and a 25% decrease in tardiness 2 months after receiving SBHC services.[52]

SBHCS AND THE MEDICAL HOME

The American Academy of Pediatrics defines the medical home as a model of delivering primary care that is accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective to all children and youth.[56,57] Some pediatricians are concerned that SBHCs might not support the medical home model because they do not provide access to care when schools are closed or may provide duplicative services to children outside of their medical homes without communicating with the medical homes.[10] Most SBHCs are able to avoid these concerns by conducting needs assessments and coordinating or collaborating with the community's local health care providers to address their community's documented needs.[11] SBHCs can meet the definition of the medical home for their patients in collaboration with their sponsoring agencies by (1) ensuring linkage so that services are available 24 hours per day, 7 days a week, and 52 weeks per year, even when schools are closed; (2) encouraging parental

participation and providing education about the health care needs of the youth they serve; (3) working collaboratively with primary care practices, school districts, and community agencies; and (4) coordinating all specialty and subspecialty consultations, referrals, and collaborations.

For families who do not have access to a medical home, SBHCs can assist in linking them to a medical home. For example, SBHCs can:

- Provide families with onsite insurance eligibility and enrollment and connect them to health insurance plans (private or public) that will provide financial access to primary care practices.
- Connect families to primary care practices/medical homes that are accepting new patients and families.
- Provide satellite primary care services in collaboration with existing pediatric medical homes (eg, private practices, community health centers) that are not otherwise able to enroll these patients into their practice.
- Become the medical home for school youth who are in need of a provider if the SBHCs meet the criteria for a medical home described in the preceding paragraph.

OPPORTUNITIES

1. SBHCs can provide families with onsite insurance eligibility and enrollment and connect them to health insurance plans (private or public) that will provide financial access to primary care practices and can connect families to primary care practices that are accepting new patients and families.
2. Community primary care providers can collaborate with SBHCs to expand both the SBHCs' and the practices' enrollment, particularly for populations such as adolescent boys, which may not readily access traditional health services. Basic preventive services could be provided in the SBHC and consultative services, specialty referral, and follow-up could be provided in the community practice for patients enrolled at both sites.
3. SBHCs can provide assistance in the day-to-day monitoring and case management of children with chronic disease and disabilities.
4. SBHCs can help reinforce *Bright Futures* health examination goals by implementing health–promoting, evidence-based curricula, and interventions in the school setting.
5. Large SBHCs may provide health and health-related services, including dental services, mental health services, and nutrition counseling, as well as confidential reproductive health services that pediatric offices do not or cannot supply, especially for families with limited financial resources.

CHALLENGES

1. The health and education systems do not always share the same priorities. SBHC providers and community pediatricians can bring the health and education communities together with a common goal of better outcomes for children. They can help educate the school community about prioritizing children's health because children do not learn well if they are not healthy.[58]
2. Communication among schools, SBHCs, and community primary care providers should be facilitated. SBHCs should be planned and executed with primary care providers' input to result in a collaborative and integrated model that supports the medical home.[4,10] In addition, SBHCs should develop systems to regularly communicate with community providers about shared patients.
3. Pediatricians interested in starting a new SBHC may be unable to do so because of the time required to involve appropriate stakeholders, conduct a needs assessment, develop a business plan, and identify funding sources. However, school health advisory councils, which already exist in the majority of schools or districts, can assist in these activities and reduce the burden.[12,59,60]
4. SBHCs require multiple funding sources to stay financially solvent. Most SBHCs serve uninsured or underinsured patients or patients who may require additional case management or social support that is poorly reimbursed by insurance. Therefore, initial and ongoing funding in addition to insurance billing is required.[12,15]
5. Concerns about confidentiality and privacy can be a barrier to communication. Confidentiality for adolescents and health information transfer are challenges regulated by the Health Insurance Portability and Accountability Act and the Family Educational Rights and Privacy Act, laws that are implemented differently from state to state. However, model forms and approaches have been developed by the National Association for School-Based Health Centers and American School Health Association.[61,62]

RECOMMENDATIONS

1. Advocate for SBHCs as 1 model of a system of health care delivery that provides a health care "safety net" for children and adolescents who are uninsured or underinsured or represent special populations who do not regularly access health care.

2. Learn about SBHCs and the services they provide in the community. Pediatricians should become familiar with current or planned school health initiatives in their communities and assess their practices' capabilities to work with such efforts. SBHCs should conduct outreach activities to ensure that pediatricians and other health care providers in the community know about what SBHCs have to offer.
3. Ensure that all patients served by SBHCs have access to a medical home, either in the SBHC itself or with a practice in the community. Community pediatricians with experience in implementing the medical home model in their practices can educate and assist SBHCs in doing the same. SBHCs should work with their sponsoring agency to ensure that all patients they serve have access to a medical home by meeting the requirements of a medical home in the SBHC itself and/or collaborating with other community providers.
4. Facilitate coordination of care between SBHCs and community primary care providers. Community pediatricians can determine whether youth and families in their practices may be utilizing services at SBHCs and contact the SBHCs to facilitate coordination of care. In turn, SBHCs should identify enrollees that have a medical home and perform outreach to community pediatricians to facilitate a model of collaboration and communication.
5. Support access to services provided by SBHCs that are limited, not affordable, or not available in private practice or other community settings for children and adolescents. These services may include: mental health, substance use or nutritional counseling, oral health services, or confidential reproductive health services. In addition, students with chronic conditions may benefit from school-based monitoring that is reported back to the medical home.
6. Consider SBHCs as sites to provide volunteer pediatric services and supervised educational opportunities for health services professionals in training.[63] Pediatricians can support community schools and families by volunteering or working part time at SBHCs, supervising trainees at SBHCs, or serving as the SBHC's consultant or medical director.
7. Encourage the development of school health advisory councils to establish a setting for planning, monitoring, and developing SBHCs and coordinated school health services.[12,59,60]

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ERRATA

American Academy of Pediatrics. School-Based Health Centers and Pediatric Practice. *Pediatrics*. 2012;129(2):387–393

An error occurred in the American Academy of Pediatrics policy statement "School-Based Health Centers and Pediatric Practice" published in the February 2012 issue of *Pediatrics* (2012;129[2]:387–393; originally published online January 30, 2012; doi: 10.1542/peds.2011-3443). On page 390, in Challenge No. 5, the organization listed as National Association for School-Based Health Centers should have been National Assembly on School-Based Health Care. We regret the error.

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POLICY STATEMENT

Screening Examination of Premature Infants for Retinopathy of Prematurity

AMERICAN ACADEMY OF PEDIATRICS Section on Ophthalmology, AMERICAN ACADEMY OF OPHTHALMOLOGY, AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS, and AMERICAN ASSOCIATION OF CERTIFIED ORTHOPTISTS

KEY WORDS
retinopathy of prematurity, preterm infants

ABBREVIATION
ROP—retinopathy of prematurity

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abstract

FREE

This statement revises a previous statement on screening of preterm infants for retinopathy of prematurity (ROP) that was published in 2006. ROP is a pathologic process that occurs only in immature retinal tissue and can progress to a tractional retinal detachment, which can result in functional or complete blindness. Use of peripheral retinal ablative therapy by using laser photocoagulation for nearly 2 decades has resulted in a high probability of markedly decreasing the incidence of this poor visual outcome, but the sequential nature of ROP creates a requirement that at-risk preterm infants be examined at proper times and intervals to detect the changes of ROP before they become permanently destructive. This statement presents the attributes on which an effective program for detecting and treating ROP could be based, including the timing of initial examination and subsequent reexamination intervals. *Pediatrics* 2013;131:189–195

INTRODUCTION

Retinopathy of prematurity (ROP) is a disorder of the developing retina of low birth weight preterm infants that potentially leads to blindness in a small but significant percentage of those infants. In almost all term infants, the retina and retinal vasculature is fully developed, and ROP cannot occur; however, in preterm infants, the development of the retina, which proceeds from the optic nerve head anteriorly during the course of gestation, is incomplete, with the extent of the immaturity of the retina depending mainly on the degree of prematurity at birth.

The Multicenter Trial of Cryotherapy for Retinopathy of Prematurity demonstrated the efficacy of peripheral retinal cryotherapy (ie, cryoablation of the immature, avascular peripheral retina) in reducing unfavorable outcomes for threshold ROP, defined as morphologic changes beyond which the incidence of unfavorable outcome was >50%.[1] The study's 15-year follow-up report[2] confirmed the following lasting benefits: unfavorable structural outcomes were reduced from 48% to 27%, and unfavorable visual outcomes (ie, best corrected visual acuity worse than 20/200) were reduced from 62% to 44%. Subsequently, laser photocoagulation has been used for peripheral retinal ablation with at least equal success and is now the preferred method of ablation.[3–6] More recently, the Early Treatment for Retinopathy of Prematurity Randomized Trial confirmed the efficacy of

treatment of high-risk prethreshold ROP and redefined the indications for treatment.[7]

Because of the sequential nature of ROP progression and the proven benefits of timely treatment in reducing the risk of visual loss, effective care now requires that at-risk infants receive carefully timed retinal examinations by an ophthalmologist who is experienced in the examination of preterm infants for ROP using a binocular indirect ophthalmoscope on a scheduled basis according to their gestational age at birth and their subsequent disease severity and that all pediatricians or any other primary care providers who care for these at-risk preterm infants be aware of this schedule.

This statement outlines the principles on which a program to detect ROP in infants at risk might be based. The goal of an effective ROP screening program is to identify the infants who could benefit from treatment and make appropriate recommendations on the timing of future screening and treatment interventions. Because unchecked ROP can lead to permanent blindness, it is important that all at-risk infants be screened in a timely fashion, recognizing that not all infants require treatment. On the basis of information published thus far, the sponsoring organizations of this statement suggest the following guidelines for the United States. It is important to recognize that other world locations could have different screening parameters.[8,9] It is also important to note that despite appropriate timing of examinations and treatment, a small number of infants at risk progress to poor outcomes.[3–6]

RECOMMENDATIONS

1. Infants with a birth weight of ≤1500 g or gestational age of 30 weeks or less (as defined by the attending neonatologist) and selected infants with a birth weight between 1500 and 2000 g or gestational age of >30 weeks with an unstable clinical course, including those requiring cardiorespiratory support and who are believed by their attending pediatrician or neonatologist to be at high risk for ROP, should have retinal screening examinations performed after pupillary dilation by using binocular indirect ophthalmoscopy with a lid speculum and scleral depression (as needed) to detect ROP. Dilating drops should be sufficient to allow adequate examination of the fundi, but care should be used in using multiple drops if the pupil fails to dilate, because poor pupillary dilation can occur in advanced ROP, and administering multiple doses of dilating drops can adversely affect the systemic status of the infant. Sterile instruments should be used to examine each infant to avoid possible cross-contamination of infectious agents. One examination is sufficient only if it unequivocally shows the retina to be fully vascularized in both eyes. Effort may be made to minimize the discomfort and systemic effect of this examination by pretreatment of the eyes with a topical anesthetic agent such as proparacaine; consideration also may be given to the use of pacifiers, oral sucrose, and so forth.
2. Retinal examinations in preterm infants should be performed by an ophthalmologist who has sufficient knowledge and experience to identify accurately the location and sequential retinal changes of ROP. The International Classification of Retinopathy of Prematurity Revisited[10] should be used to classify, diagram, and record these retinal findings at the time of examination.
3. The initiation of acute-phase ROP screening should be based on the infant's postmenstrual age. The onset of serious ROP correlates better with postmenstrual age (gestational age at birth plus chronologic age) than with postnatal age.[11] That is, the more preterm an infant is at birth, the longer the time to develop serious ROP. This knowledge has been used previously in developing a screening schedule.[12,13] Table 1 was developed from an evidence-based analysis of the Multicenter Trial of Cryotherapy for Retinopathy of Prematurity natural history data and confirmed by the Light Reduction in ROP Study, which was conducted a decade later.[14] It represents a suggested schedule for the timing of the initial eye examinations based on postmenstrual age and chronologic (postnatal) age to detect ROP before it becomes severe enough to result in retinal detachment while minimizing the number of potentially traumatic examinations.[15] Although Table 1 provides a schedule for detecting ROP potentially damaging to the retina with 99% confidence, it should be

TABLE 1 Timing of First Eye Examination Based on Gestational Age at Birth

Gestational Age at Birth, wk	Age at Initial Examination, wk	
	Postmenstrual	Chronologic
22[a]	31	9
23[a]	31	8
24	31	7
25	31	6
26	31	5
27	31	4
28	32	4
29	33	4
30	34	4
Older gestational age, high-risk factors[b]		4

Shown is a schedule for detecting prethreshold ROP with 99% confidence, usually before any required treatment.
[a] This guideline should be considered tentative rather than evidence-based for infants with a gestational age of 22 to 23 wk because of the small number of survivors in these postmenstrual-age categories.
[b] Consider timing based on severity of comorbidities.

appreciated that infants born before 25 weeks' gestational age should be considered for earlier screening on the basis of severity of comorbidities (6 weeks' chronologic age, even if before 31 weeks' postmenstrual age to enable earlier identification and treatment of aggressive posterior ROP [a severe form of ROP that is characterized by rapid progression to advanced stages in posterior ROP] that is more likely to occur in this extremely high-risk population).

4. Follow-up examinations should be recommended by the examining ophthalmologist on the basis of retinal findings classified according to the international classification (see Fig 1).[8] The following schedule is suggested:

1-Week or Less Follow-up

- immature vascularization: zone I—no ROP
- immature retina extends into posterior zone II, near the boundary of zone I
- stage 1 or 2 ROP: zone I
- stage 3 ROP: zone II
- the presence or suspected presence of aggressive posterior ROP

1- to 2-Week Follow-up

- immature vascularization; posterior zone II
- stage 2 ROP: zone II
- unequivocally regressing ROP: zone I

2-Week Follow-up

- stage 1 ROP: zone II
- immature vascularization: zone II—no ROP
- unequivocally regressing ROP: zone II

2- to 3-Week Follow-up

- stage 1 or 2 ROP: zone III
- regressing ROP: zone III

5. The conclusion of acute retinal screening examinations should be based on age and retinal ophthalmoscopic findings.[13] Findings that suggest that examinations can be terminated include the following:
   - zone III retinal vascularization attained without previous zone I or II ROP (if there is examiner doubt about the zone or if the postmenstrual age is less than 35 weeks, confirmatory examinations may be warranted);
   - full retinal vascularization in close proximity to the ora serrata for 360°—that is, the normal distance found in mature retina between the end of vascularization and the ora serrata. This criterion should be used for all cases treated for ROP solely with bevacizumab;
   - postmenstrual age of 50 weeks and no prethreshold disease (defined as stage 3 ROP in zone II, any ROP in zone I) or worse ROP is present; or
   - regression of ROP[16] (care must be taken to be sure that there is no abnormal vascular tissue present that is capable of reactivation and progression in zone II or III).
6. The use of digital photographic retinal images that are captured and sent for remote interpretation is a developing approach to ROP screening[17,18]; however, outcomes comparison between large-scale operational digital-imaging systems with remote interpretation versus binocular indirect ophthalmoscopy have not been published. Nevertheless, some neonatal centers are conducting remote ROP screening for infants still in the hospital.[17] At a minimum, programs that employ this method should comply with the timing and other recommendations outlined in the preceding guidelines. Protocol modifications may be required to allow for additional time for communication, processing, transportation, or other

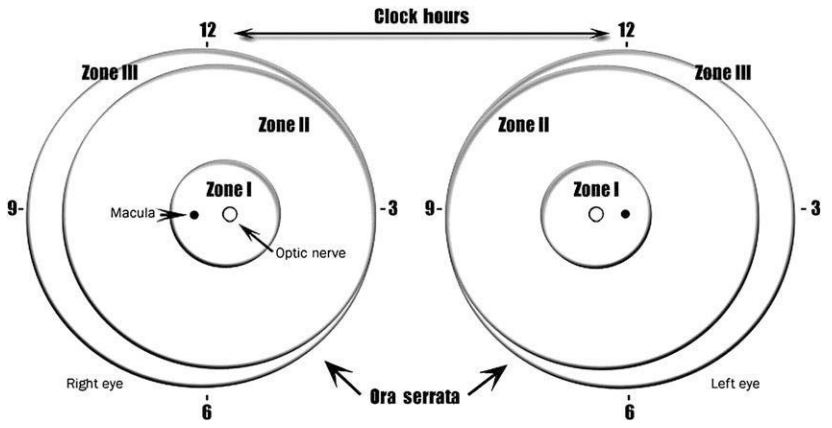

FIGURE 1

Scheme of retina of the right and left eyes showing zone borders and clock hours used to describe the location and extent of ROP. Diagrammatic representation of the potential total area of the premature retina, with zone I (the most posterior) symmetrically surrounding the optic nerve head (the earliest to develop). A larger retinal area is present temporally (laterally) rather than nasally (medially) (zone III). Only zones I and II are present nasally. The retinal changes discussed in recommendation 4 are usually recorded on a diagram such as this one.

logistical issues.[19] Captured images and their interpretation should be incorporated into the permanent medical record. It is also recommended that indirect ophthalmoscopy be performed at least once by a qualified ophthalmologist before treatment or termination of acute phase screening of ROP for infants at risk for ROP.

Digital image capture (taking of photographs) requires skill, experience, practice, a broad understanding of the infant eye, and ideally, a knowledge of the pathophysiology of ROP (zone, stage, and plus). Remote ROP graders should have the same training requirements as bedside examiners and a mentored experience in interpretation of digital images for ROP. Interpretation requires not only expert knowledge about ROP but also understanding of the limitations of interpreting static images and the special care that must be taken to schedule more frequent imaging sessions that may be required because of those limitations. Remote interpreters must provide clinical input on the timing of follow-up imaging sessions and ophthalmoscopic examinations and appropriate methodology, and these findings need to be communicated in a manner that is compliant with rules of the Health Insurance Portability and Accountability Act (HIPAA).

Digital retinal imaging may also be a useful tool for objective documentation of retinal findings and for teaching NICU staff and parents about examination results, even if it is not the primary method used for ROP screening in the NICU.[20]

ROP care that includes off-site photographic interpretation requires close collaboration among neonatologists, imaging staff, and ophthalmologists. As with all ROP screening programs, specific responsibilities of each individual must be carefully delineated in a written protocol in advance so that repeat imaging and/or confirmatory examinations and required treatments can be performed without delay.

Treatment

7. The presence of plus disease (defined as abnormal dilation and tortuosity of the posterior retinal blood vessels in 2 or more quadrants of the retina meeting or exceeding the degree of abnormality represented in reference photographs[1,8]; see below) in zones I or II suggests that peripheral ablation, rather than observation, is appropriate.[13]

   Treatment should be initiated for the following retinal findings:

   - zone I ROP: any stage with plus disease
   - zone I ROP: stage 3—no plus disease
   - zone II: stage 2 or 3 with plus disease

8. Practitioners involved in the ophthalmologic care of preterm infants should be aware that the retinal findings that require strong consideration of ablative treatment were revised according to the Early Treatment of Retinopathy of Prematurity Randomized Trial study.[7] This recommendation is based on the findings of improved visual outcomes with earlier treatment recommended by the Final Visual Acuity Results in the Early Treatment of Retinopathy of Prematurity Study.[21] "Threshold ROP," a term that refers to specific morphologic features defined in the Multicenter Trial of Cryotherapy for Retinopathy of Prematurity, is no longer the least severe ROP for which intervention should be considered. Threshold ROP, as defined in the Multicenter Trial of Cryotherapy for Retinopathy of Prematurity study, is now included in type 1 ROP.

   Certain levels of high-risk prethreshold disease also respond better to ablative treatment than observation. Special care must be used in determining the zone of disease. The revised International Classification of Retinopathy of Prematurity Revisited classification gives specific examples on how to identify zone I and zone II disease by using a 28-diopter lens with binocular indirect ophthalmoscopy. As noted previously, the presence of plus disease rather than the number of clock hours of disease may be the determining factor in recommending ablative treatment. Treatment should generally be accomplished, when possible, within 72 hours of determination of treatable disease to minimize the risk of retinal detachment. Follow-up is recommended in 3 to 7 days after treatment to ensure that there is no need for additional treatment in areas where ablative treatment was not complete.

9. Recently published data[22] indicate that intravitreal bevacizumab monotherapy, as compared with conventional laser therapy, in infants with stage 3+ ROP showed a significant benefit for zone I but not zone II disease. Development of normal-appearing peripheral retinal vessels continued after treatment with intravitreal bevacizumab, but conventional laser therapy led to apparent permanent destruction of the peripheral retina,

although published studies indicate that this apparent destruction was associated with only a modest visual field loss. This trial was too small to assess safety and effects on future development of brain and other tissues. Consideration may be given to treatment of infants with zone I, stage 3+ ROP with intravitreal injection of bevacizumab; however, bevacizumab is not approved by the US Food and Drug Administration for the treatment of ROP. If intravitreal injection of bevacizumab for zone I stage 3+ ROP is contemplated, it is essential that treatment be administered only after obtaining a detailed informed consent, because there remain unanswered questions involving dosage, timing, safety, visual outcomes, and other long-term effects. Infants treated with bevacizumab injection should be monitored weekly after injection by using techniques in accord with these published ROP examination guidelines until retinal vascularization is completed. Because in the BEAT-ROP study,[22] recurrence of ROP after bevacizumab injection tended to occur considerably later than that after conventional laser peripheral retinal ablative treatment (16 $\pm$ 4.6 weeks vs 6.2 $\pm$ 5.7 weeks), longer follow-up is required for infants treated with bevacizumab to ensure that ROP requiring treatment does not recur.

10. Communication with parents by members of the care team is very important, as is documentation of those communications. Parents should be aware of ROP examinations and should be informed if their child has ROP, with subsequent updates on ROP progression. The possible consequences of serious ROP should be discussed at the time that a significant risk of poor visual outcome develops. Documentation of such conversations with parents in the nurse or physician notes is highly recommended, along with the use of standardized parental educational materials.
11. Responsibility for examination and follow-up of infants at risk for ROP must be carefully defined by the staff and consultants of each NICU. Unit-specific criteria with respect to birth weight and gestational age for examination for ROP should be established for each NICU by consultation and agreement between neonatology and ophthalmology services. These criteria should be recorded and should automatically trigger ophthalmologic examinations. If hospital discharge or transfer to another neonatal unit or hospital is contemplated before retinal development into anterior zone III has taken place or if the infant has been treated by ablation for ROP and there is either incomplete regression or incomplete retinal healing, the availability of appropriate follow-up ophthalmologic examination must be ensured, and specific arrangement for that examination must be made before such discharge or transfer occurs. The transferring primary care physician, after communication with the examining ophthalmologist, should have the responsibility for communicating to the infant's new primary care physician what eye examinations are needed and their required timing. The new primary care physician should ascertain the current ocular examination status of the infant by reviewing the record and communicating with the transferring physician so that any necessary examinations by an ophthalmologist with ongoing experience and expertise in examination of preterm infants for ROP can be arranged at the appropriate time at the receiving facility or on an outpatient basis if discharge is contemplated before the need for continued examination has ceased, as outlined in Diagnosis Recommendation 6. If responsibility for arranging follow-up ophthalmologic care after discharge is delegated to the parents, they must be made to understand the potential for severe visual loss, including blindness; that there is a critical examination time schedule to be met if treatment is to be successful; and that timely follow-up examination is essential to successful treatment. This information should be communicated both verbally and in writing and should be carefully documented in the infant's medical record. If such arrangements for communication and follow-up after transfer or discharge cannot be made, the infant should not be transferred or discharged until appropriate follow-up examination can be arranged by the unit staff who are discharging the infant.

Regardless of whether infants at risk develop ROP requiring treatment, pediatricians and other physicians who care for infants who have had ROP should be aware that these infants are at risk for other seemingly unrelated visual disorders, such as strabismus, amblyopia, high refractive errors, cataract, and so forth. Ophthalmologic follow-up for these potential problems after discharge from the NICU is indicated within 4 to 6 months after discharge.

This statement replaces the previous statement on ROP from the American Academy of Pediatrics, American Academy of Ophthalmology, and American Association for Pediatric

Ophthalmology and Strabismus[23]; ROP care is evolving, and recommendations may be modified as additional data about ROP risk factors, treatments, and long-term outcomes are published.

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POLICY STATEMENT

Sensory Integration Therapies for Children With Developmental and Behavioral Disorders

abstract

FREE

Sensory-based therapies are increasingly used by occupational therapists and sometimes by other types of therapists in treatment of children with developmental and behavioral disorders. Sensory-based therapies involve activities that are believed to organize the sensory system by providing vestibular, proprioceptive, auditory, and tactile inputs. Brushes, swings, balls, and other specially designed therapeutic or recreational equipment are used to provide these inputs. However, it is unclear whether children who present with sensory-based problems have an actual "disorder" of the sensory pathways of the brain or whether these deficits are characteristics associated with other developmental and behavioral disorders. Because there is no universally accepted framework for diagnosis, sensory processing disorder generally should not be diagnosed. Other developmental and behavioral disorders must always be considered, and a thorough evaluation should be completed. Difficulty tolerating or processing sensory information is a characteristic that may be seen in many developmental behavioral disorders, including autism spectrum disorders, attention-deficit/hyperactivity disorder, developmental coordination disorders, and childhood anxiety disorders.

Occupational therapy with the use of sensory-based therapies may be acceptable as one of the components of a comprehensive treatment plan. However, parents should be informed that the amount of research regarding the effectiveness of sensory integration therapy is limited and inconclusive. Important roles for pediatricians and other clinicians may include discussing these limitations with parents, talking with families about a trial period of sensory integration therapy, and teaching families how to evaluate the effectiveness of a therapy. *Pediatrics* 2012;129:1186–1189

SECTION ON COMPLEMENTARY AND INTEGRATIVE MEDICINE and COUNCIL ON CHILDREN WITH DISABILITIES

KEY WORDS

sensory integration, sensory processing, sensory integration therapy

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BACKGROUND: DEVELOPMENT OF THE SENSORY SYSTEM

Sensory integration is a framework first described by occupational therapist A. Jean Ayres, PhD, in the 1970s. It refers to the body's way of handling and processing sensory inputs from the environment.[1] Ayres felt that the sensory system develops over time, much like other aspects of development (language, motor, etc), and that deficits can occur in the process of developing a well-organized sensory system. A well-organized sensory system can integrate input from multiple sources (visual, auditory, proprioceptive, or vestibular). Ayres postulated that sensory integration dysfunction occurs when sensory neurons are not signaling or functioning efficiently, leading to deficits in development, learning, and/or emotional regulation.

The ability of the brain to process sensory information from the environment has been an expanding area of basic neuroscience research. Hubel and Wiesel were among the first to document the important effects of early experience (eg, deprivation) on the way visual sensory input is processed in the brain.[2–5] Animal and human research is beginning to explore how other senses are processed and integrated[6–10] and how those processes are disrupted in specific syndromes (eg, autism,[11,12] schizophrenia[13,14]) and by specific experiences (eg, institutionalization, international adoption[15,16]).

STATEMENT OF THE PROBLEM

Since Ayres[1] described sensory integration dysfunction in the 1970s, sensory-based therapies have been used increasingly, mainly by occupational therapists (but sometimes other health professionals) to treat a range of symptoms seen in children presenting from across a variety of settings, including the home, community organizations, clinics, and schools. Sensory integration, sensory "diets," and other sensory-based therapies typically are based on classic sensory integration theory but often do not use all of the originally described sensory integration protocols. Sensory-based therapies involve activities that are believed to organize the sensory system, by providing vestibular, proprioceptive, auditory, and tactile inputs, by using brushes, swings, balls, and other specially designed equipment to provide these inputs. Occupational therapists and other health professionals may also use a sensory processing approach when identifying and modifying barriers that limit the individual's ability to participate in everyday activities or occupations.

Proponents of sensory integration theory believe that inappropriate or deficient sensory processing is a developmental disorder amenable to therapy and that treatment can improve developmental outcomes.[17] A definition of sensory processing disorder has been proposed but has not been universally accepted.[18] Standardized measures, such as the Sensory Profile,[19] have been developed to classify a child's sensory deficits. The Sensory Profile provides a standard method for professionals to measure a child's sensory processing abilities and to provide a profile of the effect of sensory processing on functional performance in the daily life of a child.[20] Such standardized measures are commonly used by occupational therapists to quantify how much these developmental and behavioral differences affect the child's functional performance of the daily activities of childhood.

The possible diagnosis of sensory processing disorders remains a challenging clinical issue. In the sensory processing disorder classification system proposed by Miller et al,[18] sensory processing disorders are subdivided into 3 specific patterns: sensory modulation disorder, sensory discrimination disorder, and sensory-based motor disability. These patterns are then categorized into subtypes. Sensory modulation disorder is subdivided into overresponsive, underresponsive, and sensory seeking/craving subtypes. Sensory discrimination disorder has no subtypes. Sensory-based motor disability is subdivided into postural disorder and dyspraxia.

Sensory processing disorder or a similar diagnosis has been included in Zero to Three's *Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood Revised*[21] and the *Diagnostic Manual for Infancy and Early Childhood of the Interdisciplinary Council on Developmental and Learning Disorders*,[22] where "regulatory-sensory processing disorder" in infants has also been classified as a developmental difference for this group. For older children and adolescents, no commonly accepted definition of sensory processing disorder exists. Some experts have proposed that the definition of autism spectrum disorders in the forthcoming *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* be expanded to include definitions of associated sensory issues, such as under- and overresponsiveness; however, the committee that is preparing the textbook has requested that more studies be performed before sensory processing disorder can be officially recognized.[23]

It remains unclear whether children who present with findings described as sensory processing difficulties have an actual "disorder" of the sensory pathways of the brain or whether these deficits represent differences associated with other developmental and behavioral disorders. Specifically, the behavioral differences seen in children with autism spectrum disorders,[24] attention-deficit/hyperactivity disorder,[25] and developmental coordination disorders[26] overlap symptoms described in children with sensory processing disorders. Studies to date have not demonstrated that sensory integration dysfunction exists as a separate disorder distinct from these other developmental disabilities. Furthermore, numerous challenges exist for evaluating the effectiveness of sensory integration therapy, including the wide spectrum of symptom severity and presentation, lack of consistent outcome measures, and family factors, which make response to therapy variable.[27–29]

Despite the challenges of defining and studying the effectiveness of sensory integration therapy, it is possible that the treatment of sensory processing difficulties is helpful to children who have problems identified in sensory processing measures. Some published case series and observational studies

have reported positive outcomes of sensory integration therapy for children with sensory processing disorders.[27,29] Older meta-analyses[30,31] and at least 2 more recent reviews[32,33] have been published that suggested a positive trend in meeting occupational goals with the use of sensory integration therapy. However, the authors of the 1999 meta-analysis cautioned that most studies in the field were of insufficient scientific rigor to be included in a meta-analysis, studies varied in the use of outcome measures, and the ability to draw conclusions and detect a treatment effect was limited.[31] Many of the more recent studies, unfortunately, share some of these traits.

One recent small study cautions health care practitioners about the possible negative behavioral effects of sensory integration therapy in certain populations. Devlin et al[34] reported on the comparative effects of sensory integration therapy and behavioral interventions on rates of challenging or self-injurious behavior in 4 children in whom autism spectrum disorder was diagnosed. A functional assessment was conducted to identify the variables maintaining the challenging behaviors. The sensory integration therapy was designed by an occupational therapist who was trained in sensory integration therapy. The sensory integration therapy and a behavioral intervention were compared within an alternating treatments design. Results from this study clearly demonstrated that the behavioral intervention was more effective in reducing challenging behavior and self-injurious behavior than was the sensory integration therapy. Finally, in the best treatment phase, only the behavioral intervention was implemented, and further reduction was observed in the frequency of challenging behavior and self-injurious behavior.

RECOMMENDATIONS

1. At this time, pediatricians should not use sensory processing disorder as a diagnosis. When these sensory symptoms are present, other developmental disorders—specifically, autism spectrum disorders, attention-deficit/hyperactivity disorder, developmental coordination disorder, and anxiety disorder—must be considered and thoroughly evaluated, usually by appropriate referral(s) to a developmental and behavioral pediatrician, child psychiatrist, or child psychologist. The American Academy of Pediatrics clinical report on the management of children with autism spectrum disorders is a useful resource to help with these referrals.[35]
2. Pediatricians should recognize and communicate with families about the limited data on the use of sensory-based therapies for childhood developmental and behavioral problems.
3. If the pediatrician is managing a child whose therapist is using sensory-based therapies, the pediatrician can play an important role in teaching families how to determine whether a therapy is effective.
    a. Help families design simple ways to monitor effects of treatment (eg, behavior diaries, pre-post behavior rating scales). Help the family be specific and create explicit treatment goals, designed at the onset of therapy, focused on improving the individual's ability to engage and participate in everyday activities (eg, ability to focus, tolerate foods, and be in a room with loud noises).
    b. Set a time limit for seeing the family back to discuss whether the therapy is working to achieve the stated goals.
4. Pediatricians should inform families that occupational therapy is a limited resource, particularly the number of sessions available through schools and through insurance coverage. The family, pediatrician, and other clinicians should work together to prioritize treatment on the basis of the effects the sensory problems have on a child's ability to perform daily functions of childhood.

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POLICY STATEMENT

Standards for Health Information Technology to Ensure Adolescent Privacy

COMMITTEE ON ADOLESCENCE and COUNCIL ON CLINICAL AND INFORMATION TECHNOLOGY

KEY WORDS
confidential care, privacy, electronic medical records, personal health records

ABBREVIATIONS
AAP—American Academy of Pediatrics
EHR—electronic health record
HIE—health information exchange
HIPAA—Health Insurance Portability and Accountability Act
PHR—personal health record
STI—sexually transmitted infection

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abstract

FREE

Privacy and security of health information is a basic expectation of patients. Despite the existence of federal and state laws safeguarding the privacy of health information, health information systems currently lack the capability to allow for protection of this information for minors. This policy statement reviews the challenges to privacy for adolescents posed by commercial health information technology systems and recommends basic principles for ideal electronic health record systems. This policy statement has been endorsed by the Society for Adolescent Health and Medicine. *Pediatrics* 2012;130:987–990

BACKGROUND

State laws allow minors to consent for their health care on the basis of their status (eg, as an emancipated or mature minor or a pregnant or parenting teenager) and on the basis of the services they seek (eg, sexually transmitted infection [STI] diagnosis and treatment, contraception, pregnancy care, substance abuse counseling/treatment, or mental health care). If adolescents cannot trust that their health information will be both private and secure, they may not seek these services.[1–6] State and federal laws provide protection of privacy when minors consent for their own health care; laws pertaining to such care vary depending on where the teenager resides.[7] The American Academy of Pediatrics (AAP), along with other medical societies, encourages adolescents to discuss health issues with parents but has supported the right to adolescent privacy.[8]

Privacy control of protected information specific to adolescent health has not been adequately addressed in the development of electronic health records (EHRs). Current federal rules related to the Health Information Technology for Economic and Clinical Health Act limit the discussion of privacy as it relates to the Health Insurance Portability and Accountability Act (HIPAA) and, thus, related criteria for certification of EHRs. Such criteria have no specific references to issues of adolescent privacy.[9,10] Because electronic systems currently are unable to filter or compartmentalize health information consistent with current laws, states have been left to identify individual barriers to appropriate exchange of adolescent health information and to identify interim solutions.[11]

A policy statement regarding use of personal health records (PHRs) published in 2009 by the AAP addressed the importance of protection of privacy. The AAP policy statement "Using Personal Health Records to Improve the Quality of Health Care for Children" stresses the importance of the development of the PHR as an extension of the EHR but also addresses the lack of privacy controls, which are necessary for adolescents to access care protected by state and federal laws.[12]

STATEMENT OF THE PROBLEM

Current health information technologies, including EHRs, PHRs, personally controlled health records, health information exchanges (HIEs), or other patient portals generally do not have the flexibility or the technical capacity to maintain or support policies that address the ability of minors to give their own consent for health care or to protect minors' sensitive health care data.[13] Privacy and trust between the adolescent and provider during the health care visit is complicated by requirements to document care in the record, bill for services, and communicate with the parent/guardian within the boundaries of applicable state laws.[14–16] PHRs can improve access to health information, but to realize the benefits for teenagers, standards for developing and accessing the information within PHRs must include the ability to protect privacy and security issues for adolescents. The PHR must have the flexibility to meet the variation in the legal mandates of the state in which the teenager resides. These standards must also grant adolescents the ability to exclude parents or guardians from their PHRs when state law allows that they may consent for their own health care without parental consent on the basis of status (eg, as an emancipated or mature minor or as a parent) and on the basis of the services they seek (eg, diagnosis and treatment of STIs, contraception, substance abuse counseling and treatment, and mental health care).[7,13,16]

Currently, most systems are not capable of allowing dual (or plural) consent to allow or restrict access to different portions of a patient's electronic health information. Thus, adolescents who are minors cannot record legal consent to allow or disqualify their health information to be included in PHRs, PCRHs, and HIEs, because current technologies allow parents as the only parties who can provide informed consent. Specific challenges include:

- Lack of standards for electronic medical technology regarding privacy issues and care for the adolescent patient where rights of minors are protected by state law or precedent court cases.
- Lack of standards for electronic medical technology when states remain silent on the issue of care around sensitive area issues for the adolescent, and care is routinely provided to teenagers as mature minors.
- Lack of standards for electronic medical technology regarding who has access to the medical record—that is, parent or legal guardian, adolescent, pediatrician, or other health care providers.
- Lack of standards for electronic medical technology regarding protection of sensitive information, including laboratory test results, prescriptions, and other health data.
- Lack of standards for electronic billing to prevent disclosure of protected information through the act of generating a bill. These standards might include making it possible to suppress the laboratory test name (eg, HIV test name, pregnancy test name) while still generating a bill. Without this ability, pediatricians and health care facilities may choose to forego billing to protect the adolescent's privacy. This places the burden of care on the pediatrician or facility.
- Lack of standards for protecting sensitive information when used for public health, research, or other uses separate from the care episode.

RECOMMENDATIONS

Basic Principles for Ideal EHRs, PHRs, Personally Controlled Health Records, and HIEs (Collectively EHR Systems) for Adolescents

The AAP recommends the following basic principles for ideal EHR systems:

1. The creation and implementation of criteria for EHR systems that meet privacy standards for adolescents, particularly in areas of care that are protected by federal and state laws.
2. The creation and implementation of criteria for EHR systems that allow determination of who has access to, or who has the ability to control access to, the medical record either in total or in part. The "who" would need to accommodate any legally authorized physician, health care provider, guardian, or patient, including an adolescent or minor, and must be adaptable to change on the basis of the age and health care activity of the patient. Controlling access should also take into account the specific issues related to release of information (to other providers or secondary to subpoena) such that only the minimum necessary information pertinent to the request is released to protect the privacy of the adolescent.

3. The creation and implementation of criteria for EHR systems that allow adolescents to record their consents and authorizations for care or treatment according to privacy rules and laws (by using the HL-7 Child Health Profile DC.1.3.3 standard).[17]
4. The creation and implementation of criteria for EHR systems to allow the explicit and specific consent of the adolescent for release of specific protected health information. Authorization to access the most sensitive parts of an EHR is most definitive if made by this explicit consent.
5. Flexibility of these standards that allow for protection of privacy for diagnoses and associated laboratory test results, prescriptions, problem lists, and ultimately, any documentation/note that contains confidential data. This requirement is the most difficult to attain and control. These standards must also allow an entire visit to be marked as private and not viewable by anyone but those to whom the adolescent has given appropriate permission.
6. Certified EHR systems that meet privacy standards that are consistent with state laws.
7. EHR systems that are able to flag data that are being imported or exchanged between health entities (hospitals, clinics, emergency departments, other physician offices, health networks or exchanges) so that the information can be reviewed and placed in a confidential area of the EHR if appropriate.
8. EHR systems that are able to apply local (state) and federal privacy and confidentially rules when assembling aggregate data to prevent identification of individuals by unauthorized parties (HL-7 Child Health Profile DC.2.6.1).[17]
9. Billing systems associated with EHR systems that have the ability to suppress billing to the parent, guardian, or other legally authorized representative when an adolescent or minor seeks care for health issues that are delivered within the context of general visits and protected under state or federal statutes.

SUMMARY/CONCLUSIONS

Privacy and security of health information is a basic expectation of patients. The HIPAA Privacy Rule provides federal protections for personal health information held by covered entities and gives patients an array of rights with respect to that information. The HIPAA Security Rule specifies a series of administrative, physical, and technical safeguards for covered entities to use to ensure the protection of privacy, integrity, and availability of electronic protected health information. These protections focus on breaches of security and rarely address the needs of minors or adolescents, who routinely have health care provided under their parent's supervision. These issues apply equally to other populations including young adults who still live with their parent or guardian as well as for adult populations, and we believe that the recommendations have broader applicability beyond adolescents.

Although HIPAA rules defer to state law regarding minors with "exceptional circumstances" (eg, adolescents seeking care for STIs) and gives the minor and not the parent the right to this protected health information, the rules have not led to commercial health information technology systems having the capability to protect this information.

This policy addresses the basic needs related to privacy issues that must be protected within commercial health information technology systems. Protection must include the ability to consent for care, consent for release of information associated with care, and prevent inadvertent disclosure through billing activities or electronic aggregation of data for quality improvement, research, public health reporting, or other use. Continued lack of privacy protection in EHRs risks diminishing adolescent access to care, potentially resulting in higher adolescent pregnancy and STI (including HIV) rates, and unraveling significant gains that have been achieved. Even if these technical capacities exist in software, the privacy and security of the adolescent's health care will require educating pediatricians and staff to the specific issues outlined in this policy. This policy statement has been endorsed by the Society for Adolescent Health and Medicine.

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CLINICAL REPORT

Strategies for Prevention of Health Care–Associated Infections in the NICU

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KEY WORDS
health care–associated infection, nosocomial infection, neonatal ICU, NICU, antibiotics, neonate, newborn

ABBREVIATIONS
CDC—Centers for Disease Control and Prevention
CI—confidence interval
ESBL—extended-spectrum β-lactamase
RR—relative risk

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abstract

FREE

Health care–associated infections in the NICU result in increased morbidity and mortality, prolonged lengths of stay, and increased medical costs. Neonates are at high risk of acquiring health care–associated infections because of impaired host-defense mechanisms, limited amounts of protective endogenous flora on skin and mucosal surfaces at time of birth, reduced barrier function of their skin, use of invasive procedures and devices, and frequent exposure to broad-spectrum antibiotic agents. This clinical report reviews management and prevention of health care–associated infections in newborn infants. *Pediatrics* 2012;129:e1085–e1093

INTRODUCTION

Health care–associated infections in the NICU are infections acquired in the hospital while receiving treatment of other conditions. Although they are less likely to cause mortality than early-onset infections, they have considerable health and economic consequences. Most health care–associated infections in the NICU result from the instrumentation and procedures required to preserve an infant's life. Thus, it is not possible to lower the rate of health care–associated infections merely by limiting the use of procedures. Furthermore, it is no longer acceptable to consider health care–associated infections as a consequence of neonatal intensive care. Rather, it is incumbent on clinicians to minimize risks of infection by performing invasive procedures only when needed and in the safest manner possible. There is evidence to support the concept that proactive strategies to prevent health care–associated infections in the NICU are possible,[1–5] although data supporting specific infection-control interventions in neonates are lacking. Although neonates clearly have unique vulnerabilities, there is no reason to believe that interventions shown to be effective in the pediatric ICU or adult ICU would not be equally effective in the NICU. Because of unique issues confronting the vulnerable neonate, however, these interventions may require some accommodations and further study.

STRATEGIES FOR THE PREVENTION OF HEALTH CARE–ASSOCIATED INFECTIONS

Hand Hygiene

Hand hygiene remains the most effective method for reducing health care–associated infections.[6] Hospitals with higher rates of hand hygiene

compliance have lower rates of central line bloodstream infection; however, compliance with hand hygiene practices is less than optimal.[7] A recent meta-analysis concluded that educational programs and multidisciplinary quality-improvement teams can be effective in increasing compliance with hand hygiene procedures[8]; however, each of the 33 studies included more than 1 intervention, and it was difficult to determine which was most efficacious. The Centers for Disease Control and Prevention (CDC) published guidelines for hand hygiene in health care settings in 2002.[9] Although the guidelines were widely accepted and disseminated by members of the National Nosocomial Infection Surveillance System, a recent analysis demonstrated that implementation of these guidelines had no effect on hand hygiene compliance rates (mean, 56.6%).[10]

The sixth edition of the *Guidelines for Perinatal Care*[11] recommends use of an antiseptic soap or an alcohol-based gel or foam for routine hand sanitizing if hands are not visibly soiled. When hands are visibly contaminated, they should first be washed with soap and water. Larson et al[12] compared the effectiveness of a traditional antiseptic hand wash with an alcohol hand sanitizer in reducing bacterial colonization. There were no differences in mean microbial counts on nurses' hands or infection rates among patients in the NICU; however, nurses' skin condition improved during the alcohol phase. Other studies have demonstrated the effectiveness of alcohol-based products, but there are no data to suggest they are superior. Compliance with hand hygiene may be enhanced if alcohol-based products are available at each infant's bedside.

In May 2009, the World Health Organization published new consensus recommendations for hand hygiene.[13] The guidelines provide a comprehensive overview of hand hygiene in health care and evidence- and consensus-based recommendations for successful implementation. Consensus recommendations were categorized according to the CDC/Healthcare Infection Control Practice Advisory Committee grading system (Tables 1 and 2). A partial list of recommendations relevant to the NICU is shown in Table 3.

Prevention of Central Line–Associated Bloodstream Infections

Catheter-related bloodstream infections are the most common hospital-acquired infections in the NICU. Central line–related infections are in large part a result of poor technique at the time of placement and ongoing care of the catheter site. Attempts to reduce the incidence of central line–associated bloodstream infections primarily fall into 1 of 5 categories: (1) clinical practice guidelines for the insertion and maintenance of indwelling lines[14]; (2) prophylactic administration of antibiotic agents (including antibiotic lock therapy); (3) topical emollients to reduce skin penetrance of bacteria; (4) promotion of breastfeeding; and (5) gowning for visitors and attendants. The goal of all infection-control programs should be to reduce the rate of central line–associated bloodstream infections to zero.

Both chlorhexidine (2%) and povidone-iodine are recommended for skin antisepsis in infants 2 months or older[15,16]; however, chlorhexidine is not approved by the US Food and Drug Administration for infants younger than 2 months. In a randomized trial, use of a chlorhexidine-impregnated gauze dressing (0.5% chlorhexidine gluconate in a 70% alcohol solution) in infants of very low birth weight reduced central venous catheter colonization when compared with use of a 10% povidone-iodine scrub but did not reduce the incidence of central line–associated bloodstream infections.[17] Notably, in the chlorhexidine group, contact dermatitis occurred in

TABLE 1 Evidence Grading System

Ranking System for Evidence According to the CDC/Healthcare Infection Control Practice Advisory Committee System
Category IA: Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.
Category IB: Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rational.
Category IC: Required for implementation, as mandated by federal and/or state regulation or standard.
Category II: Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale or a consensus by a panel of experts.

TABLE 2 Infectious Diseases Society of America/US Public Health Service Grading System for Ranking Recommendations for Clinical Guidelines

Category, Grade	Definition
Strength of recommendation	
A	Good evidence to support a recommendation for use
B	Moderate evidence to support a recommendation for use
C	Poor evidence to support a recommendation for use
Quality of evidence	
I	Evidence from ≥1 properly randomized controlled trial
II	Evidence from ≥1 well-designed clinical trial, without randomization; from cohort or case-controlled analytic studies (preferably from >1 center); from multiple time series; or from dramatic results from uncontrolled experiments
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports from expert committees

TABLE 3 World Health Organization Recommendations for Hand Hygiene

- Wash hands with soap and water when visibly dirty or soiled with blood or other body fluids (IB) or after using the toilet (II).
- Use of an alcohol-based hand rub for all routine antisepsis is recommended for all clinical settings if the hands are not soiled (IA). If an alcohol-based hand rub is not obtainable, wash hands with soap and water (IB). Brushes are no longer recommended (even for surgical scrubs) (IB).
- Perform hand hygiene:
  - Before and after touching the patient (IB).
  - Before handling an invasive device for patient care, regardless of whether gloves are worn (IB).
  - After contact with body fluids or excretions, mucous membranes, nonintact skin, or wound dressings (IA).
  - If moving from a contaminated body site to another body site during care of the same patient (IB).
  - After contact with inanimate surfaces and objects (including medical equipment) in the immediate vicinity of the patient (IB).
  - After removing sterile (II) or nonsterile gloves (IB).
- Selection and handling of hand hygiene agents:
  - Provide products with a low irritancy potential (IB).
  - To maximize acceptance of hand hygiene products by health care workers, solicit input regarding the skin tolerance, feel, and fragrance of any products under consideration (IB).
  - Determine any known interaction between products used to clean hands, skin care products, and the types of gloves used in the institution (II).
  - Ensure that dispensers are accessible at point of care (IB).
  - Provide alternative hand hygiene products for health care workers with confirmed allergies or adverse reactions to standard products (II).
  - When alcohol-based hand rub is available in the health care facility, use of antimicrobial soap is not recommended (II).
  - Soap and alcohol-based hand rub should not be used concomitantly (II).
- Use of gloves:
  - The use of gloves does not replace the need for hand hygiene (IB).
  - Wear gloves when it can be reasonably anticipated that contact with blood or other potentially infectious materials, mucous membranes, or nonintact skin will occur (IC).
  - Remove gloves after caring for a patient. Do not wear the same pair of gloves for more than 1 patient (IB).
  - Change or remove gloves during patient care if moving from a contaminated body site to either another body site (including nonintact skin, mucous membrane, or medical device) within the same patient or the environment (II).
- Other aspects of hand hygiene:
  - Do not wear artificial fingernails or extenders when having direct contact with the patient (IA).
  - Keep natural nails short.
- Hand hygiene promotion programs:
  - In hand hygiene–promotion programs for health care workers, focus specifically on factors currently found to have a significant influence on behavior and not solely on the type of hand hygiene product. The strategy should be multifaceted and multimodal and include education and senior executive support for implementation (IA).
  - Educate health care workers about the type of patient-care activities that can result in hand contamination and about the advantages and disadvantages of various methods used to clean their hands (II).
  - Monitor health care workers' adherence to recommended hand hygiene practices and provide them with performance feedback (IA).
  - Encourage partnerships between patients, their families, and health care workers to promote hand hygiene in the health care setting (II).

15% of neonates weighing less than 1000 g. In a meta-analysis of studies comparing chlorhexidine gluconate solution with a povidone-iodine solution, the overall risk reduction (for central line–associated bloodstream infections) with chlorhexidine gluconate compared with a povidone-iodine solution was approximately 50%.[18]

Extraluminal contamination of the intracutaneous tract is believed to be responsible for catheter-related infections that happen in the week after placement.[19] Catheters are more mobile during the first week after insertion and can slide in and out of the insertion site, drawing organisms down into the catheter tract. Techniques to reduce the likelihood of extraluminal contamination include proper hand hygiene, aseptic catheter insertion (including use of a maximal sterile barrier for catheter insertion and care [IA]), use of a topical antiseptic (IA), and use of sterile dressing (IA). Although transparent dressings permit easier inspection of the catheter site, they have no proven benefit in reducing infection.[20] Catheter sites must be monitored visually or by palpation on a daily basis (IB) and should be redressed and cleaned on a weekly basis (IA). In neonates, there are no data indicating that tunneled catheters have a lower risk of infection than nontunneled catheters.[21]

After the first week of placement, intraluminal colonization after hub manipulation and contamination is responsible for most central line–associated bloodstream infections.[19] Mahieu et al[22] demonstrated that the frequency of catheter manipulations was directly related to the frequency of central line–associated bloodstream infections. Tubing used to administer blood products or lipid emulsions should be changed daily (IB). Tubing used to infuse dextrose and amino acids should be replaced every 4 to 7 days. It is important to remove all central venous catheters when they are no longer essential (1A). Many NICUs remove central catheters when the volume of enteral feedings reaches 80 to 100 mL/kg per day. Topical antibiotic agents or creams should not be used at the insertion site for catheters (1B).

Guidelines for the prevention of intravascular catheter-related infections have been published.[23] These guidelines make specific recommendations for umbilical catheters. Levels of evidence are indicated in parentheses (Table 4).

Recently, there has been a focus on implementing "NICU care bundles" to reduce the incidence of hospital-acquired infections. Care bundles are groups of interventions (extrapolated from studies in adults or recommendations from professional organizations) that are likely to be effective. This multifaceted approach has reduced the incidence of health care–associated sepsis in each center or groups of centers where it has been implemented.[24–27]

Coagulase-negative staphylococci are the most common cause of central line–associated bloodstream infections in the United States. Therefore, the use of low-dose vancomycin in parenteral alimentation solutions (at concentrations above the minimal inhibitory concentration) has been suggested as a way to decrease the incidence of bacteremia attributable to coagulase-negative staphylococci. Five randomized clinical trials of low-dose vancomycin in preterm neonates have been conducted, all of which date from the late 1990s. In 4 of the studies, there was a statistically significant reduction in the incidence of coagulase-negative staphylococcal sepsis (relative risk [RR], 0.11; 95% confidence interval [CI], 0.05–0.24)[28]; however, there were no significant differences in mortality or length of stay. The use of antibiotic lock therapy has also been investigated. Lock solutions containing vancomycin are instilled into the catheter lumen to reduce intraluminal colonization. Most randomized clinical trials of antibiotic lock therapy have been completed in adults and older children.[29] A meta-analysis of these trials demonstrated a significant reduction in bloodstream infections (RR, 0.49; 95% CI, 0.26–0.95). Use of vancomycin as a true lock solution (instilling it for a defined period rather than flushing it through the catheter) conferred greater benefit. The single study of antibiotic lock therapy in the neonatal population[30] demonstrated a statistically significant reduction in central line–associated bloodstream infections (RR, 0.13; 95% CI, 0.01–0.57). No increase in vancomycin resistance occurred in this study; however, the study was not sufficiently powered to address that question. Because of the concern for development of vancomycin-resistant organisms and the lack of long-term efficacy data, neither continuous infusions of vancomycin nor antibiotic lock therapy can be recommended.

Invasive fungal infections are responsible for 9% to 12% of health care–associated infections in infants weighing less than 1500 g.[31] In a prospective study from the National Institute for Child Health and Human Development research network, 9% of infants weighing less than 1000 g developed candidiasis.[32] Death or neurodevelopment impairment occurred in 73% of these infants. Prophylactic fluconazole has been suggested as a way to decrease the incidence of invasive fungal disease. The rationale is that prevention of fungal colonization in high-risk infants will lower the risk of invasive disease. A meta-analysis of 5 trials comparing systemic fluconazole with placebo, demonstrated a statistically significant reduction in the incidence of invasive fungal infections (RR, 0.48; 95% CI, 0.31–0.73)[33]; however, there was no significant difference in the incidence of death before discharge from the hospital and insufficient data to assess neurodevelopmental outcomes. There is a concern that the use of azoles to prevent fungal infections will lead to an increase in fluconazole resistance or will result in toxicity, especially among the most immature infants for whom there are limited pharmacokinetic data.

In many NICUs, it is policy that care providers and visitors wear gowns on entering the nursery. Eight trials have evaluated the benefit of gowning.[34] A meta-analysis demonstrated that there was no significant effect of a gowning policy on reducing the incidence of systemic nosocomial infection (RR, 1.24; 95% CI, 0.90–1.71). For that reason,

TABLE 4 Guidelines for the Prevention of Intravascular Catheter-related Infections

1. Remove and do not replace umbilical artery catheters if any signs of central line–associated bloodstream infection, vascular insufficiency in the lower extremities, or thrombosis are present (Category II).
2. Remove and do not replace umbilical venous catheters if any signs of central line–associated bloodstream infection or thrombosis are present (Category II).
3. Cleanse the umbilical insertion site with an antiseptic before catheter insertion. Avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (eg, povidone-iodine) can be used (Category IB).
4. Do not use topical antibiotic ointment or creams on catheter insertion sites because of the potential to promote fungal infections and antimicrobial resistance (Category IA).
5. Add low doses of heparin (0.25–1.0 U/mL) to the fluid infused through umbilical arterial catheter (Category IB).
6. Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place for more than 5 d (Category II).
7. Umbilical venous catheters should be removed as soon as possible when no longer needed but can be used up to 14 d if managed aseptically (Category II).
8. An umbilical catheter may be replaced if it is malfunctioning and there is no other indication for catheter removal and the total duration of catheterization has not exceeded 5 d for an umbilical artery catheter or 14 d for an umbilical vein catheter (Category II).

gowns should not be required for routine admission to the NICU by health care workers or visitors. Despite the lack of overall benefit, gowns and gloves should be worn when an infant is colonized with a resistant or invasive pathogen, consistent with appropriate isolation requirements. Additional personal protective equipment may be required on the basis of isolation requirements of the specific pathogen or clinical condition and the activity or procedure to be performed.

Prevention of Health Care–Associated Pneumonia

The CDC published guidelines for preventing health care–associated pneumonia in 2003.[35] These guidelines were not specifically designed to address the unique issues facing the mechanically ventilated patient in the NICU; however, many of the recommendations are relevant to all patient populations.

General concepts discussed in the CDC document include the following:

1. Staff Education and Involvement in Infection Prevention. All providers should receive appropriate information relating to the epidemiology of and infection control procedures for preventing health care–associated pneumonia. There should be procedures in place to ensure worker competency, including performance of appropriate infection-control activities. Staff should be involved with implementation of interventions to prevent health care–associated pneumonia using performance-improvement tools and techniques (IA).
2. Infection and Microbiologic Surveillance. Surveillance for health care–associated pneumonia in patients in the NICU should be performed to determine trends and help identify outbreaks or other problems (IB). Routine surveillance cultures of patients or equipment should not be performed (II).
3. Prevention of Transmission of Microorganisms. Within the NICU, risks for acquisition of microorganisms that could result in health care–associated pneumonia can be reduced by (1) proper sterilization or disinfection and maintenance of equipment and devices (IA), and (2) prevention of person-to-person transmission of bacteria by use of Standard Precautions as well as other isolation practices when appropriate (IA).
4. Modifying Host Risk for Infection. Aspiration is a major risk for the development of health care–associated pneumonia. Devices such as endotracheal tubes, tracheostomy tubes, or enteral tubes should be removed from patients as soon as appropriate and clinically indicated (IB). In the absence of medical contraindication(s), the head of the bed should be elevated at an angle of 30 to 45 degrees for mechanically ventilated patients (II). A comprehensive oral-hygiene program should be followed for the infant (II).

Suctioning practices and position of the infant in the bed may influence tracheal colonization. The use of closed-suctioning systems allows endotracheal suctioning without disconnecting patients from the ventilator. Closed-suctioning methods reduce physiologic disruptions (hypoxia and decrease in heart rate), and NICU nurses judged them to be easier to use than an open system.[36,37] Closed-suctioning systems provide an opportunity for bacterial contamination when pooled secretions in the lumen are reintroduced into the lower respiratory tract with repeat suctioning. On the other hand, closed-suctioning systems could potentially reduce environmental contamination of the endotracheal tube. In studies evaluating mechanically ventilated adults, airway colonization was more common when closed-suctioning systems were used,[38,39] but ventilator-associated pneumonia rates were equal to or slightly less than the rates among patients managed with open systems.[38–40] CDC recommendations[35] do not endorse one system over the other, and there is no recommendation addressing the frequency at which closed-suctioning systems should be changed.

Tracheal colonization from oropharyngeal contamination is less common among neonates on mechanical ventilation when the neonates are placed in a lateral position on the bed as compared with the supine position (30% for lateral versus 87% for supine; $P < .01$).[41] Keeping the endotracheal tube and the ventilator circuit in a horizontal position might reduce tracking of oropharyngeal sections down into the lower respiratory tract.[42] The lateral position also is associated with reduced aspiration of gastric secretions into the trachea.[41] Using a nonsupine position may reduce the risk of ventilator-associated pneumonia.[43]

Other Strategies to Reduce Health Care–Associated Infections in the NICU

The skin of the preterm newborn infant has compromised barrier and immune function. In addition, the skin of the extremely preterm infant can be easily damaged and serve as a portal for the entry of organisms into the bloodstream. Topical emollients have been used to decrease transepidermal water losses and have been suggested as a method to decrease health care–associated infections. In a meta-analysis of 4 trials completed in industrialized countries, a significantly increased risk of coagulase-negative staphylococcal infection was found in infants treated with prophylactic topical ointment.[44] In contrast, infants born at <33 weeks' gestation in Bangladesh treated topically with sunflower oil were 41% less likely to

develop health care–associated infections than were control infants.[45] The lack of effectiveness of topical emollients in industrialized countries may be attributable to different mechanisms of transcutaneous sepsis. In industrialized countries, instrumentation is used more commonly, and sites of insertion can serve as a portal for bacterial invasion. In developing countries, environmental contamination and malnutrition play a greater role, and invasive devices are used less frequently. Therefore, bacterial invasion is likely attributable to microscopic sites of skin barrier compromise, which might be protected by the use of an emollient.

The use of human milk feedings has been associated with a lower risk of sepsis and necrotizing enterocolitis in preterm infants.[46] Human milk contains a large number of immunoprotective substances, prebiotics, and probiotics and has been shown to decrease the incidence of gastrointestinal and respiratory infections in infancy.[47] Although a number of randomized clinical trials and cohort studies have concluded that human milk feedings had a protective effect on infection in preterm infants, a meta-analysis of 9 studies (6 cohort and 3 randomized clinical trials from India) failed to show an advantage of human milk feedings.[48] The authors believed there were serious methodologic flaws in all of the cohort studies, "including poor study design, inadequate sample sizes, neglecting to account for some confounders, failure to eliminate the effects associated with maternal choice of feeding method and other sociodemographic variables." In addition, the definition of human milk feedings was not consistent among studies. It is important to note that necrotizing enterocolitis was excluded from this systematic review.

A number of other practices may provide opportunities to reduce colonization of the critically ill neonate with health care–associated pathogens or to modify the risk of developing disease if colonized. Specific practices that may provide benefit include (1) appropriate vaccination of health care workers (eg, influenza vaccine and tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis, adsorbed); (2) cohorting in selected outbreak situations; and (3) visitation guidelines to identify ill/infected visitors.

Antibiotic Use and Misuse

The use and misuse of antibiotics can be associated with alteration in neonates' microflora and the development of antibiotic resistance. This is a particular concern within the confines of a NICU, where there is a population of vulnerable children who have medical conditions that may require frequent and/or prolonged antibiotic use, long hospitalizations, crowded conditions, and frequent contact and interventions.

Antimicrobial resistance can be intrinsic (ie, present without exposure to antimicrobial agents) or acquired. An example of intrinsic resistance is the resistance of Gram-negative organisms to vancomycin. Acquired antimicrobial resistance is driven by antimicrobial exposure, as is seen in methicillin-resistant *Staphylococcus aureus* and the extended-spectrum β-lactamase (ESBL)-producing organisms. These patterns of resistance represent adaptations of bacteria to antibiotic exposure.

Judicious use of antibiotic agents is commonly recommended as appropriate in the NICU, but it is not commonly practiced. The critically ill nature of patients in the NICU prompts frequent and prolonged use of antimicrobial agents. Judicious use of antibiotic agents in the NICU would include limiting use to only those situations in which a bacterial infection is likely, discontinuing empirical treatment when a bacterial infection has not been identified, changing the antibiotic agents administered to those with the narrowest spectrum on the basis of susceptibility testing, and treating for the appropriate duration. Although clinical situations will vary, these principles remain consistent. It is also relevant to consider the potential for different antibiotic agents to drive the development of resistance. ESBL-producing organisms (primarily Gram-negative enteric agents) are present in many NICUs because of the frequent use of third-generation cephalosporins and other broad-spectrum β-lactam antibiotic agents. Curtailing the use of third-generation cephalosporins and using other antibiotic agents, such as aminoglycosides for empirical therapy, has been associated with less antibiotic resistance, including ESBL-producing organisms. Good infection-control practices also play a significant role in reducing horizontal transmission of antibiotic-resistant bacteria.

The Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America have developed guidelines for "Antimicrobial Stewardship" to reduce antimicrobial resistance.[49] These guidelines are designed to address programmatic changes that improve control of antibiotic resistance (see Table 1 for levels of evidence). Strategies that might be helpful in the NICU setting include the following: (1) auditing antimicrobial use of practitioners and providing feedback (IA); (2) formulary restriction and preauthorization requirements for selected antimicrobial agents (IB); (3) education of prescribers and nurses concerning the role of antimicrobial use and the development of resistance (IB); (4) development of clinical guidelines/pathways for selected conditions (IA); (5) antimicrobial order forms (IB); (6) specific plans for streamlining (broad- to narrow-spectrum antibiotic agents) or deescalating (elimination of redundant or unnecessary) antimicrobial

agents (IB); (7) dose optimization on the basis of individual characteristics (eg, weight, renal status, drug-drug interactions) (IB); and (8) switching from parenteral to oral antibiotic agents when appropriate and feasible (IB). Data are not sufficient to recommend antimicrobial cycling or routine use of combination therapy merely to prevent the development of resistance; however, antimicrobial combinations may be valuable for preventing development of resistance in specific circumstances.

CONCLUSIONS

Health care–associated infections are an important medical morbidity facing an already vulnerable group of infants. The epidemiology and strategies that can reduce these infections are well known; however, implementation of strategies that can influence the occurrence of health care–associated infections within the NICU requires a concerted team effort by all individuals who participate in the care of these infants. Each care provider must understand his or her role in preventing health care–associated infections and have a willingness to modify behaviors such that they comply with recognized infection-control practices. All too frequently, the health of a tiny infant whose life is being saved through the use of the best in 21st-century technology is jeopardized by the smallest of acts—such as a care provider neglecting to wash his or her hands. Recognition of the importance of even the most basic care practices can result in behavior modification within the NICU and improve compliance with established infection-control practices.

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CLINICAL REPORT

Supporting the Family After the Death of a Child

abstract

FREE

The death of a child can have a devastating effect on the family. The pediatrician has an important role to play in supporting the parents and any siblings still in his or her practice after such a death. Pediatricians may be poorly prepared to provide this support. Also, because of the pain of confronting the grief of family members, they may be reluctant to become involved. This statement gives guidelines to help the pediatrician provide such support. It describes the grief reactions that can be expected in family members after the death of a child. Ways of supporting family members are suggested, and other helpful resources in the community are described. The goal of this guidance is to prevent outcomes that may impair the health and development of affected parents and children. *Pediatrics* 2012;130:1164–1169

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KEY WORDS

child death, family support, grief, pediatrician, parents, siblings

INTRODUCTION

The death of an infant, child, or adolescent, from any cause, has a devastating effect on the family. For parents, the loss of a child defies the natural order. In our era, parents do not expect to bury their children. The death of a child or adolescent also often means there is a sibling or siblings who experience their own significant loss. The pediatrician is in a position to help family members cope, both with the immediate loss and then the ongoing effect of the child's death. Because of the general good health of children in our society, pediatricians are often unfamiliar with how to deal with the death of a child, however. Or they may feel that addressing this event is too emotionally painful. This report identifies the most important issues to be considered and suggests ways the pediatrician can and should help.

PARENTAL GRIEF

The death of a child of any age is extremely painful for parents. Parents have an obligation and a strong emotional need to protect their children from harm. Most parents experience a profound sense of guilt when harm comes to their child, even if through no fault of their own. Parents invest much of their hopes and wishes for the future in their children. All of these factors lead to a devastating grief that is much longer lasting than most people realize.[1] The depth of parental grief often shocks and surprises others. It is common for grieving parents to be unable to function for varying times after their child's death. They may spend days in bed, away from work, and unable to carry out

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household tasks. It is common for parents to have great difficulty eating and sleeping. The thought that life is not worth living is frequent, as are thoughts that one might be "going crazy."

ISSUES RELATED TO THE CIRCUMSTANCES OF THE DEATH

Death as the Result of Chronic Illness or Disability

When a child or adolescent's death results from chronic illness or disability, it is likely that the pediatrician has been involved in the patient's care and may have a long-standing relationship with the family. Although the family may have anticipated the death, the grief will still likely be profound. Even when the child has had severe disability or has suffered, the parents' sense of grief and loss is not usually diminished. When there has been a long-standing relationship with the family surrounding the child's illness or disability, the family also may suffer from the loss of the relationship with the pediatrician. Under these circumstances, the pediatrician's continuing involvement with the family may be especially important.

Sudden, Unexpected Death

Injuries are the single most common reason for death in children and adolescents. In adolescents, suicide and homicide are also a common cause of death. Pediatricians may not immediately be aware of the death in such circumstances. If there is a brief period of survival after the event, the pediatrician may be involved; however, these deaths often occur in the emergency department. If this situation is the case, the emergency physician should inform the pediatrician of the death, including the details of the last hours of care.[2,3] If not actually witnessed by the parents, these details will often be what haunts the parents' thoughts in the months after the death. Pediatricians may hear about the death of a child or adolescent who was one of their patients from the news or from their office staff or other parents in their practice. Although the pediatrician was not involved at the time of the death, if there has been a relationship with the family and if there are surviving siblings who are still patients in the practice, the pediatrician has an important role in supporting the family.

Infant Death

In the case of infant death, many physicians fail to appreciate the intense attachment to the fetus and infant and the extent to which parents and other family members invest in that infant's imagined future. The grief at this loss is intense, and the surviving siblings also may be deeply affected. The physician should recognize the depth of these feelings and be prepared to provide the kind of support outlined in this statement.

Helpful Responses and Those That Hurt

The most helpful response after a child or adolescent death is to provide an opportunity to meet with the parents, face to face, and to just listen, responding in ways that encourage the parents to talk. Frequently, in the context of an unexpected death, physicians fail to respond at all. This failure to respond may contribute to the family's pain. Many physicians find the thought of losing a child so terrible that they avoid contact with the grieving parents rather than confront their own fears. Others find it difficult to be with parents who are crying or showing their grief in other ways. Physicians often hold the mistaken belief that talking about the death will be harmful because such talk will reawaken and prolong the parents' grief.[4] Quite the contrary, grieving parents report that acknowledging their grief is important, and they seldom forget the pain of a friend, family member, or physician who fails to make contact after such a loss.[5] If pediatricians have a relationship with a family, they should always contact the parents when they learn of the death of a child in that family, including the pediatrician who hears about the death from the news or from others in the community. Such contact should be more than attendance at a viewing or a funeral. At such formal times of grieving, personal contact is not possible, and parents are usually in shock and unable to ask the questions that may be on their minds. The most helpful response is a face-to-face visit.[6] The purpose of such an encounter is to acknowledge the death and allow the parents to talk. The pediatrician might say, simply, "I'm so sorry to hear about _____'s death. What a terrible loss for you and your family." Attempts to alleviate the grief by providing advice are usually ineffective and may be hurtful. Expressions of religious interpretation may or may not be appropriate and should be tailored to what the pediatrician knows of the family's beliefs. Comments made to parents of children with disabilities, such as "he/she is better off now," are often perceived as diminishing the value of the child. Some parents, however, may voice this thought themselves.

Duration of Grieving

Many people are surprised at how long parents may grieve the loss of a child. The period of a year of grieving is acknowledged by many religions and cultural practices, but commonly, parents experience significant grief for much longer. Parents frequently report waves of grief that include reliving the traumatic details of the injury or visions of the person suffering the final stages of a fatal illness.

Anniversaries of the death and important dates, such as the child's birthday, bring recurring waves of grief, often for several years. Family events, such as graduations, marriages, and births, reawaken grief. These events are reminders of the hopes and dreams shattered by the child's death. Eventually, and the period of time varies greatly, parents describe a gradual pattern of change. They no longer relive the experiences at the time of death, and they are able to remember common and happy events in the child's life with less pain and even with pleasure. This change is, however, usually measured in years. Parents frequently report that their greatest fear is that the child will be forgotten, so failing to mention or talk about the child who has died confirms these fears.

Helping During Prolonged Grief

Every parent grieves in his or her own way, and the pediatrician should not expect a prescribed timetable of grieving. Parents find it painful to hear a statement such as, "You should get over it and get on with your life." Yet such statements are frequently made. Self-help support groups, such as The Compassionate Friends and Bereaved Parents USA (see Resources section), are specifically designed for parents whose children have died and provide some of the best help for this prolonged grieving process.[7] These peer-led support groups provide an atmosphere in which it is possible to talk about the loss without the pressure to "get over it." Also, most parents are comforted by an environment in which others have been through a similar experience and in which they meet those who have survived this devastating loss. Descriptive studies confirm that many parents resolve their grief by talking about their loss in an accepting environment.[4] Family members who are discouraged from expressing their grief may find it more difficult to get past the most painful part of their grieving and function effectively. Pediatricians are encouraged to learn about the support groups in their community and how they function. They can then refer parents who might benefit from such groups (see Resources).

Special Circumstances

The death of a child, no matter what the cause, is devastating. But there are some circumstances that make this loss particularly difficult. When the death occurs by suicide or through the child's use of alcohol or drugs, the guilt experienced by parents can be particularly strong. Homicide or injuries that are caused by negligence, such as by drunk driving, produce intense anger. The grief also may be especially intense if the parent's actions may have contributed to the death, such as in situations in which supervision was lacking or if the parent was driving when an injury occurred. Parents in these circumstances may require special help through counseling or therapy. If the cause of a child's death might be filicide, special circumstances beyond the scope of this statement must be addressed.

Complicated Grief, Medication, and Grief Counseling

In this report, the term "complicated grief" refers to the situation when grief is so intense and/or prolonged that the pediatrician believes that professional mental health evaluation or treatment is required. It is difficult to specify either the symptoms or the circumstances when this point is reached, but a few general guidelines can be given. Complicated grief occurs most frequently when the parent is already experiencing a psychiatric problem, or the parent may have had a psychiatric disorder in the past. Most obviously, when a parent is already experiencing depression, the death of his or her child is likely to exacerbate that problem. Other psychiatric disorders also may worsen with such a death. Another situation that is known to result in a more serious grief reaction is the death of a child when the parent-child relationship has been a troubled one[8]; however, grief (including intense and prolonged grief, as described previously) is a normal reaction to the loss of a child. In most situations, medication is not needed and can be counterproductive. If, however, the pediatrician judges the grief to be especially intense and debilitating, medication may be needed, and a referral to a mental health specialist should be considered.

Grief counseling is available and/or provided under a variety of circumstances. In situations of injury death in which a number of people have been killed, such as in an airplane crash, grief counselors may provide help in the immediate aftermath. Also, in most communities and at most hospitals, grief counseling groups meet, usually for a prescribed period of time, typically lasting from 6 to 8 weeks. Such groups usually are not designed just for parents who have lost children. Although these groups are helpful to many parents, they do not address the long-term issues mentioned previously. Grief counselors can be especially helpful when they are trained to recognize the complicated grief described previously and can make appropriate referrals.

SIBLINGS

Siblings in a family in which an infant, child, or adolescent has died are sometimes called "the forgotten mourners."[9] This phrase acknowledges that the grief of siblings is often neglected because parents are the focus of grieving within the family. The pediatrician is in a unique position to provide support to siblings

who are in their practice, both at the time of death of their brother or sister and in the context of the sibling's ongoing health care. What follows are suggestions on how to provide this type of care.

Initially, particularly in the case of sudden, unexpected death, the problem may be that parents may not be able to provide ongoing support to their surviving children in the midst of their own grief. For very young siblings for whom the need for parental support is great, this problem may be acute. Members of the extended family may be in the position to help once the need is identified. When not available, however, other social services may need to be recruited to provide support. Older siblings often experience an ongoing lack of emotional support and feel abandoned by their grieving parents. The pediatrician may be in the best position to assess these issues and identify other resources if needed.

The way siblings respond to the death of a brother or a sister of any age varies depending on the developmental age of the sibling, and this response changes as the sibling matures. The reactions to death in the family and the changes that occur during development are discussed elsewhere in the pediatric literature[10]; however, there are special issues associated with sibling loss that are less well known and are reviewed here.

Survivor Guilt

Survivor guilt in siblings is common, especially in situations of unexpected death. Guilty feelings may be especially strong in siblings who have experienced intense sibling rivalry. Before the death, the sibling may have had negative feelings about the deceased, or there may have been harsh words spoken during angry arguments. The sibling may have harbored thoughts wishing that harm would come to his or her brother or sister. These thoughts and words may haunt the surviving sibling. Such thoughts and memories may be emotionally crippling unless talked about in counseling or dealt with in therapy.

Overprotection

Parents commonly fear that their surviving child or children will also die. These fears may lead to serious overprotection of surviving siblings, such as restricting age-appropriate activities. Behavior problems in these siblings may stem from the need to break free from stifling overprotection. Pediatricians should be sensitive to this possibility and should counsel parents under such circumstances.

Idealization and the Replacement Child

Parents and other family members frequently idealize the deceased child. Parents often create shrines to memorialize the child, which may reinforce this idealization. Siblings, especially younger ones, may be jealous and resent this picture of the idealized child. The surviving sibling may feel he or she cannot live up to that ideal and may respond with rebellious behavior. Parents also may come to view a surviving sibling, particularly a younger one, as a replacement for the child who died.[11] In this situation, the family member projects on to the surviving sibling his or her hopes and wishes for the child who died. The sibling may sense the parents' feelings and rebel against these wishes and hopes, especially if they are unrealistic. If pediatricians recognize these dynamics, they can be discussed with the parents, and suggestions can be made to address the sibling's feelings.[12] A referral for therapy may be needed if the problem persists.

Assuming the Parental Role

It is especially common for older siblings to assume a parental role when parents are absorbed with their own grief. Although this reaction may be adaptive in the early months of the parents' grief journey, it may become maladaptive as the sibling matures. The pediatrician should look for this situation and help the parent and surviving sibling to relinquish this distortion of family roles.

General Issues of Sibling Grief

One's siblings play a special role in a child's growth and development. Siblings share family secrets, and no one else in a child's life may share that experience. Siblings also have a special role to play in protecting each other in the wider environment of school and playground. Surviving siblings may experience a profound sadness at the loss of this special relationship and may find it helpful to talk about this aspect of their loss.

Providing Sibling Support

If a surviving sibling is in the pediatrician's practice, the clinician should find a way to follow that sibling's emotional development and intervene when problems are detected. One suggestion is to place a picture of the deceased child in the sibling's chart as a reminder whenever that sibling is seen in ongoing health care. A helpful approach is to raise the issue of the brother's or sister's death at well-child visits. The surviving sibling's feelings and thoughts will change with time. The pediatrician should be aware that siblings may refuse to talk about their deceased brother or sister at first. The pediatrician should honor this resistance but be persistent in raising the issue, because this reaction often changes over time.

Some self-help support groups provide support for siblings who are old enough

to benefit from talking to other young people who have suffered a similar loss. Support for siblings may also be provided by schools, religious organizations, and groups such as scouts or other organizations. Knowledge of these and other such services in one's community allows the pediatrician to tap other sources of support (see Resources).

SUMMARY

The death of an infant, child, or adolescent is a devastating experience for the family. The pediatrician is in a special position to help families through their grief experience. The ultimate goal of such support is the prevention of problems that may result from such trauma. The following are suggestions for pediatricians regarding this support.

1. Expect that grief after the loss of a child is intense and long lasting.
2. Recognize that failing to acknowledge the death of an infant, child, or adolescent who was a patient can contribute to the family's pain. A telephone call or a face-to-face visit with the parent(s) of a patient who has died is encouraged.
3. Follow up with and provide guidance to surviving siblings who are still patients. Providing guidance to siblings requires recognition of the special issues experienced by grieving siblings.
4. Understand that the duration of grieving within a family after the loss of a child is longer than many expect and is usually measured in years.
5. Recognize the power of self-help support groups in helping parents get through the prolonged grief after their child's death. Be aware of the presence of such groups in the community and make referrals when indicated.
6. Be aware that when the death of a child or adolescent is by suicide, through the use of alcohol or drugs, or through homicide, the grief is especially intense and is accompanied by intense guilt and/or anger. Consider referral for counseling or therapy in these cases.
7. Be aware that complicated grief is more likely when the parent has a preexisting psychiatric problem or when there was a troubled parent-child relationship before death. In such cases, referral to a mental health specialist may be indicated. Most intense and prolonged grief is normal, however, and the use of medication is usually not helpful.

RESOURCES

The Compassionate Friends

A national self-help support organization with >600 local chapters. Many local chapters have special groups for siblings. National office telephone number (toll free): 877-969-0010; Web site: www.compassionatefriends.org.

SHARE

Support for those touched by the death of an infant through miscarriage, stillbirth, or newborn death. Web site: www.nationalshare.org.

BEREAVED PARENTS OF THE USA (BP/USA)

Provides support, care, and compassion for bereaved parents, siblings, and grandparents. Web site: www.bereavedparentsusa.org.

SURVIVORS OF SUICIDE (SOS)

Support for those who have lost a loved one to suicide. Web site: www.survivorsofsuicide.com.

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POLICY STATEMENT

Trampoline Safety in Childhood and Adolescence

abstract

FREE

Despite previous recommendations from the American Academy of Pediatrics discouraging home use of trampolines, recreational use of trampolines in the home setting continues to be a popular activity among children and adolescents. This policy statement is an update to previous statements, reflecting the current literature on prevalence, patterns, and mechanisms of trampoline-related injuries. Most trampoline injuries occur with multiple simultaneous users on the mat. Cervical spine injuries often occur with falls off the trampoline or with attempts at somersaults or flips. Studies on the efficacy of trampoline safety measures are reviewed, and although there is a paucity of data, current implementation of safety measures have not appeared to mitigate risk substantially. Therefore, the home use of trampolines is strongly discouraged. The role of trampoline as a competitive sport and in structured training settings is reviewed, and recommendations for enhancing safety in these environments are made. *Pediatrics* 2012;130:774–779

George Nissen, a competitive gymnast, patented the modern trampoline as a "tumbling device" in 1945. Nissen initially designed the trampoline as a training tool for acrobats and gymnasts and subsequently promoted it for military aviator training. Recreational use of trampolines is a more recent phenomenon, driven primarily by the increased availability of relatively inexpensive trampolines marketed for home use.

The evolving pattern of trampoline use and injury resulted in a series of published policy statements from the American Academy of Pediatrics (AAP) in 1977, 1981, and 1999.[1–3] The American Academy of Orthopedic Surgeons issued trampoline safety position statements in 2005 and 2010.[4] The Canadian Pediatric Society and the Canadian Academy of Sports Medicine issued a joint statement on trampoline use in 2007.[5] These statements all discouraged recreational and playground use of trampolines and urged caution with and further study of trampoline use in supervised training and physical education settings.

The recent growth of trampoline as a competitive sport, the emergence of commercial indoor trampoline parks, research on the efficacy of safety measures, and more recently recognized patterns of catastrophic injury with recreational trampoline use have prompted a review of the current literature and an update of previous AAP policy statements regarding trampolines.

COUNCIL ON SPORTS MEDICINE AND FITNESS

KEY WORDS

trampoline, injury, sports medicine, safety, cervical spine injury

ABBREVIATIONS

AAP—American Academy of Pediatrics
NEISS—National Electronic Injury Surveillance System
USCPSC—US Consumer Product Safety Commission

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EPIDEMIOLOGY

Over the past several decades, national estimates of trampoline injury numbers have been generated annually by using the US Consumer Product Safety Commission's (USCPSC) National Electronic Injury Surveillance System (NEISS).[6] Trampoline injuries increased throughout the 1990s, with case numbers more than doubling between 1991 and 1996 (from approx 39 000 to >83 000 injuries per year). Injury rates and trampoline sales both peaked in 2004 and have been decreasing since then (Table 1).[6,7] As home trampoline use appears to be waning, commercial trampoline parks and other trampoline installations have been emerging over the past several years. Although indoor commercial parks typically consist of multiple contiguous trampoline mats with padded borders, other setups are highly variable. Any effect of these facilities on trampoline injury trends should be monitored but is not yet evident.

A comparison of trampoline injury prevalence with those from other sports and recreational activities provides a sense of the societal burden of injury; however, it does not reflect the true risk of trampoline use by an individual. Risk takes into account the exposure or frequency of a given activity, and unfortunately, exposure data for many recreational activities, including trampoline use, are difficult to define and measure. Trampoline injury rates for 2009 were 70 per 100 000 for 0- to 4-year-olds[6] and increased to 160 per 100 000 for 5- to 14-year-olds. Injury rates attributable to bicycling and use of playground equipment were higher in these age groups, but population exposure was likely significantly greater in these 2 activities as well.

In children younger than 14 years, rates of swimming injuries were similar to those for trampoline.[6] Once again, exposure comparisons are difficult, but home swimming pools and home trampolines do share some features in terms of injury risk. Home trampolines and home swimming pools are both considered by many insurance companies to be "attractive nuisances" capable of enticing children into potentially dangerous situations. As such, many homeowner insurance policies have trampoline exclusions or mandate that trampolines are within enclosed areas with restricted access, similar to rules for swimming pools and spas. A key difference between swimming pools and trampolines is that evidence-based safety recommendations for home swimming pools (ie, 4-sided fencing that completely isolates the pool from the house and yard) are a broadly publicized focus for many groups concerned with public safety, but trampoline safety information has not been as well studied or as widely disseminated. Many parents and supervising adults do not appear to be aware of key components of trampoline safety, such as limiting the trampoline to 1 user at a time, and this may contribute significantly to current injury rates.[8]

Although the prevalence of trampoline injuries is decreasing, concern persists regarding the severity of injuries sustained on the trampoline. Studies over the past decade in other countries revealed hospitalization rates between 3% and 14%.[8,9] Hospitalization rates in the United States have been approximately 3% from 2005 to 2009.[6]

TABLE 1 Trampoline-Related Injuries

Year	Actual Number of Cases[a]	Estimated Number of Injuries[b]	Rate of Injury per 100 000	Estimated Number of Hospitalizations/DOA
2004	3277	111 851	38.1	—
2005	3330	108 029	36.4	3537
2006	3277	109 522	36.6	4793
2007	3226	107 435	35.6	3188
2008	3130	104 752	34.5	2843
2009	3041	97 908	31.9	3164

DOA, deaths on arrival.
[a] From the USCPSC, NEISS, which gives a probability sample. Each injury case has a statistical weight.
[b] Calculated national estimate of trampoline injuries treated in US emergency departments.

TRAMPOLINE SAFETY CONCERNS

Unfortunately, the very forces that make trampoline use fun for many children also lead to unique injury mechanisms and patterns of injury. The trampoline industry has attempted to address the safety concerns with implementation of voluntary safety standards. In response to the 1999 AAP policy statement recommendation against consumer trampoline use, the USCPSC, the International Trampoline Industry Association, and the American Society of Testing and Materials Trampoline Subcommittee issued a revision of performance and safety standards. Equipment recommendations included the following: (1) extending padding to the frame and springs; (2) improving the quality of the padding; and (3) prohibiting inclusion of ladders in the packaging to help prevent young children from accessing the trampoline. Printed warnings were included with new trampoline equipment that recommended avoiding somersaulting, restricting multiple jumpers, and limiting trampoline use to children 6 years or older. Concerns have been raised as to whether these recommendations, in addition to other measures proposed in previous policy statements, have substantially affected the rate or severity of injuries.[9,10]

Another area of concern included reports of decreased quality of recreational trampoline equipment sold over the

past several decades. According to the International Trampoline Industry Association, trampolines sold in 1989 had an expected life of 10 years; the expectation for trampolines sold in 2004 was only 5 years.[10] Warranty coverage has also decreased since 2004, but the warranty for the frame and mat is consistently found to be greater than for the padding and enclosure nets. This reflects the manufacturers' expectation that the padding and enclosure net will need replacement during the lifetime of the trampoline.[10]

MECHANISMS OF TRAMPOLINE-RELATED INJURY AND THE EFFICACY OF CURRENT SAFETY MEASURES

Multiple Simultaneous Users

Several studies have revealed that approximately three-quarters of injuries occurred when multiple people were using the trampoline at the same time.[11–13] The smallest participants were up to 14 times more likely to sustain injury relative to their heavier playmates.[14] Heavier users create more recoil of the mat and springs and greater upward impaction forces than smaller users can generate on their own. These forces must be absorbed by the falling body and can be larger than landing on solid ground.[15] The risk associated with weight differences in the participants, in combination with less developed motor skills, likely contributes to the increased risk of fractures and dislocations in younger children.

Falls From the Trampoline

The most obvious risk of trampoline use is the ability to propel oneself to greater heights off a trampoline than from a jump on the ground. Falls from the trampoline can be severe and accounted for 27% to 39% of all trampoline-associated injuries.[10,16,17] Risk of falling is increased by the "off-balance" bounce that occurs when the trampoline is placed on an uneven surface, and children who fall off the mat are more likely to be injured if they make contact with nearby trees or other ground obstacles.

Netting and other perimeter enclosures to prevent falls from the trampoline were first commercially available in 1997, and the American Society for Testing and Materials produced a safety standard for enclosures in 2003. There is a paucity of literature on the effects of netting and other safety measures on injury risk. However, current evidence suggests that the availability of enclosures on the market has not significantly affected the proportions of injuries attributable to falls off the trampoline,[10] and there does not appear to be an inverse correlation between presence of safety equipment and rates of injury.[8] Proposed reasons for lack of efficacy of safety enclosures include positioning of enclosures on the outside of the frame[8] and inappropriate installation and maintenance.[10] Children are often tempted to climb or grasp the netting, which may be an additional source of injury.

Impact With Trampoline Frame and Springs

Approximately 20% of trampoline injuries have been attributable to direct contact with the springs and frame. However, similar to concerns regarding enclosure use, current literature on the effects of padding use on injury is sparse. Available data suggest that the availability and use of padding does not seem to correlate with decreased rates of injury.[8,10] Rapid deterioration of padding has been cited as 1 potential reason for the lack of safety efficacy.[8,10]

Trampoline Shape

No data exist regarding the difference in injury rates between rectangular and round trampolines. However, rectangular trampoline mats have a larger "sweet spot" that may provide a straighter and more consistent bounce across a broader area of the mat. This may translate into lower injury risk with rectangular trampolines as compared with round.

Recommendation for Adult Supervision

Trampoline safety recommendations have consistently advised adult supervision when children are on the trampoline. However, multiple studies reveal that approximately one-third to one-half of injuries[8,12,17–19] occurred despite reported adult supervision. These authors have raised concerns regarding supervision complacency, particularly when safety measures are in place, as well as lack of adult knowledge and intervention regarding risk behavior with trampoline use.

PATTERNS OF INJURY WITH TRAMPOLINE USE

Most trampoline injuries are manifestations of routine musculoskeletal injury mechanisms, but several unique patterns of injury are attributed to trampoline use and may warrant additional attention. Although the most common trampoline-related injury is an ankle sprain,[12] more serious injuries are not uncommon.

By Age

Patterns of injury vary by patient age. In retrospective reviews, individuals younger than 6 years accounted for 22% to 37% of individuals with a trampoline-related injury presenting to emergency departments for evaluation.[8,16] Although most trampoline injuries are sprains, strains, contusions, or other soft tissue injury, younger children seem to be more prone to bony injury.[11,18] According to an analysis of data from the NEISS,

29% of injuries in the 6- to 17-year age group resulted in fractures or dislocations, as compared with 48% in children 5 years and younger.[18] Data from the Canadian Hospitals Injury Reporting and Prevention Program revealed higher rates of hospitalization for trampoline injuries in children younger than 4 years as compared with their older counterparts.[9]

Extremity Injuries

The lower extremity is the most common site of trampoline injury, accounting for 34% to 50% of injuries.[11,20] Of these injuries, 1 study revealed that >60% involved the ankle,[20] and approximately three-quarters of ankle injuries were sprains.[6] The upper extremities were injured in 24% to 36% of cases. Of these, approximately 60% were fractures.[3,11] Upper extremity injuries were more common in participants who fell off the trampoline.[12]

Head and Neck Injuries

Although rates of extremity injuries are high, often the most frightening and alarming trampoline injuries are those to the head and neck. Many reports have revealed that head and/or neck injuries accounted for 10% to 17% of all trampoline-related injuries,[3,11,12,20] and 0.5% of all trampoline injuries resulted in permanent neurologic damage.[21] Head injuries occurred most commonly with falls from the trampoline.[20] Cervical spine injuries can happen with falls but also commonly occur on the trampoline mat when failed somersaults or flips cause hyperflexion or hyperextension of the cervical spine. These injuries can be the most catastrophic of all trampoline injuries suffered.

UNIQUE INJURIES ATTRIBUTED TO TRAMPOLINE USE

Proximal Tibial Fractures

Trampoline-related fractures of the proximal tibia have been described in children 6 years and younger.[15,22] These injuries have included transverse fractures as well as more subtle torus-types injuries. These injuries occurred when young children were sharing the trampoline with larger individuals, resulting in greater impact forces, as discussed previously.

Manubriosternal Dislocations/ Sternal Injuries

Sternal injuries have traditionally been described as a result of major trauma. However, several case reports[23] have been published of children between 10 and 11 years old suffering from isolated trampoline-related sternal fracture or manubriosternal dislocation. These occur after thoracic hyperflexion injuries on the trampoline.[23,24] They typically heal uneventfully; however, surgical stabilization may be necessary if pain persists.[24]

Vertebral Artery Dissection

Several cases of vertebral artery dissection presenting 12 to 24 hours after a neck injury on the trampoline have been reported. Vertebral artery dissections are the result of abrupt cervical hyperextension and rotation. Trauma to the artery may result in an intramural thrombus, which can cause a subsequent dissection of the vessel and possible intracranial emboli. These are often devastating injuries and may produce lasting neurologic complications.[25,26] Any neck pain associated with trampoline use requires prompt medical evaluation and diagnostic assessment.

Atlanto-axial Subluxation

Although patients with known atlanto-axial instability are often advised against the use of trampolines, there have been 2 reported cases of trampoline-related atlanto-axial subluxation in previously normal children.[27] Torticollis or neck pain after a trampoline-related neck injury warrants prompt medical evaluation and diagnostic assessment.

TRAMPOLINE USE IN A STRUCTURED TRAINING PROGRAM

Trampoline was accepted as an Olympic sport in 2000. In addition, trampolines are part of structured training programs in sports such as gymnastics, diving, figure skating, and freestyle skiing. USA Gymnastics and US Trampoline and Tumbling Association both administer competitive training and development programs in the sport of trampoline. USA Gymnastics oversees Olympic competition in single trampoline. The US Trampoline and Tumbling Association sponsors competition in single trampoline, synchronized trampoline, and double mini-trampoline. Some competitions accept athletes as young as 3 years old, although the majority of competitors are older than 8 years.

Competitive trampoline programs use a rectangular trampoline that is significantly different in size, quality, and cost than a recreational trampoline. Competition-style trampolines have center mats that are 7 ft by 14 ft. They are surrounded by a rim of padding over the springs and the 10-ft by 17-ft frame. These trampolines are raised off the ground and have 6 ft of end-deck padding. They do not have enclosure netting present. Within the competition setting, these trampolines have an additional 5- to 6-ft radius of padding present on the floor. In the training setting, competitive trampolines may be either raised off the ground, or "pit" trampolines, which are located at ground level. Either a bungee system or a rope and pulley system with a harness is used as athletes master tumbling skills.

No research documents the injury patterns or rates that occur specifically

in the structured training environment or with competitive trampoline events. Given the significant differences between the recreational and the structured training settings, extrapolation of data from the recreational setting to a formal training program is not appropriate. This is an area in which more research is warranted.

CONCLUSIONS

1. Although trampoline injury rates have been decreasing since 2004, the potential for severe injury remains relatively high. More prospective data are needed on this topic.
2. Enclosures and padding are not expected to prevent the large numbers of injuries that occur on the trampoline mat itself and may provide a false sense of security.
3. Many injuries occur even with reported adult supervision.
4. Multiple jumpers increase injury risk, particularly to the smallest participants.
5. Current trampoline equipment has shorter warranties than in the past, and protective equipment may require earlier replacement.
6. Individuals 5 years and younger appear to be at increased risk of fractures and dislocations from trampoline-related injuries.
7. Somersaulting, flipping, and falls put jumpers at increased risk of head and cervical spine injury with potentially permanent and devastating consequences.
8. Equipment, safety measures, and supervision within structured training programs are significantly different than those used in the recreational environment.

RECOMMENDATIONS FOR TRAMPOLINE USE

1. Pediatricians should counsel their patients and families against recreational trampoline use and explain that current data indicate safety measures have not significantly reduced injury rates and that catastrophic injuries do occur. For families who persist in home trampoline use despite this recommendation, pediatricians should advise parents and their children on the following guidelines until better information becomes available:

   a. Homeowners should verify that their insurance policies cover trampoline-related claims. Coverage is highly variable and a rider may need to be obtained.
   b. Trampoline use should be restricted to a single jumper on the mat at any given time.
   c. Trampolines should have adequate protective padding that is in good condition and appropriately placed.
   d. Trampolines should be set at ground level whenever possible or on a level surface and in an area cleared of any surrounding hazards.
   e. Frequent inspection and appropriate replacement of protective padding, net enclosure, and any other damaged parts should occur.
   f. Trampolines should be discarded if replacement parts are unavailable and the product is worn or damaged.
   g. Somersaults and flips are among the most common causes of permanent and devastating cervical spine injuries and should not be performed in the recreational setting.
   h. Active supervision by adults familiar with the above recommendations should occur at all times. Supervising adults should be willing and able to enforce these guidelines. Mere presence of an adult is not sufficient.
   i. Parents should confirm that these guidelines are in place anytime their child is likely to use a trampoline.

2. Data are insufficient regarding the safety of trampoline parks and similar installations. Until further safety information is available, the cautions outlined here regarding home trampolines are also applicable to recreational trampoline use in any setting.
   a. Pediatricians should advocate for all commercial jump parks to inform jumpers of the risk associated with trampoline use and the AAP guidelines for use.
   b. Parents should be aware that the rules and regulations of jump parks may not be consistent with the AAP guidelines for trampoline use and that the jumpers may be at increased risk for suffering an injury, potentially catastrophic.
   c. Injury rates at these facilities should be monitored.
3. The trampoline was designed as a piece of specialized training equipment for specific sports. Pediatricians should only endorse use of trampolines as part of a structured training program with appropriate coaching, supervision, and safety measures in place. In addition to the aforementioned recommendations, the following apply to trampolines used in the training setting:
   a. Any attempts at new skills, particularly somersaults or flips, should only follow an appropriate skill progression and include appropriate coaching and spotting measures.
   b. Use of safety belts/harnesses is encouraged when skill development is being taught.

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Morbidity and Mortality Weekly Report

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Prevention of Perinatal Group B Streptococcal Disease

Revised Guidelines from CDC

Centers for Disease Control and Prevention

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CONTENTS

Prevention of Perinatal Group B Streptococcal Disease

Revised Guidelines from CDC

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Summary

Group B streptococcus (GBS) remains a leading cause of serious neonatal infection despite great progress in perinatal GBS disease prevention in the 1990s. In 1996, CDC, in collaboration with other agencies, published guidelines for the prevention of perinatal group B streptococcal disease (CDC. Prevention of perinatal group B streptococcal disease: a public health perspective. MMWR 1996;45[RR-7]:1–24). *Data collected after the issuance of the 1996 guidelines prompted reevaluation of prevention strategies at a meeting of clinical and public health representatives in November 2001. This report replaces CDC's 1996 guidelines. The recommendations are based on available evidence and expert opinion where sufficient evidence was lacking. Although many of the recommendations in the 2002 guidelines are the same as those in 1996, they include some key changes:*

- *Recommendation of universal prenatal screening for vaginal and rectal GBS colonization of all pregnant women at 35–37 weeks' gestation, based on recent documentation in a large retrospective cohort study of a strong protective effect of this culture-based screening strategy relative to the risk-based strategy*
- *Updated prophylaxis regimens for women with penicillin allergy*
- *Detailed instruction on prenatal specimen collection and expanded methods of GBS culture processing, including instructions on antimicrobial susceptibility testing*
- *Recommendation against routine intrapartum antibiotic prophylaxis for GBS-colonized women undergoing planned cesarean deliveries who have not begun labor or had rupture of membranes*
- *A suggested algorithm for management of patients with threatened preterm delivery*
- *An updated algorithm for management of newborns exposed to intrapartum antibiotic prophylaxis*

Although universal screening for GBS colonization is anticipated to result in further reductions in the burden of GBS disease, the need to monitor for potential adverse consequences of intrapartum antibiotic use, such as emergence of bacterial antimicrobial resistance or increased incidence or severity of non-GBS neonatal pathogens, continues, and intrapartum antibiotics are still viewed as an interim strategy until GBS vaccines achieve licensure.

Introduction

Group B streptococcus (GBS) emerged as the leading infectious cause of neonatal morbidity and mortality in the United States in the 1970s (*1–4*). Initial case series reported case-fatality ratios as high as 50%. In the early 1980s, clinical trials demonstrated that administering antibiotics during labor to women at risk of transmitting GBS to their newborns could prevent invasive disease in the first week of life (i.e., early-onset disease) (*5*). As a result of the collaborative efforts of clinicians, researchers, professional organizations, parent advocacy groups, and the public health community in the 1990s, recommendations for intrapartum prophylaxis to prevent perinatal GBS disease were issued in 1996 by the American College of Obstetricians and Gynecologists (ACOG) (*6*) and CDC (*7*), and in 1997 by the American Academy of Pediatrics (*8*).

Those guidelines recommended the use of one of two prevention methods, a risk-based approach or a culture-based screening approach. Providers using the risk-based method identify candidates for intrapartum chemoprophylaxis according to the presence of any of the following intrapartum risk factors associated with early-onset disease: delivering at <37 weeks' gestation, having an intrapartum temperature ≥100.4°F (≥38.0°C), or rupture of membranes for ≥18 hours. The screening-based method recommends screening of all pregnant women for vaginal and rectal GBS colonization between 35 and 37 weeks' gestation. Colonized women are then offered intrapartum antibiotics at the time of labor. Under both strategies, women with GBS bacteriuria during their current

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pregnancy, or who previously gave birth to an infant with early-onset GBS disease are candidates for intrapartum antibiotic prophylaxis.

Before active prevention was initiated, an estimated 7,500 cases of neonatal GBS disease occurred annually (*9*). Despite striking declines in disease incidence coinciding with increased prevention activities in the 1990s, GBS disease remains a leading infectious cause of morbidity and mortality among newborns in the United States (*10,11*). Moreover, since the release of the 1996 guidelines, new data are available to evaluate the effectiveness of the screening approach relative to the risk-based approach and to resolve some of the clinical challenges of implementing prevention.

In light of these new data, in November 2001, CDC consulted with multiple partners to revise the 1996 guidelines for the prevention of perinatal group B streptococcal disease, using an evidence-based approach where possible and scientific opinion when sufficient data were lacking (Table 1). These updated guidelines replace CDC's 1996 guidelines. They are intended for the following groups: providers of prenatal, obstetric, and pediatric care; supporting microbiology laboratories, hospital administrators and managed care organizations; childbirth educators; public health authorities; and expectant parents and their advocates.

Differences and similarities between current and previous guidelines

Following are major differences in the new guidelines:

- Recommendation of universal prenatal culture-based screening for vaginal and rectal GBS colonization of all pregnant women at 35–37 weeks' gestation
- Updated prophylaxis regimens for women with penicillin allergy
- Detailed instruction on prenatal specimen collection and expanded methods of GBS culture processing, including instructions on susceptibility testing
- Recommendation against routine intrapartum antibiotic prophylaxis for GBS-colonized women undergoing planned cesarean deliveries who have not begun labor or had rupture of membranes
- A suggested algorithm for management of patients with threatened preterm delivery
- An updated algorithm for management of newborns exposed to intrapartum antibiotic prophylaxis

Although important changes have been instituted, many recommendations remain the same:

- Penicillin remains the first-line agent for intrapartum antibiotic prophylaxis, with ampicillin an acceptable alternative.
- Women whose culture results are unknown at the time of delivery should be managed according to the risk-based approach; the obstetric risk factors remain unchanged (i.e., delivery at <37 weeks' gestation, duration of membrane rupture ≥18 hours, or temperature ≥100.4°F [≥38.0°C]).
- Women with negative vaginal and rectal GBS screening cultures within 5 weeks of delivery do not require intrapartum antimicrobial prophylaxis for GBS even if obstetric risk factors develop (i.e., delivery at <37 weeks' gestation, duration of membrane rupture ≥18 hours, or temperature ≥100.4°F [≥38.0°C]).
- Women with GBS bacteriuria in any concentration during their current pregnancy or who previously gave birth to an infant with GBS disease should receive intrapartum antimicrobial prophylaxis.
- In the absence of GBS urinary tract infection, antimicrobial agents should not be used before the intrapartum period to treat asymptomatic GBS colonization.

TABLE 1. Evidence-based rating system used to determine strength of recommendations

Category	Definition	Recommendation
Strength of recommendation		
A	Strong evidence for efficacy and substantial clinical benefit	Strongly recommended
B	Strong or moderate evidence for efficacy, but only limited clinical benefit	Generally recommended
C	Insufficient evidence for efficacy; or efficacy does not outweigh possible adverse consequences	Optional
D	Moderate evidence against efficacy or for adverse outcome	Generally not recommended
E	Strong evidence against efficacy or for adverse outcome	Never recommended
Quality of evidence supporting recommendation		
I	Evidence from at least one well-executed randomized, controlled trial or one rigorously designed laboratory-based experimental study that has been replicated by an independent investigator	
II	Evidence from at least one well-designed clinical trial without randomization; cohort or case-controlled analytic studies (preferably from more than one center); multiple time-series studies; dramatic results from uncontrolled studies; or some evidence from laboratory experiments	
III	Evidence from opinions of respected authorities based on clinical or laboratory experience, descriptive studies, or reports of expert committees	

Source: Adapted from CDC, 1999 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus. MMWR 1999; 48(RR-10):1-66.

Background

Early Infancy and Pregnancy-Related Infections

GBS causes severe invasive disease in young infants. The majority of infections in newborns occur within the first week of life and are designated early-onset disease. Late-onset infections occur in infants aged >1 week, with most infections evident in the first 3 months of life. Young infants with invasive GBS disease usually present with sepsis or pneumonia, and less often contract meningitis, osteomyelitis, or septic arthritis. The proportion of infants with meningitis is higher among those with late-onset infections. When neonatal infections caused by GBS appeared in the 1970s, as many as 50% of patients died. During the 1990s, the case-fatality ratio of early- and late-onset disease was 4% (*10*) because of advances in neonatal care.

Intrauterine infection of the fetus results from ascending spread of GBS from the vagina of a colonized woman who is typically asymptomatic. Fetal aspiration of infected amniotic fluid can lead to stillbirth, neonatal pneumonia, or sepsis. Infants can also become infected with GBS during passage through the birth canal, although the majority of infants who are exposed to the organism through this route become colonized on skin or mucous membranes but remain asymptomatic.

In pregnant women, GBS can cause clinical infections, but most women have no symptoms associated with genital tract colonization. Urinary tract infections caused by GBS complicate 2%–4% of pregnancies (*12,13*). During pregnancy or the postpartum period, women can contract amnionitis, endometritis, sepsis, or rarely, meningitis caused by GBS (*14–19*). Fatalities among women with pregnancy-associated GBS disease are extremely rare.

GBS Colonization

The gastrointestinal tract serves as the natural reservoir for GBS and is the likely source of vaginal colonization. Vaginal colonization is unusual in childhood but becomes more common in late adolescence (*20*). Approximately 10% to 30% of pregnant women are colonized with GBS in the vagina or rectum (*21*). GBS colonization can be transient, chronic, or intermittent. Maternal intrapartum GBS colonization is a major risk factor for early-onset disease in infants, and vertical transmission of GBS from mother to fetus primarily occurs after the onset of labor or membrane rupture. However, colonization early in pregnancy is not predictive of neonatal sepsis (*22*). Culture screening of both the vagina and rectum for GBS late in gestation during prenatal care can detect women who are likely to be colonized with GBS at the time of delivery and are thus at higher risk of perinatal transmission of the organism (*23*).

Classic epidemiologic studies conducted during the 1980s revealed that women with prenatal GBS colonization were >25 times more likely than women with negative prenatal cultures to deliver infants with early-onset GBS disease (*24*). Researchers used prenatal cultures as the basis for identifying candidates for intrapartum antimicrobial chemoprophylaxis; clinical trials identified reductions in vertical transmission of the organism, as measured by infant colonization (*25,26*) or by protection against early-onset disease (*5,27*). Heavy colonization, defined as culture of GBS from direct plating rather than only from selective broth, is associated with higher risk for early-onset disease. GBS identified in clean-catch urine specimens is considered a surrogate for heavy maternal colonization and also is associated with a higher risk for early-onset GBS disease (*12,13*); it has been included among indications for intrapartum antibiotic prophylaxis.

GBS Culture-Based Screening Methods

Numerous studies have documented that the accuracy of prenatal screening cultures in identifying intrapartum colonization status can be enhanced by careful attention to the timing of cultures, the anatomic sites swabbed, and the precise microbiologic methods used for culture and detection of organisms (Box 1). Collection of cultures between 35 and 37 weeks' gestation is recommended to improve the sensitivity and specificity of detection of women who remain colonized at the time of delivery (*23,28*). Swabbing both the lower vagina and rectum (i.e., through the anal sphincter) increases the yield substantially compared with sampling the cervix or sampling the vagina without also swabbing the rectum (*29*). Studies have indicated that when women in the outpatient clinic setting collect their own screening specimens, with appropriate instruction, GBS yield is similar to when specimens are collected by a health-care provider (*30*). Although swabbing both sites is recommended and use of two swabs can be justified, both swabs should be placed in a single broth culture medium because the site of isolation is not important for clinical management and laboratory costs can thereby be minimized. Because vaginal and rectal swabs are likely to yield diverse bacteria, use of selective enrichment broth is recommended (Box 1) to maximize the isolation of GBS and avoid overgrowth of other organisms. When direct agar plating is used instead of selective enrichment broth, as many as 50% of women who are GBS carriers have false-negative culture results (*31*).

BOX 1. Procedures for collecting and processing clinical specimens for group B streptococcal culture and performing susceptibility testing to clindamycin and erythromycin

Procedure for collecting clinical specimens for culture of group B streptococcus at 35–37 weeks' gestation

- Swab the lower vagina (vaginal introitus), followed by the rectum (i.e., insert swab through the anal sphincter) using the same swab or two different swabs. Cultures should be collected in the outpatient setting by the health-care provider or the patient herself, with appropriate instruction. Cervical cultures are not recommended and a speculum should not be used for culture collection.
- Place the swab(s) into a nonnutritive transport medium. Appropriate transport systems (e.g., Amies or Stuart's without charcoal) are commercially available. If vaginal and rectal swabs were collected separately, both swabs can be placed into the same container of medium. Transport media will maintain GBS viability for up to 4 days at room temperature or under refrigeration.
- Specimen labels should clearly identify that specimens are for group B streptococcal culture. If susceptibility testing is ordered for penicillin-allergic women (Box 2), specimen labels should also identify the patient as penicillin allergic and should specify that susceptibility testing for clindamycin and erythromycin should be performed if GBS is isolated.

Procedure for processing clinical specimens for culture of group B streptococcus

- Remove swab(s) from transport medium.* Inoculate swab(s) into a recommended selective broth medium, such as Todd-Hewitt broth supplemented with either gentamicin (8 µg/ml) and nalidixic acid (15 µg/ml), or with colistin (10 µg/ml) and nalidixic acid (15 µg/ml). Examples of appropriate commercially available options include Trans-Vag broth supplemented with 5% defibrinated sheep blood or LIM broth.†
- Incubate inoculated selective broth for 18–24 hours at 35°–37°C in ambient air or 5% CO_2. Subculture the broth to a sheep blood agar plate (e.g., tryptic soy agar with 5% defibrinated sheep blood).
- Inspect and identify organisms suggestive of GBS (i.e., narrow zone of beta hemolysis, gram-positive cocci, catalase negative). Note that hemolysis may be difficult to observe, so typical colonies without hemolysis should also be further tested. If GBS is not identified after incubation for 18–24 hours, reincubate and inspect at 48 hours to identify suspected organisms.
- Various streptococcus grouping latex agglutination tests or other tests for GBS antigen detection (e.g., genetic probe) may be used for specific identification, or the CAMP test may be employed for presumptive identification.

Procedure for clindamycin and erythromycin disk susceptibility testing of isolates, when ordered for penicillin-allergic patients§

- Use a cotton swab to make a suspension from 18–24-hour growth of the organism in saline or Mueller-Hinton broth to match a 0.5 McFarland turbidity standard.
- Within 15 minutes of adjusting the turbidity, dip a sterile cotton swab into the adjusted suspension. The swab should be rotated several times and pressed firmly on the inside wall of the tube above the fluid level. Use the swab to inoculate the entire surface of a Mueller-Hinton sheep blood agar plate. After the plate is dry, use sterile forceps to place a clindamycin (2 µg) disk onto half of the plate and an erythromycin (15 µg) disk onto the other half.
- Incubate at 35°C in 5% CO_2 for 20–24 hours.
- Measure the diameter of the zone of inhibition using a ruler or calipers. Interpret according to NCCLS guidelines for *Streptococcus* species other than *S. pneumoniae* (2002 breakpoints:§ clindamycin: ≥19 mm = susceptible, 16–18 = intermediate, ≤15 = resistant; erythromycin: ≥21 mm = susceptible, 16–20 = intermediate, ≤15 = resistant).

* Before inoculation step, some laboratories may choose to roll swab(s) on a single sheep blood agar plate or CNA sheep blood agar plate. This should be done only in addition to, and not instead of, inoculation into selective broth. The plate should be streaked for isolation, incubated at 35–37°C in ambient air or 5% CO_2 for 18–24 hours and inspected for organisms suggestive of GBS as described above. If suspected colonies are confirmed as GBS, the broth can be discarded, thus shortening the time to obtaining culture results.

† **Source:** Fenton, LJ, Harper MH. Evaluation of colistin and nalidixic acid in Todd-Hewitt broth for selective isolation of group B streptococci. J Clin Microbiol 1979;9:167–9. Although Trans-Vag medium is often available without sheep blood, direct comparison of medium with and without sheep blood has shown higher yield when blood is added. LIM broth may also benefit from the addition of sheep blood, although the improvement in yield is smaller and sufficient data are not yet available to support a recommendation.

§ **Source:** NCCLS. Performance standard for antimicrobial suceptibility testing, M100-S12, Table 2H, Wayne, Pa.: NCCLS, 2002. NCCLS recommends disk diffusion (M-2) or broth microdilution testing (M-7) for susceptibility testing of GBS. Commercial systems that have been cleared or approved for testing of streptococci other than *S. pneumoniae* may also be used. Penicillin susceptibility testing is not routinely recommended for GBS because penicillin-resistant isolates have not been confirmed to date.

Additional Risk Factors for Perinatal GBS Disease

In addition to colonization with GBS, other factors increase the risk for early-onset disease. These include gestational age <37 completed weeks, longer duration of membrane rupture, intraamniotic infection, young maternal age, black race, Hispanic ethnicity, and low maternal levels of anticapsular antibody (*32–37*). In a 1985 report of predictors of early-onset disease (*24*), women with gestation <37 weeks, membrane rupture of >12 hours, or intrapartum temperature >99.5°F (37.5°C) had 6.5 times the risk of having an infant with early-onset GBS disease compared with women with none of those factors. Of note, women who had one of these risk factors but who had negative prenatal screening cultures were at relatively low risk for early-onset GBS disease (attack rate 0.9 per 1,000 births) compared with women who were colonized prenatally but had none of the risk factors (attack rate 5.1 per 1,000 births) (*24*). In a risk-based strategy promoted during the 1990s as an alternative to prenatal culture-based screening approaches, prematurity (gestation <37 weeks), intrapartum fever (temperature ≥100.4°F or 38°C), or duration of membrane rupture >18 hours were used as clinical indications for intrapartum prophylaxis. Previous delivery of an infant with invasive GBS disease may increase the risk of early-onset disease in subsequent deliveries (*38,39*), and intrapartum treatment of such women in subsequent pregnancies has been promoted. By contrast, colonization with GBS in a previous pregnancy is not considered an indication for intrapartum prophylaxis in subsequent pregnancies; rather, women require evaluation for prenatal colonization in each pregnancy. Because colonization is transient, the predictive value of culture-based screening is too low to be clinically useful when performed more than 5 weeks before delivery (*28*); thus, many women with GBS colonization during one pregnancy will no longer be colonized during subsequent pregnancies.

Impact and Implementation of the 1996 Guidelines

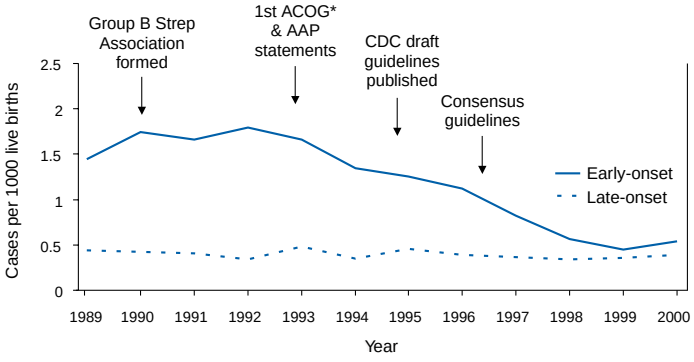
Declines in Perinatal GBS Disease Incidence in the Era of Chemoprophylaxis

Before the widespread use of intrapartum antibiotics, the incidence of invasive neonatal GBS disease ranged from 2 to 3 cases per 1,000 live births (*9,40*). Active, population-based surveillance in selected states in 1990, when GBS prevention was still rarely implemented, projected an incidence of 1.8 cases per 1,000 live births in the United States (early-onset disease: 1.5/1,000; late-onset: 0.35/1,000) (*9*).

Coinciding with active prevention efforts in the 1990s, the incidence of early-onset disease declined by 70% to 0.5 cases per 1,000 live births in 1999 (Figure 1). Projections from active surveillance data for 1999 from the Active Bacterial Core surveillance/Emerging Infections Program Network (ABCs)(*41*) estimate that intrapartum antibiotics prevented nearly 4,500 early-onset cases and 225 deaths that year (*10,11*). Other countries that have adopted perinatal GBS disease prevention guidelines similar to the United States have seen comparable declines in early-onset disease incidence (*42–44*). Recent estimates of early-onset disease incidence in the United States suggest a slight increase in incidence from 1999 to 2000, consistent with a plateau in the impact of prevention efforts (Figure 1).

The incidence of invasive GBS infections among pregnant women in the United States declined by 21% from 0.29 per 1,000 live births in 1993 to 0.23 in 1998 (*10*), suggesting that increased use of intrapartum antibiotics also prevented some cases of maternal GBS amnionitis and endometritis. In contrast, the rate of late-onset disease remained fairly constant throughout the 1990s (Figure 1). Although intrapartum chemoprophylaxis for women with heavy GBS colonization may prevent a portion of late-onset disease, the stable incidence of late-onset disease during a period when use of intrapartum antibiotics was increasing suggests that this intervention is not effective against late-onset disease.

FIGURE 1. Incidence of early- and late-onset invasive group B streptococcal diseaseð selected Active Bacterial Core surveillance areas, 1989ï 2000, and activities for prevention of group B streptococcal disease



* ACOG, American College of Obstetricians and Gynecologists; AAP, American Academy of Pediatrics. **Source:** Adapted from CDC. Early-onset group B streptococcal disease, United States, 1998ï 1999. MMWR 2000;49:793ï 6; and Schrag SJ, Zywicki S, Farley MM, et al. Group B streptococcal disease in the era of intrapartum antibiotic prophylaxis. N Engl J Med 2000;342:15ï 20.

Implementation of Chemoprophylaxis Strategies After the Release of the 1996 Guidelines

Declines in perinatal GBS disease incidence in the 1990s suggest that prevention strategies have been implemented successfully. Several studies have explored directly the challenges of implementation and extent of compliance with recommendations. Surveys of prenatal care providers in Connecticut and Minnesota in 1998 found that over 80% had a GBS prevention policy (Connecticut, 95%; Minnesota, 85%) (*45*). In Minnesota, family physicians were less likely to have a policy than were obstetrician/gynecologists and certified nurse midwives (*45*). A national survey of ACOG members in 2000 found that 98% of respondents had a GBS prevention policy; 75% of respondents reported using a version of the culture-based screening approach (*46*). Providers in all three surveys scored well on questions about their knowledge of the screening and risk-based strategies (*45,46*).

In hospitals that established or revised policies for GBS prevention shortly after the release of the 1996 guidelines, rates of early-onset GBS disease declined by 1997 (*47*). By 1999, although only 63% of hospitals in a multistate survey of hospitals in the ABCs areas had a formal GBS prevention policy (*48*), having a hospital policy was no longer associated with changes in incidence of GBS disease, likely because a high proportion of individual practitioners had adopted policies by this time.

Several studies of single institutions or health maintenance organizations have evaluated adherence of hospital personnel to GBS guidelines (Table 2). Among hospitals with a risk-based policy, intrapartum antibiotics were administered in 40%–80% of preterm deliveries or deliveries with prolonged rupture of membranes (Table 2) (*49–53*). Among hospitals with a culture-based screening policy, close to 90% of delivering women had documented GBS screening, and close to 90% of GBS-positive women received intrapartum antibiotics (Table 2) (*42,51,54–59*).

Correct laboratory processing of culture specimens (Box 1) plays a critical role in successful implementation of the screening policy. A survey of clinical laboratories in selected counties of three states in 1997–1998 found that only a proportion of laboratories were using the recommended selective broth media to process GBS cultures (Georgia, 39% of laboratories; Minnesota, 42%; Connecticut, 62%), suggesting that this may be an area in need of improvement (*31*).

Although surveys of practitioners and laboratories and reports from single hospitals help monitor implementation of GBS prevention guidelines, a recent CDC-sponsored review of labor and delivery records in selected counties of eight states in the ABCs areas in 1998 and 1999 sheds light on actual provider practices 2 to 3 years after the release of the 1996 guidelines (*60*). In this population, GBS screening was documented in 52% of deliveries, although this varied widely, from 24% in selected counties of Oregon to 70% in Maryland.

TABLE 2. Institutional-level compliance with 1996 perinatal group B streptococcal disease prevention recommendations

Type of population sampled (*ref.*)	Deliveries receiving intrapartum antibiotics, %*	Deliveries with prolonged ROM* receiving intrapartum antibiotics, %*	Preterm deliveries receiving intrapartum antibiotics, %*	Women screened overall, %	GBS culture-positive women receiving intrapartum antibiotics, %*
Risk-based strategy evaluated					
2 HMO* hospitals, California (*49*)	ï [Å]	88	81	N/A[Å]	N/A
University hospital, Florida (*50*)	ï	20 in 1992 72 in 1995	13 in 1992 42 in 1995	N/A	N/A
Single hospital, Vienna, Austria (*51*)	11.9	ï	ï	N/A	N/A
Single hospital, Massachusetts (*52*)	ï	81	ï	N/A	N/A
Connecticut (statewide), 1996 (*53*)	15.2	45	53	N/A	N/A
Screening-based strategy evaluated					
Community hospital, New York (*54*)	ï	N/A	76	91	86
University hospital, North Carolina (*55*)	12.9 for GBS prophylaxis	N/A	ï	98	92
Single hospital, Sydney, Australia (*42*)	ï	N/A	ï	90	ï
Single hospital, Vienna, Austria (*51*)	14.5	N/A	96	98.6	91
University hospital, New Mexico (*56*)	ï	N/A	ï	81	72
Single hospital, California (*59*)	26.3	N/A	91	89.8	94.4
Single hospital, Pennsylvania (*57*)	ï -	N/A	ï	92	86
2 HMO hospitals, Washington State (*58*)	ï	N/A	53	91	74 (automated data) 87 (chart review)
Single hospital, Massachusetts (*52*)	ï	N/A	ï	N/A	100
Connecticut (statewide), 1996 (*53*)	15.2	N/A	ï	(36% of Connecticut births)	78

*Given for any reason.
[Å]ROM, rupture of membranes; HMO, health maintenance organization; ï , data not available; N/A, not applicable.

Among screened women, 24% were GBS positive, consistent with carriage rates reported in earlier studies; 89% of GBS-positive women received intrapartum antibiotics. The median time of GBS culture collection was at 35.6 weeks' gestation, consistent with the recommendation of 35–37 weeks' gestation. Among unscreened women, 24% had at least one intrapartum risk factor; however, only 61% of women with at least one risk factor received intrapartum antibiotics. Preterm delivery (<37 weeks' gestation) was the most common indication for which intrapartum antibiotics were not administered. Thus, this multistate record review confirmed trends in adherence identified in reports from single hospitals (Table 2).

Maximizing Prevention by Chemoprophylaxis

Effectiveness of the Risk-Based Approach Versus the Screening Approach

Despite dramatic declines in GBS incidence in the United States in the 1990s, GBS remains a leading cause of newborn morbidity and mortality, resulting in an estimated 1,600 early-onset cases and 80 deaths annually. Although alternatives to intrapartum antibiotics such as a vaccine may become available in the future, intrapartum chemoprophylaxis remains the most effective available intervention against perinatal GBS disease. However, debate about the most effective strategy for identifying candidates for intrapartum chemoprophylaxis continues.

When the 1996 guidelines were issued, data regarding the relative effectiveness of the risk-based and screening approaches were not available. Theoretical predictions based on population estimates of the proportion of early-onset GBS cases without obstetric risk factors (approximately 45% in the preprevention era [*61*]) suggested that the screening-based approach would lead to greater declines in disease incidence than the risk-based approach (*61,62*). However, because implementation of the risk-based approach has been viewed as simpler than the screening-based approach, which requires correct specimen collection at the prenatal clinic, appropriate laboratory processing, and timely reporting of results to delivery staff, the actual effectiveness of these strategies is unknown. Consequently, since 1996, both approaches have been recommended as equally acceptable pending further data (*6–8*).

Although observational data are now available suggesting that each strategy can lead to reduced incidence of early-onset GBS disease (*49,50,63–65*), the strategies have not been directly compared by clinical trial because of the large sample size required. A series of single hospital analyses finding benefits of screening over the risk-based approach (*51,56,59,66*) were limited by sequential use of the strategies and inability to control for potential confounders. A recent CDC-sponsored multistate study provided the first large-scale direct comparison of the strategies (*60*). By incorporating population-based surveillance for early-onset GBS disease into a sample survey of a population of over 600,000 live births, this analysis found that the screening approach was >50% more effective than the risk-based approach at preventing perinatal GBS disease.

The protective effect of the screening approach was robust and persisted after controlling for risk factors associated with early-onset GBS disease (e.g., preterm delivery, prolonged membrane rupture, young maternal age, black race). The benefit of screening stemmed from two main factors. First, by identifying GBS-colonized women who did not present with obstetric risk factors, screening reached more of the population at risk than did the risk-based approach. Among the cohort of screened women, 18% of all deliveries were to mothers who were colonized with GBS but did not have obstetric risk factors. The efficacy of intrapartum antibiotics in preventing early-onset GBS disease among infants in this cohort was close to 90%, suggesting that chemoprophylaxis of GBS-positive women without obstetric risk factors resulted in significant prevention of early-onset disease.

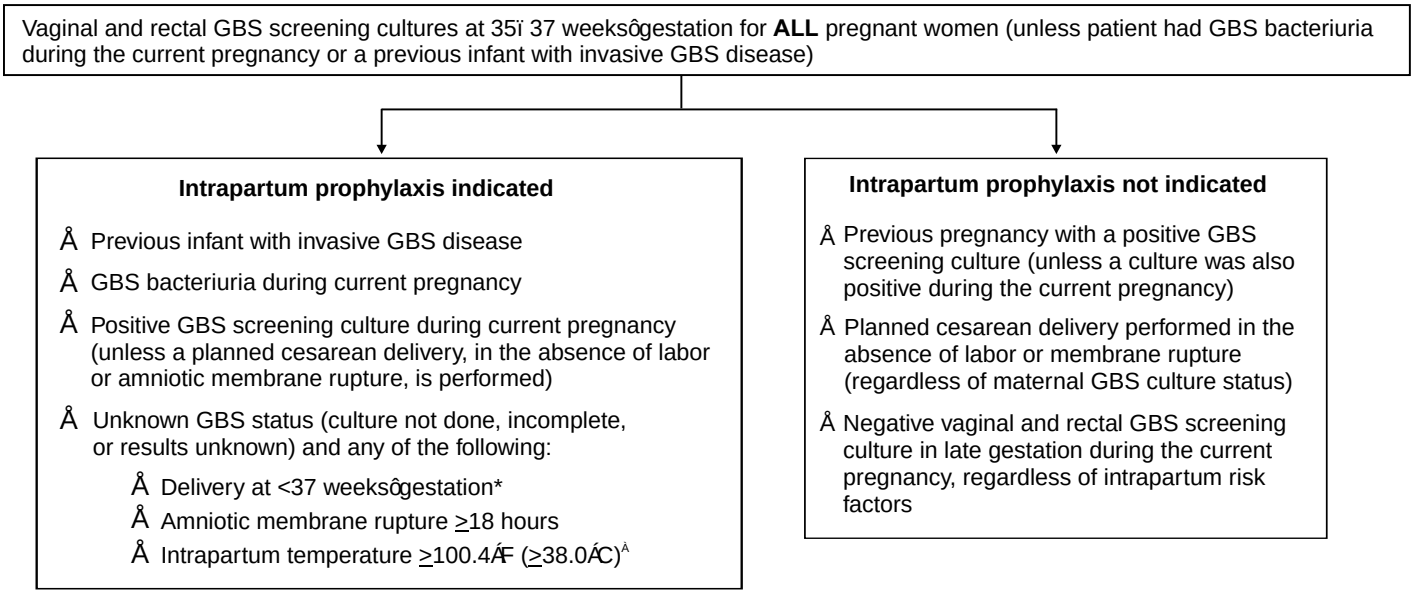
Women who were GBS positive in the screening cohort were also more likely to receive intrapartum antibiotics than were women with obstetric risk factors in the risk cohort. Although improvements in implementation of the risk-based approach would lead to further decline in disease, this would not be as great as with universal screening (*60*).

Finally, because the effectiveness of screening in this study was based on actual implementation of this strategy in clinical practice in 1998 and 1999, further improvements in screening implementation (e.g., improvements in specimen collection and the methods used for processing cultures) are expected to result in further benefits.

Rationale for a Universal Prenatal Screening Strategy to Detect GBS Status

The new availability of category II evidence (Table 1) for a large protective effect of prenatal GBS screening compared with the risk-based approach provides the foundation for a recommendation of universal prenatal GBS screening (Figure 2). Statewide prevention activities in some ABCs areas further demonstrate that culture-based screening can be successfully implemented in a variety of settings and institutions. For example, a health department-led survey of clinical

FIGURE 2. Indications for intrapartum antibiotic prophylaxis to prevent perinatal GBS disease under a universal prenatal screening strategy based on combined vaginal and rectal cultures collected at 35ï 37 weeksôgestation from all pregnant women



* If onset of labor or rupture of amniotic membranes occurs at <37 weeksôgestation and there is a significant risk for preterm delivery (as assessed by the clinician), a suggested algorithm for GBS prophylaxis management is provided (Figure 3).
Á If amnionitis is suspected, broad-spectrum antibiotic therapy that includes an agent known to be active against GBS should replace GBS prophylaxis.

laboratories in Connecticut followed by rapid feedback of survey results found that the proportion of laboratories in Connecticut using the correct media for processing GBS screening cultures increased from 62% in 1997 to 92% in 1998 (*67*) and 100% in 2000. Moreover, coinciding with an active prevention campaign launched by the state health department that advocated the screening-based approach, the incidence of early-onset GBS disease in Connecticut declined from 0.6 cases per 1,000 live births in 1996 (*68*) to 0.2 cases per 1,000 live births in 1999.

From the standpoint of implementation, universal screening has two additional benefits over the dual recommendations of 1996. Communication of the public health messages associated with a single strategy is simpler than communicating and educating about multiple strategies. Additionally, screening has clear indicators that facilitate evaluation of implementation (e.g., documentation of GBS test, timing of test, rates of GBS positivity) (*58*) compared with the risk-based approach, in which evidence of prevention implementation cannot be assessed for approximately 75% of deliveries because they have no intrapartum risk factors.

Cost-effectiveness analyses of the screening- and risk-based strategies (*62,69–73*) have indicated that although the initial costs associated with specimen collection and processing make the screening strategy more expensive than the risk-based approach, the overall cost savings due to disease prevention do not differ importantly between strategies. Additionally, multistate review of labor and delivery records in 1998 and 1999 suggests that perfect implementation of the screening- or risk-based strategies will result in a comparable proportion of deliveries in which women receive intrapartum antibiotic prophylaxis for GBS (24% for both strategies) (*60,74*). Thus, the strategies cannot be distinguished in terms of the proportion of deliveries that will be exposed to intrapartum antibiotics.

Adverse Effects and Unintended Consequences of Chemoprophylaxis

Potential adverse or unintended effects of GBS prevention efforts that have raised concern include allergic or anaphylactic reactions to agents used for intrapartum antibiotic prophylaxis, emergence of GBS strains resistant to standard therapies, and increasing incidence of serious neonatal infections caused by pathogens other than GBS, including antimicrobial-resistant strains. Because of the increasing emergence of bacterial resistance to antimicrobial agents in both nosocomial and community settings, assessment of the impact and continued effectiveness of interventions based on antimicrobial prophylaxis is critical.

Antibiotic Allergies Including Anaphylaxis

Anaphylaxis associated with GBS chemoprophylaxis occurs but is sufficiently rare that any morbidity associated with anaphylaxis is greatly offset by reductions in the incidence of maternal and neonatal invasive GBS disease. Anaphylaxis-related mortality is likely to be a rare event since women receiving intrapartum antibiotics will be in hospital settings where rapid intervention is readily available. Estimates of the rate of anaphylaxis caused by penicillin range from 4/10,000 to 4/100,000 recipients. Additionally, as many as 10% of the adult population have less severe allergic reactions to penicillin (*75*). Anaphylaxis associated with GBS prophylaxis was reported in the early 1990s (*76*); since the release of the 1996 guidelines, an additional report of a nonfatal case of anaphylaxis associated with GBS chemoprophylaxis has been published (*77*). In a CDC multistate sample of over 5,000 live births, a single, nonfatal anaphylactic reaction was noted among the 27% of deliveries in which intrapartum antibiotics were administered (*60*). In that case, a single dose of penicillin was administered approximately 4 hours before a preterm cesarean delivery, and an anaphylactic reaction occurred shortly after the mother received a single dose of a cephalosporin following umbilical cord clamping.

Resistance in GBS

GBS isolates with confirmed resistance to penicillin or ampicillin have not been observed to date (*78–83*). Penicillin remains the agent of choice for intrapartum antibiotic prophylaxis. Ampicillin is an acceptable alternative, but penicillin is preferred because it has a narrower spectrum of antimicrobial activity and may be less likely to select for resistant organisms. The efficacy of both penicillin (*27*) and ampicillin (*5*) as intrapartum agents for the prevention of early-onset neonatal GBS disease has been demonstrated in clinical trials. Although the intramuscular route of administration for penicillin has been evaluated (*25*), intravenous administration is the only route of administration recommended for intrapartum chemoprophylaxis to prevent perinatal GBS disease, regardless of the antimicrobial agent used, because of the higher intraamniotic concentrations achieved with this method.

In contrast, the proportions of GBS isolates with in vitro resistance to clindamycin and erythromycin have increased since 1996. The prevalence of resistance among invasive GBS isolates in the United States and Canada ranged from 7% to 25% for erythromycin and from 3% to 15% for clindamycin in reports published between 1998 and 2001(*79–81,84*). Resistance to erythromycin is frequently but not always associated with clindamycin resistance. Resistance of GBS isolates to cefoxitin, a second-generation cephalosporin sometimes used as a component of broad-spectrum coverage for chorioamnionitis, has also been reported (*85*); cefoxitin resistance has similarly been observed among invasive GBS isolates collected from 1996 to 2000 as part of CDC's active surveillance. Whether in vitro resistance of GBS has direct clinical implications remains unclear (*86*). Despite emerging resistance to some drug classes, minimum inhibitory concentrations of cefazolin, a first-generation cephalosporin available in an intravenous formulation, were low ($\leq$0.5 µg/ml) among a sample of invasive U.S. isolates from 1996 to 2000 (*87*), suggesting that GBS isolates are currently susceptible to this agent. Although NCCLS guidelines do not specify susceptibility breakpoints for cefazolin, they recommend that all isolates susceptible to penicillin be considered susceptible to cefazolin (*88*).

In light of the increasing prevalence of resistance to clindamycin, erythromycin, or both, recommended strategies for providing intrapartum antibiotic prophylaxis to penicillin-allergic women are updated (Box 2). Because the efficacy of recommended alternatives to penicillin or ampicillin has not been measured in controlled trials, and because some of the recommended alternatives have a broad spectrum of activity and may be more complicated and costly to administer, verification of a reported history of penicillin allergy is important. Patients with reported penicillin allergy should then be assessed to determine their risk for anaphylaxis. Persons at high risk for anaphylaxis are those who have had immediate hypersensitivity reactions to penicillin (e.g., anaphylaxis, angioedema, or urticaria) or who have a history of asthma or other conditions that would make anaphylaxis more dangerous (*89,90*). An estimated 10% of persons with penicillin allergy also have immediate hypersensitivity reactions to cephalosporins (*90*). Among penicillin-allergic women not at high risk for anaphylaxis, cefazolin, because of its narrow spectrum of activity and ability to achieve high intraamniotic concentrations, is the agent of choice for intrapartum chemoprophylaxis.

For penicillin-allergic women at high risk for anaphylaxis, testing of GBS isolates from prenatal screening for susceptibility to clindamycin and erythromycin is recommended if feasible (Box 1). One of these agents should be employed for intrapartum GBS prophylaxis if the screening isolate is susceptible to both agents.

Vancomycin should be reserved for penicillin-allergic women at high risk for beta-lactam anaphylaxis when clindamycin or erythromycin are not options because of in vitro resistance or unknown susceptibility of a prenatal isolate. Vancomycin use is generally restricted because of emerging vancomycin resistance among some gram-positive organisms (e.g., vancomycin-resistant enterococcus and vancomycin-resistant *Staphylococcus*

BOX 2. Recommended regimens for intrapartum antimicrobial prophylaxis for perinatal GBS disease prevention*

Recommended	Penicillin G, 5 million units IV initial dose, then 2.5 million units IV every 4 hours until delivery
Alternative	Ampicillin, 2 g IV initial dose, then 1 g IV every 4 hours until delivery
If penicillin allergic†	
Patients not at high risk for anaphylaxis	Cefazolin, 2 g IV initial dose, then 1 g IV every 8 hours until delivery
Patients at high risk for anaphylaxis§	
GBS susceptible to clindamycin and erythromycin¶	Clindamycin, 900 mg IV every 8 hours until delivery
	OR
	Erythromycin, 500 mg IV every 6 hours until delivery
GBS resistant to clindamycin or erythromycin or susceptibility unknown	Vancomycin,** 1 g IV every 12 hours until delivery

* Broader-spectrum agents, including an agent active against GBS, may be necessary for treatment of chorioamnionitis.

† History of penicillin allergy should be assessed to determine whether a high risk for anaphylaxis is present. Penicillin-allergic patients at high risk for anaphylaxis are those who have experienced immediate hypersensitivity to penicillin including a history of penicillin-related anaphylaxis; other high-risk patients are those with asthma or other diseases that would make anaphylaxis more dangerous or difficult to treat, such as persons being treated with beta-adrenergic–blocking agents.

§ If laboratory facilities are adequate, clindamycin and erythromycin susceptibility testing (Box 1) should be performed on prenatal GBS isolates from penicillin-allergic women at high risk for anaphylaxis.

¶ Resistance to erythromycin is often but not always associated with clindamycin resistance. If a strain is resistant to erythromycin but appears susceptible to clindamycin, it may still have inducible resistance to clindamycin.

** Cefazolin is preferred over vancomycin for women with a history of penicillin allergy other than immediate hypersensitivity reactions, and pharmacologic data suggest it achieves effective intraamniotic concentrations. Vancomycin should be reserved for penicillin-allergic women at high risk for anaphylaxis.

aureus). An estimated 13.8 million hospitalized patients received vancomycin therapy in 1998 (*91*). If penicillin allergy occurs in approximately 10% of adults, and 25% of parturients are colonized with GBS prenatally, approximately 100,000 of the 4 million annual deliveries would require prophylaxis with vancomycin in the absence of clindamycin and erythromycin susceptibility testing of GBS prenatal isolates. This represents a 7% increase in the number of patients exposed to vancomycin. The total grams of vancomycin used annually would increase by less than 1% if all penicillin-allergic colonized women received vancomycin prophylaxis.

Increased Incidence or Resistance in Non-GBS Pathogens

Decreases in the incidence of early-onset GBS sepsis have not usually been accompanied by increases in incidence of early-onset sepsis caused by other pathogens, including those that are antibiotic resistant. Most studies, including population-based multicenter studies, have found stable (*59,92,93*) or decreasing (*43*) rates of non-GBS early-onset sepsis during a period of increasing use of intrapartum antibiotic prophylaxis for GBS (Table 3). This is true both for overall non-GBS sepsis and for neonatal sepsis caused by *Escherichia coli*, the second leading bacterial cause of neonatal sepsis after GBS (*93,94*). Some single hospital studies have found increased rates or case counts of neonatal sepsis caused by *E. coli*, gram-negative organisms in general, or ampicillin-resistant pathogens (*64,94,95*), but these increases appear to be limited to preterm or low-birth-weight infants. An increasing proportion of *E. coli* neonatal sepsis cases caused by ampicillin-resistant organisms was observed in two studies (*92,94*), but again was limited to preterm or low-birth-weight infants. Furthermore, the proportion of community-acquired *E. coli* infections that are ampicillin resistant has been increasing (*96*), suggesting that trends in antimicrobial resistance should not be attributed to GBS prophylaxis.

An association between intrapartum antibiotic exposure and ampicillin resistance in cases of *E. coli* or other non-GBS early-onset sepsis has been observed in several studies (*36,94,95, 97,98*). These reports established that infections caused by antibiotic-resistant organisms were more frequently preceded by antibiotic use than were infections caused by susceptible organisms, and that more doses or longer duration of antibiotics before delivery increased the chance that a neonatal infection, if it occurred, would be caused by an antibiotic-resistant organism. These studies, however, were not designed to assess whether intrapartum antibiotic use increased the rate of antibiotic-resistant infections. Moreover, findings from these studies are consistent with intrapartum antibiotics inducing

TABLE 3. Trends in neonatal sepsis incidence in the era of perinatal GBS disease prevention

Study site	Total births	Cause of early-onset sepsis	Number of cases (rate per 1,000 live births)						p-value
Illinois	61,498		1982–1987		1988–1993				
(1 hospital) (*94*)		*E. coli*	12	(0.37)	18	(0.62)			NS*
		E. coli (among low-birth-weight† infants)	2	(0.64)	8	(2.63)			0.05
California	29,897		1991		1992		1993		
(1 hospital) (*95*)		GBS	5	(0.93)	3	(0.6)	2	(0.41)	NS
		Non-GBS	3	(0.56)	4	(0.8)	3	(0.61)	NS
		E. coli	0	(0)	1	(0.2)	1	(0.2)	0.001
Illinois	20,981		1992–1996		1997				
(1 hospital) (*64*)		GBS	30	(1.7)	0	(0)			0.02
		All causes	— §	(2.7)	—	(2.1)			NS
		All gram negative	5	(0.29)	5	(1.3)			0.02
Connecticut	140,923		1996		1997		1998		
(19 hospitals) (*92*)		GBS	20	(0.56)	17	(0.49)	20	(0.56)	0.01
		Non-GBS	24	(0.68)	23	(0.66)	24	(0.68)	NS
		E. coli	5	(0.14)	12	(0.35)	14	(0.39)	NS
Australia	172,947		1991–1993		1993–1995		1995–1997		
(multiple hospitals) (*43*)		GBS	33	(1.4)	68	(0.9)	27	(0.4)	<0.0001
		Non-GBS	30	(1.3)	63	(0.8)	29	(0.4)	<0.0001
California	29,403		1992–1993		1994–1996		1997–1998		1999–2000
(1 hospital) (*59*)		GBS	8	(1.2)	15	(1.1)	0	(0)	2 (0.2)	0.001
		Non-GBS	11	(1.6)	14	(1.1)	7	(0.8)	6 (0.6)	NS
Ohio	41,738		1986–1991		1992–1997				
(1 hospital) (*93*)		GBS	24	(1.1)	11	(0.54)			0.04
		Non-GBS	28	(1.3)	29	(1.4)			NS

*NS = not statistically significant.
†Low birth weight defined as 1,501–2,500 g.
§Data not available.

resistance among initially susceptible organisms, but also with intrapartum antibiotics preventing antibiotic-susceptible infections and having no impact on antibiotic-resistant infections, resulting in a net decrease in the total rate of infection.

The reported increases in antibiotic-resistant early-onset infections in a few studies are not of sufficient magnitude to outweigh the benefits of intrapartum antibiotic prophylaxis to prevent perinatal GBS disease. However, to assure early detection of increases in the rate of disease or deaths caused by organisms other than GBS, continued surveillance of neonatal sepsis caused by organisms other than GBS is needed.

Clinical Challenges

GBS Bacteriuria During Pregnancy

The presence of GBS bacteriuria in any concentration in a pregnant woman is a marker for heavy genital tract colonization. Therefore, women with any quantity of GBS bacteriuria during pregnancy should receive intrapartum chemoprophylaxis. Vaginal and rectal screening at 35–37 weeks is not necessary for these women. GBS can cause both symptomatic and asymptomatic urinary tract infections, which should be diagnosed and treated according to current standards of care for urinary tract infections in pregnancy. Women with GBS urinary tract infections during pregnancy should receive appropriate treatment at the time of diagnosis as well as intrapartum GBS prophylaxis. Laboratory personnel should report any presence of GBS bacteriuria in specimens obtained from pregnant women. For this to occur, labeling of urine specimens to indicate that they were obtained from a pregnant woman is imperative.

Planned Cesarean Delivery

Because GBS can cross intact amniotic membranes, a cesarean delivery does not prevent mother-to-child transmission of GBS. Moreover, because cesarean delivery itself is associated with health risks for mother and newborn, GBS colonization of

the mother is not an indication for cesarean delivery, and cesarean delivery should not be used as an alternative to intrapartum antibiotic prophylaxis for GBS prevention.

However, although a risk does exist for transmission of GBS from a colonized mother to her infant during a planned cesarean delivery performed before onset of labor in a woman with intact amniotic membranes, it is extremely low, based on a retrospective study at a single hospital (*99*) and a review of CDC active, population-based surveillance data from the 1990s. Thus, in this specific circumstance, in which the risk for disease is extremely low, the individual risks to a mother and her infant from receiving intrapartum antibiotic prophylaxis may balance or outweigh the benefits. Intrapartum antibiotic prophylaxis to prevent perinatal GBS disease is, therefore, not recommended as a routine practice for women undergoing planned cesarean deliveries in the absence of labor or amniotic membrane rupture, regardless of the GBS colonization status of the mother. Patients expected to undergo planned cesarean deliveries should nonetheless still undergo routine vaginal and rectal screening for GBS at 35–37 weeks because onset of labor or rupture of membranes may occur before the planned cesarean delivery. In rare situations in which patients or providers opt for intrapartum prophylaxis before planned cesarean deliveries, administration of antibiotics at the time of incision rather than at least 4 hours before delivery may be reasonable (*100*).

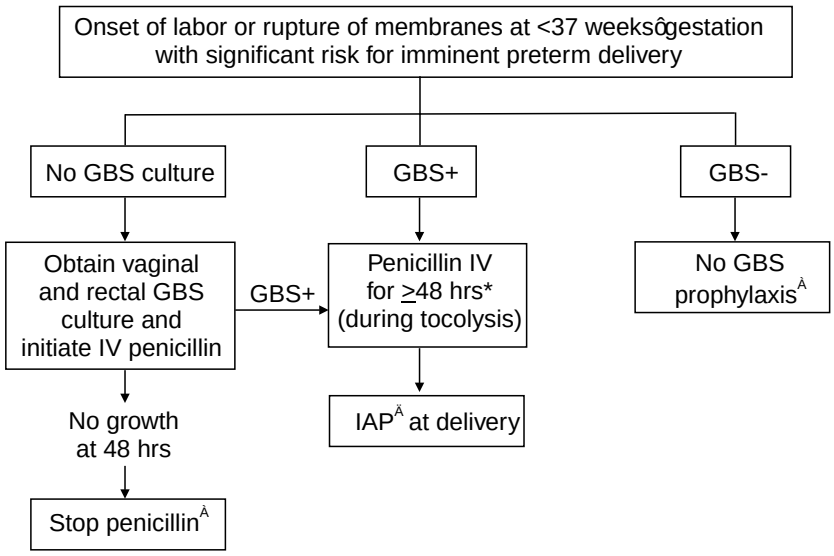
Threatened Preterm Delivery

Because preterm (at <37 weeks' gestation) delivery is an important risk factor for early-onset GBS disease, and because timing of delivery can be difficult to assess, management of intrapartum prophylaxis for women with threatened preterm delivery can be challenging. Assessing the need for intrapartum prophylaxis for these women can also be difficult because GBS screening is recommended at 35 to 37 weeks' gestation, and culture results are not always available when labor or rupture of membranes occur preterm.

A suggested approach to GBS chemoprophylaxis in the context of threatened preterm delivery is outlined (Figure 3). Because insufficient data are available to suggest a single course of management, other management strategies developed by individual physicians or institutions may be appropriate alternatives. The algorithm suggests that if GBS screening culture results from the current pregnancy are not available and if onset of labor or rupture of membranes occurs before 37 weeks' gestation with a substantial risk for preterm delivery (as assessed by the woman's health-care provider), intrapartum antibiotic prophylaxis for GBS should be provided pending culture results. For women not yet screened for GBS, a vaginal and rectal specimen for GBS culture should be obtained if time permits. If a negative culture result within the previous 4 weeks is on record, or if the clinician determines that labor can be successfully arrested and preterm delivery averted, antibiotics for GBS prophylaxis should not be initiated. Because recent clinical trials suggest that antibiotics administered during pregnancy may be associated with adverse neonatal outcomes, such as necrotizing enterocolitis or increased need for supplementary oxygen, without evident benefit for preterm labor or preterm premature rupture of membranes (*101,102*), antibiotics should be reserved for instances in which a significant risk for preterm delivery is present.

No data are available on which to recommend a specific duration of antibiotic administration for GBS-positive women with threatened preterm delivery when delivery is successfully postponed. Management strategies based on scientific opinion

FIGURE 3. Sample algorithm for GBS prophylaxis for women with threatened preterm delivery. This algorithm is not an exclusive course of management. Variations that incorporate individual circumstances or institutional preferences may be appropriate.



* Penicillin should be continued for a total of at least 48 hours, unless delivery occurs sooner. At the physicianõs discretion, antibiotic prophylaxis may be continued beyond 48 hours in a GBS culture-positive woman if delivery has not yet occurred. For women who are GBS culture positive, antibiotic prophylaxis should be reinitiated when labor likely to proceed to delivery occurs or recurs.

Å If delivery has not occurred within 4 weeks, a vaginal and rectal GBS screening culture should be repeated and the patient should be managed as described, based on the result of the repeat culture.

Ä Intrapartum antibiotic prophylaxis.

have been proposed (*100*); without further data, the management approach is left to the discretion of the individual provider. Regardless of management strategy chosen, these women should also receive intrapartum antibiotic chemoprophylaxis for GBS when labor likely to proceed to delivery occurs or recurs.

Previous data (*28*) suggest that the accuracy of GBS screening cultures in predicting colonization status at delivery is greatest if the cultures are collected within 5 weeks of delivery. Therefore, if a woman is screened early for GBS because of threatened preterm delivery but does not deliver within 4 weeks, she should be screened again for GBS colonization and managed according to the result of the repeated screening culture (Figure 3).

Obstetric Procedures for GBS-Colonized Women

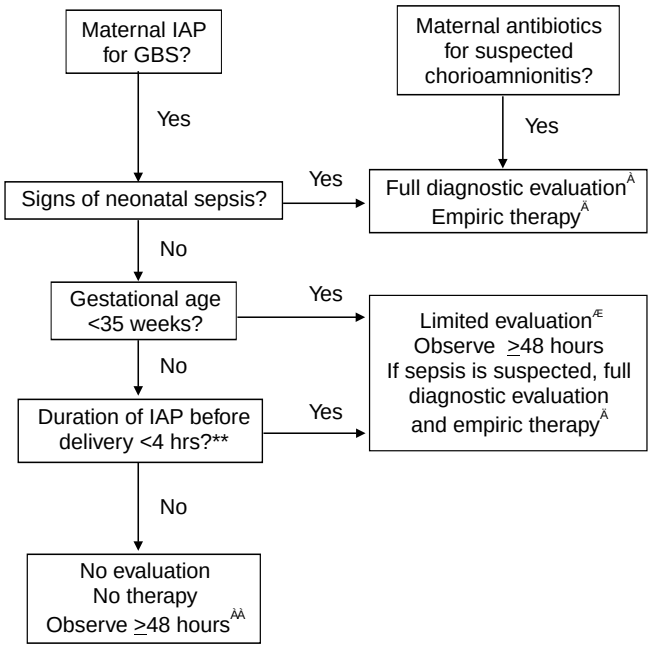
Questions have arisen regarding whether certain obstetric procedures, such as digital vaginal examinations, intrauterine fetal monitoring, and membrane stripping or sweeping to hasten the onset of labor, should be performed on GBS-colonized women. Asymptomatic GBS colonization is not an indication to perform any of these procedures. When such procedures are indicated for other reasons, evidence is currently not sufficient to recommend that particular procedures should be avoided because of increased risk of peripartum or perinatal infection. Although some obstetric procedures (frequent vaginal examinations after onset of labor or membrane rupture [*17,36,103–105*], intrauterine fetal monitoring [*104,106,107*], and mechanical cervical ripening devices [*108*]) have been significantly associated with peripartum or perinatal infectious outcomes, most studies to date have been limited by an inability to randomly allocate women to treatment groups and have yielded conflicting results. Moreover, because many studies were performed before GBS prevention was widely implemented, GBS colonization status was often not known and intrapartum chemoprophylaxis was less common. A meta-analysis of available studies examining the use of membrane stripping among women of undetermined GBS colonization status (*109*) found no significant increases in overall peripartum or perinatal infection rates among women who underwent this procedure and their infants compared with those who did not.

Management of Newborns Exposed to Intrapartum Prophylaxis

On the basis of information available since the publication of the 1996 guidelines, a modified approach for empiric management of newborns born to women who receive intrapartum antibiotics to prevent early-onset GBS disease or to treat suspected chorioamnionitis is provided (Figure 4). Variations in the algorithm that incorporate individual circumstances or institutional preferences may be appropriate. The modified approach contains the following changes:

- If a woman receives intrapartum antibiotics for treatment of suspected chorioamnionitis, her newborn should have a full diagnostic evaluation and empiric therapy pending

FIGURE 4. Sample algorithm for management of a newborn whose mother received intrapartum antimicrobial agents for prevention of early-onset group B streptococcal disease* or suspected chorioamnionitis. This algorithm is not an exclusive course of management. Variations that incorporate individual circumstances or institutional preferences may be appropriate.



* If no maternal intrapartum prophylaxis for GBS was administered despite an indication being present, data are insufficient on which to recommend a single management strategy.

† Includes complete blood cell count and differential, blood culture, and chest radiograph if respiratory abnormalities are present. When signs of sepsis are present, a lumbar puncture, if feasible, should be performed.

¨ Duration of therapy varies depending on results of blood culture, cerebrospinal fluid findings, if obtained, and the clinical course of the infant. If laboratory results and clinical course do not indicate bacterial infection, duration may be as short as 48 hours.

¨ CBC with differential and blood culture.

** Applies only to penicillin, ampicillin, or cefazolin and assumes recommended dosing regimens (Box 2)

†† A healthy-appearing infant who was ≥38 weeksôgestation at delivery and whose mother received ≥4 hours of intrapartum prophylaxis before delivery may be discharged home after 24 hours if other discharge criteria have been met and a person able to comply fully with instructions for home observation will be present. If any one of these conditions is not met, the infant should be observed in the hospital for at least 48 hours and until criteria for discharge are achieved.

culture results, regardless of clinical condition at birth, duration of maternal antibiotic therapy before delivery, or gestational age at delivery (*110*). Empiric therapy for the infant should include antimicrobial agents active against GBS as well as other organisms that might cause neonatal sepsis (e.g., ampicillin and gentamicin).

- When clinical signs in the infant suggest sepsis, a full diagnostic evaluation should include a lumbar puncture, if feasible. Blood cultures can be sterile in as many as 15% of newborns with meningitis (*111–113*), and the clinical management of an infant with abnormal cerebrospinal fluid (CSF) findings differs from that of an infant with normal CSF. If a lumbar puncture has been deferred for a neonate receiving empiric antibiotic therapy, and the therapy is continued beyond 48 hours because of clinical instability, CSF should be obtained for cell count, glucose, protein, and culture.
- In addition to penicillin or ampicillin, initiation of intrapartum antibiotic prophylaxis with cefazolin at least 4 hours before delivery can be considered adequate, based on achievable amniotic fluid concentrations of cefazolin (*114*). Although other agents may be substituted for penicillin if the woman has a history of penicillin allergy (Box 2), the effectiveness of these agents in preventing early-onset GBS disease has not been studied and no data are available to suggest the durations before delivery of these regimens that can be considered adequate.
- Based on the demonstrated effectiveness of intrapartum antibiotic prophylaxis at preventing early-onset GBS disease (*65*) and data indicating that clinical onset occurs within the first 24 hours of life in over 90% of infants who contract early-onset GBS disease (*115*), hospital discharge as early as 24 hours after delivery may be reasonable under certain circumstances. Specifically, a healthy-appearing infant who is ≥38 weeks' gestation at delivery and whose mother received ≥4 hours of intrapartum antibiotic prophylaxis before delivery may be discharged home as early as 24 hours after delivery, assuming that other discharge criteria have been met and that a person able to comply fully with instructions for home observation will be present. A key component of following instructions is the ability of the person observing to communicate with health-care providers by telephone and to transport the child promptly to an appropriate health-care facility if clinical signs of sepsis develop. If these conditions are not met, the infant should remain in the hospital for at least 48 hours of observation and until criteria for discharge are achieved.

Investigations since 1996 lend additional support to several components of the algorithm. A retrospective study of over 250,000 live births (*115*) found that administration of intrapartum antibiotic prophylaxis did not change the clinical spectrum of neonatal illness or delay the onset of clinical signs among infants who contracted GBS disease despite prophylaxis. Thus, the algorithm targets infants born to mothers with suspected chorioamnionitis and infants with signs of sepsis for full diagnostic evaluation and empiric therapy. Also, new evidence indicates that 4 or more hours of intrapartum ampicillin or penicillin administered according to recommended dosing intervals (Box 2) significantly reduces vertical transmission of GBS (*116*) and risk of early-onset GBS disease (*65*). Thus, although the American Academy of Pediatrics 1997 guidelines suggested 2 or more doses as a threshold for prophylaxis adequacy for infants ≥35 weeks' gestation (*8*), the revised algorithm continues to use ≥4 hours, administered according to recommended dosing intervals, as the benchmark for optimal prevention of early-onset GBS disease. Moreover, a review of pregnancies at a West Coast health maintenance organization using the GBS culture-based screening strategy found that among women who received intrapartum antibiotic prophylaxis, 50% received prophylaxis at least 4 hours before delivery, whereas only 14% received at least 2 doses of intrapartum antibiotics (*58*); this indicates that duration of prophylaxis is a more practical target than number of doses, in addition to being associated with efficacy.

One objective of developing an algorithm for management of newborns was to minimize unnecessary evaluation and antimicrobial treatment of infants whose mothers received intrapartum prophylaxis. Although early provider surveys indicated that pediatricians and neonatologists were more likely to conduct diagnostic evaluations and initiate empiric antibiotics for an infant whose mother received intrapartum antibiotic prophylaxis (*117–119*), more recent data indicate that implementation of GBS prevention strategies has not resulted in increased use of health services for neonates (*120*), and in some circumstances, when GBS prophylaxis increased a decrease occurred in the proportion of neonates who received laboratory evaluations (*58*).

Intrapartum antibiotic prophylaxis is the method of choice for preventing neonatal early-onset GBS disease. In the event that intrapartum antibiotics are not given despite an indication (e.g., delivery occurred precipitously before antibiotics could be administered to a GBS-positive woman), sufficient data are not available on which to recommend a single management strategy for the newborn. Some centers provide intramuscular penicillin to asymptomatic infants within 1 hour of birth, based on results of observational studies showing

declines in early-onset GBS disease coincident with a policy of universal administration of intramuscular penicillin to all newborns (*121*).

Future Prevention Technology

Rapid Tests to Detect GBS Colonization Status

Rapid tests for detection of GBS colonization at the time of onset of labor or rupture of amniotic membranes might obviate the need for prenatal culture-based screening if their sensitivity and specificity are comparable to culture in selective broth media and they yield results rapidly enough to permit administration of adequate intrapartum antibiotic prophylaxis to women detected as carriers. Currently available rapid tests detect GBS antigen from swab specimens. These tests are insufficiently sensitive to detect light colonization, and therefore are not adequate to replace culture-based prenatal screening (*122,123*) or to use in place of the risk-based approach when culture results are unknown at the time of labor. An adequate rapid intrapartum test must be as sensitive as culture (minimally 85% compared with culture of vaginal and rectal swabs inoculated into selective broth media), rapid so that results are available to clinicians in time for antibiotics to be given before delivery, and convenient for integration into routine laboratory use. Even a highly sensitive rapid detection test would not be adequate if results were not available to clinicians 24 hours a day, 7 days a week. Alternatives to culturing vaginal and rectal swab specimens at 35–37 weeks' gestation using recommended procedures should be validated to show sensitivity similar to recommended culture methods.

A rapid intrapartum test possessing the attributes described above offers the advantage of ascertaining GBS colonization status before delivery among women who have had no prenatal care. Although such tests might initially be introduced selectively in certain facilities with sufficient demand and capability, a general recommendation for their use would require the capacity for effective implementation in a wide range of hospital settings. Drawbacks of rapid tests include delays in administration of intrapartum antibiotic prophylaxis while test results are pending and lack of an isolate for susceptibility testing, which is of particular concern for penicillin-allergic women. Additionally, until rapid tests are universally used, missed opportunities for GBS screening may occur among women who receive prenatal care at institutions relying on intrapartum rapid tests but who deliver at institutions where such tests are not yet available.

In a study of 112 pregnant women at an academic hospital in Quebec, a new, not yet commercially available fluorogenic polymerase chain reaction assay was 97% sensitive and 100% specific when compared with vaginal and rectal cultures collected at admission for delivery. Test results in this study were available within 45 minutes of specimen collection (*124*). Further studies are needed to determine whether this type of test can be adapted for use outside the research setting. If appropriate techniques for rapid detection of GBS become commercially available, they may be integrated into the currently recommended screening strategy.

Vaccines To Prevent GBS Disease

Improved use of intrapartum antimicrobial prophylaxis has resulted in a substantial reduction in early-onset GBS disease, but it is unlikely to prevent most late-onset neonatal infections, GBS-related stillbirths, or prematurity, and does not address GBS disease in nonpregnant adults. Immunization of women during or before pregnancy could prevent peripartum maternal disease and protect infants from perinatally acquired infection by transplacental transfer of protective IgG antibodies (*125,126*). This would eliminate the need for prenatal GBS screening and intrapartum antimicrobial prophylaxis, along with associated costs and concerns regarding the potential adverse effects of intrapartum antibiotic use discussed previously.

Serotype-specific antibodies to GBS capsular polysaccharide, although rare in populations of unvaccinated women, have been shown to protect against disease (*32,127*). Phase 1 and 2 clinical trials among healthy, nonpregnant adults of monovalent protein-conjugate vaccines containing capsular polysaccharide antigens of GBS disease-associated serotypes have shown these vaccines to be well tolerated and immunogenic (*128–130*). One challenge of demonstrating vaccine efficacy in preventing early-onset GBS disease is that the sample size required for clinical trials may be prohibitively large. Identification of surrogate immunologic measures of clinical efficacy may thus be important (*131,132*). Surrogate information on clinical vaccine efficacy may also be gained by measuring the impact of multivalent conjugate vaccines on vaginal GBS colonization (*132,133*).

Anticipated difficulties in making vaccine available to pregnant women have resulted in consideration of other target populations for vaccine administration, including adolescent girls (*134*), women of childbearing age, and infants (*135*). The duration of protection that could be afforded by vaccination is unknown; one or more booster doses might be required, potentially complicating vaccine delivery. Shifts in the GBS serotypes causing disease have provided an additional

challenge to vaccine development (*133*) and may necessitate modification of vaccine serotype composition over time.

Research Priorities and Tools To Aid Prevention

Technological advances that aid the implementation of a universal screening strategy will further prevention efforts. In addition to development of reliable rapid tests that can be performed in a wide range of labor and delivery settings, methods of simplifying prenatal culture procedures, e.g., the development of media with a reliable color indicator to signal presence of GBS, might improve accuracy of prenatal culture results and facilitate prenatal culture processing at clinical laboratories with limited technical capacity. Media that have been developed for this purpose, such as Granada (*136,137*) or GBS medium (*138*), should be further evaluated to determine if sensitivity and specificity are comparable to recommended methods, which consist of culture in selective broth media followed by GBS-specific identification.

Although universal prenatal GBS culture-based screening is likely to result in substantial further declines in the incidence of early-onset disease, intrapartum chemoprophylaxis is not a permanent or comprehensive strategy for GBS disease prevention. Because vaccines under development hold promise to prevent a larger portion of the burden of GBS disease with a simpler and sustainable intervention, further work on GBS vaccine development and support of phase 3 clinical trials are warranted (*139*).

Until a safe, effective, and economical vaccine achieves licensure, it will be important to continue to monitor for potential adverse effects of chemoprophylaxis, with an emphasis on tracking key sentinel events signaling a need for revision of the guidelines. Such sentinel events include the emergence of penicillin resistance among GBS, which to date has not been detected, and an increase in the incidence of disease or deaths due to neonatal pathogens other than GBS that offsets the burden of early-onset disease prevented by chemoprophylaxis. Monitoring for the latter will require long-term surveillance of a large population of term and preterm births (*140*).

Because GBS carriage is common among delivering women in the United States, continued surveillance for GBS disease and evaluation of prevention implementation remains important to minimize missed opportunities for prevention. States are encouraged to monitor incidence of GBS disease, to promote activities that enhance perinatal GBS disease prevention and education, and to assess progress toward national objectives for disease reduction, such as Healthy People 2010, which sets a target of reducing the incidence of early-onset GBS disease in all racial and ethnic groups to 0.5 cases per 1,000 live births (*141*). Practical tools to assist with monitoring for missed opportunities for perinatal GBS prevention within hospitals have been published (*142*); additional prevention information and tools for providers, patients and clinical microbiologists are available at http://www.cdc.gov/groupbstrep, http://www.acog.org, http://sales.acog.com, http://www.aap.org, and http://www.health.state.mn.us/divs/dpc/ades/invbact/strepb.htm.

Recommendations

The following updated recommendations for the prevention of GBS disease are based on critical appraisal of multistate population-based observational data and several studies from individual institutions that have been completed since publication of previous CDC (*7*), ACOG (*6*), and AAP (*8*) recommendations. They replace previous recommendations from CDC. The strength (indicated by a letter) and quality (indicated by a roman numeral) of evidence supporting each recommendation are shown in parentheses, according to the evidence-based rating system outlined in Table 1.

Obstetric-care practitioners, in conjunction with supporting laboratories and labor and delivery facilities, should adopt the following strategy for the prevention of perinatal GBS disease based on prenatal screening for GBS colonization. The risk-based approach is no longer an acceptable alternative except for circumstances in which screening results are not available before delivery (AII).

- All pregnant women should be screened at 35–37 weeks' gestation for vaginal and rectal GBS colonization (Figure 2) (AII). At the time of labor or rupture of membranes, intrapartum chemoprophylaxis should be given to all pregnant women identified as GBS carriers (AII). Colonization during a previous pregnancy is not an indication for intrapartum prophylaxis in subsequent deliveries. Screening to detect GBS colonization in each pregnancy will determine the need for prophylaxis in that pregnancy.
- Women with GBS isolated from the urine in any concentration (e.g., 10^3) during their current pregnancy should receive intrapartum chemoprophylaxis because such women usually are heavily colonized with GBS and are at increased risk of delivering an infant with early-onset GBS disease (BII). Labels on urine specimens from prenatal patients should clearly state the patient's pregnancy status to assist laboratory processing and reporting of results. Prenatal culture-based screening at 35–37 weeks' gestation is not necessary for women with GBS bacteriuria. Women with symptomatic or asymptomatic GBS urinary

tract infection detected during pregnancy should be treated according to current standards of care for urinary tract infection during pregnancy.

- Women who have previously given birth to an infant with invasive GBS disease should receive intrapartum chemoprophylaxis; prenatal culture-based screening is not necessary for these women (BII).
- If the result of GBS culture is not known at the onset of labor, intrapartum chemoprophylaxis should be administered to women with any of the following risk factors: gestation <37 weeks, duration of membrane rupture ≥18 hours, or a temperature of ≥100.4° F (≥38.0°C) (AII). Women with known negative results from vaginal and rectal GBS screening cultures within 5 weeks of delivery do not require prophylaxis to prevent GBS disease even if any of the intrapartum risk factors develop.
- Women with threatened preterm (<37 weeks' gestation) delivery should be assessed for need for intrapartum prophylaxis to prevent perinatal GBS disease. An algorithm for management of women with threatened preterm delivery is provided (Figure 3). Other management approaches, developed by individual physicians or institutions, may be appropriate (CIII).
- Culture techniques that maximize the likelihood of GBS recovery are required for prenatal screening (Box 1). Collection of specimens for culture may be conducted in the outpatient clinic setting by either the patient, with appropriate instruction, or health-care provider (BII). This involves swabbing the lower vagina and rectum (i.e., through the anal sphincter). Because lower vaginal as opposed to cervical cultures are recommended, cultures should not be collected by speculum examination. Specimens should be placed in a nonnutritive transport medium (e.g., Amies or Stuart's without charcoal). Specimen labels should clearly identify that specimens are for group B streptococcal culture. If susceptibility testing is ordered for penicillin-allergic women (Box 2), specimen labels should also identify the patient as penicillin allergic and should specify that if GBS is isolated, it should be tested for susceptibility to clindamycin and erythromycin. Specimens should be inoculated into a selective broth medium (examples of appropriate commercially available media include Trans-Vag Broth supplemented with 5% defibrinated sheep blood or LIM broth), incubated overnight, and subcultured onto solid blood agar medium (AII). Methods of testing prenatal isolates from penicillin-allergic women for susceptibility to clindamycin and erythromycin are outlined (Box 1). Laboratories should report culture results (positive and negative) and susceptibility testing results to the anticipated site of delivery (when known) and to the health-care provider who ordered the test.
- Health-care providers should inform women of their GBS screening test result and the recommended interventions. In the absence of GBS urinary tract infection, antimicrobial agents should not be used before the intrapartum period to treat GBS colonization. Such treatment is not effective in eliminating carriage or preventing neonatal disease and may cause adverse consequences (DI).
- GBS-colonized women who have a planned cesarean delivery performed before rupture of membranes and onset of labor are at low risk for having an infant with early-onset GBS disease. These women should not routinely receive intrapartum chemoprophylaxis for perinatal GBS disease prevention (CII).
- For intrapartum chemoprophylaxis, the following regimen is recommended for women without penicillin allergy (Box 2): penicillin G, 5 million units intravenously initial dose, then 2.5 million units intravenously every 4 hours until delivery (AII). Because of its narrow spectrum of activity, penicillin is the preferred agent. An alternative regimen is ampicillin, 2 g intravenously initial dose, then 1 g intravenously every 4 hours until delivery (AI).
- Intrapartum chemoprophylaxis for penicillin-allergic women takes into account increasing resistance to clindamycin and erythromycin among GBS isolates (Box 2). During prenatal care, history of penicillin allergy should be assessed to determine whether a patient is at high risk for anaphylaxis, i.e., has a history of immediate hypersensitivity reactions to penicillin (e.g., anaphylaxis, angioedema, or urticaria) or history of asthma or other conditions that would make anaphylaxis more dangerous (*89*). Women who are not at high risk for anaphylaxis should be given cefazolin, 2 g intravenously initial dose, then 1 g intravenously every 8 hours until delivery (BIII). For women at high risk for anaphylaxis, clindamycin and erythromycin susceptibility testing, if available, should be performed on isolates obtained during GBS prenatal carriage screening. Women with clindamycin- and erythromycin-susceptible isolates should be given either clindamycin, 900 mg intravenously every 8 hours until delivery; OR erythromycin, 500 mg intravenously every 6 hours until delivery. If susceptibility testing is not possible, susceptibility results are not known, or isolates are resistant to erythromycin or clindamycin, the following regimen can be used for women with immediate penicillin hypersensitivity: vancomycin, 1 g intravenously every 12 hours until delivery (CIII).

- Routine use of antimicrobial prophylaxis for newborns whose mothers received intrapartum chemoprophylaxis for GBS infection is not recommended. However, therapeutic use of these agents is appropriate for infants with clinically suspected sepsis. An updated algorithm for management of infants born to mothers who received intrapartum chemoprophylaxis for GBS infection is provided (Figure 4). This revised algorithm is not an exclusive approach to management; variation that incorporates individual circumstances or institutional preferences may be appropriate (CIII).
- Local and state public health agencies, in conjunction with appropriate groups of hospitals, are encouraged to establish surveillance for early-onset GBS disease and to take other steps to promote perinatal GBS disease prevention and education to reduce the incidence of early-onset GBS disease in their states. Efforts to monitor the emergence of perinatal infections caused by other organisms are also encouraged.

Before full implementation of this strategy can be expected in all health-care settings, all members of the health-care team will need to improve protocols for isolation and reporting of GBS culture results, to improve information management to ensure communication of screening results, and to educate medical and nursing staff responsible for prenatal and intrapartum care. Within institutions, such efforts may take several months.

Even with ideal implementation, cases of early-onset GBS disease will continue to occur. Tools to help promote prevention and educate parents of infants with early-onset GBS disease are available at http://www.cdc.gov/groupbstrep. Additional tools available to assist with prevention implementation are available at http://www.acog.org, http://sales.acog.com, http://www.aap.org and http://www.health.state.mn.us/divs/dpc/ades/invbact/strepb.htm Multiple copies of educational materials published by CDC are available at the Public Health Foundation, 1220 L St., NW Suite 350, Washington, DC 20005, telephone 877-252-1200, or online at http://www.phf.org.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Alcohol Use by Youth and Adolescents: A Pediatric Concern

abstract

Alcohol use continues to be a major problem from preadolescence through young adulthood in the United States. Results of recent neuroscience research have substantiated the deleterious effects of alcohol on adolescent brain development and added even more evidence to support the call to prevent and reduce underaged drinking. Pediatricians should be knowledgeable about substance abuse to be able to recognize risk factors for alcohol and other substance abuse among youth, screen for use, provide appropriate brief interventions, and refer to treatment. The integration of alcohol use prevention programs in the community and our educational system from elementary school through college should be promoted by pediatricians and the health care community. Promotion of media responsibility to connect alcohol consumption with realistic consequences should be supported by pediatricians. Additional research into the prevention, screening and identification, brief intervention, and management and treatment of alcohol and other substance use by adolescents continues to be needed to improve evidence-based practices. *Pediatrics* 2010;125:1078–1087

COMMITTEE ON SUBSTANCE ABUSE

KEY WORDS
alcohol, substance abuse, adolescent brain development, advocacy

ABBREVIATIONS
DSM-IV-TR—*Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision*
ADHD—attention-deficit/hyperactivity disorder

INTRODUCTION

Alcohol use and heavy drinking are common during adolescence and young adulthood, although the minimum legal drinking age across the United States is 21 years. Some individuals may start hazardous alcohol consumption earlier in childhood. The prevalence of problematic alcohol use continues to escalate into the late adolescent and young-adult age range of 18 to 20 years. Drinking by college-aged students remains a major issue. Results of recent research that have demonstrated that brain development continues well into early adulthood[1] and that alcohol consumption can interfere with such development[2,3] indicate that alcohol use by youth is an even greater pediatric health concern.

Use of alcohol at an early age is associated with future alcohol-related problems.[4–6] Data from the National Longitudinal Alcohol Epidemiologic Study[4] substantiated that the prevalence of both lifetime alcohol dependence and alcohol abuse show a striking decrease with increasing age at onset of use. For those aged 12 years or younger at first use, the prevalence of lifetime alcohol dependence was 40.6%, whereas those who initiated at 18 years was 16.6% and at 21 years was 10.6%. Similarly, the prevalence of lifetime alcohol abuse was 8.3% for those who initiated use at 12 years or younger, 7.8% for those who initiated at 18 years, and 4.8% for those who initiated at 21 years. The contribution of

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age at alcohol use initiation to the odds of lifetime dependence and abuse varied little across gender and racial subgroups in the study. Early alcohol initiation has been associated with greater sexual risk-taking (unprotected sexual intercourse, multiple partners, being drunk or high during sexual intercourse, and pregnancy)[7]; academic problems; other substance use; and delinquent behavior in mid- to later adolescence.[8] By young adulthood, early alcohol use is associated with employment problems, other substance abuse, and criminal and violent behavior.[8] Independent of genetic risk, exposure to alcohol or other drug use disorders of parents predicts substance use disorders in children.[9]

ALCOHOL USE, MISUSE, ABUSE, AND DEPENDENCE

Adolescent drinking behaviors cover the alcohol use spectrum, from primary abstinence to alcohol dependence. The *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision* (DSM-IV-TR)[10] defines alcohol abuse as a maladaptive pattern of use that leads to clinically significant impairment or distress, as manifested by 1 or more of the following within a 12-month period:

- recurrent alcohol use that results in a failure to fulfill major role obligations at work, school, or home;
- recurrent alcohol use in situations in which it is physically hazardous;
- recurrent alcohol-related legal problems;
- continued alcohol use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the alcohol; and
- the symptoms have never met the criteria for alcohol dependence.

Alcohol dependence is defined as a maladaptive pattern of use that leads to clinically significant impairment or distress, as manifested by 3 or more of the following within the same 12-month period:

- tolerance;
- withdrawal;
- alcohol is often taken in larger amounts or over a longer period than was intended;
- there is a persistent desire or unsuccessful efforts to cut down or control use;
- a great deal of time is spent in activities necessary to obtain alcohol, use alcohol, or recover from its effects;
- important social, occupational, or recreational activities are given up or reduced because of use; or
- alcohol use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by alcohol.

Because these diagnostic criteria were developed largely from research and clinical work with adults, there are limitations to applying these definitions to classify alcohol use and associated risks to adolescents.[11–13] As defined by the *DSM-IV-TR*, alcohol abuse or dependence may not have had time to develop in an adolescent, especially a younger one, and yet the adolescent may be engaging in very risky behavior. Applicability is also potentially limited in that several of the criteria, such as withdrawal, are not typically experienced by adolescents, and other criteria, such as tolerance, have low specificity for adolescents. Tolerance can be anticipated as a developmental process that will occur over time in most adolescents who drink.[11]

Alcohol misuse can be defined as "alcohol-related disturbances of behavior, disease, or other consequences that are likely to cause an individual, his/her family, or society harm now or in the future."[14] Because the term "alcohol misuse" encompasses earlier stages of problematic alcohol use as well as alcohol dependence that do not meet diagnostic criteria, it may be a more useful concept clinically in pediatrics and when developing alcohol use primary prevention programs for youth.

In examining the use of drugs by US youth, the annual Monitoring the Future Study (sponsored by the National Institute on Drug Abuse and implemented by the University of Michigan)[15] has consistently reported that the drug most commonly used by youth is alcohol, exceeding the use of tobacco and illicit drugs. The 2009 survey of more than 46 000 8th-, 10th-, and 12th-grade students in more than 380 schools nationwide revealed that the prevalence of alcohol use in the previous 30 days had declined by more than one-third since most recently peaking in 1996 but that less of a decline was found for older students. The prevalence of being drunk at least once in the previous month was 5.4% for 8th-graders, 15.5% for 10th-graders, and 27.4% for 12th-graders. Prevalence of use in the previous 30 days of the relatively new flavored alcoholic beverages, also known as "alcopops" or "malternatives," decreased somewhat since initial inclusion in this survey in 2004. Alcopop use in the previous 30 days was reported by 9.5% of 8th-graders, 19.0% of 10th-graders, and 27.4% of 12th-graders in 2009. Recent "binge-drinking," defined as the consumption of 5 or more drinks in a row on at least 1 occasion in the previous 2 weeks, has continued at a relatively stable level, with 7.8% of 8th-graders, 17.5% of 10th-graders, and 25.2% of 12th-graders reporting this activity. Since the start of this century, more than 90% of 12th-graders have reported that alcohol is "fairly easy" or "very easy" to get, and more than 60% of 8th-graders say the same. These

epidemiologic statistics are corroborated by data reported from 2 other large surveys of youth alcohol use in the United States: the Youth Risk Behavior Survey[16] of the Centers for Disease Control and Prevention and the National Survey on Drug Use & Health (formerly the National Household Survey).[17]

HAZARDS OF USE OF ALCOHOL

When compared with use by adults, alcohol use by adolescents is much more likely to be episodic (binge) and heavy, which makes alcohol use by those in this age group particularly dangerous. Rapid binge-drinking, possibly related to a bet or dare, puts the teenager at even higher risk of alcohol overdose or alcohol poisoning, in which suppression of the gag reflex and respiratory drive can be fatal. The adult definition of binge-drinking (the consumption of 5 or more drinks in a row over approximately a 2-hour period) is often also used to describe adolescent or young-adult alcohol use. Recent literature, however, suggests that for 9- to 13-year-old children and girls aged 14 to 17 years, binge-drinking should be defined as 3 or more drinks. For boys, binge-drinking should be defined as 4 drinks or more for those aged 14 or 15 years and 5 or more drinks for those aged 16 or 17 years.[18]

Alcohol use is the primary contributor to the leading causes of adolescent death (ie, motor-vehicle crashes, homicide, and suicide) in the United States.[19] Motor-vehicle crashes rank as the top cause of death for US teenagers and young adults. The Youth Risk Behavior Survey in 2007 revealed that during the 30 days preceding the survey, 29.1% of students nationwide had ridden 1 or more times in a car or other vehicle driven by someone who had been drinking alcohol, and 10.5% of students had driven a car or other vehicle at least once when they had been drinking alcohol.[16] The impressive relationship of alcohol use and motor-vehicle crashes involving youth is also highlighted by the fact that after the legal drinking age was changed uniformly to 21 years across the United States, the number of motor-vehicle fatalities in individuals younger than 21 years significantly decreased.[20] Teenagers drink and drive less frequently than do adults, but their motor-vehicle crash risks are higher than those of adults when they do drink, especially at low and moderate blood alcohol concentrations.[21]

Lower minimum legal drinking ages in the United States have also been associated with higher youth suicide rates.[22] The research literature consistently reports the association of alcohol use or abuse with other risk-taking behaviors, including assault, sexual risk-taking, and other drug use.[12,13,23,24] Thus, alcohol use by adolescents is not safe, even when they are not driving.

Alcohol misuse and alcohol use disorders in adolescents are associated with many other mental and physical disorders. Alcohol use disorders are a risk factor for suicide attempts.[25] Psychiatric conditions most likely to co-occur with alcohol use disorders include mood disorders, particularly depression; anxiety disorders; attention-deficit/hyperactivity disorder (ADHD); conduct disorders; bulimia; and schizophrenia.[23] Associated physical health problems include trauma sequelae,[26] sleep disturbance, modestly elevated serum liver enzyme concentrations, and dental and other oral abnormalities,[27] despite relatively few abnormalities being evident on physical examination.[27,28]

FACTORS THAT CONTRIBUTE TO HAZARDOUS USE

Genetic and Familial Factors

Twin studies in adult populations have consistently demonstrated genetic influences on use and abuse of alcohol,[29–31] but less research has examined genetic influences on the adolescent age range.[32–34] Through a sibling/twin/adoption study of adolescents, Rhee et al[35] examined the relative contribution of genetics and environment on initiation, use, and problem use of substances. The results of this study demonstrated that for adolescents, compared with adult-twin study findings, the magnitude of genetic influences was higher and that of shared environmental influences was lower for problem alcohol or drug use than for initiation of use.

Families play an important role in the development of alcohol and other drug problems in youth. Drug use by parents or older siblings and permissive parental attitudes toward drug use by young people predict greater risk of youth drug and alcohol use.[36,37] Both parental monitoring of children's use and the convincing conveyance of household rules governing use aid in deterring alcohol use among youth.[38,39] In the United States, 7 million children younger than 18 years are children of alcoholic parents. Children of alcohol abusers are at increased risk of many behavioral and medical problems, including delinquent behavior, learning disorders, ADHD, psychosomatic complaints, and problem drinking or alcoholism as adults.[40]

Other Factors

Having friends who use alcohol, tobacco, or other substances is one of the strongest predictors of substance use by youth. Patterns of use in the community also predict individual substance use behaviors. Rates of use are higher in communities in which alcohol and other drugs are less expensive and easily obtainable. Other risk factors for substance abuse include poor school performance, untreated ADHD, and conduct disorder.[36]

Media influences on the use of alcohol by young people are substantial. Jernigan et al[41] examined boys' and girls' exposure to magazine advertising for alcohol compared with that of legal-aged adults and found that underaged youth saw 45% more beer and ale ads, 12% more distilled-spirit ads, and 65% more low-alcohol refresher beverage ads (for alcopops or lemonades, iced teas, or fruity beverages containing alcohol) as well as 69% less wine advertising than did people aged 21 years or older. Exposure to alcohol advertising was greater for girls than for boys. Other media, such as television, movies, billboards, and the Internet, are known to be very influential in promoting alcohol use through attractive portrayals of use without associated negative consequences. Considerable research has shown that media exposure can make children and adolescents more likely to experiment with alcohol.[42,43]

ADOLESCENT DEVELOPMENTAL AND NEUROBIOLOGICAL FACTORS

Over the past decade, great strides have been made in understanding the neurobiological basis of addiction. Studies investigating normal brain development have yielded information that elucidate the effects of alcohol and other drugs on the adolescent brain. As summarized by Sowell et al,[44] results of postmortem studies have shown that myelination, a cellular maturational process of the lipid/protein sheath of nerve fibers, begins near the end of the second trimester of fetal development and extends well into the third decade of life and beyond. Autopsy results have shown both a temporal and spatial systematic sequence of myelination, which progresses from inferior to superior and posterior to anterior regions of the brain. This sequencing results in initial brain myelination occurring in the brainstem and cerebellar regions and myelination of the cerebral hemispheres and frontal lobes occurring last. Converging evidence from electrophysiological and cerebral glucose-metabolism studies has revealed relatively late frontal lobe maturation, and results of neuropsychological studies have shown that performance on tasks that involve the frontal lobes continues to improve into adolescence.

Sowell et al[44] documented reduction in gray matter in the regions of the frontal cortex between adolescence and adulthood, which probably reflects increased myelination in the peripheral regions of the cortex. Gray-matter loss, with pruning and elimination of neural connections during normative adolescent development, seems to reflect a sculpting process that turns the immature brain into a mature one.[45] These changes are thought to improve cognitive processing in adulthood. Results of neuropsychological studies have shown that the frontal lobes are essential for functions such as response inhibition, emotional regulation, planning, and organization, all of which may continue to develop between adolescence and young adulthood. Conversely, parietal, temporal, and occipital lobes show little change in maturation between adolescence and adulthood. Parietal association cortices are involved in spatial relationships and sensory functions, and the lateral temporal lobes are associated with auditory and language processing, and these functions are largely mature by adolescence. Hence, the observed patterns of brain maturational changes are consistent with cognitive development.[44] Connections are being fine-tuned in adolescence with the pruning of overabundant synapses and the strengthening of relevant connections with development and experience. It is likely that the further development of the prefrontal cortex aids in the filtering of information and suppression of inappropriate actions.[45]

The effects of alcohol and other drugs on the adolescent brain are probably multiple, because the immaturity or plasticity of the brain developmental processes likely confers greater vulnerability to both the toxic and the addictive actions of drugs, and drug use itself may directly affect brain development. The use of alcohol and drugs during early adolescence, coupled with genetic predisposition to substance abuse and addiction, may increase the magnitude of risk-taking during adolescence. All substances of abuse that lead to dependence share 2 common effects during withdrawal: a decrease in dopamine 2 (D_2) receptors (which can lead to tolerance) and hypofunctioning of the prefrontal cortex. The effects of drugs and alcohol on an immature prefrontal cortex may increase the incentive to seek substances of abuse, especially to decrease the effects that are felt during withdrawal.[46,47] Continued use may impair an already immature prefrontal cortex and further affect decision-making once substance use begins.

Results of developmentally focused research on how alcohol affects the adolescent brain have started to demonstrate that adolescents with an alcohol use disorder use fewer strategies to learn new information and demonstrate significantly reduced memory skills that continue to deteriorate with continued alcohol use. In neuroimaging studies of patients with adolescent-onset alcohol use disorders, reduced hippocampal volumes and subtle white-matter abnormalities have been documented.[3] Research continues to explore these brain developmental processes that may confer greater vulnerability to the addictive actions of drugs, including alcohol.[2]

NATIONAL CALL TO PREVENT AND REDUCE UNDERAGED DRINKING

In 2007, *The Surgeon General's Call to Action to Prevent and Reduce Underage Drinking*[48] was issued after being developed in collaboration with the National Institute on Alcohol Abuse and Alcoholism (NIAAA) and the Substance Abuse and Mental Health Services Administration (SAMHSA). This call to action identified 6 goals:

- Foster changes in American society that facilitate healthy adolescent development and that help prevent and reduce underaged drinking.
- Engage parents and other caregivers, schools, communities, all levels of government, all social systems that interface with youth, and youth themselves in a coordinated national effort to prevent and reduce underaged drinking and its consequences.
- Promote an understanding of underaged alcohol consumption in the context of human development and maturation that takes into account individual adolescent characteristics as well as environmental, ethnic, cultural, and gender differences.
- Conduct additional research on adolescent alcohol use and its relationship to development.
- Work to improve public health surveillance on underaged drinking and on population-based risk factors for this behavior.
- Work to ensure that policies at all levels are consistent with the national goal of preventing and reducing underaged alcohol consumption.

The Surgeon General's report outlined specific strategies for implementing these goals, including recommendations for parents and other caregivers; schools, colleges, and universities; communities; the criminal and juvenile justice systems and law enforcement; entertainment and media industries; the health care system; professional health care associations; and governments and policy makers.

ROLE OF THE PEDIATRICIAN

Pediatricians and other health care providers who care for children and adolescents should help prevent, identify, and treat alcohol and other substance use by youth. The American Academy of Pediatrics guidelines for the health care of children and adolescents recommend that pediatricians discuss substance use as part of anticipatory guidance and preventive care.[49] Because of their understanding of family dynamics and long-standing relationships with families, pediatricians can identify substance-abusing families and facilitate their care.[50] Pediatricians can be involved in the primary prevention of alcohol misuse through educational and psychological interventions with youth. Although evaluation of such programs has revealed many methodologic weaknesses, there is some evidence to support the effectiveness of family-focused prevention programs and culturally focused skills training in the long-term prevention of alcohol misuse.[14] Pediatricians should support parenting programs that have been shown to reduce or prevent substance use by youth. The most effective programs emphasize active parental involvement and have components that emphasize development of social skills and promote a sense of personal responsibility among young people, as well as address issues related to substance abuse.[51] Pediatricians also have an important advocacy role in health systems' changes as well as legislative efforts, such as increasing alcohol taxes,[52] resisting efforts to weaken minimum-drinking-age laws, and implementing graduated-driver licensing.[21] A recent Cochrane review showed implementation of graduated-driver licensing to be effective in reducing the crash rates of young drivers and, specifically, alcohol-related crashes in most studies in the United States and internationally.[53]

The American Academy of Pediatrics recommends that pediatricians routinely screen and evaluate youth for substance use and provide office interventions and referrals for patients who are using alcohol or other substances.[49] The American Medical Association *Guidelines for Adolescent Preventive Services (GAPS)*[54] and the American Academy of Pediatrics *Bright Futures* guidelines[55] recommend that pediatricians and other health care providers who work with children and adolescents conduct routine annual substance use screening of all adolescents and use brief intervention techniques as indicated. In addition, it is recommended that pediatricians be familiar with community resources and refer patients with problematic use or a substance use disorder for treatment.[56] Despite these recommendations, primary care providers have reported many barriers to implementing alcohol and other drug use screening as a routine. Barriers to such screening have been identified to include insufficient time, lack of training to manage a positive screening, the need to triage competing medical problems, lack of treatment resources, tenacious parents who will not leave the examination room, and unfamiliarity with screening tools.[57]

Brief screening surveys for adolescent substance use are available and include the Alcohol Use Disorders Identification Test (AUDIT) developed by the World Health Organization,[58] the Problem Oriented Screening Instrument for Teenagers (POSIT) substance use/abuse scale developed by the National Institute on Drug Abuse,[59] and the CRAFFT instrument, a 6-question, developmentally appropriate screening tool developed by Knight et al (see Table 1).[60] Although all 3 of these tools

TABLE 1 CRAFFT Questions: A Brief Screening Test of Adolescent Substance Abuse

C	Have you ever ridden in a car driven by someone (including yourself) who was "high" or had been using alcohol or drugs?
R	Do you ever use alcohol or drugs to relax, feel better about yourself, or fit in?
A	Do you ever use alcohol or drugs while you are by yourself, alone?
F	Do you ever forget things you did while using alcohol or drugs?
F	Do your family or friends ever tell you that you should cut down on your drinking or drug use?
T	Have you ever gotten into trouble while you were using alcohol or drugs?

Two or more yes answers suggest a significant problem, abuse, or dependence. The CRAFFT questions were developed with grant support from the Robert Wood Johnson Foundation, the National Institute on Alcohol Abuse and Alcoholism, and the Substance Abuse and Mental Health Services Administration.

have acceptable sensitivity for identifying alcohol problems or disorders in 14- to 18-year-old adolescents,[61] the CRAFFT instrument has emerged as a quick, validated, reliable, and easy-to-use screening tool that can be administered in the primary care setting in verbal or written format and has good discriminative properties for determining substance use disorders in adolescents.[62] Test-retest reliability of the CRAFFT has been shown to be high, especially when the questions are prefaced with the phrase "in the past year" when office-based screening is performed.[63] Recently, the CRAFFT tool use was integrated into an adolescent substance use screening, brief intervention, and referral-to-treatment algorithm and tool kit to augment pediatricians' confidence and ability in responding effectively to screening results.[64]

More research is still needed to aid in developing brief intervention strategies (ie, short, efficient, office-based techniques) that health care providers who work with adolescents can use to detect and intervene with alcohol misuse. Motivational interviewing is one of the most promising brief intervention strategies that can be used in an office-based setting.[65] Motivational interviewing is a patient-centered, directive counseling style that builds on the intrinsic motivation of an individual. When conducting a motivational interview, the pediatrician or counselor creates a partnership with the adolescent patient to explore and resolve his or her ambivalence about behavioral change. Motivational interviewing is often associated with the transtheoretical model described by Prochaska and DiClemente,[66] who identified what they called "stages of change," a continuum of readiness to change behavior. In this model, change is facilitated by matching the counseling strategy to the stage of patient readiness to change behavior. The essential spirit of motivational interviewing comprises 3 elements: collaboration, or forming a partnership with the patient; evocation, or using open-ended questions and reflections to help the patient determine his or her own motivation to change; and autonomy, or accepting that it is the adolescent's responsibility to change his or her behavior and decide how the change will occur and that direct persuasion by a pediatrician or counselor is unlikely to be effective. Expressing empathy, developing discrepancy between goals and current behavior, "rolling" with the resistance a patient may have (ie, avoiding arguing for change), and supporting patient self-efficacy are the 4 principles of motivational interviewing.[67]

Results of research have shown that motivational interviewing as a counseling style has been effective in decreasing alcohol use in both younger and older adolescents.[68–71] The authors of a recent Cochrane review of primary prevention for alcohol misuse by young people noted that, although much research investigating the effectiveness of alcohol interventions was of poor quality, there was "strong design and consistent pattern of results indicating potential value of motivational interviewing."[14] Further research is indicated to improve all aspects of adolescent substance abuse intervention and treatment.[72]

Specific recommendations regarding the best management tools and techniques for treatment will be available in a forthcoming statement from the American Academy of Pediatrics on substance use screening, brief intervention, and referral to treatment for pediatricians. For more information, please see the resources listed at the end of this statement.

RECOMMENDATIONS

Pediatricians and other health care providers who work with children and adolescents are recommended to:

1. Become knowledgeable about all aspects of adolescent alcohol, tobacco, and other substance use through participation in training-program curricula and/or continuing medical education that provide current best-practices training, including media-literacy training.
2. Obtain a complete family medical and social history at prenatal and health supervision visits to explore potential genetic and family influences regarding alcohol and other substance use.
3. Recognize risk factors for alcohol (as well as other drug) use among youth and be aware of coexisting mental health problems, such as depression, that may occur in this age group.
4. Regularly screen for current alcohol (as well as other drug) use by adolescents and young adults by using nonjudgmental, validated screening methods and appropriate confidentiality assurances.

5. Assess patients whose screening results are positive for alcohol use to determine the appropriate level of intervention.
6. Use brief intervention techniques in the clinical setting and be familiar with motivational interviewing techniques to work with patients who use alcohol but do not meet criteria for immediate referral. Offer referral to treatment when indicated.
7. Discuss the hazards of alcohol and other substance use with patients as part of anticipatory guidance and patient/parent education at health supervision visits as well as when relevant at acute-problem visits. Anticipatory guidance aligned with key school calendar events, such as proms and graduation, may be especially meaningful.
8. Strongly advise against the use of alcohol, tobacco, and other illicit drugs by youth.
9. Encourage parents to be good role models for healthy life choices and never allow underaged drinking at their home or other property. Empower parents with the realization that their involvement with their adolescents is a powerful deterrent of substance abuse.
10. Be familiar with local resources to which various pediatric-aged patients with alcohol use disorders, their parents, and other family members can be referred for developmentally appropriate treatment.
11. Support adolescents with substance use disorders throughout and after their treatment.
12. Serve as a resource and support for school and other community-based alcohol use prevention programs.
13. Support advocacy efforts to promote appropriate media modeling of alcohol consumption and consequences, including print media, television, film, and the Internet.
14. Support advocacy efforts to promote legislation that reduces alcohol-related morbidity and mortality, such as graduated-driver licensing; treatment parity from third-party payers; legal ramifications for parent sponsorship of adolescent drinking; increased alcohol excise taxes; and other prevention and treatment policies recommended in the Surgeon General's call to action.[48]
15. Support continuation of the age of 21 as the minimum legal drinking age, and support enforcement that decreases access to alcohol for minors.
16. Support further research into prevention, evidence-based screening and identification, brief intervention, and management and treatment of alcohol and other substance use by adolescents.

RESOURCES

AAP Resources

Alcohol: Your Child and Drugs (patient education brochure)

Join Together (www.jointogether.org)

Parent-Teen Driving Agreement and a Message to Parents of Teen Drivers (patient education brochure)

Substance Abuse Prevention (patient education brochure)

Tobacco, Alcohol, and Other Drugs: The Role of the Pediatrician in Prevention, Identification, and Management of Substance Abuse[49] (policy statement)

Tobacco as a Substance of Abuse (technical report from Sims TH and Committee on Substance Abuse). *Pediatrics.* 2009;124(5):e1045–e1053

Suggested Internet Resources

AAP District II, New York Chapter 2, Committee on Youth and Adolescence. Teen Parties in Your Home: A Guide for Parents

www.ny2aap.org/teenparties.pdf

Al-Anon/Alateen

www.al-anon.alateen.org

American Council for Drug Education

www.acde.org

American Medical Association

Office of Alcohol and Other Drug Abuse

National Office of the Robert Wood Johnson Foundation

Helping Patients Who Drink Too Much: A Clinician's Guide

http://pubs.niaaa.nih.gov/publications/Practitioner/CliniciansGuide2005/guide.pdf

College Drinking—Changing the Culture

www.collegedrinkingprevention.gov

Monitoring the Future Study

www.monitoringthefuture.org

National Institute on Alcohol Abuse and Alcoholism

www.niaaa.nih.gov

National Survey on Drug Use & Health (formerly the National Household Survey on Drug Abuse)

www.oas.samhsa.gov/nhsda.htm

Partnership for a Drug-Free America

www.drugfree.org

US Department of Health and Human Services and the Substance Abuse and Mental Health Services Administration's National Clearinghouse for Alcohol and Drug Information

http://ncadi.samhsa.gov

Self-help and Advocacy Group Resources

Alcoholics Anonymous–Alcoholics Anonymous World Services, Inc

PO Box 459

New York, NY 10163

Telephone: 212-870-3400

www.alcoholics-anonymous.org

Mothers Against Drunk Driving (MADD)

National Headquarters

Victim Assistance and Book Orders

511 E John Carpenter Freeway, Suite 700

Irving, TX 75062

Telephone: 214-744-6233

www.madd.org

Narcotics Anonymous World Services, Inc.

Main Office

PO Box 9999

Van Nuys, CA 91409

Telephone: 818-773-9999

Fax: 818-700-0700

www.na.org

WSO-Europe

48 Rue de l'Été/Zomerstraat

B-1050 Brussels, Belgium

Telephone: 32-2-646-6012

Fax: 32-2-649-9239

www.na.org

National Clearinghouse for Alcohol and Drug Information

PO Box 2345

Rockville, MD 20847-2345

Telephone: 800-729-6686 (toll-free), 301-468-2600 (local), 811-767-8432 (in Spanish), or 800-487-4889 (TDD)

Fax: 301-468-6433

http://ncadi.samhsa.gov

Students Against Destructive Decisions (formerly Students Against Drunk Driving) (SADD)

SADD National

255 Main St

Marlborough, MA 01752

Telephone: 877-SADD-INC (877-723-3462)

Fax: 508-481-575

www.sadd.org

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

Allergy Testing in Childhood: Using Allergen-Specific IgE Tests

Scott H. Sicherer, MD, Robert A. Wood, MD, and the SECTION ON ALLERGY AND IMMUNOLOGY

KEY WORDS
allergy, allergy testing, immunoglobulin, IgE, immunotherapy, pediatrics

ABBREVIATIONS
IgE—immunoglobulin E
sIgE—allergen-specific IgE
SPT—skin prick test
IgG—immunoglobulin G

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abstract

FREE

A variety of triggers can induce common pediatric allergic diseases which include asthma, allergic rhinitis, atopic dermatitis, food allergy, and anaphylaxis. Allergy testing serves to confirm an allergic trigger suspected on the basis of history. Tests for allergen-specific immunoglobulin E (IgE) are performed by in vitro assays or skin tests. The tests are excellent for identifying a sensitized state in which allergen-specific IgE is present, and may identify triggers to be eliminated and help guide immunotherapy treatment. However, a positive test result does not always equate with clinical allergy. Newer enzymatic assays based on anti-IgE antibodies have supplanted the radioallergosorbent test (RAST). This clinical report focuses on allergen-specific IgE testing, emphasizing that the medical history and knowledge of disease characteristics are crucial for rational test selection and interpretation. *Pediatrics* 2012;129:193–197

INTRODUCTION

Allergic diseases (allergic rhinitis [hay fever], asthma, atopic dermatitis, and allergic or anaphylactic reactions to foods, drugs, insect venom, or other allergens) often warrant identification of specific allergic triggers for treatment. Most allergic responses are mediated by immunoglobulin E (IgE) antibodies specific for the trigger allergen, which can be detected with in vitro tests or skin testing. This clinical report focuses on using in vitro allergen-specific IgE (sIgE) testing, which is widely available to pediatricians. A full description of the use of tests for diagnosis and management of allergic disease is beyond the scope of this report, but is described in recent guidelines and practice parameters.[1–9]

TESTS AVAILABLE FOR DETECTING sIgE

A number of enzymatic assays that are based on anti-IgE antibodies have supplanted the radioallergosorbent test.[10] Commercial laboratories that are federally licensed under the Clinical Laboratory Improvement Act of 1988 often use automated systems capable of detecting and quantifying sIgE. Laboratory reports may indicate a number of readouts (eg, classes, counts, or units), but quantification of results in units reflecting concentrations of sIgE is becoming more common (eg, kU_A/L). Although the 3 commercial detection systems approved by the Food and Drug Administration have excellent performance characteristics (analytical sensitivity, 0.1 kU_A/L), the

individual systems appear to detect different populations of IgE antibody or do not measure IgE antibodies with comparable efficiencies. Thus, a result for an allergen in 1 of the 3 test systems may not be equivalent to the same allergen tested in a different system.

The skin prick test (SPT), typically used by allergy specialists, is another means of detecting sIgE antibodies.[11] A number of devices are available for introducing allergen into the surface of the skin with minimal discomfort; a resulting wheal-and-flare response can be measured in 10 to 20 minutes. Saline and histamine controls are placed for comparison. Intradermal skin testing is performed in special circumstances when increased sensitivity is required (eg, after negative SPT for vaccines, venom, penicillin, and some inhalant allergens, such as *Alternaria* organisms and perhaps other outdoor molds).

Both serum sIgE tests and SPT are sensitive and have similar diagnostic properties.[11,12] Advantages of the SPT include immediate results visible to the patient/family and low cost compared with serum sIgE tests. Disadvantages include the need to withhold medications with antihistamine properties and having rash-free skin available for testing. Advantages of the serologic tests include availability and lack of interference from antihistamines or extensive dermatitis. Disadvantages include the need to obtain blood samples, delayed results, and cost. Some discrepancies exist, however; one test or the other may be more sensitive to detect specific allergens, probably because different proteins or IgE binding sites are represented.[2,3,7,9,11,13]

TEST SELECTION AND INTERPRETATION

Tests might be selected to identify triggers from a number of potential common allergens, for confirming a specific trigger when there is suspicion of one, or in less common circumstances, screening for atopy. A positive serum sIgE or skin test denotes a sensitized state. However, detection of sensitization to an allergen is not equivalent to a clinical diagnosis. In fact, many children with positive tests have no clinical illness when exposed to the allergen.[2,3,7,9,11,13] This limitation highlights the need for the clinician to use a detailed medical history and have knowledge of the features of the specific illness when selecting and interpreting tests. For example, there is no need to test for an allergen that is clearly tolerated (eg, egg in a child who eats egg without symptoms) or when exposure is not relevant (eg, testing a pollen to which the child is not geographically exposed). Knowledge of local aerobiology is, therefore, essential. Testing large panels of allergens without consideration of the history, geographic relevance, and disease characteristics may result in many clinically irrelevant positive results, which, if overinterpreted, may lead to costly and socially, emotionally, and/or nutritionally detrimental actions of unnecessary allergen avoidance. Similarly, caution is advised when testing is negative despite a convincing history. Testing for sIgE would also generally not be useful when the disorder has no pathophysiological basis for a relationship to sIgE (eg, behavioral disorders; allergic disorders not related to sIgE, such as allergic contact dermatitis).

Few studies have correlated clinical outcomes to test results.[2,3,4,11] Studies have generally supported the notion that increasingly strong tests correlate with increasing likelihood of clinical reactivity.[2,3,11] Patients should not be told they are allergic based solely on either a skin test or the identification of sIgE. The test characteristics underscore the need to select and interpret tests with consideration of the medical history, which increases diagnostic value by applying previous probability.[4]

A physician interested in screening for atopy (eg, distinguishing recurrent viral infections from allergic rhinitis) might select a small panel of common triggers. Another means to screen for atopy is to use a multiallergen test that contains several common allergens in one test (eg, one test that includes several perennial allergens, such as dust mite, dog dander, and mold). Availability and composition of these tests varies by manufacturer. A positive result will not identify IgE to a specific antigen but can, at less cost than performing many individual tests, identify a child whose symptoms may relate to exposure to a specific allergen and warrant further specific testing or referral. The multiallergen test had excellent predictive value for identifying atopic children compared with SPTs and an allergist's diagnosis.[14,15]

ISSUES SPECIFIC TO RESPIRATORY ALLERGY[1,6,11]

The disorders that respiratory allergy comprises are allergic asthma and seasonal or perennial allergic rhinitis. National asthma guidelines[1] suggest that patients with persistent asthma be evaluated for the role of allergens as contributing factors, with an emphasis on testing for perennial indoor allergens (eg, dust mite, animal dander, cockroach, mold) that might otherwise not be identified as contributing to disease and also suggest testing seasonal or perennial allergens for selected patients with any level of asthma severity as a basis for education about the role of allergens for avoidance and for immunotherapy.

The clinician may be interested in identifying specific indoor (eg, dust mite, animal dander, molds, mice, and cockroach) or outdoor (eg, pollens, molds) triggers. Rational selection and interpretation of specific tests

requires consideration of the environmental exposures (housing, pets, and geographic floristic patterns), medical history (nature of symptoms, timing in relation to exposures), and disease characteristics (eg, pollen allergy is uncommon in infancy; patients are unlikely to have acute symptoms from dust mite exposure; food allergens do not typically cause chronic respiratory disease). Provocation tests can confirm environmental allergy but are not often undertaken for clinical purposes.

ISSUES SPECIFIC TO FOOD ALLERGY[2,3,4,11]

Food allergy may be suspected when specific symptoms (eg, urticaria, angioedema, cough, wheeze, vomit, and anaphylaxis) occur minutes to hours after the ingestion of a food, and in children diagnosed with certain disorders, such as moderate to severe atopic dermatitis, eosinophilic esophagitis, and other allergic gastrointestinal tract disorders. Testing for sIgE to foods might be considered to identify or confirm triggers, to assist in diagnosis of chronic disorders, or to monitor for allergy resolution. However, they are not considered diagnostic in and of themselves. SPT and serum sIgE provide similar sensitivity and specificity.[12] It is common to have positive test results for tolerated foods; therefore, indiscriminate testing (ie, panels that include foods that are already tolerated) is not advised. Additional means to assist in diagnosis include the medical history and results of medically supervised oral food challenges. Elimination diets, if initiated, should not be maintained in the absence of a convincing previous history of a reaction or a medically supervised oral food challenge. A comprehensive description of the diagnostic and management process is reviewed in recent guidelines.[2–4] Key observations include:

- Screening panels of food allergens without previous consideration of the history is not recommended, because sensitization without clinical allergy is common. For example, ~8% have positive test results for peanut, but ~1% are clinically allergic.[16]
- A negative SPT or serum sIgE test result does not entirely exclude a diagnosis of a food allergy. One test may be positive when the other is negative. SPT using fresh food extracts may increase sensitivity, especially for fruits. Caution is needed when tests are negative when a specific food allergy history is convincing; a medically supervised oral food challenge may be needed.
- Cross-reactivity among proteins may result in a much higher degree of positive sIgE test results among related foods than clinical reactions (eg, >50% of patients with peanut allergy test positive to other legumes, but <5% have clinical symptoms of allergy from ingestion of legumes). Cross-reactivity among homologous proteins of aeroallergens and food allergens may result in positive tests to foods, often without clinical allergy (eg, birch pollen with hazelnut, peanut, soy; grass pollen with wheat, peanut; dust mite with shrimp).
- Strong positive test results correlate with increasing probability of clinical allergy, and particularly high values may indicate a high degree (>95%) of likely allergy; however, there are few studies correlating outcomes to test results, and results vary by age, disease, and other factors.
- sIgE serum concentration or SPT wheal size do not accurately predict the severity of allergic reactions, but do reflect the likelihood of an allergic reaction of variable intensity.
- Testing for total IgE does not identify specific allergies. Atopic individuals often have elevated total IgE, but there is no current evidence to support the interpretation of sIgE in relation to total IgE.
- Tests measuring immunoglobulin G (IgG) antibodies for diagnosis are not recommended.
- Intradermal tests are not recommended, because they are too sensitive and carry risk of a severe allergic reaction.
- Food protein-induced enterocolitis and proctocolitis (eg, cell-mediated food allergic disorders) are not associated with positive IgE tests.

ISSUES SPECIFIC TO OTHER ALLERGIES (DRUG ALLERGY, INSECT VENOM, VACCINES, LATEX)[7-9]

The general caveats regarding sensitization and clinical allergy described previously also apply to allergy tests for substances that may cause acute allergic reactions or anaphylaxis, such as medications, insect venom, vaccines, and latex. The medical history is essential in decision making regarding testing and interpretation, including understanding whether the symptoms are likely to be IgE mediated.

Tests for drug allergy (eg, acute allergic reactions) are generally not standardized, and the sensitivity of serum tests appears poor.[8] IgE tests are not relevant for many drug reactions (maculopapular rashes, Stevens-Johnson syndrome). SPT and intradermal tests for penicillin allergy using recently available reagents have potential utility for IgE-mediated allergies.[8]

Allergy testing for venom allergy should be considered when symptoms of anaphylaxis occur after a sting. When anaphylactic allergy to venom is confirmed by skin testing, immunotherapy

is indicated and highly effective.[7,9,11] Isolated, localized swelling at a sting site does not identify a risk of anaphylaxis, and testing is not warranted. Generalized urticaria without other symptoms of anaphylaxis in children 16 years and younger usually does not warrant testing, because more severe reactions appear to be unlikely; however, systemic anaphylaxis in any age group and generalized urticaria in adolescents older than 16 years warrant testing. SPT and intradermal testing are considered the standard means of diagnosis, although serum IgE tests for venom or venom components may be performed when skin tests are negative and the history is suggestive.

SPT and intradermal tests can be performed for vaccines suspected of triggering allergic reactions, although care is needed to choose the proper dilution to prevent irritant reactions.[7,17,18] Skin tests are not available for latex; serum tests are available, but the diagnostic utility is not well characterized.[7,11]

TESTS UNDER DEVELOPMENT AND UNPROVEN TESTS

Tests are under development that detect IgE binding to specific proteins in foods (component-resolved diagnosis), with a potential to more accurately identify people likely to react or with more severe allergies; however, further validation of these tests is needed.[2,3,11] Additional tests requiring more validation include basophil activation and atopy patch tests with foods.[2,3,11] These tests are currently primarily research tools, although specific uses have been identified.[8,11]

A number of tests have no evidence to support their use and are not recommended, including: lymphocyte stimulation, facial thermography, gastric juice analysis, hair analysis, applied kinesiology, provocation-neutralization, allergen-specific IgG/IgG4, cytotoxic assay, electrodermal test (VEGA), and mediator release assay.[2,3,11]

SUMMARY

1. Treatment decisions for infants and children with allergy should be made on the basis of history and, when appropriate, identified through directed serum sIgE or SPT testing. Newer in vitro sIgE tests have supplanted radioallergosorbent tests.
2. Allergy tests for sIgE must be selected and interpreted in the context of a clinical presentation; test relevance may vary according to the patient's age, allergen exposure, and performance characteristics of the test.
3. Positive sIgE test results indicate sensitization, but are not equivalent to clinical allergy. Large panels of indiscriminately performed screening tests may, therefore, provide misleading information.
4. Tests for sIgE may be influenced by cross-reactive proteins that may or may not have clinical relevance to disease.
5. Increasingly higher levels of sIgE (higher concentrations on serum tests or SPT wheal size) generally correlate with an increased risk of clinical allergy.
6. sIgE test results typically do not reflect the severity of allergies.
7. Use of a multiallergen serum test can be helpful for screening for atopic disease if there is a clinical suspicion. If positive, allergen-specific testing may be considered.
8. Tests for allergen-specific IgG antibodies are not helpful for diagnosing allergies.
9. Because test limitations often warrant additional evaluation to confirm the role of specific allergens, consultation with a board-certified allergist-immunologist should be considered.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

All-Terrain Vehicle Injury Prevention: Two-, Three-, and Four-Wheeled Unlicensed Motor Vehicles

ABSTRACT. Since 1987, the American Academy of Pediatrics (AAP) has had a policy about the use of motorized cycles and all-terrain vehicles (ATVs) by children. The purpose of this policy statement is to update and strengthen previous policy. This statement describes the various kinds of motorized cycles and ATVs and outlines the epidemiologic characteristics of deaths and injuries related to their use by children in light of the 1987 consent decrees entered into by the US Consumer Product Safety Commission and the manufacturers of ATVs. Recommendations are made for public, patient, and parent education by pediatricians; equipment modifications; the use of safety equipment; and the development and improvement of safer off-road trails and responsive emergency medical systems. In addition, the AAP strengthens its recommendation for passage of legislation in all states prohibiting the use of 2- and 4-wheeled off-road vehicles by children younger than 16 years, as well as a ban on the sale of new and used 3-wheeled ATVs, with a recall of all used 3-wheeled ATVs.

ABBREVIATIONS. CPSC, US Consumer Product Safety Commission; ATV, all-terrain vehicle; AAP, American Academy of Pediatrics.

TWO-WHEELED VEHICLES

Miniature motorcycles intended for off-road use by children and adolescents have enjoyed wide popularity since the 1960s. However, manufacture of these vehicles is not regulated by federal motor vehicle safety standards. Neither the rider nor the vehicle is required to be licensed. Some of these cycles are small enough to be operated by children as young as 4 years, and many have been sold for use by school-aged children.[1]

Minibikes, the smallest and most primitive of the 2-wheelers, are motorized bicycle-style frames that weigh <45 kg and are powered by engines operating at <4 horsepower. The more sophisticated and higher-powered *minicycles* are constructed with suspension systems and transmissions that resemble miniature motorcycles. *Trailbikes* or *trailcycles* are larger than minicycles and have power and design characteristics that make them suitable for rough terrain. They are generally only approved for off-road use. *Mopeds* are bicycles with small, unenclosed assist motors and top speeds of about 30 mph. They are intended for street use but, in many states, neither the mopeds nor their drivers must be licensed.[2] Two-wheeled vehicles generally have a short and relatively unstable wheelbase, small tires, slow acceleration, borderline brakes, and poor visibility in traffic (both of the cycle and by the cycle operator).[2,3] *Motorcycles* are also 2-wheeled cycles, but require licenses in all states; these vehicles are not specifically discussed in this statement.

About 40 000 injuries related to 2-wheeled motorized off-road cycles were treated in emergency departments each year, 1994 through 1996.[4] Of the injuries, 26% were sustained by children younger than 15 years. From 1990 through the first quarter of 1995, the US Consumer Product Safety Commission (CPSC) collected at least 50 reports of deaths related to minibike and trailcycle use. All but 1 of the victims were male, and 42% were 16 years of age or younger.[5]

Injury typically results from loss of control of the cycle after striking rocks, bumps, or holes, or from illegal on-road use. Mopeds are more often involved in collisions with other vehicles, presumably because they are legally used on-road, and frequently in urban areas.[2] Shoulder, knee, and leg injuries account for more than one third of emergency department visits for moped-related injuries. Head injuries account for about half of the deaths.[5] Laryngotracheal trauma may result from driving across open fields into poorly visible wire fences. Thermal burns occur when engines are not enclosed, which is usual for mopeds.[6] Deaths are more likely to be associated with racing or jumping.[5]

THREE- AND FOUR-WHEELED VEHICLES

All-terrain vehicles (ATVs) are motorized cycles, with 3 or 4 balloon-style tires, designed for off-road use on a variety of terrains. Although ATVs give the appearance of stability, the 3-wheeled design is especially unstable on hard surfaces. The ATV stability is further compromised by a high center of gravity, a poor or absent suspension system, and no rear-wheel differential. The danger is magnified because these vehicles can attain substantial speeds (30–50 mph).[7]

Most injuries associated with ATVs occur when the driver loses control, the vehicle rolls over, the driver or passenger is thrown off, or there is a collision with a fixed object.[8] Studies in Alaska and Missouri have identified a number of risk factors for injury, including rider inexperience, intoxication with alcohol, excessive speed, and lack of helmet use.[9,10] The recognition of the significant hazards associated with ATV use led to a federal investigation

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

and the acceptance of consent decrees by the ATV manufacturers in early 1988.[11] Under the decrees, the industry agreed to cease production and sale of new 3-wheeled ATVs (but not to recall old ones), to implement a rider-safety training program nationally, and to develop a voluntary standard to make ATVs safer. Warnings and age recommendations were included on the vehicle and in advertising. ATVs with engines >70 mL could be used only by children 12 years and older; "adult-sized" engines (those >90 mL) were not to be used by children or adolescents under 16 years.[11] Although the decrees did not prohibit the sale of the ATVs with engines <70 mL, which previously had been promoted for children younger than 12 years, none have been manufactured since 1986. After acceptance of the decrees, problems have occurred with some dealers not communicating the age restrictions to consumers, although pressure and enforcement by the CPSC have improved the situation. Nevertheless, children under 12 years still represent 15% of the deaths related to ATVs.[12–14] It is probable that the most effective outcome of the 1988 consent decrees was the attendant publicity that led up to the decrees and the educational campaigns that occurred after them. The consent decrees expired in 1998. At that time, participating manufacturers agreed to an ATV Action Plan in which they agreed not to market or sell 3-wheeled ATVs, not market or sell adult-size ATVs to or for use by children younger than 16, promote training, and conduct safety education campaigns.[15]

The approximately 2.4 million ATVs still in use are associated with significant morbidity and mortality. Almost 2800 deaths have been attributed to ATVs (about 200 to 300 annually) since 1985.[14] The risk of death, approximately .8 to 1.0 per 10 000 ATVs, has remained fairly steady since 1987. Annual emergency department visits for treatment of ATV-related injuries reached a peak of 108 000 in 1986 and declined after that to the present level of about 54 500.[14] Children younger than 16 years account for 47% of the injuries in 1997 and >36% of the deaths since 1985.[15] Head injuries account for most of the deaths, which usually are instantaneous.[12] Serious nonfatal injuries include head and spinal trauma, abdominal injuries, and multiple trauma.[4] Abrasions, lacerations, and clavicle and extremity fractures are common and less serious.[4,13] Some studies have suggested that children suffer more severe injuries. The severity of injury is the same for 3- and 4-wheeled ATVs.[10,13,16] Currently, 4-wheeled vehicles account for 75% of the injuries, largely because of changes in the manufacture and sales of 3-wheeled ATVs after the 1988 consent decree, although many 3-wheeled ATVs remain in use. More injuries occur when ATVs are used for recreation than when they are used for nonrecreational purposes, for example, as farm vehicles.[4]

It is clear that deaths and injuries began to decline in 1986, possibly as an effect of the publicity before the consent decrees on the driving behavior of ATV users. A decline in sales, as well as diminished use by children, occurred after the decrees, but well before the ban on 3-wheelers and design changes to make "safer" vehicles could have had a great effect.

RECOMMENDATIONS

The American Academy of Pediatrics (AAP) now updates its earlier recommendations[10,17] to decrease death and injury related to the use of all 2-, 3-, and 4-wheeled ATVs:

1. Education, public and individual patient and parent, about the hazards of all ATVs should continue. (Besides benefiting the riders, it may increase public demand for greater regulation; eg, helmet laws and limitation on use by children.)
2. During anticipatory guidance, families should be asked, either by direct questioning or intake survey, about the kinds of recreational activities in which they engage. Just as those who have a swimming pool merit special counseling, so do families who engage in off-road vehicle use. The following points should be emphasized:
   - Off-road vehicles are particularly dangerous for children younger than 16 years who may have immature judgment and motor skills.[10] Children who are not licensed to drive a car should not be allowed to operate off-road vehicles.
   - Injuries frequently occur to passengers, therefore riding double should not be permitted.
   - All riders should wear helmets, eye protection, and protective reflective clothing. Appropriate helmets are those designed for motorcycle (not bicycle) use, and should include safety visors/face shields for eye protection.
   - Parents should never permit the street use of off-road vehicles, and nighttime riding should not be allowed.
   - Flags, reflectors, and lights should be used to make vehicles more visible.
   - Drivers of recreational vehicles should not drive after drinking alcohol. Parents should set an example for their children in this regard.
   - Young drivers should be discouraged from on-road riding of any 2-wheeled motorized cycle, even when they are able to be licensed to do so, because they are inherently more dangerous than passenger cars.
3. Although the consent decrees required some equipment modifications to make ATVs safer, further changes have been suggested. They include the following:
   - Install seat belts on 4-wheeled ATVs and require that the vehicles also have a roll bar to prevent the driver from being crushed by the weight of the vehicle in the event of a rollover.
   - Headlights that automatically turn on when the engine is started should be routinely installed on all ATVs to improve visibility by other vehicles.
   - Speed governors (devices that limit maximum speed) should be installed on ATVs used by inexperienced operators.
   - Efforts should be made to design ATVs so that they cannot carry passengers.
   - Engine covers on small 2-wheeled vehicles, such as mopeds and minibikes, could reduce

burn injuries resulting from body contact with the engine and exhaust system. A sturdy leg guard could avoid injuries from sideswiping solid objects or being pinned to the ground.

All of these proposed modifications should be thoroughly evaluated before use and monitored after introduction.

4. Laws should be passed in all states requiring motorcycle-style helmets for off-road use as well as for on-road use. Motorcycle helmet laws have been proven to increase helmet use, and helmet use has been proven to reduce death and serious head injuries.[16,18]
5. Many injuries are caused by various disruptions in the driving surface such as, bumps and holes. Developing and maintaining trails for the use of off-road vehicles may help reduce injury rates.
6. Prehospital care networks and emergency services should be improved in rural areas, which may minimize the effects of injuries and reduce deaths.[11]
7. The AAP recommends a ban on the sale of all 3-wheeled ATVs, new and used, and a recall with a refund for present owners of the 3-wheeled models.
8. Laws should prohibit the use of ATVs, on- or off-road, by children and adolescents younger than 16 years. An automobile driver's license, and preferably some additional certification in ATV use, should be required to operate an ATV. The safe use of ATVs requires the same or greater skill, judgment, and experience as needed to operate an automobile.
9. ATVs should not be used after sunset or before sunrise, and carrying passengers should not be allowed. These provisions should be included in legislation.
10. Pediatricians should advocate for the passage of the AAP's model bill[19] that:
    - prohibits the use of ATVs, on- or off-road, by children and adolescents younger than 16 years;
    - requires an automobile drivers' license, and preferably some additional certification in ATV use;
    - prohibits the use of ATVs on public streets and highways;
    - prohibits passengers from riding on ATVs;
    - prohibits operating an ATV under the influence of alcohol; and
    - prohibits the use of ATVs between sundown and sunrise.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Children With Disabilities

Auditory Integration Training and Facilitated Communication for Autism

ABSTRACT. This statement reviews the basis for two new therapies for autism—auditory integration training and facilitative communication. Both therapies seek to improve communication skills. Currently available information does not support the claims of proponents that these treatments are efficacious. Their use does not appear warranted at this time, except within research protocols.

ABBREVIATIONS. AIT, auditory integration training; FC, facilitated communication.

Auditory integration training (AIT) is a treatment for autism that was originally developed by Guy Berard in France in the 1960s and introduced into the United States in 1991. It has since become increasingly popular with parents of autistic children. The publication of a book[1] in 1991 that described the use of AIT in "curing" a child with autism after a 10-hour intervention program generated extensive interest, particularly among parents of autistic children who were frustrated by the lack of effective traditional medical therapy for autism.[2] AIT has been advocated for children and adults with a wide range of disorders other than autism, including learning disabilities, depression, migraine headaches, and epilepsy. It is important that pediatricians know about this intervention to respond to parents who may ask them for an opinion about its usefulness.[a]

The first step in AIT is to obtain a detailed audiogram, which determines auditory thresholds to a larger series of frequencies (octave and interactive frequencies) than are typically used for measuring hearing ability. An auditory training practitioner then examines the audiogram looking for evidence of hyperacusis,[3] which then is examined in relation to the clinical history of sound sensitivities and behavioral profile. If an individual is determined to be an appropriate candidate for AIT, the treatment program consists of 20 half-hour sessions during a 10- to 12-day period, with two sessions conducted daily. Treatment sessions consist of listening to music that has been computer-modified to remove frequencies to which the individual demonstrates hypersensitivities, and to reduce the predictability of the auditory patterns. A special device (an Audiokinetron) is used to modify the music for the treatment sessions. Audiograms are repeated midway and at the end of the training sessions, to document "progress" and to determine whether additional sessions are needed. Disciples of another proponent of AIT, Tomatis, generally recommend repeating the 20-session series of training sessions during a 4- to 12-month period.[4]

The limitations of the premises on which AIT is based were reviewed by Gravel.[3] She notes that current objective electrophysiologic measures such as auditory-evoked brainstem responses fail to demonstrate differences in hearing sensitivity between autistic and nonautistic children. Moreover, autistic children are extremely difficult to test using behavioral audiometry, because their responses are frequently inconsistent, often showing small (5-decibel) differences between frequencies generally considered within normal clinical variation. Although AIT practitioners declare the technique to be safe, there is some information about both the quality control characteristics of the equipment used and potentially unsafe sound levels produced by it.[5]

AIT practitioners report that individuals who have received AIT demonstrate many benefits: improved attention, improved auditory processing, decreased irritability, reduced lethargy, and improved expressive language and auditory comprehension. Unfortunately, little scientific documentation exists to support these assertions. Rimland and Edelson[6] recently conducted a pilot study of AIT in 17 autistic children aged 4 to 21 years. Eight children underwent AIT for 10 days and 9 children listened to unprocessed music under identical conditions, with evaluators and parents blinded to the treatment received. Although random assignment was not used, and the comparability of the two groups was not described, the authors reported decreases in repetitive behaviors, irritability, and hyperactivity, and improved attention noted by parents in the study group. In addition, Bettison[7] studied 80 children randomized to two groups, one received AIT and the other listened to unmodified music. Twelve months later both groups demonstrated significant improvements in behavior and verbal and performance IQ, suggesting that some aspect of listening to music may have some effect on features of autism. Further studies are underway to better document any effects of this controversial treatment.

Facilitated communication (FC) is a method of providing assistance to a nonverbal person in typing out words using a typewriter, computer keyboard, or

[a] Although there are several AIT methods, this statement addresses that which Berard introduced, for it is the only one that has been studied scientifically.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

other communication device. FC involves supporting the individual's hand to make it easier for him or her to indicate the letters that are chosen sequentially to develop the communicative statement. This manual prompting, by a trained facilitator, is claimed to provide expressive language abilities to a wide range of individuals, including those with severe intellectual disabilities or autism. Originally applied to assist people with physical disabilities by Jacobson et al,[8] FC was brought to the United States by Biklen in 1989.[9] According to Biklen, this procedure often produces unexpected literacy and reveals normal or even superior intelligence and/or communicative ability that was "trapped in a wordless person."[9,10] FC is at the center of a growing controversy, because several scientific studies have suggested that facilitators may unintentionally influence the communication, perhaps to the extent of actually selecting the words themselves.[11–14] Yet proponents point to a series of nonexperimental reports that promote the use of FC and suggest that it is unethical to use a rigorous scientific method to study its efficacy.[15]

As reviewed by Jacobson et al,[8] FC has been the subject of many controlled studies with consistently negative findings, indicating that the technique is neither reliably replicable nor valid. Methods that have been used include single and double-blind procedures, repeated measures and self-controls, or passing messages about which the facilitator would have no prior information.

For example, Smith et al[16] studied 10 individuals with autism specifically to investigate the effects of facilitator influence and level of assistance on the results of FC. Each subject had six sessions, two with no help, two with partial assistance, and two with full assistance. Results showed that there were no cases of correct responses from the subject unless the facilitator knew the correct response. In addition, numerous responses were typed by the subjects to stimuli that were shown only to the facilitator, and not the subject. Similar results have been found by Regal et al[17] and Eberlin et al.[18]

A recently published study by Cardinal et al[19] attempted to support the ability of experienced FC users to transmit single words to a naive facilitator. They found that this only occurred with prolonged practice of the experimental task, and there were many inconsistencies in the responses, even after prolonged practice. They suggested that further research is needed, especially to develop methodologies to clearly separate facilitator influence from user communication.

Despite this evidence, some states have promoted and supported the use of FC for children and adults with autism and other disabilities, and even issued guidelines to promote technology transfer of FC. There has been widespread national media attention to this alternative therapy, and many parents are interested in exploring this option for their children; the attraction of unlocking the child's "hidden abilities" is a strong incentive for its use.

One complication of the use of FC has been the allegation of abuse, particularly sexual abuse, that has been obtained from individuals through the use of FC against third persons. This has generated adverse publicity and caused severely negative consequences for families who may be unsure of the validity of the allegations. Because of legal mandates regarding reports of child abuse, this becomes a critical issue for teachers and pediatricians alike, who may find the credibility of the report highly questionable but are obligated to fulfill their legal responsibilities. Margolin[20] notes that although more than 50 such allegations have resulted in legal proceedings, most have terminated before trial. The ethical dilemmas posed by FC for practitioners have been reviewed by Jacobson et al.[8]

RECOMMENDATIONS

AIT and FC are controversial treatment options for autism and other disorders. Although two investigations indicated AIT may help some children with autism,[5,6] as yet there are no good controlled studies to support its use. In the case of FC, there are good scientific data showing it to be ineffective.[11–14] Moreover, as noted before, the potential for harm does exist, particularly if unsubstantiated allegations of abuse occur using FC. Many families incur substantial expense pursuing these treatments, and spend time and resources that could be used more productively on behavioral and educational interventions. When controversial or unproven treatments are being considered by a family, the pediatrician should provide guidance and assistance in obtaining and reviewing information. The pediatrician should ensure that the child's health and safety, and the family's financial and emotional resources are not compromised. It is important for the pediatrician to obtain current data on both AIT and FC as they become available. Until further information is available, the use of these treatments does not appear warranted at this time, except within research protocols. Information on communicating with families who choose an alternative medical approach for their child with chronic illness and disability is also available in the literature.[21]

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ERRATUM

In the policy statement entitled "Guidance for Effective Discipline" (April 1998; 101:723–728), the names of two former committee members whose contributions were crucial were not included in the list of authors. We apologize for not crediting the following individuals:

Martin T. Stein, MD, Chairperson, Committee on Psychosocial Aspects of Child and Family Health, 1992–1996

Ellen C. Perrin, MD, Member, Committee on Psychosocial Aspects of Child and Family Health, 1990–1996

American Academy of Pediatrics

Policy Statement

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The Adolescent's Right to Confidential Care When Considering Abortion (RE9614)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Adolescence

ABSTRACT. In this statement, the American Academy of Pediatrics (AAP) reaffirms its position that the rights of adolescents to confidential care when considering abortion should be protected. The AAP supports the recommendations presented in the report on mandatory parental consent to abortion by the Council on Ethical and Judicial Affairs of the American Medical Association. Adolescents should be strongly encouraged to involve their parents and other trusted adults in decisions regarding pregnancy termination, and the majority of them voluntarily do so. Legislation mandating parental involvement does not achieve the intended benefit of promoting family communication, but it does increase the risk of harm to the adolescent by delaying access to appropriate medical care. The statement presents a summary of pertinent current information related to the benefits and risks of legislation requiring mandatory parental involvement in an adolescent's decision to obtain an abortion. The AAP acknowledges and respects the diversity of beliefs about abortion and affirms the value of voluntary parental involvement in decision making by adolescents.

Assuring adolescent access to health care, including reproductive health care, has been a long-standing objective of the American Academy of Pediatrics (AAP). Assured access to timely medical care is especially important for pregnant adolescents because of the significant medical, personal, and social consequences of adolescent childbearing. The AAP strongly advocates for the prevention of unintended adolescent pregnancy by supporting comprehensive health and sexuality education, abstinence, and the use of contraception by sexually active youths. For two decades the AAP has been on record as supporting the access of minors to all options regarding undesired pregnancy, including the right to obtain an abortion. Membership surveys confirm this support.[1,2]

Under current federal constitutional law, minors have the right to obtain abortions without parental consent unless otherwise specified by state law. Legislation that mandates parental involvement (parental consent or notification) as a condition of service when a minor seeks an abortion has generated considerable controversy. Recent US Supreme Court rulings, although upholding the constitutional rights of minors to choose abortion, have held that it is not unconstitutional for states to impose requirements for parental involvement as long as "adequate provision for judicial bypass" is available for minors who think that this involvement would not be in their best interest.[3,4] Subsequently, there has been renewed activity to include mandatory parental consent or notification requirements in state and federal abortion-related legislation.

The American Medical Association, the Society for Adolescent Medicine, the American Public Health Association, the American College of Obstetricians and Gynecologists, the AAP, and other health professional organizations have reached a consensus that minors should not be compelled or required to involve their parents in their decisions to obtain abortions, although they should be encouraged to discuss their pregnancies with their parents and other responsible adults. These conclusions result from objective analyses of current data, which indicate that legislation mandating parental involvement does not achieve the intended benefit of promoting family communication but does increase the risk of harm to the adolescent by delaying access to appropriate medical care.[5-9]

In this statement, the AAP reaffirms its position that the rights of adolescents to confidential care when considering abortion should be protected. The AAP supports the recommendations presented in the report on mandatory parental consent to abortion by the Council on Ethical and Judicial Affairs of the American Medical Association.[5] This statement does not duplicate the extensive analysis published in that report but presents a summary of pertinent current information related to the benefits and risks of legislation requiring mandatory parental involvement in an adolescent's decision to obtain an abortion. This statement does not discuss the philosophical or religious issues related to abortion. Beliefs about abortion are deeply personal and are shaped by class, culture, religion, and personal history, as well as the current social and political climate. The AAP acknowledges and respects the diversity of beliefs about abortion. This statement affirms the value of parental involvement in decision making by adolescents and the importance of productive family communication in general. The AAP is a foremost advocate of strong family relationships and holds that parents are generally supportive and act in the best interests of their children.

BACKGROUND

Statistical Trends

One million pregnancies occur annually among American teenagers. Of these, about 400 000 occur in minors younger than 18 years of age, of which 41% are terminated by elective abortion.[10] The percentage of pregnancies terminated by induced abortion in minors increased in the 1970s, plateaued in the early 1980s, and has decreased since 1985, particularly in younger girls. Whereas 46% of pregnant adolescents 15 years of age and younger obtained abortions in 1985, only 39% did so in 1988.[10] Postulated explanations for the decline include a shift in attitudes toward abortion among adolescents, increased legal and financial barriers to abortion, particularly for low-income adolescents, and increasing social acceptance of childbearing among unmarried adolescents. Birth rates among adolescents nationally are now the highest since the early 1970s. Approximately 80% of births to minors younger than 18 years of age are to unmarried adolescents.[11] Adoption ratios have declined during the last decade; approximately 2% to 4% of unmarried adolescents place their infants for adoption.[12]

Compared with those who choose childbirth, adolescents who choose abortion tend to come from higher socioeconomic backgrounds, have higher educational aspirations and achievements, have mothers with higher educational levels, have higher self-esteem, have greater feelings of control over life, have lower levels of anxiety, and are better able to conceptualize the future.[13-15]

State Laws

The status of legislation requiring mandatory parental involvement in a minor's abortion decision is currently in flux. As of 1992, 38 states had some form of specific legislation on record, highly variable among states in both content and degree of enforcement.[9,16] However, US Supreme Court rulings in 1992 on "undue burden" standards and requirements for judicial bypass procedures raise legal questions about the validity of many existing state statutes, while allowing new or revised clauses that could be held constitutional. Groups opposed to legal abortion view parental notification requirements for minors as politically feasible; thus, adolescent rights to confidential care have become part of a larger battle regarding access to abortion in general.[17] Continuing legislative activity can be anticipated. Of 308 abortion-related bills introduced in 41 states during 1992, 61 were related to parental consent or notification, confirming the need for health professionals to be prepared to protect the best interests of adolescents with objective data on this issue.

EFFECT OF LEGISLATION ON FAMILY COMMUNICATION

Basic principles of law and society hold that parents should be involved in and responsible for assuring medical care for their children, that parents ordinarily act in the best interests of their children, and that minors benefit from the advice and emotional support of their parents. Legislation mandating parental involvement in abortion decisions is promoted on the basis of its theoretical benefits on strengthening family responsibility and communication. Some who support reproductive choice may be ambivalent about parental notification requirements. Adults may fear that minors contemplating abortion are immature, isolated, or at risk of being coerced into decisions without adequate counseling. Many parents vote for notification clauses because they hope these laws will increase communication that otherwise might not happen.[18] The 1990 AAP membership survey showed that although 85% of members thought that mandatory parental notification for abortion would cause some adolescents to delay seeking care, 49% said there should be such laws,[2] suggesting that many AAP members assume there is benefit from such legislation. Because outcome analysis, as supported by the evidence that follows, shows a minimal benefit compared with a significant risk, there is clearly a need for current data to be better understood.

Voluntary Parental Involvement

Research confirms that pregnant minors do not make abortion decisions in isolation; they actively involve adults to whom they feel close. Even when not required to, the majority of minors seeking abortions voluntarily involve at least one parent in their decisions. A survey of 1519 unmarried pregnant minors in states where parental involvement is not mandatory found that 61% told one or both parents about their intent to have abortions. The younger the minor, the more likely she was to do so (90% of those 14 years old or younger, 74% of those 16 years old).[19] Among minors who did not involve a parent, virtually all involved at least one responsible adult other than clinic staff (such as another relative, teacher, counselor, professional, or clergy). A study of inner-city, black, pregnant teenagers younger than 18 years of age confirmed that more than 91% voluntarily consulted a parent or "parent surrogate" about pregnancy decisions. The term parent surrogate refers to a close adult who is fulfilling a parental role. This person was often a grandmother, aunt, or other relative who had "raised them" or with whom they lived, even if that adult was not the legal guardian.[20]

The importance of parent surrogates and extended families is significant when assessing the impact of attempts to legislate family communication. Most notification clauses are restricted to traditional definitions of biological parents or legal guardians and fail to address the complexity and diversity of modern family structures and adult support systems relevant to adolescents. For minors who are willing to involve parents or parent surrogates in their abortion decisions, legislation adds no benefit and actually may impede appropriate family communication channels.

Involuntary Parental Notification

Minors who choose not to inform parents about their intention to have abortions are disproportionately older (16 and 17 years old), white, and employed.[19] Very young adolescents almost always agree to voluntary parental involvement. In the unusual instance of resistance, the

possibility of incest or abuse should be carefully evaluated. The most frequent reasons minors cite for not telling parents include the belief that the knowledge would damage their relationship, the fear that it would escalate conflict or coercion, and the desire to protect a vulnerable parent from stress and disappointment.[19] Adolescents who are strongly opposed to informing parents tend to predict family reactions accurately.[21] Involuntary parental notification can precipitate a family crisis characterized by severe parental anger and rejection of the minor and her partner. One third of minors who do not inform parents already have experienced family violence and fear it will recur.[19] Research on abusive and dysfunctional families shows that violence is at its worst during a family member's pregnancy and during the adolescence of the family's children.[5] Although parental involvement in minors' abortion decisions may be helpful in many cases, in others it may be punitive, coercive, or abusive.[22]

Credible reviews of available data conclude that there is no evidence that mandatory parental involvement results in the benefits to the family intended by the legislation. No studies show that forced disclosure results in improved parent-child relationships, improved communication, or improved satisfaction with the decision about pregnancy outcome.[22-24]

The current data also indicate that such legislation does not increase the likelihood that parents will be involved. The percentages of minors who inform parents about their intent to have abortions are essentially the same in states with and without notification laws.[25] In states with such laws, adolescents who are not willing to inform parents use judicial bypass mechanisms,[26] go out of state to obtain services,[27] obtain clandestine care,[28] or delay care.[29,30]

ADOLESCENT COMPETENCY TO MAKE HEALTH CARE DECISIONS

Adolescents who are willing to involve parents in their abortion decisions will likely benefit from adult experience, wisdom, and support. Legislation requiring mandatory parental consent or notification for abortion presupposes, however, that pregnant minors are not competent to make informed decisions and therefore require legal protection. The age of 18 years is a convenient legal dividing line, but it has no scientific validity as the point at which individuals become competent decision makers. Summaries of well-designed research conclude that most minors 14 to 17 years of age are as competent as adults to provide consent to abortion. They are able to understand the risks and benefits of options and to make voluntary, rational, independent decisions.[31-33] Once pregnant, an adolescent by most state laws is considered an "emancipated minor" and is held responsible and competent to consent to her own medical treatment during the pregnancy and to the medical decisions regarding her fetus or newborn (eg, amniocentesis, genetic testing, life-saving treatment, and circumcision). No state laws require the minor's parent to consent to the minor's decision to continue the pregnancy when the parent thinks that terminating the pregnancy is in the minor's best interest or, with few exceptions, to place the infant for adoption. It is inconsistent, then, to presume that the minor is not legally competent to make decisions regarding pregnancy termination.[24,31,34]

Legal Issues

The legal issues involved in a minor's right to confidential abortion care have been well covered in other reviews.[35-38] The vast majority of court opinions and legal analyses hold that the justifications presented for mandatory parental involvement in a minor's abortion decision are not sufficiently compelling to outweigh the minor's right to privacy in deciding whether to terminate a pregnancy.[39] Teenagers perceive no difference in legal requirements for consent versus notification. Both abridge confidentiality. All analyses confirm that confidential care for adolescents is critical to improving their health. There is a "remarkable degree of consensus that adolescents should have access to confidential health services and that parental involvement, consent, or notification should not be a barrier to care."[9] There is substantial legal consensus that parental consent and notification laws, whether or not ruled constitutional, run counter to fundamental principles of family law, which ideally seek to protect the privacy of family decision making from government interference and to protect the best interests of the minor in the circumstances when the government does intervene in family affairs.[39]

CONCERNS ABOUT PSYCHOLOGICAL OR PHYSICAL CONSEQUENCES OF ABORTION DECISIONS

Some adults support mandatory parent notification, thinking that it will protect the adolescent from making a decision she might regret later. Most adolescents, however, express satisfaction with their ultimate pregnancy decisions, providing they think that the decisions were their own. No significant differences in the levels of later satisfaction with their decisions have been found between adolescents who choose abortion and those who bear children or between those who parent as opposed to those who place their infants for adoption; almost all think that they made the right choices for themselves.[40-42] The key determinant of this expressed satisfaction is the sense of "ownership" over the pregnancy decisions and the belief that their choices were not the results of coercion.[42] In other research, pregnant adolescents who chose not to communicate with parents were as satisfied with their decisions as those who did consult with parents and received support for their decisions.[20] Adolescents who communicated with nonsupportive parents were the ones more likely to express dissatisfaction with pregnancy decisions.

Extensive reviews conclude that there are no documented negative psychological or medical sequelae to elective, legal, first-trimester abortion among teenaged women.[43,44] No significant psychological sequelae have been substantiated, despite extensive searches of the scientific literature.[45-47] When facing an unwanted pregnancy, regardless of the ultimate outcome, most women experience a range of normal emotional reactions, including regret, mild depression, and anxiety. Adverse reactions after abortion are rare; most women experience relief and reduced depression and distress.[48] Some women may experience feelings of grief and guilt after termination of pregnancies, especially those who consider themselves deeply religious or who were ambivalent about their decisions, and they may benefit from appropriate therapeutic counseling.[49] The incidence of diagnosed psychiatric illness and hospitalization is considerably lower after abortion than after childbirth. Psychiatric disorders, when found, have been attributed to preexisting psychiatric illness, undergoing abortion under coercion or pressure, or concomitant highly stressful life circumstances, including abandonment.[46]

The medical risks of legal first-trimester abortion likewise are extremely low. Mortality risks seem to be five times greater for teenagers who continue their pregnancies than they are for teens who terminate them. Morbidity rates and medical complications from continuing a pregnancy are more adverse than those from abortion at all stages of gestation.[48,50] The scientific evidence indicates that legal abortion results in fewer deleterious sequelae for women compared with other possible outcomes of unwanted pregnancy. There is no rational basis for policies that put barriers in the way of an adolescent's selection of abortion because of concerns about physical or psychological consequences.

ADVERSE EFFECTS OF MANDATORY PARENTAL INVOLVEMENT LEGISLATION

Mandatory parental consent or notification laws do not protect the health of young women and, in fact, may do harm.

Adverse Health Impact

The most damaging impact of mandatory parental notification laws is that they can delay and obstruct the access of pregnant adolescents to timely professional advice and medical care.[5,48] Teenagers are twice as likely as adults to delay the diagnosis of first-trimester pregnancy. Adolescents are often confused about their right to confidential care, and even a perceived lack of confidentiality in health care regarding sexual issues deters them from seeking services.[51] Once the minor does present for pregnancy counseling, mandatory parental involvement laws can delay medical care further. After enactment of such statutes, court proceedings in Massachusetts delayed the termination of pregnancy by as much as 6 weeks; in Minnesota, the average delay was 1 to 3 weeks, and the proportion of second-trimester abortions in teens increased by 12%.[48] In Mississippi, a parental consent requirement increased by 19% the ratio of minors to adults who underwent their procedures after 12 weeks' gestation.[52] Later-trimester procedures (after 14 weeks) increase both the medical risks and financial costs to the patient, and a prolonged delay can eliminate abortion as an accessible option.[50]

It is likely that mandatory parental consent legislation decreases access to abortion by adolescents, although confounding variables make it difficult to ascertain causal effects on abortion rates. Both abortion rates and abortion ratios have decreased nationwide in states with and without parental consent statutes. In Minnesota, after parental consent laws were enacted in 1981, at first it seemed that abortion rates decreased disproportionately in 15- to 17-year-olds, but with no increase in birth rates, leading some to hypothesize that teenagers were more motivated to avoid pregnancy.[53] However, after the Supreme Court upheld Minnesota's consent laws in 1990,[3] abortion rates in minors fell to the lowest level in 10 years, and birth rates for the same age group rose to the highest level since 1980 (*St Paul Dispatch.* June 30, 1992).

Adverse Psychological and Social Impact

There is increasing evidence of the negative effects of delayed or denied abortion on both the emotional health of the mothers and the developmental status of the unwanted children. Later-stage abortions are associated with a greater risk of psychological sequelae for pregnant teenagers (compared with first-trimester abortions, which are without significant negative sequelae).[54] American studies have recently confirmed European research that women who are denied abortions only rarely give up their unwanted infants for adoption and may harbor resentment and anger toward their children for years. Despite strong social pressure not to acknowledge that a child is unwanted, more than one third of the women confessed to having strong negative feelings toward their children. Compared with the offspring of willing parents, the children of women who did not obtain requested abortions were much more likely to be troubled and depressed, to drop out of school, to commit crimes, and to have serious illnesses.[55,56] Compared with peers who terminate their pregnancies, adolescents who bear children are at significantly higher risk of educational deficits, economic disadvantage, and marital instability.[41,48]

Adverse Family Impact

As discussed, parental involvement can have adverse effects on both minors and their families, particularly if it takes on a coercive character. The risks of violence, abuse, coercion, unresolved conflict, and rejection are significant in nonsupportive or dysfunctional families when parents are informed of a pregnancy against the adolescent's considered judgment.[1,30] In *Hodgson vs Minnesota*, the majority of the Supreme Court found that mandatory parental involvement can result in family upheaval and can be dangerous for minors in homes where physical, emotional, or sexual abuse is present.[1,39]

Judicial Bypass

The option of obtaining a judicial bypass (a court proceeding in which a judge determines whether the adolescent is mature enough to make the decision to have an abortion or whether it is in her best interest not to inform parents) is viewed by some as a reasonable compromise to protect a concerned adolescent from harm while permitting states to impose mandatory parental involvement statutes.[5] The US Supreme Court ruled in 1990 that judicial bypass mechanisms are constitutionally required if state legislation is enacted, and they are ethically essential for adolescents at risk of abuse. However, judges who preside over bypass rulings testify unequivocally that this procedure is of no benefit to minors.[57,58] It has no effect on the ultimate decision with respect to abortion or on the process by which that decision is made. Of 12 000 petitions in Massachusetts and Minnesota, only 21 were denied, and half of the denials were overturned on appeal.[24] The judicial bypass process itself poses risks of medical and psychological harm. It is detrimental to medical well-being, because it causes further delays in access to medical treatment (from 4 days to several weeks), which increase the risk of complications from delayed or second-trimester procedures.[22]

It is detrimental to emotional well-being, because adolescents perceive the court proceedings as extremely burdensome, humiliating, and stressful.[24] The pregnant adolescent is required to divulge intimate details of her private life to dozens of strangers (clerks, bailiffs, court reporters, witnesses, and others) to obtain a brief (10-minute) hearing before a judge who has no firsthand knowledge of her case and typically no training in counseling adolescents or developmental issues.[39] Regardless of the Supreme Court ruling, many legal opinions hold that the judicial bypass process constitutes "undue burden" for adolescents seeking abortion care.[22,24,39]

CONCLUSIONS AND RECOMMENDATIONS

1. Adolescents should be strongly encouraged to involve their parents and other trusted adults in decisions regarding pregnancy termination, and the majority of them voluntarily do so. A minor's decision to involve parents is determined by the quality of the family relationship, not by laws. Family communication is inherently a family responsibility, and parents themselves create the emotional atmosphere that fosters productive dialogue. Adolescents who feel loved and supported by their parents normally will communicate with them in times of crisis. Studies show that adolescents are most likely to disclose their pregnancies if the family has a history of warmth, rapport, and involvement of parents in past problem solving.[25,26] As emphasized in previous AAP position statements, enhancing parental skills for listening, communicating, valuing, and nurturing throughout the childhood years is the most effective means of ensuring family involvement in adolescent decisions.[1,59] The pediatrician's most valued role may be to strengthen these family communication skills and supportive behaviors.

2. Concerned professionals should make every effort to ensure that a pregnant teenager receives adult guidance and support when considering all the options available, so she can make the decision that is in her best interest. This is best achieved by adhering to existing professional ethics and standards for obtaining meaningful informed consent.[60] Physicians should ensure that the minor patient has full information and has given careful consideration to the issues involved. They should encourage minors to consult with parents, other family members, or other trusted adults if parental support is not possible. The very young adolescent is especially needy in this regard. Ultimately, the pregnant patient's right to decide should be respected regarding who should be involved and what the outcome of the pregnancy will be, which is the approach most consistent with ethical, legal, and health care principles.

3. The AAP reaffirms its position that the rights of adolescents to confidential care when considering abortion should be protected. Genuine concern for the best interests of minors argues strongly against mandatory parental consent and notification laws. Although the stated intent of mandatory parental consent laws is to enhance family communication and parental responsibility, there is no supporting evidence that the laws have these effects. No evidence exists that legislation mandating parental involvement against the adolescent's wishes has any added benefit in improving productive family communication or affecting the outcome of the decision. There is evidence that such legislation may have an adverse impact on some families and that it increases the risk of medical and psychological harm to the adolescent. Judicial bypass provisions do not ameliorate the risk.

4. The AAP reaffirms its support of measures that increase access to health care for children and youths, regardless of age or financial status, and opposes unnecessary regulations that limit or delay access to care. The documented impact of parental consent laws is to reduce minors' access to early legal abortion. Public policies should encourage sexually active adolescents to seek timely, professional health care. The threat of compelled parental notification against the adolescent's wishes, even if judicial bypass is available, is a strong disincentive to seeking care. The AAP holds that public policies can and should encourage voluntary involvement of parents or other mature adults, but specific laws mandating notification of biological parents or legal guardians as a condition of service are counterproductive.[57]

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The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Adolescents and HIV Infection: The Pediatrician's Role in Promoting Routine Testing

COMMITTEE ON PEDIATRIC AIDS

KEY WORDS
HIV testing, adolescence, opt-out testing, risk-reduction counseling

ABBREVIATIONS
STI—sexually transmitted infection
CDC—Centers for Disease Control and Prevention
EIA—enzyme immunoassay

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abstract

FREE

Pediatricians can play a key role in preventing and controlling HIV infection by promoting risk-reduction counseling and offering routine HIV testing to adolescent and young adult patients. Most sexually active youth do not feel that they are at risk of contracting HIV and have never been tested. Obtaining a sexual history and creating an atmosphere that promotes nonjudgmental risk counseling is a key component of the adolescent visit. In light of increasing numbers of people with HIV/AIDS and missed opportunities for HIV testing, the Centers for Disease Control and Prevention recommends universal and routine HIV testing for all patients seen in health care settings who are 13 to 64 years of age. There are advances in diagnostics and treatment that help support this recommendation. This policy statement reviews the epidemiologic data and recommends that routine screening be offered to all adolescents at least once by 16 to 18 years of age in health care settings when the prevalence of HIV in the patient population is more than 0.1%. In areas of lower community HIV prevalence, routine HIV testing is encouraged for all sexually active adolescents and those with other risk factors for HIV. This statement addresses many of the real and perceived barriers that pediatricians face in promoting routine HIV testing for their patients. *Pediatrics* 2011;128:1023–1029

INTRODUCTION AND BACKGROUND

The HIV epidemic persists in the United States despite great progress in treatment and continued efforts to screen targeted populations. In 2006, an estimated 1 106 400 HIV-infected people were living in the United States, of whom 55 320 (5%) were adolescents and young adults aged 13 to 24 years.[1] Between 2005 and 2008, the estimated number of HIV/AIDS cases increased among 15- to 19-year-olds and 20- to 24-year-olds.[2] HIV continues to be among the top 10 leading causes of death in the 20- to 24-year age group.[3] Of the 1.1 million people living with HIV/AIDS in the United States, approximately 20% are unaware of their infection[4]; this is a group that accounts for 54% to 70% of new HIV infections.[5] In 2006, an estimated 48% of HIV-infected adolescents and young adults were unaware of their infection.[6,7] The American Academy of Pediatrics encouraged HIV testing of all sexually active youth in a 2001 policy statement.[8] This updated statement reflects advances in diagnostic testing, changes in epidemiology, and updated recommendations.

The risk of HIV infection varies with community prevalence rates, sexual behaviors, and concurrent substance use. The rate of new HIV

diagnoses per 100 000 population increases with age from 12.6 in the 15- to 19-year age group to 37.2 in the 20- to 24-year age group.[2] In 2007, 73% of 13- to 24-year-olds diagnosed with HIV/AIDS were male, and 27% were female.[9] As with adults, most adolescent cases occur through sexual transmission. Among young men, at least two-thirds of HIV transmissions occur via male-to-male sex, whereas heterosexual encounters are the primary means of transmission among female adolescents and young adults.[3] The greatest increase in new diagnoses has occurred among young minority men who have sex with men, which is a finding that necessitates new approaches to prevention. HIV infection disproportionately affects minorities, occurring 7 times more often in black people and 2.6 times more often in Latino people than in white people[10] and is more common in people living in the South and the Northeast.[3]

Drug and alcohol use contributes to high-risk sexual activity. The 2009 Youth Risk Behavior Survey found that 46% of high school students reported having engaged in sexual activity (62% by the 12th grade), and 22% had consumed alcohol or used drugs before their last sexual intercourse.[11] History of other sexually transmitted infections (STIs) can increase the risk of HIV acquisition,[12] and a recent survey found that 26% of adolescent girls (14–19 years of age) tested positive for an STI.[13]

Most sexually active adolescents and young adults do not feel that they are at risk of HIV infection and do not get tested. Although 65% of the high school students who took the survey reported being sexually active by the 12th grade and more than 85% had received HIV/AIDS education, only 13% had been tested for HIV.[11] Surveys of sexually active youth aged 15 to 19 years found that they do not believe that they are at risk of HIV infection, and fewer than one-third of them had been tested for HIV.[14] In contrast, surveys of older youth (18–25 years of age) have revealed that 48% have been tested for HIV at some point, but fewer than one-third of them have been tested in the preceding 12 months.[15] This sense of invulnerability is, in part, attributable to the adolescent's physical, psychological, and social development—factors that contribute to low testing rates. Adolescents also cite concerns about confidentiality, access to testing, and invasive blood procedures as barriers to testing.[16] A 2005 American Academy of Pediatrics survey revealed that nearly 50% of pediatricians recommend that all sexually active youth be screened for STIs; however, only 28% of them recommend that all adolescents be tested for HIV.[17]

In light of the increasing numbers of people with HIV/AIDS and missed opportunities for HIV testing, the Centers for Disease Control and Prevention (CDC) recommends universal and routine HIV screening rather than targeted testing. Opt-out HIV testing, which refers to testing performed unless the patient declines,[18] should be routinely performed for all patients aged 13 to 64 years who are seen in health care settings; this testing is performed without a separate written informed consent or pretest counseling.[4] Individual states are changing local laws to meet these recommendations.[18] The complex issues of confidentiality, disclosure, and consent in adolescent care make implementation of these recommendations more challenging. Nevertheless, pediatricians can play a key role in preventing and controlling HIV infection by promoting risk reduction and offering HIV testing to their adolescent and young adult patients.

RISK ASSESSMENT AND COUNSELING

Because adolescents are a vulnerable population at increased risk of HIV infection, they should be routinely assessed for high-risk behaviors and screened for HIV. Pediatricians should also implement primary and secondary prevention strategies for STIs and HIV infection. Resources that facilitate assessment in a busy practice include the *Bright Futures* curriculum[19] and *Guidelines for Adolescent Preventive Services* (GAPS)[20] questionnaires. Although the new CDC recommendations deemphasize risk assessment and counseling as precursors for opt-out testing, these activities are critical components of routine adolescent visits. Adolescents may be more willing to disclose high-risk behaviors if pediatricians establish confidential, private discussions at each health maintenance visit.[21] Ideally, a confidentiality policy should be reviewed with adolescents and their parents in early adolescence (ie, before 14 years of age) and can be modeled on a sample provided by *Bright Futures*.[19]

Discussing same-sex and opposite-sex attractions, sexual identity, sexual activity, and exposure to sexual violence or abuse are key components of taking sexual histories and providing health guidance to adolescents.[22] Creating a supportive atmosphere and factual, nonjudgmental counseling is essential for reaching youth.

The US Preventive Services Task Force[23] and the American Academy of Pediatrics recognize that all youth are at current or future risk of STIs and HIV infection. Both groups recommend that all youth receive behavioral counseling to prevent STIs, including the recommendation that they delay sexual activity. Opportunities to discuss HIV and STIs with youth during routine health assessments are often missed, and youths of ethnic minorities are

less likely to receive regular preventive health care.[24] The expansion of adolescent vaccine requirements to include human papillomavirus vaccine has provided additional opportunities for risk counseling, because discussion regarding this vaccination affords a natural segue into discussions of other STIs and HIV.[25] School physicals and annual athletic preparticipation physical examinations provide other opportunities to discuss HIV and STIs, conduct risk assessments, and provide health guidance and offer testing; these examinations are often the only contact youth have with any health provider.[21]

The use of postexposure prophylaxis with antiretroviral drugs should be considered for adolescents who may have been exposed to HIV after an episode of high-risk sexual activity or needle use. Victims of sexual violence should have baseline HIV testing as well as STI screening and treatment and should be offered mental health counseling.[26] Guidelines for the use of postexposure prophylaxis in nonoccupational exposures are available,[27] and practitioners can get expert consultation from the AIDS Education and Training Centers National Clinicians Consultation Center (800-448-8765).

TESTING FOR HIV

Much progress has been made in the area of HIV testing, and rapid and less invasive diagnostic HIV tests are readily available[28] (http://www.cdc.gov/hiv/topics/testing/resources/factsheets/rtlab.htm). The gold standard for HIV diagnosis remains the detection of HIV antibody in serum by enzyme-linked immunoassay (EIA) followed by confirmatory Western blot or immunofluorescent assay. The sensitivity and specificity of current assays are more than 99%. False-positive EIA results, although uncommon, can occasionally occur. False-negative results can occur if testing is performed during the acute phase of infection, before the development of an antibody response, or in subjects with severe immunosuppression. The use of an oral fluid testing device that measures HIV antibody in mucosal transudate is well accepted by youth and is used in many outreach settings.[16] In addition, several point-of-care rapid HIV-1 antibody tests provide results in minutes to hours.[29] These tests have sensitivity and specificity rates similar to those for standard EIA. In routine care, a negative rapid antibody test result does not need confirmation; however, as with EIAs, positive results should be confirmed with a more specific test, such as a Western blot or immunofluorescent assay. If the rapid test or EIA result is positive but the Western blot result is indeterminate, the adolescent might be in the process of seroconversion, or the result could be false-positive; the test should be repeated, and a virologic test (eg, nucleic acid test; HIV RNA test, or viral load test) should be performed for confirmation.

Most laboratories that perform standard EIA testing will automatically repeat an EIA if the first result is positive, followed by a Western blot test if the repeat EIA result is positive and will not report the positive results unless the Western blot confirms positivity. However, the advantage of the rapid test is that the results can be given to the patient immediately with the caution that the results need to be confirmed. Pediatricians who see youth with initial positive rapid test results should discuss the results with the patient and obtain a confirmatory Western blot. A positive HIV test result should be discussed with the patient in person; positive results should not be given by telephone. Local health departments or case management agencies can assist with linking youth with appropriate care and counseling after diagnosis. HIV-infected youth should be cared for by providers with expertise in HIV medicine.[30] Reviewing negative HIV results with youth provides an opportunity for pediatricians to provide additional risk counseling. In high-risk situations such as sexual assault or other nonoccupational exposures, negative testing should be repeated in 3 months and postexposure prophylaxis considered as previously discussed.

Pediatricians should be aware that an estimated 50% of patients acutely infected with HIV present with symptoms to health care providers; however, few providers make the diagnosis at this time.[31] Symptoms of acute retroviral syndrome are outlined in Table 1. During the acute stages of infection, antibody testing might yield a negative or indeterminate result while RNA testing results are positive. HIV RNA (viral load) testing should be performed on patients with suspect symptoms of acute infection and a negative antibody test result. Influenza-like illness and aseptic meningitis are also frequent presentations of the acute retroviral syndrome, and HIV testing may be appropriate, especially during seasons in which influenza and aseptic meningitis are not prevalent. The decision to include HIV RNA testing in this clinical scenario is based on age, risk factors, social history, and prevalence of HIV in the geographic area.

IMPLEMENTATION OF HIV SCREENING

The CDC recommendation is to screen, through opt-out testing, all patients aged 13 to 64 years unless or until the HIV prevalence of their patient population is determined to be less than 0.1% (Table 2). Pediatricians who care for youth in areas that have low prevalence rates should continue targeted testing. Youth at risk include all sexually active

TABLE 1 Identifying and Diagnosing Acute HIV-1 Infection

Suspecting acute HIV infection: signs or symptoms of acute HIV infection with recent (within 2–6 wk) high HIV risk exposure[a]
Signs/symptoms/laboratory findings can include but are not limited to ≥1 of the following: fever, lymphadenopathy, skin rash, myalgia/arthralgia, headache, diarrhea, oral ulcers, leucopenia, thrombocytopenia, transaminase elevation, aseptic meningitis
High-risk exposures include sexual contact with a person infected with HIV or at risk of HIV, sharing of injection drug use paraphernalia, or contact of potentially infectious blood with mucous membranes or breaks in skin[a]
Differential diagnosis: EBV and non-EBV (eg, CMV)–related infectious mononucleosis syndromes, influenza, viral hepatitis, streptococcal infection, syphilis
Evaluation/diagnosis of acute/primary HIV infection
HIV antibody EIA (rapid test if available)
Reactive EIA must be followed by Western blot
Negative EIA result or reactive EIA with negative or indeterminate Western blot should be followed by a virologic test[b]
A positive virologic test result in this setting is consistent with acute HIV infection
Positive quantitative or qualitative HIV RNA test results should be confirmed with subsequent documentation of seroconversion

EBV indicates Epstein-Barr virus; CMV, cytomegalovirus.

[a] In some settings, behaviors conducive to acquisition of HIV infection might not be ascertained or might not be perceived as "high risk" by the health care provider, the patient, or both. Thus, symptoms and signs consistent with acute retroviral syndrome should motivate consideration of this diagnosis even in the absence of reported high-risk behaviors.

[b] p24 antigen or HIV RNA assay. The p24 antigen is less sensitive but more specific than HIV RNA tests; HIV RNA tests are generally preferred. HIV RNA tests include quantitative branched DNA (bDNA) or reverse-transcriptase polymerase chain reaction (RT-PCR) or qualitative transcription-mediated amplification (APTIMA [GenProbe, San Diego, CA]).

Data source: modified from Panel on Antiretroviral Guidelines for Adults and Adolescents. Department of Health and Human Services. Guidelines for the use of antiretroviral agents in HIV-1-infected adults and adolescents. Available at: www.aidsinfo.nih.gov/ContentFiles/AdultandAdolescentGL.pdf.

TABLE 2 CDC Recommendations on Consent and Pretest Information

Screening should be voluntary and undertaken only with the patient's knowledge and understanding that HIV testing is planned
Patients should be informed verbally or in writing that HIV testing will be performed unless they decline (opt-out screening). Verbal or written information should include an explanation of HIV infection and the meanings of positive and negative test results, and the patient should be offered an opportunity to ask questions and to decline testing. With such notification, consent for HIV screening should be incorporated into the patient's general informed consent for medical care on the same basis as are other screening or diagnostic tests; a separate consent form for HIV testing is not recommended
Easily understood informational materials should be made available in the languages of the commonly encountered populations within the service area. The competence of interpreters and bilingual staff to provide language assistance to patients with limited English proficiency must be ensured
If a patient declines an HIV test, the decision should be documented in the medical record

Data source: Branson BM, Handsfield HH, Lampe MA, et al; Centers for Disease Control and Prevention. *MMWR Recomm Rep.* 2006;55(RR-14):1–17.[4]

adolescents. Youth at high risk, which include those who use intravenous drugs, exchange sex for money, or have sex with multiple partners or are men who have sex with men, should be tested yearly. Pediatricians should be aware of their local HIV prevalence data, because some communities have very high rates of HIV, which places youth at disproportionate risk(www.cdc.gov/hiv/topics/surveillance/resources/slides/2007report_tables). Because 13% of pregnancies occur in youth aged 15 to 19 years, routine HIV testing and early identification can also positively affect prevention of mother-to-child transmission of HIV.

The US Preventive Services Task Force strongly recommends HIV testing of at-risk adults and adolescents and all pregnant women; however, it has made no recommendation for or against routine screening.[32] Its accompanying review of the evidence discusses that, depending on the setting, many patients will be missed with risk-based screening and that there is good evidence for routine screening of patients seen in high-risk or high-prevalence settings, including STI clinics, correctional facilities, and adolescent clinics with high STI rates.[33] Although several studies have shown the cost-effectiveness of routine HIV screening, data addressing this issue in youth are insufficient.[34–36]

Nearly half of recently identified infected people had their first HIV test within 1 year of being diagnosed with AIDS. These so-called late testers are generally young, heterosexual, poorly educated, and black or Latino, and they are more likely to be identified through a health care setting than through targeted testing.[4] Early testing plays an important role in the health of the individual adolescent and the community. There is evidence that at least 20% of newly diagnosed youth seroconverted within the previous 6 months.[37] This early phase of illness is a time of high viremia, during which the risk of infectivity and transmission is greatest. People who are aware of their HIV status are more likely to practice safer sex or remain abstinent.[38] Patients who are diagnosed and treated earlier have a slower progression to AIDS, are more likely to restore immunologic function, and are less likely to transmit HIV to others.[39]

The health care setting has many advantages as a site of HIV testing for youth. Adolescents are more likely to agree to be tested if it is recommended by a physician,[40] and youth who are diagnosed at a health care facility are more likely to enter into HIV care in a timely fashion.[37] The 2007 National Health Interview Survey found that among adults who received an HIV test, more than 80% did so in doctors' offices, hospitals, emergency departments, and clinics compared with test-

ing at HIV counseling and testing centers or STI clinics.[41]

The use of acute care settings to improve testing rates is attractive to youth, because they are more likely to use urgent care settings for their health care needs.[42] In the years before diagnosis, many HIV-infected adults seek care for HIV-related symptoms in acute care settings.[43] Implementation of rapid HIV testing in the emergency department setting has improved testing rates and greatly benefits youth who prefer rapid testing. A recent study in a large pediatric emergency department used a multisystems approach to implement routine screening with rapid HIV testing. More than 50% of youth were offered HIV testing, and only 13% opted out.[44] Effective implementation in emergency care settings requires commitment by emergency department staff, education, training, and an effective means of reminding staff to routinely perform the test (eg, electronic prompts).

PERCEIVED BARRIERS TO ROUTINE TESTING

Research has found that youth might forgo reproductive health services if parental consent is required.[45] Laws concerning consent and confidentiality for HIV care and treatment vary among states; thus, physicians need to familiarize themselves with local laws. Public health statutes and legal precedents allow for medical evaluation and treatment of minors with certain illnesses—particularly STIs—without parental knowledge or consent. Consent and confidentiality laws, even for the treatment of STIs, may have special provisions in some states for teenagers in foster care. Minors can now consent to HIV testing in all states, although the age of consent varies (www.guttmacher.org/statecenter/spibs/spib_OMCL.pdf).[46] Although these state laws might be in the process of being changed, pediatricians need to know and abide by the laws in effect in their jurisdiction. The Compendium of State HIV Testing Laws from the National HIV/AIDS Clinicians' Consultation Center (www.nccc.ucsf.edu) can help clinicians seeking clarification of how their state laws and the CDC recommendations apply in clinical practice. The compendium comprehensively presents clinicians with regular updates to each state's HIV testing laws. Excellent tools are also available to assist providers in implementing HIV testing in their adolescent practices (www.adolescentaids.org/healthcare/acts.php).[47] Reimbursement and disclosure to parents via insurance billing are issues that require additional attention. At present, health insurance coverage of HIV screening is variable.[18] Health advocates, insurers, and states must influence policies around confidentiality and insurance coverage that can address the aforementioned issues.

If pediatricians are unable to ensure confidentiality for HIV testing for adolescent patients in their office setting, they should identify and refer youth to confidential community-based HIV testing. Pediatricians should familiarize themselves with available resources in their communities. A CDC Web site (www.hivtest.org) provides assistance in finding local testing sites.

Disclosure of the HIV status of an adolescent should be held to the same legal and ethical standards as those for an adult. An important concern for HIV-positive adolescents is the limits of confidentiality related to notification of sexual partners. Partner-notification services can play a key role in preventing and controlling the HIV epidemic in the United States. Physicians should be familiar with state laws, and they should use reasonable means to persuade an infected person to voluntarily inform his or her partner(s). Physicians who intend to disclose their adolescent patient's HIV status to sexual partners or parents should inform the patient of their intent before testing and should describe the circumstances under which disclosure would occur. Optimally, adolescents should have the support of a parent or guardian when faced with a diagnosis of HIV; however, each case should be approached individually. Disclosure of HIV-infection status is regulated by state laws, and disclosure to school authorities without an adolescent's consent generally is not indicated.[48]

CONCLUSIONS AND RECOMMENDATIONS

1. Routine HIV screening should be offered to all adolescents at least once by 16 to 18 years of age in health care settings when the prevalence of HIV in the patient population is more than 0.1%.
2. In areas of lower community HIV prevalence, routine HIV testing is encouraged for all sexually active adolescents and those with other risk factors for HIV (eg, substance use).
3. High-risk youth should be tested annually for HIV. Adolescents tested for other STIs should be tested for HIV at the same visit.
4. Emergency departments and urgent care facilities in high-prevalence areas should implement routine HIV testing, which will provide an excellent opportunity to reach youth who do not seek primary care services often.
5. Physicians should recognize the symptoms of the acute retroviral syndrome, such as mononucleosis-like syndromes, and consider including HIV RNA testing (viral load) in the diagnostic workup of youth when the appropriate risk factors are present.

6. Although parental involvement in adolescent health care is always desirable, consent of the adolescent should be sufficient to provide testing and treatment for HIV infection or STIs. Pediatricians should make use of free and confidential community-based testing programs if there are cost or confidentiality concerns.
7. Pediatricians should assess sexual and substance use behaviors, an essential component of routine adolescent care, regardless of perceived risk. Standardized assessment tools and a confidentiality protocol can be helpful.
8. Pediatricians are encouraged to create an environment of tolerance and facilitate open discussion of gender and sexual orientation.
9. Opt-out HIV testing is preferred if allowed by state laws, and rapid HIV testing has similar sensitivity to EIAs and can provide immediate notification of preliminary results. Physicians must follow the guidelines of their local jurisdictions for routine HIV opt-out testing in adolescents and are encouraged to advocate for change when such jurisdictions create barriers for implementation of opt-out testing.
10. A negative HIV test result should be used as an opportunity to counsel adolescents on sexual and drug use behaviors to reduce future risk.
11. For adolescents with a positive HIV test result, it is critical to arrange linkages to age-appropriate HIV specialty care, including prenatal care when appropriate.
12. Pediatricians are encouraged to advocate for the dissemination of accurate, evidence-based prevention education, access to confidential HIV and STI testing and counseling, and HIV treatment for adolescents.
13. Preventive care screening should include universal coverage and adequate payment for HIV testing and related counseling. Physicians should advocate for confidential billing practices related to HIV and STI testing in adolescent and young adults.

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POLICY STATEMENT

Advanced Practice in Neonatal Nursing

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Fetus and Newborn

ABSTRACT

The participation of advanced practice registered nurses in neonatal care continues to be accepted and supported by the American Academy of Pediatrics. Recognized categories of advanced practice neonatal nursing are the neonatal clinical nurse specialist and the neonatal nurse practitioner. *Pediatrics* 2009;123:1606–1607

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

Key Word
neonatal care

Abbreviations
AAP—American Academy of Pediatrics
APRN—advanced practice registered nurse
NNP—neonatal nurse practitioner
NCNS—neonatal clinical nurse specialist

INTRODUCTION

The American Academy of Pediatrics (AAP) endorses the role of the advanced practice registered nurse (APRN) and the current training and credentialing process developed by the National Association of Neonatal Nurses.[1,2] These guidelines were specifically designed to educate APRNs at the graduate level to manage critically ill and convalescing infants. These guidelines and standards include requirements for the completion of a graduate-level education program of study and supervised practice beyond the level of basic nursing. This preparation includes the attainment of a master's degree in the neonatal nursing specialty. The neonatal nurse practitioner (NNP) curriculum must have included a minimum of 200 neonatal-specific didactic hours plus a minimum of 600 directly supervised hours with critically ill neonates/infants in level II and III NICUs.[1–5] Currently credentialed NNPs who have graduated from non–master's degree programs or certificate programs should be allowed to maintain their practice and be encouraged to complete a formal graduate education.[6] The AAP supports the documented competency of the master's degree–prepared APRN for entry into practice as an NNP. Some APRNs may wish to pursue the highest level of educational preparation in nursing, either the doctor of philosophy (PhD) or the doctor of nurse practice (DNP). However, the AAP does not consider such a degree to be necessary for clinical practice.

Included in the category of neonatal APRNs are the following[1,2]:

- Neonatal clinical nurse specialist (NCNS): a registered nurse with a master's degree who, through study and supervised practice at the graduate level, has become expert in the theory and practice of neonatal nursing. The NCNS is responsible for fostering continuous quality improvement in neonatal nursing care and developing and educating staff. The NCNS models expert nursing practice and applies and promotes evidence-based nursing practice.
- NNP: a registered nurse with clinical expertise in neonatal nursing who has obtained a master's degree with supervised clinical experience in the management of newborn infants and their families. The NNP manages patients in collaboration with a physician, usually a pediatrician or neonatologist. Using the acquired knowledge of pathophysiology, pharmacology, and physiology, the NNP may exercise independent judgment in the assessment, diagnosis, and management of infants and in the performance of certain procedures. The NNP may also be responsible for education of staff, research, and developing standards of nursing care.[6,7]

The spectrum of duties performed by the neonatal APRN will vary among institutions and may be governed by state regulations. Each of these roles currently requires advanced education and a master's degree. Nationally recognized certification examinations and requirements for maintenance education exist for each category.[8] Credentialing for practice is currently governed by individual states. Inpatient care privileges are granted by the individual institution. Each institution needs to develop a procedure for the initial granting and subsequent maintenance of privileges, ensuring that the proper professional credentials are in place. That procedure is best developed by the collaborative efforts of the nursing administration and the medical staff.

RECOMMENDATIONS

1. Medical care by the APRN for patients receiving level III newborn intensive care is provided in collaboration with, or under the supervision of, a physician, usually a neonatologist.
2. Medical care by the APRN for patients receiving level I and II care is provided in collaboration with, or under the supervision of, a physician with special interest and experience in neonatal medicine, usually a pediatrician or neonatologist.
3. Determination of whether the APRN practices in collaboration with, or under the supervision of, a physician should be determined in accordance with the board of nursing regulations in the state in which the APRN is practicing.[8]
4. The APRN should be certified by a nationally recognized organization and should maintain that certification.
5. The APRN should maintain clinical expertise and knowledge of current therapy by participating in continuing education and other scholarly activities as recommended by the National Certification Corporation.[9]
6. The APRN should comply with hospital policy regarding credentialing and recredentialing.[10]

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American Academy of Pediatrics

Policy Statement

Pediatrics **Volume 81, Number 5** **May, 1988, p 736**

Age Limits of Pediatrics (RE8116)

AMERICAN ACADEMY OF PEDIATRICS

Council on Child and Adolescent Health

The purview of pediatrics includes the physical and psychosocial growth, development, and health of the individual. This commitment begins prior to birth when conception is apparent and continues throughout infancy, childhood, adolescence, and early adulthood, when the growth and developmental processes are generally completed. The responsibility of pediatrics may therefore begin with the fetus and continue through 21 years of age. There are special circumstances (eg, a chronic illness and/or disability) in which, if mutually agreeable to the pediatrician, the patient, and when appropriate the patient's family, the services of the pediatrician may continue to be the optimal source of health care past the age of 21 years.

Reaffirmed 9/92, 1/97
The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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POLICY STATEMENT

AAP Principles Concerning Retail-Based Clinics

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Retail-Based Clinic Policy Work Group

THE AMERICAN Academy of Pediatrics (AAP) opposes retail-based clinics (RBCs) as an appropriate source of medical care for infants, children, and adolescents and strongly discourages their use, because the AAP is committed to the medical home model. The medical home model provides accessible, family-centered, comprehensive, continuous, coordinated, compassionate, and culturally effective care for which the pediatrician and the family share responsibility.[1] Given that the RBC is not a medical home model, the AAP is particularly concerned with the effects of the following attributes of an RBC on health care for children and adolescents:

- Fragmentation of care.
- The possible effects on quality of care.
- Provision of episodic care to children with special health care needs and chronic diseases, who may not be readily identifiable.
- Lack of access to and maintenance of a complete, accessible, central health record that contains all pertinent patient information.
- The use of tests for the purposes of diagnosis without proper follow-up.
- Possible public health issues that could occur when patients with contagious diseases are in a commercial, retail environment with little or no isolation (eg, fevers, rashes, mumps, measles, strep throat, etc).
- Seeing children with "minor" conditions, as will often be the case in an RBC, is misleading and problematic. Many pediatricians use the opportunity of seeing the child for something minor to address issues in the family, discuss any problems with obesity or mental health issues, catch up on immunizations, identify undetected illness, and continue strengthening the relationship with the child and family. These visits are important and provide an opportunity to work with patients and families to deal with a variety of other issues.

The AAP acknowledges that the shifting economic and organizational dynamics of the current health care system will likely support the continued existence and expansion of RBCs. However, the aforementioned concerns and the overall effects these clinics will have on pediatric practice have led the AAP to respond with the following principles:

1. Supporting the medical home model: RBCs should support the medical home model by referring the patient back to the pediatrician or other primary care physician for all future care. In the event that the patient does not have a relationship with a pediatrician or primary care physician, RBCs should have the means to assist the family in establishing contact with one within a medical

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Abbreviations
AAP—American Academy of Pediatrics
RBC—retail-based clinic

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home. Third-party payers are encouraged to provide appropriate incentives to plan members to access the medical home as the best practice model for pediatric primary care.

2. Communication: The AAP recommends that RBCs promptly communicate with the patient's pediatrician or other primary care physician within 24 hours of the visit. At a minimum, the following information should be included: patient's name, date of birth, at least 2 additional pieces of identifying information (eg, parents' name and/or address), reason for visit, diagnosis and disposition, findings, laboratory results (if any), and an indication as to whether any follow-up is needed.
3. Using evidence-based medicine: The AAP recommends that all those providing care to children follow all AAP clinical guidelines as well as those guidelines developed by other medical organizations that have the support and endorsement of the AAP. RBCs should be required to participate in ongoing quality-improvement and quality-assurance processes, as is required of pediatric and other primary care practices. RBCs must meet all requirements related to quality assurance and ensure full compliance with state licensure requirements for oversight or collaborative protocols relative to scope of practice.
4. Contagious diseases: By providing medical care to individuals in a retail-based setting, RBCs must take the necessary precautions to prevent the spread of contagious diseases. Although the RBC may have policies that limit the scope of services, this may not prevent individuals with contagious diseases from seeking care at RBCs. This presents a potential public health hazard to retail staff and customers who may come in contact with a contagious individual. RBCs should be subject to and comply with all health care facility standards (eg, hygiene, safety, regulations of the Occupational Safety and Health Administration, policies and procedures for children with communicable diseases, etc).
5. Financial incentives: The AAP is opposed to waiving or lowering copays or offering financial incentives for visits to RBCs in lieu of visits to pediatricians' or other primary care physicians' offices. The AAP believes that the medical home model is the optimal standard of care, and RBCs are not medical homes. Payer incentives should not promote fragmentation of care but instead should recognize and reward systems of care that promote continuous, coordinated, and comprehensive care.

AAP RETAIL-BASED CLINIC POLICY WORK GROUP, 2006

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POLICY STATEMENT

Abusive Head Trauma in Infants and Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Cindy W. Christian, MD, Robert Block, MD, and the Committee on Child Abuse and Neglect

ABSTRACT

Shaken baby syndrome is a term often used by physicians and the public to describe abusive head trauma inflicted on infants and young children. Although the term is well known and has been used for a number of decades, advances in the understanding of the mechanisms and clinical spectrum of injury associated with abusive head trauma compel us to modify our terminology to keep pace with our understanding of pathologic mechanisms. Although shaking an infant has the potential to cause neurologic injury, blunt impact or a combination of shaking and blunt impact cause injury as well. Spinal cord injury and secondary hypoxic ischemic injury can contribute to poor outcomes of victims. The use of broad medical terminology that is inclusive of all mechanisms of injury, including shaking, is required. The American Academy of Pediatrics recommends that pediatricians develop skills in the recognition of signs and symptoms of abusive head injury, including those caused by both shaking and blunt impact, consult with pediatric subspecialists when necessary, and embrace a less mechanistic term, abusive head trauma, when describing an inflicted injury to the head and its contents. *Pediatrics* 2009;123:1409–1411

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Abbreviation

AHT—abusive head trauma

HISTORY

The recognition of child abuse in modern medicine began in the 19th century, with the work of the French forensic physician Ambroise Tardieu,[1,2] who described a wide array of physical and sexual injuries to children, including meningeal hemorrhage and brain injuries in fatally abused infants. More than 80 years later, American physicians began describing the clinical and radiologic manifestations of child abuse. Pediatrician and radiologist John Caffey[3,4] first described the association of chronic subdural hemorrhages and long-bone fractures in 1946, but it was not until 1972 that he published a seminal paper describing the radiologic and clinical features attributed to shaking injuries. Ludwig and Warman[5] first published the term "shaken baby syndrome" in their review of 20 infants and young toddlers injured by shaking, none of whom showed evidence of impact injury to the head. In 1987, Duhaime et al[6] reported that victims of fatal shaken baby syndrome, and many of those who survived their trauma, showed evidence of blunt impact to the head at the time of diagnosis. The importance of impact in acceleration/deceleration injury was supported by their basic biomechanical models, and they concluded that most serious abusive head injuries required an impact to the head. The relative importance of impact as a contributor to the head injury sustained by abused children became a source of controversy. Biomechanical modeling has since been used to both support and refute the contributions of shaking or impact to abusive head trauma (AHT).[7,8] In reality, all models and theories have known limitations, and many clinicians and researchers acknowledge that precise mechanisms for all abusive injuries remain incompletely understood.[9] Efforts to better understand the mechanisms and causations of injury have improved the gathering of objective data in the clinical realm. Case investigations, including meticulous medical history taking, examinations, and medical workups, have expanded and improved. Medical diseases that can mimic the presentation of AHT are recognized, and screening is performed when indicated. Social welfare, law enforcement, and legal professionals have become better educated about AHT. Clinical research has expanded, and biomechanical modeling of injuries has improved.

Case histories clearly support the conclusion that shaking occurs in some injury scenarios. Shaking was the most commonly reported mechanism of injury described in a series of AHT cases in which perpetrators admitted abuse (68% of 81 cases).[10] Shaking alone was described in 32 cases, and only 4 of the victims showed evidence of impact injury. Although this indicates incomplete admission to the injury mechanism in some cases, the commonality of a described shaking mechanism along with the infrequency of impact evidence supports shaking as an important mechanism of AHT. In addition, blunt impact trauma or impact combined with shaking can result in infant head injuries.[11] In severe and fatal cases, concomitant cervical spine injury can sometimes be found.[12] Secondary brain injury resulting from hypoxia, ischemia, and metabolic cascades contributes to poor outcomes.[13,14] Shaken baby

syndrome is a subset of AHT. Injuries induced by shaking and those caused by blunt trauma have the potential to result in death or permanent neurologic disability, including static encephalopathy, mental retardation, cerebral palsy, cortical blindness, seizure disorders, and learning disabilities. Medical and biomechanical research, clinical and pathologic experience, and radiologic advances have improved our understanding of the range of mechanisms that contribute to brain injury from AHT, yet controversy remains.

DISCUSSION

Few pediatric diagnoses engender as much debate as AHT, in part because of the social and legal consequences of the diagnosis. The diagnosis can result in children being removed from their homes, parents losing their parental rights, and adults being imprisoned for their actions. Controversy is fueled because the mechanisms and resultant injuries of accidental and abusive head injury overlap, the abuse is rarely witnessed, an accurate history of trauma is rarely offered by the perpetrator, there is no single or simple test to determine the accuracy of the diagnosis, and the legal consequences of the diagnosis can be so significant.[15] Because the civil and criminal justice systems are often involved in cases of AHT, the scientific debates related to mechanism and causation of injury often are argued during courtroom proceedings. On occasion, the courtroom allows for scientific theory to be confirmed or refuted,[16] but in reality, the American justice system is not designed to determine scientific truth but, rather, to balance contested facts and bring closure to a dispute. Medical terminology should accurately reflect the medical diagnosis. The term "shaken baby syndrome" has become synonymous in public discourse with AHT in all its forms.[17] The term is sometimes used inaccurately to describe infants with impact injury alone or with multiple mechanisms of head and brain injury and focuses on a specific mechanism of injury rather than the abusive event that was perpetrated against a helpless victim. Legal challenges to the term "shaken baby syndrome" can distract from the more important questions of accountability of the perpetrator and/or the safety of the victim. The goal of this policy statement is not to detract from shaking as a mechanism of AHT but to broaden the terminology to account for the multitude of primary and secondary injuries that result from AHT, some of which contribute to the often-permanent and significant brain damage sustained by abused infants and children.

The term "shaken baby syndrome" has become recognized by the public; prevention strategies for curtailing the incidence of AHT have been developed and researched, and some states have mandated shaken baby syndrome education for parents of all newborn infants.[18] Because it may not be obvious to parents that shaking can be harmful to infants, the newborn nursery is an appropriate venue for this education. The American Academy of Pediatrics supports prevention efforts that reduce the frequency of AHT and recognizes the utility of maintaining the use of the term "shaken baby syndrome" for prevention efforts. Just as the public commonly uses the term "heart attack" and not "myocardial infarction," the term "shaken baby syndrome" has its place in the popular vernacular. However, for medical purposes, the American Academy of Pediatrics recommends adoption of the term "abusive head trauma" as the diagnosis used in the medical chart to describe the constellation of cerebral, spinal, and cranial injuries that result from inflicted head injury to infants and young children.

THE ROLE OF THE PEDIATRICIAN

As mandated reporters of suspected child abuse and neglect, pediatricians carry the burden of recognizing and responding to medical manifestations of AHT. The diagnosis is sometimes obvious, but injuries in many symptomatic infants are unrecognized by unsuspecting physicians.[19] In addition, physicians do not always report to child welfare agencies injuries that are highly suspicious for abuse, which puts children at further risk for injury.[20,21] To protect abused infants and prevent future severe neurologic injury, pediatricians must remain cognizant of the possibility of AHT in infants who present with both subtle and overt neurologic symptoms and take seriously the ethical and legal mandates to report suspected child abuse to governmental agencies for investigation. Pediatricians also have a responsibility to consider alternative hypotheses when presented with a patient with findings suggestive of AHT. A medical diagnosis of AHT is made only after consideration of all the clinical data. On some occasions, the diagnosis is apparent early in the course of the evaluation, because some infants and children have injuries to multiple organ systems that could only be the result of inflicted trauma. On other occasions, the diagnosis is less certain, and restraint is required until the medical evaluation has been completed. However, as physicians, we have an obligation to make a working diagnosis, as we do with many other diagnoses, and take the legally mandated steps for further investigation when indicated. Pediatricians often find it helpful to consult a subspecialist in the field of child abuse pediatrics to ensure that the medical evaluation has been complete and the diagnosis is accurate. Subspecialists in radiology, ophthalmology, neurosurgery, neurology, and other fields should also be consulted when necessary to ensure a complete and accurate evaluation. When child protective services or law enforcement is involved in an investigation, the pediatrician is required to interpret medical information for nonmedical professionals in an understandable manner that accurately reflects the medical data. Pediatricians also have a responsibility to the family of the abused child. The diagnosis of child abuse has enormous social, psychological, and legal implications for families. The role of the pediatrician is not to apportion blame or investigate potential criminal activity but to identify the medical problem, treat the child's injuries, and offer honest medical information to parents and families. Finally, pediatricians can work to prevent AHT by supporting prevention efforts in the community and in practice. Pediatricians may help prevent AHT by providing anticipatory guidance to new parents about the dangers of shaking or impact and providing methods for dealing

with the frustration of a crying infant. They can also stress the importance of leaving a young infant or toddler in the care of adults whom the parents trust will not harm their child and can participate in comprehensive community-based prevention efforts. AHT commonly results in permanent neurologic damage and carries tremendous family and societal costs. With an aim toward prevention, the American Academy of Pediatrics recommends the following.

RECOMMENDATIONS

1. Pediatricians should be alert to the signs, symptoms, and head injury patterns associated with AHT.
2. Pediatricians should know how to begin a thorough and objective medical evaluation of infants and children who present for medical care with signs and symptoms of potential AHT. Consultants in radiology, ophthalmology, neurosurgery, and other subspecialties are important partners in the medical evaluation and can assist in interpreting data and reaching a diagnosis.
3. Pediatricians should consider consulting a subspecialist in the field of child abuse pediatrics to ensure that the medical evaluation of the patient has been complete and that the diagnosis is accurate.
4. Pediatricians should use the term "abusive head trauma" rather than a term that implies a single injury mechanism, such as shaken baby syndrome, in their diagnosis and medical communications.
5. Pediatricians should continue to educate parents and caregivers about safe approaches to calming and coping with crying infants and the dangers of shaking, striking, or impacting an infant's head.

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POLICY STATEMENT

Access to Optimal Emergency Care for Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine

ABSTRACT

Millions of pediatric patients require some level of emergency care annually, and significant barriers limit access to appropriate services for large numbers of children. The American Academy of Pediatrics has a strong commitment to identifying barriers to access to emergency care, working to surmount these obstacles, and encouraging, through education and system changes, improved levels of emergency care available to all children.

INTRODUCTION

Millions of infants, children, adolescents, and young adults seek emergency care every year in the United States. Many individuals may not receive appropriate acute care in a timely fashion because of numerous obstacles. Emergency departments (EDs) are the nation's safety net. EDs provide comprehensive acute care 24 hours a day, 7 days a week.[1–3] Factors that weaken this safety net disproportionately affect vulnerable populations. Access to appropriate pediatric emergency medical care is important for children, because substantial morbidity may occur if care is delayed.

Problems That Restrict Access to Care

A. Lack of universal understanding and application of a definition of "emergency."

B. Lack of reasonable access to alternative sources of health care so that the ED is left as the only place that will see everyone.

C. ED crowding and diversion of emergency medical services (EMS).

D. Lack of universal access to enhanced or basic 911 services and wireless 911 service for cellular phones, with reliance in some areas on local 10-digit emergency telephone numbers.

E. The misconception that freestanding urgent care centers provide comprehensive emergency services and that all EDs are equally equipped to care for children.

F. Variability in the availability of appropriate equipment, supplies, and medications in emergency departments for children of all ages.[4]

G. Variability in pediatric training and experience among physicians and nurses staffing EDs.

H. Lack of pediatric training and experience for prehospital EMS and interhospital transport personnel.

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Key Words
access to care, emergency readiness, emergency medical services for children

Abbreviations
ED— emergency department
EMS— emergency medical services
AAP—American Academy of Pediatrics
EMSC—Emergency Medical Services for Children

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I. Lack of evidence-based guidelines for care efficacy and safety within all levels of emergency medical services for children.

J. Lack of access to pediatric emergency medical care in many regions of the country.

K. Lack of reliable access to pediatric medical subspecialists, pediatric surgical specialists, and mental health professionals.

L. Lack of, or failure to initially identify, the medical home, or failure to return the child to the medical home after ED discharge.

M. Lack of or inadequate reimbursement for primary care for large numbers of children.

N. Managed care protocols that bypass regional emergency services for children.

O. Managed care protocols designed to reduce the use of emergency facilities without providing appropriate alternatives for care.

P. Failure by payers to use the "prudent-layperson" standard for definition of emergency.

Q. Retroactive denial of third-party payment when diagnostic signs and/or symptoms suggest an emergent condition but the final diagnosis (often established after evaluation and treatment) is "nonemergent."

R. Denial of payment for services to insured patients for any reason (eg, preexisting or chronic conditions).

S. Increasing legislation and managed care initiatives related to emergency access for children that often require complex and time-consuming telephone calls and documentation.

T. Fears borne by families of ill or injured children regarding immigration issues, social service agency intervention for child custody concerns, and other legal or financial concerns.

U. Language and education barriers to understanding appropriate utilization of less emergent sources of care.

Since the American Academy of Pediatrics (AAP) published the original policy statement on access to emergency care in 1992[5] and a revision in 2000,[6] several substantial advances have occurred.

Advances That Promote Access to Emergency Care

- Significant increases in the number of emergency medicine residents and residency programs that include specific training and experience in pediatric emergencies.
- Development of dual pediatrics-emergency medicine residency training programs.
- Significant increases in pediatric emergency medicine fellowship programs.
- Increased availability of physicians with specific training and certification in pediatric emergency care.
- A substantial and ongoing increase in the presence of board-certified emergency medicine physicians in EDs throughout the country.
- Increasing numbers of providers at all levels taking pediatric emergency courses such as Pediatric Advanced Life Support (PALS),[7] Advanced Pediatric Life Support (APLS),[8] the Neonatal Resuscitation Program (NRP),[9] and the Emergency Nursing Pediatric Course (ENPC).[10]
- Improvements in pediatric education for EMS providers and the Pediatric Education for Prehospital Professionals (PEPP) program.[11]
- Many available resources covering school and child care emergencies[12,13] (see additional publications at http://bolivia.hrsa.gov/emsc and www.aap.org and courses at www.nasn.org).
- Publication of the Institute of Medicine 1993[14] and 2006[3] reports on pediatric emergency care.
- Development of models and educational materials on access to pediatric emergency medical care through the Emergency Medical Services for Children (EMSC) program of the Health Resources and Services Administration's Maternal and Child Health Bureau (see http://bolivia.hrsa.gov/emsc).[15]
- Publication of new manuals and texts that provide education and information about access to pediatric emergency care.[16]
- Publication of statements and guidelines for pediatric facility categorization, emergency centers, office preparedness, urgent care centers, and prehospital and interfacility transport[17–20] (including a policy statement currently in development from the AAP on preparation of the offices of pediatricians and pediatric primary care providers).
- Institutional adoption of pediatric facility standards, such as Emergency Departments Approved for Pediatrics [EDAP], through legislation or voluntary participation.[21]
- Development of model legislation for emergency care for children.
- Formation of the Pediatric Emergency Care Applied Research Network (PECARN) as a means to promote evidence-based approaches to care.[21]

Despite this progress in access to emergency care, more advances are needed.

RECOMMENDATIONS

The AAP recommends that every child in need have access to quality pediatric emergency medical care. Efforts must be made at local, state, and federal levels to:

1. Improve prompt and appropriate access to pediatric emergency medical care for all children regardless of socioeconomic status, ethnic origin, immigration status, type of insurance, location, or health status.
2. Increase public, professional, and government awareness about the magnitude of the problem of access to pediatric emergency medical care for children.
3. Fund, support, and promote the further development and improvement of EMS for children at federal, state, and local levels.
4. Improve awareness, dissemination, and use of the large body of resources available through the Health Resources and Services Administration's Maternal and Child Health Bureau's EMSC program and provide ongoing funding support for future resource development, education, research, and outcomes evaluation by the EMSC program, as recommended in the 2006 Institute of Medicine report.[3]
5. Improve optimal emergency care for children throughout every aspect of the EMSC continuum, from injury prevention to tertiary-level pediatric emergency and critical care to rehabilitation, and ultimately coordinate emergency care through the medical home.
6. Promote the development of evidence-based guidelines and other strategies, such as medication dosing guidelines, to improve care consistency and quality and to reduce errors in the emergency care of children.
7. Fund, support, and further develop research efforts directed at all aspects of pediatric emergency care to provide the foundation for evidence-based standards for efficacious and safe patient care.
8. Encourage the implementation of enhanced (emergency-access) 911 systems and wireless 911 services for cellular phones.
9. Improve collaboration between schools, child care facilities, mental health professionals, medical homes, and local EMS to facilitate easy access into the EMS system.
10. Encourage collaborative efforts by emergency care physicians and primary care physicians to identify a medical home for every child. If a medical home is not identified, the ED should initiate the process of locating a medical home for follow-up and ongoing care after discharge.
11. Encourage the use of the emergency information form (EIF) published by the AAP and American College of Emergency Physicians (http://aappolicy.aappublications.org/cgi/content/full/pediatrics;104/4/e53) for children with special health care needs.
12. Encourage all EDs to establish transfer agreements with facilities with higher levels of pediatric care to ensure timely access to pediatric emergency and subspecialty tertiary care for critically ill and injured children.
13. Encourage state and local EMS system and ED preparedness for pediatric emergencies and care of children in disasters.
14. Encourage the availability of existing pediatric medical subspecialists, pediatric surgical specialists, and mental health professionals who have special skills and expertise that are required for comprehensive and optimal care of critically ill and injured children.
15. For pediatric surgical specialists and pediatric medical subspecialists who are in short supply, encourage the expansion of training programs to ensure the future availability of these professionals necessary to provide specialized pediatric care.
16. Support and facilitate the practice of telemedicine to optimize the delivery of care for services that can be delivered via telemedicine.
17. Encourage managed care organizations to accept the prudent-layperson definition of an emergency and to provide reimbursement for services mandated by the Emergency Medical Treatment and Active Labor Act (42 USC §1395dd).
18. Payers should cover the expense of language-translation services required to provide emergency care.

The AAP membership and leadership, as advocates for children, can and should make a strong commitment to assist pediatricians and families in making decisions about seeking timely and appropriate emergency care.

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AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
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POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

ACCF/AHA/AAP RECOMMENDATIONS FOR TRAINING IN PEDIATRIC CARDIOLOGY

A Report of the American College of Cardiology Foundation/American Heart Association/American College of Physicians Task Force on Clinical Competence (ACC/AHA/AAP Writing Committee to Develop Training Recommendations for Pediatric Cardiology)

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Training Guidelines for Pediatric Cardiology Fellowship Programs

Thomas P. Graham, Jr, MD, FACC, FAHA, FAAP, *Chair*; and Robert H. Beekman, III, MD, FACC, FAHA, FAAP, *Co-Chair*

INTRODUCTION

Pediatric cardiology is a complex, multifaceted specialty composed of diverse clinical and academic subspecialty areas. It is characterized by rapid growth of subspecialty areas and swift incorporation of new information from the clinical and laboratory sciences. It is important, therefore, to define the fellowship training required to launch a successful career in pediatric cardiology. The following document represents the first broad-based effort to do so.

In 2000, the Society of Pediatric Cardiology Training Program Directors (SPCTPD) embarked on the process of defining fellowship training guidelines. The process itself was broad-based and inclusive. All pediatric cardiology training program directors were invited to nominate members to participate in the training guidelines task forces; in turn, each task force was comprised of all nominated members who agreed to participate. Therefore, all training programs were provided an opportunity to actively participate.

In 2002, the American College of Cardiology (ACC) approved and published the Revised Recommendations in Adult Cardiovascular Medicine Core Cardiol-

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This document was approved by the American College of Cardiology Foundation Board of Trustees in June 2005, by the American Heart Association Science Advisory and Coordinating Committee in July 2005, and by the American Academy of Pediatrics Board in July 2005.

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Copies: This document is available on the Websites of the American College of Cardiology (www.acc.org), the American Heart Association (www.americanheart.org), and the American Academy of Pediatrics (www.aap.org). Single copies of this document may be purchased for $10.00 each by calling 1-800-253-4636 or by writing to the American College of Cardiology, Resource Center, 9111 Old Georgetown Road, Bethesda, Maryland 20814-1699.

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ogy Training.[1] As the SPCTPD was concluding its training guideline development, plans were formalized to use a similar process through the ACC Pediatric Cardiology/Congenital Heart Disease Committee and the ACC Training Program Directors Committee. Accordingly, a steering committee was developed with original authors of the Pediatric Cardiology Training Guidelines to form a liaison with the ACC, the American Heart Association (AHA), and the Section on Pediatric Cardiology and Cardiac Surgery of the American Academy of Pediatrics (AAP) to agree on the final guidelines and to publish them widely.

These guidelines are written with the planned goal of serving as a practical resource for directors of pediatric cardiology training programs. We also hope that this document will prove useful to the Residency Review Committee (RRC) for pediatric training programs in the revision of requirements for the accreditation of pediatric cardiology programs. The general requirements, clinical competencies, and oversight for fellows in pediatric cardiology would remain the same as outlined by the Accreditation Council for Graduate Medical Education (ACGME).

GENERAL CONSIDERATIONS

The guidelines proposed in this document address overall recommendations for training in pediatric cardiology and important subspecialties within the field of pediatric cardiology. Although we understand that the pediatric RRC sets minimum standards for accreditation of fellowship programs, this document endeavors to define a more comprehensive set of guidelines for pediatric cardiology fellowship training. Fellowship training guidelines are presented for: general pediatric cardiology (including inpatient care and consultations); echocardiography and noninvasive imaging; electrophysiology; cardiac catheterization and intervention; cardiac intensive care; adult congenital heart disease; and research participation. Each section other than general pediatric cardiology specifies "core" and "advanced" training experiences. *Core* recommendations are intended to be common training experiences for all pediatric cardiology trainees regardless of long-term career goals. *Advanced* recommendations are additional training experiences for trainees intending to develop a clinical or academic area of special competence. All guidelines are recommended experiences, and not absolute mandates, as it is recognized that each training program has unique strengths and that clinical and academic variation across training programs provides important diversity for the specialty.

Table 1 summarizes the approximate time commitment (in months) recommended for core training in the task force reports that follow. Variations in these time commitments should be allowed, as pediatric cardiology programs vary widely in size, organization, and emphasis. For example, in some programs, fellows may get considerable cardiac intensive care unit training during their general inpatient experiences and not require a two- to four-month standalone rotation. Thus, the training guidelines must provide programs with flexibility to address individual trainee clinical and/or research training needs during a core fellowship of 36 months' duration.

TABLE 1. Core Training Recommendations

Experience	Time Commitment (in months)
General experience (inpatient)	3–6
Echocardiography/imaging	4–6
Cardiac catheterization	3–4 (estimate*)
Electrophysiology	2–3
Cardiac intensive care	2–4
Adult congenital heart disease	0–2 (estimate*)
Research	12–18
Total	36

* Task Force identified experience-based recommendations. See individual section for numbers.

The training program must possess the faculty expertise, patient volume, and inpatient/outpatient facilities to provide meaningful trainee experiences as outlined in this document. All faculty should be board certified or possess suitable equivalent qualifications. Recommendations for trainee and faculty evaluation are those outlined in the "general and special requirements" as published by the ACGME, and training should take place within a program that is accredited by the ACGME.

A comment about trainee research participation is appropriate. The field of pediatric cardiology is absolutely dependent upon research (basic and clinical) for meaningful progress. There is a critical need for the development of physician-scientists in our specialty to assure such future progress. Therefore, it is key that training programs begin to prepare trainees for a successful investigative career. Such preliminary research training will in most instances require 18 months or more. The balancing of clinical and research training will continue to be a major issue for training programs. It is highly probable that trainees who want to pursue a physician-scientist career will require at least four years of fellowship to begin the academic process and to finish training in the clinical areas. The authors are in complete agreement with the newly published American Board of Pediatrics (ABP) Training Requirements for subspecialty certification concerning scholarly activity, meaningful accomplishments in research, scholarship oversight, and differing pathways to train physician-scientists.

APPENDIX

The authors of this section declare they have no relationships with industry pertinent to this topic.

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Task Force 1: General Experiences and Training

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INTRODUCTION

The goals of pediatric cardiology training include acquiring the cognitive and procedural expertise required to provide high-quality care to children with cardiovascular disease, acquiring the academic skills to make meaningful scholarly contributions to the specialty, and, importantly, to develop the capacity for ongoing self-education beyond the years of formal training.

The general training of pediatric cardiology fellows builds on the general clinical and academic skills acquired during residency training. The pediatric cardiology fellow should be given broad exposure to clinical activities in pediatric cardiology inpatient and outpatient care, pediatric cardiology inpatient and outpatient consultations, and in preventive cardiology. The academic skills of formal presentation, small-group teaching, literature review, data analysis, and study design are also components of the general training guidelines.

CLINICAL TRAINING

A fundamental goal of clinical training is to acquire bedside diagnostic skill and the ability to provide high-qualilty consultative inpatient and outpatient pediatric cardiology care. The core skills of history-taking and physical examination are the only means for correctly initiating diagnostic and management options appropriate to the individual patient, and these must be heavily stressed at all points of patient contact. Pediatric cardiology fellows should be observed by faculty while performing key portions of the history and physical examination, and to also have the opportunity to observe faculty perform history-taking and physical examination, so that meaningful discussion of useful strategies and techniques may develop. Consultation services, general inpatient wards, and outpatient clinics all provide excellent opportunities for such interaction.

The pediatric cardiology fellow must have the opportunity to provide not only inpatient and outpatient consultation services but also direct patient care in both inpatient and outpatient settings. There must be a continuity of care in the outpatient clinic so that fellows can begin to appreciate the course of pediatric cardiac disease over time and its cumulative impact on individual patients and their families. The combined time commitment of the general inpatient and inpatient consultation services should be no less than three months. The continuity outpatient clinic should begin early in fellowship and continue throughout training, preferably on a biweekly basis. Both inpatient and outpatient experiences should include exposure to the management of the adult patient with congenital heart disease.

There are many ways for general inpatient and outpatient practices to be organized. In the delivery of high-level inpatient and outpatient care the pediatric cardiologist must demonstrate effective team leadership, accurate and efficient medical record keeping, sensitivity to medical ethical issues, an ability to communicate with and support patients and their families through stressful decisions and experiences, and show strict compliance with federal regulatory statutes. The general inpatient and outpatient training environment for pediatric cardiology fellows must provide full opportunity for observation, acquisition, and application of these skills by the trainee.

During the course of inpatient and outpatient activities the pediatric cardiology fellow will become familiar with a core knowledge base, as outlined in Table 1, at a minimum.

DIDACTIC CONTENT

The Core Curriculum

The program should offer courses, seminars, workshops, and/or laboratory experiences to provide appropriate background in basic and fundamental disciplines related to the heart and cardiovascular system. A lecture series encompassing a core curriculum in clinical and basic science topics must be provided for pediatric cardiology fellows. It should be designed so that the spectrum of topics presented will be completed at least once in the three years of accredited fellowship training. Pediatric cardiology fellows should contribute formal presentations of selected topics in the core curriculum, both to strengthen their knowledge base and to develop formal presentation skills. General areas to be covered in the core curriculum include those listed in Table 1.

TABLE 1. Core Knowledge Base

Anatomy and physiology of congenital heart defects (e.g., tetralogy of Fallot, hypoplastic left heart syndrome, ventricular septal defect)
Cardiac, autonomic and noncardiac causes of syncope and near-syncope
Cardiac MRI/CT
Cardiac sequelae of chronic hepatic disease
Cardiac sequelae of chronic renal disease
Cardiac sequelae of HIV/AIDS
Cardiac sequelae of obstructive sleep apnea
Cardiac sequelae of oncologic therapy
Cardiomyopathy, heart failure, and transplantation in the pediatric patient
Cardiopulmonary bypass
Cardiovascular pharmacology
Cardiovascular physiology and anatomy
Cardiovascular sequelae and follow-up in Marfan, William, DiGeorge, Turner, and Noonan syndromes
Cardiovascular sequelae of pregnancy and the impact of congenital heart disease
Cardiovascular sequelae of rheumatologic disease
Cardiovascular sports medicine
Care of the single ventricle patient
Cellular electrophysiology (e.g., action potentials and ion channels)
Chest pain
Clinical electrophysiology (e.g., mechanisms of arrhythmias, pacemakers, ablative therapy)
Coagulation and anticoagulation
Diagnosis and management of arrhythmias
Diagnosis and management of elevated pulmonary vascular resistance
Diagnosis and management of intravascular/intracardiac thrombosis
Diagnosis and management of left-to-right shunt lesions
Diagnosis and management of patent ductus arteriosus in premature infants
Diagnosis and management of right to left shunt lesions
Diagnosis and management of valvular heart disease, including artificial heart valves
Diagnostic evaluation of heart murmurs
Differential diagnosis and management of cardiac tumors
Differential diagnosis and management of pericardial effusion and pericardial tamponade
Embryonic, fetal, and postnatal cardiovascular development
Endocarditis
Exercise testing
Fetal/neonatal/perinatal cardiovascular physiology
Genetics of cardiovascular diseases of childhood
Hyperlipidemia
Hypertension
Kawasaki disease
Medical ethics
Normal cardiovascular anatomy and physiology, including exercise physiology
Obesity
Pericarditis and pericardial effusions
Physics of echocardiography and Doppler analysis
Physiology and natural history of congenital heart disease
Population health
Preventive cardiology, including prevention of adult acquired heart disease
Quality assurance and process improvement methodology
Rationale, expectations, and methods of screening for congenital heart disease in neonates with trisomy of chromosome 21, 18, or 13
Rationale, expectations, and methods of screening for congenital heart disease infants of diabetic pregnancies
Rationale, expectations, and methods of screening for congenital heart disease in the presence of neonatal emergencies such as gastroschisis, omphalocele, congenital diaphragmatic hernia, or cardiorespiratory failure leading to extracorporeal membrane oxygenation
Rheumatic fever
Risk factors in childhood and adolescence
Segmental cardiac analysis
Statistics and study design

Additional Conferences

Preoperative conferences with the cardiovascular surgical service are essential. Journal clubs are a recommended element of an academic environment and provide an excellent venue for participatory evaluation of study design and data analysis. Quality assurance evaluation and morbidity/mortality conferences should be held periodically. Multidisciplinary clinical and research conferences are highly desirable; according to the strengths of the institution, contributors might include neonatology, cardiothoracic surgery, adult cardiology, cardiac pathology, physiology, pharmacology, pulmonology, intensive care, cardiac anesthesiology, cardiovascular radiology, clinical genetics, molecular genetics, tissue engineering, stem cell biology, or developmental biology. In all of these conferences, pediatric cardiology fellows should be provided with active roles appropriate to their level of knowledge and training.

TEACHING AND EVALUATION SKILLS

It is a fundamental responsibility in academic medicine that those with the most experience must teach. The pediatric cardiology fellow will often be the most clinically experienced house officer on a team of residents, interns, and/or medical students. The fellow in that setting should be expected to provide lectures/seminars to the team of house officers. The pediatric cardiology fellow should also be allowed the opportunity to practice clinical leadership, organizational skills, and impromptu educational activities as appropriate to his/her demonstrated level of knowledge and training. There should be occasion for observation and critique of these skills by the attending physician as well as demonstration of these skills to the fellow by the attending.

Pediatric cardiology fellows should develop formal evaluation of trainees and training skills during their fellowship. To do so, they should participate in feedback to residents, students, and cardiology attendings throughout their rotations regarding their own educational and technical progress and the progress of other team members. Accurate self-evaluation is the most valuable skill of all and should be nurtured in all phases of pediatric cardiology training.

APPENDIX

The authors of this section declare they have no relationships with industry pertinent to this topic.

Task Force 2: Pediatric Training Guidelines for Noninvasive Cardiac Imaging

Endorsed by the American Society of Echocardiography and the Society of Pediatric Echocardiography

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INTRODUCTION

Noninvasive imaging, including echocardiography and magnetic resonance imaging (MRI), is a primary means for elucidating the anatomy and physiology of childhood heart disease. Competence in performance and interpretation of echocardiography and MRI is now essential to the practice of pediatric cardiology. Depending upon one's individual career goals, varying levels of expertise may be expected to be achieved during fellowship training. This document defines the levels of knowledge and expertise that pediatric cardiology trainees should acquire in echocardiography and MRI during training, and it offers guidelines for achieving these levels of competence.

Training guidelines have been previously published for pediatric echocardiography,[1] fetal echocardiography,[2] and pediatric transesophageal echocardiography.[3] Those documents were reviewed and considered during preparation of these guidelines. The guidelines presented here differ in some instances from previous recommendations because this task force recognizes that training programs have changed significantly over the decade since the last guidelines were promulgated.

PEDIATRIC ECHOCARDIOGRAPHY

Echocardiography, as used in this document, includes two-dimensional imaging of the heart and related structures, M-mode echocardiography for assessment of chamber size and function, color M-mode and Doppler tissue and flow mapping, pulsed and continuous-wave spectral Doppler flow analysis, and other variations of these basic modalities used to assess the structure and function of the heart and related organs, including new technologies such as three-dimensional echocardiography as they become available.

Facilities and Environment

The pediatric echocardiography laboratory should serve a hospital with inpatient and outpatient facilities, neonatal and pediatric intensive care units, a pediatric cardiac catheterization/interventional laboratory, and an active pediatric cardiac surgical program. The pediatric echocardiography laboratory should be under the supervision of a full-time pediatric cardiologist-echocardiographer qualified to direct a laboratory, and whose primary responsibility is supervision of the laboratory. The laboratory must perform a sufficient number of pediatric transthoracic, pediatric transesophageal, and fetal echocardiograms[1,4] each year to allow trainees sufficient exposure to both normal and abnormal examinations.

LEVELS OF EXPERTISE

Training goals defined here are to enable trainees to achieve one of two levels of expertise in echocardiography as appropriate for career goals.

Core

- Understanding of the general physical properties of ultrasound and clinical ultrasound technology.
- Ability to perform and interpret transthoracic echocardiography in normal infants, children and adolescents, and in those with childhood heart disease, with consultation as needed.
- Basic introduction to the principles of performing and interpreting transesophageal and fetal echocardiograms. Physicians with *core* expertise only are not expected to perform transesophageal and fetal echocardiograms independently.

Advanced

- Special expertise in performance and interpretation of transthoracic echocardiography in all forms of congenital and acquired pediatric heart disease, including the adult with congenital heart disease, enabling the practitioner to function independently.
- Ability to perform and interpret transesophageal and fetal echocardiography independently.
- Ability to supervise training and performance of sonographers, fellows, and other physicians.

TRAINING GUIDELINES

Core training should be achieved by all pediatric cardiology fellows during core clinical training, typically during four to six months dedicated to echocardiography over the course of the standard three-year training program. This level of expertise is anticipated to be sufficient for those fellows who do not plan to pursue echocardiography as an area of subspecialization.

Advanced training requires an additional 9 to 12 months of training and may be achieved through a dedicated experience in pediatric echocardiography after completion of core pediatric echocardiography instruction. This level of training is appropriate for those physicians who intend to be dedicated pediatric echocardiographers.

TRAINING GOALS

Successful completion of each training level should result in competence in the following specific areas.

Core

- Understanding of the physical properties of ultrasound.
- Proper, safe, and facile use of ultrasound instruments.
- Knowledge of the limitations of echocardiography.
- Recognition of cardiac structures displayed by echocardiography and the correlation between echocardiographic images and cardiac anatomy.
- Interpretation of Doppler flow information and deduction of cardiovascular physiology.
- Performance and interpretation of complete transthoracic two-dimensional and M-mode echocardiograms, Doppler color-flow mapping, and pulsed- and continuous-wave spectral Doppler flow analysis in normal pediatric patients and in those with childhood heart disease, with consultation as needed.
- Assessment of systolic, diastolic, and regional myocardial function in normal pediatric patients and those with childhood heart disease, with consultation as needed.
- Ability to review critically published clinical research in echocardiography.

Advanced

In addition to *core* competencies, other goals include:

- Independent performance and interpretation of complete transthoracic two-dimensional and M-mode echocardiograms, Doppler color-flow mapping, and pulsed- and continuous-wave spectral Doppler flow analysis in normal pediatric patients and in those with childhood heart disease.
- Independent assessment of systolic, diastolic and regional myocardial function in normal pediatric patients and in those with congenital or acquired heart disease, to include stress echocardiographic studies.
- Special expertise in the performance and interpretation of pediatric transthoracic, pediatric transesophageal, and fetal echocardiography.
- Training of sonographers and junior pediatric cardiology trainees.
- Participation in basic or clinical research in echocardiography, including presenting original data at one or more scientific meetings.

TRAINING METHODS

Each level of training may be achieved by the methods outlined in the following text or by comparable alternative methods. A summary of the recommended minimum number of procedures is found in Table 1.

TABLE 1. Echocardiography Training—Recommended Minimum Procedure Numbers

Core training	
TTE perform and interpret (≤1 year of age)	150 (50)
TTE review	150
Advanced training*	
TTE perform and interpret (≤1 year of age)	200 (50)
TTE review	200
TEE perform and interpret	50
Fetal echocardiogram	50

* Numbers are in addition to those obtained during core training.
TEE = transesophageal echocardiogram; TTE = transthoracic echocardiogram.

Core

Each trainee should perform and interpret at least 150 pediatric echocardiograms, including at least 50 in patients one year of age or younger, under the supervision of the laboratory director or other qualified staff pediatric cardiologist-echocardiographer(s). Each trainee should also review at least 150 additional pediatric echocardiograms.

In addition, the laboratory director or other staff pediatric cardiologist-echocardiographer(s) should conduct regular laboratory conferences with the trainee(s) to present illustrative cases and to teach proper interpretation and the limitations of echocardiography. Pathological specimens, models, or photographs for echocardiographic-anatomic correlation are excellent teaching aids that should be incorporated wherever possible.

Integration of echocardiography into the clinical practice of pediatric cardiology should be demonstrated on inpatient and outpatient rotations and at medical-surgical management conferences.

Research training for pediatric cardiology trainees should include active participation in reviews of scientific journal articles that pertain to echocardiography.

Advanced

Each *advanced*-level trainee should perform and interpret at least 200 additional pediatric transthoracic echocardiograms and review, or perform and interpret, another 200 pediatric echocardiograms. As with core training, at least 50 of these should be done in infants one year of age or younger. Each trainee should perform a significant number of echocardiograms independently (one-third to one-half of the exams), with subsequent review and critique of the examination by the responsible staff pediatric cardiologist-echocardiographer. Teaching methods outlined in the previous text should be continued here.

Each *advanced*-level trainee should perform and interpret at least 50 pediatric transesophageal echocardiograms, including manipulation of the transducer and registration of images, under direct supervision by a dedicated pediatric cardiologist-echocardiographer. The trainee should perform intubation of the esophagus in at least 20 patients under the direct supervision of a pediatric cardiologist-echocardiographer or anesthesiologist experienced in the procedure. An ideal environment for learning pediatric transesophageal echocardiography is the operating suite during performance of intraoperative

examinations, but the training experience should not be limited to this venue and should include the intensive care unit, cardiac catheterization suite, and outpatient examinations.

Each *advanced* trainee should perform and/or review at least 50 fetal echocardiograms. The trainee must master the fundamental skills of determining fetal position, situs, cardiac anatomy, and cardiac rhythm under the supervision of a dedicated pediatric cardiologist-echocardiographer. The trainee should observe and participate in the discussion of the findings with the parents by the staff echocardiographer responsible for the examination. As the trainee's experience progresses, a significant proportion (30% to 50%) of studies should be performed independently, including cases with normal and abnormal cardiac anatomy and rhythm, with supervision by a dedicated pediatric cardiologist-echocardiographer. Each trainee should understand how to recognize and approach fetal heart failure, and he or she should understand the association of fetal heart disease with extracardiac structural abnormalities, syndromes, and chromosomal abnormalities.

Research training for pediatric cardiology trainees should include, at a minimum, active participation in reviews of scientific journal articles that pertain to echocardiography. In addition, participation in basic or clinical research in echocardiography should be encouraged.

Each *advanced*-level trainee should be given responsibility for participating in the training of sonographers and junior pediatric cardiology fellows, initially with supervision of the laboratory director and then independently and also presenting echocardiography-related teaching conferences and formal didactic lectures.

EVALUATION

The laboratory director, in consultation with the teaching staff, should evaluate each trainee in writing on a regular basis. Trainees should maintain a log of all echocardiograms performed and reviewed, including the age of the patient and the diagnosis. The log should be reviewed regularly by both the laboratory director and the training program director to ensure that each trainee is obtaining adequate and balanced experience.

The evaluation should be reviewed with each trainee and a written copy provided. If a trainee does not appear to be progressing adequately during the rotation, a meeting should be scheduled as soon as possible to inform the trainee and to discuss potential remedial measures. The evaluation should be based on achievement of the expected levels of competence in the areas outlined in the previous text.

Direct observation of the trainee during performance of echocardiograms provides information about imaging skills and understanding of the ultrasound instruments. Conferences in which echocardiograms are presented provide an opportunity to assess skills in interpretation of images and Doppler recordings. The trainees' understanding of research design and methods and ability to review research can be critically evaluated during journal club meetings or other venues for medical literature review. Teaching skills and effectiveness can be evaluated by direct observation and from evaluations by sonographers and more junior trainees and by performance at teaching conferences prepared and delivered by trainees.

Pediatric Cardiovascular Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) as used in this document includes anatomic and functional cardiovascular MRI in congenital and acquired pediatric heart disease as well as in the adult with congenital heart disease. At present, there are no specific guidelines for training or credentialing in pediatric cardiovascular MRI. It is likely that the training guidelines for pediatric cardiovascular MRI proposed here will require amendment as the field evolves. These guidelines must be considered as goals and should not be considered as requirements.

LEVELS OF EXPERTISE

Trainees may achieve one of two levels of expertise in pediatric cardiovascular MRI as appropriate for career goals.

Core

- Familiarity with the general physical principles upon which MRI is based.
- Ability to view and understand MR images in normal infants, children, and adolescents and those with childhood heart disease.
- Introduction to commonly used imaging protocols and MRI terminology.

Advanced

- Thorough understanding of clinical MRI instruments and the imaging protocols used for cardiovascular imaging and physiological analysis (e.g., quantitative analysis of ventricular function and blood flow).
- Ability to independently perform and interpret all types of MRI in childhood heart disease and congenital heart disease at all ages.
- Ability to supervise training of technologists, fellows, and other physicians.

TRAINING GUIDELINES

Training in pediatric cardiovascular MRI should occur within a pediatric cardiology fellowship program and/or a pediatric radiology training program accredited by the Accreditation Council for Graduate Medical Education (ACGME). The MR laboratory should serve a hospital with both inpatient and outpatient facilities, neonatal and pediatric intensive care units, a pediatric cardiac catheterization/interventional laboratory, and an active pediatric cardiac surgical program. The MRI laboratory should be under the supervision of a full-time cardiologist and/or radiologist qualified in cardiovascular MRI, and it must perform a sufficient number of annual examinations to allow each trainee sufficient exposure to both normal and abnormal examinations.

Core training should be achieved by all pediatric cardiology fellows during the core clinical years of the program. This level of expertise may be sufficient for those fellows who plan to practice clinical pediatric cardiology with access to a pediatric cardiologist or radiologist with special expertise in pediatric cardiovascular MRI.

Advanced training requires a minimum of six months of instruction in addition to *core* training. This level of training is appropriate for those physicians who intend to have special expertise in pediatric cardiovascular MRI and is recommended for directors of pediatric cardiovascular MRI laboratories.

TRAINING GOALS

Successful completion of each training level should result in competence in the following specific areas.

Core

- Physical principles of MRI and physiologic analysis.
- Limitations of, and contraindications to, MRI.
- Recognition of cardiac structures displayed by MRI and the correlation between MR images and cardiac anatomy.
- Basic familiarity with commonly used imaging protocols, their clinical uses, and MRI terminology.
- Critical review of published clinical research in pediatric cardiovascular MRI.

Advanced

- Thorough understanding of MRI physics, instrumentation, nomenclature, and safety.
- Special expertise in the performance and interpretation of pediatric cardiovascular MRI, including all commonly used imaging and flow analysis protocols.
- Training of technologists and junior pediatric cardiology trainees.
- Management of and quality assurance for the MRI laboratory.
- Basic or clinical research in pediatric cardiovascular MRI, including presenting original data at one or more scientific meetings.

TRAINING METHODS

Each level of training may be achieved by the methods outlined in the following text or by comparable alternative methods.

Core

Pediatric cardiology trainees should gain exposure to cardiovascular MRI through active review of scientific journal articles that pertain to pediatric cardiovascular MRI, discussion with cardiologists and radiologists who perform cardiovascular MRI, and, if possible, review of cardiovascular MRI examinations.

Advanced

During a fellowship in pediatric cardiovascular MRI, each trainee should perform and/or interpret at least 100 cardiovascular MRI examinations in patients with congenital or acquired childhood heart disease, including adult patients with congenital heart disease. As the trainee's experience progresses, an increasing proportion of these examinations should be performed independently, with review and critique by the laboratory director.

Research training should include continued critical review of the pediatric cardiovascular MRI literature and an opportunity to perform basic or clinical research leading to publication or presentation of scientific data.

Each trainee should be given responsibility for participating in the training of technologists and junior pediatric cardiology fellows, initially with supervision of the laboratory director and subsequently independently. In addition, each trainee should have opportunities to observe and participate in the management of the laboratory, especially quality improvement initiatives.

EVALUATION

The laboratory director, in consultation with the teaching staff, should evaluate each trainee in writing. The evaluation should be reviewed with each trainee and a written copy provided. The trainee should maintain a log of all examinations performed and reviewed, including the age of the patient, diagnosis, and role of the trainee in the examination.

APPENDIX

The authors of this section declare they have no relationships with industry pertinent to this topic.

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Task Force 3: Training Guidelines for Pediatric Cardiac Catheterization and Interventional Cardiology

Endorsed by the Society for Cardiovascular Angiography and Interventions

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INTRODUCTION

The purpose of this document is to recommend minimum training experiences in cardiac catheterization for clinical fellows in pediatric cardiology training programs. Training guidelines in cardiac catheterization are well-established in adult cardiovascular medicine,[1,2] and they have been considered recently in pediatric cardiology as well.[3,4]

Pediatric cardiac catheterization is a unique specialty encompassing a wide range of diagnostic and therapeutic techniques applied to a diverse group of congenital and acquired cardiovascular disorders. A physician who performs a pediatric cardiac catheterization must possess the technical skills and clinical judgment to safely and accurately perform a thorough diagnostic cardiac catheterization and angiographic study. Furthermore, an interventional pediatric cardiologist must also assess the indications for a catheter intervention, including the risks of performing or not performing the procedure (i.e., requires knowledge of the natural history of the defect), and must skillfully perform the appropriate catheter intervention. It is appropriate, therefore, to delineate minimal training requirements in cardiac catheterization for pediatric cardiology trainees.

There are no studies relating training experiences to subsequent clinical skill in pediatric cardiac catheterization. Therefore, the recommendations in Task Force 3 represent the opinions of the authors. To help guide this process, all Accreditation Council for Graduate Medical Education (ACGME)-accredited pediatric cardiology training programs were surveyed in 2001 to inquire about current practices and opinions regarding fellow training in pediatric cardiac catheterization and intervention. Thirty-two programs responded. The responses represented the opinions of fellowship directors (n = 21), catheterization laboratory directors (n = 15), and division directors (n = 13) (in some programs one individual holds more than one position). This document draws on this Training Program Survey to help define training guidelines in this specialty.

FACILITIES AND ENVIRONMENT

Training in cardiac catheterization should occur within a pediatric cardiology fellowship program that is accredited by the ACGME. The cardiac catheterization laboratory should serve a hospital with inpatient and outpatient facilities, neonatal and pediatric intensive care units, and an active pediatric cardiac surgical program. The pediatric cardiac catheterization laboratory should be under the supervision of a full-time pediatric cardiologist, whose primary responsibility is supervision of the laboratory. The laboratory must perform a sufficient number of cardiac catheterizations and interventional procedures to provide each trainee with an acceptable experience.

The cardiac catheterization program must have a regular teaching conference in which diagnostic data (hemodynamic and angiographic) and therapeutic outcomes are formally discussed. In addition, each program that provides *advanced* interventional training must have a regular morbidity and mortality conference in which all adverse outcomes of catheter interventions are systematically reviewed. Participants in this conference should include cardiology faculty, clinical fellows, and preferably pediatric cardiothoracic surgeons and cardiac anesthesiologists. Active participation in these conferences by all clinical cardiology fellows, particularly those at *advanced* levels, is essential to clinical training that emphasizes quality outcomes.

LEVELS OF EXPERTISE

In this report we discuss *core* training for all fellows, and *advanced* training for fellows desiring special expertise in cardiac catheterization and interventional cardiology. The *core* training is recommended for all clinical fellows during their core clinical experience. It is intended to be sufficient for fellows who do not plan a career in interventional pediatric cardiology, but who may be required to perform simple diagnostic studies and to interpret catheterization and angiographic data in their clinical practices. (Cardiologists who provide "diagnostic only" catheterization services must coordinate the care closely with interventional cardiologists and surgeons at referral centers to minimize the need for repeat catheterization procedures.) The *advanced* training provides expertise in both diagnostic and interventional catheterization procedures, and it is intended to qualify a fellow to embark upon a career in cardiac catheterization and intervention.

Core Training: Goals and Methods

Core training in cardiac catheterization refers to the training experiences recommended for all clinical cardiology fellows, regardless of specific career goals. In the Training Program Survey, there was unanimous support for core training in cardiac catheterization for all clinical fellows. The goal of such

TABLE 1. Recommended Body of Knowledge Covered During Core Training

- Indications for and risks of cardiac catheterization and angiography
- Indications for and risks of therapeutic catheter procedures
- Interpretation of pressure waveforms
- Interpretation of O_2 saturation data
- Fick principle and shunt calculations
- Vascular resistance calculations
- Cardiac angiography: basic techniques/angles/interpretation
- Radiation safety

core training is to introduce fellows to the field of cardiac catheterization and the risks and benefits of catheter-based procedures, to teach basic diagnostic catheterization skills, and to provide a basic knowledge of hemodynamics, angiography, and radiation safety. A core curriculum in pediatric cardiac catheterization should include the topics and experiences outlined in Table 1.

The core training should involve each clinical fellow in a minimum of 100 cardiac catheterizations, at least 20 of which include an interventional component (Table 2). These experiences should familiarize the fellow to the indications for cardiac catheterization and intervention, femoral vessel access techniques, basic catheter manipulations, hemodynamic measurements and calculations, and angiographic interpretations. Participation by the fellow as either the primary operator or the primary assistant is satisfactory involvement. A log book should be maintained by the fellow to document the experience and outcomes of catheterization.

Advanced Training: Goals and Methods

Advanced training in cardiac catheterization refers to the training recommended for pediatric cardiology fellows who intend to pursue a career in pediatric cardiac catheterization and interventional cardiology. Therefore, the advanced training goal is to prepare the trainee to independently perform diagnostic and therapeutic catheter procedures with excellent outcomes. Prerequisite to these advanced training experiences is the successful completion of core training. Advanced training should involve each fellow in a minimum of 200 catheterization procedures, at least 100 of which are interventional. The minimum recommended numbers of procedures are specified in Table 3 (and are in addition to those obtained during the core training). The procedure types and numbers in Table 3 are recommended guidelines, not mandates, as it is understood that some qualified programs may not perform every procedure. Participation by the fellow as either the primary operator or the primary assistant is satisfactory involvement.

TABLE 2. Core Training—Recommended Minimum Case Numbers*

Total cardiac catheterizations	100
Interventional procedures	20
Type of intervention	
Balloon septostomy†	5
Other	Not specified

* Numbers represent the median response from the Training Program Survey.
† Fluoroscopic orechocardiographic guidance.

TABLE 3. Advanced Training—Recommended Minimum Case Numbers*

Total cardiac catheterizations	200
Interventional procedures	100
Type of intervention	
Balloon septostomy†	5
Transseptal puncture	10
Pulmonary valve dilation	10 (5 newborns)
Aortic valve dilation	10 (5 newborns)
Pulmonary artery dilation	10
Pulmonary artery stent	10
Coarctation dilation	10
Coarctation stent	5
Collateral occlusion	10
Ductus arteriosus occlusion	10
Atrial septal defect occlusion	10

* Numbers represent the median response from the Training Program Survey.
† Fluoroscopic or echocardiographic guidance.

A minimum number of procedures is necessary, but this is not sufficient to prepare a trainee for a career in cardiac catheterization and intervention. Also important to a successful career, and perhaps more crucial, are technical facility and good clinical judgment. During advanced training the trainee must acquire sophisticated skills in complex catheter manipulations, wire and sheath exchanges, device implantation techniques, and retrievals. Furthermore, good clinical judgment regarding the indications for and against intervention require a thorough knowledge of the natural history of congenital cardiac defects,[5,6] and of the medical, catheter, and surgical options available for treatment. It is the responsibility of the training program director to assure that each advanced trainee graduates with the technical skills, clinical judgment, and cognitive knowledge to pursue an independent career in pediatric cardiac catheterization.

A log book is to be maintained by the advanced fellow to document the nature and outcome of each diagnostic and interventional procedure he or she participated in throughout training. The fellow should also participate actively in regular cardiac catheterization teaching and morbidity conferences where outcomes and complications of interventional procedures are thoroughly discussed (see the previous text). Finally, it is strongly recommended that the advanced fellow participate in at least one clinical research project related to cardiac catheterization and/or interventional cardiology.

Advanced training in pediatric cardiac catheterization requires a dedicated 12-month experience, at a minimum. Some fellowship programs may be able to offer the recommended advanced training experiences during a 3- or 3.5-year training program. Nevertheless, even in those programs additional training provides the fellow an opportunity to enhance technical skills and clinical judgment in this very complex specialty. The authors of this document believe that the highest-quality training is obtained during a fourth-year experience. Three or 3.5 years of training may be satisfactory for some individuals if all advanced training guidelines are achieved, and partic-

APPENDIX. Author Relationships With Industry and Others

Name	Consultant	Research Grant	Scientific Advisory Board	Speakers' Bureau	Steering Committee	Stock Holder	Other
Dr. Robert H. Beekman III	None	None	None	None	None	None	
Dr. William E. Hellenbrand	• AGA	None	• AGA	• AGA	None	None	
Dr. Thomas R. Lloyd	None	None	None	None	None	None	
Dr. James E. Lock	None	None	None	None	None	• NMT	• Royalties greater than 10%—Cook, NMT
Dr. Charles E. Mullins	• NuMED Inc. • NMT	None	None	• AGA	None	• Boston Scientific	• Proctor for devices—AGA, NMT
Dr. Jonathan J. Rome	None	• Gore, Inc.	None	None	None	None	
Dr. David F. Teitel	None	None	None	None	None	None	

ularly if the fellow's next postgraduate position can be anticipated to provide ongoing mentoring for complex interventions.

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Task Force 4: Recommendations for Training Guidelines in Pediatric Cardiac Electrophysiology

Endorsed by the Heart Rhythm Society

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INTRODUCTION

The field of clinical cardiac electrophysiology has rapidly expanded over the past 30 years. Advances in the diagnosis and treatment of pediatric cardiac rhythm disorders, and the increasing trend in medicine in general to develop criteria or guidelines for competence and training in specific fields, have led to the need to develop guidelines for training in pediatric clinical cardiac electrophysiology (CCEP).

The American College of Cardiology (ACC), American Heart Association (AHA), and Heart Rhythm Society (formerly NASPE) have addressed training guidelines in adult CCEP.[1–3] The extensive body of literature regarding adult CCEP training and basic electrophysiology (EP) knowledge provides an important background and should be applied in an appropriately modified form to pediatric CCEP training.[4–21] Recognizing the considerable differences in the pediatric and adult cardiology populations, guidelines that are unique to the pediatric and congenital heart disease population must be developed. Canadian recommendations for training in pediatric EP have been published.[22] It should be recognized that pediatric patients are unique, as recognized by the separate training programs and board certification for pediatricians and internists, and for adult and pediatric cardiologists. In addition, the pediatric electrophysiologist will have experience and expertise in groups unique to pediatric cardiac electrophysiology, including the fetus with in utero arrhythmias, the child with a structurally normal heart and supraventricular tachycardia, ventricular tachycardia, or other arrhythmias, the child with preoperative or postoperative arrhythmias after surgery for congenital heart disease, and the adult with congenital heart disease, both in the pre- and postoperative states. This unique group of adults with congenital heart disease is best served by those with a combined knowledge of congenital heart disease and age-specific disease processes, whether this be provided by a combination of pediatric and adult cardiologists or single individuals with broad training or dual training in pediatric and adult cardiology.

FACILITIES AND ENVIRONMENT

Training should be obtained in an Accreditation Council for Graduate Medical Education (ACGME)-accredited pediatric cardiology training program. Recommendations for catheter ablation facilities have been published.[2,9] Pediatric catheterization laboratory facilities should be available with the appropriate EP equipment to perform EP studies and catheter ablation. These facilities should ensure a safe, sterile, and effective environment for invasive EP studies and implantation of pacemakers and arrhythmia control devices. In many settings, the operating room can be used for the pacing/arrhythmia control devices. Although experience at outside institutions, including adult programs, may be valuable, no more than two to four months of the one-year advanced training should be spent at other institutions. In particular, added experience in pacemaker and implantable cardioverter-defibrillator (ICD) implantation, as well as in ventricular tachycardia studies, may be acquired at a certified adult CCEP program, provided that it is within the previously noted time frame.

At least one board-certified pediatric cardiologist with advanced CCEP skills should be identified as the director of the core and advanced Electrophysiology Training Program. Because there is currently no pediatric EP examination, consideration should be given for one pediatric EP faculty member to take the NASPExAM, or its successor examination. For advanced training of fellows, at least one faculty member should be skilled in the implantation of pacemakers and ICDs.

LEVELS OF EXPERTISE

In this report we discuss *core* training for all fellows and *advanced* training for fellows desiring special expertise in pediatric CCEP. The *core* training is recommended for all clinical fellows during their core clinical experience. It is intended to be sufficient for fellows who do not plan a career in EP. The *advanced* training provides expertise in both diagnostic and therapeutic EP and it is intended to qualify a fellow to embark upon a career in pediatric CCEP. Within the *advanced* level are two tracks related to expertise in pacemaker/ICD care: track 1 physicians prescribe and follow patients who require pacemaker/ICD care; track 2 physicians will also be skilled in device implantation.

Core Training: Goals and Methods

Core EP training is required of all trainees to be a competent pediatric cardiologist. The goal is to enable all trainees to be skilled in electrocardiographic (ECG) interpretation, including standard, ambulatory (Holter), exercise ECGs, and transtelephonic ECGs.

Additionally, the trainee should understand the indications for and the use of noninvasive diagnostic techniques including exercise testing, 24-h ambulatory and event monitors, and tilt table testing and should have a general understanding of their interpretation. All trainees should be able to properly interpret cardiac arrhythmias and manage arrhythmias in the acute care setting. There should be an understanding of the use of non-pharmacologic methods and pharmacologic agents to treat arrhythmias, including drug interactions and proarrhythmic potential. The trainee should understand the indications for the selection of patients for specialized electrophysiologic studies, including ablation. In addition, the trainee should obtain a basic understanding of the indications for, and the information obtained from, invasive EP studies. This should include an understanding of the use of information obtained from these testing modalities for the management of the patient's clinical condition. The trainee should have skills in the interpretation of basic EP information obtained from electrophysiology study (EPS).

Participation in at least 10 EPS cases including catheter placement and analysis of electrophysiologic tracings are needed to acquire these skills. The trainee should understand the evaluation of patients with syncope, palpitations, chest pain, and irregular heart rhythms. All trainees should understand the indications for pacemaker placement, know the differences in pacing modes, understand and be able to perform basic pacemaker interrogation, reprogram and troubleshoot pacemakers, recognizing basic malfunctions such as capture failure, sensing malfunctions, and battery end of service characteristics. Participation by the trainee in at least 20 pacemaker evaluations is recommended to develop these skills. The trainee should receive instruction in the insertion, management, and follow-up of temporary pacemakers, including measurement of pacing and sensing thresholds. He or she should understand the general indications for consideration of the use of arrhythmia control devices (ICDs and anti-tachycardia devices) and know when to refer these patients for more advanced EP evaluation. The trainee should understand the indications and techniques for elective and emergency cardioversion. Four elective direct current cardioversions are required.

The core training to obtain the previously described skills and knowledge should occur in the first three years of pediatric cardiology training and be equivalent to two to three months of concentrated study, but may be acquired throughout the three years as needed to obtain designated competence skills (Table 1).

Advanced Training (Year 4 ± Year 5): Goals and Methods

The goal of *advanced* training is to enable the pediatric electrophysiologist to perform, interpret, and train others to conduct and interpret specific procedures at a high skill level. Tables 2 and 3 describe the competence skills necessary for advanced-level training. The recommended minimum procedures are summarized in Table 4 for both core and advanced training.

Advanced-level skills involve understanding the evaluation and management of common arrhythmias, from the fetus to young adult. In addition, advanced understanding of complex arrhythmia management, especially in the postoperative period after repair of congenital heart defects and in special

TABLE 1. Core Competence Skills

- Interpretation of ECGs, Holters, exercise testing, and event monitors with arrhythmia recognition
- Recognition of developmental changes in cardiac rates and rhythm with age and of "normal" variants of rhythm
- Management of arrhythmias in the acute care setting, including uses of pharmacologic agents, cardioversion with esophageal or intracardiac pacing, and direct current cardioversion
- Management of common chronic arrhythmias such as infant supraventricular tachycardia
- Evaluation of the patient with documented arrhythmia, symptoms of arrhythmia (palpitations, increased or decreased heart rate, irregular heart rhythm), and syncope or presyncope
- Treatment of patients with all forms of syncope
- Evaluation of patients with long QT syndrome or family history of sudden death and management of these patients
- Knowledge of indications for use of noninvasive EP testing
- Knowledge of indications for invasive EP studies and general understanding of information obtained from EPS, including interpretation of basic EP information
- Knowledge of indications for catheter ablation, understanding of procedure and complications of procedure
- Knowledge of indications for pacing, anti-tachycardia device, and ICD placement
- Knowledge of pacing modes, basic pacemaker interrogation, reprogramming, and trouble-shooting for loss of capture, under or over sensing, battery end of life
- Temporary transvenous and transcutaneouspacing
- Evaluation of EP literature

TABLE 2. Advanced EP Clinical Competence Skills

Advanced competence skills include core basic skills plus:

- Management of all types of cardiac arrhythmias in all ages from the fetus to young adult
- Evaluation and management of patients with specific arrhythmia syndromes including long QT syndrome, Brugada syndrome, and right ventricular dysplasia
- Evaluation of patients with family history of sudden cardiac death
- Management of complex arrhythmias, especially in postoperative congenital heart disease patients
- Evaluation of patient with syncope including, when appropriate, performance of tilt table testing with appropriate interpretation and management of patient
- Performance of esophageal EPS
- Knowledge of the indications, risks, and benefits of EPS/catheter ablation
- Interpretation and use of EPS data
- Technical and cognitive skills to perform EPS/catheter ablation, using current mapping technology and techniques
- Advanced knowledge of selection of pacemaker type, programming, follow-up, and trouble-shooting
- Advanced knowledge of pacemakers and implantable cardioverter-defibrillators
- Intraoperative evaluation and programming of pacemakers and ICDs

TABLE 3. Advanced EP Research Competence Skills

- Evaluation of EP literature
- Development of clinical research skills
- Completions of EP project which results in an abstract and/or manuscript
- Grant submission is encouraged

groups such as long QT syndrome, Brugada syndrome, and right ventricular dysplasia, should be attained. Evaluation and management of the patient with all forms of syncope should be accomplished, including the performance of tilt table testing when appropriate. In those programs that employ tilt testing, participation in at least 10 procedures in a pediatric or adult laboratory is advisable. A thorough understanding of pathophysiology and therapy of syncope and tilt testing should be required of all trainees. Advanced-level trainees should develop the cognitive skills to evaluate the patient with a family history of sudden cardiac arrest or death. Skill and experience should be encouraged in pediatric EPS interpretation and use of the EP data to make management and therapeutic decisions. Experience with esophageal EPS should be obtained with participation in 10 procedures. The indications, risks, and benefits of these procedures should be known.

Advanced-level trainees will develop technical and cognitive skills and experience in the performance of invasive diagnostic and therapeutic CCEP. At least 75 diagnostic intracardiac EPS should be performed, of which at least 10 should be patients with ventricular tachycardia. At least 40 of these diagnostic procedures must be in patients who are 12 years of age or younger, and at least 10 should be in patients with repaired or palliated congenital heart disease. In addition, participation in at least 40 catheter ablation procedures is required. The diagnostic portion of a catheter ablation procedure may be used to satisfy the requirement for participation in 75 diagnostic procedures. Participation should include scrubbing for the case, catheter manipulation, analysis, review of tracings, and generation of a report.

Advanced understanding of pacemaker indications, optimal pacemaker choices, and follow-up of pacemaker patients should be obtained. The Heart Rhythm Society has recommended two tracks for those caring for pacemaker patients. Track 1 involves electrophysiologists who will be involved in prescribing and following pacemaker and ICD patients. Track 2 individuals prescribe, implant, and follow patients with pacemakers and ICDs. In both tracks, advanced understanding of pacemaker and ICD indications, optimal pacemaker choices, and evaluation or follow-up of 75 pacemaker/ICD patients should be obtained. In addition, attendance—including intraoperative testing of 35 pacemaker or ICD implants (20 new, 10 revisions, 5 ICDs)—is required. To implant pacemakers and ICDs, direct participation in a total of at least 50 pacemaker and device implants is required, of which a reasonable number should be complex devices including ICDs. As new technology develops, the number of device implants necessary to achieve competence may change. Participation should include scrubbing for the surgery, catheter manipulation, participation in intraoperative testing, and generation of a report. As the skills for implanting devices in smaller children are specific to pediatric EP, at least 15 of these implantation procedures should be in children less than 12 years of age. Also, experience with implantation in patients with repaired congenital heart disease is essential.

Advanced-level pediatric electrophysiologists should have all the skills noted in the previous text, but they may or may not perform the implantation of pacemakers and ICDs. If the pediatric clinical cardiac electrophysiologist does not actually perform these

TABLE 4. Core and Advanced Training: Recommended Minimum Experiences

Level of Training	Core Pediatric Cardiology Training	Advanced Pediatric EP Training
Training time	2 to 3 months equivalent	12 months or more post general PC training*
ECG interpretation	500†	1,500
Ambulatory ECG interpretation	50	200
Exercise ECG	10	40
Tilt table tests	2	10
Transesophageal EPS/temporary postoperative epicardial wire study	5	10
Intracardiac EPS	10	75‡
Intracardiac EPS 12 years of age or less		40
Intracardiac EPS in repaired congenital heart disease		10
Catheter ablation	5	40
Catheter ablation 12 years of age of age or less		20
Catheter ablation in repaired congential heart disease		10
DC cardioversion	4	10
Pacemaker + ICD		
Evaluations/follow-up	20	50
Intraoperative evaluation pacemakers and devices		35 (20 new, 10 revisions, 5 ICDs)
Track 2: implant pacemaker and complex devices		50 (15 in ages 12 yrs or less)

* 4 to 6 months of this training could be obtained during a regular 3-year pediatric cardiology training program if it did not interfere with other required training.
† ECG reading may be performed throughout three-year fellowship.
‡ The diagnostic portion of an ablation procedure may be used to satisfy this requirement.

procedures, they should participate in the intraoperative evaluation and postoperative care. Advanced-level training is expected for any pediatric electrophysiologist who implants pacemakers and ICDs. An additional one to two years after the general cardiology training program is required to achieve advanced-level training. Supplementary training may be required to achieve track 2 implantation competence. Part of this experience with implantation may be gained in an outside program or an affiliated adult CCEP training program. Until specific pediatric pacemaker and ICD certification is available, consideration should be given for advanced trainees implanting pacemakers and ICDs to take the NASPE examination.

Specific Program Content (Core and Advanced Levels)

Trainees will be expected to develop an appropriate level of knowledge and experience in the following areas:

- Basic cellular and whole organ EP related to normal physiology and cardiac arrhythmias in all pediatric and adult congenital patients.
- Pharmacologic principles underlying the use of antiarrhythmic drugs and the effects of various conditions encountered in pediatrics on the use of those drugs (prematurity, developmental biologic changes, including those in volume of distribution, hepatic and renal clearance, drug interactions, and congestive heart failure).
- Management of pediatric and adult patients with congenital heart disease and cardiac arrhythmias; knowledge of presentation and natural history of the variety of arrhythmias encountered in pediatric electrophysiology practice; understanding of the effects of various management strategies on the physiology and psychology of the pediatric and congenital heart patient.
- Expertise in the use of the ECG and other noninvasive specialized testing, including ambulatory monitoring, transtelephonic monitoring, exercise stress testing, and tilt table testing to evaluate cardiac arrhythmias and symptoms.
- An understanding of the indications, contraindications, and potential risks and benefits of intracardiac EPS and esophageal EPS. Core-level trainees should have a general understanding of the information provided by EPS and recognize basic information provided such as site of heart block, identification of mechanism of the arrhythmia, and location of accessory pathways or focal arrhythmia sites. Advanced-level trainees should have experience with esophageal EPS for the treatment and evaluation of arrhythmias. Advanced trainees should also develop an advanced understanding of intracardiac EPS interpretation and use of the data for management. In addition, advanced trainees should develop the advanced cognitive and technical skills to perform EPS.
- Proficiency in the use of esophageal, temporary postoperative epicardial wire, and intracardiac EPS for diagnosis and treatment should be achieved. This includes the ability to manipulate catheters, knowledge of EP equipment and catheters, and ability to perform the full spectrum of programmed electrical stimulation and intracardiac mapping and to interpret the results.
- Advanced trainees should develop the full spectrum of cognitive and technical skills in all types of catheter ablation in children and young adults with congenital heart disease. Advanced trainees should develop skills in the indications for and

APPENDIX. Author Relationships With Industry and Others

Name	Consultant	Research Grant	Scientific Advisory Board	Speakers' Bureau	Steering Committee	Stock Holder	Other
Dr. Victoria L. Vetter	None	None	None	None	None	None	
Dr. Michael J. Silka	None	None	None	None	None	None	
Dr. George F. Van Hare	None	• Medtronic	None	None	None	None	• Support for fellow training—Medtronic
Dr. Edward P. Walsh	None	None	None	None	None	None	

potential complications of catheter ablation and should be prepared to treat any of these complications. During the four years of training, the advanced trainee should develop skills in transseptal perforation by participating in at least 10 transseptal procedures. Trainees should have exposure to and develop skills in manipulation of ablation catheters for antegrade ablation; retrograde (transaortic) ablation experience is also highly desirable.

Core-level trainees should have a basic knowledge and understanding of the use of pacemakers and ICDs in pediatric and congenital heart patients. In addition, the core trainee should develop an understanding of pacemakers and skills in evaluation of pacemaker problems that may occur. Advanced-level trainees should have advanced knowledge in the evaluation and management of pacemakers and ICDs. In addition, advanced trainees will participate in implantation (either intraoperative evaluation or actual implant depending on whether track 1 or 2 is chosen) of pacemakers and ICDs, and provide expert understanding and management of implanted pacemakers and ICDs. In addition, advanced-level trainees should have an understanding and experience in using pacemakers and ICDs for noninvasive EPS and internal cardioversion. All levels should have skills in introducing temporary transvenous pacemakers. All levels should have experience with transcutaneous pacing. Both levels should have the skill to use transthoracic temporary postoperative epicardial wires for the recording of electrograms. Advanced trainees should have knowledge and experience in using these wires to convert arrhythmias.

Core-level trainees should have a basic understanding of the indications for and use of cardiac surgery to treat arrhythmias. Advanced level trainees should provide expert mapping and other EP knowledge at the surgical procedure.

Specific formal instruction topics should be covered in a core lecture series and in a journal club format. There should be regularly scheduled conferences regarding EPS interpretation, application of the EPS to the patient's clinical management, and conferences on interpretation of standard and ambulatory ECGs.

EVALUATION AND DOCUMENTATION OF COMPETENCE

The program director is expected to maintain adequate records of each individual's training experiences and performance of various procedures for appropriate documentation for levels 1 or 2. The trainees should maintain records of participation in the form of a log book containing clinical information, procedure performed, and outcomes, listing any complications encountered. Finally, formal written evaluations should occur at least every three months.

Track 2 will develop skills in implantation of pacemakers and ICDs, including extraction.

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Task Force 5: Requirements for Pediatric Cardiac Critical Care

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INTRODUCTION

Although pediatric cardiac critical care, as a distinct field of interest, is a relatively recent development, treating critically ill patients has always been a substantial part of clinical pediatric cardiology. In addition, even pediatric cardiologists who do not provide primary care for critically ill patients will be asked to consult on such patients. It therefore seems appropriate to specify what knowledge and skills relevant to the care of critically ill patients should be taught in a pediatric cardiology fellowship program.

FACILITIES AND ENVIRONMENT

Not all pediatric cardiac training programs have a separate pediatric cardiac intensive care unit (ICU), and in some training programs the primary care of hemodynamically compromised cardiac patients is provided by physicians other than pediatric cardiologists. However, this should not preclude trainees from attaining the specified requirements through interaction with pediatric cardiologists, pediatric intensivists, neonatologists, pediatric cardiac surgeons, and other practitioners. Because the advanced practitioner must be board eligible or board certified in pediatric cardiology, it is implied that the pediatric cardiology training be done in an Accreditation Council for Graduate Medical Education (ACGME)-approved training program. The additional nine months of advanced training specified below should take place in an institution in which at least 250 pediatric cardiac procedures per year (this number is by consensus of the authors), utilizing cardiopulmonary bypass, are performed.

LEVELS OF EXPERTISE

In formulating the core training requirements, it was expected that all board-certified pediatric cardiologists should be proficient in the following: 1) the evaluation and (at least) initial stabilization of the hemodynamically compromised pediatric patient with heart disease; and 2) consultation with surgeons, pediatric intensivists, neonatologists, and others regarding the medical, and preoperative and postoperative management of pediatric patients with heart disease.

It is unrealistic to expect all pediatric cardiac trainees to be expert (and stay expert) in the most advanced aspects of pediatric cardiac critical care. In many centers the critical care management of pediatric cardiac patients is provided primarily by pediatric intensivists, neonatologists, or pediatric cardiac surgeons, rather than by cardiologists. However, given that most pediatric cardiologists will occasionally be responsible for situations such as those previously noted, it is important that they can provide appropriate care until consultation with those more experienced in pediatric cardiac intensive care can be obtained. In some cases the pediatric cardiologist may be the only source of expertise (e.g., in understanding the limitations of echocardiography in delineating the anatomy/physiology of a hemodynamically compromised postoperative patient). Hence, it is important that the pediatric cardiologist be familiar with critical care-related issues, often specific to a given cardiac lesion, when providing consultation in the context of the critically ill patient. Thus, *core* requirements apply to *all* trainees seeking board certification in pediatric cardiology.

Advanced requirements, which are more comprehensive, apply to practitioners who will undertake primary responsibility for the comprehensive management of critically ill pediatric patients with congenital or acquired heart disease.

These documents specify training guidelines in pediatric cardiac critical care for pediatric cardiology trainees. The advanced guidelines specify training requirements only for practitioners who are board eligible/board certified in pediatric cardiology. These guidelines do not address what might be a suitable course of training for cardiac critical care for practitioners with primary training in a discipline other than pediatric cardiology.

CORE TRAINING: GOALS AND METHODS

General Requirements

At the end of the pediatric cardiology fellowship, the board-eligible pediatric cardiologist should reliably be able to do the following:

1) Evaluate and treat neonates and infants with critical structural cardiac disease. Evaluation and treatment includes:
   a) Establishing an accurate anatomic diagnosis and ascertaining the relevant cardio-pulmonary physiology.
   b) Providing appropriate medical therapy to stabilize the patient (provide for adequate oxygen delivery and organ perfusion).
   c) Knowing what medical and surgical treatments are appropriate for the condition and what the short- and long-term outcomes of these therapies are.

   In particular, the trainee should have sufficient training and experience to be efficient in managing these patients:
   - Neonates and infants with ductal-dependent left and right-sided obstructive lesions.
   - Neonates with d-transposition of the great arteries.
   - Neonates with total anomalous pulmonary venous connection with obstruction.
   - Infants with anomalous origin of the left coronary artery.
2) Evaluate and treat neonates, infants, and older patients with other forms of critical cardiac disease.

   In particular, the trainee should have sufficient training and experience to be efficient in evaluating and treating these patients:
   - Patients with primary myocardial dysfunction.
   - Patients with acutely compromised cardiopulmonary status due to myocarditis or cardiomyopathy (including that due to rheumatic fever, Kawasaki disease, and so on).
   - Patients with acutely symptomatic arrhythmias.
   - Patients with acutely compromised cardiopulmonary status due to endocarditis.
   - Patients with pericardial effusion.
   - Patients having a hypercyanotic episode ("tet spell").
   - Neonates and infants with increased pulmonary vascular resistance, with or without structural abnormality of the heart.
3) Provide care, or consultation for those providing primary care, for cardiac patients with illness of non-cardiac origin.

   For example, a cyanotic patient with respiratory syncitial virus pneumonitis requires care somewhat different than a patient with a normal heart.
4) Provide consultation for those caring for postoperative cardiac patients.

   In particular, the pediatric cardiologist should be able to do the following:
   - Provide interpretation of diagnostic studies, such as echocardiograms and heart catheterization, including clearly delineating the limitations of such studies.
   - Diagnose and treat acutely symptomatic arrhythmias.
   - Provide consultation regarding therapies to maximize oxygen delivery and cardiac output.
   - Provide consultation regarding pharmacologic and other therapies for patients with "single ventricle" physiology.
   - Provide consultation regarding therapy for patients with increased pulmonary vascular resistance.

SPECIFIC AREAS OF KNOWLEDGE AND COMPETENCE

The following section lists certain areas of special importance.

1. Cardiopulmonary physiology, especially as it applies to cardiac patients in the ICU setting.
   a) Determinants of, and means of influencing, oxygen delivery, cardiac output, and vascular resistance.
   b) The physiology of the patient with a single ventricle, including determinants of, and means of influencing, systemic arterial oxygen saturation, systemic perfusion, and myocardial work.
   c) The physiology of the patient with a ductal-dependent left-sided obstructive lesion, including determinants of, and means of influencing, systemic arterial oxygen saturation, systemic perfusion, and myocardial work.
   d) The physiology of the patient with a fixed restriction of pulmonary blood flow, including determinants of, and means of influencing, systemic arterial oxygen saturation, systemic perfusion, and myocardial work.
   e) The physiology associated with d-transposition of the great arteries.
   f) The physiology of cardiopulmonary interaction, including how mechanical ventilation affects cardiac output.
2. Cardiovascular pharmacology.

   The trainee should learn the actions, mechanisms of action, side effects, and clinical use of:
   a) Inotropic agents (e.g., digoxin, adrenergic agonists, phosphodiesterase inhibitors).
   b) Vasodilators/antihypertensive agents (e.g., alpha adrenergic antagonists, angiotensin-converting enzyme inhibitors, calcium channel antagonists, beta adrenergic antagonists).
   c) Commonly used antiarrhythmic drugs (e.g., digoxin, procainamide, lidocaine, amiodarone).
   d) Inhaled nitric oxide.
   e) Prostaglandin E_1.
   f) Neuromuscular blocking agents (e.g., pancuronium, succinylcholine).
   g) Analgesics and sedatives (e.g., morphine, fentanyl, ketamine, benzodiazepines).

h) Anticoagulants (unfractionated and low molecular weight heparin, warfarin).
i) Diuretics (e.g., furosemide, chlorothiazide).
j) Prostacyclin and other pulmonary vasodilators.

3. The relationship between cardiac structure, function, and clinical state.
   The trainee should learn:
   a) How cardiac structural abnormalities (e.g., obstruction of the atrial septum in hypoplastic left heart syndrome) affect cardiopulmonary function, physiology, and hence the clinical state of the patient.
   b) Methods (e.g., echocardiography, invasive pressure measurements, arterial blood gas analysis, magnetic resonance imaging) to determine and measure cardiac structure, function, and physiology in the ICU patient, and the limitations of these techniques.
   c) Indications for remedy of structural lesions (in both unoperated and operated patients), and appropriate means of therapy (surgical, catheter-based intervention).
4. Diagnosis and therapy of arrhythmias, especially those occurring in ICU patients.
   In particular, the trainee should be familiar with the use of atrial and ventricular pacing leads or transesophageal electrocardiography for diagnosing and treating arrhythmias, and the diagnosis and therapy of junctional ectopic tachycardia.
5. Airway management skills.
6. Provision of analgesia and sedation.
7. Conduct of cardiopulmonary resuscitation.
8. Commonly used modes of mechanical ventilation and their application in patients with heart disease.
9. Common complications that occur in cardiac patients in the ICU, and how they may be prevented and treated.
   The trainee should be familiar with factors that predispose to common postoperative complications (e.g., catheter-related sepsis, pathological thrombosis, surgically-induced heart block), appropriate diagnostic techniques, and therapy for these complications.
10. Familiarity with extracorporeal membrane oxygenation and other cardiac support systems.
11. Indications for, and general principles, for providing "end-of-life" or "palliative" care.

REQUIRED TRAINING PERIOD FOR CORE TRAINING

In training programs where pediatric cardiology fellows provide primary care of pediatric cardiac patients in the ICU (generally programs that have a separate cardiac ICU), a minimum of two months' full-time experience in the ICU is recommended. For programs where pediatric cardiology fellows act as consultants for cardiac patients in the intensive care setting, at least four months' experience providing such consultation is recommended.

Trainees will be evaluated by the appropriate supervising faculty, and both written and oral feedback will be provided to the trainee. Written evaluations, addressing specific areas of competence, will be developed at each training site.

ADVANCED TRAINING: GOALS AND METHODS

Advanced training in pediatric cardiac intensive care is intended to prepare practitioners who will undertake primary responsibility for the comprehensive management of critically ill patients with congenital or acquired heart disease. Because this discipline stands at the nexus of pediatric cardiology and pediatric critical care, some physicians with primary training in fields other than pediatric cardiology work in this area. This document describes an appropriate advanced practitioner training program only for physicians board eligible or board certified in pediatric cardiology; it does not specify what an appropriate training program should be for those trained in other disciplines (e.g., critical care medicine [CCM] or pediatric anesthesiology).

GENERAL REQUIREMENTS

1. The advanced practitioner must be board certified/board eligible in pediatric cardiology.
2. Advanced practitioners must have (at least) nine months of clinical training beyond the core training as outlined in the previous text. (This excludes practitioners doubly boarded in pediatric cardiology and pediatric CCM.) Practitioners with training in (only) pediatric cardiology are therefore expected, in addition to having three years of pediatric cardiology training, to have one month of training in anesthesia, four months' experience predominantly in general pediatric CCM, and at least four months' experience caring for pediatric cardiac patients in the ICU setting (a total of 9 months).

The practitioner must have sufficient experience in managing term and pre-term neonates both preoperatively and postoperatively.

SPECIFIC AREAS OF KNOWLEDGE AND COMPETENCE

Specific requirements for advanced training include all of those for core training (listed in the previous text), as well as the following:

1. Mechanical ventilation.
   a) Indications for and utilization of commonly employed modes of mechanical ventilation, as well as more advanced modes of ventilation (e.g., high-frequency oscillatory ventilation).
   b) Optimal ways of providing gas exchange for patients with congenital heart disease, taking into account factors such as the effect of airway pressure on venous return, the impact of fiO_2 on pulmonary vascular resistance, arterial O_2 saturation, and systemic perfusion.
   c) Pulmonary toxicity related to barotrauma, volutrauma, and high levels of inspired oxygen, and how to minimize such toxicity.
2. Indications for, application of, and complications related to mechanical support for the failing cardiopulmonary system. Current systems that provide such support include extracorporeal life

support, ventricular support devices, and intra-aortic balloon pumps. Expertise in at least one form of mechanical support should result from advanced-level training.
3. Performance of invasive procedures often required in managing critically ill cardiac patients. These procedures include advanced techniques for intravascular access (e.g., subclavian vein and internal jugular venous cannulation), insertion of chest tubes, pericardiocentesis, and so on.
4. Utilization of more advanced cardiovascular pharmacologic therapy (e.g., esmolol for therapy of hypertension, vasopressin for therapy of hypotension).
5. Advanced skills in evaluation and treatment of arrhythmias (e.g., utilization of epicardial electrodes and transesophageal leads for diagnosis and treatment of rhythm abnormalities, use of pharmacologic agents to treat arrhythmias, and so on).
6. Advanced management of pulmonary hypertension.
7. Diagnosis and treatment of less frequently encountered/more complex postoperative complications, including lesion-specific complications. Such complications include significant residual cardiac lesions, paralyzed hemi-diaphragm(s), large airway obstruction, compartment syndrome following femoral arterial cannulation for cardiopulmonary bypass, prolonged chest tube drainage, and so on. The practitioner should be familiar with indications for invasive evaluation (e.g., heart catheterization or bronchoscopy) and invasive therapy (e.g., additional cardiac surgery, interventional catheterization, tracheostomy).
8. Evaluation and management of multisystem organ failure.
9. Postoperative management of orthotopic heart transplant patients, and management of acute rejection.
10. Diagnosis and management of renal failure, including indications for renal replacement therapy.
11. Diagnosis and management of forms of neurological dysfunction, sometimes seen in patients with critical heart disease (seizures, stroke, global ischemia, increased intracranial pressure).
12. Available means of providing nutritional support, and the most appropriate means for a given patient.
13. Transfusion management, and recognition and treatment of common transfusion-related complications.

APPENDIX

Dr. David L. Wessel declared that he had the following relationships with industry relevant to this topic—Pfizer (consultant and research grant); INO Therapeutics (consultant and scientific advisory board). The other authors of this report declared that they have no relationships with industry pertinent to this topic.

Task Force 6: Training in Transition of Adolescent Care and Care of the Adult With Congenital Heart Disease

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INTRODUCTION

The number of adults with congenital heart disease (CHD) has increased significantly over the past 20 years. Palliative surgery and, more recently, non-surgical and medical interventions have permitted even those with the most complex lesions to reach adulthood. The recent Bethesda Conference estimated that there are approximately 420,000 CHD patients in the U.S., based on models that exclude simple congenital lesions such as bicuspid aortic valve, small atrial or ventricular septal defect, and mild pulmonary stenosis. Of those patients, approximately three-fourths have lesions that are moderately complex and one-fourth have lesions of great complexity.

Establishing an adequate system for the care of these individuals is a challenging task that can best be accomplished through an integrative approach that draws on the skills and knowledge base of both pediatric and medical (adult) cardiologists within an adult CHD center. Many adults with CHD continue to be cared for by pediatric cardiologists, who are well trained to deal with the often complex problems associated with CHD, but are generally unprepared to manage unique problems of adults with CHD, including long-term complications and adult health care issues such as pregnancy and overlay of acquired disease. Thus, basic knowledge of issues unique to adults with CHD as well as knowledge of the indications for referral to a specialized adult CHD (ACHD) center is required of all pediatric cardiologists.

The American College of Cardiology (ACC) has published training guidelines for Adult Cardiovascular Medicine Core Cardiology Training II (COCATS 2) which include recommendations regarding care of adult patients with CHD. These recommendations were developed with the recognition that appropriate training and education for adult cardiologists is currently deficient in CHD, but that eventually the numbers and complexity of such adult patients will demand that many be cared for in adult settings by cardiologists with an internal medicine-

adult cardiology background.[1] It will be at least a decade or more before the graduates of adult cardiology training programs are sufficiently numerous and adequately trained to staff specialized adult congenital centers as recommended in the 32nd Bethesda Conference.[2] Medical/pediatric residents with double boards in adult and pediatric cardiology would provide excellent training to care for these patients. Meanwhile, for the foreseeable future, significant numbers of adults will need to receive all or a part of their cardiac care from pediatric cardiologists with training in adult issues.

Even if in the future the majority of adults with CHD are cared for in specialized ACHD centers, staffed primarily by specially trained adult cardiologists, there are compelling reasons for the pediatric cardiology training curriculum to address issues relating to ACHD. The Bethesda Conference recommended that such centers maintain a liaison with pediatric cardiology programs for purposes of patient care, education, and support. For example, as surgical treatments evolve, the postoperative course changes, requiring new forms of surveillance and follow-up; the lessons learned from adolescents will shape the care of adults with CHD, and only close coordination between pediatric cardiologists and specialists in ACHD will optimize that care.

This report suggests an approach to the training of pediatric cardiologists. These guidelines will emphasize the importance of preparing young patients with CHD for transition to adult care, the need for pediatric cardiologists to understand the outcomes of CHD in the adult patient, and will serve as a guide for pediatric cardiologists who will participate directly in the care of adults with CHD.

LEVELS OF TRAINING

Core Training (Level 1)

We differentiate three levels of training and expected expertise in the care of adults with CHD. Core training represents the level of knowledge appropriate for all trainees in pediatric cardiology and indicates the knowledge content that each graduate of such a program should acquire. This level of knowledge should be tested in the Subspecialty Certification Examination in Pediatric Cardiology and will provide the graduate with sufficient expertise to care for adolescents with CHD and prepare them for transition to ACHD care. In addition to the basic science and clinical knowledge included in every pediatric cardiology curriculum, certain additional knowledge areas should be included:

- general knowledge
- natural history of cardiac defects
- postoperative residua, long-term issues
- understanding care in the adult setting
- transition issues
- adolescent medicine
- outpatient experience
- lectures as part of core curriculum
- indications for and access to local/regional expert consultation
- adolescent and young adult medical care issues
- contraception, gynecologic issues, pregnancy
- physical activity, sports, and activity counseling
- education, health and general
- insurability
- employment
- psychosocial issues

Advanced Training (Level 2): Special Expertise in Adults With CHD

The COCATS 2 guidelines for adult cardiology fellows suggest at least one year of concentrated exposure for those trainees who wish to care independently for adult patients with CHD. Certain knowledge areas should be included:

Basic Science

Pathophysiology of acquired heart disease with a strong emphasis on heart failure, arrhythmias, and coronary atherosclerosis.

Adult Medical Care Issues

- coronary artery disease, hypertension, lipid management, chronic obstructive pulmonary disease
- contraception, gynecologic issues, management during pregnancy and delivery
- physical activity, sports, and activity counseling
- education, health and general
- insurability
- employment
- psychosocial issues
- palliative care

In addition to didactic materials, training should include the following activities and aims:

- Participation in a regular (at least weekly) clinic organized for the care of adults with CHD—at least 10 patients per week; and participation in the perioperative care of adult patients with CHD including direct observation of surgical repair.
- Program requirements.

To train effectively at level 2, a pediatric cardiology program should include at least one faculty member with a career commitment to the care of adult patients with CHD.

Advanced Training (Level 3): Advanced Expertise in Adults With CHD

The COCATS 2 guidelines recommend an additional year of continued participation in clinical practice relating to ACHD to achieve advanced level 3 training. In addition to the guidelines for advanced level 2 training, level 3 should include active participation in clinical and/or laboratory research in

conjunction with clinical activities and direct participation in additional cardiac catheterization and echocardiographic procedures in adults with CHD.[1]

APPENDIX

The authors of this section declare they have no relationships with industry pertinent to this topic.

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Task Force 7: Training Guidelines for Research in Pediatric Cardiology

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Historically, pediatric cardiology has been a dynamic clinical field where a rapid transfer of knowledge from the research laboratory to the bedside occurred regularly. Conversely, many problems on which laboratory effort was focused were first identified at the bedside. This pattern continues today, and there is every reason to believe it will accelerate in the future. Research in pediatric cardiology is defined in broad terms because it is anticipated that future advances in the care of pediatric patients with cardiovascular disease will go beyond current practice and come from diverse areas of biomedical science. If the pediatric cardiologist is to maintain clinical competence and improve clinical knowledge in step with the progress of biomedical science, it is crucial that he or she thoroughly understands the concepts, methods, and pitfalls of the research process. It is important that every pediatric cardiology trainee participate directly in research as training that is limited to practical experience can teach only the status quo, and the status quo cannot improve patient care. The guidelines that follow are based in part on recommendations published in 1995 and revised in 2002[1,2] and a Task Force Report on Pediatric Cardiovascular Diseases.[3]

In addition to direct involvement in research, every trainee should gain practical experience in review of published data, research design, data analysis, and logical deduction. The research experience plays a unique role in developing the skills in continuing self-education essential to all pediatric cardiologists. Trainees contemplating a career in investigative cardiology bear a special responsibility to prepare effectively to advance understanding in the broad area of clinical, translational, and basic cardiovascular science as well as population science, behavioral science, quality of care, and outcomes research.

Because the research experience is such an integral component, pediatric cardiology training should be carried out in institutions in which the opportunity to participate in research is available. The training site should be one that provides an atmosphere of intellectual inquiry and support of the investigational process.

GENERAL STANDARDS

The training institution must have staff and facilities for research. Opportunities for research for the trainees should be available not only within the clinical cardiology division, but also within biomedical science, epidemiological, or other clinical programs of the institution. Availability of expertise in cardiac development, cardiovascular genetics, epidemiology, outcome evaluation, biostatistics, population science, behavioral science, quality of care, outcomes research, and biomedical ethics should be readily available. There should be a critical mass of investigators, and it is expected that cardiovascular investigation be well represented. Not all investigators need to be clinical cardiologists, but at least one full-time faculty member from each training program should have demonstrated skill and research productivity as an investigator.

DURATION OF RESEARCH TRAINING

For trainees planning careers in education and patient care, the core research training should include substantial research time devoted to a specific research project or projects. In most cases, this will encompass a full 12 months of the training period. For those planning a career with a major emphasis on investigation, an additional one to two years beyond the core research training, working directly with an experienced funded mentor, is needed in most cases.

CONTENT OF TRAINING PROGRAM

Research training is an important part of the core instruction of every trainee. Those planning a substantive commitment to clinical, translational, or basic cardiovascular research, as well as population science, behavioral science, quality of care, and outcomes research, will need advanced research training.

Core Research Training

It is anticipated that in most instances core research training will be devoted to a specific project or projects with a clinical or translational research focus. Such research training must be carried out under the supervision of an experienced investigator and according to approved principles of biomedical ethics and institutional rules for patient protection. It must be recognized that such research is difficult because of the complexity of achieving valid scien-

tific conclusions while working with a diverse population and simultaneously protecting the interests of each patient. Advanced educational activities as outlined by the American Board of Pediatrics may meet the core research training objectives when appropriately planned, supervised, and evaluated by faculty with expertise in this area.

Components of Core Research Training

With appropriate mentoring, the trainee should develop skills in at least the following areas:

1. Literature study, to ascertain the exact state of knowledge before undertaking new investigation.
2. Formulation of hypothesis and specific goals, ensuring that the hypothesis is testable, that the goals are appropriate, and that statistical power is achievable.
3. Development of the research plan and the protocol, including study design, recruitment of subjects, ethical considerations, informed consent and protection of privacy, data collection modes, full description of procedures, and institutional approval of human investigation, where appropriate.
4. Data collection, including preparation of data forms.
5. Development of analytic methods or procedural skills, as required, and particularly the handling of artifacts, missing data, outliers, and statistical inference.
6. Presentation of results, preferably both oral and written, emphasizing that no investigation is complete until it is reported in peer-reviewed journals.
7. Risk-benefit analysis, regarding both patient (subject) risk and benefit and societal risk and benefit.
8. Health policy implications of research.

In the case of multiple center clinical trials, participation in the full range of special activities outlined here is required. The clinician lacking expertise in these areas may be unable to interpret critical reports bearing directly on his or her practice. New data might be accepted uncritically or important advances recognized tardily. The training program should provide frequent opportunities for faculty and trainees to review and analyze small- and large-scale clinical and basic research reports in depth. Core research training in the eight skill areas in the previous text could be most easily obtained as part of a master's program in Clinical Investigation, Public Health, or some other structured program.

Advanced Research Training

Trainees preparing for research careers in pediatric cardiology need an extensive foundation in scientific investigation. Some trainees may have obtained extensive research preparation in combined MD/PhD programs, but may lack the special skills appropriate to their personal research goals. These may be obtained during a postdoctoral research fellowship or as part of the cardiology traineeship. Advanced research training should be a mentored investigational experience with a productive and active scientist, MD or PhD, working in the appropriate fields of clinical, epidemiological, genetic, developmental, or biomolecular investigation as well as population science, behavioral science, quality of care, and outcomes research.

Trainees who aim for a career in investigative cardiology but who have not had the opportunity to obtain a PhD or equivalent training prior to embarking on their cardiology traineeships should have the opportunity and be encouraged to obtain the essential coursework and laboratory experience necessary for a productive research career. Several types of individual or institutional research training grants are important resources to support such training.

The advanced research training previously outlined constitutes only the beginning of the education of an independent cardiovascular investigator. Individuals who pursue this path will require additional research mentoring as junior faculty, and compensation during the prolonged period of research training and mentoring should be sufficient to allow a substantial time commitment to this training. To prepare for a successful investigative career, mentored training during and following fellowship of two to five years is usually necessary. Current models to support young faculty during these critical times of career development include the American Heart Association Scientist Development Grant and the National Heart, Lung, and Blood Institute K08 or K23 awards.

The fundamental demonstration of successful training for a pediatric cardiology investigator is successful competition for external funding obtained via peer-reviewed mechanisms. Advanced research training plans should be formulated with this goal in mind.

EVALUATION

Evaluation of a trainee's research progress and research skills should be subjective as well as objective, based on agreed-upon criteria and standards, and should be ongoing throughout the training period. Each trainee's competence and understanding should be documented at the completion of training. The American Board of Pediatrics requirements for research oversight should guide the evolution process.

Trainees should be strongly encouraged to publish substantive results, thereby providing an evaluation by peer-reviewed journals.

FLEXIBILITY

It must be appreciated that the education of future investigative cardiologists is a continuing process and that they usually remain in an educational institution where they are immersed in clinical cardiology. They often have unique demands that might require altering the sequence and exposure of clinical training, consistent with their previous clinical experience. Therefore, the program director should be afforded latitude in the assignment of responsibilities for the three years of training while guaranteeing

full clinical competence. Blocked research time of 12 to 18 months with clinical duties limited to one-half day per week plus weekend and night call during this time is highly desirable.

SUMMARY

It is vital to the future intellectual health of cardiovascular medicine and the welfare of pediatric patients with cardiovascular disease that all future pediatric cardiologists be familiar with the principles and tools of research. Training in research requires the intense involvement of productive and established investigators. Those trainees preparing for a career in investigative cardiology require a carefully developed but flexible educational plan that will permit them to be successful in their research careers over an extended period.

APPENDIX

Dr. D. Woodrow Benson declared that he had the following relationships with industry relevant to this topic—stock ownership in Medtronic, Guidant, and Proctor & Gamble. The other authors of this report declared that they have no relationships with industry pertinent to this topic.

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American Academy of Pediatrics
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POLICY STATEMENT

Achieving Quality Health Services for Adolescents

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Adolescence

ABSTRACT

In recent years, there has been an increased national focus on assessing and improving the quality of health care. This statement provides recommendations and criteria for assessment of the quality of primary care delivered to adolescents in the United States. Consistent implementation of American Academy of Pediatrics recommendations (periodicity of visits and confidentiality issues), renewed attention to professional quality-improvement activities (access and immunizations) and public education, and modification of existing quality-measurement activities to ensure that quality is delivered are proposed as strategies that would lead to improved care for youth. *Pediatrics* 2008;121:1263–1270

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

Key Words
quality preventive services, periodicity of visits, confidentiality issues, access, immunizations

Abbreviations
IOM—Institute of Medicine
AAP—American Academy of Pediatrics
STI—sexually transmitted infection
SCHIP—State Children's Health Insurance Program
AHRQ—Agency for Healthcare Research and Quality
CDC—Centers for Disease Control and Prevention
NCQA—National Committee for Quality Assurance
MCHB—Maternal and Child Health Bureau
CAHMI—Child and Adolescent Health Measurement Initiative
YAHCS—Young Adult Health Care Survey
HIPAA—Health Insurance Portability and Accountability Act

INTRODUCTION

In recent years, there has been an increased national focus on assessing and improving the quality of health care.[1,2] In a recently published policy statement, "Principles for the Development and Use of Quality Measures," the AAP's Steering Committee on Quality Improvement and Management and the Committee on Practice and Ambulatory Medicine provided a guide for pediatricians on the appropriate uses of quality measures and the criteria on which they should be based.[3] The Institute of Medicine (IOM) has identified health care quality as a national priority and has framed 4 consumer-oriented perspectives on health care needs: staying healthy, getting better, living with illness or disability, and coping with the end of life. The IOM has also addressed quality issues from the perspective of concern for safety, effectiveness, patient centeredness, and timeliness of care and with regard to equity across population subgroups.[4,5]

Access, affordability, cultural effectiveness, communication, and empathy are important attributes of quality care for all age groups. The American Academy of Pediatrics (AAP) has included quality of care in its strategic priorities. Providing quality care for children and adolescents requires that pediatricians maintain relationships with families and with community institutions such as schools or child care providers while maintaining the relationship with their patient. In providing quality care for adolescents, pediatricians must also help patients and their families as teenagers develop autonomy, responsibility, and an adult identity. Thus, adolescent services should also be developmentally appropriate.[6,7] Confidentiality, both in determining whether youth receive what they need and whether there are opportunities for private one-on-one time during health care visits, is a major factor that affects quality of care for many youth.[8,9]

Most adolescents are healthy. However, the preventable health problems of adolescents make specific screening and counseling services important. Most adult chronic diseases have origins during childhood and adolescence.[10,11] Reduction of risky behavior has great potential for reducing preventable adolescent and adult morbidity and mortality, and primary care clinicians can play a critical role in preventing adverse outcomes and promoting healthy lifestyles. Nonetheless, many youth are at high risk of early unintended pregnancy, sexually transmitted infections (STIs), and tobacco, alcohol, and substance use.[12] Alcohol, substance abuse, drunk driving, sexual activity, depression, suicide, smoking, violence, and guns are the primary causes of morbidity and mortality among adolescents.[13,14] Anticipatory guidance, screening, and counseling to reduce health risks are the centerpiece of pediatric and adolescent preventive care; nonetheless, the content of care delivered to many youth does not meet guidelines for care or the perceived needs of adolescent patients.[15]

With passage of the State Children's Health Insurance Program (SCHIP), commitment has been building to ensure that children and adolescents are part of national, state, and local efforts to improve health care quality. The expansion of health insurance coverage and emergence of new quality measures for children and youth create opportunities to assess and improve health services for America's 40 million adolescents. In 2002, the US Congress

mandated that the Agency for Healthcare Research and Quality (AHRQ) produce an annual report on health care disparities in the United States. The National Healthcare Disparities Report includes a broad set of performance measures used to monitor the nation's progress toward improved health care quality for all Americans and builds on the conceptual framework of reports from the IOM. In addition, in 2002, the AHRQ issued a call for measures for inclusion in its National Quality Measures Clearinghouse. Although performance measurement can help move efforts to improve preventive services for adolescents, federal quality and disparity measures are often restricted to those that can be obtained easily from hospital or other administrative databases. In addition, in 2006, the AHRQ issued the National Healthcare Quality Report,[6] which provided additional data on adolescent care and emphasized the need for assessment and measurements. Despite expert and consumer agreement about the importance of adolescent preventive care for health care system accountability and performance reporting, there are few current measurement methods.[2,16–19]

This statement provides recommendations and criteria for assessment of the quality of adolescent care and the need for comprehensive efforts to improve the quality of primary care delivered to adolescents in the United States. Because much of adolescent morbidity and mortality is preventable, this statement focuses on quality issues that relate to staying healthy—preventive care themes. Quality issues for acute, specialty, and hospital care needs, issues for children with special health care needs, and end-of-life issues, although important, are outside the scope of this review. As the federal government addresses increased attention to measurement and to development of quality indicators, better implementation of AAP guidelines,[12] renewed attention to professional quality-improvement activities and public education, and modification of existing quality-measurement activities to ensure that quality care is delivered are proposed as strategies that will lead to better care for youth.

ADOLESCENT HEALTH STATUS AND RISKY BEHAVIORS

The state of America's youth with regard to progress toward achieving national health objectives is mixed. Adolescents engage in high-risk behaviors that cause significant morbidity and mortality. Adolescents and young adults have higher incidences of substance abuse, unprotected sex, reckless driving, and violent behavior compared with adults. Unintentional injuries are the leading cause of death for children, adolescents, and young adults, and alcohol use plays a role in many injuries. Homicide and suicide are the next leading causes of death for adolescents.[15] Violence affects adolescents as both perpetrators and victims. Adolescents are susceptible to intimate partner violence as well, with between 9% and 60% of adolescents having experienced some form of dating violence, and as many as 21% of child abuse cases are perpetrated against adolescents.[20]

Risky and healthy behaviors that affect adult morbidity also have their origins during the adolescent years. According to the Centers for Disease Control and Prevention (CDC), more than half of all teenagers report having had sex, many do not use appropriate barrier protection, and 25% of all annual STI cases in the United States occur in adolescents. Nearly 13.4% of students in the United States had smoked at least 1 cigarette in the previous 30 days, and 23% have reported current cigarette use. Most American adolescents have consumed alcohol at least once in their lifetimes, almost half (43.3%) had consumed alcohol at least once in the previous 30 days, and more than 1 (25.5%) in 4 reported having consumed 5 or more alcoholic drinks on at least 1 occasion in the preceding month. The recommended daily fruit and vegetable intake in the United States is 5 servings per day; however, only 20.1% of adolescents eat the recommended amount. In addition, most adolescents engage in physical activities at lower-than-recommended levels.[15]

PRIMARY CARE ACCESS AND UTILIZATION

Adolescents are among those least likely to have access to health care, and they have the lowest rate of primary care use of any age group in the United States.[9,13] Adolescents and young adults, especially those in poverty, are more likely to be uninsured than any other age group, and many are underinsured with coverage that does not include preventive care, counseling, or other needed services.[13,21] More than 12 million (14.1%) infants, children, and young adults are uninsured, and an estimated 7 of those 12 million are either adolescents or young adults.[22] Although implementation of the SCHIP has improved access to care for more than 2 million previously uninsured children and adolescents, tremendous variation remains across states.[23]

More than 85% of adolescents in the United States report having a regular source of health care. Most families identify a pediatrician or family practitioner as a source of primary care, and most adolescents report having seen their clinician within the last year.[9,24] A study by the AAP Department of Practice and Research in 2003 found that pediatricians' share of visits from adolescents (ages 12–18) increased from 32.3% to 38.5% during a 10-year study period from 1991 to 2000.[25] For many reasons, including barriers to care for adolescents and lack of provider training and incentives, few adolescents receive recommended comprehensive preventive counseling and screening services on key topics such as alcohol use, depression, sexual activity, smoking, injury prevention, physical activity, and diet.[11,22,26,27]

Currently, even adolescents who receive health care often do not receive adequate preventive counseling, health promotion, or screening. Most physicians perform recommended preventive services at low rates, few adolescent visits are for preventive care, and many adolescent visits do not include health counseling or guidance.[11,26–28] Moreover, nearly half of the visits between adolescents and their doctors do not include an opportunity for the teenager to talk privately with the physician. Almost 1 in 3 adolescent girls and 1 in 4 boys report having missed needed care, almost 4 of 10 girls report

having been too embarrassed to talk about an issue with their physician, and fewer than half who thought they should talk about prevention of pregnancy or STIs had ever done so with their doctor.[9,28] Thus, a substantial proportion of visits could not have provided confidential counseling or screening for preventable risky behaviors.

Data from the National Committee for Quality Assurance (NCQA) in the Health Plan Employer Data and Information Set (HEDIS) are used to determine if adolescents have had an annual well visit as a measure of quality for health maintenance organizations' delivery of preventive care. However, this measure provides information only about how many continuously enrolled adolescents have had a visit that was administratively coded as a well visit. The measure does not provide information about whether counseling and/or screening was provided, whether there was an opportunity for a private and confidential encounter, or whether preventive services were provided outside the context of well visits.[29,30] In addition, few health plans score more than 50% on this measure,[31] despite the higher proportion of visits reported by either parents or adolescents. Adolescents might report a higher proportion of well visits because they believe that the care they receive during school or sports physical encounters is equivalent to regular preventive care. However, sports physicals, especially station-based examinations, are generally not comprehensive, high-quality preventive care encounters. Most station examinations do not include psychosocial screening to identify behavioral and other risks. Station examinations also do not allow for attention to longer-term risks of morbidity and mortality, because they are primarily focused on safety, orthopedic fitness, and risk of death from sports.[32] Station examinations also lack confidentiality. Without comprehensive screening, there are many missed opportunities for early diagnosis and treatment.[32]

Appropriate measures of quality also require definition of adolescents' expectations for the content of care delivered to them. Adolescents cite confidentiality, cost, and convenience as key determinants of their use of and satisfaction with care.[7,10] Confidentiality is the key for addressing many types of preventable problems, because fear of disclosure, diagnosis, and treatment may cause adolescents to delay or avoid needed care. Although most physicians support providing confidential care to adolescents, some are uncomfortable with the family negotiations that may surround independent care and decision-making, and few routinely arrange alternative billing or other systems to facilitate adolescents' using their practices confidentially. Nevertheless, several studies have shown that adolescents are both interested in and willing to talk with clinicians about recommended preventive counseling and screening topics, especially during private, confidential health care visits.[9,10,28,29]

ACCESS TO QUALITY CARE FOR ADOLESCENTS

For health services to meet adolescents' needs, they should meet criteria for both the system of health service delivery and the specific services provided.[7,33] Systems factors affect or facilitate adolescents actually receiving services. They are not services themselves but, rather, form the infrastructure of service delivery. These factors include health service organization and financing as well as various domains of access, including availability, affordability, confidentiality, visibility, convenience, flexibility, and coordination.[7] In contrast, services are a measure of the therapeutic interactions received and reflect service capacity, content, and utilization. Services variables also include quality.

Seven criteria for access to care have been proposed by the Society for Adolescent Medicine,[7] including:

- Availability: age-appropriate services and trained clinicians must be available in all communities.
- Visibility: health services for adolescents must be recognizable and convenient and should not require complex planning by adolescents or their parents.
- Quality: a basic level of service must be provided to all youth, and adolescents should be satisfied with the care they receive.
- Confidentiality: adolescents should be encouraged to involve their families in health decisions, but confidentiality must be ensured.
- Affordability: public and private insurance programs must provide adolescents with preventive and other services designed to promote healthy behaviors and decrease morbidity and mortality.
- Flexibility: services, clinicians, and delivery sites must cater to developmental, cultural, ethnic, and social diversity among adolescents.
- Coordination: service providers must ensure that comprehensive services are available to adolescents.

The developmental characteristics of adolescents make these 7 criteria critical for adolescents' health. Similarly, the preventable health problems of adolescents make the availability and visibility of certain preventive services—including family planning and reproductive health services, diagnosis and treatment of STIs and HIV, mental health counseling and treatment, and substance abuse counseling and treatment—critically important for those in this age group. Confidentiality, or the lack thereof, affects quality of care. In a recent survey, 58% of high school students reported health concerns that they wanted to keep private from their parents, approximately only one third of the respondents knew they were legally entitled to receive confidential care for specific health issues, and 68% reported concerns about the confidentiality of services provided in school-based clinics.[34]

The specific services that should be provided to adolescents are summarized by the AAP in its recommendations for clinical preventive services[35] and in *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*,[12] which recommend comprehensive preventive counseling and screening services, including annual preventive health care visits for adolescents between 11 and 21 years of age. Such visits should include confidential screening (through trigger questionnaires, clinical inter-

views, or other means), early identification, appropriate preventive care interventions, and referrals for behavioral, emotional, and medical risk; education and counseling on behavioral, emotional, and medical risks to health; and recommended immunizations. Ideally, these health services should be provided in the context of a medical home that provides coordinated care for youth and their families. When school-based health clinics serve as medical homes and provide primary care, they should be expected to meet similar criteria for the quality of the care they provide. In contrast, sports physicals conducted in schools, especially station-style examinations, undermine the primary care relationship and are unlikely to provide quality comprehensive care. Thus, school or other policies should not encourage supplanting routine well visits or the primary care relationship with sports physicals. In addition, forms used by schools and athletic teams for preparticipation sports examinations should incorporate preventive health assessment tools into their content.

It is also important to stress the implementation of office systems that prompt annual screening of adolescents. Preventive health prompts that alert the clinician or other members of the health care team when adolescents present for urgent care visits that preventive health services are due and systems that remind clinicians to address specific content can systematically increase the delivery of preventive services.[36]

Education and counseling include encouraging good health habits and providing guidance on avoiding risky behaviors (specifically, promotion of healthy eating, physical activity, and exercise; responsible sexual behaviors; avoidance of tobacco, alcohol, and other substances; use of seat belts and protective helmets; avoidance of drunk driving, interpersonal violence, and weapons; and other injury-prevention strategies). Screening, followed by target counseling or interventions for those found to be at risk, includes assessment for hypertension and hyperlipidemia, obesity, eating disorders, substance abuse, sexual orientation, sexual activity, pregnancy, HIV and other STIs and cervical cancer, school performance and learning disorders, depression and suicidality, involvement in or victimization from violence or abuse, and tuberculosis. In addition to AAP policies, similar components for adolescent preventive services have also been set forth by the American Medical Association, American Academy of Family Physicians, and the US Maternal and Child Health Bureau (MCHB).[12,35,37,38]

Recommendations for delivery of clinical preventive services to adolescents include counseling families to reinforce the importance of setting clear expectations for adolescent behavior, review firearm safety and access issues, and address the importance of parents as role models for healthy behavior.[12,35,37] Recent evidence also supports the importance of providing anticipatory guidance to parents, because it helps support their role in promoting positive youth development and helping develop protective factors in the lives of adolescents.[39]

EMERGING QUALITY MEASURES FOR ADOLESCENT CARE

The IOM conceptual framework for quality addresses 4 consumer-oriented perspectives on health needs: staying healthy, getting better, living with illness or disability, and coping with the end of life.[2] These concepts are crossed by 4 components of health care quality: safety, effectiveness, patient centeredness, and timeliness, each of which has had policy prominence in its own way. In addition, the IOM has identified equity across populations as a cross-cutting issue.[2,4] Equity refers to providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status. The IOM has also delineated criteria to apply in thinking about individual quality measures: the overall importance of the aspect of quality being measured, the scientific soundness of the measure, and the feasibility of measurement.[4]

During the 1990s, numerous observers remarked on the lack of valid or reliable quality measures for children's health care.[40,41] In response, federal and private-sector funders invested in the development, testing, and implementation of quality measures for children's health care. Access (as in provider capacity), immunization rates, and the rates at which children and adolescents have well visits are used by the NCQA as quality indicators for health maintenance organizations, but these measures provide no information about the provision of preventive counseling and screening and do not take into account the fact that preventive services are often provided outside of well visits. Mangione-Smith and McGlynn,[41] of the Rand Corporation, have developed extensive chart-based measures of care quality for children and youth. The AHRQ and CDC have also helped develop other valid and reliable adolescent quality measures that could be used for public health or managed care surveillance. The AHRQ has also called for a research agenda in quality measurement for children's health care, the National Initiative for Children's Health Care Quality has been founded, and the AAP has launched several quality-improvement initiatives for pediatric practice.[19,36]

The Child and Adolescent Health Measurement Initiative (CAHMI) was established in 1998 by the Foundation for Accountability to provide leadership and resources for quality of health care for children and adolescents. The CAHMI collaboration includes the NCQA, the AAP, Children Now, the CDC, the AHRQ, the MCHB, and others.[36] The CAHMI has developed and studied 3 measures for children and youth services quality: a child development measure for children between 0 and 48 months of age; a measure for identification of children with chronic illness or special health needs; and an adolescent preventive care measure, called the Young Adult Health Care Survey (YAHCS),[29] for teenagers 14 to 18 years of age, which assesses whether adolescents are receiving recommended health care services. This YAHCS has also been endorsed by the National Quality Forum.

Adolescents have been found to be more valid and reliable than chart review and other data sources in reporting their experiences with preventive care.[30,42] The YAHCS items have been shown to be valid (compared with audiotaped visits) and more accurate than chart data about processes of care.[42] The YAHCS items have also been shown to be reliable[30] in measuring quality of

adolescent preventive care. The YAHCS measurement scales have also demonstrated strong construct validity (mean factor loading = .64) and reliability (mean Cronbach's α = .77).[29]

The YAHCS items ask adolescents directly about the health care they received in the previous 12 months. In fact, because many of the discussions during adolescents' visits are conducted privately between adolescents and their clinicians, adolescents are likely to be a better source of some kinds of information than either their parents or their charts. The 7 YAHCS quality measures address key aspects of recommended preventive care, including (1) screening and counseling for risky behavior (smoking, alcohol use, violence, and guns); (2) screening and counseling for sexual activity and STIs and pregnancy prevention; (3) screening and counseling for mental health and depression; (4) promotion of healthy lifestyle issues (diet, weight, and exercise); (5) private and confidential health care; (6) perceived helpfulness and effectiveness of visits; and (7) adolescents' rating of their clinician's communication and an overall rating of care. The YAHCS also asks about adolescents' health care use, health status, and participation in risky behaviors, because this information can be helpful in assessing whether an adolescent's needs are being met.

The YAHCS is also aligned with the AAP preventive care policies as well as with guidelines from the American Medical Association, American Academy of Family Physicians, MCHB, and *Healthy People 2010*. Average preventive counseling and screening scores from the YAHCS range from 18.2% for discussing risky behavior topics to 50.4% for discussing diet, weight, and exercise topics.[29] The YAHCS can be used to bridge efforts to measure the performance of health care plans and clinicians, target and improve health care quality, and assess and improve public health.

Health plan accreditation and quality assessment, state policies and surveillance systems, and tracking of quality and disparities by the AHRQ have few measures for adolescent care. The AAP is concerned that the gaps in the proposed measure set reflect inconsistent measurement development and will fail to document quality in important domains such as health status and outcomes of care. Thus, it is critical that the gaps in reporting be seen as mandates for improved measure specification and data collection and not as a de facto standard in our expectations for future reporting. Better implementation of AAP policies, renewed attention to professional quality-improvement activities and public education, and modification of existing quality-measurement activities to ensure that quality care is delivered are proposed as strategies that would lead to better care for youth.

OPPORTUNITIES AND CHALLENGES FOR PRIMARY CARE

The system of primary care for adolescents in the United States is changing along with broader changes in the content, organization, and financing of all health services. These changing patterns in the organization of health care may both improve and hinder the care received by adolescents. Similarly, changes in the science of medicine, as well as in technology both in and out of health care may have significant implications for health care delivery to children and their families. The growth of large, integrated health care delivery systems may lead to greater community orientation and more explicit consideration of adolescents' needs. On the other hand, consolidation of services may lead to fewer opportunities and may not result in greater attention to the quality of care delivered or studies of prevention or treatment effectiveness.

Large systems may threaten the quality of health care for children and adolescents. If service delivery systems are not appropriately designed for them, adolescents' ability to use health care may suffer. Regulations of the Health Insurance Portability and Accountability Act (HIPAA) allow states with permissive confidentiality policies to continue them. However, the HIPAA is also expected to make confidential care more difficult to deliver in some areas. Some clinicians may interpret and view HIPAA regulations as restrictive barriers to delivering preventive health care services to adolescents rather than as protective of confidential care. A focus on costs may erode support for many services. Primary care clinicians may have less opportunity to provide anticipatory guidance, behavioral assessment and interventions, or health promotion and disease-prevention counseling.

Adolescents are often unable to anticipate or plan for their needs. Thus, to serve adolescents appropriately, services must be available in a wide range of health care settings, including community-based adolescent health, family planning, and public health clinics; school-based and school-linked health clinics; physicians' offices and physicians' offices affiliated with health maintenance organizations; health maintenance organizations; and hospitals. Without multiple entry points and a diversity of care resources, adolescents are less likely to connect with the appropriate care resources.

Computer technology and the Internet have affected the practice of medicine in the method and speed of access to information and in the nature of communication among physicians, patients, and other members of the health care team. These technological advances provide opportunities for distance education and support for patients. However, the media and the Internet also may lead to misinformation for physicians and patients. Many consumers have difficulty critically appraising health-related information. The education of primary care clinicians must include training in the informatics of health care and the potential promise and problems inherent in technological change.

Coordinated efforts to address disparities in quality should be part of the quality agenda for adolescents' health. This must include measures and surveillance that can identify disparities based on age as well as sensitivity to cultural differences in interpretation and performance of quality measures. However, there are concerns about both the relevancy and appropriateness of the measure set proposed by AHRQ in tracking quality and disparities for pediatric and adolescent health care. Overreliance on clinical or administrative data will fail to document qual-

ity in important domains such as health status and outcomes of care. In addition, if the national initiatives simply report on available data, they may fail to truly address quality and may lead clinicians and others to focus their attention on what is now measured rather than on what is truly important in improving health care.

CONCLUSIONS AND RECOMMENDATIONS

The IOM refers to the discrepancy between the health care that Americans receive and the health care that Americans should receive as a "quality chasm." Adolescents, although traditionally thought of as healthy, are not exempt from this problem. Adolescents have unique health care needs that are not always addressed, and young people often face significant barriers to obtaining needed health care, including lack of insurance, financial difficulty, and lack of (or perceived lack of) confidentiality. Most adolescent morbidity and mortality is attributable to preventable risk factors, and AAP guidelines for quality adolescent health care include screening and counseling to promote healthy behaviors and prevent risky behaviors and for the provision of confidential care.

The AAP believes that it is possible to raise awareness about these issues and ensure that primary care for children and adolescents provides comprehensive service packages and sufficient support to allow clinicians to identify and coordinate services for the common biomedical, behavioral, and educational problems of children.

Public policy must help support improvements in our health care system so that more children and adolescents receive quality care. Employer-sponsored insurance often leaves uncovered some of the services, such as reproductive health or mental health services, that adolescents need the most. Public insurance programs, including Medicaid and the SCHIP, provide an opportunity to increase the number of children with insurance coverage. The first challenge for these programs, as has been the case for Medicaid, is to enroll eligible children and adolescents. However, as the SCHIP expands insurance coverage to a greater proportion of poor and near-poor youth, understanding and addressing the nonfinancial factors that affect access and quality of care become increasingly important. To be effective, these programs must address the reasons that adolescents miss needed care, such as lack of confidentiality or the ability to choose clinicians who are geographically and culturally accessible.

Meaningful measures that assess the quality of primary care have been developed but have been slow to enter the field, with actual use in the health care system itself far from optimal. Child and adolescent health has unique characteristics that differentiate it from adult health and require the development of specific measures. First, children's growth is rapid and presents challenges that often require distinct measures for different age groups. In addition, children have different patterns of health, illness, and disability. They have fewer chronic conditions than adults do; thus, quality measurement for children with chronic illness requires noncategorical approaches to assessment. Children also depend on adults for access to care, adherence to recommended treatments, and continuity of care. Quality-measurement and -improvement initiatives need to be developed to specifically address the transition of care from adolescence into adulthood. As adolescents assume responsibility for their own health behaviors, the importance of confidential screening and counseling requires clinicians to derive information directly from youth.

Improving the health of children and adolescents is a quality-of-care issue, a professional education issue, and a personal and family responsibility issue. National and community solutions and coordinated efforts are needed to improve health care systems and improve the quality of preventive health care delivered to youth; to help promote improvements in quality through support of professional and consumer education campaigns; and to support quality-improvement initiatives in states, managed care plans, and communities.

Families have a special role to play in advocating for their teenagers' health. Most parents or guardians want a professional they trust, such as their pediatrician, to promote healthy, responsible behavior and provide accurate information about health risks so that youth at risk can be identified and offered appropriate help. Thus, every adolescent's parent or guardian should be supportive of ensuring that their teenager has private, confidential time during their health care encounters so that important, preventable issues are addressed.

Pediatricians need to provide care that includes effective counseling skills and must have the right incentives to work with adolescents and their families. This depends on understanding the adolescent's health-behavior choices in context and helping patients make the healthiest choices for themselves. Skills such as motivational interviewing[43] and tailoring behavior-change counseling to patients' stage of change can help physicians counsel youth and their families more effectively.[44]

There are few current federal initiatives to improve care for adolescents. The MCHB funds the Office of Adolescent Health, interdisciplinary adolescent health training programs, and implementation of comprehensive preventive care guidelines. In addition, the Bureau of Primary Care, the CDC, and some states have supported adolescent prevention services quality-improvement initiatives. However, concerted and sustained federal and state efforts will be needed to ensure quality services for most of our nation's youth.

Public health surveillance and health care quality-assurance activities should use measures that assess adolescents' experiences with care, ensuring that confidential counseling opportunities are provided (rather than by relying on parental report). Use of adolescent self-report to assess the content of primary care delivered to youth via managed care quality assurance and public health surveillance systems has the potential to improve the quality of adolescent care.

The AAP recommends the following:

1. All children and adolescents should receive comprehensive, confidential (as appropriate) primary care as recommended by AAP guidelines,[12] including screen-

ing, counseling, and physical and laboratory evaluations.

2. All children and adolescents should be covered by health insurance that provides benefits and care in accordance with AAP guidelines[12] and that provides coverage and access to pediatric specialists for care identified as medically necessary during recommended screening and health supervision visits.
3. State governments should ensure that adolescent confidentiality is preserved and/or protected as HIPAA regulations and electronic health records undergo implementation.
4. Private-sector and government payers should develop policies and contract standards to promote access to adolescent care and availability of confidential services for adolescents and should provide other incentives for delivery of high-quality care to adolescents.
5. Public education should help parents and other consumers understand what constitutes high-quality adolescent primary care so that consumers can be better advocates for confidential and private screening and counseling in settings they trust to help keep their children healthy.
6. Pediatricians and other adolescent health care clinicians should be provided professional education about effective strategies for delivery of high-quality adolescent primary care.
7. Feasible, valid, and reliable quality measures should be developed and implemented that use adolescent self-reported data to help assess the quality of preventive care provided to youth. In addition, existing measures that were developed in association with initiatives designed to improve the care delivered to adolescent patients should be catalogued and improved for use by external quality-measurement organizations

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Active Healthy Living: Prevention of Childhood Obesity Through Increased Physical Activity

Council on Sports Medicine and Fitness and Council on School Health

ABSTRACT

The current epidemic of inactivity and the associated epidemic of obesity are being driven by multiple factors (societal, technologic, industrial, commercial, financial) and must be addressed likewise on several fronts. Foremost among these are the expansion of school physical education, dissuading children from pursuing sedentary activities, providing suitable role models for physical activity, and making activity-promoting changes in the environment. This statement outlines ways that pediatric health care providers and public health officials can encourage, monitor, and advocate for increased physical activity for children and teenagers.

INTRODUCTION

In 1997, the World Health Organization declared obesity a global epidemic with major health implications.[1] According to the 1999–2000 National Health and Nutrition Examination Survey (www.cdc.gov/nchs/nhanes.htm), the prevalence of overweight or obesity in children and youth in the United States is over 15%, a value that has tripled since the 1960s.[2] The health implications of this epidemic are profound. Insulin resistance, type 2 diabetes mellitus, hypertension, obstructive sleep apnea, nonalcoholic steatohepatitis, poor self-esteem, and a lower health-related quality of life are among the comorbidities seen more commonly in affected children and youth than in their unaffected counterparts.[3–7] In addition, up to 80% of obese youth continue this trend into adulthood.[8,9] Adult obesity is associated with higher rates of hypertension, dyslipidemia, and insulin resistance, which are risk factors for coronary artery disease, the leading cause of death in North America.[10]

Assessment of Overweight

Ideally, methods of measuring body fat should be accurate, inexpensive, and easy to use; have small measurement error; and be well documented with published reference values. Direct measures of body composition, such as underwater weighing, magnetic resonance imaging, computed axial tomography, and dual-energy radiograph absorptiometry, provide an estimate of total body fat mass. These techniques, however, are used mainly in tertiary care centers for research purposes. Anthropometric measures of relative fatness may be inexpensive and easy to use but rely on the skill of the measurer, and their relative accuracy must be validated against a "gold-standard" measure of adiposity. Such indirect methods of

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Key Words
healthy living, physical activity, obesity, overweight, advocacy, children, youth

Abbreviations
PE—physical education
AAP—American Academy of Pediatrics

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estimating body composition include measuring weight and weight for height, body mass index (BMI), waist circumference, skinfold thickness, and ponderal index.[11] Of these, perhaps the most convenient is BMI, which can be calculated according to the following formulas (www.cdc.gov/growthcharts):

$$\text{BMI} = \text{weight (kg)}/(\text{height})\ (\text{m}^2) \text{ or}$$

$$\text{BMI} = \text{weight (kg)}/\text{height (cm)}/\text{height (cm)} \times 10\,000$$

$$\text{BMI} = \text{weight (lb)}/\text{height (in)}/\text{height (in)} \times 703$$

BMI varies with age and gender. It typically increases during the first months of life, decreases after the first year, and increases again around 6 years of age.[11] A specific BMI value, therefore, should be evaluated against age- and gender-specific reference values. In the United States, such reference charts based on early 1970s survey data of children 2 to 20 years of age are readily available for clinical use.[12] Children and youth with a BMI greater than the 95th percentile are classified as overweight or obese, and those between the 85th and 95th percentiles are designated at risk of overweight.[13] Although BMI tends to underestimate overweight in tall individuals and overestimate overweight in short individuals and those with high lean body mass (ie, athletes), it generally correlates well with more precise measures of adiposity in individuals with BMI in the 95th percentile or greater.[14]

Factors Contributing to Obesity

Some children have medical conditions associated with obesity and/or require pharmacologic treatments resulting in significant weight gain. Others (1%–2% of obese children) have underlying genetic conditions such as Down, Prader-Willi, or Bardet-Biedle syndrome, which can be associated with obesity. Rarely, single-gene disorders, including congenital leptin deficiency and defects in the melanocortin 4 receptor, cause morbid childhood obesity.

Observations in twin, sibling, and family studies suggest that children are more likely to be overweight if relatives are similarly affected and that heritability may play a role in as many as 25% to 85% of cases. However, to suggest that only genetic factors have caused the recent global epidemic of childhood obesity would not be realistic. It is more likely that most of the world's population carries a combination of genes that may have evolved to cope with food scarcity. In obesogenic environments in which calorie-dense foods are readily available and low-energy expenditure is commonplace, this genetic predisposition would be maladaptive and could lead to an obese population.[11]

Nutritional factors contributing to the increase in obesity rates include, in no particular order, (1) insufficient infant breastfeeding, (2) a reduction in cereal fiber, fruit, and vegetable intake by children and youth, and (3) the excessive consumption of oversized fast foods and soda, which are encouraged by fast-food advertising during children's television programming and a greater availability of fast foods and sugar-containing beverages in school vending machines.[15,16] Although nutritional issues have a significant role to play, this statement focuses on factors associated with decreased energy expenditure, namely excessive sedentary behaviors and lack of adequate physical activity.

Children and youth are more sedentary than ever with the widespread availability of television, videos, computers, and video games. Data from the 1988–1994 National Health and Nutrition Examination Survey indicated that 26% of American children (up to 33% of Mexican American and 43% of non-Hispanic black children) watched at least 4 hours of television per day, and these children were less likely to participate in vigorous physical activity. They also had greater BMIs and skinfold measurements than those who watched <2 hours of television per day.[17]

Not only are the rates of sedentary activities rising, but participation in physical activity is not optimal. In a 2002 Youth Media Campaign Longitudinal Survey, 4500 children 9 to 13 years of age and their parents were polled about physical activity levels outside of school hours. The report indicated that 61.5% of 9- to 13-year-olds did not participate in any organized physical activities and 22.6% did not partake in nonorganized physical activity during nonschool hours.[18]

Youth at Risk of Decreased Physical Activity

Particular individuals at increased risk of having low levels of physical activity have been identified and include children who are from ethnic minorities (especially girls) in the preadolescent/adolescent age groups, children living in poverty, children with disabilities, children residing in apartments or public housing, and children living in neighborhoods where outdoor physical activity is restricted by climate, safety concerns, or lack of facilities.[19,20] According to the Centers for Disease Control and Prevention (www.cdc.gov/nccdphp/sgr/adoles.htm), inactivity is twice as common among females (14%) as males (7%) and among black females (21%) as white females (12%). In a meta-analysis that evaluated physical activity and cardiorespiratory fitness, 6- to 7-year-olds were more active in moderate to vigorous physical activity (46 minutes/day) compared with 10- to 16-year-olds (16–45 minutes/day). Boys were approximately 20% more active than girls, and mean activity levels decreased with age by 2.7% per year in boys compared with 7.4% per year in girls.[21] Many reasons are stated for the general lack of physical activity among children and youth. These reasons include inactive role models (eg, parents and other caregivers), competing demands/time pressures, unsafe environments, lack of

recreation facilities or insufficient funds to begin recreation programs, and inadequate access to quality daily physical education (PE).

Physical Activity in Schools

Children and youth spend most of their waking hours at school, so the availability of regular physical activity in that setting is critical. Although the *Healthy People 2010* report recommends increasing the amount of daily PE for all students in a larger proportion of US schools, such changes do not seem to be forthcoming.[19] In 2000, a school health policies and program study[22] looked at a nationally representative sample of private and public schools and found that only 8% of American elementary schools, 6.4% of middle schools, and 5.8% of high schools with existing PE requirements provided daily PE classes for all grades for the entire year. In addition, although approximately 80% of states have policies calling for students to participate in PE in all schools, 40% of elementary schools, 52% of middle schools, and 60% of high schools allow exemption from PE classes, particularly for students with permanent physical disabilities and those having religious reasons.[22] The National Association of State Boards of Education recommends 150 minutes per week of PE for elementary students and 225 minutes per week for middle and high school students.[23] Unfortunately, these requirements are not being implemented. In a study of 814 third-grade students from 10 different US data-collection sites, the mean duration of PE was 33 minutes twice a week, with only 25 minutes per week at a moderate to vigorous intensity level.[24] In addition, 1991–2003 Youth Risk Behavior Surveillance data showed that although the percentage of high school students enrolled in PE class remained constant (48.9%–55.7%), the percentage of students with daily PE attendance decreased from 41.6% in 1991 to 25.4% in 1995 and remained stable thereafter (25.4%–28.4%).[25]

Management of the Obese Child

The successful treatment of obesity in the pediatric age group has been somewhat obscure to date. Studies have shown that younger children seem to respond better to treatment than adolescents and adults.[11,26] Reasons given for this include greater motivation, more influence of the family on behavioral change, and the ability to take advantage of longitudinal growth, which allows children to "grow into their weight." Treatment programs that include nutritional intervention in combination with exercise have higher success rates than diet modification alone. Indeed, a research program that included dietary modification, exercise, and family-based behavioral modification demonstrated enhanced weight loss and better maintenance of lost weight over 5 years.[27] Successful activity-related interventions include a reduction in sedentary behavior and an increase in energy expenditure. Improvements in BMI have been shown to occur when television viewing is restricted.[28] In this regard, the American Academy of Pediatrics (AAP) recommends no more than 2 hours of quality television programming per day for children older than 2 years.[29] Lifestyle-related physical activity, as opposed to calisthenics or programmed aerobic exercise, seems to be more important for sustained weight loss.[30] Such treatment programs should be individually tailored to each child, and their success should be measured not just in terms of weight loss but also in terms of the effects of the programs on associated morbidities.

Health Benefits of Physical Activity

Regular physical activity is important in weight reduction and improving insulin sensitivity in youth with type 2 diabetes.[31] Aerobic exercise has been shown in a prospective randomized, controlled study of 64 children (9–11 years old) with hypertension to reduce systolic and diastolic blood pressure over 8 months.[32] Resistance training (eg, weight lifting) after aerobic exercise seems to prevent the return of blood pressure to preintervention levels in hypertensive adolescents.[33] Weight loss through moderate aerobic exercise has been shown to reduce the hyperinsulinemia, hepatomegaly, and liver enzyme elevation seen in patients with steatohepatitis.[6,34] Regular physical activity is also beneficial psychologically for all youth regardless of weight. It is associated with an increase in self-esteem and self-concept and a decrease in anxiety and depression.[35]

Prevention of Overweight in Children and Youth

Given the challenges of reversing existing obesity in the pediatric population, preventive tactics are likely to be the key to success. Unfortunately, controlled prevention trials have been somewhat disappointing to date. In a systematic Cochrane Database review,[36] 3 of 4 long-term studies combining dietary education with physical activity showed no difference in overweight, and 1 long-term physical activity intervention study showed a slight reduction in overweight. However, the randomized control design may not be ideal for the study of most health-promotion interventions. This is because these are typically population-based programs, which tend to be complex, are delivered over long periods of time, and present some difficulties in controlling all variables.[11] Solution-oriented research, which evaluates promising interventions, often in a quasi-experimental manner, may be more appropriate in the long run.[37] It is unlikely, however, that any single strategy will be sufficient to reverse current trends in pediatric obesity. Success is more likely to be achieved by the implementation of sustainable, economically viable, culturally acceptable active-living policies that can be integrated into multiple sectors of society.

Increasing Physical Activity Levels in Children and Youth

Physical activity needs to be promoted at home, in the community, and at school, but school is perhaps the most encompassing way for all children to benefit. As of June 2005, there is a new opportunity for pediatricians to get involved with school districts. Section 204 of the Child Nutrition and WIC [Supplemental Nutrition Program for Women, Infants, and Children] Reauthorization Act of 2004 (Public Law 108–265) requires that every school receiving funding through the National School Lunch and/or Breakfast Program develop a local wellness policy that promotes the health of students, with a particular emphasis on addressing the problem of childhood obesity. By the 2006–2007 school year, each school or school district is required to set goals for healthy nutrition, physical activity, and other strategies to promote student wellness. Parents, students, school personnel, and members of the community are required to be involved in the policy development. Pediatricians can take advantage of this requirement to get involved. In light of the school wellness policy, many schools are looking to modify their present PE programs to improve their physical activity standards.

In past years, PE classes used calisthenics and sport-specific skill acquisition to promote fitness. This approach did not meet the needs of all students, such as those with obesity or physical disabilities. PE curricula and instruction should emphasize the knowledge, attitudes, and motor and behavioral skills required to adopt and maintain lifelong habits of physical activity.[38] Cross-sectional school-based studies have shown modest correlation between physical activity and lower BMI, although long-term follow-up data are lacking. In an observational study of 9751 kindergarten students, an increase in PE instruction time was associated with a significant reduction in BMI among overweight girls.[39] Project SPARK (Sports, Play, and Active Recreation for Kids Curriculum) looked at increasing physical activity through modified PE and classroom-based teaching on health and skill fitness. Physical activity levels increased during PE classes, and fitness levels in girls improved as a result.[40] It is interesting to note that, despite a significant increase in PE class time, there was no interference with academic attainment, and some achievement test results improved. A recent review of the literature suggests that school-based physical activity programs may modestly enhance academic performance in the short-term, but additional research is required to establish any long-term improvements. There does not seem to be sufficient evidence to suggest that daily physical activity detracts from academic success.[41]

An increase in school PE participation alone is not likely to be sufficient to reverse the childhood obesity epidemic. A 2-year study of elementary students showed that those who had enhanced physical activity education as well as modified PE classes to increase lifestyle aerobic activity increased their physical activity inside the classroom, but lower levels were noted outside the classroom in their leisure time, and no improvements on fitness testing or body fat percentage were seen.[42] The PLAY (Promoting Lifestyle Activity for Youth) program, which encourages the accumulation of 30 to 60 minutes of moderate to vigorous physical activity daily beyond school time and during regular school hours outside of PE classes, has been shown to increase the physical activity levels of children, especially girls.[43] Children can increase their physical activity levels in many other ways during school and nonschool hours, including active transportation, unorganized outdoor free play, personal fitness and recreational activities, and organized sports. Parents of children in organized sports should be encouraged to stimulate their children to be physically active on days when they are not participating in these sports and not rely solely on the sports to provide all their away-from-school physical activity. This should include participation in physical activities with the entire family. Communities designed with green spaces and biking trails help provide families the means to enjoy such active lifestyles.

During late childhood and adolescence, strength training may be additionally beneficial. Youth taking part in this type of exercise may gain strength, improve sport performance, and derive long-term health benefits.[44] Obese children often prefer strength training because it does not require agility or aerobic ability, and the benefits become apparent within as little as 2 to 3 weeks. Because of their added body mass, overweight participants also tend to be stronger than their peers, giving them a relative psychological advantage. Recent studies have shown that obese students are more compliant and increase their free fat mass when weight training is added to aerobic exercise or a standardized energy-reduction diet.[45,46]

Recommended physical activity levels for children and youth vary somewhat in different countries. The Centers for Disease Control and Prevention and the United Kingdom Health Education Authority recommend that children and youth accumulate at least 60 minutes daily of moderate to vigorous physical activity in a variety of enjoyable individual and group activities.[47,48] Health Canada guidelines recommend increasing physical activity above the current level by at least 30 minutes (10 minutes vigorous) and reducing sedentary activity by the same amount per day. Each month, physical activity should be increased and sedentary behavior should be decreased by 15 minutes until at least 90 minutes more active time and 90 minutes less inactive time are accumulated (www.paguide.com). The Canadian Paediatric Society has endorsed these recommendations and emphasizes a wide variety of activities as part of recreation, transportation, chores, work, and

planned exercise to encourage lifestyle changes that may last a lifetime.[49]

Age-Appropriate Recommendations for Physical Activity

Clinicians should encourage parents to limit sedentary activity and make physical activity and sport recommendations to parents and caregivers that are consistent with the developmental level of the child.[50] The following are guidelines from the AAP for different age groups.

Infants and Toddlers

There is insufficient evidence to recommend exercise programs or classes for infants and toddlers as a means of promoting increased physical activity or preventing obesity in later years. The AAP has recommended that children younger than 2 years not watch any television. The AAP suggests that parents be encouraged to provide a safe, nurturing, and minimally structured play environment for their infant.[51] Infants and toddlers should also be allowed to develop enjoyment of outdoor physical activity and unstructured exploration under the supervision of a responsible adult caregiver. Such activities include walking in the neighborhood, unorganized free play outdoors, and walking through a park or zoo.

Preschool-Aged Children (4–6 Years)

Free play should be encouraged with emphasis on fun, playfulness, exploration, and experimentation while being mindful of safety and proper supervision. Preschool-aged children should take part in unorganized play, preferably on flat surfaces with few variables and instruction limited to a show-and-tell format. Appropriate activities might include running, swimming, tumbling, throwing, and catching. Preschoolers should also begin walking tolerable distances with family members. In addition, parents should reduce sedentary transportation by car and stroller and, as applies to all age groups, limit screen time to <2 hours per day.

Elementary School–Aged Children (6–9 Years)

In this age group, children improve their motor skills, visual tracking, and balance. Parents should continue to encourage free play involving more sophisticated movement patterns with emphasis on fundamental skill acquisition. These children should be encouraged to walk, dance, or jump rope and may enjoy playing miniature golf. There is little difference between the sexes in weight, height, endurance, and motor skill development at this age; thus, co-ed participation is not contraindicated. Organized sports (soccer, baseball) may be initiated, but they should have flexible rules and short instruction time, allow free time in practices, and focus on enjoyment rather than competition. These children have a limited ability to learn team strategy.

Middle School–Aged Children (10–12 Years)

Preferred physical activities that focus on enjoyment with family members and friends should be encouraged as with previous groups. Emphasis on skill development and increasing focus on tactics and strategy as well as factors promoting continued participation are needed. Fully developed visual tracking, balance, and motor skills are typical in late childhood. Middle school–aged children are better able to process verbal instruction and integrate information from multiple sources so that participation in complex sports (football, basketball, ice hockey) is more feasible. Puberty may begin at different rates, making some individuals bigger and stronger than others. Basing placement in contact and collision sports on maturity rather than chronologic age may result in less risk of injury and enhanced chance of success, especially for those at lower Tanner stages. Weight training may be initiated, provided that the program is well supervised, that small free weights are used with high repetitions (15–20), that proper technique is demonstrated, and that shorter sets using heavier weights and maximum lifts (squat lifts, clean and jerk, dead lifts) are avoided.[44]

Adolescents

Adolescents are highly social and influenced by their peers. Identifying activities that are of interest to the adolescent, especially those that are fun and include friends, is crucial for long-term participation. Physical activities may include personal fitness preferences (eg, dance, yoga, running), active transportation (walking, cycling), household chores, and competitive and noncompetitive sports. Ideally, enrollment in competitive contact and collision sports should be based on size and ability instead of chronologic age. Weight training may continue, and as the individual reaches physical maturity (Tanner stage 5), longer sets using heavier weights and fewer repetitions may be safely pursued while continuing to stress the importance of proper technique.

Office-Based Physical Activity Assessment

An accurate assessment of an individual child's physical activity level by history or questionnaire is difficult and fraught with methodologic problems. It may be easier for parents to recall the number of times per week their child plays outside for at least 30 minutes than to estimate the average daily minutes spent in physical activity. In addition, asking parents about the number of hours per day their child spends in front of a television, video game, or computer screen may be simpler to quantify and track than time spent in active play. Pedometers may also be helpful, because they provide a simple and more objective method of measuring activity, are inexpensive, and have a "gadget appeal" among youngsters. It has been recommend that adults accumulate 10 000 steps per day to follow a healthy lifestyle.[52] Require-

ments are less clearly defined in children, but guidelines range from 11 000 to 12 000 steps per day for girls and 13 000 to 15 000 steps per day for boys.[53,54]

CONCLUSIONS

The prevalence of pediatric obesity has reached epidemic proportions. It is unlikely that the medical profession alone will be able to solve this serious health problem. The promotion of decreased caloric intake and increased energy expenditure will need to take place within all aspects of society. Among the most difficult but most important challenges for society are making exercise alternatives as attractive, exciting, and enjoyable as video games for children, convincing school boards that PE and other school-based physical activity opportunities are as important to long-term productivity as are academics, changing both supplier and consumer attitudes about food selection and portion sizes, and reengineering living environments to promote physical activity.

RECOMMENDATIONS

Research has shown the importance of social, physical, and cultural environments in determining the extent to which people are able to be active in all facets of daily life, including work, education, family life, and leisure.[55] Creating active school communities is an ideal way to ensure that children and youth adopt active, healthy lifestyles. These communities require a collaborative framework between families, schools, community recreation leaders, and health care professionals. Physicians can be instrumental in the development of active school communities by advocating for policy changes at the community, state, and national levels that support healthy nutrition, reducing sedentary time, and increasing physical activity levels while providing education and health supervision about regular physical activity and reduced sedentary time to families in their practices.

ADVOCACY

In addition to promoting healthy nutrition recommendations suggested by the AAP Committee on Nutrition, physicians and health care professionals and their national organizations should advocate for:

- Social marketing that promotes increased physical activity.
- The appropriate allocation of funding for quality research in the prevention of childhood obesity.
- The development and implementation of a school wellness counsel on which local physician representation is encouraged.
- A school curriculum that teaches children and youth the health benefits of regular physical activity.
- Comprehensive community sport and recreation programs that allow for community and school facilities to be open after hours and make physical activities available to all children and youth at reasonable costs; access to recreation facilities should be equally available to both sexes.
- The reinstatement of compulsory, quality, daily PE classes in all schools (kindergarten through grade 12) taught by qualified, trained educators. The curricula should emphasize enjoyable participation in physical activity that helps students develop the knowledge, attitudes, motor skills, behavioral skills, and confidence required to adopt and maintain healthy active lifestyles. These classes should allow participation by all children regardless of ability, illness, injury, and developmental disability, including those with obesity and those who are disinterested in traditional competitive team sports. Commitment of adequate resources for program funding, trained PE personnel, safe equipment, and facilities is also recommended.
- The provision of a variety of physical activity opportunities in addition to PE, including the protection of children's recess time and the requirement of extracurricular physical activity programs and nonstructured physical activity before, during, and after school hours, that address the needs and interests of all students.
- The reduction of environmental barriers to an active lifestyle through the construction of safe recreational facilities, parks, playgrounds, bicycle paths, sidewalks, and crosswalks.

PROMOTING A HEALTHY LIFESTYLE

Physicians and health care professionals should promote active healthy living within each family unit by:

- Serving as role models through the adoption of an active lifestyle.
- Inquiring about nutritional intake, calculating and plotting BMI, identifying obesity-related comorbidities, and promoting healthy eating as suggested by the AAP Committee on Nutrition.
- Documenting the number of hours per day spent on sedentary activities and limiting screen (television, video game, and computer) time according to AAP guidelines.
- Determining physical activity levels of the child and family members at regular health care visits.
- Tabulating the amount of physical activity the child or youth does each day at home, school, or child care as part of transportation, work, recreation, and unorganized sports, which should include determining the actual minutes of PE and recess-related physical activity achieved at school each week. In addition, the

number of times per week spent in outdoor play for at least 30 minutes and/or the number of daily steps achieved (monitored by using a pedometer) should be documented. Specific involvement in organized sports and dance also should be noted.

- Encouraging children and adolescents to be physically active for at least 60 minutes per day, which does not need to be acquired in a continuous fashion but rather may be accumulated by using smaller increments. Events should be of moderate intensity and include a wide variety of activities as part of sports, recreation, transportation, chores, work, planned exercise, and school-based PE classes. These activities should be primarily unstructured and fun if they are to achieve best compliance.
- Identifying any barriers the child, youth, or parent might have against increasing physical activity, which might include lack of time, competing interests, perceived lack of motor skills, and fear of injury on the part of the child. Parents might be additionally concerned about financial and safety issues. Efforts must then be made to work with the family to educate them regarding the importance of lifelong physical activity and to identify potential strategies to overcome some of their barriers.
- Recommending that parents become good role models by increasing their own level of physical activity. Parents should also incorporate physical activities that family members of all ages and abilities can do together. They should encourage children to play outside as much as possible. Safety should be promoted by the use of appropriate protective equipment (bicycle helmets, life jackets, etc).
- Advising parents to support their children and youth in developmentally and age-appropriate sports and recreational activities. The child's favorite types of physical activity should be a priority. These might best occur in the school setting during extracurricular activities, in which parents/grandparents can take part as leaders and coaches.
- Suggesting that overweight children partake in activities that take advantage of their tall stature and muscle strength, such as water-based sports and strength training, rather than those that require weight bearing (eg, jumping, jogging).
- Recommending that parents of overweight children and youth play a supporting, accepting, and encouraging role in returning them to healthier lifestyles to increase self-esteem.
- Encouraging youth to promote physical activities for their peers and become role models and leaders for younger students.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Additional Recommendations for Use of Tetanus Toxoid, Reduced-Content Diphtheria Toxoid, and Acellular Pertussis Vaccine (Tdap)

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS

Tdap vaccine, tetanus, diphtheria, pertussis, adolescents, adults, infants

ABBREVIATIONS

AAP—American Academy of Pediatrics
Tdap—tetanus toxoid, reduced-diphtheria toxoid, and reduced-content acellular pertussis vaccine
Td—tetanus and diphtheria toxoid vaccine
DTP—diphtheria and tetanus toxoids and whole-cell pertussis vaccine
DTaP—diphtheria-tetanus-acellular pertussis vaccine
CDC—Centers for Disease Control and Prevention
ACIP—Advisory Committee on Immunization Practices

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abstract

FREE

The American Academy of Pediatrics and the Centers for Disease Control and Prevention are amending previous recommendations and making additional recommendations for the use of tetanus toxoid, reduced-content diphtheria toxoid, and acellular pertussis vaccine (Tdap). Review of the results from clinical trials and other studies has revealed no excess reactogenicity when Tdap is given within a short interval after other tetanus- or diphtheria-containing toxoid products, and accrual of postmarketing adverse-events reports reveals an excellent safety record for Tdap. Thus, the recommendation for caution regarding Tdap use within any interval after a tetanus- or diphtheria-containing toxoid product is removed. Tdap should be given when it is indicated and when no contraindication exists. In further efforts to protect people who are susceptible to pertussis, the American Academy of Pediatrics and Centers for Disease Control and Prevention recommend a single dose of Tdap for children 7 through 10 years of age who were underimmunized with diphtheria-tetanus-acellular pertussis (DTaP). Also, the age for recommendation for Tdap is extended to those aged 65 years and older who have or are likely to have contact with an infant younger than 12 months (eg, health care personnel, grandparents, and other caregivers). *Pediatrics* 2011;128:809–812

INTRODUCTION

The American Academy of Pediatrics (AAP)[1] and the Centers for Disease Control and Prevention (CDC)[2] currently recommend a single dose of tetanus toxoid, reduced-diphtheria toxoid, and reduced-content acellular pertussis vaccine (Tdap) instead of tetanus and diphtheria toxoid vaccine (Td) for adolescents aged 11 through 18 years of age who have completed the recommended pediatric-formulation diphtheria and tetanus toxoids and whole-cell pertussis vaccine (DTP)/diphtheria-tetanus-acellular pertussis vaccine (DTaP) series in childhood; the adolescent dose of Tdap should preferably be given at a preventive care visit at 11 through 12 years of age. The CDC currently recommends a single dose of Tdap to replace a single decennial Td booster for adults 19 through 64 years of age who have not previously received Tdap and as soon as is feasible for health care providers who have direct patient contact.[2] Two Tdap vaccines are licensed in the United States—Boostrix (GlaxoSmithKline Biologicals, Research Triangle Park, NC), for persons 10 through 64 years of age, and Adacel (Sanofi Pasteur, Swiftwater, PA),

for persons 11 through 64 years of age. On October 27, 2010, the Advisory Committee on Immunization Practices (ACIP) of the CDC amended recommendations and made additional recommendations for use in those who have not received Tdap previously: (1) whenever indicated, regardless of interval since the last tetanus- or diphtheria-containing vaccine; (2) for children 7 through 10 years of age who did not receive the full recommended series of DTaP before 7 years of age; and (3) for certain adults aged 65 years and older. The CDC policy changes are published.[3]

The ACIP Pertussis Working Group, composed of liaison members from multiple organizations, including the AAP Committee on Infectious Diseases, reviewed published and unpublished data on Tdap immunogenicity and safety from vaccine trials and other relevant experiences in formulating its recommendations. The working group also considered the current epidemiology of pertussis, the need to protect vulnerable infants through encouragement and expansion of cocooning,[4,5] and data and expert opinion on barriers to receipt of Tdap. This vaccine policy statement expands previous AAP recommendations for Tdap[4] and will be incorporated into the 2012 *Red Book*.

No Minimum Interval Between Td and Tdap Is Necessary

At the time of licensure of Tdap in 2005, there were few data on the reactogenicity of Tdap after a short interval from another tetanus toxoid– or diphtheria toxoid–containing vaccine. Thus, Tdap was recommended with a minimum interval of 5 years for standard use, and an interval as short as 2 years was acceptable when potential risk of pertussis was high.

Confirming adult immunization status by review of immunization records or recall is difficult and is an important barrier to achieving the vaccine coverage needed for this group. Accumulating data demonstrate no increased risk of severe local reactions or serious adverse events for adolescents or adults who receive Tdap at short intervals after tetanus toxoid– or diphtheria toxoid–containing vaccines. Together, these findings support removal of any cautionary minimum interval regarding any tetanus toxoid– or diphtheria toxoid–containing vaccine when Tdap is indicated. Reports reviewed for safety of short intervals included Canadian children and adolescents with a DTP/DTaP/Td-to-Tdap interval as low as 2 years[6]; French adults 18 to 76 years of age with a Td/Td-inactivated polio vaccine (IPV)-to-Tdap/Td-IPV interval of 28 days to 2 years[7]; and health care personnel vaccinated in an institutional respiratory illness outbreak with tetanus toxoid (TT)- or Td-to-Tdap interval of less than 2 years.[8] The number of subjects in these studies is small; therefore, data do not exclude a significant but rare event. In addition, a postlicensure retrospective cohort study found that medically attended local reactions after Tdap were low (2.6 events per 10 000 Tdap vaccinations) and comparable with those after Td.[9] Since licensure, evidence on safety of Tdap in persons 10 through 64 years of age has been collected through the Vaccine Safety Datalink (VSD) and has revealed no association with several predetermined adverse neurologic events, including encephalopathy/encephalitis/meningitis, paralytic syndromes, seizure, cranial nerve disorder, or Guillain-Barré syndrome.[10] Postmarketing data from the Vaccine Adverse Events Reporting System (VAERS) 2 years after licensure also support the safety of Tdap.

Children 7 Through 10 Years of Age Who Were Not Fully Immunized With DTaP Should Be Given Tdap

At the time of recommendation of universal Tdap for adolescents,[1,2] the AAP and ACIP recommended that children 7 through 10 years of age with a history of incomplete childhood immunization with DTP/DTaP should be given Td to complete the tetanus and diphtheria toxoid series, because Tdap is not licensed in the United States for children younger than 10 years. Although data on immunogenicity of Tdap in undervaccinated or completely unvaccinated children 7 through 10 years of age are limited, 2 studies of use of Tdap in place of the fifth dose of DTaP have shown similar immunogenicity to DTaP.[11,12] Lower rates of local reactions also were reported after Tdap in place of the fifth DTaP.[11–13] If a child 7 through 10 years of age is not fully immunized against pertussis (ie, has not received 5 doses of DTP/DTaP or 4 doses when the fourth dose was administered after the fourth birthday) or has an unknown or uncertain immunization history, a single dose of Tdap should be given. Only 1 dose of Tdap is recommended at this time, because Tdap vaccines are not licensed for multiple doses. If further doses of Td-containing vaccine are required, they are given on a catch-up schedule. Although Tdap could be substituted for any 1 of the 3 doses, the preferred 3-dose schedule would be Tdap followed by Td at 4 weeks and 6 to 12 months. Either Tdap product (Boostrix or Adacel) can be used for the underimmunized child 7 through 10 years of age. At this time, it is recommended that children who receive Tdap at 7 through 10 years of age should not be given the usual adolescent Tdap dose at the 11- through 12-year visit but should be given a booster dose of Td 10 years after their last dose of Td-containing vaccine (Tdap or Td). At the present time, only 1 dose of Tdap should be administered. A repeat dose is not advised.

Certain Adults Aged 65 Years and Older Should be Given Tdap

The objective for vaccinating adults aged 65 years and older is to protect

them from pertussis and to improve the cocooning of young infants who are too young to be protected by the DTaP series and who are at substantial risk of severe disease, hospitalization, and death should they be exposed and infected with *Bordetella pertussis*. Multiple studies have found that family members and extended family members, including grandparents, are source cases for most infants with pertussis. In 1 study of more than 1000 children 0 through 3 years of age, 35% of the children were cared for by grandparent(s) at least during one 3-month period. Health care personnel also are at potential risk of acquiring and transmitting pertussis. Although Tdap vaccines are not licensed for persons 65 years and older, unpublished immunogenicity and safety data as well as Vaccine Adverse Events Reporting System data are supportive of the recommendation that persons 65 years and older in the high-risk setting of potential transmission to young infants should be given Tdap. On February 23, 2011, the ACIP made provisional recommendations that all health care personnel, regardless of age, receive a single dose of Tdap as soon as is feasible if they have not previously received Tdap and regardless of the time since the last dose of Td. At this time, the CDC does not recommend immunizing all persons aged 65 years and older. However, there are no contraindications to immunizing persons in this age group, and anyone desiring vaccine can be immunized.

RECOMMENDATIONS

Recommendations for changes in and additional uses of Tdap:

- There is no minimum interval required or advised between receipt of a tetanus toxoid– or diphtheria toxoid–containing vaccine and Tdap when Tdap is otherwise indicated.
- A single dose of Tdap should be given to children 7 through 10 years of age who have incomplete or unknown pertussis vaccine history. Additional vaccines may be required on the basis of a catch-up schedule.
- A single dose of Tdap should be given to adults of any age (including those aged 65 years or older) who have not received Tdap previously, who are health care personnel, or who have or anticipate having close contact with an infant younger than 12 months, such as grandparents and other caregivers.
- A single dose of Tdap may be given in place of Td to any person aged 65 years or older who has not received Tdap previously.

At the time of the ACIP vote on these changes in Tdap recommendations in October 2010, the Vaccines for Children Program advisors concurred with coverage of Tdap for use relevant to the program. Tdap is set forth in the Vaccine Injury Table for eligibility to receive compensation under the Vaccine Injury Compensation Act. Because Tdap is a "covered" vaccine, such eligibility extends to the added recommendations mentioned here (www.hrsa.gov/vaccinecompensation).

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

CLINICAL PRACTICE GUIDELINE

ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents

SUBCOMMITTEE ON ATTENTION-DEFICIT/HYPERACTIVITY DISORDER, STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT

KEY WORDS

attention-deficit/hyperactivity disorder, children, adolescents, preschool, behavioral therapy, medication

ABBREVIATIONS

AAP—American Academy of Pediatrics
ADHD—attention-deficit/hyperactivity disorder
DSM-PC—*Diagnostic and Statistical Manual for Primary Care*
CDC—Centers for Disease Control and Prevention
FDA—Food and Drug Administration
DSM-IV—*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*
MTA—Multimodal Therapy of ADHD

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All clinical practice guidelines from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

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abstract


Attention-deficit/hyperactivity disorder (ADHD) is the most common neurobehavioral disorder of childhood and can profoundly affect the academic achievement, well-being, and social interactions of children; the American Academy of Pediatrics first published clinical recommendations for the diagnosis and evaluation of ADHD in children in 2000; recommendations for treatment followed in 2001. *Pediatrics* 2011;128: 1007–1022

Summary of key action statements:

1. The primary care clinician should initiate an evaluation for ADHD for any child 4 through 18 years of age who presents with academic or behavioral problems and symptoms of inattention, hyperactivity, or impulsivity (quality of evidence B/strong recommendation).
2. To make a diagnosis of ADHD, the primary care clinician should determine that *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria have been met (including documentation of impairment in more than 1 major setting); information should be obtained primarily from reports from parents or guardians, teachers, and other school and mental health clinicians involved in the child's care. The primary care clinician should also rule out any alternative cause (quality of evidence B/strong recommendation).
3. In the evaluation of a child for ADHD, the primary care clinician should include assessment for other conditions that might coexist with ADHD, including emotional or behavioral (eg, anxiety, depressive, oppositional defiant, and conduct disorders), developmental (eg, learning and language disorders or other neurodevelopmental disorders), and physical (eg, tics, sleep apnea) conditions (quality of evidence B/strong recommendation).
4. The primary care clinician should recognize ADHD as a chronic condition and, therefore, consider children and adolescents with ADHD as children and youth with special health care needs. Management of children and youth with special health care needs should follow the principles of the chronic care model and the medical home (quality of evidence B/strong recommendation).

5. Recommendations for treatment of children and youth with ADHD vary depending on the patient's age:
   a. For *preschool-aged children (4–5 years of age)*, the primary care clinician should prescribe evidence-based parent- and/or teacher-administered behavior therapy as the first line of treatment (quality of evidence A/strong recommendation) and may prescribe methylphenidate if the behavior interventions do not provide significant improvement and there is moderate-to-severe continuing disturbance in the child's function. In areas where evidence-based behavioral treatments are not available, the clinician needs to weigh the risks of starting medication at an early age against the harm of delaying diagnosis and treatment (quality of evidence B/recommendation).
   b. For *elementary school–aged children (6–11 years of age)*, the primary care clinician should prescribe US Food and Drug Administration–approved medications for ADHD (quality of evidence A/strong recommendation) and/or evidence-based parent- and/or teacher-administered behavior therapy as treatment for ADHD, preferably both (quality of evidence B/strong recommendation). The evidence is particularly strong for stimulant medications and sufficient but less strong for atomoxetine, extended-release guanfacine, and extended-release clonidine (in that order) (quality of evidence A/strong recommendation). The school environment, program, or placement is a part of any treatment plan.
   c. For *adolescents (12–18 years of age)*, the primary care clinician should prescribe Food and Drug Administration–approved medications for ADHD with the assent of the adolescent (quality of evidence A/strong recommendation) and may prescribe behavior therapy as treatment for ADHD (quality of evidence C/recommendation), preferably both.
6. The primary care clinician should titrate doses of medication for ADHD to achieve maximum benefit with minimum adverse effects (quality of evidence B/strong recommendation).

INTRODUCTION

This document updates and replaces 2 previously published clinical guidelines from the American Academy of Pediatrics (AAP) on the diagnosis and treatment of attention-deficit/hyperactivity disorder (ADHD) in children: "Clinical Practice Guideline: Diagnosis and Evaluation of the Child With Attention-Deficit/Hyperactivity Disorder" (2000)[1] and "Clinical Practice Guideline: Treatment of the School-aged Child With Attention-Deficit/Hyperactivity Disorder" (2001).[2] Since these guidelines were published, new information and evidence regarding the diagnosis and treatment of ADHD has become available. Surveys conducted before and after the publication of the previous guidelines have also provided insight into pediatricians' attitudes and practices regarding ADHD. On the basis of an increased understanding regarding ADHD and the challenges it raises for children and families and as a source for clinicians seeking to diagnose and treat children, this guideline pays particular attention to a number of areas.

Expanded Age Range

The previous guidelines addressed diagnosis and treatment of ADHD in children 6 through 12 years of age. There is now emerging evidence to expand the age range of the recommendations to include preschool-aged children and adolescents. This guideline addresses the diagnosis and treatment of ADHD in children 4 through 18 years of age, and attention is brought to special circumstances or concerns in particular age groups when appropriate.

Expanded Scope

Behavioral interventions might help families of children with hyperactive/impulsive behaviors that do not meet full diagnostic criteria for ADHD. Guidance regarding the diagnosis of problem-level concerns in children based on the *Diagnostic and Statistical Manual for Primary Care* (DSM-PC), *Child and Adolescent Version*,[3] as well as suggestions for treatment and care of children and families with problem-level concerns, are provided here. The current DSM-PC was published in 1996 and, therefore, is not consistent with intervening changes to *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM). Although this version of the DSM-PC should not be used as a definitive source for diagnostic codes related to ADHD and comorbid conditions, it certainly may continue to be used as a resource for enriching the understanding of ADHD manifestations. The DSM-PC will be revised when both the DSM-V and ICD-10 are available for use.

A Process of Care for Diagnosis and Treatment

This guideline and process-of-care algorithm (see Supplemental Fig 2 and Supplemental Appendix) recognizes evaluation, diagnosis, and treatment as a continuous process and provides recommendations for both the guideline and the algorithm in this single publication. In addition to the formal recommendations for assessment, diagnosis, and treatment, this guideline

provides a single algorithm to guide the clinical process.

Integration With the Task Force on Mental Health

This guideline fits into the broader mission of the AAP Task Force on Mental Health and its efforts to provide a base from which primary care providers can develop alliances with families, work to prevent mental health conditions and identify them early, and collaborate with mental health clinicians.

The diagnosis and management of ADHD in children and youth has been particularly challenging for primary care clinicians because of the limited payment provided for what requires more time than most of the other conditions they typically address. The procedures recommended in this guideline necessitate spending more time with patients and families, developing a system of contacts with school and other personnel, and providing continuous, coordinated care, all of which is time demanding. In addition, relegating mental health conditions exclusively to mental health clinicians also is not a viable solution for many clinicians, because in many areas access to mental health clinicians to whom they can refer patients is limited. Access in many areas is also limited to psychologists when further assessment of cognitive issues is required and not available through the education system because of restrictions from third-party payers in paying for the evaluations on the basis of them being educational and not health related.

Cultural differences in the diagnosis and treatment of ADHD are an important issue, as they are for all pediatric conditions. Because the diagnosis and treatment of ADHD depends to a great extent on family and teacher perceptions, these issues might be even more prominent an issue for ADHD. Specific cultural issues are beyond the scope of this guideline but are important to consider.

METHODOLOGY

As with the 2 previously published clinical guidelines, the AAP collaborated with several organizations to develop a working subcommittee that represented a wide range of primary care and subspecialty groups. The subcommittee included primary care pediatricians, developmental-behavioral pediatricians, and representatives from the American Academy of Child and Adolescent Psychiatry, the Child Neurology Society, the Society for Pediatric Psychology, the National Association of School Psychologists, the Society for Developmental and Behavioral Pediatrics, the American Academy of Family Physicians, and Children and Adults With Attention-Deficit/Hyperactivity Disorder (CHADD), as well as an epidemiologist from the Centers for Disease Control and Prevention (CDC).

This group met over a 2-year period, during which it reviewed the changes in practice that have occurred and issues that have been identified since the previous guidelines were published. Delay in completing the process led to further conference calls and extended the years of literature reviewed in order to remain as current as possible. The AAP funded the development of this guideline; potential financial conflicts of the participants were identified and taken into consideration in the deliberations. The guideline will be reviewed and/or revised in 5 years unless new evidence emerges that warrants revision sooner.

The subcommittee developed a series of research questions to direct an extensive evidence-based review in partnership with the CDC and the University of Oklahoma Health Sciences Center. The diagnostic review was conducted by the CDC, and the evidence was evaluated in a combined effort of the AAP, CDC, and University of Oklahoma Health Sciences Center staff. The treatment-related evidence relied on a recent evidence review by the Agency for Healthcare Research and Quality and was supplemented by evidence identified through the CDC review.

The diagnostic issues were focused on 5 areas:

1. ADHD prevalence—specifically: (*a*) What percentage of the general US population aged 21 years or younger has ADHD? (*b*) What percentage of patients presenting at pediatricians' or family physicians' offices in the United States meet diagnostic criteria for ADHD?
2. Co-occurring mental disorders—of people with ADHD, what percentage has 1 or more of the following co-occurring conditions: sleep disorders, learning disabilities, depression, anxiety, conduct disorder, and oppositional defiant disorder?
3. What are the functional impairments of children and youth diagnosed with ADHD? Specifically, in what domains and to what degree do youth with ADHD demonstrate impairments in functional domains, including peer relations, academic performance, adaptive skills, and family functioning?
4. Do behavior rating scales remain the standard of care in assessing the diagnostic criteria for ADHD?
5. What is the prevalence of abnormal findings on selected medical screening tests commonly recommended as standard components of an evaluation of a child with suspected ADHD? How accurate are these tests in the diagnosis of ADHD compared with a reference standard (ie, what are the psychometric properties of these tests)?

The treatment issues were focused on 3 areas:

1. What new information is available

regarding the long-term efficacy and safety of medications approved by the US Food and Drug Administration (FDA) for the treatment of ADHD (stimulants and nonstimulants), and specifically, what information is available about the efficacy and safety of these medications in preschool-aged and adolescent patients?

2. What evidence is available about the long-term efficacy and safety of psychosocial interventions (behavioral modification) for the treatment of ADHD for children, and specifically, what information is available about the efficacy and safety of these interventions in preschool-aged and adolescent patients?
3. Are there any additional therapies that reach the level of consideration as evidence based?

Evidence-Review Process for Diagnosis

A multilevel, systematic approach was taken to identify the literature that built the evidence base for both diagnosis and treatment. To increase the likelihood that relevant articles were included in the final evidence base, the reviewers first conducted a scoping review of the literature by systematically searching literature using relevant key words and then summarized the primary findings of articles that met standard inclusion criteria. The reviewers then created evidence tables that were reviewed by content-area experts who were best able to identify articles that might have been missed through the scoping review. Articles that were missed were reviewed carefully to determine where the abstraction methodology failed, and adjustments to the search strategy were made as required (see technical report to be published). Finally, although published literature reviews did not contribute directly to the evidence base, the articles included in review articles were cross-referenced with the final evidence tables to ensure that all relevant articles were included in the final evidence tables.

For the scoping review, articles were abstracted in a stratified fashion from 3 article-retrieval systems that provided access to articles in the domains of medicine, psychology, and education: PubMed (www.ncbi.nlm.nih.gov/sites/entrez), PsycINFO (www.apa.org/pubs/databases/psycinfo/index.aspx), and ERIC (www.eric.ed.gov). English-language, peer-reviewed articles published between 1998 and 2009 were queried in the 3 search engines. Key words were selected with the intent of including all possible articles that might have been relevant to 1 or more of the questions of interest (see the technical report to be published). The primary abstraction included the following terms: "attention deficit hyperactivity disorder" or "attention deficit disorder" or "hyperkinesis" and "child." A second, independent abstraction was conducted to identify articles related to medical screening tests for ADHD. For this abstraction, the same search terms were used as in the previous procedure along with the additional condition term "behavioral problems" to allow for the inclusion of studies of youth that sought to diagnose ADHD by using medical screening tests. Abstractions were conducted in parallel fashion across each of the 3 databases; the results from each abstraction (complete reference, abstract, and key words) were exported and compiled into a common reference database using EndNote 10.0.[4] References were subsequently and systematically deduplicated by using the software's deduplication procedure. References for books, chapters, and theses were also deleted from the library. Once a deduplicated library was developed, the semifinal database of 8267 references was reviewed for inclusion on the basis of inclusion criteria listed in the technical report. Included articles were then pulled in their entirety, the inclusion criteria were reconfirmed, and then the study findings were summarized in evidence tables. The articles included in relevant review articles were revisited to ensure their inclusion in the final evidence base. The evidence tables were then presented to the committee for expert review.

Evidence-Review Process for Treatment

In addition to this systematic review, for treatment we used the review from the Agency for Healthcare Research and Quality (AHRQ) Effective Healthcare Program "Attention Deficit Hyperactivity Disorder: Effectiveness of Treatment in At-Risk Preschoolers; Long-term Effectiveness in All Ages; and Variability in Prevalence, Diagnosis, and Treatment."[5] This review addressed a number of key questions for the committee, including the efficacy of medications and behavioral interventions for preschoolers, children, and adolescents. Evidence identified through the systematic evidence review for diagnosis was also used as a secondary data source to supplement the evidence presented in the AHRQ report. The draft practice guidelines were developed by consensus of the committee regarding the evidence. It was decided to create 2 separate components. The guideline recommendations were based on clear characterization of the evidence. The second component is a practice-of-care algorithm (see Supplemental Fig 2) that provides considerably more detail about how to implement the guidelines but is, necessarily, based less on available evidence and more on consensus of the committee members. When data were lacking, particularly in the

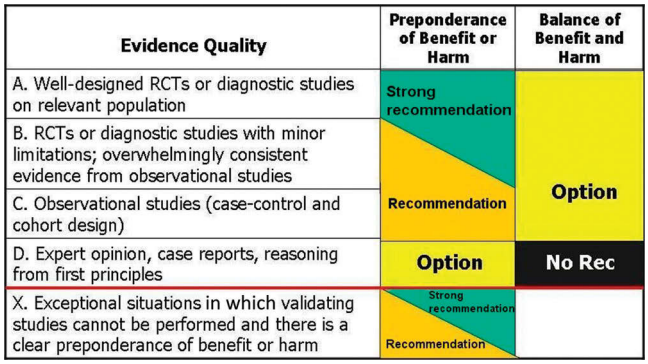

FIGURE 1

Integrating evidence-quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is conducted leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation. The evidence is discussed in more detail in a technical report that will follow in a later publication. RCT indicates randomized controlled trial; Rec, recommendation.

process-of-care algorithmic portion of the guidelines, a combination of evidence and expert consensus was used. Action statements labeled "strong recommendation" or "recommendation" were based on high- to moderate-quality scientific evidence and a preponderance of benefit over harm.[6] Option-level action statements were based on lesser-quality or limited data and expert consensus or high-quality evidence with a balance between benefits and harms. These clinical options are interventions that a reasonable health care provider might or might not wish to implement in his or her practice. The quality of evidence supporting each recommendation and the strength of each recommendation were assessed by the committee member most experienced in epidemiology and graded according to AAP policy (Fig 1).[6]

The guidelines and process-of-care algorithm underwent extensive peer review by committees, sections, councils, and task forces within the AAP; numerous outside organizations; and other individuals identified by the subcommittee. Liaisons to the subcommittee also were invited to distribute the draft to entities within their organizations. The resulting comments were compiled and reviewed by the chairperson, and relevant changes were incorporated into the draft, which was then reviewed by the full committee.

ABOUT THIS GUIDELINE

Key Action Statements

In light of the concerns highlighted previously and informed by the available evidence, the AAP has developed 6 action statements for the evaluation, diagnosis, and treatment of ADHD in children. These action statements provide for consistent and quality care for children and families with concerns about or symptoms that suggest attention disorders or problems.

Context

This guideline is intended to be integrated with the broader algorithms developed as part of the mission of the AAP Task Force on Mental Health.[7]

Implementation: A Process-of-Care Algorithm

The AAP recognizes the challenge of instituting practice changes and adopting new recommendations for care. To address the need, a process-of-care algorithm has been developed and has been used in the revision of the AAP ADHD toolkit.

Implementation: Preparing the Practice

Full implementation of the action statements described in this guideline and the process-of-care algorithm might require changes in office procedures and/or preparatory efforts to identify community resources. The section titled "Preparing the Practice" in the process-of-care algorithm and further information can be found in the supplement to the Task Force on Mental Health report.[7] It is important to document all aspects of the diagnostic and treatment procedures in the patients' records. Use of rating scales for the diagnosis of ADHD and assessment for comorbid conditions and as a method for monitoring treatment as described in the process algorithm (see Supplemental Fig 2), as well as information provided to parents such as management plans, can help facilitate a clinician's accurate documentation of his or her process.

Note

The AAP acknowledges that some primary care clinicians might not be confident of their ability to successfully diagnose and treat ADHD in a child because of the child's age, coexisting conditions, or other concerns. At any point at which a clinician feels that he or she is not adequately trained or is uncertain about making a diagnosis or continuing with treatment, a referral to a pediatric or mental health subspecialist should be made. If a diagnosis of ADHD or other condition is made by a subspecialist, the primary care clinician should develop a management strategy with the subspecialist that ensures that the child will continue to receive appropriate care consistent with a medical home model wherein the pediatrician part-

ners with parents so that both health and mental health needs are integrated.

KEY ACTION STATEMENTS FOR THE EVALUATION, DIAGNOSIS, TREATMENT, AND MONITORING OF ADHD IN CHILDREN AND ADOLESCENTS

Action statement 1: The primary care clinician should initiate an evaluation for ADHD for any child 4 through 18 years of age who presents with academic or behavioral problems and symptoms of inattention, hyperactivity, or impulsivity (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** In a considerable number of children, ADHD goes undiagnosed. Primary care clinicians' systematic identification of children with these problems will likely decrease the rate of undiagnosed and untreated ADHD in children.
- **Harms/risks/costs:** Children in whom ADHD is inappropriately diagnosed might be labeled inappropriately, or another condition might be missed, and they might receive treatments that will not benefit them.
- **Benefits-harms assessment:** The high prevalence of ADHD and limited mental health resources require primary care pediatricians to play a significant role in the care of their patients with ADHD so that children with this condition receive the appropriate diagnosis and treatment. Treatments available have shown good evidence of efficacy, and lack of treatment results in a risk for impaired outcomes.
- **Value judgments:** The committee considered the requirements for establishing the diagnosis, the prevalence of ADHD, and the efficacy and adverse effects of treatment as well as the long-term outcomes.
- **Role of patient preferences:** Success with treatment depends on patient and family preference, which has to be taken into account.
- **Exclusions:** None.
- **Intentional vagueness:** The limits between what can be handled by a primary care clinician and what should be referred to a subspecialist because of the varying degrees of skills among primary care clinicians.
- **Strength: strong recommendation.**

The basis for this recommendation is essentially unchanged from that in the previous guideline. ADHD is the most common neurobehavioral disorder in children and occurs in approximately 8% of children and youth[8–10]; the number of children with this condition is far greater than can be managed by the mental health system. There is now increased evidence that appropriate diagnosis can be provided for preschool-aged children[11] (4–5 years of age) and for adolescents.[12]

Action statement 2: To make a diagnosis of ADHD, the primary care clinician should determine that *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV-TR) criteria have been met (including documentation of impairment in more than 1 major setting), and information should be obtained primarily from reports from parents or guardians, teachers, and other school and mental health clinicians involved in the child's care. The primary care clinician should also rule out any alternative cause (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** The use of DSM-IV criteria has lead to more uniform categorization of the condition across professional disciplines.
- **Harms/risks/costs:** The DSM-IV system does not specifically provide for developmental-level differences and might lead to some misdiagnoses.
- **Benefits-harms assessment:** The benefits far outweigh the harm.
- **Value judgments:** The committee took into consideration the importance of coordination between pediatric and mental health services.
- **Role of patient preferences:** Although there is some stigma associated with mental disorder diagnoses resulting in some families preferring other diagnoses, the need for better clarity in diagnoses was felt to outweigh this preference.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

As with the findings in the previous guideline, the DSM-IV criteria continue to be the criteria best supported by evidence and consensus. Developed through several iterations by the American Psychiatric Association, the DSM-IV criteria were created through use of consensus and an expanding research foundation.[13] The DSM-IV system is used by professionals in psychiatry, psychology, health care systems, and primary care. Use of DSM-IV criteria, in addition to having the best evidence to date for criteria for ADHD, also affords the best method for communication across clinicians and is established with third-party payers. The criteria are under review for the development of the DSM-V, but these changes will not be available until at least 1 year after the publication of this current guideline. The diagnostic criteria have not changed since the previous guideline and are presented in Supplemental Table 2. An anticipated change in the DSM-V is increasing the age limit for when ADHD needs to have first presented from 7 to 12 years.[14]

Special Circumstances: Preschool-aged Children (4–5 Years Old)

There is evidence that the diagnostic criteria for ADHD can be applied to preschool-aged children; however, the subtypes detailed in the DSM-IV might not be valid for this population.[15–21] A review of the literature, including the multisite study of the efficacy of methylphenidate in preschool-aged children, revealed that the criteria could appropriately identify children with the condition.[11] However, there are added challenges in determining the presence of key symptoms. Preschool-aged children are not likely to have a separate observer if they do not attend a preschool or child care program, and even if they do attend, staff in those programs might be less qualified than certified teachers to provide accurate observations. Here, too, focused checklists can help physicians in the diagnostic evaluation, although only the Conners Comprehensive Behavior Rating Scales and the ADHD Rating Scale IV are DSM-IV–based scales that have been validated in preschool-aged children.[22]

When there are concerns about the availability or quality of nonparent observations of a child's behavior, physicians may recommend that parents complete a parent-training program before confirming an ADHD diagnosis for preschool-aged children and consider placement in a qualified preschool program if they have not done so already. Information can be obtained from parents and teachers through the use of validated DSM-IV–based ADHD rating scales. The parent-training program must include helping parents develop age-appropriate developmental expectations and specific management skills for problem behaviors. The clinician may obtain reports from the parenting class instructor about the parents' ability to manage their children, and if the children are in programs in which they are directly observed, instructors can report information about the core symptoms and function of the child directly. Qualified preschool programs include programs such as Head Start or other public prekindergarten programs. Preschool-aged children who display significant emotional or behavioral concerns might also qualify for Early Childhood Special Education services through their local school districts, and the evaluators for these programs and/or Early Childhood Special Education teachers might be excellent reporters of core symptoms.

Special Circumstances: Adolescents

Obtaining teacher reports for adolescents might be more challenging, because many adolescents will have multiple teachers. Likewise, parents might have less opportunity to observe their adolescent's behaviors than they had when their children were younger. Adolescents' reports of their own behaviors often differ from those of other observers, because they tend to minimize their own problematic behaviors.[23–25] Adolescents are less likely to exhibit overt hyperactive behavior. Despite the difficulties, clinicians need to try to obtain (with agreement from the adolescent) information from at least 2 teachers as well as information from other sources such as coaches, school guidance counselors, or leaders of community activities in which the adolescent participates. In addition, it is unusual for adolescents with behavioral/attention problems not to have been previously given a diagnosis of ADHD. Therefore, it is important to establish the younger manifestations of the condition that were missed and to strongly consider substance use, depression, and anxiety as alternative or co-occurring diagnoses. Adolescents with ADHD, especially when untreated, are at greater risk of substance abuse.[26] In addition, the risks of mood and anxiety disorders and risky sexual behaviors increase during adolescence.[12]

Special Circumstances: Inattention or Hyperactivity/Impulsivity (Problem Level)

Teachers, parents, and child health professionals typically encounter children with behaviors relating to activity level, impulsivity, and inattention who might not fully meet DSM-IV criteria. The DSM-PC[3] provides a guide to the more common behaviors seen in pediatrics. The manual describes common variations in behavior as well as more problematic behaviors at levels of less impairment than those specified in the DSM-IV.

The behavioral descriptions of the DSM-PC have not yet been tested in community studies to determine the prevalence or severity of developmental variations and problems in the areas of inattention, hyperactivity, or impulsivity. They do, however, provide guidance to clinicians regarding elements of treatment for children with problems with mild-to-moderate inattention, hyperactivity, or impulsivity. The DSM-PC also considers environmental influences on a child's behavior and provides information on differential diagnosis with a developmental perspective.

Action statement 3: In the evaluation of a child for ADHD, the primary care clinician should include assessment for other conditions that might coexist with ADHD, including emotional or behavioral (eg, anxiety, depressive, oppositional defiant, and conduct disorders), developmental (eg, learning and language disorders or other neurodevelopmental disorders), and physical (eg, tics, sleep apnea) conditions (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** Identifying coexisting conditions is important for developing the most appropriate treatment plan.
- **Harms/risks/costs:** The major risk is misdiagnosing the conditions and providing inappropriate care.
- **Benefits-harms assessment:** There is a preponderance of benefit over harm.
- **Value judgments:** The committee members took into consideration the common occurrence of coexisting conditions and the importance of addressing them in making this recommendation.
- **Role of patient preferences:** None.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

A variety of other behavioral, developmental, and physical conditions can coexist in children who are evaluated for ADHD. These conditions include, but are not limited to, learning problems, language disorder, disruptive behavior, anxiety, mood disorders, tic disorders, seizures, developmental coordination disorder, or sleep disorders.[23,24,27–38] In some cases, the presence of a coexisting condition will alter the treatment of ADHD. The primary care clinician might benefit from additional support and guidance or might need to refer a child with ADHD and coexisting conditions, such as severe mood or anxiety disorders, to subspecialists for assessment and management. The subspecialists could include child psychiatrists, developmental-behavioral pediatricians, neurodevelopmental disability physicians, child neurologists, or child or school psychologists.

Given the likelihood that another condition exists, primary care clinicians should conduct assessments that determine or at least identify the risk of coexisting conditions. Through its Task Force on Mental Health, the AAP has developed algorithms and a toolkit[39] for assessing and treating (or comanaging) the most common developmental disorders and mental health concerns in children. These resources might be useful in assessing children who are being evaluated for ADHD. Payment for evaluation and treatment must cover the fixed and variable costs of providing the services, as noted in the AAP policy statement "Scope of Health Care Benefits for Children From Birth Through Age 26.[40]

Special Circumstances: Adolescents

Clinicians should assess adolescent patients with newly diagnosed ADHD for symptoms and signs of substance abuse; when these signs and symptoms are found, evaluation and treatment for addiction should precede treatment for ADHD, if possible, or careful treatment for ADHD can begin if necessary.[25]

Action statement 4: The primary care clinician should recognize ADHD as a chronic condition and, therefore, consider children and adolescents with ADHD as children and youth with special health care needs. Management of children and youth with special health care needs should follow the principles of the chronic care model and the medical home (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** The recommendation describes the coordinated services most appropriate for managing the condition.
- **Harms/risks/costs:** Providing the services might be more costly.
- **Benefits-harms assessment:** There is a preponderance of benefit over harm.
- **Value judgments:** The committee members considered the value of medical home services when deciding to make this recommendation.
- **Role of patient preferences:** Family preference in how these services are provided is an important consideration.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

As in the previous guideline, this recommendation is based on the evidence that ADHD continues to cause symptoms and dysfunction in many children who have the condition over long periods of time, even into adulthood, and that the treatments available address symptoms and function but are usually not curative. Although the chronic illness model has not been specifically studied in children and youth with ADHD, it has been effective for other chronic conditions such as asthma,[23] and the medical home model has been accepted as the preferred standard of care.[41] The management process is also helped by encouraging strong family-school partnerships.[42]

Longitudinal studies have found that, frequently, treatments are not sustained despite the fact that long-term outcomes for children with ADHD indicate that they are at greater risk of significant problems if they discontinue treatment.[43] Because a number of parents of children with ADHD also have ADHD, extra support might be necessary to help those parents provide medication on a consistent basis and institute a consistent behavioral program. The medical home and chronic illness approach is provided in the process algorithm (Supplemental Fig 2). An important process in ongoing care is bidirectional communication with teachers and other school and mental health clinicians involved in the child's care as well as with parents and patients.

Special Circumstances: Inattention or Hyperactivity/Impulsivity (Problem Level)

Children with inattention or hyperactivity/impulsivity at the problem level (DSM-PC) and their families might also benefit from the same chronic illness and medical home principles.

Action statement 5: Recommendations for treatment of children and youth with ADHD vary depending on the patient's age.

Action statement 5a: For *preschool-aged children (4–5 years of age)*, the primary care clinician should prescribe evidence-based parent- and/or teacher-administered behavior therapy as the first line of treatment (quality of evidence A/strong recommendation) and may prescribe methylphenidate if the behavior interventions do not provide significant improvement and there is moderate-to-severe continuing disturbance in the child's function. In areas in which evidence-based behavioral treatments are not available, the clinician needs to weigh the risks of starting medication at an early age against the harm of delaying diagnosis and treatment (quality of evidence B/recommendation).

Evidence Profile

- **Aggregate evidence quality:** A for behavior; B for methylphenidate.
- **Benefits:** Both behavior therapy and methylphenidate have been demonstrated to reduce behaviors associated with ADHD and improve function.
- **Harms/risks/costs:** Both therapies increase the cost of care, and behavior therapy requires a higher level of family involvement, whereas methylphenidate has some potential adverse effects.
- **Benefits-harms assessment:** Given the risks of untreated ADHD, the benefits outweigh the risks.
- **Value judgments:** The committee members included the effects of untreated ADHD when deciding to make this recommendation.
- **Role of patient preferences:** Family preference is essential in determining the treatment plan.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

Action statement 5b: For *elementary school-aged children (6–11 years of age)*, the primary care clinician should prescribe FDA-approved medications for ADHD (quality of evidence A/strong recommendation) and/or evidence-based parent- and/or teacher-administered behavior therapy as treatment for ADHD, preferably both (quality of evidence B/strong recommendation). The evidence is particularly strong for stimulant medications and sufficient but less strong for atomoxetine, extended-release guanfacine, and extended-release clonidine (in that order) (quality of evidence A/strong recommendation). The school environment, program, or placement is a part of any treatment plan.

Evidence Profile

- **Aggregate evidence quality:** A for treatment with FDA-approved medications; B for behavior therapy.
- **Benefits:** Both behavior therapy and FDA-approved medications have been demonstrated to reduce behaviors associated with ADHD and improve function.
- **Harms/risks/costs:** Both therapies increase the cost of care, and behavior therapy requires a higher level of family involvement, whereas FDA-approved medications have some potential adverse effects.
- **Benefits-harms assessment:** Given the risks of untreated ADHD, the benefits outweigh the risks.
- **Value judgments:** The committee members included the effects of untreated ADHD when deciding to make this recommendation.
- **Role of patient preferences:** Family preference, including patient preference, is essential in determining the treatment plan.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

Action statement 5c: For *adolescents (12–18 years of age)*, the primary care clinician should prescribe FDA-approved medications for ADHD with the assent of the adolescent (quality of evidence A/strong recommendation) and may prescribe behavior therapy as treatment for ADHD (quality of evidence C/recommendation), preferably both.

Evidence Profile

- **Aggregate evidence quality:** A for medications; C for behavior therapy.
- **Benefits:** Both behavior therapy and FDA-approved medications have been demonstrated to reduce behaviors associated with ADHD and improve function.
- **Harms/risks/costs:** Both therapies increase the cost of care, and behavior therapy requires a higher level of family involvement, whereas FDA-approved medications have some potential adverse effects.
- **Benefits-harms assessment:** Given the risks of untreated ADHD, the benefits outweigh the risks.
- **Value judgments:** The committee members included the effects of untreated ADHD when deciding to make this recommendation.
- **Role of patient preferences:** Family preference, including patient preference, is essential in determining the treatment plan.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation/ recommendation.**

Medication

Similar to the recommendations from the previous guideline, stimulant medications are highly effective for most children in reducing core symptoms of ADHD.[44] One selective norepinephrine-reuptake inhibitor (atomoxetine[45,46]) and 2 selective α_2-adrenergic agonists (extended-release guanfacine[47,48] and extended-release clonidine[49]) have also demonstrated efficacy in reducing core symptoms. Because norepinephrine-reuptake inhibitors and α_2-adrenergic agonists are newer, the evidence base that supports them—although adequate for FDA approval—is considerably smaller than that for stimulants. None of them have been approved for use in preschool-aged children. Compared with stimulant medications that have an effect size [effect size = (treatment mean − control mean)/control SD] of approximately 1.0,[50] the effects of the nonstimulants are slightly weaker; atomoxetine has an effect size of approximately 0.7, and extended-release guanfacine and extended-release clonidine also have effect sizes of approximately 0.7.

The accompanying process-of-care algorithm provides a list of the currently available FDA-approved medications for ADHD (Supplemental Table 3). Characteristics of each medication are provided to help guide the clinician's choice in prescribing medication.

As was identified in the previous guideline, the most common stimulant adverse effects are appetite loss, abdominal pain, headaches, and sleep disturbance. The results of the Multimodal Therapy of ADHD (MTA) study revealed a more persistent effect of stimulants on decreasing growth velocity than have most previous studies, particularly when children were on higher and more consistently administered doses. The effects diminished by the third year of treatment, but no compensatory rebound effects were found.[51] However, diminished growth was in the range of 1 to 2 cm. An uncommon additional significant adverse effect of stimulants is the occurrence of hallucinations and other psychotic symptoms.[52] Although concerns have been raised about the rare occurrence of sudden cardiac death among children using stimulant medications,[53] sudden death in children on stimulant medication is extremely rare, and evidence is conflicting as to whether stimulant medications increase the risk of sudden death.[54–56] It is important to expand the history to include specific cardiac symptoms, Wolf-Parkinson-White syndrome, sudden death in the family, hypertrophic cardiomyopathy, and long QT syndrome. Preschool-aged children might experience increased mood lability and dysphoria.[57] For the nonstimulant atomoxetine, the adverse effects include initial somnolence and gastrointestinal tract symptoms, particularly if the dosage is increased too rapidly; decrease in appetite; increase in suicidal thoughts (less common); and hepatitis (rare). For the nonstimulant α_2-adrenergic agonists extended-release guanfacine and extended-release clonidine, adverse effects include somnolence and dry mouth.

Only 2 medications have evidence to support their use as adjunctive therapy with stimulant medications sufficient to achieve FDA approval: extended-release guanfacine[26] and extended-release clonidine. Other medications have been used in combination off-label, but there is currently only anecdotal evidence for their safety or efficacy, so their use cannot be recommended at this time.

Special Circumstances: Preschool-aged Children

A number of special circumstances support the recommendation to initiate ADHD treatment in preschool-aged children (ages 4–5 years) with behavioral therapy alone first.[57] These circumstances include:

- The multisite study of methylphenidate[57] was limited to preschool-aged children who had moderate-to-severe dysfunction.
- The study also found that many children (ages 4–5 years) experience improvements in symptoms with behavior therapy alone, and the overall evidence for behavior therapy in preschool-aged children is strong.
- Behavioral programs for children 4 to 5 years of age typically run in the form of group parent-training programs and, although not always compensated by health insurance, have a lower cost. The process algorithm (see Supplemental pages s15-16) contains criteria for the clinician to use in assessing the quality of the behavioral therapy. In addition, programs such as Head Start and Children and Adults With Attention Deficit Hyperactivity Disorder (CHADD) (www.chadd.org) might provide some behavioral supports.

Many young children with ADHD might still require medication to achieve maximum improvement, and medication is not contraindicated for children 4 through 5 years of age. However, only 1 multisite study has carefully assessed medication use in preschool-aged children. Other considerations in the recommendation about treating children 4 to 5 years of age with stimulant medications include:

- The study was limited to preschool-aged children who had moderate-to-severe dysfunction.
- Research has found that a number of young children (4–5 years of age) experience improvements in symptoms with behavior therapy alone.
- There are concerns about the possi-

ble effects on growth during this rapid growth period of preschool-aged children.

- There has been limited information about and experience with the effects of stimulant medication in children between the ages of 4 and 5 years.

Here, the criteria for enrollment (and, therefore, medication use) included measures of severity that distinguished treated children from the larger group of preschool-aged children with ADHD. Thus, before initiating medications, the physician should assess the severity of the child's ADHD. Given current data, only those preschool-aged children with ADHD who have moderate-to-severe dysfunction should be considered for medication. Criteria for this level of severity, based on the multisite-study results,[57] are (1) symptoms that have persisted for at least 9 months, (2) dysfunction that is manifested in both the home and other settings such as preschool or child care, and (3) dysfunction that has not responded adequately to behavior therapy. The decision to consider initiating medication at this age depends in part on the clinician's assessment of the estimated developmental impairment, safety risks, or consequences for school or social participation that could ensue if medications are not initiated. It is often helpful to consult with a mental health specialist who has had specific experience with preschool-aged children if possible.

Dextroamphetamine is the only medication approved by the FDA for use in children younger than 6 years of age. This approval, however, was based on less stringent criteria in force when the medication was approved rather than on empirical evidence of its safety and efficacy in this age group. Most of the evidence for the safety and efficacy of treating preschool-aged children with stimulant medications has been from methylphenidate.[57] Methylphenidate evidence consists of 1 multisite study of 165 children and 10 other smaller single-site studies that included from 11 to 59 children (total of 269 children); 7 of the 10 single-site studies found significant efficacy. It must be noted that although there is moderate evidence that methylphenidate is safe and efficacious in preschool-aged children, its use in this age group remains off-label. Although the use of dextroamphetamine is on-label, the insufficient evidence for its safety and efficacy in this age group does not make it possible to recommend at this time.

If children do not experience adequate symptom improvement with behavior therapy, medication can be prescribed, as described previously. Evidence suggests that the rate of metabolizing stimulant medication is slower in children 4 through 5 years of age, so they should be given a lower dose to start, and the dose can be increased in smaller increments. Maximum doses have not been adequately studied.[57]

Special Circumstances: Adolescents

As noted previously, before beginning medication treatment for adolescents with newly diagnosed ADHD, clinicians should assess these patients for symptoms of substance abuse. When substance use is identified, assessment when off the abusive substances should precede treatment for ADHD (see the Task Force on Mental Health report[7]). Diversion of ADHD medication (use for other than its intended medical purposes) is also a special concern among adolescents[58]; clinicians should monitor symptoms and prescription-refill requests for signs of misuse or diversion of ADHD medication and consider prescribing medications with no abuse potential, such as atomoxetine (Strattera [Ely Lilly Co, Indianapolis, IN]) and extended-release guanfacine (Intuniv [Shire US Inc, Wayne, PA]) or extended-release clonidine (Kapvay [Shionogi Inc, Florham Park, NJ]) (which are not stimulants) or stimulant medications with less abuse potential, such as lisdexamfetamine (Vyvanse [Shire US Inc]), dermal methylphenidate (Daytrana [Noven Therapeutics, LLC, Miami, FL]), or OROS methylphenidate (Concerta [Janssen Pharmaceuticals, Inc, Titusville, NJ]). Because lisdexamfetamine is dextroamphetamine, which contains an additional lysine molecule, it is only activated after ingestion, when it is metabolized by erythrocyte cells to dexamphetamine. The other preparations make extraction of the stimulant medication more difficult.

Given the inherent risks of driving by adolescents with ADHD, special concern should be taken to provide medication coverage for symptom control while driving. Longer-acting or late-afternoon, short-acting medications might be helpful in this regard.[59]

Special Circumstances: Inattention or Hyperactivity/Impulsivity (Problem Level)

Medication is not appropriate for children whose symptoms do not meet DSM-IV criteria for diagnosis of ADHD, although behavior therapy does not require a specific diagnosis, and many of the efficacy studies have included children without specific mental behavioral disorders.

Behavior Therapy

Behavior therapy represents a broad set of specific interventions that have a common goal of modifying the physical and social environment to alter or change behavior. Behavior therapy usually is implemented by training parents in specific techniques that improve their abilities to modify and

TABLE 1 Evidence-Based Behavioral Treatments for ADHD

Intervention Type	Description	Typical Outcome(s)	Median Effect Size[a]
Behavioral parent training (BPT)	Behavior-modification principles provided to parents for implementation in home settings	Improved compliance with parental commands; improved parental understanding of behavioral principles; high levels of parental satisfaction with treatment	0.55
Behavioral classroom management	Behavior-modification principles provided to teachers for implementation in classroom settings	Improved attention to instruction; improved compliance with classroom rules; decreased disruptive behavior; improved work productivity	0.61
Behavioral peer interventions (BPI)[b]	Interventions focused on peer interactions/relationships; these are often group-based interventions provided weekly and include clinic-based social-skills training used either alone or concurrently with behavioral parent training and/or medication	Office-based interventions have produced minimal effects; interventions have been of questionable social validity; some studies of BPI combined with clinic-based BPT found positive effects on parent ratings of ADHD symptoms; no differences on social functioning or parent ratings of social behavior have been revealed	

[a] Effect size = (treatment median − control median)/control SD.

[b] The effect size for behavioral peer interventions is not reported, because the effect sizes for these studies represent outcomes associated with combined interventions. A lower effect size means that they have less of an effect. The effect sizes found are considered moderate.

Adapted from Pelham W, Fabiano GA. *J Clin Child Adolesc Psychol.* 2008;37(1):184–214.

shape their child's behavior and to improve the child's ability to regulate his or her own behavior. The training involves techniques to more effectively provide rewards when their child demonstrates the desired behavior (eg, positive reinforcement), learn what behaviors can be reduced or eliminated by using planned ignoring as an active strategy (or using praising and ignoring in combination), or provide appropriate consequences or punishments when their child fails to meet the goals (eg, punishment). There is a need to consistently apply rewards and consequences as tasks are achieved and then to gradually increase the expectations for each task as they are mastered to shape behaviors. Although behavior therapy shares a set of principles, individual programs introduce different techniques and strategies to achieve the same ends.

Table 1 lists the major behavioral intervention approaches that have been demonstrated to be evidence based for the management of ADHD in 3 different types of settings. The table is based on 22 studies, each completed between 1997 and 2006.

Evidence for the effectiveness of behavior therapy in children with ADHD is derived from a variety of studies[60–62] and an Agency for Healthcare Research and Quality review.[5] The diversity of interventions and outcome measures makes meta-analysis of the effects of behavior therapy alone or in association with medications challenging. The long-term positive effects of behavior therapy have yet to be determined. Ongoing adherence to a behavior program might be important; therefore, implementing a chronic care model for child health might contribute to the long-term effects.[63]

Study results have indicated positive effects of behavior therapy when combined with medications. Most studies that compared behavior therapy to stimulants found a much stronger effect on ADHD core symptoms from stimulants than from behavior therapy. The MTA study found that combined treatment (behavior therapy and stimulant medication) was not significantly more efficacious than treatment with medication alone for the core symptoms of ADHD after correction for multiple tests in the primary analysis.[64] However, a secondary analysis of a combined measure of parent and teacher ratings of ADHD symptoms revealed a significant advantage for the combination with a small effect size of $d = 0.26$.[65] However, the same study also found that the combined treatment compared with medication alone did offer greater improvements on academic and conduct measures when ADHD coexisted with anxiety and when children lived in low socioeconomic environments. In addition, parents and teachers of children who were receiving combined therapy were significantly more satisfied with the treatment plan. Finally, the combination of medication management and behavior therapy allowed for the use of lower dosages of stimulants, which possibly reduced the risk of adverse effects.[66]

School Programming and Supports

Behavior therapy programs coordinating efforts at school as well as home might enhance the effects. School programs can provide classroom adaptations, such as preferred seating, modified work assignments, and test modifications (to the location at which it is administered and time allotted for taking the test), as well as behavior plans as part of a 504 Rehabilitation Act Plan or special education Individualized Education Program (IEP) under the "other health impairment" designation as part of the Individuals With

Disability Education Act (IDEA).[67] It is helpful for clinicians to be aware of the eligibility criteria in their state and school district to advise families of their options. Youths documented to have ADHD can also get permission to take college-readiness tests in an untimed manner by following appropriate documentation guidelines.[68]

The effect of coexisting conditions on ADHD treatment is variable. In some cases, treatment of the ADHD resolves the coexisting condition. For example, treatment of ADHD might resolve oppositional defiant disorder or anxiety.[68] However, sometimes the co-occurring condition might require treatment that is in addition to the treatment for ADHD. Some coexisting conditions can be treated in the primary care setting, but others will require referral and comanagement with a subspecialist.

Action statement 6: Primary care clinicians should titrate doses of medication for ADHD to achieve maximum benefit with minimum adverse effects (quality of evidence B/strong recommendation).

Evidence Profile

- **Aggregate evidence quality:** B.
- **Benefits:** The optimal dose of medication is required to reduce core symptoms to or as close to the levels of children without ADHD.
- **Harms/risks/costs:** Higher levels of medication increase the chances of adverse effects.
- **Benefits-harms assessment:** The importance of adequately treating ADHD outweighs the risk of adverse effects.
- **Value judgments:** The committee members included the effects of untreated ADHD when deciding to make this recommendation.
- **Role of patient preferences:** The families' preferences and comfort need to be taken into consideration in developing a titration plan.
- **Exclusions:** None.
- **Intentional vagueness:** None.
- **Strength: strong recommendation.**

The findings from the MTA study suggested that more than 70% of children and youth with ADHD respond to one of the stimulant medications at an optimal dose when a systematic trial is used.[65] Children in the MTA who were treated in the community with care as usual from whomever they chose or to whom they had access received lower doses of stimulants with less frequent monitoring and had less optimal results.[65] Because stimulants might produce positive but suboptimal effects at a low dose in some children and youth, titration to maximum doses that control symptoms without adverse effects is recommended instead of titration strictly on a milligram-per-kilogram basis.

Education of parents is an important component in the chronic illness model to ensure their cooperation in efforts to reach appropriate titration (remembering that the parents themselves might be challenged significantly by ADHD).[69,70] The primary care clinician should alert parents and children that changing medication dose and occasionally changing a medication might be necessary for optimal medication management, that the process might require a few months to achieve optimal success, and that medication efficacy should be systematically monitored at regular intervals.

Because stimulant medication effects are seen immediately, trials of different doses of stimulants can be accomplished in a relatively short time period. Stimulant medications can be effectively titrated on a 3- to 7-day basis.[65]

It is important to note that by the 3-year follow-up of 14-month MTA interventions (optimal medications management, optimal behavioral management, the combination of the 2, or community treatment), all differences among the initial 4 groups were no longer present. After the initial 14-month intervention, the children no longer received the careful monthly monitoring provided by the study and went back to receiving care from their community providers. Their medications and doses varied, and a number of them were no longer taking medication. In children still on medication, the growth deceleration was only seen for the first 2 years and was in the range of 1 to 2 cm.

CONCLUSION

Evidence continues to be fairly clear with regard to the legitimacy of the diagnosis of ADHD and the appropriate diagnostic criteria and procedures required to establish a diagnosis, identify co-occurring conditions, and treat effectively with both behavioral and pharmacologic interventions. However, the steps required to sustain appropriate treatments and achieve successful long-term outcomes still remain a challenge. To provide more detailed information about how the recommendations of this guideline can be accomplished, a more detailed but less strongly evidence-based algorithm is provided as a companion article.

AREAS FOR FUTURE RESEARCH

Some specific research topics pertinent to the diagnosis and treatment of ADHD or developmental variations or problems in children and adolescents in primary care to be explored include:

- identification or development of reliable instruments suitable to use in primary care to assess the nature or degree of functional impairment in children/adolescents with ADHD and monitor improvement over time;
- study of medications and other therapies used clinically but not approved by the FDA for ADHD, such as

electroencephalographic biofeedback;

- determination of the optimal schedule for monitoring children/adolescents with ADHD, including factors for adjusting that schedule according to age, symptom severity, and progress reports;
- evaluation of the effectiveness of various school-based interventions;
- comparisons of medication use and effectiveness in different ages, including both harms and benefits;
- development of methods to involve parents and children/adolescents in their own care and improve adherence to both behavior and medication treatments;
- standardized and documented tools that will help primary care providers in identifying coexisting conditions;
- development and determination of effective electronic and Web-based systems to help gather information to diagnose and monitor children with ADHD;
- improved systems of communication with schools and mental health professionals, as well as other community agencies, to provide effective collaborative care;
- evidence for optimal monitoring by some aspects of severity, disability, or impairment; and
- long-term outcomes of children first identified with ADHD as preschool-aged children.

SUBCOMMITTEE ON ATTENTION DEFICIT HYPERACTIVITY DISORDER (OVERSIGHT BY THE STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT, 2005–2011)

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

David G. Jaimovich, MD, and the Committee on Hospital Care and Section on Critical Care

Admission and Discharge Guidelines for the Pediatric Patient Requiring Intermediate Care

ABSTRACT. During the past 3 decades, the specialty of pediatric critical care medicine has grown rapidly, leading to a number of pediatric intensive care units opening across the country. Many patients who are admitted to the hospital require a higher level of care than routine inpatient general pediatric care, yet not to the degree of intensity of pediatric critical care; therefore, an intermediate care level has been developed in institutions providing multidisciplinary subspecialty pediatric care. These patients may require frequent monitoring of vital signs and nursing interventions, but usually they do not require invasive monitoring. The admission of the pediatric intermediate care patient is guided by physiologic parameters depending on the respective organ system involved relative to an institution's resources and capacity to care for a patient in a general care environment. This report provides admission and discharge guidelines for intermediate pediatric care. Intermediate care promotes greater flexibility in patient triage and provides a cost-effective alternative to admission to a pediatric intensive care unit. This level of care may enhance the efficiency of care and make health care more affordable for patients receiving intermediate care. ***Pediatrics*** **2004; 113:1430–1433;** ***coordination of care, admission, discharge, multidisciplinary, intermediate care.***

The purpose of this statement is to provide lists of criteria that may be incorporated into multidisciplinary guidelines for the admission and discharge of children requiring intermediate care. Because of the continuous and rapidly changing developments in critical care pediatrics, these criteria may require periodic revision. Equally important, because of significant differences in personnel, facilities, and diagnostic and treatment capabilities from hospital to hospital, no single set of criteria will apply to every institution providing intermediate care.

Intermediate care is provided in acute care hospitals to a patient population with a severity of illness that does not require intensive care but does require greater services than those provided by routine inpatient general pediatric care. These patients may require frequent monitoring of vital signs and/or nursing interventions but usually will not require invasive monitoring. The development of intermediate care services has been proposed as an appropriate means to enhance resource utilization for intermediately ill patients.[1–4] In light of the recent emphasis on cost containment, intermediate care promotes flexibility in patient triage, provides pediatric patients with monitoring and therapies tailored to their severity of illness, and may be a cost-effective alternative to admission to a pediatric intensive care unit. Patients with a low risk of, but potential for, significant deterioration and who are admitted for routine monitoring are excellent candidates for intermediate care.

Intermediate care is ideally provided in facilities that have a pediatric intensive care unit.[5] However, these resources may not be widely available, particularly in geographically remote regions, where tertiary pediatric centers may be several hours and hundreds of miles away. Therefore, this statement is also intended to provide guidance for the care of children requiring intermediate care in hospitals without a pediatric intensive care unit. These hospitals should ensure that the resources, facilities, and personnel needed to provide care beyond the level of a general pediatric medical-surgical unit are available; furthermore, they should have the ability to immediately stabilize a child who becomes critically ill. In addition, these hospitals should identify facilities with pediatric intensive care units to which patients can be transferred if their condition worsens.[6] Established transfer policies with these facilities can ensure timely and effective transition of care for these patients.

In a hospital that has a pediatric intensive care unit, these intermediate care admission and discharge guidelines should be compatible with the admission and discharge guidelines for the hospital's pediatric intensive care unit.[6] This statement provides a framework for individual hospitals to establish admission and discharge criteria for intermediate pediatric care. It is intended that these guidelines be modified by individual institutions, depending on the availability of resources, personnel, and equipment necessary to evaluate and treat a seriously ill child.

Physiologic parameters may be added to these guidelines according to individual patient care unit and institutional policies so that triage may be pro-

The recommendations in this report do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

vided appropriately into and out of intermediate care. These criteria will need to be studied in relation to outcomes over the next several years, such as is done for pediatric intensive care units nationwide. Until that time these criteria, based on expert opinion, may assist hospitals and physicians in creating a safe environment for children with a higher intensity of service needs.

GUIDELINES FOR THE PATIENT REQUIRING INTERMEDIATE CARE

I. Respiratory Diseases

Patients with moderate pulmonary or airway disease requiring multidisciplinary intervention and frequent monitoring, including but not limited to the following, may be admitted:

A. Patients with the potential need for endotracheal intubation.
B. Patients requiring minimal support with mechanical ventilation delivered by mature and stable tracheostomy. This would apply primarily to children with chronic respiratory insufficiency.
C. Patients with progressive pulmonary (lower or upper airway) disease of moderate severity with risk of progression to respiratory failure or with obstruction potential.
D. Patients acutely requiring supplemental oxygen (fraction of inspired oxygen ≥ 0.5), regardless of cause.
E. Stable tracheotomy patients.
F. Patients requiring frequent (at intervals <2 hours), intermittent, or continuous nebulized medications (according to institutional guidelines).
G. Patients requiring apnea work-up and cardiorespiratory monitoring.

II. Cardiovascular Diseases

Patients with moderate cardiovascular disease requiring multidisciplinary intervention and frequent monitoring, including but not limited to the following, may be admitted:

A. Patients with non–life-threatening dysrhythmias with or without the need for cardioversion.
B. Patients with non–life-threatening cardiac disease requiring low-dose intravenous inotropic or vasodilator therapy.
C. Patients undergoing high-risk cardiac procedures who require close monitoring and who do not have hemodynamic or respiratory compromise.
D. Patients who have undergone closed-heart cardiovascular and intrathoracic surgical procedures, including patent ductus-arteriosis repair, vascular shunts, permanent pacemaker placement, and open thoracotomy who do not have hemodynamic or respiratory compromise.

III. Neurologic Diseases

Patients with non–life-threatening neurologic disease requiring multidisciplinary intervention, frequent monitoring, and neurologic assessment not more than every 2 hours, including but not limited to the following, may be admitted:

A. Patients with seizures who are responsive to therapy but require continuous cardiorespiratory monitoring and who do not have hemodynamic compromise but have the potential for respiratory compromise.
B. Patients with altered sensorium in whom neurologic deterioration or depression is unlikely and neurologic assessment is required.
C. Postoperative neurosurgical patients requiring cardiorespiratory monitoring.
D. Patients with acute inflammation or infections of the central nervous system without neurologic deficiency or other complications.
E. Patients with head trauma without progressive neurologic signs or symptoms.
F. Patients with progressive neuromuscular dysfunction without altered sensorium requiring cardiorespiratory monitoring.

IV. Hematologic/Oncologic Diseases

Patients with potentially unstable hematologic or oncologic disease or non–life-threatening bleeding requiring multidisciplinary intervention and frequent monitoring, including but not limited to the following, may be admitted:

A. Patients with severe anemia without hemodynamic or respiratory compromise.
B. Patients with moderate complications of sickle cell crisis, such as respiratory distress, without acute chest syndrome.
C. Patients with thrombocytopenia, anemia, neutropenia, or solid tumor who are at risk of cardiopulmonary compromise but who are currently stable and, as a result, require close cardiorespiratory monitoring.

V. Endocrine/Metabolic Diseases

Patients with potentially unstable endocrine or metabolic disease requiring multidisciplinary intervention and frequent monitoring, including but not limited to the following, may be admitted:

A. Patients with moderate diabetic ketoacidosis (blood glucose concentration <500 mg/dL or pH ≥ 7.2) requiring continuous insulin infusion therapy without altered sensorium.
B. Patients with other moderate electrolyte and/or metabolic abnormalities (requiring cardiac monitoring and therapeutic intervention), such as:
   1. Hypokalemia (blood potassium concentration <2.0 mEq) and hyperkalemia (blood potassium concentration >6.0 mEq)
   2. Hyponatremia and hypernatremia with alterations in clinical status (ie, seizures or altered mental status)
   3. Hypocalcemia or hypercalcemia.
   4. Hypoglycemia or hyperglycemia.
   5. Moderate metabolic acidosis requiring bicarbonate infusion.
C. Patients with inborn errors of metabolism requiring cardiorespiratory monitoring.

VI. Gastrointestinal Diseases

Patients with potentially unstable gastrointestinal disease requiring multidisciplinary intervention and frequent monitoring, including but not limited to the following, may be admitted:

A. Patients with acute gastrointestinal bleeding but who do not have hemodynamic or respiratory instability.
B. Patients with a gastrointestinal foreign body or other gastrointestinal problem requiring emergency endoscopy but who do not have cardiorespiratory compromise.
C. Patients who have chronic gastrointestinal or hepatobiliary insufficiency but do not have coma, hemodynamic, or respiratory instability.

VII. Surgery

All patients requiring multidisciplinary intervention and frequent monitoring who have undergone surgical procedures but who do not have hemodynamic or respiratory instability, including but not limited to the following, may be admitted:

A. Patients who have undergone cardiovascular surgery.
B. Patients who have undergone thoracic surgery.
C. Patients who have undergone neurosurgical procedures.
D. Patients who have undergone upper or lower airway surgery.
E. Patients who have undergone craniofacial surgery.
F. Patients who have had thoracic or abdominal trauma.
G. Patients being treated for multiple traumatic injuries.

VIII. Renal Diseases

Patients with potentially unstable renal disease requiring multidisciplinary intervention and frequent monitoring, including but not limited to the following, may be admitted:

A. Patients with hypertension without seizures, encephalopathy, or other symptoms, but who require frequent intermittent therapeutic intravenous or orally administered medication.
B. Patients with noncomplicated nephrotic syndrome (regardless of cause) with chronic hypertension requiring frequent blood pressure monitoring.
C. Patients with renal failure, regardless of cause.
D. Patients requiring chronic hemodialysis or peritoneal dialysis.

IX. Multisystem and Other Diseases

Patients with potentially unstable multisystem disease requiring multidisciplinary intervention and frequent monitoring, including but not limited to the following, may be admitted:

A. Patients requiring the application of special technologic needs, including:
   1. Use of respiratory assistance, such as continuous positive airway pressure, bilevel positive airway pressure, or chronic home ventilation.
   2. Tracheostomy care requiring frequent pulmonary hygiene and suctioning.
   3. Pleural or pericardial drains after initial stabilization (for patients who do not have respiratory or hemodynamic compromise).
   4. Medications or resource needs in excess of those provided in the general patient care unit.
B. Patients who are direct admissions from another health care facility outside the hospital (may be directly admitted for intermediate care).
C. Patients with uncomplicated toxic ingestion who do not have cardiovascular or respiratory compromise and who require cardiorespiratory monitoring.

DISCHARGE AND TRANSFER GUIDELINES FOR THE INTERMEDIATE CARE PATIENT

Patients will be evaluated and considered for transfer to general care or special care units when the disease process has reversed or the physiologic condition that prompted admission has resolved and the need for multidisciplinary intervention and treatment is no longer present.

The decision to transfer or discharge to home will be made on the basis of the following criteria:

A. If patient's condition deteriorates and he or she requires care beyond the capabilities of the unit providing intermediate care, he or she should be admitted or readmitted to a pediatric intensive care unit.
B. Patient should be transferred to a floor or specialty care unit or discharged from the hospital, as appropriate, if the following criteria apply:
   1. Patient has stable hemodynamic parameters for at least 6 to 12 hours.
   2. Patient has stable respiratory status and has been extubated with evidence of acceptable gas exchange for more than 4 hours.
   3. Patient has minimal oxygen requirements as evidenced by a fraction of inspired oxygen of 0.4 or less.
   4. Intravenous inotropic support, vasodilators, and antiarrhythmic drugs are no longer required, or, when applicable, low doses of these medications may be administered to otherwise stable patients in a designated patient care unit.
   5. Cardiac arrhythmias are controlled for a reasonable period of time but not less than 24 hours.
   6. Patient has neurologic stability with control of seizures for a reasonable period of time.
   7. All invasive hemodynamic monitoring devices have been removed (eg, arterial lines).
   8. Patient who had required chronic mechanical ventilation and has experienced resolution of the acute illness that required intermediate or

intensive care has now returned to baseline clinical status.
9. Patient will require peritoneal dialysis or hemodialysis on a routine basis and therefore may receive these treatments as an outpatient or in a designated patient care unit.
10. The need for multidisciplinary intervention is predictable and compatible with policies of the receiving patient care unit.
11. The health care team, after careful multidisciplinary assessment and together with the patient's family, decides that there would be no benefit to keeping the child hospitalized or that the course of treatment is medically futile.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT
Guidance for the Clinician in Rendering Pediatric Care

Jonathan D. Klein, MD, MPH, and the Committee on Adolescence

Adolescent Pregnancy: Current Trends and Issues

ABSTRACT. The prevention of unintended adolescent pregnancy is an important goal of the American Academy of Pediatrics and our society. Although adolescent pregnancy and birth rates have been steadily decreasing, many adolescents still become pregnant. Since the last statement on adolescent pregnancy was issued by the Academy in 1998, efforts to prevent adolescent pregnancy have increased, and new observations, technologies, and prevention effectiveness data have emerged. The purpose of this clinical report is to review current trends and issues related to adolescent pregnancy, update practitioners on this topic, and review legal and policy implications of concern to pediatricians. *Pediatrics* 2005; 116:281–286; *pregnancy, contraceptives, childbearing, adolescent parents.*

ABBREVIATIONS. AAP, American Academy of Pediatrics; STD, sexually transmitted disease.

INTRODUCTION

Adolescent pregnancy in the United States is a complex issue affecting families, health care professionals, educators, government officials, and youths themselves.[1,2] Since 1998, when the last statement on this topic was issued by the American Academy of Pediatrics[3] (AAP), efforts to prevent adolescent pregnancy have increased,[1] and new observations, technologies, and prevention effectiveness data have emerged. The purpose of this clinical report is to provide pediatricians with recent data on adolescent sexuality, contraceptive use, and childbearing as well as information about preventing adolescent pregnancy in their communities and in clinical practice. This report does not address diagnosis of pregnancy or management of the transition to prenatal care. Information about counseling pregnant youth is provided in the AAP policy statement "Counseling the Adolescent About Pregnancy Options,"[4] and from the Alan Guttmacher Institute,[5] and information about early prenatal care is available from the American College of Obstetricians and Gynecologists (www.acog.org).

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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SEXUAL ACTIVITY

The proportion of American adolescents who are sexually active has decreased in recent years; however, rates are still high enough to warrant concern.[6–9] Currently, more than 45% of high school females and 48% of high school males have had sexual intercourse.[6] The average age of first intercourse is 17 years for girls and 16 years for boys.[10] However, approximately one fourth of all youth report having had intercourse by 15 years of age.[11,12] Younger teenagers are especially vulnerable to coercive and nonconsensual sex. Involuntary sexual activity has been reported by 74% of sexually active girls younger than 14 years and 60% of those younger than 15 years.[10,11] Sexually active youth, similar to older unmarried adults, usually have monogamous, short-lived relationships with successive partners. Current surveys indicate that 11% of high school females and 17% of high school males report having had 4 or more sexual partners.[7] In addition to intercourse, many adolescents report having had oral sex or engaging in kissing, touching, or other mutual stimulation; however, data on these other behaviors are reported rarely.[13]

There are several predictors of sexual intercourse during the early adolescent years, including early pubertal development, a history of sexual abuse, poverty, lack of attentive and nurturing parents, cultural and family patterns of early sexual experience, lack of school or career goals, substance abuse, and poor school performance or dropping out of school.[1,2,6,11,12,14] Factors associated with a delay in the initiation of sexual intercourse include living with both parents in a stable family environment, regular attendance at places of worship, and higher family income.[11,12,15,16] Recently, parental supervision, setting expectations, and parent/child "connectedness" have been recognized as clearly associated with decreasing risky sexual behavior and other risky behaviors among adolescents.[14,16]

CONTRACEPTIVE USE

Despite increasing use of contraception by adolescents at the time of first intercourse,[10–12,17,18] 50% of adolescent pregnancies occur within the first 6 months of initial sexual intercourse.[11] The human immunodeficiency virus (HIV) epidemic and public health education efforts have led more adolescents to use barrier contraceptives; nonetheless, in 2003, among high school students who reported that they

had ever had sexual intercourse, only 63% reported having used a condom the last time they had intercourse.[6] Despite HIV prevention guidelines, initiation of prescription contraceptives is often accompanied by decreased condom use, especially among adolescents who do not perceive themselves to be at risk of sexually transmitted diseases (STDs).[19] Many adolescents who currently report using prescription contraceptives delayed seeing a clinician for a contraceptive prescription until they had been sexually active for 1 year or more.[10] Adolescent women, similar to adult women, have changed contraceptive methods in recent years, with decreases in pill use and increases in injectable contraceptive use.[20] Factors associated with more consistent contraceptive use among sexually active youth include academic success in school, anticipation of a satisfying future, and being involved in a stable relationship with a sexual partner.[21] The Centers for Disease Control and Prevention unambiguously recommends both abstinence and the use of barrier contraceptives for individuals who choose to be sexually active.[22] However, some groups continue to question the effectiveness of condoms.[23] Youth who participated in programs that provided information about abstinence, condoms, and/or contraception; who were engaged in one-on-one discussions about their own behavior; who were given clear messages about sex and condom or contraceptive use; and who were provided condoms or contraceptives have been found to increase consistent condom and contraception use without increasing sexual activity.[1]

TRENDS IN ADOLESCENT CHILDBEARING

Each year, approximately 900 000 teenagers become pregnant in the United States,[1] and despite decreasing rates, more than 4 in 10 adolescent girls have been pregnant at least once before 20 years of age.[1] Most of these pregnancies are among older teenagers (ie, those 18 or 19 years of age).[1,24] Approximately 51% of adolescent pregnancies end in live births, 35% end in induced abortion, and 14% result in miscarriage or stillbirth.[1,2,11,15,24] Historically, the highest adolescent birth rates in the United States were during the 1950s and 1960s, before the legalization of abortion and the development of many of the current forms of contraception.[20] After the legalization of abortion in 1973, birth rates for US females 15 to 19 years of age decreased sharply until 1986. Rates increased steadily until 1991; since then, the birth rate among teenagers has decreased every year since 1991.[1,24,25] Since 1991, the rate has decreased 35% for 15- to 17-year-olds and 20% for 18- to 19-year-olds.[23] Rates for 10- to 14-year-olds were 1.4 per 1000 in 1992 and have gradually decreased to 0.7 per 1000 in 2002.[26]

Although birth rates have been decreasing steadily for white and black teenagers in recent years, 1996 is the first year that birth rates decreased for Hispanic teenagers; Hispanic adolescents also have had the highest overall birth rates and smallest decreases in recent years.[25,27]

Once a teenager has had 1 infant, she is at increased risk of having another. Approximately 25% of adolescent births are not first births.[1,2,9,28]

ADOLESCENT PARENTS AND THEIR PARTNERS

Adolescent childbearing is usually inconsistent with mainstream societal demands for attaining adulthood through education, work experience, and financial stability. Poverty is correlated significantly with adolescent pregnancy in the United States. Although 38% of adolescents live in poor or low-income families, as many as 83% of adolescents who give birth and 61% who have abortions are from poor or low-income families. At least one third of parenting adolescents (both males and females) are themselves products of adolescent pregnancy. Although it is difficult to establish causal links between childhood maltreatment and subsequent adolescent pregnancy, in some studies as many as 50% to 60% of those who become pregnant in early or midadolescence have a history of childhood sexual or physical abuse.[10,11]

The problem of adolescent pregnancy is often assumed to be both an adolescent and an adult problem, because many partners of childbearing youth are adults. The percentage of adolescent pregnancies in which the father is an adult is unclear; studies report a range from 7% to 67%.[29–33] Adult men having sexual relationships with adolescents is problematic, because many of these relationships may be abusive or coercive. Adolescents who have sex with older men are also more likely to contract HIV infection or other STDs.[30,31,33,34] Although more than two thirds of adolescent girls' sexual partners are the same age or within a few years older and the sexual activity is consensual in nature, some partners are more than 4 years older.[35] Sexual relationships between adults and minors may be coercive or exploitative, with detrimental consequences for the health of both the teenager and her children.[30,36] Although some states and local jurisdictions have changed statutory rape laws and their enforcement, mandated reporting of all sexual activity as statutory rape or as child abuse has not been effective at changing behavior, does not allow for clinical judgment, and has the effect of deterring some of the adolescents most in need from seeking health care.[36,37]

Adolescent fathers are similar to adolescent mothers; they are more likely than their peers who are not fathers to have poor academic performance, higher school drop-out rates, limited financial resources, and decreased income potential.[37–39] Some fathers disappear from the lives of their adolescent partners and children,[40] but many others attempt to stay involved, and many young fathers struggle to be involved in their children's lives.[40,41] Current programs in adolescent pregnancy and parenting are exploring ways to reach and engage young fathers in the lives of their children.

RATES OF UNMARRIED CHILDBEARING

The birth rate to unmarried female adolescents has been increasing steadily for most of the last 30 years. In 2001, 78.9% of all births to adolescents occurred outside of marriage.[24] The increasing birth rate of

unmarried adolescents is primarily attributable to higher rates of births to unmarried white adolescents. However, adolescents account for a smaller percentage of total out-of-wedlock births now (26% in 2001) than they did in 1970 (50%).[24] Births to unmarried teenagers reflect a larger societal trend toward single parenthood, because birth rates for unmarried adults have also increased.[25,42,43] Although some reports have suggested that rates of marriage among childbearing teenagers are increasing, few teenagers or young adults who become pregnant are married before their infant is born.[44]

UNINTENDED VERSUS INTENDED PREGNANCY

More than 90% of 15- to 19-year-olds (and half of all adults) describe their pregnancies as being unintended. More than half of unintended adolescent pregnancies end in induced or spontaneous abortion,[43,44] compared with 35% of adolescent pregnancies overall.[21] On the other hand, some adolescent pregnancies are intended, and some young women are motivated to become pregnant and have children. Similar to adults, adolescents give many reasons for wanting to have children; the reason that some adolescents are motivated to be mothers at an early age is unclear.[1] Recent data suggest that many young women are ambivalent about becoming pregnant, and this is associated with less consistent and less effective contraceptive use.[45]

COMPARISON WITH INTERNATIONAL STATISTICS

Even with recent decreases, the United States has the highest adolescent birth rate among comparable industrialized countries despite sexual activity rates that are similar or higher among Western European teenagers than among teenagers in the United States.[5,17,21,25,46] For every 1000 females 15 to 19 years of age in 1992, 4 in Japan gave birth, 8 in the Netherlands gave birth, 33 in the United Kingdom gave birth, 41 in Canada gave birth, and 61 in the United States gave birth.[21] The higher birth rate for American adolescents compared with their peers in other countries is not attributable solely to high birth rates among American minority groups; non-Hispanic white adolescents in the United States also have a higher birth rate than do teenagers observed in any other developed country.[5,10,47] The reasons for this contrast are unclear, but European teenagers may have greater access to and acceptance of contraception. The contrast also may be related to universal sexuality education that exists in some European countries. Welfare benefits tend to be more generous in Europe than in the United States; thus, it is unlikely that the current welfare system motivates or explains American teenagers' decisions to have children.

MEDICAL RISKS OF ADOLESCENT PREGNANCY

Pregnant adolescents younger than 17 years have a higher incidence of medical complications involving mother and child than do adult women, although these risks may be greatest for the youngest teenagers.[17,48] The incidence of having a low birth weight infant (<2500 g) among adolescents is more than double the rate for adults, and the neonatal death rate (within 28 days of birth) is almost 3 times higher.[49] The mortality rate for the mother, although low, is twice that for adult pregnant women.[15,17]

Adolescent pregnancy has been associated with other medical problems including poor maternal weight gain, prematurity (birth at <37 weeks' gestation), pregnancy-induced hypertension, anemia, and STDs. Approximately 14% of infants born to adolescents 17 years or younger are preterm versus 6% for women 25 to 29 years of age.[49] Young adolescent mothers (14 years and younger) are more likely than other age groups to give birth to underweight infants, and this is more pronounced in black adolescents.[1,50–53]

Biological factors that have been associated consistently with negative pregnancy outcomes are poor nutritional status, low prepregnancy weight and height, parity, and poor pregnancy weight gain.[51,52] Many social factors have also been associated with poor birth outcomes, including poverty, unmarried status, low educational levels, smoking, drug use, and inadequate prenatal care.[54] Both biological and social factors may contribute to poor outcomes in adolescents. Adolescents also have high rates of STDs, substance use, and poor nutritional intake, all of which contribute to the risk of preterm delivery.[52] Interventions, such as prenatal intake of folic acid as a strategy for prevention of spina bifida, can be effective at decreasing observed disparities between adolescents and older women.[55]

PSYCHOSOCIAL COMPLICATIONS OF ADOLESCENT PREGNANCY

The psychosocial problems of adolescent pregnancy include school interruption, persistent poverty, limited vocational opportunities, separation from the child's father, divorce, and repeat pregnancy. When pregnancy does interrupt an adolescent's education, a history of poor academic performance usually exists.[56] Having repeat births before 18 years of age has a negative effect on high school completion. Factors associated with increased high school completion for pregnant teenagers include race (black teenagers fare better than do white teenagers), being raised in a smaller family, presence of reading materials in the home, employment of the teenager's mother, and having parents with higher educational levels.[54,56,57]

Research suggests that long-term negative social outcomes are not inevitable. Several long-term follow-up studies indicate that 2 decades after giving birth, most former adolescent mothers are not welfare-dependent; many have completed high school, have secured regular employment, and do not have large families.[51,57] Comprehensive adolescent pregnancy programs seem to contribute to good outcomes, as do home-visitation programs designed to promote good child health outcomes.[51,58]

CHILDREN OF ADOLESCENT PARENTS

Research during the past decade confirms the common belief that children of adolescent mothers do

not fare as well as those of adult mothers. These children have increased risks of developmental delay, academic difficulties, behavioral disorders, substance abuse, early sexual activity, depression, and becoming adolescent parents themselves.[57,59]

Adolescent mothers may not possess the same level of maternal skills as do adults. There is debate in the literature regarding the association of maternal age and child abuse. Some studies indicate that young maternal age is a risk factor for abuse, including fatalities, and others indicate the presence of reporting biases that may confound the findings.[60–63]

Although the current political climate tends to require that adolescent mothers live at home with their own families to qualify for government assistance, there is evidence that intensive involvement of families in rearing children of older adolescents may not be beneficial for either the adolescent or her child.[54,64] Many adolescent parenting programs are exploring ways to involve the families of the parenting adolescent in child care activities that are helpful.

ADOLESCENT PREGNANCY PREVENTION

Many models of adolescent pregnancy-prevention programs exist.[65–68] Most successful programs include multiple and varied approaches to the problem and include abstinence promotion and contraception information, contraceptive availability, sexuality education, school-completion strategies, and job training. Primary-prevention (first pregnancy) and secondary-prevention (repeat pregnancy) programs are both needed, with particular attention to adolescents who are at highest risk of becoming pregnant and innovative programs that include males.[69–72] Parents, schools, religious institutions, physicians, social and government agencies, and adolescents all have roles in successful prevention programs.

Efforts to prevent adolescent pregnancy at both the national and local levels have increased in recent years, and there has been increasing evidence that several different kinds of programs may help decrease sexual risk taking and pregnancy among teenagers. Recent studies have found that some sexuality- and HIV-education programs have sustained positive effects on behavior, and at least 1 program that combines sexuality education and youth development has been shown to decrease pregnancy rates for as long as 3 years.[1] Additionally, both community learning programs and sexuality- and HIV-education programs have been found to decrease sexual risk taking and/or pregnancy, and short clinic-based interventions involving educational materials coupled with counseling also may increase contraceptive use.[1]

Despite encouraging trends, efforts to prevent pregnancy must be constantly renewed as children enter into adolescence. By 2010, the population of adolescent girls 15 to 19 years of age is expected to increase by 10%; thus, decreasing pregnancy rates may not mean fewer pregnancies or births. Nonetheless, condom use has increased slightly, and adolescent contraceptive users have increasingly adopted long-acting hormonal methods, which have the lowest failure rates; thus, overall contraceptive effectiveness among teenagers has been improving.[73]

Current research indicates that encouraging abstinence and urging better use of contraception are compatible goals. Evidence shows that sexuality education that discusses contraception does not increase sexual activity, and programs that emphasize abstinence as the safest and best approach, while also teaching about contraceptives for sexually active youth, do not decrease contraceptive use. Some program models have resulted in better protective and preventive health behaviors.

CLINICAL CONSIDERATIONS FOR THE PEDIATRICIAN

1. Encourage adolescents to postpone early sexual activity and encourage parents to educate their children and adolescents about sexual development, responsible sexuality, decision-making, and values.
2. Be sensitive to issues relating to adolescent sexuality and be prepared to obtain a developmentally appropriate confidential sexual history from all adolescent patients. Because medical complications are possible, offer confidential screenings for sexual activity and pregnancy risk as well as for STD risk and abuse as a routine part of all adolescent care encounters.
3. Help ensure that all adolescents have knowledge of and access to contraception including barrier methods and emergency contraception supplies. As stated in the AAP policy statement "Folic Acid for the Prevention of Neural Tube Defects,"[74] recommend folic acid supplementation for all women of childbearing age who are capable of becoming pregnant, especially sexually active women who do not plan to use effective contraception or abstain from sexual intercourse.
4. Encourage and participate in community efforts to delay onset of sexual activity and to prevent first and subsequent adolescent pregnancies and advocate for implementation and investments in evidence-based programs that provide comprehensive information and services to youth. These efforts may vary widely from one community to another but should be directed at the specific needs of youth in that community.
5. Be aware of options and resources for adolescents and advocate for comprehensive medical and psychosocial support for all pregnant adolescents in the community. When diagnosing pregnancy, discuss pregnancy options or refer the patient for counseling; discuss adoption, abortion, and prenatal care; and provide follow-up. Tailor prenatal care to the medical, social, nutritional, and educational needs of the adolescent and include child care and contraceptive information.
6. Assess the adolescent mother's abilities to care for her children and have resources available for referral and assistance before neonatal discharge.
7. Advocate for the inclusion of the adolescent mother's partner and/or father of her child in pregnancy and parenting programs when appropriate.

These programs should provide access to education and vocational training, parenting skills classes, and contraceptive education.

8. Serve as a resource for the pregnant teenager and her infant, the teenager's family, and the father of the infant to ensure that optimal health care is obtained and appropriate support is provided.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT
Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Fetus and Newborn

Age Terminology During the Perinatal Period

ABSTRACT. Consistent definitions to describe the length of gestation and age in neonates are needed to compare neurodevelopmental, medical, and growth outcomes. The purposes of this policy statement are to review conventional definitions of age during the perinatal period and to recommend use of standard terminology including gestational age, postmenstrual age, chronological age, corrected age, adjusted age, and estimated date of delivery. ***Pediatrics*** **2004;114:1362–1364;** ***gestational age, postmenstrual age, chronological age, menstrual age, conceptional age, postconceptual age, corrected age, adjusted age, estimated date of delivery, estimated date of confinement.***

INTRODUCTION

Consistent definitions to describe the length of gestation and age in neonates are needed to compare neurodevelopmental, medical, and growth outcomes. The terms "gestational age," "postmenstrual age," "corrected age," and "postconceptional age" have frequently been defined unconventionally,[1,2] misapplied,[3–5] or left undefined.[6,7] Inconsistent use of terminology limits the accurate interpretation of data on health outcomes for newborn infants, especially for those born preterm or conceived using assisted reproductive technology. The purposes of this statement are to review conventional definitions of age during the perinatal period and to recommend standard terminology.

"Gestational age" (or "menstrual age") is the time elapsed between the first day of the last normal menstrual period and the day of delivery (Fig 1).[8–10] The first day of the last menstrual period occurs approximately 2 weeks before ovulation and approximately 3 weeks before implantation of the blastocyst. Because most women know when their last period began but not when ovulation occurred, this definition traditionally has been used when estimating the expected date of delivery. As long as menstrual dates are remembered accurately, this method of estimating the date of delivery is reliable.[11] Minor inaccuracy (4–6 days) in the expected date of delivery determined from menstrual dates is attributable to inherent biological variability in the relative timing of onset of the last menstrual period, fertilization of the egg, and implantation of the blastocyst.[12] Additional inaccuracy (weeks) may occur in women who have menstrual cycles that are irregular or variable in duration or if breakthrough bleeding occurs around the time of conception. Gestational age is conventionally expressed as completed weeks. Therefore, a 25-week, 5-day fetus is considered a 25-week fetus. To round the gestational age of such a fetus to 26 weeks is inconsistent with national and international norms.[2] The term "gestational age" should be used instead of "menstrual age" to describe the age of the fetus or newborn infant.

"Chronological age" (or "postnatal" age) is the time elapsed after birth (Fig 1). It is usually described in days, weeks, months, and/or years. This is different from the term "postmenstrual age." Postmenstrual age is the time elapsed between the first day of the last menstrual period and birth (gestational age) plus the time elapsed after birth (chronological age). Postmenstrual age is usually described in number of weeks and is most frequently applied during the perinatal period beginning after the day of birth. Therefore, a preterm infant born at a gestational age of 33 weeks who is currently 10 weeks old (chronological age) would have a postmenstrual age of 43 weeks. When postmenstrual age is quantitated in weeks and days for postnatal management reasons, a 33-week, 1-day gestational age infant who is 10 weeks, 5 days chronological age would have a postmenstrual age of 43 weeks, 6 days.

"Corrected age" (or "adjusted age") is a term most appropriately used to describe children up to 3 years of age who were born preterm (Fig 1). This term is preferred to "corrected gestational age" or "gestational age" and represents the age of the child from the expected date of delivery.[13,14] Corrected age is calculated by subtracting the number of weeks born before 40 weeks of gestation from the chronological age. Therefore, a 24-month-old, former 28-week gestational age infant has a corrected age of 21 months according to the following equation:

$$24 \text{ months} - [(40 \text{ weeks} - 28 \text{ weeks}) \times 1 \text{ month}/4 \text{ weeks}]$$

Corrected age and chronological age are not synonymous in preterm infants. Additionally, the term "corrected age" should be used instead of "adjusted age."

"Conceptional age" is the time elapsed between the day of conception and the day of delivery. (The term "conceptual age" is incorrect and should not be

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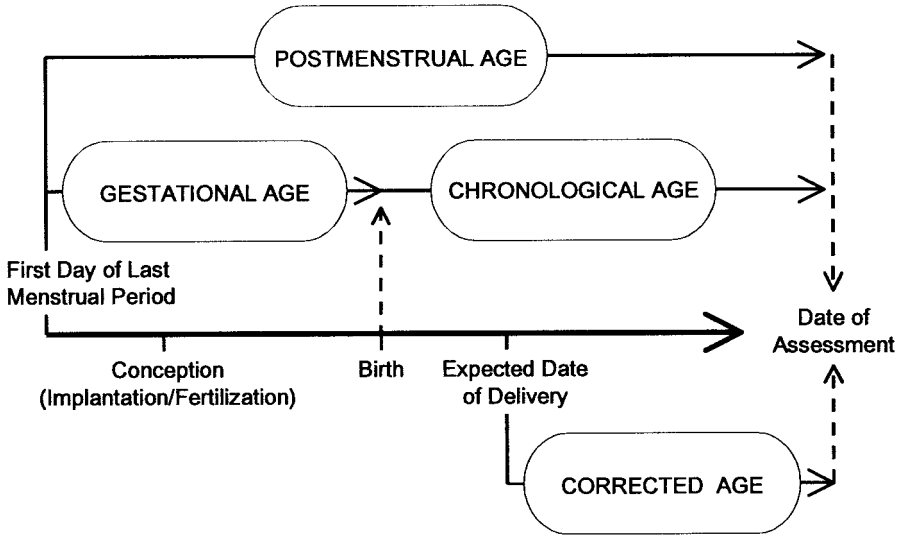

Fig 1. Age terminology during the perinatal period.

used.) Because assisted reproductive technologies accurately define the date of fertilization or implantation, a precise conceptional age can be determined in pregnancies resulting from such technologies. Much of the variability inherent in other methods of gestational age determination,[11–13] except for that attributed to timing of implantation, is eliminated when the date of conception is determined during assisted reproductive procedures. The convention for calculating gestational age when the date of conception is known is to add 2 weeks to the conceptional age.[10] Therefore, gestational age is 2 weeks longer than conceptional age; they are not synonymous terms. When describing the age of a fetus or neonate, "gestational age" is the term conventionally applied. This is particularly important for interpreting outcome studies of preterm infants. As an example, a preterm infant conceived using assisted reproductive technology who has a conceptional age of 25 weeks has a gestational age of 27 weeks. Outcomes for this infant should be compared with those of 27-week gestational age infants, not 25-week gestational age infants. To avoid confusion, the term "gestational age" should be used. The terms "conceptional age" and "postconceptional age," reflecting the time elapsed after conception, should not be used.

Gestational age is often determined by the "best obstetric estimate," which is based on a combination of the first day of last menstrual period, physical examination of the mother, prenatal ultrasonography, and history of assisted reproduction. The best obstetric estimate is necessary because of gaps in obstetric information and the inherent variability (as great as 2 weeks) in methods of gestational age estimation.[8,10,14–19] Postnatal physical examination of the infant is sometimes used as a method to determine gestational age if the best obstetric estimate seems inaccurate. Therefore, methods of determining gestational age should be clearly stated so that the variability inherent in these estimations can be considered when outcomes are interpreted.[8,10,14–19]

RECOMMENDATIONS

1. Standardized terminology should be used when defining ages and comparing outcomes of fetuses and newborns. The recommended terms (Table 1) are:
   - Gestational age (completed weeks): time elapsed between the first day of the last menstrual period and the day of delivery. If pregnancy was achieved using assisted reproductive technology, gestational age is calculated by adding 2 weeks to the conceptional age.
   - Chronological age (days, weeks, months, or years): time elapsed from birth.
   - Postmenstrual age (weeks): gestational age plus chronological age.
   - Corrected age (weeks or months): chronological age reduced by the number of weeks born before 40 weeks of gestation; the term should be used only for children up to 3 years of age who were born preterm.
2. During the perinatal period neonatal hospital stay, "postmenstrual age" is preferred to describe

TABLE 1. Age Terminology During the Perinatal Period

Term	Definition	Units of Time
Gestational age	Time elapsed between the first day of the last menstrual period and the day of delivery	Completed weeks
Chronological age	Time elapsed since birth	Days, weeks, months, years
Postmenstrual age	Gestational age + chronological age	Weeks
Corrected age	Chronological age reduced by the number of weeks born before 40 weeks of gestation	Weeks, months

the age of preterm infants. After the perinatal period, "corrected age" is the preferred term.
3. "Conceptional age," "postconceptional age," "conceptual age," and "postconceptual age" should not be used in clinical pediatrics.
4. Publications reporting fetal and neonatal outcomes should clearly describe methods used to determine gestational age.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Environmental Health

Ambient Air Pollution: Health Hazards to Children

ABSTRACT. Ambient (outdoor) air pollution is now recognized as an important problem, both nationally and worldwide. Our scientific understanding of the spectrum of health effects of air pollution has increased, and numerous studies are finding important health effects from air pollution at levels once considered safe. Children and infants are among the most susceptible to many of the air pollutants. In addition to associations between air pollution and respiratory symptoms, asthma exacerbations, and asthma hospitalizations, recent studies have found links between air pollution and preterm birth, infant mortality, deficits in lung growth, and possibly, development of asthma. This policy statement summarizes the recent literature linking ambient air pollution to adverse health outcomes in children and includes a perspective on the current regulatory process. The statement provides advice to pediatricians on how to integrate issues regarding air quality and health into patient education and children's environmental health advocacy and concludes with recommendations to the government on promotion of effective air-pollution policies to ensure protection of children's health. *Pediatrics* 2004;114:1699–1707; *air pollution, adverse effects, children, asthma, environmental health.*

ABBREVIATIONS. $PM_{2.5}$, particulate matter with a median aerodynamic diameter less than 2.5 μm; PM_{10}, particulate matter with a median aerodynamic diameter less than 10 μm; EPA, Environmental Protection Agency; HAP, hazardous air pollutant; AQI, air quality index.

INTRODUCTION

Although it has been 3 decades since passage of the Clean Air Act in 1970 (Pub L No. 91–604), the air in many parts of the United States is far from clean. Air quality has improved in some areas but decreased in others.[1] In addition, there are important health effects from air pollutants at levels once considered safe. Children and infants are among the most susceptible to many of the air pollutants.

In 2002, approximately 146 million Americans were living in areas where monitored air failed to meet the 1997 National Ambient Air Quality Standards for at least 1 of the 6 "criteria air pollutants": ozone, particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead (Table 1).[1] Although the standards for ozone and particulate matter were revised in 1997, legal barriers have delayed timely implementation.[2] Recent reports have identified adverse health effects at levels near or below the current standards for ozone, particulate matter, and nitrogen dioxide. Thus, the 1997 federal standards may not adequately protect children. Additionally, numerous other toxic air pollutants are of public health concern.[3]

Outdoor air pollution is also a major problem in developing countries. The World Health Organization found that the air quality in large cities in many developing countries is remarkably poor and that very large numbers of people in those countries are exposed to ambient concentrations of air pollutants well above the World Health Organization guidelines for air quality (www.who.int/ceh/publications/en/11airpollution.pdf).

Scientific understanding of the health effects of air pollution, including effects on children, has increased in the last decade. This statement updates a 1993 American Academy of Pediatrics (AAP) statement titled "Ambient Air Pollution: Respiratory Hazards to Children."[4]

EFFECTS OF AIR POLLUTION ON CHILDREN

Children are more vulnerable to the adverse effects of air pollution than are adults. Eighty percent of alveoli are formed postnatally, and changes in the lung continue through adolescence.[5] During the early postneonatal period, the developing lung is highly susceptible to damage after exposure to environmental toxicants.[5–7]

Children have increased exposure to many air pollutants compared with adults because of higher minute ventilation and higher levels of physical activity.[8] Because children spend more time outdoors than do adults, they have increased exposure to outdoor air pollution.[9,10]

Infants, children, the elderly, and those with cardiopulmonary disease are among the most susceptible to adverse health effects from criteria pollutants.[11–15] Lead is neurotoxic, especially during early childhood. Carbon monoxide interferes with oxygen transport through the formation of carboxyhemoglobin. Other criteria pollutants (ozone, sulfur dioxide, particulate matter, nitrogen dioxide) have respiratory effects in children and adults, including increased respiratory tract illness, asthma exacerbations, and decreased lung function (eg, changes in peak flow).[11–12] In adults, particulate air pollution is associated with respiratory and cardiovascular hos-

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TABLE 1. National Ambient Air Quality Standards for Criteria Air Pollutants, 1997

Pollutant	Primary Standards*
Ozone	
1-h average	0.12 ppm (235 $\mu g/m^3$)
8-h average	0.08 ppm (157 $\mu g/m^3$)
PM_{10}	
Annual arithmetic mean	50 $\mu g/m^3$
24-h average	150 $\mu g/m^3$
$PM_{2.5}$	
Annual arithmetic mean	15 $\mu g/m^3$
24-h average	65 $\mu g/m^3$
Sulfur dioxide	
Annual arithmetic mean	0.03 ppm (80 $\mu g/m^3$)
24-h average	0.14 ppm (365 $\mu g/m^3$)
Nitrogen dioxide	
Annual arithmetic mean	0.053 ppm (100 $\mu g/m^3$)
Carbon monoxide	
8-h average	9 ppm (10 mg/m^3)
1-h average	35 ppm (40 mg/m^3)
Lead	
Quarterly average	1.5 $\mu g/m^3$

Additional information on air quality standards are available at www.epa.gov/air/criteria.html.
* People residing in regions with pollutant concentrations above the primary standard may experience adverse health effects from poor air quality.

pitalizations, cardiovascular mortality,[16] and lung cancer.[17] Air pollution also has effects on indirect health indicators such as health care utilization and school absences.[11–13]

Although numerous studies have shown that outdoor air pollution exacerbates asthma, the effect of outdoor air pollution on the development of asthma has been less clear. Recently, a prospective study found that the risk of developing asthma was not greater, overall, in children living in communities with high levels of ozone or particulate air pollution. However, in communities with high levels of ozone, there was an increased risk of developing asthma in a small subset of children involved in heavy exercise (participation in 3 or more team sports per year [relative risk: 3.3; 95% confidence interval: 1.9–5.8]). This increased risk with heavy exercise was not seen in low-ozone communities. Time spent outside was also associated with new cases of asthma in high-ozone communities (relative risk: 1.4; 95% confidence interval: 1.0–2.1) but not in low-ozone communities.[18] Additional studies are needed to define the role of outdoor air pollution in the development of asthma.

Children in communities with higher levels of urban air pollution (acid vapor, nitrogen dioxide, particulate matter with a median aerodynamic diameter less than 2.5 μm [$PM_{2.5}$], and elemental carbon [a component of diesel exhaust]) had decreased lung function growth, and children who spent more time outdoors had larger deficits in the growth rate of lung function.[19,20] Ambient air pollution (especially particulate matter with a median aerodynamic diameter less than 10 μm [PM_{10}]) has also been associated with several adverse birth outcomes, as discussed in the next section.

Levels of ozone and particulate matter are high enough in many parts of the United States to present health hazards to children.[1] Additionally, National Ambient Air Quality Standards for nitrogen dioxide may not be protective. Findings on these pollutants are summarized here.

Ozone

Ambient ozone is formed by the action of sunlight on nitrogen oxides and reactive hydrocarbons, both of which are emitted by motor vehicles and industrial sources. The levels tend to be highest on warm, sunny, windless days and often peak in midafternoon, when children are most likely to be playing outside.

Ozone is a powerful oxidant and respiratory tract irritant in adults and children, causing shortness of breath, chest pain when inhaling deeply, wheezing, and cough.[11] Children have decreases in lung function, increased respiratory tract symptoms, and asthma exacerbations on days with higher levels of ambient ozone.[11,21–23] Increases in ambient ozone have been associated with respiratory or asthma hospitalizations,[24,25] emergency department visits for asthma,[26] and school absences for respiratory tract illness.[27] In Atlanta, Georgia, summertime children's emergency department visits for asthma increased 37% after 6 days when ozone levels exceeded 0.11 ppm.[25] In southern California, school absences for respiratory tract illness increased 63% in association with a 0.02-ppm increase in ozone.[27]

In healthy adults, ozone causes airway inflammation and hyperreactivity, decrements in pulmonary function, and increased respiratory tract symptoms.[11] Ozone exposures at concentrations of 0.12 ppm or higher can result in decrements in lung function after subsequent challenge with aeroallergen.[28] Although most of the controlled studies of ozone exposure have been performed with adults, it is reasonable to believe that the results of these findings could be extended to children.

Ozone may be toxic at concentrations lower than 0.08 ppm, the current federal regulatory standard. Field studies suggest potential thresholds of between 0.04 and 0.08 ppm (1-hour average) for effects on lung function.[29–31] Recent studies of hospitalizations for respiratory tract illness in young children and emergency department visits for asthma suggest that the effects of ozone may occur at ambient concentrations below 0.09 ppm.[32,33] Another study found associations of ozone and respiratory symptoms in children with asthma at levels below the current US Environmental Protection Agency (EPA) standards.[34] If these findings are confirmed, the ozone standards may need additional revision.

In addition to studies on short-term effects, 2 recent studies of college freshmen suggest that increasing cumulative childhood exposure to ozone may affect lung function when exposed children reach young adulthood, particularly in measures of flow in small airways.[35,36] Early childhood exposures may, therefore, be particularly important.[35]

Particulate Matter

PM_{10} is small enough to reach the lower respiratory tract and has been associated with a wide range of serious health effects. PM_{10} is a heterogeneous

mixture of small solid or liquid particles of varying composition found in the atmosphere. Fine particles ($PM_{2.5}$) are emitted from combustion processes (especially diesel-powered engines, power generation, and wood burning) and from some industrial activities. Coarse particles (diameter between 2.5 and 10 μm) include windblown dust from dirt roads or soil and dust particles created by crushing and grinding operations. Toxicity of particles may vary with composition.[37,38]

Particle pollution contributes to excess mortality and hospitalizations for cardiac and respiratory tract disease.[14,39–41] The mechanism for particulate matter–associated cardiac effects may be related to disturbances in the cardiac autonomic nervous system, cardiac arrhythmias, or increased blood concentrations of markers of cardiovascular risk (eg, fibrinogen).[16,42]

Daily changes in mortality rates and numbers of people hospitalized are linked to changes in particulate air pollution.[14,39–41] These studies and others have estimated that for every 10 $\mu g/m^3$ increase in PM_{10}, there is an increase in the daily mortality rate between 0.5% and 1.6%. Effects were seen even in cities with mean annual PM_{10} concentrations between 25 and 35 $\mu g/m^3$. These recent studies suggest that even the current federal standards for $PM_{2.5}$ (24-hour standard = 65 $\mu g/m^3$; annual standard = 15 $\mu g/m^3$) and PM_{10} (24-hour standard = 150 $\mu g/m^3$; annual standard = 50 $\mu g/m^3$) should be lowered to protect public health. In 2002, California adopted more stringent standards for particulate matter: the annual average standard for $PM_{2.5}$ is 12 $\mu g/m^3$ and for PM_{10} is 20 $\mu g/m^3$.[43]

In children, particulate pollution affects lung function[44–46] and lung growth.[19] In a prospective cohort of children living in southern California, children with asthma living in communities with increased levels of air pollution (especially particulates, nitrogen dioxide, and acid vapor) were more likely to have bronchitis symptoms. In this study, bronchitis symptoms refers to a parental report of "one or more episodes of 'bronchitis' in the past 12 months" or report that, "apart from colds, the child usually seems to be congested in the chest or able to bring up phlegm").[47] The same mix of air pollutants was also associated with deficits in lung growth (as measured by lung function tests).[19] Recent studies in different countries have also found associations between ambient air pollution (especially particulates and/or carbon monoxide) and postneonatal infant mortality (attributable to respiratory causes and possibly sudden infant death syndrome),[48,49] low birth weight,[50–53] and preterm birth.[51,54–56]

The relative contribution of fine versus coarse particles to adverse health effects is being investigated. In studies of cities on the East Coast, fine particles seem to be important.[57] In other areas, coarse particles have a stronger or similar effect.[58] Several studies have found that fine particles from power plants and motor vehicles[59] or industrial sources[60] may be more closely associated with mortality.

Nitrogen Dioxide

Nitrogen dioxide is a gaseous pollutant produced by high-temperature combustion. The main outdoor sources of nitrogen dioxide include diesel and gasoline-powered engines and power plants. Levels of nitrogen dioxide around urban monitors have decreased over the past 20 years. Currently, all areas of the country meet the national air quality standard for nitrogen dioxide of 0.053 ppm (100 $\mu g/m^3$), measured as an annual arithmetic mean. However, national emissions (overall production) of nitrogen oxides have actually increased in the past 20 years because of an increase in nitrogen oxide emissions from diesel vehicles.[1] This increase is of concern, because nitrogen oxide emissions contribute to ground-level ozone (smog) and other environmental problems such as acid rain.[1]

Controlled-exposure studies of people with asthma have found that short-term exposures (30 minutes) to nitrogen dioxide at concentrations as low as 0.26 ppm can enhance the allergic response after subsequent challenge with allergens.[61,62] These findings are of concern, because some urban communities that are in compliance with the federal standards for nitrogen dioxide (annual average) may experience substantial short-term peak concentrations (1-hour average) that exceed 0.25 ppm. Confirmation of these studies is needed.

Epidemiologic studies have reported relationships between increased ambient nitrogen dioxide and risks of respiratory tract symptoms[63,64] and asthma exacerbations.[65] As noted previously, children with asthma living in communities with increased levels of air pollution (especially nitrogen dioxide, acid vapor, and particulates) were more likely to have bronchitis symptoms.[47] The same mix of air pollutants was also associated with deficits in lung growth (as measured by lung function tests).[19] These effects were increased in children who spent more time outdoors.

The epidemiologic studies of health effects associated with nitrogen dioxide should be interpreted with caution. Increased levels of ambient nitrogen dioxide may be a marker for exposure to traffic emissions or other combustion-related pollution. An independent role of nitrogen dioxide cannot be clearly established because of the high covariation between ambient nitrogen dioxide and other pollutants. Nonetheless, these studies illustrate that adverse respiratory tract effects are seen in urban areas where traffic is a dominant source of air pollution.

Traffic-Related Pollution

Motor vehicles pollute the air through tailpipe exhaust emissions and fuel evaporation, contributing to carbon monoxide, $PM_{2.5}$, nitrogen oxides, hydrocarbons, other hazardous air pollutants (HAPs), and ozone formation. Motor vehicles represent the principal source of air pollution in many communities, and concentrations of traffic pollutants are greater near major roads.[66] Recently, investigators (primarily in Europe and Japan) have found increased adverse health effects among those living near busy roads.

Studies examining associations between adverse respiratory tract health and traffic have been reviewed.[67] Increased respiratory tract complications in children (eg, wheezing, chronic productive cough, and asthma hospitalizations) have been associated with residence near areas of high traffic density (particularly truck traffic).[68–71] Other investigators have linked various childhood cancers to proximity to traffic.[72–74]

Diesel exhaust, a major source of fine particulates in urban areas, is carcinogenic. Numerous studies have found an association between occupational exposure to diesel exhaust and lung cancer.[75] On the basis of extensive toxicologic and epidemiologic evidence, national and international health authorities, including the EPA and the International Agency for Research on Cancer, have concluded that there is considerable evidence of an association between exposure to diesel exhaust and an increased risk of lung cancer.[76,77] Additionally, fine particles in diesel exhaust may enhance allergic and inflammatory responses to antigen challenge and may facilitate development of new allergies.[78,79] Thus, diesel exhaust exposure may worsen symptoms in those with allergic rhinitis or asthma.

School buses operate in proximity to children, and most of the nation's school bus fleets run on diesel fuel. The EPA and some state agencies are establishing programs to eliminate unnecessary school bus idling and to promote use of cleaner buses to decrease children's exposures to diesel exhaust and the amount of air pollution created by diesel school buses (www.epa.gov/cleanschoolbus). A recent pilot study found that a child riding inside a school bus may be exposed to as much as 4 times the level of diesel exhaust as someone riding in a car.[80] These findings underscore the importance of advocating for school districts to replace diesel buses or retrofit them with pollution-reducing devices and limit school bus idling where children congregate as soon as possible.

Other Air Pollutants

Airborne levels of lead, sulfur dioxide, and carbon monoxide have decreased dramatically because of the implementation of control measures. However, levels of these pollutants may still be high near major sources. For example, high lead levels may be found near metals-processing industries, high sulfur dioxide levels may occur near large industrial facilities (especially coal-fired power plants), and high levels of carbon monoxide may occur in areas with heavy traffic congestion.[1]

In addition to criteria air pollutants, there are numerous other air pollutants produced by motor vehicles, industrial facilities, residential wood combustion, agricultural burning, and other sources that are hazardous to children. More than 50000 chemicals are used commercially, and many are released into the air. For most of these chemicals, data on toxicity are sparse.[81] Some pollutants remain airborne or react in the atmosphere to produce other harmful substances. Other air pollutants deposit into and contaminate land and water. Some toxic air pollutants such as lead, mercury, and dioxins degrade slowly or not at all. These pollutants may bioaccumulate in animals at the top of the food chain, including humans. Children can be exposed to toxic air pollutants through contaminated air, water, soil, and food.[3] One example of a persistent pollutant emitted into ambient air that leads to exposure through another route is mercury, a developmental neurotoxicant.[82] Industrial emissions, especially from coal-fired power plants, are the leading source of environmental mercury. Although the levels of airborne mercury may not be hazardous, mercury deposits into soil and surface waters and ultimately accumulates in fish.[82]

The HAPs, often referred to as "toxic air contaminants" or "air toxics," refer to 188 pollutants and chemical groups known or suspected to cause serious health effects including cancer, birth defects, and respiratory tract and neurologic illness.[3,83] The Clean Air Act directs the EPA to regulate HAPs, which include compounds such as polycyclic aromatic hydrocarbons, acrolein, and benzene from fuel or fuel combustion; solvents such as hexane and toluene; hexavalent chromium from chrome-plating facilities; perchloroethylene from dry-cleaning plants; asbestos; metals (eg, mercury and cadmium); and persistent organic pollutants such as polychlorinated biphenyls. In 2001, diesel exhaust was listed as a mobile-source HAP. Many of these compounds are included in a priority list of 33 HAPs that are of special concern because of their widespread use and potential carcinogenicity and teratogenicity.[81] The priority list and general sources of these compounds are available on the EPA Web site (www.epa.gov/ttn/atw/nata).

Limited monitoring data suggest that concentrations of some HAPs may exceed the goals of the Clean Air Act in many cities.[84] Mobile sources (on- and off-road vehicles) account for approximately half of the emissions[3] but may contribute to 90% of the cancer risk (www.scorecard.org/env-releases/hap/us.tcl). A number of studies assessing health risks have found that estimated levels of some of the HAPs are a potential public health problem in many parts of the United States.[3,84–86] For example, estimated concentrations of benzene, formaldehyde, and 1,3-butadiene may contribute to extra cases of cancer (at least 1 extra case per million population exposed) in more than 90% of the census tracts in the contiguous United States. Additionally, the most recent national cancer-risk assessment for HAPs (1996 data) did not include diesel exhaust in the risk estimates.[3] The health risks may also be underestimated, because there is limited information on toxicity values for many of the HAPs,[87] and the risk models did not consider the potential for increased risk in children. These findings underscore the need for better ways to decrease toxic air emissions and assess exposures and risks.

Air-pollution episodes created by disasters (eg, accidents, volcanoes, forest fires, and acts of terrorism) can also create hazards for children. A discussion of these events and of bioaerosols in ambient air (eg, fungal spores and pollen) is beyond the scope of this

policy statement. Additionally, this statement does not address the hazards of indoor air pollution.

PREVENTION

Public health interventions to improve air quality can improve health at the population level. A decrease in levels of air pollution in former East Germany after reunification was associated with a decrease in parent-reported bronchitis[88] and improved lung function.[89] During the 1996 Summer Olympics in Atlanta, Georgia, extensive programs were implemented to improve mass transportation and decrease anticipated downtown traffic congestion. These programs were successful and were associated with a prolonged decrease in ozone pollution and significantly lower rates of childhood asthma visits during this period.[90] Closure of a steel mill in Utah Valley and resultant reductions in particulate matter were associated with a twofold decrease in hospitalizations for asthma in preschool children.[91,92] Finally, lung function improved in children who moved away from communities with high particulate air pollution, compared with those who remained or moved to communities with comparable particulate air pollution.[93] These studies provide support for continued efforts to decrease air pollution and improve health via decreases in motor vehicle traffic and industrial emissions. Dietary factors may play a role in modulating the effects of air pollution in children. A recent study in Mexico City, Mexico, found that children with asthma given antioxidant supplements were less affected by ozone compared with a control group that did not receive supplementation.[94] Additional studies are needed to explore this issue further.

Air Pollution and the Regulatory Process

The Clean Air Act of 1970 mandated the EPA to establish the National Ambient Air Quality Standards (Table 1). Standards were set for criteria air pollutants because they are common, widespread, and known to be harmful to public health and the environment.[11,12,83,95] The standards are reviewed every 5 years and set to protect public health, including the health of "sensitive" populations such as people with asthma, children, and the elderly. These standards are set without considering the costs of attaining these levels.

The standards for ozone and particulate matter were revised in 1997 on the basis of numerous scientific studies showing that the previous standards were not adequate to ensure health protection. Legal challenges were made by the American Trucking Associations, the US Chamber of Commerce, and other state and local business groups. However, the Supreme Court ultimately supported the EPA and ordered implementation of the standards.[2] Establishing implementation plans will be a lengthy process that will require the coordinated efforts of the EPA, state and local governments, and industry and environmental organizations.

Population exposures to toxic air contaminants may be of substantial public health concern.[84,86] In contrast to criteria pollutants, monitoring of toxic air contaminants is more limited. Exposures are estimated on the basis of reported emissions and may underestimate actual exposures.[87] The EPA is mandated to develop regulations through a lengthy process that first sets standards to control emissions on the basis of best-available technology. After maximum available control technology emission standards are established, the EPA must assess the risk remaining after emission decreases for the source take effect (residual risk).

To date, the EPA has focused primarily on establishing technology-based emission standards,[3] and this has been a slow process for some sources (eg, mobile toxic air contaminants and mercury emissions). Nationwide, emissions of toxic air contaminants have dropped approximately 24% from baseline (1990–1993) because of regulation and voluntary decreases by industry. With the current plans for gradual fleet turnover and implementation of controls for motor vehicles and fuels, the EPA projects that toxic air-contaminant emissions from gasoline-powered and diesel mobile sources will not be decreased to 75% and 90% of baseline (1990–1993) levels, respectively, until the year 2020.[3] However, major decreases could be more rapidly achieved simply from a prompt, wider application of existing technology.

Protecting populations from exposure to the harmful effects of air pollutants will require effective control measures. Industry (eg, coal-burning power plants, refineries, and chemical plants) and motor vehicles (both gasoline- and diesel-powered) are major sources of criteria pollutants and HAPs.[11,12] For example, coal-fired power plants are important sources of nitrogen oxides (precursors of ozone), particulates, and sulfur dioxide and are the largest sources of mercury emission in the United States. Smaller sources such as dry cleaners, auto body shops, and wood-burning fireplaces can also affect air quality locally. Municipal and hospital waste incinerators release toxic air pollutants including mercury, lead, cadmium, and dioxin emissions. Depending on weather conditions and individual physicochemical properties, some pollutants can be carried by air currents to areas many miles from the source.

In numerous cities in the United States, the personal automobile is the single greatest polluter, because emissions from millions of vehicles on the road add up. Despite significant technologic advances that have led to tighter pollution control from vehicles, emissions vary substantially between vehicles, particularly between classes of vehicles, because of differences in fuel-economy standards set by regulatory agencies. For instance, the corporate average fuel-economy standards have less stringent fuel-economy requirements (average: 20.7 miles per gallon) for light-duty trucks, sport utility vehicles, and minivans, compared with passenger cars (average: 27.5 miles per gallon). The former group of vehicles tends to have higher emissions of air pollutants, higher fuel consumption, and higher emissions of greenhouse gases.[96,97] Information on emissions and fuel-economy ratings for recent models and a

guide for choosing clean, fuel-efficient vehicles are available from the EPA Web site (www.epa.gov/greenvehicles/index.htm). The high levels of particulate emissions from diesel-powered buses and trucks must also be addressed. More than 70% of fine particle emissions from traffic are attributable to diesel-powered buses and trucks.

Driving a private car is probably a typical citizen's most "polluting" daily activity, yet in many cases, individuals have few alternative forms of transportation. Thus, urban planning and smart growth are imperative. Urban sprawl affects land use, transportation, and social and economic development and ultimately has important implications for public health.[98] Ways in which individuals can help to decrease air pollution are available at www.epa.gov/air/actions and www.arb.ca.gov/html/brochure/50things.htm.

Air Quality Index

The air quality index (AQI) provides local information on air quality and potential health concerns at the observed (or forecasted) levels of air pollution and can be a useful tool for educating families about local air quality and health.[99] The AQI is reported daily in metropolitan areas, often as part of local weather forecasts on television or radio or in newspapers. The AQI divides air-pollution levels into 6 categories of risk for 5 common pollutants (ozone, PM_{10}, nitrogen dioxide, carbon monoxide, and sulfur dioxide). Each category has a descriptive name reflecting levels of health concern (ranging from good through very hazardous), an associated color, and an advisory statement. Information about air quality in a specific area can be obtained from www.epa.gov/air/urbanair/index.html, www.scorecard.org, or www.weather.com. Although many states and local air districts actively forecast and disseminate health warnings, the challenge is to have people take actions to protect themselves and decrease activities that cause air pollution.

Pediatric Environmental Health[100] from the AAP provides additional information about the outdoor air pollutants and the use of the AQI.

CONCLUSIONS

Ambient air pollution has important and diverse health effects, and infants and children are among the most susceptible. Currently, levels of ozone and particulates remain unhealthful in many parts of the United States, and the current National Ambient Air Quality Standards may not protect the public adequately. There is a compelling need to move forward on efforts to ensure clean air for all.

The assurance of healthy air for children to breathe is beyond the control of an individual pediatrician, and there are no easy solutions. State chapters of the AAP, as well as individual members, can play an important role as advocates for children's environmental health. Areas of involvement might include working with community coalitions in support of strong pollution-control measures and informing local and national representatives and policy makers about the harmful effects of the environment on children's health. Advocates for children's health are needed in discussions about land use and transportation issues. Pediatricians can also advocate for energy-saving (and pollution-minimizing) lifestyles to their patients' families, especially regarding vehicles driven.

In communities with poor air quality, pediatricians can play a role in educating children with asthma or other chronic respiratory tract disease and their families about the harmful effects of air pollution. Patients and families can be counseled on following the AQI to determine when local air-pollution levels pose a health concern. Ozone levels tend to be highest in the afternoon, and it may be possible to decrease children's exposure by scheduling strenuous outdoor activity earlier in the day.

As pediatricians become better informed about local air quality issues in their communities (eg, ozone, nearby industrial facilities, traffic, diesel buses, wood burning, etc), these local concerns can provide a starting point for discussion and education.

Pediatricians who serve as physicians for schools or for team sports should be aware of the health implications of pollution alerts to provide appropriate guidance to school and sports officials, particularly in communities with high levels of ozone.

RECOMMENDATIONS

1. The National Ambient Air Quality Standards are designed to protect the public. To achieve this, the following points should be addressed:
   - The revised standards for ozone and particulate matter adopted by the EPA in 1997 should be promptly implemented.
   - During implementation, the standards should not be weakened in any way that decreases the protection of children's health.
   - Because recent studies suggest that current standards for PM_{10}, $PM_{2.5}$, ozone, and nitrogen dioxide may not be protecting children, the standards should be promptly reviewed and revised.
   - Because the law requires that the most vulnerable groups be protected when setting or revising the air quality standards, the potential effects of air pollution on the fetus, infant, and child should be evaluated, and all standards should include a margin of safety for protection of children.
2. The current measures to protect children from exposures to HAPs are not effective and should be critically reevaluated. The EPA should focus on prompt implementation of the Clean Air Act Amendments of 1990 (Pub L No. 101–549) to decrease HAPs. Additional monitoring for HAPs should be undertaken to allow more accurate characterization of children's exposures to these compounds. Risk assessments for HAPs should be reviewed to ensure that goals are protective of children. Control measures that specifically protect children's health should be implemented.
3. States and local air districts with air quality concerns should actively implement forecasting and

dissemination of health warnings in ways that help people take actions to protect themselves and decrease activities that cause air pollution.
4. Children's exposure to diesel exhaust particles should be decreased. Idling of diesel vehicles in places where children live and congregate should be minimized. Ongoing programs to fund conversion of diesel school bus fleets to cleaner alternative fuels and technologies should be pursued.
5. Industrial emissions of mercury should be decreased.
6. Federal and state governments' policies should encourage reductions in mobile and stationary sources of air pollution, including increased support for mass transit, carpooling, retiring or retrofitting old power plants that do not meet current pollution-control standards, and programs that support marked improvements in fuel emissions of gasoline- and diesel-powered vehicles. Additionally, the development of alternative fuel fleets, low-sulfur diesel, and other "low-emission" strategies (eg, retrofit of existing diesel engines) should be promoted. Before promoting new alternative fuels, these alternative fuel sources should be critically evaluated and determined by governmental authorities to have a good safety profile.
7. The same overall fuel-economy standard should apply to all passenger vehicles. Programs that allow certain passenger vehicles to be exempt from the usual fuel-economy standards should be abolished.
8. City and land-use planning should encourage the design and redevelopment of communities to promote mass transit, carpooling, pedestrian walkways, and bicycle use.
9. Siting of school and child care facilities should include consideration of proximity to roads with heavy traffic and other sources of air pollution. New schools should be located to avoid "hot spots" of localized pollution.

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Clinical Report—Antenatal Counseling Regarding Resuscitation at an Extremely Low Gestational Age

abstract

The anticipated delivery of an extremely low gestational age infant raises difficult questions for all involved, including whether to initiate resuscitation after delivery. Each institution caring for women at risk of delivering extremely preterm infants should provide comprehensive and consistent guidelines for antenatal counseling. Parents should be provided the most accurate prognosis possible on the basis of all the factors known to affect outcome for a particular case. Although it is not feasible to have specific criteria for when the initiation of resuscitation should or should not be offered, the following general guidelines are suggested. If the physicians involved believe there is no chance for survival, resuscitation is not indicated and should not be initiated. When a good outcome is considered very unlikely, the parents should be given the choice of whether resuscitation should be initiated, and clinicians should respect their preference. Finally, if a good outcome is considered reasonably likely, clinicians should initiate resuscitation and, together with the parents, continually reevaluate whether intensive care should be continued. Whenever resuscitation is considered an option, a qualified individual, preferably a neonatologist, should be involved and should be present in the delivery room to manage this complex situation. Comfort care should be provided for all infants for whom resuscitation is not initiated or is not successful. *Pediatrics* 2009;124:422–427

INTRODUCTION

The anticipated delivery of an extremely low gestational age infant presents difficult ethical issues for caregivers and parents. Despite previously published guidelines,[1–4] no consensus exists on this subject, and it remains one of the most controversial and emotionally charged areas in perinatology. Antenatal treatment decisions at an extremely low gestational age are complex, because they affect both the mother and the fetus, and the balance between risk and benefit may be quite different for each. For example, a cesarean delivery performed for fetal indications increases morbidity to the mother but may or may not benefit the infant. Uncertainty also exists regarding the timing of antenatal interventions, such as corticosteroid administration and fetal monitoring. These difficult decisions should optimally be made by the parents and their obstetrician, in collaboration with a neonatologist, after a thorough discussion of all currently available information.[2]

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KEY WORDS
prematurity, resuscitation, ethics, antenatal counseling.

ABBREVIATION
NRP—Neonatal Resuscitation Program

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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In addition to decisions about antepartum care and mode of delivery, parents and their physicians also must decide whether to initiate resuscitation for an infant born at an extremely low gestational age. The approach to counseling parents about decision-making regarding resuscitation of these infants should be comprehensive and consistent. The purpose of this revised clinical report (previously titled "Perinatal Care at the Threshold of Viability"[1]) is to offer guidance for clinicians providing antenatal counseling to parents in this situation.

BACKGROUND

Most clinicians agree that some infants are so immature that initiating resuscitation is futile, whereas others are sufficiently mature such that not initiating resuscitation is unacceptable.[5] Uncertainty exists, however, for infants between these 2 extremes, when it is unclear whether resuscitation is in the infant's best interest.[5] For these infants, selective resuscitation on the basis of parental preference is often considered to be an appropriate option, and general guidelines for decision-making are commonly based on estimated gestational age.[1–5] The Nuffield Council on Bioethics suggests that infants born from 22⁰⁄₇ through 23⁶⁄₇ weeks' gestation should be considered candidates for selective resuscitation.[4] They also state that from 24⁰⁄₇ through 24⁶⁄₇ weeks' gestation, the "normal practice should be that a baby will be offered full invasive intensive care and support from birth and admitted to a neonatal intensive care unit unless the parents and the clinicians are agreed that in light of the baby's condition it is not in his or her best interests to start intensive care." The Neonatal Resuscitation Program (NRP) considers the group appropriate for selective resuscitation on parental request may include an infant born at 23 to 24 weeks' gestation.[3] The International Liaison Committee on Resuscitation suggests that resuscitation is not indicated for an infant born at <23 weeks' gestation or with a birth weight less than 400 g but also recommends, "In conditions associated with uncertain prognosis, when there is borderline survival and a relatively high rate of morbidity, and where the burden to the child is high, the parent's views on starting resuscitation should be supported."[6] A recent summary of international guidelines concluded that an individual approach consistent with parents' wishes should be considered for infants born at 23 to 24 weeks' gestation.[7]

However, caution has also been expressed against using these general guidelines for managing specific cases, and individualized decision-making is encouraged. The NRP states that "these uncertainties (regarding the accuracy of antenatal gestational age and birth weight estimates) underscore the importance of not making firm commitments about withholding resuscitation until you have the opportunity to examine the baby after birth."[3] The importance of individualized decision-making is also emphasized by a statement from the summary of international guidelines: ". . . because of the uniqueness of every pregnancy and neonate, to protect mothers and infants from futile treatment, as well as incorrect withholding of life-sustaining treatment, the specific circumstances of every individual situation must always be kept in mind."[7] It is clear that individualized decision-making is required for this complex issue, and many factors have to be considered when providing antenatal counseling to parents.

FACTORS TO CONSIDER WHEN COUNSELING PARENTS

Infants born at an extremely low gestational age have a high mortality rate, and a substantial percentage of survivors have serious neurodevelopmental disabilities.[8–18] Estimated gestational age has served as the basis for estimating these risks for parents because of its strong association with outcome.[1–19] However, there are limitations of using estimated gestational age alone for antenatal counseling purposes. One limitation is that the length of gestation is rarely certain to the precise day, except when conception occurred via in vitro fertilization.[3,20,21] Another limitation is that many other factors influence the outcome of infants besides gestational age.[19,22–28] Data from the National Institute of Child Health and Development Neonatal Research Network have been used to create an algorithm predicting outcome that considers birth weight, gender, use of prenatal steroids, and singleton pregnancy in addition to estimated gestational age.[19] Each of these factors individually improves outcome for infants by as much as 1 additional week of gestation from 22 through 25 weeks' gestation. These data were averaged from multiple centers with a wide variety of outcomes, and the healthiest infants (those not requiring mechanical ventilation) were excluded from the analysis. Nevertheless, these data indicate that a decision regarding resuscitation should not be made on the basis of gestational age alone. Because this study included only infants born at a perinatal center, the impact of delivery outside a perinatal center was not evaluated. Because preterm infants born at a perinatal center have better outcomes than those transported after delivery, this should be considered when providing parents of infants born outside a perinatal center with estimates of morbidity and mortality risks.

Studies show that clinicians who provide perinatal care, patients (later in life), and parents differ in their

interpretation of outcomes of extremely preterm birth. Obstetricians and neonatologists tend to overestimate morbidity and mortality rates for extremely preterm infants,[29] which leads to underutilization of proven therapies, creating a self-fulfilling prophecy.[30,31] In addition, neonatal nurses and neonatologists generally view disabilities in surviving infants more negatively than do parents of surviving infants or the children themselves as adolescents.[32] Most families who have a surviving preterm infant with a disability do not believe that there has been a negative impact on the family, although this is not the case for all families.[33,34] Finally, adolescents who themselves were surviving extremely preterm infants generally have the same self-perceived quality of life as their control peers who were of normal birth weight, despite having more physical disabilities.[35–37] These observations highlight some of the challenges in providing guidance to parents in this complex situation.

In the United States, many neonatologists are concerned about the impact of the Born-Alive Infants Protection Act of 2001[38] on antenatal counseling, because this federal legislation specifies that a born-alive infant's legal status does not depend on gestational age, birth circumstances, or "whether anyone happens to want him or her." However, this legislation does not specify when resuscitation efforts must be initiated in the delivery room and recognizes that perceived medical futility is a justification for noninitiation of resuscitation. Although a universal definition of medical futility does not exist, a therapy is generally considered futile if it is very unlikely to benefit the patient.[39]

The antenatal consideration of noninitiation of resuscitation for an extremely low gestational age infant is a unique ethical dilemma in that the patient has not yet been seen or examined. This fact distinguishes this decision-making process from essentially all others in medicine that involve the noninitiation of life support. Therefore, whenever resuscitation is considered an option, a qualified individual should be involved and present in the delivery room to manage this complex situation. Whenever possible, this individual should be a neonatologist.

COMMUNICATIONS WITH THE PARENTS

The purpose of antenatal counseling is to inform parents and assist with decision-making. These discussions should be sensitive to the culture of the family and appropriate for the family's level of understanding of complex issues. Translation services should be used if the family is not proficient in English. Parents should be given the most accurate prognostic morbidity and mortality data available for their infant. In some situations, these may be hospital-specific data,[40,41] and in other situations, regional or national data may be more appropriate.[19] Parents need to be informed that despite the best efforts, the ability to give an accurate prognosis for a specific infant either antenatally or immediately after delivery remains limited.[40–45] Parents should be told that even with resuscitation and intensive care, many infants born at an extremely low gestational age die within the first few days after delivery.[41] Parents also need to recognize that infants who survive the first few days are likely to survive until hospital discharge, but prediction of long-term neurologic outcome remains limited.[42] It should be made clear to parents that if resuscitation is attempted and successful, situations may occur later in which it is reasonable to consider withdrawing treatment.[46] If the parents' preferences regarding resuscitation are either unknown or uncertain, both the Nuffield Council on Bioethics and the NRP suggest that resuscitation should be initiated pending further discussions.[3,4] Two surveys of parents have indicated that the vast majority of parents prefer resuscitation to be initiated even when there is great uncertainty about the outcome.[47,48] Parents should also be told that if the decision is not to initiate resuscitation or if resuscitation is unsuccessful, their infant will be provided comfort care and they will have the opportunity to hold their infant after delivery.

The most effective method of communicating complex information to parents is unknown.[41,49] Some have suggested providing written information, because parents often forget what they have been told.[50] When considering noninitiation of resuscitation for an infant, established ethical principles require that the parents be fully informed about their infant's prognosis and care options.[46,51] Whenever possible, these conversations should involve both parents at the same time, and parents must have adequate time to ask questions and consider the content of the discussions. Ideally, the neonatologist and the obstetrician should speak with the parents together and present a consistent approach. More than 1 conversation may be necessary and decisions may need to be altered if the pregnancy continues. It is important to realize that what physicians think parents hear and understand during these discussions may not reflect what the parents later report being told.[52,53]

Opinions differ on whether counseling of parents should be directive.[41] The traditional approach has been to give parents outcome data in a nondirective manner and ask them to decide whether they want their infant resuscitated. Others have argued that this places an unfair burden on parents, who may later regret their decision,

regardless of what it was, and experience feelings of guilt. In addition, parents can rarely be as informed as physicians about the complexities of prolonged hospitalization and the long-term outcome for these infants. Still others have suggested the degree to which counseling should be directive is in part related to the characteristics of individual parents. Although no consensus exists on this point, antenatal counseling may be of little value unless some degree of direction is provided to parents. After appropriate discussions, conflicts may still exist between parents and physicians regarding whether to initiate resuscitation. Further discussions will usually resolve these conflicts, but for unusual cases, referral to an ethics committee may be necessary.

CLINICAL IMPLICATIONS

1. Whether to initiate resuscitation of an infant born at an extremely low gestational age is a difficult decision, because the consequences of this decision are either the inevitable death of the infant or the uncertainties of providing intensive care for an unknown length of time with an uncertain outcome.
2. Each hospital that provides obstetric care should have a comprehensive and consistent approach to counseling parents and decision-making.
3. Parents should be provided the most accurate prognostic data available to help them make decisions. These predictions should not be based on gestational age alone but should include all relevant information affecting the prognosis.
4. It is not possible to develop specific criteria for when the initiation of resuscitation should or should not be offered. Rather, the following general guidelines are suggested when discussing this situation with parents.
   a. If the physicians involved believe that there is no chance of survival, resuscitation is not indicated and should not be initiated.
   b. If the physicians consider a good outcome to be very unlikely, then parents should be given the choice of whether resuscitation should be initiated, and clinicians should respect their preference.
   c. When the physicians' judgment is that a good outcome is reasonably likely, clinicians should initiate resuscitation and, together with the parents, continually re-evaluate whether intensive care should be continued.
5. Whenever resuscitation is considered an option, a qualified individual should be involved and present in the delivery room to manage this complex situation. Whenever possible, this individual should be a neonatologist.
6. Comfort care should be provided for all infants for whom resuscitation is not initiated or is not successful.

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CLINICAL REPORT

Antiviral Therapy and Prophylaxis for Influenza in Children

Guidance for the Clinician in Rendering Pediatric Care

Committee on Infectious Diseases

ABSTRACT

Antiviral agents are available that are safe and effective for the treatment and prophylaxis of influenza virus infections in children. The neuraminidase inhibitors (oseltamivir [Tamiflu] and zanamivir [Relenza]) are preferred agents because of current widespread resistance to the adamantanes (amantadine [Symmetrel] and rimantadine [Flumadine]). Therapy should be provided to children with influenza infection who are at high risk of severe infection and to children with moderate-to-severe influenza infection who may benefit from a decrease in the duration of symptoms. Prophylaxis should be provided (1) to high-risk children who have not yet received immunization and during the 2 weeks after immunization, (2) to unimmunized family members and health care professionals with close contact with high-risk unimmunized children or infants who are younger than 6 months, and (3) for control of influenza outbreaks in unimmunized staff and children in an institutional setting. Testing of current H5N1 avian influenza virus isolates, the potential agents of pandemic influenza, suggests susceptibility to oseltamivir and zanamivir. Because no prospective data exist on the efficacy of these agents in humans for H5N1 strains, the dosage and duration of therapy in adults and children may differ from those documented to be effective for epidemic influenza strains.

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Key Words
influenza, children, influenza antiviral, oseltamivir, zanamivir, amantadine, rimantadine, ribavirin

Abbreviations
NAI—neuraminidase inhibitor
FDA—Food and Drug Administration
CNS—central nervous system

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INTRODUCTION

Antiviral agents for treatment and prophylaxis of influenza are safe and effective in children. Annual immunization against influenza is the preferred strategy for prevention of infection, but certain situations exist in which the use of antiviral agents is beneficial.

The morbidity and mortality of epidemic influenza in unimmunized children is substantial, particularly in those younger than 2 years.[1–5] The purpose of this report is to offer guidance regarding antiviral treatment and prophylaxis to clinicians caring for children during yearly influenza epidemics and to provide resources for information on antiviral treatment in the event of an influenza pandemic, because no prospective human data currently exist on which to base recommendations for treatment of infections caused by potential H5N1 pandemic influenza virus strains.

ANTIVIRAL DRUGS FOR EPIDEMIC AND PANDEMIC INFLUENZA

Two classes of antiviral medications are currently available for treatment or prophylaxis of influenza infections: neuraminidase inhibitors (NAIs) (oseltamivir [Tamiflu; Roche Laboratories, Nutley, NJ] and zanamivir [Relenza; GlaxoSmith-Kline, Research Triangle Park, NC]) and the adamantanes (amantadine [Symme-

TABLE 1 Dosing Recommendations for Antiviral Agents for Treatment and Prophylaxis of Influenza

Drug	Formulations	Dosing Recommendations									
		Treatment					Prophylaxis				
		Children				Adults	Children				Adults
Oseltamivir (Tamiflu)	75-mg capsule; 60 mg/5 mL suspension	For treatment, children ≥12 mo should receive ~4 mg/kg per d divided into 2 doses for a 5-d treatment course				150 mg/d divided into 2 doses for 5 d	≤15 kg	>15–23 kg	>23–40 kg	>40 kg	75 mg once daily
		≤15 kg: 60 mg/d divided into 2 doses	>15–23 kg: 90 mg/d divided into 2 doses	>23–40 kg: 120 mg/d divided into 2 doses	>40 kg: 150 mg/d divided into 2 doses		30 mg once daily	45 mg once daily	60 mg once daily	75 mg once daily	
		Children ≥7 y and Adults					Children ≥5 y and Adults				
Zanamivir (Relenza)	5 mg per inhalation (Diskhaler)	2 inhalations (10 mg total per dose), twice daily for 5 d					2 inhalations (10 mg total per dose), once daily for 10 d				
		1–9 y		9–12 y		Adults	1–9 y		9–12 y		Adults
Amantadine (Symmetrel)	100-mg tablet; 50 mg/5 mL suspension	5–8 mg/kg per d as a single daily dose or divided into 2 doses but not to exceed 150 mg/d[a,b]; treat for 24–48 h after the disappearance of signs and symptoms		200 mg/d divided into 2 doses (not studied as a single daily dose)[a,b]; treat for 24–48 h after the disappearance of signs and symptoms		200 mg/d, either as a single daily dose or divided into 2 doses[a,b]; treat for 24–48 h after the disappearance of signs and symptoms	Same as treatment dose[a,b]		Same as treatment dose[a,b]		Same as treatment dose[a,b]
		1–9 y		≥10 y		Adults	1–9 y		≥10 y		Adults
Rimantadine (Flumadine)	100-mg tablet; 50 mg/5 mL suspension	Not FDA approved for treatment in children, but published data exist on safety and efficacy[45]				200 mg/d, either as a single daily dose or divided into 2 doses[a]	5 mg/kg per d once daily, not to exceed 150 mg[a,b]		200 mg/d, either as a single daily dose or divided into 2 doses[a,b]		200 mg/d, either as a single daily dose or divided into 2 doses[a,b]
		6.6 mg/kg per d (maximum 150 mg/kg per d) divided into 2 doses		200 mg/d, either as a single daily dose or divided into 2 doses[a]							

[a] Amantadine and rimantadine should only be used for prophylaxis in winter seasons during which a majority of influenza A virus strains isolated are adamantane-susceptible; the adamantanes should not be used for primary therapy because of the rapid emergence of resistance. However, for those requiring adamantane therapy, a treatment course of approximately 7 days is suggested, or 24 to 48 hours after the disappearance of signs and symptoms.

[b] For prophylaxis, antiviral drugs should be continued for the duration of known influenza A in the community because of the potential for repeated and unknown exposures or until immunity can be achieved after immunization.

trel; Endo Pharmaceuticals, Chads Ford, PA] and rimantadine [Flumadine; Forest Pharmaceuticals, St Louis, MO]). Guidelines for the use of these 4 antiviral agents are summarized in Table 1. Little is currently known about the efficacy of antiviral agents against H5N1 strains of influenza A virus that may ultimately cause an influenza pandemic. Current concerns about widespread resistance to the adamantanes limit the usefulness of this class of agents for both epidemic strains and H5N1 strains of influenza A virus.

The NAIs block the action of influenza neuraminidase, an enzyme present on the viral envelope that provides for the efficient release of progeny virion particles from the surface of an infected cell. The target of the adamantanes is the viral M2 matrix protein, an ion-channel protein that spans the viral envelope's lipid bilayer and is required for viral uncoating. Detailed reviews of antiviral therapy have been published recently.[6–12]

With all antiviral medications, treatment earlier in the course of infection is likely to offer maximum benefit. Treatment starting as early as 12 hours after onset of symptoms has the greatest impact on disease resolution.[13] Most studies have been performed in otherwise healthy children who had symptoms for less than 48 hours, with the reported improvement in outcomes being most profound in those children who were provided early therapy. Although study populations may not accurately reflect the diverse patient population seen by health care professionals, the longer symptoms extend beyond 48 hours before starting treatment, the less likely the child will benefit from antiviral therapy.

The antiviral agents discussed below that are approved for treatment and/or prophylaxis of influenza are active only against influenza viruses. Exposing children to antiviral therapy for noninfluenza infections results in unnecessary toxicity and cost and may deplete the supply of antiviral agents. Testing for influenza is encouraged if available and expected to influence clinical management, particularly at the onset of the influenza season.[5] The sensitivity and specificity of rapid diagnostic tests for influenza have been reviewed recently.[9]

NAIs

Background

There are 2 NAIs approved by the US Food and Drug Administration (FDA): oseltamivir and zanamivir. Oseltamivir is available in tablet and liquid forms, but zanamivir is only available in an aerosol formulation.

Infection of the cell by influenza virus is initiated when viral hemagglutinin binds to sialic acid–containing glycoproteins on the cell surface. After the virus enters the cell and viral proteins and nucleic acid subsequently are produced, new viral particles assemble at the cell surface. The viral neuraminidase cleaves the virus from the host cell membrane attachment site, thus freeing the virus to infect other cells. The NAI antiviral agents inhibit productive infection by preventing release of infectious virus from host cell membranes and promote clumping of viral particles via binding to glycoproteins that are present in respiratory mucus.[10,12]

Oseltamivir Treatment

Oseltamivir has been investigated in a prospective, randomized, blinded, placebo-controlled study in children 1 to 12 years of age.[14] A 5-day treatment course was associated with a median reduction in overall clinical illness of 36 hours and a reduction in fever of 25 hours in oseltamivir-treated children compared with placebo recipients. Furthermore, the incidence of acute otitis media (assessed by tympanometry and physician-prescribed antimicrobial therapy) was reduced by 44% compared with placebo recipients. A significant decrease in viral shedding was also noted in treated children, with few children still shedding virus on day 4 of therapy. The most common adverse drug effects noted were gastrointestinal tract disturbances, with vomiting in 14% of oseltamivir-treated children compared with 8% of children who were given placebo.

In studies of unimmunized children with asthma 6 to 12 years of age who received oseltamivir or placebo, no difference in the median time to freedom from illness was demonstrated, but a significant improvement in pulmonary function was noted on day 6 after treatment.[15] For oseltamivir-treated children whose therapy was started within 24 hours of onset, a more dramatic difference in alleviation of all symptoms was noted, compared with those who were started on therapy after 24 to 48 hours of symptoms.

Although earlier therapy may lead to a more profound treatment effect, it is also possible that earlier treatment may impair the host immunologic response to influenza infection. An impaired immune response could leave the host susceptible on reexposure to the virus, as has been reported in 2 children with influenza B virus infections.[16]

Oseltamivir is not approved for therapy in children younger than 12 months because of concerns of central nervous system (CNS) toxicity seen in infant rats.[17] Limited data on safety and efficacy of oseltamivir exist in this young age group, although no specific drug-attributable toxicities have been observed to date.[18,19]

Oseltamivir may be taken with or without food and is eliminated entirely by glomerular filtration and tubular secretion. The dose of oseltamivir should be decreased by 50% for children with decreased renal function associated with a creatinine clearance of between 10 and 30 mL/minute.

Unpublished safety data on oseltamivir were recently reviewed by the FDA on the basis of reports of neuropsychiatric events associated with patients treated for influ-

enza with oseltamivir (www.fda.gov/ohrms/dockets/ac/06/briefing/2006-4254b_09_01_Tamiflu%20AE%20Review%202006%20Redacted_D060309_092.pdf). Although 92% of the most recent cases were reported from Japan, a country with approximately 4 times more courses of oseltamivir prescribed than in the United States, package labeling was changed in the United States in 2006 to alert physicians to the possibility of these rare and unusual clinical findings. Accurate data on the incidence of these events are not available, but they seem to be in the range of 1 in 10 000 to 100 000 treatment courses. On the basis of the FDA review, it is not known whether the spontaneous reports of neuropsychiatric behavior reflect a true adverse event caused by oseltamivir, perhaps with a greater incidence in populations with a certain genetic background; a result of CNS infection caused by influenza virus; or a combination of both drug and virus in the CNS. There are no reports of neuropsychiatric events in adults or children receiving oseltamivir prophylaxis for influenza infection.

Zanamivir Treatment

Zanamivir is administered by aerosol twice daily for 5 days. In a study of children 4 to 12 years of age, the mean duration of symptomatic illness was reduced by 1.25 days in children who received zanamivir, compared with those who received placebo.[20] In 3 trials in subjects 12 years and older, zanamivir treatment decreased symptoms by 1 to 2.5 days in influenza-positive subjects.[21–24] In a multicenter prospective study of subjects whose therapy was started within 30 hours of the onset of symptoms, resolution of major symptoms occurred 3 days earlier in the treatment group compared with that in controls.[24]

Reported adverse effects in otherwise healthy children and adults were similar between those treated with zanamivir and those given placebo. However, concerns by the FDA regarding bronchospasm and decreased pulmonary function after inhalation of zanamivir in patients with underlying reactive airways disease, including asthma and chronic obstructive pulmonary disease, prompted warnings about use of zanamivir in this population. Potential risks and benefits should be carefully weighed before treatment of these children. Monitoring of respiratory function should be considered if treatment is given.[25]

Zanamivir is minimally absorbed from the respiratory tract mucosa. No dosing changes are required for renal failure.

Prophylaxis With Oseltamivir and Zanamivir

Postexposure prophylaxis with oseltamivir has been reported in a multicenter study in North America and Europe for family contacts who were at least 1 year of age after identification of a documented index case within the family.[26] In this setting, in which the index case was also treated with oseltamivir, the protective efficacy against proven influenza for individual contacts was 68%.[26] In a similar multicenter study for household contacts 12 years and older, oseltamivir was 89% effective in the prevention of laboratory-confirmed symptomatic influenza infection when used within 48 hours of contact with an index case who had not been treated.[27] Adverse events reported in treated subjects in this study, including gastrointestinal tract symptoms, were not different from those in controls.[27]

Zanamivir was investigated as postexposure prophylaxis for family members 5 years and older, at a dosage of 10 mg, inhaled once daily for 10 days, with the index case also receiving treatment. After exposure to a virus-positive index case, the number of families with a clinically symptomatic member decreased 72%.[28]

Antiviral Resistance

Development of resistance to NAIs while on therapy occurs less often than resistance to adamantanes.[29] In a multicenter study in the United States, only 5% of children who received oseltamivir therapy developed in vitro resistance in influenza isolates cultured during therapy.[14] In contrast, a study from Japan documented resistance of 18% in isolates cultured from 50 oseltamivir-treated children.[12,30] Fortunately, oseltamivir-resistant isolates from children do not seem to be as capable of sustaining infection as wild-type strains as assessed in animal models of influenza infection.[31,32] However, when generated entirely in vitro, some mutants are just as capable of infectivity as the parent strain,[33] which indicates that the possibility still exists for the development and spread of oseltamivir-resistant strains among children. Zanamivir resistance was not reported in the published large-scale clinical trials.

Adamantanes

Background

Amantadine and rimantadine are approved for children 12 months and older. Amantadine, the first antiviral agent available against influenza, was approved by the FDA in 1966; rimantadine was approved in 1993. Antiviral activity is mediated by binding these agents to the M2 protein ion channels on the viral envelope, preventing acidic conditions within the virus that are required for uncoating and subsequent release of viral nucleic acid into the host cell.[34] Only influenza A virus contains the M2 protein. A different envelope protein that does not bind to the adamantanes provides a similar function in influenza B virus; amantadine and rimantadine are not active against influenza B. The effectiveness of adamantanes has been limited by the emergence of widespread resistance in H3N2 strains isolated in the 2005–2006 influenza season.[35] Recommendations for adamantane antiviral use in subsequent years will be based on the resistance patterns docu-

mented in strains circulating during those influenza seasons.

Amantadine Treatment

Placebo-controlled, randomized clinical trials have documented that amantadine treatment decreases the duration of fever and other influenza-attributable symptoms in influenza caused by adamantane-susceptible strains by approximately 1 day in children 1 year and older.[36–40] However, many of the earlier placebo-controlled studies that included children did not report age-specific response or adverse-event rates. Adverse events have been most accurately assessed and reported in adults. The most commonly occurring (5%–10%) adverse events are nausea, lightheadedness, and insomnia. Those that occur infrequently (1%–5%) include anxiety, nervousness, irritability, dry mouth, headache, fatigue, and diarrhea.[41] The incidence of CNS adverse effects noted above is twofold higher in those taking amantadine than in those taking rimantadine. Gastrointestinal adverse effects are equivalent between the 2 agents. These effects are dosage related and are usually mild, resolving when the agent is discontinued. Serious adverse effects have been reported in adults and are often associated with either high plasma drug concentrations in patients with renal insufficiency or in those with an underlying psychiatric or seizure disorder.[42]

Although no prospective studies have been published on the treatment of children with encephalitis as a complication of influenza, data on cerebrospinal fluid concentrations of amantadine suggest a high degree of cerebrospinal fluid penetration, with concentrations that may provide antiviral activity.[43]

Amantadine is well absorbed orally and is excreted almost entirely by the kidneys with variable metabolism before elimination. The dose should be decreased 50% in children with creatinine clearance between 30 and 50 mL/minute per 1.73 m^2. Additional reductions are required for more profound renal failure.

Rimantadine Treatment

Rimantadine was evaluated in prospective studies of children using acetaminophen-treated controls between 1 and 12 years of age[44] and 1 and 15 years of age.[45] In a study by Thompson et al,[44] no differences were recorded in the reduction of symptoms between the 2 groups, although the amount of virus shed was less during the first 2 days of therapy for the treatment group. Of concern, the virus shed by those who continued to have positive culture results on the fourth day of treatment was often resistant to rimantadine. Hall and colleagues[45] noted a significant reduction in severity of disease, including fever. However, a high rate of rimantadine resistance occurred in treated children, with almost half of the strains noted to be resistant when isolated from children who were still shedding virus at the end of the 7-day treatment course. In addition, it is concerning that rimantadine-treated children were more likely to be shedding virus at the end of therapy than were controls. No differences in adverse-event rates were noted between children treated with rimantadine and those treated with acetaminophen. In controlled studies in adults, no drug-attributable adverse effects occurred in more than 5% of the study subjects, with the most commonly reported events being insomnia and dizziness.[46]

Rimantadine is also well absorbed orally but, unlike amantadine, undergoes extensive hepatic metabolism with subsequent renal elimination. Dose adjustment should be made for severe hepatic dysfunction or renal failure.

Prophylaxis With Amantadine and Rimantadine

Early studies on the prevention of influenza with amantadine were conducted in home or institutional settings during the influenza season using prospective, double-blind trial designs and documented a statistically significant benefit by reducing the attack rate of influenza A.[47–50] However, as with the early amantadine treatment studies, age-specific data are lacking.

Studies on the use of rimantadine as prophylaxis for children within families were conducted during influenza seasons in which the predominant circulating strains were H1N1[51] and H3N2.[52] In both studies, prophylaxis reduced the number of symptomatic influenza cases in children relative to an attack rate of 15% to 20% among placebo recipients. Prophylaxis in children also reduced the number of cases of symptomatic influenza in adult family members. Of note, cases of asymptomatic influenza infection as documented by throat culture or fourfold increase in influenza antibody titers did occur in a small number of children who received rimantadine prophylaxis.

Antiviral Resistance

Amantadine or rimantadine resistance develops in approximately one third of patients who receive antiviral therapy.[53] The development of resistance has implications for therapeutic failure for (1) the child, if resistance develops early in therapy, (2) household or close contacts, because resistance in the index case determines which therapy is likely to be effective in those exposed to the index case, and (3) communities, in which resistance may be so widespread to a particular agent that empiric therapy with that agent may no longer be recommended.

Resistance to adamantanes occurs rapidly, often within the first 3 days of therapy. Mutations lead to structural changes at predictable, specific sites on the M2 protein. These changes are relatively stable, with little reversion to wild-type susceptible virus after stopping the adamantane. Appreciable differences in virulence or

transmissibility between resistant and susceptible viruses have not been noted.

In a recent study, nasal swabs, nasal aspirates, or throat cultures were obtained from hospitalized children before, during, and after a 3- to 5-day course of amantadine, and 80% of isolates from treated children demonstrated amantadine resistance.[54] Shedding of resistant strains was not associated with persistent or relapsing clinical disease, which is felt to reflect an adequate host immunologic response that develops as resistant strains are emerging. For the high-risk child with a poor immunologic response to infection, persistent disease or relapse is a concern.

Close contacts of an amantadine- or rimantadine-treated child who subsequently develop influenza infection are at high risk of infection caused by an adamantane-resistant influenza virus. If such patients require treatment or prophylaxis, an NAI should be used. During the 2005–2006 influenza season, data collected on widespread resistance to adamantanes in circulating influenza A strains in the United States led the Centers for Disease Control and Prevention to recommend against the use of these agents for either treatment or prophylaxis of influenza A infections.[55]

Ribavirin

Ribavirin has in vitro activity against influenza virus but is not currently approved for treatment of influenza infection. Limited studies have been performed with aerosolized ribavirin in the treatment of influenza in children.[56] For life-threatening influenza infection requiring parenteral therapy, intravenous ribavirin may be obtained as an investigational product through the FDA, as supplied by the manufacturer. No prospective, controlled data currently exist on the safety or efficacy of parenteral ribavirin for severe, invasive influenza infection, although limited data on pharmacokinetics of parenteral ribavirin exist for adults.[57]

INDICATIONS FOR THERAPY AND PROPHYLAXIS

Therapy

- Influenza infection of any severity in high-risk children (see Appendix) regardless of immunization status
- Any otherwise healthy child with moderate-to-severe influenza infection who may benefit from the decrease in duration of clinical symptoms documented to occur with therapy

Prophylaxis

- High-risk children during the 2 weeks after influenza immunization, if influenza is active in the community
- High-risk children for whom influenza vaccine is contraindicated
- Family members or health care providers who are unimmunized and are likely to have ongoing, close exposure to (1) high-risk, unimmunized children or (2) infants who are younger than 6 months
- Control of influenza outbreaks for unimmunized staff and children in a closed institutional setting with high-risk pediatric residents (eg, extended-care facilities)
- As a supplement to immunization among high-risk children
- Postexposure prophylaxis in a family setting
- High-risk children and their family members and close contacts, as well as health care workers, when circulating strains of influenza virus in the community are not matched with vaccine strains

ANTIVIRAL THERAPY IN PANDEMIC INFLUENZA

Antiviral therapy may play a major role in both treatment and prophylaxis during a pandemic.[58,59] Pandemic influenza is likely to occur sometime within the next decade. Recent observations document the spread of an epidemic of H5N1 strain of avian influenza A virus in both wild and domestic bird species from southeast Asia to Indonesia, Europe, and Africa, with further spread felt likely to occur. As of October 16, 2006, 256 adult and pediatric cases of H5N1 influenza infection have been documented worldwide, associated with a mortality rate of 59%.[60] These infections have occurred most often in those with close, direct contact with poultry. Efficient transmission of the virus between humans, an event that is required before a human pandemic can occur, has not been documented to date with any of the currently identified H5N1 strains.

Intense planning for the possibility of an influenza pandemic with a virulent strain of H5N1 or another influenza virus subtype is ongoing at international, national, state, and local levels. The American Academy of Pediatrics and other professional organizations and stakeholders have had important input into the Pandemic Influenza Strategic Plan of the US Department of Health and Human Services, which was released in late 2005.[61] Interim priorities for antiviral therapy and vaccine are included as part of the plan and reflect a need to treat and protect those most at risk of severe and fatal influenza and to preserve critical societal infrastructure (eg, law enforcement, medical facilities, government). Efforts are currently underway to stockpile adequate supplies of antiviral drugs to address both health care and societal requirements. The Strategic National Stockpile currently includes oseltamivir and rimantadine. Although most strains of H5N1 are susceptible only to the NAIs, some are susceptible to the adamantanes. The dose

and duration of therapy for H5N1 infections may be different from those for currently circulating H3N2 or H1N1 infections. In the case of a pandemic, the Centers for Disease Control and Prevention, the American Academy of Pediatrics, and state and local health departments will provide current recommendations for therapy and prophylaxis.

APPENDIX: INFANTS AND CHILDREN AT HIGH RISK OF COMPLICATIONS FROM INFLUENZA INCLUDE THOSE WITH:

- Ages between 6 and 24 months (no antiviral agent is currently approved for infants younger than 12 months)
- Asthma or other chronic pulmonary diseases such as cystic fibrosis
- Hemodynamically significant cardiac disease
- Immunosuppressive disorders or therapy
- HIV infection
- Sickle cell anemia and other hemoglobinopathies
- Diseases requiring long-term aspirin therapy, such as rheumatoid arthritis or Kawasaki disease
- Chronic renal dysfunction
- Chronic metabolic disease such as diabetes mellitus
- Neuromuscular disorders, seizure disorders, or cognitive dysfunction that may compromise the handling of respiratory secretions

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Committee on Obstetric Practice

ABSTRACT

The Apgar score provides a convenient shorthand for reporting the status of the newborn infant and the response to resuscitation. The Apgar score has been used inappropriately to predict specific neurologic outcome in the term infant. There are no consistent data on the significance of the Apgar score in preterm infants. The Apgar score has limitations, and it is inappropriate to use it alone to establish the diagnosis of asphyxia. An Apgar score assigned during resuscitation is not equivalent to a score assigned to a spontaneously breathing infant. An expanded Apgar score reporting form will account for concurrent resuscitative interventions and provide information to improve systems of perinatal and neonatal care.

INTRODUCTION

In 1952, Dr Virginia Apgar devised a scoring system that was a rapid method of assessing the clinical status of the newborn infant at 1 minute of age and the need for prompt intervention to establish breathing.[1] A second report evaluating a larger number of patients was published in 1958.[2] This scoring system provided a standardized assessment for infants after delivery. The Apgar score comprises 5 components: heart rate, respiratory effort, muscle tone, reflex irritability, and color, each of which is given a score of 0, 1, or 2. The score is now reported at 1 and 5 minutes after birth. The Apgar score continues to provide a convenient shorthand for reporting the status of the newborn infant and the response to resuscitation. The Apgar score has been used inappropriately in term infants to predict specific neurologic outcome. Because there are no consistent data on the significance of the Apgar score in preterm infants, in this population the score should not be used for any purpose other than ongoing assessment in the delivery room. The purpose of this statement is to place the Apgar score in its proper perspective.

The neonatal resuscitation program (NRP) guidelines[3] state that "Apgar scores should not be used to dictate appropriate resuscitative actions, nor should interventions for depressed infants be delayed until the 1-minute assessment." However, an Apgar score that remains 0 beyond 10 minutes of age may be useful in determining whether additional resuscitative efforts are indicated.[4] The current NRP guidelines[3] state that "if there is no heart rate after 10 minutes of complete and adequate resuscitation efforts, and there is no evidence of other causes of newborn compromise, discontinuation of resuscitation efforts may be appropriate. Current data indicate that, after 10 minutes of asystole, newborns are very unlikely to survive, or the rare survivor is likely to survive with severe disability."

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Key Words
Apgar score, asphyxia, neurologic outcome, resuscitation, cerebral palsy

Abbreviation
NRP—neonatal resuscitation program

Previously, an Apgar score of 3 or less at 5 minutes was considered an essential requirement for the diagnosis of perinatal asphyxia. *Neonatal Encephalopathy and Cerebral Palsy: Defining the Pathogenesis and Pathophysiology*,[5] produced in 2003 by the American College of Obstetricians and Gynecologists in collaboration with the American Academy of Pediatrics, lists an Apgar score of 0 to 3 beyond 5 minutes as one suggestive criterion for an intrapartum asphyxial insult. However, a persistently low Apgar score alone is not a specific indicator for intrapartum compromise. Further, although the score is used widely in outcome studies, its inappropriate use has led to an erroneous definition of asphyxia. Intrapartum asphyxia implies fetal hypercarbia and hypoxemia, which, if prolonged, will result in metabolic acidemia. Because the intrapartum disruption of uterine or fetal blood flow is rarely, if ever, absolute, asphyxia is an imprecise, general term. Descriptions such as hypercarbia, hypoxia, and metabolic, respiratory, or lactic acidemia are more precise for immediate assessment of the newborn infant and retrospective assessment of intrapartum management.

LIMITATIONS OF THE APGAR SCORE

It is important to recognize the limitations of the Apgar score. The Apgar score is an expression of the infant's physiologic condition, has a limited time frame, and includes subjective components. In addition, the biochemical disturbance must be significant before the score is affected. Elements of the score such as tone, color, and reflex irritability partially depend on the physiologic maturity of the infant. The healthy preterm infant with no evidence of asphyxia may receive a low score only because of immaturity.[6] A number of factors may influence an Apgar score, including but not limited to drugs, trauma, congenital anomalies, infections, hypoxia, hypovolemia, and preterm birth.[7] The incidence of low Apgar scores is inversely related to birth weight, and a low score is limited in predicting morbidity or mortality.[8] Accordingly, it is inappropriate to use an Apgar score alone to establish the diagnosis of asphyxia.

APGAR SCORE AND RESUSCITATION

The 5-minute Apgar score, and particularly a change in the score between 1 and 5 minutes, is a useful index of the response to resuscitation. If the Apgar score is less than 7 at 5 minutes, the NRP guidelines state that the assessment should be repeated every 5 minutes up to 20 minutes.[3] However, an Apgar score assigned during a resuscitation is not equivalent to a score assigned to a spontaneously breathing infant.[9] There is no accepted standard for reporting an Apgar score in infants undergoing resuscitation after birth, because many of the elements contributing to the score are altered by resuscitation. The concept of an "assisted" score that accounts for resuscitative interventions has been suggested, but the predictive reliability has not been studied. To describe such infants correctly and provide accurate documentation and data collection, an expanded Apgar score report form is proposed (Fig 1).

PREDICTION OF OUTCOME

A low 1-minute Apgar score alone does not correlate with the infant's future outcome. A retrospective analysis concluded that the 5-minute Apgar score remained a valid predictor of neonatal mortality, but using it to predict long-term outcome was inappropriate.[10] On the other hand, another study[11] stated that low Apgar scores at 5 minutes are associated with death or cerebral palsy, and this association increased if both 1- and 5-minute scores were low.

An Apgar score at 5 minutes in term infants correlates poorly with future neurologic outcomes. For example, a score of 0 to 3 at 5 minutes was associated with a slightly increased risk of cerebral palsy compared with higher scores.[12] Conversely, 75% of children with cerebral palsy had normal scores at 5 minutes.[12] In addition, a low 5-minute score in combination with other markers of asphyxia may identify infants at risk of developing seizures (odds ratio: 39; 95% confidence interval: 3.9–392.5).[13] The risk of poor neurologic outcomes increases when the Apgar score is 3 or less at 10, 15, and 20 minutes.[7]

A 5-minute Apgar score of 7 to 10 is considered normal. Scores of 4, 5, and 6 are intermediate and are not markers of increased risk of neurologic dysfunction. Such scores may be the result of physiologic immaturity, maternal medications, the presence of congenital malformations, and other factors. Because of these other conditions, the Apgar score alone cannot be considered evidence or a consequence of asphyxia. Other factors including nonreassuring fetal heart rate monitoring patterns and abnormalities in umbilical arterial blood gases, clinical cerebral function, neuroimaging studies, neonatal electroencephalography, placental pathology, hematologic studies, and multisystem organ dysfunction need to be considered when defining an intrapartum hypoxic-ischemic event as a cause of cerebral palsy.[5]

OTHER APPLICATIONS

Monitoring of low Apgar scores from a delivery service can be useful. Individual case reviews can identify needs for focused educational programs and improvement in systems of perinatal care. Analyzing trends allows assessment of the impact of quality improvement interventions.

CONCLUSION

The Apgar score describes the condition of the newborn infant immediately after birth[14] and, when properly ap-

APGAR SCORE

Gestational Age _____ weeks

SIGN	0	1	2	1 minute	5 minute	10 minute	15 minute	20 minute
COLOR	Blue or Pale	Acrocyanotic	Completely Pink					
HEART RATE	Absent	<100 minute	>100 minute					
REFLEXIRRITABILITY	No Response	Grimace	Cry or Active Withdrawal					
MUSCLE TONE	Limp	Some Flexion	Active Motion					
RESPIRATION	Absent	Weak Cry; Hypoventilation	Good, crying					
			TOTAL					

Comments:

Resuscitation

Minutes	1	5	10	15	20
Oxygen					
PPV/NCPAP					
ETT					
Chest Compressions					
Epinephrine					

FIGURE 1

Expanded Apgar score form. Record the score in the appropriate place at specific time intervals. The additional resuscitative measures (if appropriate) are recorded at the same time that the score is reported using a check mark in the appropriate box. Use the comment box to list other factors including maternal medications and/or the response to resuscitation between the recorded times of scoring. PPV/NCPAP indicates positive-pressure ventilation/nasal continuous positive airway pressure; ETT, endotracheal tube.

plied, is a tool for standardized assessment. It also provides a mechanism to record fetal-to-neonatal transition. An Apgar score of 0 to 3 at 5 minutes may correlate with neonatal mortality but alone does not predict later neurologic dysfunction. The Apgar score is affected by gestational age, maternal medications, resuscitation, and cardiorespiratory and neurologic conditions. Low 1- and 5-minute Apgar scores alone are not conclusive markers of an acute intrapartum hypoxic event. Resuscitative interventions modify the components of the Apgar score. There is a need for perinatal health care professionals to be consistent in assigning an Apgar score during a resuscitation. The American Academy of Pediatrics and the American College of Obstetricians and Gynecologists propose use of an expanded Apgar score reporting form that accounts for concurrent resuscitative interventions.

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POLICY STATEMENT

Application of the Resource-Based Relative Value Scale System to Pediatrics

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Coding and Nomenclature

ABSTRACT

With an increased focus on payment and productivity measurement in health care, it is essential to understand the genesis and principles behind the Medicare Resource-Based Relative Value Scale (RBRVS) physician fee schedule. The majority of third-party payers, including a growing number of Medicaid programs and commercial payers, use variations of the Medicare RBRVS as their basis for physician payment. Many group practices have also adopted this system to benchmark physician productivity and determine variable compensation and bonus payments. Because pediatric care is underrepresented in any Medicare-based payment system analysis, unique aspects of physician work and practice expense may not be accurately reflected in the total relative value units (RVUs) for certain pediatric services. Despite this potential limitation, the American Academy of Pediatrics supports the use of *Current Procedural Terminology* (CPT) codes to report unique physician work and the RBRVS physician fee schedule as a uniform payment system. The American Academy of Pediatrics will continue to work to rectify perceived inequities of the RBRVS system as they pertain to pediatrics. *Pediatrics* 2008;122:1395–1400

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Key Words

payment, coding, Resource-Based Relative Value Scale, RBRVS, physician work, practice expense

Abbreviations

RBRVS—Resource-Based Relative Value Scale
OBRA 89—Omnibus Budget Reconciliation Act of 1989
wRVU—work relative value unit
PE—practice expense
RVU—relative value unit
CPR—customary, prevailing and reasonable
CF—conversion factor
CPT—*Current Procedural Terminology*
CMS—Centers for Medicare and Medicaid Services
AAP—American Academy of Pediatrics
AMA—American Medical Association
RUC—American Medical Association/Specialty Society Relative Value Scale Update Committee
COCN—Committee on Coding and Nomenclature
HIPAA—Health Insurance Portability and Accountability Act of 1996
ICD-9-CM—*International Classification of Diseases, Ninth Revision, Clinical Modification*
PLI—professional liability insurance
GPCIs—geographic practice cost indices
HCPCS—Healthcare Common Procedural Coding System

BACKGROUND

Creation of Resource-Based Relative Value Scale Payment System

The Medicare Resource-Based Relative Value Scale (RBRVS), which reformed physician payments for Medicare recipients, was enacted by Congress and signed into law as part of the Omnibus Budget Reconciliation Act of 1989 (OBRA 89). The OBRA 89 created a uniform RBRVS physician payment system based on objective measures of physician work (work relative value units [wRVUs]), accurate assessments of the practice expense (PE) in providing professional services to patients, and an additional payment factor representing the professional liability cost (malpractice expense) inherent in each specific service. Together, these 3 components make up the total relative value units (RVUs) for the service. The 5-year transition plan to this payment methodology began on January 1, 1992. Because these RVUs are uniformly applied across all medical specialties providing services, the RBRVS system promotes equity in physician payment. The RBRVS system eliminated many of the dramatic disparities when payments were specialty and practice specific and based on the customary, prevailing, and reasonable (CPR) or usual, customary, and reasonable (UCR) fees for the service provided.

Conversion Factor

Congress also established a budget-neutral conversion factor (CF) that would not increase Medicare payments above that seen under the CPR system. This CF (or dollars per RVU) is an annual legislatively set national dollar value that converts the total RVUs for any service into a physician payment amount (RVU × CF = payment) for the Medicare service provided. Congress recognized that increases in Part B (physician payments) Medicare expenditures attributable to increased enrollment, changes in medical practice, new technology, new *Current Procedural Terminology* (CPT) codes, and additional screening recommendations would occur but decided in toto that they must not exceed $20 million dollars annually. However, every year the projected increases have

exceeded that amount. In response to this conundrum, Congress agreed to a yearly update to the CF that was based on the percentage increase in the Medicare Economic Index (MEI). This index is a comparison of the projected increases in utilization, described as the Medicare Volume Performance Standard (MVPS), to the actual increase in spending and other Medicare funding factors. This link between payment and utilization was anticipated to provide physicians an incentive to control the type and number of services offered to Medicare recipients instead of merely linking the CF only to expenditure targets. Subsequently, the Balanced Budget Act of 1997 replaced the MVPS with a new sustainable growth rate system to control Medicare expenditures.

Sustainable Growth Rate

The sustainable growth rate is a formula for determining the annual CF on the basis of the projected growth in gross domestic product per capita instead of historical patterns of volume growth. The Centers for Medicare and Medicaid Services (CMS) have maintained budget neutrality by a variety of measures but primarily by lowering the CF or rescaling Medicare RVUs. If utilization increases, updates that result in lower Medicare CF updates in subsequent years can lead to annual declines in payments to physicians providing services to Medicare recipients. Medicare RVU reductions have sometimes also been adopted by private payers. Historically, the American Academy of Pediatrics (AAP) has advocated that adjustments must only be made by alterations to the CF to maintain the integrity of the RVU-based payment system. This integrity is best preserved by maintaining the American Medical Association (AMA)/Specialty Society Relative Value Scale Update Committee (RUC)-recommended and CMS-published RVUs for each code.

Five-Year Review Process

The congressionally mandated 5-year review of RVU values is an opportunity to review changes in medical practice that may increase or decrease the cost of providing a specific service. During the 5-year review in 2005, the evaluation and management (E/M) codes, which make up the bulk of primary care billing (office, consultation, and hospital visit codes), were resurveyed. The surveys recognized the increase in average severity of illness as well as the increase in PEs associated with insurance processing and compliance monitoring. The CMS agreed with the 5-year review code revaluations, increasing RVU work values for the higher-level office, consultation, and hospital E/M services.

Payers must be encouraged to embrace the CMS 5-year review of relative work values and the recent efforts to implement an accurate, resource-based approach to the PE portion of total RVUs. The AAP recognizes that the CMS annual budget neutrality adjustments to the CF is a legislative mandate; however, the AAP strongly opposes arbitrary adjustments to the wRVUs as a method of controlling increasing Medicare costs. Private payers and Medicaid programs must recognize that these Medicare adjustments are the result of budgetary constraints imposed by Congress (budget neutrality) and do not reflect changes in the provision of care or the relative value of work expended in providing a specific physician service.

Pediatric CPT Codes

The AAP, through its Committee on Coding and Nomenclature (COCN), continues to develop new/revised CPT codes appropriate for pediatrics. Once new codes are accepted by the CPT Editorial Panel of the AMA, the COCN works within the RUC process to provide the CMS with RVU recommendations that accurately reflect the work and direct PEs involved in providing services to children. The AAP has had significant successes in this process, as evidenced by the expanded list of neonatal and pediatric critical care, continuing intensive care, cardiac catheterization, care plan oversight, immunization administration, and non–face-to-face services codes. However, acceptance of a new code and its RUC valuation does not guarantee payment. As a first step toward appropriate payment, payers are expected to accept new codes as soon as they become effective.

Non-Medicare Use of the RBRVS

Pediatricians care for few patients covered by Medicare (with the exception of children with chronic renal failure). However, because the majority of non-Medicare payers, including Medicaid, have converted to the Medicare RBRVS payment system, changes in Medicare RVUs affect payments for children's services.

Non-Medicare payers are not legally bound to utilize the Medicare RBRVS or its CF and can establish their own payment methodologies. However, most, if not all, non-Medicare payers have adopted the RBRVS system. Although the RBRVS physician fee schedule was initially implemented by the CMS (formerly the Health Care Financing Administration [HCFA]) as a mechanism for the payment of physician services provided to Medicare recipients, the schedule has now been applied to all patient populations, including those commonly covered by Medicaid programs and commercial insurers. A recent report by the AMA revealed that 77% of the private plans surveyed in 2006 reported some use of an RBRVS payment system, compared with 74% in 2001 and 63% in 1998.[1] The AAP has dedicated itself to advocating for non-Medicare payers' CFs to at least be in parity with, if not above, the Medicare CF and for utilization of the most current Medicare RBRVS RVUs to be the basis of their payment methodologies.

APPLICABILITY TO PEDIATRICS

The work estimates driving the RBRVS Medicare physician fee schedule were developed primarily to reflect the services rendered to the typical Medicare patient and, as such, may not accurately reflect the breadth and scope of work expended to provide care to neonates, infants, children, and adolescents. A few Medicaid agencies have established a higher pediatric CF or established auxiliary fee schedules or case management fees to augment physician payment for children's care, recognizing that some pediatric services

are undervalued. These increases have been useful in some states to stimulate participation by physicians to expand access to prenatal care, obstetric care, and well-infant services.

Despite aforementioned reservations, the AAP advocates for the use of the RBRVS physician fee schedule as an appropriate and fundamentally fair system for valuing and establishing payment for pediatric services. The AAP believes that, in principle, an RBRVS-based fee schedule, supported by objective assessments of physician work, is more consistent and equitable than the previous CPR payment system under which physicians historically had been paid for their services. However, if appropriate access to health care for all children is to be ensured, Medicaid and other payers must recognize all of the CPT codes and their values; thus, the CMS must publish values for codes including those that are not applicable to the Medicare population. In addition, all payers, including Medicaid, must update their payment schedules in a timely fashion to include new codes and incorporate annual updates and revisions. Finally, with the advent of the Health Insurance Portability and Accountability Act (HIPAA [Pub L No. 104-191, 1996]), payers should no longer be allowed to utilize their own payment methodologies independent of the RBRVS.

The CMS has recognized that a Medicare-driven payment system may underrepresent or undervalue some components of pediatric work. The original Hsiao et al study[2] that led to the creation of the RBRVS was based on the AMA Master File list of physicians; because few pediatricians maintain membership in the AMA, few pediatricians were surveyed. It is inappropriate and not in the best interest of pediatricians to simply extrapolate work values assigned for services to children from those values determined by surveyed physicians who provide services primarily to adults.

In addition, the assumption that there is equivalency of work of pediatricians and pediatric medical subspecialists to that of internists and adult medical subspecialists has not been rigorously studied. In some pediatric medical subspecialties (eg, pediatric cardiology and pediatric nephrology) in which valid survey data have been collected, there is quantifiable evidence of underestimation of total pediatric physician work, particularly for situations in which major physiologic and developmental differences exist.[3,4]

The AAP appreciates the efforts of the AMA to incorporate most of the unique characteristics of children's health care services into the CPT nomenclature. The AAP supports the continued efforts of the AMA and the CMS through the CPT and RUC processes to ensure that all pediatric services are represented by HIPAA code sets and that all RUC-surveyed codes have their RVU values published in the RBRVS via the *Federal Register*, even in cases in which the service is not paid under the Medicare program. Presently, the AAP is well represented on the CPT Advisory Committee, the RUC, and the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) Editorial Advisory Board. This representation provides the AAP a voice that is being more consistently heard and positively received by our adult colleagues and national payers. This representation must continue if children's unique coding challenges and the additional physician work and PE involved in many pediatric services is to be reflected in nationally assigned RVUs. However, given that payment policies vary dramatically across many Medicaid agencies, these published values are not always used for payment. This continues to lead to underpayment for many children's preventive health services, including screening services and immunization delivery. This will continue to threaten the health of children until Medicaid programs assume the same national regulatory requirements for payment that the Medicare program has established.

The connection between payment policy and health policy can be demonstrated in the Medicare system, in which a single national database (Medicare Part B Database) tracks Medicare utilization of CPT codes annually and over time. If Medicare payment levels fall, it is possible to see the immediate effect on health outcomes and higher future costs for Medicare recipients. Although this same premise certainly holds for pediatric patients, the absence of a single national database for Medicaid makes the demonstration of this association challenging. A single national Medicaid database would allow the AAP to demonstrate the strong correlation between access to preventive services and payment policies that fairly compensate the pediatrician for resources expended in the provision of those services.

COMPONENTS OF THE RBRVS PAYMENT SYSTEM

The RBRVS system assigns value to each procedure on the basis of 3 components:

- physician work;
- PE; and
- professional liability insurance (PLI).

Physician Work

The physician work involved in actually providing a service or performing a procedure is called "intraservice work." In the office setting, the intraservice period is defined as face-to-face patient encounter time; in the hospital setting, it is the time spent on the patient's unit or floor; and for surgical procedures, it is the period from initial incision to the closure of the incision. Work performed before and after provision of a service is referred to as "preservice" and "postservice" work, respectively. When preservice, intraservice, and postservice work are combined, they create the "total work" involved in the provision of a service.

Because children are less cooperative and more anxious, many services and procedures for children, even when the more frequent need for procedural sedation is accounted for, require more face-to-face time compared with similar services provided to the typical adult. These differences are not represented in existing CPT codes for children's services. Children also require constant adaptations to the physical examination, in response to their constantly changing behavior and level of cooperation. CPT modifier 63 (procedure performed on infants <4

kg) was developed to recognize the increased intraservice time for and complexity of the smallest patients. For larger infants and children, modifier 25 is available to recognize situations in which a significant and separately identifiable evaluation and management service is provided. Follow-up communication with child-care facilities, schools, absent parents, or extended family (eg, grandparents) can also lead to a significant increase in surveyed postservice times.

Practice Expense

The PE component of the RBRVS includes clinical staff time, medical supplies, and medical equipment and accounts for 44% of a code's total RVUs, on average. Increased paperwork, reporting regulations (eg, immunization registries), and expenses involved in a movement to computerized practices are common to all practitioners. However, pediatric practices are more readily affected by factors such as prevalence of low-intensity office visits, larger volume of telephone calls, and increased case management requirements. High patient volume in pediatric practices requires more examination rooms per provider to maintain physician efficiency when compared with specialties that see only 1 to 3 patients per hour. Higher patient volumes require more administrative staff, more supplies, and more telephone calls. Recognizing that 40% to 50% of most pediatric office visits are scheduled within 24 hours of the encounter, pediatric staff members are often required to perform insurance verification at the time of patient arrival, which adversely affects their ability to process patients efficiently. Providing care to young children also requires more direct hands-on clinical staff time, resulting in less-efficient room use because of difficulties dressing and undressing patients, and is marked by increased complexity and time in collecting laboratory specimens or performing screening examinations. Furthermore, routine services, such as venipuncture, are typically more time and staff intensive for pediatric patients. These factors need to be accounted for in any resource-based PE study and in the resulting PE calculations for pediatric services.

The PE is quite different when the service is reported in the office (nonfacility) versus in a hospital or other facility. The facility PE is much lower, resulting from Medicare's separate payments for hospital services under Part A and physician services under Part B. Therefore, total RVUs to physicians for the same service provided in the office setting exceed the total RVUs for a similar service provided in the hospital or other facility setting.

When the RBRVS system was created, the CMS used the Socioeconomic Monitoring System (SMS) of the AMA to assign PE. The socioeconomic monitoring system was developed through a nationally representative sample of 4000 physicians in 34 specialties (low pediatrician membership in the AMA led to underrepresentation in this sample). PE was higher in the more "boutique" practices of the well-compensated specialties. These differences were retained in the original payment formulas. In 1998, the CMS changed to a new formula for calculating PEs. They chose a so-called top-down approach using actual practice cost data that are allocated to services and procedures by using expert panels to decide what a typical patient encounter required. PE was then broken into 6 categories: clinical labor, medical supplies, medical equipment, office expense, administrative labor, and all other expenses. This new approach has led to significant readjustments in the PE component, which generally have been beneficial to primary care physicians.

Professional Liability Insurance

The RBRVS system assigns RVUs to cover the malpractice risk incurred by physicians in providing each cognitive or procedural service. These malpractice RVUs (PLI), originally calculated for office-based pediatricians, may systematically undervalue the practice liability costs for many pediatric specialties. The prolonged statute of limitation on child-related medicolegal actions, as compared with adult care, results in increased malpractice risk exposure (malpractice insurance tail) for physicians providing services for children, compared with adults. In many states, that exposure risk is measured in decades rather than years. As such, physicians treating minors are required to purchase an "extended reporting endorsement" to cover the liability risk until the patient achieves at least the age of majority. This imposes additional PEs in retaining medical charts and the attendant security protections for that protracted period. This difference in exposure is not calculated into the RBRVS PLI and was not included in the initial Hsiao et al study.[2] Pediatric-specific survey data for malpractice expense should be used for this component when assigning final RVU valuations. Without pediatric-specific CPT codes, however, there is no way to do this without having different CFs for pediatric patients.

Geographic Practice Cost Indices

The OBRA 89 also introduced the concept of geographic practice cost indices (GPCIs), initially to address the disparity in CPR charges seen in urban (37% higher) versus rural practices. This was implemented despite the difficulty that rural communities faced in recruiting and retaining sufficient medical providers. Both the PE and the medical liability costs (PLI) are known to be higher in the urban setting. Physician earning calculations also include inherent cost-of-living expenses, most usually higher in more urban settings. Higher PE and medical liability costs in the urban setting were built into these RVU values. However, only one quarter of the cost-of-living difference was built into the RVU values. Each component of the total RVU (physician work, PE, and PLI) are subjected to different correction values, with states varying in the number of regions that are assigned different GPCIs. For example, Alabama has only a single correction value for each component, whereas California has 10 regions with different GPCIs, and Texas has 8 such regions.

RBRVS CONVERSION

Conversion from RVUs to dollar payments is a multistep process that is covered in detail in the AAP RBRVS

brochure (www.aap.org/visit/rbrvsbrochure.pdf) and RBRVS conversion spreadsheet (www.aap.org/visit/RBRVSConversionSpreadsheet.xls).

HIPAA CODE SETS

The HIPAA established standard transaction codes for medical claims submission. The primary codes for reporting physician encounters include the Healthcare Common Procedure Coding System (HCPCS) level I and level II codes for procedural reporting and the ICD-9-CM[5] codes for diagnosis reporting.

HCPCS Level I Codes: CPT

HCPCS level I codes are also called CPT codes. CPT is a listing of descriptive terms and identifying codes for reporting medical services and procedures developed and maintained by the AMA. The CPT nomenclature comprises 3 categories of codes: category I CPT codes, category II CPT codes, and category III CPT codes.

Category I CPT Codes

Category I CPT codes describe a procedure or service identified with a 5-digit CPT code and descriptor nomenclature. Category I CPT codes must represent services/procedures that are:

- approved by the US Food and Drug Administration;
- performed across the country in multiple locations;
- performed by many providers; and
- clinically efficacious.

Category II CPT Codes

Category II CPT codes are supplemental tracking codes used to measure performance. The purpose of these codes is to decrease the need for record abstraction and chart review associated with performance-improvement initiatives, thereby minimizing administrative burdens and associated costs to providers when measuring the quality of patient care. Category II CPT codes are intended to facilitate data collection about the quality of care rendered by allowing providers to code certain services and test results that support nationally established performance measures, presumably having an evidence base contributing to quality patient care. Category II codes are optional and are not required for correct coding and may not be used as a substitute for category I codes. As physician payment begins to be tied more closely to patient outcomes through pay-for-performance programs, the reporting of category II codes will be necessary to qualify for supplemental payments. Pediatric practices must also be prepared for rapidly expanding quality and disease management measures. To qualify for payer pay-for-performance (P4P) incentives, pediatricians must be able to easily code for the services being measured or explain why services were not indicated or refused by patients. Although this need has led to a rapidly expanding set of codes that describe these expected/refused services, the number of applicable pediatric measures has not kept pace with adult measures. There must be appropriate codes and modifiers in place to accurately report pediatric patient encounters.

Category III CPT Codes

Category III CPT codes are temporary codes for emerging technology, services, and procedures. If a category III CPT code is available, it must be reported in lieu of an unlisted category I CPT code, because the latter does not allow the opportunity for the collection of specific data.

HCPCS Level II Codes

HCPCS level II codes (commonly referred to as "hick-picks" codes) are Medicare national level II codes used to identify services not included in the CPT nomenclature (eg, ambulance services, durable medical equipment, prosthetics, orthotics, and supplies). HCPCS level II codes are alphanumeric codes that consist of a single letter followed by 4 digits. Pediatricians most commonly utilize HCPCS level II codes that start with the letter "J" for reporting things such as injectable drugs that ordinarily cannot be self-administered, chemotherapeutic and immunosuppressive drugs, and inhalation solutions, as well as some orally administered drugs. HCPCS level II codes also include American Dental Association *Current Dental Terminology* (CDT) codes ("D" codes) used to record and report dental procedures.

ICD-9-CM Codes

The *International Classification of Diseases, Ninth Edition* (ICD-9)[6] was published by the World Health Organization (WHO) in 1975. The current edition in the United States for morbidity classification, ICD-9-CM,[5] has been in use since 1979. The original intent of ICD codes was for epidemiologic reporting and not billing for services, albeit in the United States third-party payers tend to use it for that purpose. The ICD-9-CM consists of 3 volumes. Volumes 1 and 2 (a tabular list containing a numerical list of the disease code numbers and an alphabetical index to the disease entries) are used to assign diagnosis codes. Volume 3 is a classification system only used by hospitals for tracking inpatients for surgical, diagnostic, and therapeutic procedures. The rules and guidance for ICD-9-CM are published in the *ICD-9-CM Official Guidelines for Coding and Reporting*[7] and the American Hospital Association *Coding Clinic for ICD-9-CM*.[8]

In 1989, the World Health Organization released ICD-10. It has replaced ICD-9 throughout the world for both morbidity and mortality statistics since 1994 and has been used in mortality statistics in the United States since 1999. The AAP has been a supporter of implementing ICD-10-CM for morbidity diagnosis coding because of its greater specificity. In addition to allowing for better epidemiologic tracking of injuries and diseases, it would also allow providers to better identify certain patients with specific conditions that might benefit from tailored disease management programs.

HIPAA Standard

Because HIPAA code sets are the national standard for coding physician services and communicating with

third-party payers, regulations require their use for electronic data exchange. Third-party payers, however, do not necessarily recognize or pay for the full spectrum of health care services or follow the diagnosis coding rules represented by these codes. The HIPAA does not require insurers to pay for all HIPAA-mandated codes; it merely requires them to follow the respective code-set coding rules and accept transactions electronically that utilize these codes. The AAP strongly advocates for the acceptance and payment for all HIPAA-mandated CPT codes by all payers and encourages AAP members to work to that end in negotiating contracts with individual payers.

RECOMMENDATIONS

1. The principles of the Medicare RBRVS system should be supported by pediatricians as an intrinsically more reasoned and equitable payment methodology than alternative systems.
2. The AAP and its members should continue, through the involvement of the COCN on the AMA/Specialty Society Relative Value Scale Update Committee, to correct RBRVS system inequities and ensure that the RBRVS system appropriately accounts for the work, PE, and professional liability expense in caring for neonates, infants, children, and adolescents.
3. Pediatric health care providers should advocate for recognition by all payers, including Medicaid, of the full spectrum of CPT codes and their guidelines.
4. The AAP and its members should continue to advocate that RBRVS adjustments only be made by the CMS exclusively through changes to the annual CF and not through changes to wRVUs to maintain the integrity of the RVU-based payment system that is used by most payers.
5. Pediatric health care providers should insist that the CMS publish values for all RUC-valued CPT codes, not just those that are applicable to the Medicare population.
6. The AAP and its members should continue to advocate for a national Medicaid pediatric database analogous to the Part B Medicare Data Files database that is legislated and published annually. A national Medicaid database for health care services for children is critical for making the Office of the Inspector General, Medicare, and Medicaid compliance programs applicable to pediatricians. The current use of Medicare-based utilization patterns inappropriately labels pediatricians as "outliers" and potential targets for health care fraud investigations. Only by understanding the frequency with which codes for pediatric services are reported will there be an ability to analyze utilization patterns and the effects of new codes on total health care costs. Such a database will also provide an improved ability to determine the effects of coding and payment on access to children's health care services.

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Appropriate Medical Care for the Secondary School-Age Athlete

Communication

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The information contained within this document does not necessarily reflect endorsement from the individual organizations listed above.

Appropriate Medical Care for the Secondary School-Age Athlete

Objective: To provide evidence-based support for the recommendations made by the Appropriate Medical Care for Secondary Schoolï Age Athletes (AMCSSAA) Task Force consensus statement.

Data Sources: MEDLINE, CINAHL, and Sport Discus databases were searched for relevant literature regarding secondary school-age athletes, health care administration, pre-participation physical examination, facilities, athletic equipment, emergency action planning, environmental conditions, recognition, evaluation, and treatment of injuries, rehabilitation and reconditioning, psychosocial consultation, nutrition, and prevention strategies.

Conclusions & Recommendations: There is adequate evidence-based support for all eleven of the AMCSSAA Task Forceôs consensus points. Organizations that sponsor athletic programs for secondary school-age athletes should establish an athletic health care team (AHCT) to ensure appropriate medical care is provided to all participants.

Key Words: safety, high school, adolescent, injury

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TABLE OF CONTENTS

DOCUMENT BACKGROUND

In 2002, the National Athletic Trainers' Association developed an inter-association task force to develop recommendations and guidelines for adolescents competing in school and club-level sports. The Appropriate Medical Care for Secondary Schoolï Age Athletes Task Force (AMCSSAA) comprised experts from 17 school, health care, and medical associations who all shared the same goal ð ensuring young athletes receive consistent and adequate medical care while participating in practices and games.

The group developed a consensus statement (Appendix A) stating minimum standards of health care for adolescent athletes. After unanimously approving the document, the task force decided to take the project one step further and put together this scientifically based document that augments the recommendations set forth in the consensus statement.

This communication will help organizations sponsoring athletic programs for this age group justify the importance of providing appropriate medical care and establishing an athletic health care team to identify the resources they should make available to adolescents participating in organized athletic programs. The article can also be used as an evaluation tool to assess current athletic health care delivery programs.

Disclaimer: This communication provides general practice recommendations and guidelines for medical care provided by organizations sponsoring athletic programs for secondary school-age individuals. Actual medical care provided should not be based solely on the information contained in this manuscript, but should be tailored to specific facts and circumstances unique to each entity and location.

PARTICIPATING IN THE DEVELOPMENT AND IMPLEMENTATION OF A COMPREHENSIVE ATHLETIC HEALTH CARE ADMINISTRATIVE SYSTEM

Organizations sponsoring athletic programs for secondary schoolï age individuals should establish an athletic health care team (AHCT) that functions to ensure appropriate medical care is provided for all participants. To provide appropriate medical care, the AHCT must function in a coherent, coordinated, and efficient manner with coaches and administrators of sponsoring organizations and adhere to commonly accepted standards of good clinical practice.

Medical and allied health professionals representing various disciplines are involved in the provision of athletic health care to adolescents. This communication summarizes the evidence base for points addressed in the consensus statement, which was was prepared and ratified by professional organizations representing numerous disciplines but does not mandate which specific individuals are essential to the AHCT. Nonetheless, the American Medical Association (AMA), at the request of the American Academy of Pediatrics (AAP), has recommended that athletic medical units (AMUs) include a physician director and an athletic health coordinator, with preference given to NATABOC-certified athletic trainers (ATCs) in this role (AMA Resolution H-470.995 Athletic [Sports] Medicine, 1998).[1] Furthermore, many jurisdictions require that ATCs be supervised by licensed physicians, just as school nurses are supervised by school physicians and emergency medical technicians (EMTs) are supervised by emergency medical services (EMS) physicians. Therefore, the ATC and team physician form the core of the AHCT, with the ATC being the most appropriate on-site member of the AHCT and the official team physician, if one has been designated, being ultimately responsible for medical decisions made by the AHCT (Figure 1). A designated school official or member of the sponsoring organization should be a liaison to the AHCT when having a member of the AHCT on-site is not possible. Other members of the team, along with the relationships among them, should be dictated by local needs and statutes.

A comprehensive athletic health care system should enhance the care of the athlete by allowing the strengths of individual members to complement each other and by preventing the unnecessary duplication of efforts. The roles and responsibilities of all team members should be clearly defined and available to all. Regardless of the specifics of a given situation (i.e., local and state qualifications and regulations) or the personnel involved in the AHCT, the extent to which the ATC is responsible for medical decisions must be explicitly understood between the team physician and ATC, with administrative members of the AHCT (e.g., athletic directors) being wholly supportive of the guidelines for decision-making established between the team physician and ATC.

At the request of the AAP, in 1998 the AMA passed Resolution H-470.995, which called for the establishment of athletic medical units (AMUs) by all organizations that sponsor athletic programs, school boards, and local boards of health. The scientific rationale for this resolution was thoroughly reviewed and published by the AMA and NATA in 1999.[1]

Expert panels[2] and peer-reviewed journal articles[3] have recommended standardization of sports injury surveillance systems to help improve athletic health care, but little to no primary research has been conducted to demonstrate that AMUs either decrease injury rates or improve athletic health care. The AHCT proposed in this document is similar to the AMU with respect to the allied health care professionals recommended to comprise the team and the roles and responsibilities of the team.

Nonetheless, case law over the past three decades[4, 5] has established the precedent that school districts and other agencies sponsoring athletic programs have a legal responsibility to provide medical care for participants. In *O'Brien v. Township High School District* (1979),[6] the court held that a school district has a responsibility to provide proper medical treatment. Care provided by a minor student was not found improper or negligent at the time, but in the interim many states have enacted licensure statutes for athletic training. Therefore, organizations that do not provide appropriate medical care for athletes, defined as that administered by trained and certified professionals, could risk significant liability exposure.

Components of recommendation

To properly develop and implement a comprehensive athletic health care administrative system, the sponsoring organization must create the AHCT, identify their roles and responsibilities, create the appropriate policies and procedures to ensure all on-site athletic staff adhere to safe clinical practice parameters for adequate medical care, designate appropriate physical space and equipment, document the activities of the AHCT, take part in injury surveillance, and commit to cycles of quality improvement so that appropriate medical care is available for all secondary schoolï age athletes.

Members of the Athletic Health Care Team

Local availability, needs, and statutes should guide organizations that sponsor athletic programs (e.g., schools, school districts, clubs, youth leagues) to establish desirable team members. Also, organizations should be aware of recommendations made in AMA Resolution H-470.995, the American College of Sports Medicine (ACSM)/American Orthopaedic Society for Sports Medicine (AOSSM) *Team Physician Consensus Statement*, the National Federation of State High School Associations (NFHS) *Sports Medicine Handbook*, and the National Collegiate Athletic Association (NCAA) *Sports Medicine Handbook*. The AHCT should include medical professionals from various organizations, including those listed in Table 1. When appropriate, the AHCT should consult with and develop an on-going coordination of efforts with the athlete, the athlete's parents, coaches, administrators, and other school or organization officials.

Individuals interested in improving the care provided to athletes should generate a needs assessment for their program based on injury risk data collected locally as well as that found in national databases, including the NATA surveillance studies, National Electronic Injury Surveillance System (NEISS), NCAA Injury Surveillance System, and National Center for Catastrophic Sports Injury Research.

Local professionals and groups should be identified and approached to join the AHCT. These may include sports medicine and other physician groups, medical schools, athletic training curriculum programs at local universities, physical therapy groups, physical therapy schools, and nursing schools.

Guidelines such as the NATA *Position Proposal Guide* (PPG) for the creation of new programs or the NATA *Position Improvement Guide* (PIG) for the improvement of existing athletic health care programs are available to the sponsoring organization as resources. Funding issues may need to be addressed by demonstrating savings in liability/health insurance premiums through the establishment of an AHCT and athletic health care delivery program, although such national data are not available.

Roles and responsibilities

The roles and responsibilities of each team member should be clearly defined and established, especially with each of the areas addressed in the following sections of this document. It is recommended that an "exclusion policy" be instituted whereby any single member of the AHCT, including but not limited to the ATC, team physician, consulting physician, or primary physician, may, based on the member's particular expertise, render an athlete ineligible for participation due to concerns for the health or welfare of the athlete. This exclusion policy should also allow the athlete, his/her parents, coaches, and sponsoring organization to limit participation for reasons justified by their role.

Policies and procedures

Written policies and procedures for the AHCT should be established and kept in a manual easily referenced by team members as well as outside constituencies (e.g., parent-teacher associations) and governing bodies (e.g., school boards, local boards of health). Specific policies should be established and approved in advance of the athletic season relating to the following: 1) Readiness to participate and return-to-play decisions, 2) Facilities inspection and maintenance, 3) Proper fit, inspection, and maintenance of athletic equipment, 4) Emergency responseð the written emergency action plan, 5) Environmental conditions protocols, 7) Sideline preparedness for practice and competition sessions, 8) Nutritional and weight requirements for different activities, such as wrestling, 9) Coordination of referrals to consultants, 10) Channels of communication, 11) Chain of command, 12) Documentation and record-keeping, and 13) Injury surveillance and quality improvement

This communication has been devoted to outlining the recommended roles, responsibilities, policies, and procedures of the AHCT. Several other professional organizations in medicine, sports medicine, and athletic health have also published policies and procedures that may serve as useful templates for local AHCTs.

Physical space and equipment

The physical space and equipment necessary for the AHCT must be established and maintained. To obtain and maintain this equipment, the athletic health care annual budgeting process should include input from a member of the AHCT. Recommended

standard athletic health care equipment and supplies are detailed later in this communication. In addition, other resources[7] have extensive sections devoted to planning, constructing, equipping, and maintaining facilities for appropriate medical care of the adolescent athlete.

Documentation

Issues relating to the safety of equipment and facilities, as well as athlete injuries, treatment, and reconditioning, should be well documented in accordance with generally accepted standards of their respective state practice acts. To facilitate communication among members of the AHCT as well as with outside consultants and primary treating clinicians, all patient encounters should be documented in adherence with federal, state, and local regulations while keeping within the recommendations set forth by the Health Insurance Portability and Accountability Act of 1996 (HIPAA)[8] and Federal Education Records Protection Act (FERPA)[9] when applicable. Patient records (i.e., personal medical information) should be maintained in such as manner as to ensure privacy and confidentiality in all circumstances.

Injury surveillance

As detailed later in of this document, surveillance is the first step in the cycle of developing effective public health injury control strategies. Anonymous, high-quality injury surveillance and outcomes data should be collected regularly and shared not only with public health officials and other supervisory and regulatory agencies but also with professional health care societies committed to the advancement of their respective fields.

Injury surveillance can be defined on a continuum from action at the local level to the national level. At the local level, injury surveillance can be as simple as a coach removing a field hazard following injury to an athlete so as to not cause additional injuries to other athletes or a coach altering the bullpen throwing schedule if a rash of shoulder injuries occurs to the pitching staff. Injury surveillance at the national level could mean establishing a national secondary schoolï age sports injury and illness database to begin to collect data regarding the incidence of various injuries and illnesses in this population.

To more easily compare and share such information, it would be ideal to establish uniform sports injury surveillance system standards on the local, state, and national levels. Important elements of sports injury surveillance data may include a clearly defined and standardized definition of injury, type of sports event, position played, and particular activity and moment of injury, level of competition, place where the injury occurred, injury mechanism, level of supervision, nature of the injury, injured body region, severity of the injury (e.g., activity lost, working time lost, need for treatment, cost of treatment, permanent damage, impairment, and disability), characteristics of the injured person, duration and nature of the treatments needed, use of protective equipment, follow-up of game rules, cost of the injury, and well-defined exposure data (population at risk and exposure time), which are critical in determining and comparing incidence rates.[10] However, staffing, time, and cost constraints may limit the feasibility of such extensive injury surveillance. A cooperative effort between the primary members of the AHCT along with the administrators of sponsoring organizations, coaches, and

parents provides the best opportunity to establish an injury surveillance system for each specific group. Analysis of the results of this surveillance system can provide vital information regarding recommendations to improve the overall safety of the athletic activity.

Just as injury surveillance is but the first step in the public health model of prevention, AHCTs and members of the sponsoring organization, including administrators, coaches, and parents, should be committed to ongoing, continuous cycles of quality improvement, whereby local surveillance and outcome data are used to suggest changes in its own members' roles, responsibilities, policies, and procedures. Practices involving quality improvement and injury surveillance need to start locally and move toward a national level.
Ideally, such information would be shared regionally and nationally to contribute to the medical literature and to provide a basis for evidence-based practice of clinical medicine.

Strategies for implementation
Potential strategies for the prevention of injury and illness as they relate to athletic participation by secondary schoolï age individuals are described in detail in the following sections of this communication. A brief overview of each consensus statement point is listed.

Consensus Statement Point 1: Develop and implement a comprehensive athletic health care administrative system
The demands of athletic health care require a team with diverse skills and a comprehensive administrative system. The AHCT should coordinate the various aspects of the athletesôhealth in a coherent, effective, and professional manner.

Consensus Statement Point 2: Determine the individualôs readiness to participate
To promote safe participation of the student athlete, the preparticipation physical examination (PPE) is used to identify individuals who may be at risk for the development of injuries related to their activity and those who may be at risk for sudden death due to an underlying medical problem.

Consensus Statement Point 3: Promote safe and appropriate practice, competition, and treatment facilities
Sports organizations are expected to provide a safe environment for all athletes, including keeping the premises in safe repair, inspecting the premises for obvious and hidden hazards, removing the hazards if possible or warning of their presence, protecting invitees from foreseeable dangers, and conducting operations on the premises with reasonable care for the invitees. It is recommended that a specific treatment facility be set-up by the organization.

Consensus Statement Point 4: Advise on the selection, fit, function, and maintenance of athletic equipment
Sports organizations should, to the greatest degree possible, ensure that athletes have access to appropriate equipment for the sport and that such equipment is properly fit in accordance with manufacturer recommendations and maintained by qualified

personnel.

Consensus Statement Point 5: Develop and implement a comprehensive emergency action plan
Based on the activity, skills of participants, and geographic characteristics, various types of emergency incidents are likely to occur. An emergency action plan (EAP) is essential to ensure that all incidents are responded to in an appropriate manner and that the roles of the AHCT members are well defined and communicated in advance.

Consensus Statement Point 6: Establish protocols regarding environmental conditions
Environmental conditions pose potential threats to the safety and welfare of athletic participants. It is crucial that organizations responsible for athletic events develop policies and protocols to address the safety of play in hazardous environmental conditions.

Consensus Statement Point 7: Provide for on-site recognition, evaluation, and immediate treatment of injury and illness, with appropriate referrals
Injured athletes who do not receive timely evaluation or treatment are at greater risk for improper healing, reinjury, extended time loss from athletic participation and school, and potentially life-threatening consequences. Having a qualified individual on-site and ready to care for the ill or injured person is critical to the safety of the participants and for decision making regarding when an athlete can safely return to play.

Consensus Statement Point 8: Facilitate rehabilitation and reconditioning
Although the evaluation and treatment provided immediately after an injury are critical, a rehabilitation and reconditioning program designed to return the individual to their pre-injury level of function is just as important. The process of rehabilitation and reconditioning is fundamental for the safe return of injured athletes to their prior level of competition as quickly as possible and prevention of further injuries.

Consensus Statement Point 9: Provide for psychosocial consultation and referral
The AHCT should be able to identify potential psychosocial pathologies (e.g., disordered eating) frequently associated with secondary schoolï age athletes and refer them for appropriate diagnosis and management. Sponsoring organizations must identify local experts in these medical fields and facilitate the referral of athletes to these consultants.

Consensus Statement Point 10: Provide scientifically sound nutritional counseling and education
Nutrition is a key factor for an athleteûs health, growth, and performance. It is essential that valid and understandable information regarding nutrition be provided to secondary schoolï age athletes, parents, and coaches. Even more essential is the ability to refer athletes to appropriate medical personnel for treatment when necessary.

Consensus Statement Point 11: Develop injury and illness prevention strategies
Injury and illness can be a heavy burden on the well-being of the secondary schoolï age athlete. A public health framework can be used to develop effective interventions to reduce the affliction of injuries and illnesses to these young persons.

DETERMINING AN INDIVIDUALÕS READINESS TO PLAY: THE PREPARTICIPATION PHYSICAL EXAMINATION

The number of individuals participating in organized sports has increased dramatically, with various sources estimating close to 6.5 million student participants in high school athletics each year.[11] The National Center for Catastrophic Sports Injury Research (NCCSIR) noted that between fall 1982 and spring 2001, close to 72 million males and 35 million females had participated in high school athletics.[12] These numbers unfortunately do not reflect the number of people participating in non–school-sanctioned programs such as community- or religious group–based leagues and recreational and developmental programs.

The Preparticipation Physical Examination (PPE) is essential to identify athletes at risk for injury and implement corrective actions before injuries occur. Yearly screening of these athletes is imperative because health conditions may change from year to year and the development of subtle problems may be overlooked. The PPE is an important requirement for all participants in any organized program and should be performed by the athleteÕs primary care physician, school physician, or team physician.

The purpose of the PPE is not to exclude an individual from activity but instead to recognize individuals who may be at risk for developing injuries related to their activity and those who may be at risk for sudden death due to underlying medical problems. The goal is to promote safe participation of the secondary schoolï age athlete. There is an inherent risk of injury in secondary schoolï age athletes through participation in sports and recreational activities. Krowchuk[13] noted that 22% to 39% of high school athletes sustain a significant injury and that as many as 20% of such injuries may be preventable. The value of identifying those at risk therefore is paramount to prevention.

In 1997, Beachy et al.[14] noted that over an 8-year time span, 14,318 athletes participating in more than 32 different sports reported a total of 11,184 injuries that required medical help. The male injury rate was 0.90 injury per athlete with 0.33 day-lost injury per athlete; the female injury rate was 0.64 injury per athlete with 0.21 day-lost injury. The overall injury rate for day-lost injuries was 28%. Almost all of the injuries reported in this study were musculoskeletal in nature.

Fortunately, the risk of sudden death is not as common as is that of musculoskeletal injuries. Between 1983 and 1993, 126 nontraumatic deaths among high school athletes were identified by the NCCSIR (overall annual death rate, 4.68:1 million athletes).[13] The impact of an unexpected death in a perceived healthy young person is remarkable and warrants screening measures and education for recognizing those at risk. Unfortunately, not all injuries and sudden deaths can be prevented, but strategies to minimize the risk are paramount. Periodic assessment of an athleteÕs medical history and a comprehensive physical examination provide one such prevention strategy. The AAP noted in a 2001 policy statement that although PPEs are typically not mandated until junior high school and high school, annual examinations for younger children afford the opportunity to promote physical activity and to address issues of readiness as they apply to organized sports.[15]

In July 2002, the NFHS released the second edition of their *Sports Medicine Handbook,* which clearly states that the PPE is ña necessary and desirable pre-condition to participation.ò[16] It is our objective to have the PPE be required for all participants in all organized programs, including those that are school, community, and religious group based.

Components of recommendation

In 1992, five organizations (American Academy of Family Physicians, American Academy of Pediatrics, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine) published a consensus report regarding the PPE. This document, herein referred to as the PPE Monograph,[17] clearly outlines the stated goals of the PPE along with guidelines for the organization and administration of the examination. Along with the 1998 American Heart Association guidelines for cardiovascular screening of competitive athletes,[18] these documents set the standard for the PPE.

The PPE should be incorporated to detect conditions that may predispose injury or preclude participation in specific sports; prevent further injuries by identifying and treating musculoskeletal abnormalities; detect medical conditions that may be life threatening or disabling; determine the athleteôs general health; assess fitness level for specific sports; advise the athlete in which sports he or she can participate if a condition exists that precludes participation in some sports; develop treatment and rehabilitation plans for problems; counsel the athlete on health-related issues such as nutrition, alcohol, drugs, and other psychosocial issues,;and meet legal and insurance requirements. [16-20]

Discovery of limiting or disqualifying conditions

Conditions such as acute, recurrent, chronic, or untreated injuries or illnesses may compromise the performance of the athlete and place him or her at greater risk for the development of other injuries. For example, examination of foot pain in a young gymnast may uncover a chronic stress fracture that may be due in part to an underlying eating disorder and, if left unrecognized, may lead to further disability and injury.

The discovery of a new medical condition during the PPE is very rare. Recently, the Mayo Clinic[21] reported that of 2,739 students screened over a 3-year period, 13.9% were given dispositions other than being cleared for sports. In this group, 1.9% (53 students) were not cleared for sports due to underlying medical concerns.

Musculoskeletal abnormalities accounted for the largest proportion of those not cleared (43.4%). Cardiac abnormalities, which included exertional presyncope or syncope and palpitations, were the second leading cause of a ñnot clearedò disposition.

If medical conditions are identified during the PPE, recommendations for handling these problems should be dealt with on an individual basis and follow guidelines set forth by the AAP[22] and the 26th Bethesda Conference.[23] A summary of these guidelines can be found in various sources, including the PPE Monograph.[17]

Sudden death
The incidence of sudden death in school-age athletes is low compared with the number of musculoskeletal injuries incurred during participation. However, sudden death in a young competitive athlete is usually a devastating and tragic event that affects the community. Most cases of sudden death are related to underlying cardiac abnormalities. Maron et al.[24] evaluated a total of 158 sudden deaths that occurred in trained athletes between 1985 and 1995. A total of 124 deaths were cardiac: 48 (36%) were due to hypertrophic cardiomyopathy and 17 (13%) were due to congenital malformations of the coronary arteries. In 3 individuals (2%), a ñormalò heart was found on autopsy with no other apparent cause of death. In the same study, Maron et al.[24] noted that PPEs were performed before competition in 115 of the 158 cases reviewed. Of these 115, only 4 (3%) were suspected of having cardiovascular disease and the cardiovascular abnormality responsible for sudden death was correctly identified in only 1 athlete (0.9%).

Given this information, it has been argued that the PPE may not be an adequate tool in assessing risk for sudden death in young athletes. Many articles have been written about using other noninvasive means for screening this population such as the use of echocardiograms, electrocardiograms, and stress tests to identify those at risk. This testing is cost prohibitive and the yield is too low to have a dramatic impact on the overall screening process and therefore is still not required as part of the PPE.[23, 25-28] However, there remains a critical need for effective, low-cost screening methods. The American Heart Associationôs[29] history module that consists of five questions has been adopted by some states for use on the PPE and may be a reasonable alternative.

Assessing general health of the athlete
The PPE should be considered as part of an overall health care plan for the secondary schoolï age athlete and should not be a substitute for the student-athleteôs routine medical care. It can be incorporated into a regular examination with the student-athleteôs primary care physician and should not replace regular scheduled visits and/or checkups. Unfortunately, approximately 80% to 90% of adolescents report that the PPE substitutes for a routine examination.[30]

It is important to recognize that the PPE may be the only contact that some student-athletes have with a physician on a regular basis and that attention should be given to issues of routine health maintenance. A standardized form, like that printed in the PPE Monograph,[16, 17] helps address some of these issues and can aid in further screening of potential problems and/or deficiencies.

Assessing fitness level for specific sports
The fitness assessment should include body composition, flexibility, strength, and endurance.[16] Not all of these components can be routinely assessed as part of the PPE, but a review of some of these components and a discussion of the sports in which they want to participate can help establish a baseline for training. For example, an obese male who wants to participate in his high school football program should be counseled on the effects his weight may have on his play. The excess weight may also make him more prone to heat injuries and this should be discussed, by a member of the AHCT, with the athlete, his parents/guardians, and the coaching staff. The athlete should be

encouraged to participate because the physical activity is important, but it should also be recommended that he be counseled on proper nutrition, weight training, and aerobic conditioning prior to and during the season to help improve his performance and to avoid injury and illness.

Counseling athletes on health-related topics
The PPE affords an opportunity for the physician to counsel athletes on potentially risky behaviors such as drug, alcohol, and supplement use and nutritional concerns. As previously noted, the PPE may be the only contact a student has with a health care provider during the school year and this opportunity should not be lost.

The use of a standardized PPE form that includes questions about drug, alcohol, and supplement use and concerns about weight can provide a useful screening tool for the physician and coaching staff; any ñyesòresponse should prompt discussions with the athlete at the time of the PPE. Further recommendations for counseling and/or follow-up with the athlete's primary care provider can be made on an individual basis. In female athletes, a review of menstrual history is paramount because many young female athletes have menstrual irregularities that may be related to their training.

Screening for amenorrhea, alterations in body image, and eating disorders can be accomplished by review of the medical history and discussion with the student-athlete at the time of the PPE.

Implement rehabilitation programs
If a chronic condition is uncovered during the PPE or if the athlete has not completely recovered from a prior injury, the examiner should address the potential for reinjury or the risk for other injuries. The medical team should perform a thorough evaluation. Any problems noted during this evaluation should be addressed, treated, or referred to an appropriate medical professional to prevent further injury

McCoy et al.[31] noted that primary care physicians now carry a major responsibility to become familiar with general rehabilitation principles for all types of sports-related injuries and that the reinforcement of a sophisticated plan of applying ice and elevation as treatment for acute injury and range of motion (ROM) exercises followed by strengthening exercises and functional evaluation is critical in the return-to-play decision process. It is no longer acceptable to keep an athlete away from the sport for an indefinite period of time. Short- and long-term goals of treatment need to be established and monitored. In schools or organizations with access to ATCs, this process can usually be accomplished more quickly and efficiently. If ATCs are not available, the responsibility rests with the primary care physician, team physician, school nurse, coaching staff, parents/guardians, and the athlete to ensure proper referrals to appropriate resources for an efficient and safe return to play.

Meeting legal needs
In 1988, Feinstein et al,[32] found that 35 states require yearly physical examinations, 3 states require a physical examination every 3 years, 1 state required only 1 physical examination, and 6 states did not specify their requirements. Many local school districts and organizations have their own policies in place with regard to the medical eligibility of

secondary schoolï age athletes, with the PPE, generally the cornerstone of this requirement.

Strategies for implementation

Implement an optimal time frame for the PPE

While no time frame exists for performing the PPE, it has been suggested that the PPE be performed in advance of the sports season to allow optimum time to address any issues that may arise during the examination ï 4 to 6 weeks before the start of a season seems to be most appropriate. In scholastic sports played in the fall season, the PPE should be performed before the end of the preceding school year so that any chronic injuries can be addressed and a treatment plan can be laid out for the student-athlete for the summer months.

Many schools and states require yearly evaluations as a prerequisite to participation. The American Heart Association[18] recommends that both a history and physical examination be performed before participation in organized high school sports, with repeat screening every 2 years. An interim history should be performed in intervening years or sooner if there have been any changes in the student-athleteôs health.

The AMA Group on Science and Technology endorses the work of Risser et al.[33] and McKeag,[34] who recommend that a PPE be performed at the beginning of any new level of competition with an intercurrent review before the start of each new season.[35] Regardless of the time frames adapted, it is important to realize the importance of routine screening for injury and illness recognition and prevention.

Methods of performing the PPE

The PPE can be performed in three different ways: (1) by the athleteôs private physician in the office setting; (2) by multiple examiners as part of a station examination; or (3) by a physician as part of a mass ñassembly-lineò examination.[16, 19, 32]

Examination by the athleteôs *private physician* would be the most ideal situation because this offers the most continuity of care with the most comprehensive medical history. The physician is likely to have an established relationship with the athlete, and the components of the PPE can be incorporated into a comprehensive health evaluation. Unfortunately, not all physicians are familiar with sports medicine issues, and they may be limited in their ability to detect musculoskeletal abnormalities. Also, many student-athletes do not have a physician whom they see on a regular basis.[13] Communication issues may arise because the private physician is not usually the school or team physician. Confusion regarding abnormalities, treatment plans and clearance can ensue if concerns are not directly forwarded to the ATC, coaching staff, and/or athletic director by the private physician. Comments from the primary physician should be forwarded to on-site personnel through the AHCT to alleviate any possible problems.

The *station* method, in which components of the PPE are broken down and delegated to adequately trained support staff, has been more widely accepted as the best model for efficiently performing large numbers of examinations.[16, 18, 19, 33]

These stations are often staffed by personnel who are educated in sports medicine and can provide better evaluation of potential problems. The final station is manned by the supervising school or team physician, who reviews each athleteôs history and physical examination and makes final recommendations with regard to clearance. This method is very helpful in providing adequate communication with the other members of the AHCT and the coaching staff, as most will be actively involved in the PPE process. A potential drawback to the multistation PPE is lack of sufficient qualified medical personnel to man the stations. In addition, any abnormal findings identified through use of this method should be reported back to the athleteôs family physician for follow-up care.

The ñ*assembly line*ò method or traditional ñ*locker room*ò examination, in which one physician examines a large number of athletes with little or no support staff, is very inefficient and not recommended.[18]

Identify and use a standard form for all PPEs
The history portion of the PPE is vital in obtaining accurate and up-to-date information regarding the student-athleteôs past medical problems, injuries, and current medications. Rifat et al.[35] reviewed 2,574 PPEs and showed that the history accounted for 88% of the abnormal findings and 57% of the reasons cited for restriction from a particular sport. Many sources advocate the development of a standardized form to help ensure uniformity; these forms can be given to the student-athlete before the PPE for completion of the history section with their parents/guardians. The **history** section should include questions that assess for the following[13, 16, 17, 19]:

1. *Past injuries causing the athlete to miss a game or practice.* Specific questions should be posed regarding a prior history of fractures, operations, or use of casts or braces.

2. *A loss of consciousness or memory after a head injury.* Repeated concussions may be criteria for exclusion from contact sports and/or prompt or warrant a comprehensive assessment.

3. *Previous exclusion from sports for any reason*

4. *Syncope, near syncope, chest pains, or palpitations during exercise.* Specific questions regarding passing out, nearly passing out, chest pains, or irregular heartbeats during exercise must be asked because these may be the only clue to an underlying cardiac condition.

5. *Past medical history.* This includes conditions currently being treated, history of asthma or exercise-induced bronchospasm, history of one paired organ, and history of sickle cell disease or trait.

6. *Prior surgical procedures and complications*

7. *Current medications and dosage*

8. *Allergies to medication, stinging insects, foods, and other environmental triggers*

9. *Immunization records, including tetanus*

10. *Family history of sudden death*

11. *Menstrual history with age of menarche and frequency of menses for all female athletes*

12. *History of significant weight gain or loss and the athleteôs perception of his or her current body weight*

13. *History of over-the-counter supplement use*

The **physical examination** portion of the PPE form should include the following[13, 16, 17, 19].

1. *Vital signs, including height, weight, blood pressure, and resting and postexercise pulse*

2. *Vision screening with the use of a traditional Snellen chart.* If corrected acuity in either eye is 20/40 or greater, the athlete should be referred to a specialist for follow-up.

3. *Tanner staging*

4. *Assessment of the head, eyes, ears, nose, mouth, and throat for any abnormalities*

5. *Cardiovascular and lung examination*

6. *Abdominal examination with evaluation for hernia in males.* Pelvic examinations in females should be referred to appropriate specialists if the history warrants concerns because these are usually not required as part of the PPE.

7. *Muscle strength testing and brief neurological assessment*

8. *Examination of the skin for any rashes, chronic skin condition, or abnormal moles*

9. *Musculoskeletal evaluation.* This should include ROM testing in the upper and lower extremities; assessment of laxity or instability in the shoulders, elbows, wrists, hips, knees, and ankles; and assessment of the spine for scoliosis and/or abnormalities of the thorax, such as pectus excavatum.

10. *Section to list abnormalities and recommendations for clearance and, if necessary, treatment plans*

11. *Determine Body Mass Index (BMI)*

Preprinted forms that encompass all of the above points can be found in several sources, including the NFHS *Sports Medicine Handbook*[16] and the PPE Monograph.[17]

These forms can be copied and adapted to the needs of the school district or organization.

Communication system

A good communication system should be in place between the medical staff, athlete, parents/guardians, coaches, and athletic director. It is recommended in HIPAA that this communication begin with a formal letter to parents/guardians advising them of the purpose and nature of the PPE. Consent forms and a copy of the PPE history can be mailed separately or along with the introductory letter with instructions for completion before the PPE. A cover letter should also accompany the PPE to the family physician as a mechanism to avoid any communication problems that could arise. This cover letter should specifically ask for any physician comments on any specific concerns that might affect athletic performance as well as suggested rehabilitation or treatment options for current problems. Once the data have been collected, it must be kept on file for reference purposes; this should be the responsibility of the school nurse or ATC. If the athlete is participating in a non–school-sponsored program, the sponsoring organization should keep these records up to date. Any abnormalities need to be communicated to the student-athlete, his/her parents/guardians, the ATC, and the athletic department. If the student opts to have the PPE performed by his or her primary care physician, the use of the standardized PPE form is imperative to maintain uniformity and to ensure that all components of the examination have been addressed. New regulations instituted by HIPAA may require other specifications with regard to the privacy of these records; this should be part of the organizationôs overall compliance plan. School-based groups should adhere to FERPA regulations.

PROMOTING SAFE AND APPROPRIATE PRACTICE, COMPETITION, AND TREATMENT FACILITIES

Secondary schoolï age athletes have a right to play in facilities that are safe and without the potential for unnecessary harm. When injuries do occur, these participants also have a right to be treated in a clean and appropriate environment that is dedicated to this purpose. While the benefits young athletes gain from sports participation are immeasurable, the impact of accidental injuries and deaths to this age group cannot be ignored. Although very few youth sports injuries are fatal, or even catastrophic, their frequency and financial impact warrant our attention. The U.S. Consumer Products Safety Commission has estimated that up to 22% of girls and 39% of boys in organized sports are injured per season.[36] According to the National Youth Sports Safety Council,[37] sports-related injuries to youths up to 14 years of age cost society more than $49 billion in 1997.

These statistics, coupled with a desire to make sports participation a positive experience for children, underscore the need to prevent injuries whenever possible. Making sports facilities safe for young athletes is of paramount importance.

Providing safe facilities is an integral component of effective sports management and is governed by ethical, legal, and other administrative considerations. Safe facilities provide the opportunities for safe participation and a positive experience for the young athlete. The right to participate in safe and healthy environments is contained in *The Bill of Rights for Young Athletes*.[38] Well-maintained facilities ensure that safety is a priority, and that priority is then carried to the public.

A review of case law shows that sponsoring organizations that do not provide a safe environment expose themselves to unnecessary legal action and the athletes they are supposed to help to undue preventable injury. Facilities that are not maintained routinely also provide opportunity for undue accidental injury.

Countless lawsuits have been filed, and frequently won, by parties who have sustained injuries due to improper inspection and maintenance of facilities,[39-41] hazards in and around facilities,[42-45] unsafe grounds and external walkways,[46-48] and improper facility signage.[49-51] Such litigation depletes the financial resources of sponsoring institutions and reflects a negative image to the public about the specific institution and about sports in general.

Federal, state, local, and professional guidelines regulate certain aspects of most sports facilities. Parties who administer youth sports programs can avoid potential professional censure or criminal proceedings through diligent compliance with regulations pertaining to health and safety.

Components of recommendation

Athletic facilities can vary greatly in size and complexity. Regardless of the size and purpose of a facility or the resources of its caretakers, entities that sponsor sports opportunities for secondary schoolï age athletes should ensure that all facilities are

safe. The AHCT can play a vital role in sports facility safety issues, specifically maintenance and sanitation, use, and supervision.

Maintenance and Sanitation

A regular maintenance program should be developed for all said facilities and capital equipment. Organizations sponsoring athletic events for the secondary schoolï age athletes, as well as members of the AHCT, should be aware of maintenance issues in and around the athletic facility. In addition, it is imperative for AHCT members to incorporate proper sanitary procedures when treating the secondary schoolï age athlete and to provide guidance and recommendations for coaches to comply with proper sanitary, maintenance, and repair procedures.

Maintenance schedules should follow industry or regulatory standards. Individuals who will perform specific maintenance tasks must be familiar with the prerequisite techniques (e.g., pool sanitation, field maintenance) and ensure that these techniques are used. With indoor facilities, appropriate circulation, temperature, and humidity must be maintained. Other health and safety considerations pertaining to sports facilities may include electrical, lighting, signage, and slip control areas of floors.

Locker rooms, bathrooms, and shower areas can present special problems in maintaining a safe environment for young athletes. According to Seidler,[52] ñConcrete floors and walls, steel lockers with sharp corners, and standing water, all make locker rooms perhaps the single most dangerous facility in sports and recreation.òBecause of the potential for injury and infection that these areas pose, they should be checked frequently for hazards, sanitized regularly, and supervised closely to prevent horseplay.

When dealing with outdoor facilities, the sponsoring organization should be concerned with the ground and surface conditions, spacing around fields, and vehicular traffic around the facility. Hazards in any of these areas could pose a risk to participating secondary schoolï age athletes. Ground hazards requiring immediate attention include holes and depressions in fields, excess moisture, erosion, rocks, broken glass, and playing surfaces or access ways that are abnormally uneven. Prior to athletic competitions, the grounds and/or playing fields should be inspected by the coach or an on-site member of the AHCT as a means of injury prevention. Structures that encroach upon playing areas should be moved. If this is not feasible, then the activity should be repositioned or modified to eliminate potential player impact with the structure. Other hazards include low hanging power lines over playing areas and exposing young athletes to vehicular traffic, either as they play or as they enter and leave the facility.

When a facility hazard is discovered, it is appropriate to either avoid using the facility or modify the sports activity to avoid exposing the young athletes to the hazard. If the problem cannot be corrected on the spot, written reports and requests for repairs should be submitted at the earliest opportunity.

Treatment facilities where athletes would be provided injury treatment and rehabilitation should be maintained in a manner consistent with medical facilities.

Use and Supervision

Before activity begins, venue-specific Emergency Action Plans (EAPs) must be formulated, reviewed, and posted within the facility (Section 5 of this document addresses EAPs in detail). Adult sponsors must ensure that first aid/emergency equipment is readily available, that some form of communication is available to contact EMS personnel, and that the facilities are accessible to EMS vehicles. This designation should be clearly marked so all know where help can be obtained. In addition, an area of the facility should be dedicated to sports medicine, with an AHCT member available to provide appropriate treatment and care for injuries sustained through the course of participation in sport.

To minimize injury potential, the activities of young athletes must be supervised. Athletes must also be instructed to use facilities safely. This is particularly true in higher-risk venues, such as aquatic facilities. The use of appropriate signage can help instruct the secondary schoolï age athlete on safe facility use, but should be used in conjunction with appropriate adult supervision. Some signage, such as those marking emergency exit routes, may be required and/or regulated by local fire codes. Signage should comply with the American National Standards Institute (ANSI) and other professional standards for readability, color, and size. Although specific needs will be unique to a particular facility, safety-oriented signage within sports facilities can include general regulations for facility use, instructions for use of specific equipment (e.g., weight equipment, whirlpools, saunas), the EAP, the location of emergency/first aid equipment, the location of automated external defibrillators (AEDs) if available, warning signs identifying known or potential hazards, and markers to delineate play/activity areas, as well as those used to designate buffer areas around equipment.

Facilities specifically designated for injury treatment and rehabilitation should be used in a manner that promotes a safe environment for all participants and allow direct supervision of all athletes and equipment at all times by a qualified member of the AHCT.

Construction and Design

The opportunities to be involved in the design and construction of sports facilities are limited, but there is little doubt that a well-designed facility can make the job of injury prevention easier. In addressing the significance of design and construction on sports facility safety, it has been noted that poorly planned, designed, or constructed sports and recreation facilities often lead to an increase in the exposure to hazardous conditions for the participants.[52] In addition, these hazardous conditions may make facility maintenance and daily operation more difficult and can increase liability.

Problems commonly encountered in the design and construction of sports facilities include the use of improper building materials, poor access control and security, poorly planned pedestrian traffic flow through activity areas, a lack of proper storage space, inadequate lighting, and inadequate safety zones around courts and fields. It should be noted that once construction on a sports facility has been completed, these problems can be difficult to correct.

Strategies for implementation
The best implementation strategy begins during the design and construction of new athletic facilities to ensure that all of the safety features listed above are present. However, because most secondary schoolï age athletes practice and compete in existing facilities, individuals and organizations involved with these athletes should implement strategies to establish procedures, inspect facilities, and record and repair potential hazards.

All parties involved with youth sports activities should regularly and thoroughly inspect their facilities: coaches, administrators, grounds/facilities staff, and members of the AHCT. Some areas, such as fixed building structures, will require less frequent inspections, whereas other areas, such as fields and floors, must be constantly inspected. Young athletes should be encourage to be a part of this ñinjury prevention teamò by immediately reporting any unsafe conditions to their adult sponsor.

The methods to be used for evaluating the safety of facilities and locations to be inspected should be established and recorded (Table 2). In general, sports safety inspections should include all structures and surfaces used by the athletes. A form or other instrument onto which findings are recorded can be helpful. The individual performing the inspections should sign the tool. As Hossler[53] points out, ñIt is better to prepare than to repair.òThis statement underscores the importance of aggressive injury prevention in youth sports. Many strategies for providing safer sports facilities have been previously mentioned in this document. The success of any sports facility safety program depends on the cooperation of many individuals, from players to parents to coaches to administrators. Therefore, it is of paramount importance to involve these persons as the program is planned and then implemented.

In addition, Clover[54] suggests professional staff use the mental cue ñS.A.F.E.òto ensure safety in the performance of their duties and responsibilities: **Supervision** from the locker room to the practice field. **Aid** the athletes when needed. This includes creating and practicing the EAP; keeping proper records of physical examinations, injuries, treatments, insurance, parental releases, and equipment; ensuring first aid kits are available and well stocked; and checking to ensure that water and injury ice are available for the athletes. **Facilities** must be checked daily for possible hazards. If there is a hazard, the area must be clearly marked or precluded from use. A written work order must be filled out and a time frame for completion of work must be established in writing on the work order. A copy of the work order should be kept on file. **Equipment** in facilities should be checked daily. From the pitching machine to the modalities used in the athletic training room, all equipment should be well maintained. This ensures the equipment lasts longer and stays in proper working condition.

ADVISING ON THE SELECTION, FIT, FUNCTION, AND MAINTENANCE OF ATHLETIC EQUIPMENT

Participation without proper equipment, or with equipment that is inappropriate or improperly fitted, subjects the participant to an increased risk of injury, illness, and even death. A great number of secondary schoolï age children want to participate in sports, and most parents allow and encourage their participation. Equipment essential to some sports (helmets, shoulder pads for football, sticks for field hockey) may be supplied by the sponsoring organization or the individual participant. If a sponsoring organization requires the participant to provide such equipment, it is incumbent upon the sponsoring entity to ensure that all equipment worn and used is appropriate and properly fitted. In addition, equipment specific to the purpose of caring for injuries and illnesses of athletes on-site will be addressed. Proper supervision is also essential when using equipment, including frequent inspections to ensure proper fit and function. Safe, effective, and appropriate equipment should be maintained and provided to the participant. Sponsoring organizations that require the participant to provide their own equipment must ensure that personal equipment complies with requirements outlined by a sports regulatory agency.

Entities that provide guidelines for approval of athletic equipment are the National Operating Committee on Standards in Athletic Equipment (NOCSAE) and the American Society for Testing and Materials (ASTM). Equipment that has not been approved by certifying bodies ï that is, inappropriate equipment or appropriate equipment that is improperly fitted or in poor repair or not maintained on a regular schedule ï could introduce the athlete to injury that is needless and preventable.

Equipment that is properly fitted and appropriate for the sport or activity is essential for the secondary schoolï age athlete to be able to enjoy athletic participation in a safe and orderly environment. ATCs and educated coaches of the particular sport are the persons most likely to have the education and qualifications to select, fit, maintain, inspect, and supervise athletic equipment use. An on-site member of the AHCT may be recommended as responsible to perform this activity and a member of the AHCT can be responsible to oversee this in the absence of an on-site AHCT member. A review of case law shows that equipment that is not well maintained or improperly fitted can contribute to, if not cause, injury to participants. In addition, the use of equipment that has not been approved by the appropriate certifying body exposes the athlete to injury as well as liability and negligence to the sponsoring entity.[4-6, 55-65]

<u>Fitting Protective Equipment</u>

Ensuring that all athletes have properly fitting equipment is important to maintaining a safe athletic environment. Sponsoring agencies should ensure that qualified personnel (coach, ATC, equipment manager) fit equipment and that the participant has appropriate equipment for participation. Schutt Inc., a helmet manufacturer, as well as other manufacturers, provide detailed instructions on the fitting of their equipment.[66-68] Use of these instructions should be followed when fitting participants or the sponsoring agency could be found liable. In the case of *Gerritty v. Beatty,*[63] the school was found liable when an athlete reported poorly fitting equipment and the school had done nothing about it.

Maintenance and Reconditioning

Once equipment is properly fit to the athlete, sponsoring agencies and members of the AHCT must make sure the equipment is properly maintained and reconditioned. All athletic equipment should be examined periodically during the season and the fit maintained throughout the season (i.e., if an athlete shaves his head, the helmet should be refit).[69] In addition, school and team officials should closely inspect any equipment used by or around participants and know the risks involved in the use of such equipment. Case law has judged in favor of the plaintiffs in cases where a latent defect in a pitching machine caused injury to the face of an athlete while the machine was unplugged[58] and where a vaulting horse was altered and the holes for the pommels were exposed.[65]

Many manufacturers now recommend that equipment be reconditioned on a regular basis, checking for flaws and defects in the product. Most manufacturers state that they will not stand behind the product if the proper reconditioning and checks have not been made.[70] In the case of *Gerritty v. Beatty*,[63] the school district was found negligent for refusing to furnish well-maintained equipment. Therefore, school districts should ensure that qualified personnel purchase, fit, and maintain appropriate athletic equipment and recondition existing equipment according to manufacturer recommendations. In addition, the sponsoring organization should be cautioned not to accept used equipment passed down from higher level organizations unless the equipment has been properly maintained and reconditioned.

Supervision During Use of Equipment

Finally, all participants in physical education, sports, and recreational teams and events have the right to be supervised by qualified and competent coaches and provided with competent health care.[71] *Competent* may be defined as being proficient in the skills required by the job description and training. Sponsoring entities and governing bodies should ensure that competent, trained individuals always supervise participants. State or local regulations may influence the parameters of what is required for appropriate supervision. Training should focus on the sport(s) to be supervised, as well as proper fit and use of equipment. In addition, the sponsoring entity or school should provide adequate and appropriate health care as described throughout this monograph.[71, 72]

Lack of appropriate supervision when using equipment in sport can also expose the athlete to undue risk. Two cases, *Grant v. Lake Oswego School District Number 7*[59] and *Tiemann v. Independent School District #740,*[65] provide emphasis that not only should participants be supervised while using equipment but also that the supervisors or coaches should be trained in how to adequately supervise individuals. In both cases, equipment was used that either was set up incorrectly or dangerously (*Grant*) or was faulty (*Tiemann*).

Components of recommendation

The sponsoring organization should identify personnel to educate in the necessary procedures to appropriately select, fit, and maintain all equipment specific to individual sports; protective equipment consistent with specific sports; and protective equipment general to all sports. The person who issues equipment should be trained in the proper fit, function, and use of athletic equipment specific to his/her sport. Members of the

AHCT should be educated on the proper selection, fit, and maintenance of athletic equipment and take an active role in reviewing quality and selection of safety equipment provided by a sponsoring organization. Equipment should be chosen based on the appropriateness to the sport, level of competition, age of participants, and overall quality. Maintenance of such equipment should be subject to a predetermined schedule and follow all of the manufacturer's recommendations and rules of the governing sporting association.

Rule changes should be investigated by governing bodies of contact and collision sports and of small ball sports to protect the face and eye from injury. Rules should include requiring the use of eye protection in practice and games.[73, 74] Investigation by a governing body provides the basis for rules changes to be implemented by that governing body. These changes should be based on scientific data. Governing bodies should use such scientific data to amend rules to best protect the participant.
Many times, professional athletes do not wear a complete set of *pads*, making it enticing for younger athletes to emulate the actions of the professionals. Secondary school leagues and officials should be encouraged to enforce the rules designed to protect these players.

Strategies for implementation
Coaches, parents, athletes, and members of the AHCT should be aware of the limitations of each piece of equipment and be able to instruct the athlete in its proper use, as well as potential hazards with its misuse. Sponsoring entities should mandate general training as well as sport-specific training for all coaches and individuals dealing with participants, including but not limited to equipment fit, function, and maintenance.[71, 72] In addition, sponsoring organizations should require appropriately trained personnel to maintain adequate supervision (i.e., within a close proximity as to prevent an inappropriate or dangerous action) of participants at all times.

With respect to equipment, braces should be used to treat or prophylactically prevent injury as directed by, or under the supervision of, a physician.[75] A qualified member of the AHCT should be the designated person to determine and fit appropriate braces, tape, or safety equipment. *Shoulder harnesses; braces* for the wrist, elbow, ankle, and knee; and custom-made braces should all conform to the rules of the sport and be used under the direction of a physician or other health care provider.[75] No equipment should be modified from manufacturers' standards. Equipment should be used only for the intent it was manufactured.

Mouthguard use is recommended for all sports with a risk for mouth and dental injuries. The use of a *mouthguard* is required by some organizations in football, lacrosse, ice hockey, and boxing for both practices and games.[76-78] Organizations that sponsor sports in which mouthguards are required should provide education to the participants and parents on the appropriate fit and care of mouthguards.[79]

Helmets for all sports should always comply with the appropriate standards. They should be periodically inspected and reconditioned in accordance to the manufacturers' recommendations. Helmets should be used only as directed and should never be used as a weapon or be the point of attack.[16, 69, 80, 81]

Facial protection or *facemasks* should be worn in sports where such rules apply or the possibility for injury to the face is high, such as football, ice hockey, menôs lacrosse, baseball, and softball. In baseball and softball, it is recommended that children between 5 and 14 years of age wear a batting helmet with a polycarbonate face shield.[82-84]

Eyewear is recommended as a wise precaution in limited-contact sports[85] such as racquetball and high school girls' lacrosse.[74] Extra eye protection should be required for any athlete with corrected vision poorer than 20/40 in either eye or with a history of eye injury or surgery.[69, 74]

Footwear that fit and is appropriate for the sport and playing surface should be used. The footwear should be replaced when worn out.[69]

Athletic mats, such as those used in wrestling, should be cleaned at least once daily and on a regular schedule with a tuberculocidal cleaner. Further study is recommended to determine the effectiveness of mat-cleaning programs to prevent the spread of skin disorders in wrestling.[86]

Maintenance and reconditioning are essential in providing appropriate safe equipment. A member of the AHCT should document that a designated employee of the sponsoring organization has been trained in the proper fit and care of athletic equipment in the absence of an on-site AHCT member. Sponsoring entities should schedule regular maintenance before equipment is issued to or used by participants. Inspections should be performed on a regular basis throughout the course of the season. In addition, season-end equipment inspections are also recommended to ensure that equipment is repaired or replaced before the start of the next season.

In some sports, forms stating ñassumption of riskò for equipment fitting and appropriate use should be used to ensure that there is proper documentation that the participants, and their parents, understand these concepts. If rule changes are to be used to implement improved equipment to protect the participant, care must be used to address public education, the cost of implementation, liability, manpower to implement the rule changes, and the timing of the program. [87]

Additional research has been identified in a number of recommendations. This research is vital in determining how best to protect the participant in any sports program. Every effort or consideration should be made to fund research when it is proposed.

DEVELOPING AND IMPLEMENTING AN EMERGENCY ACTION PLAN

Sports-related injuries and illnesses are common in athletics involving secondary schoolï age athletes. Members of the AHCT, along with coaches and administrators, need to be prepared for possible emergency situations through the development and implementation of a comprehensive Emergency Action Plan (EAP).

An understood principle within athletics is the possibility that a serious or life-threatening injury and/or illness may occur. There are both intrinsic and extrinsic risks involved with participation in athletics, and it is essential for the sponsoring organization to have a well-developed EAP for such instances to ensure that the appropriate care can be provided in a timely manner. In addition, the EAP should include planning for events that are not athletic related such as natural disasters and crowd control problems that may occur when large groups of people are gathered for athletic events.

In 2002, NATA issued a position statement regarding the need for established emergency plans in all athletic venues and suggested guidelines for developing and implementing the plans.[88] The need for an EAP has been well documented in literature and injury/illness statistics[15, 88-94] and supported in case law.[95] In *Kleinknecht v. Gettysburg College* in 1993,[96] it was decided that an institution owes a duty to each athlete to provide an emergency plan that is adequate for the risks involved in sport participation. This extends beyond the collegiate level and interscholastic athletic events, as seen in *Barth by Barth v. Board of Education* in 1986,[97] which showed the need for obtaining prompt medical treatment for students injured in physical education activities. In the case of *Jarreau v. Orleans Parish School Board* in 1992,[98] a school board was found to be vicariously liable for the failure to promptly seek medical attention for an injured athlete. The implementation of an EAP addresses these needs and provides the most efficient opportunity for treatment for injury and/or illness.

Components of recommendation

The AHCT is an important component of establishing a good EAP. The medical personnel who make up the AHCT often have experience in various areas of emergency athletic care and can contribute to the plan to ensure it is comprehensive and appropriate for school-age athletic events. The development of an EAP requires the input of all members of the AHCT in addition to the administrators of the sponsoring organization, coaches, and facility managers, along with parents and official groups. This allows for the writing of a comprehensive EAP that fully covers all aspects of emergency situations and environmental conditions and involves the expertise and cooperation of all team members. Examples of individuals to participate in EAP development include the members of the AHCT, coaches, administrators, venue managers, officials, and organizations.

If the event will take place in areas such as city parks, recreation departments, or golf courses, then the governing bodies of these organizations should also be involved or consulted in the development of the EAP. This multiorganization committee would be responsible for developing protocols to manage emergency situations, including establishing the chain of command for emergencies, the specific responsibilities for each team member, emergency situations specific to each sport, emergency situations

specific to a particular venue, the necessary emergency equipment and use of said equipment and the training of athletes to help the coach in an isolated situation.

Once the EAP has been developed and implemented, it is essential that all personnel be fully trained in the steps of emergency management, that these training procedures are documented and that there is communication with EMS personnel before the event to ensure cooperation and quicker response to emergency situations. Game and event personnel should also be trained in the necessary skills for emergencies, such as first aid, CPR and AED use, and the prevention of disease transmission.

Minimum athletic emergency equipment should include vacuum splints (or suitable alternative), a long spine board (or scoop stretcher), hard neck (Philadelphia) collars, facemask removal equipment, resuscitation masks, shoulder immobilizers, blankets, crutches, blood pressure cuff, gloves for universal precautions, and a first aid kit. [99] It is also advisable to have access to an AED during practice and/or competition. This emergency equipment must be readily accessible during all practices and games to all staff responsible for first aid or medical care of the injured athlete.[72]

Steps should also be in place for the documentation of all injury and/or illness situations that occur during the event. A review of the established procedures and all incidences of emergency situations should occur at the conclusion of each event, and a comprehensive review of the entire EAP should occur on an annual basis.

Strategies for implementation

One of the most important immediate steps is to identify the appropriate personnel to write the EAP. The AHCT should be led by a medical director, preferably the team physician, and include the other members of the team. The members of this team must take into consideration all possible emergency situations that might arise during practice and/or competition. Categories of incidences to consider would be life-threatening injuries, life-threatening illness, and environmental threats. There should be specific thought given to the types of possible incidents based on the type of activity as well as the specific venue in which it is being held. It is also imperative to ensure that emergency medications, such as an individual athleteôs asthma inhaler, EpiPen, Glucagon, or insulin, are available and that the correct protocols for use are followed. Although it is not anticipated that all contingencies will be thought of, a well-developed plan can cover most emergencies and leave a protocol in place to address other issues that arise. The development team should carefully document the emergency treatments and procedures for incidences based on the input and advice of physicians, ATCs, EMS personnel, and other qualified AHCT members. Careful consideration should be given to establishing and documenting specific responsibilities for each member of the AHCT before and during the event.

Written documentation should also include the types and locations of emergency equipment present, methods of communication (e.g., walkie-talkie, cellphone, land line telephone), venue-specific maps, and the location of the hospital or other health care facility for transportation and a list of emergency telephone numbers.

Once the EAP has been written, it is essential to review, practice, and revise the EAP

so that all duties and responsibilities are clearly outlined and understood. Placing the responsible individuals in mock scenarios is an effective way of testing the EAP for validity. Documentation of all emergency situations during an event is key for liability issues and for revision of the existing EAP. At a minimum, the EAP should be reviewed and practiced on an annual basis and subsequent retraining should take place to refamiliarize the necessary personnel with their duties and responsibilities.

There are several existing documents from supporting organizations that can assist in the development and implementation of an EAP for various venues and athletic settings, including those published by the NATA [88], NFHS[16], NCAA[94, 100], American Academy of Pediatrics [15, 91, 92, 94, 100], AOSSM[101], and The Inter-Association Task Force for Appropriate Care of the Spine-Injured Athlete.[102]

ESTABLISHING PROTOCOLS REGARDING ENVIRONMENTAL CONDITIONS

Secondary schoolï age individuals participating in athletics are subject to injury due to adverse environmental conditions. Each organization that sponsors an athletics program should establish protocols related to adverse environmental conditions specific to their region. The organizations should identify individuals responsible for ensuring the implementation of the protocols.

Adverse environmental conditions pose varying challenges to athletic events based on geographic regions and the influencing factors specific to those regions. The sponsoring organizationôs AHCT should be responsible for the development and implementation of policies regarding adverse environmental conditions. Threats can include heat stress, cold stress, lightning, severe weather, air quality, insects, rodents, reptiles, fire, and possible allergic reaction–inducing conditions. Other factors as indicated by geography and climate should be taken into consideration.

It is an understood principle that adverse environmental conditions can pose potential threats to the safety and welfare of athletic participants. Therefore, it is essential that institutions and organizations associated with athletic events have policies and protocols in place to regulate athletic participation.[101] These protocols should be specific to each athletic venue and should take individual geographic effects into consideration. Some environmental conditions can pose greater threats to athletes in particular regions of the country.

There are several environmental considerations and threats that can be included in an individual protocol depending on the venue and geographic region, as given earlier. Several established policies regarding heat stress,[103-107] cold stress,[107, 108] and lightning[109, 110] can be used as models for development. Other environmental condition protocols should be established with the members of the AHCT to ensure that all contingencies have been discussed in detail.

Heat Stress

Exercising in hot temperatures has been shown to have a variety of physiological effects on the human body and can compromise the health of the athlete if not closely monitored.[111, 112] *Heat acclimatization* is a process through which athletes improve from a physiological standpoint when exposed to exercise in the heat through careful monitoring.[113] Athletes often become acclimatized and adjust to the demands placed on the body by exercise in heat. Throughout this acclimatization period, they should be closely monitored by qualified personnel, most preferably an on-site member of the AHCT.[114] The responsibility of the members of the AHCT should be to allow athletes to acclimatize to heat conditions within certain limits.

There are several position statements and supporting documents that outline safe methods of participation in heat stress conditions and when practice and competition should be suspended.[103, 105, 106, 115] In 2000, the NATA position statement on fluid replacement for athletes outlined the practices that would encourage the optimum fluid replacement for athletes, decreasing the chances for occurrence of heat stress syndromes.[115] In 2002, the NATA position statement on exertional heat illness

established recommendations for preventing, recognizing, and treating illnesses that occur from athletic participation. This position statement,[103] as well as the Inter-Association Task Force on Exertional Heat Illnesses Consensus Statement,[105] contains many details concerning the methods of preventing heat stress syndromes as well as the necessary accommodations that should be made for practices and competitions under given conditions.[103] The NFHS also addresses heat illnesses in detail in their *Sports Medicine Handbook*.[16] The handbook describes the signs and symptoms of heat stress syndromes, as well as treatments and prevention techniques, and provides information on when practices and competitions should be limited based on the ratio of heat to relative humidity.[16] Other organizations that have issued policy statements, position stands, and/or guidelines for heat illnesses include the ACSM,[107] the NCAA,[106] and the AOSSM.[101]

Cold Stress

Cold stress is often an overlooked cause of injury and illness, as heat stress syndromes tend to receive the most attention. However, exposure to cold is obviously more of a concern in certain geographic regions than in others.[116] Extensive research has been done concerning the effects of and possible damage caused by cold on the body during exercise. Exercise and athletic activity in a cold environment can have deleterious effects on performance and human health, which may not be realized by the participant until damage has occurred.[117] Therefore, it is essential to carefully establish a protocol regarding participation in cold environments.

Lightning

Lightning is the second most common environmental cause of death in the United States after floods.[118] It is particularly abundant in early afternoon storms, during which many outside athletic practices and competitions occur.[109] Because there is no absolute protection against the effects of lightning while outside, proper education and a well-established protocol can prevent many deaths and injuries.[119, 120]

The NATA published a position statement on lighting safety for athletics and recreation in 2000 to educate those involved in athletics about the risks involved with participation in a lightning environment and to provide guidelines for safe behaviors during lightning and to advocate appropriate care for lightning strike victims.[109] The NCAA guidelines for lightning safety emphasize many of the same points, including details on an established chain of command and on obtaining weather reports and monitoring of weather systems to provide the most accurate and up-to-date data.[110] The NATA and the NCAA advocate evacuating outside areas as soon as lightning is seen or thunder is heard and seeking shelter in safe buildings. This is the protocol encouraged by the NFHS.[16] The key to lightning injury prevention is to carefully monitor the weather conditions and to allow those individuals in the chain of command to perform their duties in protecting the athletes and participants.

The established environmental protocols should be carefully documented and distributed to all members of the AHCT, coaches and administrators. Opportunities for rehearsing scenarios and revising policies should also be made. It is imperative to ensure that all involved individuals must be aware of the protocols and understand their role in the event of an environmental emergency. An annual revision (similar to that of

the EAP) should take place to retrain AHCT members and to address any inaccuracies and inadequacies in the plan.

Components of recommendation

Before an athletic event or contest takes place, it is essential for the necessary members of the AHCT to meet to develop policies regarding adverse environmental conditions, including lightning, heat stress, and cold stress. The details of this vary as each individual venue and geographic region have concerns that are inherent to that area. The AHCT will begin to develop methods for assessing the site-specific concerns that have been identified. There is a great deal of information available concerning the various environmental conditions and the appropriate planning for prevention and treatment that can be used in identifying the steps to take in each circumstance.[103, 109, 115] Each AHCT will have to decide what is best for each geographic region based on normal environmental conditions for that area.

Taking into account the given possible adverse environmental concerns, written detailed plans that provide for the safety and welfare of all participants will assist the AHCT and event management personnel with decisions regarding participation. In writing these environmental policies, it is also important to carefully delegate responsibility to the appropriate decision makers. Factors to take into consideration include who is responsible for monitoring conditions, what methods will be used to monitor the environment, the time frame parameters for decision making, detailed alternative plans for participants and spectators, and who communicates plans to all relevant individuals.

Strategies for implementation

There are many members of the AHCT who may be capable of providing input into the development of environmental conditions policies, but it is essential that there is effective communication between the medical director, the ATC, and the administrators of the sponsoring agency. These individuals have the greatest opportunity to effectively design and provide input for the development of these policies. The involvement of all members of the team not only increases the effectiveness of the document but also ensures that all individuals are aware of the policies for safeguarding athletes. It is also essential that communication from the AHCT during contest continues to include the administration and officials.

The use of existing position statements and policies will ease the process of developing individual policies. It is essential that these policies be put into writing so that they may be adequately enforced. Responsibilities for each member of the AHCT should also be put in writing to ensure compliance and to ensure that all members are clear as to what they are to do in given situations. The methods of communication between AHCT members and for the acquisition of necessary environmental information need to be clearly outlined as well (e.g., walkie-talkie, cellphone, CB radio, weather radio).

Heat Stress

Members of the AHCT should be involved with the written guidelines regarding when it is potentially hazardous to participate in athletic events during times of heat and humidity. These guidelines should be implemented by the sponsoring organization and AHCT to determine when it is unsafe for the secondary schoolï age athlete to participate

in sporting events. Several position statements have been written regarding heat illness, and they recommend that an individual be responsible for evaluating the temperature and humidity. Established local guidelines (limiting personal equipment, increasing fluid replacement breaks, limiting practice intensity and duration, avoiding the heat of the day when possible, etc.) can be followed. Inexpensive sling psychrometers can be used to evaluate wet-bulb and dry-bulb temperatures and humidity, and heat stress.[103, 105, 106, 115]

Cold Stress

Sponsoring agencies and the AHCT also need to create guidelines for determining when it is unsafe to participate in athletics due to the cold and/or wind chill. The implementation of these protocols should fall to a designated individual who determines the outdoor temperature with the wind chill and advises whether it is safe for the secondary schoolï age athlete to participate without the added risk of frostbite or hypothermia. The NCAA has written a guideline for member institutions that reflects the effects of exposure to cold temperature and wind over a period of time and the increased risk for frostbite. These guidelines also include methods of preventing cold illness, such as appropriate clothing, maintenance of energy/hydration levels, and use of a proper warm-up.[108] The NFHS also addresses cold illness in their *Sports Medicine Handbook* and includes greater details on the effects of temperature and wind on the body as well as recognition and treatment of frostbite, hypothermia, and related syndromes.[16] Both organizations provide a solid foundation that can be used to develop an individual cold stress protocol to protect athletic populations.

Lightning

A written lightning policy, such as that published by the NATA,[109] should be put into place by the sponsoring agency. It should include the name of a person(s) responsible for monitoring the weather, the criteria for suspension and resumption of activity during lightning, and the safe areas to which the participants and spectators should retreat during inclement weather. Often, the criterion used to determine when activities should cease and resume during lightning is the 30-30 rule, which dictates suspension of activities when the flash-to-bang count nears 30 seconds and resumption of activities after a 30-minute wait following the last lightning flash thunder or after lightning has been seen or heard.[121] In addition, there are other methods of detection, including the weather service radio, lightning detection equipment, and lightning detection services.

There should be a designated person responsible for determining the flash-to-bang count at each outside venue, practice, and competition when severe storms are forecast. It is recommended that this designee be someone other than a game official or coach due to the attention they must pay to the game. This count is determined by beginning to count the seconds from the time the lightning is seen to the time the thunder is heard. The time in seconds between the flash of the lightning and the bang of the thunder is divided by 5 to determine the how far the storm is from the individual who is counting.[119, 121] It is recommended that as the flash-to-bang count nears 30 seconds (means that lightning strike was 6 miles away), all participants and spectators should immediately seek a safe shelter.[109]

Other Environmental Conditions

Special consideration should be given to the incidence of environmental allergens and potential bites from insects, rodents, and reptiles. The on-site member of the AHCT, or the coach when there is no on-site AHCT member, should be aware of those athletes with allergies who might be at increased risk for respiratory ailments or anaphylaxis. The AHCT should monitor the exposure of those athletes and plan ahead for proper treatment (e.g., have an athleteôs EpiPen available) should it occur. Specific information can be gathered from the American Academy of Asthma, Allergy and Immunology (AAAAI) and from organizations such as the National Outdoor Leader School (NOLS) and their Wilderness Medicine School.

PROVIDING ON-SITE RECOGNITION, EVALUATION, AND IMMEDIATE TREATMENT OF INJURIES AND ILLNESSES

Secondary schoolï age individuals participating in athletics are subject to injury, including certain injuries and medical conditions unique to this population.[3] Each organization that sponsors an athletics program should develop an EAP that highlights mechanisms for evaluating and treating adolescents sustaining an injury. As part of the EAP, the organization should identify individuals responsible for providing these services and ensure they are educated, trained, and appropriately certified and licensed (if required by state law) to provide these services during every practice and competition. The ATC offers the best option, offering advanced first aid knowledge, CPR/AED use, and the ability to make return-to-play decisions. The AMA recommends that ATCs provide these services, although the AMA recognizes that EMTs, paramedics, and physicians are viable options in the absence of an ATC.[1, 122] In some cases, the coach is the only person available on-site during practices and games and should be trained in first aid and CPR; however, the coach cannot practice outside of his/ her scope of practice, which would include making decisions regarding when it is appropriate for an athlete to return to play following an injury or illness.

Early injury evaluation and treatment encourages proper healing and decreases the risk of reinjury,[1, 3, 123-125] and the initiation of prompt treatment is critical in the management of life- or limb-threatening injuries or conditions. These services should be available to injured athletes at each and every athletic activity.

The amount of epidemiological data concerning the incidence of injury in youth sports participation is increasing.[1, 3, 14, 85, 91, 125-144] The injuries sustained by the participants vary in severity, from relatively minor to catastrophic.[3, 14, 135, 139] It is important to remember that secondary schoolï age athletes are not miniature adults[124] and are susceptible to injuries that are specific to their age and level of physical maturity, presenting special challenges with respect to their participation in athletic activities.[85] A thorough, on-site initial evaluation is important in recognizing the nature and severity of the injury, determining if more advanced treatment and care are required, and limiting participation to protect the initial injury and prevent further harm.

One of the primary concerns regarding adolescent injuries is the child's developing musculoskeletal system.[124, 135, 136, 139, 145] The fact that the epiphysis, or growth plates, remain open is the reason physically immature youngsters are at greater risk, especially if they compete against more mature youngsters who have completed puberty and have closed growth plates and more mature muscular support for joints.[124, 145] An adolescentôs bones and articular surfaces may not be sufficiently developed to handle the stresses associated with athletic activity. Therefore, adolescents may develop a number of characteristic injuries, including osteochondritis dessicans, spondylolysis, stress fractures, and Salter-Harris fractures, many of which may have long-term consequences.[135, 136, 139, 144, 145]

Adolescents who have sustained an injury should be evaluated immediately to determine the nature and extent of the injury, because its signs and symptoms may change relatively quickly.[1, 3, 123-125] For example, the signs and symptoms of a head

injury may resolve soon after the injury, even though a significant, possibly life-threatening, head injury has occurred.[132] This individual may return to play because of resolution of their symptoms; however, Guskiewicz et al.[132] report that football players sustaining one concussion were three times more likely to sustain a second concussion during the same season than were athletes who have not had a concussion. Identifying the head injury through a thorough initial injury evaluation is essential to limiting the õserious sequelaeò associated with repeated head injury.[132] An example of this sequelae is second impact syndrome (SIS), which occurs when an individual with a head injury receives a second blow to the head before the brain has recovered from the first injury and can lead to death.[127, 134] Immediate recognition of the initial concussion by members of the AHCT, as well as team members and coach, is important in the prevention of SIS and can be made through a proper initial evaluation.

An immediate injury evaluation also permits the quick initiation of appropriate medical treatment, which is associated with proper healing and a reduced risk of reinjury.[1, 124] Immediate treatment can mean the difference between life and death. Heat exhaustion, for example, is one condition that can be fatal without prompt recognition and treatment.[103] In addition, improper treatment of a suspected neck or spine injury may lead to secondary injury or a worsening of the original injury.[102]

When identifying the individuals to fulfill these roles, most organizations consider several options: physicians, paramedics or EMTs, coaches, and ATCs. Physicians certainly have the knowledge to complete an injury evaluation. Physicians also possess the medical expertise required to make decisions regarding injury treatment. However, one concern when asking physicians to provide these services is their availability at each practice and competition.

Several studies discuss the medical coverage afforded high schools for athletic activities in a variety of states.[128, 143, 146] In a survey of 240 California high schools, physicians provided medical coverage at football games over 70% of the time.[146] In contrast, a survey of 119 high schools in Alabama reported physician coverage at less than 25% of school-sponsored sporting events and less than 15% of practices.[128] Although practice coverage was not addressed specifically, reports from 301 high schools in Wisconsin indicated that only 35.5% of schools had a designated team physician.[143] Hence, although physicians certainly have the skills and training required to provide immediate medical care, they are often not available or able to satisfy the need for immediate injury evaluation and treatment at all practices and games.[1]

Similar results were found when schools were surveyed regarding the presence of an ambulance during practices and competitions. Vangsness et al.[146] report that less than 38% of schools had an ambulance with an EMT or a paramedic available at home football games. Culpepper[128] found that at least 80% of schools provided an ambulance during varsity football games, although less than 38% provided an ambulance for junior varsity football games. In a survey of 302 high schools, Rutherford, Niedfeldt, and Young[143] found that almost 79% of schools had an ambulance available or on call for practices or scrimmages. Although this percentage is higher than reports from other states,[146] having an ambulance õon callò does not necessarily mean the ambulance is on-site. In cases where an ambulance is available on-site, that ambulance may be

called away at a moment's notice in response to an emergency. An athleteôs medical condition can change dramatically in a few minutes, less time than it may take an ambulance to arrive on the scene. Relying on the presence of an ambulance and personnel to provide medical care may not satisfy the need for immediate injury evaluation or treatment.

Coaches are another viable option for providing immediate injury evaluation and treatment. Coaches certainly are available on-site at each practice and competition and are encouraged to become educated about responding to emergencies, including certification in first aid and CPR.[16, 85, 88, 91, 123, 125, 126] In fact, some states require coaches to obtain these certifications.[141, 146] However, state laws often prohibit coaches from making return-to-play decisions or care beyond first aid such as taping an injured body part. The U.S. Navy defines *first aid* as the emergency care and treatment of a sick or injured person before professional medical services are obtained. First aid measures are not meant to replace proper medical diagnosis and treatment ï they only provide temporary support until professional medical assistance is available. The purposes of first aid are to save life, prevent further injury, and minimize or prevent infection. Therefore, using coaches as health care providers is not always appropriate.

Moreover, a study by Ransone and Dunn-Bennett[141] questions the ability of coaches to provide these services. They surveyed 104 coaches of boys' and girls' sports at 17 high schools in California. The survey consisted of two separate parts: a test of first aid knowledge and a game situation data sheet that asked coaches to make decisions regarding athletic injuries in nine different athletic scenarios. Of the coaches surveyed, 92% were certified in first aid, yet only 36% passed the first aid assessment. The game situation questionnaire asked coaches to indicate whether they would return a starting player to the game after an injury. The authors note that, in general, coaches tended to return players to the game, especially those coaches who passed the first aid assessment. The authors express concern that coaches may not understand the ñramifications of returning an athlete to competitionò and suggest that ñadditional knowledge on the treatment and rehabilitation of athletic injuries should enable coaches to make more objective decisions.ò[141] Of additional concern is that standard first aid courses do not teach the specifics regarding athletic-related injuries so many coaches have not been taught how to make these types of decisions. There is also a conflict of interest in allowing coaches to make return-to-play decisions.

Coaches should not be expected to split their attention between evaluating athletes, making return decisions, and their coaching duties. In addition, they do not possess the education to appropriately make the decision to return an athlete to participation following an injury.

In many cases, coaches are asked to fill the role of injury evaluator and treatment provider. However, during the course of an athletic practice or competition, coaches focus their energy on supervising their athletes and instructing them in the skills of the game. In addition, of the coaches responding to Culpepperôs survey examining medical coverage in Alabama high schools, ñonly about half of them said they felt adequately trained to handle a medical emergency.ò[128] Given the concerns expressed regarding a coachôs ability to handle medical emergencies, their expertise in first aid and CPR, and

their ability to make objective return-to-play decisions, assigning coaches the additional responsibility of providing immediate injury care may not be the best solution. The CDC will soon release a coachôs kit for concussion management that was developed based on input from coaches and an expert task force. The consensus was that coaches should be able to identify a concussion but should make no decisions about return to play based on their preoccupation with all the other players and a limited knowledge. Providing an individual, such as the ATC, to specifically provide injury evaluation and treatment services at all athletic activities has been recommended.

In summary, while physicians are capable of performing injury evaluations and rendering decisions about injury treatment, they generally are not available to perform these duties at all practices and competitions. And although an ambulance complete with EMTs and paramedics is only a telephone call away, rarely is an ambulance available at each and every athletic activity. Immediate injury evaluation and treatment is a critical component in the successful management of many athletic injuries; however, EMTs are trained in only emergency care and cannot fulfill the role of the comprehensive AHCT. Therefore, organizations that sponsor athletic programs must ensure that an individual or individuals capable of performing these tasks are on-site at each and every athletic event.

The AMA recommends that schools sponsoring athletic programs establish an AMU that consists of a physician and an athletic health coordinator.[1, 122] The AMA suggests that athletic organizations place an ATC in the role of the athletic health coordinator.[1, 122, 147] ATCs are appropriate choices for the athletic health coordinator because they have the skills and knowledge required to perform injury evaluations and to provide immediate treatment.[1]

Components of the recommendation

Organizations that sponsor athletic programs should establish an AHCT, identify an athletic health coordinator, and develop a comprehensive EAP[1, 122] that includes mechanisms for providing immediate injury evaluation and treatment. Individuals capable of providing these services should be available for all athletic practices and competitions.

Strategies for implementation

On-site medical professionals such as the team physician or ATC should lead the AHCT. The organization sponsoring the athletics program should identify the individuals responsible for performing injury evaluations and providing injury treatment within applicable state law. The selection of this individual should be based on his/her education and availability to provide these services at each athletic practice and competition. At a minimum, a coach or other individual who is with the team on a regular basis, and is trained in CPR (including AED use) and first aid, should be available to tend to injuries that occur. In addition, protocols should be established, in advance, governing referrals and return-to-play decisions, especially in instances where a sponsoring organization may have multiple events going on at several sites.

Another viable option is the presence of an EMT/paramedic or a registered nurse at practices and games. These individuals would offer a higher level of care than an

individual with first aid and CPR training; however, these individuals may be limited in their ability to render return-to-play decisions and apply protective taping and padding following an injury.

FACILITATING REHABILITATION AND RECONDITIONING

Adolescents who participate in athletics are subject to injury. When injuries occur, the injured individual requires proper treatment and rehabilitation to regain full physical function and safely return to athletic participation. This treatment should include not only the care provided immediately after the injury but also the postinjury rehabilitation and reconditioning. Rehabilitation and reconditioning programs reduce the likelihood of reinjury and promote a safe return to play. Organizations that sponsor athletic programs should establish an on-site member of the AHCT and identify this individual to manage the postinjury treatment plans of the athletes. Coaches should also be taught to follow the AHCTôs recommendations in regard to athlete rehabilitation.

Injuries are a common occurrence in all levels of athletics. For most athletes, a return to activity after the injury is expected. However, when the individual returns to competition, the likelihood of reinjury is directly dependent on the care this individual receives after the injury. Although the evaluation and treatment provided immediately after the injury are critical, a rehabilitation and reconditioning program designed to safely return the individual to play is just as important.

Trauma to the body causes tissue damage and cell death, resulting in swelling, pain, and decreased ROM.[148] Prolonged periods of disuse can further limit ROM and lead to decreases in strength, cardiovascular conditioning, and muscular endurance.[148] Effective postinjury care can limit the long-term consequences of the initial injury by decreasing pain and increasing ROM, muscular strength, and overall function.[149-151]

Programs designed to return an injured individual to a preinjury level of function can be described using a variety of terms, including *injury treatment, rehabilitation programs*, and *therapy.* In general, these programs consist of exercise, therapeutic modalities, and functional activities specific to the individual and his/her injury.[148, 152, 153] The goals of rehabilitation and reconditioning programs include preventing further injury and promoting a safe return to play.[148] Adolescents who are injured during athletic performance should complete a rehabilitation and reconditioning program to promote a safe return to play.

Adolescents who sustain an athletic injury should receive treatment. This, as a whole, consists of two distinct parts or phases. The first component is the treatment received immediate after the injury; the second component is the postinjury rehabilitation and reconditioning. The rehabilitation and reconditioning component should be viewed as a process that lasts days, weeks, or months, with the length dependent on the severity of the injury.

Programs designed to return an injured individual to a preinjury level of function can be described using a variety of terms, including *injury treatment, rehabilitation and reconditioning programs, therapy,* and *physical therapy*. Although these terms are familiar to most, the concepts behind them are less well known. Understanding these concepts is best achieved by describing the characteristics and goals of rehabilitation and reconditioning programs. The first primary goal of every rehabilitation and reconditioning program is injury prevention.[3, 148] The second goal is a safe and timely

return of injured athletes to their preinjury level of competition.[148] Rehabilitation and reconditioning programs consist of individualized therapeutic exercise that is performed in orderly, progressive steps until return to play.[148]

One of the hallmarks of rehabilitation and reconditioning programs is the progression of *therapeutic exercise*. This is enhanced through the setting of both short- and long-term goals. Short-term goals tend to focus on increasing ROM, strength, and flexibility and on restoring proprioception.[130, 148] Long-term goals tend to focus on optimizing the individualõs functional status.[148, 154] Achieving these goals depends on many factors, of which perhaps the most important is *frequent reevaluation* of the athlete to modify the goals and treatments as needed.[148] Therefore, qualified personnel capable of reevaluating and modifying the rehabilitation and reconditioning program as needed should be available.

The benefits of completing rehabilitation and reconditioning programs are also well known. Stylianos[155] notes that individuals participating in ñeffective rehabilitation programs will often surpass expectations for functional recovery.ò Entering into a rehabilitation and reconditioning program after injury permits injured athletes to return to play sooner with fewer long-term disabilities.[136] Individuals have noted decreased pain and disability and increased ROM and functional activity following the completion of rehabilitation programs for patellofemoral pain and neck pain, respectively.[149, 151] Gilbey et al.[150] found that individuals who completed an exercise program before total hip arthroplasty and continued with the program after surgery exhibited an earlier return to functional activity.[150] In a study of injury patterns in select high school sports, Powell and Barber-Foss[3] noted that, as part of an overall injury prevention program, rehabilitation after the initial injury minimized the risk of reinjury.

Adolescents who return to participation before completing a rehabilitation and reconditioning program are risking reinjury and other long-term consequences. There are a number of reasons why an adolescent may not successfully complete a rehabilitation and reconditioning program. An adolescent may lack access to such a program or choose not to participate in the program. Compliance with rehabilitation and reconditioning programs and the length of time an individual receives these services correlates strongly with better treatment outcomes.[156, 157]

The rehabilitation and reconditioning of athletic injuries represents a major component of a comprehensive injury prevention program and should be undertaken by a selected member of the AHCT. The NATABOC-certified athletic trainer (ATC) is the choice of the AMA because they have the appropriate training and educational background to provide appropriate care for injured athletes and to make sound decisions regarding when an athlete can return to play.[1, 122] Although it has been noted that not all organizations have the resources to hire an ATC or implement a sophisticated sports medicine program, they can designate a qualified member of the coaching staff to work with a member of the AHCT to prevent injuries, provide medical care, and rehabilitate injured athletes.[1]

Components of recommendation

Organizations that sponsor athletic programs should identify an individual who is responsible for coordinating rehabilitation and reconditioning programs with physicians

and other health care professionals. This individual should also be responsible for determining return-to-play following rehabilitation.

Strategies for implementation

Organizations that sponsor athletic programs should establish an AHCT consisting of a team physician and an athletic health coordinator.[1, 122] The organization may choose to provide an athletic health coordinator such as an ATC who is qualified to evaluate injured individuals and develop appropriate rehabilitation and reconditioning programs. If the organization cannot provide an ATC, it should identify both (1) an athletic health coordinator to provide rehabilitative care and (2) an athletic health coordinator to work with health care providers outside the organization to ensure their recommendations regarding treatment and participation are being followed.

The on-site member of the AHCT can ensure injured athletes receive appropriate rehabilitation and reconditioning services in several ways. An ATC possesses the education and credentials to design the rehabilitation and reconditioning program, supervising and reevaluating individuals as they progress through it. In cases where the athletic health coordinator does not have the training to provide these services, s/he can coordinate with outside health care providers to ensure that the recommendations of the treating physician, physical therapist, and others are followed. Regardless of the athletic health coordinatorôs qualifications, this individual plays an important role in injury rehabilitation and reconditioning.

PROVIDING FOR PSYCHOSOCIAL CONSULTATION AND REFERRAL

Members of the AHCT may be the health care professionals who most often interact with adolescent athletes. In some cases, a PPE or injury management may be an adolescentôs only interaction with any health care system. Members of the team must therefore be capable of identifying potential psychosocial pathologies and referring the athlete for appropriate diagnosis and management. Organizations that sponsor athletic programs must identify local experts who specialize in these areas.

Adolescents are at significant risk for morbidities associated with substance abuse, sexual activity, depression, eating disorders, suicidal tendencies, weapon use, violence, and vehicular recklessness. Adolescent athletes in particular may have an increased risk of depression associated with injury or athletic ñburn-out.ò Furthermore, although adolescent athletes may have a decreased risk of cigarette smoking, some studies have suggested an increased use of smokeless tobacco, unsafe sexual activity, alcohol abuse, vehicular recklessness, and other risk-taking behaviors among certain adolescent athletes.

The AMA has estimated that the athletic PPE serves as the only routine health maintenance for 80% to 90% of adolescents.[30] Even though the consensus PPE monograph recommends counseling and screening for psychosocial problems,[17] some have called the PPE a ñmissed opportunityò[158] to adequately evaluate the physical, emotional, and psychological well-being of secondary schoolï age athletes.

Studies have shown that not only do secondary schoolï age athletes engage in numerous health risk behaviors,[159] they may also have a higher rate of certain behaviors than their non-athletic peers. Due to the requirement for parental consent, conducting research to estimate the prevalence of health-risk behaviors is difficult in secondary schoolï age athletes. However, if one extrapolates conclusions from data in the collegiate population, to which many secondary schoolï age athletes aspire and will graduate, some conclusions can be made regarding athletes and risky health habits. Nattiv and Puffer[160] found that collegiate athletes have higher proportions of risky behaviors than do their non-athletic peers, including a higher quantity of alcohol consumed, lower use of contraception, higher number of sexual partners and sexually transmitted diseases, greater rates of driving while intoxicated with alcohol or other drugs and riding with an intoxicated driver, and lower use of seatbelts and of helmets when riding a motorcycle or moped. In addition, high school athletes have been found to have a higher rate of accidental non-athletic injuries[161] and to demonstrate earlier sexual contact[162] compared to non-athletes.

The risk-taking behaviors seem to vary by gender, with male athletes disproportionately more likely to engage in them than female athletes.[163] Nattiv et al.[164] confirmed this finding in a follow-up study to their prior work and further identified participants in contact sports as at the highest risk. They also showed that athletes who engage in one high-risk behavior are more likely to engage in multiple high-risk behaviors. There are suggestions that addictive disorders, such as gambling, may often be seen as a comorbid factor with depression among athletes.[165] An excellent review of certain risk-

taking behaviors of athletes and the studies comparing health risk behaviors in athletes and nonathletes was published by Patel and Luckstead.[166]

Of importance is that the same studies also demonstrated important benefits of athletic participation, including lower likelihood to smoke cigarettes or marijuana, greater likelihood to engage in healthy dietary behaviors, and lower likelihood to feel bored or hopeless[161]; a significant decrease in drug and alcohol use and abuse over all 4 years of high school[162]; and less depression, less suicidal ideation, and fewer suicide attempts.[167] Looking more critically at the Nattiv and Puffer[160] data, if certain male contact sports were removed from the sample, the remaining athletes may have demonstrated no greater risk-taking behaviors than the general student body.

In general, then, athletic participation seems to correlate with improved emotional well-being in adolescents.[168] Injured patients in sports medicine clinics may therefore experience significant psychological distress associated with the loss of this participation.[169] Interestingly, among injured adolescent athletes who reported higher athletic self-identity, higher depressive symptom scores were measured.[170]

The health professionals best positioned and suited to address these psychosocial concerns in the athletic setting may be ATCs, because the necessary skills and knowledge are standard to their professional practice and because they are more likely to be consistently available on-site.[171]

Components of recommendation

Members of the AHCT team and coaches often develop close and/or long-term relationships with adolescent athletes and may be well positioned to identify subtle early warning signs of common psychosocial problems. Coaches should work with members of the AHCT to provide for psychosocial consultation and referral of adolescent athletes with the following guidelines:

- Coaches and AHCT members should be aware of the psychosocial problems of adolescence, including disordered eating, substance abuse, sexual activity, athletic ñburn-out,ò depression, suicidal tendencies, weapon use, violence, and vehicular recklessness.
- At least one AHCT member should review the PPE to look for specific warning signs.
- Coaches and AHCT members should be aware that psychosocial problems of adolescent athletes might manifest themselves as overtly as dropping out of participation or as subtly as small decreases in performance.
- AHCT team members should be able to easily refer athletes to identified consultants who can further evaluate and treat these suspected conditions.
- The organizations that sponsor athletic programs must establish systems to facilitate these referrals by identifying local mental health providers, ensuring prompt access to them, and minimizing barriers such as insurability and payment.

- At least one, if not all, of the AHCT members should be aware of the specialized developmental needs and stages of growing adolescents.
- At a minimum, one on-site AHCT or coach should be well versed in the recognition of psychosocial issues and the referral system established by the sponsoring organization

Strategies for implementation

Members of the AHCT may be well positioned but, because of their training, not well suited to identify emerging psychosocial problems. Implementation of this recommendation would therefore require some, if not all, of the following elements: As detailed in the PPE monograph,[17] thorough psychosocial screening should be an important component of the PPE and should be conducted, ideally, by the athleteôs primary care provider. If not conducted by the primary care provider, a thorough psychosocial screening could be conducted by another health care professional who is comfortable with adolescents and familiar with the basic tenets of confidential and sensitive interviewing. The issues that can be addressed in a thorough psychosocial screening can include questions regarding home life and family dynamics, education (school performance and relationships), activities (sports, jobs, and leisure enjoyment), diet, drug use, safety issues (violence, weapon use vehicular recklessness), sexuality (contraception, type, number and frequency of partners), depression, and suicidal tendencies

Texts such as Neinsteinôs *Adolescent Health Care*[172] provide more detailed examples of the content of and techniques for adolescent psychosocial screening. Other tools for screening specific conditions include a screening instrument that can reliably and validly identify disordered eating behaviors in the secondary schoolï age population and ones that evaluate depressive symptoms such as sleep disturbances, irritability, guilt, low energy levels, inability to concentrate, changes in appetite, and suicidal tendencies.

Team members should be provided education and training by local experts in adolescent health such as the multidisciplinary members of the Society for Adolescent Medicine (SAM) (http://www.adolescenthealth.org). Curricular goals could include understanding of the basic cognitive, emotional, physical, and psychosocial developmental stages of adolescence (Table 3) and identifying signs and symptoms of common psychosocial problems, such as disordered eating, substance abuse, sexual activity, athletic ñburn-out,ò depression, suicidality, weapon use, violence, and vehicular recklessness.

While a sports psychologist may be a valuable member of or consultant to the AHCT, ATCs are specifically trained in the components listed and often practice on-site with adolescent athletes and therefore would be extremely valuable members of the AHCT. In addition, the ATC should refer any athletes with identified problems to the school counselors and, if comfortable, discuss the issue with the athlete and/or his or her parents.

PROVIDING SCIENTIFICALLY SOUND NUTRITIONAL COUNSELING AND EDUCATION

Sports nutrition is a key factor in an athleteôs growth, development, and performance. It is well known that adolescents have unique nutritional requirements that are further complicated by sport participation. The massive industry of supplements marketed to enhance sports performance and the lack of regulation as to the effectiveness and safety of such products pose an additional risk to secondary schoolï age athletes. Athletes need guidance to make sound nutritional decisions in an age where fad diets and performance enhancement products are prevalent.

Sponsoring organizations of athletic programs have a responsibility to provide a safe environment including sound, scientifically based information regarding nutrition and supplements. A solid knowledge of nutritional concepts is crucial to any AHCT; especially those caring for secondary schoolï age athletes. In addition to basic growth and development, competition puts an increased demand on daily nutritional requirements. Factors such as ethnicity, social and economic status, family history and environment, peer pressure, and inaccurate diet information can complicate the prescription for good nutrition. In addition, adolescents' tendencies to skip meals, snack on junk food, and feast at fast food restaurants can add to poor eating habits.

A system for reviewing an athleteôs nutritional status is the basis of providing appropriate information to athletes and parents regarding long-term nutritional health. Childhood obesity is on the rise in United States and puts children at risk for heart disease, illness, and injury.[173] A review of an athleteôs nutritional status could alert the child and parents to a problem. If a child is found to have poor nutritional habits, an allied health care professional should help combat the problem by creating a plan to address the issues identified in the nutritional review.

Included within the topic of nutrition is proper hydration, especially during activities conducted in high heat stress environments. The availability of hydration fluids in a clean, noninfectious environment at all sport settings should be ensured. It has been well documented in the NATAôs Heat Illnesses Position Statement[103] that one major preventative measure is to maintain proper hydration. Not only should the athlete be given the opportunity to consume the appropriate amount of fluid, but s/he should also be educated as to how much to consume and why it is important. Athletic performance may decrease due to hypohydration.[115] Education of athletes, coaches, and parents in regard to hydration is crucial in the prevention of unwanted injuries and illness and should be a consideration of any group working with adolescent athletes. In addition, coaches or other personnel should never restrict fluids for exercising athletes.

Pre-event and post-event nutritional needs are important considerations for the secondary schoolï age athlete. For optimal performance, an athlete needs to know what to eat and when to stop eating before a competition. Eating the wrong foods at the wrong time will not give an athlete the appropriate energy for competition and may cause bloating and discomfort.[174]

After exercise, it is important to replenish the nutrients used. Athletes, parents, and coaches should have an avenue to find out the necessary information. Resources reflecting sound scientific material should be used; examples are provided in the Identification of Additional Resources section of this document.

Body weight has a direct influence on some sports such as wrestling and crew and is associated with performance in many other sports such as gymnastics and dance. It has an aesthetic impact in sports such as cheerleading. The pressure to achieve or maintain a low body weight during the secondary school years can lead some to develop disordered eating. There should be a system in place to identify athletes at risk for eating disorders and to treat those who have been identified. It is important that someone close to the athlete knows what to look for. People with eating disorders are very manipulative; so once they have been identified, it is very important to have a plan set in place to provide referral to an appropriate allied health care professional who specializes in this field.

Use of sports supplements and performance-enhancing drugs is fairly common among secondary school students.[175] Young people are taking them to perform better or to build muscle, as well as to look better. The main sources of knowledge regarding supplements and performance-enhancing drugs are friends and advertising. Most athletic governing bodies prohibit the use of supplements and drugs that are designed to enhance performance.[16] Supplements marketed to enhance athletic performance often are touted as ñherbalòor ñnatural,òwhich implies an element of safety. This, coupled with the massive marketing campaigns and use by professional athletes, provides for the ñeasy path to successòfor the secondary schoolï age athlete. Societyôs emphasis on winning and a childôs desire to please parents and coaches make for a potentially deadly combination. While young people may realize that supplements and performance-enhancing drugs are dangerous, few are reported to know the potential side effects.[175]

Dietary supplements are not required to be standardized in the United States. In fact, no legal or regulatory definition exists in the United States for standardization as it applies to dietary supplements.[176] Studies conducted on sports supplements rarely include subjects of adolescent population. Adverse potential side effects of sports supplements may include, but are not limited to, heart failure/cardiac anomalies, organ malfunction, personality disorders, reproductive disorders, headache, and acne.

Members of the AHCT should be well versed in proper sports nutrition for the adolescent and have a basic knowledge of proper nutrition and eating habits. They should also have access to a professional nutritionist or dietician.

Components of recommendation

Sponsoring organizations should establish components of a comprehensive sports nutritional support system, based on current scientific facts, and should include, 1) A system for reviewing an athleteôs nutritional status, 2) Policies to ensure the availability of hydration fluids in a clean, noninfectious environment at all sport settings, 3) Encouragement of appropriate pre-exercise and post-exercise food, 4) A system to identify athletes at risk for disordered eating and a system to treat those who have been

identified, and 5) The use of scientifically supported literature when developing rules that restrict the use of performance-enhancing supplements, drugs and substances, or educational programs to inform coaches, athletes, and parents of the dangers of ergogenic aids

Strategies for Implementation

Reviewing the athleteôs nutritional status

Information sheets with general nutrition goals for an active secondary schoolï age athlete can be provided by the sponsoring organization. Each athlete should have a basic understanding of what nutritional requirements s/he needs to have for normal growth and activities of daily living as well as the additional needs that exist because of the energy expenditure caused by his/her sport. Reference to appropriate print and Web media can also be provided; sources are available later in this document. Coaches, as well as members of the AHCT, should be alert to the athletesônutritional well-being and provide additional information and interaction when circumstances warrant.

Maintaining adequate hydration

The sponsoring organization, via the coaches and members of the AHCT, has a responsibility to provide an environment and information to facilitate or help athletes maintain adequate hydration during physical activity. Several documents are available to assist with the development of a fluid replacement program such as NATAôs Position Statement on Fluid Replacement,[115] as well as educational materials that can be provided to athletes, coaches, and parents, such as NATA's Exertional Heat Illness Consensus Statement.[105] Encouraging fluid replacement adequate to replace fluids lost due to sweating before, during, and after intense physical activity is essential to maintain performance levels and general health.

Pre-exercise and post-exercise nutrition

There should be an encouragement of appropriate preexercise and postexercise food. For optimal performance, an athlete needs to know what to eat and when to stop eating before a competition. Informational handouts with recommendations based on accurate scientifically proven information can be provided to athletes and parents.

Sponsoring organizations that provide opportunities for athletes to travel (e.g., youth travel soccer) can lead by example and provide the teams with nutritionally sound eating opportunities, both before and after exercise. Members of the AHCT should investigate available resources such as community-based wellness centers and hospitals that have registered dietitians and nutritionists on staff to provide appropriate information to the team, coaches, and parents.

Identify athletes at risk for disordered eating

Disordered eating can have a variety of signs and symptoms. Providing information to coaches about the signs and symptoms of disordered eating can encourage early recognition. The complexity of dealing with disordered eating necessitates referral of athletes who exhibit signs and symptoms to an appropriate professional. Appropriate professionals include physicians, psychologists, school nurses, and nutritional counselors. Establishing, in advance, a systematic protocol to follow when an athlete is

suspected of disordered eating is essential to ensure athletes receive the appropriate support.

Performance-enhancing supplements

Supplements marketed to enhance athletic performance come in many different forms. Most athletic governing bodies prohibit the use of supplements and drugs that are designed to enhance performance. Sponsoring organizations should support rules prohibiting supplement use and provide education addressing the potential health risks associated with them. Caution should be taken when researching information on specific supplements and drugs to ensure it is from a reputable source.

DEVELOPING INJURY AND ILLNESS PREVENTION STRATEGIES

Injuries and illnesses are a heavy burden on the well-being of secondary schoolï age athletes and a leading reason why people stop participating in physical activities. There are many interventions that have proved to be effective in reducing the severity of athletic injuries.[177-180] Still, many opportunities for prevention remain. This document establishes recommendations for the prevention, care, and appropriate management of athletic-related injury and illness specific to the secondary schoolï age individual. This overview presents a public health framework for developing effective interventions to reduce the burden of injuries to secondary schoolï age athletes.

Participation by secondary schoolï age children in sports, recreation, and exercise is widespread, with nearly 6.5 million high school students participating in organized athletics.[11] However, many of these activities involve elevated risks of injury. As a result, approximately 715,000 sports- and recreation-related injuries occur in the school setting each year.[181] These injuries may lead to a number of costs, some of which are financial and some of which affect a personõs quality of life.[182] In the short term, costs include medical care expenses and time lost from classes and athletic play. Of U.S. schoolchildren who received medical attention for a sport/recreation injury, 20% had one or more days of lost time from school.[183] Long-term costs may include medical and rehabilitation expenses, restriction of future athletic activities, loss of some amount of physical function, and increases in insurance premiums.

A wide variety of injury control interventions have been accepted in the athletic community over the years, including changes to the environment (e.g., break-away bases),[184] use of protective equipment in contact sports (e.g., helmets),[185] and rule changes (e.g., footballõs prohibition of spearing).[186] Scientific progress has demonstrated that certain sports, certain positions, and certain competitive situations have greater risks of injury than others. By recognizing the greatest risks, we can develop ideas that reduce the chances of a serious injury to a young athlete.

Developing a comprehensive approach to injury control strategies for athletics is difficult. To begin to establish this direction, NATA sponsored the development of recommendations for appropriate medical care of secondary schoolï age athletes. This effort addresses more than basic emergency care during sports participation; it involves virtually all aspects of prevention, and activities of ongoing daily athletic health care. The recommendations are intended for use by the sponsoring organizations of athletic programs, and the AHCT they establish, in consultation with administrators, coaches, parents, and participants. Establishing an AHCT should be one of the sponsoring organizationõs first priorities and should include medical professionals such as ATCs, allopathic or osteopathic physicians, school nurses, and other allied health care providers.[1] By approaching the issue of athletic injuries in a comprehensive way, we develop a better sense of where the problems lie and what can be done to eliminate or reduce them.

This holistic approach involves considering characteristics of the athlete (host), the environment associated with athletic performance (both physical and social-cultural), and the energy that is transferred to the body that causes damage. These elements and

their relationships are represented as a public health framework. This framework has long been used in the study of disease and has recently been applied to the topic of athletic injury. As described by Weaver et al.,[125] ñThe public health framework suggests that multiple types of social environmentsé operate within a physical environment, and provide the context in which an energy vector acts on an athlete to cause an injury. Each of these components and their multiple interactions can be further investigated as a potential target for injury prevention efforts."

Athletics includes a long history of interventions designed to protect players from specific injuries. However, not all of these efforts have been scientifically evaluated to demonstrate their effectiveness. Also, not all interventions have been found to be acceptable to players, and enforcement of protective rules may be rejected by the athletic community, who view the rule change as an offense to the sportôs tradition.[182] Nevertheless, games are constantly evolving with safety concerns often driving the changes. The following outline presents some examples of the best practices for injury control in modern sport using elements of the implementation hierarchy previously described.

Engineering controls
Although safety balls have long been assumed to cause fewer injuries, no epidemiological study had examined their effectiveness before the study of Marshall et al.[84] in a 3-year nationwide study involving more than 6.7 million player-seasons, the use of safety balls was associated with a 23% reduced risk of ball-related injury in Little League Baseball. The effect was more dramatic among younger divisions than among older divisions. The authors also suggest that concerns of poorer performance by the reduced-impact ball, the greatest barrier to wider acceptance, are based on misperception ñof the ballôs play, rather than the actual performance of the ball.ò[84]

Administrative controls
Based on surveillance data of head and neck injuries occurring in tackle football, axial loading was identified in 1975 as the primary cause of serious cervical spine injuries.[187] The incidence of catastrophic head and neck injuries increased in 1976 as a result of the new helmets, which led some athletes to consider themselves indestructible. Subsequent rule changes in high school and college play banned ñspearingò and using the top of the helmet as the initial point of contact in striking an opponent during a tackle or block. Once the actual mechanism of injury was understood, modification of the rules to affect a change in playing technique was very effective. From 1976 to 1984, cervical spine injury rates sharply decreased and injuries that resulted in quadriplegia decreased 85% from 34 to 5 incidences.[186]

Educational intervention
In a prospective controlled intervention study, a prevention program that focused on education and supervision of soccer coaches and players demonstrated 21% fewer injuries in the intervention group among male youth amateur players.[178] The effects were more dramatic for injuries that were mild, resulted from overuse, or occurred during training. Also, the program was more successful with low-skill teams, demonstrating the potential of education strategies for a great number of youth teams.

Personal protective equipment
A good case study of the need for personal protective equipment involves the long-running debate over whether protective eyewear should be required in womenôs lacrosse. Proponents of protective equipment cite a fast-moving sport, the use of sticks and a hard rubber ball, and documented eye injuries as evidence of the need for protective eyewear. Opponents suggest that by requiring protective equipment, players will feel secure enough to increase their aggression and ultimately change the nature of the game from one of incidental contact to one of full contact, similar to the menôs game. Further, it is argued that this increase in aggression will eventually cause more injuries than the original intervention (protective eyewear) prevents.

To assess the true effect of protective eyewear, Webster et al.[188] collected field data from 700 varsity and junior varsity players in central New York over a 2-year transition from sparse to almost complete eyewear use. The findings indicated a 16% reduction in overall head/face injuries among goggle wearers, with an even greater effect in game situations (51% reduction). This and similar studies[189] demonstrated a beneficial use of eyewear and provided the basis for strategic decisions on how best to prevent head and facial injuries in young athletes. One such change is the recent decision by the U.S. Lacrosse Womenôs Division Board of Governors to amend the rules of womenôs lacrosse to highly recommend the use of protective eyewear meeting current ASTM lacrosse standards for 2004 and to mandate use beginning in 2005.[190]

Components of recommendation
There is a well-accepted scientific process for addressing a public health injury problem, and in this case, athletic injury among secondary schoolï age athletes. This public health approach[191-194] includes the following five components, which are then described in greater detail: 1) Determine the existence and size of the problem, 2) identify what may cause the problem, 3) determine strategies and interventions that may prevent the problem, 4) implement prevention strategies, and 5) monitor and evaluate the effectiveness of prevention efforts.

Determine the existence and size of the problem
The success of the first step relies on a complete and accurate collection of relevant data. This includes a good description of the circumstances surrounding the injury, including person, place, and time. Surveillance describes such characteristics as the magnitude of the problem (ñHow many players have been injured?ò), the physical location of the problem (ñWhere on the field do injuries occur?ò), what body parts are at greatest risk of injury (ñAre there more head injuries than shoulder injuries?ò), and who is affected (ñAre more boys injured than girls?ò).[195] Along with the descriptive injury data, it is imperative that injury surveillance also takes into consideration exposure data (athlete-exposures). Additional information should be collected to allow for comparisons to be made within and between positions, sports, and those with and without a previous injury history. Only with a strong surveillance effort can we be sure that the biggest problems are being addressed and our efforts to reduce them are successful.

Identify what may cause the problem
This information suggests why certain people may be at greater risk of injury while others are protected. This type of data requires long-term, expensive longitudinal

studies. However, some risk factors have already been identified in high school athletes and interventions can be developed from these known risk factors (e.g., landing biomechanics and anterior cruciate ligament [ACL] injury in females has led to jump training programs). Understanding which risk factors are involved is often overlooked, yet is crucial to developing effective interventions.

Determine strategies and interventions that may prevent the problem
Developing strategies for injury prevention is usually based on the approach introduced by William Haddon, known as the Haddon Matrix.[196] It is based on Haddon's observation that all injury events come from the uncontrolled release of physical energy.[197] Efforts focused on prevention can occur at one of three times: before the injury (when the energy becomes uncontrolled), during the injury (when the energy transferred to the body is more than can be safely absorbed), or after the injury (when the body attempts to heal the damage). In addition to the time axis, the Haddon Matrix includes an axis of risk factors also found in the public health framework; the host (potentially injured person), the agent (the energy and the way in which it is transferred), and the environment (both physical and social). The resulting 12-cell matrix can be used as a brainstorming tool to devise interventions according to a specific time phase and a specific risk factor. An example of the use of the Haddon Matrix applied to the problem of athletic injuries is found in Table 4. A strong prevention program incorporates interventions that address the different risk factors and span the time axis.

Implement prevention strategies
Once potential strategies are identified, the next step is to assess which strategies should be implemented and how to put them into action. Recently, Runyon[198] added another dimension to the Haddon Matrix to help with this decision. A set of value criteria is included as a starting point for planners to consider. Depending on the nature of the injury problem, some criteria will be weighted more heavily than others; these criteria include

- *Effectiveness:* How well does the intervention work when applied?
- *Cost:* What are the costs of implementing and enforcing the program?
- *Freedom:* Do the freedoms of some groups have to be sacrificed to achieve the goal?
- *Equity:* Are people treated equally or in a universal fashion?
- *Stigmatization:* Does a program result in a person/team being stigmatized?
- *Preferences:* Are preferences recognized to encourage compliance?
- *Feasibility:* Can the intervention actually be produced?

Another strategy for developing effective interventions for athletic injuries is to consider whether players are protected from injury without having to take additional precautions.[125, 199] A passive strategy, such as adding padding to an outfield wall, provides automatic protection without requiring the cooperation of the athlete to be effective. An active strategy, such as a rule change to ban slaps to the side of the helmet, requires an athlete to modify his or her play or cooperate in some other way. Passive strategies are generally considered to be more effective because they do not rely on player compliance each and every time a potential injury situation presents itself.

Different types of interventions can be classified according to the degree of compliance required of athletes. This principle is presented in an intervention implementation hierarchy that includes engineering modification to the athletic environment, administrative changes to a rule, educational efforts to introduce a safer technique or less risky behavior during play, and the use of personal protective equipment. [200] Engineering controls are typically considered to be most effective because they require the least amount of effort/cooperation from the athlete to provide safety, although they also require a greater commitment and resources from the organization with overall responsibility for player safety. Educational controls and personal protective equipment are more active interventions because they require the players to consider the risk of a situation and to act in a safe manner every time the situation presents itself during play.

Monitor and evaluate the effectiveness of prevention efforts

The evaluation step provides answers to the ultimate questions, ñDoes our intervention work?ò or ñHave injuries been reduced?ò[195] We return to our first step of surveillance for data that support or deny the effectiveness of the interventions that have been implemented. Although we are most interested in this primary question, we also must consider whether there may be other reasons, unrelated to the intervention, which might explain why injuries were reduced. Another key issue is whether there are any unintended consequences (good or bad) that are a direct result of the intervention. A bad unintended consequence may ruin any positive effect of the intervention, so it must be determined not only whether fewer injuries occurred, but also whether the intervention had a positive effect on the athletes' overall well-being. Evaluation requires the conduct of well-designed randomized controlled effectiveness studies.

Strategies for implementation

The potential strategies for the prevention of injury and illness in the secondary schoolï age athlete have been presented in the previous 10 sections of this monograph. These interventions address various aspects of the framework previously described, including the athlete, energy transfer, and environment. They also relate to efforts that affect the safety and welfare of athletes before, during, and after the injury or illness.

CONCLUSIONS

Appropriate medical care of the secondary schoolï age individual involves more than basic emergency care during sports participation. It encompasses the provision of many other health care services. While emergency medical care and event coverage are critical, appropriate medical care also includes activities of ongoing daily athletic health care. The athletic health care team (AHCT) comprises appropriate health care professionals in consultation with administrators, coaches, parents, and participants. Appropriate health care professionals could be certified athletic trainers, team physicians, consulting physicians, school nurses, physical therapists, emergency medical services (EMS) personnel, dentists, and other allied health care professionals. Organizations sponsoring athletic programs for secondary schoolï age individuals should establish an AHCT that functions to ensure appropriate medical care is provided for all participants.

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TABLE 1. MEDICAL PROFESSIONALS WHO SHOULD BE CONSIDERED MEMBERS OF THE ATHLETIC HEALTH CARE TEAM

Certified athletic trainers
Team physicians
Orthopaedic physicians
School physicians
Primary care providers (pediatricians, family practice, nurse practitioners, etc.)
Consulting and other physicians
School nurses and guidance counselors
Physical therapists
EMS personnel
Physician assistants
Registered dieticians
Public safety personnel
Public health officials
Dentists
Other allied health care professionals
Students and trainees in the above disciplines

TABLE 2. STRATEGIES TO ENSURE SAFE FACILITIES

Develop a written EAP for all venues or facilities
Evaluate your present facilities for safety
Develop appropriate checklists, forms, and other documentation to ensure thorough and consistent standards of facility evaluation
Follow a standardized timeline for when facility evaluations will take place and who will be responsible for completing the forms
Use ñCritical Incident Reportsòto direct corrective actions whenever an accident occurs
Post warning signs where appropriate.
Provide in-services for staff regularly on injury prevention and how to monitor and manage facility safety
Cultivate a safety awareness culture in your program
Ensure facilities are adequately secured to prevent improper use
Ensure athletes are properly supervised during participation
Maintain a regular schedule for cleaning shared equipment shared and encourage athletes to maintain good hygiene
Follow universal precautions for blood and body fluids

TABLE 3. CHARACTERISTICS OF THE DEVELOPMENTAL STAGES OF ADOLESCENCE

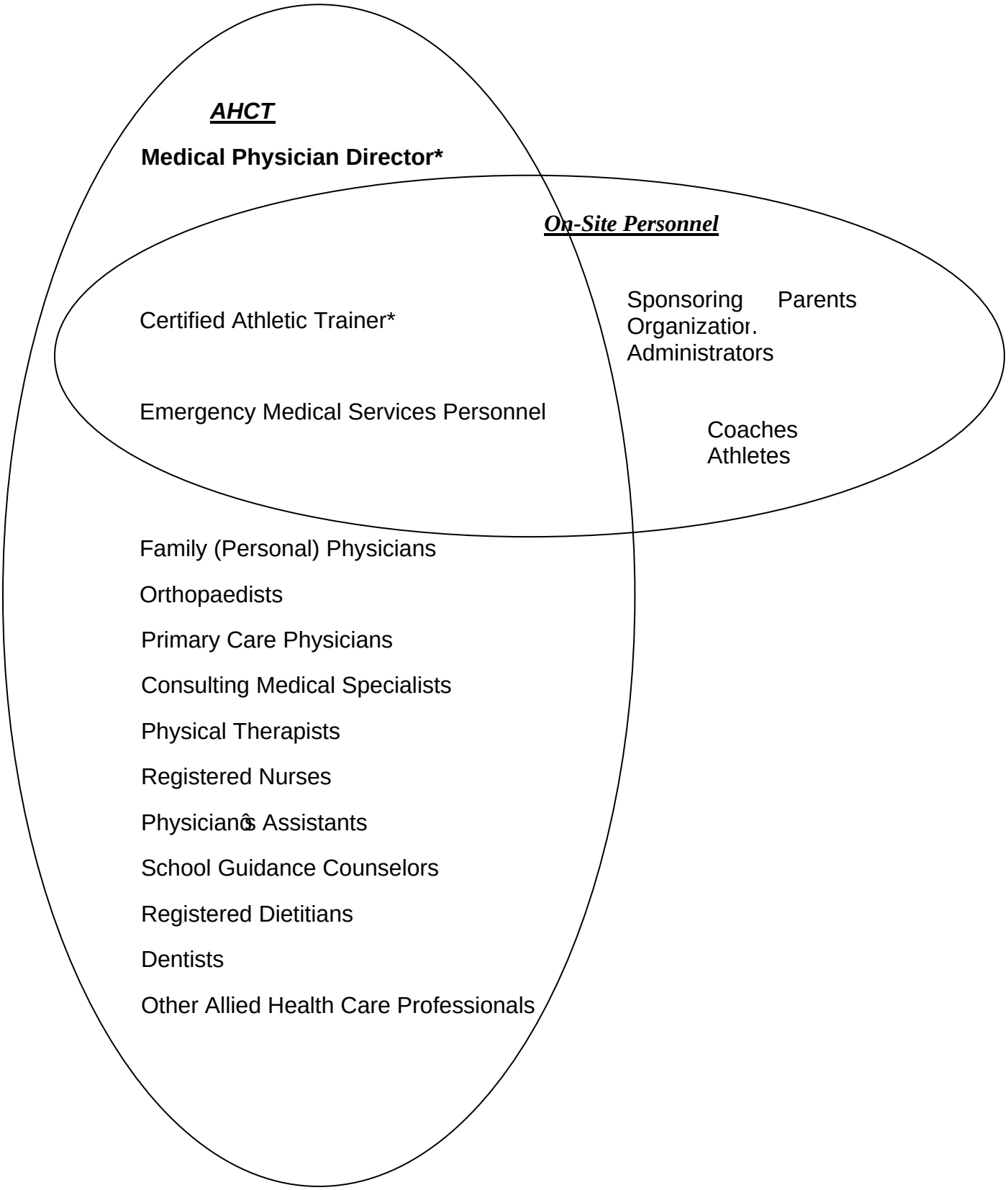
Stage	Characteristics
Early ï individuation	During this time, athletes may become confused or question their identity as they encounter the physical and emotional changes of puberty.
Middle ï separation/rebellion	This is the phase during which many of the risk-taking behaviors may be initiated or reach their peak
Late ï abstract thinking, future/goal orientation	This level of maturity is not often reached during the secondary school years

TABLE 4. HADDON MATRIX APPLIED TO THE PROBLEM OF ATHLETIC INJURIES*

Phases/Factor	Host	Agent	Physical environment	Social environment
Before injury	CS #2. Determine the individualûs readiness to participate.	CS #3. Advise on the selection, fit, function, and maintenance of athletic equipment.	CS #3. Promote safe and appropriate practice, competition, and treatment facilities. CS #5. Establish protocols regarding environmental conditions.	CS #10. Provide scientifically sound nutritional counseling and education. CS #1. Develop and implement a comprehensive athletic health care administrative system.
Injury	Protective responses	Player size and speed	Field condition	Rules enforcement
After injury	CS #8. Facilitate rehabilitation and reconditioning.	Exposure to repeat trauma	CS #4. Develop and implement a comprehensive emergency action plan. CS #7. Provide for on-site recognition, evaluation, and immediate treatment of injury and illness, with appropriate referrals.	CS #9. Provide for psychosocial consultation and referral.

*Consensus Statement # (revised)

FIGURE 1.


AHCT
Medical Physician Director*
On-Site Personnel
Certified Athletic Trainer*
Emergency Medical Services Personnel
Sponsoring Organization Administrators
Parents
Coaches
Athletes
Family (Personal) Physicians
Orthopaedists
Primary Care Physicians
Consulting Medical Specialists
Physical Therapists
Registered Nurses
Physicians Assistants
School Guidance Counselors
Registered Dietitians
Dentists
Other Allied Health Care Professionals

*Denotes core members of the AHCT

APPENDIX A. CONSENSUS STATEMENT

APPROPRIATE MEDICAL CARE FOR SECONDARY SCHOOLï AGE ATHLETES

CONSENSUS STATEMENT

(Revised April 2004)

Mission Statement

Establish recommendations for the prevention, care, and appropriate management of athletic-related injury and illnesses specific to the secondary schoolï age individual.

Athletic Health Care Team

The athletic health care team (AHCT) may be composed of appropriate health care professionals in consultation with administrators, coaches, parents, and participants. Appropriate health care professionals could be certified athletic trainers, team physicians, consulting physicians, school nurses, physical therapists, emergency medical services (EMS) personnel, dentists, and other allied health care professionals.

Recommendations for Appropriate Medical Care

Appropriate medical care of the secondary schoolï age individual involves more than basic emergency care during sports participation. It encompasses the provision of many other health care services. While emergency medical care and event coverage are critical, appropriate medical care also includes activities of ongoing daily athletic health care.

Organizations sponsoring athletic programs for secondary schoolï age individuals should establish an AHCT that functions to ensure appropriate medical care is provided for all participants.

The AHCT should have a designated athletic health care provider(s) who is educated and qualified to

1. Participate in the development and implementation of a comprehensive athletic health care administrative system (e.g., personal health information, policies and procedures, insurance, referrals).
2. Determine the individualôs readiness to participate.
3. Promote safe and appropriate practice, competition, and treatment facilities.
4. Advise on the selection, fit, function, and maintenance of athletic equipment.
5. Develop and implement a comprehensive emergency action plan.

6. Establish protocols regarding environmental conditions.
7. Provide for on-site recognition, evaluation, and immediate treatment of injury and illness, with appropriate referrals.
8. Facilitate rehabilitation and reconditioning.
9. Provide for psychosocial consultation and referral.
10. Provide scientifically sound nutritional counseling and education.
11. Develop injury and illness prevention strategies.

Education

Designated athletic health care providers shall maintain expertise through continuing education and professional development.

All coaches should be trained in first aid, cardiopulmonary resuscitation (CPR), and automated external defibrillator (AED) use; utilization of AHCT professionals; injury prevention; and modification of training in response to injury and illness.

DEFINITIONS

Certified athletic trainer: An allied health care professional who, on graduation from an accredited college or university, and after successfully passing the National Athletic Trainers' Association Board of Certification (NATABOC) examination, is qualified and appropriately credentialed according to state regulations to work with individuals engaged in physical activity in the prevention of injuries and illnesses; the recognition, evaluation, and immediate care of injuries and illnesses; the rehabilitation and reconditioning of injuries and illnesses; and the administration of this health care system. This individual must have current certification in cardiopulmonary resuscitation (CPR) and be qualified in first aid and blood-borne pathogens. Other health care professionals with equivalent certification and/or licensure would also meet this standard.

Team physician: The team physician must have an unrestricted medical license and be an MD or a DO who is responsible for treating and coordinating the medical care of athletic team members. The principal responsibility of the team physician is to provide for the well-being of individual athletes, enabling each to realize his or her full potential. The team physician should possess special proficiency in the care of musculoskeletal injuries and medical conditions encountered in sports. The team physician also must actively integrate medical expertise with that of other health care providers, including medical specialists, athletic trainers, and allied health professionals. The team physician must ultimately assume responsibility within the team structure for making medical decisions that affect the athlete's safe participation.

(Reference: Team Physician Consensus Statement, http://www.acsm.org.)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Bicycle Helmets

ABSTRACT. Bicycling remains one of the most popular recreational sports among children in America and is the leading cause of recreational sports injuries treated in emergency departments. An estimated 23 000 children younger than 21 years sustained head injuries (excluding the face) while bicycling in 1998. The bicycle helmet is a very effective device that can prevent the occurrence of up to 88% of serious brain injuries. Despite this, most children do not wear a helmet each time they ride a bicycle, and adolescents are particularly resistant to helmet use. Recently, a group of national experts and government agencies renewed the call for all bicyclists to wear helmets. This policy statement describes the role of the pediatrician in helping attain universal helmet use among children and teens for each bicycle ride.

ABBREVIATIONS. ANSI, American National Standards Institute; ASTM, American Society for Testing and Materials; CPSC, Consumer Product Safety Commission.

BACKGROUND

Bicycling continues to be one of the most popular recreational sports in America. An estimated 44.3 million children younger than 21 years ride bicycles in the United States.[1] It is a clean, efficient mode of transportation for children to make short neighborhood trips, and bicycling can be an enjoyable form of aerobic physical activity for children and adolescents.

As with all physical activities, bicycling is not without hazards. Children are at risk of injury from falls resulting from either intrinsic factors, such as exceeding their ability level, or extrinsic factors, such as swerving from or striking a motor vehicle or fixed object. Bicycle-related injuries among children younger than 21 years resulted in approximately 275 deaths[2] and an estimated 430 000 visits to emergency departments in 1998.[3] Among all recreational sports, bicycling injuries are the leading cause of emergency department visits for children and adolescents. Traumatic brain injury accounts for two thirds of all bicycle-related fatalities.[4] An estimated 23 000 children required emergency care after sustaining a traumatic brain injury while bicycling in 1998, accounting for about 5% of all bicycle-related injuries.[3]

Use of a bicycle helmet can prevent or lessen the severity of brain injury during a bicycle crash. Helmets work by absorbing some of the energy and dissipating the sharp energy peak of the blow over a larger area for a slightly longer time. A bicycle helmet typically consists of rigid crushable foam covered with a thin layer of plastic. It is held to the head by a retention system (chin strap) composed of flexible straps and hardware. The skull provides another layer of protection and absorbs additional energy. If forces are not extreme and the helmet is intact and worn correctly, the helmet-skull system should protect the brain from injury in most cases.

Correctly placing and securing a helmet on the head is important to maximize protection. Because 4 helmet sizes exist and models fit slightly differently, a child should try on several sizes and models to find the best fit when purchasing a helmet. Correct fit involves positioning the helmet on the head so it sits low on the forehead and is parallel to the ground when the head is held upright (the wearer should be able to see its lower brim when looking all the way up); installing or removing inside pads to make the helmet snug; and adjusting the chin strap so it is comfortably snug (ie, tight with room for only 2 fingers to be inserted between the strap and the chin). When in place with the chin strap secure, the helmet should not come off or shift over the eyes when the wearer tries to shake it loose.

Even when worn properly, a helmet does not offer an unlimited degree of protection, particularly against high-energy crashes. Even in low-impact falls, the helmet may be damaged by the force delivered, rendering it less effective in subsequent impacts. This damage may not be apparent to the eye. Accordingly, any helmet that has sustained a substantial blow should be discarded and replaced, including any helmet involved in a crash in which the head has hit a hard surface or in which a fall has resulted in marks on the shell. Furthermore, helmet integrity does not persist throughout time. Because some helmet materials deteriorate with age, the Snell Memorial Foundation, a nonprofit organization established to test and certify helmet safety, recommends that a helmet be replaced at least every 5 years, or sooner if the manufacturer recommends it.

Wearing a bicycle helmet is one of the most effective safety measures a child can take to prevent injury. The first study of helmet effectiveness indicated that it could prevent 88% of serious brain injuries.[5] In subsequent studies, helmets prevented 69% of head injuries[6] and 65% of injuries to the mid and upper face.[7] Despite the enormous degree of protection afforded by a bicycle helmet, a 1994 study indicated

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

that only 25% of children 5 to 14 years of age usually or always wore a helmet while bicycling.[8] In 1999, the percentage of children who reported always using helmets varied among states from 13% to 65%.[9] Reasons usually given for not using a helmet are discomfort (especially heat), perceived lack of importance for casual riding (in contrast to sport or race bicycling), lack of style, or peer pressure.[8,10] Cost was seldom cited as an important factor now that helmets are widely available for less than $20.

Two factors are strongly associated with bicycle helmet use by young children—helmet use by an accompanying parent and a state mandatory helmet use law or local ordinance. In one study, a helmet was worn by 90% of children from a low-income neighborhood and 100% of children from a high-income neighborhood when an accompanying parent wore a helmet.[11] After enactment of a helmet law in Georgia, reported helmet use increased from 35% to 53%,[12] and in Oregon, enactment of a helmet law was associated with a doubling of observed helmet use to 49% among children and youth.[13] Presently, 17 states and the District of Columbia have age-specific bicycle helmet laws, usually covering bicyclists younger than 16 years. These laws affect 49% of all US children younger than 15 years. Another 2 states have recently enacted legislation. Such legislation has been shown to be more cost-effective than community-based or school-based interventions[14] and is a *Healthy People 2010* objective.[15]

Recently, a group of national experts from safety organizations and government agencies called for universal helmet use by all bicyclists, regardless of age. This goal has 3 strategies: 1) creating a national bicycle helmet safety campaign; 2) creating tools to promote helmet use; and 3) assisting states and communities wishing to address helmet use through legislation.[16]

Voluntary helmet safety standards have existed for many years, with the American National Standards Institute (ANSI), Snell Memorial Foundation, and American Society for Testing and Materials (ASTM) each establishing their own safety standards based on the ability of a helmet to manage the energy of a drop onto a metal anvil and the strength of the strap system. In 1999, the US Consumer Product Safety Commission (CPSC) issued a mandatory safety standard for bicycle helmets, requiring all helmets manufactured or imported for sale in the United States after March 1999 to comply with this standard.[17] Accordingly, parents should look for a sticker documenting CPSC approval on the inside liner of any new helmet purchased. Older helmets certified by the ASTM and/or the Snell Memorial Foundation may continue to be used, but helmets certified only by the ANSI should be discarded, because they were drop-tested from a height below the current 2 meter standard. Multisport helmets are designed for in-line skating, skateboarding, bicycling, and other sports. If a multisport helmet is intended or marketed (even by implication) to be used while bicycling, it must be certified to meet the CPSC standard for bicycle helmets.

RECOMMENDATIONS

Helmet Use

1. All bicyclists should wear properly fitted bicycle or multisport helmets each time they ride. A bicycle helmet or multisport helmet intended for bicycle use manufactured after March 1999 must have certification that it met the CPSC standard, regardless of whether it met the standards of any other organization. If a bicycle helmet manufactured before March 1999 meets the standards established by the Snell Memorial Foundation or ASTM (but not ANSI alone), it may be used. However, once damaged or outgrown, it should be replaced with a new helmet that has been certified to meet the CPSC standard.
2. Young children who ride as passengers must wear an appropriately sized helmet and be placed securely in a bicycle-mounted child seat or, preferably, a bicycle-towed child trailer. Children should never ride on the handlebars or crossbar.[18] Passengers should be at least 1 year old, by which age most children have sufficient muscle strength to control head movement during a sudden stop, even with the additional weight of a helmet.
3. Pediatricians should emphasize that any helmet involved in a crash or otherwise damaged should be discarded and replaced. Otherwise, all helmets should be replaced at least every 5 years, or sooner if the manufacturer recommends it. Purchase of helmets from yard sales should be discouraged, because the age and integrity of the helmet cannot be assured.
4. Parents and children should learn all essential aspects of bicycle safety. Helmet use is only 1 aspect of bicycle safety and does not substitute for the child's knowledge and practice of the rules of the road, sufficient visibility to drivers, and other safety measures.

Advocacy

1. Pediatricians should encourage parents and other child care providers to require children to wear a bicycle helmet when they begin riding tricycles or other wheeled vehicles or toys. Pediatricians should inform parents and patients of the importance of wearing a bicycle helmet and the dangers of riding without one. This information is especially important for adolescents, because they are particularly resistant to wearing a helmet.
2. Pediatricians should encourage parents to wear a helmet when bicycling to model safe behavior for their children.
3. Pediatricians should serve as community and legislative advocates to encourage state and local governments to enact legislation requiring helmet use by all bicyclists and mandating bicycle rental agencies to include helmets as part of the rental contract. The American Academy of Pediatrics has developed model state legislation titled "Child Bicycle Safety Act."[19]

4. Pediatricians should encourage school districts to make helmet wearing mandatory during bicycle rides to and from school and during school-related bicycle trips.
5. Coalitions of physicians, parents, and community leaders should develop and support community-based and school-based education programs to promote bicycle safety training that emphasizes helmet use. A national initiative to encourage all children to wear a helmet whenever bicycling deserves support.
6. Retail outlets are urged to carry affordable helmets and include them in the purchase of every new bicycle sold.
7. Organizations promoting helmet use are encouraged to provide attractive posters and educational videotapes for retailers and pediatricians to display as well as other materials for parent groups to distribute, emphasizing the safety advantages and attractiveness of protective headgear. All materials should teach how to wear a helmet correctly.
8. When bicyclists are shown in the popular media (including television, advertisements, movies, and promotional materials), those responsible are urged to consistently show them wearing a helmet.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Bone Densitometry in Children and Adolescents

Laura K. Bachrach, MD, Irene N. Sills, MD, and THE SECTION ON ENDOCRINOLOGY

KEY WORDS
bone densitometry, DXA, osteoporosis, pediatrics

ABBREVIATIONS
DXA—dual-energy x-ray absorptiometry
PDC—[Pediatric] Position Development Conference
BMD—bone mineral density
BMC—bone mineral content

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

FREE

Concern for bone fragility in children and adolescents has led to increased interest in bone densitometry. Pediatric patients with genetic and acquired chronic diseases, immobility, and inadequate nutrition may fail to achieve the expected gains in bone size, mass, and strength, which leaves them vulnerable to fracture. In older adults, bone densitometry has been shown to predict fracture risk and reflect response to therapy. The role of densitometry in the management of children at risk of bone fragility is less certain. This clinical report summarizes the current knowledge about bone densitometry in the pediatric population, including indications for its use, interpretation of results, and its risks and costs. This report emphasizes consensus statements generated at the 2007 Pediatric Position Development Conference of the International Society of Clinical Densitometry by an international panel of bone experts. Some of these recommendations are evidence-based, and others reflect expert opinion, because the available data are inadequate. The statements from this and other expert panels have provided general guidance to the pediatrician, but decisions about ordering and interpreting bone densitometry still require clinical judgment. Ongoing studies will help to better define the indications and best methods for assessing bone strength in children and the clinical factors that contribute to fracture risk. *Pediatrics* 2011;127:189–194

INTRODUCTION

The bone health of children and adolescents has become an increasingly important medical concern. There is growing recognition that low bone mass and fractures may complicate several genetic and acquired chronic disorders of childhood.[1] Fractures are common in otherwise healthy youth as well; peak incidence occurs during the peripubertal growth spurt.[2] The documented 35% to 65% increase in common childhood fractures over the past 4 decades has raised concerns that current lifestyles are compromising early bone health.[3] Children with forearm fractures have been shown to have lower bone mass, a greater percentage of body fat, and less calcium intake than their peers without a history of fracture.[4,5] Vitamin D insufficiency and deficiency are widespread, calcium intake often falls below recommended levels, and physical inactivity is common among American youth.[6,7]

These observations have increased the demand for better diagnostic and therapeutic tools to address bone health in children and adolescents. Bone densitometry and pharmacologic therapy for osteoporosis in older adults have been refined in recent years. The efficacy, cost-effectiveness, and safety of these tests and treatments in pediatric

patients have not been adequately determined. This lack of data has left the pediatrician in a quandary about how to best diagnose and manage skeletal fragility in children and teenagers. To address these uncertainties, pediatric bone experts have proposed guidelines for evaluating skeletal health in youth.[8] This report briefly reviews current bone-densitometry methods, indications for ordering densitometry, and the role for densitometry in choosing and monitoring therapy.

BONE-DENSITOMETRY METHODS

The pediatric skeleton can be assessed by using dual-energy x-ray absorptiometry (DXA), quantitative computed tomography, peripheral quantitative computed tomography, quantitative ultrasonography, magnetic resonance imaging, or plain films (radiogrammetry). Each modality offers distinct advantages and disadvantages, which have been reviewed previously.[9] DXA remains the preferred method for clinical measurements of bone density in children because of its availability, reproducibility, speed, low exposure to ionizing radiation, and robust pediatric reference data.[10]

FOR WHOM SHOULD BONE DENSITOMETRY BE PERFORMED?

The general goals of bone densitometry are to identify patients at greatest risk of skeletal fragility fractures, to guide decisions regarding treatment, and to monitor responses to therapy. Skeletal assessments have been recommended for children with recurrent fractures, bone pain, bone deformities, or osteopenia on standard radiographs or to monitor therapy.[11,12] Specific recommendations have been proposed for monitoring bone health in patients with cystic fibrosis[13] and childhood cancer.[14] For example, a baseline DXA is recommended by 18 years of age or 2 years after the end of chemotherapy (for cancer survivors) but earlier in patients with more severe disease, low body weight, chronic glucocorticoid therapy, delayed puberty, gonadal failure, or a history of fracture. For patients receiving drugs that may adversely affect bone, such as anticonvulsants or depot medroxyprogesterone (Depo-Provera), there is insufficient evidence to support routine bone densitometry.[15,16]

The most comprehensive recommendations related to bone densitometry have evolved from the Pediatric Position Development Conference (PDC) of the International Society of Clinical Densitometry after rigorous analysis of the literature.[8] The PDC guidelines identified the primary and secondary disorders that have been associated with evidence of increased fracture risk (Table 1). PDC guidelines recommended that densitometry be performed "at clinical presentation" of these disorders and "before initiation of bone-active treatment," such as bisphosphonates.[17] The authors of the guidelines acknowledged that the recommendations are controversial and that experts will not agree with all the statements,[18] which reflects the lack of sufficient high-quality evidence to support some of the recommendations. Until such evidence is obtained, however, these parameters provide general guidance for the pediatrician and may help to secure reimbursement from insurance providers.

TABLE 1 Diseases That May Affect the Skeleton

Primary bone disorders
Idiopathic juvenile osteoporosis
Osteogenesis imperfecta
Potential secondary bone diseases
Chronic inflammatory disorders
Inflammatory bowel disease
Juvenile idiopathic arthritis
Cystic fibrosis
Chronic immobilization
Cerebral palsy
Myopathic disease
Epidermolysis bullosa
Endocrine disturbance
Turner syndrome
Anorexia nervosa
Cancer and therapies with adverse effects on bone health
Acute lymphoblastic leukemia
Status post chemotherapy for childhood cancer
Status post transplantation (nonrenal)
Hematologic disorders
Thalassemia

Data source: Bishop N, Braillon P, Burnham J, et al. *J Clin Densitom.* 2008;11(1):29–42.[17]

Beyond these guidelines, the decision to order bone densitometry for an individual patient requires clinical judgment. The risk of bone fragility will depend on age of onset and severity of the underlying disorder, if any; the number of associated risk factors (such as poor nutrition or inactivity); and exposure to potentially bone-toxic drugs (eg, glucocorticoids, anticonvulsants) or irradiation. A family history of bone fragility is relevant, because an estimated 60% to 80% of the variability in bone mass between individuals is determined by genetic factors.[6] This history is best assessed by asking about a history of hip fractures in older relatives. The decision to evaluate an otherwise healthy child with a history of fractures will depend on the number of broken bones and the intensity of the trauma that caused the injury. Low-trauma fractures are defined as those that occur from standing height or less. The PDC has defined a clinically significant fracture history as "one long bone fracture of the lower extremity, two or more long bone fractures of the upper extremity or a vertebral fracture."[8] Children with this history sustained after minimal or no trauma should be considered for evaluation with densitometry, whereas children with fractures of digits and toes do not warrant such investigation. Data are insufficient to recommend routine densitometry for infants in these situations. A final consideration before ordering DXA scans should be how the results will influence patient management. For example, it may not be helpful to document that bone mineral

density (BMD) is low for age in a child with cerebral palsy if the child has not had a fracture, because low BMD alone is not considered an indication for bisphosphonate therapy.[8]

ORDERING DXA IN PEDIATRICS

The preferred skeletal sites for DXA measurements in children are the lumbar spine and total body.[10] If possible, the cranium should be excluded from the total-body-scan analysis, because the head constitutes a large portion of the total body bone mass but changes little with growth, activity, or disease; inclusion of the skull potentially masks gains or losses at other skeletal sites.[19] DXA measurements of the hip region (total hip or femoral neck) are not as reliable in younger patients because of difficulties in identifying the bony landmarks for this region of interest. For children with contractures who cannot be positioned properly for spine or whole-body studies, measurements of the lateral distal femur may be a useful alternative but have been less extensively studied than spine or whole-body measurements.[20] Scanning alternative skeletal sites may also be necessary for patients with metal hardware (such as rodding for scoliosis) in the usual regions of interest. Vertebral fractures are best detected by standard lateral radiographs of the thoracolumbar spine,[21] not by DXA.[22]

INTERPRETATION OF DXA RESULTS

Bone mass, as measured by DXA, is reported as bone mineral content (BMC) (g) or areal BMD (g/cm^2). These values are compared with reference values from healthy youth of similar age, gender, and, if possible, race/ethnicity to calculate a *z* score, the number of SDs from the expected mean. Abundant pediatric reference data are now available for children and teenagers but not for infants.[10] It is essential to select norms collected by using equipment from the same manufacturer as that used for the patient because of systematic differences in software.[10] *T* scores (which compare the patient's BMD with that of a healthy young adult) should not be used before 20 years of age, because the person may not have achieved peak bone mass. Unfortunately, some software packages from DXA manufacturers automatically generate a *T* score, even for younger subjects. The ordering physician must be careful to not use *T* scores when interpreting DXA results.

Appropriate interpretation of DXA results may require more than the calculation of *z* scores. Children with chronic illness often have delayed growth and pubertal development, which are factors that contribute to a low bone mass for age or gender. BMD, as measured by DXA, corrects bone mineral for the area (height and width) but not for the volume (height, width, and thickness) of bone. For this reason, if 2 people with identical "true" volumetric bone density are compared, the shorter person will have a lower BMD than the taller one.[9,23] Similarly, a child with delayed puberty will not have had the gains in bone size, geometry, and density that occur with sex-steroid exposure. Controversy persists about the optimal method for adjusting for variations in bone size, body composition, and maturity as well as the criteria by which "best method" is defined; ideally, the adjustment method would prove to be a stronger predictor of fracture.[23] The PDC guidelines recommend that BMD in children with delayed growth or puberty be adjusted for height or height age or compared with reference data with age-, gender-, and height-specific *z* scores.[10]

A BMC or BMD *z* score of more than 2 SDs below expected (less than −2) should be labeled "low for age."[10] The terms "osteopenia" and "osteoporosis," which are used to describe milder or greater deficits in bone mass in older adults, should not be used for pediatric patients. Instead, the PDC guidelines suggested that the diagnosis of osteoporosis in children be made only when both low bone mass (BMC or BMD *z* scores of less than −2) and a clinically significant fracture history (defined previously) are present.[24]

INTERPRETING LONGITUDINAL DATA

Repeat DXA studies are performed to monitor the skeletal response to ongoing illness, the regaining of health, or the response to bone-active therapies. For a change in BMD to be technically meaningful, it must exceed the variability that is observed when DXA measurements are repeated for the same patient. The "least-significant change" refers to the smallest percentage difference in measurements that exceeds the variability or "noise" from repeated measurements.[25] In densitometry centers that provide rigorous attention to precision, a least-significant change of 3% or less can be achieved.[25] Gains or losses of BMD that are less than that cannot be labeled as change with certainty.

Longitudinal changes in bone densitometry must also take into account interval changes in growth and maturity. Assessing whether observed gains in bone mass and size are appropriate for age and pubertal stage requires thoughtful assessment of *z* scores, as described above. The recommended interval between repeat densitometry studies will depend on the progression of disease or the type of intervention being used. The minimal interval between scans should be 6 months,[10] but often 1 year or more may be appropriate to allow for measurable change to occur.

CAN DXA PREDICT FRACTURES?

Low BMD is such a sufficiently powerful predictor of fracture in older

adults that it has been used as a diagnostic criterion for "osteoporosis" in elderly patients.[26] Reduced BMD is associated with increased fracture risk in children and teenagers as well, but data are not sufficient to establish the diagnosis of osteoporosis on the basis of bone-densitometry criteria alone.[10,24] In studies of otherwise healthy youth, children with a history of fracture have been shown to have lower BMC, BMD, and estimated volumetric BMD than their peers without fractures.[4,5] In particular, children with reduced spine or whole-body bone mass or smaller bone area for height had an increased risk of fracture.[5,24]

Less is known about the relationship between low bone mass and fracture risk in children with chronic illness, because the studies in these populations have been limited to smaller cohorts with varying diagnoses and risk factors for poor bone health. The most common site of fractures in these children may not be the forearm; lower-extremity fractures are common in immobilized children,[27] and spine fractures are more common in young patients with childhood leukemia, osteogenesis imperfecta, or exposure to glucocorticoids.[28] In a study that examined only children with acute lymphoblastic leukemia, the odds for fracture increased by 80% for every 1-SD reduction in spine BMD *z* score.

Clinical variables other than bone mass influence the risk that a person will have a fracture. For older adults, age, weight, family history of hip fracture, exposure to glucocorticoids, smoking and alcohol use, and history of a fracture are key predictors of absolute fracture risk.[26] Clinical factors that influence bone fragility in children have not yet been well established. However, it has been recognized that bone densitometry by DXA is only part of a comprehensive skeletal health screening that includes review of nutrition, physical activity, pubertal stage, disease severity, patient and family fracture history, and medication exposure. A child with low bone mass for age or one with a significant fracture history warrants evaluation by a pediatric endocrinologist, nephrologist, geneticist, or rheumatologist (depending on clinical presentation) with expertise in bone.[10]

RISKS AND COSTS OF DENSITOMETRY

Exposure to the very low doses of ionizing radiation with DXA poses no known health risk. The estimated 5 to 6 microsieverts (μSv) of radiation exposure from a spine and whole-body DXA scan is far less than the 80 μSv accumulated during a round-trip transatlantic flight.[29] More concerning is the potential risk of misdiagnosis if DXA data are not interpreted by skilled professionals at pediatric densitometry centers. One study revealed errors in 88% of the scans from children referred for an osteoporosis-intervention study; 62% of the errors involved a misdiagnosis of osteoporosis based on inappropriate use of a *T* score.[30] Errors in interpreting DXA results generate considerable parental concern and can result in costly and unnecessary use of pharmacologic agents and restrictions on physical activity.

THERAPY FOR CHILDHOOD SKELETAL FRAGILITY

It is beyond the scope of this review to discuss therapy in detail. However, treatment options for children with low bone mass and fractures are more limited than those for adults, which underscores the importance of accurate skeletal assessments.[31] General measures to address skeletal risk factors are safe and appropriate first steps for all patients. Calcium intake should meet the current recommended daily intake of 500 mg for children 1 to 3 years of age, 800 mg for children 4 to 8 years of age, and 1300 mg for children and adolescents 9 to 18 years of age.[6] Adequacy of total-body vitamin D stores should be assessed by measuring serum concentrations of 25-hydroxyvitamin D; concentrations of at least 20 to 32 ng/mL (50–80 nmol/L) have been recommended for children.[7] Weight-bearing activity should be encouraged, and even short periods of high-intensity exercise (such as jumping 10 minutes/day, 3 times per week) have produced measurable gains in bone mass.[32] For patients with limited mobility, reducing immobility through physical therapy[33] or use of vibrating platforms can be helpful.[34] Reducing inflammation, undernutrition, or hormone imbalances is necessary as well.

If these general measures fail to prevent further bone loss and fracture, pharmacologic therapy may be considered. None of the drugs used to treat bone fragility in the elderly have yet been approved by the US Food and Drug Administration for pediatric use.[35] Nevertheless, therapy with bisphosphonates is considered reasonable for children with moderate-to-severe osteogenesis imperfecta ($\geq$2 fractures in 1 year or vertebral compression fractures).[36] For secondary osteoporosis attributable to chronic disease, bisphosphonates may be used on a compassionate basis to treat low-trauma fractures of the spine or extremities.[37]

SUMMARY

DXA has been established as a valuable tool as part of a comprehensive skeletal assessment of children and teenagers but not yet of infants. Acquiring and interpreting densitometry data from younger patients remains challenging and should be performed in experienced pediatric densitometry centers. Panels of pediatric experts have set standards

for when and how to perform DXA scans on the basis of the best available data.[10] Ongoing research will serve to refine the best modalities for assessing the bone strength of children and to determine the key clinical variables that influence fracture risk independent of bone.

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American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Boxing Participation by Children and Adolescents

AMERICAN ACADEMY OF PEDIATRICS, COUNCIL ON SPORTS MEDICINE AND FITNESS, CANADIAN PAEDIATRIC SOCIETY, HEALTHY ACTIVE LIVING AND SPORTS MEDICINE COMMITTEE

KEY WORDS
boxing, youth, children and adolescents, head injuries, concussion

ABBREVIATIONS
RTP—return to play
CTE—chronic traumatic encephalopathy

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abstract

FREE

Thousands of boys and girls younger than 19 years participate in boxing in North America. Although boxing provides benefits for participants, including exercise, self-discipline, and self-confidence, the sport of boxing encourages and rewards deliberate blows to the head and face. Participants in boxing are at risk of head, face, and neck injuries, including chronic and even fatal neurologic injuries. Concussions are one of the most common injuries that occur with boxing. Because of the risk of head and facial injuries, the American Academy of Pediatrics and the Canadian Paediatric Society oppose boxing as a sport for children and adolescents. These organizations recommend that physicians vigorously oppose boxing in youth and encourage patients to participate in alternative sports in which intentional head blows are not central to the sport. *Pediatrics* 2011; 128:617–623

INTRODUCTION

Amateur or Olympic-style boxing is a collision sport that is won on the basis of the number of clean punches landed successfully on an opponent's head and body (Appendix).[1,2] A match is won outright if an opponent is knocked out. Participants in boxing are at risk of serious neurologic and facial injuries.[3–7] Despite these potential dangers, thousands of boys and girls participate in boxing in North America. In 2008, more than 18 000 youths younger than 19 years were registered with USA Boxing (Lynette Smith, USA Boxing, written communication, August 2009).

The societal debate regarding boxing has raged for decades. Many authors and medical organizations have called for boxing to be banned (Table 1), citing medical, ethical, legal, and moral arguments.[8–13] Others state that participants should be allowed to make autonomous decisions about participation and that the role of the medical profession should be restricted to the provision of injury care, advice, and information only.[14]

Supporters of amateur boxing state that the sport is beneficial to participants by providing exercise, self-discipline, self-confidence, character development, structure, work ethic, and friendships.[14] For some disadvantaged youth, boxing is a preferential alternative to gang-related activity, providing supervision, structure, and goals.[14] The overall risk of injury in amateur boxing seems to be lower than[15] in some other collision sports such as football, ice hockey, wrestling, and soccer.[4,16] However, unlike these other collision sports, boxing encourages and rewards direct blows to the head and face.

TABLE 1 Position Statements on Boxing

Organization	Position
American Medical Association[9] (2007)	Recommends that until boxing is banned, head blows should be prohibited
American Academy of Pediatrics[8] (1997)	Opposes boxing as a sport for any child, adolescent, or young adult
Australian Medical Association[10] (2007)	Opposes all forms of boxing; recommends the prohibition of all forms of boxing for people younger than 18 y
British Medical Association[11] (2007)	Opposes amateur and professional boxing; calls for complete ban on boxing; recommends banning boxing for those younger than 16 y
Canadian Medical Association[12] (2002)	Recommends that all boxing be banned in Canada
World Medical Association[13] (2005)	Recommends that boxing be banned

The American Academy of Pediatrics and the Canadian Paediatric Society oppose boxing and, in particular, discourage participation by children and adolescents.[8]

BOXING-RELATED INJURIES

Data are limited on injuries that result from boxing in children and adolescents.[17,18] National organizations, such as Boxing Canada and USA Boxing, do not keep data on the participation or injury rates of their members.

Some data on boxing injuries in children are available from the Canadian Hospitals Injury Reporting and Prevention Program database, maintained by the Public Health Agency of Canada. This database includes data collected from 15 hospitals across Canada, including 10 children's hospitals. From 1990 to 2007, the prevalence of injury from combat sports requiring admission to a hospital was highest for boxing (4.8%),[17] which compares with admission rates of 3.6% for judo, 3.1% for karate, and 2.9% for wrestling.[17] Of those hospitalized for injuries from boxing, 58% had facial fractures and 25% sustained closed head injuries.[17] There was a significant increase in the overall number of injuries from 1999–2007 (16.4 in 100 000), compared with 1990–1998 (11.4 in 100 000). Sixty-eight percent of these injuries occurred during sparring and competition; the remainder occurred during training. Of the 273 injured boxing athletes reported in the Canadian Hospitals Injury Reporting and Prevention Program database, fewer than 1% were 5 to 9 years of age, 29.3% were 10 to 14 years of age, 39.2% were 15 to 18 years of age, and 30.8% were 19 years of age or older.[17]

The National Electronic Injury Surveillance System (NEISS) contained reports of 1263 boxing-related injuries in children and adolescents 5 to 14 years of age and 8082 in adolescents and adults 15 to 24 years of age in the United States in 2007. The types and severity of injuries were not delineated.[18]

Published injury data in amateur boxing (youth and adult participants) do not distinguish injuries according to age, so it is difficult to delineate injuries that specifically affected children and adolescents. Most injuries in boxing, both amateur and professional, occur during competition (57%), compared with training (43%).[4] The authors of 1 cohort study reported an injury rate of 1.0 injury per 1000 hours of participation for amateur boxers (15.1–37.1 years of age).[4] This rate is actually lower than reported high school athlete injury rates of 4.4 per 1000 athlete-exposures in football, 2.5 in wrestling, and 2.4 in soccer.[16] Intentional facial and head injuries, however, are more frequent in boxing.[17]

Types of Injuries

The most common injuries in boxing are to the head, face, and neck regions.[4,5,19,20] One prospective cohort study documented that more than 70% of injuries in amateur (average age: 23.7 years) and professional boxers were to the head.[4] Concussion was the most common injury (33%), followed by open wounds/lacerations/cuts (29%) and fractures (19%).[4] The eyebrow and nose were other common sites of injury (19% each).[4] Most injuries to the eye region were lacerations/cuts, although conjunctival, corneal, lenticular, vitreal, ocular papilla, and retinal lesions were also reported.[3] Canadian Hospitals Injury Reporting and Prevention Program data are similar; one-third of the reported injuries affected the head, face, and neck regions, and almost half of the injuries occurred in the upper extremity (Table 2).[17]

Brain injury is the most significant risk associated with boxing, and acute subdural hematoma is the most common cause of death in amateur and professional boxers.[5,16] Between 1918 and 1997, 659 deaths from boxing have occurred, all from catastrophic brain injury.[6]

There is evidence that amateur boxers are at risk of structural brain injuries, cognitive abnormalities, and neurologic deficits from the sport.[7,21–25] One study of 14 amateur boxers revealed elevated levels of cerebrospinal fluid biochemical markers from neuronal and astroglial injury after bouts.[21] Significant increases in levels of these markers were associated with multiple or high-impact hits to the head.[21] In addition, new MRI techniques have revealed structural brain abnormalities in boxers, including microhemorrhages.[22] Furthermore, electroencephalography studies have found a significantly higher incidence of abnormalities among retired amateur

TABLE 2 Boxing-Related Injuries,[a] Ages 5 to 59 Years: Canadian Hospitals Injury Reporting and Prevention Program, 1990–2007[17]

Body Part/Nature of Injury	Sparring/Competition, *n* (%)	Conditioning, *n* (%)
Upper extremity	87 (47.0)	80 (94.1)
Fracture, dislocation	32 (17.3)	33 (38.8)
Bruise, abrasion, laceration	25 (13.5)	20 (23.5)
Soft tissue	14 (7.6)	9 (10.6)
Sprain/strain	12 (6.5)	18 (21.2)
Other (bite, nerve injury)	4 (2.2)	0 (0.0)
Head, face, neck	62 (33.5)	0 (0.0)
Facial fractures	17 (9.2)	
Closed head injuries	17 (9.2)[b]	
Facial bruise, abrasion; soft tissue	12 (6.5)	
Facial, scalp laceration	7 (3.8)	
Eye injury	5 (2.7)	
Neck sprain/strain	3 (1.6)	
Neck soft tissue	1 (<1.0)	
Trunk	19 (10.2)	0 (0.0)
Bruise, abrasion, soft tissue	13 (7.0)	
Rib fracture	3 (1.6)	
Sprain/strain	2 (1.1)	
Internal abdominal	1 (<1.0)	
Lower extremity	15 (8.1)	4 (4.7)
Sprain/strain/dislocation	6 (3.2)	1 (1.2)
Fracture/dislocation	3 (1.6)	0 (0.0)
Other (bruise, abrasion, soft tissue, nerve injury)	6 (3.2)	3 (3.5)
Other and unknown	2 (1.1)	1 (1.2)
Total	185 (100.0)	85 (100.0)

[a] In 3 cases, the training type was unknown: 2 upper-extremity fractures and 1 lower-extremity soft tissue injury.
[b] $n = 10$ minor closed head injuries, 6 concussions, and 1 intracranial injury.

boxers compared with active soccer players and track-and-field athletes.[23] There is also evidence of diminished neurocognitive functioning on neuropsychological tests in amateur boxers without concussions despite the use of headgear.[23–25] The long-term significance of these findings is yet to be determined.

Concussions

Concussions in sport are a significant public health concern, and they occur frequently in boxing.[4,7,20,25] The exact incidence of concussion in children and adolescents participating in boxing has not been published, because studies of amateur boxers do not separate data according to age. However, reports of concussions in amateur boxing range from 6.5% to 51.6% of all injuries.[5] The authors of 1 study of amateur boxers (older than 16 years) reported that more than half of all injuries sustained in competition were concussions (51.6%), and the incidence was 11.4 concussions per 1000 boxing exposures.[5,20] A prospective cohort study of amateur and professional boxers revealed that 33% of all injuries were concussions.[4] Another source cited a concussion rate in amateur boxing (age not specified) of 0.58 per 100 athlete-exposures, compared with 0.28 in hockey (males 5–17 years old) and 0.38 in high school rugby.[7] Yet another study of amateur boxers (median age: 22 years) documented that 13% of matches ended because of concussions.[25]

Concussions are particularly concerning in children and adolescents, because there is evidence that a child's brain is more vulnerable to injury and that recovery from concussion is prolonged when compared with adults.[26–29] A prospective case-control study comparing neurocognitive recovery after concussion in high school (aged 14–18 years) and college (aged 17–25 years) football and soccer athletes found that high school athletes had more prolonged memory dysfunction. Neuropsychological test values were significantly lower in concussed high school athletes than age-matched controls 7 days after injury, whereas college athletes recovered within 3 days after injury.[26] Another prospective case-control study in high school athletes with concussion demonstrated memory impairment up to 10 days after injury.[29] These findings can be extrapolated to young boxers, which suggests that they may take up to 10 days (or longer) to recover from concussions.

Return-to-play (RTP) guidelines after sport-related concussions is a particular area of controversy. The most recent guidelines proposed by the Concussion in Sport Group, and endorsed by both the American Academy of Pediatrics and Canadian Paediatric Society, recommend that an athlete who has sustained a concussion rest, both physically and cognitively, until the symptoms of concussion have resolved completely.[28,30,31] "Cognitive rest" in children means limiting scholastic and other cognitive stressors such as text-messaging, computer work, and video games.[28,30,31]

Because children may take longer to recover from concussions and because of the risks associated with head impact in younger athletes (ie, cerebral swelling), the Concussion in Sport Group recommends a more conservative approach to RTP decisions for children and adolescents, including no RTP the same day.[30] It is appropriate to extend the length of the asymptomatic rest period to ensure that symptoms have resolved completely and then allow athletes to progress through a medically supervised stepwise graded-exertion protocol (Table 3).[28,30,31] No athlete should return to

TABLE 3 Graduated RTP Protocol (After a Sport-Related Concussion)[30]

Rehabilitation Stage	Functional Exercise at Each Stage of Rehabilitation	Objective of Each Stage
1. No activity	Complete physical and cognitive rest	Recovery
2. Light aerobic exercise	Walking, swimming, or stationary cycling, keeping intensity at <70% of MPHR; no resistance training	Increase HR
3. Sport-specific exercise	Skating drills in hockey, running drills in soccer; no head impact	Add movement
4. Noncontact training drills	Progression to more complex training drills (eg, passing drills in football and ice hockey); may start progressive resistance training	Exercise, coordination, and cognitive load
5. Full-contact practice	After medical clearance, participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6. RTP	Normal game play	

HR indicates heart rate; MPHR, maximum permitted heart rate.

sport without being medically cleared by an experienced physician.[28,30,31]

Concussion management and RTP decisions should be individualized on the basis of resolution of symptoms rather than prescribing RTP on arbitrary time frames. In particular, the current Boxing USA postconcussion boxing restriction period of 30 days or longer does not follow the latest Concussion in Sport Group guidelines (Appendix; Table 3).

Chronic Traumatic Brain Injury

The risk of chronic traumatic brain injury has been a concern of opponents of boxing. Numerous study authors have cited the risks of dementia pugilistica or chronic traumatic encephalopathy (CTE), thought to be caused by the cumulative effects of repeated blows to the head. CTE occurs in up to 20% of professional boxers.[32] Most cases of dementia pugilistica occurred in the 1930s to 1950s, when boxing careers were much longer and involved more bouts.[32,33] It is believed that the incidence of CTE will diminish in the modern era of boxing because of shorter careers, fewer bouts, and improved medical care; however, more longitudinal prospective studies are necessary to determine if there is truth to this assumption or whether other factors may play a role in changing rates of CTE.[32,33]

Although predominantly described in boxing, chronic traumatic brain injury can be associated with any sport in which there is a risk of repetitive head blows, including soccer, football, ice hockey, and martial arts.[34] There is ample evidence indicating a cumulative effect from repeated concussive injuries.[34–36] A prospective study of high school athletes compared neuropsychological evaluations of those with no history of concussion, asymptomatic athletes with 1 previous concussion, asymptomatic athletes with 2 or more previous concussions, and athletes who had sustained a concussion within the previous week. Asymptomatic athletes with 2 or more previous concussions had decreased performance on measures of attention and concentration, similar to athletes with recent concussion.[35] Another prospective study of high school athletes found that those with a history of 3 concussions were more than 9 times more likely than athletes with no previous concussion history to demonstrate 3 to 4 abnormal on-field markers of concussion severity, including loss of consciousness, anterograde amnesia, and confusion.[36] These study results raise the concern that repeated head injuries associated with boxing may similarly lead to long-lasting neurocognitive effects.

The risk of CTE for amateur boxers is believed to be lower than that for professional boxers, because amateur boxers have fewer, shorter fights. Amateur bouts last only 3 rounds, compared with up to 12 in professional boxing matches, and amateur careers tend to be shorter. In addition, amateur boxers are required to wear head guards.[5,23,32,33,37,38] There is no evidence, however, that head guards prevent concussions, and although mouth guards are useful for protecting dentition, they also do not protect against concussion.[25,37,39] More research is needed to determine if there is an association of CTE with amateur boxing.[38–41]

Making Weight

Because boxing athletes participate in weight classes, part of the prebout medical examination involves weighing the athletes. Methods to maintain weight can be dangerous to young athletes. Boxers, similar to wrestlers, may use voluntary dehydration practices such as fluid restriction, diuretics and laxatives, rubber suits, and saunas and steam baths to lose weight.[42] Weight loss by dehydration can result in decreased performance because of impaired reaction time, endurance, and strength as well as electrolyte imbalance and acidosis.[42] Dehydration also negatively affects the acclimation process and thermoregulation during exercise. With increasing dehydration and electrolyte loss, the athlete is at risk of cramps, heat exhaustion, and heat stroke.[42]

CONCLUSION

Despite the ongoing debate regarding boxing and clear opposition from medical associations around the world (Table 1),[8,9–13] boxing continues to be available to youths under 19 years. Because the sport encourages deliberate blows to the head, participants are at risk of head injuries that may be cumulative

and even fatal. Pediatricians should strongly discourage boxing participation among their patients and guide them toward alternative sport and recreational activities that do not encourage intentional head injuries. For those youth who, despite education and counseling, choose to participate in boxing, appropriate medical care should be ensured by boxing organizations, including medical coverage at events, preparticipation medical examinations, and regular neurocognitive and ophthalmologic screening examinations, which should be provided by physicians who are knowledgeable about common boxing injuries and appropriate RTP guidelines after any injury.

RECOMMENDATIONS

The American Academy of Pediatrics and the Canadian Paediatric Society recommend that pediatricians:

1. vigorously oppose boxing for any child or adolescent.
2. educate patients who may be engaged in or considering engaging in boxing, as well as parents/caregivers/teachers/coaches, regarding the medical risks of boxing.
3. encourage young athletes to participate in alternative sports in which intentional blows to the head are not central to the sport, such as swimming, tennis, basketball, and volleyball.
4. advocate that boxing organizations ensure that appropriate medical care is provided for children and adolescents who choose to participate in boxing, ideally including medical coverage at events, preparticipation medical examinations, and regular neurocognitive testing and ophthalmologic examinations.

APPENDIX: DEFINITIONS ABOUT THE SPORT OF BOXING[1,2]

Amateur boxing: A sport in which participants fight and win points for scoring clean blows to the head and body above the belt. Matches consist of 3 or 4 rounds of 2 minutes each. No money is awarded. The age limit is a minimum of 11 years for bouts (none for training); there is no upper age limit.

Head injury management: USA Boxing organization rules state that boxers who sustain head injuries during a match are restricted from further participation. A 30-day restriction is applied if a boxer is knocked down by a blow to the head and gets up quickly, if a boxer fails to demonstrate "normal responses," or if a boxer receives 3 standing 8-counts during a round or 4 standing 8-counts in a match because of head blows. A 90-day restriction is applied if there is a loss of consciousness up to 2 minutes or if the boxer has had a previous concussion-related restriction. A 180-day restriction is applied if there is a loss of consciousness for more than 2 minutes or a previous 90-day concussion-related restriction. During the restriction period, the boxer is prohibited from sparring and competitive boxing but not from conditioning. The boxer must be reexamined by a physician at the end of the restriction period before return. Individual teams/physicians/coaches can implement their own management system in addition to the USA Boxing restrictions.

Medical requirements: Prebout and postbout medical examinations are required for all amateur competitions; these are brief examinations to rule out acute injuries that may limit participation. Ringside physicians must be present for all matches and may stop a match at their discretion at any point during the bout.

Olympic boxing: A form of amateur boxing consisting of a single-elimination tournament in which participants compete for medals (gold, silver, bronze). Matches consist of 4 rounds of 2 minutes each.

Professional boxing: A sport in which participants fight for financial gain. Matches consist of 4 to 12 rounds of 3 minutes each. Professional boxing regulation in the United States varies according to state.

Protective equipment: Amateur boxers are required to wear a form-fitted mouth guard, a head guard, and a foulproof cup (males) or a breast protector (females). Professionals do not wear head guards.

Rounds: Time periods of a boxing match.

Scoring (amateur boxing): Electronic scoring has been used internationally since 1992. Participants are awarded points for clean blows to their opponent. A scoring blow requires that the white part of the glove, covering the knuckles, makes contact within the target area (above the belt).

Standing 8-count: A referee can award a standing 8-count if a hard blow is landed or if a boxer seems to be outclassed. This time allows the referee to determine if the match can continue.

Weight classes: Boxers compete in classes, or divisions, based on weight.

Winning a bout (amateur):

- Win on points: the boxer with the most points wins.
- Win by retirement: if a boxer voluntarily retires the match, the opponent is declared the winner.
- Win by referee stopping the contest (RSC): a referee can stop a bout for a number of reasons:
  - RSC opponent outclassed: referee stops the bout because a boxer is outclassed by his or her opponent.
  - RSC opponent outscored: referee stops a bout because an opponent is outscored.
  - RSC head blows: referee stops a bout because of head blows. Boxers who receive an "H" are evalu-

ated by the ringside physician and issued a 30-, 60-, or 90-day restriction from sparring and competition depending on the severity of the injury. A boxer must be cleared by a physician before returning to boxing.[16]

- RSC injury: referee stops a bout because of injury.

- Win by disqualification: if a boxer is disqualified for dangerous or unsportsmanlike behavior, the opponent is declared the winner.
- Win by walkover: a boxer's opponent wins if a boxer fails to make weight, misses a scheduled bout, or is unable to compete because of medical reasons.
- No contest: a match that is called off for extenuating circumstances (lights fail, ring is damaged, etc).
- Winning a bout (professional): A professional boxer wins a fight by (1) knockout, (2) technical knockout, (3) decision, or (4) disqualification.
- Knockout (KO): occurs when a boxer is knocked down and does not get up within 10 seconds, as counted by the referee.
- Technical knockout (TKO): occurs when a boxer is judged physically unable to continue fighting. This judgment can be made by the referee, the official ring physician, the fighter, or the fighter's assistants. If a boxer is knocked down 3 times in 1 round, the opponent wins on a TKO.
- Decision: results when boxers fight the scheduled number of rounds without a KO or a TKO. The winner is decided by the officials on the basis of a round- or point-scoring system.
- Disqualification: results when a boxer is disqualified for dangerous or unsportsmanlike behavior.

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American Academy of Pediatrics
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POLICY STATEMENT

The Built Environment: Designing Communities to Promote Physical Activity in Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Environmental Health

ABSTRACT

An estimated 32% of American children are overweight, and physical inactivity contributes to this high prevalence of overweight. This policy statement highlights how the built environment of a community affects children's opportunities for physical activity. Neighborhoods and communities can provide opportunities for recreational physical activity with parks and open spaces, and policies must support this capacity. Children can engage in physical activity as a part of their daily lives, such as on their travel to school. Factors such as school location have played a significant role in the decreased rates of walking to school, and changes in policy may help to increase the number of children who are able to walk to school. Environment modification that addresses risks associated with automobile traffic is likely to be conducive to more walking and biking among children. Actions that reduce parental perception and fear of crime may promote outdoor physical activity. Policies that promote more active lifestyles among children and adolescents will enable them to achieve the recommended 60 minutes of daily physical activity. By working with community partners, pediatricians can participate in establishing communities designed for activity and health. *Pediatrics* 2009;123: 1591–1598

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Key Words
physical activity, youth, neighborhood, active transport, walk to school, parks, built environment, active living, urban design, pedestrian safety

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INTRODUCTION

A child's life is affected by the environment in which he or she lives. Relationships between health and the quality of air, water, and food are well recognized.[1–3] The physical environments of the home and school also influence health through exposures to lead,[4] mold,[5] noise,[6] or ambient light.[7] In addition, the overall structure of the physical environment of a child's community (referred to as the "built environment") can also affect health in diverse ways.

As cities have expanded into rural areas, large tracts of land have been frequently transformed into low-density developments in a "leapfrog" manner. The resultant urban sprawl can increase automobile travel, which increases air pollution[8] as well as passenger and pedestrian traffic fatalities.[9] Some urban areas may have few supermarkets, produce stands, or community gardens, thereby limiting access to fresh fruits and vegetables.[10] The physical environment of a community can support opportunities for play, an essential component of child development,[11] and for physical activity, a health behavior that not only reduces risk of excess weight gain[12,13] but also has many other benefits for overall well-being.

Many factors influence a child's level of physical activity, including individual-level psychosocial factors such as self-efficacy[14,15]; family factors such as parental support[16]; and larger-scale factors such as social norms.[17] Although these are all important contributors, this policy statement is limited to focusing on how the physical design of the community affects children's opportunities for physical activity. Opportunities for recreational physical activity arise with parks and green spaces. "Utilitarian" physical activity, such as walking or bicycling to school and to other activities, is an equally important part of a child's daily life. Environments that promote more active lifestyles among children and adolescents will be important to enable them to achieve recommended levels of physical activity.

BACKGROUND

The term "built environment" refers to spaces such as buildings and streets that are deliberately constructed as well as outdoor spaces that are altered in some way by human activity. This term may be unfamiliar to most clinicians, but with the high prevalence of childhood overweight and obesity,[18] the subject is increasingly relevant.

An individual's lifestyle and behaviors influence weight-gain patterns and physical fitness, and health education through clinicians and public health or community affiliates has long been recognized as important in influencing health behaviors. However, as the relationship between physical activity and obesity unfolds, it has become apparent that certain aspects of the environment influence the adoption of positive health behaviors. For example, a pediatrician's recommendation that a patient get regular physical activity loses its salience if this patient's everyday world lacks opportunities to walk, play, or run.

Physical activity has many health benefits.[12] As an important component of play,[11] physical activity contributes to children's organization and social skills[19] and promotes self-esteem and higher grade achievement among adolescents.[20] The American Academy of Pediatrics recommends that children be physically active for at least 60 minutes/day.[12] This can be met with structured activities, including sports and school-based physical education classes, or through an active lifestyle, including outdoor play and walking or biking for transportation. For preschool-aged children, outdoor play may be particularly important, because their highest levels of physical activity occur outside.[21,22] Environments that support recreational opportunities for children and adolescents also support the engagement of adults as they supervise, coach, and mentor youth.

The physical layout of communities can promote or limit opportunities for physical activity. There is growing research and policy interest in active living, defined as "a way of life that integrates physical activity into daily routines."[23] Under this principle, by establishing communities that support an active lifestyle, neighborhood design can promote physical activity patterns that are sustainable and important to health.

RECREATIONAL PHYSICAL ACTIVITY: PARKS AND RECREATIONAL FACILITIES

Although parks do not guarantee physical activity among nearby residents, they offer the opportunity.[24] In an experimental study in which children were made to decrease their time spent being sedentary, they increased the time spent engaged in physical activity, and the extent of increase was associated with proximity to a park.[25] The same research team has shown that as the percentage of park area within a child's neighborhood increases, so does the physical activity among children 4 to 7 years of age[26] and nonoverweight children 8 to 12 years of age.[27] Park space may vary considerably between neighborhoods. In Los Angeles, California, park acreage within neighborhoods ranges from 0.6 to 31.8 acres per 1000 people.[28,29]

Children living in low-income or predominantly minority neighborhoods may have less access to parks or other recreational facilities. In a national sample, access to a physical activity or recreational facility (including parks) was most often found for adolescents living in areas with higher percentages of the population having a college education. In areas where ≤25% of the population had a college education, higher proportions of minority population were associated with a lower likelihood of having a recreational facility.[30] Youth with low socioeconomic status are more likely than their affluent peers to report that a nearby recreation facility is important for their degree of physical activity,[31] possibly because they have limited access to more remote (or more expensive) opportunities for physical activity.

Examples of successful strategies to promote public space exist. Local communities have created parks and playgrounds in previously unused areas. Nonprofit organizations, such as the Trust for Public Land, have helped communities by assisting them in tasks ranging from park siting to development of funding strategies. Between 1971 and 2002, the Trust for Public Land's work in US cities resulted in the acquisition of 532 properties totaling 40 754 acres of newly created public land.[28] Legislative efforts are also an important mechanism to fund park development and maintenance. Proposition K, enacted in 1996 in Los Angeles, generates funds to provide $25 million annually to the improvement, construction, and maintenance of city parks. In the November 2002 elections, voters in 93 communities in 22 states approved ballot measures that committed $2.9 billion to acquire and restore land for parks and open space.[28] In addition to parks, community gardens are also being created.[32] (Community gardens provide a space for generation of food and the opportunity for gardening, a beneficial physical activity in its own right.)

"INCIDENTAL" PHYSICAL ACTIVITY

An important component of a healthy lifestyle is participation in activities for which exercise is not the primary goal. This might be a "purposeful walk"—an errand to buy groceries or a trip to school. Such incidental physical activities (also known as "utilitarian trips"[33]) play an important role in energy balance and can be influenced by neighborhood design.[34]

Neighborhood Design

The positioning of homes, schools, businesses, parks, and sidewalks within a neighborhood can influence physical activity. Neighborhood design typically considers 4 land uses: residential, industrial, green space, and institutional (eg, schools). Sprawling urban design has less mixing of these types (or less "land-use mix"). Figure 1 illustrates this distinction. Houses and apartments in the lower section of the diagram (the traditional neighborhood) are closer to other types of destinations such as the school or the mall, and the houses in the upper section (suburban sprawl) are more isolated. This figure also demonstrates a second core concept from urban planning known as "connectivity," or the ease of moving between origins (eg, home and work).[35] Street grids with many intersections provide many options for navigating to a destination.[36] In the low-density upper part of the diagram, although there are houses that are not far from the school "as the crow flies," getting to the school requires winding out of the enclave of houses to a busy main road. Thus, a child who lives close to school may still find walking to school prohibitive.

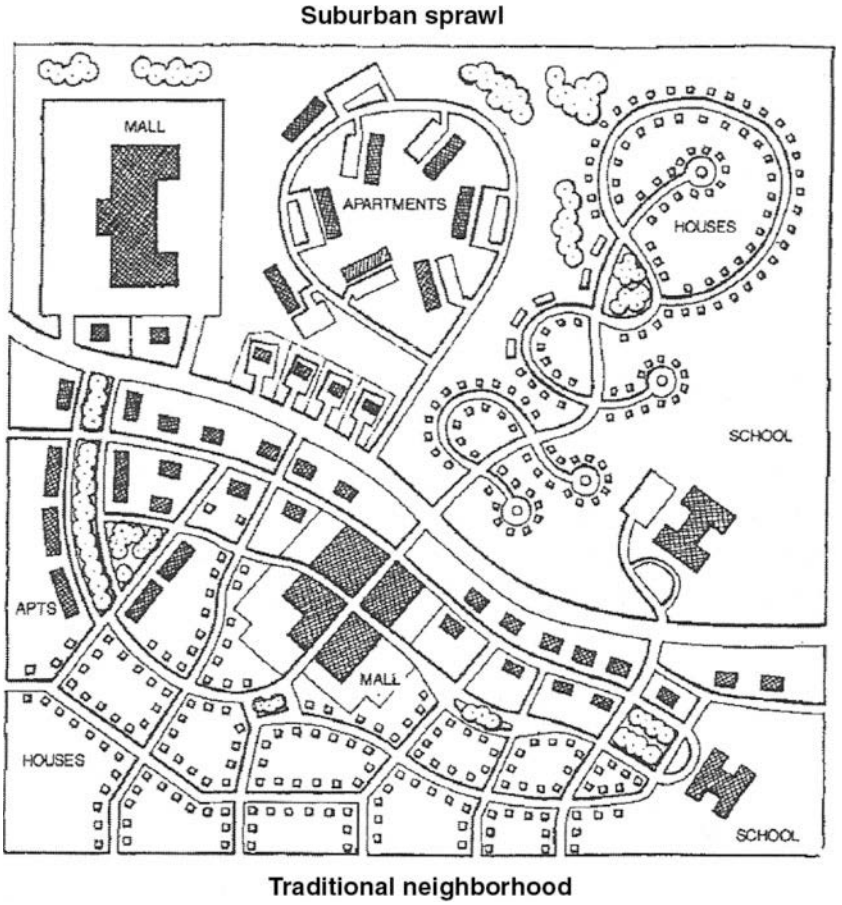

FIGURE 1
Comparison of street networks and land use in sprawled (upper) and traditional (lower) neighborhoods. Source: Drawing by Duany Plater Zyberk as shown in Spielberg F. The traditional neighborhood development: how will traffic engineers respond? *ITE J.* 1989;59:17.

Building new communities that are less car dependent and making existing communities more dense are 2 strategies that can make it easier for people to walk to their destinations of daily life. Higher land-use mix encourages more utilitarian trips among residents and increases their ability to reach their destinations on foot rather than by automobile. Proximity of neighborhood shops to residences promotes trips on foot or by bicycle.[37–39] In addition to mixed-land use, other measures, such as higher residential density, smaller street blocks,[40,41] and access to sidewalks,[42,43] have been reported to translate to increased walking in adults. Increased urban sprawl, by which farther distance between destinations decreases walkability, has been associated with less physical activity and with more obesity in adults,[44,45] as well as higher automobile passenger and pedestrian fatality rates.[9]

Air pollution exposure has been associated with the development and exacerbation of asthma in children.[46–48] Although physical activity is a positive aspect of outdoor play, it is important to recognize that time spent outdoors can make a child more vulnerable to ambient air pollution. Direct exposure to vehicle exhaust can affect a child's health, and higher urban density theoretically can increase one's daily exposure to vehicle exhaust and street traffic. Conversely, low-density sprawl promotes vehicle dependence and long-distance commuting, thus threatening air quality of the population at large. Children will benefit from planning that actively promotes outdoor play and walking while addressing the negative health effects of traffic and air pollution.

Higher housing density with increased land-use mix is a design strategy that promotes more physical activity among residents. However, there are other hybridized approaches that include creative design solutions that blend the benefits of connected streets with green space that is protected from automobile traffic. A street block plan can have "shared outdoor space,"[49] set aside within the heart of a cluster of residences. In this plan, front entrances of homes face the street and the back entrances face the shared outdoor spaces, which are accessible only to the residents. This design promotes a separation of outdoor recreational areas from traffic and an increased sense of ability to supervise children while preserving the community's ability to fit well onto a traditional grid of streets, which promotes walking to nearby destinations.

Walking to School

The most universal opportunity for incidental physical activity among children is in getting to and from school. Walking or biking to school has not yet been documented to lower BMI,[50] but it is a valuable opportunity for activity[51] and promotes higher levels of physical activity in boys.[52] Among middle-school girls in the Trial of Activity for Adolescent Girls (TAAG) study, every mile

that a girl lived farther from school translated to significantly fewer minutes of metabolic activity per week.[53] Closer proximity to school also provides the opportunity for use of school grounds for physical activity in after-school hours, and researchers have shown that provision of an open (supervised) school yard led to increased levels of physical activity and less television and video game use.[54]

In 1969, 40.7% of all American children walked to school. Currently, approximately 12.9% of all American children walk to school,[55] and in some areas as few as 5% of children walk to school.[56] Two national telephone surveys, HealthStyles in 1999[57] and ConsumerStyles in 2004,[58] queried parents about what barriers prevented their children from walking to school. The most commonly cited reason from those surveys and from the National Personal Transportation Survey from 1969–2001[55] was that the school was too far away.

School Sprawl

Suburbanization and decisions about school siting are important determinants of why children now live so far from school. Historically, small neighborhood schools served as "anchors" within the community and places for after-school programs, for social and recreational gathering, and as disaster shelters.[59] However, after the 1950s, many states established policies on the size and location of school buildings that influenced school siting. According to those guidelines, to receive state funding, schools had to have a minimum acreage (eg, elementary schools needed to be on at least 10 acres), and more students translated to larger required school-grounds size (eg, an extra acre for every 100 students).[8,60] Because untapped acreage sufficient to meet these standards is most often at the edge of an urban area, neighborhood schools (typically only 2–8 acres in size)[60] were frequently demolished or closed in favor of "big-box schools" at the outskirts of cities. Recommendations on school size from the Council of Education Facilities Planners International (CEFPI) were revised in 2004[61] and no longer recommend a minimum acreage. There is increasing interest in supporting smaller schools,[62] but change to policies on school land size occurs slowly. It is also important to acknowledge that there may be some trade-offs to consider regarding school size and physical activity. There is some research suggesting that larger school campuses, buildings, and play areas may promote youth physical activity during the school day.[63]

Distance is, of course, not the only barrier preventing children from walking or biking to school. A recent nationally representative study found that even among children who lived within 1 mile of school, less than half walk to school even 1 day/week. The proportion of children walking to school was the lowest among those living in the South, those living in a rural area, or those whose parent had an advanced degree.[64] The ConsumerStyles survey determined that parents' foremost concern was distance from school, followed by concerns about danger from traffic and crime, weather, and other miscellaneous factors.[58] These barriers are important, because they may prevent children not only from walking and biking to school but also from getting other physical activity in their neighborhood. To address these concerns about children's commutes to school, schools and parents in many US cities have organized a "walking school bus."[65] A walking school bus is created when groups of schoolchildren, supervised by volunteer adults, walk together through the neighborhood to "pick up" other children waiting with a parent at designated "bus stops." These programs represent an example of practical solutions to address concerns about environment and safety.

THEMES IMPORTANT FOR BOTH RECREATIONAL AND INCIDENTAL PHYSICAL ACTIVITY

Roads and Traffic

When parents are asked what prevents their children from walking to school, the second most commonly mentioned factor is traffic danger.[57,58] In addition, parental concern about traffic is a major barrier to children having opportunities for active free play.[66] "Traffic calming" refers to a variety of modifications and engineering techniques that can be applied to roads to slow driver speed. For example, road-design interventions can force cars to slow as they pass through undulations of the road surface.[67] A meta-analysis involving studies from multiple countries has shown that traffic calming reduces traffic injuries,[68] and research from the United Kingdom has shown that area-wide traffic-calming programs decreased pedestrian injuries in both affluent and poor areas.[69] There are traffic-calming programs in cities in 39 states, in cities such as Seattle, Washington, and Austin, Texas.[70] Research in Oakland, California, showed that children living near speed humps are less likely to be struck by an automobile in their neighborhood.[71] Measures that facilitate pedestrian crossing, such as single-lane roundabouts and islands in roadways, are effective countermeasures against pedestrian injury.[72] Taken together, there are many existing tools that address this very important parental concern about traffic danger.

Streetscapes, Esthetics, and Crime

Sidewalks and the perceived attractiveness of a neighborhood have effects on walking behaviors that are independent of socioeconomic status.[42] In addition, sidewalk presence seems to be protective for pedestrian safety in urban, residential, and mixed-use settings.[72,73] Although many new housing developments are encouraged to install sidewalks, installation is often waived with the substitution of other amenities.[62]

Safety concerns play an important role in how people respond to the built environment, with perception and fear of crime an important contributor to inactivity. Signs of disorderliness, such as broken windows, cue children to feel unsafe at school.[74] Children of parents who report anxiety about neighborhood safety get less physical activity.[75–77] A recent study that examined data on crime incidents showed that adolescent girls living near high-crime areas participate in less outdoor physical activity.[78] Urban design strategies may be able to foster "eyes on the street" to reduce fears by achieving

natural surveillance with storefronts that face the street or transit facilities (such as bus stops) that can be seen by shop owners or residents.[79] Living in a neighborhood considered "walkable" by objective methods was associated with more walking to school but only among neighborhoods with higher-level socioeconomic status.[80] This disparity may be attributable to the higher levels of concern about child safety found among parents in neighborhoods with lower socioeconomic status.

In 1999, California passed Safe Routes to School legislation, which funded improvements such as pedestrian crossings, sidewalks, and bicycle routes. Subsequent data have demonstrated that children walked to school more frequently after the improvements were made.[81] Because of the proven success of the California program, legislation established the Federal Safe Routes to School (SRTS) program in 2005, permitting communities to compete for funds administered by state departments of transportation.[82] This program funds a range of different approaches to increasing the number of children who walk to school, ranging from programs such as a walking school bus (groups of children walking to school under the supervision of volunteer adult) to traffic-calming engineering interventions or sidewalk improvements.[83]

Built Environment and Physical Activity: Translating Opportunity to Action

Research on relationships between the built environment and physical activity is an emerging field. Most studies are limited in that they are cross-sectional or focus only on adults. Nonetheless, the studies suggest that the built environment has a facilitative role in promoting child physical activity.[84–86] Furthermore, understanding relationships between the built environment and adult physical activity behaviors is important. Urban patterns that lengthen parents' time spent commuting to work may limit the time they have to engage in physical activity with their children. Factors that affect adult physical activity also affect the degree to which parents can serve as positive role models for their children. Ultimately, an environment in which physical activity is prohibitive will mean that our youth inherit a society in which sedentary behavior is the social norm.

Many communities are working to make their communities more walkable and bikeable and to make these activities more accessible and safe. These efforts provide timely research opportunities to examine the effects of built environment changes on children's physical activity.[86] However, the path from inactivity to activity is complex. Research will need to account for attitudes, beliefs, and social factors that influence behavior change, and interventions will require multifaceted approaches to overcome barriers that foster the status quo. Providing opportunities for physical activity through the built environment is only 1 of many important steps toward an active lifestyle.

RECOMMENDATIONS FOR PEDIATRICIANS

1. Ask patients and families about opportunities for recreational and incidental physical activity in nearby parks, playgrounds, or open spaces. Identify barriers that could be preventing children from using community locations and offer suggestions, when possible.
2. Encourage patients to advocate on behalf of their children and their schools for relevant environmental improvements, such as Safe Routes to School programs or a walking school bus. When present in their communities, encourage families to participate and use these programs. Encourage families who are considering a move of residence to consider the opportunities for physical activity at the new location.
3. Advocate for environmental improvements that will promote physical activity in children. Become involved in local community planning processes to encourage cities and local governments to prioritize space for parks. Emphasize the need for built structures, such as playgrounds, which will provide more opportunities for physical activity. Advocate for safe routes for incidental activity opportunities, including walking or biking to school.

RECOMMENDATIONS FOR GOVERNMENT

1. Pass and promote laws and regulations to create new or expand existing efforts to promote active living. Federal programs can incentivize states to incorporate these principles into planning and zoning standards. State and local governments should examine planning and zoning efforts to ensure that children's ability to walk, play, and get to school safely are a top priority.
2. Create and maintain playgrounds, parks, and green spaces within communities as well as the means to access them safely. Prioritize resources to low-income neighborhoods to ensure that all children and adolescents have access to safe and desirable opportunities for play and active lifestyles. Funding should also be prioritized to support specific evidence-based goals, such as building sidewalks in new and existing neighborhoods to create safe corridors to schools and neighborhood parks.
3. Promote legislation and fund programs that allow communities to create programs and environmental improvements to neighborhoods that can support children's active commuting to school. Consider children's ability for active transportation to school in the process of determining the location of a school.
4. Fund research on the impact of the built environment at neighborhood and community levels on the promotion of overall health and active lifestyles for children and families.
5. Serve as a model for communities. Whenever possible, new government buildings should be sited within walking distance of public transportation, walking trails, and residential areas to promote active living.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Section on Cardiology and Cardiac Surgery

Cardiovascular Health Supervision for Individuals Affected by Duchenne or Becker Muscular Dystrophy

ABSTRACT. Duchenne muscular dystrophy is the most common and severe form of the childhood muscular dystrophies. The disease is typically diagnosed between 3 and 7 years of age and follows a predictable clinical course marked by progressive skeletal muscle weakness with loss of ambulation by 12 years of age. Death occurs in early adulthood secondary to respiratory or cardiac failure. Becker muscular dystrophy is less common and has a milder clinical course but also results in respiratory and cardiac failure. The natural history of the cardiomyopathy in these diseases has not been well established. As a result, patients traditionally present for cardiac evaluation only after clinical symptoms become evident. The purpose of this policy statement is to provide recommendations for optimal cardiovascular evaluation to health care specialists caring for individuals in whom the diagnosis of Duchenne or Becker muscular dystrophy has been confirmed. *Pediatrics* 2005;116:1569–1573; *cardiovascular.*

ABBREVIATIONS. DMD, Duchenne muscular dystrophy; BMD, Becker muscular dystrophy.

INTRODUCTION

Duchenne muscular dystrophy (DMD) is a common genetic disease that affects approximately 1 in 3000 males. Becker muscular dystrophy (BMD) is less common, affecting approximately 1 in 30 000 males.[1] Both diseases result from a mutation in the gene located at Xp21,[2,3] which encodes dystrophin, a sarcolemmal protein abundant in skeletal and cardiac muscle cells.[4] Dystrophin is typically absent in DMD and reduced or abnormal in size in BMD.[5]

DMD typically is diagnosed between the ages of 3 and 7 years and is characterized by progressive skeletal muscle weakness with loss of ambulation between the ages of 7 and 13 years. The BMD phenotype is clinically more heterogeneous with initial presentation in the teenage years. Death secondary to cardiac or respiratory failure typically occurs in the second or third decade in DMD and in the fourth or fifth decade in BMD. Cardiac disease in both DMD and BMD manifests as a dilated cardiomyopathy and/or cardiac arrhythmia.[6,7] End-stage cardiac disease is characterized by alternating areas of myocyte hypertrophy, atrophy, and fibrosis.[8]

Over the last 20 years, respiratory care of this group of patients has improved as a result of the development of supportive equipment and techniques.[9] Consequently, dilated cardiomyopathy is increasing as the major cause of death.[10–12] The time course for the development of cardiomyopathy has not been well characterized; however, clinical studies demonstrate that the disease process in the heart is underway long before symptoms appear.[13–15] Early manifestations of heart failure often go unrecognized secondary to physical inactivity and a lack of classic signs and symptoms.[16] Signs of cardiac dysfunction may be vague and nonspecific, such as fatigue, weight loss, vomiting, or sleep disturbance. Currently at many medical centers, affected individuals do not come to the attention of the cardiac specialist until late in the disease process when the clinical manifestations of cardiac dysfunction become evident. This reactive, rather than proactive, approach must change if progress is to be made in the treatment of dilated cardiomyopathy in this patient population.[17] Sensitive and specific diagnostic tests to detect early and subtle manifestations of cardiac dysfunction are not available currently and need to be developed. Echocardiography, which remains the standard noninvasive diagnostic modality for cardiomyopathy, is often limited in patients with DMD and BMD by scoliosis and poor echocardiographic acoustic windows.

Cardiac rhythm abnormalities are frequent and play a significant role in morbidity and mortality in both DMD and BMD.[18] Electrocardiographic abnormalities can be seen early in the disease, with an incidence of 26% by 6 years of age.[16] Autonomic dysfunction with increased mean baseline heart rate and decreased rate variability has been well described.[19–21] However, the significance of these findings relative to the course of the cardiomyopathy has not been well established.

Treatment paradigms to date have been individually based and rely on evidence acquired from other patient populations. Cardiac dysfunction is treated by using standard heart-failure strategies that remain suboptimal. Unfortunately, there is minimal evidence-based literature regarding the use and effect of angiotensin-converting enzyme inhibitors or β-blockers

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on morbidity and mortality in this patient population.[22–24] Prospective clinical trials are required to evaluate the effectiveness of these treatments in this group of patients. Strategies that target the unique molecular etiology of heart failure in dystrophin-deficient individuals need to be developed if the cardiovascular care of patients with DMD and BMD is to improve.

The cardiovascular system must also be considered when addressing the diverse medical and surgical issues faced by patients with DMD and BMD. The administration of systemic glucocorticoids is becoming standard treatment for the skeletal muscle disease.[25–27] In addition to the potential to improve or stabilize cardiac function, there is the potential to increase long-term cardiovascular risk[28,29] including but not limited to the development of obesity and systemic arterial hypertension. Glucocorticoid treatment also may result in the development of left ventricular hypertrophy, with the potential of altering cardiac function.[30] At present, there is no uniformly accepted or standardized treatment protocol for glucocorticoid use.[31,32] Research is required to determine the cardiovascular effects of long-term glucocorticoid use in patients with DMD.

To manage the musculoskeletal complications in DMD and BMD, orthopedic surgical procedures are frequently recommended.[33,34] The patient with DMD or BMD faces unique risks not only in the operating room but also in the postoperative period.[35,36] Potential complications include respiratory failure, pulmonary aspiration, atelectasis or collapse of major lung segments, postoperative pneumonia, congestive heart failure, and cardiac arrhythmias. The patient with DMD or BMD often has a limited ability to increase cardiac output in response to stress and thus is at risk of inadequate oxygen delivery. Blood loss and fluid shifts during surgical procedures further compromise cardiac output and adequate oxygen delivery.[37] As a result, it is essential that baseline cardiac and pulmonary function be evaluated before any major surgical procedure. Patients with DMD or BMD have additional operative risks. Succinylcholine chloride should be avoided because of its predilection to cause a hyperkalemic response, which is different from malignant hyperthermia but is potentially as life threatening. Prolonged exposure to inhaled anesthetic agents should also be avoided, because they may provoke a life-threatening hypermetabolic state similar to malignant hyperthermia. All patients with DMD or BMD should be monitored during surgery by measuring expired carbon dioxide concentration and body temperature.[38–40]

The patient with DMD or BMD continues to be at risk during the postoperative period. Pain may worsen already compromised pulmonary mechanics, leading to additional increases in oxygen consumption. Treatment with narcotics may result in hypoventilation, which affects airway clearance. In addition, anemia or inadequate volume replacement can impair oxygen delivery. After major surgical procedures such as scoliosis surgery, the patient is likely to experience significant, prolonged fluid shifts, which markedly affect ventricular preload. Postoperative maintenance of fluid balance and cardiopulmonary monitoring is critical for this patient population.

Nutrition is also critical in the care and management of patients with DMD, because they require regular monitoring to maintain ideal body weight. Obesity and undernutrition are known to occur in this group of patients.[41,42] Both have been shown to be detrimental to cardiac health in other populations,[43] although there is a paucity of literature regarding the effect of nutrition on cardiovascular health in patients with DMD. Glucocorticoid-induced obesity and osteoporosis will further nutritionally affect the patient with DMD.

Patients with DMD and BMD may also be at increased risk of thromboembolic events secondary to the prothrombotic consequences of muscle degeneration.[44–48] This risk is amplified in the presence of cardiac dysfunction. As a result, anticoagulation therapy should be considered in this subgroup of patients. However, there is minimal evidence-based literature regarding the use and effect of anticoagulation therapy in these patients.

Optimal cardiac care cannot be accomplished without maximizing pulmonary function.[49] Hypoventilation and respiratory muscle weakness are known to increase wall stress.[50] Aggressive pulmonary care not only affects morbidity and mortality as a result of reducing respiratory complications but also functions to decrease afterload and left ventricular wall stress, resulting in improved cardiac output. In 2004, the American Thoracic Society released a consensus statement regarding the respiratory care of patients with DMD.[9] These recommendations should be considered carefully.

Female carriers of DMD or BMD are also at risk of developing cardiomyopathy. The age of onset of clinically significant disease is unclear but is thought to be in the adult years.[51] Cardiac involvement in the carrier can be variable, ranging from asymptomatic to severe heart failure necessitating cardiac transplantation.[52,53] Carriers, therefore, require periodic cardiovascular screening.[54,55] In addition, there is a critical need to research the natural history and outcome of therapies in female carriers.

Mutations in dystrophin clearly place affected individuals at risk of developing cardiac disease irrespective of skeletal muscle disease. The dystrophin gene has been shown to be the cause of X-linked dilated cardiomyopathy and some cases of sporadic dilated cardiomyopathy.[56–60]

Ultimately, investigation of cardiomyopathy in patients with DMD and BMD, as well as carriers, will benefit affected individuals, and new knowledge may lead to the elucidation of novel treatment strategies for dilated cardiomyopathy. Given the number of affected children and limited financial resources available for investigation, medical information must be pooled and shared for maximal effectiveness.

RECOMMENDATIONS FOR CARDIAC CARE IN PATIENTS WITH DMD OR BMD

1. Cardiac care of the patient with DMD or BMD should begin after confirmation of the diagnosis.

The patient should be referred for evaluation to a cardiac specialist with an interest in the management of cardiac dysfunction and/or neuromuscular disorders.
2. A complete cardiac evaluation should include (but not be limited to) a history and physical examination, electrocardiogram, and transthoracic echocardiogram. Consideration should be given to a multigated acquisition study (MUGA) or cardiac MRI in patients with limited echocardiographic acoustic windows.
3. Clinicians should be aware that the typical signs and symptoms of cardiac dysfunction may not be present secondary to the patient's musculoskeletal limitations. Weight loss, cough, nausea and vomiting, orthopnea, and increased fatigue with a decreased ability to tolerate the daily regimen may represent cardiac impairment and should be investigated. However, the development of dilated cardiomyopathy usually precedes the development of heart-failure symptoms by years and must be identified at its earliest onset.
4. Signs and symptoms of cardiac dysfunction should be treated. Consideration should be given to the use of diuretics, angiotensin-converting enzyme inhibitors, and/or β-blockers.
5. Abnormalities of cardiac rhythm should be promptly investigated and treated. Periodic Holter monitoring should be considered for patients with demonstrated cardiac dysfunction.
6. Respiratory abnormalities contribute to the cardiovascular morbidity and mortality of the disease. Concurrent evaluation and treatment of respiratory abnormalities are recommended.
7. Individuals undergoing treatment with glucocorticoids warrant increased cardiac surveillance with specific monitoring for weight gain and hypertension.
8. Complete cardiac evaluation should be undertaken before scoliosis surgery or other major surgical procedures. Consideration should be given to cardiac stress testing (such as a dobutamine stress echocardiogram) if abnormalities of cardiac function are present during resting evaluation. Medical therapy should be optimized before surgery, and the risks and benefits of the procedure should be discussed in detail with the patient and the family.
9. Intraoperative cardiac monitoring should be undertaken in individuals with DMD or BMD during major surgical procedures. Specific anesthetic techniques and decisions about intraoperative ventilation will depend on the patient and the procedure. Agents known to trigger hyperkalemia (eg, succinylcholine chloride) or a hypermetabolic state (eg, inhaled anesthetic agents) should be avoided. Cardiac monitoring should continue in the postoperative period.
10. Anticoagulation therapy should be considered in patients with severe cardiac dysfunction to prevent systemic thromboembolic events.
11. Clinicians who are experienced in the care of patients with DMD or BMD and are knowledgeable about the pathogenesis of the disease should be actively involved when patients are treated in an intensive care setting.
12. Nutritional status should be optimized to the special needs of patients with DMD or BMD.

RECOMMENDATIONS SPECIFIC FOR CARDIAC CARE IN PATIENTS WITH DMD

1. Patients should be routinely managed in early childhood with a complete cardiac evaluation at least biannually.
2. Yearly complete cardiac evaluations should begin at approximately 10 years of age or at the onset of cardiac signs and symptoms. However, individuals demonstrating these signs and symptoms are relatively late in their course.

RECOMMENDATIONS SPECIFIC FOR CARDIAC CARE IN PATIENTS WITH BMD

1. Complete cardiac evaluations should begin at approximately 10 years of age or at the onset of signs and symptoms. Evaluations should continue at least biannually.

RECOMMENDATIONS FOR CARDIAC CARE IN CARRIERS OF DMD OR BMD

1. Carriers of DMD or BMD should be made aware of the risk of developing cardiomyopathy and educated about the signs and symptoms of heart failure.
2. Carriers of DMD or BMD should be referred for evaluation by a cardiac specialist with experience in the treatment of heart failure and/or neuromuscular disorders. Patients should undergo initial complete cardiac evaluation in late adolescence or early adulthood or at the onset of cardiac signs and symptoms, if these signs or symptoms appear earlier.
3. Carriers should be screened with a complete cardiac evaluation at a minimum of every 5 years starting at 25 to 30 years of age.
4. Treatment of cardiac disease is similar to that outlined for boys with DMD or BMD.

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POLICY STATEMENT

Cardiovascular Monitoring and Stimulant Drugs for Attention-Deficit/Hyperactivity Disorder

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

James M. Perrin, MD, Richard A. Friedman, MD, Timothy K. Knilans, MD, the Black Box Working Group, the Section on Cardiology and Cardiac Surgery

INTRODUCTION

A recent American Heart Association (AHA) statement[1] recommended electrocardiograms (ECGs) routinely for children before they start medications to treat attention-deficit/hyperactivity disorder (ADHD). The AHA statement reflected the thoughtful work of a group committed to improving the health of children with heart disease. However, the recommendation to obtain an ECG before starting medications for treating ADHD contradicts the carefully considered and evidence-based recommendations of the American Academy of Child and Adolescent Psychiatry[2] and the American Academy of Pediatrics (AAP).[3,4] These organizations have concluded that sudden cardiac death (SCD) in persons taking medications for ADHD is a very rare event, occurring at rates no higher than those in the general population of children and adolescents. Both of these groups also noted the lack of any evidence that the routine use of ECG screening before beginning medication for ADHD treatment would prevent sudden death. The AHA statement pointed out the importance of detecting silent but clinically important cardiac conditions in children and adolescents, which is a goal that the AAP shares. The primary purpose of the AHA statement is to prevent cases of SCD that may be related to stimulant medications. The recommendations of the AAP and the rationale for these recommendations are the subject of this statement.

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Abbreviations
AHA—American Heart Association
ECG—electrocardiogram
ADHD—attention-deficit/hyperactivity disorder
AAP—American Academy of Pediatrics
SCD—sudden cardiac death

This statement has been endorsed by the American Academy of Child and Adolescent Psychiatry, the Society for Developmental and Behavioral Pediatrics, the National Initiative for Children's Healthcare Quality, the National Association of Pediatric Nurse Practitioners, and Children and Adults with Attention Deficit/Hyperactivity Disorder.

BACKGROUND

ADHD affects 5% to 8% of children and adolescents,[5,6] and stimulant medications have been shown for decades to be effective for treatment of the disorder.[4] Sudden death is rare in the pediatric population as a whole,[7] and screening to predict and hopefully prevent sudden death in the general population is a frequent topic of discussion. Despite the absence of scientific data to establish an increased risk of sudden death in individuals receiving stimulant medications for ADHD,[8] much attention has been directed to warning about and screening for causes of sudden death in this population.

Substantial evidence exists concerning the efficacy and safety of ADHD treatments, including both stimulant medications and behavior therapies.[4] Limiting children's access to effective treatment for ADHD could have serious implications, because there are substantial risks of not treating ADHD. Untreated ADHD in adolescence is associated with higher rates of substance use and abuse,[9] academic failure,[10] and automobile accidents.[11] Therefore, the evidence supporting any recommendation that may inhibit caregivers from treating ADHD effectively must be considered carefully.

STATEMENT OF THE PROBLEM

The AHA scientific statement[1] is controversial because of its extensive recommendations for children without heart disease and the lack of information on the methods used to arrive at its recommendations. Ultimately, the authors recommended that, in addition to a careful history, family history, and physical examination, "an ECG be added to increase the likelihood of identifying significant cardiac conditions such as HCM [hypertrophic cardiomyopathy], LQTS [long QT syndrome] and WPW [Wolff-Parkinson-White syndrome] that might place the child at risk." However, no data were provided that document a higher risk for patients with these diagnoses who are treated with stimulant drugs. In fact, elsewhere in the report, the authors stated: "We would agree with the conclusion of a recent

special article in *Pediatrics* that states that 'there does not seem to be compelling findings of a medication-specific risk necessitating changes in our stimulant treatment of children and adolescents with ADHD.' "[8]

In addition, the AHA scientific statement's final recommendation stated that "[t]he consensus of the committee is that it is reasonable and useful to obtain ECGs as part of the evaluation of children being considered for stimulant drug therapy. We recognize there are no clinical trials to inform us. . . . There are no widely accepted recommendations or standards of care for cardiac monitoring on stimulant medications. It is not known if the risk of SCD on stimulants is higher than in the general population or that the approach described will decrease the risk." Despite this lack of evidence, the authors assigned the recommendation, using AHA and American College of Cardiology classification, a class IIa (weight of evidence/opinion is in favor of usefulness/efficacy) and level of evidence C (only consensus opinion of experts, case studies or standard of care) label. The AAP and its constituent groups disagree with the AHA statement as to both the classification and the level of evidence. Using AHA criteria, the AAP would, at most, classify this recommendation as IIb ("the level of evidence is less well established by evidence/opinion. . . . Additional studies with broad objectives needed.") In addition, using the AAP classification of recommendations,[12] the AAP would assign the recommendation a category D level of evidence (on the basis of expert opinion without even observational studies.) The AAP avoids making guideline recommendations with level D evidence. Moreover, the substantial expert opinion and reasoning outlined in the AHA statement suggests that harm outweighs the benefit of recommending routine ECGs for healthy children who are starting stimulant medication for ADHD. Accordingly, the AAP would recommend against such routine ECG screening.

No relationship has been established between medicines used to treat ADHD and SCD. Specifically, the US Food and Drug Administration (FDA) has collected 25 anecdotal reports of sudden death documented during industry-sponsored medication trials as well as those reported for individual patients to the FDA. The mechanism that led to the sudden death of these patients is unknown. The frequency of sudden unexpected death among those taking stimulants is no higher than that in the general population of children. Only 19 children and adolescents of the 2.5 million taking stimulants died suddenly over 5 years, suggesting a base rate among children and adolescents of 4 incidents of sudden death per year per 2.5 million children or fewer than 2 incidents per million; however, reported rates of SCD in the general child and adolescent population are substantially higher, with reports varying from 8 to 62 per million.

Screening methods for underlying cardiac abnormalities, which could predispose to SCD, have typically included personal and family history and physical examination but have not routinely included electrocardiography and echocardiography. Assessment of personal and family history and a physical examination seem quite appropriate for a physician evaluating a patient with ADHD, for many reasons unrelated to risk of sudden death. Electrocardiography or echocardiography in this population would not otherwise be routine or recommended. Because the risk of sudden death in the population of patients pharmacologically treated for ADHD is no higher than that in the general population, performance of cardiac screening tests would not seem to be any more indicated than in the general population, and the AHA, along with the AAP, does not recommend routine ECG screening for children and adolescents because of problems with the sensitivity and specificity of the ECG as a general screening test.[13]

The AHA report provided no cost-effectiveness analysis to justify ECG screening of young people receiving ADHD medications or for special evaluation by pediatric cardiologists. It is important to note that, in some communities, difficulties in obtaining an ECG and pediatric cardiology consultation may serve as additional barriers to care for patients with ADHD.

SUMMARY

Although the sudden death of a child is a tragedy, there have been no studies or compelling clinical evidence to demonstrate that the likelihood of sudden death is higher in children receiving medications for ADHD than that in the general population. It has not been shown that screening ECGs before starting stimulants have an appropriate balance of benefit, risk, and cost-effectiveness for general use in identifying risk factors for sudden death. Until these questions can be answered, a recommendation to obtain routine ECGs for children receiving ADHD medications is not warranted.

The AAP recommends that clinicians carefully assess all children for cardiac abnormalities, including those in whom ADHD treatment is being considered, by using history and physical assessment. The AAP does not recommend the routine use of ECGs before initiating stimulant therapy for ADHD. An algorithm developed by the AAP Section on Cardiology and Cardiac Surgery and designed to aid clinicians in the evaluation of children on medicines to treat ADHD is shown in Fig 1.

The AAP shares the concern of the AHA about improving the diagnosis of silent but clinically significant cardiac conditions in children and adolescents and urges additional research into effective methods to detect these conditions and reduce the incidence of SCD.

RECOMMENDATIONS

1. The AAP continues to recommend a careful assessment of all children, including those starting stimulants, by using a targeted cardiac history (eg, patient history of previously detected cardiac disease, palpitations, syncope, or seizures; a family history of sudden death in children or young adults; hypertrophic cardiomyopathy; long QT syndrome) and a physical examination, including a careful cardiac examination (evidence quality: C; strength: recommendation).
2. Given current evidence, the AAP encourages primary care and subspecialty physicians to continue currently recommended treatment for ADHD, including stimu-

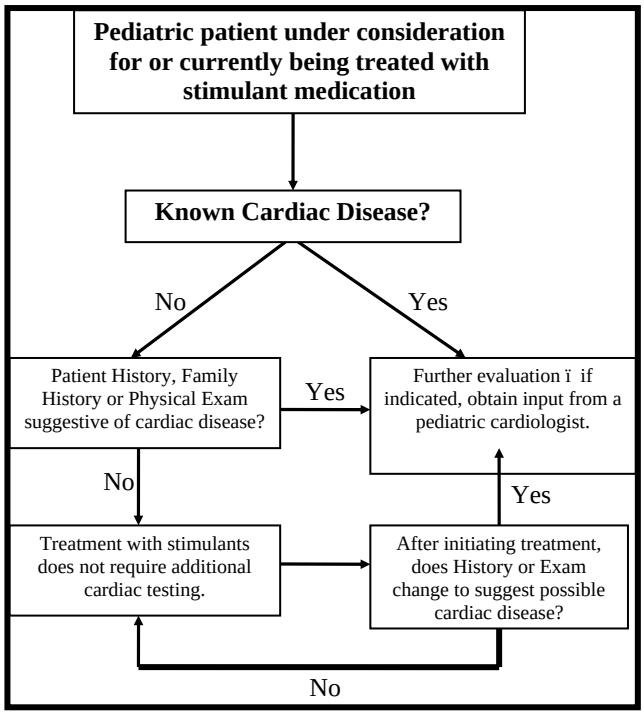

FIGURE 1
Cardiac evaluation of children and adolescents receiving or being considered for stimulant medications.

lant medications, without obtaining routine ECGs or routine subspecialty cardiology evaluations for most children before starting therapy with these medications (see Fig 1) (evidence quality: D; strength: option).

3. The AAP urges additional research on risk factors for SCD among all children and adolescents, including those with ADHD who are treated with stimulant medications. Improved methods for detecting hidden cardiac disease in children should be another focus of such research efforts.

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ADDITIONAL READING

American Heart Association. American Academy of Pediatrics/American Heart Association clarification of statement on cardiovascular evaluation and monitoring of children and adolescents with heart disease receiving medication for ADHD [press release]. Available at: http://americanheart.mediaroom.com/index.php?s=43&item=422. Accessed May 28, 2008

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AHA Scientific Statement

Cardiovascular Risk Reduction in High-Risk Pediatric Patients

A Scientific Statement From the American Heart Association Expert Panel on Population and Prevention Science; the Councils on Cardiovascular Disease in the Young, Epidemiology and Prevention, Nutrition, Physical Activity and Metabolism, High Blood Pressure Research, Cardiovascular Nursing, and the Kidney in Heart Disease; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research

Endorsed by the American Academy of Pediatrics

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Abstractð Although for most children the process of atherosclerosis is subclinical, dramatically accelerated atherosclerosis occurs in some pediatric disease states, with clinical coronary events occurring in childhood and very early adult life. As with most scientific statements about children and the future risk for cardiovascular disease, there are no randomized trials documenting the effects of risk reduction on hard clinical outcomes. A growing body of literature, however, identifies the importance of premature cardiovascular disease in the course of certain pediatric diagnoses and addresses the response to risk factor reduction. For this scientific statement, a panel of experts reviewed what is known about very premature cardiovascular disease in 8 high-risk pediatric diagnoses and, from the science base, developed practical recommendations for management of cardiovascular risk. (***Circulation.*** **2006;114:000-000.)**

Key Words: AHA Scientific Statements ■ atherosclerosis ■ cardiovascular diseases ■ risk factors ■ prevention ■ pediatrics

The atherosclerotic process begins in childhood, with progression clearly shown to be mediated by the presence of identified risk factors. Pathological studies in children and young adults demonstrate that the extent of atherosclerotic vascular change is associated with both the number of premortem risk factors and their intensity.[1ï6] In vivo noninvasive studies relate each of the known risk factors measured in childhood to abnormalities of vascular structure and function.[7ï19] Finally, a decrease in number or intensity of risk factors is associated with improvement in the vascular abnormalities.[20ï24]

For most children, the degree of vascular involvement is minor, the rate of progression is slow, and the appropriate therapeutic approach is preventive, with an emphasis on healthy lifestyles and behavior modification.[25,26] By contrast, certain pediatric disease states are associated with dramatically accelerated atherosclerosis, with clinical coronary events occurring in childhood or very early in adult life. A classic example is homozygous hypercholesterolemia, in which markedly elevated low-density lipoprotein (LDL) cholesterol levels are associated with coronary disease in the first decade of life.[27] Another is Kawasaki disease, in which

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coronary pathology developed as part of the acute disease process predisposes patients to very early coronary events.[28] For children with diagnoses like these, intensive cardiovascular risk reduction is of critical importance. However, awareness of the risk for premature atherosclerosis is often limited when the main focus of medical care is the complex primary diagnosis. The goal of this statement is to summarize the evidence for accelerated atherosclerosis in high-risk pediatric settings and to present guidelines for cardiovascular risk management. The recommendations are directed toward both the pediatric care providers and the subspecialists who manage the primary disease process in these complex young patients.

The statement was developed by a writing group convened under the joint direction of the American Heart Associationõs Expert Panel on Population and Prevention Science and the Council for Cardiovascular Disease in the Young, cosponsored by the Councils on Epidemiology and Prevention, Nutrition, Physical Activity, and Metabolism, High Blood Pressure Research, Cardiovascular Nursing, and the Kidney in Cardiovascular Disease and by the Quality of Care and Outcomes Research Working Group. Members were nominated by ≥1 of these scientific councils and are each recognized experts in premature atherosclerosis beginning in childhood. The group selected 8 pediatric disease settings for inclusion: (1) familial hypercholesterolemia; (2) diabetes mellitus, type 1 and type 2; (3) chronic kidney disease; (4) heart transplantation; (5) Kawasaki disease; (6) congenital heart disease; (7) chronic inflammatory disease; and (8) childhood cancer. For each, the evidence for early coronary disease was reviewed by an expert in the area. On the basis of the risk of manifest coronary disease in childhood and very early adult life, a stratification protocol was established, and each disease was classified as follows (Table 1):

Tier I: Pathological and/or clinical evidence for manifest coronary disease before 30 years of age
Tier II: Pathophysiological evidence for arterial dysfunction indicative of accelerated atherosclerosis before 30 years of age
Tier III: Increased cardiovascular risk factors with epidemiological evidence for manifest coronary disease with or without arterial dysfunction early in adult life but after 30 years of age

Recommendations for cardiovascular risk identification and reduction specific to each disease setting were developed as a consensus of the group, and an algorithm was developed outlining the risk factor evaluation and management strategy by disease tier (Figure). As in current risk-reduction recommendations for adults and for children with type 1 diabetes, critical levels for intervention and goals for risk reduction have been tailored to the risk intensity (Table 2).[29,30] For children with diagnoses in tier I, complete risk factor assessment is recommended, and therapy is instituted essentially at the time of diagnosis, aimed at maximally decreasing risk factor levels; the intervention strategy for tier I patients regards the diagnosis as a ñcoronary heart disease equivalent,ò with recommendations similar to the secondary prevention guidelines for adults with established coronary disease (Table 3). For children in tier II, complete assessment of all risk factors is recommended, with defined therapeutic goals. For children in tier III, complete risk factor assessment is recommended, with therapeutic goals as recommended for children in general.

In this era of evidence-based medicine, most scientific statements require positive results from multiple randomized trials to recommend any intervention. To date, no randomized trials beginning in childhood have demonstrated an improvement in hard clinical cardiac end points in response to risk factor reduction; given the major cost and time limitations, the potential for such trials in the near future seems low. There is, however, a large and growing knowledge base in pediatric populations with regard to the presence of accelerated atherosclerosis, the relationship of the atherosclerotic process to the presence and intensity of risk factors, and the response to risk factor change at the vascular level. The present scientific statement is not intended to preclude or inhibit the design and execution of future randomized treatment trials. Rather, we hope to assist physicians in learning what is already known about increased risk for premature atherosclerosis in children with these diagnoses, as well as the range of approaches to risk assessment and treatment. Until evidence-based data are available, the present statement provides practical interim recommendations based on a consensus of the group after a careful review of the available science for each diagnosis, including all published guidelines. Typical statements about level of evidence and the strength of

TABLE 1. Disease Stratification by Risk

	Risk Category	Rationale	Disease Process/Condition
Tier I	High risk	Manifest CAD <30 years of age: Clinical evidence	Homozygous familial hypercholesterolemia (FH)
			Diabetes mellitus, type 1
			Chronic kidney disease (CKD)/end-stage renal disease (ESRD)
			Post–orthostatic heart transplantation (OHT)
			Kawasaki disease with current coronary aneurysms
Tier II	Moderate risk	Accelerated atherosclerosis: Pathophysiological evidence	Heterozygous FH
			Kawasaki disease with regressed coronary aneurysms
			Diabetes mellitus, type 2
			Chronic inflammatory disease
Tier III	At risk	High-risk setting for accelerated atherosclerosis: Epidemiological evidence	Post–cancer-treatment survivors
			Congenital heart disease
			Kawasaki disease without detected coronary involvement

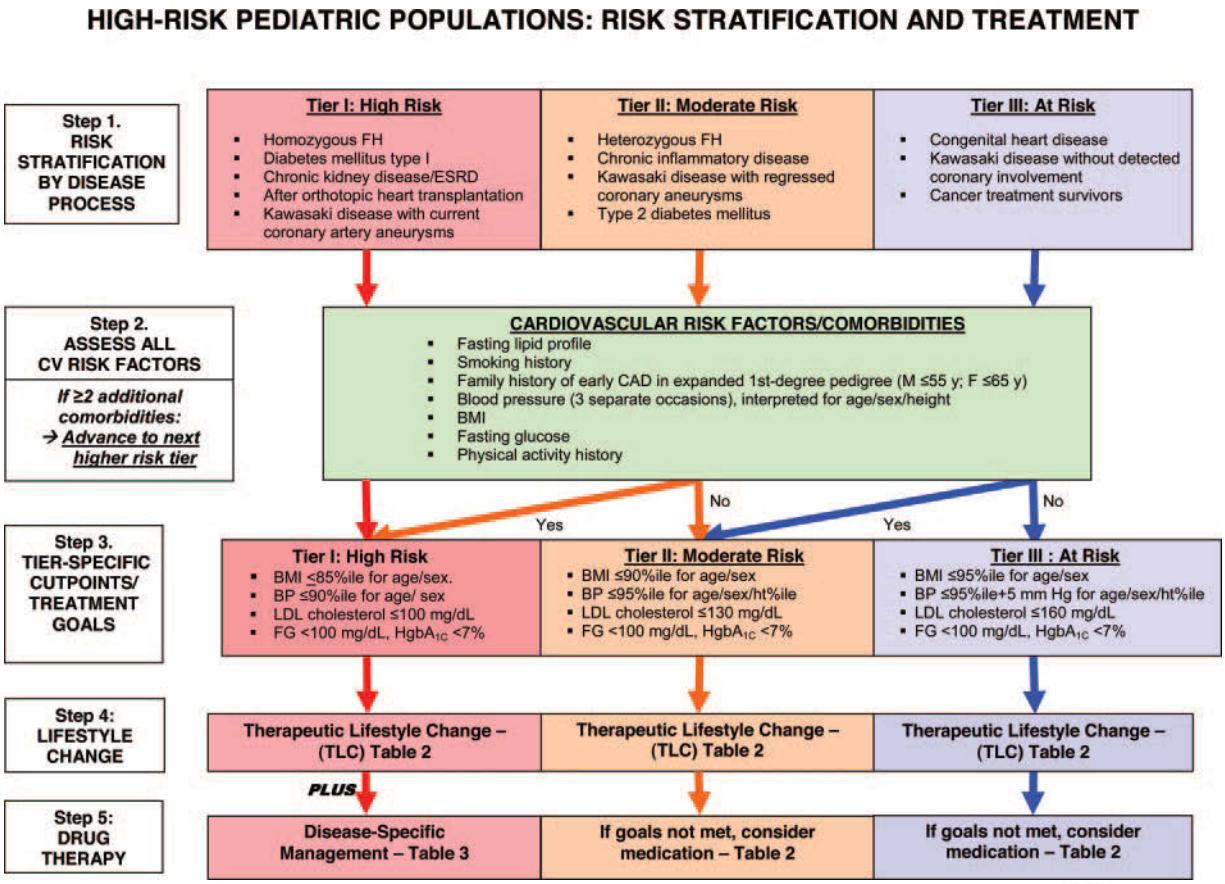

Figure. Risk-stratification and treatment algorithm for high-risk pediatric populations.

Directions: *Step 1:* Risk stratification by disease process (Table 1). *Step 2:* Assess all cardiovascular risk factors. If there are ≥2 comorbidities, assign patient to the next higher risk tier for subsequent management. *Step 3:* Tier-specific treatment goals/intervention cut points defined. *Step 4:* Initial therapy: For tier I, initial management is therapeutic lifestyle change (Table 2) PLUS disease-specific management (Table 3). For tiers II and III, initial management is therapeutic lifestyle change (Table 2). *Step 5:* For tiers II and III, if goals are not met, consider medication as outlined in Table 2.

CV indicates cardiovascular; BP, blood pressure; %ile, percentile; FG, fasting glucose; $HgbA_{1c}$, hemoglobin A_{1c}; ht%ile, height percentile; pt, patient; and TLC, therapeutic lifestyle change.

each recommendation are not included. For easy access, references for each section of the report are grouped together.

Familial Hypercholesterolemia

Introduction

Aggressive management of hyperlipidemia in adults, particularly directed toward lowering LDL cholesterol levels, has led to major reductions in cardiovascular morbidity and mortality. In children and adolescents, hyperlipidemia may be secondary to associated conditions such as medications or obesity, but extreme LDL elevations are more commonly associated with primary or genetic hyperlipidemias.[47] Both types of lipid abnormalities have been shown to be associated with vascular pathology in youth: a greater extent of vascular involvement, with fatty streaks and fibrous plaques at autopsy; higher presence of coronary artery calcium by electron-beam computed tomography; and increased carotid intima-media thickness, reduced arterial distensibility and compliance, and endothelial dysfunction by ultrasound.[7,48,49] Increasing evidence indicates that appropriate therapy can reverse these changes.[20,21] Of the primary hyperlipidemias, familial hypercholesterolemia (FH) is the most common and the most clearly documented to have important cardiovascular consequences beginning in childhood.[49–52] Therefore, the identification and management of FH in children is of great consequence.[53]

Pathophysiology

FH is an autosomal dominant monogenetic condition. Homozygous hypercholesterolemia is rare, with an occurrence of 1:1 000 000 individuals, but the heterozygous state exists in the general population with an incidence of 1:500. It is the most common monogenetic disorder in North America and Europe. Certain populations have a higher frequency and greater concentrations of specific mutations.

The genetic defect is characterized by various mutations that affect the production and processing of cell-surface LDL receptors.[54–56] Defectiveness or deficiency of these receptors results in impaired hepatic clearance of circulating LDL particles, which leads to their accumulation in the bloodstream. A similar phenotype can be produced by mutations in the receptor that recognizes apolipoprotein B100 protein on the surface of LDL particles, known as familial defective apolipoprotein B100.[57,58]

The elevated levels of LDL contribute to accelerated atherosclerosis, with manifest cardiovascular disease within the first 2 decades of life for homozygotes[59] and beginning in early to mid-adulthood for heterozygotes.[60] Elevated LDL levels are evident before birth[61] and persist throughout the lifespan.

Homozygous FH can be distinguished from heterozygous FH clinically by the much more extreme elevations in LDL and can be confirmed by either genetic characterization of the LDL receptor mutations (from leukocytes) or by quantification of LDL receptor activity (from skin fibroblasts). Children with homozygous FH have more severe and earlier functional and structural vascular abnormalities, including clinical coronary artery disease (CAD), aortic valve disease, and aortic disease, beginning in the first decade of life.[59]

Children with heterozygous FH have been shown to have abnormalities on noninvasive vascular assessments, including greater carotid-intima media thickness and abnormal arterial endothelial function.[11,13,49,62–64] Effective lipid-lowering therapy has been shown to improve these abnormalities.[20,21]

Identification

Children with homozygous FH usually present within the first decade of life, most commonly after investigation of physical findings related to cholesterol deposition, such as tendon xanthomata, cutaneous xanthelasma, or corneal arcus, or with clinical manifestations of atherosclerotic cardiovascular disease.[59] Children and adolescents with heterozygous FH are asymptomatic, with no findings on physical examination related to their hypercholesterolemia.[65] Often, they present with either elevated LDL levels noted on blood screening or after investigation prompted by a family history of premature cardiovascular disease or hyperlipidemia.

The lipid profile abnormalities are strikingly abnormal in homozygous patients. Although LDL levels vary between individuals, they are often in the 15- to 25-mmol/L (500- to 1000-mg/dL) range, with high-density lipoprotein (HDL) levels reduced between 0.5 and 1.0 mmol/L (20 to 40 mg/dL). Both parents will have lipoprotein profiles consistent with heterozygous FH. Although not necessary for clinical management, determination of an LDL receptor mutation on skin biopsy or leukocyte culture confirms the diagnosis.

In heterozygous FH, fasting lipoprotein profile characteristics include LDL levels well above the 95th percentile for age and gender, often associated with low HDL and normal triglyceride levels. Additional criteria include the presence of a parent with a similar profile in a family with a history of premature cardiovascular disease in conjunction with tendon xanthomata.[66] Determination of an LDL receptor mutation is not routinely performed.

A Dutch study of 1034 children with heterozygous FH showed that an LDL level >3.5 mmol/L (135 mg/dL) had a 98% posttest probability of the presence of an LDL receptor mutation.[65] Mean LDL levels were 5.8 mmol/L (225 mg/dL) for girls and 5.42 mmol/L (210 mg/dL) for boys. A positive family history of premature cardiovascular disease in a first-degree relative was present for 31% of children. Children of a parent with FH and premature cardiovascular disease had higher LDL, lower HDL, and higher lipoprotein(a) levels. Children with lower HDL levels were heavier and had higher triglyceride levels. LDL levels appeared to be independent of lifestyle or anthropometric characteristics.

Risk Factors/Comorbidities

A study of 2400 heterozygous FH Dutch adults showed that during 112 943 person-years of follow-up, 33% had at least 1 atherosclerotic cardiovascular event, predominantly clinical CAD.[66] Male gender, smoking, hypertension, diabetes mellitus, low HDL, and elevated lipoprotein(a) levels were shown to independently contribute to the development of cardiovascular disease.

Treatment Recommendations for Children With FH

Children With Homozygous FH Who Are at High Risk for Very Early Cardiovascular Disease (Tier I)

- Complete cardiovascular assessment is necessary at diagnosis, because important subclinical cardiovascular disease requiring intervention may already be present.[59]
- Treatment should be instituted as soon as possible.[41,67,68] The cornerstone of therapy in the majority of patients is weekly or biweekly plasmapheresis, preferably LDL apheresis.[67,69] Although the majority of lipid-lowering drugs lower LDL primarily by feedback mechanisms that upregulate LDL receptor activity, patients with homozygous FH may still benefit.[68,70] Use of high-dose statins is therefore recommended, in combination with a cholesterol absorption inhibitor.
- Low-dose anticoagulation may also be indicated. Ongoing surveillance for cardiovascular disease is essential.
- The presence of homozygous FH mandates intensive therapy aimed at reducing LDL levels. Interventions to prevent or reduce associated risk factors are important, but the critical therapy is lipid lowering.

Children With Heterozygous FH Who Are at Moderate Risk for Premature Cardiovascular Disease (Tier II)

- Routine cardiovascular assessment is not generally indicated, although referral to a lipid specialist is recommended.
- The presence of heterozygous FH merits therapy focused primarily at reducing LDL levels.[71,72] Lifestyle interventions are important to prevent or reduce associated risk factors but are insufficient for lipid lowering.[73–76]
- There is uniform consensus that lipid-lowering drug therapy is the cornerstone of management in adults, but considerable controversy exists over when to initiate pharmacological treatment in children.[77] Randomized clinical trial results indicating a decline in future atherosclerotic disease in response to lipid-lowering therapy begun in childhood are not available. However, extrapolation from adult studies suggests that lipid-lowering therapy should be considered when LDL cholesterol levels are severely elevated. The only existing guideline, from 1991, recommends consideration of drug therapy after 10 years of age in children with specific LDL cutpoints.[36] We are in general agreement with this recommendation, but we also recommend tailoring therapy to each child, considering actual LDL levels, sex, presence of other risk

factors, and important family history of premature disease. The wishes of the family with regard to drug therapy also need to be taken into account. Thus, there is room for discretion and clinical judgment.

- When the decision is made to begin drug treatment, initial therapy with a statin is recommended, because bile-acid binding resins[78–81] and cholesterol absorption inhibitors (not yet studied in children) are usually inadequate alone to achieve sufficient LDL reduction.[52,82] Several recent studies of statins in children have shown similar safety and efficacy as in adults.[21,83–87]
- Statin therapy is recommended at age ≥10 years in males and after the onset of menses in females.[77] In selected patients with extremely high LDL levels, associated lipid abnormalities or other risk factors, or the presence of a particularly worrisome family history, statin therapy may be initiated at a younger age. Appropriate safety monitoring and surveillance of growth and development is recommended.[77] The use of bile-acid binding resins and the cholesterol absorption inhibitors should be considered important adjunctive therapy in combination with a statin.
- Some evidence suggests that consumption of plant sterol esters may be a useful adjunct to therapy.[88–91] Other therapies, such as antioxidant vitamins[92,93] and docosahexanoic acid,[94] are more controversial, and some other complementary therapies have been shown to have no therapeutic effect.[95]
- Identification and treatment of comorbidities have been shown to be effective. Specific management is outlined in the algorithm shown in the Figure and in Tables 2 and 3.

Diabetes Mellitus

Introduction

Diabetes mellitus, a metabolic disease characterized by hyperglycemia that results from defects in insulin secretion (type 1) and insulin action (type 2), is associated with accelerated development of vascular disease. Diabetic vascular disease in children and adolescents with type 1 diabetes mellitus is represented mainly by microangiopathy that involves the eye and kidney. In adults with diabetes, microangiopathy persists and is responsible for the high incidence of renal failure; however, a major cause of morbidity and early mortality is macroangiopathy, characterized by clinical cardiovascular, cerebrovascular, and peripheral vascular disease.[96–98]

Because insulin is the only significant hypoglycemic hormone, hyperglycemia is the result of impaired secretion of insulin; resistance to the effect of insulin in liver, muscle, and fat cells; or a combination of these pathophysiological situations. Insulin resistance is very frequently seen in association with obesity, particularly abdominal obesity.

The most recent criteria for diagnosis of diabetes recommended by the American Diabetes Association are as follows[99]:

1. Symptoms of diabetes (polyuria, polydipsia, or unexplained weight loss) plus casual plasma glucose concentration ≥200 mg/dL (11.1 mmol/L). (ñCasualò means any time of day, without regard to time since last meal.) *OR*
2. Fasting plasma glucose concentration ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 hours. *OR*
3. Two-hour plasma glucose concentration ≥200 mg/dL (11.1 mmol/L) during an oral glucose tolerance test. The test should be performed as described by the World Health Organization with a glucose load that contains the equivalent of 75 g of anhydrous glucose dissolved in water.
4. Current American Diabetes Association guidelines recommend 100 mg/dL as the upper limit of normal for fasting glucose in adults.
5. In the absence of unequivocal hyperglycemia with acute metabolic decompensation, these criteria should be confirmed by repeat testing on a different day. An oral glucose tolerance test is not recommended for routine clinical testing.

The progression from insulin resistance and impaired carbohydrate metabolism to type 2 diabetes mellitus has been documented in adults[100,101] and children.[102,103] In adults, weight loss has been shown to reverse this, with frank diabetes regressing to insulin resistance.[104] Patients with impaired fasting glucose and/or impaired glucose tolerance are referred to as ñprediabetic,ò which acknowledges the relatively high risk for development of frank diabetes.[105] With the current obesity epidemic and its metabolic consequences, the identification of children with early prediabetes is very important, because appropriate management may decrease the progression to overt diabetes. The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus defines impaired fasting glucose as >100 mg/dL (5.6 mmol/L) but <126 mg/dL (7.0 mmol/L) and impaired glucose tolerance as 2-hour oral glucose tolerance test values >140 mg/dL (7.8 mmol/L).[99,106] Specific guidelines have been defined for screening for type 2 diabetes mellitus in obese children, particularly those from high-risk racial/ethnic groups (Native American, Hispanic-American, black, Asian, and Pacific Islander), those with a positive family history of type 2 diabetes mellitus, and those with physical signs of insulin resistance.[37]

Epidemiology: Type 1 Diabetes Mellitus

Epidemiological data from the Third National Health and Nutrition Examination Survey (NHANES III) reveal that the prevalence of type 1 diabetes mellitus in adolescents is 1.7/1000. Although limited, data show a significant increase in atherosclerosis in adolescents and young adults with diabetes relative to nondiabetics.[107–109]

Adolescents with type 1 diabetes mellitus have increased levels of subclinical atherosclerosis as measured by carotid intima-media thickness and by radial tonometry.[110–112] In children, type 1 diabetes mellitus is independently associated with oxidative modification of LDL cholesterol.[113]

Pathogenesis of Premature Atherosclerosis: Type 1 Diabetes Mellitus

Hyperglycemia is the primary mediator of atherosclerosis in type 1 diabetes mellitus; insulin therapy to control this should be under the direction of endocrinology specialists. Hyperglycemia causes raised levels of atherogenic, cholesterol-

enriched, apolipoprotein Bï containing remnant particles by reducing the expression of heparin sulfate.[114]

Autopsy studies in young adults with fatal myocardial infarction and type 1 diabetes mellitus showed that the atherosclerotic plaque in these patients was more dense in fibrous tissue than the more calcific plaques of nondiabetic individuals; this may influence the timing and severity of clinical disease in these patients.[115] In addition, microalbuminuria is a predictor of increased risk for vascular complications.[116]

In defining risk for adults, the presence of type 1 diabetes mellitus is considered the equivalent of a history of coronary disease.[98] The intensity of lipid-lowering therapy is correspondingly increased in this setting.

Epidemiology: Type 2 Diabetes Mellitus

In 2003, the US Centers for Disease Control and Prevention reported that 40% (5.2 million) of all diabetic individuals >35 years of age had been diagnosed with cardiovascular disease. Although it was previously considered a disease of adults, in the past decade, type 2 diabetes mellitus has become a far more common occurrence in the pediatric population. Depending on the ethnic composition of the population, between 8% and 50% of newly diagnosed adolescent diabetic patients have type 2 diabetes mellitus.[117,118] Data from NHANES III reveal that the prevalence of type 2 diabetes mellitus in adolescents is 4.1/1000. These increases coincide with increasing rates of overweight and physical inactivity in children.[119]

Because type 2 diabetes mellitus is a relatively recent problem in adolescents, few long-term follow-up data exist. One study of Pima Indians followed a cohort of 36 individuals for a mean of 10 years to a median age of 26 years. At baseline (age 5 to 19 years), 85% were obese, and 14% had hypertension, whereas 30% had total cholesterol >200 mg/dL, and 55% had triglyceride concentrations >200 mg/dL. Fifty-eight percent of the patients had microalbuminuria, and 16% had a urinary albumin/creatinine ratio >300 mg/g, which indicates that the renal effects of diabetes were already present at diagnosis. After 10 years of follow-up, the number of patients with increased urinary albumin excretion was increased significantly, as was the magnitude of albuminuria, which is evidence of increased cardiovascular risk over that relatively short period of time.[120]

In adults, the metabolic syndrome is now an extremely common diagnosis. This cluster of findings (abdominal obesity, insulin resistance, dyslipidemia, and hypertension) frequently appears together and has been shown to predict future overt diabetes and early cardiovascular disease.[121] There is no current definition for metabolic syndrome in children, but the components of this diagnosis are known to cluster together as they do in adults.[122] Presence of the components of the metabolic syndrome in adolescence has been shown to predict early cardiovascular disease.[123] Although no current guidelines address management of the metabolic syndrome in children, it is important to identify and address the individual elements of the syndrome whenever a child presents with obesity.

Pathogenesis of Premature Atherosclerosis: Type 2 Diabetes Mellitus

Both hyperglycemia and insulin resistance are implicated in endothelial dysfunction, to a greater degree in type 2 diabetes mellitus than in type 1.[124] Microalbuminuria is a predictor of increased risk for vascular complications.[116]

Insulin resistance has been implicated in the development of dyslipidemia by enhancing hepatic synthesis of very-low-density lipoprotein (VLDL), which results in increased plasma triglyceride and LDL cholesterol levels.[125] Resistance to the action of insulin on lipoprotein lipase in peripheral tissues may also contribute to elevated triglyceride and LDL cholesterol levels.[126,127] Insulin resistance may also be responsible for the reduced levels of HDL cholesterol observed in type 2 diabetes mellitus, and this is accounted for by an increase in the rate of apolipoprotein A1/HDL cholesterol degradation, which exceeds the rate of its synthesis.[128] The increase of triglyceride-rich lipoproteins due to both exaggerated postprandial lipemia and VLDL overproduction in the face of low lipoprotein lipase activity results in long residence time of these particles in circulation and the formation of small, dense LDL.

Insulin resistance is also associated with hypertension through urinary sodium retention, increased sympathetic nervous system activity,[129] and stimulation of vascular smooth muscle growth.[130] Insulin levels have been found to be significantly higher in adult patients with essential hypertension[131ï 133] and borderline hypertension[134] than in normotensive control patients. In addition hyperinsulinemia is known to directly stimulate the formation of the atherogenic plaque by promoting smooth muscle proliferation, connective tissue formation, and LDL deposition in the plaque.

Other intrinsic metabolic factors such as apolipoproteins, lipoprotein(a), and homocysteine are known to influence the development of cardiovascular disease; their potential relationship to insulin resistance remains to be clarified. Free fatty acids may also stimulate, either independently or in concert with hyperglycemia, the production of reactive oxygen species (oxidative stress),[135] which has been associated with target-organ damage such as that related to diabetes and atherosclerotic cardiovascular disease.[136] Finally, oxidative stress is associated with an increase in insulin resistance.[137]

Risk Factors/Comorbidities

Patients with type 2 diabetes mellitus often have other risk factors for cardiovascular disease. It is believed that obesity leads to insulin resistance and increased circulating insulin concentrations over time. At some point, a loss of control of blood glucose begins to emerge, resulting in dietary glucose intolerance and ultimately in type 2 diabetes mellitus. Obese individuals develop different degrees of insulin resistance, and not all those with obesity develop glucose intolerance. Obesity-associated insulin resistance varies significantly with genetic background. Black children are more insulin resistant than age-, sex-, and body mass index (BMI)ï matched white children.[138] The factors that make some individuals more likely to progress to type 2 diabetes mellitus are not well understood at the present time.[139] A strong family predisposition is known to exist, and parental history is therefore

important in risk assessment. In the future, genetic markers may help identify those offspring of diabetic parents who are at greatest risk of developing diabetes. Children with type 2 diabetes mellitus are usually diagnosed after 10 years of age and are almost always obese. The mean BMI in clinical series has ranged from 26 to 38 kg/m^2.[117,118] Current American Diabetes Association guidelines recommend routine glucose testing in obese children >10 years of age with 2 additional risk factors for type 2 diabetes mellitus.[37]

The prevalence of hypertriglyceridemia has ranged from 4% to 32%.[113,114] Weight control improves glucose tolerance, with a recommended weight loss in adults of 10% to 15%.

The prevalence of hypertension has ranged from 17% to 32%. Essential hypertension is known to be associated with diabetes in adults,[139] and it is estimated that the cardiovascular risk doubles when hypertension and diabetes coexist. Prevalence data are not available for hypertension in children with diabetes.

Exercise training improves insulin sensitivity and endothelial vascular function beyond the benefits of glycemic control and blood pressure reduction in children and adults.[140,141] Agents such as metformin and thiazolidinediones have been used effectively in adolescents with type 2 diabetes mellitus and have been shown to decrease BMI and improve glucose tolerance.[142,143]

Recommendations in Children With Diabetes Mellitus

Children With Type I Diabetes Mellitus Who Are at High Risk for Early Cardiovascular Disease (Tier I)

Optimal management of hyperglycemia will modify this risk, but aggressive management of related risk factors has been shown to improve outcome and is recommended. Specific management recommendations are presented in the algorithm (Figure) and accompanying tables.

Children With Type 2 Diabetes Mellitus Who Are at Moderate Risk for Cardiovascular Disease (Tier II)

The differences between type 1 and type 2 diabetes mellitus are significant: Age at presentation for type 1 diabetes mellitus is younger, with 25% of patients diagnosed between 5 and 10 years of age and another 40% between 10 and 15 years of age; typically, the degree of hyperglycemia in type 1 diabetes mellitus is severe, and patients are very symptomatic. By contrast, type 2 diabetes mellitus diagnosed in childhood usually presents asymptomatically, with mild to moderate hyperglycemia in adolescence in combination with obesity, signs of insulin resistance, and other components of the metabolic syndrome. When type 2 diabetes mellitus begins in childhood, the risk for accelerated atherosclerosis is increased beyond that seen in those who develop this diagnosis as adults, but less than when type 1 diabetes mellitus is diagnosed in a child. Specific recommendations for management are contained in the algorithm (Figure) and accompanying tables; using the treatment algorithm, patients with type 2 diabetes mellitus are defined as being at moderate risk but will almost always be managed as ñhigh riskò because of associated comorbidities.

Pediatric Chronic Kidney Disease

Introduction

Success with renal replacement therapy has lengthened the life expectancy of children with chronic kidney disease (CKD) and end-stage renal disease (ESRD). Now, morbidity and mortality in children with CKD/ESRD are not only related to chronic renal failure and renal replacement therapy but also to cardiovascular disease as a result of prolonged exposure to cardiovascular risk factors.

Epidemiology

Cardiovascular disease now accounts for the majority of deaths in adults with ESRD and approximately one fourth of pediatric ESRD deaths.[144–146] The cardiac abnormalities associated with ESRD include pericardial disease, arrhythmias, abnormalities of left ventricular function, and CAD.[144,145] Twenty percent of hospitalizations in pediatric ESRD patients enrolled in Medicare are reported to be due to arrhythmias, 10% to cardiomyopathy, and 3% to a cardiac arrest.[147] The incidence of cardiomyopathy reported among pediatric ESRD patients doubled over the 6-year period from 1991 to 1996.[147]

Pathogenesis

The mechanisms that lead to cardiovascular disease in CKD primarily originate with vascular or myocardial injury from a multitude of highly prevalent cardiovascular risk factors in renal failure, and perhaps uremia itself. Damage to the vascular endothelium and left ventricle manifests as accelerated CAD and cardiomyopathy and has been described extensively in adults undergoing dialysis or after kidney transplantation. In children with CKD, subclinical manifestations of vascular disease have been reported.

Subclinical evidence of atherosclerosis with intimal plaque has been reported in pediatric ESRD. In a series of children with iliac artery biopsy at the time of transplantation, atherosclerosis in the uropathy group was also associated with increased serum calcium and longer duration of dialysis.[148]

Medial vessel calcification and arteriosclerosis or Mönckebergös arteriosclerosis has also been reported in the pediatric ESRD population, with vascular calcification in the coronary arteries, aorta, peripheral vessels, and aortic valve. An autopsy series of subjects with CKD revealed soft tissue calcification in 60% of the pediatric patients, half of whom were undergoing dialysis at the time of death.[149] In a small autopsy series, 4 of 8 had evidence of arteriosclerosis, diffuse vascular calcification, and calcified valves.[150]

There is evidence of significant left ventricular hypertrophy in children with CKD and ESRD.[151] Depending on the setting and the classification system used, hypertrophy is reported in 40% to 75% of the pediatric ESRD population.[152–156] At initiation of dialysis, 69% of subjects 4 to 18 years of age had evidence of left ventricular hypertrophy.[152] Postmortem studies have shown >50% of children with ESRD have evidence of left ventricular hypertrophy.[150]

Decreased arterial wall compliance is also common among dialysis patients, coincident with worsening left ventricular hypertrophy.[157] Stiffness of the aorta has been shown to be higher in children undergoing dialysis than in healthy control subjects.[157] Carotid artery compliance has been shown to be

significantly lower in children undergoing dialysis, with the decrease correlating significantly with age and blood pressure.[157]

Risk Factors/Comorbidities

Most risk factors for the development of cardiovascular disease are highly prevalent in CKD. Hypertension is seen in 49% of children with CKD[158] and 50% to 60% of patients undergoing dialysis.[159] Hypertension is even more common in the transplant population, with 65% to 80% of patients being treated.[159] In the young adult population, 18 to 35 years of age, systolic hypertension occurs in 51% and diastolic hypertension in 35% of the dialysis population.[160]

Approximately 29% to 87% of pediatric peritoneal dialysis patients have elevated cholesterol levels, with LDL >100 mg/dL (>2.29 mmol/L).[44] Similarly, 72% to 84% of pediatric kidney transplant recipients had LDL >100 mg/dL (>2.29 mmol/L).[44] In ESRD, triglycerides are consistently elevated, with average triglyceride levels >150 mg/dL and HDL cholesterol levels reduced. Lipoprotein(a), a lipoprotein associated with a mild increase in cardiovascular risk in the general population, is significantly elevated in ESRD, although the contribution to increased risk is unclear. Lipoprotein(a) is primarily genetically regulated, but increasing levels are also related to worsening renal function.[162,163]

Homocysteine levels also increase with worsening renal function, because metabolism of homocysteine may require intrarenal metabolism.[164] Homocysteine has been shown to be elevated in 65% of children with CKD.[165] Interestingly, the level only increases after 7 years of age and appears to be independent of renal function.[165,166] The higher the homocysteine levels in children with CKD, the lower the vitamin B_{12} and folate levels.[165,166]

C-reactive protein levels are elevated 3-fold in pediatric ESRD patients undergoing dialysis and 2-fold in renal transplant recipients compared with healthy control subjects.[167] C-reactive protein is highly correlated with coronary calcium, especially in patients who also have an elevated parathyroid hormone level. An elevated C-reactive protein level may reflect chronic inflammation from many sources, including overt or occult infectious processes, comorbid conditions such as access complications, and factors associated with the dialysis procedure per se, including bioincompatible membrane and possibly dialysate leak in the membrane.[168]

Coronary calcium burden is increased, as measured by coronary computed tomography with either helical or electron-beam computed tomography. In young adults with a history of pediatric ESRD, higher calcium scores are associated with longer dialysis duration and elevated C-reactive protein levels.[167,169] It is not known to what extent this represents a dramatic acceleration of atherosclerosis in ESRD or an increased propensity for calcium to accumulate in the medial wall of the coronary vessel owing to altered calcium phosphorus metabolism in ESRD.

Endothelial dysfunction assessed by brachial artery reactivity in CKD is independent of lipid levels and hypertension but is correlated with left ventricular hypertrophy expressed as left ventricular mass index.[166,170] In 25 children with CKD, a double-blind, placebo-controlled, randomized crossover trial of folic acid for 8 weeks showed statistically significant improvement in endothelium-dependent dilatation with lowering of homocysteine levels.[171]

Treatment Recommendations for Children With CKD

Children With CKD Who Are at High Risk for Cardiovascular Disease (Tier I)

- The origins of cardiovascular morbidity and mortality are in childhood, when the cardiovascular risk milieu is established. Recommendations are directed toward children with CKD stage 5 (estimated glomerular filtration rate <15 mL·min^{-1}·1.73 m^{-2}), children undergoing dialysis, and renal transplant recipients.
- The risk of cardiovascular disease can be reduced by modifying traditional cardiovascular risk factors and monitoring for end-organ injury through the use of echocardiography to estimate left ventricular mass[172] and, in young adults, computed tomography studies for coronary calcium. Chronic cardiovascular risk factor reduction, begun early in the course of CKD, should be an essential part of clinical management.
- Specific guidelines for cardiovascular risk factor management in children with advanced CKD or ESRD are available from the National Kidney Foundation's Kidney Dialysis Outcomes and Quality Initiative. The guidelines include recommendations for management of cardiovascular disease in dialysis patients and for treatment of hypertension and dyslipidemias in CKD.[44,172,173]

These recommendations were considered in development of the algorithm shown in the Figure and the treatment guidelines described in Tables 2 and 3.

Pediatric Heart Transplantation

Introduction/Epidemiology

Orthotopic heart transplantation (OHT) in children continues to increase in frequency, with ≈400 transplantations performed annually in children in the United States.[174] After heart transplantation, transplant CAD is the most important cause of mortality beyond the first year after surgery in adults.[175] In pediatric survivors of OHT, transplant CAD has been found to be the primary cause of late mortality in 20% to 30% of cases.[176,177] On the basis of combined angiographic and intracoronary ultrasound imaging, 74% of pediatric heart transplant patients have evidence of transplant CAD.[178] In a recent pathology series, 94% of pediatric OHT specimens showed evidence of cardiac allograft vasculopathy.[179]

Pathology/Natural History

The histopathology of transplant CAD is the same in children as it is in adults and differs markedly from the typical atherosclerotic process. Histologically, monocyte and T-cell accumulation plus concurrent smooth muscle proliferation comprise the intimal hyperplasia of the coronary arteries.[180] Some degree of coronary intimal thickening is seen in virtually every heart transplant recipient beginning in the first year after transplantation.[181]

Angiographically, affected coronary vessels demonstrate diffuse concentric narrowing along their entire length. With intravascular ultrasound, the pathological process is characterized by concentric intimal thickening.[182]

When stenosis is diagnosed in the context of transplant CAD, both surgical and catheter revascularization techniques have been used with initial procedural success rate. However, over a very short period of time, the restenosis rate is high, and the long-term outcome is poor.[183] The only other option is retransplantation, with known limitations on organ procurement and potential development of coronary vasculopathy in the retransplanted heart.[184]

Pathogenesis

The pathogenesis of transplant CAD is complex and is still not completely understood. The underlying mechanism has been shown to involve multiple factors including those mechanisms discussed below.

Rejection

Development and progression of transplant CAD have been shown to correlate with evidence of increased rejection.[185] Noncompliance with immune-suppressive regimens correlates significantly with increased transplant CAD in children[186] and adults.[187] Conversely, regression of transplant CAD has been demonstrated with improved immunosuppression in adults.[188]

In children, late rejection is an independent predictor of transplant CAD, and increased immune suppression has been shown to correlate with a decreased incidence of transplant CAD.[189,190] Introduction of novel proliferation signal inhibitors such as sirolimus as part of immunosuppressive therapy has been associated with a decrease in transplant CAD in adults; this type of drug is now being used in children.[191]

Donor Status

In adults, older donor age, donor atherosclerotic disease, donor hypertension, and male sex of either donor or recipient have been shown to correlate with transplant CAD.[192] Donor hearts from patients who suffered explosive brain death have also been shown to have earlier onset of transplant CAD.[193]

Cytomegalovirus Infection

In adults and in children, cytomegalovirus infection has been associated with accelerated coronary vasculopathy after OHT.[194,195] Preemptive treatment with ganciclovir and cytomegalovirus hyperimmune globulin has reduced the incidence and delayed the progression of transplant CAD.[196]

Risk Factors/Comorbidities

Hyperlipidemia

After transplantation, the combination of immunosuppressive therapy, obesity, and an underlying genetic predisposition to hyperlipidemia promotes combined hyperlipidemia, with elevated total and LDL cholesterol, high triglycerides, and reduced HDL cholesterol.[197,198] Hyperlipidemia is present in ≈60% of adults and at least 40% of children in the first year after transplantation.[198,199]

Elevated levels of triglycerides have been shown to correlate directly with increased prevalence of transplant CAD in adults.[200] In adults, a greater increase in LDL cholesterol in the first year after transplantation has been associated with increased severity of transplant vasculopathy.[201] Lipid-lowering therapy with 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors (statins) has led to lower total and LDL cholesterol levels and a significantly lower incidence of transplant vasculopathy in both adults and children.[201,202] Benefits have been maximized when lipid therapy has been initiated immediately after transplantation.

Obesity

After transplantation, progressive obesity is common in both children and adults, correlating with the intensity and duration of steroid treatment.[203,204] In adults and children, pretransplantation and posttransplantation BMI have been shown to be strong predictors of transplant CAD.[204] The association of obesity and the metabolic syndrome confers additional risk for transplant CAD and for progression of donor atherosclerosis.[205]

Hypertension

Cyclosporine therapy, a mainstay of immune suppression after heart transplantation, is associated with hypertension and with renal dysfunction. By 3 years after transplantation, 35% of pediatric heart transplant patients are undergoing chronic antihypertensive therapy; however, in cyclosporine-treated children, 83% of long-term survivors required antihypertensive therapy.[174,176]

Both hypertension and renal failure are predictors of progressive atherosclerotic disease and of transplant CAD.[185] Treatment with angiotensin-converting enzyme inhibitors and calcium channel blockers is associated with a reduction in transplant CAD in adults.[206,207]

Use of the antioxidant L-arginine has been shown to reverse endothelial dysfunction and attenuate hypertension after transplantation.[208] Use of omega-3 fatty acids has also been shown to reduce the rise in blood pressure after heart transplantation.[209] Immune suppression with proliferation signal inhibitors, such as everolimus, has resulted in a decrease in cyclosporine dose and in renal dysfunction in adults.[210]

Insulin Resistance/Diabetes Mellitus

Both chronic hyperglycemia as evidenced by elevated hemoglobin A_{1C} and overt diabetes are prevalent in adult patients after heart transplantation.[205,211] Approximately 2% of pediatric heart transplant recipients develop diabetes.[212] In adults, higher glucose and insulin levels and elevated levels of hemoglobin A_{1C} are associated with increased evidence of transplant CAD.[205,211]

Deconditioning

In both children and adults, exercise performance, expressed as measured maximum oxygen uptake, improves from pretransplantation levels but remains significantly reduced compared with normal subjects. This has been attributed in part to chronotropic incompetence caused by cardiac denervation, but deconditioning is also common.[213,214]

In children and adults, exercise training programs result in increased exercise capacity and in decreased resting heart rate and blood pressure, improved endothelial function, and in-

creased lean body mass, all known factors in the pathogenesis of allograft vasculopathy.[215,216] With serial exercise testing, exercise performance deteriorates as transplant CAD develops.

Hyperhomocysteinemia

In adults and children, elevated homocysteine levels are common after OHT.[217,218] In adult subjects with evidence of transplant CAD, homocysteine levels have been shown to be significantly higher than in those without evidence of vasculopathy.[217] Folate supplementation in adults and children after OHT normalized homocysteine levels, with no evidence to date of any impact on development of transplant CAD.[219]

Treatment Recommendations After Pediatric Heart Transplantation

After Pediatric Heart Transplantation, Children Are at High Risk for Very Early Cardiovascular Disease (Tier I)

- Please see the algorithm in the Figure and Tables 2 and 3 for specific treatment guidelines.
- Although the process appears to be primarily mediated by chronic rejection, modification of traditional risk factors, particularly reduction in LDL cholesterol, has significantly affected the disease process in children and adults.
- Risk factor identification and intensive modification are indicated beginning in the early posttransplantation period.[184] Although there are no guidelines for lipid management after heart transplantation in children, usual care in the United States includes initiation of lipid-lowering therapy with 3-hydroxy-3-methylglutaryl coenzyme A enzyme inhibitors in the early posttransplantation period.[220]
- Optimization of immunosuppression, improved compliance, and preemptive treatment of cytomegalovirus are all critical factors in the pathogenesis of transplant CAD that are being addressed by transplantation cardiologists.
- Specific screening for evidence of transplant CAD is recommended every 6 to 12 months with angiography, with optional intravascular coronary ultrasound.[221] Dobutamine stress echocardiography or stress perfusion imaging may be helpful in risk stratification.[222]
- Patients who develop any evidence of graft dysfunction should be screened specifically for transplant CAD.

Kawasaki Disease

Kawasaki disease is an acute, self-limited vasculitis of unknown origin that occurs predominantly in infants and young children. First described in 1967 in Japan, the disease is now known to occur throughout the world in children of all races.[223] Kawasaki disease is characterized by fever, bilateral nonexudative conjunctivitis, erythema of the lips and oral mucosa, changes in the extremities, rash, and cervical lymphadenopathy. The cause of Kawasaki disease remains unknown, and no specific diagnostic test or pathognomonic clinical feature can confirm the diagnosis early in the illness. Kawasaki disease is likely to be caused by an infectious agent(s) that produces clinically apparent disease in genetically predisposed individuals.[224] Coronary artery aneurysms or ectasia develops in approximately 15% to 25% of untreated children with the disease and may lead to myocardial infarction, sudden death, or ischemic heart disease.[225,226] Kawasaki disease has now surpassed acute rheumatic fever as the leading cause of acquired heart disease in children[227]; >4000 hospitalizations associated with Kawasaki disease occurred in the United States in 2000.[228] Therapy of Kawasaki disease in the acute phase is aimed at reducing inflammation in the coronary artery wall and preventing coronary thrombosis. Long-term management is guided by stratification of patients according to the severity of their CAD and consequent risk of myocardial ischemia. Although coronary artery aneurysms produce the most serious sequelae of Kawasaki disease, vascular inflammation during the acute stage of the illness is diffuse. Children with coronary aneurysms, and even those in whom coronary dilatation was never detected, appear to be at increased risk for future atherosclerotic CAD on the basis of abnormalities in arterial stiffness and endothelial function.

Pathology

Kawasaki disease is a generalized systemic vasculitis that involves blood vessels throughout the body. Aneurysms affect medium-sized extraparenchymal arteries and result from segmental destruction of the vessel wall in sites strikingly similar to those affected by atherosclerosis.[229] Although aneurysms in the coronary arteries are the main cause of morbidity and mortality, they can also occur in other vessels, such as the celiac, mesenteric, femoral, iliac, renal, axillary, and brachial arteries.[229]

Early in the illness, coronary arteries demonstrate marked edema and infiltration of the arterial wall, initially by neutrophils,[230] with a rapid transition to mononuclear cells, primarily CD8+ T cells, monocytes, macrophages, and IgA plasma cells.[231–234] This cellular infiltration is accompanied by destruction of the internal elastic lamina and media, which results in aneurysm formation. Matrix metalloproteinases (MMPs) are likely to effect destruction and remodeling in the arterial wall.[235,236] MMP-2 expression is prominent in the thickened neointima and in endothelial cells of new capillaries in areas of angiogenesis, and MMP-9 is expressed in coronary artery aneurysms, nonaneurysmal coronary arteries, and noncoronary arteries.

Coronary arterial remodeling occurs over months to years, sometimes with progressive stenosis due to intimal proliferation and neoangiogenesis; it differs from that seen in adult atherosclerosis by extensive expression of vascular growth factors, such as tumor necrosis factor-β, platelet-derived growth factor-α, basic fibroblast growth factor, and vascular endothelial growth factor, in the microvessels of the intima.[237] These growth factors are prominently expressed at the inlet and outlet of aneurysms, where they are activated by high shear stress.[237]

Few postmortem studies are available in children in whom coronary abnormalities were not detected in the acute phase. Recently, Suzuki and colleagues[238] performed the first immunohistochemical study of the coronary arteries of a child without coronary dilation by echocardiography at any stage of illness and who died of unrelated causes. The coronary artery intima was mildly thickened, and platelet-derived growth factor-α, transforming growth factor-β1, and induc-

ible nitric oxide synthase were expressed in the intimal smooth muscle cells in the child with normal coronary dimensions after Kawasaki disease but not in control subjects.

Natural History

Cardiovascular complications and long-term sequelae of Kawasaki disease depend on the severity of coronary artery lesions. The risk of coronary aneurysms is highest among children who do not receive timely treatment with high-dose intravenous immunoglobulin (≤10 days and ideally 7 days from the onset of fever), who have persistent fever despite treatment with intravenous immunoglobulin, or who have laboratory test results that reflect severe, persistent inflammation. Young (<6 months) or old (>8 years) age and male sex are also risk factors.

Patients With Aneurysms (High Risk)

Among patients with aneurysms, the incidence of coronary stenosis secondary to myointimal proliferation increases linearly with time since illness onset.[225,239,240] The likelihood of progression to coronary artery stenosis is directly related to aneurysm size and is especially high among arterial segments with giant aneurysms (≥8 mm in diameter).[240,241] Patients with persistent aneurysms have systemic inflammation years after disease onset, as evidenced by C-reactive protein levels that are significantly higher than those seen in normal age-matched children or among those who had Kawasaki disease without aneurysms or with regressed aneurysms.[242]

Patients With Regressed Aneurysms (Moderate Risk)

Angiographic regression of aneurysms to normal lumen diameter occurs in ≈50% of vessels by 2 years after illness onset.[225,243] The likelihood of resolution of an aneurysm is inversely related to its size.[243–245] Pathological studies have shown that regression occurs primarily through fibrous intimal thickening.[246–248] Intravascular ultrasound of regressed coronary aneurysms demonstrates either marked symmetrical or asymmetrical myointimal thickening.[249–251] Regressed coronary artery aneurysms are not only histopathologically abnormal but also have reduced vascular reactivity to isosorbide dinitrate and constriction with acetylcholine, which indicates endothelial dysfunction.[252–254]

Intravascular ultrasound has revealed a significant direct correlation between the initial diameters of the coronary arteries and the degree of intimal-medial thickness >10 years later.[250] Individuals with persistent or regressed aneurysms have greater stiffness of the proximal and peripheral arterial beds, as well as higher arterial wave reflection, than normal control patients.[255] Indeed, aortic pressure waveforms of Kawasaki disease patients with persistent or regressed aneurysms late after illness onset resemble those generally observed in the elderly.[255]

The carotid artery wall in patients with coronary artery lesions 6 to 20 years after illness onset has been found to be less distensible and thicker than that in control patients.[256] These changes of arterial properties in patients with Kawasaki disease are not associated with major alterations of the lipid profile and are postulated to be secondary to the changes in arterial walls that occur after the diffuse vasculitis. Extrapolation from these findings in carotid arteries suggests that the coronary arteries may be predisposed to accelerated atherosclerosis in patients with Kawasaki disease and coronary artery lesions.

Patients Without Detectable Coronary Aneurysms (At Risk)

With careful clinical follow-up 10 to 20 years after Kawasaki disease onset, such patients appear to have morbidity and mortality that are similar to those in the normal population.[257] Increased risk for premature atherosclerosis in these children is suggested by research studies that have demonstrated subclinical abnormalities of arterial function and myocardial flow reserve.[258–261]

Kawasaki disease patients with normal coronary arteries have been reported to have higher brachial-radial artery mean pulse-wave velocity than normal children, which suggests increased arterial stiffness.[262,263] Lower myocardial flow reserve and higher total coronary resistance have been found in children without coronary dilation after Kawasaki disease compared with normal controls.[264] Children without detectable coronary abnormalities have been reported to have abnormal endothelium-dependent brachial artery reactivity.[261] Data conflict with regard to impairment of endothelium-dependent relaxation of the epicardial coronary arteries among children in whom coronary artery dilation was never detected.[265,266]

Presence of Comorbidities

With or without overt coronary artery sequelae, Kawasaki disease produces altered lipid metabolism (in particular, lower HDL cholesterol) that persists beyond clinical resolution of disease.[262,267,268] North American children with Kawasaki disease have been reported to have a more adverse cardiovascular risk profile, with higher blood pressure and greater adiposity, than control children.[269]

Recommendations for Children After Kawasaki Disease

Kawasaki disease is associated with significant coronary artery pathology and comorbidities that predispose patients to atherosclerosis. Cardiovascular risk assessment and treatment in children with Kawasaki disease are based on the status of the coronary arteries: patients with persistent aneurysms, high risk (tier I); patients with regressed aneurysms, moderate risk (tier II); and patients without detected abnormalities, at risk (tier III). The algorithm and tables contain tier-specific management. In addition, patients should be encouraged to exercise to the greatest extent possible given coronary artery status, in accordance with the 36th Bethesda Conference recommendations.[41] Prospective counseling and annual assessment of risk factors for atherosclerotic CAD are recommended.

Chronic Inflammatory Disease

Introduction

In adults with chronic inflammatory disease, increased prevalence of cardiovascular disease is well documented. Specifically, patients with systemic lupus erythematosus (SLE) and rheumatoid arthritis experience cardiovascular events at a

significantly greater incidence than age-matched normal controls.[270,271] In women with SLE 35 to 44 years of age, the incidence of myocardial infarction is 50 times greater than for women without the disease. In adults with rheumatoid arthritis, cardiovascular disease is the leading cause of death, with rates that average 2 to 4 times those of age-matched controls. For both SLE and rheumatoid arthritis, the increased incidence of cardiovascular disease is not explained by traditional risk factors alone.[272,273]

For a substantial number of children with chronic inflammatory disease, the process will persist into adult life. Children constitute 15% to 20% of patients with SLE, and survival into adult life is now the norm.[274] In at least 50% of children with rheumatoid arthritis, active disease persists into adult life.[275] To date, no studies have tracked the development of atherosclerotic disease as children with chronic inflammatory disease age. In a small series, 16% of 31 children with SLE were shown to have abnormalities of coronary perfusion with thallium perfusion scanning.[276] Several studies document evidence of increased markers for subclinical atherosclerosis in young adults with both rheumatoid arthritis and SLE.[277,278] Extrapolating from these, the atherosclerotic process appears to begin at an earlier age and progress at an accelerated pace for those with chronic inflammatory disease that begins in childhood.

Pathophysiology of Accelerated Atherosclerosis in Adults With Chronic Inflammatory Disease (Rheumatoid Arthritis and SLE)

Major similarities exist between the inflammatory and immune responses in atherosclerosis and in chronic inflammatory disease.[279] Inflammation is part of the pathology of atherosclerotic plaque, and serum markers of inflammation, including C-reactive protein, cytokines, serum amyloid-α, and tumor necrosis factor-α, have been shown to mediate the development of atherosclerosis.[280–283]

At autopsy, coronary stenotic lesions are typical of traditional atherosclerotic plaque, with the addition of a higher population of cellular components. In a very small number of cases, an acute vasculitic process alone has been associated with a coronary thrombotic event.[284]

The degree of inflammation in adult SLE and rheumatoid arthritis patients as measured by laboratory testing correlates with markers of subclinical atherosclerosis, including increased carotid intima-media thickness and impaired arterial dilation assessed by ultrasound, as well as increased coronary calcification by electron-beam computed tomography.[278,285–288] In adults, increased severity of disease and greater cumulative damage assessed by standard scoring systems have been shown to correlate with evidence for atherosclerosis, which suggests that systemic inflammation itself is a major mediator of the development of atherosclerosis in these disease settings.[278,287–289]

Conflicting reports exist with regard to a potential role for antiinflammatory and immunosuppressive treatment. Several studies have shown a negative correlation between the extent of atherosclerosis and the cumulative dose and duration of immunotherapy. This suggests that optimization of immune therapy is a potential approach to reducing the development of atherosclerosis.[285,290] Conversely, others have reported increased coronary disease in adult patients with more long-term antiinflammatory and immunosuppressive therapy, which implicates either increased severity of the disease process itself or an atherosclerotic response to treatment in the development of CAD.[278,291]

Glucocorticoid, cyclophosphamide, and methotrexate therapy are all associated with metabolic changes that have been shown to increase atherosclerotic risk by augmenting standard risk factors such as obesity, dyslipidemia, insulin resistance, and hypertension, independent of underlying diagnosis.[292] By contrast, methotrexate therapy has been shown to decrease cardiovascular mortality in patients with rheumatoid arthritis.[293]

A prothrombotic state associated with the presence of antiphospholipid antibodies develops in a significant proportion of adult patients with SLE (34% to 44%) compared with only 1% to 5% of the general population. The presence of these antibodies increases the risk of a vascular thrombotic event by a factor of at least 10 times when patients with lupus are compared with those without.[294]

In adult patients with rheumatoid arthritis, several thrombotic markers have also been shown to be elevated.[295] In addition, elevated levels of lipoprotein(a), considered to be a prothrombotic agent, have been demonstrated in patients with both rheumatoid arthritis and SLE.[296,297]

Renal disease is a common complication of SLE, and severe renal involvement with nephrotic-range proteinuria has been suggested to be a major risk factor for early atherosclerosis on the basis of a small series of young adults with juvenile-onset SLE studied by carotid ultrasound. Nephritis is associated with hypertension, and this may be the major mediator of increased carotid intima-media thickness, a subclinical marker of atherosclerosis noted to be abnormal in these patients. Nephritis may simply indicate overall increased severity of disease. Its presence needs to be expressly considered in the evaluation of cardiovascular risk in patients with SLE.[298,299]

Traditional Risk Factors/Comorbidities

Dyslipidemia

Abnormalities of the lipid profile have been identified in children and adults with both SLE and rheumatoid arthritis.[300,301] Typical findings vary with the disease state. During clinical flare-ups, the lipid profile pattern is typical of that seen in diverse inflammatory states, with elevated triglyceride and VLDL levels and reduced HDL cholesterol. After steroid therapy, elevated total and LDL cholesterol levels, with persistent but less impressive elevation in VLDL and triglycerides, have been described.[301,302] In addition, increased LDL susceptibility to oxidation has been reported in patients with chronic inflammatory disease in general and in pediatric patients with SLE in particular.[302,303]

Increased lipoprotein(a) levels are reported in patients with SLE and rheumatoid arthritis.[296,297] Clinical coronary disease and measures of subclinical disease correlate with dyslipidemia in adult patients with SLE and rheumatoid arthritis.[286,304–306] A single study of children with SLE demon-

strated normal endothelial function despite recorded lipid profile abnormalities.[307]

Statin therapy has been shown to have both lipid-lowering and antiinflammatory effects. A randomized, placebo-controlled trial of atorvastatin in adult patients with rheumatoid arthritis showed a reduced disease activity score, decreased levels of inflammation, and decreased levels of total/LDL cholesterol and triglycerides in the statin-treated group after 6 months.[308] A similar trial is ongoing for adult patients with SLE. No trial of lipid-lowering therapy and CAD incidence has been reported.

Hypertension

Hypertension occurs in a significant proportion of patients with SLE. At diagnosis in adults, 18% of patients with SLE have hypertension; by 10 years from diagnosis, this has increased to 59%.[309] In adults with rheumatoid arthritis and SLE, hypertension has been shown to be associated with an increased risk for manifest cardiovascular disease on long-term follow-up.[310,311]

Hypertension is much more prevalent in SLE patients with renal involvement and in children; nephritis is present in as many as 80% of patients. The combination of renal involvement and hypertension predicts an adverse outcome in juvenile onset SLE.[298,312] In addition to hypertension-related renal disease, both steroid and immunosuppressive therapies can be associated with hypertension and on this basis, hypertension occurs with increased incidence in patients with rheumatoid arthritis and is a factor for all children with chronic inflammatory disease. In both SLE and rheumatoid arthritis, hypertension is strongly associated with increased BMI.[313,314]

Obesity

Obesity is a frequent complication of chronic inflammatory disease in adults and children, reflecting the inactivity imposed by the disease process and the effects of steroid treatment. BMI has been shown to be higher in patients with SLE and rheumatoid arthritis who develop coronary disease than in age-matched patients with these diagnoses who do not develop cardiovascular disease.[313,314] The role of obesity is exaggerated by its association with the metabolic syndrome.[305]

Homocysteine

In adults in general, elevated levels of plasma homocysteine have been identified as a potential risk factor for atherosclerosis.[315] In patients with both rheumatoid arthritis and SLE, homocysteine levels have been shown to be increased, particularly in association with methotrexate therapy.[316,317] Oral administration of folic acid reduces homocysteine levels in both groups, but no reduction in atherosclerotic disease has been shown.[316,318]

Recommendations for Children With Chronic Inflammatory Disease

Children with chronic inflammatory disease are at moderate risk for premature cardiovascular disease (tier II) based on the combination of a chronic inflammatory state and the documented presence of multiple traditional risk factors.

- The atherosclerotic process is primarily mediated by chronic inflammation and immune dysregulation, but traditional risk factors are prevalent. Extrapolating from studies of adults with SLE and rheumatoid arthritis and of children in other high-risk settings, reduction in traditional risk factors should ameliorate the atherosclerotic process. A routine rigorous process of risk factor identification and treatment is indicated. Please see the algorithm (Figure) and Table 2 for specific diagnosis and treatment guidelines.
- Per immunology and rheumatology, treatment of the primary disease process with optimization of therapy to suppress the inflammatory response and its contribution to accelerated atherosclerosis is an important focus for disease management.

Congenital Heart Disease

Introduction/Epidemiology

Although the diagnosis of congenital heart disease includes rare and diverse disorders, some specific diagnoses appear to be associated with increased risk for premature atherosclerotic CAD. Children with congenital heart disease represent a growing population: The incidence of congenital heart defects is almost 1 in 100 live births, and of these, ≈23 of 1000 newborns will require invasive treatment or will die as a consequence of their diagnosis by 1 year of age.[319,320] Because of improved interventions, >1 million adults are now living with congenital heart disease.[321] Selected congenital heart defects (or the process of their repair) lead to an increased risk for adult cardiovascular disease compared with the general population. To date, relatively few data exist to provide an understanding of the presence of cardiovascular disease risk factors and the development of atherosclerosis in these patients.

Pathophysiology

Risk of premature atherosclerotic cardiovascular disease in patients with congenital heart defects is based on 2 principal mechanisms: lesions with coronary artery abnormalities and obstructive lesions of the left ventricle and aorta.

Lesions With Coronary Artery Abnormalities

Congenital coronary anomalies (in isolation or in association with other congenital defects) may predispose individuals to coronary events relatively early in life. In addition, surgical repair of congenital heart defects may result in abnormalities of the coronary arteries. The clinical outcome of coronary artery defects depends on the anatomy of the lesion.

Origin of the left main coronary artery from the right sinus of Valsalva, passing between the aorta and pulmonary artery, has been associated with sudden death, particularly during or just after physical activity.[322] In these patients, autopsies may reveal subendocardial scars and occasionally, large myocardial infarction. Importantly, atherosclerosis in a segment of the abnormal artery has been demonstrated even in young individuals.[322]

Other congenital anomalies of coronary origin and course (origin of the left circumflex from the right main coronary artery being the most common) are thought to have little clinical importance. However, these anomalous coronary

arteries have been reported to have a high incidence of coronary atheroma.[322] This high incidence may be due to abnormal blood flow patterns.

Some surgeries for congenital heart disease involve manipulation of the coronary arteries. These surgeries include the arterial switch operation for d-transposition of the great arteries and repair of anomalous origin of left coronary artery from the pulmonary artery. In these settings, coronary ostial stenosis may develop over time, and there may be increased risk of associated atherosclerosis.[323] A recent intravascular ultrasound study demonstrated proximal eccentric intimal thickening, a finding compatible with early atherosclerosis, in all the translocated coronary arteries in a small series of survivors of the arterial switch procedure studied at a median age of 9.5 years.[324] Abnormal epicardial coronary artery dilation in response to pharmacological stimulation has also been demonstrated in a small group of d-transposition subjects evaluated at a mean of 5 years after arterial switch.[325]

Obstructive Lesions of the Left Ventricle and Aorta

One group of congenital cardiac lesions that has been shown to be associated with increased risk of cardiovascular disease in adulthood is obstructive lesions of the left side of the heart.

Coarctation of the Aorta

The pathophysiology for acquired cardiovascular disease associated with coarctation of the aorta is primarily related to systemic hypertension.[326] Arterial abnormalities may persist after correction of the coarctation and result in long-term systemic hypertension and, therefore, increased risk of cardiovascular disease.

A 20-year postoperative follow-up study of patients who underwent repair in an era when coarctation repair was delayed (mean age at repair 20 years) reported a mortality rate of 12% at a mean age of 32.5 years. Deaths were secondary to myocardial infarction, stroke, congestive heart failure, and aortic rupture, which indicates the potential negative impact of the combination of this congenital diagnosis and chronic hypertension.[327]

Upper-body hypertension is related to constriction of the aorta at the site of repair, but coarctation may also be associated with abnormalities of vascular reactivity, arterial wall compliance, or abnormal baroreceptor function.[328–330] The prevalence of hypertension at rest after repair of coarctation is at least 10%.[331] Exercise-induced systolic hypertension may also occur in patients after repair of coarctation of the aorta, even when the blood pressure is normal at rest.[332] To evaluate for this, patients with coarctation should have routine exercise/blood pressure evaluation.

Beyond hypertension, coarctation of aorta is associated with other important sequelae that lead to morbidity and mortality, which suggests a more widespread vascular abnormality. Cerebrovascular accidents occur in association with systemic hypertension[326] and even in its absence, in the setting of berry aneurysms in the circle of Willis. Aortic dissection in the ascending aorta or near the repair site may occur whether or not an aneurysm forms in the aorta at the site of the repair. Persistent hypertension, older age at repair, association with bicuspid aortic valve, aortic atherosclerosis, and dilation of the aorta proximal to the repair site all predispose coarctation patients to this serious risk.[327,332]

Aortic Stenosis

Aortic stenosis occurs most often at the level of the aortic valve but can also be subvalvular or supravalvular and can result in myocardial changes that predispose to cardiovascular disease. Valvular aortic stenosis occurs in 3% to 6% of patients with congenital cardiovascular defects.[333]

Significant aortic stenosis is associated with left ventricular hypertrophy (due to increased left ventricular pressure and peak systolic wall stress, a powerful stimulus for hypertrophy). Left ventricular hypertrophy is known to be an independent risk factor for cardiovascular disease morbidity and mortality in adults.[334]

Myocardial blood flow may be compromised in patients with aortic stenosis, despite normal coronary artery patency. Increased myocardial work results in increased demand for oxygen, exceeding the capacity of the coronary supply (abnormal coronary flow reserve). Furthermore, redistribution of blood away from the subendocardium can result in ischemia in the subendocardium.[335]

Even mild aortic stenosis during childhood can progress and may therefore be associated with increased left ventricular mass and increased risk for cardiovascular disease over time. Increase in the left ventricular outflow tract gradient is caused by progressive calcification of the aortic valve.[333]

Supravalvular aortic stenosis (most commonly associated with Williams syndrome[336]) may confer an additional increased cardiovascular risk because of its association with arterial stenoses. Coronary artery ostial stenoses can result directly in myocardial ischemia and exercise-induced syncope, and renal artery stenosis can lead to hypertension.[337]

Hypertrophic Cardiomyopathy

Hypertrophic cardiomyopathy may occur in as many as 1 in 500 people. It is the most common genetically transmitted form of cardiovascular disease.[338,339] Hypertrophic cardiomyopathy is associated with an increased risk for sudden death in children and in adults.[340] The overall cardiovascular mortality rate is ≈2% per year for those diagnosed in childhood and ≈1% per year for those diagnosed as adults.[341] A number of pathophysiological sequelae may contribute to sudden death and potentially to increased cardiovascular disease risk in general.

Sudden death in patients with hypertrophic cardiomyopathy is usually due to a ventricular arrhythmia.[342] It is the most common cause of sudden death in the young. Vigorous physical activity may contribute to increased risk of sudden death in these patients.

Left ventricular hypertrophy is the major manifestation of hypertrophic cardiomyopathy, with a pathognomonic finding of cellular myocardial disarray. In addition, left ventricular outflow tract obstruction may exacerbate the development of hypertrophy.

Hypertrophic cardiomyopathy may be associated with myocardial bridging, in which epicardial coronary arteries can be compressed by muscle overgrowth. The presence of these vessels may result in increased risk of sudden death,

abnormal myocardial perfusion, and localized atherosclerosis in adjacent coronary segments.

The long-term role of hypertrophic cardiomyopathy in the development of atherosclerotic cardiovascular disease is not known. Similarly, the effect of modification of risk factors for atherosclerosis on the long-term prognosis of hypertrophic cardiomyopathy has not been established. Further study is needed to evaluate these issues.

Traditional Risk Factors/Comorbidities

All the known risk factors for accelerated atherosclerosis will occur at the same incidence as seen in the general population. In the setting of a repaired congenital defect, these may represent even more potent harbingers of premature cardiovascular disease.

Some children with repaired congenital heart defects may have limitation in their ability to perform physical activity. A sedentary lifestyle is an independent risk factor for accelerated atherosclerosis. In addition, such children may be even more prone to obesity in our current obesogenic environment. Cardiac rehabilitation has been shown to improve the exercise performance of children with congenital heart disease, even those with known residual cardiac dysfunction.[343] Published guidelines can be used to determine the level of exercise considered appropriate for specific congenital diagnoses.[41]

Recommendations for Children With Congenital Heart Disease

Because children with congenital heart disease have other abnormalities that may make the heart more vulnerable to both the development of atherosclerosis and the adverse sequelae of a cardiovascular event, it seems prudent to be aggressive about the evaluation of their cardiovascular disease risk status. This is particularly true of those with the congenital cardiac defects presented above. Children, adolescents, and young adults with these specific congenital heart diseases are at risk (tier III) for premature cardiovascular disease. The algorithm in the Figure and Table 2 provide specific management guidelines. Future research will clarify which additional congenital cardiac diagnoses require specific attention to cardiovascular risk reduction.

Childhood Cancer Survivors

Introduction/Epidemiology

The prevalence of childhood cancer has been steadily increasing over the past decades, exceeded only by the adult cancers of prostate, lung, breast, colorectum, and bladder.[344] A newborn child is estimated to have a 1 in 325 chance of developing cancer before 20 years of age.[344] Progressively more effective surgical intervention, radiotherapy, and risk-stratified chemotherapeutic approaches have led to dramatic improvements in survival rates for many childhood cancers during the past 3 decades.[345] The overall 5-year probability of survival for children diagnosed with cancer since 1992 is >77%.[346]

As many childhood cancer survivors progress into adulthood, clinical and epidemiological research is now focusing on an array of long-term medical and psychosocial effects from cancer treatment to characterize and understand the ñconsequences of cure.ò[347] Among 5-year or longer survivors of childhood cancer, the standardized mortality ratio for cardiac-related deaths was found to be significantly elevated at 8.2 (95% confidence interval 6.4 to 10.4).[348] The combination of acquired atherosclerotic disease with a previously damaged myocardium represents a serious late complication for survivors of childhood cancer. In a recent comparative study of 201 long-term childhood cancer survivors and 76 healthy siblings, Lipshultz et al[349] showed that overall, the cancer survivor group had increased cardiovascular risk due to the combination of reduced left ventricular mass and high prevalence of risk factors for atherosclerosis.

Pathophysiology

Both anthracyclines used as chemotherapy for childhood cancers and direct cardiac radiation have been associated with the development of dilated cardiomyopathy. With anthracyclines, the development of cardiac dysfunction is related to cumulative dose. The cardiomyopathy that develops can be severe, with cardiac transplantation required in a small number of cases. Subclinical cardiac dysfunction has been shown to be present in 14% to 47% of patients after anthracycline therapy.[350,351] Late-onset clinical symptoms mandate routine serial evaluation of cardiac function for these patients. Preliminary data suggest that pretreatment with dexrazoxane, a free-radical scavenger, may prevent or reduce cardiac injury related to doxorubicin infusion, but a clinical benefit has not yet been confirmed.[352]

Risk Factors/Comorbidities

Obesity

Obesity is very common in survivors of childhood cancer.[353] In adult survivors of childhood acute lymphoblastic leukemia, various factors, including female sex, genetic predisposition, exposure to steroids, and cranial radiation therapy, have been implicated in the development of excess body fat.[348,354–360]

Leptin, an adipocytokine produced by adipocytes, controls energy metabolism at the level of the hypothalamus by suppressing appetite and stimulating energy expenditure.[361,362] Leptin levels are elevated in otherwise healthy obese adults and children, which indicates resistance to the effects of leptin in these individuals.[363–366] Elevated leptin levels and leptin receptor abnormalities have been reported in childhood cancer survivors.[367,368]

Radiation exposure to the hypothalamic-pituitary axis in children can result in late-onset deficiency of growth hormone secretion and subsequent development of adult obesity.[348,356,368–372] Growth hormone is involved in the determination of fat cell size, fat cell differentiation,[370] and levels of resistin,[369] all of which are important determinants of insulin sensitivity.[368] Impaired growth hormone levels in childhood cancer survivors are potentially operative in the development of obesity, insulin resistance, and type 2 diabetes mellitus.[369–373]

Cachexia acutely affects ≈50% of cancer patients and is characterized by weakness, fatigue, loss of lean body mass, and abnormal metabolism. It may be associated with an increased risk for subsequent cardiovascular disease in child-

TABLE 2. Tiers I, II, and III: Treatment Recommendations

GROWTH/DIET[32–34]

- Nutritionist evaluation, diet education for all: total fat <30% of calories, saturated fat <10% of calories, cholesterol <300 mg/d, avoid *trans* fats; adequate calories for growth.
- Calculate BMI percentile for gender/height.*
  - If initial BMI >95th percentile:
    - → Step 1:
      - Age-appropriate reduced-calorie training for child and family
      - Specific diet/weight F/U every 2 to 4 weeks for 6 months; repeat BMI calculation at 6 months
      - Activity counseling (see below)
  - If F/U BMI >85th percentile for tier I, >90th percentile for tier II, or >95th percentile for tier III:
    - → Step 2:
      - Weight-loss program referral plus exercise training program appropriate for cardiac status

BLOOD PRESSURE (Tiers I, II, and III)[35]

- BP measurement/interpretation for age/gender/height
  - If SBP and/or DBP=90th to 95th percentile or BP >120/80 mm Hg (3 separate occasions within 1 month):
    - → Step 1: Decreased calorie intake, increased activity for 6 months
  - If initial SBP and/or DBP >95th percentile (confirmed within 1 week) *OR* 6-month F/U SBP and/or DBP >95th percentile:
    - → Step 2: Initiate pharmacological therapy per Fourth Task Force recommendations[35]

LIPIDS

- LDL-C (tiers II and III)[36]
  - See Table 3 for recommendations for LDL-C for tier I.
  - If initial LDL-C ≥130 mg/dL (tier II) or >160 mg/dL (tier III):
    - → Step 1: Nutritionist training for diet with <30% of calories from fat, <7% of calories from saturated fat, cholesterol <200 mg/d, avoidance of *trans* fats for 6 months
  - If repeat LDL-C >130 mg/dL in tier II or >160 mg/dL in tier III and child >10 y old:
    - → Step 2: Initiate statin therapy with LDL goal of 130 mg/dL
- Triglycerides
  - If initial TG=150 to 400 mg/dL:
    - → Step 1:
      - Nutritionist training for low simple carbohydrate, low-fat diet
      - If elevated TGs are associated with excess weight, nutritionist referral for weight loss management: energy balance training plus activity recommendations (see below)
  - If TG >700 to 1000 mg/dL, initial or F/U:
    - → Step 2:
      - Consider fibrate or niacin if >10 y old.†
      - Weight loss recommended when TG elevation is associated with overweight/obesity.

GLUCOSE (Tiers I, II, and III, except for patients with diabetes mellitus)[37]

- If fasting glucose=100 to 126 mg/dL:
  - → Step 1: Reduced-calorie diet, increased activity aimed at 5% to 10% decrease in weight over 6 months
- If repeat fasting glucose=100 to 126 mg/dL:
  - → Step 2: Insulin-sensitizing medication per endocrinologist
- Casual glucose >200 mg/dL or fasting glucose >126 mg/dL=Diabetes mellitus → Endocrine referral for evaluation and management
- Maintain HbA_{1C} <7%

SMOKING (Tiers I, II, and III)

- → Step 1: Parental smoking history at every visit; child smoking history beginning at age 10. Active antismoking counseling for all; smoke-free home strongly recommended at each encounter.
- → Step 2: Smoking cessation referral for any history of cigarette smoking.

ACTIVITY (Tiers I, II and III)[38–40]

- For children in all tiers, participation in activity is at the discretion of the physician(s) directing care. For specific cardiac diagnoses such as Kawasaki disease and congenital heart disease, activity guidelines are referenced.
  - → Step 1: Specific activity history for each child, focusing on time spent in active play and screen time (television+computer+video games). Goal is ≥1 hour of active play per day; screen time limited to ≤2 h/d.
- Encourage activity at every encounter.
  - → Step 2: After 6 months, If goals not met, consider referral for exercise testing, recommendations from exercise specialist.

Abbreviations: F/U indicates follow-up; BP, blood pressure; SBP, systolic blood pressure; DBP, diastolic blood pressure; LDL-C, LDL cholesterol; and TG, triglycerides.

Specific treatment goals for each risk factor and each tier are given in the algorithm (Figure). For risk factor–specific guidelines, references are provided.

*Normal BMI values for age and sex are available at http://www.cdc.gov/growthcharts.

†Elevation of triglycerides to ≥1000 mg/dL is associated with significant risk for acute pancreatitis. A fasting TG of 700 mg/dL is likely to rise to >1000 mg/dL postprandially. Treatment recommendation is congruent with guidelines for management of dyslipidemia in diabetic children.[30]

TABLE 3. Tier I Conditions: Specific Treatment Recommendations

- Rigorous age-appropriate education in diet, activity, and smoking cessation for all
- Specific therapy as needed to achieve BP, LDL-C, glucose, and HbA_{1C} goals as indicated for each tier, as outlined in algorithm; timing individualized for each patient and diagnosis. Step 1 and Step 2 therapy for all outlined in Table 2.
- For diagnosis-specific guidelines, references are provided.

Homozygous FH[41]

- LDL management: Scheduled apheresis every 1 to 2 weeks beginning at diagnosis to maximally lower LDL-C, plus statin and cholesterol absorption inhibitor
- Rx per cardiologist/lipid specialist. (Specific therapeutic goals for LDL-C are not meaningful with this diagnosis.)
- Assess BMI, BP, and FG: Step 1 management for 6 months
- If tier I goals not achieved, proceed to Step 2.

Diabetes mellitus, type 1[37,42]

- Intensive glucose management per endocrinologist, with frequent glucose monitoring/insulin titration to maintain PG <200 mg/dL, HbA_{1C} <7%
- Assess BMI, fasting lipids: Step 1 management of weight, lipids for 6 months
- If goals not achieved, proceed to Step 2; statin Rx if >10 y old to achieve tier I treatment goals
- Initial BP >90th percentile: Step 1 management plus no added salt, increased activity for 6 months
- BP consistently >95th percentile for age/sex/height: initiate ACE inhibitor therapy with BP goal <90th percentile or <130/80 mm Hg, whichever is lower.

CKD/ESRD[44]

- Optimization of renal failure management with dialysis/transplantation per nephrology
- Assess BMI, BP, lipids, FG: Step 1 management for 6 months
- If goals not achieved, proceed to Step 2; statin Rx if >10 y old to achieve tier I treatment goals

After heart transplantation[45]

- Optimization of antirejection therapy, treatment for CMV, routine evaluation by angiography/perfusion imaging per transplant physician
- Assess BMI, BP, lipids, FG: Initiate Step 2 therapy, including statins, immediately in all patients >1 y old to achieve tier I treatment goals

Kawasaki disease with coronary aneurysms[46]

- Antithrombotic therapy, activity restriction, ongoing myocardial perfusion evaluation per cardiologist
- Assess BMI, BP, lipids, FG: Step 1 management for 6 months
- If goals not achieved, proceed to Step 2; statin Rx if >10 y old to achieve tier I treatment goals

BP indicates blood pressure; LDL-C, LDL cholesterol; Rx, prescription/treatment; FG, fasting glucose; PG, plasma glucose; ACE, angiotensin-converting enzyme; and CMV, cytomegalovirus.

hood cancer survivors in a manner similar to that of fetal malnutrition in healthy populations.[374–379]

The induction and intensification stages of therapy include prolonged continuous administration of high-dose steroids, which induce hunger and decrease lean body mass.[354,358] The combination of initial malnutrition and muscle wasting from cancer counterposed by treatment-induced intense appetite underlies the potential development of poor eating habits.

Insulin Resistance/Type 2 Diabetes Mellitus

Childhood cancer survivors have higher fasting plasma glucose and insulin levels than age-matched control subjects,[379] and type 2 diabetes is reported to be more common in childhood cancer survivors than among sibling control subjects, with an odds ratio of 1.8 (95% confidence interval 1.1 to 1.29). Cancer types associated with a statistically significant increased risk of diabetes include leukemia, Wilmsô tumor, and neuroblastoma.[380] Impaired glucose tolerance and impaired insulin response were also found in 69% of a cohort of children who survived acute lymphoblastic leukemia, which suggests pancreatic β-cell dysfunction.[381]

Some evidence supports the hypothesis that growth hormone deficiency may play an important role in the pathogenesis of insulin resistance among survivors of childhood cancer.[353,355,382] Both chemotherapy and cranial radiation can cause a variety of chronic endocrine abnormalities. In addition to its effect on growth and development, growth hormone directly and indirectly influences insulin sensitivity and lipid metabolism.

Dyslipidemia

As would be anticipated, obese childhood cancer survivors have the typical lipid pattern associated with obesity: elevated triglycerides and reduced HDL cholesterol.[354] Cyclophosphamide administration in animal models results in hypertriglyceridemia and impairment of vascular lipoprotein lipase.[383,384] The frequently seen constellation of obesity, insulin resistance, and dyslipidemia suggests that the cluster of findings known as the metabolic syndrome is common in survivors of childhood cancer.[385]

Physical Deconditioning

Reductions in cardiac output and cardiorespiratory fitness are prevalent among leukemia survivors, particularly those who are overweight and have features of metabolic syndrome.[386–391] Although resting metabolic rate does not appear to be reduced in cancer survivors, growth hormone deficiency is suggested as a potential mechanism to explain reductions in strength and in exercise capacity seen in adult survivors of childhood leukemia and in children and adults who are cancer free.[392–396] Because of

its effects on body composition and muscle strength, growth hormone deficiency may contribute synergistically to decreased fitness.[397] Lack of adequate physical activity and the approach to a survivor of childhood cancer as a ñvulnerable childò may also contribute to the conditions characteristic of the metabolic syndrome, a common occurrence in this group.

Exercise may attenuate the effects of cachexia in cancer survivors by suppressing inflammatory responses and by improving insulin sensitivity, rates of protein synthesis, and antioxidant activities.[398] A decrease in cardiac output and a reduction in pulmonary elasticity with diminished aerobic capacity have been demonstrated in leukemia survivors, limiting their participation in tasks that require sustained or vigorous activity.[386,399,400]

Other Factors

A recent study in young adult survivors of disseminated testicular cancer who underwent surgery and chemotherapy reported a high prevalence of microalbuminuria and increased levels of endothelial and inflammatory marker proteins compared with both patients who underwent surgery alone and healthy control subjects.[401] To date, it is not clear whether the underlying mechanisms for insulin resistance in childhood cancer survivors are different from those in noncancer populations. However, there is a strong possibility that in addition to obesity, which is very common in this group, other pathways may be activated in childhood cancer survivors. These include growth hormone deficiency (a known outcome after central nervous system radiation), reduced physical activity, inflammatory mediators, and adipocytokines, which may be altered by therapies to treat cancer. Currently, data on specific anticancer drugs are insufficient to allow inferences on causality.

Recommendations for Childhood Cancer Survivors

Survivors of Childhood Cancer Are at Risk for Early Cardiovascular Disease (Tier III)

With the number of childhood cancer survivors increasing, thousands of individuals worldwide every year are faced with a variety of long-term adverse effects. Regular evaluation of cardiac function and identification of risk factors for accelerated atherosclerosis are clearly indicated. The algorithm in the Figure and Table 2 provide specific diagnosis and treatment guidelines.

Conclusions

In contrast to the normal pediatric population, children with specific underlying conditions experience accelerated atherosclerosis that leads to early CAD. In the present statement, we have reviewed what is known about coronary disease and the atherosclerotic process for 8 specific diagnoses and described current approaches to cardiovascular risk identification and treatment. A modified nominal group process was used to risk-stratify the diagnoses and to develop recommendations for risk identification and intervention.[29] Further research is needed to explore the pathophysiology of atherosclerosis unique to each specific diagnosis, to develop improved methods for assessment of preclinical disease, and to critically evaluate therapeutic interventions. Because the time course to clinical disease with some of these diagnoses is short, they offer a unique opportunity in pediatric cardiovascular research to perform randomized trials of the safety and efficacy of interventions.

The recommendations presented here are directed toward the primary care providers and pediatric subspecialists who care for these patients in childhood, as well as to internists, family practitioners, and adult subspecialists who will assume their care as they reach adult life. When published data did not permit evidence-based practice, we suggested practical interim recommendations. As new information develops, the guidelines will need to be modified to effectively provide guidance on cardiovascular risk reduction in these high-risk pediatric settings. Finally, decisions on the management of individual patients must be tailored to their unique circumstances.

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During the time that most of the work on this paper was accomplished, Dr Kavey was employed at Children's Memorial Hospital, Northwestern University–Feinberg School of Medicine, Chicago, Ill. She had nothing to disclose at that time.

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Introduction, Conclusions, and Tables

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Childhood Cancer Survivors

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CLINICAL REPORT

Care of the Adolescent Sexual Assault Victim

Guidance for the Clinician in Rendering Pediatric Care

Miriam Kaufman, MD, and the Committee on Adolescence

ABSTRACT

Sexual assault is a broad-based term that encompasses a wide range of sexual victimizations including rape. Since the American Academy of Pediatrics published its last policy statement on sexual assault in 2001, additional information and data have emerged about sexual assault and rape in adolescents and the treatment and management of the adolescent who has been a victim of sexual assault. This report provides new information to update physicians and focuses on assessment and care of sexual assault victims in the adolescent population. *Pediatrics* 2008;122:462–470

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
sexual assault, victim, victimization, adolescent, violence, dating violence

Abbreviations
GHB—γ-hydroxybutyrate
STI—sexually transmitted infection
NAAT—nucleic acid–amplification test

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INTRODUCTION

Many terms have been used to describe sexual assault, including rape, statutory rape, acquaintance or date rape, sexual abuse, molestation, and incest. There is great overlap and some confusion in the definitions of nonconsensual sex acts. "Sexual assault" is a comprehensive term that includes any forced or inappropriate sexual activity. Sexual assault includes situations in which there is sexual contact with or without penetration that occurs because of physical force or psychological coercion or without consent, including situations in which the victim would be unable to consent because of intoxication, inability to understand the consequences of his or her actions, misperceptions because of age, and/or other incapacities. These situations can include touching of a person's "sexual or intimate parts or the intentional touching of the clothing covering those intimate parts."[1]

The age of consent for sex varies from state to state. Reporting requirements to child welfare agencies, parents, or the police are also variable, sometimes governed by local jurisdictions, and in flux. In addition, in some states (eg, Texas and California), there are laws mandating that sexual intercourse and sexual contact must be reported if certain age differences exist between a minor (usually defined as younger than 18 years) and his or her sex partner (whether minor or adult), even if the sexual act was voluntary and consensual. Some adolescents may refuse to seek care or disclose personal risk information because of possible reporting of sexual partners.[2–5]

This report only addresses acute sexual assault in the adolescent age group and not sexual abuse that might be chronic and identified long after the fact. For more information about sexual abuse, see the American Academy of Pediatrics clinical report "The Evaluation of Sexual Abuse in Children."[6]

Because of the differences between states and the likelihood of change, physicians need to be familiar with the particular laws in their state and continue to be aware of any changes that may occur. This information is available online through the Child Welfare Information Gateway.[7]

EPIDEMIOLOGY

National data show that teens and young adults have the highest rates of rape and other sexual assaults of any age group. It is widely accepted that statistics on sexual assault reflect substantial underreporting, so the reported rates, in all likelihood, are underestimates. Annual rates of sexual assault per 1000 persons (male and female) were reported in 2004 by the US Department of Justice to be 1.2 for ages 12 through 15 years, 1.3 for ages 16 through 19 years, 1.7 for ages 20 through 24 years, and 1.6 for ages 24 through 29 years.[8] There are significant gender differences in reports of adolescent rape and sexual assault, with the 2005 National Crime Victimization Survey statistics reporting 176 540 rapes and sexual assaults of females 12 years or older and 15 130 rapes and sexual assaults of males 12 years or older.[9] This represents a significant decrease from peak rates of rape and sexual assault reported in this group in 1992.[9,10] These figures may not indicate a true decrease in the rate of rape but may reflect, instead, methodologic differences in reporting rates over time. Studies have demonstrated that two thirds to three quarters

of all adolescent sexual assaults are perpetrated by an acquaintance or relative of the adolescent.[10,11] Older adolescents are most commonly the victims during social encounters with the assailants (eg, a date). With younger adolescent victims, the assailant is more likely to be a member of the adolescent's extended family. Adolescents with developmental disabilities, especially those with mild mental retardation, are at particular risk of acquaintance and date rape.[12]

Adolescent rape victims presenting to emergency departments are more likely than adult victims to have used alcohol or drugs and are less likely to be physically injured during a rape, because assailants in adolescent rape tend to use weapons less frequently.[11,13] Adolescent female victims are also more likely to delay seeking medical care after rape and sexual assault and are less likely to press charges (when given a choice) than are adult women.[11,13] Male victims are less likely to report a sexual assault than are female victims.[14–16] Studies of sexual assault of males have demonstrated that up to 90% of perpetrators are male. Sexual assault of males by females is more commonly reported by older adolescents or young adults, compared with children or young adolescents.[14,16] Male perpetrators of male sexual assault more commonly identify themselves as heterosexual than homosexual.[14] The rate of perpetration by an acquaintance of the victim is similar for male and female victims, but multiple assailants, use of a weapon, and forced oral assaults are more common in assault of males than of females.[4]

SUBSTANCES AND SEXUAL ASSAULT

Alcohol or drug use immediately before a sexual assault has been reported by more than 40% of adolescent victims and adolescent assailants.[15] Adults have been shown to significantly underreport voluntary drug use associated with sexual assault, but the same has not been demonstrated in adolescents.[17] Increasing rates of adolescent acquaintance rape have been associated with the availability of illegal so-called date-rape drugs. The most well known of these is flunitrazepam (Rohypnol, manufactured by Roche Pharmaceuticals Inc outside of the United States), which is a benzodiazepine sedative/hypnotic. The effects of flunitrazepam begin 20 to 30 minutes after ingestion, peak within 2 hours, and persist for up to 8 to 12 hours if given without alcohol and up to 36 hours with alcohol. Drug effects include somnolence, decreased anxiety, muscular relaxation, and profound sedation. There may also be amnesia for the time that the drug exerts its action. Flunitrazepam can go undetected by an adolescent if added to any drink, thus increasing the risk of sexual assault, especially in the adolescent population. Hypotension, visual disturbances, dizziness, and urinary retention are all possible medical complications. After ingestion, it can be found in the bloodstream for 24 hours and in urine samples for up to 48 hours.[18–21] Therefore, urine and blood samples can be sent for toxicology screening, with every effort made to ensure the chain of evidence. Date-rape drugs and many other drugs of abuse are not included in standard drug-screening panels. At the time of evaluation, health care professionals should inquire how to detect the presence of suspected drugs and collect the proper specimens from the victim.

γ-Hydroxybutyrate (GHB) is also used as a date-rape drug. People who are given GHB in low doses are likely to experience drowsiness, euphoria, increased libido, and passivity.[22] In addition, at higher doses, they can experience amnesia, intoxication, dizziness, and visual hallucinations. Medical complications of high doses include hypotension, bradycardia, severe respiratory depression, and coma. GHB acts quickly, usually within 15 minutes of ingestion. The effects last for 3 to 6 hours when taken without alcohol and 36 to 72 hours when mixed with alcohol or other drugs. It is cleared quickly and is undetectable in urine after only 12 hours or even earlier.[23]

Ketamine effects include amnesia, delirium, vivid hallucinations, tachycardia and arrhythmias, mild respiratory depression, confusion, irrationality, violent or aggressive behavior, vertigo, ataxia, slurred speech, delayed reaction time, euphoria, altered body image, analgesia, and coma. Ketamine effects occur within 20 minutes. The effects last for less than 3 hours. Opinion varies on clearance, with sources quoting detectability in urine from 24 to 72 hours after ingestion.[24,25]

Because all of these drugs are detectable for only a short time, if there is suspicion that 1 of them has been used, toxicology screening should be performed as soon as possible, perhaps even before finishing the history and physical examination. The reference concentrations of these drugs are not universally available, and referral to a sexual assault center may be required for drug testing.

In addition to these 3 drugs, common prescription benzodiazepines and over-the-counter antihistamines are also being used to facilitate sexual assault, so testing should be performed for these medications also.[26]

Alcohol is still the most common date-rape drug, and adolescents should be warned of their increased vulnerability to assaults when drinking. If their friends are also drinking, they cannot count on them to notice that an assault is taking place.

SEXUAL ASSAULT OF YOUNG PEOPLE WITH DISABILITIES

Children and adolescents with disabilities are at significantly increased risk of sexual assault: 1.5 to 2 times higher than the general population.[27] Those who have milder cognitive disabilities are at the highest risk.[28,29] A number of factors probably result in the increased risk, including decreased ability to flee or fight off an attacker; an expectation of increased compliance and tolerance of levels of physical intrusion not expected of people without disabilities; dependence on others for personal care; and, in general, ineffective safeguards.[30]

A number of factors apply to the reporting of sexual abuse or assault by those with disabilities, including what significance the victim attaches to the incident; whether the victim has a means of communication; whether they perceive there to be a trustworthy, capable person to whom the information may be disclosed; and issues of being believed and feeling safe.[29,31,32] Some of these factors uniquely affect individuals with disabilities,

but others are shared by individuals without disabilities as well.

Health care professionals should be familiar with counseling agencies, programs that specialize in child abuse, and other services that are physically accessible and that have communication skills that are appropriate for teenagers using augmentative communication devices or who are cognitively impaired. Services should be identified that can provide appropriate genital and pelvic examinations for victims having physical disabilities requiring mobility aids.

ADOLESCENTS' PERCEPTIONS AND ATTITUDES REGARDING SEXUAL ASSAULT

Exploring the perceptions and attitudes of adolescents regarding nonconsensual sexual encounters is important. Because there may have been voluntary participation before the assault occurred, an adolescent might think that he or she will not be believed. Teenagers may be reluctant to report an incident because they feel guilty, are worried that their parents will restrict them from going to social events, or have little memory of the assault because of the use of date-rape drugs. One study demonstrated that male and female adolescents who viewed a vignette of unwanted sexual intercourse accompanied by a photograph of the victim dressed in provocative clothing were more likely to indicate that the victim was responsible for the assailant's behavior, more likely to view the man's behavior as justified, and less likely to judge the act as rape than when the victim was in less-provocative clothing.[33] Also, some aggressive behavior on the part of a male perpetrator may be seen by some adolescents as normative.[34–37]

ADOLESCENT REACTIONS TO RAPE

Unwanted sexual experiences during adolescence are common, with a large survey of middle- and high-school students indicating that 18% of females and 12% of males have had an unwanted experience.[38] Studies of female adolescents have found rape during childhood or adolescence to be associated with increased risky behaviors and mental health problems, including younger age of first voluntary intercourse; higher rates of depression, including suicidal ideation/attempts; and other self-harm behaviors such as self-mutilation and eating disorders.[34,35,37,39–42] When found in the gender less affected, psychiatric or behavioral problems that are more prevalent in the other gender (such as eating disorders in girls, fighting in boys) may be an indication that sexual assault or abuse has occurred.[40]

Rape trauma syndrome is described as consisting of an initial phase that lasts for days to weeks, during which the victim experiences disbelief, anxiety, fear, emotional lability, and guilt followed by a reorganization phase that lasts for months to years, during which the victim goes through periods of adjustment, integration, and recovery.[43,44] Part of rape trauma syndrome is posttraumatic stress disorder, which occurs in up to 80% of rape victims.[45] A 4-question screening tool for posttraumatic stress disorder has been used with some success with adults by gynecologists.[46] Counseling designed to specifically address these issues, as well as additional psychological trauma that results from date or acquaintance rape, should be available. Psychotropic medications may be required in some instances. The physician should be knowledgeable about services available in the community to address these issues and should provide initial psychological support.

Other victim reactions to sexual assault can include the feeling that his or her trust has been violated, increased self-blame, less-positive self-concept, anxiety, alcohol abuse, and effects on sexual activity (including younger age at first voluntary sexual activity, poor use of contraception, greater number of abortions and pregnancies, sexually transmitted infections [STIs], victimization by older partners, erectile dysfunction in males, and sexual dissatisfaction).[41,47–52] Adolescent victims may feel that their actions contributed to the act of rape and have confusion as to whether the incident was forced or consensual.[53–55] Male victims also report fragility of their gender identity and sense of masculinity and confusion about their sexual orientation.[50] All victims should be screened for suicidal ideation and self-harm behavior.

INVESTIGATIONS

Adolescents may report a sexual assault to their physician, sometimes because they came to do so and other times because the question has been asked. Depending on the patient's current age, age at time of the event, the identity and presence of the alleged perpetrator (such as an acquaintance, a relative, teacher/coach, or even health care professional), and state law, the assault may have to be reported even if the teenager does not want it to be reported. At the time of examination after acute assault, an adolescent may have a hard time making a decision to press charges and can be encouraged to have a forensic medical examination to assess for injury and infection and to collect forensic evidence. Before any forensic examination, victims should be advised not to wash their clothes, bathe, or shower until they have been examined. These clothes should be stored in a paper, not plastic, bag. In some facilities, adolescents may have the option of freezing forensic evidence if they are uncertain about filing charges for possible use in the future. A forensic medical examination includes a medical forensic history, documentation of biological and physical findings, collection of evidence from the patient, and follow-up for additional evidence gathering.[56] With DNA-amplification techniques, a forensic examination can be useful for at least 4 days after the assault[57] and possibly longer.[58–60] Between 4 and 7 days, local authorities should be contacted to determine if it is useful to collect evidence. After 1 week, examination, counseling, and treatment can take place without need for forensic collection. Unfortunately, not everyone presenting with the same history may get the same forensics and treatment, with homeless females being a group that has been identified as getting less-than-adequate services.[61] Decreased access to care is likely to lead to increased rates of infections with STIs and their sequelae, unwanted pregnancies, increased psychiatric

TABLE 1 **Investigations According to Site**[62]

Screening	Throat	Vagina	Cervix/Urethra	Anorectal	Blood (Bodily Fluids, Any Site)
Gonorrhea culture	Yes	No	Yes	Yes	NA
Chlamydia culture	No	No	Yes	Yes	NA
NAAT for chlamydia, gonorrhea	No	Yes	Yes	No	NA
Microscopy for trichomoniasis, bacterial vaginosis, candidiasis	No	Yes	No	No	NA
HIV, hepatitis B, syphilis	No	No	No	No	Yes

NA indicates not applicable.

complications, and poor reporting of sexual assault. The Centers for Disease Control and Prevention's treatment guidelines for STIs[62] include a recommendation for comprehensive clinical treatment of victims of sexual assault, including emergency contraception and HIV prophylaxis, if indicated. The evaluating health care professional should ensure that specimens are available for timely clinical care and that follow-up plans are communicated and feasible.

Before any examination, the health care professional should address the adolescent's immediate health concerns such as the likelihood of having contracted an STI, the possibility of pregnancy, and worries about acute and permanent physical injury/damage. A referral for examination and treatment should be made to an emergency department or sexual assault treatment center where there are personnel experienced with adolescent assault victims. Physicians involved in the management and forensic examination of adolescent victims of sexual assault should be trained in the forensic procedures required for documentation and collection of evidence. Colposcopic procedures allow examiners to detect and document genital trauma, including microtrauma, with a growing body of literature demonstrating the patterns of genital injury in sexual assault victims.[63–65] Physical examination is unlikely to yield evidence of penetration that, other than the possible presence of seminal fluid, is visible to the naked eye. After the acute period, it is uncommon to find any indication of genital trauma,[66] although as many as 32% of teenagers who have not previously had intercourse may show physical signs after the acute period.[67,68] Adolescents have reported that the experience of video colposcopy may be beneficial, with many accepting offers to watch their own examination on screen.[69]

It is essential that the forensic examination be performed by a person such as a physician who specializes in child abuse or a nurse with sexual assault care training, who can ensure an unbroken chain of evidence and accurate documentation of findings.[43,47,58,70–72] Details of the required examination and documentation are presented in a handbook published by the American College of Emergency Physicians, *Evaluation and Management of the Sexually Assaulted or Sexually Abused Patient* (available online).[73] Physicians who treat sexually abused or assaulted patients need to be aware of the legal requirements, including completion of appropriate forms and maintaining the legal chain of evidence and reporting to appropriate authorities specific to their locale.

Documentation of the history and physical examination is important. Value judgments should not be included, nor should interpretations of the meaning of the adolescent's body language or facial expressions. Descriptions should be exact, and terms such as "hymen not intact" should be avoided. The clinical records from both the referring physician and the assault center are likely to be subpoenaed if there is a prosecution. Again, there is more likelihood of the evidence being accepted if the examiner is an expert in handling cases of sexual assault. Any examination or treatment should be performed only with the consent of the adolescent.

For an examination after acute assault, testing for STIs is somewhat controversial. There is a concern that a speculum examination may be traumatic, especially for a teenager who has not had one before, possibly leading to avoidance of pelvic examinations in the future. Finding an STI, particularly *Chlamydia trachomatis*, may give a defense lawyer an opportunity to introduce the victim's previous sexual history. However, many victims of assault have been reported to have positive culture results and/or samples at the time of the acute evaluation.[74–76] Obviously, positive results may indicate an existing infection as a result of the victim's history of consensual sexual contact, but some cultures or samples may be positive as a result of the assault even when obtained within 72 hours of the assault. Specimen collection should be discussed with the adolescent, who then can choose whether to have cultures performed. If specimens are to be collected, the decision of which sites should be sampled should be based on possible contact with the perpetrator's bodily fluids (see Table 1). Because some courts will only accept positive culture results for gonorrhea and chlamydia (as opposed to nucleic acid–amplification tests [NAATs] and other indirect tests), cultures are preferable over NAATs for any case in which there is likely to be prosecution. However, there may be an advantage to using an NAAT in addition to a culture to detect chlamydia, because the high sensitivity makes it more likely to detect before the end of the incubation period.[77] Vaginal secretions can be microscopically examined for *Trichomonas* species and sent for culture where available.

If prophylactic treatment is given, cultures do not need to be performed at follow-up unless requested by the victim. If there is no prophylaxis prescribed, then

TABLE 2 **Prophylactic Treatment Recommendations**

Condition	Recommended Regimen
Gonorrhea	Ceftriaxone, 125 mg intramuscularly once (for oral and/or anogenital penetration) or may use, if available, cefixime, 400 mg orally once (for anogenital but not oral penetration)
Trichomonas species	Metronidazole, 2 g orally once
Chlamydia	Azithromycin, 1 g orally once, or doxycycline, 100 mg orally twice daily for 7 d
Hepatitis B	Immunize, if not previously completed
Human papillomavirus	Immunize, if not previously completed
Pregnancy prevention or emergency contraception	0.75-mg levonorgestrel tablet: 2 tablets orally, 12 h apart
HIV	See text

cultures are recommended 1 to 2 weeks after the assault.[77]

Serum samples can be obtained for baseline testing for syphilis and HIV in areas or populations in which there is a high incidence of infection or if the victim wishes for these tests to be performed (see below for HIV prophylaxis). Syphilis tests should be repeated after 6 to 12 weeks, and HIV tests should be repeated after 3 to 6 months.[43,58,72,73]

MANAGEMENT

Acute Care

The examining physician should keep in mind that the young person may have nongenital injuries, the treatment of which may be a priority depending on the severity of the injury.

Pregnancy prevention and emergency contraception should be addressed with every adolescent female rape and sexual assault victim. The discussion should include risks of failure and options for pregnancy management. Progestin-only emergency contraceptive pills have the most favorable mix of safety, with fewer adverse effects and increased efficacy.[78] A baseline urine pregnancy test should be performed. Emergency contraception should be offered to females who have been (or may have been) vaginally penetrated or who think that ejaculate has come into contact with their genitalia.[43,47,58,65,70,71] Although package labels suggest a dosage of 0.75 mg of levonorgestrel taken twice, 12 hours apart, taking both tablets at once is an easier regimen and is just as effective without increasing adverse effects.[79]

Prophylactic treatment for chlamydia and gonorrhea should be recommended to adolescent sexual assault victims who have been vaginally or anally penetrated (with or without ejaculation) or orally penetrated (with ejaculation). Current recommendations from the Centers for Disease Control and Prevention are to treat with 125 mg of ceftriaxone intramuscularly, 2 g of metronidazole once orally, and either 1 g of azithromycin once orally or 100 mg of doxycycline twice daily for 1 week.[62] If available, cefixime at a dose of 400 mg once orally can be used instead of the ceftriaxone if only genital penetration occurred (see Table 2).

Teenagers who have not initiated or completed immunization against hepatitis B virus should be offered the vaccine with completion of the series to be facilitated. There are currently no recommendations regarding immunization against human papillomavirus infections in the context of an acute sexual assault; however, all adolescent female victims are within the recommended age group for receiving this immunization, so depending on insurance coverage, immunization can be discussed at this time.

There are only a handful of cases in the literature of HIV being transmitted from a single episode of sexual assault.[80–82] HIV prophylaxis is not universally recommended but should be considered when there is mucosal exposure (oral, vaginal, or anal). Factors to consider include the risks and benefits of the medical regimen, including whether there was repeated abuse or multiple perpetrators; if there is oral, vaginal, or anal trauma, including bleeding; if the perpetrator is known to have HIV infection; or if either the victim or perpetrator has a genital lesion or if there is a high prevalence of HIV in the geographic area in which the sexual assault occurred.[43,58,62,72,73,83,84] If rapid testing of the assailant is available, prophylaxis can be started and then stopped if the test result is negative. In 1 study, only 71 of 258 people who had been sexually assaulted agreed to HIV prophylaxis, 29 continued with the treatment past 5 days, and only 8 completed the full course. Those at higher risk were more likely to complete treatment.[85] A retrospective study found that uncertainties regarding exposure, high rates of psychiatric comorbidity, and low rates of return for follow-up care were all factors in the low rates of adherence to postexposure prophylaxis.[86] Centers that specialize in treatment of sexual assault victims often provide care without cost to their clients and can advise about local resources when payment, confidentiality, and safety are concerns. No large studies examining different combinations of treatment have been performed with sexual assault victims, but on the basis of current occupational-exposure guidelines, 2 nucleoside reverse-transcriptase inhibitors and 1 of either a nonnucleoside reverse-transcriptase inhibitor or protease inhibitor for 4 weeks is recommended.[87] In situations in which significant risk exists, prophylaxis with 3 medications should be offered only if the drugs can be started within 72 hours of exposure.[88]

Follow-Up Care

Follow-up can include a visit within 1 week of presentation to assess injury healing and to ensure that counseling has been arranged. Reassessment for STIs may need to occur depending on medications given at the time of the initial evaluation and the intervening history of consensual sexual activity.[75] At 2 weeks, pregnancy testing can be performed, along with discussion of test results, assessment of adherence to any medications, and the teenager's emotional status. The Centers for Disease Control and Prevention recommends that syphilis and HIV testing be repeated 6 weeks, 3 months, and 6 months after the assault if initial test results were negative and infection in the assailant could not be ruled out.[62]

Because responses to rape can vary, it is important for physicians to address both the physical and psychological needs of the adolescent. Physicians should be aware that self-blame, humiliation, lack of information (ignorance), and naiveté might prevent the adolescent from seeking medical care. Effective screening, referral, and follow-up allow for support of the adolescent rape victim and appropriate delivery of health care services. Because patients treated in emergency departments often do not return for follow-up care,[89] it is important that the emergency treatment team refer the assaulted adolescent back to his or her medical home or a specialty treatment center, if they have one and if the teenager consents to his or her primary health care professional knowing about the assault. Contact with the primary health care professional from the emergency department with the information would relieve the teenager of the burden of introducing the topic and encourage follow-up. The adolescent should be encouraged to share information with a parent or other trusted adult. Although adolescents may want confidentiality and have the right to it, this is a time during which support from an adult is very important, especially when teenagers are being treated in unfamiliar emergency department environments. Involving a support person may help ensure that the adolescent gets supportive help and appropriate counseling, particularly if he or she later becomes depressed and lacks the ability to access help. Parents can be counseled and encouraged to focus on their teenager's needs and not blame themselves or their son or daughter.

Male victims' concerns about their sexuality, in particular their sexual orientation, should be addressed.

Physicians should be prepared to provide follow-up STI testing, completion of the hepatitis B virus and human papillomavirus immunization series, treatment of injuries, screening for mental health problems, and management of substance use issues.

A number of studies have shown that trauma-focused cognitive behavioral therapy is useful for adolescents who have been abused or assaulted,[90] and a call or referral to a sexual assault care center may yield the names of mental health professionals who are more skilled in the care of victims and their families. Under some circumstances, funding may be available to pay for tests and treatments through the Victims of Crime Act (Pub L No. 98–473 [1984]).

SEXUAL ASSAULT AND RAPE-PREVENTION STRATEGIES

Adolescent rape exists in a sociocultural context, including some religious and ethnic values, in which issues of male dominance, appropriate gender behaviors, victimization, violence, and power imbalances in relationships are highly visible. Prevention messages for adolescents need to be designed for males and females.[47,70,91–93] Adolescents need to be able to identify high-risk situations (such as attending parties with unknown people, meeting people with whom they have had contact on the Internet, walking alone at night, allowing themselves to be photographed nude or in sexually explicit poses or situations); they also should be advised that if they are ever assaulted, they should seek medical care. Factors that may increase the likelihood of assaults (eg, use of drugs or alcohol) and strategies to prevent sexual assaults (eg, "buddying up," not drinking from anything that has been left unattended, abstaining from or moderating alcohol intake, not accepting drinks from strangers) should be discussed, and associated educational materials should be available and distributed.[47,70,91–93]

A survey of more than 600 young women in an urban setting showed that the vast majority thought that young women should be screened and counseled by their health care professional regarding dating violence.[94] Physicians should be aware that sexual assault is common and need to be prepared to counsel their adolescent patients to avoid high-risk situations. Screening of adolescents for sexual victimization should be part of visits for psychological problems, sexuality issues, contraception or substance abuse, and health supervision. Physicians should include information about ways to prevent sexual assault as part of anticipatory guidance with adolescents with and without disabilities, tailored to cognitive abilities to understand. Adolescents should be asked direct questions without their parents present regarding their past sexual experiences. These questions should include those that explore age of first sexual experience, use of the Internet to find romantic or sexual partners, and unwanted or forced sexual acts. Exploration of gender roles and relationship parameters (eg, exploitative, nonconsensual versus healthy) are critical. Adolescents who have been sexually assaulted need the opportunity to describe the experience at their own pace and in their own words.[47,63–65,70]

SUMMARY STATEMENTS

1. Physicians are encouraged to routinely discuss with their adolescent patients the potential for sexual and physical violence, including relationship violence. The discussion may help prevent and/or reduce the stigma of revealing such issues if violence occurs.
2. Physicians are encouraged to be aware of the current reporting requirements for sexual assault and laws protecting the confidential rights of adolescents to obtain care at rape crisis care centers in their state.
3. Physicians should be knowledgeable about sexual assault and rape evaluation services available in their communities. This information should include when and where to refer adolescents for a forensic medical examination and sexual assault care as well as for services appropriate for teenagers with disabilities.
4. Physicians are encouraged to routinely screen adolescents, including those with disabilities, for a history of sexual violence, covering the potential of dating violence and sexual assaults.
5. For those adolescents with positive histories, appropriate STI screening, prophylaxis, and treatment should be available on a timely basis, including referrals for care and potential sequelae.
6. Emergency contraception should be offered to female sexual assault victims if reported within 120 hours of

the assault. Given the safety of emergency contraception, it should be offered even if the adolescent is not sure whether penetration occurred. Documentation of pregnancy status should occur at the time of the evaluation with either a blood or urine sample.

7. Because of the potential for long-term psychological consequences, physicians should be prepared to offer psychological support or referral for counseling and should be aware of the services in the community that provide management, examination, and counseling for the adolescent patient who has been sexually assaulted.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on Children With Disabilities

Care Coordination in the Medical Home: Integrating Health and Related Systems of Care for Children With Special Health Care Needs

ABSTRACT. Care coordination is a process that facilitates the linkage of children and their families with appropriate services and resources in a coordinated effort to achieve good health. Care coordination for children with special health care needs often is complicated because there is no single point of entry into the multiple systems of care, and complex criteria frequently determine the availability of funding and services among public and private payers. Economic and sociocultural barriers to coordination of care exist and affect families and health care professionals. In their important role of providing a medical home for all children, primary care physicians have a vital role in the process of care coordination, in concert with the family. ***Pediatrics*** **2005;116: 1238–1244;** ***care coordination, case management, children with special health care needs, medical home.***

ABBREVIATION. AAP, American Academy of Pediatrics.

INTRODUCTION

As defined by the Maternal and Child Health Bureau and accepted by the American Academy of Pediatrics (AAP), "children with special health care needs are those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally."[1] It has become apparent that these more extensive health and related services require forethought in the development of their structure and coordination. *Healthy People 2010* calls for all children* with special health care needs to receive coordinated, ongoing, comprehensive care within a medical home.[2] The New Freedom Initiative announced in 2001 outlines goals to remove barriers to community living for people with disabilities.[3] Care coordination plays an essential role in ongoing efforts to integrate health and related systems of care for children and youth with special health care needs.[4] In a recent publication, the Institute of Medicine identified overly complex and uncoordinated care as a major reason for "a chasm…that exists between the health care that we now have and the health care that we could have."[5] Although efforts to better define the population continue,[6] data support the fact that children with special health care needs account for a substantial amount of health services utilization. Children with special health care needs are estimated to account for 13% of all children, yet they represent 70% of health care expenditures.[7–9] Individuals with chronic illness need coordinated services to provide chronic care management. Recent research supports the benefits of professional care coordination in clinical and process improvements and in reducing health care costs and improving family satisfaction.[10–13] The importance of these issues is reflected in the work of the National Center of Medical Home Initiatives for Children With Special Needs[14] and in a recent AAP policy statement, "The Medical Home."[4]

The medical home is an optimal setting for family-centered care coordination. Primary care physicians and other professionals caring for children with special health care needs generally acknowledge the importance of and the need for care coordination services. The increasing number of children with special health care needs, complexity of care, and outreach efforts necessary to educate about the medical home result in even greater responsibility for care coordination. Additionally, initiatives from health care reform and managed care have further expanded the role of the primary care physician in the areas of gatekeeper and coordination roles. New trends in the private health care market are reflected in consumer-driven health plans, a concept that has strong advocates and opponents. Arguments against the concept include biased selection of well members for the consumer-driven health plan, with resultant higher premiums for the chronically ill in traditional insurance programs, less preventive care, and a complicated system. Others argue that there will be cost benefits, more consumer choice, and support for health improvement. Another new trend is health savings accounts, which were created through the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (Pub L No. 108–173) and are designed to help individuals save for future qualified medical and retiree health expenses on a tax-free basis. However, these represent a significant potential negative effect on the concept of the medical home if parents are forced to seek low-cost

* In accordance with the policies of the AAP, references to "child" and "children" in this document include infants, children, adolescents, and young adults up to 21 years of age.

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health care professionals when their health plan requires significant out-of-pocket expenses. If this becomes the case, then the medical home is fragmented,, and quality care coordination services are put at risk. This transition to managed systems of care from traditional fee-for-service care has important implications for aspects of care coordination.

This policy statement reviews the importance of the primary care physician's role in care coordination in the context of the medical home.

MULTIPLE SYSTEMS OF CARE

Advances in medicine have resulted in more children surviving conditions that were once considered to be life threatening. This is often reflected in an increased demand for all levels of care, from primary care to community and educational services to special health care services required by children with chronic conditions.[15,16] Great variability exists among programs with services for these children. The provision of care includes multiple organizations, often with different missions,[17–20] and consists of independent health care professionals, third-party payers, private organizations, and public agencies funded by a variety of sources. These entities, as currently arranged, do not often function collectively as a system of care. Care coordination is complicated by the lack of a single entry point to gain access to systems of health care, social services, education, public health services, and home services. Furthermore, complex eligibility criteria (ie, family income and the child's age and/or health condition) that determine the availability of funding and services often differ among organizations and agencies. Therefore, families may struggle to access needed services and would benefit from professional assistance.[18] Few health plans offer risk-adjusted capitation or fee-for-service reimbursement rates that would justly compensate professionals for the additional time and effort invested in the provision of coordinated and comprehensive care for children with special health care needs.

Because children spend a substantial amount of time in school and child care settings, the linkages between health care and educational and child care systems are especially important for many children and youth with special health care needs.[18,20] However, each state's educational system uniquely interprets federal laws that mandate services for children with special health care needs, which creates variations in services among states. Although the laws are designed to provide special education and related services for all children with disabilities, some children with special health care needs are excluded from services because they do not meet the categorical definitions stated in these laws.[21]

THE ROLE OF HEALTH PLANS

Historically, public agencies and private organizations involved in human services have helped families determine the needs of their children and access appropriate services. This process is referred to as "case management." Case managers may assist with care coordination. Current payer systems often use case managers in an attempt to control the costs of health care. These case managers work directly for the payer and may help families with access to services and resource utilization, especially less costly out-of-hospital care, but a major role of theirs has been to limit the financial risk of the payer.

During the past 10 to 20 years, children with special health care needs have had greater access to case management services. Families of children with special health care needs frequently demonstrate the ability to participate in the management of their child's care in a cooperative effort rather than as the subordinates in an authoritarian system.[18] As a result, "care coordination" has replaced the term "case management." Care coordination occurs when care plans are implemented by a variety of service providers and programs in an organized fashion. Care coordination is multifaceted. It involves needs identification, assessment, prioritizing, and monitoring. A coordinator is required to communicate, network, and educate as well as advocate for resources.

THE ROLE OF THE PRIMARY CARE MEDICAL HOME

The role of the primary care medical home in care coordination is not fixed or determined by a defined set of tasks. Instead, it is a dynamic process driven by the health status and developmental progress of the child, the specific needs of the child and family, the primary care physician's expertise with children with special health care needs, and the ability of the family and/or other professionals to participate in care coordination. The primary care physician in the medical home should be aware of the array of available subspecialty services, know when these services are needed, know how to gain access to and advocate for subspecialty care within health plans, and know how to use subspecialists' recommendations and communicate the subspecialists' reports to the family.

The medical home is an important means for the primary care physician to provide care for children.[4] Medical homes for children with special health care needs incorporate the same elements of health supervision, community-based preventive care, developmental surveillance, and anticipatory guidance used in the ongoing care of all children. Care should be accessible, comprehensive, continuous, compassionate, culturally effective, and family centered. The medical home reinforces care coordination activities by the primary care practice team: the primary care physicians in collaboration with nurses, families, and support staff.

The AAP policy statement "The Medical Home"[4] lists the desirable characteristics of coordinated care within the medical home, including the following:

1. A plan of care is developed by the physician, practice care coordinator, child, and family in collaboration with other providers, agencies, and organizations involved with the care of the patient.
2. A central record or database containing all pertinent medical information, including hospitalizations and specialty care, is maintained at the prac-

tice. The record is accessible, but confidentiality is preserved.
3. The medical home physician shares information among the child, family, and consultant and provides a specific reason for referral to appropriate pediatric medical subspecialists, surgical specialists, and mental health/developmental professionals.
4. Families are linked to family support groups, parent-to-parent groups, and other family resources.
5. When a child is referred for a consultation or additional care, the medical home physician assists the child and family in understanding clinical issues.
6. The medical home physician evaluates and interprets the consultants' recommendations for the child and family and, in consultation with them and subspecialists, implements recommendations that are indicated and appropriate.
7. The plan of care is coordinated with educational and other community organizations to ensure that special health needs of the individual child are addressed.

"A Consensus Statement on Health Care Transitions for Young Adults With Special Health Care Needs"[22] emphasizes the importance of developing a written transition plan by 14 years of age that will include what services need to be provided, who will provide them, and how they will be financed. Although the pediatrician continues to provide the medical home throughout adolescence, early development of an individualized transition plan that addresses transfer of care as well as educational, recreational, and vocational opportunities will facilitate a successful transition. The plan for transition is often difficult; thus, preparatory time is imperative.

Additional guidelines are outlined in the AAP policy statement "Role of the Physician in Care Coordination for Family-Centered Early Intervention Services,"[23] published in 2001. Training in care coordination and other aspects of the medical home are available through the Every Child Deserves a Medical Home training curriculum of the AAP.[14] Additionally, tools have been developed through the AAP Committee on Coding and Nomenclature to help physicians with the complexities of reimbursement and the determination of the appropriate *Current Procedural Terminology* codes involved with the medical home.

There are increasing time and financial demands on health care professionals. The burdens become even more accentuated in small and rural practices and those dealing with special populations, such as immigrants, for which there is a limited range of available resources.

THE ROLE OF THE FAMILY

The family's role in the medical care of any child is vital. The AAP recognizes that "the family is the child's primary source of strength and support" in its policy statement on "Family-Centered Care and the Pediatrician's Role."[24] Additionally, the policy affirmed that the concept of the family as a primary partner in care coordination is linked to improved health outcomes.

Family members who are knowledgeable about their child's condition often lead the care coordination activities effectively or are active participants in their children's care if they are given opportunities to further develop their skills and strengths.[25] The participation of adolescent patients in the decision-making process should be encouraged. Some families and adolescents require greater efforts to be empowered to function optimally as care coordinators.

There are clearly circumstances in which families may need more assistance with care coordination, reflecting factors such as language barriers, educational level, migrant or immigrant status, economic situation, and insurance benefits. In situations in which family members are unable to perform a leadership role and coordination of care has been insufficient, the only person available may be designated by default. This assigned or default care coordinator may not be qualified or prepared or have the needed support. For the treatment plan to be most effective, the individual in charge of taking the lead in care coordination should be designated before the treatment plan is determined.

Professionals who assume primary responsibility for care coordination are often physicians, nurses, and social workers. Alternatively, physical and occupational therapists and other professionals can lead and participate in the coordination process. Families and children themselves are important participants, advisors, and consultants throughout the process. This collaboration with family members is vital because they know the child's needs best.[26] Positive changes occur when families and professionals work together to support families in their central role as caregivers.[27] In contrast, when they do not work together, the cost of care may increase, patient and family satisfaction may decrease, and patient care may become fragmented and disorganized.[28,29]

THE ROLE OF THE COMMUNITY

In the educational system, care coordination involves a written individual family service plan, individualized education program, 504 plan, or individual health service plan if individualized testing, special education, therapy, nursing services, psychosocial/emotional supports, appropriate transportation, or assistive technology devices are needed. Care coordination in the social service and public health systems may involve locating and accessing financial assistance programs and public health services. Care coordination in the home setting may mean organizing home nursing/therapy services and/or respite care and adapting the home environment to safely support special technology such as a ventilator or motorized wheelchair.

Many children with special health care needs, especially those who are medically fragile, have unique needs during an emergency that require care coordination and planning. Children who are technology dependent, such as those who require ventilator support or who have pacemakers, tracheostomies, gas-

trostomy tubes, or central venous catheters, have unique problems that often require care by emergency medical services personnel. For additional information, refer to the AAP policy statement "Emergency Preparedness for Children With Special Health Care Needs."[30] The primary care physician can facilitate coordination of services by ensuring appropriate communication and advocating for training of emergency medical services personnel. An emergency care form can be completed, including the family's wishes regarding advance directives for end-of-life issues.

BARRIERS TO EFFECTIVE CARE COORDINATION

Several barriers challenge the primary care physician in providing care coordination. These barriers include the following:

- a lack of knowledge and information about the chronic condition, community resources, and/or the coordination process;
- a lack of communication among health care professionals and organizations involved in the child's care;
- a lack of clearly defined roles for each of the members of the practice team, the specialty team, the community agencies, and the family;
- insufficient acknowledgment for the amount of time and work needed to provide quality care coordination services;
- inadequate reimbursement for care coordination because of the additional administrative tasks associated with care coordination, including extensive documentation and counseling;
- a lack of an organized system of care coordination with multiple service delivery systems with multiple care coordinators; and
- language and cultural barriers.

Published reports[31,32] and families themselves[17] have indicated that there is a greater need for involvement of primary care physicians in the care coordination process, in addition to the provision of primary care, for children with special health care needs. The absence of such involvement results in incomplete coordination and episodic, expensive, fragmented care.

The roles of the primary care physician as both gatekeeper and patient advocate may conflict with each other as physicians strive to manage limited economic resources while providing access to necessary subspecialty care and services.[33] Primary care physicians who provide a medical home for children with special health care needs are actively involved in care coordination, thereby improving quality of care.

CHARACTERISTICS OF SUCCESSFUL CARE COORDINATION MODELS

A number of studies have shown significant benefits related to implementation of care coordination models.[10–13] Benefits include reduced hospital admissions, reduced length of hospital stay, reduced inpatient charges, reduced emergency department visits, improved patient satisfaction, and enhanced opportunities for outcome-based clinical process improvement.

Title V of the Social Security Act had its origin in 1935 but has undergone multiple revisions. The amendments of 1989 (42 USC Chapter 7, Subchapter V §§701–710) reinforced the development of case management services.[34] The initial goal of case management was to decrease overlapping of multiple services. Other recognized benefits that accrued were improved access to care and a resultant feeling that the care provided was superior.[35]

Early intervention services were mandated in 1986 as an entitlement program when Congress passed the Education of the Handicapped Act Amendments (Pub L No. 99–457). They were reauthorized under the Individuals With Disabilities Education Act (Pub L No. 101–476 [1990]) as Part C. This legislation required the formation of the individual family service plan and defined community-based, family-centered, multidisciplinary intervention programs for infants and toddlers with developmental delays. Family training and counseling also were provided. New Jersey developed a unique model that combined the funding from Title V and the Individuals With Disabilities Education Act to provide county-based case management units, which provides a single point of entry into an otherwise very complex system when entry is based on need or funding. Many state Title V programs are implementing similar systems of care coordination.[14]

Successful models of care coordination have a number of common characteristics.[10,36–38] Both the Center for Medical Home Improvement[35] and the Institute for Community Inclusion[38] have published guidelines for care coordination in primary care settings. Standardized criteria help to identify children in need of care coordination and should be used.[6,36,38,39] Collaboration between insurers and professionals at the local and state level is critical. Each practice or community should have a designated care coordinator who provides a single point of entry. Nurses, nurse practitioners, physician assistants, and social workers have been successful in this role. One possible advantage for nurse practitioners and physician assistants in some settings is that their services may be reimbursed.[38] Ongoing assessment of the needs of each child and family is essential. The acuity and requirements of services fluctuate depending on the needs and wishes of the family. The process also may vary depending on the extent and multiplicity of the child's needs, family strengths, type of health care services available, limitation of benefits by the payer, and mission of the agency. Updated, standardized educational materials related to the care of children with special health care needs in general, as well as disease-specific information, should be available. The care coordination program should include an outcome-focused quality improvement component.

The care coordinator has the primary responsibility for the child's treatment plan and should document completion of tasks or, conversely, the need to vary from the original plan. The plan should include

the following components: a medical summary for use by emergency and hospital services as well as for medical care by physicians who are not familiar with the patient; patient- and family-centered short-term and long-term goals; role of the family and other supports; locus of implementation; methodology; intensity; and duration. The coordinator may need to communicate with payers such as Medicaid or health plans to obtain preapproval for services. The care coordinator should be knowledgeable about family and medical resources and insurance options, be able to identify and access resources for family support, and act as an advocate when necessary. Throughout the process, patient advocacy in the context of the family is important. High-intensity care coordination is needed at the time of medical diagnosis, hospital discharge, entrance into child care and school settings, transition to young adulthood, and when a change in health care status occurs. At these times, the primary care physician's special relationship with a child and the family can facilitate the appropriate support. At other times, coordination requirements may be less demanding and could be accomplished with a lesser degree of service, such as making a telephone call or forwarding records.

Generally, the goals of care coordination are to (1) develop an anticipatory/proactive plan for appropriate services for the child and family, integrating the recommendations of multiple professionals and service systems, (2) assist the family in accessing needed services and resources, (3) facilitate communication among multiple professionals, (4) avoid duplication of services and unnecessary costs, (5) optimize the physical and emotional health and well-being of the child, and (6) improve the child's and family's quality of life.

CONCLUSIONS

Although care coordination can be complex and time consuming and is always challenging, it is essential for efficient management of the many complex issues surrounding the care of children with special health care needs within the context of the medical home. Becoming aware of available resources, being involved in the care coordination process, and developing unique care coordination approaches within one's own practice and community and in relationship with existing tertiary care centers are essential for providing optimal care for children with special health care needs. Families, primary care physicians, and other professionals can collaborate meaningfully to provide effective coordinated care. Successful care coordination results in optimal outcomes for children with special health care needs and their families and provides an opportunity for professional fulfillment for physicians.

RECOMMENDATIONS

1. Primary care physicians, medical subspecialists and surgical specialists, physician's staff, families, community agencies, educators, early intervention professionals, allied health professionals, tertiary care centers, state Title V agencies, and insurers should work cooperatively to develop effective care coordination models that take into consideration the continuum of health, education, and social services needed to improve the quality of care for children with special health care needs.
2. Families of children with special health care needs should have the opportunity to lead the care coordination team and/or be proactive participants. To do so, the parents (or adolescent patients themselves) must have information about the condition, proper education in care coordination, and access to necessary resources.
3. Primary care physicians caring for children with special health care needs should facilitate access to community-based services through use of the medical home strategies. The AAP National Center of Medical Home Initiatives for Children With Special Needs (www.medicalhomeinfo.org) is a resource that can assist the pediatrician.
4. The primary care physician's role in care coordination should be flexible to meet the dynamic needs of the child and family. The primary care physician, a member of the physician's staff, a family member, or another member of the child's medical home may be designated the leader of the care coordination team. The Center for Medical Home Improvement[36] and the Institute for Community Inclusion[38] have developed kits that provide tools to identify needs and areas for improvement.
5. Successful provision of care coordination is contingent on adequate reimbursement for efforts. Health care professionals should be financially reimbursed by third-party payers for the time spent on care coordination and care plan development and oversight; otherwise, the efforts will fail. *Current Procedural Terminology* codes for telephone calls, prolonged service, team conferences, and care plan oversight and management should be reimbursed in all benefit packages.
6. Research efforts should continue to develop new approaches in care coordination and to investigate the outcomes and benefits of care coordination, especially within the context of the medical home.
7. Interdisciplinary training opportunities in the medical home philosophy and care coordination are available through the National Center of Medical Home Initiatives for Children With Special Needs.[7] Medical students and residents in training should incorporate care coordination skills so that they are better prepared to coordinate care when they begin community practice. (For additional information, refer to the AAP policy statement "The Pediatrician's Role in Community Pediatrics."[40])
8. Barriers to care coordination should be addressed and overcome. These barriers for the family often include cultural/language status, educational level, economic situation, and transportation resources.

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ADDITIONAL RESOURCE

Center for Infants and Children With Special Needs, Cincinnati Children's Hospital Medical Center and The National Center of Medical Home Initiatives for Children With Special Needs. *Care Coordination Toolkit: Proper Use of Coordination of Care Codes With Children With Special Health Care Needs (CSHCN)*. Elk Grove Village, IL: American Academy of Pediatrics; 2004. Available at: www.medicalhomeinfo.org/tools/continuous.html

This toolkit provides information on billing for the coordination of care with descriptions of individual codes and proper documentation and an easy-to-follow billing slip. The appendices include:

- Identification of Children and Youth With Special Health Care Needs: Tools and Strategies
- How to Label/Flag the Chart: Tools and Strategies
- Forms
- How to Negotiate With Public and Private Insurers: Tools and Strategies
- Selected Vignettes

All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT
Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Task Force on Sudden Infant Death Syndrome

The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk

ABSTRACT. There has been a major decrease in the incidence of sudden infant death syndrome (SIDS) since the American Academy of Pediatrics (AAP) released its recommendation in 1992 that infants be placed down for sleep in a nonprone position. Although the SIDS rate continues to fall, some of the recent decrease of the last several years may be a result of coding shifts to other causes of unexpected infant deaths. Since the AAP published its last statement on SIDS in 2000, several issues have become relevant, including the significant risk of side sleeping position; the AAP no longer recognizes side sleeping as a reasonable alternative to fully supine sleeping. The AAP also stresses the need to avoid redundant soft bedding and soft objects in the infant's sleeping environment, the hazards of adults sleeping with an infant in the same bed, the SIDS risk reduction associated with having infants sleep in the same room as adults and with using pacifiers at the time of sleep, the importance of educating secondary caregivers and neonatology practitioners on the importance of "back to sleep," and strategies to reduce the incidence of positional plagiocephaly associated with supine positioning. This statement reviews the evidence associated with these and other SIDS-related issues and proposes new recommendations for further reducing SIDS risk. *Pediatrics* **2005;116:1245–1255;** ***SIDS, sudden infant death syndrome, sudden unexpected infant death, infant mortality, supine position, infant sleep, infant bedding.***

ABBREVIATIONS. SIDS, sudden infant death syndrome; AAP, American Academy of Pediatrics; OR, odds ratio; ALTE, apparent life-threatening event; PWS, plagiocephaly without synostosis.

INTRODUCTION

Sudden infant death syndrome (SIDS) continues to be a phenomenon of unknown cause and, despite marked reductions in rates over the past decade, still is responsible for more infant deaths in the United States than any other cause of death during infancy beyond the neonatal period.[1] This statement endorses elements from the previous statement from the American Academy of Pediatrics (AAP)[2] that have not changed, includes information about recent research, and presents updated recommendations based on current evidence.

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Although there is ongoing discussion about changing the definition,[3] the current generally accepted definition of SIDS remains as follows:

> The sudden death of an infant under 1 year of age, which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history.[4]

The occurrence of SIDS is rare during the first month of life, increases to a peak between 2 and 3 months of age, and then decreases. In conjunction with a more than 50% reduction in SIDS deaths since 1992, there has been a small shift in the age of death. A slightly higher proportion of deaths in the neonatal period and after 6 months of age were reported in 2001 than in 1992 (Fig 1).[5]

The following have been consistently identified across studies as independent risk factors for SIDS: prone sleep position, sleeping on a soft surface, maternal smoking during pregnancy, overheating, late or no prenatal care, young maternal age, preterm birth and/or low birth weight, and male gender. Consistently higher rates are found in black and American Indian/Alaska Native children—2 to 3 times the national average.

CHANGE IN SIDS STATISTICS IN THE UNITED STATES

Although SIDS was defined somewhat loosely until the mid-1980s, there was minimal change in the incidence of SIDS in the United States until the early 1990s. In 1992, in response to epidemiologic reports from Europe and Australia, the AAP recommended that infants be laid down for sleep in a nonprone position as a strategy to reduce the risk of SIDS.[6] The National Institute of Child Health and Human Development began conducting national surveys of infant care practices to evaluate the implementation of the AAP recommendation. The "Back to Sleep" campaign was initiated in the United States in 1994 under the leadership of the National Institute of Child Health and Human Development and as a joint effort of the US Public Health Service, the AAP, the SIDS Alliance, and the Association of SIDS and Infant Mortality Programs (800-505-CRIB; www.nichd.nih.gov/sids/sids.cfm).

Since 1992, and consistent with a steady decrease in the prone sleeping rate, there has been a consistent

Fig 1. Percent of SIDS deaths by age of death.[5]

decrease in the SIDS rate.[5] In 1992, the SIDS rate for the United States was 1.20 deaths per 1000 live births. In 2001, the SIDS rate was reported at 0.56 deaths per 1000 live births,[7] representing a decrease of 53% over 10 years. The rate in 2002 remained constant at 0.57.[8] The all-cause postneonatal death rate over this period also decreased 27%, from 3.14 to 2.29 per 1000 live births (Fig 2).[5] However, the all-cause postneonatal mortality rate has not changed since 1999 ($P = .61$), whereas until 2001, the postneonatal SIDS rate had continued to decrease at an average annual rate of 9.0% ($P < .01$).

Postneonatal mortality rates of several other causes of sudden unexpected infant death* have increased significantly, particularly over the years 1999–2001.[9] These observations increase the likelihood that some deaths previously classified as SIDS are now being classified in other categories and the true SIDS rate since 1999 may be static. Categories of SIDS have been proposed with the intent to be more inclusive and reduce potential diagnostic shift.[10] This proposal requires more discussion at the national level.

The apparent leveling of the previously declining SIDS rate is occurring coincident with a slowing in the reduction of the prevalence of prone positioning. The prevalence of prone positioning in the United States, as assessed from an ongoing national sampling, decreased from 70% in 1992 to 11.3% in 2002 and increased slightly to 13.0% in 2004.[11] Racial disparity in the prevalence of prone positioning may also be contributing to the continued disparity in SIDS rates between black and white infants (Fig 3).[5,12] The rate of SIDS among black infants was 2.5 times that of white infants in 2001.[7] The prevalence of prone positioning in 2001 among white infants was 11%, compared with 21% among black infants.[11] Additional work in promoting appropriate infant sleep positions and sleeping-environment conditions may be necessary to resume the previous rate of decline for SIDS and all-cause postneonatal mortality.

* Sudden unexpected infant death: other ill-defined and unspecified causes of mortality (*International Classification of Diseases, Ninth Revision* [ICD-9]: 799[0–9]; International *Classification of Diseases, 10th Revision* [ICD-10]: R99); suffocation-in-bed (ICD-9: E913[0]; ICD-10: W75); suffocation-other (ICD-9: E913[1]; ICD-10: W76-7 and W81-4).

There also has been a decrease in the seasonality of SIDS over the past decade in the United States. SIDS deaths have historically been observed more frequently in the colder months, with the fewest SIDS deaths occurring in the warmest months.[13] In 1992, SIDS rates had an average seasonal change of 16.3%, compared with only 7.6% in 1999,[14] which is consistent with reports from other countries.[15]

ISSUES RELATED TO SLEEP POSITION

The original 1992 sleeping-position recommendation from the AAP identified any nonprone position (ie, side or supine) as being optimum for reducing SIDS risk.[6] In 2000, on the basis of new evidence, the AAP advised that placing infants on their backs confers the lowest risk and is the preferred position. However, the risk of side position was reported as less than prone, and the AAP advised that if the side position is used, caregivers should be advised to bring the dependent arm forward to lessen the likelihood of the infant rolling to the prone position.

With the large decrease in the proportion of infants placed to sleep prone in the years since the initiation of Back to Sleep campaigns around the world, the contribution of side sleep position to SIDS risk has increased. Several studies, including 2 in the United States, have demonstrated that side sleep position confers an increased risk relative to back.[12,16–19] The population-attributable risk reported for side sleep position in the New Zealand[15] and British[16] studies were higher than those for prone position. In addition, the Nordic study[20] reported that the presence of infectious symptoms in combination with the side sleep position increased the risk far greater than the sum of the individual factors.

A study conducted in California[17] after the Back to Sleep era (1997–2000) found that the SIDS risks associated with side and prone position were similar in magnitude (adjusted odds ratios [ORs]: 2.0 and 2.6, respectively). Further examination found that the risk of SIDS was exceptionally high for infants who were placed on the side and found on the stomach (adjusted OR: 8.7). Previous studies have found that side sleep position is unstable. The probability of an infant rolling to the prone position from the side sleep position is significantly greater than rolling prone from the back.[16,21,22]

Diagnosis	ICD-9/ICD-10 Code
SIDS	7980/R95
Sudden unexpected infant death	
Unknown and unspecified causes	799.9/R99
Suffocation in bed	E913.0/W75
Suffocation "other"	E913.1-E913.9/W76-W77 and W81-W85

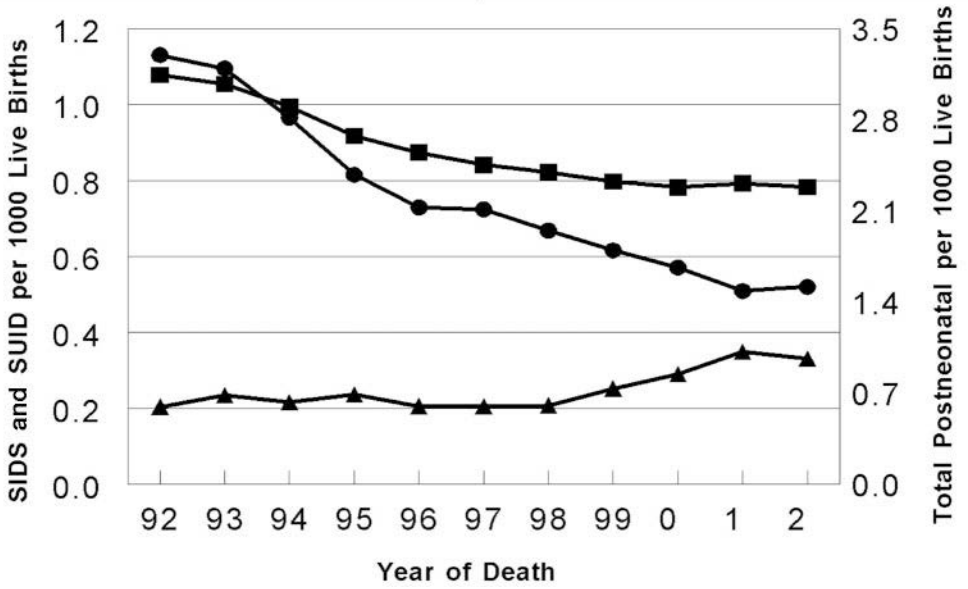

Fig 2. Trends in postneonatal mortality: United States 1992–2002.[5]] indicates all-cause postneonatal mortality; ●, SIDS; ▲, sudden unexpected infant death. SUID indicates sudden unexpected infant death.

The California study also extended 2 previous observations that infants unaccustomed to the prone position and placed prone for sleep were at greater risk than those usually placed prone.[19,23] It was found that infants who were usually placed supine but were placed on their sides or prone for the last sleep were at very high risk of SIDS (adjusted OR: 6.9 and 8.2, respectively),[17] which emphasizes the importance of every caregiver using the back sleep position during every sleep period, particularly when the infant's accustomed position is supine.

BEDDING

In 1944, Abramson[24] reported that approximately 40% of infants in New York City dying suddenly and unexpectedly during sleep were prone, with their nose and mouth burrowed into "soft pillows, mattresses, or mattress coverings." Early reports from the New Zealand Cot Death study[25] suggested that a majority of infants dying prone were on sheepskins. Soft crib mattresses, unfamiliar to North Americans, filled with "natural fibers" such as bark from the ti tree, were mentioned in studies from Australia linking prone sleep to sudden death.[26] Other studies have shown that infants dying from SIDS or "crib death" were more likely to have used a pillow or soft mattress, to have been found with their nose and mouth completely covered by bedding, and/or to have assumed a face-down posture.[27–30] A case-control study from the United States[31] has confirmed the strong association of SIDS and using soft bedding (OR: 5.1) or pillows (OR: 2.5), independent of prone sleep position (adjusted OR: 5.2 and 2.8, respectively). A strong interaction was found between prone sleep position and soft bedding surface, with an adjusted OR of 21.0, indicating that these 2 factors together are very hazardous. Soft surfaces have also been implicated in infant deaths occurring on adult beds.[32–34]

BED SHARING

Bed sharing between an infant and adult(s) is a highly controversial topic. Although electrophysiologic and behavioral studies offer a strong case for its effect in facilitating breastfeeding and the enhancement of maternal-infant bonding,[35,36] epidemiologic studies of bed sharing have shown that it can be hazardous under certain conditions. Several case series of accidental suffocation or death from undetermined cause suggest that bed sharing is hazardous.[34,37–39] A number of case-control studies of SIDS deaths have investigated the relationship of SIDS with parent(s) and/or other adults or children sleep-

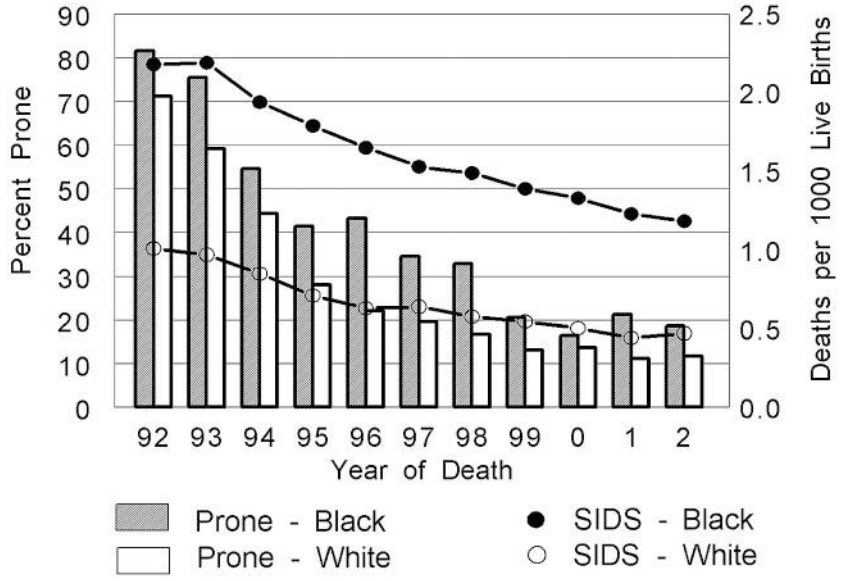

Fig 3. US trends in SIDS rates and prevalence of prone positioning according to race.[5,12]

ing with an infant.[16,31,40–48] Some of these studies have found the correlation between death and bed sharing to reach statistical significance only among mothers who smoked.[41,47] However, the European Concerted Action on SIDS study,[42] which was a large multisite study, found that bed sharing with mothers who did not smoke was a significant risk factor among infants up to 8 weeks of age. Similarly, a more recent study conducted in Scotland[48] found that the risk of bed sharing was greatest for infants younger than 11 weeks, and this association remained among infants with nonsmoking mothers. The risk of SIDS seems to be particularly high when there are multiple bed sharers[31] and also may be increased when the bed sharer has consumed alcohol or is overtired.[42,47] Also, the risk of SIDS is higher when bed sharing occurs with young infants.[40–42] It is extremely hazardous when adults sleep with an infant on a couch.[31,40,41,48] Finally, the risk of bed sharing is higher the longer the duration of bed sharing during the night.[41,47] Returning the infant to his or her crib was not associated with an increased risk in 2 studies,[40,41] and in another, the risk was significant only when the bed sharing occurred for more than 1 hour or for the whole night.[16] There is growing evidence that room sharing (infant sleeping in the parent's room) without bed sharing is associated with a reduced risk of SIDS.[41,42,43,48] Data from the European Concerted Action on SIDS[42] study led to the recommendation by its authors that the most protective sleep setting for an infant is in a crib in the parents' room. On the basis of their study results, investigators in Scotland[48] endorsed the United Kingdom Department of Health's advice that the safest place for an infant to sleep is in a crib in the parents' room for the first 6 months of life.

PACIFIERS

Several studies[31,40,42,49–53] have reported a protective effect of pacifiers on the incidence of SIDS, particularly when used at the time of last sleep (Fig 4). The mechanism for this apparent strong protective effect is still unclear, but several mechanisms such as lowered arousal thresholds have been proposed.[54,55]

Concerns about possible deleterious effects of pacifier use have prevented most SIDS experts and policy makers from making a recommendation for pacifier use as a risk-reducing method.[54–56] Concerns specifically about breastfeeding have led others to recommend pacifiers only for bottle-fed infants.[53] Although several studies have shown a correlation between pacifiers and reduced breastfeeding duration, the results of well-designed randomized clinical trials indicate that pacifiers do not seem to cause shortened breastfeeding duration for term and preterm infants.[57,58] One study reported a small deleterious effect of pacifier introduction in the first week of life on breastfeeding at 1 month of age, but this effect did not persist beyond 1 month.[59] Some dental malocclusions have been found more commonly among pacifier users than nonusers, but the differences generally disappeared after cessation.[60] The American Academy of Pediatric Dentistry policy statement on oral habits[61] states that "nonnutritive sucking behaviors (ie, finger or pacifier) are considered normal in infants and young children … and in general, sucking habits in children to the age of five are unlikely to cause any long-term problems." There is an approximate 1.2- to 2-fold increased risk of otitis media associated with pacifier use, but the incidence of otitis media is generally lower in the first year of life, especially the first 6 months, when the risk of SIDS is the highest.[62–67] However, pacifier use, once established, may persist beyond 6 months, thus increasing the risk of otitis media. Gastrointestinal infections and oral colonization with *Candida* species were found to be more common among pacifier users.[63–65]

SECONDARY CAREGIVERS

Two thirds of US infants younger than 12 months are in nonparental child care. Infants of employed

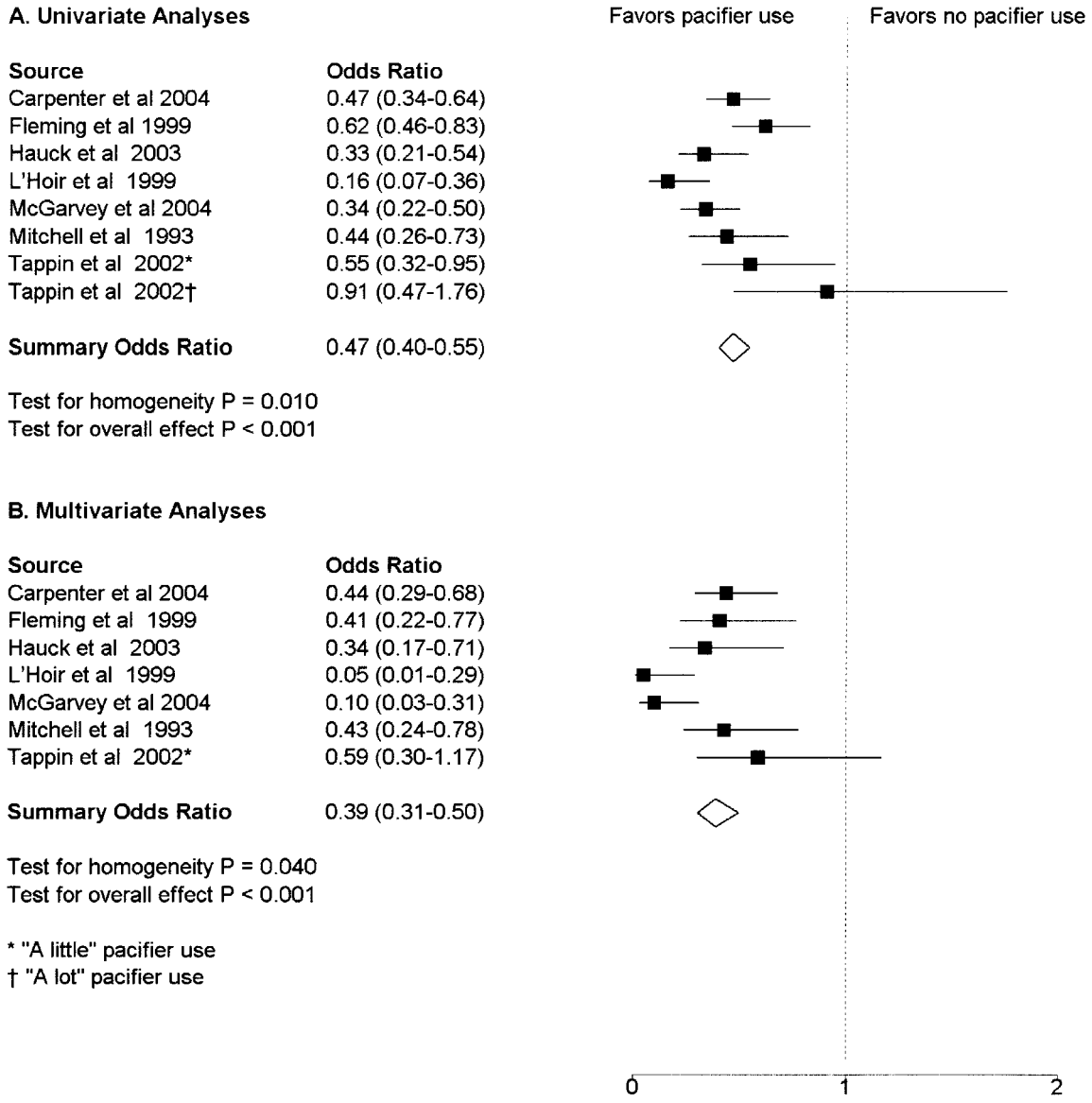

Fig 4. Meta-analysis of studies examining the relationship of a pacifier used during the last sleep in SIDS victims versus controls. (Reproduced with permission from Hauck FR, Omojokun OO, Siadaty MS. Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis. *Pediatrics*. 2005;116:e716.)

mothers spend an average of 22 hours each week in child care, and 32% of infants are in child care full-time (defined as 35 hours or more each week).[68] Of the infants who are cared for by secondary (nonparental) caregivers, approximately 50% are cared for by relatives, 10% are cared for by an in-home babysitter, and the remainder are in organized child care (ie, a child care center or family child care home).[68] In the United States, approximately 20% of SIDS deaths occur while the infant is in the care of a nonparental caregiver. Despite the remarkable decrease in the rate of SIDS and decreased frequency of prone sleeping nationally, the proportion of SIDS deaths occurring in child care remained constant between 1996 and 1998.[69] Many child care deaths have been associated with the prone sleep position, especially when the infant is unaccustomed to being placed in that position. This is particularly concerning, because unaccustomed prone sleep increases the risk of SIDS by as much as 18-fold.[23,70] It is frequently a nonparental caregiver who places the infant in an unaccustomed prone position.

A 1996 study[71] revealed that 43% of licensed child care centers were unaware of the relationship between SIDS and infant sleep position, and subsequent surveys of child care centers have documented that, despite an increased awareness, 20% to 28% of centers continue to place infants prone for sleep,[72,73] reportedly because they are unaware of the dangers of sleeping prone and/or are misinformed of the risks and benefits of various sleep positions. However, licensed child care centers seldom have adequate regulations regarding safe sleep for infants, and most states do not have safe-sleep regulations for child care providers.[74] In addition, many infants are cared for by relatives and nonlicensed caregivers

(babysitters, nannies, unregulated family child care homes) who still may be unaware of the importance of supine sleeping in a safe sleep environment.

HOME MONITORS, SIDS, AND APPARENT LIFE-THREATENING EVENTS

For many years, apnea was thought to be the predecessor of SIDS, and home apnea monitors were thought to be an effective strategy for preventing SIDS.[75] Although there is no evidence that home monitors are effective for this purpose,[76–78] distribution of home monitors continues to be a substantial industry in the United States. An apparent life-threatening event (ALTE) is defined as "an episode that is frightening to the observer and is characterized by some combination of apnea (central or occasionally obstructive), color change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking, or gagging."[4] After interpreting data from the Collaborative Infant Home Monitoring Study Group,[79] the AAP has recommended that infant home monitoring not be used as a strategy to prevent SIDS but may be useful in some infants who have had an ALTE.[80] The AAP recognizes that monitors may be helpful to allow rapid recognition of apnea, airway obstruction, respiratory failure, interruption of supplemental oxygen supply, or failure of mechanical respiratory support. Infants for whom these indications may apply include infants who have experienced an ALTE. The Task Force on Sudden Infant Death Syndrome endorses these recommendations.

IMMUNIZATIONS AND SIDS

Reports of a possible association between diphtheria-pertussis-tetanus immunizations and SIDS[81,82] brought forth a series of reviews and studies that refuted the association.[83,84] Still, of 100 deaths reported to the federally administered Vaccine Adverse Event Reporting System from 1997 to 1998, approximately half were attributed to SIDS.[85] Recent reports, however, continue to show no association between immunizations and SIDS.[86,87]

RELATIONSHIP BETWEEN BREASTFEEDING AND SIDS

Physiologic sleep studies of infants demonstrate that breastfed infants are more easily arousable than their formula-fed counterparts during sleep,[54,88] which may explain a possible protective effect against SIDS. However, epidemiologic studies have not been consistent in demonstrating such a protective effect.[16,18,31,49,89–98] Although some studies show a protective effect of breastfeeding on SIDS,[18,98,99] others do not.[31,49,91,96,97,100,101] In addition, a recent article has demonstrated that although breastfeeding is associated with decreased postneonatal deaths overall, it is not associated with a reduced risk of SIDS.[102] Many of the case-control studies demonstrate a protective effect of breastfeeding against SIDS in univariate analysis but not when confounding factors are taken into account.[31,49,91,96,97] These results suggest that factors associated with breastfeeding, rather than breastfeeding itself, are protective. One of these possible factors is nonsmoking, which is associated with a decreased incidence of SIDS and with both increased initiation and duration of breastfeeding.[103–107] Although breastfeeding is beneficial and should be promoted for many reasons, the task force believes that the evidence is insufficient to recommend breastfeeding as a strategy to reduce SIDS.

POSITIONAL PLAGIOCEPHALY

Over the past decade, several reports have suggested that there has been a dramatic increase in the incidence of plagiocephaly without synostosis (PWS).[108,109] Although there have been no published population-based studies and there has been some debate of whether there has been a real increase or simply an increased awareness,[110,111] it seems likely that both have occurred.[112–115]

Congenital PWS is generally thought to be caused by in utero or intrapartum molding and, therefore, is often associated with multiple births or birth injury.[116,117] Infants born preterm may develop plagiocephaly or dolichocephaly from having fixed head positions during respiratory support administered while receiving neonatal intensive care. Some infants develop PWS as a result of torticollis caused by sternocleidomastoid shortening.[112,118,119] However, a recent case-control study has shown that many cases of PWS are associated with supine sleeping position (OR: 2.51; 95% confidence interval: 1.23–5.16).[119] Such infants are also more likely not to have had the head position varied when put down to sleep, more likely to have had less than 5 minutes per day of "tummy time," and less likely to have been held in the upright position when not sleeping. Children with developmental delay and/or neurologic injury have increased rates of PWS, although a causal relationship has not been demonstrated.[119–123] One study showed that the incidence of PWS in healthy normal children decreases spontaneously from 20% at 8 months to 3% at 24 months of age.[124]

DISCHARGE FROM NEONATAL INTENSIVE CARE UNITS AND NEWBORN NURSERIES

The original Back to Sleep campaign recommendation in 1992 excluded "premature infants with respiratory distress."[6] Subsequent statements[2] and the current statement have removed the preterm infant as a recognized exception from the supine sleep recommendation because of the increased risk of SIDS among infants born preterm[125,126] and evidence that the association between prone sleeping and SIDS among low birth weight infants is equal to, or perhaps even stronger than, the association among those born at term.[19] However, a recent survey of mothers from Massachusetts and Ohio who had delivered preterm infants in 1995–1998[127] disclosed that very low birth weight infants (birth weight of less than 1500 g) were almost twice as likely to be placed prone for sleep at 1 month after hospital discharge than were infants born in the next higher low birth weight category (birth weight of 1500–2500 g). Another study of infants delivered in 15 states during

the same time period[128] also found that very low birth weight infants were especially unlikely to sleep supine. The authors surmised that this increased likelihood of prone positioning is a reflection of the following: (1) very preterm infants in intensive care nurseries are frequently managed in the prone position; (2) such infants and their caregivers become habituated to using this position; and (3) mothers are likely to follow the advice given by physicians and other health care professionals, and such advice is more likely to be conveyed during a long hospitalization. The task force believes that neonatologists, neonatal nurses, and other health care professionals responsible for organizing the hospital discharge of infants from neonatal intensive care units should become more vigilant about endorsing and modeling the SIDS risk-reduction recommendations significantly before the infant's anticipated discharge.

There is also some concern about practitioners in newborn nurseries continuing to place infants on the side after birth. The practice occurs presumably because of the impression that newborn infants need to clear their airways of amniotic fluid and may be less likely to aspirate while in the side position. Although there is no evidence that such fluid will be cleared more readily while in the side position, there is also no compelling evidence that sleep position is related to SIDS during the immediate neonatal period, because the incidence of SIDS at this age is quite rare. However, there is evidence that mothers will tend to copy the practices at home that they observe health care professionals practicing in the hospital and, therefore, may be more likely to use the side position at home when the risk of SIDS and its relationship to sleep position increases.[129,130] If there are concerns about possible choking during the first few hours after birth, hospital personnel can place the infants on their sides, propped up against the side of the bassinet for stability. However, the task force recommends that the infants be placed on their backs as soon as possible.

INFANTICIDE AND SIDS RECURRENCE

Several publications have suggested that the level of suspicion of foul play should be increased on the recurrence of SIDS within a family unit.[131–133] However, on the basis of an in-depth review of recurrent sudden unexpected infant deaths among families that had experienced 1 SIDS death, Carpenter et al[134] calculated an 87% probability that a second SIDS death within a family would be of natural cause. Calculations of the proportion of SIDS deaths attributable to covert homicide range from 6% to 10%, and recurrence risks for SIDS within a family in which 1 infant previously died of SIDS range from 2% to 6%.[135,136] Therefore, the task force supports the position that the vast majority of either initial or second sudden unexpected infant deaths within a family seem to be natural rather than attributable to abuse, neglect, or homicide. However, the task force maintains that a complete autopsy, examination of the death scene, and review of the clinical history are necessary to obtain the most accurate diagnosis.

OTHER ISSUES

There are several issues that were addressed in previous statements that are not revisited in this statement because there have not been new findings, including the effects of overheating, maternal antenatal smoking, and infant environmental smoke on SIDS incidence; cardiac arrhythmias as an etiologic factor in SIDS; and complications of nonprone sleeping, other than plagiocephaly. The reader is referred to the previous statement for discussion of these issues.[2]

The predominant hypothesis regarding the etiology of SIDS remains that certain infants, for reasons yet to be determined, may have a maldevelopment or delay in maturation of the brainstem neural network that is responsible for arousal and affects the physiologic responses to life-threatening challenges during sleep. Recent examinations of the brainstems of infants who died of SIDS have revealed unique deficits in serotonin receptors in a network of neurons throughout the ventral medulla. The medullary regions involved develop in midgestation from a common embryonic anlage and are thought to be involved with arousal, chemosensitivity, respiratory drive, thermoregulation, and blood pressure responses.[137]

RECOMMENDATIONS

The recommendations outlined here were developed to reduce the risk of SIDS in the general population. As it is defined by epidemiologists, risk refers to the probability that an outcome will occur given the presence of a particular factor or set of factors. Scientifically identified associations between risk factors (eg, socioeconomic characteristics, behaviors, or environmental exposures) and outcomes such as SIDS do not necessarily denote causality. Furthermore, the best current working model of SIDS suggests that more than 1 scenario of preexisting conditions and initiating events may lead to SIDS. Therefore, when considering the recommendations in this report, it is fundamentally misguided to focus on a single risk factor or to attempt to quantify risk for an individual infant. Individual medical conditions may warrant a physician to recommend otherwise after weighing the relative risks and benefits.

1. Back to sleep: Infants should be placed for sleep in a supine position (wholly on the back) for every sleep. Side sleeping is not as safe as supine sleeping and is not advised.
2. Use a firm sleep surface: Soft materials or objects such as pillows, quilts, comforters, or sheepskins should not be placed under a sleeping infant. A firm crib mattress, covered by a sheet, is the recommended sleeping surface.
3. Keep soft objects and loose bedding out of the crib: Soft objects such as pillows, quilts, comforters, sheepskins, stuffed toys, and other soft objects should be kept out of an infant's sleeping environment. If bumper pads are used in cribs, they should be thin, firm, well secured, and not "pillow-like." In addition, loose bedding such as blankets and sheets may be hazardous. If blan-

kets are to be used, they should be tucked in around the crib mattress so that the infant's face is less likely to become covered by bedding. One strategy is to make up the bedding so that the infant's feet are able to reach the foot of the crib (feet to foot), with the blankets tucked in around the crib mattress and reaching only to the level of the infant's chest. Another strategy is to use sleep clothing with no other covering over the infant or infant sleep sacks that are designed to keep the infant warm without the possible hazard of head covering.

4. Do not smoke during pregnancy: Maternal smoking during pregnancy has emerged as a major risk factor in almost every epidemiologic study of SIDS. Smoke in the infant's environment after birth has emerged as a separate risk factor in a few studies, although separating this variable from maternal smoking before birth is problematic. Avoiding an infant's exposure to second-hand smoke is advisable for numerous reasons in addition to SIDS risk.
5. A separate but proximate sleeping environment is recommended: The risk of SIDS has been shown to be reduced when the infant sleeps in the same room as the mother. A crib, bassinet, or cradle that conforms to the safety standards of the Consumer Product Safety Commission and ASTM (formerly the American Society for Testing and Materials) is recommended. "Cosleepers" (infant beds that attach to the mother's bed) provide easy access for the mother to the infant, especially for breastfeeding, but safety standards for these devices have not yet been established by the Consumer Product Safety Commission.

   Although bed-sharing rates are increasing in the United States for a number of reasons, including facilitation of breastfeeding, the task force concludes that the evidence is growing that bed sharing, as practiced in the United States and other Western countries, is more hazardous than the infant sleeping on a separate sleep surface and, therefore, recommends that infants not bed share during sleep. Infants may be brought into bed for nursing or comforting but should be returned to their own crib or bassinet when the parent is ready to return to sleep. The infant should not be brought into bed when the parent is excessively tired or using medications or substances that could impair his or her alertness. The task force recommends that the infant's crib or bassinet be placed in the parents' bedroom, which, when placed close to their bed, will allow for more convenient breastfeeding and contact. Infants should not bed share with other children. Because it is very dangerous to sleep with an infant on a couch or armchair, no one should sleep with an infant on these surfaces.
6. Consider offering a pacifier at nap time and bedtime: Although the mechanism is not known, the reduced risk of SIDS associated with pacifier use during sleep is compelling, and the evidence that pacifier use inhibits breastfeeding or causes later dental complications is not. Until evidence dictates otherwise, the task force recommends use of a pacifier throughout the first year of life according to the following procedures:
   - The pacifier should be used when placing the infant down for sleep and not be reinserted once the infant falls asleep. If the infant refuses the pacifier, he or she should not be forced to take it.
   - Pacifiers should not be coated in any sweet solution.
   - Pacifiers should be cleaned often and replaced regularly.
   - For breastfed infants, delay pacifier introduction until 1 month of age to ensure that breastfeeding is firmly established.
7. Avoid overheating: The infant should be lightly clothed for sleep, and the bedroom temperature should be kept comfortable for a lightly clothed adult. Overbundling should be avoided, and the infant should not feel hot to the touch.
8. Avoid commercial devices marketed to reduce the risk of SIDS: Although various devices have been developed to maintain sleep position or to reduce the risk of rebreathing, none have been tested sufficiently to show efficacy or safety.
9. Do not use home monitors as a strategy to reduce the risk of SIDS: Electronic respiratory and cardiac monitors are available to detect cardiorespiratory arrest and may be of value for home monitoring of selected infants who are deemed to have extreme cardiorespiratory instability. However, there is no evidence that use of such home monitors decreases the incidence of SIDS. Furthermore, there is no evidence that infants at increased risk of SIDS can be identified by in-hospital respiratory or cardiac monitoring.
10. Avoid development of positional plagiocephaly:
    - Encourage "tummy time" when the infant is awake and observed. This will also enhance motor development.
    - Avoid having the infant spend excessive time in car-seat carriers and "bouncers," in which pressure is applied to the occiput. Upright "cuddle time" should be encouraged.
    - Alter the supine head position during sleep. Techniques for accomplishing this include placing the infant to sleep with the head to one side for a week and then changing to the other and periodically changing the orientation of the infant to outside activity (eg, the door of the room).
    - Particular care should be taken to implement the aforementioned recommendations for infants with neurologic injury or suspected developmental delay.
    - Consideration should be given to early referral of infants with plagiocephaly when it is evident that conservative measures have been ineffective. In some cases, orthotic devices may help avoid the need for surgery.
11. Continue the Back to Sleep campaign: Public education should be intensified for secondary care-

givers (child care providers, grandparents, foster parents, and babysitters). The campaign should continue to have a special focus on the black and American Indian/Alaska Native populations. Health care professionals in intensive care nurseries, as well as those in well-infant nurseries, should implement these recommendations well before an anticipated discharge.

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POLICY STATEMENT

Chemical-Biological Terrorism and Its Impact on Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Environmental Health and Committee on Infectious Diseases

ABSTRACT

Children remain potential victims of chemical or biological terrorism. In recent years, children have even been specific targets of terrorist acts. Consequently, it is necessary to address the needs that children would face after a terrorist incident. A broad range of public health initiatives have occurred since September 11, 2001. Although the needs of children have been addressed in many of them, in many cases, these initiatives have been inadequate in ensuring the protection of children. In addition, public health and health care system preparedness for terrorism has been broadened to the so-called all-hazards approach, in which response plans for terrorism are blended with plans for a public health or health care system response to unintentional disasters (eg, natural events such as earthquakes or pandemic flu or manmade catastrophes such as a hazardous-materials spill). In response to new principles and programs that have appeared over the last 5 years, this policy statement provides an update of the 2000 policy statement. The roles of both the pediatrician and public health agencies continue to be emphasized; only a coordinated effort by pediatricians and public health can ensure that the needs of children, including emergency protocols in schools or child care centers, decontamination protocols, and mental health interventions, will be successful.

INTRODUCTION

In April 2000, the American Academy of Pediatrics (AAP) Committee on Environmental Health and Committee on Infectious Diseases published the technical report "Chemical-Biological Terrorism and Its Impact on Children."[1] Events until that time, including the 1995 sarin attack in Tokyo, Japan, had made clear the possibility that acts of domestic terrorism can occur, with significant impact on the health of children. Since publication of the 2000 technical report, many additional acts of chemical and biological terrorism have occurred, including the release of anthrax spores through the US postal system, intentional food contamination by toxic chemicals in Grand Rapids, Michigan, and Fresno, California, and the identification of ricin-laden letters in a post office in South Carolina.

Immediately after the September 11, 2001, terrorist attacks in the United States, which soon were followed by anthrax releases, the AAP, recognizing the need to address the impact of terrorism on children, initiated a series of unprecedented actions. These actions included (1) formation of the AAP Task Force on Terrorism, (2) creation of a comprehensive Web site on the AAP home page devoted to providing information on terrorism and its impact on children (www.aap.org/terrorism/index.html), (3) publication of the technical report "Radiation Disasters and Children,"[2] (4) publication of a policy statement on smallpox immunization,[3]

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

Key Words
chemical terrorism, biological terrorism, emergency preparedness

Abbreviations
AAP—American Academy of Pediatrics
PPE—personal protective equipment
CDC—Centers for Disease Control and Prevention
SNS—Strategic National Stockpile
CHC—community health center
DMAT—disaster medical assistance team
CISD—critical incident stress debriefing

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(5) an addition to the *Red Book* of descriptions of biological weapons and management of the diseases they produce,[4] (6) publication of a technical report[5] and policy statement[6] on the pediatrician and disaster preparedness, and (7) publication of the CD-ROM *Feelings Need Checkups Too*, designed to address mental health consequences of terrorism in children (www.aap.org/profed/childrencheckup.htm).

The continuing occurrence of chemical and biological terrorism makes clear the ongoing need to improve public health and health care system preparedness in all respects, including the detection of covert events, establishment of comprehensive response protocols for children, and implementation of plans for rapid resource mobilization. At the governmental level, these actions have been facilitated by the passage of key federal legislation (Table 1).[7] However, there remains a need for pediatricians to be knowledgeable about the chemical and biological weapons that could be used against a population that includes children. Moreover, many new principles in the care of children after chemical and biological terrorism have been developed. This policy statement replaces the 2000 policy statement, with an added focus on systems issues that are key in minimizing morbidity and mortality to children after their exposure to a chemical or biological weapon.

AGENTS OF CONCERN

Chemicals

In recent years, there have been 3 significant changes in the traditional concepts of terrorism involving chemical weapons. First, the narrow belief that such weapons would be intentionally manufactured to be instruments of mass destruction has been expanded by the recognition that readily available chemicals (eg, chlorine) manufactured for another purpose can be used for chemical terrorism (so-called weapons of opportunity). Second, the general impression that chemical terrorist events are likely to be dramatic and immediately recognized, such as the sarin incident in Tokyo, has been expanded to include the possibility that these acts can be covert, with delayed recognition. Finally, the concept that single individuals, acting impulsively and having few to no resources, can successfully release a chemical weapon must be considered in addition to the concept that chemical weapons are likely to be released by well-organized and funded terrorist groups after extensive planning.

TABLE 1 **Federal Legislation Enacted Since 2001 to Improve Public Health Response to Bioterrorism and Other Public Health Emergencies**

Date	Legislation
June 2002	Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (H.R. 3448)
November 2002	Homeland Security Act (H.R. 5005)
April 2003	Smallpox Emergency Personnel Protection Act (H.R. 1770)
April 2003	Emergency Preparedness and Response Act of 2003 (S. 930)
July 2003	Community Protection and Response Act of 2003 (H.R. 2878)
July 2003	Enhanced-911 Implementation Act of 2003 (H.R. 2898)
July 2004	Project Bioshield Act of 2004 (S. 1504)
2003	Robert T. Stafford Disaster Relief and Emergency Assistance Act (Pub L No. 106-390)
2003	First Responders Partnership Grant Act of 2003 (S. 466)

Two recent acts of chemical terrorism involving children illustrate these new concepts. In 1999 in Fresno, California, patrons of a restaurant developed severe gastroenteritis. An investigation by public health authorities ultimately found that the carbamate insecticide methomyl had been maliciously added to the salt.[8] More than 100 adults and children became ill with nausea, vomiting, and diarrhea; a perpetrator was never identified. In 2002 in Grand Rapids, Michigan, a disgruntled grocery worker placed a nicotine-containing insecticide into ground beef, making it available for purchase by unsuspecting customers. It was not until widespread illness (nausea, mouth burning, vomiting) was reported and there was a recall and analysis of the meat, revealing the presence of nicotine, that this was recognized as an act of terrorism.[9] Ultimately, more than 100 people became ill, including more than 40 children, in what is now considered the largest act of chemical terrorism in US history.

The chemicals considered the most likely threat for use as chemical weapons are placed into 6 categories: nerve agents, vesicants, irritants/corrosives, choking agents, cyanogens, and incapacitators, including lacrimators (Table 2).

Nerve Agents

Nerve agents are well absorbed through intact skin and even through examination gloves used in clinical settings. All nerve agents act as acetylcholinesterase inhibitors, producing the same signs and symptoms associated with organophosphate poisoning. Manifestations can range from mild (miosis, nausea, diarrhea) to severe (muscle weakness, fasciculations, respiratory failure, coma, seizures).

In the 1995 sarin episode in Tokyo, the most unanticipated sequela was the degree of injury to health care professionals.[10] Several hundred physicians, nurses, and other health care professionals became ill as a result of 2 factors: handling of sarin-contaminated victims without wearing personal protective equipment (PPE) and the entry of contaminated victims into health care facilities, leading to transmission of sarin vapor through the ventilation system.[10,11] This event firmly demonstrated the importance of protecting health care professionals through the use of PPE and the importance of maintaining office or hospital safety by ensuring that victims are adequately decontaminated before entering the building.

TABLE 2 **Chemical Weapons of Concern**

Agent Classification	Built Weapon	Weapon of Opportunity
Nerve agents	Tabun	Pesticides
	Sarin	Nicotine
	Soman	Organophosphates
	VX gas	Carbamates
Vesicants	Lewisite	
	Mustard gas	
	Nitrogen mustard	
Irritants/corrosives		Ammonia
		Bromine
		Chlorine
Choking agents	Phosgene	Perfluoroisobutylene (Teflon) and other chemical polymers
	Nitrogen oxides	Smoke, products of combustion
Cyanogens ("blood agents")	Hydrogen cyanide	Industrial cyanide
		Sodium azide
		Carbon monoxide
Incapacitators	3-Quinuclidinyl benzilate (BZ)	Anticholinergics
	Cannabinoids	
	Barbiturates	
	Fentanyl derivatives	
Lacrimators	Chloroacetophenone (CN)	Capsaicin
	Chlorobenzylidene (CS)	

Management of nerve-agent exposure includes supportive care and, when indicated, prompt administration of the antidotes atropine and pralidoxime.[12] Both of these antidotes are available in autoinjector form, permitting rapid administration; autoinjectors are particularly important in mass-casualty incidents where there is a need to treat large numbers of victims as quickly and efficiently as possible. Until recently, the rapid administration of atropine and pralidoxime to children was complicated by the absence of pediatric autoinjectors; only the forms approved for adults, containing 2 mg of atropine and 600 mg of pralidoxime, were available. A pediatric atropine autoinjector was recently approved by the Food and Drug Administration for use in small children after nerve-agent exposure.[13] However, the continued absence of a pediatric pralidoxime autoinjector, which is key in the successful treatment of central nervous system and muscular toxicity from nerve agents, leaves the use of standard, multidose vials as the only therapeutic option. To address this issue, consensus guidelines now recommend that children weighing 13 kg or more (2–3 years or older) receive a 600-mg dose of pralidoxime from an autoinjector, on the basis of the belief that this pralidoxime dose falls within the range of safety for the drug.[5] Children weighing less than 13 kg should receive the customary weight-based (20–50 mg/kg) dose, administered from a multidose vial; if unavailable, an autoinjector should be used.

Other aspects of care to children who have been exposed to nerve agents are found in recent reviews.[12,14]

Vesicants

Vesicants include sulfur mustard and lewisite, an arsenic-based blistering agent. These chemicals, both of which are released as an aerosol, produce erythema, burning, vesiculation, and then desquamation of the skin. Victims of vesicant exposure typically develop skin tingling followed by burning; within 24 hours, skin sloughing begins to occur, with wounds having the appearance of partial-thickness burns. These agents are also immunosuppressive, further increasing the risk of severe infection. Treatment is largely supportive. Important principles of management include protection of health care professionals through the use of PPE and topical decontamination.[15] Because vesicants are often oil based, a mild soap or shampoo should be used during decontamination.

Choking Agents

Choking agents are created to produce, usually in delayed fashion, pulmonary injury with resulting bronchospasm, pulmonary edema, and respiratory failure. Immediate symptoms include eye burning, tearing, and blepharospasm. The major agent of this group is phosgene; however, common industrial chemicals, including polytef (Teflon) and other chemical polymers, act as choking agents depending on their ambient concentration. Most choking agents are heavier than air, which could result in higher concentrations at the breathing level of the child. Treatment is supportive.

Cyanogens

The cyanogens are similar to cyanide in structure and/or function. Agents in this class include cyanide salts and sodium azide. The cyanogens interrupt cellular utilization of oxygen, producing respiratory distress, coma, and metabolic acidosis. Victims of cyanogen exposure must

be recognized promptly to administer the life-saving antidotes sodium nitrite and sodium thiosulfate.

Incapacitating Agents

Incapacitating agents include several different chemical classes (eg, anticholinergic agents, hallucinogens, cannabinoids, and fentanyl derivatives). In the Russian theater hostage incident in 2002, what is thought to have been a fentanyl-based incapacitating agent was released during the rescue effort. The agent, although successful in overwhelming the hostage-takers, also killed 127 hostages.[16]

Many incapacitating agents are weapons of opportunity, being easily acquired pharmaceutical agents or substances of abuse that are surreptitiously added to common sources of food or drink.

Included among incapacitators are lacrimators. Often referred to collectively as Mace or "tear gas," lacrimators include the chemicals chloroacetophenone and chlorobenzylidene as well as capsaicin ("pepper spray"). Lacrimators are designed to produce incapacitation from irritation of the eye and other mucous membranes. Exposure to Mace results in eye burning, tearing, and blepharospasm; victims may become temporarily blind. Inhalation produces mouth pain, shortness of breath, and, in rare cases, laryngospasm. Because capsaicin is widely sold as a nonlethal weapon, episodes of capsaicin release into the ventilation system of schools and buildings are a relatively common prank, although such incidents meet the definition of terrorism (ie, an act designed to frighten, hurt, or kill).

Biological Agents

Most of the biological agents that could be used as weapons are now discussed in the *Red Book*,[4] although some agents (eg, ricin) are not discussed in detail. Ricin is discussed in a subsequent section of this report.

The biological weapons of concern are listed in Table 3. These agents have been placed by the Centers for Disease Control and Prevention (CDC) into categories A, B, or C. Thirty-nine agents are included in these 3 categories.

Category A agents are considered the greatest public health threat because of their high morbidity and mortality, potential ease of dissemination, and potential to cause public panic. Currently, there are 6 agents in this group: anthrax, plague, smallpox, botulinum, tularemia, and the viral hemorrhagic fevers, including Ebola and Marburg viruses. Detailed descriptions of these agents have been published in *Red Book*[4] and elsewhere.

Smallpox

The most widely discussed category A agent in recent years has been smallpox. In 2001, because of increasing concerns that smallpox was in the hands of terrorists and had the potential to produce widespread morbidity and mortality, the CDC recommended a "ring immunization" (surveillance and containment) strategy in the United States. This strategy of containment was reviewed and endorsed by the AAP Committee on Infectious Diseases in its 2002 policy statement "Smallpox Vaccine."[3] Subsequently, the CDC recommended a 3-phase plan for smallpox immunization of health care professionals and other individuals.[3] During the first phase, health care professionals in acute care facilities were to be immunized. In the second phase, there would be potential expansion to other health care professionals and first responders. In a possible third phase, voluntary immunization would be available to all those interested in being immunized. This campaign, to date, has struggled from several difficulties, including (1) the inability to quantitate the risk of a smallpox release, preventing individuals from making their own risk/benefit analysis, (2) an extensive list of contraindications to the vaccine, (3) general fears about the safety of the vaccine, (4) the appearance of unrecognized adverse effects from the vaccine (eg, fatal cardiac disease[17,18]), (5) lack of endorsement by several medical organizations,[19] and (6) a high rate of vaccine refusal by health care professionals.[20] Currently, the immunization campaign remains underway, still in phase I. Review and updating of the recommendations are ongoing.[21,22]

TABLE 3 Biological Weapons of Concern

Category A
Anthrax (*Bacillus anthracis*)
Smallpox (*Variola major*)
Tularemia (*Francisella tularensis*)
Plague (*Yersinia pestis*)
Viral hemorrhagic fevers (filoviruses [eg, Ebola, Marburg] and arenaviruses [eg, Lassa])
Botulinum (*Clostridium botulinum* toxin)
Category B
Q fever (*Coxiella burnetii*)
Brucellosis (*Brucella* species)
Glanders (*Burkholderia mallei*)
Melioidosis (*Burkholderia pseudomallei*)
Viral encephalitis (alphaviruses [VEE, EEE, WEE])
Typhus (*Rickettsia prowazekii*)
Biotoxins (ricin, staphylococcal enterotoxin B)
Psittacosis (*Chlamydia psittaci*)
Food-safety threats (eg, *Salmonella* species, *Escherichia coli* O157:H7)
Water-safety threats (eg, *Vibrio cholerae, Cryptosporidium parvum*)
Category C
Emerging threat agents (eg, Nipah virus, hantavirus)
Multidrug-resistant tuberculosis
Tick-borne encephalitis viruses
Tick-borne hemorrhagic fever viruses
Yellow fever

VEE indicates Venezuelan equine encephalomyelitis; EEE, eastern equine encephalomyelitis; WEE, western equine encephalomyelitis.

Ricin

Although it is a category B agent, ricin has become a major biological weapon of concern. A plant-derived,

heat-stable toxin, ricin is an extract of the castor bean (*Ricinus communis*). Ricin acts by first entering cells through endocytosis; once in the cell, it is transported to the Golgi apparatus and endoplasmic reticulum. In the cytosol, ricin acts as a protease-resistant, enzymatically active structure that interacts with the sarcin-ricin domain of the large ribosome subunit RNA. This interaction can disturb translation by preventing the binding of elongation factors to the ribosome. Ricin is also capable of inactivating nonribosomal nucleic acid substrates.[23–26] With these effects, ricin produces severe morbidity and mortality. Rapidly dividing tissues, particularly the gastrointestinal epithelium, are most susceptible to ricin actions.

Ricin is a versatile agent that can be administered by ingestion, inhalation, or injection. When ingested, it can produce a syndrome of severe gastrointestinal upset, vomiting, hemorrhagic gastroenteritis, shock, and cardiovascular collapse. After inhalation, respiratory distress with a necrotizing pneumonitis may occur. Injection produces rapid shock and cardiovascular collapse. Treatment is supportive. A vaccine against ricin is currently under development.

Over the last 2 years, ricin has been associated with terrorist activity in the United States on multiple occasions. In October 2003, 2 ricin-containing letters were found in the US postal system.[27] In a third incident, ricin was found in the mail sorter of a congressional post office in January 2004. There have also been multiple confiscations of ricin in the United States and abroad over the last 5 years.

EXPOSURE VECTORS FOR CHEMICAL AND BIOLOGICAL WEAPONS

Exposure to chemical and biological weapons can occur through several potential vectors. Airborne releases of agents have remained the primary concern, because very large populations can be exposed by this route. Potential mechanisms of exposure include crop-dusting airplanes, tainted letters, and release into confined spaces (eg, subway tunnels, office buildings, theaters). Although contamination of the water supply is also a potential vector for exposure, there are very few chemical or biological agents that are both water-stable and resistant to water-purification techniques.[28] Finally, the contamination of food that is either unprocessed (eg, uncultivated grain) or processed (eg, a consumer product) is considered a potential means of exposure to chemical or biological weapons.[29]

SPECIFIC VULNERABILITIES IN CHILDREN

After events of chemical or biological terrorism, children have a greater risk of both exposure and harm, the result of key developmental and physiologic vulnerabilities.

For each of the vectors of exposure to biological or chemical weapons (air, water, or food), children possess a significantly greater likelihood of exposure because of their intake patterns. Children inhale considerably more air on a per-weight basis than adults (400 vs 140 mL/kg per minute, respectively). Consequently, for any concentration of airborne toxin, a child will inhale more of the substance on a per-weight basis than an adult. Also, substances that are heavier than air have their highest concentration near the ground, closer to the breathing zone of the child. Because children have less-keratinized, more-permeable skin and/or a proportionately greater body-surface area, they have both greater exposure and a greater likelihood of systemic toxicity to agents that fall on their skin.[30] Children have fluid and food intakes that differ significantly from adults. For example, children ingest approximately 100 mL/kg per day of water, compared with the 40 to 60 mL/kg per day that adults ingest. Children drink more milk than adults, placing them at risk of exposure to agents that can enter the milk supply through contamination of the grass on which cows feed; in the Chernobyl radiation disaster, cows grazed in contaminated pastures, resulting in excess radioactivity in their milk. Children drinking this milk sustained significant exposure to radioisotopes, including iodine and strontium. Finally, children not only eat more food on a per-kilogram basis but also have diets that are distinctly different from adults (eg, greater consumption of fruits).

Once exposed to a chemical or biological agent, children have numerous physiologic vulnerabilities that could lead to a greater risk of harm.[1] These vulnerabilities include undeveloped self-preservation skills that make them less able to flee danger; an immature immune system that makes them less able to contain infection (eg, plague)[31]; less fluid reserve, which can result in a greater risk of severe dehydration after exposure to agents that produce excess gastrointestinal fluid loss; and a greater risk of anxiety reactions and posttraumatic stress disorder after witnessing or being victim to a terrorist act.[32–34]

PUBLIC HEALTH PREPAREDNESS

The All-Hazards Approach

Over the last 5 years, a massive public health effort to improve response capability to future acts of biological terrorism has appeared. Such efforts have included antibiotic stockpiling, resurrection of smallpox immunization, and an unprecedented level of added support to state and local public health departments. Similarly, to respond to a possible chemical attack, extensive resources have been provided to public health authorities and first responders (fire, police, and emergency medical services) to create systems that will provide effective mitigation efforts. The initiation of these response campaigns revealed large-scale weaknesses in state and local public health infrastructure. Moreover, it became evi-

dent that intense effort was being directed toward events that might never occur rather than public health threats of much greater likelihood (eg, the appearance of an emerging infection or an unintentional hazardous chemical release).[35] Finally, it became clear that a fragmented and reactive public health–response plan is more expensive and inefficient than a single, comprehensive plan. As a result, disaster-response agencies and public health authorities have increasingly embraced the concept of the "all-hazards approach." Representing a dramatic paradigm shift in the preparation for chemical and biological terrorism, the all-hazards approach is designed to augment public health infrastructure, using an integrated model of disaster response.

Creation of all-hazards response systems has led to significant enhancements in public health–response capabilities. For example, the same protocol created to respond to the appearance of smallpox can be easily modified to contain an outbreak of severe acute respiratory syndrome (SARS). Similarly, an effective public health–response protocol for a sarin release would be equally effective for a hazardous-materials ("HAZMAT") release in the community.

Syndromic Surveillance

Overt acts of chemical and biological terrorism such as the sarin release in Tokyo present the challenge of rapidly identifying the agent and mobilizing the proper interventions. However, acts of chemical and biological terrorism may also be covert. Examples include the release of anthrax in 2001 and contamination of ground beef with nicotine in 2002. Covert incidents pose a significantly greater public health challenge and are more likely to induce widespread fear than overt events. Mechanisms for early recognition of a covert chemical or biological event, therefore, are necessary to contain the incident and minimize its impact.

Syndromic surveillance, a specialized type of outbreak detection, is a term used to describe mechanisms for monitoring health indices or events that reflect the early stages of an infection or disease of public health importance in an effort to minimize consequences.[36,37] Syndromic surveillance is considered an important means of identifying public health emergencies in their initial stages. Syndromic surveillance techniques can be clinician based or automated. Many syndromic surveillance systems are emergency department based. In addition, most state and local health departments are pursuing automatic electronic laboratory disease reporting.

The traditional mechanism of syndromic surveillance has been the clinician who recognizes unusual patterns of disease and reports them to public health authorities. The "astute clinician" principle places all health care professionals (including physicians, nurses, emergency medical technicians, epidemiologists, and health educators) in the role of sentinels for the appearance of disease clusters or other clinical abnormalities. The pivotal role of physicians and other health care professionals in syndromic surveillance, particularly for acts of terrorism, has led the CDC and other agencies to educate clinicians about chemical and biological weapons release and the diseases they produce. Clinical cues, case definitions, and syndromes for chemical weapons exposure have been published (Table 4), along with numerous resources to expand clinicians' ability to recognize covert terrorist incidents.[37,38]

Over the last few years, there has also been a rapid increase in the development of real-time, automated syndromic surveillance tools. A rapidly proliferating area, such automated decision support uses software to identify sentinel events such as an unusual amount of work or school absenteeism, changes in consumer purchase of over-the-counter products (eg, cough syrups or antipyretics), and changes in the chief-complaint profile among those who visit primary care physicians or emergency departments.[39–41] For example, the CDC has de-

TABLE 4 **Clinical Syndromes Associated With Chemical and Biologic Agents**

Category	Clinical Syndrome	Potential Etiologies
Cellular hypoxia	Altered mental status, dyspnea, seizures, metabolic acidosis	Cyanide, carbon monoxide, hydrogen sulfide, sodium azide
Cholinergic crisis	Salivation, diarrhea, lacrimation, bronchorrhea, diaphoresis, miosis, fasciculation, weakness, bradycardia, altered mental status, seizures	Nicotine, nerve agents, organophosphates
Gastrointestinal illness	Abdominal pain, vomiting, profuse diarrhea, hypotension, cardiovascular collapse	Ricin, staphylococcal enterotoxin E, arsenic
Lacrimation	Tearing, blepharospasm, incapacitation	Lacrimators ("Mace"), ammonia, halogens (chlorine, bromine)
Mucosal irritation	Tearing, nose and mouth burning, sore throat	Ammonia, halogens
Muscle rigidity	Generalized muscle contractions, painful neck/limb spasm, seizure-like activity	Strychnine
Muscle weakness	Generalized muscle weakness, ptosis, respiratory embarrassment	Botulism
Peripheral neuropathy	Muscle weakness or atrophy, "stocking-glove" sensory loss, depressed or absent deep tendon reflexes	Arsenic, thallium
Respiratory distress, acute onset	Cough, wheeze, shortness of breath, generalized mucosal irritation	Ammonia, halogens
Respiratory distress, delayed	Cough, respiratory distress, wheeze, hypoxia, pulmonary edema	Phosgene, sulfur mustard

veloped the Early Aberration Reporting System as a software tool available to clinicians and health departments around the nation (www.bt.cdc.gov/surveillance/ears).

New Governmental Roles in Emergency Preparedness

Although emergency-preparedness legislation existed before 2001, passage of additional rules between 2002 and 2005 resulted in massive efforts by the federal government to improve public health readiness across the nation (Table 1). Over the last 4 years, appropriations from federal to state public health agencies have been substantial. The Department of Homeland Security was established as a new member of the federal cabinet. Several departments within the Department of Health and Human Services have undergone extensive change, such as the CDC, Food and Drug Administration, and National Institutes of Health, all of which have reorganized their practice, regulatory, and research priorities to include chemical and biological terrorism, along with other public health threats; in 2002, the CDC established the Office of Terrorism Preparedness and Emergency Response. At state and local levels, planning for chemical and biological terrorism is now coordinated by multiple agencies, including departments of health, emergency-management agencies, poison control centers,[42] and law enforcement authorities.

The Strategic National Stockpile (SNS) has become one of the most important initiatives in mass-casualty disaster response.[5] Designed to respond to disasters that overwhelm local resources, the SNS includes such capabilities as the delivery of medications and supplies to areas of need within 12 hours of the request. SNS supplies include a pediatric formulary and materials for compounding tablets and capsules into liquid formulations (www.bt.cdc.gov/stockpile/index.asp).

SYSTEMS ISSUES IN PREPAREDNESS FOR CHEMICAL AND BIOLOGICAL TERRORISM

School and Child Care Center Preparedness

Children spend most of their waking hours in school or child care centers, away from their parents and guardians. Despite the fact that the majority of most children's day is spent in the care of the school system, efforts to create a blueprint that assists schools in developing comprehensive disaster-response protocols have been weak. School districts remain highly variable in the extent of their preparation for public health emergencies of any type, including chemical and biological terrorism.

Ideally, every school should produce its own response protocols rather than following a one-size-fits-all disaster plan that fails to take into account the school's physical plant, student size and characteristics, the presence of children with special needs, school nurse availability, and proximity to certain areas such as industries, rail yards, or highways.[40] All schools, in conjunction with local public health officials, should develop comprehensive evacuation and sheltering-in plans. Because local school bus fleets can typically evacuate only a fraction of children at one time, a means of mobilizing additional transport vehicles should be developed. General outlines for the development of a school emergency-response plan are found in Table 5.

Hospital Preparedness

Hospital protocols for pediatric victims of chemical or biological terrorism must be established in both pediatric and nonpediatric hospitals. These disaster protocols require an integrated response from the emergency department, ICU, operating rooms, and other key clinical areas within the hospital. Response needs include an adequate number of pediatric supplies, and a staff trained in the care of ill children will be needed to minimize morbidity and mortality.[5,6] All hospitals should have disaster protocols for pediatric patients, including mobilization of child life specialists, volunteers, and others who can provide comfort and distraction to children, particularly if those children are not yet united with their parents.

To be fully prepared for chemical or biological terrorism, pediatric and general hospitals must also have an evacuation plan should the hospital environment become uninhabitable. Although protocols for "vertical evacuation" (ie, the removal of patients to other floors within the same building) are well established in hospital-based disaster response, comprehensive plans for complete building evacuation are less well developed. Pediatric hospitals requiring full evacuation may have the additional challenge of transporting pediatric pa-

TABLE 5 **Key Aspects of School Response to Chemical-Biological Terrorism and Other Public Health Emergencies**

Assembly of the school crisis-response team
Principal, counselors, nurses, custodians
Contact and coordination with local public health–response team(s)
Evacuation[52]
Plan includes plans for rapid evacuation of physically and developmentally disabled children from all floors
Plan includes strategy for evacuation/relocation in inclement weather
Relocation
Plan includes the transport of medications, contact telephone numbers, and other essential material
Plan informs parents in advance of relocation site
Sheltering-in[53]
Designed for response to outdoor threats
Lockdown
Designed for response to a threat within the school
Communication with parents
Anticipates inability of parents to reach the school by telephone
Potentially includes automatic callout system, voice mail, parent contact "tree," or Web-based communication system
Policy for use of cellular phones by students during a disaster
Protocols for disaster response by after-school programs, including athletics

tients to health care facilities with relatively few pediatric resources. Nonetheless, memoranda of agreement with nearby or affiliated institutions are a key part of a comprehensive pediatric hospital disaster plan.

After exposure to a chemical or biological weapon, children may become covered by toxic material that can produce skin injury or be absorbed, producing systemic toxicity. In the case of infectious material, the contamination of skin could be sufficient to represent a threat to health care professionals as well as the victim. When children are covered with unknown but potentially dangerous chemical or infectious material, immediate decontamination is required.[43] Topical decontamination has 2 distinct components: disrobing and showering. To minimize exposure to health care professionals and patients within the health care facility, the child should be disrobed outdoors, before entering the ambulance or building. Disrobing alone accounts for more than 85% of topical decontamination and is an extremely effective means of ending exposure. When possible, the victim should disrobe himself or herself to minimize exposure to others. Health care professionals should not assist in disrobing unless they are wearing appropriate PPE.

Showering complements disrobing by further removing chemicals, microbes, and debris. As with disrobing, showering must occur outdoors; protocols should include strategies for preventing hypothermia in children. Principles of showering include the establishment of 3 management zones in the decontamination staging area (so-called hot, warm, and cold in reference to the site's degree of contamination), use of water that has been warmed to a temperature of 100°F, a water pressure of 60 psi, and, if possible, containment of the wastewater. If the toxic material is oily or firmly adherent to the child's skin, soap or a mild shampoo should be used; solutions such as mild bleach should not be used on children because of the risk of skin injury.[5] If an outdoor shower is not available, the child can be simply disrobed before being brought into the health care facility for care. Decontamination can be a frightening procedure for children, exacerbated by the identity-concealing PPE that clinicians are wearing. Efforts should be made to keep parents nearby; when possible, parents should be used to assist with their child's decontamination.

All health care professionals who assist in decontamination must protect themselves by wearing appropriate PPE. Currently, there are 4 levels of PPE, ranging from level A, which is the highest level of protection, to level D, which consists of simple gown, gloves, and surgical mask. For hospital personnel, level C PPE (a chemical-resistant suit and gloves, with an air-purifying respirator) is considered adequate for hospital-based management of most contaminated victims. Health care facilities should develop plans for rapid access to such equipment. Staff should be appropriately trained. Other principles of decontamination and PPE are outlined in Table 6 and have been published recently.[44,45]

Community Health Center Preparedness

Community health centers (CHCs) and local health departments are, in most major metropolitan areas, an important source of "safety-net" health care and social support to a community. In a large-scale terrorist disaster, CHCs could play a pivotal role in supporting the community and nearby hospitals. First, in the event of an infectious outbreak, families will likely go to their CHC for treatment and to obtain information from professionals whom they trust and who are more likely to provide culturally competent care. In addition, after a multiple-casualty incident, hospitals may become too crowded to treat every patient. In such cases, CHCs could potentially be used as alternate care sites, providing care to those with minor injury and assisting in interventions (eg, mass administration of antimicrobial agents). CHCs, therefore, should be included in planning by local public health authorities.[5]

Office Preparedness

The pediatrician should have an important role in the community response to any disaster involving children. First, the pediatrician's office may be the preferred site of care for many victims who are transporting themselves for treatment. Both chemically contaminated children and children with suspected illness from a biological weapon might go directly to the pediatrician's office. Consequently, pediatricians should consider the development of office protocols for disasters, including (1) management of a child who requires decontamination, (2) management of a child with a potentially transmis-

TABLE 6 Principles of Decontamination

All decontamination should occur outside the health care facility.
All health care professionals should wear appropriate PPE, as determined by their safety officer and occupational health specialist.
All levels of health care professionals should be trained to use PPE, including physicians, nurses, clinical assistants, security, and environmental services.
Remove clothing from the victims as quickly as possible. Victims should disrobe themselves when possible.
Discarded clothing should be placed in labeled plastic bag and stored for possible use by law enforcement.
Shower water should have a temperature of approximately 100° F and a pressure of 60 psi.
Water alone is used routinely. If material is oily, a mild soap or shampoo can be added.
Victims should shower for 5 minutes unless specific alternative recommendations are given.
If possible, water effluent should be contained rather than placing it in the local wastewater stream.
Use heat lamps, blankets, and other mechanisms to prevent hypothermia.
Critically ill victims should simply be disrobed and not showered before entering the health care facility. Cover hands, feet, and other exposed areas if there is evidence of gross contamination.
If there are multiple victims, anticipate the need to perform out-of-hospital triage.

sible infection, and (3) management of a sudden influx of pediatric patients after a large-scale incident.[5] The AAP textbook *Childhood Emergencies in the Office, Hospital, and Community*[46] is a useful resource to assist in office planning for such emergencies. Pediatricians should also consult their state and local health departments, because most have electronic health alert networks.

Surge Capacity

An effective response to large-scale chemical or biological terrorism (ie, an incident with more casualties than routine operations can accommodate) requires the creation of surge-capacity protocols. Federal, state, and local public health authorities are essential in assisting health facilities during crises of large magnitude. Nonetheless, both pediatric and nonpediatric hospitals should consider how a large-scale event would affect their facility. Plans for such an event might include (1) the creation of additional bed spaces through cohorting, (2) mechanisms for the rapid discharge of inpatients to increase capacity, (3) an inventory of all sites in the hospital where critical care can be provided, (4) establishment of a site, ideally out of the hospital, for patient triage, (5) identification of care sites for those whose injuries are minor, (6) mechanisms for labeling and tracking patients, particularly children who arrive without personal identification, and (7) plans for maintaining hospital security by preventing the entry of contaminated victims and other unauthorized individuals. For nonpediatric hospitals, surge-capacity plans for a mass-casualty chemical or biological incident involving children should also include mechanisms for mobilizing health care professionals with pediatric expertise. Surge-capacity principles are summarized in Table 7. Disaster medical assistance teams (DMATs), supported by the US Public Health Service, have been created by the National Disaster Medical System to provide assistance to regions after a large-scale disaster. However, among the 27 DMATs in the United States, only 2 are dedicated pediatric DMATs, significantly limiting the federal response capability to a pediatric mass-casualty incident. The Metropolitan Medical Response System, another federal effort designed to create regional "medical strike teams," has no clearly established pediatric capability or standards.

TABLE 7 **Surge-Capacity Principles for Hospitals**

Preparation
Obtain PPE, showers, and other emergency-response equipment
Stockpile supplies
Stockpile or plan for additional pharmaceuticals
Perform drills; consider tabletop exercise
Response
Anticipate a 1:5:7 ratio of critically ill/urgently ill ("walking wounded")/well ("worried well") casualties
Anticipate the "second-wave" phenomenon
Reserve the emergency department for critically ill patients
Perform triage and decontamination outside the hospital
Ensure campus security from unauthorized intrusion
Identify and utilize alternate sites of care; identify transportation options

Mental Health

The mental health consequences of terrorism are extensive and, in many cases, enduring. Children have a disproportionate risk of developing emotional and behavioral sequelae; investigations after the September 11th attacks found that as many as 25% of children developed acute anxiety followed by posttraumatic stress disorder.[33,47,48] Children can develop a broad range of behavioral problems after a disaster, whether they witness the incident or simply observe their parents' response to an incident (eg, from a television broadcast). Overt manifestations may include emotional lability, insomnia, frequent crying, depression, fear, and "anniversary grief." Alternatively, mental health consequences may also be subtle and elusive (eg, manifesting as multiple somatic complaints).

Parents may similarly become psychological casualties after chemical or biological terrorism. Visual replay of events on television may contribute to the development of long-term behavioral disturbances. As with children, the parent may have overt or subtle signs of distress. Adults typically display loss of appetite, insomnia, depression, hopelessness, and acute anxiety.

Finally, health care professionals who care for victims of chemical or biological terrorism can develop mental health consequences. There is an extensive body of literature indicating that health care professionals can become extremely depressed, developing posttraumatic stress disorder after caring for victims. To reduce the risk of this occupational hazard, the concept of critical incident stress debriefing (CISD) was created many years ago. In principle, a prompt debriefing session can be therapeutic by permitting staff to verbalize their feelings and anxieties about what they have experienced. CISD has become a common part of postevent disaster management. Recently, however, questions about the efficacy of CISD in reducing mental health sequelae among health care professionals have been raised.[49] There are increasing concerns that the process of debriefing forces health care professionals to relive events, undoing internal resolution that is already underway. In addition, the process of group debriefing may carry the risk of having health care professionals hear about disturbing events that they themselves did not witness, creating anxiety and depression that was not present initially. Although this issue remains controversial, there is consensus that efforts should be made to identify health care professionals who are suffering psychological sequelae from their involvement in responding to an act of chemical or biological terrorism.

Individual/Family Preparedness

Large-scale disasters, whether they are natural (eg, hurricanes or floods), unintentional (eg, hazardous-materials release), or intentional (ie, terrorist), can occur at any time. All families, particularly families with children, should have a disaster plan. Such plans should include communication in the event of cellular phone failure, a reunification plan if disaster occurs when family members are not together, and emergency provisions in the home. Multiple resources are available to assist families in home disaster planning (www.ready.gov/index.html and www.fema.gov/plan/index.shtm).

RECOMMENDATIONS TO PEDIATRICIANS

1. Because the threat of chemical or biological terrorism continues and children are likely to be affected disproportionately by such acts, pediatricians should be knowledgeable about agents of concern and their management and the response systems that are needed to minimize physical and mental trauma to children. Following the principle of the all-hazards approach, pediatricians should become and remain knowledgeable about principles of preparation and response to similar public health emergencies (eg, hazardous-materials incidents or emerging infections).
2. Pediatricians should participate, as need and opportunity arises, in local public health activities in chemical and biological terrorism preparedness. The pediatrician can be a valuable resource to public health authorities in issues such as first-responder training and hospital preparedness. In addition, involvement of pediatricians in these activities increases the likelihood that the needs and vulnerabilities of children will be considered.
3. Pediatricians should work, where possible, with local school systems to develop plans for rapid evacuation, relocation, triage, and initial care of children who are in school when an act of chemical or biological terrorism occurs.
4. Because pediatric victims of chemical or biological terrorism may present to their pediatrician's office, there should be consideration of plans and protocols for management of such children on site. Such preparation may include the establishment of out-of-building decontamination protocols and isolation of potentially infectious patients from others.
5. Pediatricians should be prepared to assist families in disaster planning by providing education on key principles such as basic emergency equipment in the homes, including flashlights, alternative heating, lighting, and a supply of water, food, and clothing. Discussion about how to talk to children about war and terrorism should be included.[50]
6. Pediatricians should evaluate and ensure proper treatment for children for mental health sequelae after chemical-biological terrorism, particularly because these sequelae can develop days to months after the event.[51] The AAP Web site offers multiple resources for pediatricians and families (www.aap.org/terrorism/index.html, www.aap.org/profed/childrencheckup.htm, www.aap.org/advocacy/releases/disastercomm.htm, and www.aap.org/terrorism/topics/psychosocial_aspects.html).

RECOMMENDATIONS TO GOVERNMENT

1. The needs of children should be addressed in all preparedness efforts at the federal, state, regional, and local levels.
2. All recommendations made by the National Advisory Committee on Children and Terrorism (www.bt.cdc.gov/children/recommend.asp), designed to ensure that children are included in emergency-response planning, should be implemented.
3. Public health agencies should make a concerted effort to assist schools and school districts in their preparedness efforts. Emergency-response plans for schools should be tailored to the individual school and its location, population, staff, and resources.
4. DMATs created by the National Disaster Medical System will play a key role in a mass-casualty incident involving children. The pediatric training of these teams should be comprehensive. Creation of additional pediatric DMATs should be considered.
5. Public health agencies should continue to actively provide assistance and resources to hospitals, pediatric offices, CHCs, and other health care facilities to ensure that they are prepared to respond to a chemical or biological terrorist incident that involves children.
6. As funding for emergency preparedness continues, the needs of children should always be included among the deliverables and performance benchmarks.

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American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Chemical-Management Policy: Prioritizing Children's Health

COUNCIL ON ENVIRONMENTAL HEALTH

KEY WORD
environmental health

ABBREVIATIONS
TSCA—Toxic Substances Control Act
EPA—Environmental Protection Agency

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abstract

FREE

The American Academy of Pediatrics recommends that chemical-management policy in the United States be revised to protect children and pregnant women and to better protect other populations. The Toxic Substance Control Act (TSCA) was passed in 1976. It is widely recognized to have been ineffective in protecting children, pregnant women, and the general population from hazardous chemicals in the marketplace. It does not take into account the special vulnerabilities of children in attempting to protect the population from chemical hazards. Its processes are so cumbersome that in its more than 30 years of existence, the TSCA has been used to regulate only 5 chemicals or chemical classes of the tens of thousands of chemicals that are in commerce. Under the TSCA, chemical companies have no responsibility to perform premarket testing or postmarket follow-up of the products that they produce; in fact, the TSCA contains disincentives for the companies to produce such data. Voluntary programs have been inadequate in resolving problems. Therefore, chemical-management policy needs to be rewritten in the United States. Manufacturers must be responsible for developing information about chemicals before marketing. The US Environmental Protection Agency must have the authority to demand additional safety data about a chemical and to limit or stop the marketing of a chemical when there is a high degree of suspicion that the chemical might be harmful to children, pregnant women, or other populations. *Pediatrics* 2011;127:983–990

INTRODUCTION

Over the past several decades, tens of thousands of chemicals have entered commerce and the environment, often in extremely large quantities (eg, multiple millions of pounds per year). There has also been an explosion of knowledge about special vulnerabilities and differential exposures that children and pregnant women have to environmental toxicants. A growing body of research indicates potential harm to child health from a range of chemical substances.

The primary federal law that governs chemical management in the United States, the Toxic Substances Control Act (TSCA) (Pub L No. 94-469 [1976]), is not protective of the health of children and pregnant women and has not undergone any meaningful revision since its passage almost 35 years ago. Since then, of the tens of thousands of chemicals that are in commerce, the TSCA has been used to regulate only 5 chemicals or chemical classes: polychlorinated biphenyls (PCBs); fully halogenated chlorofluoroalkanes; dioxin; asbestos; and hexavalent chromium.[1] The TSCA is so ineffective that it took a separate act of

Congress to amend the TSCA so that the US Environmental Protection Agency (EPA) could regulate asbestos, one of the most dangerous toxic substances. It is because of the inadequacies of the TSCA that parents and pediatricians have been subjected to multiple high-profile media blitzes about specific chemicals, such as phthalates in toys and bisphenol A in infant bottles,[2,3] that create anxiety without solving the problems of risky chemical exposures.

The American Academy of Pediatrics recommends that chemical-management policy in the United States be substantially revised to better protect children and pregnant women.

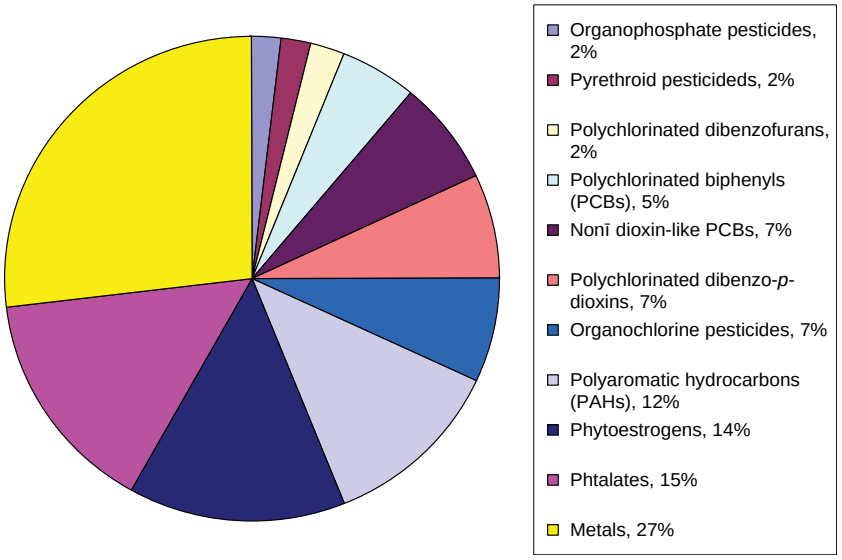

FIGURE 1
Distribution of detected chemicals in the Centers for Disease Control and Prevention biomonitoring study, 2005. (Modified with permission from Rushing R. *Reproductive Roulette: Declining Reproductive Health, Dangerous Chemicals, and a New Way Forward.* Washington, DC: Center for American Progress; 2009. Available at: www.americanprogress.org/issues/2009/07/reproductive_roulette.html.)

THE HOPE OF "BETTER LIVING THROUGH CHEMISTRY"

From the mid-19th century until today, there has been phenomenal growth in our knowledge about chemistry. Currently, there are more 80 000 chemicals in commerce in the United States, more than 3000 of which are considered to be "high-production volume" chemicals (chemicals produced in or imported into the United States in quantities of ≥1 million pounds/year). Under the EPA Inventory Update Reporting program, the chemical-manufacturing industry estimated that approximately 27 trillion pounds of chemicals were produced in or imported into the United States per year in the early part of this decade, which is the equivalent of approximately 74 billion pounds/day (nearly 250 pounds per person) and does not include fuels, pesticides, pharmaceuticals, or food products.[4] Many of these chemicals are in the environment, and some affect the health of children.

From biomonitoring data from the Centers for Disease Control and Prevention[5] and other documentation[6–11] it is known that there is widespread human exposure to many of these substances (see Fig 1). These chemicals are found throughout the tissues and body fluids of children and adults alike, including blood, cord blood, and human milk.

Few of the chemicals that are supposed to be controlled by the TSCA were intended for human consumption. Because the TSCA does not require premarket testing of these chemicals, scientific studies of their effects on the human body may be scarce or nonexistent. Food additives, pesticides, and pharmaceuticals, all of which are intended for human consumption (although at low levels in the case of pesticides), do require premarket testing and, depending on the product, some postmarket follow-up. However, the paradigm established for food additives, pesticides, and pharmaceuticals should not be taken as a model for chemical management. There are too many chemicals and too many tests that would need to be performed to use individual chemical testing as a means of ensuring safe chemical management.

CHILDREN ARE NOT LITTLE ADULTS

Children have unique physiologic, developmental, and behavioral differences that influence their environmental exposures. Because children are smaller than adults, their surface area–to–body mass ratio is greater. Children eat more food and drink more water per unit of body weight than do adults.[12] The respiratory minute ventilation—inspired air per unit time adjusting for weight—is greater in young children than in adults.[13]

Children's behavior changes with age, and with it, the routes of exposure to chemicals change.[14] Infants are incapable of independent locomotion, which makes it impossible for them to remove themselves from environmental hazards such as heat and cold. Children of all ages spend more time on the floor or ground than do adults. Therefore, children will come into more contact with contaminants on these surfaces.

Exposure of people to environmental toxicants may affect fertility. A recent

study of blood levels of polybrominated diphenyl ether (PBDE) flame retardants in women found that it took significantly longer for women with higher PBDE levels to get pregnant.[15] Exposure of the fetus in utero to at least 1 pharmaceutical, diethyl stilbestrol (DES), is recognized to produce adverse health effects on the children and even the grandchildren of that fetus.[16] Further research may reveal that there may be such a concern with chemicals in the environment as well.

As children grow and mature, their bodies may be especially vulnerable to certain chemical exposures during critical windows of development. Neurologic and endocrine systems have demonstrated particular sensitivity to environmental toxicants at certain stages of growth. These differences in biological susceptibility and exposures in children versus adults support the need for strong consideration of children in chemicals policies. This principle must underpin all chemical-management legislation and regulation.

THE TSCA FAILS TO PROTECT CHILDREN AND PREGNANT WOMEN

A number of federal laws govern the safety of food additives, cosmetics, pharmaceuticals, and pesticides (Table 1). The TSCA, which was passed in 1976, with subsequent modifications, sets out the current federal framework for the regulation of most chemicals. Congress established the following as the original goals of the TSCA:

1. to develop adequate data about the effects of chemical substances and mixtures on health and the environment and to ensure that the manufacturers and processors of such chemical substances and mixtures be responsible for the development of such data;
2. to provide adequate authority to regulate chemical substances and mixtures that present an unreasonable risk of injury to health or the environment and to take action with respect to chemical substances and mixtures that are imminent hazards; and
3. to ensure that authority over chemical substances and mixtures does not impede unduly or create unnecessary economic barriers to technologic innovation while ensuring that the innovation and commerce of chemical substances and mixtures do not present an unreasonable risk of injury to health or the environment.[17]

TABLE 1 US Legislation Concerning Chemicals

Act	Year Passed	Subject
Federal Food, Drug, and Cosmetics Act (FFDCA)	1938	Gives authority to the US Food and Drug Administration to oversee the safety of food, drugs, and cosmetics
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	1972	Pesticides
Toxic Substances Control Act (TSCA)	1976	Chemicals 1988 and 1990: asbestos and radon 1992: lead-based paint 2002: healthy and high-performance schools
Food Quality Protection Act (FQPA)	1996	Pesticides

Unfortunately, the TSCA has not met its goals. The law suffers from a number of defects that render it ineffective in assessing the risk posed by chemicals. Without sufficient information on the safety or health effects of chemicals, it is impossible for the EPA to engage in appropriate regulation. Key weaknesses of the TSCA include the following.

- Costs of TSCA safety testing are often borne by the public sector. Manufacturers of chemicals are not required to test chemicals before they are marketed or to collect data from tests that may have been performed by others. The TSCA places the burden of obtaining information about the potential toxicity of a chemical on the public rather than the manufacturer. The EPA is charged with developing information on toxicity, but the agency has neither the technical nor the financial resources to perform extensive research on even a fraction of the tens of thousands of chemicals in commerce.
- The TSCA has created a non–evidence-based system for chemical management. Manufacturers are required to notify the EPA of their intent to market a new chemical; however, they are not required to perform any safety testing before notifying the EPA. The EPA estimates that most such notifications do not include test data of any type, and only approximately 15% include health or safety test data.[18] It is ironic that companies may harm themselves by performing premanufacture testing, because they must disclose any health or safety data they obtain. This system discourages manufacturer safety testing and also results in chemicals for which there are less data seeming to be safer than chemicals for which there are more data.
- Concerns about chemicals are permitted to be kept from the public. In their notifications to the EPA, chemical companies may declare large amounts of information to be "confidential business information." This broad exemption has effectively prevented the EPA from sharing information about potentially hazardous chemicals with community groups, local and state governments, and foreign governments or international organizations.

- Chemicals introduced before 1976 have little oversight. The TSCA distinguished between chemicals in existence in 1976 and those introduced after passage of the law. Those on the market in 1976 were assumed to be relatively safe and in need of less testing than "new" chemicals. To pursue regulation of these "grandfathered" chemicals, the EPA must demonstrate that a chemical has a high likelihood of causing harm before it can order testing to determine if there is a health risk. Between 1979 and 2005, the EPA used its authority to require testing on fewer than 200 chemicals in commerce.[1]
- Implementation of TSCA regulatory action is unwieldy. Rule-making under the TSCA is extremely time-consuming and labor intensive. After a nearly decade-long effort to ban asbestos, the EPA found its initiative struck down by the courts on the basis that the agency had overstepped its authority under the TSCA. Since passage of the TSCA, the EPA has issued regulations to ban or limit only 5 existing chemicals or chemical classes.[18]
- The TSCA does not allow review of chemicals by group. The TSCA requires regulation on a chemical-by-chemical basis. With tens of thousands of chemicals in need of review and the multiyear process for each such undertaking, it would require many decades to review just the high-production chemicals. For example, the finding of toxicity of a radioactive substance such as plutonium would not allow another similar substance such as uranium to be defined as toxic. The TSCA would require that testing on the second compound be conducted completely anew.

THE EPA HAS ATTEMPTED TO IMPLEMENT THE TSCA THROUGH VOLUNTARY ACTION

The EPA has implemented several voluntary programs in attempts to compensate for inadequacies of the TSCA. These programs include the Endocrine Disruptor Screening Program, the Voluntary Children's Chemical Evaluation Program, and the Chemical Assessment and Management Program. Because these programs are voluntary, the EPA cannot require companies to produce information about the health and safety risks of these chemicals. Each of these programs has produced few data over long periods of time, and none has led to any significant regulatory changes.[1,19] For example, the Endocrine Disruptor Screening Program was called for in legislation passed in 1996, but the EPA only issued its first test orders, the first step in a multistep process, in October 2009.[20] The Voluntary Children's Chemical Evaluation Program was launched by the EPA at the end of 2000. It had the meager goal of gathering information on health effects, exposure, risk, and data needs for 23 chemicals to which children have a high likelihood of exposure. More than a decade later, for various reasons, complete data are not available for any of those chemicals.[21] Because of its inadequacies, in September 2009 the EPA replaced the Chemical Assessment and Management Program with what it hopes will be a "more comprehensive approach to chemicals management."[22]

CALLS TO REFORM THE TSCA

The American Medical Association,[23] the American Public Health Association,[24] and the American Nurses Association[25] have all endorsed the need for changes to the TSCA. Recognizing that "[t]he science of testing chemicals and understanding their health or environmental effects has evolved considerably since TSCA was enacted," the American Chemistry Council has also called for the modernization of the TSCA to ". . . help assure that we protect . . . our children . . ."[26]

TABLE 2 Six Essential Principles for Reform of Chemical-Management Legislation (EPA[36])

Chemicals should be reviewed against safety standards that are based on sound science and reflect risk-based criteria protective of human health and the environment.
Manufacturers should provide the EPA with the necessary information to conclude that new and existing chemicals are safe and do not endanger public health or the environment.
Risk-management decisions should take into account sensitive subpopulations, cost, availability of substitutes, and other relevant considerations.
Manufacturers and the EPA should assess and act on priority chemicals, both existing and new, in a timely manner.
"Green" chemistry should be encouraged, and provisions that ensure transparency and public access to information should be strengthened.
The EPA should be given a sustained source of funding for implementation.

A number of environmental health policy entities have been critical of the TSCA.[4,27–30] In addition, the US Government Accountability Office has issued a number of reports in which the TSCA was criticized.[1,18,31–33] In 2009, the Government Accountability Office added the TSCA to its high-risk list for federal legislation that needs to be updated.[34]

In 2009, the EPA established 6 essential principles for reform of chemicals management legislation (Table 2).[35] The proposed principles address many of the deficiencies of the TSCA discussed above.

STATE ATTEMPTS AT CHEMICAL-MANAGEMENT POLICY

In the absence of up-to-date federal regulatory policy, many states have attempted to fill the gap. A handful of state legislatures have undertaken measures to control individual chemicals, such as bisphenol A, or attempted the comprehensive identification, pri-

TABLE 3 State-Proposed Principles on Reform of the TSCA[38]

Require chemical data-reporting
Demonstrate that chemicals and products are safe
Prioritize chemicals of concern
Protect the most vulnerable
Promote safer chemicals and products
Address emerging contaminants
Strengthen federal law and preserve states' rights
Fund state programs

oritization, and regulation of chemicals.[36] Some states have targeted their efforts specifically at chemicals of concern in children's products. Chemicals that have been the subject of state laws include phthalates and fire retardants. Officials from California, Connecticut, Illinois, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Oregon, Vermont, and Washington have issued a list of principles on reform of the TSCA (Table 3).[37]

EXAMPLES OF INTERNATIONAL EFFORTS TO REGULATE CHEMICALS

Over the past decade, an increasing number of nations have attempted to exert greater control over the entrance of new chemicals into commerce and their use in various contexts. A number of treaties have addressed certain classes of pollutants (eg, the Stockholm Convention on Persistent Organic Pollutants), and more comprehensive approaches have been attempted by individual nations or international entities.

In 1999, Canada passed legislation that requires the development of a categorization and prioritization system for the Domestic Substances List, its chemicals registry. The Domestic Substances List catalogued approximately 23 000 chemicals known to be in commerce in Canada since the mid-1980s. The review, which was completed in 2006, methodically categorized the chemicals to prioritize those of greatest concern for review and possible restriction. On the basis of a screening assessment, chemicals were: designated as Canadian Environmental Protection Act (CEPA)—toxic, in which case they were subject to additional regulation and restriction; added to the priority substances list, which requires an in-depth assessment to be completed within 5 years; or set aside as not requiring further study at the time.[38] This process resulted in the designation of 85 substances as CEPA-toxic[39] and the placement of 67 on the priority substances list.[40] Although the Domestic Substances List categorization has been hailed as a model, critics have stated that Canadian law does not permit aggressive enough regulation to occur on those substances considered to be CEPA-toxic.

In early 2006, the United Nations Environment Program's Governing Council adopted the Strategic Approach to International Chemicals Management (SAICM), a strategy developed and negotiated with the participation of a wide range of stakeholders from more than 140 countries. The SAICM global plan of action sets out nearly 300 different activities that will help countries reach the plan's overall objective of achieving the sound management of chemicals throughout their life cycle so that, by 2020, they are used and produced in ways that reduce major adverse effects on health and the environment.[41,42] The SAICM includes activities in the area of policy change, research, and capacity-building, among others. It must be noted, however, that the strategy is purely voluntary for all participating nations, and each country is free to adapt and alter the approaches used. There is no formal oversight of the strategy or any enforcement of its recommendations.

In perhaps the most ambitious regulatory effort to date, the European Union (EU) established the new Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation in 2006.[43] The stated aim of REACH is to "to improve protection of human health and the environment from the risks of chemicals while enhancing the competitiveness of the EU chemicals industry."[44] This system, which began to phase in during 2007 and will continue its staged implementation over a decade, sought to develop a comprehensive regulatory regime for chemicals with the ultimate goal of restricting the use of the most toxic substances. Companies must register all chemicals that are sold in the EU market in quantities above 1 metric ton. A list of substances of very high concern is under development, which will constitute chemicals for which substitution is required whenever feasible and which will require an authorization for each individual use of a substance of very high concern. As of late 2009, 16 substances had been officially identified as substances of very high concern,[45] but nonprofit organizations were pressing for the addition of at least 350 more substances to this designation.[46] Although REACH was developed as a system that will cover all EU countries, there is some flexibility for member nations to opt out of or alter certain provisions. Many key provisions of REACH have not yet been implemented, so its full impact is, as yet, unclear.

RECOMMENDATIONS FOR GOVERNMENT AND ADVOCACY

1. Whenever a new chemicals policy is developed or existing policy is revised, the wide range of consequences of chemical use on children and their families should be a core component.
2. Federal, state, and local policies should support and enforce sound chemical management. Policies should incorporate the following principles.

a. The regulation of chemicals must be based on evidence. However, decisions to limit or ban chemicals or classes of chemicals from commerce or to promote the substitution of demonstrably less hazardous chemicals should be based on reasonable levels of concern and not depend on demonstrated negative health effects after release.
b. "Old" and "new" chemicals must meet the same requirements for evidence.
c. Although testing of individual chemicals should not be the sine qua non for decisions to limit or ban chemicals or classes of chemicals, when testing is appropriate, those who propose to market a chemical must be mandated to provide evidence that the product has been tested in systems that provide information that is relevant to the special needs of pregnant women and children, including data on reproductive toxicity; developmental toxicity, including but not limited to neurodevelopmental toxicity; and endocrine disruption, as it relates to reproduction, neurotoxicity, and puberty.
d. Decisions should be based on information about hazards, proposed use, and potential exposures. Hazard implies intrinsic properties of chemicals or classes based on molecular structure (eg, persistence, carcinogenicity, or neurotoxicity). When appropriate for hazard determination, there must be consideration of aggregate (exposure to a single pollutant via multiple pathways) and cumulative (concurrent exposures to multiple pollutants with a common mechanism of action via multiple pathways) exposure concepts similar to those of the Food Quality Protection Act.
e. Chemicals must meet safety standards similar to those met by pharmaceuticals or pesticide residues on food, that is, "reasonable certainty of no harm." Exceptions should be available for chemical use when no safer alternatives exist. Such exemptions should require individual regulatory approval and biannual review to ascertain whether the exemption is still necessary.
f. There must be postmarketing surveillance of the effects of a chemical, and the EPA must have the authority and means to remove a chemical if postmarketing surveillance indicates that it no longer meets the standard for being released to the market.
g. Companies that propose to place a new chemical on the market must develop a means for biomonitoring of that chemical before it is marketed.
h. Companies must develop a public information document for each new chemical marketed. This document must be in lay language and approved by the EPA before the chemical is marketed. A companion document must be developed for all consumer products that contain the chemical and must be updated with each new formulation of the product or every 3 years. This document must include the results of any premarket testing and any postmarket surveillance. It must include information about risks associated with acute, high-dose exposure and chronic low-dose exposure as well as contact information for people who need additional information.

3. The EPA must have a relatively simple process to require additional testing when information suggests the need for such testing.
4. Federal biomonitoring programs, such as the Centers for Disease Control and Prevention National Biomonitoring Program, must be expanded. It is recognized that this program provides secondary prevention, but it may serve as an early warning system. Stored samples may allow look-backs when new problems develop in the future.
5. Federal funding should be provided for research to prevent, identify, and evaluate the effects of child exposures to chemicals. Development of additional chemical testing methodologies is needed to ensure that exposures to existing and new chemicals can be identified. Consensus in the scientific community is needed on methods and biomarkers to identify and evaluate chemicals for adverse effects through endocrine disruption. Funding to support studies to examine long-term and subclinical chemical effects is needed.
6. Federal policies should reward and promote developments in green chemistry that serve to replace existing chemicals of concern and their commercial applications.

RECOMMENDATIONS FOR PEDIATRICIANS

1. Pediatricians should familiarize themselves with the information about chemicals in the environment and their effects on child health. Many chemicals are reviewed in the

American Academy of Pediatrics manual *Pediatric Environmental Health*.[47] The third edition of this book will be available in 2011.

2. Pediatricians should learn about the resources contained in the Environmental Health and Toxicology pages of the National Library of Medicine Web site. (http://sis.nlm.nih.gov/enviro.html). Those portions that will be of most use in counseling families include LactMed (http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?LACT) (a peer-reviewed and fully referenced database of drugs to which breastfeeding mothers could be exposed) and the Household Products Database (http://householdproducts.nlm.nih.gov) (which links >8000 consumer brands to chemicals they may contain on the basis of Material Safety Data Sheets provided by the manufacturers).
3. Pediatricians with questions about acute chemical exposures and toxicity should call the Poison Control Center at 800-222-1222. For questions about long-term, low-dose exposure or other issues related to children and chemicals, pediatricians should contact their regional Pediatric Environmental Health Specialty Unit (www.pehsu.net).
4. Pediatricians should advocate for chemical policies that consider the special vulnerabilities of children and pregnant women. The American Academy of Pediatrics, through its chapters, committees, councils, sections, and staff, can provide information and support for public policy advocacy efforts. See www.aap.org/advocacy.html or contact your chapter leadership for further information.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Child Abuse, Confidentiality, and the Health Insurance Portability and Accountability Act

COMMITTEE ON CHILD ABUSE AND NEGLECT

KEY WORDS
HIPAA, child abuse

ABBREVIATIONS
HIPAA—Health Insurance Portability and Accountability Act
CPS—child protective services

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abstract

The federal Health Insurance Portability and Accountability Act (HIPAA) of 1996 has significantly affected clinical practice, particularly with regard to how patient information is shared. HIPAA addresses the security and privacy of patient health data, ensuring that information is released appropriately with patient or guardian consent and knowledge. However, when child abuse or neglect is suspected in a clinical setting, the physician may determine that release of information without consent is necessary to ensure the health and safety of the child. This policy statement provides an overview of HIPAA regulations with regard to the role of the pediatrician in releasing or reviewing patient health information when the patient is a child who is a suspected victim of abuse or neglect. This statement is based on the most current regulations provided by the US Department of Health and Human Services and is subject to future changes and clarifications as updates are provided. *Pediatrics* 2010;125:197–201

OVERVIEW AND PURPOSE OF THE HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT

The overarching purpose of the federal Health Insurance Portability and Accountability Act (HIPAA) of 1996 (Pub L No. 104–191) is to protect health insurance coverage for individuals who change or lose their jobs (Title I) and to establish national standards for electronic health care transactions that ensure the security and privacy of patient information (Title II). The latter goal required the US Department of Health and Human Services to establish such standards, which were enacted in April 2003. Title II also addresses the release of information about children and minors who are suspected victims of child abuse. Although HIPAA generally overrides state laws, HIPAA rules do not apply where the "provision of state law. . .provides for the reporting of disease or injury, child abuse, birth, or death, or for the conduct of public health surveillance, investigation or intervention" (Section 160.203[c]) or where state laws are more stringent than HIPAA rules.[1] Pediatricians are responsible for updating their practice in concurrence with changing HIPAA statutes, such as Health Information Technology for Economic and Clinical Health (HITECH), which was signed into law in February 2009.

DEFINITIONS

Covered Entity

HIPAA regulations apply to "covered entities." Covered entities include a health care professional (examples include "doctors, clinics, and psychol-

ogists"; see www.hhs.gov/ocr/privacy/hipaa/understanding/coveredentities/index.html) who documents and exchanges at least some patient information in electronic form (eg, via the Internet or an intranet), a health care clearinghouse that processes health care information from one format to another, and an individual or group health plan (eg, insurance plan) that provides or pays for medical care. A health care professional or a practice group that requests payment from a health care plan conducts electronic exchange of information and is, therefore, a covered entity. Covered entities cannot disclose certain patient information without written authorization from the patient or the patient's legal guardian unless exceptions are provided through HIPAA or state laws that override HIPAA.

Physicians who are employed by covered entities, including governmental organizations, but who work at a facility that may not be a covered entity, such as a children's advocacy center, may still be required to comply with HIPAA regulations. If there is a contract, such as a business associate agreement, between the physician's employer, a covered entity, and any other agency or facility, the physician is required to comply with HIPAA to the same extent as the covered entity is required to comply.

Protected Health Information

Information governed by the rules of HIPAA is called protected health information (also referred to as individually identifiable health information) and is defined as information, including demographic data, that relates to an individual's past, present, or future physical or mental health care; the provision of such health care; and the payment related to such health care.[1] A covered entity may disclose protected health information without patient or legal guardian authorization for the purposes of treatment, investigation, intervention, and public health–related functions. Treatment is defined as the provision, coordination, or management of health care and related services by a health care professional, including consultation between health care professionals regarding a patient.[1] Therefore, it is permissible under these exceptions to disclose protected health information to other health care professionals who care for, or consult on, the patient and to public health authorities without patient or parent authorization.

Public Health Authority

Public health authorities include appropriate government authorities who are authorized by law to receive reports of child abuse and neglect.[1] In most states, child protective services (CPS) and/or law enforcement agencies are designated to receive such reports.

PATIENT/PARENT RIGHTS TO CONFIDENTIALITY

Physicians who are covered entities are required to give their patients written notice of their privacy rights, and patients are expected to acknowledge receipt and understanding of these rights. Informing patients of their rights to have protected health information kept private (which only requires acknowledgment that they have received and understood the information) is distinct from obtaining authorization for disclosure of such information. An authorization for release of information that is not exempt by HIPAA is different from an informed consent to release information for treatment, payment, and health care operations, which are generally exempted by HIPAA.[2] Authorization is written permission from the legal guardian to use or disclose the child's protected health information to another person, entity, health care professional, or agency for purposes other than those not exempted (eg, treatment, payment, and health care operations) by HIPAA rules or state law. Authorization may be required when a physician is asked to disclose or discuss a patient's protected health information in legal proceedings. Authorization must include:

1. a description of the information used or disclosed;
2. the person authorized to make the disclosure;
3. the person to whom the disclosure is made;
4. an expiration date;
5. the risk of redisclosure once protected health information is disclosed and no longer protected by HIPAA; and
6. the purpose for which the information is used or disclosed.

If information regarding substance abuse is involved, federal law requires additional statements in the authorization as well as the signature of a minor aged 16 years or older.

SPECIFIC EXCEPTIONS TO HIPAA REGULATIONS RELATED TO CHILD ABUSE

In general, HIPAA permits disclosure of information without legal guardian authorization in matters that affect the treatment of, and medical intervention for, the child and the intervention and investigation of matters that relate to abuse or neglect, public health, and safety. HIPAA also regulates release of information to the legal guardian of the child for situations in which such disclosure may jeopardize the safety of the child.

Child Abuse Reports and Investigation

All states have laws that mandate reporting of suspected child abuse or ne-

glect, and HIPAA rules allow disclosure of protected health information without legal guardian authorization under these circumstances. In general, if a pediatrician suspects abuse or neglect, as defined within state statutes, then he or she is obligated to disclose information to the appropriate investigative agencies, which in most states includes CPS and law enforcement agencies.

Section 164.512(f) places limitations on the information released to law enforcement but not to CPS agencies.[1] However, if a law enforcement agency is a designated authority by the state to receive and investigate child abuse reports, the pediatrician may disclose all protected health information important to the investigation without legal guardian authorization. In other circumstances, the physician may disclose protected health information to law enforcement without authorization if there is a probability of imminent physical injury to the patient, physician, or another person or if the child is missing and a law enforcement agency confirms it is investigating a missing person.

Disclosing Information When the Pediatrician Is Not the Child Abuse Reporter

If the pediatrician is not the reporter, he or she is still able to disclose information about a child who is a suspected victim of abuse or neglect without parent authorization, but only if such disclosure (1) is permissible by state law "for the conduct of . . . investigation" (Section 10.203[c]), or (2) is deemed to be necessary to prevent serious harm to the child and other potential victims, and (3) is limited to the information relevant to the suspected abuse or neglect of the child (Section 164.512[c]).[1] The legal guardian of the child should be verbally notified of the disclosure unless informing him or her would place the child at risk of harm or would not be in the child's best interest.

HIPAA rules and state laws that govern release of protected health information pertain to treating physicians who are also covered entities. In addition, CPS agencies may contract with a child abuse pediatrician who does not treat the child but who may review medical and/or investigative records and photographs to provide an expert opinion. In these circumstances, written authorization from parents (who may retain custody of the child) to review such information is not needed, because CPS agencies (and, often, law enforcement agencies) are authorized by statute to investigate abuse and contract with an expert. However, the pediatrician would need parental authorization or a court order to provide such information to others outside the CPS agency, even when such parties have a copy of the physician's report or other protected health information of the patient.

DISCLOSING PROTECTED HEALTH INFORMATION BEYOND REPORTING AND INVESTIGATING CHILD ABUSE

HIPAA rules do permit disclosures "made pursuant to court or administrative orders or by subpoena, discovery, or other legal processes."[3] State laws that are more stringent than HIPAA may take precedence in these situations and may require a court order signed by a judge before disclosures of protected health information are made to attorneys or in court. State laws may also require the court to make a determination of relevancy before issuing a court order that allows the physician to disclose confidential information during testimony. When state laws do not override HIPAA, the physician is required to receive a written notice from the party sending the subpoena that the legal guardian of the child has been informed that the physician is going to disclose the child's information (Section 164.512e1iii).[1] Whenever a request or subpoena is received for release of medical records for the purpose of a child abuse investigation, the subpoena should be retained in the records and a description of the information provided, and the date of release should be documented.

Child fatality review teams usually comprise professionals from CPS, pediatrics, the medical examiner's office, emergency medical services (EMS), law enforcement, the district attorney's office, and children's advocacy centers, the duties of which are to review medical records and autopsy and investigation findings related to a child's death. The purpose is to exchange information, identify any trends, and identify preventable deaths, including those attributable to child abuse or neglect. Disclosure of a child's protected health information during child fatality reviews is a permissible HIPAA exception that relates to public health matters and surveillance. It is also permissible to disclose such information to multidisciplinary teams and organizations that review child abuse cases.

ISSUES SPECIFIC TO CHILD ABUSE

Parent Rights

Although HIPAA regulations more clearly exempt disclosure of information about children who are suspected victims of abuse or neglect, exceptions regarding disclosure of medical and mental health information about the parents, caregivers, and siblings of the child are not as clearly defined or inclusive. For example, HIPAA specifies the type of information that a physician can release to law enforcement about a patient who may be an abuser, which includes distinguishing physical characteristics, blood type, name, and address. Because the pediatrician's

patient is the child, any statements made by the parent to the pediatrician that relate to the child's health or injuries are considered part of the child's protected health information and can be disclosed to investigative agencies; this information may include intimate partner abuse, mental illness, admission to causing injury to the child, and explanations for the child's injuries.

Child Rights/Media Exposure

When a pediatrician discloses verbal or written information to law enforcement about a child who is a suspected victim of abuse or neglect, this information may become public. For example, if a warrant is issued for a person's arrest related to an injury to a child, information about the child's injury and the source of the information may be contained in the warrant and accessed by the media. In addition, if a pediatrician testifies about the child's protected health information, this information is also accessible to the public. Although these disclosures of information by others are beyond the pediatrician's control, the pediatrician should release information only to the appropriate individuals involved in the treatment, intervention, or investigation of child abuse and provide accurate and verifiable information. The pediatrician should not speculate beyond the realm of his or her expertise or the facts of the case. Physicians are not permitted to release any information about a patient to the media.

EFFECT OF HIPAA ON PEDIATRIC PRACTICE

Consent for Release of Protected Health Information

When a parent brings his or her child to a pediatrician for care, pediatric offices are required to provide the parent with information regarding his or her rights to confidentiality and protection of the child's health data. Parents are requested to sign a form that indicates they have received and understand this information; in some cases, the parent is requested to sign consent to release the child's protected health information under the HIPAA exceptions for the purposes of treatment, payment for services, and health care oversight. The form is retained in the child's health record. In the case of suspected child abuse or neglect, the pediatrician must decide whether release of information to the parent or to a person that the parent designates could endanger the child. Section 164.502(g) (5) [1] indicates that when there is a reasonable belief that the child "has been or may be subjected to domestic violence, abuse or neglect by [the parent or legal guardian]" or "it is not in the best interest of the [child] to treat the person as the [legal guardian]," then the pediatrician is not required to provide information or access or control of the child's protected health information to the legal guardian. The pediatrician, therefore, is not required to provide the child's information to a parent who could be a suspected abuser or to a parent who seems to be protective of a suspected abuser, because this would not be in the best interest of the child. If the pediatrician is unsure whether the parent is a suspected abuser or does not know the results of the investigation, then the pediatrician may wish to confirm with the investigative agencies whether it is safe to disclose information to the legal guardian.

Obtaining and Documenting Consent

Although HIPAA specifies that consent is voluntary for use and disclosure of information related to treatment, payment, and health care operations, a physician may wish to document when they do obtain consent, including whether the parent was informed verbally or in writing of the disclosure of information. Again, the parent should be informed of information disclosure only if the child's well-being and safety are not jeopardized by such.

Documentation of Ongoing Disclosures Related to Child Abuse Investigations

The physician may receive requests for the protected health information of a child from individuals involved in the investigation of, or legal proceedings related to, suspected abuse or neglect. The physician or facility's custodian of records is responsible for ensuring that the release of such information is permissible without specific parent authorization, is provided in response to a court order or subpoena, and is disclosed confidentially only to the acceptable individuals or agencies. For example, if the information is transmitted via facsimile, the physician should take all reasonable steps to verify that the recipient is available to receive the information as it is transmitted.[4] Whenever information is disclosed, the physician should document what was disclosed, how it was disclosed (verbally or in writing), and to whom the information was disclosed.

RECOMMENDATIONS

1. Pediatricians should become familiar with their state laws regarding disclosure of a child's protected health information when child abuse or neglect is reported or investigated and should know when HIPAA or state laws take precedence. Specifically, the pediatrician should know which agencies are authorized to receive and investigate child abuse reports and which laws govern release of protected health information after an investigation is completed. When HIPAA regulations were announced, attorneys general from each state were required to do a preemption analysis for their state; physicians may

consult their state's attorney general's office for information on state laws and HIPAA. In addition, the American Academy of Pediatrics has developed a HIPAA toolkit for medical practices to facilitate implementation of HIPAA rules; a glossary of terms is included in this resource (http://practice.aap.org/hipaa.aspx).

2. When abuse or neglect is suspected, the pediatrician must report and may disclose a child's protected health information to the CPS (and/or law enforcement) agency without parent authorization. When child abuse has already been reported and is being investigated, it is permissible for the pediatrician to disclose information to the appropriate investigative agencies without parent notification or authorization.
3. When disclosures of protected health information are made, the pediatrician should attempt to inform the parent unless doing so could result in danger to the child. The pediatrician must recognize situations for which disclosure of information is necessary and obtaining authorization from the legal guardian may delay the child's treatment or jeopardize the child's safety. It is permissible for pediatricians to withhold the child's information from the parent if there is a possibility that the parent is the abuser or is protective of a suspected abuser.
4. HIPAA privacy rules apply to physicians of record. If a physician reviews records made by another health care professional to assist in the investigation of child abuse or neglect or to contribute to a child abuse case review related to public health matters or surveillance, it does not require authorization from the child's legal guardian.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Psychosocial Aspects of Child and Family Health

The Child in Court: A Subject Review

ABSTRACT. When children come to court as witnesses, or when their needs are decided in a courtroom, they face unique stressors from the legal proceeding and from the social predicament that resulted in court action. Effective pediatric support and intervention requires an understanding of the situations that bring children to court and the issues that will confront children and child advocates in different court settings.

When children pass through the doors into a courtroom, they enter a formal adult setting that is designed for the resolution of often contentious adult arguments. All children are anxious in a courtroom, but the setting and the nature of the stressors on the child depend on the nature of the court proceeding and the child's role in the process. Three situations typically bring children into court: child protection actions, contested parental divorce, and delinquency offenses. A child also might be a witness in a criminal proceeding as the result of an abusive incident. Only rarely will children need to be present for other types of cases, such as adoptions or traffic offenses.

This statement outlines common events affecting children in the US judicial system and delineates the different settings, events, expectations, and sources of conflict and stress that children are likely to experience. Key advances in law enforcement techniques, investigation of cases involving children, and state law and judicial policy have improved the ways that children participate in most courts. This statement reviews the new policies and procedures and provides guidance for pediatricians who work with children who must become witnesses.

CHILDREN AND THE TYPICAL COURT SYSTEM

Each state court system makes some provision for handling legal matters involving children. The legislature of Illinois was the first to recognize, in 1899, that matters involving children need to be handled differently from those involving adults. First, children are dependent on adults. Children also are developing emotionally and cognitively and have varying levels of understanding. Illinois founded the first "juvenile court," not a new court with its own administration and infrastructure, but a set of rules for Illinois county courts that would consider cases of children accused of crimes. After this institution was developed, young offenders were not convicted as criminals but were found to be, or adjudicated, delinquents. This judgment emphasized education and rehabilitation rather than punishment. Juvenile courts were gradually adopted by all states.[1]

In recent years, the number of children involved in the court system has increased owing to the meteoric rise in child abuse and neglect cases during the 1980s, the increased number of divorces with disputes about child custody, and the escalated number of serious crimes committed by children. These increases and the recognition that legal matters involving children and families need to be addressed differently than criminal matters or money disputes led many states to establish a specific family court with its own infrastructure and administration. This family court system addresses all types of cases that involve children: abuse and neglect or child protection, divorce, juvenile delinquencies, parentage, guardianship, and adoptions. Other states may continue to handle family cases by a court structure that primarily addresses civil or criminal matters. Pediatricians need to familiarize themselves with the court structure of their state and how it works for families.

Children are involved in the US court system in the following matters:

- *Child protection cases* involve children who are alleged victims of abuse or neglect. These matters include hearings involving the disposition of and/or placement of children, as well as the termination of parental rights, if there is a finding of child abuse or neglect, including child sexual abuse.
- Some states also include so-called status offenses in their child protection laws. A *status offense*, eg, truancy, underage drinking, is a crime because of the child's status as a minor.
- *Parental divorce* or *parentage* cases rarely require a child to testify; however, a child's testimony might be sought in acrimonious contested cases, in which there may be multiple opportunities for the pediatrician to act as a problem solver to prevent the child from unnecessary testimony.
- *Delinquency cases* involve children who would have been charged for a criminal act as adults. They also can be charged for status offenses.

In all these cases, the juvenile court system uses a process in which the aim is treatment and reparation, not punishment. Children, however, are increasingly being charged as adults for serious crimes, especially crimes involving acts of violence, and tried in the adult criminal justice system, where treatment and

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

reparation may not be available. If found guilty as adults, children may be sent to adult criminal correctional institutions.

CHILD PROTECTION CASES: CASES OF ABUSE, NEGLECT, AND CHILD SEXUAL ABUSE

Child protection cases are under the jurisdiction of juvenile or family court under the *parens patriae* role of the court, the state's interest in and responsibility for the well-being of all children in the state. The state, recognizing that the *parens patriae* role conflicts with common law reflecting children as chattel (personal property) of their parents, will exercise its authority with caution. Although no state now recognizes parental ownership and unrestricted control of children, each state is committed to protecting a family's autonomy and privacy and the parents' right to decide how to raise their children.

In this arena, a child witness may be asked to provide factual information to the court that might result in a determination to take the child into state custody. Depending on the state, the child may or may not be a witness and will be a party to the proceeding only on rare occasion. The child's case is brought to court by the state child protective agency that files suit against the parents. The child may or may not be represented by an attorney or have an appointed *guardian ad litem. Guardians ad litem* may be attorneys, or in some courts lay *guardians* are used. It is their responsibility to assess the child's interest and needs and present them to the court on behalf of the minor child; they serve as guardians only for the court proceeding.

The investigation of alleged child maltreatment leads to court action and also may have implications for how the court is able to proceed in making its judgment. Allegations of child abuse are brought by the state child protection agency after its investigation. When there has been serious physical harm and for almost all allegations of child sexual abuse, a law enforcement investigation also is accomplished. Many jurisdictions have developed programs to allow child protective service workers and police to do a joint investigation, thereby reducing the number of times that children must retell their experiences, while providing a gentle and supportive environment for the children. Some jurisdictions now have data indicating that a thorough and complete investigation reduces the need for child testimony (Unpublished data, the Chittenden Unit for Special Investigation, year-end report, 1996 [CUSI, 50 Cherry St, Suite 102, Burlington, VT 05401]).

Whether children should testify is a difficult decision in cases of physical abuse and neglect. Several studies have described the emotional effects of testimony on children who have been sexually abused. Some researchers believe that children benefit from facing their abuser.[2] They suggest that when children see the abuser take responsibility for his or her acts, their sense of self-worth and personal safety improves. Others are concerned that child witnesses will experience distress sufficient to affect the reliability of their testimony and exacerbate their feelings of victimization and stigmatization.[3] In addition, when children are asked to serve as a witness against a family member with whom they might have positive attachments and negative experiences, they are being placed in the awkward position of "sentencing" a family member.[4]

This question was recently reviewed by the National Institute of Justice of the US Department of Justice.[2,5–7] Of the studies published to date, no agreement has been reached as to whether the effect of testimony on children is positive or negative. All children had high levels of anxiety before testimony. Maternal support of the child witness, if available, contributed to improvement in the child's mental health, and, perhaps most important, the emotional health of most children improved with time regardless of a positive or negative court experience.

Pediatricians need to be aware of the possible emotional effects of being a child witness in the child protection system and be prepared to work with child protective service workers, other human service professionals, and lawyers to help determine if a child should testify and to help find solutions that protect the child.

DIVORCE PROCEEDINGS

In 1994, there were 1 191 000 divorces in the United States.[8] It is estimated that approximately 10% of divorces with minor children involve court-contested custody. The rate of return to court for changes in custody agreements for these initially contested cases is quite high.

Divorce proceedings exist to sever the marriage contract between a husband and wife; legal precedent is traced to contract law. Because children were not part of the contract, they are not parties to the divorce proceeding. The state, in its *parens patriae* role of protecting the well-being and best interest of all children in the state, has an interest in how the parties (parents) provide for children of the marriage as the marriage contract is dissolved. But the state expects that parents will make appropriate plans for their children and will intervene only when it views that the children are at risk of harm. When parents cannot decide, the judge will write an order to provide for the children, and the parents are expected to comply with the divorce decree. Visitation is seen in most jurisdictions as a parental right that will be restricted or denied only when harm to the child is likely to result.

In a contested divorce complicated by parental acrimony, anger, or allegations of abuse, most courts will take a much stronger interest in providing for the future safety and nurturance of children. Many courts will appoint *guardians ad litem* for minor children. In highly contested matters, attorneys may be appointed to represent children directly. Occasionally, *guardians ad litem* will seek information from professionals involved with their charges, and pediatricians might be asked for information about a child's health and factors that might assist the court to decide about the competency and appropriateness of the parents. *Pediatricians are cautioned to be knowledgeable of laws of confidentiality, which are state-specific.* Sharing information with any party requires written

permission provided by *both* parents or the direction of a court order. Even a subpoena for records requires caution and clarification. If the subpoena is not from the court but on behalf of one parent (party), the written permission of the court or the other parent is recommended. Although information that the pediatrician might share is important to the court, it rarely will constitute the full and thorough evaluation the court may require for determination of custody.

In some instances, a court may order a formal custody evaluation. This evaluation generally will be performed by mental health professionals, sometimes in a team, who will assess the child and each parent individually. Such an evaluation often will include a visit to each parental home, psychological testing, and child and parent interviews. The mental health professional performing this evaluation may contact a pediatrician for information that can be most useful in the preparation of the custody evaluation. *Again, appropriate permissions to share information must be provided to the pediatrician.* In some cases, a parent will hire a mental health professional or other expert solely for the purpose of testifying at the custody trial. Owing to the lack of input from the other parent, the pediatrician should view an involvement with such one-sided evaluations with caution. Although the professional services of the pediatrician are not covered by the family's health insurance, the court will direct one or both parties to pay for the evaluation. It is appropriate to ask the interviewer who will bear financial responsibility for pediatric consultation and reports.

The role of the pediatrician in family divorce has been discussed in a previous statement by the American Academy of Pediatrics.[9] It involves anticipatory guidance and support during the various stages of the divorce process and reconstitution of family function. If children are to serve as witnesses in divorce cases, the pediatrician needs to address with the family issues specific to child witnesses.

Generally, children will not be asked to testify in a divorce proceeding except those that are hotly contested. The fact that the child is asked to testify should alert the pediatrician to the possibility of severe family dysfunction and is an indication to consider a mental health referral to support the child during this period of stress and adjustment.

Most court jurisdictions make strong efforts to avoid testimony by children in court, believing that this asks children to choose one parent over the other. Although only limited published data support this view, it seems prudent to avoid the risk of a guilt reaction about the parent not chosen. For example, Vermont has statutory limitations on children's testimony. For any child to testify, the judge must be convinced that the child's testimony is necessary to assist the court in determining the issue before it, that the value of the child's testimony outweighs the potential detriment to the child, that the evidence sought from the child is not reasonably available by any other means, and that an attorney will be appointed for the child to protect the child's specific interest.[10]

JUVENILE CASES: DELINQUENCY

Children are charged with delinquency when their acts would have been criminal had they been committed as adults. A child charged with a crime should be represented by an attorney, who is court-appointed if necessary.

Minor children are unable technically to tell their attorneys how they would like the case handled. For example, if the attorney presents a plea bargain, can a minor child make the decision to accept or reject the attorney's recommendation? Many states provide for the emancipation, by statute or judicial rule, of older minors charged with certain crimes, just as states provide for emancipation in certain decisions about health care. Younger children will need a *guardian ad litem* in this setting, which ideally would be the child's parent. If necessary, a court-appointed *guardian ad litem* might be provided.

The extent of the authority of the *guardians ad litem* or when the child's wishes should be a determinative factor is not settled in most states. If the child is a teenager and the *guardian ad litem* wants to proceed differently than the child wants, different states will resolve this dispute in different ways. If the *guardian ad litem* is a parent, the court may dismiss the parent and appoint a disinterested *guardian ad litem,* while another court will determine that the child is old enough to direct a legal defense.

COMPETENCY

The legal system is especially interested in 3 questions about a child's competence as a witness: 1) Can the child receive and relay information accurately? 2) Does the child know the difference between telling the truth and telling a lie? 3) Does the child understand the need to tell the truth in court?

Children can be competent witnesses. Younger children may not remember with as much accuracy as older children, but the poignancy of an event may enhance their memory. A 3- or 4-year-old's ability to recall major events is excellent, although less important information is less well remembered. A lack of accuracy may be attributable to the following: 1) poor recall of an event or sequences in an event, 2) misinterpretation or confusion about an event, 3) suggestibility, 4) delusion or other mental disorder, 5) intellectual disabilities, and 6) intentional deception initiated by the child or resulting from adult coercion. Nurcombe[4] has reviewed the competency and creditability of child witnesses, and the literature in this field is growing.[11]

SUPPORT IN THE PEDIATRIC OFFICE

Pediatricians are an important source of support for children who may be witnesses, from the initial contact through preparation for court appearance and the legal negotiation process until after the court proceedings. Most legal cases are settled without trial. If the pediatrician has had a long-term relationship with the child and the child's family, the pediatrician may be able to help parents find out-of-court solutions to family issues. The pediatrician should attempt to keep the legal process in the child's best

interest and to help the child maintain a healthy adaptation to a stressful experience. The pediatrician also should address the psychological effect of the event responsible for the child's court appearance. Mental health referrals might be the most appropriate way to assist the child and family in their adjustment about the court proceedings. However, pediatricians who are experienced and knowledgeable about court proceedings and children's common reactions may successfully provide brief interventions that help the child and family.

The role of the pediatrician in child abuse and neglect, child sexual abuse,[12] and family divorce[9] has been discussed in previous statements published by the American Academy of Pediatrics. Separate attention must be devoted to preparing a child for the stress that accompanies a legal hearing or other out-of-court involvement with the legal system. Pediatricians can help prepare children for court appearances by explaining what will occur and that the child will always be accompanied by a supportive person, such as a parent. Pediatricians can help minimize the anxiety of children by explaining that they will not be judged on their performance in the courtroom, that efforts will be made to ensure safety from recrimination, and that questions should be answered to the best of their ability. Pediatricians can also help parents, lawyers, and judges to find solutions to protect children.

Because of the stressful events before and surrounding a court appearance by a child, a follow-up visit with the pediatrician is indicated after a child appears as a witness. Children should be assessed for behavioral manifestations of acute stress (eg, sleep disorders, somatic complaints), adjustment, and functional status (eg, school performance, resumption of usual activities, physical functioning, social functioning, and mental health).

CONCLUSION

Pediatricians can provide important guidance and support for children involved in the legal system. With their understanding of child development and the special knowledge and relationship with the child and knowledge of the legal proceedings, pediatricians are equipped to be a unique resource for support, consultation, care, and advocacy. With some families, the pediatrician's involvement may encompass the entire process, from the initial stressful event to the resolution of the proceeding and healing of the family. In other cases, the pediatrician will be involved only for brief interventions during the often extended court proceedings. Mental health referrals may be indicated, including referrals to therapists with special legal expertise. Application of the principles outlined in this statement can lead to more effective support and to a better outcome during and after the child's experience as a witness in a legal proceeding.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Child Fatality Review

abstract

FREE

Injury remains the leading cause of pediatric mortality and requires public health approaches to reduce preventable deaths. Child fatality review teams, first established to review suspicious child deaths involving abuse or neglect, have expanded toward a public health model of prevention of child fatality through systematic review of child deaths from birth through adolescence. Approximately half of all states report reviewing child deaths from all causes, and the process of fatality review has identified effective local and state prevention strategies for reducing child deaths. This expanded approach can be a powerful tool in understanding the epidemiology and preventability of child death locally, regionally, and nationally; improving accuracy of vital statistics data; and identifying public health and legislative strategies for reducing preventable child fatalities. The American Academy of Pediatrics supports the development of federal and state legislation to enhance the child fatality review process and recommends that pediatricians become involved in local and state child death reviews. *Pediatrics* 2010; 126:592–596

THE COMMITTEE ON CHILD ABUSE AND NEGLECT, THE COMMITTEE ON INJURY, VIOLENCE, AND POISON PREVENTION, and THE COUNCIL ON COMMUNITY PEDIATRICS

KEY WORDS

child fatality review teams, child deaths

ABBREVIATIONS

AAP—American Academy of Pediatrics
CFRT—child fatality review team

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INTRODUCTION

The preventable death of a child is an unparalleled tragedy for a family. Similarly, a nation's ability to reduce child mortality rates is a measure of that society's overall well-being, and failure to address preventable causes of child mortality is a national tragedy. Each year in the United States, more than 17 000 infants and children die from injury, which remains the leading cause of child mortality in the United States.[1] Add to this the number of preventable noninjury deaths, including many deaths related to prematurity, and it becomes clear that a majority of American child deaths are preventable. The 1999 American Academy of Pediatrics (AAP) policy statement "Investigation and Review of Unexpected Infant and Child Deaths"[2] supported analysis of child deaths, standards for adequate investigations for individual deaths, and the importance of child death review. The purpose of this AAP policy statement is to highlight the importance of child fatality review in the public health approach to prevention of child deaths and to advocate for improving this process through attention to better training, data collection, and data dissemination.

Reducing preventable child mortality requires a systematic and integrated evaluation of fatality causes, which begins with accurate vital statistics data. Vital statistics data do not, however, accurately capture all causes of child fatality (eg, deaths attributable to child maltreatment). National and state mortality statistics, which rely on the *International Classification of Diseases* (ICD) coding system to define cause of death on death certificates, underestimate child fatalities attribut-

able to homicide and unintentional death. Detailed review of child deaths in Missouri, North Carolina, Colorado, and, more recently, Michigan, California, and Rhode Island has revealed that approximately half of child abuse fatalities are unrecognized in vital statistics data.[3–6] The incidence of sudden infant death syndrome (SIDS) has decreased significantly since the 1992 AAP recommendations for safe sleeping positions for infants.[7,8] Evaluation of more recent declines in SIDS rates in the United States suggest that, despite the significant decreases in SIDS deaths over the past 15 years, more recent declines might be attributable to an increase in diagnostic coding of asphyxia, suffocation, and other causes of sudden, unexpected infant death. These discoveries have resulted from coordinated, multidisciplinary investigations of child deaths at local and state levels through a child fatality review process. Ultimately, the purpose of child fatality review is to identify effective prevention and intervention processes to decrease preventable child deaths through systematic evaluation of individual child deaths and the personal, familial, and community conditions, policies, and behaviors that contribute to preventable deaths.

CHILD FATALITY REVIEW TEAMS

Child fatality review teams (CFRTs), multidisciplinary committees comprising representatives from law enforcement, child protective services, the office of the coroner/medical examiner, prosecuting attorney's office, the medical community, and/or public health and other community stakeholders, were first established to review suspicious child deaths involving possible abuse or neglect.[9] Although originally developed to improve identification and prosecution of fatal abuse,[10] the role of CFRTs has expanded toward a public health model of prevention of child fatality through systematic review of child deaths from birth through adolescence.[11] In addition to reviewing child fatalities related to maltreatment, many CFRTs now review all child fatalities in the jurisdiction covered by the team.[12] Approximately half of all states report reviewing child deaths from all causes.[11] This expanded approach can be a powerful tool in understanding the epidemiology and preventability of child death locally, regionally, and nationally; improving accuracy of vital statistics data; and identifying public health and legislative strategies to reduce preventable child fatalities. In addition, CFRTs remain an effective surveillance tool for identifying victims of fatal maltreatment.[6]

Another challenge in reducing preventable child deaths is to find ways to implement prevention strategies that have been determined to be effective. In general, identifying public health problems and increasing public and professional awareness of them is more easily accomplished than planning and implementing reasonable and well-tested solutions.[13] CFRTs can serve to highlight local, state, or national contributors to preventable child deaths and serve to catalyze action to prevent these deaths and provide a means of monitoring the effectiveness of these changes. These functions of scientific data collection in evidence-based decision-making form a cornerstone of evidence-based public health[14] and provide the type of data described in a recent Institute of Medicine report on evidence-based decision-making.[15]

In the few years since their establishment, child fatality review processes have been used to inform local and state prevention strategies to reduce child deaths. For example, Rimsza et al[16] published the experience of a statewide review process that examined 95% of child deaths in Arizona over a 5-year period. Evaluation of local CFRT data revealed that 29% of the 4806 child deaths were preventable and that preventability increased with age. Leading causes of preventable deaths included motor vehicle crashes, medical illness, and drowning. The ability to accurately assess local and regional causes of death enabled the Arizona chapter of the AAP, in partnership with other advocates, to work with state legislators to establish a graduated driver's license program for teenagers.

In Massachusetts, the state CFRT found that a large proportion of sudden, unexpected infant deaths occurred while bed-sharing with adults. As a result, the state launched a publicity campaign to highlight this danger and included letters to all 3500 child health care providers in the state.[17] Georgia enacted improved child restraint laws as a result of a statewide child fatality review process that identified large numbers of child fatalities that were related to the inappropriate use of child restraints in motor vehicles.[18] The state of Nevada, after focused child fatality reviews in Las Vegas, Reno, and rural Nevada, instituted widespread changes to its child welfare system, including additional funding, training, policy improvements, interagency protocols, new laws, and improvements to the medical examiner/coroner, child protective services, and health systems throughout the state.

These examples illustrate the promise of using local data to prompt public policy discussion and action. In fact, the determination of many of the leading causes of preventable deaths have resulted in implementation of prevention procedures (eg, child safety restraints and pool fencing), and child fatality data have been used to emphasize the need for enforcing existing

laws and improving public education related to existing strategies.[13,19]

In addition to improved surveillance of child mortality data, the child fatality review process can improve interagency collaboration and coordination of public health and law enforcement efforts, improve accuracy of death-certificate data, decrease misclassification of deaths, uncover missed child homicides, and foster the development and implementation of interventions to prevent mortality and morbidity attributable to injury.[5,6,20–22]

Fatality review can also identify failures or oversights in medical care; gaps in community services, including emergency medical services for children; improve allocation of limited resources; improve policy and procedures at local and state agencies; and identify legislative initiatives to improve child health.[23,24] Both the AAP and American Bar Association have endorsed child death reviews.[2,25]

ESTABLISHMENT OF CFRTs

In the past, a variety of mechanisms were used to establish CFRTs, including state legislation that enabled or mandated child death reviews, executive orders established by governors, or community establishment of teams that were not legislated or mandated. This variability—from legislative mandate to grass roots community efforts—engendered great differences in program organization and process. Most states have CFRTs that are established by statute, and approximately three-quarters of state laws include mandatory review; the remainder of them provide for discretionary formation of teams. CFRTs exist at both the state and local levels but vary by state in the membership of teams, the relationship of the state and local teams, the criteria for case review, the timing of the reviews, the data collected, and team policies and procedures.[11] Within the past few years, however, there has been a national effort to develop standards for child death review, and many states are working to implement these standards.[26,27] In addition, the Maternal and Child Health Bureau funded a National Center for Child Death Review in 2001, and the Health Resources and Services Administration has provided funds for the development of an Internet-based case-reporting system, which is now in use by slightly more than half of the states in the United States.

Despite these recent efforts, no federal funds have been directly appropriated for state or local child death review, and not all states have attained the level of funding or leadership commitment necessary to meet national standards.

In contrast to the local variations in definitions and procedures inherent in the current child fatality review system, the long-established transportation-related Fatality Analysis Review System and the newer National Violent Death Reporting System (NVDRS) both illustrate the power of developing and implementing national standards for data collection in addressing preventable deaths. The NVDRS, which is currently active in approximately one-third of the states, collects data on fatalities associated with child maltreatment and has potential synergy with CFRTs.[28]

CFRTs support the public health approach of using data collection or surveillance to define the issues; identify risk factors, protective factors, and barriers within individual families and the greater community; develop interventions that are based on analysis; implement interventions at the community level; and use evaluation results to modify and improve the initial interventions.[16]

SUMMARY

A national network of CFRTs offers the potential to harness public health models to reduce the large number of preventable child deaths in the United States. National leadership and support are critical for expanding child death review and preventing unnecessary childhood deaths. Measures that require a uniform national approach that could improve the child fatality review process include:

1. standardizing the process of child death review;
2. providing standardized definitions for fatality coding and structure for standard data collection;
3. providing training, technical assistance, and support for CFRTs that review deaths and for public health officials in collecting, accessing, and using these data;
4. establishing criteria for quality improvement in CFRT data collection, evaluation, and dissemination;
5. providing mechanisms to enable interstate and cross-jurisdictional data-sharing;
6. establishing standardized confidentiality protocols and legal protections for team members; and
7. publishing online annual reports of CFRT data to compare program effectiveness across states and to provide robust data regarding national child fatality causes.

THE PEDIATRICIAN'S ROLE

The pediatrician can influence the child fatality review process for individual patients and, more broadly, for their communities and states. The following recommendations are based on the epidemiologic evidence discussed above and the expert opinions of the authors and the AAP committees involved in preparing this statement. The AAP recommends the following.

1. Pediatricians should advocate for proper death certification for children. Recognize that such certification is only possible for sudden, unexpected deaths after comprehensive death investigation that involves an immediate evaluation at the scene of the death and includes an autopsy.
2. Pediatricians should work with their state AAP chapters to advocate for and support state legislation that requires autopsies in deaths of children younger than 6 years that result from trauma; that are unexpected, including sudden, unexplained infant death; and that are suspicious, obscure, or otherwise unexplained. These same guidelines for unexplained deaths should apply to all children, including those with chronic diseases.
3. Pediatricians should work with their state AAP chapters to advocate for and support state legislation and other public policies that establish comprehensive and fully funded child death investigation and review systems at the local and state levels and that the data from child death investigations be aggregated, analyzed, and disseminated nationally.
4. Child fatality review committees at both the state and local levels should include pediatricians who serve as expert members in reviewing case files of the medical examiner or other agency investigating the deaths of children who were patients. Pediatricians should also serve as consultants to the child fatality teams on medical issues that need clarification as well as on social issues and community resources that might contribute to the prevention or causation of preventable child deaths. Physicians should receive payment commensurate with the time and value of their services on such teams. Primary care physicians, emergency medicine physicians, and child abuse specialists are ideally suited for participation on such review teams. Other physicians, such as obstetricians, would be valuable partners in reviewing deaths from prematurity.
5. Pediatricians should work collaboratively to ensure that information from child fatality reviews is used to inform local, state, and national policies to reduce preventable child deaths.
6. Public policy initiatives directed at preventing childhood deaths should be supported at the national and chapter levels provided that they are based on information acquired at the local and state levels from adequate death investigations, accurate death certifications, and systematic death reviews. The AAP Division of State Government Affairs offers assistance and guidance to AAP chapters in developing state public policy on CFRTs; for more information, call the division at 800-433-9016, extension 7799, or e-mail stgov@aap.org.

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American Academy of Pediatrics
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POLICY STATEMENT

Child Life Services

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Child Life Council
Committee on Hospital Care

ABSTRACT

Child life programs have become standard in most large pediatric centers and even on some smaller pediatric inpatient units to address the psychosocial concerns that accompany hospitalization and other health care experiences. The child life specialist focuses on the strengths and sense of well-being of children while promoting their optimal development and minimizing the adverse effects of children's experiences in health care or other potentially stressful settings. Using play and psychological preparation as primary tools, child life interventions facilitate coping and adjustment at times and under circumstances that might prove overwhelming otherwise. Play and age-appropriate communication may be used to (1) promote optimal development, (2) present information, (3) plan and rehearse useful coping strategies for medical events or procedures, (4) work through feelings about past or impending experiences, and (5) establish therapeutic relationships with children and parents to support family involvement in each child's care, with continuity across the care continuum. The benefits of this collaborative work with the family and health care team are not limited to the health care setting; it may also optimize reintegration into schools and the community.

CHILD LIFE PROGRAMS

Most hospitals specializing in pediatric care have child life programs,[1] and the number of these programs has doubled since 1965. There are now more than 400 child life programs in the United States and Canada.[2] A 2001 survey by the National Association of Children's Hospitals and Related Institutions found that 95% of 118 responding hospitals employed child life specialists (S. Dull, RN, MSN, MBA, National Association of Children's Hospitals and Related Institutions, verbal communication of unpublished data, June 30, 2005). Child life services are offered in inpatient pediatric health care settings as well as ambulatory clinics, emergency departments, rehabilitation settings, hospice programs, and even some dental and physician offices.[2–4] The provision of such services is a quality benchmark of an integrated child health delivery system and an indicator of excellence in pediatric care.[5,6] Child life programs and the kinds of services they provide are a component of family-centered care.[7,8] Child life services are also recommended for community hospitals with pediatric units.[9] Some states have identified the importance of child life services through the regulatory process; for example, a 1999 California statute allowed for the reimbursement of bereavement services by a certified child life specialist for someone who experienced trauma.[10] In addition, hospital licensing standards in New Jersey require the services of a child life specialist in PICUs.[11]

A ratio of 1 child life specialist to 15 or 20 inpatients has been used successfully in some institutions; however, the patient's age and mobility, the patient popula-

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tion on the unit, and the institution's needs should influence actual staffing allocation.[12,13] An increasing number of child life specialists are employed in outpatient settings. There are no standardized ratios for outpatient areas, but the same factors should be considered as those for inpatient settings, and thought should be given to providing maximal services during peak visit hours (eg, the emergency department may be busier in the afternoon and evening, and the perioperative area may be more active in the early morning). Child life specialists are generally supervised by a child life manager who, in turn, may report to the hospital or division leadership.

The credentials of a certified child life specialist include the minimum of a bachelor's degree in child life, child development, human development, or a closely related field; the successful accomplishment of a 480- to 600-hour child life internship under the supervision of a certified child life specialist; and the satisfactory completion of the standardized certification examination. The child life specialist should have an understanding of children of all ages and the family, good communication skills, experience with diverse groups of patients, developmental assessment expertise, and collaborative teamwork abilities. Child life specialists often develop specific areas of expertise related to the patient population they serve, such as infants, toddlers, elementary school–aged children, adolescents, oncology patients, critically ill children, radiology patients, technology-dependent children, etc. They recognize the developmental issues specifically related to illness and health care experiences and understand how to mitigate fears, fantasies, and concerns through adaptive role play, education, and behavior-management techniques. Information about the child life profession and certification of child life specialists is available from the Child Life Council (see "Additional Resources").

An effective child life program provides developmentally appropriate play, offers informative and reassuring psychological preparation before and during procedures, and helps children plan and rehearse coping skills.[14] Child life specialists are part of an interdisciplinary and family-centered model of care, collaborating with the family, physicians, and other members of the health care team to develop a plan of care.[8,15] The child life component of this plan is based on the individual patient's perception and understanding of the anticipated health care experience with the goal of enhancing coping.[16,17] Child life specialists support these goals by, for example, teaching the child coping strategies for adjusting to a life-changing injury or dealing with impending death, offering nonpharmacologic pain-management techniques, and communicating the child's developmental and individual needs and perspective to team members.

The therapeutic interventions of child life staff are most effective when delivered in collaboration with the attending physician, primary care physician, and other members of the health care team as part of the medical home* for the hospitalized child. Child life programs offer services that support the medical home, defined by the American Academy of Pediatrics as care that is "accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective."[18(p184)]

PLAY AND NORMALCY

Play is the primary modality of a child life program because it is both familiar and reassuring for children. It helps make the health care experience less intimidating and more comfortable.[19–22] Experts state that play is believed to be "used by children as a means of reducing anxiety produced by stressful conditions."[17(p213)] Child life programs provide opportunities for play in inpatient medical and surgical areas, ICUs, outpatient clinics, emergency departments, presurgical waiting areas, radiology departments, laboratory waiting rooms, and sibling care centers. Play is adapted to the many age groups in pediatrics. Young children are given opportunities for make-believe play, whereas school-aged children enjoy games with rules.[23] Adolescents will seek to continue their relationships with peers outside the hospital through Internet access and must be provided with opportunities to form new friendships within the hospital. This is particularly important for adolescents with chronic illnesses who may have multiple hospitalizations.[24,25] Activities that promote self-esteem are vital, as is continuation with schooling.

Engaging in developmentally appropriate play, creative or expressive arts (including music therapy, art therapy, drama, video work, and creative writing), and reading activities all help moderate children's anxiety and decrease the possibility that health care encounters will disrupt their normal development.[3,26–28] Auxiliary programs, such as animal-assisted therapy, therapeutic clowning, or electronic networks for hospitalized children, when used in conjunction with child life services, provide additional supportive activities for all ages of pediatric patients.[29–31]

To help children cope with their feelings, a child life specialist often uses health care play or "medical play." This child-directed play allows children to be active and exert control over their experiences.[1,12,31–34] These exercises may offer insight into the patients' concerns and levels of understanding of the health care events. Some examples of child-directed medical play are the exploration of medical equipment, dramatic (or dress-up) play,

* The American Academy of Pediatrics believes that the medical care of infants, children, and adolescents ideally should be accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective. It should be delivered or directed by well-trained physicians who provide primary care and help to manage and facilitate essentially all aspects of pediatric care. The physician should be known to the child and family and should be able to develop a partnership of mutual responsibility and trust with them. These characteristics define the "medical home.[18(p184)]"

games or puzzles depicting medical themes, and the creation of artwork using health care materials such as bandage strips, tongue depressors, and syringes.[1,3,20,34–36] Such activities allow pediatric patients of all ages to approach a threatening situation with greater familiarity and gain a sense of mastery of the experience, which will help build a basis for future difficult experiences.[37]

PSYCHOLOGICAL PREPARATION

Preparing children for hospitalizations, clinic visits, surgeries, and diagnostic/therapeutic procedures is a second important element of a child life program.[38] Psychological preparation is a "process of communicating accurate and developmentally appropriate information, identifying potential stressors, as well as planning and practicing coping strategies."[37(p18)] Many hospitals and other health care facilities have developed preparation programs on the basis of this process that familiarize the children and their families with the circumstances and procedures they will encounter. These developmentally supportive programs help reduce emotional disturbances in hospitalized children.[1,8,39,40] Two studies with children in a perioperative setting indicated that preparation programs before surgery lowered the children's anxiety and increased their comfort levels.[35,41] Oncology clinics, day surgery units, radiology departments, dialysis units, primary care clinics, emergency departments, eating disorder programs, dental clinics, and other health care settings have used child life specialists to help children anticipate and manage health care experiences.[38,42–55] An emergency department study reported that child life specialists play a major role in calming fears of children, particularly 11- to 14-year-olds requiring sutures, and lead to a higher parent satisfaction rating of the entire care experience.[52]

The child life role in children's perioperative experiences is important. When preparing children and families for procedures, child life specialists not only share accurate descriptions of the experiences children will have but assist children in expressing what they think is going to happen.[37] Plain body-outline dolls and other dolls are useful tools of the child life specialist during psychological preparation before procedures occur.[33,56] Misconceptions can be corrected, and a child's understanding can be clarified. In addition, child life specialists provide opportunities for children to examine equipment and give them developmentally appropriate explanations of their use.[8,20,55] Information and opportunities to handle equipment help make the unpredictable events more manageable, reduce anxiety, and enable the child to plan and rehearse coping strategies.[57,58] Strategies used may include relaxation, visualization, guided imagery, and pain-management techniques. Such observations are shared with the rest of the health care team so that all are better prepared to respond supportively to the individual patient.

A child life specialist who is present with a parent during a procedure also can enhance the parent's ability to support the child. This can contribute to a patient's ability to cope more effectively, often resulting in greater cooperation and success during the procedure.[59] In the absence of parental support, a child life specialist can provide support, enabling staff members to use their time more efficiently.

FAMILY SUPPORT

The third major area of child life services involves education and support of parents and family members, including siblings. Because the presence of family members has an important positive effect on a child's adjustment to the health care experience, pediatric health care teams encourage family involvement in patient care.[60] Parents and other family members may be highly anxious about the child's illness or the various diagnostic and treatment regimens, and such anxiety can be transmitted easily to the patient.[20,39] Child life specialists and other members of the health care team collaborate to facilitate the family's coping with and adjustment to the child's illness and health care experience. Child life specialists help family members understand their child's response to treatment and can help parents maintain their caregiving roles by promoting parent/child play sessions and by sharing strategies for comforting their children during medical procedures, for example. Well siblings can be helped to comprehend a brother's or sister's illness via developmentally appropriate teaching sessions and by offering support during visits to ICUs. In collaboration with the primary care physician and other members of the interdisciplinary team, child life services may be integrated within some palliative care teams, hospice services, and home care programs. Specially trained child life specialists can offer grief support activities for siblings in the event of catastrophic injury or death. They also have assisted children during episodes of terrorism.[8,61–64] It is important to protect children and families from prolonged or repeated exposures to situations in which they feel overwhelmed, unable to escape, or unable to have choices. The health care experience can become complicated by these scenarios, and child life specialists can help ameliorate the effects that these adverse experiences have on children and families.

CHILD LIFE SERVICES IN A CHANGING HEALTH CARE ENVIRONMENT

There are almost twice as many hospitalized children in the 0- to 4 year-old age group as there are in the 5- to 14 year-old age range.[65] In addition, although fewer children are hospitalized, the children who are admitted are more seriously ill and often require longer stays.[66] Child life programs have had to adapt to younger, less mobile patients who have more complex medical problems. As

a result, fewer group interactions are possible, and greater individualization of care is needed. Child life staff members are challenged to meet each child's emotional, developmental, and educational needs more quickly and efficiently than before and to provide as many normal life experiences as possible. In a continued effort to create "normalcy" for patients, child life specialists often assist parents in arranging for tutoring services for children.[9]

The adolescent population must also be considered. The increased survival rate of chronically ill patients has resulted in an expanded need for child life specialists in adolescent care. Teenagers with spina bifida, cystic fibrosis, and other chronic diseases are living longer now.[67] A new challenge has emerged as more chronically ill adolescents are making the transition to the adult health care system.[67,68] Child life specialists have often played a role with the health care team in helping with that transition.

The expansion of outpatient care has resulted in more demands for ambulatory child life activities as their value and benefits have become recognized. Both direct and indirect interventions are used to support patients and families across the continuum of care. For example, posters may be mounted in treatment areas to educate staff and parents about effective positioning or coping techniques to use with children of different ages. In some cases, a telephone consultation made by a child life specialist can help parents prepare their child for an outpatient procedure.

As health care costs escalate, there is an ongoing effort to justify the cost of child life services. It is clear that more empirical data are needed to explore the value and effectiveness variables of child life services. An experimental evaluation of one child life program model showed that its presence had a significant positive effect on the pediatric patients.[39] Specifically, the children in the experimental study had less emotional distress, better overall coping during the hospital stay, a clearer understanding of the procedures, and a more satisfactory posthospital adjustment and physical recovery. The children spent less time on initial pain-management narcotics, the length of stay was slightly reduced, and parents were more satisfied. In another study, child life specialists taught parents in the emergency department how to use distraction and "positioning for comfort" before their child's venipunctures. The combination of interventions resulted in lower fear and distress scores.[69]

ADDITIONAL CONTRIBUTIONS

Child life services contribute to an organization's efforts to meet the standards of the Joint Commission on Accreditation of Healthcare Organizations such as developmentally appropriate care, effective communication for patient education, safety issues, age-appropriate environments, and assessment of patients. These specialists assist health care team members to communicate with patients and families on the basis of the child's developmental and individual needs.[70] Child life programs can assist in the education of students and professional staff in medical, nursing, and other fields regarding psychosocially sound and developmentally appropriate care.[53,71,72] The role and competence of pediatric unit volunteers are enhanced when they are educated, guided, and supervised as part of a child life program.[73]

Child life specialists are keenly aware of the perspective and concerns of children and the benefits of family-centered care and, thus, are valuable consultants regarding the physical environment of pediatric settings and the effect of these settings on the behavior and adaptation of children. Child life specialists offer a useful perspective on hospital committees such as ethics or bereavement committees.

Child life expertise has applications beyond conventional hospital care. Child life interventions can help children transition back to home, school, and community. Child life specialists can actively help with school reentry and facilitate a variety of support groups for patients and their siblings.[74,75] In addition, child life specialists in pediatric programs located within larger adult-oriented institutions often are called on to work with children of adult patients.[76] They are able to help children deal with a parent's illness or impending death. Child life specialists also use their skills and training for positions in disease-specific camps, hospice programs, supplemental child care for technology-dependent children, programs for high-risk infants, and courtrooms for pretrial support of juvenile victims.[13]

CONCLUSIONS

Child life services make a difference in pediatric care. Although more research is needed, there is some evidence that child life services may help to contain costs by reducing hospital length of stay and decreasing the need for analgesics.[39,59] Observation and consumer satisfaction feedback further confirm the positive effects of child life programs on children, families, and staff. It remains essential for child life specialists to adapt and grow with the changing health care system in support of the emotional well-being of children and families.[77,78]

RECOMMENDATIONS

1. Child life services should be considered an essential component of quality pediatric health care and are integral to family-centered care and best-practice models of health care delivery for children. Child life services should be performed in collaboration with and give support to the child's medical home.
2. Child life services should be provided directly by or in consultation with qualified child life specialists in pediatric inpatient units, ambulatory areas, emergency

departments, and chronic care centers to the extent appropriate for the population served.

3. An appropriate ratio of child life specialists to patients should be developed for inpatient and ambulatory areas. Both inpatient and ambulatory ratios should be adjusted as needed for the severity and acuity of illnesses of the patients served.
4. Child life services should not be withheld for lack of reimbursement. Advocacy for financing of child life services should occur at the facility, local, state, and federal levels.
5. Home health, hospice, and bereavement programs should be encouraged to include child life services.
6. Additional research should be conducted to validate the effect of child life services on patient care outcomes with attention to outcomes of specific interventions as well as cost-effectiveness.

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Policy Statement—Child Passenger Safety

abstract

FREE

Child passenger safety has dramatically evolved over the past decade; however, motor vehicle crashes continue to be the leading cause of death of children 4 years and older. This policy statement provides 4 evidence-based recommendations for best practices in the choice of a child restraint system to optimize safety in passenger vehicles for children from birth through adolescence: (1) rear-facing car safety seats for most infants up to 2 years of age; (2) forward-facing car safety seats for most children through 4 years of age; (3) belt-positioning booster seats for most children through 8 years of age; and (4) lap-and-shoulder seat belts for all who have outgrown booster seats. In addition, a fifth evidence-based recommendation is for all children younger than 13 years to ride in the rear seats of vehicles. It is important to note that every transition is associated with some decrease in protection; therefore, parents should be encouraged to delay these transitions for as long as possible. These recommendations are presented in the form of an algorithm that is intended to facilitate implementation of the recommendations by pediatricians to their patients and families and should cover most situations that pediatricians will encounter in practice. The American Academy of Pediatrics urges all pediatricians to know and promote these recommendations as part of child passenger safety anticipatory guidance at every health-supervision visit. *Pediatrics* 2011;127:788–793

Improved vehicle crashworthiness and greater use of child restraint systems have significantly affected the safety of children in automobiles. Major shifts in child restraint use, particularly the use of booster seats among older children, have occurred in response to public education programs and enhancements to child restraint laws in nearly every state.[1–3] In addition, there has been a substantial increase in scientific evidence on which to base recommendations for best practices in child passenger safety. Current estimates of child restraint effectiveness indicate that child safety seats reduce the risk of injury by 71% to 82%[4,5] and reduce the risk of death by 28% when compared with those for children of similar ages in seat belts.[6] Booster seats reduce the risk of nonfatal injury among 4- to 8-year-olds by 45% compared with seat belts.[7] Despite this progress, approximately 1500 children younger than 16 years die in motor vehicle crashes each year in the United States, nearly half of whom were completely unrestrained.[8]

The American Academy of Pediatrics (AAP) strongly supports optimal safety for children and adolescents of all ages during all forms of travel.

COMMITTEE ON INJURY, VIOLENCE, AND POISON PREVENTION

KEY WORDS

child passenger safety, motor vehicle crash, child restraint system

ABBREVIATIONS

AAP—American Academy of Pediatrics
CSS—car safety seat

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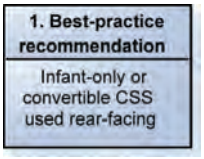
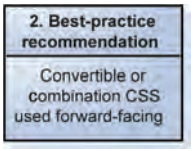
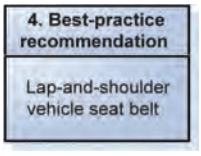
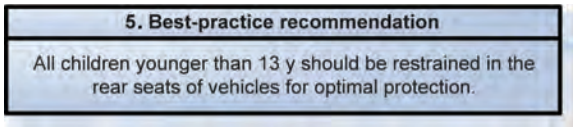
This policy statement provides 5 evidence-based recommendations for best practices to optimize safety in passenger vehicles for all children, from birth through adolescence (a summary of recommendations is listed in Table 1):

1. All infants and toddlers should ride in a rear-facing car safety seat (CSS) until they are 2 years of age

TABLE 1 Summary of Best-Practice Recommendations

Best-Practice Recommendation	Complementary Information
 All infants and toddlers should ride in a rear-facing car safety seat (CSS) until they are 2 y of age or until they reach the highest weight or height allowed by the manufacturer of their CSS.	Infant-only seats usually have a handle for carrying and can be snapped in and out of a base that is installed in the vehicle. They can only be used rear-facing. Convertible CSSs can be used either forward- or rear-facing and typically have higher rear-facing weight and height limits than infant-only seats. When children using infant-only seats reach the highest weight for their seat, they should continue to ride rear-facing in a convertible seat for as long as possible. Most currently available convertible seats can be used rear-facing to at least 35 lb. Combination CSSs are seats that can be used forward-facing with a harness system and then, when the child exceeds the height or weight limit for the harness, as a booster seat with the harness removed.
 All children 2 y or older, or those younger than 2 y who have outgrown the rear-facing weight or height limit for their CSS, should use a forward-facing CSS with a harness for as long as possible, up to the highest weight or height allowed by the manufacturer of their CSS.	Several models of convertible and combination CSSs can accommodate children up to 65 or 80 lb when used forward-facing. The lowest maximum weight limit for currently available forward-facing CSSs is 40 lb.
 All children whose weight or height is above the forward-facing limit for their CSS should use a belt-positioning booster seat until the vehicle lap-and-shoulder seat belt fits properly, typically when they have reached 4 feet 9 inches in height and are between 8 and 12 y of age.	There is a safety advantage for young children to remain in CSSs with a harness for as long as possible before transitioning to booster seats.
 When children are old enough and large enough to use the vehicle seat belt alone, they should always use lap-and-shoulder seat belts for optimal protection.	Booster seats function by positioning the child so that both the lap and shoulder portions of the vehicle seat belt fit properly; the lap portion of the belt should fit low across the hips and pelvis, and the shoulder portion should fit across the middle of the shoulder and chest. They come in both high-back (a seat back that extends up beyond the child's head) and backless models. The lap portion of the belt should fit low across the hips and pelvis, and the shoulder portion should fit across the middle of the shoulder and chest when the child sits with his or her back against the vehicle seat back. If they do not, then the child is likely too small to use the vehicle seat belt alone and should continue to use a belt-positioning booster seat.
 All children younger than 13 y should be restrained in the rear seats of vehicles for optimal protection.	CSSs should be installed tightly either with the vehicle seat belt or with the LATCH system, if available. LATCH is a system of attaching a CSS to the vehicle that does not use the seat belt. It was designed to ease installation of the CSS. Whether parents use LATCH or the seat belt, they should always ensure a tight installation of the CSS into the vehicle.

LATCH indicates lower anchors and tethers for children.

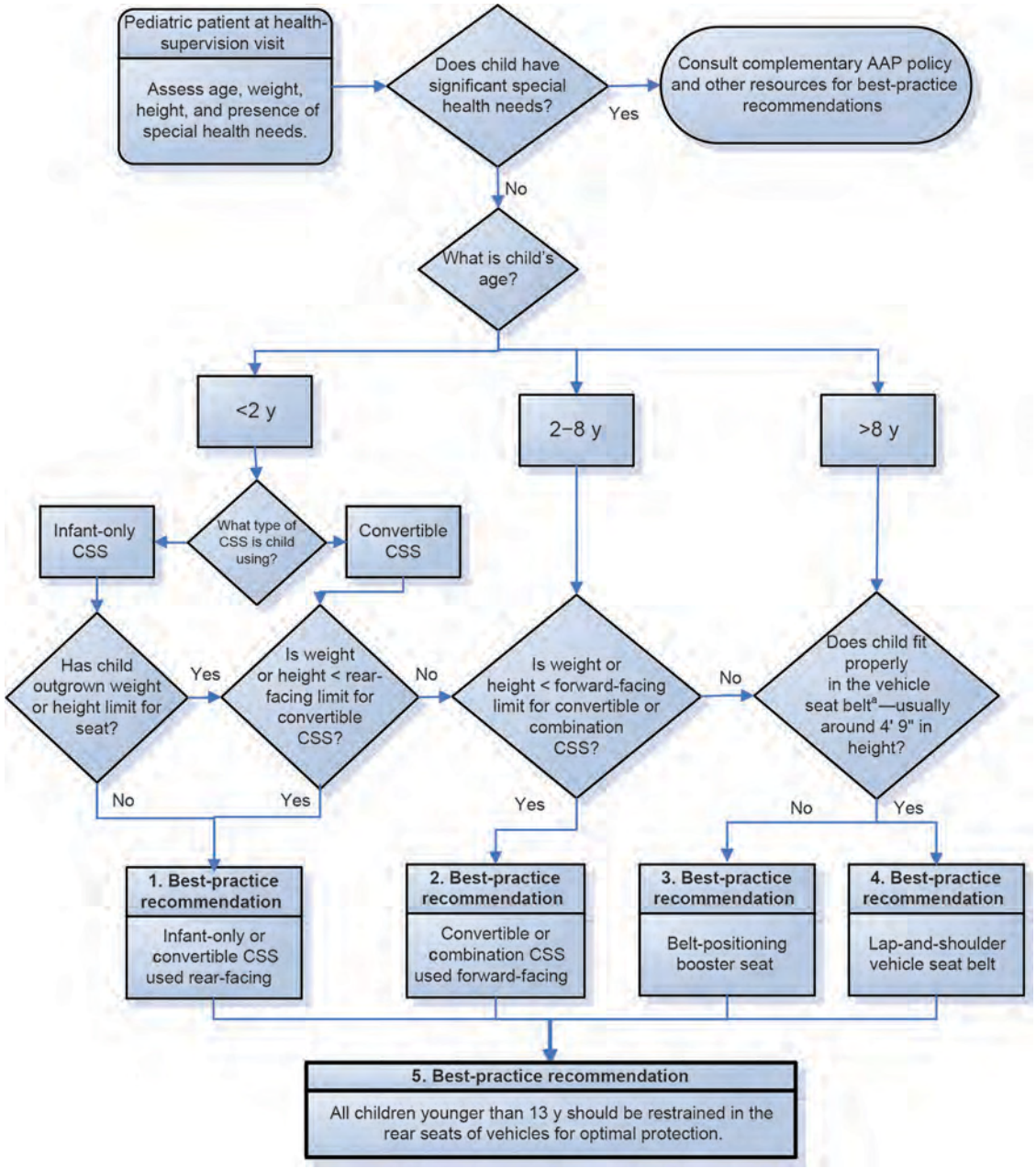


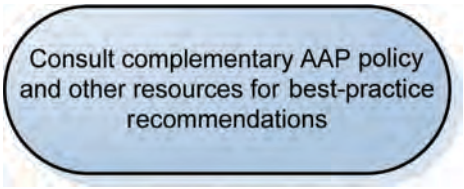
FIGURE 1
Algorithm to guide the implementation of best-practice recommendations for optimal child passenger safety (see Table 1 for a summary of recommendations and Table 2 for definitions and explanations).

or until they reach the highest weight or height allowed by the manufacturer of their CSS.

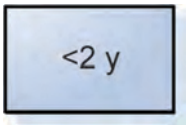
2. All children 2 years or older, or those younger than 2 years who have outgrown the rear-facing weight or height limit for their CSS, should use a forward-facing CSS with a harness for as long as possible, up to the highest weight or height allowed by the manufacturer of their CSS.
3. All children whose weight or height is above the forward-facing limit for their CSS should use a belt-positioning booster seat until the vehicle lap-and-shoulder seat belt fits properly, typically when they have reached 4 feet 9 inches in height and are between 8 and 12 years of age.
4. When children are old enough and large enough to use the vehicle seat belt alone, they should always use lap-and-shoulder seat belts for optimal protection.
5. All children younger than 13 years should be restrained in the rear

TABLE 2 Explanations of Decision Points and Additional Resources

Children with certain temporary or permanent physical and behavioral conditions such as altered muscle tone, decreased neurologic control, skeletal abnormalities, or airway compromise may preclude the use of regular CSSs and may require the use of regular CSSs may require specialized restraint systems.



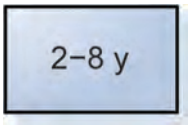
The AAP has issued a policy statement that provides specific guidance on best-practice recommendations for children with special health care needs (www.pediatrics.org/cgi/content/full/pediatrics%3B104/4/988). To locate a child passenger safety technician in your area with special training in special health needs, go to http://cert.safekids.org.



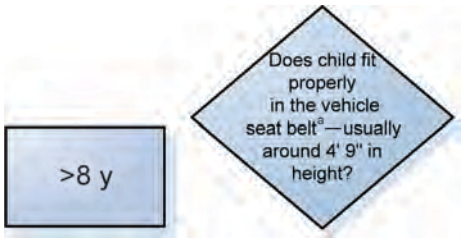
Infants younger than 2 y have relatively large heads and several structural features of their neck and spine that place them at particularly high risk of head and spine injuries in motor vehicle crashes. Rear-facing CSSs provide optimal support to the head and spine in the event of a crash, and evidence indicates that this benefit extends to children up to 2 y of age or longer.

Children who are 2 y of age or older and small for age may need to be evaluated like children younger than 2 y. Consult a child passenger safety technician with enhanced training in special needs or other resources for assistance.

The AAP annually updates information on child restraint systems currently available in the United States (http://aap.org/family/carseatguide.htm). More recent products have higher weight limits and should be used when possible. In general, children should remain in a child restraint system until they outgrow the weight or height limits for its intended use.



Most children 2 to 8 y of age are not large enough to fit properly in the vehicle seat belt and will require a CSS or booster seat for optimal restraint. A belt-positioning booster seat positions a child so that the lap and shoulder portions of the seat belt fit properly: the lap portion low across the hips and pelvis and the shoulder portion across the middle of the shoulder and chest.



Most children shorter than 4 feet 9 inches in height will not fit properly in vehicle lap-and-shoulder seat belts.

These 3 questions are an evaluation to determine whether a child is ready to be restrained by the vehicle seat belt without a booster seat. If the answer is "no" to any of these questions, the child should use a booster seat:

Is the child tall enough to sit against the vehicle seat back with his or her knees bent at the edge of the vehicle seat without slouching and stay in this position comfortably throughout the trip?

Does the shoulder belt lie across the middle of the chest and shoulder, not against the neck or face?

Is the lap belt low and snug across the upper thighs, not the abdomen?

seats of vehicles for optimal protection.

It should be noted that the recommendation that all children younger than 2 years be restrained in an infant-only or convertible CSS used rear-facing represents a significant change from previous AAP policy and is based on new data from the United States[9] as well as extensive experience in Sweden.[10,11] It is important to note that most currently available CSSs have weight limits for rear-facing use that can accommodate the new recommendations.[12]

Certain considerations contained in this policy statement are relevant to commercial airline travel as well and are noted in the accompanying technical report.[13] Other AAP policy statements provide specific recommendations to optimize safety for preterm and low birth weight infants,[14] children in school buses,[15] and children using other forms of travel and recreational vehicles.[16–18] In addition, complementary AAP policy statements provide recommendations for teenaged drivers[19] and the safe transport of newborn infants[20] and children with special health care needs.[21,22]

Pediatricians play a critical role in promoting child passenger safety. To facilitate their widespread implementation in practice, evidence-based recommendations for optimal protection of children of all ages in passenger vehicles are presented in the form of an algorithm (Fig 1) with an accompanying table of explanations and definitions (Table 2). A summary of the evidence in support of these recommendations is provided in the accompanying technical report.[13] Because pediatricians are a trusted source of information to parents, every pediatrician must maintain a basic level of knowledge of these best-practice recommendations and promote and document them at every health-supervision visit. Prevention of motor vehicle crash injury is unique in health-supervision topics, because it is the only topic recommended at every health-supervision visit by *Bright Futures*.[23] Pediatricians can also use this information to promote child passenger safety public education, legislation, and regulation at local, state, and national levels through a variety of advocacy activities, including ensuring that their state's child passenger safety law is in better alignment with the best-practice recommendations promoted in this policy statement.

Because motor vehicle safety for children is multifaceted and will continue to evolve, all pediatricians should familiarize themselves with additional resources to address unique situations for their patients that may not be covered by the algorithm and to maintain current knowledge. In particular, many communities have child passenger safety technicians who have completed a standardized National Highway Traffic Safety Administration (NHTSA) course and who can provide hands-on advice and guidance to families. In most communities, child passenger safety technicians work at formal inspection stations; a list of these stations is available at www.seatcheck.org. If your community does not have an inspection station, you can find a child passenger safety technician in your area on the National Child Passenger Safety Certification Web site (http://cert.safekids.org) or the NHTSA child safety seat inspection station locator (www.nhtsa.dot.gov/cps/cpsfitting/index.cfm). Car seat checkup events are updated at www.safekidsweb.org/events/events.asp. In addition, additional resources for pediatricians and families can be found at www.aap.org or www.healthychildren.org.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Technical Report—Child Passenger Safety

abstract

FREE

Despite significant reductions in the number of children killed in motor vehicle crashes over the past decade, crashes continue to be the leading cause of death for children 4 years and older. Therefore, the American Academy of Pediatrics continues to recommend inclusion of child passenger safety anticipatory guidance at every health-supervision visit. This technical report provides a summary of the evidence in support of 5 recommendations for best practices to optimize safety in passenger vehicles for children from birth through adolescence that all pediatricians should know and promote in their routine practice. These recommendations are presented in the revised policy statement on child passenger safety in the form of an algorithm that is intended to facilitate their implementation by pediatricians with their patients and families. The algorithm is designed to cover the majority of situations that pediatricians will encounter in practice. In addition, a summary of evidence on a number of additional issues that affect the safety of children in motor vehicles, including the proper use and installation of child restraints, exposure to air bags, travel in pickup trucks, children left in or around vehicles, and the importance of restraint laws, is provided. Finally, this technical report provides pediatricians with a number of resources for additional information to use when providing anticipatory guidance to families. *Pediatrics* 2011;127:e1050–e1066

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KEY WORDS

car safety seat, booster seat, child restraint system, air bag, child passenger safety, motor vehicle crash

ABBREVIATIONS

NHTSA—National Highway Traffic Safety Administration
CSS—car safety seat
AAP—American Academy of Pediatrics
LATCH—lower anchors and tethers for children
OR—odds ratio
CI—confidence interval
FARS—Fatality Analysis Reporting System
RR—relative risk
FMVSS—Federal Motor Vehicle Safety Standard
FAA—Federal Aviation Administration

INTRODUCTION: MAGNITUDE OF THE PROBLEM OF MOTOR VEHICLE CRASHES

Motor vehicle crashes represent the leading cause of death for children and youth older than 3 years in the United States.[1] Each year, more than 5000 children and adolescents under the age of 21 years die in crashes, which represents approximately 15% of people killed each year in crashes.[2] Fatalities represent only the tip of the motor vehicle crash problem for children and youth. For every fatality, approximately 18 children are hospitalized and more than 400 receive medical treatment for injuries sustained in a crash.[1] Current estimates of injuries and fatalities are updated annually and can be found in the Centers for Disease Control and Prevention Web-based Injury Statistics Query and Reporting System at www.cdc.gov/injury/wisqars.

In the United States, motor vehicle traffic-related mortality rates are highest for black and American Indian/Alaskan Native children, lowest among Asian/Pacific Islander children, and intermediate for Hispanic and white children.[3] Examining trends over a 20-year period through 2003 reveals significantly declining rates for child occupant deaths among all race and ethnic groups examined. However, among infants (aged 0–12 months), improvements in mortality rates among black children have slowed more recently. Occupant mortality rates among

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children 1 to 4 years of age showed a tendency toward increased mortality in black, Hispanic, and American Indian/Alaskan Native children. Although there were significant declines in total motor vehicle mortality rates across all racial groups, improvement in occupant injury was greater for white children, and disparities actually widened for both black and American Indian/Alaskan Native children compared with white children.

The racial/ethnic disparities in motor vehicle occupant death rates are likely explained in large part by lower use of restraints, including child restraint systems, by people of racial minorities. Seat belt and child restraint use among black adults and children are lower than the national average.[4,5] Similarly, seat belt use among Hispanic (85%) and non-Hispanic black (80%) adults traveling with children was lower than that for white (96%) adults traveling with children.[6] The reasons for these disparities in restraint use are not completely known but may be related to a lack of knowledge as well as a lack of culturally appropriate messages from generalized public education intervention programs.[7] More culturally sensitive intervention programs designed to increase child restraint use among minority populations have resulted in significant increases in restraint use among target populations.[8]

Through the early 1990s, child occupant fatality rates remained relatively stagnant at approximately 3.5 deaths per 100 000 population.[9] Beginning in 1995, when children killed by deploying passenger air bags were first reported clinically, attention began to focus on the unique needs of children in automotive safety. Subsequently, in the United States, the number of motor vehicle fatalities and serious injuries has been reduced through a combination of increased attention to age-appropriate restraint use and rear seating position[10–15] as well as enhanced child restraint laws and enforcement of these laws.[16,17] In the 10 years from 1999 to 2008, the number of children younger than 15 years who died in motor vehicle crashes in the United States declined by 45%.[2] Annual updates on the number of children killed in motor vehicle crashes can be obtained from the National Highway Traffic Safety Administration (NHTSA) at www-fars.nhtsa.dot.gov/Main/index.aspx.

Although significant progress has been made in reducing the number of children killed in crashes, the exposure of children to motor vehicle travel and, thus, to potential crashes is great. Children younger than 16 years travel nearly as much as adults (average of 3.4 trips per day and 45 to 50 minutes/day spent in a vehicle), which emphasizes the importance of age-appropriate restraint on every trip.[18]

THE IMPORTANCE OF AGE-APPROPRIATE RESTRAINT USE

Mechanism of Action of Restraint Systems

Restraint systems are designed to reduce risk of ejection during a crash, better distribute the energy load of the crash through structurally stronger bones rather than soft tissues, limit the crash forces experienced by the vehicle occupant by prolonging the time of deceleration, and limit the contact of the occupant with interior vehicle structures. Optimal performance of restraint systems depends on an adequate fit between the restraint system and the occupant at the time of the crash. Restraint systems can be generally categorized as vehicle restraints—air bags and seat belts—or add-on restraints specifically made for children—child restraint systems. Child restraint systems include infant-only car safety seats (CSSs), convertible and combination CSSs, integrated seats, travel vests, and belt-positioning booster seats. A description of each type of restraint is provided below as well as in Table 1 of the accompanying policy statement.[19]

Age-Specific Prevalence of Restraint Use

In large part because of the increased attention paid to the needs of children in motor vehicle safety beginning in the mid-1990s, large increases in restraint use (including CSSs and booster seats) by children have been observed over the past decade. Data from the National Occupant Protection Use Survey and the National Survey of the Use of Booster Seats indicate that restraint use for children in the United States in 2008 stood at 99% among infants younger than 1 year, 92% among 1- to 3-year-olds, and 89% among 4- to 7-year-olds.[20] Restraint use for children driven by a belted driver was significantly higher (92%) than for those driven by an unbelted driver (54%). It is important to note that although child restraint use is high among the youngest children, improper use of the restraint may limit the effectiveness of the system. Among children either younger than 1 year or who weighed less than 20 lb, a group that has traditionally been recommended to ride in a rear-facing CSS, 21% were not compliant with these recommendations.[21] Similarly, although overall restraint use among older children is relatively high, nearly half of children 12 years and younger who are under 54 inches in height are not using a CSS or booster seat, which is their recommended form of optimal restraint.[21] Although the prevalence of use according to race and ethnicity varied somewhat among age groups, use rates tended to be higher among white and Asian non-Hispanic children (at least 90% for all age groups) and lower among black non-Hispanic children

(ranging from 72% for 8- to 12-year-olds to 94% for infants younger than 1 year).[22] It should be noted that child restraint use among black children 4 to 7 years of age increased from 73% in 2007 to 84% in 2008.

Among children 8 years and younger in crashes, overall reported use of child restraint systems has increased nearly threefold since 1999 to 80% of children in a large sample of children in crashes by 2007.[23] The largest relative increase in child restraint use among children in crashes was among 6- to 8-year-olds, yet 57% of these children continued to be inappropriately restrained in 2007. Forward-facing CSSs were primarily used by children 3 years and younger, whereas belt-positioning booster seats have become the most common restraints for 4- to 5-year-olds.[24]

Pediatric obesity has become a major public health concern in the United States as the prevalence of being overweight among children tripled over the past 2 decades.[25] Currently, 34% of children are categorized as being "overweight" (BMI $\geq$ 95th percentile) or "at risk for overweight" (BMI $\geq$ 85th to $<$95th percentile).[26] Childhood obesity has significant implications for child passenger safety, because young children who are overweight may not fit properly in CSSs or booster seats that would otherwise be appropriate for their age.[27] It is fortunate that, over the past several years, increasing numbers of CSSs and booster seats with higher weight and height limits have been introduced into the market in response to this challenge. Among currently available products listed in the American Academy of Pediatrics (AAP) pamphlet "2011 Car Safety Seats: A Guide for Families" (available at www.healthychildren.org/carseatlist), nearly half (14 of 29) of infant-only seats can accommodate children to 30 lb or more, which represents at least the 75th percentile for girls and boys at 24 months of age. Nearly all (30 of 35) currently available convertible CSSs can accommodate children to 35 lb or more when used rear-facing, a weight that exceeds the 95th percentile for boys and girls at 24 months of age. Similarly, for children 2 to 8 years of age, 34 of 53 currently available forward-facing seats used with a harness can accommodate children to at least 50 lb, which exceeds the 95th percentile for boys and girls younger than 5 years. Therefore, there are sufficient products available to consumers to accommodate larger children in the correct restraint. Limited data exist on the risk of injury to overweight children in motor vehicle crashes but suggest that overweight children may be at an increased risk of particular types of injuries, particularly lower-extremity fractures, compared with children of normal weight.[28–30] Further research is needed to establish motor vehicle safety as yet another public health burden imposed by childhood obesity and to ensure that overweight children are properly protected in motor vehicles.

Seat belt use among all front-seat occupants (drivers and front passenger-seat occupants) in the United States increased to 84% in 2009.[31] Among older children, restraint use in any seating location in the vehicle in 2008 was 85% among 8- to 12-year-olds and 83% among 13- to 15-year-olds.[6,20] Seat belt use anywhere in the vehicle among 13- to 15-year-olds varied according to race and ethnicity; white adolescents had higher seat belt use rates (89%) than either Hispanic (82%) or black non-Hispanic (46%) youth.

It is important to note that CSSs were designed as occupant safety devices in motor vehicles, not as general child seating devices. A recent study that used data from the National Electronic Injury Surveillance System operated by the US Consumer Product Safety Commission estimated that more than 8000 infants younger than 1 year are evaluated in hospital emergency departments each year for car seat–related (non–motor vehicle crash) injuries suffered when the car seats were used improperly or for unintended purposes.[32] The majority (85%) of injuries were related to falls, either infants falling out of car seats or car seats falling from elevated surfaces such as countertops and tables. Nearly half of the injuries occurred at home, and head and neck injuries accounted for 84% of the injuries to infants. Prolonged use of CSSs by young infants for positioning also contributes to the increased incidence of plagiocephaly, exacerbates gastroesophageal reflux, and increases risk of respiratory compromise.[33] Families should be encouraged to use CSSs only as occupant-protection devices for travel as they were intended.

Installation of Child Restraint Systems

CSSs must be installed tightly to derive the optimum benefit of both the crashworthiness of the vehicle (eg, crumple zones that dissipate the energy of the crash and prolong the time of deceleration of the vehicle) and the design of the seat itself. As a general rule, if a CSS can be moved more than 1 inch from side to side or front to back when grasped at the bottom of the seat near the belt or lower anchors and tethers for children (LATCH) attachment points, it is not installed tightly enough. Improper installation of a CSS may result in an increased likelihood of excessive movement of the child in the event of a crash, thus increasing the child's risk of injury.

The most recent estimates of CSS misuse are derived from an observational study of more than 5000 children in which 72.6% of CSSs were observed to have some form of misuse.[34,35] The

most common critical misuses were loose harness straps and a loose attachment of the CSS to the vehicle when using the seat belt. Results of several studies have indicated that misused CSSs may increase a child's risk of serious injury in a crash.[13,14,36,37]

An issue specific to installing rear-facing CSSs relates to the recline angle of the seat. Proper installation results in a semireclined angle of approximately 45°, which enables the infant's head to lie against the back of the CSS, as opposed to potentially falling forward, which compromises the infant's airway, if the seat is angled too upright. Preterm infants are particularly vulnerable to an increased risk of oxygen desaturation, apnea, and/or bradycardia, especially when placed in a semireclined position in CSSs.[38–41] Therefore, CSS monitoring in the infant's own CSS before discharge from the hospital should be considered for any infant who was less than 37 weeks' gestation at birth to determine if the infant is physiologically mature and has stable cardiorespiratory function. More specific information on car seat testing of preterm newborn infants and recommendations based on results of testing are available in an AAP clinical report on the subject.[33]

A relatively new way by which CSSs can be installed in passenger vehicles, known as LATCH, was designed to reduce the difficulty associated with installing CSSs. This system uses dedicated attachment points in the vehicle rather than using the vehicle seat belt for CSS installation. All vehicles and child restraints manufactured and sold in the United States after September 2002 are required to have this anchoring system. For rear-facing CSSs, there are 2 points of attachment at the base of the CSS. For forward-facing CSSs, a third dedicated attachment point near the top of the CSS is used for a top tether to attach to a separate anchor point in the vehicle (see Fig 1).

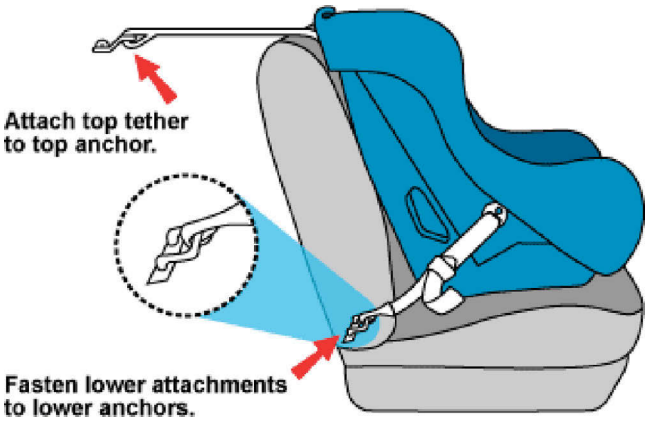

FIGURE 1
Schematic of the LATCH system.

Previous research has evaluated the performance of LATCH (or its European counterpart, ISOFIX) in laboratory sled-test environments[42–44] and demonstrated improved kinematics and reduced injury measures on crash test dummies, in particular with use of the top tether, when compared with using a seat belt to attach the CSS. To date, there are no real-world data from evaluations of the performance of LATCH, although its theoretical advantages in ensuring proper installation suggest that families should use it when available.

Arbogast and Jermakian have reviewed cases of CSSs attached by using LATCH and illustrated examples of LATCH misuse.[45] In 2005, a large-scale observation study that examined LATCH use and misuse in the United States was conducted at 66 sites across 7 states.[46] The study results indicated that many parents who purchased newer vehicles did not update their CSS to take advantage of the available LATCH attachment system. Approximately one-fifth of CSSs in vehicles equipped with LATCH did not have tether straps, and one-sixth did not have lower attachments. Even when their CSSs were LATCH equipped, approximately one-third of the drivers with LATCH-equipped vehicles stated that they could not use LATCH because there were no anchors in their vehicles. Much of the nonuse of lower anchors in this study related to the fact that the vehicle safety belt was the only method available in the center rear-seating position for installing a CSS. The rear seats of most passenger vehicles typically are equipped with lower LATCH anchors only in the outboard seating positions. When parents had experience attaching CSSs by using the safety belt and LATCH system, three-quarters reported a preference for LATCH, because they found it easier to use and obtained a tighter fit, and they felt that the child was more secure.

EVIDENCE FOR BEST-PRACTICE RECOMMENDATIONS

The following section of this technical report will provide a summary of the evidence in support of each of the best-practice recommendations included in the accompanying policy statement.

Children with certain physical and behavioral conditions may require specialized restraint systems and other considerations. Relevant conditions may include prematurity, cerebral palsy, the presence of a tracheostomy, muscle tone abnormalities, skeletal abnormalities, and certain behavioral or emotional conditions as well as

temporary conditions such as fractures that require spica casts. Therefore, the AAP has developed a separate policy statement that reviews important considerations for transporting children with special health care needs and provides current guidelines for the protection of children with specific health care needs, including those transported in wheelchairs.[47]

1. Best-Practice Recommendation: All Infants and Toddlers Should Ride in a Rear-Facing CSS Until They Are 2 Years of Age or Until They Reach the Highest Weight or Height Allowed by the Manufacturer of Their CSS

This best practice results from the need to support the young child's posterior torso, neck, head, and pelvis and to distribute crash forces over the entire body. Developmental considerations, including incomplete vertebral ossification, more horizontally oriented spinal facet joints, and excessive ligamentous laxity put young children at risk of head and spinal cord injury. Rear-facing CSSs address this risk by supporting the child's head and preventing the relatively large head from moving independently of the proportionately smaller neck.

In the United States, although the majority of children use rear-facing CSSs during the first year of life, 21% of infants who are either younger than 1 year or weigh less than 20 lb have been turned forward-facing.[21] In Sweden, many children remain rear-facing up to the age of 4 years and transition directly from the rear-facing CSS to a booster seat. Swedish researchers have reported that rear-facing CSSs reduce the risk of significant injuries (those with an Abbreviated Injury Scale score of $\geq$2) by 90% relative to unrestrained children, which reinforces their policy of children remaining in a rear-facing CSS up to the age of 4 years.[48,49]

Henary et al[50] reviewed US crash data to calculate the relative effectiveness of rear-facing CSSs compared with forward-facing CSSs for children 0 through 23 months of age in crashes from 1988 to 2003. The authors reported that children in forward-facing CSSs were significantly more likely to be seriously injured when compared with children restrained in rear-facing CSSs in all crash types (odds ratio [OR]: 1.76 [95% confidence interval [CI]: 1.40–2.20]). When considering frontal crashes alone, children in forward-facing CSSs were more likely to be seriously injured, although this finding was not statistically significant (OR: 1.23 [95% CI: 0.95–1.59]). In side-impact crashes, however, children in forward-facing CSSs were much more likely to be injured (OR: 5.53 [95% CI: 3.74–8.18]). When children 12 to 23 months of age were analyzed separately, those who were restrained in forward-facing CSSs were also more likely to be seriously injured (OR: 5.32 [95% CI: 3.43–8.24]). These authors concluded that for children through 23 months of age, rear-facing CSSs provided optimal protection. The lack of meaningful numbers of children 24 months or older in rear-facing CSSs in US databases has prevented extension of these analyses to even older age groups of children, such as those studied in Sweden.

2. Best-Practice Recommendation: All Children 2 Years or Older, or Those Younger Than 2 Years Who Have Outgrown the Rear-Facing Weight or Height Limit for Their CSS, Should Use a Forward-Facing CSS With a Harness for as Long as Possible, up to the Highest Weight or Height Allowed by the Manufacturer of Their CSS

The recommendation for forward-facing CSSs has been based, in part, on an analysis by Kahane[51] of laboratory sled tests, observational studies, and police-reported crash data from the early 1980s that estimated that correctly used forward-facing CSSs reduce the risk of death and injury by approximately 71% compared with unrestrained children. The engineering tests documented the biomechanical benefits of the CSS in spreading the crash forces over the shoulders and hips and controlling the excursion of the head during a crash. Kahane further estimated the effectiveness of a partially misused CSS as providing a 45% reduction in risk of fatality and serious injury. Using Fatality Analysis Reporting System (FARS) data from 1988 to 1994, NHTSA found that, among children between 1 and 4 years of age in passenger cars, those in forward-facing CSSs had a 54% reduction in risk of death compared with unrestrained children.[52] Given the currently high rates of restraint use among children in the United States, it is no longer meaningful to quote effectiveness estimates in comparison to unrestrained children.

Estimates of the effectiveness of forward-facing CSSs in comparison with children using seat belts, on the basis of real-world crash data, vary depending on the source of data used, the time period studied, and the analytical approach taken. Estimating effectiveness of child restraint systems through analysis of crash databases is challenging because of the association between how passengers are restrained in a given crash and whether that crash will be in a specific database. For example, the FARS, operated by the NHTSA, is a census of vehicle crashes in the United States in which at least 1 person died. The FARS has a sufficient number of outcomes of fatal child injuries for analyses but has a biased selection of crashes in that inclusion of crashes is associated with the outcome of interest (ie, mortality). Several different analytic techniques, de-

scribed hereafter, have been developed to minimize the effects of this bias.

The results of most studies to date have indicated that forward-facing CSSs are effective at preventing nonfatal injuries when compared with seat belts; effectiveness estimates have ranged from 71% to 82% reduction in serious injury risk.[13,53] Elliott et al[14] compared the effectiveness of child restraints to seat belts in preventing fatal injuries to 2- to 6-year-old children in crashes by combining data from the FARS with data from the National Automotive Sampling System–Crashworthiness Data System. The combined data set, in theory, overcame several of the known limitations of using either data source alone. Compared with seat belts, child restraints, when not seriously misused (eg, unattached restraint, child restraint system harness not used) were associated with a 28% reduction in risk of death (relative risk [RR]: 0.72 [95% CI: 0.54–0.97]) after adjusting for seating position, vehicle type, model year, driver and passenger ages, and driver survival status. When including cases of serious misuse, the effectiveness estimate was slightly lower (21%) and not statistically significant (RR: 0.79 [95% CI: 0.59–1.05]).

In a controversial analysis, Levitt[54] used FARS data from 1975 to 2003 and, by various methods, directly compared the mortality rates for child restraints and for seat belts for children aged 2 to 6 years and could not demonstrate a difference in effectiveness. Levitt restricted the FARS data set to 2-vehicle crashes in which someone in the other vehicle (ie, the vehicle without the index child occupant) died, under the assumption that the distribution of restraint use among children in potentially fatal crashes is independent of whether someone in the other vehicle dies, after adjusting for various crash-related characteristics. In a subsequent study in which a marginal-structural-model-type estimator was used in an attempt to explore the relationship between various biases inherent in data sources and the estimates of CSS restraint effectiveness, Elliott et al[55] suggested a 17% reduction in fatality risk for children 2 through 6 years of age in child restraint systems relative to seat belts. This reduction is estimated at 22% when severe misuse of the restraint is excluded.

3. Best-Practice Recommendation: All Children Whose Weight or Height Is Above the Forward-Facing Limit for Their CSS Should Use a Belt-Positioning Booster Seat Until the Vehicle Lap-and-Shoulder Seat Belt Fits Properly, Typically When They Have Reached 4 Feet 9 Inches in Height and Are Between 8 and 12 Years of Age

Children who have outgrown a forward-facing CSS (based on the height or weight limit of the seat) should be restrained in belt-positioning booster seats by using the lap-and-shoulder belts in the back seat of a vehicle. Booster seats position the child so that the lap-and-shoulder belt fits properly. Correct fit of the belt is defined as follows:

- The shoulder belt lies across the middle of the chest and shoulder, not the neck or face.
- The lap belt is low across the hips and pelvis, not the abdomen.
- The child is tall enough to sit against the vehicle seat back with his or her knees bent without slouching and can stay in this position comfortably throughout the trip.

Although seat belt geometry varies from vehicle to vehicle depending on the depth of the seat bottom and placement of the upper and lower anchor points of the belt, most vehicle seat belts will not fit correctly until a child reaches approximately 4 feet 9 inches in height and is between 8 and 12 years of age. This height threshold was derived from a study of 155 children 6 to 12 years of age who were assessed for the fit of the vehicle seat belt in 3 different types of vehicles in 1993.[56] The minimum height of a child who could fit properly in the vehicle seat belts was 148 cm (58 inches). It is important to note that this study is nearly 20 years old, and significant changes have been made to the vehicle fleet during this time.

Cases of serious cervical and lumbar spinal cord injury, as well as intraabdominal injuries, to children in motor vehicle crashes resulting from poorly fitting seat belts have been described for many years and are known as the "seat belt syndrome."[57] First described by Kulowski and Rost in 1956,[58] the term "seat belt syndrome" was coined by Garrett and Braunstein in 1962[59] to describe a distinctive pattern of injuries associated with lap seat belts in serious crashes. Two predominant factors have been hypothesized to explain this constellation of injuries: the immaturity of the pediatric pelvis to properly anchor the lap portion of the belt and the tendency of children to scoot forward in the seat so that their knees bend at the edge of the vehicle seat. From this position, in a rapid deceleration, the belt can directly compress abdominal organs against the spinal column, and the child's body may "jack-knife" around the belt, putting high tension forces on the lumbar spine, which may lead to distraction injuries of the posterior elements of the spine, such as Chance-type fractures.

Durbin et al[12] published results of the first real-world evaluation of the performance of booster seats compared with seat belts for young children. These authors determined that the risk of injury after adjusting for child, crash, driver, and vehicle characteristics was 59% lower for 4- to 7-year-olds in belt-positioning booster seats than those using only seat belts. Applying these results to Wisconsin state data

from 1998 to 2002, Corden[60] determined that there would be an approximate 57% reduction in deaths and hospitalizations if all 4- to 7-year-olds were in booster seats. A recent updated analysis of booster effectiveness in preventing nonfatal injuries was able to examine a greater percentage of older children using booster seats; 37% of the more recent study sample using booster seats were 6 to 8 years of age.[24] In this study, children 4 to 8 years of age using belt-positioning booster seats were 45% (95% CI: 4%–68%) less likely to sustain nonfatal injuries than children of similar ages using the vehicle seat belt. Among children restrained in belt-positioning booster seats, there was no detectable difference in the risk of injury between the children in backless versus high-back boosters.

Rice et al[61] extended the data on booster seat performance by estimating the effectiveness of booster seats in reducing the risk of fatal injuries to children 4 to 8 years of age. Using a matched cohort analysis of data from the FARS, Rice et al determined that booster seats reduced the risk of fatal injuries by 67% for 4- to 5-year-olds and 55% for 6- to 8-year-olds compared with unrestrained adults and children. They also determined that seat belts alone reduced the risk of fatal injury by approximately 62% for 4- to 8-year-olds compared with unrestrained adults and children. They did not demonstrate a significant difference in fatality risk reduction for booster seats when compared with seat belts (RR: 0.92 [95% CI: 0.79–1.08]). The authors postulated that although booster seats, which improve seat belt fit, may reduce the risk of nonfatal injuries (some of which may be attributable to improperly fitting seat belts), they may not improve the likelihood that children will survive a severe crash with major occupant compartment intrusion or during rollovers. It may be that properly fitting seat belts are no better than poorly fitting seat belts at preventing fatal injuries in these severe crashes.

Although most newer vehicles include lap-and-shoulder belts in all rear-seating positions, many older vehicles still in use may have only lap belts available in some seating positions, typically in the center of the rear seat. Laboratory tests have revealed increased head excursions when booster seats are used with lap belts compared with when only lap belts are used.[62,63] Other research results have indicated that booster-aged children using only lap belts are likely to strike their heads on vehicle seat backs or other interior components in front of them, even without booster seats.[64,65] Results of a recent study that used 2 real-world data sources suggested that children restrained in booster seats with lap belts had a lower injury risk when compared with children restrained in lap belts only, although the possibility of no difference could not be excluded.[66] For families faced with frequently transporting booster-aged children in lap-belt-only seating positions, there are other restraint options (eg, forward-facing CSSs with higher weight limits and safety vests) that, although typically more expensive than booster seats, are more likely to provide optimal protection if children ride regularly in these seating positions. It should be noted that the number of children in this scenario will decrease over time as vehicles equipped with lap-belt-only restraints in rear seats are phased out of the US vehicle fleet.

4. Best-Practice Recommendation: When Children Are Old Enough and Large Enough to Use the Vehicle Seat Belt Alone, They Should Always Use Lap-and-Shoulder Seat Belts for Optimal Protection

Lap-and-shoulder belts have been required in rear outboard positions of vehicles since 1989. However, it was not until 2005 that lap-and-shoulder belts were required in the center rear-seat position. Many manufacturers introduced center rear lap-and-shoulder belts in advance of this requirement, and by model year 2001, most vehicles provided them as standard equipment.[67] Arbogast et al[68] determined that the presence of a shoulder belt reduced the risk of injury by 81% for children seated in the center rear in seat belts, and the primary benefit is seen in reductions in abdominal injuries. Parenteau et al[69] had previously documented a similar shift in the pattern of injury to children in lap-only belt restraints to lap-and-shoulder belts. Their study, however, examined the rear seat as a whole and did not separate the rear seating positions.

Using data from the FARS, the NHTSA has evaluated the performance of lap-and-shoulder belts in the rear rows and found them to be effective (compared with unrestrained occupants) in all crash directions for children and adult occupants 5 years and older. The estimated fatality reduction, compared with unrestrained occupants, was 77% in rollover crashes, 42% in side impacts, 29% in frontal impacts, and 31% in rear impacts and other crashes.[70] Two studies have evaluated seat belt effectiveness specifically for children. Chipman et al,[71] using a database of fatal crashes in Ontario, Canada, estimated that seat belts reduced the risk of serious injury or death by 40% for children 4 to 14 years of age. Data from Wisconsin suggested that 100% seat belt use by children 8 to 15 years of age (compared with current 72% use) would result in reductions of 45% and 32% for deaths and hospitalizations, respectively.[60]

5. Best-Practice Recommendation: All Children Younger Than 13 Years Should Be Restrained in the Rear Seats of Vehicles for Optimal Protection

In large part because of the attention resulting from the tragedy of children killed by passenger air bags, significant declines in front seating of children in vehicles have occurred since the mid-1990s. By 2008, 95% of infants, 98% of children 1 to 3 years of age, and 88% of children 4 to 7 years of age rode in the rear seat.[20] These rates compare with rates of 85%, 90%, and 71%, respectively, in 2002, the first year from which these data were available from direct observation studies.[72] It should be noted that rear seating does not seem to vary on the basis of whether there is a state law requiring children to ride in the rear. In 2008, 92% of children who lived in states in which such a law existed rode in the rear, versus 93% of children from states in which no such law exists.[20] Children using child restraint systems were more likely to sit in the rear (≥93%) than were those in seat belts (89%) or riding unrestrained (84%). In a study of children involved in nonfatal crashes, children were more likely to be seated in the front if the vehicle was driven by a male or by someone other than the child's parent or if the vehicle was not equipped with a passenger air bag.[73] Among children younger than 4 years in CSSs who have been in crashes, there seems to be a preference for placing the CSS in the right outboard seating position in the rear row (41%) compared with the center rear (31%) or left outboard (28%),[74] which likely has to do with the increased ability for the driver to directly observe the child more easily when in the right outboard rear seating position.

Several studies have documented the benefits of rear seating for children. Estimates of the elevated risk of injury for children in the front seat compared with children in the rear have ranged from 40% to 70% depending on the time period and characteristics of the group studied.[10,75,76] The authors of 1 of these studies specifically noted that the beneficial effects of the rear seat were no longer seen for children 13 years and older.[10] Thus, the AAP continues to recommend that all children younger than 13 years ride in the rear seat. It is interesting to note that the benefits of rear seating for child occupants extend to side impacts as well; children seated in the rear are 62% less likely to sustain an injury.[77] Not only is the overall risk higher, but the severity of injury is also greater in the front seat. An analysis of crashes identified through the Crash Injury Research and Engineering Network (CIREN) revealed that child occupants in the front seat sustained more severe injuries than those seated in the rear rows as measured by an injury severity score higher than 16.[78]

Two recent studies specifically evaluated the potential incremental benefits of the center rear seating position compared with the rear outboard positions. Lund[79] used data from the National Automotive Sampling System–General Estimates System system from 1992 to 2000 to evaluate the effect of seating position on the risk of injury for children in child restraints. Lund reported that children in the center rear seat had a similar risk of injury to children in the outboard rear seats. In contrast, Kallan et al[74] used data from the Partners for Child Passenger Safety project, a large, child-focused crash-surveillance system, from 1998 to 2006 and found that children restrained in forward-facing CSSs and seated in the center rear had an injury risk 43% lower than similarly restrained children in either of the rear outboard positions (adjusted OR: 0.57 [95% CI: 0.38–0.86]). These contrasting findings are likely attributable to how injuries were defined in the 2 studies. Lund defined injury as any police-reported injury, which included those of a relatively minor nature. The threshold for injury was higher in the Kallan et al analysis, which included only injuries involving internal organs and fractures of the extremities.

CHILDREN AND AIR BAGS

In November 1995, an article in the *Morbidity and Mortality Weekly Report* of the Centers for Disease Control and Prevention described 8 deaths of child occupants involving air-bag deployment that were of special concern, because they involved low-speed crashes in which the children otherwise should have survived.[80] As passenger air bags diffused into the market, numerous case reports began appearing in the medical literature describing brain and skull injuries sustained by children in rear-facing CSSs and brain and cervical spine injuries sustained by older children who were often unrestrained or restrained in seat belts inappropriately for their age.[81–85]

Several researchers reviewed case series of children exposed to deploying passenger air bags to elucidate the mechanisms of injury.[86–90] For children killed in a rear-facing CSSs, the air bag typically deployed into the rear surface of the child restraint near the child's head and caused fatal skull and brain injuries. For older children who were either unrestrained or restrained in seat belts inappropriate for their age, braking before impact caused the child to pitch forward so that they were in the path of the air bag as it deployed. On deployment, the air bag caused a spectrum of injuries to the brain and cervical spine, including atlanto-occipital fractures, brainstem injuries, and diffuse axonal injury. Case series of other less serious injuries to child occupants associated with

air-bag deployment continue to appear in the literature, including injuries to the eye[91] and upper extremities[92] as well as respiratory and hearing problems related to the sound wave and cloud of fine particulate matter released during an air-bag deployment.[93]

Several population-based estimates of the effects of air bags on young children in crashes have consistently indicated an increased risk of fatal and nonfatal injuries to both restrained and unrestrained child occupants.[11,12,94–98] Exposure to passenger air bags increased the risk of both minor injuries, including facial and chest abrasions, and moderate and more serious injuries, particularly head injuries and upper-extremity fractures.

On the basis of this evidence, the NHTSA initiated a 2-pronged program of education and regulation in response to the initial reports of deaths and serious injuries to children from air bags. First, the NHTSA, joined by many national organizations including the AAP, recommended that all child passengers younger than 13 years sit in the rear seats of vehicles. Second, in 1997, the NHTSA enacted a substantial regulatory change to Federal Motor Vehicle Safety Standard (FMVSS) 208, the safety standard that governs the protection of motor vehicle occupants in frontal impact crashes. Because frontal air bags are designed to primarily protect occupants in frontal impact crashes, their performance is certified through FMVSS 208. The change provided automakers a choice in the type of test that could be used to certify frontal crash performance for unbelted adults.[99] This change in the standard resulted in the redesign of frontal air bags to reduce the force with which they deploy. These new air bags are often referred to as "second-generation air bags" and were generally present in all vehicles beginning with model year 1998.

Several studies have examined the effect of these design changes on child occupants in real-world crashes. Olson[100] found that second-generation air bags reduced the risk of death among right-front-seated children 6 to 12 years of age by 29% compared with no air bag. For children younger than 6 years, both first- and second-generation air bags increased the risk of death compared with no air bag; however, the increased risk of death was less for second-generation air bags (10%) compared with first-generation air bags (66%). Arbogast et al[101] quantified the risk of serious nonfatal injuries in frontal crashes among belted children in the front seat of vehicles in which second- versus first-generation passenger air bags deployed. Serious injuries were reported in 14.9% in the first-generation group versus 9.9% in the second-generation group. In particular, children in the second-generation group sustained fewer head injuries, including concussions and other serious brain injuries, than in the first-generation group.

Braver et al[102] examined federal crash data to determine the effect of second- versus first-generation air bags on the risk of fatal injuries to children in the right-front seat. Right-front passengers younger than 10 years in vehicles with second-generation air bags had statistically significant reductions in risk of dying in frontal collisions compared with children of similar ages in vehicles with first-generation air bags, including a 65% reduced risk among children 0 to 4 years of age (RR: 0.35 [95% CI: 0.21–0.60]). Nonsignificant decreases in risk of death were observed among children 10 to 14 years of age.

Kuppa et al[103] evaluated the influence of the air bag on the effectiveness of rear seating by using a double-pair comparison study of frontal impact crashes identified in the FARS. Two pairs were analyzed: the first group consisted of fatal crashes in which a driver and front outboard seat passenger were present and at least 1 of them was killed; the second group consisted of fatal crashes in which a driver and a rear outboard seat passenger were present and at least 1 of them was killed. This analysis examined vehicles with and without a passenger air bag separately. For restrained children 5 years or younger, the presence of a passenger air bag increased the benefit, in terms of reduced fatalities, associated with rear seating. For restrained child occupants older than 8 years, the rear seat was still associated with a lower risk of death than the front, but its benefit was less in vehicles with a passenger air bag than in vehicles without a passenger air bag.

Air bags continue to undergo significant redesigns in an effort to optimize their effectiveness in serious crashes while minimizing their risk of adverse injuries in minor crashes. In 2001, additional revisions were made to FMVSS 208, which now requires the testing of air-bag systems for all sizes of occupants, including children. At this time, no studies have evaluated the benefits of these designs, often termed "certified advanced compliant air bags," for child occupants.

There have been limited studies that have attempted to examine age-specific effects of air bags on risk of injury to children. Newgard and Lewis[97] used data from the National Automotive Sampling System–Crashworthiness Data System to evaluate specific cutoff points for age, height, and weight as effect modifiers of the association between the presence of a passenger air bag and serious injury among children involved in motor vehicle crashes. The time period studied (1995–2002) preceded the time when

second-generation air bags were generally available in the vehicle fleet. Newgard and Lewis found that children 0 to 14 years of age involved in frontal collisions seemed to be at increased risk of serious injury from air-bag presence (OR: 2.66 [95% CI: 0.23–30.9]) and deployment (OR: 6.13 [95% CI: 0.30–126]), although these values did not reach statistical significance. Among children 15 to 18 years of age involved in frontal collisions, there was a protective effect on injury from both air-bag presence (OR: 0.19 [95% CI: 0.05–0.75]) and deployment (OR: 0.31 [95% CI: 0.09–0.99]). A similar analysis has not been replicated to determine if different age cutoffs might be identified with children in vehicles equipped with second-generation air bags. Therefore, the AAP continues to strongly recommend that all children younger than 13 years sit in the rear seat. In vehicles with only a single row of seats, such as compact pickup trucks, the frontal air bag can be deactivated, or an on/off switch can be installed, to prevent its deployment in the event of a crash, thus allowing either the installation of a CSS in the front seat or the ability of a child younger than 13 years to ride in the front if necessary.[104]

Side air bags were introduced in the mid-1990s as a safety strategy to reduce serious injuries and fatalities occurring in side-impact crashes. Initial crash tests that involved vehicles equipped with so-called torso side air bags in the front seats revealed that the head was still at risk of serious injury in side-impact crashes.[105,106] To maximize protection of the head for adult front and rear-seat occupants of a variety of statures and seating postures, the roof-rail or head curtain air bag was developed and has become the preferred head-protection system for side-impact crashes. These systems, frequently accompanied by a separate torso side air bag, provide more extensive coverage of the upper vehicle side interior and often extend the entire length of the vehicle, including the rear rows. Side air bags have become a common safety technology in the vehicle; 79% of model-year 2006 vehicles have some type of side air bag either as standard or optional equipment.[107] The NHTSA recently conducted an analysis of side-impact protection with a focus on side air-bag technology[108] and determined that side air bags resulted in a reduction in struck-side fatality risk of 18% in multivehicle crashes and substantial improvement in a thoracic injury metric, the Thoracic Trauma Index, in laboratory assessments. Benefits were greater for head side air bags than those with torso side air bags alone. However, these analyses were primarily focused on protection of adult drivers and front-seat occupants. Arbogast and Kallan[109] used the Partners for Child Passenger Safety (PCPS) database to estimate the prevalence of side air-bag exposure to children in crashes and to provide estimates of injury risk among those exposed. In the study sample, 2.7% of children in crashes were exposed to a deployed side air bag. More than 75% of these children were seated in the rear seat, and 65% of those exposed were younger than 9 years. Of those exposed, 10.6% sustained an Abbreviated Injury Scale 2 injury to the head or upper extremity, a rate similar to that of children exposed to second-generation frontal air bags. These limited field data on the performance of side air bags with respect to child occupant protection suggest that, although a significant number of children are exposed to side air-bag deployments, there is no evidence that these air bags pose a particular risk of serious or fatal injuries to children.

SPECIAL CONSIDERATIONS

The Safety of Children Left in or Around Vehicles

Children should never be left unattended in or around parked cars. Among the safety risks that have been described, being backed over when the vehicle is set in motion, hyperthermia, and strangulation from entrapment in power windows are among the most serious and preventable injuries. In 2008, Kids and Cars, a safety advocacy group dedicated to the prevention of such injuries, amassed reports of a wide range of safety incidents that involved nearly 1000 children and resulted in more than 200 deaths.[110] In response to the Cameron Gulbransen Kids Transportation Safety Act of 2007 (Pub L No. 110-189), the NHTSA created a virtual database called the Not in Traffic Surveillance (NiTS) system to ascertain population-based estimates of the prevalence of noncrash deaths and injuries. NiTS data indicate that approximately 35 to 40 occupants (primarily children) die of hyperthermia and 5 die of power-window strangulation each year, which highlights the importance of never leaving children unsupervised in or around cars.[111]

The Safety of Children in Pickup Trucks

Pickup trucks are popular vehicles in the United States and accounted for approximately 13% of new vehicle sales in 2008.[112] Although many have only a single row of seats, extended-cab models have a second row of seats and may be viewed as family vehicles by parents who want to follow safety recommendations that children be placed in the rear seat. Compact extended-cab pickup trucks, which typically have a smaller rear-seat compartment, sometimes with side-facing, fold-down seats, present a particular safety hazard to children. Winston et al[113] found that children in the rear

seat of compact extended-cab pickup trucks were more than 4 times as likely to be injured (adjusted OR: 4.69 [95% CI: 2.44–9.01]) as were rear-row–seated children in other vehicles. A substantial portion of the increased risk was mediated by contact with the vehicle interior during the crash, because the rear-seat compartment in these trucks is typically not as well padded as in other vehicles. It is important to note that full-size extended-cab pickup trucks, which typically have a rear-seat compartment similar in size and configuration to other vehicles, were found to have injury risks similar to those of other passenger vehicles.

Of particular concern regarding the safety of pickup trucks for children is the use of the cargo area of pickup trucks for the transport of children and youth. Because the cargo area is not intended for passenger use, it is neither required nor designed to meet occupant safety standards applicable to passenger locations. The fatality risk to children in the cargo area of pickup trucks has been well described.[114,115] The most significant hazard of travel in the cargo area of a pickup truck is ejection of a passenger in a crash or noncrash event (eg, sudden stop, turn, swerve, or loss of balance, as well as intentional or unintentional jumps and falls). It is fortunate that the number of children and adolescents younger than 18 years killed as passengers in the cargo area of pickup trucks has declined by more than 50% over the past decade, from more than 40 per year to less than 20 per year more recently.[2] The most effective prevention strategies for reducing the number of deaths and injuries to children in pickup trucks are the prohibition of travel in the cargo area and age-appropriate restraint use in an appropriate rear-seat location in the cab.

The Safety of Children on Commercial Airlines

Currently, the Federal Aviation Administration (FAA) exempts children younger than 2 years from the requirement that all aircraft passengers occupy a seat with a separate safety belt.[116] The FAA and NHTSA agreed on a single government performance standard, FMVSS 213, that would satisfy both aviation and highway safety requirements for child restraint systems.[117] The FAA has also approved a harness-type restraint appropriate for children who weigh between 22 and 44 lb. This type of device provides an alternative to using a hard-backed seat and is approved only for use on aircraft. It is not approved for use in motor vehicles.[118] Newman et al[119] examined the potential impact and costs of a requirement for use of child restraint systems by young children on aircraft. The potential impact of such a regulation requires a number of assumptions, primarily regarding the effectiveness of child restraint systems in survivable aircraft crashes and the proportion of families who would switch from air to ground travel if required to assume the added cost of an additional aircraft seat and the child restraint system for their children younger than 2 years. Using available data on the risk of fatalities from air travel and the survivability of crashes and reasonable assumptions for RRs of death for restrained and unrestrained young children involved in crashes, Newman et al found that the number of deaths that could be prevented in the United States with mandatory child restraint system use in commercial aircraft is small: less than 1 per year. The number of deaths that could be prevented by mandatory child restraint system use is limited, because the number of deaths of unrestrained young children in survivable aircraft crashes is already low. Newman et al suggested that a policy of requiring child restraint system use for airplane travel is likely to lead to a net increase in deaths caused by increased motor vehicle travel if the proportion of families switching to automobile travel exceeds approximately 5% to 10%. This threshold varied with the estimated number of lives saved by child restraint system use on airplanes, the average length of the added round trips by car, and the risk profile of the drivers but was unlikely to exceed 15%. The National Transportation Safety Board disputed the "diversion" claim made by Newman et al and others and suggested that available data did not indicate that diversion to road travel has previously occurred when circumstances made it likely (eg, immediately after the terrorist attacks on September 11, 2001).[120]

An alternative approach supported by the FAA is to encourage families to inquire about the availability of open seats on less crowded flights so that parents could put their child in a child restraint system in a seat next to them without needing to buy a ticket and without revenue loss to the airline. This approach was also advocated by Bishai[121] in an editorial that accompanied the Newman et al study. If open seats are not available, families would be required to check the CSS as luggage. In 2008, the Department of Federal Affairs surveyed all major US airlines on their baggage policies and learned that with 1 exception, airlines have adopted policies that do not count CSSs toward checked baggage allowances.[122]

Data fundamental to creating an evidence-based policy, including information on the number of children younger than 2 years of age who currently fly unrestrained, as well as data on the number of children who sustain injuries in turbulence, are not available. Until data systems are created

and used to provide evidence to inform the policy debate and ticket-pricing policies and security screening procedures are enhanced to make it easier for families to follow best-practice recommendations for correct child restraint use during commercial airline travel, and to have their own CSS or booster seat available to them after airline travel, the current situation of allowing young children to travel in a manner inconsistent with best-practice recommendations is likely to continue.

CHILD RESTRAINT LAWS

The first state child occupant restraint law was passed in Tennessee in 1978, primarily attributable to the efforts of pediatrician Robert Sanders. By 1985, all 50 states and the District of Columbia had passed laws requiring child restraints for young children. However, these initial child passenger safety laws were generally inconsistent with best-practice recommendations at the time, which created several gaps in coverage of children and resulted in poor compliance with the provisions of the laws.[123] Recognizing the importance of laws in both changing restraint behavior and educating the public about recommended restraint practices, most states have recently enhanced their child occupant restraint laws through the enactment of booster seat use provisions for older children. Current information on all child restraint laws in the United States is updated by the Insurance Institute for Highway Safety and can be found at www.iihs.org/laws/ChildRestraint.aspx. Although the laws aim to ensure the appropriate use of all forms of child restraints (eg, CSSs and belt-positioning booster seats), the revised laws generally became known as "booster seat laws." Results of subsequent study of the association of a booster seat provision in a state child restraint law with changes in child restraint use in that state indicated that booster seat provisions that cover children from 4 through 7 years of age increase the use of child restraints by 39% among children in this age range.[16] Children 4 to 5 years of age in states with booster seat laws were 23% more likely to be reported as appropriately restrained than were children in other states, and those 6 to 7 years of age were twice as likely to be reported as appropriately restrained. For 6- to 7-year-olds, the effect was much stronger when the law included children through 7 years of age than when it included only those 4 to 5 years of age.

A focus-group study of violators of California's child restraint law revealed that multiple complex factors influence consistent use of a CSS.[124] At the time of the study, the California law required children younger than 4 years and weighing less than 40 lb to be properly secured in a CSS that meets federal standards. Parents who violated the law described a number of factors, including unreliable access to a vehicle, the trip circumstances, parenting style, and child refusal, that affected the use of a CSS at the time of the citation. Among parents who had been ticketed for not restraining their children, participation in a class in which child passenger safety information was provided demonstrated some benefit in their subsequent knowledge of child passenger safety issues, compared with a fine alone.

Seat belt laws have played a critical role in increasing seat belt use by 83% of front-seat occupants by 2008.[125] However, seat belt use continues to be lower—at 80% in 2008—among drivers and front-seat occupants 16 to 24 years of age. There are 2 different types of enforcement of seat belt laws: primary and secondary enforcement. Primary-enforcement laws allow a citation to be issued whenever a law enforcement officer observes an unbelted driver or passenger. Secondary enforcement seat belt laws require the officer to stop a violator for another traffic infraction before being able to issue a citation for not using a seat belt. Previous studies have demonstrated that, on average, the effects of primary-enforcement laws are larger and more consistent than secondary-enforcement laws in increasing seat belt use and decreasing injuries among adult drivers and passengers.[126–129]

Gaps between adult seat belt laws and child restraint laws result in lack of coverage for many older children (5–15 years of age) in all seating positions. For example, in some states, a 15-year-old can ride legally in the back seat without a restraint, because the laws in those states apply only to front-seat occupants. To gain insight on the potential effect of primary-enforcement safety belt laws on older child passengers, Durbin et al[130] compared reported use of seat belts among 13- to 15-year-old passengers in crashes in states with a primary-enforcement seat belt law versus states with a secondary-enforcement law. Restraint use was 7.2% (95% CI: 4.3%–10.1%) higher among 13- to 15-year-olds in primary-enforcement states versus those in secondary-enforcement states. Restraint use among 13- to 15-year-olds was significantly lower in secondary-enforcement versus primary-enforcement states, particularly when the driver was unrestrained. For 13- to 15-year-olds in a secondary state with an unrestrained driver, 65.8% were unrestrained compared with 22.8% in a primary-enforcement state (adjusted RR: 3.0 [95% CI: 1.5–15.7]). After adjusting for both driver age and restraint use, a 13- to 15-year-old was more than twice as likely to be unrestrained in a secondary-enforcement state com-

pared with a primary-enforcement state (RR: 2.2 [95% CI: 1.4–3.5]). The authors concluded that primary-enforcement laws were associated with higher rates of seat belt use compared with secondary-enforcement laws among children 13 to 15 years of age, a group not generally covered by restraint laws.

RESOURCES FOR PEDIATRICIANS AND FAMILIES

The NHTSA began a standardized child passenger safety training and certification program in 1998. Since then, tens of thousands of people have been certified as child passenger safety technicians.[131] These people participate in community-based child safety seat clinics and are a source of information for families on appropriate use and installation of all types of CSSs and booster seats. Although the algorithm to guide implementation of best-practice recommendations by pediatricians provided in the policy statement is designed to cover the majority of situations that pediatricians will encounter in practice, pediatricians should consider child passenger safety technicians as sources of information when atypical circumstances may be encountered that are not adequately managed by the algorithm. In most communities, technicians work at formal inspection stations; a list of these stations is available at www.seatcheck.org. If your community does not have an inspection station, you can find a technician in your area via the National Child Passenger Safety Certification Web site (http://cert.safekids.org) or the NHTSA child safety seat inspection station locator (www.nhtsa.dot.gov/cps/cpsfitting/index.cfm). Technicians with enhanced training in restraining children with special health needs, as well as those with Spanish-language proficiency, can be identified at these sites. Car seat checkup events are updated at www.safekidsweb.org/events/events.asp. In addition, additional resources for pediatricians and families can be found at www.aap.org and www.healthychildren.org.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Children, Adolescents, and Advertising

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Communications

ABSTRACT

Advertising is a pervasive influence on children and adolescents. Young people view more than 40 000 ads per year on television alone and increasingly are being exposed to advertising on the Internet, in magazines, and in schools. This exposure may contribute significantly to childhood and adolescent obesity, poor nutrition, and cigarette and alcohol use. Media education has been shown to be effective in mitigating some of the negative effects of advertising on children and adolescents.

INTRODUCTION

Several European countries forbid or severely curtail advertising to children; in the United States, on the other hand, selling to children is simply "business as usual."[1] The average young person views more than 3000 ads per day on television (TV), on the Internet, on billboards, and in magazines.[2] Increasingly, advertisers are targeting younger and younger children in an effort to establish "brand-name preference" at as early an age as possible.[3] This targeting occurs because advertising is a $250 billion/year industry with 900 000 brands to sell,[2] and children and adolescents are attractive consumers: teenagers spend $155 billion/year, children younger than 12 years spend another $25 billion, and both groups influence perhaps another $200 billion of their parents' spending per year.[4,5] Increasingly, advertisers are seeking to find new and creative ways of targeting young consumers via the Internet, in schools, and even in bathroom stalls.[1]

THE EFFECTS OF ADVERTISING ON CHILDREN AND ADOLESCENTS

Research has shown that young children—younger than 8 years—are cognitively and psychologically defenseless against advertising.[6–9] They do not understand the notion of intent to sell and frequently accept advertising claims at face value.[10] In fact, in the late 1970s, the Federal Trade Commission (FTC) held hearings, reviewed the existing research, and came to the conclusion that it was unfair and deceptive to advertise to children younger than 6 years.[11] What kept the FTC from banning such ads was that it was thought to be impractical to implement such a ban.[11] However, some Western countries have done exactly that: Sweden and Norway forbid all advertising directed at children younger than 12 years, Greece bans toy advertising until after 10 PM, and Denmark and Belgium severely restrict advertising aimed at children.[12]

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Key Words
advertising, media, television, product placements, children and media, smoking, alcohol, birth control, obesity, junk food, fast food, Channel One, Federal Trade Commission

Abbreviations
TV—television
FTC—Federal Trade Commission
ED—erectile dysfunction

ADVERTISING IN DIFFERENT MEDIA

Television

Children and adolescents view 40 000 ads per year on TV alone.[13] This occurs despite the fact that the Children's Television Act of 1990 (Pub L No. 101–437) limits advertising on children's programming to 10.5 minutes/hour on weekends and 12 minutes/hour on weekdays. However, much of children's viewing occurs during prime time, which features nearly 16 minutes/hour of advertising.[14] A 30-second ad during the Super Bowl now costs $2.3 million but reaches 80 million people.[15]

Movies

A 2000 FTC investigation found that violent movies, music, and video games have been intentionally marketed to children and adolescents.[16] Although movie theaters have agreed not to show trailers for R-rated movies before G-rated movies in response to the release of the FTC report, children continue to see advertising for violent media in other venues. For instance, M-rated video games, which according to the gaming industry's own rating system are not recommended for children younger than 17 years, are frequently advertised in movie theaters, video game magazines, and publications with high youth readership.[17] Also, movies targeted at children often prominently feature brand-name products and fast food restaurants.[18] In 1997–1998, 8 alcohol companies placed products in 233 motion pictures and in 1 episode or more of 181 TV series.[18]

Print Media

According to the Consumer's Union,[19] more than 160 magazines are now targeted at children. Young people see 45% more beer ads and 27% more ads for hard liquor in teen magazines than adults do in their magazines.[20] Despite the Master Settlement Agreement with the tobacco industry in 1998, tobacco advertising expenditures in 38 youth-oriented magazines amounted to $217 million in 2000.[21]

The Internet

An increasing number of Web sites try to entice children and teenagers to make direct sales. Teenagers account for more than $1 billion in e-commerce dollars,[22] and the industry spent $21.6 million on Internet banner ads alone in 2002.[23] More than 100 commercial Web sites promote alcohol products.[23] The content of these sites varies widely, from little more than basic brand information to chat rooms, "virtual bars," drink recipes, games, contests, and merchandise catalogues. Many of these sites use slick promotional techniques to target young people.[23,24] In 1998, the Children's Online Privacy Protection Act (Pub L No. 105–277) was passed, which mandates that commercial Web sites cannot knowingly collect information from children younger than 13 years. These sites are required to provide notice on the site to parents about their collection, use, and disclosure of children's personal information and must obtain "verifiable parental consent" before collecting, using, or disclosing this information.[25]

MARKETING TECHNIQUES

Advertisers have traditionally used techniques to which children and adolescents are more susceptible, such as product placements in movies and TV shows,[26] tie-ins between movies and fast food restaurants,[18] tie-ins between TV shows and toy action figures or other products,[7] kids' clubs that are linked to popular shows, and celebrity endorsements.[27] Cellular phones are currently being marketed to 6- to 12-year-olds, with the potential for directing specific advertisers to children and preteens. Coca-Cola reportedly paid Warner Bros. Studios $150 million for the global marketing rights to the movie "Harry Potter and the Sorcerer's Stone,"[28] and nearly 20% of fast food restaurant ads now mention a toy premium in their ads.[29] Certain tie-in products may be inappropriate for children (eg, action figures from the World Wrestling Federation or an action doll that mutters profanities from an R-rated *Austin Powers* movie).

Children's advertising protections will need to be updated for digital TV, which will be in place before 2010. In the near future, children watching a TV program will be able to click an on-screen link and go to a Web site during the program.[30] Interactive games and promotions on digital TV will have the ability to lure children away from regular programming, encouraging them to spend a long time in an environment that lacks clear separation between content and advertising. Interactive technology may also allow advertisers to collect vast amounts of information about children's viewing habits and preferences and target them on the basis of that information.[31]

SPECIFIC HEALTH-RELATED AREAS OF CONCERN

Tobacco Advertising

Tobacco manufacturers spend $30 million/day ($11.2 billion/year) on advertising and promotion.[32] Exposure to tobacco advertising may be a bigger risk factor than having family members and peers who smoke[33] and can even undermine the effect of strong parenting practices.[34] Two unique and large longitudinal studies have found that approximately one third of all adolescent smoking can be attributed to tobacco advertising and promotions.[35,36] In addition, more than 20 studies have found that children exposed to cigarette ads or promotions are more likely to become smokers themselves.[37,38] Recent evidence has emerged that tobacco companies have specifically targeted teenagers as young as 13 years of age.[39]

Alcohol Advertising

Alcohol manufacturers spend $5.7 billion/year on advertising and promotion.[40] Young people typically view 2000 beer and wine commercials annually,[41] with most of the ads concentrated in sports programming. During prime time, only 1 alcohol ad appears every 4 hours; yet, in sports programming, the frequency increases to 2.4 ads per hour.[42,43] Research has found that adolescent drinkers are more likely to have been exposed to alcohol advertising.[44–50] Given that children begin making decisions about alcohol at an early age—probably during grade school[50]—exposure to beer commercials represents a significant risk factor.[46,50] Minority children may be at particular risk.[51]

Drug Advertising

"Just Say No" as a message to teenagers about drugs seems doomed to failure given that $11 billion/year is spent on cigarette advertising, $5.7 billion/year is spent on alcohol advertising, and nearly $4 billion/year is spent on prescription drug advertising.[52] Drug companies now spend more than twice as much on marketing as they do on research and development. The top 10 drug companies made a total profit of $35.9 billion in 2002—more than the other 490 companies in the Fortune 500 combined.[53] Is such advertising effective? A recent survey of physicians found that 92% of patients had requested an advertised drug.[54,55] In addition, children and teenagers may get the message that there is a drug available to cure all ills and heal all pain, a drug for every occasion (including sexual intercourse).[41]

Food Advertising and Obesity

Advertisers spend more than $2.5 billion/year to promote restaurants and another $2 billion to promote food products.[56] On TV, of the estimated 40 000 ads per year that young people see, half are for food, especially sugared cereals and high-calorie snacks.[29,57] Healthy foods are advertised less than 3% of the time; children rarely see a food advertisement for broccoli.[58] Increasingly, fast food conglomerates are using toy tie-ins with major children's motion pictures to try to attract young people.[59] Nearly 20% of fast food ads now mention a toy premium in their commercials.[29] Several studies document that young children request more junk food (defined as foods with high-caloric density but very low nutrient density) after viewing commercials.[60–63] In 1 study, the amount of TV viewed per week correlated with requests for specific foods and with caloric intake.[61] At the same time, advertising healthy foods has been shown to increase wholesome eating in children as young as 3 to 6 years of age.[64]

Sex in Advertising

Sex is used in commercials to sell everything from beer to shampoo to cars.[65] New research is showing that teenagers' exposure to sexual content in the media may be responsible for earlier onset of sexual intercourse or other sexual activities.[66,67] What is increasingly apparent is the discrepancy between the abundance of advertising of products for erectile dysfunction (ED) (between January and October, 2004, drug companies spent $343 million advertising Viagra, Levitra, and Cialis)[68] and the lack of advertising for birth control products or emergency contraceptives on the major TV networks. This is despite the fact that 2 national polls have found that a majority of Americans favor the advertising of birth control on TV.[69,70] Ads for ED drugs give children and teens inappropriate messages about sex and sexuality at a time when they are not being taught well in school sex education programs.[71,72] Research has definitively found that giving teenagers increased access to birth control through advertising does not make them sexually active at a younger age.[73–80]

American advertising also frequently uses female models who are anorectic in appearance and, thus, may contribute to the development of a distorted body self-image and abnormal eating behaviors in young girls.[79,81,82]

ADVERTISING IN SCHOOLS

Advertisers have slowly but steadily infiltrated school systems around the country. The "3 Rs" have now become the "4 Rs," with the fourth R being "retail."[83,84] Ads are now appearing on school buses, in gymnasiums, on book covers, and even in bathroom stalls.[85] More than 200 school districts nationwide have signed exclusive contracts with soft drink companies.[86] These agreements specify the number and placement of soda-vending machines, which is ironic given that schools risk losing federal subsidies for their free breakfast and lunch programs if they serve soda in their cafeterias. In addition, there are more than 4500 Pizza Hut chains and 3000 Taco Bell chains in school cafeterias around the country.[87]

There is some good news, however. In May, 2006, the nation's largest beverage distributors agreed to halt nearly all sales of sodas to public schools and sell only water, unsweetened juice, and low-fat milk in elementary and middle schools. Diet sodas would be sold only in high schools.[88]

School advertising also appears under the guise of educational TV: Channel One. Currently available in 12 000 schools, Channel One consists of 10 minutes of current-events programming and 2 minutes of commercials. Advertisers pay $200 000 for advertising time and the opportunity to target 40% of the nation's teenagers for 30 seconds.[89] According to a recent government report, Channel One now plays in 25% of the nation's middle and high schools[81] and generates profits estimated at $100 million annually.[89]

CONCLUSIONS

Clearly, advertising represents "big business" in the United States and can have a significant effect on young people. Unlike free speech, commercial speech does not enjoy the same protections under the First Amendment of the Constitution.[90] Advertisements can be restricted or even banned if there is a significant public health risk. Cigarette advertising and alcohol advertising would seem to fall squarely into this category, and ads for junk food could easily be restricted.[91]

One solution that is noncontroversial and would be easy to implement is to educate children and teenagers about the effects of advertising—media literacy. Curricula have been developed that teach young people to become critical viewers of media in all of its forms, including advertising.[92–94] Media education seems to be protective in mitigating harmful effects of media, including the effects of cigarette, alcohol, and food advertising.[93–96]

RECOMMENDATIONS

1. Pediatricians should become familiar with the methods that advertisers use to target children and adolescents.
2. Pediatricians should only subscribe to magazines that are free of tobacco and alcohol advertisements for their waiting rooms (eg, *Good Housekeeping* has refused to carry tobacco ads since 1952).
3. Pediatricians should counsel their patients to limit total noneducational screen time to no more than 2 hours/day,[97] which will limit exposure to advertising of all kinds.
4. Pediatricians should write letters to advertisers if they see inappropriate ads and should encourage parents to do the same (letters can be addressed to the Children's Advertising Review Unit, Council of Better Business Bureaus, 845 Third Ave, New York, NY 10022).
5. Pediatricians should work with community groups and local school boards to implement media education programs that teach about the effects of advertising on children and adolescents. The federal government should help underwrite the cost of establishing and disseminating such programs.
6. Pediatricians should work with parents, schools, community groups, and others to ban or severely curtail school-based advertising in all forms.
7. Pediatricians should work with parent and public health groups to:
   a. ask Congress and the Federal Communications Commission to limit commercial advertising on children's programming to no more than 5 to 6 minutes/hour, which would decrease the current amount by 50%;
   b. ask Congress to implement a ban on cigarette and tobacco advertising in all media, including banners and logos in sports arenas;
   c. ask Congress to restrict alcohol advertising to what is known as "tombstone advertising," in which only the product is shown, not cartoon characters or attractive women;
   d. ask Congress to implement a ban on junk-food advertising during programming that is viewed predominantly by young children;
   e. ask Congress to increase funding for public TV—the sole source of high-quality, educational, noncommercial programming for children;
   f. advocate for confining ads for ED drugs to after 10 PM. The American Academy of Pediatrics has always strongly endorsed the advertising of birth control on TV. There is now considerable evidence that birth control advertising could lower teen pregnancy rates even further while having no impact on rates of teen sexual activity.[79] However, when birth control advertising is so rare on prime time TV, it makes no sense to allow ED drug advertising that may confuse children and teens about human sexuality and make sexual activity seem like a recreational sport.
   g. ask Congress and the Federal Communications Commission to prohibit interactive advertising to children in digital TV; and
   h. ask Congress to convene a national task force on advertising under the auspices of the Institute of Medicine, the National Institutes of Health, or the FTC. This task force would discuss the nature of the current problem and the current research and would propose solutions toward limiting children's exposure to unhealthy advertising, including the funding of future research. The task force would include representatives from the toy industry, the fast food industry, and the advertising community, as well as pediatricians, child psychiatrists and psychologists, and public health advocates.
8. Pediatricians, together with the American Academy of Pediatrics Media Resource Team, should work with the entertainment industry to ensure that the advertising of violent media to children does not occur, that product placements in movies and TV do not occur, that the dissemination and enforcement of the individual industries' own rating systems is facilitated, and that advertising for contraceptives is more widely disseminated on network TV.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Children, Adolescents, Obesity, and the Media

COUNCIL ON COMMUNICATIONS AND MEDIA

KEY WORDS

media, obesity, overweight, screen time, junk food, television

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abstract

Obesity has become a worldwide public health problem. Considerable research has shown that the media contribute to the development of child and adolescent obesity, although the exact mechanism remains unclear. Screen time may displace more active pursuits, advertising of junk food and fast food increases children's requests for those particular foods and products, snacking increases while watching TV or movies, and late-night screen time may interfere with getting adequate amounts of sleep, which is a known risk factor for obesity. Sufficient evidence exists to warrant a ban on junk-food or fast-food advertising in children's TV programming. Pediatricians need to ask 2 questions about media use at every well-child or well-adolescent visit: (1) How much screen time is being spent per day? and (2) Is there a TV set or Internet connection in the child's bedroom? *Pediatrics* 2011;128:201–208

INTRODUCTION

Obesity represents a clear and present danger to the health of children and adolescents. Its prevalence among American youth has doubled in the past 3 decades,[1] and there are now more overweight and obese adults in the United States than adults of normal weight.[2] However, obesity is also a worldwide problem; rates are increasing in nearly every country.[3,4] It is increasingly clear that the media, particularly TV, play an important role in the etiology of obesity.[5] As a result, many countries are now establishing new regulations for advertising to children on TV, and many government health agencies are now issuing recommendations for parents regarding the amount of time children spend watching TV.[6] Unfortunately, there are currently no data relating other media to obesity.

MEDIA AND OBESITY

There are a number of ways that watching TV could be contributing to obesity: (1) increased sedentary activity and displacement of more physical pursuits; (2) unhealthy eating practices learned from both the programming and the advertisements for unhealthy foods; (3) increased snacking behavior while viewing; and (4) interference with normal sleep patterns. However, most researchers now agree that the evidence linking excessive TV-viewing and obesity is persuasive.[7–9] There have been dozens of longitudinal and correlational studies documenting a connection.[9] An increasing number of these studies hold ethnicity and socioeconomic status—known to be key factors in obesity—constant and still reveal that TV-viewing is a significant con-

tributor to obesity.[7,10] Results of the longitudinal studies are particularly convincing. For example, a remarkable 30-year study in the United Kingdom found that a higher mean of daily hours of TV viewed on weekends predicted a higher BMI at the age of 30. For each additional hour of TV watched on weekends at age 5, the risk of adult obesity increased by 7%.[11] A group of researchers in Dunedin, New Zealand, followed 1000 subjects from birth to 26 years of age and found that average weeknight TV-viewing between the ages of 5 and 15 years was strongly predictive of adult BMI.[12] In a study of 8000 Scottish children, viewing more than 8 hours of TV per week at age 3 was associated with an increased risk of obesity at age 7.[13] Also, in 8000 Japanese children, more TV-viewing at age 3 resulted in a higher risk of being overweight at age 6.[14] Numerous American studies have had similar findings.[15–23]

The presence of a TV set in a child's bedroom seems to exacerbate the impact of TV-viewing on children's weight status.[24–28] A study of 2343 children aged 9 to 12 years revealed that having a bedroom TV set was a significant risk factor for obesity, independent of physical activity.[24] A cross-sectional study of 2761 parents with young children in New York found that 40% of the 1- to 5-year-olds had a bedroom TV, and those who did were more likely to be overweight or obese.[25] Teenagers with a bedroom TV spent more time watching TV, less time being physically active, ate fewer family meals, had greater consumption of sweetened beverages, and ate fewer vegetables than did teenagers without a bedroom TV.[26]

Recent correlational studies have also found a strong association between time spent watching TV and blood glucose level control in young people with diabetes,[29] type 2 diabetes mellitus,[30] insulin resistance,[31] metabolic syndrome,[32] hypertension,[33,34] and high cholesterol levels.[35–37] Furthermore, when TV time is diminished, so are measures of adiposity.[38,39]

MECHANISMS

How might time spent with media result in obesity? Contrary to popular opinion, overweight and obesity probably result from small, incremental increases in caloric intake (or increases in sedentary activities).[40] An excess intake of 50 kcal/day (eg, an extra pat of butter) produces a weight gain of 5 lb/year. Drinking a can of soda per day produces a weight gain of 15 lb/year.[41] Nearly 40% of children's caloric intake now comes from solid fat and added sugars, and soda or fruit drinks provide nearly 10% of total calories.[42] Because obesity is caused by an imbalance between energy intake and energy expenditure, screen time may contribute in several different ways.

Displacement of More Active Pursuits

Children spend more time with media than in any other activity except for sleeping—an average of more than 7 hours/day.[43] Many studies have found that physical activity decreases as screen time increases,[44–46]but many other studies have not.[47–49] Children and teenagers who use a lot of media may tend to be more sedentary in general,[7,50] or researchers' measures of physical activity may be too imprecise.[9] Nevertheless, increasing physical activity, decreasing media time, and improving nutritional practices have been shown to prevent the onset of obesity, if not decrease existing obesity as well.[51–55] Some of the newer interactive video games may be useful in this way.[56,57] For example, a study of preteens playing *Dance Revolution* and Nintendo's *Wii Sports* found that energy expenditure was equivalent to moderate-intensity walking.[58]

Unhealthy Eating Habits and Effects of Advertising

Children and teenagers who watch more TV tend to consume more calories or eat higher-fat diets,[59–64] drink more sodas,[65] and eat fewer fruits and vegetables.[66] Some researchers have argued that the viewing of TV while eating suppresses cues of satiety, which leads to overeating.[60] Others believe that viewers are primed to choose unhealthy foods as a consequence of viewing advertisements for foods high in fat, salt, and/or sugar and low in nutritional content ("junk food").[61] On any given day, 30% of American youngsters are eating fast food and consuming an additional 187 kcal (equaling 6 lb/year).[67,68] Fast food is big business: Americans spend more than $110 billion annually on it, which is more than that spent on higher education, computers, or cars.[69] A December 2010 study examined 3039 possible meal combinations at a dozen restaurant chains and found only 12 meals that met nutrition criteria for preschoolers. The same study found that 84% of parents had purchased fast food for their children in the previous week.[70] More than 80% of all advertisements in children's programming are for fast foods or snacks,[71–73] and for every hour that children watch TV, they see an estimated 11 food advertisements.[74] Although exposure to food ads has decreased in the past few years for young children,[73] it has increased for adolescents.[75]

In 2009, the fast-food industry alone spent $4.2 billion on advertising in all media.[70] A study of 50 000 ads from 2003–2004 on 170 top-rated shows found that 98% of food ads seen by children aged 2 to 11 years and nearly 90% of food ads seen by teenagers are for products that are high in fat, sugar, and/or sodium and low in nutritional content (junk food).[76] A newer study of 1638 hours of TV and nearly 9000 food

ads found that young people see an average of 12 to 21 food ads per day, for a total of 4400 to 7600 ads per year, yet they see fewer than 165 ads that promote fitness or good nutrition.[77] In 1 study, black children viewed 37% more ads than other youth.[78] New technology is enabling advertisers to reach young children and teenagers with a variety of online interactive techniques.[79–82] A study of the top 5 brands in 8 different food and beverage categories found that all of them had Internet Web sites: 63% had advergames (games used to advertise the product), 50% had cartoon characters, and 58% had a designated children's area.[79] Half of the Web sites urged children to ask their parents to buy the products, yet only 17% contained any nutritional information.[79] Teenagers' cell phones can be targeted by fast-food companies that can offer teenagers a discount on fast food as they walk by a particular restaurant.[81]

Available research results clearly indicate that advertising is effective in getting younger children to request more high-fat/low-nutrition food (junk food) and to attempt to influence their parents.[5,9,83–85] For example, a 2006 study of 827 third-grade children followed for 20 months found that total TV time and total screen media time predicted future requests for advertised foods and drinks.[86] Even brief exposures to TV food ads can influence children as young as preschool age in their food choices.[87] In 1 recent experiment, children consumed 45% more snacks when exposed to food advertising while watching cartoons than advertising for other products.[64] Similarly, children who played an online advergame that marketed healthy foods were more likely to eat healthy snacks than those who played an online advergame that advertised junk food.[82] Perhaps the most convincing study about the impact of advertising involved 63 children who tasted 5 pairs of identical foods (eg, French fries) and beverages (eg, milk) from unbranded packaging versus branded packaging. The results of the experiment revealed that the children strongly preferred the branded food and drinks to the unbranded foods.[88]

To illustrate the power of marketing, compare the commitment of the Robert Wood Johnson Foundation to spend $100 million per year to try to decrease childhood obesity with the fact that the food industry spends more than that every month marketing primarily junk food and fast food to young people.[84,89]

Food is also unhealthily portrayed in most TV programming and movies.[9,84,90,91] A study of the 30 highest-rated programs among 2- to 5-year-olds found that an average child would see more than 500 food references per week, half of which were to empty-calorie or high-fat/sugar/salt foods (D. L. G. Borzekowski, EdD, "Watching What They Eat: A Content Analysis of Televised Food References Reaching Preschool Children," unpublished manuscript, 2001). In an analysis of 100 films from 1991 through 2000, fats and sweets were the most common foods depicted.[91] Hollywood product placements are also being used to influence the food preferences and purchasing patterns of children and adolescents.[92,93] In the 200 movies examined from 1996 to 2005, a total of 1180 brand placements were identified. Candy (26%) and salty snacks (21%) were the most prevalent food brands, sugar-sweetened beverages (76%) were the most prevalent beverage brands, and fast food composed two-thirds of the food retail establishment brand placements.[93]

Effect of Media on Sleep Habits

TV and other media are known to displace or disturb young people's sleep patterns.[5,94,95] A longitudinal study of adolescents in New York found that viewing 3 or more hours/day of TV doubled the risk of difficulty falling asleep compared with adolescents who watch less than 1 hour/day.[96] There is also now evidence that later bedtimes and less sleep may be associated with a greater risk of obesity.[97–101] The mechanism may be that sleep loss leads to increased snacking and consumption of less healthy foods to maintain energy,[102,103] that sleep deprivation leads to fatigue and therefore greater sedentary behavior,[104] or that children who do not get enough sleep have metabolic changes as well.[105]

Stress may also play a role, although there are only a handful of studies that have studied this subject so far. For example, a Scottish study of nearly 1500 4- to 12-year-olds found that heavier TV use produced greater psychological stress in children and that this effect was independent of, but exacerbated by, decreases in exercise.[106]

CONCLUSIONS

Media clearly play an important role in the current epidemic of childhood and adolescent obesity. The sheer number of advertisements that children and adolescents see for junk food and fast food have an effect. So, too, does the shift away from good nutritional practices that increased media screen time seems to create. Any success in dealing with the current epidemic will require a major change in society's recognition of media exposure as a major risk factor for obesity and in young people's media habits and the advertisements to which they are exposed.[107,108]

RECOMMENDATIONS

1. Pediatricians should ask parents and patients 2 key questions about media use: (1) How much time per day does the child or teenager spend with screen media? and (2) Is there a TV set or unrestricted,

unmonitored Internet connection throughout the house, including in the child's bedroom?[109] This recommendation should be incorporated into every well-child visit, as outlined in *Bright Futures*.[110]

2. Pediatricians should encourage parents to discuss food advertising with their children as they monitor children's TV-viewing and teach their children about appropriate nutrition.[111–113]
3. Pediatricians should continue to counsel parents to limit total noneducational screen time to no more than 2 hours/day, to avoid putting TV sets and Internet connections in children's bedrooms, to coview with their children, to limit nighttime screen media use to improve children's sleep, and to try strongly to avoid screen exposure for infants under the age of 2 years. In a recent study of 709 7- to 12-year-olds, children who did not adhere to the American Academy of Pediatrics guidelines of less than 2 hours/day of screen time[114] and 11 000 to 13 000 pedometer steps per day were 3 to 4 times more likely to be overweight.[115] Conversely, preschool-aged children who ate dinner with their parents, got adequate sleep, and had limited screen-time hours had a 40% lower prevalence of obesity than those exposed to none of these routines.[116]
4. Pediatricians should work with community groups and schools to implement media education programs in child care centers, schools, and community-based programs such as the YMCA. Such programs that teach children how to understand and interpret advertisements may have the potential to immunize young people against harmful media effects.[117] In addition, programs that educate parents about limiting media use in general have already been shown to be highly effective.[8,38,39,118,119] Pediatricians should work with their state chapters, the AAP, parent and public health groups, and the White House[120] to do the following:

- Ask Congress, the Federal Trade Commission, and the Federal Communications Commission to implement a ban on junk-food advertising during programming that is viewed predominantly by young children.[84,121,122] Currently, several European countries restrict food advertising aimed at young children.[123] Several food manufacturers have already indicated a willingness to implement such a ban voluntarily,[124,125] but it remains to be seen whether they will follow through.[126–128] For example, children's cereals remain considerably unhealthier than adult cereals; they contain 85% more sugar, 65% less fiber, and 60% more sodium.[129] One-quarter of all food and beverage advertising originates from companies that do not participate in the initiative, and two-thirds of all advertising by companies that do participate is still for food and beverages of low nutritional value.[85] In addition, the food and beverage industry remains steadfastly opposed to any regulation. For example, in 2007, 1 soft drink company spent more than $1.7 million to lobby against marketing restrictions and school nutrition legislation.[130] Two recent studies showed that a ban on fast-food ads would reduce the number of overweight children and adolescents in the United States by an estimated 14% to 18%.[131,132] Just eliminating federal tax deductions for fast-food ads that target children would reduce childhood obesity by 5% to 7%.[131] On the other hand, advertisements and public service announcements for health foods and healthy nutritional practices should be encouraged. One recent experiment showed that children exposed to attractive advertisements for healthy foods develop significantly more positive attitudes than children shown junk-food ads.[133]
- Ask Congress and the Federal Communications Commission to prohibit interactive advertising involving junk food or fast food to children via digital TV, cell phones, and other media[79–81,121] and to ban payments for product placement in movies. Restoring power to the Federal Trade Commission to more tightly regulate children's advertising could be another way of accomplishing this goal.[84,134,135]
- Ask Congress to fund media research (eg, the Children Media Research and Advancement Act [CAMRA]). More research is specifically needed to determine (1) how heavy media use in children reflects or contributes to psychosocial elements of the child's life, such as stress in the home, (2) how new media technologies may be playing a role in exacerbating exposure to ads or encouraging more sedentary behavior, and (3) which of the above-mentioned mechanisms is most responsible for contributing to obesity and how such mechanisms can be ameliorated.[83,134]
- Encourage the production of more counteradvertising and more prosocial video games[136,137] and Web sites that encourage

children to choose healthy foods.[82]

6. Pediatricians should be aware that children with high levels of screen time have higher levels of childhood stress, which puts them at risk not only for obesity but also for a number of stress-associated morbidities (eg, mood disorders, substance abuse, diabetes, cardiovascular disease, asthma).[138] Consequently, displacing screen time with more prosocial or resilience-building activities (eg, exercise, imaginative or social play) is an important approach to addressing a wide array of societal ills including obesity.[139]

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ERRATA

Policy Statement—Children, Adolescents, Obesity, and the Media. *Pediatrics*. 2011;128(1):201–208

An error occurred in the American Academy of Pediatrics policy statement "Children, Adolescents, Obesity, and the Media" originally published online June 27, 2011 and published in the July 2011 issue of *Pediatrics* (2011;128:201–208; DOI: 10.1542/peds.2011-1066). On page 204, middle column, third line, a new Recommendation No. 5 should have begun at "Pediatricians should work with their state chapters, the AAP, parent and public health groups, and the White House[120] to do the following:" and included all four subsequent bulleted paragraphs. We regret the error.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Children, Adolescents, Substance Abuse, and the Media

THE COUNCIL ON COMMUNICATIONS AND MEDIA

KEY WORDS
adolescence, substance use, alcohol, tobacco, cigarettes, illicit drugs, TV, movies, Internet

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abstract

The causes of adolescent substance use are multifactorial, but the media can play a key role. Tobacco and alcohol represent the 2 most significant drug threats to adolescents. More than $25 billion per year is spent on advertising for tobacco, alcohol, and prescription drugs, and such advertising has been shown to be effective. Digital media are increasingly being used to advertise drugs. In addition, exposure to PG-13– and R-rated movies at an early age may be a major factor in the onset of adolescent tobacco and alcohol use. The American Academy of Pediatrics recommends a ban on all tobacco advertising in all media, limitations on alcohol advertising, avoiding exposure of young children to substance-related (tobacco, alcohol, prescription drugs, illegal drugs) content on television and in PG-13– and R-rated movies, incorporating the topic of advertising and media into all substance abuse–prevention programs, and implementing media education programs in the classroom. *Pediatrics* 2010;126:791–799

INTRODUCTION

Although parents, schools, and the federal government are trying to get children and teenagers to "just say no" to drugs, more than $25 billion worth of cigarette, alcohol, and prescription drug advertising is effectively working to get them to "just say yes" to smoking, drinking, and other drugs.[1,2] In addition, television programs and movies contain appreciable amounts of substance use. Unlike traditional advertising, media depictions of legal drugs are generally positive and invite no criticism, because they are not viewed as advertising.[3] The result is that young people receive mixed messages about substance use, and the media contribute significantly to the risk that young people will engage in substance use.

ADOLESCENT DRUG USE

Although illegal drugs take their toll on American society, 2 legal drugs—alcohol and tobacco—pose perhaps the greatest danger to children and teenagers. Both represent significant gateway drugs and are among the earliest drugs used by children or teenagers. A preadolescent or adolescent who smokes tobacco or drinks alcohol is 65 times more likely to use marijuana, for example, than someone who abstains.[4] The younger the age at which experimentation occurs, the greater the risk of serious health problems.[5] Every year, more than 400 000 Americans die from illnesses directly related to cigarette use—more than from AIDS, car crashes, murder, and suicide combined.[6] More than 100 000 deaths annually can be attributed to exces-

sive alcohol consumption,[7] including the death of 5000 people younger than 21 years.[8] Drug use also represents one of many risky behaviors that occur during adolescence: teenagers who report that at least half of their friends are sexually active are 31 times more likely to drink, 5 times more likely to smoke, and 22 times more likely to try marijuana than are teenagers who do not report such a high prevalence of sexual activity among friends.[9]

EFFECTS OF ADVERTISING

The power of advertising to influence children and adolescents (and adults, for that matter) is incontrovertible.[1,10] Advertising works; otherwise, companies would not spend billions of dollars on it.[1] Many ads use celebrity endorsers, humor, rock music, or attractive young models, all of which have been shown to be effective with children and adolescents.[11] Advertising makes smoking and drinking seem like normative activities and may function as a "superpeer" in subtly pressuring teenagers to experiment.[12] Research has revealed that advertising may be responsible for up to 30% of adolescent tobacco and alcohol use.[13,14]

Cigarettes

More money is spent advertising tobacco than any drug—an estimated $15 billion per year,[15] almost half of what the National Institutes of Health spends each year to study all aspects of health (www.nih.gov/about/budget.htm). The tobacco industry (often referred to as "Big Tobacco") has engaged in a systematic campaign to attract underage smokers for decades and then lied to Congress about it.[16–19] Given the demographics of smoking (1200 deaths per day, half of which are of middle-aged adults; 50% of smokers begin by 13 years of age, and 90% of smokers begin by 19 years of age), the industry must recruit young people as smokers.[20] Recent statistics show that they continue to succeed. According to the 2009 Monitoring the Future study, nearly half of all teenagers have tried smoking, as have 20% of all 8th-graders.[21] Cigarette advertising seems to increase teenagers' risk of smoking by glamorizing smoking and smokers.[3,20] Smokers are depicted as young, independent, rebellious, healthy, and adventurous. By contrast, the adverse consequences of smoking are never shown. As a result, the US Surgeon General concluded in 1994 that cigarette advertising increases young people's risk of smoking.[20]

The most heavily advertised brands of cigarettes are also the most popular.[22] Tobacco advertising may even trump strong parenting practices.[23] Teen magazines have attracted an increasing number of cigarette ads since 1965.[24–26] Numerous studies have revealed that children or teenagers who pay closer attention to cigarette ads, who are able to recall such ads more easily, or who own promotional items are more likely to become smokers themselves.[27–31] Joe Camel single-handedly increased the market share for Camel cigarettes from 0.5% of adolescent smokers to 32%.[32] A recent meta-analysis of 51 separate studies revealed that exposure to tobacco marketing and advertising more than doubles the risk of a teenager beginning to smoke.[33]

Alcohol

Approximately $6 billion is spent annually on alcohol advertising and promotion.[34] Similar to tobacco ads, beer commercials are virtually custom-made to appeal to children and adolescents, using images of fun-loving, sexy, successful young people having the time of their lives.[3,35,36] Unlike tobacco advertising, alcohol advertising faces few restrictions. For example, whereas the tobacco industry gave up television advertising in the 1960s, beer, wine, and liquor ads are frequently featured on prime-time television, and young people view 1000 to 2000 alcohol ads annually.[12,37] Much of the advertising is concentrated during teen-oriented shows and sports programming. All of the top-15 teen-oriented shows contain alcohol ads.[38] Currently, teenagers are 400 times more likely to see an alcohol ad than to see a public service announcement (PSA) that discourages underage drinking.[39] Teen-oriented magazines contain 48% more advertising for beer, 20% more advertising for hard liquor, and 92% more advertising for sweet alcoholic drinks than do magazines aimed at adults of legal drinking age.[40,41]

According to the research, the effects of all of this advertising are increasingly clear.[3,42,43] A sample of 9- to 10-year-olds could identify the Budweiser frogs nearly as frequently as they could Bugs Bunny.[44] In a study of more than 3500 South Dakota students, 75% of 4th-graders and nearly 90% of 9th-graders recognized the Budweiser ferret ad.[45] Many studies have revealed that exposure to alcohol advertising results in more positive beliefs about drinking and is predictive of drinking during early adolescence and young adulthood.[46–52] The results of several longitudinal studies have shown a similar trend,[53,54] although they have sometimes been mixed.[48]

Prescription Drugs

Nearly $4 billion is spent annually on prescription drug advertising.[55] Drug companies now spend more than twice as much money on marketing as they do on research and development, and studies have revealed that the marketing efforts pay off[56]: results of a recent survey of physicians showed that 92% of patients had requested an advertised drug.[57] Children and teenagers get the message that there is a pill to cure all ills and a drug for every

occasion, including sexual intercourse. In the first 10 months of 2004, drugs companies spent nearly half a billion dollars advertising Viagra, Levitra, and Cialis.[58] Yet, the advertising of condoms, birth control pills, and emergency contraception is haphazard and rare and remains controversial.[1,59]

DRUGS IN ENTERTAINMENT MEDIA

Cigarettes

Scenes with smoking remain common in movies and, to a lesser extent, on prime-time television. Hollywood seems to use smoking as a shorthand for troubled or antiestablishment characters, but the smoking status of the actors themselves is also influential in whether their characters will smoke on-screen.[60] On prime-time television, 19% of shows portray tobacco use, and approximately one-fourth of them depict negative statements about smoking.[61] In addition, smoking is also found in nearly one-fourth of all music videos,[62] one-fourth of ads for R-rated movies, and 7.5% of ads for PG-13 and PG movies.[63]

Box-office movies and their subsequent video and pay-per-view distribution have become a major route of exposure to tobacco use. Although the most recent analyses show that smoking has decreased in popular movies,[64,65] the occurrence remains high. A content analysis of the top 100 box-office hits between 1996 and 2004 revealed that tobacco use was depicted in three-quarters of G-, PG-, and PG-13–rated movies and in 90% of R-rated movies.[66] Half of all G-rated animated films between 1937 and 1997 contained tobacco use.[67] Although the most recent content analysis of top-grossing movies between 1991 and 2009 showed that tobacco use peaked in 2003 and has since declined, in 2009, more than half of PG-13 movies still contained tobacco use.[65] But overall, the percentage of all top-grossing movies without smoking exceeded 50% for the first time in 2009.[65]

Unique longitudinal research has revealed that one of the most important factors in the onset of adolescent substance use is exposure to others who use drugs.[68] Nowhere is that exposure greater than on contemporary movie screens, and teenagers constitute 26% of the movie-going audience (but only 16% of the US population).[69] Results of a number of correlational and longitudinal studies have confirmed that exposure to television and movie smoking is now one of the key factors that prompt teenagers to smoke.[29,70–77] According to a new meta-analysis, it may account for nearly half of smoking initiation in young teenagers.[80] In fact, exposure to movie smoking may even trump parents' smoking status as being the key factor in adolescents' initiation of smoking.[73] A prospective study of more than 3500 teenagers revealed that exposure to R-rated movies doubles the risk of smoking, even when controlling for all other known factors.[79] Preadolescents whose parents forbid them from seeing R-rated movies are less likely to begin smoking (or drinking).[80] A study of 735 12- to 14-year-olds, with a 2-year follow-up, revealed that exposure to R-rated movies or having a television in the bedroom significantly increased the risk of smoking initiation for white teenagers.[81] The movie effect seems not to be confined to US teenagers but applies also to teenagers from other countries as well.[82,83]

Alcohol

Alcohol remains the number one drug portrayed on American television: 1 drinking scene is shown every 22 minutes, compared with 1 smoking scene every 57 minutes and 1 illicit drug use scene every 112 minutes.[84] On Music Television (MTV), teenagers can see alcohol use every 14 minutes. An analysis revealed that drugs were present in nearly half of 359 music videos—alcohol in 35%, tobacco in 10%, and illicit drugs in 13%.[85] On prime-time television, 70% of programs depict alcohol use.[61] More than one-third of the drinking scenes are humorous, and negative consequences are shown in only 23%. One study revealed that alcohol portrayals are as common on shows for 9- to 14-year-olds as on adult-oriented shows.[86] In popular music, the average teenager is exposed to nearly 85 drug references a day, the majority of which are for alcohol.[87] Popular movies are nearly equally rife with alcohol, with only 2 of the 40 highest-grossing movies not containing alcohol depictions.[88] Even G- and PG-rated movies contain frequent references to alcohol.[89,90] And, drinking is frequently depicted as normative behavior, even for teenagers.[91]

Again, the impact is increasingly clear from the research. A longitudinal study of more than 1500 California 9th-graders revealed that increased television and music video viewing was a risk factor for the onset of alcohol use among adolescents.[92] Results of a Columbia University study showed that teenagers who watch more than 3 R-rated films per month are 5 times more likely to drink alcohol compared with teenagers who watch none.[93] Also, in an intriguing study of 2- to 6-year-olds ($n = 120$) who were asked to role-play in a make-believe store, children were 5 times more likely to "buy" beer or wine if they had been allowed to see PG-13 or R-rated movies.[94] Finally, good longitudinal evidence is emerging to indicate that watching more movie depictions of alcohol is strongly predictive of drinking onset and binge drinking in US adolescents,[86,95,96] and the same results are being found for adolescents from other countries.[82,97]

Illegal Drugs

Illicit drugs are rarely seen on television,[61] with the exception of programs such as Showtime's *Weeds* and Fox's *That 70s Show*. Drug scenes are more common in movies (22% of the movies in 1 study contained drug scenes), and no harmful consequences are shown more than half of the time.[90] Marijuana is the most frequent drug seen in movies and seems to be making a comeback in R-rated movies such as *Harold and Kumar Go to White Castle* (2004) and *The Pineapple Express* (2008).[98] A Columbia study revealed that viewing R-rated movies was associated with a sixfold increased risk of trying marijuana.[93] Hollywood filmmakers do not seem to understand that humor tends to undermine normal adolescent defenses against drugs and legitimizes their use.[3] Increased consumption of popular music is also associated with marijuana use.[95,99]

NEW MEDIA

The new technologies—the Internet, social networking sites, and even cellular phones—offer new and problematic opportunities for adolescent drug exposure.[3,100] A variety of Web sites sell tobacco products, and few of them have effective age-verification procedures.[3,101] One national survey of more than 1000 youths 14 to 20 years of age revealed that 2% reported having purchased alcohol online, and 12% reported having a friend who did so.[102] Prescription drugs can also be purchased online with minimal difficulty. Popular beer brands use "advergames" online to entice a younger audience.[103] Teenagers also see considerable alcohol and drug content in online videos[104] and on social networking sites,[105] on which 1 study revealed that 40% of profiles referenced substance abuse.[106]

SUMMARY

The so-called war on drugs has been waged for decades, yet teenagers continue to use and abuse a variety of substances, especially tobacco and alcohol. The contribution of the media to adolescent substance use is only recently becoming fully recognized and appreciated. The Master Settlement Agreement has greatly restricted tobacco marketing by the tobacco companies that signed the agreement. However, tobacco continues to appear frequently in movies, and this fact contrasts markedly with US reality (approximately half of the US population lives in a community with restrictions on indoor smoking). Moreover, the case is strong for the argument that smoking shown in entertainment media plays a causal role in smoking onset. Certainly, it is time to eliminate all tobacco advertising and to decrease greatly the depiction of smoking in mainstream media. Because alcohol use is still condoned in many venues and use in moderation may be healthful for adults, such severe restrictions on alcohol advertising and programming may not be indicated. On the other hand, underage alcohol use does pose a clear and immediate threat to the teenagers who use it. Taken together, the evidence supports strong actions aimed at the entertainment industry about media depictions of tobacco use and strong actions aimed at motivating and assisting parents of children and young teenagers to restrict access to adult media venues with excessive substance use exposure.

Anticipatory Guidance by Pediatricians

1. Pediatricians should encourage parents to limit unsupervised media use and especially encourage removal of televisions from children's bedrooms. At every well-child visit, pediatricians should be asking at least 2 questions regarding media use: (*a*) How much entertainment media per day is the child or adolescent watching? and (*b*) Is there a television set or Internet access in the child's or adolescent's bedroom?[107] Research has revealed that having a television in the bedroom is associated with greater substance use and sexual activity in teenagers.[108]
2. Pediatricians should encourage parents to limit access by children and young adolescents to television venues with excessive substance use depictions (eg, MTV, HBO, Showtime, Comedy Central).
3. Pediatricians should encourage parents to limit younger children's exposure to PG-13 movies and avoid R-rated movies.[29,75–81,109]
4. Pediatricians should encourage parents to co-view media with their children and teenagers and discuss the content being viewed.
5. Pediatricians should encourage parents to turn off the television during evening meals.
6. Pediatricians should ensure that their waiting rooms are free of magazines that accept cigarette and alcohol advertising.

Community Advocacy by Pediatricians

7. Pediatricians should encourage their local school systems to incorporate media education into their curricula. In particular, drug-prevention programs should use basic principles of media literacy, designed to imbue skepticism toward media advertising. Currently, Drug Abuse Resistance Education (DARE) does not accomplish this goal, nor is there any evidence that DARE is effective.[12,110] More psychologically sophisticated drug-prevention cur-

ricula are available and should be used.[110–113]

Legislative Advocacy by Pediatricians

8. Pediatricians should encourage Congress to ban tobacco advertising in all media accessible to children, which several European countries have already done. Such a ban would seem to be constitutional, given that the US Supreme Court has already ruled that commercial speech does not enjoy the absolute First Amendment protections that free speech does.[114] Recently, Congress gave the Food and Drug Administration the authority to regulate tobacco products; however, the tobacco industry is expected to challenge any advertising bans.[115,116]
9. Pediatricians should encourage Congress to require the alcohol industry to report its annual expenditures to the Federal Trade Commission, including expenditures for media venues in which children and adolescents represent more than 10% of the market share (currently, voluntary advertising restrictions allow for venues in which up to 30% of the audience is children).
10. Pediatricians should encourage the alcohol industry to restrict advertising and product placement in venues in which more than 10% of the audience is children and adolescents.
11. Pediatricians should encourage the White House Office of National Drug Control Policy to begin conducting antismoking and anti–teen-drinking public service campaigns, including strong antismoking and antidrinking ads to be placed before television programming and movies that have youth ratings and contain alcohol and tobacco depictions.
12. Pediatricians should encourage allocation of more money in media research, given the importance of the media on the development and behavior of children and adolescents. Higher taxes on tobacco products and alcohol could be used to fund such research.
13. Pediatricians should encourage Congress to pass new strict laws regulating digital advertising that targets children and adolescents.[100,117]

Involvement of the Alcoholic Beverage, Tobacco, Drug, and Entertainment Industries in Encouraging Responsible Behavior

14. Pediatricians should encourage the advertising industry, drug companies, public health groups, and medical groups to have a full and open debate on the necessity of advertising prescription drugs. In addition, ads for erectile dysfunction drugs should be confined to after 10 PM in all time zones and should not be overly suggestive.[1]
15. Pediatricians should encourage the entertainment industry to have greater sensitivity about the effects of television and movies on children and adolescents and accept that the industry does, indeed, have a public health responsibility.[118] Cigarette smoking in movies should be avoided at all costs and should never be glamorized.[119,120] Disney has already promised to eliminate smoking in its movies.[121] Making film sets smoke-free zones would go far to diminish the portrayal of smoking in movies and would protect actors and actresses from secondhand smoke. Antismoking ads should precede the showing of any film that has tobacco use depicted.[119] Alcohol use should not be portrayed as normative behavior for teenagers, and the traditional depiction of the "funny drunk" should be retired. Television networks that have a large adolescent viewership should air public service ads about the dangers of smoking and drinking. Finally, the Motion Picture Association of America (MPAA) ratings need to be amended so that tobacco use will routinely garner an R rating in all new movies unless the risks and consequences of smoking are unambiguously shown or the depiction is necessary to represent a real historical figure who actually used tobacco.[119] So far, the MPAA has only agreed to consider smoking as a factor in assigning a rating.[122,123]
16. Pediatricians should encourage state and federal agencies, the entertainment industry, and the advertising industry to develop and maintain vigorous anti–drug-advertising campaigns that focus on the 2 drugs most dangerous to adolescents—tobacco and alcohol—in addition to illegal drugs. Antidrug ads have been shown to be highly effective at times (eg, the Truth campaign),[124–129] but the effectiveness of the National Youth Anti-Drug Media Campaign has been questioned.[130] Recently, and laudably, 6 major Hollywood studios have agreed to place antismoking ads on new movie DVDs that appeal to children.[131,132]
17. Pediatricians should work with and support the American Academy of Pediatrics Julius Richmond Center of Excellence (www.aap.org/richmondcenter), the mission of which is "to improve child health by eliminating children's exposure to tobacco and secondhand smoke," including through media exposure.[119]

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Public Education

Children, Adolescents, and Television

ABSTRACT. This statement describes the possible negative health effects of television viewing on children and adolescents, such as violent or aggressive behavior, substance use, sexual activity, obesity, poor body image, and decreased school performance. In addition to the television ratings system and the v-chip (electronic device to block programming), media education is an effective approach to mitigating these potential problems. The American Academy of Pediatrics offers a list of recommendations on this issue for pediatricians and for parents, the federal government, and the entertainment industry.

ABBREVIATIONS. AAP, American Academy of Pediatrics; MTV, Music Television; E/I, educational/informational.

For the past 15 years, the American Academy of Pediatrics (AAP) has expressed its concerns about the amount of time children and adolescents spend viewing television and the content of what they view.[1] According to recent Nielsen Media Research data, the average child or adolescent watches an average of nearly 3 hours of television per day.[2] This figure does not include time spent watching videotapes or playing video games[3] (a 1999 study found that children spend an average of 6 hours 32 minutes per day with various media combined).[4] By the time the average person reaches age 70, he or she will have spent the equivalent of 7 to 10 years watching television.[5] One recent study found that 32% of 2- to 7-year-olds and 65% of 8- to 18-year-olds have television sets in their bedrooms.[4] Time spent with various media may displace other more active and meaningful pursuits, such as reading, exercising, or playing with friends.

Although there are potential benefits from viewing some television shows, such as the promotion of positive aspects of social behavior (eg, sharing, manners, and cooperation), many negative health effects also can result. Children and adolescents are particularly vulnerable to the messages conveyed through television, which influence their perceptions and behaviors.[6] Many younger children cannot discriminate between what they see and what is real. Research has shown primary negative health effects on violence and aggressive behavior[7–12]; sexuality[7,13–15]; academic performance[16]; body concept and self-image[17–19]; nutrition, dieting, and obesity[17,20,21]; and substance use and abuse patterns.[7]

In the scientific literature on media violence, the connection of media violence to real-life aggressive behavior and violence has been substantiated.[8–12] As much as 10% to 20% of real-life violence may be attributable to media violence.[22] The recently completed 3-year National Television Violence Study found the following: 1) nearly two thirds of all programming contains violence; 2) children's shows contain the most violence; 3) portrayals of violence are usually glamorized; and 4) perpetrators often go unpunished.[23] A recent comprehensive analysis of music videos found that nearly one fourth of all Music Television (MTV) videos portray overt violence and depict weapon carrying.[24] Research has shown that even television news can traumatize children or lead to nightmares.[25] In a random survey of parents with children in kindergarten through sixth grade, 37% reported that their child had been frightened or upset by a television story in the preceding year.[26]

According to a recent content analysis, mainstream television programming contains large numbers of references to cigarettes, alcohol, and illicit drugs.[27] One fourth of all MTV videos contain alcohol or tobacco use.[28] A longitudinal study found a positive correlation between television and music video viewing and alcohol consumption among teens.[29] Finally, content analyses show that children and teenagers continue to be bombarded with sexual imagery and innuendoes in programming and advertising.[14,30,31] To date, there are no data available to substantiate the behavioral impact of this exposure.[31]

The new television ratings system and the v-chip are tools that can help protect children from potentially harmful content. All new television sets with screens measuring 13 inches or greater contain a v-chip that enables parents to program televisions to block out any shows that they deem inappropriate for their children.[32] To block out television shows, parents must use the television ratings system, which has age and content descriptors for violence, sexual situations, suggestive dialogue, and adult language. Although the ratings system and the v-chip can assist parents, ongoing evaluation is necessary to ensure that these tools are as effective as possible.[33–35] For example, the ratings should be applied uniformly and listed in television guides, newspapers, and journals so parents know what they mean.

Besides the v-chip, there are other means of protecting children from what is on television. Evidence

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

now shows that media education can help mitigate the harmful effects of media violence[36–40] and alcohol advertising[41,42] on children and adolescents. Media education programs have been included in the school curricula beginning in early elementary school in many states across the United States.[43]

Furthermore, continued support of the Children's Television Act of 1990[44] and additional regulations made in 1996[45] will help to ensure the airing of television programs specifically designated for children. The act requires broadcasters to air educational and informational programming for children at least 3 hours per week and to limit the amount of advertising time allowed during children's programming. The shows must be labeled E/I (for educational and informational) on the television screen.

RECOMMENDATIONS

The following recommendations are given for pediatricians and other health care professionals:

1. Remain knowledgeable about the effects of television, including violent and aggressive behavior, obesity, poor body concept and self-image, substance use, and early sexual activity, by becoming involved in the AAP *Media Matters* campaign.[46] Educate patients and their parents about these effects.
2. Use the AAP *Media History* form[46] to help parents recognize the extent of their children's media consumption.
3. Work with local schools to implement comprehensive media-education programs that deal with important public health issues.[36]
4. Serve as good role models by using television appropriately and by implementing reading programs using volunteer readers in waiting rooms and hospital inpatient units.
5. Become involved in the AAP's Media Resource Team (contact the Division of Public Education), and learn how to work effectively with writers, directors, and producers to make media more appropriate for children and adolescents. Contact networks and producers of television programs with concerns about the content of specific shows and episodes.
6. Ensure that appropriate entertainment options are available for hospitalized children and adolescents. Work with child life staff to assemble a screening committee that selects programs for closed circuit broadcast or a video library. Develop institution-specific, formal guidelines based on the established ratings system (which takes profanity, sex, and violence into account), and screen for content containing ethnic and sex role stereotyping. Considerations should also be made to avoid themes hospitalized children might find upsetting, and efforts should be made to enforce the ratings system in the hospital setting.
7. Support the Children's Television Act of 1990 and its 1996 rules by working to ensure that local television stations are in compliance with the act and by urging local newspapers to list ratings and E/I denotations of programs.
8. Monitor the television ratings system for appropriateness and advocate for substantive, content-based ratings in the future.

Pediatricians should recommend the following guidelines for parents:

1. Limit children's total media time (with entertainment media) to no more than 1 to 2 hours of quality programming per day.
2. Remove television sets from children's bedrooms.
3. Discourage television viewing for children younger than 2 years, and encourage more interactive activities that will promote proper brain development, such as talking, playing, singing, and reading together.
4. Monitor the shows children and adolescents are viewing. Most programs should be informational, educational, and nonviolent.
5. View television programs along with children, and discuss the content. Two recent surveys involving a total of nearly 1500 parents found that less than half of parents reported always watching television with their children.[5,47]
6. Use controversial programming as a stepping-off point to initiate discussions about family values, violence, sex and sexuality, and drugs.
7. Use the videocassette recorder wisely to show or record high-quality, educational programming for children.
8. Support efforts to establish comprehensive media-education programs in schools.
9. Encourage alternative entertainment for children, including reading, athletics, hobbies, and creative play.

Pediatricians should lead efforts in their communities to do the following:

1. Form coalitions including libraries, religious organizations, and other community groups to broaden media education beyond the schools.
2. Organize activities promoting media education, such as letter-writing campaigns to local television stations to advocate for better programming for children, and developing local TV turnoff week projects.[48]

Pediatricians should work with the Academy and local chapters to challenge the federal government to do the following:

1. Initiate legislation and rules that would ban alcohol advertising from television.
2. Fund ongoing annual research, such as the National Television Violence Study, and fund more research on the effects of television on children and adolescents, particularly in the area of sex and sexuality.
3. Assemble a *National Institutes of Health Comprehensive Report on Children, Adolescents, and Media* that would bring together all of the current relevant research.
4. Work with the US Department of Education to support the creation and implementation of media-education curricula for school children.

Pediatricians should work with the Academy and local chapters to challenge the entertainment industry to do the following:

1. Take responsibility for the programming it produces.
2. Adhere to the current television ratings system, and label programs conscientiously.
3. Collaborate with other public health advocates to convene a series of seminars with writers, directors, and producers to discuss ways to make media more appropriate for children and adolescents.
4. Produce more educational programming for children and adolescents, and ensure that the programming it produces is of higher quality, with less content that is gratuitously violent, sexually suggestive, or drug oriented.

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ADDENDUM

A policy statement on "Developmental Anomalies of the External Genitalia in the Newborn" has recently been published (*Pediatrics*. 2000;106:138–142). The purpose of this review is to identify which newborns among those with abnormal genital development need to be screened for intersexuality, to outline the investigations necessary, and to suggest indications for referral to a center with experience in the diagnosis and management of these disorders.

The 1996 policy on Timing of Elective Surgery states that "children whose genetic sexes are not clearly reflected in external genitalia (ie, hermaphroditism) can be raised successfully as members of either sex if the process begins before the age of 2 years" [see the heading under Body Image and Sexual Development]. The 2000 policy on Developmental Anomalies of the External Genitalia acknowledges the considerable recent debate about the appropriate gender assignment of newborns with the most extreme forms of genital ambiguity, and notes that some have suggested that the current early surgical treatment be abandoned in favor of allowing the affected person to participate in gender assignment at a later time.

This controversy about gender reassignment does not invalidate the other recommendations about the timing of elective surgery on the genitalia of male children with particular reference to the risks, benefits, and psychological effects of surgery and anesthesia that are present in the 1996 statement.

American Academy of Pediatrics
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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Children as Hematopoietic Stem Cell Donors

abstract

In the past half-century, hematopoietic stem cell transplantation has become standard treatment for a variety of diseases in children and adults, including selected hematologic malignancies, immunodeficiencies, hemoglobinopathies, bone marrow failure syndromes, and congenital metabolic disorders. There are 3 sources of allogeneic hematopoietic stem cells: bone marrow, peripheral blood, and umbilical cord blood; each has its own benefits and risks. Children often serve as hematopoietic stem cell donors, most commonly for their siblings. HLA-matched biological siblings are generally preferred as donors because of reduced risks of transplant-related complications as compared with unrelated donors. This statement includes a discussion of the ethical considerations regarding minors serving as stem cell donors, using the traditional benefit/burden calculation from the perspectives of both the donor and the recipient. The statement also includes an examination of the circumstances under which a minor may ethically participate as a hematopoietic stem cell donor, how the risks can be minimized, what the informed-consent process should entail, the role for a donor advocate (or some similar mechanism), and other ethical concerns. The American Academy of Pediatrics holds that minors can ethically serve as stem cell donors when specific criteria are fulfilled. *Pediatrics* 2010;125:392–404

COMMITTEE ON BIOETHICS

KEY WORDS

stem cell donors, hematopoietic stem cell transplantation, psychosocial risks, child, adolescent, siblings, cord blood transplants

ABBREVIATIONS

HSCT—hematopoietic stem cell transplantation
GVHD—graft-versus-host disease
AAP—American Academy of Pediatrics
G-CSF—granulocyte colony-stimulating factor
IVF—in vitro fertilization
PGD—preimplantation genetic diagnosis
IRB—institutional review board
FDA—Food and Drug Administration
CIRB—Central Institutional Review Board

INTRODUCTION

In the past half-century, allogeneic hematopoietic stem cell transplantation (HSCT) has become standard treatment for a variety of conditions in children and adults, including selected hematologic malignancies, immunodeficiencies, hemoglobinopathies, bone marrow failure syndromes, and congenital metabolic disorders. There are 3 sources of allogeneic hematopoietic stem cells: bone marrow, peripheral blood, and umbilical cord blood.

The ideal allogeneic hematopoietic donor matches the recipient at the major HLA sites; that is, the donor and recipient are identical at the major histocompatibility complex sites. HLA-matched biological siblings are generally preferred as donors by physicians who perform transplants because of reduced risks of graft-versus-host disease (GVHD) and other transplant-related complications as compared with unrelated donors.[1–3]

When an HLA-matched sibling is not available, those in need of HSCT sometimes cannot find an HLA-matched donor despite the listing of more than 7 million living adult persons on the National Marrow Donor

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Program registry and 6 million additional donors and cord blood units in other registries around the world.[4] This is particularly true for members of ethnic minority groups.[5–7]

When the potential recipient is a child, potential sibling donors may be children themselves. In rare cases, children may also be considered as potential donors for an adult sibling, parent, or other family member.

The American Academy of Pediatrics (AAP) believes that minors can ethically participate as hematopoietic stem cell donors. This statement includes a discussion of the ethical considerations regarding minors serving as stem cell donors using the traditional benefit/burden calculation from the perspectives of both the donor and the recipient. This statement also includes an examination of the circumstances under which a minor can ethically participate as a hematopoietic stem cell donor, how the risks can be minimized, what the informed-consent process should entail, and other ethical concerns.

SOURCES OF HEMATOPOIETIC STEM CELLS

The first successful bone marrow transplant occurred in 1963.[8] The patient was a 26-year-old physician with relapsed acute lymphoblastic leukemia that was refractory to chemotherapy. He received bone marrow from 6 family members, although it was shown that his bone marrow was mainly repopulated by cells from 1 brother, with some female cells present. The first successful pediatric bone marrow transplants occurred 5 years later in 1968 for children with severe combined immunodeficiency (SCID) and Wiskott-Aldrich diseases.[9,10] In 1973, the first successful unrelated bone marrow transplant for a 5-year-old with SCID was performed in the United States with an adult European donor.[11]

Gianni et al[12] described the collection of peripheral blood stem cells using granulocyte colony-stimulating factor (G-CSF), a growth factor that stimulates mobilization of bone marrow stem cells into the peripheral blood, in 1989. G-CSF–mobilized peripheral blood stem cells were first used for autologous transplantation; their use was subsequently expanded to include allogeneic transplantation.[13] More recently, some adult bone marrow donors have received G-CSF because stimulated bone marrow is richer in stem cells and, therefore, induces a quicker engraftment.[14–16] Experience with G-CSF–mobilized bone marrow in pediatrics is limited, although a phase 3 trial is in process.[17]

The use of cord blood for allogeneic stem cell transplantation began in 1988 with the successful umbilical cord blood transplantation from an HLA-matched sibling to a patient with Fanconi anemia.[18] In 1998, the Children's Hospital of Oakland, with the support of the National Heart, Lung, and Blood Institute, created a sibling-donor cord blood program that collects, characterizes, stores, and releases cord blood units from families with children who are affected by conditions that may require HSCT.[19] Today, that program continues in collaboration with Viacord.[20]

Even before the establishment of the sibling-donor cord blood program, families have gone to great measures to conceive an HLA-matched child when an HLA-matched sibling did not exist to obtain umbilical cord blood for transplantation. In 1990, Abe and Mary Ayala became the first successful publicized case in which a family sought to conceive a child (Marissa) to save another child (Anissa).[21] Marissa's cord blood was stored for more than 1 year when additional stem cells were procured from her bone marrow to ensure an adequate number of cells.[22]

The movement to create siblings who can serve as HLA-matched donors has been aided by the development of in vitro fertilization (IVF) and preimplantation genetic diagnosis (PGD). In the first such reported case, cord blood was collected at the birth of Adam Nash, who was conceived using IVF and PGD for his sister Molly Nash, a 5-year-old with Fanconi anemia.[23]

The more common umbilical cord blood transplant, however, occurs not within families but between strangers through public cord blood banks. Public cord blood banks collect blood from the umbilical cords of newborn infants to be used as a source of hematopoietic stem cells for unknown pediatric and adult patients.[24] The National Marrow Donor Program lists 90 000 cord blood units donated by parents after their infant's birth,[4] and there are more than 359 000 cord blood units stored internationally,[25] with ongoing attempts to expand collection and storage and enhance ethnic diversity.[26] These public cord blood banks contrast with private cord blood registries that advertise to pregnant women and couples to encourage prospective parents to store their newborn infant's cord blood as a form of insurance in case their own child (or his or her siblings) will need a transplant.[27] To date, at least 1 child has benefited from her parents' decision,[28] but the likelihood of this occurring is quite low, and the collection and storage in private stem cell banks for families at low risk is discouraged by the AAP, the American Medical Association, the American College of Obstetrics and Gynecology, and the American Society for Blood and Marrow Transplantation.[29–32]

ETHICAL CONSIDERATIONS

Most pediatric physicians who perform transplants believe it is acceptable to expose minors to the risks of a

stem cell donation when that donation offers a substantial prospect of benefit to a close family member and when proper consent is obtained.[33] As detailed later in this statement, the risks to the minors who serve as stem cell donors can be characterized as more than minimal, but they are nonetheless generally modest, with few serious complications.[17,34–40] Although healthy children are restricted to a minimal risk threshold in research,[41] parents expose their children to greater risks in selected activities, such as when they permit their children to participate in certain athletic activities or in the workforce.[42–44] Furthermore, family members are often asked to assist each other, at times at personal cost to themselves.[45–47] Ethically, then, to determine if a stem cell donation by a minor is permissible, one must examine the risks and benefits from the perspective of the donor as well as the risks and benefits to the recipient and to his or her family.[45,48]

Risks and Benefits of Serving as a Hematopoietic Stem Cell Donor

Medical Risks and Benefits

There is no direct medical benefit from serving as a stem cell donor. The benefit is always stated as the psychosocial benefit of helping a sibling or other close family member[36] (discussed in the next section).

The medical risks of stem cell collection depend, in part, on its source and how it is collected. The medical risks of bone marrow collection from children and adults are similar, with the major risk being that of anesthesia, but other serious complications include nerve, bone, or tissue injury.[36] Between 9 and 11 deaths have been reported worldwide, for an estimated incidence of 1 death per 10 000 donations.[37] Two of these deaths were cardiac arrests before donation. Postdonation deaths were caused by cardiac events, respiratory arrest, pulmonary emboli, sickle cell crisis, and stroke.[37] Morbidity risks include blood loss and the potential need for transfusions, wound infection, and pain at the site of marrow aspiration.[35] Common short-term adverse effects associated with bone marrow donation include fatigue, pain at donation site, low back pain, headaches, nausea, difficulty walking, problems sleeping, and, less commonly, bleeding problems.[34,36] Long-term adverse effects are rare, but some donors experience chronic pain at the donation site.[34] Many donors are placed on iron supplementation after marrow collection, although smaller children who donate for larger recipients may require a blood transfusion after the donation procedure.[38]

To collect peripheral blood stem cells for hematopoietic donation, the donors receive G-CSF to increase the number of circulating stem cells. Preparation begins with 4 to 5 daily injections of G-CSF and is usually associated with bone pain. Although the bone pain is often described as the most uncomfortable part of the procedure in adults, the pain appears to be less in children. Stem cells are then collected through a process known as apheresis, which requires 2 large venous catheters. Most children younger than 12 years require central vascular access for apheresis; line placement may require either general anesthesia or conscious sedation.[39] Although complications are uncommon (1.1% overall for adults and children), many of the complications arise from the central venous catheter.[17]

Priming of the apheresis circuit with heterologous packed red blood cells is virtually universal for donors who weigh less than 20 kg.[39] This exposes the healthy donors to the risks of heterologous blood products. The donors may also develop thrombocytopenia, although the platelet count is rarely so low that it puts them at risk of bleeding. More than 5% of child donors receive platelet concentrates, particularly when the donor's platelet count decreases and subsequent days of collection are planned.[39]

To ensure that there is an adequate number of stem cells in the peripheral blood, donors require G-CSF mobilization. Some evidence suggests that the effects of G-CSF in healthy subjects may be more complex than originally thought. Although most G-CSF effects are thought to be transient and self-limited, preliminary data suggest that G-CSF affects not only myeloid cells but also chromosomal integrity and gene expression.[49] There is also the theoretic risk of potentially increasing the long-term risk of leukemia,[36,49] but to date, no clinical data support this concern.[50] Peripheral blood stem cell donors complain in the short-term of fatigue, low back pain, sleeping problems, lightheadedness, and difficulty walking.[34] Recovery time, however, is shorter than that for bone marrow donors.[36] Serious adverse events, including splenic rupture after G-CSF administration, have been reported[17,50]; however, to date, splenic rupture has not been described in children.[17]

A review by Pulsipher et al[51] of 2408 adult patients who donated peripheral blood stem cells through the National Marrow Donor Program revealed that severe events occurred in 15 donors (0.6%), the majority of whom required hospitalization for such medical issues as severe symptoms (nausea, chills, bone pain), severe chest pain, bleeding, and thrombocytopenia. In addition, 25 nonhematologic cancers and 1 case of chronic lymphocytic leukemia were reported. When compared with the expected cancer rates according to the National Cancer Institute's Surveillance Epidemiology and End Results database, there was no evidence of increased risk in the donor cohort.[51]

Although G-CSF is not approved for use in healthy children, data from the Pediatric Blood and Marrow Consortium have shown that approximately 23% of all matched sibling transplants use peripheral blood stem cells primed with G-CSF.[36] The most common adverse effects reported in children include pain and arthralgia, which increase with donor age.[36]

An analysis that compared the amount of pain from bone marrow aspiration with that from peripheral blood stem cell collection revealed that the severity of the pain was similar in adult siblings, although the type of pain differed. For bone marrow donors, the pain was at the site of aspiration, whereas for peripheral blood, the pain was bone pain attributable to marrow expansion related to G-CSF.

Finally, stem cells may be collected from cord blood. The collection of umbilical cord blood for hematopoietic stem cell donation occurs in the delivery room. Although one can modify the delivery to maximize the number of cells collected,[52] the Institute of Medicine and the American College of Obstetrics and Gynecology strongly discourage this practice.[52,53] If the mode of delivery is not modified, the collection poses no risks to the infant.[53] The number of umbilical cord stem cells that can be obtained may not be adequate if the recipient is large, and decisions may need to be made about collecting additional hematopoietic stem cells from the cord blood–donating child at a later date.

A major advantage of umbilical cord blood is that HLA-matching is less critical, because lymphocytes in cord blood are less immunologically reactive than are lymphocytes from older donors. This increases the utility of cord blood for unrelated donations, particularly for minority recipients, for whom identifying a fully matched unrelated donor may be difficult.[54] Even within related donor-recipient pairs, however, there is the advantage of a reduced likelihood of acute and chronic GVHD with umbilical cord blood transplants, compared with recipients of bone marrow transplants, even when in both cases the donors are HLA-identical siblings.[55] However, slower immunologic recovery and delayed engraftment may counterbalance some of the benefits of decreased GVHD.

Psychosocial Risks and Benefits

The primary benefit to the donor is the psychosocial benefit of helping a sibling or other close family member. This benefit may accrue even if the transplant is unsuccessful, because the donor and family can at least be reassured that the stem cell transplant was tried.

There is a small but growing literature on the psychosocial risks and harms caused by hematopoietic stem cell donation by children. Data show that many children experience distress related to their role as a donor. Many pediatric donors believe that they did not have a choice about whether to serve as a marrow donor, report being poorly prepared for the procedures, and describe feeling responsible for the recipient's course after transplantation.[56,57]

An important period of psychosocial risk follows the donation and the infusion of the stem cells into the recipient, because the recipient must then go into isolation for weeks to months, and 1 or both parents may be at the hospital for extended periods of time. Data show that many donors feel that they were inadequately prepared for what to expect after the infusion.[58–60] In addition, until engraftment occurs, donors often feel neglected, but this is also true of nondonor siblings. Careful psychological research, then, is necessary to separate the confounding effect of being a donor from that of having a sibling with a life-threatening illness.[36,61–63] That is, part of the distress may be attributable to having a very sick sibling who is the focus of the parents' attention,[62,63] regardless of whether one serves as a donor. Research is needed to compare the harms and benefits of being a sibling donor versus a sibling nondonor. The data that exist were based on small samples. A small study of donor and nondonor siblings revealed a trend toward increased behavioral problems exhibited by donor children when compared with nondonor siblings, which the authors speculated could have been the result of unmet emotional needs in donor siblings.[64] Nondonors, however, felt some envy toward donors who could contribute to the care of the ill sibling.[57] In 2 studies that compared experiences of nondonor siblings and successful donor siblings, one third of the siblings in each group reported a moderate level of posttraumatic stress.[65,66] In addition, donor siblings experienced higher levels of anxiety and lower self-esteem than did nondonor siblings, but donor siblings had more adaptive skills in school, whereas nondonor siblings had more school problems.[65,66] Both donors and nondonors reported loneliness and a lack of attention from parents.[65,66] It is not surprising that siblings of recipients who underwent unsuccessful transplants reported greater negative effects and feelings of guilt than those of recipients whose transplants were successful.[56,58,62] However, all siblings agreed that the psychological benefits and harms of serving as a donor outweighed the physical harms.[62,65,66]

Risks and Benefits to the Hematopoietic Stem Cell Recipient

The main risks and benefits to the recipient are clinical, and they vary depending on the source of stem cells. In general, there is quicker engraftment

after transplantation with primed peripheral blood stem cells. However, there is also greater T-lymphocyte infusion with peripheral blood stem cell transplantation and, therefore, greater risk of chronic GVHD without improvement in survival.[16,67] Transplantation using umbilical cord stem cells is associated with a decreased risk of GVHD, perhaps because fewer lymphocytes accompany the stem cell graft or because those lymphocytes are less immunocompetent.

Recent data suggest that pediatric patients with leukemia have better outcomes when they receive bone marrow rather than peripheral blood stem cell transplants, although bone marrow transplants are associated with slower engraftment.[36,68] This has led to a reemphasis on bone marrow collection. There has also been some research on the use of G-CSF with bone marrow collection to promote more rapid engraftment and reduce risks to the recipient, thus prompting consideration of the use of primed bone marrow. The latter may increase the risks to the donor both short-term (ie, pain from G-CSF for 4–5 days before collection) and long-term (ie, uncertain long-term risks of exposure to G-CSF).

CONDITIONS UNDER WHICH A MINOR MAY PARTICIPATE AS A HEMATOPOIETIC STEM CELL DONOR

Currently, there are no guidelines regarding participation of minors as hematopoietic stem cell donors. The AAP believes it is ethically permissible for minors to participate as donors if 5 criteria are fulfilled. The criteria are: (1) there is no medically equivalent histocompatible adult relative who is willing and able to donate; (2) there is a strong personal and emotionally positive relationship between the donor and recipient; (3) there is some likelihood that the recipient will benefit from transplantation; (4) the clinical, emotional, and psychosocial risks to the donor are minimized and are reasonable in relation to the benefits expected to accrue to the donor and to the recipient; and (5) parental permission and, where appropriate, child assent have been obtained.

Condition 1

The first criterion requires that there be no medically equivalent histocompatible adult relative who is willing and able to donate. Given the relatively modest medical risks of hematopoietic stem cell donation and the great need for histocompatibility, the AAP supports family decisions to screen both adult and child family members in the initial donor search. However, when multiple siblings are histocompatible with a recipient, and donor characteristics that lead to the choice of the best donor are equivalent, a donor above or closest to the age of consent should be approached first about donation, because he or she can better understand the risks, benefits, purpose, and procedures of donation. Likewise, siblings with normal cognitive function should be preferred to siblings with significant cognitive disabilities because of their greater ability to understand the risks and benefits of donation. In the earliest reports of bone marrow donation by children, 1 family explicitly requested the donor to be a sibling with mental retardation, although other siblings may have been available.[69] Although all children are vulnerable, younger children who cannot understand what is happening and children with cognitive disabilities cannot actively assent, and they are considered more vulnerable than cognitively intact or older children.

Although some might argue that a search of adult family members and even the international bone marrow donor registry should be undertaken before children are screened, there are reasons to permit sibling pediatric donors to undergo screening earlier in the process. A sequential search of adults or a requirement to search the international registries takes additional time and is frequently unsuccessful. To require a family to undertake a search for an unrelated donor ignores the fact that authorization of a stem cell donation by a minor is within the proper realm of parental decision-making.[45,48] It also ignores the fact that transplants from HLA-matched siblings are associated with similar or better outcomes and fewer complications for the recipients than transplants from HLA-matched unrelated donors. In particular, although some studies have suggested no difference,[1,70] relative risks of acute and chronic GVHD are generally 1.5 to 3.5 times more frequent after unrelated-donor transplants compared with sibling-donor transplants.[2,3,67,70–72] Finally, a search of the unrelated donor registries will incur costs that may become the responsibility of the family. Therefore, although parents may choose to defer testing their minor children, it is morally permissible to seek stem cells from all sources simultaneously and not to require a sequential search.

Condition 2

The second condition requires that there be a strong personal and positive relationship between the donor and recipient or, in the case of directed cord blood, that a strong personal and positive emotional relationship be anticipated. This is important, in part, to increase the likelihood that the donor will experience some psychological benefit. Case reports in the literature help clarify this point. Marissa Ayala, for example, served as a donor for her older sister by combining her cord blood with additional hematopoietic stem cells procured under anesthesia when she was 14

months of age. She then served as a flower girl at her sister's wedding at 2.5 years of age[73] and, at 18 years of age, positively described her participation in an interview while vacationing with her sister in Hawaii.[74] Although one cannot expect nor require most donor-recipient sibling relationships to be this emotionally strong, it would be morally problematic to ask a minor to serve as a donor to an unknown, emotionally distant, or emotionally abusive relative. In *Cruzan v Bosze*, a father sought to have his twin children tested as potential bone marrow donors for their half-brother.[75] The twins' mother objected, in part because the children did not know their stepbrother. In its decision, the court agreed with the mother. In the case of A. R., a younger sister was asked to serve as the bone marrow donor for her teenaged brother, who had sexually assaulted her.[76] Despite an inadequate psychosocial evaluation, A. R. was declared fit to serve as a stem cell donor. Authors of a commentary argued that the sister should never have been evaluated for donor compatibility and that the donation should have been prohibited.[77] Most recently, an adopted child developed acute lymphoblastic leukemia, and his 3 biological siblings with whom he had no relationship were tested for HLA compatibility.[78] None were HLA compatible, but the case raised the question of why the children were HLA-tested in the first place, given the lack of an intimate relationship with the ill child.[79] These cases reveal how parents may be so focused on the ill child that they do not adequately consider the needs and interests of the potential minor donor siblings. Rather, minors should only serve as hematopoietic stem cell donors for family members when there is a strong personal and emotionally positive relationship between the donor and recipient. Exceptions should only be considered with judicial review. Minors should never be considered as potential donors for strangers or listed on an international bone marrow registry except as cord blood donors.

Condition 3

The third condition requires that there be some likelihood that the recipient will benefit from transplantation. It is hard to define what the threshold of likelihood of success for the recipient should be to justify the procurement of donor stem cells, and this is further complicated by the inexactness of the recipient's prognosis. However, the fact that a histocompatible sibling is available does not mean that a transplant should be attempted without regard to the likelihood of success. Although the medical risks of serving as a hematopoietic stem cell donor do not change regardless of the transplant outcome, the psychosocial risks should not be underestimated. This is particularly true for the donor whose sibling dies.[80] Therefore, although the transplant team may be willing to attempt a transplant regardless of likelihood of success, there should be some minimum threshold of anticipated success below which the potential minor donor should not be exposed to the risks of stem cell collection.[33,81] The threshold likelihood of success may be less stringent for donors who are competent older teenagers or adults and who can, therefore, consent for themselves. The donor advocate (or some similar mechanism as befits an individual program as discussed for condition 5) should ensure that the likelihood of success is above some threshold to justify imposing the risks of donation on the minor sibling.

Condition 4

The fourth condition requires that the clinical, emotional, and psychosocial risks to the donor be minimized and be reasonable in relation to the benefits expected to accrue to the donor and the recipient. The transplant team should help ensure that the parents consider the risks and benefits of a sibling donation from the independent perspectives of the recipient and of the donor.

One way to minimize risks is to carefully select the method of stem cell collection. Each method of obtaining stem cells has distinct risks and benefits. Numerous factors should be considered in this decision, including the preferences of the minor and parents and the potential benefit to the recipient. For example, one may want to avoid peripheral blood stem cell donation by young children to minimize the need for central venous catheters and to avoid exposing the donor to third-party blood products. Central venous lines in children have a low risk of harm, but the harms can be serious and include the risks of anesthesia as well as the risks from the catheter placement (eg, pneumothorax, hemothorax).[39,40] Some of the psychological and emotional risks to child donors can be minimized by preparing them through medical play-acting, by allowing them to ask questions, and by including them in the decision-making process, to the extent of their ability.[56–60]

Finally, in some situations, it may be appropriate for the transplant team to educate the family about alternative therapies that may be tried that offer a reasonable likelihood of success. For example, for children with malignancies, chemotherapeutic trials may offer an alternative to HSCT. For children with enzyme deficiencies secondary to genetic conditions, some enzyme-replacement therapies exist, and others are in development. For children with bone marrow failure or hemoglobinopathies, nontransplant alternatives may include chronic transfusion or growth-factor support, and gene transfer is on the horizon.

Condition 5

The fifth condition requires that parental permission and donor assent be obtained. Legally, in pediatrics, parental permission is sufficient for proceeding with clinical treatment (with a few exceptions), whereas parental permission and the child's assent (when possible) is necessary for research purposes.[82] However, stem cell donation by minor siblings is unusual in that it is often performed as a clinical procedure, yet the direct benefits of the clinical procedure accrue to a third party (the recipient) rather than to the donor child. Even in the research setting, the risks and benefits may or may not accrue to the donor (discussed further in the next section). In seeking parental permission, it is important to acknowledge the tension that parents experience when 1 of their children is ill and to appreciate the conflict of interest created if they consider authorizing 1 of their healthy children to serve as a hematopoietic stem cell donor.

Transplant teams also face a conflict of interest in that their primary responsibility is to the potential recipient; yet, the same physicians may advise, consent, and possibly take the potential donor to the operating room for stem cell procurement. The Advisory Committee on Organ Transplantation of the US Department of Health and Human Services recommends that all living solid-organ donors have a donor advocate,[83] and this recommendation was incorporated into the AAP statement "Minors as Living Solid-Organ Donors."[84] The AAP proposes a similar requirement for all minors who are potential hematopoietic stem cell donors, a mechanism first implemented at the M. D. Anderson Cancer Center in 1994.[36] The primary obligation of the donor advocate (or some similar mechanism as befits an individual program) is to help the donor (and parents) understand the process and procedures and to protect and promote the interests and well-being of the donor. As such, the donor advocate (for the rest of this statement, "donor advocate" will be used to indicate either a specific donor advocate or some similar mechanism) should not be involved in direct patient care of the potential transplant recipient.[85] The donor advocate or, if necessary, a donor advocate team should have (1) training and education in child development and child psychology, (2) skills in communicating with children and understanding children's verbal and nonverbal communication, and (3) working knowledge of hematopoietic stem cell donation and transplantation.[84] The donor advocate should help to ensure that the risks to the child are reasonable and minimized, that the siblings' relationship is a personal and emotionally positive relationship (ie, that there is a healthy emotional relationship between them), that the donation has a reasonable likelihood of success, and that there is no other medically equivalent histocompatible adult relative who is able and willing to serve as a source of stem cells.

The donor advocate should help the parents weigh the risks and benefits for the healthy child to serve as a hematopoietic donor for an ill family member and not just weigh the risks and benefits from the perspective of the potential recipient or from that of the family as a unit. The donor advocate should be involved from the onset, starting with the decision about whether the minor should undergo HLA testing. When older children and adolescents are being considered as hematopoietic stem cell donors, they should be included in all stages of the decision-making process to the extent that they are capable.[82,86] Discussions that involve the potential minor donor must be developmentally appropriate.[86] The psychological as well as medical aspects of the donation should be discussed in language that is understandable to the potential donor. Consistent with his or her capacity, the minor needs to be aware that the donated stem cells may not engraft or may fail after engraftment, the recipient may develop severe or even fatal complications of the transplant (eg, GVHD), or the original disease may recur. The minor needs to be aware that the outcome is beyond his or her control. The literature shows that many donors feel neglected after donation as the focus returns to the ill recipient.[58,62,87] Parents and other family members should be reminded that they need to be attentive to the needs of both the donor and recipient.

Research on minors who served as stem cell donors has revealed that most siblings felt they had no choice about whether to serve as a stem cell donor, but most also agreed that they would do it again.[56] Nevertheless, in some cases, a minor may object to participation. Although the parents' consent alone may be sufficient, unless state law or institutional policy requires the minor's active assent,[88] a donor advocate should explore the reasons for the refusal and determine if further education and discussion can modify the minor's refusal. A child mental health professional and/or an ethics consultant/ethics committee may also need to be involved to help clarify the child's concerns. The donor advocate, child mental health professional, ethics consultant, or ethics committee must have the authority to suspend or prohibit a donation if it is determined that the donation is likely to have a serious and sustained long-term adverse effect on the donor. The recipient should not begin myeloablative preparation for bone marrow infusion (conditioning) unless there is a clear decision to proceed with the do-

nation. Once the recipient has begun conditioning, the child donor should not be offered the opportunity to renege, because this would be lethal to the recipient.

RESEARCH ON HSCT

To advance the effectiveness of HSCT, research will need to be performed on both donors and recipients. When the participants are minors, the research must conform to Subpart D of the federal regulations that govern pediatric research.[41]

Subpart D distinguishes between research that does and does not offer the prospect of direct benefit. Children are permitted to participate in research that offers the prospect of direct benefit, provided the "risk is justified by the anticipated benefit to the subjects" and "the relation of the anticipated benefit to the risk is at least as favorable to the subjects as that presented by available alternative approaches."[41] For most research on HSCT, the research offers the prospect of direct benefit to the recipient, but the donor is a healthy child. As such, the research does not offer the prospect of direct benefit to the donor child. Although some have tried to argue that the donor and recipient should be viewed as a dyad, this would permit greater risk taking on the part of a healthy child than most interpretations of the regulations permit.[36]

When research does not provide the prospect of direct benefit, children are permitted to participate in minimal-risk research (eg, surveys of pain experience). What counts as minimal risk, however, is ambiguous.[89–91] Children with a disorder or condition are permitted to participate in research that poses a minor increase over minimal risk. Healthy siblings do not have a disorder or condition. This restriction has raised 3 objections. First, it is not clear what it means to have a "disorder or condition," that is, whether one must have a disease or condition or whether it is adequate to be at risk of having a disease or condition.[92–95] Some have even argued that having an ill sibling constitutes a "condition."[36,92] A second objection is that the regulations are overly restrictive in that the minor increase over the minimal-risk standard is adequate protection for all children.[91] The third objection is that the regulations are unjust in providing greater protection to healthy than to ill children.[96]

If the proposed research pertains to adequate pain control and the standard therapies are used, then one might state that survey research to quantify the degree of pain entails minimal risk. However, if the research entails the use of a drug (eg, the original expansion of G-CSF from adult volunteer donors to sibling donors), the research is always classified as posing at least a minor increase over minimal risk. Such research can only be performed if the responsible institutional review board (IRB) determines that the donor's participation involves a prospect of direct benefit to the donor himself or herself (45 CFR 46.405 approval) or if the IRB determines that being a donor constitutes a condition and the incremental risks of the research involve no greater than a minor increase over minimal risk (45 CFR 46.406 approval). Either of these determinations by an IRB is likely to be controversial. Otherwise, the research requires national review under 45 CFR 46.407.[97,98] Although this will increase the regulatory burden for performing research on healthy donors, it may also increase the oversight that research that exposes a healthy child to significant risk without prospect of direct benefit deserves.[36,97] In December 2008, the US Food and Drug Administration (FDA) Pediatric Advisory Committee's Pediatric Ethics Subcommittee convened to review a proposed pediatric study under the provisions of 45 CFR 46.407 and the corresponding regulations that govern clinical investigations regulated by the FDA, 21 CFR 50.54. The protocol involved a phase 3 trial in which donors would be randomly assigned to receive G-CSF to determine its effect on engraftment and GVHD.[99] The National Cancer Institute Central Institutional Review Board (CIRB) acknowledged the pressure that normal siblings would experience with respect to participation and "that it would be difficult or impossible to separate this influence from the pressure to act as a bone marrow donor independent of the research."[100] The CIRB elaborated: "the CIRB suggests but does not require the use of a third party informed assent monitor to minimize potential influence, as well as the use of different doctors for the recipients and the donors. The board notes that the latter suggestion is already standard practice in many allogeneic stem cell transplant programs."[100] The FDA approved the protocol under 45 CFR 46.407 but mandated use of a donor advocate as a stipulation of 407 approval. The donor advocate or assent monitor is analogous to the donor advocate proposed in our condition 5 as a mandatory component for all HSCT when the donor is a minor.

Subpart D also gives significant respect to the child's preferences regarding research participation. The regulations are clear that, when the child is "capable of assenting," the child must provide "affirmative agreement" to participate.[41] The regulations also give IRBs the authority to decide from which children assent should be sought.[41] Although no age is provided in the regulations, many studies seek assent of children as young as 6 or 7 years of age. However, given the complexities involved in stem cell transplant research, it would be reasonable for the IRB to restrict the assent requirement to donors older than 9 years.[101]

When an IRB finds that assent is necessary and the child donor refuses to assent, transplant teams, families, and donor advocates should try to understand the reason for a refusal and try to address the objections. However, under current regulations, if the child is determined to have sufficient capacity to assent, then his or her refusal to participate in research is definitive.

CHILDREN CONCEIVED TO SAVE A SIBLING

In some families, parents intentionally conceive a child to serve as an umbilical cord blood stem cell donor for an older sibling. Often, these children are conceived through IVF and PGD to ensure an HLA match.[102] PGD may be performed either to ensure that the embryo is HLA-identical while simultaneously avoiding the birth of a child with a severe heritable condition (eg, Fanconi anemia) or purely to ensure that the embryo is HLA-identical. As of 2005, 5 PGD centers in 4 countries have performed HLA-genotyping in 180 IVF cycles. In 122 cycles, the goal was to avoid a genetic condition (thalassemia being the most common) and to create an HLA-matched sibling. In 58 cycles, PGD was used solely for HLA-typing.[102]

Some people have moral or religious objections to the use of IVF and PGD because they can result in excess embryos, many of which are discarded. Even those who accept IVF and PGD to avoid the birth of a child with a severe heritable condition and simultaneously to ensure a specific HLA identity may be troubled by the use of PGD when it is used only to ensure an HLA-identical sibling.[103–107] When PGD is used purely for HLA-matching, the objection is that the child is used solely as a means (donor) for the sibling-recipient and that all children should be treated as ends in themselves.[108] This is a misunderstanding of the Kantian ethical principle. There is no absolute moral prohibition against using a person as a means, provided that the person is not used solely as a means. Available evidence is anecdotal but reveals that children conceived to save siblings are loved both for their role in saving their sibling's life (means) and as another member of the family (end-in-itself) which is consistent with the moral permissibility of children as hematopoietic stem cell donors.[103–107]

Pediatricians may be asked about PGD by parents who are willing to attempt to conceive an HLA-matched sibling. Pediatricians should educate these parents about the risks and benefits of attempting to conceive a child who will serve as a hematopoietic stem cell donor and should support them emotionally throughout the process or refer them to a colleague who has the competency and expertise to do so. The willingness of health care professionals to collect cord blood for stem cells in the delivery room must be ensured before delivery, although the pregnant woman and couple must also understand that the health of both the newborn infant and the pregnant woman have priority and that peripartum events may preclude collection.[29] To avoid exposing the newborn infant to any risks from the donation, the delivery should not be modified to maximize the number of cells collected. If delivery is not modified, the procedure poses no risk to the newborn infant, and there is no need for a donor advocate.

COURT REVIEW

The earliest cases of bone marrow transplant with a minor donor often involved judicial review.[109] Given that legal precedent for stem cell donation by incompetent adults and children is firmly established, as a general matter, donation by a minor should not require court review or approval. Historically, the primary value of the judicial review process was to ensure an independent advocate for the incompetent potential donor.[69] In solid-organ transplantation, there is now a requirement to provide an independent donor advocate for living donors.[83] The AAP supports the appointment of a donor advocate in any HSCT that involves a donor younger than 18 years (except for cord blood stem cell donation). The donor advocate should assess whether the recipient for whom the minor is being asked to donate is an appropriate candidate (eg, a child sibling who has a reasonable chance of benefit from the transplant procedure), should ensure that the donor and recipient have a strong personal and emotionally positive relationship, and should verify that no adult family members are appropriate and willing donors. The donor advocate should also work with the child to provide developmentally appropriate education and support and to ensure that the family attends to the needs and interests of the donor. In cases for which there is concern regarding parental motives or what is in the donor's best interest, ethics consultation with either an ethics consult service or ethics committee may be an appropriate next step.[32,84] Judicial review should be reserved as a last resort or to permit exceptions to any of the conditions listed above. For example, a court may be asked to adjudicate the permissibility of a stem cell donation by a minor when no strong personal relationship exists between the minor donor and recipient.

LONG-TERM FOLLOW-UP

There is an urgent need for improved understanding of the long-term effects, both medical and psychosocial, of minors who serve as hematopoietic stem cell donors. Ideally, national donor registries would be established that would collect short-term and long-term medical and psychological data that would allow for more accurate assessment of the risks, benefits, and

outcomes of hematopoietic stem cell donation. Currently, there is 1 such project titled RDSafe (related donor safety initiative) that is evaluating approximately 10 000 related and unrelated donors over the next 5 years. The researchers plan to examine both psychological and medical issues for 1 year. This project is laudable, although when the donors are children, follow-up will be needed for a much longer time frame. In this vein, the AAP supports health care professionals who seek authorization from minor donors and their parents for long-term collection and storage of donor health data. Parents should be responsible for authorizing the child's registration, but the child should be asked to give his or her own consent when he or she reaches the age of majority.

RECOMMENDATIONS

1. Children who are medically appropriate potential donors may ethically serve as hematopoietic stem cell donors if 5 criteria are fulfilled: (1) there is no medically equivalent histocompatible adult relative who is willing and able to donate; (2) there is a strong personal and emotionally positive relationship between the donor and recipient; (3) there is a reasonable likelihood that the recipient will benefit; (4) the clinical, emotional, and psychosocial risks to the donor are minimized and are reasonable in relation to the benefits expected to accrue to the donor and to the recipient; and (5) parental permission and, when appropriate, child assent are obtained (see recommendation 3).
2. A donor advocate (or some similar mechanism as befits an individual program) with expertise in pediatric development should be appointed for all individuals who have not reached the age of majority and who are being considered as hematopoietic stem cell donors. The donor advocate must be independent of the team responsible for direct care of the recipient and should be involved from the onset, starting with the decision about whether the minor should undergo HLA-testing. A donor advocate is not necessary in cord blood donation. Donor advocates should ensure that the criteria in recommendation 1 are met.
3. When children and adolescents are being considered as hematopoietic stem cell donors, they should be included in all stages of the decision-making process to the extent that they are capable. The donor advocate should facilitate their inclusion. Parents may authorize their child's participation as a hematopoietic stem cell donor. A minor's dissent should lead to further discussion and involvement of the donor advocate, child mental health professional, and ethics consultants and/or ethics committee if necessary. The donor advocate, with the assistance of child mental health professionals and ethics consultants and/or ethics committee as needed, should have the authority to prevent or delay the donation if the donation is likely to have a serious and sustained long-term adverse impact on the donor. The recipient should not begin conditioning unless there is a clear decision to go ahead with the donation. Once the recipient has begun myeloablative preparation for bone marrow infusion (conditioning), the child donor cannot renege, because this would be lethal to the recipient.
4. Pediatricians should be aware that they may be asked about IVF with PGD to ensure the conception of an HLA-matched sibling for cord blood donation. If delivery is not modified, umbilical cord blood procurement poses no risk to the newborn infant. In some cases, it will be necessary to collect additional hematopoietic stem cells from this child at a later date. In those cases, the other criteria enumerated in recommendation 1 regarding pediatric donors must be met.
5. To advance the effectiveness of different hematopoietic stem cell transplants, research will need to be performed on donors and recipients. When the donor is a minor, the research must conform to the federal regulations governing pediatric research. This may require national review when the research imposes more than minimal risk without prospect of direct benefit to donor subjects.
6. Long-term follow-up data should be collected to help determine the actual medical and psychological benefits and risks for child donors. These data should then be used to modify future recommendations regarding the permissibility of minors serving as hematopoietic stem cell donors.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Children in Pickup Trucks

ABSTRACT. Pickup trucks have become increasingly popular in the United States. A recent study found that in crashes involving fatalities, cargo area passengers were 3 times more likely to die than were occupants in the cab. Compared with restrained cab occupants, the risk of death for those in the cargo area was 8 times higher. Furthermore, the increased use of extended-cab pickup trucks and air bag-equipped front passenger compartments creates concerns about the safe transport of children. The most effective preventive strategies are the legislative prohibition of travel in the cargo area and requirements for age-appropriate restraint use and seat selection in the cab. Parents should select vehicles that are appropriate for the safe transportation needs of the family. Physicians have an important role in counseling families and advocating public policy measures to reduce the number of deaths and injuries to occupants of pickup trucks.

Motor vehicle trauma remains a leading cause of death of children. Occupants in pickup trucks should receive the same level of protection provided in other vehicles according to national policies that address protection of motor vehicle occupants. The safety issues relevant for pickup trucks include the following: 1) prohibition of cargo area travel; 2) age-appropriate restraint use; 3) appropriate seat location in the cab; 4) appropriate use of rear seating positions in various models of extended cab vehicles; and 5) risk of air bag-related injuries.

Pickup trucks have become increasingly popular vehicles for passenger transportation. Pickup truck registrations numbered 36.2 million in 1998, representing 17% of registered motor vehicles in the United States.[1] Census data for 1992 indicated that 73% of pickup trucks were used for personal transportation.[2] Restraint use in the cab of pickup trucks has been reported to be lower than restraint use in other passenger vehicles.[3]

TRAVEL IN THE CARGO AREA

Travel in the cargo area of the pickup truck is a major occupant protection issue that disproportionately involves youth. Because the cargo area is not intended for passenger use, it is neither required nor designed to meet occupant safety standards applicable to passenger locations. Nevertheless, the cargo area is used for transporting passengers. In 1997, 161 deaths of occupants riding in the cargo area were reported; 77 (48%) were children and adolescents younger than 20 years. Of these occupants, 7 (9%) were younger than 5 years; 15 (19%) were 5 through 9 years of age; 14 (18%) were 10 through 14 years of age; and 41 (53%) were 15 through 19 years of age.[4]

Persons who are injured when traveling in cargo areas of pickup trucks are more likely to sustain multiple injuries and injuries of greater severity and have a greater likelihood of death than do occupants in the cab. The most significant hazard of travel in the cargo area of a pickup truck is ejection of a passenger in a crash or noncrash event (eg, sudden stop, turn, swerve, or loss of balance, as well as intentional or unintentional jumps and falls). Studies have demonstrated that the proportion of occupants ejected from the cargo area markedly exceeds the proportion ejected from the cab.[5–11]

In a recent study of fatalities in pickup trucks from 1987 through 1996, nearly one third of the deaths among occupants of the cargo area were a result of noncrash events. Of the deaths that occurred as a result of cargo area occupants being ejected, 40% were children and adolescents 17 years or younger. Cargo area passengers were 3 times more likely to die than were occupants in the cab. Compared with restrained cab occupants, the risk of death for those in the cargo area was 8 times higher.[12]

Enclosed cargo areas (camper shells) do not provide adequate protection against injury to occupants. In 1997, 14% of cargo area deaths of children and adolescents younger than 20 years were in enclosed cargo areas.[4] Carbon monoxide poisoning, which may result in death, is an additional hazard to those traveling in the enclosed cargo area of a pickup truck.[13]

Fewer than 50% of the states restrict transport of passengers in the cargo area. No 2 states have identical laws, and only 1 state fully prohibits travel in cargo areas. Restrictions in other states vary according to the age groups to which they apply, conditions of travel (eg, if restrained), and presence of an enclosed cargo area.[14] The application of seat belt and child passenger safety laws to travel in pickup truck cargo areas may be an option in some states; however, in certain states, even occupant area seat belt laws do not apply to pickup trucks. Many Native American nations have adopted occupant restraint laws that apply to pickup trucks as well as passenger cars; other nations use the laws of the state.[15]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

EXTENDED CABS

With increased sales and use of pickup trucks for personal and family transportation, manufacturers have produced vehicles that can accommodate an increased number of occupants. A variety of extended cab vehicles are available with additional seating capacity that may include a rear bench seat, side-facing back seats, a full back seat with lap/shoulder belts, and/or a middle front seat position with a lap belt (also available in standard pickup trucks). Crash data for occupants in these seats are limited. Compatibility issues exist between vehicle seats and safety seats, including booster seats in some pickup truck seating positions. Car safety seats can only fit and be properly secured in a full-size rear or front seat. Many rear-facing car safety seats do not fit in pickup seats with limited space in front of them, and this limited space may not provide adequate head excursion distance for children in untethered forward-facing car safety seats. For older children, booster seats must be used with lap/shoulder belts to provide adequate protection; however, lap/shoulder belts may not be available in pickup rear seats.

AIR BAGS

Concerns about the safety of children in front passenger seats equipped with an air bag are the same as those for other passenger vehicles. Infants must always ride in rear-facing car safety seats in the back seat until they are at least 1 year old and weigh at least 20 pounds. Infants must never ride in the front passenger seat when it is equipped with an air bag. All children should be properly restrained in car safety seats, booster seats, or lap/shoulder belts appropriate for their size and age. The safest place for children is in the back seat in vehicles with a full-size rear seat. However, if there is no rear seat, the rear seat is not full-size, or the rear seat is incompatible with use of a car safety seat or booster seat, the front passenger air bag should be equipped with an on/off switch to accommodate the safe transport of children. The switch should be off when transporting children in the front seat.

Hospital Record Keeping

A need for data exists about injuries in extended cabs, use and nonuse of occupant protection systems, and comparisons of injuries and injury mechanisms between enclosed and unenclosed cargo areas. Documentation of the circumstances of injuries that occur in pickup trucks is needed to contribute to epidemiologic data and to develop preventive counseling guidelines.

RECOMMENDATIONS

1. The most effective prevention strategies to reduce the number of deaths and injuries to children in pickup trucks are the prohibition of travel in the cargo area and age-appropriate restraint use in an appropriate seat location in the cab.
2. Parents should be counseled about the following considerations for selecting or using vehicles to meet the safe transportation needs of the family:
   - No passengers should be transported in the cargo area of a pickup truck or a nonpassenger section of any vehicle.
   - Trips should be planned in advance so that an appropriate seat position and restraint device are used for each passenger.
   - Compatibility should be checked between the vehicle seat (front and back seats) and the car safety seat before purchasing a vehicle or a child safety seat.
   - Infants in rear-facing car safety seats should not be placed in front passenger seats when an airbag is present and activated. If no appropriate rear seating position is available, only place the infant in the front passenger seat if an airbag on/off switch is installed and turned off.
   - Car safety seats should fit completely on the rear seat of the pickup truck and can be properly secured facing the rear for infants younger than 1 year and weighing <20 pounds, and facing forward for older children. The addition of a tether may improve the security of a car safety seat.
   - All forward-facing car safety seats should be installed using a top tether in addition to the vehicle belt.
   - Teenagers should agree that they will not ride or transport others in the cargo area of a pickup truck.
3. The who, what, when, where, why, and how of the injury event should be recorded.[16]
4. Physicians should serve as educators and public policy advocates for measures that will decrease the number of deaths and injuries to children and youth who travel in pickup trucks.
5. Physicians need to be effective advocates for more stringent and comprehensive state legislation that would prohibit any occupant from traveling in the cargo area of a pickup truck. If the state exempts pickup trucks from seat belt laws, efforts should be made to modify these laws to include all passengers in all seat locations. The American Academy of Pediatrics has developed a model state legislation packet related to travel in pickup trucks.[17]
6. Law enforcement agencies should be strongly urged to enforce laws relating to occupant travel, including restraint and seat belt use laws, as well as laws prohibiting travel in cargo areas of pickup trucks.

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AMERICAN ACADEMY OF PEDIATRICS

NORTH AMERICAN SOCIETY FOR PEDIATRIC GASTROENTEROLOGY, HEPATOLOGY, AND NUTRITION

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Subcommittee on Chronic Abdominal Pain

Chronic Abdominal Pain in Children

ABSTRACT. Children and adolescents with chronic abdominal pain pose unique challenges to their caregivers. Affected children and their families experience distress and anxiety that can interfere with their ability to perform regular daily activities. Although chronic abdominal pain in children is usually attributable to a functional disorder rather than organic disease, numerous misconceptions, insufficient knowledge among health care professionals, and inadequate application of knowledge may contribute to a lack of effective management. This clinical report accompanies a technical report (see page e370 in this issue) on childhood chronic abdominal pain and provides guidance for the clinician in the evaluation and treatment of children with chronic abdominal pain. The recommendations are based on the evidence reviewed in the technical report and on consensus achieved among subcommittee members. ***Pediatrics*** **2005;115:812–815;** ***abdominal pain, irritable bowel syndrome, functional bowel disorders.***

ABBREVIATION. ENS, enteric nervous system.

BACKGROUND

Despite decades of clinical observations resulting in numerous articles, books, and monographs, the subject of long-lasting constant or intermittent abdominal pain in childhood remains one of ambiguity and concern for most pediatric health care professionals. The definition of chronic abdominal pain used clinically and in research over the last 40 years has used the criterion of at least 3 pain episodes over at least 3 months interfering with function.[1] In clinical practice, it is generally believed that pain that exceeds 1 or 2 months in duration can be considered chronic. A child who chronically complains of abdominal pain is often a formidable challenge; although the symptom usually indicates a benign problem, the parents may be terribly worried, the child may be in distress, the practitioner may be concerned about ordering tests to avoid missing serious occult disease, and the family may be enmeshed in psychosocial complexities. Management of this problem can be time consuming and frustrating. Yet, in only a small number of such children is the abdominal pain caused by an underlying organic disease. In most children, the pain is functional, that is, without demonstrable evidence of a pathologic condition such as an anatomic, metabolic, infectious, inflammatory, or neoplastic disorder.

The pathophysiology of functional abdominal pain is thought to involve abnormalities in the enteric nervous system (ENS), a rich and complex nervous system that envelops the entire gastrointestinal tract. The ENS is also known as the "gut brain" or the "little brain in the gut."[2] The ENS interacts with the central nervous system, allowing bidirectional communication. A dysregulation of this brain-gut communication plays an important role in the pathogenesis of functional abdominal pain. Most of the research on childhood visceral pain in the 1980s and early 1990s focused on the role of motility disorders and psychiatric abnormalities. Recently, however, more sophisticated diagnostic techniques have failed to identify motor abnormalities severe enough to account for these patients' symptoms. It is now believed that adults and children with functional bowel disorders, rather than having a baseline motility disturbance, may have an abnormal bowel reactivity to physiologic stimuli (meal, gut distension, hormonal changes), noxious stressful stimuli (inflammatory processes), or psychological stressful stimuli (parental separation, anxiety).[3] Additionally, adult patients with functional bowel disorders attending gastrointestinal clinics were often found to have psychological disturbances regardless of the final diagnosis. It was concluded that psychological factors may have been more important in determining health-seeking behavior than the cause of the symptom.[4]

There is growing evidence to suggest that functional abdominal pain disorders may be associated with visceral hyperalgesia, a decreased threshold for pain in response to changes in intraluminal pressure.[5,6] Mucosal inflammatory processes attributable to infections, allergies, or primary inflammatory diseases may cause sensitization of afferent nerves and

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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have been associated with the onset of visceral hyperalgesia.[7] The concept of visceral hyperalgesia may be explained to the patients and family members comparing gut hyperalgesia to what happens when one experiences a burn or a scar: the skin may remain sensitive for prolonged periods of time and perceive as noxious even stimuli that are normally not uncomfortable (such as contact with clothes). There is also an increasing body of evidence in adults suggesting that an abnormal central processing of afferent signals at the level of the central nervous system may play a role in the pathophysiology of this condition.[8,9]

Functional abdominal pain is the subject of many misconceptions in both the health care and lay communities. A recent survey by the American Academy of Pediatrics and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition completed by more than 300 general pediatricians showed that functional abdominal pain was considered an unclear or wastebasket diagnosis by 16% of responders and a specific diagnosis with clear criteria for diagnosis by only 11% of responders (unpublished data). There is ambiguity and confusion with nomenclature as well, with many clinicians using the term "recurrent abdominal pain" to mean functional, psychological, or stress-related abdominal pain. Furthermore, many clinicians are unaware of the different symptom patterns with which functional abdominal pain can present.

The systematic review of the medical literature on chronic abdominal pain in children summarized in the technical report[10] has identified findings that may be surprising to many clinicians. For example, although children with chronic abdominal pain and their parents are more often anxious or depressed than are children without chronic abdominal pain, the presence of anxiety, depression, behavior problems, or recent negative life events does not seem to be useful in distinguishing between functional abdominal pain and abdominal pain attributable to organic disease. Similarly, although children with chronic abdominal pain are more likely than children without chronic abdominal pain to have headache, joint pain, anorexia, vomiting, nausea, excessive gas, and altered bowel symptoms, the presence of these associated symptoms is unlikely to help the physician discriminate between functional and organic disorders. In contrast, the presence of alarm symptoms or signs (see recommendation 3 below for a list) may suggest a higher likelihood of organic disease and is an indication for the performance of diagnostic tests, whereas in the absence of alarm symptoms, diagnostic studies are unlikely to have a significant yield of organic disease. Furthermore, there is no evidence that emotional or behavioral symptoms predict the clinical course or that families of children with chronic abdominal pain differ in broad areas of family functioning. Although clinicians prescribe a range of treatments, there are only limited or inconclusive studies of pharmacologic or behavioral therapy in children.

RECOMMENDATIONS

1. The term "recurrent abdominal pain" as currently used clinically and in the literature should be retired. Functional abdominal pain is the most common cause of chronic abdominal pain. It is a specific diagnosis that needs to be distinguished from anatomic, infectious, inflammatory, or metabolic causes of abdominal pain. Functional abdominal pain may be categorized as one or a combination of: functional dyspepsia, irritable bowel syndrome, abdominal migraine, or functional abdominal pain syndrome (see Table 1).
2. Functional abdominal pain generally can be diagnosed correctly by the primary care clinician in children 4 to 18 years of age with chronic abdominal pain when there are no alarm symptoms or signs, the physical examination is normal, and the stool sample tests are negative for occult blood, without the requirement of additional diagnostic evaluation.

TABLE 1. Recommended Clinical Definitions of Long-Lasting Intermittent or Constant Abdominal Pain in Children

Chronic abdominal pain	Long-lasting intermittent or constant abdominal pain that is functional or organic (disease-based)
Functional abdominal pain	Abdominal pain without demonstrable evidence of a pathologic condition, such as an anatomic, metabolic, infectious, inflammatory, or neoplastic disorder; functional abdominal pain may present with symptoms typical of functional dyspepsia, irritable bowel syndrome, abdominal migraine, or functional abdominal pain syndrome
Functional dyspepsia	Functional abdominal pain or discomfort in the upper abdomen
Irritable bowel syndrome	Functional abdominal pain associated with alteration in bowel movements
Abdominal migraine	Functional abdominal pain with features of migraine (paroxysmal abdominal pain associated with anorexia, nausea, vomiting, or pallor as well as a maternal history of migraine headaches)
Functional abdominal pain syndrome	Functional abdominal pain without the characteristics of dyspepsia, irritable bowel syndrome, or abdominal migraine

3. The presence of alarm symptoms or signs, including but not limited to involuntary weight loss, deceleration of linear growth, gastrointestinal blood loss, significant vomiting, chronic severe diarrhea, persistent right upper or right lower quadrant pain, unexplained fever, family history of inflammatory bowel disease, or abnormal or unexplained physical findings, is generally an indication to pursue diagnostic testing for specific anatomic, infectious, inflammatory, or metabolic etiologies on the basis of specific symptoms in an individual case. Significant vomiting includes bilious emesis, protracted vomiting, cyclical vomiting, or a pattern worrisome to the physician. Alarm signs on abdominal examination include localized tenderness in the right upper or right lower quadrants, a localized fullness or mass effect, hepatomegaly, splenomegaly, costovertebral angle tenderness, tenderness over the spine, and perianal abnormalities.
4. Testing may also be performed to reassure the patient, parent, and physician of the absence of organic disease, particularly if the pain significantly diminishes the quality of life of the patient.
5. The child with functional abdominal pain is best evaluated and treated in the context of a biopsychosocial model of care. Although psychological factors do not help the clinician distinguish between organic (disease-based) and functional pain, it is important to address these factors in the diagnostic evaluation and management of these children.
6. Education of the family is an important part of treatment of the child with functional abdominal pain. It is often helpful to summarize the child's symptoms and explain in simple language that although the pain is real, there is most likely no underlying serious or chronic disease. It may be helpful to explain that chronic abdominal pain is a common symptom in children and adolescents, yet few have a disease. Functional abdominal pain can be likened to a headache, a functional disorder experienced at some time by most adults, which very rarely is associated with serious disease. It is important to provide clear and age-appropriate examples of conditions associated with hyperalgesia, such as a healing scar, and manifestations of the interaction between brain and gut, such as the diarrhea or vomiting children may experience during stressful situations (eg, before school examinations or important sports competitions).
7. It is recommended that reasonable treatment goals be established, with the main aim being the return to normal function rather than the complete disappearance of pain. Return to school can be encouraged by identifying and addressing obstacles to school attendance.
8. Medications for functional abdominal pain are best prescribed judiciously as part of a multifaceted, individualized approach to relieve symptoms and disability. It is reasonable to consider the time-limited use of medications that might help to decrease the frequency or severity of symptoms. Treatment might include acid-reduction therapy for pain associated with dyspepsia; antispasmodic agents, smooth muscle relaxants, or low doses of psychotropic agents for pain or nonstimulating laxatives or antidiarrheals for pain associated with altered bowel pattern.
9. Additional research is needed to fill the large gaps of knowledge on chronic abdominal pain in children.

FUTURE RESEARCH

Research on chronic abdominal pain in children should incorporate several methodologic features to generate higher-quality evidence for future clinical practice guidelines. The following specific suggestions are made:

1. Symptom phenotypes of study patients should be described in detail, including not only abdominal pain (intensity, frequency, duration, location) but also associated gastrointestinal and other symptoms.
2. Investigators should specify how eligibility criteria were assessed for research participation.
3. Investigators should specify the work-up performed and provide details of the organic conditions found as part of the diagnostic investigation.
4. Validated outcome measures should be used to assess global improvement and changes in individual symptoms.
5. Potential differences in illness course and treatment response should be examined for patients with different symptom phenotypes.
6. Diverse populations should be investigated, including patients in primary care, community controls, and children from different cultural and ethnic groups.
7. The Rome II criteria[11] (see Table 6 of the technical report[10]) should be validated in a range of clinical settings and populations to determine the utility of the criteria in making clinically useful distinctions between individuals and groups of patients.

In view of the paucity of published literature on therapeutic approaches to this condition, there is an urgent need for trials of all currently used interventions in children with functional abdominal pain. We support the statement of the Functional Bowel Disorders Working Group Report of the First World Congress of Pediatric Gastroenterology, Hepatology, and Nutrition meeting that "there is a need to develop drugs to modulate abnormalities in sensorimotor function of the enteric nervous system in functional disorders to relieve specific symptoms and to assess the proper role of these drugs in the treatment of children and adolescents" and "the role of antidepressants (tricyclics, selective serotonin reuptake inhibitors) in the treatment of functional gastrointestinal disorders associated with abdominal pain needs to be assessed."[12(pS113)] The Rome II working teams also agreed with this need, recommending guidelines for clinical trial research.[13]

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AMERICAN ACADEMY OF PEDIATRICS

NORTH AMERICAN SOCIETY FOR PEDIATRIC GASTROENTEROLOGY, HEPATOLOGY, AND NUTRITION

TECHNICAL REPORT

Subcommittee on Chronic Abdominal Pain

Chronic Abdominal Pain in Children

ABSTRACT. Chronic abdominal pain, defined as long-lasting intermittent or constant abdominal pain, is a common pediatric problem encountered by primary care physicians, medical subspecialists, and surgical specialists. Chronic abdominal pain in children is usually functional, that is, without objective evidence of an underlying organic disorder. The Subcommittee on Chronic Abdominal Pain of the American Academy of Pediatrics and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition has prepared this report based on a comprehensive, systematic review and rating of the medical literature. This report accompanies a clinical report based on the literature review and expert opinion.

The subcommittee examined the diagnostic and therapeutic value of a medical and psychological history, diagnostic tests, and pharmacologic and behavioral therapy. The presence of alarm symptoms or signs (such as weight loss, gastrointestinal bleeding, persistent fever, chronic severe diarrhea, and significant vomiting) is associated with a higher prevalence of organic disease. There was insufficient evidence to state that the nature of the abdominal pain or the presence of associated symptoms (such as anorexia, nausea, headache, and joint pain) can discriminate between functional and organic disorders. Although children with chronic abdominal pain and their parents are more often anxious or depressed, the presence of anxiety, depression, behavior problems, or recent negative life events does not distinguish between functional and organic abdominal pain. Most children who are brought to the primary care physician's office for chronic abdominal pain are unlikely to require diagnostic testing. Pediatric studies of therapeutic interventions were examined and found to be limited or inconclusive. *Pediatrics* **2005;115:e370–e381. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2004-2523;** ***abdominal pain, functional bowel disorders, irritable bowel syndrome, dyspepsia, stress, anxiety, depression.***

ABBREVIATIONS. IBS, irritable bowel syndrome; RCT, randomized, controlled trial.

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INTRODUCTION

The exact prevalence of chronic abdominal pain in children is not known. It seems to account for 2% to 4% of all pediatric office visits.[1] One study suggested that 13% of middle-school students and 17% of high-school students experience weekly abdominal pain.[2] In the latter study, it was also noted that approximately 8% of all students had seen a physician for evaluation of abdominal pain in the previous year. Quality of life in adult patients with chronic abdominal pain is substantially poorer than that of the general population.[3] The economic cost related to this condition in children is not known but is likely to be substantial, considering that expenses associated with irritable bowel syndrome (IBS) in adults have been estimated to be $8 billion to $30 billion per year.[4–6] The long-term outcome of this condition has not been determined, but preliminary data indicate that young adults with a history of recurrent abdominal pain that began in childhood who are treated by a subspecialist are significantly more likely than their peers without recurrent abdominal pain to have lifelong psychiatric problems and migraine headaches.[7] Despite the high prevalence and effects of this condition, no evidence-based guidelines for its evaluation and treatment exist.

With this background in mind, the American Academy of Pediatrics and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition established a subcommittee charged with developing evidence-based guidelines for the evaluation and treatment of chronic abdominal pain in children. A major problem in reviewing the literature arose in defining criteria for recurrent or chronic abdominal pain. For many years, the term "recurrent abdominal pain" has been used to describe all cases without an organic etiology. It was first introduced in the pediatric literature by Apley and Naish[8] in the late 1950s, an era in which some organic gastrointestinal disorders had not been fully appreciated. Children were considered to have recurrent abdominal pain if they had experienced at least 3 bouts of pain, severe enough to affect activities, over a period of at least 3 months. This definition had initially constituted the entry criteria for their descriptive studies, but recurrent abdominal pain later became a term used clinically to describe

all children with abdominal pain without an organic etiology. It is now agreed that recurrent abdominal pain is a description, not a diagnosis. Recurrent abdominal pain, as a case definition, includes children with a variety of functional gastrointestinal disorders causing abdominal pain, such as nonulcer dyspepsia, IBS, or abdominal migraine. It also may include children with organic disease (see questions 2–6 later in this report). In this article we avoid use of the term "recurrent abdominal pain" whenever possible to lessen the confusion that the term engenders. Table 1 summarizes terms currently used to describe long-lasting constant or intermittent childhood abdominal pain.

The preponderance of the available pediatric literature on this subject is still based on the Apley and Naish criteria.[8] Thus, evidence was sought in articles that were selected based on the presence of Apley and Naish criteria as entry criteria unless the subcommittee felt that other strong qualities (for example, large epidemiologic study or double-blind, randomized, controlled trial [RCT]) justified their evaluation and inclusion as part of the evidence, which meant that some articles including children with abdominal pain of <3 months' duration were excluded from consideration.

After a careful evaluation of the published literature, no evidence-based procedural algorithm could be produced; instead, questions of interest to clinicians were posed and clinical guidance was generated linked to the standard clinical approach of history, physical examination, diagnostic testing, and treatment. This article is organized in 3 parts: (1) the methodology used to review the evidence and generate the statements is described; (2) questions are answered regarding subgroups of disorders, the role of diagnostic evaluation (history, laboratory tests, radiologic and invasive techniques, and psychosocial evaluation), and the efficacy of pharmacologic, behavioral, and surgical interventions; and (3) a summary of the quality of the evidence is provided (Appendix 1).

TABLE 2. Literature-Search Strategy

Search Terms	No. of Articles Returned
([("abdominal pain"[MeSH terms] OR abdominal pain[text word]) AND notpubref[sb]] AND "child"[MeSH terms])	6662
([([(chronic[all fields] OR recurrent[all fields]) OR functional[all fields]] AND ("abdominal pain"[MeSH terms] OR abdominal pain[text word])) AND notpubref[sb]] AND "child"[MeSH terms]))	1498
Clinical queries	
AND therapy/sensitivity	232
AND diagnosis/sensitivity	932

MeSH indicates medical subject heading (PubMed's controlled vocabulary); notpubref[sb] limits the search to the biomedical literature.

METHODOLOGY

The guideline-development process of Woolf[9] was used with a subcommittee of experts and community physicians guiding the work of the methodologist (H.P.L.) to assemble the evidence, reviewing the results of the methodologist and using the nominal group technique[10] to arrive at conclusions based on the evidence.

After initial discussions, 15 questions were defined and collapsed into the 8 questions in this review. An initial search (see Table 2) was performed on PubMed (www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed) on October 27, 2000, searching for "abdominal pain" in the broadest possible way but limited to pediatric studies; 1498 titles were retrieved. The search was repeated on June 19, 2002, providing another 158 references, for a total of 1656.

In the review process, the following were exclusion criteria: non-English, nonpediatric, nonrecurrent/nonfunctional/nonchronic abdominal pain, small study (sample size ≤5), no original data, letter to the editor, study on *Helicobacter pylori*, and study subjects not baseline-healthy (eg, patients with sickle cell disease). The studies regarding *H pylori* were excluded because the literature regarding *H pylori* had been reviewed recently by a North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition committee and a practice guideline had been published.[11] All titles were reviewed by a single reader (H.P.L.); 10% of the excluded articles were reviewed by 2 committee members (C.D.L. and R.B.C.), with 100% agreement regarding exclusion criteria. Of nonrejected titles, abstracts were read by a single reader (H.P.L.), and additional exclusions were made. Articles

TABLE 1. Currently Used Definitions to Describe Childhood Abdominal Pain

Recurrent abdominal pain as defined by Apley and Naish8	≥3 episodes of abdominal pain, over a period of ≥3 mo, severe enough to affect activities
RAP	A common abbreviation for recurrent abdominal pain that has been used in the literature to depict recurrent abdominal pain as defined by Apley and Naish; many physicians incorrectly use this term to imply functional abdominal pain
Chronic abdominal pain	Abdominal pain with a minimum duration of 3 mo; some clinicians believe that pain lasting >1–2 mo is chronic
Rome II criteria for abdominal pain	Abdominal pain for at least 12 wk, which need not be consecutive, in the preceding 12 mo; these criteria apply to IBS, functional dyspepsia, and functional abdominal pain
Functional abdominal pain	Abdominal pain that occurs in the absence of anatomic abnormality, inflammation, or tissue damage
Nonorganic abdominal pain	A term that is often used interchangeably with functional abdominal pain
Psychogenic abdominal pain	A term that is often used interchangeably with functional abdominal pain

TABLE 3. Articles and Studies Processed in the Review

Reason	Title	Abstract	Article	Total
Non-CAP	688	114	55	857
Sample size ≤5	143	32	33	208
Non-English	164	16	0	180
No original data	35	51	69	155
Nonpediatric	32	86	20	138
Nonbaseline normal	16	5	1	22
Case series	0	0	62	60
Duplicates other study	0	0	2	2
Total*	1078	304	242	1562*
Remaining articles				94
Methodology reviewed				94
Article detailed data review				64
Study detailed review				83

CAP indicates chronic abdominal pain. Non-CAP includes articles on *Helicobacter* and abdominal pain.
* These totals reflect the following overlaps: 45 rejected as abstracts and titles; 9 articles rejected as abstracts and articles; 7 rejected as titles and articles; and 1 rejected as abstract, title, and article.

were read by at least 2 readers (medical student and H.P.L.). Ten articles were abstracted in parallel, with similar results, demonstrating a reliable procedure. Data were abstracted regarding the study as a whole, design and quality, patient groups, and outcomes and their values. Efforts were made to standardize the vocabulary used in recording the methodology and results, resulting in a controlled vocabulary of 1262 terms. After review, 94 articles were included in the evidence review.

The definitions of the study designs were as follows: uncontrolled experiment, an unspecified group of participants received intervention and follow-up data were provided; case-series cross section, data were provided on a single group of participants; case-series follow-up, baseline and follow-up data were provided on a single group of participants; cohort cross section, a single group of participants was divided into 2 or more groups on the basis of a specified feature (eg, history or laboratory tests) and described; cohort follow-up, baseline and follow-up data were provided on a single group of participants who were divided into 2 or more groups; case control, 2 or more groups were assembled and retrospective or current data are provided; and RCT, participants were randomly assigned to intervention, and follow-up data are provided. Because the questions were all comparative, only studies with 2 arms or more were included in this review (thereby excluding case series).

Table 3 shows the type of articles and studies as processed in the review. Most articles were rejected on the basis of title review. Some articles were rejected at more than 1 point in the process, as indicated by the overlaps. Ninety-four articles were left for review. Sixty-four articles had full data investigation, which included separating articles into 1 or more studies in case there was, for example, a baseline case-control study with a cohort follow-up; hence, the 64 articles translated into 83 studies.

An article might have more than 1 study in it if, for instance, there was an initial cohort cross-section with a subsequent cohort follow-up reported in the same article. Of the 83 studies for which methodology was reviewed, 46 were case control, 20 were cohort cross section, 10 were cohort follow-up, and 7 were RCTs. A recent systematic review of treatments in recurrent abdominal pain identified the same RCTs,[12] providing validation for our approach.

Data abstracted for each study as a whole included study city; study country; single or multiple site; site type (community, physician office, academic pediatric setting, gastroenterologist office); funding source; age range, mean, and SD; sample size; number of groups; number of outcomes; and number of time points.

A methodology review was performed for each study, based on the Newcastle-Ottawa Scale for assessing the quality of nonrandomized studies in meta-analyses.[13] Inclusion and exclusion criteria were noted by using the controlled vocabulary. The evidence was characterized in terms of outcome type (based on the controlled vocabulary), outcome name (specific to this study), outcome units (for continuous outcomes), outcome time point (baseline or later), method (how outcome was assessed), sample size at outset, and sample size at termination (a difference from sample size at outset indicated loss to follow-up). Data for continuous outcomes (in which a quantity was measured within a participant) were usually characterized by the mean and SD. For categorical data (in which participants were counted once), the category was labeled by using the controlled vocabulary, test statistic name, *P* value (and comments), and data source (page/figure/table).

Figure 1 summarizes the geographic distribution of the studies for which the country was provided. Of 89 articles for which data were provided, 62 (70%) were performed at a single site, 30 (34%) were based on research at an academic pediatric center, 27 (31%) were performed at a gastroenterology clinic, 17 (19%) were performed at the community level, and 9 (10%) were performed at general pediatric offices.

We calculated a quality score for each study as the ratio of quality items attained to the total number of items. The average, SD, and confidence intervals are given for each design in Table 4. Although the quality scores seem to increase for the more preferred designs, the confidence intervals all overlap.

Evidence tables for each of the 8 questions were generated across studies and grouped according to arm type, method, or outcome, as pertinent to the question. There were 685 outcomes across the studies, categorized as history outcomes (550 [80%]), tissue/physiologic outcomes (115 [17%]), physical examination outcomes (15 [2%]), and use of medications (5 [1%]). Among the 685 outcomes, 161 of the *P* values (23%) were not statistically significant, and an additional 316 (46%) were not provided by investigators. Each subcommittee member took responsibility for 1 or more questions. Each reviewed the evidence tables and the

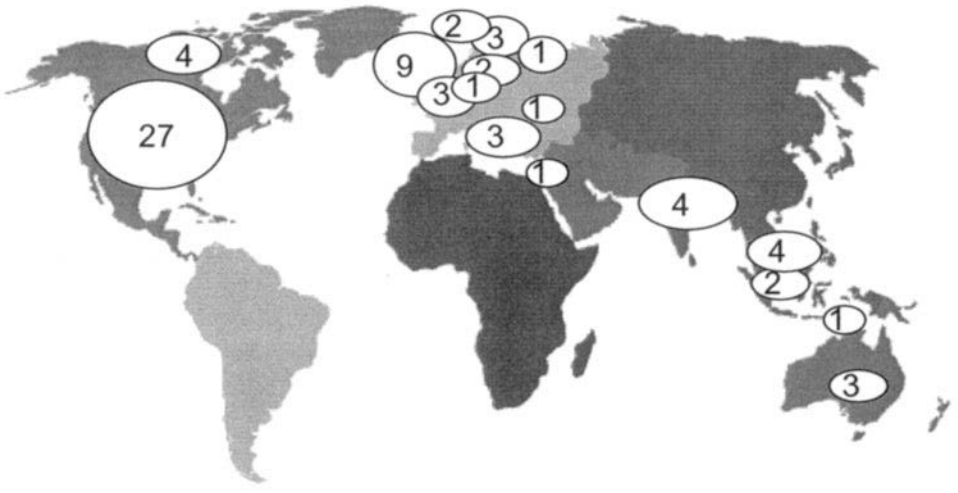

Fig 1. Geographic distribution of articles. Map courtesy of www.worldatlas.com.

TABLE 4. Quality Scores by Design

	No. of Studies	Average Score, %	SD, %	Confidence Interval, %
RCT	7	70	15	(58–82)
Cohort follow-up	9	64	21	(50–78)
Cohort cross section	18	58	18	(50–67)
Case control	46	53	26	(45–60)

TABLE 5. Rating of Evidence Quality

Level	Criteria
A	Well-designed RCTs or diagnostic studies on relevant populations: ≥2 studies that compared the test with a criterion standard in an independent, blind manner in an unselected population of children similar to those addressed in the report
B	RCTs or diagnostic studies with minor limitations and overwhelmingly consistent evidence from observational studies: a single study that compared the test with a criterion standard in an independent, blind manner in an unselected population of children similar to those addressed in the report
C	Observational studies (case-control and cohort design)
D	Expert opinion, case reports, reasoning from first principles

primary articles and generated a summary of the research. The scale for rating evidence is given in Table 5.

The reviews were discussed by the subcommittee, and the nominal group technique[10] was used to achieve consensus.

QUESTIONS

Question 1: Is there evidence that children with chronic abdominal pain have symptom patterns that can be categorized as functional dyspepsia, IBS, or abdominal migraine?

There is limited but credible evidence of the existence of functional dyspepsia, IBS, and abdominal migraine in children (evidence quality C).

Although often discussed as a homogeneous group of patients, there are different phenotypic manifestations of functional abdominal pain. The wide variety of descriptive terms applied to these patients' symptoms, including irritable bowel of childhood, spastic colon of childhood, nonorganic recurrent abdominal pain, and psychogenic recurrent abdominal pain, reflects both the heterogeneity of the group and the limited understanding of the pathogenesis of symptoms.

The sensitivity and specificity of the Apley and Naish criteria have been questioned, and some investigators have proposed the "Rome" criteria,[14] which suggest that many children and adolescents with recurrent or chronic abdominal pain manifest symptom clusters that facilitate the diagnosis of disorders on the basis of symptoms alone. In 1999, a group of investigators (Rome II committee) was charged with identifying and then developing diagnostic criteria for childhood functional disorders including recurrent abdominal pain. They developed a symptom-based classification of functional disorders

TABLE 6. Rome II Criteria for Functional Bowel Disorders Associated With Abdominal Pain or Discomfort in Children[14]

Functional dyspepsia: in children mature enough to provide an accurate pain history (at least 12 wk, which need not be consecutive) within the preceding 12 mo of:
- Persistent or recurrent pain or discomfort centered in the upper abdomen (above the umbilicus); and
- No evidence (including upper endoscopy) that organic disease is likely to explain the symptoms; and
- No evidence that dyspepsia is exclusively relieved by defecation or associated with the onset of a change in stool frequency or stool form

IBS: in children old enough to provide an accurate pain history (at least 12 wk, which need not be consecutive) in the preceding 12 mo of:
- Abdominal discomfort or pain that has 2 of the following 3 features:
  - Relieved with defecation
  - Onset associated with a change in frequency of stool
  - Onset associated with a change in form (appearance) of stool
  - and
- There are no structural or metabolic abnormalities to explain the symptoms
- The following symptoms also support a diagnosis of IBS:
  - Abnormal stool frequency defined as >3 bowel movements per day or <3 bowel movements per week
  - Abnormal stool form (lumpy/hard or loose/watery)
  - Abnormal stool passage (straining, urgency, or feeling of incomplete evacuation)
  - Passage of mucus with stool
  - Bloating or feeling of abdominal distention

Functional abdominal pain: at least 12 wk of:
- Nearly continuous abdominal pain in a school-aged child or adolescent;
- No, or only occasional, relation of pain with physiologic events (eg, eating, menses, or defecation);
- Some loss of daily functioning;
- Pain that is not feigned (eg, malingering); and
- Insufficient criteria for other functional gastrointestinal disorders that would explain the abdominal pain

Abdominal migraine: in the preceding 12 mo:
- Three or more paroxysmal episodes of intense, acute midline, abdominal pain lasting 2 h to several days, with intervening symptom-free intervals lasting weeks to months;
- Evidence of absence of metabolic, gastrointestinal, and central nervous system structural or biochemical diseases is absent; and
- Two of the following features:
  - Headache during episodes
  - Photophobia during episodes
  - Family history of migraines
  - Headache confined to 1 side only
  - An aura or warning period consisting of visual disturbances, sensory symptoms, or motor abnormalities

associated with abdominal pain (Table 6). The goal for these criteria was to decrease cost and suffering for the patients by encouraging a defined-criteria diagnosis of the disorder rather than one obtained after excluding organic diseases. The group felt that the classic Apley and Naish criteria of recurrent abdominal pain were too general and failed to recognize that recurrent abdominal pain was not a final diagnosis. It was also apparent to the group that children and adolescents often displayed a symptom complex similar to previously described functional disorders in adults, such as IBS and functional dyspepsia. Clinical experience also suggested that a symptom complex called abdominal migraine existed.

A prospective study of 257 children 5 years of age or older presenting with abdominal pain or discomfort, nausea, or vomiting for 1 month or more identified 127 subjects meeting the Rome II criteria for dyspepsia (before evaluation for disease).[15] Symptoms were ulcer-like in 26% and dyspepsia-like in 15% of the subjects. Fifty six of these subjects underwent esophagogastroduodenoscopy, and 35 were found to have no evidence of disease. These 35 subjects were believed to fulfill strict criteria for functional dyspepsia. Symptoms of IBS were present in approximately one fourth of the patients with functional dyspepsia.

Questionnaires administered during a population-based study of middle- and high-school students revealed a symptom complex consistent with IBS in 6% of middle-school students and 14% of high-school students.[2] None of these subjects were tested for organic disease. A prospective study of 227 children 5 years of age or older referred to a pediatric gastroenterology clinic for evaluation of chronic abdominal pain showed that 117 had symptoms consistent with IBS.[16] Diagnostic testing failed to reveal underlying disease. Concomitant upper abdominal discomfort or nausea was present in one third of these subjects.

A well-designed and implemented epidemiologic study[17] of a general population demonstrated an increased prevalence of a lifetime maternal history of migraine in children with recurrent abdominal pain, migraine headache, and abdominal migraine. Abdominal migraine was defined as recurrent abdominal pain associated with nausea and/or vomiting of sufficient severity to stop normal activity plus 3 of the following: pallor, fever, limb pain, dizziness, or headache. Among study patients, 2.4% had abdominal migraine. Children with abdominal migraine were 2.6 times more likely to have a maternal history of migraine. Another prospective cross-sectional questionnaire study[18] of a large random sample of school children 5 to 15 years old compared children with migraine headaches and children with abdominal migraine. Abdominal migraine was defined as (1) pain severe enough to interfere with normal daily activities; (2) pain dull or colicky in nature; (3) periumbilical or poorly localized pain; (4) any 2 of anorexia, nausea, vomiting, or pallor; (5) attacks lasting for at least 1 hour; and (6) complete resolution of symptoms between attacks. Approximately 4.1% had abdominal migraine. Children with migraine headaches were twice as likely to have abdominal migraine, and children with abdominal migraine were twice as likely to have migraine headaches as the general population.

Question 2: What is the predictive value of history items?

There are no studies of unselected patients showing that pain frequency, severity, location, or effects on lifestyle are able to distinguish between functional and organic disorders (evidence quality C).

Children with recurrent abdominal pain are more likely than children without recurrent abdominal pain to have headache, joint pain, anorexia, vomiting, nausea, excessive gas, and altered bowel symptoms. There are insufficient data to determine if the presence of associated symptoms can help the physician distinguish between functional and organic disorders (evidence quality C).

The presence of alarm symptoms or signs suggests a higher pretest probability or prevalence of organic disease and may justify the performance of diagnostic tests. Alarm symptoms or signs include but are not limited to involuntary weight loss, deceleration of linear growth, gastrointestinal blood loss, significant vomiting, chronic severe diarrhea, persistent right upper or right lower quadrant pain, unexplained fever, and family history of inflammatory bowel disease (evidence quality D).

Functional abdominal pain lacks a diagnostic marker. Because no prospective studies on natural history or incidence compare the history of children with and without recurrent episodes of abdominal pain, it cannot be stated that duration of pain itself supports a diagnosis of functional pain. The committee was able to identify 25 peer-reviewed studies of patients with chronic abdominal pain of >3 months' duration in which symptom description was included in the results and patient-selection criteria were most likely to exclude author bias (survey, questionnaire, or consecutive patients prospectively or retrospectively enrolled for study).[2,8,19–41] One quarter of these studies were performed in North America, one quarter were performed in the Far East, and half were performed in Europe. The available studies provide evidence that frequency, severity, location, and timing (postprandial, waking during night) of abdominal pain do not help distinguish between organic and functional abdominal pain. Children with recurrent episodes of abdominal pain are more likely than children without abdominal pain or children with behavior disorders to have anorexia, nausea, episodic vomiting, constipation, diarrhea, headache, arthralgia, or eye problems. Yet, none of these associated symptoms have been reported to help distinguish between organic and functional abdominal pain. Younger age of onset of pain and inability to attend school because of pain were associated with a decision to consult a physician.[37]

Physical examination of children with recurrent or chronic abdominal pain has been described rarely. The presence of tenderness on abdominal palpation has been reported to be characteristic of children with recurrent episodes of abdominal pain without

evidence of organic disease when compared with control children.[28]

Question 3: What is the predictive value of laboratory tests?

There is no evidence to evaluate the predictive value of blood tests (evidence quality D).

There is no evidence to determine the predictive value of blood tests in the face of alarm signals (evidence quality D).

Because researchers have used results of laboratory testing as inclusion or exclusion criteria for functional abdominal pain, there are no studies that have evaluated the usefulness of common laboratory tests (complete blood cell count, erythrocyte sedimentation rate, comprehensive metabolic panel, urinalysis, stool parasite analysis) to distinguish between organic and functional abdominal pain. Investigations of specific biological markers have described significant differences between patients with recurrent episodes of abdominal pain and control subjects (such as increased plasma cholecystokinin concentrations and decreased plasma oxytocin and cortisol concentrations in children with pain).[29,42] However, the number of patients in these studies is small, and the value of such measurements to clinical practice remains to be determined. The coexistence of abdominal pain and an abnormal test result for a common gastrointestinal disorder such as lactose malabsorption or *H pylori* infection does not necessarily indicate a causal relationship between the 2. Treatment of lactose malabsorption often does not result in resolution of abdominal pain, and children with *H pylori* infection are not more likely to have abdominal pain than children without *H pylori*. Children with lactose malabsorption may have a phenotype overlapping with diarrhea-predominant IBS.

Question 4: What are the predictive values of other diagnostic tests?

There is no evidence to suggest that the use of ultrasonographic examination of the abdomen and pelvis in the absence of alarm symptoms has a significant yield of organic disease (evidence quality C).

There is little evidence to suggest that the use of endoscopy and biopsy in the absence of alarm symptoms has a significant yield of organic disease (evidence quality C).

There is insufficient evidence to suggest that the use of esophageal pH monitoring in the absence of alarm symptoms has a significant yield of organic disease (evidence quality C).

Ultrasonographic examination of the abdomen and pelvis is a painless, noninvasive, and inexpensive test that can detect abnormalities of the kidneys, gallbladder, liver, pancreas, appendix, intestines, ovaries, and uterus. When abdominal and pelvic ultrasonography has been performed in children with recurrent episodes of abdominal pain without alarm symptoms, abnormalities have been found in fewer than 1%.[43] Abnormalities detected on ultrasonography may not be causally related to the patient's abdominal pain. When atypical symptoms are present, such as jaundice, urinary symptoms, back or flank pain, vomiting, or abnormal findings on physical examination, an abdominal and pelvic ultrasonography is more likely to detect an abnormality (approximately 10%).

Endoscopy and biopsy of the esophagus, stomach, and duodenum, an invasive and expensive procedure, can detect esophagitis, gastritis, duodenitis, and ulceration. Esophageal pH monitoring, also an invasive and expensive test, measures the frequency and duration of exposure of the esophagus to gastric acid as a means of diagnosing gastroesophageal reflux. Studies of endoscopy, biopsy, and/or esophageal pH monitoring performed in children with recurrent abdominal pain have demonstrated abnormalities in 25% to 56%, but reports have been limited by small sample size, sample bias, variability of findings, and questionable specificity and generalizability.[40,44–46] Endoscopic or histopathologic abnormalities such as esophagitis, gastritis, or duodenitis do not predict the prognosis, which is generally favorable in children with recurrent abdominal pain, including those with dyspepsia.[15]

Question 5: What is the diagnostic value of the psychosocial history?

The literature was reviewed with respect to 3 domains of psychosocial history: life-event stress, child emotional/behavioral symptoms, and family functioning.

Life-Event Stress

There is a small amount of evidence suggesting that the presence of recent negative life events is not useful in distinguishing between functional abdominal pain and abdominal pain of other causes (evidence quality B). There is limited evidence suggesting that daily stressors are associated with the occurrence of pain episodes and that higher levels of negative life events are associated with increased likelihood of symptom persistence (evidence quality C). There is no evidence on whether life stress influences symptom severity, course, or response to treatment (evidence quality D).

Studies including comparison groups of other patients are relevant in assessing the value of the psychosocial history in the differential diagnosis of chronic abdominal pain. One study[47] compared 30 pediatric patients with recurrent episodes of abdominal pain with 30 patients referred for acute minor illness or injury. Life-event change in the previous year did not differ significantly between the 2 groups. Another study found no difference between patients with recurrent abdominal pain and patients with minor organic disease (eg, gastritis, esophagitis) on measures of patients' personal life events or mothers' reports of family life events.[48] No studies have found that the presence of life-event stress significantly differentiates patients with functional abdominal pain from other patient groups.

Nonetheless, several investigations have reported higher levels of life stress in children with chronic abdominal pain compared with children without abdominal pain. Two studies compared pediatric patients with abdominal pain with healthy school children and found significantly higher levels of life-event stress in patients with pain.[23,49] A diary study

found that patients with recurrent episodes of abdominal pain reported significantly more daily stressors than healthy school children; moreover, the relation between daily stressors and somatic complaints was significantly stronger for patients with abdominal pain than for healthy school children.[41] Thus, although there is no evidence that life stress helps distinguish between patients with functional abdominal pain and patients with organic disease, children with functional abdominal pain may experience stressors that warrant attention. Additional research is needed to evaluate whether these stressors contribute to symptom severity, course, or response to treatment.

Emotional/Behavioral Symptoms

There is evidence suggesting that the presence of anxiety, depression, or behavior problems is not useful in distinguishing between functional abdominal pain and abdominal pain of other causes (evidence quality B). There is evidence that patients with recurrent abdominal pain have more symptoms of anxiety and depression (internalizing emotional symptoms) than do healthy community controls (evidence quality B). In contrast, there is evidence that children with recurrent abdominal pain do not have higher levels of conduct disorder and oppositional behavior (externalizing emotional symptoms) compared with healthy community controls (evidence quality B). There are no data on whether emotional/behavioral symptoms predict symptom severity, course, or response to treatment (evidence quality D). There is evidence suggesting that children with recurrent abdominal pain are at risk of later emotional symptoms and psychiatric disorders (evidence quality B).

Several studies have used standardized measures to assess emotional/behavioral symptoms in patients with chronic abdominal pain and other patient groups. In a study comparing 30 patients with abdominal pain with 30 patients with acute minor illness or injury, no significant differences were found between the patient groups when depression was assessed by interview or a child self-report measure.[47] Another study comparing 19 patients with functional abdominal pain with 19 patients with an organic etiology of abdominal pain found no significant differences between the groups on the Child Behavior Checklist completed by the mother or on the Rutter B2 Behavioral Scale completed by the teacher.[50] Similarly, no significant differences were found between patients with and without organic findings in 2 studies that included pediatric patients whose abdominal pain ranged in duration from 1 month to several years.[48,51] Thus, no studies have found a significant difference between patients with abdominal pain that is functional or organic in etiology with respect to emotional/behavioral symptoms.

Considerable evidence suggests that patients with chronic abdominal pain have more symptoms of anxiety and depression than do community controls. In a study of 31 children with recurrent abdominal pain and 31 matched classroom control children, mothers' reports indicated significantly higher scores for internalizing emotional symptoms (anxiety, depression) in children with abdominal pain.[52] Teachers' reports did not show significant group differences. However, a structured diagnostic interview indicated that 26 of the 31 children with abdominal pain met the criteria for a psychiatric diagnosis. In most cases, these diagnoses were anxiety related. Others also have observed higher levels of anxiety and depression in patients with recurrent episodes of abdominal pain compared with community controls,[48,51] although 1 study found that patients with abdominal pain were within the normal range for anxiety and depression on the basis of published normative data,[53] and another found no difference between patients with abdominal pain and controls on self-report or interview measures of depression.[25] A community-based study of students in middle and high school found that those with IBS-like symptoms had significantly higher scores than their peers without IBS on self-report questionnaire measures of anxiety and depression.[2] In contrast to the positive findings for anxiety and depression, no studies have found significant differences between children with recurrent episodes of abdominal pain and community controls on measures of conduct disorder or oppositional behavior.

Finally, results of 3 studies suggest that children with recurrent abdominal pain may be at risk of later anxiety and depression. A recent study compared 28 young adults evaluated for functional abdominal pain between the ages of 6 and 17 years with 28 matched former childhood participants of a study of tonsillectomy and adenoidectomy (controls).[7] An average of 11 years after the target visit, a structured psychiatric diagnostic interview was administered to identify psychiatric disorders based on *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*[54] criteria. Compared with controls, those with persistent abdominal pain were significantly more likely to meet criteria for a lifetime or current history of anxiety disorder. In another study, children with abdominal pain and controls were identified in data from a national longitudinal birth cohort study.[34] At 36 years of age, participants were administered a semistructured psychiatric interview that generated scores representing thresholds for psychiatric disorder. Persistent abdominal pain in childhood was significantly associated with psychiatric disorder in adulthood. In a prospective study of 31 patients with recurrent abdominal pain and 31 control children, mothers' reports of depressive symptoms and anxiety in their children 5 years after baseline assessment were significantly higher for patients with abdominal pain than for control children.[55]

Family Functioning

There is evidence that parents of patients with recurrent abdominal pain have more symptoms of anxiety, depression, and somatization than do parents of community controls or parents of other pediatric patients (evidence quality C). There is some evidence that families of patients with recurrent abdominal pain do not differ from families of control children or families of patients with acute illness in broad areas of family functioning, such as family cohesion, conflict, and marital satisfaction (evidence quality C).

Two studies used structured diagnostic interviews to assess family history of psychiatric disorders in patients with recurrent episodes of abdominal pain compared with other patient groups. In 1 study, 28 adults with a childhood history of recurrent episodes of abdominal pain were compared with 28 adults who had undergone minor surgery as children (controls).[7] Participants with a history of childhood abdominal pain were significantly more likely than controls to report having a first-degree relative with generalized anxiety disorder, and there was a trend suggesting group differences on family history of major depression. In another study, on the basis of interviews with 20 mothers of children with functional abdominal pain and 20 mothers of children with an organic etiology for abdominal pain, the mean number of psychiatric disorders per relative was found to be significantly higher in the functional-pain group than in the organic-pain group.[56] With respect to particular types of disorders, a significant difference was found only for somatization disorder, with the functional-pain group having a higher proportion of affected relatives. A third study[51] found that, compared with control parents, mothers (but not fathers) of children with recurrent episodes of abdominal pain had significantly higher levels of anxiety, depression, and somatization symptoms. Studies also have reported higher levels of emotional distress in parents of children with recurrent episodes of abdominal pain compared with parents of children without abdominal pain.[24,25,34]

Finally, a few studies have examined broad areas of family functioning. These studies found no difference between patients with abdominal pain and other patient groups or controls on measures of parent marital satisfaction[47,48] or family cohesion and conflict.[48] In 1 study, children with recurrent episodes of abdominal pain reported greater parental encouragement of illness behavior than did children without abdominal pain.[48]

Question 6: What is the effectiveness of pharmacologic treatment?

A thorough review of the literature with a focus on RCTs revealed a paucity of studies examining pharmacologic and dietary interventions. Therefore, definitive statements concerning therapeutic efficacy are quite limited.

There is evidence that treatment for 2 weeks with peppermint oil may provide benefit in children with IBS (evidence quality B).

In a randomized, double-blind, controlled trial, 42 children with IBS were given pH-dependent, enteric-coated peppermint-oil capsules or placebo. After 2 weeks, 75% of those receiving peppermint oil had decreased severity of pain associated with IBS.[57] It was concluded that peppermint oil can be used as a therapeutic agent during the symptomatic phase of IBS. This was a short study of an agent not commonly used in the treatment of IBS. Entry criteria were not well described, other symptoms were not affected, and the safety and palatability of the drug were not described. Despite these shortcomings, the study represents an important proof-of-concept study supporting a beneficial effect of a medication with possible smooth muscle–relaxing properties in children with IBS.

There is inconclusive evidence of the benefit of H_2-receptor antagonists to treat children with dyspepsia (evidence quality B).

A double-blind, placebo-controlled trial of famotidine was conducted in 25 children with abdominal pain and dyspepsia.[58] Among the different variables evaluated, only the global evaluation suggested that there was a benefit of famotidine over placebo. Using the quantitative assessment, however, the mean improvement of the score using famotidine versus placebo was not statistically significant. There was also a significant improvement in symptoms during the first treatment period regardless of the medication used. A subset of patients with dyspeptic symptoms demonstrated a significant benefit from the drug. In this study, enrolled children had to meet Apley and Naish criteria and had to have dyspeptic symptoms. The study population was heterogeneous, with some patients having positive *H pylori* titers and others having an abnormal lactose breath hydrogen test. It is the opinion of the subcommittee that H_2-receptor antagonists may be beneficial for children with severe dyspeptic symptoms (including heartburn), but the results were difficult to generalize to children with functional abdominal pain.

There is inconclusive evidence that fiber supplement intake decreases the frequency of pain attacks for patients with recurrent abdominal pain (evidence quality B).

A randomized, double-blind, placebo-controlled study in 52 children with recurrent episodes of abdominal pain recruited from primary care practices[59] demonstrated a statistically significant decrease in pain attacks in children who were given additional fiber, compared with those receiving placebo. The study involved small groups (26 each), and improvement was marginal (7 improved with placebo and 13 with fiber).

There is inconclusive evidence that a lactose-free diet decreases symptoms in children with recurrent abdominal pain (evidence quality B).

In a study of 103 children 6 to 14 years of age with nonlocalized abdominal pain for 4 months, a similar prevalence of lactase deficiency was found in the control and abdominal-pain groups.[60] Thirty-eight patients completed 3 successive 6-week diet trials conducted in a double-blind fashion. The patients then were placed on a 12-month milk-elimination diet. The results suggested that the elimination of lactose did not affect the overall rate of improvement in abdominal pain. In addition, the recovery rate was similar in both lactose absorbers and nonabsorbers, independent of dietary restrictions. This study suggested that lactose intolerance and recurrent abdominal pain are 2 separate entities, and a lactose-free diet has no effect on outcome of abdominal pain in lactose absorbers and nonabsorbers.

There are limited data to suggest that pizotifen is efficacious in the treatment of abdominal migraine (evidence quality B).

Pizotifen is a potent antagonist of the serotonin 2A (5-HT2A) receptor, which is not approved for use in

the United States. A placebo-controlled crossover study used pizotifen for the treatment of 14 children with abdominal migraine.[61] Patients received either pizotifen (0.25 mg, twice daily) or placebo syrup for 2 months, then the alternate treatment for 2 months. While being treated with pizotifen, the study children had fewer days of abdominal pain and lower indices of severity and misery. The medication was well tolerated. These results may not be generalizable to children with milder symptoms. Common adverse effects include drowsiness, dizziness, increased appetite, and weight gain.

Question 7: What is the effectiveness of cognitive-behavioral therapy?

There is evidence that cognitive-behavioral therapy may be useful in improving pain and disability outcome in the short term (evidence quality B).

Two RCTs[62,63] evaluated the efficacy of a cognitive-behavioral program and a cognitive-behavioral family intervention for the treatment of nonspecific abdominal pain. In the first study, results showed that both the experimental and the control groups had decreased levels of pain. However, the treated group improved more quickly, the effects generalized to the school setting, and a larger proportion of subjects were completely pain-free by 3 months' follow-up. In the second study, the children and mothers who were taught coping skills had a higher rate of complete elimination of pain, lower levels of relapse at 6 and 12 months' follow-up, and lower levels of interference with their activities as a result of pain, and parents reported a higher level of satisfaction with the treatment. After controlling for pretreatment levels of pain, children's active self-coping and mothers' caregiving strategies were significant independent predictors of pain behavior after treatment.

Question 8: What is the effectiveness of surgery?

There is no evidence of the possible beneficial role of surgery in the evaluation or management of children with recurrent abdominal pain (evidence quality D).

There are no studies comparing diagnostic or therapeutic surgery with other approaches (evidence quality D).

The literature search identified a study[64] aimed at evaluating the results of diagnostic laparoscopy in children with chronic recurrent abdominal pain. It was a series of 13 children with chronic severe episodes of abdominal pain who were subjected to diagnostic laparoscopy. Extensive laboratory and imaging studies did not contribute to the diagnosis. Laparoscopic findings that identified the cause of abdominal pain were obtained in 12 of 13 patients. Laparoscopic appendectomy was performed in all patients. Follow-up varied from 6 months to 3 years. Abdominal pain resolved in 10 patients. It was concluded that diagnostic laparoscopy is a valuable procedure in the management of children with chronic recurrent abdominal pain. The study patients represented a subgroup of children with very severe symptoms of abdominal pain, all having required hospitalization and multiple imaging studies. Although they all were found to have an organic etiology for their pain, some of the etiologies may actually be debatable as causes of disease (for example, cecal adhesion or fibrosed appendix). Two patients required a second laparoscopy for complications related to the first one. No other study addresses laparoscopy or other procedures as treatments of recurrent abdominal pain.

SUMMARY

Chronic abdominal pain (long-standing intermittent or constant abdominal pain) is common in children and adolescents. In most children, chronic abdominal pain is functional, that is, without objective evidence of an underlying organic disorder. Yet, an important part of the physician's job is to determine which children have an organic disorder. A review of the current evidence, however, indicates that there are no studies showing that pain frequency, severity, location, or effects on lifestyle help to discriminate between functional and organic disorders. Children with chronic abdominal pain are more likely than children without chronic abdominal pain to have headache, joint pain, anorexia, vomiting, nausea, excessive gas, and altered bowel symptoms, but there is insufficient evidence that the presence of the associated symptoms can help the physician discriminate between functional and organic disorders. Although children with chronic abdominal pain and their parents are more often anxious or depressed, the presence of anxiety, depression, behavior problems, or recent negative life events does not seem to be useful in distinguishing between functional and organic abdominal pain.

There is evidence that children with functional abdominal pain can have symptom clusters characterized as functional dyspepsia, IBS, or abdominal migraine as well as isolated abdominal pain. Some patients have features of more than 1 type of functional abdominal pain.

The physician also must decide whether to order diagnostic tests and, if so, which tests. The presence of alarm symptoms or signs suggests a higher pretest probability or prevalence of organic disease and may justify the performance of diagnostic tests. Alarm symptoms or signs include but are not limited to weight loss, deceleration of linear growth velocity, significant vomiting, chronic severe diarrhea, evidence of gastrointestinal blood loss, persistent right upper or right lower quadrant pain, unexplained fever, family history of inflammatory bowel disease, or abnormal or unexplained physical findings. The predictive value of blood tests, with or without alarm signals, has not been studied adequately. There is no evidence to suggest that the use of ultrasonographic examination of the abdomen and pelvis in the absence of alarm symptoms has a significant yield of organic disease. There is little evidence to suggest that the use of endoscopy with biopsy or esophageal pH monitoring has a significant yield of organic disease in the absence of alarm symptoms.

There is limited evidence suggesting that daily stressors are associated with the occurrence of pain episodes and that higher levels of negative life events are associated with increased likelihood of symptom persistence. Some evidence suggests that patients

with chronic abdominal pain have more symptoms of anxiety and depression than do community controls and are at greater risk of later emotional symptoms and psychiatric disorders. However, there are no data on whether emotional or behavioral symptoms predict symptom severity, course, or response to treatment. Parents of patients with chronic abdominal pain seem to have more symptoms of anxiety, depression, and somatization than do parents of community controls or parents of other pediatric patients. However, families of children with chronic abdominal pain do not seem to differ from families of children without abdominal pain or families of patients with acute illness in broad areas of family functioning.

There have been few studies of the treatment of chronic abdominal pain in children. There is inconclusive evidence that a lactose-free diet decreases symptoms or that a fiber supplement decreases the frequency of pain attacks. There is inconclusive evidence of the benefit of acid suppression with H_2-receptor antagonists to treat children with dyspepsia. There is evidence that treatment for 2 weeks with peppermint oil may provide benefit in children with IBS. There is also evidence that cognitive-behavioral therapy may be useful in improving pain and disability outcome in the short term.

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APPENDIX 1. Summary of the Quality of the Evidence

Question	Evidence	Quality of Evidence
1	There is limited but credible evidence of the existence of functional dyspepsia, IBS, and abdominal migraine in children.	C
2	There are no studies of unselected patients showing that pain frequency, severity, location, or effects on lifestyle are able to distinguish between functional and organic disorders.	C
2	Children with recurrent abdominal pain are more likely than children without recurrent abdominal pain to have headache, joint pain, anorexia, vomiting, nausea, excessive gas, and altered bowel symptoms. There are insufficient data to determine whether the presence of associated symptoms can help the physician to distinguish between functional and organic disorders.	C
2	The presence of alarm symptoms or signs suggests a higher pretest probability or prevalence of organic disease and may justify the performance of diagnostic tests. Alarm symptoms or signs include but are not limited to involuntary weight loss, deceleration of linear growth, gastrointestinal blood loss, significant vomiting, chronic severe diarrhea, persistent right upper or right lower quadrant pain, unexplained fever, and family history of inflammatory bowel disease.	D
3	There is no evidence to evaluate the predictive value of blood tests.	D
3	There is no evidence to determine the predictive value of blood tests in the face of alarm signals.	D
4	There is no evidence to suggest that the use of ultrasonographic examination of the abdomen and pelvis in the absence of alarm symptoms has a significant yield of organic disease.	C
4	There is little evidence to suggest that the use of endoscopy and biopsy in the absence of alarm symptoms has a significant yield of organic disease.	C
4	There is insufficient evidence to suggest that the use of esophageal pH monitoring in the absence of alarm symptoms has a significant yield of organic disease.	C
5	There is a small amount of evidence suggesting that the presence of recent negative life events is not useful in distinguishing between functional abdominal pain and abdominal pain of other causes.	B
5	There is limited evidence suggesting that daily stressors are associated with the occurrence of pain episodes and that higher levels of negative life events are associated with increased likelihood of symptom persistence.	C
5	There is no evidence on whether life stress influences symptom severity, course, or response to treatment.	D
5	There is evidence suggesting that the presence of anxiety, depression, or behavior problems is not useful in distinguishing between functional abdominal pain and abdominal pain of other causes.	B
5	There is evidence that patients with recurrent abdominal pain have more symptoms of anxiety and depression (internalizing emotional symptoms) than do healthy community controls.	B
5	In contrast, there is evidence that children with recurrent abdominal pain do not have higher levels of conduct disorder and oppositional behavior (externalizing emotional symptoms) compared with healthy community controls.	B
5	There are no data on whether emotional/behavioral symptoms predict symptom severity, course, or response to treatment.	D
5	There is evidence suggesting that children with recurrent abdominal pain are at risk of later emotional symptoms and psychiatric disorders.	B
5	There is evidence that parents of patients with recurrent abdominal pain have more symptoms of anxiety, depression, and somatization than do parents of community controls or parents of other pediatric patients.	C
5	There is some evidence that families of patients with recurrent abdominal pain do not differ from families of community controls or families of patients with acute illness in broad areas of family functioning, such as family cohesion, conflict, and marital satisfaction.	C
6	There is evidence that treatment for 2 wk with peppermint oil may provide benefit in children with IBS.	B
6	There is inconclusive evidence of the benefit of H_2 blockers to treat children with dyspepsia.	B
6	There is inconclusive evidence that fiber supplement intake decreases the frequency of pain attacks for patients with recurrent abdominal pain.	B
6	There is inconclusive evidence that a lactose-free diet decreases symptoms in children with recurrent abdominal pain.	B
6	There are limited data to suggest that pizotifen is efficacious in the treatment of abdominal migraine.	B
7	There is evidence that cognitive-behavioral therapy may be useful in improving pain and disability outcome in the short term.	B
8	There is no evidence of the possible beneficial role of surgery in the evaluation or management of children with recurrent abdominal pain.	D
8	There are no studies comparing diagnostic or therapeutic surgery with other approaches.	D

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Steering Committee on Quality Improvement and Management

Classifying Recommendations for Clinical Practice Guidelines

ABSTRACT. Clinical practice guidelines are intended to improve the quality of clinical care by reducing inappropriate variations, producing optimal outcomes for patients, minimizing harm, and promoting cost-effective practices. This statement proposes an explicit classification of recommendations for clinical practice guidelines of the American Academy of Pediatrics (AAP) to promote communication among guideline developers, implementers, and other users of guideline knowledge, to improve consistency, and to facilitate user understanding. The statement describes 3 sequential activities in developing evidence-based clinical practice guidelines and related policies: 1) determination of the aggregate evidence quality in support of a proposed recommendation; 2) evaluation of the anticipated balance between benefits and harms when the recommendation is carried out; and 3) designation of recommendation strength. An individual policy can be reported as a "strong recommendation," "recommendation," "option," or "no recommendation." Use of this classification is intended to improve consistency and increase the transparency of the guideline-development process, facilitate understanding of AAP clinical practice guidelines, and enhance both the utility and credibility of AAP clinical practice guidelines. ***Pediatrics*** **2004;114:874–877;** ***practice guidelines, evidence-based, recommendation, classification system.***

ABBREVIATION. AAP, American Academy of Pediatrics.

INTRODUCTION

Clinical practice guidelines are intended to reduce inappropriate variations in clinical care, minimize harm, promote cost-effective practice, and produce optimal health outcomes for patients. Evidence-based guidelines use a systematic process to select and review scientific evidence to develop policy. In a clinical practice guideline, policy is stated in terms of recommendations. Recommendations are the guideline components that are intended to influence practitioner and patient behavior.

The contemporary, evidence-based approach to guideline development differs from other methods of creating policy in several ways, including:

1. The high level of rigor with which the evidence in support of a policy is identified, appraised, and summarized, and
2. The explicit linkage between recommendations and the evidence that supports them.

Like all scientists, evidence-based guideline developers define their methods first and then allow their methods to lead to the results rather than deciding first on the outcome.

A variety of systems have been used to convey information to guideline readers regarding the quality of evidence that supports a given recommendation and the strength assigned to the recommendation by guideline developers. A large number of numeric and alphabetic codes contribute to general confusion about the meaning of these scales. A recent evidence report prepared by the Agency for Healthcare Research and Quality found 121 scales, checklists, or other types of instruments for rating evidence quality.[1]

The American Academy of Pediatrics (AAP) develops clinical practice guidelines internally through various entities and in collaboration with other organizations and also considers for endorsement guidelines developed by external organizations. Clearly, the method used to classify recommendations in clinical practice guidelines should be consistent and explicit. A unified approach will facilitate communication between guideline developers and users and promote appropriate interpretation and application of guidelines by clinicians.

The objective of this statement is to describe a system for defining recommendation strength for AAP evidence-based practice guidelines that is clear, informative, and helpful to users. A common current approach to indicate the strength of a recommendation is to append a term to describe the "level of consensus" or, in some instances, fervor achieved. Because this judgment may not reflect unanimity of the development team and can be influenced disproportionately by vociferous or persuasive team members, it represents a lapse in an otherwise explicit system to link guideline statements to the strength of evidence and recommendation.

The proposed system was derived from existing systems that support the principle of using explicit criteria for guideline development. This system is intended for use by the AAP in the process of developing evidence-based clinical practice guidelines. This statement describes 3 sequential processes in evidence-based policy setting: 1) determination of evidence quality in support of a proposed recom-

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mendation; 2) evaluation of the balance between anticipated benefits and harms when the recommendation is carried out; and 3) designation of recommendation strength.

CLASSIFICATION PROCEDURE

1. Assess Evidence Quality: Individual and Aggregate

Quality appraisal of individual studies examines both the type of study and the rigor of the investigator's adherence to methodologic principles. Evidence quality refers to "the extent to which all aspects of a study's design and conduct can be shown to protect against systematic bias, nonsystematic bias, and inferential error."[2] Systematic errors include selection bias and confounding, in which values tend to be inaccurate in a particular direction. Nonsystematic errors are attributable to chance. Inferential errors result from problems in data analysis and interpretation, such as choice of the wrong statistical measure or wrongly rejecting the null hypothesis.

Highest-quality evidence for therapeutic interventions comes from well-designed and well-conducted randomized, controlled trials performed on a population similar to the guideline's target population. The lowest-quality evidence is derived from case reports, reasoning from first principles of pathophysiology, and expert opinion based on ill-defined "clinical experience." Intermediate-quality evidence is associated with a randomized, controlled trial with "nonfatal flaws" or methodologic limitations (for example, one performed on a group from a population different from the target population, therefore requiring that findings be extrapolated) or with an observational design such as a case-control or cohort study. For studies of diagnostic tests, the representativeness of the population studied, the adequacy of the description of the test, the appropriateness of the reference standard against which the test is compared, and the methods used to avoid bias in interpretation of results (such as blinded comparison with the reference standard) are criteria for judging quality.[3]

After systematically reviewing the literature for studies that bear on a policy decision, evidence-based guideline developers must carefully review each study, extract the findings, and appraise both the quality of the study design and its execution. The specific quality criteria applied depend on the design and type of study. For example, appraisal of controlled trials requires consideration of the adequacy of randomization and blinding and loss to follow-up; assessing case-control studies requires consideration of the appropriateness of matching cases and controls.

Next, guideline developers must consider the quality of the aggregate of studies that bear on the issue. Judging the strength of a body of evidence requires careful consideration of the consistency of the results of individual studies, the magnitude of the effect that the studies detect, and the individual and aggregate sample sizes of these studies.[1]

2. Assess Anticipated Balance Between Benefits and Harms

The anticipated benefit, harm, risk, and cost of adherence to a guideline recommendation constitute the second factor that influences the strength of a recommendation. Guyatt et al[4] suggest looking at the clarity of the balance between benefits and harms. When the evidence indicates a clear benefit not offset by important harms or costs or a clear harm not mitigated by important benefit, stronger recommendations are possible. On the other hand, when the magnitude of the benefit is small or benefits are present but offset by important adverse consequences, the equilibrium between benefits and harms prevents a strong recommendation. A clear preponderance of benefit or harm supports stronger statements for or against a course of action. When the benefit-harm assessment is balanced, no matter how good the studies, practitioners should be offered options rather than recommendations. Such cases mirror the situation described by Bass,[5] in which "there is adequate evidence at hand to support those who wish to treat...yet the evidence is not so overwhelming as to suggest that those who do not choose to use this form of therapy are in error."

3. Assign Recommendation Strength

Recommendation strength communicates the guideline developers' (and the sponsoring organizations') assessment of the importance of adherence to a particular recommendation and is based on both the quality of the supporting evidence and the magnitude of the potential benefit or harm. The proposed classification defines 4 levels of policy (strong recommendation, recommendation, option, and no recommendation) based on:

- Four levels of aggregate evidence quality: A, B, C, and D (see Fig 1);
- Two benefit-harm assessments: clear (ie, substantial) preponderance of benefit or harm versus a relative balance of benefits and harms; and
- A category for recommendation under exceptional situations in which evidence cannot be obtained but clear benefits or harm are evident.

Because guideline recommendations are prescriptive or proscriptive (constraining variation in practice), guideline developers must follow an approach that has a high likelihood of doing more good than harm. The more restrictive the guidance (strong recommendation), the more certain the guideline developers and endorsers must be of its correctness. The AAP believes that its policy makers should be cautious about classifying a recommendation as strong, lest they jeopardize their credibility by making statements that do not stand up to scientific scrutiny. Most recommendations are likely to be just that: recommendations.

When the evidence is of low quality and the benefit-harm equilibrium is balanced, guideline developers generally should not constrain the clinician's discretion by making a recommendation but instead should designate acceptable alternatives as options.

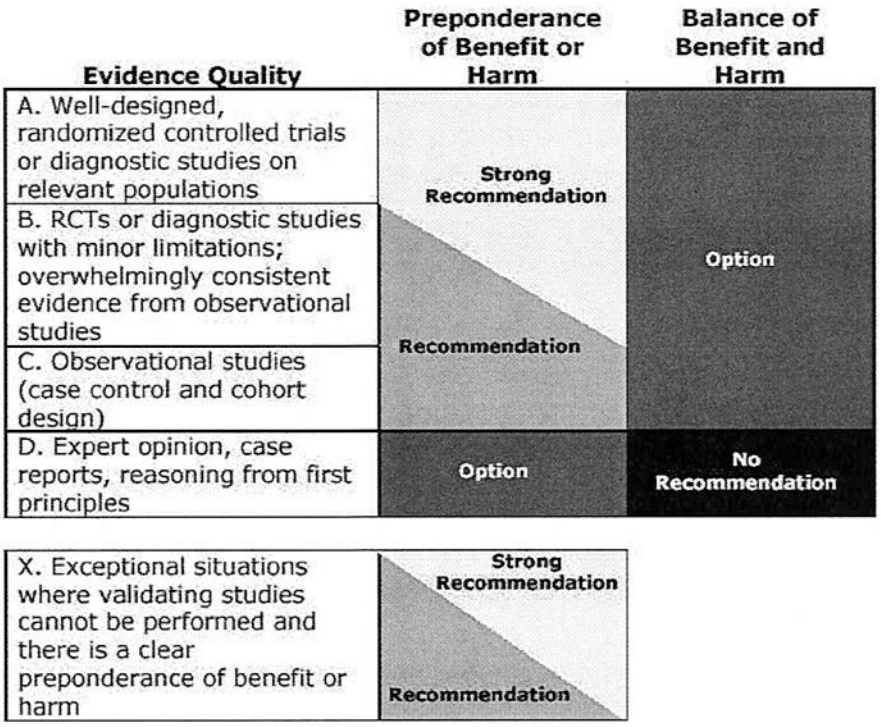

Fig 1. Integrating evidence quality appraisal with an assessment of the anticipated balance between benefits and harms if a policy is carried out leads to designation of a policy as a strong recommendation, recommendation, option, or no recommendation.

Although options do not direct clinicians' actions toward one activity or another, they may place boundaries by delineating appropriate alternative practices.

When the evidence is scant and the balance of benefit and harm is unknown, as for example with some complementary and alternative medicine practices, no recommendation regarding therapy may be possible. Stating that no recommendation is possible provides information but little direction to the clinician. No-recommendation statements are therefore of limited utility and should be discouraged. In some cases, guideline developers still may be able to make policy or offer options based on evidence. For example, although there may be no evidence of effectiveness of a complementary and alternative medicine practice, developers may be able to recommend that clinicians should inquire about use of complementary and alternative medicine and counsel about potential interactions. In other circumstances, guideline developers might suggest individualization on the basis of risk and values.

In some cases, a recommendation or strong recommendation may be made when analysis of the balance of benefits and harms demonstrates an exceptional preponderance of benefit or harm and it would be unethical to perform clinical trials to "prove" the point. These are almost exclusively situations of a medical (not social or political) nature. For example, the anticipated benefit of a recommendation for prescribing anthrax prophylaxis to exposed patients clearly outweighs the expected harms and calls for a strong recommendation, although studies do not exist to support the practice. Such situations with poor evidence but a highly unbalanced benefit-harm equation must be unmistakably differentiated from other circumstances in which high-quality evidence supports strong recommendations. Requiring the authors to explicitly state the benefit-harm proposition opens it up for constructive debate.

INTERPRETING GUIDELINE RECOMMENDATIONS

How should a clinician interpret recommendations from the AAP in light of the proposed criteria for guideline recommendations? Guidelines are never intended to overrule professional judgment; rather, they may be viewed as a relative constraint on individual clinician discretion in a particular clinical circumstance. Less frequent variation in practice is expected for a strong recommendation than might be expected with a recommendation. Options offer the most opportunity for practice variability.[6] Clinicians should always act and make decisions on behalf of their patients' best interests and needs regardless of guideline recommendations. Guidelines represent the best judgment of a team of experienced clinicians and methodologists addressing the scientific evidence for a particular clinical topic.

A strong recommendation means that the committee believes that the benefits of the recommended approach clearly exceed the harms of that approach (or, in the case of a strong negative recommendation, that the harms clearly exceed the benefits) and that the quality of the evidence supporting this approach is either excellent or impossible to obtain. Clinicians should follow such guidance unless a clear and compelling rationale for acting in a contrary manner is present.

A recommendation means that the committee believes that the benefits exceed the harms (or, in the case of a negative recommendation, that the harms exceed the benefits), but the quality of the evidence on which this recommendation is based is not as

strong. Clinicians also generally should follow such guidance but also should be alert to new information and sensitive to patient preferences.

An option means either that the evidence quality that exists is suspect or that well-designed, well-conducted studies have demonstrated little clear advantage to one approach versus another. Options offer clinicians flexibility in their decision-making regarding appropriate practice, although they may set boundaries on alternatives. Patient preference should have a substantial role in influencing clinical decision-making, particularly when policies are expressed as options.

No recommendation is made when there is both a lack of pertinent evidence and an unclear balance between benefits and harms. Clinicians should feel little constraint in their decision-making when addressing areas with insufficient evidence. Patient preference should have a substantial role in influencing clinical decision-making.

The AAP believes that adoption of an explicit, consistent classification of recommendations will facilitate communication between the AAP entities that develop guidelines (committees, sections, and task forces and the board of directors) and pediatricians who apply them to clinical practice. We recognize that any classification system may be considered by payors in making reimbursement decisions. This classification is intended only to increase transparency and to enhance the utility and credibility of AAP clinical practice guidelines. Direct linkage of this classification to reimbursement decisions would be overly simplistic, because recommendation strength is one of many factors that should be considered in developing reimbursement policy. Experience and new knowledge will likely require periodic revision of the proposed classification system.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Climatic Heat Stress and Exercising Children and Adolescents

COUNCIL ON SPORTS MEDICINE AND FITNESS AND COUNCIL ON SCHOOL HEALTH

KEY WORDS

body-temperature regulation, heat stroke, primary prevention, risk management, school health, sports medicine, youth sports

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abstract

FREE

Results of new research indicate that, contrary to previous thinking, youth do not have less effective thermoregulatory ability, insufficient cardiovascular capacity, or lower physical exertion tolerance compared with adults during exercise in the heat when adequate hydration is maintained. Accordingly, besides poor hydration status, the primary determinants of reduced performance and exertional heat-illness risk in youth during sports and other physical activities in a hot environment include undue physical exertion, insufficient recovery between repeated exercise bouts or closely scheduled same-day training sessions or rounds of sports competition, and inappropriately wearing clothing, uniforms, and protective equipment that play a role in excessive heat retention. Because these known contributing risk factors are modifiable, exertional heat illness is usually preventable. With appropriate preparation, modifications, and monitoring, most healthy children and adolescents can safely participate in outdoor sports and other physical activities through a wide range of challenging warm to hot climatic conditions. *Pediatrics* 2011;128:e741–e747

INTRODUCTION

The American Academy of Pediatrics recognizes that appropriate and sufficient regular physical activity plays a significant part in enhancing and maintaining health.[1–7] However, special consideration, preparation, modifications, and monitoring are essential when children and adolescents are engaging in sports or other vigorous physical activities in warm to hot weather. Exertional heat illness, including heat exhaustion and heat stroke, might occur even in a temperate environment, but the risk is highest when children and adolescents are vigorously active outdoors in hot and humid conditions. Severe exertional heat injury or heat stroke is associated with significant morbidity and mortality, especially if diagnosis is delayed and appropriate medical management is not initiated promptly. The Appendix contains definitions of the heat-illness–related terms used in this statement.

Researchers have previously suggested that children are less effective in regulating body temperature, incur greater cardiovascular strain, and have lower exercise tolerance during exercise in the heat compared with adults.[8–13] However, more recent studies, in which both groups were exposed to *equal* relative intensity exercise workloads and environmental conditions while minimizing dehydration, have compared 9- to 12-year-old boys and girls to *similarly* fit and heat-acclimatized adults. These newer findings indicate that children and adults have similar rectal and skin temperatures, cardiovascular re-

sponses, and exercise-tolerance time during exercise in the heat.[14–17] Accordingly, modifiable evidence-based determinants of exertional heat-illness risk in youth should be the focus of prevention measures.

Current or recent illness increases the challenge of participating in physical activity safely in the heat because of the potential negative residual effects on hydration status and regulation of body temperature. This is especially true for illnesses that involve gastrointestinal distress (eg, vomiting, diarrhea) and/or fever. Notable chronic clinical conditions and medications that contribute to decreased exercise-heat tolerance and increased exertional heat-illness risk include diabetes insipidus,[18] type 2 diabetes mellitus,[19] obesity,[20,21] juvenile hyperthyroidism (Graves disease),[22] cystic fibrosis,[23] and anticholinergic drugs or certain other medications that affect hydration or thermoregulation (eg, a dopamine-reuptake inhibitor to treat attention-deficit/hyperactivity disorder or enhance performance[24] or diuretics). Any other chronic or acute medical condition[25] or injury[26] that adversely affects water-electrolyte balance, thermoregulation, and exercise-heat tolerance warrants particular concern as well. Sickle cell trait should also be considered a possible contributing clinical risk/complicating factor for vascular dysfunction, exertional rhabdomyolysis, and collapse related to red blood cell sickling in youth during strenuous physical activity in the heat.[27–29] A previous episode of heat stroke, however, generally does not seem to have long-term negative effects on thermoregulation, exercise-heat tolerance, or exertional heat-illness risk, especially for those who received prompt cooling therapy.[30]

POLICY AND RECOMMENDATIONS

Most healthy children and adolescents can safely participate in outdoor sports and other physical activities through a wide range of challenging warm to hot climatic conditions. With appropriate preparation, modifications, and monitoring, exertional heat illness is usually preventable. Table 1 summarizes key heat-illness risk factors during sports and other physical activity and recommended responses (actions) for reducing physiologic strain and improving safety and activity tolerance. As heat and humidity increase and as additional other exertional heat-illness risk factors such as those listed in Table 1 are present, the

TABLE 1 Key Exertional Heat-Illness Risk Factors During Exercise, Sports, and Other Physical Activities and Recommended Responses (Actions) for Reducing Physiologic Strain and Improving Activity Tolerance and Safety

Risk factors
Hot and/or humid weather
Poor preparation
Not heat-acclimatized
Inadequate prehydration
Little sleep/rest
Poor fitness
Excessive physical exertion
Insufficient rest/recovery time between repeat bouts of high-intensity exercise (eg, repeat sprints)
Insufficient access to fluids and opportunities to rehydrate
Multiple same-day sessions
Insufficient rest/recovery time between practices, games, or matches
Overweight/obese (BMI ≥ 85th percentile for age) and other clinical conditions (eg, diabetes) or medications (eg, attention-deficit/hyperactivity disorder medications)
Current or recent illness (especially if it involves/involved gastrointestinal distress or fever)
Clothing, uniforms, or protective equipment that contribute to excessive heat retention
Actions[a]
Provide and promote consumption of readily accessible fluids at regular intervals before, during, and after activity
Allow gradual introduction and adaptation to the climate, intensity, and duration of activities and uniform/protective gear
Physical activity should be modified
Decrease duration and/or intensity
Increase frequency and duration of breaks (preferably in the shade)
Cancel or reschedule to cooler time
Provide longer rest/recovery time between same-day sessions, games, or matches
Avoid/limit participation if child or adolescent is currently or was recently ill
Closely monitor participants for signs and symptoms of developing heat illness
Ensure that personnel and facilities for effectively treating heat illness are readily available on site
In response to an affected (moderate or severe heat stress) child or adolescent, promptly activate emergency medical services and rapidly cool the victim

With any of these risk factors or other medical conditions[25] adversely affecting exercise-heat safety present, some or all of the actions listed may be appropriate responses to reduce exertional heat-illness risk and improve well-being.

[a] As environmental conditions become more challenging (heat and humidity increase) and as additional other listed risk factors are present, the possible actions to improve safety become more urgent. Note that each listed action does not necessarily correspond or apply to any particular or every listed risk factor.

actions for improving safety become more urgent. Likewise, as the number of risk factors for exertional heat illness increases, the maximum environmental heat and humidity level for safe exercise, sports participation, or other physical activities will decrease.

Operationally, pediatricians, coaches, and administrators need to make appropriate recommendations and "on-the-field" decisions to improve safety and minimize exertional heat-illness risk for a team or event as a whole. However, given individual variations in health status, conditioning, or other circumstances, some participants might not require the same heightened concern as other young athletes who might need implementation of additional exertional heat-illness prevention measures and closer monitoring in the same or a less challenging environment. For instance, even with a heat index of 95°F (35°C), a very fit, well-hydrated, rested, healthy 12-year-old who is acclimatized to the hot and humid conditions can likely safely compete in a soccer game without significant risk to his or her well-being or safety. On the other hand, with a heat index of only 85°F (29.4°C), an overweight high school football player who recently recovered from diarrhea and is running wind sprints at the end of the second 3-hour workout on an unusually warm first day of preseason football is much more likely to be at risk of overheating and exertional collapse. These examples also underscore the infinite number of scenarios that can alter individual exertional heat-illness risk. Therefore, it is extremely difficult to impose appropriate universal measures for maintaining optimal safety for all children and adolescents while sensibly allowing sports participation and other physical activities to continue. Although Table 1 can be used to help guide the decision-making process in taking appropriate prevention measures, considerably more research is needed to examine core body-temperature responses and exertional heat-illness risk with children and adolescents in different environmental conditions during various practice,[31] competition,[32] and other physical activity scenarios.[33] With such empirical information, appropriate sport- and activity-specific "heat safety grids" and field evidence-based prevention, participation, and cancellation guidelines can be developed.

Community pediatricians can be instrumental in improving heat safety for children and adolescents engaged in youth sports and other physical activities by actively participating as school team physicians or on school wellness committees or health councils; on school boards; on local, regional, or national sport or sports medicine advisory committees; or in local parks and recreation programs to educate youth and parents and to guide coaches and administrators in developing and implementing effective exertional heat-illness prevention and management strategies. However, field evidence is not currently sufficient to optimally guide pediatricians, coaches, administrators, and youth sport governing bodies in making the most appropriate and advantageous modifications to play and practice specific to heat safety or deciding when to cancel activities altogether if necessary. Accordingly, parents, teachers, coaches, athletic trainers, and pediatricians as well as youth sports governing bodies and administrators should always emphasize and use suitable prevention strategies, to the best of their ability, to improve safety and appropriately minimize the risk of exertional heat illness for all children and adolescents during exercise, sports participation, and other physical activities in warm to hot weather. To this end, the American Academy of Pediatrics recommends the following.

1. Community and team/school physicians as well as athletic directors, community parks and recreation programs, and youth sport governing bodies should emphasize comprehensive awareness, education, and implementation of effective exertional heat-illness risk-reduction strategies to coaches and their staff, athletic trainers, teachers, administrators, and others who oversee or assist with exercising children and adolescents and youth sports, especially for those involved with youth and preseason high school American football.
2. Trained personnel and facilities capable of effectively treating all forms of heat illness, especially exertional heat stroke by rapidly lowering core body temperature, should be readily available on site during all youth athletic activities and community programs that involve vigorous physical activity and are held in the heat.
3. Children and adolescents should be regularly educated on the merits of proper preparation, ample hydration, honest reporting, and effectively managing other factors under their control, such as recovery and rest, which will directly affect exercise-heat tolerance and safety.
4. Each child and adolescent should be given the opportunity to gradually and safely adapt to preseason practice and conditioning, sport participation, or other physical activity in the heat by appropriate and progressive acclimatization. This process includes graduated exposure (typically over a 10- to 14-day period) to the environment, intensity, duration, and volume of physical activity and to the insulating and metabolic effects of

wearing various uniform and protective-equipment configurations. Specific guidelines for American youth football are available[34,35] and can be used as a basis for developing other youth sports-acclimatization and practice-modification/monitoring strategies.

5. Sufficient, sanitary, and appropriate fluid should be readily accessible and consumed at regular intervals before, during, and after all sports participation and other physical activities to offset sweat loss and maintain adequate hydration while avoiding overdrinking. Generally, 100 to 250 mL (approximately 3–8 oz) every 20 minutes for 9- to 12-year-olds and up to 1.0 to 1.5 L (approximately 34–50 oz) per hour for adolescent boys and girls is enough to sufficiently minimize sweating-induced body-water deficits during exercise and other physical activity as long as their preactivity hydration status is good. Preactivity to postactivity body-weight changes can provide more specific insight to a person's hydration status and rehydration needs. Although water is often sufficient to maintain adequate hydration, long-duration (eg, ≥1-hour) or repeated same-day sessions of strenuous exercise, sport participation, or other physical activity might warrant including electrolyte-supplemented beverages that emphasize sodium to more effectively optimize rehydration.[36–40] This is especially justified in warm- to hot-weather conditions, when sweat loss is extensive.
6. Exercise, sport participation, and other physical activity should be modified for safety in relation to the degree of environmental heat stress: air temperature, humidity, and solar radiation, as indicated by the heat index or wet-bulb globe temperature (WBGT), for those with access to such a device. Effective modifications include lowering the intensity and/or shortening the activity duration and increasing the frequency and duration of breaks, which would preferably be in the shade. Individual medical conditions[25] and other risk factors identified by a preparticipation physical examination or as indicated by a more recent change in health status that could lower tolerance for exercise in the heat and increase risk for exertional heat illness should also prompt these and additional modifications (see Table 1).
7. Any child or adolescent should avoid or limit exercise, sport participation, or other physical activity in the heat if he or she is currently ill or is recovering from an illness, especially those involving gastrointestinal distress (eg, vomiting, diarrhea) and/or fever.
8. Supervisory staff such as coaches, athletic trainers, physical education teachers, and playground aides should receive appropriate training and closely monitor all children and adolescents at all times during sports and other physical activity in the heat for signs and symptoms of developing heat illness. Any significant deterioration in performance with notable signs of struggling, negative changes in personality or mental status, or other concerning clinical markers of well-being, including pallor, bright-red flushing, dizziness, headache, excessive fatigue, vomiting, or complaints of feeling cold or extremely hot, should be sufficient reason to immediately stop participation and seek appropriate medical attention for those affected. First aid for evolving heat illness should not be delayed. Anyone experiencing exertional heat illness should not return to practice or competition, recreational play, or other physical activity for the remainder of the current session, game/match, or play/activity period.
9. An emergency action plan with clearly defined written protocols should be developed and in place ahead of time. Emergency medical services (EMS) communication should be activated immediately for any child or adolescent who collapses or exhibits moderate or severe central nervous system dysfunction or encephalopathy during or after practice, competition, or other physical activity in the heat, especially if the child or adolescent is wearing a uniform and/or protective equipment that is potentially contributing to additional heat storage. Although treatment should not be delayed pending core body-temperature verification, when feasible, rectal temperature should be promptly checked by trained personnel and, if indicated (rectal temperature > 40°C [104°F]), on-site whole-body rapid cooling using proven techniques should be initiated without delay.[41–44] This process includes promptly moving the victim to the shade, immediately removing protective equipment and clothing, and cooling by cold- or ice-water immersion (preferred, most effective method) or by applying ice packs to the neck, axillae, and groin and rotating ice-water–soaked towels to all other areas of the body until rectal temperature reaches just under 39°C (approximately 102°F) or the victim shows clinical improvement. If rectal temperature cannot be assessed

in a child or adolescent with clinical signs or symptoms suggestive of moderate or severe heat stress, appropriate treatment should not be delayed. Prompt rapid cooling for 10 to 15 minutes and, if the child or adolescent is alert enough to ingest fluid, hydration should be initiated by attending staff while awaiting the arrival of medical assistance.

10. To improve athlete safety and performance, youth sports governing bodies, tournament directors, and other event administrators should provide adequate rest and recovery periods of 2 hours or *more* between same-day contests in warm to hot weather to allow sufficient recovery and rehydration.[45,46]
11. In conditions of extreme heat or humidity when children or adolescents can no longer maintain thermal balance, safety should be the priority, and outdoor contests and practice sessions should be canceled or rescheduled to cooler times, even if it means playing or practicing very early in the day or later in the evening.

APPENDIX: DEFINITIONS

Heat stress: High air temperature, humidity, and solar radiation that lead to perceived discomfort and physiologic strain when children and adolescents are exposed to such environmental conditions, especially during vigorous exercise and other physical activity.

Exertional heat illness: A spectrum of clinical conditions that range from muscle (heat) cramps, heat syncope, and heat exhaustion to life-threatening heat stroke incurred as a result of exercise or other physical activity in the heat.

Heat exhaustion: Moderate heat illness, characterized by the inability to maintain blood pressure and sustain adequate cardiac output, that results from strenuous exercise or other physical activity, environmental heat stress, acute dehydration, and energy depletion. Signs and symptoms include weakness, dizziness, nausea, syncope, and headache; core body temperature is $<$104°F (40°C).

Exertional heat stroke: Severe multisystem heat illness, characterized by central nervous system abnormalities such as delirium, convulsions, or coma, endotoxemia, circulatory failure, temperature-control dysregulation, and, potentially, organ and tissue damage, that results from an elevated core body temperature ($>$104°F [$>$40°C]) that is induced by strenuous exercise or other physical activity and typically (not always) high environmental heat stress.

Heat injury: Profound damage and dysfunction to the brain, heart, liver, kidneys, intestine, spleen, or muscle induced by excessive sustained core body temperature associated with incurring exertional heat stroke, especially for those victims in whom signs and/or symptoms are not promptly recognized and are not treated effectively (rapidly cooled) in a timely manner.

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CLINICAL REPORT

Clinical Genetic Evaluation of the Child With Mental Retardation or Developmental Delays

Guidance for the Clinician in Rendering Pediatric Care

John B. Moeschler, MD, Michael Shevell, MD, and the Committee on Genetics

ABSTRACT

This clinical report describes the clinical genetic evaluation of the child with developmental delays or mental retardation. The purpose of this report is to describe the optimal clinical genetics diagnostic evaluation to assist pediatricians in providing a medical home for children with developmental delays or mental retardation and their families. The literature supports the benefit of expert clinical judgment by a consulting clinical geneticist in the diagnostic evaluation. However, it is recognized that local factors may preclude this particular option. No single approach to the diagnostic process is supported by the literature. This report addresses the diagnostic importance of clinical history, 3-generation family history, dysmorphologic examination, neurologic examination, chromosome analysis (≥650 bands), fragile X molecular genetic testing, fluorescence in situ hybridization studies for subtelomere chromosome rearrangements, molecular genetic testing for typical and atypical presentations of known syndromes, computed tomography and/or magnetic resonance brain imaging, and targeted studies for metabolic disorders.

INTRODUCTION

The purpose of this clinical report of the American Academy of Pediatrics (AAP) Committee on Genetics is to describe an optimal clinical genetics evaluation of the child with developmental delays or mental retardation (DD/MR). Developmental surveillance is an integral component of a primary care medical home, and much is written about the importance of early identification and referral of children with developmental delays. For example, in "Developmental Surveillance and Screening of Infants and Young Children," the AAP Committee on Children With Disabilities discusses the importance of early identification and referral of infants with developmental delays by the primary care pediatrician and the importance of the pediatrician's responsibility to "determine the cause of delays or refer to appropriate consultant for determination."[1] No AAP statement has addressed the elements that constitute an optimal diagnostic evaluation of the infant or young child with DD/MR. This clinical report focuses on the diagnostic evaluation once the primary care pediatrician or other health care professional determines that there is a developmental delay. The goal of this diagnostic evaluation is to identify the etiology of the disability, including any medical genetic cause. The medical genetics diagnostic evaluation takes place within the context of a comprehensive evaluation of a child's neurodevelopmental status, which is designed to address

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Key Words
developmental delay, mental retardation, medical home, diagnostic evaluation, dysmorphology, medical genetics, chromosome, fragile X, molecular genetics, inborn errors of metabolism, central nervous system malformations

Abbreviations
AAP—American Academy of Pediatrics
DD/MR—developmental delays or mental retardation
CNS—central nervous system
EEG—electroencephalography
CT—computed tomography
FISH—fluorescence in situ hybridization

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the child's developmental management needs and guide the etiologic evaluation process.[2–5] The primary care pediatrician has a role in determining whether neurologic, developmental pediatrics, audiologic, or ophthalmologic evaluations, as well as other rehabilitative services, are needed in the child's neurodevelopmental diagnosis. Many primary care pediatricians will initiate aspects of the diagnostic evaluation; others will seek specialty consultation before embarking on the diagnostic evaluation. It is appropriate for the individual pediatrician to determine the diagnostic approach that is optimal for a particular child and family.

The type of developmental delay identified is an important preliminary step, because such typing influences the path of investigation that is undertaken later. The focus of this report is the child with cognitive developmental delays rather than those with motor delays or language delays solely. Such delays require accurate documentation using norm-referenced and age-appropriate standardized measures of development by experienced pediatricians or developmental specialists whenever feasible.[6,7] The term "developmental delay" is usually reserved for younger children (typically younger than 5 years), and the term "mental retardation" is usually applied to older children when IQ testing is valid and reliable.[8] Children with developmental delays are those who present with delays in the attainment of developmental milestones at the expected age. Developmental delays imply deficits in learning and adaptation,[2] which may be significant and predict later cognitive or intellectual disability. However, delays in development, especially those that are mild, may be transient and lack predictive reliability for mental retardation or other developmental disabilities.

Mental retardation (often referred to as "intellectual disability" and "cognitive disability") is a lifelong disability that presents in infancy or the early childhood years but cannot be diagnosed until the child is older than 5 years, when standardized measures of intelligence become reliable and valid. The American Association on Mental Retardation defines mental retardation by measures of 3 domains: intelligence (IQ), adaptive behavior, and systems of supports. Thus, one cannot rely solely on the measure of IQ to define mental retardation.[9]

The prevalence of developmental delay is estimated at 1% to 3% based on the rate often quoted for mental retardation.[2] However, this may be an overestimate.[10,11] The US Department of Education data from 1993 indicated a rate of 1.14%, although there are state-to-state variations in rates.[12] Developmental disabilities, taken together, affect 5% to 10% of all children.[13]

Developmental surveillance is one important component of a primary care medical home. The AAP Committee on Children With Disabilities states: "All infants and young children should be screened for developmental delays. Screening procedures should be incorporated into the ongoing health care of the child as part of the provision of a medical home, as defined by the Academy."[1] Developmental screening or surveillance identifies those who may need further evaluation and referral for services. Of those who are screened and identified with developmental delays, only a subset of the whole will be diagnosed with developmental delays that indicate the presence of a cognitive disability and for which this suggested diagnostic evaluation is warranted. The proportion of children who will have developmental delays detected on screening depends on the psychometric characteristics of the screening method used, including sensitivity and specificity of the screening test.[14]

The diagnosis of mental retardation cannot be made accurately or reliably until the child is at least 5 years of age; therefore, many children will continue with the diagnosis of developmental delay until 5 years or older. Thus, developmental delay might be considered as a set of symptoms and signs (a "phenotype") for which a variety of etiologies are known.

This clinical report will not address the etiologic evaluation of young children who are diagnosed with cerebral palsy, autism, or a single-domain developmental delay (gross motor delay or specific language impairment). Some children present with both developmental delay and features of autism. In such cases, the judgment of the clinical geneticist will be important in determining the evaluation of the child depending on the primary neurodevelopmental diagnosis. It is recognized that the determination that an infant or young child has a cognitive disability can be a matter of clinical judgment, and it is important for the pediatrician and consulting clinical geneticist to discuss this before deciding on the best approach to the diagnostic evaluation.

Pediatricians are key in the process that ultimately leads to making a diagnosis of DD/MR. Pediatricians often are charged with explaining the etiology of the child's DD/MR to the family as one role in providing a medical home.[1] The primary care pediatrician, by providing the medical home, is key in translating diagnostic results to help families develop an integrated, anticipatory plan including health care, education, and eventual transition planning.[15]

The yield of etiologic evaluations of children with DD/MR vary widely (10% to 81%).[2–5] The wide variation reflects many factors, such as study population differences, extent of the diagnostic evaluation, era during which the study was completed, and improving diagnostic technologic advances over time. There is also wide variation in the category of reported causes of mental retardation: 18.6% to 44.5% of cases have exogenous causes, such as teratogen exposure or infection, and 17.4% to 47.1% have genetic causes.[11,16–18]

For the purposes of this clinical report, we have adopted the definition of "etiology" proposed by Schaefer and Bodensteiner[19]: "a specific diagnosis [is]

that [which] can be translated into useful clinical information for the family, including providing information about prognosis, recurrence risks, and preferred modes of available therapy." For example, agenesis of the corpus callosum is a finding or sign and not a diagnosis, whereas Down syndrome is a clinical diagnosis, and when confirmed by a routine chromosome study, there is certainty that the clinical diagnosis is correct and indication as to how the patient came to have trisomy 21 (eg, nondisjunction versus translocation).

Pediatricians are expected to know the elements that constitute an optimal clinical genetics diagnostic evaluation for the cause of DD/MR. Families of children with DD/MR expect and deserve to know, whenever possible, the underlying etiology of their child's diagnosis. Pediatricians often refer such patients to consultants, including clinical geneticists, to assist with diagnosis and management and would benefit from knowing what represents an optimal evaluation. Knowing what is likely to be involved in the clinical genetics diagnostic evaluation will assist pediatricians in preparing the family for what to expect during the course of the evaluation and in integrating a diagnosis into the care provided to the child and family (Table 1).

Recently, the American College of Medical Genetics[3] and the American Academy of Neurology and Child Neurology Society[2] published statements on the evaluation of children with DD/MR. This clinical report will refer to these statements and to more recent literature to support this description of an optimal medical genetics evaluation for DD/MR. The AAP recognizes that the evaluation of a child is tailored to the specific facts of that child's situation as defined by the child, family, and referring pediatrician and that the consulting clinical geneticist will use clinical judgment in devising the most appropriate diagnostic evaluation schema. As Curry et al[3] stated, "there was no uniform consensus regarding the 'right' or 'wrong' approach. No unifying or single algorithm was found appropriate for every patient or every situation. A large number of variables currently affect the physician's evaluation process." And although Shevell et al[2] suggested a diagnostic algorithm, they acknowledge that there are few systematic studies of the process of evaluation. Cost savings are documented[20] when the evaluation process suggested by Shevell et al[2] is used, compared with that of a group of specialists not following a particular process; the diagnostic rate was no different. The AAP Committee on Genetics favors an approach modified from that suggested by van Karnebeek et al,[4] because it emphasizes the importance of the clinical history, family history, and diagnostic skill of the clinical geneticist (Fig 1).

TABLE 1 **What Families Might Expect From the Clinical Genetics Evaluation**

Before visit	Request for child's medical charts; neurodevelopmental test results; all medical test results; copies of MRI, CT, or other imaging studies
	Request to bring photographs of child and family members
	Asked about the family history
	Asked to set aside sufficient time for prolonged consultation
At the visit	Clarify the purpose of the visit
	Review the child's medical history and neurodevelopmental status
	Review family history (≥3 generations)
	Complete physical and neurologic examinations
	Geneticist's initial impressions discussed
After the visit	Clinical photographs
	Laboratory studies (blood and/or urine tests)
	Arrangements for MRI or CT studies
	Arrangements for other consultations (eg, neurology, developmental pediatrics, ophthalmology, etc)
	Arrangements for ongoing communication and follow-up visits

EXPECTED OUTCOMES OF A MEDIAL GENETICS EVALUATION

There is no systematic study of the benefits (or harms) of a comprehensive evaluation of the child with DD/MR. However, there are recurring statements of likely benefits for parents and patients in the literature.[3,21–24] For example, Shevell[21] indicated that the "etiologic diagnosis in the young child has immediate implications with respect to recurrence risks and therapeutic imperatives, possessing the potential to modify management and expected outcomes" and that "future medical challenges and the actual prognosis for the disabled child can be more accurately addressed." The family of a child with DD/MR often experiences the feeling of a loss of control,[25] and a diagnosis can contribute to the family feeling in control once more. "As physicians we have experience with other children who have the same disorder, access to management programs, knowledge of the prognosis, awareness of research on understanding the disease and many other elements that when shared with the parents will give them a feeling that some control is possible"[23] (Table 2).

KEY COMPONENTS OF THE GENETICS EVALUATION

The referring pediatrician and the family will benefit from knowing what to expect from the medical genetics consultation and evaluation. The approach to a child with DD/MR includes the clinical history (including prenatal and birth histories), family history and construction of a pedigree of 3 generations or more, and physical and neurologic examinations, emphasizing the examination for minor anomalies and neurologic or behavioral signs that might suggest a specific recognizable syndrome or diagnosis (Table 3). After this clinical consultation, judicious use of laboratory tests, imaging, and

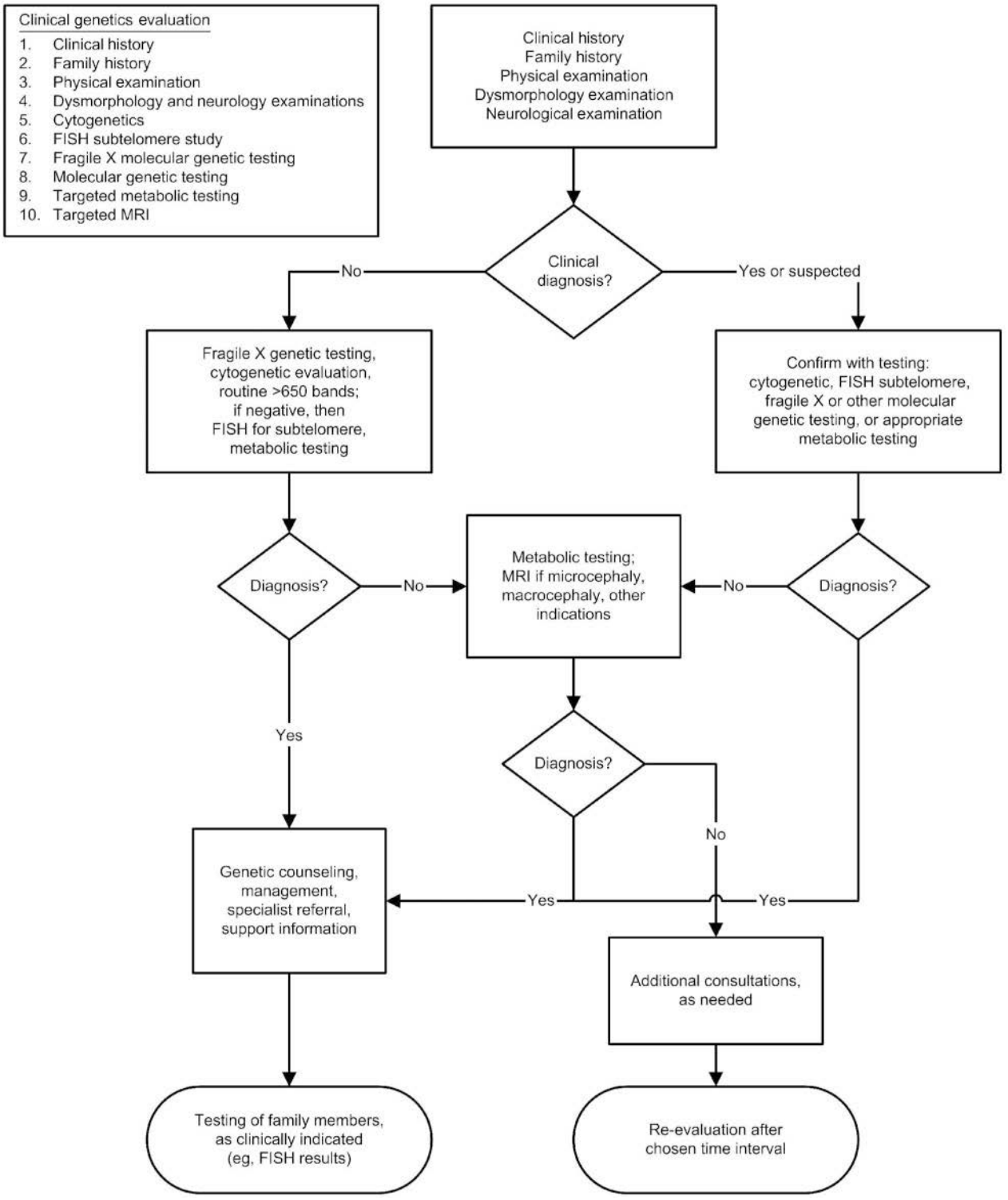

FIGURE 1
Approach to the clinical genetics evaluation for DD/MR.

other consultant services can be anticipated with most patients.

Family History

An optimal medical genetics evaluation starts with a comprehensive history and physical examination, including a 3-generation family history with particular attention to family members with mental retardation, developmental delays, psychiatric diagnoses, congenital malformations, miscarriages, stillbirths, and early childhood deaths. The medical and family history allows for the clinical geneticist to suspect an etiology and helps in

TABLE 2 **Expected Benefits of Evaluation for DD/MR[3]**

For parents	Questions addressed
	What is the cause of my child's delays?
	How did this happen?
	Are there medical complications?
	What can we expect in the future?
	Is there treatment?
	Will this happen again in future children?
	Can it be prevented in future children?
	Can we test for it in future pregnancies?
	Are others in my family at risk?
	How can I learn more?
	What support resources are available?
For pediatricians	Clarification of etiology, prognosis, genetic mechanism(s), recurrence risks, treatment options
	Avoidance of unnecessary tests
	Information regarding management or surveillance and family support
	Research/treatment protocols
	Co-management of appropriate patients

TABLE 3 **Selected Clinical Findings or Laboratory Abnormalities Suggesting a Metabolic Disorder[3]**

Failure of appropriate growth
Recurrent unexplained illness
Seizures
Ataxia
Loss of psychomotor skills
Hypotonia
"Coarse" appearance
Eye abnormalities (cataracts, ophthalmoplegia, corneal clouding, abnormal retina)
Recurrent somnolence/coma
Abnormal sexual differentiation
Arachnodactyly
Hepatosplenomegaly
Metabolic/lactic acidosis
Hyperuricemia
Hyperammonemia
Low cholesterol
Structural hair abnormalities
Unexplained deafness
Bone abnormalities (dysostosis, occipital horns, punctuate calcifications)
Skin abnormalities (angiokeratoma, "orange-peel" skin, ichthyosis)

guiding the diagnostic evaluation; it does not stand alone and is important only in the context of the clinical examination. The family history can help in suggesting a diagnosis, particularly when other family members are affected similarly. This is important especially in the case of male patients who have male relatives with DD/MR, related through females who are not mentally retarded. Such a pedigree suggests an X-linked genetic cause of DD/MR and requires special attention (see section on fragile X testing later in this report).

The Dysmorphologic Examination

Pediatricians and families can expect that an optimal clinical genetics evaluation will include a thorough examination for minor anomalies that might suggest an etiology or contribute to the recognition of a particular diagnostic pattern—a dysmorphologic examination.[26–28] Schaefer and Bodensteiner[19] state that the "association of mental retardation and congenital malformations has long been recognized" and that "a necessary component of the evaluation of the child with idiopathic mental retardation is a comprehensive dysmorphologic examination."

Several studies of etiology of mental retardation suggest that the dysmorphologic examination and syndrome recognition by an experienced clinical geneticist is the critical diagnostic modality. An early study of the co-occurrence of mental retardation and minor anomalies was that of Smith and Bostian.[29] The authors examined 50 children with mental retardation of unknown cause for the numbers and kinds of minor anomalies; controls consisted of 100 children without mental retardation. They found that 42% of the children with DD/MR had 3 or more minor anomalies, compared with none of the controls. They concluded that the etiology of the mental retardation was abnormal development of the central nervous system (CNS) heralded by the presence of the minor anomalies on the surface examination. Hunter[18] completed a retrospective study of the diagnostic evaluation of 411 children with mental retardation referred to a university-based genetics center between 1986 and 1997. He found that "physical findings in the patient were the most important factors in determining whether or not a diagnosis was made. . . A diagnosis was significantly more likely when a patient was noted to have an unusual appearance (sic) and, although the numbers are small, the presence of a major malformation did not increase the diagnostic rate. Half the diagnoses were made on the basis of a key finding (eg, velopharyngeal incompetence) or the Gestalt of the patient."

In a prospective study of patients referred to a university hospital clinical genetics center in Amsterdam, Netherlands, for diagnostic evaluation for DD/MR, van Karnebeek et al[5] studied 281 children prospectively and made etiologic diagnoses in 150 (54%). One third of these diagnoses were made on the basis of history and examination alone; in another one third, history and examination provided essential clues to the diagnosis, later confirmed by additional studies; and laboratory studies alone provided diagnoses in the remaining one third. For example, in patients with Prader-Willi syndrome, these authors felt the history and examination were contributory to the diagnosis and the molecular genetic analysis was essential for the diagnosis. Using these definitions, they found that the dysmorphologic examination was contributory to the diagnosis in 79% of cases and essential in 62%. This study found that on the basis of clinical history alone, a diagnosis could be estab-

lished in 1 of 20 patients, and on the basis of physical examination alone, a diagnosis could be established in 1 of 30 patients. On the basis of history and examination together, a diagnosis was made in 1 of 3 patients. In addition, the clinical history and examination provided essential guidance to the clinician regarding which additional investigations should be performed. The additional investigations (laboratory and consultation) allowed for diagnosis in another one third of the patients in the study.

Similarly, Battaglia and Carey[30] found that a "pathogenetic diagnosis" could be identified in 80% of all patients; of these, half were diagnosed by history and physical examination alone. Majnemer and Shevell[7] found that a diagnosis was made in 63.3% of patients with "global developmental delays"; of this total, the diagnosis was made by history and physical examination alone in 18.4%. Shevell et al[22] studied 99 children with global developmental delays prospectively, and in 44, an etiology was determined. Of these 44, 15 (38.6%) had diagnoses made by history and physical examination alone. It is emphasized that Wood lamp examination for neurocutaneous disorders, such as tuberous sclerosis, is an essential component of the diagnostic evaluation. Thus, the dysmorphologic examination by the experienced clinical geneticist is a key element of the diagnostic evaluation.

Neurologic Examination

Like the dysmorphologic examination, the neurologic examination (defined as the physical examination focused on detecting neurologic abnormalities) is considered essential in the evaluation of every child with DD/MR. However, there are few systematic studies of the utility of the neurologic examination in establishing a diagnosis. For example, in their review, Majnemer and Shevell[7] included in this category the utility of electroencephalography (EEG) and neuroimaging by computed tomography (CT) or magnetic resonance imaging (MRI). The role of the neurologic examination itself is addressed by van Karnebeek et al[4] in their systematic review. They included 5 studies that addressed the neurologic examination alone[18,31–34] and reported that the total yield of etiologic diagnoses in all studies was 42.9%, which means that 42.9% of patients presenting with DD/MR had abnormalities, which typically included cerebral palsy, muscle weakness, spasticity, paresis, and microcephaly. Finding such abnormalities on neurologic examination assisted in determining the need for additional studies, such as EEG, neuroimaging or molecular genetic testing, or referral to other specialists.

Cytogenetic Studies

Cytogenetic studies in the evaluation of children with DD/MR are to be expected in all children for whom the etiology of DD/MR is unknown. The reported frequency of chromosome anomalies detected by high-resolution karyotyping (ie, ≥650 bands) in patients evaluated for DD/MR varies between 9% and 36%.[35] In a recent review of the frequency of cytogenetic abnormalities in the evaluation of patients with mental retardation by van Karnebeek et al,[5] the authors found the median frequency of detected chromosome abnormalities was nearly 1 in 10 patients investigated. Their review noted a wide range of reported frequencies of chromosome abnormalities causing mental retardation—from 2% to 50% depending on the variation in the study design among published reports. They found that chromosome abnormalities were present in all categories of mental retardation (mild to profound) and in both genders. The authors concluded that cytogenetic studies are a "valuable diagnostic technique" in the evaluation of children with DD/MR. In a recent prospective study of the etiology of mental retardation in which karyotyping was performed in 266 children in Amsterdam, van Karnebeek et al[31] found that 21 children (8.3%) had abnormalities (8 numerical, 13 structural). These authors found that there was a relationship between the number of minor anomalies and the likelihood of a chromosomal abnormality: a higher number of anomalies (more than 6) indicated a significantly higher likelihood to find a chromosomal abnormality. They concluded that all patients with no known cause for the DD/MR should have chromosome analysis performed.

Likewise, a review by Shevell et al[2] reported the range of chromosomal abnormalities found on routine cytogenetic analysis to be 2.93% to 11.6%, with a median of 3.7%. They concluded that "routine cytogenetic testing is indicated in the evaluation of the child with developmental delay even in the absence of dysmorphic features or clinical features suggestive of a syndrome." They cite Graham and Selikowitz,[36] who found that 4 of 10 patients with mental retardation attributable to chromosomal abnormalities had no dysmorphic features. Curry et al[3] state that "chromosome analysis in the individual with mental retardation is generally regarded as a mainstay in the overall evaluation process." van Karnebeek et al[4] found that approximately 10% of all patients with DD/MR had a chromosomal abnormality and recommended routine karyotyping in all patients for whom the etiology of the DD/MR was unknown. It is key that the cytogenetic study be reviewed by the clinical geneticist during the evaluation of a particular child. At times, a clinical geneticist may request a second chromosomal analysis for a number of reasons, ranging from high clinical suspicion of a certain chromosomal diagnosis to a desire to have a chromosomal study of sufficient bands to find smaller rearrangements, such as a 700-band study. Thus, pediatricians and families can anticipate that a routine chromosome analysis will be recommended for those patients in whom an etiology is not recognized after the clinical history and examination.

Submicroscopic Subtelomeric Rearrangements

Approximately half of all structural chromosomal abnormalities ("segmental aneusomies") include the telomere of the chromosome. A test for the absence of the functional end of the chromosome (subtelomere region) will effectively evaluate many potential abnormalities of that chromosome and, thus, the cause of the DD/MR. Many deletions of the telomeres are visible by standard techniques, and the syndromes caused by such deletions are often clinically recognizable (eg, cri-du-chat syndrome, which is caused by the deletion of the telomere of the short [p] arm of chromosome 5). However, deletions of other subtelomeric regions lead to a phenotype that is not recognized easily, and the deletions often go undetected by routine karyotyping.

Recently, fluorescence in situ hybridization (FISH) techniques have been applied to examine the subtelomeric regions of each chromosome for abnormalities that are known to cause mental retardation.[37–44] Since a complete set of FISH probes has become available clinically, the utility of these probes has been demonstrated by the numerous reports of patients with mental retardation who have had a previously normal routine karyotype, suggesting that subtelomeric abnormalities (deletions or duplications of chromosome regions) are second only to Down syndrome as the most common cause of mental retardation.[41,45] Some deletions and duplications of clinically significant chromosome material at the telomeres are not visible by standard karyotype analytic techniques; these are often referred to as "cryptic" subtelomeric chromosome anomalies (ie, they are not detectable by routine cytogenetic testing). The newer FISH techniques have allowed more sensitive analysis of the telomeres for clinically significant abnormalities.

The application of the FISH technique to examine the subtelomere region of each chromosome has led to the recognition that approximately 7.4% of children with moderate to severe mental retardation who have had normal results of routine chromosome analysis have an abnormality detected (either a deletion or duplication, sometimes both) by the FISH technique to explain their mental retardation. Also, 0.5% of children with mild mental retardation of previously unknown etiology have been found to have cryptic telomere rearrangements as the etiology.[41,45] Only a few subtelomeric syndromes have been delineated to date (Table 4).

Most subtelomeric abnormalities detected by FISH cause mental retardation syndromes that have not been fully delineated, thus making recognition and selection of patients for such testing challenging and counseling families regarding the natural history of their child's diagnosis difficult.

There have been apparent subtelomere deletions detected by FISH techniques that have been proven to be benign familial "variations" and not the cause of the child's DD/MR. Such "false positives" are thought to be rare[31] but complicate the evaluation of patients and their families by requiring parental samples for confirmation.

TABLE 4 **Recognizable Syndromes Caused by Subtelomeric Abnormalities Detected by FISH Technique**

Chromosome Syndrome	Key Features
1pter deletion	Growth retardation; mental retardation; seizures; visual problems; large anterior fontanelle; asymmetric and low-set, dysplastic ears; deep-set eyes; depressed nasal bridge; pointed chin; and fifth finger clinodactyly[72,73]
1p36.3 deletion	Ebstein anomaly; mental retardation[72–74]
1qter deletion	Microcephaly; growth and mental retardation; corpus callosum abnormalities; cardiac anomalies; hypospadias; characteristic facial features[75]
22qter deletion	Developmental delay; hypotonia; absent speech; and normal growth or somatic overgrowth[76–79]

Biesecker[45] reviewed 14 studies involving 1718 subjects who were selected on the basis of mental retardation, growth retardation, major and minor anomalies, exclusion of known diagnosis, and familial versus sporadic occurrence. It is notable that even with the variation in subject selection criteria from study to study, there was a relatively constant yield of subtelomere abnormalities detected by FISH of approximately 6%. The presence of major and minor physical anomalies did not affect the yield; however, the yield was higher among familial cases compared with sporadic cases. de Vries et al[47] have proposed a 5-item checklist designed to increase the yield of FISH subtelomere studies; using a score of ≥ 3 as a cutoff for subtelomere testing, the authors note that approximately 20% of cases could be excluded from testing without missing a subtelomeric case.

Thus, when the standard karyotype is normal, a FISH study for subtelomere rearrangements is an important diagnostic component in the evaluation of the child with DD/MR.

The use of microarray comparative genomic hybridization in the evaluation of children with DD/MR might be considered best as "emerging technology."[47] This methodology promises to detect abnormal copy numbers of DNA sequences—deletions and duplications of very small segments of the entire chromosomes. Currently, this testing technique samples many known clinically important loci simultaneously in addition to the subtelomeres and pericentric regions of all chromosomes. Some clinical geneticists have begun to take advantage of this testing technique in patients with undiagnosed DD/MR because it is an efficient method for subtelomere testing and can be used to confirm clinical suspicion on certain diagnoses (eg, Williams syndrome). It appears that this method will increase the clinician's ability to determine the cause of DD/MR, particularly in cases with minor anomalies. There are currently insufficient published reports of the use of this technology in the evaluation of the child with DD/MR. At the time of

this writing, a few clinical laboratories are offering this type of testing.

Molecular Genetic Diagnostic Testing and Fragile X Syndrome

Molecular genetic diagnostic testing is used to establish the genetic etiology for DD/MR when the diagnosis is considered established clinically (eg, a girl who fulfills established clinical diagnostic criteria for typical Rett syndrome) or suspected clinically (a young boy with nonspecific mental retardation suspected to have fragile X syndrome).

Fragile X Syndrome

Fragile X syndrome is said to be the most common genetic cause of DD/MR,[2] yet reviews suggest that only approximately 2.0% of patients with mental retardation (both genders) will be found to have a mutation in this gene (with prevalence ranging from 0% to 28.6%).[4] In their comprehensive review of the literature, van Karnebeek et al[4] found that those with more significant mental retardation are more likely to have positive results of fragile X testing (4.1%), compared with those with milder delays or borderline intelligence testing results (1.0%). In a large study of unselected school-aged patients with mental retardation, de Vries et al[48,49] reported a prevalence of fragile X diagnosed by molecular genetic testing to be 0.7%, with a higher prevalence among boys (1.0% for boys, 0.3% for girls). There have been a number of studies using clinical checklists aimed at improving identification of patients for whom fragile X testing is warranted. For example, de Vries et al[49] found that a 7-item clinical checklist increased the molecular genetic diagnostic yield to 7.6% without the loss of cases identified. This checklist included positive family history of mental retardation, long jaw or high forehead, large and/or protuberant ears, hyperextensible joints, soft and velvety palmar skin with redundancy on the dorsum of the hands, testicular enlargement, and behaviors of initial shyness and lack of eye contact followed by friendliness and verbosity. Other checklists designed to increase the efficiency of fragile X genetic testing have been used with results that are generally positive.[50–54] However, the design of such checklists varies, and comparisons among them are difficult. Generally, they included male gender, a positive family history for mental retardation, and absence of microcephaly.

At a consensus conference convened by the American College of Medical Genetics, it was recommended that fragile X testing be "strongly considered in both males and females with unexplained mental retardation especially in the presence of a positive family history, a consistent physical and behavioral phenotype and absence of major structural abnormalities."[3] Likewise, the Child Neurology Society and American Academy of Neurology advise in a practice parameter that fragile X testing be "considered in the evaluation of the child with global developmental delay" and that "clinical preselection may narrow the focus of who can be tested without sacrificing diagnostic yield."[2] van Karnebeek et al[4] recommend that all boys with unexplained mental retardation have molecular genetic testing for fragile X syndrome but caution that routine testing of girls is not warranted unless there are indications of increased risk (eg, a positive family history).

Pediatricians and families can expect that clinical geneticists are likely to recommend testing for fragile X syndrome in any child with undiagnosed DD/MR, particularly if there are findings in the history or examination suggestive of this diagnosis. Molecular genetic testing for fragile X is highly sensitive and specific and is considered the diagnostic standard for fragile X syndrome.[55]

Other Molecular Genetic Testing

There are situations in which the clinical geneticist may establish a clinical diagnosis and use genetic testing to confirm it (much in the same way that the clinical diagnosis of Down syndrome is confirmed by karyotyping). In addition to confirming the clinical diagnosis, genetic testing may be important for describing the genetic mechanism for the diagnosis and for improving the precision of genetic counseling. For example, Angelman syndrome might be attributable to one of several genetic mechanisms (interstitial deletion of the critical region of chromosome 15q, uniparental disomy, an imprinting mutation, or a mutation in the gene *UBE3A*), the knowledge of which becomes important for genetic counseling as well as for confirming the clinical diagnosis.[56]

In other situations, the clinical geneticist may consider molecular genetic testing for the patient who presents with "atypical features" of a known syndrome, as is the case for those suspected to have a mutation in the *MECP2* gene, which causes Rett syndrome in patients who do not fulfill the diagnostic criteria. There are now case reports of girls with milder presentations consistent with DD/MR who have mutations in *MECP2*[57] as well as males with X-linked mental retardation syndromes.[58] (Also see Laumonnier et al[59] for discussion of *NGLN4* gene mutations and X-linked mental retardation and autism.) Thus, in certain circumstances, the clinical geneticist may suggest testing for *MECP2* mutations when the patient does not fulfill the clinical diagnostic criteria for the syndrome in question (in this example, Rett syndrome) but when deemed appropriate to address the question of an "atypical presentation" of the known clinical syndrome. There is not yet sufficient data to suggest that this be part of the optimal genetics evaluation, but it does serve as a example of a likely trend in clinical genetics.

MRI and CT

The literature does not indicate universal agreement on the role that brain imaging by CT or MRI plays in the

evaluation of children with DD/MR. Recommendations range from performing brain imaging on all patients with DD/MR[60] to performing it only on those with indications on clinical examination.[4] Major or minor malformations of the brain are known to be an important finding in patients with DD/MR. The finding of a brain abnormality may lead to the recognition of the specific cause for a particular child's DD/MR in the same way that a dysmorphologic examination might lead to a clinical diagnosis. However, like other major or minor anomalies noted on physical examination, abnormalities on brain imaging typically are not sufficient for determining the cause of the DD/MR; the cause of the brain anomaly is often unknown. Thus, although a CNS anomaly (often called "CNS dysgenesis") is a useful finding (and considered, according to the definition by Schaefer and Bodensteiner,[19] a useful "diagnosis"), it is frequently not an etiologic or "syndrome" diagnosis. This distinction is not always made in the literature on the utility of MRI in the evaluation patients with DD/MR.

Early studies of the use of CT in the evaluation of patients with idiopathic mental retardation[61] indicated a low diagnostic yield or the nonspecific finding of "cerebral atrophy," which did not contribute to clarifying the cause of the mental retardation.[62] Later studies that used MRI to detect CNS abnormalities suggested that MRI is more sensitive than CT, with increased yield.[2,63] The rate of abnormalities detected on imaging varies widely in the literature as a result of many factors such as subject selection criteria and method of imaging (CT, MRI, whether quantitative methods were used). Schaefer and Bodensteiner,[60] in their literature review, found reported ranges of abnormalities from 9% to 80% of those patients studied. Shevell et al[2] reported a similar range of findings in their review.[2] For example, in 3 studies of a total of 329 children with developmental delay in which CT was used in almost all patients and MRI was used in a small sample, a specific cause was determined in 31.4%,[7] 27%,[22] and 30% of the children.[64] In their systematic review, van Karnebeek et al[4] reported on 9 studies of the use of MRI in children with mental retardation. The mean rate of abnormality found was 30%, with a range of 6.2% to 48.7%, and more abnormalities were found in children with moderate to profound mental retardation versus borderline to mild mental retardation (means of 30% and 21.2%, respectively). These authors also noted that none of the studies reported on the value of the absence of any neuroradiologic abnormality for a diagnostic workup and concluded that the "value for finding abnormalities or the absence of abnormalities must be higher" than the 30% mean rate implies.

If neuroimaging is performed in only selected cases with abnormal head circumference or an abnormal focal neurologic finding, the rate of abnormalities detected is increased. Shevell et al[22] reported that the percentage of abnormalities was 13.9% if performed on a "screening basis" but increased to 41.2% if performed on an "indicated basis." In their practice parameter, the American Academy of Neurology and Child Neurology Society[2] discussed other studies on smaller numbers of patients that showed similar results, which led to the recommendation that "neuro-imaging is a recommended part of the diagnostic evaluation," particularly should there be abnormal findings on examination (microcephaly, focal motor findings), and that MRI is preferable to CT. However, in the American College of Medical Genetics consensus conference report,[3] the authors state that neuroimaging by CT or MRI in the normocephalic patient without focal neurologic signs should not be considered "standard of practice" or mandatory. These authors felt that the decisions regarding "cranial imaging will need to follow (not precede) a thorough assessment of the patient and the clinical presentation."

In contrast, van Karnebeek et al[4] found that MRI alone leads to an etiologic diagnosis in a much lower percentage of patients studied. They cited Kjos et al,[65] who reported diagnoses in 3.9% of patients who had no known cause for their mental retardation and followed no progressive or degenerative course. Bouhadiba et al[66] reported diagnoses in 0.9% of patients with neurologic symptoms, and in 4 additional studies, no etiologic or syndrome diagnosis on the basis of neuroimaging alone was found.[18,62,64,67] The authors of 3 studies reported the results of unselected patients: Majnemer and Shevell[7] reported a diagnosis by this type of investigation in 0.2% of patients, Stromme[34] reported a diagnosis in 1.4% of patients, and van Karnebeek et al[31] reported a diagnosis in 2.2% of patients.

Abnormal findings on MRI are seen in approximately 30% of patients with DD/MR. However, MRI leads to an etiologic or syndrome diagnosis in 0% to 3.9% of patients studied. The value of a negative MRI result in leading to a diagnosis has not been studied. In addition, MRI in the young child with DD/MR invariably requires sedation or anesthesia to immobilize the child to accomplish the study. Although this poses a small risk for the child, it merits appropriate consideration by the clinicians and family.[60] Thus, although MRI is often useful in the evaluation of the child with DD/MR, it is not a mandatory study and has a higher diagnostic yield when indications exist (eg, microcephaly, focal motor findings on neurologic examination).

Metabolic Studies

Inborn errors of metabolism are a rare cause of DD/MR (approximately 1%), particularly when there are no other signs or symptoms suggestive of a metabolic disorder. Although rare, the effect of proper diagnosis and treatment of a metabolic disorder on the patient's prognosis may be substantial.

Shevell et al[2] found that "routine metabolic screen-

ing" of patients with DD/MR has a diagnostic yield of less than 1% and that a stepwise evaluation (on the basis of clinical indicators) will increase the diagnostic yield (on the basis of the single report of Papavasiliou et al[68]). Curry et al[3] found an "extremely low yield for unselected metabolic screening" and concluded that metabolic testing should be selective and "targeted at the suspected category of disorder" on the basis of the history and examination. In their systematic literature review, van Karnebeek et al[4] identified 16 studies that addressed the metabolic evaluation of patients with DD/MR. They reported diagnostic yield from metabolic studies of 0.2% to 8.4%, with a median of 1.0% of patients. The higher rates were from countries in which a specific metabolic disorder is common (eg, aspartylglycosaminuria in Finland) or from a study that included targeted screening of highly inbred populations. van Karnebeek et al[4] also found that comparison between studies was not possible given the lack of uniformity of metabolic testing from study to study.[4] These authors suggest that the need for any metabolic studies be determined by the history and examination findings and that, to standardize and study the approach, checklists be used to guide the metabolic evaluation of patients with DD/MR. Hunter[18] accepted "a metabolic screen . . . in any child under a year of age or who showed apparent deterioration" in his review of his center's evaluation process. Hunter reported that 37.5% of his patient sample had a metabolic screening of urine amino acids, mucopolysaccharides, nitroprusside, ketones, reducing substances, phenylhydrazide, and ferric chloride, and 7.1% had an organic acid screening. Using criteria that screening was justified if there were signs of a specific biochemical disease or the child had unexplained mental retardation and was younger than 1 year or there was evidence of apparent deterioration, Hunter[18] concluded that 75.3% of the metabolic screens and 69% of the organic acid studies were unnecessary. van Karnebeek et al[5] stated that "metabolic studies should not be performed as the first diagnostic study in each child, but in the absence of clues for other causes the yield is still of sufficiently high level to allow testing." Thus, there is a range of expert opinion regarding what constitutes the optimal metabolic screening pathway for patients who present with nonspecific DD/MR. More study in this area is needed.

Routine metabolic screening of all patients with DD/MR is not required; targeted metabolic studies are expected in patients on the basis of findings in the history or examination or if the clinical geneticist judges them necessary. Curry et al[3] have listed selected clinical findings or laboratory abnormalities that may indicate the need for further metabolic investigations (Table 3). Even in the absence of such indicators, some experts recommend routine metabolic testing of patients with nonspecific DD/MR.

Tandem mass spectrometry for screening for inborn errors of metabolism in newborn infants is an example of a recent technology that may affect the ability to screen patients with DD/MR for inborn errors of metabolism. Many metabolic conditions appear to be identifiable with relatively little cost[69,70] and a small sample of blood. However, there is insufficient literature on the clinical application at this time to judge its appropriateness in the evaluation of the child with DD/MR. Because the technology is used for newborn screening programs, the clinical utility in other settings, such as the evaluation of children who might be clinically symptomatic, is being discussed.[69,71] Studies addressing the optimal metabolic evaluation of patients with DD/MR are needed.

TABLE 5 Clinical Genetics Evaluation of the Child With DD/MR

1. Clinical history
2. Family history
3. Dysmorphologic examination
4. Neurologic examination
5. Karyotype
6. FISH for subtelomere abnormalities
7. Fragile X molecular genetic testing
8. Molecular genetic testing
9. Brain imaging (MRI)
10. Metabolic testing

SUMMARY

The aim of this clinical report was to describe what pediatricians and patients can anticipate as an optimal clinical genetics evaluation of the child with DD/MR (Table 5) and the anticipated benefits and outcome of such an evaluation. The literature supporting the clinical genetics diagnostic evaluation has been provided, as has a description of what pediatricians and families can anticipate. It is important to note that many patients will not have an etiologic diagnosis as a result of a complete diagnostic consultation. These patients and families deserve occasional reevaluations by the clinical geneticist as new diagnostic testing becomes available that might address the etiology of the child's DD/MR. The interval between diagnostic evaluations or the indications for reconsidering the evaluation timing (eg, new signs or symptoms) are topics that have not been systematically studied. It is important that the consulting clinical geneticist, primary care pediatrician (medical home), and family discuss the interval between evaluations and any signs or symptoms that might prompt an earlier return to the clinical geneticist.

COMMITTEE ON GENETICS, 2005–2006

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Clinical Policy: Evidence-Based Approach to Pharmacologic Agents Used in Pediatric Sedation and Analgesia in the Emergency Department

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INTRODUCTION

The appropriate management of pain and anxiety in the emergency department (ED) is a significant facet of emergency care for all patients, including pediatric patients. The administration of drugs for the purpose of reducing or eliminating pain and awareness or providing sedation is an essential component of emergency medicine practice and is a requirement of emergency medicine training programs.[1-3] Proactively addressing pain and anxiety may improve quality of care and patient satisfaction by facilitating interventional procedures and minimizing patient suffering.

Effective and safe procedural sedation requires the selection of appropriate drugs, given in appropriate doses, on selected patients, and in the proper environment. The logistics of procedural sedation in the ED and the hospital has been documented elsewhere.[1,4] There are a variety of drugs available for use in procedural sedation and analgesia. Selection of a particular drug is dependent on many variables, including patient characteristics, the procedure to be performed, and clinician experience. For example, sedation of children with American Society of Anesthesiologists (ASA) status III or IV has been associated with a higher rate of oxygen desaturation and airway difficulties than children with ASA status I or II.[5]

This clinical policy focuses on the use of medications to achieve sedation and analgesia in pediatric patients undergoing procedures in the ED. Specific sedation and analgesia drugs focused on in this document are: etomidate, fentanyl/midazolam, ketamine, methohexital, pentobarbital, and propofol. These 6 drugs represent sedation and analgesia agents used in the ED.

Procedural sedation is defined as the technique of administering sedatives or dissociative agents with or

without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardiorespiratory function.[1] Procedural sedation is generally combined with analgesia to minimize pain whenever the procedure is uncomfortable or painful. The goal of procedural sedation and analgesia is to create a depressed level of consciousness while the patient concurrently maintains his or her own airway and oxygenation without assistance. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the ASA, and the American Academy of Pediatrics (AAP) have defined the levels of sedation and analgesia.[4,6,7]

Moderate sedation/analgesia, formerly "conscious sedation," is a drug-induced depression of consciousness during which patients respond purposefully to verbal or light tactile stimulation while generally maintaining protective airway reflexes.[4,7,8] Deep sedation/analgesia is a drug-induced depression of consciousness in which patients are not easily aroused and may need airway and ventilatory assistance, although they purposefully respond to repeated or painful stimulation.[4,7,8] General anesthesia is a drug-induced loss of consciousness during which patients are not arousable and often have impaired cardiorespiratory function needing support.[4,8] Because individuals vary in their response to medications, and sedation for analgesia is a continuum, the practitioner providing sedation and analgesia needs to be proficient in airway management and cardiovascular support.[1,4,7,8] Guidelines for monitoring patients under moderate sedation, deep sedation, and anesthesia have been recommended.[1,4,7,8] Furthermore, whenever moderate or deep sedation is given, the standards for anesthesia care are applicable.[6]

This policy is not intended to be all encompassing and is a guideline. It represents evidence for answering important questions about critical diagnostic and management issues. Recommendations in this policy are not intended to represent the only diagnostic and management options that the emergency physician can consider. The authors clearly recognize the importance of the individual physician's judgment. Rather, this guideline defines for the physician those strategies for which medical literature exists to provide support for answers to the critical questions addressed in this policy.

METHODOLOGY

This policy provides an evidence-based approach to pediatric procedural sedation and analgesia and was created after careful review and critical analysis of the peer-reviewed literature. Multiple MEDLINE searches were done on each of the 6 drugs (etomidate, fentanyl/midazolam, ketamine, methohexital, pentobarbital, and propofol). The drug names were then combined with a search expression designed to identify adverse effects, apnea, vomiting/aspiration, laryngospasm, and hypotension. Finally, the results were limited to English-language studies published between 1966 and 2002 that examined human subjects aged 1 to 18 years. Variants on this search strategy, limiting results to clinical trials or to review articles, were also run.

Searches were done for pre-1966 articles by drug name and were limited to English-language studies; however, no studies from this search were selected for further scrutiny.

Several additional searches were done crossing specific drugs or drug combinations with the terms "conscious sedation" or "procedural sedation" or "procedures." A search of other relevant materials, such as textbooks and reference databases, identified 3 additional papers that were not indexed by drug name. A final set of searches was performed that did not use any specific drug names, but was limited to publication dates from 1966 to 2002, human subjects, subjects aged 1 to 18 years, and conscious sedation or pediatric sedation. A manual search was performed in the peer-reviewed emergency medicine literature for pertinent articles published in 2003.

References obtained on the searches were reviewed by panel members (title and abstract, where available) for relevance before inclusion in the pool of studies to be reviewed. Abstracts and articles were reviewed by subcommittee members, and pertinent articles were selected. These articles were evaluated, and those addressing the questions considered in this document were chosen for grading. Subcommittee members also supplied references from bibliographies of initially selected articles or from their own files.

All publications were graded by at least 2 of the subcommittee members into 1 of 3 categories of strength of evidence. Some articles were downgraded on the basis of a standardized formula that considers the size, age, and location of the study population, methodology, validity of conclusions, and potential sources of bias (Appendix A).

During the review process, all articles were given a baseline "strength of evidence" by the subcommittee members according to the following criteria:

Strength of evidence Class I–Interventional studies including clinical trials, observational studies including prospective cohort studies, aggregate studies including meta-analyses of randomized clinical trials only.

Strength of evidence Class II–Observational studies including retrospective cohort studies, case-controlled

studies, aggregate studies including other meta-analyses.

Strength of evidence Class III–Descriptive cross-sectional studies, observational reports including case series and case reports, consensus studies including published panel consensus by acknowledged groups of experts.

Strength of evidence Class I and II articles were then rated on elements the subcommittee members believed were most important in creating a quality work. Class I and II articles with significant flaws or design bias were downgraded on the basis of a set formula (Appendix B). Strength of evidence Class III articles were downgraded if they demonstrated significant flaws or bias. Articles downgraded below strength of evidence Class III were given an "X" rating and were not used in formulating recommendations in this policy. An Evidentiary Table was constructed and is included at the end of this policy.

Most of the studies included in this guideline lacked a standardized validated scoring system for evaluation of efficacy. In addition, the endpoints differed among the various studies. For many studies, efficacy was defined as the completion of the procedure without any measurement of the degree of sedation. When this occurred, the panel noted "efficacy was not addressed." When a success/failure rate was given, efficacy was graded as Class III. When there was a quantitative measure of sedation, efficacy was given a higher grade (Class I or II) depending on the overall assessment.

In considering the question of safety with respect to the administration of the various drugs included in this clinical policy, the panel recognized that there is not sufficient power in the peer-reviewed literature to document true "safety" for any of the agents involved in any setting, including the operating suite, because critical incidents of very low frequency would require patient cohorts of thousands to be fully evaluated. Lacking this type of data, the panel considered all of the available information from studies that took place in an ED or analogous venue and graded safety on the basis of the available data. More conclusive statements concerning the safety of pediatric sedation with respect to specific agents will await future studies.

Recommendations regarding patient management were then made according to the following criteria:

Level A recommendations. Generally accepted principles for patient management that reflect a high degree of clinical certainty (ie, based on strength of evidence Class I or overwhelming evidence from strength of evidence Class II studies that directly address all the issues).

Level B recommendations. Recommendations for patient management that may identify a particular strategy or range of management strategies that reflect moderate clinical certainty (ie, based on strength of evidence Class II studies that directly address the issue, decision analysis that directly addresses the issue, or strong consensus of strength of evidence Class III studies).

Level C recommendations. Other strategies for patient management based on preliminary, inconclusive, or conflicting evidence, or in the absence of any published literature, based on panel consensus.

There are certain circumstances in which the recommendations stemming from a body of evidence should not be rated as highly as the individual studies on which they are based. Factors such as heterogeneity of results, uncertainty about effect magnitude and consequences, strength of prior beliefs, and publication bias, among others, might lead to such a downgrading of recommendations.

Expert review comments were received on an earlier draft of this document from members of the AAP, the American Pediatric Surgical Association, the ASA, the Emergency Nurses Association, and the American College of Emergency Physicians. Their responses were used to further refine and enhance this policy.

Scope of Application. This policy is intended for physicians administrating procedural sedation and analgesia to pediatric patients in hospital-based EDs.

Inclusion Criteria. This policy applies to patients between the ages of 1 to 18 years who are in a hospital ED and have conditions necessitating the alleviation of anxiety, pain, or both.

Exclusion Criteria. This policy excludes: (1) children younger than 1 year, (2) patients receiving analgesia to treat pain without concomitant sedative use, (3) intubated patients, and (4) inhalational anesthetics.

CRITICAL QUESTIONS

Etomidate

Etomidate is an imidazole derivative that acts as a hypnotic without analgesic properties and has a favorable hemodynamic profile in both adults and children.[9-11] There are limited data available on the use of etomidate in procedural sedation.

There were 56 articles reviewed. The articles that described the use of etomidate for procedural sedation in a setting compatible to the ED were then included. A total

of 4 ED-based studies were included. In addition, 4 studies evaluating the presence of adrenal suppression and 3 studies looking at myoclonus and/or pain with injection in patients receiving etomidate were included.

I. Is etomidate effective for providing procedural sedation in children in the ED?

Four recent studies have been published regarding the performance of etomidate as a procedural agent specifically in the ED. The literature does not clearly address the need for the use of analgesia with etomidate, thus no recommendation can be made in this document. In a retrospective review of 53 children (25 <10 years), Dickinson et al[12] described the drug's use in the reduction of pediatric orthopedic procedures. The authors found an 83% procedural success rate after the first attempt. After an initial retrospective pilot study of 9 patients, Ruth et al[13] designed a descriptive, prospective feasibility study that specifically evaluated complications arising from intravenous etomidate in 51 patients. Physician assessments reported a 98% (59/60) satisfaction with adequate sedation. This study included only 18 children aged 5 to 18 years with the predominance of pediatric sedation performed for fracture reduction. The authors reported that 98% (50/51) of the patients reached adequate sedation, and procedural success was reported in 92% (47/51) of the patients. In a retrospective observational study performed by Vinson and Bradbury[14] of 150 procedures, 11% (15/134) of patients enrolled were children aged 6 to 17 years. Moderate sedation was documented in 32% (48/150) of the procedures, and deep sedation was induced in 68% (102/150) of the procedures as measured by the Aldrete Postanesthetic Recovery Score. The authors reported that 11% (16/150) of the procedures required additional doses of medication to complete the procedure, with 9% (13/150) receiving 2 doses and 2% (3/150) requiring 3 doses. These results are complicated by the 23% (34/150) of procedures that used adjunctive medications including opiates, benzodiazepines, or both. In the 113 patients receiving etomidate only, the authors could identify no proportional increase in depth and duration of sedation with increasing mean etomidate doses.

Another smaller retrospective chart review of 46 adults and 2 children identified 8.3% (4/48) of patients with procedural failure.[15] Each of the retrospective studies have been criticized because of the inherent flaws associated with their incomplete data sets.

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. None specified.

Level C recommendations. Etomidate is an effective agent for procedural sedation in the pediatric patient population within the ED.

II. Is etomidate safe for providing procedural sedation in children in the ED?

Dickinson et al[12] documented side effects including 0.7% (1/153) of patients with nausea and 0.7% (1/153) of patients requiring a fluid bolus for transient hypotension. There were no reported incidences of patients who required assisted ventilation of any kind. Adverse events captured by Ruth et al[13] included brief desaturations requiring face-mask oxygen supplementation in 9.8% (5/51), myoclonus in 7.8% (4/51), vomiting in 1.9% (1/51), pain with injection in 1.9% (1/51), and a less than 30-second episode of desaturation-induced bradycardia that was "immediately" corrected with face-mask oxygen supplementation in 1.9% (1/51). The authors fail to further describe the pediatric age distribution, and no specific pediatric issues received comment. Vinson and Bradbury[14] described oxygen desaturation in 5 adults (N=150; 3.3%) that was treated with face-mask oxygen supplementation. Of these 5 patients, 4 (N=150; 2.7%) also received bag-assisted ventilation. The 5 patients needing supplemental face-mask oxygen all received higher doses of etomidate (0.23 mg/kg) and were older than 55 years; 2 (N=150; 1.3%) patients had emesis. A follow-up questionnaire revealed that 95% (114/120) of responders stated they would be "extremely" willing to have etomidate again. Keim et al[15] found 21% (10/48) of patients with adverse reactions. Respiratory complications occurred in 4% (2/48) of patients, with 1 patient developing transient apnea requiring bag-valve-mask ventilation, whereas another patient required a nonrebreather mask for oxygen desaturation below 90%. In addition, 4% (2/48) of patients developed emesis, and procedure failure was documented in 8% (4/48) of patients.

In a study by McDowell et al,[16] the etomidate group was associated with more episodes of vomiting (9.9%; 10/101) and agitation (4%; 4/101) compared with 603 reviewed charts of patients receiving propofol (0.5% [3] and 1.2% [7], respectively). The etomidate group did experience significantly less hypoxia (oxygen saturation <94%; 2% [2/101]) than the propofol group (15.7% [95/603]). Myoclonus was also noted in 18% (18/101) of the etomidate group.

Although trials investigating etomidate-induced adrenal suppression in procedural sedation are not available, numerous studies have demonstrated cortisol depression for up to 24 hours with as little as a single dose of etomidate. However, the levels consistently remain in the normal range with no clinically significant sequelae.[17-20]

Pain with injection and myoclonus are also commonly reported side effects associated with etomidate.[13,16,21] Pain with injection occurred in 1.9% (1/51) of patients in the study by Ruth et al[13] (patients were also given analgesics), and in 17% (5/29) of patients in the study by Helmers et al.[21] Myoclonus was noted in 7.8% (4/51),[13] 17.8% (18/101) (versus 0% [0/267] for ketamine and 0% [0/603] for propofol),[16] and 37.9% (11/29)[21] of patients. When present, myoclonus usually lasts less than 1 minute but can resemble seizure activity and can be decreased by the coadministration of other drugs. These tremors are benign and not epileptiform activity.[21,22]

One study has evaluated etomidate's ability to induce electroencephalogram burst suppression to facilitate intubation in the presence of increased intracranial pressure. A significant reduction in intracranial pressure was observed during tracheal manipulation, with minimal effects on cerebral perfusion pressure.[22]

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. None specified.

Level C recommendations. Etomidate is a safe agent for procedural sedation in the pediatric patient population within the ED.

Fentanyl/Midazolam

Fentanyl is an opiate that is 100 times more potent than morphine. Opiates are powerful analgesics that also produce varying amounts of sedation and reduce anxiety through direct action on opiate receptors.[9] Fentanyl is active within 2 to 3 minutes of intravenous administration, with a duration of action of 20 to 30 minutes.[23]

Midazolam is a short-acting benzodiazepine. Benzodiazepines produce sedation, anxiolysis, and antegrade amnesia through direct action on a benzodiazepine receptor. Benzodiazepines have no analgesic properties. Midazolam is active within 2 to 3 minutes of intravenous administration, with a duration of approximately 30 minutes.[24]

Twenty-eight articles concerning the parenteral use of fentanyl and midazolam were reviewed. After grading, 14 articles were included in this analysis. These articles include several ED-based clinical studies and some studies involving only adults.

III. Are fentanyl and midazolam effective for providing procedural sedation in children in the ED?

Fentanyl and midazolam are widely used and effective agents for sedation and analgesia in the pediatric population. The efficacy of intravenous fentanyl and midazolam is reported to be high, ranging from 91% to 100%.[25-28] It has been found to be of similar efficacy when compared with alternative agents. The analgesic and sedative effects of fentanyl may be increased when combined with a benzodiazepine.[29]

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. Intravenous use of fentanyl and midazolam is effective for pediatric sedation during painful procedures in the ED.

Level C recommendations. None specified.

IV. Is the use of fentanyl and midazolam safe for providing procedural sedation for painful procedures in children in the ED?

The primary adverse effect of opiates is respiratory depression and resultant hypoxia and/or apnea. Additional side effects include nausea, vomiting, and pruritis.

In rare cases, chest wall rigidity, in addition to hypoxia from respiratory depression, is reported when fentanyl is given in moderate-to-large doses or with rapid administration.[30] The effects of fentanyl may be reversed with naloxone or naltrexone.[31]

The primary adverse effects of midazolam are respiratory depression, paradoxical excitement, and occasional hypotension.[32] The effects of midazolam may be reversed by flumazenil.

The use of opiates and benzodiazepines together is widely reported to produce a synergistic response of both the desired effects and adverse side effects.[33] In 2 adult studies, the risk of respiratory depression and apnea was increased (92% versus 50% and 63% versus 3%) when fentanyl was administered in conjunction with midazolam.[34,35] The strong respiratory depressant effect of the fentanyl and midazolam combination was further underscored by McQuillen and Steele[31] and Kennedy et al,[29] who both reported an increased risk of respiratory depression. However, 2 retrospective case series refute the assertion that fentanyl and midazolam in combination are more dangerous than either agent alone.[24,32] Two randomized trials did not find a significantly increased risk for fentanyl

and midazolam in combination, but both of these studies were very small.[25,26] In Pena and Krauss'[23] large prospective series of 1,180 patients, the authors found no increased risk of respiratory depression with fentanyl and midazolam compared with other agents. The disparity in these findings may be related to the method used to assess respiratory depression or monitor for serious adverse events. Most studies report very low incidences of apnea or serious adverse events (0% to 2%), with much higher frequencies of decreased pulse oximetry or increases in end-tidal carbon dioxide ($ETCO_2$). When these occurred, the patients usually responded to verbal stimulation, repositioning, or other minor interventions. Rarely did patients require bag-valve-mask ventilation or intubation.

The incidence of serious respiratory events is quite low for pediatric sedation with fentanyl and midazolam. Of 334 patients reported by Graff et al,[32] 11% had minor respiratory events and 2 required naloxone. No patients required ventilatory assistance. Hostetler and Barnard[33] reported transient hypoxia in 15% of 28 children receiving fentanyl and midazolam and no life-threatening events. Other reports similarly found that approximately 10% to 20% of patients had a mild respiratory event requiring oxygen or stimulation, while the need for respiratory assistance was rare, and the incidence of life-threatening events was near zero.[23,26,29,32] One case report of a respiratory arrest in an unmonitored 13-month-old child receiving fentanyl and midazolam serves as a reminder that these drugs do have potentially life-threatening consequences and that close monitoring and emergency backup measures are essential.[36]

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. The combination of fentanyl and midazolam appears to result in a greater risk of respiratory depression; therefore, the clinician should take particular care to monitor the patient for signs of respiratory depression and should have appropriate training and support to treat apnea.

Level C recommendations. None specified.

Ketamine

Ketamine is a sedative-analgesic medication for procedural sedation.[9] It has a unique mechanism of action based on N-methyl-D-aspartate glutamate receptor antagonism and is classified as a dissociative agent allowing potent sedation, analgesia, and amnesia during painful procedures. Onset of sedation-analgesia is rapid by either intravenous or intramuscular administration. Twenty-nine articles concerning the parenteral use of ketamine in an ED were reviewed. After grading, 19 articles were included in this analysis. There were no ED-based studies of ketamine for imaging sedation.

V. Is ketamine effective for providing procedural sedation in children in the ED?

A partially blinded, randomized, controlled trial of intravenous propofol/fentanyl (1 mg/kg initially with smaller aliquots and 1 to 2 μg/kg aliquots, respectively) versus ketamine/midazolam (1 to 2 mg/kg and 0.05 mg/kg aliquots, respectively) for orthopedic procedural sedation in children aged 3 to 18 years showed ketamine/midazolam to have statistically better but questionable clinical significance, improved Observation Score of Behavioral Distress–Revised (OSBD-R) scores during manipulation (0.278 versus 0.084 [Δ0.194; 95% confidence interval (CI) 0.048 to 0.340; P=.008]), and equivalent orthopedic, nursing, and parental satisfaction scores.[37] Intravenous ketamine/midazolam (1 mg/kg and 0.1 mg/kg, respectively) was superior to intranasal midazolam (0.5 mg/kg) in patients undergoing laceration repair for sedation onset and consistency of effect. At 30 minutes, the average sedation score was 2.4 versus 3.5 (P<.001), and the average sedation visual analog scale (VAS) score was 1.8 versus 3.8 (P<.001). Physician and parental satisfaction was rated "excellent or good" in 88% versus 54% (P=.006) and 92% versus 65% (P=.02), respectively.[38] Intramuscular ketamine (4 mg/kg) was superior to intramuscular meperidine/promethazine/chlorpromazine in a study of patients undergoing wound repair, burn care, or lumbar puncture, demonstrating a mean OSBD-R score of 2.7 versus 9.8 (P<.003).[39] Ketamine/midazolam was superior to fentanyl/midazolam for procedural sedation for orthopedic procedures demonstrating a mean OSBD-R score of 1.12 versus 2.70 (P≤.0001).[29] In these 3 Class I studies, the efficacy of ketamine for "adequacy of sedation" to complete the procedure was 100%.

Low-dose intramuscular ketamine (2.5 mg/kg) was shown to be superior to intranasal midazolam in laceration repair: 100% versus 70% were rated as "cooperative" or "intermittently crying" during repair (P<.01).[40] Several prospectively designed, single treatment arm studies have also shown that ketamine has a high efficacy rate and high provider and parental satisfaction.[41-43] (See Evidentiary Table for comparisons.)

Patient Management Recommendations

Level A recommendations. Ketamine is effective either as a sole agent or in combination with a benzodiazepine for brief painful procedures in children.

Level B recommendations. None specified.

Level C recommendations. None specified.

VI. Is ketamine safe for providing procedural sedation in children in the ED?

Two Class I studies for safety, either comparing ketamine/midazolam to fentanyl/midazolam or ketamine with or without midazolam, have demonstrated a good safety profile for ketamine in procedural sedation in children.[29,44] Kennedy et al[29] found that, for ketamine/midazolam versus fentanyl/midazolam, in 260 cases patients had an incidence of hypoxemia of 6% versus 24% during sedation (*P*=.001), required breathing cues 1% versus 12% of the time (*P*=.001), required an airway maneuver 6% versus 11% of the time (*P*=NS), and required bag-valve-mask ventilatory support 2% versus 0% of the time (*P*=NS). A small pilot study of 20 pediatric patients undergoing ketamine sedation and using sidestream $ETCO_2$ monitoring demonstrated no evidence of hypoventilation.[45] In a study of 266 sedations, of which 137 received midazolam, Wathen et al[44] found that the rates of adverse effects in the ketamine versus ketamine/midazolam groups of recovery agitation were 7.1% versus 6.2% (Δ0.8 [95% CI −5.3 to 7.0]); Spo_2 less than 90% in 1.6% versus 7.3% (Δ −5.7% [95% CI −5.7% to −0.9%]); and emesis in 19.4% versus 9.6% (Δ9.8% [95% CI 1.4% to 18.2%]). For patients older than 10 years, recovery agitation was 5.7% versus 35.7% (Δ −30.0% [95% CI −49.3% to −10.7%]). Several large and moderate-sized Class II studies confirm that ketamine is very safe when used with adequate monitoring and resuscitation equipment for procedural sedation in children in the ED. There was no evidence of clinically evident aspiration in any of these studies.[23,37,38,40-43,46-52] Specifically, the incidence of laryngospasm is very low: 1/108 (0.9%) in 1 prospective cohort study[52] and 1.4% in a large (1,022 patients) retrospective cohort study.[50] However, a study of pediatric patients undergoing gastroenterology procedures (generally, esophagogastroduodenoscopy and/or colonoscopy) performed in a gastroenterology suite or in the pediatric ICU found transient laryngospasms occurred in 8.2% of patients. The only predictor of laryngospasm was decreasing age (13.9% in children <6 years versus 3.6% in children ≥6 years). Nearly half the patients in this study were ASA status III or greater.[53]

Of note, despite some concern for the use of ketamine for sedation for procedures involving the oropharyngeal and upper aerodigestive tract, several studies have evaluated this issue. A retrospective, uncontrolled comparison in esophageal foreign body removal using ketamine/midazolam versus fentanyl/midazolam showed hypoxemia in 10.7% (95% CI 6.6% to 14.8%) versus 15.4% (95% CI 8.6% to 22.2%) of patients; stridor in 1.8% (95% CI 0% to 3.6%) versus 0% (95% CI 0% to 1.9%) of patients; and bag-valve-mask ventilatory support in 3.6% (95% CI 1.1% to 6.1%) versus 3.8% (95% CI 0.2% to 7.4%) of patients.[33] Another prospective, nonrandomized study of intramuscular ketamine/midazolam for dental procedural sedations in the ED showed Spo_2 greater than 96% and no adverse airway events in all patients, and emesis in only 2 (4.8%) patients.[43]

Patient Management Recommendations

Level A recommendations. Ketamine can be safely used for procedural sedation in children in the ED, but may require head positioning, supplemental oxygen, occasional bag-valve-mask ventilatory support, and measures to address laryngospasm.

Level B recommendations. None specified.

Level C recommendations. None specified.

VII. Does the addition of midazolam as an adjunct to ketamine for procedural sedation for children in the ED reduce recovery agitation or vomiting?

In many centers, ketamine is administered along with a benzodiazepine (usually midazolam) to reduce the incidence of unpleasant recovery agitation, hallucinations, or "bad dreams."

Two Class I studies have shown that midazolam does not decrease the incidence of recovery agitation when used with ketamine. Wathen et al[44] found that the incidence of recovery agitation in the ketamine versus ketamine/midazolam groups was 7.1% versus 6.2% (Δ0.8 [95% CI −5.3% to 7.0%]). In addition, in the age group greater than 10 years of age, the incidence of recovery agitation was increased in the ketamine/midazolam group 5.7% versus 35.7% (Δ −30.0% [95% CI −49.3% to −10.7%]). The incidence of emesis was decreased in the ketamine/midazolam group: 19.4% versus 9.6% (Δ9.8% [95% CI 1.4% to 18.2%]). Sherwin et al[46] demonstrated no difference between the ketamine and ketamine/midazolam treatment groups in the incidence of recovery agitation (VAS 5 mm [interquartile range 3 mm to 14 mm] versus 4 mm [interquartile range 2 mm to 19 mm]; *P*=.70), and the incidence of emesis 12% versus 2% (Δ −10% [95% CI −20% to 0%]; *P*=.058).

Patient Management Recommendations

Level A recommendations. The addition of midazolam as an adjunct to ketamine for procedural sedation for children in the ED does not decrease the incidence of emergent reactions.

Level B recommendations. The addition of midazolam as an adjunct to ketamine for procedural sedation for children decreases the incidence of emesis.

Level C recommendations. None specified.

Methohexital

Methohexital is a rapid-acting barbiturate that produces its effect through direct stimulation of the gamma-aminobutyric acid receptor.[9] As a barbiturate, methohexital may be described as a pure sedative. As such, most of its applications are for sedation for painless diagnostic studies. A review of methohexital use in pediatric patients for procedural sedation was performed. A total of 50 articles were reviewed; however, only articles describing methohexital use for procedural sedation compatible to ED practice were included in the analysis. Those articles describing methohexital effectiveness as part of an induction process for general anesthesia in the operating room were excluded from analysis except for a single study describing only the hemodynamic parameters in children after a rectal dose commonly used in the ED. There were 6 articles selected for inclusion in this analysis.

VIII. Is methohexital effective for providing procedural sedation in children in the ED?

In all but 1 of the studies, the patients underwent sedation with methohexital for computed tomography (CT) or magnetic resonance imaging (MRI) scan studies.[54-58] In the remaining study, the patients underwent oncology-related procedures such as lumbar punctures, in which local anesthesia was used.[59]

Three different routes were described for methohexital administration (ie, intravenous, intramuscular, rectal) for CT scans.[54-59] For all of the studies examining use for CT or MRI sedation, methohexital demonstrated efficacy from 92% to 100% as determined by cooperation with study and quality of study obtained.[56-59] For the intravenous route, Class II and Class III data exist supporting efficacy of 99% to 100% for methohexital as determined by the ability to complete either CT studies or hematology/oncology procedures.[57,59] For the intramuscular routes, a single Class II study documented 92% efficacy for ability to complete CT scan.[58] For rectal administration, a single Class I study demonstrated 95% efficacy.[56] Efficacy was defined on 2 separate 3-point scales, 1 examining the need for restraint and the other motion artifacts on the CT scan. Doses of methohexital described included 1 mg/kg intravenously, 10 mg/kg intramuscularly, and 25 mg/kg rectally.

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. Methohexital administered by either the intravenous, intramuscular, or rectal routes can provide effective sedation for children undergoing painless diagnostic studies.

Level C recommendations. None specified.

IX. Is methohexital safe for providing procedural sedation in children in the ED?

As a barbiturate, methohexital has the potential to produce hypotension, hypoventilation, and apnea in children in whom it is administered.[54-59] Safety documentation was demonstrated through prospective monitoring of children undergoing sedation with methohexital. Continuous cardiac monitoring, pulse oximetry, and intermittent blood pressure monitoring were all used to document the safety of this medication.

Regardless of the route of administration, methohexital has the capacity to produce hypoventilation leading to hypoxia. The incidence of hypoxia with methohexital ranged from 1% to 6%.[55-57,59] In all but 1 of the studies, the hypoxia was resolved through repositioning of the patient or administration of supplemental oxygen.[55-57] In the only grade I study, 3 out of 100 patients required bag-valve-mask ventilation support, although this was performed as required by a sedation protocol and not at the discretion of the managing clinician.[56] No child demonstrated adverse affects from the hypoxia, and none required endotracheal intubation. Transient hypotension was noted in up to 17% of 1 group of patients when administered intravenously.[59] When studied echocardiographically, rectal administration was found to produce clinically insignificant hemodynamic effects.[54]

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. Methohexital can be safely used for procedural sedation but may require head positioning, supplemental oxygen, and occasional bag-valve-mask ventilatory support.

Level C recommendations. None specified.

Pentobarbital

Pentobarbital is a short-acting barbiturate used to facilitate obtaining diagnostic studies such as CT and MRI

scans of children.[9] Barbiturates function at the gamma-aminobutyric acid receptor complex and produce a central nervous system depressant effect. Pentobarbital is a pure sedative agent. There were 14 articles reviewed and 11 studies included for this analysis. Most studies were done in fasted patients undergoing painless, diagnostic procedures.

X. Is pentobarbital effective for providing procedural sedation in children in the ED?

In the 11 studies included, pentobarbital was given intravenously, except in 1 study in which it was given orally.[60] Greenberg et al,[61] using 6 mg/kg of pentobarbital divided in 3 doses to a maximum of 200 mg, found that 8% (8 children out of 100) of patients were not successfully sedated (were unable to complete their diagnostic study). The children who were not successfully sedated were either 12 years or older (characteristics of older children that required sedation were not defined in this article) or weighed greater than 50 kg, which may reflect the 200-mg maximum dose in this study. Best results were seen in children younger than 8 years.

When using pentobarbital for pediatric sedation, higher success rates of 99% or greater were found by Karian et al,[62] Mason et al,[63] and Strain et al.[64]

Mason et al,[63] in a nonblinded prospective study of 1,070 children, compared the use of intravenous pentobarbital alone and a combination of pentobarbital and midazolam and found no beneficial effect by adding midazolam. The success rate of the pentobarbital alone group was 99.5% compared with 99.8% in the pentobarbital-midazolam group. The use of midazolam increased time to sedation (pentobarbital-midazolam 8.0±4.4 minutes versus pentobarbital 6.5±4.4 minutes) and also prolonged the time to discharge by approximately 14 minutes when used in conjunction with pentobarbital (pentobarbital-midazolam 120±32 minutes versus pentobarbital 106±34 minutes).

Moro-Sutherland et al[65] compared the efficacy of intravenous midazolam to intravenous pentobarbital when used for sedation of 55 pediatric patients undergoing CT imaging of the head in the ED and found that pentobarbital had a 97% success rate compared with a 19% success rate for midazolam.

In a study by Kain et al[66] of 58 pediatric patients, group 1 received 1 to 2 mg/kg of propofol followed by propofol infusion, and group 2 received 1 to 3 mg/kg of thiopental followed by a 2- to 3-mg/kg pentobarbital bolus and supplemental doses of 1 to 2 mg/kg of thiopental were administered to maintain sedation. Time to recovery in group 1 was 19±7 minutes versus 35±20 minutes in group 2. Time to discharge in group 1 was 24±6 minutes versus 40±11 minutes in group 2. Pentobarbital had a greater recovery time and longer time to discharge than propofol; however, adverse reactions were not addressed in this study.

Rooks et al,[60] in a study of 675 pediatric patients, compared the use of oral pentobarbital at an average dose of 4 mg/kg to oral chloral hydrate at an average dose of 50 mg/kg and found similar time to sedation (pentobarbital 19±14 minutes and choral hydrate 16±11 minutes), time to discharge (pentobarbital 100±35 minutes and chloral hydrate 103±36 minutes), length of sedation (pentobarbital 81±34 minutes and chloral hydrate 81±34 minutes), and adverse reactions in both groups (pentobarbital 1.6 % and chloral hydrate 1.7%). Adverse reactions were reported in 5 (1.6%) patients in the oral pentobarbital group versus 6 (1.7%) patients in the chloral hydrate group. In the pentobarbital group, 1 patient vomited after the second dose of pentobarbital, 1 patient who received 6 mg/kg had prolonged sedation with discharge after 5 hours, 1 patient had decrease in oxygen saturation level (patient had a history of severe gastroesophageal reflux) and required suctioning and airway repositioning, 1 patient had inspiratory and expiratory wheezing and responded to albuterol (patient had preexisting respiratory condition), and 1 patient had a paradoxical reaction. One delayed event occurred in the oral pentobarbital group 4 hours after discharge when the patient had an episode of perioral cyanosis and was observed in the ED for 4 hours and discharged. In the chloral hydrate group, there were 4 patients with mild decrease in oxygen saturation. Of these 4, 2 patients required airway repositioning and 1 required bag-valve-mask ventilation. Other adverse reactions included irritability and hyperactivity lasting 30 minutes, and 1 episode of vomiting.

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. Pentobarbital alone is effective in producing cooperation for painless diagnostic procedures. Best sedation results are seen in children younger than 8 years.

Level C recommendations. None specified.

XI. Is pentobarbital safe for providing procedural sedation in children in the ED?

Transient respiratory depression to oxygen saturation less than 10% below the baseline has been reported from

1.2% to 7.5% of pediatric patients undergoing sedation with pentobarbital, although in most cases oxygen desaturation responded to interventions such as head positioning or supplemental oxygen.[60-64,67,68]

In a study by Sanderson[69] using a pentobarbital average dose of 4.6 mg/kg, there was a 14% rate of complications, including desaturation, vomiting, increased airway secretions, airway obstruction, coughing, and bronchospasm.

Emergence reactions were documented in 4 separate studies.[60,61,63,68] Hyperactivity was noted by Slovis et al[68] and Greenberg et al[61] in 5% (17/357) to 7% (7/100) of children sedated with pentobarbital. Slovis et al[68] also reported an even higher rate of 8.4% in children older than 8 years. However, Greenberg et al[61] noted that this only led to sedation failure in 1 child out of 100. Rooks et al[60] and Mason et al[63] described a paradoxical reaction as a patient experiencing sustained inconsolability and severe irritability and combativeness for more than 30 minutes after the administration of pentobarbital or after awakening from the sedation. A paradoxical reaction occurred in less than 0.01% (1/317) of children in the oral pentobarbital group in the study by Rooks et al,[60] and in 1.5% (10/640) of children in the intravenous pentobarbital group in the study by Mason et al.[63] Emesis was reported in 0.53% to 1% of the patients.[61,63,67] One study reported a 3% incidence of coughing that led to a 1% failure rate.[61]

The duration of action is variable, the average induction time is 6 minutes, and the duration of sedation is up to 106 minutes, but most patients are alert within 30 to 60 minutes of administration.[63,65] Greenberg et al[61] found a 2% prolonged sedation rate of greater than 120 minutes when the maximum suggested dose was exceeded.

Slovis et al[68] performed a 24-hour follow-up of pediatric patients aged 12 months and older who had been sedated for MRI by using 3 mg/kg of pentobarbital alone or followed by 1 μg/kg of fentanyl if the patient was not asleep 5 minutes after the administration of pentobarbital; the study found that 19% of children slept for more than 8 hours. The multiple-dose regimen of pentobarbital had a significant short-term effect on children aged younger than 8 years, with 35% sleeping longer than 8 hours after the MRI.

Bloomfield et al[70] found greater recovery time (range 0 to 67 minutes) for pentobarbital compared with propofol (range 1 to 18 minutes); however, the pentobarbital group had fewer adverse reactions, less decrease in pulse rate, and less transient decrease in oxygen saturation than propofol.

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. Pentobarbital can be safely used for procedural sedation but may require head positioning, supplemental oxygen, and occasional bag-valve-mask ventilatory support.

Level C recommendations. None specified.

Propofol

Propofol is a highly lipid-soluble alkyl phenol sedative agent.[9] Operating through an interaction with the gamma-aminobutyric acid receptor system, propofol is proposed to prolong the duration of contact between gamma-aminobutyric acid and its receptor site. This action promotes an extended chloride influx into the neuron, leading to hyperpolarization of the neuronal cell membrane.[71]

Propofol is classified as a pure sedative. Unlike other pure sedatives, because of its potency propofol has been used for both painful and painless procedures. For painless diagnostic studies such as MRI or CT scans, propofol is generally used alone. For painful procedures, it is frequently combined with a short-acting potent opiate analgesic, although it has been used alone for painful procedures.[37,72]

A total of 63 articles were reviewed; however, only articles describing propofol use for procedural sedation compatible to ED practice were included in the analysis. Although propofol has an extensive history of safe and effective use in general anesthesia, articles describing its use as an induction agent in the operating room or in combination with inhalation agents were not selected. Articles describing propofol's use for brief procedures, such as lumbar puncture for intrathecal medications or bone marrow biopsies, were included. Although these are not necessarily ED procedures, the manner in which propofol was used to facilitate a brief painful activity was considered consistent with how the drug may be used in the ED. There were 14 articles selected for inclusion in the analysis.

XII. Is propofol effective for providing procedural sedation in children in the ED?

In all instances, propofol was administered intravenously. For short procedures, propofol was administered as a bolus followed by additional doses as needed to maintain cooperation.[37,73-76] For longer procedures, propofol treatment was initiated with an intravenous bolus, with sedation maintained through a continuous infusion.[66,70,72,77-82]

Of the studies included in the analysis, 12 described propofol's efficacy in providing cooperation for an intended procedure. One study with Class I and 1 with Class III evidence used the 6-point Ramsay scoring system in documenting propofol's efficacy.[72,82] In these studies, propofol produced mean sedation levels of 5.5[72] and 5.6.[82] In 1 of these studies, propofol was paired with a fixed dose of an opiate.[72] A second study with Class I evidence again combined propofol with an opiate but used the OSBD-R scoring system to rate the efficacy of this combination for orthopedic procedures.[37] Propofol's sedation score was 0.278 in this system, in which a score of 0 represents no distress, whereas 23.5 represents maximal distress. Another study with Class II evidence used radiologists' objective assessments of lack of motion artifacts in MRI scans and showed good efficacy for children sedated with propofol, with mean quality scores of 9.0 out of 10.[66]

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. Propofol combined with opiate agents is effective in producing cooperation for painful therapeutic or diagnostic studies.

Level C recommendations. Propofol alone, without the concomitant use of opiate agents, is likely to be effective in producing sedation for painless diagnostic studies in ED patients.

XIII. Is propofol safe for providing procedural sedation in children in the ED?

In addition to its sedative hypnotic properties, propofol also has the potential to produce hypoventilation and apnea. Because of the monitoring practices used with procedural sedation, Class I prospective data are available concerning propofol's respiratory depression effects. The specific definition of hypoxia varied between studies, with some regarding pulse oximetry levels below 95% as hypoxia whereas others did not consider a patient hypoxic until saturations decreased below 90%.

If definitions of hypoxia or hypoventilation are accepted as study specific, then 7 studies with Class I to III evidence indicate that this occurs in 2% to 31% of patients sedated with a propofol bolus and infusion.[37,66,70,72,78,79,82] In all but 1 of the studies, the hypoxia responded to minimal interventions such as head repositioning or supplemental oxygen. In 1 Class I study, oxygen desaturation occurred in 11.6% of patients, with no intervention required aside from supplemental oxygen.[72] In another Class I study, the desaturation rate was 31% but was again transient, responding to jaw thrusts or supplemental oxygen.[37] In a single Class III study using high doses of propofol in an ICU setting, 20% of patients experienced hypoxia and 19% of patients required bag-valve-mask ventilation.[82] This study was in marked contrast to data in all other studies, in which the highest incidence of bag-valve-mask ventilation was 2.5%. In the 2 studies evaluating propofol use for painless diagnostic sedation for MRI scans, the incidence of hypoxia was 5% to 10%.[66,70]

Propofol also had hemodynamic effects associated with decreased peripheral vascular resistance when administered intravenously. Clinically insignificant transient decreases in blood pressure are reported in some patients, although in none of these patients was any intervention required.[37,77,78,81,82]

Because of the hydrophobic nature of propofol, it must be delivered in a lipophylic suspension. Such vehicles can produce pain on injection of the drug. Clinical measures described to limit this effect include pretreatment of the vein with lidocaine and rapid infusion rates of normal saline solution with a slow injection of propofol.[74,82]

Patient Management Recommendations

Level A recommendations. None specified.

Level B recommendations. Propofol combined with opiate agents can be safely used for procedural sedation but may require head positioning, supplemental oxygen, and occasional bag-valve-mask ventilatory support.

Level C recommendations. Propofol alone, without the concomitant use of opiate agents, can be safely used for procedural sedation but may require head positioning, supplemental oxygen, and occasional bag-valve-mask ventilatory support.

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Evidentiary Table.

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Guldner et al[10]	Retrospective pediatric rapid sequence intubation study in ED; intravenous dosing of etomidate with median dose 0.32±0.12 mg/kg; adjunctive medications included atropine in 78/105 (74%), lidocaine in 62/105 (59%), morphine in 3/105 (3%), and midazolam in 7/105 (7%); 105 charts; average age 3±2.9 y	The authors describe a slight increase in blood pressure; no episodes of myoclonus or seizure activity noted; there were no reported episodes of adrenal suppression determined either clinically or with laboratory testing as a result of etomidate administration	Design was retrospective; the main clinical endpoint was adrenal suppression	The authors note very little hemodynamic changes with the use of etomidate	Efficacy was not objectively measured	III
Sokolove et al[11]	Retrospective pediatric study evaluating rapid sequence intubation at 2 academic centers of both hospital and ED patients; etomidate IV dosing with mean dose of 0.37 mg/kg; adjunctive medications included lidocaine in 58/100 (58%), atropine in 37/100 (37%), and benzodiazepines in 9/100 (9%); 100 patients aged <10 y	Etomidate resulted in a mean blood pressure decrease of 1% during rapid sequence intubation; clinically important adrenal suppression was defined as the need for exogenous corticosteroid replacement for suspected adrenal insufficiency during the hospital course; inpatient records were available on 99 patients, and none of these patients received corticosteroids for suspected adrenal suppression	Design; only endpoints of study were hypotension and adrenal suppression; all patients were intubated	Based on a low incidence of hypotension and no important adrenal suppression	Efficacy was not objectively measured	III
Dickinson et al[12]	Retrospective descriptive study in a university-based ED; 53 charts of children aged <18 y; all patients received IV etomidate (most received 0.1 to 0.2 mg/kg) and an IV opioid; a single etomidate dose was required in 40/53 (75%) patients and a second dose was necessary in 9/53 (17%) patients; 4/53 (7.5%) patients also received a dose of midazolam; 0.2-mg/kg initial bolus	There were no major adverse effects; 1 patient reported nausea, and another was given a fluid bolus for transient hypotension; no patient required ventilatory assistance; measure of efficacy was procedural success	Retrospective design; selection bias; documentation concerns as demonstrated by no reported cases of myoclonus	Results suggest that etomidate may be used safely in children, but the authors warn that further larger prospective studies are indicated	III	III
Ruth et al[13]	2-phase feasibility study: retrospective pilot followed by a prospective descriptive study performed in a university-based ED; IV dosing in 9 patients in the pilot phase and in 51 patients in the prospective phase; a mean of 1.6 doses were required to complete procedures (range 1–3 doses); initial etomidate bolus used was 0.1 mg/kg; 18 patients included aged 1–25 y	Procedural success was achieved in 56/60 (93%) patients, with adequate sedation as documented by the physician in 59/60 (98%) patients; 12 complications were reported including oxygen desaturation below 90% (5), myoclonus (4), vomiting (1), pain with injection (1), and a "brief" bradycardic episode; none of the patients required ventilatory assistance	13 patients had missing nursing records, and another 4 patients lacked depth of sedation information	Etomidate administered IV for procedural sedation in the ED was both effective and safe in this group of patients	III	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Vinson and Bradbury[14]	Retrospective observational study in 3 affiliated suburban EDs; chart review performed with prospective questionnaire sent to patients, with 120 (90%) completed; IV etomidate dosing with mean cumulative dose of 0.2 mg/kg; 134 total patients enrolled aged 6–93 y; 3 patients were aged 6–12 y and 12 patients included were aged 13–17 y	Moderate sedation was achieved in 48 (32%) patients, and deep sedation induced in 102 (68%) patients as measured by the Aldrete Postanesthetic Recovery Score; 5 (4.7%) of 7 adverse reactions were the result of oxygen desaturation requiring face mask oxygen; 4/5 also received bag-assisted ventilation; each of these patients were >55 y and had received relatively higher doses of etomidate, 0.23 mg/kg compared with 0.19 mg/kg in the nonrespiratory-compromised patients; no intubations; 2 patients experienced emesis; 114 (94%) responders stated they would be "extremely" willing to have this medication again	Design; few pediatrics; no standardized dosing; adjunctive medications given in 23% of procedures; only patients meeting ASA status I or II were candidates for procedural sedation; some patients were entered into the study more than once	The authors concluded that etomidate appears to be a brief, safe, and effective drug for emergency procedural sedation; however, the power of the study is not enough to evaluate incidence of all complications	III	III
Keim et al[15]	Retrospective chart review in a university-based ED; the charts of 46 adults and 2 children, all receiving IV dosing were reviewed; mean initial dose of etomidate was 13 mg	10/48 (21%) of patients had adverse reactions; 1 (2%) patient had transient apnea requiring bag-valve-mask ventilation (this patient had multiple doses of analgesics as well); 1 (2%) patient required a nonrebreather for a desaturation <90%; emesis in 2 (4%) patients; anxiety in 2 (4%) patients; 4 (8%) patients had failed procedures	Design; limited pediatric patients; not an etomidate-only study, so some adverse side effects may be related to other sedatives and analgesics; documentation concerns as demonstrated by no reported cases of myoclonus	The authors conclude that although further study is indicated, etomidate holds promise as a procedural agent in the ED; the authors further stressed the need for adequate monitoring in the ED when using agents that may induce deep sedation	III	III
McDowell et al[16]	Retrospective review of 971 pediatric oncology patients at a university hospital; 101 received IV etomidate (0.3 mg/kg) combined with either fentanyl or alfentanil for brief diagnostic or therapeutic procedures; all patients were <19 y	Etomidate was effective as defined by procedural success but was associated with more episodes of vomiting (9.9%) and agitation (4%) compared with propofol (0.5%) and (1.2%), respectively	Retrospective design; all 101 etomidate patients received narcotics for analgesia that could confound both the efficacy and safety data	Etomidate is an effective agent but had more vomiting and agitation when compared with propofol; however, propofol had a greater incidence of hypoxia (15.7%) than etomidate (2%)	Efficacy was not objectively measured	III
Schenarts et al [17]	Prospective randomized controlled trial; included 10 etomidate and 8 control (midazolam) patients; each had a 4-h, 12-h, and 24-h cosyntropin stimulation test performed after standard drug administration during rapid sequence intubation induction in the ED; patients were ≥18 y, with a mean age of 58.4 y	Although a significant decrease in the normal adrenal response was noted at the 4-h level, all measured levels remained within normal levels throughout the study process; at 12 h, levels were no longer affected by the single 0.3-mg/kg induction dose	Study design does not evaluate clinical significance of brief adrenal suppression; no pre-induction cortisol levels were obtained; 13 additional patients were excluded	The authors concluded that, although a single dose of etomidate resulted in a decrease in normal adrenal response, adrenocortical levels remained in a normal laboratory range	Efficacy was not objectively measured	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Absalom et al[18]	Prospective randomized trial; adrenocortical function of 35 critically ill patients was evaluated at pre-induction of general anesthesia in operating room with etomidate or thiopentone and after 24 h; each patient with an ASA status $\geq$III and aged $\geq$16 y	The etomidate group was significant for more patients with an ACTH-stimulated cortisol increment $<$200 nmol/L; however, cortisol levels were never documented as low during the study	Number of patients aged 16–18 y not given; no baseline ACTH stimulation performed before induction; only 3 cortisol levels obtained; study power may be too small to show a significant difference	No significant difference between pre- and post-ACTH cortisol levels; significance of findings of the smaller ACTH-stimulated increment unclear	Efficacy was not objectively measured	III
Allolio et al[19]	Prospective controlled trial; 29 patients undergoing general anesthesia induction were randomly assigned to etomidate or thiopentone, and ACTH and cortisol levels were measured up to 240 min after induction	The etomidate group had a significantly higher ACTH level and a significantly lower cortisol level; cortisol levels remained in a normal range	All patients were aged >14 y	The authors conclude that etomidate is safe for minor surgeries, but the adrenal suppression may cause problems for patients who require a greater adrenal response	Efficacy was not objectively measured	III
Allolio et al[20]	Prospective controlled trial evaluating the effect of a single induction dose of IV etomidate or thiopentone on adrenocortical function up to 210 min after induction; included 14 patients undergoing induction for general anesthesia; patient aged 14–74 y; with mean age for etomidate group of 45.5$\pm$16.1 y	ACTH levels were elevated in the etomidate group but not to significant levels compared with the thiopentone group; demonstrated suppression of cortisol levels compared with thiopentone dosing	Time of day not noted	Authors found that despite inhibition of 11 β-hydroxylase after etomidate induction, no other comparable blockade of other enzymes in the corticosteroid-synthetic pathway could be demonstrated; confirmed previous data demonstrating suppression of cortisol levels with single etomidate dosing	Efficacy was not objectively measured	II
Helmers et al[21]	Prospective double-blind controlled trial to determine if IV injection of droperidol or fentanyl before etomidate could attenuate side effects of pain and myoclonus; 83 patients aged 14–78 y with ASA status I, II, and III were enrolled; a severity score was assigned to pain and involuntary movements; operating room study	The incidence of pain on delivery in patients was: etomidate+normal saline solution 17% (5/29), etomidate+droperidol 16.7% (4/24), etomidate+fentanyl 18.5% (5/27); the incidence of myoclonus in patients was: etomidate+normal saline solution 37.9% (11/29), etomidate+droperidol 14.3% (3/24), etomidate+fentanyl 12.5% (3/24) ($P<.05$ for the groups using etomidate+another drug vs etomidate alone)	Not a sedation study; evaluated side effects during initial induction only; potential bias in scoring of pain and myoclonus	Both fentanyl and droperidol showed a significant difference in attenuating myoclonus after etomidate administration	Efficacy was not objectively measured	II

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Modica and Tempelhoff[22]	Prospective observational study; included 8 patients meeting ASA III–IV status with space occupying lesions and undergoing surgery; IV dosing; ages 18–71 y; anesthesia was induced with 0.2-mg/kg of etomidate followed by a 20-mg/min infusion	All patients monitored during induction with IV etomidate for EEG burst suppression and changes in intracranial pressure; the etomidate bolus required to reach burst suppression was 1.28±0.11 mg/kg	No pediatric patients; small study size	Etomidate did result in significant reduction in intracranial pressure during intubation	Efficacy was not objectively measured	II
Pena and Krauss[23]	Prospective case series of 1,180 patients aged <21 y requiring procedural sedation in pediatric ED of large urban hospital using standard sedation record; midazolam and fentanyl used in 391, IV midazolam in 67, oral midazolam in 62, IN midazolam in 3; remainder used a variety of other drugs and combinations; 180 patients had IM ketamine/midazolam (3.30±0.80 mg/unknown); 40 patients had IV ketamine/midazolam (1.31±0.45 mg/unknown)	For fentanyl/midazolam: adverse event rate was 2.3%, with no serious or life-threatening complications; complications included oxygen desaturation in 10 (0.8%), paradoxical reaction in 7 (0.6%), emesis in 3 (0.25%), requirement for supplemental oxygen in 2 (0.17%); no significant differences between regimens; for ketamine/midazolam: 1.8% experienced adverse event (1 laryngospasm, 2 desaturations, 1 emesis)	Wide variety of agents and techniques; efficacy not measured; authors conclude that fentanyl/midazolam does not have increased rate of respiratory complications, but data show OR of 2.94 (95% CI 0.93–10.29, *P*=.070); small sample size for ketamine, selection bias, single center	Procedural sedation (fentanyl/midazolam or ketamine/midazolam) can be safely administered in pediatric ED by pediatric emergency physician; adverse event rate is low	Efficacy was not objectively measured	III
Sievers et al[24]	Prospective case series of 24 patients undergoing 70 pediatric oncology procedures using IV midazolam with (59%) or without (41%) morphine or fentanyl; mean age 7.83±4.44 y (range 1.5–15.5 y); pediatric oncology clinic treatment room	Anxiety scores were highest on entry into treatment room and lowered during the procedure to levels approaching preprocedure baseline; restraint requirements were: much (20%), some (35%), none (45%); 13% experienced desaturation (oxygen saturation <90%), 14% required verbal stimulation, and 3% required oxygen; no patients required assisted ventilation or intubation; no serious complications; amnesia complete in 62%, partial in 28%	Sample size too small to make conclusions about adverse events; small sample size precludes conclusion that adding fentanyl to midazolam does not increase respiratory complications	Midazolam alone can cause respiratory depression in absence of narcotics; hypoxemia is dose related and subject to marked individual variation; observation period of 60 min after procedure appeared sufficient	III	III
Sandler et al[25]	Prospective, randomized crossover trial of midazolam vs fentanyl as premedication for painful oncology procedures; pediatric oncology clinic treatment room; mean age 10.04±5.01 y (range 3.33–18.77 y); 86 procedures on 27 patients	No serious adverse events in either group; no episodes of oxygen desaturation <90%; efficacy (defined as patient/parent satisfaction) good in both groups; amnesia 91% for midazolam, 28% for fentanyl; patients/parents preferred midazolam 72% to 28%; OSBD scores increased from first procedure to last and decreased slightly for those choosing fentanyl	Small sample size; nonblinded assessment	Both agents are effective; patients and families prefer midazolam probably because of amnestic effects	II	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Hart et al[26]	Prospective, randomized, blinded experimental trial in 42 children requiring painful ED procedures treated with (1) fentanyl, (2) fentanyl-midazolam, or (3) MPC; all patients monitored for safety with $ETCO_2$ and pulse oximetry; efficacy was measured by objective clinical signs and subjective scale by blinded observers; mean age 4.8±2.0 y (range 2–11 y)	Pain was measured by the 10-point scale of Broadman et al[83]; anxiety was measured using the author's 4-point scale; sedation was measured by the author's 5-point scale; author states that all scales were previously published and research assistants were trained in the use of scales; all equally efficacious; subclinical respiratory depression by hypoxemia or elevated $ETCO_2$ in 20% fentanyl, in 23% fentanyl-midazolam and in 11% MPC; prolonged sedation with MPC	The small sample size limits conclusions especially for safety concerns; the clinical relevance of documented transient hypercarbia in the absence of hypoxemia is not clear; the absence of any significant clinical events leaves the $ETCO_2$ data difficult to interpret	The new technique of noninvasive $ETCO_2$ monitoring may be a useful monitoring tool in the pediatric ED; fentanyl and midazolam cause a high incidence of subclinical respiratory depression	II	II
Kovoor et al[27]	Prospective observational case series of 1,344 adults requiring 2–3-h electrophysiologic studies for cardiac arrhythmias; efficacy data are included on 775 patients and safety data on 1,344 patients; cardiac catheterization lab	No serious complications; insignificant changes in respiratory rate, oxygen saturation, $ETCO_2$, and blood pressure; upper airway obstruction defined as snoring increases; increases in $ETCO_2$ or clinical evidence of upper airway obstruction occurred in 42%; restlessness occurred in 20%; 0.3% required conversion to general anesthesia for apnea or severe restlessness; efficacy in the sedation group was measured against those who had the study without sedation; in the sedated group vs the unsedated: no distress 74% vs 42%; moderate distress 24% vs 50%; extreme distress 2% vs 8%	All data are from adults; study was of continuous infusion of drugs rather than bolus for short procedure; procedure is 2–3-h electrophysiologic study primarily; this requires anxiolysis but not significant analgesia or sedation; applicability of these results to short painful procedures in children is questionable; no comparison group was used; observers of efficacy were not blinded	Continued infusion of fentanyl/midazolam can be safe and effective for adult electrophysiologic studies	III	III
Wright et al[28]	Retrospective case series of midazolam use in 389 patients in adult ED	Serious adverse event rate 1%; all serious adverse events associated with use of opiate drugs in addition to midazolam; efficacy defined as the procedure being accomplished and the physician not noting a problem	All adult patients; no standardized evaluation form	Midazolam is safe and effective when used in the ED in adult patients	Efficacy was not objectively measured	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Kennedy et al[29]	Prospective, single-blind, randomized, controlled trial of ketamine/midazolam vs fentanyl/midazolam in 260 patients, aged 5–15 y requiring orthopedic procedures in ED; ASA status I–II; videotaped blinded assessment of adequacy of sedation; safety assessed by objective monitoring; efficacy assessed by 9-point facial affective scale, parents 10-cm VAS, orthopedist satisfaction VAS, and OSBD-R scored by blinded observers and blinded treating physicians; midazolam ≤0.1 mg/kg, maximum 2.5 mg every 3 min until sedated; fentanyl ≤0.5 μg/kg every 3 min until decrease response to verbal/painful stimuli vs ketamine ≤0.5 mg/kg every 3 min (up to 2 mg/kg) + glycopyrrolate 5 μg/kg up to 250 μg	Safety: hypoxia occurred in 6% of patients in the ketamine/midazolam group vs 25% of patients in the fentanyl/midazolam group, breathing cues needed 1% vs 12%, oxygen required 10% vs 20%; 2 patients in ketamine/midazolam group required assisted mask ventilation vs 0 in fentanyl/midazolam group; Efficacy: ketamine/midazolam had better efficacy measured by lower distress scores during procedure and increased orthopedic physician satisfaction; ketamine/midazolam had more vomiting in 2 wk after procedure (4% vs 0%); OSBD-R 1.08±1.12 vs 2.70±2.16 (P≤.0001), parental pain VAS 4.21±3.30 vs 5.55±3.33 (P=.004), parental anxiety 4.48±3.26 vs 5.49±3.26 (P=.02), orthopedic satisfaction 8.71±2.21 vs 9.61±0.78 (P=.0001), equal induction time of 13 min, recovery time 113.7±36.9 min vs 127.6±56.2 min (P=.02), hypoxia 24% vs 6% (P=.001), breathing cues 12% vs 1% (P=.001), airway maneuver 11% vs 6% (P=NS), and bag-valve-mask 0% vs 2% (P=NS)	Study examined only orthopedic procedures; age range 5–15 y; results may not apply to younger patients; single-blind study	Well-done randomized controlled trial; ketamine/midazolam is more efficacious for sedation than fentanyl/midazolam for orthopedic procedures with less hypoxia and airway maneuvers; ketamine/midazolam is associated with fewer respiratory complications, but respiratory support may be needed with either regimen; vomiting in weeks following slightly more common with ketamine/midazolam (4% vs 0%)	I	I
Bauman et al[30]	Retrospective case series of randomly selected charts (convenience sample) (64/243) of sedation for lumbar puncture and BM biopsy in an outpatient oncology population; administered by pediatric critical care physician or anesthesiologist; nonstandardized treatments included multiple drug regimens; no data on fentanyl or midazolam use in absence of other agents; average age 6.6 y (range 3 mo to 15 y)	4/64 (6.25%) complications: 1/64 (1.6%) desaturation, 1/64 (1.6%) apnea, 1/64 (1.6%) hypotension, and 1/64 (1.6%) prolonged sedation; all complications were reversible and not serious; all procedures were completed; no complications with fentanyl/propofol	Very small study with small numbers in each group and much heterogeneity within each group; multiple agents used; difficult to glean efficacy or safety data about fentanyl and midazolam alone; retrospective descriptive study with no uniformity of data collection or observation of patients between groups	A fentanyl/propofol combination can be used in the pediatric population	Efficacy was not objectively measured	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
McQuillen and Steele[31]	Prospective case series of 106 children undergoing ED sedation for painful procedures; patients assessed with $ETCO_2$ monitoring; mean age 6.8 y (range 1.2–16.6 y)	Mean increase in $ETCO_2$ during sedation was: for all sedation combined 6.7 (95% CI 5.8–7.5 mm Hg), for midazolam alone 3.2 (95% CI 2.2–4.2 mm Hg), for midazolam and ketamine 5.4 (95% CI 4.5–6.4 mm Hg), and for midazolam and opiate 8.8 (95% CI 7.4–10.2 mm Hg); percentage of patients with increased $ETCO_2$ >10 mm Hg: for all sedation combined 19% (95% CI 0%–60%), for midazolam alone 9% (95% CI 3%–22%), for midazolam and ketamine 35% (95% CI 21%–50%), and for midazolam and opiate 50% (95% CI 13%–99%); all drug combinations used increased $ETCO_2$, but midazolam and fentanyl increased it to a greater degree than other agents	Did not measure efficacy; assessment not blinded; clinical significance of increased $ETCO_2$ not clear	$ETCO_2$ can be used as a monitoring adjunct in patients requiring sedation in the pediatric ED; midazolam/fentanyl causes more CO_2 retention than other commonly used agents	Efficacy was not objectively measured	III
Graff et al[32]	Retrospective observational study of fentanyl and midazolam for 334 children undergoing orthopedic procedures (retrospective grading of depth of sedation); mean age 8.4±3.75 y; pediatric ED of large urban children's hospital	11% with some respiratory event (37 patients), with 2 patients requiring naloxone; 10% needed airway positioning or stimulation, but none required ventilation or intubation	Efficacy was not rigorously measured; this is the primary weakness of this study; retrospective study with no comparison group	Fentanyl and midazolam can be safely used for ED treatment of orthopedic injuries; close monitoring of respiratory status is essential	Efficacy was not objectively measured	II
Hostetler and Barnard[33]	Retrospective case series comparing ketamine/midazolam to fentanyl/midazolam in 93 children undergoing esophageal foreign body removal in the ED over a 2-y period; 57 (61.2%) of the 93 patients received ketamine/midazolam, 28 (30.1%) received fentanyl/midazolam, 5 (5.4%) received general anesthesia, and 3 (3.2%) received other; per protocol, midazolam was dosed initially at 0.05–0.1 mg/kg followed by 0.05-mg/kg subsequent doses; ketamine was given initially in 1–2-mg/kg IV doses followed by 0.5–1.0-mg/kg doses; fentanyl was given in 1–2-μg/kg IV doses initially, followed by 0.5–1.0-μg/kg; mean age 39.3± 33.9 mo (range 3–168 mo)	Comparing ketamine/midazolam vs fentanyl/midazolam: mean procedure time 4.8 min (95% CI 3.7–6.0) vs 7.0 min (95% CI 5.1– 8.9); mean length of stay 3.6 h (95% CI 3.3–3.9) vs 5.7 h (95% CI 3.0–8.3); transient hypoxia 10.7% (95% CI 6.6–14.8) vs 15.4% (95% CI 8.6–22.2); stridor 1.8% (95% CI 0–3.6) vs 0 (95% CI 0–1.9); and bag-valve-mask 3.6% (95% CI 1.1–6.1) vs 3.8% (95% CI 0.2–7.4)	Retrospective data collection and uncontrolled comparison; small sample size; removal of esophageal foreign body may cause hypoxia unrelated to sedation/analgesia	Ketamine/midazolam and fentanyl/midazolam are safe and effective for foreign body removal in children; recovery time appears longer for fentanyl/midazolam than for ketamine/midazolam	Efficacy was not objectively measured	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Bailey et al[34]	Randomized, blinded, prospective experimental trial of drug administration to 12 healthy adult volunteers to evaluate safety profile	Midazolam alone produced no significant respiratory effects; fentanyl alone produced hypoxemia in 50% of subjects, hypoxemic episodes were defined as Spo_2 <90% and lasting ≥10 s; decreased ventilatory response to CO_2, and apnea in 0%; combination of fentanyl and midazolam produced hypoxemia in 92%, decreased ventilatory response to CO_2 similar to but no worse than fentanyl, and apnea in 50%	Small sample size for safety study limits conclusions; study done in adults; it is not clear how dosage, adverse effect profile, and responses to decreased ventilatory response to CO_2 will affect children in the clinical setting; study of drug effect in healthy volunteers with no painful stimulus may be difficult to translate to children undergoing painful procedures	Combination of fentanyl and midazolam markedly increase risk of hypoxia and apnea in comparison to either agent alone	Efficacy was not objectively measured	III
Milgrom et al[35]	Randomized, blinded, placebo-controlled trial of midazolam, fentanyl, and methohexital in various combinations in 207 adults undergoing dental procedure (molar extraction); university dental clinic	Midazolam fentanyl combination resulted in greater efficacy but increased level of sedation and complications; efficacy measures included observer-reported sedation score and self-reported pain and anxiety scores; apnea in 63% of midazolam and fentanyl and in 3% midazolam alone	All adult data but well-done study of drug use in painful procedures	High rate of apnea in combination group does not justify its use based on small increase in sedation effect	II	II
Yaster et al[36]	Case report	Respiratory arrest in a 13-month-old toddler receiving midazolam and fentanyl	Anecdotal	Midazolam and fentanyl are respiratory depressants	X	X
Godambe et al[37]	Prospective, partially blinded, randomized (videotaped) controlled trial in convenience sample of patients; ASA status I–III for orthopedic procedures in ED; 59 patients given IV propofol (1 mg/kg initially with smaller aliquots)/ fentanyl (1–2-μg/kg aliquots) vs 54 patients given ketamine (1–2-mg/kg)/midazolam (0.05 mg/kg aliquots); measurement of sedation and recovery times; use of OSBD-R and Likert satisfaction scores for orthopedist and nurse, and VAS for parents; 113 patients aged 3.1–16.3 y (median 9.0 y)	Total sedation and recovery time for propofol/fentanyl vs ketamine/midazolam 38.9 min vs 62.1 min (P<.0001) and 54.2 min vs 20.8 min (P<.0001), respectively; transient desaturation (responsive to jaw thrust or head repositioning or supplemental oxygen) occurred in 18/59 (31%) of propofol/fentanyl patients vs 4/54 (7%) of ketamine/midazolam patients (P=.002); mean OSBD-R during manipulation for propofol/ fentanyl vs ketamine/ midazolam 0.278 on scale of 0–23.5, with 0 representing no distress, vs 0.084 (P=.787); for propofol/fentanyl vs ketamine/ midazolam: orthopedic satisfaction 4.85 vs 4.93 (P=.245), nurse satisfaction 4.85 vs 4.95 (P=.173), and parental VAS 8.7 vs 13.0 (P=.380)	No significant limitations; partially blinded only; loss of videotaping in 3 patients	Both propofol and ketamine are safe and effective for ED orthopedic procedures; propofol/fentanyl had significantly shorter sedation times and longer recover times than ketamine/midazolam and equivalent satisfaction scores; there were significantly more transient desaturations with propofol/fentanyl than with ketamine/ midazolam	I	I

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Acworth et al[38]	Single-blinded (sedation assessment), randomized, controlled trial; ketamine 1 mg/kg/midazolam 0.1 mg/kg IV vs IN midazolam 0.4 mg/kg; laceration repair and foreign body removal; VAS (author's sedation scoring system); age 6 mo to 12 y; ED study; total of 53 patients	"Adequate" sedation in 27/27 vs 24/26 (P=NS), onset 2.0 min vs 7.3 min ($P<.001$), time to discharge 97.9 min vs 79.0 min (P=.02), average sedation score at 30 min: 2.4 vs 3.5 (Δ1.1, 95% CI 0.7–1.4, $P<.001$), average VAS (author's scoring system used) at 30 min: 1.8 vs 3.8 (Δ2.0, 95% CI 1.1–2.9, $P<.001$), overall VAS 2.1 vs 4.5 (Δ2.4, 95% CI 1.1–3.6, P=.001); physician satisfaction "excellent/good" 88% vs 54%, P=.006, parental satisfaction "excellent/good": 92% vs 65%, P=.02; one significant adverse event: saturation <90% in the ketamine group	Treating physician and nurse not blinded; small study for adverse events	IV ketamine/midazolam superior to IN midazolam in sedation onset, time to discharge, sedation scores, and physician and parental satisfaction	II	II
Petrack et al[39]	Double-blinded randomized, controlled trial 12 h/d with research assistant; patients aged 6 mo to 6 y requiring sedation for wound repair, burn care, or lumbar puncture; randomized to ketamine 4 mg/kg/atropine 0.01 mg/kg IM vs meperidine 2 mg/kg/promethazine 1 mg/kg/chlorpromazine 1 mg/kg IM; ED study; total of 27 patients	15 patients received ketamine vs 12 received MPC; ages 31±20 mo vs 39±22 mo, onset of sedation 3 min vs 18 min ($P<.01$), duration 82 min vs 97 min (P=.15), time to discharge 85 min vs 113 min (P=.01), and mean OSBD-R score 2.7 (95% CI 0.4–4.9) vs 9.8 (95% CI 4.9–14.6, $P<.003$); there were no significant adverse effects seen in either group	Small numbers for adverse effects; patients only recruited 12 h/d	Ketamine is superior to MPC in time of onset of sedation, time to discharge, and mean OSBD-R score; the durations of sedation were similar	I	X
McGlone et al[40]	Prospective nonrandomized comparison of IM ketamine 2.5 mg/kg + atropine (additional 1 mg/kg given prn) versus IN midazolam 0.5 mg/kg for laceration repair age 12 mo to 7 y; used nonvalidated, simple 4-point behavior scales; ED study; 102 patients, average age 3.6 y	For ketamine vs midazolam: during anesthetic injection 96% vs 38% and during suturing 100% vs 70% patients were cooperative/intermittent crying ($P<.01$); 18% vs 8% had vomiting (P=.234), median Spo_2 97% for both, recovery behavior quiet or mild agitation in 92% vs 86% (P=.44)	Nonblinded alternating of sedative	IM ketamine 2.5 mg/kg more effective than IN midazolam for suturing	III	II
Dachs and Innes[41]	Prospective nonrandomized study; patients aged 18 mo to 8 y; brief painful procedures; IV ketamine 1–1.5 mg/kg±atropine; ED study; 30 patients	Median age 38 mo, 90% laceration repair, local anesthesia used in 52%; 1mg/kg dose resulted in 6/11 (54%) patients requiring additional ketamine, dose increased to 1.5 mg/kg during study, 1.5 mg/kg dose resulted in 1/18 (5.5%) patients requiring additional ketamine; all patients were unresponsive to painful stimulation (endpoint); Spo_2 >93% on room air for all patients; telephone follow-up in 96.6%: 1 patient vomited in recovery, 1 at home, 9 with ataxia for 0.5–2 h and no nightmares	Small sample size, nonblinded outcome assessments	IV ketamine at 1.5 mg/kg effective for procedural sedation	III	II

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
McCarty et al[42]	Prospective cohort of patients aged 12 mo to 11 y undergoing orthopedic procedures using ketamine by standard protocol; emergency physician monitored sedation along with nurse while orthopedist did reduction and measured sedation with CHEOPS; 99 received 2 mg/kg IV ketamine and 15 received 4 mg/kg IM ketamine; ED study; total 114 patients	Average onset to reduction for IV: 96 s (20 s to 5 min) and IM: 4 min 42 s (60 s to 15 min); average CHEOPS score 6.4 (5–10) and all had adequate sedation for reduction; emesis in 8 (7%), nausea in 5 (4%), ataxia in 8 (7%), and dysphoria in 1 (1%); time to discharge IV: 84 min (22–215 min), IM: 90 min (60–130 min)	Nonrandomized study; small numbers for serious adverse effects	IV and IM ketamine allowed adequate sedation for fracture and/or joint reduction without serious adverse effects; IV ketamine has a rapid onset of action, both IV and IM ketamine have a fairly prolonged recovery time	II	II
Pruitt et al[43]	Prospective, single-arm trial of IM ketamine 3 mg/kg/ midazolam 0.05 mg/kg/ glycopyrrolate for lacerations/dental procedures in patients aged 1–7 y; additional ketamine 1 mg/kg prn; nonvalidated, simple behavior scales during procedure and recovery (Spo_2, etc); ED study; 42 patients (average age 2.7 y)	Onset average 4.8 min (3–10 min); recovery average 76 min (50–120 min); 26/37 patients cooperative/ sleeping; 11/37 patients intermittently crying/ fighting, 5/11 got additional 1 mg/kg of ketamine; heart rate increased 18%, respiratory rate increased 13%, Spo_2 >96% in all; no airway adverse events; emesis in 2 patients	Nonrandomized trial; small number of patients to assess frequency of major adverse events	IM ketamine/ midazolam/ glycopyrrolate safe and effective	III	II
Wathen et al[44]	Double-blind randomized, controlled trial of patients aged 4.5 mo to 16 y requiring sedation, ASA status I–II; received ketamine 1 mg/kg/ glycopyrrolate 5 μg/kg IV±midazolam 0.1 mg/kg IV; videotaped blinded assessment using OSBD-R; ED study; 266 patients	129 had ketamine alone, 92% fracture reduction or wound repair; total sedation time: 78 min (60–100 min) vs 75 min (60–95 min), Δ3 (95% CI −5 to 10), recovery agitation 7.1% vs 6.2%, Δ0.8 (95% CI −5.3 to 7.0); desaturations 1.6% vs 7.3%, Δ −5.7% (95% CI −5.7% to −0.9%); emesis: 19.4% vs 9.6%, Δ9.8% (95% CI 1.4%–18.2%); for patients >10 y: recovery agitation 5.7% vs 35.7%, Δ–30.0% (95% CI −49.3% to −10.7%)	None	Adding midazolam to ketamine does not increase sedation time, does not decrease recovery agitation; increases recovery agitation in patients >10 y, but decreases emesis	I	I
Kim et al[45]	Pilot study of sidestream $ETCO_2$ monitoring for consecutive patients aged 12 mo to 15 y ASA status I–II receiving IV ketamine (1.5 mg/kg)/atropine 0.01 mg/kg, minimum 0.1 mg, maximum 0.5 mg for procedural sedation; ED study; total of 27 patients	20 of 27 patients in whom $ETCO_2$ monitoring was attempted had usable data; no significant change in $ETCO_2$ and Spo_2; no $ETCO_2$ >47 mm	Selected small pilot study	Ketamine appears to not induce hypoventilation	Efficacy was not objectively measured	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Sherwin et al[46]	Double-blind randomized, controlled trial; patients aged 12 mo to 15 y undergoing short, painful procedure in ED; ketamine 1.5 mg/kg/atropine 0.01 mg/kg IV±midazolam 0.05 mg/kg up to 2 mg; 0–100 mm VAS (author's scoring system used) for agitation; 104 patients	53 patients received midazolam; recovery agitation VAS (author's scoring system used) 4 mm (IQR 2–19 mm) vs 5 mm (IQR 3–14 mm), *P*=.70; adequate sedation 100% vs 100%, *P*=1.00; recovery 61 min (40–98 min) vs 64 min (44–79 min) *P*=.57; airway complication 4% vs 2%, *P*=1.00; emesis 2% vs 12% (Δ–10%, 95% CI −20% to 0%, *P*=.058)	None	Midazolam does not decrease recovery agitation when ketamine is used for sedation; there is a strong trend to less emesis	I	II
Holloway et al[47]	Retrospective chart review of all children who received ketamine over a 20-mo period, primarily for laceration repair; no standardized sedation record; follow-up parent standardized interview regarding: adverse effects, mean 5 mo (range 1 wk to 14 mo) postsedation; ED study; 100 patients	78% of patients had wound repair, all IM, mean dose 5.5 mg/kg (range 3.65–8.91 mg/kg); no admissions or "airway problems" noted; vomiting during recovery in 14%, after discharge in 12%; agitation/nightmares in 2%, "unusual behavior" in 4%	Retrospective review; no standardized sedation records	Ketamine is safe when administered IM for short painful procedures	Efficacy was not objectively measured	III
Hostetler and David[48]	Prospective cohort of patients aged 6 mo to 18 y; received ketamine 0.5 to 1.5 mg/kg/midazolam 0.035 to 0.05 mg/kg/atropine 0.01 mg/kg IV and prehypnotic suggestion; sedative redosing with ketamine 0.5–1.0 mg/kg IV; 1 physician and nurse monitored sedation, and second physician did procedure; ED study; 301 eligible patients recruited	68.8% of patients for orthopedic procedures, 20.6% for wound care, and 10.6% other; 205 patients aged <10 y, 96 aged ≥10 y; physician and nurse evaluation of behavioral reaction κ=0.77; for patients aged <10 y: 7/205, 3.4% (95% CI 0.9%–5.9%) had mild reaction, 2/205, 1.0% (95% CI 0%–2.4%) had severe reaction; for patients aged ≥10 y: 2/96, 2.1% (95% CI 0%–5.0%) had mild reaction, 4/96, 4.2% (95% CI 0%–8.2%) had severe reaction; 13.2% of 167 patients followed up had nighttime awakening; overall 97.5% of parents were satisfied, 98.1% for patients not having behavioral reaction, 80.0% for patients suffering behavioral reaction	Behavioral reaction measurement not validated; not randomized or blinded; phone follow-up for approximately 50% of the patients	There is a low rate of mild or severe behavioral reaction to ketamine with a moderate number suffering nighttime awakening; there is good parental satisfaction with ketamine sedation	Efficacy was not objectively measured	II

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Green et al[49]	Retrospective cohort study of children aged <15 y receiving IM ketamine in 2 EDs following a treatment protocol; used multiple logistic regression to test predictor variables (ie, age, sex, ASA status, quantity of first ketamine dose, number of doses) for adverse events; protocol dictated initial IM dose of 4 mg/kg with repeat allowed in 5–10 min of another IM dose of 2–4 mg/kg; 1,022 patients	No association of risk factors for airway complications; emesis increased with age: OR 1.25/y (95% CI 1.17–1.34, $P<.001$); recovery agitation associated with ASA status >I: OR 3.05 (95% CI 1.65–7.30, $P=.004$) and decreasing age: OR 0.79 (95% CI 0.69–0.89, $P<.001$)	Retrospective data collection	Recovery agitation associated with higher ASA status but decreasing age; emesis is associated with increasing age; effects are not large and may not be clinically important	Efficacy was not objectively measured	II
Green et al[50]	9-y retrospective cohort study of children aged <15 y receiving IM ketamine in 2 EDs following a treatment protocol; some prospective data collection for sedation (42% of cases), supplemented by chart review; unvalidated outcome measures; protocol dictated initial IM dose of 4 mg/kg with repeat allowed in 5–10 min of another IM dose of 2–4 mg/kg; 1,022 patients	4.4% of the patients were ASA status >II, 86.5% for wound and orthopedic procedures, 4% were critical care procedures; "adequate" sedation in 98%, 215 patients required >1 dose; adverse events included airway complications in 1.4% without intubation or sequelae, emesis without evidence of aspiration in 6.7%, mild recovery agitation in 17.6%, moderate-to-severe agitation in 1.6%, and no hospitalizations due to ketamine; median time from ketamine administration of a single dose to discharge was 110 min	Retrospective series, <50% compliance with data collection form; nonblinded and unvalidated outcome measures	Ketamine in this very large cohort has a low rate of significant adverse events without serious sequelae	Efficacy was not objectively measured	II
Green et al[51]	9-y retrospective cohort study of all children aged <15 y who received IV ketamine for procedural sedation using treatment protocol at 2 centers; initial dose 1.5±0.5 mg/kg, total dose 2.5±1.6 mg/kg, 31% received midazolam; ED study; 156 patients, average age 6.3±3.2 y	81% of patients for orthopedic or wound management, 6% for endotracheal intubation and 13% miscellaneous, 17 with ASA status III–IV; adverse events: 1 with apnea with rapid IV infusion, 1 with respiratory depression requiring jaw thrust only, and 6 with emesis without evidence of aspiration; median recovery time 103 min (IQR 76–146 min)	Mixed indications for use of IV ketamine; retrospective data collection; not blinded	IV ketamine appears safe even in high-risk patients	Efficacy was not objectively measured	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Green et al[52]	Prospective uncontrolled cohort, age 14 mo to 13 y requiring sedation for painful procedures; protocol: IM ketamine 4 mg/kg; unvalidated sedation assessment; ED study; 108 patients, mean age 54 mo	75% of patients with lacerations, 9.3% orthopedic procedures; 86% procedures completed without local anesthesia, 7% received local, 3% needed additional ketamine; onset by 5 min in 83%, recovery mean 82±33 min, recovery behavior quiet in 80%, mild agitation in 17%, moderate agitation in 3%, pronounced agitation in 1%, laryngospasm in 1 after study completed, and emesis in 6	Uncontrolled unvalidated trial; unblinded outcome measures; small sample size for safety	Ketamine is effective for brief painful procedures with a low rate of adverse effects	III	II
Green et al[53]	Retrospective 5-y cohort of non-ED patients, ages <1 mo to 21 y, receiving IV ketamine/midazolam to facilitate gastrointestinal procedures (86% esophagoscopy); median ketamine dose 1.3 mg/kg, 46% patients ASA status ≥III	636 patients given ketamine, 86% for esophagoscopy; laryngospasms noted in 8.2% overall, and in 14% of preschoolers; median lowest oxygen saturation, if recorded, with laryngospasms was 70% (range 30%–89%); 37% received positive pressure ventilation	Retrospective design with no comparison group; the main clinical efficacy endpoint was accomplishment of procedure; safety endpoints were adverse cardiopulmonary events that were not routinely recorded (eg, lowest oxygen saturation, presence/absence of laryngospasm)	Authors conclude no adverse outcomes attributable to ketamine	Efficacy was not objectively measured	X
Forbes et al[54]	Prospective observational study to examine hemodynamic effects of rectal methohexital (25 mg/kg) through echocardiography in operating room; the study included 12 patients aged 32.4±3.8 mo	Methohexital had increased heart rate but had no effect on other parameters; no arterial desaturation or apnea	Study did not effectively examine apnea or desaturation but only echocardiographic effects	Rectal methohexital has minimal hemodynamic effects	Efficacy was not objectively measured	III
Manuli and Davies[55]	Retrospective study of CT and MRI patients; non-ED study; 25 mg/kg of methohexital given rectally; 94 patients aged 25±2 mo	Sleep was induced in 81% of children; 1% desaturation rate	Retrospective nature and methods prevented valid conclusions on efficacy; deduced from chart	Rectal methohexital is safe	Efficacy was not objectively measured	II
Pomeranz et al[56]	Prospective observational study of ED patients undergoing CT scan; 25 mg/kg of methohexital given rectally; efficacy was determined with 2 separate measures: a 3-point scale recorded the need for restraints to complete the CT study while another scale recorded the quality of the CT scan as determined by the presence of motion artifact; 100 patients with average age of 24 mo	95% efficacy; 3% required bag-valve-mask ventilatory support briefly, no endotracheal intubations, 2 head repositionings, and 2 given nasal oxygen	None; complications may not be as severe as noted because bag-valve-mask ventilatory support was by protocol	Methohexital safe and effective for CT scanning	I	I

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Sedik[57]	Retrospective and prospective observational study; IV methohexital in ED patients for CT scans; used a dosing range of 0.5–2 mg/kg; efficacy was determined by the ability to complete the CT scan; 55 patients; 2-phase study—phase 1 patient age: 28±24 mo; phase 2 patient age: 27±17 mo	1% of patients had oxygen saturation <93%, and 1% had a failure rate of sedation	Part of the study was done retrospectively, although the prospective portion compensates	Methohexital is safe and effective with brief duration of action	II	II
Varner et al[58]	Prospective observational study of 10 mg/kg IM methohexital for CT studies; 2 different strengths examined (3.5% and 5%); efficacy was determined by the ability to complete the CT scan; non-ED study with 50 patients aged 2 mo to 5 y	Efficacy data only, 92% effective for CT	Safety data are not well documented, although no apnea was noted	Methohexital is effective at 10 mg/kg	II	Safety was not objectively measured
Schwanda et al[59]	Retrospective observational study of hematology/oncology patients; 1 mg/kg IV methohexital; efficacy was determined by the ability to complete hematology/oncology procedure; because the drug was titrated by the physician to the endpoint of cooperation with the procedure, the drug was 100% effective; 132 procedures in 33 patients aged 8.3±5 y	100% effective; 1.5% needed bag-valve-mask ventilatory support, 17% had decreased blood pressure, 5.3% had complications with intervention	Safety data were prospectively collected and are grade II; the efficacy data were collected through chart review and should be regarded as grade III; not truly reflective of ED patients; the use for lumbar punctures may be of some value	Slightly higher complication rate than reported in other studies	III	II
Rooks et al[60]	Prospective, nonblinded study; 317 children in pentobarbital group; 358 children in chloral hydrate group; total of 675 patients; comparison of oral pentobarbital to oral chloral hydrate; pentobarbital at dose of 4 mg/kg/dose; chloral hydrate at dose of 50 mg/kg/dose; radiology study; patients in the oral pentobarbital group were sedated for MRI (230 patients), CT (85 patients), nuclear medicine (1 patient), and interventional radiology (1 patient) procedures. In the chloral hydrate group the breakdown was as follows: MRI (268 patients), CT (87 patients), nuclear medicine (1 patient), and interventional radiology (2 patients) procedures	Oral pentobarbital: time to sedation 19±14 min; time to discharge 100±35 min; length of sedation 81±34 min; adverse reactions 1.6%; sedation was unsuccessful in 1 patient (0.3%) in the oral pentobarbital group; Oral chloral hydrate: time to sedation 16±11 min; time to discharge 103±36 min; length of sedation 81±34 min; adverse reactions 1.7%; sedation was unsuccessful in 1 patient (0.3%) in the chloral hydrate group	Radiology study, fasted patients	Similar time to sedation, time to discharge, length of sedation, and adverse reactions	II	II

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Greenberg et al[61]	Prospective, nonblinded study included 100 children; pentobarbital dose 6 mg/kg in 3 divided doses to a maximum of 200 mg; age range 2–15 y with a mean age of 6.8 y; radiology department study; all patients had MRI	8% (8 children out of 100) that failed were either $\geq$12 y or weight was >50 kg; side effects: 7% hyperactivity, 6% oxygen desaturation, 3% cough, 2% prolonged sedation, 1% vomiting	Routine and fasted studies	The success rate was good, it could be improved if the use was limited to children $<$12 y and weighing $<$50 kg	II	II
Karian et al[62]	Retrospective study included 1,665 children; children aged $<$1 y were sedated with chloral hydrate (50–100 mg/kg) or oral pentobarbital (4–8 mg/kg); children aged >1 y received IV sedation, pentobarbital IV 2–6 mg/kg, fentanyl 1–2 μg/kg if required; midazolam dose of 0.05 mg/kg IV or 0.5–0.75 mg/kg orally; 216 patients were >10 y; radiology study—1,665 pediatric patients had sedation for various radiology studies, of these 1,110 had a scan (302 MRI, 179 CT), 675 patients received IV contrast	Paradoxical reaction in 1.2% and decreased oxygen saturation in 0.5% of patients who recovered with head positioning; sedation failure rate of 1%	Radiology study; fasted patients; multiple drug regimens	Pentobarbital has a low sedation failure and few adverse reactions	III	II
Mason et al[63]	Prospective, nonblinded; study included 1,070 children; pentobarbital compared with combination of pentobarbital and midazolam; pentobarbital group received 2–6 mg/kg IV; pentobarbital-midazolam group received an initial 0.1 mg/kg of IV midazolam followed after 1 min by 2–6 mg/kg IV pentobarbital; in both groups, all pentobarbital was titrated to effect in standardized 1–2 mg/kg doses; age in pentobarbital group: 3.3$\pm$2.5 y; age in pentobarbital/midazolam group: 4.3$\pm$2.7 y; radiology study; pentobarbital group: MRI 482 (75%), CT 120 (19%), nuclear medicine 22 (3%), and MRI combined with CT 16 (3%); pentobarbital-midazolam group: MRI 340 (79%), CT 65 (15%), nuclear medicine 20 (5%), MRI combined with CT 5 (1%)	The success rate of the pentobarbital alone group was 99.5% vs 99.8% in the pentobarbital-midazolam group; the use of midazolam increased time to sedation (pentobarbital-midazolam 8.0$\pm$4.4 min vs pentobarbital 6.5$\pm$4.4 min) and also prolonged the time to discharge by approximately 14 min when used in conjunction with pentobarbital (pentobarbital-midazolam 120$\pm$32 min vs pentobarbital 106$\pm$34 min)	Radiology study; fasted patients	No beneficial effect by adding midazolam to pentobarbital; it actually increased the time to sedation and the time to discharge	II	I

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Strain et al[64]	Prospective, nonrandomized, nonblinded, no comparison group; study included 225 children; 2–6 mg/kg were given in the following manner: 2.5 mg/kg IV and patient is observed for disconjugate eye movement, yawning, quiet sleep, or a slowed respiratory rate, wait 30 s then if still active give 1.25 mg/kg, wait 30 s, then the remaining dose of 1.25 mg/kg was given if the patient did not become quiet over the next 30–60 s; occasionally an additional dose of 1 mg/kg was given to a total dose of 6 mg/kg; the patients received a mean dose of 4.5 mg/kg; 25% of patients aged 6 wk to 6 mo; 30% of patients aged 6 mo to 1 y; 30% of patients aged 1–3 y; upper age limit not given; radiology study—sedation for CT imaging	7.5% transient desaturation to ≤80%: oxygen normalized spontaneously in 14 patients (sample size 225) and 2 patients needed head positioning; sedation failure rate <1%	Radiology study; fasted patients	IV nembutal is safe, effective, and efficient form of sedation for pediatric CT imaging	II	II
Moro-Sutherland et al[65]	Prospective, randomized, nonblinded; study included 55 children aged 6 mo to 6 y; compared pentobarbital vs midazolam; standardized dose of midazolam: total dose 0.2 mg/kg (maximum dose 7.5 mg); pentobarbital: total dose of 5 mg/kg (maximum dose 100 mg); protocol for the administration of midazolam: IV midazolam 0.2 mg/kg drawn up, 0.1 mg/kg IV over 2 min, wait 2 min, 0.05 mg/kg IV over 2 min, wait 2 min, 0.05 mg/kg IV over 2 min; dose titrated against response; protocol for the administration of pentobarbital: IV pentobarbital 5 mg/kg drawn up, 2.5 mg/kg IV over 30 s, wait 1 min, 1.25 mg/kg IV over 30 s, wait 1 min, 1.25 mg/kg IV over 30 s, dose titrated against response, average dose was 3.75 mg/kg; radiology study—sedation for head CT	With pentobarbital, 97% of patients scanned successfully; induction time 6 min, duration of sedation 86 min; with midazolam, 19% of patients scanned successfully; mild oxygen desaturation, oxygen saturation >90%	Radiology study; fasted patients; only 55 patients; not blinded to outcomes	IV pentobarbital is more effective than IV midazolam for sedation of children requiring CT imaging	II	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Kain et al[66]	Prospective, randomized, nonblinded controlled trial comparing propofol with a combination of thiopental and pentobarbital for MRI studies in radiology suite; study included 58 patients; 29 patients received 1–2 mg/kg of propofol followed by propofol infusion 5.4 mg/kg/h, and second group received 1–3 mg/kg of thiopental followed by a pentobarbital bolus of 2–3 mg/kg, and supplemental doses of 1–2 mg/kg of thiopental; ages 11 mo to 6.5 y; radiology study—MRI of the brain or spine	Time to recovery in propofol group was 19±7 min vs 35±20 min in thiopental/pentobarbital group; time to discharge in propofol group was 24±6 min vs 40±11 min in thiopental/pentobarbital group; for propofol group: 5% pulse oximetry level desaturation <90% and 4% for thiopental/pentobarbital group with all events responding spontaneously or to head repositioning; all studies were completed, and the average MRI quality score was comparable in both groups	Radiology study; fasted patients; sample size is a minor limitation	Propofol and pentobarbital are safe for use in painless diagnostic studies; propofol and pentobarbital had similar desaturation levels; pentobarbital had longer recovery time and longer time to discharge than propofol	II	III
Egelhoff et al[67]	Retrospective, observational study; study included 6,006 children; oral choral hydrate was given to infants aged <18 mo, the initial dose was usually 50–75 mg/kg with additional doses of 25–50 mg/kg up to 100 mg/kg as needed; nembutal (3–8 mg/kg) was started at 3 mg/kg in children >18 mo; fentanyl was added if painful procedure at a dose of 1 μg/kg up to 3 μg/kg; patient ages: 1 d to 18 y; radiology study; imaging studies included CT, sonography, MRI, special procedures, and nuclear medicine (actual number of patients included in each group was not specified)	Sedation failure rate was 1%; 0.06% required overnight hospitalization; transient respiratory depression to oxygen saturation <10% below the baseline despite repositioning; vomiting in <0.53% of patients; irritability in 0.21% of patients	Radiology study; fasted patients; 3 different drug regimens were used: chloral hydrate, pentobarbital, and pentobarbital with fentanyl	This study looked mainly at the use of chloral hydrate and pentobarbital alone or pentobarbital in combination with fentanyl; however, additional drugs were used including but not limited to diazepam and midazolam; the sedation failure rate was 1% and the rate of complications was low	III	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Slovis et al[68]	Prospective study; study included 549 children, above or below 8 y; 70% <8 y, of those 48% were <4 y; multiple drug regimens: chloral hydrate, pentobarbital, midazolam, diazepam, and with any of these drugs fentanyl was used for enhancement; dosing: oral chloral hydrate either 50 mg/kg or 75 mg/kg given depending on weight, age, and length of examination, up to a maximum of 1,000 mg, age <12 mo, optional use at age 12–18 mo; IV pentobarbital 3 mg/kg for ≥12 mo, 1 μg/kg fentanyl given if not asleep 5 min after pentobarbital; IV fentanyl 1 μg/kg at any age, used mostly for pain; IV midazolam 0.2–0.3 mg/kg × 2, with 2–5 min between doses, use for children aged ≥8 y; oral diazepam 5–10 mg in children aged >5 years, used on anxious older children in MRI; radiology study; imaging procedures included MRI (1,202 patients), CT (1,238 patients), nuclear medicine (162 patients), ultrasound (9 patients), diagnostic imaging (6 patients), and special procedures (240 patients)	With pentobarbital 8.4% hyperactivity in children >8 y and 19% sleeping for >8 h; if multiple doses of pentobarbital were used, there was a significant short-term effect on children <8 y, with 35% sleeping >8 h after the MRI; among 2,857 patients sedated in a 12-mo period, there were 40 failures (1.4%), complications (all minor) in 142 (5%); among the 2,857 patients, 1,202 had an MRI, with 26 failures (2.2%) including hyperactivity and vomiting, and 1,238 had a CT	Radiology study; fasted patients	Hyperactivity was found only in those children who received pentobarbital; the association of pentobarbital with hyperactivity was statistically significant for all ages when compared with drug regimens not containing pentobarbital	II	II
Sanderson[69]	Retrospective study; study included 149 children aged 3 mo to 7 y and 3 mo; children undergoing abdominal CT scan with oral contrast media, therefore not NPO; 141 patients received pentobarbital as the only sedative agent (94.6%), 8 patients (5.4%) required supplemental sedation with midazolam, with 1 patient requiring both midazolam and fentanyl; pentobarbital average dose 4.6 mg/kg; midazolam average dose 0.18 mg/kg (range 0.13–0.27); fentanyl was given to 1 patient at a dose of 2 μg/kg; radiology department	Abdominal CT with oral contrast was completed in all patients; 14% complication rate: desaturation, vomiting, airway secretions, airway obstruction, coughing, and bronchospasm	Retrospective study; radiology department; abdominal CT, however, patients were not NPO and had received oral contrast 45 min before the scan	Pentobarbital was an effective sedation agent with abdominal CT scan completed in all patients; complication rate was high (14.7%); some of the complications included desaturation, vomiting, and cough	III	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Bloomfield et al[70]	Prospective, randomized, controlled, nonblinded trial; pentobarbital compared with propofol; dosing: pentobarbital IV in successive boluses of 2.5 mg/kg to a maximum of 7.5 mg/kg; propofol IV 2 mg/kg (with supplemental 1-mg/kg boluses) followed by continuous infusion of 6–10 mg/kg/h; efficacy was determined by the ability to complete MRI study; MRI patients, radiology study; pentobarbital group mean age 4 y; propofol group mean age 5 y; age range 2–11 y; 61 total patients, 31 propofol cases and 30 pentobarbital cases	There was no significant difference in the responses between the propofol and pentobarbital groups; however, the propofol group had a greater decrease in pulse rate and 3/31 (10%) patients had transient decreases in oxygen saturation $<90\%$, with all responding to head repositioning, compared with the pentobarbital group that had 0 decrease in pulse oximetry levels $<90\%$; the propofol group had a faster recovery than the pentobarbital group; the propofol group average time to arousal was 5 min and time to discharge 12.5 min; in the pentobarbital group, the average time to arousal was 21.5 min and time to discharge 34 min; both 100% effective	Radiology study; fasted patients; some difficulties with early randomization	Both propofol and pentobarbital are safe and effective for sedation for painless diagnostic studies, but require careful patient selection and diligent monitoring; pentobarbital had less decrease in pulse rate and less transient desaturation but had greater recovery time than propofol	II	II
Havel et al[72]	Prospective, blinded, randomized, controlled trial comparing IV midazolam and propofol for painful procedures in the ED; 46 patients in midazolam group: 0.1 mg/kg; 43 patients in propofol group: bolus 1 mg/kg, infusion 4–6 mg/kg/h; total of 89 patients; aged 9.0 ± 3.8 y in propofol group, and 8.6 ± 4.2 y in midazolam group	11.6% had oxygen saturation below 93%; no interventions were needed aside from oxygen; mean sedation 5.5/6 on Ramsay Sedation Scale	Sample size is only a minor limitation	Propofol is effective and safe; shorter recovery time than midazolam	I	I
Skokan et al[73]	Prospective observational study of ED procedures; 1-mg/kg dose followed by 0.5-mg/kg boluses; mean age 7.4 y; 40 patients	Oxygen administered by 2/3 physicians regardless of pulse oximetry levels; all patients received opiate as well; 30% required supplemental oxygen; 1 (2.5%) patient required brief bag-valve-mask ventilation; 100% rated sedation as excellent	Data collection very unclear; multiple variations in delivery and recording of information	Propofol is safe and effective for use in ED procedures	III	III
Hertzog et al[74]	Prospective observational study of propofol for oncology procedures in a pediatric ICU–affiliated procedural unit; 2-mg/kg bolus and additional intermittent bolus injections; efficacy was determined by the ability to complete hematology/oncology procedure; ages 7.5 ± 4.3 y; 50 cases	4 (8%) transient pulse oximetry levels $<92\%$, 1 patient required bag-valve-mask ventilation, 2 cases of transient apnea; 100% effective	No significant limitation	Propofol reasonable option for procedural sedation in pediatric ICU	Efficacy was not objectively measured	II

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Guenther et al[75]	Prospective observational study of procedural patients managed in a pediatric ED–associated sedation unit; patients electively scheduled for unit from multiple outpatient sources, most commonly hematology/ oncology; protocol delivered propofol with fentanyl as 1–2 μg/kg; fentanyl initially, followed by 1 mg/kg of propofol; subsequent doses of 0.5 mg/kg administered at discretion of pediatric emergency physician managing sedation; mean dose 3.9 mg/kg of propofol; total of 87 patients underwent 291 separate sedations; efficacy defined as successful completion of procedure; 100% procedures successfully completed; median age 6 y	7% of children had transient desaturation below 90%, 4% partial airway obstruction requiring jaw thrust, 1% required transient bag-valve-mask assisted ventilation; transient decrease in systolic blood pressure noted with no clinical impact noted in almost all cases	Patients preselected and scheduled; success defined as completion of procedure with no adverse events	Propofol safe and effective for administration by pediatric emergency physicians in an ED-associated sedation unit	II	II
Bassett et al[76]	Prospective observational study of consecutive patients sedated with propofol in a pediatric ED; protocol delivered propofol with fentanyl as 1–2 μg/kg; fentanyl initially, followed by 1 mg/kg of propofol; subsequent doses of 0.5 mg/kg administered at discretion of pediatric emergency physician managing sedation; supplemental oxygen was applied to patients per protocol; mean dose 2.9 mg/kg of propofol; total of 392 patients underwent 393 separate sedations; median age 8 y	5% of children had transient desaturation below 90%, 3% partial airway obstruction, 0.8% required transient bag-valve-mask assisted ventilation; clinically insignificant transient decrease in systolic blood pressure noted in 84% of patients (median decrease 10.5 mm Hg); 6% demonstrated transient bradycardia with no clinical impact	No observations or definition of efficacy contained; conclusion that propofol is efficacious is stated and implied in lack of data that no procedures were not successfully completed	Propofol safe and effective when administered in ED setting	II	III
Jayabose et al[77]	Retrospective review of prospectively collected data on patients undergoing painful cancer-related procedures in an oncologic procedure unit; dosing varied depending on combination with other drugs; when only propofol was used the dosing was 25 mg/kg/min; age 2–15 y; 52 patients, 335 procedures	6 episodes of hypoxia <94%; no endotracheal tube intubations; efficacy on a unique scoring system was 93% for propofol only (160 episodes)	Some use of fentanyl, midazolam, and other agents	Propofol is safe and effective for use in patients undergoing painful procedures	III	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Keidan et al[78]	Prospective, randomized, controlled trial of propofol vs propofol/remifentanil for bone marrow biopsy in outpatient clinic; 3-mg/kg bolus infusion of 18 mg/kg/h; 36 pure propofol patients; propofol group mean age 8.4±4.8 y; propofol/remifentanil group mean age 9±5 y; 77 total patients	4 (11%) saturation <90%	May not be able to extrapolate from ASA III patients to ED	Propofol combined with remifentanil is better than propofol alone	Efficacy was not objectively measured	II
Levati et al[79]	Prospective observational study of MRI patients in radiology suite; origin of patients from multiple clinical areas; 3.7- to 5.4-mg/kg propofol bolus (lower dose in weight >10 kg), 7.1- to 10.1-mg/kg/h infusion; efficacy was determined by the ability to complete MRI study; ages 2 wk to 11 y; 84 patients	No apnea, 5 (6%) $ETCO_2$ elevation, 1 hypoxia <97%; 100% effective	Some variation in monitoring in some patients	Propofol is useful and safe for painless diagnostic study such as MRI	II	II
Merola et al[80]	Retrospective review of anesthesia records of sedation for MRI; compared with chloral hydrate; unclear to what extent data were prospectively collected; 2 mg/kg bolus drip 80–140 μg/kg/min (4.8–8.4 mg/kg/h); efficacy was determined by the ability to complete MRI study; ages 1 mo to 17 y; 318 propofol sedations; 455 total patients	No adverse outcomes documented; defined as pulse oximetry levels <94%	Unclear methods of data collection and documentation of adverse events	Propofol is reliable and safe	III	III
Scheiber et al[81]	Retrospective chart review of prospectively collected data in children undergoing radiation therapy in radiology suite; sedated with 3.4 mg/kg bolus IV propofol, 7.6 mg/kg/h infusion; efficacy was determined by the ability to complete radiation therapy; mean age 30±7.8 mo; 11 patients underwent 155 sedative procedures	No saturation <92% on room air	Results not clearly documented; mean pulse oximetry levels reported; effective treatment	Sedation with propofol excellent method for radiotherapy	III	III

Evidentiary Table (continued).

Study	Design	Findings	Limitations	Conclusions	Grade (Efficacy)	Grade (Safety)
Vardi et al[82]	Prospective, randomized, controlled trial of propofol vs ketamine for procedures in pediatric ICU; propofol dose 2.5–3 mg/kg bolus 12 mg/kg/h; ketamine dose 2 mg/kg plus midazolam 0.1 mg/kg plus fentanyl 2 μg/kg; mean age 7.25±5.73 y; 58 patients	For propofol sedation 9.6/10 scale and 5.6/6 on Ramsay Scale; for ketamine sedation 9.3/10 scale and 5.3/6 on Ramsay scale; for propofol: head repositioning 12 (20%), apnea requiring bag-valve-mask ventilation 10 (19%), no endotracheal tube intubations; for ketamine: airway repositioning 7 (14%), apnea 3 (6%), intubations 1 (2%)	May not be able to extrapolate from critically ill patients to stable ED patients	Both propofol and ketamine are safe and effective in pediatric ICU setting	III	III

IV, Intravenous; **ACTH,** adrenocorticotropic hormone; **IN,** intranasal; **IM,** intramuscular; **EEG,** electroencephalogram; **MPC,** meperidine-promethazine-chlorpromazine; **BM,** bone marrow; **prn,** as needed; **CHEOPS,** Children's Hospital of Eastern Ontario Pain Scale; **IQR,** interquartile range; **OR,** odds ratio; **NPO,** nothing by mouth.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Policy Statement—Cochlear Implants in Children: Surgical Site Infections and Prevention and Treatment of Acute Otitis Media and Meningitis

Lorry G. Rubin, MD, Blake Papsin, MD and the COMMITTEE ON INFECTIOUS DISEASES AND SECTION ON OTOLARYNGOLOGY–HEAD AND NECK SURGERY

KEY WORDS
cochlear implant, deafness, meningitis, acute otitis media, vaccination

ABBREVIATIONS
FDA—Food and Drug Administration
CSF—cerebrospinal fluid
CI—confidence interval
PCV7—heptavalent pneumococcal conjugate vaccine
PPSV23—23-valent pneumococcal polysaccharide vaccine
PCV13—13-valent pneumococcal conjugate vaccine
Hib—*Haemophilus influenzae* type b conjugate vaccine

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abstract

FREE

The use of cochlear implants is increasingly common, particularly in children younger than 3 years. Bacterial meningitis, often with associated acute otitis media, is more common in children with cochlear implants than in groups of control children. Children with profound deafness who are candidates for cochlear implants should receive all age-appropriate doses of pneumococcal conjugate and *Haemophilus influenzae* type b conjugate vaccines and appropriate annual immunization against influenza. In addition, starting at 24 months of age, a single dose of 23-valent pneumococcal polysaccharide vaccine should be administered. Before implant surgery, primary care providers and cochlear implant teams should ensure that immunizations are up-to-date, preferably with completion of indicated vaccines at least 2 weeks before implant surgery. Imaging of the temporal bone/inner ear should be performed before cochlear implantation in all children with congenital deafness and all patients with profound hearing impairment and a history of bacterial meningitis to identify those with inner-ear malformations/cerebrospinal fluid fistulas or ossification of the cochlea. During the initial months after cochlear implantation, the risk of complications of acute otitis media may be higher than during subsequent time periods. Therefore, it is recommended that acute otitis media diagnosed during the first 2 months after implantation be initially treated with a parenteral antibiotic (eg, ceftriaxone or cefotaxime). Episodes occurring 2 months or longer after implantation can be treated with a trial of an oral antimicrobial agent (eg, amoxicillin or amoxicillin/clavulanate at a dose of approximately 90 mg/kg per day of amoxicillin component), provided the child does not appear toxic and the implant does not have a spacer/positioner, a wedge that rests in the cochlea next to the electrodes present in certain implant models available between 1999 and 2002. "Watchful waiting" without antimicrobial therapy is inappropriate for children with implants with acute otitis media. If feasible, tympanocentesis should be performed for acute otitis media, and the material should be sent for culture, but performance of this procedure should not result in an undue delay in initiating antimicrobial therapy. For patients with suspected meningitis, cerebrospinal fluid as well as middle-ear fluid, if present, should be sent for culture. Empiric antimicrobial therapy for meningitis occurring within 2 months of implantation should include an agent with broad activity against Gram-negative bacilli (eg, meropenem) plus vancomycin. For meningitis occurring 2 months or longer after implantation, standard empiric antimicrobial therapy for meningitis (eg, ceftriaxone plus vancomycin) is indicated. For patients with meningitis, urgent evaluation by an otolaryngologist is indicated for consideration of imaging and surgical exploration. *Pediatrics* 2010; 126:381–391

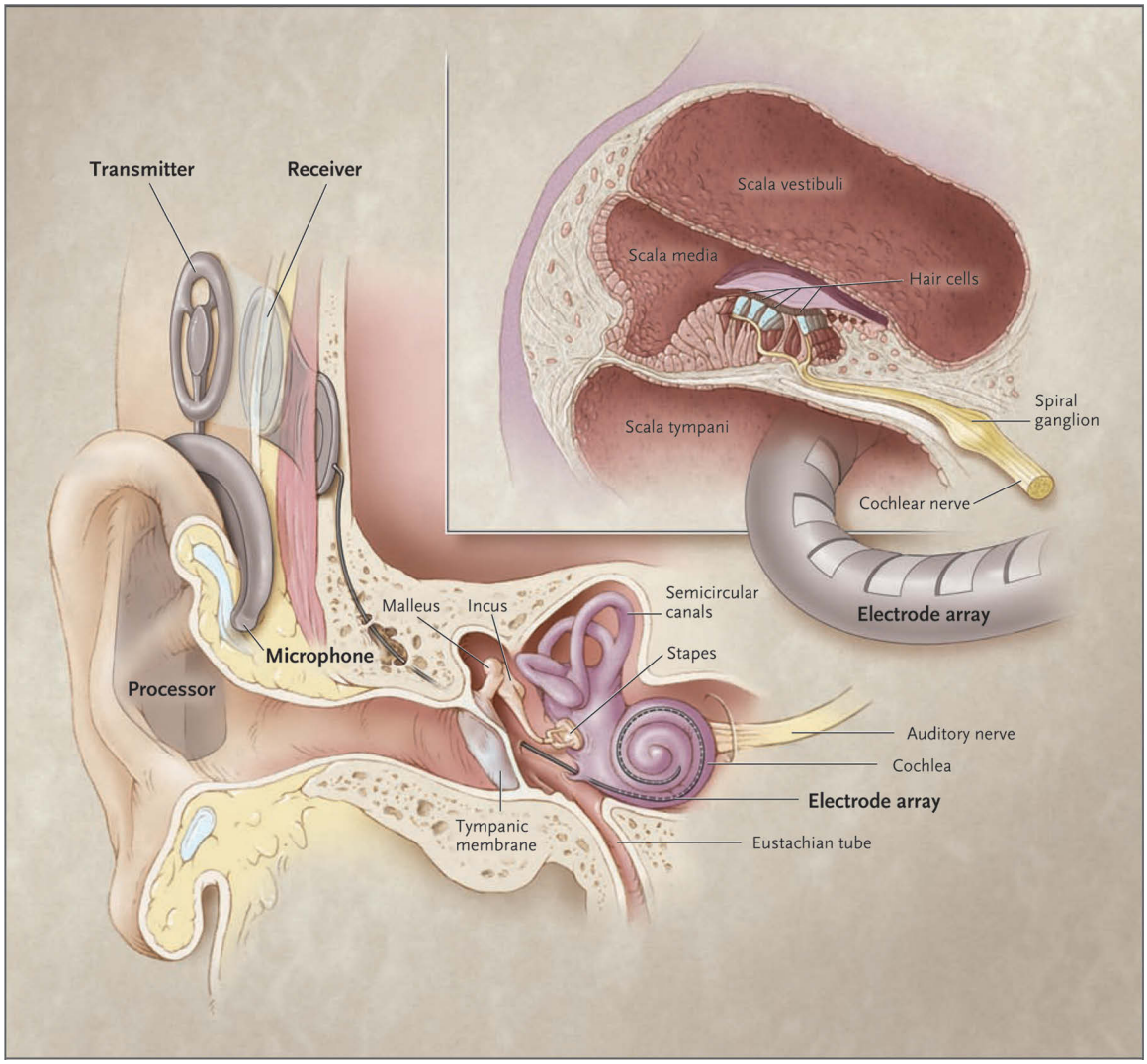

FIGURE 1

Diagram of the implanted cochlear device. External devices pick up, process, and transmit the sound across the skin to a receiver-stimulator implanted in bone. The receiver sends the code down a bundle of wires that passes through the middle ear and continues as the electrode array that is threaded into the cochlea. (Reprinted with permission from Papsin BC, Gordon KA. *N Engl J Med.* 2007;357[23]:2380–2387. Copyright © 2007 Massachusetts Medical Society. All rights reserved.)

BACKGROUND

A cochlear implant is an implanted electronic hearing device designed to produce useful hearing sensations to a person who is profoundly deaf or severely hard of hearing by electrically stimulating nerves inside the inner ear. The implant consists of an external portion that sits behind the ear and internal components that are surgically placed under the skin and inserted in the cochlea (Fig 1).[1,2] Cochlear implants are increasingly being used as a treatment for hearing loss. By the end of 2005, nearly 15 000 children and 22 000 adults in the United States and nearly 100 000 people worldwide had received cochlear implants for treatment of hearing loss.[2] In another important trend, some adults and children are now receiving bilateral cochlear implants.[1] Approximately 1 million people in the United States are potential candidates for cochlear implants. The current minimum age for placement of cochlear implants approved by the US Food and Drug Administration (FDA) is 1 year, although implants have been placed successfully in infants younger than 1 year with profound hearing loss.[3–5] It is increasingly likely that a primary care pediatrician will have 1 or more children with a cochlear implant in his or her practice. Potential infectious complications of cochlear implants include postoperative wound and device-related infections and bacterial meningitis. In children with cochlear implants, an episode of acute otitis media may lead to inner-ear infection, device infection, device extrusion, device

TABLE 1 Acute Otitis Media in Children With Cochlear Implants

Reference (Year)	Study Design	No. of Patients Evaluated	No. of Patients With ≥1 Episode of Acute Otitis Media in Implanted Ear (Total No. of Episodes That Occurred in Either or Both Ears)	Age at Implantation (Mean Age at Implantation), y	Length of Follow-up Time After Implantation (Mean), y	Time Interval From Implantation to Acute Otitis Media, Range (Mean), mo	Management	No. of Episodes of Meningitis
Luntz et al[9] (2004)	Prospective	60	17 (22)	(3.4)	0.25–2.5(1.7)	<1, 6 cases >1, 11 cases	Myringotomy and tube placed All received oral antimicrobial agents; 46% also received parenteral antimicrobial agents	0
House et al[10] (1983)	Retrospective	43	NR (4)	2.7–17.5 (8.3)	Up to 2¾	NR	Oral antimicrobial therapy	0
House et al[11] (1985)	Retrospective	20	8 (13)	2.9–8.7	1–4 (1.3)	1–17 (6.4)	Oral antimicrobial therapy	NR
Kempf et al[12] (2000)	Retrospective	366	11 (20)	1–14	≤8	NR	Route or choice of antimicrobial agent not specified; myringotomy performed in 7 of 20 episodes	0
Migirov et al[13] (2006)	Retrospective	234	47	0.9–16 (4.8)	≥2	NR	Intravenous ceftriaxone for 3–5 d; no myringotomy	NR

NR indicates not reported.

failure, and/or meningitis. Thus, there is a need for guidelines for prevention, recognition, and management of cochlear implant–related infections, acute otitis media, and bacterial meningitis in children with cochlear implants.

Postoperative Wound Infections

Postoperative surgical site infection has been reported in 1% to 12% of patients who have undergone cochlear implantation.[6,7] Major infections may have serious consequences, including loss of the implant, and may occur more frequently in pediatric patients.[6] In 1 case series, 8 of 9 patients with device exposure (ie, an opening in the skin overlying the device as a result of wound infection and resultant wound dehiscence) ultimately required device removal, compared with 3 of 17 patients with a wound infection without device exposure.[7] Although the use of prophylactic perioperative antimicrobial agents has varied among centers and surgeons, the FDA recommended in 2003 that "[h]ealth care providers should consider prophylactic antibiotic treatment perioperatively in children receiving cochlear implants."[8] This recommendation was made to reduce the risk of meningitis that occurs in the immediate postoperative period, but it is possible that the use of prophylactic antimicrobial agents may also reduce the rate of occurrence of postoperative wound infection, acute otitis media, and implant infection. Patients with suspected postoperative wound infections should be referred urgently to the surgeon who performed the implant.

Acute Otitis Media in Cochlear Implant Recipients

With an increasing number of children younger than 3 years receiving cochlear implants, primary care providers are likely to be confronted with children with cochlear implants who present with acute otitis media. Rates of morbidity associated with acute otitis media may be higher in children with cochlear implants than in other children, because the surgically placed electrode traverses the middle ear to the inner ear through the cochlear wall (cochleostomy) or the round window membrane (Fig 1). Although the opening created between the middle and inner ear is generally sealed with fascia or other material, it remains a potential route for acute otitis media–causing bacteria in the middle ear to spread to the inner ear. Inner-ear infection can result in severe symptoms including hearing loss attributable to damage to auditory primary afferent neurons, vestibular dysfunction, and meningitis. In addition, inner-ear infection can result in loss of the implant because of implant contamination or implant malfunction related to ossification of the cochlea.

Published data concerning the incidence and prognosis of acute otitis media in children with implants are limited (Table 1).[9–13] Theoretically, in the initial months after placement of a cochlear implant, the risk of complications associated with an episode of acute otitis media may be higher if the cochleostomy, the communication between the middle and inner ear created during implantation, has not healed. An animal model has demonstrated that acute otitis media induced within 2 weeks after cochlear implantation may result in severe cochlear damage.[14] However, postmortem study of the temporal bone of implant recipients 2 to 10 years after implantation demonstrated that the opening in the round window around the electrode was sealed with fibrous tissue.[15]

In the only prospective study of acute otitis media in implant recipients, Luntz et al[9,16] studied 60 children whom

they categorized as otitis media prone (on the basis of previous history of frequent otitis media; $n = 34$; mean age at cochlear implant: 48 months) and non–otitis media prone ($n = 26$; mean age at cochlear implant: 35 months). Preoperatively, the otitis media–prone group underwent ventilation-tube placement with or without adenoidectomy and, in some cases, additional measures. Patients were required to have a normal tympanic membrane and no drainage via the ventilation tube for at least 2 weeks before implantation. With a mean follow-up period of 20 months after implantation, at least 1 episode of acute otitis media had occurred in 15 (44%) of the 34 otitis media–prone children and 2 (8%) of the non–otitis media–prone children. Six (10%) children with implants, 5 of whom were in the otitis media–prone group, had an episode of acute otitis media within 1 month of implantation, a finding that supports the assertion that children are at highest risk of acute otitis media during the immediate postoperative period. All these episodes of acute otitis media were treated successfully with oral antimicrobial agents, typically amoxicillin/clavulanate. Thirteen patients developed acute otitis media later than 1 month after implantation; all of them had installation of a new ventilation tube to establish middle-ear drainage, unless the patient had a preexisting ventilation tube, and were treated initially with oral antimicrobial therapy. Six children required hospitalization and administration of intravenous antimicrobial therapy because of failure of oral antimicrobial agents and, in 2 of these 6 children, acute mastoiditis.

Four retrospective studies of acute otitis media in children with implants have been reported. In 3 studies, the severity or outcome of acute otitis media was found to be satisfactory when using standard treatments (Table 1).[10,11,13] In contrast, the fourth study[12] revealed that patients with implants were more likely to require intravenous antimicrobial therapy and a myringotomy.[12] Furthermore, of the 11 episodes of acute otitis media reported in this study, 7 patients underwent surgical treatment for mastoiditis. No child in any of the 4 series was reported to have developed bacterial meningitis. Although these reports provide useful insight, they contain significant limitations, including the retrospective design, possibly leading to identification and inclusion of only the more severe acute otitis media episodes. Another limitation is the lack of report of pathogens causing acute otitis media episodes.

That no cases of bacterial meningitis were reported in these case series of children with acute otitis media is not surprising, given the small number of cases in these series and a reported incidence of *Streptococcus pneumoniae* meningitis in children with cochlear implants of 138 cases per 100 000 person-years.[17] However, in a study of bacterial meningitis in children with implants, for the subgroup of children with bacterial meningitis that occurred at least 30 days after implant surgery (and for whom clinical information was available concerning the presence of acute otitis media), acute otitis media was present in 13 (50%) of 26 patients at the time of presentation with meningitis (although whether acute otitis media was in the same ear as the implant was not reported).[17,18] These findings indicate that, at least in some cases, there may be a causal relationship between acute otitis media and bacterial meningitis. Signs of acute otitis media were not reported in any of 9 episodes of bacterial meningitis that presented within 30 days of implantation of a cochlear device. To prevent episodes of acute otitis media after cochlear implantation, surgeons may place tympanostomy tubes before or at the time of implantation in children with a history of recurrent acute otitis media or persistent middle-ear effusion.[16,19] A consensus report prepared by 8 cochlear implant surgeons recommended, on the basis of theoretical considerations and a series of otitis media–related meningitis episodes in adults,[20] avoidance of implantation if middle-ear fluid is present.[21] The surgeons stated that if middle-ear fluid is encountered at the time of implantation, they recommended high-volume irrigation of the middle ear, administration of topical antimicrobial agents into the middle-ear space, and systemic therapy with ceftriaxone.[21]

Bacterial Meningitis in Cochlear Implant Recipients

Factors independent of cochlear implantation may place children with hearing loss at increased risk of bacterial meningitis.[17] Some children have an inner-ear malformation (eg, common cavity malformation) that predisposes them to bacterial meningitis as a complication of middle- and inner-ear infection. For example, a 6-year-old child with Mondini-type malformation and a cochlear implant in the left ear placed 2 years earlier developed rapidly fatal meningitis.[22] Examination of the temporal bones at autopsy showed that acute meningitis was related to right middle-ear infection and suppurative labyrinthitis. The left middle ear on the side of the implant was uninfected. Thus, in this case and in a second case,[23] just having an inner-ear malformation, rather than a cochlear implant, was the risk factor for acute otitis media–related meningitis. Bacterial meningitis in infants is an important cause of acquired deafness, which may lead to cochlear implantation, and preimplant meningitis has been identified as a risk factor for postimplant meningitis.[24]

In most cases of meningitis in patients with an implant, the initial event in the pathogenesis of meningitis is acute otitis media that occurs in the ipsilateral ear, especially when meningitis occurs more than 30 days after surgery. After acute otitis media develops, bacteria can enter the inner ear through an incompletely sealed cochleostomy. Pathways of bacterial access to the cerebrospinal fluid (CSF) from the inner ear include entry into the labyrinth, infiltration of the cochlear turns along the electrode entering the Schuknecht bony channels, and following perineural and/or perivascular pathways into the internal auditory canal to the meninges.[21] In patients with a malformed cochlea in which there is a connection to the subarachnoid space, meningitis also can occur via the cochlear aqueduct. In the absence of a surgical procedure to reduce such risks, these children remain at increased risk of meningitis after cochlear implantation. In addition, as postulated by Arnold et al[21] and studied experimentally by Wei et al,[25] cases of bacterial meningitis in implant recipients may originate via pneumococcal bacteremia with hematogenous seeding of the cochlea, such as at a site of tissue necrosis related to the electrode or positioner (locus minoris resistentiae) with contiguous spread to the CSF and meninges.

In addition, cochlear implants themselves increase the risk of bacterial meningitis, especially during the first 2 months after implantation. In a nested case-control investigation of US children younger than 6 years with cochlear implants and meningitis between 1997 and 2002, 26 children with bacterial meningitis were identified among 4264 children with cochlear implants.[17] During an additional 2 years of follow-up of this cohort, 12 additional episodes of bacterial meningitis were identified.[18] The rate of bacterial meningitis was 189 cases per 100 000 person-years, a more than 30-fold increased risk compared with that in the overall population.[17] In a study in Denmark, the rate of bacterial meningitis was 43 cases per 100 000 person-years in young children with hearing loss (10.4% of the cohort had cochlear implants).[26] In the same study, young children with hearing loss and without a cochlear implant were at a 4.1-fold increased relative risk (95% confidence interval [CI]: 1.5–11.0) for development of bacterial meningitis compared with a group of children without hearing loss. Within the group of children with implants in the US study, the risk of meningitis was significantly higher for patients with a particular implant model (AB-5100H or AB-5100H-11 [Advanced Bionics, Sylmar, CA]) that included a positioner (or a so-called spacer, a wedge that rests in the cochlea next to the electrodes).[17] During the period from 1997 to 2004, only 19% of the cohort of children had a model with a positioner, yet these children accounted for 71% of the children with meningitis. The models with positioners were available beginning in 1999 and were voluntarily recalled in the United States in July 2002. In a multivariate analysis of a case-control study, the odds ratio for meningitis in patients with an implant with a positioner was 4.5 (95% CI: 1.3–17.9). Although the increased risk of meningitis in patients with an implant with a positioner continues beyond 24 months after implantation,[18] to date, elective removal of these implants or their positioners is not recommended,[18,27] and these implants remain in place in many patients. In the same analysis, an additional risk factor for development of meningitis was inner-ear malformation with a CSF leak (odds ratio: 9.3 [95% CI: 1.2–94.5]).

Episodes of meningitis in patients with a cochlear implant may have a fatal outcome. Of 198 cases of postimplant bacterial meningitis in children and adults reported to the FDA, the mortality rate in the 184 cases for which the outcome of infection was known was 16% (Eric Mann, FDA, personal communication, February 7, 2008). Of 38 children who experienced 41 episodes of meningitis reported by Reefhuis et al[17] and Biernath et al,[18] 3 children died.

Streptococcus pneumoniae is the most common pathogen that causes meningitis in children with cochlear implants[17,18] and in patients with an inner-ear malformation that predisposed them to bacterial meningitis.[28] Pathogens associated with bacterial meningitis that occurred within 30 days of implant surgery were *S pneumoniae* in 4 of 9 cases and *Acinetobacter baumannii* (2 cases), *Escherichia coli*, *Haemophilus influenzae* type b, and *Enterococcus* spp in the remainder.[17] Of 25 cases that occurred more than 30 days after implant surgery with an identified pathogen, the etiology was *S pneumoniae* in 80%; nontypeable *H influenzae* in 12%; *H influenzae* type b in 4%; and *Streptococcus pyogenes* in 4%.[17,18] *Neisseria meningitidis* (meningococcus) has not been reported as an etiology of meningitis in children with cochlear implants (although meningococcal meningitis has been reported in 2 children with congenital malformation of the middle ear[26]), and available data do not support cochlear implants as a risk factor for meningitis attributable to *N meningitidis*. As noted earlier, acute otitis media was not noted to be present at the time of diagnosis in any of the cases that occurred during the first 30 days after implantation but was noted in 52% of cases that occurred more than 30 days after implantation.

Use of Pneumococcal and *H influenzae* Type b Vaccines for Prevention of Acute Otitis Media and Meningitis

Immunization of the general population of infants with the primary series of heptavalent pneumococcal conjugate vaccine (PCV7) has resulted in a marked decrease in invasive pneumococcal disease, including meningitis.[29,30] In addition, immunization of infants has resulted in an approximately 7% reduction in episodes of acute otitis media from all etiologies and a 34% reduction in pneumococcal otitis media.[31,32] However, 2 randomized double-blind studies of prevention of acute otitis media in children 1 to 6 years of age identified as otitis prone in which the treatment group received 1 or 2 doses of PCV7 followed 6 months later by a dose of 23-valent pneumococcal polysaccharide vaccine (PPSV23) revealed no effect on the rate or severity of episodes of acute otitis media.[33,34] Although PCV7 results in a reduction in nasopharyngeal colonization with vaccine serotypes, overall carriage of pneumococci is unchanged as a result of colonization with nonvaccine serotypes.[35] PPSV23, licensed for children 2 years of age and older, reduces the incidence of invasive pneumococcal disease but does not prevent pneumococcal colonization or acute otitis media.[36] Therefore, it is uncertain, theoretically, whether PPSV23 in children with implants would prevent meningitis attributable to pneumococcal infections that originate in the middle ear and cause meningitis by contiguous spread of bacteria. There are no data on the efficacy of PCV7 or PPSV23 in prevention of pneumococcal meningitis in children with cochlear implants, but there are immunogenicity data. A single dose of PCV7 in children 14 months through 5 years of age with cochlear implants induced a substantial immune response with mean 12-fold and 7.8-fold increases in anticapsular antibody concentration to the 7 serotypes in the vaccine in children 14 months to 2 years of age and children 2 through 5 years of age, respectively.[37] Among children 2 through 5 years of age, a single dose of PCV7 was more immunogenic than a single dose of PPSV23 for the 7 serotypes in PCV7. PPSV23 was immunogenic in children older than 5 years, adolescents, and young adults; there was a mean 4.2-fold increase in anticapsular antibody concentration to the 7 PCV7 serotypes.[37] The distribution of serotypes of *S pneumoniae* causing meningitis in implant recipients is unknown but is assumed to be the same as in children without cochlear implants. On February 24, 2010, a 13-valent pneumococcal conjugate vaccine (PCV13) was licensed by the FDA on the basis of safety and immunogenicity. This vaccine contains polysaccharides of the 7 serotypes in PCV7 and polysaccharides from 6 additional serotypes. It has not been studied in children with cochlear implants or in children older than 71 months. This vaccine replaces PCV7 for all scheduled doses of PCV7 in infants.[38] In addition, a supplemental dose of PCV13 is recommended for children 14 months through 18 years of age with a cochlear implant.[38]

H influenzae type b conjugate vaccine (Hib) is highly effective for prevention of invasive disease and colonization with this pathogen[39,40] and, presumably, is effective for prevention of acute otitis media attributable to *H influenzae* type b. Cochlear implant recipients have anticapsular antibody concentrations to *H influenzae* type b after immunization that are likely to be protective.[37,41] Hib vaccine does not prevent colonization or infection with non–serotype b strains; most *H influenzae* strains that cause acute otitis media are nontypeable strains, as were the isolates from most cases of *H influenzae* meningitis in implant recipients.[17]

RECOMMENDATIONS

US Preventive Services Task Force Ratings criteria[42] were used to assess the strength of evidence for recommendations. All of the recommendations were classified as "I" indicating insufficient evidence except where a different rating (ie, ratings A, B, C, or D) is noted after the statement (see Appendix).

1. Evaluations and Management Before or During Insertion of Cochlear Implant

- Imaging of the temporal bone/inner ear should be performed before cochlear implantation in all children with congenital deafness and all patients with profound hearing impairment and a history of bacterial meningitis (if not known to have normal hearing before meningitis) to identify those with inner-ear malformations/CSF fistulas or ossification of the cochlea. In patients with inner-ear malformations that are associated with a higher likelihood of CSF fistulas after cochlear implantation (eg, wide vestibular aqueduct syndrome or Mondini malformation), particular attention must be paid to sealing the cochleostomy during the cochlear implant surgery to further lower the risk of developing bacterial meningitis.
- For otitis-prone children or children with persistent middle-ear effusion, tympanostomy tube placement should be considered before cochlear implantation.[9,16,43]

2. Primary and Secondary Prevention of Meningitis and Acute Otitis Media

- All children, including those with severe hearing impairment or infants with profound deafness, should receive all doses of PCV13 (or PCV7 if PCV13 is not yet available) and Hib, according to the routine recom-

mended schedule (ie, a dose of each at 2, 4, 6, and 12–15 months of age, except that a dose of Hib is not needed at 6 months of age if PRP-OMP [PedvaxHIB or ComVax, Merck, Whitehouse Station, NJ] was given for the first 2 doses)[44] (**recommendation A**).

- Starting at 2 years of age and at least 2 months after the last dose of PCV13 (or PCV7 if PCV13 is unavailable), a dose of PPSV23 should be administered to (1) children scheduled for cochlear implantation (or after cochlear implantation if not previously administered) and (2) children with an inner-ear malformation with a CSF communication[45,46] (**recommendation B**). For maximal benefit, administration of the doses of PCV13 and PPSV23 should be completed at least 2 weeks before implant surgery. Children 24 through 71 months of age who have received 2 or fewer previous doses of PCV13 (or PCV7) before 24 months of age should receive 2 doses of PCV13 at least 2 months apart, and those who have received 3 previous doses of PCV13 (or PCV7) should receive 1 dose of PCV13.[47] PPSV23 should be administered 2 months after completion of the PCV13 (PCV7) series. For children older than 71 months who have not received PCV13, administration of 1 dose of PCV13 should be considered. All such children should receive PPSV23 (2 months after PCV13 if PCV13 is administered) if not previously administered (**recommendation B**). Administration of more than 1 dose of PPSV23 to children with cochlear implants is not recommended.
- A single supplemental dose of PCV13 should be administered to children 14 months through 71 months of age who have been fully immunized with PCV7. A supplemental dose is unnecessary if the fourth dose of pneumococcal conjugate vaccine given at 12 months of age or older was PCV13.
- A single dose or supplemental dose of PCV13 may be administered to pediatric patients 6 through 18 years of age who have a cochlear implant or are scheduled to receive a cochlear implant regardless of previous doses of PCV7 and PPSV23.
- When assessing a history of previous immunization with pneumococcal vaccines, care should be exercised to avoid confusing past immunization with other vaccines that could be considered "meningitis vaccines" (ie, Hib and quadrivalent meningococcal polysaccharide or conjugate vaccines) with doses of PCV7 and PPSV23.
- Meningococcal conjugate vaccine should be administered in accordance with routine recommendations,[48–50] but given current data, cochlear implant recipients should not be considered a group at high risk of invasive meningococcal disease. Therefore, children younger than 11 years should not be immunized routinely.
- In most studies, administration of influenza vaccine to healthy children reduced the incidence of episodes of acute otitis media during influenza season.[51–54] To reduce the number of episodes of acute otitis media, annual administration of influenza vaccine with trivalent inactivated vaccine or live attenuated nasal vaccine (if the child has no condition that constitutes a medical contraindication) to patients with a cochlear implant is recommended, and influenza immunization of their household contacts should be strongly considered (**recommendation B**).
- Tympanostomy tube placement also should be considered if recurrent episodes of acute otitis media occur after cochlear implantation.

3. Management of Postoperative Wound Infection or Suspected Cochlear Implant Infection

- Patients with suspected postoperative wound infection or suspected implant infection should be referred urgently to the surgeon who performed the implant procedure. Broad-spectrum antimicrobial therapy that includes an agent or agents with activity against methicillin-susceptible and methicillin-resistant *Staphylococcus aureus* should be initiated.

4. Early Diagnosis of Acute Otitis Media and Meningitis

- Patients and parents should be educated as to symptoms of acute otitis media and meningitis and to seek immediate medical evaluation for acute illness with symptoms possibly attributable to either acute otitis media (eg, fever or earache) or meningitis (eg, fever, headache, vomiting, stiff neck, or change in level of consciousness).
- Clinicians should consider bacterial meningitis in the differential diagnosis of all patients with cochlear implants who present with fever with or without acute otitis media on physical examination, particularly during the first 2 years after implantation in patients with cochlear implants without positioners and indefinitely in patients with cochlear implants placed between 1999 and August 2002 with positioners (Advanced Bionics model AB-5100H or AB-5100H-11).

5. Management of Acute Otitis Media in Children With Cochlear Implants

- Patients with cochlear implants who are diagnosed with acute otitis media should be started urgently on systemic antimicrobial therapy; watchful waiting is inappropriate for these children.[55] Initial empiric treatment

with an oral antimicrobial agent (eg, amoxicillin or amoxicillin/clavulanate, at a dose of 80–90 mg/kg per day) is reasonable if all of the following criteria are fulfilled: (1) the episode occurs 2 or more months after cochlear implantation; (2) the patient does not have an uncorrected Mondini or similar inner-ear malformation or CSF/middle-ear fistula; (3) the patient does not appear severely ill and there is no clinical evidence of mastoiditis or meningitis; and (4) the cochlear implant does not have a spacer/positioner (Advanced Bionics model AB-5100H or AB-5100H-11). Patients with acute otitis media who fulfill these criteria are likely to be at a lower risk of developing inner-ear infection or meningitis complicating acute otitis media. If feasible, middle-ear fluid should be obtained through the tympanostomy tube or a tympanocentesis or myringotomy for culture just before initiation of antimicrobial therapy, but this should not be allowed to cause an undue delay in initiation of antimicrobial therapy. For patients with a cochlear implant who do not meet these criteria (including patients with implants of an unknown type implanted between 1999 and August 2002), initial therapy with a parenteral antimicrobial agent for treatment of acute otitis media (eg, ceftriaxone or cefotaxime) is recommended. Patients with a cochlear implant and acute otitis media should be evaluated by an otolaryngologist if their condition worsens despite 24 hours of antimicrobial therapy. A sample of middle-ear fluid should be obtained for culture, and a myringotomy with or without ventilation placement should be performed to drain the middle ear.

6. Management of Bacterial Meningitis in Patients With a Cochlear Implant

- CSF should be submitted for culture. If present, middle-ear fluid should be obtained and sent for culture. The choice of empiric antimicrobial therapy for meningitis (eg, ceftriaxone or cefotaxime plus vancomycin) is similar to that for children without implants. An exception is for children with the onset of meningitis during the first 2 weeks after cochlear implantation; in such circumstances, causal bacteria may include a broader range of pathogens, including Gram-negative bacilli such as *A baumannii* and Gram-positive bacteria such as *Enterococcus* spp. Selection of a combination of agents that provide broader-spectrum activity against Gram-negative bacilli (eg, meropenem and vancomycin) should be considered. Patients with a cochlear implant and bacterial meningitis should be evaluated urgently by an otolaryngologist for consideration of imaging and surgical exploration.

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APPENDIX Grading of Recommendations

Grade	Definition
A	Recommended: there is high certainty that the net benefit is substantial.
B	Recommended: there is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.
C	Recommendation against routinely providing: there may be considerations that support providing the service in an individual patient, and there is at least moderate certainty that the net benefit is small.
D	Recommends against the service: there is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.
I	The current evidence is insufficient to assess the balance of benefits and harms of the recommendation. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.

Modified from the US Preventive Services Task Force recommendations categories (available at: www.ahrq.gov/clinic/uspstf/grades.htm).

APPENDIX A.

*Literature classification schema.**

Design/Class	Therapy†	Diagnosis‡	Prognosis§
1	Randomized, controlled trial or meta-analyses of randomized trials	Prospective cohort using a criterion standard	Population prospective cohort
2	Nonrandomized trial	Retrospective observational	Retrospective cohort Case control
3	Case series Case report Other (eg, consensus, review)	Case series Case report Other (eg, consensus, review)	Case series Case report Other (eg, consensus, review)

*Some designs (eg, surveys) will not fit this schema and should be assessed individually.
†Objective is to measure therapeutic efficacy comparing $\geq$2 interventions.
‡Objective is to determine the sensitivity and specificity of diagnostic tests.
§Objective is to predict outcome including mortality and morbidity.

APPENDIX B.

Approach to downgrading strength of evidence.

	Design/Class		
Downgrading	**1**	**2**	**3**
None	I	II	III
1 level	II	III	X
2 levels	III	X	X
Fatally flawed	X	X	X

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TECHNICAL REPORT

Communicating With Children and Families: From Everyday Interactions to Skill in Conveying Distressing Information

Marcia Levetown, MD, and the Committee on Bioethics

ABSTRACT

Health care communication is a skill that is critical to safe and effective medical practice; it can and must be taught. Communication skill influences patient disclosure, treatment adherence and outcome, adaptation to illness, and bereavement. This article provides a review of the evidence regarding clinical communication in the pediatric setting, covering the spectrum from outpatient primary care consultation to death notification, and provides practical suggestions to improve communication with patients and families, enabling more effective, efficient, and empathic pediatric health care.

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Key Words
patient-doctor communication, medical education, patient-centered and family centered care, medical home, health care outcomes, breaking bad news, death notification, assent, empathy, treatment adherence

Abbreviations
AAP—American Academy of Pediatrics
AACH—American Academy on Communication in Healthcare
ED—emergency department

INTRODUCTION/OVERVIEW

Health care communication is a critical, but generally neglected, component of pediatric and pediatric subspecialty practice and training and is a skill that can and must be taught.[1–13] The practicing clinician's ability to communicate openly and with compassion is essential for effective and efficient routine health care; this ability becomes a vital lifeline for parents and children confronted with life-altering and sometimes life-ending conditions.[13–16] The purpose of this report is to provide research-based and practical guidance to enable effective communication with pediatric patients and their families in a number of common settings and situations. Although child abuse, sexuality, divorce, and many other situations are not individually addressed, the principles and approaches discussed apply equally to these situations.

Communication is the most common "procedure" in medicine. Health care communication is different from normal social discourse, because intimate and very private issues are often discussed. These include hopes and fears, developmental concerns, sexuality, and mental health disorders. Painful issues, such as abuse, school failure, drug use, and terminal illness, are also discussed. Communication is the foundation of the therapeutic relationship; it is the basis of fiduciary and ethical obligations of physicians to patients and their families. Effective health care communication is an essential tool for accurate diagnosis[17–19] and for the development of a successful treatment plan,[20–23] correlating with improved patient knowledge,[15,24] functional status,[25,26] adherence to the agreed-on treatment regimen,[20,21,27–32] improved psychological and behavioral outcomes,[15,33–36] and even reduced surgical morbidity.[3,4,37] In the case of distressing news, skillful communication can enable a family to adapt better to a challenging situation,[12,38,39] including a child's unanticipated impairments.[40–43] Poor communication, on the other hand, can prompt lifelong anger[31,42,44–48] and regret,[14,40] can result in compromised outcomes for the patient and family, and can have medicolegal consequences for the practitioner.[49]

WHAT IS COMMUNICATION?

Effective communication is responsive to the needs of the whole patient and family dynamic; it is essential to patient-centered and family centered care, the basic building block of the medical home concept (www.medicalhomeinfo.org) endorsed by the American Academy of Pediatrics (AAP) as a cornerstone of care.[50]

Taking time to build rapport and understand the child and family builds trust, leading to increased reporting of the actual reason for the visit.[51,52] Clearly, improved communication will enhance patient outcomes and satisfaction.[4] There are 3 elements of physician-parent-child communication[53]:

- Informativeness: quantity and quality of health information provided by the physician;
- Interpersonal sensitivity: affective behaviors that reflect the doctor's attention to, and interest in, the parents' and child's feelings and concerns; and
- Partnership building: the extent to which the physician invites the parents (and child) to state their concerns, perspectives, and suggestions during the consultation.

There are 2 types of patient needs to be addressed during the medical interview: cognitive (serving the need to know and understand) and affective (serving the emotional need to feel known and understood). Thus, physicians are expected to have task-related behavior and relational behavior. The first involves asking questions and providing information. The latter includes reflecting feelings and showing respect, concern, and compassion, often by nonverbal means, such as gestures, posture, and eye contact, as well as the use of silence to allow for the processing of emotional responses and the formulation of questions. (An example of a reflective response is, "When you say you don't think you can manage this, what is the hardest thing about Chad's illness for you and your family?") Parent satisfaction with quality of care is substantially influenced by the interpersonal skills of the practitioner, particularly in the case of anxious parents.[53,54]

MEDICAL EDUCATION AND COMMUNICATION

Despite the essential nature of communication in health care, there is little programmatic or curricular emphasis on building interpersonal skills in pediatric service or training. Instead, a preponderance of time is spent on facts and procedures, with minimal attention to feelings, relationships, and continuity of care.[12,34,47,54–60] The AAP, in its policy statement "The New Morbidity Revisited: A Renewed Commitment to the Psychosocial Aspects of Pediatric Care," states that "there is a need to better learn how to elicit information, including using a narrative interview approach, allowing the child, adolescent, and parents to tell their stories," and "there is a need to communicate empathy."[3] The AAP suggests that the teaching of these skills involves supervised practice, feedback, and mentoring.

There is a long history of concern among holistic medical educators and philosophers regarding the loss of empathy related to current medical education methods and role models.[61–66] This concern has led to attempts to measure empathy and to reinforce it during medical education.[67–69] It has been demonstrated in preliminary studies that empathy not only can be extinguished by training but also can be amplified and taught. Empathy affects quality of care and patient satisfaction; physicians who are empathetic have been shown to elicit patient concerns more accurately and address needs more effectively, often enhancing cost efficiency.[70–76]

Unfortunately, studies over the last 15 years do not indicate a trend toward improvement in this area. Despite requirements and recommendations of the American Council for Graduate Medical Education,[77] the Future of Pediatric Education II Task Force,[2] and the long-standing dedication to the child, family, and psychosocial environment by the AAP as manifested in numerous policies and published goals,[3,4,50,78–84] the "informal" or "hidden curriculum" (that which is taught by observing the daily behavior of health care professionals, both good and bad)[85] continues to disproportionately reward "hard" data collection while downplaying the role of the psychosocial, existential, and interpersonal concerns and needs of the patient and family. Such a training emphasis does not enhance the ability of the physician to fully meet the needs of our patients and their families.[86]

The Current Situation

Health care communication is currently learned primarily through trial and error.[1] This may be attributable, in part, to a dearth of skilled mentors. A large national survey published in 2003 indicates that medical school faculty members may, themselves, need communication skills training.[87] Nonphysician mentors who are trained communicators, such as child life therapists,[88] child psychologists (as an example, see Sourkes[89]), and members of the American Academy on Communication in Health Care (AACH [www.aachonline.org]), can help practicing physicians and medical school faculty develop these skills.[55] In the inpatient setting, social workers, advanced practice nurses, psychologists, and chaplains can assist in the provision and modeling of effective communication with children and their families,[90–93] but the practice of depending on numerous caregivers to communicate poses a risk of families being exposed to conflicting information and opinions, often provoking anxiety and confusion. True interdisciplinary teamwork and collaboration can prevent this complication.[43] Regardless of the help available, however, the physician must always play a significant role in the communication process.

Communication Needs

Patients and families expect more accessible information than is commonly provided in virtually every health care setting.[12,31,58,94–98] It is estimated that 35% to 70% of medicolegal actions result from poor delivery of information, failure to understand patient and family perspectives, failure to solicit and incorporate patients' values into the plan of care, and perceptions of desertion.[49,99–104]

Psychosocial and practical/family issues are often overlooked.[52] Closed interviewing techniques, such as asking yes or no questions, may be used by clinicians to control the duration of the interview. Families perceive this style as indicative of a lack of interpersonal interest, sometimes resulting in a reluctance to reveal the true reason for seeking consultation; potential results are treatment failure and poor health outcomes.[56,105–107] Invitations by physicians to the child and family to contribute and to express concerns are nearly always welcomed by parents and do not increase the duration, but do increase the utility, of the encounter.[49,108] Formal

TABLE 1 **Physician "Competencies" for Health Care Communication**

1.	Develop a partnership with the patient
2.	Establish or review the patient's preferences for information
3.	Establish or review the patient's preferences for his or her role in decision making
4.	Ascertain and respond to the patient's ideas, concerns, and expectations
5.	Identify choices (including those suggested by the patient) and evaluate research in relation to the individual patient
6.	Present information and assist the patient to reflect on the impact of alternate decisions with regard to his or her lifestyle and values
7.	Negotiate a decision with the patient
8.	Agree on an action plan and complete arrangements for follow-up

communication training is helpful in developing this skill.[6,35,72,109–116]

Communication Competencies for Physicians

One group identified 8 physician "competencies" that enable "informed shared decision-making" to take place[117] (see Table 1). These competencies, behaviors, and protocols will also result in patient-centered and family-centered interviews, which are key elements in the construction of a medical home.

According to these investigators, such an interview can be accomplished in 10 minutes with adult patients. The triadic nature of pediatric patient interactions would, as always, require more time. The child's preferences and values should be solicited in addition to that of the parents. Sharing of information and responsibility for decision-making must be negotiated.

Effective Methodologies for Teaching Communication Skills

High proportions of physicians at all levels of practice are willing to reveal their discomfort with communication, particularly involving unwelcome information that is likely to upset parents.[118] In response to residents' requests and parents' complaints, Northwestern University's pediatric residency program developed a communication course[9] designed according to the articulated needs of the learners. Provided during the middle of the first year of pediatric residency, training addressed "breaking bad news" and "difficult families." Scenarios were designed with input from the residents. Teaching tools included didactic sessions, interactive discussion, parent-panel discussions (including children who had survived life-threatening illness and bereaved parents), paired role play, and discussion. Although well received, the effect was difficult to evaluate because of the low number of participants.

Use of simulated patients, observation of role models, attendance at camps, support groups, and home visits are also useful in developing a patient-centered and family-centered perspective, resulting in more effective communication skills.

A teaching program for "breaking bad news" in the emergency department (ED) setting using simulated patients and video feedback demonstrated improvement in skills after 2 sessions on the basis of a checklist of desired behaviors, simulated patient feedback, and improved confidence of trainees.[6] A study of a 1-day workshop using scenarios relevant to the PICU also demonstrated statistically significant improvements.[10] Simulated or "standardized patient" programs are, however, expensive.

Other investigators have found measurable success improving communication by using immediate video feedback alone.[7] One innovative program designed for undergraduate medical students used two 2-hour sessions in both inpatient and outpatient settings, interviews with parents, and play with child patients to enable students to better understand family perspectives about communication.[113] Progressive experiences included a small-group discussion about the difficulties of breaking bad news, a video role model followed by a parent panel, and finally, time to meet the child patient. The training was favorably received by student, parent, and patient participants. After the experience, some students reported a profound effect on their attention to the patient and his or her supporters; 18 months after the seminar, 1 student noted he still "keenly felt the influence of his eyes being opened to the myopic view of the medical fraternity" in health care communication.

Another communication workshop to teach pediatric residents how to tell parents about a child's lifelong disability was developed by a parent support group and a pediatrician.[119] In this workshop, the psychosocial dynamics of the interchange are defined/identified, and facilitative behaviors are described. The resident chooses a skill in which he or she feels most deficient and works specifically to improve it in a role-play exercise. The workshop concludes with a debriefing and a review of the interview tape with the parent.

There are several communication skills teaching aids available. The Initiative for Pediatric Palliative Care (www.ippcweb.org) has communication modules, including videotapes for difficult conversations. The AACH has 3- to 5-day intensive training sessions on communication, generally focused on adult patient scenarios, which include videotaped feedback, self-critique, and peer critique. In addition, the AACH provides Web-based, multimedia interactive modules on communication and relational topics (www.aachonline.org). A list of tips, techniques, and resources can also be found in other publications.[120,121]

Unfortunately, efforts to elevate health care communication, empathy, patient-centered and family-centered care as core competencies within the educational process and professional practice have, thus far, failed. Despite the overwhelming evidence of the benefit to patients, physicians, and society, effective communication is not rewarded by academic promotion or financial compensation. In fact, increased attention to communication can be costly to the practitioner in the short term because of inadequate payment for time spent discussing treatment plans and otherwise counseling families. The willingness of students, mentors, and practitioners to exert the time and effort to learn and practice effective and compassionate communication is undoubtedly influenced by these factors. Long-term benefits, such as improved patient outcome and satisfaction, decreased

risk, and greater professional satisfaction, may be harder to quantify and appreciate.

Practitioners' Needs

Practicing physicians' self-assessment of skill level in breaking bad news is often inaccurate and overly self-flattering.[1,122] Practice alone clearly does not result in improved communication skills. When self-assessed skill in this critical area is inadequate, some physicians avoid the discomfort by not engaging in difficult conversations. Less dramatically, given the widespread dissatisfaction with communication, it is clear that most practitioners would benefit from objective assessment of their current communication skills followed by targeted training, regardless of seniority.

Need for Research on Communication Education and Practice

If communication skill training is to be recommended throughout medical training and for continuing education, it is important to understand what techniques are most efficacious, time-efficient, and cost-efficient to achieve the goal of more consistently achieving effective, empathetic, and culturally appropriate communication that meets the needs identified by patients and parents. What timing during the course of education is most likely to result in durable change? Which communication techniques best prevent the anger and dismay that too often lead to suboptimal patient outcomes or malpractice litigation? Finally, what changes in institutional culture or reimbursement mechanisms will reinforce good communication throughout the career of the practitioner? Research on these topics should be a priority, given the central importance of communication in medicine.

CLINICAL PRACTICE ISSUES

Communication With Parents: Ensuring Effective Communication

Factors predictive of effective communication between physicians and patients/parents are the perception of interest, caring, warmth, and responsiveness.[123–125] Parents' most frequent criticisms of health care practice concern relationships with practitioners[53]; these relationships have a dramatic effect on parental satisfaction, recall of instructions and, not surprisingly, treatment adherence.[126,127] Greater trust and a better relationship with the physician have more of an effect on patient recall and satisfaction than written instructions or even the amount of time spent.[128]

Causes of Dissatisfaction

Even with very detailed explanations, parents who feel they are not treated with respect or who have unrecognized or unaddressed fears feel unhappy about the amount of information provided. For instance, being asked to consent to a new aspect of a procedure while standing in the hall the night before surgery caught 1 parent by surprise, coloring her overall satisfaction and perception of the sufficiency of information.[54] Facilitators of improved communication include clear demonstrations of empathy and respect. See Table 2 for additional recommendations.

TABLE 2 Recommended Communication Behaviors for Procedural Interventions

Find a private setting for discussion and decision making
Use language the family can understand
Use visual aids (drawings, models, and radiographs)
Pace the information, providing it in a logical sequence; be prepared to patiently repeat information and answer questions
Recognize emotional distress
Discuss indications, risks, benefits, and all reasonable alternatives (including not doing the procedure at all) and the associated risks and benefits
Discuss specific tubes and drains immediately before surgery
Personalize the information rather than giving it as a rote speech (eg, use the child's name)
Avoid last-minute surprises when feasible
Ask parents and the child (when appropriate) to repeat what they understood in their own words, and clarify information and plans as needed

Data were adapted from Lashley et al.[54]

Audiotapes as Communication Aids

Several articles support the use of audiotapes to allow parents to repeatedly listen to the information, allowing it to soak in, and importantly, enabling dissemination of accurate information to others who could not be present.[129–135] Parents frequently consult others in making health care decisions for their children, ranging from extended family members to other practitioners, other parents, religious leaders, and tribal elders. One study found that tapes made during outpatient encounters were listened to by parents nearly universally; grandparents listened to them more than half the time (52.8%), 70% were listened to more than once, and one third of parents made a copy to keep for themselves. The tapes were found to be helpful >99% of the time.[129] Physician fears of the use of such tapes in medicolegal actions are understandable but, thus far, unfounded. In fact, the tapes often reveal that much more information was shared than either party realized, suggesting that the tapes may even be protective.[136]

What Parents Want to Know: Surgical Procedures and Chronic Conditions

Patients undergoing surgery and their parents often want answers to seemingly "minor" questions.[137] The expected duration of the surgery, the amount of hair to be removed, the location and length of the incision and bandages, location and purpose of intravenous lines and other assorted tubes, and the child's likely appearance after the procedure are sources of concern that, although routine for practitioners, should be prospectively addressed.[54]

Parents consistently state that they need more and clearer information about their children's health status, particularly in the setting of chronic or terminal illness.[50,94,138–142] Parents of chronically ill children want more information about the child's condition, its treatment, and its long-term implications;[94,142–144] they want

that information to be shared with them as soon as it is known.[42]

Parents want advice about their child's behavior and development, genetic implications of the child's condition, and social contact with families in similar situations.[39,142] They would like someone, preferably the physician, to provide oversight of the long-term care plan, including an opportunity for advance care planning and execution of advance directives.[143,145] They want their views and concerns factored into the care plan and to be treated like partners (and often experts) in their child's care.[5,53,54,94,137,142,143] They need affirmation of their efforts and assistance with and recognition of the need to preserve family solidarity and support, including social support, child care, education, and professional services;[94,140,143,146] in some studies, parents report assistance with family and social support as their greatest unmet need.[94,142,143] One proposed solution is to have an annual meeting of the family and physician to discuss the "big picture."[94] In short, parents of chronically ill children want a "medical home" as envisioned by the AAP. When appropriate information is not provided and this style of communication and relationship does not occur, the bitterness can linger for years.[12–14,32,41,42] Physicians who are empathic, well informed, and honest are a source of strength for parents, particularly those struggling to adapt to a difficult situation.

Intraprofessional Communication

Particularly for children living with chronic health conditions, communication between primary care practitioner and specialist is critical for effective and efficient care.[50,147–152] A recent study[153] indicates that pediatric practitioners agree about the importance of such communication but have difficulty putting it into practice. Specific recommendations include timely, systematic information transfer from generalist to specialist at the time of referral, after consultation, and during follow-up visits. A toolkit with practical recommendations and reimbursement strategies can be found at www.medicalhomeinfo.org/tools/toolkits.html. In addition, recognition of the medical home concept and a plan for comanagement and communication should be in place.[50,147,153]

Telemedicine

In the setting of rural health care and limited numbers of pediatric specialists, communication and medical care may be provided via video and audio conferencing. Even in the case of psychiatric illness[154] and chronic illness requiring multispecialty input,[155,156] parents and caregivers found this means of communication nearly as efficacious as in-person communication, particularly when combined with less frequent face-to-face consultations.[155,156] Another application of telemedicine is to provide frequent updates and secure communication for parents and extended families and other practitioners when a child is receiving care in the ICU.[157]

Communication With the Child Patient: Ethical, Relational, Developmental, and Cultural Considerations

Moral, Ethical, and Developmental Obligation to Include Children in Communication About Their Health

There is a moral and ethical obligation to discuss health and illness with the child patient, which is supported by a number of United Kingdom,[158,159] Canadian,[160,161] and US[162,163] laws, policies, and court decisions (eg, *Bellotti vs Baird*, 443 US 622 [1979][164]), indicating an expectation that children will be active participants in their care.[165–167] The principle of self-determination applies to children and adults.[158,168–172] Involving children in communication about their health and in decisions regarding their health care shows respect for their capacities, will enhance their skill in the process of making future health decisions, and enables their essential input into decisions where there is no "right answer" other than the 1 that best meets the needs of the individual child and family.[167,169,173,174] Older children and adolescents should have a significant role in such cases. When the patient and family disagree, the cultural and family values, roles, and structure that have always governed the relationship should be treated with due respect.

Communication as a Developmental, Relational, and Cultural Process

At its core, child health decision making is family-centered decision making.[173] Parents and children themselves are more satisfied and adherence to the treatment regimen is enhanced when the child is addressed in information gathering and in the creation of the treatment plan.[5,78,169,175] However, parents want to be involved in the decision regarding how their children are informed about their health conditions.[150] It is, therefore, important to understand the preexisting parent-child relationship, the family's cultural and idiosyncratic values,[176–178] and the developmental needs of the child, including the desire to participate in his or her own care plan.[178] Simultaneously, determination of the parents' perspectives on providing information to the child is imperative. It is important for parents to understand that research demonstrates improved adherence to the plan and resultant health outcomes when the child is treated as a partner. (For 2 recent reviews of the literature, see Tates and Meeuwesen[175] and Rushforth.[168]) Pediatric health care quality will improve if the child is recognized to have his or her own individual cognitive and emotional needs, is taken seriously, and is considered to be intelligent, capable, and cooperative.[5,137,150,168–170,173,175] Parents and practitioners should decide together whether the child will be present at the informational consultations, whether parents would prefer to tell the child themselves or have another person tell the child, and whether the informing interview will occur with or without the parents present. A recent literature review indicates that children 7 years and older are more accurate than their parents in providing health data that predicts future health outcomes, although they are worse at providing past medical histories.[179] Thus, significant attention to the child's input should be routine

TABLE 3 **Strategies to Engage Children in the Outpatient Setting**

Speak with the child; not at or to him or her
Speak in a private setting
Determine whom the child would like to be present (younger children will generally prefer parents to be present; children who have been abused by family members may need privacy to facilitate disclosure; most adolescents prefer privacy)
Begin with a nonthreatening topic
Listen actively
Pay attention to body language and tone of voice
Use drawings, games, or other creative communication tools
Elicit fears and concerns by reference to self or a third party
Ask the child what he or she would do with 3 wishes or a magic wand

Data were adapted from Lask.[180]

practice. Assisting the child to achieve gradually increased capacity to take responsibility for the maintenance of health and the treatment of illness is a crucial task, specific to pediatric physicians and practitioners.[5,168,169] See Table 3 for helpful strategies to accomplish this goal.

Despite these seemingly simple and cost-effective techniques, recent studies indicate that children are generally passive recipients of medical care, with little opportunity to express their concerns and virtually no attempt to engage them in the creation or implementation of a feasible care plan.[150,181] In 1 study, children 8 to 15 years of age who had cancer perceived that they "occupy a marginal position in consultations . . . their priorities were of little interest to medicine."[150]

Enabling Effective Child Participation

In the past, children of any age were rarely consulted about their own health concerns. In current Western culture, children are highly valued, yet attention to their autonomous needs, especially when the child is not yet an adolescent, remains challenging.[137,150,168,169,173] There are many reasons to include children as active partners in their own health care; however, this rarely happens.[170] Some attribute this situation to the dearth of tools to clarify children's conceptualization of health and illness, to assess their capacity for decision-making, to effectively share information with children, and to assess the outcome of shared decision making on the child patient.[169]

Children can be coached to effectively assume the role of a health partner. One study[5] used brief videos, age-appropriate workbooks, and a short (1- to 2-minute) role-play for the child subjects. Simultaneously, the physician and parents were educated on the importance of the child's participation. The goal was to enable children to raise concerns, ask questions, note information, and participate in the creation and troubleshooting of potential problems with the care plan. Coached children preferred an active role in their care and reported better rapport with the physician, recalling significantly greater amounts of information about their medication regimen than controls (77% vs 47%, respectively). Physicians can encourage the parent to coach the child to be an effective advocate for his or her own health.

The importance of the child possessing effective health communication skills becomes evident when trying to assess and treat a child's subjective symptom, including pain. In the absence of the child's input, it is difficult to understand the nature and severity of the pain; thus, it is nearly impossible to relieve the discomfort effectively and safely. It is well known that the use of patient-controlled analgesia assists with the resolution of pain beyond the dose of medication. The message that the child knows his pain, is in control of his therapy, and is trusted is a powerful therapeutic intervention.[182] Children as young as 4 years of age have used patient-controlled anesthesia effectively.[183]

In many cases, parents mistakenly think that not informing the child is best. Some professionals argue that paternalistic decisions (primarily on the part of the family) to withhold "harmful" information from the child can be justified.[184] This position is not supported in the literature that examines the child's preference for information.[5,150,167–169,181,185–188] One of the most striking was Bluebond-Langner's[189] landmark study of terminally ill children, indicating that children as young as 3 years of age were aware of their diagnosis and prognosis without ever having been told by an adult. She found that adult avoidance of disclosure and denial of difficult information led the child to feel abandoned and unloved. At the same time, the child's response is often to "protect" the "unaware" adults, despite great personal cost; this situation is called mutual pretense and it hurts both parties.[189] By using whatever information they have, children will continually try to make sense of their situations. An incomplete ability to understand does not justify a lack of discussion with a child who desires involvement in his or her care and decision making.

Children often understand more than has been assumed;[168,185] increased experience with information they can understand creates a stable framework on which to add new information, promoting the integration of increasingly complex pieces of information.[169] Children need to have usable information, to be given choices (including their desired level of involvement), and to be asked their opinion, even when their decision will not be determinative.[165] Enhanced understanding provides a sense of control, which in turn mitigates fear, reducing the harms associated with illness and injury. Moreover, if the child is asking about the condition, he or she often already knows something is wrong and is checking to see whom to trust. Children who do not ask should be given the opportunity to receive information, but if they refuse it, information should never be forced on them.

Parents are also apparently harmed in the aftermath of nondisclosure to their children. A study of bereaved parents in Sweden indicates that all those who spoke openly with their children had no regrets, whereas 27% of those who did not speak to their children about dying not only regretted their decision but also suffered from an increased incidence of depression and anxiety as a result.[190] Thus, counseling parents about the benefits of disclosure should be invoked when they are reluctant to speak with their child about illness or death.

Adolescents' Roles in Health Care Communication and Decisional Authority

If adolescents are to be given authority for their health care decisions, they must receive thorough, developmentally appropriate, understandable information,[165] to enable an understanding of the condition, what to expect with various tests and treatments, the range of acceptable and practical alternative care plans, and likely outcomes of each option.[191] Only then can adolescents fully participate as partners in their health care.

Because the ability to comprehend and decide is fluid and variable within and between individuals, the assent given by an informed child or adolescent who can weigh the pros and cons of the proposed intervention should be given progressively greater weight compared with parental permission.[165] However, the child's choice and parents' choices may be discordant. Expecting children to adhere to adult priorities and preferences may be illogical; Ladd and Forman[192] argue that adults' priorities clearly change over the trajectory of adulthood. Thus, if no value set is static, the adolescent's seemingly trivial or superficial judgments may be just as legitimate as any other. They argue that total paternalism toward adolescents' decisions undermines respect for the emerging, autonomous adults they will become and the emotional investment they have in their current values. The values with which adolescents judge their options are applied to an adolescent who holds those values, not to an adult with divergent values. This tolerant model of decision making addresses potentially harmful decisions by giving weight to the adolescent's decision, with the proxy taking the role of educator, discussant, challenger, and shared decision maker.[193] Overriding the adolescent's decision should be undertaken with great trepidation, using the same criteria as are used to override an adult's choice.[192]

Adolescents and Forgoing "Life-Prolonging" Treatments

Children who have undergone treatments for a condition know the burdens of therapy more intimately than the adults trying to help them. Although they may not appreciate all the hoped-for benefits, their input into treatment decisions is clearly critical for a legitimate weighing of the benefit-burden calculus.[186,193–196] When adolescents are able to appreciate the hoped-for benefits, they then also have the capacity to make full-fledged decisions regarding whether to forgo medical interventions. Decisions to forgo life-prolonging treatments made by adolescents have been upheld in courts of law. Landmark cases are described by Traugott and Alpers.[173] Ridgway[197] found that when physicians oppose these decisions, the courts generally decide for the professionals, prompting a caution to physicians to carefully weigh the likely burdens and benefits before going to court to force treatment.

Adolescent Decision Making: Legal and Ethical Issues

By US law, adolescents younger than 18 years (19 years in Nebraska and 21 years in Michigan)[198] cannot make decisions about their health without their parents' permission with some exceptions, notably emancipated minor status. Emancipated minors are persons younger than 18 years who live independent of their parents, who have taken on the responsibilities of an adult, including financial independence, parenthood, or military service, or who are emancipated by court order.[199] Most states recognize "mature minors" by criteria strikingly similar to emancipated minor status.[200] However, both the age of the patient and the conditions vary somewhat from state to state. Adolescents who are neither emancipated nor mature minors are allowed by some state statutes to give legally binding consent for treatments for limited reasons (examples include testing and treatment for sexually transmitted infections, including HIV infection; drug or alcohol abuse; family planning; blood donation; and mental health care) without parental notification.[201]

Cultural Considerations

Minority and non–English-speaking families often have cultural expectations and nuanced understandings of language that, if not understood and attended to, can substantially interfere with effective medical care and may lead to a decrease in health status for their children.[176] The AAP endorses the responsibility of the practitioner to be aware of and to accommodate the needs of such families.[178] At issue are concerns regarding who gets information, who makes decisions, amount of eye contact, forthrightness, and the need for indirect discussion. It is a good idea to be aware of the general cultural norms and taboos of the dominant subcultures attending the practice. Although there are guidelines for what is "culturally competent,"[178,203] none describes any individual family. Rather than assuming that a family will identify itself a certain way or follow cultural "norms," it is generally safer to ask family members about the etiquette for communicating with them. "How should I give your family medical information about Mary?" "With whom do I share information?" "Who makes decisions?" "Are there topics that should not be directly discussed in your family?" Offering to wait until the relevant persons arrive is culturally respectful.

Members of subcultures that are typically passive with authority figures, who are fearful in medical situations, who make decisions that favor the group over the individual, or who have generally low educational levels may have special needs. These needs may include repeated invitations to ask questions, use of long silences during discussions, accommodation of large groups for information dissemination and health-planning discussions, extra time to consult with others when decisions are to be made, and written summaries or tapes of conversations to facilitate understanding through sharing information with others,[129,177] particularly if there is limited English language proficiency. See Table 4 for suggested prompts to elicit culturally related health beliefs, concerns, and practices.

Use of Translators

The availability of trained translators is required by the Joint Commission.[205] Medicaid partially pays for transla-

TABLE 4 **Prompts to Elicit Medically Relevant, Culturally Important Information**

What concerns prompted you to bring your child (use the child's name) for health care?
What behaviors and symptoms are of greatest concern to you?
What do you think caused this problem?
How do you think the illness affects your child?
What have you tried to do to make the illness better? Have you tried any traditional remedies?
Are there any specific dietary, religious, or cultural practices that need to be accommodated?

Data were adapted from De Trill and Kovalcik.[204]

tion services.[206] Well-trained translators are often aware of cultural norms in addition to their language proficiency. Effective use of translators includes the establishment of a framework for collaboration; before the consultation begins, acknowledge the potential for and the desire to prevent cultural missteps. "I may ask you to say some things that you think are not culturally acceptable. If that happens, please let me know and guide me to more appropriately approach these topics." Use of untrained translators, such as bilingual children or other family members who are trying to absorb information and transmit it while emotionally upset, is inappropriate. Nonprofessional hospital employees are also a common source of "translation." Their knowledge of the English language is often limited, their educational levels, even in their own country, may be low, and they too will be assaulted emotionally with confidential and difficult information. There is rarely a debriefing opportunity for these kinds volunteers in the aftermath of the discussion. Use of untrained translators is, therefore also, an unacceptable option.

Bad News

Bad news can be defined as "pertaining to situations where there is a feeling of no hope, a threat to a person's mental or physical well-being, a risk of upsetting an established lifestyle, or where a message is given that conveys to an individual fewer choices in his or her life."[207] An alternate definition is that bad news is information that "results in a cognitive, behavioral, or emotional deficit that persists for some time."[46] Recognition that much of health care communication is actually bad news will improve attention to its delivery. As an example, although the diagnosis of neurofibromatosis type 1 may not seem to the practitioner to be bad news, the variability of the outcome and the lack of predictability of the disease make this diagnosis very difficult for parents.[13]

Similarly, the need for unanticipated blood tests for a needle-phobic child or the disruption of an unexpected overnight hospital stay, the need to take medications for the rest of one's life for a chronic condition, and many other common occurrences are bad news for families. Greater attention to the empathic delivery of bad news will result in improved skills when the stakes escalate, as in terminal conditions. Communication skills will be well honed and practitioner fear and guilt will not predominate when a bereaved parent states "I remember every aspect of what was said and how it was said when the doctor told me that my daughter had cancer."[208]

Pediatric oncologists have significant-to-profound discomfort in discussing prognosis, particularly the impending death of their patients.[1] Bereaved parents of trauma victims[12] have reported being told of the death in the hallway, waiting room, or other public area, implying a lack of training of emergency and surgery personnel. When information is delivered poorly, parents perceive a lack of empathy and respect, and memories of this experience may be etched in the minds of the survivors for the remainder of their lives, compounding and prolonging the grieving process.[14] Given the risks of such permanent damage, there is a moral imperative to ensure that preparation for the effective and empathetic disclosure of bad news is routinely integrated into pediatric training.

Good Ways to Give Bad News

Most of the advice about breaking bad news in general applies to the ICU, ED, and delivery room settings and to the disclosure of terminal illness. The main difference is the time frame and the intensity of emotion, although even parents of chronically ill children who have survived many previous hospitalizations will also often be shocked (and frequently unbelieving) that the child will not recover this time ("We've been told that before, and he is still here").

Many clinicians believe there is no good way to give bad news. However, research with parents whose children had a wide range of diagnoses provides consistent guidance.[15,24,32–35,40–42,46,47,92,209–213] See Table 5 for suggestions for breaking bad news with skill and empathy.

When hearing bad news, parents value a physician who clearly demonstrates a caring attitude and who allows them to talk and to express their emotions.[47] One effective opening to the conversation is to ask, "What do you already know about what is happening to (patient's name)?" Once their ideas are elicited, misperceptions should be corrected. Asking whether they know someone else with this diagnosis or situation and inquiring about their associated experience can be helpful. The latter question assists the physician to be aware of the family's fears and expectations. Pointing out how the child's situation is similar to or different from the previous experience helps parents to better understand the child's likely course.

Parental dissatisfaction with the process of breaking bad news is common. Use of a protocol for breaking bad news can substantially improve the experience.[41] Comprehensive guides for breaking bad news are available.[40] Although needing to inform parents of a chronic, incurable diagnosis may challenge a physician's feelings of competency, parents are most attentive to the affective relationship of their informant, rather than the ability of the informer to "fix it." Parents are able to distinguish the difference between the delivery of the news and the news itself.[32]

One US study in the 1980s[209] found that parents of children with cancer, when hearing the initial diagnosis,

TABLE 5 **Suggestions for "Breaking Bad News" With Skill and Empathy**

Do not disclose bad news over the telephone
Use trained translators as needed
Avoid telling a lone parent without his or her spouse and/or a preferred support person present
Enable the parents to touch the deceased child before or during the interview
Hold or touch the child with obvious care
Recognize that parents are primarily responsible for their child
Show caring, compassion, and a sense of connection to the patient and the family
Pace the discussion to the parents' emotional state; do not overwhelm them with information
Do not use jargon
Elicit parents' ideas of the cause of the problem; ensure they do not blame themselves or others
Name the illness and write it down for the parents
Ask the parents to use their own words to explain what you have just told them to confirm effective transmission of information
Address the implications for the child's future
Acknowledge their emotions and be prepared for tears and a need for time; it is helpful to bring a social worker and/or chaplain to the meeting
Be willing to show your own emotion; aloofness or detachment is offensive
Give parents time to be alone to absorb the information, react, and formulate additional questions
Be able to recommend relevant community-based resources
Provide contacts with other willing families with a similarly affected child
Provide a follow-up plan and make an appointment for the next conversation

Data were adapted from Krahn et al,[15] Fallowfield,[35] Nursey et al,[42] Heller and Solomon,[125] and Woolley et al.[214]

desire less information at that time, preferring an emphasis on establishing trust with new caregivers. Parents' trust of advice is built by acknowledging the grief, anxiety, and fear the family is experiencing and inviting them to share their feelings and ask questions. Gradually sharing additional illness and treatment information, supplemented by written or taped materials, and providing a means to contact the physician when additional questions arise, is also greatly appreciated.[32] Many parents now are asking for e-mail contact and, in some instances, this is a reimbursable service.[215]

When parents (predictably) become upset during the informing interview, acknowledge their grief and fear by waiting until their attention turns back to the discussant, then state (for instance):

"I can see you were not expecting this." (Silence)

"You seem quite upset; I would be, too. (Silence.) Do you know anyone who has had this illness? (Silence.) How did things go for them?"

Facial tissues are essential equipment. Parents want hopeful and positive things said about their child, and an opportunity to touch or hold the child, particularly newborn infants or children from whom they have been separated during a transport. They need recognition by the physician of the child's unique value as an individual first and as an ill or injured person second.[15] Speaking of the child as if he or she "is" the diagnosis is hurtful.

As time progresses, parents also appreciate emotional support and affirmation of their efforts and ability to care for the child. "Your child is lucky to have you for parents! I can't imagine anyone doing a better job than you two!" Harsh or judgmental statements about the child, the parents, or their behaviors are unhelpful.

Communication in the ICU and ED

Bad News in the ED

In the ED, parents often arrive separately from the child. If they are available by telephone, let them know the child is seriously ill/injured, but do not disclose death over the telephone unless the parent is insistent. Suggest they come in as soon as possible and bring their spouse and a close friend with them. Ask them to be careful and to consider letting someone else drive, because they are at an increased risk of having an accident because of their appropriately upset emotional state.

If a child is undergoing resuscitation when the parents arrive at the ED, it may be appropriate to offer the parents the opportunity to be with the child.[216–222] The majority of families offered this option accept and feel much better knowing that "everything was done" and that they were there in the child's last moments of life.[223–228] Parents should know they do not have to go into the resuscitation area if they choose not to; affirmation should be provided indicating that loving and good parents decide either way. If the parents choose to be present, a staff member should be assigned as a dedicated escort. This individual should tell them what they will see and let them know they can leave at any time. Parents should be informed that they will be asked to leave if they interfere with the team's function or seem to be harmed by being there. When in the room, the escort explains the role of each person present, what is being done, then affirms that, despite all that is going on, this is still their child (use the child's name) and that he or she may be able to hear the parent. The escort can suggest the parents touch and speak to the child, assuring him or her of the family's love.

An even more challenging task is to inform families of trauma victims that their previously healthy child is dead.[229] Jurkovich et al[12] studied the experiences of bereaved families of child and adult trauma victims. The findings and recommendations were consistent with those for ICU patients. The most important attributes of the communication, from the parents' perspectives, are the attitude of the informer, clarity of the message, privacy of the conversation, and the ability of the informer to accurately answer parents' questions. Many parents recounted positive experiences, primarily of having caring hospital and prehospital staff. Physicians garnered most of the negative comments. Rank and attire were of minimal concern to these families.

After greeting the parents and escorting them to a private area, have someone who has directly participated in the care of their child speak with them. Sit down and bring tissues. Begin by asking what they know so far. Ask when they saw the child last and what he or she was doing at that time. Explain any factual details that are known about what happened at the scene and what has been done so far in the resuscitation. There are

TABLE 6 **Family Centered Communication and Support in the ICU**

Early (within 24–48 hours of admission) and frequent communication
Indication that the health care team cares for the child as an individual
Practitioners trained in meeting facilitation and conflict management
The use of open-ended questions and reflective explanation
Hopeful but honest and clear communication; acknowledgment of uncertainty
Discussion of likely and hoped-for outcomes
Use of numeric terms when describing probabilities; use of drawings and models
Provide timeframes for improvement and future discussion
Participation of families in clinical bedside rounds, caregiving for their child and ability to stay with their child during invasive procedures
Listen to and involve the nurse, chaplain, and social worker in the information loop
Open visitation, including sibling and pet visitation
Consistent caregivers; if this is not possible, ensure consistency of the message
Prompt informing of parents of transitions, such as a change of location, condition, treatment plan, assignment of attending physician or residents
Shared decision making rather than autonomy; encourage the parents to involve their family, friends, and medical home pediatrician to help them to understand information and make decisions
Written, audiotaped, and computerized education for families (see www.icu-usa.com)
Discussion and support of coping mechanisms, including religious and spiritual values
Initiation of palliative care at the time of admission

Data were adapted from Todres et al,[16] Davidson et al,[228] Robinson et al,[231] and Todres.[232]

TABLE 7 **Coping Strategies of Parents of Critically Ill and Injured Children[16]**

Focus on the positive (hope)
Minimize the significance of the information
Preoccupation with medical details
Support from family, friends, and clergy
Religious faith
Hostility, depression, irritability

2 choices at this point; the first is immediate notification of the death, offering to escort the parents into the room to be with the body, and explaining what was done and that the child's injuries were too severe to survive but reassuring them that everything that could have been done to save the child's life was done.[92] Alternatively, there can be a staged disclosure, initially telling them that the child is very severely injured and at risk of dying, but that everything possible to save him is still being done. Tell them you are going to check on the rescue team's progress, leaving a team member in the room with them; make sure the rescue area is cleaned up and that the child's body is presentable. Leave some of the tubes in place to demonstrate the efforts that were made to save the child's life. Call the chaplain and the social worker if they are not on the scene.[230] Then, go back and inform the parents of the child's death a few minutes later. In the case of sudden, unexpected, and overwhelming illness or death, parents will likely be shocked, highly emotional, angry, and suspicious. This reaction, although difficult to endure as the perceived target of their animosity, is certainly understandable. A parent might blurt:

> "But I put Juanita on the school bus this morning. She can't be dead!"

Offer to take parents in to see their child, and ensure a member of the resuscitation team is available to provide the specifics of what was done and to answer any questions. If feasible, move the body and the family to a private area to maximize privacy and minimize disruption; allow families to have some private time with the body. Ensure an appropriate environment, including a rocking chair, support persons from the family, and a limited number of members of the care team, if desired by the family. Do not rush them. Experience indicates that 2 to 3 hours is the maximum time most families want to remain with the body; 15 to 20 minutes is more common.[93]

Communication in the NICU and PICU

Communication within an NICU or PICU generally involves bad news in a very foreign environment, virtually always with large numbers of unfamiliar health care professionals. Guidelines have been promulgated to suggest important ways to support families of ICU patients.[228] See Table 6 for suggestions with regard to communication.

Understanding how parents cope with bad news may prevent some judgmental conclusions and may assist ICU caregivers to be effective communicators with families. See Table 7 for a list of coping mechanisms, both adaptive and maladaptive, of parents with critically ill children.

The stakes involved in having a child in the ICU and the constant uncertainty make negative reactions understandable.[16] Parental sources of stress include seeing their child in pain, frightened, or sad, and the inability to communicate with the child.[233] Increased attention to the fulfillment of parental needs can improve relations between parents and ICU staff.

Special Communication Considerations in Terminal Illness

No communication is more difficult than telling a parent that his or her child will die. However, in many instances, painful as it is, parents may be hoping doctors will do just that. Parental recognition that one's child is suffering, disproportionate to the likelihood of benefit, is extremely distressing. However, it is a rare parent who will challenge the physician who continues to hold out hope for "cure" or prolonged life. Parents and adult patients expect physicians to recognize and discuss the need to change the goals of care. In 1 study, 45% of parents of critically ill children thought it may be time to stop attempts to treat the illness before the physician brought it up, but none broached the topic.[234] Many physicians, however, wait until they perceive the family or patient is "ready," leading to additional emotional and physical suffering, including a prolonged dying process. Mixed messages from multiple consultants, particularly in the ICU setting, can be extremely confusing and upsetting for families, often leading to poor decision making as the parents (understandably) hold on to the most hopeful messages. Having a clear captain of the care team, one who is evaluating the situation as a whole,

particularly as death nears, is extremely helpful in preventing such problems.

Bad News in the Delivery Room

Despite increasing accuracy and availability of prenatal diagnosis, a pediatrician can be confronted in the delivery room by a child who is too immature to survive or who has anomalies that are incompatible with life; attempts at resuscitation would be inappropriate in these situations.[235] When prematurity is the problem, the parent is generally already aware of this. Introducing oneself and providing "a warning shot" may be helpful.

> "I am Dr. _____ and I am the pediatrician who was called by your physician to care for your infant. My team and I have experience doing everything possible to help premature newborns. Based on your history and our examination, it seems, unfortunately, that your daughter was born too early to survive for very long, no matter what we do. (Pause) I am sorry. I really wish it were different. At this point, we are ensuring her warmth and comfort. (Pause) Does she have a name? Would you like to spend some time with her and hold her?"

Point out the infant's normal features. Important things not to say at his time include asking when the mother noted her premature labor or asking about factors that may have triggered premature delivery. Blaming is unhelpful and unnecessary; avoidance of a recurrence can be accomplished at a future time when the information can be seen as helpful and can be absorbed.

For the near-term child with lethal anomalies, the diagnosis has typically been made before delivery. In this case, it can be helpful for pediatricians to ask parents what they know and provide confirmation of what they see. Goals of care should have already been established; in some settings, a prenatal hospice program may have been set up and available for support during the delivery.[236] If not, or if the diagnosis is unexpected, a "warning shot" is needed, followed by empathic and clear disclosure. Hovering and whispering about the infant only adds to the panic and confusion.

> "I am Dr. ____ and I was asked to help care for your son. He has beautiful hands! And he also appears to have some unusual characteristics. Did you or your obstetrician have any concerns or suspicions that something may have been different about your baby before his birth?"

If the prognosis or diagnosis is not clear, the infant will likely be brought to the NICU for additional evaluation and management.[235] An explanation of what will be done, how long it will take, when the parents can visit, and when more will be known is important. If the child has a clearly lethal anomaly (eg, anencephaly), the child should not be separated from the parents unless that is their preference, and the process of palliative care should begin immediately. Pointing out the normal features of the child and ensuring the parents do not blame themselves for the anomalies are important therapeutic interventions. Asking whether parents wish to bathe or dress their child or have siblings hold their child helps families accept the newborn. If the infant is alive, attend to its comfort with warm blankets and maternal skin contact, if desired. Suggest making a hand mold or print, cutting a lock of hair, or taking photographs. Offer to call a chaplain or the parents' own clergy, if they prefer, to assist them to explore meaning and to help with any rituals.[231] Give them time to be with the infant or the body in a private place for as long as they desire. Offer help to call friends or family if they choose. Ensure bereavement follow-up.

In the NICU and PICU, parents are often asked to participate in the decision-making process regarding the use of "life-prolonging" measures. Little research addresses effective and compassionate ways to communicate about stopping critical care interventions and changing goals of care, although much research documents dissatisfaction with current methods. The usual way of addressing the failure of medical therapy can be very problematic and may generate thoughts or conclusions that are unintended but potentially devastating. Table 8 presents common medical statements, how they may be perceived, and suggests alternatives.

INFORMED CONSENT, COMMUNICATING RISKS, AND BENEFITS OF RESEARCH

Sometimes, when conventional treatment has failed, clinical trails are available. Although parents often state their motives to enroll their child in research are altruism and/or the desire to learn more about their child's disease, it is interesting to note that, when they are in an outpatient setting and less rushed to make a decision, participation rates in clinical trials are lower than in inpatient settings.[237] It is clearly difficult to achieve truly informed consent for medical care or procedures, let alone clinical research, when death is likely; strong emotions govern such situations. The need to explain complex constructs of risks and benefits, randomization, physiology, and often, pharmacology to lay people is daunting. Nevertheless, there is still an obligation to make a valiant effort to obtain truly informed consent. Too often there is a problem of therapeutic misperception, representing that the purpose of the research is to treat the patient rather than benefit future patients.[238] Indeed, therapeutic misperception may sometimes even be fostered by investigators. However, a recent analysis of cancer trials found that there were "insufficient data to conclude" that enrollment in clinical trials resulted in improved outcomes.[239] According to the Institute of Medicine Committee on Clinical Research Involving Children,[240] consent, permission, and assent should be viewed as a process of communication, encouraging questions at the initiation and throughout treatment to assess understanding and ensure lack of coercion in ongoing participation. These recommendations are based in part on 2 other important, recent reports on research ethics.[241,242]

A study of consent for childhood leukemia trials found that not providing information, and lack of understanding of information presented, hampered the achievement of informed consent.[243] For instance, randomization was not mentioned in 17% of cases, and parents did not understand it 50% of the time, despite efforts to explain the concept. Similarly, 18% of parents

TABLE 8 **Methods of Communicating Sensitive Health Care Information and Perceptions of Communication**

Usual Method of Communicating Message	How the Usual Communication May Be Perceived	Alternative Method of Communicating Message
"Do you want us to do CPR?"	"CPR would work if you would allow us to do it"	"Tell me what you know about" CPR. "CPR is most helpful for patients who are relatively healthy, and even then, only 1 of 3 patients survive. Many of Lisa's organs are not working. As you know, she is getting dialysis to clean her blood like her kidneys would have, a breathing machine for her lungs, and medicine to keep her blood pressure up. If her heart were to stop, it would not be because there is a problem with her heart (it is fine), but it would be because she is dying. All of our hearts stop when we die. So pumping on her heart, or "doing CPR" will not make her better. On the other hand, while I would recommend not doing CPR, I am not recommending stopping any other treatment she is receiving at this time. There is still a chance that she may get better. Let's hope for the best, but also plan for the worst. We will need to keep a close watch on her and keep you up to date on how she is doing. Do you have any questions?" "Let's talk again later today so I can update you. Is there anyone else I need to talk to?"
"Let's stop heroic treatment"	"We will provide less than optimal care" (What is heroic about performing invasive, painful, costly, nonbeneficial care?)	"At this time, I think the most heroic thing we can do is to understand how sick Jamal is and stop treatments that are not working for him. I think we should do all we can to ensure his comfort and yours, make sure there are no missed opportunities, and ensure we properly celebrate his life. I will follow your lead on this. Some ideas that have helped other families include getting him home with help for you if you wish, or you may choose to have his friends and your family come here instead and have a party; you can bring his clothes so that he will look like himself, bring in his music or a photo album and relive some of your best memories of him, make a mold of his hand so that you will always have his hand to hold, or anything else that would be a proper celebration of his life."
"Let's stop aggressive treatment"	"We will not be attentive to his needs, including symptom distress and need for comfort"	"We will do all we can to ensure he is as comfortable as possible."
"Aeisha has failed the treatment"	"The patient is the cause of the problem"	"We have tried all the proven treatments and even some experimental ones for Aiesha. Unfortunately, we did not get the results we had hoped for. I wish it were different!"
"We are recommending withdrawal of care for Marisa"	"We are going to abandon her and you"	"Marisa is too ill to get better. We need to refocus our efforts on making the most of the time she has left."
"There is nothing more we can do for Adam"	"We will allow him to suffer, we do not care about him, we only care about fighting the disease"	"We need to change the goals of our care for Adam. At this point we clearly cannot cure him, but that does not mean we can't help him and your family."
"Johnny is not strong enough to keep going"	"Johnny is weak"	"Johnny is a strong boy and he has fought hard with us to beat his disease. Unfortunately, as much as we wish we could, we cannot cure Johnny. At this point, we are hurting him rather than helping, giving him side effects, and keeping him from being at home or taking a trip, or whatever he really wants to do with the time he has left."
"We will make it so Thuy does not suffer"	"We are going to kill Thuy."	"We will do everything we can to make Thuy comfortable."
"We need to stop active treatment for Dwayne"	"We will not take care of him at all"	"The goal of curing Dwayne's disease, despite the best efforts of a lot of smart and hard-working people, is no longer possible. We are so sorry and wish that that were different! I have cared for many children who are as sick as your son. It is very hard on all of us, especially you, his parents and family when the treatments do not work as we had hoped. Many parents like you have agreed to stop efforts to cure when they are not working, as difficult as that is. Would you like me to put you in touch with some of the other parents who have been through this too?"
"Do you want us to stop Bobby's treatment?"	"You are the final arbiter of your child's death"	"Bobby is lucky to have such excellent, loving and selfless parents. I know this is hard; we will get through it together. I am glad you agree with our recommendations to change the goals of care to better meet Bobby's needs. I will let my team know what we have decided."
"I am glad you agree. Will you sign Juan's do-not-resuscitate order?"	"You are signing his death warrant"	"There is no surgery, no medicine, and all the love you clearly feel for Juan will not make him better, he is just too sick. I wish it were different." (Silence) "I will change his orders to make sure he only gets tests and treatments that can help him now."

CPR indicates cardiopulmonary resuscitation.

TABLE 9 **Suggestions to Improve Communication About Clinical Trials**

Ensure the presence of a nurse
Read the consent document with the parents, explicitly soliciting questions and allocating sufficient time to answer them
Provide time to process the information, including taking the consent document home overnight
Provide written and video explanations
Provide information in the family's native language when possible
Provide names and contact information for practioners who can offer independent, competent second opinions
Conduct a daily education conference to allow information to be incrementally processed

Data were adapted from Kodish et al.[244]

lacked understanding of the right to refuse to participate (attempted explanation, 97%) and 20% did not understand the right to withdraw from the study at any time (attempted explanation, 72%).[243] In another study, parents did not understand the existence or details of treatment alternatives.[244] Health literacy is a problem for much of the adult US population, not just parents.[245,246]

Children being offered the opportunity to participate in clinical research trials must be asked their opinion and must give permission to proceed. In fact, the requirement for affirmative child assent is codified in the Current Federal Regulations.[247–249] The opportunity to provide assent implies the ability to dissent as well; dissent must be taken seriously but is not considered to be determinative, when rendered by the child, if the trial holds realistic promise for a beneficial outcome. These concerns and needs must be anticipated as routine and accommodated. Clinical investigators need explicit training regarding how to obtain truly informed consent.[244] Suggestions to help improve communication about clinical trials are in Table 9.

In the setting of research with a potentially terminally ill child, emotions run high. Parental and clinician ability to judge the situation on the objective merits of the alternatives, within the framework of long-held values, is severely challenged and rarely accomplished. An altruistic child may prefer to continue on to benefit others, regardless of his or her own outcome.[195] These children are ideal candidates for research. However, others want desperately to control their destinies and to enjoy the time remaining. Parents' need to sustain life, often at all costs, can blind them to the child's need to enjoy it. It is the clinician's obligation to ensure that the risks and benefits are communicated in an unbiased way, while giving recommendations based on disclosed priorities and experience. Decisions should incorporate the views of the child, parents, and other caregivers who know the child well. Additional research is desperately needed to ensure a process that enables truly informed consent.[240]

Presenting Palliative Care as a Viable Alternative to Research Participation

At such vulnerable times, parents are often told that the "only" alternative to enrollment in experimental therapies is "doing nothing," an alternative that is never attractive and is also never true. Each treatment option should be evaluated based on the likely (not just hoped for) outcomes in this individual child's case, given his or her illness history and comorbidities, and the known and possible burdens and complications, including pain, isolation, fatigue, and missed opportunities. The merits and burdens of pursuing palliative goals of care without further attempts to reverse the disease versus experimental or "innovative" (uncontrolled research) treatment must be clearly explained to ensure that a choice is truly being offered.

Palliative care can be provided concurrently with life-extending measures[81,228] or can be the sole focus of care. Palliative care is intensive care, addressing the whole child within the context of self, family, and community. Palliative care attends to spiritual, physical, emotional, and social needs of the patient while also addressing the needs of parents, siblings, and others affected by the child's illness and ultimate death. Palliative care can facilitate an excellent quality of living in the face of a short life expectancy, ensuring that the child and his or her family live fully, despite being in the shadow of inevitable death.[14,81,121,250] Children can even live longer than expected when effective palliative care is offered because of renewed hope and relief of symptoms that are too often ignored in other treatment paradigms.

Postmortem Communication

Parents are generally supported by family, friends, the community-based medical home pediatrician, and their congregational clergy after the death.[93] However, they often feel cut off from the people with whom they developed an intense bond in the hospital; the last people to assist them to care for their child, the people who guided their initial acknowledgment of their child's death.[234] Even small tokens of continued concern have a huge effect on families. In a study of bereaved survivors of adult patients, a condolence card, signed by direct care providers and mailed 2 weeks after the death, had a profound impact.[251] Ninety-four percent of the recipients still had the card in an easily accessible place 1 year later. One woman whose husband died in the ED stated that the card helped her cope with his unanticipated death, because "at least I know he died among caring people." There is published guidance for physicians about how to write a condolence card,[252] but even a signature will suffice.

Sometimes, especially when practitioners have become extremely close to the patient, attending the memorial or funeral service may be appropriate. This act serves to let the family know that the concern and attachment they perceived were real; it may also allow some healing for the practitioner, who otherwise may "burn out" from the emotional exhaustion of the investment in children who die and their families. Giving oneself permission to love and let go is important, and societal rituals may assist in the resolution of the professionals' grief as well. Families are generally overcome with appreciation when the physician attends the memorial or funeral and can be resentful when they do

not.[125] The AAP endorses an active role for the pediatrician in providing bereavement care.[82]

Autopsies as Communication Opportunities

Particularly if an autopsy is performed, it is advisable to have a postmortem conference with the parents (and sometimes siblings as well) approximately 6 to 8 weeks after the death.[93,253–255] As parents reflect on the whirlwind events of their final days with their child, numerous questions arise. They need a vehicle to have these questions answered efficiently. If an autopsy is performed and there is no opportunity to hear and discuss the results, parents may become suspicious that the medical establishment was "experimenting" on their child.[92,93] Moreover, parents may have requested the autopsy to assist in family planning or to determine the need to do screening procedures on close relatives; thus, they may be awaiting the results anxiously. An in-person meeting allows the treating physician to answer all the family's questions, translate the autopsy findings into understandable lay language, and importantly, to check on the well-being of the parents and siblings. The family and the staff appreciate coordination of the timing of this meeting so all important members of the care team can attend. Long-term follow-up may include an annual card on the child's birthday or anniversary of the death, invitation to annual memorial services at the hospital, or other locally appropriate options.

MEDICAL ERROR DISCLOSURE

Medical errors are increasingly in the public eye. Communication about medical errors is 1 of the most challenging aspects of health care,[256] yet parents exhort caregivers to be forthright and timely in revealing the mishap.[104] Training on how to approach patients and families about the occurrence of a medical error can increase family and patient satisfaction regarding these situations and can substantially decrease the medical malpractice payouts related to such occurrences. (Multiple case studies are available at www.sorryworks.net.)

PHYSICIAN SELF-CARE

Medicine is a challenging and rewarding profession. It requires lifelong learning, not only from books, journals, and courses, but also from attention to interactions with patients and families. Physicians have a difficult job; the responsibility to communicate effectively and efficiently to clarify the diagnosis, consider psychosocial and existential concerns, respect family and other supporters' needs, and to come to an agreed-on plan of care is substantial and can be overwhelming. Allowing time between patients and debriefing conversations with staff, increased physician education on communication, and improved payment for counseling time can help.

SUMMARY

Effective, empathic communication is an essential skill for physicians caring for pediatric patients and their families. It can lead to improved outcomes for children, their families, and physicians themselves. Communication deserves a place at center stage for pediatric education, practice, and research.

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CLINICAL REPORT

Comprehensive Health Evaluation of the Newly Adopted Child

abstract

FREE

Children who join families through the process of adoption often have multiple health care needs. After placement in an adoptive home, it is essential that these children have a timely comprehensive health evaluation. This evaluation should include a review of all available medical records and a complete physical examination. Evaluation should also include diagnostic testing based on the findings from the history and physical examination as well as the risks presented by the child's previous living conditions. Age-appropriate screens should be performed, including, for example, newborn screening panels, hearing, vision, dental, and formal behavioral/developmental screens. The comprehensive assessment can occur at the time of the initial visit to the physician after adoptive placement or can take place over several visits. Adopted children should be referred to other medical specialists as deemed appropriate. The Section on Adoption and Foster Care is a resource within the American Academy of Pediatrics for physicians providing care for children who are being adopted. *Pediatrics* 2012;129:e214–e223

Increasing numbers of children are joining families through adoption. It is estimated that every year, more than 100 000 children are adopted in the United States.[1] Children can be adopted through the national public welfare system, private agencies, existing relationships, or the international process. Regardless of the route or timing of adoption, these children may have a myriad of special health care needs. Numerous studies have demonstrated that many children who enter the foster care system or children adopted domestically or internationally have an increased incidence of physical, developmental, and mental health concerns.[2–5] Although these concerns may be addressed before adoption, many of these issues persist and continue to be significant or do not become apparent until after the time of placement in an adoptive home.

The number of international adoptions has tripled over the past 15 years, with an average of 22 000 adoptees entering the United States each year for the past 4 years.[6,7] Most of these children come from China, Guatemala, Russia, Ethiopia, South Korea, Vietnam, Ukraine, and Kazakhstan.[7] Regardless of their countries of origin, many of these children may have concerns related to infectious diseases and developmental delays.[4,8–13] Several risk factors have been identified that may account for the aforementioned outcomes, including poverty, little or no prenatal care, malnutrition, perinatal and postnatal exposure to bloodborne and environmental toxins and pathogens, and inadequate

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developmental stimulation and emotional sustenance.[14,15] Children available for adoption are at high risk of having been exposed prenatally to illegal drugs or alcohol.[8,15,16] Before adoption, children may have been directly or indirectly exposed to physical, emotional, or sexual abuse.[8]

Pediatricians have played a significant role in the adoption process, in some cases providing counseling to parents during the preadoption phase and subsequently providing health care for these children. The pediatrician must be aware of the special needs of many of these children to evaluate and treat them appropriately. The pediatrician also needs to become knowledgeable of the resources available to help families integrate the new adoptee into the family unit. The purpose of this statement is to provide the general pediatrician with practical guidance that addresses the initial comprehensive health evaluation of adopted children.

COMPONENTS OF THE INITIAL PLACEMENT EVALUATION

A comprehensive medical evaluation should be completed soon after placement in an adoptive home to confirm and clarify existing medical diagnoses, assess for any previously unrecognized medical issues, discuss developmental and behavioral concerns, and make appropriate referrals.[8] This evaluation should include a thorough review of the medical history, including an assessment of health risks, a developmental assessment, and a complete, unclothed physical examination.[8,9,15,17] The initial health evaluation of an adopted child should be comprehensive in nature, but it is not necessary for this to occur during only one medical visit. Several visits to the pediatrician may be necessary to complete the assessment of the child's history, to review laboratory findings, and to make referrals to medical, developmental, mental health, and dental specialists. Subsequent evaluations, including referrals and laboratory testing, should be undertaken to allow for comprehensive health planning.

The Preadoption Visit

The preadoption visit can be helpful for the adoptive family.[15,17–21] Parents may request the pediatrician review medical records of the child and/or biologicical parents. The pediatrician may be able to use those records to help parents determine additional questions that could clarify a particular health issue and help parents clarify what special needs they are prepared to accept. Some specific issues to address in the medical records include growth trends and a preliminary assessment of developmental progress, and, if available, family history and information about the pregnancy course and childbirth. The pediatrician may offer clarification of medical diagnoses, particularly from international adoptions, that may be more prevalent in particular regions of the world.[17,18,20] Besides medical records, parents may have other materials, such as photos and video, for review. Although these may be informative to confirm or refute what is written in the medical record, they do not provide a conclusive diagnosis. The preadoption visit also allows for counseling on other issues. The issue of closed versus open adoption can be explored with the parents. Open adoption describes a continuum of communication between the birth parents and the adoptive family.[22] Pediatricians should discuss with families the extent of communication between the adoptive family and the biological family and provide needed support by identifying potential and real benefits and drawbacks to the relationship.

Special issues related to nutrition of the child could be addressed. Some families may be interested in breastfeeding their infant, so the pediatrician needs to be familiar and supportive of the option and techniques of induced lactation.[23,24] Finally, providing information about available community support services may ease the transition for the expected family. For further assistance, the primary care physician can consult with the American Academy of Pediatrics (AAP) Section on Adoption and Foster Care.

Initial History and Review of Medical Records

When a child presents for an initial complete adoption evaluation, a review of the current and past medical history must be undertaken, with particular attention to any previous medical findings in the child's medical records. The Electronic Health Record (EHR), using the Health Information Exchange standards, may eventually help facilitate transfer of this medical information. A list of information to be sought from the child's history is provided in Table 1.

A complete medical history, including prenatal history obtained from the mother and genetic history obtained from both parents, is ideal but rarely available.[10] The adoption agency social worker (who should be trained appropriately to do a skilled genetic, medical, and prenatal interview) should take an extensive history from the birth parent(s), if possible, and enter these data into the formal medical record for the future adoptive parent. Perinatal risks, which must include lifestyle-related information about the parent(s) that may affect the fetus at birth or later in development, also should be reviewed.[19,21] Such information includes parental use of alcohol or drugs and history of sexual practices that increase the risk of sexually transmitted infections both in the mother and her

TABLE 1 Review of Medical History/Previous Records

- Birth records should be obtained whenever possible, particularly for children younger than 6 y
  - Prenatal blood and urine test results of biological mother
  - Exposure to medications, illegal substances, alcohol, tobacco
  - Gestational age, birth weight, length, head size; Apgar scores
  - Prenatal concerns, neonatal complications
  - Newborn hearing screening results
  - Results of newborn metabolic screening
- Previous growth points, including head circumference
- History of abuse, physical and sexual; history of neglect
- Reason for placement into adoptive home
  - Voluntary versus involuntary termination of parental rights
- Nutritional history, particularly with respect to iron, calcium, vitamin D, iodine, and other nutrients
  - Assess current dietary habits
  - Determine whether the child has any issues eating textured foods
  - Exercise history
- Developmental milestones, past and present
- Behavioral issues, particularly with respect to socialization, indiscriminate friendliness
- Laboratory test results, radiographic studies, other studies
- Immunizations
  - School records may be sufficient, particularly for older children
  - Original records and adequate timing of doses should be verified with antibody titers
  - Children with no records or records that do not appear to be original or accurate should be reimmunized
- Results (if known) of previous testing for tuberculosis, including treatment
- Chronic medical diagnoses
- Allergies (medication, food, environmental, latex, insect stings)
- Medications (both used acutely and chronically)
- Reports from previous specialists seen
  - Consider having an original translation of records from other countries
- Family history (when available)
  - Vision, hearing deficits
  - Genetic diseases
  - Concerns related to ethnicity (eg, sickle cell anemia, thalassemia, Tay Sachs disease, lactose intolerance)
  - Mental health diagnoses
- Environmental risk factors
  - Lead risks
  - Institutionalization
    - Reason and timing, if known, of placement
    - If known, feeding and sleeping schedule and environment where feeding and sleeping occurred
  - Risks for previous physical, emotional, and sexual abuse
    - Substandard housing, multiple changes in residence
    - Family members using illegal substances or alcohol, domestic violence
  - Passive tobacco exposure, methamphetamines, other illicit substances in the home environment
  - Other environmental toxins, both in the home and in the surrounding community
- Number of prior placements, quality of such care

Notes:

- Children who have been adopted internationally may have neurologic, hematologic, cardiac, and metabolic disorders that were previously overdiagnosed, underdiagnosed, or missed completely.
- Medical records from other countries (if available) may be limited in information, inaccurate, or even falsified.
- For children adopted domestically, there may be issues of confidentiality associated with obtaining records, particularly if the child's name was changed at the time of the adoption. In all cases, physicians should work with families and adoption workers to obtain complete medical records, while also strictly adhering to laws regarding confidentiality of medical information.

partner(s). Physicians and adoption agency social workers should be trained to obtain such information in a manner that is sensitive to the psychological and cultural issues of the families.[25]

Children being adopted from foster care most likely have had fragmented care and limited continuity of medical records. Health care before foster care placement may have been inadequate, with multiple unmet medical needs.[1,19,26]

The AAP recommends a comprehensive health evaluation of all children at the time of entrance into foster care.[26] The medical records from all previous health care providers should be made available for review for the adoptive parents as soon as possible after placement into an adoptive home and before finalization of adoption from foster care. Lack of availability of medical records should not delay the timing of the initial comprehensive health evaluation. Parents, working in collaboration with their legal representative, their pediatrician, and local child welfare and adoption agencies, should obtain the child's complete medical records, including (if possible) developmental, educational, and mental health assessments.[1,27] For children being adopted from foster care, equal emphasis should be placed on review of the medical history and the physical examination of the child.[1,19]

With international placements, medical history may be sparse or inaccurate. The evaluation of a child who has been adopted internationally will depend, to a large degree, on a complete physical examination and comprehensive laboratory screening based on environmental, nutritional, ethnic, and infectious disease risks.[8,28] Pediatricians should take advantage of current literature that specifically addresses issues that may be prevalent for a potential health risk secondary to the child's countries of origin.[17,28,29]

Initial Physical Examination

The initial physical examination, as noted in Table 2, should be comprehensive, with particular attention to systems that have been found to be more "at risk" for adopted children.[1,5,30,31] Care should be used when approaching the newly adopted child, particularly for internationally

TABLE 2 Components of the Comprehensive Physical Examination Pertinent to Adoption

- Vital signs (temperature, pulse, respiratory rate, blood pressure)
- Growth points, including length or height, weight, head circumference (on all children). Data should be plotted on World Health Organization growth charts, along with comparison with any measurements previously obtained. Body mass index should be calculated and plotted.
- Complete physical examination, with emphasis on the following areas:
  - Skin examination
    - Identify infectious diseases, rashes, or infestations, including scabies, lice, and impetigo
    - Identify and document any congenital skin abnormalities, including hemangiomas, nevi, and blue macules of infancy (usually seen in children of Asian, African, or Hispanic ethnicity).
    - Identify and document bruises or scars that may have resulted from previous abuse or previous immunization.
  - Careful genitalia examination (including the anus) should be performed to identify any abnormality suspicious for prior sexual abuse or genital cutting.
    - Testing for sexually transmitted diseases should be performed with any suspicion of abuse.
    - Testing for sexually transmitted diseases should be performed if sexually active.
  - Neurologic examination, with emphasis on developmental and neurologic abnormalities.

adopted children. The child, who may be new to the country, may have never experienced a comprehensive examination and may become anxious. For older international adoptees, it is often helpful to have a translator present to explain what is happening. For all children, one needs to go slowly and be sensitive to the child's cues and provide reassurance.

Growth parameters, including height, weight, and head circumference, should be measured accurately for all children. Ethnically oriented growth charts should be used when available, particularly for international adoptees. If possible, previous measurements should be obtained to assess growth over time, because this may provide an objective assessment of the child's nutritional and medical status.[15,21] Attention should be given to the child's general appearance. Any abnormal features that might be suggestive of a genetic disorder, syndromes (such as fetal alcohol syndrome), or congenital defects should be noted, as should any abnormalities of the skin that may lead to a diagnosis of an infectious disease or are suggestive of previous abuse. A thorough but sensitive examination of the genital area should be performed to identify any abnormality suggestive of previous sexual abuse. Ritual genital cutting should be documented. The timing of this examination may need to be adjusted depending on the child. Children who have been traumatized in the past and are new to their adoptive homes may become anxious and overwhelmed. If the relationship with the adoptive parent is still very new, the child may feel helpless without adequate support. As is expected for any new patient, a comprehensive neurologic examination should be performed.

Referral for Diagnostic Testing

For all children, diagnostic studies appropriate for the evaluation of the child's risk factors should be completed (Table 3). Children born outside of the United States should have all tests that were completed in the country of birth repeated according to US recommendations.[15] Previous laboratory testing may not be verifiable because of concerns about accuracy, appropriate reporting and interpretation, and timing of the tests. Recommendations are also available for children who have lived in foster care.[26] For children who lived in a foster home before finalization of adoption, diagnostic studies do not need to be repeated if the physician can review the results of the diagnostic studies, unless there has been additional risk of infectious disease and environmental exposures. Children being adopted shortly after birth should have accurate verification of the biological mother's prenatal laboratory studies, with testing performed on the child if the information is unavailable or if the accuracy of the records is unclear.

Children who previously lived in conditions of significant poverty, in institutional settings, or in other countries are at particular risk of infectious diseases. Recommendations for screening children adopted internationally are available in the current AAP *Red Book*.[17]

Immunizations

Immunization records should be reviewed carefully, particularly with respect to the immunizations given, the dates, intervals between vaccines, and the age of the child at the time the immunizations were given.[7,17,31] Records for children who have lived in several foster homes may be incomplete. Children who were immunized in an institutional setting may have an inadequate immunologic response because of poor storage of vaccines or vaccines used beyond the expiration date.[32] For children with previous immunizations, vaccines may be repeated for most children using an accelerated immunization schedule.[17] As an alternative, antibody titers may be performed to determine serum immunity for major antigens (see Table 4 for recommended antibody titers). This approach is usually more cost-effective for older children.[28,30] If antibody concentrations are to be obtained, it is important to interpret results in light of the dates of the last vaccine doses and possible persistence of maternal antibodies. An

TABLE 3 Diagnostic Testing

- Infectious diseases (for updates on infectious disease screening, please consult the current AAP *Red Book*[17])
  - Hepatitis B surface antigen (HBsAg), hepatitis C antibody (if from country with high prevalence)
  - HIV 1 and 2 serologic testing
  - Syphilis serologic testing
    - Nontreponemal test (RPR, VDRL, or ART)
    - Treponemal test (MHA-TP, FTA-ABS, or TPPA)
    - For newborn infants, acceptable testing includes biological mother's prenatal laboratory test results.
    - For children adopted internationally, all testing done before adoption should be repeated.
    - For children adopted internationally, the aforementioned bloodborne pathogen tests should be repeated after placement in the adoptive home for 6 mo.
    - If sexual abuse is suspected, the child should be tested for gonorrhea, *Chlamydia*, and other sexually transmitted infections. Testing should include any suspected site of abuse, including the mouth and rectum.
  - Tuberculosis
    - PPD should be placed on all at risk newly adopted children, including those with previous BCG immunization before placement with the adoptive family.
    - For all children adopted internationally, testing must be repeated after placement in the adoptive home for 6 mo.
      - Children who are anergic because of chronic malnutrition may have a negative initial PPD. PPD also evaluates children who were exposed to active cases of tuberculosis just before placement.
    - Interpretation of positive test results should be consistent with the exposure history and nutritional status of the child, as per the guidelines in the *Red Book*. Previous BCG immunization before placement should not be considered to be a contraindication to placement of a PPD in any child. A positive PPD should never be assumed to be secondary to the BCG vaccine.
  - Stool pathogens should be screened for any child who previously lived in inadequate housing, another country, or an institution or has diarrhea. Diarrhea need not be present for children to have parasite infections.
    - Ova and parasites: 3 tests for optimal screening (48–72 h between collection of each specimen)
      - If available, antigen testing for *Giardia* and *Cryptosporidia* species should be obtained.
    - Following treatment of stool parasites, repeat stool studies should be performed to ensure eradication of the parasite.
    - Consider stool bacterial culture if diarrhea is present.
- Anemia, metabolic, and nutritional screening
  - Complete blood cell count with red cell indices
    - Routine anemia screening is indicated for all children 6 mo or older, as well as all children adopted internationally.
    - In children with an absolute eosinophil count exceeding 450 cells/mm^3 and negative stool ova and parasite examinations, consider serologic testing for *Strongyloides* and *Schistosoma* species for children from certain regions.[15]
  - Screening for hemoglobinopathies and blood disorders in children of African, Asian, Hispanic, or Mediterranean ethnicities
    - Sickle cell disease
    - Thalassemia
    - G-6-PD deficiency
  - Blood lead concentration for children up to 6 y of age; older ages if indicated (ie, refugees, at-risk cultural practices)
  - Newborn screening panel (young infants)
  - Rickets screening (calcium, phosphorus, alkaline phosphatase) for children who were institutionalized, have growth delay, or had history of poor vitamin D intake or limited sunlight.
    - Most children are easily treated for this with increased calcium in the diet and a daily multivitamin.
- Testing does not need to be repeated for children adopted from the US foster care system who previously had laboratory studies consistent with the recommendations from the AAP

ART, automated reagin test; BCG, bacille Calmette-Guérin; FTA-ABS, fluorescent treponemal antibody absorption; G-6-PD, glucose-6-phosphate dehydrogenase; MHA-TP, microhemagglutination *Treponema pallidum*; PPD, purified protein derivative; RPR indicates rapid plasma reagin; TPPA, *Treponema pallidum* particle agglutination; VDRL, Venereal Disease Research Laboratory.

acceptable alternative when doubt exists is to reimmunize the child.

Chronic Health Concerns

During the health assessment of an adopted child, health concerns not previously diagnosed may be identified. Following a review of any previous medical testing, it is appropriate to make referrals to pediatric medical subspecialists. The pediatrician should play a key role in coordinating the health care management of adopted children with special health care needs. Although referral is important, one may take into consideration that the child is adapting to a new home, and parents are adapting to the child. Minimizing the number of referrals or at least planning them carefully is critical to ensure successful adjustment and to encourage the family to establish a medical home for ongoing continuity of care.[33]

Hearing and Vision Screening

Hearing and vision screening of children is recommended (Table 5). A child adopted in the newborn period should have an examination of his or her hearing if not performed previously. In many states, routine hearing screenings are performed for all newborn infants. These results should be documented and made a part of the child's permanent medical record. Even if tested in the newborn period, a hearing evaluation should be obtained for any child with a history of recurrent otitis media or developmental delays, including speech delay.[26,34,35]

TABLE 4 Evaluation and Administration of Immunization Status of Adopted Children

- Infectious diseases (for updates on infectious disease screening, please consult the AAP *Red Book*[17])
  - Hepatitis B
    - Test for HBsAb; if negative, give age-appropriate immunization
  - Diphtheria, pertussis, and tetanus toxoids
    - Immunize as appropriate for age. Serologic testing for antitoxoid antibodies 4 wk after dose 1 if severe local reaction.
    - If previously received ≥3 doses, serologic testing for antitoxoid antibody to diphtheria and tetanus toxins before administrating additional doses or administer a single dose of diphtheria and tetanus-containing vaccine, followed by serologic testing 1 mo later for antitoxoid antibody.
  - *Haemophilus influenza* type b (Hib)
    - Age-appropriate immunization
    - If >12 mo of age, serologic testing for Hib immunoglobulin G (IgG) is available
  - Pertussis
    - There is no serologic test routinely available, but may use antibodies to diphtheria or tetanus as a marker that vaccine was previously given.
  - Poliovirus
    - Immunize with inactivated poliovirus vaccine (IPV) per routine schedule
    - An alternative to vaccination would be to perform serologic testing for neutralizing antibody to poliovirus types 1, 2, and 3 or give a single dose of IPV, followed by serologic testing.
  - Measles-Mumps-Rubella (MMR)
    - Immunize with MMR or obtain measles antibody concentration. If positive, give MMR vaccine to protect against mumps and rubella.
    - An alternative would be to perform serologic testing for IgG antibody to vaccine viruses, indicated by the immunization record.
  - Varicella
    - Give age-appropriate immunization if there is not a reliable history of previous disease or serologic evidence of disease by varicella antibody.
  - Pneumococcal
    - Give age-appropriate immunization.
    - If >12 mo of age, serologic testing for IgG for serotypes 7-14

TABLE 5 Other Screening Evaluations

- Hearing
  - Validate newborn screening when available
  - Screen all children if possible, particularly those with risk factors for hearing loss as well as developmental (speech) delays
- Vision
  - Eye examination as appropriate for age
  - Screening for refraction error as of age 3
  - Funduscopic examination for children with birth wt <1500 g
- Dental
  - Referral to dentist for all children 12 mo or older
  - Earlier referral if evidence of dental caries or abuse via the mouth
- Developmental screening/assessment/interventions
  - Timely identification of developmental delays is strongly recommended
  - Risk factors include prematurity, illegal drug and/or alcohol exposure, poor prenatal care, institutionalization
    - Formal referral for all children adopted in the newborn period or beyond with risk factors as listed or other concerns
    - Referral for all children adopted beyond the newborn period with risk factors or concerns about development when appropriate.
    - For children adopted internationally, a speech evaluation within a few weeks of arrival home by a speech therapist fluent in the child's native language is optimal to help reveal gaps in articulation and language processing skills
  - Referrals may be made to the early intervention program for children birth through 35 mo of age
  - Referrals through the school system for children 36 mo and older with establishment of an Individualized Educational Plan (IEP) when appropriate
  - Referral for speech/language, occupational, and physical therapy when indicated
  - Children adopted internationally should be placed in an educational setting with flexible placement based on the child's developmental profile

All children should have an eye examination. Newborn infants should have careful documentation of the red reflex. A funduscopic examination of dilated eyes should be performed by an ophthalmologist for all children with a birth weight <1500 g.[36] Older children should have examination for strabismus and for abnormalities of the fundus, eyelids, and extraocular muscles. Vision screening should be performed for all children 3 years and older.[37–39]

Dental

Any previous dental diagnoses should also be noted, with appropriate referrals to dental specialists. Dental professionals should be informed about previous medical illnesses and malnutrition, as well as periods in which the child lived in an area of the world with no fluoride in the diet. A dental evaluation, as recommended by the AAP[37,39] should be performed for all children 12 months or older, as well as younger children with evidence of dental caries, baby bottle tooth decay, or historical risk factors, including abuse via the mouth (Table 5).

Age Determination

For some international adoptees, questions may arise with respect to the child's accurate date of birth. For children younger than 1 year, a difference of weeks or a few months will not be critical in the long term.[18,31] For older children, age determination may be more important, especially with respect to placement in school and eligibility for special education services.[18,31] There are no accurate or reliable tests for age determination. Malnutrition and deprivation may affect assessments using standard measurements, including radiographic bone age and dental eruption. Onset of puberty may be advanced as a child's nutritional status rapidly improves. It is usually best to delay changing a birth date until at least 12 months after adoption to allow for catch-up growth, as well as prolonged observation of a child's physical and emotional development.[28,31]

Developmental Screening

Developmental screening should be performed using validated screening tools; for the internationally adopted child, it may be a very complicated issue (Table 5). Validated screening tools performed shortly after arrival often may be difficult to interpret. The child usually faces a language barrier, and his or her exposure to the types of materials used for testing may be limited. For these children, early scores may not be predictive of later functioning, as seen in studies by Rutter et al.[40] Several studies have demonstrated significant developmental delays in children as they enter foster care, particularly in speech and language.[2,5,41–43] Likewise, children adopted internationally nearly always demonstrate delays in at least one area of development, with nearly half of the children having global delays.[13,44–46] Children adopted internationally may demonstrate delays in expressive and receptive language that are not solely related to acquisition of a new language.[13,15,39,47] Although "catch-up" development does occur, studies have shown that many children are at increased risk of long-term consequences of developmental delay, depending on the age of adoption and the length of time spent in an institutional setting.[40,46]

Mental Health Review

Children adopted from foster care and children adopted from institutions are at an increased risk of mental health disorders, including socioemotional problems.[4,46] Preplacement factors such as prenatal drug and alcohol exposure, prolonged institutionalization, multiple placements, and previous abuse and neglect contribute significantly to the emotional problems of these children.[27,40,46] When available, pediatricians should take into consideration any history of mental health diagnoses in members of the birth family, watching a child carefully with the use of validated screening tests, such as the Pediatric Symptom Checklist,[48] Brief Infant-Toddler Social Emotional Assessment,[49] or Ages and Stages Questionnaire: Social-Emotional,[50] that can be performed in the pediatric office. Appropriate referrals should be made when such a risk presents itself. Although referrals should be performed at the time of placement for children with a history of abuse or neglect, screening for mental health disorders should take place at all medical visits, particularly at the time of regular health assessments (refer to Table 6).

Issues of Adjustment

Adjustment issues should be addressed at the time of placement into the home. Children may be withdrawn, have temper tantrums, be aggressive or defiant, cry inconsolably, or even have autisticlike behavior as they undergo changes in their family placement.[12] Some children may regress in previously obtained skills. Older, internationally adopted children will likely

TABLE 6 Behavioral and Mental Health Recommendations

- Review behavior, including past and present concerns
  - Adjustment
  - Fostering of positive relationships
  - Aggressive behavior
  - Hyperactive
  - Impulsivity
  - Internalizing behaviors (withdrawal, anxiety)
  - Sleep issues
  - Feeding issues, including overeating or hoarding food
  - Enuresis
- Document psychiatric medications used currently or in the past
- Document any past psychiatric hospitalizations
- Previous violent behavior or animal cruelty
- Sexualizing behaviors
  - Sexual promiscuity or acting out
  - Excessive or inappropriate masturbation
- Substance abuse
  - Tobacco, alcohol, illicit substances
- Suicide
  - Suicide ideology
  - Previous suicide attempts
- Children need to be monitored for issues related to loss and grief, attachment disturbances, posttraumatic stress disorder
  - Children may not admit to previous abuse or neglect until they are secure in an adoptive home
  - Even children placed as newborn infants may have issues related to their history of adoption (ie, identity development) that do not necessarily rise to the level of mental health issues

encounter frustrating language barriers with their adoptive family.[12,15] Even if transitions into an adoptive home are gradual, most children experience grief with the change in their caregivers, peers, and home environment.[12,51] Sleep problems are also common.[12,51] Difficulties in timing, location, duration, and quality of sleep are typical.[12] Feeding problems may present after adoption. Feeding issues may include overeating, hoarding, or food refusal.[12] Pediatricians need to counsel families about potential adjustment issues and encourage them to look for cues that the child may be overwhelmed and help them to develop strategies to promote strong, healthy attachments within the family unit.[52]

Kinship-Specific Issues

Children placed with kin should also receive the same comprehensive evaluation as those living in nonrelative placements. This recommendation applies even if the child has had no interruption in the child's medical home before or after placement. Studies have demonstrated that the incidence of chronic medical problems and mental health concerns in children living in kin foster care are similar to those of children living in nonrelative foster care.[53–55]

Role of Adoption Medical Specialists

Adoption and foster care medicine is an evolving subspecialty within the field of pediatrics. The AAP Section on Adoption and Foster Care provides a mechanism for obtaining information related to enhancing further training for physicians who care for children who have been adopted.

Financial Considerations

The comprehensive assessment of a newly adopted child requires extensive physician time and commitment. Services can be reimbursed on the basis of type of services provided, time spent, and complexity of care.[56] Services such as the preplacement consultation may not be covered by most insurance carriers, but the pediatrician should advise the adoptive parent to seek information from the parent's employer about benefits covered through an adoption subsidy plan or flexible-spending account. Children adopted through the foster care system may have continuation of their Medicaid benefits even after the adoption is finalized. Finally, families may be eligible for the federal adoption tax credit to offset some of the adoption-related costs.

CONCLUSIONS

Children placed for adoption are in need of a comprehensive health evaluation to fully address all of their health and developmental needs. This is best accomplished with the establishment of a medical home for these children. The comprehensive evaluation should include a review of the child's medical history, complete physical examination, and results of necessary diagnostic testing. Important consideration should be given to risks in the child's past, with full attention to infectious diseases and environmental, nutritional, developmental, and mental health issues. Pediatricians play an important role in working with families in identification of children's needs and providing emotional support to help families through the adoption process. Ongoing awareness of the adopted child's history through routine follow-up visits will enable the pediatrician to identify other health issues that may develop and assist families in accessing resources that will help them in the long term.

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A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States

Recommendations of the Advisory Committee on Immunization Practices (ACIP) Part 1: Immunization of Infants, Children, and Adolescents

INSIDE: Continuing Education Examination

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

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CONTENTS

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A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States

Recommendations of the Advisory Committee on Immunization Practices (ACIP) Part 1: Immunization of Infants, Children, and Adolescents

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Summary

This report is the first of a two-part statement from the Advisory Committee on Immunization Practices (ACIP) that updates the strategy to eliminate hepatitis B virus (HBV) transmission in the United States. The report provides updated recommendations to improve prevention of perinatal and early childhood HBV transmission, including implementation of universal infant vaccination beginning at birth, and to increase vaccine coverage among previously unvaccinated children and adolescents. Strategies to enhance implementation of the recommendations include 1) establishing standing orders for administration of hepatitis B vaccination beginning at birth; 2) instituting delivery hospital policies and procedures and case management programs to improve identification of and administration of immunoprophylaxis to infants born to mothers who are hepatitis B surface antigen (HBsAg) positive and to mothers with unknown HBsAg status at the time of delivery; and 3) implementing vaccination record reviews for all children aged 11–12 years and children and adolescents aged <19 years who were born in countries with intermediate and high levels of HBV endemicity, adopting hepatitis B vaccine requirements for school entry, and integrating hepatitis B vaccination services into settings that serve adolescents. The second part of the ACIP statement, which will include updated recommendations and strategies to increase hepatitis B vaccination of adults, will be published separately.

Strategy to Eliminate Hepatitis B Virus Transmission

Hepatitis B virus (HBV) is a bloodborne and sexually transmitted virus. Rates of new infection and acute disease are highest among adults, but chronic infection is more likely to occur in persons infected as infants or young children. Before hepatitis B vaccination programs became routine in the United States, an estimated 30%–40% of chronic infections are believed to have resulted from perinatal or early childhood transmission, even though <10% of reported cases of hepatitis B occurred in children aged <10 years (*1*). Chronically infected persons are at increased lifetime risk for cirrhosis and hepatocellular carcinoma (HCC) and also serve as the main reservoir for continued HBV transmission.

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Hepatitis B vaccination is the most effective measure to prevent HBV infection and its consequences. Since they were first issued in 1982, recommendations for hepatitis B vaccination have evolved into a comprehensive strategy to eliminate HBV transmission in the United States (*2–6*) (Box 1). A primary focus of this strategy is universal vaccination of infants to prevent early childhood HBV infection and to eventually protect adolescents and adults from infection. Other components include routine screening of all pregnant women for hepatitis B surface antigen (HBsAg) and postexposure immunoprophylaxis of infants born to HBsAg-positive women, vaccination of children and adolescents who were not previously vaccinated, and vaccination of unvaccinated adults at increased risk for infection.

To date, the immunization strategy has been implemented with considerable success. Recent estimates indicate that >95% of pregnant women are tested for HBsAg, and case management has been effective in ensuring high levels of initiation and completion of postexposure immunoprophylaxis among identified infants born to HBsAg-positive women (*7*). Hepatitis B vaccine has been successfully integrated into the childhood vaccine schedule, and infant vaccine coverage levels are now equivalent to those of other vaccines in the childhood schedule. During 1990–2004, incidence of acute hepatitis B

BOX 1. Immunization strategy to eliminate transmission of hepatitis B virus (HBV) infection in the United States

- Universal vaccination of infants beginning at birth
- Prevention of perinatal HBV infection through
  - routine screening of all pregnant women for hepatitis B surface antigen (HBsAg), and
  - immunoprophylaxis of infants born to HBsAg-positive women and infants born to women with unknown HBsAg status
- Routine vaccination of previously unvaccinated children and adolescents
- Vaccination of previously unvaccinated adults at increased risk for infection

in the United States declined 75%. The greatest decline (94%) occurred among children and adolescents, coincident with an increase in hepatitis B vaccine coverage. As of 2004, among U.S. children aged 19–35 months, >92% had been fully vaccinated with 3 doses of hepatitis B vaccine (*8*). This success can be attributed in part to the established infrastructure for vaccine delivery to children and to federal support for perinatal hepatitis B prevention programs.

Vaccine coverage among adolescents has also increased substantially. Preliminary data demonstrate that 50%–60% of adolescents aged 13–15 years have records indicating vaccination (with 3 doses) against hepatitis B (CDC, unpublished data, 2003). As of November 2005, a total of 34 states require vaccination for middle-school entry (*9*). Certain programs provide hepatitis B vaccine to youth who engage in behaviors that place them at high risk for HBV infection (i.e., injection-drug use, having more than one sex partner, and male sexual activity with other males), and adolescent hepatitis B vaccination is included as a Health Plan Employer Data Information Set (HEDIS) measure (*10*).

Despite these successes, challenges remain. Even with improvements in the management of pregnant women, only approximately 50% of expected births to HBsAg-positive women are identified (on the basis of application of racial/ethnic-specific HBsAg prevalence estimates to U.S. natality data) for case management, which maximizes timely delivery of postexposure immunoprophylaxis (*11*; CDC, unpublished data, 2004). The need for proper management of women without prenatal care, including HBsAg testing at the time of admission for delivery and administration of the first dose of vaccine to infants <12 hours of birth, is underscored by the higher prevalence of HBsAg seropositivity among these women than among women who are screened prenatally (*12*). Even when maternal HBsAg testing does occur, certain infants of HBsAg-positive mothers do not receive postexposure immunoprophylaxis because of testing errors and lapses in reporting of test results (*13*), and infants of women with unknown HBsAg status at the time of delivery often do not receive a birth dose of vaccine (*14*). Birth dose coverage in 2004 was only 46% (National Immunization Survey, unpublished data, 2004), and coverage has not returned to levels from before July 1999 (54%), when recommendations were made to temporarily suspend administration of hepatitis B vaccines at birth until vaccines that do not contain thimerosal as a preservative became available (*15*). Among adolescents, efforts to prevent HBV transmission are hampered by the low rate of health-care visits in this age group compared with that of young children and the frequency of initiation of high-risk behaviors.

To address these remaining challenges and accelerate progress toward elimination of HBV transmission in the United States, the ACIP has updated the hepatitis B immunization recommendations for infants, children, and adolescents and supplemented the recommendations with strategies for implementation. The recommendations and implementation strategies address prevention of perinatal and early childhood transmission and routine vaccination of children and adolescents. A main focus is on universal infant vaccination beginning at birth, which provides a "safety net" for prevention of perinatal infection, prevents early childhood infections, facilitates implementation of universal vaccination recommendations, and prevents infections in adolescents and adults. The second part of the ACIP statement, which includes updated recommendations and implementation strategies to increase hepatitis B vaccination among unvaccinated adults, will be published separately (*16*).

Major Updates to the Recommendations

This report provides updated recommendations and approaches to address challenges in implementing the strategy to eliminate HBV transmission in the United States. These include the following measures:

- **Improve prevention of perinatal and early childhood HBV transmission.** Implement delivery hospital policies and procedures, case-management programs, and laws and regulations to improve identification of infants born to HBsAg-positive mothers and to mothers with unknown HBsAg status at the time of delivery, ensure administration of appropriate postexposure immunoprophylaxis to these infants beginning at birth, and administer a birth dose of hepatitis B vaccine to medically stable infants who weigh ≥2,000 g and who are born to HBsAg-negative mothers.

- **Improve vaccine coverage of children and adolescents who were not previously vaccinated.** Implement immunization record reviews for all children aged 11–12 years and children and adolescents aged <19 years who were born in countries in which HBV endemicity is high or intermediate (Figure 1 and Box 2); adopt hepatitis B vaccine requirements for school entry; and vaccinate all unvaccinated adolescents in settings that provide health-care services to persons in this age group.

Background

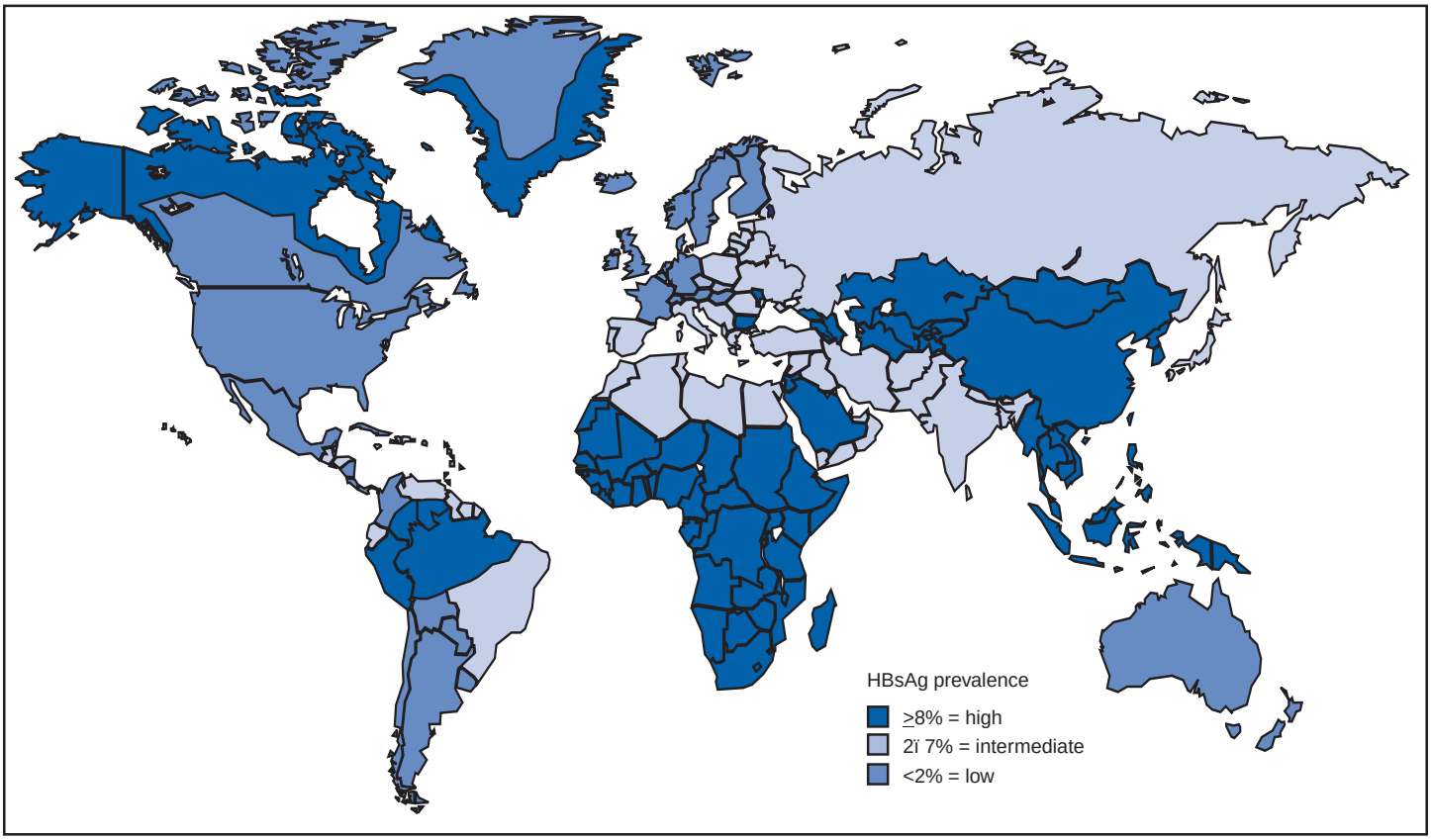
Clinical Features and Natural History of HBV Infection

HBV is a 42-nm DNA virus classified in the *Hepadnaviridae* family. The liver is the primary site of HBV replication. After a susceptible person is exposed, the virus enters the liver via the bloodstream; no evidence exists indicating that the virus replicates at mucosal surfaces. HBV infection can produce either asymptomatic or symptomatic infection. The average incubation period is 90 days (range: 60–150 days) from exposure to onset of jaundice and 60 days (range: 40–90 days) from exposure to onset of abnormal serum alanine aminotransferase (ALT) levels (*17,18*).

The onset of acute disease is usually insidious. Infants and young children (aged <10 years) are typically asymptomatic (*19*). When present, clinical symptoms and signs might include anorexia, malaise, nausea, vomiting, abdominal pain, and jaundice. Extrahepatic manifestations of disease (e.g., skin rashes, arthralgias, and arthritis) also can occur (*20*). The fatality rate among persons with reported acute hepatitis B is 0.5%–1.5%, with highest rates in adults aged >60 years (*21*).

Although the consequences of acute hepatitis B can be severe, the majority of serious sequelae associated with HBV disease occur in persons who are chronically infected. Persons with chronic infection also serve as the major reservoir for continued HBV transmission. Chronic infection occurs in approximately 90% of infected infants, 30% of infected children aged <5 years, and <5% of infected persons aged ≥5 years, with continuing viral replication in the liver and persistent viremia (*19,22–24*). Primary infections also become chronic more fre-

FIGURE 1. Geographic distribution of chronic hepatitis B virus (HBV) infection, 2005*



* For multiple countries, estimates of prevalence of hepatitis B surface antigen (HBsAg), a marker of chronic HBV infection, are based on limited data and might not reflect current prevalence in countries that have implemented routine childhood hepatitis B vaccination. In addition, HBsAg prevalence rates might vary within countries by subpopulation and locality.

BOX 2. Geographic areas with intermediate* and high† hepatitis B virus endemicity

Africa: all countries
South Asia: all countries except Sri Lanka
Western Pacific: all countries and territories except Australia and New Zealand
Middle East: all countries except Cyprus
Eastern Europe: all countries except Hungary
Newly Independent States of the former Soviet Union: all countries
Western Europe: Greece, Italy, Malta, Portugal, and Spain
North America: Alaska Natives and indigenous populations of Northern Canada and Greenland
Central America: Belize, Guatemala, Honduras, and Panama
South America: Argentina, Bolivia, Brazil, Ecuador, Guyana, Suriname, Venezuela, and the Amazonian areas of Colombia and Peru
Caribbean: Antigua and Barbuda, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Puerto Rico, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenadines, Trinidad and Tobago, and Turcs and Caicos

* Hepatitis B surface antigen (HBsAg) prevalence of 2%–7%.
† HBsAg prevalence of ≥8%.

quently in immunosuppressed persons (e.g., hemodialysis patients and persons with human immunodeficiency virus [HIV] infection) (*23,25,26*). On the basis of data from follow-up studies of persons infected with HBV as infants or young children, approximately 25% of those with chronic infection die prematurely from cirrhosis or liver cancer; the majority remain asymptomatic until onset of cirrhosis or end-stage liver disease (*27–29*).

No specific treatment exists for acute hepatitis B. Persons who have chronic HBV infection require medical evaluation and regular monitoring (*30,31*). Therapeutic agents approved by the Food and Drug Administration (FDA) for treatment of chronic hepatitis B can achieve sustained suppression of HBV replication and remission of liver disease in certain persons (*31*). Periodic screening with alfa fetoprotein or imaging studies has been demonstrated to enhance early detection of HCC (*31*). Chronically infected persons with HCC have been reported to have experienced long-term survival after resection or ablation of small HCCs, and persons who were screened had a substantial survival advantage compared with historic controls (*31*).

Reinfection or reactivation of latent HBV infection has been reported among certain groups of immunosuppressed persons, including renal transplant recipients, HIV-infected patients, bone marrow transplant recipients, and patients receiving chemotherapy (*32–35*). The frequency with which this phenomenon occurs is unknown.

Interpretation of Serologic Markers of HBV Infection

The antigens and antibodies associated with HBV infection include HBsAg and antibody to HBsAg (anti-HBs), hepatitis B core antigen (HBcAg) and antibody to HBcAg (anti-HBc), and hepatitis B e antigen (HBeAg) and antibody to HBeAg (anti-HBe). At least one serologic marker is present during the different phases of HBV infection (Table 1) (*18,36*). Serologic assays are commercially available for all markers except HBcAg because no free HBcAg circulates in blood.

The presence of a confirmed HBsAg result is indicative of ongoing HBV infection. All HBsAg-positive persons should be considered infectious. In newly infected persons, HBsAg is the only serologic marker detected during the first 3–5 weeks after infection, and it persists for variable periods at very low levels. The average time from exposure to detection of HBsAg is 30 days (range: 6–60 days) (*17,18*). Highly sensitive single-

TABLE 1. Typical interpretation of serologic test results for hepatitis B virus infection

Serologic marker				
HBsAg*	Total anti-HBc[À]	IgM[Ä] anti-HBc	Anti-HBs[Æ]	Interpretation
ï **	ï	ï	ï	Never infected
+[ÀÀÄÄ]	ï	ï	ï	Early acute infection; transient (up to 18 days) after vaccination
+	+	+	ï	Acute infection
ï	+	+	ï	Acute resolving infection
ï	+	ï	+	Recovered from past infection and immune
+	+	ï	ï	Chronic infection
ï	+	ï	ï	False positive (i.e., susceptible); past infection; ñlow-levelòchronic infection;[ÆÆ]passive transfer to infant born to HBsAg-positive mother
ï	ï	ï	+	Immune if concentration is ≥10 mIU/mL,*** passive transfer after hepatitis B immune globulin administration

* Hepatitis B surface antigen.
[À] Antibody to hepatitis B core antigen.
[Ä] Immunoglobulin M.
[Æ]Antibody to HBsAg.
** Negative test result.
[ÀÀ] Positive test result.
[ÄÄ] To ensure that an HBsAg-positive test result is not a false positive, samples with repeatedly reactive HBsAg results should be tested with a licensed (and, if appropriate, neutralizing confirmatory) test.
[ÆÆ]Persons positive for only anti-HBc are unlikely to be infectious except under circumstances in which they are the source for direct percutaneous exposure of susceptible recipients to large quantities of virus (e.g., blood transfusion or organ transplant).
*** Milli-International Units per milliliter.

sample nucleic acid tests can detect HBV DNA in the serum of an infected person 10–20 days before detection of HBsAg (*37*). Transient HBsAg positivity has been reported for up to 18 days after vaccination and is clinically insignificant (*38,39*).

Anti-HBc appears at the onset of symptoms or liver test abnormalities in acute HBV infection and persists for life. Acute or recently acquired infection can be distinguished by the presence of the IgM class of anti-HBc, which is detected at the onset of acute hepatitis B and persists for up to 6 months if the disease resolves. In patients who develop chronic hepatitis B, IgM anti-HBc can persist at low levels during viral replication and can result in positive tests for IgM anti-HBc (*40*). In addition, false-positive IgM anti-HBc test results can occur. Because the positive predictive value is low in asymptomatic persons, for diagnosis of acute hepatitis B, testing for IgM anti-HBc should be limited to persons with clinical evidence of acute hepatitis or an epidemiologic link to a case.

In persons who recover from HBV infection, HBsAg is eliminated from the blood, usually within 3–4 months, and anti-HBs develops during convalescence. The presence of anti-HBs typically indicates immunity from HBV infection. Infection or immunization with one genotype of HBV confers immunity to all genotypes. In addition, anti-HBs can be detected for several months after hepatitis B immune globulin (HBIG) administration. The majority of persons who recover from natural infection will be positive for both anti-HBs and anti-HBc, whereas persons who respond to hepatitis B vaccine have only anti-HBs. In persons who become chronically infected, HBsAg and anti-HBc persist, typically for life. HBsAg will become undetectable in approximately 0.5%–2% of chronically infected persons yearly, and anti-HBs will occur in the majority of these persons (*41–44*).

In certain persons, the only HBV serologic marker detected in serum is anti-HBc. Isolated anti-HBc can occur after HBV infection among persons who have recovered but whose anti-HBs levels have waned or among persons in whom anti-HBs failed to occur. Persons in the latter category include those with circulating HBsAg levels not detectable by commercial assays. These persons are unlikely to be infectious except under circumstances in which they are the source for direct percutaneous exposure of susceptible recipients to substantial quantities of virus (e.g., through blood transfusion or following liver transplantation) (*45*). HBV DNA has been detected in the blood of <5% of persons with isolated anti-HBc (*46*). Typically, the frequency of isolated anti-HBc relates directly to the prevalence of HBV infection in the population. In populations with a high prevalence of HBV infection, isolated anti-HBc likely indicates previous infection, with loss of anti-HBs. For persons in populations with a low prevalence of HBV infection, an isolated anti-HBc result often represents a false-positive reaction. The majority of these persons have a primary anti-HBs response after a 3-dose series of hepatitis B vaccine (*47,48*). Infants who are born to HBsAg-positive mothers and who do not become infected might have detectable anti-HBc for ≤24 months after birth from passively transferred maternal antibody.

HBeAg can be detected in the serum of persons with acute or chronic HBV infection. The presence of HBeAg correlates with viral replication and high levels of virus (i.e., high infectivity) (*49,50*). Anti-HBe correlates with the loss of replicating virus and with lower levels of virus, although reversion to HBeAg positivity has been observed (*44*).

Epidemiology of HBV Infection

Transmission

HBV is transmitted by percutaneous (i.e., puncture through the skin) or mucosal (i.e., direct contact with mucous membranes) exposure to infectious blood or to body fluids that contain blood. All HBsAg-positive persons are infectious, but those who are also HBeAg positive are more infectious because their blood contains high titers of HBV (typically 10^7–10^9 virions/mL) (*49,50*). Although HBsAg has been detected in multiple body fluids, only serum, semen, and saliva have been demonstrated to be infectious (*51,52*). HBV is comparatively stable in the environment and remains viable for ≥7 days on environmental surfaces at room temperature (*53*). HBV at concentrations of $10^{2–3}$ virions/mL can be present on environmental surfaces in the absence of any visible blood and still cause transmission (*53,54*).

For infants and children, the two primary sources of HBV infection are perinatal transmission from infected mothers and horizontal transmission from infected household contacts. Adolescents are at risk for HBV infection primarily through high-risk sexual activity (i.e., sex with more than one partner and male sexual activity with other males) and injection-drug use (*21*). Transmission of HBV via transfusion of blood and plasma-derived products is rare because of donor screening for HBsAg and viral inactivation procedures.

For a newborn infant whose mother is positive for both HBsAg and HBeAg, the risk for chronic HBV infection is 70%–90% by age 6 months in the absence of postexposure immunoprophylaxis (*55–57*). For infants of women who are HBsAg positive but HBeAg negative, the risk for chronic infection is <10% in the absence of postexposure immunoprophylaxis (*58–60*). Rare cases of fulminant hepatitis B among perinatally infected infants also have been reported (*61,62*). Studies suggest that breastfeeding by an HBsAg-

positive mother does not increase the risk for acquisition of HBV infection in the infant (*63*).

Children who are not infected at birth remain at risk from long-term interpersonal contact with their infected mothers. In one study, 38% of infants who were born to HBsAg-positive mothers and who were not infected perinatally became infected by age 4 years (*64*). In addition, children living with any chronically infected persons are at risk for becoming infected through percutaneous or mucosal exposures to blood or infectious body fluids (e.g., sharing a toothbrush, contact with exudates from dermatologic lesions, contact with HBsAg-contaminated surfaces). HBV transmission rates to susceptible household contacts of chronically infected persons have varied (range: 14%–60%) (*65,66*). High rates of infection also have been reported among unvaccinated long-term residents of institutions for the mentally handicapped (*67,68*), and, in rare instances, person-to-person transmission has been reported in child care settings (*69,70*).

Incidence

During 1990–2004, overall incidence of reported acute hepatitis B declined 75%, from 8.5 to 2.1 per 100,000 population. The most dramatic declines occurred in the cohort of children to whom recommendations for routine infant and adolescent vaccination have applied. Incidence among children aged <12 years and adolescents aged 12–19 years declined 94%, from 1.1 to 0.36 and 6.1 to 2.8 per 100,000 population, respectively (Figure 2). Since implementation of routine childhood immunization, an estimated 6,800 perinatal infections and an additional 18,700 infections during the first 10 years of life have been prevented annually in the United States (*71*).

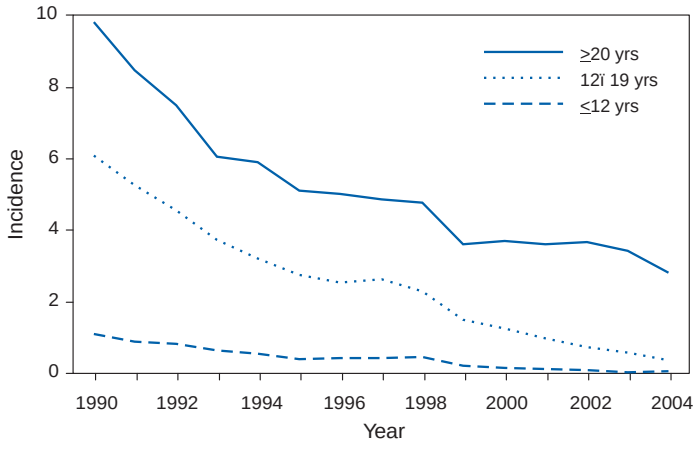
Although infections in infants and children aged <10 years represented <10% of all HBV infections before implementation of childhood immunization programs, childhood infections resulted in an estimated 30%–40% of the chronic HBV infections among persons who acquired their infections in the United States (*1*). In two population-based studies conducted among Asian/Pacific Islander children who were born in the United States before perinatal hepatitis B prevention programs were widely implemented, 61%–66% of the chronic HBV infections occurred in children born to HBsAg-negative mothers (*72,73*). A substantial proportion of these chronic infections would not have been prevented by a selective program of identification and immunization of only infants born to HBsAg-positive mothers.

In addition to declines in incidence among all age groups, racial disparities in hepatitis B incidence among children have been substantially reduced (Figure 3). The reduction of the disparity between Asian/Pacific Islander and other children is consistent with recent observations noting a decline in seroprevalence of HBV infection after successful implementation of routine hepatitis B vaccination among Asians who have recently immigrated to the United States (*74,75*). However, as hepatitis B incidence has declined among U.S.-born children, unvaccinated foreign-born children account for a high proportion of infections. During 2001–2002, of 19 children born after 1991 in whom acute hepatitis B had been verified, eight (42%) were foreign born (*76*).

Prevalence

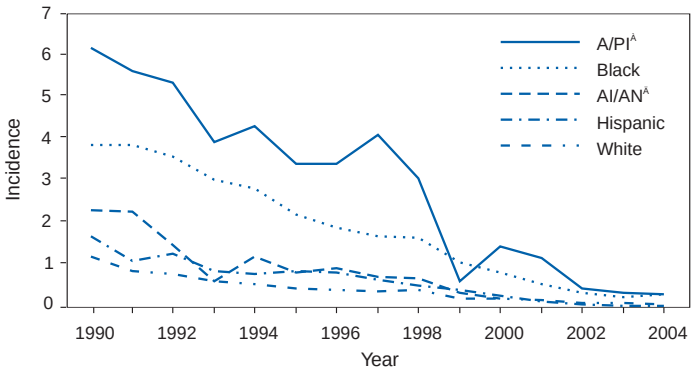
In the U.S. population, the overall age-adjusted prevalence of HBV infection (including persons with chronic infection and those with previous infection) was 4.9% in the third

FIGURE 2. Reported acute hepatitis B incidence,* by age group and year ð United States, 1990ï 2004



* Per 100,000 population.

FIGURE 3. Reported acute hepatitis B incidence* among persons aged <19 years, by race/ethnicity and year ð United States, 1990ï 2004



* Per 100,000 population.
ÅAsian/Pacific Islander.
ÅAmerican Indian/Alaska Native.

National Health and Nutrition Examination Survey (NHANES III, 1988–1994) (*77*). Foreign-born persons (particularly Asian/Pacific Islanders) who have emigrated from countries in which HBV is endemic (Figure 1 and Box 2) contribute disproportionately to the burden of chronic HBV infection in the United States. The prevalence of chronic HBV infection among foreign-born persons immigrating to the United States from Central and Southeast Asia, the Middle East, and Africa varies (range: 5%–15%) and reflects the patterns of HBV infection in the countries and regions of origin for these persons. During 1994–2003, approximately 40,000 immigrants with chronic HBV infection were admitted annually to the United States for permanent residence (*78*; CDC, unpublished data, 2005).

Prophylaxis Against HBV Infection

Hepatitis B Vaccine

HBsAg is the antigen used for hepatitis B vaccination (*79,80*). Vaccine antigen can be purified from the plasma of persons with chronic HBV infection or produced by recombinant DNA technology. Vaccines available in the United States use recombinant DNA technology to express HBsAg in yeast, which is then purified from the cells by biochemical and biophysical separation techniques (*81,82*). Hepatitis B vaccines licensed in the United States are formulated to contain 10–40 μg of HBsAg protein/mL. Since March 2000, hepatitis B vaccines produced for distribution in the United States do not contain thimerosal as a preservative or contain only a trace amount (<1.0 mcg mercury/mL) from the manufacturing process (*83,84*).

Hepatitis B vaccine is available as a single-antigen formulation and also in fixed combination with other vaccines. Two single-antigen vaccines are available in the United States: Recombivax HB® (Merck & Co., Inc., Whitehouse Station, New Jersey) and Engerix-B® (GlaxoSmithKline Biologicals, Rixensart, Belgium). Of the three licensed combination vaccines, one (Twinrix® [GlaxoSmithKline Biologicals, Rixensart, Belgium]) is used for vaccination of adults, and two (Comvax® [Merck & Co., Inc., Whitehouse Station, New Jersey] and Pediarix® [GlaxoSmithKline Biologicals, Rixensart, Belgium]) are used for vaccination of infants and young children. Twinrix contains recombinant HBsAg and inactivated hepatitis A virus. Comvax contains recombinant HBsAg and *Haemophilus influenzae* type b (Hib) polyribosylribitol phosphate conjugated to *Neisseria meningitidis* outer membrane protein complex. Pediarix contains recombinant HBsAg, diphtheria and tetanus toxoids and acellular pertussis adsorbed (DTaP), and inactivated poliovirus (IPV).

HBIG

HBIG provides passively acquired anti-HBs and temporary protection (i.e., 3–6 months) when administered in standard doses. HBIG is typically used as an adjunct to hepatitis B vaccine for postexposure immunoprophylaxis to prevent HBV infection. HBIG administered alone is the primary means of protection after an HBV exposure for nonresponders to hepatitis B vaccination.

HBIG is prepared from the plasma of donors with high concentrations of anti-HBs. The plasma is screened to eliminate donors who are positive for HBsAg, antibodies to HIV and hepatitis C virus (HCV), and HCV RNA. In addition, proper manufacturing techniques for HBIG inactivate viruses (e.g., HBV, HCV, and HIV) from the final product (*85,86*). No evidence exists that HBV, HCV, or HIV ever has been transmitted by HBIG commercially available in the United States. HBIG that is commercially available in the United States does not contain thimerosal.

Vaccination Schedules and Results of Vaccination

Preexposure Vaccination

Infants and Children

Primary vaccination consists of ≥3 intramuscular doses of hepatitis B vaccine (Table 2). Vaccine schedules for infants and children (Tables 3–5) are determined on the basis of immunogenicity data and the need to integrate hepatitis B vaccine into a harmonized childhood vaccination schedule. Although not all possible schedules for each product have been evaluated in clinical trials, available licensed formulations for both single-antigen vaccines produce high (>95%) levels of seroprotection among infants and children when administered in multiple schedules (*87–91*).

The immunogenicity of the combined hepatitis B-Hib conjugate vaccine (Comvax) and the combined hepatitis B-DTaP-IPV vaccine (Pediarix) is equivalent to that of their individual antigens administered separately. However, these vaccines cannot be administered to infants aged <6 weeks; only single-antigen hepatitis B vaccine may be used for the birth dose. Use of 4-dose hepatitis B vaccine schedules, including schedules with a birth dose, has not increased vaccine reactogenicity (*92,93*). Anti-HBs responses after a 3-dose series of hepatitis B-containing combination vaccines among infants who were previously vaccinated at birth with single-antigen hepatitis B vaccine are comparable to those observed after a 3-dose series of combination vaccine without a birth dose (*93*).

TABLE 2. Recommended doses of currently licensed formulations of hepatitis B vaccine, by age group and vaccine type

	Single-antigen vaccine				Combination vaccine					
	Recombivax HB		Engerix-B		Comvax*		Pediarix[À]		Twinrix[Ä]	
Age group	Dose (õg)[Æ]	Volume (mL)	Dose (õg)[Æ]	Volume (mL)	Dose (õg)[Æ]	Volume (mL)	Dose (õg)[Æ]	Volume (mL)	Dose (õg)[Æ]	Volume (mL)
Infants (<1 yr)	5	0.5	10	0.5	5	0.5	0	0.5	NA**	NA
Children (1ï 10 yrs)	5	0.5	10	0.5	5*	0.5	10[À]	0.5	NA	NA
Adolescents										
11ï 15 yrs	10[ÀÀ]	1.0	NA	NA	NA	NA	NA	NA	NA	NA
11ï 19 yrs	5	0.5	10	0.5	NA	NA	NA	NA	NA	NA
Adults (≥20 yrs)	10	1.0	20	1.0	NA	NA	NA	NA	20[Ä]	1.0
Hemodialysis patients and other immunocompromised persons										
<20 yrs[ÄÄ]	5	0.5	10	0.5	NA	NA	NA	NA	NA	NA
≥20 yrs	40[ÆÆ]	1.0	40***	2.0	NA	NA	NA	NA	NA	NA

* Combined hepatitis Bï *Haemophilus influenzae* type b conjugate vaccine. This vaccine cannot be administered at birth, before age 6 weeks, or after age 71 months.
[À] Combined hepatitis Bï diphtheria, tetanus, and acellular pertussis-inactivated poliovirus vaccine. This vaccine cannot be administered at birth, before age 6 weeks, or at age ≥7 years.
[Ä] Combined hepatitis A and hepatitis B vaccine. This vaccine is recommended for persons aged ≥18 years who are at increased risk for both hepatitis B virus and hepatitis A virus infections.
[Æ] Recombinant hepatitis B surface antigen protein dose.
** Not applicable.
[ÀÀ] Adult formulation administered on a 2-dose schedule.
[ÄÄ] Higher doses might be more immunogenic, but no specific recommendations have been made.
[ÆÆ] Dialysis formulation administered on a 3-dose schedule at age 0, 1, and 6 months.
*** Two 1.0-mL doses administered at one site, on a 4-dose schedule at age 0, 1, 2, and 6 months.

Birth Dose

Hepatitis B vaccine can be administered soon after birth with only minimal decrease in immunogenicity, compared with administration at older ages, and no decrease in protective efficacy (*87*). Administration of a birth dose of hepatitis B vaccine is required for effective postexposure immunoprophylaxis to prevent perinatal HBV infection. Although infants who require postexposure immunoprophylaxis should be identified by maternal HBsAg testing, administering a birth dose to infants even without HBIG serves as a "safety net" to prevent perinatal infection among infants born to HBsAg-positive mothers who are not identified because of errors in maternal HBsAg testing or failures in reporting of test results (*13*). The birth dose also provides early protection to infants at risk for infection after the perinatal period. Administration of a birth dose has been associated with higher rates of on-time completion of the hepatitis B vaccine series (*15,94*). In certain populations, the birth dose has been associated with improved completion rates for all other infant vaccines (*95*), although findings have not been consistent (*15,94*).

Adolescents

Recommended vaccination schedules for adolescents balance available immunogenicity data with the need to achieve compliance with vaccination in this age group (Tables 2 and 5). Both licensed single-antigen hepatitis B vaccines administered intramuscularly at 0, 1, and 6 months produce a >95% sero-protection rate in adolescents. Equivalent seroprotection rates are achieved among adolescents vaccinated at 0, 1–2, and 4 months and 0, 12, and 24 months. The adult (10 µg) dose of Recombivax-HB administered in a 2-dose schedule to children and adolescents aged 11–15 years at 0 and 4–6 months produces antibody levels equivalent to those obtained with the 5-µg dose administered on a 3-dose schedule (*96,97*). However, no data on long-term antibody persistence or protection are available for 2-dose schedules. No combination vaccines containing hepatitis B vaccine antigen are approved for use in adolescents aged 11–17 years.

Nonstandard Vaccine Schedules

No apparent effect on immunogenicity has been documented when minimum spacing of doses is not achieved precisely. Increasing the interval between the first 2 doses has little effect on immunogenicity or final antibody concentration (*98–100*). The third dose confers the maximum level of seroprotection but acts primarily as a booster and appears to provide optimal long-term protection (*101*). Longer intervals between the last 2 doses result in higher final antibody levels but might increase the risk for acquisition of HBV infection among persons who have a delayed response to vaccination. No differences in immunogenicity have been observed when 1 or 2 doses of hepatitis B vaccine produced by one manufacturer are followed by doses from a different manufacturer (*102*).

TABLE 3. Hepatitis B vaccine schedules for newborn infants, by maternal hepatitis B surface antigen (HBsAg) status*

Maternal HBsAg status	Single-antigen vaccine		Single antigen + combination vaccine	
	Dose	Age	Dose	Age
Positive	1[†]	Birth (≤12 hrs)	1[†]	Birth (≤12 hrs)
	HBIG[§]	Birth (≤12 hrs)	HBIG	Birth (≤12 hrs)
	2	1ï 2 mos	2	2 mos
	3[¶]	6 mos	3	4 mos
			4[¶]	6 mos (Pediarix) or 12ï 15 mos (Comvax)
Unknown**	1[†]	Birth (≤12 hrs)	1[†]	Birth (≤12 hrs)
	2	1ï 2 mos	2	2 mos
	3[¶]	6 mos	3	4 mos
			4[¶]	6 mos (Pediarix) or 12ï 15 mos (Comvax)
Negative	1[†,††]	Birth (before discharge)	1[†,††]	Birth (before discharge)
	2	1ï 2 mos	2	2 mos
	3[¶]	6ï 18 mos	3	4 mos
			4[¶]	6 mos (Pediarix) or 12ï 15 mos (Comvax)

* See Table 4 for vaccine schedules for preterm infants weighing <2,000 g.
† Recombivax HB or Engerix-B should be used for the birth dose. Comvax and Pediarix cannot be administered at birth or before age 6 weeks.
§ Hepatitis B immune globulin (0.5 mL) administered intramuscularly in a separate site from vaccine.
¶ The final dose in the vaccine series should not be administered before age 24 weeks (164 days).
** Mothers should have blood drawn and tested for HBsAg as soon as possible after admission for delivery; if the mother is found to be HBsAg positive, the infant should receive HBIG as soon as possible but no later than age 7 days.
†† On a case-by-case basis and only in rare circumstances, the first dose may be delayed until after hospital discharge for an infant who weighs ≥2,000 g and whose mother is HBsAg negative, but only if a physicianõs order to withhold the birth dose and a copy of the motherõs original HBsAg-negative laboratory report are documented in the infantõs medical record.

TABLE 4. Hepatitis B immunization management of preterm infants weighing <2,000 g, by maternal hepatitis B surface antigen (HBsAg) status

Maternal HBsAg status	Recommendation
Positive	Å HBIG* + hepatitis B vaccine (≤12 hrs of birth) Å Continue vaccine series beginning at age 1ï 2 mos according to recommended schedule for infants born to HBsAg-positive mothers (see Table 3). Å Do not count birth dose as part of the vaccine series. Å Test for HBsAg and antibody to HBsAg after completion of the vaccine series at age 9ï 18 mos (i.e., next well-child visit).
Unknown	Å HBIG + hepatitis B vaccine (≤12 hrs of birth) Å Test mother for HBsAg. Å Continue vaccine series beginning at age 1ï 2 mos according to recommended schedule based on the motherõs HBsAg result (see Table 3). Å Do not count birth dose as part of the vaccine series.
Negative	Å Delay first dose of hepatitis B vaccine until age 1 mo or hospital discharge. Å Complete the vaccine series (see Table 3).

* Hepatitis B immune globulin.

Response to Revaccination

A study of infants born to HBsAg-positive mothers who did not respond to a primary vaccine series indicated that all those not infected with HBV responded satisfactorily to a repeat 3-dose revaccination series (*103*). No data suggest that children who have no detectable antibody after 6 doses of vaccine would benefit from additional doses.

Groups Requiring Different Vaccination Doses or Schedules

Preterm infants. Preterm infants weighing <2,000 g at birth have a decreased response to hepatitis B vaccine administered before age 1 month (*104–106*). By age 1 month, medically stable preterm infants, regardless of initial birth weight or gestational age, have a response to vaccination that is comparable to that of full-term infants (*107–110*).

Hemodialysis patients and other immunocompromised persons. Although data concerning the response of pediatric hemodialysis patients to vaccination with standard pediatric doses are lacking, protective levels of antibody occur in 75%–97% of those who receive higher dosages (20-*µ*g) on either the 3- or the 4-dose schedule (*111–114*). Humoral response to hepatitis B vaccination is also reduced in other children and adolescents who are immunocompromised (e.g., hematopoietic stem cell transplant recipients, patients undergoing chemotherapy, and HIV-infected persons) (*115–119*). Modified dosing regimens, including a doubling of the standard antigen dose or administration of additional doses, might increase response rates (*120*). However, data on response to these alternative vaccination schedules are limited (*121*).

Immune Memory

Anti-HBs is the only easily measurable correlate of vaccine-induced protection. Immunocompetent persons who achieve anti-HBs concentrations ≥10 mIU/mL after preexposure vaccination have virtually complete protection against both acute disease and chronic infection even if anti HBs concentrations subsequently decline to <10 mIU/mL (*122–125*). Although immunogenicity is lower among immunocompromised persons, those who achieve and maintain a protective antibody response before exposure to HBV have a high level of protection from infection.

After primary immunization with hepatitis B vaccine, anti-HBs concentrations decline rapidly within the first

TABLE 5. Hepatitis B vaccine schedules for children, adolescents, and adults*

Age	Schedule
Children (1ï 10 yrs)	0, 1, and 6 mosÀ 0, 2, and 4 mosÀ 0, 1, 2, and 12 mosÀÄ
Adolescents (11ï 19 yrs)	0, 1, and 6 mosÀ 0, 1, and 4 mosÀ 0, 2, and 4 mosÀ 0, 12, and 24 mosÀ 0 and 4ï 6 mosÆ* 0, 1, 2, and 12 mosÀÆ
Adults (≥20 yrs)	0, 1, and 6 mos**ÀÀ 0, 1, and 4 mos** 0, 2, and 4 mos** 0, 1, 2, and 12 mosÆ*

* Children, adolescents, and adults may be vaccinated according to any of the schedules indicated, except as noted. Selection of a schedule should consider the need to optimize compliance with vaccination

À Pediatric/adolescent formulation.

ÆA 2-dose schedule of Recombivax-HB adult formulation (10 Õg) is licensed for adolescents aged 11ï 15 years. When scheduled to receive the second dose, adolescents aged >15 years should be switched to a 3-dose series, with doses 2 and 3 consisting of the pediatric formulation administered on an appropriate schedule.

Ä A 4-dose schedule of Engerix B is licensed for all age groups.

** Adult formulation.

ÀÀ Twinrix may be administered to persons aged ≥18 years at 0, 1, and 6 months.

year and more slowly thereafter. Among children who respond to a primary vaccine series with antibody levels ≥10 mIU/mL, 15%–50% have low or undetectable concentrations of anti-HBs (anti-HBs loss) 5–15 years after vaccination (*126–130*). The persistence of detectable anti-HBs after vaccination, in the absence of exposure to HBV, depends on the level of post-vaccination antibody concentration.

Despite declines in anti-HBs to <10 mIU/mL, nearly all vaccinated persons are still protected against HBV infection. The mechanism for continued vaccine-induced protection is thought to be the preservation of immune memory through selective expansion and differentiation of clones of antigen-specific B and T lymphocytes (*131*). Persistence of vaccine-induced immune memory among persons who responded to a primary childhood vaccine series 13–23 years earlier but then had levels of anti-HBs below 10 mIU/mL has been demonstrated by an anamnestic increase in anti-HBs levels in 67%–76% of these persons 2–4 weeks after administration of an additional vaccine dose (*132,133*). Although direct measurement of immune memory is not yet possible, these data indicate that a high proportion of vaccine recipients retain immune memory and would develop an anti-HBs response upon exposure to HBV.

Studies of cohorts of immunocompetent persons vaccinated as children or infants also indicate that, despite anti-HBs loss years after immunization, nearly all vaccinated persons who respond to a primary series remain protected from HBV infection. No clinical cases of hepatitis B have been observed in follow-up studies conducted 15–20 years after vaccination among immunocompetent vaccinated persons with antibody levels ≥10 mIU/mL. Certain studies have documented breakthrough infections (detected by the presence of anti-HBc or HBV DNA) in a limited percentage of vaccinated persons (*130,131*), but these infections are usually transient and asymptomatic; chronic infections have been documented only rarely (*134*). Breakthrough infections resulting in chronic infection have been observed only among vaccinated infants born to HBsAg-positive women.

Limited data are available on the duration of immune memory after hepatitis B vaccination in immunocompromised persons (e.g., HIV-infected patients, dialysis patients, patients undergoing chemotherapy, or hematopoietic stem cell transplant patients). No clinically important HBV infections have been documented among immunocompromised persons who maintain protective levels of anti-HBs. In studies of long-term protection among HIV-infected persons, breakthrough infections occurring after a decline in anti-HBs concentrations to <10 mIU/mL have been transient and asymptomatic (*135*). However, among hemodialysis patients who respond to the vaccine, clinically significant HBV infection has been documented in persons who have not maintained anti-HBs concentrations of ≥10 mIU/mL (*136*).

Postexposure Prophylaxis

Both passive-active postexposure prophylaxis (PEP) with HBIG and hepatitis B vaccine and active PEP with hepatitis B vaccine alone have been demonstrated to be highly effective in preventing transmission after exposure to HBV (*137–140*). HBIG alone has also been demonstrated to be effective in preventing HBV transmission (*141–144*), but with the availability of hepatitis B vaccine, HBIG typically is used as an adjunct to vaccination.

The major determinant of the effectiveness of PEP is early administration of the initial dose of vaccine. The effectiveness of PEP diminishes the longer it is initiated after exposure (*17,145,146*). Studies are limited on the maximum interval after exposure during which PEP is effective, but the interval is unlikely to exceed 7 days for perinatal (*147*) and needlestick (*140–142*) exposures and 14 days for sexual exposures (*122, 138,139,143,144*).

No data are available on the efficacy of HBsAg-containing combination vaccines when used to complete the vaccine series for PEP, but the efficacy of combination vaccines is expected to be similar to that of single-antigen vaccines because the HBsAg component induces a comparable anti-HBs response.

Perinatal HBV Exposure

Passive-active PEP. PEP with hepatitis B vaccine and HBIG administered 12–24 hours after birth, followed by completion of a 3-dose vaccine series, has been demonstrated to be 85%–95% effective in preventing acute and chronic HBV infection in infants born to women who are positive for both HBsAg and HBeAg (*137*). Although clinical trials have evaluated the efficacy of passive-active PEP with hepatitis B vaccine and HBIG administered only within 24 hours of birth, studies of passive immunoprophylaxis have demonstrated that HBIG provided protection when administered as late as 72 hours after exposure. The majority of clinical trials have evaluated the efficacy of passive-active PEP when the second vaccine dose was administered at age 1 month (*137*). Administration of HBIG plus vaccine at birth, 1 month, and 6 months and at birth, 2 months, and 6 months has demonstrated comparable efficacy in prevention of acute and chronic infection among infants born to women who were both HBsAg and HBeAg positive (Cladd E. Stevens, MD, New York Blood Center, personal communication, 1994).

Infants born to HBsAg-positive/HBeAg-negative mothers who receive passive-active PEP with HBIG and hepatitis B vaccine should have the same high degree of protection as infants born to women who are HBsAg positive/HBeAg positive. However, the efficacy of this regimen has not been examined in controlled clinical trials because the low infection rate would require an unattainable sample size.

Active PEP. Active PEP with hepatitis B vaccine alone (i.e., without HBIG) is frequently used in certain remote areas (e.g., Alaska and the Pacific Islands) where implementation of maternal HBsAg testing is difficult because no access exists to a laboratory. In randomized, placebo-controlled clinical trials, administration of hepatitis B vaccine in a 3- or 4-dose schedule without HBIG beginning ≤12 hours after birth has been demonstrated to prevent 70%–95% of perinatal HBV infections among infants born to women who are positive for both HBsAg and HBeAg (*58,148–152*). Population-based studies in areas with a high endemicity of HBV infection have demonstrated that active postexposure vaccination is highly effective in preventing infection when the first dose is administered soon after birth, the second at age 1–2 months, and the third at age 6–8 months (*153–155*).

Vaccine Safety

Hepatitis B vaccines have been demonstrated to be safe when administered to infants, children, adolescents, and adults. Since 1982, an estimated >60 million adolescents and adults and >40 million infants and children have been vaccinated in the United States.

Vaccine Reactogenicity

The most frequently reported side effects among persons receiving hepatitis B vaccine are pain at the injection site (3%–29%) and fever >99.9° F (>37.7° C) (1%–6%) (*156,157*). However, in placebo-controlled studies, these side effects were reported no more frequently among persons receiving hepatitis B vaccine than among persons receiving placebo (*87*). Administration of hepatitis B vaccine soon after birth has not been associated with an increased rate of elevated temperatures or microbiologic evaluations for possible sepsis in the first 21 days of life (*158*).

Adverse Events

A causal association has been established between receipt of hepatitis B vaccine and anaphylaxis (*159*). On the basis of data from the Vaccine Safety Datalink (VSD) project, the estimated incidence of anaphylaxis among children and adolescents who received hepatitis B vaccine is one case per 1.1 million vaccine doses distributed (95% confidence interval = 0.1–3.9) (*160*).

Early postlicensure surveillance of adverse events suggested a possible association between Guillain-Barré syndrome and receipt of the first dose of plasma-derived hepatitis B vaccine among U.S. adults (*161*). However, in a subsequent analysis of Guillain-Barré syndrome cases reported to CDC, FDA, and vaccine manufacturers, among an estimated 2.5 million adults who received ≥1 dose of recombinant hepatitis B vaccine during 1986–1990, the rate of Guillain-Barré syndrome occurring after hepatitis B vaccination did not exceed the background rate among unvaccinated persons (CDC, unpublished data, 1992). A review by persons with clinical expertise concluded that evidence was insufficient to reject or accept a causal association between Guillain-Barré syndrome and hepatitis B vaccination (*159,162*).

Multiple sclerosis (MS) has not been reported after hepatitis B vaccination among children. However, one retrospective case-control study (*163,164*) reported an association between hepatitis B vaccine and MS among adults. Multiple other studies (*165–168*) have demonstrated no association between hepatitis B vaccine and MS. Reviews of these data by panels of persons with clinical expertise have favored rejection of a causal association between hepatitis B vaccination and MS (*169,170*).

Chronic illnesses that have been reported in rare instances after hepatitis B vaccination include chronic fatigue syndrome (*171*), neurologic disorders (e.g., leukoencephalitis, optic neu-

ritis, and transverse myelitis) (*172–174*), rheumatoid arthritis (*175,176*), type 1 diabetes (*177*), and autoimmune disease (*178*). No evidence of a causal association between these conditions or other chronic illnesses and hepatitis B vaccine has been demonstrated (*159,169,170,179–182*).

Reported episodes of alopecia (hair loss) after rechallenge with hepatitis B vaccine suggest that vaccination might, in rare cases, trigger episodes of alopecia (*183*). However, a population-based study determined no statistically significant association between alopecia and hepatitis B vaccine (*184*).

No evidence exists of a causal association between hepatitis B vaccination, including administration of the birth dose, and sudden infant death syndrome (SIDS) or other causes of death during the first year of life (*185–187*). Infant death rates, including rates of SIDS, declined substantially in the United States during the 1990s, coincident with an increase in infant hepatitis B vaccination coverage from <1% to >90% and implementation of efforts to reduce SIDS through infant sleep positioning and separation from other persons in bed (*188*).

The safety of hepatitis B vaccine and other vaccines is assessed continuously through ongoing monitoring of data from VSD, the Vaccine Adverse Events Reporting System (VAERS), and other surveillance systems. Any adverse events after vaccination should be reported to VAERS; report forms and assistance are available from CDC at telephone 1-800-822-7967 or at http://www.vaers.hhs.gov.

Contraindications and Precautions

Hepatitis B vaccination is contraindicated for persons with a history of hypersensitivity to yeast or to any vaccine component (*92,189–191*). Despite a theoretic risk for allergic reaction to vaccination in persons with allergy to *Saccharomyces cerevisiae* (baker's yeast), no evidence exists that documents adverse reactions after vaccination of persons with a history of yeast allergy.

Persons with a history of serious adverse events (e.g., anaphylaxis) after receipt of hepatitis B vaccine should not receive additional doses. As with other vaccines, vaccination of persons with moderate or severe acute illness, with or without fever, should be deferred until the illness resolves (*192*). Vaccination is not contraindicated in persons with a history of MS, Guillain-Barré syndrome, autoimmune disease (e.g., systemic lupus erythematosis or rheumatoid arthritis), or other chronic diseases.

Pregnancy is not a contraindication to vaccination. Limited data indicate no apparent risk for adverse events to developing fetuses when hepatitis B vaccine is administered to pregnant women (*193*). Current vaccines contain noninfectious HBsAg and should cause no risk to the fetus.

Future Considerations

Implementation of the recommendations and strategies in this document should ultimately lead to the elimination of HBV transmission in the United States. New information will have implications for this effort, and adjustments and changes are expected to occur.

Long-Term Protection and Booster Doses

Studies are needed to assess long-term protection after vaccination and the possible need for booster doses of vaccine. The longest follow-up studies of vaccine protection have been conducted in populations with an initially high endemicity of HBV infection (i.e., ≥8% prevalence of chronic infection) (*130*). Implementation of hepatitis B vaccination programs in populations with a high endemicity of HBV infection has resulted in virtual elimination of new HBV infections by providing vaccine-induced immunity to susceptible persons. In these populations, ongoing exposure of vaccinated persons to persons with chronic HBV infection might complicate future efforts to assess long-term hepatitis B vaccine efficacy. Assessment of efficacy provided by hepatitis B immunization after 15–20 years will require studies among populations that continue to have exposures to HBsAg-positive persons (e.g., communities of immigrants from highly endemic countries, populations of injection-drug users, or health-care workers) and studies among populations with a low prevalence of infection.

Immunization Escape Mutants

Mutations in the S gene of HBV can lead to conformational changes in the *a* determinant of the HBsAg protein, which is the major target for neutralizing anti-HBs. These variants have been detected in humans infected with HBV, and concern has been expressed that these variants might replicate in the presence of vaccine-induced anti-HBs or anti-HBs contained in HBIG (*194,195*). Although no evidence suggests that S gene immunization escape mutants pose a threat to existing programs using hepatitis B vaccines (*196*), further studies and enhanced surveillance to detect the emergence of these variants are high priorities for monitoring the effectiveness of current vaccination strategies.

Recommendations for Hepatitis B Vaccination of Infants, Children, and Adolescents

This section outlines updated ACIP recommendations and associated implementation strategies for hepatitis B vaccina-

tion of infants, children, and adolescents. These recommendations have been summarized (Box 3).

Prevention of Perinatal HBV Infection and Management of Pregnant Women

Recommendations

Prenatal HBsAg Testing

- All pregnant women should be tested routinely for HBsAg during an early prenatal visit (e.g., first trimester) in each pregnancy, even if they have been previously vaccinated or tested.
- Women who were not screened prenatally, those who engage in behaviors that put them at high risk for infection (e.g., injection-drug use, having had more than one sex partner in the previous 6 months or an HBsAg-positive sex partner, evaluation or treatment for a sexually transmitted disease [STD], or recent or current injection-drug use) and those with clinical hepatitis should be tested at the time of admission to the hospital for delivery.
- All laboratories that provide HBsAg testing of pregnant women should use an FDA-licensed or -approved HBsAg test and should perform testing according to the manufacturer's labeling, including testing of initially reactive specimens with a licensed neutralizing confirmatory test. When pregnant women are tested for HBsAg at the time of admission for delivery, shortened testing protocols may be used and initially reactive results reported to expedite administration of immunoprophylaxis to infants.
- Women who are HBsAg positive should be referred to an appropriate case-management program to ensure that their infants receive timely postexposure prophylaxis and follow-up (see Case-Management Programs to Prevent Perinatal HBV Infection). In addition, a copy of the original laboratory report indicating the pregnant woman's HBsAg status should be provided to the hospital where delivery is planned and to the health-care provider who will care for the newborn.
- Women who are HBsAg positive should be provided with or referred for appropriate counseling and medical management (Appendix A). HBsAg-positive pregnant women should receive information concerning hepatitis B that discusses
  - — modes of transmission;
  - — perinatal concerns (e.g., infants born to HBsAg-positive mothers may be breast fed);
  - — prevention of HBV transmission to contacts, including the importance of postexposure prophylaxis for the newborn infant and hepatitis B vaccination for household, sexual, and needle-sharing contacts;
  - — substance abuse treatment, if appropriate; and
  - — medical evaluation and possible treatment of chronic hepatitis B.
- When HBsAg testing of pregnant women is not feasible (i.e., in remote areas without access to a laboratory), all infants should receive hepatitis B vaccine ≤12 hours of birth and should complete the hepatitis B vaccine series according to a recommended schedule for infants born to HBsAg-positive mothers (Tables 2 and 3).

Management of Infants Born to Women Who Are HBsAg Positive

- All infants born to HBsAg-positive women should receive single-antigen hepatitis B vaccine (Table 2) and HBIG

BOX 3. Summary of hepatitis B vaccination recommendations for infants, children, and adolescents

Maternal hepatitis B surface antigen (HBsAg) testing
- All pregnant women should be tested routinely for HBsAg.

Vaccination of infants

At birth
- Infants born to mothers who are HBsAg positive should receive hepatitis B vaccine and hepatitis B immune globulin (HBIG) ≤12 hours of birth.
- Infants born to mothers whose HBsAg status is unknown should receive hepatitis B vaccine ≤12 hours of birth. The mother should have blood drawn as soon as possible to determine her HBsAg status; if she is HBsAg positive, the infant should receive HBIG as soon as possible (no later than age 1 week).
- Full-term infants who are medically stable and weigh ≥2,000 g born to HBsAg-negative mothers should receive single-antigen hepatitis B vaccine before hospital discharge.
- Preterm infants weighing <2,000 g born to HBsAg-negative mothers should receive the first dose of vaccine 1 month after birth or at hospital discharge.

After the birth dose
- All infants should complete the hepatitis B vaccine series with either single-antigen vaccine or combination vaccine, according to a recommended vaccination schedule (see Tables 3 and 4).
- Infants born to HBsAg-positive mothers should be tested for HBsAg and antibody to HBsAg after completion of the hepatitis B vaccine series at age 9–18 months.

Vaccination of children and adolescents
- All unvaccinated children and adolescents aged <19 years should receive the hepatitis B vaccine series.

(0.5 mL) ≤12 hours of birth, administered at different injection sites. The vaccine series should be completed according to a recommended schedule for infants born to HBsAg-positive mothers (Table 3). The final dose in the vaccine series should not be administered before age 24 weeks (164 days).

- For preterm infants weighing <2,000 g, the initial vaccine dose (birth dose) should not be counted as part of the vaccine series because of the potentially reduced immunogenicity of hepatitis B vaccine in these infants; 3 additional doses of vaccine (for a total of 4 doses) should be administered beginning when the infant reaches age 1 month (Tables 3 and 4).
- Postvaccination testing for anti-HBs and HBsAg should be performed after completion of the vaccine series, at age 9–18 months (generally at the next well-child visit). Testing should not be performed before age 9 months to avoid detection of anti-HBs from HBIG administered during infancy and to maximize the likelihood of detecting late HBV infection. Anti-HBc testing of infants is not recommended because passively acquired maternal anti-HBc might be detected in infants born to HBV-infected mothers to age 24 months.
  - — HBsAg-negative infants with anti-HBs levels ≥10 mIU/mL are protected and need no further medical management.
  - — HBsAg-negative infants with anti-HBs levels <10 mIU/mL should be revaccinated with a second 3-dose series and retested 1–2 months after the final dose of vaccine.
  - — Infants who are HBsAg positive should receive appropriate follow-up (Appendix A).
- Infants of HBsAg-positive mothers may be breast fed beginning immediately after birth.
- Although not indicated in the manufacturer's package labeling, HBsAg-containing combination vaccines may be used for infants aged ≥6 weeks born to HBsAg-positive mothers to complete the vaccine series after receipt of a birth dose of single-antigen hepatitis B vaccine and HBIG.

Management of Infants Born to Women with Unknown HBsAg Status

- Women admitted for delivery without documentation of HBsAg test results should have blood drawn and tested as soon as possible after admission.
- While test results are pending, all infants born to women without documentation of HBsAg test results should receive the first dose of single-antigen hepatitis B vaccine (without HBIG) ≤12 hours of birth (Tables 2 and 3).
  - — If the mother is determined to be HBsAg positive, her infant should receive HBIG as soon as possible but no later than age 7 days, and the vaccine series should be completed according to a recommended schedule for infants born to HBsAg-positive mothers (Table 3).
  - — If the mother is determined to be HBsAg negative, the vaccine series should be completed according to a recommended schedule for infants born to HBsAg-negative mothers (Table 3).
  - — If the mother has never been tested to determine her HBsAg status, the vaccine series should be completed according to a recommended schedule for infants born to HBsAg-positive mothers (Table 3). Administration of HBIG is not necessary for these infants.
- Because of the potentially decreased immunogenicity of vaccine in preterm infants weighing <2,000 g, these infants should receive both single-antigen hepatitis B vaccine and HBIG (0.5 mL) if the mother's HBsAg status cannot be determined ≤12 hours of birth. The birth dose of vaccine should not be counted as part of the 3 doses required to complete the vaccine series; 3 additional doses of vaccine (for a total of 4 doses) should be administered according to a recommended schedule on the basis of the mother's HBsAg test result (Table 3).

Vaccination of Pregnant Women

- Pregnant women who are identified as being at risk for HBV infection during pregnancy (e.g., having more than one sex partner during the previous 6 months, been evaluated or treated for an STD, recent or current injection-drug use, or having had an HBsAg-positive sex partner) should be vaccinated.
- Pregnant women at risk for HBV infection during pregnancy should be counseled concerning other methods to prevent HBV infection.

Implementation

Delivery Hospital Policies and Procedures

- All delivery hospitals should implement policies and procedures (Box 4) to ensure 1) identification of infants born to HBsAg-positive mothers and infants born to mothers with unknown HBsAg status (see Prenatal HBsAg Testing), and 2) initiation of immunization for these infants). Such policies and procedures should include the following standing orders:
  - — for all pregnant women, review of HBsAg test results at the time of admission for delivery;
  - — for women who do not have a documented HBsAg test result, HBsAg testing as soon as possible after admission for delivery;

BOX 4. Delivery hospital policies and procedures to prevent perinatal HBV transmission

At time of admission for delivery

- Review hepatitis B surface antigen (HBsAg) status of all pregnant women.
- Record maternal HBsAg test results on both labor and delivery record and on infant's delivery summary sheet.
- Perform HBsAg testing as soon as possible on women who
  - do not have a documented HBsAg test result,
  - were at risk for HBV infection during pregnancy (e.g., more than one sex partner in the previous 6 months, evaluation or treatment for a sexually transmitted disease, recent or current injection-drug use, or HBsAg-positive sex partner), or
  - had clinical hepatitis since previous testing.

After delivery

HBsAg-positive mothers and their infants

- Administer single-antigen hepatitis B vaccine and hepatitis B immune globulin (HBIG) to all infants born to HBsAg-positive mothers ≤12 hours after birth and record date and time of administration of HBIG and hepatitis B vaccine in infant's medical record.
- Provide information regarding hepatitis B to HBsAg-positive mothers, including
  - advice that they may breast feed their infants upon delivery;
  - modes of HBV transmission;
  - need for vaccination of their susceptible household, sexual, and needle-sharing contacts;
  - need for substance abuse treatment, if appropriate; and
  - need for medical management and possible treatment for chronic hepatitis B.

Mothers with unknown HBsAg status and their infants

- Administer single-antigen hepatitis B vaccine (without HBIG) to all infants born to mothers with unknown HBsAg status ≤12 hours after birth and record date and time of administration of hepatitis B vaccine on infant's medical record.
- Alert infant's pediatric health-care provider if an infant is discharged before the mother's HBsAg test result is available; if the mother is determined to be HBsAg positive, HBIG should be administered to the infant as soon as possible, but no later than age 7 days.

All mothers and their infants

- Administer a dose of single-antigen hepatitis B vaccine to all infants weighing ≥2,000 g.
- Ensure that all mothers have been tested for HBsAg prenatally or at the time of admission for delivery and document test results.

At time infant is discharged

- Provide infant's immunization record to mother and remind her to take it to the infant's first visit to pediatric health-care provider.
  - identification and management of all infants born to HBsAg-positive mothers;
  - identification and management of all infants born to mothers with unknown HBsAg status; and
  - for all infants, documentation on the infant's medical record of maternal HBsAg test results, infant hepatitis B vaccine administration, and administration of HBIG (if appropriate).
- Delivery hospitals should enroll in the federally funded Vaccines for Children (VFC) program to obtain free hepatitis B vaccine for administration of the birth dose to newborns who are eligible (i.e., Medicaid eligible, American Indian or Alaska Native, underinsured, or uninsured).

Case-Management Programs to Prevent Perinatal HBV Infection

- States and localities should establish case-management programs (Box 5), including appropriate policies, procedures, laws, and regulations, to ensure that
  - all pregnant women are tested for HBsAg during each pregnancy, and
  - infants born to HBsAg-positive women and infants born to women with unknown HBsAg status receive recommended case management.
- The location of these programs and the methods by which they operate will depend on multiple factors (e.g., population density and annual caseload of HBsAg-positive women). Programs may be located in state or local health departments, private health-care systems (e.g., health maintenance organizations), or institutions (e.g., correctional facility systems). Program administrators will need to work with prenatal care providers, delivery hospital staff, pediatric care providers, private health-care systems, and health departments.

Universal Vaccination of Infants

Recommendations

- All infants should receive the hepatitis B vaccine series as part of the recommended childhood immunization schedule (Table 5 and Appendix B). (For recommendations on management of infants born to HBsAg-positive mothers and infants born to mothers with unknown HBsAg status, see Prevention of Perinatal HBV Infection and Management of Pregnant Women.)
- For all medically stable infants weighing ≥2,000 g at birth and born to HBsAg-negative mothers, the first dose of vaccine should be administered before hospital discharge. Only single-antigen hepatitis B vaccine should be used for the birth dose.

BOX 5. Components of case-management programs to prevent perinatal hepatitis B virus infection

Test all pregnant women for hepatitis B surface antigen (HBsAg)

- Health-care providers should test all pregnant women for HBsAg during each pregnancy.
- HBsAg testing should be incorporated into standard prenatal testing panels (e.g., blood type, human immunodeficiency virus) infection, Rh factor, rubella antibody titer, and syphilis infection) used by all health-care providers caring for pregnant women.
- Delivery hospitals should ensure that all pregnant or delivering women have been tested for HBsAg before hospital discharge.
- Reporting of HBsAg test status should be included on hospital-based electronic birth certificates or neonatal metabolic screening requests.

Report and track HBsAg-positive women

- All HBsAg-positive pregnant women and all women of childbearing age with HBsAg-positive laboratory results should be reported to state or local perinatal hepatitis B prevention programs.
- All HBsAg-positive pregnant women should be entered into case-management tracking systems.

Provide prenatal HBsAg testing records to delivery hospitals

- HBsAg test results should be included on all forms (hard copy, electronic) used by practitioners to record and transmit information regarding care during pregnancy.
- For all pregnant women, a copy of the original laboratory report of HBsAg test results should be transferred from the prenatal care provider to the delivery hospital.
- Practitioners should document that HBsAg-positive pregnant women have a copy of the original laboratory report, that a copy of the original laboartory report is transferred from the prenatal care provider to the delivery hospital, and that patients are informed of their HBsAg test status and advised to notify delivery staff.

Identify and manage infants born to HBsAg-positive mothers

- Delivery hospitals should implement policies and procedures to ensure identification and initiation of postexposure immunization of infants born to HBsAg-positive mothers (see Delivery Hospital Policies and Procedures).
- Delivery hospitals should document the date and time of birth and the date and time of administration of hepatitis B immune globulin (HBIG) and hepatitis B vaccine for all infants born to HBsAg-positive mothers.

Identify and manage infants born to mothers without HBsAg test results

- Delivery hospitals should implement policies and procedures to ensure identification and initiation of postexposure immunization of infants born to mothers with unknown HBsAg status at delivery (see Delivery Hospital Policies and Procedures).
- Delivery hospitals should document the date and time of birth, date and time of administration of hepatitis B vaccine, and maternal HBsAg test results for all infants born to mothers with unknown HBsAg status at the time of delivery.

Complete the hepatitis B vaccine series

- Practitioners should document the dates of administration of all doses of the hepatitis B vaccine series for all infants born to HBsAg-positive mothers.

Complete postvaccination testing

- Health-care providers should document the results of testing for HBsAg and antibody to hepatitis B surface antigen (anti-HBs) after completion of the hepatitis B vaccine series for all infants born to HBsAg-positive mothers.

Monitor and evaluate the case management program

- Annually, each program should track
  - — the number of HBsAg-positive pregnant women;
  - — the proportion of infants born to HBsAg-positive women receiving postexposure prophylaxis ≤12 hours of birth, third vaccine dose by age 6 months, and postvaccination serologic testing for HBsAg and anti-HBs;
  - — the number of delivering women with unknown HBsAg status; and
  - — the proportion of infants born to mothers with unknown HBsAg status receiving hepatitis B vaccine within 12 hours of birth.
- Programs should determine reasons for
  - — >10% difference between expected and identified number of HBsAg-positive pregnant women;
  - — <90% completion rates for HBIG and hepatitis B vaccine ≤12 hours of birth, third dose by age 6 months, and postvaccination testing for infants born to HBsAg-positive mothers; and
  - — <90% completion rates for hepatitis B vaccine ≤12 hours of birth for infants born to mothers with unknown HBsAg status.

- On a case-by-case basis and only in rare circumstances, the first dose may be delayed until after hospital discharge for an infant who weighs ≥2,000 g and whose mother is HBsAg negative.
  - — When such a decision is made, a physician's order to withhold the birth dose and a copy of the original laboratory report indicating that the mother was HBsAg negative during this pregnancy should be placed in the infant's medical record.
  - — For infants who do not receive a first dose before hospital discharge, the first dose should be administered no later than age 2 months.
  - — Situations in which the birth dose should not be delayed include any high-risk sexual or drug-using practices of the infant's mother during pregnancy (e.g., having had more than one sex partner during the previous 6 months or an HBsAg-positive sex partner, evaluation or treatment for an STD, or recent or current injection-drug use) and expected poor compliance with follow-up to initiate the vaccine series.
- Preterm infants weighing <2,000 g and born to HBsAg-negative mothers should have their first vaccine dose delayed until 1 month after birth or hospital discharge (Table 4). For these infants, a copy of the original laboratory report indicating that the mother was HBsAg negative during this pregnancy should be placed in the infant's medical record.
- The vaccine series should be completed according to a recommended schedule with either single-antigen vaccine or a combination vaccine that contains the hepatitis B vaccine antigen (e.g., Hib-hepatitis B or DTaP-IPV-hepatitis B) (Table 2). The final dose in the vaccine series should not be administered before age 24 weeks (164 days).
- Administration of 4 doses of hepatitis B vaccine to infants is permissible in certain situations (e.g., when combination vaccines are administered after the birth dose).
- In populations with currently or previously high rates of childhood HBV infection (i.e., Alaska Natives; Pacific Islanders; and immigrant families from Asia, Africa, and other regions with intermediate or high endemic rates of infection [Figure 1 and Box 2]), the first dose of hepatitis B vaccine should be administered at birth and the final dose at age 6–12 months.

Implementation

- All delivery hospitals should implement standing orders for administration of hepatitis B vaccination as part of routine medical care of all medically stable infants weighing ≥2,000 g at birth (Box 4).
- All delivery hospitals should implement policies and procedures for management of infants weighing <2,000 g at birth, including the following:
  - — ensuring initiation of postexposure immunization of infants born to HBsAg-positive mothers and infants born to mothers not screened for HBsAg prenatally (see Prevention of Perinatal HBV Infection and Management of Pregnant Women), and
  - — documentation of maternal HBsAg test results on the infant's medical record.
- Prenatal care education should include information regarding the rationale for and importance of newborn hepatitis B vaccination.
- States are encouraged to adopt regulations or laws that require hepatitis B vaccination for entry into child care and also for entry into kindergarten and/or elementary school to ensure high vaccine coverage among infants and children.

Vaccination of Children and Adolescents Who Were Not Previously Vaccinated

Recommendations

- Hepatitis B vaccination is recommended for all children and adolescents aged <19 years.
- Children and adolescents who have not previously received hepatitis B vaccine should be vaccinated routinely at any age with an appropriate dose and schedule (Tables 2 and 5). Selection of a vaccine schedule should consider the need to achieve completion of the vaccine series. In all settings, vaccination should be initiated even though completion of the vaccine series might not be ensured.

Implementation

- To ensure high vaccination coverage among children and adolescents, the following measures are recommended:
  - — All children aged 11–12 years should have a review of their immunization records and should complete the vaccine series if they were not previously vaccinated or were incompletely vaccinated.
  - — All children and adolescents aged <19 years (including internationally adopted children) who were born in Asia, the Pacific Islands, Africa, or other intermediate- or high-endemic countries (Figure 1 and Box 2) or who have at least one parent who was born in one of these areas should have a review of their immunization records and should complete the vaccine series if they were not previously vaccinated or were incompletely vaccinated.

— States are encouraged to adopt regulations or laws that require hepatitis B vaccination before entry into middle school or its equivalent.
— Vaccination requirements should be considered for older high school students and for students before college entry, when feasible.
— States are encouraged to expand or implement immunization registries to include adolescents.
— Hepatitis B vaccine should be offered to all unvaccinated adolescents in settings that provide health-care services to this age group (Box 6), particularly those who engage in behaviors that place them at high risk for HBV infection.

BOX 6. Health-care settings in which hepatitis B vaccine should be offered to all unvaccinated children and adolescents

Primary care clinics
Substance abuse treatment facilities
Family planning clinics
Institutions for the developmentally disabled
Juvenile correctional facilities
Nonresidential daycare facilities for the developmentally disabled
Sexually transmitted disease clinics
School-based clinics

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Appendix A

Case Finding and Management of Hepatitis B Surface Antigen (HBsAg)–Positive Persons During Delivery of Vaccination Services

Chronically infected persons are at high risk for chronic liver disease and are a major reservoir of hepatitis B virus (HBV) infection. Foreign-born persons, especially persons from Africa, Asia, and the Pacific Islands, have high* rates of chronic HBV infection. During delivery of recommended hepatitis B vaccination services (e.g., HBsAg screening of pregnant women and serologic testing to assess susceptibility), vaccination providers will identify persons who are HBsAg positive. These persons require counseling and medical management for chronic HBV infection to reduce their risk for chronic liver disease. Their susceptible household, sexual, and needle-sharing contacts also need to be vaccinated against hepatitis B.

Few programs have been implemented to identify HBsAg-positive persons, provide or refer these persons for appropriate medical management, and provide vaccination to their contacts (*1*). Extending these services to persons identified as HBsAg positive will help prevent serious sequelae in chronically infected persons and enhance vaccination strategies for elimination of HBV transmission. This Appendix addresses case finding and management of persons with chronic HBV infection in the context of vaccine delivery. The recommendations are not intended to represent a comprehensive prevention program for chronically infected persons.

Case Finding in the Context of Vaccination Service Delivery

- All foreign-born persons (including immigrants, refugees, asylum seekers, and internationally adopted children) born in Asia, the Pacific Islands, Africa, and other regions with high endemicity of HBV infection (Box A-1) should be tested for HBsAg, regardless of vaccination status.
  - — For all persons born in high-endemic countries who are applying for permanent U.S. residence, HBsAg screening and appropriate follow-up on the basis of HBsAg test results should be included as part of the required overseas premigration and domestic adjustment-of-visa status medical examination process (*2*). HBsAg-positive persons should be considered eligible for migration and adjustment-of-visa status and counseled and recommended for follow-up medical evaluation and management in U.S. resettlement communities.
  - — Providers should identify children born in high-endemic countries and provide HBsAg testing and follow-up in all settings that provide health care. Retesting of persons who were tested for HBsAg in other countries should be considered.
- Other persons who should be tested for HBsAg as part of vaccination services include
  - — all pregnant women (See Prevention of Perinatal HBV Infection and Management of Pregnant Women),
  - — persons who receive prevaccination testing for susceptibility and who test positive for anti-HBc (See Prevaccination Testing for Susceptibility),
  - — hemodialysis patients, and
  - — nonresponders to vaccination (See Appendix B, Postvaccination Testing for Serologic Response).

BOX A-1. Geographic areas with high* hepatitis B virus endemicity

Africa: all countries except Algeria, Egypt, Lybia, and Tunisia
South Asia: all countries except Afghanistan, Bangladesh, Bhutan, India, Malaysia, Maldives, Nepal, Pakistan, and Sri Lanka
Western Pacific: all countries except Australia, Guam, Japan, and New Zealand
Middle East: Jordan and Saudi Arabia
Eastern Europe and Newly Independent States of the former Soviet Union: Albania, Armenia, Azerbaijan, Bulgaria, Croatia, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan, and Uzbekistan
Western Europe: Malta
North America: Alaska Natives and indigenous populations in Northern Canada and Greenland
South America: Amazonian areas of Bolivia, Brazil, Columbia, Peru, and Venezuela

* Hepatitis B surface antigen prevalence of ≥8%.

Management of Persons Identified as HBsAg Positive

- All persons with HBsAg-positive laboratory results should be reported to the state or local health department.
- To verify the presence of chronic HBV infection, HBsAg-positive persons should be retested. The absence of immu-

* Hepatitis B surface antigen prevalence of ≥8%.

noglobulin M antibody to HBcAg or the persistence of HBsAg for 6 months indicates chronic HBV infection.

- Persons with chronic HBV infection should be referred for evaluation by a physician experienced in the management of chronic liver disease (*3*). Certain patients with chronic hepatitis B will benefit from early intervention with antiviral treatment or screening to detect hepatocellular carcinoma at an early stage.
- Household, sexual, and needle-sharing contacts of chronically infected persons should be identified. Unvaccinated sex partners and household and needle-sharing contacts should be tested for susceptibility to HBV infection (see Prevaccination Serologic Testing for Susceptibility) and should receive the first dose of hepatitis B vaccine immediately after collection of the blood sample for serologic testing. Susceptible persons should complete the vaccine series using an age-appropriate vaccine dose and schedule (see Tables 2 and 6) Persons who are not fully vaccinated should complete the vaccine series.
- Sex partners of HBsAg-positive persons should be counseled to use methods (e.g., condoms) to protect themselves from sexual exposure to infectious body fluids (e.g., semen or vaginal secretions) unless they have been demonstrated to be immune after vaccination (i.e., anti-HBs ≥10 mIU/mL) or previously infected (anti-HBc positive).
- To prevent or reduce the risk for transmission to others, HBsAg-positive persons should be advised concerning the risks for
  - — perinatal transmission to infants born to HBsAg-positive women and the need for such infants to receive hepatitis B vaccine beginning at birth (see Prevention of Perinatal HBV Infection and Management of Pregnant Women) and
  - — transmission to household, sexual, and needle-sharing contacts and the need for such contacts to receive hepatitis B vaccine.
- HBsAg-positive persons should also be advised to
  - — use methods (e.g., condoms) to protect nonimmune sex partners from acquiring HBV infection from sexual activity until the sex partners can be vaccinated and immunity documented;
  - — cover cuts and skin lesions to prevent the spread of infectious secretions or blood;
  - — refrain from donating blood, plasma, tissue, or semen (organs may be donated to HBV-immune or chronically infected persons needing a transplant); and
  - — refrain from sharing household articles (e.g., toothbrushes, razors, or personal injection equipment) that could become contaminated with blood.
- To protect the liver from further harm, HBsAg-positive persons should be advised to
  - — avoid or limit alcohol consumption because of the effects of alcohol on the liver;
  - — refrain from beginning to take any new medicines, including over-the-counter and herbal medicines, without consulting their health-care provider; and
  - — obtain vaccination against hepatitis A if chronic liver disease is found to be present.
- When seeking medical or dental care, HBsAg-positive persons should be advised to inform those responsible for their care of their HBsAg status so they can be evaluated and their care managed appropriately.
- Other counseling messages:
  - — HBV is not spread by breastfeeding, kissing, hugging, coughing, ingesting food or water, sharing eating utensils or drinking glasses, or casual contact.
  - — Persons should not be excluded from school, play, child care, work, or other settings on the basis of their HBsAg status unless they are prone to biting (*4*).
  - — Involvement with a support group might help patients cope with chronic HBV infection.

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Appendix B

Immunization Management Issues

Hepatitis B Vaccine Dose and Administration

- Recommended vaccine doses vary by product, age of recipient, and needs of special populations (see Table 2). Administration of single-antigen or combination vaccine simultaneously with other childhood vaccines produces no clinically significant interference in antibody responses (*1–13*). Although the antigen contents of vaccines differ, vaccines made by different manufacturers are interchangeable, except for the 2-dose schedule used for adolescents aged 11–15 years, for which only Recombivax HB is approved. Combination vaccines are not approved for use as a birth dose because of potential suppression of the immune response to subsequent doses of the *Haemophilus influenzae* type b (Hib) component in Comvax (*14*) and possible decreased immunogenicity of the diphtheria component of Pediarix when administered at birth.
- Hepatitis B vaccine should be administered by intramuscular injection. Injection into the buttock is associated with decreased immunogenicity (*15–18*). Intradermal administration can result in a lower seroconversion rate and final concentration of antibody to hepatitis B surface antigen compared with intramuscular administration; limited data are available to assess long-term protection from this route of administration (*19,20*).
- The anterolateral thigh muscle is the recommended site of administration for neonates (aged <1 month) and infants (aged 1–12 months). For toddlers (aged 1–2 years) and older children, either the anterolateral thigh or the deltoid muscle may be used if the muscle mass is adequate. The deltoid muscle is the preferred site of administration for adolescents.
- For intramuscular injection, the needle should be long enough to reach the muscle mass and prevent vaccine from seeping into subcutaneous tissue, but not so long as to involve underlying nerves and blood vessels or bone (*21*). The appropriate needle length is usually $^5/_8$" for neonates, $^7/_8$"–1" for infants, and $^7/_8$"–1$^1/_4$" for toddlers, older children, and adolescents. A 22- to 25-gauge needle should be used.
- Hepatitis B vaccine administered by any route or site other than intramuscularly in the anterolateral thigh or deltoid muscle should not be counted as valid and should be repeated unless serologic testing indicates that an adequate response has been achieved (see Postvaccination Testing for Serologic Response).
- Hepatitis B vaccine and other vaccines administered during the same visit should be administered in different injection sites. When more than one injection must be administered in the same limb, the anterolateral thigh is usually the preferred site, with injections separated by 1"–2" to avoid overlap in local reactions.
- For persons at risk for hemorrhage (e.g., persons with hemophilia), the risk of bleeding after intramuscular injection can be minimized by use of a 23-gauge (or smaller) needle, application of direct pressure to the injection site for ≥2 minutes, and administration of vaccine immediately after infusion of coagulation factor. Subcutaneous administration of vaccine can be considered for these persons but might result in lower response and an increased local reaction.
- Hepatitis B vaccine should be stored at 35°–46° F (2°–8° C) and should not be frozen.
- A vaccine information statement (VIS) must be provided to recipients of hepatitis B vaccine. The National Childhood Vaccine Injury Act of 1986 (42 U.S.C. § 300aa-26) requires vaccine providers to give a copy of the most current vaccine-specific VIS to all recipients (children or their guardians) of vaccines that are included on the National Vaccine Injury Compensation Program table maintained by the Health Resources and Services Administration (available at http://www. hrsa.gov). Hepatitis B vaccine is included on this table. The most current VIS for hepatitis B vaccine is available at http://www.cdc.gov/nip/publications/vis. Statements in languages other than English are available from the Immunization Action Coalition at http://www.immunize.org.

Hepatitis B Immune Globulin (HBIG) Dose and Administration

- The standard dose of HBIG is 0.5 mL for postexposure prophylaxis of infants born to hepatitis B surface antigen (HBsAg)–positive women and 0.06 mL/kg for all other applications.
- HBIG may be administered simultaneously with hepatitis B vaccine but in a different injection site.
- HBIG is administered by intramuscular injection. For infants, HBIG should be administered intramuscularly

in the anterolateral thigh using a 22–25-gauge needle that is 7/8"–1" in length. For older children and adolescents, an appropriate muscle mass (i.e., deltoid or gluteal) should be chosen in which to deliver the larger volumes of HBIG required for these age groups by using a needle length appropriate for the person's age and size (*21*).
- Vaccination with certain live-virus vaccines (measles, mumps, rubella, and varicella) should be deferred for at least 3 months after administration of HBIG because HBIG can inhibit the response to these vaccines (*21*).
- HBIG should be stored at 35°–46° F (2°–8° C) and should not be frozen.

Unknown or Uncertain Vaccination Status

- A reliable vaccination history is defined as a written, dated record (personal, school, physician, or immunization registry) of each dose of a complete series.
- In the majority of clinical practice settings and in situations when postexposure prophylaxis is indicated (see Appendix C), providers should accept only written and dated records (e.g., personal, school, physician, or immunization registry) as evidence of vaccination. Although vaccinations should not be postponed if records cannot be located, providers should try to locate missing records by contacting previous health-care providers and searching for personally held records.
- Persons whose records cannot be located should be considered susceptible and started or continued on the age-appropriate vaccine schedule.
- Persons who reside in the United States but were vaccinated in other countries should be considered fully vaccinated if they have written documentation of ≥3 doses of vaccine administered at recommended minimum intervals, including the third dose at age ≥24 weeks. If they were not vaccinated according to recommended minimum intervals, they should be revaccinated (see Minimum Dosing Intervals and Management of Persons Who Were Incorrectly Vaccinated). Persons without written documentation of full vaccination should complete the age-appropriate vaccine series.

Interrupted Vaccine Schedules

- When the hepatitis B vaccine schedule is interrupted, the vaccine series does not need to be restarted.
- If the series is interrupted after the first dose, the second dose should be given as soon as possible, and the second and third doses should be separated by an interval of at least 8 weeks.
- If only the third dose is delayed, it should be administered as soon as possible, after age 24 weeks (164 days).
- It is not necessary to restart the vaccine series for infants switched from one vaccine brand to another, including combination vaccines.

Minimum Dosing Intervals and Management of Persons Who Were Incorrectly Vaccinated

- The third dose of vaccine must be administered at least 8 weeks after the second dose and should follow the first dose by at least 16 weeks; the minimum interval between the first and second doses is 4 weeks. In infants, administration of the final dose is not recommended before age 24 weeks (164 days).
- Inadequate doses of hepatitis B vaccine (see Table 2) or doses received after a shorter-than-recommended dosing interval should be readministered.

Accelerated Vaccine Schedules

- The Food and Drug Administration (FDA) has not approved accelerated schedules in which hepatitis B vaccine is administered more than once in a month. If clinicians choose to use an accelerated schedule (i.e., doses at days 0, 7, and 14 days), the patient should also receive a booster dose at least 6 months after the start of the series to promote long-term immunity.

Hemodialysis Patients and Other Immunocompromised Persons

- Standard hepatitis B vaccine doses (see Table 2) are approved by FDA for vaccination of all persons aged <20 years. For hemodialysis patients and other immunocompromised persons, higher doses might be more immunogenic, but no specific recommendations have been made.
- Serologic testing of hemodialysis patients and other immunocompromised persons is recommended 1–2 months after administration of the final dose of the primary vaccine series to determine the need for revaccination (see Postvaccination Testing for Serologic Response). In addition, booster doses of vaccine might be needed (see Booster Doses).

Prevaccination Serologic Testing for Susceptibility

- Because of the low prevalence of HBV infection among infants, children, and adolescents born in the United States, prevaccination testing for susceptibility usually is not indicated for these age groups.
- Prevaccination testing for susceptibility is recommended for unvaccinated household, sexual, and needle-sharing contacts of HBsAg-positive persons.
- Anti-HBc is the test of choice for prevaccination testing.
- Persons tested for anti-HBc and found to be anti-HBc negative are susceptible and should complete the vaccine series.
- Persons found to be anti-HBc positive should be tested for HBsAg. HBsAg testing may be performed on the same specimen collected for anti-HBc testing. If the HBsAg test result is positive, the person should receive appropriate management (see Appendix A).
- In most situations, the first vaccine dose should be administered immediately after collection of the blood sample for serologic testing.

Postvaccination Testing for Serologic Response

Recommendations for postvaccination testing of infants born to HBsAg-positive women are provided in this report (see Management of Infants Born to Women Who Are HBsAg Positive). This section provides recommendations for postvaccination testing of other persons.

- Serologic testing for immunity is not necessary after routine vaccination of infants, children, or adolescents.
- Testing after vaccination is recommended only for the following persons whose subsequent clinical management depends on knowledge of their immune status:
  - — health-care workers;
  - — chronic hemodialysis patients, HIV-infected persons, and other immunocompromised persons (e.g., hematopoietic stem-cell transplant recipients or persons receiving chemotherapy), to determine the need for revaccination and the type of follow-up testing; and
  - — sex partners of HBsAg-positive persons, to determine the need for revaccination and the need for other methods of protection against HBV infection.
- Testing should be performed 1–2 months after administration of the last dose of the vaccine series by using a method that allows determination of a protective level of anti-HBs (≥10 mIU/mL).
- Persons found to have anti-HBs levels of ≥10 mIU/mL after the primary vaccine series are considered to be immune.
  - — Immunocompetent persons have long-term protection and do not need further periodic testing to assess anti-HBs levels.
  - — Immunosuppressed persons might need annual testing to assess anti-HBs levels (see Booster Doses).
- Persons found to have anti-HBs levels of <10 mIU/mL after the primary vaccine series should be revaccinated. Administration of three doses on an appropriate schedule (Table 7), followed by anti-HBs testing 1–2 months after the third dose, is usually more practical than serologic testing after one or more doses of vaccine.
- Persons who do not respond to revaccination should be tested for HBsAg.
  - — If the HBsAg test result is positive, the persons should receive appropriate management (see Appendix B), and any household, sexual, or needle-sharing contacts should be identified and vaccinated (see Appendix A).
  - — Persons who test negative for HBsAg should be considered susceptible to HBV infection and should be counseled about precautions to prevent HBV infection and the need to obtain HBIG postexposure prophylaxis for any known or likely parenteral exposure to HBsAg-positive blood (see Appendix C).

Booster Doses

- Booster doses are not recommended for persons with normal immune status who were vaccinated as infants, children, or adolescents. Serologic testing is not recommended to assess antibody levels in any age group, except in specific circumstances (see Postvaccination Testing for Serologic Response).
- For hemodialysis patients, the need for booster doses should be assessed by annual antibody to hepatitis B survace antigen (anti-HBs) testing. A booster dose should be administered when anti-HBs levels decline to <10 mIU/mL.
- For other immunocompromised persons (e.g., HIV-infected persons, hematopoietic stem cell transplant recipients, and persons receiving chemotherapy), the need for booster doses has not been determined. Annual anti-HBs testing and booster doses when anti-HBs levels decline to <10 mIU/mL should be considered in persons with an ongoing high risk for exposure.

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Appendix C

Postexposure Prophylaxis of Persons with Discrete Identifiable Exposures to Hepatitis B Virus (HBV)

This appendix provides recommendations for management of persons who are exposed to HBV through a discrete, identifiable exposure to blood or body fluids that contain blood. Recommendations for management of infants born to mothers who test positive for hepatitis B surface antigen (HBsAg)-positive mothers are provided in this report (see Prevention of Perinatal HBV Transmission and Management of Pregnant Women).

HBsAg-Positive Source

- Unvaccinated persons (Table C-1) or persons known not to have responded to a complete hepatitis B vaccine series should receive both hepatitis B immune globulin (HBIG) and hepatitis B vaccine as soon as possible after exposure (preferably ≤24 hours). For sexual exposures, HBIG should not be administered more than 14 days after exposure. Hepatitis B vaccine may be administered simultaneously with HBIG in a separate injection site. The hepatitis B vaccine series should be completed using the age-appropriate vaccine dose and schedule (see Tables 2 and 3).
- Persons who are in the process of being vaccinated but who have not completed the vaccine series should receive the appropriate dose of HBIG and should complete the vaccine series.
- Children and adolescents who have written documentation of a complete hepatitis B vaccine series and who were did not receive postvaccination testing should receive a single vaccine booster dose.

Source with Unknown HBsAg Status

- Unvaccinated persons (Table C-1) should receive the hepatitis B vaccine series with the first dose initiated as soon as possible after exposure, preferably ≤24 hours. The vaccine series should be completed using the age-appropriate dose and schedule (see Tables 2, 3, and 5).
- Persons who are not fully vaccinated should complete the vaccine series.
- Children and adolescents with written documentation of a complete hepatitis B vaccine series require no further treatment.

TABLE C-1. Guidelines for postexposure immunoprophylaxis of unvaccinated persons who are exposed to blodo or body fluids that contain blood

Cause	Action
Discrete exposure to an HBsAg*-positive source	
Percutaneous (e.g., bite, needlestick) or mucosal exposure to HBsAg-positive blood or body fluids that contain blood	Administer hepatitis B vaccine and hepatitis B immune globulin (HBIG)[À]
Sexual or needle-sharing contact of an HBsAg-positive person	Administer hepatitis B vaccine and HBIG[À]
Victim of sexual assault/abuse by a perpetrator who is HBsAg-positive	Administer hepatitis B vaccine and HBIG[À]
Discrete exposure to a source with unknown HBsAg status	
Victim of sexual assault/abuse by a perpetrator with unknown HBsAg status	Administer hepatitis B vaccine[À]
Percutaneous (e.g., bite or needclestick) or mucosal exposure to blood or body fluids that contain blood from a source with unknown HBsAg status	Administer hepatitis B vaccine[À]

* Hepatitis B surface antigen.
[À] Immunoprophylaxis should be administered as soon as possible, preferably ≤24 hours. Studies are limited on the maximum interval after exposure during which postexposure prophylaxis is effective, but the interval is unlikely to exceed 7 days for percutaneous exposures and 14 days for sexual exposures. The hepatitis B vaccine series should be completed.

Glossary

Terms and Abbreviations Used in This Report

ACIP	Advisory Committee on Immunization Practices
ALT	alanine aminotransferase
Anti-HBc	antibody to hepatitis B core antigen
Anti-HBe	antibody to hepatitis B e antigen
Anti-HBs	antibody to hepatitis B surface antigen
DTaP	diphtheria and tetanus toxoids and acellular pertussis adsorbed
FDA	Food and Drug Administration
HBcAg	hepatitis B core antigen
HBeAg	hepatitis B e antigen
HBIG	hepatitis B immune globulin
HBsAg	hepatitis B surface antigen
HBV	hepatitis B virus
HCC	hepatocellular carcinoma
HCV	hepatitis C virus
Hib	*Haemophilus influenzae* type b
HIV	human immunodeficiency virus
IgM	immunoglobulin M
IPV	inactivated poliovirus
MS	multiple sclerosis
NHANES	National Health and Nutrition Examination Survey
VAERS	Vaccine Adverse Events Reporting System
VSD	Vaccine Safety Datalink

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Recommendations and Reports December 23, 2005 / Vol. 54 / No. RR-16

Continuing Education Activity Sponsored by CDC

A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States

Recommendations of the Advisory Committee on Immunization Practices (ACIP) Part 1: Immunization of Infants, Children, and Adolescents

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DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Goal and Objectives

This report updates the immunization strategy to eliminate hepatitis B virus (HBV) transmission in the United States. The report includes new recommendations and implementation strategies for immunization of infants, children, and adolescents. The goal of the report is to provide guidance for health-care professionals to implement these recommendations and strategies to prevent perinatal HBV transmission, to promote universal vaccination of infants as part of the routine childhood vaccination schedule, and to promote vaccination of children and adolescents who were not previously vaccinated. Upon completion of this educational activity, the reader should be able to a) identify ways to maintain high hepatitis B surface antigen (HBsAg) screening rates among pregnant women, b) describe the components of a case management program for HBsAg-positive women, c) describe methods to ensure that newborn infants of HBsAg-positive mothers and mothers with unknown HBsAg status receive appropriate immunoprophylaxis, d) describe how to structure programs to increase the number of infants who receive a birth dose of hepatitis B vaccine, e) list ways to increase vaccine coverage among adolescents, and f) identify ways to increase rates of HBsAg screening and hepatitis B vaccination of foreign-born persons.

To receive continuing education credit, please answer all of the following questions.

1. **Components of a health department case-management program to enhance prevention of perinatal hepatitis B virus (HBV) infection should ensure that…(*Indicate all that apply.*)**
   - A. all pregnant women are tested for HBsAg.
   - B. HBsAg-positive women are reported and tracked.
   - C. prenatal HBsAg testing records are received by maternity hospitals before delivery.
   - D. infants born to HBsAg-positive mothers and infants born to mothers with unknown HBsAg status are identified and managed.
   - E. all of the above.

2. **All delivery hospitals should implement standing orders for administration of hepatitis B vaccination before hospital discharge as part of routine medical care to all medically stable infants weighing >2,000 g at birth. (*Choose the one correct answer.*)**
   - A. True.
   - B. False

3. **Which of the following statement(s) regarding HBsAg screening and vaccination of immigrants and international adoptees is true? (*Indicate all that apply.*)**
   - A. All foreign-born persons (including immigrants, refugees, asylum seekers, and internationally adopted children) from Asia, the Pacific Islands, and Africa and other countries with HBsAg prevalence ≥2% should be tested for HBsAg.
   - B. Persons who test positive for HBsAg should receive appropriate follow-up, including counseling, evaluation for chronic liver disease and antiviral treatment, and vaccination of susceptible household and sexual contacts.
   - C. Persons who reside in the United States but who were vaccinated in other countries should be considered fully vaccinated if they have written documentation of at least three doses of vaccine administered at recommended minimum intervals.
   - D. All of the above.

4. **Identify health-care settings in which hepatitis B vaccine should be offered to all unvaccinated adolescents. (*Indicate all that apply.*)**
   - A. Drug treatment facilities.
   - B. Institutions for the developmentally disabled.
   - C. College health clinics.
   - D. Family planning clinics.
   - E. All of the above.

5. **Which of the following statements regarding the hepatitis B vaccination schedule in infants and children are true? (*Indicate all that apply.*)**
   - A. Administration of the final dose to infants is not recommended before age 24 weeks.
   - B. A vaccine series started with a birth dose of single-antigen vaccine cannot be completed with 3 doses of combination vaccine.
   - C. No differences in immunogenicity have been observed when one or two doses of hepatitis B vaccine produced by one manufacturer are followed by dose(s) from a different manufacturer.
   - D. Currently licensed formulations for both single-antigen vaccines have been demonstrated to produce high (>95%) levels of seroprotection among infants, children, and adolescents when administered in different schedules.
   - E. All of the above.

6. **Which of the following statements regarding the management of perinatal HBV exposure are true? (*Indicate all that apply.*)**
   - A. Passive-active prophylaxis with hepatitis B vaccine and HBIG should be administered within 12 hours after birth.
   - B. A vaccine series started with a birth dose of single-antigen vaccine can be completed with three doses of combination vaccine.
   - C. Active postexposure prophylaxis with hepatitis B vaccine alone (i.e., without HBIG) beginning at birth is frequently used in areas where implementation of maternal HBsAg testing is difficult (e.g., in Alaska, Pacific Islands, and developing countries).
   - D. Although rates of perinatal HBV transmission are higher from HBeAg-positive mothers compared with HBeAg-negative mothers, testing of HBsAg-positive pregnant women for HBeAg is not warranted for the management of the infant because postexposure prophylaxis is recommended for all infants born to HBsAg-positive women.
   - E. All of the above.

7. **Which best describes your professional activities:**
   - A. Physician.
   - B. Nurse.
   - C. Health educator.
   - D. Office staff.
   - E. Other.

8. **I plan to use these recommendations as the basis for…(*Indicate all that apply.*)**
   - A. health education materials.
   - B. insurance reimbursement policies.
   - C. local practice guidelines.
   - D. public policy.
   - E. other.

9. **Overall, the length of the journal report was…**
   - A. much too long.
   - B. a little too long.
   - C. just right.
   - D. a little too short.
   - E. much too short.

10. **After reading this report, I am confident I can identify ways to maintain high hepatitis B surface antigen (HBsAg) screening rates among pregnant women.**
    - A. Strongly agree.
    - B. Agree.
    - C. Undecided.
    - D. Disagree.
    - E. Strongly disagree.

11. **After reading this report, I am confident I can describe the components of a case management program for HBsAg-positive women.**
    - A. Strongly agree.
    - B. Agree.
    - C. Undecided.
    - D. Disagree.
    - E. Strongly disagree.

12. After reading this report, I am confident I can describe methods to ensure that newborn infants of HBsAg-positive mothers and mothers with unknown HBsAg status receive appropriate immunoprophylaxis.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

13. After reading this report, I am confident I can describe how to structure programs to increase the number of infants who receive a birth dose of hepatitis B vaccine.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

14. After reading this report, I am confident I can increase vaccine coverage among adolescents.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

15. After reading this report, I am confident I can identify ways to increase rates of HBsAg screening and hepatitis B vaccination of foreign-born persons.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

16. The learning outcomes (objectives) were relevant to the goal of this report.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

17. The instructional strategies used in this report (text, tables, figures, boxes, and appendices) helped me learn the material.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

18. The content was appropriate given the stated objectives of the report.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

(Continued on pg CE-4)

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December 23, 2005/Vol. 54/No. RR-16

A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States

Recommendations of the Advisory Committee on Immunization Practices (ACIP)

Part 1: Immunization of Infants, Children, and Adolescents

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9. [ ]A [ ]B [ ]C [ ]D [ ]E	22. [ ]A [ ]B [ ]C [ ]D [ ]E		
10. [ ]A [ ]B [ ]C [ ]D [ ]E	23. [ ]A [ ]B [ ]C [ ]D [ ]E		
11. [ ]A [ ]B [ ]C [ ]D [ ]E	24. [ ]A [ ]B		
12. [ ]A [ ]B [ ]C [ ]D [ ]E	25. [ ]A [ ]B [ ]C [ ]D [ ]E [ ]F		
13. [ ]A [ ]B [ ]C [ ]D [ ]E			

Signature ***Date I Completed Exam***

19. The content expert(s) demonstrated expertise in the subject matter.
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D. Disagree.
E. Strongly disagree.

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A. Strongly agree.
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C. Undecided.
D. Disagree.
E. Strongly disagree.

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C. Undecided.
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Correct answers for questions 1–6.
1. E; 2. A; 3. D; 4. E; 5. A, C, and D; 6. E.

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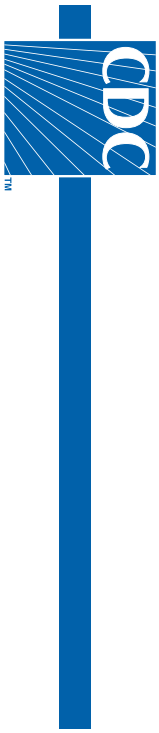

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rate reported by the Emerging Infections Program[§§] for children aged 0–17 years was 0.24 per 10,000. For children aged 0–4 years and 5–17 years, the rate was 0.66 per 10,000 and 0.04 per 10,000, respectively. During October 30, 2005–January 21, 2006, the preliminary laboratory-confirmed influenza-associated hospitalization rate for children aged 0–4 years in the New Vaccine Surveillance Network[¶¶] was 0.21 per 10,000.

Human Avian Influenza A (H5N1)

No human avian influenza A (H5N1) virus infection has ever been identified in the United States. From December 2003 through February 13, 2006, a total of 169 laboratory-confirmed human avian influenza A (H5N1) infections were reported to WHO from Cambodia, China, Indonesia, Iraq, Thailand, Turkey, and Vietnam.[***] Of these, 91 (54%) were fatal (Table). This represents an increase of two cases and one death in China and two cases and two deaths in Indonesia since February 6, 2006. The majority of infections appear to have been acquired from direct contact with infected poultry. No evidence of sustained human-to-human transmission of H5N1 has been detected, although rare instances of human-to-human transmission likely have occurred (*1*).

[§§] The Emerging Infections Program Influenza Project conducts surveillance in 60 counties associated with 12 metropolitan areas: San Francisco, California; Denver, Colorado; New Haven, Connecticut; Atlanta, Georgia; Baltimore, Maryland; Minneapolis/St. Paul, Minnesota; Albuquerque, New Mexico; Las Cruces, New Mexico; Albany, New York; Rochester, New York; Portland, Oregon; and Nashville, Tennessee.

[¶¶] The New Vaccine Surveillance Network conducts surveillance in Monroe County, New York; Hamilton County, Ohio; and Davidson County, Tennessee.

[***] Available at http://www.who.int/csr/disease/avian_influenza/en.

TABLE. Number of laboratory-confirmed human cases and deaths from avian influenza A (H5N1) infection reported to the World Health Organization, by country ð worldwide, 2003ï 2006*

	Year of onset									
	2003		2004		2005		2006		Total	
Country	No. of cases	Deaths	No. of cases	Deaths	No. of cases	Deaths	No. of cases	Deaths	No. of cases	Deaths
Cambodia	0	0	0	0	4	4	0	0	**4**	**4**
China	0	0	0	0	8	5	4	3	**12**	**8**
Indonesia	0	0	0	0	17	11	8	7	**25**	**18**
Iraq	0	0	0	0	0	0	1	1	**1**	**1**
Thailand	0	0	17	12	5	2	0	0	**22**	**14**
Turkey	0	0	0	0	0	0	12	4	**12**	**4**
Vietnam	3	3	29	20	61	19	0	0	**93**	**42**
Total	**3**	**3**	**46**	**32**	**95**	**41**	**25**	**15**	**169**	**91**

* As of February 13, 2006.

Reference

1. Ungchusak K, Auewarakul P, Dowell SF, et al. Probable person-to-person transmission of avian influenza A (H5N1). N Engl J Med 2005;352:333–40.

Notice to Readers

Draft of Applied Epidemiology Competencies

In October 2004, CDC and the Council of State and Territorial Epidemiologists (CSTE) convened a panel to define competencies for applied epidemiology for local, state, and federal government public health epidemiologists. This panel includes representatives from state and local health agencies, academia, private industry, and CDC. The complete draft of defined competencies for all levels of practicing epidemiologists is now available for review and comment at http://www.cste.org/assessment/competencies/indexnew.asp.

Practicing epidemiologists and those employing applied epidemiologists can also submit questions and comments to CSTE by e-mail (competencies@cste.org) through March 17, 2006. After the review period, the panel will consider all information received and revise the competencies for publication.

Errata: Vol. 54, No. RR-16

In the *MMWR Recommendations and Reports*, "A Comprehensive Immunization Strategy to Eliminate Transmission of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP), Part 1: Immunization of Infants, Children, and Adolescents," the following errors occurred:

On page 8, the last two footnotes in Table 2 should read, "[¶¶]Dialysis formulation administered on a 3-dose schedule **at 0, 1, and 6 months**. [***]Two 1.0-mL doses administered at one site, on a 4-dose schedule **at 0, 1, 2, and 6 months**."

On pages 27–28, in the section titled, "Hepatitis B Immune Globulin (HBIG) Dose and Administration," the second sentence of the third bullet should read, "**For neonates (aged <1 month) and infants (aged 1–12 months)**, HBIG should be administered intramuscularly in the anterolateral thigh using a 22–25-gauge needle. **The appropriate needle length is usually 5/8" for neonates and 7/8"–1" for infants**."

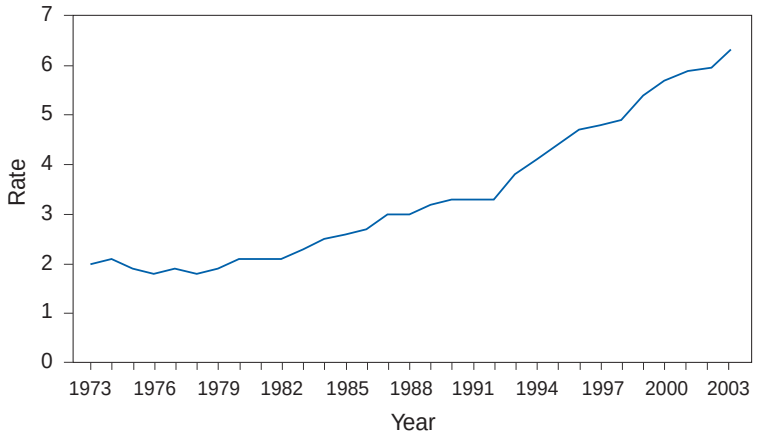
On page 29, second column, the second sentence of the second bullet should read, "Administration of three doses on an appropriate schedule (**Table 5**), followed by anti-HBs testing 1–2 months after the third dose, is usually more practical than serologic testing after one or more doses of vaccine."

Also on page 29, second column, third bullet, the first sub-bullet should read, "— If the HBsAg test result is positive, the persons should receive appropriate management, and any household, sexual, or needle-sharing contacts should be identified and vaccinated (see Appendix A)."

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Death Rates* for Parkinson Disease ð United States, 1973ï 2003À



* Per 100,000 standard U.S. population.
À Coded in accordance with the *International Classification of Diseases, Eighth Revision, Adapted*, during 1973ï 1978 and the *Ninth Revision* during 1979ï 1998. The *Tenth Revision* (codes G20-G21) is now in effect.

Annual U.S. death rates for Parkinson disease increased during 1973ï 2003. Parkinson disease became the 14th leading cause of death in the United States in 2003. This increase might be attributable to multiple factors, including an aging population, greater awareness of the disease, and improved identification of cases.

SOURCE: Hoyert DL, Heron M, Murphy SL, Kung HC. Health E-Stats. Deaths: final data for 2003. Hyattsville, MD: US Department of Health and Human Services, CDC; 2006. Available at http://www.cdc.gov/nchs/products/pubs/pubd/hestats/finaldeaths03/finaldeaths03.htm.

American Academy of Pediatrics

Policy Statement

April, 1989

AAP News

Confidentiality in Adolescent Health Care (RE9151)

AMERICAN ACADEMY OF PEDIATRICS

This statement was approved as policy by the following organizations: the American Academy of Pediatrics; the American Academy of Family Physicians; the American College of Obstetricians and Gynecologists; NAACOG-The Organization for Obstetric, Gynecologic, and Neonatal Nurses; and the National Medical Associations.

Adolescents tend to underutilize existing health care resources. The issue of confidentiality has been identified, by both providers and young people themselves, as a significant access barrier to health care.

Adolescents in the United States, while generally considered healthy, have a range of problems, including some of such severity as to jeopardize their development and health, their future opportunities and even their lives. To illustrate, there is an urgent need to reduce the incidence of adolescent suicide, substance abuse, and sexually transmitted diseases and unintended pregnancy.

As the primary providers of health care to adolescents, we urge the following principles for the guidance of our professional members and for broad consideration in the development of public policy:

1. Health professionals have an ethical obligation to provide the best possible care and counseling to respond to the needs of their adolescent patients.
2. This obligation includes every reasonable effort to encourage the adolescent to involve parents, whose support can, in many circumstances, increase the potential for dealing with the adolescent's problems on a continuing basis.
3. Parents are frequently in a patient relationship with the same providers as their children or have been exercising decision-making responsibility for their children with these providers. At the time providers establish an independent relationship with adolescents as patients, the providers should make this new relationship clear to parents and adolescents with regard to the following elements:
* The adolescent will have an opportunity for examination and counseling apart from parents, and the same confidentiality will be preserved between the adolescent patient and the provider as between the parent/adult and the provider.
* The adolescent must understand under what circumstances (eg, life-threatening emergency), the provider will abrogate this confidentiality.
* Parents should be encouraged to work out means to facilitate communication regarding appointments, payment, or other matters consistent with the understanding reached about confidentiality and parental support in this transitional period when the adolescent is moving toward self-responsibility for health care.
4. Providers, parents, and adolescents need to be aware of the nature and effect of laws and regulations in their jurisdictions that introduce further constraints on these relationships. Some of these laws and regulations are unduly restrictive and in need of revision as a matter of public policy. Ultimately, the health risks to the adolescent are so impelling that legal barriers and deference to parental involvement should not stand in the way of needed health care.

Reaffirmed 1/93, 11/97 COA, reaffirmed 5/00 COCAN.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

AMERICAN ACADEMY OF PEDIATRICS

Section on Endocrinology and Committee on Genetics

Technical Report: Congenital Adrenal Hyperplasia

ABSTRACT. The Section on Endocrinology and the Committee on Genetics of the American Academy of Pediatrics, in collaboration with experts from the fields of pediatric endocrinology and genetics, developed this policy statement as a means of providing up-to-date information for the practicing pediatrician about current practice and controversial issues in congenital adrenal hyperplasia (CAH), including the current status of prenatal diagnosis and treatment, the benefits and problem areas of neonatal screening programs, and the management of children with nonclassic CAH. The reference list is designed to allow physicians who wish more information to research the topic more thoroughly.

ABBREVIATIONS. CAH, congenital adrenal hyperplasia; 21-OH, 21-hydroxylase; 17-OHP, 17α-hydroxyprogesterone; AF, amniotic fluid; HLA, human leukocyte antigen; ACTH, adrenocorticotropic hormone.

Congenital adrenal hyperplasia (CAH) consists of a family of disorders caused by reduced activity of enzymes required for cortisol biosynthesis in the adrenal cortex. The most common defect is 21-hydroxylase (21-OH) deficiency, which accounts for >90% of all cases of CAH. Classic 21-hydroxylase deficiency is found in about 1:12 000 to 1:15 000 births; the frequency of nonclassic deficiency is unknown, although it may occur in up to 3% of individuals in certain groups. Clinical consequences of 21-OH deficiency arise primarily from overproduction and accumulation of precursors proximal to the blocked enzymatic step. These precursors are shunted into the androgen biosynthesis pathway, producing virilization in the female fetus or infant and rapid postnatal growth with accelerated skeletal maturation, precocious puberty, and short adult stature in both males and females. Approximately 75% of patients with classic 21-OH deficiency also have a defect in their ability to synthesize aldosterone. Such patients, especially undiagnosed male infants, may die during the newborn period of shock resulting from salt wasting.

Recent advances in molecular genetic analysis allow for prenatal diagnosis and treatment of at-risk fetuses. However, controversy remains regarding the efficacy and safety of prenatal intervention that attempts to minimize prenatal virilization in girls. Other controversial issues include the optimal regimen for postnatal treatments and the effects of long-term corticosteroid therapy on final height, sexual function, and fertility. Approximately 20 states include screening for CAH as a part of their newborn screening profiles. The cost-effectiveness of the programs in detecting patients who would not have been diagnosed before clinical manifestation of CAH continues to improve as new standards for levels of 17α-hydroxyprogesterone (17-OHP) in premature infants, very sick infants, and infants younger than 24 hours decrease the rate of false-positive results.

This review is designed to provide current information on prenatal diagnosis and treatment, the status of newborn screening, methods of diagnosis of affected patients and heterozygote carriers, and newer treatment approaches for CAH.

PRENATAL DIAGNOSIS AND TREATMENT

The objective of prenatal diagnosis and treatment of 21-OH deficiency is the prevention of prenatal virilization in affected female infants and the early recognition of the potential for salt wasting in the newborn infant.

Prenatal Diagnosis of 21-OH Deficiency

Prenatal prediction of CAH attributable to classic 21-OH deficiency is possible by using a number of modalities: determination of amniotic fluid (AF) hormone levels, human leukocyte antigen (HLA) typing of chorionic villus cells and/or AF cells, and molecular genetic studies of chorionic villus cells and AF cells. Advances in molecular genetic techniques have made molecular genetic studies the test of choice.

Prenatal diagnosis of CAH was first reported in 1965, based on elevated levels of AF 17-ketosteroids and pregnanetriol.[1] In 1975, the association between an elevated 17-OHP concentration in AF and the birth of an infant with salt-wasting CAH was reported.[2] Subsequent reports have confirmed the usefulness of AF 17-OHP concentrations for the prenatal diagnosis of classic CAH attributable to 21-OH deficiency.[3–13] Although amniocentesis has been performed routinely during the second trimester in women at risk of having an infant with CAH, elevated 17-OHP levels in AF obtained as early as 9 to 13 weeks in pregnancies with an affected fetus have been reported. Androstenedione levels (Δ4), which also are elevated in pregnancies in which the fetus is affected with CAH, provide another diagnostic measurement.

Because the gene for 21-OH has been linked to the HLA system on chromosome 6, prenatal prediction of CAH may be made by HLA typing of cultured AF

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

cells and cultured chorionic villus cells.[5,7,10,13–18] Use of chorionic villus cells permits earlier identification of the affected fetus than is possible with amniocentesis. In a pregnancy in which the fetus has an HLA type identical to that of the index case with 21-OH deficiency, the fetus is predicted to be affected. The fetus that shares 1 parental haplotype with the index case is predicted to be a heterozygous carrier, and the fetus with both haplotypes different from the index case is predicted to be homozygous normal.

The preferred technique for prenatal diagnosis is molecular genetic analysis using DNA extracted from chorionic villus cells or amniocytes for analysis of *CYP21B*, *C4* and HLA class I and II genes.[18–23] Advances in these molecular techniques have made genetic characterization more reliable and rapid,[24] such that in most centers the analysis of fetal *P450c21B* genes from chorionic villus cells or amniocytes has largely replaced hormonal and HLA analysis in the prenatal diagnosis of CAH attributable to 21-OH deficiency.[25] Causative mutations can now be identified on 95% of chromosomes using Southern blot analysis and selective amplification of the *CYP21B* gene by polymerase chain reaction, followed by allele-specific hybridization with oligonucleotide probes for a panel of 9 known *CYP21B* mutations.[26] A newly developed, rapid, allele-specific polymerase chain reaction has been used for prenatal diagnosis.[27] Mutations not detected by this approach can be characterized by direct sequencing of *CYP21B* genes.[28,29] Determination of satellite markers also may be informative. De novo mutations, found in patients with CAH but not in parents, are found in 1% of disease-causing *CYP21B* mutations.[28] Accurate prenatal prediction requires the correct molecular genetic analysis of the index case and molecular genetic analysis and complete hormonal profiling of the parents.

Prenatal Treatment of CAH Attributable to 21-OH Deficiency

Prenatal treatment of CAH to prevent the virilization of an affected female fetus has been considered desirable by a number of investigators.[2,30–33] Because masculinization of the external genitalia begins at about 6 to 7 weeks of gestation (8 to 9 weeks after the last menstrual period),[34,35] suppression of the fetal pituitary-adrenal axis at no later than 6 weeks of gestation theoretically could prevent ambiguity of the external genitalia in the female fetus with classic CAH, whereas therapy after that time would prevent progression of virilization.

Successful prenatal treatment to ameliorate or prevent virilization of a female fetus with classic CAH attributable to 21-OH deficiency was first reported in 1984.[36] In 2 pregnancies at risk for classic salt-wasting CAH, the mothers were treated with hydrocortisone and dexamethasone, respectively. Subsequent amniocentesis demonstrated that both infants were girls and had HLA types identical to those of their affected siblings, and treatment was continued to term. At birth, the external genitalia were normal in the infant whose mother was given dexamethasone and minimally virilized in the infant whose mother received hydrocortisone. Postnatally, the diagnosis of 21-OH deficiency was confirmed in both infants.[36] There are reports of >50 affected female infants in whom prenatal treatment with dexamethasone has been attempted. The dose of dexamethasone has ranged between 0.5 and 2 mg/d in 1 to 4 divided doses. Treatment was begun as early as the 4th week of pregnancy to as late as the 16th week. In some cases, treatment was interrupted for 5 to 7 days before amniocentesis, and, in a few cases, treatment was discontinued at 21 to 26 weeks.[18,21–23,37–53]

Fetal Outcome

Of the total number of cases for which data are available, treatment was considered successful for almost three fourths of the female infants; approximately one third had normal genitalia, and two thirds were described as being mildly virilized with clitoromegaly, partial labial fusion, or both. In slightly more than one fourth of all female infants treated, therapy was unsuccessful, and the infants had marked genital virilization.

The variability of the results has been attributed to a number of factors: inadequate dosage, interruption of treatment, delay in initiating treatment, variability in maternal metabolic clearance, and variability of placental metabolism of the administered glucocorticoid.[23,50] Variability in onset of fetal sexual differentiation and maternal noncompliance to therapy also must be considered.[23,50]

Spontaneous abortion, fetal demise during late pregnancy, intrauterine growth retardation, liver steatosis, hydrocephalus, agenesis of the corpus callosum, and hypospadias with unilateral cryptorchidism[51] have been reported occasionally when mothers received short-term treatment in unaffected pregnancies, as well as in affected pregnancies in which the mother received prolonged corticosteroid treatment. These events generally have not been considered related to the treatment or to the disease itself.[17,45,49,50] In a report of intrauterine growth retardation in an infant treated successfully for CAH, however, it was concluded that intrauterine growth retardation still should be considered "a possible fetal complication of treatment."[46] In long-term follow-up of most infants treated throughout the pregnancy or treated prenatally until midgestation,[17,44–50] development seems to be normal, and growth has been consistent with the family pattern and that of the other affected siblings.[17,41,42,44,45] Rare adverse events, including failure to thrive and psychomotor and psychosocial delay in development, have been observed.[51] Long-term follow-up is limited, however, and detailed neuropsychological evaluations have not been reported.

In a preliminary report, cognitive and behavioral development of young children aged 6 months to 5.5 years treated prenatally with dexamethasone because of risk for CAH was assessed by standard questionnaires completed by the mothers. The development of those children was compared with the development of children from untreated pregnancies at risk for CAH.[52] No significant differences in cognitive abilities or behavior problems were identified.[50] However, the demonstration of an increased

frequency of neurologically silent white matter abnormalities and temporal lobe atrophy in children and adults with CAH indicates that the long-term effects of glucocorticoids on the central nervous system are not fully known and must be evaluated carefully.[54] Although experimental treatment given to animals cannot be directly extrapolated to humans, high doses of dexamethasone administered to rhesus monkeys toward the end of gestation were associated with abnormalities of the fetal brain consisting of neuronal degeneration of hippocampal, pyramidal, and dentate regions.[55] Other animal studies have focused on long-term cardiovascular risks of prenatal dexamethasone treatment. Intrauterine growth retardation, lower kidney weight, oligonephronia, and the development of hypertension in adulthood have been demonstrated in rat pups whose mothers received dexamethasone prenatally.[56–58] These studies underscore the need for careful long-term outcome studies of prenatal dexamethasone treatment, in which treated mothers and infants are followed up to determine possible ill effects in later adult life.

Maternal Complications of Prenatal Treatment

Maternal adverse effects of dexamethasone may be serious and long-lasting.[23,44] Reported adverse effects include edema, excessive weight gain, irritability, nervousness, mood swings, hypertension, glucose intolerance, chronic epigastric pain, gastroenteritis, cushingoid facial features, increased facial hair growth, and severe striae with permanent scarring.[17,18,23,40,44–47,49,50]

In a European survey, adverse effects occurred in approximately one third of women who were treated until delivery and for whom data were available.[48] Marked weight gain, reported in approximately 25%, was the most common problem.[48] The maternal adverse effects prompted decreasing the dosage or discontinuing treatment and may have resulted in nonadherence with therapy and unsatisfactory genital outcome for the infant.[40,49] Transient symptoms of glucocorticoid deficiency on tapering or discontinuing treatment have been reported rarely.[17,41] A recent report indicated that one third of the mothers who received dexamethasone treatment during pregnancy would not elect treatment in a future pregnancy.[51]

Current Recommendations for Prenatal Diagnosis and Treatment

Prenatal diagnosis and treatment is performed most commonly in families with a previously affected child with CAH with a defined genetic defect.

Informed consent, in which the risks of possible maternal adverse effects, variable genital outcome, and possible but presently unknown long-term effects of dexamethasone treatment on the treated children are discussed, should be obtained from all parents seeking genetic counseling before prenatal diagnosis and treatment. Mothers with previous medical or mental conditions that may be aggravated by dexamethasone, such as psychosis, hypertension, overt diabetes, gestational diabetes, or toxemia, should not be treated or should be treated only with extreme caution. Patients should be referred to centers with expertise in the prenatal management of pregnancies at risk for CAH. Treatment should be initiated by the fifth week of gestation with dexamethasone, at a dose of approximately 20 to 25 μg/kg per day, given in 2 or 3 divided doses. Chorionic villus sampling during the 9th to 10th week of gestation for prenatal diagnosis should be performed with karyotyping, and, optimally, *HLA, CYP21B,* and *C4* gene analysis of chorionic villus cells. If chorionic villus sampling is performed during the 10th to 11th week, a small amount of AF can be obtained for hormonal analysis as well, to gain some measure of fetal adrenal suppression. If the fetus is a boy or an unaffected girl, treatment is discontinued. If the fetus is an affected girl, or if prenatal diagnosis by chorionic villus sampling is unsuccessful or not performed, treatment is continued. If necessary, for further clarification, amniocentesis can be performed at 15 weeks with genetic analysis of amniocytes and hormonal determination in the AF. If the fetus is an affected girl, treatment is continued to term. It is important to note that if the mother is receiving treatment with dexamethasone, hormonal analysis of AF is unreliable for prenatal diagnosis. Furthermore, because only 1 of 8 infants will be an affected girl, 7 of 8 infants will be treated unnecessarily for at least 12 weeks.

Maternal monitoring for physical, hormonal, and metabolic changes should begin at the initiation of treatment and should be continued throughout the pregnancy. The serum estriol level to evaluate adequacy of fetal adrenal suppression and the fasting blood glucose level should be determined monthly, and an oral glucose tolerance test should be performed during the second and third trimesters. In the presence of excessive weight gain, increased blood pressure, and glucose intolerance or other adverse effects, prompt intervention should be instituted. Consideration should be given to reducing the dosage of dexamethasone during the second and third trimesters.

Maternal treatment seems to prevent or reduce virilization in approximately 75% of affected female fetuses but has not been uniformly successful in all pregnancies. Its efficacy and safety remain to be fully defined. It should be offered only to patients who have a clear understanding of the possible risks and benefits and who are able to comply with the need for close monitoring throughout pregnancy and the need for long-term follow-up of the infants, children, and adults treated prenatally.

NEONATAL SCREENING

The major objectives of newborn screening for CAH attributable to 21-OH deficiency are to identify infants at risk for the development of life-threatening adrenal crisis and to prevent the incorrect male sex assignment of affected female infants with ambiguous genitalia. The former is particularly important for affected boys whose initial manifestation may be adrenal crisis. In addition, early identification will permit the monitoring and treatment of affected in-

fants and children to prevent postnatal exposure to excessive androgens and the accompanying clinical manifestations. In 1977, newborn screening for 21-OH deficiency became possible after development of the method to measure 17-OHP in a heel-stick capillary blood specimen on filter paper. A pilot newborn screening program was developed in Alaska shortly thereafter. National and regional screening programs now have been developed worldwide, and in almost 20 states.[59–61] Data on >8 million neonates screened are available. The disorder occurs in 1 of 21 000 newborns in Japan, 1 of 10 000 to 16 000 in Europe and North America, and 1 of 300 in Yupik Eskimos of Alaska. About 75% of affected infants have the salt-losing, virilizing form, and 25% have the simple virilizing form of the disorder. The nonclassic form is not detected reliably by newborn screening.

Newborn Screening Procedures and Cost Analysis

Neonatal screening for CAH requires the following procedures for optimal efficiency and effective screening results: 1) early sample collection, ideally between 2 and 3 days of life; 2) immediate and reliable analysis of 17-OHP levels after sample collection; 3) optimally chosen 17-OHP cutoff levels that distinguish affected from unaffected newborns; 4) immediate and clear communication of presumptive positive results to the appropriate health care professional and to family members; and 5) diagnostic confirmation of newborns with positive screening results.

All CAH newborn screening programs use the measurement of 17-OHP in a filter paper blood spot sample obtained by the heel-stick technique as used for newborn screening of other disorders. The concurrent screening test procedures for disorders such as phenylketonuria and congenital hypothyroidism, which were established before the initiation of CAH screening, seem to have influenced the age at which CAH screening samples were collected in many programs. Although most screening samples for CAH had been collected between 3 and 5 days after birth,[59,62] recent practices of early discharge from the nursery and increased numbers of deliveries at birthing centers have resulted in many screening samples being collected at 1 to 2 days after birth. This may result in an increased number of false-positive tests.

The majority of screening programs worldwide use a single screening test without retesting of questionable 17-OHP levels.[62] This single-screen method offers the advantage of expedited results but may cause inaccurate classification in borderline cases. A small number of programs perform a second screening test of the initial sample to confirm borderline cases identified in the first screening.[62] Although relatively time-intensive, this approach provides greater accuracy than the single-screen method. One program (Manitoba, Canada) collects and tests a second sample on request when 17-OHP levels are elevated above the cutoff level in the initial test.[62] A number of programs mandate 2 screenings and routinely obtain and test a second sample.[62–64] In addition to detecting infants with the salt-wasting form of CAH and preventing life-threatening adrenal crisis by using results of the first screening, this approach is optimal for minimizing false-negative results by detecting newborns with the simple virilizing and mild forms of the disorder on the second screening who may not have been identified initially.[59]

Laboratory Screening Assay Methods and Cutoff Levels

Three principal assay techniques are used for the initial screening of CAH in neonates: radioimmunoassay, enzyme-linked immunosorbent assay, and time-resolved fluoroimmunoassay. These assays measure the 17-OHP concentration in a filter paper blood spot sample obtained by the heel-stick technique without prior extraction or purification. The 17-OHP levels measured by direct fluoroimmunoassay are significantly higher than levels measured by radioimmunoassay after extraction. Screening fluoroimmunoassay may overestimate 17-OHP levels in low birth weight infants weighing <1500 g.[65] Although theoretically 17-OHP concentrations in newborns should be comparable regardless of the assay method, there is considerable variation in cutoff levels from one program to another. The 17-OHP cutoff levels that divide positive from negative screening test results have been established at greater than the 99th percentile of the mean level in healthy newborns or on the basis of a normal range established in that program or on the experience of other programs.[62] Other sources of variation include the different antibodies and reagents used in the assay systems, varying thickness and density of the filter paper used for sample collection, and, most significantly, the ethnic background of the reference newborns.

Reliability of Screening Tests

The reliability of each screening program is based on evaluation of both the false-negative and false-positive rates. There have been extraordinarily few false-negative results in newborn screening worldwide.[62] The majority of reported false-positive results have been caused by low birth weight and premature birth, in which the 17-OHP levels are invariably higher. Therefore, separate normative reference levels should be established based on birth weight or gestational age to minimize an otherwise unacceptably high false-positive rate. In 1 study, application of multitiered weight-adjusted 17-OHP cutoff levels compared with a 2-tiered criterion reduced the number of false-positive results requiring immediate follow-up testing by >50%, and the rate was reduced by >90% among low birth weight infants.[65] Two-tier weight-adjusted cutoff levels are being used by many programs with acceptable false-positive rates,[62] but further modification of the test cutoff levels and recall procedures is necessary in programs with persistently high false-positive rates.

As more adequate reference data have been developed, 17-OHP cutoff levels in low birth weight infants have been adjusted, and the false-positive rates in preterm screening populations have improved.[62,65,66] Issues relating to false-positive results, however, including the cost of evaluating false-pos-

itive cases and the undesirable psychological effect on patients' families, continue to be problematic. Therefore, periodic review of 17-OHP cutoff levels is essential to minimize false-positive and false-negative rates and ensure high sensitivity and specificity of neonatal screening tests for CAH. Genotyping for mutations in *CYP21B* causing CAH has been suggested as an adjunct to newborn screening.[67]

DIAGNOSIS

In classic 21-OH deficiency, serum levels of 17-OHP are markedly elevated. However, 17-OHP levels are normally high during the first 2 to 3 days after birth and may range as high as levels found in affected patients. By the third day, however, levels in healthy infants fall, and those in affected infants rise to clearly diagnostic levels. Ill, unaffected infants and premature infants may have elevated levels of 17-OHP. Serum concentrations of testosterone in girls and androstenedione in boys and girls also are elevated in affected infants. Salt losers may have low serum sodium and chloride levels, inappropriately increased urine sodium levels, and elevated levels of serum potassium and serum urea nitrogen. However, hyponatremia and hyperkalemia are usually not present before 7 days of age. Plasma levels of renin are elevated, and the serum aldosterone level is inappropriately low for the renin level.

In the late-onset variant of CAH, basal circulating levels of 17-OHP are not as high as in the classic form and may even be normal, especially if the specimen is not obtained in the morning. Therefore, for initial screening, blood specimens should be obtained between 7:30 and 8:30 AM. Elevated basal 17-OHP levels may suggest the diagnosis, but an adrenocorticotropic hormone (ACTH) test with measurement of serum cortisol and 17-OHP levels is necessary to confirm the diagnosis. A significant rise in the 17-OHP level 60 minutes after an intravenous bolus of 0.25 mg of ACTH (1–24) is diagnostic. The 17-OHP–cortisol ratio is markedly elevated, and there may be a blunted or absent response in cortisol.

TREATMENT

Administration of glucocorticoids inhibits excessive production of androgens and prevents progressive virilization. A variety of glucocorticoids (hydrocortisone, prednisone, dexamethasone) and dosage schedules have been used for this purpose. Most often, hydrocortisone (10–20 mg/m^2 per 24 hours) is administered orally in 3 divided doses. There have been recent problems with consistent dosing with the liquid formulation of hydrocortisone. Tablets may give more reliable levels. Infants usually require 2.5 to 5 mg 3 times daily and children, 5 to 10 mg 3 times daily. The morning dose should be given as early as possible to blunt the early morning corticotropin increase that begins during the predawn hours. Doses must be individualized by monitoring growth, bone age, and hormonal levels. Patients with disturbances of electrolyte regulation (salt losers) and elevated plasma renin activity require a mineralocorticoid and sodium supplementation in addition to the glucocorticoid. Maintenance therapy with fludrocortisone acetate (Florinef) (0.05–0.3 mg daily) and sodium chloride (1–3 g) is usually sufficient to normalize plasma renin activity. Increased doses of glucocorticoid are indicated during periods of stress, such as infection or surgery, for salt-losing and non–salt-losing patients.

Non–salt-losing children, particularly boys, frequently are not diagnosed until 3 to 7 years of age, at which time osseous maturation may be 5 years or more in advance of chronologic age. Institution of treatment slows growth and osseous maturation to more nearly normal rates in some children. In others, especially if the bone age is 12 years or more, spontaneous gonadotropin-dependent puberty may occur as therapy with hydrocortisone suppresses production of adrenal androgens and permits release of pituitary gonadotropins if the appropriate level of hypothalamic maturation is present. This form of superimposed true precocious puberty may be treated with a long-acting potent luteinizing hormone–releasing hormone analog.

Patients with nonclassic 21-OH deficiency do not always require treatment. Many are asymptomatic throughout their lives, or symptoms may develop during puberty, after puberty, or postpartum. Traditionally, therapy with lower amounts of glucocorticoid than those required for patients with classic 21-OH deficiency have been used. Indications for treatment include bone age advancement, severe acne, hirsutism, menstrual irregularity, and infertility.

The protocol for monitoring these patients varies with personal preference. Measurements of 24-hour urinary levels of 17-ketosteroids and pregnanetriol are unnecessary. Serum levels of 17-OHP, androstenedione, testosterone, and renin, measured preferably between 7:30 and 8:30 AM, either before or shortly after taking the morning medication, usually provide adequate indices of control. Recent reports indicate that 17-OHP may be measured reliably and accurately at home using filter paper techniques.[68] Careful monitoring for signs of cortisol and androgen excess, growth and weight gain, pubertal development, and osseous maturation is important.

The administration of glucocorticoid must be lifelong for all patients with classic forms of CAH. More potent glucocorticoids tend to suppress growth more than hydrocortisone. However, after growth is completed, prednisone, given once or twice daily, or dexamethasone, given as a single dose at bedtime, may result in adequate suppression of androgens.

Heterozygous carriers of 21-OH deficiency have been identified by measuring the ratio of 17-OHP to 11-deoxycortisol or cortisol 60 minutes after an intravenous bolus injection of 0.25 mg of ACTH (1–24) and, in families with an affected individual, by HLA genotyping. Molecular characterization, alone or in combination with hormonal measurements and HLA genotyping, should be used when available for genetic counseling.

A number of clinical trials have been designed to evaluate the efficacy of new treatment modalities. These modalities should be considered experimental at this time.

Because it is recognized that patients with Addison's disease are more easily and successfully treated than patients with CAH, adrenalectomy for patients with salt-wasting 21-OH deficiency has been suggested as a possible mode of therapy. This would eliminate the difficult problems of achieving adequate suppression of adrenal androgens without giving excessive glucocorticoid, and without the rapid advancement of bone age and early virilization that occur with inadequate adrenal androgen suppression. Adrenalectomy has been performed for treatment of 21-OH deficiency. Long-term follow-up of a large number of patients will be necessary to determine the safety and efficacy of this mode of therapy.[69]

Preliminary use of a combination of an antiandrogen (to block androgen effect) and an aromatase inhibitor (to block conversion of androgen to estrogen) with a reduced hydrocortisone dose also has been reported.[70,71] Again, long-term studies are required to determine if this regimen will further improve the final outcome. The use of synthetic blockers of the corticotropin-releasing hormone and corticotropin receptors theoretically could provide a pharmacologic adrenalectomy and may provide additional future treatment options.

CAH is a chronic disease requiring lifelong monitoring and treatment. The diagnosis and treatment are complex, requiring specific training and expertise to individualize therapy. Thus, a pediatric endocrinologist ideally should be involved in the management of all children and adolescents with CAH. A high index of suspicion should be present in any infant with ambiguous genitalia and nonpalpable testes, especially in the presence of increased pigmentation of nipples, genitalia, and/or skin creases. A family history of early neonatal deaths or previously affected family members adds to the risk of having CAH. Markedly elevated levels of 17-OHP should prompt immediate evaluation in any newborn infant. Pediatricians should call their state department of health to determine if newborn screening for CAH is available. New molecular techniques permit early prenatal diagnosis and have made possible intervention to prevent prenatal virilization in affected female infants. Early diagnosis through newborn screening may avert salt-losing crises, particularly in affected boys, by permitting early initiation of therapy. Although glucocorticoid therapy is the mainstay of treatment, the outcome has not been optimal and therapeutic regimens vary. New approaches to treatment, including adrenalectomy, combination antiandrogen and aromatase inhibitors, and synthetic blockers of corticotropin-releasing hormone and corticotropin receptors are under investigation. Support for families is available through a national CAH group, The Magic Foundation, 1327 North Harlem Avenue, Oak Park, IL, 60302 (http://www.magicfoundation.org).

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AMERICAN ACADEMY OF PEDIATRICS

AMERICAN ACADEMY OF FAMILY PHYSICIANS

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A Consensus Statement on Health Care Transitions for Young Adults With Special Health Care Needs

ABSTRACT. This policy statement represents a consensus on the critical first steps that the medical profession needs to take to realize the vision of a family-centered, continuous, comprehensive, coordinated, compassionate, and culturally competent health care system that is as developmentally appropriate as it is technically sophisticated. The goal of transition in health care for young adults with special health care needs is to maximize lifelong functioning and potential through the provision of high-quality, developmentally appropriate health care services that continue uninterrupted as the individual moves from adolescence to adulthood. This consensus document has now been approved as policy by the boards of the American Academy of Pediatrics, the American Academy of Family Physicians, and the American College of Physicians-American Society of Internal Medicine.

INTRODUCTION

Each year in the United States, nearly half a million children with special health care needs cross the threshold into adulthood.[1] One generation ago, most of those with severe disabilities died before reaching maturity; now more than 90% survive to adulthood.[2] Most young people with special health care needs are able to find their way into and negotiate through adult systems of care.[3] However, many adolescents and young adults with severe medical conditions and disabilities that limit their ability to function and result in complicating social, emotional, or behavioral sequelae experience difficulty transitioning from child to adult health care. There is a substantial number whose success depends on more deliberate guidance.[4]

Children grow up within complex living arrangements, communities, and cultures and receive medical care within an equally complex, interlocking set of relationships that includes social services, education, vocational training, and recreation. Clearly, no single approach will work equally well for all young people, and the health care sector cannot work in isolation from the other professionals and networks that impact these young people.[5] By focusing on the health care sector in this policy statement, we do not ignore other critical relationships. Rather, we are acknowledging that physicians have an important role in facilitating transitions to adulthood and to adult health care for young people who are least likely to do it successfully on their own.

The goals of this policy statement are to ensure that by the year 2010 all physicians who provide primary or subspecialty care to young people with special health care needs 1) understand the rationale for transition from child-oriented to adult-oriented health care; 2) have the knowledge and skills to facilitate that process; and 3) know if, how, and when transfer of care is indicated.

WHAT IS MEANT BY "HEALTH CARE TRANSITIONS"?

Transitions are part of normal, healthy development and occur across the life span. Transition in health care for young adults with special health care needs is a dynamic, lifelong process that seeks to meet their individual needs as they move from childhood to adulthood. The goal is to maximize lifelong functioning and potential through the provision of high-quality, developmentally appropriate health care services that continue uninterrupted as the individual moves from adolescence to adulthood. It is patient centered, and its cornerstones are flexibility, responsiveness, continuity, comprehensiveness, and coordination.

Physicians are of special importance in this process because of the frequent contact with many of these young people and the close relationships that often develop with them and their families.

A well-timed transition from child-oriented to adult-oriented health care allows young people to optimize their ability to assume adult roles and functioning. For many young people with special health care needs, this will mean a transfer from a child to an adult health care professional; for many others, it will involve an ongoing relationship with the same provider but with a reorientation of clinical interac-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

tions to mirror the young person's increasing maturity and emerging adulthood.

Whether the transition entails a transfer of care or not, all adults with special health care needs deserve an adult focused primary care physician. This is not to say that the child health specialist will not have an ongoing role. Rather, it is to affirm that just as children receive optimal primary care in a medical practice experienced in the care of children, so too adults benefit from receiving care from physicians who are trained and experienced in adult medicine.[5] Whether or not a transfer of care occurs, successful transition requires communication and collaboration among primary care specialists, subspecialists, young adult patients, and their families.

WHY IS PLANNING FOR TRANSITIONS IMPORTANT NOW?

Healthy People 2010[6] established the goal that all young people with special health care needs will receive the services needed to make necessary transitions to all aspects of adult life, including health care, work, and independent living. Just as the Individuals With Disabilities Education Act of 1997[7] requires a plan for education transition, so too there should be a plan for health care transition. The challenges faced by health care professionals include ensuring age-appropriate care, advocating for improved health insurance coverage, and negotiating adequate compensation for services provided.

Optimal health care is achieved when every person at every age receives health care that is medically and developmentally appropriate. The central rationale for health care transition planning for young people with special health care needs is to achieve this goal by ensuring that adults receive primary medical care from those trained to provide it.

CRITICAL FIRST STEPS TO ENSURING SUCCESSFUL TRANSITIONING TO ADULT-ORIENTED HEALTH CARE

1. Ensure that all young people with special health care needs have an identified health care professional who attends to the unique challenges of transition and assumes responsibility for current health care, care coordination, and future health care planning. This responsibility is executed in partnership with other child and adult health care professionals, the young person, and his or her family. It is intended to ensure that as transitions occur, all young people have uninterrupted, comprehensive, and accessible care within their community.
2. Identify the core knowledge and skills required to provide developmentally appropriate health care transition services to young people with special health care needs and make them part of training and certification requirements for primary care residents and physicians in practice.
3. Prepare and maintain an up-to-date medical summary that is portable and accessible. This information is critical for successful health care transition and provides the common knowledge base for collaboration among health care professionals.
4. Create a written health care transition plan by age 14 together with the young person and family. At a minimum, this plan should include what services need to be provided, who will provide them, and how they will be financed. This plan should be reviewed and updated annually and whenever there is a transfer of care.
5. Apply the same guidelines for primary and preventive care for all adolescents and young adults, including those with special health care needs, recognizing that young people with special health care needs may require more resources and services than do other young people to optimize their health. Examples of such guidelines include the American Medical Association's *Guidelines for Adolescent Preventive Services (GAPS)*,[8] the National Center for Education in Maternal and Child Health's *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*,[9] and the US Public Health Service's *Guidelines to Clinical Preventive Services*.[10]
6. Ensure affordable, continuous health insurance coverage for all young people with special health care needs throughout adolescence and adulthood. This insurance should cover appropriate compensation for 1) health care transition planning for all young people with special health care needs, and 2) care coordination for those who have complex medical conditions.

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SPECIAL ARTICLE

Consensus Statement on Management of Intersex Disorders

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THE BIRTH of an intersex child prompts a long-term management strategy that involves myriad professionals working with the family. There has been progress in diagnosis, surgical techniques, understanding psychosocial issues, and recognizing and accepting the place of patient advocacy. The Lawson Wilkins Pediatric Endocrine Society and the European Society for Paediatric Endocrinology considered it timely to review the management of intersex disorders from a broad perspective, review data on longer-term outcome, and formulate proposals for future studies. The methodology comprised establishing a number of working groups, the membership of which was drawn from 50 international experts in the field. The groups prepared previous written responses to a defined set of questions resulting from evidence-based review of the literature. At a subsequent gathering of participants, a framework for a consensus document was agreed. This article constitutes its final form.

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Key Words
intersex, sexual differentiation, ambiguous genitalia, genital surgery

Abbreviations
DSD— disorder(s) of sex development
CAH— congenital adrenal hyperplasia
CAIS— complete androgen insensitivity syndrome
5αRD2—5-α-reductase
PAIS—partial androgen insensitivity syndrome
MGD—mixed gonadal dysgenesis

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NOMENCLATURE AND DEFINITIONS

Advances in identification of molecular genetic causes of abnormal sex with heightened awareness of ethical issues and patient advocacy concerns necessitate a reexamination of nomenclature.[1] Terms such as "intersex," "pseudohermaphroditism," "hermaphroditism," "sex reversal," and gender-based diagnostic labels are particularly controversial. These terms are perceived as potentially pejorative by patients[2] and can be confusing to practitioners and parents alike. We propose the term "disorders of sex development" (DSD), as defined by congenital conditions in which development of chromosomal, gonadal, or anatomic sex is atypical.

The proposed changes in terminology are summarized in Table 1. A modern lexicon is needed to integrate progress in molecular genetic aspects of sex development. Because outcome data in individuals with DSD are limited, it is essential to use precision when applying definitions and diagnostic labels.[3,4] It is also appropriate to use terminology that is sensitive to the concerns of patients. The ideal nomenclature should be sufficiently flexible to incorporate new information yet robust enough to maintain a consistent framework. Terms should be descrip-

TABLE 1 **Proposed Revised Nomenclature**

Previous	Proposed
Intersex	DSD
Male pseudohermaphrodite, undervirilization of an XY male, and undermasculinization of an XY male	46,XY DSD
Female pseudohermaphrodite, overvirilization of an XX female, and masculinization of an XX female	46,XX DSD
True hermaphrodite	Ovotesticular DSD
XX male or XX sex reversal	46,XX testicular DSD
XY sex reversal	46,XY complete gonadal dysgenesis

tive and reflect genetic etiology when available and accommodate the spectrum of phenotypic variation. Clinicians and scientists must value the nomenclature's use, and it must be understandable to patients and their families. An example of how the proposed nomenclature could be applied in a classification of DSD is shown in Table 2.

Psychosexual development is traditionally conceptualized as 3 components: "gender identity" refers to a person's self-representation as male or female (with the caveat that some individuals may not identify exclusively with either); "gender role" (sex-typical behaviors) describes the psychological characteristics that are sexually dimorphic within the general population, such as toy preferences and physical aggression; and "sexual orientation" refers to the direction(s) of erotic interest (heterosexual, bisexual, homosexual) and includes behavior, fantasies, and attractions. Psychosexual development is influenced by multiple factors such as exposure to androgens, sex chromosome genes, and brain structure, as well as social circumstance and family dynamics.

Gender dissatisfaction denotes unhappiness with assigned sex. Causes of gender dissatisfaction, even among individuals without DSD, are poorly understood. Gender dissatisfaction occurs more frequently in individuals with DSD than in the general population but is difficult to predict from karyotype, prenatal androgen exposure, degree of genital virilization, or assigned gender.[5–7] Prenatal androgen exposure is clearly associated with other aspects of psychosexual development.[8,9] There are dose-related effects on childhood play behavior in girls with congenital adrenal hyperplasia (CAH), whereby those with the more severe mutations and marked genital virilization play more with boys' toys.[10] Prenatal androgen exposure is also associated with other psychological characteristics such as maternal interest and sexual orientation. It is important to emphasize the separability of sex-typical behavior, sexual orientation, and gender identity. Thus, homosexual orientation (relative to sex of rearing) or strong cross-sex interest in an individual with DSD is not an indication of incorrect gender assignment. Understanding variations in psychosexual development in individuals with DSD requires reference to studies in nonhuman species that show marked but complex effects of androgens on sex differentiation of the brain and on behavior. Outcomes can be influenced by the timing, dose, and type of androgen exposure, receptor availability, and modification by the social environment.[11–14]

Data from rodent studies suggest that sex chromosome genes may also influence brain structure and behavior directly.[15,16] However, studies in individuals with complete androgen insensitivity syndrome (CAIS) do not indicate a behavioral role for Y-chromosome genes, although data are limited.[17] Sex differences in brain structures have been identified across species, some of which coincide with pubertal onset, perhaps suggesting hormonal responsivity.[18–20] The limbic system and hypothalamus, both of which play a role in reproduction, show sex differences in specific nuclei, but it is not clear

TABLE 2 **An Example of a DSD Classification**

Sex Chromosome DSD	46,XY DSD	46,XX DSD
45,X (Turner syndrome and variants)	Disorders of gonadal (testicular) development: (1) complete gonadal dysgenesis (Swyer syndrome); (2) partial gonadal dysgenesis; (3) gonadal regression; and (4) ovotesticular DSD	Disorders of gonadal (ovarian) development: (1) ovotesticular DSD; (2) testicular DSD (eg, SRY^+, duplicate SOX9); and (3) gonadal dysgenesis
47,XXY (Klinefelter syndrome and variants)	Disorders in androgen synthesis or action: (1) androgen biosynthesis defect (eg, 17-hydroxysteroid dehydrogenase deficiency, 5αRD2 deficiency, StAR mutations); (2) defect in androgen action (eg, CAIS, PAIS); (3) luteinizing hormone receptor defects (eg, Leydig cell hypoplasia, aplasia); and (4) disorders of anti-Müllerian hormone and anti-Müllerian hormone receptor (persistent Müllerian duct syndrome)	Androgen excess: (1) fetal (eg, 21-hydroxylase deficiency, 11-hydroxylase deficiency); (2) fetoplacental (aromatase deficiency, POR [P450 oxidoreductase]); and (3) maternal (luteoma, exogenous, etc)
45,X/46,XY (MGD, ovotesticular DSD)		Other (eg, cloacal exstrophy, vaginal atresia, MURCS [Müllerian, renal, cervicothoracic somite abnormalities], other syndromes)
46,XX/46,XY (chimeric, ovotesticular DSD)		

Although consideration of karyotype is useful for classification, unnecessary reference to karyotype should be avoided; ideally, a system based on descriptive terms (eg, androgen insensitivity syndrome) should be used wherever possible. StAR indicates steroidogenic acute regulatory protein.

when these differences emerge. Interpretation of sex differences is complicated by the effect of cell death and synaptic pruning on normal maturation and by effects of experience on the brain. Structure of the brain is not currently useful for gender assignment.

INVESTIGATION AND MANAGEMENT OF DSD

General Concepts of Care

Optimal clinical management of individuals with DSD[21] should comprise the following: (1) gender assignment must be avoided before expert evaluation in newborns; (2) evaluation and long-term management must be performed at a center with an experienced multidisciplinary team; (3) all individuals should receive a gender assignment; (4) open communication with patients and families is essential, and participation in decision-making is encouraged; and (5) patient and family concerns should be respected and addressed in strict confidence.

The initial contact with the parents of a child with a DSD is important, because first impressions from these encounters often persist. A key point to emphasize is that the child with a DSD has the potential to become a well-adjusted, functional member of society. Although privacy needs to be respected, a DSD is not shameful. It should be explained to the parents that the best course of action may not be clear initially, but the health care team will work with the family to reach the best possible set of decisions in the circumstances. The health care team should discuss with the parents what information to share in the early stages with family members and friends. Parents need to be informed about sexual development, and Web-based information may be helpful, provided the content and focus of the information is balanced and sound.

Ample time and opportunity should be made for continued discussion with review of information previously provided.[1]

The Multidisciplinary Team

Optimal care for children with DSD requires an experienced multidisciplinary team that is generally found in tertiary care centers. Ideally, the team includes pediatric subspecialists in endocrinology, surgery, and/or urology, psychology/psychiatry, gynecology, genetics, neonatology, and, if available, social work, nursing, and medical ethics.[22] Core composition will vary according to DSD type, local resources, developmental context, and location. Ongoing communication with the family's primary care physician is essential.[23]

The team has a responsibility to educate other health care staff in the appropriate initial management of affected newborns and their families. For new patients with DSD, the team should develop a plan for clinical management with respect to diagnosis, gender assignment, and treatment options before making any recommendations. Ideally, discussions with the family are conducted by one professional with appropriate communication skills.[24] Transitional care should be organized with the multidisciplinary team operating in an environment that includes specialists with experience in both pediatric and adult practice. Support groups can have an important role in the delivery of care to patients with DSD and their families[25] (see Appendix 1).

Clinical Evaluation

A family and prenatal history, a general physical examination with attention to any associated dysmorphic features, and an assessment of the genital anatomy in comparison to published norms need to be recorded (Table 3). Criteria that suggest DSD include (1) overt genital ambiguity (eg, cloacal exstrophy), (2) apparent female genitalia with an enlarged clitoris, posterior labial fusion, or an inguinal/labial mass, (3) apparent male genitalia with bilateral undescended testes, micropenis, isolated perineal hypospadias, or mild hypospadias with unde-

TABLE 3 **Anthropometric Measurements of the External Genitalia**

Sex	Population	Age	Stretched Penile Length, Mean ± SD, cm (Males), or Clitoral Length, Mean ± SD, mm (Females)	Penile Width, Mean ± SD, cm (Males), or Clitoral Width, Mean ± SD, mm (Females)	Mean Testicular Volume, mL (Males), or Perineum Length, Mean ± SD, mm (Females)	Ref No.
M	United States	30 wk GA	2.5 ± 0.4			26
M	United States	Term	3.5 ± 0.4	1.1 ± 0.1	0.52 (median)	26 and 27
M	Japan	Term to 14 y	2.9 ± 0.4 − 8.3 ± 0.8			28
M	Australia	24–36 wk GA	2.27 + (0.16 GA)			29
M	China	Term	3.1 ± 0.3	1.07 ± 0.09		30
M	India	Term	3.6 ± 0.4	1.14 ± 0.07		30
M	North America	Term	3.4 ± 0.3	1.13 ± 0.08		30
M	Europe	10 years	6.4 ± 0.4		0.95–1.20	27 and 31
M	Europe	Adult	13.3 ± 1.6		16.5–18.2	27 and 31
F	United States	Term	4.0 ± 1.24	3.32 ± 0.78		32
F	United States	Adult nulliparous	15.4 ± 4.3			33
F	United States	Adult	19.1 ± 8.7	5.5 ± 1.7	31.3 ± 8.5	34

GA indicates gestational age.

scended testis, (4) a family history of DSD such as CAIS, and (5) a discordance between genital appearance and a prenatal karyotype. Most causes of DSD are recognized in the neonatal period; later presentations in older children and young adults include (1) previously unrecognized genital ambiguity, (2) inguinal hernia in a female, (3) delayed or incomplete puberty, (4) virilization in a female, (5) primary amenorrhea, (6) breast development in a male, and (7) gross and occasionally cyclic hematuria in a male.

Diagnostic Evaluation

Considerable progress has been made with understanding the genetic basis of human sexual development,[35] yet a specific molecular diagnosis is identified in only ~20% of cases of DSD. The majority of virilized 46,XX infants will have CAH. In contrast, only 50% of 46,XY children with DSD will receive a definitive diagnosis.[36,37] Diagnostic algorithms do exist, but with the spectrum of findings and diagnoses, no single evaluation protocol can be recommended in all circumstances. Some tests, such as imaging by ultrasound, are operator dependent. Hormone measurements need to be interpreted in relation to the specific assay characteristics and to normal values for gestational and chronological age. In some cases, serial measurements may be needed.

First-line testing in newborns includes karyotyping with X- and Y-specific probe detection (even when prenatal karyotype is available), imaging (abdominopelvic ultrasound), measurement of 17-hydroxyprogesterone, testosterone, gonadotropins, anti-Müllerian Hormone, and serum electrolytes, and urinalysis. The results of these investigations are generally available within 48 hours and will be sufficient for making a working diagnosis. Decision-making algorithms are available to guide additional investigation.[38] These assessments include human chorionic gonadotropin– and adrenocorticotropin-stimulation tests to assess testicular and adrenal steroid biosynthesis, urinary steroid analysis by gas chromatography mass spectroscopy, imaging studies, and biopsies of gonadal material. Some gene analyses are performed in clinical service laboratories. However, current molecular diagnosis is limited by cost, accessibility, and quality control.[39] Research laboratories provide genetic testing, including functional analysis, but may face restrictions on communicating results.[40]

Gender Assignment in Newborns

Initial gender uncertainty is unsettling and stressful for families. Expediting a thorough assessment and decision is required. Factors that influence gender assignment include diagnosis, genital appearance, surgical options, need for lifelong replacement therapy, potential for fertility, views of the family, and, sometimes, circumstances relating to cultural practices. More than 90% of patients with 46,XX CAH[41] and all patients with 46,XY CAIS assigned female in infancy[42] identify as females. Evidence supports the current recommendation to raise markedly virilized 46,XX infants with CAH as female.[43] Approximately 60% of 5-α-reductase (5αRD2)-deficient patients assigned female in infancy and virilizing at puberty (and all assigned male) live as males.[5] In 5αRD2 and possibly 17β-hydroxysteroid dehydrogenase deficiencies, for which the diagnosis is made in infancy, the combination of a male gender identity in the majority and the potential for fertility (documented in 5αRD2 but unknown in 17β-hydroxysteroid dehydrogenase deficiencies) should be discussed when providing evidence for gender assignment.[5,44,45] Among patients with partial androgen insensitivity syndrome (PAIS), androgen biosynthetic defects, and incomplete gonadal dysgenesis, there is dissatisfaction with the sex of rearing in ~25% of individuals whether raised male or female.[46] Available data support male rearing in all patients with micropenis, taking into account equal satisfaction with assigned gender in those raised male or female but no need for surgery and the potential for fertility in patients reared male.[42] Those making the decision on sex of rearing for those with ovotesticular DSD should consider the potential for fertility on the basis of gonadal differentiation and genital development and assuming that the genitalia are, or can be made, consistent with the chosen sex. In the case of mixed gonadal dysgenesis (MGD), factors to consider include prenatal androgen exposure, testicular function at and after puberty, phallic development, and gonadal location. Individuals with cloacal exstrophy reared female show variability in gender identity outcome, but >65% seem to live as female.[6]

Surgical Management

The surgeon has a responsibility to outline the surgical sequence and subsequent consequences from infancy to adulthood. Only surgeons with expertise in the care of children and specific training in the surgery of DSD should perform these procedures. Parents now seem to be less inclined to choose surgery for less severe clitoromegaly.[47] Surgery should only be considered in cases of severe virilization (Prader III–V) and be performed in conjunction, when appropriate, with repair of the common urogenital sinus. Because orgasmic function and erectile sensation may be disturbed by clitoral surgery, the surgical procedure should be anatomically based to preserve erectile function and the innervation of the clitoris. Emphasis is on functional outcome rather than a strictly cosmetic appearance. It is generally felt that surgery that is performed for cosmetic reasons in the first year of life relieves parental distress and improves attachment between the child and the parents[48–51]; the systematic evidence for this belief is lacking.

Currently, there is inadequate evidence in relation to establishment of functional anatomy to abandon the practice of early separation of the vagina and urethra.[52]

The rationale for early reconstruction is based on guidelines on the timing of genital surgery from the American Academy of Pediatrics,[53] the beneficial effects of estrogen on tissue in early infancy, and the avoidance of potential complications from the connection between the urinary tract and peritoneum via the Fallopian tubes. It is anticipated that surgical reconstruction in infancy will need to be refined at the time of puberty.[54–56] Vaginal dilatation should not be undertaken before puberty. The surgeon must be familiar with a number of operative techniques to reconstruct the spectrum of urogenital sinus disorders. An absent or inadequate vagina (with rare exceptions) requires a vaginoplasty performed in adolescence when the patient is psychologically motivated and a full partner in the procedure. No one technique has been universally successful; self-dilatation, skin substitution, and bowel vaginoplasty each have specific advantages and disadvantages.

In the case of a DSD associated with hypospadias,[57] standard techniques for surgical repair such as chordee correction, urethral reconstruction, and the judicious use of testosterone supplementation apply. The magnitude and complexity of phalloplasty in adulthood should be taken into account during the initial counseling period if successful gender assignment depends on this procedure.[58] At times, this may affect the balance of gender assignment. Patients must not be given unrealistic expectations about penile reconstruction, including the use of tissue engineering. There is no evidence that prophylactic removal of asymptomatic discordant structures, such as a utriculus or Müllerian remnants, is required, although symptoms in the future may indicate surgical removal. For the male who has a successful neophalloplasty in adulthood, an erectile prosthesis may be inserted but has a high morbidity.

The testes in patients with CAIS[35] and those with PAIS, raised female, should be removed to prevent malignancy in adulthood. The availability of estrogen-replacement therapy allows for the option of early removal at the time of diagnosis that also takes care of the associated hernia, psychological problems with the presence of testes, and the malignancy risk. Parental choice allows deferment until adolescence, recognizing that the earliest reported malignancy in CAIS is at 14 years of age.[59] The streak gonad in a patient with MGD raised male should be removed laparoscopically (or by laparotomy) in early childhood.[35] Bilateral gonadectomy is performed in early childhood in females (bilateral streak gonads) with gonadal dysgenesis and Y-chromosome material. In patients with androgen biosynthetic defects raised female, gonadectomy should be performed before puberty. A scrotal testis in patients with gonadal dysgenesis is at risk for malignancy. Current recommendations are testicular biopsy at puberty seeking signs of the premalignant lesion termed carcinoma in situ or undifferentiated intratubular germ cell neoplasia. If positive, the option is sperm banking before treatment with local low-dose radiotherapy that is curative.[60]

Surgical management in DSD should also consider options that will facilitate the chances of fertility. In patients with a symptomatic utriculus, removal is best performed laparoscopically to increase the chance of preserving continuity of the vas deferens. Patients with bilateral ovotestes are potentially fertile from functional ovarian tissue.[35,61] Separation of ovarian and testicular tissue can be technically difficult and should be undertaken, if possible, in early life.

Sex-Steroid Replacement

Hypogonadism is common in patients with dysgenetic gonads, defects in sex-steroid biosynthesis, and resistance to androgens. The timing of initiation of puberty may vary, but this is an occasion that provides an opportunity to discuss the condition and set a foundation for long-term adherence to therapy. Hormonal induction of puberty stimulates replication of normal pubertal maturation to induce secondary sexual characteristics, a pubertal growth spurt, and optimal bone mineral accumulation, together with psychosocial support for psychosexual maturation.[62] Intramuscular depot injections of testosterone esters are commonly used in males; another option is oral testosterone undecanoate, and transdermal preparations are also available.[63–65] Patients with PAIS may require supraphysiologic doses of testosterone for optimal effect.[66] Females with hypogonadism require estrogen supplementation to induce pubertal changes and menses. A progestin is usually added after breakthrough bleeding develops or within 1 to 2 years of continuous estrogen. There is no evidence that the addition of cyclic progesterone is beneficial in women without a uterus.

Psychosocial Management

Psychosocial care provided by mental health staff with expertise in DSD should be an integral part of management to promote positive adaptation. This expertise can facilitate team decisions about gender assignment/reassignment, timing of surgery, and sex-hormone replacement. Psychosocial screening tools that identify families at risk for maladaptive coping with a child's medical condition are available.[67] Once the child is sufficiently developed for a psychological assessment of gender identity, such an evaluation must be included in discussions about gender reassignment. Gender identity development begins before the age of 3 years,[68] but the earliest age at which it can be reliably assessed remains unclear. The generalization that the age of 18 months is the upper limit of imposed gender reassignment should be treated with caution and viewed conservatively. Atypical gender-role behavior is more common in children with DSD than in the general population but should not be taken as an indicator for gender reassignment. In

affected children and adolescents who report significant gender dysphoria, a comprehensive psychological evaluation[69] and an opportunity to explore feelings about gender with a qualified clinician is required over a period of time. If the desire to change gender persists, the patient's wish should be supported and may require the input of a specialist skilled in the management of gender change.

The process of disclosure concerning facts about karyotype, gonadal status, and prospects for future fertility is a collaborative, ongoing action that requires a flexible individual-based approach. It should be planned with the parents from the time of diagnosis.[70] Studies in other chronic medical disorders and of adoptees indicate that disclosure is associated with enhanced psychosocial adaptation.[71] Medical education and counseling for children is a recurrent gradual process of increasing sophistication that is commensurate with changing cognitive and psychological development.[72]

Quality of life encompasses falling in love, dating, attraction, ability to develop intimate relationships, sexual functioning, and the opportunity to marry and raise children, regardless of biological indicators of sex. The most frequent problems encountered in DSD patients are sexual aversion and lack of arousability, which are often misinterpreted as low libido.[73] Health care staff should offer adolescent patients opportunities to talk confidentially without their parents and encourage the participation in condition-specific support groups that enhance the ability of the patient to discuss their concerns comfortably. Some patients avoid intimate relationships, and it is important to address fears of rejection and advise them on the process of building a relationship with a partner. The focus should be on interpersonal relationships and not solely on sexual function and activity. Referral for sex therapy may be needed. Repeated examination of the genitalia, including medical photography, may be experienced as deeply shaming.[74] Medical photography has its place for record keeping and education but should be undertaken, whenever possible, when the patient is under anesthesia for a procedure. Medical interventions and negative sexual experiences may have fostered symptoms of posttraumatic stress disorder, and referral to a qualified mental health professional may be indicated.[75]

OUTCOME IN DSD

As a general statement, information across a range of assessments is insufficient in DSD. The following is based on those disorders for which some evidence base is available. They include CAH, CAIS, and PAIS, disorders of androgen biosynthesis, gonadal dysgenesis syndromes (complete and partial), and micropenis. Long-term outcome in DSD should include external and internal genital phenotype, physical health including fertility, sexual function, and social and psychosexual adjustment, mental health, quality of life, and social participation. There are additional health problems in individuals with DSD, including the consequences of associated problems such as other malformations, developmental delay and intellectual impairment, delayed growth and development, and unwanted effects of hormones on libido and body image.[76]

Surgical Outcome

Some studies suggest satisfactory outcomes from early surgery.[43,46,47,77] Nevertheless, outcomes from clitoroplasty identify problems related to decreased sexual sensitivity, loss of clitoral tissue, and cosmetic issues.[78] Techniques for vaginoplasty carry the potential for scarring at the introitus necessitating repeated modification before sexual function can be reliable. Surgery to construct a neovagina carries a risk of neoplasia.[79] The risks from vaginoplasty are different for high and low confluence of the urethra and vagina. Analysis of long-term outcomes is complicated by a mixture of surgical techniques and

TABLE 4 **Risk of Germ Cell Malignancy According to Diagnosis**

Risk Group	Disorder	Malignancy Risk, %	Recommended Action	Patients, *n*	Studies, *n*
High	GD[a] (+Y)[b] intraabdominal	15–35	Gonadectomy[c]	12	>350
	PAIS nonscrotal	50	Gonadectomy[c]	2	24
	Frasier	60	Gonadectomy[c]	1	15
	Denys-Drash (+Y)	40	Gonadectomy[c]	1	5
Intermediate	Turner (+Y)	12	Gonadectomy[c]	11	43
	17β-hydroxysteroid	28	Watchful waiting	2	7
	GD (+Y)[b] scrotal	Unknown	Biopsy[d] and irradiation?	0	0
	PAIS scrotal gonad	Unknown	Biopsy[d] and irradiation?	0	0
Low	CAIS	2	Biopsy[d] and ???	2	55
	Ovotesticular DSD	3	Testicular tissue removal?	3	426
	Turner (−Y)	1	None	11	557
No (?)	5αRD2	0	Unresolved	1	3
	Leydig cell hypoplasia	0	Unresolved	1	2

[a] Gonadal dysgenesis (including not further specified, 46,XY, 46,X/46,XY, mixed, partial, and complete).

[b] GBY region positive, including the TSPY (testis-specific protein Y encoded) gene.

[c] At time of diagnosis.

[d] At puberty, allowing investigation of at least 30 seminiferous tubules, preferentially diagnosis on the basis of OCT3/4 immunohistochemistry.

TABLE 5 **Genes Known to be Involved in DSD**

Gene	Protein	OMIM No.	Locus	Inheritance	Gonad	Müllerian Structures	External Genitalia	Associated Features/Variant Phenotypes
46,XY DSD								
Disorders of gonadal (testicular) development: single-gene disorders								
WT1	TF	607102	11p13	AD	Dysgenetic testis	+/−	Female or ambiguous	Wilms' tumor, renal abnormalities, gonadal tumors (WAGR, Denys-Drash and Frasier syndromes)
SF1 (NR5A1)	Nuclear receptor TF	184757	9q33	AD/AR	Dysgenetic testis	+/−	Female or ambiguous	More severe phenotypes include primary adrenal failure; milder phenotypes have isolated partial gonadal dysgenesis
SRY	TF	480000	Yp11.3	Y	Dysgenetic testis or ovotestis	+/−	Female or ambiguous	
SOX9	TF	608160	17q24-25	AD	Dysgenetic testis or ovotestis	+/−	Female or ambiguous	Camptomelic dysplasia (17q24 rearrangements; milder phenotype than point mutations)
DHH	Signaling molecule	605423	12q13.1	AR	Dysgenetic testis	+	Female	The severe phenotype of 1 patient included minifascicular neuropathy; other patients have isolated gonadal dysgenesis
ATRX	Helicase (? chromatin remodeling)	300032	Xq13.3	X	Dysgenetic testis	−	Female, ambiguous, or male	α-Thalassemia, mental retardation
ARX	TF	300382	Xp22.13	X	Dysgenetic testis	−	Ambiguous	X-linked lissencephaly, epilepsy, temperature instability
Disorders of gonadal (testicular) development: chromosomal changes involving key candidate genes								
DMRT1	TF	602424	9p24.3	Monosomic deletion	Dysgenetic testis	+/−	Female or ambiguous	Mental retardation
DAX1 (NR0B1)	Nuclear receptor TF	300018	Xp21.3	dupXp21	Dysgenetic testis or ovary	+/−	Female or ambiguous	
WNT4	Signaling molecule	603490	1p35	dup1p35	Dysgenetic testis	+	Ambiguous	Mental retardation
Disorders in hormone synthesis or action								
LHGCR	G-protein receptor	152790	2p21	AR	Testis	−	Female, ambiguous, or micropenis	Leydig cell hypoplasia
DHCR7	Enzyme	602858	11q12-13	AR	Testis	−	Variable	Smith-Lemli-Opitz syndrome: coarse facies, second-third toe syndactyly, failure to thrive, developmental delay, cardiac and visceral abnormalities
StAR (steroidogenic acute regulatory protein)	Mitochondrial membrane protein	600617	8p11.2	AR	Testis	−	Female	Congenital lipoid adrenal hyperplasia (primary adrenal failure), pubertal failure
CYP11A1	Enzyme	118485	15q23-24	AR	Testis	−	Female or Ambiguous	CAH (primary adrenal failure), pubertal failure
HSD3B2	Enzyme	201810	1p13.1	AR	Testis	−	Ambiguous	CAH, primary adrenal failure, partial androgenization caused by dehydroepiandrosterone sulfate

TABLE 5 **Continued**

CYP17	Enzyme	202110	10q24.3	AR	Testis	−	Female, ambiguous, or micropenis	CAH, hypertension caused by corticosterone and 11-deoxycorticosterone (except in isolated 17,20-lyase deficiency)
POR (P450 oxidoreductase)	CYP enzyme electron donor	124015	7q11.2	AR	Testis	−	Male or ambiguous	Mixed features of 21-hydroxylase deficiency, 17α-hydroxylase/17,20-lyase deficiency, and aromatase deficiency; sometimes associated with Antley Bixler craniosynostosis
HSD17B3	Enzyme	605573	9q22	AR	Testis	−	Female or ambiguous	Partial androgenization at puberty, androstenedione/testosterone ratio
SRD5A2	Enzyme	607306	2p23	AR	Testis	−	Ambiguous or micropenis	Partial androgenization at puberty, testosterone/dihydrotestosterone ratio
Anti-Müllerian hormone	Signaling molecule	600957	19p13.3-13.2	AR	Testis	+	Normal male	Persistent Müllerian duct syndrome; male external genitalia, bilateral cryptorchidism
Anti-Müllerian hormone receptor	Serine-threonine kinase transmembrane receptor	600956	12q13	AR	Testis	+	Normal male	
Androgen receptor	Nuclear receptor TF	313700	Xq11-12	X	Testis	−	Female, ambiguous, micropenis, or normal male	Phenotypic spectrum from CAIS (female external genitalia) and PAIS (ambiguous) to normal male genitalia/infertility
46,XX DSD								
Disorders of gonadal (ovarian) development								
SRY	TF	480000	Yp11.3	Translocation	Testis or ovotestis	−	Male or ambiguous	
SOX9	TF	608160	17q24	dup17q24	Not determined	−	Male or ambiguous	
Androgen excess								
HSD3B2	Enzyme	201810	1p13	AR	Ovary	+	Clitoromegaly	CAH, primary adrenal failure, partial androgenization caused by dehydroepiandrosterone sulfate
CYP21A2	Enzyme	201910	6p21-23	AR	Ovary	+	Ambiguous	CAH, phenotypic spectrum from severe salt-losing forms associated with adrenal failure to simple virilizing forms with compensated adrenal function, 17-hydroxyprogesterone
CYP11B1	Enzyme	202010	8q21-22	AR	Ovary	+	Ambiguous	CAH, hypertension caused by 11-deoxycortisol and 11-deoxycorticosterone
POR (P450 oxidoreductase)	CYP enzyme electron donor	124015	7q11.2	AR	Ovary	+	Ambiguous	Mixed features of 21-hydroxylase deficiency, 17α-hydroxylase/17,20-lyase deficiency, and aromatase deficiency; associated with Antley Bixler craniosynostosis
CYP19	Enzyme	107910	15q21	AR	Ovary	+	Ambiguous	Maternal androgenization during pregnancy, absent breast development at puberty, except in partial cases
Glucocorticoid receptor	Nuclear receptor TF	138040	5q31	AR	Ovary	+	Ambiguous	Adrenocorticotropin, 17-hydroxyprogesterone and cortisol; failure of dexamethasone suppression (patient heterozygous for a mutation in CYP21)

OMIM indicates Online Mendelian Inheritance in Man; TF, transcription factor; AD, autosomal dominant (often do novo mutation); AR indicates autosomal recessive; Y, Y-chromosomal; X, X-chromosomal. Chromosomal rearrangements likely to include key genes are included. Modified from Achermann JC, Ozisik G, Meeks JJ, Jameson JL. Genetic causes of human reproductive disease. *J Clin Endocrinol Metab*. 2002;87:2447-2454.

diagnostic categories.[80] Few women with CAIS need surgery to lengthen the vagina.[81]

The outcome in undermasculinized males with a phallus depends on the degree of hypospadias and the amount of erectile tissue. Feminizing genitoplasty as opposed to masculinizing genitoplasty requires less surgery to achieve an acceptable outcome and results in fewer urologic difficulties.[46] Long-term data regarding sexual function and quality of life among those assigned female as well as male show great variability. There are no controlled clinical trials of the efficacy of early (<12 months of age) versus late (in adolescence and adulthood) surgery or of the efficacy of different techniques.

Risk of Gonadal Tumors

Interpretation of the literature is hampered by unclear terminology and effects of normal cell-maturation delay.[82–84] The highest tumor risk is found in TSPY (testis-specific protein Y encoded) positive gonadal dysgenesis and PAIS with intraabdominal gonads, whereas the lowest risk (<5%) is found in ovotestis[85] and CAIS.[83,86] Table 4 provides a summary of the risk of tumor development according to diagnosis and recommendations for management.

Cultural and Social Factors

DSD may carry a stigma. Social and cultural factors, as well as hormonal effects, seem to influence gender role in 5αRD2 deficiency. Gender-role change occurs at different rates in different societies, suggesting that social factors may also be important modifiers of gender-role change.

In some societies, female infertility precludes marriage, which also affects employment prospects and creates economic dependence. Religious and philosophical views may influence how parents respond to the birth of an infant with a medical condition. Fatalism and guilt feelings in relation to congenital malformations or genetic conditions have an influence, whereas poverty and illiteracy negatively affect access to health care.[87]

FUTURE STUDIES

Establishing a precise diagnosis in DSD is just as important as in other chronic medical conditions that have lifelong consequences. Considerable progress has been achieved with molecular studies, as illustrated in Table 5, which summarizes the genes known to be involved in DSD. Use of tissue-specific animal knock-out models, comparative genomic hybridization, and microarray screens of the mouse urogenital ridge will provide benefits in identifying new genes causing DSD.[88] It is essential that the momentum for an international collaborative approach to this task be maintained.

Much remains to be clarified about the determinants of gender identity in DSD. Future studies require representative sampling to carefully conceptualize and measure gender identity, recognizing that there are multiple determinants to consider, and gender identity may change into adulthood. In terms of psychological management, studies are needed to evaluate the effectiveness of information management with regard to timing and content. The pattern of surgical practice in DSD is changing with respect to the timing of surgery and the techniques used. It is essential to evaluate the effects of early versus later surgery in a holistic manner, recognizing the difficulties posed by an ever-evolving clinical practice.

The consensus has clearly identified a major shortfall in information about long-term outcome. Future studies should use appropriate instruments that assess outcomes in a standard manner[68,69] and take cognizance of guidelines relevant to all chronic conditions (see www.who.int/classifications/icf/en). These studies would preferably be prospective in nature and designed to avoid selection bias. A number of countries already have registers of DSD cases, but there could be added benefit from pooling such resources to enable prospective, multicenter studies to be undertaken on a larger number of cases that are clearly defined. Allied to this should be an educational program to ensure that multiprofessionals tasked with providing care to families with a child with DSD are suitably trained to discharge their responsibilities.

APPENDIX 1: ROLE OF SUPPORT GROUPS

The value of peer and parent support for many chronic medical conditions is widely accepted, and DSD, being lifelong conditions that affect developmental tasks at many stages of life, are no exception.

Those affected by DSD and parent members value the following:

- Peer support ends isolation and stigma, providing a context in which conditions are put into perspective and intimate issues of concern can be discussed safely with someone who has "been there."
- Children who form relationships with peers and affected adults early in their lives benefit from a feeling of normalcy early on, with support in place well before adolescence. Adolescents often resist attempts to introduce them to peer support.
- Support groups can help families and consumers find the best quality care.

Although clinical practice may focus on gender and genital appearance as key outcomes, stigma and experiences associated with having a DSD (both within and outside the medical environment) are more salient issues for many affected people.

Support groups complement the work of the health care team and, together, can help improve services. Initiatives by support groups have led to improvements in

management of DSD and research directed toward clinically relevant issues. Dialogue between health care professionals and support groups and collaboration as partners is to be encouraged.

APPENDIX 2: LEGAL ISSUES

Basic principles of medical law will remain even as research and clinical experience evolve in etiology, diagnosis, and treatment. This Appendix draws on practice in 3 countries on standards of medical negligence and patient informed consent. In the United States, the medical profession sets standards of care on the basis of prevailing medical custom.[89] However, a treatment may also be that used by a respected minority of practitioners.

Informed consent in the United States was founded on the principle of battery, whereby it is an offense to violate another person's bodily integrity without consent. Nowadays, most states are concerned with negligent nondisclosure to the patient. The standard of adequate disclosure may be physician based, requiring conduct of a reasonable practitioner, or it may be patient based, asking what a reasonable patient would find material. Physician-based disclosure must include information about risks, alternatives, outcomes, and prognosis, with or without treatment.

US courts assume that parents know what is best for their child when parental authority applies to consent for the child (substituted judgment). Parental decisions are deferred to except in situations in which potentially life-saving treatment is withheld. Consent to treatment by a child depends on an understanding of its nature and consequences.

Medical negligence in the United Kingdom defines treatment that falls below the standard expected of a reasonably competent practitioner. The standard of proof in court is whether negligence is demonstrated on the balance of probabilities. It is incumbent on the practitioner to demonstrate that treatment was consistent with a rationally defensible body of medical opinion. A shift in parental prerogative to consent to treatment was reflected in the Children Act 1989 in which parental rights were replaced by parental responsibilities. United Kingdom courts can intervene with orders made requiring or preventing a specific action related to the child. Age is not a barrier to informed consent, providing that a minor demonstrates an understanding of the issues sufficient to have the capacity to consent.

Colombian law is noted for a reasoned set of guidelines advanced by the highest court in cases of DSD.[90] A protocol was formulated for parental and physician intervention. The process of consent requires "qualified and persistent informed consent" over an extended period of time. Authorization is given in stages to allow time for the parents to come to terms with their child's condition. The court aimed to strike a balance between parental autonomy for those who did and those who did not want early surgery for their child until there was clear evidence of harm in deferring surgery until the child was competent to decide. Parents cannot consent for children over 5 years of age, because by then, children are deemed to have identified with a gender and, thus, are considered to be autonomous.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Consent for Emergency Medical Services for Children and Adolescents

COMMITTEE ON PEDIATRIC EMERGENCY MEDICINE AND COMMITTEE ON BIOETHICS

KEY WORDS

informed consent, Emergency Medical Treatment and Active Labor Act, confidentiality, mature minor, emancipated minor, emergency medical condition

ABBREVIATIONS

ED—emergency department
AAP—American Academy of Pediatrics
EMS—emergency medical services
MSE—medical screening examination
EMC—emergency medical condition
IRB—institutional review board

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abstract

FREE

Parental consent generally is required for the medical evaluation and treatment of minor children. However, children and adolescents might require evaluation of and treatment for emergency medical conditions in situations in which a parent or legal guardian is not available to provide consent or conditions under which an adolescent patient might possess the legal authority to provide consent. In general, a medical screening examination and any medical care necessary and likely to prevent imminent and significant harm to the pediatric patient with an emergency medical condition should not be withheld or delayed because of problems obtaining consent. The purpose of this policy statement is to provide guidance in those situations in which parental consent is not readily available, in which parental consent is not necessary, or in which parental refusal of consent places a child at risk of significant harm. *Pediatrics* 2011;128:427–433

INTRODUCTION

Minors (persons under the age of legal consent as defined by state law) often require care in the prehospital environment and present to emergency departments (EDs) with medical concerns. Parental consent generally is required for the medical evaluation and treatment of minor children. In most cases, children will present to the ED with a parent or legally authorized decision-maker who can provide informed consent for evaluation and treatment. However, a number of well-recognized exceptions to this "general rule" have been outlined in common and statutory law to allow for the treatment of minors without parental consent in situations that frequently occur in EDs.[1–14] The purpose of this document is to provide guidance for those situations in which parental consent is not readily available, in which parental consent is not necessary, or in which parental refusal of consent places a child at risk of harm.

The American Academy of Pediatrics (AAP) supports the principle that all pediatric patients who present to any emergency medical services (EMS) provider or ED for evaluation and treatment should receive an initial evaluation or medical screening examination (MSE) regardless of ability to pay or presence of a legally authorized decision-maker who can provide consent. The AAP has written 2 previous versions of this document. The original document, "Consent for Medical Services for Children and Adolescents," was published in 1993 and subsequently revised in 2003.[15] The recommendations made in the 2003 revision remain important and pertinent to current practice. In addition to reaffirming the 2003 recommendations, this policy statement attempts

to explore additional situations in which obtaining consent presents special challenges.

EVALUATION AND TREATMENT OF THE UNACCOMPANIED MINOR

If a parent or legal guardian is present or available, the health care professional treating the child should make every reasonable effort to obtain and document informed consent. Children occasionally present to the ED unaccompanied by a parent or legal guardian. In some cases (discussed later in this statement), adolescents may have the legal authority to consent for treatment without a parent present. In most situations, however, the child or adolescent will either not have the authority to consent or will be unable to do so. Common and statutory law generally has supported the health care professional in evaluating these children and providing emergently needed care while attempts are made to locate a parent or legally authorized decision-maker. In addition, current federal law under the Emergency Medical Treatment and Active Labor Act (EMTALA) mandates an MSE for every patient seeking treatment in an ED of any hospital that participates in programs that receive federal funding, regardless of consent or reimbursement issues.[16–19] The purpose of the MSE is to determine if an emergency medical condition (EMC) exists, including life- or limb-threatening conditions, severe pain, or conditions with the potential for serious impairment or dysfunction if left untreated. The MSE might require the use of extensive ED resources, including laboratory testing, radiographic imaging, and subspecialty consultation, as needed for diagnosis. Although the ED should attempt to contact the unaccompanied patient's parent or legal guardian to seek consent for evaluation and treatment, the performance of the MSE and the stabilization of the patient with an identified EMC must not be delayed. If an EMC is not identified, EMTALA regulations no longer apply, and the physician or health care professional generally should seek proper consent before further (nonemergent) care is provided. In cases of suspected abuse or neglect, child protective services or local law enforcement officers may have the authority to consent for evaluation and treatment, although the extent of this authority might differ from one jurisdiction to the next.

In situations in which a minor has a condition that represents a threat to life or health and a parent or legally authorized decision-maker is not readily available to provide consent, health care professionals may provide necessary medical treatment or transport the child for more definitive evaluation and stabilizing treatment. The ethical basis for this approach is based in the professional's duty to seek the best interest of the child. The legal basis for taking action in an emergency when consent is not available is known as the "emergency exception rule."

The emergency exception rule is also known as the doctrine of "implied consent." This emergency exception rule is based on the assumption that reasonable persons would consent to emergency care if able to do so and that if the legal guardian knew the severity of the emergency, he or she would consent to medical treatment for the child. Under the emergency exception rule, a medical professional may presume consent and proceed with appropriate treatment and transport if the following 4 conditions are met:

1. The child is suffering from an emergent condition that places his or her life or health in danger.
2. The child's legal guardian is unavailable or unable to provide consent for treatment or transport.
3. Treatment or transport cannot be safely delayed until consent can be obtained.
4. The professional administers only treatment for emergent conditions that pose an immediate threat to the child.

Any time a minor is treated without consent, the burden of proof falls on the professional who is evaluating, treating, or transporting the child to justify and document that the emergency actions were necessary to prevent imminent and significant harm to the child. In addition to actions necessary to save a person's life and prevent permanent disability or harm, the treatment of fractures, infections, pain, and other conditions may broadly be considered as emergent conditions that require treatment. As a general rule, health care professionals should always do what they believe to be in the best interest of the minor. The emergency exception exists to protect the health care professional from liability with the assumption that if the parents were present, they would consent to treatment.[20] The professional must clearly document in the child's record the nature of the medical emergency and the reason the minor required immediate treatment and/or transport and the efforts made to obtain consent from the patient's legal guardian, if unavailable.[15]

EMANCIPATION AND THE MATURE MINOR DOCTRINE

There are 3 situations in which a minor, rather than his or her parents, has the legal authority to make decisions regarding his or her health care: emancipation; the mature minor exception; and exceptions based on specific medical conditions. In fact, every state has enacted minor consent statutes that address some or all of these exceptions to the "general rule."[21,22]

In general, an emancipated minor can function as an adult, independent from

his or her parents, with regard to consent for medical evaluation and treatment.[23] Children who are legally emancipated may give consent for medical treatment and transport. They may also refuse medical care and/or transport. Although emancipated minor laws vary from state to state, most states recognize minors to be emancipated if they are married, economically self-supporting and not living at home, or on active-duty status in the military. In some states, a minor who is a parent or who is pregnant might also be considered emancipated. Other states might require a court to declare the emancipation of a minor.

Most states also recognize a mature minor exception, in which a minor, usually 14 years old or older, displays sufficient maturity and intelligence to understand and appreciate the benefits, risks, and alternatives of the proposed treatment and to make a voluntary and reasonable choice on the basis of that information. States vary in terms of whether a physician can make this determination or whether a judicial determination is required.[23]

Finally, most states allow a minor to consent to evaluation and treatment of specific medical conditions without the consent of a parent, generally including mental health services, treatment for drug and alcohol addiction, pregnancy-related care, contraceptive services, and testing for and treatment of sexually transmitted diseases. The specific nature of these exceptions and the age at which they apply vary from state to state. Because state laws vary, it is important to be familiar with the specifics of emancipated and mature minor laws in the state in which care is being provided.

If none of the 3 scenarios described previously (emancipation, mature minor, or condition-specific exceptions) are applicable, then the minor has no legal authority to either provide consent or refuse medical care. Regardless of whether a child has the legal authority to provide or withhold consent, it is always prudent to attempt to get the child's agreement or assent to treatment and transport. This approach respects the personal dignity and self-determination of the child/patient and minimizes confrontation. A willingness to provide the child with some control and some choice might allow for a compromise that allows transport personnel to achieve a safe transfer. Using force or restraint to evaluate, treat, or transport a child should be reserved only for those situations in which all efforts to negotiate respectfully with the child have failed and the child is at risk of serious harm if he or she is not restrained. In these unusual circumstances, appropriate measures should be taken to ensure the safety of the patient.

CONSENT FOR NONURGENT PEDIATRIC CARE OF CHILDREN ACCOMPANIED BY SOMEONE WHO IS NOT AUTHORIZED TO PROVIDE LEGAL CONSENT

Health care professionals should refrain from providing nonurgent testing and treatment to children who present to medical facilities unaccompanied by a custodial parent or legal guardian. An MSE should be performed to ensure that the child does not have a condition that requires emergent attention, and any treatment necessary to prevent immediate and serious harm to the child should be provided while an attempt is made to obtain consent from a legally authorized decision-maker. The AAP clinical report "Consent for Nonurgent Pediatric Care"[24] describes the issue of "consent by proxy" and provides practical steps that will help to balance a patient's ready access to medical care, family integrity, and the health care professional's need to limit his or her exposure to liability. Unless a minor's right to consent has been legally established, health care professionals should attempt to notify parents or legal guardians of their intentions to test and/or treat the minor and consider delaying all nonurgent diagnostic and treatment decisions until the parent or legal guardian can be reached for informed permission or consent.[24]

REFUSALS OF CONSENT FOR EMERGENT EVALUATION AND TREATMENT

A particularly challenging situation occurs when the health care professional is faced with a legal guardian who refuses to give permission for treatment of a child in situations in which such treatment is considered essential to the child's well-being. Competent adult patients have the right to refuse evaluation and treatment, even for EMCs, unless they are determined to lack decision-making capacity. Under US law, minors are generally considered incompetent to provide legally binding consent regarding their health care; parents or legal guardians are empowered to make those decisions on their behalf, and those decisions are considered legally binding. Except for the exceptions cited previously, parental permission is required before the evaluation and treatment of a child. Parental authority is not absolute, however, and when a parental decision places a child at significant risk or serious harm compared with an alternative decision, the state may intervene to require intervention over the objections of the legal decision-maker.

As long as a child's legal guardian possesses medical decision-making capacity, he or she has the right to refuse medical care for the child. However, the guardian is required to act in the best interest of the child. When a legal guardian refuses to consent to medical care or transport that is necessary

and likely to prevent death, disability, or serious harm to the child, law enforcement officers may intervene under local and state child abuse and neglect laws. It is always preferable to negotiate with the legal decision-maker and attempt to achieve an agreeable plan for safely managing the child's medical condition.

When faced with a guardian who refuses to allow the provision of necessary medical care or transport of a child when it is necessary to save a child's life or prevent serious harm, it might be necessary to notify the police and enlist their assistance in placing the child in temporary protective custody. In a life-threatening emergency, it might be necessary to involve hospital security so that emergent evaluation and treatment can begin while child protective services and the police are notified. Likewise, when a legal guardian appears to be intoxicated or otherwise impaired, involvement of law enforcement officers might be necessary to place a minor in temporary protective custody. Once the professional has received authorization to treat from a state child protective agency or police, the emergency medical professional does not have the right to treat a minor for medical conditions that are not serious or life-threatening. Under these circumstances, a medical professional should provide medical treatment without consent only when the child has a medical condition that poses a risk of death or serious harm, when immediate treatment is necessary to prevent that harm, and when only those treatments necessary to prevent the harm are provided.[25]

INFORMED CONSENT AND THE LANGUAGE BARRIER

If a language barrier exists, informed consent for medical treatment should, when clinical circumstances permit, be obtained through a trained medical interpreter. Using an interpreter not only increases the likelihood of truly informed consent but also enhances the possibility of optimal medical treatment by allowing the professional to obtain accurate information about a child's underlying medical conditions, allergies, current medications, or other relevant and important information. Such interpretation may be performed in person, via videoconferencing, or by telephone, but a certified medical interpreter should be used. Using a family member as interpreter should be avoided unless absolutely necessary, and the medical professional should be aware that translation might not be accurate when a trained interpreter is not used.

CONSENT AND CONFIDENTIALITY

State statutes that allow the consent of a minor do not all guarantee an adolescent protection from parental disclosure. However, some states explicitly require either confidentiality or parental notification. Other states require the health care professional to at least make a good-faith effort to involve the family of the minor in his or her treatment. The only federal law that requires confidentiality for minors is the Family Planning Act.[26] It is crucial that every health care professional be knowledgeable of his or her respective state and all federal laws relating to confidentiality and minors.[27]

The issue of adolescent confidentiality was addressed in the recently published AAP technical report "Patient- and Family-Centered Care and the Role of the Emergency Physician Providing Care to a Child in the Emergency Department."[28] This report suggested that ED health care professionals be familiar with the limitations to and obligations for providing care to the unaccompanied older pediatric patient seeking care without the knowledge of his or her family[15,24,29] and make those limits and obligations clear to the patient. For example, both the patient and the health care provider should identify a secure and confidential means of receiving follow-up information regarding pending laboratory results, return visits, and billing notification. In particular, confidentiality can only be reliably realized when attached to financial accountability. The child must be willing and able to pay the bill for the ED visit or risk a breach of confidentiality as a result of billing notification. Some professional organizations have formalized their opinions on the issue of confidentiality. The American Medical Association recommends a conservative approach to confidentiality and encourages parental involvement whenever possible.[30] The Society for Adolescent Medicine believes that health care professionals have an obligation to protect patient confidentiality when appropriate.[31]

As discussed previously, the lack of legal clarity provides health care professionals with some discretionary control over whether to provide testing and treatment to a minor without parental notification. That responsibility should not be taken lightly, and consideration for issues such as family dynamics (eg, will the child be punished if the parents are consulted?), developmental maturity (eg, is the child a runaway risk?), and the actual scope of testing and treatment must be taken into consideration before excluding or including parents in the discussion. In addition, health care professionals should be honest and consistent with their patients and families. A clinician should never promise a patient confidentiality if he or she might not be able to honor that promise.

PREHOSPITAL CONSENT

EMS providers and EMS medical directors caring for minors might find it difficult or impossible to make real-time

contact with parents or legal guardians of patients, despite the increased availability of communication tools in the prehospital environment (eg, cell phones). Although most EMS systems promote a good-faith effort on the part of the prehospital provider to make contact with the parents and legal guardians of minors, many systems do not have formal policies addressing the lack of informed minor or parental consent. If at all possible, an assessment should be performed to determine if there is a medical emergency, and medical consultation should be sought if the emergency medical technicians are unclear about whether a threat to life or limb exists. If parents are present or accessible and refuse care for their injured or ill child, they must be informed of the risk of not transporting a sick or injured pediatric patient, which might include death or permanent disability. Regardless of religious beliefs or parental desires, every attempt should be made to treat and/or transport a child with a life-threatening emergency or if providers suspect child abuse. EMS providers should involve medical control early in these situations and use law enforcement resources as necessary to ensure that the patient receives the necessary emergency stabilization and transport.

CONSENT DURING A DISASTER

Health care professionals evaluating and treating a minor during a disaster should always attempt to obtain consent from the parents or legally authorized decision-maker. The mere existence of a disaster event does not automatically authorize emergency medical professionals to evaluate and treat minors without parental consent unless the minor's life or health would be jeopardized by delay.[32] However, in an overwhelming disaster scenario, time pressures on medical providers, a chaotic environment, interruption of normal communication methods, the inability to identify patients, and multiple casualties might make it impossible to seek timely informed consent for the evaluation and treatment of minors. In such a situation, medical professionals should act in the best interest of the patient and provide stabilizing care until consent can be obtained.

CONSENT FOR RESEARCH IN THE EMERGENCY SETTING

For research protocols that enroll ED patients, informed consent will require a process separate from that of informed consent for evaluation and treatment. Whether to enroll a child in a research project can never be decided solely by a health care professional but must occur in accord with the requirements of an institutional review board (IRB). The IRB will determine the requirements for informed consent, including the content of the informed consent, who can obtain consent, and whether consent requires the agreement of 1 or both parents.

In some cases, research in the emergency environment is designed to investigate emergency procedures that offer the prospect of direct benefit to potential participants, and in these situations, enrollment must take place immediately, and parents might not yet be available to provide permission.[33] Such special situations are governed by special rules. Under these circumstances, the research can proceed without permission of the parents only under restricted guidelines outlined by federal regulation. These guidelines require that the subject be facing a life-threatening or permanently disabling situation for which the only known therapy is investigational, unproven, or unsatisfactory; that the child is incapable or unable to provide valid consent, and the parents cannot be reached for permission before the time the investigational treatment must be started; and that there is no accepted therapy that is clearly superior to the experimental therapy. In addition, the research protocol must have received IRB approval that the experimental treatment has a realistic probability of benefit that equals or exceeds that of standard care, that the risks of the experimental therapy are reasonable in comparison to the patient's condition and standard therapy, that there is minimal added risk from participation in the research protocol, that there is no possibility of getting prospective consent from those who are likely to need the experimental therapy, that participants and/or parents will be provided with all pertinent information regarding the study as soon as possible, and that alteration or waiver of consent will not adversely affect the rights and welfare of the subjects. Once the legal decision-maker has been informed of the research, he or she might choose to discontinue participation at any time after being fully informed of the consequences of doing so. Finally, federal regulations require that input from community representatives be sought regarding the protocol before IRB approval to gain a form of "community consent" to proceed with the research and that public disclosure of the research and its risks and benefits be made to the community from which potential participants will be enrolled before initiation of the research. Public disclosure of study results is also required by law in this situation.

CONCLUSIONS

A health care professional's decision to treat combined with parental consent and patient assent (when appropriate) is the preferred scenario encountered by the pediatrician working in the emergency medical environment. When any one of those factors is absent or unclear, the health care pro-

vider must be (1) knowledgeable of state and federal laws related to a minor's right (or lack thereof) to consent for testing and treatment and (2) prepared to confront the ethical challenges surrounding those same issues.

RECOMMENDATIONS

1. An MSE and any medical care necessary and likely to prevent imminent and significant harm to the pediatric patient with an EMC should never be withheld or delayed because of problems with obtaining consent.
2. The physician or health care professional should document in the patient's medical record all informed-consent discussions, including the identity of the person providing consent (if the patient) or permission for treatment (if a parent or another adult with legal decision-making authority) and the efforts made to obtain consent from the patient's legal guardian, if unavailable.
3. The physician or health care professional should be familiar with Emergency Medical Treatment and Active Labor Act federal regulations, state laws concerning consent for the treatment of minors, and state laws enumerating the conditions under which minors can provide consent for their own care.
4. Unless a minor is allowed to consent under the law, health care professionals should consider delaying all nonurgent diagnostic and treatment decisions until the parent or legal guardian can be reached for informed permission or consent.
5. The physician or health care professional should seek patient assent for medical testing and treatment from the pediatric patient as appropriate for the patient's age, stage of development, and level of understanding.
6. If a language barrier exists, informed consent for medical treatment from health care professionals should be obtained through a trained medical interpreter.
7. Every EMS agency and ED should develop written policies and guidelines that conform to federal and state laws regarding consent for the treatment of minors, including specific guidelines on financial billing, parental notification, and patient confidentiality for the unaccompanied minor.
8. For research protocols, the decision to enroll a child in a research project must occur in accord with the requirements of an IRB.

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Clinical Report—Consent by Proxy for Nonurgent Pediatric Care

abstract

FREE

Minor-aged patients are often brought to the pediatrician for nonurgent acute medical care, physical examinations, or health supervision visits by someone other than their legally authorized representative, which, in most situations, is a parent. These surrogates or proxies can be members of the child's extended family, such as a grandparent, adult sibling, or aunt/uncle; a noncustodial parent or stepparent in cases of divorce and remarriage; an adult who lives in the home but is not biologically or legally related to the child; or even a child care professional (eg, au pair, nanny). This report identifies common situations in which pediatricians may encounter "consent by proxy" for nonurgent medical care for minors, including physical examinations, and explains the potential for liability exposure associated with these circumstances. The report suggests practical steps that balance the need to minimize the physician's liability exposure with the patient's access to health care. Key issues to be considered when creating or updating office policies for obtaining and documenting consent by proxy are offered. *Pediatrics* 2010;126:1022–1031

BACKGROUND INFORMATION

Before providing nonurgent medical care to a minor patient not accompanied by a legally authorized representative (LAR), important questions regarding informed consent and the delegation of parental responsibilities need to be asked and answered. These questions include:

1. Who has a legal right to delegate consent to health care decisions for a child?
2. To whom can the power to consent to health care for a child be delegated?
3. In what circumstances can the power to consent to health care for a child be delegated?
4. What are the limitations on the right to delegate the power to consent to health care for a child?
5. How is authorization of proxy consent verified and documented?
6. When or how often does information on proxy consent need to be updated?

Many aspects of informed consent in pediatrics have been set forth in previous policy statements from the American Academy of Pediatrics (AAP). Some of these statements addressed informed consent in broad terms, and others addressed narrowly focused situations. The AAP statement on informed consent[1] noted that, unlike

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KEY WORDS
consent, pediatrics, nonurgent care, liability, surrogate, guardian

ABBREVIATIONS
LAR—legally authorized representative
AAP—American Academy of Pediatrics
LEP—limited English proficiency
VICP—Vaccine Injury Compensation Program
VIS—vaccine information statement

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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in other specialties, "the doctrine of 'informed consent' has limited *direct* application in pediatrics," because parents or other surrogates provide informed permission, rather than informed consent, for diagnosis and treatment of children. Other AAP policy statements have provided guidance to pediatricians on consent for treatment of minor patients in specific circumstances such as emergency care,[2] adolescent health issues,[3] genetic testing and newborn screening,[4] procedures that involve sedation,[5] and parental denial of medical care for religious reasons.[6]

This report does not replace the aforementioned policy statements; they stand on their own merit. Instead, this report addresses the potential liability risks that physicians may incur when providing nonurgent medical care to pediatric patients without obtaining permission or consent directly from the patient's LAR. This report is a revision of the 2003 clinical report on consent by proxy.[7] The authors acknowledge that not permitting consent by proxy may pose a challenge to the efficient operation of a busy pediatric practice. However, suggestions are offered to help pediatricians minimize their exposure to legal risk in situations in which an LAR has delegated the authority to consent to nonurgent medical care to another adult. Pediatricians should use their good judgment in balancing the patient's health care needs with their own need for legal protection. Because pediatricians are primarily concerned with their patients' welfare, discretion must be used to differentiate situations in which care can be delayed pending appropriate LAR consent from situations in which the pediatrician should provide care and accept the risk of legal repercussions. Careful planning and good office policies can minimize those instances.

LEGAL BACKGROUND

Except for situations in which a minor's right to consent to care without involvement of an LAR has been legally established, persons who have not yet reached the age of majority do not usually have the right to consent to their own medical care. In most states, the age of majority is 18 years. Thus, a physician is required to obtain consent from an LAR before performing a medical or surgical test, procedure, or treatment on a minor.[8] Under some scenarios, the consent can be obtained from the LAR via telephone, even if a proxy accompanies the minor. Also, judicial decisions and legislative action have resulted in several exceptions to the LAR-consent requirement, which depends on the specific state rule (eg, emergency treatment; treatment of an emancipated or "mature" minor; treatment of an adolescent for, eg, sexual assault, sexually transmitted infections, mental health disorders, drug abuse, and alcohol dependency).

A physician who provides nonurgent care, including the physical examination, to a minor without the consent of someone who is legally authorized to speak for the minor may be vulnerable to legal action. Lawsuits that allege a lack of informed consent usually are based on the concept of negligence but may involve battery as well.[9–11] In general, battery is the unsolicited physical touching of a person. Medical battery may be alleged if treatment is provided without appropriate informed consent, when a procedure is performed that is substantially different from the one for which consent was given, when the treatment exceeds the scope of the consent, or when a physician different than the one to whom consent was granted performs the procedure.[12] A physician may face a battery claim although the treatment or procedure may have been performed without any negligence.[13] When a plaintiff is not satisfied with the results of the medical treatment or procedure but is unable to prove negligence in litigation against the physician, the plaintiff may resort to the theory of battery to seek a recovery. If the plaintiff who alleges an unauthorized procedure cannot prove actual harm, typically only nominal damages will be recovered. However, in a successful battery case, punitive damages may be assessed, which may not be covered by malpractice insurance or dischargeable by bankruptcy. Some states have replaced the theory of battery with the theory of medical negligence. Besides civil liability, physicians may face penalties from licensing boards for performing services without appropriate consent.[14] The impact of state privacy laws and the federal Health Insurance Portability and Accountability Act (HIPAA) on physician liability for disclosure of health information of minors to unauthorized individuals has not yet been tested.

To date, physician liability for treating without consent by an LAR seems to be uncommon. However, past frequency may not reflect future likelihood, because the concepts of informed consent and consent by proxy have evolved both ethically and legally. In fact, inadequate informed consent, which had not previously been a major source of liability for physicians, has become increasingly problematic, especially in the context of issues such as limited English proficiency (LEP) and limited health literacy (discussed later). Consent by proxy could become a source of future concern, and physicians should not ignore the risks associated with it.

Many of the published cases are of older judicial decisions.[15] The ramifications of these cases are unclear to a contemporary jury and judge. In addition, these older cases did not address

issues such as LEP and limited health literacy, which may impact informed consent situations, including consent by proxy. In many of these cases, treatment without consent by an LAR was deemed appropriate by the court either on the basis of the emergency-treatment doctrine or because the court deemed the minor patient to be a "mature" or emancipated minor.[15] However, there is also judicial precedent in which liability was imposed on the physician.[10,16–18]

Although not specifically addressing consent by proxy, more recent court cases have assessed the validity of informed consent when a parent was not present.[19,20] These cases have involved consent by adolescents for treatments and diagnoses other than those already permitted in most jurisdictions, such as treatment of sexually transmitted infections and mental health disorders. In viewing the informed consent as valid, these courts have determined that the adolescents were mature minors, although the minors had not previously sought mature-minor status through adjudication. The courts relied on the adolescents' age, ability, education, training, degree of maturity and judgment, conduct and demeanor, and the nature and risks of the treatments in assessing whether the minor adolescents were capable of consenting on their own. Nevertheless, despite this legal precedent, practitioners should be wary of treating adolescents without parental consent unless the adolescent is seeking treatment for a legally permitted condition.

A claim of "inadequate" informed consent is usually predicated on the notion that a "reasonable" person would have refused the treatment or procedure offered to the plaintiff had proper informed consent been conducted.[12] A claim of inadequate informed consent may be added to a claim of medical malpractice because proof of inadequate informed consent might imply to a jury that the physician was careless about the care delivered.[21] The importance of appropriate informed consent is underscored by recent appellate court decisions that held that neither proof of medical malpractice nor battery is required for a claim of inadequate informed consent to be valid.[22,23]

DEFINITION OF TERMS

Nonurgent Pediatric Care

For the purposes of this clinical report, nonurgent pediatric care is defined as preventive medicine (ie, services encompassed in pediatric health supervision visits, including immunizations and screening tests) and outpatient medical encounters for minor illnesses or injuries. Differences in operations and procedures may depend on whether the nonurgent medical encounter is the initial or a follow-up visit.

Informed Consent

Informed consent is a general principle of law that imposes on physicians a duty to disclose to their patients the benefits and risks associated with each of the following: (1) the proposed course of treatment; (2) alternate treatments; and (3) no treatment at all. In general, informed consent is meant to allow patients to voluntarily consent to medical interventions by reasonably balancing the probable risks against the probable benefits.[24] State standards in assessing the adequacy of disclosure under informed consent can be physician/professional based (ie, benefits and risks that a reasonable physician would disclose), patient based (ie, benefits and risks that a reasonable patient would want to know), or a hybrid of both. Legal requirements for informed consent may also be specific to medical procedures or tests.[25]

Consent by Proxy

The process by which people delegate to another person the legal right to consent to medical treatment for themselves, for a minor, or for a ward is called consent by proxy. There are 3 fundamental constraints on this right to delegate consent for children: (1) the guardian of a minor must have the right to consent to medical treatment for that minor; (2) the guardian must be legally and medically competent to delegate the right to consent to medical treatment for that child; and (3) the right to consent to medical treatment for the child must be delegated to a legally and medically competent adult.[8,15,26] Physicians must realize that persons who have been delegated consent-by-proxy status may have different opinions than the LAR about both recommended and alternate treatment.

Physicians need to be aware that state laws may mandate a hierarchy of persons who may give consent by proxy to nonurgent treatment if an LAR cannot be contacted.[27–29] An example of such a hierarchy is (1) stepparent, (2) grandparent of minor, (3) adult brother/sister, and (4) adult aunt/uncle of minor.[30] When a hierarchy is the rule, a person lower on the list generally cannot give consent if one higher on the list is available. A written power of attorney or affidavit may be needed. Such a document may need to be notarized or witnessed,[26,31,32] may have a time limit to it,[26,31–33] and may be needed to supersede this hierarchy.[30]

State law or custodial agreement may not permit a noncustodial parent to consent to treatment of a child. State law may permit foster care licensees and court-appointed guardians to consent depending on the scope of authority granted by the court and the treat-

ment proposed. Typically, consent to "routine" care is permitted, although the definition of routine may vary among states. Some states have permitted proxies to consent to routine or "ordinary" medical and dental care, which can include radiography, surgery, and anesthesia.[34] Other states have excluded surgery, anesthesia, and even psychotropic drugs from the definition of ordinary care.[26,27,35,36] Immunizations may be excluded from consent by proxy.[26] Some state laws on consent by proxy that are drafted lack specific guidelines for implementation. Also, some states provide immunity for physicians from civil and criminal liability if the physician obtains the consent in good faith.[26]

Minor

A person who is younger than the age of legal competence is a minor by definition. In most states, a person is no longer a minor after reaching 18 years of age.

Current Pediatric Practice

Because there is no legal requirement to provide nonurgent pediatric care to a minor without the consent of an LAR, pediatricians who choose to treat such patients may unwittingly be assuming additional risk of exposure to liability. According to a 2004 periodic survey of AAP fellows, "Pediatricians' Experiences With Child Care Health and Safety,"[37] many pediatricians have not adopted policies to minimize these risks. The survey revealed that fewer pediatricians in 2004, compared with those in 1999, said that it was their policy to see all children brought in by child care providers (16% vs 21%), whereas more pediatricians said that they see children brought in by child care providers only if they have authority from the parents (50% vs 40% [$P < .001$]). One-third of pediatricians responded that they had no set policy regarding treating patients brought in for nonurgent acute care or preventive visits by child care providers. Fewer pediatricians in 2004 than in 1999 said that it was their policy to take all telephone calls from child care providers (16% vs 25%). More said that they take the telephone call only if given authority by the parent (32% vs 21% [$P < .001$]). Fewer pediatricians in 2004 than in 1999 offered telephone consultations to child care providers (36% vs 48% [$P < .001$]). The results of 1 national study showed that only 64% of pediatricians and family practitioners often or always saw adolescent patients for routine health maintenance examinations without parents present.[38] Practices that maintained a specific clinic policy were less likely to see an adolescent for routine care without a parent present, compared with those without such a policy.[38]

FAMILY LIVING ARRANGEMENTS

Changes in family living arrangements and use of child care are leading reasons why someone other than an LAR may bring a minor patient in for nonurgent ambulatory pediatric care. The US Census Bureau has described many aspects of family living arrangements.[39] In 2004, of the more than 73 million children younger than 18 years in the United States, 70% spent most of their childhood living in 2-parent families. However, a significant proportion of children resided in homes with other family configurations. Approximately 1 child in 4 (19.3 million) lived with a single parent, most often a single mother. Also, many children lived with single parents who had cohabiting partners. Furthermore, 4% of children lived with neither parent and lived instead with another adult, usually a grandparent, which means that approximately one-third of all children in the United States do not have 2 parents in the home with legal authority to consent to medical treatment.

CHILD CARE

Census reports confirm that an increasing proportion of children spend substantial amounts of time in the care of a person other than their parents.[40] In 2005, 30% of 11.3 million children younger than 5 years whose mothers were employed were cared for on a regular basis by a grandparent during the mother's working hours.[40] A slightly greater percentage spent time in an organized child care, nursery, or preschool.

DOCUMENTING CONSENT BY PROXY

Whenever someone other than the LAR accompanies the child for medical care, it affords an opportunity to assess the relationship between the child and the caregiver, but it precludes face-to-face contact between the pediatrician and the LAR. If it has been anticipated that a caregiver other than an LAR may bring the child to pediatric visits, arrangements should be made for the LAR to provide a written consent for consent by proxy. In general, these documents specify the name of the LAR, the name of the person to whom the LAR's legal authority to consent to the child's medical care has been delegated, and the relationship of that person to the child. Such documentation may need to delineate the extent of the surrogate's authorization (ie, the circumstances, the kinds of medical services, or the specified time period for which the surrogate may provide consent for medical care). State law related to consent by proxy should always be reviewed. Signatures may be required, and state law may require that the signatures be notarized.[26,41] State law may also dictate the specific time period for which a written consent by proxy is valid.[26,33]

The proxy relationship should be verified and documented periodically. The proxy accompanying the patient

should be the same person to whom proxy has been delegated on the aforementioned form. Requesting a dated signature and photograph identification from the proxy is one way to document that verification. Dissimilar signatures may indicate a problem. It should also be verified that the person is authorized to consent to the specific care that will be provided. The patient's medical record should be flagged to alert the pediatrician and nursing staff of situations in which the caregiver cannot provide consent. If the pediatrician has any doubts about the caregiver's capability to provide permission for medical care (eg, lack of maturity; presence of intoxication[42]; unclear legal standing; or the inability to understand risk communication, perhaps because of language barriers or limited health literacy), then the pediatrician may need to consider deferring elective care until permission from the LAR can be obtained.

If the pediatrician is uncomfortable with consent-by-proxy arrangements, it needs to be communicated with parents as soon as possible. The topic could be broached during early discussions of child care arrangements at prenatal or newborn visits or addressed during medical encounters before the parent returns to employment outside the home. If parents are the caregivers, the pediatrician can explain the importance of the "therapeutic alliance"[43] between the pediatrician, parents, and patient and emphasize why it is preferable for at least 1 parent to be present during nonurgent visits. Offering extended office hours (evenings or weekends) is another way pediatricians have made it possible for working parents to attend their children's medical appointments.

INITIAL VISIT

Pediatricians should be cautious about proxy situations if they are providing initial care for the child. Medical decisions may be made on the basis of information obtained from the proxy that may not be entirely accurate. Similarly, medical decisions may be made on the basis of follow-up visits that are contingent on the accuracy of the information from the documentation during the initial visit. Pediatricians who decide to treat children under these circumstances may want to consider "flagging" such charts so that baseline information obtained from the initial visit can be later verified by the LAR. This would be especially important for details such as medication allergy.

UNACCOMPANIED TRAVEL

Consent-by-proxy forms can be useful in other situations as well. Children who travel without their LAR sometimes require medical treatment for a minor injury or illness, which often occurs when children are visiting friends or relatives without their LAR. Although most LARs will sign a proxy consent form when their children go to school or summer camp, few LARs think about sending a signed proxy consent form along when their children leave home for an extended period (eg, a week visiting grandparents). Depending on state law, a child may not be able to obtain routine medical care (which may or may not be defined under state law) without consent to such care by an authorized adult. Pediatricians may encourage LARs to anticipate these problems and take the steps necessary to ensure that their children traveling without an LAR can receive needed nonurgent medical care. When in doubt, pediatricians should consider the best interests of the child in making their decision about rendering care.

CUSTODY AND CONSENT

It is prudent for the physician to inquire about marital status and custody issues when relevant. In most states, parents who are married to each other have an equal right to consent to medical care for the children of that marriage, and the consent of only 1 parent is required for nonurgent pediatric care in such cases. The physician should not assume which parent has the right to consent for the child when the parents are divorced or legally separated. The right to consent in these situations may be contingent on state law or court order. Some states limit the rights of noncustodial parents and fathers of children born out of wedlock, in which case proof of paternity may not be available, to provide consent to medical care for children.

One of the most difficult situations for securing parental consent for a child's health care occurs when children are used as pawns in marital conflict. "Physical custody" refers to where the child lives. A "residential custodial parent" has sole physical custody, and this parent's home is the child's primary residence. A "noncustodial parent" is usually granted visitation or access rights to the child. "Legal custody," which can be sole (if only 1 parent) or joint (if both parents equally), refers to parental rights and responsibilities, which include medical decisions and other issues that pertain to the child's general welfare. "Joint custody," when used generically, can either be joint legal custody (parents share nearly equal responsibilities for parenting decisions, such as medical care) or joint physical custody (providing the child with a home). It should be noted that each divorce or legal separation agreement is unique, and specific rights may be granted or denied to a parent, even when the court document describes them as having legal custody of the child. It is important, therefore, to inquire about who has "medi-

cal decision-making rights," because it is more directly pertinent to the issue of providing consent for the child's medical care.

Disputing parents can use situations for deciding whether the child should receive nonurgent medical care as an opportunity to spar over parental rights. Generally, if both parents have equal right to consent to care for their child, the physician need only obtain consent from 1 parent to provide that care. However, there may be situations in which it is not clear whether the pediatrician may seek consent from 1 parent if consent has been refused by the other.[8]

The pediatrician should clarify who has the right to medical information and should specifically ask about any joint physical or legal custody agreements.[44] Joint legal custody may be relevant to coordinating medical care, because some joint custody agreements require that both parents need to give consent and be informed about their child's medical needs.

Less commonly recognized is the problem of children visiting a noncustodial parent in another state, especially if that state's law does not permit a noncustodial parent to give permission for the child to receive medical care. These situations are usually unexpected but not unmanageable. For instance, a pediatrician may be puzzled when a family associated with the practice seeks medical care for a child never mentioned or seen previously. It may be a child or stepchild from a previous marriage or relationship who lives in another state and who, while visiting the family, develops a minor illness and needs medical attention. In such situations, pediatricians need to make sure that the adult with the child has the authority to consent to the medical care before treating. Unless a stepparent has legally adopted the child or has been designated as a legally authorized caregiver, he or she may have no legal authority to give consent for treatment.[8] It is suggested that office staff document the name and relationship of the person providing permission and how his or her authority to do so was ascertained.

OTHER CIRCUMSTANCES

Four percent of all US children do not live with either of their biological parents.[39] They may be in foster care, under the care of a relative, with a potential adoptive parent, or in other situations in which their caregiver is not a biological parent. The pediatrician should ascertain the exact nature of the relationship, verify the authority of the proxy, and document the legal basis of the proxy-child relationship and the exercise of the informed consent process within that context.

For some children, there has not yet been a request to the court for a guardian to be appointed. For this reason, authority to consent to these children's nonurgent care may be unclear, but a physician should probably not deny them necessary care because of their legal status. The pediatrician should use his or her best judgment in deciding whether to postpone care until a guardian can be appointed or to render the care. If care is provided, careful documentation of the circumstances is recommended. Pediatricians should notify child protective services when a child needs a legal guardian. As noted above, for children in state custody under a foster care arrangement, there may be restrictions on consent by proxy. Consent for surgery may require a court order.[27,33]

IMMUNIZATIONS

Although some would debate the logic of requiring informed consent for state-mandated services such as immunizations, it is clear that open dialogue about risk is at the crux of the national Vaccine Injury Compensation Program (VICP).[45] Vaccine information statements (VISs) were created to meet the informational requirements of the VICP; however, VISs alone are not considered informed consent. Under the VICP, providers must distribute a VIS to the patient's legal representative every time a covered immunization is administered. Federal law does not require parental consent for immunizations but instead uses the term "legal representative" as one who may consent. Federal law defines legal representative as a parent or other individual who is qualified under state law to consent to the immunization of a minor. Thus, regarding immunizations, state law controls. Non-LAR consent to immunizations may have restrictions under some state laws.[46,47] These state laws may cover procedural requirements (eg, whether consent may be verbal or must be written) or substantive requirements (eg, types of information required). Most states require separate consent for each injection when more than 1 is required to complete immunization. Most states require consent for immunization services provided to adolescents.[48] Some states allow adolescents to self-consent for immunization. Unless the law provides otherwise, immunizations should not be given without appropriate consent.

VISs explain the benefits and risks associated with each childhood immunization. However, VISs are intended to facilitate, not replace, effective risk communication and proper informed consent between the health care professional and the patient's legal representative. Guidelines on the distribution of VISs and documentation of vaccine administration are available in a booklet published by the Department of Health and Human Services[49] (www.cdc.gov/vaccines/pubs/vis/default.htm)

and are summarized in the 2009 AAP *Red Book*.[50] In addition, the AAP produces vaccine administration record forms to help pediatricians comply with the VICP documentation requirements. For non–English-speaking patients, VISs have been translated into 49 languages. These VISs can be accessed and downloaded from the Immunization Action Coalition Web site (www.immunize.org/vis).[51]

LANGUAGE BARRIERS TO INFORMED CONSENT BY PROXY

People with LEP pose a burgeoning challenge in the delivery of health care. A similar approach may be needed for patients or LARs with hearing impairment.[52] LEP has the potential to become a major future medical malpractice issue relating to informed consent,[53] which will be compounded in scenarios that involve consent by proxy. Various federal and state laws and regulations apply to individuals with LEP, including the American With Disabilities Act, the Rehabilitation Act of 1973, Title VI of the Civil Rights Act, and the Health Insurance Portability and Accountability Act (HIPAA). The 2000 US Census noted that 37 million adults and 10 million children older than 5 years primarily spoke a language other than English at home.[54] Furthermore, even among English-speaking patients, a large proportion have poor reading skills.[55] If the proxy does not speak the same language as the pediatrician, it may be difficult to obtain appropriate informed consent. Although patient education materials and consent forms can be developed in various languages for common procedures that require informed consent, it would be unwise to rely exclusively on written informed-consent methods. Translations that are accurate according to the textbook language may not be appropriate to the comprehension level of the reader.

Most pediatricians report using untrained interpreters to communicate with patients and families with LEP,[56] especially in smaller and rural practices but also in states with higher proportions of people with LEP.[56] If the pediatrician suspects that language barriers may compromise the communication between him or her and the proxy necessary for informed consent, other steps may need to be taken. Health care professionals who participate in federal health programs (eg, Medicaid, State Children's Health Insurance Program, TriCare, Medicare) must meet requirements for accommodating patients with LEP, which may involve qualified translators other than family members.[57] Some patients with LEP may be eligible for language assistance if their provider participates in a federal government program.[58] Practitioners may be placing themselves at risk of liability if the proxy has problems understanding the practitioner because of a language barrier. Malpractice lawsuits related to the issue of LEP have been based on both negligence and inadequate informed consent.[59,60] It is preferable to have someone who is medically knowledgeable explain the illness, treatment options, and known risks and benefits in the proxy's own language. The practice should record and retain on file the name, address, and background of the translator. Translators should be instructed that they are to communicate the caregiver's answer directly, which is vital for conveying to the pediatrician whether the respondent's answer indicates an understanding of the elements needed for informed consent and whether an agreement has been reached as to the medical treatment. It is not advisable to use children (eg, the patient or an older sibling or relative) as translators for informed consent. The use of adult family members as translators may result in incorrect history because of concerns about their desire to not disclose personal information. Certain scenarios could violate Title VI of the Civil Rights Act of 1964.[57]

PROBLEMS WITH PROXIES WITH LIMITED HEALTH LITERACY

Besides potential problems with a proxy having a language barrier, some proxies may have limited health literacy. Health literacy is the ability to obtain, process, read, and understand health information so that an appropriate and informed health care decision can be made.[55] Results of the 2003 National Assessment of Adult Literacy indicated that only 12% of the American adult population has proficient health literacy skills,[61] and the Institute of Medicine has estimated that 90 million American adults lack the literacy skills to effectively use the health care system in this country.[55] Thus, physicians must be sure that proxies understand the health information that is being conveyed to them.

SUMMARY

The liability risk of a pediatrician providing nonurgent care without the appropriate informed consent is likely to be low, especially if the care is provided in the best interest of the child. This risk is likely to be higher in certain situations such as those that involve immunizations, language barriers, limited health literacy, and the initial visit. State laws are applicable. Pediatric practices need to anticipate that situations that involve consent by proxy can occur for a variety of reasons. Policies should be developed that promote good, informed decision-making and risk management. Care should be taken to make sure that such policies meet applicable laws without blocking access to necessary but nonurgent health care. Pediatricians have sought ways to accommodate

the diverse living and working arrangements of their patients' families. Many pediatricians are working parents themselves and know well the challenges of family life. Developing a legally sound office policy on consent by proxy is essential for maintaining efficient office operations and strong physician-patient relationships.

IMPLEMENTATION SUGGESTIONS

1. Determine if the practice will see minor patients without an LAR present. It is usually best if all physicians within the practice adopt the same policy; otherwise, problems can occur during coverage situations.
2. If the practice's decision is not to provide nonurgent care to patients without an LAR present, then the policy for the office and an information sheet explaining it should be provided to patients. The policy should also be made clear during contacts with new or prospective patients.
3. If the practice decides to provide nonurgent care to patients accompanied by someone other than their LAR, then it should establish a policy and procedural guide for the office as well as a patient information sheet that explains the policy. This statement may spell out the LAR's responsibilities in providing and documenting his or her consent-by-proxy arrangement. The pediatrician should ensure that office staff members, particularly those involved in telephone triage and scheduling appointments, understand the policy and their responsibilities.
4. It is advisable to create a template form to be used in cases in which individuals other than LARs may be expected to accompany a child to the office. Suggested items to address include:
   a. Who has the legal right to delegate consent to health care decisions for the child?
   b. To whom can the power to consent to health care for a child be delegated?
   c. In what circumstances can the power to consent to health care for a child be delegated (eg, while child is vacationing out of state with grandparents or while parents are traveling overseas and child remains home with the nanny)?
   d. For which services (eg, preventive care, immunizations, laboratory tests) can the power to consent to health care for a child be delegated?
   e. With what limitations can the power to consent to health care for a child be delegated? (For example, the proxy may consent to treatment for a child's sprained ankle but may not be authorized to take child to the visit with the orthopedic surgeon).
   f. How is authorization of proxy consent verified and documented?
   g. When or how often should information on proxy consent be updated?
5. The proxy relationship should be verified and documented periodically.
6. Establish an office procedure for providing and documenting informed consent for proxies with LEP, hearing impairment, and limited health literacy.
7. It is advisable to have legal counsel review office policy and supporting documents to ensure compliance with applicable laws.
8. It is recommended that informed consent, including consent by proxy, be included in residency training and continuing medical education. Such educational efforts have been effective in improving knowledge and attitudes about informed consent.[62]
9. When in doubt about informed consent in a proxy situation, practitioners should use discretion in deciding whether to treat and should base the decision on the best interests of the child.

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American Academy of Pediatrics
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POLICY STATEMENT

Contraception and Adolescents

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Adolescence

ABSTRACT

Although adolescent pregnancy rates in the United States have decreased significantly over the past decade, births to adolescents remain both an individual and public health issue. As advocates for the health and well-being of all young people, the American Academy of Pediatrics strongly supports the recommendation that adolescents postpone consensual sexual activity until they are fully ready for the emotional, physical, and financial consequences of sex. The academy recognizes, however, that some young people will choose not to postpone sexual activity, and as health care providers, the responsibility of pediatricians includes helping teens reduce risks and negative health consequences associated with adolescent sexual behaviors, including unintended pregnancies and sexually transmitted infections. This policy statement provides the pediatrician with updated information on contraception methods and guidelines for counseling adolescents.

INTRODUCTION

Pediatricians have an important role in adolescent reproductive health care. Their long-term relationships with patients and families allow them to help promote healthy decision-making around sexuality and include abstinence as a way to avoid the negative consequences associated with risky sexual behaviors. As advocates for the health and well-being of young people, pediatricians communicate their recommendation to adolescent patients to postpone sexual activity until they are ready, because any sexual activity for which the adolescent is ill prepared may have emotional, physical, and financial consequences. However, clinicians recognize that some of their adolescent patients are sexually active or will choose to become so. Recent studies indicate that, for some adolescents, even participating in formal programs that advocate abstinence and signing abstinence pledges do not result in abstinent behavior.[1,2] Pediatricians can have an active role in encouraging their adolescent patients to use contraception to reduce the risk of unintended pregnancies and to prevent sexually transmitted infections (STIs). In previous publications, the American Academy of Pediatrics (AAP) has addressed issues of adolescent sexuality, unwanted pregnancy, STIs, and contraception.[3] This policy statement provides the pediatrician with updated information on adolescent sexual behavior, which may lead to pregnancy, including guidelines for counseling adolescents about available methods of contraception. Current methods available are discussed, as are methods in development.

ADOLESCENT SEXUAL BEHAVIOR AND USE OF CONTRACEPTION

Reported contraceptive use by adolescents has increased in recent years. From 1991 to 2005, the percentage of sexually active high school students who reported using a condom the last time they had sexual intercourse increased from 46.2% to

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Key Words
contraception, adolescents, pregnancy, sexually transmitted infections

Abbreviations
STI—sexually transmitted infection
AAP—American Academy of Pediatrics
OCP—oral contraceptive pill
FDA—Food and Drug Administration
DMPA—depot medroxyprogesterone acetate
BMD—bone mineral density
VTE—venous thromboembolism
IUD—intrauterine device

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62.8% in 2005.[4] Despite this increase, consistent use of any contraceptive method remains a challenge for most adolescents.

Levels of reported sexual intercourse by adolescents in the United States decreased during the 1990s for both sexes after increasing for the previous 2 decades.[4–6] The Centers for Disease Control and Prevention's 2005 Youth Risk Behavior Surveillance Summary indicated that less than half (46.8%, down from 49.9% in 1999) of all high school students reported having had sexual intercourse in their lifetimes, and approximately one third (34.3%, down from 37.5% in 1991 and 36.3% in 1999) of all students reported having sexual intercourse during the 3 months preceding the survey and are considered currently sexually active.[4–6]

Each year, almost 850 000 adolescent girls become pregnant. The adolescent pregnancy rate has dropped steadily over the past decade. As of 2004, it was estimated that approximately 41.2% of all pregnancies are to adolescents 15 to 19 years of age.[7] Since 1991, the adolescent birth rate has declined by 33%, the lowest rate ever reported for the nation. The pregnancy rate for 15- to 17-year-olds has dropped by 43% to 22.1% of all pregnancies.[7] Approximately 20% of abortions are in adolescents, although these rates continue to decrease.[8,9] Decreases in pregnancy rates are thought to reflect a decrease in reported rates of sexual intercourse and an increase in reported use of longer-acting, more effective contraceptive agents.[10–12] Over the last decade, evaluations of curricula suggest that those with a comprehensive approach to sexuality education have been effective in improving sexual behaviors and, thus, may also contribute to this trend.[13–15] Despite these declining rates of pregnancies and births, adolescent childbearing (22% of women report giving birth before age 20) is still more common in the United States than in other developed countries such as Great Britain (15%), Canada (11%), and France (6%).[16]

Providing information to adolescents about contraception does not result in increased rates of sexual activity, earlier age of first intercourse, or a greater number of partners.[15] In fact, if adolescents perceive obstacles to obtaining contraception and condoms, they are more likely to experience negative outcomes related to sexual activity.[17] Two school-based studies that demonstrated a delay of onset of sexual intercourse used a comprehensive approach to sexuality education that included a discussion of contraception.[18,19]

Race, ethnicity, age, marital status, education, income, requirements for confidential care, and fertility intentions have all been demonstrated to affect contraceptive choice. Trends in methods of contraception used by adolescents over the past 2 decades show an increase in oral contraceptive pill (OCP) use and an increase in male condom use.[20] In recent years, the number of adolescents reporting OCP use has remained stable at approximately 18% to 20%.[21] Use of injectable contraception by adolescents 15 to 19 years of age has increased from 0% to 13% between 1988 and 1995. A 9% decrease in contraceptive-failure–related pregnancies is attributed to the shift to longer-acting birth control methods.[16]

Factors that contribute to lack of contraceptive use or inconsistent use include issues related to adolescent development, such as reluctance to acknowledge one's sexual activity, belief that one is immune from the problems or consequences surrounding sexual intercourse or pregnancy, and denial of the possibility of pregnancy. Other important factors are lack of education and misconceptions regarding use or appropriateness of contraception. However, an adolescent's level of knowledge about how to use contraception effectively does not necessarily correlate with consistent use. Adolescents may not use or may delay use of contraception for several reasons including lack of parental monitoring, fear that their parents will find out, ambivalence, and the perception that birth control is dangerous or causes unwanted adverse effects such as weight gain.[22–25]

THE ROLE OF THE PEDIATRICIAN

Pediatricians should encourage abstinence and provide appropriate risk-reduction counseling regarding sexual behaviors. Ideally, counseling should include discussion about the prevention of STIs, education on contraceptive methods, and family planning services for the sexually active patient. Such discussion necessarily takes place within the context of an individual patient's physical and emotional development as well as his or her social situation. Although pediatricians are optimally suited for such inquiry, we recognize that not every visit will allow the time required. The demands of comprehensive patient evaluation, counseling, and treatment are daunting, indeed, but are part of the ongoing education of teens and often other family members. This report is intended as a guide and, we hope, is helpful to busy clinicians.

When contraceptive services are provided in the pediatrician's office, policies and procedures that address the provision of such services, including confidentiality, should be developed and then explained to families before the provision of such services is ever needed.[26,27]

Counseling Adolescents About Contraception

Comprehensive health care of adolescents should include a confidential sexual history that should be obtained in a safe, nonthreatening environment through open, honest, and nonjudgmental communication with assurances of confidentiality. During the preadolescent years, the pediatrician can provide anticipatory guidance by discussing puberty and offering health education materials to both the youth and his or her family. At the onset of puberty, the patient's history should include

information on both the family's and the patient's attitudes and knowledge about sexual behaviors and the degree of involvement in sexual activity. General information may be offered or accessible to both the family and patient about methods of contraception and their uses. In addition, around this time, health maintenance visits should begin to include private, confidential time with the adolescent to establish rapport as well as assess degree of involvement in sexual activity. For sexually active adolescents who use contraception, the role of the health care professional is to educate and support compliance, to assist in managing adverse effects or, alternatively, to counsel the patient regarding a new contraceptive method as circumstances require, and to provide referrals and follow-up with periodic screening for STIs. Throughout adolescence, comprehensive sexuality education that includes discussion of abstinence, appropriate contraceptive use, and protection from STIs should be provided as part of healthy sexual development. When initiating any hormonal contraceptive method, the need for consistent protection against STIs (either male or female condoms) should be reinforced.

Confidentiality and Consent

The primary reason that adolescents may hesitate or delay obtaining family planning or contraceptive services is concern about lack of confidentiality.[25,28] It is important for pediatricians to develop office policies that ensure patient confidentiality. State requirements and standards of practice should be reviewed, and the development of clear, concise, and standardized office protocols for confidentiality should be developed for staff, patients, and parents.[29] These policies should include information and education regarding when confidentiality must be waived, guidelines for reimbursement of services, medical chart access, appointment scheduling, and information disclosure.

For those patients whose parents are unaware of their contraceptive use, it may be helpful to discuss with the adolescent patient how the contraceptive method will be consistently used in all circumstances. Consistent adolescent contraceptive use is often derailed during weekends away, family vacations, adolescents' trips to stay with other relatives, and/or visits to noncustodial parents.

Sexual Responsibility

Pediatricians can help adolescents identify their own goals for safe and responsible sexual behavior, including reinforcing and supporting abstinence. The promotion of healthy and responsible sexual decision-making is one of the goals of counseling adolescents about contraception. Successful counseling requires a supportive and nonjudgmental pediatrician who engages in effective dialogue, which includes skillful history taking, careful listening, and repetition of simple educational messages that contain essential information.[26,30]

Sexual Decision-Making

Adolescents should be strongly encouraged to postpone or delay the initiation of sexual activity. For patients who are already engaged in sexual intercourse or who are contemplating having sexual intercourse, a discussion of contraceptive methods and prevention of STIs (including HIV and AIDS) is essential. Condom use should always be reinforced, and teens must be reminded that, for some STIs, condoms are not totally protective. Adolescents should be made aware, in a nonthreatening and nonjudgmental manner, that although condom use is essential and may be life-saving, any individual who engages in sexual contact is at risk of contracting STIs that are transmitted through sexual contact, such as herpes simplex and human papillomaviruses, rather than body-fluid exchange, such as gonorrhea and trichomoniasis. Discussions should address and explore the adolescent's reasons for becoming sexually active and the effect that sexual intercourse may have on relationships with peers, parents, and significant others. Clinicians may also find it useful to explore with the adolescent how he or she believes the sexual experiences will change his or her own self-image. Adolescent sexual decision-making has emerged in recent studies as a complex interplay between an adolescent's perception of peer-group expectations, personal self-image, values, and desires and media influences.[30–33] However, a caring, nonjudgmental yet informative, nonparental adult can wield substantial influence in teens' sexual decision-making; teens cite lack of such a person as a missing key feature of sexuality education.[34] Pediatricians, therefore, may have some influence in adolescent sexual decision-making and are especially well positioned to assess risk-taking behaviors in the area of sexuality.[35]

ADOLESCENTS WITH DISABILITIES

The issue of contraception for adolescents with chronic illness or disability is often forgotten. An estimated 10% to 20% of children and adolescents experience a disability or chronic illness by the age of 20 years.[36] Recent data from the National Longitudinal Study of Adolescent Health has shown that physically disabled adolescents are as sexually experienced as adolescents without disabilities. Attitudes about contraceptives as well as sexuality education and counseling needs within this population should not be overlooked.[37] A list of additional resources for clinicians who desire more information about contraception for adolescents with chronic illness and/or disability is included at the end of this statement.

METHODS OF CONTRACEPTION

Numerous reviews and protocols for prescribing and managing contraception are available. The following section focuses on the appropriateness of various contraceptive methods available for adolescents. The pediatrician should emphasize the need for STI prevention as well as contraception with each patient at each visit.[17,38]

Abstinence

Abstinence is the most effective means of birth control and prevention of STIs and is a viable strategy in the clinician's toolkit for reducing unintended pregnancy and achieve reduction in STI rates. Abstinence education generally focuses on delaying the initiation of adolescent sexual activity until marriage or adulthood. Many schools have adopted abstinence-dominant or abstinence-only education programs for school sexuality curricula. To date, the evidence regarding the efficacy of such interventions in the reduction of risky sexual behaviors, including risk for STIs, has not been proven.[14,39] No data have directly examined how well abstinence counseling works to reduce an individual's pregnancy and STI risk. In practice, many adolescents who intend to be abstinent often fail and have sex. A longitudinal analysis of teens and virginity pledges compared pledgers to nonpledgers and found at a 6-year follow-up that 88% of pledgers reported experiencing premarital sex and had STI rates that, statistically, were no different from those of nonpledgers.[2] A recent article provides some practical tips for abstinence counseling within an office-based setting using a comprehensive perspective including motivational interviewing.[40]

Several published studies and evaluations have suggested that comprehensive sexuality education is an effective strategy for helping young people delay initiation of sexual intercourse. In addition, research has shown that these programs do not hasten the onset or frequency of sexual intercourse and do not increase the number of partners that sexually active teens have.[15]

There is some consensus that sexuality education and interventions with some abstinence-based or "abstinence-plus" curriculum components are most effective when targeted at younger adolescents before they become sexually active.[1,41] Some recent studies demonstrated the importance of youth, parent, physician, and education partnerships for the prevention of health risk behaviors such as early initiation of sexual intercourse.[13,42] One study illustrated that an abstinence-only curriculum had no significant impact on the initiation of sex, the frequency of sex among those students who had ever had sex, or the number of sexual partners among those who had ever had sex. Two other studies produced similar results.[1] The AAP supports a comprehensive approach to sexuality education for adolescents. Abstinence should play a part in any comprehensive discussion of sexuality, and resources should be made available for adolescents who feel pressured, but prefer not, to engage in sexual activity.

For some adolescents, abstinence may be a difficult choice. Adolescents who choose to abstain from sexual intercourse should be encouraged and supported by their parents, peers, and society (including the media) and especially by their pediatricians. Adolescents need to know about other contraceptive options before (or if) they decide to have intercourse.

Male and Female Condoms

The male condom is a mechanical barrier method of contraception. The failure rate at the end of first-year use for the male latex condom is 3% with perfect use and as much as 14% with typical use.[43] Latex condoms significantly reduce the transmission of some STIs and, therefore, should be used by all sexually active adolescents regardless of whether an additional method of contraception is used. Male condoms have several other advantages for adolescents, including involving males in the responsibility of contraception, easy accessibility and availability to minors, use without a prescription, and low cost.[44] Polyurethane condoms can be used by adolescents with a documented latex allergy; however, latex condoms are preferred, because they have a higher efficacy rate with typical use than polyurethane condoms.[43] Some adolescents may have local reactions to condoms that have been pretreated with spermicide and should be counseled that condoms without these agents are also available. Nonoxynol-9 is the only chemical agent in spermicidal products available in the United States; there are nonspermicidal hypoallergenic lubricants available over the counter. Only water-based lubricants may be used with latex condoms, and both water- and oil-based products may be used with polyurethane condoms.[44] Currently, there is a general movement away from products with nonoxynol-9 because of concerns that use increases risk of genital ulceration and irritation, which may facilitate the acquisition of STIs.[44] Condom use reported at most recent intercourse by females was 54% and by males was 71%, which is an increase in the last decade.[20] Surveys of high school students over the last decade indicate that condom use has increased, with condom use at last intercourse increasing from 46.2% in 1991 to 62.8% in 2005.[4]

The female condom, another barrier method of contraception, provides contraceptive efficacy in the same range as other barrier methods, such as the diaphragm and cervical cap (with typical use).[45] One trial of the most widely available female condom on the market yielded a failure rate of 0.8% with perfect use and between 12% and 15% with typical use.[46] The female condom also helps protect against STIs. Adolescents' concerns about using a female condom include difficulty of insertion, higher cost than male condoms, and appearance and noisiness of the device. Female adolescents

have reported that the female condom could be useful if their male partners did not want to use a condom. Further education on using the female condom is needed for both genders. For adolescents who already use male condoms, it is important to market the female condom as an alternative contraceptive choice, because male and female condoms should not be used simultaneously.[47] Male condoms are preferred over female condoms because of higher efficacy rates of preventing pregnancy and STIs and lower cost.

Vaginal Spermicides

Vaginal spermicides are a chemical barrier method of contraception applied intravaginally through a variety of forms: gel, foam, suppository, or film. Spermicides consist of 2 components: a formulation (the gel, foam, suppository, or film) and the chemical ingredient that kills the sperm (eg, nonoxynol-9). As with any barrier method, the effectiveness of spermicides depends on consistent and correct use. The combination of vaginal spermicide and condoms is a very effective means of contraception for adolescents, because it provides effective prevention of pregnancy, reduces the risk of contracting an STI, is available without a prescription, and is inexpensive.[48]

There has been a question as to whether use of nonoxynol-9 alone provides adequate protection against STIs and HIV. In high doses, nonoxynol-9 can irritate the vaginal lining, which makes young women more susceptible to HIV transmission. The Centers for Disease Control and Prevention have concluded that women should be discouraged from using nonoxynol-9 alone for STI and HIV protection, because 1 study found that a product containing nonoxynol-9 did not protect against HIV infection and may have caused an even greater likelihood of transmission as compared with a vaginal lubricant.[49,50] Use of spermicide alone is not advocated as a contraceptive method; condoms must be used in conjunction with vaginal spermicides for protection against STIs

Oral Contraceptives

OCPs are a reliable, effective method for the prevention of pregnancy, are available only by prescription in the United States, and are the most popular method of prescribed contraceptive among adolescents.[21] Of the 2.7 million adolescent women who use contraceptives, 44% rely on the pill.[51] The Youth Risk Behavior Surveillance Summary reported that in both males and females who had sexual intercourse during the 3 months before the survey, the percentage who used birth control pills to prevent pregnancy during last sexual intercourse was 17.6% in 2005, down from 20.8% in 1991.[4]

Three forms of OCPs are currently available: the fixed-dose, monophasic combination (each tablet contains the same dose of estrogen and progestin); the phasic dose (the triphasic and biphasic packs that contain varying doses of estrogen and progestin); and the minipill (which contains progestin only). Many of the newer forms of birth control pills have a low dose of estrogen (20–35 μg) and contain new forms of progestin. These low-dose pills are typically the "first-line" therapy for OCP initiation. There is theoretic potential for lowered efficacy of low-dose OCPs in patients who are taking some medications. Some common medications that increase the metabolism of synthetic steroids by increasing conjugation in the gut and enzyme induction in the liver are listed in Table 1.[52–54] In this clinical situation, prescription of OCPs that contain 50 μg of ethinyl estradiol or switching to a hormonal method that avoids first-pass metabolism, such as injectable progestin, may be indicated; efficacy of transdermal or intravaginal contraceptives with these medications are not known. Generally, the standard 28-day pack of pills (21 days of hormone and 7 days of placebo) is prescribed for teens, and daily compliance is encouraged, particularly over the 21 days of hormone-containing pills to maximize efficacy and minimize bleeding irregularities.[55] The 21-day packs, if available, are better for adolescents who are taking OCPs in continuous or extended cycles.

The US Food and Drug Administration (FDA) recently approved a monophasic 30-μg ethinyl estradiol/0.15-mg levonorgestrel pill for extended cycling called Seasonale (Barr Pharmaceuticals, Woodcliff Lake, NJ). This formulation provides 84 days of continuous hormonally active pills followed by 7 days of placebo. This formulation may be particularly appropriate for adolescents with medical conditions such as anemia, severe dysmenorrhea, endometriosis, dysfunctional uterine bleeding, or Von Willebrand and other bleeding diatheses and adolescents who prefer amenorrhea.[56] In addition, adolescents who frequently miss OCPs may have lower failure rates when using continuous or extended regimens of OCPs with shorter or no placebo intervals.

TABLE 1 Medications That Decrease OCP Efficacy

Antibiotics
Rifampin (Rifadin, Rimactane)
Anticonvulsants
Felbamate (Felbatol)
Ethosuximide (Zarontin)
Primidone (Myidone, Mysoline)
Phenobarbital (Solfoton, Barbita, Luminal)
Phenytoin (Dilantin, Phenytek)
Carbamazepine (Tegretol)
Oxcarbazepine (Trileptal)
Topiramate (Topamax)
Antidepressants
St John's wort
Antifungal agents
Griseofulvin (Fulvicin, Grifulvin, Grisactin, Gris-PEG)
Anti-HIV drugs
Protease inhibitors
Nonnucleoside reverse transcriptase inhibitors

The noncontraceptive benefits of OCP use include improvement in acne and decreased menstrual cramping, pain, blood loss, and ovarian cysts. OCP use that exceeds 3 years provides significant protection against endometrial and ovarian cancers. Overall, observational data indicate that OCP use does not increase risk of breast cancer. Adverse effects include nausea, breast tenderness, headaches, and breakthrough bleeding. OCPs are one of the best-studied medications ever prescribed and are a safe option throughout a woman's reproductive years, because the method is completely reversible and has no negative effect on long-term fertility.[57]

OCPs have a failure rate of 0.1% when used perfectly. However, failure rates range between 5% and 8% with typical use and for adolescents may reach 15% to 26% because of noncompliance.[58] Adolescents may have difficulty complying with OCPs because of forgetfulness, attempts to hide contraception from parents, and inconsistency of sexual relations, among other reasons. The National Survey on Family Growth reported that as many as 42% of adolescents 15 to 19 years of age missed 2 or more pills in a 3-month period.[57] Adolescent compliance with OCP use may be enhanced by appropriate patient education and problem-solving techniques, which includes careful instruction regarding the use of OCPs; anticipatory guidance about adverse effects and their management; a discussion of correct pill usage (including when the first pill should be taken during the menstrual cycle or what to do if a pill or pills are late or missed); use of emergency contraception; and frequent follow-up and monitoring. Patients should also be encouraged to use condoms in conjunction with OCPs to provide protection against STIs and additional pregnancy prevention. In addition, when possible, involving the patient's mother can greatly enhance compliance with pill taking.[59]

OCPs have few contraindications in healthy female adolescents. Estrogen-containing OCPs are contraindicated for those with a history of thromboembolism or thrombophilia (ie, factor V Leiden mutation or protein C, protein S, or antithrombin III deficiencies); cyanotic heart disease or pulmonary artery hypertension; systemic lupus erythematosus associated with antiphospholipid antibody syndrome or renal disease, particularly associated with hypertension; or hepatic dysfunction. Patients who are taking anticonvulsant medications and HIV medications need to be counseled carefully and may be encouraged to use injectable progestins (Table 1).

Adolescents need not receive a complete gynecologic examination by the pediatrician before initiating OCPs or any other hormonal contraceptive method.[60] In most circumstances, the pelvic examination may be deferred and OCPs may be prescribed if the patient is healthy, is not pregnant, and has no contraindications to taking the pills. An inspection of the external genitalia and either a urine screen or vaginal swab for STIs may be substituted for a pelvic examination as a screening for initiation of contraceptive use. A pelvic examination is indicated for most situations in which abdominal pain is part of the presenting complaint in a sexually experienced adolescent. Sexually active female adolescents should be screened for STIs, especially chlamydia, at least annually and preferably with each new sexual partner.[61] Guidelines from the American Cancer Society and the American College of Obstetricians and Gynecologists recommend initiation of Papanicolaou (Pap) test screening within 3 years of first intercourse (whether consensual or nonconsensual) or by 21 years of age.[62]

Injectable Hormonal Contraception

Depot medroxyprogesterone acetate (DMPA) injection is a long-acting progestin that is given every 12 weeks (11–13 weeks) as a single 150-mg intramuscular dose. This method of contraception, also known by the brand name Depo-Provera (Pfizer, New York, NY), is highly effective in preventing pregnancy. In the first year of use, the probability of becoming pregnant is approximately 0.3%.[63] Available since 1992 in the United States, some experts believe that the use of this method since 1992 among adolescents who are at high risk of becoming pregnant is one factor responsible for the declining rates of adolescent pregnancy in the United States.[17] This method is convenient for women who do not want to have to remember to take their pill each day, cannot use the patch, or cannot use a contraceptive at the actual time of intercourse.[16] Other advantages include lack of estrogen-related adverse effects and, similar to OCPs, protection against endometrial cancer and iron-deficiency anemia.[64]

The major disadvantage of this contraceptive method for adolescents are menstrual cycle irregularities (present for nearly all patients initially), the need for intramuscular administration every 11 to 13 weeks, and potential adverse effects including acne, weight gain, headaches, and bloating. A new formulation, which is administered subcutaneously, contains 104 mg of medroxyprogesterone acetate (Depo-Subq Provera 104 [Pfizer]), and is given on the same dosing schedule as the intramuscular formulation, is now available. The subcutaneous route makes home administration of Depot-Provera possible, although there have been no studies of home use in the adolescent population. The lower dose could decrease suppression of pituitary function and ovarian estradiol production, although no conclusive data are yet available to indicate such an effect.[65] Two large open-label phase-3 studies have found subcutaneous DMPA to be equally effective as intramuscular DMPA; however, the irregular uterine bleeding that many patients complain of after initiating the drug also accompanies subcutaneous use. As with the intramuscular route, this adverse effect largely resolves over the

first year of use: amenorrhea increased from 26% of patients in month 3 of use to 55% during month 12.[66]

In addition to uterine bleeding irregularities, DMPA use over a prolonged period is associated with a delayed return to fertility, typically 9 to 18 months, while the endometrial lining returns to its pre-DMPA state and ovulatory function returns. Both subcutaneous and intramuscular DMPA show similar delays to fertility after injection.[67] However, for adolescent patients, such a delay does not usually pose a major deterrent to using this method. Both intramuscular and subcutaneous DMPA may be safely recommended for adolescents who have chronic illnesses (eg, seizures, sickle cell disease), are lactating, or are at risk of estrogen-related complications.[64]

Pediatricians should discuss potential adverse effects. Studies have shown that patients are more likely to continue DMPA use if they are counseled about potential irregular bleeding before their first injection, but these studies did not target adolescents specifically.[68] Clinicians must also ensure that the patient is not pregnant at the time of the initial injection and at each injection that occurs at an interval greater than 12 weeks.

Because DMPA suppresses circulating estradiol concentrations, it causes reductions in bone mineral density (BMD), which has generated some concern regarding the long-term effects. A prospective cohort study of adolescents aged 12 to 18 years found that BMD decreased 3.1% after 2 years of DMPA use, whereas BMD increased 9.5% in the controls who were using no hormonal method of contraception.[69] Some other studies have indicated an adverse impact on biochemical markers of bone formation and resorption as well as the decreased BMD.[70–72] In response to these concerns, the FDA issued a "black-box" warning regarding the risk of decreased BMD among DMPA users in November 2004.[73] Currently, the warning recommends limiting the use of DMPA to 2 years and using DMPA as long-term contraception only if other methods are inadequate. The warning also emphasized the lack of certainty regarding peak BMD attained later in life among users of DMPA, but experts think such a restriction may be unwarranted, especially for patients with no other alternatives for contraception. A recently published study of teens and young adult women documented complete recovery of BMD after DMPA use, thus offering some degree of reassurance about use not affecting long-term skeletal health of adolescent patients.[74] In addition, an increased incidence of fractures has not been reported in adolescents using DMPA.

It is important to consider other risk factors for osteoporosis and to tailor counseling and recommendations to each patient. Factors such as small body habitus, chronic alcohol or tobacco use, eating disorders, or illness that necessitates chronic use of corticosteroids may lead a clinician to recommend against DMPA use more strongly. All patients should be encouraged to include foods and/or supplements to ensure intake of at least 1300 mg of calcium each day along with 400 IU of vitamin D, to participate in weight-bearing exercise regularly, and to stop smoking as important measures to promote skeletal health. Using supplemental estrogen has been observed to prevent loss of BMD in 1 study of teens, whereas the use by teens of antiresorptive medications prescribed for postmenopausal women is definitely not recommended.[75] As with all hormonal methods of contraception, condoms should be used in conjunction with DMPA for protection from STIs.

Another injectable hormonal contraceptive (known by the product name Lunelle [previously manufactured by Pharmacia & Upjohn, Kalamazoo, MI]) combined estrogen and medroxyprogesterone acetate. Lunelle was made available in the United States after confirmation of safety in clinical trials in the United States and internationally. However, Lunelle was voluntarily withdrawn from the market by its manufacturer in September 2002 because some doses may not have contained enough hormone to prevent pregnancy. Women who used Lunelle required monthly clinic visits for the injection of medications. Adverse effects were similar to those of Depo-Provera and included weight gain, menstrual irregularity, headaches, and breast tenderness, although adverse effects were fewer than in trials with DMPA alone.[76,77] A general acceptance of and overall satisfaction with Lunelle by women in clinical trials suggested that this method was widely accepted, but its return into the market is not expected in the future.

Progestin Implants

Levonorgestrel implants, also known by the brand name Norplant (previously manufactured by Wyeth-Ayerst Laboratories, St Davids, PA), were highly effective long-acting progestin-only contraceptives that provided pregnancy prevention for up to 5 years. These implants required insertion of subcutaneous polymeric silicone capsules into the upper arm by a trained health care professional. The 6-rod Norplant system was the first progestin implant available in the United States but has been permanently removed from the US market.[78] Implanon (Organon USA, Roseland, NJ), a single-rod implant that contains etonogestrel, the active metabolite of desogestrel, has been used in Europe since 1998 and is now available in some areas of the United States. Highly effective (in clinical trials, no unintended pregnancies were reported in ~73 000 cycles), Implanon may remain in place for 3 years, but it is associated with irregular bleeding in many users, especially during the first year of use.[63]

Levonorgestrel implants are ideal for adolescents who desire an extended length of protection, feel unable to remember to take OCPs, or have already had 1 preg-

nancy. It is also an excellent contraceptive option for females who may have difficulty remembering to use a contraceptive on a daily basis or at the time of intercourse. The major disadvantages for use in the adolescent population include high initial cost and potential adverse effects such as breakthrough bleeding and headaches. The drugs listed in Table 1 also impair the efficacy of levonorgestrel implants. The difficulty of removal of the implant, in combination with these other disadvantages, made Norplant an unpopular form of contraception for adolescents, and although Implanon is easier to remove, it shares many of Norplant's adverse effects. In addition, condoms must be used in conjunction with progestin implants for protection against STIs.[63]

Other Combined Hormonal Contraceptive Methods (NuvaRing and Ortho Evra)

The vaginal ring (NuvaRing [Organon USA]; 15 μg ethinyl estradiol/120 μg etonogestrel) is a round, flexible device that measures 54 mm in outer diameter and 4 mm cross-sectionally; it is inserted in the vagina and stays in place for 3 weeks, with removal for 1 week to induce menstruation followed by insertion of a new ring. This soft silicone vaginal ring releases both estrogen and progestin hormones that protect against pregnancy for 1 month. The ring has been shown to have greater than 99% efficacy when used correctly by adult women. However, trials with adolescent populations have not been conducted. Compliance with the ring is high, and few adverse effects are experienced. Adverse effects would be the same as other combined hormonal methods, which include breast tenderness, headaches, nausea, and some breakthrough bleeding/spotting and an increased risk of the more serious condition of thrombotic events; local adverse effects may include vaginal symptoms of discharge, discomfort, and device problems.[55]

The combination hormonal transdermal adhesive skin patch (Ortho Evra [Ortho-McNeil Pharmaceutical, Raritan, NJ]) can be applied to the abdomen, upper torso, upper outer arm, or buttocks weekly by using 1 patch for each of 3 weeks in a row, followed by 1 week off the patch, during which a withdrawal bleed usually occurs. While in place, the 4.5-cm^3 contraceptive patch delivers 150 μg of norelgestromin and 20 μg of ethinyl estradiol daily. Efficacy rates from 1 study suggested that the overall annual probability of pregnancy was 0.8%, whereas the method failure probability was 0.6%, similar across age and racial groups.[55]

One study reported that women who use the patch are no more likely to become pregnant than women who use a combination OCP. At least 1 study indicated a higher rate of local adverse effects with adolescents who use the patch than with older patients; these effects include patches dislodging as well as irritation and hyperpigmentation.[79–81] Very concrete counseling regarding patch placement with adolescent patients, and perhaps even demonstration of initial placement, is helpful.[81]

Although compliance with using the patch is improved compared with OCPs, the risk of pregnancy with correct use of the patch was higher for women who weigh more than 198 pounds (0.9% in first 12 months of use) compared with women who weigh less (0.3%).[82,83] Obviously, the risks of pregnancy must be discussed as methods are considered; a pregnancy rate of 1% at the end of 1 year in a patient who weighs more than 200 pounds, refuses other methods, and chooses to remain sexually active is a more acceptable alternative than a pregnancy risk of 85% with no protection. For issues related to compliance, the added value of the patch should be considered. It has demonstrated increased compliance, which results in fewer contraceptive failures. Other possible adverse effects of combined hormone methods include temporary irregular bleeding, temporary breast discomfort, weight gain or loss, and nausea.

The most concerning possible adverse effect of transdermal contraception or any combined hormone method is risk of thrombotic events. In the large clinical trials of the transdermal contraceptive patch, 1 case of nonfatal pulmonary embolism occurred during use of the patch, and 1 case of postoperative nonfatal pulmonary embolism was reported. Recently, the higher bioavailability of estrogens delivered transdermally has prompted Ortho McNeil Pharmaceutical to issue a warning specifically related to risk of thrombotic events in Ortho Evra users.[84] An increased risk of venous thromboembolic disorders has been associated with the use of combination hormonal oral contraceptives compared with nonusers; generally, increases in rates by a factor of 3 to 6 have been reported in studies that evaluated healthy young women who had no other risk factors. A review of studies compared the risk of nonfatal venous thromboembolism (VTE) among different OCPs. The authors found that users of OCPs containing desogestrel, a third-generation progestin, had an increased risk compared with users of OCPs containing levonorgestrel.[85] Thus, a baseline risk for VTE of 1 per 10 000 person-years is increased to 3 to 4 per 10 000 person-years during the time when oral contraceptives are being used.[85] The risk is much greater in those over age 35 and those who smoke, especially if cigarette use equals or exceeds 15 cigarettes daily. Although smoking should be discouraged for teens and young adults, smoking and use of combined hormone methods of contraception are not contraindicated in this age group.[86] Whether the patch places teens and women at increased risk of VTEs compared with combined hormone OCPs is not known, because 2 different studies with different methodologies had different outcomes.[87] No studies to date have directly examined whether the patch increases the risk of

thrombotic events compared with other types of estrogen-containing methods. The risk of VTE is slightly elevated but still quite low for anyone on an estrogen-containing method compared with not being on a method. The risk of VTE associated with pregnancy should be weighed against the risks of the patch or any combined hormone method. Compared with the risk of VTE during pregnancy, risk of VTE associated with combined hormone methods is considered lower in healthy young women.[55]

As with oral or transvaginal combined contraceptives, condoms must be used in conjunction with each method for protection against STIs.

Intrauterine Devices

Intrauterine devices (IUDs) are inserted into the uterus and release hormones, ions, or enzymes that prevent sperm from fertilizing the ova or prevent implantation. The effectiveness of IUDs is influenced by several factors, including size of the IUD surface area and the type of IUD used. When used appropriately, IUDs are generally safe, effective methods of contraception with a failure rate of less than 1%. Condoms must be used in conjunction with IUDs for protection against STIs. IUDs have previously not been recommended for adolescents; risk of infection in teens (who often have multiple partners or are serially monogamous) and liability concerns (a patient who has not conceived before using an IUD may attribute future infertility to IUD use) have contributed to clinicians' reluctance to prescribe this method for adolescent patients. IUDs have not been shown to affect fertility in the absence of infection; however, STI rates in adolescent populations are certainly cautionary. In some cases, however, an IUD may be appropriate for an adolescent who already has children and is taking precautions to protect against STIs. Mirena (Berlex, Montville, NJ), a newly developed IUD that contains the progestin levonorgestrel, gradually releases the progestin over an effective period of 5 years and has a failure rate of 0.3%. This IUD may be particularly useful for adolescents with severe menorrhagia and dysmenorrhea, as has been shown in adult women. Also available is the copper IUD called ParaGard, which releases a small amount of copper that kills or immobilizes sperm before they can fertilize an egg. The ParaGard can be removed at any time but should be replaced after 10 years.[88]

Diaphragm and Cervical Cap

The diaphragm and cervical cap are barrier methods of contraception that also require use of a spermicide. Diaphragms are flexible latex cups that are inserted into the vagina before intercourse and must remain in place for 6 hours after intercourse. Cervical caps are latex or silicone cups with a firm rim that adhere to the cervix and provide continuous contraceptive protection for up to 48 hours. Because of risk of toxic shock syndrome, caps should not remain for more than 48 hours.[89] Consistent, correct use of these methods is critical for achieving a high rate of effectiveness. The failure rate of the diaphragm with perfect use is 6% and with typical use is 20%; for the cervical cap, the failure rate is 26% with perfect use and 40% with typical use.[89] These contraceptive methods may not be feasible for some adolescents, because they require a prescription and visit with a health care professional for a fitting, because 1 size does not fit all. The adolescent must also be comfortable and skilled with insertion. Incidence of urinary tract infection increases over baseline with both diaphragms and cervical caps; in addition, condoms must be used in conjunction with these devices for protection against STIs.[89]

Withdrawal

The withdrawal method, which involves the male partner's attempt to withdraw the penis before ejaculation, is still widely used by adolescents in sexual relationships. Adolescents should receive counseling that emphasizes the high failure rate of withdrawal for pregnancy prevention. On average, of every 100 women whose partners use withdrawal, 19 will become pregnant during the first year of typical use. It is important to stress that preejaculatory fluid can contain enough sperm to cause pregnancy. Pregnancy is also possible if semen or preejaculate leaks out onto the vulva. In addition, providers should stress that this contraceptive method does not provide protection against STIs.[90]

Fertility Awareness and Other Periodic Abstinence Methods

Using fertility-awareness methods as a contraceptive option depends on several factors and requires a strong knowledge of the menstrual cycle and reproductive fertility. This method involves the identification of fertile days within each menstrual cycle when intercourse is most likely to result in pregnancy. Couples can abstain during the fertile times of a woman's cycle or use a combination of either barrier or withdrawal methods. As many as 25% of users of these methods will experience an unintended pregnancy within the first year of use, with some estimates of the pregnancy rate even higher.[91] To optimize method efficacy, users of this method should track their menses on a calendar for 3 months while also checking and recording their basal body temperature daily and should check their cervical mucus consistency to track when they ovulate. Pediatricians should be prepared to teach adolescents about the menstrual cycle but should emphasize that ovulation may not be predictable in the first few year(s) after menarche. Thus, abstinence or more reliable methods should be recommended for adolescents. In addition, health care professionals should stress that this contraceptive method provides no protection against STIs if no barrier methods are used during periods of sexual activity.

Emergency Contraception

Emergency contraception can be administered in 2 ways: by orally administering hormones or by inserting a copper-releasing IUD. An IUD can be inserted to prevent pregnancy up to 5 days after unprotected intercourse but is usually not recommended for adolescents (see IUD section).

The most commonly prescribed and best-studied methods of emergency contraception are the combined estrogen-progestin (also called the Yuzpe regimen) and progestin-only regimens. There is now only 1 dedicated product for emergency contraception: Plan B (DuraMed Pharmaceuticals, Pomona, NY). Plan B, a progestin-only regimen that contains levonorgestrel, is widely available as 2 hormone pills that are taken within 72 hours of unprotected intercourse. The most recent data support extending the time limit of use to 120 hours after unprotected intercourse; however, emergency contraception's efficacy diminishes as hormonal administration becomes more remote from the unprotected intercourse event.[92–94] Adolescent patients especially should be counseled that Plan B is 90% effective if used within 24 hours, 75% effective if used within 72 hours, and approximately 60% effective if used within 120 hours. The Plan B regimen can now be simplified to give both tablets at one time without sacrificing efficacy or resulting in more adverse effects.[94] Combination OCPs may be used for emergency contraception when Plan B is not readily available; the dose depends on the specific product chosen.[95] A recent study found that combination OCPs with progestin norethindrone can also be used effectively for emergency contraception. This study found that even a single dose of the oral contraceptives or combined hormone method was effective for emergency contraception.[96] Adverse effects may include nausea, vomiting, and changes in the menstrual cycle during the month of use. The progestin-only regimen is generally preferred, because it is more effective and causes fewer adverse effects.[97,98] Overall, emergency contraceptives reduce the risk of pregnancy after unprotected sex by at least 74%.[99,100]

Most women who need emergency contraception can use it safely. If the patient or practitioner suspects pregnancy, a pregnancy test can be administered; however, pregnancy testing before emergency contraceptive use is not necessary. It is important to note that emergency contraception does not cause abortion and it is not teratogenic if taken in early pregnancy. Women who are already pregnant should not use emergency contraceptives because they are ineffective at terminating established pregnancies; however, using them inadvertently will not have an adverse effect on the fetus.[99] Six studies have found that providing emergency contraception in advance increases the likelihood of women using it when it is needed and does not increase sexual or contraceptive risk-taking behavior.[101–106]

As the AAP states in its policy statement on emergency contraception, reduction of unintended pregnancy is best achieved by strategies that include developing and implementing programs to help delay and reduce sexual activity and increasing the use of effective contraceptives.[95] However, the AAP continues to support improved availability of emergency contraception to adolescents and advocates clinicians' consideration of advance emergency contraception prescription to sexually active adolescents, recognizing that in some cases, emergency contraception may be quite valuable in preventing unintended pregnancy and that emergency contraception is most effective when used soon after unprotected intercourse.[95] Recently, the FDA approved over-the-counter access for Plan B for women 18 years and older, but Plan B still requires a prescription for those younger than 18 years.[107] In view of the potential value of emergency contraception, pediatricians should inform adolescents about the availability of emergency contraception; however, it should not be advocated as a routine method of contraception.

Newer Forms/Formulations of Contraception

The FDA recently approved the first chewable OCP, Ovcon 35 (Bristol Myers Squibb Company, Princeton, NJ), a spearmint-flavored, 28-day regimen pill that contains the same hormones used in standard OCPs. Women who chew the pills instead of swallowing them should drink 8 oz of liquid afterward to ensure that the full dose reaches the stomach.[108] Another method recently approved by the FDA is the FemCap, a soft silicone dome that covers the cervix. FemCap will be available by prescription in 3 sizes and is designed to last 48 hours per use.[89,109] New forms of contraception for males are also being studied, including an implantation system similar to Norplant, weekly and monthly hormone injections, and a contraceptive patch.[110] A progestin-only vaginal ring is being developed, and Norplant II (a 2-rod system as opposed to the 6-rod system in Norplant) is awaiting FDA approval. Condoms must be used in conjunction with these new forms of contraception for protection against STIs.

COMPLIANCE AND FOLLOW-UP

Frequent follow-up is important to maximize compliance for all methods of contraception, to promote and reinforce healthy decision-making, and to screen periodically for risk-taking behaviors and STIs. Follow-up visits should include periodic examinations, reassessment for contraception method, STI surveillance, and cervical cytologic screening (Papanicolaou test) when appropriate. The timing and frequency of reassessment will vary depending on the contraceptive method. In general, sexually active adolescents should have annual STI screening with consideration for repeat screening for chlamydia 3 to 6 months after a positive test result and

treatment and/or with each new partner.[111] Regularly scheduled visits need to occur to assess contraceptive issues such as use, compliance, adverse effects, and complications. Adolescents should receive ongoing support, personal guidance, and reinforcement to enhance effective and consistent contraceptive use, parental support (when possible), and couples counseling or the opportunity for couples interaction with the health care professional. In addition, condom use at each sexual intercourse must be advised and reinforced at every visit.

RECOMMENDATIONS

1. Pediatricians should encourage sexual abstinence as part of comprehensive sexuality education and services offered to their adolescent patients.
2. Pediatricians should be prepared to offer confidential, nonjudgmental education and risk-reduction counseling around issues of sexuality for adolescent patients, including teens with chronic illnesses and/or disabilities.
3. Pediatricians should be aware that extensive information regarding contraceptive choices and decisions for adolescents with chronic illness or disability are available in references and texts on adolescent medicine (see "Additional Resources").
4. Pediatricians should update each patient's sexual history regularly to counsel about and determine risk of STIs as well as needs for contraceptive initiation and management.
5. Time to counsel, educate, and solve problems regarding contraceptive needs and/or management needs to be a part of any given visit, or arrangements need to be made for a separate visit for contraceptive follow-up.
6. Pediatricians should encourage the consistent and correct use of latex condoms with every event of sexual intercourse.
7. Pediatricians should know that it is appropriate to prescribe contraceptives without a "first pelvic examination," but screenings for STIs, especially chlamydial infections, should not be delayed.
8. Pediatricians should ensure access to basic contraceptive services for their teen patients either within their office setting or by referral to appropriate services and/or sites.
9. Pediatricians who offer contraceptive services to adolescents should provide appropriate follow-up to ensure compliance and monitor for adverse effects and complications.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Fetus and Newborn

Controversies Concerning Vitamin K and the Newborn

ABSTRACT. Prevention of early vitamin K deficiency bleeding (VKDB) of the newborn, with onset at birth to 2 weeks of age (formerly known as classic hemorrhagic disease of the newborn), by oral or parenteral administration of vitamin K is accepted practice. In contrast, late VKDB, with onset from 2 to 12 weeks of age, is most effectively prevented by parenteral administration of vitamin K. Earlier concern regarding a possible causal association between parenteral vitamin K and childhood cancer has not been substantiated. This revised statement presents updated recommendations for the use of vitamin K in the prevention of early and late VKDB.

ABBREVIATION. VKDB, vitamin K deficiency bleeding.

BACKGROUND

Vitamin K deficiency may cause unexpected bleeding (0.25%–1.7% incidence) during the first week of life in previously healthy-appearing neonates (early vitamin K deficiency bleeding [VKDB] of the newborn [formerly known as classic hemorrhagic disease of the newborn]). The efficacy of neonatal vitamin K prophylaxis (oral or parenteral) in the prevention of early VKDB is firmly established. It has been the standard of care since the American Academy of Pediatrics recommended it in 1961.[1]

Late VKDB, a syndrome defined as unexpected bleeding attributable to severe vitamin K deficiency in infants 2 to 12 weeks of age, occurs primarily in exclusively breastfed infants who have received no or inadequate neonatal vitamin K prophylaxis. In addition, infants who have intestinal malabsorption defects (cholestatic jaundice, cystic fibrosis, etc) may also have late VKDB. The rate of late VKDB (often manifesting as sudden central nervous system hemorrhage) ranges from 4.4 to 7.2 per 100 000 births, according to reports from Europe and Asia.[2,3] When a single dose of oral vitamin K has been used for neonatal prophylaxis, the rate has decreased to 1.4 to 6.4 per 100 000 births. Parenteral neonatal vitamin K prophylaxis prevents the development of late VKDB in infants, with the rare exception of those with severe malabsorption syndromes.[2]

Oral administration of vitamin K has been shown to have efficacy similar to that of parenteral administration in the prevention of early VKDB.[4–6] However, several countries have reported a resurgence of late VKDB coincident with policies promoting the use of orally administered prophylaxis, even with multiple-dose regimens. In a 1997 review of these experiences by Cornelissen et al,[7] surveillance data from 4 countries revealed oral prophylaxis failures of 1.2 to 1.8 per 100 000 live births, compared with no reported cases after intramuscular administration. Newborns receiving incomplete oral prophylaxis tended to have a higher risk of developing VKDB, with rates of approximately 2 to 4 per 100 000. Small daily oral doses, as practiced in the Netherlands, may decrease the risk of late VKDB[8] and approach the efficacy of the parenteral route; however, this needs to be better studied.

Draper and Stiller,[9] using other data from Great Britain, have questioned the results of earlier studies of Golding et al[10,11] that attempted to show an association between intramuscular vitamin K administration in newborns and an increased incidence of childhood cancer. Using data from the National Registry of Childhood Tumors, they estimated the cumulative incidence of childhood leukemia. Three sources of data, including the estimates from Golding et al, provided rates of intramuscular vitamin K use over the same time frame. Their analyses failed to show a correlation between increased use of intramuscular vitamin K and the incidence of childhood leukemia.

The Vitamin K Ad Hoc Task Force of the American Academy of Pediatrics[12] reviewed the reports of Golding et al and other information regarding the US experience[13] and concluded that there was no association between the intramuscular administration of vitamin K and childhood leukemia or other cancers.

Additional studies that have since been conducted by other investigators have not supported a clinical relationship between newborn parenteral administration of vitamin K and childhood cancer. Ross and Davies[14] published a review of the evidence in 2000. They found no randomized or quasi-randomized evidence of an association between parenteral vitamin K prophylaxis and cancer in childhood. Ten case-control studies were identified, of which 7 found no relationship and 3 found only a weak relationship of neonatal administration of intramuscular or intravenous vitamin K with the risk of solid childhood tumors or leukemia.

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Recent research on the pathogenesis of childhood leukemia additionally weakens the plausibility of a causal relationship between parenteral administration of vitamin K and cancer. Investigations by Wiemels et al[15] suggest a prenatal origin of childhood leukemia. They found an acute lymphocytic leukemia-associated gene in 12 children with newly diagnosed acute lymphocytic leukemia and postulated that an in utero chromosomal translocation event combined with a postnatal promotional event results in clinical leukemia. Although intramuscular administration of vitamin K could conceivably be a postnatal promotional event, a genetic etiologic explanation further lessens the likelihood of a clinically significant relationship between intramuscular administration of vitamin K and leukemia.

There is concern that adequate vitamin K prophylaxis be provided to the increasing numbers of newborns who are breastfed exclusively to avoid an increased risk of late VKDB with its associated intracranial hemorrhage.[7]

RECOMMENDATIONS

Because parenteral vitamin K has been shown to prevent VKDB of the newborn and young infant and the risks of cancer have been unproven, the American Academy of Pediatrics recommends the following:

1. Vitamin K_1 should be given to all newborns as a single, intramuscular dose of 0.5 to 1 mg.[16]
2. Additional research should be conducted on the efficacy, safety, and bioavailability of oral formulations and optimal dosing regimens of vitamin K to prevent late VKDB.
3. Health care professionals should promote awareness among families of the risks of late VKDB associated with inadequate vitamin K prophylaxis from current oral dosage regimens, particularly for newborns who are breastfed exclusively.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Psychosocial Aspects of Child and Family Health

Coparent or Second-Parent Adoption by Same-Sex Parents

ABSTRACT. Children who are born to or adopted by 1 member of a same-sex couple deserve the security of 2 legally recognized parents. Therefore, the American Academy of Pediatrics supports legislative and legal efforts to provide the possibility of adoption of the child by the second parent or coparent in these families.

Children deserve to know that their relationships with both of their parents are stable and legally recognized. This applies to all children, whether their parents are of the same or opposite sex. The American Academy of Pediatrics recognizes that a considerable body of professional literature provides evidence that children with parents who are homosexual can have the same advantages and the same expectations for health, adjustment, and development as can children whose parents are heterosexual.[1–9] When 2 adults participate in parenting a child, they and the child deserve the serenity that comes with legal recognition.

Children born or adopted into families headed by partners who are of the same sex usually have only 1 biologic or adoptive legal parent. The other partner in a parental role is called the "coparent" or "second parent." Because these families and children need the permanence and security that are provided by having 2 fully sanctioned and legally defined parents, the Academy supports the legal adoption of children by coparents or second parents. Denying legal parent status through adoption to coparents or second parents prevents these children from enjoying the psychologic and legal security that comes from having 2 willing, capable, and loving parents.

Several states have considered or enacted legislation sanctioning second-parent adoption by partners of the same sex. In addition, legislative initiatives assuring legal status equivalent to marriage for gay and lesbian partners, such as the law approving civil unions in Vermont, can also attend to providing security and permanence for the children of those partnerships.

Many states have not yet considered legislative actions to ensure the security of children whose parents are gay or lesbian. Rather, adoption has been decided by probate or family courts on a case-by-case basis. Case precedent is limited. It is important that a broad ethical mandate exist nationally that will guide the courts in providing necessary protection for children through coparent adoption.

Coparent or second-parent adoption protects the child's right to maintain continuing relationships with both parents. The legal sanction provided by coparent adoption accomplishes the following:

1. Guarantees that the second parent's custody rights and responsibilities will be protected if the first parent were to die or become incapacitated. Moreover, second-parent adoption protects the child's legal right of relationships with both parents. In the absence of coparent adoption, members of the family of the legal parent, should he or she become incapacitated, might successfully challenge the surviving coparent's rights to continue to parent the child, thus causing the child to lose both parents.
2. Protects the second parent's rights to custody and visitation if the couple separates. Likewise, the child's right to maintain relationships with both parents after separation, viewed as important to a positive outcome in separation or divorce of heterosexual parents, would be protected for families with gay or lesbian parents.
3. Establishes the requirement for child support from both parents in the event of the parents' separation.
4. Ensures the child's eligibility for health benefits from both parents.
5. Provides legal grounds for either parent to provide consent for medical care and to make education, health care, and other important decisions on behalf of the child.
6. Creates the basis for financial security for children in the event of the death of either parent by ensuring eligibility to all appropriate entitlements, such as Social Security survivors benefits.

On the basis of the acknowledged desirability that children have and maintain a continuing relationship with 2 loving and supportive parents, the Academy recommends that pediatricians do the following:

- Be familiar with professional literature regarding gay and lesbian parents and their children.
- Support the right of every child and family to the financial, psychologic, and legal security that results from having legally recognized parents who are committed to each other and to the welfare of their children.
- Advocate for initiatives that establish permanency through coparent or second-parent adoption for

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children of same-sex partners through the judicial system, legislation, and community education.

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AMERICAN ACADEMY OF PEDIATRICS

Ellen C. Perrin, MD, and the Committee on Psychosocial Aspects of Child and Family Health

Technical Report: Coparent or Second-Parent Adoption by Same-Sex Parents

ABSTRACT. A growing body of scientific literature demonstrates that children who grow up with 1 or 2 gay and/or lesbian parents fare as well in emotional, cognitive, social, and sexual functioning as do children whose parents are heterosexual. Children's optimal development seems to be influenced more by the nature of the relationships and interactions within the family unit than by the particular structural form it takes.

CURRENT SITUATION

Accurate statistics regarding the number of parents who are gay or lesbian are impossible to obtain. The secrecy resulting from the stigma still associated with homosexuality has hampered even basic epidemiologic research. A broad estimate is that between 1 and 9 million children in the United States have at least 1 parent who is lesbian or gay.[1]

Most individuals who have a lesbian and/or gay parent were conceived in the context of a heterosexual relationship. When a parent (or both parents) in a heterosexual couple "comes out" as lesbian or gay, some parents divorce and others continue to live as a couple. If they do decide to live separately, either parent may be the residential parent or children may live part-time in each home. Gay or lesbian parents may remain single or they may have same-sex partners who may or may not develop stepparenting relationships with the children. These families closely resemble stepfamilies formed after heterosexual couples divorce, and many of their parenting concerns and adjustments are similar. An additional concern for these parents is that pervasively heterosexist legal precedents have resulted in denial of custody and restriction of visitation rights to many gay and lesbian parents.

Increasing social acceptance of diversity in sexual orientation has allowed more gay men and lesbians to come out before forming intimate relationships or becoming parents. Lesbian and gay adults choose to become parents for many of the same reasons heterosexual adults do. The desire for children is a basic human instinct and satisfies many people's wish to leave a mark on history or perpetuate their family's story. In addition, children may satisfy people's desire to provide and accept love and nurturing from others and may provide some assurance of care and support during their older years.

Many of the same concerns that exist for heterosexual couples when they consider having children also face lesbians and gay men. All parents have concerns about time, finances, and the responsibilities of parenthood. They worry about how children will affect their relationship as a couple, their own and their children's health, and their ability to manage their new parenting role in addition to their other adult roles. Lesbians and gay men undertaking parenthood face additional challenges, including deciding whether to conceive or adopt a child, obtaining donor sperm or arranging for a surrogate mother (if conceiving), finding an accepting adoption agency (if adopting), making legally binding arrangements regarding parental relationships, creating a substantive role for the nonbiologic or nonadoptive parent, and confronting emotional pain and restrictions imposed by heterosexism and discriminatory regulations.

Despite these challenges, lesbians and gay men increasingly are becoming parents on their own or in the context of an established same-sex relationship. Most lesbians who conceive a child do so using alternative insemination techniques with a donor's sperm. The woman or women may choose to become pregnant using sperm from a completely anonymous donor, from a donor who has agreed to be identifiable when the child becomes an adult, or from a fully known donor (eg, a friend or a relative of the nonconceiving partner). Lesbians also can become parents by fostering or adopting children, as can gay men. These opportunities are increasingly available in most states and in many other countries, although they are still limited by legal statutes in some places.

A growing number of gay men have chosen to become fathers through the assistance of a surrogate mother who bears their child. Others have made agreements to be coparents with a single woman (lesbian or heterosexual) or a lesbian couple.[2–4] Still other men make arrangements to participate as sperm donors in the conception of a child (commonly with a lesbian couple), agreeing to have variable levels of involvement with the child but without taking on the responsibilities of parenting.

When a lesbian or a gay man becomes a parent through alternative insemination, surrogacy, or adoption, the biologic or adoptive parent is recognized within the legal system as having full and more or less absolute parental rights. Although the biologic or adoptive parent's partner may function as

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a coparent, he or she has no formal legal rights with respect to the child. Most state laws do not allow for adoption or guardianship by an unmarried partner unless the parental rights of the first parent are terminated. An attorney can prepare medical consent forms and nomination-of-guardian forms for the care of the child in the event of the legal parent's death or incapacity. These documents, however, do not have the force of an adoption or legal guardianship, and there is no guarantee that a court will uphold them. Some states recently have passed legislation that allows coparents to adopt their partner's children. Other states have allowed their judicial systems to determine eligibility for formal adoption by the coparent on a case-by-case basis. Coparent (or second-parent) adoption has important psychologic and legal benefits.

Historically, gay men and lesbians have been prevented from becoming foster parents or adopting children and have been denied custody and rights of visitation of their children in the event of divorce on the grounds that they would not be effective parents. Legal justifications and social beliefs have presumed that their children would experience stigmatization, poor peer relationships, subsequent behavioral and emotional problems, and abnormal psychosexual development. During the past 20 years, many investigators have tried to determine whether there is any empiric support for these assumptions.

RESEARCH EVIDENCE

The focus of research has been on 4 main topic areas. Investigators have concentrated on describing the attitudes and behaviors of gay and lesbian parents and the psychosexual development, social experience, and emotional status of their children.

Parenting Attitudes and Behavior, Personality, and Adjustment of Parents

Stereotypes and laws that maintain discriminatory practices are based on the assumption that lesbian mothers and gay fathers are different from heterosexual parents in ways that are important to their children's well-being. Empirical evidence reveals in contrast that gay fathers have substantial evidence of nurturance and investment in their paternal role and no differences from heterosexual fathers in providing appropriate recreation, encouraging autonomy,[5] or dealing with general problems of parenting.[6] Compared with heterosexual fathers, gay fathers have been described to adhere to stricter disciplinary guidelines, to place greater emphasis on guidance and the development of cognitive skills, and to be more involved in their children's activities.[7] Overall, there are more similarities than differences in the parenting styles and attitudes of gay and nongay fathers.

Similarly, few differences have been found in the research from the last 2 decades comparing lesbian and heterosexual mothers' self-esteem, psychologic adjustment, and attitudes toward child rearing.[8,9] Lesbian mothers fall within the range of normal psychologic functioning on interviews and psychologic assessments and report scores on standardized measures of self-esteem, anxiety, depression, and parenting stress indistinguishable from those reported by heterosexual mothers.[10]

Lesbian mothers strongly endorse child-centered attitudes and commitment to their maternal roles[11–13] and have been shown to be more concerned with providing male role models for their children than are divorced heterosexual mothers.[6,14] Lesbian and heterosexual mothers describe themselves similarly in marital and maternal interests, current lifestyles, and child-rearing practices.[14] They report similar role conflicts, social support networks, and coping strategies.[15,16]

Children's Gender Identity and Sexual Orientation

The gender identity of preadolescent children raised by lesbian mothers has been found consistently to be in line with their biologic sex. None of the more than 300 children studied to date have shown evidence of gender identity confusion, wished to be the other sex, or consistently engaged in cross-gender behavior. No differences have been found in the toy, game, activity, dress, or friendship preferences of boys or girls who had lesbian mothers, compared with those who had heterosexual mothers.

No differences have been found in the gender identity, social roles, or sexual orientation of adults who had a divorced homosexual parent (or parents), compared with those who had divorced heterosexual parents.[17–19] Similar proportions of young adults who had homosexual parents and those who had heterosexual parents have reported feelings of attraction toward someone of the same sex.[20] Compared with young adults who had heterosexual mothers, men and women who had lesbian mothers were slightly more likely to consider the possibility of having a same-sex partner, and more of them had been involved in at least a brief relationship with someone of the same sex,[10] but in each group similar proportions of adult men and women identified themselves as homosexual.

Children's Emotional and Social Development

Because most children whose parents are gay or lesbian have experienced the divorce of their biologic parents, their subsequent psychologic development has to be understood in that context. Whether they are subsequently raised by 1 or 2 separated parents and whether a stepparent has joined either of the biologic parents are important factors for children but are rarely addressed in research assessing outcomes for children who have a lesbian or gay parent.

The considerable research literature that has accumulated addressing this issue has generally revealed that children of divorced lesbian mothers grow up in ways that are very similar to children of divorced heterosexual mothers. Several studies comparing children who have a lesbian mother with children who have a heterosexual mother have failed to document any differences between such groups on personality measures, measures of peer group relationships, self-esteem, behavioral difficulties, academic success, or warmth and quality of family relationships.[9,11,15,16,20,21] Children's self-esteem has been

shown to be higher among adolescents whose mothers (of any sexual orientation) were in a new partnered relationship after divorce, compared with those whose mothers remained single, and among those who found out at a younger age that their parent was homosexual, compared with those who found out when they were older.[22]

Prevalent heterosexism and stigmatization might lead to teasing and embarrassment for children about their parent's sexual orientation or their family constellation and restrict their ability to form and maintain friendships. Adult children of divorced lesbian mothers have recalled more teasing by peers during childhood than have adult children of divorced heterosexual parents.[23] Nevertheless, children seem to cope rather well with the challenge of understanding and describing their families to peers and teachers.

Children born to and raised by lesbian couples also seem to develop normally in every way. Ratings by their mothers and teachers have demonstrated children's social competence and the prevalence of behavioral difficulties to be comparable with population norms.[8,24] In fact, growing up with parents who are lesbian or gay may confer some advantages to children. They have been described as more tolerant of diversity and more nurturing toward younger children than children whose parents are heterosexual.[25,26]

In 1 study, children of heterosexual parents saw themselves as being somewhat more aggressive than did children of lesbians, and they were seen by parents and teachers as more bossy, negative, and domineering. Children of lesbian parents saw themselves as more lovable and were seen by parents and teachers as more affectionate, responsive, and protective of younger children, compared with children of heterosexual parents.[25,27] In a more recent investigation, children of lesbian parents reported their self-esteem to be similar to that of children of heterosexual parents and saw themselves as similar in aggressiveness and sociability.[15]

Recent investigations have attempted to discern factors that promote optimal well-being of children who have lesbian parents. The adjustment of children who have 2 mothers seems to be related to their parents' satisfaction with their relationship and specifically with the division of responsibility they have worked out with regard to child care and household chores.[28] Children with lesbian parents who reported greater relationship satisfaction, more egalitarian division of household and paid labor,[29] and more regular contact with grandparents and other relatives[30] were rated by parents and teachers to be better adjusted and to have fewer behavioral problems.

Children in all family constellations have been described by parents and teachers to have more behavioral problems when parents report more personal distress and more dysfunctional parent-child interactions. In contrast, children are rated as better adjusted when their parents report greater relationship satisfaction, higher levels of love, and lower interparental conflict regardless of their parents' sexual orientation. Children apparently are more powerfully influenced by family processes and relationships than by family structure.

SUMMARY

The small and nonrepresentative samples studied and the relatively young age of most of the children suggest some reserve. However, the weight of evidence gathered during several decades using diverse samples and methodologies is persuasive in demonstrating that there is no systematic difference between gay and nongay parents in emotional health, parenting skills, and attitudes toward parenting. No data have pointed to any risk to children as a result of growing up in a family with 1 or more gay parents. Some among the vast variety of family forms, histories, and relationships may prove more conducive to healthy psychosexual and emotional development than others.

Research exploring the diversity of parental relationships among gay and lesbian parents is just beginning. Children whose parents divorce (regardless of sexual orientation) are better adjusted when their parents have high self-esteem, maintain a responsible and amicable relationship, and are currently living with a partner.[22,31] Children living with divorced lesbian mothers have better outcomes when they learn about their mother's homosexuality at a younger age, when their fathers and other important adults accept their mother's lesbian identity, and perhaps when they have contact with other children of lesbians and gay men.[22,24] Parents and children have better outcomes when the daunting tasks of parenting are shared, and children seem to benefit from arrangements in which lesbian parents divide child care and other household tasks in an egalitarian manner[28] as well as when conflict between partners is low. Although gay and lesbian parents may not, despite their best efforts, be able to protect their children fully from the effects of stigmatization and discrimination, parents' sexual orientation is not a variable that, in itself, predicts their ability to provide a home environment that supports children's development.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on School Health

Corporal Punishment in Schools

ABSTRACT. The American Academy of Pediatrics recommends that corporal punishment in schools be abolished in all states by law and that alternative forms of student behavior management be used.

It is estimated that corporal punishment is administered between 1 and 2 million times a year in schools in the United States.[1] Increasingly, states are abolishing corporal punishment as a means of discipline, but statutes in some states still allow school officials to use this form of discipline.[2–4]

The American Academy of Pediatrics believes that corporal punishment may affect adversely a student's self-image and school achievement and that it may contribute to disruptive and violent student behavior.[1,5–7] Alternative methods of behavioral management have proved more effective than corporal punishment and are specifically described in the reference articles.[5–7] Physical force or constraint by a school official may be required in a limited number of carefully selected circumstances to protect students and staff from physical injury, to disarm a student, or to prevent property damage.

The American Academy of Pediatrics urges parents, educators, school administrators, school board members, legislators, and others to seek the legal prohibition by all states of corporal punishment in schools and to encourage the use of alternative methods of managing student behavior.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Adolescence

Counseling the Adolescent About Pregnancy Options

ABSTRACT. When consulted by a pregnant adolescent, pediatricians should be able to make a timely diagnosis and to help the adolescent understand her options and act on her decision to continue or terminate her pregnancy. Pediatricians may not impose their values on the decision-making process and should be prepared to support the adolescent in her decision or refer her to a physician who can.

ABBREVIATIONS. β-hCG, β-subunit human chorionic gonadotropin; hCG, human chorionic gonadotropin.

Pediatricians are likely to encounter adolescent patients who become pregnant and need counseling on the options available to them. The American Academy of Pediatrics continues to endorse the principles published in its statement on this topic in 1989,[1] namely:

1. The statement represents an objective guide for pediatricians assisting patients and their families in making decisions about adolescent pregnancy.
2. None of the options offered is necessarily ideal or universally preferred by physicians or their patients.
3. The pediatrician, the adolescent patient, and other concerned persons must be given complete information on all available options to help the adolescent make an informed decision.

More than 1 million individuals <20 years old become pregnant annually.[2–4] Slightly >50% of adolescent pregnancies result in a birth.[2,4] The basic approach to effective ethical counseling has not changed since the 1989 statement; however, medical, sociological, and technological advances warrant an update of earlier information.

Premarital sex, pregnancy, and abortion engender strong personal and individual feelings. Pediatricians and other health professionals should not allow their personal beliefs and values to interfere with optimal patient health care. The physician needs to respect the adolescent's personal decision and her legal right to continue or to terminate her pregnancy and not impose barriers to health services from another provider. Should a pediatrician choose not to counsel the adolescent patient about sexual matters such as pregnancy and abortion, the patient should be referred to other experienced professionals.

IDENTIFICATION

All pregnancy options benefit from an early diagnosis. Some adolescents will seek medical care with characteristic signs and symptoms of pregnancy or as the result of a positive home pregnancy test. However, pregnancy symptoms may also be vague and nonspecific, particularly in the younger adolescent. The pediatrician cannot always rely on the menstrual and sexual history of the patient to diagnose pregnancy. Psychological denial may exist to such an extent that the adolescent may not consider pregnancy to be the cause of her symptoms, even when it is evident to others.

Laboratory test results for pregnancy are likely to become positive before the appearance of clinical symptoms or signs on physical examination. A serum β-subunit human chorionic gonadotropin (β-hCG) assay may show positive results as early as 1 week after conception. Most pregnancies are diagnosed by monoclonal human chorionic gonadotropin (hCG) urine pregnancy tests, which are rapid, cost-effective, specific to hCG, and almost as sensitive as the serum hCG assays. These urine tests will also demonstrate positive results within 7 to 10 days after conception, before the first missed menstrual period. Office personnel can be educated to perform these tests. When there is clinical suspicion of pregnancy, a negative test result suggests the need to repeat the test in 1 to 2 weeks. The pediatrician should use the negative result of the pregnancy test as an opportunity for further counseling.

The physical diagnosis of a normal intrauterine pregnancy can usually be made by 6 weeks from the last menstrual period with the finding of an enlarged softened uterus during a pelvic examination. The fetal heart tones may be detected as early as 10 weeks' gestation by Doppler fetoscopy. The observation or notice of fetal movement occurs at about 20 weeks in women experiencing their first pregnancy. If questions remain about uterine size or the confirmation of pregnancy, obstetric consultation or ultrasonography should be arranged. Ultrasonography can confirm an intrauterine pregnancy, with cardiac activity demonstrable at approximately 6 weeks from the last menstrual period. Concurrent with pregnancy evaluation, appropriate testing for sexually transmitted diseases should be performed.[4,5] Early first trimester complications include ectopic pregnancy and spontaneous abortion, and these problems should be considered if abdominal pain or

This statement has been approved by the Council on Child and Adolescent Health.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

vaginal bleeding develops. An ectopic pregnancy should also be considered in a patient with a positive pregnancy test in the absence of expected uterine enlargement.

COMMUNICATION

While waiting for the results of a urine pregnancy test, the pediatrician has the opportunity to discuss the adolescent's expectations and feelings about her possible pregnancy. The pediatrician should convey the results of the pregnancy test to the adolescent alone in a private setting.

Minors have legal rights protecting their privacy about the diagnosis and treatment of pregnancy. Pediatricians should be familiar with local confidentiality laws being aware that they vary from state to state. In considering confidentiality, the pediatrician should assess the adolescent's ability to understand the diagnosis of pregnancy and appreciate the implications of that diagnosis. The diagnosis should not be conveyed to others, including parents, until the patient's consent is obtained, except when there are concerns about suicide, homicide, or abuse. The pediatrician should be sensitive to the possibility of sexual abuse or incest in the young or developmentally delayed pregnant adolescent. In those cases, the pediatrician should inform child protective services as required by the law in most jurisdictions.

Reactions to the diagnosis of pregnancy vary. Some adolescents may be pleased, while others may be upset or confused. Some may have already discussed potential options with their family or sexual partner. The pediatrician needs to be sensitive to family, social, and cultural issues that may influence the adolescent and her decisions about pregnancy.[5,6] Adolescents should be encouraged to include their parents in a full discussion of their options. The pediatrician should explain how parental involvement can be helpful and that parents generally are supportive. If parental support is not possible, minors should be urged to seek the advice and counsel of adults in whom they have confidence, including other relatives, counselors, teachers, or clergy. This is especially true for younger adolescents, age 12 to 15 years.

MANAGEMENT

The duration of the pregnancy should be assessed and documented because options depend on this assessment. Usually, the adolescent has the following options available:

1. Carrying her pregnancy to delivery and raising the baby.
2. Carrying her pregnancy to delivery and placing the baby for adoption.
3. Terminating her pregnancy.

The pediatrician should discuss with or counsel the adolescent about all three options or refer the adolescent to a health care professional who will discuss all three options.

Financial status should not deprive a person of her options for management of the pregnancy. The pediatrician should be knowledgeable about local funding resources for continuing or terminating her pregnancy. The patient should be counseled to consider all options, encouraged to return for as many visits as needed, and helped to understand the need to make a timely decision. She should be encouraged to include her parents and the father of the baby in these counseling sessions. If the adolescent is reluctant to reveal the identity of the father, the pediatrician should consider the possibility of sexual abuse, sexual assault, or incest. Pediatricians should be aware of state laws about reporting suspected abuse or statutory rape and take appropriate action.

The pediatrician should address any coexisting medical conditions—chronic medical illness, physical disability, or psychiatric illness—that could affect the decision to continue or terminate the pregnancy. If there is a question of the adolescent's mental competence to make an informed decision about the pregnancy, the pediatrician should be aware of state law and procedures necessary to make this determination.

If the adolescent decides to continue the pregnancy, the pediatrician should refer her for timely and appropriate prenatal care. Adolescents receiving prenatal care in comprehensive adolescent pregnancy programs generally have had better outcomes than adolescents not in such programs, and pediatricians may choose to refer preferentially to such programs, when available.[7] Family and social support systems are essential for optimal outcomes for young adolescent parents and their infants.[8]

Adoption is an important option for the pediatrician to discuss with the adolescent. To make appropriate referrals, the pediatrician should be familiar with the available medical, legal, counseling, and social service resources that facilitate adoption. Throughout the pregnancy, the adolescent should have the opportunity to discuss the possibility of adoption with the pediatrician or other health care professionals.

If the adolescent decides to terminate her pregnancy, the pediatrician should be knowledgeable about community resources, considering the stage of pregnancy and any coexisting medical conditions. The pediatrician should also consider the adolescent's financial resources and should be aware of local or federal law affecting the availability of services, parental notification, or consent.[9] With the anticipated US Food and Drug Administration approval of pharmacologic agents, such as mifepristone, and the availability of prostaglandin analogues and methotrexate to induce abortion nonsurgically, pediatricians need to become aware of the nature and availability of these methods and have a clear understanding of their role in the counseling, provision of care, or referral for these methods.

Whatever the adolescent's decision, the pediatrician should follow up with the patient to ensure that there has been a successful referral and that appropriate social support is in place and to discuss the prevention of future unintended pregnancies. If the adolescent chooses to continue her pregnancy, the pediatrician should remain available for further dis-

cussion during the pregnancy should later events require reconsideration of decisions made at the time of the initial confirmation of pregnancy. If the adolescent chooses to place the child for adoption or to terminate her pregnancy, the pediatrician should be available to provide for her subsequent health care and emotional support. In either case, the pediatrician should encourage the adolescent to continue her education and be available to help her identify appropriate community scholastic programs.

The diagnosis of pregnancy is a sensitive and emotional time for the adolescent, her family, and her sexual partner. A warm and accepting environment in which the adolescent feels sufficiently secure to explore her own feelings about pregnancy is essential. Becoming a parent, placing a child for adoption, or having an abortion may have significant personal and long-term consequences for adolescents. It is important to ensure continuing help and support, regardless of the adolescent's decisions about her pregnancy. Ideally, the pediatrician has the counseling expertise, an understanding of adolescent developmental and medical issues, and, often, a long-standing relationship with the patient, and, therefore, is the appropriate person to review these issues with her.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Children With Disabilities

Counseling Families Who Choose Complementary and Alternative Medicine for Their Child With Chronic Illness or Disability

ABSTRACT. The use of complementary and alternative medicine (CAM) to treat chronic illness or disability is increasing in the United States. This is especially evident among children with autism and related disorders. It may be challenging to the practicing pediatrician to distinguish among accepted biomedical treatments, unproven therapies, and alternative therapies. Moreover, there are no published guidelines regarding the use of CAM in the care of children with chronic illness or disability. To best serve the interests of children, it is important to maintain a scientific perspective, to provide balanced advice about therapeutic options, to guard against bias, and to establish and maintain a trusting relationship with families. This statement provides information and guidance for pediatricians when counseling families about CAM.

ABBREVIATION. CAM, complementary and alternative medicine.

STATEMENT OF THE PROBLEM

The use of complementary and alternative medicine (CAM) is increasing in Western countries. Indeed, more than one third of the adults in the United States have used CAM in recent years.[1,2] Pediatric use of CAM is especially likely among children with chronic illness or disability. Up to 50% of children with autism in the United States probably are using some form of CAM.[3] In many instances, the physician providing medical care is unaware of the concurrent use of CAM. Increasingly, pediatricians providing care for children with chronic illness or disability are discussing CAM with families or are asked to prescribe such treatments. Pediatricians' expertise in biomedicine may not adequately prepare them for discussion of CAM.

BACKGROUND INFORMATION AND DEFINITIONAL ISSUES

CAM has been defined as "a broad domain of healing resources that encompasses all health systems, modalities, and practices and their accompanying theories and beliefs, other than those intrinsic to the politically dominant health system of a particular society or culture in a given historic period."[4] An enormous array of unconventional therapies may be used as alternative therapies (instead of conventional treatments) or as complementary therapies (in addition to conventional treatments) (see Fig 1).

Currently, courses on CAM approaches are offered in the majority of US medical schools.[5] The US government established the Office of Alternative Medicine (now the National Center for Complementary and Alternative Medicine) in the National Institutes of Health to carry out scientific study of CAM.[6]

Biomedicine is based on laws of science and the rigorous applications of the scientific method. It may aptly be called scientific medicine or evidence-based medicine. Disease is explained by pathophysiologic processes, and treatments are designed to affect these processes. The term *biopsychosocial medicine* has long been used to describe a biomedical model that recognizes the importance of psychosocial factors.[7] Biomedical treatments are based on accumulated evidence of effectiveness from peer-reviewed scientific research. There is a hierarchy of research evidence, at the top of which is the controlled clinical trial. Many accepted biomedical treatments lack evidence of effectiveness from controlled clinical trials (eg, the use of physical therapy in the care of the premature infant). Unproven therapies also may be based on pathophysiology and limited research, but they lack accepted standards of proven effectiveness (eg, the use of immunoglobulins in the treatment of autism).[8] Alternative therapies are based on a variety of nonbiomedical beliefs and usually have not been subjected to clinical research. Most are supported by anecdotal evidence, but some alternative therapies have proven effectiveness. For example, preliminary studies of acupuncture in addiction treatment show positive results.[9] In time, such proven therapies may come into wider use and lose their "alternative" status.

Biopsychosocial medicine and CAM have at least one thing in common: both recognize that the relationship between physician-healer and patient is integral to the success of treatments offered. This is part of the age-old "art" of medicine and is a basis of the placebo response.[10] The emphasis of biomedicine on pathophysiology and on technical outcomes has reinforced the perception among some families that physicians undervalue their relationships with their patients. The failure of biomedicine to recognize and respond adequately to individual differences among patients is one reason families turn elsewhere and has contributed to the increasing use of CAM.

The distinctions among unproven therapies, CAM, and biomedicine may become especially blurred in the care of children with chronic illness or disability.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

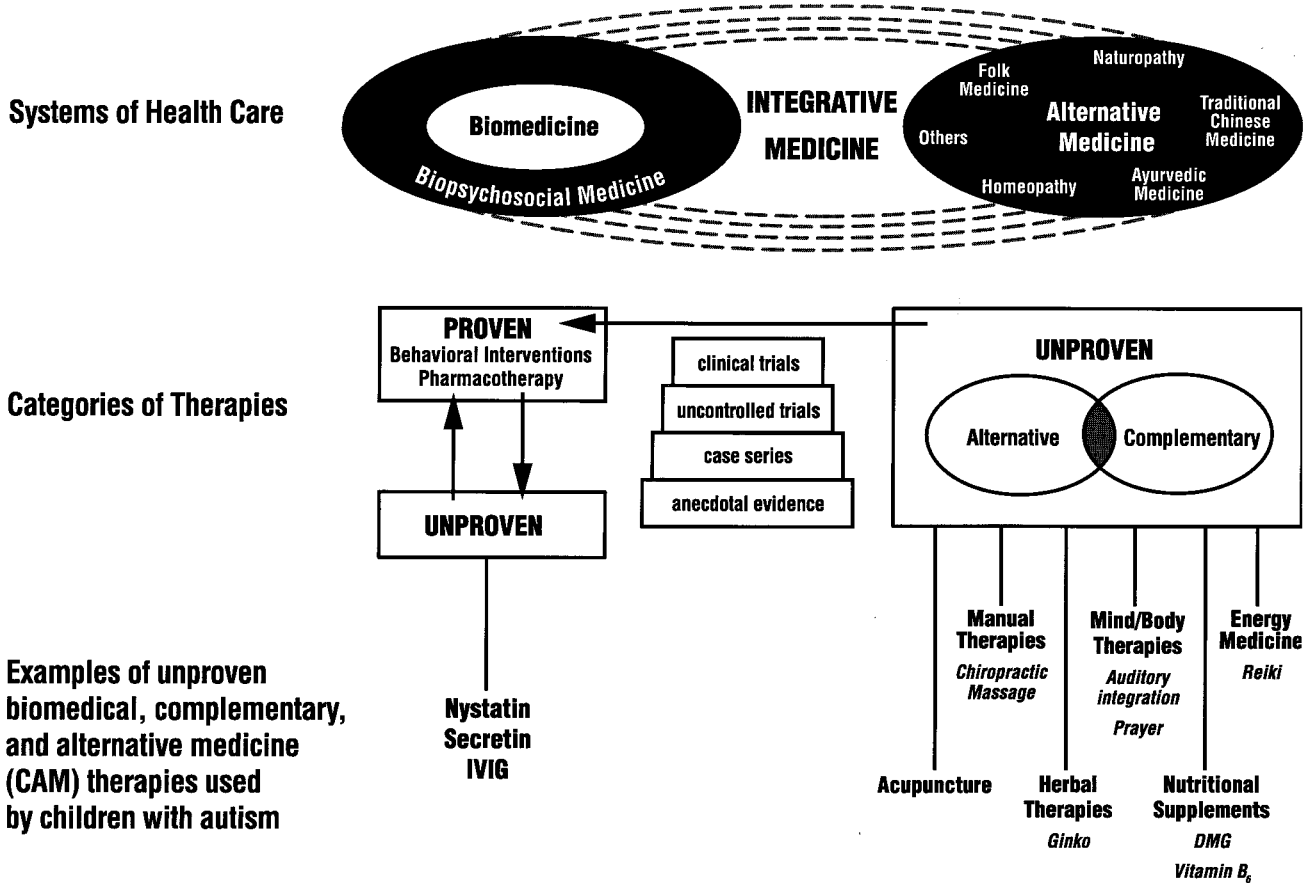

Fig 1. Biopsychosocial medicine and alternative medicine are broad systems of health care that encompass theories, practices, and therapies. Integrative medicine is a term loosely used to describe these systems used in combination. Therapies (whether biomedical, complementary, or alternative) are considered proven or unproven based on a hierarchy of evidence.

Some conventional biomedical therapies lack proof of effectiveness, and some unproven and alternative therapies may in time prove effective. Also, some alternative therapies conceivably may have placebo effects, which confer additional therapeutic gain and enhanced quality of life. These factors may present significant challenges to the health care professional. Moreover, there are no published clinical guidelines regarding the use of CAM in the care of children with chronic illness or disability.[11]

WHY PARENTS OF CHILDREN WITH CHRONIC ILLNESS OR DISABILITY CHOOSE CAM

Parental questioning of a child's diagnosis, treatment, and prognosis reflects a normal process of adjustment to the permanence or chronicity of the condition and the desire to ensure the best possible outcome for their child. Many parents become frustrated with biomedical therapies because of complexity, discomfort, bewildering technology, or uncertainty of cure. Indeed, for some conditions, biomedicine has little or nothing to offer. Also, families may be frustrated because they have not been sufficiently involved in the development of a care plan. The media, condition-specific publications, and parent-to-parent contacts provide essential opportunities for families to learn about resources, including CAM. Furthermore, the Internet has dramatically increased exposure of families to sophisticated marketing, testimonials, and unproven claims. Some parents are attracted to simple explanations of causality, some by an approach perceived to be more "natural." Many try a succession of alternative therapies, believing that any approach that does no harm is worth a trial. For almost all, CAM approaches represent an attempt to gain a sense of control over their child's chronic illness or disability and to improve quality of life.

BALANCING FAMILY-CENTERED CARE WITH THE ETHICAL RESPONSIBILITY OF THE PEDIATRICIAN

The "medical home" concept emphasizes that care should be compassionate and family-centered. Mutual participation in decision making and informed consent are essential elements of respectful care.[12] Decisions and plans should be made through a process of collaborative decision making in which the family receives complete and unbiased information needed to understand and make informed decisions. The quality of the relationship between the health care professional and patient with chronic illness has been shown clearly to affect outcomes.[13] Honest and supportive relationships with health care professionals can help parents cope[14] and promote the child's independence.[15] Such relationships are strengthened when health care professionals understand the perspectives of the family, provide care with flexibility, and attempt to meet the family's needs and expecta-

tions. Clearly, it is optimal for children with chronic illness or disability to receive health care in a setting that is family-centered. At the same time, pediatricians have an ethical responsibility to guard the welfare of children by ensuring that any treatment they endorse is "in accordance with science and proven experience."[16,17] Dilemmas may arise when families ask their pediatrician to endorse or to provide a therapy that is considered by the pediatrician not to be in the best interests of the child. There may be evidence of the possibility of direct harm, unknown risks, or concerns about indirect harm to the child. The pediatrician is in a position to balance a commitment to family-centered care with the ethical responsibility to guard the welfare of children.[18,19]

SUMMARY/CONCLUSION

The use of CAM approaches in the United States is increasing, especially among children with chronic illness or disability. Distinctions among unproven therapies, CAM, and biomedicine may become blurred, presenting special challenges to the pediatrician. To best serve the interests of children, it is important to provide balanced advice about therapeutic options, to guard against bias, and to establish and maintain a trusting relationship with families. Although the focus of this statement is chronic illness or disability, the recommendations that follow also may apply to the use of alternative medicine in other pediatric domains.

RECOMMENDATIONS FOR PEDIATRICIANS WHO DISCUSS ALTERNATIVE, COMPLEMENTARY, AND UNPROVEN THERAPIES WITH FAMILIES

1. Seek information for yourself and be prepared to share it with families.

   Families are likely to be appreciative of information you have obtained through literature searches. Reviews of CAM discuss currently popular alternative approaches and their attendant risks.[3,20–22] Also, Appendix I shows several Web sites that may be useful resources.
2. Evaluate the scientific merits of specific therapeutic approaches.

   Critical evaluation of claims of effectiveness requires training in the scientific method and an understanding of processes of disease. This training is equally important for evaluating conventional biomedical treatments and alternative therapies. Many CAM approaches are based on inconsistent or implausible biomedical explanations, and claims of effectiveness rest on anecdotal information and testimonials. The pediatrician can be uniquely helpful to parents seeking an assessment of the merits of specific therapies by evaluating such therapies and providing guidance.
3. Identify risks or potential harmful effects.

   Alternative therapies may be directly harmful by causing direct toxic effects, compromising adequate nutrition, interrupting beneficial medications or therapies, or postponing biomedical therapies of proven effectiveness. Indirect harm may be caused by the financial burden of the alternative therapy, other unanticipated costs (eg, the time investment required to administer the therapy), and feelings of guilt associated with inability to adhere to rigorous treatment demands. If a child receiving alternative therapy is at direct or indirect risk of harm, the pediatrician should advise against the therapy. In some circumstances, it may be necessary for the pediatrician to seek an ethics consultation or to refer to child welfare agencies. If there is no risk of direct or indirect harm, a pediatrician should be neutral.
4. Provide families with information on a range of treatment options (avoid therapeutic nihilism).

   Although effective treatments to cure the underlying condition or restore function may be lacking, there may be adjunctive treatments to improve quality of life, address specific concerns of the child or family, or modify environmental conditions that may be causing additional problems. Consultation with pediatric specialists may suggest therapeutic options. Discussion of a range of treatment options may avert feelings of frustration and powerlessness that drive families to alternative sources of care.
5. Educate families to evaluate information about all treatment approaches.

   Families should be informed about placebo effects and the need for controlled studies. The pediatrician should explain that anecdotal and testimonial evidence is very weak. Families also should be advised to be vigilant for exaggerated claims of cure, especially if such claims are for treatments requiring intense commitment of time, energy, and money on the part of the family.
6. Avoid dismissal of CAM in ways that communicate a lack of sensitivity or concern for the family's perspective.

   Some alternative therapies considered by families may warrant independent review and evaluation of scientific merit by the pediatrician. Respectful family-centered care rests on the pediatrician's willingness to listen carefully and to acknowledge the family's concerns, priorities, and fears, including social and cultural factors that may affect their choice of therapies. If CAM is chosen against the advice of the pediatrician, he or she should continue to offer care to the child.
7. Recognize feeling threatened and guard against becoming defensive.

   Families may express their opinions in ways that challenge the professional expertise of the pediatrician. They may bring to the discussion of CAM a number of biased assumptions that contribute to an atmosphere of distrust and an adversarial relationship. It may be helpful for the pediatrician to make empathic statements that acknowledge the families' deep concerns, thereby avoiding angry or defensive reactions.
8. If the CAM approach is endorsed, offer to assist in monitoring and evaluating the response.

   The pediatrician can help to establish clinical outcomes and target behaviors or symptoms that can be observed and measured. Sometimes, the

pediatrician and family can agree on a time-limited trial of the proposed approach.

9. Actively listen to the family and the child with chronic illness.

   The pediatrician should be aware of their concerns, their understanding of the condition, and their needs for support. Support groups and community networks can greatly enhance family comfort with the management of the chronic illness or disability.

APPENDIX I

Helpful Resources on the Internet

1. University of Texas Center for Alternative Medicine Research, http://www.sph.uth.tmc.edu/utcam/default.htm
2. The National Institutes of Health Office of Alternative Medicine, http://altmed.od.nih.gov/
3. The National Council for Reliable Health Information, http://www.ncahf.org
4. The Consumer Federation of America, http://www.quackwatch.com

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Erratum

In "Counseling Families Who Choose Complementary and Alternative Medicine for Their Child With Chronic Illness or Disability" by the AAP Committee on Children With Disabilities, Virginia Randall, MD, was omitted from the list of consultants due to an oversight. The statement was published in the March 2001 issue of *Pediatrics.* (*Pediatrics.* 2001;107(3):598-601.)

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Creating Healthy Camp Experiences

abstract

FREE

The American Academy of Pediatrics has created recommendations for health appraisal and preparation of young people before participation in day or resident camps and to guide health and safety practices for children at camp. These recommendations are intended for parents, primary health care providers, and camp administration and health center staff. Although camps have diverse environments, there are general guidelines that apply to all situations and specific recommendations that are appropriate under special conditions. This policy statement has been reviewed and is supported by the American Camp Association. *Pediatrics* 2011;127:794–799

COUNCIL ON SCHOOL HEALTH

KEY WORDS

camping, recreation, child, adolescent

ABBREVIATION

AAP—American Academy of Pediatrics

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

BACKGROUND

For 150 years, children have been attending camp.[1] Today, approximately 11 million children attend day or resident camp, supported by 1.2 million staff members.[2] Currently, camp programs exist in myriad forms and cater to any interest or population imaginable. The camp experience has been proven to have a lasting effect on psychosocial development, including significant effects on self-esteem, peer relationships, independence, leadership, values, and willingness to try new things.[3] Camps also offer an opportunity to overcome a lack of connection with the natural environment, which has been associated with depression, attention disorders, and obesity.[4] Safety research has revealed that camps have a safety profile equivalent to, or better than, many other activities that parents choose for their children.[5]

Camp health care providers can expect to care for campers with any of the medical and psychological issues seen daily by primary pediatric providers. As a result, the precamp health evaluation takes on increased importance. Parents, the primary health care provider, camp administrators, and camp health care providers should openly share information to ensure that a camper is appropriate for his or her new environment. In addition, parents should medically and psychosocially prepare their child for camp. Camp administration must create appropriate policies and procedures and work in cooperation with local health care providers and facilities to ensure that off-site support is in place.

PREPARING CAMPERS

1. Before choosing a camp, parents or guardians should be encouraged to assess their child's interests, skills, and overall physical, mental, and emotional well-being and evaluate his or her ability

to effectively participate in a particular camp setting. Camp mission statements and promotional handouts can help guide parents when choosing an appropriate camping environment for their child. Before enrolling their child, parents should be aware of preadmission medical requirements for campers and the scope of health services available at camp.

Some day and overnight camps offer programs that require an increased level of physical fitness because of strenuous activities and/or geographic factors such as altitude or remote location. These camps may require a more extensive health evaluation relevant to the nature, conditions, and activities of the camp. Exact health requirements for participation will depend on the program.

2. All campers should provide the camp with a complete annual review of their health by a licensed health care provider, preferably before the first day of camp. This recommendation is consistent with the *Bright Futures* initiative.[6] The appropriateness of the camp's program for the individual camper should be addressed during that review, which, in turn, means that the health care provider must be provided pertinent information about the camp. An evaluation within the 6 months before camp arrival should be considered for children with ongoing health care needs.

   The annual review should include a comprehensive health history. The history should include the child's significant previous illnesses, surgeries, injuries, and allergies and present state of physical and psychological health. Campers with clinically significant medical histories or those with conditions that require long-term management (eg, asthma, seizures, diabetes, anaphylactic allergies, immunocompromise, congenital anomalies, mood or anxiety disorders, attention-deficit/hyperactivity disorder) should have specific medical clearance before participation. A management plan appropriate to the camp program that addresses any ongoing medical or psychological issues should be created. This plan should also address medications, both prescription and over-the-counter, to be used by the child while at camp.[7] Written orders from a licensed health care provider should be obtained for prescription medications, diets, physical activity limitations, or special medical devices. Additional information about coding and documentation related to providing these services is included in the Appendix.

3. Parents or guardians are responsible for providing to the appropriate camp representatives information about any changes in health status, recent travel, new medications, or any changes in maintenance medications. Elective interruption of medications (drug holiday) should be avoided by campers on long-term psychotropic therapy or those on maintenance therapy required for a chronic medical condition.[8–10]

4. Before starting camp, all campers should be in compliance with the recommended childhood immunization schedule published annually by the American Academy of Pediatrics (AAP), the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention, and the American Academy of Family Physicians.[11] Camp administrators should be aware that individual states might require other immunizations in addition to those recommended by the AAP. Polices must also be in place regarding participation in the camp program by campers who are incompletely immunized or unimmunized. People who travel internationally as part of a camp program should consult the Centers for Disease Control and Prevention traveler's health Web site or visit a traveler's clinic for information regarding particular immunization requirements or health concerns that may be associated with their destination.[12]

5. Some inexperienced campers experience acute psychological distress associated with separation from home and loved ones, which is commonly known as homesickness. The following interventions may be helpful for prospective campers and their parents, because they have been found to significantly reduce the incidence and severity of homesickness[9]:

   - Involve the child in the process of choosing and preparing for camp.
   - Discuss homesickness openly. Be positive about the upcoming camp experience and avoid expressing personal doubts or concerns.
   - Arrange practice time away from home with friends or relatives before camp.
   - Frame the time to be spent at camp in comparison with previous enjoyable experiences of similar duration that the child may have had.

Parents should avoid making "pick-up" arrangements in the event of homesickness, because these arrangements may undermine the child's confidence in his or her own independence. Health care providers should

discuss these interventions as part of the anticipatory guidance associated with the health evaluation before camp.

PREPARING THE CAMP

1. Camp administrative officials should have a clear understanding of the essential functions of a camper insofar as their specific camp program is concerned.[13] It is the responsibility of the camp to provide to parents, children, and precamp examiners expectations for successful participation in the camp program. Certain camp activities may increase the risk of complications from specific medical conditions (eg, scuba diving may trigger an asthma exacerbation). It should be a combined effort of parents, health care providers, and camp personnel to identify children who might be at risk and specify the extent of accommodations necessary for safe participation for that child.
2. All camps should have written health policies and protocols that have been reviewed and approved by a physician with specialized training in children's health, preferably a pediatrician or family physician. These policies and protocols should be tailored to the training and scope of practice of the on-site camp health care providers and should be developed with the input of those providers.[14,15] Camp administrators should inquire about the previous training and camp experience of the camp health care provider and provide additional training or support if necessary.[16]

   Camp health policies and protocols should address both major and minor illnesses and injuries and include information on the camp's relationship and coordination with local emergency services. Local emergency medical services providers should be contacted before camp begins to ensure prompt and coordinated response in the event of an emergency.[16,17] Camps should also establish relationships with local dentists and/or orthodontists who are willing to treat dental emergencies if the need arises and with local mental health professionals. The AAP encourages its members to cooperate with local camps in reviewing such policies and protocols and by providing medical support, if practical.

   Illnesses and conditions that commonly affect camp life should be considered for inclusion in protocols for treatment by camp health care providers, including:

   - fever;
   - conjunctivitis;
   - upper respiratory tract infections;
   - otitis externa and media;
   - streptococcal pharyngitis and sore throat;
   - vomiting and diarrhea (including large outbreaks);
   - asthma, anaphylaxis, and allergy management, including food allergies;
   - skin infections: impetigo, fungal, abscess;
   - lice and scabies;
   - dermatitis, including poison ivy and poison oak;
   - insect bites, stings, and tick exposure;
   - common injuries, head injury and concussion;
   - heat- or cold-related illness;
   - homesickness; and
   - behavioral or psychiatric episodes.

   The 2009–2010 H1N1 influenza pandemic and the emergence of methicillin-resistant *Staphylococcus aureus* (MRSA) have highlighted the need for increased screening and surveillance at camps and the ongoing importance of teaching good hygiene practices, the most important of which are good hand-washing and cough/sneeze behaviors. Camps should have in place management plans for infectious outbreaks.[18] These plans should include guidance for caring for ill campers or staff and for isolating ill people from the healthy population. Camp health care providers should also be aware of health hazards that are particular to their area (eg, Lyme disease, Rocky Mountain spotted fever).[19] A camp disaster plan should also be in place.

   On initial arrival at camp, all campers and staff should undergo a screening supervised by the camp health staff to assess the potential for communicable diseases, establish a health status baseline, and identify health problems such as impetigo or lice. Updated medication orders and health history should be made available to camp health staff at this time.
3. Camp health care providers with appropriate knowledge and training should be responsible for the safe storage and administration of medications. This responsibility varies with the type of camp (eg, a camp for children with diabetes or a camp for children with cancer). A protocol should be established for safe transport of medications during out-of-camp trips, and a determination should be made by the on-site health care provider as to the skill of camp personnel to administer medications and the safety of sending a particular child on the trip.[7]

   Camps that maintain oxygen or other emergency medication or equipment should periodically check supplies and ensure that necessary training has been completed. Recent guidelines support

the use of automated external defibrillators (AEDs) in children 1 year or older.[20] All camps should critically review the populations they serve and the need for an AED on site. Camps with an AED should comply with local regulations regarding required protocols and training for their use. With regard to personal emergency medications or medical devices such as inhalers or epinephrine autoinjectors, campers should be instructed in their use before arrival at camp. Parents should also make clear to the camp staff primarily responsible for the camper the situations that may require use of these medications and whether the child is competent in their administration. Specific protocols for administration of these medications or use of specialized equipment by the camper, counselors, or other nonlicensed providers should be created. These devices should be kept in locations that are easily accessible to the people who may need them.[7]

4. A health record system should be maintained that documents all camper and staff illnesses and injuries and that allows for surveillance of the camp illness and injury profile. In addition, camps should consider use of an electronic health record that is compliant with federal guidelines.[21] Camp records should include emergency contacts for all children. The parent or guardian with legal custody should be clearly indicated. Protocols for parental notification should be established. In addition, if a chronic condition exists, the child's primary care physician and any subspecialty physicians should be identified by name, telephone number, and e-mail address, and the date of the last health care visit should be noted.[22] Written authorization to obtain treatment, to transport children in camp vehicles for nonemergent care, and to share medical information should be provided by the parent or guardian.[23] Camps should make clear their requirements for health insurance coverage, and parents or guardians should ensure that their policy is in force at the camp's location. Confidentiality of health information should be maintained.[24] Camp health history and physical examination forms that meet the aforementioned recommendations and that have been reviewed by the AAP are available to camps and health care providers from the American Camp Association.[25]
5. It is important for all camps to have personnel who can administer onsite first aid and cardiopulmonary resuscitation (CPR), irrespective of their distance from definitive medical care. This statement does not address specific camp staff issues; however, those who are involved in waterfront activities should be certified in cardiopulmonary resuscitation.
6. Obesity and related cardiovascular risk factors are important public health priorities, and camp communities should adhere to principles of healthy living.[26] Food that is served and sold in camps should, at least, follow federal guidelines for school nutrition. Camp staff should model healthful food choices for their campers. Food should not be used as a reward, nor should withholding food be used as a punishment. At least 30 minutes of daily physical activity should be included as a component of any camp program. Plain water should be available throughout the day, and sweetened beverages, including sport drinks, should be strictly limited or simply not used.[27]
7. The principles promoted in this statement apply to all camps; it should be noted, however, that inclusion of children with disabilities and other special health care needs may require the establishment of additional assessments and services and that camps designed to serve that population of children and adolescents specifically will be equipped differently. Camp authorities should work with local pediatricians and other health care providers to conduct health appraisals for children before their participation in camp and determine appropriate services and programs for children with special needs.[22] In addition, camp personnel should be familiar with the health and safety guidelines for child care centers developed by the AAP, American Public Health Association, and Maternal and Child Health Bureau and should adhere to those that are appropriate to their programs and facilities.[28]

Parents should feel confident that their children are ready for camp and that their chosen camp is well prepared to care for their children. To this end, the AAP offers the aforementioned recommendations for creating a healthy camp experience.

APPENDIX: CODING AND DOCUMENTATION FOR CAMP/SCHOOL/SPORTS EXAMINATIONS

Pediatric providers should become skilled at and comfortable with establishing coding practices of (and expecting appropriate reimbursement for) their services in performing and documenting camp, school, and sports examinations.

CPT (*Current Procedural Terminology*) Coding

1. When possible, use the preventive medicine services codes (99381–99397). These codes most accurately describe both the comprehensive examination and counseling services rendered. Many camp, school, and sports forms require additional examinations (eg, measuring heart rate and blood pressure after exercise) or counseling (eg, asthma management related to exercise or high altitude) above and beyond the "standard" parameters included in annual evaluations.
2. If the need for examination arises after a patient has already received an annual preventive medicine services examination, health plans typically do not cover the cost of a second examination. Providers may elect to complete camp forms on the basis of a recent preventive medicine services visit or schedule an additional visit. If allowed by the child's insurance, parents may be billed for the additional noncovered services.
3. Office or other outpatient services codes (99201–99215) may be used if a problem is identified during the visit.
4. Office or other outpatient consultation codes (99241–99245) provide a possible alternative method if the "rule of 3 'Rs" is met:
   a. The service is requested by the camp or school (the office record should verify the request).
   b. The services (examination and documentation) are rendered by the provider.
   c. A written report (the completed camp or school form) is provided to the requesting camp or school.
5. In addition, the special report code (99080) may be reported if a provider is required to complete a specific camp or school form.

ICD-9-CM (International Classification of Diseases, Ninth Revision, Clinical Modification) Coding

1. Use code V20.2 if the camp or school service is incorporated into the annual "well-child care" visit.
2. Use code V70.3 if the camp or school service is a separate preventive medicine services, consultation, or office or other outpatient services visit.
3. Use specific problem-based code(s) if specific problems are found and addressed.

Documentation

1. Specific forms are usually provided by the camp or school. Once completed by the provider, these forms should contain documentation consistent with the provider's chart records.
2. Care should be exercised to avoid breaches of issues of confidentiality, especially with preteen and teenaged patients.
3. The American Camp Association has excellent resources to serve as guidelines for proper documentation of camp-related examinations (www.acacamps.org/knowledge/health/forms).

For coding questions, please contact the AAP coding hotline at aapcodinghotline@aap.org.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

John J. Fraser, Jr, MD, JD; Gary N. McAbee, DO, JD; and the Committee on Medical Liability

Dealing With the Parent Whose Judgment Is Impaired by Alcohol or Drugs: Legal and Ethical Considerations

ABSTRACT. An estimated 11 to 17.5 million children are being raised by a substance-abusing parent or guardian. The importance of this statistic is undeniable, particularly when a patient is brought to a pediatric office by a parent or guardian exhibiting symptoms of judgment impairment. Although the physician-patient relationship exists between the pediatrician and the minor patient, other obligations (some perceived and some real) should be considered as well. In managing encounters with impaired parents who may become disruptive or dangerous, pediatricians should be aware of their responsibilities before acting. In addition to fulfilling the duty involved with an established physician-patient relationship, the pediatrician should take reasonable care to safeguard patient confidentiality; protect the safety of the patient and other patients, visitors, and employees; and comply with reporting mandates. This clinical report identifies and discusses the legal and ethical concepts related to these circumstances. The report offers implementation suggestions when establishing anticipatory office procedures and training programs for staff on what to do (and not do) in such situations to maximize the patient's well-being and safety and minimize the liability of the pediatrician. ***Pediatrics*** **2004;114:869–873;** ***judgment impaired, alcohol, substance abuse, disruptive parent, informed permission, informed consent.***

ABBREVIATIONS. AAP, American Academy of Pediatrics; HHS, US Department of Health and Human Services; OSHA, Occupational Safety and Health Administration.

INTRODUCTION

In the course of providing health care services to children, pediatricians may encounter situations in which a patient arrives at the office accompanied by a parent, guardian, or caregiver who displays signs of judgment impairment. In these circumstances, pediatricians are challenged by an array of professional, ethical, and legal obligations, some of which may conflict. Pediatricians have sought guidance from the American Academy of Pediatrics (AAP) on how to respond to these potentially volatile and risk-laden scenarios. The purpose of this clinical report is to analyze the physician's potentially conflicting duties and suggest ways that he or she can help both the child and the judgment-impaired adult in a situation fraught with legal complexity. This clinical report primarily addresses the situation in which the judgment of the parent, guardian, or caregiver is impaired by use of alcohol or drugs. However, the principles should be applicable to judgment impairment attributable to any cause (eg, prescription medication use, unstable medical condition such as diabetes, suspected dementia).

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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SCOPE OF THE PROBLEM

The Children of Alcoholics Foundation estimates that there are between 11 and 17.5 million children in the United States younger than 18 years currently living with a parent with alcoholism.[1] The number of children living in homes with an adult who abuses drugs is unknown. Clearly, this represents a substantial public health problem that most pediatricians will encounter at some point in their careers. Encounters with children accompanied by an impaired parent may take place wherever pediatric services are delivered. This report focuses on the legal and ethical issues pediatricians and their staff should consider when a patient's parent or guardian arrives at a pediatric office in a judgment-impaired state.

The profound effects of parental substance abuse on children have been described throughout the pediatric literature and summarized comprehensively in various AAP policy statements[2–4] and the manual on substance abuse.[5] A multidisciplinary working group developed a consensus paper titled "Core Competencies for Involvement of Health Care Providers in the Care of Children and Adolescents in Families Affected by Substance Abuse"[6] to identify the pivotal role of the primary health care professional in addressing the health needs of children in substance-abusing environments. It also suggests levels of responsibility and competencies for health care professionals in protecting the health and safety of these children. By virtue of their training and experience, pediatricians are well aware of the long-term risks to the child's physical, mental, and developmental health and safety associated with parental substance abuse. Therefore, it is not necessary for this clinical report to address the effects of parental substance abuse on the child. Instead, the report outlines the immediate risks and legal considerations associated with managing a parent or guardian

whose judgment is impaired from alcohol or drugs during a pediatric office visit.

LEGAL CONSIDERATIONS

Pediatricians should consider the following legal principles when dealing with the parent whose judgment is temporarily impaired by alcohol or drugs:

- the physician-patient relationship;
- the duty to act in the best interest and for the safety of the patient;
- the need to obtain informed consent;
- the importance of safeguarding patient confidentiality;
- the mandated reporting of suspected child abuse and neglect; and
- the duty as an employer and business owner to protect the safety of employees and visitors in the office.

At times, there may be apparent conflict in these obligations. Every case is unique. The general considerations in this report are provided to enable pediatricians to develop office policies responsive to these situations. In translating this guidance into office policy, pediatricians should seek advice from competent legal counsel to ensure that the office policy is appropriate for a specific health care facility in a given state. The report's implementation suggestions serve as general guidance and, as such, should not be considered a specific course of action for a specific situation.

PHYSICIAN-PATIENT RELATIONSHIP

The parents, guardians, or caregivers who accompany infants, children, adolescents, and young adults play an important role in pediatric encounters. Depending on the age and circumstances of the patient, the adult often provides consent to treatment, furnishes pertinent historical information on the family and the child, and is financially responsible for medical care. Nevertheless, the pediatrician needs to remember that the physician-patient relationship exists between the pediatrician and the child. Thus, the pediatrician's first duty is to the patient.

The physician-patient relationship conveys many duties; one is to prevent harm. If there is reason to believe that the parent's impaired judgment substantially risks harming the patient or others, the pediatrician should attempt to decrease that risk by the least restrictive means. For instance, an impaired parent should not be allowed to drive. Not only would the patient be in considerable danger if allowed to ride in a motor vehicle being driven by someone under the influence of chemical substances, but the parent and the public also would be endangered. Depending on the circumstances, taking appropriate action could involve securing alternate transportation (eg, calling a taxi, contacting another family member to intervene). It may necessitate reporting the situation to the appropriate authorities including police or child protective services if discussion with the parent fails to result in a safe and satisfactory resolution. Local laws regarding public drunkenness or impairment may specify the appropriate course of action. Failing to fulfill the duty owed to a patient may constitute medical negligence and may even subject the pediatrician to liability from third parties.

BEST INTEREST OF THE PATIENT

Parents are presumed to have the best interests of their children at heart. Parents exhibiting signs of alcohol or drug impairment may be incapable of caring for a child properly. Therefore, the pediatrician's actions should be guided by the child's best interest, especially when the parent's condition compromises his or her ability to share that interest.

CONSENT TO CARE

Consent to care is a complicated concept in pediatrics. The ethical and legal considerations have been articulated in a number of AAP policy statements.[7–9] Pediatricians should be aware that it is likely that judgment-impaired parents are incapable of giving informed consent for their children's medical treatment. Pediatricians may have to use their judgment in determining whether a parent is incapable of consenting for a child. In some situations, it may be apparent that the parent has recently used alcohol or drugs but may not necessarily be impaired. In these circumstances, the pediatrician should be very careful about providing nonemergent care because of liability concerns brought forth later about insufficient informed consent. Therefore, if the child, by virtue of age or legal status, cannot consent to his or her own medical treatment and the parent's competency to do so is uncertain because of the chemical impairment, it would be advisable to postpone routine nonurgent medical care until consent can be obtained. To provide nonurgent care without consent would risk allegations of unauthorized treatment and even battery.[10,11]

However, in hospital emergency departments, the Emergency Medical Treatment and Active Labor Act[12] (EMTALA) plays a role. Under this act, a physician in certain situations may be mandated to screen for an emergency medical condition regardless of consent. Additional care may need to be given in the absence of consent if a delay would result in a threat of harm to the child's life or health. The EMTALA requirement for a medical screening examination does not apply to physician offices.

CONFIDENTIALITY AND PRIVACY

Parents have a reasonable expectation that information provided to the child's physician during a medical encounter will be considered confidential and protected by applicable laws. Thus, physicians should take reasonable care to safeguard health information obtained from the parent or guardian concerning the family (health and social history). Additional safeguards may be needed for sensitive topics such as substance abuse. These efforts should be reflected in the medical office's security policies for protecting patient records and other forms of identifiable health data according to any state and federal

(Health Insurance Portability and Accountability Act of 1996 [HIPAA]) laws.[13,14]

Due care should be taken to ensure that discussions with parents, patients, and appropriate government agencies concerning the substance-abuse problem and the family are conducted in a manner that protects confidentiality. For example, if the receptionist notices that an adult appears to be intoxicated when checking in for an appointment, it might be prudent to isolate the impaired person from others so that he or she can be spoken to privately. That would be preferable to confronting the impaired parent in the reception area in the presence of his or her child and others. The office could have a policy in place to summon the impaired parent as though it were time for the child's appointment and usher him or her into a more private location (eg, an office, conference room, or examining room) and take the child ostensibly to be weighed or measured in another room. This not only would minimize the risk of the conversation being overheard by others but also could afford an opportunity to discuss the problem without the child being present. However, if the impaired parent is disruptive in the office reception area, quick action may be needed to contain the situation, and in such instances, keeping the impaired person from harming others would take precedence over preserving the confidentiality of his or her chemical impairment.

MANDATED REPORTING

Every state has enacted laws to mandate reporting of child abuse and neglect. This is a legal obligation that is extended to children outside the physician-patient relationship. The physician must put the child's best interest before the parent's expectation of privacy and comply with mandated reporting to child protective services.[15–17]

An issue paper from the US Department of Health and Human Services (HHS) titled "Current Trends in Child Maltreatment Reporting Laws" summarizes how the standards used to determine when a mandatory reporter is required to notify authorities of abuse or neglect vary slightly from state to state.[18] These variances include who is a mandated reporter, the level of knowledge or suspicion of abuse necessary to report, and what constitutes abuse. The HHS issue paper provides a summary of common themes and general information on this complex topic. State Web sites may offer additional guidance to health care providers on mandated reporting of child abuse. However, specific legal advice interpreting the applicable laws and regulations is necessary when developing office policies for these situations.

It is important that mandated reporters understand these nuances in their state law. The patient should be carefully assessed for other signs of neglect or abuse. To do otherwise puts the pediatrician at risk of prosecution for failure to report suspected abuse or neglect of the patient. Should the patient subsequently be harmed as a consequence of the physician failing to act, the physician could be sued for medical negligence or face possible sanctions from a state licensing board. Anyone who is mandated to report suspected child abuse or maltreatment and fails to do so could be subject to criminal charges and could be sued in a civil court for monetary damages for any harm caused by their failure to report.

Two states impose penalties on mandatory reporters who intentionally, negligently, or purposefully fail to report suspected abuse. A few states impose penalties without imposing a standard. Failure to report is classified as a misdemeanor in approximately 35 states. Typically, sanctions are in the form of a fine and/or imprisonment.

Of greater impact on mandatory reporters themselves are the provisions exposing them to civil lawsuits for failure to report. The potential financial liability for additional injury of a child whose maltreatment should have been detected and prevented by a timely report can be considerable.

If a mandated reporter makes a report in earnest concern for the welfare of the child, that reporter is immune from any criminal or civil liability that may result. However, this good-faith immunity may not be available when the liability results from willful misconduct or gross negligence by the mandated reporter. Approximately 30 states impose penalties for false reporting of abuse. The most common standards used are knowingly and/or willfully filing an unproven report of abuse or neglect. A few jurisdictions impose penalties for intentionally making an unproven notification of abuse or neglect.[18]

GENERAL DUTY

In recent years, health care facilities have become targets of violence. Thus, the Occupational Safety and Health Administration (OSHA) has imposed regulations requiring health care employers to establish policies and procedures to safeguard employees from violent actions. Specific recommendations are enumerated in the OSHA regulations under the general duty heading.[19] Several documents are available on the OSHA Web site (www.osha.gov) that can be helpful in establishing practical step-by-step safety policies to protect employees in health care settings from potentially violent visitors.

IMPLEMENTATION SUGGESTIONS

The following suggestions are intended to help pediatricians implement office policies and procedures that may minimize legal risks should a patient arrive at the medical office in the care of an adult whose judgment is impaired.

Safety

Conduct a safety audit of your facility, including procedures for management of judgment-impaired visitors. Establish an office policy and train staff to respond appropriately. Incorporate this policy into your OSHA compliance program. Review and update the policy periodically. If the procedure is implemented, document the incident, how it was handled, and any injuries that occurred and evaluate whether the safety policy needs to be revised as a result of this occurrence. Maintain these records in a secure area of the office. Contact your professional

liability insurance company to determine whether consulting services for developing such a loss-prevention program are available.

Confidentiality

Verify the confidentiality laws applicable in these situations and align your office confidentiality policies with these laws. Unless state laws indicate otherwise, the physician's duty to the patient should take precedence over the parent's expectation of confidentiality. Discuss with the parent your concerns regarding the risk to the child caused by his or her impairment in a compassionate, nonjudgmental fashion. Use the benefit of your previous rapport and professional relationship to show that the concern is for both the child's and the parent's welfare. Both the child and the parent should know what is happening and why it is necessary. Provide a referral for counseling to address the parent's substance abuse and its effect on the child. The Substance Abuse and Mental Health Services Administration of the HHS maintains a searchable directory of 12 000 facilities with treatment programs for drug and alcohol abuse throughout the United States (http://findtreatment.samhsa.gov).

Consent

Remember that an impaired parent cannot consent to medical treatment for the child. Therefore, it would be prudent to postpone nonurgent pediatric care until a time at which consent can be obtained. If no care is delivered, it is suggested that the physician document in the medical record that "valid and sufficient consent was not given by the parent for treatment today."

Mandated Reporting

It would be difficult to imagine how children under the care of an adult whose judgment is sporadically or habitually impaired by alcohol or drugs would not be at risk of harm. Use your best clinical judgment to determine the specific risks that the parent's condition poses to the child, and take action accordingly. Be knowledgeable of your state's laws governing reporting child abuse, standards of abuse, and consequences of failing to report for mandated reporters. Contacting child protective service agencies may be the only way to get treatment for the parent and protection for the child. If you believe that the judgment-impaired person may harm himself or herself or others, take action in accordance with applicable laws. Summoning for police escort or emergency personnel to transport the impaired adult to the emergency department for evaluation and treatment may be necessary. Should the child's custodial parent or guardian agree to it, it may be preferable to release the child to the care of a relative rather than have the child accompany the parent to the emergency department or police station. However, child protective services may be in the best situation to make such determinations.

The greatest risk is to do nothing.

DISCLAIMER

The information contained in this clinical report is provided for educational purposes only and should not be used as a substitute for licensed legal advice.

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All clinical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

AMERICAN ACADEMY OF PEDIATRICS

TECHNICAL REPORT

Jane Knapp, MD, and Deborah Mulligan-Smith, MD; and the
Committee on Pediatric Emergency Medicine

Death of a Child in the Emergency Department

ABSTRACT. Of the estimated 40 000 American children ≤14 years old who die each year, approximately 20% die or are pronounced dead in outpatient sites, primarily the emergency department (ED). The ED is distinguishable from other sites at which children die, because the death is often sudden, unexpected, and without a previously established physician-patient care relationship. Despite these difficult circumstances and potentially limited professional experience with the death of a child, the emergency physician must be prepared to respond to the emotional, cultural, procedural, and legal issues that are an inevitable part of caring for ill and injured children who die. All of this must be accomplished while supporting a grieving family. There is also a responsibility to inform the child's pediatrician of the death, who in turn also must be prepared to counsel and support bereaved families. The American Academy of Pediatrics and American College of Emergency Physicians collaborated on the joint policy statement, "Death of a Child in the Emergency Department," agreeing on recommendations on the principles of care after the death of a child in the ED. This technical report provides the background information, consensus opinion, and evidence, where available, used to support the recommendations found in the policy statement. Important among these are the pediatrician's role as an advocate to advise in the formulation of ED policy and procedure that facilitate identification and management of medical examiners' cases, identification and reporting of child maltreatment, requests for postmortem examinations, and procurement of organ donations. *Pediatrics* **2005;115:1432–1437;** ***death, child, postmortem examination, family-centered care.***

ABBREVIATIONS. ED, emergency department; EMS, emergency medical services; EP, emergency physician; AAP, American Academy of Pediatrics; ACEP, American College of Emergency Physicians; IOM, Institute of Medicine; EMS-C, emergency medical services for children; CPR, cardiopulmonary resuscitation.

INTRODUCTION

Background Information

The death of a child under any circumstances is tragic and devastating. It changes the lives of all those involved who grieve for a life that has ended prematurely. In the immediate aftermath of death there is a great deal of confusion and disbelief. Parents are left struggling with overwhelming emotions and searching for explanations for such a tragedy. Because it is so charged with emotion, this is a time when the skill of caring professionals in the emergency department (ED) can make a difference. This technical report provides support for professionals when they are faced with the difficult task of performing professionally and with compassion at the time of the death of a child.

Children who die and their families are a diverse group. No single policy, plan, or approach can address all the situations and circumstances of death. However, based on the fact that injury is the leading cause of death in children, it is inevitable that many deaths will involve emergency medical services (EMS) systems. An analysis of 1997 national mortality data showed that 16% of deaths in children <19 years old occurred in outpatient hospital sites, primarily the ED, and another 5% were declared dead on arrival at a hospital.[1] The frequently sudden, unexpected nature of a child's death in the ED is an important confounding factor, because even the relatively brief nature of the family's interaction with health care providers can have a profound and enduring impact.

A child's death involves family members, including siblings, and health care providers. Members of the involved health care team potentially include out-of-hospital providers, day care or school personnel, nurses, social workers, child-life workers, mental health professionals, chaplains, and physicians. When a child's death occurs in the ED, it involves both the emergency physician (EP) who cared for the child at the end of his or her life, the pediatrician who has cared for the child before death, and possibly other subspecialty physicians.

Establishing policy in areas of common interest and shared care is one focus of collaborative efforts between the Committees on Pediatric Emergency Medicine of the American Academy of Pediatrics (AAP) and American College of Emergency Physicians (ACEP). Our committees believe that this collaboration between professional organizations to establish consensus policy promotes the highest-quality emergency care for children. This collaboration lead to the jointly published "Death of a Child in the Emergency Department" policy.[2,3] This is the technical report to support those policy recommendations.

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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Statement of the Problem

Forty thousand American children ≤14 years old died during the year 2000.[4] Providing and organizing child- and family-centered care at the time of death is the subject of the Institute of Medicine (IOM) report *When Children Die: Improving Palliative and End-of-Life Care for Children and Their Families*.[5] In this report, the IOM's Committee on Palliative and End-of-Life Care for Children and Their Families describes current practice and the numerous challenges to providing palliative and end-of-life care for children and families. Perhaps the foremost challenge is the inadequate amount of research on which to base policy. Faced with this recognized scarcity of data, this technical report relies on the available research, expert consensus opinion, and published experience to formulate recommendations.

Overall, the occurrence of a death of a child in the ED is an uncommon event. Thus, few physicians in emergency medicine or pediatrics have a great depth of experience on which to base their practice. Additionally, physicians lack training in palliative, end-of-life, and bereavement care.[6] Only 26% of primary care residency-training programs report education in end-of-life care.[7] Sixty-two percent of pediatric residency program directors who responded to a survey reported that their residents were involved in end-of-life situations, but only 42% indicated that their residents received direct education in palliative care.[8] In a survey of EPs, only 14% recalled having training in notifying parents of a child's death.[9]

Although the IOM has noted that, in general, research on palliative and end-of-life care for all children who die and their surviving families is very limited, there are even less data specific to the death of a child who has received EMS care. With only a modest amount of published EMS for children (EMS-C) research to direct practice, EDs must rely on principles of palliative care and other information such as consensus reports and clinical guidelines in the areas of mental health needs and bereavement practices for guidance.[10–13]

Clearly there are similarities between the needs of children and families in palliative care and those who die in the ED. Most applicable among these similarities are appropriate attention to pain relief; facility design; timely provision of information that is accurate, consistent, and expressed in language that families can understand; provision of immediate and long-term bereavement support; identification of community-based resources; and family involvement in decision-making. Other epidemiologic and medical considerations create unique needs specific to EMS-C for end-of-life care, which are described in "End-of-Life Care in Emergency Medical Services for Children," Appendix F of *When Children Die: Improving Palliative and End-of-Life Care for Children and Their Families*[14] and include the number and diversity of personnel involved, unique parental needs when a child dies suddenly and unexpectedly, and medical care issues in the context of sudden death. The areas of EMS-C end-of-life care in need of research investigation and evaluation are summarized in Table 1.

NEW INFORMATION

Education and Training

Education of health care professionals to provide palliative, end-of-life, and bereavement care to children and families is one of the major recommendations from *When Children Die: Improving Palliative and End-of-Life Care for Children and Their Families*. This education should include scientific and clinical knowledge and skills, interpersonal skills and attitudes, ethical professional principles, and organizational knowledge skills. A physician who is a skilled communicator with parents and able to convey empathy and compassion can minimize any misunderstandings that might arise during these difficult situations. Education should also consider the bereavement care of siblings and other child acquaintances.[15] These learning objectives are summarized in Table 2.

The understanding that the death of a child is an important, underaddressed issue in EMS-C has initiated efforts to fill gaps in education and training for emergency health care providers through established courses. The AAP Pediatric Education for Prehospital Professionals course contains a child and family

TABLE 1. Research Directions for End-of-Life Care in EMS-C

Issue	Research Questions
Bereavement	What is the association of acute, sudden, or unexpected loss with the development of posttraumatic stress disorder?
	What is the impact on the bereavement process of parental presence during the attempted resuscitation of a dying child?
Critical incident stress management	How does critical incident stress management affect emergency care providers in the short and long term?
	What are the important outcomes to evaluate?
Clinical research on resuscitation	What are the predictors of mortality during resuscitation in the prehospital and ED arenas?
	Is it beneficial to exercise extraordinary intervention in the resuscitation of children who have experienced prolonged hypoxic-ischemic injury?

Adapted from Wright JL, Johns CMS, Joseph JG. Appendix F: end-of-life care in emergency medical services for children. In: Field MJ, Behrman RE, eds. *When Children Die: Improving Palliative and End-of-Life Care for Children and Their Families*. Washington, DC: National Academy Press; 2003:332–333. Available at: http://books.nap.edu/books/0309084377/html/580.html.

TABLE 2. Educational Needs of Health Professionals to Provide Palliative, End-of-Life, and Bereavement Care to Children and Families

Learning Domain	Learning Objective
Cognitive knowledge and skills	Learning biological mechanisms of end-stage conditions
	Understanding the pathophysiology of pain and other physical and emotional symptoms
	Developing appropriate expertise and skill in the pharmacology of symptom management
	Acquiring appropriate knowledge and skill in nonpharmacological symptom management
	Understanding the tools for assessing patient symptoms, quality, and prognosis
	Recognizing when consultation with palliative care specialists is appropriate
	Understanding the epidemiology of death in childhood
	Learning clinical indications for and limits of life-sustaining treatments
Interpersonal skills and attitudes	Listening to child patient and families
	Conveying difficult news to children and their families
	Understanding and managing child and family responses to life-threatening illness
	Sharing goal setting and decision-making with the care team
	Developing skills in avoiding and resolving conflicts
	Cultivating empathy, compassion, humility, and altruism
	Developing sensitivity to religious and cultural differences
	Recognizing and understanding one's own feelings and anxieties about the death of a child
Ethical and professional principles	Acting as a role model of clinical proficiency, integrity, and compassion
	Determining and respecting child and family preferences
	Learning principles of end-of-life care
	Understanding societal and population interests and resources
	Balancing competing objectives or principles
	Being alert to personal and organizational conflicts of interests
Organization knowledge and skills	Developing and sustaining effective teamwork
	Identifying and mobilizing supportive resources
	Understanding and managing relevant rules and procedures
	Protecting children and their families from harmful rules and procedures
	Assessing and managing care options, settings, and transitions
	Making effective use of existing financial resources

Adapted from Institute of Medicine, Committee on Palliative and End-of-Life Care for Children and Their Families. Educating health care professionals. In: Field MJ, Behrman RE, eds. *When Children Die: Improving Palliative and End-of-Life Care for Children and Their Families.* Washington, DC: National Academy Press; 2003:332–333.

interaction module that addresses sudden infant death syndrome, family responses to the death of a child, and community resources for support.[16] The current AAP/American Heart Association Pediatric Advanced Life Support course contains an optional module on coping with death and dying that discusses the priorities for family support.[17] *APLS: The Pediatric Emergency Medicine Resource*[18] has sections on family presence during procedures and resuscitation attempts including CPR, termination of CPR, and the approach to the deceased child and family.

Family-Centered Care

Family-centered care is an approach to health care that shapes health care policies, programs, facility design, and day-to-day interactions among patients, families, physicians, and other health care professionals. The AAP outlined the core principles of family-centered care in the policy statement "Family-Centered Care and the Pediatrician's Role."[19] This statement recommends that parents and guardians should be offered the option to be present with their child during medical procedures and offered support before, during, and after the procedure. The statement does not make recommendations regarding family presence during situations of resuscitation or CPR. Both the Emergency Nurses Association and the American Heart Association recommend that health care providers should offer family members the opportunity to be present during CPR whenever possible.[20,21] The *APLS: The Pediatric Emergency Medicine Resource*,[18] developed jointly by the AAP and ACEP, notes that the family's presence during CPR can help in the acceptance of the child's death.

Additional evidence shows that most family members favor having the choice to be present during resuscitation attempts and that they tend to feel that being present was helpful.[22–27] Results from psychological examinations suggest that family members present during resuscitation attempts have more positive grieving behavior than family members not present during resuscitation attempts.[28] Despite these facts, parents and family members often do not ask if they can be present.

The presence of family members during resuscitation attempts prompts consideration of many additional issues including medicolegal issues. For this reason the Emergency Nurses Association has recommended that multidisciplinary consensus guidelines be developed to help organizations and institutions formulate policy regarding family presence during procedures and CPR. If multidisciplinary consensus can be achieved, these guidelines will be helpful in defining when and how to offer the option of family presence and thus in establishing ED policy.

There is a need for additional research regarding the effects of family presence. The IOM Committee on Palliative and End-of-Life Care for Children and Their Families cautions that most studies on family presence during resuscitation attempts are small, often retrospective, and limited in scope. Because this is such a critical experience for parents and care providers, they recommend that additional system-

atic research on the bereavement outcomes and other consequences of family-presence policies be conducted.

Team-Oriented Approach

The care team can include out-of-hospital providers such as emergency medical technicians and paramedics, social workers, child-life workers, mental health professionals, chaplains (including the families religious or spiritual leader), nurses, and physicians; each team member must understand his or her role. It is essential that team members work together to ensure that the occurrence of a death of a child is managed smoothly and with sensitivity.

Sensitive care includes awareness and respect for varied beliefs and cultural backgrounds. In a country as diverse as the United States, there can be profound differences between families and health care providers in beliefs and practices concerning the end of life. Additionally, open communication may be hampered by language barriers. Because cultural issues are most acute if language barriers are present, it is important that EDs and hospitals have rapid, efficient access to translators. In all cases, the health care team must remain sensitive to issues such as family methods for decision-making, the care of the body after death, and culturally appropriate expressions of grief. This is a daunting task. Appendix D of *When Children Die: Improving Palliative and End-of-Life Care for Children and Their Families*, titled "Cultural Dimensions of Care at Life's End for Children and Their Families,"[29] is a complete discussion of the relevance of cultural difference at the end of life.

Effective counseling, especially at the time of death, has a dramatic, positive impact on the family's grieving process, ultimate recovery, and ability to cope.[30–32] When possible, it is helpful to let the family know that the child was not in pain or did not suffer. One team member should be assigned to be with the family continuously during the resuscitation attempt. The purpose of this individual is to answer questions, explain procedures, and/or prepare the family and bring them to the resuscitation area.[33]

The EP has the responsibility of notifying the family of the child's death. The EP also has the responsibility of speaking with the family regarding the circumstances of death and notifying the family if there are concerns of child maltreatment that must be reported and investigated.

Care for the child does not stop with death. Family members should be encouraged to be with their child after death. Many authors have emphasized that being with the child after death is an integral part of bereavement.[34,35] Some families may wish to bathe the child themselves. Many will want to hold and rock their child. Providing the space to do this can be a challenge for creative administrators. However, the benefits to the families in these devastating situations are tremendously positive and enduring. The exact nature of aftercare will be determined and sometimes limited by the circumstances of the child's death, cultural practices, religious beliefs, and practical issues of facilities within the ED. Legal and medical examiner requirements may limit what is done in terms of removing resuscitation tubes and lines. The ED team can be sensitive and supportive by cleaning the resuscitation area and the body, covering disfiguring injuries and wounds as much as possible with clean sheets, and carefully explaining the purpose of remaining tubes or lines.

Kits with plastic molds for an imprint or three dimensional mold of the child's hands and/or feet and Ziploc bags to store a lock of the child's hair can be stored in the ED. Parents surveyed after their child's death have found these small mementos helpful in easing the bereavement after the tragic event.[36]

In addition, a chaplain, social worker, child-life therapist, and/or psychologist should be made available to the family. Families will have immediate and long-term mental health needs. Attention must be paid to the siblings (who are often overlooked in such overwhelming situations), grandparents, and classmates. The pediatrician has a role in monitoring the siblings for signs of emotional and somatic complaints that could be secondary to the death. Also, primary care physicians should take the lead in directly asking families how they are doing. At the very least, a condolence card should be signed by the direct care providers and sent to the family home, along with a list of community resources for grief and loss.

NOTIFYING THE PEDIATRICIAN AND SUBSPECIALISTS OF THE CHILD'S DEATH

The process of bereavement begins in the ED and continues over time. Many children who die have had an established medical home, and others have had complex medical problems for which they may have received care and established relationships with several providers. These pediatricians and/or subspecialists should be notified at the time of such a child's death. They can be a vital source of counsel and support for the bereaved family.

ASSISTING ED STAFF, OUT-OF-HOSPITAL PROVIDERS, AND OTHERS WHO ARE EXPERIENCING CRITICAL INCIDENT STRESS

The professionals who care for children who die after receiving care in the EMS system are also at risk for emotional distress including posttraumatic stress disorder. Access to appropriate mental health services should be available to provide immediate counseling for members of the ED health care team.

POSTMORTEM EXAMINATIONS AND TISSUE AND ORGAN DONATION

In most jurisdictions, the sudden and unexpected death of a child occurring in the field or ED is considered a medical examiners case requiring an autopsy. These legal requirements must be explained to the family.

It is important to explain to families that the extent of an autopsy is often limited to the relevant injury and that there will be no additional disfiguration that would interfere with an open-casket ceremony. Additionally, if it is desired, the medical examiner will often honor requests to restore all organs to the original location.

The AAP Committee on Child Abuse and Neglect has published several policy statements to aid professionals by providing information and guidelines that are helpful in situations in which sudden infant death syndrome and other unexpected infant and child deaths must be distinguished from child abuse. These policies and statements include "Investigation and Review of Unexpected Infant and Children Deaths,"[37] "Distinguishing Sudden Infant Death Syndrome From Child Abuse Fatalities,"[38] and "Addendum: Distinguishing Sudden Infant Death Syndrome from Child Abuse Fatalities."[39] These difficult situations require the collaboration of health professionals to ensure the appropriate utilization of available medical specialists and the preservation of evidence and the performance of additional studies such as an appropriately performed skeletal survey or toxicologic screens. Many child-fatality–review teams have established guidelines for evidence preservation and suggestions for documentation for cases of sudden pediatric death.

Cases that are not referred to the medical examiner should also be considered for autopsy. A forthcoming report from the American College of Medical Genetics on newborn screening notes that we may gain a better understanding of the incidence and spectrum of diseases associated with perinatal and early childhood mortality by implementing uniform child autopsy policies and procedures which ensure availability of appropriate studies (including metabolic and genetic studies for all perinatal deaths, including stillbirths) and early unexpected childhood deaths. Currently, autopsy can provide additional information in more than one third of pediatric deaths,[40] including previously undiagnosed findings, complications, and unsuspected contributors to death.[41–43] This information may be of importance to parents and other relatives in future family planning and to physicians in helping to educate and improve the quality of care in medicine. Providing this information can help parents to make an informed decision when they are asked about permission for postmortem examination. This must be implemented with sensitivity and respect for the family beliefs and values.

Hospitals are required by federal and state laws to have a mechanism for requesting organ donation from the appropriate family members or surrogates.

SUMMARY/CONCLUSIONS

Of the estimated 40 000 American children who die each year, approximately 20% die or are pronounced dead in outpatient sites, primarily the ED. The processes and protocols surrounding the death of a child in the ED are underaddressed and understudied issues related to end-of-life care. Because death in the ED is usually sudden and unexpected, the traditional patient-physician relationship has not been established, the family has not been counseled and advised, and the EP is expected to provide an environment for grieving parents that addresses their emotional, spiritual, and cultural needs while also providing support in responding to legal and procedural demands.

It is unfortunate that, currently, there are few evidence-based data to guide policy in responding to the unique needs of parents and families when a child's death occurs. The recommendations set forth by the AAP, ACEP, and the IOM are vital in solving this problem. Improving the education of physicians in end-of-life care is extremely important. Meeting objectives such as improving and developing clinical knowledge and skills, interpersonal skills and attitudes, ethical principles, and organizational skills can and will help EPs and other team members provide exemplary palliative, end-of-life, and bereavement care to children and families. In addition, creating a family-centered environment in the ED that involves them in the care process can have a positive bereavement effect.

For many families, the process of bereavement after the loss of a child begins in the ED. When a sensitive and understanding environment is provided, the family will truly be in the presence of a system of "care."

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Pediatric Emergency Medicine

AMERICAN COLLEGE OF EMERGENCY PHYSICIANS

Pediatric Emergency Medicine Committee

Death of a Child in the Emergency Department: Joint Statement by the American Academy of Pediatrics and the American College of Emergency Physicians

Note: Please be advised that the American Academy of Pediatrics and the American College of Emergency Physicians are in the process of independently developing technical reports on this issue that will provide more in-depth educational and clinical information for their respective members on the death of a child in the emergency department. When completed, these reports will be published separately by each organization to supplement this joint policy statement.

ABBREVIATION. ED, emergency department.

The death of a child in the emergency department (ED) is an event with emotional, cultural, procedural, and legal challenges that often distinguish it from other deaths.

The American Academy of Pediatrics and the American College of Emergency Physicians support the following principles:

- Emergency physicians should use a family-centered and team-oriented approach when a child dies in the ED.
- Emergency physicians should provide personal, compassionate, and individualized support to families while respecting social, religious, and cultural diversity.
- Emergency physicians should notify the child's primary care physician of the death and, as appropriate, work with the primary care physician in follow-up of postmortem examination results.
- EDs should incorporate procedures to organize resources and staff to provide a coordinated response to a child's death. These include the following:
  - Working with the primary care physician to ensure notification of subspecialty physicians of the death of their patient.
  - Educating staff as to the resources available to assist families.
  - Facilitating identification and management of a medical examiner's case and identification and reporting of cases of child maltreatment.
  - Promulgating liaisons with other individuals and organizations that may assist families, communities, and staff.
  - Assisting ED staff, out-of-hospital providers, and others who are experiencing critical incident stress.
  - Facilitating organ procurement and obtaining consent for postmortem examinations when appropriate.

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TECHNICAL REPORT

Diagnosis of HIV-1 Infection in Children Younger Than 18 Months in the United States

Jennifer S. Read, MD, MS, MPH, DTM&H, and the Committee on Pediatric AIDS

ABSTRACT

The objectives of this technical report are to describe methods of diagnosis of HIV-1 infection in children younger than 18 months in the United States and to review important issues that must be considered by clinicians who care for infants and young children born to HIV-1–infected women. Appropriate HIV-1 diagnostic testing for infants and children younger than 18 months differs from that for older children, adolescents, and adults because of passively transferred maternal HIV-1 antibodies, which may be detectable in the child's bloodstream until 18 months of age. Therefore, routine serologic testing of these infants and young children is generally only informative before the age of 18 months if the test result is negative. Virologic assays, including HIV-1 DNA or RNA assays, represent the gold standard for diagnostic testing of infants and children younger than 18 months. With such testing, the diagnosis of HIV-1 infection (as well as the presumptive exclusion of HIV-1 infection) can be established within the first several weeks of life among nonbreastfed infants. Important factors that must be considered when selecting HIV-1 diagnostic assays for pediatric patients and when choosing the timing of such assays include the age of the child, potential timing of infection of the child, whether the infection status of the child's mother is known or unknown, the antiretroviral exposure history of the mother and of the child, and characteristics of the virus. If the mother's HIV-1 serostatus is unknown, rapid HIV-1 antibody testing of the newborn infant to identify HIV-1 exposure is essential so that antiretroviral prophylaxis can be initiated within the first 12 hours of life if test results are positive. For HIV-1–exposed infants (identified by positive maternal test results or positive antibody results for the infant shortly after birth), it has been recommended that diagnostic testing with HIV-1 DNA or RNA assays be performed within the first 14 days of life, at 1 to 2 months of age, and at 3 to 6 months of age. If any of these test results are positive, repeat testing is recommended to confirm the diagnosis of HIV-1 infection. A diagnosis of HIV-1 infection can be made on the basis of 2 positive HIV-1 DNA or RNA assay results. In nonbreastfeeding children younger than 18 months with no positive HIV-1 virologic test results, presumptive exclusion of HIV-1 infection can be based on 2 negative virologic test results (1 obtained at ≥2 weeks and 1 obtained at ≥4 weeks of age); 1 negative virologic test result obtained at ≥8 weeks of age; or 1 negative HIV-1 antibody test result obtained at ≥6 months of age. Alternatively, presumptive exclusion of HIV-1 infection can be based on 1 positive HIV-1 virologic test with at least 2 subsequent negative virologic test results (at least 1 of which is performed at ≥8 weeks of age) or negative HIV-1 antibody test results (at least 1 of which is performed at ≥6 months of age). Definitive exclusion of HIV-1 infection is based on 2 negative

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Key Words
HIV-1, infants, children, diagnosis, United States

Abbreviations
MTCT—mother-to-child transmission
WHO—World Health Organization
ELISA—enzyme-linked immunosorbent assay
IFA—indirect immunofluorescence assay
FDA—Food and Drug Administration
Ig—immunoglobulin
PCR—polymerase chain reaction
NAAT—nucleic acid amplification test
PBMC—peripheral blood mononuclear cell

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virologic test results, 1 obtained at ≥1 month of age and 1 obtained at ≥4 months of age, or 2 negative HIV-1 antibody test results from separate specimens obtained at ≥6 months of age. For both presumptive and definitive exclusion of infection, the child should have no other laboratory (eg, no positive virologic test results) or clinical (eg, no AIDS-defining conditions) evidence of HIV-1 infection. Many clinicians confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay result at 12 to 18 months of age. For breastfeeding infants, a similar testing algorithm can be followed, with timing of testing starting from the date of complete cessation of breastfeeding instead of the date of birth.

INTRODUCTION

Most children acquire infection with HIV-1 through mother-to-child transmission (MTCT) of the virus.[1] MTCT of HIV-1 can occur in utero, at the time of labor and delivery, and postnatally through breastfeeding.[2] Before treatment or interventions to prevent transmission were available, the rate of MTCT of HIV-1 in the United States was approximately 25%.[3] Major successes have been achieved in prevention of MTCT of HIV-1 in the United States; the MTCT rate has decreased to less than 2%[4] with antiretroviral treatment of HIV-1–infected pregnant women and, for women who do not yet require treatment of their HIV-1 infection, with the use of the following efficacious interventions to prevent transmission: antiretroviral prophylaxis,[3,5–11] cesarean section before labor and before rupture of membranes,[12] and complete avoidance of breastfeeding.[13] The estimated annual number of perinatal HIV-1 infections in the United States has decreased from a peak of 1650 infections in 1991[14] to an estimated 111 infections in 2005.[15] Similarly, the estimated number of perinatally acquired cases of AIDS in the United States peaked in 1992 (945 cases) but subsequently decreased by 95% by 2004 (90 cases).[16]

Despite the dramatic decrease in rate of MTCT of HIV-1 and in the number of pediatric HIV infections and AIDS cases in the United States, MTCT of HIV-1 has not been eradicated in the United States. The timely and accurate determination of the HIV-1 infection status for all children born to HIV-1–infected women is essential. Concomitant with improvements in prevention of MTCT of HIV-1 in the United States, significant advances have been made in the treatment options for HIV-1–infected infants and children. Thus, in contrast to the early years of the epidemic, when therapy for HIV-1 infection was nonexistent or very limited, the outlook today for pediatric patients with HIV-1 infection is much improved. HIV-1 infection now represents, with appropriate therapy, a chronic disease; early antiretroviral treatment allows prolonged symptom-free survival with preservation of immune system function. Exclusion of HIV-1 infection is also important for HIV-1–exposed but uninfected children so that opportunistic infection prophylaxis does not have to be instituted or can be discontinued and so that age-appropriate immunizations for HIV-1–uninfected children can be administered.

Appropriate HIV-1 diagnostic testing for infants and children younger than 18 months differs from that for older children, adolescents, and adults because of passively transferred maternal HIV-1 antibodies, which may be present in the child's bloodstream until 18 months of age. As work progresses on eradication of pediatric HIV-1 infection, knowledge and understanding of the available diagnostic modalities for infants and young children, as well as factors that affect the choice and timing of implementation of such diagnostic methods, is essential for the timely provision of appropriate care for both HIV-1–infected and –uninfected infants and young children. The objectives of this technical report are to describe methods of diagnosis of HIV-1 infection in children younger than 18 months in the United States and to review important issues that must be considered by clinicians who care for infants and young children born to HIV-1–infected women. Obviously, the protection of the privacy of health information as required by state and federal laws, as well as the laws and regulations regarding consent for HIV-1 testing, are important issues, but they are outside the scope of this technical report.

METHODS OF DIAGNOSIS OF HIV-1 INFECTION

Both clinical and laboratory-based methods for the diagnosis of HIV-1 infection in children have been developed. Laboratory-based methods include both immunologic and virologic assays.

Clinical Diagnosis

Beginning in the late 1980s, the World Health Organization (WHO) developed clinical case definitions and clinical staging systems for HIV-1 infection.[17–21] In addition, the WHO and the United Nations Children's Fund developed the "integrated management of childhood illness" strategy to provide guidelines for the diagnosis and management of sick children at the primary care level.[22] However, evaluations of clinical staging systems for the diagnosis of HIV-1 infection in children in sub-Saharan Africa, especially in young infants, have suggested limited sensitivity.[23–25] The WHO has released revised case definitions of HIV-1 infection for surveillance purposes and a revised clinical staging classification of HIV-1–related disease in adults and children.[26] Included in these guidelines are clinical criteria for the presumptive diagnosis of severe HIV-1 disease (among HIV-1–seropositive, HIV-1–exposed children younger than 18 months in situations in which virologic testing is not available) to allow for the early initiation of antiretroviral therapy.

Similarly, in the United States, guidelines for the clinical staging of HIV-1 disease were developed in the early years of the epidemic.[27–29] Subsequently, new definitions

of HIV-1 infection in children were published,[30] including clinical diagnosis of HIV-1 infection (a child younger than 18 months who is born to an HIV-1–infected mother and who meets criteria for diagnosis of AIDS on the basis of the 1987 surveillance case definition[27] is defined as being HIV-1 infected). A clinical classification system for children, originally intended for the classification of severity of HIV infection for surveillance purposes, comprises 4 clinical stages that range from asymptomatic infection to AIDS.[30] However, dependence on clinical signs and symptoms for the diagnosis of HIV-1 infection has been largely superseded in the United States and similar settings because of the availability of laboratory-based methods for diagnosis of HIV-1 infection. With virologic assays, the determination of HIV-1 infection status can be accomplished within the first few weeks of life.

Laboratory-Based Methods of Diagnosis

Laboratory-based methods for the diagnosis of HIV-1 infection can be divided into 2 groups: immunologic and virologic. Immunologic assays detect the antibody response to HIV-1 or the extent to which the immune system has deteriorated as a consequence of HIV-1 infection. Virologic assays detect HIV-1 genetic material or components of the virus. All laboratory tests used for the diagnosis of HIV-1 infection must be confirmed (ie, the diagnosis of HIV-1 infection is never based on only a single test result).

Immunologic Assays

Immunologic assays, which detect the antibody response to HIV-1 and are used as screening tests, include enzyme immunoassays or enzyme-linked immunosorbent assays (ELISAs) as well as rapid serologic tests. A Western blot assay or an indirect immunofluorescence assay (IFA) is used to confirm reactive screening test results. These assays are currently available.

Assays that provide an assessment of immune system abnormalities include $CD4^+$ and $CD8^+$ T-lymphocyte absolute counts and percentages, the $CD4^+/CD8^+$ T-lymphocyte ratio, and other assays. Such assays are not currently used routinely to diagnose HIV-1 infection but have been and are being evaluated for such use.

Detection of HIV-1 Antibodies

Antibodies against HIV-1 are found in essentially all HIV-1–infected individuals. An important exception is HIV-1–uninfected children who are born to HIV-1–infected women; even in the absence of infection with HIV-1, these children may have detectable HIV-1 antibodies until 18 months of age. Situations in which HIV-1–infected individuals fail to produce a detectable antibody response against this virus are unusual but have been observed during the acute ("preantibody" or "window") phase of infection (ie, during the first several weeks after infection) and during the very late stages of HIV-1 infection, when immune suppression is severe.[31]

Enzyme-Linked Immunosorbent Assays In general, an HIV-1 ELISA involves adding a patient's fluid sample to inert substrates that contain HIV-1 antigen.[32] Usually, diluted serum or plasma is used, but assays that use urine and oral fluid are also available. For assays that have been approved by the US Food and Drug Administration (FDA), see www.fda.gov/cber/products/testkits.htm. Positive and negative controls for each ELISA are tested in parallel with patient specimens. If anti–HIV-1 antibody is present in the test sample (primary antibody), it will bind to the HIV-1 antigen on the plate. The plate is then washed, and an enzyme-labeled secondary antibody ("conjugate") is added and will bind to human antibody. A chromogenic chemical substrate is applied, which is modified by the enzyme, resulting in a color change in an inert substrate (eg, microtiter well or physical strip/spot). In the case of a microtiter well-based assay, a spectrophotometer measures the resultant optical density. In this situation, a positive, or reactive, ELISA result occurs if the optical density of a patient sample microtiter well significantly exceeds the value calculated as the "cutoff" value. The microtiter optical density cutoff value is determined by using specific algorithms particular to each test kit method, but all kits use, to some degree, the optical density of the parallel negative controls as part of their calculations. As noted above, any ELISA with a reactive (positive) result should be repeated on the same blood sample, and if the result of the ELISA is repeatedly reactive, then the result is confirmed with a Western blot or IFA (see "Indirect Immunofluorescence Assays"). In general, a negative result with the ELISA requires no further confirmatory testing, although for persons suspected of being in the preantibody or window period of early HIV-1 infection, virologic assays (see "Virologic Assays") could be performed or follow-up testing with ELISAs could be performed at a later date.

False-negative results can occur among individuals who are HIV-1–infected but have not yet begun to produce antibodies against HIV-1 (ie, within the first 6 weeks of infection, including those with clinical signs and symptoms of the acute retroviral syndrome)[33] or among individuals in the late stages of HIV-1 infection with concomitant hypogammaglobulinemia. It is important to note that false-positive ELISA results can occur among individuals with immune stimulation (eg, among those with acute [non–HIV-1] viral infections or autoimmune disorders, among pregnant women, and among recipients of multiple transfusions).[32] Finally, because of transplacental transfer of maternal immunoglobulin G (IgG) antibody, children born to HIV-1–infected women are seropositive (even if the child is not HIV-1–infected). Therefore, a positive ELISA result in a child younger than 18 months must be confirmed virologically (see "Virologic Assays") before the child can be considered

HIV-1–infected. (However, a positive ELISA result confirms that the child was exposed to HIV-1.) There are no reliable HIV-1–specific antibody assays to differentiate between maternal and autologous antibody in the child.

ELISAs are less expensive than virologic assays, and they can be readily used for testing large batches of samples. However, their use in batch testing means that, generally, there is a delay of up to 1 week in obtaining test results, depending on the laboratory system used, and such delays often preclude their use in settings such as labor-and-delivery units. This factor was one impetus for the development of the rapid antibody tests described in the next section.

Rapid Tests A number of rapid serologic tests for detection of IgG antibodies against HIV-1 are now available (for assays that have been approved by the FDA, see www.fda.gov/cber/products/testkits.htm). Such assays are based on 1 of 4 principles: particle agglutination, immunodot (dipstick), immunofiltration, or immune chromatography.[32] For example, test kits that include HIV-1 antigens attached to a test strip allow detection of HIV-1 antibodies, if present in the test fluid sample (oral fluid, whole blood, serum, or plasma), through a rapid, visually interpreted color change. Rapid HIV-1 antibody tests are comparable to ELISAs in both sensitivity (99.3%–100%) and specificity (98.6%–100%).[34] They require no special instrumentation outside of the test kit, and results can be available in as little as 20 to 30 minutes. Some of these kits are licensed for point-of-care testing so that clinics without extensive laboratory facilities (but that meet state and federal standards and have appropriately trained personnel) can perform the tests on-site and report the result to the patient immediately. As with routine ELISAs, confirmation of positive results is necessary, but confirmation of a negative result is not. Note that ELISAs cannot be used to "confirm" a rapid-test result, and all reactive rapid HIV-1 test results should be confirmed with either a Western blot or an IFA.[35]

Semiquantitative Antibody Assays Traditional HIV-1 antibody assays have been modified to produce a semiquantitative value. Semiquantitative HIV-1 antibody assays evaluate the quantity of antibody and not simply its presence or absence. Thus, HIV-1–uninfected infants and young children would have decreasing quantities of maternal antibody as more time elapses after birth. Conversely, HIV-1–infected children would lack evidence of such a decrease in the quantity of antibody (because although maternal antibodies against HIV-1 will decay over time, the child will begin to produce antibodies against HIV-1). Although such assays have been advocated for the diagnosis of HIV-1 infection in pediatric patients in resource-limited settings,[36] they have not been incorporated into routine HIV-1 diagnostic algorithms for infants and young children in the United States (because the optimal performance characteristics of such assays generally do not become apparent until late infancy).

Western Blot Assays An immunoblot assay, such as a Western blot assay, typically is used to confirm a reactive ELISA or rapid serologic test result as being truly positive. The Western blot assay detects and visualizes the presence of antibodies against specific HIV-1 proteins (structural and enzymatic).[32] HIV-1 proteins are separated according to their molecular weight by electrophoresis and transferred electrophoretically to a membrane. The subsequent steps are similar to those of the ELISAs. A patient's fluid sample (usually diluted serum or plasma, but assays that use urine and oral fluid are also available; for assays approved by the FDA, see www.fda.gov/cber/products/testkits.htm) is added to the membrane and incubated. If the patient's sample contains antibodies against any of the blotted HIV-1 proteins, these antibodies will bind to them in the areas where the respective proteins are located on the membrane. If antigen-antibody binding takes place, it can be visualized by an enzyme-labeled reaction that involves an anti-Ig (causing visible "bands" to appear on the membrane where the antibody bound the protein).

Different organizations have developed criteria for interpretation of HIV-1 Western blot assay results on the basis of the pattern of bands observed. HIV-1 proteins and their corresponding bands on the Western blot are designated as "p" (protein) or "gp" (glycoprotein), along with molecular weight in kilodaltons. There are 3 groups: envelope (env) glycoproteins (gp41, gp120, gp160), nuclear (gag) proteins (p18, p24/25, p55), and endonuclease-polymerase (pol) proteins (p31/p34, p40, p51/p52, p65/p68). According to the criteria of the Association of State and Territorial Public Health Laboratory Directors,[37] a positive assay result is one that indicates the presence of antibodies to any 2 of the following proteins: p24, gp41, or gp120/gp160. An assay result that indicates no reactivity against any HIV-1 proteins is interpreted as being negative. An assay result that shows reactivity against 1 or more of the HIV-1 proteins but not those required for a positive assay result is interpreted as being indeterminate.

Western blot assays are only performed as confirmation of a repeatedly reactive screening result (ELISA or rapid antibody test). A negative Western blot assay result indicates that the positive ELISA or rapid-test result represents a false-positive result and that the patient does not have HIV-1 antibodies. A positive Western blot assay result confirms the presence of HIV-1 antibodies; thus, in individuals older than 18 months, it is diagnostic of HIV-1 infection. A positive HIV-1 antibody assay result followed by an indeterminate Western blot assay is compatible with (1) an HIV-1–infected child with early HIV-1 infection (before the full range of HIV-1 antibodies have developed), and follow-up HIV-1 diagnostic tests (virologic assays and/or Western blot assay results)

4 weeks later would be positive; (2) an HIV-1–uninfected child, with false-positive ELISA or rapid-test results originally and repeat ELISA/Western blot assays performed 4 weeks later that give the same results as originally obtained and with negative virologic assay results; or (3) an HIV-1–uninfected child with gradual loss of passively acquired maternal HIV-1 antibodies.

Indirect Immunofluorescence Assays The IFA can be used as a confirmatory test for HIV-1 infection. This assay is simple to perform and is less time consuming and less expensive than many Western blot assays. However, it does require an expensive fluorescence microscope and experienced laboratory personnel to read and interpret the results. The IFA is similar to the ELISA. A microscope slide that contains cells (usually human T lymphocytes) that have been infected with HIV-1 is used. There is a control that consists of uninfected cells. The infected and control cells are attached (fixed) onto the slide in specific areas (wells). Test serum is added to each well. The slides are incubated, usually for 30 minutes, which allows specific antibody (if present) to attach to viral antigens in the infected cells. The slides are then washed and dried. Anti-human Ig labeled with a fluorochrome (a substance that fluoresces when exposed to ultraviolet light) is added and will bind to HIV-1 antibodies if present in the sample. If the slide exhibits cytoplasmic fluorescence, it is considered to be a positive (reactive) result, which indicates that HIV-1 antibodies are present.[33]

Immune System Deterioration as a Consequence of HIV-1 Infection

Flow cytometry for immunophenotyping of lymphocytes is widely available in the United States. This method permits the enumeration of T-cell lymphocytes into $CD4^+CD3^+$ T-helper cells and $CD8^+CD3^+$ T-suppressor cells. The hallmark of progression of HIV-1 infection is depletion of $CD4^+$ T lymphocytes, the major cellular target of HIV-1 in humans. Differences in $CD4^+$ T-lymphocyte counts between HIV-1–infected and –uninfected infants may be detectable soon after birth.[38] However, HIV-1–infected infants may maintain normal $CD4^+$ T-lymphocyte absolute counts and percentages throughout infancy. The $CD4^+$ T-lymphocyte percentage was evaluated as a surrogate marker of HIV-1 infection in west Africa, but the sensitivity of this marker was only 87% to 88% at 3 to 6 months of age.[39]

As $CD4^+$ T-lymphocyte depletion progresses, the ratio of $CD4^+$ to $CD8^+$ T lymphocytes decreases. A study explored the possibility of using $CD4^+$ T-lymphocyte counts, $CD8^+$ T-lymphocyte counts, and the $CD4^+/CD8^+$ T-lymphocyte ratio to distinguish between HIV-1–infected and –uninfected infants.[40] In this study, infants who had positive results of HIV-1 DNA polymerase chain reaction (PCR) testing had lower $CD4^+$ T-lymphocyte counts, higher $CD8^+$ T-lymphocyte counts, and lower $CD4^+/CD8^+$ T-lymphocyte ratios compared with infants who had negative results of HIV-1 DNA PCR testing. Additional evaluations of the $CD4^+/CD8^+$ T-lymphocyte ratio as a diagnostic modality have been conducted.[41,42,43] Thus, this method of diagnosis of HIV-1 infection remains investigational.

Other immunologic differences between HIV-1–infected and –uninfected children, which may serve as the basis for diagnostic testing in the future, have been investigated. HIV-1 infection in infants is associated with certain phenotypic markers of lymphocyte activation and differentiation. For example, HIV-1–uninfected infants have higher $CD3^+$, $CD4^+$, and naive $CD4^+$ T-lymphocyte counts, whereas HIV-1–infected infants have higher total $CD8^+$, $CD8DR^+$, $CD45RA\text{-}DR^+$, and $CD28\text{-}DR^+$ T-lymphocyte counts.[44] Also, total IgG, IgA, and IgM concentrations are significantly higher among HIV-1–infected children than among HIV-1–uninfected children, although individual HIV-1–infected children may have normal concentrations.[38]

Virologic Assays

The life cycle of HIV-1[45] begins with attachment of viral particles to cells via $CD4^+$ T-lymphocyte receptors and various coreceptors. After entry into the cell, the virus uncoats. A DNA copy of the RNA genome is produced by the viral-encoded reverse transcriptase. The DNA provirus can either integrate into the host cell genome or it can remain unintegrated in the cytoplasm. Replication of HIV-1 does not occur until the provirus is integrated into the host cell genome and the cell becomes activated either in vivo or in vitro. In vitro activation can occur through the use of various agents, including interleukin 2. Mature viral particles are produced from RNA copies of integrated proviral sequences. Ultimately, budding of mature virions occurs at the cell surface. Virologic tests for the diagnosis of HIV-1 infection encompass culturing of the virus, using nucleic acid amplification tests (NAATs [ie, tests that detect HIV-1 nucleic acids such as HIV-1 DNA or HIV-1 RNA]), and testing for components of the virus (eg, assays for a viral capsid protein [p24 antigen]). Advantages and disadvantages of each of these diagnostic modalities are shown in Table 1.

HIV-1 Culture

HIV-1 culture involves incubating peripheral blood mononuclear cells (PBMCs) from a patient with in vitro–activated PBMCs from an HIV-1–uninfected volunteer and culturing for up to 6 weeks.[46] The culture medium contains interleukin 2, which maintains the target PMBCs in an activated state susceptible to viral infection and replication. Therefore, high levels of viral replication occur within the target PBMCs if infectious HIV-1 is present. Measurement of p24 antigen in the culture supernatant using ELISA allows assessment of the growth of HIV-1 in the PBMCs. The culture is classified as positive for HIV-1 if a significant amount of p24

TABLE 1 **Advantages and Disadvantages of Virological Diagnostic Assays for HIV-1 Infection**

Diagnostic Assay	Advantages	Disadvantages
Culture	Previously considered the gold standard for diagnosis of HIV-1 infection in infants	Labor intensive Requires special laboratory and equipment 2–3 wk required for determination of a positive assay result Expensive Potential biohazard
DNA assays	Most experience to date for diagnosis of HIV-1 infection in infants and young children	Costly Require special equipment, experienced laboratories, trained personnel False-positive results if laboratory contamination occurs Not currently licensed for use in diagnosing HIV-1 infection
RNA assays	Widely available Short turnaround time	Costly Require special equipment, experienced laboratories, trained personnel Low copy numbers (eg, <10 000 copies per mL) may represent false-positive results Not currently licensed for use in diagnosing HIV-1 infection
p24 Antigen assays	More affordable and easier to perform than the other assays	Requires specific equipment, trained personnel

antigen is detected (usually defined as ≥30 pg/mL) and demonstrates significantly increasing concentrations of p24 antigen over subsequent culture supernatant fluid collection time points. The use of viral culture for the diagnosis of HIV-1 infection in infants and young children has been studied extensively.[47–52] Although previously considered the gold standard of HIV-1 diagnostic assays for infants and young children, the disadvantages of viral culture (ie, that it is labor intensive, time consuming, costly, and poses a biohazard risk) are now generally considered to outweigh its advantages. HIV-1 culture has limited availability, and its routine use in the clinical care of HIV-1–exposed infants and young children has been supplanted by HIV-1 NAATs.

HIV-1 NAATs

HIV-1 NAATs that detect viral RNA or proviral DNA are the most widely used assays for diagnosis of children younger than 18 months. Because viral nucleic acid may be present in very small quantities in test samples, NAATs are used to increase the amount of HIV-1 proviral DNA or HIV-1 RNA, or the amount of positive signal, in a test sample.

HIV-1 DNA Assays Amplification of proviral DNA allows detection of cells that harbor quiescent provirus as well as cells with actively replicating virus. HIV-1 DNA PCR assays involve separating double-stranded DNA located in PBMCs from the test sample into 2 single strands by heating.[53,54] On cooling, the HIV-1 DNA strands reanneal with complementary nucleotide sequences of HIV-1–specific primers in the reagent mixture, which allows synthesis of new complementary DNA strands. After 1 heating and cooling cycle, the number of DNA strands that contain the HIV-1 proviral sequence that originated in the test sample has doubled, and through repetition of these steps numerous times, amplification of the HIV-1 proviral DNA from the test sample proceeds in a logarithmic manner. After a set number of amplification steps, HIV-1 proviral sequences are detected by hybridizing amplified DNA to a synthetic, enzyme-labeled HIV-1 DNA probe. A positive result is indicated by a color change in a chromogenic substrate. The sensitivity of HIV-1 DNA assays for the diagnosis of HIV-1 infection in infants and young children has been evaluated (Table 2) in several studies[51,52,55–62] and meta-analyses,[63,64] with estimates as high as 90% to 100% by 1 month of age.[51,56,59] Similarly high specificity has been observed by 1 month of age in nonbreastfed infants.[51,55,56,59]

HIV-1 RNA Assays HIV-1 RNA assays detect plasma (cell-free) viral RNA by using different techniques. Methods of amplification of HIV-1 RNA include target (nucleic acid sequence-based amplification and reverse-transcriptase PCR) and signal (branched-chain DNA) amplification techniques. For HIV-1 RNA assays approved by the FDA, see www.fda.gov/cber/products/testkits.htm. In the nucleic acid sequence-based amplification assay, quantitation of HIV-1 RNA is achieved with internal calibrators, which are amplified along with the patient's sample. As part of the branched-chain DNA assay, a light-emitting chemical reaction occurs, with the amount of light produced being proportional to the amount of RNA in the sample. In reverse-transcriptase PCR, reverse transcriptase is used to convert RNA into DNA; subsequently, amplification is performed by PCR.

TABLE 2 **Sensitivity and Specificity of HIV-1 DNA Assays**

Author (Year)	Age of Child	Sensitivity			Specificity		
		No.	%	95% Confidence Interval	No.	%	95% Confidence Interval
Kline et al[51] (1994)	Birth (75% cord blood)	5	100	—	26	96	—
	1 mo	2	100	—	5	100	—
	2 mo	3	100	—	8	100	—
	3 mo	2	100	—	11	100	—
	4 to 6 mo	7	86	—	18	78	—
Kovacs et al[55] (1995)	Cord blood	10	60	26–88	33	94	80–99
	0 to 2 d	15	40	16–68	41	100	91–100
	3 to 14 d	9	67	30–92	21	100	84–100
	15 to 30 d	5	80	28–99	24	100	86–100
	>1 to ≤2 mo	11	100	72–100	33	100	89–100
	>2 to ≤6 mo	39	95	83–99	170	99	97–100
	>6 mo	316	97	95–99	337	99	97–100
Bremer et al[56] (1996)	0 to 7 d	21	29	11.3–42.2	66	100	94.5–100
	1 mo	26	92	74.9–99.0	86	100	95.8–100
	2 mo	29	90	72.7–97.8	105	98	93.3–99.8
	4 mo	29	93	77.2–99.2	111	96	91.0–99.0
	6 mo	27	100	87.2–100	109	95	89.6–98.5
	9 to 12 mo	27	96	81.0–99.9	133	95	90.4–98.3
	15 to 36 mo	64	97	89.2–99.6	249	97	94.3–98.9
	1 to 36 mo (overall)	200	95	92.7–97.9	793	97	96.8–98.8
Kuhn et al[57] (1996)	Birth	—	22	—	—	—	—
	4 d	—	42	—	—	—	—
	7 d	—	55	—	—	—	—
	14 d	—	73	—	—	—	—
	21 d	—	90	—	—	—	—
Nelson et al[58] (1996)	0 to 7 d	5	20	—	28	96.4	—
	8 d to 6 mo	38	100	—	111	100	—
	7 to 15 mo	16	93.7	—	30	100	—
	16 to 24 mo	9	77.8	—	6	100	—
	>24 mo	37	94.6	—	6	100	—
	0 to 15 mo	59	91.5	—	169	99.4	—
	0 to 24 mo	68	89.7	—	175	99.4	—
	All age groups	105	91.4	—	181	99.4	—
Cunningham et al[59] (1999)	≤1 wk	2	50	—	43	100	—
	1 to 3 wk	9	22.2	—	16	100	—
	4 to 6 wk	26	96.2	—	45	100	—
	≥7 wk	95	100	—	47	100	—
	Overall	132	93.2	—	152	100	—
Lambert et al[52] (2003)	Birth	19	10.5	—	100	100	—
	6 wk	18	83.3	—	100	99	—
	24 wk	6	66.7	—	100	100	—
Puthanakit et al[60] (2003)	4, 6, or 9 mo	15	100	—	70	98.4	—
Sherman et al[61] (2005)	6 wk	58	98.8	98.0–99.5	469	99.4	98.9–99.9
Sherman et al[62] (2005)	6 wk	25	100	—	263	99.6	—

— indicates that data were not available.

These assays are available as "standard" or "ultrasensitive" assays, and the lower limit of detection possible when using the ultrasensitive assays is in the range of 50 to 75 HIV-1 copies per mL of plasma.

Numerous studies of the use of HIV-1 RNA assays for the diagnosis of HIV-1 infection in pediatric populations have been conducted,[52,59,65–75] with the reported sensitivity of testing (Table 3) for such assays ranging from 25% to 50% within the first few days of life to 100% by 6 to 12 weeks of age.[65,67] HIV-1 RNA assays have been assessed to be at least as sensitive as, or more sensitive than, HIV-1 DNA assays among young infants.[52,59,66–68,71] Similarly high specificity by 6 to 12 weeks of age (as compared with HIV-1 DNA assays or HIV-1 culture) has been observed among nonbreastfed infants.[52,59,65,68,72]

HIV-1 RNA assays are now commonly used to diagnose HIV-1 infection in infants. HIV-1 RNA assays are often more readily available than HIV-1 DNA assays because of the common use of RNA assays in follow-up testing of patients during treatment for HIV-1 infection. When HIV-1 RNA quantitative assays are used for diagnosis of infants and young children, a plasma viral load of ≥10 000 copies per mL is generally required before

TABLE 3 **Sensitivity and Specificity of HIV-1 RNA Assays**

Author (Year)	Age of Child	Sensitivity			Specificity		
		No.	%	95% Confidence Interval	No.	%	95% Confidence Interval
Delamare et al[65] (1997)	0 to 10 d	48	25	13–37	48	100	96–100
	10 d to 3 mo	39	100	95–100	47	98	94–100
Simonds et al[67] (1998)	<7 d	34	38	22–56	80	99	—
	7 to 41 d	58	97	88–100	144	99	—
	42 to 93 d	39	95	83–99	24	100	—
Cunningham et al[59] (1999)	≤1 wk	2	50	—	43	93	—
	1 to 3 wk	9	66.7	—	16	100	—
	4 to 6 wk	26	96.2	—	45	95.6	—
	≥7 wk	95	100	—	47	97.9	—
	Overall	132	96.2	—	152	96.1	—
Young et al[69] (2000)	Birth	53	47	33–61	100	100	96–100
	2 mo	47	100	92–100	—	—	—
	6 mo	35	100	90–100	100	100	96–100
Lambert et al[52] (2003)	Birth	15	26.7	—	100	100	—
	6 wk	19	94.7	—	100	100	—
	24 wk	7	85.7	—	100	100	—
Neisheim et al[72] (2003)	0 to 7 d	14	29	—	7	100	—
	8 to 28 d	19	79	—	11	100	—
	29 to 60 d	34	91	—	42	93	—
	61 to 120 d	26	96	—	52	100	—
	120 to 180 d	28	97	—	13	100	—

— indicates that data were not available.

the assay result is interpreted as being positive. Infants with untreated HIV-1 infection typically have extremely high viral loads (eg, >100 000 copies per mL), and many experts agree that HIV-1 RNA assay results of <10 000 copies per mL should not be interpreted as being definitively positive when used for diagnosis of HIV-1 in infancy, and the assay should be repeated on a plasma sample obtained through a separate venipuncture or fingerstick procedure to confirm that such a low-level positive result is a true-positive result.

p24 Antigen Assays

The viral protein p24 exists either bound to anti-p24 antibody or unbound (free) in the bloodstream of HIV-1–infected individuals. Many studies of p24 antigen for diagnosis of HIV-1 infection have been conducted over the past several years,[49,76–93] with the sensitivity of the assay increasing with increasingly effective techniques used to dissociate p24 antigen from anti-p24 antibody (immune complex–dissociated p24 antigen detection).[94] In general, p24 antigen assays have been used much less frequently than HIV-1 DNA- or RNA-amplification techniques for diagnosis of HIV-1 infection because of the relatively poor sensitivity of p24 antigen assays and the absence of readily available commercial, FDA-approved reagents. It should be noted that the ultrasensitive p24 antigen assay performed on plasma samples for diagnostic purposes has a sensitivity of 97% to 100% within the first 6 months of life.[81,85,89,92] However, this assay has not yet been widely recommended for identification or exclusion of HIV-1 infection in infants in the United States, but it may have a role in infant diagnosis in resource-limited settings.

FACTORS THAT AFFECT CHOICE AND TIMING OF USE OF DIAGNOSTIC MODALITIES

Several important factors must be considered when choosing HIV-1 diagnostic assays for pediatric patients and when to use them. Such factors include the age of the child, the potential timing of infection of the child, whether the infection status of the child's mother is known or unknown, the antiretroviral exposure history of the mother and of the child, and characteristics of the virus.

Age of the Child

As alluded to previously, serologic testing for HIV-1 in infants and young children born to HIV-1–infected women must be interpreted with caution because of transplacental transfer of maternal HIV-1 antibody.[95] Studies of the decay of maternally derived antibodies to HIV-1 indicate that most children serorevert (ie, lose maternal antibodies) by 12 months of age.[96–99] However, the median time to loss of maternal antibody has varied in different studies, with numbers of subjects ranging from 40 to 520 (eg, 7 months,[100] 11.6 months,[101] and 13.3 months[102]), and a small proportion of uninfected children remained HIV-1 antibody-positive at 15 months[98] or 18 months.[96] Therefore, loss of maternal antibody (seroreversion) as an HIV-1–exposed child

grows older is informative (because it indicates the absence of HIV-1 infection), but HIV-1 seropositivity in a child younger than 18 months is not diagnostic (because a positive antibody test result during the first 18 months of life could represent either persistent maternal antibody in an HIV-1–uninfected child or antibody newly produced by an HIV-1–infected child). Thus, serologic testing of a child younger than 18 months generally cannot be used to diagnose HIV-1 infection; therefore, virologic assays are required. (However, a positive antibody test result in the infant generally indicates maternal HIV-1 infection.)

Potential Timing of Infection of the Child

Infants who are presumed to have been infected with HIV-1 in utero may have detectable virus at birth, whereas infants presumed to have been infected around the time of delivery may not have detectable virus until days or weeks after birth.[103] Thus, in nonbreastfeeding populations, an accurate diagnosis of HIV-1 infection among children of HIV-1–infected women can be made during the first few weeks of life with virologic assays. The sensitivity of testing depends on the timing of the test; sensitivity increases with increasing age of the infant. It has been recommended[104] that diagnostic testing with HIV-1 DNA or RNA assays be performed within the first 14 days of life, at 1 to 2 months of age, and at 3 to 6 months of age. Furthermore, if any of these test results are positive, repeat testing is recommended to confirm the diagnosis of HIV-1 infection. A diagnosis of HIV-1 infection can be made on the basis of 2 separate positive HIV-1 DNA or RNA assay results.[105] The Centers for Disease Control and Prevention recently revised its surveillance definition for defining lack of HIV-1 infection in an HIV-1–exposed infant. In nonbreastfeeding children younger than 18 months with no positive HIV-1 virologic test results, presumptive exclusion of HIV-1 infection can be based on 2 negative virologic test results (1 obtained at ≥2 weeks and 1 obtained at ≥4 weeks of age); 1 negative virologic test result obtained at ≥8 weeks of age; or 1 negative HIV-1 antibody test result obtained at ≥6 months of age. Alternatively, among children with 1 positive HIV-1 virologic test result, presumptive exclusion of HIV-1 infection can be based on at least 2 subsequent negative virologic test results (at least 1 of which is performed at ≥8 weeks of age). Finally, children can be considered presumptively uninfected with negative HIV-1 antibody test results (at least 1 of which is performed at ≥6 months of age). Definitive exclusion of HIV-1 infection is based on 2 negative virologic tests (1 obtained at ≥1 month of age and 1 obtained at ≥4 months of age) or 2 negative HIV-1 antibody tests from separate specimens obtained at ≥6 months of age. For both presumptive and definitive exclusion of infection, the child should have no other laboratory (eg, no positive virologic test results) or clinical (eg, no AIDS-defining conditions) evidence of HIV-1 infection.[106] Many clinicians confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay result at 12 to 18 months of age.

The diagnosis of HIV-1 infection among infants and young children with a history of breastfeeding is more difficult because of continuing exposure to the virus postnatally. The exclusion of HIV-1 infection among breastfeeding infants and young children cannot be definitively accomplished until after cessation of breastfeeding. There is no consensus on the best approach to testing for HIV-1 infection after breastfeeding has stopped. Some clinicians use an HIV-1 diagnostic testing algorithm similar to that suggested for nonbreastfed infants, with timing of testing based on the date of complete cessation of breastfeeding instead of the date of birth (ie, testing at the time breastfeeding has stopped, again 1–2 months after cessation, and again 3–6 months after cessation), with confirmation of the absence of HIV-1 infection by negative HIV-1 antibody assay results at 12 to 18 months of age; serologic testing should be performed at least 6 months after complete cessation.

Maternal HIV-1 Infection Status

The diagnostic approach to an infant or young child differs according to whether the mother's HIV-1 infection status is known. Children of HIV-1–infected women have maternal antibodies to HIV-1 during the first months of life, and these children may remain HIV-1–seropositive until 18 months of age. Therefore, serologic testing (except if the test result is negative) is not informative in children younger than 18 months, but does reflect the serostatus of the mother. Virologic testing generally is required to determine the HIV-1 infection status of the child.

Women of unknown HIV-1 serostatus and their newborn infants can undergo rapid HIV-1 testing in the peripartum period to ascertain the HIV-1 infection status of the woman and the HIV-1–exposure status of the infant.[107] It is recommended that rapid testing be available at all hospitals that serve pregnant women and that prompt testing using the rapid HIV-1 antibody assays be performed for pregnant women or infants of unknown HIV-1 serostatus.[108]

Rapid HIV-1 antibody testing should be completed and results should be available quickly, because the effectiveness of postexposure prophylaxis administered to the infant (if the mother did not receive prophylaxis) is greatest if initiated within the first 12 hours of life.[109] If the rapid-test result is positive during the intrapartum or immediate postpartum period, antiretroviral prophylaxis can be administered to the mother and/or infant. Subsequent to initiation of antiretroviral prophylaxis, confirmatory testing for HIV-1 infection can be performed. If the confirmatory test result is ultimately negative (suggesting that the initial rapid HIV-1 antibody test result was a false-positive), prophylaxis can then be discontinued. If the confirmatory test result is positive, HIV-1

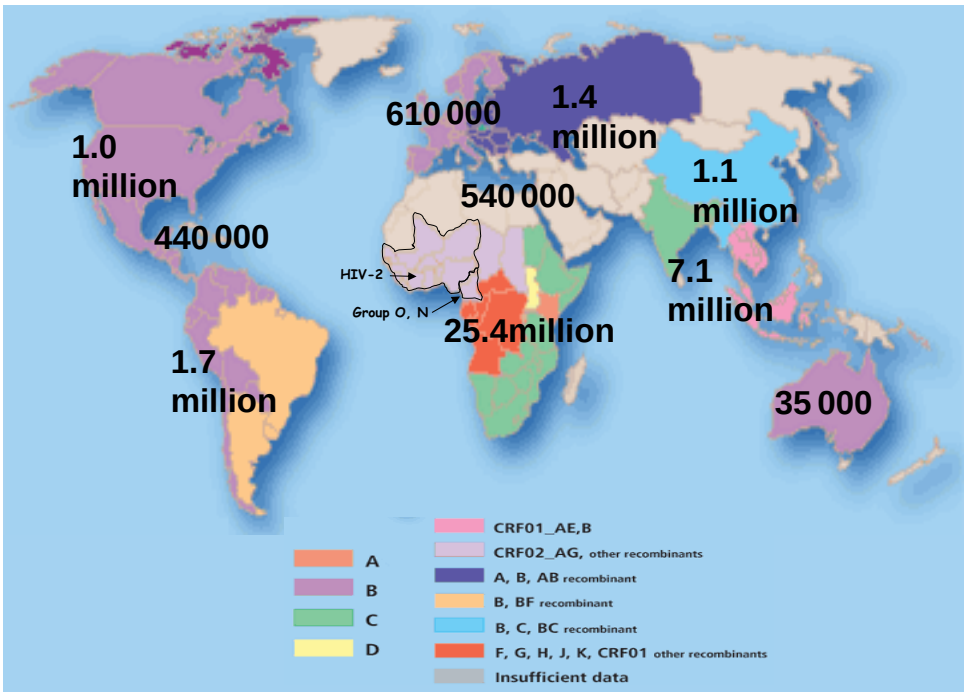

FIGURE 1

Global HIV prevalence and distribution. The estimated numbers of HIV-1–infected individuals in North America, western Europe, central Asia, east Asia, southeast Asia, north Africa and the Middle East, sub-Saharan Africa, and Australia are indicated. The colors depict regional patterns of HIV variation as follows: subtype A in east Africa; subtype B in the Americas, Europe, and Australia; subtype C in southern and eastern Africa and in India; subtype D in east Africa; CRF01_AE and subtype B in southeast Asia; CRF02-AG and other recombinants in west Africa; A, B, and AB recombinants in central Asia; subtype B and BF recombinants in South America; subtypes B and C and BC recombinants in east Asia; rare subtypes, CR01_AE, and other recombinants in central Africa and areas in which there are insufficient data. The principal concentrations of HIV-1 groups O and N in Cameroon, and of HIV-2 in west Africa, are indicated by arrows. (Reproduced with permission from McCutchan FE. Global epidemiology of HIV. *J Med Virol.* 2006;78(suppl1):S8)

infection in the mother and HIV-1 exposure in the child are confirmed. In this situation, antiretroviral prophylaxis is continued, and additional testing is indicated (as described previously).

Antiretroviral Exposure History of the Mother and Child

There are limited published data regarding what effect, if any, maternal and/or infant antiretroviral exposure has on the results of HIV-1 diagnostic testing with NAATs. HIV-1 DNA has remained detectable in PBMCs and lymphoid tissues of HIV-1–infected children despite years of exposure to antiretroviral agents and even when HIV-1 RNA assay results have been negative.[110] In some studies, detection of virus with DNA PCR assays has been reported not to vary according to receipt of maternal or infant antiretroviral prophylaxis.[111] However, a study by Prasitwattanaseree et al[112] suggested that the age at which HIV-1 infection was detectable (by using a DNA PCR assay) among 98 HIV-1–infected infants depended on the duration of exposure to zidovudine by the mother and the infant. Detectable infection at birth was less frequent among children with a longer maternal duration of zidovudine receipt. Among mothers with a short duration of zidovudine receipt, infants who received a long duration of zidovudine were diagnosed later than those who received a short duration. To date, studies have suggested that maternal and infant receipt of perinatal transmission prophylaxis with zidovudine or nevirapine does not decrease the sensitivity of HIV-1 RNA PCR assays performed during the first 6 months of age.[68,72] More research is needed to answer the question of whether the antiretroviral exposure history of the mother or the child affects the results of HIV-1 diagnostic testing with NAATs.

Characteristics of the Virus

HIV-1 viruses are classified into 3 groups; the main group (group M) accounts for at least 90% of HIV-1 infections around the world[113] (Fig 1). The other groups are the outlier group (group O) and the non-M/non-O group (group N).[114] Within group M, clusters of related viral strains are classified into subtypes (clades): subtypes A, B, C, D, E, F, G, K, and O. More than 50% of HIV-1 infections globally are caused by subtype C viruses, which predominates in sub-Saharan Africa and India. Subtypes A and B also account for large proportions of infections worldwide. Subtype B viruses predominate in North America and Europe. In addition to these subtypes, recombinant viruses (for example, BC recombinant viruses) exist. Group O infections seem to be localized to western and central Africa. Infections with group N virus are extremely rare.

An estimated 16.7% of infants in whom HIV-1 was diagnosed in New York State between 2001 and 2002

had infections with non–subtype B strains.[115] False-negative results on HIV-1 DNA assays in infants and young children infected with non–subtype B viruses have been reported.[116–119] Therefore, it has been recommended that, for young children undergoing HIV-1 diagnostic testing who were born to HIV-1–infected mothers whose HIV-1 infection may have originated outside of Europe or the United States, a sample from the mother be tested with a virologic assay at the same time as a sample from the child.[116] The child's assay results can be interpreted only if the maternal test result is positive for HIV-1. Because maternal virus could exist as multiple, perhaps recombinant "quasi species," only 1 of which is transmitted to the child, this approach may not identify all HIV-1–infected children with subtypes other than B. Assays for amplification of HIV-1 proviral DNA or RNA that are sensitive to group O viruses and/or to group M/non-B subtypes have been developed.[68,117,120–122] Although HIV-1 DNA PCR assays optimized for non-B subtype HIV-1 have had limited availability in the United States, the availability has improved recently. Because HIV-1 RNA assays are, in general, more widely availability in formats optimized to identify non-B subtype HIV-1 infection, one of the commercially available RNA assays may be preferable to HIV-1 DNA PCR for identification of the child with non-B subtype HIV-1 infection.

In addition to HIV-1, another human retrovirus associated with AIDS is HIV type 2 (HIV-2). In terms of the more conserved *gag* and *pol* genes, the 2 viruses share approximately 60% overall nucleic acid sequence homology. Otherwise, the 2 viruses share 30% to 40% homology.[123] Similar to HIV-1, there are different subtypes of HIV-2 (subtypes A, B, C, D, E, F, and G), although only HIV-2 subtypes A and B seem to be established significantly in human populations.[124] Although HIV-1 is the major cause of AIDS in the United States and elsewhere in the world, HIV-2 is most prevalent in west Africa. Therefore, most HIV infections in the United States are HIV-1 infections, but HIV-2 infections can be encountered in pediatric practice in the United States (although MTCT of HIV-2 occurs less frequently than MTCT of HIV-1, largely because of the lower maternal viral loads with HIV-2 infection).[125] Whether a specific HIV-1 diagnostic assay is also able to detect HIV-2 infection becomes important in the evaluation of infants and young children who are born to women who may have acquired HIV infection in west Africa. Both virologic[126,127] and serologic assays for the diagnosis of HIV-2 infection have been developed. For HIV-2 diagnostic assays (as well as combined HIV-1 and HIV-2 assays) approved by the FDA, see www.fda.gov/cber/products/testkits.htm.

CONCLUSIONS

Appropriate HIV-1 diagnostic testing for infants and children younger than 18 months differs from that for older children, adolescents, and adults because of passively transferred maternal HIV-1 antibodies, which may be detectable in the child's bloodstream until 18 months of age. Therefore, routine serologic testing of these infants and young children is generally only informative before 18 months of age if the test result is negative. Virologic assays, especially HIV-1 NAATs, such as HIV-1 DNA PCR assays, represent the gold standard for diagnostic testing of infants and children younger than 18 months. With such testing, the diagnosis of HIV-1 infection (as well as the presumptive exclusion of HIV-1 infection) can be established within the first several weeks of life among nonbreastfed infants. Important factors that must be considered when selecting HIV-1 diagnostic assays for pediatric patients and when choosing the timing of such assays include the age of the child, the potential timing of infection of the child, whether the infection status of the child's mother is known or unknown, the antiretroviral exposure history of the mother and the child, and characteristics of the virus.

In infants and young children of HIV-1–infected women, HIV-1 antibody testing of the child is not helpful around the time of birth (because the result will be reactive because of passively acquired maternal antibody). However, if the mother's HIV-1 serostatus is unknown, rapid HIV-1 antibody testing of the mother or the newborn infant to identify HIV-1 exposure of the infant is essential so that antiretroviral prophylaxis can be initiated within the first 12 hours of life. For HIV-1–exposed infants (identified by positive maternal testing or by positive antibody testing of the infant shortly after birth), it has been recommended that diagnostic testing with HIV-1 DNA or RNA assays be performed within the first 14 days of life, at 1 to 2 months of age, and at 3 to 6 months of age. If any of these test results are positive, repeat testing is recommended to confirm the diagnosis of HIV-1 infection. A diagnosis of HIV-1 infection is made on the basis of 2 positive HIV-1 DNA or RNA assays. In nonbreastfeeding children younger than 18 months with no positive HIV-1 virologic test results, presumptive exclusion of HIV-1 infection can be based on 2 negative virologic test results (1 obtained at ≥2 weeks and 1 obtained at ≥4 weeks of age); 1 negative virologic test result obtained at ≥8 weeks of age; or 1 negative HIV-1 antibody test result obtained at ≥6 months of age. Alternatively, among children with at least 1 positive HIV-1 virologic test result, presumptive exclusion of HIV-1 infection can be based on at least 2 subsequent negative virologic test results (at least 1 of which is performed at ≥8 weeks of age). Finally, children can be considered presumptively uninfected with negative HIV-1 antibody test results (with at least 1 of the tests performed at ≥6 months of age). Definitive exclusion of HIV-1 infection is based on 2 negative virologic test results (1 obtained at ≥1 month of age and 1 obtained at ≥4 months of age) or 2 negative HIV-1

antibody test results from separate specimens obtained at ≥6 months of age. For both presumptive and definitive exclusion of infection, the child should have no other laboratory (eg, no positive virologic test results) or clinical (eg, no AIDS-defining conditions) evidence of HIV-1 infection. Many clinicians confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay result at 12 to 18 months of age. For breastfeeding infants, a similar testing algorithm can be followed, with timing of testing based on the date of complete cessation of breastfeeding instead of the date of birth.

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Diagnosis and Prevention of Iron Deficiency and Iron-Deficiency Anemia in Infants and Young Children (0–3 Years of Age)

abstract

FREE

This clinical report covers diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants (both breastfed and formula fed) and toddlers from birth through 3 years of age. Results of recent basic research support the concerns that iron-deficiency anemia and iron deficiency without anemia during infancy and childhood can have long-lasting detrimental effects on neurodevelopment. Therefore, pediatricians and other health care providers should strive to eliminate iron deficiency and iron-deficiency anemia. Appropriate iron intakes for infants and toddlers as well as methods for screening for iron deficiency and iron-deficiency anemia are presented. *Pediatrics* 2010;126: 1040–1050

INTRODUCTION

Iron deficiency (ID) and iron-deficiency anemia (IDA) continue to be of worldwide concern. Among children in the developing world, iron is the most common single-nutrient deficiency.[1] In industrialized nations, despite a demonstrable decline in prevalence,[2] IDA remains a common cause of anemia in young children. However, even more important than anemia itself is the indication that the more common ID without anemia may also adversely affect long-term neurodevelopment and behavior and that some of these effects may be irreversible.[3,4] Because of the implications for pediatric health care providers and their patients, this report reviews and summarizes this information.

This clinical report is a revision and extension of a previous policy statement published in 1999,[5] which addressed iron fortification of formulas. This report covers diagnosis and prevention of ID and IDA in infants (both breastfed and formula fed) and toddlers aged 1 through 3 years.

DEFINITIONS

Anemia: A hemoglobin (Hb) concentration 2 SDs below the mean Hb concentration for a normal population of the same gender and age range, as defined by the World Health Organization, the United Nations Children's Fund, and United Nations University.[6] On the basis of the 1999–2002 US National Health and Nutrition Examination Survey, anemia is defined as a Hb concentration of less than 11.0 g/dL for both male and female children aged 12 through 35 months.[7,8] For certain populations (ie, people living at high altitudes), adjustment of these values may be necessary.

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KEY WORDS

iron deficiency, iron-deficiency anemia, iron intake, infants, toddlers, breastfeeding, formula

ABBREVIATIONS

ID—iron deficiency
IDA—iron-deficiency anemia
Hb—hemoglobin
SF—serum ferritin
IOM—Institute of Medicine
WIC—Special Supplemental Program for Women, Infants, and Children
CHr—reticulocyte hemoglobin
TfR1—transferrin receptor 1
CRP—C-reactive protein
AAP—American Academy of Pediatrics

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Iron sufficiency: A state in which there is sufficient iron to maintain normal physiologic functions.

Iron deficiency: A state in which there is insufficient iron to maintain normal physiologic functions. ID results from inadequate iron absorption to accommodate an increase in requirements attributable to growth or resulting from a long-term negative iron balance. Either of these situations leads to a decrease in iron stores as measured by serum ferritin (SF) concentrations or bone marrow iron content. ID may or may not be accompanied by IDA.

Iron-deficiency anemia: An anemia (as defined above) that results from ID.

Iron overload: The accumulation of excess iron in body tissues. Iron overload usually occurs as a result of a genetic predisposition to absorb and store iron in excess amounts, the most common form of which is hereditary hemochromatosis. Iron overload can also occur as a complication of other hematologic disorders that result in chronic transfusion therapy, repeated injections of parenteral iron, or excessive iron ingestion.

Recommended dietary allowance for iron: The average daily dietary intake that is sufficient to meet the nutrient requirements of nearly all individuals (97%–98%) of a given age and gender.

Adequate intake for iron: This term is used when there is not enough information to establish a recommended dietary allowance for a population (eg, term infants, 0–6 months of age). The adequate intake is based on the estimated average nutrient intake by a group (or groups) of healthy individuals.

IRON REQUIREMENTS FOR INFANTS (UP TO 12 COMPLETED MONTHS OF AGE)

Eighty percent of the iron present in a newborn term infant is accreted during the third trimester of pregnancy. Infants born prematurely miss this rapid accretion and are deficient in total body iron. A number of maternal conditions, such as anemia, maternal hypertension with intrauterine growth restriction, or diabetes during pregnancy, can also result in low fetal iron stores in both term and preterm infants.

Preterm Infants

The deficit of total body iron in preterm infants increases with decreasing gestational age. It is worsened by the rapid postnatal growth that many infants experience and by frequent phlebotomies without adequate blood replacement. On the other hand, sick preterm infants who receive multiple transfusions are at risk of iron overload. The use of recombinant human erythropoietin to prevent transfusion therapy in preterm infants will further deplete iron stores if additional supplemental iron is not provided. The highly variable iron status of preterm infants, along with their risks for ID as well as toxicity, precludes determining the exact requirement, but it can be estimated to be between 2 and 4 mg/kg per day when given orally.[9]

Term Infants (Birth Through 12 Completed Months of Age)

The Institute of Medicine (IOM)[10] used the average iron content of human milk to determine the adequate intake of 0.27 mg/day for term infants from birth through 6 months' completed age. The average iron content of human milk was determined to be 0.35 mg/L, and the average milk intake of an exclusively breastfed infant was determined to be 0.78 L/day. Multiplying these 2 numbers determined the adequate intake of 0.27 mg/day for term infants from birth through 6 months of age in the IOM report. The IOM further reasoned that there should be a direct correlation between infant size and human milk ingestion; therefore, no correction need be made for infant weight. It should be pointed out, however, that although bigger infants may ingest more milk, there is a large variation in iron concentration of human milk, and there is no guarantee that the iron content of the maternal milk matches the needs of the infant for iron.

For infants from 7 to 12 months' completed age, the recommended dietary allowance for iron, according to the IOM, is 11 mg/day, which was determined by using a factorial approach. The amount of iron lost, primarily from sloughed epithelial cells from skin and the intestinal and urinary tracts, was added to the amounts of iron required for increased blood volume, increased tissue mass, and storage iron during this period of life. It was noted that the iron needs of infants do not suddenly jump from 0.27 to 11 mg/day at 6 months of age; this disjuncture is the result of the use of very different methods of determining these values. However, it is clear that healthy, term newborn infants require very little iron early in life compared with the significant amounts of iron required after 6 months of age.

IRON REQUIREMENTS FOR TODDLERS (1–3 YEARS OF AGE)

Using a similar factorial approach as described for infants 7 to 12 months' completed age, the IOM determined that the recommended dietary allowance for iron for children from 1 through 3 years of age is 7 mg/day.[9]

PREVALENCE OF ID AND IDA

There are currently no national statistics for the prevalence of ID and IDA in infants before 12 months' completed age. Hay et al[11] reported on a cohort of 284 term Norwegian infants. Using the definitions provided by Dallman[12] in an IOM report, the prevalence of ID at 6

months of age was 4% and increased to 12% at 12 months of age.

The prevalence of ID and IDA among toddlers (1–3 years of age) in the United States is listed in Table 1 and was derived from National Health and Nutrition Examination Survey data collected between 1999 and 2002.[7,8] The overall prevalence of anemia and possibly ID and IDA in infants and toddlers has declined since the 1970s.[2] Although there is no direct proof, this decline has been attributed to use of iron-fortified formulas and iron-fortified infant foods provided by the Special Supplemental Program for Women, Infants, and Children (WIC) in the early 1970s and the decrease in use of whole cow milk for infants.[8] Still, ID remains relatively common and occurs in 6.6% to 15.2% of toddlers, depending on ethnicity and socioeconomic status. The prevalence of IDA is 0.9% to 4.4%, again depending on race/ethnicity and socioeconomic status,[7,8] but only accounts for approximately 40% of the anemia in toddlers (Table 1). These numbers are comparable to data collected in other industrialized countries.[13,14]

Related to the problem of ID/IDA is the interaction of iron and lead. Results of both animal and human studies have confirmed that IDA increases intestinal lead absorption.[15–17] A reasonably well-established epidemiologic association has been made between IDA and increased lead concentrations.[18] Thus, primary prevention of IDA could also serve as primary prevention of lead poisoning. This possibility is all the more attractive, because lead has been reported to induce neurotoxicity at even very low blood concentrations.[19,20] In addition, preexisting IDA decreases the efficiency of lead chelation therapy, and iron supplementation corrects this effect. In contrast, iron supplementation in a child with IDA who also has lead poisoning without chelation therapy seems to increase blood lead concentrations and decrease basal lead excretion.[21,22] The effect of iron supplementation on blood lead concentrations in iron-replete children with or without lead poisoning is not known. Thus, in theory, selective rather than universal iron supplementation would be more likely to reduce lead poisoning and its potential harmful effects on these children.

TABLE 1 ID, IDA, and Anemia in the 1999–2002 National Health and Nutrition Examination Survey,[7] Children 12 to 35 Months of Age

Population Sampled (No.)	Proportion of US Toddler Population, % (SE)[a]	ID, % (SE)	IDA, % (SE)	All Anemia, % (SE)
General US population (672)		9.2 (1.3)	2.1 (0.6)	5.1 (0.8)
Above poverty line (355)[b]	66.4 (2.9)	8.9 (1.7)	2.2 (0.8)[c]	4.6 (1.1)
Below poverty line (268)[b]	33.6 (2.9)	8.6 (1.6)	2.3 (1.2)[c]	6.2 (1.3)
Enrolled in WIC (360)[d]	44.4 (3.2)	10.7 (2.1)	3.1 (1.2)[c]	6.6 (1.4)
Non-Hispanic white (196)	58.0 (3.8)	7.3 (1.9)	2.0 (0.8)[c]	4.6 (1.2)
Non-Hispanic black (173)	14.1 (2.1)	6.6 (1.8)	1.6 (0.9)[c]	8.3 (1.9)
Mexican American (231)	15.0 (2.2)	13.9 (3.1)	0.9 (0.7)[c]	3.2 (1.2)[c]
Other ethnicity (72)	13.0 (2.7)	15.2 (4.7)[c]	4.4 (2.7)[c]	5.5 (2.7)[c]

Shown are the unweighted number and weighted percentage and SEs for all children with complete data for Hb, SF, transferrin saturation, and zinc protoporphyrin. Anemia was defined as a Hb concentration of <11.0 g/dL; ID[7] was defined as an abnormal value for at least 2 of 3 indicators: SF (abnormal cutoff: <10 μg/dL), zinc protoporphyrin (>1.42 μmol/L red blood cells), and transferrin saturation (<10%); and IDA was defined as anemia plus ID.

[a] Proportion of row descriptor of all children in analytic sample ($N = 672$).

[b] Children with income data ($N = 623$).

[c] Estimate is statistically unreliable. Relative SE (SE of estimate/estimate × 100) ≥ 30%.

[d] Any member of household who received benefits from WIC in the previous 12 months: children with food-security data ($N = 668$).

ID AND NEURODEVELOPMENT

The possible relationship between ID/IDA and later neurobehavioral development in children is the subject of many reports.[3,23–31] Results of a preponderance of studies have demonstrated an association between IDA in infancy and later cognitive deficits. Lozoff et al[3,25] have reported detecting cognitive deficits 1 to 2 decades after the iron-deficient insult during infancy. However, it has been difficult to establish a causal relationship because of the many confounding variables and the difficulty in designing and executing the large, randomized controlled trials necessary to distinguish small potential differences. The authors of a Cochrane Database systematic review, in which the question of whether treatment of IDA improved psychomotor development was examined, stated that there was inconclusive but plausible evidence (only 2 randomized controlled trials) demonstrating improvement if the treatment extended for more than 30 days.[27] McCann and Ames[28] recently reviewed the evidence of a causal relationship between ID/IDA and deficits in cognitive and behavioral function. They concluded that for IDA, there is at least some support for causality, but because specificity for both cause and effect have not been established unequivocally, it is premature to conclude the existence of a causal relationship between IDA and cognitive and behavioral performance. For ID, some evidence of causality exists, but it is less than that for IDA.[28]

It is known that iron is essential for normal neurodevelopment in a number of animal models. ID affects neuronal energy metabolism, the metabolism of neurotransmitters, myelination, and memory function. These observations would explain the behavioral findings in human infants that have been associated with ID.[29–31] Therefore, taking into account that iron is the world's most common

single-nutrient deficiency, it is important to minimize IDA and ID among infants and toddlers, even if an unequivocal relationship between IDA and ID and neurodevelopmental outcomes has yet to be established.

DIAGNOSIS

Iron status is a continuum. At one end of the spectrum is IDA, and at the other end is iron overload. ID and IDA are attributable to an imbalance between iron needs and available iron that results in a deficiency of mobilizable iron stores and is accompanied by changes in laboratory measurements that include Hb concentration, mean corpuscular Hb concentration, mean corpuscular volume, reticulocyte Hb concentration (abbreviated in the literature as CHr) content, total iron-binding capacity, transferrin saturation, zinc protoporphyrin, SF concentration, and serum transferrin receptor 1 (TfR1) concentration. Measurements that are used to describe iron status are listed in Table 2.

In a child with ID, as the Hb concentration falls 2 SDs below the mean for age and gender, IDA is present, by definition; for infants at 12 months of age, this is 11.0 mg/dL.[7,8] When IDA accounted for most cases of anemia in children, "anemia" and "IDA" were roughly synonymous, and a simple measurement of Hb concentration was sufficient to make a presumptive diagnosis of anemia attributable to ID. Particularly in industrialized nations, the prevalence of ID and IDA has decreased, and other causes of anemia, such as hemolytic anemias, anemia of chronic disease, and anemia attributable to other nutrient deficiencies, have become proportionately more common.[32]

TABLE 2 Spectrum of Iron Status

Parameter	ID Without Anemia	IDA	Iron Overload
SF[a]	↓	↓ ↓	↑
Transferrin saturation	↓	↓	↑ ↑
TfR1	↑ ↑	↑ ↑ ↑	↓
CHr	↓	↓	Normal
Hb	Normal	↓	Normal
Mean corpuscular volume	Normal	↓	Normal

[a] Confounded by the presence of inflammation. If SF is normal or increased and the CRP level is normal, then there is no ID. If SF is decreased, then ID is present regardless of the measure of CRP. If SF is normal or increased and the CRP level is increased, then the presence of ID cannot be determined.

Modified from American Academy of Pediatrics, Committee on Nutrition. Iron deficiency. In: Kleinman RE, ed. *Pediatric Nutrition Handbook*. 5th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2004:304.

No single measurement is currently available that will characterize the iron status of a child. The limitations of using Hb concentration as a measure of iron status are its lack of specificity and sensitivity. Factors that limit erythropoiesis or result in chronic hemolysis, such as genetic disorders and chronic infections, may result in low Hb concentrations. Vitamin B_{12} or folate deficiency, although uncommon in the pediatric population, also can result in a low Hb concentration. The lack of sensitivity is largely attributable to the marked overlap in Hb concentrations between populations with iron sufficiency and those with ID.[33] Thus, to identify ID or IDA, Hb concentration must be combined with other measurements of iron status. Once the diagnosis of IDA has been established, however, following Hb concentration is a good measure of response to treatment.

In establishing the definitive iron status of an individual, it is desirable to use the fewest tests that will accurately reflect iron status. Any battery of tests must include Hb concentration, because it determines the adequacy of the circulating red cell mass and whether anemia is present. One or more tests must be added to the determination of Hb concentration if ID or IDA is to be diagnosed. The 3 parameters that provide discriminatory information about iron status are SF, CHr, and TfR1 concentrations.

SF is a sensitive parameter for the assessment of iron stores in healthy subjects[34–36]; 1 μg/L of SF corresponds to 8 to 10 mg of available storage iron.[34,37,38] Measurement of SF concentration is widely used in clinical practice and readily available. Cook et al[36] selected an SF concentration below 12 μg/L as diagnostic for ID after a comprehensive population survey in the United States. Thus, a cutoff value of 12 μg/L has been widely used for adults and denotes depletion of iron stores. In children, a cutoff value of 10 μg/L has been suggested.[39] Because SF is an acute-phase reactant, concentrations of SF may be elevated in the presence of chronic inflammation, infection, malignancy, or liver disease, and a simultaneous measurement of C-reactive protein (CRP) is required to rule out inflammation. Although Brugnara et al[40] found SF concentration to be less accurate than either the CHr or TfR1 concentration in establishing iron status of children, combining SF concentration with a determination of CRP is currently more readily available to assess iron stores and is a reliable screening test as long as the CRP level is not elevated[41] (Table 2).

CHr and TfR1 concentrations are not affected by inflammation (infection), malignancy, or anemia of chronic disease and, thus, would be preferable as biomarkers for iron status. Only the CHr assay is currently available for use in children. The CHr content assay has been validated in children, and standard values have been determined.[40,42] The CHr assay provides a measure of iron available to cells recently released from the bone marrow. CHr content can be measured by flow cytometry, and 2 of the 4 automated hematology analyzers commonly used in the United States have the capability to measure CHr.[43] A low CHr concentra-

tion has been shown to be the strongest predictor of ID in children[40,42,43] and shows much promise for the diagnosis of ID when the assay becomes more widely available.

TfR1 is a measure of iron status, detecting ID at the cellular level. TfR1 is found on cell membranes and facilitates transfer of iron into the cell. When the iron supply is inadequate, there is an upregulation of TfR1 to enable the cell to compete more effectively for iron, and subsequently, more circulating TfR1 is found in serum. An increase in serum TfR1 concentrations is seen in patients with ID or IDA, although it does not increase in serum until iron stores are completely exhausted in adults.[44–46] However, the TfR1 assay is not widely available, and standard values for infants and children have yet to be established.

Thus, to establish a diagnosis of IDA, the following sets of tests can be used at the present time (when coupled with determination of a Hb concentration of <11 g/dL): (1) SF and CRP measurements or (2) CHr measurement. For diagnosing ID without anemia, measure either (1) SF and CRP or (2) CHr.

Another approach to making the diagnosis of IDA in a clinically stable child with mild anemia (Hb concentration between 10 and 11 g/dL) is to monitor the response to iron supplementation, especially if a dietary history indicates that the diet is likely to be iron deficient. An increase in Hb concentration of 1 g/dL after 1 month of therapeutic supplementation has been used to signify the presence of IDA. This approach requires that iron supplementation be adequate, iron be adequately absorbed, and patient compliance with adequate follow-up can be ensured. However, because only 40% of the cases of anemia identified at 12 months of age will be secondary to IDA (Table 1), strong consideration should be given to establishing a diagnosis of IDA by using the screening tests described previously.

PREVENTION OF ID AND IDA

Preterm Infants

The preterm infant (<37 weeks' gestation) who is fed human milk should receive a supplement of elemental iron at 2 mg/kg per day starting by 1 month of age and extending through 12 months of age.[47] This can be provided as medicinal iron or in iron-fortified complementary foods. Preterm infants fed a standard preterm infant formula (14.6 mg of iron per L) or a standard term infant formula (12.0 mg of iron per L) will receive approximately 1.8 to 2.2 mg/kg per day of iron, assuming a formula intake of 150 mL/kg per day. Despite the use of iron-containing formulas, 14% of preterm infants develop ID between 4 and 8 months of age.[48] Thus, some formula-fed preterm infants may need an additional iron supplement,[47] although there is not enough evidence to make this a general recommendation at this time. Exceptions to this iron-supplementation practice in preterm infants would be infants who received multiple transfusions during hospitalization, who might not need any iron supplementation.

Term, Breastfed Infants

Infants who are born at term usually have sufficient iron stores until 4 to 6 months of age.[49] Infants born at term have high Hb concentration and high blood volume in proportion to body weight. They experience a physiologic decline in both blood volume and Hb concentration during the first several months of life. These facts have led to the supposition that breastfed infants need very little iron. It is assumed that the small amount of iron in human milk is sufficient for the exclusively breastfed infant. The World Health Organization recommends exclusive breastfeeding for 6 months, and the American Academy of Pediatrics (AAP) has recommended exclusive breastfeeding for a minimum of 4 months but preferably for 6 months. Exclusive breastfeeding for more than 6 months has been associated with increased risk of IDA at 9 months of age.[49,50] Recommendations for exclusive breastfeeding for 6 months do not take into account infants who are born with lower-than-usual iron stores (low birth weight infants, infants of diabetic mothers), a condition that also has been linked to lower SF concentrations at 9 months of age.[51] In a double-blind study, Friel et al[52] demonstrated that exclusively breastfed infants supplemented with iron between 1 and 6 months of age had higher Hb concentration and higher mean corpuscular volume at 6 months of age than did their unsupplemented peers. Supplementation also resulted in better visual acuity and higher Bayley Psychomotor Developmental Indices at 13 months. Thus, it is recommended that exclusively breastfed term infants receive an iron supplementation of 1 mg/kg per day, starting at 4 months of age and continued until appropriate iron-containing complementary foods have been introduced (Tables 3 and 4). For partially breastfed infants, the proportion of human milk versus formula is uncertain; therefore, beginning at 4 months of age, infants who receive more than one-half of their daily feedings as human milk and who are not receiving iron-containing complementary foods should also receive 1 mg/kg per day of supplemental iron.

Term, Formula-Fed Infants

For the term, formula-fed infant, the level of iron fortification of formula to prevent ID remains controversial.[53,54] For more than 25 years, 12 mg of iron per L has been the level of fortification in standard term infant formulas in the United States, consistent with

guidelines of WIC for iron-fortified formula (at least 10 mg/L), thus creating a natural experiment. The level of 12 mg/L was determined by calculating the total iron needs of the child from 0 to 12 months of age, assuming average birth weight and average weight gain during the first year. The calculation also assumed that formula was the only source of iron during this period. Others have recommended lower amounts of iron in infant formula,[55] and there have been studies to examine iron-fortification levels of less than 12 mg/L.[56–61] However, it is the conclusion of the AAP that infant formula that contains 12 mg of elemental iron per L is safe for its intended use. Although there has been some concern about linear growth in iron-replete infants given medicinal iron,[62] no published studies have convincingly documented decreased linear growth in iron-replete infants receiving formulas containing high amounts of iron. Evidence is also insufficient to associate formulas that contain 12 mg of iron per L with gastrointestinal symptoms. At least 4 studies have shown no adverse effects.[63–66] Reports have conflicted on whether iron fortification is associated with increased risk of infection. Decreased incidence, increased incidence, and no change in number of infections have all been reported.[67,68] The authors of a recent systematic review concluded that "iron supplementation has no apparent harmful effect on the overall incidence of infectious illnesses in children, though it slightly increases the risk of developing diarrhoea."[69] Finally, when examining specifically infants given formula with 12 mg of iron per L, Singhal et al[70] were "unable to identify adverse health effects in older infants and toddlers consuming a high iron-containing formula." They found no difference between controls and the treatment group in incidence of infection, gastrointestinal problems, or general morbidity.

TABLE 3 Foods to Increase Iron Intake and Iron Absorption

	Elemental Iron, mg
Commercial baby food,[a] heme iron	
Meat	
Baby food, lamb, junior, 1 jar (2.5 oz)	1.2
Baby food, chicken, strained, 1 jar (2.5 oz)	1.0
Baby food, lamb, strained, 1 jar (2.5 oz)	0.8
Baby food, beef, junior, 1 jar (2.5 oz)	0.7
Baby food, beef, strained, 1 jar (2.5 oz)	0.7
Baby food, chicken, junior, 1 jar (2.5 oz)	0.7
Baby food, pork, strained, 1 jar (2.5 oz)	0.7
Baby food, ham, strained, 1 jar (2.5 oz)	0.7
Baby food, ham, junior, 1 jar (2.5 oz)	0.7
Baby food, turkey, strained, 1 jar (2.5 oz)	0.5
Baby food, veal, strained, 1 jar (2.5 oz)	0.5
Commercial baby food,[a] nonheme iron	
Vegetables	
Baby food, green beans, junior, 1 jar (6 oz)	1.8
Baby food, peas, strained, 1 jar (3.4 oz)	0.9
Baby food, green beans, strained, 1 jar (4 oz)	0.8
Baby food, spinach, creamed, strained, 1 jar (4 oz)	0.7
Baby food, sweet potatoes, junior (6 oz)	0.7
Cereals	
Baby food, brown rice cereal, dry, instant, 1 tbsp	1.8
Baby food, oatmeal cereal, dry, 1 tbsp	1.6
Baby food, rice cereal, dry, 1 tbsp	1.2
Baby food, barley cereal, dry, 1 tbsp	1.1
Table food, heme iron	
Clams, canned, drained solids, 3 oz	23.8
Chicken liver, cooked, simmered, 3 oz	9.9
Oysters, Eastern canned, 3 oz	5.7
Beef liver, cooked, braised, 3 oz	5.6
Shrimp, cooked moist heat, 3 oz	2.6
Beef, composite of trimmed cuts, lean only, all grades, cooked, 3 oz	2.5
Sardines, Atlantic, canned in oil, drained solids with bone, 3 oz	2.5
Turkey, all classes, dark meat, roasted, 3 oz	2.0
Lamb, domestic, composite of trimmed retail cuts, separable lean only, choice, cooked, 3 oz	1.7
Fish, tuna, light, canned in water, drained solids, 3 oz	1.3
Chicken, broiler or fryer, dark meat, roasted, 3 oz	1.1
Turkey, all classes, light meat, roasted, 3 oz	1.1
Veal, composite of trimmed cuts, lean only, cooked, 3 oz	1.0
Chicken, broiler or fryer, breast, roasted, 3 oz	0.9
Pork, composite of trimmed cuts (leg, loin, shoulder), lean only, cooked, 3 oz	0.9
Fish, salmon, pink, cooked, 3 oz	0.8
Table food, nonheme iron	
Oatmeal, instant, fortified, cooked, 1 cup	14.0
Blackstrap molasses,[b] 2 tbsp	7.4
Tofu, raw, regular, ½ cup	6.7
Wheat germ, toasted, ½ cup	5.1
Ready-to-eat cereal, fortified at different levels, 1 cup	~4.5 to 18
Soybeans, mature seeds, cooked, boiled, ½ cup	4.4
Apricots, dehydrated (low-moisture), uncooked, ½ cup	3.8
Sunflower seeds, dried, ½ cup	3.7
Lentils, mature seeds, cooked, ½ cup	3.3
Spinach, cooked, boiled, drained, ½ cup	3.2
Chickpeas, mature seeds, cooked, ½ cup	2.4
Prunes, dehydrated (low-moisture), uncooked, ½ cup	2.3
Lima beans, large, mature seeds, cooked, ½ cup	2.2
Navy beans, mature seeds, cooked, ½ cup	2.2
Kidney beans, all types, mature seeds, cooked, ½ cup	2.0
Molasses, 2 tbsp	1.9
Pinto beans, mature seeds, cooked, ½ cup	1.8
Raisins, seedless, packed, ½ cup	1.6

TABLE 3 Continued

	Elemental Iron, mg
Prunes, dehydrated (low moisture), stewed, ½ cup	1.6
Prune juice, canned, 4 fl oz	1.5
Green peas, cooked, boiled, drain, ½ cup	1.2
Enriched white rice, long-grain, regular, cooked, ½ cup	1.0
Whole egg, cooked (fried or poached), 1 large egg	0.9
Enriched spaghetti, cooked, ½ cup	0.9
White bread, commercially prepared, 1 slice	0.9
Whole-wheat bread, commercially prepared, 1 slice	0.7
Spaghetti or macaroni, whole wheat, cooked, ½ cup	0.7
Peanut butter, smooth style, 2 tbsp	0.6
Brown rice, medium-grain, cooked, ½ cup	0.5

Note that all figures are rounded.

[a] Baby food values are generally based on generic jar, not branded jar; 3 oz of table-food meat = 85 g; a 2.5-oz jar of baby food = 71 g (an infant would not be expected to eat 3 oz [approximately the size of a deck of cards] of pureed table meat at a meal).

[b] Source of iron value was obtained from a manufacturer of this type of molasses.

Source of iron values in foods: US Department of Agriculture, Agricultural Research Service. USDA National Nutrient Database for Standard Reference, Release 20: Nutrient Data Laboratory home page. Available at: www.ars.usda.gov/ba/bhnrc/ndl.

TABLE 4 Selected Good Vitamin C Sources to Increase Iron Absorption

Fruits	Vegetables
Citrus fruits (eg, orange, tangerine, grapefruit)	Green, red, and yellow peppers
Pineapples	Broccoli
Fruit juices enriched with vitamin C	Tomatoes
Strawberries	Cabbages
Cantaloupe	Potatoes
Kiwifruit	Leafy green vegetables
Raspberries	Cauliflower

Toddlers (1–3 Years of Age)

The iron requirement for toddlers is 7 mg/day. Ideally, the iron requirements of toddlers would be met and ID/IDA would be prevented with naturally iron-rich foods rather than iron supplementation. These foods include those with heme sources of iron (ie, red meat) and nonheme sources of iron (ie, legumes, iron-fortified cereals) (Table 3). Foods that contain vitamin C (ascorbic acid), such as orange juice, aid in iron absorption and are listed in Table 4. Foods that contain phytates (found in soy) reduce iron absorption. Through public education and altering feeding practices, the amount of iron available to older infants and toddlers via a normal diet could be maximized (Table 3).

In developing countries, iron requirements of older infants and toddlers have been met by iron fortification of various foods, including corn flour,[71] soy sauce,[72] fish sauce,[73] and rice.[74] However, there are many technical and practical barriers to a successful fortification program for toddlers. Not the least of these barriers is the determination of which foods to fortify with iron. In the United States, fortification of infant formula and infant cereal has been credited with the decline in IDA. However, toddlers in the United States typically do not eat enough of any other food to serve as a vehicle for iron fortification. Universal food fortification for all ages is problematic, given the possible adverse effects of iron in certain subsets of older children and adults.

As an alternative for toddlers who do not eat adequate amounts of iron-containing food (Table 3), iron supplements are available in the form of iron sulfate drops and chewable iron tablets or as a component of either liquid or chewable multivitamins. Iron sprinkles with or without additional zinc are available in Canada. Barriers to adequate iron supplementation are (1) lack of education for care providers and patients, (2) poor compliance made worse by the perception of adverse effects, including nausea, vomiting, constipation, stomach upset, and teeth staining, (3) cost, (4) current federal supplemental nutrition programs not providing iron supplements, and (5) risk of iron overload.

Screening for ID and IDA

The AAP has concluded that universal screening for anemia should be performed with determination of Hb concentration at approximately 1 year of age. Universal screening would also include an assessment of risk factors associated with ID/IDA: history of prematurity or low birth weight; exposure to lead; exclusive breastfeeding beyond 4 months of age without supplemental iron; and weaning to whole milk or complementary foods that do not include iron-fortified cereals or foods naturally rich in iron (Table 3). Additional risk factors include the feeding problems, poor growth, and inadequate nutrition typically seen in infants with special health care needs as well as low socioeconomic status, especially children of Mexican American descent, as identified in the recent National Health and Nutrition Examination Survey[8,75] (Table 1). Selective screening can be performed at any age when these risk factors for ID and IDA have been identified, including risk of inadequate iron intake according to dietary history.

It has been acknowledged that screening for anemia with a Hb determination neither identifies children with ID nor specifically identifies those with IDA.[76] In the United States, 60% of anemia is not attributable to ID, and most tod-

dlers with ID do not have anemia (Table 2). It is also known that there is poor follow-up testing and poor documentation of improved Hb concentrations. In 1 study, 14% of the children had a positive screening result for anemia. However, only 18.3% of these children with a positive screening result had follow-up testing performed, and of that group, only 11.6% had documented correction of low Hb levels.[77] Therefore, for infants identified with a Hb concentration of less than 11.0 mg/dL or identified with significant risk of ID or IDA as described previously, SF and CRP or CHr levels in addition to Hb concentration should be measured to increase the sensitivity and specificity of the diagnosis. In addition, the AAP, the World Health Organization, and the European Society for Pediatric Gastroenterology, Hepatology and Nutrition also support the use of the measurement of TfR1 as a screening test once the method has been validated and normal values for infants and toddlers have been established.

Another step to improve the current screening system is to use technology-based reminders for screening and follow-up of infants and toddlers with a diagnosis of ID/IDA. Reminders could be incorporated into electronic health records, and there should be documentation that Hb concentrations have returned to the normal range. The efficacy of any program for minimizing ID and IDA should be tracked scientifically and evaluated through well-planned surveillance programs.

SUMMARY

Given that iron is the world's most common single-nutrient deficiency and there is some evidence of adverse effects of both ID and IDA on cognitive and behavioral development, it is important to minimize ID and IDA in infants and toddlers without waiting for unequivocal evidence. Controversies remain regarding the timing and methods used for screening for ID/IDA as well as regarding the use of iron supplements to prevent ID/IDA. Although further study is required to generate higher levels of evidence to settle these controversies, the currently available evidence supports the following recommendations.

1. Term, healthy infants have sufficient iron for at least the first 4 months of life. Human milk contains very little iron. Exclusively breastfed infants are at increasing risk of ID after 4 completed months of age. Therefore, at 4 months of age, breastfed infants should be supplemented with 1 mg/kg per day of oral iron beginning at 4 months of age until appropriate iron-containing complementary foods (including iron-fortified cereals) are introduced in the diet (see Table 3). For partially breastfed infants, the proportion of human milk versus formula is uncertain; therefore, beginning at 4 months of age, partially breastfed infants (more than half of their daily feedings as human milk) who are not receiving iron-containing complementary foods should also receive 1 mg/kg per day of supplemental iron.
2. For formula-fed infants, the iron needs for the first 12 months of life can be met by a standard infant formula (iron content: 10–12 mg/L) and the introduction of iron-containing complementary foods after 4 to 6 months of age, including iron-fortified cereals (Table 3). Whole milk should not be used before 12 completed months of age.
3. The iron intake between 6 and 12 months of age should be 11 mg/day. When infants are given complementary foods, red meat and vegetables with higher iron content should be introduced early (Table 3). To augment the iron supply, liquid iron supplements are appropriate if iron needs are not being met by the intake of formula and complementary foods.
4. Toddlers 1 through 3 years of age should have an iron intake of 7 mg/day. This would be best delivered by eating red meats, cereals fortified with iron, vegetables that contain iron, and fruits with vitamin C, which augments the absorption of iron (Tables 3 and 4). For toddlers not receiving this iron intake, liquid supplements are suitable for children 12 through 36 months of age, and chewable multivitamins can be used for children 3 years and older.
5. All preterm infants should have an iron intake of at least 2 mg/kg per day through 12 months of age, which is the amount of iron supplied by iron-fortified formulas. Preterm infants fed human milk should receive an iron supplement of 2 mg/kg per day by 1 month of age, and this should be continued until the infant is weaned to iron-fortified formula or begins eating complementary foods that supply the 2 mg/kg of iron. An exception to this practice would include infants who have received an iron load from multiple transfusions of packed red blood cells.
6. Universal screening for anemia should be performed at approximately 12 months of age with determination of Hb concentration and an assessment of risk factors associated with ID/IDA. These risk factors would include low socioeconomic status (especially children of Mexican American descent [Table 1]), a history of prematurity or low birth weight, exposure to lead, exclusive breastfeeding beyond 4 months of age without supplemental iron, and weaning to whole milk or complementary foods that do not include iron-fortified cereals or

foods naturally rich in iron (Table 3). Additional risk factors are the feeding problems, poor growth, and inadequate nutrition typically seen in infants with special health care needs. For infants and toddlers (1–3 years of age), additional screening can be performed at any time if there is a risk of ID/IDA, including inadequate dietary iron intake.

7. If the Hb level is less than 11.0 mg/dL at 12 months of age, then further evaluation for IDA is required to establish it as a cause of anemia. If there is a high risk of dietary ID as described in point 6 above, then further testing for ID should be performed, given the potential adverse effects on neurodevelopmental outcomes. Additional screening tests for ID or IDA should include measurement of:
   - SF and CRP levels; or
   - CHr concentration.
8. If a child has mild anemia (Hb level of 10–11 mg/d) and can be closely monitored, an alternative method of diagnosis would be to document a 1 g/dL increase in plasma Hb concentration after 1 month of appropriate iron-replacement therapy, especially if the history indicates that the diet is likely to be iron deficient.
9. Use of the TfR1 assay as screening for ID is promising, and the AAP supports the development of TfR1 standards for use of this assay in infants and children.
10. If IDA (or any anemia) or ID has been confirmed by history and laboratory evidence, a means of carefully tracking and following infants and toddlers with a diagnosis of ID/IDA should be implemented. Electronic health records could be used not only to generate reminder messages to screen for IDA and ID at 12 months of age but also to document that IDA and ID have been adequately treated once diagnosed.

ADDENDUM

Development of This Report

This report was written by the primary authors after extensive review of the literature using PubMed, previous AAP reports, Cochrane reviews, and reports from other groups.[1,6,7,48,77]

The report was also submitted to the following sections and committees of the AAP that were asked to comment on the manuscript: Committee on Fetus and Newborn (COFN); Committee on Psychosocial Aspects of Child and Family Health (COPACFH); Section on Administration and Practice Management (SOAPM); Section on Developmental and Behavioral Pediatrics (SODBP); Section on Gastroenterology, Hepatology, and Nutrition (SOGHN); Section on Hematology and Oncology (SOHO); and Section on Breast Feeding (SOBr).

Additional comments were sought from the Centers for Disease Control and Prevention (CDC), the Department of Agriculture (WIC), the National Institutes of Health (NIH), and the Food and Drug Administration (FDA), because these governmental agencies were involved in the development of the statement and will necessarily deal with its impact. As it was developed it was extensively reviewed and revised by members of the AAP Committee on Nutrition, who unanimously approved this clinical report. It is openly acknowledged that where the highest levels of evidence are absent, the opinions and suggestions of members of the Committee on Nutrition as well as other groups consulted for this statement were taken into consideration in developing this clinical report.

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AMERICAN ACADEMY OF NEUROLOGY

Special Article

CME

Practice Parameter: Diagnostic assessment of the child with cerebral palsy

Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society

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Abstract—*Objective:* The Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society develop practice parameters as strategies for patient management based on analysis of evidence. For this parameter the authors reviewed available evidence on the assessment of a child suspected of having cerebral palsy (CP), a nonprogressive disorder of posture or movement due to a lesion of the developing brain. *Methods:* Relevant literature was reviewed, abstracted, and classified. Recommendations were based on a four-tiered scheme of evidence classification. *Results:* CP is a common problem, occurring in about 2 to 2.5 per 1,000 live births. In order to establish that a brain abnormality exists in children with CP that may, in turn, suggest an etiology and prognosis, neuroimaging is recommended with MRI preferred to CT (Level A). Metabolic and genetic studies should not be routinely obtained in the evaluation of the child with CP (Level B). If the clinical history or findings on neuroimaging do not determine a specific structural abnormality or if there are additional and atypical features in the history or clinical examination, metabolic and genetic testing should be considered (Level C). Detection of a brain malformation in a child with CP warrants consideration of an underlying genetic or metabolic etiology. Because the incidence of cerebral infarction is high in children with hemiplegic CP, diagnostic testing for coagulation disorders should be considered (Level B). However, there is insufficient evidence at present to be precise as to what studies should be ordered. An EEG is not recommended unless there are features suggestive of epilepsy or a specific epileptic syndrome (Level A). Because children with CP may have associated deficits of mental retardation, ophthalmologic and hearing impairments, speech and language disorders, and oral-motor dysfunction, screening for these conditions should be part of the initial assessment (Level A). *Conclusions:* Neuroimaging results in children with CP are commonly abnormal and may help determine the etiology. Screening for associated conditions is warranted as part of the initial evaluation.

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Cerebral palsy (CP) can be defined as a disorder of aberrant control of movement and posture, appearing early in life secondary to a CNS lesion or dysfunction that is not the result of a recognized progressive or degenerative brain disease.[1] The brain abnormality may occur pre-, peri-, or postnatally. The diagnosis of CP always involves a motor deficit and the usual presenting complaint for which medical evaluation is sought is that the child is not reaching motor milestones at the appropriate chronological age. In most

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instances, a medical history establishes that the child is not losing function, assuring that the patient does not have a progressive disease. This history, combined with a neurologic examination establishing that the patient's motor deficit is due to a cerebral abnormality, leads to the diagnosis of CP. Serial examinations may be necessary to assure the diagnosis of CP, especially when the history is not reliable.

There is agreement that CP is due to a defect or lesion in the developing brain, which may have had its onset in the prenatal, perinatal, or postnatal period.[1] While often a cutoff age for the appearance of symptoms early in life is generally not given, the great majority of children with CP present with symptoms as infants or toddlers, and the diagnosis of CP is made before age 2 years. In some children, symptom onset may be delayed (e.g., dystonic cerebral palsy), whereas in other children the appearance of pseudoprogression of symptoms may occur. The term CP is descriptive and includes a number of etiologies and clinical presentations. Although there is no consensus about a precise age cut-off either for the timing of the insult or the onset of symptoms, of importance is that affected individuals have similar needs for rehabilitation, education, and medical and social services.

CP is a common problem. The worldwide incidence of CP is approximately 2 to 2.5 per 1,000 live births.[2] Each year about 10,000 babies born in the United States develop CP.[3] CP occurs more commonly in children who are born very prematurely or at term. Data from Sweden on 241 children with CP indicate that 36% were born at a gestational age (GA) of less than 28 weeks; 25% at 28 to 32 weeks GA; 2.5% at 32 to 38 weeks GA; and 37% at term.[2]

The types and severity of CP are clinically well established. A Scandinavian study reported that 33% of the CP population was hemiplegic, 44% diplegic, and 6% quadriplegic.[2]

Half of the individuals with CP use assistive devices such as braces, walkers, or wheelchairs to help develop or maintain mobility and almost 70% have other disabilities, primarily mental retardation.[3] Individuals with CP may need specialized medical care, educational and social services, and other help throughout their lives from their families and communities. A study 10 years ago in California of the extra economic costs associated with CP and 17 other congenital disorders (e.g., Down syndrome, spina bifida) showed that CP had the highest lifetime costs per new case, averaging $503,000 in 1992 dollars.[4]

Laboratory tests are not necessary to confirm the diagnosis of CP as it is based on the history and examination. It is a syndrome with many etiologies. Genetic diseases, brain malformations, infections, and anoxic injury to the developing brain are a few of the many causes of CP. Accurate determination of the etiology of CP has specific implications regarding treatment, prognosis, and ongoing medical management of associated conditions. The importance of determining whether there is a malformation, genetic etiology, or injury and whether the injury is due to an acquired pre-, peri-, or postnatal process has obvious significance from the point of view of assessment of recurrence risk, counseling of families, and implementation of prevention programs, and when medicolegal issues arise. Determining causality also helps limit further unnecessary testing. Finally, understanding the etiology of CP has implications for prevention and intervention strategies. This knowledge will direct further research efforts.

Determining the types of evaluations appropriate for children with CP has posed tremendous challenges for parents and health care providers. The purpose of this practice parameter is to review data regarding the value and role of diagnostic tests used to evaluate children diagnosed with CP. Data regarding the role of neuroimaging, metabolic and genetic testing, and evaluation for coagulopathy are discussed. There was insufficient evidence to make any recommendations regarding the role of SPECT scans or evoked potentials in children with CP. This parameter also reviews evidence regarding the prevalence of associated problems such as epilepsy, mental retardation, speech and language disorders, and ophthalmologic and hearing impairments, and the need for their systematic evaluation.

Description of process. Literature searches were conducted with the assistance of the University of Minnesota Biomedical Information Services for relevant articles published from 1980 to March 2002. Medline, CINAHL, and Healthstar databases were searched for relevant articles published from 1966 to 2002, in the English language, using the following key words: CP, magnetic resonance imaging, MRI, computed axial tomography, CT scan, single photon emission tomography, SPECT, metabolic disease, thrombophilia, brain stem evoked potentials, sensory evoked potentials, visual evoked potentials, electroencephalography (EEG), seizures, epilepsy, vision loss, hearing loss, developmental delay, and speech and language delay. Approximately 350 titles and abstracts were reviewed for content regarding the establishment of the etiology of CP. Articles were excluded if the tests were ordered for reasons other than to establish the etiology. We included only studies that contained more than 20 patients; smaller case series were excluded. The ages of infants and children included in these studies were similar to the ages of children typically seen for diagnostic evaluation so it was believed that the evidence-based recommendations included in this parameter were appropriate. It was also believed that as CP is usually due to a static process, it was unlikely for neuroimaging studies to change over time so that data from studies done in older children with CP were valid regarding etiologic yield. Each article was reviewed, abstracted, and classified by a committee member. Data extracted include first author, year, study population, study design, number of patients, types of CP, results of testing,

Table 1 *American Academy of Neurology evidence classification scheme for determining the yield of established diagnostic and screening tests*

Class I: A statistical,[1] population-based[2] sample of patients studied at a uniform point in time (usually early) during the course of the condition. All patients undergo the intervention of interest. The outcome, if not objective,[5] is determined in an evaluation that is masked to the patients' clinical presentations.

Class II: A statistical, non-referral-clinic-based[3] sample of patients studied at a uniform point in time (usually early) during the course of the condition. Most (>80%) patients undergo the intervention of interest. The outcome, if not objective,[5] is determined in an evaluation that is masked to the patients' clinical presentations.

Class III: A selected, referral-clinic-based[4] sample of patients studied during the course of the condition. Some patients undergo the intervention of interest. The outcome, if not objective,[5] is determined in an evaluation by someone other than the treating physician.

Class IV: Expert opinion, case reports, or any study not meeting criteria for class I to III.

This is a new classification scheme developed by the Quality Standards Subcommittee (QSS) for studies related to determining the yield of established diagnostic and screening tests or interventions and is appropriate only when the diagnostic accuracy of the test or intervention is known to be good. Additionally, the abnormality potentially identified by the screening intervention should be treatable or should have important prognostic implications. This classification is different from others currently recommended by the QSS that have been published in recent parameters that relate to diagnostic, prognostic, or therapeutic studies.

[1] Statistical sample: A complete (consecutive), random, or systematic (e.g., every third patient) sample of the available population with the disease;
[2] Population-based: The available population for the study consists of all patients within a defined geographic region;
[3] Non-referral-clinic-based: The available population for the study consists of all patients presenting to a primary care setting with the condition;
[4] Referral-clinic-based: The available population for the study consists of all patients referred to a tertiary care or specialty setting. These patients may have been selected for more severe or unusual forms of the condition and thus may be less representative;
[5] Objective: An outcome measure that is very unlikely to be affected by an observer's expectations (e.g., determination of death, the presence of a mass on head CT, serum B12 assays).

Table 2 *American Academy of Neurology system for translation of evidence to recommendations*

Rating of recommendations	Translation of evidence to recommendations
A = Established as useful/predictive or not useful/predictive for the given condition in the specified population	Level A rating requires at least one convincing class I study or at least two consistent, convincing class II studies
B = Probably useful/predictive or not useful/predictive for the given condition in the specified population	Level B rating requires at least one convincing class II study or overwhelming class III evidence
C = Possibly useful/predictive or not useful/predictive for the given condition in the specified population	Level C rating requires at least two convincing class III studies
U = Data inadequate or conflicting. Given current knowledge, test, predictor is unproven.	

and outcomes measured. A new four-tiered classification scheme for determining the yield of established diagnostic and screening tests developed by the Quality Standards Subcommittee was utilized as part of this assessment (table 1). This classification scheme is different from the one currently used in recently published practice parameters that evaluate diagnostic, prognostic, or therapeutic articles. Depending on the strength of this evidence, it was decided whether specific recommendations could be made, and if so, the level of strength of these recommendations (table 2).

Neuroimaging. Should neuroimaging be routinely obtained in the child with CP?

Evidence. In neonates, neuroimaging is frequently obtained when there is a history of complications during pregnancy, labor, and delivery; when the infant is born very prematurely (<32 weeks); or when neurologic symptoms or findings are present on neonatal examination. A practice parameter regarding the value of and indications for obtaining neuroimaging in preterm and term infants has recently been published.[5] The current parameter addresses the role of neuroimaging in the infant or child who has been diagnosed with or is suspected of having CP based upon a motor deficit or delay that is not worsening and a history and neurologic examination that places the lesion in the CNS. In some situations, the risks of obtaining a neuroimaging study in an infant with CP may potentially outweigh the benefits of further defining the etiology.

Recent data encompassing a total of 1,426 children who underwent either CT[6-14] or MRI[15-24] scans indicated an abnormality in 62% to 100% of individuals (mean for CT, 77%; for MRI, 89%) (tables 3a and 4a). For the combined CT and MRI class I studies (n = 238), 88% of children had abnormal scans whereas 77% of patients in a class II study (n = 22) had abnormal scans as did 83% of children in the class III studies (n = 1166). The timing of the brain insult causing CP may be categorized into prenatal, perinatal, and postnatal subgroups and the neuropathologic changes seen in CP have been linked to the gestational age of the infant at the time of insult. Historical features (e.g., neonatal intracranial hemorrhage, neonatal encephalopathy, stroke, CNS infection, trauma) or prior neuroimaging studies that document such disorders or the presence of a brain malformation may provide sufficient information to establish the etiology when a child is seen later in life as the symptoms of CP evolve. Likewise, findings

Table 3 *CT in children with cerebral palsy (CP)*

a. Overall yield of finding an abnormal CT scan in children with CP

Reference	Class	N	Ages, y	Type of CP	% Abnormal
Wiklund et al., 1991[6]	I	83	5–16	H	73
Wiklund et al., 1991[7]	I	28	5–16	H	75
Miller and Cala, 1989[8]	I	29	6–35	A	62
Chen, 1981[9]	III	281	0.08–7	M	84
Kolawole et al., 1989[10]	III	120	1–>10	M	73
Taudorf et al., 1984[11]	III	83	NA	M	67
Schouman-Claeys et al., 1989[12]	III	76	0.6–15	M	63
Cohen and Duffner, 1981[13]	III	52	0.67–>10	H	87
Molteni et al., 1987[14]	III	30	5–16	H	93
Total no. of patients		782			
Mean abnormal CT					77

b. Percent of patients with an abnormal CT scan based on the type of CP (n = 485)

Hemiplegic (n = 146)	89	Quadriplegic (n = 111)	70
Ataxic (n = 19)	88	Hypotonic (n = 19)	73
Mixed (n = 29)	79	Dyskinetic (n = 14)	36
Diplegic (n = 153)	75		

c. Classification of timing of injury of CP based on CT scan abnormalities (n = 626)*

Reference	Class	N	Type of CP	% Prenatal	% Perinatal	% Postnatal	% Unclassifiable
Wiklund et al., 1991[6]	I	83	H	44	39	0	17
Wiklund et al., 1991[7]	I	28	H	64	82	0	7
Chen, 1981[9]	III	282	M	33	54	13	0
Kolawole et al., 1989[10]	III	120	M	16	35	26	28
Taudorf et al., 1984[11]	III	83	M	11	74	15	0
Molteni et al., 1987[14]	III	30	H	53	47	0	0
Total		626					
Mean values				32	50	12	6

d. Percent of patients with other etiologies of CP based on CT and clinical data (n = 702)*

Metabolic	4	Brain malformation	7
Genetic	2	Treatable condition	5

* Etiologies could not be determined in all patients in the studies listed in section a and in some patients more than one category of etiology was given. Data from the studies listed in section a.

H = hemiplegic; A = ataxic; M = mixed.

on physical examination (e.g., cataracts, chorioretinitis, dysmorphic features, myoclonus, dystonia) may suggest a specific etiology or an alternative diagnosis. An abnormality on MRI does not necessarily mean that the etiology of the motor deficit has been established. For example, the findings of diffuse cortical atrophy, delayed myelination, or polymicrogyria are nonspecific and only suggest that a CNS disturbance was present and may not allow one to know the underlying cause without a more specific workup.

CT. Data from 782 children with CP who had CT scans found abnormalities in 77% (range 62% to 93%) (see table 3a). For the class I studies (n = 140), 86% of children had abnormal scans whereas 78% of patients in class III studies (n = 642) had abnormal scans (there were no class II studies). The yield from CT scans varied depending on the type of CP (hemiplegic > ataxic > mixed > diplegic > quadriplegic > hypotonic > dyskinetic) with the percent abnormal in those with dyskinetic CP being much lower than in other forms of CP (table 3b).

Table 4 *MRI in children with cerebral palsy (CP)*

a. Overall yield of finding an abnormal MRI scan in children with CP

Reference	Class	N	Ages, y	Type of CP	% Abnormal
Krageloh-Mann et al., 1995[15]	I	56	5–17	SQ	91
Yin et al., 2000[16]	I	42	0.25–18	M	91
Candy et al., 1993[17]	II	22	0.25–2.25	M	77
Okumara et al., 1997, pt 2[18]	III	152	1–19	M	78
Cioni et al., 1999[19]	III	91	1–18.3	M	100
Jaw et al., 1998[20]	III	86	0.33–13	M	95
Sugimoto et al., 1995[21]	III	70	0.75–15	M	100
Hayakawa et al., 1996[22]	III	63	0.5–6	SD	79
Truwit et al., 1992[23]	III	40	0.08–41	M	93
Yokochi et al., 1991[24]	III	22	NA	D	68
Total no. of patients		644			
Mean abnormal MRI					89

b. Percent of patients with an abnormal MRI scan based on the type of CP (n = 286)

Mixed (n = 4)	100	Ataxic (n = 8)	75
Quadriplegic (n = 105)	98	Dyskinetic (n = 10)	70
Hemiplegic (n = 50)	96	Hypotonic (n = 6)	67
Diplegic (n = 102)	94		

c. Classification of timing of injury of CP based on MRI scan abnormalities*

Reference	Class	N	Type of CP	% Prenatal	% Perinatal	% Postnatal	% Unclassifiable
Krageloh-Mann et al., 1995[15]	I	56	SQ	14	39	0	46
Yin et al., 2000[16]	I	42	M	26	54	3	18
Cioni et al., 1999[19]	III	91	M	59	30	11	0
Jaw et al., 1998[20]	III	86	M	29	28	3	8
Sugimoto et al., 1995[21]	III	70	M	44	37	0	19
Total		345					
Mean values				37	35	4	15

d. Percent of patients with other etiologies of CP based on MRI and clinical data (n = 682)*

Metabolic	0	Brain malformation	12
Genetic	1.4	Treatable condition	0.1

* Etiologies could not be determined in all patients in the studies listed in section a and in some patients more than one category of etiology was given. In some studies there were no data provided as to a specific etiology.

SQ = spastic quadriplegic; M = mixed; SD = spastic diplegic; NA = not available; D = dyskinetic.

When abnormal, CT scans are helpful in delineating the timing of the etiology of CP in most children (table 3c). For the class I studies (n = 111), onset was prenatal in 44%, perinatal in 43%, and postnatal in 0%. For the class III studies (n = 515), onset was prenatal in 29%, perinatal in 52%, and postnatal in 15%. In the remaining patients, the timing of the insult was not determined. Some of the more common etiologies of prenatal onset include intrauterine infection, stroke, toxemia, and placental abruption; of perinatal onset, etiologies include hypoxic ischemic encephalopathy, kernicterus, and trauma; and of postnatal onset, etiologies include infection, trauma, and progressive hydrocephalus. There was insufficient information from the CT studies to calculate an accurate breakdown by specific etiology for any of the three groups although in many of the individual cases a specific etiology was assigned. Etiologies tend to be different in term and preterm babies and are discussed further in the section on MRI.

A CT scan in a child with CP may on occasion detect conditions that are surgically treatable that

Table 5 *MRI abnormalities in children with cerebral palsy based on preterm, term, and postnatal onset of insult*

Abnormalities	Preterm (n = 335)	Term (n = 272)	Postnatal (n = 29)
Acquired lesions	261	178	22
PVL with other areas of injury	227	45	—
Diffuse encephalopathy (cortical/subcortical atrophy/ventriculomegaly)	14	71	—
Focal ischemic/hemorrhagic (e.g., infarct porencephaly)	14	52	10
Multicystic encephalomalacia	3	10	—
Trauma (at birth or later)	0	0	4
Infection	3	0	8
Malformations*	48	55	0
Cortical dysplasia/polymicrogyria	8	18	—
Schizencephaly	6	11	—
Pachygyria/lissencephaly	5	9	—
Complex brain malformation	22	6	0
Agenesis/hypoplasia of the corpus callosum	3	3	—
Arachnoid cyst	1	0	—
Vermian/cerebellar hypoplasia	1	2	—
Hydrocephalus/holoprosencephaly/hydranencephaly	2	2	—
Miscellaneous/unknown	23	18	1
Miscellaneous etiologies	22	9	1
Delayed/abnormal myelination	1	9	0
Normal	3	21	6

Data from the following studies: Yin et al., 2000[16]; Okumara et al., 1997, pt 2[18]; Cioni et al., 1999[19]; Sugimoto et al., 1995[21]; Hayakawa et al., 1996[22]; Krageloh-Mann et al., 1995[15]; Yokochi et al., 1991[24]; Candy et al., 1993[17]; Jaw et al., 1998[20]; Truwit et al., 1992.[23] Abnormalities considered insults on neuroimaging were designated as preterm (insult occurred before 38 weeks gestation whether infant born prematurely or at term), term (insult occurred after full term gestation in the perinatal period up to 1 month of age), or postnatal (insult occurred after 1 month of age in infants born prematurely or at term). Malformations were categorized as preterm if detected in infants born before 38 weeks gestation or term if detected in infants born after a full term pregnancy.

* The data in the malformations section of this table are separated into preterm, term, and post-term as that is how they were reported in the original reports. It is believed, however, that these malformations occur prenatally.

PVL = periventricular leukomalacia.

might not be detected by neurologic examination. The chance of finding a surgically treatable lesion based on data from 702 children with various types of CP is 5% (range 0% to 22.5%) (table 3d). This may vary as one class III study reported that 22.5% of 120 patients had potentially treatable lesions identified (hydrocephalus, porencephaly, arteriovenous malformation, subdural hematomas and hygromas, and a vermian tumor).[10] The majority of other studies reported either no patients with potentially treatable lesions[6,13,14] or lower incidences of 5%,[9] 14%,[11] and 17%.[8] On occasion, CT (as well as MRI) may detect abnormalities that suggest a potentially treatable inborn error of metabolism.

When the CT scan is abnormal, the presence of coexisting conditions should be anticipated. In studies of 240 children with CP, the presence of mental retardation was greater if scans were abnormal than if they were normal or had minor abnormalities (78% versus 39%).[8,11-13] Three of these studies had additional data regarding the relation between CT findings and epilepsy.[8,11,12] Ninety-one percent of children with CP who had an abnormal CT scan had epilepsy or an abnormal EEG in contrast to only 38% of children whose scans were normal or minimally abnormal. One of these studies found normal EEG in 37%, paroxysmal EEG in 44%, and other abnormalities such as hemispheric asymmetry or suppression of activity in 19% of children.[13] Although an abnormal CT suggested greater risk of coexistent conditions, the specific nature of these conditions (e.g., type of epilepsy) did not correlate with scan abnormalities.[13]

Conclusions. Data from three class I (75%) and six class III (77%) studies indicate that the yield of finding an abnormal CT scan in a child with CP is high (average of 77%) and related to the type of CP. Scan abnormalities may determine an etiology in many children but there were insufficient data to assess this further. Scan abnormalities may occasionally (i.e., 5 to 22%) identify treatable conditions and may suggest an increased risk for associated conditions such as mental retardation and epilepsy.

MRI. Data from studies involving 644 children with CP who had MRI scans found abnormalities in

89% (range 68% to 100%) (see table 4a). For the two class I studies (n = 98), 92% of children had abnormal scans whereas 77% of patients in one class II study (n = 22) had abnormal scans as did 89% of children in the class III studies (n = 524). The yield on MRI (table 4b) depended on the type of CP that was present (mixed > quadriplegic > hemiplegic > diplegic > ataxic > dyskinetic > hypotonic) and was somewhat different from that reported using CT.

MRI was helpful in determining whether the injury was prenatal, perinatal, or postnatal in onset (table 4c). Based on studies involving 345 children (class I n = 98; class III n = 247) with different types of CP, onset was prenatal in 37% (29% in class I and 45% in class III studies), perinatal in 35% (45% in class I and 31% in class III), and postnatal in 4% (1% in class I and 5% in class III studies). The yield from MRI also depended on whether the child with CP was born prematurely, at term, or whether CP was due to an insult later in life. Data from studies on 620 patients found that MRI scans were abnormal in 332/335 (99%) preterm infants, 251/272 (92%) term infants, and 23/29 (79%) infants older than 1 month (table 5). In most series, this was due to the fact that MRI was more sensitive in detecting periventricular leukomalacia, other perinatally acquired lesions, as well as subtle congenital anomalies of brain development. MRI can help define abnormalities based on the timing of insult in most patients as summarized in table 5. The etiology of CP in these children was suggested or established based on neuroimaging findings in combination with the clinical history.

Conclusions. Data from two class I (92%), one class II (77%), and seven class III studies (89%) indicate that the yield of finding an abnormal MRI scan in a child with CP is very high (average of 89%) and greater than that reported using CT (77%). The yield on MRI (as with CT) depends on the type of CP that is present. MRI is more likely to be abnormal in cases of CP associated with prematurity, showing abnormalities such as periventricular leukomalacia, compared to infants born at term. An etiology of CP can be determined in many patients based on the results of neuroimaging in combination with the clinical history.

Recommendations. 1. Neuroimaging is recommended in the evaluation of a child with CP if the etiology has not been established; for example, by perinatal imaging (Level A, class I and II evidence).

2. MRI, when available, is preferred to CT scanning because of the higher yield of suggesting an etiology and timing of insult leading to CP (Level A, class I–III evidence).

Metabolic and genetic testing. Should metabolic or genetic testing be routinely ordered in children with CP?

Evidence. Data from 2 class I, 13 class II, and 4 class III studies on 1,384 children with CP who underwent neuroimaging (CT or MRI) and who also had metabolic and genetic testing indicate that it is rare to identify an underlying metabolic or genetic disorder. The mean incidence of metabolic (4%) and genetic disorders (2%) in those children who had CT scans was slightly higher than with MRI (metabolic, 0%; genetic, 1.4%) and did not vary substantially between the different classes of studies (see tables 3d and 4d). The low and variable incidence of metabolic and genetic disorders in these studies was, in part, due to patient selection factors, as in some studies children with metabolic disorders were excluded from analysis.[17] Also, in these retrospective studies, the extent and type of metabolic or genetic testing was variable so that the exact prevalence of such disorders in children with CP remains uncertain.

Since the advent of neuroimaging, it has become more apparent that children with CP may have congenital brain malformations. Data from this same group of 1,426 children found that 7% of patients who had a CT scan and 12% of those who underwent MRI had major brain malformations such as lissencephaly, schizencephaly, or pachygyria (see tables 3d and 4d). Because these malformations are ever increasingly associated with specific genetic disorders (e.g., lissencephaly/Miller-Dieker syndrome/chromosome 17p13.3), their presence in affected children indicates the need for further genetic testing. Certain neurometabolic disorders (e.g., peroxisomal disorders such as Zellweger syndrome) may be associated with cerebral malformations and can present within the first years of life with a motor deficit that might appear to be nonprogressive. At present, no studies have prospectively evaluated children with CP with or without brain malformations to determine the incidence of metabolic or genetic abnormalities.

Metabolic disorders may on rare occasions masquerade as CP. Six small case series (i.e., class IV studies) describe 30 children who ultimately developed what appeared to be dyskinetic CP due to glutaric aciduria (type 1).[25-30] These children typically develop normally until 5 to 10 months of age when they suffer an acute encephalopathy manifested by coma that is followed by dystonia, motor impairment, and macrocephaly (in about 60%).[25] Distinctive MRI and CT findings occur in half the patients and are manifested by frontal and temporal atrophy. Early diagnosis is important as glutaric aciduria is treatable; early intervention may prevent significant motor and cognitive impairment.[28] Other metabolic disorders presenting with symptoms suggestive of CP also have been reported in small case series and include Lesch-Nyhan syndrome,[31] 3-methylglutaconic aciduria,[32] pyruvate dehydrogenase deficiency,[33] argininemia,[34] cytochrome oxidase deficiency,[35] succinic semialdehyde dehydrogenase deficiency,[36] and female carriers of ornithine transcarbamylase deficiency.[37]

Other childhood neurologic disorders (e.g., dopa-responsive dystonia, hereditary spastic paraplegia, ataxia telangiectasia) may initially be misdiagnosed as CP because of the slow rate of progression of symptoms. Other clinical or laboratory features of

Table 6 *Associated conditions in children with cerebral palsy*

Reference	Class	N	% Mental retardation	% Visual defects	% Speech-language disorders	% Hearing impaired
Zafeiriou et al., 1999[47]	I	493	40	39	54	15
Murphy et al., 1993[48]	I	204	65	10	NA	4
von Wendt et al., 1985[49]	I	69	70	19	NA	7
Kolawole et al., 1989[10]	III	120	66	15	59	14
Total		886	52	28	38	12

NA = not available.

such conditions and observations over time that neurologic symptoms are progressive should suggest that the child does not have CP and mandates the need for further evaluation.

Conclusions. Metabolic or genetic causes for CP occur infrequently (i.e., 0 to 4%). However, the true incidence is unknown as there have been no prospective studies that have examined this issue. In almost all such cases, there are atypical complaints, features in the history of a progressive rather than a static encephalopathy, findings on neuroimaging that are representative of certain genetic or metabolic disorders, or a family history of childhood neurologic disorder with associated CP. Neuroimaging studies have shown that 7 to 11% of children with CP will have a brain malformation suggesting additional risk for genetic and possibly a metabolic etiology.

Recommendations. 1. Metabolic and genetic studies should not be routinely obtained in the evaluation of the child with CP (Level B, class II and III evidence).

2. If the clinical history or findings on neuroimaging do not determine a specific structural abnormality or if there are additional and atypical features in the history or clinical examination, metabolic and genetic testing should be considered (Level C, class III and IV).

3. Detection of a brain malformation in a child with CP warrants consideration of an underlying genetic or metabolic etiology (Level C, class III and IV evidence).

Coagulopathies. Should coagulation studies be performed in children with CP?

Evidence. Patients with hemiplegic CP frequently have suffered a prenatal or perinatal cerebral infarction. Data from three CT studies listed in table 3a (n = 196) found cerebrovascular occlusion, usually in the middle cerebral artery distribution, in 13%,[6] 32%,[11] and 37%[14] of individuals. There are insufficient data concerning the incidence of cerebral infarction or other causes of cerebrovascular compromise in children with other forms of CP.

Children, in contrast to adults, often have a coagulopathy, congenital heart disease, or an infectious process as the etiology of stroke.[38] However, none of the MRI series listed in table 4a focused on children with hemiplegic CP. None of the reported series (see tables 3 and 4) included information indicating that a systematic examination for the etiology of infarction was performed. One class I study[39] and several class II studies have reported coagulation abnormalities as the etiology of neonatal cerebral infarction.[39-42] These have included Factor V Leiden deficiency, the presence of anticardiolipin or antiphospholipid antibodies, and Protein C or S deficiency. One class III study[42] and several class IV case reports[43-46] have also described the relation between neonatal cerebral infarction, coagulopathies, and a later diagnosis of hemiplegic CP.

Conclusions. Class I–III evidence indicates that cerebral infarction due to pre- or perinatal cerebrovascular occlusion occurs in 13 to 37% of children with hemiplegic CP. Class II and III evidence suggests that an etiology of cerebral infarction in this population may be due to a coagulation disorder and that the yield of testing will be higher if done in the neonatal period rather than if the child is evaluated later at the time of diagnosis of CP. There is insufficient evidence regarding the relation between coagulation disorders and other forms of CP.

Recommendations. Because the incidence of unexplained cerebral infarction seen with neuroimaging is high in children with hemiplegic CP, diagnostic testing for a coagulation disorder should be considered (Level B, class II–III evidence). There is insufficient evidence to be precise as to what studies should be ordered.

Associated conditions. What evaluations for associated conditions should be performed in children with CP?

Evidence. Children with CP often have associated conditions such as mental retardation or epilepsy that are equal in severity to their motor impairment. Because of the motor difficulties associated with CP, these conditions may not be readily recognized. These conditions may also seriously hamper the ability of a child to realize his or her intrinsic developmental potential.

Data from three class I and one class II studies involving 886 children with CP summarize the frequency of some of the major associated conditions that occur in children with CP (table 6).[47-49] The incidence of mental retardation (52%), epilepsy (45%), ophthalmo-

Table 7 *Prevalence of epilepsy in children with cerebral palsy*

Reference	Class	N	Types of cerebral palsy	% Patients with epilepsy
Murphy et al., 1993[48]	I	204	M	46
von Wendt et al., 1985[49]	I	69	M	48
Miller and Cala, 1989[8]	I	29	A	59
Zafeiriou et al., 1999[50]	II	493	M	36
Hadjipanayis et al., 1997[51]	II	323	M	42
Al-Sulaiman, 2001[52]	II	151	M	54
Chambers et al., 1999[53]	II	114	M	36
Bruck et al., 2001[54]	II	100	M	62
Cioni et al., 1999[19]	II	91	M	35
Kwong et al., 1998[55]	II	85	M	38
Kaushik et al., 1997[56]	II	50	M	56
Taudorf et al., 1984[11]	III	83	M	35
Senbil et al., 2002[57]	III	74	M	42
Cohen and Duffner, 1981[13]	III	52	H	58
Total		1918		43

M = mixed; A = ataxic; H = hemiplegic.

logic defects (28%), speech and language disorders (38%), and hearing impairment (12%) are quite significant. Data from some of these studies also suggest that those children who have abnormal neuroimaging are more likely to have one or more of these deficits and in some of the studies severity of scan findings was associated with the severity of deficit.

Epilepsy. Should EEG be routinely performed in the assessment of children with CP?

Evidence. Given the higher frequency of epilepsy in children with CP, EEG is often considered during the initial evaluation.[47] The utility of EEG from a diagnostic perspective in this population has not been prospectively investigated. The vast majority of articles on EEG and CP are class III and IV studies that describe the frequency and types of seizures in children with different forms of CP but do not address the role of EEG in determining the etiology of CP nor in predicting the development of seizures in a child with CP.

Data from studies involving 1,918 children have found on average that 43% (range 35 to 62%) of children with CP develop epilepsy (table 7). In the three class I studies (n = 302), 48% had epilepsy in contrast to 42% of the children in the eight class II studies (n = 1,407) and 43% in the class III studies (n = 209). In none of these studies was there evidence that the EEG was useful in determining the etiology of the child's CP.

Data from one class II study compared patients with CP and epilepsy to those with epilepsy alone.[55] Children with CP had a higher incidence of epilepsy with onset within the first year of age (47% versus 10%), history of neonatal seizures (19% versus 3%), status epilepticus (16% versus 1.7%), need for polytherapy (25% versus 3%), and treatment with second-line antiepileptic drugs (31% versus 6.7%). They also had a lower incidence of generalized seizures (28% versus 59%) and of remaining seizure free (37% versus 90%).[55] Factors associated with a seizure-free period of 1 year or more in epileptic children with CP include normal intelligence, single seizure type, monotherapy, and spastic diplegia. Similar findings have been observed by other investigators in the studies listed in table 7 and are summarized in the review by Wallace.[47] Children with CP who have abnormal neuroimaging studies are more likely to have epilepsy. One class I and two class II CT studies have examined the association between CT findings and epilepsy.[8,11,13] Fifty-four percent of children with CP and an abnormal CT had epilepsy in contrast to only 27% of those who had a normal scan. In one study, EEG abnormalities (described as paroxysmal or asymmetric) were also much more commonly found in those children with an abnormal CT scan.[13]

The prevalence of epilepsy also varies depending on the type of CP that is present. Data from the studies listed in table 7 indicate that children with spastic quadriplegia (50 to 94%) or hemiplegia (30%) have a higher incidence of epilepsy than patients with diplegia or ataxic CP (16 to 27%). In patients with dyskinetic CP, it may occasionally be difficult to differentiate partial complex seizures from dyskinetic movements.

Conclusions. Although approximately 45% of children with CP develop epilepsy, in none of the retrospective studies involving 2,014 children was there evidence that the EEG was useful in determining the etiology of the child's CP. There is no evidence to make any recommendation regarding the child with CP who does not have a history of seizures as to whether an EEG should be ordered to screen for epileptiform abnormalities.

Recommendations. 1. An EEG should not be obtained for the purpose of determining the etiology of CP (Level A; class I and II evidence).

2. An EEG should be obtained when a child with CP has a history or examination features suggesting the presence of epilepsy or an epileptic syndrome (Level A; class I and II evidence).

Mental retardation. Cognitive and neuropsychological function in children with CP are commonly impaired.[58] In general, there is some but no absolute relation between the type of CP and severity of cognitive impairment. Children with spastic quadriplegia have greater degrees of mental impairment than children with spastic hemiplegia. Motor deficits of children with spastic CP appear to correlate with the severity of cognitive deficits in contrast to those children with dyskinetic CP where this relation is lacking.[58]

Children with different forms of CP may be difficult to assess because of the motor deficits and in some forms of CP (e.g., spastic diplegia) the differences between performance and verbal intelligence test scores actually increase with age.[59] Laterality of hemiplegia may also be a contributing factor—those children with right hemiplegia may be more likely to have impaired language function due to left hemisphere injury,[59] although this remains controversial.[60] There is also a strong association between greater intellectual impairment in children with CP and the presence of epilepsy, an abnormal EEG, or an abnormal neuroimaging study.[47]

Ophthalmologic impairments. Visual impairments and disorders of ocular motility are common (28%) in children with CP (see table 6). There is an increased presence of strabismus, amblyopia, nystagmus, optic atrophy, and refractive errors.[61] Children whose CP is due to periventricular leukomalacia are also more likely to have visual perceptual problems. Many of these difficulties should be detected if currently accepted guidelines for vision screening in children with CP are employed.[62,63]

Speech and language disorders. Because of bilateral corticobulbar dysfunction in many CP syndromes, anarthric or dysarthric speech and other impairments related to oral-motor dysfunction are common. For example, articulation disorders and impaired speech intelligibility are present in 38% of children with CP (see table 6).[64,65] Because their impaired mobility can cause limited interaction with individuals in the environment, children with CP might not be able to develop the linguistic skills necessary to develop more complex speech patterns.[66] Language (as opposed to speech) deficits in CP go hand in hand with verbal intellectual limitations associated with mental retardation.[67] Oral-motor problems including feeding difficulties,[68-70] swallowing dysfunction,[65,70] and drooling[71] may lead to potential serious impacts on nutrition and growth,[72] oral health,[73,74] respiration,[75] and self-esteem.

Hearing impairment. Hearing impairment occurs in approximately 12% of children with CP (see table 6). This occurs more commonly if the etiology of CP is related to very low birth weight, kernicterus, neonatal meningitis, or severe hypoxic-ischemic insults. Children with CP who have mental retardation or abnormal neuroimaging studies are at greater risk for hearing impairment. Of concern are recent studies from the Centers for Disease Control that almost half the children found to have severe congenital hearing loss (with or without CP) in the greater Atlanta area were not recognized until almost age 3 years.[76] Established guidelines for neonatal audiometric screening have recently been published.[77]

Conclusions. Children with CP are more likely to have associated conditions including mental retardation (52%), ophthalmologic defects (28%), hearing impairment (12%), and speech and language disorders (38%) and additional oral-motor deficits. Children with CP are also at greater risk for epilepsy (mean 43%; range 34 to 94%). However, there is no evidence that an EEG is helpful in determining the etiology of CP.

Recommendations. Because of the high incidence of associated conditions, children with CP should be screened for mental retardation, ophthalmologic and hearing impairments, and speech and language disorders (Level A, class I and II evidence). Nutrition, growth, and other aspects of swallowing dysfunction should be monitored. Further specific evaluations are warranted if screening suggests areas of impairment.

Recommendations for the evaluation of children with CP. Although there is insufficient evidence to recommend the optimal sequence of tests to determine the etiology of CP, taking into account diagnostic yield and potential treatability, we propose the following consensus-based evaluation as outlined in the algorithm (figure). All children should undergo a detailed history and physical examination. It is important to determine that the child's condition is due to a static and not a progressive or degenerative neurologic disorder. It is also important to classify the type of CP as this has diagnostic implications as well as implications regarding associated problems. Because children with CP commonly have associated mental retardation, ophthalmologic abnormalities, hearing impairments, speech and language disorders, and disorders of oral-motor function, screening for these conditions should be part of the initial assessment. An EEG is recommended when there are features suggestive of epilepsy or a specific epileptic syndrome. In order to establish an etiology and prognosis in children with CP, neuroimaging is recommended, with MRI preferred to CT. However, if neuroimaging performed in the perinatal period provided an etiology of the child's CP, it may obviate the need for later study. Metabolic and genetic studies should not be routinely obtained in the evaluation of the child with CP. If the clinical history or findings on neuroimaging do not determine a specific structural abnormality or if there are additional and atypical features in

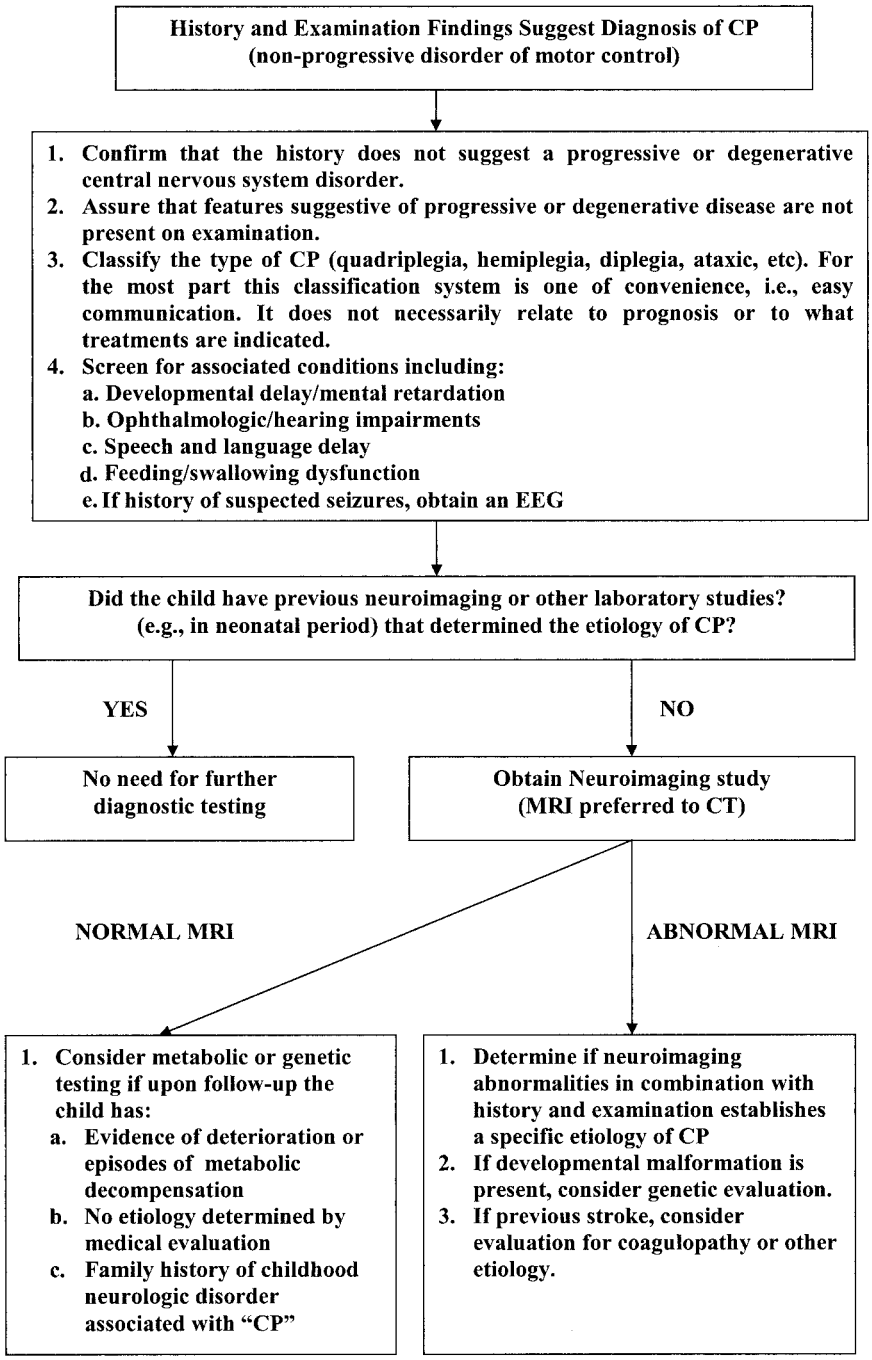

Figure. Algorithm for the evaluation of the child with cerebral palsy (CP). Screening for associated conditions (mental retardation, vision/hearing impairments, speech and language delays, oral motor dysfunction, and epilepsy) is recommended. Neuroimaging (MRI preferred to CT) is recommended for further evaluation if the etiology of the child's CP has not been previously determined. In some children, additional metabolic or genetic testing may be indicated.

the history or clinical examination, metabolic and genetic testing should be considered. Because the incidence of cerebral infarction is high in children with hemiplegic CP, diagnostic testing for a coagulation disorder should be considered.

Future research. 1. Prospective studies on the etiologic yields of genetic, metabolic, and neuroimaging diagnostic tests should be undertaken in large numbers of young children with CP compared with control subjects. This would permit the development of specific diagnostic algorithms.

2. Large prospective cohorts of children with CP should be studied to identify features based on CP subtypes that can improve specific evaluation strategies and enhance etiologic yield.

3. It should be determined at what age and on what basis we can be certain that a child has CP sufficient to justify testing and at what age the yield will be optimal. Strategies of conducting testing simultaneously or sequentially need to be assessed. This should reduce unnecessary testing and provide cost-effective evaluations (i.e., a favorable balance between the cost of testing versus savings from early intervention, prevention of the birth of affected children).

4. Studies are needed to better characterize speech and language, ophthalmologic, auditory, oral-motor, nutrition, and growth deficits in children with

CP. Investigation of the sensorimotor impairments of children with CP is also needed so that studies of early intervention therapies might be done to improve the overall function of children who are likely to have multiple needs.

5. Issues related to quality of life and social support for families need further study. Included should be the benefits that medical testing confers by reducing parental concerns related to determining an etiology and by providing important information regarding prognosis, genetic counseling, and planning future educational and treatment needs.

6. Future research should also be directed to determine the underlying mechanisms causing CP that are associated with perinatal stroke, coagulopathies, genetic disorders, pre- and perinatal inflammatory diseases, and environmental factors.

Mission statement. The Quality Standards Subcommittee (QSS) of the AAN seeks to develop scientifically sound, clinically relevant practice parameters for the practice of neurology. Practice parameters are strategies for patient management that assist physicians in clinical decision making. A practice parameter is one or more specific recommendations based on analysis of evidence of a specific clinical problem. These might include diagnosis, symptoms, treatment, or procedure evaluation.

Disclaimer. This statement is provided as an educational service of the American Academy of Neurology and the Child Neurology Society. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN and the CNS recognize that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved.

Appendix 1: Members of the Quality Standards Subcommittee

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AMERICAN ACADEMY OF NEUROLOGY

Special Article

Practice Parameter: Diagnostic assessment of the child with status epilepticus (an evidence-based review)

Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society

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Abstract—*Objective:* To review evidence on the assessment of the child with status epilepticus (SE). *Methods:* Relevant literature were reviewed, abstracted, and classified. When data were missing, a minimum diagnostic yield was calculated. Recommendations were based on a four-tiered scheme of evidence classification. *Results:* Laboratory studies (Na^{++} or other electrolytes, Ca^{++}, glucose) were abnormal in approximately 6% and are generally ordered as routine practice. When blood or spinal fluid cultures were done on these children, blood cultures were abnormal in at least 2.5% and a CNS infection was found in at least 12.8%. When antiepileptic drug (AED) levels were ordered in known epileptic children already taking AEDs, the levels were low in 32%. A total of 3.6% of children had evidence of ingestion. When studies for inborn errors of metabolism were done, an abnormality was found in 4.2%. Epileptiform abnormalities occurred in 43% of EEGs of children with SE and helped determine the nature and location of precipitating electroconvulsive events (8% generalized, 16% focal, and 19% both). Abnormalities on neuroimaging studies that may explain the etiology of SE were found in at least 8% of children. *Recommendations:* Although common clinical practice is that blood cultures and lumbar puncture are obtained if there is a clinical suspicion of a systemic or CNS infection, there are insufficient data to support or refute recommendations as to whether blood cultures or lumbar puncture should be done on a routine basis in children in whom there is no clinical suspicion of a systemic or CNS infection (Level U). AED levels should be considered when a child with treated epilepsy develops SE (Level B). Toxicology studies and metabolic studies for inborn errors of metabolism may be considered in children with SE when there are clinical indicators for concern or when the initial evaluation reveals no etiology (Level C). An EEG may be considered in a child with SE as it may be helpful in determining whether there are focal or generalized epileptiform abnormalities that may guide further testing for the etiology of SE, when there is a suspicion of pseudostatus epilepticus (nonepileptic SE), or nonconvulsive SE, and may guide treatment (Level C). Neuroimaging may be considered after the child with SE has been stabilized if there are clinical indications or if the etiology is unknown (Level C). There is insufficient evidence to support or refute routine neuroimaging in a child presenting with SE (Level U).

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Table 1 *Classification of status epilepticus (SE)*

Type	Definition	Examples
Acute symptomatic (26%)*	SE occurring during an acute illness (an acute CNS insult) (an acute encephalopathy)	Meningitis, encephalitis, electrolyte disturbance, sepsis, hypoxia, trauma, intoxication
Remote symptomatic (33%)	SE occurring without an acute provocation in a patient with a prior history of a CNS insult (a chronic encephalopathy)	CNS malformation, previous traumatic brain injury or insult, chromosomal disorder
Remote symptomatic with an acute precipitant (1%)	SE occurring with a chronic encephalopathy, but with an acute provocation	CNS malformation or previous CNS insult with concurrent infection, hypoglycemia, hypocalcemia, or intoxication
Progressive encephalopathy (3%)	SE occurring with an underlying, progressive CNS disorder	Mitochondrial disorders, CNS lipid storage diseases, amino- or organic acidopathies
Febrile (22%)	SE occurring when the only provocation is a febrile illness, after excluding a direct CNS infection, such as meningitis or encephalitis	Upper respiratory infection, sinusitis, sepsis
Cryptogenic† (15%)	SE occurring in the absence of an acute precipitating CNS insult, systemic metabolic disturbance, or both	No definable cause

* Data for percentages for each group are presented in more detail in appendix 4.
† The category cryptogenic is now used instead of idiopathic, which had been used in the original classification.

Status epilepticus (SE) in children, as in adults, is a life-threatening emergency that requires prompt recognition and immediate treatment. Although various definitions of SE have been used since 1983, the most commonly accepted is a 30-minute duration of seizures based on previous studies that found evidence of brain injury in adult monkeys after 45 to 60 minutes of continuous seizures.[1-3] This 30-minute definition was adopted in subsequent studies of SE and by the working group on SE of the Epilepsy Foundation of America.[4,5] This definition also includes two or more sequential seizures without full recovery of consciousness between seizures.[5]

SE is classified by seizure type and etiology.[6,7] The seizure type is determined by the origin of the epileptic discharge (i.e., focal or generalized) or if insufficient information is available, indeterminate or unclassifiable.[8-10] As defined in table 1, the etiologic classification of SE includes 1) acute symptomatic, 2) remote symptomatic, 3) remote symptomatic with an acute precipitant, 4) progressive encephalopathy, 5) febrile, and 6) cryptogenic (idiopathic).[4,5,11,12] When some of these studies were done the term idiopathic was used for episodes now called cryptogenic. The category idiopathic is now reserved for the genetically determined epilepsies.[13] Remote symptomatic with an acute precipitant refers to SE in a child with a prior known diagnosis of epilepsy.

The incidence of SE in children ranges from 10 to 58 per 100,000 per year for children ages 1 to 19 years (mean 38.8 and median 43.8/100,000/year; 95% CI 18.2 to 59.5/100,000/year) or would be 31,600 (range 7,300 to 41,600) children under age 18 years in the United States per year.[14-17] A higher incidence has been reported in infants younger than 1 year of age in two studies (135.2/100,000/year and 156/100,000/year).[14,16] SE is a common occurrence in children with epilepsy, ranging from 9.1% to 27% over time.[18-20] SE may also be the presenting manifestation of epilepsy. Symptomatic SE is common in infants and younger children. In one study of 394 children aged 1 month to 16 years, more than 80% of children less than 2 years of age had acute symptomatic SE, febrile SE, or a progressive encephalopathy whereas cryptogenic and remote symptomatic SE was more common in children older than 4 years.[21] SE has been reported to recur in 17% of children.[22]

Guidelines for AED treatment have been developed for pediatric SE,[23-25] but specific pediatric guidelines have not been developed for its diagnostic evaluation. The 1993 recommendations of the Epilepsy Foundation of America (EFA) Working Group on Treatment of Convulsive SE included adults and children.[5] These recommendations, including a treatment sequence with antiepileptic drugs (AEDs), were consensus, rather than evidence-based, and are currently under revision including redefining the duration considered necessary to diagnose SE.

These guidelines recommended a Dextrostix level in all patients with SE, noting that hypoglycemia rarely caused SE, but is obtained to avoid a glucose infusion, and recommended consideration on an individual basis of other diagnostic studies including a complete blood count (CBC), serum chemistries (glucose, sodium, calcium, magnesium, and BUN), AED

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levels, and urine and blood toxicology studies. A lumbar puncture (LP) was recommended when fever occurred with SE, especially in young children, unless a contraindication to LP was present.

This Practice Parameter reviews available evidence concerning the value of diagnostic testing in children and adolescents with SE and provides recommendations based upon this evidence. Treatment guidelines are not included but are under development.

Description of process. We performed a literature search through the library of the University of Minnesota, and MEDLINE, for English-language articles from 1970 to 2005 and yielded 1,609 articles. The search terms were as follows: status epilepticus and, children and, MRI, cranial CT scan, lumbar puncture, spinal tap, electrolytes, metabolic studies, inborn errors of metabolism, EEG, hyponatremia, hypokalemia, hypocalcemia, hypoglycemia, acidosis, alkalosis, azotemia, hypophosphatemia, hypomagnesemia, pleocytosis, toxicology, intoxication. Seizures occurring in neonates less than 1 month of age were excluded, as these are defined as neonatal seizures and are different in cause and prognosis. The upper age limit was 19 years. Only articles reporting studies with more than 20 patients were included in this review. Articles consisting of single patient case reports or small samples of unusual pathologic findings, that would have biased the analysis, or articles that referred specifically to febrile or refractory SE, were excluded. Febrile SE and refractory SE were excluded because each is a selected population. Twenty-five articles were identified and reviewed for preparation of this Parameter. Relevant position papers from professional organizations were also reviewed.

Individual committee members reviewed titles and abstracts for content and relevance. Those papers dealing with diagnostic assessments of SE were selected for further detailed review. Bibliographies of the articles cited were checked for additional pertinent references. Each of the selected articles was reviewed, abstracted, and classified by at least two committee members. Abstracted data included the number of patients, total episodes of SE (if given), ages, nature of subject selection, case-finding methods (prospective, retrospective, or referral), inclusion and exclusion criteria, classification, etiology, and the results of laboratory, EEG, or neuroimaging tests. A four-tiered classification scheme for determining the validity of studies on yield of established diagnostic and screening tests developed by the Quality Standards Subcommittee was utilized as part of this assessment (appendix 2). Depending on the strength of this evidence, it was decided whether specific recommendations could be made, and if so, the level of strength of these recommendations (appendix 3). Evidence pertinent to each diagnostic test together with the committee's evidence-based recommendations is presented.

Recommendations included in this Parameter were based on review of data regarding the following tests for children presenting in SE: 1) blood culture and LP studies; 2) AED levels; 3) toxicology screening; 4) metabolic and genetic studies; 5) EEG; and 6) neuroimaging including CT and MRI.

Most available literature did not specify whether the diagnostic tests analyzed were uniformly applied during each SE episode. Therefore, where reported data were missing, we calculated a minimum diagnostic yield for each test by dividing the total number of positive diagnostic tests reported by the total number of reported SE episodes from each study (therefore assuming that each diagnostic test was performed for each episode of SE, likely leading to an underestimate of the true diagnostic yield of these tests).

It is now common practice to obtain a CBC and chemistry profiles routinely in children presenting with SE. Thus, we did not develop evidence-based recommendations for these tests but did include in appendix 4 a summary of previous studies regarding their diagnostic yield. Electrolyte (e.g., Na^{++} or other electrolytes, Ca^{++}, glucose) abnormalities or basic metabolic disorders were reported in an average of 6% (range 1 to 16%) of children with SE. In most studies these abnormalities were listed as the etiology. However, it was unclear whether these abnormalities were responsible for the episode of SE and if correction resulted in cessation of SE.

Analysis of the evidence. In 2,093 children from 20 class III studies, SE was attributed to an acute symptomatic cause in 26%, a remote symptomatic cause in 33%, a remote symptomatic with an acute precipitant in 1%, a progressive encephalopathy in 3%, febrile SE in 22%, and cryptogenic in 15% (table 1).

Laboratory studies. Should blood cultures and LP be routinely done in children with SE? Infectious or inflammatory disorders may cause seizures by direct involvement of the CNS, such as with meningitis or encephalitis, or by systemic involvement affecting the brain (i.e., acute symptomatic SE). Systemic illness may aggravate pre-existing epilepsy by lowering the seizure threshold. An infectious disorder may be included in the differential diagnosis if fever is present or if there has been a history of fever or preceding illness. Common clinical practice is that blood cultures are obtained if there is a clinical suspicion of an infection and likewise LP is done when there are clinical features suggestive of CNS infection, especially if fever is present.

Blood cultures (evidence). In six class III studies that reported the category sepsis, with a total of 357 children, blood cultures were reported as positive in 2.5 ± 0.9% (range 0.01 to 3.8%; median 2.6%; 95% CI 1.7% to 3.3%).[33-35,37,38,40] This is a minimum yield based on the assumption that blood cultures were done in all patients with SE whether or not sepsis was suspected. Data were not available to determine

the rate of positive blood cultures in patients in whom sepsis was suspected. Likewise, data were not available to ascertain the incidence of positive blood cultures in those patients clinically considered not to be at risk for infection.

LP (evidence). A documented CNS infection was reported on average in 12.8 ± 6.2% (range 3.4 to 26.1%; median 11.5%; 95% CI 9.9% to 15.6%) of the 1,859 children in the class III studies listed in appendix 4, but the criteria for obtaining a LP, and the actual number done, is not known. Again, this may represent a lower rate of positive studies than if we knew the actual number of LPs done. In addition, if some patients who did not undergo LP had CNS infection, this also would have raised the diagnostic yield. The variability in range may be related to age, with a higher incidence of CNS infections occurring in the younger children, or to selection criteria.[29,30,33,39,41]

A class III study of 49 children with convulsive SE identified 24 children with SE and fever and in this group bacterial meningitis was detected in 4 of 9 children who had a LP done (8% of entire group and 17% of febrile group).[44] None of the 25 children without febrile SE were diagnosed with meningitis. The etiology of CNS infection in these studies was based on author assignment of diagnosis rather than on the reported confirmatory laboratory test results and included bacterial meningitis in 4.8% and encephalitis in 3.0% of children. In three Class III studies (n = 185),[29,31,40] the following diagnoses were documented with LP results: meningitis (14%),[29,31] encephalitis (11%),[29] leukemic meningitis (1%),[29] vasculitis (0.5%),[31] and shunted hydrocephalus (0.5%).[29,31] In 3% of these children, pleocytosis of undetermined etiology was found and suggested that the episode of SE itself was the presumed cause of the pleocytosis.[31]

Conclusions. Data from six class III studies revealed a minimum diagnostic yield of a positive blood culture in 2.5% of children with SE. Data based on the 1,859 children from the studies listed in appendix 4 revealed that the frequency of diagnosed CNS infection rate was 12.8%. In all of these studies there was no indication that tests were done routinely on all children with SE; it was either stated or presumed that the tests were done selectively.

Recommendations. 1. There are insufficient data to support or refute whether blood cultures should be done on a routine basis in children in whom there is no clinical suspicion of infection (Level U).

2. There are insufficient data to support or refute whether LP should be done on a routine basis in children in whom there is no clinical suspicion of a CNS infection (Level U).

Should AED levels be routinely obtained in children taking AEDs who develop SE? If a child with epilepsy treated with AEDs develops SE, it is possible that AED levels are low, because either there had been a therapeutic response at that level or because of inadequate dosing, noncompliance, or withdrawal of the AED.

Table 2 *Results of studies in which AED levels were obtained**

Reference no.	Class	N	Low AED levels	AED withdrawn or D/C	AED noncompliance
45	II	51	9†	—	—
4	III	193	—	4	—
34	III	83	—	23	—
31	III	60	32	—	—
38	III	37	1	—	1
27	III	43	27	—	—
39	III	37	—	3	—
42	III	24	5	1	—
Total‡		528	74	31	1 (0.2%)
Mean, %			32 ± 25	9 ± 10	—
Median, %			21	4.2	—
Range, %			2.7–63	1–28	—
95% CI, %			8.8–51	−0.5–18.6	

* Numbers in columns indicate the number of patients in each study who had an abnormal laboratory value for that test. All studies were class III. Fields marked with — indicates that there was no diagnostic category in that individual study for the column entry.
† Total number of abnormalities for each test given with percentage of total abnormalities discontinued (D/C).
‡ Four acutely withdrawn in <1 week.

AED = antiepileptic drugs.

Evidence. We assumed that AED levels were obtained in those children who were supposed to be on AEDs rather than on all children presenting in SE. One article addressing this question was considered class II.[45] Data on AED levels were available for review in 528 children in SE from nine studies (table 2). AED levels were low in 32% ± 25% (range 2.7 to 63%; median 21%; 95% CI 8.8% to 51%) of those children already on AEDs; they had been withdrawn on average in 9% ± 10% (range 1% to 28%; median 4.2%; 95% CI −0.5% to 18.6%) and patients were noncompliant in 0.2% overall (2.7% when specifically mentioned as a category). Noncompliance was determined by clinical history. In one study it was reported that 4 of the 9 children with low levels had the AED acutely withdrawn or discontinued within 1 week. However, the low AED levels reported in these studies were not necessarily the cause of SE.[7,27,45]

Conclusions. Class II data showed low AED levels in 32% of children on AEDs, although this was not necessarily the cause of the SE.

Recommendation. AED levels should be considered when a child with epilepsy on AED prophylaxis develops SE (Level B, class II and III evidence).

Should toxicology testing be routinely ordered in children with SE? Ingestion of a toxin or drug abuse are possible etiologies of SE that require very prompt diagnosis and treatment.

Evidence. A toxic ingestion was documented in 3.6% (range 1.5 to 5.3%; median 3.8%; 95% CI 2.3% to 6.8%) of 1,221 children enrolled in 11 class III studies.[4,26,27,29-32,36,37,41,43] The specific toxins were theophylline, lindane, carbamazepine, or chemotherapy. This represents a minimum rate as we used as the denominator all patients in the studies. There is no information on whether toxicology testing was performed based on suggestive history or physical examination findings or because initial screening laboratory studies were negative. A routine urine toxicology screen identifies only drugs of abuse and specific serum toxicology levels are needed to identify specific toxins.

Conclusions. Data from 11 class III studies of children with SE revealed a diagnosis of ingestion in 3.6%. It is not known what proportion of these ingestions was suspected. We deemed this yield high enough to consider testing with specific serum toxicology levels, if indicated, since establishing the diagnosis is critical to treatment.

Recommendation. 1. Toxicology testing may be considered in children with SE, when no apparent etiology is immediately identified, as the frequency of ingestion as a diagnosis was at least 3.6% (Level C, class III evidence). To detect a specific ingestion, suspected because of the clinical history, it should be noted that a specific serum toxicology level is required, rather than simply urine toxicology screening.

Metabolic and genetic testing. Should testing for inborn errors of metabolism or genetic (chromosomal or molecular) studies be routinely ordered in children with SE? Inborn errors of metabolism (IEM) and specific chromosomal or genetic disorders may cause neurologic dysfunction and epilepsy. In some patients, seizures may worsen during an intercurrent illness or because of metabolic stress. Historic features suggestive of a metabolic disorder are unexplained neonatal encephalopathy; unexplained developmental delay, especially when there is a neurologic deterioration during an acute illness; unusual odors to the urine; unexplained acidosis or coma, especially with recurrent episodes of intolerance to certain foods; the need to eat frequently to prevent lethargy; or episodes of dehydration disproportionate to fluid loss during an illness. The major conditions that are considered to be IEMs include disorders of amino acid, ammonia, and organic acid metabolism, and disorders affecting mitochondrial and peroxisomal functions.

Evidence. Of 735 children in nine class III studies,[4,29,30,32,34,35,39,41,42] an IEM was diagnosed or present in 4.2% of children (range 1.2 to 8.3%; median 4.0%; 95% CI 2.9% to 5.8%) based on a denominator of all children in these studies, although it is likely that testing was done selectively. When specified, pyridoxine dependency, Leigh's disease, neuronal ceroid lipofuscinosis, and a mitochondrial disorder were each found in 0.3%, and Alper's disease, methylmalonic acidemia, and carnitine deficency in 0.2% each. Data on chromosomal or genetic disorders are not separately available.

Conclusions. Data from nine class III studies revealed that an IEM was diagnosed in approximately 4% of children in these studies with SE.

Recommendations. 1. Studies for inborn errors of metabolism may be considered when the initial evaluation reveals no etiology, especially if there is a preceding history suggestive of a metabolic disorder (Level C, class III evidence). The specific studies obtained are dependent on the history and the clinical examination. There is insufficient evidence to support or refute whether such studies should be done routinely (Level U).

2. There are insufficient data to support or refute whether genetic testing (chromosomal or molecular studies) should be done routinely in children with SE (Level U).

Electroencephalography. Should an EEG be routinely performed in the evaluation of a child with SE? SE is classified as generalized or focal convulsive SE or nonconvulsive SE (NCSE), and the clinical manifestations are associated with electrographic SE. EEG may be needed to demonstrate focality and because the distinction of generalized vs focal epilepsy is important in the choice of chronic AED therapy. Convulsive SE occurs with overt clinical signs, such as tonic, tonic-clonic, or clonic motor movements. Nonconvulsive status epilepticus (NCSE) occurs when either electrographic SE is associated with altered awareness without overt clinical signs, or altered awareness with subtle motor signs, such as minimal eyelid blinking. An EEG done at the time of SE (ictal EEG) can determine if the electrographic discharge is focal or generalized, demonstrate NCSE, or may also distinguish an epileptic event from a nonepileptic event (pseudoseizures).[47,48] EEG has been recommended as routine in a Practice Parameter on the evaluation of the first nonfebrile seizure in children; SE was specifically excluded from the evidence examined.[46]

Evidence. Six class III studies[29,31,34,40,49,50] report 413 EEG findings in 358 children who presented in SE and had an EEG. EEGs were obtained hours to days after the acute episode and 89.3 ± 13.6% (range 66% to 100%; median 92.9%; 95% CI 78.3% to 100%) were abnormal. Findings were described as generalized epileptiform features in 8%, focal epileptiform features in 16%, combined generalized and focal epileptiform features in 19%, generalized slowing in 41%, focal slowing in 6.3%, electrocerebral inactivity in 1.9%, and normal in 7.7%. An epileptiform EEG was noted in 43.1% of these 358 children (table 3). One class III study (n = 407) that focused on the prognosis of children with a first unprovoked seizure also had EEG data on 46 children with SE.[49,50] This study found an abnormal EEG in 62% of children with SE, compared to 41% of children whose seizures were less than 30 minutes in duration.

Nonconvulsive status epilepticus: In adults, NCSE is present in 14% of patients in whom convul-

Table 3 *EEG findings in 358 children with status epilepticus*

EEG findings	No. of patients	Percentage	Range, %
Normal	32	7.7	0–34
Generalized slowing	169	41.0	26–93
Focal slowing	26	6.3	0–23
Epileptiform features, generalized only	33	8.0	0–19
Epileptiform features, focal only	66	16.0	0–47
Epileptiform features, generalized and focal	79	19.1	0–42
Electrocerebral inactivity	8	1.9	0–3.9
Total*	413		

* Refers to 413 EEG abnormalities reported in 358 patients from six class III studies (references 29, 31, 34, 40, 49, and 50).

sive SE is controlled but in whom consciousness remains impaired.[51] Data are not available regarding the prevalence of NCSE after the control of convulsive SE in children or with other neurologic conditions (e.g., coma). A single study reported an 8% incidence of NCSE in a mixed population of children and adults with unexplained coma; data on children were not reported separately.[52]

Pseudostatus epilepticus: Pseudostatus epilepticus, defined as a nonepileptic event that mimics SE, may occur in children.[53-55] In the only series of SE in children that reported on pseudostatus epilepticus, 6 of 29 (21%) children admitted with convulsive SE had pseudoseizures (class III).[53]

Conclusions. Data from six class III studies revealed generalized or focal epileptiform activity in 43.1% of the EEGs done for SE. Abnormalities on EEG occur in 62% of children with SE compared to 41% of children with a first unprovoked seizure less than 30 minutes duration. Sufficient data on the prevalence of NCSE in children who presented with SE are not available. One small class III study reported that 21% of children initially thought to be in SE had pseudostatus.

Recommendations. 1. An EEG may be considered in a child presenting with new onset SE as it may determine whether there are focal or generalized abnormalities that may influence diagnostic and treatment decisions (Level C, class III evidence).

2. Although NCSE occurs in children who present with SE, there are insufficient data to support or refute recommendations regarding whether an EEG should be obtained to establish this diagnosis (Level U).

3. An EEG may be considered in a child presenting with SE if the diagnosis of pseudostatus epilepticus is suspected (Level C, class III evidence).

Neuroimaging. Should CT or MRI be performed in children with SE? Neuroimaging studies were recommended based on specific clinical circumstances by the Practice Parameter for the evaluation of a first afebrile seizure in children.[46] Emergent neuroimaging was recommended if there was a focal deficit that did not quickly resolve or if there was no return to baseline mental status after several hours, and nonurgent MRI should be seriously considered in any child with a seizure of partial (focal) onset with or without secondary generalization.

A previously published Practice Parameter on neuroimaging in the patient presenting with a seizure to the emergency department (1996) made no recommendations concerning neuroimaging in SE, but suggested emergent neuroimaging when a serious structural lesion was suspected, especially when there were new onset focal deficits, persistent altered awareness, fever, recent trauma, history of cancer, history of anticoagulation, or a suspicion of AIDS.[56] There have been no Parameters published on the use of neuroimaging in adult or pediatric cases of SE.

Neuroimaging should be done only after the child is stabilized and the SE has been controlled. Neuroimaging options include CT or MRI. MRI is more sensitive and specific than CT scanning, but CT is readily available on an emergency basis. CT and MRI may detect focal changes that may be transient,[57] or secondary to a focal seizure (suggesting the origin of the focus), with MRI being more sensitive. Diffusion-weighted imaging (DWI) and apparent diffusion coefficient (ADC) changes have also been reported after SE in children and suggest cytotoxic and vasogenic edema.[58-61] Progressive changes such as hippocampal atrophy/sclerosis or global atrophy have also been documented.[62] Most childhood SE studies do not report neuroimaging findings specifically or were done before the advent of modern neuroimaging, but the diagnosis made in these studies supports the potential usefulness of neuroimaging.

Evidence. In 20 class III studies involving 1,951 children with SE (323 before the advent of neuroimaging), structural lesions were found in 7.8% (table E-1, on the *Neurology* Web site at www.neurology.org). Specific abnormalities included CNS malformation (1.7%), trauma (1.6%), stroke/hemorrhage (0.9%), neurocutaneous disorder (0.9%), tumor (0.8%), infarct/vascular (0.6%), hemorrhage (0.4%), abscess/cerebritis (0.4%), and arteriovenous malformation (AVM), hydrocephalus, or other (0.2% each). These lesions are potentially diagnosable by neuroimaging.

Five class III studies (n = 174) reported actual CT data.[29,31,40,49,50] Of the CT scans done in children with SE, a mean of 49% (range 29% to 70%; median 53.4%; 95% CI 32.2% to 66.7%) were abnormal. Abnormalities included cerebral edema in 14.4%, atrophy in 12.1%, infection (meningitis/abscess/cerebritis/granuloma) in 4.6%, CNS dysplasia in 3.5% (tuberous sclerosis and Sturge Weber syndrome, 1 each), infarction in 2.9%, tumor and hematoma in 2.3% each, 1.2% each in trauma and AVM, and calcifications in 0.6%; an old deficit/no change was specified in 4.6%.[31] In 38 new-onset cases, CT

was abnormal in 29% (n = 11), with dysplasia in 4, atrophy, infarction, and infection in 2 each, and calcifications in 1.[49,50] The timing after onset of SE when CT was done was not reported. This could affect interpretation of the presence of atrophy, which could be secondary to the episode of SE rather than to a preexisting abnormality. Under-representation of a cortical dysplasia as an etiology is likely due to the lower sensitivity of CT scanning in detecting such malformations.

In one small class III study MRI was done in 9 of 24 children with SE.[42] Imaging findings were reported as normal in two and abnormal in seven of the nine children (78%).[42] Two each had atrophy, hydrocephalus, or cerebritis, and infarction occurred in one.

Conclusions. We assumed that neuroimaging was performed for clinical indications or the absence of a known etiology. The yield of lesions important for diagnosis and treatment was relatively high. Data from 20 class III studies found lesions likely detectable with neuroimaging in 7.8% of children, based on a denominator of all available subjects in the studies, thus these data represent an estimate of the minimal yield of these studies. Neuroimaging can identify structural causes for SE, especially to exclude the need for neurosurgical intervention in children with new onset SE without a prior history of epilepsy, or in those with persistent SE despite appropriate treatment.

Recommendations. 1. Neuroimaging may be considered for the evaluation of the child with SE if there are clinical indications or if the etiology is unknown (Level C, class III evidence). If neuroimaging is done, it should only be done after the child is appropriately stabilized and the seizure activity controlled.

2. There is insufficient evidence to support or refute recommending routine neuroimaging (Level U).

Future research. 1. Prospective studies are needed to define what factors, or combination of factors, may precipitate SE in children.

2. Controlled prospective studies should be conducted to define the role for routine or selective laboratory investigations in the evaluation of children with SE. This should include studies of IEM, and specific serum toxicology levels, as a cause of SE in children with the diagnostic tests now available.

3. Controlled prospective blinded studies should be conducted to define the setting and timing for EEG done in the evaluation of children with SE, and to determine if postictal and unexpected ictal EEG findings have prognostic and treatment significance.

4. Controlled prospective studies with blinded assessments should examine the yield of neuroimaging, either routine or selective, in children with SE.

5. Prospective studies are needed to determine the frequency of NCSE after the control of convulsive SE in children, its etiology, and prognostic significance.

Mission statement. The Quality Standards Subcommittee (QSS) of the AAN seeks to develop scientifically sound, clinically relevant Practice Parameters for the practice of neurology. Practice Parameters are strategies for patient management that assist physicians in clinical decision making. A Practice Parameter is one or more specific recommendations based on analysis of evidence of a specific clinical problem. These might include diagnosis, symptoms, treatment, or procedure evaluation.

Disclaimer. This statement is provided as an educational service of the American Academy of Neurology. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved.

Conflict of interest statement. The American Academy of Neurology is committed to producing independent, critical and truthful clinical practice guidelines (CPGs). Significant efforts are made to minimize the potential for conflicts of interest to influence the recommendations of this CPG. To the extent possible, the AAN keeps separate those who have a financial stake in the success or failure of the products appraised in the CPGs and the developers of the guidelines. Conflict of interest forms were obtained from all authors and reviewed by an oversight committee prior to project initiation. AAN limits the participation of authors with substantial conflicts of interest. The AAN forbids commercial participation in, or funding of, guideline projects. Drafts of the guideline have been reviewed by at least three AAN committees, a network of neurologists, *Neurology* peer reviewers, and representatives from related fields. The AAN Guideline Author Conflict of Interest Policy can be viewed at www.aan.com.

Appendix 1

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Appendix 2

AAN evidence classification scheme for determining the yield of established diagnostic and screening tests.

Class I. A statistical,[1] population-based[2] sample of patients studied at a uniform point in time (usually early) during the course of the condition. All patients undergo the intervention of interest. The outcome, if not objective,[5] is determined in an evaluation that is masked to the patients' clinical presentations.

Class II. A statistical, non-referral-clinic-based[3] sample of patients studied at a uniform point in time (usually early) during the course of the condition. Most (>80%) patients undergo the intervention of interest. The outcome, if not objective,[5] is determined in an evaluation that is masked to the patients' clinical presentations.

Class III. A selected, referral-clinic-based[4] sample of patients studied during the course of the condition. Some patients undergo the intervention of interest. The outcome, if not objective,[5] is determined in an evaluation by someone other than the treating physician.

Class IV. Expert opinion, case reports or any study not meeting criteria for class I to III.

This is a classification scheme developed by the QSS for studies related to determining the yield of established diagnostic and screening tests or interventions and is appropriate only when the diagnostic accuracy of the test or intervention is known to be good. Additionally, the abnormality potentially identified by the screening intervention should be treatable or, should have important prognostic implications. This classification is different than others currently recommended by the QSS that have been published in recent parameters that relate to diagnostic, prognostic or therapeutic studies.

(1) Statistical sample: a complete (consecutive), random or systematic (e.g., every third patient) sample of the available population with the disease; (2) Population-based: The available population for the study consists of all patients within a defined geographic region; (3) Non-referral-clinic-based: The available population for the study consists of all patients presenting to a primary care setting with the condition; (4) Referral-clinic-based: The available population for the study consists of all patients referred to a tertiary care or specialty setting. These patients may have been selected for more severe or unusual forms of the condition and thus may be less representative; (5) Objective: An outcome measure that is very unlikely to be affected by an observers' expectations (e.g., determination of death, the presence of a mass on head CT, serum B12 assays).

Appendix 3

Classification of recommendations

A = Established as effective, ineffective, or harmful for the given condition in the specified population. (Level A rating requires at least two consistent Class I studies.)

B = Probably effective, ineffective, or harmful for the given condition in the specified population. (Level B rating requires at least one Class I study or at least two consistent Class II studies.)

C = Possibly effective, ineffective, or harmful for the given condition in the specified population. (Level C rating requires at least one Class II study or two consistent Class III studies.)

U = Data inadequate or conflicting; given current knowledge, test is unproven.

Appendix 4

*Classification and laboratory data from class III studies of children presenting with status epilepticus (SE)**

Reference	No. of patients	Acute symptomatic	Remote symptomatic	Remote symptomatic with an acute precipitant	Progressive encephalopathy	Febrile	Cryptogenic	Elec/ DeH_2O	Met	Sepsis	CNS infection
26	239	63	40	—	10	67	59	18	—		29
27	218	87	72	—	3	50	6	25	—		30
28	189	26	86	—	—	†	77	—	8		10
29	153	71	59	—	2	21	—	5	—		40
30	139	56	9	—	10	57	7	—	14		26
31	114	17	66	7	—	16	8	5	—		8
32	112	25	69	1	7	5	5	1	—		10
4	193	45	45	—	11	46	46	—	4		14
33	90	24	33	6	—	27	—	2	—	1	18
34	83	13	42	—	2	—	26	1	—	2	8
35	65	13	10	—	3	24	15	—	3	1	8
36	59	8	29	3	—	18	1	2	—		2
37	52	16	17	—	2	11	6	6	—	2	6
38	37	14	16	—	—	6	1	—	3	1	4
39	37	22	5	—	4	2	4	—	4		8
40	30	12	14	—	—	3	1	2	2	1	3
41	25	11	8	—	1	3	2	4	—		5
42	24	6	9	—	—	1	8	—	1		4
Total‡	1,859							71 (3.8%)	39 (2.1%)	8 (0.4%)	233 (12.8%)
43§	234	19	66	—	2	114	33	—	—		
SE classification, all studies	2,093	548 (26%)	695 (33%)	17 (1%)	57 (3%)	471 (22%)	305 (15%)	—	—		

Specific electrolyte abnormalities were noted as follows: Na (n = 28, 1.5%); Ca++ (n = 9, 0.5%); glucose (n = 10, 0.5%).

* Numbers in columns indicate the number of patients in each study who had an abnormal laboratory value for that test.

† Fever occurred in 35% of the overall group.

‡ Total number of abnormalities for each test given with percentage of total abnormalities.

§ Maegaki included here because it contained data on SE categories but did not have data for specific etiologies.

Elec/DeH_2O = electrolyte disorder or dehydration; Met = metabolic category, not otherwise specified; Na = sodium; Ca = calcium; Glu = glucose.

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American Academy of Pediatrics
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POLICY STATEMENT

Diagnostic Imaging of Child Abuse

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Section on Radiology

ABSTRACT

The role of imaging in cases of child abuse is to identify the extent of physical injury when abuse is present and to elucidate all imaging findings that point to alternative diagnoses. Effective diagnostic imaging of child abuse rests on high-quality technology as well as a full appreciation of the clinical and pathologic alterations occurring in abused children. This statement is a revision of the previous policy published in 2000. *Pediatrics* 2009;123:1430–1435

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Key Words
diagnostic imaging, child abuse, injury, trauma

Abbreviations
CT— computed tomography
DWI— diffusion-weighted imaging

INTRODUCTION

The concept of child abuse as a medical entity has an origin in the studies of pediatric radiologist John Caffey, MD,[1] as well as many other specialists in the field of diagnostic imaging.[2–4] Kempe et al[5] relied heavily on the work of Caffey and his protégé, Frederick Silverman, MD,[6] when developing the now-familiar concept of the "battered-child syndrome."

When all cases of child abuse and neglect are studied, the incidence of physical evidence documented by diagnostic imaging studies is relatively small. However, imaging studies are often critical, particularly in the assessment of the infant and young child with evidence of physical injury. Imaging alterations may also be the first indication of abuse in a child who is seen with an apparent natural illness. When viewed in conjunction with clinical and laboratory studies, imaging findings commonly provide additional objective evidence in the evaluation of possible inflicted injury or abuse.[7] For severely abused infants, the imaging findings alone may form the basis for a diagnosis of the inflicted injury. The role of imaging in cases of suspected abuse is not only to identify the extent of physical injury when abuse has occurred but also to elucidate all imaging findings that point to alternative diagnoses.[8,9] All imaging studies involving use of ionizing radiation should be performed in accordance with the ALARA ([using an exposure] as low as reasonably achievable) principle.[10] Because the detection of inflicted skeletal injury depends on the technical quality of the radiographs and the imaging protocol, recommendations regarding imaging should focus on examinations that provide the highest diagnostic yield at acceptable patient risk and cost.[11] Certain diagnostic imaging studies entail additional risks associated with sedation, and these risks should be weighed against the benefit of the study.[12]

SKELETAL TRAUMA

Although skeletal injuries rarely pose a threat to the life of the abused child, they are often the strongest radiologic indicators of abuse. In fact, in an otherwise normal infant, certain patterns of injury are sufficiently characteristic to permit a firm diagnosis of inflicted injury in the absence of clinical information.[13] Furthermore, dating of skeletal injuries may provide investigators with critical temporal data, which may help in identifying potential assailants. These facts mandate that imaging surveys performed to identify skeletal injury be acquired with at least the same level of technical excellence routinely used to evaluate accidental injuries. The "baby gram" (a study that encompasses the entire infant or young child on 1 or 2 radiographic exposures) or abbreviated skeletal surveys have no role in the imaging of these subtle but highly specific bony abnormalities.[14]

THE RADIOGRAPHIC SKELETAL SURVEY

Equipment

In general, the radiographic skeletal survey is the method of choice for global skeletal imaging in cases of suspected abuse.[14] General-purpose (medium-speed) pediatric imaging systems provide insufficient anatomic detail to image the skeleton of the abused infant or young child. The American College of Radiology has published standards for skeletal survey imaging in cases of suspected abuse. Modern pediatric imaging systems commonly use special film

cassettes and intensifying screens to minimize exposure. Although these low-dose systems are adequate for chest and abdominal imaging, they fail to provide the necessary detail (contrast and spatial resolution) to image subtle metaphyseal, rib, and other high-specificity injuries that are characteristic of abuse. According to the American College of Radiology, high-detail imaging systems should be used for suspected abuse in infancy.[14] These systems should be used without an antiscatter grid. Beyond infancy, faster general-purpose systems are required for thicker body regions (eg, skull, lateral lumbar spine).

Digital or filmless radiography has replaced screen/film imaging in most pediatric health care facilities in the United States.[15] A wide array of digital systems are available, including direct and indirect technologies. Data suggest that despite its lower spatial resolution, digital radiography, with its wide dynamic range and high contrast capabilities, can provide diagnostic performance comparable to high-detail screen/film systems in the evaluation of skeletal injury.[16,17] High-detail digital systems are being used successfully in the rigorous field of mammography, and efforts are currently underway to apply similar techniques to demanding skeletal applications.[18] Unfortunately, most digital systems currently used for skeletal surveys in the United States operate at relatively low spatial resolutions, and they are not routinely optimized for the demanding practice of imaging for suspected child abuse.[15] Imaging departments should use digital systems with sufficient spatial resolution and signal-to-noise characteristics to detect subtle skeletal injuries. Image detail and diagnostic performance can be improved by optimizing exposure to diminish system noise. Acceptable diagnostic accuracy with traditional screen/film imaging has required higher radiation exposures than for routine pediatric radiography, and similarly, an increase in exposure over standard digital radiography can be expected if maximal diagnostic accuracy is to be preserved with the digital medium. However, recent data have suggested that a performance comparable to the high-detail screen/film gold standard may be achievable with high-detail digital imaging at a substantially lower patient dose.[17] Digital facilities should optimize their acquisition and display parameters for high diagnostic performance,[19] and if the resultant images provide insufficient bony detail, an acceptable alternative should be sought. A radiologist should monitor the skeletal survey to ensure that appropriate high-quality images are obtained and to determine if additional views are required to fully define the pathologic alterations.

Imaging Protocol

Once the appropriate imaging system is chosen, a precise protocol for skeletal imaging must be developed to ensure consistent quality. In routine skeletal imaging, an accepted principle is that film must be coned or restricted to the specific anatomic area of interest. It is common practice to encompass larger anatomic regions when skeletal surveys are performed, which results in areas of underexposure and overexposure as well as loss of resolution resulting from geometric distortion and other technical factors. The standard skeletal survey imaging protocol that has been developed by the American College of Radiology[14] is provided in Table 1. Of special note is the inclusion of lateral views of the spine to assess for vertebral fractures and dislocations and separate views of the hands and feet to identify subtle digital injuries. Anteroposterior and lateral views of the skull are mandatory even when cranial computed tomography (CT) has been performed, because skull fractures coursing in the axial plane may be missed with axial CT.[11] A full 4-view examination of the skull (right and left lateral, Townes, and anteroposterior) should be obtained when head injury is present. Skeletal injuries, especially those requiring orthopedic management, necessitate at least 2 radiographic projections. Oblique views of the thorax increase the yield for the detection of rib fractures.[20] At a minimum, right and left oblique views of the thorax should be obtained when rib fractures are evident, and consideration should be given to including obliques in the standard survey protocol. A follow-up skeletal survey approximately 2 weeks after the initial study increases the diagnostic yield[21,22] and should be performed when abnormal or equivocal findings are found on the initial study and when abuse is suspected on clinical grounds. A repeat study may permit more precise determination of the age of individual injuries. Lack of interval change may indicate that the initial radiographic finding is a normal anatomic variant or is related to a bone dysplasia. Views of the skull can be omitted from the follow-up study.

TABLE 1 Complete Skeletal Survey Table[14]

Appendicular skeleton
Arms (AP)
Forearms (AP)
Hands (PA)
Thighs (AP)
Legs (AP)
Feet (PA or AP)
Axial skeleton
Thorax (AP and lateral), to include thoracic spine and ribs
AP abdomen, lumbosacral spine, and bony pelvis
Lumbar spine (lateral)
Cervical spine (AP and lateral)
Skull (frontal and lateral)

AP indicates anteroposterior; PA, posteroanterior.

Radionuclide Bone Scans

When performed by staff experienced with pediatric nuclear imaging, skeletal scintigraphy may offer an alternative or adjunct to the radiographic skeletal survey in selected cases, particularly for children older than 1 year. Scintigraphy can provide increased sensitivity for detecting rib fractures, subtle shaft fractures, and areas of early periosteal elevation. However, scintigraphy is less sensitive than radiography for detection of classic metaphyseal lesions, which are fractures that carry a high specificity for abuse in infants.[23–25] Skeletal scintigraphy usually requires sedation and is generally more expensive than radiographic surveys. Bone scans are used to

supplement radiographic skeletal surveys in the acute-care setting,[24] but for the child who is placed in a "safe" environment, a follow-up skeletal survey is an attractive alternative to initial scintigraphy. If radionuclide bone scans are performed as the initial study, all positive areas must be evaluated further with radiography. Because scintigraphy is insensitive for detecting cranial injuries, skull radiography in at least 2 projections must supplement the bone scan.

Imaging Guidelines

The skeletal survey is mandatory in all cases of suspected physical abuse in children younger than 2 years; its utility diminishes thereafter.[8,26] The screening skeletal survey or bone scan has little value in children older than 5 years. Decisions about which types of imaging to perform for patients in the 2- to 5-year-old age group must be made individually on the basis of the specific clinical indicators of abuse. At any age, when clinical findings point to a specific site of injury, the customary radiographic protocol for imaging that anatomic region should be used. MRI and ultrasonography may be indicated when epiphyseal separations are suspected on the basis of plain-film radiography.[2,27] Evidence suggests that if 1 infant twin is injured, the other is at risk and should also undergo a skeletal survey.[28] Although there seems to be an association between physical and sexual abuse, the prevalence of fractures in sexually assaulted children is low; thus, skeletal surveys should be performed only in selected cases on the basis of specific clinical indications.[29,30] Although the high-quality skeletal survey is essential in the evaluation of suspected physical abuse in infants and toddlers, it may not be available in the emergency department setting during evening hours.[15] The American Academy of Pediatrics has stated that hospitalization of the abused child may be medically necessary for diagnosis,[31] and in some instances it may be advisable to place a child in a safe haven until a proper skeletal survey can be performed.[31] A skeletal survey may be difficult to obtain in a critically injured child on life support. Efforts should be directed at performing an adequate examination in a timely manner, because the results may have an effect on the early investigation of the case.

HEAD TRAUMA

High-energy forces associated with impact or violent shaking result in a variety of central nervous system injuries that can be detected by modern neuroimaging techniques. The evolution of these injuries, as well as processes that develop secondary to the original insult, are often effectively displayed on serial imaging studies.[2,32–35]

All infants and children with suspected intracranial injury must undergo cranial CT, MRI, or both. Strategies should be directed toward the detection of all intracranial sequelae of abuse and neglect with a thorough characterization of the extent and age of the abnormalities.[36] In the acute-care setting, efforts are directed toward rapid detection of treatable conditions. Subsequent studies are designed to more fully delineate all abnormalities, determine the timing of the injuries, and monitor their evolution.

Computed Tomography

CT without intravenous contrast should be performed as part of the initial evaluation for suspected acute inflicted head injury. CT has high sensitivity and specificity for diagnosing acute intraparenchymal, subarachnoid, subdural, and epidural hemorrhage. Abnormalities that require emergency surgical intervention generally are well demonstrated. CT is readily available and rapidly performed for critically ill patients and is generally better than MRI for evaluation of acute hemorrhage. Skull fractures, associated soft tissue swelling, and facial fractures also can be diagnosed on CT images with appropriate bone window and level settings. With modern multidetector CT scanners, the brain can be imaged in a few seconds, usually obviating the need for sedation.

Ultrasonography

Ultrasonography via the anterior fontanelle in young infants has gained an important role in clarifying the nature of extra-axial fluid collections in infancy. Because ultrasonography reliably differentiates convexity subdural from subarachnoid collections, it is particularly useful for the infant with macrocephaly or any infant with large hypodense cerebral convexity collections demonstrated by CT.[37] Subcortical white matter tears in the frontal and anterior parietal parasagittal regions can be demonstrated with ultrasonography.[38] These lesions are less well defined by axial CT, and ultrasonography provides the advantage of a bedside technique. Because ultrasonography is insensitive for detecting small acute subdural hematomas, particularly within the interhemispheric fissure, and many other acute intracranial injuries, it must be performed in conjunction with CT or MRI when traumatic injury is suspected.[29,39]

Magnetic Resonance Imaging

Although cranial MRI has some limitations in the acute-care setting, it remains the best modality for fully assessing intracranial injury, including extra-axial collections, intraparenchymal hemorrhages, contusions, shear injuries, and brain swelling or edema. A strong argument can be made for MRI in all cases with positive cranial CT findings and in selected cases with normal CT results but strong clinical concerns. MRI should be performed with T_1 and T_2 weighting with proton-density or inversion-recovery sequences to differentiate cerebrospinal fluid collections from other water-containing lesions. Gradient echo sequences should be included to detect hemorrhage or mineralization not demonstrable by other MRI techniques. Although the specific type and order of pulse sequences may vary, imaging must be performed at least in the axial and coronal planes. Acute subarachnoid and subdural hemorrhage may be inconspicuous on MRI, and consideration should be given to delaying the examination for 5 to 7 days, permitting subacute

blood to become hyperintense on T1-weighted sequences.

Diffusion-weighted imaging (DWI) is a relatively new and valuable technique for the evaluation of stroke and is gaining a role in the assessment of inflicted cerebral injury. When performed early in the critically injured infant, DWI may provide information regarding cerebral injury before parenchymal abnormalities are visible on CT or conventional MRI sequences.[40,41] The value of the potential findings revealed with DWI must be weighed against the lower sensitivity of MRI in the detection of acute extra-axial blood collections and the practical problems encountered when performing MRI in severely ill infants.

Abused infants may not demonstrate neurologic signs and symptoms despite significant central nervous system injury.[2,42,43] MRI offers the highest sensitivity and specificity for diagnosing subacute and chronic injury and should be considered whenever typical skeletal injuries associated with shaking or impact are identified.[39,44]

SPINAL TRAUMA

Plain radiographs are often sufficient to evaluate vertebral compression and spinous process fractures. Complex fractures may require helical CT with multiplanar reformatted images. If a fracture or subluxation may compromise the spinal contents or if clinical findings indicate spinal cord or nerve root injury, MRI should be performed. Increasing attention has been directed toward a possible association of cervical spinal cord injury and extra-axial hemorrhage with inflicted head injury, and some centers include the cervical region in their cranial MRI trauma protocols.[45,46]

THORACOABDOMINAL TRAUMA

Blunt thoracoabdominal injury may occur in victims of child abuse. The evaluation and management of acute thoracoabdominal injury is the same as for children with accidental injuries.[47] However, when an infant or child sustains serious injury to the chest or abdomen without a known or observed mechanism or when the imaging findings are inconsistent with the purported history, investigation of potential child abuse is warranted. Failure to recognize inflicted blunt abdominal trauma contributes to higher morbidity and mortality rates than those seen with accidental abdominal injury.[48] Pancreatitis, duodenal hematomas, bowel perforation, and thoracoabdominal injury associated with rib fracture heighten the suspicion of child abuse. Chest, abdominal, and cervical spine radiographs often are obtained in the initial assessment of injured children. If internal chest or abdominal injury is suspected and the patient's condition is stable, a CT scan should be performed. A CT scan will best demonstrate many of the injuries associated with child abuse. The chest should be included if serious chest trauma is suspected.

The use of oral contrast is debatable. Oral contrast in the stomach and small bowel is useful to better define the lesser sac of the peritoneum, pancreas, duodenum, and jejunum. However, oral contrast may place the patient at greater risk of aspirating, especially if the patient is obtunded, sedated, or immobilized. If surgery or general anesthesia is likely, it is better to have an empty stomach.

TABLE 2 Imaging Recommendations for Thoracoabdominal Trauma

1.	Helical CT[a] of abdomen and/or thorax with intravenous contrast; nonionic is preferable; gastrointestinal contrast optional
2.	Ultrasonography of abdomen, usually as a follow-up examination
3.	Upper-gastrointestinal series

[a] Relative contraindication: strong history of allergy to iodine, severe shock, and renal failure.

Intravenous contrast is used routinely. Vascular injuries and injuries to the liver, spleen, pancreas, and kidneys are best demonstrated after administration of intravenous contrast material. Helical scanning with proper timing of the intravenous contrast bolus is important for accurate diagnosis. Given the heightened awareness of cancer risks associated with CT scanning in childhood, care should be taken to adjust technical factors to achieve diagnostic quality images at an exposure as low as reasonably achievable.[49,50] The only relative contraindications for intravenous contrast are a strong history of allergy to iodine, severe shock, and renal failure.

Abused children suffer some of the same injuries as children with accidental blunt trauma. In the chest, pulmonary contusion, pneumothorax, pleural effusion, rib fractures, and vascular or tracheobronchial injuries may occur. Abused children have an increased occurrence of pancreatic injuries and duodenal hematomas. Bowel injury should be suspected when there is peritoneal fluid without evidence of solid organ injury and assumed when free intraperitoneal air or extraluminal contrast is observed.[51] Bone windows should be monitored not only for rib fractures but also for signs of pelvic or spine fractures.

Peritoneal lavage rarely is used in pediatric practice. If performed before CT, it may decrease the diagnostic usefulness. Peritoneal lavage sometimes is used when emergency surgery is required to treat a patient whose condition is not stable enough for a CT scan.[49]

The use of ultrasonography in pediatric trauma is controversial. Some institutions have used ultrasonography successfully for a more detailed, comprehensive evaluation of organ injury. However, for seriously injured children and those with suspected child abuse, CT scanning is the preferred initial diagnostic modality in most institutions. Peritoneal fluid alone, which can be detected well with both ultrasonography and CT scanning, is a poor predictor of major trauma in children. An upper-gastrointestinal series sometimes is used to evaluate and follow-up duodenal hematomas.

Nonoperative management of injury to the liver, spleen, kidney, or pancreas is common in most pediatric centers. Follow-up imaging usually is limited but may be useful to help determine recommendations for the level of physical activity (Table 2).

CONCLUSIONS

The diagnostic imaging of suspected inflicted injury in infancy and childhood should be performed with at least the same rigor used in the imaging evaluation of accidental trauma and naturally occurring disease. To be confident that the imaging studies are acquired and interpreted in a thorough and informed manner, clinicians charged with reporting and providing evidence in cases of suspected abuse should work in close collaboration with radiologists experienced in pediatric imaging. This approach will help ensure that child abuse is accurately identified and reliably differentiated from conditions that may simulate abuse.[14]

SECTION ON RADIOLOGY, 2006–2007

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POLICY STATEMENT

Disaster Planning for Schools

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on School Health

ABSTRACT

Community awareness of the school district's disaster plan will optimize a community's capacity to maintain the safety of its school-aged population in the event of a school-based or greater community crisis. This statement is intended to stimulate awareness of the disaster-preparedness process in schools as a part of a global, community-wide preparedness plan. Pediatricians, other health care professionals, first responders, public health officials, the media, school nurses, school staff, and parents all need to be unified in their efforts to support schools in the prevention of, preparedness for, response to, and recovery from a disaster. *Pediatrics* 2008;122:895–901

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

Key Words
school, crisis, disaster, incident command, preparedness

Abbreviations
AAP—American Academy of Pediatrics
EMS—emergency medical services
LEPC—local emergency planning committee
FEMA—Federal Emergency Management Agency

Background and Information

Schools are generally considered to be safe havens for millions of children and the greatest socializing institutions after the family. However, the recent experiences with natural disasters, in-school violence, acts of terrorism, and the threat of pandemic flu demonstrate the need for schools to be prepared for all-hazard crisis possibilities. For the purposes of this discussion, "crisis" and "disaster" are used interchangeably and refer to events of global and/or community significance rather than to the health emergencies of individual children.

It is important to note that there is a fundamental link between day-to-day emergency readiness and disaster preparedness. Schools that are well prepared for an individual emergency involving a student or staff member are more likely to be prepared for complex events such as community disasters. Individual emergencies are covered in a separate policy statement from the American Academy of Pediatrics (AAP), "Medical Emergencies Occurring at School."[1] It is helpful to view these 2 policy statements together to appreciate the full spectrum of school emergency planning.

There are 55 million US children enrolled in kindergarten through 12th grade, attending 17 000 public school districts and 29 000 private schools.[2,3] Children spend a large part of their time in school, so whether a large-scale crisis occurs during school hours, before or after school, or off the school campus, the school district plays an important role in the unfolding of events.

Although there are no federal laws requiring all school districts to have emergency-management plans, 32 states have reported having laws or other policies that do require plans. An estimated 95% of school districts reported that they have a plan, although there is great variability in these plans.[3]

To help guide the process, the US Department of Education, Office of Safe and Drug-Free Schools, has prepared emergency-management planning guidelines for school systems.[4] The guidelines are intended to give schools, school districts, and communities the critical concepts and components of good crisis planning, stimulate thinking about the crisis-preparedness process, and provide examples of promising practices. These guidelines focus on 4 stages of planning: mitigation and prevention; preparedness; response; and recovery. These school-focused guidelines are also designed to complement and integrate with the complex system of emergency preparedness in the greater community locally, regionally, and nationally.[5]

Funding for these activities comes from a mix of national, state, and local grants. The US Department of Education provides funding to some school districts specifically for emergency-management planning through its Readiness and Emergency Management for Schools grant program. School districts receiving grant funds through this program may use them to improve planning for all 4 phases of crisis planning. The US Department of Homeland Security also provides funding to states and local jurisdictions for emergency-management planning, and some of this funding can be provided to school districts or schools for emergency-management planning.

Despite the availability of grants, many school systems simply do not have the capacity to access these monies and/or efficiently use the funding streams. According to results of a Governmental Accountability Office survey of school districts, many school districts struggle to balance priorities relating to educating students and other admin-

istrative responsibilities with activities for emergency management. Challenges include a lack of emergency equipment, staff training, and expertise in the area of emergency planning.[3]

Studies focusing on recent national disasters have concurred that there are several important deficiencies in school preparedness for emergencies.[6–8] In a 2004 survey of more than 2100 superintendents, most (86.3%) reported having a disaster-response plan, but fewer (57.2%) had a plan for prevention. Most (95.6%) had an evacuation plan, but almost one third (30%) had never conducted an evacuation drill. Almost one quarter (22.1%) had no disaster plan provisions for children with special health care needs, and one quarter reported having no plans for postdisaster counseling. Almost half (42.8%) had never met with local emergency medical services (EMS) officials to discuss emergency planning. Urban school districts were better prepared than rural districts on almost all measures in the survey.[9] Regional differences were also evident. Districts within tornado belts and earthquake/hurricane-prone areas may have more of an impetus to create and practice plans compared with districts located in regions where natural disasters are rare.

Schools may also have to function as the de facto mental health system for children and adolescents not only in the recovery phase but also in the prevention and preparedness stages. Currently, on average, only one fourth of children in need of mental health care get the help they need.[10] Of those receiving care, 70% to 80% already receive some care in a school setting.[11] Mental health and substance abuse issues are the most common reasons for visits to school-based health centers.[12] The capacity to meet the needs of posttraumatic event counseling would add further stress to an already underresourced system and requires additional financial and resource preparedness.[13]

School disaster planning is a facet of larger community planning and, therefore, requires coordinated planning and allocation of community resources. Plans should be developed in partnership with other community groups, including law enforcement, fire safety, public health, EMS, and pediatric and mental health professionals. How these various groups interface varies by region and whether the incident is of local, state, or national significance.[5] Although EMS traditionally involved emergency medical technicians and ambulances, today it encompasses all out-of-hospital care events through emergency department management. In the event of an emergency in a school or in the community while a child is under school jurisdiction, EMS also includes school nurses, teachers, and other school staff. In addition, schools play a role in medical surge capacity (the ability of health care systems to adequately care for large numbers of patients). Schools lend space (eg, shelter, temporary clinics, morgues) and sometimes supplies (eg, school meal diversion) to the community during times of crisis.

Yet, even if there is coordination of planning, community members at large may not be aware of a school district's and/or an individual school's emergency plans. Without community understanding of the school plan, parents separated from their children may amplify the crisis by their well-meaning efforts to reach their children. Without participation in planning, primary care clinicians cannot be expected to assist with a coordinated and integrated response and/or recovery. When community agencies are involved in the prevention stage of planning, they can reinforce prevention messages that may help decrease the extent of the crisis, such as infection-control measures for preventing the spread of pandemic influenza and messages about bullying, parent education/guidance, and media education for violence prevention.

Because each district and each school has a unique set of parameters that affect disaster planning, there is no one ideal school crisis plan.[4] However, the same stages in school disaster planning occur for each type of crisis. These stages, as viewed through the school lens, are outlined below.

Mitigation and Prevention

The goal of mitigation is to minimize the effect of the hazardous event and decrease the need for response, as opposed to simply increasing response capability. From school violence to floods to pandemic influenza, there are measures that schools can take to decrease the risks of these events to children. An important first step is for the school or community to identify situations they could be facing on the basis of geography, community trends, school incident data, and other factors.

To address school violence concerns, schools can review their incident data and assess their violence- and injury-prevention strategies and initiatives to improve the school environment. If gang activity is common in the neighborhood, partnerships with law enforcement may be essential to ensure safe arrival and departure from school. The Office of Juvenile Justice and Delinquency Prevention supports Blueprints for Violence Prevention, a national violence prevention initiative to identify violence prevention programs that are effective and evidence based.[14] From overall improvement of school climate to classroom curricula on antibullying to individual and group counseling programs, there is much that schools can do to maintain safety. Community mental health linkages, if they are available, are important prevention and mitigation resources.

Communicable-disease mitigation can involve surveillance and health education. School absenteeism logs may be helpful as part of syndromic surveillance systems that monitor key community data to detect unusual symptom or illness patterns. Awareness of infection-control measures (ie, use of cough and sneeze etiquette, good hand hygiene, and appropriate sanitation techniques) can decrease disease transmission and can be incorporated easily into classroom culture. These efforts are important in the regular cold and influenza season but assume a more critical function if a pandemic begins to unfold.

To address environmental disasters such as toxic spills, hurricanes, tornadoes, floods, and earthquakes, schools should be having discussions with the local community-planning infrastructure, such as local emergency

planning committees (LEPCs). These groups identify and catalog potential hazards and resources to mitigate disasters, when feasible, and write emergency plans. The local emergency-planning infrastructure can work with schools to address local environmental hazards or vulnerabilities and provide resources for examining the school risk potential. The schools can then translate this information into school protocol so that appropriate essential responses of schools and students can occur.

Preparedness

During the preparedness stage, the school district, as well as the individual schools in the district, identify school crisis teams and clearly delineate the roles that staff would play during emergencies. The crisis teams work with community stakeholders involved in crisis planning (such as LEPCs) and link internal crisis planning to the other community crisis plans. The school crisis teams should assess the medical equipment as well as mental health and other resources available in the school environment. Children with special health care needs must be identified and have valid emergency care plans in place, including plans for managing both individual emergencies related to the child's illness and plans to manage the complex medical needs of the student in the event of a larger community emergency. The emergency information form, developed by AAP and the American College of Emergency Physicians, is useful in developing both an individual health plan and an emergency care plan.[15] Also, children with special health care needs require additional disaster-preparedness planning. Students in wheelchairs may need evacuation chairs that can glide down stairwells when the elevator is inoperable. Multiple evacuation routes need to be preplanned, and assistance staff members need to be assigned for these children. Medication availability during a prolonged lockdown or shelter-in-place situation poses a challenge for students with diabetes and other chronic diseases.[15] The Emergency Medical Services for Children National Resource Center, in association with the National Association of School Nurses, has compiled a list of minimal essential emergency equipment and resources that should be available in all schools.[16] In the event of a large-scale emergency, day-to-day supplies for managing individual student emergencies may not be sufficient.

Police, public health officials, firefighters, and other members of the local disaster-response infrastructure are versed in the Incident Command System, a federally supported system designed to effectively and efficiently manage incidents by integrating agencies, personnel, procedures, equipment, and communications under a common organizational structure. School administrators should collaborate with LEPCs or equivalent agencies so that the school plan is integrated with the Incident Command System. This is the stage at which the challenges of integrating the internal school response with the external school response system are addressed. These challenges include the schools' ability to effectively communicate with the rest of the community, including use of a shared incident command vocabulary and alignment of communication devices such that fire, police, school, and other LEPC members are on the same radio frequency. Practice of the plans through drills and community-wide exercises ensures that gaps will be identified and weaknesses will be addressed.[17] Online self-paced courses in the Incident Command System are available through the Federal Emergency Management Agency (FEMA) Emergency Management Institute as part of the National Incident Management System. These courses were designed for people who have emergency-management responsibilities as well as the general public.[18]

A key challenge that school districts face during preparation relates to lockdowns, evacuations, and relocations. Issues to be addressed include responding to various scenarios, developing plans to transport children when there are not enough buses, having a mechanism to track which children are where, and putting a system in place that ensures children are kept safe during evacuation, are relocated to a place that is appropriate for children, and are released to the most appropriate family member. Additional information (including an algorithm to assist in decision-making) can be found online within the US Department of Education's resource, "Practical Information on Crisis Planning: A Guide for Schools and Communities" (www.ed.gov/admins/lead/safety/emergencyplan/crisisplanning.pdf).

One of the most important aspects of preparedness is addressing parental understanding of the emergency plan and the reunification process. Classrooms should be equipped with "jump-and-go" folders that contain emergency contact information, individual health plans, name tags, and other critical information for all students, particularly the youngest ones. These packets go with the teacher if there is an evacuation. Parents should be informed annually and reminded in advance of high-risk seasons about the district's and individual school's emergency plans, including the differences between lockdown, shelter-in-place, evacuation, and relocation. Parents should clearly understand that well-meaning attempts to approach a school in crisis could direct resources away from children, undermine emergency efforts, and increase risk to students. Schools need to have multiple media outlets to accurately inform parents, including those with limited English proficiency. A detailed plan to reunite children and parents once the crisis has been resolved should be communicated to parents before any crisis occurs. Emergency consent protocols should be reviewed for appropriateness and relevance to large-scale emergencies.

Communication venues (eg, television and radio broadcasts) should consider school issues when planning disaster-preparedness strategies. Local media outlets should be prepared to place emergency public information ahead of other news to increase media attention given to disaster-preparedness efforts. Existing Web sites can be reviewed for their capacity to provide real-time updates.[19]

If a disaster occurs and cell phone use is increased, cell phone towers are typically overwhelmed, yet text messaging, e-mailing, etc, still may work. Ham radios and 2-way radios ("walkie talkies") work between people

who are near each other. Hand-held satellite phones or a satellite phone unit (which requires a contract) are best in worst-case scenarios. In severe situations, word of mouth and hand-painted signs may have to be used. Last, once telephone systems are up and running, voice messages can be a good way to communicate. Many school districts are using technology (eg, automated call-outs, simple voice mail, or automatic call forwarding to another location) to address parent notification and maximize communication.

Response

The response phase is when the planning and preparation efforts are put to the test. The school crisis team is activated, and the routines, which ideally have been practiced and fine-tuned, are rolled out depending on the nature of the crisis. The ideal response involves practiced collaboration with the LEPC and the community response team and use of the Incident Command System.[4,20] In this response, school nurses, teachers, and other school staff become a seamless part of EMS. During the response, and not just during recovery, it is important to identify children who are having trouble coping and address any developing mental health concerns.

School facilities are often designated as disaster evacuation shelter sites. These venues provide shelter for many who have lost their homes as a result of disaster and also provide an opportunity for school officials to assess family and child needs. Likewise, disaster recovery centers operated by FEMA are set up in heavily affected communities to support the reestablishment of infrastructure and the provision of food, supplies, health care, and human services. It is recommended that school district officials, including mental health professionals, be present in all disaster recovery centers to disseminate information and provide guidance for parents seeking support for their children.[20]

The media play an important role during this stage in keeping the public, particularly parents, informed. The parent-reunification plan is activated. From television and radio broadcasts to Web sites to newspapers, the redundant delivery of information via several sources would help to fill in the gaps in the event of power outages or other interruptions in services. During the response, the community needs to be prepared for a surge of external media organizations that would be providing coverage of the event.

Recovery

The goal of recovery, from the school perspective, is to restore the school's infrastructure and return to learning as soon as possible. Although returning to the classroom does not ensure that children are ready to address learning tasks, evidence points to the restorative power of the educational routine in guiding children through emotional crises.[20] The responsibilities of the community are to support schools with the necessary mental health resources and to determine which therapies are appropriate for school incorporation and which are based more appropriately in the community. The AAP has a disaster-preparedness Web site that offers resources for health care professionals and laypersons on various aspects of pediatric emergency and disaster readiness (www.aap.org/disasters).

During this time, the effects on the students and staff should be monitored, and the school system should debrief with the LEPC or equivalent group concerning the lessons learned during the event. Anniversary planning is also an important part of the prolonged recovery.[4,21]

CONCLUSIONS

The ongoing risk of natural disasters, such as hurricanes, and a seemingly growing occurrence of man-made disasters, such as school shootings, have underscored the need for schools to have disaster plans that are uniquely designed for the school culture and interface with the larger community. Clear guidelines are only part of the process. Schools must also have the resources and expertise to implement disaster plans. Pediatricians can play important roles in the development and execution of these plans as both medical home providers and school physicians.

RECOMMENDATIONS

The following recommendations support the 4 stages of school-based crisis planning and are compatible with non–school-based recommendations for disaster preparedness. These recommendations describe how the school's role highlighted in this statement relates to both the pediatrician within the medical home and the school health and safety team (school nurse, social worker, school resource officer), including the school physician. They are intended to assist both pediatricians and school physicians in providing support to schools in their efforts to prepare for disasters.

Recommendations for Pediatricians and Other Community Clinicians

Pediatricians have a role in all aspects of emergency and disaster planning for children.

- Pediatricians or their practices should know the names and means of contacting the school physician(s) (where available) and the school health and safety team (school nurse, social worker, school resource officer).
- Pediatricians should be familiar with AAP resources on emergency and disaster preparedness (www.aap.org/healthtopics/disasters.cfm and www.aap.org/disasters).
- Pediatricians and/or their practices should, at a minimum, familiarize themselves with their local community and school districts' disaster plans. Ideally, these plans should have primary care clinician input in all 4 areas of crisis planning. Pediatricians should also be aware of local EMS capabilities and key contacts.
- Pediatricians can be advocates for improved communication between school officials and local medical and emergency officials in the preparation and prac-

tice of an emergency plan, ensuring that prevention, preparedness, response, and recovery components are addressed and integrated into the larger community plan. This improved communication includes linking disaster planning at the hospitals where they have privileges with school crisis and disaster planning.

- Pediatricians can share information about the school district's response plan with their emergency department clinician colleagues and determine ways to ensure that the school district's response plan is integrated with the overall community disaster plan, emergency medical system, and LEPC or other equivalent groups.
- Pediatricians may opt to reinforce, through waiting-room literature, the health-promotion and injury-prevention messages of the school district(s). Examples are violence-prevention messages, cough/sneeze etiquette and hand-hygiene behaviors, attendance polices that do not encourage children who are ill to attend school (to have perfect attendance), resources for stressed families, and support for individual family crisis planning.
- Reinforcing family awareness of the school district's crisis plan could be part of anticipatory guidance in the medical home, particularly calling attention to the school's plan for parental notification in the event of lockdown, shelter-in-place, or evacuation to an alternative site.
- Pediatricians and/or their practices should be aware of the capacity for each school in the district to provide on-site first aid and should assist the school in developing that capacity.
- Pediatricians may help develop school protocols on absenteeism, psychosocial support, and disease surveillance.
- Students with special health care needs will require individual crisis plans to be developed and implemented at the individual school level. Pediatric primary and specialty care providers should help families and schools plan for prolonged sheltering or evacuation of the medically fragile student and to use the emergency information form.[15]
- Each community has idiosyncratic elements that predispose it to possible crises such as tornadoes, earthquakes, hurricanes, toxic chemical hazards, radiation, and community violence. Pediatricians should have an office-based disaster plan that reflects these hazards and not only be prepared to treat the medical outcomes of these crises but also be aware of the school district's attempts to prepare for these unique disaster issues.
- As a crisis is unfolding, pediatricians should activate their office-based plan (see www.aap.org/disasters/pdf/DisasterPrepPlanforPeds.pdf for guidance on developing an office-based plan), follow the predetermined community and school-based disaster plans, and stay informed through the appropriate communication systems established in the planning process.
- Pediatricians should support efforts of schools to return to the learning mode as soon as possible.
- Assisting others in the school and community in recognizing symptoms of posttraumatic stress is an important role of the clinician. The medical community's collective sense of the emotional effects of a disaster can help guide schools and staff in their continuing interventions. Pediatricians also may participate in those interventions, which can include trauma and grief counseling.

Recommendations for School Physicians

Some school districts use physicians as medical consultants, with some states mandating a school consultant per district. The school physician is a critical member of the school health and safety team (school nurse, social worker, school resource officer). School physicians assist in developing health-related policies and are a ready source of information. They work closely with school nurses and are often the bridge between the educational community and primary care clinicians, emergency department clinicians, other health care professionals, first responders, public health officials, and parents and, as such, have a more in-depth involvement with the school system. School physicians are, thereby, uniquely positioned to assist in developing school crisis-management policies. The presence or absence of a school physician does not preclude pediatricians from becoming involved in the following activities:

- School physicians should support schools in developing a risk-potential profile at both the district and individual school levels, including hazard identification and effects on the physical facility and on people. The risk can be environmental, as with hurricanes, or man-made, as with terrorism and gang violence.
- School physicians should become trained in the FEMA Incident Command System and the National Incident Management Systems instruction.
- School physicians, depending on the school district communication plan, should be prepared to serve as spokespersons for medical queries.
- The school physician can assist in the review of incident data and assess the capacity for the violence-, injury-, and communicable-disease–prevention strategies to address the needs of the district and individual schools.
- The school physician may assist with emergency education and training for staff at individual schools so that staff members are aware of their individual roles in a crisis.
- The school physician should review plans for children with special health care needs, addressing the school's capacity to meet the needs of these children in circumstances when the students will be evacuated or contained for prolonged periods (ie, lockdown, shelter-in-place). School physicians can help advocate for adequate emergency supplies to address evacuation, shelter-in-place, and lockdown needs, including classroom ca-

pacity to have medical information readily available for each student.

- The school physician, along with the school health and safety team, should advocate for practice/drills of the protocols and procedures.
- The role the school physician consultant plays will vary depending on availability and should be predetermined by the consultant and school district.
- The school physician has a key role in reviewing the details of the school's plans for disaster response, adherence to the emergency protocol, and the assessment of the adequacy of services available and should assist with refinement of the school's crisis plan.
- The school physician should actively educate staff and parents regarding common mental health reactions to crisis (including symptoms that indicate a need for treatment), strategies to promote resilience, and interventions to facilitate recovery. The plan should include possible interventions to facilitate the recovery of students who develop mental health problems.
- The school physician can provide communication to the health and mental health community about the crisis/recovery needs of the school and can assist in soliciting community linkages.

Recommendations for Public Policy

All levels of government have a clear, vested interest in protecting the health and safety of children during a disaster. Government can play a critical role in providing clear guidelines and resources to schools to ensure that every school does not need to "reinvent the wheel" and can benefit from the work already completed by other institutions similarly situated to develop optimal preparedness plans and strategies.

Pediatricians, as experts in the physical, mental, social, and emotional health and well-being of children, play a vital role in advocating on behalf of children and their interests. To ensure that children's unique needs are appropriately addressed in planning for emergencies and disasters, pediatrician representation should be integrated throughout all federal, state, and local emergency and disaster planning activities. Working in concert with the AAP on federal efforts, AAP chapters and districts on regional and state efforts, and school administrators, emergency and disaster-preparedness experts, child advocates, and others on local efforts, pediatrician advocacy can ensure that children's physical, mental, social, and emotional needs are incorporated into all emergency- and disaster-preparedness plans. The unique needs of children, including those specific to age and health status, should be addressed in such plans, and pediatricians and pediatric medical/surgical subspecialists are encouraged to participate in emergency- and disaster-preparedness planning to ensure that children's needs are appropriately represented.

- The needs of children of all ages should be integrated into federal, state, and local emergency and disaster plans. Pediatricians and pediatric medical/surgical subspecialists should participate at all levels of emergency and disaster planning.
- Federal, state, and local disaster plans should recognize that children are likely to be at school when a disaster occurs. Disaster-readiness efforts must include specific components to ensure appropriate care for children of all ages and all stages of development, including those with special health care needs, in various school settings.
- Federal agencies should take a leadership role in providing schools with models for preparation, shelter-in-place, evacuation, reunification of children with caregivers, and other aspects of disaster preparedness. The US Department of Education Web site (http://rems.ed.gov) is a useful start but should be greatly expanded.
- Federal and state government agencies should increase the resources provided to school districts to ensure that schools can prepare appropriately for disasters that are likely to occur in their areas.
- State and local disaster drills and exercises should include schools as potential direct or indirect sites of disasters. Special attention should be given to evacuation and reunification plans in these drills.
- Federal, state, and local disaster-response plans should recognize possible problems that will occur if these plans involve using schools as mass care sites. Such plans would interfere with the need to restore educational services for children. State and local planning groups should include representatives from the schools in developing preparedness plans, especially, but not only, if those plans include the use of school buildings or other school resources for the purpose of responding to a community disaster.
- Federal, state, and local disaster-response plans should acknowledge that schools are a critical part of society's infrastructure that should be restored as soon as feasible after a disaster to provide needed continuity of care and education for children as well as a safe place for them to be while their caregivers return to work.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Pediatric AIDS

Disclosure of Illness Status to Children and Adolescents With HIV Infection

ABSTRACT. Many children with human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome are surviving to middle childhood and adolescence. Studies suggest that children who know their HIV status have higher self-esteem than children who are unaware of their status. Parents who have disclosed the status to their children experience less depression than those who do not. This statement addresses our current knowledge and recommendations for disclosure of HIV infection status to children and adolescents.

ABBREVIATIONS. HIV, human immunodeficiency virus; AIDS, acquired immunodeficiency virus.

Disclosure of HIV infection status to children and adolescents should take into consideration their age, psychosocial maturity, the complexity of family dynamics, and the clinical context.

Many children with perinatally acquired human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS) are surviving to middle childhood and some to adolescence. By the end of 1997, there were over 8000 reported cases of AIDS in children younger than 13 years and over 3000 adolescents with AIDS.[1] The median survival for children with perinatal HIV infection has been reported to be between 8.6 to 13 years and between 36% to 61% of infants with perinatally acquired HIV are expected to survive to age 13 years[2]; the median survival of children after a diagnosis of AIDS is made is longer than 5 years.[3] Consequently, the disclosure of a diagnosis of HIV infection/AIDS to a child is becoming an increasingly common clinical issue. As some family members have been reluctant to discuss the nature of the illness with their infected child or adolescent, this statement gives recommendations for disclosure of illness to HIV-infected children and adolescents.

Considerable guidelines exist about the disclosure of a chronic illness to a child. In general, disclosure is geared to a child's level of cognitive development[4] and psychosocial maturity. For most illnesses, young children receive simple explanations about the nature of their illness and what their responsibilities are in caring for themselves. The exact diagnosis and prognosis of the disease are less important in early discussions with young children. As children mature, they should be fully informed of the nature and consequences of their illness and encouraged to actively participate in their own medical care. Children with a variety of chronic diseases, including those with cancer, have exhibited better coping skills and fewer psychosocial problems when appropriately informed about the nature and consequences of their illness.[5,6]

Nevertheless, some parents and health care professionals are reluctant to inform children about their HIV infection status. Data from several centers indicate that between 25% and 90% of school-age children with HIV infection/AIDS have not been told they are infected.[7–9] Some of the reasons given by family members for not disclosing HIV infection/AIDS status are similar to reasons expressed by parents of children with other serious diseases, which include concerns about the impact that disclosure may have on a child's emotional health and fear by the parents that the knowledge will negatively affect a child's will to live. Additional reasons often given by parents of HIV-infected children include a sense of guilt about having transmitted infection to the child, anger from the child related to knowledge of perinatal transmission, and fear of inadvertent disclosure by the child. Disclosure of status by the child may lead to stigmatization, discrimination, or ostracism toward the child and other family members. Health care professionals and families are also concerned about the difficulty children have keeping a "secret" and limiting the disclosure to selected persons.

Parents may choose not to disclose the health status to their child because of difficulty in coping with their own illness. Denial is common, and parents may not be able to deal with their own infection with HIV or that of a family member. Accepting the full consequences of illness within a family and learning to cope can be a lengthy process for individuals with any chronic disease. Failure to cope with illness appropriately may signify psychosocial dysfunction that merits specific counseling and therapy for parents. Furthermore, while parents may be making requests for nondisclosure based on what they believe is best for their child, physicians also have a responsibility to make an independent assessment of a child's readiness for disclosure.

Families desiring to protect their children from certain problems by concealing information risk having encounters with other issues. Children may de-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

velop inappropriate and hurtful fantasies about their illness. A conspiracy of silence surrounding children infected with HIV may isolate them from potential sources of support. In the unfortunate event of the death of a parent, the opportunity is lost for children to discuss their illness with that parent. Children also may inadvertently learn of the nature of their illness in a manner that is not supportive. If children find out their infection status from someone other than a parent, they may feel unable to confide in their parent or feel a need to conceal that they are aware of their diagnosis.

Studies on the impact of HIV infection/AIDS disclosure to children are limited.[7,8,10,11] Preliminary work suggests, however, that children who know their HIV status have higher self-esteem than infected children who are unaware of their status. Parents who have disclosed the status to their children experience less depression than those who do not.[7] Disclosure should not only take into consideration the child's age, maturity, and the complexity of family dynamics, but the clinical context as well.[8,10,11] In critically ill children, issues of dying rather than disclosure may be more appropriate to address.

Pediatricians may serve as advocates for children in their care to their parents. For adolescents, the American Academy of Pediatrics has established that health care professionals have an ethical obligation to provide counseling to respond to the needs of adolescent patients and to insure that adolescents have an opportunity for examinations and counseling apart from their parents.[12] Consequently, physicians should provide full disclosure of HIV status to their adolescent patients. Physicians are also obligated to encourage adolescents to involve their parents in their care. Adolescents need to be informed about their illness to assist in their own care and to reduce the risk of transmitting the infection to others through unprotected sex or behaviors associated with illicit drug use.[12,13]

Pediatricians should anticipate the need for eventual disclosure when caring for HIV-infected children. Although physicians can listen to and discuss with parents potential reluctance to disclose, pediatricians should not accept parental or guardian requests to withhold the diagnosis under all circumstances. Pediatricians need to inform parents that if older children question them about their HIV infection status they will answer direct questions truthfully. Although disclosure should occur in a supportive environment that optimally includes knowledgeable professionals and parents, some parents may decide to have professionals assume this responsibility. Ongoing counseling is required throughout the child's infection to obtain parental understanding of the importance of disclosure.[13]

The American Academy of Pediatrics recommends the following for disclosure of HIV infection/AIDS status to children and adolescents:

1. Parents and other guardians of an HIV-infected child should be counseled by a knowledgeable health care professional about disclosure to the child of their infection status. This counseling may need to be repeated throughout the course of the child's illness.
2. Disclosure of the diagnosis to an HIV-infected child should be individualized to include the child's cognitive ability, developmental stage, clinical status, and social circumstances.
3. In general, younger children, if symptomatic with illness, are most interested in learning what will happen to them in the more immediate future. They do not need to be informed of their diagnosis, but the illness should be discussed with them. If children are informed of their diagnosis, considerable effort should be directed toward eliciting and addressing their fears and misperceptions.
4. The American Academy of Pediatrics strongly encourages disclosure of HIV infection status to school-age children. The process for disclosure should be discussed and planned with the parents and may require a number of visits to assess the child's knowledge and coping capacity. Older children have a better capacity to understand the nature and consequences of their illness. Considerable effort will need to be directed to facilitate coping with the illness. Symptomatic children, particularly those requiring hospitalization, should be informed of their HIV status. The likelihood of children inadvertently learning about their status in a hospital setting is high. Disclosure should optimally be conducted in a controlled situation with parent(s) and knowledgeable professionals.
5. Adolescents should know their HIV status. They should be fully informed to appreciate consequences for many aspects of their health, including sexual behavior.
6. Adolescents also should be informed of their HIV status to make appropriate decisions about treatment and participation in clinical treatment trials. Physicians should also encourage adolescents to involve their parents in their care.

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CLINICAL REPORT

Distinguishing Sudden Infant Death Syndrome From Child Abuse Fatalities

Guidance for the Clinician in Rendering Pediatric Care

AMERICAN ACADEMY OF PEDIATRICS
Kent P. Hymel, MD, and the Committee on Child Abuse and Neglect
NATIONAL ASSOCIATION OF MEDICAL EXAMINERS

ABSTRACT

Fatal child abuse has been mistaken for sudden infant death syndrome. When a healthy infant younger than 1 year dies suddenly and unexpectedly, the cause of death may be certified as sudden infant death syndrome. Sudden infant death syndrome is more common than infanticide. Parents of sudden infant death syndrome victims typically are anxious to provide unlimited information to professionals involved in death investigation or research. They also want and deserve to be approached in a nonaccusatory manner. This clinical report provides professionals with information and suggestions for procedures to help avoid stigmatizing families of sudden infant death syndrome victims while allowing accumulation of appropriate evidence in potential cases of infanticide. This clinical report addresses deficiencies and updates recommendations in the 2001 American Academy of Pediatrics policy statement of the same name.

INTRODUCTION

Approximately 50 years ago, the medical community began a search to understand and prevent sudden infant death syndrome (SIDS).[1,2] Almost simultaneously, medical professionals were awakened to the realities of child abuse.[3–6] Since then, public and professional awareness of SIDS and fatal child abuse during infancy has increased steadily. More recently, well-validated reports of child abuse and infanticide—intentional suffocation presenting as apparent life-threatening events (ALTEs) and/or apparent SIDS—have appeared in the medical literature and in the lay press.[7,8] The differentiation between SIDS and fatal child abuse can be a critical diagnostic decision.[9] Additional funding for research into the causes and prevention of SIDS and child abuse is needed.

For more than a decade, SIDS (also called crib or cot death) has been defined as the sudden death of an infant younger than 1 year that remains unexplained after thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history.[10] Very recently, an expert panel of pediatric and forensic pathologists and pediatricians proposed a new definition of SIDS that is stratified to facilitate research, administrative, and vital-statistics purposes.[11] SIDS is the most common cause of death for children between 1 and 6 months of age. The incidence of SIDS peaks between 2 and 4

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

The Board of Directors of the National Association of Medical Examiners endorsed this clinical report in February 2006.

Key Words
sudden infant death syndrome, SIDS, child abuse

Abbreviations
SIDS—sudden infant death syndrome
ALTE—apparent life-threatening event

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months of age. Approximately 90% of SIDS cases occur before the age of 6 months.[12]

SIDS is suspected when a previously healthy infant, usually younger than 6 months, apparently dies during sleep, prompting an urgent call for emergency assistance. Often, the infant is fed normally just before being placed in bed to sleep, no outcry is heard, and the infant is found in the position in which he or she had been placed at bedtime or naptime. In some cases, cardiorespiratory resuscitation initiated at the scene is continued without apparent beneficial effect en route to the hospital, where the infant is finally declared dead. Evidence of terminal motor activity, such as clenched fists, may be seen. There may be serosanguineous, watery, blood-tinged, frothy, or mucoid discharge coming from the nose or mouth. Skin mottling and postmortem lividity in dependent portions of the infant's body are commonly found. Review of the medical history, scene investigation, radiographs, and autopsy are unrevealing.

Despite extensive research, our understanding of the causes of SIDS remains incomplete.[13] The discovery of abnormalities in the arcuate nucleus of the brainstems of some SIDS victims suggests that true SIDS cases likely reflect delayed development of arousal, cardiorespiratory control, or cardiovascular control.[14,15] When the physiologic stability of such infants becomes compromised during sleep, they may not arouse sufficiently to avoid the noxious insult or condition.[16]

The SIDS rates are 2 to 3 times higher among black, Alaska native, and some American Indian populations. SIDS has been linked epidemiologically in research studies to prone sleep position, sleeping on a soft surface, bed sharing, maternal smoking during or after pregnancy, overheating, late or no prenatal care, young maternal age, prematurity, low birth weight, and male gender.[13,17–25] To date, no definitive evidence establishes causality between SIDS and recurrent cyanosis, apnea, ALTEs, or immunizations during infancy.

In recent years, national campaigns aimed at reducing prone sleeping during infancy have succeeded in dramatically decreasing the prevalence of prone positioning and may be associated with a decrease in the incidence of SIDS in the United States and in other countries.[16,26–31] Many of these educational campaigns have also emphasized prompt evaluation and treatment of sick infants, appropriate immunizations, breastfeeding, and avoidance of bed sharing, overheating, overdressing or overbundling, gestational or postnatal passive smoke exposure, and soft sleep materials or surfaces.

SIDS: A DIAGNOSIS OF EXCLUSION

The diagnosis of SIDS is exclusionary and requires a complete autopsy, investigation of the circumstances of death,[32] and review of case records that fail to reveal another cause of death. Infant deaths without such a comprehensive death investigation and infants that are autopsied and whose deaths are carefully investigated but reveal substantial and reasonable uncertainty regarding the cause or manner of death should be designated as "undetermined." Examples of undetermined cases include suspected (but unproven) infant death attributable to infection, metabolic disease, asphyxiation, or child abuse.

A diagnosis of SIDS reflects the clear admission by medical professionals that an infant's death remains unexplained. A young infant's death should be ruled as "attributable to SIDS" when all of the following are true:

- a complete autopsy is performed, including examination of the cranium and the cranial contents, and autopsy findings are compatible with SIDS;
- there is no evidence of acute or remote inflicted trauma, significant bone disease, or significant and contributory unintentional trauma, as judged by skeletal radiologic survey,[33] postmortem examination, and reliable clinical history;
- other causes and/or mechanisms of death are sufficiently excluded, including meningitis, sepsis, aspiration, pneumonia, myocarditis, trauma, dehydration, fluid and electrolyte imbalance, significant congenital defects, inborn metabolic disorders, asphyxia, drowning, burns, or poisoning;
- there is no evidence of toxic exposure to alcohol, drugs, or other substances; and
- thorough death- and/or incident-scene investigation and review of the clinical history reveal no other cause of death.

CHILD ABUSE FATALITIES BY SUFFOCATION

In some cases, it may be difficult or impossible to differentiate between a natural unexplained infant death, an unintentional or accidental infant death, and an unnatural (intentional) infant death. Recent literature has suggested that the index of suspicion for unnatural death should be higher, particularly in families in which an unexplained infant death has occurred previously.[34] More recent publications, however, provide some reassurance that a percentage of recurrent, unexplained infant deaths may be, in fact, natural.[35,36]

Estimates of the incidence of infanticide among cases designated as SIDS range from less than 1% to 5%.[7,9,37–39] The parents of some infants with recurrent ALTEs have been observed trying to suffocate and harm their infants.[7,40] In Great Britain, covert video surveillance was used to assess child abuse risk in 39 young children referred for evaluation of recurrent ALTEs.[7] Abuse was revealed in 33 of 39 cases, with documentation of intentional suffocation observed in 30 patients. Among 41 siblings of the 39 infants in the studies, 12 had previously died suddenly and unexpectedly. Although 11 of these deaths had been classified as SIDS, 4 parents later

admitted to suffocating 8 of these siblings. Other cases previously thought to be multiple SIDS cases within a family[40,41] have been revealed to be cases of serial homicide by suffocation.[8,34]

It is difficult, if not impossible, to distinguish at autopsy between SIDS and accidental or deliberate suffocation with a soft object.[42] However, certain circumstances could indicate the possibility of intentional suffocation, including

- recurrent cyanosis, apnea, or ALTEs occurring only while in the care of the same person;
- age at death older than 6 months;
- previous unexpected or unexplained deaths of 1 or more siblings;
- simultaneous or nearly simultaneous death of twins[43];
- previous death of infants under the care of the same unrelated person[44]; or
- evidence of previous pulmonary hemorrhage (such as marked siderophages in the lung).

MANAGEMENT OF SUDDEN UNEXPECTED INFANT DEATH

Most sudden infant deaths occur at home. Parents are shocked, bewildered, and distressed. Parents who are innocent of blame in their child's death often feel responsible nonetheless and imagine ways in which they might have contributed to or prevented the tragedy.[45] The appropriate medical professional response to every child death must be compassionate, empathic, supportive, and nonaccusatory. Inadvertent comments, as well as unnecessary questioning by medical personnel and investigators, are likely to cause additional stress. It is important for those in contact with parents during this time to remain nonaccusatory even while conducting a thorough death- and/or incident-scene investigation.

Personnel on first-response teams should be trained to make observations at the scene, including position of the infant, marks on the body, body temperature and rigor, type of bed or crib and any defects, amount and position of clothing and bedding, room temperature, type of ventilation and heating, and reaction of the caregivers. Guidelines are available for investigation of the circumstances of sudden, unexplained infant deaths.[32,37] Paramedics and emergency department personnel should be trained to distinguish normal findings, such as postmortem anal dilation and lividity, from trauma attributable to abuse.[46,47]

When a previously healthy infant has died unexpectedly in the absence of external evidence of injury or initial history/scene findings suggestive of another cause/manner of death, then a preliminary diagnosis of "possible SIDS" may be given. Assignment of this preliminary diagnosis should not limit or prevent subsequent thorough case investigation. Parents should be informed that other causes and mechanisms of death will be excluded only by thorough investigation of the circumstances of death, postmortem examination, and review of case records. It should be explained to parents that these procedures might enable them and their physician to understand why their infant died and how other children in the family, including children born later, might be affected. Only after completion of a thorough case investigation (including performance of a complete autopsy, examination of the circumstances of death, and review of the clinical history) that does not reveal another cause of death should a diagnosis of SIDS be assigned as the cause of death.

Depending on local protocols and statutes, if permitted by the medical examiner, the family may be given an opportunity to see and hold the infant once death has been pronounced. It is suggested that an unrelated observer remain with the family throughout this period to serve as a witness should issues regarding postmortem artifacts arise later. A protocol[48] may help in planning how and when to address the many issues that require attention, including baptism, grief counseling, funeral arrangements, religious support, termination of breastfeeding, and the reactions of surviving siblings.[45,49] All parents should be provided with information about sudden infant death[50,51] and the telephone number of the local SIDS support group.[48]

Controversy exists in the medical literature regarding the likelihood of a repetition of SIDS within a sibship.[52–55] When an infant's sudden and unexpected death has been thoroughly evaluated and alternate genetic, environmental, accidental, or inflicted causes of death have been carefully excluded, parents should be informed that the risk of SIDS in subsequent children is not likely increased. Although repetitive sudden and unexpected infant deaths occurring within the same family should compel investigators to consider the possibility of serial homicide,[8] it is important to remember that serial infant deaths within a sibship can also be explained by a fatal, inheritable disorder, 2 separate and unrelated natural disease processes, or an unrecognized environmental hazard.

In many states, multidisciplinary teams have been established to review child fatalities.[56,57] Ideally, a multidisciplinary death-review committee should include a child welfare/child protective services social worker, a law enforcement officer, a public health officer, the medical examiner/coroner, a pediatrician with expertise in child maltreatment, a forensic pathologist, a representative of the emergency medical services (EMS) system, a pediatric pathologist, and the local prosecutor. The proceedings of multidisciplinary death-review committees should remain confidential. Sharing data among agencies helps to ensure that deaths attributable to child abuse are not missed and that surviving and subsequent siblings are protected. Some child-fatality teams rou-

tinely review infant deaths attributable to apparent SIDS.

THE IMPORTANCE OF AUTOPSY, SCENE INVESTIGATION, AND CASE REVIEW

The failure to differentiate fatal child abuse or other causes of death from SIDS is costly. In the absence of postmortem examination, investigation of the circumstances of death, and case review, child maltreatment is missed, familial genetic diseases go unrecognized, public health threats are overlooked, inadequate medical care goes undetected, product-safety issues remain unidentified, and progress in understanding the etiology of SIDS and other causes of unexpected infant death is delayed. Inaccurate vital statistics lead to inappropriate allocation of limited health care resources. By thoroughly investigating apparent SIDS cases, the potential hazards of defective infant furniture, water beds, and bean-bag mattresses have been identified and remedied.[58,59]

If appropriate toxicological tests are not performed, infant deaths attributable to accidental or deliberate poisoning will be missed.[46,60] For example, occult cocaine exposure is potentially lethal. One review of autopsies performed on stillborns and newborns in Los Angeles, California, in the early 1990s found that 17 (40%) of 43 infants who died before 2 days of age without an obvious cause of death at autopsy had toxicological evidence of cocaine exposure. Obviously, these exposures represent intrauterine exposures.[61] Although the age and circumstances of death of these infants would exclude them from the SIDS population, it is enlightening to review the percentage of occult exposure in this population. A second review of 600 infant deaths revealed evidence of cocaine exposure in 16 infants (2.7%) younger than 8 months who died suddenly and unexpectedly.[62] "Lethal" concentrations of cocaine and many other drugs in infancy are not yet established.

Neither child abuse nor SIDS is rare. Some young victims of nonlethal child maltreatment will die from SIDS. In such cases, the failure to differentiate objectively between fatal child abuse and SIDS could result in an inappropriate criminal investigation and/or prosecution for homicide.

POSTMORTEM IMAGING

Radiographic skeletal surveys performed before autopsy in cases of possible SIDS may reveal evidence of traumatic skeletal injury or skeletal abnormalities indicative of a naturally occurring illness. Ideally, the skeletal survey should be performed in a manner comparable to that recommended for living infants in whom abuse is suspected[63,64] and reviewed by a physician experienced in identifying the subtle radiologic alterations seen with abuse, as well as findings that may be confused with inflicted injuries. Thorough documentation of all sites of suspected skeletal injury may require additional procedures that may include specimen resection, high-detail specimen radiography, and histologic analysis. The presence of both old and new traumatic injuries identified on skeletal survey before autopsy may suggest inflicted injuries and may lend focus to the postmortem examination, investigation of the circumstances of death, and police investigation.[33,65]

PATHOLOGY

The American Academy of Pediatrics and the National Association of Medical Examiners (NAME) endorse universal performance of autopsies on infants who die suddenly and unexpectedly by forensic pathologists experienced in the diagnosis of SIDS.[66] Postmortem findings in cases of fatal child abuse most often reveal cranial injuries, abdominal trauma (eg, liver laceration, hollow viscous perforation, or intramural hematoma), burns, or drowning as the cause of death.[67–70] Although cytomegalovirus inclusion bodies have been identified in some infants who died suddenly and unexpectedly, a definitive causal link between cytomegalovirus infection and SIDS has not been established.[71] Forensic pathologists establish the diagnosis of SIDS by exclusion when, after a thorough investigation including a complete autopsy, they are unable to identify a specific cause for a child's death.[46]

Inborn errors of metabolism[72–74] have been implicated in a small percentage of sudden unexplained deaths in infants with autopsy findings consistent with SIDS. When repetitive, sudden, and unexpected infant deaths occur within a sibship, thorough evaluation to exclude or confirm an inborn error of metabolism is essential. Analysis of blood and bile may facilitate diagnosis of a fatal inborn error of metabolism. Blood tests for evaluation of many metabolic disorders are now available at low cost. Many medical examiners routinely screen all victims of sudden unexpected infant death for inborn errors of metabolism at autopsy. If an inborn error of metabolism is suspected by autopsy findings (eg, hepatic steatosis) or history (eg, previous unexpected deaths in childhood in the family), then the forensic pathologist may elect to retain additional tissues such as brain, liver, kidney, heart, muscle, adrenal gland, and/or pancreas for further analysis, pending the results of the postmortem metabolic screening.

CONCLUSIONS

The following are important components in the evaluation of sudden, unexplained infant deaths:

- accurate history taking by emergency responders and medical personnel at the time of death and immediate transmission of this historical information to the medical examiner or coroner;
- prompt investigation of the scene[32,37] at which the infant was found lifeless or unresponsive and careful

interviews of household members by knowledgeable individuals with the legal authority and mandate to conduct such investigations;

- appropriate consultations with available medical specialists (eg, pediatrician, pediatric pathologist, pediatric radiologist, and/or pediatric neuropathologist) by medical examiners and coroners;
- complete autopsy performed by a forensic pathologist within 24 hours of death, including examination of the all major body cavities including cranial contents, microscopic examination of major organs, radiographic examination, and toxicological and metabolic screening;
- collection of medical history through interviews of caregivers, interviews of key medical providers, and review of previous medical charts;
- maintenance of an unbiased, nonaccusatory approach to parents during the death-review process;
- consideration of intentional asphyxia in cases of unexpected infant death with a history of recurrent cyanosis, apnea, or ALTEs witnessed only by a single caregiver;
- use of accepted diagnostic categories on death certificates as soon as possible after review;
- prompt imparting of information to parents when results indicate SIDS or accidental or medical causation of death; and
- review of collected data by locally based infant death-review teams[57] with participation of the medical examiner or coroner.

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CELLPHONES DON'T BELONG IN SCHOOL

"You're a teacher in the New York City public school system. It's September, and you're lecturing the class on the structure of an essay. Your students need to know this information to pass your class and the Regents exam, and you, of course, hope that one day our talented students will dazzle and amaze English professors all over the country. You turn your back to write the definition of 'thesis' on the chalkboard. It takes about 15 seconds. You turn around to the class expecting to see 25 students scribbling the concept in their notebook. Instead, you see a group of students who have sprung appendages of technology. Jose has grown an earphone. Maria's thumbs have sprouted a two-way. Man Keung, recently arrived from China, is texting away on a cell phone connected to his wrist. And Christina appears to be playing Mine Sweeper on a Pocket PC on her lap. . . . But as a former New York City public school teacher, I can tell you that cellphones don't belong in the classroom. A student with a cellphone is an uninterested student, one with a short attention span who cares more about his social life than education."

Scaccia J. *New York Times*. May 23, 2006
Noted by JFL, MD

AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Mary E. Fallat, MD; Jayant K. Deshpande, MD; and the Section on Surgery, Section on Anesthesia and Pain Medicine, and Committee on Bioethics

Do-Not-Resuscitate Orders for Pediatric Patients Who Require Anesthesia and Surgery

ABSTRACT. This clinical report addresses the topic of preexisting do-not-resuscitate (DNR) orders for children undergoing anesthesia and surgery. Pertinent issues addressed include the rights of children, surrogate decision-making, the process of informed consent, and the roles of surgeons and anesthesiologists. The reevaluation process of DNR orders called "required reconsideration" can be incorporated into the process of informed consent for surgery and anesthesia. Care should be taken to distinguish between goal-directed and procedure-directed approaches to DNR orders. By giving parents or other surrogates and clinicians the option of deciding from among full resuscitation, limitations based on procedures, or limitations based on goals, the child's needs are individualized and better served. ***Pediatrics*** **2004;114: 1686–1692;** ***anesthesia, pediatric surgery, pediatrics, children, resuscitation, cardiac arrest, respiratory arrest.***

ABBREVIATIONS. DNR, do-not-resuscitate, CPR, cardiopulmonary resuscitation, ASA, American Society of Anesthesiologists, ACS, American College of Surgeons.

CONSIDERATIONS FOR CHILDREN WITH DO-NOT-RESUSCITATE ORDERS WHO REQUIRE ANESTHESIA AND SURGERY

In the 1970s, the Critical Care Committee at the Massachusetts General Hospital developed the original do-not-resuscitate (DNR) guidelines in response to nursing requests for clarification of what should be done when cardiopulmonary resuscitation (CPR) was unwanted or believed to be unwarranted by a patient or surrogate.[1] DNR orders are clinically and ethically appropriate when the burdens of resuscitation exceed the expected benefit. Currently, all hospitals seeking accreditation from the Joint Commission on Accreditation of Healthcare Organizations are required to have a DNR policy in place.[2–6] This policy should define a DNR order and describe the guidelines for its inclusion on a patient's medical record. A DNR order is a written order by an attending physician and precludes resuscitative efforts being undertaken in the event of cardiopulmonary arrest. DNR orders should not have implications regarding the use of other therapeutic interventions that may be appropriate for the patient, including surgery and anesthesia.[7,8]

The controversial topic of DNR orders for patients undergoing surgery and anesthesia has received growing attention in the medical literature since the early 1990s. However, the literature does not specifically address the pediatric age group. For children, DNR orders are written when (1) in the judgment of the treating physician, an attempt to resuscitate the child would not benefit the child and (2) the parent or surrogate decision-maker (with the assent of an age-appropriate child) expresses his or her preference that CPR be withheld in the event that the child suffers a cardiopulmonary arrest, as long as this is in accordance with the child's best interests.[7,9] DNR orders are written on the assumption that cardiopulmonary arrest will be a spontaneous event that is the culmination of the dying process of a child who has a terminal illness or a poor quality of life. The dilemma surgeons and anesthesiologists are confronted with regarding children with DNR orders undergoing an operative procedure is twofold: (1) anesthesia promotes some degree of hemodynamic abnormality that may result in cardiopulmonary arrest, and (2) many routine anesthetic manipulations can be classified as resuscitative measures.

A number of hospitals across the nation still do not have a policy that specifically addresses the extent to which DNR orders apply in the operating room[2,5,10,11] or have a policy that mandates suspension of DNR orders.[9] According to 1 study, surgical procedures are performed in ~15% of patients with DNR orders.[12] The American Academy of Pediatrics and the American Society of Anesthesiologists (ASA) have issued guidelines on forgoing life-sustaining medical treatment, issues of informed consent,[13,14] and evaluation and preparation of pediatric patients undergoing anesthesia.[15] None of these policies address in detail the approach to be taken when an operative procedure is considered for a child with an existing DNR order. This encounter includes the dilemmas of who should assume responsibility (ie, the primary care physician, the surgeon, or the anesthesiologist) for discussing with the parent or surrogate decision-maker the potential risks of cardiopulmo-

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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nary arrest during surgery and anesthesia, whether the DNR order should be temporarily suspended during the procedure, and how long a temporary suspension should last if this option is chosen.

SURVEY OF SECTIONS ON SURGERY AND ANESTHESIA

The relevance of this topic was assessed by distributing a survey to the 570 members of the Section on Surgery and 293 members of the Section on Anesthesiology of the American Academy of Pediatrics in 1995. The survey was returned by 242 surgeons (42.5%) and 107 anesthesiologists (36.5%). Demographic data on the respondents are shown in Table 1.

For each group, surgeons and anesthesiologists, finite sample confidence intervals for proportions were computed.[16] The finite population correction factor was used for hypotheses testing as needed.[16] Statistical software used included SPSS version 10 (SPSS Inc, Chicago, IL [2000]) and StatXact version 4 (Cytel Software Inc, Cambridge, MA [2000]).

The majority of surgeons (88.8%) and anesthesiologists (86%) had been asked to operate on or provide anesthesia to a child with a DNR order in place at the time of surgery, and most indicated that they would not refuse to provide these services. Most surgeons (75.3%) and anesthesiologists (69.2%) would agree to honor a DNR order during a palliative operative procedure, but smaller percentages of surgeons (49.6%) and anesthesiologists (46.7%) were willing to honor a DNR order during an elective operative procedure. More than 95% of surgeons and anesthesiologists discuss resuscitation issues before surgery with parents of children who have standing DNR orders, and a majority of each group felt that there should be a hospital policy for children with DNR orders in the operating room. Only 50.5% of anesthesiologists and 27.5% of surgeons stated that their hospital has such a policy in place.

Surgeons and anesthesiologists then were asked which resuscitation maneuvers should be withheld during intraoperative arrest in a child with a DNR order. Results are summarized in Table 2.

The majority of anesthesiologists (86%) and surgeons (94.7%) were willing to withdraw life support at the request of the family a few days after surgery if a child suffered an arrest in the operating room, was resuscitated, and had an adverse change in quality of life. The majority of anesthesiologists (55.1%) felt that the perioperative period ended when the child left the recovery room, with only 38.2% of surgeons agreeing ($P = .0037$). Many anesthesiologists (22.4%) and surgeons (39.5%) felt that the perioperative period should be extended until 24 hours after surgery.

TABLE 1. Demographics of Respondents to Survey Regarding DNR Orders

	Pediatric Surgeons	Pediatric Anesthesiologists
Demographics		
Median age, y	50 (35–81)	44 (32–63)
Median years in practice, y	18 (3–45)	11 (2–41)
Practice characteristics,* *n* (%)		
Full-time university	132 (54.8)	55 (51.4)
University clinical affiliate	57 (23.4)	30 (28.0)
Private practice	68 (28.2)	26 (24.3)
Military	3 (1.2)	0 (0)
Hospital type,* *n* (%)		
Children's hospital	116 (49.2)	55 (51.4)
University hospital	95 (40.3)	36 (3.6)
Community hospital	53 (22.5)	17 (15.9)
Military hospital	2 (0.8)	0 (0)

* A small number of surgeons and anesthesiologists reported multiple affiliations.

DISCUSSION

The medical literature contains some ambiguities on the scope of a DNR order and the resuscitative interventions it prevents during surgery and anesthesia. Resuscitative interventions may be broadly defined as any maneuvers and techniques used to prevent or reverse cardiopulmonary arrest.[17] However, this definition is inappropriate in an operative setting, because anesthetic agents routinely promote cardiovascular instability.[2,5,11,18] Perioperatively, resuscitative measures should only refer to the measures undertaken to restore life once a cardiopulmonary arrest has occurred.[8,19] Surveys of physicians and patients with DNR orders confirm that clarification is needed on the interpretation of a DNR order, especially its applicability in the operating room.[12,20–22]

Physicians caring for children have a duty to respect the wishes of the child and family, to do good (beneficence), and to avoid harm (nonmaleficence), which may lead to conflicting considerations for a child with a DNR order. Some physicians believe that honoring a DNR request harms a child by allowing a potentially reversible death to occur. On the other hand, the child's welfare is best served by not having a poor quality of life unnecessarily prolonged and not having to endure ineffective therapy.[23] Older children and adolescents should be included in the decision-making process (patient assent) when their neurologic status, development, and level of maturity allow. However, legally they require a surrogate decision-maker to act on their behalf (surrogate or parental permission).[14] A child's surrogate, usually a parent, should be the person presumed to be the most appropriate and capable to determine what actions would be in the best interest of the child. Conflicts arise when the parent or other surrogate and/or child and the physician fail to agree on what would be optimal care under a given set of circumstances.

Informed Consent

To respect the child's and family's wishes, physicians must obtain informed permission from a parent or surrogate before a child can undergo any medical intervention including surgery and resuscitation. Ordinarily, resuscitation efforts do not require informed consent, because they are deemed emergency interventions and consent is implied. However, terminally ill or severely disabled children and their parents are often confronted with the decision of whether resuscitation should be attempted in the

TABLE 2. Responses When Asked Whether Resuscitation Maneuvers Should Be Withheld During Intraoperative Arrest in a Child With a DNR Order

	Pediatric Surgeons*		Pediatric Anesthesiologists		*P* Value
	Yes, %	No	Yes, %	No	
Maneuver					
Positive-pressure ventilation	60 (26.7)	165	23 (21.5)	84	NS
Vasoactive drugs	93 (41.5)	131	34 (31.8)	73	.0005
Endotracheal intubation	63 (28.1)	161	22 (20.6)	85	NS
Defibrillation	166 (73.8)	56	65 (60.7)	42	.0092
Closed cardiac massage	175 (77.4)	51	36 (33.6)	71	<.00005

NS indicates not significant.
* Some respondents did not answer every question

event the child's underlying disease results in cardiopulmonary arrest.

Customarily, physicians will approach the parent or surrogate about instituting a DNR order when it is felt that resuscitation of the child would not be beneficial and would only prolong the time to death.[22] When a parent or surrogate consents to a DNR order, it is under the assumption that cardiopulmonary arrest will be a direct consequence of the child's underlying disease. Surgery and anesthesia constitute a change in the child's medical status, because they introduce additional risks to the patient. Because surgeons and anesthesiologists are rarely involved in the original DNR decision, they cannot be certain that the implications of the DNR status in the perioperative setting were discussed with the patient's parent (or other surrogate).[3] Therefore, the parent or surrogate, the surgeon, and the anesthesiologist should reevaluate the DNR order for a child who requires an operative procedure. This reevaluation process has been called "required reconsideration"[3] and should be incorporated into the process of informed consent for surgery and anesthesia. Discussions regarding consent under these circumstances should be initiated by attending staff, particularly in hospitals with residency teaching programs in which residents may be routinely involved in the consent process.

The surgeon and anesthesiologist must approach the parents and child with compassion. There is often no previous relationship established between the patient, parents, and surgical team, precluding a brief preoperative assessment. "Active listening" is essential. The parent or surrogate should be asked about specific interventions and their understanding of the relative merits of each of these interventions during resuscitation (Table 3).[15] Airway management should be determined by what is mandated by the child's condition and the surgical procedure. Specific prohibition of tracheal intubation is problematic, and beliefs and concerns must be carefully elicited and discussed. Exceptions to the injunctions against intervention should be specifically noted in the patient's medical record. The parent may agree to a temporary suspension of the DNR order during the perioperative period. If so, the temporal end point to the DNR suspension needs to be recorded as well. If an agreement cannot be obtained after thorough discussion, the wishes of the informed parent or surrogate must prevail. In some cases, the parents may feel that the burden of a therapy is not worth the potential benefits and decline the procedure. When an individual physician feels that the parent's wishes are inconsistent with his or her medical, ethical, or moral views, the physician should withdraw from the case after ensuring continuity of care[13] and could consider consulting the institutional ethics committee.

TABLE 3. Potential Interventions During Resuscitation

- Airway management
  - Supplemental oxygen
  - Oral airway
  - Bag and mask ventilation
  - Intubation
- Arterial puncture
- Needle thoracentesis
- Chest tube insertion
- Blood product transfusion
- Invasive monitoring
- Chest compressions
- Defibrillation
- Cardiac pacing
- Arrest medications (epinephrine, atropine, sodium bicarbonate, calcium, other vasoactive drugs)
- Postoperative ventilatory support

Role of the Surgeon

The following are operative interventions that might be considered for a pediatric patient with a DNR order:

1. Provision of a support device that will enable the child to be discharged from the hospital (eg, gastrostomy tube or tracheostomy).
2. Urgent surgery for a condition unrelated to the underlying chronic problem (eg, acute appendicitis in a terminal cancer patient).
3. Urgent surgery for a condition related to the underlying chronic problem but not believed to be a terminal event (eg, a pathologic fracture or bowel obstruction).
4. A procedure to decrease pain.
5. A procedure to provide vascular access.

It is the duty of the operating surgeon to discuss risks of a procedure with the parent or other surrogate of any pediatric patient, including how the patient's condition might influence the risk of anesthesia. The American College of Surgeons (ACS) issued

a statement to guide surgeons in operating on patients with an active DNR order.[24] The ACS statement does not make specific reference to patient surrogates, although it is implied.[24] It is expected that the surgeon will advise parents or other surrogates and the child (if developmentally appropriate) regarding operative risks and benefits and advocate a policy of required reconsideration of previous DNR orders. The results of all discussions should be documented in the patient's medical record. The surgeon should also ultimately convey the patient's wishes to the members of the entire operating room team, help operating team members understand the patient's or surrogate's wishes, and find alternate team members to replace individuals who disagree with the patient's or surrogate's wishes. With children, the difficulty arises when there is no one who is willing to honor a family's wish to continue the DNR status during the anesthesia and surgery. Stalemates such as this should be referred to the ethics committee of the institution.

Role of the Anesthesiologist

In 1994 and 1999, the ASA released recommendations on caring for surgical patients with active DNR orders.[15] These guidelines explicitly reject the practice of automatically rescinding the DNR order before procedures involving the use of anesthesia, because this practice "may not sufficiently address a patient's rights to self-determination in a responsible and ethical manner."[15] The purpose of required reconsideration of DNR orders is to determine what is best for the patient under the circumstances, not to convince the patient and family to have the DNR order suspended. The guidelines proposed by the ASA clearly recommend that all physicians involved in the case (primary physician, surgeon, and anesthesiologist) discuss together with the patient (or other surrogate) the appropriateness of maintaining the DNR order during the operation. The 1999 guidelines distinguish between goal-directed and procedure-directed DNR orders.[15] Model procedure-specific DNR documentation forms are published and may be modified for individual hospital use.[9]

A goal-directed approach focuses on the patient's goals, values, and preferences rather than on individual procedures. The primary goal is to do everything to prevent the need for resuscitation, but if it occurs, this approach recognizes that patients are often less concerned with technical details of the resuscitation than with more subjective and personal issues regarding quality of life before and after resuscitation. This model promulgates an approach that honors the family's treatment goals while reflecting the reality and unique aspects of the perioperative environment. However, some anesthesiologists are uncomfortable with the indeterminate nature of a goal-directed DNR order and have ethical or legal concerns about having such crucial decisions rest solely on their best judgment at the time of arrest.

Goal-directed DNR orders may be less feasible if the anesthesiologist and surgeon caring for the child have not established a relationship with the family before surgery. A procedure-directed approach may be more appropriate in these circumstances, which involves careful consideration of a series of specific interventions that are likely to be used (Table 3). Each must be placed in the context of the child's usual quality of life and likelihood of the ability of the procedure to produce the desired effect, given his or her unique physiology. This approach has limited flexibility when an unexpected situation occurs.[9]

Perioperative suspension of the DNR order is considered by some anesthesiologists to be the ideal compromise, because it enables the physician to act without restraint while providing the patient with a realistic chance of achieving the operative goals.[10,25] Anesthetic agents and techniques may promote some degree of hemodynamic and respiratory abnormality, especially in patients with a deteriorated health condition.[2] The deliberate depression of vital functions by the anesthetic may require resuscitative measures to stabilize the patient.[11] Consequently, controversy about the use of these interventions arises when the patient has a written DNR order. Many of the routine anesthetic interventions performed as part of operative maintenance are considered resuscitative measures under different circumstances. These interventions include the use of paralytic agents, vasoactive drugs, blood products, and positive-pressure ventilation. This overlap in terminology promotes confusion and inconsistencies among physicians on the interpretation of a patient's DNR order and what it implies in an operative setting. Keffer and Keffer[8,19] proposed that resuscitation in the operating room be defined as "those measures undertaken to reestablish cardiac rhythm once a cardiac arrest has occurred."[8(p644)] This definition establishes a simple end point beyond which a patient's wish not to be resuscitated would come into play.

The anesthesiologists' concern for patient comfort during the procedure may support perioperative suspension of DNR orders. An active DNR order restricts the physicians' ability to treat any complications of their own procedure during anesthesia. Faced with this dilemma, anesthesiologists are forced to decrease the risk of cardiopulmonary arrest by increasing hemodynamic stability through the use of less anesthetic.[2,11,26] For the patient, this may potentially result in more discomfort and suffering.

One reason to distinguish DNR in the operating room from DNR in other settings is the difference in the success rate of CPR administered for a spontaneous cardiopulmonary arrest versus one that results from anesthesia. Anesthetic-related arrests are believed to be more easily reversible because of the immediate ability to respond and the controlled nature of the event.[3,19,26,27] One study of surgical patients suggested that when a cardiac arrest was ascribed to anesthesia, 92% of the patients were resuscitated successfully.[3,28] However, it is difficult to determine how these statistics apply to terminally ill patients with a DNR designation, because the survey was very broad and inclusive. A more relevant survey was conducted on 4301 seriously ill adult patients, and a few underwent an operative

procedure and had previously written DNR orders in their medical records. Only 3 of the 57 patients with DNR orders (5%) experienced an intraoperative cardiopulmonary arrest, but all died within 5 days of operation.[29]

Traditionally, CPR has been considered a success if the patient survives the initial resuscitation effort. For patients with DNR orders, the success of CPR may be better gauged on the length of patient survival[7] and expected quality of life after resuscitation. Using this definition, CPR may be inappropriate from the parent's or surrogate's viewpoint if resuscitation has the overwhelming probability of resulting in patient suffering and only prolonging the time to death.[7] Anesthesiologists have the duty to inform the parent or other surrogate of the risks and potential benefits of intraoperative resuscitation. Required reconsideration as part of the process of informed consent for anesthesia eliminates ambiguities and misunderstandings associated with patients who have DNR orders by providing anesthesiologists with the opportunity to educate the parent (or other surrogate) to become familiar with their values and perceptions of the child's quality of life and together clarify how the child's DNR order should be interpreted perioperatively. By giving parents or surrogates and clinicians the option of deciding from among full resuscitation, limitations based on procedures, or limitations based on goals, the child's needs are individualized and better served. Regardless of the decision made by the parent or other surrogate, the individual acting on behalf of the child must be readily available for consultation during the procedure. The ASA, like the ACS, advocates that physicians withdraw from a case when they are unwilling or unable to respect and implement a patient's (or other surrogate's) decision to limit the use of resuscitation.[15,24]

If DNR Orders Are Suspended: Qualification of Perioperative Interval

If the family or medical personnel involved in a child's care choose to suspend DNR orders during anesthesia and surgery, it is necessary to define the duration of suspension.[30] The physiologic effects of anesthesia and surgery rarely terminate at the end of the procedure, but the duration thereafter depends on the anesthetic technique used and the type of surgical procedure performed. The acute effects of most anesthetic medications generally resolve within several hours or 1 day after surgery, and most anesthesiologists visit the patient the day after a surgical procedure and document recovery status in the patient record. Recovery of respiratory function after surgery depends on preoperative pulmonary function, chronicity of illness, and length of the procedure. Some patients will experience cardiopulmonary arrest during or immediately after surgery, which may be the result of an acute and reversible complication. It is appropriate to use mechanical ventilation after surgery as long as the patient continues to show significant and sustained improvement in pulmonary function. Once the patient ceases to recover or deteriorates, withdrawal of ventilatory support should be considered. Generally speaking, the suspension of DNR orders should continue until the postanesthetic visit, until the patient has been weaned from mechanical ventilation, or until the primary physician involved in the patient's care and the family agree to reinstate the DNR order.

The surgeon and anesthesiologist should feel comfortable, and should be allowed, to reinstate a DNR order intraoperatively through consultation with the family under certain conditions. For example, if cardiac arrest occurs during surgery and it is apparent that the arrest is the result of an irreversible underlying disease or complication and that CPR would only allow continued deterioration, the DNR order should be reinstated. If resuscitation measures are withheld and intraoperative arrest occurs, such a death should be classified as "expected" for quality-assurance purposes rather than "unexpected." Expected deaths do not require mandatory quality-assurance review.[18,31]

IMPLEMENTING "REQUIRED RECONSIDERATION"

Hospitals are encouraged to develop and maintain written policies permitting the forgoing of life-sustaining treatment of patients, including children, in appropriate circumstances.[13] Once a DNR order is in place according to accepted standards, it is important that it be reviewed before surgery to determine applicability in the operating room and the postoperative recovery period. Hospitals wishing to develop a "required reconsideration" policy (Table 4) may want to address the following elements:

- Include in the discussion with a child's parent or other surrogate information about the likelihood of requiring resuscitative measures, a description of these measures and their reversibility, the chance of success, and possible outcomes with and without resuscitation. Establish an agreement about what, if any, resuscitative measures will be instituted during the procedure.
- Make the decision to uphold or suspend a DNR order on the basis of the planned procedure, the anticipated benefit for the child, and the likelihood of patient compromise as a result of the procedure.
- Document the salient features of the physician-family discussion in the medical record.
- Communicate plans to honor an intraoperative DNR order among relevant staff.
- Require any physician or other health care professional who is unwilling to honor a family's refusal

TABLE 4. Required Reconsideration Options for Pediatric Patients With DNR Orders Who Require Anesthesia and Surgery

Full resuscitation
Perioperative suspension of DNR orders with qualification of perioperative interval
Goal-directed approach
Focuses on patient goals, values, and preferences
Implies personal relationship between physician and patient/family with understanding of quality-of-life concerns
Most subjective approach
Procedure-directed approach
Specific interventions (see Table 3) placed in context of child's quality of life are each reviewed prior to procedure

of resuscitation to withdraw from the case and allow others to assume care. The withdrawing physician or health care professional should make a conscientious effort to identify another physician who is willing to honor the DNR request.[13]

- Recognize that a patient's or surrogate's decision to refuse intraoperative resuscitation can be compatible with the provision of therapeutic measures to treat conditions other than arrest. This decision does not necessarily imply limits on other forms of care such as intensive care.
- If the family chooses to rescind the DNR order in the operating room and arrest occurs with resuscitation, but the patient's process of dying has only been prolonged, make a provision to discuss withdrawal of life support after a determined amount of time.[3,5,19]

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POLICY STATEMENT

Drinking Water From Private Wells and Risks to Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Environmental Health and Committee on Infectious Diseases

ABSTRACT

Drinking water for approximately one sixth of US households is obtained from private wells. These wells can become contaminated by pollutant chemicals or pathogenic organisms and cause illness. Although the US Environmental Protection Agency and all states offer guidance for construction, maintenance, and testing of private wells, there is little regulation. With few exceptions, well owners are responsible for their own wells. Children may also drink well water at child care or when traveling. Illness resulting from children's ingestion of contaminated water can be severe. This policy statement provides recommendations for inspection, testing, and remediation for wells providing drinking water for children. *Pediatrics* 2009;123:1599–1605

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Key Words
water, drinking water, well, well water, private well, groundwater, nitrate, waterborne disease

Abbreviation
EPA—Environmental Protection Agency

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

INTRODUCTION

Approximately 15% to 20% of households in the United States obtain their water from private wells.[1] Private wells are not subject to federal regulations of the US Environmental Protection Agency (EPA) or those of the Navajo Nation (which has its own EPA) and are minimally regulated by states. Coliform contamination of home private wells in Iowa in the 1990s was as high as 27%.[2] According to the Centers for Disease Control and Prevention, there were 31 waterborne disease outbreaks reported in the United States in 2005–2006, the latest years for which data are published.[3] Twenty of the outbreaks were from drinking water, of those, 8 were groundwater sources, usually private wells. Those caused illness in 458 people. The etiology of 5 of the outbreaks is known: 1 was *Campylobacter*, 3 were norovirus, and 1 was Hepatitis A. Waterborne illness is undoubtedly underrecognized and underreported.

GROUNDWATER AND WELLS

Groundwater is water below the topsoil and above impervious bedrock. When groundwater collects in and saturates relatively porous fractured bedrock and soil, it is said to be in an aquifer. The water table is a depth below which the soil and fractured bedrock (ie, the aquifer) is saturated with water. The water table can vary from season to season and year to year. For a well to produce water reliably, it must be deep enough so that water can be pumped from the aquifer under virtually all weather conditions. Aquifers are recharged from above by precipitation and runoff.

WELL TYPES

Dug wells usually are shallow holes, 10 to 30 ft deep, lined with rock, brick, tile, or concrete, with a pump in a nearby pump house or in the dwelling. Dug wells usually are relics on older home sites. They are easy to contaminate and unreliable in most of the United States.

For driven wells, pipe is driven through gravel or sandy soil. These wells also tend to be shallow, usually approximately 50 ft deep; the pump is installed at the top of the well or in the dwelling. Driven wells are still relatively easy to contaminate because of their shallowness but can be installed rapidly and inexpensively if the geologic conditions are right. Dug wells and driven wells are often the water source at camps or vacation homes.

Drilled wells are 100 to 400 ft deep and reach bedrock. Most drilled wells have an electric submersible pump at the bottom. Because the water has been filtered by soil on the way down and is relatively safe from contamination while in the aquifer, water from these deeper wells is less likely to be contaminated.

TABLE 1 Relevant Chemicals in Well Water

Chemical	Source	Effects
Nitrates	Sewage	Methemoglobinemia
	Fertilizer	Possible promoter of carcinogenesis
Volatile organics and pesticides	Dry-cleaning agents, gasoline, etc	Compound-specific effects
	Often a source cannot be identified	
Lead	Leached from the brass in a submersible pump, from solder, or from old lead pipes	Impairs neurocognitive development
Arsenic	Occurs in specific rock formations (eg, the "slate belt" in the southeastern United States, Nevada, Alaska, and other areas in the western United States)	Acutely toxic carcinogenic (bladder, skin, and lung) in humans
Chromium VI	Used in the electroplating and other industries	Toxic and carcinogenic in laboratory animals
Radon	Naturally occurring radioactive gas	Carcinogenic (lung) in humans
Fluoride	Naturally in water in a few parts of the United States	Accepted preventive for dental caries, supplement if low concentrations
		Too much can cause dental fluorosis
Uranium	Naturally occurring in western mountains in the United States and in areas that have granite outcrops in the eastern United States	High dose is acutely toxic
		A source of ionizing radiation, which causes cancer
Methyl tertiary butyl ether	Partially oxidized hydrocarbon fuel additive used to oxygenate gasoline	Carcinogenic in laboratory animals
Perchlorate	Oxidizing agent used in rocket fuels, fireworks, and airbag inflators, among other applications	Inhibits synthesis of thyroid hormone
	Can occur naturally	

COMPOSITION OF WELL WATER

Chemicals

The chemical composition of well water varies with region, underlying geologic formation, and environmental contamination and can be harmful, beneficial, or merely undesirable. For example, some fluoride is desirable in drinking water, whereas iron is undesirable. Many other chemicals, some of them potentially toxic, can contaminate well water, with their presence or absence attributable to naturally occurring geologic factors or dispersion from industry, farms, or business (Table 1). The presence of nitrates is particularly problematic for infants.[4] The most commonly occurring pollutant chemicals are volatile organics and pesticides, which may be identifiable in more than one third of US wells,[5] albeit mostly at concentrations below federal public water standards.

Many commercial sources will measure water hardness and concentrations of iron and manganese. Calcium and magnesium carbonate make water hard. Hard water is not toxic, but it may require treatment to prevent precipitation from clogging pipes and causing other problems, such as coating electric hot water heater elements and causing them to burn out. Manganese and iron can appear as rust-colored to black flecks and can stain clothing, plumbing, and fixtures. So-called iron and manganese bacteria can grow in such water and form visible black slimy colonies of microorganisms, sometime clogging pipes and faucets.

Microorganisms

Microorganisms, including bacteria, viruses, fungi, and parasites, can contaminate the ground water that supplies wells (Table 2). The major source of these organisms is fecal material from animals and humans. Analyzing well water at its point of use for "total coliforms" is the commonest way of detecting fecal contamination of the water. Where available, testing for fecal coliforms and/or *Escherichia coli* may be performed as a combined assay with total coliforms and used for the annual bacterial testing. The absence of coliforms is good but not absolute evidence that significant fecal contamination is not present. Samples that contain any coliforms should be retested to determine if they are fecal coliforms; specimens that test positive should be examined for the presence of *E coli* or other pathogens.

Much of the information describing the pathogens that can be present in well water has been obtained from investigations of waterborne outbreaks. In the United States, most waterborne outbreaks are associated with noncommunity water systems, chiefly private or communal wells.[3]

MITIGATION

Bacterial

If test results confirm bacterial contamination, the water system must be treated. The first approach is to inspect the well to make sure that there are no structural defects that may have fostered the contamination. "Shock chlorination," using concentrations of chlorine that are 100

TABLE 2 Pathogenic Microorganisms Found in Well Water

Bacteria	Viruses	Parasites
Escherichia coli, including O157:H7	Norovirus, sapovirus	*Giardia intestinalis*
Salmonella species	Rotavirus	*Cryptosporidium*
Shigella species	Enteroviruses	*Cyclospora*
Campylobacter jejuni	Hepatitis A and E	Microsporidia
Yersinia enterocolitica		*Isospora*
Mycobacterium avium-intracellulare		*Naegleria fowleri*

to 400 times the amount found in municipal water supplies, should be performed initially. This can be performed by the homeowner using household bleach (many Web sites [eg, www.water-research.net/shockwelldisinfection.htm] have instructions), but consultation with the health department or other experienced individuals is advisable before the first time.

Most other treatment measures require the service of a trained home water-treatment professional. If bacterial contamination persists despite efforts at continuous disinfection, natural or structural factors may be present that may not be under the control of the well owner. This may require that the well be closed and a new well be drilled. A certified well contractor should fill or seal the contaminated well.

Chemical

Chemical contaminants are approached by investigating the possibility that the contamination exists on the homeowner's or on an adjacent homeowner's property, such as from agricultural application of nitrogen-containing fertilizers, pesticide application, or fuel tanks. If the water supply cannot be remediated further and the well is still contaminated or the chemicals in question are naturally occurring, then it is possible to filter out or treat for virtually any chemical or biological contaminant.[6] However, treatment can become complex and/or expensive and can require meticulous or professional maintenance.

Because there are no standards for private wells for many contaminants of concern, those seeking a specific concentration to indicate potability have little choice but to apply the same standards that municipalities do under the Safe Drinking Water Act amendments of 1996 (Pub L No. 104–182 [for the current list of drinking water contaminants, see www.epa.gov/safewater/mcl.html]). Municipalities regard water that is persistently above these federal standards as not potable. Nonetheless, well owners or home occupants are under no obligation to apply this same standard to their well water.

RECOMMENDATIONS FOR PEDIATRICIANS

1. Pediatricians should ask whether a family drinks water from a private well at home, on vacation, when traveling, in child care, or other locations where they might drink water. This is particularly important for families with an infant. Families with children of high school age or younger should follow the algorithm in Appendix 1. A description of the tests and some rationale for their use is provided as follows.

Routine Testing

A. Purchase of a New Home With a Well

The builder should provide the results of coliform, nitrate, inorganic (total dissolved solids, iron, magnesium, calcium, chloride), fluoride, radon, and lead testing. If the well was shock-chlorinated after drilling, it should be retested for coliforms after some period of time as recommended by the local health department or agricultural extension agent. Have the builder or agent provide a site plan with the well, its water lines, and the septic tank and field.

B. Purchase/Rental/Lease of an Existing Home With a Well

Recommend including the well and septic field in any general inspection. If this cannot be performed, families should arrange for well inspection and testing as described in 1A and have the septic tank located and inspected to determine if it needs to be pumped. If there are filters, softeners, or other devices in the water-supply lines, determine from the seller or landlord what they are treating.

C. Vacation Homes, Camps, etc

A vacation home or camp with a shallow well and no other water source should be tested each season, if possible. If not, consider bottled water for infants or anyone with a compromised immune system. For a short stay, it may be safer and more convenient to use bottled water for drinking and cooking for everyone. Boiling water and filtration systems on the tap can reduce the risk of acquiring microorganisms from the untested well water. Boiling water means that the water must be brought to a full boil for 1 to 3 minutes, but recommendations vary and local advice should be sought. Filtration will allow viruses and possibly some *Giardia* cysts through.

Test kits are available for coliforms and nitrate, but it is difficult for the consumer to judge the accuracy and quality control for each product. Thus, for families with an infant, for whom it is crucial to know that the nitrate concentration is below 10 mg/L, home testing is inadvisable.

D. Child Care and School

Child care in rural and suburban areas can be in a setting where the water comes from a private well. Parents should inquire about the child care center's water source if they have any doubt. If the water comes from a well, parents should ask whether the well has been regularly and recently tested for nitrate and coliforms and what the results were. If recent results are not available, infants should be given bottled water until the well is shown not to have excessive nitrate concentrations.

E. Scheduled Testing

Every spring, the well should be examined to make sure that there are no mechanical problems. Well water should be tested annually for coliforms and nitrates. Testing more than once per year may be warranted in the following special situations: (1) someone in the household is pregnant or nursing; (2) there are unexplained illnesses in the household; (3) neighbors find a dangerous contaminant in their well water; (4) there is a change in the odor or taste of the well water; (5) there is a chemical spill in proximity of the well; or (6) there was a significant repair or replacement in the well. Routine testing for *Giardia* and *Cryptosporidium* organisms is not recommended because of the technical difficulty

(filtering very large volumes of water) and expense. However, in the following situations, it may be prudent to test for these parasites: (1) members of family have developed gastrointestinal disease attributable to *Giardia* and/or *Cryptosporidium* species; (2) the well is at the bottom of a hill and/or is shallow (vulnerable to runoff); or (3) the well is in a rural area where animals graze. The risk factors for *E coli* O157:H7 are similar to those for *Giardia* and *Cryptosporidium* species. So when these situations exist, vigilance should be maintained for *E coli* O157:H7 contamination and/or clinical symptoms. Much information about potential for contamination is local lore, so national sources of information about drinking water, such as the EPA Web site, repeatedly advise contact with local experts. Thus, the time of annual testing for nitrates and coliforms is a reminder to check with the health department about any water-quality problems that have emerged.

Occasional Testing

F. New Infant

A new infant or a child younger than 1 year in the home should prompt testing if the yearly test has indicated any fluctuation in nitrate concentrations or has never been performed. Even a breastfed infant may need water at some time, and boiling does not remove and can concentrate nitrate.

G. Damage or Disturbance to the Well

If a new submersible pump is installed or the well integrity is compromised, such as by a falling tree, a vehicle collision, a flood, or a cut to the water line during landscaping, the well should be tested and, if necessary, shock-chlorinated.

H. Sentinel Illnesses

Every episode of gastroenteritis does not require well testing or an investigation of the cause of the illness. However, if multiple individuals become ill with gastroenteritis, if the gastroenteritis is recurrent, or if a pathogen causing the gastroenteritis is a bacteria or parasite that may have been present in the well water as a result of fecal contamination, then well testing for pathogens is indicated. Any occurrence of methemoglobinemia in an infant consuming well water requires testing the well water for nitrate. An elevated blood lead concentration in a child living in a home built after 1978, or a persistently elevated blood lead concentration, requires testing for lead in well water. At some point in the evaluation of unusual or cryptogenic illness, the possibility of contaminated well water should be considered. For a list of symptoms associated with various well contaminants, see the work by Wagenet et al[6]

2. Fluoride is an accepted preventive for dental caries, and if a child's drinking water contains little or none, then supplements (available as drops or chewable tablets) are necessary. The American Academy of Pediatrics recommends no fluoride supplementation before 6 months of age; from 6 months to 3 years of age, children (including those who are breastfed) require fluoride supplementation if the water has a fluoride concentration of less than 0.3 ppm. Supplementation from 3 to 16 years of age is recommended where drinking water fluoride concentrations are less than 0.6 ppm.[7] To avoid dental fluorosis, water with fluoride concentrations greater than 2 ppm should not be consumed by children younger than 9 years.
3. Become familiar with well water considerations in your area. Advocate for water safety practices that will protect the health of children.

RECOMMENDATIONS TO GOVERNMENT

1. Local governments should provide access to information about local groundwater conditions. Recommendations for testing should be easily available with a telephone call or a Web-page visit. If water contamination becomes a public health issue, then multiple means of alerting and informing the public should be considered. In areas where agricultural land is being developed, paved, or put to any new use, local governments should consider mailing or using some other active means of getting their policies and recommendations concerning well testing to homes with permitted wells and the possibility of being affected by the new use.
2. Tests determined to be necessary for the safety and health of the families drinking well water should be convenient and, if possible, free or inexpensive (see Appendix 2 for current costs).
3. Community wells that serve just enough households to be regulated are sometimes exempted from testing that is required of larger systems. Although this may be appropriate, it should not be routine, and adequate local data should justify any exemption.
4. For housing that has drinking water supplied by a private well, states should require testing for coliforms, nitrate, fluoride, and any contaminant of local concern when a dwelling is sold, and the results should be made available to the buyer before closing.

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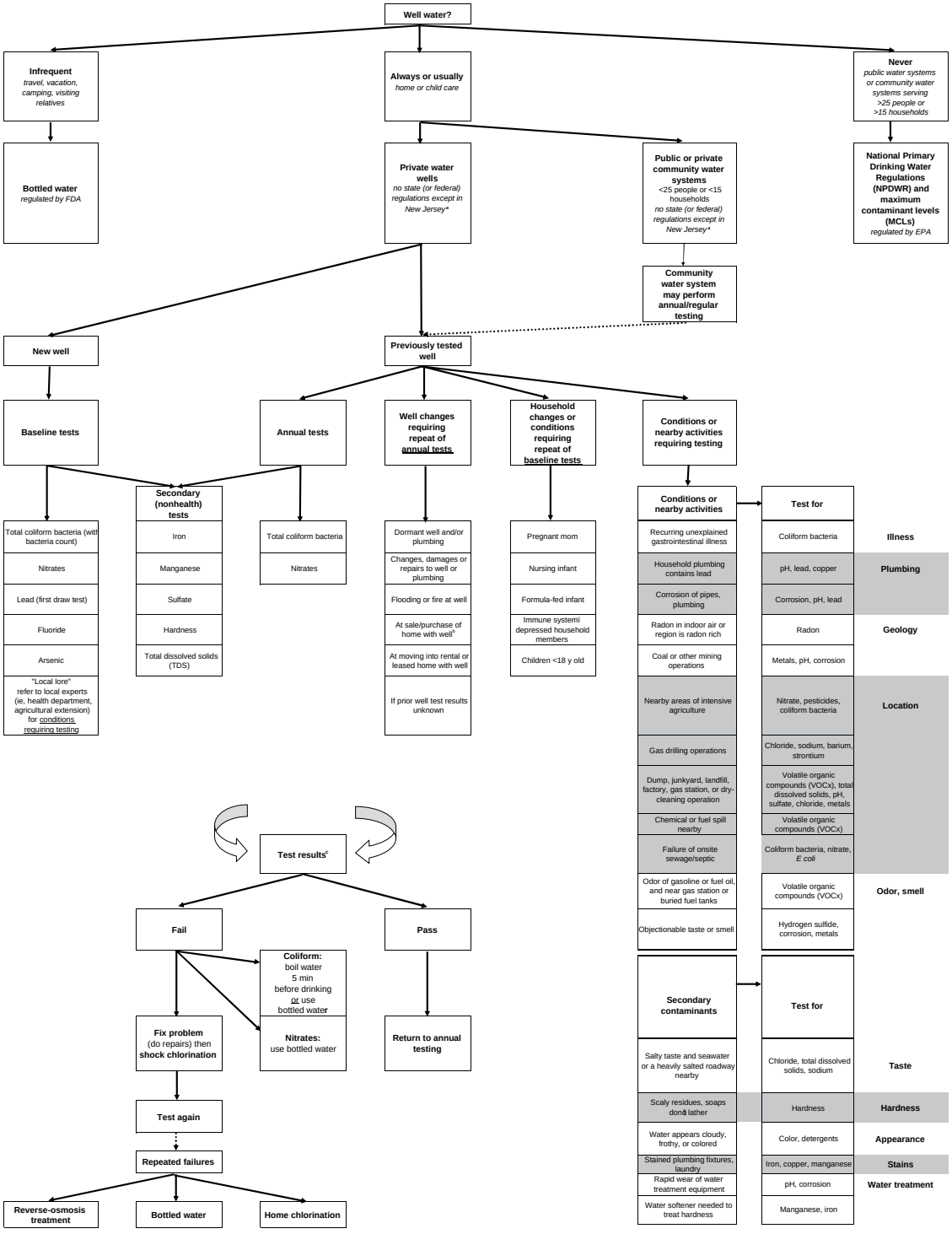
APPENDIX 1 Flowchart for Testing Well Water



[a] Testing at sale/purchase of home is required by law in state of New Jersey.

[b] Testing at sale/purchase of homes is often required by mortgage lender/bank, VA/FHA (Veteran Affairs/Federal Housing Administration), or county health department.

[c] Maximum contaminant levels from the EPA, same as those used by public water systems. FDA indicates Food and Drug Administration.

APPENDIX 2 Well Water Tests, Recommended Frequency, and Approximate Costs

Test	Frequency	Approximate Costs, 2006 $
Annual tests	Annually	30
Total coliform bacteria		
Nitrate		
Common inorganic test battery		25
Fluoride		
Chloride		
Hardness		
Copper	Every 3–5 y	
Iron		
pH		
Manganese		
Uranium		
Arsenic		10
FHA/VA loan for new well; additional 1-time tests		10
Color		
Turbidity		
Odor	Every 3–5 y	
Sodium		
Lead (first draw) (1-time test free for FHA/VA loans)	Every 10 y for homes built before 1985	15, stand-alone lead test
Additional "more thorough" 1-time tests		25
Zinc		
Cadmium		
Detergents		
Miscellaneous individual tests		15 each
Nitrate, chloride, hardness, copper, iron, pH, manganese, color, turbidity		
Fluoride, sodium, detergents, conductivity, total solids, ammonia nitrogen		
Arsenic, barium, cadmium, chromium, lead, silver, selenium, uranium		
Organic compound tests		
Volatile petroleum screen (gasoline, MTBE), in water		60
Volatile petroleum screen (gasoline, MTBE), in soil		80
Diesel organics and fuel oil		140
Volatile organics screen (especially solvents, degreasers)		135
Semivolatiles organic screen (including wood preservatives)		200
Semivolatiles organic screen plus chlordane, PCBs, and toxaphene		275
PCBs		150
Chlorinated acids: herbicides screen		200
Carbamate pesticides		125
Radiologic tests		
Radon in water		25
Radon in air		20
Radon in air (long-term) "α track"		25
Gross α (radioactivity in water; does not test for radon)	Every 5–10 y	55
Gross β		55
Radium (if gross $\alpha > 5$ pCi)		195
Radium 228 (only)		150
Gamma		50

FHA indicates Federal Housing Administration; VA, Veteran Affairs; MTBE, methyl tertiary butyl ether; PCB, polychlorinated biphenyl.

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TECHNICAL REPORT

Drinking Water From Private Wells and Risks to Children

Walter J. Rogan, MD, Michael T. Brady, MD, the Committee on Environmental Health, and the Committee on Infectious Diseases

ABSTRACT

Drinking water for approximately one sixth of US households is obtained from private wells. These wells can become contaminated by pollutant chemicals or pathogenic organisms, leading to significant illness. Although the US Environmental Protection Agency and all states offer guidance for construction, maintenance, and testing of private wells, there is little regulation, and with few exceptions, well owners are responsible for their own wells. Children may also drink well water at child care or when traveling. Illness resulting from children's ingestion of contaminated water can be severe. This report reviews relevant aspects of groundwater and wells; describes the common chemical and microbiologic contaminants; gives an algorithm with recommendations for inspection, testing, and remediation for wells providing drinking water for children; reviews the definitions and uses of various bottled waters; provides current estimates of costs for well testing; and provides federal, national, state, and, where appropriate, tribal contacts for more information. *Pediatrics* 2009;123:e1123–e1137

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Key Words
water, drinking water, well, well water, private well, groundwater, nitrate, waterborne disease, fluoride, *Escherichia coli*

Abbreviations
EPA—US Environmental Protection Agency
MTBE—methyl tertiary butyl ether

BACKGROUND

Approximately 15% to 20% of households in the United States obtain their water from private wells.[1] Public drinking water systems are regulated by the US Environmental Protection Agency (EPA), with national drinking water regulations providing the legally enforceable standards. Unlike municipal water supplies and some community wells, private wells are not subject to federal regulations and are minimally regulated by states. States sometimes require that a well be dug or drilled by a certified contractor and that the water from the well be tested at least once for nitrate and coliform bacteria. After that, the owner of the well is not required to inspect the well or test the water; only New Jersey requires testing at the time of resale. The states, the Navajo Nation, and the EPA offer suggested inspection and testing schedules (Appendix).

Well water is not sterile, nor does it need to be, but it should be free of fecal contamination; such contamination is usually detected by coliform bacteria counts. In Iowa wells in the 1990s, 27% had coliforms.[2] Rigorous data are not available to compare the frequency of illness between children drinking well water versus municipal water. In a Canadian study of 235 rural households using well water, the odds of a child younger than 10 years having an episode of gastrointestinal illness, given the presence of at least 5 colony-forming units of *Escherichia coli* in the water, was 4.2 (95% confidence interval: 1.1–16.2) times higher than that for adults older than 50 years.[3] However, the risk as compared with the child drinking uncontaminated water was not studied. In a clinical trial of reverse-osmosis water filters, which should remove all infectious agents, in families drinking municipal water meeting bacteriologic standards, approximately 30% of acute gastrointestinal illnesses were prevented by the filters, with no difference according to age group. This study showed that even bacteriologically "clean" water produces some illnesses and that, because the background rate of illness was higher in the young children, the use of reverse-osmosis water filters prevented more illnesses in that age group.[4] It is likely, then, that contaminated water from a well would add to an already higher rate of such illness in children.

Well water can be a significant source of nitrate,[5] which comes from both sewage and fertilizer. In Iowa[2] and New York State,[6] approximately 2% of wells had nitrate concentrations greater than 10 mg/L, which should not be

consumed by infants. Other chemicals, such as solvents, fuel additives, and pesticides, also may contaminate private wells.

According to the Centers for Disease Control and Prevention, 28 waterborne disease outbreaks were reported in the United States in 2005–2006, the latest years for which data are published.[7] Twenty-three of the outbreaks were from drinking water, of those 8 were groundwater sources, usually private wells. Those caused illness in 458 people. The ages of the individuals were not reported. The etiology of 5 of the outbreaks is known: 1 was *Campylobacter*, 3 were norovirus, and 1 was Hepatitis A. Waterborne illness is undoubtedly underrecognized and underreported.

Although recommendations regarding wells note that infants are most susceptible to nitrate-induced methemoglobinemia,[8] recommendations regarding well water specific to families with children are not available; similarly, recommendations that address events that might expose a child to untested water, such as the birth or adoption of a child, are not available. As a general principle, children are likely to be more susceptible to waterborne illness than adults, because they drink relatively more water, develop gastroenteritis more often, and become dehydrated more quickly when they develop gastrointestinal illness. Thus, the fact that adults can consume the water without incident is not a guarantee that the child can do so. What follows is a selective compilation of information and recommendations concerning wells and well water.

GROUNDWATER AND WELLS

Groundwater is water below the topsoil and above impervious bedrock. When groundwater collects in and saturates relatively porous fractured bedrock and soil, it is said to be in an aquifer. The water table is a depth below which the soil and fractured bedrock (ie, the aquifer) is saturated with water. The water table can vary from season to season and year to year. For a well to produce water reliably, it must be deep enough so that water can be pumped from the aquifer from which it draws under virtually all weather conditions. Aquifers are recharged from above by precipitation and runoff. Wells drilled into water under sufficient pressure to come out of the ground spontaneously are called artesian wells because of their existence in the French region of Artois ("artesian," in old French, means "of Artois") (Fig 1).

Groundwater is naturally filtered on its way from the surface to the water table, so it is relatively free of particulate organic material and bacteria. It will only remain so if it is protected on its way from the aquifer to the tap.

WELL TYPES

Dug wells usually are shallow holes, 10 to 30 ft deep, lined with rock, brick, tile, or concrete, with a pump in a nearby pump house or in the dwelling. Dug wells usually are relics on older home sites. They are easy to contaminate and unreliable in most of the United States.

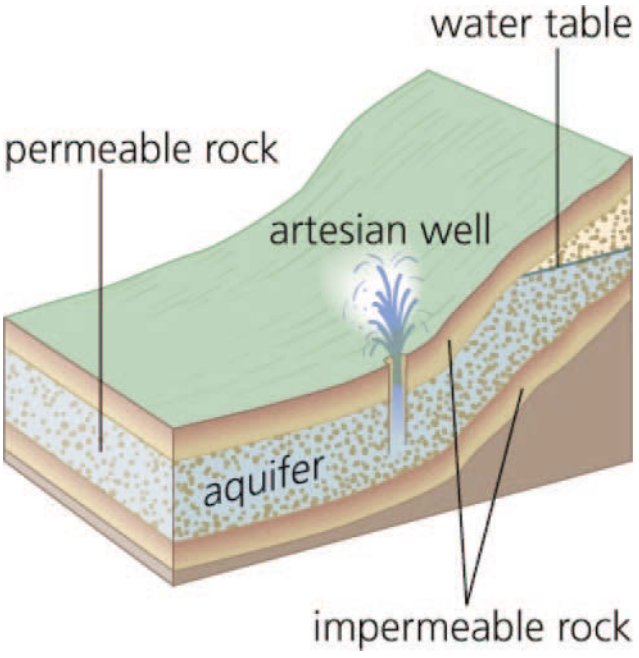

FIGURE 1
An artesian well. (Copyright © 2006 by Houghton Mifflin Harcourt Publishing Company; reproduced with permission from *The American Heritage Dictionary of the English Language*. 4th ed. Boston, MA: Houghton Mifflin Harcourt; 2006.)

For driven wells, a pipe is driven through gravel or sandy soil. These wells also tend to be shallow, usually approximately 50 ft deep; the pump is installed at the top of the well or in the dwelling. Driven wells are still relatively easy to contaminate because of their shallowness but can be rapidly and inexpensively installed if the geologic conditions are right. Dug wells and driven wells are often the water source at camps or vacation homes.

Drilled wells are 100 to 400 ft deep and reach bedrock. Most drilled wells have an electric submersible pump at the bottom.

Although the recommended minimum distances vary on the basis of the contaminant, private wells should be as far as feasible and no less than 50 ft from septic fields; they should be even further from underground fuel tanks, sheds in which fertilizers or other chemicals are stored, livestock, and cultivated fields. Thus, when siting a new well or when there is concern about contamination of an existing well, consultation with the local health department should be sought. In addition, the well should be on relatively high ground (ie, uphill from septic tanks) and covered by a well housing unit of impermeable material such as concrete. Although it is occasionally necessary to access the wellhead, security of the well housing should take precedence over convenience of access. If a homeowner is in doubt about the safety or integrity of the well, inspection by the state or county health department or a licensed well contractor should be arranged. In addition, if there is a flood or if the well housing is damaged by a vehicle, tree, etc, professional inspection is warranted.

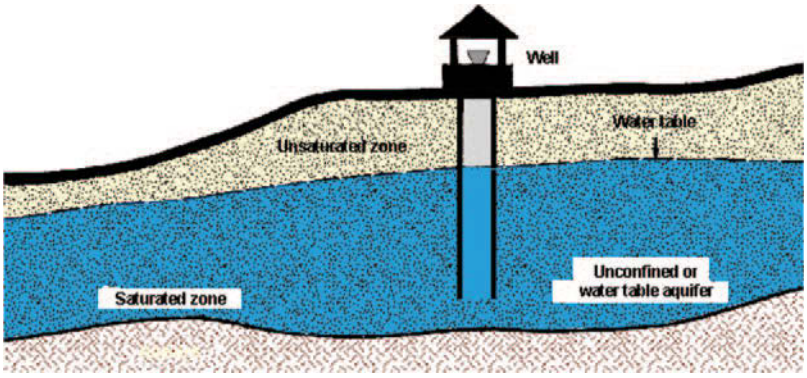

FIGURE 2
An unconfined aquifer and well (http://ecommons.library.cornell.edu/bitstream/1813/3408/2/What%20is%20Groundwater.pdf.) (Adapted from Raymond L Jr. *What Is Groundwater?* Ithaca, NY: Cornell Cooperative Extension, Cornell University; 1988:6.)

COMPOSITION OF WELL WATER

Chemicals

Nitrates

Nitrate is the most familiar and one of the most common contaminants of wells. Nitrate comes from either sewage or fertilizer. Agricultural scale application of fertilizer and permeable soil can lead to nitrate contamination of area groundwater. Nitrate is reported from the laboratory as nitrate nitrogen (NO_3-N); a level of 3 mg/L or greater indicates contamination. Water with a nitrate concentration of greater than 10 mg/L should not be used to prepare infant formula or other foods or given to a child younger than 1 year to drink.[8] The presence of nitrate requires testing for coliforms. Nitrate with no coliforms is likely from fertilizer; if possible, neighboring wells should be tested to determine if the aquifer, rather than the well, is contaminated. Nitrate with coliforms is likely from sewage (either livestock or human). Septic fields or tanks, manure fields, or settling ponds also can be sources of contamination. Examination of neighboring wells may be helpful in determining the source. The standard for nitrate is set to protect infants from methemoglobinemia. There is some evidence that long-term effects, such as gastric cancer, might result from exposure to even smaller amounts of nitrate if they help form endogenous *N*-nitroso compounds, which are potent carcinogens in many species. So far, however, the data are largely ecological and inconsistent.[9]

Volatile Organic Compounds and Pesticides

Volatile organic compounds and pesticides are problems throughout the United States. Although individual sources of these compounds are sometimes identified, such as abandoned dry cleaning shops with underground storage tanks, these compounds are very mobile and can appear without specific sources. The US Geological Survey evaluated 1255 domestic wells between 1992 and 1999, and found volatile organic compounds in 44% and pesticides in 38%.[10] Wells were more likely to be contaminated if they were shallow, were in a more urban area, or if they drew water from an aquifer with no impermeable layer between the surface and the water (see Fig 2).

Inorganic Compounds

Most state health departments and many commercial sources offer testing for inorganic compounds including calcium, sodium, fluoride, chloride, iron, manganese, magnesium, pH, hardness, and total dissolved solids. Total dissolved solids usually consist of calcium and magnesium as their bicarbonates. These bicarbonates make water "hard." Hard water is not toxic; however, the calcium and magnesium precipitate when the water is heated, and this precipitation will eventually cause electric hot water heaters, coffee pots, kettles, and any electrical device in which water is heated repeatedly to fail as the precipitate insulates the heating element. Hard water also forms scum with soaps and detergents.

Manganese and iron can appear as rust-colored to black flecks and can stain clothing, plumbing, and fixtures. However, their levels are not usually high enough to be toxic. So-called iron and manganese bacteria can grow in such water and form black slimy colonies of microorganisms, sometimes clogging pipes and faucets.

Sodium Chloride

Sea salt is a problem near the ocean and in areas where there was formerly salt water. Most people cannot or will not drink enough salt water for it to be toxic. Domestic desalinization is neither economic nor practical except under extraordinary circumstances.

Lead

Lead is not often present in groundwater but can be leached from the brass in a submersible pump, from solder, and, in some cases, old lead pipes if the water is naturally acidic or made acidic by treatment. For example, techniques such as anion exchange remove nitrate and sulfate but leave the water acidic.

Arsenic

Arsenic occurs in specific rock formations, for example, the "slate belt" in the southeastern United States. Its presence in well water is sometimes predictable from geologic data. Arsenic has been reported to be a common well contaminant in Maine,[11] parts of North Carolina,[12] Alaska, and parts of the western United States. Arsenic is extremely toxic and is known to cause bladder, skin, and

lung cancers in humans[13]; however, there have been no reports of acute or subacute arsenic poisoning from well water in the United States. A substantial fraction of the population of Bangladesh must drink from arsenic-contaminated wells, with resulting intoxication.[14]

Radon

Radon is a naturally occurring radioactive gas. Radon, similar to uranium, emits α particles containing 2 protons and 2 neutrons. α particles are strongly ionizing but do not penetrate far into tissue or other substances. Miners exposed to radon in underground mines develop excess lung cancer.[13] Some radon exposure from water occurs by ingestion, although showering, bathing, cleaning, and spraying water are likely to produce higher exposures. Radon in well water commonly exceeds the concentrations allowed in municipal water but does not correlate well with indoor air measurements.[15]

Fluoride

Fluoride is the lightest halogen on the periodic table. It occurs naturally in water in a few parts of the United States. Fluoride is an accepted preventive for dental caries; if a child's drinking water contains none, fluoride supplements are recommended. The American Academy of Pediatrics recommends no fluoride supplementation before 6 months of age; from 6 months to 3 years of age, children require fluoride supplementation if the water has <0.3 ppm (3 μg/L) fluoride. Supplementation from 3 to 16 years of age is recommended for children in areas where drinking water fluoride concentrations are <0.6 ppm.[16] Fluorosis, a condition that results from excess fluoride intake, produces tooth discoloration in children. The discoloration can range from mild white specks to brown streaks with pitting. According to the American Academy of Pediatric Dentistry,[17] fluorosis is most commonly caused by giving fluoride supplements to a child who already has adequate fluoride in drinking water or by the child's ingestion of fluoridated toothpaste rather than from excess fluoride in well water. However, because caries prevention is achieved at drinking water concentrations of 1 ppm and the risk of dental fluorosis increases with concentration,[18] children younger than 9 years should not drink water with a fluoride concentration of >2 ppm.[1] Determining fluoride concentration in well water should be performed as part of the initial evaluation of the well.

Uranium

Uranium in groundwater, although mostly found in the Western mountains in the United States, can also be found in areas that have granite outcrops, the result of granite intrusion into existing subterranean strata and subsequent weathering. There have been reports of high uranium concentrations in waters of Connecticut and South Carolina.[19,20] Those who drink uranium-containing water absorb and then excrete it; urinary concentrations as high as 25% of peak can be present 6 months after exposure has ceased.[19] Exposures likely to be encountered in drinking water have not resulted in acute toxicity. Radiation carcinogenesis, however, is currently thought to have no threshold, and the biological effects of ionizing radiation reports[21] estimated that some cancer may be attributable to background uranium exposure, including uranium in water.

TABLE 1 Most Common Pathogenic Microorganisms Found in Well Water

Bacteria	Viruses	Parasites
E coli, including O157:H7	Small round-structured viruses, including norovirus	*Giardia intestinalis*
Salmonella species	Rotavirus	*Cryptosporidium parvum*
Shigella species	Enteroviruses	*Cyclospora*
Campylobacter jejuni	Hepatitis A and E	*Microsporidia*
Yersinia enterocolitica		*Isospora*
M. avium-intracellulare		*Naegleria fowleri*

Methyl Tertiary Butyl Ether

Methyl tertiary butyl ether (MTBE) is a partially oxidized hydrocarbon fuel additive used to oxygenate gasoline. The oxygenation of gasoline during certain seasons was mandated by the Clean Air Act in 1990 (Pub L No. 101–549) to reduce carbon monoxide emissions. Motor vehicle exhausts are the primary source of ambient carbon monoxide levels, and carbon monoxide is highest during the cold-weather months. Oxygenated gasoline is designed to increase the combustion efficiency of gasoline, thereby reducing carbon monoxide emissions. The tertiary butyl group on MTBE hinders breakdown by sterically protecting the molecule; as a result, uncombusted MTBE can persist in the environment. MTBE is now found in water supplies throughout the United States. Because it has no other uses, its presence indicates contamination by gasoline; its concentrations are higher in wells near gasoline stations and particularly high near gasoline stations that sell oxygenated fuel.[22] MTBE is toxic and carcinogenic in experimental animals[23] and is now banned in most states. Ethanol will likely replace MTBE entirely for oxygenating fuel.

Perchlorate

Perchlorate is an oxidizing agent used in rocket fuels, fireworks, and airbag inflators. It also occurs naturally. Perchlorate is a well-studied steric inhibitor of the thyroid symporter, which transports iodine across the gland's membrane before hormone synthesis. It is now recognized as a water pollutant. There is evidence that perchlorate interferes with thyroid function in adult women in the United States, even at background exposures.[24]

Microorganisms

Microorganisms, including bacteria, viruses, fungi, and parasites, may contaminate the groundwater that supplies wells (Table 1). The major source of these organisms is fecal material from animals and humans. Analyzing well water at its point of use for "total coliforms" is the most common way of detecting fecal contamination of the water. Coliform bacteria may be pathogenic or nonpathogenic. Coliforms include many species of

Gram-negative bacteria found in the intestinal tract of animals and humans, in the soil, on vegetation, and in surface water runoff. Although coliforms do not reproduce in water, they can survive there for extended periods of time. Thus, assessing total coliforms in a water sample is a useful screening tool, because it does not require sophisticated technology and is inexpensive. No coliforms of any sort should be detectable in 100 mL of water. The absence of coliforms is good but not absolute evidence that significant fecal contamination is not present. The presence of coliforms does not mean that pathogens are present, but it does make fecal contamination and, thus, contamination by pathogens much more likely. Samples that contain any coliforms should be retested to determine if they are fecal coliforms; specimens that test positive should be examined for the presence of *Escherichia coli* or other pathogens.

Much of the information describing the pathogens that may be present in well water has been obtained from investigations of waterborne outbreaks. In the United States, most waterborne outbreaks are associated with noncommunity water systems, chiefly private or communal wells.[7] The microorganisms listed in Table 1 typically cause a gastrointestinal illness. However, there are notable exceptions; for example, enterovirus exposure may be asymptomatic but may also result in a febrile illness associated with sore throat, rash, myalgia, or, less commonly, aseptic meningitis syndrome. *Naegleria* species may cause a fatal meningoencephalitis. *Mycobacterium avium*-intracellulare and *Cryptosporidium* species may be found in well water, producing systemic or pulmonary disease in specific vulnerable populations. *Legionella* species and *M avium*-intracellulare are present naturally in water and do not represent fecal contamination. However, disease from *Legionella* species typically results from inhalation rather than ingestion of bacteria. Outbreaks caused by *Legionella* species typically occur in large buildings after colonization of the water-distribution system[7] and have not been identified as a result of contamination of well water.

Iron and sulfur bacteria also may be present in well water. Although these bacteria do not pose a health threat, they can cause the water to smell (like "rotten egg") and taste bad; they also increase the likelihood that plumbing equipment will become plugged or corroded.

MITIGATION

If test results confirm bacterial contamination, the well must be inspected to identify any structural defects that may have permitted the contamination. After any such defects are repaired, the well must be treated to eliminate pathogenic bacteria immediately, usually by "shock chlorination," which uses concentrations of chlorine that are 100 to 400 times the amount found in municipal water supplies. This can be done by the homeowner using household bleach, (many Web sites have instructions [www.water-research.net/shockwelldisinfection.htm]), but consultation with the health department or other experienced individuals is advisable the first time. The highly chlorinated water needs to be held within the water system pipes for 12 to 24 hours before it is completely flushed out of the system. The water should be retested in 1 to 2 weeks. If shock chlorination does not eliminate the bacteria, a continuous disinfection system or further repairs to the well are needed. A consultation with the local health department can help the well owner understand which additional treatment measures are required.

If the contamination is ongoing but under the control of the homeowner, such as from a failing septic field, that problem must be fixed before the well can be used for drinking water again. Successful, lasting decontamination of a well may require more persistent efforts. Swistock and Sharpe[25] disinfected and installed sanitary well caps on 16 wells with coliform contamination; coliforms were again present in 7 of the wells within 60 days and in all but 2 within a year. The 2 wells that did not have coliforms after 1 year had low initial coliform counts and no *E coli*. The authors suggested that contamination may occur far from the well head and may commonly be an aquifer problem. Such a problem is beyond the scope of the homeowner. If the well cannot be used, it should not be abandoned, because it would still provide access for contamination of groundwater. A certified well contractor should fill or seal the contaminated well.

Chemical contaminants are approached by investigating the possibility that the contamination from fertilizers, pesticides, or fuel from leaking tanks exists on the homeowner's or on an adjacent homeowner's property. However, remediation may be inconvenient and/or expensive. If the water supply cannot be remediated and the well is still contaminated or the chemicals in question are naturally occurring, it is possible to treat for or filter most chemicals.[26] An illustration of the relative sizes of filterable contaminants versus filter pore size is provided in Fig 3.

Carafe and faucet-mounted filters usually are designed to reduce lead, some organic materials, *Giardia* and *Cryptosporidium* cysts, and sediment. These units are intended for municipal water and would not be suitable for more heavily contaminated well water. Most other treatment measures require the service of a trained home water-treatment professional, at least for initial installation. Chemical disinfection with chlorine, ozone or hydrogen peroxide, distillation, and ultraviolet light can remove or kill many microorganisms. Chlorine is effective at killing bacteria and viruses but is less effective against *Giardia* species and not effective against *Cryptosporidium* species. Reverse-osmosis filters, usually used in conjunction with activated charcoal and mechanical filtration, can remove inorganic materials, microorganisms, and all but a few organic compounds; however, they are expensive. Treatment systems must be properly maintained to ensure safe water. Most filters, membranes, or ultraviolet lights need to be replaced at least once per year and more frequently if damaged or not working properly.

Consumer Reports magazine periodically reviews home water-treatment devices, including the inexpensive carafe and faucet-mounted types. Although the emphasis is on treating municipal water, they also review reverse-osmosis filters. *Consumer Reports* is available in libraries and through a subscription Web site. NSF International (www.nsf.com) is a not-for-profit, nongovernmental, independent agency

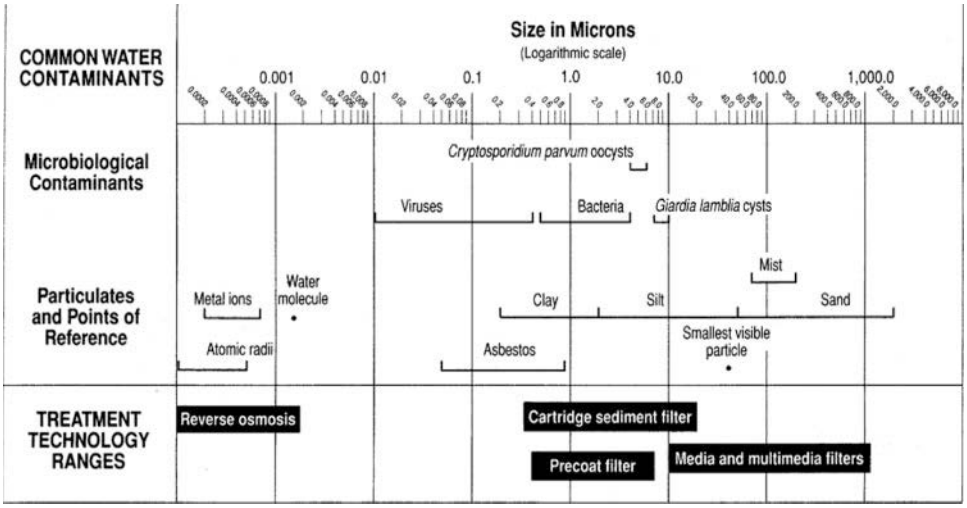

FIGURE 3
Filters and particle sizes for water contaminants.[24]

that tests and certifies consumer products, including water-treatment devices. The NSF Web site allows the consumer to pick the contaminants that are present, and the NSF will provide names of appropriate products and manufacturers. NSF certification is a voluntary program paid for by the manufacturer of the device. Some states and universities, such as Purdue University (www.purdue.edu/dp/envirosoft/groundwater/src/treat.htm#menu), provide descriptions of water-treatment devices. All sites recommend that the water first be tested and then the treatment device or devices selected to deal with the contaminants that are present.

Because there are no standards for private wells for many contaminants of concern, those seeking a specific concentration to indicate potability have little choice but to apply the same standards that municipalities do under the Safe Drinking Water Act amendments of 1996 (Pub L No. 104–182 [for the current list of drinking water contaminants, see www.epa.gov/safewater/mcl.html]). Municipalities regard water that is persistently above these federal standards as not potable. Nonetheless, well owners or home occupants are under no obligation to apply this same standard to their well water.

BOTTLED WATER

Bottled water is often labeled to describe its characteristics, source, or method of treatment. Bottled water is regulated as a packaged food by the US Food and Drug Administration under the Federal Food, Drug and Cosmetic Act (21 USC §301 et seq [1938]) if it is in interstate commerce (ie, crosses a state line). Food and Drug Administration rules for bottled water mirror EPA rules for municipal water. Thus, bottled water in interstate commerce should be free of coliform bacteria and have <1 mg/L of nitrate nitrogen.

Distilled water is boiled (killing microbes), and the steam is condensed to remove salts, metals, minerals, asbestos, particles, and some organic materials, giving it a "flat" taste. Purified water originates from any source but has been treated to be essentially pure H_2O. It must contain <10 ppm of total dissolved solids and may also be free of microbes if treated by distillation or reverse osmosis. Sterilized water originates from any source but has been treated to be free from all microbes. These waters should be sterile until opened. Other bottled waters may or may not be sterile.

Artesian water, groundwater, spring water, and well water are from underground aquifers, the waters of which may or may not be treated. It may or may not be sterile. Bottled drinking water is intended for human consumption and sealed in bottles and may contain disinfectants. Some of these are fluoridated, which should be noted on the label. Mineral water is groundwater that naturally contains ≥ 250 ppm of total dissolved solids. Carbonated water, soda water, seltzer water, sparkling water, and tonic water are considered soft drinks and are not regulated as bottled water.

CONCLUSIONS

Well water can be used safely by families, but regular testing is recommended by all relevant authorities. A recommended approach to testing is given in the accompanying policy statement[25] and outlined as a flowchart in that statement. In much of the United States, well water is hard and must be softened in order not to damage hot water heaters, kettles, and other devices, but softening per se does not remove most other contaminants or microorganisms. Whether and how water is treated should be guided by the results of testing. Testing can be expensive, and the American Academy of Pediatrics encourages states and counties to provide free or low-cost testing to families who need their water tested and cannot afford it. A list of current costs is provided in the accompanying policy statement[27]; these costs are, of course, subject to change. Inexpensive water filters can remove lead, *Cryptosporidium* species, and some volatile hydrocarbons, but these are designed more for tap water from municipal water supplies and may not be suitable for well water. Water contamination is inher-

ently local, and families with wells and pediatricians are encouraged to keep in contact with state and any local programs. A list of contacts, all of which are current as of May 2007, is provided in the Appendix. Within states, private well water programs, resources, guidance, testing groups, and regulations are found in a variety of state Departments of Health, Public Health, Environment, Natural Resources, Licensure or Water, and sometimes within multiple departments within a state. Many states also have university-based Cooperative Extension services with private well water resources. Unfortunately, website addresses change frequently. In addition to web site addresses, the Appendix includes both document titles, and, when available, authorship organization names to aid in internet searches for relevant information. Bottled water should be considered for travel or other circumstances in which an infant might need water and the source of the water is unknown, but bottled water is subject to limited regulation.

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APPENDIX Private Well Water Resources: Web Sites and Telephone Contacts and Federal, Tribal, National, and State Organizations

Organization	Web Site	Web Site/Document Title/ Description	Telephone No.	Telephone Contact Organization
Federal and tribal government organizations				
EPA	EPA private drinking water site: www.epa.gov/ogwdw/privatewells/index2.html EPA state water well Web sites: www.epa.gov/safewater/privatewells/whereyoulive_state.html EPA state water well analysis laboratories: www.epa.gov/safewater/labs/index.html	The EPA Office of Ground Water and Drinking Water, together with states, tribes, and its many partners, ensures safe drinking water and protects ground water. This office, along with the EPA's 10 regional drinking water programs, also oversees implementation of the national Safe Drinking Water Act	(800) 426-4791	EPA Safe Drinking Water Hotline
EPA-Region 9 Tribal Program	http://earth1.epa.gov/region09/indian/success/03/water.html	The EPA-Region 9 Tribal Program serves 147 federally recognized tribes in the American Southwest. For other tribes, EPA regional offices coordinate tribal programs within their respective regions. The Navajo Nation has its own EPA (see below)	(415) 972-3560	EPA Regional Drinking Water Office
Navajo Nation Environmental Protection Agency	www.navajopublicwater.org/index.html www.navajonationepa.org	The Navajo Nation EPA serves the Navajo Nation in the states of Arizona, New Mexico, and Utah. The Navajo Nation EPA Surface and Groundwater Protection Department is responsible for protecting the waters of the Navajo Nation and enforcing the Navajo Nation Safe Drinking Water Act	(928) 729-4320 (928) 871-7755, ext 7758	Navajo Nation Division of Natural Resources Department of Water Resources Navaho Nation EPA Public Water Systems Supervision Program
Indian Health Service	www.dehs.ihs.gov/index.cfm	The Indian Health Service is the federal health program for American Indian and Alaska Native individuals. The Indian Health Service provides information on safe water to American Indian/Alaska Native communities on reservations, many of which depend on wells (usually community wells) for drinking water	(301) 443-1247	Indian Health Service Office of Environmental Health and Engineering
US Geological Survey	www.usgs.gov/science/science.php?term=1235&type=feature	The US Geological Survey provides scientific information about regional issues, supply and management, watershed, and contaminants of well water		
Centers for Disease Control and Prevention	www.cdc.gov/ncidod/dpd/healthywater/privatewell.htm	The Centers for Disease Control and Prevention Division of Parasitic Diseases maintains this Web site with information on contaminants that can be found in water from private wells		

APPENDIX Continued

Organization	Web Site	Web Site/Document Title/ Description	Telephone No.	Telephone Contact Organization
US Department of Agriculture	www.csrees.usda.gov/qlinks/partners/state_partners.html or www.csrees.usda.gov/Extension/index.html	Department of Agriculture CSREES maintains these Web sites with links to all states' state and national (university) partners and to all states' Local Cooperative Extension System Offices. These offices have extensive information on local and regional well water issues		
US Food and Drug Administration	www.fda.gov/oca/sthealth.htm	The Food and Drug Administration maintains this Web site with links to all state health departments or agencies		
Oak Ridge National Laboratory	http://rais.ornl.gov/CRE/CRE_eco_state.html	The Oak Ridge National Laboratory maintains this Web site with listings of all state departments of environment and/or natural resources protection. Information on local contaminants in well water can be found within state departments		
National Organizations				
NSF International	www.nsf.org/consumer/drinking_water/dw_well.asp?program=WaterTre	NSF International maintains this Web site with information about private well water systems and groundwater		
National Ground Water Association	www.wellowner.org; www.ngwa.org	The National Ground Water Association maintains the Web site with resources for private water well owners. The National Ground Water Association maintains a separate Web site (www.ngwa.org) with information geared to groundwater professionals.		
State Contacts				
AL	www.aces.edu/waterquality/faq/faq_list.php3?Code=303	AL State Water Program, AL Cooperative Extension Service, US Department of Agriculture, CSREES, and Land Grant Colleges: "Applying Knowledge to Improve Water Quality"	(334) 271-7773	AL State Water Program; Extension Water Coordinator
AK	www.uaf.edu/coop-ext/water/drinking_water_and_human_health.html	AK Water Quality Program and CSREES: "Drinking Water & Human Health"	(907) 786-6300 (907) 786-6311	AK Water Quality Program Rural Drinking Water and Small Systems
AZ	www.azdeq.gov/environ/water/dw/download/privatewells.pdf	AZ Department of Environmental Quality: "Private Wells After the Fire"	(602) 771-4644 (602) 364-0720	AZ Department of Environmental Quality AZ Department of Health Services Bureau of State Laboratory Services

APPENDIX Continued

Organization	Web Site	Web Site/Document Title/ Description	Telephone No.	Telephone Contact Organization
AR	www.healthyarkansas.com/eng/index.html	AR Department of Health and Human Services, Division of Health: "Drinking Water Information for Arkansans"	(501) 661-2623	AR Department of Health and Human Services, Division of Health
CA	www.water.ca.gov/drought/wellinfo.cfm	California Department of Water Resources, Drought Preparedness: "Well Information"	(916) 653-5791	CA Department of Water Resources
	www.groundwater.water.ca.gov/technical_assistance/gw_wells/gww_domown/index.cfm	"Domestic Well Owners"	(916) 653-6192 (916) 341-5779	CA State Water Resources Control Board Groundwater Ambient Monitoring and Assessment Program
CO	www.ext.colostate.edu/PUBS/NATRES/06700.html	Colorado State University Cooperative Extension: "Private Wells for Home Use"	(303) 692-3500, ext 4	CO Department of Public Health and Environment Water Program
CT	www.drought.state.ct.us/well.htm	State of CT Drought Response: "Guidance for Private Well Users"	(860) 509-7389	CT Department of Public Health Lab Certification Program
DE	http://ag.udel.edu/dwrc/concerns.html	DE Water Resources Center, University of Delaware: "The Water Resource Problems of Delaware"	(302) 739-9950	DE Public Water Systems Supervision Program
DC	There are no private water wells in the District of Columbia. All public water is through the Washington Aqueduct. See http://washingtonaqueduct.nab.usace.army.mil	NA	NA	NA
FL	www.doh.state.fl.us/environment/water/index.html#Public	FL Department of Health Bureau of Water Programs	(904) 791-1599 (850) 245-8059 (850) 245-4240	FL Department of Environmental Protection FL Bureau of Water Programs
GA	www.engr.uga.edu/service/extension/publications/c819-9c.html	University of Georgia Cooperative Extension	(404) 656-4807	GA Department of Natural Resources, Drinking Water Permitting Program
HI	www2.ctahr.hawaii.edu/oc/freepubs/pdf/HH-9.pdf	University of Hawaii at Manoa Cooperative Extension Service: "Drinking Water Wells"	(808) 586-4258	HI Department of Health, Drinking Water Branch
ID	www.deq.state.id.us/water/prog_issues/ground_water/wells/overview.cfm	ID Department of Environmental Quality: "Ground Water Quality in Idaho: Ground Water and Private Wells"	(208) 334-2235, ext 233	ID State Health Department
IL	www.idph.state.il.us/envhealth/waterwells.htm	IL Department of Public Health: "Water Wells"	(217) 782-5830	IL Department of Public Health, Drinking Water Section
IN	www.in.gov/isdh/23258.htm www.in.gov/dnr/water/2457.htm	IN Department of Natural Resources, Division of Water: "Recommended Standards for Private Water Wells" and "Ground Water/Wells"	(317) 921-5500 (317) 308-3286	IN State Department of Health Drinking Water Compliance Officer
IA	www.iowadnr.com/water/wells/index.html	IA Department of Natural Resources, Water Supply Operations: "Iowa's Private Water Well Program"	(800) 421-4692 (319) 335-4500	University of Iowa Hygienic Labs

APPENDIX Continued

Organization	Web Site	Web Site/Document Title/ Description	Telephone No.	Telephone Contact Organization
KS	www.oznet.ksu.edu/library/H20QL2/MF871.PDF	Kansas State University: "Recommended Water Tests for Private Wells"	(785) 296-1639	KS Health and Environmental Lab
KY	www.water.ky.gov/dw/profi/tips/welltest.htm	KY Division of Water: "Well Testing"	(502) 564-3410	KY Department of Environmental Protection Drinking Water Management
LA	www.dhh.louisiana.gov/offices/publications.asp?ID=205&Detail=1198&Arch=2002	LA Department of Health and Hospitals Environmental Epidemiology/Toxicology:	(225) 765-5038	LA Department of Health and Hospitals Office of Public Health Safe Drinking Water Program
		"Private Water Well Testing in LA: What You Need to Know to Protect Your Water"	(504) 219-4447	Laboratory Services
ME	www.maine.gov/dhhs/eng/water/Templates/PrivateWells/privatewells.htm	ME Division of Environmental Health Drinking Water Program: "Private Well Information for Homeowners"	(207) 287-1929	ME Division of Environmental Health, Drinking Water Program
MD	http://extension.umd.edu/environment/Water/files.well.html	MD Cooperative Extension, University of Maryland: "Water Wells and their Maintenance Guidelines"	(410) 537-3729	MD Department of the Environment, Water Supply Program
MA	www.mass.gov/dep/public/publications/mapwell2.pdf and www.mass.gov/dep/water/drinking/privurb.pdf	MA Department of Environmental Protection: "A Guide	(978) 682-5237, ext 331	MA Department of Environmental Protection
		to Water Quality Testing for Private	(617) 983-6870	Division of Epidemiology and Immunization
		Wells" and "Private Wells in Urban Areas"	(978) 640-9673 (617) 292-5770	Drinking Water Program
MI	http://web1.msue.msu.edu/waterqual/docs/wq02p1.html	Michigan State University Extension: "Testing of Private Wells"	(517) 353-5459	Michigan State University, Center for Environmental Toxicology
			(517) 373-1376	MI Department of Public Health, Water Supply Division
MN	www.health.state.mn.us/divs/eh/wells	MN Department of Health: "Well Management: Protect Your Health—Test Your Private Well Water"	(800) 383-9808	MN Department of Health
MS	http://msucares.com/pubs/publications/p1868.htm	MS State University Extension Service: "Protecting Your Private Well: An Environmental Self-assessment"	(601) 576-7518 (601) 987-6893 (800) 626-7739	MS State Department of Health
MO	www.scchealth.org/docs/ph/ph_docs/phnews/jun01.html	St Charles County, MO Division of Public Health: "Private Drinking Water Supplies"	(573) 751-4090 (800) 361-4827	MO Public Drinking Water Program
MT	http://waterquality.montana.edu/docs/homeowners/qanda.shtml	MT State University Bozeman, Department of Land Resources and Environmental Sciences: "Q&A: Water Quality testing for Private Well Owners"	(406) 444-2642	MT Department of Public Health and Human Services, State Environmental Lab
	www.dphhs.mt.gov/PHSD/Lab/Environmental/environ-lab-private-well-testing.shtml	MT Department of Public Health and Human Services: "Private Well Testing Program at the State Environmental Laboratory"		

APPENDIX Continued

Organization	Web Site	Web Site/Document Title/ Description	Telephone No.	Telephone Contact Organization
NE	www.hhs.state.ne.us/enh/recwtrprac.htm	NE Department of Health and Human Services: "Recommended Water Supply Practices"	(402) 471-2122	NE Department of Health and Human Services, Division of Labs
	www.unce.unr.edu/publications/files/ho/2006/fs0651.pdf	University of Nevada, Cooperative Extension: NV NEMO – Nonpoint Education for Municipal Officials POW: Protecting our Water: Action Guide #10: "What to do about Private Water Wells"	(775) 784-7070	University of Nevada, Cooperative Extension
NH	http://des.nh.gov/organization/divisions/water/dwgb/well_testing/index.htm	NH Department of Environmental Services, Water Division: Private Well Testing Program	(603) 271-3139 (603) 271-2952	NH Department of Environmental Services
NJ	www.state.nj.us/dep/pwta	NJ Department of Environmental Protection: "Private Well Testing Act: Buying or Selling a Home With a Private Well?"	(609) 292-3950	NJ Department of Environmental Protection
NM	www.nmenv.state.nm.us/dwb/Documents/Drought%20Fact%20Sheet.pdf	NM Department of Health: "Information for Well Owners: Safe Drinking Water During a Drought"	(877) 654-8720	NM Drinking Water Bureau
NY	www.health.state.ny.us/environmental/water/drinking/part5/append5b/index.htm	NY Department of Health Drinking Water Protection Program: "Information on Protection of Water Wells"	(518) 485-5570	NY Department of Health Drinking Water Protection Program
NC	http://h2o.enr.state.nc.us/aps/gpu/well_construction.htm	NC Department of Environmental and Natural Resources Division of Water Quality, Aquifer Protection Section: "Well Construction: Technical Assistance"	(919) 733-3221	NC Department of Environmental and Natural Resources Division of Water Quality, Aquifer Protection Section
	www.terraquestpc.com/downloads/brochures/WellAbandonment.pdf	Division of Water Quality, Groundwater Section "Well Abandonment: Know the Rules to Protect Yourself and Our Groundwater"	(919) 733-7308	NC Department of Health and Human Services, referral to county health departments
ND	www.health.state.nd.us/wq/gw/pubs/WellTestingBrochure.pdf	ND Board of Water Well Contractors: "Private Water Well Construction Requirements"	(701) 328-6140	ND Department of Health Division of Chemistry
OH	www.dnr.state.oh.us/water/pubs/fs_div/fctsht03/tabid/4083/Default.aspx	OH Department of Natural Resources Division of Water: "Water Efficiency for Private Well Owners" Sheet 92–3	(614) 265-6740	OH Department of Natural Resources Division of Water
OK	www.owrb.ok.gov/supply/wd/wd_forms.php	OK Water Resources Board: "Water Well Drilling Forms"	(405) 530-8800	OK Water Resources Board
OR	http://oregon.gov/DHS/ph/dwp/index.shtml	OR Department Human Services Drinking Water Program: "Ensuring that Oregonians have Safe Drinking Water"	(971) 673-0405	OR Department of Human Resources Drinking Water Program
	http://wellwater.oregonstate.edu/wells.php	Oregon State University: "The Oregon Well Water Program: Wells"	(541) 766-3556	Oregon State University Well Water Program

APPENDIX Continued

Organization	Web Site	Web Site/Document Title/ Description	Telephone No.	Telephone Contact Organization
PA	www.dep.state.pa.us/dep/deputate/watermgt/wc/subjects/SrceProt/well/default.htm	PA Department of Environmental Protection: "Private Water Wells in Pennsylvania"	(717) 787-8184	PA Department of Environmental Protection Bureau of Water Standards and Facility Regulation
RI	www.dem.ri.gov/programs/benviron/water/permits/privwell/index.htm	RI Department of Environmental Management Office of Water Resources: "Private Well Installation"	(401) 222-6867	RI Department of Health
SC	www.scdhec.net/water/html/dwrw.html	SC Department of Health and Environmental Control: "Residential Well Program"	(888) 761-5989 (803) 898-3376	SC Department of Health and Environmental Control Private Well Program
SD	www.state.sd.us/denr/des/drinking/privatewell.htm	SD Department of Environment and Natural Resources: "General Private Well Sampling"	(605) 773-3754	SD Department of Environment and Natural Resources Drinking Water Program
TN	www.state.tn.us/environment/dws/WWregprog.shtml#well	TN Department of Environment and Conservation Division of Water Supply: "Well Program"	(615) 532-0191	TN Department of Environmental Conservation Division of Water Supply
TX	www.license.state.tx.us/wwd/welldisinfection.pdf	TX Department of Licensing and Regulation Water Well Driller Program: "Private Well Disinfection"	(512) 463-7880 (800) 803-9202 (512) 458-7591	TX Department of Licensing and Regulation Well Water Driller/Pump Installer Program TX Department of Health
UT	http://health.utah.gov/lab/microbiology/envtech.html	UT Public Health Lab Bureau of Microbiology: "Drinking Water Bacteriology"	(801) 584-8400 (801) 584-8476 (801) 536-4200	UT Public Health Laboratory UT Division of Health
VT	http://healthvermont.gov/enviro/water/safe_water.aspx and http://healthvermont.gov/enviro/water/dug_well.aspx	VT Department of Health: "Safe Water Resource Guide" and "Dug Wells for Drinking Water"	(802) 863-7200 (800) 464-4343	VT Department of Health
VA	www.vdh.state.va.us/EnvironmentalHealth/ONSITE/regulations/PrivateWellInfo/index.htm	VA Department of Health Office of Environmental Health Services "Private Well Water Information"	(804) 864-7473	VA Department of Health
WA	www.doh.wa.gov/ehp/dw/Publications/331-349.pdf	WA Department of Health Office of Drinking Water: "Important Information for Private Well Owners"	SW: (360) 236-3030 NW: (253) 395-6750 E: (509) 456-3115	WA Department of Health Water Quality
WV	www.wvdhhr.org/phs/water/index.asp	WV Department Heath and Human Resources Office of Environmental Health Services Public Health Sanitation Division: "Individual Water Supplies: Wells, Cisterns, and Springs"	(304) 293-5785 (304) 558-6732	WV University Office of Environmental Health and Safety WV Department of Heath and Human Resources Office of Environmental Health Services Public Health Sanitation Division
WI	www.dnr.state.wi.us/org/water/dwg/wells.htm	WI Department of Natural Resources: "Drinking Water & Groundwater"	(608) 266-2621	WI Department of Natural Resources
	www.uwsp.edu/cnr/gndwater/privatewells	Groundwater Center University WI at Stevens Point: "For Private Well Users: Water Testing and Private Wells"	(715) 346-4270	Groundwater Center University WI at Stevens Point

APPENDIX Continued

Organization	Web Site	Web Site/Document Title/ Description	Telephone No.	Telephone Contact Organization
WY	http://deq.state.wy.us/wqd/groundwater/downloads/Private%20Wells/wellheadintro.asp or www.wywaterwell.org/educational.htm	WY Department of Environmental Quality: "Introduction to Wellhead Protection"	(307) 777-7431	WY Department of Health Public Health Lab Water Microbiology
	http://wdh.state.wy.us/phsd/lab/waterlab.html	WY Well Water Association or WY Department of Health Public Health Lab Water Microbiology	(307) 777-7781	WY Department of Environmental Quality Water Quality Division

CSREES indicates Cooperative State Research, Education and Extension Services; NA, not applicable.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science Into Lifelong Health

abstract

FREE

Advances in a wide range of biological, behavioral, and social sciences are expanding our understanding of how early environmental influences (the ecology) and genetic predispositions (the biologic program) affect learning capacities, adaptive behaviors, lifelong physical and mental health, and adult productivity. A supporting technical report from the American Academy of Pediatrics (AAP) presents an integrated ecobiodevelopmental framework to assist in translating these dramatic advances in developmental science into improved health across the life span. Pediatricians are now armed with new information about the adverse effects of toxic stress on brain development, as well as a deeper understanding of the early life origins of many adult diseases. As trusted authorities in child health and development, pediatric providers must now complement the early identification of developmental concerns with a greater focus on those interventions and community investments that reduce external threats to healthy brain growth. To this end, AAP endorses a developing leadership role for the entire pediatric community—one that mobilizes the scientific expertise of both basic and clinical researchers, the family-centered care of the pediatric medical home, and the public influence of AAP and its state chapters—to catalyze fundamental change in early childhood policy and services. AAP is committed to leveraging science to inform the development of innovative strategies to reduce the precipitants of toxic stress in young children and to mitigate their negative effects on the course of development and health across the life span. *Pediatrics* 2012;129:e224–e231

INTRODUCTION

"It is easier to build strong children than to repair broken men."

Frederick Douglass (1817–1895)

From the time of its inception as a recognized specialty of medicine, the field of pediatrics has attached great significance to both the process of child development and the social/environmental context in which it unfolds. When the American Academy of Pediatrics (AAP) was founded in 1930, the acute health care needs of children were largely infectious in nature.[1] Over the ensuing 80 years, as increasingly effective vaccines, hygiene, and other public health initiatives produced dramatic gains, astute observers began to note that many noninfectious disease entities, such as developmental, behavioral, educational, and

COMMITTEE ON PSYCHOSOCIAL ASPECTS OF CHILD AND FAMILY HEALTH, COMMITTEE ON EARLY CHILDHOOD, ADOPTION, AND DEPENDENT CARE, AND SECTION ON DEVELOPMENTAL AND BEHAVIORAL PEDIATRICS

KEY WORDS

advocacy, brain development, ecobiodevelopmental framework, family pediatrics, health promotion, human capital investments, new morbidity, toxic stress, resilience

ABBREVIATIONS

AAP—American Academy of Pediatrics
EBD—ecobiodevelopmental

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family difficulties, were playing increasingly prominent roles in affecting child health and well-being.

In 1975, the term "new morbidity" was introduced to describe those noninfectious entities that appeared to be most prevalent.[2] This important conceptualization underscored a growing realization that significant societal changes (eg, increasing numbers of single parents and families with 2 working parents) were challenging pediatric health care providers to address complex concerns that were not strictly medical in nature. Although the impact of these "new" morbidities on pediatrics, public health, and society in general is no longer in question,[3–5] the professional training and practice of pediatricians continues to focus primarily on the acute medical needs of individual children. The pressing question now confronting contemporary pediatrics is how we can have a greater impact on improving the life prospects of children and families who face these increasingly complex and persistent threats to healthy development.

The need for creative, new strategies to confront these morbidities in a more effective way is essential to improve the physical and mental health of children, as well as the social and economic well-being of the nation.[6] Developmental, behavioral, educational, and family problems in childhood can have both lifelong and intergenerational effects.[7–18] Identifying and addressing these concerns early in life are essential for a healthier population and a more productive workforce.[5,6,19–21] Because the early roots or distal precipitants of problems in both learning and health typically lie beyond the walls of the medical office or hospital setting, the boundaries of pediatric concern must move beyond the acute medical care of children and expand into the larger ecology of the community, state, and society. Because this call for a broader, contextual approach to health is not new,[22] and the track record of matching rhetoric with effective action is limited, there is a compelling need for bold, new thinking to translate advances in developmental science into more effective interventions.

THE MERITS OF AN ECOBIODEVELOPMENTAL FRAMEWORK

The accompanying technical report[23] presents an ecobiodevelopmental (EBD) framework for understanding the promotion of health and prevention of disease across the life span that builds on advances in neuroscience, molecular biology, genomics, and the social sciences. Together, these diverse fields provide a remarkably convergent perspective on the inextricable interactions among the personal experiences (eg, family and social relationships), environmental influences (eg, exposures to toxic chemicals and inappropriate electronic media), and genetic predispositions that affect learning, behavior, and health across the life span. Applying this EBD framework to the challenges posed by significant childhood adversity reveals the powerful role that toxic stress can play in disrupting the architecture of the developing brain, thereby influencing behavioral, educational, economic, and health outcomes decades and generations later.[24] In contrast to positive or tolerable stress, toxic stress is defined as the excessive or prolonged activation of the physiologic stress response systems in the absence of the buffering protection afforded by stable, responsive relationships.[25] Within the ongoing interplay among assets for health and risks for illness, toxic stress early in life plays a critical role by disrupting brain circuitry and other important regulatory systems in ways that continue to influence physiology, behavior, and health decades later.[23] In short, an EBD approach to childhood adversity suggests that (1) early experiences with significant stress are critical, because they can undermine the development of those adaptive capacities and coping skills needed to deal with later challenges; (2) the roots of unhealthy lifestyles, maladaptive coping patterns, and fragmented social networks are often found in behavioral and physiologic responses to significant adversity that emerge in early childhood; and (3) the prevention of long-term, adverse consequences is best achieved by the buffering protection afforded by stable, responsive relationships that help children develop a sense of safety, thereby facilitating the restoration of their stress response systems to baseline.[25] An EBD approach recognizes that it is not adversity alone that predicts poor outcomes. It is the absence or insufficiency of protective relationships that reinforce healthy adaptations to stress, which, in the presence of significant adversity, leads to disruptive physiologic responses (ie, toxic stress) that produce "biological memories"[26] that increase the risk of health-threatening behaviors and frank disease later in life. The recent AAP technical report[23] summarizes the growing evidence base that links childhood toxic stress to the subsequent development of unhealthy lifestyles (eg, substance abuse, poor eating and exercise habits), persistent socioeconomic inequalities (eg, school failure and financial hardship), and poor health (eg, diabetes and cardiovascular disease). Given the extent to which costly health disparities in adults are rooted in these same unhealthy lifestyles and persistent inequalities,[5,9] the reduction of toxic stress in young children ought to be

a high priority for medicine as a whole and for pediatrics in particular.

AN IMPORTANT ROLE FOR THE PEDIATRIC MEDICAL HOME

The effective reduction of toxic stress in young children could be advanced considerably by a broad-based, multisector commitment in which the profession of pediatrics plays an important role in designing, implementing, evaluating, refining, and advocating for a new generation of protective interventions. Pediatric providers are uniquely qualified and placed to assist in translating recent advances in developmental science into effective interventions for the home, the clinic, and the community. In addition to regular interactions with young children and an appreciation for the important role that families[27–29] and communities[30] play in determining child well-being, pediatricians bring several time-honored perspectives to this challenging task. These perspectives include a developmental approach to health, an understanding of the advantages of prevention over remediation, and an awareness of the critical importance of effective advocacy to promote changes in well-established systems that influence child health and development, even when those systems lie outside the traditional realm of pediatric practice.[31] In this context, it is essential that innovative and practical strategies continue to be developed that strengthen the capacity of the medical home to reduce sources of toxic stress and to mitigate their impact on the lives of young children. Rather than continuing the current trend of "doing more with less," as pediatricians take on a wide range of additional responsibilities, payment reforms should reflect the value of pediatricians' time and knowledge, as well as the importance of a pediatrician-led medical home serving as a focal point for the reduction of toxic stress and for the support of child and family resiliency. This additional work and the reprioritization of efforts should reflect pediatricians' interest in preventive care that is more developmentally relevant,[32] parents' desire for a greater emphasis on their child's emerging skills and behavior,[33] the commitment to team-based services within the pediatric medical home,[28] and the growing evidence base that early developmental interventions can have significant effects on life-course trajectories.[34]

As the most logical candidate for a universal platform to promote healthy development and optimal life course trajectories, the pediatric medical home has become the focus of both increasing expectations and formidable challenges. High expectations are grounded in the public's deep respect for pediatricians as trusted guardians of child health. Compelling challenges include (1) the need for more extensive training for all health professionals on the adverse effects of excessive stress on the developing brain, as well as on the cardiovascular, immune, and metabolic regulatory systems (the technical report[23] is a start); (2) the significant constraints on existing, office-based approaches to fully address the new morbidities effectively; (3) the relatively limited availability of evidence-based strategies, within the medical home and across the full array of existing early childhood service systems, that have been shown to reduce sources of toxic stress in the lives of young children or mitigate their adverse consequences[35]; and (4) the financial difficulties associated with the incorporation of evidence-based developmental strategies into the pediatric medical home.

A Critical Assessment of Prevention at the Practice Level

From immunizations to seat belts to parenting education, the field of pediatrics has always embraced the centrality of prevention. That said, some degree of childhood adversity is inevitable, and dealing with manageable levels of stress is an important part of healthy development. Because the essence of toxic stress is the absence of buffers needed to return the physiologic stress response to baseline, the primary prevention of its adverse consequences includes those aspects of routine anticipatory guidance that strengthen a family's social supports, encourage a parent's adoption of positive parenting techniques, and facilitate a child's emerging social, emotional, and language skills. Examples include the promotion of the 7Cs of resilience (competence, confidence, connectedness, character, contribution, coping, and control),[36] optimism,[37] Reach Out and Read,[38–40] emotional coaching,[41–44] and numerous positive parenting programs (eg, Triple P,[45–47] Incredible Years,[48] Home visiting,[49,50] and Nurturing Parenting[51,52]). Although AAP resources, such as *Bright Futures*,[53] *Connected Kids*,[54] and the clinical report "The Pediatrician's Role in Child Maltreatment Prevention,"[55] already provide significant recommendations in this area, implementing a comprehensive, yet practical program of effective anticipatory guidance that nurtures the child's emerging social, emotional, and language skills and promotes positive parenting remains an ongoing challenge.

Beyond working to improve the impact of anticipatory guidance provided in the medical home, some motivated pediatric providers also advocate for a variety of community-based interventions that are implemented in homes,[56,57] preschools,[58] and

schools,[59–61] as well as through an extended array of programs organized by faith-based organizations, social groups, and recreational centers. A more thorough description of the full range of practices designed to strengthen parenting skills and enhance child development can be found elsewhere.[35,62–64] Although most primary prevention programs have not been evaluated systematically, those that show promise should be assessed and, if found to be effective, replicated and taken to scale. As the number of evidence-based services increases, the pediatric community needs to continue to advocate for systemic changes in reimbursement strategies that incentivize collaboration among pediatric medical homes and the full range of effective community-based resources.[65]

Screening for Children and Families at Risk

Identifying children at high risk for toxic stress is the first step in providing targeted support for their parents and other caregivers. The challenges of developing secondary prevention strategies within the medical home begin with the implementation of practice-relevant screening and proceed through the complexities of diagnostic evaluations, sharing information, formulating joint action plans with parents, locating needed services beyond the medical home, arranging successful referrals, and conducting an ongoing monitoring and assessment of intervention impacts. That said, after several decades of prescriptive guidelines and outcome evaluations of a broad array of prevention strategies, the cumulative evidence of effectiveness is mixed. Some primary care practices have been successful in regularizing the identification and management of new morbidities within their daily routines. Many continue to struggle with the basics of developmental screening, routine referral, and ongoing collaboration with community-based programs outside the medical system.[32] All confront the limited availability of accessible and affordable preventive supports for children and families experiencing significant adversity.

Within this highly variable and multidimensional context, the AAP and others have encouraged pediatric providers to develop a screening schedule that uses age-appropriate, standardized tools to identify risk factors that are highly prevalent or relevant to their particular practice setting.[29,66,67] In addition to the currently recommended screenings at 9, 18, and 24/36 months to assess children for developmental delays, pediatric practices have been asked to consider implementing standardized measures to identify other family- or community-level factors that put children at risk for toxic stress (eg, maternal depression, parental substance abuse, domestic or community violence, food scarcity, poor social connectedness). Pediatric providers have been encouraged to use *Current Procedural Terminology* code 99420 when they are assessing a child's risk and, if additional visits are needed to address any identified concerns, providers are encouraged to bill for that additional time by using codes 99401-4.[68] Continued advocacy at the national and state levels is needed, however, to ensure proper payment for the time needed for universal screening, problem identification, and ongoing assessments. More specific recommendations (regarding which screening tools should be used, when they should be administered, and how to secure reimbursement for their use) will be presented in a forthcoming AAP policy statement on social-emotional screening.

Collaborating With the Community

Routine screening for increased vulnerability is useful only if collaborative relationships exist with local services to address the identified concerns (as outlined in several previous reports[69–71]); moreover, it is also essential that those services demonstrate evidence of effectiveness. This is particularly important for the identification of young children experiencing toxic stress, given the limited proportion of community-based interventions for which significant, positive impacts have been documented in this domain, and the relatively modest magnitude of impact found for those that have been shown to be effective.

Rethinking Advocacy Beyond the Office Setting

Because so many of the origins and consequences of childhood toxic stress lie beyond the boundaries of the clinical setting, pediatric providers are often called on to work collaboratively with parents, social workers, teachers, coaches, civic leaders, policy makers, and other invested stakeholders to influence services that fall outside the traditional realm of clinical practice.[72] In many cases, these efforts extend even further afield, moving into the realm of ecologically based, public health initiatives that address the precipitants of toxic stress at the community, state, and national levels. Translating advances in developmental science into effective interventions and lifelong health will require a fundamental shift in the way the general public and policy makers view and invest in early childhood. Pediatric providers are integral to this effort, as they have a long history of advocating for systemic changes to advance child health and development.[31]

Examples of preventive interventions that could serve as targets for pediatrician-led advocacy campaigns include (1) education efforts focused

on parents, foster parents, child care providers, and preschool teachers to increase awareness of the adverse consequences of toxic stress in early childhood for lifelong outcomes in learning, behavior, and health; (2) calls for investments in the development of creative, new strategies that can be incorporated into home-, school-, and center-based services to reduce sources of toxic stress and to strengthen the relationships that buffer children from the long-term consequences of significant adversity; (3) investments in community-based mentoring activities (eg, after-school programs, Big Brother/Big Sister, Little League, gymnastics, martial arts programs) that provide supportive relationships for vulnerable children that help them learn to cope with adversity in an adaptive manner; (4) investments in selected early-intervention programs, early-childhood mental health services, specialized family therapies, and medicolegal partnerships that have demonstrated evidence of positive impacts on vulnerable young children and families; (5) professional development programs that educate judges and other key participants in the juvenile court and foster care systems about the biology of adversity and its implications for case management, child custody, and foster care of children who have been abused or neglected; and (6) collaborative efforts with social workers, mental health providers, and other related professionals to address urgent needs as early as possible and to integrate effective services for the most vulnerable children and their families.

Treatment of Toxic Stress

Finally, the pediatric community must provide strong, proactive advocacy for more effective interventions for children with symptomatic evidence of toxic stress. These could include (1) the formation and/or continuous strengthening of local traumatic stress networks to treat children and families experiencing significant adversity; and (2) increasing the number of accessible, affordable, and culturally competent mental health professionals who are qualified to provide evidence-based treatments, such as trauma-based cognitive behavioral therapy and parent-child interaction therapy. In addition to the paucity of appropriately trained professionals in this area of significant unmet need, inadequate or inappropriate reimbursement mechanisms often block access to services for the most vulnerable young children. In such circumstances, pediatricians can be powerful advocates for expanded insurance coverage for childhood mental health services, even when they do not provide those services themselves.[73]

REAFFIRMING A COMMITMENT TO LEAD

This Policy Statement builds on numerous previous statements, including those regarding the new morbidities,[3] community pediatrics,[30] family-centered care,[27] home visitation,[49] and the prevention of child abuse.[55] The proposed EBD framework (1) incorporates growing evidence of the impact of toxic stress on the developing brain, (2) informs a deeper understanding of the early life origins of both educational failure and adult disease, and (3) underscores the need for collaborative efforts to prevent the long-term consequences of early adversity. The AAP is committed to leading an invigorated, science-based effort at transforming the way our society invests in the development of all children, particularly those who face significant adversity.[74]

RECOMMENDATIONS

1. All health care professionals should adopt the proposed EBD framework as a means of understanding the social, behavioral, and economic determinants of lifelong disparities in physical and mental health (see technical report[23]). Psychosocial problems and the new morbidities should no longer be viewed as categorically different from the causes and consequences of other biologically based health impairments.
2. The growing scientific knowledge base that links childhood toxic stress with disruptions of the developing nervous, cardiovascular, immune, and metabolic systems, and the evidence that these disruptions can lead to lifelong impairments in learning, behavior, and both physical and mental health, should be fully incorporated into the training of all current and future physicians (see technical report[23]).
3. Pediatricians should adopt a more proactive leadership role in educating parents, child care providers, teachers, policy makers, civic leaders, and the general public about the long-term consequences of toxic stress and the potential benefits of preventing or reducing sources of significant adversity in early childhood. Protecting young children from adversity is a promising, science-based strategy to address many of the most persistent and costly problems facing contemporary society, including limited educational achievement, diminished economic productivity, criminality, and disparities in health.
4. Pediatricians should be vocal advocates for the development and implementation of new, evidence-based interventions (regardless of the provider or venue) that reduce sources of toxic stress and/or

mitigate their adverse effects on young children, as they are likely to produce better outcomes and potentially be more cost-effective than trying to treat or remediate the numerous consequences of excessive childhood stress that reach far into adulthood. Such advocacy is particularly important when budget constraints force critical reassessments of public spending priorities.

5. Pediatric medical homes should (1) strengthen their provision of anticipatory guidance to support children's emerging social-emotional-linguistic skills and to encourage the adoption of positive parenting techniques; (2) actively screen for precipitants of toxic stress that are common in their particular practices; (3) develop, help secure funding, and participate in innovative service-delivery adaptations that expand the ability of the medical home to support children at risk; and (4) identify (or advocate for the development of) local resources that address those risks for toxic stress that are prevalent in their communities.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Early Childhood Caries in Indigenous Communities

abstract

FREE

The oral health of Indigenous children of Canada (First Nations, Inuit, and Métis) and the United States (American Indian, Alaska Native) is a major child health issue: there is a high prevalence of early childhood caries (ECC) and resulting adverse health effects in this community, as well as high rates and costs of restorative and surgical treatments under general anesthesia. ECC is an infectious disease that is influenced by multiple factors, including socioeconomic determinants, and requires a combination of approaches for improvement. This statement includes recommendations for preventive oral health and clinical care for young infants and pregnant women by primary health care providers, community-based health-promotion initiatives, oral health workforce and access issues, and advocacy for community water fluoridation and fluoride-varnish program access. Further community-based research on the epidemiology, prevention, management, and microbiology of ECC in Indigenous communities would be beneficial. *Pediatrics* 2011;127:1190–1198

AMERICAN ACADEMY OF PEDIATRICS, COMMITTEE ON NATIVE AMERICAN CHILD HEALTH, CANADIAN PAEDIATRIC SOCIETY, FIRST NATIONS, INUIT AND MÉTIS COMMITTEE

KEY WORDS

dental caries, early childhood caries, oral health, Indigenous, First Nations, American Indians

ABBREVIATIONS

ECC—early childhood caries
IHS—Indian Health Services
AI/AN—American Indian/Alaska Native

Indigenous children of Canada (First Nations, Inuit, and Métis) and the United States (American Indian, Alaska Natives) face many health disparities compared with the general American and Canadian populations. Oral health disparities for Indigenous children exemplify many of the inequities and the major need for health promotion, disease prevention, and early care services in these communities. Various organizations have provided guidelines on health promotion, disease prevention, and early visits for dental care; however, the severity of dental disease and the barriers to care in Indigenous communities require special consideration.

Early childhood caries (ECC) is defined as the presence of tooth decay that involves any primary tooth in a child younger than 6 years.[1] Also referred to as early childhood tooth decay in the vernacular (and formerly called baby-bottle tooth decay), the term ECC better reflects that the disease process is much more complex and involves transmission of infectious bacteria, dietary habits, and oral hygiene. ECC is an infectious disease; *Streptococcus mutans* is the most dominant causative organism. The causative triad for caries includes the presence of cariogenic bacteria, diet (exposure to fermentable carbohydrate), and host susceptibility (integrity of tooth enamel). ECC has been termed the most prevalent pediatric infectious disease and the most common chronic disease of children.[2]

The effects of ECC go beyond the oral cavity and influence overall childhood health and well-being, which are already compromised for many

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Indigenous children. ECC has been associated with other infectious diseases, such as respiratory tract infections and acute otitis media, in the first year of life, but the relationships are weak and may indicate common risk factors.[3] When left to progress, ECC can become painful and result in altered chewing, eating, and sleeping patterns in addition to potential growth restriction.[3] Early tooth loss as a result of ECC may result in speech difficulties and associated self-esteem issues because of altered appearance. Children with ECC are known to be at increased risk of decay in both primary and permanent dentition and may also experience malalignment and crowding of permanent teeth that result in poor bite.[4] Dental caries has also been associated with obesity in children from low socioeconomic status, possibly from common risk factors.[5] The other consequence of more severe ECC is that it frequently requires extensive treatment under general anesthesia—a procedure all too common among Indigenous children.[6]

ORAL HEALTH STATUS IN INDIGENOUS CHILDREN

The poor oral health of Indigenous children in Canada and the United States is a major public health issue. In some Canadian Indigenous communities, the prevalence of ECC exceeds 90%.[4] Similarly, in the United States, the disparities in oral health for Indigenous children are significant and may be increasing. A 1999 Indian Health Services (IHS) survey of 2663 American Indian/Alaskan Native (AI/AN) children between 2 and 5 years of age revealed that 68% had untreated decay, which is more than 3 times greater than the rate found in children from the National Health and Nutrition Examination Survey (19%).[7] The same survey revealed that 60% of preschool-aged AI/AN children had severe ECC constituted by decay on a maxillary incisor or 6 or more decayed teeth. When compared with a similar survey in 1991, a statistically significant increase in the number of decayed, missing, and filled teeth was found in AI/AN children.[7]

One of the major consequences of more severe ECC is the need for pediatric dental surgery under general anesthesia with the related economic burdens of health care fees and transportation and accommodation costs for families from remote communities to urban centers.[8] In addition to the potential health risks of general anesthesia, the benefits of rehabilitative treatment under general anesthesia may be short-lived, because relapse and recurrent decay are common if proper oral hygiene behaviors are not maintained postoperatively.[9,10] The reliance on and necessity for operative treatment of ECC is evidenced by the fact that pediatric dental surgery is the most common outpatient surgical procedure in many Canadian pediatric hospitals,[11] and wait times are substantial.[12,13] Results of recent studies also suggest that a significant number of First Nations children with dental caries require repeat dental procedures under general anesthesia.[6]

RISK FACTORS FOR ECC

There are a multitude of risk factors associated with ECC; however, the single greatest risk factor for ECC is being poor.[14] Unfortunately, Indigenous children in the United States and Canada face poverty rates more than double those of the general population; approximately 52% of Canadian First Nations children live in poverty,[15,16] and 36% of US AI/AN children overall and up to 60% of children of single parents who reside on reservations live in poverty.[17]

The infectious disease model of caries indicates the influence of poverty, household crowding, family size, nutrition, health behaviors, parenting practices, and other risk factors. An association is found between parents' oral health status and the oral health status of their infants.[18] Dietary factors influence the availability of fermentable carbohydrates required for caries formation but also influence host susceptibility, because primary tooth enamel development is influenced by prenatal and early infant nutrition.[19] Among American Indigenous populations, ECC has been found to be associated with parenting practices such as prolonged use of the bottle or training cups with sugar-containing drinks and a high frequency of sugary snacks per day.[19–23] Environmental tobacco smoke and maternal smoking status also have been associated with increased risk of caries among children.[24,25]

PREVENTION STRATEGIES

Restorative or surgical treatment of ECC is challenging and costly for children, but especially so for those from remote communities, and is unlikely to solve dental disease in Indigenous communities. Disease prevention is likely to be the most cost-effective alternative and the best long-term solution to oral health problems in these communities.[26] Primary prevention of dental disease not only preserves healthy teeth but also decreases the current tremendous demand for restorative and surgical care. With ECC being a result of the interplay of oral bacteria, substrate, and host as well as family, economic, and social conditions, health-promotion strategies that emphasize community development and address the determinants of health are required along with strategies that focus on disease prevention.[27,28] This will take collaboration among Indigenous communities; dental, primary care, and public health practitioners; and decision-makers, policy-makers, and researchers involved with young children.

Oral Health Promotion

Oral health promotion, like overall health promotion, should be part of a total healthy-living strategy, because many health disparities have similar underlying issues, such as socioeconomic challenges, food availability and costs of nutritious choices in remote communities, exposure to environmental tobacco smoke, and unacceptably low rates of breastfeeding and nutritious food awareness, access, and availability.

Disease Prevention

The first dental experience for many Indigenous children is for dental treatment resulting from caries rather than for preventive care. In fact, regular dental visits are not the norm for many Indigenous children.[29] Perceptions that deciduous teeth are not important and the acceptance that ECC and dental surgery are inevitable parts of childhood can be a barrier to adopting available prevention strategies.[29,30] These barriers may be reduced by increasing awareness of the importance of oral health to the overall well-being of the child; of the consequences of poor oral health, including the risks of general anesthesia; and that ECC is a potentially preventable disease.

ECC prevention should start during the prenatal period, progress through the perinatal period, and continue with the mother and infant within the context of the family and during preschool programs.[31,32] Given the evidence for vertical transmission of cariogenic bacteria, primarily from mother to child, involving pregnant women in oral health screening, dental treatment, and education on oral health hygiene and bolstering their nutrition along with the use of fluoride toothpaste are strategies that can assist in the prevention or delay of ECC.[31] Recent guideline documents support the safety of dental care in pregnancy to reduce or delay ECC in infants.[33–35] Prenatal visits may also provide an opportunity to build awareness of the importance of oral health for mothers and their infants.

Fluoride

Many national and international organizations, agencies, and governments, including the World Health Organization, the US Surgeon General, the Centers for Disease Control and Prevention, Health Canada, the American Dental Association, the American Academy of Pediatric Dentistry, the Canadian Dental Association, the Canadian Academy of Pediatric Dentistry, the American Academy of Pediatrics, and the Canadian Paediatric Society, strongly endorse the use of fluorides for the prevention and control of caries. Fluoride use is recognized by the American Dental Association, American Academy of Pediatric Dentistry, and Canadian Dental Association as a safe and highly effective strategy for preventing and controlling caries.[36–40] Multiple products provide fluoride. Effectiveness may require adherence (eg, toothpastes) or access to dental care or funding (eg, fluoride varnish).

Water fluoridation is seen as effective and inexpensive, does not require daily adherence, and promotes equity, because it benefits everyone regardless of socioeconomic status.[2,41] The World Health Organization has reported that fluoridation has substantial advantages, especially for high-risk groups, when it is culturally acceptable and technically feasible.[42] A recent unpublished study performed in Alaskan communities revealed a reduction in caries of 30% to 50% with community fluoridation, even when other risk factors were accounted for (Michael Bruce, Arctic Investigations Program, Centers for Disease Control and Prevention, verbal communication, June 6, 2009). In North America, there is wide disparity in the access to water fluoridation. It is estimated that 45% of Canadians benefit from access to fluoridated water,[43] whereas in 1998, less than 10% of First Nations people who lived on reservations had access to fluoridated water.[44] In 2006, 69% of US residents were served with community water fluoridation.[45] The role of public controversy in hindering the uptake of water fluoridation in Indigenous communities has not been documented.

Topical fluorides have been found to be effective in preventing caries. A Cochrane Collaboration review revealed that fluoride varnish substantially reduces tooth decay in both primary and permanent teeth.[46] A randomized controlled trial of fluoride varnish offered at least 2 times per year in Indigenous communities in northern Ontario, Canada, revealed an 18% reduction in the 2-year mean caries increment in participating Indigenous children and an adjusted odds ratio for caries incidence of nearly 2 times higher in the control group than in the fluoride-varnish group.[47] Lawrence et al suggested that the costs of fluoride varnish, although small, can be reduced and access could be improved through the expansion of providers of fluoride-varnish applications to include other health workers such as dental hygienists, dental therapists, dental assistants, and primary health care providers such as public health nurses, physician assistants, and other community health workers trained to administer fluoride varnish.[47] In more than 140 Canadian First Nations communities participating in the Children's Oral Health Initiative program, dental professionals and trained aides apply fluoride varnish.[48] Similar initiatives exist in the United States; 37 states provide primary care provider reimbursement for preventive oral health services, including fluoride-

varnish application, to Medicaid-eligible children younger than 3 years during well-child visits (Amos S. Deinard, Department of Pediatrics, University of Minnesota [Minneapolis, MN], verbal communication, November 22, 2009).[49] The application of fluoride varnish at the conclusion of "well-child" visits but before vaccinations at an IHS pediatric clinic was believed to be an effective way of reaching more AI/AN children.[50] IHS considers 4 or more topical applications of fluoride varnish between 9 and 24 months of age as best practice for children involved with Head Start programs.[51]

According to the American Academy of Pediatric Dentistry, the Canadian Dental Association, the American Academy of Pediatrics, and the Canadian Paediatric Society, fluoride supplements are appropriate for children at high risk of dental caries and may be necessary if the patient is not receiving adequate fluoride from other sources such as water and toothpaste.[37–40] Most Indigenous children fit into the high dental-caries-risk category, and few Canadian Indigenous communities have access to fluoridated drinking water. However, adherence can be an issue with supplements, especially by children at greatest risk, and the authors of a recent systematic review of fluoride supplementation concluded that the evidence for the prevention of caries in primary teeth is weak and inconsistent.[52] Health Canada's First Nations and Inuit Health does not recommend fluoride supplementation for First Nations children but instead puts more emphasis on oral hygiene, fluoride varnish, and fluoridated toothpaste (P. Cooney, BDS, Chief Dental Officer, Health Canada [Ottawa, Ontario, Canada], verbal communication, March 23, 2010).[53]

Canadian Dental Association and American Academy of Pediatric Dentistry guidelines support the use of fluoridated toothpaste twice daily; they suggest that children (2–5 years of age in the American Academy of Pediatric Dentistry guideline and 3–6 years of age in the Canadian Dental Association guideline) be assisted during brushing and use a small amount (eg, green pea–sized portion) of fluoridated toothpaste and that infants (younger than 2 years in the American Academy of Pediatric Dentistry guideline and younger than 3 years in the Canadian Dental Association guideline) have their teeth brushed by an adult using a minimal amount or rice grain–sized portion of fluoridated toothpaste, especially for children at high risk of dental caries.[37,38] Because of the high risk of dental caries in Indigenous children, supervised use of fluoridated toothpaste for Indigenous children starting at the first tooth eruption should be encouraged.

Sealants

Sealants have traditionally been used on occlusal tooth surfaces to protect pits and fissures from dental caries. Results of recent reviews have indicated that there is agreement that in populations at high risk of dental caries, such as First Nations and Inuit populations, all children should receive sealants, and some literature supports the placement of sealants on both primary and permanent molars.[54,55] However, the use of sealants for primary teeth may need to be promoted, because some dental professionals consider sealants for permanent teeth only.

ACCESS TO EARLY ORAL HEALTH CARE AND THE ROLE OF PRIMARY HEALTH CARE PROVIDERS

A measure of the geographic and workforce barriers to ECC prevention and care is the 1999 survey of oral health in AI/AN, which revealed that 68% of AI/AN children 2 to 5 years of age had untreated caries, compared with just 19% of US children as a whole.[56] In the face of this ECC epidemic in AI/AN communities, there are severe dental workforce shortages. The ratio of dentists per person is 1:2800 for AI/AN communities compared with the US average of 1:1500.[56] This situation is unlikely to improve in the near future, because the IHS vacancy rate for dentists is higher than it has been for many years and is currently at 24% despite recruitment efforts.[57] Innovative approaches for recruitment and human resource planning is required, including the expanded roles of other members of the dental health team and other primary care providers in oral health with a focus on the delivery of preventive strategies.

A number of professional associations, including the American Academy of Pediatric Dentistry, the Canadian Dental Association, the American Academy of Pediatrics, and the Canadian Paediatric Society, have called for comprehensive dental health care through dentists and an oral health examination for infants within 6 months after the first tooth erupts or by 12 months of age.[58,59] A lack of access to dental care contributes to the oral health disparities experience by AI/AN[60] and Canadian Indigenous children. Unfortunately, many dentists and primary care providers are still unaware of these new recommendations or are hesitant to examine and treat very young patients because of inadequate education or training, which limits its access to early preventive care by high-risk populations.[61] Inadequate numbers of dentists and the challenges of recruiting and retaining dentists in IHS clinics, tribal health facilities, and remote Indigenous communities cause significant issues for access. In some Indigenous communities, other members of the oral health team provide components of a comprehensive oral health program

supported by dentists. Health Canada supports training and utilization of dental therapists for First Nations communities.[48] Dental therapists are commonly used in northern communities in some Canadian provinces and territories, and more recently, a dental health aide program has evolved in Alaska. The effective use of appropriate dental health aides is seen by some in the American Dental Association as key to improving the oral health of Alaska Native people,[26] but there is some disagreement on the extent of the roles and scope of practice of the various types of dental health aides.

Primary care providers (eg, pediatricians, family physicians, nurse practitioners, community health nurses, physician assistants) in various Indigenous communities in North America are in unique positions to complement the work of dental health professionals. These health care providers often are afforded the opportunity to examine young children long before they are seen by dental personnel. In many Indigenous communities, well-infant, infant health, and immunization clinics are provided on a regular basis through community health nurses and physicians. These providers have an opportunity to emphasize the importance of good oral health practices as part of their overall health-promotion activities. In addition, they may be able to provide oral health screening for infants and young children and arrange referrals to dental health professionals. The American Academy of Pediatrics, through its Oral Health Initiative, has developed training programs for children's oral health to integrate these concepts into routine pediatric care.[62] This training helps complement the current American Academy of Pediatrics policy statements on oral health for children.[39,58]

ORAL HEALTH RECOMMENDATIONS FOR INDIGENOUS COMMUNITIES*

Clinical Care

- ECC should be considered an infectious disease that is influenced by a variety of factors including socioeconomic conditions, parenting practices, and maternal and infant nutrition.
- Early childhood oral health should be included as part of overall childhood health and well-being.
- Oral health should be discussed during well-child care visits by using motivational interviewing and anticipatory guidance on oral hygiene and diet for the parents and caregivers of infants and children.
- Supervised twice-daily use of fluoridated toothpaste should be promoted for all Indigenous and other high-risk children after the first tooth has erupted (rice grain–sized portion of toothpaste for infants and pea-sized portion for children).
- Community health nurses, family physicians, or pediatricians should perform oral health screening during early childhood health assessments and provide referrals as needed to dental health providers.
- Women in Indigenous communities should be provided the access to receive preconception and prenatal screening for oral health, anticipatory guidance for oral health and hygiene, and referral for dental care if required.
- Primary care providers should be aware of the access to fluoride in the drinking water for the various Indigenous communities in their service area.

*See Appendices 1–3 for evidence grades for the recommendations.

Community-Based Promotion Initiatives

- Change should be promoted in Indigenous communities to alter practices of frequent consumption of sugar-containing drinks and sugary snacks through education and improving the selection of foods available in the communities.
- Community-based activities should be used to emphasize the importance of oral health for the pregnant woman and her infant(s).

Workforce and Access Issues

- Early access to dental health professionals (to establish a dental home) should be provided by 12 months of age to provide the full range of oral health-promotion and interceptive disease-prevention services.
- All Indigenous children should have access to the evidence-based schedule for fluoride varnish and an assessment to determine the need for sealant placement on deep grooves and fissures on primary teeth. Alternative health or child care professionals and dental auxiliaries (or trained lay child care workers such as early childhood development workers) should be used to ensure access to fluoride-varnish programs. Fluoride varnish can be provided as part of a regular child health clinic program (well or sick visit) by trained health auxiliaries, community health workers, family physicians, or pediatricians. When specific programs are available, participation should be encouraged.
- Oral health services should be provided to pregnant women in Indigenous communities to get their teeth cleaned and examined and to have any needed periodontal and dental work performed before their infant is born.
- Roles that other dental health and primary health care providers can

assume should be considered in areas where it is difficult to recruit and retain an adequate number of dentists to provide oral health services and promote an early dental visit by the first year of life.

- Adequate cultural competency training opportunities should be provided for dentists, dental hygienists, therapists, and assistants to work in Indigenous communities. Advocate for increased representation of Indigenous people in oral health professions.
- Oral health training should be incorporated into pediatric and family medicine residency programs.

Advocacy

- Indigenous communities should be provided with information on water fluoridation, and opportunities for fluoridation (capital and maintenance costs and training for operators) of the community drinking water should be advocated within and for Indigenous communities.
- Appropriate funding for access to fluoride-varnish programs and for other oral health prevention and treatment services to Indigenous populations should be advocated.

Research

- Further community-based participatory research on the epidemiology, prevention, management, and microbiology of ECC in Indigenous communities and ECC-prevention projects should be supported.

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RECOMMENDED RESOURCES

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APPENDIX 1 Levels of Evidence and Grade of Recommendations for Individual-Level "Clinical/Prevention" Recommendations

Recommendation	US Preventive Services Task Force[63]		Canadian Task Force on Preventive Health Care[64]	
	Grade	Level of Certainty	Grade	Level of Evidence
Use motivational interviewing and anticipatory guidance on oral hygiene and diet for the parents and caregivers of infants and children	B	Moderate	B	II-3
Promote the supervised use of fluoridated toothpaste for all Indigenous and other high-risk children after the first tooth has erupted ("smear" of toothpaste for infants and pea-sized amount for children)	A	High	A	I
Community health nurses, family physicians, or pediatricians should perform oral health screening during child health assessments and provide referrals as needed to dental health providers	B	Moderate	B	II-3
Provide women with preconception and prenatal screening for oral health, anticipatory guidance for oral health and hygiene, and referral for dental care if required	B	Moderate	B	I
Ensure that all Indigenous children have access to (1) the series of fluoride varnish and (2) an assessment to determine the need for sealant placement on deep grooves and fissures	A A	Moderate High	A A	II-1 I

APPENDIX 2 Grades of Recommendations

Grade	US Preventive Services Task Force[63]	Canadian Task Force on Preventive Health Care[64]
A	High certainty that the net benefit is substantial	Good evidence to recommend
B	High certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.	Fair evidence to recommend
C	Recommends against routinely providing the service. There may be considerations that support providing the service in an individual patient. At least moderate certainty that the net benefit is small.	Existing evidence is conflicting and does not allow to make a recommendation for or against; however, other factors may influence decision-making.
D	Recommends against the service. Moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.	Fair evidence to recommend against the action.
I	Current evidence is insufficient to assess the balance of benefits and harms. Balance of benefits and harms cannot be determined.	Insufficient evidence (in quantity or quality) to make a recommendation; however, other factors may influence decision-making.

APPENDIX 3 Levels of Evidence/Certainty Regarding Net Benefit

US Preventive Services Task Force[63]		Canadian Task Force on Preventive Health Care[64]	
Level of Certainty	Description	Level of Evidence	Description
High	Evidence usually includes consistent results from well-designed, well-conducted studies in representative primary care populations. These studies assess the effects on health outcomes. This conclusion is unlikely, therefore, to be strongly affected by the results of future studies.	I	Evidence obtained from at least 1 properly randomized trial
Moderate	The evidence is sufficient to determine the effects of the service on health outcomes, but confidence in the estimate is constrained by factors such as Number, size, or quality of studies Inconsistency of findings across studies Limited generalizability of findings Lack of coherence in the chain of evidence As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion	II-1 II-2 II-3	Evidence obtained from well-designed controlled trial without randomization Evidence obtained from well-designed cohort or case-controlled analytic studies, preferably from >1 center or research group Evidence obtained from comparisons between times and places, with or without the intervention; dramatic results in uncontrolled experiments could also be included in this category
Low	The available evidence is insufficient to assess effects on health outcomes. Evidence is insufficient because of Limited number or size of studies Important flaws in study design/methods Inconsistency of findings across studies Gaps in the chain of evidence Findings not being generalizable Lack of information on important health outcomes More information may allow estimation of effects of health outcomes.	III	Opinions of respected authorities based on clinical experience, descriptive studies, or reports of expert committees

AMERICAN ACADEMY OF PEDIATRICS

Section on Cardiology

Echocardiography in Infants and Children

ABSTRACT. It is the intent of this statement to inform pediatric providers on the appropriate use of echocardiography. Although on-site consultation may be impossible, methods should be established to ensure timely review of echocardiograms by a pediatric cardiologist. With advances in data transmission, echocardiography information can be exchanged, in some cases eliminating the need for a costly patient transfer. By cooperating through training, education, and referral, complete and cost-effective echocardiographic services can be provided to all children.

Advances in echocardiography, including the introduction of Doppler and color flow mapping, have provided prompt, detailed, and noninvasive diagnoses of cardiac disorders. Although performance of echocardiographic studies in adults is fairly straightforward, the nearly infinite variety of cardiovascular abnormalities in the infant and child make similar studies in infants and children much more difficult to perform and interpret.

Although echocardiographic equipment is now available in nearly all communities in the United States, many areas do not have pediatric cardiologists. Additionally, many community hospitals can treat neonates with mild or moderate respiratory disease, but lack facilities and personnel to treat children with cardiac diseases. Transfer to a tertiary care center may be costly and disruptive to the family, but may be life-saving. The challenge is to bring the technology and expertise to the community hospital and to assure prompt transfer of the infant with life-threatening congenital heart disease but to avoid unnecessary transfers.

The American Academy of Pediatrics' 1995 policy statement with regard to access to pediatric subspecialty services states that: "When the services of a physician specialist or other health care professional are needed by children, plans should use providers with appropriate pediatric training and expertise. Pediatric-trained medical and surgical specialists should have completed an appropriate fellowship in their area of expertise and be certified by subspecialty boards in a timely fashion if certification is available."[1] In virtually all parts of the country, pediatric cardiologists are available by telephone to help guide the application of diagnostic studies and to aid in their interpretation. Should congenital heart disease be indicated by echocardiographic findings, a physician specifically trained in pediatric cardiology should be consulted. In emergency situations, data can be exchanged by telephone or fax. Within a few hours' time, videotapes can be delivered by courier. Telephone transmission of diagnostic images such as an echocardiogram can now be accomplished.

Interpretation of echocardiographic studies is highly dependent on appropriate and thorough collection of data by the ultrasound technologist. Although most community hospitals have sonographers skilled in performing echocardiographic studies in adults, these sonographers usually have little training or experience in performing studies in infants and children with serious congenital heart disease. Sonographers based in community hospitals face several logistical problems when placed in the position of needing further pediatric training and experience. These problems consist of time away from their community hospital, funding for training, and educational commitment from their community hospitals and from a training center. These problems can be solved if all involved parties (sonographer, community hospital, community-based pediatricians, and tertiary pediatric cardiology care centers) work together.

The American Academy of Pediatrics encourages all parties involved in providing pediatric cardiology care to establish linkages among themselves to ensure prompt, cost-effective administration of quality echocardiographic services.

Section on Cardiology, Executive Committee 1995 to 1996
Douglas Moodie, MD, Chairperson
J. Timothy Bricker, MD
Derek Fyfe, MD
Kenneth Jue, MD
Larry Mahoney, MD
John Moore, MD
Samuel Ritter, MD
John Kugler, MD, Ex-Officio Chairperson

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Pediatric AIDS

Education of Children With Human Immunodeficiency Virus Infection

ABSTRACT. Treatment for human immunodeficiency virus (HIV) infection has enabled more children and youths to attend school and participate in school activities. Children and youths with HIV infection should receive the same education as those with other chronic illnesses. They may require special services, including home instruction, to provide continuity of education. Confidentiality about HIV infection status should be maintained with parental consent required for disclosure. Youths also should assent or consent as is appropriate for disclosure of their diagnosis.

ABBREVIATIONS. HIV, human immunodeficiency virus; AIDS, acquired immunodeficiency syndrome; CNS, central nervous system; IDEA, Individuals With Disabilities Education Act; IFSP, Individual Family Service Plan; IEP, Individualized Education Program; AAP, American Academy of Pediatrics.

Asymptomatic children with human immunodeficiency virus (HIV) infection cannot be distinguished from children without infection, and their educational opportunities should be the same as other children. Children and youths with HIV infection should not be excluded from school or isolated within the school setting.[1] The spread of HIV infection in school has not been documented, and fear of its communicability must be allayed by appropriate education of all school personnel. Participation in school provides a sense of normalcy for children and adolescents with HIV infection and offers opportunities for socialization that are important to their development. School attendance promotes a sense of belonging and reduces feelings of isolation and rejection.[2] Those with HIV infection should participate in all activities in school[3,4] to the extent that their health permits, which includes a spectrum of illness ranging from no symptoms to acquired immunodeficiency syndrome (AIDS). The need to exclude children or youths with HIV infection from school to protect their own health is unusual. Such a decision should be made by the physician in consultation with the child's parent or caregiver.

HIV INFECTION AND DEVELOPMENTAL DELAY

The majority of children with HIV infection reaching school age have normal cognitive function.[5–8] When symptoms develop in a child or adolescent with HIV infection, central nervous system (CNS) dysfunction can occur and cause a decrease in cognitive function followed by a decline in academic performance. Controlled clinical trials of antiretroviral therapy have shown improved neurodevelopmental function in symptomatic children.[9] Clinical trials have also shown that with different antiretroviral therapy, CNS disease occurs at different rates, indicating that optimal therapy can delay or prevent CNS dysfunction.[9] The pediatrician should ensure that initiation of developmental testing, evaluation of CNS function, and appropriate referral of children and youths to early intervention and special education programs are the same as for children and youths with other chronic illness that can require such services. Physical education programs suitable for the needs of the developmentally disabled or chronically ill child, including those with HIV, should be available.

FEDERAL DISABILITIES RIGHTS LAWS

Important protections exist for children and adolescents with disabilities including HIV infection. Several laws have been enacted to improve the availability of services in schools to assist children with special health care needs to benefit optimally from education.[10] The pediatrician should be familiar with federal disabilities rights laws.

The Individuals With Disabilities Education Act (IDEA), as reauthorized in 1997, is an outgrowth of the Education of All Handicapped Children Act of 1975 (PL 94-142) and the Education of the Handicapped Act Amendments of 1986 (PL 99-457). IDEA is a federal program that applies to children and youths, ages 3 to 21 years, with developmental disabilities and health impairments. It includes a provision to encourage states to expand opportunities for children younger than 3 years who would be at risk of having substantial developmental delay if they did not receive early intervention services. IDEA guarantees access to needed educational services and provides for related services that may be required to assist a child with a disability to benefit from special education. Related services include transportation, speech pathology, audiology, counseling, physical therapy, and medical services for diagnosis. For persons to be eligible for services under IDEA, their condition, specified by the law, must have the potential to interfere with the educational process and normal school performance and requires special educational-related services.

For infants and toddlers birth to age 3 years with disabilities, an annual Individual Family Service Plan (IFSP), which is a component of IDEA, is developed

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

to provide early intervention services. For children and youths 3 to 21 years of age who require special assistance, schools must prepare an Individualized Education Program (IEP) and update it annually. The IEP sets out a plan for special education and related services to meet the child's education goals. The plan is designed by a multidisciplinary team that includes the student's parent(s), regular education teacher, special education teacher, a representative of the school administration, and, when appropriate, the student. Ideally, the IEP team may include the pediatrician and school nurse who are knowledgeable about the student's condition.

Section 504 of the Rehabilitation Act of 1973 is available for any children or adolescents with special health care needs and is applicable to those who do not require special education instruction. It provides the legal support for education in regular classes with the use of supplementary services including medical, nursing, psychological, physical, and occupational therapies.

The Americans With Disabilities Act also provides children and youths with disabilities certain protections by ensuring that schools and school programs are available and accessible. For example, this act mandates wheelchair-accessible buildings.

HIV MANAGEMENT IN THE SCHOOL SETTING

School personnel must be educated about HIV disease and the potential long-term needs of the infected student. All schools should have programs for educating school personnel in standard precautions and in recognition and management of medical emergencies.[11,12] Students with chronic illnesses, including HIV, may need medications administered during the school day and established school procedures should be used.[13] Confidentiality must be ensured. Under optimal circumstances and with parental consent (and student assent when appropriate), the person(s) giving medications should be informed of the student's diagnosis and the side effects associated with the drugs being taken. In the event that the HIV diagnosis is not disclosed to school personnel, only the person(s) directly involved with the provision of medication should be informed of the student's need for medication. Some medications have special requirements, such as increased fluid requirements. Appropriate access to fluid and bathroom privileges should occur in response to physician requests.

HOME INSTRUCTION

Children and youths with symptomatic HIV infection or other chronic illnesses may be absent from school and need home instruction sporadically until the illness improves, or may require other special school arrangements including permanent home instruction when the disease progresses. The policy on home instruction published by the American Academy of Pediatrics (AAP) provides guidelines for reference, and schools must meet the requirements and Section 504 of the Rehabilitation Act of 1973, the Americans With Disabilities Act of 1990, and IDEA.[14] Home instruction should be provided promptly under IDEA guidelines through the special education coordinator working with the school medical advisor and the student's physician. The student's physician should help parents to facilitate the transition between school and other special arrangements, including home instruction.

The student's ability to continue his or her education may diminish as disease progresses, and anger, withdrawal, or depression can be present. The school should continue to work with the medical system to assist the family with counseling and emotional support. The school may also assist other students to a better understanding of chronic illness and how to be supportive of their classmates. Although family disruption and community rejection occur for students with HIV infection, they are more common in families who may need assistance from school mental health personnel.

CONFIDENTIALITY

As long as disclosure of HIV infection can stigmatize students and families, confidentiality is important. The need to safeguard the rights of the student must be balanced with information essential to the school to educate the students and faculty. The primary responsibility of the pediatrician is to care for the child or youth and the family. Disclosure of the child's HIV status should be done only with the consent of the parents and age-appropriate assent of the student. Some families may not permit disclosure, which should not prohibit the student from attending school. Also, some HIV-infected children who attend school have not had their conditions diagnosed. An effective HIV/AIDS education program for school personnel provides accurate information about HIV infection and its transmission. This education should provide reassurance to school personnel and a more accepting environment for the HIV-infected student.[11]

EXPOSURE TO ILLNESS

Specific immunization requirements as recommended by the AAP[2] are designed to be applicable to HIV-infected children and youth. General immunization requirements for healthy children are also available in the *1997 Red Book*. These immunization requirements are designed to protect all children and adolescents and should be rigorously enforced to reduce risk of exposure to vaccine-preventable illnesses. Parents should be informed when measles or varicella is occurring in the school setting.[1] Parents of children and youths at increased risk of developing severe illnesses should consult their physician.

CONCLUSION

Transmission of HIV from mother to child has been significantly decreased with treatment, resulting in fewer HIV-infected children entering preschool and kindergarten. The advent of early aggressive antiretroviral therapy has prolonged the number of years that children can attend school,[15] enabling many to continue their education through high school and perhaps higher education. An understanding by school personnel of chronic illness man-

ifestations attributable to HIV infection is essential for providing appropriate educational programs.

RECOMMENDATIONS

1. All children and youths with HIV infection should have the same right as those without infection to attend school and receive high-quality educational services.
2. Children and youths with HIV infection should have access to special education and other related services in accord with their needs as the disease progresses.
3. Mechanisms for administration of medications, including confidential methods for HIV infection, should be in place in all schools. This includes appropriate facilitation of specific needs for fluids or bathroom privileges.
4. Continuity of education must be ensured for children and adolescents with HIV infection and encompasses the spectrum of traditional school, medical day treatment programs, and home schooling.
5. Confidentiality of HIV infection status should be respected and maintained, with disclosure given only with the consent of the parent(s) or legal guardian(s) and age-appropriate assent of the student.
6. The pediatrician/medical home provider should maintain appropriate communication with the school to facilitate the education of children in their care.

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CLINICAL REPORT

Effects of Early Nutritional Interventions on the Development of Atopic Disease in Infants and Children: The Role of Maternal Dietary Restriction, Breastfeeding, Timing of Introduction of Complementary Foods, and Hydrolyzed Formulas

Guidance for the Clinician in Rendering Pediatric Care

Frank R. Greer, MD, Scott H. Sicherer, MD, A. Wesley Burks, MD, and the Committee on Nutrition and Section on Allergy and Immunology

ABSTRACT

This clinical report reviews the nutritional options during pregnancy, lactation, and the first year of life that may affect the development of atopic disease (atopic dermatitis, asthma, food allergy) in early life. It replaces an earlier policy statement from the American Academy of Pediatrics that addressed the use of hypoallergenic infant formulas and included provisional recommendations for dietary management for the prevention of atopic disease. The documented benefits of nutritional intervention that may prevent or delay the onset of atopic disease are largely limited to infants at high risk of developing allergy (ie, infants with at least 1 first-degree relative [parent or sibling] with allergic disease). Current evidence does not support a major role for maternal dietary restrictions during pregnancy or lactation. There is evidence that breastfeeding for at least 4 months, compared with feeding formula made with intact cow milk protein, prevents or delays the occurrence of atopic dermatitis, cow milk allergy, and wheezing in early childhood. In studies of infants at high risk of atopy and who are not exclusively breastfed for 4 to 6 months, there is modest evidence that the onset of atopic disease may be delayed or prevented by the use of hydrolyzed formulas compared with formula made with intact cow milk protein, particularly for atopic dermatitis. Comparative studies of the various hydrolyzed formulas also indicate that not all formulas have the same protective benefit. There is also little evidence that delaying the timing of the introduction of complementary foods beyond 4 to 6 months of age prevents the occurrence of atopic disease. At present, there are insufficient data to document a protective effect of any dietary intervention beyond 4 to 6 months of age for the development of atopic disease.

INTRODUCTION

Over the past several decades, the incidence of atopic diseases such as asthma, atopic dermatitis, and food allergies has increased dramatically. Among children up to 4 years of age, the incidence of asthma has increased 160%, and the incidence of atopic dermatitis has increased twofold to threefold.[1] The incidence of peanut allergy has also doubled in the past decade.[2] Thus, atopic diseases increasingly are a problem for clinicians who provide health care to children.

It has been recognized that early childhood events, including diet, are likely to be important in the development of both childhood and adult diseases. This clinical report will review the nutritional options during pregnancy, lactation, and the first year of life that may or may not affect the development of atopic disease. Although

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Key Words
atopy, food allergies, breastfeeding, complementary foods, hydrolyzed formula, atopic dermatitis, asthma

Abbreviations
AAP—American Academy of Pediatrics
IgE—immunoglobulin E
OR—odds ratio
CI—confidence interval

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atopic diseases have a clear genetic basis, environmental factors, including early infant nutrition, may have an important influence on their development and, thus, present an opportunity to prevent or delay the onset of the disease. This clinical report replaces an earlier policy statement[3] from the American Academy of Pediatrics (AAP) that addressed the use of hypoallergenic infant formulas and included provisional recommendations for dietary management for the prevention of atopic disease. This report is not directed at the treatment of atopic disease once an infant or child has developed specific atopic symptoms.

DEFINITIONS

The following definitions are used throughout this clinical report (adapted from work by Muraro et al[4]):

Allergy: A hypersensitivity reaction initiated by immunologic mechanisms.

Atopy: A personal or familial tendency to produce immunoglobulin E (IgE) antibodies in response to low-dose allergens, confirmed by a positive skin-prick test result.

Atopic disease: Clinical disease characterized by atopy; typically refers to atopic dermatitis, asthma, allergic rhinitis, and food allergy. This report will be limited to the discussion of conditions for which substantial information is available in the medical literature.

Atopic dermatitis (eczema): A pruritic, chronic inflammatory skin disease that commonly presents during early childhood and is often associated with a personal or family history of other atopic diseases.

Asthma: An allergic-mediated response in the bronchial airways that is verified by the variation in lung function (measured by spirometry) either spontaneously or after bronchodilating drugs.

Cow milk allergy: An immunologically mediated hypersensitivity reaction to cow milk, including IgE-mediated and/or non—IgE-mediated allergic reactions.

Food allergy: An immunologically mediated hypersensitivity reaction to any food, including IgE-mediated and/or non—IgE-mediated allergic reactions.

Hypoallergenic: Reduced allergenicity or reduced ability to stimulate an IgE response and induce IgE-mediated reactions.

Infants at high risk of developing allergy: Infants with at least 1 first-degree relative (parent or sibling) with documented allergic disease.

The following definitions are from various industry sources:

Partially hydrolyzed (PH) formula: Contains reduced oligopeptides that have a molecular weight of generally less than 5000 d (Table 1).

Extensively hydrolyzed (EH) formula: Contains only peptides that have a molecular weight of less than 3000 d (Table 1).

Free amino acid—based formula: Peptide-free formula that contains mixtures of essential and nonessential amino acids (Table 1).

TABLE 1 **Examples of Hydrolyzed Protein and Amino Acid–Based Infant Formulas Available in the United States**

Extensively hydrolyzed casein (cow milk protein)
Enfamil Nutramigen Lipil (Mead Johnson Nutritionals, Evansville, IN)
Enfamil Pregestimil (Mead Johnson Nutritionals)
Similac Alimentum Advance (Ross Products, Columbus, OH)
Partially hydrolyzed whey (cow milk protein)[a]
Good Start Supreme (Nestlé USA, Glendale, CA)
Partially hydrolyzed whey/casein (cow milk protein)[a]
Enfamil Gentlease Lipil (Mead Johnson Nutritionals)
Partially Hydrolyzed Soy (Soy Protein)
Good Start Supreme Soy (Nestlé USA)
Free amino acid–based
Neocate (and Neocate 1+ for children >12 mo) (Nutricia North America, Gaithersburg, MD)
EleCare (Ross Pediatrics)

[a] For infants with known cows milk allergy, the residual milk protein peptides in these formulas may cause an allergic reaction.

DIETARY RESTRICTIONS FOR PREGNANT AND LACTATING WOMEN

The earliest possible nutritional influence on atopic disease in an infant is the diet of the pregnant woman. However, studies generally have not supported a protective effect of a maternal exclusion diet (including the exclusion of cow milk and eggs) during pregnancy on the development of atopic disease in infants, as summarized in a 2006 Cochrane review.[5–10] Although previous AAP publications have suggested that pregnant women avoid peanuts,[3,11] a more recent study has reported that there is no association between the maternal consumption of peanuts during pregnancy and childhood peanut allergy.[12] Previous AAP publications have advised lactating mothers with infants at high risk of developing allergy to avoid peanuts and tree nuts and to consider eliminating eggs, cow milk, and fish from their diets while nursing.[3,11] Dietary food allergens can be detected in breast milk, including peanuts, cow milk protein, and egg.[13–15] Two studies found a preventive effect of maternal dietary exclusion of milk, egg, and fish while breastfeeding on the development of atopic dermatitis in the infant.[16,17] Other studies found no association between the development of atopic diseases and a maternal exclusion diet.[8,18,19] A 2003 study found no association between breastfeeding and peanut allergy, and there was no difference in peanut intake during lactation between mothers with and without children with peanut allergy.[12] Dietary food allergens in human milk may interact with the mucosal immune system[20] and induce allergic reactions in infants who are known to be clinically allergic to the antigen. Rare cases of anaphylaxis to cow milk protein present in human milk have been described even in exclusively breastfed infants.[21]

Consideration of a large number of studies on maternal diet, not all of which were randomized or included dietary restriction during lactation, demonstrated no impact on various outcomes among the majority of the studies, particularly when follow-up was beyond 4 years, and led one recent group of reviewers to conclude that there is no convincing evidence for a long-term preventive effect of maternal diet during lactation on

atopic disease in childhood.[22] A 2006 Cochrane review also concluded that there was insufficient evidence that antigen avoidance during lactation was beneficial in preventing atopic disease in the breastfed infant, with the exception of atopic dermatitis.[5] Because the available published trials have had methodologic shortcomings, more data are necessary to conclude that the avoidance of antigens during lactation prevents atopic dermatitis in infants.[5]

ROLE OF HUMAN MILK AND EXCLUSIVE BREASTFEEDING ON THE DEVELOPMENT OF ATOPIC DISEASE

Since the 1930s, many studies have examined the benefits of breastfeeding on the development of atopic disease. In general, these have been nonrandomized, retrospective, or observational in design and, thus, inconclusive.[22,23] Of course, it is not possible to truly randomize breastfeeding, which is always a confounding variable in these studies. Acknowledging this difficulty, Kramer[23] proposed 12 criteria to apply to studies designed to assess the relationship between atopic disease and breastfeeding. These criteria included nonreliance on late maternal recall of breastfeeding, sufficient duration of exclusive breastfeeding, strict diagnostic criteria for atopic outcomes, assessment of effects of children at high risk of atopic outcomes, and adequate statistical power. Unfortunately, no studies to date have completely fulfilled these criteria.

Atopic Dermatitis

A 2001 meta-analysis of 18 prospective studies compared the incidence of atopic dermatitis in infants who were breastfed versus infants who were fed cow milk formula.[24] Overall, there was a protective effect of exclusive breastfeeding for 3 months (odds ratio [OR]: 0.68; 95% confidence interval [CI]: 0.52–0.88), the stronger effect having been shown for infants with a family history of allergy (OR: 0.58; 95% CI: 0.4–0.92). No protective effect of breastfeeding was seen in children who were not at risk of developing allergy (OR: 1.43; 95% CI: 0.72–2.86).[24] A 2005 study published from Sweden[25] found no effect of exclusive breastfeeding for ≤4 months on the incidence of atopic dermatitis in the first year of life with or without a family history of atopic disease. On the other hand, another 2005 study from Sweden[26] found that exclusive breastfeeding for more than 4 months reduced the risk of atopic dermatitis at 4 years of age (OR: 0.78; 95% CI: 0.63–0.96) with or without a family history of allergy. In their review, Kramer and Kakuma[27] also found no benefit of exclusive breastfeeding beyond 3 months of age on the incidence of atopic dermatitis in studies in which parents were not selected for risk of allergy.

A series of recent reports from the German Infant Nutritional Intervention Program[28–30] also found that breastfeeding reduces the incidence of atopic dermatitis, supporting the results of the meta-analysis.[24] In the interventional arm of this study, 1834 newborn infants identified as being at high risk of developing atopic disease were enrolled in a 3-year longitudinal, prospective study. Breastfeeding infants at risk for atopic disease were enrolled in the study before 14 days of life and, at that time, were exclusively breastfed and had no history of formula supplementation. Infants were randomly assigned at the time of entry to receive supplements of 1 of 3 hydrolyzed formulas (2 extensively hydrolyzed formulas and 1 partially hydrolyzed formula) or a cow milk formula, if formula supplementation had begun. Eight hundred eighty-nine mothers exclusively breastfed for 4 months and did not use any of the formula supplements they were randomly assigned to use. Nine hundred forty-five infants were introduced to the randomly assigned formula before 4 months and, thus, were not exclusively breastfed. Of these, 689 infants were randomly assigned to receive one of the hydrolyzed formulas, and 256 were randomly assigned to receive cow milk formula. The incidence of atopic dermatitis in infants who were exclusively breastfed, breastfed with supplemental hydrolyzed formula, and breastfed with supplemental cow milk formula was 9.5%, 9.8%, and 14.8%, respectively, at the 1-year follow-up.[28–30] Thus, exclusive breastfeeding for 4 months showed a positive effect compared with breastfeeding with supplemental cow milk formula in these infants at high risk of developing allergy. Breastfeeding with supplemental hydrolyzed formula (both partially and extensively hydrolyzed) also showed a positive effect compared with breastfeeding with supplemental cow milk formula; however, breastfeeding with supplements of hydrolyzed formulas showed no advantage compared with exclusive breastfeeding. Both groups showed a one-third decrease in the risk of atopic dermatitis compared with the risk of breastfeeding with supplements of cow milk formula. Thus, exclusive breastfeeding or breastfeeding with hydrolyzed formula is not enough to prevent the majority of cases of atopic dermatitis.

The advantages of breastfeeding are less clear for infants who are not selected for high risk of developing atopic disease, as shown in the noninterventional arm of the German Infant Nutritional Intervention Program.[28] In this arm, mothers unselected for a history of atopy who either formula fed or partially breastfed their infants were free to select cow milk–based or hydrolyzed formulas. No differences in the incidence of atopic dermatitis occurred among the 3 groups of infants (exclusively breastfed for 4 months, cow milk formula fed with or without breastfeeding, and hydrolyzed formula fed with or without breastfeeding). This lack of effect has been attributed to reverse causation; thus, mothers who knew that their infants were at risk of developing allergy were more likely not only to breastfeed but also to breastfeed for a longer period of time. Alternatively, mothers who were not going to breastfeed or were going to supplement with formula were more likely to choose hydrolyzed formula if they believed that their children were at risk of developing atopy. This reverse causation effect may explain why some studies have found an increased incidence of atopic dermatitis in breastfed infants.[31–33]

In summary, for infants at high risk of developing atopy, there is evidence that exclusive breastfeeding for at least 4 months or breastfeeding with supplements of

hydrolyzed infant formulas decreases the risk of atopic dermatitis compared with breastfeeding with supplements of standard cow milk–based formulas. On the basis of currently available evidence, this is less likely to apply to infants who are not at risk of developing atopy, and exclusive breastfeeding beyond 3 to 4 months does not seem to lead to any additional benefit in the incidence of atopic eczema.[27]

Asthma

The evidence for the protective effects of human milk on the development of asthma is more controversial. A 2001 meta-analysis of 12 prospective studies that met preestablished criteria found that exclusive breastfeeding for at least 3 months was protective against the development of asthma between 2 and 5 years of age (OR: 0.70; 95% CI: 0.60–0.81).[34] The effect of breastfeeding was even stronger when the analysis was limited to children from families with a history of atopic disease (OR: 0.52; 95% CI: 0.35–0.79). No benefit was seen in children from families without a history of atopic disease (OR: 0.99; 95% CI: 0.48–2.03).[34] Two more studies[35,36] not included in this meta-analysis supported these results. On the other hand, a 2002 Cochrane review found no benefit of exclusive breastfeeding beyond 3 months on the incidence of asthma in families not preselected for a history of atopic disease.[27]

Two additional reports in the literature with a more accurate definition of asthma[37,38] made a distinction between the wheezy bronchitis associated with viral infections in younger children and that of the allergic disease seen in older children associated with respiratory spirometric changes. In the first of these studies, a cohort of 1246 children in Tucson, Arizona, was followed from birth to 13 years of age.[37] The study found that an association between breastfeeding and asthma at 13 years of age depended on the presence of maternal asthma in children with atopic disease. Infants whose mothers had asthma were at greatest risk of developing asthma by 13 years of age if they had been breastfed exclusively for ≥4 months (OR: 8.7; 95% CI: 3.4–22.2). When infants with atopic disease whose mothers had asthma were exclusively breastfed for any length of time (either greater than or less than 4 months), the risk of developing asthma between 6 and 13 years of age was also increased (OR: 5.7; 95% CI: 2.3–14.1). An increased risk of developing asthma was not found in breastfed children of mothers without asthma. However, in this same study during the first 2 years of life, exclusive breastfeeding was associated with significantly lower rates of recurrent wheezing of infancy (OR: 0.45; 95% CI: 0.2–0.9), similar to results from a recent study performed in Perth, Australia.[35]

In the second of these studies, a long-term longitudinal study from New Zealand,[38] 1037 children from a general population (not selected for risk of allergic disease) were followed from 3 to 26 years of age. Five hundred four infants were breastfed for 4 weeks or more, and 533 infants were formula fed from the time of birth or breastfed for less than 4 weeks. Breastfeeding for more than 4 weeks significantly increased the risk of developing asthma at 9 years (OR: 2.40; 95% CI: 1.36–4.6) and at 21 years (OR: 1.83; 95% CI: 1.35–2.47). This increased risk was not related to the presence of maternal atopic disease, unlike in the Tucson study. The study has been criticized for retrospective determination of breastfeeding and unclear definitions of atopic heredity.[22] There was also no evidence of a "dose-response" effect of breastfeeding on the incidence of atopy or asthma.

In summary, at the present time, it is not possible to conclude that exclusive breastfeeding protects young infants who are at risk of atopic disease from developing asthma in the long term (>6 years of age), and it may even have a detrimental effect.[37,38] On the other hand, breastfeeding seems to decrease the wheezing episodes seen in younger children (<4 years of age) that are often associated with respiratory infections.[35,36]

Food Allergy

Food allergy, similar to atopic dermatitis and asthma, is more likely to occur in infants with a family history of atopic disease. In a prospective study of infants born to families with a history of atopic disease, it was determined that 25% will develop food allergy between birth and 7 years of age.[39] Because both atopic dermatitis and asthma are closely associated with the development of food allergy, it is difficult to sort out the effect of breastfeeding on the development of food allergy. As reviewed above, maternal dietary exposure during pregnancy and lactation is unlikely to contribute significantly to the development of food allergy in the infant, although many food antigens can be found in human milk. In theory, human milk should inhibit food antigen absorption; however, prospective studies have failed to show a protective effect of human milk–specific antibodies to cow milk on infant sensitization.[40] Investigations of the role of breastfeeding on the outcomes of allergies to specific foods have been few, and the results may have been influenced by additional dietary variables such as length and degree of breastfeeding exclusivity. In reviewing the available studies, Muraro et al[22] concluded that exclusively breastfeeding for at least 4 months in infants who are at risk of developing atopic diseases is associated with a lower cumulative incidence of cow milk allergy until 18 months of age. A Cochrane review included only 1 study with a blinded challenge (using the double-blind, placebo-controlled food-challenge technique) and concluded that at least 4 months of exclusive breastfeeding did not protect against food allergy at 1 year of age.[27] Overall, firm conclusions about the role of breastfeeding in either preventing or delaying the onset of specific food allergies are not possible at this time.

ROLE OF HYDROLYZED FORMULA ON THE DEVELOPMENT OF ATOPIC DISEASE

The role of partially hydrolyzed and extensively hydrolyzed formulas for the prevention of atopic disease has been the subject of many studies in both formula-fed and breastfed infants in the last 15 years. Most studies with published results have been of infants at high risk of developing allergy.

Approximately 100 studies in the literature have examined the role of hydrolyzed formulas on the development of atopic disease. However, using the criteria of a 2006 Cochrane review,[41] only 14 randomized or quasi-randomized (eg, using alternation) trials in term infants compared the use of partially or extensively hydrolyzed formula with the use of human milk or an adapted cow milk formula.[42–55] All of these trials have followed up with at least 80% of study participants. It is important to note that none of these studies reported any adverse effects, including any adverse effect on infant growth. No long-term studies have compared partially or extensively hydrolyzed formula to exclusive breastfeeding. Thus, there is no evidence that the use of these formulas is any better than human milk in the prevention of atopic disease.

Three studies of 251 infants examined the effect of partially hydrolyzed formula on reduction of the occurrence of any allergy compared with cow milk formula in infants at high risk of developing allergy.[49,51,52] Two of these studies found no significant effect,[51,52] and a third study found an OR of 0.45 (95% CI: 0.22–0.94) for partially hydrolyzed formula versus cow milk formula.[49] Three more studies[53–55] examined prolonged feeding of extensively hydrolyzed formula compared with partially hydrolyzed formula in 411 infants at high risk of developing allergy. None of these studies found a significant difference in the incidence of atopic dermatitis between the 2 feeding groups. Two of these studies[53,55] of 352 infants also examined other manifestations of atopic disease and did not show a significant difference in the occurrence of food allergy, cow milk allergy, or asthma between the groups of infants who were fed extensively or partially hydrolyzed formula.

A very large published study from the German Infant Nutritional Intervention Program[30] raised additional issues. In the interventional arm of this study, 945 newborn infants were identified as being at high risk of developing atopic disease and were enrolled in a longitudinal, prospective study through 12 months of age. Although the majority of infants were breastfed initially, formula was introduced in the first 4 weeks to most infants. The infants were randomly assigned to receive 1 of 3 hydrolyzed formulas ($n = 689$) or cow milk formula ($n = 256$). The 3 hydrolyzed formulas were a partially hydrolyzed whey-based formula, an extensively hydrolyzed whey-based formula, and an extensively hydrolyzed casein-based formula. The incidence of atopic dermatitis was significantly reduced in those using the extensively hydrolyzed casein-based formula (OR: 0.42; 95% CI: 0.22–0.79; $P < .007$) and the partially hydrolyzed whey-based formula (OR: 0.56; 95% CI: 0.32–0.99; $P < .046$) but not the extensively hydrolyzed whey-based formula (OR: 0.81; 95% CI: 0.48–1.4; $P < .44$), compared with the incidence in those in the cow milk formula group. However, the overall results for prevention of allergic disease (atopic dermatitis, urticaria, and food allergy) for the 3 hydrolyzed formulas compared with cow milk formula were less impressive (extensively hydrolyzed whey-based: OR: 0.86; 95% CI: 0.52–1.4; partially hydrolyzed whey-based: OR: 0.65; 95% CI: 0.38–1.1; and extensively hydrolyzed casein-based: OR: 0.51; 95% CI: 0.28–0.92; $P < .025$). Thus, this study indicated that different hydrolysates have different effects on atopic disease, and there may be an advantage for the extensively hydrolyzed casein-based formula. However, as the study demonstrated, it is difficult to show that partially hydrolyzed formulas have a very large effect on the reduction of atopic disease in infants who are fed formula or mixed feedings of human milk and formula, even if they are at high risk of developing allergic disease. If atopic disease associated with cow milk allergy has occurred, partially hydrolyzed formula is not recommended, because it contains potentially allergic cow milk peptides.

More studies are needed to determine if any of the hydrolyzed formulas have any effect on the incidence of atopic disease later in childhood and adolescence and whether the modest effects of the use of extensively or partially hydrolyzed formulas in early childhood can be confirmed and are sustained. Such studies should also include a cost/benefit analysis of the use of the more expensive hydrolyzed formulas. It should be noted that the potential benefit of these formulas has only been documented in infants at risk of developing atopic disease. Additional studies are needed among unselected infants or infants at low risk.

The use of amino acid–based formulas for prevention of atopic disease has not been studied. Soy formulas, on the other hand, have a long history of use for atopic disease in infants. In a recent meta-analysis of 5 randomized or quasi-randomized studies, the authors concluded that feeding with soy formula should not be recommended for the prevention of atopy in infants at high risk of developing allergy.[56]

ROLE OF INTRODUCTION OF COMPLEMENTARY FOODS ON ATOPIC DISEASE

Many studies have examined the duration of breastfeeding and its effect on atopic disease. However, few studies have examined the timing of the introduction of complementary foods as an independent risk factor for atopic disease in breastfed or formula-fed infants. An expert panel from the European Academy of Allergology and Clinical Immunology has recommended delayed introduction of solid foods for 4 to 6 months in breastfed or formula-fed infants.[22] The AAP has also recommended that solid foods be delayed until 4 to 6 months of age and that whole cow milk be delayed until 12 months of age.[11] Before publication of this clinical report, AAP recommendations for infants who are at risk of developing atopic disease were to avoid eggs until 2 years of age and avoid peanuts, tree nuts, and fish until 3 years of age.[3,11] These guidelines for solid food introduction and avoidance of specific allergens were based on the evidence of a few studies with various limitations.[39,57–59] Three newer studies have reported mixed results regarding the timing of the introduction of solid foods and development of childhood atopic disease.[60–62]

In a prospective (nonrandomized) study of infants at risk of developing atopic disease by Kajosaari[57], atopic dermatitis and history of food allergy were reduced at 1

year of age if the introduction of solid foods was delayed until 6 months compared with at 3 months of age. However, in a 5-year follow-up study, no difference was seen in the incidence of atopic dermatitis or symptoms of food allergy.[57] In a second prospective study of a birth cohort of 1210 unselected children between 2 and 4 years of age, there was more atopic dermatitis but not asthma in infants who were fed 4 or more solid foods compared with no solid foods before 4 months of age.[58] This difference was maintained in a 10-year follow-up study in 85% of the original study infants.[59]

In a study of 257 preterm infants (34.4 weeks' gestational age; birth weight: 2.3–2.4 kg), the introduction of 4 or more, compared with fewer than 4, solid foods before 17 weeks after term was associated with a higher risk of atopic dermatitis (unconfirmed by skin-prick testing) at 12 months after term (OR: 3.49; 95% CI: 1.51–8.05).[60] Also in this study, the introduction of solid foods before 10 weeks of age or atopic disease in either parent increased the risk of atopic dermatitis in infants (OR: 2.94; 95% CI: 1.57–5.52). In a more recent prospective, longitudinal cohort study in which atopic dermatitis was confirmed by skin testing, 642 infants were followed until 5.5 years of age.[61] The history of the introduction of solid foods was carefully recorded during the first year of life. Most children had at least 1 parent with a positive skin-prick test result. Rice cereal was introduced at a median age of 3 months, milk was introduced at a median age of 6 months, and egg was introduced at a median age of 8 months. However, the later introduction of solids had no effect on the prevalence of asthma or atopic dermatitis (confirmed by skin-prick testing), although there was an increased risk of atopic dermatitis in relation to the late (6–8 months) rather than the earlier introduction of eggs (OR: 1.6; 95% CI: 1.1–2.4) or milk (OR: 1.7; 95% CI: 1.1–2.5).[61]

Finally, an ongoing prospective, cohort study[62] of 2612 infants (without a risk of developing atopic disease) found no evidence to support delayed introduction of solid foods beyond 6 months of age for prevention of atopic disease. However, in the same study, the effect of delayed introduction of solid foods for the first 4 months of life was less clear. Another study has even suggested that children exposed to cereal grains before 6 months of age (as opposed to after 6 months of age) are protected from the development of wheat-specific IgE.[63]

In summary, the evidence from these conflicting studies, in balance, does not allow one to conclude that there is a strong relationship between the timing of the introduction of complementary foods and development of atopic disease. This raises serious questions about the benefit of delaying the introduction of solid foods that are thought to be highly allergic (cow milk, fish, eggs, and peanut-containing foods) beyond 4 to 6 months of age; additional studies are needed.

SUMMARY

It is evident that inadequate study design and/or a paucity of data currently limit the ability to draw firm conclusions about certain aspects of atopy prevention through dietary interventions. In some circumstances in which there are insufficient studies (pregnancy and lactation avoidance diets, timing of introduction of specific complementary foods), the lack of proven efficacy does not indicate that the approach is disproved. Rather, more studies would be needed to clarify whether there is a positive or negative effect on atopy outcomes. The following statements summarize the current evidence within the context of these limitations.

1. At the present time, there is lack of evidence that maternal dietary restrictions during pregnancy play a significant role in the prevention of atopic disease in infants. Similarly, antigen avoidance during lactation does not prevent atopic disease, with the possible exception of atopic eczema, although more data are needed to substantiate this conclusion.
2. For infants at high risk of developing atopic disease, there is evidence that exclusive breastfeeding for at least 4 months compared with feeding intact cow milk protein formula decreases the cumulative incidence of atopic dermatitis and cow milk allergy in the first 2 years of life.
3. There is evidence that exclusive breastfeeding for at least 3 months protects against wheezing in early life. However, in infants at risk of developing atopic disease, the current evidence that exclusive breastfeeding protects against allergic asthma occurring beyond 6 years of age is not convincing.
4. In studies of infants at high risk of developing atopic disease who are not breastfed exclusively for 4 to 6 months or are formula fed, there is modest evidence that atopic dermatitis may be delayed or prevented by the use of extensively or partially hydrolyzed formulas, compared with cow milk formula, in early childhood. Comparative studies of the various hydrolyzed formulas have also indicated that not all formulas have the same protective benefit. Extensively hydrolyzed formulas may be more effective than partially hydrolyzed in the prevention of atopic disease. In addition, more research is needed to determine whether these benefits extend into late childhood and adolescence. The higher cost of the hydrolyzed formulas must be considered in any decision-making process for their use. To date, the use of amino acid–based formulas for atopy prevention has not been studied.
5. There is no convincing evidence for the use of soy-based infant formula for the purpose of allergy prevention.
6. Although solid foods should not be introduced before 4 to 6 months of age, there is no current convincing evidence that delaying their introduction beyond this period has a significant protective effect on the development of atopic disease regardless of whether infants are fed cow milk protein formula or human milk. This includes delaying the introduction of foods that are considered to be highly allergic, such as fish, eggs, and foods containing peanut protein.

7. For infants after 4 to 6 months of age, there are insufficient data to support a protective effect of any dietary intervention for the development of atopic disease.
8. Additional studies are needed to document the long-term effect of dietary interventions in infancy to prevent atopic disease, especially in children older than 4 years and in adults.
9. This document describes means to prevent or delay atopic diseases through dietary changes. For a child who has developed an atopic disease that may be precipitated or exacerbated by ingested proteins (via human milk, infant formula, or specific complementary foods), treatment may require specific identification and restriction of causal food proteins. This topic was not reviewed in this document.

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American Academy of Pediatrics
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POLICY STATEMENT

Electronic Prescribing Systems in Pediatrics: The Rationale and Functionality Requirements

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on Clinical Information Technology

ABSTRACT

The use of electronic prescribing applications in pediatric practice, as recommended by the federal government and other national health care improvement organizations, should be encouraged. Legislation and policies that foster adoption of electronic prescribing systems by pediatricians should recognize both specific pediatric requirements and general economic incentives required to speed the adoption of these systems. Continued research into improving the effectiveness of these systems, recognizing the unique challenges of providing care to the pediatric population, should be promoted.

BACKGROUND

The American Academy of Pediatrics (AAP) is committed to providing the best and safest health care system possible for children.

Statement of Problem

The AAP recognizes that the "increasing complexity in patient care in addition to the public's increased scrutiny of the health care system underscores the need to make patient safety an issue of high priority."[1] The AAP supports national efforts to improve patient safety and the recommendations of the Institute of Medicine, the Institute for Safe Medical Practices, the Leapfrog Group, and others who encourage the implementation and use of electronic prescribing (e-prescribing) by physicians as a method to improve patient safety.[2,3]

New Information

E-prescribing systems reduce transcription errors by eliminating illegible prescriptions. Computerized decision support can ensure that prescriptions are checked for drug-drug and drug-allergy interactions before the prescription is written. Dosage calculators can ensure that the correct dose of medication is given on the basis of patient age and weight, and dose-range checking can alert prescribers when doses outside the predetermined ranges are prescribed. Many e-prescribing systems can also check formulary information to determine if a selected medication is covered by a patient's insurance, thereby decreasing patient drug cost and increasing both patient and physician compliance with insurers' preferred-drug prescription programs.[5–9] Additional information is available in the accompanying technical report on e-prescribing.[4] Research examining the impact of e-prescribing on reducing malpractice claims might result in a commensurate reduction in malpractice

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Key Words
electronic prescribing, clinical decision support, pediatrics, adverse drug event, computer-assisted therapy

Abbreviations
AAP—American Academy of Pediatrics
e-prescribing—electronic prescribing

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liability insurance. Ongoing research will be needed to study the types of errors that may continue to occur after implementation of these systems, including potential new types of errors introduced by the use of e-prescribing systems. This research will guide refinements and improvements to the effectiveness of these systems.[8,10,11]

SUMMARY/CONCLUSIONS

The AAP believes there is sufficient evidence supporting the ability of e-prescribing systems to prevent medical errors and enhance patient care.[5–9] However, as with any new technology, the use of these systems may have unintended consequences or novel risks that will need to be monitored and studied over time.

RECOMMENDATIONS

1. Federally sponsored research should be conducted to document, in both inpatient and ambulatory (office) settings, specific characteristics of e-prescribing systems that are most beneficial in preventing errors and enhancing patient care. Office processes and methods of implementation that facilitate the effective and efficient use of e-prescribing systems require study.[10,12–14]

   Accurate data on the incidence and scope of prescribing errors, adverse drug events, and near-miss errors must be available. Regulations should be promoted to facilitate no-fault, anonymous adverse drug event reporting systems as an enabling step toward understanding and intervening to prevent medical errors.[1]

2. Because safety for children is paramount, e-prescribing systems used for the care of children should include, at a minimum, pediatric-specific decision support such as weight-based dose calculations and alerts and pediatric drug information and formulation options.[3,7,15–17]

   When possible, e-prescribing systems should be implemented as part of a robust electronic health record. Such implementations offer advantages well beyond those of freestanding e-prescribing systems. When implementing a stand-alone e-prescribing system, thought should be given to the potential future need to transfer data to, or interface the e-prescribing system with, an electronic health record.

3. Federal legislation that would unify state regulations and allow for e-prescribing and digital transmission of all prescriptions directly to pharmacies, including those for controlled drugs, should be encouraged.[18] The AAP furthermore supports legislation that would require all pharmacies, either directly or through a clearinghouse, to accept digitally transmitted and signed prescriptions. The AAP supports a process for the development of standards for the transmission of digital prescriptions, analogous to the standards-development process under the Health Insurance Portability and Accountability Act for electronic data interchange.

4. Despite significant benefits to medical and liability insurers, patients, and pharmacy benefit managers,[19] e-prescribing applications are an office-practice expense that generates a disproportionately small or no pediatric practice revenue; therefore, the AAP believes adoption of e-prescribing technology would be hastened by the offering of incentives such as pay-for-performance bonuses to practices that routinely use e-prescribing systems that incorporate clinical decision-support alerts.

5. Because practitioners in rural or low-income areas may face financial and system barriers and, in many cases, do not have access to the network infrastructure to support e-prescribing systems, federal grant and loan programs should be available to support system enhancements such as Internet access and start-up costs.

IMPLEMENTATION

Recommendations 1 and 5 (federally funded research and federal grants and loans for e-prescribing systems) may be implemented by providing research grants through the National Library of Medicine, the Agency for Healthcare Research and Quality, the Health Resources and Services Administration, and other federal and local agencies.

Recommendation 2 (minimum standards for e-prescribing systems) may be implemented by educating providers before purchase of such systems on the required elements through published reports such as the accompanying technical report.[4] Such reports should also be shared with standards-development organizations to encourage the inclusion of minimum requirements into the development of these standards.

Recommendation 3 (federal legislation on e-prescribing) requires action by the collaborative action of the Drug Enforcement Administration to develop standards for the secure digital transmission of category II controlled substances and enable federal legislation that takes precedence over the restrictions placed by state regulations.

Recommendation 4 (incentives for purchase) should be part of federal and state initiatives to reduce medical errors. Efforts to encourage larger insurers to underwrite such systems should continue—with demonstration projects to document the cost savings to them by the adoption of e-prescribing systems.

COUNCIL ON CLINICAL INFORMATION TECHNOLOGY, 2006–2007
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TECHNICAL REPORT

Electronic Prescribing Systems in Pediatrics: The Rationale and Functionality Requirements

Robert S. Gerstle, MD, Christoph U. Lehmann, MD, and the Council on Clinical Information Technology

ABSTRACT

This technical report discusses electronic prescribing systems and their limitations and potential benefits, particularly to the pediatrician in the ambulatory setting. In the report we acknowledge the benefits of integrating these systems with electronic health records and practice-management systems and recommend that the adoption of electronic prescribing systems be done in the context of ultimately moving toward an electronic health record. This technical report supports the accompanying American Academy of Pediatrics policy-statement recommendations on the adoption of electronic prescribing systems by pediatricians.

INTRODUCTION

Electronic prescribing (e-prescribing) systems are computer applications designed for use by clinicians to generate paper or electronic medication prescriptions.[1] They offer the clinician and the patient the promise of safer prescribing and improved office efficiencies, 2 major drivers for the adoption of such systems. Many organizations, notably the Institute of Medicine (IOM), the Institute for Safe Medical Practice (ISMP), and the Leapfrog Group,[2] involved in efforts to improve medical quality and reduce medical errors, have endorsed e-prescribing systems as a major tool in reducing medical errors.[3] The American Academy of Pediatrics has recognized that within the hospital, computerized physician order entry (CPOE) can prevent medication errors.[4]

One significant cause of medication errors has been the misinterpretation of physician handwriting. The National Hospital Ambulatory Medical Care Survey suggests that the prescription illegibility rate may be 1% to 2%.[5] Illegible orders may account for 30% of errors.[6]

In their simplest implementation, e-prescribing systems provide printer-generated, easily readable prescriptions that are less likely to be misinterpreted or misread by a pharmacist. The most completely envisioned e-prescribing systems provide extensive decision support to the clinician and offer additional office efficiencies designed to streamline the prescribing and renewal process, facilitate insurance formulary adherence, and improve prescribing safety.[7] This technical report will review the current state of e-prescribing to provide the clinician with an understanding of the subject and to better guide clinician decision-making in the adoption of this technology in the office setting.

CPOE is the component of the clinical information system that allows prescrib-

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Key Words
electronic prescribing, clinical decision support, pediatrics, adverse drug event, computer assisted therapy

Abbreviations
e-prescribing— electronic prescribing
IOM—Institute of Medicine
ISMP—Institute for Safe Medical Practice
CPOE— computerized physician order entry
OR— odds ratio
ADE—adverse drug event
EHR— electronic health record
OTC— over-the-counter
ASP—application service provider

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ers to enter orders (for medications and/or clinical procedures) directly into a computer for electronic processing and transmission to appropriate departments and/or individuals for completion.[8] The most obvious advantages of CPOE include the immediate transmission of orders without further transcription or delay to (usually) hospital departments, which eliminates transcription errors by nurses and speeds the health care–delivery process. Most research on CPOE has been performed in the inpatient setting. Analysis of research done on inpatient prescribing by the IOM resulted in the conclusion that 44 000 to 98 000 inpatient deaths could be attributed to avoidable medical errors, and many of these deaths could potentially be prevented by CPOE.[9] In an analysis at 1 academic medical center, 64.4% of errors were rated as likely to be prevented with CPOE (including 43% of the potentially harmful errors).[10]

Less is known about the error rates and resulting morbidity and costs to the medical system that result from prescribing errors in the outpatient setting. In 1 study, the use of e-prescribing in the emergency department demonstrated a reduction in prescriptions that contained errors (odds ratio [OR]: 0.31) or required pharmacist clarification (OR: 0.19).[11] The Center for Information Technology Leadership projects that use of e-prescribing would prevent more than 3 million adverse drug events (ADEs) and prevent 190 000 hospitalizations yearly. Potential financial benefits from the universal adoption of e-prescribing include a savings of $27 billion/year, including $2 billion/year from the reduction in ADEs.[12] As noted previously, knowledge of the specific health, safety, and financial impact of drug errors and e-prescribing in the pediatric outpatient setting is considerably less well understood.

Despite these limitations, there is a groundswell for the adoption of e-prescribing by the medical community. Organizations such as the IOM, ISMP, and Leapfrog Group have strongly endorsed e-prescribing; the Centers for Medicare and Medicaid Services will require e-prescribing as part of its Medicare prescription drug program; and insurers are looking to these systems as a way to avoid costly medical errors and to "enforce" compliance with tiered formularies to drive down their pharmacy costs. Thus, a number of commercial insurers are now underwriting the upfront costs for physicians who are willing to adopt this new technology. Currently, 5% to 18% of physicians are using some type of e-prescribing system in their offices, with this number expected to grow rapidly over the next 3 to 5 years.

BENEFITS

E-prescribing has potential benefits for public health, the patient, the insurer/pharmacy benefits manager, and the physician. Specific benefits to each are noted below.

Benefits to public health include:

- reduction in medical errors and associated costs to society;
- reduction in drug diversion (forgeries);
- improved patient care and improved health outcomes; and
- improved efficiency and reduced costs associated with prescribing.

Benefits to patients include:

- reduced chance for medication misadventures; and
- improved patient satisfaction.

Benefits to pharmacists, pharmacy benefit managers, and insurers include:

- workflow efficiencies;
- improved compliance with formulary prescribing, with attendant reduction in drug costs; and
- reduction in costs attributable to preventable ADEs.

Benefits to the physician include:

- improved office efficiencies for medication renewals;
- incentive reimbursement for compliance with formulary programs; and
- improved record keeping and documentation.

CPOE AND E-PRESCRIBING SYSTEMS REDUCE MEDICAL ERRORS AND IMPROVE OUTCOMES

Hospital-Based Studies

Accurately determining the frequency of medication errors is limited by findings that medical errors are significantly underreported in the incident-reporting systems used by many hospitals, especially when errors did not reach the patient (near-miss events).[13] Despite this limitation, however, 2.4% of hospitalized patients develop a clinically significant ADE during their hospitalization.[14] Medication errors are one of the most common medical errors and the most frequent cause of adverse events, accounting for 19% to 20% of all adverse events.[9,15,16] In pediatric patients, the most common type of medication error is a dosing error at the ordering stage.[17–19]

Preventable ADEs (eg, ordering and administering an incorrect medication or dosage) are more common than nonpreventable ADEs (eg, a newly developed drug allergy). In 1995, Leape et al[17] described poor dissemination of drug knowledge (29%) and inadequate availability of patient information (18%), such as the results of laboratory tests, as the most common causes of ADEs. An analysis of significant ADEs concluded that 52% of the cases were preventable; of these events, 50% could have been prevented by a pharmacist.[20]

E-prescribing tools have been used successfully to reduce errors in the prescribing process. Use in the emergency department demonstrated a reduction in prescriptions that contained errors (OR: 0.31) or required pharmacist clarification (OR: 0.19).[11]

Decision support provides knowledge, information, and data to the provider to optimize the selection and specification of medication for ordering. Such knowledge may be provided at the point of care through updated formularies for handheld devices and online guidelines and tools for specific domains such as infectious diseases.[21,22] A computer-assisted antibiotic-management program was able to reduce ADEs and reduce total costs in 1 study[23] and reduce length of stay and antibiotic use in another.[24] E-prescribing tools have been used successfully to prevent the prescription of gender-specific drugs for patients of the opposite gender.[10]

Pediatric Studies

Children are at increased risk of certain specific types of ADEs. Pharmacologic factors, including age-based variability in absorption, metabolism, and excretion of drugs as compared with adults, pose special vulnerabilities to the adverse effects of overdosing (often by an order of magnitude). Physiologic factors, such as the nearly universal need for weight or body surface area considerations in dosing and recognition of the variability of organ development, also make the medication process for pediatric patients more prone to dosage errors than for adults.[4,25]

Error rates for children seem to be inversely related to the weight of the patient, with infants in the NICU being most likely to experience medication errors and potential ADEs.[26,27] A study of errors for preterm neonates before discharge demonstrated a linear increase in medical error rates that was inversely related to birth weight, although the overall rate of errors was lower in comparison with children and adults.[28] Medical errors in pediatric patients are more likely to be caused by calculation or dose errors than in adults. Medications in adults that require weight-based calculation (the norm for pediatric patients) were found to be more error prone.[29,30]

Process factors, including the need for individualized dilution of stock medications and fluids (because of weight and body surface area considerations), place children at increased risk of medication errors in comparison with adults. Location-specific factors, such as the fast pace and high complexity in ICUs, are associated with a sevenfold risk of medication errors.[31]

Medication errors may occur at any step in the process, from ordering (56%) to transcription (6%), dispensing (4%), and administration (34%).[32–34] Orders by prescribers are the most error-prone steps in the medication process, with the wrong dosage being the most common type of error.[35–37] These errors may or may not be caught by subsequent checks, such as during dispensing and administration.[38] In pediatric inpatients, almost three quarters of all medication errors were discovered in the ordering stage.[27] In academic pediatric critical care settings, prescribing error rates of 11% to 30% were observed, compared with 6% of prescription errors in an internal medicine setting.[10,39,40]

The evidence for error reduction in pediatric patients using computerized systems is not yet robust. A recent Cochrane review[41] concluded that limited data from randomized trials exist on which to assess the effects of clinical decision-support systems in neonatal care. However, some evidence that highlights the benefits of CPOE in the neonatal population is emerging. Cordero et al[42] reported that implementation of CPOE resulted in a significant reduction in medication turnaround times and medication errors for selected drugs (gentimycin) and a decrease in ancillary service (radiology) response time. CPOE eliminates illegibility. Vanderbilt University's WizOrder system reduced the rate of errors caused by illegible pediatric intensive care orders from 1 error per 100 orders to zero.[39] CPOE with calculators and point-of-care decision support has also been used successfully to drastically reduce provider errors in the ordering of total parenteral nutrition[43] and continuous infusions.[44] An ambulatory study from Singapore showed that automated calculation reduced pediatric prescribing errors from 28.2% to 12.6%.[45] CPOE has also been shown to reduce errors in the ordering of chemotherapy agents in pediatric patients.[46]

Ambulatory Care Studies

ADEs are common in ambulatory care, and many are preventable or ameliorable.[34] E-prescribing tools in outpatient settings have been used successfully to lower prescription costs through electronic, evidence-based decision support during the prescribing process.[47] Computerized prescription systems have been shown in randomized trials to improve the quality of anticoagulation.[48]

LIMITATIONS OF CPOE AND E-PRESCRIBING IN REDUCING ERRORS

Computerized ordering and prescription tools have been advertised as means to reduce the frequency of ADEs.[49] However, evidence exists that computerized systems cannot prevent all errors or ADEs and may, in some situations, be responsible for new types of errors.[50,51] A recent study of a 110-bed computerized Veterans Administration hospital found 70 ADEs per 100 patient-days (significantly higher than previously reported).[14] The authors suggested that the legible and accessible electronic records may have facilitated the increased identification of ADEs. Of note in the Veterans Administration study is the finding that errors in ordering (74%) accounted for a larger percentage of errors than previously reported (56%).[51] At the same time, errors

during transcription and administration were reduced. The authors speculated that these findings were a direct result of the system design—a computerized system that eliminates need for transcription and ensures legibility but lacks decision support for drug selection and dosing—and will "redistribute" error frequencies. In other words, unless an electronic system is designed to prevent errors at the ordering stage, it will not prevent these errors; on the contrary, it will increase the speed at which these errors can be committed and executed. Another recent study from the University of Pennsylvania that evaluated an older CPOE system with very limited decision support received significant media attention when the authors concluded that a leading CPOE system often facilitated medication-error risks.[50] Although there was no comparison between manual ordering and CPOE, the authors emphasized that electronic systems will do just what they are designed to do. If they are not designed to provide decision support, they will not do so. In contrast, a study of the WizOrder CPOE system at Vanderbilt University demonstrated that a CPOE system that includes sophisticated decision support at the point of order entry may reduce medication-prescribing errors by 99.4% and rule violations (deviations from ordering policy) by 97.9%.[39] A recent study in a PICU showed that implementation of a CPOE system, even in the early months after implementation, was not associated with an increase in mortality.[52]

In addition to incomplete design, computerized prescription-writing tools are limited to the content of the program. For example, they may have a limited drug inventory or lack dose-range information and may, especially when used on handheld devices, pose usability problems.[53] Fernando et al,[54] who used simulated test cases, found that computing systems currently in use in approximately three quarters of general practices in the United Kingdom have clinically important safety deficiencies.

The Rand Electronic Prescribing Expert Advisory Panel has provided 60 capability recommendations for ambulatory prescribing systems.[1] However, a recent study of 10 commercially available e-prescribing systems demonstrated that only 50% (range: 26%–64%) of these recommendations were implemented.[55] It must be recognized that electronic systems are only as good as they are designed and implemented. A system that strives to provide legibility and accessibility only will improve the error rate in transcription and administration processes but not in ordering processes. For CPOE and e-prescribing systems to reduce provider ordering errors, they must be integrated with sophisticated clinical decision-support capabilities.[39]

E-PRESCRIBING SYSTEMS

An e-prescribing system, at its simplest, is a computer application that allows physicians to print out prescriptions (a word processor would fulfill this definition). The advanced vision of an e-prescribing system, however, is that of an application that facilitates the rapid and efficient generation of prescriptions (including electronic renewals); includes a knowledge base with drug information relevant to the prescribing process; performs all necessary calculations automatically and accurately; checks for prescription completeness, drug contraindications, drug interactions, allergies, and medical conditions that affect prescribing; verifies appropriateness of dose on the basis of patient age, weight, gender, and medical conditions (eg, renal insufficiency); checks insurance formulary preferences; and then transmits the prescription electronically to the pharmacy. An ideal closed-loop system would also receive data back from the pharmacy to confirm that the patient has filled the prescription.

Although generating printed prescriptions would be expected to reduce medical errors related to handwriting, it is the integrated clinical decision support, automatic calculations, and electronic transmittal functions that are likely to have the greatest effect on physician prescribing habits and to improve the safety and efficiency of the prescribing process. Merely printing out prescriptions can be done on a word processor; a fully functional e-prescribing application requires significant domain knowledge often contained in database tables and is most effective when integrated (bidirectional data transfer) with office practice–management and/or electronic health record (EHR) systems. Higher levels of systems are associated with higher startup costs and complexity and are generally associated with higher benefits. These levels of e-prescribing have been described.

Electronic Drug Reference Only; No Prescription-Writing Capability

This functionality is supplied by commercially available software programs, many of which are designed for mobile personal digital assistants, that allow access to drug dosages, contraindications, adverse effects, and drug interactions. It is important that reference data be kept current and updated at least monthly.

Stand-Alone Prescription Writer With No Medication History or Supporting Data

In addition to providing electronic drug references, a stand-alone writer provides computerized printing of prescriptions that are then given to the patient or manually faxed to the patient's pharmacy.

Reference Data and Prescription Writer With the Addition of Basic Supporting Data Such as Allergies, Demographics, Past Prescriptions and Formulary Information, Which Can Be Used to Generate Alerts

This functionality allows the application to incorporate clinical decision support (including drug-allergy, drug-

drug, and dose-range checking; renal function adjustments; and possibly preferred insurer formulary information) but requires the input of information (eg, demographics, allergy history, other concurrent medications, renal function/creatinine), often manually, depending on interfaces to practice-management systems, laboratory systems, EHRs, and insurer formulary databases.

Medication Management: Long-term Tracking and Monitoring of Each Patient's Active Medications

This level contains the previous functionality and maintains a database of the patient's previous prescriptions and prescription renewals. These applications typically monitor for drug-drug interactions automatically. These systems should also allow for the manual entry of other medications the patient is taking. Less commonly available, but useful, is the ability to enter alternative and nonprescription medications. Some vendors offer the ability to check for drug interactions with alternative medications.

Unidirectional Connectivity From Practices to Pharmacies, Payers, Pharmacy Benefit Managers, or Clearinghouses

This type of system typically provides the previous functions and allows for the electronic transmittal of prescriptions to pharmacies and often includes subscriptions to electronic versions of insurance formularies to identify preferred and tiered drugs and alert for noncovered medications. This requires that patient insurance information be entered into the e-prescribing system or transferred from practice-management systems.

Integration With a More Complete EHR

Systems integrated with an EHR allow for a wider range of clinical decision support without the need to manually reenter data into the e-prescribing system. They also automatically update the patient's current medication list within the EHR.

Bidirectional Connectivity Between Physicians, Pharmacies, Payers, Pharmacy-Benefit–Management Programs, or Clearinghouses

This functionality is not generally available in systems today but is in the planning stages. It would allow for feedback of prescription information from the pharmacy to the clinician, such as confirming that the prescription has been received, has been given to the patient, or is overdue for refilling, thus enabling compliance monitoring by the physician and improved medical management.

Bidirectional functionality could allow physicians to receive up-to-date information from other physicians' prescribing systems or from the pharmacy on their patient's prescriptions, such as information on prescriptions prescribed by another physician or in another care setting. Up-to-date medication lists are essential for accurate drug-interaction checking.

BARRIERS AND POTENTIAL SOLUTIONS TO E-PRESCRIBING ADOPTION

Despite the opportunities potentially available with the use of e-prescribing systems, a number of potential barriers have slowed their adoption. Among others, these barriers include the following.

Failure to Recognize Current System Deficiencies

Often, physicians do not perceive that they make prescription errors or have illegible handwriting. They do not perceive themselves as part of the drug-error problem and are often reluctant to change their practices.[56]

Technology Barriers (Equipment Setup and Maintenance) in the Office Setting

The lack of access to a broadband Internet connection especially affects smaller and more rural practices. Those practices may also suffer from lack of access to the technological support they need.

Implementation, Training, and Maintenance Cost

Establishing e-prescribing in the office is not a 1-time expense. Licensing and maintenance-agreement costs are ongoing and are generally not offset by a reduction in other office expenses. E-prescribing may not be more time-efficient than handwriting prescriptions and could affect office productivity, particularly in the initial implementation phase. Additional manual data-entry requirements may also reduce efficiency. Potential office cost benefits may result from improvements in the medication-renewal process, reduction in manual chart pulls, and compliance with insurer incentive programs for using generic or preferred drugs. However, even these efficiencies may not always allow for a reduction of office staff, which would equate to decreased office salary expense.

Beneficiary-Payer Discrepancy (Misaligned Incentives)

Although providers must carry the bulk of the investment for e-prescribing systems, benefits from automation are more likely to accrue primarily to others such as insurers, pharmacists, and patients. Patients appreciate the potential of having prescriptions ready to be picked up without a wait. Without incentives to physicians to invest in e-prescribing systems, the adoption of this technology by physicians is likely to be slow.[12]

Interface/Integration Costs

It is likely that physicians in the future will want to implement a complete EHR system in their offices. Transferring data from the e-prescribing system or integrating the e-prescribing system with an EHR system can be difficult and expensive. Physicians expecting to move

to an EHR system in the near-to-medium future will need to build in a transition strategy to avoid duplicate data-entry costs.

Existing Legacy Systems

Although most pharmacies can accept facsimile transmissions, many still do not have the ability to electronically accept transmitted prescriptions into their electronic pharmacy systems and, thus, miss out on potential benefits. Even where pharmacies can accept the electronic transmissions or facsimiles, pharmacy workflow may be such that the drug is not dispensed before the patient arrives to pick up the medication.

Legal and Regulatory Barriers

In regard to e-prescribing, nonuniform state regulations and lack of federal standardization (preempting state regulations) place an additional burden. In particular, regulations on controlled substances that mandate triplicate prescriptions and special forms may significantly limit the use of e-prescribing. Pediatricians commonly prescribe schedule II controlled substances (eg, stimulants for attention-deficit/hyperactivity disorder) and might, therefore, not be able to fully benefit from e-prescribing. The Drug Enforcement Agency currently allows e-prescribing of controlled drugs in category III to VI and is considering issuing digital certificates and using public-key infrastructure encryption to allow for digital prescription for category II drugs.[57] Until state and federal legislatures generate a uniform regulatory approach, e-prescribing systems are required to fulfill all mandates or to be tailored for use in specific states.

Negative Past User Experiences

Poorly designed systems have been available for several years and may have given the market a bad reputation. Current systems are evolving to be more user friendly, intuitive, and customizable. Nonetheless, any potential user of an e-prescribing system should test a system that is in actual use before investing the significant resources required. Testing should include some of the more complex prescriptions used in practice, such as prednisone tapers, drugs that require additional information or diagnosis to be included on the prescription, drugs with as-needed indications, and over-the-counter (OTC) drugs (covered by some insurers with prescription). Physicians must be aware of the fluidity of the vendor market and must appreciate the risk involved in the bankruptcy, sale, or merger of their e-prescribing system vendor and the possible subsequent discontinuation of software maintenance and technical support for their system.

Lack of Standards

Several transmission standards for prescriptions exist; however, a move toward consolidation of standards has been underway, and the recent Centers for Medicare and Medicaid Services move to establish electronic standards under the Medicare Part D prescription drug plan will help to establish a de facto standard.[58] However, these rules, regulations, and standards only apply to prescription drugs. E-prescribing systems may not be set up to handle prescribing or provide decision support for OTC and alternative medications.

OPTIONS AND FUNCTIONAL REQUIREMENTS

There are many ways to implement e-prescribing systems; solutions that work for one practice may not work for another. Careful consideration of the risks and benefits of implementation alternatives is necessary. It is critical that physicians considering the use of e-prescribing be aware of the risks including costs (purchase, training, workload, and maintenance) as well as legal and regulatory requirements in their state.

All systems that are capable of electronically transmitting prescriptions share certain characteristics such as a need for connectivity. Most will require dedicated telephone lines or broadband Internet connectivity, a potential problem in more remote areas. All of them will require a computer, modem to connect to the telephone (usually dedicated digital subscription line) or Internet (via digital subscription line or cable), and likely a router. The need for connectivity may introduce a single point of failure in which a malfunction may render the whole system inoperable, particularly for those applications that run as an application service-provider (ASP) system.

If more than 1 computer or device in the office is to be used for prescribing, a computer network or a way to synchronize information will be necessary. The input equipment can be a computer (desktop, laptop, tablet computer), wireless handheld device, or personal digital assistant. The network can be wired, wireless, or a combination of both. A wireless router and perhaps several wireless antennas will be required for wireless networks. When local printing of prescriptions is planned, printing may be centralized within the office, or multiple printers may be necessary, possibly convenient to each examination room. If integrated electronic facsimile transmission is not part of the e-prescribing system, a fax machine for manual transmission may be required. Technical help is usually required to wire and set up networks.

Systems can be administered from off-site centralized locations through an ASP, where everything is "done for you" to manage the system, or maintained on-site in the office. ASP systems use secure connections to allow office access devices to be logged into the remote system. With the ASP model, patient data are typically stored off-site, but in either case regular data backups need to be ensured.

Computer interfaces to transfer data from other office

systems (eg, practice management or scheduling) can initially be expensive but may save providers time by eliminating the need to enter demographic data and by keeping data current and synchronized across multiple systems with single data entry. There are usually additional costs associated with purchasing and integrating various databases, including insurance company drug formularies, prescribing-information updates, decision-support data, and pharmacy lists with up-to-date fax numbers.

A number of insurers have been paying the implementation costs for selected e-prescribing systems, at least for their high-volume prescribers. Insurance companies expect to realize benefit from providing e-prescribing systems to providers by steering physicians to the selection of specific preferred drugs and the reduction in ADEs to insured clients. Some medical societies have negotiated "discounted" deals with preferred e-prescribing providers. It is estimated that the direct cost of implementing a stand-alone system can be under $2000 per physician and, in some cases, considerably less. However, the cost of implementing an integrated EHR with an e-prescribing component is considerably higher. Providers will need to determine if an integrated EHR solution, although more expensive and difficult to implement, will have other offsetting benefits that would justify the additional work and expense.

Physicians must be aware that the market for these applications is somewhat "fluid" as vendors come, go, and merge with others. Choosing a product from a well-established, financially stable vendor, although no guarantee of sustainability, will help to ensure longer-term product support. Thus, it is important that an "exit strategy" be in place, including provision for recovery of the data contained in the system (in a standard nonproprietary database format). Ongoing costs are for equipment depreciation and replacement, renting telephone or Internet access, licensing and maintenance-agreement costs, and staff training and can vary considerably.

An expert consensus panel recently published recommendations for comparing e-prescribing systems.[1] They categorized the functionality to be assessed into the categories summarized below. They noted that no current system met their recommended criteria fully.

Patient Identification

Patient name, gender, and date of birth or age must be visible throughout the ordering process. These data should be imported from other systems when available, or the system should allow for manual entry when not imported. Duplicate records created under separate identities for one individual should be able to be reconciled and merged. The ability to perform patient searches using combinations of date of birth, gender, and partial name helps to positively locate and identify patients.

Access to Patient Historical Data

The system and clinicians should have access to external sources of data (hospitals, pharmacies, laboratories, EHRs) and be able to review all patient prescriptions, not just those written by the current provider, as well as OTC and alternative medications taken by the patient. The ability to manually enter additional patient medications is required. Current and past medication-prescription details should be viewable by class, with start and stop dates. When a medication is discontinued or changed, a notification should be sent to the original prescriber. When a diagnosis is entered, a list of medications by diagnosis should be viewable.

Medication Selection

When the e-prescribing system is presented with a patient diagnosis, a customizable selection of appropriate medications should be presented to the user. Prepopulated lists or dynamically maintained lists of common medications based on prescribing frequency can speed medication ordering. Medication options should not be influenced by vendor or insurer promotional considerations.

When the system displays a preferred drug, the rationale for that preference should be immediately viewable, and contraindicated medications (based on allergy or drug interactions) should not be viewable as a preferred medication choice. Prescribing by medication name should override restricted-medication menus. The system should provide formulary status and cost to the patient for medication options on the basis of insurance and any benefit or prescribing caps. Clinical summary data useful to the selection process should be easily accessible.

The user should be able to easily select the drug form and available strengths for each medication. Dosing recommendations based on calculations of body size (weight or body surface area) and age, when appropriate, should be available. When appropriate, adjustments calculated and based on renal and liver function should be made. The ability to default to generic drug name on prescriptions should be available (unless specifically overridden) to aid in insurance prescribing compliance programs and reduced costs to patients.

Alerts and Other Messages to Prescribers

Dose-range checks based on dose, dose per weight, daily dose, daily dose per weight, and lifetime dose-checking alerts should be available. Prescribers should be alerted when there is a contraindication or precaution based on allergy, drug interaction, medical condition, or laboratory results. The system should send a reminder when a medication is indicated in a particular instance (immunization due or medication based on diagnosis, laboratory results, and peer-reviewed recommendations). Messages should provide a clear rationale for any rec-

ommendations. Messages not based on patient safety concerns should be suppressible to avoid "alert fatigue." A user should be able to prioritize safety alerts and set a threshold that allows only alerts of a certain level/priority to result in a message to a provider while other alerts are suppressed. Providers should be able to override alerts with reasonable justification, and the system should track all changes and their justification. Prescribers should be able to flag or correct (update) incorrect information.

Patient Education

Patient medication-information sheets, written at an appropriate level for patients and their parents, and patient medication lists should be printable. Information sheets should be editable or customizable (and then saved for reuse) for pediatric indications (eg, β_2 blockers used for migraine control, not heart disease; digoxin for arrhythmia control, not congestive heart failure). Patient education materials should be able to be edited or personalized and be available in other languages in addition to English.

Data Transmission and Storage

Prescriptions should be able to be transmitted to the patient's pharmacy of choice. Transmission should conform to current Health Level 7 (HL7) and National Council for Prescription Drug Programs standards. Physicians should receive transmission and dispensing receipts and should be notified of any transmission failures.

When prescriptions are printed locally and given to the patient, prescription abbreviations should be avoided, and the prescriptions should be consistent with best-practice recommendations (eg, Joint Commission on Accreditation of Healthcare Organizations or ISMP).[59,60]

Monitoring and Renewals

The prescriber should be notified electronically when a prescription or refill is not dispensed within a provider-specified time period. Ideally, the system should alert the clinician to place orders for manufacturer-recommended laboratory monitoring and alert the physician when laboratory results require action. Prescriptions and renewals entered should be clearly attributable to the person who enters the order.

Many e-prescribing systems have a messaging ability integrated into the system so that nurses and clerical staff can access the system and forward renewal requests that come in directly from patients. Office processes and staff training needs require attention.

Transparency and Accountability

The system should clearly display any sponsorships or relationships that could represent conflicts of interest and any sources and methods used to develop clinical decision-support rules and messages.

Prescriber-Level Feedback

Prescribers should be able to review profiles of their own prescribing patterns and history of overriding alerts.

Security and Confidentiality

Systems must be compliant with the Health Insurance Portability and Accountability Act (HIPAA). Access to protected health information should be auditable. Each user should have a unique sign-on and password and role-based access privileges. The system should support data integrity checking of stored and transmitted data. Provisions for the routine backup of data and secure storage must be considered. Firewalls may be needed to protect systems, and antivirus software must be current if the network is not dedicated to the e-prescribing application. Access-management processes must be in place (eg, to revoke access when an employee is terminated).

CONCLUSIONS

Ultimately, the issue for consideration is "not if, but when." A uniform system for providing incentives and removing barriers to the adoption of e-prescribing systems by physicians who wish to use these systems will likely be needed to accelerate the migration to e-prescribing. The expenditure of time and money to implement a well-designed e-prescribing system has the potential, in the long run, to benefit society, the patient, the insurer, and the physician.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Robert S. Gerstle, MD, and the Task Force on Medical Informatics

E-mail Communication Between Pediatricians and Their Patients

ABSTRACT. This report addresses specific e-mail patient communication issues relevant to pediatricians and their appropriate use of e-mail in the office setting. The report briefly reviews: 1) e-mail privacy and security concerns; 2) e-mail in the office environment; 3) the legal status of e-mail; and 4) available e-mail technologic solutions. *Pediatrics* 2004;114:317–321; *electronic communications, health care delivery, medical liability, e-mail, pediatrics.*

ABBREVIATIONS. HIPAA, Health Insurance Portability and Accountability Act; PHI, protected health information.

The American Academy of Pediatrics Periodic Survey of Fellows No. 51 documented that of the 1616 active US members reporting from October 2001 to February 2002, 14% already use e-mail to communicate with patients. Reasons cited for using e-mail included managing requests for prescription refills (54%), communicating test results (41%), and scheduling appointments (37%). Reasons for not using e-mail to communicate with patients included lack of physician time (52%), lack of office staff time (42%), concerns about privacy or confidentiality (45%), lack of interest in communicating via e-mail (38%), and too few patients with e-mail (34%).[1] The volume of e-mail sent daily in the United States was expected to exceed 9 billion messages in 2003.[2] A Harris Interactive survey reported in April 2002 that "about 90% of US adults who use the Internet say they would like to communicate with their physicians online . . . ."[3] The study went on to report, "56% said that ability to communicate with their physician online would help influence their choice of physician."

The popularity of e-mail is attributable to some of its unique characteristics, namely its ability to allow asynchronous communication and rapid message transfer, making it a hybrid of the telephone and the written letter.[4] As it is used, e-mail is a more informal means of communication than the letter, but more rapidly transmitted. Like a letter, it can be sent or read by the recipient at convenient times, avoiding "telephone tag." In addition, it is "self-documenting," providing a lasting copy for future reference. Thus, it is no surprise that pediatric patients and their families share the desire to use e-mail to communicate with their pediatricians.[3–5] E-mail would seem to offer physicians and patients obvious benefits for facilitating communication. Therefore, it may seem somewhat surprising that there has been relatively slow adoption of e-mail as a patient communication tool by pediatricians and other physicians.[4] There are many reasons for this, including but not limited to concerns about maintaining the confidentiality of e-mail, physician concerns about the potential volume of e-mail correspondence, and potential legal issues.[1,5]

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

BACKGROUND: E-MAIL TECHNOLOGY

The transmission of e-mail messages requires: 1) access to a global network of linked computers, called the Internet; 2) the existence of an addressing system that enables messages to be routed through that network of computers to their correct destinations; and 3) programs that split messages into standard-sized "pieces," pack them into electronic "envelopes" or packets that have address information for routing each packet, and reassemble the message at the intended destination.

By design, the Internet is a very robust communication system with an architecture that was structured to maintain communication in case of national disasters that might result in the destruction of significant amounts of the national communications network (such as in the case of nuclear war). Messages transmitted across the Internet are not normally encrypted; nor is there typically authentication of author identity. Lack of encryption allows those with access to the Internet network to intercept, read, or potentially alter messages as they pass to their final destinations. These risks are not unique to e-mail. Telephones can be tapped (legally or illegally); scanners can monitor portable telephone communications; traditional mail can be intercepted, read, or altered, and letters can be forged. Despite potential confidentiality and security risks, it seems on the basis of volume alone that most people are comfortable using e-mail, particularly for relatively trivial or mundane communication needs. The perceived benefits of this fast, asynchronous, and relatively inexpensive form of communication appear to outweigh the risks to most users.

PRIVACY AND SECURITY RISKS

Physicians have special ethical and legal obligations to maintain the privacy and confidentiality of their communications with and regarding patients. Additionally, pediatricians and others who provide medical services to children and adolescents have special burdens and responsibilities by the nature of their patient population.[6,7] E-mail communication with patients adds complexity and responsibilities for the pediatrician, the office staff, and the patient and patient's family.

Pediatricians have the legal responsibility, whenever health information is requested by or communicated to an individual, to ensure that: 1) the individual has a legitimate right to release or gain access to that information before releasing or communicating that information by letter, by phone, in person, or by e-mail; 2) the information is directed only to those having a right to receive it; and 3) the information is accurately transmitted and received. These are the requirements to ensure the authenticity, confidentiality, and integrity of information exchange.[8,9]

Authenticity refers to a recipient's ability to positively know the identity of an individual sending a communication.[10] Anyone can send e-mail with virtually anyone's name attached to it. The inability of e-mail to provide methods of authentication presents a significant risk to patients and physicians. E-mail authentication has been one of the more difficult issues to address when using e-mail for medical communication. Two general solutions to the authentication problem, digital certificates and secure networks, will be discussed briefly later in this report.

Confidentiality refers to the need to protect information from those who have no legitimate right to the information presented.[11] Risks to patient confidentiality occur when multiple individuals (eg, family members) share the same e-mail address, when access passwords are not used or are not kept secured, when computers are left on and unattended without logging out of e-mail, or when e-mail at work or at school is used for personal communication. Using e-mail on systems that belong to employers, other organizations, or schools presents particular problems. Many e-mail users do not know that most organizations and companies, as policy, consider organizational e-mail to be their property and reserve the right to read e-mail on their systems. Another threat to confidentiality results from the ease with which e-mail messages can be misaddressed and erroneously sent to unintended recipients, instantaneously broadcast to multiple recipients, or forwarded by others to unintended recipients.

Integrity of message transmission refers to having absolute knowledge that the message received was unaltered and identical to the one transmitted and that the message was sent and received by the appropriate person.[11] Because e-mail messages can be intercepted, especially by hackers who break into an e-mail server but also by individuals who might gain access to another's personal electronic mailbox, there may be justifiable concern about integrity of messages. Of more concern is that a message sent to one individual might be altered by the recipient. The altered message, its intent perhaps drastically changed, might then be forwarded to another person.

E-MAIL IN THE PHYSICIAN OFFICE ENVIRONMENT

Office e-mail and confidentiality policies, procedures, and processes need to be in place before e-mail with patients can successfully, safely, and effectively be used in the office. Merely distributing or advertising a practice's e-mail address to patients may have unintended consequences. This address will rapidly become quite public, resulting in the office receiving a variety of unsolicited e-mail. A major concern is that individuals who are not current office patients may e-mail the office with medical questions. Office processes may get mired with the volume of e-mail received. The practice needs a way to determine which messages are from "legitimate" or established patients or families and needs to decide whether it will respond to queries from nonpatients. Distinguishing which messages are from current patients from those that are not can be difficult. E-mail address names may be aliases (eg, Superstud2) or common or nonunique names (eg, David Miller or Jose Rivera). Pediatric offices typically identify patients by the child's name but may have problems identifying e-mail from a parent, particularly if the message does not reference the child's name and birth date. Incorporating structured e-mail forms that require specific patient identifying information (eg, first and last name, date of birth, and practice identification or Social Security number) to be completed as part of the message helps simplify patient identification. In addition, the use of passwords as a means of identification and access can diminish the risk of outside or inappropriate access to communications.

Another concern beyond identification is that of e-mail attachments. E-mail attachments can cause a variety of problems, including the transmission of computer viruses (potentially paralyzing the computer system), the use of excessive memory, the need to read and print messages and attached documents for inclusion in patient records (using staff resources), or the need for versions of software that are not available on the office system. To rectify this issue, pediatric offices can consider restricting the use of attachments as part of patient messages. Attachments might be restricted to reports or attachments from professional sources, such as other physician offices, emergency departments, and hospital medical records departments. Having the ability to control which users may append attachments can lend a lot of flexibility to an e-mail system.

Occasionally, situations occur in which an office may want to have the ability to block the receipt of e-mail from certain individuals. E-mail systems that allow the office the ability to inactivate passwords or block e-mail from specific individuals can effectively

restrict e-mail system access for selected patients by the office when necessary.

It is very important for practices to set realistic expectations for e-mail and communicate those expectations to families. Patients must understand what the office considers a reasonable response time for nonurgent messages and must understand that emergency communication is appropriately handled by telephone, not by e-mail. Communications that are usually appropriate for e-mail include routine appointment requests, billing questions, routine prescription refill requests, provision of follow-up information, and chronic disease management questions. By providing patients with office e-mail policies in written form before they receive an e-mail password, posting the policies on the practice Web site, and verbally reinforcing these policies, pediatricians and their staffs can help patients to understand and adhere to the appropriate use of e-mail.

There are other considerations the pediatrician needs to address before providing pediatric patients with e-mail access to the office. Policies can address the age at which pediatric patients can begin to send e-mail to the office themselves. Will children and parents receive the same brochures and sign the same consents (or assents)? Will parental permission be required before a child can receive a password to access office e-mail? Although there are not necessarily any right or wrong strategies, patients and their parents must know and understand office practices and policies.

Patients typically desire to communicate by e-mail with their physician's office to schedule appointments, refill prescriptions, resolve billing questions, request referrals, obtain test results, get forms or immunization records completed, ask nonurgent medical questions, or provide medical follow-up. Most of these tasks can be delegated to an appropriate office staff member. Patients must understand who in the office will read and triage e-mail as well as the limits to privacy that messages will have in the office. Patients must know when, for example, messages addressed to a particular individual in the office, even about personal matters, may be first subjected to clerical or nurse review. E-mail systems that can automatically triage messages to the appropriate office staff member, depending on the type of message, can improve efficiency and patient confidentiality. Patients can be informed that by restricting e-mail messages to one issue per message, message triage efficiency and patient confidentiality might be enhanced. The office also needs to have policies and processes to address messages that arrive when a pediatrician or designated office staff person is unavailable or has elected not to have the messages forwarded to them, and to address e-mail received on weekends, holidays, or whenever the office is closed. Routine policies can be incorporated into a patient e-mail brochure, and the policy can be reinforced using the "auto reply" feature included in most e-mail software, stating when action will be taken on messages and telling the patient to call the office for more urgent matters. Copies of e-mail messages with responses can be incorporated into patient charts. Patients can be advised to retain copies of e-mail sent by the office to avoid their forgetting or misunderstanding the intent of messages.

A well-constructed patient brochure outlining office e-mail policies and the appropriate use of e-mail will help control patient expectations and prevent misuse of e-mail by patients. Although some offices may require patients to sign a consent form allowing e-mail communication, it is more important that patients and parents clearly understand the differences among, and appropriate use of, each available form of communication. It is a good practice to document that each patient has been provided with written information that addresses the appropriate use of e-mail and office policies and procedures that support e-mail. This information can be provided before office e-mail addresses or access passwords are given to patients.

Drawing an analogy to telephone communications, e-mail communication is another way to enhance patient communication and satisfaction and to build goodwill. Just as there are no regulations that preclude charging patients for telephone advice, except as may be contained in insurance contracts, there are no restrictions on charging patients for advice rendered by e-mail. Some insurers have begun to consider e-mail an important part of chronic disease management and have started to selectively reimburse physicians for e-mail communication related to disease management.[12,13] More plans are expected to begin reimbursing clinicians for online consultation for both acute and chronic conditions. Because e-mail self-documents, it can provide the evidence of medical work that telephonic communication does not offer. Thus, insurers have been more willing to consider reimbursement for e-mail interactions. *Current Procedural Terminology*[14] codes for care plan oversight (99374-99380) already exist and are reimbursable under some insurance plans.[15] Case management services telephone calls (99371-99373) presently are restricted to telephone use but might be broadened in the future to include e-mail services.

LEGAL STATUS OF E-MAIL IN HEALTH CARE

The Health Insurance Portability and Accountability Act (HIPAA)[8,9] privacy and security regulations apply to e-mail communications that contain a patient's protected health information (PHI), as defined in HIPAA privacy regulations.[16] HIPAA requires encryption of messages when sending PHI over the Internet. If the pediatrician is using a third party to manage the e-mail system, HIPAA privacy regulations require a written business associate agreement with the service provider. HIPAA privacy regulations require that physician offices provide each of their patients or patient's families with an outline of the office's privacy practices. Final HIPAA security regulations[9] released on February 20, 2003, require physician office networks to have appropriate protection (firewalls and physical security) to prevent unauthorized individuals from gaining access to clinical e-mail or medical records, and to have appropriate safeguards to prevent the loss or unauthorized access to or distribution of PHI. Privacy regu-

lations under HIPAA also require the ability to provide for author and user authentication for e-mail transmissions.

Just as for telemedicine, issues related to medical licensing and jurisdiction can be raised when communicating with patients and providing patient care or advice across state lines by e-mail. Although it is unlikely the pediatrician would be in jeopardy of prosecution for practicing medicine without a license by giving medical advice to an established patient via e-mail, it is important that pediatricians check their state's law on this issue. Some states have begun to address this issue in their state medical practice legislation, with the possibility of requiring a state medical license for such transactions.

There can also be medical liability risks related to providing "medical care" by e-mail or Internet communication. Before medical liability can exist, one must demonstrate that a patient-physician relationship has been formed. The establishment of the patient-physician relationship, or "duty," has not been well clarified when using e-mail or the Internet exclusively to provide advice in the absence of any physical contact. Arguably, an analogy can be drawn to the situation in which a physician provides general information on a local radio or television broadcast. In such cases, in which information is general in nature and not meant to diagnose or treat a specific individual, there is no relationship or duty established. Although case law has not been well established, there have been concerns raised as to whether a patient-provider relationship would be initiated when advice is given in an online forum ("bulletin board" or "chat room"). However, in cases in which there is a previous patient-physician relationship or in which a Web site is created to solicit patient queries, the risk of medical liability is greater.

Failure to meet patients' service expectations or follow one's own office policies and procedures can result in liability. The situation in which a physician fails to respond in an appropriate time frame to a patient e-mail, resulting in an adverse outcome, for example, might present a liability risk, emphasizing the need to educate patients about the appropriate use of e-mail and about appropriate response time expectations. Patients must be instructed and must understand when it is appropriate to escalate queries by telephoning the office directly. Although e-mail is widely used, neither the legal nor medical liability communities have significant precedents for dealing with potential e-mail communication risks. Pediatricians should monitor for the development of such precedents in the future.

E-MAIL TECHNOLOGIC SOLUTIONS

There are two commercially available solutions to the problem of providing authenticated, confidential, secure e-mail: secure servers or digital signatures.[17] Each of these approaches affords remedies for authentication of identities and facilitates secure communication with patients. No system, however, is perfect. Any system depends on patients and providers recognizing their responsibilities to keep passwords private and secure and to log off of systems properly when leaving computers unattended.

The secure server solution is analogous to doing banking online. The pediatrician's office must initially authenticate the identity of the patient, such as at the time of an office visit, and provide a sign-on code and temporary password specific to that individual. When the patient logs on to the system for the first time, he or she then changes the temporary password to a new and confidential one known only to the user. When a message is sent to that patient's system mailbox by the office, a secondary nonsecured notice is sent to the patient's identified home e-mail account alerting the patient to log on to his or her secure mailbox on the system. Logging on is accomplished securely using the patient's confidential password and via the Web browser's secure socket layer. Secure socket layer transmission across the Internet is encrypted between the mail server and the patient. Only the individual with the password to that account has access to it. From the secure mailbox, patients can also securely send messages back to the pediatric office. Such messages reside on the server, and the office logs on to the mail system securely, as does the patient. In this type of system, unencrypted messages containing medical information never travel on the Internet.

Digital signatures rely on the use of "keys" to encode (encrypt) messages sent across the Internet. The sender of a message has a private key that is used for coding the message. The receiver has a complementary public key to decode the message, thus making it readable.[18] These keys are not physical devices but rather strings of random characters that are used in the mathematical encrypting algorithm. Authentication of identity occurs before a key is released to a user, and a certification authority handles management of public and private keys. Authentication can still be an issue depending on the identity control mechanisms used.[17,18] Presently, these systems are complex to administer and cumbersome to use. However, in the future, perhaps by using smart cards or biometric forms of authentication (eg, fingerprint readers), these systems may grow in popularity.

Commercially available e-mail systems can provide added value beyond simply the ability to transmit and receive e-mail. They can provide e-mail encryption, authentication, and password management; can facilitate automatic triaging of messages on the basis of message type; and can provide the ability to "auto-fax" prescriptions to pharmacies. Some systems can assign "rights" to certain users (such as to append attachments) or allow for associated business transactions (charges for communications) to be handled online. Costs of these systems can vary widely, but for a very modest cost, most offices can implement basic secured messaging.

CONCLUSION

Successful communication between patients and pediatricians is an essential element to providing quality care and maintaining patient satisfaction. Although under certain circumstances, only face-to-

face communication is appropriate, there are other times when other forms of communication, including direct telephone contact, facsimile transmission, traditional mail, and now, e-mail would be appropriate—although they should not be considered interchangeable. Pediatricians and their patients must be aware of the risks, benefits, and limitations of any form of communication. E-mail is still an emerging vehicle for communication. Its ability to allow for the rapid asynchronous transmittal of messages and to "self-document" makes it particularly popular despite the potential confidentiality risks. These risks can be acceptably minimized with appropriate forethought and planning.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Policy Statement—Emergency Information Forms and Emergency Preparedness for Children With Special Health Care Needs

AMERICAN ACADEMY OF PEDIATRICS
COMMITTEE ON PEDIATRIC EMERGENCY MEDICINE AND
COUNCIL ON CLINICAL INFORMATION TECHNOLOGY
AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
PEDIATRIC EMERGENCY MEDICINE COMMITTEE

KEY WORDS
EIF, emergency information form, children with special health care needs, EMS, emergency medical services, disaster preparedness, emergency preparedness, quality improvement

ABBREVIATIONS
EMS—emergency medical services
HIPAA—Health Information Portability and Accountability Act
EIF—emergency information form
AAP—American Academy of Pediatrics
ACEP—American College of Emergency Physicians
EHR—electronic health record
VAC—volts of alternating current

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abstract

Children with chronic medical conditions rely on complex management plans for problems that cause them to be at increased risk for suboptimal outcomes in emergency situations. The emergency information form (EIF) is a medical summary that describes medical condition(s), medications, and special health care needs to inform health care providers of a child's special health conditions and needs so that optimal emergency medical care can be provided. This statement describes updates to EIFs, including computerization of the EIF, expanding the potential benefits of the EIF, quality-improvement programs using the EIF, the EIF as a central repository, and facilitating emergency preparedness in disaster management and drills by using the EIF. *Pediatrics* 2010;125:829–837

INTRODUCTION

Children with chronic medical conditions, including children with special health care needs, rely on multiple medications, medical technologic devices, and complex management plans, which can cause them to be at increased risk of acute deterioration, medical errors, and suboptimal outcomes. Their conditions make them particularly vulnerable and prone to complications; therefore, they frequently rely on emergency care in the ongoing management of their special medical conditions. A detailed understanding of an individual's special health care needs is required to provide optimal emergency care.[1–9]

When children with special health care needs access emergency medical services (EMS) or seek emergency care in a busy emergency or urgent care facility (or in the midst of a disaster), it is difficult for EMS personnel and/or the attending physician to review lengthy medical records (if they are available at all) and coordinate care with multiple specialty care providers.[9] A summary describing their medical condition(s), medications, and special health care needs is necessary to reduce delays in diagnosis and treatment and facilitate greater efficiency in the provision of emergency care to children with special health needs.

The transfer of traditional health-record information is slow and becoming more difficult for the following reasons:

1. Because of greater documentation requirements, health records are more comprehensive, which makes it more difficult to find important items related to the patient's condition.

2. Delays are often caused by information-transfer consent requirements and misunderstandings surrounding the regulations of the Health Information Portability and Accountability Act (HIPAA).
3. Minimum necessary standards for release of information under HIPAA can interfere with gathering a complete set of pertinent information.
4. In a disaster scenario, the transfer of health records can be problematic because of an inability to access them, or paper records may be destroyed in the disaster.

The emergency information form (EIF) was proposed as a means to provide rapid access to a health summary for children with special health care needs in a 1999 joint policy statement (reaffirmed in 2002) by the American Academy of Pediatrics (AAP) and the American College of Emergency Physicians (ACEP).[9] The EIF is a type of personal health record that was introduced as a concise, single-sheet summary designed to provide the essential information needed initially to treat a patient with special health care needs.

Experience since publication of the 1999 statement has identified the following:

- The EIF has been underused, because many health care providers and families of children with special health care needs are unaware of the EIF. Many providers consider EIF completion to be time-consuming and do not recognize the need for the EIF.
- The paper-based EIF is helpful but suboptimal for incorporation into electronic health records (EHRs) and for central repository access.[10]
- Maintaining and/or updating EIFs can be difficult and time-consuming.
- Vaccine schedules and requirements change frequently, so the immunization table on the EIF needs to be able to accommodate these changes.
- Disaster-management plans must include medical care for children with special health care needs. If a disaster compromises the availability of health records, an EIF would be beneficial in providing useful information such as medication doses.[11,12]

ADVANCING THE EIF TO A COMPUTER APPLICATION

- The computerized EIF can be easily updated with new information (eg, newly identified allergies, change in severity, addition of new problems, change in advance directives, change in specialists and their contact information) and provides an automated date stamp as to when it was most recently updated.
- The computerized EIF can be modified to accommodate system changes, such as legal requirements, immunization tables, and consents.
- A paper form physically limits the amount of information provided on the form and is not sufficiently adaptable for patients with a large set of problems. A computerized EIF can expand and adapt to the needs of the patient.
- The use of a computer-based EIF permits a central repository through which the EIF can be accessed remotely via the Internet rapidly. A capability to access a number of EIFs can also be built into such a system to facilitate a coordinated disaster response for children with special health care needs.
- Computerization of EIFs facilitates quality-improvement measures targeted at children with special health care needs and the use of the EIF.
- Computerization of EIFs facilitates the deployment of EIFs as a database that can be integrated into the EHR and can potentially be shared and networked between compatible hospitals and systems.
- A computerized EIF can accept templates or cut-and-paste management routines (clinical pathways) that are frequently recommended, such as the standard initial management of a child with tetralogy of Fallot.
- It should be noted that a computerized EIF might not be retrievable in the event of a power failure or damage to communication infrastructure (includes the Internet). An inkjet-printed paper document will smear. A water-resistant paper document or a "thumb drive" or compact disc containing the file in a plastic bag (together with insurance papers and other key documents) is more likely to be usable under certain disaster conditions.

EXPANDING THE POTENTIAL BENEFIT OF THE EIF

- The process of initiating an EIF by the medical home and the patient's specialists should include a review of likely emergencies and recommended therapies in the event of an acute exacerbation of the child's chronic condition(s). This review enables subspecialists to recognize the difficulties faced by nonspecialists encountering their patients for the first time and facilitates the codification of initial management measures to improve communication with other care providers involved in the patient's care. Examples of this include which laboratory tests should be ordered for a patient with an inborn error of metabolism, what type of intravenous fluid should be started, and whether the patient should be fed or kept off oral intake (NPO).
- Because EIF use is not yet routine, quality-improvement programs should target EIF initiation and

maintenance, and this should be added to the growing list of quality indicators for a primary care medical home that manages children with special health care needs.[9]

- The process of initiating an EIF affords the primary care physician and appropriate specialists an opportunity to further explore and discuss the difficult issues surrounding end-of-life care options for children and the inclusion of advance directives. Updating the EIF permits recurring opportunities to confirm or update these advance directives. Many states have an official form that permits out-of-hospital providers to honor advance directives that must be completed, and in these instances, this form could be electronically attached to the EIF, or the EIF could list the physical or online location of the completed official form.
- The process of initiating and maintaining an EIF should include an action plan for a disaster and a method to monitor disaster preparedness as part of a quality-improvement program.

QUALITY-IMPROVEMENT PROGRAMS USING THE EIF

- "EIF maintenance" includes the initial EIF as well as updating it when appropriate and confirming its validity during each health care visit. Each review or modification of the EIF should be dated.
- The percentage of children with special health care needs with an EIF in a practice can be audited by dividing the number of EIFs in the practice that are known to exist by all children with special health care needs in the medical home primary care practice (EIF-eligible patients). A central repository of computerized EIFs would facilitate the identification of all the EIFs in the practice. Improvements in this percentage demonstrate quality improvement.
- EIF maintenance can be monitored by the mean number of days since the last EIF update or confirmation for all the EIFs in the practice. Reducing this mean value demonstrates quality improvement, because more-current EIFs are more accurate.
- The EIF can be used to track the participation level and frequency of disaster drills. Whether this is an actual drill done at home or a discussion or mental review of what to do in the event of a specific type of disaster can be documented in the EIF. Because electrical power failure is such a common event, the EIF should document that an action plan for this has been reviewed with the family and whether an actual trial or drill has been done at home. The percentages of EIFs with a documented electrical power failure action plan review and/or an actual home drill can be used as a quality parameter. Increasing percentages demonstrate quality improvement. As this number approaches 100%, further quality improvement can be documented by monitoring the mean number of days since the last electrical power failure action plan review and/or actual home drill. Reducing this mean value demonstrates quality improvement, because recent review and practice of a disaster action plan should improve the likelihood of success.

EIF CENTRAL REPOSITORY

A central repository would provide access by primary care providers, patients, parents, pharmacies, other specialists, and emergency care practitioners.

Although central EIF-repository maintenance and access is highly desirable, implementation faces significant challenges. Measures that promote immediate access and revision/update inherently conflict with measures that preserve confidentiality of protected patient information.

Routine access can be secured by user authentication via the standard method (log in plus password). Known authorized users have access to the EIFs of patients with whom they are known to be linked but not to those of other patients, which permits the expected users of the EIF to have easy access to confirm, update, and revise the EIF at each routine visit.

Emergency access to the EIF is a more difficult issue. The Midwest Emergency Medical Services for Children Information System (www.memscis.org) is an EIF central repository program in Minnesota that uses a "break-the-glass" entry for emergency access to EIF information.[10] This terminology clearly distinguishes routine EIF-maintenance activities from emergency information access. Emergency access via the "glass breaker" is obtained by entering the requestor's identifying information. No system with broad access can totally guarantee patient confidentiality.

The Internet is far-reaching and is the obvious means to achieve broad access via a centralized server or a linked set of servers. Sophisticated traces can identify unauthorized access sources; however, tracing access from public terminals, unauthorized use of an open terminal, freestanding Internet stations, unsecured wireless networks, and foreign-country access is substantially more difficult or impossible.

Although high security is desired to protect patient information when developing new information systems, it should be noted that standard paper-record systems in use have relatively low security/protection measures. Parents and patients should be made

aware of the inherent compromises in patient confidentiality that must be made to facilitate emergency access. Although perfect confidentiality is often expected or desired, it is unrealistic, especially when compared with the current security status of all health records (paper and electronic).

The Midwest Emergency Medical Services for Children Information System has demonstrated feasibility on a smaller scale, and its experience suggests the need for the advocacy of local physician champions and referral center entities for enrollment success to be achieved.[10]

THE ROLE OF THE EIF IN PREPARING FOR A DISASTER[11,12]

- The EIF permits many different health care providers, regardless of background, to provide initial care to children with special health care needs.
- The EIF should include a plan in the event of a disaster, the most common of which is the loss of electrical power. Lack of access to medications, water, food, shelter, and transportation should also be considered. At a minimum, medical home practitioners should consider the planned response for likely emergencies and disasters.
- For technology-dependent children, the loss of electrical power (a common occurrence even in the absence of natural disasters) is a significant disaster event. A simple temporizing measure is that all critical life-support devices should include an internal battery back-up, a power-failure alarm, and a secondary means of back-up power (see Technical Appendix 1). A hospital's back-up generator electricity is a fairly reliable source of electricity, and transport to the hospital to use it can be considered, but it should not be relied on entirely, because back-up generators are not always reliable, there might be significant traffic getting to the hospital, and there might be overcrowding at the hospital because of other patients doing the same thing. Identifying alternate sites of back-up power should be part of a disaster plan. Hospitals should anticipate their role as a source of electrical power during a prolonged power failure and should plan back-up generator capacity to meet the needs of the hospital plus the needs of technology-dependent patients who are likely to use the hospital's electrical power.
- The EIF should include a prompt to enter the date of the most recent disaster drill for the most common type of disaster that is anticipated, such as the loss of electrical power.
- The different types, severity, and duration of disasters make it practically impossible to develop a single action plan to specifically and comprehensively manage all disasters. Some geographic regions are more prone to specific types of disasters, and some patients are particularly more vulnerable to specific types of disasters. Determining the most likely disaster (after electrical power failure) is geographic and patient specific.
- Extreme disasters are uncommon, yet survivability during an extreme disaster depends on being prepared in knowing what to do and having the necessary equipment and resources to survive. Extreme and less common disasters are more difficult to drill and are more realistically reviewed with mental exercises that verbally simulate what might happen and what the response would be.
- Because disasters are usually uncommon and difficult to predict, it might be more useful to prepare for generic categories of shortages rather than for a specific type of disaster. For example, several different types of disasters will result in the nonavailability of an important resource that is normally available, such as food, water, shelter, clothing, medication, electrical power, transportation, and medical services. However, mass trauma, bioagent, chemical, or radiation exposure disasters represent challenges that are not necessarily related to resource shortages.

RECOMMENDATIONS

1. Medical home primary care physicians (ideally together with motivated families) are the most qualified persons to globally coordinate completion of the EIF for children with special health care needs[4,8] by obtaining specific recommendations from the pertinent specialists (eg, what type of intravenous fluid to use for a patient with a metabolic condition or what antidysrhythmia measures should be tried first in a patient with recurrent dysrhythmias). Specialty care physicians will need to assist and provide specialty recommendations to ensure that their patients are properly managed.
2. Completion of the EIF should be the responsibility of the medical home primary care physician and specialty care providers for every child with special health care needs. Medical home primary care physicians should be strongly encouraged to include an EIF as part of the patient's health care maintenance and medical home. For the onset of new conditions for which the tertiary pediatric center has initial access to the patient, an EIF should be initiated during hospitalization (eg, a preterm infant is born, hospitalization

for newly diagnosed diabetes mellitus, hospitalization for a traumatic brain injury sustained in an automobile collision).

3. Ideally, EIFs should be reviewed periodically by local emergency care providers to confirm that the recommendations are clear and that the necessary specialized equipment, medications, and services are available at the emergency care center.
4. EIF maintenance should be a routine part of the ongoing care of children with special health care needs and should be performed every 6 months (and at each health encounter as needed) to confirm the validity of the EIF and/or update specific changes in the patient's clinical status on the EIF.
5. End-of-life planning and advance-directive updates and confirmations should be included in the EIF-maintenance process when appropriate. The EIF affords medical home primary care physicians with an opportunity to discuss this most difficult but necessary topic as part of the patient's ongoing care. This can also serve as a reminder for the medical home primary care physician to discuss with the family the need for any forms required by out-of-hospital providers to honor advance directives.
6. A central standardized electronic repository of EIFs needs to be established and maintained to facilitate updates to and retrieval of EIFs. The repository should be set up by a national medical lead agency, such as the AAP and/or the ACEP, a private national health care organization, and/or an agency of the federal government.
7. An electronic EIF that is compliant with existing American Society for Testing and Materials Continuity of Care Record (ASTM CCR) and Health Level 7 Continuity of Care Document (HL 7 CCD) standards and with HIPAA requirements should be endorsed by the AAP and ACEP as a first step toward a national repository of EIFs. When possible, the EIF data elements should use standardized nomenclature such as the Systematized Nomenclature of Medicine (SNOMED). In addition, the EIF should be accessible via the Internet. EIF standardization will facilitate EHR development and help to ensure that the content of the EIF is accessible in a variety of clinical settings.
8. A central repository does not guarantee availability of the information. A water-resistant paper document or a thumb drive or compact disc that contains the file, kept in a plastic bag (together with insurance papers and other key documents), is more likely to be usable under certain disaster conditions.
9. Quality-improvement parameters of EIF use and maintenance should be added to the growing list of quality indicators for a primary care medical home.
10. Disaster planning should be included as part of the EIF-maintenance process. Medical home primary care providers must consider and anticipate the most likely emergencies and other potentially serious disasters and review the planned response with patients and caregivers. At a minimum, medical home practitioners should consider the planned response for likely emergencies and disasters.
11. Although it might be an expectation that the computerized EIF should be included in this policy statement, the specifications of creating a computerized entity with all the functionality described is a difficult task given the evolution of computer systems, EHRs, access methods, confidentiality/security requirements, and the experience of pilot projects that are currently determining the best way to achieve this. The actual computerized EIF and a reasonable implementation plan should be developed into a technical report to follow. Although other computerized EIF entities have been proposed, it would be premature for the AAP to endorse any of these at this time. A sample computerized EIF is provided for reference (see Appendix 2). The paper EIF version (www.aap.org/advocacy/eif.doc) contained in the original policy statement (www.pediatrics.org/cgi/content/full/104/4/e53) can still be manually modified to achieve part of the functionality described above until a computerized EIF standard can be developed and recommended.
12. Fair reimbursement for these services is necessary. Initiating, completing, and maintaining an EIF and other quality-improvement activities associated with the EIF add value but are time-consuming activities that optimize care coordination for children with special health care needs. Optimal care coordination is worthy of and, indeed, contingent on fair reimbursement for these services by medical home primary care and specialty care providers. *Current Procedural Terminology* (CPT) codes for telephone calls, prolonged service, team conferences, and care-plan oversight and management already exist and can be used to bill for these services. Reimbursement for these services should be a standard part of all health benefit packages.

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TECHNICAL APPENDIX 1: ELECTRIC POWER ALTERNATIVES

A simple and economical recommendation for powering life-support devices in the event of an electrical power failure is for all technology-dependent patients to have an available 12-V inverter, which is an inexpensive device that plugs into a car's cigarette lighter to deliver 110 to 120 volts of alternating-current (VAC) power. By plugging into a 12-V inverter, the patient's life-support device can be further sustained by using the automobile's battery, which can provide power on its own for a moderate period (depending on the power requirements of the life-support device) and indefinitely as long the automobile's engine is running (until the car runs out of gas). There are different power capacities of 12-V inverters (measured in watts) that must exceed the sum total of the power requirements of the life-support devices required by the patient. For example, if the patient's ventilator is rated at 110 to 120 VAC, 100 W, and the patient's oxygen concentrator is rated at 110 to 120 VAC, 150 W, then the 12-V inverters must be able to match this power capacity. This can be accomplished by having two 12-V inverters (one rated at >100 W and the other rated at >150 W) or a single 12-V inverter rated at more than 250 W. Using two 12-V inverters requires that 2 cigarette-lighter sockets be available. Using a single 12-V inverter requires that this inverter have two 120-VAC outlet sockets on the inverter to accommodate both devices.

The power ratings of the 12-V inverters are limited by the electrical current capacity of the automobile's wiring and fuses. Typically, most cigarette lighters are on 20-ampere (A) (sometimes 10-A) fused lines, which means that if the 12-V inverter draws more than 20 A of current, the fuse will blow (break) and no power will be available until the fuse is replaced. Replacing the fuse with a 30-A fuse (ie, one that is rated higher than what is in the car) is dangerous, because the higher current will exceed the electrical-current capacity of the wiring and could cause a fire. Power in watts is calculated by multiplying voltage and current (amperes). Thus, the 20-A circuit fuse limits the maximum wattage to 240 W (12 V × 20 A). Having 2 cigarette-lighter sockets in the same car does not increase this maximum, because it is likely that both cigarette lighter outlets are on the same circuit. If the sum exceeds 20 A or 240 W, the 20-A fuse will still blow.

The watt rating (power rating) of the life-support device should be stamped on the device itself. If it is not, then the current rating (in amperes or milliamperes) should be stamped. If the device plugs into a standard household outlet, it will be rated at 120 VAC. If the device is rated at 1.5 A, then the power rating will be 180 W (120 V × 1.5 A). The power rating (in watts) of the 12-V inverter must exceed the power rating of the life-support device. These calculations are all theoretical and must be tested in a drill to determine if everything will actually work. During the drill, it should be confirmed that the life-support device is in fact running off of the 12-V inverter and not the device's internal battery. Depleting the internal battery will test the 12-V inverter's ability to charge the battery as well, but a back-up power option must be available in case this does not work. Note that it will take more power and current to run the life-support device and charge the battery at the same time, so the drill should test the 12-V inverter under these more stressful conditions. Some devices have uneven power requirements such that periodic surges of power are required. For example, a feeding pump might have a low power consumption while pumping formula, but its power consumption will increase if pumping in something more viscous, such as formula with cereal. Power surges must also be within the range of power that the inverter can deliver.

There are high-wattage (eg, 500, 1000, and 2000 W) 12-V inverters, but they cannot be plugged into an automobile cigarette lighter. They can run off of an automobile battery directly with high-capacity cables. This requires more technical expertise and is more risky, because there is the possibility of a battery short circuit, which could melt wires, damage the life-support device, or cause a fire. If the life-support device requires such high power, it would be useful to get some technical advice on how to do this. The process is similar to "jumping" a dead car battery with jumper cables. A high-wattage life-support device will deplete the automobile's battery rapidly, so the car's engine should be running to prevent the battery from dying. The process of starting the car (ie, turning the key) will place a large stress on the car's battery briefly, which could cause a brief decrease in power to the life-support device if it is running on the car's battery when the car is started.

Portable generators can also be used to provide electrical power. These generators require gasoline and

motor oil to run. Small generators are rated at approximately 500 W, with larger generators capable of 5000 W and higher. Generators are fairly reliable, but they are often kept in storage and difficult to access when they are suddenly needed. Also, storage does not necessarily guarantee that the generator will work when it is needed. It should be noted that gasoline cannot be stored. Its composition changes with time, and old gasoline will likely damage the generator (similar to putting gum in it) regardless of whether the gasoline is stored in the generator's tank or in a gasoline-storage container. Because gasoline cannot be easily stored, it is often siphoned from automobile gas tanks. This can be hazardous to the siphoner's lungs if done incorrectly. Most generators require special motor oil, so several liters of the correct oil need to be available when the generator is run. All of these factors require that periodic drills be done to be certain that the generator will run when it is needed. Follow the generator's maintenance instructions during periods of nonuse to reduce the likelihood of generator failure when it is truly needed.

The generator or automobile engine must be run in a well-ventilated location to avoid carbon monoxide accumulation. When traveling outside of the United States, it should be noted that different countries use different voltage, current, and outlet-socket configurations.

Sophisticated generators that burn propane, natural gas, liquid petroleum gas, diesel fuel, or fuel oil or use fuel cells are much more expensive and beyond the scope of this report.

Disclaimer: The information contained in Technical Appendix 1 does not represent the opinion, recommendation, or policy of the AAP and is provided for information and consideration only. The AAP recommends that families contact the manufacturer(s) of electrical equipment used in the care of children with special health care needs in developing a plan of action in the event of electrical power failure.

APPENDIX 2: SAMPLE COMPUTERIZED EIF

Disclaimer: The information contained in Appendix 2 does not represent the opinion, recommendation, or policy of the AAP and is provided for information and consideration only as an example of a computerized EIF. It is not intended to serve as a standard of medical care.

Emergency Information Form For Children With Special Health Care Needs

Patient ID

Today's date		Who is completing this form? You must confirm consent to use this form:	
Your name		Is this a new form or just an update? ○ Update ◉ New	
CONSENT REQUIRED →		I (above named person) confirm that parent/guardian consents to the use of this form	☐ Consent
Patient's name		Address	
Birthdate		Nickname	
Primary language		Parent/guardian	
Contact phones		Emergency contacts	

Facilities & Providers

Care Provider	Provider's Name	Specialties	All contact phone numbres (E-mail optional)	Fax
Primary Care				
Specialist-1				
Specialist-2				
Specialist-3				
Specialist-4				
Specialist-5				
Others				
Primary Pharmacy (branch, phone, other)				
Anticipated primary emergency department (name, phone, other)				
Anticipated tertiary care center (name, phone, other)				

Clinical Baseline

Diagnoses/problem list (list all) starting with most important	
Baseline physical findings	
Baseline vital signs	
Baseline neurologic status	
Immunologic competency status	
Synopsis of clinical status	
Medications (doses, purpose)	
Antibiotic prophylaxis (drug, dose, indication)	
Significant baseline lab/imaging/diagnostic studies	
Prostheses, appliances, advanced technology devices, life support	
Allergies: Medications, foods, substances to be avoided and why	
Advanced directives (include date of last review)	
Procedures to be avoided and why	

ED Management

Describe common presenting problems/findings		Suggested studies	Treatment recommendations
Problem-1			
Problem-2			
Problem-3			
Problem-4			
Problem-5			
Problems-other			
Comments on child, family, or other specific medical issues			

Immunizations

DPT dates		Varicella status	
Dtap dates		Hep B dates	
OPV or IPV dates		Hep A dates	
MMR dates		Meningococcal	specify which one if possible
HiB dates		TB status	
Pneumococcal-7		HP virus	
Other		Other	

Disaster Planning & Drills

Check or enter at least two of the most likely disasters that could affect this patient:

☐ Power failure	☐ Fire, forest fire
☐ Hurricane	☐ Infrastructure (roads, communication) damage
☐ Tornado	☐ Shelter structure damage
☐ Earthquake	☐ Food and water supply compromise
☐ Flood	☐ Medication, supplies, equipment compromise
☐ Tsunami	☐ Nuclear radiation accident (fallout, meltdown, contamination, detonation, etc.)
☐ Blizzard	☐ Explosion, blast, Other (e.g., terrorism, biological accident, chemical accident, other weat
☐ Avalanche	☐ Other (e.g., terrorism, biological epidemic/accident, chemical accident, other weather event)
☐ Land/Mud slide	
Other (describe)	Other (describe)

Disaster drills reviewed or practiced with patient. Documentation of completed drills and planned dates for future drills.

Date	Disaster type	Example drills:	Describe type of drill
		verbal review	
		paper review	
		table top model	
		computer simulation	
		hand on practice	
		equipment review	
		in home review	
		alternate electrical power	
		electric generator use	

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Endorsement of Health and Human Services Recommendation for Pulse Oximetry Screening for Critical Congenital Heart Disease

abstract

FREE

Incorporation of pulse oximetry to the assessment of the newborn infant can enhance detection of critical congenital heart disease (CCHD). Recently, the Secretary of Health and Human Services (HHS) recommended that screening for CCHD be added to the uniform screening panel. The American Academy of Pediatrics (AAP) has been a strong advocate of early detection of CCHD and fully supports the decision of the Secretary of HHS.

The AAP has published strategies for the implementation of pulse oximetry screening, which addressed critical issues such as necessary equipment, personnel, and training, and also provided specific recommendations for assessment of saturation by using pulse oximetry as well as appropriate management of a positive screening result. The AAP is committed to the safe and effective implementation of pulse oximetry screening and is working with other advocacy groups and governmental agencies to promote pulse oximetry and to support widespread surveillance for CCHD.

Going forward, AAP chapters will partner with state health departments to implement the new screening strategy for CCHD and will work to ensure that there is an adequate system for referral for echocardiographic/pediatric cardiac evaluation after a positive screening result. It is imperative that AAP members engage their respective policy makers in adopting and funding the recommendations made by the Secretary of HHS. *Pediatrics* 2012;129:190–192

Delayed diagnosis of critical congenital heart disease (CCHD) can result in death or injury to infants. The current approach to detect CCHD in the United States relies on prenatal ultrasound examinations and the physical examination findings in the newborn nursery. Unfortunately, this approach fails to identify a significant number of cases of CCHD, which may lead to late diagnosis with significant morbidity, permanent injury of vital organs, and in some cases, death. A number of studies have revealed that adding pulse oximetry to the assessment of the newborn can enhance detection of CCHD. Pulse oximetry is a readily available, noninvasive, and painless technology that can be incorporated into the routine assessment of the newborn.

On September 21, 2011, the Secretary of Health and Human Services (HHS), Kathleen Sebelius, recommended that screening for CCHD be

SECTION ON CARDIOLOGY AND CARDIAC SURGERY EXECUTIVE COMMITTEE

KEY WORDS

pulse oximetry, critical congenital heart disease, recommended uniform screening panel, screening, newborn infants

ABBREVIATIONS

AAP—American Academy of Pediatrics
CCHD—critical congenital heart disease
HHS—Health and Human Services
RUSP—recommended uniform screening panel

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added to the recommended uniform screening panel (RUSP). This recommendation was based in large part on the Secretary's Advisory Committee on Heritable Disorders in Newborns and Children's recommendations and a 2-day comprehensive evidence review of screening strategies by national and international stakeholders. The American Academy of Pediatrics (AAP) strongly supports the decision of the Secretary of HHS to add screening with pulse oximetry to the RUSP. The AAP has been a vigorous advocate of early detection of CCHD to prevent childhood deaths or injury that might occur as a result of late detection.

There are a number of important issues that relate to the implementation of pulse oximetry into the routine care of the newborn. A detailed description of these issues has been published by the AAP.[1] This publication provides a detailed screening algorithm developed by the Secretary's Advisory Committee on Heritable Disorders in Newborns and Children. It also provides detailed recommendations regarding necessary equipment, personnel and training, and appropriate management of a positive screening result. The highlights of screening implementation are as follows:

- The screening is targeted toward healthy newborn infants in the newborn nursery.
- Screening should be performed with motion-tolerant pulse oximeters. It is appropriate to use either disposable or reusable pulse oximetry probes.
- Screening should not be undertaken until 24 hours of life or as late as possible if early discharge is planned to reduce the number of false-positive results. Separate consideration for home births is necessary.
- Oxygen saturations should be obtained in the right hand and one foot. Threshold for a positive screening result is detailed in the publication and relates to both the absolute reading by the pulse oximeter as well as the difference between the 2 extremities. Screening that has a pulse oximetry reading of $\geq$95% in either extremity with a $\leq$3% absolute difference between the upper and lower extremity would be considered a pass, and the screening would end. It is recommended that repeated measurements be performed in those cases in which the initial screening result was positive, again in an effort to reduce false-positive results. Infants with saturations <90% should receive immediate evaluation. It is important to note that the oxygen saturation thresholds for a positive screening result may vary at high altitude. Appropriate studies need to be performed at high altitude to establish reliable thresholds.
- In the event of a positive screening result, CCHD needs to be excluded with a diagnostic echocardiogram. Infectious and pulmonary causes of hypoxemia should also be excluded.

The AAP can play an important role in assuring the safe and effective implementation of screening for CCHD. This includes preparing members to implement screening; engaging pediatricians to participate in quality-improvement activities to ensure that newborn infants are appropriately screened with follow-up echocardiograms and specialty care, as required; partnering with public health agencies for surveillance of CCHD; and advocating for appropriate payment for all screening-related activities. In addition to promoting the implementation of pulse oximetry based screening programs, the AAP supports widespread surveillance for CCHD. Such surveillance will yield several benefits, including documentation of any improvement in detection as well as identification of areas of weakness for this comprehensive screening strategy.

Although the Secretary of HHS has recommended that screening for CCHD be added to the RUSP, it will be up to states to determine how they wish to incorporate this into their own screening programs. This may be accomplished by legislation, regulation, or adoption as a standard of practice. The majority of disorders identified on the RUSP are adopted by most states, but there is variability among the states. A number of states have already incorporated routine screening for CCHD into the statewide panel. These states can serve as a paradigm for subsequent implementation by other states.* It will be critical that AAP chapters work with state health departments to implement the new screening strategy for CCHD in a manner that is adequately financed, cost-effective, and practical; that ensures screening and for echocardiographic/pediatric cardiac evaluation and therapeutic intervention as indicated with provision for follow-up for all newborn infants within the framework of the medical home; and that ensures that related payment issues for technical and professional services are addressed. It is hoped that through these collaborative efforts, the burden of delayed diagnosis of congenital heart disease will be reduced and the health of children will be enhanced for years to come.

*For more information on your state law, please contact the AAP Division of State Government Affairs at stgov@aap.org.

RECOMMENDATIONS

- Pulse oximetry screening for CCHD should be performed by using evidence-based guidelines such as those reported by the Secretary of HHS Advisory Committee Work Group, as detailed in the algorithm in the special article on screening for congenital heart disease.[1]
- AAP members should encourage incorporating pulse oximetry screening into routine newborn care and the development of effective systems to allow for timely and accurate diagnostic assessment with echocardiography and to ensure a medical home for those found to have CCHD.
- AAP chapters, AAP members, and local advocates should engage their respective policy makers at the federal and state legislative and regulatory levels in considering, adopting, funding, and implementing the recommendations made by the Secretary of HHS to ensure the development of the educational materials; training; equipment, including echocardiography and telemedicine needs; system development; and support with access to funding ensured for all components of medically necessary care.
- The AAP will actively engage other stakeholders and the American Medical Association to develop appropriate *Current Procedural Terminology* codes for pulse oximetry screening with appropriate relative value units and should advocate for appropriate payment for CCHD screening-related activities.

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1. Kemper AR, Mahle WT, Martin GR, et al. Strategies for implementing screening for critical congenital heart disease. *Pediatrics*. 2011;128(5). Available at: www.pediatrics.org/cgi/content/full/128/5/e1259

Environmental Management of Pediatric Asthma

Guidelines for Health Care Providers

N • E • E • T • F
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NIEHS National Institute of Environmental Health Sciences

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This document has been reviewed in draft form by individuals chosen for their unique perspectives and technical expertise. The purpose of this independent review was to elicit candid and critical comments that would assist in making this publication as sound and effective as possible. We thank the following individuals for their review of this document:

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Although the reviewers listed above provided constructive comments and suggestions, they did not see the final draft of the document before its release. Responsibility for the final content rests with The National Environmental Education & Training Foundation.

Table of Contents

Introduction

These guidelines are the product of a new Pediatric Asthma Initiative aimed at integrating environmental management of asthma into pediatric health care. This document outlines competencies in environmental health relevant to pediatric asthma that should be mastered by primary health care providers, and outlines the environmental interventions that should be communicated to patients.

These environmental management guidelines were developed for pediatricians, family physicians, internists, pediatric nurse practitioners, pediatric nurses, and physician assistants. In addition, these guidelines should be integrated into respiratory therapists' and licensed case/care (LICSW) management professionals' education and training.

The guidelines contain three components:

- **Competencies:** An outline of the knowledge and skills that health care providers and health professional students should master and demonstrate in order to incorporate management of environmental asthma triggers into pediatric practice.
- **Environmental History Form:** A quick, easy, user-friendly document that can be utilized as an intake tool by the health care provider to help determine pediatric patients' environmental asthma triggers.
- **Environmental Intervention Guidelines:** Follow-up questions and intervention solutions to environmental asthma triggers.

Although environmental factors may play a role in the prevalence of asthma in the population, these guidelines are not directed at the primary prevention of pediatric asthma on a general scale. They are aimed instead at educating health care professionals on how to advise families about environmental interventions that can reduce or eliminate triggers for children who are already diagnosed with asthma.

It is important to recognize that environmental management is only one component of a comprehensive asthma management plan. These guidelines are founded upon the National Asthma Education and Prevention Program's (NAEPP) "Guidelines for the Diagnosis and Management of Asthma"[1] and it is recommended that they be used in conjunction with the clinical and pharmacological components of the NAEPP Guidelines. Additional guidance includes the use of pulmonary function testing and referral to an asthma specialist, either a pulmonologist or an allergist. No attempt is being made with these guidelines to supersede those of NAEPP, but rather to complement them. All children should have a written asthma care plan, and every child with mild persistent or more severe asthma should be treated with long-term control medication.

Environmental asthma triggers include indoor and outdoor allergens — such as dust mites, cockroaches, animal allergens, molds, and pollens — and indoor and outdoor pollutants and irritants, including environmental tobacco smoke (or secondhand smoke), chemicals, combustion by-products, and ozone and particulate matter. Although viruses and upper respiratory infections can exacerbate an asthma attack, they are not considered environmental asthma triggers for purposes of these guidelines.

The role of the asthma specialist (allergist or pulmonologist) may be crucial in helping to improve the care of these children. Primary care providers and asthma specialists should work together in evaluating the child, and in developing appropriate therapies and interventions. These guidelines are intended to guide primary care providers to consider environmental factors that may affect their patients' asthma. In some cases triggers may be more readily apparent than others. However, primary care providers should refer patients for allergy testing for confirmation of allergy when complicated or expensive interventions are being considered.

These guidelines are intended to be used with children (0-18 years) already diagnosed with asthma. Referral to a specialist is advised if the diagnosis of asthma is in doubt. Sources of guidelines for making the diagnosis of asthma include the NAEPP Guidelines and resources from Kaiser Permanente, the American Academy of Allergy Asthma & Immunology, and the American Academy of Pediatrics.

Background on the Pediatric Asthma Initiative

The Pediatric Asthma Initiative was launched by The National Environmental Education & Training Foundation, in partnership with the National Institute of Environmental Health Sciences and a steering committee of experts from academic institutions, federal agencies, and medical and nursing organizations. The Pediatric Asthma Initiative replicates the strategic framework of the National Strategies for Health Care Providers: Pesticides Initiative[2] developed by NEETF and the U.S. Environmental Protection Agency in partnership with a wide range of stakeholders. The Pesticides Initiative provides a model for incorporating environmental health information into the education and practice of primary health care providers. The Pesticides Initiative's National Pesticide Competency Guidelines for Medical & Nursing Education and the National Pesticide Practice Skills Guidelines for Medical & Nursing Practice served as models for the asthma guidelines.[3,4] Additional models were identified through a comprehensive literature search, in order to capitalize on current best practices and build upon existing tools and resources.

Environmental Management of Pediatric Asthma

The last several decades have seen a significant rise in the prevalence of asthma in children ages 0-17. Between 1980 and 1996, 12-month asthma prevalence among children increased from 3.5% to 6.2%. As of 2002, nine million U.S. children (12.2%) had ever been diagnosed with asthma[5], 6.1 million children (8.3%) currently had asthma[6], and 4.2 million (5.8%) had experienced an asthma attack within the previous year.[5] Asthma is more prevalent in children living in families below the poverty level. Children in poor families are more likely to have ever been diagnosed with asthma (16%) than children in families that are not poor (11%).[5] Children in fair or poor health are almost 7 times more likely to have had an asthma attack in the past 12 months than children in excellent or very good health (29% versus 4%).[5] In 2002, children age 5-17 missed 14.7 million school days due to asthma.[6] The environmentally attributable annual cost of pediatric asthma is estimated to be $2.0 billion.[7]

The role of environmental triggers of asthma is well recognized and has been included in the NAEPP Guidelines. Studies, such as the inner-city asthma study about individualized, home-based environmental interventions for hundreds of children in major U.S. cities, have demonstrated that environmental interventions decrease exposure to allergens, resulting in reduced asthma-associated morbidity.[8] However, in general, neither medical and nursing education programs nor pediatric practices frequently or fully incorporate environmental management and environmental history-taking into pediatric asthma treatment. A recent study reported that, although over half of practicing pediatricians surveyed had seen a patient with health issues related to environmental exposures, fewer than one-fifth were trained in taking an environmental history.[9]

The need for improvements in health professionals' environmental health knowledge has been expressed by leading health institutions, including the Institute of Medicine, the American Medical Association, and others.[10-14] Recognizing this need, the Ambulatory Pediatric Association issued a list of competencies for specialists in pediatric environmental health.[15] The American Academy of Pediatrics published a book on the identification, prevention, and treatment of childhood environmental health problems, which states that, "Avoiding environmental allergens and irritants is one of the primary goals of good asthma management."[16] The American Academy of Allergy Asthma & Immunology, acknowledging the importance of educating health care providers in this area, created an environmental management of asthma online continuing education program for its health care provider members.

A comprehensive approach to nursing and medical practice requires awareness, recognition, and treatment of critical factors that affect individual and community health, even if these factors are not obvious at first either to patients or their providers. Environmental interventions can occur if pediatric health care providers are knowledgeable about the importance and details of the issue, and able to communicate them effectively and sensitively to their patients' families.

Integration into the Curriculum and Clinical Practice

Although some modest progress has been made in introducing environmental management of pediatric asthma into medical and nursing curriculum and practice, studies conducted by medical and nursing expert workgroups, as well as leading medical and nursing organizations, recommend that environmental health content should be increased. Rather than compete with a crowded curriculum by adding separate course content, environmental management of asthma content can be integrated into existing pediatric instruction. This can be done by using environmental management of pediatric asthma to enhance existing case studies, or as exemplars. Additional opportunities for integration include the full range of continuing education programs, including Internet-based continuing education offerings, policy statements issued by national professional associations, and certification of training in environmental management of pediatric asthma.

For both medical and nursing education, a primary strategy for incorporating environmental management of pediatric asthma into existing curricula is to develop and support faculty champions/leaders who can take a leadership role in integrating children's environmental health into their institution in a sustainable fashion. These faculty members can lend expertise and support in their institutions and surrounding communities, teach courses, integrate competencies into curriculum, and serve as role models for how to integrate environmental health into health professional education. Residency Review Committees can require that such content be included in the residency curriculum. In addition, medical and nursing students can play a role in influencing curricula by educating fellow students through student organizations, such as the American Medical Student Association and National Student Nurse Association, and by encouraging school faculty and deans to introduce such content into the courses they offer.

Below are specific examples of points of insertion for environmental management of pediatric asthma content in medical and nursing curricula. It is recommended that such content be incorporated at all levels of the curricula.

- For medical education, the competencies can be incorporated into various courses throughout the four years of medical school and in residency. In the 1st and 2nd year of medical school, competencies can be taught in physical diagnosis, introduction to clinical medicine, and introduction to patient assessment courses. In the 3rd year, this material can be reinforced during clinical rotations and be included in medical school clerkships in pediatrics and family medicine. In the 4th year, such content can be included in electives for evidence-based medicine, environmental health, preventive health, epidemiology, or similar subject curriculum; in rotations for emergency medicine, public sector medicine, primary care, and pediatric medicine; and in instruction in ethical and legal issues of medical practice. Education should continue throughout residency training so that when a physician sees a child with asthma, environmental exposures and potential interventions are always included in the asthma management plan.
- For nursing education, environmental management of pediatric asthma content can be incorporated into various courses, electives, and units of instruction, depending on the curricula and course offerings of each school. For example, competencies in the knowledge, identification, and management of asthma triggers could be incorporated into patho-physiology, pediatric nursing, or community health nursing courses. Each of the competencies can be taught in classroom settings and reinforced in clinical rotations

for various subjects, such as community health, public health, home health, maternal/child health, and primary care management. Competencies could also be incorporated into additional units of instruction on topics such as health promotion, health education/teaching; protection and prevention of illness and injury; leadership in nursing; and current trends and issues in nursing practice including school nursing. The communication skills and advocacy competencies can be included in instruction on ethical, legal, and public policy issues and the patient advocacy role of the nurse. Additional points of insertion include environmental health nursing electives and fieldwork emphasizing environmental health.

There are numerous opportunities for incorporating environmental management of pediatric asthma content into pediatric health care practice. Practicing clinicians can introduce environmental management of pediatric asthma content into their daily practice by incorporating environmental history-taking and management of environmental triggers into the practices and protocols of the health settings where they deliver health care. Examples include adding environmental history-taking to electronic medical records, understanding the reimbursement available for teaching about environmental triggers and asthma management, or making referrals to asthma specialists or educators. Medical and nursing organizations and institutions can promote inclusion of environmental management of pediatric asthma in continuing education by offering continuing medical and nursing education sessions at conferences, grand rounds, and other educational functions, and by posting online modules on their websites.

In addition to medical and nursing curricula and clinical practice, it is recommended that environmental management of pediatric asthma content be integrated into the education and training of physician assistants, respiratory therapists, and licensed case/care (LICSW) management professionals.

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Part 1: Competencies for Environmental Management of Asthma

The set of competencies developed for the environmental management of asthma follow the normal sequence of interaction of health care provider and patient: knowledge, diagnosis, intervention/treatment, counseling, and education/communication. In addition, health care providers can play an important role in achieving wider health gains through advocacy of environmental improvements in the communities where they work. Sensitivity to the special needs of communities and individual families is very important when dealing with environmental interventions related to asthma.

These competencies apply to all settings where children (0-18 years) spend time, including homes, schools, daycares, cars, school buses, and recreational and occupational environments.

Competency I:
Knowledge of Environmental Asthma Triggers

1. **Develop a comprehensive knowledge base of indoor environmental triggers of asthma:**
   a. Recognize the components of indoor air pollution
   b. Recognize the effects of environmental tobacco smoke on asthma
   c. Recognize the sources and effects of dust mites on asthma
   d. Recognize the sources and effects of animal allergens on asthma
   e. Recognize the role of cockroach antigen on asthma
   f. Recognize the sources and effects of combustion by-products on asthma
   g. Recognize the sources and effects of mold on asthma
   h. Recognize the sources and effects of solvents and other chemical irritants
2. **Develop a comprehensive knowledge base of outdoor environmental triggers of asthma:**
   a. Recognize the components of outdoor air pollution
   b. Recognize how to interpret EPA's Air Quality Index (AQI)
   c. Recognize the effects of pollen (weeds, grasses, trees) on asthma
   d. Recognize the effects of molds on asthma
3. **Identify what particular environmental exposures are unique to the community in which one is practicing**
4. **Recognize the climatic factors that can exacerbate asthma**

Discussion:

A thorough knowledge of the environmental triggers of asthma is the basis for environmental interventions. Competency includes knowing both the effects as well as the sources of each trigger. Health care providers should have both a general knowledge of triggers as well as specific knowledge of the most frequent or common environmental triggers in their patients' communities, usually a result of outdoor air pollution (industrial smokestacks, releases of chemicals, roadways heavily used by trucks, etc.) or seasonal climate factors.

The list of triggers included here is not intended to be all-inclusive. Rather, it includes the triggers that appear to be most prevalent and for which there is the most evidence of impact. As further studies are undertaken, other triggers may be added to this list.

For specific information on environmental issues and sources of pollution in your area, speak with the state environmental department or local public health or environmental programs. Consult EPA's Envirofacts program (www.epa.gov/enviro/index_java.html) as a starting point in identifying environmental factors by zip code or map. Additional information on environmental asthma triggers can be obtained from a variety of organizations, such as the ones listed in the Appendix (page 28).

Competency II: Identification of Environmental Triggers of Asthma

1. **Be able to take a thorough environmental history for pediatric asthma patients**
2. **Determine when to refer for subspecialty consultation**
3. **Inquire about exposures that are unique to the pediatric asthma patient**
4. **Inquire about exposures unique to the community of the pediatric asthma patient**

Discussion:

While some families affected by asthma may recognize a connection between environmental factors and asthma, other families may not have considered them as potential triggers. Taking an environmental history can be a first step in creating the awareness that such a connection may exist. Families will not always make these connections, therefore it is important for health care providers to ask about the unique exposures that individuals might face in the home (or other indoor environments such as school and daycare) as well as in the community.

Health care providers should take into account the age of the child, the type of dwelling the child lives in, and the community or regional exposures that are most prevalent. There are some parts of the country, such as the South and Northwest, with relatively warm and humid climates where dust mite exposure and sensitivity are highly prevalent; in other areas, such as the Northeast, cockroach allergen sensitivity is more common. As a general rule, allergy becomes a more important part of asthma with each year of age from preschool up to about age 10-12, at which point roughly 80-90 percent of asthmatic children will have allergic triggers.

Most asthma specialists will perform specific testing to determine which allergen may trigger a patient's asthma symptoms. Skin testing is one efficient way to test for a large number of allergens, although other allergy testing procedures are available. In some cases, a thorough environmental history may point to a few specific triggers. An alternative to skin testing is the CAP-RAST, an in-vitro allergen specific test, which may be considered for a select group of major inhalant indoor environmental allergens e.g. house dust mite, pets, molds and cockroach. Proper interpretation of test results will likely require input from an allergy specialist.

Competency III:
Environmental Intervention and Treatment

1. **Understand the evidence for the various mitigation strategies for environmental triggers of asthma discussed under Competency I.**
2. **Be able to provide accurate information about the benefits and harms of products and services for control of environmental triggers**

Discussion:

A continuing difficulty in environmental management of asthma is that the data vary widely on different environmental triggers. Even triggers that might be commonly encountered in practice are often not well studied. Part 3 of these guidelines contains fact sheets for the most common environmental triggers and recommended interventions.

A number of products are promoted to the general public and people with asthma, claiming that they will remove environmental triggers of asthma. While some products such as allergen–impermeable pillow covers are recommended, others, such as ozone generating air cleaners that may result in harmful levels of ozone indoors are not recommended. Ozone-generators can, under certain conditions, produce levels of the lung irritant ozone significantly above levels thought harmful to human health. Ozone can damage the cells lining nasal passages and lungs making it difficult to breathe, and can exacerbate asthma symptoms. Parents should also be made aware that such air cleaning devices are sometimes placed in schools. Providers should understand the issues involved and provide information to families.

Competency IV: Ability to Counsel Caregivers and Pediatric Asthma Patient on the Reduction of Environmental Asthma Triggers

1. **Be able to counsel about reducing the effects of indoor environmental triggers of asthma, including:**
   a. reducing the child's exposure to tobacco smoke
   b. reducing exposure to indoor air pollution
   c. reducing dust mites in the home
   d. reducing animal allergens
   e. ways to mitigate cockroach antigen in the home
   f. reducing indoor exposure to molds
   g. avoiding exposure to solvents and other chemical irritants
2. **Be able to counsel about reducing the effects of outdoor environmental triggers of asthma, including:**
   a. reducing exposure to pollen
   b. reducing outdoor exposure to molds
   c. reducing or restricting exercise under adverse conditions, such as on AQI alert days
3. **Be able to recognize the stages of behavioral change as they relate to parental desires to stop smoking and other trigger abatements**

Discussion:

The term counseling is used here to give the sense of an interactive effort, in which the family affected by asthma is seen as a partner, an active participant in caring for the child with asthma. Counseling and educational efforts should extend to the variety of people who care for the person with asthma. This could include the child, older siblings, parents, grandparents, a babysitter, or other caregivers in the home. In addition to the child's own home, there may be other places (homes of relatives or neighbors, daycare centers, schools, the adolescent's and parents' workplace, recreational facilities) where the child spends significant amounts of time, and it may be appropriate to provide information to people in those settings as well.

Exercise-induced asthma could be related to stress from the exercise itself, or triggered by environmental exposures to air pollution or climatic factors if the exercise is done outdoors. In the latter case, providers should discuss with families options for indoor exercise.

Competency V: Effective Communication and Patient Follow-Up Skills

1. **Be culturally and linguistically competent**
2. **Be aware of developmental implications and discuss issues at an age- appropriate level**
3. **Identify where in your area pediatric asthma patients can be referred for home visits and home evaluations**
4. **Develop a system to track the pediatric asthma patients in your practice**
5. **Determine when to refer to an asthma educator or other social services**

Discussion:

Primary care providers need good communication skills with patients, families, and people in the community. While some environmental interventions are fairly simple and straightforward, others relate to highly sensitive issues. Some patients' families may be less likely to offer honest answers to sensitive questions (particularly on smoking and cockroaches) and may be unreceptive to entertaining the possibility of an intervention. Knowing different ways of asking about tobacco usage, for example, can help in getting the necessary information without alienating the respondent. While sensitive, the information is needed for accurate diagnosis and intervention.

Adherence to interventions for sensitive topics (e.g., smoking cessation, reducing exposure to pet allergens in the home) may present special challenges for the health care provider. Health care providers will need skills in enlisting the help of patients' families, even when it may involve considerable effort or sacrifice on their parts, for such things as removing pets from the home, or committing to quitting smoking or smoking only outdoors. People sometimes signal a willingness to change behaviors, such as smoking cessation, and providers should be sure not to miss such opportunities.

Because pediatric asthma covers the age range of 0-18 years, practitioners need to develop age-appropriate levels of communication for dealing with children, from infants to young adults.

It is also important to have good lines of communication between the primary care professional and the asthma specialist. Referrals are likely for various reasons, including prudent diagnosis, teaching the patient how to manage the asthma, allergy testing, interpreting pulmonary function testing, etc.

Competency VI: Advocacy

1. **Be able to assess an environmental exposure in the community**
2. **Be aware of smoking cessation programs offered in the community**
3. **Be able to communicate with community members, school board members, political groups, legislative bodies, media, and other stakeholders about environmental risks**
4. **Work with school officials to identify potential environmental exposures and advocate for targeted prevention strategies**
5. **Collaborate with community leaders to promote clean air where children live, learn, work, and play**
6. **Understand the concept of environmental justice and special needs of at-risk populations**

Discussion:

Health care providers have an important proactive role to play in working with the community to prevent certain environmental exposures. Developing networks of community groups and public officials can enhance a provider's effectiveness in accomplishing goals. Providers should also become aware of community resources, such as smoking cessation programs, to which they can refer patients.

The emphasis is on partnerships, which combine the efforts of family, relatives and neighbors, health care provider, school, and community in a collaborative effort.

Part 2: Environmental History Form for Pediatric Asthma

This form is intended for use with children already diagnosed with asthma. Designed for ease of use, the Environmental History Form is obviously not comprehensive and is intended as an initial intake tool. Questions with a "yes" answer should be followed up with additional in-depth questions on particular triggers and recommendations about possible interventions provided in Part 3. It is recommended that a health care provider (physician, nurse, nurse practitioner, or physician's assistant) administer the questions rather than being given to the patient's caregiver to fill out.

The Environmental History Form is also available as a Word document on the Web (http://www.neetf.org/Health/asthmahistoryform.htm); If the practice uses an electronic medical record, clinicians can cut and paste all or parts of it into their existing history-taking templates. In addition to clinical practice, the form can be used as a teaching tool at nursing and medical schools along with the competencies and the intervention guidelines.

The far right hand side of the form has a column labeled "Follow Up", which allows the provider to add notes about what has or has not been done about particular triggers. Practitioners should be able to make a viable recommendation to control the environmental trigger about which they are asking; therefore, questions which do not have a follow-up action that can reasonably be taken are not included on this form.

Practitioners should use a great deal of sensitivity in taking an environmental history. As noted earlier, some families are aware of possible connections between behavior, conditions in the home and school, and pediatric asthma. Others are unaware of these linkages, and the environmental history will be the first opportunity to make these connections. Providers should not hesitate to ask the questions for fear that the answers will be inaccurate. Even if a question is not answered accurately, the question itself suggests to the person that there is a connection between asthma and the activity in question, and therefore may be a useful motivation to change behavior in the future.

It is very important to ask about all environments in which a child with asthma may be spending significant amounts of time, including all residences where the child sleeps or spends time, schools, daycares, camps, work, recreational activities, and college dorms (for 17-18 year olds). This form should also be used to elicit information on triggers commonly overlooked, such as weekly trips to a relative where a hobby or pet is located.

Environmental History Form for Pediatric Asthma Patient

Specify that questions related to the child's home also apply to other indoor environments where the child spends time, including school, daycare, car, school bus, work, and recreational facilities.

				Follow up/ Notes
Is your child's asthma worse at night?	❑ Yes	❑ No	❑ Not sure	
Is your child's asthma worse at specific locations? If so, where? _____	❑ Yes	❑ No	❑ Not sure	
Is your child's asthma worse during a particular season? If so, which one? _____	❑ Yes	❑ No	❑ Not sure	
Is your child's asthma worse with a particular change in climate? If so, which?_____	❑ Yes	❑ No	❑ Not sure	
Can you identify any specific trigger(s) that makes your child's asthma worse? If so, what? _____	❑ Yes	❑ No	❑ Not sure	
Have you noticed whether dust exposure makes your child's asthma worse?	❑ Yes	❑ No	❑ Not sure	
Does your child sleep with stuffed animals?	❑ Yes	❑ No	❑ Not sure	
Is there wall-to-wall carpet in your child's bedroom?	❑ Yes	❑ No	❑ Not sure	
Have you used any means for dust mite control? If so, which ones? _____	❑ Yes	❑ No	❑ Not sure	
Do you have any furry pets?	❑ Yes	❑ No	❑ Not sure	
Do you see evidence of rats or mice in your home weekly?	❑ Yes	❑ No	❑ Not sure	
Do you see cockroaches in your home daily?	❑ Yes	❑ No	❑ Not sure	
Do any family members, caregivers or friends smoke?	❑ Yes	❑ No	❑ Not sure	
Does this person(s) have an interest or desire to quit?	❑ Yes	❑ No	❑ Not sure	
Does your child/teenager smoke?	❑ Yes	❑ No	❑ Not sure	
Do you see or smell mold/mildew in your home?	❑ Yes	❑ No	❑ Not sure	
Is there evidence of water damage in your home?	❑ Yes	❑ No	❑ Not sure	
Do you use a humidifier or swamp cooler?	❑ Yes	❑ No	❑ Not sure	
Have you had new carpets, paint, floor refinishing, or other changes at your house in the past year?	❑ Yes	❑ No	❑ Not sure	
Does your child or another family member have a hobby that uses materials that are toxic or give off fumes?	❑ Yes	❑ No	❑ Not sure	
Has outdoor air pollution ever made your child's asthma worse?	❑ Yes	❑ No	❑ Not sure	
Does your child limit outdoor activities during a Code Orange or Code Red air quality alert for ozone or particle pollution?	❑ Yes	❑ No	❑ Not sure	
Do you use a wood burning fireplace or stove?	❑ Yes	❑ No	❑ Not sure	
Do you use unvented appliances such as a gas stove for heating your home?	❑ Yes	❑ No	❑ Not sure	
Does your child have contact with other irritants (e.g., perfumes, cleaning agents, or sprays)?	❑ Yes	❑ No	❑ Not sure	

What other concerns do you have regarding your child's asthma that have not yet been discussed?

_____

_____

NEETF Pediatric Asthma Initiative

Part 3:
Environmental Intervention Guidelines

These environmental intervention guidelines are to be used for children already diagnosed with asthma. A separate fact sheet is provided for each of the major environmental asthma triggers. The questions on these fact sheets are intended to supplement the questions listed in the environmental history form related to each trigger. Interventions that are thought to be the most crucial for each asthma trigger are listed first and in ***bold*** *type. In addition to educating families on effective interventions, it is also important to explain why certain interventions are not recommended, particularly the use of ozone-generating air cleaners which may be harmful. Furthermore, providers should give families affected by asthma: educational materials (an example of a patient handout is listed under each trigger); relevant website information; and information about allergy supplies, smoking cessation programs, and other community resources. A variety of these materials available from a number of organizations are listed at http://www.neetf.org/Health/asthma_resources.htm.*

The intervention guidelines assume a two-visit concept for the patient. The first visit includes taking an environmental history, possible allergy testing or referral, and a commitment by the parent to work on reducing exposures to known allergens or irritants. The second, follow-up visit involves counseling of the patient or patient's family on controlling the exposures that trigger the child's asthma. In addition to this two-visit concept, providers should work with the family to schedule appropriate follow-up visits to evaluate the patients' self-management skills. It is very important to ask about all environments in which a child with asthma may be spending significant amounts of time, including all residences where the child sleeps or spends time, such as schools, daycares, camps, and college dorms.

Although primary care providers do not perform skin testing as an asthma specialist might, in vitro testing is an option that may be considered. However, any testing should be focused on allergens that are identified by the environmental history, and should not replace timely allergy referral. The health care provider should try to document sensitivity for each suspected allergen through allergy testing before making any major or costly recommendations related to environmental controls. However, some simple and low cost recommendations may be reasonable, particularly in areas where widespread exposure to cockroaches or dust mites is well known. Providers can assist families in implementing environmental interventions by helping them prioritize the changes they make in the home. For example, providers can encourage families to begin by creating a safe sleeping zone for the child.

A separate fact sheet is not provided for outdoor pollens (from trees, grass, or weeds) and molds. To avoid exposures, children should be recommended to stay indoors with windows closed in an air conditioned environment — if possible — during the season in which they have problems with outdoor allergens, especially during the afternoon.

Viral illnesses are not included in this list of environmental triggers, although their importance in triggering and exacerbating asthma is recognized. Primary care providers should remain aware that when a child with known asthma develops an upper respiratory infection, an asthma exacerbation is likely to follow.

As noted earlier, environmental management is only one component of a comprehensive asthma management plan. It is recommended that these materials be used in conjunction with the National Asthma Education and Prevention Program's clinical and pharmacological guidelines.

Dust Mites and Asthma

Dust mites are tiny microscopic relatives of the spider that live on mattresses, bedding, upholstered furniture carpets, and curtains. These tiny creatures feed on the flakes of skin that people and pets shed daily, and they thrive in warm and humid environments.

Additional History Questions to Supplement the History Form

- Did you know that dust mite exposure can trigger asthma symptoms?
- What type of floor covering is in your child's bedroom?
- Do you have a vacuum cleaner with a HEPA filter?
- What have you tried so far to reduce dust/dust mite exposure?
- How often do you wash your child's bed linens?
- Are you currently using a mattress or pillow covering on your child's bed?
- Do you use other ways to decrease dust mite exposure?

Possible Interventions:

No matter how clean a home is, dust mites cannot be totally eliminated. The following suggestions can reduce exposure. Emphasis should be placed on reducing dust mite exposure where the child sleeps.

- **Encase all pillows and mattresses of the beds that the child sleeps on using allergen impermeable encasings.** (There are numerous sources for allergen impermeable encasings, and prices as well as quality may vary.)
- **Wash bedding weekly to remove allergen. Wash in hot water (130˚ F) to kill mites**
- Replace wool or feathered bedding with synthetic materials that will withstand repeated hot water washing
- Either remove from the bedroom or wash and thoroughly dry stuffed toys weekly
- Move stuffed toys away from the pillow the child sleeps on
- Vacuum once or twice weekly preferably using a vacuum cleaner with a HEPA filter or a double-layered microfilter bag (when the child is not around)
- Use a damp mop or rag to remove dust, not a dry cloth that just stirs up dust mite allergens
- Avoid use of humidifiers
- The following interventions are expensive and are only recommended after an allergist has identified your child as allergic to dust mites:
- Consider replacing draperies with blinds or other wipeable window covering
- Consider carpet removal in the child's bedroom
- Consider removing upholstered furniture
- Consider using portable air cleaner with HEPA filter for child's bedroom
- **Avoid use of ozone generators and certain ionic air cleaners which can actually generate harmful ozone**

Follow-Up / Notes:

Possible Information Flyer to Give to Patient Families:

Asthma & Allergy Prevention: Dust Mites
http://www.niehs.nih.gov/airborne/prevent/mites.html

Animal Allergens and Asthma

Additional History Questions to Supplement the History Form

- What type of furry pet(s) do you have (and how many of each)?
- Is it a strictly indoor pet? _____ outdoor? _____ indoor/outdoor? _____
- Does your child sleep with the pet?
- Has your child's asthma become worse since having the pet?
- If you moved your pet outdoors, did your child's asthma improve?
- If there is evidence of rodents in your home, how severe is the problem (mild, moderate, severe, very severe)
- Does your child's classroom (or other places he/she spends time) have a furry pet that he/she plays with?

Possible Interventions:

Interventions with regard to pets should only be recommended if the child is allergic to the animal. Testing should therefore be done before making any recommendations. To reduce your child's exposure to animal allergens, the first two options below have been shown to be the most effective:

- **Consider finding a new home for indoor cats, dogs, and pet rodents**
- **At a minimum, keep pets outside**
- If neither of those are possible, the following may help reduce exposure:
- Keep pets out of the child's bedroom
- Encase mattresses and pillows
- Remove carpets
- Vacuum regularly using a cleaner with a HEPA filter or a double-layered microfilter bag (when the child is not around)
- Use portable air cleaner with HEPA filter for child's bedroom
- Keep pets off furniture and out of cars
- Bathing cats and dogs has been shown to decrease these allergens, however, it must be done at least twice a week to be effective
- **If rats or mice have been observed, use the least toxic extermination method, such as traps and baits**
- **Also use methods listed for cockroach control (See Cockroach Allergen and Asthma fact sheet on page 22)**

Follow-Up / Notes:

Possible Information Flyer to Give to Patient Families:

Allergy & Asthma Prevention: Pets & Animals
http://www.niehs.nih.gov/airborne/prevent/pets.html

Cockroach Allergen and Asthma

Additional History Questions to Supplement the History Form:

- Approximately how many cockroaches do you see in your home on a daily basis?
- Do you see evidence of cockroach droppings?
- How do you get rid of the cockroaches in your home?
- Does your child's school (or other places she/he spends time) have cockroaches?

Possible Interventions:

Eradication can be very difficult, especially in apartment buildings, and it is often temporary. Roaches follow food and water sources in your house. In general, the **least toxic methods of roach control should be employed first.**

- **Clean up all food items/ crumbs/ spills as soon as possible**
- **Store food and trash in closed containers**
- **Limit spread of food around house, especially bedrooms**
- **Fix water leaks under sinks**
- **Mop kitchen floor at least once a week**
- **Clean counter tops daily**
- Take garbage out daily
- Check for and plug up crevices outside your house that cockroaches may enter
- **Use the integrated pest management (IPM) approach for extermination — least toxic methods first**
- Use boric acid powder under stoves and other appliances
- Use bait stations and gels. It is highly recommended to use a professional, licensed exterminator.
- If you choose to apply the pesticides yourself, read the product label and follow all directions carefully
- Avoid using liquid sprays inside the house, especially near places children crawl, play, or sleep
- **Never attempt to use industrial strength pesticide sprays that require dilution**

Follow-Up / Notes:

Possible Information Flyer to Give to Patient Families:

Asthma & Allergy Prevention: Cockroaches
http://www.niehs.nih.gov/airborne/prevent/roach.html

Mold/Mildew and Asthma

Mold spores are allergens that can be found both indoors and outdoors. Molds are found indoors in dark, warm, and humid environments such as basements, attics, bathrooms, and laundry rooms. They are also found in air conditioners, humidifiers, refrigerator drip trays and garbage pails. Molds grow outdoors in moist shady areas. They are common in soil, decaying vegetation, compost piles, rotting wood, and fallen leaves. Mold growth outdoors is seasonal, first appearing in early spring and thriving until the first frost.

Additional History Questions to Supplement the History Form:

- Do you see mold growth in any part of your home?
- How large an area is the mold growth? (i.e. greater than 3 ft. x 3 ft?)
- Does your child's school (or other places he/she spends time) have mold growth?
- Do you have problems with moisture or leaks in your home?
- Do you frequently have condensation on your windows?
- Have you tried using something to decrease the humidity in your home?

Possible Interventions:

The emphasis should first be on controlling all sources of moisture in the house. Items that are too moldy to clean should be discarded. The size of the mold contamination in the house should determine how the mold gets cleaned up. Generally, an area of 3 feet x 3 feet or larger should be cleaned by a professional.

- Check faucets, pipes, and ductwork for leaks and repair as soon as possible
- Control indoor humidity
  - Use a dehumidifier or air conditioner (non evaporative or water-filled type) to maintain indoor relative humidity below 50%
  - Clean the dehumidifier as instructed by the manufacturer
  - Do not use a humidifier
  - Vent bathrooms and clothes dryers to the outside
  - Install and use exhaust fans in the kitchen, baths and damp areas
  - Avoid carpet and wallpaper in rooms prone to dampness
  - For those who own a home with an evaporative cooler, control the humidity level with a dehumidifier
- When first turning on home or car air conditioners, have your child leave the room or drive with the windows open for several minutes to allow mold spores to disperse
- Remove decaying debris from the yard, roof, and gutters
- Your child should avoid raking leaves, mowing lawns, or working with peat, mulch, hay, or dead wood if he/she is allergic to mold spores
- If you choose to clean mold yourself, use chlorine solution diluted 1:10 with water but do not mix bleach with other cleaning solutions containing ammonia due to toxic fumes
- Quaternary ammonium compounds are effective fungicides when bleach cannot be used
- For extensive mold contamination, (greater than 9 square feet – 3 ft. x 3 ft.) professional removal is recommended.

Follow-Up / Notes:

Possible Information Flyer to Give to Patient Families:

Asthma & Allergy Prevention: Mold Spores
http://www.niehs.nih.gov/airborne/prevent/mold.html

Environmental Tobacco Smoke and Asthma

Cigarette smoke contains many toxic chemicals and irritants. Children exposed to tobacco smoke have increased asthma exacerbations and other problems, including lower respiratory infections and middle ear infections. Infants have an increased risk of sudden infant death syndrome. Simply "smoking outside" is not enough to limit the harm to children from tobacco smoke. Remember that smoke settles in clothes, hair, car upholstery, and furniture. Once a parent or a caregiver acknowledges that he/she smokes, the provider should consider writing a referral for a smoking cessation or a community support program.

Additional History Questions to Supplement the History Form:

- Who in the family smokes cigarettes?
  How many cigarettes per day?
  Does he/she (they) smoke in the house? _____
  Outside? _____ Both inside and outside? _____ In the car? _____
- Does anyone who spends time at your house smoke (friends, neighbors, relatives)?
- Have you established a smoking ban or no smoking policy in the household?
- Does anyone smoke in childcare settings where the child stays?
- Describe the circumstances when your child may be exposed to smoke?

Possible Interventions:

- **Keep your home and car smoke-free**
- **Seek support to quit smoking, consider aids such as nicotine gum, patch, and medication from your doctor to help you in quitting**
- **Choose smoke-free childcare and social settings**
- Seek smoke-free environments in restaurants, theaters, and hotel rooms
- If you choose to smoke, do not smoke near your child

Follow-Up / Notes:

Possible Information Flyer to Give to Patient Families:

Asthma & Allergy Prevention: Cigarette Smoke
http://www.niehs.nih.gov/airborne/prevent/smoke.html

Air Pollution and Asthma

This category covers a wide range of toxic chemicals and pollutants, whether from industrial or vehicle pollution outdoors, or from the use of wood stoves, volatile organic compounds, or other substances indoors. Combustion by–products (e.g., nitrogen dioxide) and other pollutants can be respiratory irritants. Solvents and other chemicals can be found in building materials and can volatize during the 1-2 year period after new construction. Diesel exhaust from school buses and other forms of air pollution can also worsen asthma. Health care providers may want to sign up for Enviroflash email or pager notification of air quality forecasts in areas where it is offered. (For more information, see: http://cfpub.epa.gov/airnow/index.cfm?action=airnow.enviroflash)

Additional History Questions to Supplement the History Form:

Indoor Air Pollution Questions

- Do you live in a home that was built in the past 1-2 years?
- If you recently made changes to your house – installed new carpets, painted, or other changes – how long ago was that?
- Was there a change in your child's asthma symptoms after moving to a new house or having the work mentioned above done in your home?
- Do you ever notice a chemical smell in your home?
- If you have a wood burning fireplace or stove, how many times per month in the winter do you use it?
- Does anyone in your house use strong-smelling perfumes, scented candles, hairsprays, or other aerosol substances?

Outdoor Air Pollution Questions

- Do you live within 300 yards of a major roadway or highway? _____ An area where trucks or other vehicles idle? _____ A major industry with smokestacks? _____
- Is residential or agricultural burning a problem where you live?
- How do you hear about air quality alerts?

Possible Interventions:

For **indoor** air pollution, the two best approaches to reducing indoor air pollution are source control and ventilation.

- **Eliminate tobacco smoke**
- **Use good housekeeping practices to control particles**
- **Install an exhaust fan close to the source of contaminants, and vent it to the outside**
- Properly ventilate the room where a fuel-burning appliance is being used
- Ensure that wood stove doors are tight-fitting
- Follow manufacturers' instructions when using an unvented kerosene or gas space heater
- Ensure that fireplaces are properly vented so smoke escapes through the chimney
- Never use a gas-cooking appliance as a heating source
- Open windows especially when indoor pollutant sources are in use (this option must be balanced against the concern of mold or other plant allergens and outdoor air pollution)
- Parents should change clothes prior to returning from work if they work around any strong smelling chemicals or paints or other toxic substances
- Avoid strong odors and minimize use of products and materials that emit irritants, such as smoke, strong perfumes, talcum powder, hair sprays, cleaning products, paint fumes, sawdust, chalk dust, air freshener sprays, and insect sprays

Outdoor air pollution, especially ozone and particulate matter can increase asthma symptoms.

- **Monitor air quality index levels and reduce your child's outdoor activities when the AQI is in the unhealthy range**
- **If your child's symptoms are worse or he/she requires more albuterol (rescue medicine) the day after AQI levels are in the unhealthy range, contact your health care provider**
- Use HEPA filters in household vents
- Reduce use of candles, wood-burning stoves and fireplaces
- If particle pollution levels are high outdoors, do not vacuum the floor since this increases particle levels indoors
- Advise your child to stay away from the exhaust pipe of idling school buses and trucks
- Consider moving to a new location if this is possible

Follow-Up / Notes:

Possible Information Flyers to Give to Patient Families:

Asthma Home Environment Checklist
http://permanent.access.gpo.gov/websites/epagov/www.epa.gov/asthma/images/home_environment_checklist.pdf

Asthma And Outdoor Air Pollution
http://www.epa.gov/airnow/health-prof/Asthma_Flyer_Final.pdf

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Kaiser Permanente SoCal Environmental Control Sheet.

National Institute of Environmental Health Sciences. Asthma and Allergy Prevention Home page. Available at: http://www.niehs.nih.gov/airborne/prevent/alert.html.

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Appendix: Sources of Additional Information

Information on environmental asthma triggers can be obtained from a variety of organizations, including:

- American Academy of Allergy, Asthma and Immunology (www.aaaai.org)
- American Academy of Pediatrics (www.aap.org)
- American College of Allergy, Asthma, and Immunology (www.aaai.org)
- American Lung Association (www.lungusa.org)
- Kaiser Permanente (www.kaiserpermanente.org)
- National Asthma Education and Prevention Program (http://www.nhlbi.nih.gov/about/naepp/)
- National Library of Medicine's Toxtown (http://toxtown.nlm.nih.gov)
- U.S. Environmental Protection Agency
  Asthma and Indoor Environments (www.epa.gov/asthma/)
  Regional Offices (http://www.epa.gov/epahome/locate2.htm)

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Environmental Asthma Trigger Source Reduction

Source Control: General

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Source Control: Cockroaches

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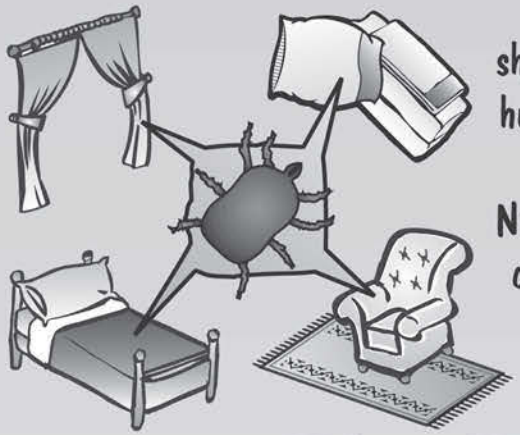
Sample Patient Flyers

DUST MITES

Dust mites are tiny microscopic relatives of the spider and live on mattresses, bedding, upholstered furniture, carpets and curtains.

These tiny creatures feed on the flakes of skin that people and pets shed daily and they thrive in warm and humid environments.



No matter how clean a home is, dust mites cannot be totally eliminated. However, the number of mites can be reduced by following the suggestions below.

Preventive Strategies

- Encase your mattress and pillows in dust-proof or allergen impermeable covers (available from specialty supply mail order companies or some bedding and department stores).
- Wash all bedding and blankets once a week in hot water (at least 130-140° F) to kill dust mites. Non-washable bedding can be frozen overnight to kill dust mites.
- Replace wool or feathered bedding with synthetic materials and traditional stuffed animals with washable ones.
- If possible, replace wall-to-wall carpets in bedrooms with bare floors (linoleum, tile or wood) and remove fabric curtains and upholstered furniture.
- Use a damp mop or rag to remove dust. Never use a dry cloth since this just stirs up mite allergens.
- Use a dehumidifier or air conditioner to maintain relative humidity at about 50% or below.
- Use a vacuum cleaner with either a double-layered microfilter bag or a HEPA filter to trap allergens that pass through a vacuum's exhaust.
- Wear a mask while vacuuming to avoid inhaling allergens, and stay out of the vacuumed area for 20 minutes to allow any dust and allergens to settle after vacuuming.

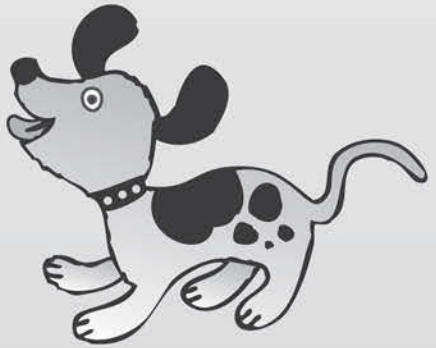
NIEHS
National Institute of Environmental Health Sciences

http://www.niehs.nih.gov/airborne/prevent/mites.html

PETS & ANIMALS

Many people think animal allergies are caused by the fur or feathers of their pet. In fact, allergies are actually aggravated by:

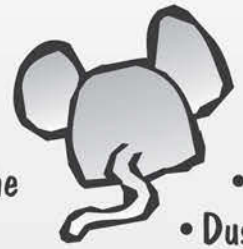
- proteins secreted by oil glands and shed as dander
- proteins in saliva (which stick to fur when animals lick themselves)
- aerosolized urine from rodents and guinea pigs



Keep in mind that you can sneeze with and without your pet being present. Although an animal may be out of sight, their allergens are not. This is because pet allergens are carried on very small particles. As a result, pet allergens can remain circulating in the air and remain on carpets and furniture for weeks and months after a pet is gone. Allergens may also be present in public buildings, schools, etc. where there are no pets.

Preventive Strategies

- Remove pets from your home if possible.
- If pet removal is not possible, keep them out of bedrooms and confined to areas without carpets or upholstered furniture.
- If possible, bathe pets weekly to reduce the amount of allergens.

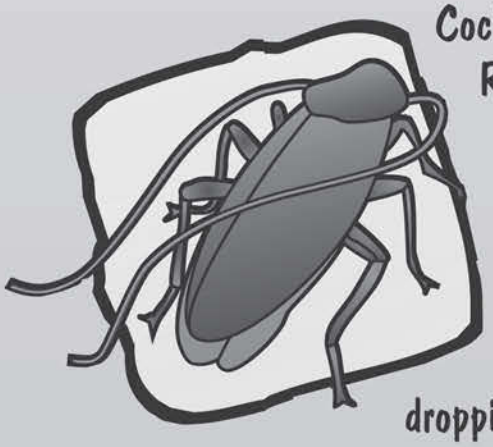


- Wear a dust mask and gloves when near rodents.
- After playing with your pet, wash your hands and clean your clothes to remove pet allergens.
- Avoid contact with soiled litter cages.
- Dust often with a damp cloth.

NIEHS
National Institute of Environmental Health Sciences

http://www.niehs.nih.gov/airborne/prevent/pets.html

COCKROACHES



Cockroaches are one of the most common and allergenic of indoor pests. Recent studies have found a strong association between the presence of cockroaches and increases in the severity of asthma symptoms in individuals who are sensitive to cockroach allergens. These pests are common even in the cleanest of crowded urban areas and older dwellings. They are found in all types of neighborhoods. The proteins found in cockroach saliva are particularly allergenic but the body and droppings of cockroaches also contain allergenic proteins.

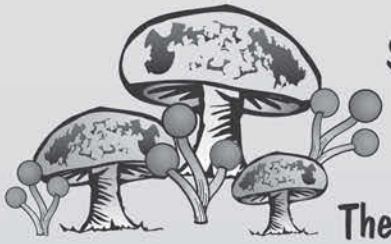
Preventive Strategies

- Limit the spread of food around the house and especially keep food out of bedrooms.
- Keep food and garbage in closed, tight-lidded containers. Never leave food out in the kitchen.
- Do not leave out pet food or dirty food bowls.
- Mop the kitchen floor and wash countertops at least once a week.
- Eliminate water sources that attract these pests, such as leaky faucets and drain pipes.
- Plug up crevices around the house through which cockroaches can enter.
- Use bait stations and other environmentally safe pesticides to reduce cockroach infestation.

NIEHS
National Institute of Environmental Health Sciences

http://www.niehs.nih.gov/airborne/prevent/roach.html

MOLD SPORES



Several molds that grow both indoors and outdoors, produce allergenic substances. These allergens can be found in mold spores and other fungal structures (e.g. hyphae). There is no definite seasonal pattern to molds that grow indoors. However outdoor molds are seasonal, first appearing in early spring and thriving until the first frost.

Indoor molds are found in dark, warm, humid and musty environments such as damp basements, cellars, attics, bathrooms and laundry rooms. They are also found where fresh food is stored, in refrigerator drip trays, garbage pails, air conditioners and humidifiers.

Outdoor molds grow in moist shady areas. They are common in soil, decaying vegetation, compost piles, rotting wood and fallen leaves.

Preventive Strategies

- Use a dehumidifier or air conditioner to maintain relative humidity below 50% and keep temperatures cool.
- Vent bathrooms and clothes dryers to the outside, and run bathroom and kitchen vents while bathing and cooking.
- Regularly check faucets, pipes and ductwork for leaks.
- When first turning on home or car air conditioners, leave the room or drive with the windows open for several minutes to allow mold spores to disperse.
- Remove decaying debris from the yard, roof and gutters.
- Avoid raking leaves, mowing lawns or working with peat, mulch, hay or dead wood. If you must do yard work, wear a mask and avoid working on hot, humid days.

NIEHS
National Institute of Environmental Health Sciences

http://www.niehs.nih.gov/airborne/prevent/mold.html

CIGARETTE SMOKE

Cigarette smoke contains a number of toxic chemicals and irritants. People with allergies may be more sensitive to cigarette smoke than others and research studies indicate that smoking may aggravate allergies.

Smoking does not just harm smokers but also those around them. Research has shown that children and spouses of smokers tend to have more respiratory infections and asthma than those of non-smokers. In addition, exposure to second-hand smoke can increase the risk of allergic complications such as sinusitis and bronchitis.

Common symptoms of smoke irritation are burning or watery eyes, nasal congestion, coughing, hoarseness and shortness of breath presenting as a wheeze.

Preventive Strategies

- Don't smoke and if you do, seek support to quit smoking. Contact Puff-Free Partners, such as:

National Cancer Institute
1-800-QUIT-NOW
http://www.smokefree.gov

Nicotine Anonymous
1-415-750-0328
http://www.nicotine-anonymous.org

American Lung Association
1-800-LUNG-USA
http://www.lungusa.org/ tobacco/index.html

Centers for Disease Control
1-800-CDC-1311
http://www.cdc.gov/tobacco/how2quit.htm

American Cancer Society
1-800-ACS-2345
http://www.cancer.org/tobacco

- Seek smoke-free environments in restaurants, theaters and hotel rooms.
- Avoid smoking in closed areas like homes or cars where others may be exposed to second-hand smoke.

NIEHS
National Institute of Environmental Health Sciences
http://www.niehs.nih.gov/airborne/prevent/smoke.html

United States Environmental Protection Agency

ASTHMA HOME ENVIRONMENT

☑ CHECKLIST

Home visits provide an opportunity to educate and equip asthma patients with the tools to effectively manage their disease in concert with a physician's care. This checklist—designed for home care visitors—provides a list of questions and action steps to assist in the identification and mitigation of environmental asthma triggers commonly found in and around the home. The checklist is organized into three sections—building information, home interior and room interior. The room interior is further subdivided by categories (such as bedding and sleeping arrangements, flooring, window treatments, and moisture control). This will allow the home care visitor to focus on the specific activities or things in a room—in particular the asthma patient's sleeping area—that might produce or harbor environmental triggers. The activities recommended in this checklist are generally simple and low cost. Information on outdoor air pollution follows the checklist. The last page includes information on U.S. Environmental Protection Agency (EPA) resources and an area for the home care visitor to record a home visit summary.

If the patient's sensitivities to allergens (such as dust mites, pests, warm-blooded pets and mold) and irritants (such as secondhand smoke and nitrogen dioxide) are known, the home care visitor should begin by focusing on relevant areas. This checklist covers the following allergens and irritants, which are commonly found in homes. Information is also provided on chemical irritants—found in some scented and unscented consumer products—which may worsen asthma symptoms.

Dust Mites

Triggers: Body parts and droppings.

Where Found: Highest levels found in mattresses and bedding. Also found in carpeting, curtains and draperies, upholstered furniture, and stuffed toys. Dust mites are too small to be seen with the naked eye and are found in almost every home.

Pests (such as cockroaches and rodents)

Triggers: Cockroaches – Body parts, secretions, and droppings.
Rodents – Hair, skin flakes, urine, and saliva.

Where Found: Often found in areas with food and water such as kitchens, bathrooms, and basements.

Warm-Blooded Pets (such as cats and dogs)

Triggers: Skin flakes, urine, and saliva.

Where Found: Throughout entire house, if allowed inside.

Mold

Triggers: Mold and mold spores which may begin growing indoors when they land on damp or wet surfaces.

Where Found: Often found in areas with excess moisture such as kitchens, bathrooms, and basements. There are many types of mold and they can be found in any climate.

Secondhand Smoke

Trigger: Secondhand smoke – Mixture of smoke from the burning end of a cigarette, pipe or cigar and the smoke exhaled by a smoker.

Where Found: Home or car where smoking is allowed.

Nitrogen Dioxide (combustion by-product)

Trigger: Nitrogen dioxide – An odorless gas that can irritate your eyes, nose, and throat and may cause shortness of breath.

Where Found: Associated with gas cooking appliances, fireplaces, woodstoves, and unvented kerosene and gas space heaters.

BUILDING INFORMATION

(This information may be helpful to determine reasonable mitigations.)

What type of building does the patient live in?

- ☐ House
- ☐ Duplex
- ☐ Apartment
- ☐ Mobile home
- ☐ Other_____

Notes:

Does the patient own or rent?

- ☐ Own
- ☐ Rent

Notes:

Questions	Answers	Action Steps
HOME INTERIOR		▲ **MAY REQUIRE ADDITIONAL TIME AND/OR RESOURCES.**
Secondhand Smoke		
Does anyone smoke in the home or car?	☐ Y ☐ N	■ Keep the home and car smoke-free. ■ Do not allow visitors to smoke in the home. ■ Take the smoke-free home pledge and post a smoke-free home decal or magnet to show that the house is a "smoke-free" zone.
Notes:		
Warm-blooded Pets (such as cats and dogs)		
Is the patient's asthma worse when around warm-blooded pets?	☐ Y ☐ N	■ If possible, remove the pet from the home or keep the pet outside. ■ If this is not possible, keep the pet out of the patient's sleeping area and off of the furniture.
Notes:		
Consumer Products		
Is the patient's asthma worse when around chemicals or products with strong odors (such as cleaners, paints, adhesives, pesticides, air fresheners, or cosmetics)?	☐ Y ☐ N	■ Limit patient's exposure as much as possible by minimizing product use, using products only when patient is not present, or trying alternative products. ■ If products are used, carefully follow manufacturer's instructions on the label and make sure the area is well ventilated.
Notes:		
Heating and Cooling Systems		
Does the heating and cooling system use filters?	☐ Y ☐ N	▲ If so, replace the filters quarterly. ▲ Use filters with higher efficiency than standard furnace filters, such as upgraded pleated filters, if heating or cooling system manufacturer's specifications allow.
Notes:		

Questions	Answers	Action Steps
HOME INTERIOR (continued)		▲ **MAY REQUIRE ADDITIONAL TIME AND/OR RESOURCES.**
Does the heating system use a fuel-burning appliance (such as an oil or gas furnace)? *Notes:*	☐ Y ☐ N	▲ Have the heating system - including furnaces, flues and chimneys - professionally inspected annually. ▲ Promptly repair cracks or damaged parts.
Are supplemental heating sources used? (Check all that apply) *Notes:*	☐ Fireplace ☐ Wood-burning stove ☐ Unvented kerosene or gas space heater ☐ Other_____	■ Properly ventilate the room where a fuel-burning appliance is used. Consider using appliances that vent to the outside whenever possible. ■ Never use a gas-cooking appliance as a heating source. ■ If using a fireplace, make sure it is properly vented to help ensure smoke escapes through the chimney. ■ If using a wood-burning stove, make sure that doors are tight-fitting. Use aged or cured wood only and follow the manufacturer's instructions for starting, stoking, and putting out the fire. ■ If using an unvented kerosene or gas space heater, follow the manufacturer's instructions for proper fuel to use and keep the heater properly adjusted.
Are there air conditioning window units? *Notes:*	☐ Y ☐ N	■ Run window air conditioner with the vent control open to increase the outdoor ventilation rate during the cooling season.
ROOM INTERIOR		
Bedding and Sleeping Arrangements		
What does the patient sleep on? (Check all that apply) *Notes:*	☐ Mattress with box springs ☐ Sofa ☐ Other_____	▲ Cover patient's mattress in a dust-proof (allergen impermeable) zippered cover. Clean cover according to manufacturer's instructions. ■ If it is necessary for the patient to sleep on upholstered furniture such as a sofa, then cover furniture with washable slipcovers or sheets and vacuum furniture regularly (including removing cushions and vacuuming in cracks and crevices).
What types of bedding does the patient use? (Check all that apply) *Notes:*	☐ Bedspread (e.g., comforter, quilt) ☐ Blankets ☐ Pillows ☐ Sheets ☐ Other (e.g., sleeping bag) _____	■ Choose washable bedding. ■ Wash bedding regularly in hot water and dry completely. ▲ Cover patient's pillow in a dust-proof (allergen impermeable) zippered cover. Clean cover according to manufacturer's instructions.

Questions	Answers	Action Steps
ROOM INTERIOR (continued)		▲ **MAY REQUIRE ADDITIONAL TIME AND/OR RESOURCES.**
Flooring		
What type of floor covering is present? (Check all that apply)	☐ Carpeting ☐ Hardwood floor, tile, or vinyl flooring ☐ Throw rugs ☐ Other_____	■ If carpeting is present, vacuum carpets, area rugs, and floors regularly. ■ If possible, use a vacuum cleaner with a high efficiency filter. ■ Mop hard surface floors regularly. ■ Wash throw rugs regularly in hot water. Dry completely. ■ Clean baseboards regularly using a damp cloth with warm, soapy water. ■ Someone besides the patient should vacuum, sweep, empty the dust canister and change the vacuum bag. ■ If possible, the patient should stay out of rooms when they are being vacuumed or swept. ■ If the patient vacuums, sweeps, empties the dust canister, or changes the vacuum bag, he or she should wear a dust mask.
Notes:		
Upholstered Furniture and Stuffed Toys		
Is there upholstered furniture present?	☐ Y ☐ N	■ Cover upholstered furniture with washable slipcovers or sheets. ■ Vacuum upholstered furniture regularly, including removing cushions and vacuuming in cracks and crevices. ▲ If replacing furniture, consider purchasing a non-upholstered furniture - such as vinyl, wood, or leather - that can be easily wiped down.
Notes:		
Are stuffed toys present?	☐ Y ☐ N	■ Choose washable stuffed toys, and wash frequently in hot water. Dry completely. ■ Limit the number of stuffed toys in patient's bed and sleeping area.
Notes:		
Window Treatments		
What window coverings are present? (Check all that apply)	☐ Curtains or drapes ☐ Blinds ☐ Shades ☐ Other_____	■ Vacuum drapes regularly. ■ Wash and dry curtains regularly. ■ Dust window sills, blinds, and shades regularly using a damp cloth with warm, soapy water. Dry completely. ▲ If possible, replace curtains or drapes with plastic, vinyl, wood, or aluminum blinds.
Notes:		
Cooking Appliances		
Are gas cooking appliances used?	☐ Y ☐ N	■ When cooking with a gas appliance, turn on an exhaust fan or open a window. ■ Avoid misuse of the appliance by following the manufacturer's instructions for operation.
Notes:		

Questions	Answers	Action Steps
ROOM INTERIOR (continued)		▲ **MAY REQUIRE ADDITIONAL TIME AND/OR RESOURCES.**
Moisture Control		
Is there evidence of water damage, moisture, or leaks (such as damp carpet or leaky plumbing)? *Notes:*	☐ Y ☐ N	■ Dry damp or wet items within 24-48 hours to avoid mold growth. ▲ Fix water leaks (such as leaky plumbing) as soon as possible. ▲ Replace absorbent materials, such as ceiling tiles and carpet, if mold is present. ▲ Use air conditioner or dehumidifier to maintain low indoor humidity. If possible, keep indoor humidity below 60% (ideally between 30-50%) relative humidity.
Do you see or smell mold or mildew (such as in the bathroom on tub, shower, walls, or windows)? *Notes:*	☐ Y ☐ N	■ Open a window or turn on an exhaust fan when there is excessive moisture in the room, such as when showering or cooking. ■ Scrub mold off hard surfaces with detergent and water. Dry completely. ■ Clean up mold and dry surfaces completely before painting or caulking. ▲ Replace absorbent materials, such as ceiling tiles and carpet, if mold is present.
Is standing water present (such as in refrigerator drip pans, air conditioner drip pans, or house plants)? *Notes:*	☐ Y ☐ N	■ Empty and clean refrigerator and air conditioner drip pans regularly. ■ Avoid standing water in plant containers.
Are humidifiers used in the patient's house? *Notes:*	☐ Y ☐ N	■ Use humidifier only when conditions require it, use the correct setting to maintain indoor relative humidity between 30-50 percent, and clean humidifier reservoirs regularly. ■ Use low mineral content water to prevent the build-up of scale and dispersal of minerals into the air. ■ Follow manufacturer's instructions for use, maintenance, and replacement of any materials supplied with the humidifier.
Are rooms and moisture-producing appliances—such as stoves, clothes dryers, or dishwashers—properly vented (including venting to the outside if specified by the manufacturer)? *Notes:*	☐ Y ☐ N	■ Increase ventilation or air movement by opening doors and/or windows when practical. Use fans as needed. ■ Run the bathroom exhaust fan or open the window when showering. ■ Use exhaust fans or open windows whenever cooking or washing dishes. ■ Vent appliances properly according to manufacturer's specifications.

Questions	Answers	Action Steps
ROOM INTERIOR (continued)		▲ **MAY REQUIRE ADDITIONAL TIME AND/OR RESOURCES.**
Pest Control		
Is there evidence of cockroaches and/or rodents (such as droppings or dead specimens in traps)? *Notes:*	☐ Y ☐ N	■ Clean all surfaces where you have seen pests. ■ Use poison baits, boric acid, or traps to kill pests. Minimize use of sprays. If sprays are used: limit the spray to the infested area, carefully follow the instructions on the label, make sure there is plenty of fresh air where the spray is being used and, if possible, keep patient out of the room.
Are there food crumbs or open or unsealed food? *Notes:*	☐ Y ☐ N	■ Clean all food crumbs or spilled liquids right away. ■ Store food in sealed containers. ■ Remove food, bags, newspapers, and empty boxes, cans, and bottles from the sleeping area. ■ Put all garbage in plastic trash bags. Seal trash bags and put them into garbage cans with fitted lids every day.
Are there holes or gaps between construction materials and pipes that could allow pests to enter the house? *Notes:*	☐ Y ☐ N	■ Seal holes or gaps between construction materials and pipes, or ask the owner to do so.
Is there evidence of standing water or leaks? *Notes:*	☐ Y ☐ N	■ Dry damp or wet items within 24-48 hours to avoid mold growth. ■ Avoid standing water in house plant containers and drip pans. ▲ Fix water leaks (such as leaky plumbing) as soon as possible.

OUTDOOR AIR POLLUTION

Exposure to air pollution (mainly ozone and particle pollution) can trigger asthma attacks. The Air Quality Index (AQI) is a tool to provide the public with clear and timely information on local air quality and whether air pollution levels pose a possible health concern. The AQI is reported and forecasted every day in many areas throughout the U.S. on local weather reports and through national media. Asthma attacks are most likely to occur the day **after** outdoor pollution levels are high.

People can take simple steps to reduce their exposure to outdoor air pollution. When the AQI reports unhealthy levels:

- Limit physical exertion outdoors.
- Consider changing the time of day of strenuous outdoor activity to avoid the period when air pollution levels are high or consider postponing sports activities to another time.
- Reduce the intensity of the activity, or spend less time engaged in strenuous activities. For example, coaches can rotate players more frequently in strenuous sports, like soccer. Resting players reduces their exposure to air pollution.

To learn more about and access the AQI, visit www.epa.gov/airnow.

Educational Resources:

To learn more about EPA's programs on:

- Asthma and steps you can take to remove environmental triggers from the home, visit www.epa.gov/asthma.
- Secondhand smoke and how to make your home and car smoke-free, visit www.epa.gov/smokefree or call the smoke-free home pledge number at 1-866-SMOKE-FREE (1-866-766-5337).
- Household pest management and how to apply integrated pest management at home, visit www.epa.gov/pesticides/controlling/home.htm.

To order materials at no cost on:

- Asthma and secondhand smoke, call EPA's Indoor Air Quality Information Line at 1-800-438-4318.
- Household pest management, call EPA's National Center for Environmental Publications at 1-800-490-9198.

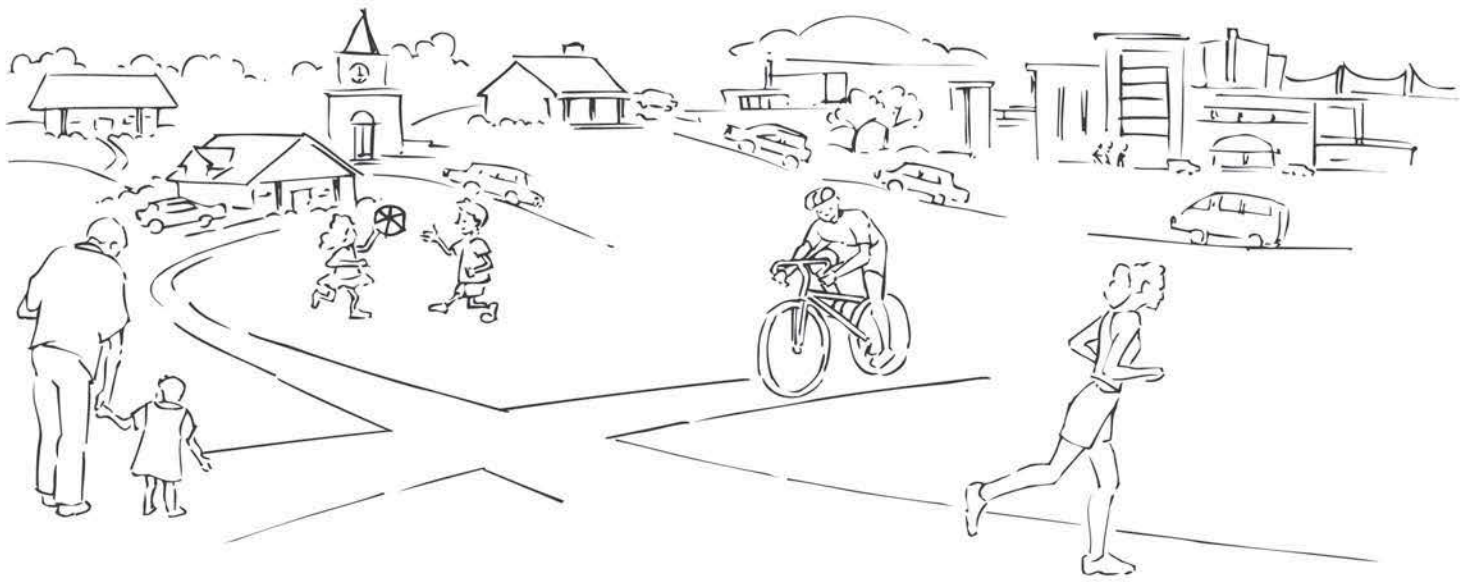
SUMMARY

Use this space to record triggers identified and mitigations recommended. You are encouraged to provide this information to the patient's health care provider.

EPA

CDC
Centers for Disease Control and Prevention

ASTHMA AND OUTDOOR AIR POLLUTION



1 Air pollution can make asthma symptoms worse and trigger attacks.

If you or your child has asthma, have you ever noticed symptoms get worse when the air is polluted? Air pollution can make it harder to breathe. It can also cause other symptoms, like coughing, wheezing, chest discomfort, and a burning feeling in the lungs.

Two key air pollutants can affect asthma. One is *ozone* (found in smog). The other is *particle pollution* (found in haze, smoke, and dust). When ozone and particle pollution are in the air, adults and children with asthma are more likely to have symptoms.

2 You can take steps to help protect your health from air pollution.

► *Get to know how sensitive you are to air pollution.*

- Notice your asthma symptoms when you are physically active. Do they happen more often when the air is more polluted? If so, you may be sensitive to air pollution.
- Also notice any asthma symptoms that begin up to a day *after* you have been outdoors in polluted air. Air pollution can make you more sensitive to asthma triggers, like mold and dust mites. If you are more sensitive than usual to indoor asthma triggers, it could be due to air pollution outdoors.

► *Know when and where air pollution may be bad.*

- *Ozone* is often worst on hot summer days, especially in the afternoons and early evenings.
- *Particle pollution* can be bad any time of year, even in winter. It can be especially bad when the weather is calm, allowing air pollution to build up. Particle levels can also be high:
  - — Near busy roads, during rush hour, and around factories.
  - — When there is smoke in the air from wood stoves, fireplaces, or burning vegetation.

► ***Plan activities when and where pollution levels are lower.*** Regular exercise is important for staying healthy, especially for people with asthma. By adjusting when and where you exercise, you can lead a healthy lifestyle and help reduce your asthma symptoms when the air is polluted. In summer, plan your most vigorous activities for the morning. Try to exercise away from busy roads or industrial areas. On hot, smoggy days when ozone levels are high, think about exercising indoors.

► ***Change your activity level.*** When the air is polluted, try to take it easier if you are active outdoors. This will reduce how much pollution you breathe. Even if you can't change your schedule, you might be able to change your activity so it is less intense. For example, go for a walk instead of a jog. Or, spend less time on the activity. For example, jog for 20 minutes instead of 30.

► ***Listen to your body.*** If you get asthma symptoms when the air is polluted, stop your activity. Find another, less intense activity.

► ***Keep your quick-relief medicine on hand when you're active outdoors.*** That way, if you do have symptoms, you'll be prepared. This is especially important if you're starting a new activity that is more intense than you are used to.

► ***Consult your health care provider.*** If you have asthma symptoms when the air is polluted, talk with your health care provider.

- If you will be exercising more than usual, discuss this with your health care provider. Ask whether you should use medicine before you start outdoor activities.
- If you have symptoms during a certain type of activity, ask your health care provider if you should follow an asthma action plan.

3 Get up-to-date information about your local air quality:

Sometimes you can tell that the air is polluted—for example, on a smoggy or hazy day. But often you can't. In many areas, you can find air quality forecasts and reports on local TV or radio. These reports use the Air Quality Index, or AQI, a simple color scale, to tell you how clean or polluted the air is. You can also find these reports on the Internet at: *www.epa.gov/airnow.* You can use the AQI to plan your activities each day to help reduce your asthma symptoms.

4 For more information:

Air quality and health:

- EPA's AIRNow website at *www.epa.gov/airnow*
- Call 1-800-490-9198 to request free EPA brochures on: *Ozone and Your Health, Particle Pollution and Your Health, and Air Quality Index: A Guide to Air Quality and Your Health.*

Asthma:

- Centers for Disease Control and Prevention (CDC) Web site at *www.cdc.gov/asthma*

Indoor air and asthma:

- EPA's asthma website at *www.epa.gov/asthma*

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Policy Statement—Equipment for Ambulances

Almost 4 decades ago, the Committee on Trauma of the American College of Surgeons (ACS) developed a list of standardized equipment for ambulances. Beginning in 1988, the American College of Emergency Physicians (ACEP) published a similar list. The 2 organizations collaborated on a joint document published in 2000, and the National Association of EMS Physicians (NAEMSP) participated in the 2005 revision. The 2005 revision included resources needed on ambulances for appropriate homeland security. All 3 organizations adhere to the principle that emergency medical services (EMS) providers at all levels must have the appropriate equipment and supplies to optimize prehospital delivery of care. The document was written to serve as a standard for the equipment needs of emergency ambulance services in both the United States and Canada.

EMS providers care for patients of all ages, who have a wide variety of medical and traumatic conditions. With permission from the ACS Committee on Trauma, ACEP, and NAEMSP, the current revision includes updated pediatric recommendations developed by members of the federal Emergency Medical Services for Children (EMSC) Stakeholder Group. The EMSC Program has developed several performance measures for the program's state partnership grantees. One of the performance measures evaluates the availability of essential pediatric equipment and supplies for basic life support (BLS) and advanced life support (ALS) patient care units. This document will be used as the standard for this performance measure. The American Academy of Pediatrics (AAP) has also officially endorsed this list.

For purposes of this document, the following definitions have been used: a neonate is 0 to 28 days old, an infant is 29 days to 1 year old, and a child is >1 through 11 years old with delineation into the following developmental stages:

- Toddlers (1–3 years old)
- Preschoolers (3–5 years old)
- Middle childhood (6–11 years old)
- Adolescents (12–18 years old)

These standard definitions are age based. Length-based systems have been developed to more accurately estimate the weight of children and predict appropriate equipment sizes, medication doses, and guidelines for fluid volume administration.

PRINCIPLES OF PREHOSPITAL CARE

The goal of prehospital care is to minimize further systemic insult or injury and manage life-threatening conditions through a series of well-defined and appropriate interventions, and to embrace principles that ensure patient safety. High-quality, consistent emergency care demands continuous quality improvement and is directly dependent on

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ABBREVIATIONS
ACS—American College of Surgeons
ACEP—American College of Emergency Physicians
NAEMSP—National Association of EMS Physicians
EMS—emergency medical services
EMSC—Emergency Medical Services for Children
BLS—basic life support
ALS—advanced life support
LMA—laryngeal mask airway

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the effective monitoring, integration, and evaluation of all components of the patient's care.

Integral to this process is medical oversight of prehospital care by using preexisting protocols (indirect medical oversight), which are evidence based when possible, or by medical control via voice and/or video communication (direct medical oversight). The protocols that guide patient care should be established collaboratively by medical directors for ambulance services, adult and pediatric emergency medicine physicians, adult and pediatric trauma surgeons, and appropriately trained basic and advanced emergency medical personnel. Current Institute of Medicine (IOM) recommendations encourage each EMS agency to have a pediatric coordinator to specifically coordinate the capability of the service to care for nonadult patients.

EQUIPMENT AND SUPPLIES

The guidelines list the supplies and equipment that should be stocked on ambulances to provide the accepted standards of patient care. Previous documents regarding ambulance equipment referred to essential or minimal equipment necessary to adequately equip an ambulance. Equipment requirements will vary, depending on the certification levels of the providers, population densities, geographic and economic conditions of the region, and other factors.

The following list is divided into equipment for BLS and ALS ambulances. ALS ambulances must have all of the equipment on the required BLS list as well as equipment on the required ALS list. This list represents a consensus of recommendations for equipment and supplies that will facilitate patient care in the out-of-hospital setting.

REQUIRED EQUIPMENT: BLS AMBULANCES

A. Ventilation and Airway Equipment

1. Portable and fixed suction apparatus with a regulator (per federal specifications; see Federal Specification KKK-A-1822F reference)
   - Wide-bore tubing, rigid pharyngeal curved suction tip; tonsillar and flexible suction catheters, 6F–16F, are commercially available (have 1 between 6F and 10F and 1 between 12F and 16F)
2. Portable oxygen apparatus capable of metered flow with adequate tubing
3. Portable and fixed oxygen-supply equipment
   - Variable flow regulator
4. Oxygen-administration equipment
   - Adequate-length tubing; transparent mask (adult and child sizes), both nonrebreathing and valveless; nasal cannulas (adult, child)
5. Bag-valve mask (manual resuscitator)
   - Hand-operated, self-reexpanding bag; adult (>1000 mL) and child (450–750 mL) sizes, with oxygen reservoir/accumulator; valve (clear, disposable, operable in cold weather); and mask (adult, child, infant, and neonate sizes)
6. Airways
   - Nasopharyngeal (16F–34F; adult and child sizes)
   - Oropharyngeal (sizes 0–5; adult, child, and infant sizes)
7. Pulse oximeter with pediatric and adult probes
8. Saline drops and bulb suction for infants

B. Monitoring and Defibrillation

All ambulances should be equipped with an automated external defibrillator (AED) unless staffed by ALS personnel who are carrying a monitor/defibrillator. The AED should have pediatric capabilities, including child-sized pads and cables.

C. Immobilization Devices

1. Cervical collars
   - Rigid for children aged 2 years or older; child and adult sizes (small, medium, large, and other available sizes)
2. Head immobilization device (not sandbags)
   - Firm padding or commercial device
3. Lower extremity (femur) traction devices
   - Lower extremity limb-support slings, padded ankle hitch, padded pelvic support, traction strap (adult and child sizes)
4. Upper and lower extremity immobilization devices
   - Joint-above and joint-below fracture (sizes appropriate for adults and children), rigid support constructed with appropriate material (cardboard, metal, pneumatic, vacuum, wood, or plastic)
5. Impervious backboards (long, short; radiolucent preferred) and extrication device
   - Short (extrication, head-to-pelvis length) and long (transport, head-to-feet length) with at least 3 appropriate restraint straps (chin strap alone should not be used for head immobilization) and with padding for children and handholds for moving patients

D. Bandages

1. Commercially packaged or sterile burn sheets
2. Triangular bandages
   - Minimum of 2 safety pins each
3. Dressings
   - Sterile multitrauma dressings (various large and small sizes)
   - ABDs, 10 × 12 in or larger
   - 4 × 4-in gauze sponges or suitable size
4. Gauze rolls
   - Various sizes
5. Occlusive dressing or equivalent
   - Sterile, 3 × 8 in or larger
6. Adhesive tape
   - Various sizes (including 1 and 2 in), hypoallergenic
   - Various sizes (including 1 and 2 in), adhesive
7. Arterial tourniquet (commercial preferred)

E. Communication

Two-way communication device between EMS provider, dispatcher, and medical control

F. Obstetrical Kit (Commercial Package Is Available)

1. Kit (separate sterile kit)
   - Towels, 4 × 4-in dressing, umbilical tape, sterile scissors or other cutting utensil, bulb suction, clamps for cord, sterile gloves, blanket
2. Thermal absorbent blanket and head cover, aluminum-foil roll, or appropriate heat-reflective material (enough to cover newborn)

G. Miscellaneous

1. Sphygmomanometer (pediatric and adult regular- and large-sized cuffs)
2. Adult stethoscope
3. Length/weight-based tape or appropriate reference material for pediatric equipment sizing and drug dosing based on estimated or known weight
4. Thermometer with low temperature capability
5. Heavy bandage or paramedic scissors for cutting clothing, belts, and boots
6. Cold packs
7. Sterile saline solution for irrigation (1-L bottles or bags)
8. Flashlights (2) with extra batteries and bulbs
9. Blankets
10. Sheets (minimum of 4), linen or paper, and pillows
11. Towels
12. Triage tags
13. Disposable emesis bags or basins
14. Disposable bedpan
15. Disposable urinal
16. Wheeled cot (conforming to national standard at the time of manufacture)
17. Folding stretcher
18. Stair chair or carry chair
19. Patient care charts/forms
20. Lubricating jelly (water soluble)

H. Infection Control*

1. Eye protection (full peripheral glasses or goggles, face shield)
2. Face protection (for example, surgical masks per applicable local or state guidance)
3. Gloves, nonsterile (must meet 1999 National Fire Protection Association requirements, which can be found at www.nfpa.org)
4. Coveralls or gowns
5. Shoe covers
6. Waterless hand cleanser, commercial antimicrobial (towelette, spray, liquid)
7. Disinfectant solution for cleaning equipment
8. Standard sharps containers, fixed and portable
9. Disposable trash bags for disposing of biohazardous waste
10. Respiratory protection (for example, N95 or N100 mask—per applicable local or state guidance)

*Latex-free equipment should be available.

I. Injury-Prevention Equipment

1. All individuals in an ambulance need to be restrained (there is currently no national standard for transport of uninjured children)
2. Protective helmet
3. Fire extinguisher
4. Hazardous material reference guide
5. Traffic-signaling devices (reflective material triangles or other reflective, nonigniting devices)
6. Reflective safety wear for each crew member (must meet or exceed American National Standards Institute/International Safety Equipment Association performance class II or III if working within the right of way of any federal-aid highway; visit www.reflectivevest.com/federalhighwayruling.html for more information)

REQUIRED EQUIPMENT: ALS AMBULANCES

For emergency medical technician-paramedic services, include all of the required equipment listed for the basic-level provider, plus the following additional equipment and supplies. For emergency medical technician–intermediate services (and other nonparamedic advanced levels), include all of the equipment for the basic-level

provider and selected equipment and supplies from the following list, on the basis of local need and consideration of prehospital characteristics and budget.

A. Airway and Ventilation Equipment

1. Laryngoscope handle with extra batteries and bulbs
2. Laryngoscope blades, sizes 0–4, straight (Miller); sizes 2–4, curved, (MacIntosh)
3. Endotracheal tubes, sizes 2.5–5.5 mm uncuffed and 6–8 mm cuffed (2 each), other sizes optional
4. Meconium aspirator adaptor
5. 10-mL non-Luerlock syringes
6. Stylettes for endotracheal tubes, adult and pediatric
7. Magill (Rovenstein) forceps, adult and pediatric
8. Lubricating jelly (water soluble)
9. End-tidal CO_2–detection capability
   - Colorimetric (adult and pediatric) or quantitative capnometry

B. Vascular Access

1. Crystalloid solutions, such as Ringer's lactate or normal saline solution (1000-mL bags × 4); fluid must be in bags, not bottles; type of fluid may vary depending on state and local requirements
2. Antiseptic solution (alcohol wipes and povidone-iodine wipes preferred)
3. Intravenous-fluid pole or roof hook
4. Intravenous catheters, 14–24 gauge
5. Intraosseous needles or devices appropriate for children and adults
6. Venous tourniquet, rubber bands
7. Syringes of various sizes, including tuberculin
8. Needles, various sizes (1 at least 1½ in for intramuscular injections)
9. Intravenous administration sets (microdrip and macrodrip)
10. Intravenous arm boards, adult and pediatric

C. Cardiac

1. Portable, battery-operated monitor/defibrillator
   - With tape write-out/recorder, defibrillator pads, quick-look paddles or electrode, or hands-free patches, ECG leads, adult and pediatric chest attachment electrodes, adult and pediatric paddles
2. Transcutaneous cardiac pacemaker, including pediatric pads and cables
   - Either stand-alone unit or integrated into monitor/defibrillator

D. Other Advanced Equipment

1. Nebulizer
2. Glucometer or blood glucose measuring device
   - With reagent strips
3. Large-bore needle (should be at least 3.25 in long for needle chest decompression in large adults)

E. Medications (Preloaded Syringes When Available)

Medications used on advanced-level ambulances should be compatible with current guidelines as published by the American Heart Association's Committee on Emergency Cardiovascular Care, as reflected in the Advanced Cardiac Life Support and Pediatric Advanced Life Support courses, or other such organizations and publications (ACEP, ACS, NAEMSP, and so on). Medications may vary depending on state requirements. Drug dosing in children should use processes that minimize the need for calculations, preferably a length-based system. In general, medications may include:

- Cardiovascular medication such as 1:10 000 epinephrine, atropine, antidysrhythmic agents (eg, adenosine and amiodarone), calcium-channel blockers, β blockers, nitroglycerin tablets, aspirin, vasopressor for infusion
- Cardiopulmonary/respiratory medications such as albuterol (or other inhaled β agonist) and ipratropium bromide, 1:1000 epinephrine, furosemide
- 50% dextrose solution (and sterile diluent or 25% dextrose solution for pediatrics)
- Analgesics, narcotic and nonnarcotic
- Antiepileptic medications such as diazepam or midazolam
- Sodium bicarbonate, magnesium sulfate, glucagon, naloxone hydrochloride, calcium chloride
- Bacteriostatic water and sodium chloride for injection
- Additional medications as per local medical director

OPTIONAL BASIC EQUIPMENT

This section is intended to assist EMS providers in choosing equipment that can be used to ensure delivery of quality prehospital care. Use should be based on local resources. The equipment in this section is not mandated or required.

A. Optional Equipment

1. Glucometer (per state protocol)
2. Elastic bandages
   - Nonsterile (various sizes)
3. Cellular phone
4. Infant oxygen mask
5. Infant self-inflating resuscitation bag
6. Airways

- Nasopharyngeal (12F, 14F)
- Oropharyngeal (size 00)

7. Alternative airway devices (eg, a rescue airway device such as the esophageal-tracheal double-lumen airway [ETDLA], laryngeal tube, or laryngeal mask airway [LMA]) as approved by local medical direction
8. Alternative airway devices for children (few alternative airway devices that have been approved by the Food and Drug Administration have been studied in children; those that have been studied, such as the LMA, have not been adequately evaluated in the prehospital setting)
9. Neonatal blood pressure cuff
10. Infant blood pressure cuff
11. Pediatric stethoscope
12. Infant cervical immobilization device
13. Pediatric backboard and extremity splints
14. Topical hemostatic agent
15. Appropriate chemical, biological, radiologic, nuclear, explosive personal protective equipment (CBRNE PPE), including respiratory and body protection
16. Applicable chemical antidote autoinjectors (at a minimum for crew members' protection; additional for victim treatment based on local or regional protocol; appropriate for adults and children)

B. Optional Advanced Equipment

1. Respirator
   - Volume-cycled, on/off operation, 100% oxygen, 40–50 psi pressure (child/infant capabilities)
2. Blood-sample tubes, adult and pediatric
3. Automatic blood pressure device
4. Nasogastric tubes, pediatric feeding tube sizes 5F and 8F, sump tube sizes 8F–16F
5. Pediatric laryngoscope handle
6. Size 1 curved (MacIntosh) laryngoscope blade
7. 3.5- to 5.5-mm cuffed endotracheal tubes
8. Needle cricothyrotomy capability and/or cricothyrotomy capability (surgical cricothyrotomy can be performed in older children in whom the cricothyroid membrane is easily palpable, usually by the age of 12 years)

OPTIONAL MEDICATIONS

A. Optional BLS Medications

1. Albuterol
2. EpiPens
3. Oral glucose
4. Nitroglycerin (sublingual tablet or paste)

B. Optional ALS Medications

1. Anxiolytic agents
2. Intubation adjuncts including neuromuscular blockers

INTERFACILITY TRANSPORT

Additional equipment may be needed by ALS and BLS prehospital care providers who transport patients between facilities. Transfers may be done to a lower or higher level of care, depending on the specific need. Specialty transport teams, including pediatric and neonatal teams, may include other personnel such as respiratory therapists, nurses, and physicians. Training and equipment needs may be different depending on the skills needed during transport of these patients. There are excellent resources available that provide detailed lists of equipment needed for interfacility transfer such as the American Academy of Pediatrics Guidelines for Air and Ground Transport of Neonatal and Pediatric Patients.

APPENDIX: EXTRICATION EQUIPMENT

Adequate extrication equipment must be readily available to the EMS responders but is more often found on heavy rescue vehicles than on the primary responding ambulance. In general, the devices or tools used for extrication fall into several broad categories: disassembly, spreading, cutting, pulling, protective, and patient related. The following is necessary equipment that should be available either on the primary response vehicle or on a heavy rescue vehicle:

Disassembly tools

- Wrenches (adjustable)
- Screwdrivers (flat and Phillips head)
- Pliers
- Bolt cutter
- Tin snips
- Hammer
- Spring-loaded center punch
- Axes (pry, fire)
- Bars (wrecking, crow)
- Ram (4 ton)

Spreading tools

- Hydraulic jack/spreader/cutter combination

Cutting tools

- Saws (hacksaw, fire, windshield, pruning, reciprocating)
- Air-cutting gun kit

Pulling tools/devices

- Ropes/chains
- Come-along
- Hydraulic truck jack
- Air bags

Protective devices

- Reflectors/flares
- Hard hats
- Safety goggles
- Fireproof blanket

- Leather gloves
- Jackets/coats/boots

Patient-related devices

- Stokes basket

Miscellaneous

- Shovel
- Lubricating oil
- Wood/wedges
- Generator
- Floodlights

Local extrication needs may necessitate additional equipment for water, aerial, or mountain rescue.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Native American Child Health and Committee on Community Health Services

Ethical Considerations in Research With Socially Identifiable Populations

ABSTRACT. Community-based research raises ethical issues not normally encountered in research conducted in academic settings. In particular, conventional risk-benefits assessments frequently fail to recognize harms that can occur in socially identifiable populations as a result of research participation. Furthermore, many such communities require more stringent measures of beneficence that must be applied directly to the participating communities. In this statement, the American Academy of Pediatrics sets forth recommendations for minimizing harms that may result from community-based research by emphasizing community involvement in the research process.

ABBREVIATIONS. IRB, institutional review board; NARCH, Native American Research Centers for Health; IHS, Indian Health Service.

The term "community-based research" is used to describe the conduct of research in community settings (in contrast to research conducted primarily in hospitals, clinics, or institutions specifically dedicated to medical research). Within the specialty of pediatrics, the Muscatine Study examining the natural history of childhood obesity in a small Iowa town is a well-known example.[1] Generally, such projects are embraced by communities because of the perception in European cultures that scientific enterprise is likely to yield information that is potentially beneficial. However, there are communities in North America in which cultural perceptions and historical experience create a different, somewhat hostile view of Western science and research. Such communities commonly comprise persons of ethnic minorities who may be economically disadvantaged, culturally isolated, or politically underrepresented. They may include people with strong ethnic/tribal affinity living in relative geographic isolation (eg, American Indian/Alaska Native individuals living on reservations) or immigrants of common national origin living within a specific urban neighborhood. Although institutional review boards (IRBs) have developed well-recognized procedures to minimize risk to individuals who participate in research studies, collective risks to members of specific geographic, racial, religious, or ethnic communities may be overlooked. The purpose of this statement is to outline the special research-related concerns of such communities and to suggest means by which investigators working with socially identifiable communities can minimize risks and maximize benefits involved with research. The considerations discussed apply to the broad spectrum of research pursuits that may take place in such communities.

SPECIAL RISKS TO SOCIALLY IDENTIFIABLE POPULATIONS

Risks to socially identifiable populations or communities generally can be subdivided into 2 areas: external risks and intracommunity risks. Although most researchers and IRB members have some familiarity with the former, the latter are seldom understood or regarded outside the community of interest.[2]

External Risks

Harms inflicted by outsiders are the best-known collective risk to people with a shared social or cultural identity. Racism, with all its negative components, is an obvious example of this sort of external risk. However, investigators seldom appreciate that the research enterprise may have unintended harms on the ethnic, religious, and social well-being of isolated or socially identifiable communities. These unintended harms may affect economic, social, legal, and political life within such communities.

Economic Risks

The lay press and professional journals have given considerable attention to the potential for employment and insurance discrimination on the basis of genetic information uncovered in the course of genetic research studies. Theoretically, individual research participants and their communities may be placed at risk by such activities. Although few cases of genetic discrimination have been documented, it continues to be a major concern.[3] The same can be said for other kinds of community-based research. For example, documentation of a high prevalence of human immunodeficiency virus infection or domestic violence within a community could have important adverse economic effects on that community, ranging from increased insurance rates for commu-

nity members to decisions by businesses to move into or remain in that community.[4]

Social Risks

Studies that focus on community problems (eg, drug abuse, human immunodeficiency virus infection, teen pregnancy, youth violence) run the risk of stigmatizing such communities or inadvertently reinforcing common misconceptions about such communities within the dominant culture. Community members also may be harmed by the way they see themselves or one another in light of data that emphasize negative aspects of community life and neglect positive aspects of the community or culture. In each case, these harms may disproportionately affect children, whose cultural identity and self-esteem may be closely linked. Genetic studies inadvertently may limit community members in their opportunities for social interactions including marriage, adoption efforts, and child-custody claims.

Legal and Political Risks

In the United States, American Indian and Alaska Native persons share special social and political status on the basis of their descent from the people who inhabited the land before European contact. Issues of tremendous social, political, and economic complexity may be raised by research (including but not limited to genetic studies) that challenges claims of descent or status as original inhabitants of a specific region (eg, the "Kennewick Man" discovered in Washington state[5]). Thus, research findings or interpretations that might be innocuous to some communities may threaten the existence of others.

Intracommunity Risks

As noted previously, intracommunity risks may not be considered when IRBs review research involving human subjects, in part because intracommunity harms are highly localized and often not evident to those outside the community. Nonetheless, outside involvement in local communities—even seemingly beneficial interventions—can be highly disruptive to existing social relationships. Although the involvement of local community members on university IRBs, encouraged by federal regulation, may reduce the occurrence of such harms, it is unusual for communities geographically removed from university centers to have representation on university IRBs. Perhaps the most important consideration from the point of view of socially identifiable communities is the risk to cultural and moral authority that may be engendered by community members' participation in research.

Although informed consent by individuals participating in research is the standard by which many Europeans and Americans judge the ethical propriety of research activities, many societies require collective consensus and assent. Such considerations were, for example, at the heart of the establishment of the Iroquois Confederacy more than 500 years ago.[6] Collective assent is especially important when research activities or findings may affect the whole community. IRB standards and procedures that govern the protection of human subjects in scientific research are based on the rights of individuals. Research cannot be conducted without the informed consent of individuals (or in the case of children, the consent of their parents). However, in many instances of community research, there are other ethical considerations of collective consensus and assent that should be carefully considered and, where appropriate, documented. For example, the University of Washington's IRB requires documentation that appropriate letters of tribal support be presented for research projects involving American Indian/Alaska Native communities. Area offices of the Indian Health Service (IHS), which also sponsor IRBs for research conducted in their areas, maintain the same requirement.

None of these considerations should be construed to indicate that community consent may properly override the autonomy of an individual who does not wish to participate in research.

Involving community members and groups on the research team from planning, through analysis, and to dissemination of the results will help the research team recognize potential risks to the community and identify how best to avoid or minimize them.[7]

SPECIAL POTENTIAL BENEFITS TO SOCIALLY IDENTIFIABLE POPULATIONS

In addition to having to consider unique aspects of informed consent in socially recognizable communities, many indigenous populations desire a rethinking of the concept of beneficence, that is, of doing no harm while maximizing potential benefits.[8] In conventional views of research, an acceptable understanding of beneficence includes the notion that, although the research may not directly benefit study participants, it has significant potential to benefit society as a whole or to benefit some portion of the society (eg, people with a specific disease). Many indigenous populations have expressed dissatisfaction with this interpretation of beneficence and have required, instead, that research proposals contain concrete, well-defined plans for how the research findings will be used to directly benefit the community.[9] In many instances, such requirements include involvement by researchers in the community even after the data-gathering phase of the research is complete. Thus, for example, a study examining the impact of violence in a neighborhood's public schools might be considered unacceptable if the investigators proposing the study could not articulate clearly how study results might be used to ameliorate the problem.

The early and continuing involvement of community members and groups on the research team will help the team recognize potential benefits to the community and identify how best to maximize them.[7] The medical and public health literature contains numerous examples of successful research partnerships established between academic organizations and socially identifiable communities. The Kahnawake Schools Diabetes Prevention Project in a Mohawk community in Canada is an excellent example of the mutual benefits researchers and commu-

nities derive from ethically sound community-based research.[7] Successful research projects have been undertaken with community participation from the onset of the project, including writing the research proposal and grant application.[10] The establishment of community members as principal investigators in research projects was given further strength and credibility by the recently combined IHS/National Institutes of Health program for establishing Native American Research Centers for Health (NARCH). The NARCH initiative, which partners American Indian and Alaska Native tribes with academic centers and other research institutions, identifies tribes as the investigators and research institutions as partners, a direct reversal of what has been common practice until now. The National Institutes of Health-funded Excellence in Partnerships for Community Outreach, Research on Health Disparities and Training (Project EXPORT) encourages the same approach with other minority communities. The NARCH and Project EXPORT initiatives have the potential to promote the benefits of national, multisite research partnerships between academia and communities and to further the impact of community-based, socially responsible research.

In summary, the ethical conduct of research in socially identifiable communities requires application of standards not commonly used in biomedical or social sciences research. These special considerations are based on the cultural views of many such communities, their historical experience with European-dominated cultures, and in many cases, the unique political statuses of these communities. Important elements of the responsible conduct of research in and with such communities include engaging indigenous or other socially identifiable communities as partners in the research enterprise, developing common goals for researchers and community members, recognizing potential risks and identifying how best to avoid or minimize them, recognizing potential benefits and identifying how to maximize and achieve them, and using knowledge gained from the research to assist communities in need. Investigators who are meticulous in observing these standards almost invariably find that their research goals are met while they are enriched by a deeper knowledge of the unique histories and cultures of their community partners.

CONSIDERATIONS

In addition to the aforementioned points, the following concepts should be considered by researchers seeking to engage socially identifiable communities in research activities.

1. Members of the research team and, where appropriate, research sponsors should strive to assist community organizations in the designing and implementing of interventions based on their research findings. If, for example, the project has examined the prevalence of hypertension among obese adolescents in an inner-city community, researchers should be encouraged to follow their study with concrete assistance to the community in addressing this problem.
2. Efforts should be made to include persons of ethnic minorities as researchers on these teams. Given the small proportion of researchers of ethnic minorities, it is critical that mentorship opportunities be created for these individuals.
3. Researchers should offer their expertise to individuals in the community who may want to develop their own research to address questions raised by the original study.
4. Individual researchers are supported by academic institutions that also have responsibilities to communities. Institutions are strongly urged to create and maintain educational, training, and funding opportunities that facilitate the mentoring relationships necessary to enable communities to cultivate researchers, particularly those of ethnic minorities.

RECOMMENDATIONS

Several steps can be taken during the planning phase of a community-based research project to minimize the aforementioned risks.[11,12] It should be noted that these recommendations may not be applicable to every community. Communities sharing identical views as the dominant culture (eg, a project conducted in a neighborhood in suburban Boston) may not require the same cautious and painstaking approach. Thus, "community" here will refer to socially identifiable groups (not necessarily living in the same geographic region) for which there is a reasonable possibility that group ethos concerning research and/or community responsibility may differ from the dominant culture.

1. Members of the community should be consulted in the planning of the research and the definition of research objectives. Potential benefits to the community should be articulated clearly and unambiguously.[13]
2. Research participants should be considered partners, not research subjects. Responsible members of the community (eg, tribal health care leaders, planners) should have ongoing oversight of the project and be given responsibility for ensuring adherence to the original goals of the project and procedures designed to protect the community. (Research that expects to use any resources of the IHS [eg, IHS personnel, review charts, blood work] must first comply with the IHS requirement that the tribal government explicitly approve the research.)
3. Community members should be the first to be informed of study results. They should be active participants in the analysis and interpretation of data. To provide community members the opportunity to articulate their interpretation of study findings, community members also should be consulted about proper methods for publishing and disseminating the data gathered in their community.
4. If there is potential that the results could be damaging to a specific community, research investiga-

tors should keep the community anonymous when publishing and presenting the results.

5. Human research protection programs and IRBs should utilize appropriate options provided within the federal regulations (45 CFR 46) to guarantee that proper representation of community interests is part of the ethical review process. This often will require the recruitment of experts from outside of the IRB to help in the review of community-based studies. Appropriate IRB review of community-based research should also be promoted and enforced within human research protection accreditation standards.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Bioethics

Ethical Issues With Genetic Testing in Pediatrics

ABSTRACT. Advances in genetic research promise great strides in the diagnosis and treatment of many childhood diseases. However, emerging genetic technology often enables testing and screening before the development of definitive treatment or preventive measures. In these circumstances, careful consideration must be given to testing and screening of children to ensure that use of this technology promotes the best interest of the child. This statement reviews considerations for the use of genetic technology for newborn screening, carrier testing, and testing for susceptibility to late-onset conditions. Recommendations are made promoting informed participation by parents for newborn screening and limited use of carrier testing and testing for late-onset conditions in the pediatric population. Additional research and education in this developing area of medicine are encouraged.

ABBREVIATIONS. IOM, Institute of Medicine; AAP, American Academy of Pediatrics; CF, cystic fibrosis.

INTRODUCTION

The Human Genome Project formally began in 1990 with an original goal of mapping and sequencing the complete set of human genes by the year 2005. Remarkably, the sequencing of the human genome essentially was complete in early 2000. The ultimate purpose of the research is to develop more effective strategies for disease prevention and treatment. However, the first practical applications of this knowledge will be expanded possibilities for genetic testing for individual evaluation and population screening. Although pediatricians are familiar with genetic testing for specific indications and rare conditions, new generations of genetic technology will detect persons at increased risk for common conditions, such as cancer, hypertension, and Alzheimer disease.[1] Although genetic research offers great promise for improvements in child health, the use of new genetic tests in children must be considered carefully. In the absence of clearly beneficial treatments or effective preventive strategies, genetic testing of children and adolescents may not be justified. This statement reviews the potential uses of genetic testing in children and offers guidance for pediatricians on the appropriate applications of this technology. This statement draws on analyses of ethical issues in genetic testing by a number of influential bodies, including the National Academy of Sciences,[2] the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research,[3] the Institute of Medicine (IOM),[4] and the Working Group on Genetic Testing for the National Human Genome Research Institute.[5]

Medical testing is familiar to physicians in the routine practice of medicine. A legitimate question may be raised whether genetic testing is sufficiently different from other forms of testing to justify additional scrutiny. Several aspects of genetic testing should be considered in this regard.[6] First, genetic information is familial. Thus, the test results of one person have direct health implications for others who are genetically related. Second, the risks of genetic testing may not be obvious because the primary risks are psychological, social, and financial. The psychosocial risks include guilt, anxiety, impaired self-esteem, social stigma, and insurance and employment discrimination. Third, genetic information often has limited predictive power. Our genes interact with our environments in complex ways, often making predictions impossible about whether disease will develop or the severity of its manifestations. Finally, many genetic conditions remain difficult to treat or prevent, meaning the value of genetic information may be limited for altering the clinical care of the person. Genetic testing is not unique in any of these respects, but the cumulative complexity of these issues requires that genetic testing receive careful consideration. Given these concerns, detailed counseling, informed consent, and confidentiality should be key aspects of the genetic testing process, particularly when the benefits are uncertain. Because young children are unable to discern the value of genetic information for their own lives, particular care must be exercised by parents and pediatricians when making decisions about genetic testing for children.

The American Academy of Pediatrics (AAP) believes pediatricians can best help children and parents by working to promote child and parent understanding of relevant information, ensure privacy and confidentiality for test results to the extent permissible by law, and provide or refer children for counseling and testing only when it is in the best interest of the child or when the legitimate interests of the parents or family can be promoted without anticipated harm to the child. This statement addresses 3 potentially problematic applications of genetic testing and screening: newborn screening, carrier testing and screening, and predictive testing for late-onset disorders.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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NEWBORN SCREENING

The purpose of newborn screening for genetic disorders is to limit the morbidity and mortality attributable to selected inherited diseases. Because newborn screening programs are organized through state governments, substantial variability in testing exists between states.[7] As new genetic tests become available, extensive consideration will be given to the introduction of these tests into newborn screening programs. Consistent with earlier guidelines on the issue, the IOM report[4] recommends that 3 principles govern the introduction of new tests and the maintenance of established tests: 1) identification of the genetic condition must provide a clear benefit to the child; 2) a system must be in place to confirm the diagnosis; and 3) treatment and follow-up must be available for affected newborns.

The challenges of introducing new tests have been brought into focus by discussions about the appropriateness of newborn screening for cystic fibrosis (CF). In 1983, the Task Force on Neonatal Screening of the AAP advised against the introduction of state programs until the validity of screening tests and the relative benefits and risks of newborn screening for CF had been evaluated.[8] A key question has been whether detection of CF in the neonatal period improves the long-term pulmonary or nutritional status of affected children. The effects of false-positive results on parental anxiety also are a serious concern.[9–13] In addition, a small percentage of parents may have a persistent misunderstanding of their child's risk for developing CF after a false-positive newborn screen, and false-positive results may influence parental reproductive decisions.[14] Thus, the justification for newborn screening for CF has been a subject for debate, although several states, including Wyoming and Colorado, have initiated programs. A long-term study in Wisconsin demonstrated nutritional benefits to early detection of CF, and reports on the effects of screening for pulmonary function are anticipated.[15] Similarly, 19 states have introduced newborn screening for congenital adrenal hyperplasia, and a number of studies are under way to evaluate the sensitivity and specificity of different approaches used by these programs[16,17] and their impact on the health of affected children.

The AAP recommends that new newborn screening tests be introduced in a carefully designed manner that facilitates evaluation of the risks and benefits of screening, including the efficacy of follow-up and treatment protocols. The Wisconsin program for evaluating CF screening was a model in this regard. Furthermore, the AAP concurs with the IOM recommendation that established programs be reviewed periodically to consider the addition, elimination, or modification of current screening modalities.[4]

A persistent ethical issue in newborn screening is whether screening should be voluntary or mandatory. Whether programs are voluntary or mandatory has significant implications for informed responses to test results and for the integration of new tests into established programs. A *voluntary* approach in this context entails an informed decision by parents about newborn screening. Wyoming and Maryland are the only 2 states that require informed consent for newborn screening, although 13 other states require that parents be informed about newborn screening before testing.[18] A *mandatory* approach in this context requires an explicit refusal of screening by parents who object to this intervention. All states except South Dakota permit parental refusal of newborn screening for religious or personal reasons.[18]

The principal ethical justification offered for mandatory screening is the claim that society's obligation to promote child welfare through early detection and treatment of selected conditions supersedes parental prerogatives to refuse this simple medical intervention.[19] An opposing argument maintains that parents traditionally have broad discretion for making health care decisions for their children. Although parents do not have the prerogative to forgo effective treatments for life-threatening conditions, they generally have the prerogative to pursue a variety of options in less threatening circumstances, including options that some medical professionals would consider unwise. Furthermore, it is argued that the great majority of parents will continue to be supportive of newborn screening when they are informed adequately of the risks and benefits.[20] With continued broad public support, approaches involving informed consent (that is, parental permission[21]) may fulfill the important goals of the programs and enhance program quality while respecting traditional parental prerogatives to be informed participants in health care decisions for their children. In a study of newborn screening in Maryland involving informed consent, the majority of women preferred that permission be asked before screening, and the informed refusal rate was only 5 per 1000 infants.[22] In the Maryland study, the consent process typically took 5 minutes or less of staff time. Additional research to develop and evaluate models of parental education and consent will be valuable.

Two potential advantages of obtaining informed consent for newborn screening include more prompt and efficient responses to positive results and an ability to incorporate experimental tests into established screening programs. Under current programs, the information provided to parents about newborn screening is often minimal. A significant source of problems in newborn screening programs is slow or uninformed responses to test results by parents and physicians.[23] If an informed consent process promotes more thorough understanding of the implications of the tests, slow or inappropriate responses to positive results may decrease. Second, advances in genetic research will offer many additional tests for consideration by newborn screening programs.[24] The relative risks and benefits of new tests will be uncertain until adequate clinical research has been conducted. In these circumstances, experimental tests should be offered on a voluntary basis with informed consent. Experimental tests could be integrated more easily in screening programs that routinely sought informed consent for newborn screening tests.

The IOM report suggests that it is appropriate for states to mandate the *offering* of "established tests

(eg, phenylketonuria, hypothyroidism) where early diagnosis leads to improved treatable outcomes."[4] The AAP Committee on Genetics concurred that state governments should mandate the *offering* of tests (although some members of the Committee expressed the opinion that testing should be mandated).[16] Consistent with the recent report of the Newborn Screening Task Force,[25] the AAP recommends that states evaluate an informed consent process for newborn screening tests to foster parental education and promote informed responses to test results. Given the established efficacy of newborn screening programs, it will be essential to demonstrate that expanded education and consent function to enhance the quality of these programs. Carefully conducted pilot programs to document benefits and costs of newborn screening and the frequency and consequences of informed refusal of newborn screening tests will be important. In addition, research to develop an efficient and effective informed consent process for newborn screening is necessary. Attention should be given to the education of women and couples about newborn screening before the immediate postpartum period. Publication and peer review of this research will be appropriate before substantial changes in state health policy on this issue to ensure that efficacy of screening programs is not impaired. Informed consent in this context need not involve a signed consent form for tests of established value, but must include basic information on the purpose of screening and the importance of prompt responses to abnormal results.

CARRIER SCREENING

Medical technology permits the identification of persons who are carriers for mutations in genes responsible for a variety of conditions, including Tay-Sachs disease, muscular dystrophy, sickle cell anemia, CF, and thalassemia major. Carrier testing and counseling of prospective parents can permit informed reproductive choices. A significant concern raised by carrier screening programs is the possibility for individual and community misunderstanding of the carrier state. Confusion about the difference between being an asymptomatic carrier for a genetic condition and being affected with the condition may lead to stigma and discrimination, as well as to adverse psychological reactions in those being screened.[26–28] An historical example is provided by the carrier screening programs for sickle cell disease in the 1970s in the United States that were not preceded by adequate broad-based education. The subsequent misunderstanding of the benign nature of being a sickle cell carrier by employers, insurance companies, government agencies, and the community being screened led to many cases of discrimination and stigmatization.[3]

To date, carrier testing or screening has not been applied extensively to children or adolescents in the United States. Theoretically, carrier testing or screening before the initiation of sexual activity would increase the reproductive choices of those found to be carriers in comparison with carrier testing during pregnancy. However, children and adolescents may be more psychologically vulnerable than adults to knowledge of carrier status, and it remains uncertain whether testing at younger ages would result in changes in future reproductive behavior. Of note, however, a report of 2 decades of carrier screening in high school students in Montreal, Quebec, suggests that many persons can effectively use the genetic information in later reproductive decisions.[29] Additional research is necessary to thoroughly evaluate these issues in the US health care system and in a variety of different cultures and ethnic communities.[30] The AAP does not support the broad use of carrier testing or screening in children or adolescents. Carrier testing for the pregnant adolescent or for the adolescent who is planning a pregnancy and who has been fully informed of the benefits and risks of carrier testing may be appropriate.

In some circumstances, carriers will be identified through newborn screening programs. For example, newborn screening for sickle cell disease will identify infants who are carriers (in addition to those who are homozygous for the disease). Reporting the infant's carrier status to parents has the theoretical advantages of informing parents that they may be at risk for bearing an affected child (if both parents are carriers) and of enabling the family to be aware of the child's future reproductive risk. However, identification of infants as carriers may lead to misinterpretation by parents and others, resulting in changes in the parent-child relationship and social discrimination. Furthermore, parents should have the opportunity to obtain or refuse their own testing for carrier status (newborn screening should not be used as a surrogate for parental testing). Finally, it remains to be determined whether newborn screening results can be used effectively years later when the person is making reproductive decisions. The AAP concurs with the IOM recommendations that newborns not be screened for the purpose of determining carrier status.[4] Carrier status results that are obtained incidentally should be conveyed to parents who have undergone previous counseling and have given consent. Newborn screening tests should be conducted with adequate parental education, including information about implications for genetically related persons.

PREDICTIVE TESTING FOR LATE-ONSET DISORDERS

Genetic technology provides the means to diagnose disorders that develop beyond infancy, including some that become manifest only in adulthood. Examples of late-onset diseases with a high degree of predictability based on genetic tests include myotonic dystrophy, hemochromatosis, polycystic kidney disease, Huntington disease, and some cancers. Furthermore, it soon may be possible to identify genetic factors that increase the probability that common disorders, such as coronary artery disease, diabetes, stroke, hypertension, Alzheimer disease, forms of colon and breast cancer, several psychiatric conditions, and some rheumatoid diseases, will develop.

For some of these conditions, knowledge of risk status may help persons reduce morbidity or risk of

mortality. In addition, members of at-risk families may benefit psychologically from learning that they are not mutation carriers or from a reduction in uncertainty if they are found to be mutation carriers. However, a reduction in morbidity or mortality as a result of genetic testing has not been demonstrated for many conditions for which predispositional testing is available.[31,32] Whether current recommendations for prevention or early detection will be effective in this high-risk population remains unclear. Furthermore, the knowledge of increased risk status may trigger adverse psychological responses and, potentially, discrimination by insurers, employers, or others. For these reasons, the rapid introduction of BRCA1/BRCA2 (which confer increased risk for breast and ovarian cancer) and HNPCC (or hereditary nonpolyposis colon cancer, which confers increased risk for colon cancer) mutation testing into clinical medicine for adults has been discouraged.[33,34] The complexities of genetic testing and the uncertain risks and benefits of the results support the use of detailed genetic counseling for predictive testing for late-onset disorders. Many adults choose not to be tested for late-onset conditions, indicating that we cannot presume that children would want or will benefit from such testing.[35,36] Further, testing in childhood inappropriately eliminates the possibility of future autonomous choice by the person and risks stigma and discrimination. Unless there is anticipated benefit to the child, pediatricians should decline requests from parents or guardians to obtain predispositional genetic testing until the child has the capacity to make the choice.[37,38]

GENETIC SERVICES

The Human Genome Project will foster the development and rapid introduction of genetic tests into clinical practice. The number of genetic counselors and geneticists is insufficient for these professionals to take primary responsibility for managing this technology.[39] As a result, primary care physicians will need to expand their knowledge of genetics and the benefits and risks of genetic testing.[40]

RECOMMENDATIONS

1. Established newborn screening tests should be reviewed and evaluated periodically to permit modification of the program or elimination of ineffective components. The introduction of new newborn screening tests should be conducted through carefully monitored research protocols.
2. Genetic tests, like most diagnostic or therapeutic endeavors for children, require a process of informed parental consent and the older child's assent. Newborn screening programs are encouraged to evaluate protocols in which informed consent from parents is obtained. The frequency of informed refusals should be monitored. Research to improve the efficiency and effectiveness of informed consent for newborn screening is warranted.
3. The AAP does not support the broad use of carrier testing or screening in children or adolescents. Additional research needs to be conducted on carrier screening in children and adolescents. The risks and benefits of carrier screening in the pediatric population should be evaluated in carefully monitored clinical trials before it is offered on a broad scale. Carrier screening for pregnant adolescents or for some adolescents considering pregnancy may be appropriate.
4. Genetic testing for adult-onset conditions generally should be deferred until adulthood or until an adolescent interested in testing has developed mature decision-making capacities. The AAP believes that genetic testing of children and adolescents to predict late-onset disorders is inappropriate when the genetic information has not been shown to reduce morbidity and mortality through interventions initiated in childhood.
5. Because genetic screening and testing may not be well understood, pediatricians need to provide parents the necessary information and counseling about the limits of genetic knowledge and treatment capabilities, the potential harm that may be done by gaining certain genetic information, including the possibilities for psychological harm, stigmatization, and discrimination, and medical conditions and disability and potential treatments and services for children with genetic conditions. Pediatricians can be assisted in managing many of the complex issues involved in genetic testing by collaboration with geneticists, genetic counselors, and prenatal care providers.
6. The AAP supports the expansion of educational opportunities in human genetics for medical students, residents, and practicing physicians and the expansion of training programs for genetic professionals.[4]

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American Academy of Pediatrics

Policy Statement

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Ethics and the Care of Critically Ill Infants and Children (RE9624)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Bioethics

ABSTRACT. The ability to provide life support to ill children who, not long ago, would have died despite medicine's best efforts challenges pediatricians and families to address profound moral questions. Our society has been divided about extending the life of some patients, especially newborns and older infants with severe disabilities. The American Academy of Pediatrics (AAP) supports individualized decision making about life-sustaining medical treatment for all children, regardless of age. These decisions should be jointly made by physicians and parents, unless good reasons require invoking established child protective services to contravene parental authority. At this time, resource allocation (rationing) decisions about which children should receive intensive care resources should be made clear and explicit in public policy, rather than be made at the bedside.

Since the advent of means for supporting newborns with respiratory distress, neonatal and pediatric intensive care has helped tens of thousands of children survive life-threatening illness and the rigors of major surgical intervention. For more than a decade, however, many responsible for the health care of children have debated the appropriateness of applying life-sustaining medical technology (LSMT) to all critically ill children. (The term LSMT here applies to methods of supporting life typically applied in intensive care units, such as the use of ventilators and mechanical or pharmacologic support of circulation. The term critically ill here refers to disorders requiring such LSMT. Both terms defy precise definition.) As a recent AAP policy statement[1] on forgoing LSMT notes, the value of such therapy may be uncertain, especially when first considered. Good medical practice may favor initiation of LSMT until clarification of the clinical situation and relevant ethical values can occur. Much discussion has focused on highly visible "selective nontreatment of handicapped infants"[2] and the responses of the federal government, now known colloquially as the "Baby Doe" rules.[3,4] In the last few years, clinicians and the public also have become increasingly concerned about the high costs, in terms of money, time, and psychosocial consequences, of neonatal and pediatric intensive care.

NEWBORNS AND INFANTS

Much controversy has surrounded the treatment of newborns and older infants with readily identifiable medical problems, including genetic disorders, malformations and deformations, and, to some extent, extreme prematurity and/or low birth weight. Scientific understanding and improved technology have permitted reductions in mortality for infants affected by an enlarging list of conditions. A better appreciation of what can be done to help many infants with disabilities and social considerations of fairness have led to the application of life-saving medical interventions to critically ill newborns and infants who, not long ago, physicians might not have treated vigorously. Concern that some infants, eg, those with Down syndrome and gastrointestinal obstruction, received insufficient treatment led to the federal legislation (the 1984 Child Abuse Amendments) and regulations that sought to ensure appropriate medical therapy for all disabled infants.

Looking back, the measures to prevent undue discrimination against disabled infants seem to have produced at least two unintended consequences. First, it seems that many persons in the health care and child advocacy professions, along with the general public, misunderstand the various federal and other legal requirements regarding treatment decisions for infants with critical illnesses.[5-7] Thus, misconceptions about the Baby Doe rules may have become de facto benchmarks for treatment decisions about critically ill newborns and older infants. Second, attention concentrated on saving the lives of infants, some with permanent, severe disabilities or neurodegenerative disorders, has hampered sufficient attention to the possible overuse of LSMT.

With regard to the first point, the actual language of the 1984 Child Abuse Amendments may permit more physician discretion than some realize. Although the law mandates provision of LSMT to most seriously ill infants, it does provide for exceptions in the case of permanent unconsciousness, "futile" treatment, and "virtually futile" therapy that imposes excessive burdens on the infant. Physicians, with parental agreement, may even forgo giving hydration and nutrition when they think these measures are not "appropriate." (Quoted words and phrases come directly from the law.[3])

With regard to the second point, possible overuse of LSMT, several book-length studies,[8-11] one personal account from parents,[12] and recent essays by pioneering neonatologists[13,14] have suggested that modern newborn care may, at times, constitute overtreatment. Articles for the general public have communicated the same message.[15-17] As previously noted, after the Child Abuse Amendments of 1984, two reports of a survey of neonatologists[5,6] indicated that many who specialize in the care of sick newborns believe they are legally constrained to provide LSMT to infants, even when their medical judgments and the views of the parents concur that withholding treatment is preferable.

Although many would like to have simply interpreted and easily applied substantive standards for clinical decisions about critically ill infants, medical and moral complexity make such rules imprudent. Scientific uncertainty regarding outcome continues in the neonatal intensive care unit. Some very tiny infants with documented brain insults, such as those that may occur with periventricular hemorrhage, defy expectations and survive with no apparent clinical deficits. Available evidence, however, continues to indicate that the decreased mortality brought about by neonatal intensive care has been accompanied by increased morbidity, ie, serious mental and physical limitations among survivors that impose burdens on affected children and their families.[18,19] These factors also play legitimate roles in decision making.[20,21]

A few well-publicized cases in the early 1980s led some to conclude that physicians and parents commonly denied beneficial treatment to imperiled newborns. However, no reliable evidence that decisions endangering children have been widespread exists. Most cases of lethal nontreatment seem to have involved infants with trisomy 21 and myelomeningocele.[22-24] However, by the early 1980s professional and public views about infants with Down syndrome and spina bifida had generally shifted to favor treatment.[25] This view is supported by results from a survey of pediatricians done in Massachusetts in the mid-1980s.[24]

The AAP supports parental involvement in decisions about imperiled infants from the earliest possible moment. Obstetricians and pediatricians need to inform and counsel parents about available options when prenatal diagnostic procedures identify disorders in fetuses. Women may legitimately decide about the treatment they and their fetuses receive.[26,27] Once parturition occurs, parents continue to have a vital role in decision making under the presumption that they accept responsibility for nurturing the infant and providing reasonable care.[28]

The AAP believes that parents and physicians should make reasoned decisions together about critically ill infants using the principles of informed parental permission recently articulated by the AAP.[29] Such decisions should consider the benefits and burdens of treatment alternatives. Physicians should remember that many parents want a strong role in these decisions[30] and that parents may bring values to the process that differ sharply from those of the physician. In rare instances, as required by law and sound ethical standards, it may be necessary to invoke established child protective mechanisms if parents wish to forgo LSMT, physicians disagree, and the parties cannot resolve their differences with help from subspecialists, ethics consultants, or ethics committees.

CHILDREN BEYOND INFANCY

As with infants, two basic questions arise in the care of children beyond the first year: Which values and whose authority ought to govern in medical treatment decisions about the critically ill? Published court cases indicate that parents have been permitted to exercise broad discretion when acting on their children's behalf,[31-36] even when court-appointed guardians ad litem or other counsel opposed the parental choice.[37-39] Laws in some states permit parents to execute advance directives on behalf of minors (*Choice and Dying. State laws regarding end-of-life decision making for minors.* New York, NY: Choice and Dying; September 1995:1-2).[40] In addition to according due respect to the beliefs, feelings, and needs of the family as expressed by parents, as children get older and acquire cognitive skill, experience, and emotional maturity, their individual views deserve careful consideration. Sensitive clinicians and parents acknowledged this in the professional literature as long as 20 years ago.[41]

In the realm of pediatric critical care, the North American literature provides sparse evidence of systematic approaches to limiting LSMT.[42,43] The pediatric intensive care unit, however, unlike the neonatal intensive care unit, has not been the focus of bureaucratic or political debate and action. Pediatric intensivists and their colleagues and consultants in ethics have tended to make decisions about discontinuing LSMT similar to the way clinicians, loved ones, ethicists, and the courts make such decisions for incompetent adult patients.[44,45]

RESOURCE ALLOCATION AND DECISIONS TO LIMIT LSMT

Recently, concerns about the high cost of critical care have led to attempts to manage critical care resources through the use of quantitative indicators of prognosis.[46-51] Some physicians, administrators, and planners would like to use increasingly accurate statistical predictors of outcome to exclude patients from receiving intensive care services. Indeed, population-based mathematical tools may prove helpful in evaluating the effectiveness of various interventions, in comparing outcomes of similar treatments used at different sites, and in informing parents of the probability of the outcome of treatment. Such studies, however, have an important inherent limitation--their results apply to groups of patients, not individuals. In the absence of perfect outcome prediction (100% survival or death, based on experience with large numbers of patients), statistical indicators cannot tell clinicians which particular patient will die or live (and with what residual problems). Moreover, even overwhelming odds of success or failure of treatment cannot take into account the complex values that individuals, including patients, family members, physicians, and other health care providers, bring to a treatment decision. Therefore, the AAP opposes the use of these formulas as the principal determinants of whether individual patients receive intensive care.

The controversy over the usefulness of critical care resources has been most poignantly highlighted by public debates about futile medical treatment.[52-56] In these discussions, physicians and other care givers have demonstrated concern that medical resources are being used inappropriately and that continued treatment violates deeply held beliefs about what properly constitutes professional activities. Others feel that professional objections to so-called futile treatment masks prejudices about those who are disabled, who come from disadvantaged social groups, or who are dying.

The AAP thinks that judgments about which diagnostic categories of patients should receive or be denied intensive care based on considerations of resource use are social policy deliberations and should be made after considerable public discussion, not ad hoc at the bedside.

CONCLUSIONS

Our society has reached a consensus that some critically ill infants previously denied treatment should receive advanced medical and surgical care. A large majority of physicians and other persons agree that most infants with Down syndrome with gastrointestinal obstruction and most infants with myelomeningocele should have surgery and other treatment they need.

There is less agreement, however, about how much treatment to provide other critically ill infants and children. Medical and public controversy still rages about the appropriate limits, if any, to place on the treatment of extremely low birth weight and premature infants, about infants with hypoplastic left heart syndrome,[57] about children with chromosomal abnormalities with known very limited life spans, about infants with complex congenital abnormalities, and about children in the final stages of terminal cancer or other fatal chronic disorders. Many think that laws, regulations, and government policies have unduly constrained parents and physicians from exercising reasonable judgments about whether to forgo LSMT.

A judicial and legislative consensus has developed that the values of patients, rather than those of physicians or policy makers, should determine the extent of the application of LSMT.[58] As noted, some states have empowered proxy decision makers to execute advance directives regarding LSMT on behalf of minors. Legislation and regulation about disabled infants conflict with the legal trends governing all other patients. In the absence of compelling evidence that infants require special legal protection, the AAP thinks that parents of newborns should have the same decision-making authority they have with older children.

Limited resources may require equitable limits on medical treatment. Such restrictions require careful consideration of their social, cultural, and economic consequences and deserve to be made at a public policy level, not at the bedside.

RECOMMENDATIONS

1. Decisions about critical care for newborns, infants, and children should be made similarly and with informed parental permission.
2. Physicians should recommend the provision or forgoing of critical care services based on the projected benefits and burdens of treatment, recognizing that parents may perceive and value these benefits and burdens differently from medical professionals.
3. Decisions to forgo critical care services on the grounds of resource limitations, generally speaking, are not clinical decisions, and physicians should avoid such "bedside rationing."

However, because many in the American public think that our health care system spends excessively on critical care services, society should engage in a thoroughgoing debate about the economic, cultural, religious, social, and moral consequences of imposing limits on which patients should receive intensive care.

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---------- The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

reaffirmed 10/99.

Special Article

CME

Practice parameter: Evaluating a first nonfebrile seizure in children

Report of the Quality Standards Subcommittee of the American Academy of Neurology, the Child Neurology Society, and the American Epilepsy Society

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Article abstract—*Objective:* The Quality Standards Subcommittee of the American Academy of Neurology develops practice parameters as strategies for patient management based on analysis of evidence. For this practice parameter, the authors reviewed available evidence on evaluation of the first nonfebrile seizure in children in order to make practice recommendations based on this available evidence. *Methods:* Multiple searches revealed relevant literature and each article was reviewed, abstracted, and classified. Recommendations were based on a three-tiered scheme of classification of the evidence. *Results:* Routine EEG as part of the diagnostic evaluation was recommended; other studies such as laboratory evaluations and neuroimaging studies were recommended as based on specific clinical circumstances. *Conclusions:* Further studies are needed using large, well-characterized samples and standardized data collection instruments. Collection of data regarding appropriate timing of evaluations would be important.

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The Quality Standards Subcommittee (QSS) of the American Academy of Neurology (AAN) seeks to develop scientifically sound, clinically relevant practice parameters for physicians for diagnostic procedures, treatment modalities, and clinical disorders. Practice parameters are strategies for patient management that might include diagnosis, symptom, treatment, or procedure evaluation. They consist of one or more specific recommendations based on the analysis of evidence.

Every year, an estimated 25,000 to 40,000 US children experience their first nonfebrile seizure, a dramatic and frightening event.[1-4] This practice parameter reviews available evidence concerning the value of diagnostic testing after a first nonfebrile seizure in a child, and provides recommendations based on this evidence. It addresses the evaluation of children age 1 month to 21 years who have experienced a first nonfebrile seizure that cannot be explained by an immediate, obvious provoking cause such as head trauma or intracranial infection. Reports concerning serum laboratory studies, CSF examination, EEG, CT, and MRI are reviewed. This parameter concerns diagnostic evaluation; a subsequent parameter will focus on treatment of the first nonfebrile seizure.

The seizure types covered by this parameter include partial (simple or complex partial, or partial with secondary generalization), generalized tonic-clonic, or tonic seizures. We are specifically not including children diagnosed with epilepsy, defined as two or more seizures without acute provocation. For this reason, myoclonic and atonic seizures are excluded because they typically are not recognized until there have been multiple occurrences. We defined the first seizure using the International League Against Epilepsy (ILAE) criteria to include multiple seizures within 24 hours with recovery of conscious-

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ness between seizures.[5] Children with significant head trauma immediately preceding the seizure or those with previously diagnosed CNS infection or tumor or other known acute precipitating causes are excluded. We excluded neonatal seizures (≤28 days), first seizures lasting 30 minutes or more (status epilepticus), and febrile seizures, because these disorders are diagnostically and therapeutically different. The American Academy of Pediatrics has recently published recommendations for evaluation of children with a first simple febrile seizure.[6]

Description of process. An initial MEDLINE literature search was performed for relevant articles published from 1980 to August 1996, using the following key words: epilepsy, seizures, convulsions, magnetic resonance imaging, computed tomography, electroencephalography, blood chemical analysis, neurological examination, and diagnostic errors. Standard search procedures were used, and subheadings were applied as appropriate. In addition, the database provided by *Current Contents* was searched for the most recent 6-month period. These searches produced 279 titles of journal articles in English, and 79 in non-English languages. An updated MEDLINE search was performed in June 1997 and again in November 1998.

Titles and abstracts were reviewed for content regarding first nonfebrile seizures in children and adults. Articles from the searches were identified for review and additional articles from the references in these primary articles were included. Articles were excluded if they contained only data on adults with established epilepsy, but references were reviewed pertaining to adults with first seizures only, to both children and adults with first seizures, and to children with both new and established seizures. Two of the articles published in non-English languages met our criteria and were included. Of the articles reviewed from searches, bibliographies, and committee member suggestions, 66 met the above criteria and were included as references. The age ranges included in the studies were variable, and most pediatric studies included up to age 16 to 19 years. In most reports, results were not broken down according to subsets of age groups.

A new three-tiered scheme of classification of evidence was developed specifically to be used for evaluation of diagnostic studies (Appendix 1). This classification scheme was approved by the QSS of the AAN and differs from one that has been used for the assessment of treatment efficacy studies, which largely pertains to randomized trials.

Each of the selected articles was reviewed, abstracted, and classified by at least two reviewers. Abstracted data included patient numbers, ages and gender, timing of subject selection (prospective, retrospective, or referral), case-finding methods, exclusion criteria, seizure characteristics, neurologic abnormalities prior to or after the seizure, evaluations and results, and recommendations of the authors. Methods of data analysis were also noted.

Goals of immediate evaluation. After stabilization of the child, a physician must determine if a seizure has occurred, and if so, if it is the child's first episode. It is critical to obtain as detailed a history as possible at the time of presentation. The determination that a seizure has occurred is typically based on a detailed history provided by a reliable observer (Appendix 2). A careful history and neurologic examination may allow a diagnosis without need for further evaluation. Children can present with seizure-like symptoms that may not in fact represent actual seizures, but rather breath-holding spells, syncope, gastro–esophageal reflux, pseudoseizures (psychogenic), and other nonepileptic events. No single clinical symptom can reliably discriminate between a seizure and a nonepileptic event.[7,8] Studies have investigated whether serum prolactin levels[9,10] or creatine kinase levels[11] may help distinguish seizures from nonepileptic events, but neither of these tests is sufficiently reliable to use routinely.

The next goal of assessment is to determine the cause of the seizure. In many children, the history and physical examination alone will provide adequate information regarding probable cause of the seizure[12] or the need for other tests including neuroimaging.[13] The etiology of the seizure may necessitate prompt treatment or provide important prognostic information. Provoked seizures are the result of an acute condition such as hypoglycemia, toxic ingestion, intracranial infection, trauma, or other precipitating factors. Unprovoked seizures occur in the absence of such factors; their etiology may be cryptogenic (no known cause), remote symptomatic (pre-existing brain abnormality or insult), or idiopathic (genetic).

Laboratory studies. *Evidence.* In one Class I study of 30 children ages 0 to 18 years, and 133 adults with seizures, of whom 24 (15%) had new onset seizures, the standard diagnostic laboratory workup, which included complete blood count (CBC), serum electrolytes, blood urea nitrogen (BUN), creatinine, glucose, calcium, and magnesium, revealed one case of hyperglycemia that was unsuspected clinically[14] (95% CI 0, 4.9%). This patient's age was not noted, nor were those with new onset seizures identified by age. Another prospective study of 136 new onset seizure patients found no clinically significant laboratory abnormalities in the 16 children in the study who were ages 12 to 19 years[15] (95% CI 0, 19%).

In two Class II studies including 507 children with both febrile and nonfebrile seizures, results of laboratory studies did not contribute to diagnosis or management.[12,16] In another Class II study including 65 children with new onset seizures not accompanied by fever, one had a positive cocaine screen, and seven had electrolyte abnormalities (additional data supplied by the author of reference 17). Of these, four children were hyponatremic and three were hy-

pocalcemic. Of the four children with hyponatremia, three had a history of illness, lethargy, or diarrhea, and one had no specific symptoms. Of the three with hypocalcemia, one (age 4 months) had clinical signs of rickets, one (age 1 month) had multiple seizures, and one (age 5 years) had a prolonged focal seizure. An exception to the small number of abnormal laboratory findings in the absence of specific suggestive features is in the under 6 month age group. Hyponatremia (<125 mM/L) was found to be associated with seizures in 70% of 47 infants younger than 6 months in a Class II study.[18]

In a sample of 56 children with a first seizure, 40 of whom were febrile, there was one positive urine toxicology screen of the 11 performed. None of 53 hematology tests (95% CI 0, 6%) and two of 96 (2%) chemistry tests were found to be clinically significant (both hyponatremia) (95% CI 0, 11%).[19] In three studies that included a total of 400 adults,[19-21] only 27 (<7%) were found to have abnormalities of calcium, sodium, glucose, BUN, or arterial blood gas (ABG) determinations. Of these abnormalities, only three were unsuspected on a clinical basis.

Conclusions. The fact that a first nonfebrile seizure occurred in the absence of any suggestive history or symptoms in a child who is older than age 6 months and has returned to baseline has not been shown to be sufficient reason to perform routine laboratory testing in the child with a first nonfebrile seizure. However, the number of children reported is too small to be confident that in rare circumstances, routine laboratory screening such as blood glucose determination[12,15,16] might not provide important information, even without specific clinical indications. There were only two reports of positive toxicology screens, but no studies that systematically evaluated the yield from doing routine toxicology screening in children with first seizures. If no cause for the seizure has been identified, it is important to ask questions regarding possible toxic ingestions or exposures.[20]

Recommendations.

- Laboratory tests should be ordered based on individual clinical circumstances that include suggestive historic or clinical findings such as vomiting, diarrhea, dehydration, or failure to return to baseline alertness.[12,14,15,20] **(Option)**
- Toxicology screening should be considered across the entire pediatric age range if there is any question of drug exposure or substance abuse. **(Option)**

Lumbar puncture. *Evidence.* Lumbar puncture (LP) is frequently performed in children in the presence of fever and seizures to rule out CNS infection.[6,21,22] In the only report found giving the frequency of positive spinal fluid examinations in children with nonfebrile seizures, of 57 spinal fluid samples in children ages 2 to 24 months following nonfebrile seizures, 12.3% had >5 leukocytes/mm^3 in the CSF.[23] These children did not have CNS infection. CSF glucose increased with seizure duration and the range of CSF glucose was 32 to 130 mg/dL; the range of CSF protein was 9 to 115 mg/dL.[23] A 1993 AAN practice parameter regarding the value of LP did not mention nonfebrile seizure as an indication for LP in either children or adults.[21]

Conclusions. There is no evidence regarding the yield of routine LP following a first nonfebrile seizure. The one study available (Class II) is limited in size and age range. Recommendations based on age and clinical symptoms are available from Class III publications. In the very young child (<6 months), in the child of any age with persistent (cause unknown) alteration of mental status or failure to return to baseline, or in any child with meningeal signs, LP should be performed.[6,21,22] If increased intracranial pressure is suspected, the LP should be preceded by an imaging study of the head.[20]

Recommendations.

- In the child with a first nonfebrile seizure, LP is of limited value and should be used primarily when there is concern about possible meningitis or encephalitis. **(Option)**

EEG. *Evidence.* Of 10 Class I studies reviewed[24-34] (references 26 and 27 were from the same study) and one meta analysis,[35] five studies addressed the prognostic value of EEG in a population of children with a first seizure.[25-27,30,32,33] In four of these studies, epileptiform discharges or focal slowing on the EEG were predictive of recurrence.[25,27,32,33] In children with a cryptogenic (cause unknown) first seizure, 54% of 103 children with an abnormal EEG had a recurrence compared with 25% of 165 children with a normal EEG ($p < 0.001$).[27] EEG abnormalities were reported to be the best predictors of recurrence in children who were neurologically normal; however, abnormal neurologic examination[25,26] and etiology[26,36] were also strong predictors of recurrence. Several of these studies indicated that the information provided by the EEG is useful for diagnosis of the event, identification of a specific syndrome, and prediction of long-term outcome.[26,27,32,33]

Of the four Class I studies of first seizures in adults only, or in both children and adults, an abnormal EEG was predictive for recurrence risk in three studies.[28,29,34] Inclusion of both an awake and a sleep tracing, as well as hyperventilation and photic stimulation,[27,31,32,37-39] are recommended by the American EEG Society,[38] as they increase the yield of abnormalities seen on EEG tracings.

A Class I study published in 1998 in children and adults concluded that an EEG obtained within 24 hours of a seizure was more likely to contain epileptiform abnormalities than one done later (51% versus 34%).[34] The value of an EEG performed in the emergency department shortly after a seizure was addressed in two Class II studies of adult first sei-

zure patients.[40,41] In these studies, interpretation was difficult in the presence of diffuse postictal slowing,[42] and an EEG done at that time was not helpful in determining which patients should be admitted to the hospital.[40]

A recent analysis of selected findings from several of the Class I studies referred to above[25-27,30,31] concluded that an EEG should not be routinely performed after a first seizure because it does not yield sufficient information to alter treatment decisions.[43] To reach this conclusion, the authors did not consider evidence that the EEG result does in fact alter treatment decisions. They assumed a treatment threshold to be at an 80% risk of recurrence, and used a univariate analysis. However, where the EEG is used as one of several variables, it can identify children with very high and very low recurrence risks.[25,26,32,35] The EEG is not used solely to determine recurrence, but also helps differentiate a seizure from other events, is essential to the diagnosis of a syndrome, and provides information on long-term prognosis; it influences the decision to perform subsequent neuroimaging studies[44] and may influence counseling about management of the child.

Conclusions. The majority of evidence from Class I and Class II studies confirms that an EEG helps in determination of seizure type, epilepsy syndrome, and risk for recurrence, and therefore may affect further management decisions. Experts commonly recommend that an EEG be performed after all first nonfebrile seizures.[39,45-47] It is not clear what the optimal timing should be for obtaining an EEG. Although an EEG done within 24 hours of the seizure is most likely to show abnormalities,[34] physicians should be aware that some abnormalities such as postictal slowing that can be seen on EEG done within 24 to 48 hours of a seizure may be transient and must be interpreted with caution.

There is no evidence that the EEG must be done before discharge from the emergency department; the study may be arranged on an outpatient basis. Epileptiform EEG abnormalities may be useful in confirming that the event was a seizure; however, an EEG abnormality by itself is not sufficient to make a diagnosis that an epileptic seizure occurred, nor can its absence rule out a seizure.[46,47] The EEG is necessary to determine the epilepsy syndrome and the diagnosis of an epilepsy syndrome may be helpful in determining the need for imaging studies.[34] The EEG is also useful in predicting the prognosis for recurrences.[20,39,45-47]

It is not clear what the optimal timing should be for obtaining an EEG. Although an EEG done within 24 hours of the seizure is most likely to show abnormalities, physicians should be aware that some abnormalities such as postictal slowing that can be seen on EEG done within 24 to 48 hours of a seizure may be transient and must be interpreted with caution.

Recommendations.

- The EEG is recommended as part of the neurodiagnostic evaluation of the child with an apparent first unprovoked seizure. **(Standard)**

Neuroimaging studies. *Evidence—CT scans.* There were five Class I studies regarding imaging by CT scan after a first seizure; the data pertained to children[32] and adults[24,42,48] with first seizures, and to adults and children over age 6 with both new onset and established seizures.[14] In the single Class I study of first seizures in children, the abnormalities (mostly atrophy) found in 12 children were "without therapeutic consequences" (95% CI 0, 3%).[32] In one of the adult studies, 1.3% of the patients who had CT scans were diagnosed with tumors,[24] and in another, of 62 patients there were three tumors seen on CT, all in patients with abnormal neurologic examinations.[42] Of 119 adults who had CT scans after a first generalized seizure, 20 had abnormalities that warranted therapeutic intervention.[48] In the Class I study in which 19 CT scans were done in selective cases (first seizures if greater than age 6 years, head trauma, or focal seizure), there was one significant abnormality (age of the patient was not given), a subdural hematoma, not predicted by history and physical examination.[14]

Of the 14 Class II studies, nine involved children only (n = 2559),[17,19,49-56] four were of adults only (n = 666),[24,42,57,58] and one involved children and adults (n = 109).[59] Only a small percentage of children in these studies (0 to 7%) had lesions on CT that altered or influenced management. These were most commonly brain tumors, communicating or obstructive hydrocephalus, one subarachnoid and one porencephalic cyst, and three children with cysticercosis. The yield of abnormality on CT when the neurologic examination and EEG were normal was 5 to 10%.[50,54] In a Class II study in which seven children (14% of children with nonfebrile seizures) had CT scans that influenced management, five had focal or complex partial seizures. Abnormalities on neuroimaging were associated with a higher recurrence risk.[54] In one study of febrile and nonfebrile children, CT scans were always normal in the absence of defined risk factors such as known neurologic diagnosis, age <5 months, or focal deficit.[57] Focal lesions on CT scans tended to be more commonly found in adults (18 to 34%)[40,48,57,58] than in children (0 to 12%),[17,32,49,52,54-56] particularly when ordered for specific clinical indications. At least three studies provided evidence that MRI scanning was preferable to CT[51,54,60] in children following nonfebrile seizures.

Evidence—MRI. There was one Class I report regarding MRI in children presenting with a first seizure[54] and another Class I report of newly diagnosed epilepsy in children.[60] Of 411 children who presented with a first seizure, 218 had neuroimaging studies. Four had lesions seen on MRI or CT (two brain tumors, two neurocysticercosis) that potentially altered

Table *Class I and II neuroimaging studies in children*

Reference	No. children	Ages	Class	Method	No. imaged	No. abnormal (%)	95% CI (%)	No. significantly abnormal* (%)	95% CI (%)
Stroink et al., 1998[32]	156	1 mo to 16 y	I	CT	112	12 (11)	9–12	0	0–3
Berg et al., 1999[60]†	273	1 mo to 15 y	I	MRI/CT	236	27 (11)	10–13	0	0–1
King et al., 1998[34]†	59	5 to 16 y	I	MRI	43	3 (3.9)	0–2	0	0–7
O'Dell et al., 1997[54]	411	1 mo to 19 y	I	MRI/CT	218	44 (20)	18–22	4 (2)	2–2
Gibbs et al., 1993[49]	964	2 mo to 17 y	II	CT	121	26 (21)	18–24	2 (2)	1–2
Yang et al., 1979[50]	256	0 to 18 y	II	CT	256	84 (33)	30–36	7 (3)	2–3
McAbee et al., 1989[52]	81	1 mo to 18 y	II	CT	81	6 (7)	6–9	4 (5)	4–6
Warden et al., 1997[56]	158	Median 3.1 y	II	CT	158	10 (6)	5–7	0	0–2
Garvey et al., 1998[17]	65	2 wk to 16 y	II	CT	65	11 (17)	16–24	7 (11)	11–17
Total	2423				1290	223 (17.3)	15–19	24 (1.9)	1–3

* Influencing treatment or management decisions.
† The author provided data regarding analyses of the children who presented with a first nonfebrile seizure.

management.[54] When these four were excluded, 407 children remained in this Class I study. Of these, 58 children had an MRI scan, and 19 (33%) scans were abnormal, but none of the children required intervention on the basis of the neuroimaging findings. In the Class I study of 613 children with newly diagnosed epilepsy, 273 had partial, generalized tonic clonic, or generalized tonic seizures and came to medical attention at the time of their first unprovoked seizure[60] (additional data supplied by the author of reference 60). Of these, 86% had neuroimaging, and none had abnormalities influencing immediate treatment or management decisions. One Class I study of 300 adults and children with first seizures reported 43 MRI scans done in 59 children, one showing hippocampal sclerosis and two showing single gray matter heterotopic nodules (additional data supplied by the author of reference 34).[34] All patients with generalized epilepsy had normal MRI scans.[34] In two Class II reports of retrospective evaluations of MRI in children with seizures, one of which was limited to children with first seizures only, abnormalities on MRI scan such as localized atrophy, mesial temporal sclerosis, and brain malformation were common but did not mandate a change in management.[51,61] There were also six Class III reports.[39,46,62-65]

It was consistently reported in the literature cited above that the MRI was more sensitive than the CT scan.[39,51,54,60,62,63,65] MRI findings included atrophy, infarction, evidence of trauma, cerebral dysgenesis, and cortical dysplasia. Authors of review articles also emphasized a preference for MRI to exclude progressive lesions such as tumors and vascular malformations, or focal cortical dysplasia.[39,62,63,65,66] Neuroimaging was recommended if there is a postictal focal deficit not promptly resolving.[46,66] A recently published practice parameter on neuroimaging in the emergency patient presenting with seizures reviewed literature primarily from adults but included children. This parameter recommended "emergent" neuroimaging if there was suspicion of a serious structural lesion, and that "urgent" neuroimaging should be considered if there was no clear cause of the seizure. This parameter states that if an emergent imaging study is needed, it would be to detect hemorrhage, brain swelling, or mass effect, conditions that are typically adequately imaged on CT.[66] These recommendations were not restricted to any age bracket.

Conclusions. Although abnormalities on neuroimaging are seen in up to one third of children with a first seizure, most of these abnormalities do not influence treatment or management decisions such as the need for hospitalization or further studies (table). Of available reported imaging results, from Class I and Class II studies of children, an average of about 2% revealed clinically significant findings that contributed to further clinical management, the majority of which were performed because the seizure was focal or there were specific clinical findings beyond the fact that a seizure had occurred (see the table).

Thus, there is insufficient evidence to support a recommendation at the level of standard or guideline for the use of routine neuroimaging, i.e., imaging performed for which having had a seizure is the sole indication, after a first nonfebrile seizure in children. However, neuroimaging may be indicated under some circumstances either as an emergent or nonurgent procedure.

The purpose of performing an *emergent* neuroimaging study in the context of a child's first seizure is to detect a serious condition that may require immediate intervention. The possible effects of emergency medication used to treat the seizure must be taken into consideration.

The purpose of performing a *nonurgent* neuroimaging study, which can be deferred to the next several days or later, is to detect abnormalities that may affect prognosis and therefore have an impact

on long-term treatment and management.[20,22] Factors to be considered include the age of the child, the need for sedation to perform the study, the EEG results, a history of head trauma, and other clinical circumstances such as a family history of epilepsy.

Recommendations.

- If a neuroimaging study is obtained, MRI is the preferred modality.[50,51,54,60,62,63,65] **(Guideline)**

Emergent neuroimaging should be performed in a child of any age who exhibits a postictal focal deficit (Todd's paresis) not quickly resolving, or who has not returned to baseline within several hours after the seizure.[46,66] **(Option)**

- Nonurgent imaging studies with MRI should be seriously considered in any child with a significant cognitive or motor impairment of unknown etiology, unexplained abnormalities on neurologic examination, a seizure of partial (focal) onset with or without secondary generalization, an EEG that does not represent a benign partial epilepsy of childhood or primary generalized epilepsy, or in children under 1 year of age.[20,34] **(Option)**

Summary. In the child with a first nonfebrile seizure, diagnostic evaluations influence therapeutic decisions, how families are counseled, and the need for hospital admission and/or specific follow-up plans. This practice parameter has reviewed the published literature concerning the usefulness of studies following a first nonfebrile seizure in children, and has classified the strength of the available evidence. There is sufficient Class I evidence, which involves a well executed prospective study, to provide a recommendation with the highest degree of clinical certainty—i.e., a **Standard**—that an EEG be obtained in all children in whom a nonfebrile seizure has been diagnosed, to predict the risk of recurrence and to classify the seizure type and epilepsy syndrome. The decision to perform other studies, including LP, laboratory tests, and neuroimaging, for the purpose of determining the cause of the seizure and detecting potentially treatable abnormalities, will depend on the age of the patient and the specific clinical circumstances. Children of different ages may require different management strategies.[20,22]

Future research. For most of the questions addressed by this parameter, evidence was insufficient for making a strong recommendation for a standard or guideline, particularly for laboratory studies. In order to generate definitive evidence regarding the value of routine (or selective) laboratory testing and the use of routine neuroimaging studies, sufficiently large samples allowing for adequate statistical power to provide precise estimates (i.e., with narrow confidence intervals) are needed. Neuroimaging studies are needed to understand the significance of neuronal migration defects in the context of a first seizure, and are important because of the improved technical ability of current MRI. In addition, prospective collection of data using standardized treatment protocols and standardized data collection instruments is essential. Results of studies will only be helpful if the patient sample and factors that resulted in inclusion into or exclusion from the sample are well described and documented. Ideally, large consecutive series of well-characterized patients are needed for the results to be accurate and generalizable. Finally, future studies should present separate data from children and adults, and it would be optimal for results in children to be presented by age groupings.

Appropriate timing as well as the choice of evaluative studies have not been adequately studied. Children may present as actively having a seizure when brought to the emergency department, as postictal, or as alert with a history of a possible seizure episode having occurred hours, days, or weeks previously. Data regarding the appropriate timing of laboratory testing, neuroimaging, or EEG studies require adequate prospective studies of these specific questions, with clearly defined entry criteria and a common protocol for type and timing of evaluations.

Research studies with adequate sample sizes and appropriate protocols that provide answers to these questions may serve to reduce the expense and discomfort of unnecessary testing in children with first seizures, and, more importantly, by identifying appropriate candidates, may improve the care and management that these children receive.

Disclaimer. This statement is provided as an educational service of the American Academy of Neurology. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved.

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Appendix 1

Classification of evidence

Class I. Must have all of a–d:

a. Prospective study of a well defined cohort which includes a description of the nature of the population, the inclusion/exclusion criteria, demographic characteristics such as age and sex, and seizure type.

b. The sample size must be adequate with enough statistical power to justify a conclusion or for identification of subgroups for whom testing does or does not yield significant information.

c. The interpretation of evaluations performed must be done blinded to outcome.

d. There must be a satisfactory description of the technology used for evaluations (e.g., EEG, MRI).

Class II. Must have a or b:

a. A retrospective study of a well-defined cohort which otherwise meets criteria for Class 1a, 1b, and 1d.

b. A prospective or retrospective study which lacks any of the following: adequate sample size, adequate methodology, a description of inclusion/exclusion criteria, and information such as age, sex, and characteristics of the seizure.

Class III. Must have a or b:

a. A small cohort or case report.

b. Relevant expert opinion, consensus, or survey.

A cost-benefit analysis or a meta-analysis may be Class I, II, or III, depending on the strength of the data upon which the analysis is based.

Appendix 2

Outline for seizure assessment

Features of a seizure:

Associated factors
Age
Family history
Developmental status
Behavior
Health at seizure onset
Precipitating events other than illness—trauma, toxins

Health at seizure onset—febrile, ill, exposed to illness, complaints of not feeling well, sleep deprived

Symptoms during seizure (ictal)
Aura: Subjective sensations
Behavior: Mood or behavioral changes before the seizure
Preictal symptoms: Described by patient or witnessed
Vocal: Cry or gasp, slurring of words, garbled speech

Motor: Head or eye turning, eye deviation, posturing, jerking (rhythmic), stiffening, automatisms (purposeless repetitive movements such as picking at clothing, lip smacking); generalized or focal movements

Respiration: Change in breathing pattern, cessation of breathing, cyanosis

Autonomic: Pupillary dilatation, drooling, change in respiratory or heart rate, incontinence, pallor, vomiting

Loss of consciousness or inability to understand or speak

Symptoms following seizure (postictal)
Amnesia for events
Confusion
Lethargy
Sleepiness
Headaches and muscle aches
Transient focal weakness (Todd's paresis)
Nausea or vomiting

Appendix 3

Strength of recommendations

Standards. Generally accepted principles for patient management that reflect a high degree of clinical certainty (i.e., based on Class I evidence or, when circumstances preclude randomized clinical trials, overwhelming evidence from Class II evidence that directly addresses the issue, decision analysis that directly addresses the issue, or strong consensus of Class III evidence).

Guidelines. Recommendations for patient management that may identify a particular strategy or range of management strategies and that reflect moderate clinical certainty (i.e., based on Class II evidence that directly addresses the issue, decision analysis that directly addresses the issue, or strong consensus of Class III evidence).

Practice options. Other strategies for patient management for which the clinical utility is uncertain (i.e., based on inconclusive or conflicting evidence or opinion).

Practice parameters. Results, in the form of one or more specific recommendations, from a scientifically based analysis of a specific clinical problem.

Appendix 4

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CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Evaluating Infants and Young Children With Multiple Fractures

Carole Jenny, MD, MBA, FAAP, for the Committee on Child Abuse and Neglect

ABSTRACT

Infants and toddlers with multiple unexplained fractures are often victims of inflicted injury. However, several medical conditions can also cause multiple fractures in children in this age group. In this report, the differential diagnosis of multiple fractures is presented, and diagnostic testing available to the clinician is discussed. The hypothetical entity "temporary brittle-bone disease" is examined also. Although frequently offered in court cases as a cause of multiple infant fractures, there is no evidence that this condition actually exists.

INTRODUCTION

When infants and toddlers present with multiple unexplained fractures, the differential diagnosis can be difficult. Although child abuse is the most frequent cause of multiple fractures in children in these age groups, bone diseases associated with increased bone fragility can be subtle or difficult to diagnose. These children are usually preverbal and cannot give a cogent history of their experiences. If abuse has occurred, caregivers of young children may not be forthcoming with a truthful history. On the other hand, family members of a child having an undiagnosed bone disorder may not be able to explain any mechanism of injury and may be completely bewildered by the injuries. Many parents of children with genetic or metabolic bone disease report that they were initially accused of abusing their children.[1]

DIFFERENTIAL DIAGNOSIS OF MULTIPLE FRACTURES IN INFANTS

Child Abuse

Any type of fracture can be caused by child abuse, although some fractures, such as metaphyseal fractures and posterior rib fractures, are more frequently found in abused children.[2] A careful review of the clinical history and a careful examination for other signs of abuse or neglect are important when child abuse is suspected.

Osteogenesis Imperfecta

Osteogenesis imperfecta is a heterogeneous family of diseases, usually caused by mutations of the genes *COL1A1* and *COL1A2*.[3] These genes encode the chains of type I collagen, which forms the structural framework of bone. Although it is a genetic disease, the presentation of the disease within the same family can be quite variable. Phenotypic expression of the disease depends on the nature of the mutation, its relative abundance resulting from mosaicism, and its expression in target tissues.[4] Some types of osteogenesis imperfecta involve slow production of

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collagen, and the symptoms resolve or lessen after bone growth stops.[5] In addition, spontaneous mutations are common, so there may be no family history of bone disease. Table 1 lists the various signs and symptoms that can be present in a case of osteogenesis imperfecta.

The diagnosis of osteogenesis imperfecta usually can be made by obtaining a careful medical and family history, performing a physical examination, and interpreting the results of appropriate biochemical and radiographic analyses. Many patients with osteogenesis imperfecta will have obvious diagnostic signs such as osteopenia, bone deformities, and wormian bones of the skull on radiographs. In addition, the classic metaphyseal lesions (planar microfractures through the primary spongiosum) that are often seen in abused children are not likely to be seen in children with osteogenesis imperfecta in the absence of obvious demineralization.[6] In some cases, the diagnostic signs of osteogenesis imperfecta can be quite subtle, and blue sclera (a sign found in many but not all cases of osteogenesis imperfecta) can also be seen in normal children with thin sclera.[7]

Osteogenesis imperfecta can be diagnosed by culturing of fibroblasts obtained from a skin biopsy. The cell culture is analyzed to determine if normal amounts and types of procollagen molecules are synthesized by the cells.[8] Eighty-seven percent of patients who are suspected to have osteogenesis imperfecta on the basis of clinical presentation will have abnormal collagen production that is identified by using this method.[9]

The authors of a recent study examined results of fibroblast cultures from skin biopsies that were obtained in cases of suspected child abuse.[10] In 138 children with fractures, osteogenesis imperfecta was identified in 9 cases. In an additional 6 cases, osteogenesis imperfecta could not be ruled out. Three of the 9 children with osteogenesis imperfecta were not suspected to have the disease before the collagen test was obtained. Rare cases of spontaneous subdural hematomas have been reported in children with osteogenesis imperfecta, presumably because of abnormally fragile blood vessels resulting from defective collagen.[11] In children, retinal hemorrhages have been documented in the posterior portion of the retina in nonabused children with osteogenesis imperfecta after accidental head trauma.[12] These hemorrhages have been described as small, intraretinal, and localized to the posterior pole of the retina. In contrast, retinal hemorrhages seen in abusive head trauma are often extensive, multilayered, and found from the posterior pole of the retina extending out to the ora serrata.[13]

A patient's DNA can also be sequenced to locate mutations of the *COLA1A* and *COLA2A* genes. This method can detect abnormal alleles in up to 96% of cases of serious osteogenesis imperfecta, but a genetic abnormality will be detected in only 60% of mild cases. In addition, approximately 5% of subjects without clinical osteogenesis imperfecta will have a sequence variation identified.[14]

In cases of osteogenesis imperfecta that are identified clinically, some patients who have abnormalities identified on analysis of their collagen will have a normal result on DNA sequencing, and some patients with abnormalities found on DNA testing will not have abnormal collagen test results. Both tests are expensive (approximately $2000 for collagen analysis and $3000 for DNA analysis). Although the collagen test requires a skin biopsy, the DNA sequencing can be performed on venous blood. Obtaining collagen test results takes 6 weeks to 3 months, and the DNA test results take up to 6 months to obtain. When testing for osteogenesis imperfecta, the better test to order is not always obvious, and each case should be considered individually. Consultation with a pediatric geneticist may be helpful in deciding which children to test and which test to order.

In cases where abuse is obvious (eg, when other abusive injuries are present or when abuse is witnessed), testing for osteogenesis imperfecta is not usually necessary.

TABLE 1 Signs and Symptoms of Osteogenesis Imperfecta

Fragile bones, with few, some, or many of the following findings:
Poor linear growth
Hypoplastic, translucent, carious, late-erupting, or discolored teeth
Blue sclera
Easy bruisability
Limb deformities
Scoliosis and/or kyphosis
Hyperextensible joints
Wormian bones
Hearing impairment as a result of otosclerosis
Inguinal and/or umbilical hernias
Triangular-shaped face
Macrocephaly
Demineralized bones

Preterm Birth

Preterm infants have decreased bone mineralization at birth, but after the first year of life, bone density normalizes.[15] Osteopenia of prematurity has been well described as a complication in low birth weight infants, particularly when prolonged parenteral nutrition is required.[16] Osteopenia of prematurity is multifactorial. Contributing factors can include inadequate calcium and phosphorus stores, inadequate mineral intake to support rapid growth, effects of medications used to treat complications of preterm birth, and limited patient mobility.[17–21] Osteopenia commonly presents between 6 and 12 weeks of postnatal age. The issue of multiple fractures in preterm infants is complicated by the fact that these infants have been reported to be at an increased risk of abuse.[22]

Rickets

Vitamin D deficiency is an uncommon condition that can be seen in infants who are solely breastfed and not receiving vitamin supplements or in dark-skinned children who are not exposed to adequate sunlight because of lifestyle or geographic location. The American Academy of Pediatrics recently recommended that all breastfed infants receive daily vitamin D supplementation.[23] Rickets can be diagnosed by typical changes on radiographs, including cupping and fraying of the costochondral junctions and epiphyses, demineralization, widened epiphyses, and cortical thinning. Serum concentrations of vitamin D metabolites are low, and alkaline phosphatase concentration is usually elevated. Other metabolic diseases can also cause rickets.

Osteomyelitis

Osteomyelitis in infants can present as multiple lesions at the metaphyses of the long bones, initially resembling the classical metaphyseal lesions found in abused children.[24] Over time, the sites of infection change in appearance to lytic lesions of the bone. Other signs of infection will be present, such as fever, increased erythrocyte sedimentation rate, elevated C-reactive protein concentration, and elevated white blood cell count.

Copper Deficiency

Preterm infants are born with lower stores of copper than term infants.[25] With their rapid rate of growth, copper deficiency can occur, usually in the second 6 months of postnatal life. Copper deficiency can cause pathologic fractures. Children with copper deficiency also have severe sideroblastic anemia and often have neutropenia. Obvious radiographic bone changes will occur before fractures occur, including symmetrical cupping and fraying of the metaphyses, osteopenia, subperiosteal new bone formation, and delayed bone age. Copper deficiency is not likely to occur in term infants of normal birth weight in the absence of a severely restricted diet or in the absence of an underlying genetic or metabolic disease.

Fractures Secondary to Demineralization From Paralysis

Any child with paralysis of the limbs can be at risk of fractures secondary to disuse demineralization, even with normal handling.[26] Often, these fractures are reported to occur during physical therapy and range-of-motion exercises. It can be difficult to distinguish between fractures caused by abnormally rough handling and fractures that occurred accidentally in these fragile children. When multiple fractures are recurring in disabled children, rarely a trial change in caregivers may be indicated to determine if the fractures can be prevented. This is an extreme intervention and should be reserved for very unusual circumstances.

Other Rare Conditions That Mimic Child-Abuse Fractures

Other conditions that can be confused with child abuse include Menkes syndrome (kinky hair syndrome), scurvy, osteopetrosis, hypophosphatasia, congenital syphilitic periostitis, leukemia, vitamin A toxicity, and metabolic and kidney diseases that cause calcium wasting and demineralization. Prolonged administration of prostaglandins, glucocorticoids, or methotrexate also can lead to bony changes that resemble child abuse. These conditions have very distinctive clinical presentations and radiographic findings.[27] Careful history, physical examination, and consultation with a pediatric radiologist may avoid mistaking these conditions for child abuse.

HYPOTHESIZED CONDITIONS PRESENTED IN MULTIPLE-FRACTURE CASES

A few articles in the literature have hypothesized the existence of a condition referred to as "temporary brittle-bone disease." One proponent of this theory claims that an infant's bones can be especially vulnerable to fractures for a short period of time because of some unknown metabolic abnormality, perhaps involving copper metabolism.[28] Another proposed explanation is that the bones are fragile because of decreased fetal movement in utero.[29] Neither of these theories are supported by any clinical or laboratory studies. The very nature of bone maturation and development make it unlikely that bones would quickly change from fragile to normal. Temporary brittle-bone disease is neither clinically validated nor generally accepted by expert professionals and should not be invoked to explain multiple fractures in an infant.[22]

DIAGNOSING CHILD ABUSE WHEN A CHILD PRESENTS WITH MULTIPLE FRACTURES

Child abuse is many times more common in the population than osteogenesis imperfecta.[30] Although osteogenesis imperfecta and other conditions should be considered, clinicians should not hesitate to report suspected child abuse and institute protective measures even before the diagnostic workup is complete. When multiple or suspicious fractures are detected, a complete skeletal survey should be performed on any child younger than 2 years.[31] Computed tomography or MRI of the head as well as a careful retinal examination by an ophthalmologist should be considered. A complete blood cell count and serum calcium, phosphorus, and alkaline phosphatase concentrations should be obtained, although the alkaline phosphatase concentration may be elevated as a result of the fractures. A serum 25-hydroxy-vitamin D concentration can be obtained if rickets is suspected because of radiographic findings or history. Serum copper and ceruloplasmin concentrations should be obtained if radiographic findings suggest copper deficiency.

In any case of suspected child abuse, liver-function studies should be performed and amylase and lipase

concentrations should be obtained to evaluate for possible occult abdominal injury.[32] A urinalysis should be performed to screen for occult blood. A careful physical examination should be performed to document bruising or other skin injury. If fractures stop occurring when the child moves to a protected environment, the diagnosis of bone disease is most likely ruled out, especially if the child has begun walking and falling without refracturing.

Bone densitometry might prove to be helpful in the future, but at this time, no age-adjusted reference values have been determined by studying a large population of infants and children. The threshold level of decreased mineralization that leads to increased fracturability is unknown. Differences in bone size and shape in the pediatric age group make densitometry results difficult to interpret.[33]

If a child has an underlying bone disorder or disability, child abuse can still coexist with the disease. Children with disabilities have been shown to have an increased risk of child abuse.[34]

Distinguishing child abuse from other conditions that cause multiple or suspicious fractures requires the clinician to have an open mind. Thoughtful and objective evaluation of the clinical evidence is required. It is critical to remember that child abuse occurs in all racial and socioeconomic groups. Physicians should not hesitate to comply with state laws that require reporting of suspected abuse.

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CLINICAL REPORT

Evaluation and Management of the Infant Exposed to HIV-1 in the United States

Guidance for the Clinician in Rendering Pediatric Care

Peter L. Havens, MD, Lynne M. Mofenson, MD, and the Committee on Pediatric AIDS

ABSTRACT

The pediatrician plays a key role in the prevention of mother-to-child transmission of HIV-1 infection. For infants born to women with HIV-1 infection identified during pregnancy, the pediatrician ensures that antiretroviral prophylaxis is provided to the infant to decrease the risk of acquiring HIV-1 infection and promotes avoidance of postnatal HIV-1 transmission by advising HIV-1–infected women not to breastfeed. The pediatrician should perform HIV-1 antibody testing for infants born to women whose HIV-1 infection status was not determined during pregnancy or labor. For HIV-1–exposed infants, the pediatrician monitors the infant for early determination of HIV-1 infection status and for possible short- and long-term toxicity from antiretroviral exposures. Provision of chemoprophylaxis for *Pneumocystis jiroveci* pneumonia and support of families living with HIV-1 by providing counseling to parents or caregivers are also important components of care. *Pediatrics* 2009;123:175–187

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Key Words
human immunodeficiency virus, HIV-1, perinatal transmission, antiretroviral prophylaxis, diagnosis, infant

Abbreviations
MTCT—mother-to-child transmission
ARV—antiretroviral
AAP—American Academy of Pediatrics
PCP—*Pneumocystis jiroveci* pneumonia
CDC—Centers for Disease Control and Prevention
ZDV—zidovudine
TB—tuberculosis
NAAT—nucleic acid amplification test
PCR—polymerase chain reaction
BCG—bacille Calmette-Guérin
TST—tuberculin skin test

INTRODUCTION

Each year in the United States, approximately 6000 pregnant women infected with HIV-1 give birth. Implementation of effective, cost-saving[1–3] preventive strategies during pregnancy has reduced the risk of mother-to-child transmission (MTCT) of HIV-1 to approximately 1% to 2%.[4] Preventive strategies include universal HIV-1 antibody testing of all pregnant women and, for women who are infected with HIV-1, (1) administration of antiretroviral (ARV) prophylaxis during pregnancy and labor and to the infant for 6 weeks after birth; (2) elective cesarean delivery before the onset of labor and before rupture of membranes for women with an HIV-1 viral load of >1000 copies per mL before delivery; and (3) complete avoidance of breastfeeding.[5,6] These strategies have been outlined in a separate American Academy of Pediatrics (AAP) policy statement titled "HIV Testing and Prophylaxis to Prevent Mother-to-Child Transmission in the United States."[7] The current clinical report offers companion guidance on the evaluation and management of the HIV-1–exposed infant after birth.

The pediatrician plays a key role in prevention of MTCT of HIV-1 by (1) identifying HIV-1–exposed infants even if the mother's HIV-1 infection was not recognized before delivery; (2) prescribing ARV prophylaxis for infants born to HIV-1–infected women to reduce the risk of MTCT of HIV-1; and (3) further reducing the risk of HIV-1 transmission by advising women with HIV-1 infection not to breastfeed. In addition to standard pediatric care, the pediatrician is also responsible for (1) monitoring of the infant for early determination of HIV-1 infection status, (2) evaluation for possible short- and long-term toxicities of in utero and neonatal ARV exposure, (3) providing chemoprophylaxis for *Pneumocystis jiroveci* pneumonia (PCP) as required, (4) administering vaccines as appropriate, and (5) supporting families living with HIV-1 infection, including providing counseling to parents or caregivers. Care of the infant or child with perinatal infection with HIV-1 should be undertaken in consultation with a pediatric HIV specialist.

Continuing technologic and medical advances in the prevention, diagnosis, and treatment of pediatric HIV-1 infection require an ongoing assessment and review of recommendations relating to management of infants known to be exposed to HIV-1 infection. This report updates previous AAP guidelines.[8]

IDENTIFICATION OF THE INFANT EXPOSED TO HIV-1

Identification of Maternal HIV Infection

Although there has been a dramatic decline in the number of new HIV-1 infections in infants in the United States since 1994, when ARV prophylaxis was first documented to prevent MTCT,[9] transmission continues to occur.[4] Many of these infant infections could have been prevented if HIV-1 infection had been identified in their mothers through adequate preconception and prenatal care and if appropriate prophylactic interventions had been performed. The Centers for Disease Control and Prevention (CDC), the AAP, and the American College of Obstetricians and Gynecologists recommend documented, routine HIV-1 antibody testing for all pregnant women in the United States after notifying the patient that testing will be performed, unless the patient declines HIV-1 testing ("opt-out" consent or "right of refusal"[5,7,10]). All HIV-1 antibody testing should be performed in a manner consistent with state and local laws. (A compendium of state HIV testing laws can be found at www.nccc.ucsf.edu/StateLaws/Index.html.)

Identification of HIV-1 infection early in pregnancy affords the greatest ability to treat the pregnant woman for her HIV-1 infection for her own health and to prevent MTCT of HIV-1. Rapid HIV-1 antibody testing allows timely identification of HIV-1 infection in women even late in pregnancy, during labor, or in the immediate postpartum period as well as rapid identification of the exposed infant whose mother's HIV-1 status is unknown. The results can be available quickly enough to allow successful ARV interventions, which can reduce MTCT of HIV-1, when administered to the mother late in pregnancy or during labor or even to the infant when administered within the first few hours of life. Rapid HIV-1 antibody testing should be immediately available at all facilities with maternity services and/or a neonatal care unit.

HIV-1 Testing of the Infant if the Mother's HIV-1 Infection Status Is Unknown

For newborn infants whose mother's HIV-1 serostatus is unknown, the newborn infant's health care provider should perform rapid HIV-1 antibody testing on the mother or the infant with appropriate consent as required by state and local law. Test results should be reported to health care providers quickly enough to allow effective ARV prophylaxis to be administered to the infant as soon after birth as possible but certainly within 12 hours of life.[5,7,11,12] ARV prophylaxis for mother and newborn infant to prevent MTCT of HIV-1 should be administered promptly solely on the basis of a positive rapid antibody test result, without waiting for results of confirmatory HIV-1 testing. Initiation of breastfeeding should be postponed while awaiting results of confirmatory testing. If confirmatory test results are negative, then prophylaxis should be stopped and breastfeeding may be initiated.

INTERVENTIONS FOR PREVENTION OF PERINATAL HIV-1 TRANSMISSION

Maternal ARV Prophylaxis to Prevent Perinatal HIV-1 Transmission

Prenatal ARV Prophylaxis

In the United States, most pregnant women with HIV-1 infection receive care during the prenatal period, which allows (1) institution of effective ARV prophylaxis for the prevention of MTCT and ARV treatment if required for maternal health, (2) decisions to be made regarding optimal mode of delivery, and (3) counseling to the mother not to breastfeed. Current US Public Health Service guidelines for prevention of MTCT recommend use of combination ARV regimens including at least 3 ARV drugs during pregnancy and labor for all pregnant women with HIV-1 infection. ARV agents are discontinued for the mother after birth unless such therapy is required for her own health, in which case ARV therapy is continued by following guidelines for nonpregnant HIV-1–infected adults. For women who are not being treated with ARV drugs and who have very low viral load (<1000 copies per mL), some experts would consider use of zidovudine (ZDV) alone during pregnancy for prophylaxis of MTCT, stopping the drug after birth.[6,13]

Interventions During Labor and at Delivery

Intravenous ZDV should be administered to all pregnant women with HIV-1 infection during labor even if they receive combination ARV therapy during pregnancy and viral load is undetectable, unless there is a contraindication to maternal receipt of ZDV. Intravenous ZDV is started after the onset of labor or rupture of membranes, or approximately 3 hours before an elective cesarean delivery. There is no maximum time for use of intravenous ZDV for women with prolonged labor. Intravenous ZDV is administered at 2 mg/kg over the first hour and then continued at 1 mg/kg per hour until delivery is complete and the cord is clamped.

Elective cesarean delivery at 38 weeks' gestation is recommended for all HIV-1–infected pregnant women with HIV-1 RNA levels of >1000 copies per mL near the time of delivery (or who have unknown viral load), irrespective of maternal prenatal ARV prophylaxis.[6]

For women who have HIV-1 infection first identified at the time of labor, prompt initiation of maternal intrapartum prophylaxis with intravenous ZDV, followed by infant prophylaxis with ZDV for 6 weeks, is recommended, because such treatment is associated with an approximately 60% lower risk of MTCT of HIV-1 compared with no prophylaxis.[6,11,12,14] In this setting, some experts may administer other ARV agents, in addition to ZDV, to both the woman during labor and the newborn infant. A detailed discussion of prophylaxis when the mother has not received antepartum ARV prophylaxis is provided in the US Public Health Service guidelines for prevention of MTCT.[6]

TABLE 1 **Newborn Infant ZDV Dose for Prophylaxis of MTCT of HIV-1**[15,16]

Gestational Age at Birth	Oral Dose, mg/kg per Dose	Intravenous Dose, mg/kg per Dose	Dosing Frequency	Duration, wk
≥35 wk	2	1.5	Every 6 h[a]	6
>30 wk but <35 wk	2	1.5	Every 12 h, advancing to every 8 h at 2 wk of age	6
<30 wk	2	1.5	Every 12 h, advancing to every 8 h at 4 wk of age	6

[a] Although there are no definitive data in infants to show pharmacokinetic equivalence or equal therapeutic efficacy of administration of double the standard oral ZDV dose twice daily, for term infants administration of ZDV 4 mg/kg per dose twice daily instead of 2 mg/kg per dose every 6 hours may increase adherence to the regimen and could be considered when there are concerns about adherence to drug administration to the infant.[26,77,78]

Infant ARV Prophylaxis

All HIV-1–exposed infants should receive postpartum ARV drugs to reduce the risk of perinatal HIV-1 transmission. The 6-week neonatal ZDV chemoprophylaxis regimen is recommended for all HIV-1–exposed infants,[6] and a quantity of drug sufficient to finish the full course of prophylaxis should be supplied to the family before hospital discharge. Insurance providers should provide payment for this medication, and issues of availability of payment should not prevent appropriate administration of ARV agents.

In certain situations, some experts combine the 6-week infant ZDV prophylaxis regimen (Table 1)[15,16] with additional ARV drugs. Such circumstances may include those under which infants are born to mothers (1) who received prenatal ARV drugs but had suboptimal viral suppression at delivery, (2) who have received only intrapartum ARV drugs, (3) who have received no antepartum or intrapartum ARV drugs, and (4) with known drug-resistant virus. Combining the 6-week infant ZDV with other ARV drugs may provide additional efficacy for prevention of MTCT of HIV-1, but this remains unproven in clinical trials. In addition, appropriate formulations are not available for all ARV drugs, dosing regimens for neonates are incompletely defined for many drugs, and there are minimal data about the safety of combination ARV drugs in the neonate. Combination infant ARV prophylaxis, therefore, involves balancing possible benefits of enhanced prevention of MTCT of HIV-1 against risks of toxicity to the infant.

The most information about use of ARV combinations in neonates is available for ZDV in combination with single-dose nevirapine[17–22] and the dual combination of ZDV and lamivudine,[23–27] which has been combined with daily nevirapine (although there are no published data on this last approach). Careful infant monitoring is needed if combination drugs are provided, because there may be enhanced hematologic toxicity from the combination of ZDV and lamivudine compared with ZDV alone. Long-lasting resistance is possible if the infant is already infected when prophylaxis is given, especially if nevirapine is used.[28] The US Public Health Service guidelines for prevention of MTCT of HIV-1 include an extensive discussion of considerations for infant ARV prophylaxis regimens for different clinical scenarios and should be reviewed for specific recommendations.[6] If drugs in addition to ZDV are considered, neonatal dosing recommendations can be found in the *Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection*.[16] Decisions should be made in consultation with a pediatrician experienced in the care of infants and children with HIV-1 infection.

The administration of ZDV (possibly with other ARV agents) to the infant should be initiated as soon as possible after birth but certainly within 12 hours after delivery.[5,7,11,12] If the infant's HIV exposure is recognized between 12 and 48 hours after delivery, ZDV prophylaxis should be initiated in that time period. Initiation of postexposure prophylaxis after 2 days of age is not likely to be efficacious in preventing transmission. Data from animal studies indicate that the longer the delay in institution of prophylaxis, the less likely that infection will be prevented. In most animal studies, ARV prophylaxis initiated 24 to 36 hours after exposure usually is not effective for preventing infection.[29–31] HIV-1 infection is established in most perinatally infected infants by 1 to 2 weeks of age.[32]

The full 6-week course of infant ARV prophylaxis and careful instructions for its administration should be provided to the family before discharge from the hospital. A prescription and recommendations to purchase ZDV for the infant are not adequate to ensure appropriate prophylaxis. In some states, infants may not be registered for insurance for a few weeks after birth, so even if the family has insurance, coverage may not immediately be available to pay for health care costs of the infant. Some families have health insurance that covers inpatient costs but not prescription medications. Outpatient pharmacies may not stock the infant dosage form of ZDV. At hospital discharge, the family should be supplied with the medication itself, not just a prescription. Special hospital programs to support this may need to be established.

Avoidance of HIV-1 Infection From Human Milk

Postnatal transmission of HIV-1 through ingestion of human milk from a mother with HIV-1 infection is well documented, with rates as high as 9% to 15% with prolonged breastfeeding.[33] In the United States, where the risk of infant mortality from infectious diseases and malnutrition is low and effective alternative sources of feeding are readily available, women with HIV-1 infection, including those receiving ARV therapy, should be counseled not to breastfeed their infants or donate their milk. Although maternal ARV therapy has been shown to reduce the concentration of cell-free HIV-1 in human milk, such therapy does not affect the amount of cell-associated virus in human milk, and there can be discor-

dance between plasma and human milk viral load.[34] It is not yet known whether maternal ARV treatment during lactation will reduce the risk of HIV-1 transmission to the infant via human milk. Ongoing studies are evaluating this question.[35] In addition, there is differential penetration of ARV drugs into human milk. Some ARVs have concentrations in human milk that are much higher than concentrations in maternal plasma, and others have human milk concentrations that are much lower than in plasma or are not detectable.[6,36] This raises concerns about infant drug toxicity and the potential for selection of drug-resistant virus within human milk. Thus, in the United States, where safe alternatives to breastfeeding are available, all HIV-1–infected women should avoid breastfeeding.

Counseling the mother about the avoidance of breastfeeding should occur in a culturally sensitive manner. For some women, the prohibition to breastfeed may be one of the most emotionally painful components of their efforts to protect their newborn infant from HIV-1 infection. Other mothers, particularly those who have migrated from parts of the world in which breastfeeding is nearly universal, may feel that formula feeding their infant publicizes their HIV-1 infection to family members or friends. Pediatricians should recognize the possibility that advice to not breastfeed may not always be followed and stress the importance of compliance with this intervention to prevent MTCT of HIV-1. Support for open communication regarding feeding practices is necessary to ensure appropriate follow-up and testing of all infants. Women should be educated regarding appropriate formula feeding with a discussion of the affordability of formula, including enrollment in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) when appropriate. Assistance from social service agencies may be necessary to help with education and support compliance.

CARE OF THE HIV-1–EXPOSED INFANT

Evaluation for Maternal Coinfections

At the time of the initial assessment of the infant, maternal health information should be reviewed to determine if the infant has been exposed to maternal coinfections, including tuberculosis (TB), syphilis, toxoplasmosis, hepatitis B or C, cytomegalovirus, or herpes simplex virus. Although there is little information as to the relative transmission or infection rates of such pathogens in infants of mothers with HIV-1 infection, there is concern that reactivation of latent infections in immunocompromised pregnant women may cause increased risk of transmission to, and disease in, exposed newborn infants. Diagnostic testing and treatment of such coinfections in infants born to women with HIV-1 infection are based both on maternal findings and evaluation of the infant.[37] In the absence of suggestive history or routine evaluation, specific laboratory testing for these pathogens is not recommended.

Testing to Determine the Infant's HIV-1 Infection Status

The early identification of HIV-1 infection in exposed infants is important to allow early initiation of ARV and adjunctive therapies and care as needed. Appropriate HIV-1 diagnostic testing for infants and children younger than 18 months differs from that for older children, adolescents, and adults. Passively transferred maternal HIV-1 antibodies may be detectable in an exposed but uninfected infant's bloodstream until 18 months of age. Therefore, routine serologic testing of HIV-1–exposed infants and children is generally only informative before the age of 18 months if the test result is negative.

Assays that directly detect HIV-1 DNA or RNA (generically referred to as HIV-1 nucleic acid amplification tests [NAATs]) represent the gold standard for diagnostic testing of infants and young children under the age of 18 months. With such testing, the diagnosis or the presumptive exclusion of HIV-1 infection can be established within the first several weeks of life among nonbreastfed infants. Although neonatal ARV use may decrease the concentration of HIV-1 RNA in infant plasma in the first 6 weeks of life,[38] HIV-1 DNA test results remain positive even in individuals receiving combination ARV therapy who have undetectable plasma HIV-1 RNA. The sensitivity of both DNA and RNA testing is high,[39,40] so either can be used for the diagnosis of HIV-1 infection in infancy.[41] False-positive results with low-level viral copy numbers have been described by using HIV-1 RNA assays,[38,42,43] reinforcing the importance of repeating any positive assay result to confirm the diagnosis of HIV-1 infection in infancy.[16] False-negative results are also possible, and even infants with multiple negative HIV-1 NAAT results should be retested (perhaps by using a different test) if clinical findings suggest the presence of HIV-1 infection.

The Detection of Non–Subtype B HIV-1 and of HIV-2 by NAATs

For infants born to women known or suspected to have acquired infection with non-B subtypes of HIV-1, use of HIV-1 RNA assays may be preferable to the use of HIV-1 DNA assays for diagnostic testing. Women who acquire HIV-1 infection in North America are most commonly infected with HIV-1 subtype B.[44] Women who acquire HIV-1 outside of North America are often infected with other HIV-1 subtypes. Subtypes C and D predominate in southern and eastern Africa, subtype C on the Indian subcontinent, and subtype E in much of Southeast Asia.[45] Currently available HIV-1 DNA polymerase chain reaction (PCR) assays may be less sensitive in the detection of non-B subtype HIV-1, and false-negative HIV-1 DNA PCR assay results have been reported in infants infected with non-B subtype HIV-1.[46,47] Some of the currently available HIV-1 RNA assays have improved sensitivity for detection of non-B subtype HIV-1 infection, although even these assays may not detect all non-B subtypes, such as the uncommon group O HIV-1 strain. When testing infants suspected of infection with non-B subtype HIV-1, consultation with a pediatrician experienced in the care of infants and children with HIV infection is recommended.

HIV-2 is a retrovirus similar to HIV-1 and is found

TABLE 2 **Evaluation and Treatment of the Infant Exposed to HIV-1 (Birth to 18 Months of Age), in Addition to Routine Pediatric Care and Immunizations**

Action[a]	Infant Age						
	Birth	14 d	4 wk	6 wk	8 wk	4 mo	12–18 mo
History and physical examination[b]	X		X				
Assess risk of other infections	X						
ARV prophylaxis[c]	→	→	→	→|			
Recommend against breastfeeding	X→						
Hemoglobin or complete blood cell count	X		X[d]		X[d]		
HIV-1 DNA PCR or RNA assay[e]	[f]	X[g]	X		[h]	X	
Initiate PCP prophylaxis[i]				X			
Enzyme immunoassay for antibody to HIV-1[j]							X

[a] See text for detailed discussion of each action. If during this period the infant is diagnosed as HIV-1 infected, laboratory monitoring and immunizations should follow guidelines for treatment of pediatric HIV infection.[16,37]

[b] Review maternal health information for possible exposure to coinfections (see text). Frequency of examinations is determined, in part, by frequency of visits for immunizations in infancy.

[c] ARV prophylaxis is initiated as soon as possible after birth but certainly within 12 hours. ZDV prophylaxis is continued for 6 weeks, at which time it is stopped.

[d] Checked at 4 weeks by some experts and rechecked at 8 weeks if the week 4 hemoglobin level was significantly low.

[e] All HIV-1–exposed infants should undergo virologic testing for HIV-1 with HIV-1 DNA PCR or RNA assays at 14 to 21 days of age and, if results are negative, repeated at 1 to 2 and 4 to 6 months of age to identify or exclude HIV-1 infection as early as possible. Any positive test result at any age is promptly repeated to confirm the diagnosis of HIV-1 infection.

[f] HIV-1 DNA PCR or RNA assay testing in the first few days of life allows identification of in utero infection and might be considered if maternal ARV agents were not administered during pregnancy or in other high-risk situations. A negative test result at this age requires repeat testing to exclude HIV-1 infection.

[g] If HIV-1 RNA or DNA testing of the newborn infant was not performed shortly after birth, or if such test results were negative, diagnostic testing with HIV-1 NAAT is delayed until 14 to 21 days of age, because the diagnostic sensitivity of virologic assays increases rapidly by the age of 2 weeks. A negative test result at this age requires repeat testing to exclude HIV-1 infection. Presumptive uninfected indicates negative NAAT result at ≥14 days and ≥4 weeks (1 month) of age; definitive uninfected, negative NAAT result at ≥1 and ≥4 months of age (see text for complete details).

[h] No NAAT is needed at 8 weeks of age if previous test results at 2 and 4 weeks of age were negative. A single negative NAAT result at 8 weeks identifies a presumptively uninfected infant.

[i] Infants diagnosed with HIV-1 infection should be given PCP prophylaxis until 1 year of age, at which time infants are reassessed on the basis of age-specific $CD4^+$ T-lymphocyte count/percentage thresholds. Infants with indeterminate HIV-1 infection status should receive prophylaxis starting at 4 to 6 weeks of age until they are deemed to be presumptively or definitively uninfected with HIV-1. Prophylaxis is not recommended for infants who meet criteria for presumptive or definitive lack of HIV-1 infection; therefore, an NAAT at 2 and 4 weeks of age allows avoidance of PCP prophylaxis if both are negative.

[j] Many experts confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay result at 12 to 18 months of age.

most commonly in western Africa. It is less virulent, with a slower rate of progression of clinical disease and lower rates of transmission from mother to child.[48] If infant infection with HIV-2 is suspected, specific HIV-2 virologic testing must be requested, because virologic tests for HIV-1 will not identify HIV-2. Consultation with the CDC via the state department of health may be helpful in arranging this testing.

Timing of Diagnostic Testing in Infants With Known Perinatal Exposure to HIV-1

It is recommended that diagnostic testing with HIV-1 DNA or RNA assays be performed at 14 to 21 days of age and, if results are negative, repeated at 1 to 2 months of age and again at 4 to 6 months of age.[41] Viral diagnostic testing in the first few days of life is recommended by some experts to allow for the early identification of infants with infection acquired in utero. For children with negative virologic tests, many experts confirm the absence of HIV-1 infection with HIV-1 antibody assay testing at 12 to 18 months of age (Table 2).

An HIV-1 NAAT might be considered at birth or in the first few days of life for infants at high risk of infection, including those whose mothers received no ARV drugs during pregnancy or when maternal prophylaxis was started late in pregnancy or during labor or if the mother had primary HIV-1 infection during pregnancy. In the absence of maternal ARV therapy, as many as 30% to 40% of infants with HIV-1 infection can be identified by 48 hours of age.[32,49] Infants with a positive virologic test result at or before 48 hours of age are considered to have in utero infection with HIV-1, whereas infants who have a negative virologic test during the first week of life and a subsequent positive test are considered to have intrapartum infection.[50] Cord blood specimens should not be used for HIV-1 RNA or DNA testing, because they are associated with an unacceptably high rate of false-positive test results.

If HIV-1 RNA or DNA testing of the newborn infant was not performed shortly after birth, or if such test results were negative, diagnostic testing with HIV-1 NAAT is delayed until 14 to 21 days of age, because the diagnostic sensitivity of virologic assays increases rapidly by 2 weeks of age. This change in assay sensitivity in the first 2 weeks of life reflects the biology of MTCT, because when HIV-1 is acquired at the time of delivery, NAAT positivity may be delayed until at or after 14 days.[50] Therefore, negative results of HIV-1 DNA PCR or RNA tests performed before 14 days of age are less helpful in excluding HIV-1 infection acquired at the time of birth than are results of tests performed at or after 14 days of age.[51]

Management if an HIV-1 Virologic Test Result Is Positive

If any of the HIV-1 virologic test results are positive, an immediate repeat HIV-1 NAAT is recommended to confirm the diagnosis of HIV-1 infection. A diagnosis of HIV-1 infection can be made on the basis of 2 separate blood samples, each of which is positive for HIV-1 DNA or RNA. If infection is confirmed, a pediatric HIV specialist should be consulted for advice regarding ARV therapy and care. HIV-1 disease can progress very rapidly in HIV-1–infected infants, and neither CD4 T-lymphocyte count nor HIV-1 RNA copy number are reliable predictors of the risk of progression in infected infants.[52] For this reason, current US pediatric HIV-1 treatment guidelines state that combination ARV treatment is recommended for all HIV-1–infected infants younger than 12 months regardless of clinical symptoms and immunologic or virologic measurements.[16]

Interpretation of Negative HIV-1 Test Results

On the basis of analysis of HIV-1 DNA PCR and HIV-1 RNA assay results from multiple studies, the CDC has revised the case definition for exclusion of HIV-1 infection in infants for surveillance purposes.[51] The definitions supplied here are based on the CDC surveillance definitions and are appropriate for the management of children born to women with HIV-1 infection. These definitions of exclusion of HIV-1 infection are only for use in infants who do not meet the criteria for HIV-1 infection noted previously.

In nonbreastfeeding infants younger than 18 months of age with no positive HIV-1 virologic test results, presumptive exclusion of HIV-1 infection is based on:

- 2 negative HIV-1 RNA or DNA virologic test results, from separate specimens, both of which were obtained at ≥2 weeks of age and 1 of which was obtained at ≥4 weeks of age; or
- 1 negative HIV-1 RNA or DNA virologic test result from a specimen obtained at ≥8 weeks of age; or
- 1 negative HIV-1 antibody test result obtained at ≥6 months of age; and
- no other laboratory or clinical evidence of HIV-1 infection (ie, no subsequent positive results from virologic tests if tests were performed and no AIDS-defining condition for which there is no other underlying condition of immunosuppression).

Infants or children with these test results are presumptively not infected with HIV-1, but further testing is required to definitively exclude and then confirm the absence of HIV-1 infection. In the unusual case of an infant with a positive HIV NAAT result followed by a negative test result, an expert in care of children with HIV infection should be consulted for further testing recommendations.

In nonbreastfeeding infants with no positive HIV-1 virologic test results, definitive exclusion of HIV-1 infection is based on:

- at least 2 negative HIV-1 RNA or DNA virologic test results, from separate specimens, both of which were obtained at ≥1 month of age and 1 of which was obtained at ≥4 months of age, or
- at least 2 negative HIV-1 antibody test results from separate specimens obtained at ≥6 months of age; and
- no other laboratory or clinical evidence of HIV-1 infection (ie, no subsequent positive results from virologic tests if tests were performed and no AIDS-defining condition for which there is no other underlying condition of immunosuppression).

Infants or children with these test results are definitively not infected with HIV-1, but follow-up testing allows confirmation of that assessment.

Many experts confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay result at 12 to 18 months of age (see next section). For both presumptive and definitive exclusion of infection, the child should have no other laboratory (eg, no positive virologic test results) or clinical (eg, no AIDS-defining conditions) evidence of HIV-1 infection.

For breastfeeding infants, a similar testing algorithm can be followed, with timing of testing based on the date of complete cessation of breastfeeding instead of the date of birth.

Role of HIV-1 Antibody Testing in HIV-Exposed Infants

In HIV-1–exposed infants who are not infected with HIV-1, maternal HIV-1 antibodies transferred in utero may persist until 18 months of age (seroreversion). Many initially seropositive infants serorevert to HIV-1 antibody negativity by 12 months of age.[53] Many experts confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay at 12 to 18 months of age. If an HIV-1–exposed infant who is not known to be infected is tested at 12 months of age and is still antibody-positive, then testing should be repeated at 18 months of age. Performing the first antibody test at 18 months of age to confirm seroreversion may avoid the cost and pain of performing 2 tests. Loss of HIV-1 antibody in an infant with previously negative HIV-1 virologic test results definitively confirms that the infant is not infected with HIV-1. Positive HIV-1 antibodies at 18 months of age or older indicate HIV-1 infection. A positive antibody test at or beyond 18 months of age in an infant with infection previously excluded as outlined above suggests that the infant was infected after infancy, such as through breastfeeding, premastication of solid food by an HIV-1–infected caregiver,[54] or sexual abuse.

Prevention of PCP

PCP is the most common serious opportunistic infection in HIV-1–infected infants and children. The highest incidence of PCP in HIV-1–infected infants is during the first year of life, with cases peaking at 3 to 6 months of age.[55,56] Chemoprophylaxis is highly effective in the prevention of PCP. HIV-1–exposed infants should be considered for prophylaxis beginning at 4 to 6 weeks of age.[37]

Infants diagnosed with HIV-1 infection should be given prophylaxis until 1 year of age, at which time

TABLE 3 **Regimens for PCP Prophylaxis in Infants[37]**

Drug	Dose	Route	Schedule
Trimethoprim-sulfamethoxazole	Trimethoprim 150 mg/m^2 per d, with sulfamethoxazole 750 mg/m^2 per d	PO	Twice daily for 3 d/wk on consecutive days (eg, Monday, Tuesday, and Wednesday) or on alternate days (eg, Monday, Wednesday, and Friday); alternatives: once daily for 3 d/wk or twice daily 7 d/wk
Dapsone	2 mg/kg	PO	Once daily
	4 mg/kg	PO	Once weekly
Pentamidine	4 mg/kg	IV	Every 2–4 wk
Atovaquone			
Infants 1–3 mo old	30 mg/kg	PO	Once daily
Infants 4–24 mo old	45 mg/kg	PO	Once daily

For further discussion, see "Guidelines for the Prevention and Treatment of Opportunistic Infections Among HIV-Exposed and Infected Children."[37] PO indicates per os (by mouth); IV, intravenous.

reassessment is made on the basis of age-specific CD4$^+$ T-lymphocyte count/percentage thresholds. Trimethoprim/sulfamethoxazole is the drug of choice for prophylaxis because of its high efficacy, relative safety, low cost, and broad antimicrobial spectrum (Table 3; for further discussion see "Guidelines for the Prevention and Treatment of Opportunistic Infections Among HIV-Exposed and Infected Children"[37]).

Infants with indeterminate HIV-1 infection status should receive prophylaxis starting at 4 to 6 weeks of age until they are deemed to be presumptively or definitively uninfected (see previous section). Prophylaxis is not recommended for infants who meet criteria for presumptive or definitive lack of HIV-1 infection. Thus, for infants with negative HIV-1 NAAT results at 2 and 4 weeks of age (who are presumptively not infected with HIV-1), PCP prophylaxis can be avoided altogether. If PCP prophylaxis is started at 4 to 6 weeks of age in an HIV-1–exposed infant with indeterminate HIV-1 infection status, prophylaxis can be stopped if the child subsequently meets criteria for presumptive or definitive lack of HIV infection (Table 4).

Prevention of TB

Although the bacille Calmette-Guérin (BCG) vaccine is routinely recommended for administration at birth to infants born in countries with a high prevalence of TB, it is not routinely administered in the United States, where TB exposure is uncommon. BCG immunization is not recommended for infants born to women with HIV-1 infection in the United States. BCG vaccine should not be administered to infants and children with known HIV-1 infection because of its potential to cause disseminated disease.[37] Counseling should be provided to families originally from countries with endemic TB, because many will visit such destinations and seek BCG vaccine during those trips.

The populations at risk for infection with HIV-1 and TB overlap, and numerous studies have documented the increased risk of TB in HIV-1–infected adults. Infants and children with TB infection and disease are almost always infected by an adult in their daily environment. Therefore, information should be obtained regarding the TB infection status of the mother and other household contacts of all infants born to HIV-1–infected mothers.

TABLE 4 **Sample Clinical Scenario for Evaluation and Treatment of the Infant Exposed to HIV-1 in the United States**

Timing (Infant Age)	Action	Comment
Birth	History and physical examination; assess risk of other infections; start ARV prophylaxis; check hemoglobin level	HIV-1 NAAT[a] is not needed at birth in this setting, because risk of in utero transmission is low; for infant whose mother had high virus load during pregnancy, consider HIV-1 NAAT at this time
14 d	HIV-1 NAAT	If result is negative, repeat at 4 wk[b,c]
4 wk	HIV-1 NAAT	If result is negative, HIV-1 infection is presumptively excluded (given previous negative result at ≥2 wk of age)
6 wk	Stop ARV prophylaxis	PCP prophylaxis is not needed if HIV-1 NAAT result is negative at 14 d and 4 wk of age[d]
8 wk	No HIV-1 NAAT needed if previous test results were negative at 14 d and 4 wk of age	A single negative result of HIV-1 NAAT performed at 8 wk of age allows presumptive exclusion of HIV-1 infection[e]
4 mo	HIV-1 NAAT	If negative, HIV-1 infection is definitively excluded in the infant with previous presumptive exclusion
12–18 mo	Enzyme immunoassay for antibody to HIV	To confirm the absence of HIV infection[f]

Scenario: infant born to an HIV-infected mother taking highly active ARV therapy since second trimester, virus load undetectable the week before delivery, and mother received 3 hours of ZDV intravenously before delivery.

[a] Either an HIV-1 DNA PCR or RNA assay.

[b] If any positive HIV-1 NAAT result, test is promptly repeated to confirm the diagnosis of HIV-1 infection (see "Management if an HIV-1 Virologic Test Result Is Positive").

[c] Some experts recommend checking hemoglobin level or complete blood cell count at 2 weeks and/or 4 weeks of age. These more frequent measurements might be warranted for preterm infants or if the baseline hemoglobin level is low.

[d] If no testing was performed before this or only a single test was performed between 14 days and 6 weeks of age, start PCP prophylaxis at this point until HIV infection is presumptively excluded.

[e] If PCP prophylaxis was started because of indeterminate HIV-1 infection status from incomplete previous testing, it can be stopped when this 8-week test result is negative.

[f] Many experts confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay result at 12 to 18 months of age.

HIV-1–exposed and –infected infants living in households with people who have had positive tuberculin skin test (TST) results should be evaluated for TB with a TST (5 tuberculin units of purified protein derivative) at 3 months of age and be retested at least once per year.[37] Infants with a positive TST result or who have exposure to a person who has active TB (regardless of the child's TST result) should be treated for latent TB infection (after excluding active TB in the infant), according to published guidelines.[37,57] If the mother or a household member has active TB that is of a contagious form (smear-positive), the infant should be separated from that person, if possible, until the person receives TB treatment and is no longer contagious (becomes smear-negative). Should the mother have documented hematogenous dissemination of TB, the infant should be evaluated for congenital TB following published guidelines.[57] Consultation with a pediatric infectious disease expert should be sought.

Immunizations

Immunization schedules for children 0 to 6 and 7 to 18 years of age are published annually (www.cdc.gov/vaccines/recs/schedules/default.htm). A schedule for HIV-1–infected children is also published.[37] All routine infant immunizations should be given to HIV-1–exposed infants. If HIV-1 infection is confirmed, then guidelines for the HIV-1–infected child should be followed.[37] All inactivated vaccines can be administered safely to HIV-1–infected children regardless of whether the vaccine is a killed whole organism or a recombinant, subunit, toxoid, polysaccharide, or polysaccharide protein-conjugate vaccine, and the usual doses and schedules are recommended. Persons with severe cell-mediated immunodeficiency should not receive live-attenuated vaccines. However, children with HIV-1 infection are at increased risk of complications of varicella, herpes zoster, and measles compared with immunocompetent children. On the basis of limited safety, immunogenicity, and efficacy data among HIV-1–infected children, varicella and measles-mumps-rubella vaccines can be considered for HIV-1 infected children who are not severely immunosuppressed (those with $CD4^+$ T-lymphocyte percentages of $\geq$15%).[37] Note that the combined measles-mumps-rubella-varicella (MMRV) vaccine is not recommended for use in children with HIV-1. HIV-1–exposed and HIV-1–infected infants should receive 1 of the live-attenuated rotavirus vaccines at 2, 4, and 6 months of age (RotaTeq) or at 2 and 4 months of age (Rotarix). The first dose should be administered between 6 and 13 weeks of age, and the last should be administered at no later than 32 weeks of age.[37]

Monitoring for Toxicity From in Utero and Neonatal ARV Drug Exposure

Monitoring for and Management of Short-term Toxicity During Infant ARV Prophylaxis

A baseline hemoglobin or complete blood cell and differential count should be performed on the newborn infant, because infants whose mothers have received ARV agents during pregnancy are at risk of small but measurable differences in several hematologic variables, including hemoglobin level and neutrophil and lymphocyte counts.[58] The risk of anemia and neutropenia is greater in infants whose mothers were treated with combination ARV therapy during pregnancy,[59,60] but anemia is also more common in infants whose mothers were treated only with ZDV compared with infants whose mothers received no ARV treatment during pregnancy.[9] Nevertheless, the benefits of maternal ARV therapy in prevention of MTCT of HIV-1 clearly outweigh the risks of this hematologic toxicity in the newborn infant.[61,62]

Anemia is the primary clinically important complication of the 6-week ZDV regimen in the neonate, but it is unusual for the anemia to be clinically significant. Anemia associated with ZDV prophylaxis resolves when ZDV is stopped. Severe anemia that persists after prophylaxis is stopped should be further evaluated for alternative etiologies. Hematologic toxicity is more significant in infants who were exposed to antepartum ZDV in combination with other ARV drugs and in infants who received both ZDV and lamivudine as infant prophylaxis for 6 weeks.[24,63] Although anemia is mild and asymptomatic in most term infants treated with ZDV, it may be more severe in preterm infants or those with additional medical problems.

Decisions about the timing of hematologic monitoring of infants treated with prophylactic ARV agents after birth depend on a number of factors, including baseline hematologic values, gestational age at birth, clinical condition of the child, receipt of concomitant medications, and maternal antepartum therapy. Some experts recheck hematologic values in a healthy infant who is receiving 6 weeks of ZDV prophylaxis only if the child is symptomatic, and others recheck hemoglobin and/or neutrophil counts after 4 weeks of ZDV treatment, particularly if the infant was born preterm or if trimethoprim/sulfamethoxazole prophylaxis is anticipated.

If hematologic abnormalities are identified, decisions on whether to continue infant ARV prophylaxis need to be individualized. Considerations include the extent of the laboratory abnormality, associated clinical symptoms, duration of infant prophylaxis already received, the magnitude of the risk of HIV-1 infection in the infant (as assessed by maternal receipt of ARV prophylaxis, maternal viral load near delivery, and mode of delivery), and availability of alternative interventions (eg, erythropoietin, red blood cell transfusion). Consultation with a pediatric HIV-1 specialist is advised if early discontinuation of prophylaxis is considered.

Routine measurement of serum lactate concentration in asymptomatic neonates to assess for potential mitochondrial toxicity is not recommended, because the clinical relevance of increased lactate concentrations is unknown, transient elevations return to normal, and predictive value for later appearance of symptomatic toxicity seems poor.[64–67] However, should an infant develop severe clinical symptoms of unknown etiology, particularly neurologic symptoms, serum lactate concentration should be determined. If the serum lactate con-

centration is significantly abnormal in an infant with compatible clinical symptoms, an expert in pediatric HIV-1 infection should be consulted regarding potential early discontinuation of prophylaxis. In most circumstances, prophylaxis should be continued unless there is a compelling reason to stop.

Long-term Toxicity

Data remain insufficient to address the effect that exposure to ZDV or other ARV agents in utero might have on long-term risk of neoplasia or organ-system toxicities. There are conflicting data regarding whether mitochondrial dysfunction is associated with perinatal ARV exposure. Mitochondrial dysfunction should be considered in children with perinatal ARV exposure who present with severe clinical findings of unknown etiology, particularly neurologic findings.[67–74]

Information regarding in utero and/or neonatal ARV exposure should be part of the ongoing permanent medical chart of the child, particularly for uninfected children. Children with in utero ARV exposure who develop significant organ-system abnormalities of unknown etiology, particularly of the nervous system or heart, should be evaluated for potential mitochondrial dysfunction.[71,73] Follow-up of children with ARV exposure should continue into adulthood because of the theoretical concerns regarding potential for carcinogenicity and teratogenicity of the nucleoside analog ARV drugs. Long-term follow-up should include yearly physical examinations of all children exposed to ARV drugs.

Testing Family Members

On identification of an HIV-1 exposed infant, HIV-1 screening should be recommended and offered to all immediate family members with unknown HIV-1 infection status, including the infant's father (or mother's sexual partners) and all siblings. The age of the siblings should not be a deterrent to testing, because it is possible for perinatally infected children to remain asymptomatic into adolescence.[75,76]

Counseling and Support

When counseling the mother of an HIV-1–exposed infant, the pediatrician should take into account that the diagnosis of HIV-1 infection may be recent for the mother, whose infection may first have been identified during or after pregnancy. The diagnosis has profound implications for the mother and the family. If the mother is not already receiving care for her HIV-1 infection, she should be referred for appropriate care for herself. Some families may require additional support because of HIV-1–associated illness or death in other family members.

Other factors that may lead to an increased need for social and psychological support services include poverty, substance abuse, depression, social isolation, lack of health care, unemployment, difficulty in finding housing, domestic violence, and fear of loss of existing supports and services, such as loss of support from a partner or loss of employment, insurance, or health care coverage. Pregnant adolescents with HIV-1 infection are a particularly vulnerable group.

For women and their families who have emigrated from other countries, there are frequently additional factors related to culture and concerns about immigration status. Many will have experienced or know of stigmatization and discrimination against people with HIV-1 infection and may have known individuals who died because they did not have access to appropriate ARV therapy. They may not have had experiences with the type of medical care available to them in the United States, which may lead to distrust or misunderstanding, complicating care and follow-up of the infant.

When counseling new parents or caregivers of an HIV-1–exposed infant, the pediatrician should provide an outline of plans for medical care for the infant. Important topics to cover include medications to prevent MTCT of HIV-1 and opportunistic infections, such as PCP, as well as the schedule of follow-up visits for assessment and laboratory assays (both for diagnosis of HIV-1 infection and to check for any adverse effects of ARV drug exposure). Mothers should be advised not to breastfeed regardless of whether they are receiving ARV drugs for treatment of their HIV-1 disease. Parents and caregivers should be advised of the importance of prompt assessment if the infant becomes ill. For the infant in foster care, caregivers should have sufficient information about the infant's health, including HIV-1 exposure status, to ensure appropriate care.

Education should be provided regarding the lack of transmission risk in family activities such as eating, bathing, or sleeping together. The pediatrician has the opportunity to review prevention of HIV-1 transmission through safer sex practices, including encouraging condom use for all acts of sexual intercourse. Similarly, review of, or referral for, risk-reduction practices regarding injection drug use should be incorporated into visits when appropriate. Education and planning regarding future reproductive plans for the family, likely in collaboration with the family's adult HIV and gynecologic and obstetric providers, can minimize the risk of HIV-1 acquisition for sexual partners and MTCT in future pregnancies.

The necessity of maintaining confidentiality should be emphasized. There may be family members who are not aware of the mother's diagnosis, so caution should be exercised in the labor and delivery unit and when discussing the management of the infant in the postpartum unit. HIV-1 exposure and infection are not reasons for exclusion from infant child care or school. Pediatricians should discuss the need for planning for future care if the mother were to become ill with her HIV-1 infection.

HIV-1 Exposure and Infection Status Reporting

By the start of 2008, name-based HIV-1 reporting to state health departments is required in all states and territories for surveillance purposes. Many require reporting pregnancy in HIV-1–infected women and also require reporting the HIV-1 infection status of their infants. Collecting the maternal ARV treatment history, maternal demographics, labor and delivery record, and

newborn records at the time of birth facilitates this required reporting. If reporting is delegated to another party, the pediatrician should facilitate the necessary information getting to the reporting provider.

SUMMARY

1. Whenever possible, maternal HIV-1 infection should be identified before or during pregnancy, which allows earlier initiation of care for the mother and for more effective interventions to prevent MTCT. The AAP recommends documented, routine HIV-1 antibody testing for all pregnant women in the United States, after notifying the patient that testing will be performed, unless the patient declines HIV-1 testing ("opt-out" consent, or "right of refusal"). All HIV-1 antibody testing should be performed in a manner consistent with state and local laws. In states where laws and regulations require written informed maternal consent for testing, practitioners should work to modify the laws or regulations to permit opt-out consent.
2. If the mother's HIV-1 serostatus is unknown at the time of labor or birth, the newborn infant's health care provider should perform rapid HIV-1 antibody testing on the mother or the newborn infant with appropriate consent consistent with state and local laws. The results should be reported to health care providers quickly enough to allow effective ARV prophylaxis to be administered to the infant as soon as possible after birth but certainly by 12 hours after birth.
3. ARV prophylaxis for the mother and newborn infant should be administered promptly on the basis of a positive rapid antibody test result without waiting for results of confirmatory HIV-1 testing, and breastfeeding should not be initiated. If the rapid test result is positive, confirmatory testing should be performed, and if confirmatory test results are negative (indicating that the infant was not truly exposed to HIV-1), then ARV prophylaxis should be stopped and breastfeeding can be initiated.
4. In the United States, HIV-1–infected mothers should not breastfeed their infants and should be educated about safe alternatives.
5. Maternal health information should be reviewed to determine if the infant may have been exposed to maternal coinfections such as TB, syphilis, toxoplasmosis, hepatitis B or C, cytomegalovirus, or herpes simplex virus. Diagnostic testing and treatment of coinfections in the infant are based on maternal findings and evaluation of the infant.[37]
6. Pediatricians should provide counseling to parents and caregivers of HIV-1–exposed infants about HIV-1 infection, including anticipatory guidance on the course of illness, infection-control measures, care of the infant, diagnostic tests, and potential drug toxicities.
7. All HIV-1–exposed infants should undergo virologic testing with HIV-1 DNA or RNA assays at 14 to 21 days of age, and if results are negative, tests should be repeated at 1 to 2 and 4 to 6 months of age to identify or exclude HIV-1 infection as early as possible. For children with negative virologic test results, many experts confirm the absence of HIV-1 infection with HIV-1 antibody assay testing at 12 to 18 months of age. If any test result is positive, the test should be repeated immediately for confirmation.
8. Initial testing in the first few days of life allows identification of in utero infection and might be considered if maternal ARVs were not administered during pregnancy or in other high-risk situations. If HIV-1 RNA or DNA testing of the newborn infant was not performed shortly after birth, or if such test results were negative, diagnostic testing with HIV-1 NAAT is delayed until 14 to 21 days of age, because the diagnostic sensitivity of virologic assays increases rapidly by 2 weeks of age.
9. For nonbreastfeeding infants and children younger than 18 months with no positive HIV-1 virologic test results, presumptive exclusion of HIV-1 infection is based on 2 negative HIV-1 RNA or DNA virologic test results from separate specimens, both of which were obtained at ≥2 weeks of age and 1 of which was obtained at ≥4 weeks of age; 1 negative HIV-1 RNA or DNA virologic test result obtained at ≥8 weeks of age; or 1 negative HIV-1 antibody test result obtained at ≥6 months of age. If these test results are negative, further testing is required to definitively exclude HIV-1 infection.
10. For nonbreastfeeding infants and children younger than 18 months of age with no positive HIV-1 virologic test results, definitive exclusion of HIV-1 infection is based on 2 negative HIV-1 RNA or DNA virologic test results from separate specimens, both of which were obtained at ≥1 month of age and 1 of which was obtained at ≥4 months of age, or 2 negative HIV-1 antibody test results from separate specimens, both of which were obtained at ≥6 months of age. Further testing is suggested to confirm the absence of HIV-1 infection.
11. Many experts confirm the absence of HIV-1 infection with a negative HIV-1 antibody assay result at 12 to 18 months of age. These laboratory tests can only be used to exclude HIV-1 infection if there is no other laboratory or clinical evidence of HIV-1 infection (ie, no subsequent positive results from virologic tests if tests were performed and no AIDS-defining condition for which there is no other underlying condition of immunosuppression).
12. For breastfeeding infants, a similar testing algorithm can be followed, with timing of testing based on the date of complete cessation of breastfeeding instead of the date of birth.

13. Infants born of HIV-1–infected mothers should be considered for PCP prophylaxis beginning at 4 to 6 weeks of age. Infants with indeterminate HIV-1 infection status should receive prophylaxis until they are determined presumptively or definitively not to be infected with HIV-1. Prophylaxis is not recommended for infants who meet criteria for presumptively or definitively not infected with HIV-1 (see "Interpretation of Negative HIV-1 Test Results").
14. All infants exposed to ARV agents in utero or as infants should be monitored for short- and long-term drug toxicity.
15. Immunizations and TB screening should be provided for HIV-1–exposed infants in accordance with published guidelines.[37]
16. HIV-1 testing should be offered and recommended to family members of HIV-1–exposed infants.
17. The practitioner providing care for the HIV-1–exposed or HIV-1–infected infant should consult with a pediatric HIV-1 specialist. If the HIV-1–infected mother is an adolescent, consultation with a practitioner familiar with the care of adolescents is advised.

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—The Evaluation of Sexual Behaviors in Children

abstract

Most children will engage in sexual behaviors at some time during childhood. These behaviors may be normal but can be confusing and concerning to parents or disruptive or intrusive to others. Knowledge of age-appropriate sexual behaviors that vary with situational and environmental factors can assist the clinician in differentiating normal sexual behaviors from sexual behavior problems. Most situations that involve sexual behaviors in young children do not require child protective services intervention; for behaviors that are age-appropriate and transient, the pediatrician may provide guidance in supervision and monitoring of the behavior. If the behavior is intrusive, hurtful, and/or age-inappropriate, a more comprehensive assessment is warranted. Some children with sexual behavior problems may reside or have resided in homes characterized by inconsistent parenting, violence, abuse, or neglect and may require more immediate intervention and referrals. *Pediatrics* 2009;124:992–998

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INTRODUCTION

Sexual behaviors in children range from normal and developmentally appropriate to abusive and violent. Concerned parents often present to the pediatrician's office with questions about whether their child's sexual behavior is normal, whether the behavior indicates that the child has been sexually abused, and how to manage such behavior. Although earlier studies[1,2] have suggested a strong correlation between sexual abuse and sexual behavior problems in children, more recent studies[3,4] have broadened this perspective, recognizing a number of additional stressors, family characteristics, and environmental factors that are associated with intrusive and frequent sexual behaviors. Clinicians must first distinguish age-appropriate and normal sexual behaviors from behaviors that are developmentally inappropriate and/or abusive (sexual behavior problems). Children with sexual behavior problems require further assessment and more specialized treatment approaches.

Sexual behaviors are common in children. More than 50% of children will engage in some type of sexual behavior before their 13th birthday.[5,6] In 1 retrospective study of 339 child welfare and mental health professionals in which participants were asked about their own experiences before 13 years of age, 73% recalled engaging in sexual behaviors with other children, 34% recalled showing their genitals to another child, 16% recalled simulating intercourse with another child, and 5% recalled inserting an object in the vagina or rectum of another

child.[7] Another study[8] of female undergraduates reported that 26% recalled exposing themselves, 17% recalled unclothed genital touching, and 4% recalled oral-genital contact during childhood. Frequencies of childhood sexual behaviors retrospectively reported by adults may differ from frequencies contemporaneously reported by parents; recollection differences through time, personal acceptance of sexual behaviors as normal, and the extent to which the behavior is covert may explain some of the discrepant results. Mothers who are more educated and who acknowledge that sexual behaviors in children can be normal tend to report more sexual behaviors in their children when compared with mothers with fewer years of education and less acceptance of these behaviors.[9] It is not clear whether the mother's acceptance of certain sexual behaviors as normal affects her observation of such behavior or her response to such behavior; a mother who is less accepting of sexual behaviors may be less likely to report such behavior or may modify her child's overt sexual behavior with disapproval or negative feedback.

Whether a child is brought to the pediatrician's office with a complaint of sexual behaviors depends in part on the parents' knowledge and attitude about the behavior. Several additional factors modify the extent and nature of the child's sexual behavior: age of the child, developmental stage of the child, family environment, and parental behavior and response to the child. Some children may display sexual behaviors that are common and age-appropriate but that can become problematic and require intervention if the frequency is such that the behavior is disruptive to others.

DIFFERENTIATING NORMAL SEXUAL BEHAVIORS FROM SEXUAL BEHAVIOR PROBLEMS

Differentiating between normal and problem sexual behaviors is a critical role for the pediatrician (Table 1) and may, at times, require more decisive therapeutic evaluation and intervention by a mental health professional. However, normal sexual behavior and sexual behavior problems are not always clearly dichotomous, and distinguishing victim from perpetrator is not always unambiguous, especially when both are children. All children involved, however, do require assistance and guidance from health care professionals as well as parents and schools.

Different terms have been used to characterize sexual or "sexualized" behavior in children. Behavior such as sexualized play may be within a range of normal development among social peers, especially at various critical stages of growth and development, and may only require adult guidance and redirection. On the other hand, sexual behavior problems are behaviors that are developmentally inappropriate, intrusive, or abusive; an alternative, less precise term is "sexual acting out." "Sexually reactive youth" is a more descriptive and less inflammatory term than "youth sex offenders" in describing children and adolescents with sexual behavior problems as a result of inappropriate sexual experiences that include sexual abuse, exposure to sexualized material, and/or witnessing sexual activity by others.

Types of Sexual Behaviors

In a prospective study of children aged 2 to 5 years without a history of abuse (determined by parental screening), common sexual behaviors reported by caregivers include touching their genitals at home and in public, masturbating, showing their genitals to others, standing too close, and trying to look at nude people.[9] These behaviors do

TABLE 1 Examples of Sexual Behaviors in Children 2 to 6 Years of Age

Normal, Common Behaviors	Less Common Normal Behaviors[a]	Uncommon Behaviors in Normal Children[b]	Rarely Normal[c]
● Touching/masturbating genitals in public/private	● Rubbing body against others	● Asking peer/adult to engage in specific sexual act(s)	● Any sexual behaviors that involve children who are 4 or more years apart
● Viewing/touching peer or new sibling genitals	● Trying to insert tongue in mouth while kissing	● Inserting objects into genitals	● A variety of sexual behaviors displayed on a daily basis
● Showing genitals to peers	● Touching peer/adult genitals	● Explicitly imitating intercourse	● Sexual behavior that results in emotional distress or physical pain
● Standing/sitting too close	● Crude mimicking of movements associated with sexual acts	● Touching animal genitals	● Sexual behaviors associated with other physically aggressive behavior
● Trying to view peer/adult nudity	● Sexual behaviors that are occasionally, but persistently, disruptive to others	● Sexual behaviors that are frequently disruptive to others	● Sexual behaviors that involve coercion
● Behaviors are transient, few, and distractable	● Behaviors are transient and moderately responsive to distraction	● Behaviors are persistent and resistant to parental distraction	● Behaviors are persistent and child becomes angry if distracted

[a] Assessment of situational factors (family nudity, child care, new sibling, etc) contributing to behavior is recommended.
[b] Assessment of situational factors and family characteristics (violence, abuse, neglect) is recommended.
[c] Assessment of all family and environmental factors and report to child protective services is recommended.

not vary significantly when boys are compared with girls across all age groups, but they do diminish in both boys and girls after 5 years of age.[9] Children also engage in sexual behaviors that include other individuals, such as putting their tongue in another's mouth while kissing, rubbing their body against others, and touching children's and adults' genitals, but these behaviors are less common, occurring in fewer than 8% of children 2 to 5 years old.[9] Fewer than 1.5% exhibit any of the following: putting the mouth on genitals, asking to engage in specific sex acts, imitating intercourse, inserting objects into the vagina or anus, and touching animal genitals.[9] Such behaviors do not necessarily imply the child has been sexually abused but do merit further assessment. Among normative study samples of children, all 38 sexual behaviors that were studied were observed in at least some of the children,[10,11] which suggests that there is no single sexual behavior that is a pathognomonic sign of sexual behavior problems or abuse. Normal sexual behaviors usually diminish or become less apparent with redirection and admonishment from the parent, and although such behaviors may result in feelings of embarrassment in the child, feelings of anger, fear, and anxiety are uncommon.[7]

Sexual behaviors that involve children who are developmentally dissimilar or use of coercion and control by 1 child are abusive.[12] Distinct developmental differences occur when children are at least 4 years apart in age or cognitive abilities. Children who are fewer than 4 years apart in age may still engage in abusive sexual contact when 1 child uses physical force or threat of harm against the other child. Abusive behaviors generally occur without other witnesses, and threats to "keep the secret" are common. Abusive sexual behaviors require immediate and effective intervention.

Children with sexual behavior problems are more likely than children with normal sexual behaviors to have additional internalizing symptoms of depression, anxiety, withdrawal, and externalizing symptoms of aggression, delinquency, and hyperactivity.[9] This association suggests that some sexual behaviors occur within a continuum of behavioral problems with multifactorial causes.

Another group of children may engage in a greater variety and frequency of sexual behaviors that may be disruptive to others but not necessarily abusive. These behaviors are often noted after a shift in caregiving environments; examples include children placed in foster homes and children who attend child care. Among children who are not suspected victims of abuse, more time spent in child care correlates positively with the number and frequency of observed sexual behaviors.[9] Child care provides more opportunities for children to interact and explore each other in both sexual and nonsexual ways.

Age

The variety and frequency of sexual behaviors increases in young children up to 5 years of age and then decreases gradually thereafter.[9] In 1 normative study of 1114 children aged 2 to 12 years, a greater variety and frequency of sexual behaviors were reported by parents of boys and girls aged 2 to 5 years when compared with parents of children aged 6 to 9 and 10 to 12 years.[3] These data do not necessarily suggest that sexual behaviors are more common among young children but may reflect differences in observation patterns by parents and display tendencies by young children. Younger children are less aware of breaches in personal space and how their behavior may be construed as sexual or inappropriate. Reactions from others of embarrassment and shame may be misinterpreted as positive responses, prompting the child to persist in the sexual behavior.

FACTORS THAT AFFECT FREQUENCY AND TYPES OF SEXUAL BEHAVIORS

In addition to the child's developmental level and child care environments, other factors influence the frequency and types of sexual behaviors manifested by children. Family sexuality and attitudes toward nudity; exposure to sexual acts or materials; extent of supervision; stressors, including violence, parental absence because of incarceration, death, or illness; and abuse can affect sexual behaviors in children.[3,7]

Situational Factors

Depending on the child's developmental level, changes in environment and situations may result in an increase in sexual behaviors. Preschool-aged children are naturally inquisitive and undergo periods of enhanced awareness of their environments. Recognition of physiologic gender differences occurs during this time and contributes to inquisitive viewing and touching of other children's genitals. This curiosity-seeking behavior tends to occur within the context of other similar, nonsexual explorations. The birth of a new sibling, suddenly viewing another child or adult in the bathroom, or seeing their mother breastfeed can trigger or amplify children's sexual behaviors. These behaviors tend to be transient and distractible and diminish once the child understands that such behaviors are inappropriate, particularly for public viewing.

Environments in Which Sexuality Is More Open

Children who reside in homes in which there is family nudity, cobathing, or

less privacy when dressing, going to the bathroom, or bathing or in which sexual activities are occurring openly are more likely to openly engage in sexual behaviors.[3] Similarly, children from homes with readily accessible pornographic materials or poor supervision of children's access to such materials may use age-inappropriate sexual language and be more prone to engage others in sexual play.

Family Dysfunction and Stress

Sexual behavior problems in children are significantly related to living in homes in which there is disruption because of poor health, criminal activity, or violence. The greater the number of life stresses—including parental battering, death, incarceration, or illness requiring hospitalization; deaths of other family members; and child illness requiring hospitalization—the greater the number and frequency of sexual behaviors observed in children.[3] Because child abuse and neglect are more common in homes characterized by violence and criminal activity, children with sexual behavior problems who reside in such homes should be carefully assessed for abuse and neglect. Among children with a history of sexual abuse, 52% indicated that they had lived with an adult batterer during their childhood, and 58% of the child sexual offenders who were in-home males also battered their adult female partner.[13] As many as 68% of children with sexual behavior problems have witnessed intimate partner violence among their caregivers.[4] Adult violence in the home is strongly linked to abuse, neglect, and sexual behavior problems in children.

Children With Developmental Disabilities

Children with developmental disabilities may have deficits in several domains that can affect their sexual knowledge and activity. Such children may encounter challenges with social skills, personal boundaries, impulse control, and understanding what is hurtful or uncomfortable to others, factors that contribute to an increased risk of sexual behavior problems as well as sexual victimization.[14] In evaluating sexual behaviors in disabled children, the clinician should focus on developmental level rather than age when assessing whether behavior is appropriate; an adolescent with the cognitive abilities of a 3-year-old may exhibit self-stimulatory behavior that is consistent with his or her developmental level and inability to determine what behavior is appropriate in public.[15]

Abuse and Neglect

Sexual abuse and physical abuse of children are both associated with sexual behavior problems. One meta-analysis of 13 studies involving sexually abused children revealed that 28% had sexual behavior problems,[16] with the highest prevalence occurring in the youngest age groups. Conversely, in 1 study of 201 children 6 to 12 years of age with inappropriate, intrusive, or aggressive sexual behaviors, 48% were sexually abused, 32% had a physical abuse history, 35% had a history of emotional abuse, and 16% had a history of neglect[17]; from another study, a 38% sexual abuse validation rate among children with sexual behavior problems was reported.[4] Manifestation of sexual behavior problems may not immediately follow sexually abusive experiences; in a study of 127 children aged 6 to 12 years with repetitive, diverse, disruptive, or abusive sexual behavior, the latency time between sexual abuse and manifestation of sexual behavior problems was 2.2 to 2.7 years for 6- to 9-year-olds and 3 to 4 years for 10- to 12-year-olds.[18] This period of latency may explain why some children placed out of abusive homes develop sexual behavior problems a number of months later. Although sexually abused children display more sexual behaviors with greater frequencies than do nonabused children,[3,19] there is no 1 specific sexual behavior that is indicative of sexual abuse. On average, sexually abused children display sexual behaviors of a variety and frequency that is 2 to 3 times that of children who are not abused or who have psychiatric diagnoses but have not been abused.[3] In sexually abused children, sexual behavior problems correlate positively with severity of abuse, number of perpetrators, family member perpetrators, and use of force.[3,10]

Given the strong correlation between violent and abusive family environments and sexual behaviors in children, it is not surprising that children who live in such homes may present clinically with sexual behavior problems after they are placed with alternative caregivers or in foster care. Sexual behaviors in these children may precede placement but may not have presented clinically or may manifest for the first time while in placement as a result of stress, situational changes, or greater accessibility to other children who may participate in such behaviors.

Neglect has also been associated with sexual behaviors in children. Lack of appropriate supervision and accessibility to sexually explicit materials may contribute to sexual behaviors seen in children from such homes. In addition, indiscriminate affection-seeking and interpersonal boundary problems have been reported in children who are victims of neglect[20]; such behaviors are often manifestations of attachment disorders seen in abused or neglected children.

Comorbid Diagnoses

In a clinical sample of 127 children aged 6 to 12 years with sexual behavior

problems, 96% had additional psychiatric diagnoses.[18] The most common diagnosis was conduct disorder (76%), followed by attention-deficit/hyperactivity disorder (40%) and oppositional defiant disorder (27%); most of the children in this sample had more than 1 psychiatric diagnosis.[18] The family environment of children diagnosed with conduct disorders is similar to the family environment of abused children: parents are more likely to administer harsh punishment, dislike their child, be unaware of where their child is, and be emotionally unavailable or unsupportive.[21] Families of children with severe sexual behavior problems seem to have the same parent-child conflicts as families of children who develop conduct disorders and engage in delinquent behaviors.[22]

CLINICAL ASSESSMENT AND TREATMENT

When children present to a clinical setting for an assessment, normal sexual behaviors should be differentiated from behaviors that are frequent, intrusive, or abusive. The Child Sexual Behavior Inventory (available at www.parinc.com/products/product.aspx?Productid=CSBI), developed to evaluate sexual behaviors in children aged 2 to 12 years who have been or may have been sexually abused, may assist clinicians in differentiating normative and atypical sexual behaviors. Because assessments are primarily based on parent history, the clinician should realize that some behaviors that are reported as problematic by the parent may be normal for the child. If sexual behaviors are normal and age-appropriate, parental reassurance and guidance regarding appropriate responses to the behavior may be all that is needed. If sexual behaviors are escalating, frequent, or intrusive, a more comprehensive assessment and treatment may be needed. If child abuse is suspected, or if the parent is ineffective in limiting the child's access to sexual material in the home, then a referral to child protective services is warranted. In addition, repetitive sexual behaviors between children that have not resolved despite pediatrician and parental guidance and redirection require more urgent intervention and may necessitate a report to child protective services for further investigation. When possible, it is important for pediatricians to maintain a dispassionate clinical response regarding the child perpetrator who may have been a victim of sexual abuse.

When conducting an assessment, clinicians may find that factors contributing to the child's sexual behaviors are multifactorial. A complete, careful assessment of sexual behavior problems will address all possible causes, including sexual abuse. An assessment of sexual behaviors in children may include the following:

1. Developmental considerations: Normal behaviors are seen more frequently in children younger than 6 years and between children of similar age and development. Sexual behavior between children of different development and/or age requires further assessment and possibly reporting to child protective services.
2. Types/frequency of sexual behaviors: Self-stimulation, personal space intrusiveness, interest in language or images of a sexual nature, exhibitionism, and mutual curiosity in peers' genitals are common normal sexual behaviors. Normal behavior tends to be transient and responsive to parental redirection or admonishment. Sexual behavior problems include behaviors that are coercive, persistently intrusive, injurious, and frequent; such behavior usually requires assessment of familial and situational factors and treatment beyond parent redirection.
3. Parent response to the behavior: Children relish attention and may enjoy the parent's discomfort that results from the sexual behaviors they display. Such children may repeat their behavior to elicit the (desired) parent response. If parents divert the child's behavior without emotional response, normal sexual behaviors tend to diminish. Sexual behavior problems may be persistently frequent or may escalate despite an appropriate parental effort to distract the child.
4. Situational factors (siblings, shift in care, nudity, parent education, acceptance of sexual behaviors): New siblings or new caregiving situations with additional children may trigger sexual behaviors; alternatively, new caregivers may become more observant of such behaviors. Children residing in homes in which nudity and/or sexuality are more open and acceptable may demonstrate more sexual behaviors.
5. Access to sexually explicit material or acts: Inappropriate or accidental exposure to sexual acts or materials can result in sexual behaviors. Such behaviors may become problematic if children are exposed to such material persistently or if the material is disturbing. In the latter situation, a careful assessment for abuse and supervisional neglect is appropriate.

In the absence of sex education at home and at school, various forms of media have been a primary source of information for many adolescents.[23] This information is often inaccurate, age-inappropriate, and misleading. In addition, early exposure to sexual content in the media has been linked to earlier onset of sexual intercourse among adolescents.[24,25]

6. Dysfunctional home environment: Life stresses, especially interparental violence, are strongly associ-

ated with sexual behavior problems in children.

7. Abuse/neglect: Children from homes characterized by physical abuse, sexual abuse, or neglect are more likely to have sexual behavior problems than children who are not from such homes. Any child with frequent, persistently intrusive, or abusive sexual behaviors should be assessed for possible abuse and neglect.

PARENTAL GUIDANCE

Reassurance and guidance about normal sexual behaviors can allay questions and concerns that many parents may have. A 3-year-old who begins to masturbate before falling asleep may simply have discovered a self-soothing technique, may have seen the genitals of a new sibling, or may be responding to the stress of returning to his or her mother's house after a weekend visit with his or her father. Appropriate parental responses are key to managing such behaviors.

The assessment of a child with sexual behavior problems may reveal a home environment characterized by abuse, neglect, or interpersonal violence. Sexual behavior problems in children who remain in such homes will be difficult to treat and manage. If the safety of the child is at risk, child protective services may place the child in alternative care, and sexual behaviors may escalate. Many children with sexual behavior problems will require referral to therapists for further assessment and treatment.

CONCLUSIONS

Many sexual behaviors in children are developmentally normal and transient and occur within a developmental trajectory that includes curiosity-seeking behaviors, testing of interpersonal boundaries, and situational factors that elicit such behaviors. Sexual behaviors that are persistently intrusive, coercive, developmentally abnormal, or abusive are associated with numerous situational and familial factors, including sexual abuse, physical abuse, and neglect. Sexual abuse is a common, but not exclusive, experience among children with sexual behavior problems. Once sexual behavior problems are identified, a careful assessment of family behaviors and home environment may clarify underlying causes and contributing factors. The clinical approach to children with sexual behaviors may entail a range of responses including tolerance and understanding, parental redirection, further assessment by a mental health professional, and referral to child protective services when abuse or neglect is suspected.

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CLINICAL REPORT

Evaluation of Suspected Child Physical Abuse

Guidance for the Clinician in Rendering Pediatric Care

Nancy D. Kellogg, MD, and the Committee on Child Abuse and Neglect

ABSTRACT

This report provides guidance in the clinical approach to the evaluation of suspected physical abuse in children. The medical assessment is outlined with respect to obtaining a history, physical examination, and appropriate ancillary testing. The role of the physician may encompass reporting suspected abuse; assessing the consistency of the explanation, the child's developmental capabilities, and the characteristics of the injury or injuries; and coordination with other professionals to provide immediate and long-term treatment and follow-up for victims. Accurate and timely diagnosis of children who are suspected victims of abuse can ensure appropriate evaluation, investigation, and outcomes for these children and their families.

PREVALENCE

In 2004, 152 250 children and adolescents were confirmed victims of physical abuse in the United States.[1] Of the 4 types of child maltreatment (neglect, physical abuse, sexual abuse, and emotional abuse), physical abuse is second to neglect, constituting approximately 18% of the total.[1]

Despite these statistics, the estimated number of victims is much higher; in 1 retrospective cohort study of 8613 adults, 26.4% reported they were pushed, grabbed, or slapped; had something thrown at them; or were hit so hard they got marks or bruises at some time during their childhood.[2] It has been estimated that 1.3% to 15% of childhood injuries that result in emergency department visits are caused by abuse.[3] Physical abuse remains an underreported (and often undetected) problem for several reasons including individual and community variations in what is considered "abuse," inadequate knowledge and training among professionals in the recognition of abusive injuries, unwillingness to report suspected abuse, and professional bias. For example, in 1 study,[4] 31% of children and infants with abusive head trauma were initially misdiagnosed. Misdiagnosed victims were more likely to be younger, white, have less severe symptoms, and live with both parents when compared with abused children who were not initially misdiagnosed. Such studies suggest a need for practitioners to be vigilant to the possibility of abuse when evaluating children who have atypical accidental injuries or obscure symptoms that are suggestive of traumatic etiologies but who do not have a history of trauma.

Child abuse has significant long-term medical and mental health morbidity.[5] Children with abusive head or abdominal injuries are more likely to die or become more severely incapacitated than are children with head or abdominal injuries caused by accidents.[6–8] Victims of physical abuse in childhood are more likely to

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develop a variety of behavioral and functional problems including conduct disorders, physically aggressive behaviors, poor academic performance, and decreased cognitive functioning.[9,10] Additional problems include anxiety and depression, as well as social and relationship deficits.

CHARACTERISTICS OF VICTIMS AND RISK FACTORS

Child physical abuse affects children of all ages, genders, ethnicities, and socioeconomic groups. Male and female children experience similar rates of physical abuse. In 1 survey study of more than 2000 children and adolescents,[11] 15% of adolescents received injuries from a physical assault and were more likely than children in younger age groups to receive injuries from abuse. Although the risk of physical abuse increases with age, fatal abuse and serious abusive injuries are more common among children and infants younger than 2 years.[1] Children in homes with annual incomes of less than $15 000 per year have 3 times the number of fatalities, 7 times the number of serious inflicted injuries, and 5 times the number of moderate inflicted injuries when compared with children living in homes with annual incomes of greater than $15 000 per year.[12] Risk factors for infant maltreatment include maternal smoking, the presence of more than 2 siblings, low infant birth weight, and an unmarried mother.[13] One study found that children living in households with unrelated adults were approximately 50 times more likely to die of inflicted injuries than were children residing with 2 biological parents.[14] The US Department of Health and Human Services has indicated that the rate of physical abuse is 2.1 times higher among children with disabilities than children without disabilities.[15] The presence of risk factors should not be used as indicators of child abuse but rather to provide guidance in prevention strategies as well as management and treatment plans.

ROLE OF THE PEDIATRICIAN

The role of the pediatrician encompasses prevention of abuse and detection and medical management of victims of abuse. Accurate identification of children who are suspected victims of abuse can facilitate appropriate evaluation, referral, investigation, and outcomes for these children and their families.[16] Children usually sustain abuse at the hands of a caregiver who misinterprets and responds inappropriately to the child's behavior. For example, caregivers who had smothered, shook, or slapped their infant within the first 6 months of life were more likely to be worried about crying and to believe that their infants cried excessively.[17] There is a close correlation between the age-specific incidence curve of infants hospitalized with abusive head trauma and the age-specific normal crying behavior of infants up to 36 weeks of age.[18]

In an anonymous telephone survey of 1435 mothers, 2.6% of children younger than 2 years were shaken by their mothers as a means of discipline.[19] Caregivers may respond inappropriately to their child's behavior when they are unduly stressed. Poverty, significant life events, and caregiver role conflicts are stressors that are often associated with abuse.[14] Pediatricians can effectively educate parents regarding the range of normal behaviors in infants and children, provide anticipatory guidance, and be a resource when the behavior becomes unmanageable for parents. In addition, pediatricians can screen for adult-partner violence; in 1 study, child abuse was 4.9 times more likely in families with identified spouse abuse than in families without identified spouse abuse.[20] Other conditions that place children at risk of being abused, such as maternal depression or drug abuse, may also be identified.

Careful medical assessment, detection of suspicious injuries, and reporting of abuse may prevent further abusive trauma in infants and adults.[4] In 1 study of abuse victims younger than 24 months, 75% had evidence of previous trauma or history of a previous injury.[21] Child abuse may recur 35% of the time without appropriate detection and intervention.[22]

As with other types of child maltreatment, there have been recent advances in medical knowledge regarding physical abuse. Most recent developments have addressed more accurate differentiation between inflicted and accidental injuries as well as detecting conditions that may mimic abusive injuries. Although consideration of nonabusive causes of injuries may merit additional evaluation and testing, the physician is mandated by law to report suspicions of abuse and should not delay reporting pending confirmatory testing or information. In all states, the law also provides some type of immunity for good-faith reporting. Once a suspected victim is identified and further assessment and management is required, using a pediatric child abuse consultant, if available, early in this process may obviate the need for invasive or expensive testing and can help direct the pediatrician toward appropriate evaluation. The detection and diagnosis of child physical abuse depends on the clinician's ability to recognize suspicious injuries, conduct a careful and complete physical examination with judicious use of auxiliary tests, and consider whether the caregivers' explanation is supported by the characteristics of the injury or injuries and the child's developmental capabilities. The physician should also ensure that the child's immediate medical and safety needs are met. Child abuse injuries, particularly traumatic brain injuries, may result in significant long-term disabilities including learning deficits, attention-deficit/hyperactivity disorder, behavioral problems, seizures, spasticity, blindness, paralysis, and mental retardation.[23,24] Continuity of care for such children is essential, especially if they are transferred to other caregivers or foster homes.

Many hospitals and communities have developed

child abuse–assessment teams of pediatricians and other professionals who specialize in the assessment of suspected victims of child abuse.[25] Such teams usually have access to additional information from law enforcement and child protective services, such as scene investigation, that may facilitate more thorough injury assessment and diagnosis. Involving such teams early in the process can ensure accurate and comprehensive assessments and information sharing among the medical and nonmedical disciplines involved and can provide for intermediate and long-term management of the child and family. Pediatricians with expertise in evaluating suspected abuse should provide training and assistance to emergency physicians and other first responders to enhance detection and appropriate referral of these patients.

Many regions do not have specialized child abuse teams but do have physicians with expertise in child abuse. Pediatricians should know which hospitals in their region have the most available expertise in the emergency evaluation of suspected child abuse. In turn, pediatricians with expertise in child abuse often act as consultants for emergency departments and child protective services. Close collaboration is necessary, particularly for establishing how the child should be transported between facilities, who should notify child protective services, who should notify the caregiver(s) of suspected abuse and when, and whether law enforcement should be notified. For those who do not require emergent transportation by ambulance, child protective services may facilitate transportation of a suspected child victim from one facility to another, assist in notifying the caregivers and law enforcement of suspected abuse, and provide an emergent safety plan on hospital discharge or clinic dismissal.

DEFINITIONS

The recognition and reporting of physical abuse is hindered by the lack of uniform or clear definitions. Many state statutes use words such as "risk of harm," "substantial harm," "substantial risk," or "reasonable discipline" without further clarification of these terms. Many states still permit the use of corporal punishment with an instrument in schools; on the other hand, the American Academy of Pediatrics has proposed that "striking a child with an object" is a type of physical punishment that "should never be used"[26] and has recommended that corporal punishment be abolished in schools.[27] The variability and disparities in definitions may hinder consistent reporting practices.

CLINICAL PRESENTATIONS AND SETTINGS

Most physical abuse injuries are likely to not be detected or reported. Minor injuries may not require medical attention and may be obscure or hidden. Infants and children are reported as suspected victims of physical abuse when 1 or more of the following occurs: an individual (including a professional) sees and reports a suspicious injury; an individual witnesses an abusive event; a caregiver observes symptoms and brings the child in for medical care but is unaware that the child has sustained an injury; an individual asks a child if he or she has been hurt in an abusive way; the abuser thinks the inflicted injury is severe enough to require medical attention; or the child victim discloses abuse. The American Academy of Pediatrics has indicated that "hospitalization of children requiring evaluation and treatment for abuse or neglect should be viewed by third-party payors as medically necessary."[28]

The clinical approach to an infant or child with possible abusive injuries is not significantly different from standard pediatric care. As with all patients, a severely injured child must be stabilized before further evaluation is undertaken. This initial evaluation may encompass a trauma response team and pediatric specialists in surgery, emergency medicine, and critical care. Careful documentation may not be possible initially and must always be secondary to resuscitation and stabilization of the patient. Once the child is stabilized, a careful and well-documented history, as always, is the most critical element of the medical evaluation. Using quotes whenever possible, the pediatrician should document descriptions of the mechanisms of injury or injuries, onset and progression of symptoms, and the child's developmental capabilities. The physical examination should include detailed documentation, either by body diagrams and/or photographs, of any concerning cutaneous findings and should include a thorough search for other signs that may suggest a nontraumatic cause. If the child is verbal, it may be helpful to gather parental and patient histories separately. If abuse is a concern after this preliminary evaluation, consultation with a child abuse pediatrician, pediatric specialist, or pediatrician experienced in this area, if available, may be helpful in determining the best way to proceed with assessment.

Physical discipline is commonly inflicted on areas of the body that are concealed by clothing (eg, back/buttocks). When inflicted injuries are visible or incidentally discovered, child victims and their abusers typically explain the injuries as accidental; if clinicians or professionals are not critical or skeptical of this information, the injuries may be incorrectly attributed to accidental causes. Other victims present with severe inflicted injuries that require medical care. The initial history is typically vague and/or benign and may become inconsistent as the investigation progresses.

MEDICAL HISTORY

The interview of parents or caregivers of infants or children who present with serious injuries may be conducted in an outpatient or inpatient setting. If the child presents to a clinic with a serious injury that requires further medical care in a specialty (eg, orthopedics) or

hospital setting, the clinician may opt to gather the minimum information to establish a need for reporting to child protective services. Any statements made by the caregiver regarding the injury should be documented accurately and completely. Once the clinician has assessed all the injuries, including approximate ages of injuries (when possible), a careful, complete, and detailed history should be obtained from the caregivers.

Explanations that are concerning for intentional trauma include:

1. no explanation or vague explanation for a significant injury;
2. an important detail of the explanation changes dramatically;
3. an explanation that is inconsistent with the pattern, age, or severity of the injury or injuries;
4. an explanation that is inconsistent with the child's physical and/or developmental capabilities; and
5. different witnesses provide markedly different explanations for the injury or injuries.

Information regarding the child's behavior before, during, and after the injury occurred, including feeding times and levels of responsiveness, should be gathered. Victims of significant trauma usually have observable changes in behavior. Access to caregivers and caregiver activities before, during, and after the injury occurred are also important to document. Frequently, infants and children present to medical settings with a history of a fall. Recent studies have indicated that short falls may result in bruising; however, more significant types of head trauma, including skull fractures, are exceedingly uncommon but possible.[29,30]

Information should be gathered in a nonaccusatory but detailed manner. Other information that may be useful in the medical assessment of suspected physical abuse includes:

1. past medical history (trauma, hospitalizations, congenital conditions, chronic illnesses);
2. family history (especially of bleeding, bone disorders, and metabolic or genetic disorders);
3. pregnancy history (wanted/unwanted, planned/unplanned, prenatal care, postnatal complications, postpartum depression, delivery in nonhospital settings);
4. familial patterns of discipline;
5. child temperament (easy to care for or fussy child);
6. history of past abuse to child, siblings, or parents;
7. developmental history of child (language, gross motor, fine motor, psychosocial milestones);
8. substance abuse by any caregivers or people living in the home;
9. social and financial stressors and resources; and
10. violent interactions among other family members.

PHYSICAL EXAMINATION

Most injuries of childhood are not the result of abuse or neglect. Minor injuries in children are exceedingly common. Physicians must also consider that unusual events, including accidents, do happen to children[31] and may produce injuries that are not characteristically seen from accidental causes. An injury pattern is rarely pathognomonic for abuse or accident without careful consideration of the explanation provided. In addition, both inflicted and accidental injuries may be seen simultaneously in a child.

General Assessment

The child's alertness and demeanor may reflect neurologic status and degree of discomfort and pain. A thorough and complete neurologic examination must be performed. For example, if alertness appears compromised, eye-opening, verbal, and motor responses should be assessed systematically. Spontaneous and symmetrical movement of all extremities should be noted, as well as any of the child's responses that indicate pain when extremities are examined and moved. Because abusive caregivers are rarely informative regarding the injuries that have been inflicted, special care should be taken during the examination of the child's extremities and neck, which may be fractured and require immobilization until diagnostic radiographs can be performed. Evidence of spinal cord injury, such as abnormal reflexes, muscle tone, or responsiveness to tactile stimuli, should be carefully pursued.

When the child is stable, height, weight, and frontooccipital circumference should be carefully measured and then plotted on a growth chart. Previous measurements obtained from past medical visits should also be obtained to gauge whether growth velocity has been appropriate. Plotting parameters is essential, because clinicians may miss significant growth failure in infants and children if the clinician relies only on their clinical impressions. Physical abuse and failure to thrive are sometimes concurrent[32,33]; in addition, some children are starved intentionally.[34]

Evidence of neglect may be seen during the general examination of the infant or child; extensive dental caries, severe diaper dermatitis, or neglected wound care may be noted in addition to injuries that raise suspicion of abuse. Bald areas on the scalp may sometimes be seen with severe nutritional deficits or with traumatic alopecia. These findings should be differentiated from nonabusive or benign causes such as tinea capitis, alopecia areata, and occipital bald spots caused by supine positioning of young infants.

If the child can be interviewed, his or her demeanor

should be noted during questioning. Some children display strong nonverbal cues of anxiety and reluctance when answering questions regarding potential abuse, because they are protective of their abuser or they fear retribution for "telling." Others may appear openly fearful of their abuser. Such responses may be important to consider when a safety plan for the child is made.

Skin Injuries

Location, size, and shape of any bruises, lacerations, burns, bites, or other skin injuries should be documented in a medical chart as well as with high-quality 35-mm or digital photographs. Inspection for injuries should be thorough and involve all aspects of the neck and head; mouth; extremities, including feet and hands; genitals; anus; buttocks; torso; and back. Obscure sites for inflicted injuries include the ears, especially the posterior aspects, the neck and angle of the jaw, scalp, and the frenula of the lip and tongue. In contrast to accidental injuries, inflicted injuries tend to occur on surfaces away from bony prominences, such as the neck, head, buttocks, trunk, hands, and upper arms.[35,36] In 1 patient series, approximately 60% of abused children had injuries on the head, face, or neck.[37] Hematomas of the scalp may be detected through palpation or may be visualized on radiographs. Some deeper bruises may not be readily visible for several hours; areas that are painful to palpate may require further examination in 1 to 2 days, when bruises may become apparent. Measurement of skin injuries may assist in determining the mechanism of injury and/or object used to inflict the injury. For example, a child that is kicked may have a discernable shoe imprint, or a knuckle imprint may be apparent if the child was punched.

Bite marks can yield important forensic information; referral to professionals that can gather such information and maintain a chain of custody is advisable.[38] Bite marks, recent or healed, should be carefully measured and photodocumented when possible; an intercanine distance of more than 2 cm suggests a human adult-sized bite.[39] In some facilities, forensic odontologists are available and may use special examination and photographic techniques to analyze bite marks. Fresh bites should be swabbed with sterile, premoistened cotton-tipped applicators for forensic analysis of potential genetic markers found in saliva.

The age of a bruise cannot be determined accurately.[40] Soft tissue swelling is seen more commonly with recent trauma but can persist for several days. The age and developmental capabilities of the infant or child also determine the frequency of bruising. For example, 1 study of infants and toddlers presenting for health maintenance examinations found that 17.8% of infants starting to "cruise" and 51.9% of ambulatory toddlers had bruises; bruises were observed only 2.2% of the time in infants who were not yet cruising.[36] In addition to accidents, bruising may occur secondary to coagulopathies and vasculitides such as idiopathic thrombocytopenic purpura, vitamin K deficiency, Henoch-Schönlein purpura, hemophilia, or von Willebrand disease.

Burn injuries may be chemical, thermal (including exposure to scalding liquids or hot objects), or electrical. The child's clothing worn during the burn should be collected and may provide information regarding the cause of the burn. Burns inflicted with hot objects can be difficult to differentiate from accidental mechanisms, because both burns may be patterned. The history, number of burns, and continuity of the burn pattern over curved body surfaces may indicate a greater probability of inflicted trauma. Accidental scalds most commonly involve hot liquids pulled or splashed onto the child's upper extremities, torso, and or neck and head.[41] Inflicted scalds or forced-immersion burns may be well demarcated in pattern, with few or no splash marks. When evaluating an apparent burn injury, other noninflicted causes to consider include chemical burns of the buttocks with senna-containing laxatives,[42] bullous impetigo, and accidents.

Cranial Injuries

Head trauma is the leading cause of child abuse fatalities.[43] When compared with child victims of severe accidents, children with abusive head trauma are more likely to have subdural and subarachnoid hematomas, multiple subdural hematomas of differing ages, more extensive retinal hemorrhages, and associated cutaneous, skeletal, and visceral injuries.[6] The inflicted injuries tend to occur in younger patients. Abusive head trauma tends to result in higher mortality and longer hospital stays than does accidental head trauma.[6,7] Infants with intracranial injuries frequently have no or nonspecific symptoms,[44,45] so the absence of neurologic symptoms should not exclude the need for imaging. Careful consideration of symptoms, signs, history, and judicious use of other ancillary tests should guide the clinician in determining the need for imaging.

Skull fractures can occur from accidents or inflicted injury. Studies have indicated that simple linear skull fractures can result from short falls of less than 3 ft and that such fractures are usually associated with scalp bruising or swelling.[46] However, it is unknown how many infants and children sustain skull fractures from simple falls, are asymptomatic, and, therefore, never present for a medical evaluation; hence, the incidence of skull fractures among infants who sustain such falls is likely unknown. Abuse should be suspected when there is a history of minor head trauma such as a short fall in children with multiple, complex, diastatic, or occipital skull fractures.[47] Whenever an infant or child presents with a skull fracture, care should be taken to ensure that there are no other injuries.

Conditions that may be confused with abusive head

trauma include glutaric aciduria type 1 (macrocranium, subdural hematoma, sparse intraretinal and preretinal hemorrhages, frontotemporal atrophy) and hemorrhagic disease of the newborn (including risk factors such as home birth, no vitamin K prophylaxis, or breastfeeding).

A fundoscopic examination for retinal hemorrhages should be considered for any infant or young child who is a suspected victim of physical abuse. Under optimal conditions, an ophthalmologist with pediatric experience should conduct an examination of dilated pupils by using indirect ophthalmoscopy. The ophthalmologist should provide documentation of the retinal hemorrhages by photography or detailed annotated drawings. Location, depth, and extent of retinal hemorrhages may distinguish between abusive and nonabusive causes of head trauma.[48] Retinal hemorrhages occur in approximately 85% of infants and children who are subjected to abusive, repetitive, acceleration-deceleration (shaking) forces with or without impact.[48] Although newborn infants may have retinal hemorrhages in the superficial nerve fiber layers, most resolve by 2 weeks of age, and most intraretinal hemorrhages resolve by 4 to 6 weeks of age.[49]

Thoracoabdominal Injuries

Inflicted injuries that involve the heart are rare and severe. Rib fractures in infants are usually caused by forceful squeezing of the chest[50]; posterior or lateral rib fractures or multiple rib fractures are especially predictive of abusive trauma.[51] Cardiopulmonary resuscitation, whether performed by experienced or inexperienced individuals, is an unlikely cause of rib fractures[52] or retinal hemorrhages. Acute rib fractures may be associated with shallow breathing attributable to pain and splinting; in severe cases, a fractured rib may puncture the lung. Alterations in respiratory patterns may also signal central nervous system damage or response to pain. Other rare injuries associated with abusive blows or compressive forces to the chest include hemopericardium, cardiac contusions occurring as a result of abusive blows to the chest, and shearing of the thoracic duct resulting in chylothorax.[53,54]

Auscultation, performed before palpation, may reveal decreased or no bowel sounds if the child has sustained intraabdominal injury. If the intestines, liver, or spleen have been ruptured, guarding or abdominal muscle rigidity may be noted on palpation. Abdominal bruising is often not seen, even with severe blows to the abdomen.[55] In 1 study,[56] solid organ injuries were most common in children with accidental and inflicted abdominal trauma, but abused children were more likely to have a hollow viscus injury or both hollow viscus and solid organ injuries than were children with accidental abdominal injuries. In comparison with children who sustain accidental trauma to the abdomen, victims of inflicted intraabdominal injury tend to be younger, are more likely to have delayed presentations to a clinical setting, have a higher mortality rate, and are more likely to have an injury to hollow viscera.[8] Liver and pancreatic enzyme tests are helpful in screening children for abdominal trauma, especially when the child presents with acute symptoms or shortly after the incident has occurred. A urinalysis may also lead to the discovery of unexpected trauma to the urinary tract and kidneys. Radiographic studies, including computed tomography, are helpful in determining the types and severity of intraabdominal trauma and are warranted in most cases when the physical examination is unreliable because of patient age, presence of other injuries that may obfuscate the abdominal examination, or the presence of head injury.

Skeletal Injuries

Careful palpation of the legs, arms, feet, hands, ribs, and head may reveal acute or healing (callus formation) fractures. If a fracture is suspected, surfaces should be carefully examined for "grab marks" that may indicate restraint or areas that were pulled or twisted to create the fracture; however, absence of such bruising does not exclude abusive mechanisms of injury. Soft tissue swelling, with or without bruising, may indicate more recent trauma. Many fractures, including rib and metaphyseal fractures, may not be clinically detectable, so a negative clinical examination should not preclude the need for a skeletal radiologic survey when inflicted trauma is suspected, particularly in children younger than 2 years.

Long-bone fractures that should be evaluated carefully for nonaccidental causes include metaphyseal fractures and spiral/oblique fractures, especially in nonambulatory infants; both types of fractures have been associated with accidental mechanisms of injury as well. Accidental causes of lower-extremity spiral or oblique fractures have been described among infants in "exersaucers"[57] and in the tibia of newly ambulatory toddlers.[58] Osteogenesis imperfecta is a rare congenital disorder that typically presents with bone fragility. Other associated findings are common and include deep-blue sclera, ligamentous laxity, osteopenia, wormian skull bones, dentinogenesis imperfecta, positive family history, and hearing loss. Less common types of this disease may present with fewer and less-severe clinical symptoms.[59] Patients with osteogenesis imperfecta are often suspected as victims of abuse before diagnosis, because the history of the injury insufficiently explains the severity of the fracture, and osteopenia may be lacking in occult cases of this disease.[60]

A complete neurologic assessment, including reflexes, cranial nerves, sensorium, gross motor, and fine motor abilities, should be conducted. Abnormalities may reflect current or past injuries to the central nervous system. Abused children may also have developmental disabili-

ties because of deprivation in the home environment or other causes.

DIAGNOSTIC TESTING AND CONSULTATIONS

When abuse is suspected as the cause of an injury, the clinician may conduct tests to screen for other injuries or underlying medical causes for the injury. The extent of diagnostic testing depends on several factors including the severity of the injury, the type of injury, the age of the child, and examination findings. In general, the more severe the injury and younger the child, the more extensive is the need for diagnostic testing for other injuries. Table 1 is a summary of tests, some of which may be used during a medical assessment for suspected abuse.

When 1 child is identified as a suspected victim of abuse, siblings and other child contacts of the suspected abuser should also be assessed for injuries. The extent of the assessment depends on the child's age, symptoms, and signs; infants and toddlers may require more extensive testing, because symptoms and signs may be less useful in determining the presence of occult inflicted injuries.

DOCUMENTATION AND DIAGNOSTIC CONSIDERATIONS

Complete documentation of visible injuries on body diagrams and with photographs is strongly urged and facilitates peer review as well as court testimony, when required. In some regions, investigators from law enforcement or child protective services are specially trained to take forensic photographs. Diagnostic impressions should address whether the explanation adequately correlates with the severity, age, pattern, and distribution of the injury or injuries and the likelihood of nonaccidental causes for the injury. If a child has sustained a serious injury because he or she was left unsu-

TABLE 1 Diagnostic Tests That May Be Used in the Medical Assessment of Suspected Physical Abuse and Differential Diagnoses

Type of Injury or Condition	Diagnostic Tests	Comments
Fractures	Skeletal survey: humeri, forearms, femurs, lower legs, hands, feet, skull, cervical spine, thorax (including oblique views[61]) and lumbar spine, pelvis[62]	1. Recommended for all children with fractures and children with any suspicious injuries under age 2 2. Repeat skeletal survey in 2 wk for high-risk cases[63] 3. Single whole-body films are unacceptable
Bruises	Tests for hematologic disorders: CBC count, platelets, prothrombin time, partial thromboplastin time, INR, bleeding time; additional testing (eg, factor levels) may be indicated after initial screening tests	1. Recommended when bleeding disorder is a concern because of clinical presentation or family history 2. A DIC screen should be performed for patients with intracranial injury, because intraparenchymal damage can alter coagulation[64] 3. PFa-100: platelet function activity is preferable to bleeding time for establishing platelet function but is not widely available
Liver injury	Liver enzyme tests: aspartate aminotransferase and alanine aminotransferase	1. May be helpful in diagnosing occult hepatic injury[65]
Pancreatic injury, pseudocyst	Pancreatic enzymes: amylase and lipase	
Urinary system/renal injury	Urinalysis	
Intracranial and extracranial injury	MRI: head/neck	1. Diffusion-weighted scan may surpass CT in characterizing extent of intercerebral edema[66] 2. May provide better dating of intracranial injuries than CT 3. More sensitive than CT for subtle intracranial injuries in patients with normal CT results and abnormal neurologic exams[67] 4. More sensitive than plain radiographs and CT for detecting cervical spine fractures/injury[68]
Intracranial and extracranial injury	CT scan: head[a]	1. When used in conjunction with radiographs, may enhance detection of skull fractures
Intracranial injury	Urine: organic acids	1. Screen for glutaric aciduria type 1
Intra-abdominal injuries	CT scan: abdomen	1. IV contrast should be used and is preferable to PO[62]
Cardiac injury	Cardiac enzymes: troponin and creatine kinase with muscle and brain subunits (CK-MB)	
Skeletal	Radionuclide bone scan	1. Better for acute rib fractures and subtle, nondisplaced long-bone fractures[62]
Osteogenesis imperfecta	Skin biopsy for fibroblast culture and/or venous blood for DNA analysis	
Bone-mineralization disorders: rickets	Calcium, alkaline phosphatase, phosphorus, vitamin D, and parathyroid hormone	

Tests should be ordered judiciously and in consultation with the appropriate genetics, hematology, radiology, and child abuse specialists. Careful consideration of the patient's history, age, and clinical findings should guide selection of the appropriate tests. CBC indicates complete blood cell; INR, international normalized ratio; DIC, disseminated intravascular coagulation; CT, computed tomography; IV, intravenous; PO, oral; CK-MB, creatine kinase MB band.

[a] CT scanning may provide clinically relevant information more expeditiously than MRI in some facilities.

pervised in a dangerous environment, the physician should report suspected neglect or inappropriate adult supervision, including injuries sustained while under the care of an intoxicated adult, to child protective services.[69] When the child is evaluated or tested for other nonabusive causes, documentation should reflect the results of this assessment as well. In general, concern for abuse is greatest for infants younger than 12 months regardless of the severity of the injury.

TREATMENT

Once medical assessment and stabilization are achieved and a referral has been made to investigative agencies, the physician should ensure that the child receives the necessary follow-up services. The child's primary care physician should be notified, and child protective services should ensure that the family complies with the plan of care. These services should not only include referral to appropriate medical providers but also address the psychological effects of abuse or neglect on the young child, the siblings, and the nonoffending caregiver. Because adult-partner violence commonly co-occurs with child abuse, several family members may require medical and mental health assistance. Medical passports, which are abbreviated medical chart forms usually kept by foster parents and presented at each medical visit, are recommended to optimize treatment regimens in children who are shifted among agencies and individuals during the course of the child abuse investigation.[70]

LEGAL ISSUES

All 50 states have statutes that mandate reporting of suspected child abuse and neglect; the physician is not required to prove abuse before reporting. Familiarity with state laws will ensure that physicians report to the appropriate agency within the required time frame; some states have provided the option of making such a report through the Internet. Information on specific state laws are provided by the Children's Bureau (Administration for Children and Families, US Department of Health and Human Services; see www.childwelfare.gov/systemwide/laws_policies/search/index.cfm). Many states have laws that permit physicians to evaluate children who are suspected victims of abuse, to conduct tests, and to take photographs without parental consent.

The physician may be required to write a sworn statement of his or her findings and to testify in civil or criminal trial proceedings. Civil hearings include testimony about the safety of the child and the need for appropriate placement with caregivers or state agencies. Judgments are based on a "preponderance of the evidence" with respect to the likelihood of abuse. Criminal hearings involve testimony about the guilt or innocence of an individual with respect to causing the injuries in a child. The burden of proof is greater than that of civil hearings; cases must be proven "beyond a reasonable doubt." Physicians are expected to testify to the facts on the basis of their knowledge and experience in pediatrics and, when appropriate, in child abuse. As such, they may be asked to render opinions regarding the normal developmental capabilities of children at certain ages as well as the mechanisms of injury, severity of the injury, and prognosis. Pediatricians should not testify to anything that is beyond their level of knowledge or expertise. Physicians act primarily as scientists and educators in legal settings rather than as child advocates.

CONCLUSIONS

Child physical abuse is a common problem of childhood. The physician must be able to recognize suspicious injuries, conduct a comprehensive and careful examination with appropriate auxiliary tests, critically assess the explanation provided for the injury or injuries, and establish the probability that the explanation does or does not correlate with the pattern, severity, and/or age of the injury or injuries. The physician is responsible for reporting suspected abuse, documenting his or her opinions clearly, and providing the necessary information and expertise to investigative and legal personnel and parents, when appropriate. In addition, pediatricians are uniquely qualified to work with parents and caregivers to prevent abuse by providing anticipatory guidance on normal child behavior and its management. Finally, physicians must advocate that children in foster care who have medical or mental health problems receive the appropriate services and medications and continuity of care through a medical home, and that a medical passport is maintained for these children.

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National Center on Sleep Disorders Research

TECHNICAL REPORT

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Excessive Sleepiness in Adolescents and Young Adults: Causes, Consequences, and Treatment Strategies

ABSTRACT. Adolescents and young adults are often excessively sleepy. This excessive sleepiness can have a profound negative effect on school performance, cognitive function, and mood and has been associated with other serious consequences such as increased incidence of automobile crashes. In this article we review available scientific knowledge about normal sleep changes in adolescents (13–22 years of age), the factors associated with chronic insufficient sleep, the effect of insufficient sleep on a variety of systems and functions, and the primary sleep disorders or organic dysfunctions that, if untreated, can cause excessive daytime sleepiness in this population. *Pediatrics* **2005;115:1774–1786;** ***sleep, sleepiness, adolescents, pediatric sleep problems, daytime sleepiness, young adults, circadian rhythm, melatonin, motor vehicle accidents, depression, attention-deficit/hyperactivity disorder, school start times, school performance, obstructive sleep apnea, narcolepsy, idiopathic hypersomnia, delayed phase syndrome, insufficient sleep.***

ABBREVIATIONS. REM, rapid eye movement; MSLT, Multiple Sleep Latency Test; GPA, grade point average; ADHD, attention-deficit/hyperactivity disorder; PSG, polysomnography; SDB, sleep-disordered breathing; RLS, restless-legs syndrome; DSPS, delayed sleep-phase syndrome.

INTRODUCTION

During adolescence (13–22 years of age), many changes occur in sleep patterns, and there are many influences on sleep quality and quantity. Excessive daytime sleepiness in this population is a widespread problem and can have major negative effects on the individuals' performance, health, and safety. Pediatricians and other health care professionals have an important opportunity to evaluate their adolescent patients for evidence of excessive daytime sleepiness and underlying sleep deprivation and/or sleep disorders.

Development of Normal Sleep and Waking

A variety of sleep-pattern changes occur from childhood through adolescence. Laboratory evaluations, as well as field studies and surveys, have shown that across the second decade of life, there are numerous alterations in sleep physiology associated with consistent developmental patterns of sleep. Notable findings include decreased sleep duration with increasing age, a delay in bedtime and rise time (except on school mornings), and an increasingly large discrepancy between school-night and weekend sleep patterns. Children at 9 to 10 years of age who sleep approximately 10 hours on school nights usually will not sleep more than that (and sometimes will sleep less) on weekends. In contrast, adolescents typically will extend sleep on weekends, and this tendency increases as they age and as their school-night sleep decreases, causing them to accumulate a significant sleep debt. Sleep-research data indicate that adolescents still require 9 to 10 hours of sleep per night.[1,2]

A number of groups have examined sleep across adolescent development in laboratory-based studies. In these studies, laboratory constraints may affect outcomes, and this needs to be kept in mind when interpreting findings. For instance, although some studies have used participants' usual schedules to set bedtimes and rise times,[3–7] other studies have used a fixed period of time (10:00 PM to 8:00 AM) for sleep.[2,8,9] In addition, a number of studies have used a longitudinal approach,[2,6,8,9] whereas others have used a cross-sectional approach.[7,10,11] In laboratory studies in which the sleep schedule was varied, total sleep time has consistently been decreased in older adolescents, as expected, because of changed (school-night) sleep habits. Despite the varied methodologies used, consistent changes in sleep/wake architecture have been reported in adolescents. These changes include a decrease in slow-wave sleep time (decreased by nearly 40% from prepubertal to late pubertal adolescents with a 10-hour sleep opportunity[8]), an increase in the amount of stage 2 sleep, and a decrease in the latency to the first episode of rapid eye movement (REM) sleep.

Developmental changes in the amount of REM sleep obtained in a number of these studies typically parallel the findings for total sleep time. With increasing age, the time in bed for sleep and, hence, the total sleep time is decreased, with a concurrent de-

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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crease in the amount of time spent in REM sleep. Conversely, the duration of REM sleep is maintained at a constant level in adolescent subjects when time in bed is fixed.[8,9] Differences in the time of child versus adolescent spontaneous morning awakenings have also been reported (ie, differences in Tanner stages 1 and 2 vs 3–5). In a longitudinal study with a fixed time in bed for sleep, younger children were more likely than adolescents to spontaneously awake before 8:00 AM.[2] Although a small number of studies have reported gender differences in sleep patterns of older children and adolescents,[12] these findings are not consistent.[13]

Sleep/Wake Regulatory Processes

The circadian and sleep homeostatic systems act to coordinate most physiologic and behavioral systems of the body and brain. These 2 systems, working together or in opposition, influence the activities of the endocrine, thermoregulatory, neurobehavioral, renal, cardiovascular, digestive, and sleep/wake systems. With regard to sleep/wake, the circadian system may be viewed as wake promoting, and the homeostatic sleep system reflects sleep need or sleep debt and provides a drive for sleep.

In humans, the central circadian pacemaker, or biological clock, is located in the suprachiasmatic nuclei of the anterior hypothalamus.[14,15] These tiny paired nuclei are responsible for the generation of the daily (circadian) rhythms of physiologic, neurobiologic, and behavioral systems.[16] The circadian pacemaker is synchronized to the 24-hour day through external time cues from the environment (zeitgebers). The strongest of these zeitgebers is exposure to the light/dark cycle. Phototransduction from the retina to the suprachiasmatic nuclei occurs primarily via the retinohypothalamic tract. Entrainment of the circadian system to Earth's 24-hour day provides temporal balance between endogenous activities and the external environment such that sleeping/waking behavior, hormonal activity, temperature fluctuations, and neurobehavioral functioning occur in proper synchrony with the environmental day.

The circadian system plays an integral role not only in regulating the timing of sleeping and waking periods but also in influencing waking neurobehavioral functioning capabilities, alertness or fatigue levels,[17] sleep/wake duration, and sleep structure (REM sleep).[18–20] Opposing the wake drive provided by the circadian system, the sleep homeostatic system affects sleep propensity, sleep duration, and sleep structure.[21]

During waking periods, and especially during periods of extended wakefulness, the homeostatic drive for sleep gradually increases, with a consequent increase in the likelihood that sleep onset will occur. The circadian variation in wake drive occurs concurrently, producing peaks and troughs in sleepiness and alertness levels across the 24-hour day. The magnitude of sleepiness or alertness experienced at a given time is a product of the opposing influences of these 2 systems.[22] As a result, across a normal waking day, clock-dependent (circadian) alertness is usually lowest in the early morning and increases into the late afternoon or evening, thus opposing the growing sleepiness from having been awake all day. Consequently, alertness may be greater in the evening even if wakefulness has been sustained or a sleep debt has accumulated.

In 1993, a theory emerged attributing certain changes in adolescent sleep to an alteration in the circadian timing system. Carskadon and colleagues[23] demonstrated that circadian phase preference was delayed in association with more mature self-reported pubertal ratings in sixth-grade girls. In a laboratory-based study,[23] it was reported that the offset time of melatonin secretion in the morning was significantly correlated with Tanner stage. These findings indicate that a change in the biological system regulating circadian timing may accompany adolescent development. Such a change may promote the later timing of sleep that occurs during adolescence.

Surveys addressing sleep habits of older children and adolescents have been performed in many countries and across many decades. These surveys demonstrate remarkable consistency with regard to developmental changes in sleep habits, although specifics of bedtimes, rise times, and sleep length tend to vary among ethnic groups. Several review articles have summarized these findings[24,25] and concluded that, irrespective of location, developmental trends are similar. Older children and young adolescents tend to sleep about the same length of time on school days as non–school days. With increasing adolescent age, however, bedtime gets later on school and non–school days, with the magnitude of the delay greater on non–school days. Additionally, rising time on non–school days also gets later as adolescence progresses. We should note that the tendency for a phase delay of sleeping pattern is not a novel finding; Terman and Hocking[26] in 1913, for example, noted a shift from "vesperal" to "matinal" sleeping during adolescence, attributing the change to increasing homework.

As a consequence of these changes, the total sleep time obtained by older adolescents is shorter than sleep time for children and younger adolescents, and the discrepancies between school-day and weekend sleep and wake times increase with age. Maternal questionnaires from the Zurich longitudinal studies[27] have provided impressive data regarding developmental changes in sleep patterns of adolescents. Although the findings are not as extreme as those reported for US teenagers, similar trends are apparent. In contrast, differences have been found in total sleep obtained by adolescents in the United States and those in Zurich, Switzerland. A recent sample of eighth-grade students in the United States demonstrates an average school-night bedtime of 10:44 PM, wake time of 6:35 AM, and total sleep period of 7.9 hours.[28] The Zurich data, on the other hand, show an average bedtime of 10:02 PM, wake time of 6:30 AM, and total sleep period of 8.5 hours. Thus, although overall trends are similar for data from developed nations, significant differences in total sleep time may point to important concerns for young people who obtain minimal sleep.

Daytime Sleepiness

The Multiple Sleep Latency Test (MSLT) is an objective test that measures speed of falling asleep to determine the tendency to fall asleep during the day. A faster sleep onset indicates a greater level of sleepiness, as does an increased number of sleep onsets during multiple tests. During an MSLT, subjects are asked to fall asleep while lying in bed in a dark and quiet room during 4 or 5 20-minute periods spaced at 2-hour intervals.[29] If sleep occurs during this time period, it is allowed for only 1.5 minutes (experimental test) or 15 minutes (clinical test); if no sleep occurs, lights are turned on after the 20-minute test and the subject has to get out of bed and stay awake until the next testing period. In a longitudinal study using the MSLT, Carskadon and colleagues[2] assessed developmental changes in daytime sleepiness and demonstrated a change in the pattern of daytime alertness occurring at midpuberty. The prepubertal and early pubertal adolescents did not fall asleep on most of the tests (average latency across all naps of approximately 19.5 minutes of a maximum of 20 minutes), whereas midpubertal and late pubertal adolescents were more likely to fall asleep during the midafternoon tests, and the average sleep latency across all the naps decreased to approximately 15 minutes. This increase in sleep propensity occurred even though the more mature adolescents were sleeping as much as the less mature adolescents. This finding indicates that either adolescents may need more sleep than children or the pattern of sleepiness is reorganized during adolescent development.[24]

External Determinants of Sleep Patterns

Parental Influence

With the transition from childhood to adolescence, parents seem to change the manner in which they exert influence on children's sleep patterns, particularly on school days.[30] In Carskadon's study,[30] children 10 and 11 years of age were significantly more likely than children 12 and 13 years of age to report that parents set their school-night bedtimes. In later studies of high school students in 9th through 12th grades, only 5% of these older adolescents had a school-night bedtime set by their parents, and more than 75% went to bed when homework, television viewing, or socializing was done for the day or whenever they felt sleepy.[31]

Thirteen-year-old children reported more frequently than younger children that they required either alarm clocks or their parents to wake them up on school mornings. This difficulty in waking in the morning continues into the older years. More than 85% of high school students in 1 study used an alarm or their parents to awaken them in the morning on school days.[32] Thus, the influence of parents shifts from setting bedtimes during childhood to assisting with rising time during adolescence.

School Start Times

Historically, schools in the United States have started early in the morning. In addition, many US school districts use a 3- or 4-tiered schedule in which high schools open first, followed by middle or junior high schools, and then elementary schools.[33] In a preliminary survey of 40 schedules posted on the Internet from high schools throughout the United States for the 1996–1997 academic year, 48% started at 7:30 AM or earlier, whereas only 12% started between 8:15 AM and 8:55 AM.[34] Most recently, in the 2001–2002 academic year, 35% of 50 high schools surveyed started earlier than 7:30 AM, nearly 50% started between 7:31 AM and 8:14 AM, and only 16% started between 8:15 AM and 8:55 AM.

Early high school start time is a significant, externally imposed constraint on teenagers' sleep/wake schedules; for most adolescents, waking up to go to school is neither spontaneous nor negotiable. Szymczak and colleagues[35] followed Polish students between 10 and 14 years of age for more than 1 year and found that all of them slept longer on weekends and during vacations by extending their sleep and waking up later. These investigators concluded that the school schedule was the predominant determinant of wake times for these students. Similarly, several surveys of high school students have found that students who start school at 7:30 AM or earlier obtain less total sleep on school nights because of earlier rise times.[31,36–38]

In a laboratory and field study, Carskadon and colleagues[39] evaluated the effect of a 65-minute advance in school start time on approximately 40 9th-graders in their transition to 10th grade. Specifically, junior high school started at 8:25 AM and high school started at 7:20 AM in a large urban school district. Sixty-two percent of the students in 9th grade and less than half the students in 10th grade got an average of as much as 7 hours of sleep on school nights. Students awoke earlier on school days in 10th grade than in 9th grade and had shorter sleep latencies on the MSLT in 10th than in 9th grade, particularly on the 8:30 AM assessment. In addition, 16% of participants experienced 2 REM episodes on the MSLT in 10th grade (48% of subjects experienced 1 REM episode). The occurrence of REM sleep episodes on the MSLT was associated with a delayed timing of melatonin secretory pattern in these adolescents. In a study of nearly 600 young adolescents (10–12 years of age), Epstein and colleagues[40] compared a 7:10 AM with an 8:00 AM school start time. In their survey, children with early start times reported significantly shorter mean sleep times (ie, approximately 25 minutes less) than did children who started school after 8:00 AM.

Employment and Extracurricular Activities

Another major influence on sleep patterns of high school students in the United States is the number of hours they spend working for pay. Students who work 20 or more hours per week report going to bed later at night, sleeping fewer hours per night, oversleeping more in the morning, and falling asleep more in class than those who do not work or who work fewer than 20 hours per week. In a survey of more than 3000 high school students (grades 9–12) from several Rhode Island school districts, nearly 60% of the students reported that they held part-time

jobs, and almost 30% indicated that they worked 20 hours or more per week.[31,34] The 11th- and 12th-grade students who worked more than 20 hours per week reported significantly different sleep/wake behaviors from those of their peers who worked less than 20 hours per week or not at all. The high-work group reported more symptoms of daytime sleepiness such as struggling to stay awake while driving, in classes, and while reading, studying, or doing homework. This group also reported greater use of caffeine, alcohol/drugs, and tobacco.

Clinical Consequences of Inadequate Sleep

Excessive Daytime Sleepiness

Alertness is defined as the inherent ability of the brain to sustain attentive wakefulness with little or no external stimulation. When someone is excessively sleepy, alertness and vigilance become unstable and unreliable. Cognitive capabilities slow down, and over time there is an increased risk of making errors[41] and an increased risk of accidents (for example, automobile crashes). When excessively sleepy, individuals may begin tasks well, but as time on tasks continues, performance will decrease. Sleepy individuals may increasingly neglect activities judged to be nonessential. High levels of sleepiness impair complex performance, leading to lapses in attention, slowing of motor and cognitive reactions, mental mistakes, working-memory errors, time-on-task decrements, and potentially uncontrolled sleep attacks.[42]

Despite the laboratory findings on the effects of sleep loss on neurocognitive functioning, it is commonly assumed that sleep loss has little or no effect on waking brain function, that the effects of sleep loss are primarily motivational, and that the amount of sleep required to maintain stable waking performance is less than that obtained.[43] In reality, the opposite is true. There have been several studies assessing the effect of sleep deprivation on tendency to fall asleep.[30,44,45] In these studies, successive days of restricting sleep duration led to a significant tendency to doze off in quiet settings. This might manifest as falling asleep in class, or there may be uncontrollable "microsleeps" leading to poor task performance. More recent studies have supported these earlier findings. For example, Fallone and colleagues[25] studied young people between 8 and 15 years of age and restricted them to 1 night of only 4 hours of sleep. Their daytime sleepiness was increased both subjectively and objectively. The effect of sleepiness on neurobehavioral functioning in these studies is less clear and may depend on whether the sleep loss is across a single night or multiple nights. There also seems to be an emotional overlay. Maayan and colleagues[46] studied 10 adolescents the day after a night of total sleep deprivation. They found that the adolescents exposed to emotion-producing pictures during the test demonstrated decreased performance on a working-memory task.

School Performance Problems

In a recent critical review, academic performance and sleep were analyzed extensively by Wolfson and Carskadon.[47] Studies clearly suggest that shortened total sleep and irregular sleep schedules are highly associated with poor school performance for adolescents. After a year-long study of 17 school districts in Minnesota, Minneapolis Public Schools changed their high school start time from 7:15 AM to 8:40 AM, beginning with the 1997–1998 school year. The Center for Applied Research and Educational Improvement at the University of Minnesota has examined the effect of the later start time.[48] The study examined student grades and attendance through district records and administered the School Sleep Habits Survey to 50 962 students in 7 high schools (grades 9–12). Analyses found that daily attendance rates were higher in the 1999–2000 academic year than they were in 1995–1996; the percentage of high school students who were continuously enrolled in the district or in the same school increased in 1999–2000, relative to the percentage in 1995–1996; and with the later start time, the dropout rate decreased. The School Sleep Habits Survey showed no change in average school-night bedtimes or weekend bedtimes and rise times. However, because of later rise times on weekdays, Minneapolis students reported that they obtained, on average, 60 more minutes of sleep on school nights than did their peers in high schools with start times 1 hour earlier. In addition, Epstein and colleagues[40] compared young adolescents who started school at 7:15 AM or earlier at least 2 times a week with those who started at 8:00 AM. Early risers complained more of daytime fatigue and sleepiness throughout the school day, greater tendency to doze off in class, and attention/concentration difficulties in school.

Wolfson and Carskadon[31] administered the School Sleep Habits Survey to 3120 high school students from 4 high schools representing 3 school districts in southern New England. Adolescents with self-reported higher grades reported significantly longer and more regular sleep/wake schedules. Specifically, they said that they got more total sleep and had earlier bedtimes on school nights than did students with lower grades. In fact, these differences distinguished students reporting mostly Bs or better from those reporting Cs and worse. Students' weekend sleep habits also differed according to self-reported grades. Specifically, A and B students reported earlier bedtimes and earlier rise times than did students with poorer grades. Students with worse grades reported greater weekend delays of sleep schedule than did those with better grades.

Meijer and colleagues[49] focused more on the relationship between sleep/wake patterns and young adolescents' perceptions of their school functioning than on academic grades or examination scores. They assessed young adolescents in 7th and 8th grades. Adolescents who reported having difficulty getting up were less motivated to do their best at school, whereas children with higher-quality sleep and reports of feeling more rested were more receptive to teacher influence, had a more positive image of themselves as students, and reported higher motivation to do their best in school.

A few studies have examined the relationship be-

tween sleep/wake patterns and academic performance in college students. Trockel and colleagues[50] interviewed or surveyed 185 randomly selected first-year college students regarding sleep/wake habits, exercise, eating, mood, perceived stress, social support, religious habits, and semester grade point averages (GPAs). Sleep habits, particularly rise times, accounted for the largest amount of variance in GPAs. In particular, later weekday and weekend wake times and increased number of work hours (paid/volunteer) were associated with lower GPAs. Eating habits, mood, stress, time management, and social support were not associated with these first-year college students' grades. Kelly and colleagues[51] also studied college students and found that short-sleepers reported significantly lower overall GPAs than did long-sleepers. Although there were no age or gender differences, long-sleepers (≥9 hours per night) reported significantly higher GPAs than did short-sleepers (≤6 hours per night; mean GPA: 3.24 vs 2.74, respectively). Average-sleepers (7–8 hours per night) were not significantly different from long- or short-sleepers.

Sleep and Attention-Deficit/Hyperactivity Disorder in Adolescents and Young Adults

As noted above, lack of sleep may cause problems with attention and concentration in the laboratory setting. The well-recognized clinical syndrome is attention-deficit/hyperactivity disorder (ADHD), which is estimated to affect 5% to 10% of the school-aged population. This disorder persists into adolescence and young adulthood in 10% to 60% of affected individuals.[52] The relationship between sleep problems and ADHD in children has been examined in multiple studies, using a number of approaches,[53–66] but similar data in adolescents and adults are largely unavailable. Reviews of clinical complications of ADHD in adolescents include some anecdotal references to sleep disturbances,[67–69] but studies of childhood ADHD and sleep are rare and have included small numbers of subjects between 12 and 18 years of age.[64]

Studies of children with ADHD have used either parental- or self-report surveys or all-night sleep testing (polysomnography [PSG]) to examine the relationship between sleep architecture/disturbances and ADHD. Methodologic limitations of these studies include small sample sizes and selection bias, variability in diagnostic criteria for ADHD, failure to document pubertal status, and variability in control groups. In addition, although parental assessment of their children's sleep behavior and disturbances is clearly more subjective, relatively objective methods such as PSG may not reflect "real-world" conditions accurately. Finally, many studies have failed to consider the effects of medication and the presence of comorbid psychiatric conditions. Despite these limitations, most of the "objective" studies have failed to find consistent differences in sleep architecture and patterns between children with ADHD and controls,[70–79] yet most parental-report studies have reported increased sleep problems in children with ADHD, including difficulty falling asleep, night wakings, and restless sleep. However, more recent studies have suggested that many of these sleep disturbances are attributable to either medication-related effects from psychostimulants or common psychiatric comorbid conditions rather than to ADHD per se.[80]

The etiology of sleep disturbances associated with ADHD in childhood is likely to be multifactorial and vary across patients. In addition to medication-related effects on sleep and the influence on sleep behavior of such common comorbid conditions as oppositional defiant disorder, depression, and anxiety disorders, primary sleep disorders may present itself with ADHD-like symptoms or may exacerbate underlying ADHD.[81–83] For example, there is mounting evidence not only that sleep-disordered breathing (SDB) is strongly associated with inattention, hyperactivity, impaired "executive" cognitive functioning, and disruptive behaviors in children but also that treatment of SDB results in significant improvement or even complete amelioration of ADHD-related symptoms.[84,85] Likewise, other primary sleep disorders such as restless-legs syndrome (RLS), periodic limb-movement disorder,[86–89] delayed sleep-phase syndrome (DSPS),[90] and narcolepsy[91] may present with ADHD symptomatology.

Primary abnormalities in central nervous system regulation of arousal, behavioral inhibition and self-regulation, and/or vigilance associated with ADHD also have been postulated to result in sleep disturbances. These disturbances suggest a more "intrinsic" sleep/wake dysregulation in at least some individuals with ADHD.[92,93] There is considerable empirical evidence to suggest that brain systems regulating sleep and attention/arousal are linked and that abnormalities in similar neurotransmitters such as the noradrenergic and dopaminergic systems may be found in ADHD and sleep disturbances.[94] Although intriguing, at the current time these hypotheses are still largely speculative. Nevertheless, it is clear from clinical observations and on theoretic grounds that an association between ADHD and sleep disturbances exists, that symptoms of ADHD and sleep disorders frequently overlap, and furthermore that the presence of a comorbid sleep disorder may significantly increase the level of impairment in an individual with ADHD.

Mood Disturbances

The relationship between sleepiness and depressed mood in adolescents must be considered in both directions. That is, there is extensive evidence that adolescents with clinical mood disorders (particularly major depressive disorder) report high rates of sleep disturbances and complaints.[95,96] There are also data indicating that adolescents with sleep problems report increased negative mood and/or difficulties with mood regulation.[97–99] Part of the relationship may be accounted for by the effects of stress and emotional arousal interfering with sleep in adolescents with emotional problems,[100] whereas there is also evidence that sleep disruption can cause irritability and negative mood in adolescents.[92]

Studies of sleep and major depressive disorder in

adolescents provide evidence for subjective sleep complaints (especially difficulty falling asleep) and are extremely common, affecting most adolescents interviewed during an episode of depression.[96] Objective electroencephalogram studies of clinical samples have revealed evidence of sleep disturbances in some depressed adolescents but at lower rates than sleep disturbances seen in adult depression.[101–105] However, subjects who showed objective evidence of sleep-onset abnormalities in adolescence were more likely to develop depressive episodes in the future.[106,107] More recently, studies focusing on the microarchitecture of sleep in depressed adolescents provide some evidence that more subtle disturbances in sleep also may be predictive of a worse clinical course among adolescents with mood problems.[108]

Given the evidence of negative effects in both directions, one of the major concerns regarding the co-occurrence of sleep and mood problems in adolescents is that it can contribute to a "negative spiral" in school and social functioning. For example, late-night and erratic schedules and early school start times can lead to sleep deprivation, which in turn can erode mood and motivation. Difficulties with mood, motivation, and school performance create greater stress and affective problems. The negative affective experiences further interfere with sleep and arousal regulation and circadian effects and lead to difficulty falling asleep, more erratic schedules, and additional deterioration across these systems. Research is needed to examine the effects of early intervention aimed at sleep while examining mood symptoms to address these important concerns.

Drowsy Driving

Motor vehicle crashes are a leading cause of death in adolescents and young adults, and sleepiness can be deadly for adolescents behind the wheel. Studies analyzing motor vehicle crash data by age group have found that young people between 16 and 29 years of age were the most likely to be involved in crashes caused by the driver falling asleep.[109–112] Pack and colleagues[109] reviewed the 5104 crash reports from North Carolina from 1990 to 1992 in which the driver was judged to have fallen asleep. In 771 of the crashes, the driver was also thought to be intoxicated. Of the remaining 4333 crashes, the majority occurred with younger individuals. Fifty-five percent occurred with a driver who was 25 years or younger. Unlike crashes with adults older than 65 years, which typically occur during midafternoon, crashes with this younger age range generally take place at night and involve young males driving alone and going off the road.

Lack of sleep has been implicated as a cause of falling asleep at the wheel.[113] Compared with sleeping 8 or more hours each night, sleeping 6 to 7 hours was associated with a 1.8 times higher risk for involvement in a sleep-related crash versus a non–sleep-related crash, and sleeping fewer than 5 hours per night invoked a 4.5 times higher risk. Forty percent of drivers had been awake for 15 or more hours before falling asleep at the wheel and crashing, and nearly 20% had been awake for 20 or more hours.

Additional Causes of Daytime Sleepiness

As described in the previous sections, there is an inherent tendency for adolescents and young adults to get insufficient sleep, and as a result, excessive daytime sleepiness may be frequently seen in this age group. Nevertheless, it is also essential to acknowledge the importance of untreated sleep disorders and other organic causes of excessive daytime sleepiness. It is very difficult to differentiate insufficient sleep from other causes of daytime sleepiness without taking a formal sleep history. The following sections will review clinical sleep disorders and propose a working algorithm to help clinicians sort through the differential diagnoses.

Insomnia and Circadian-Rhythm Disorders

Insomnia is a broad term used to describe a wide range of complaints relating to disorders of sleep. For many people, insomnia is a subjective complaint of dissatisfaction with sleep, including decreased sleep quality, decreased sleep quantity, trouble getting to sleep, and trouble maintaining sleep. In some cases, insomnia is a symptom of another underlying medical or psychological disorder, and in other cases there is no apparent physiologic cause (this type of insomnia generally is called "psychophysiological insomnia"). The waking effects of insomnia include daytime fatigue or sleepiness, neurocognitive deficits, and altered mood.

The major insomnia complaint in adolescents is difficulty initiating sleep. In this age group, a major cause of this insomnia is DSPS. DSPS is a circadian-based disorder in which an individual's internal circadian pacemaker is not in synchrony with external or environmental time. Affected adolescents typically experience difficulty in initiating and terminating sleep at a "normal" time[114] and prefer later sleep times (between 2:00 AM and 6:00 AM) and wake times (between 10:00 AM and 1:00 PM). The sleep structure of DSPS patients is otherwise normal. DSPS is characterized by a delay in the timing of activities demonstrating circadian rhythmicity, such as melatonin secretion,[115] changes in core body temperature, and the sleep/wake cycle.

The incidence of DSPS in the general population is unclear. Some reports suggest that only 0.7% of middle-aged adults have DSPS and 7% or more of adolescents suffer from this disorder.[116–118] In adolescents, there may be an overestimation of the incidence of DSPS because of developmental and/or environmental influences on the circadian system that produce a DSPS-like profile in this age group. As mentioned previously, Carskadon and colleagues[30,39] reported a phase delay in the timing of daytime sleepiness in midpubertal children by using the MSLT as an index of sleepiness. Adolescents typically do not go to sleep until late because of school, work, social, and family commitments but still must awaken early for school. When allowed to sleep without time constraints on weekends, adolescents choose to go to bed and rise later than on weekdays

and sleep for longer periods (in essence, "catching up" on sleep).[119]

The diagnosis of DSPS is based on clinical history. The classic patient with DSPS is more frequently tardy or absent from school because of an inability to get out of bed in the morning despite parental intervention. If the adolescent with DSPS does make it to class, he or she may fall asleep, frequently has poor grades, and frequently is labeled as having a behavioral problem. Although not a practical treatment option, these symptoms would abate if the adolescent were allowed to sleep late in the morning and arrive later at school.

Treatment regimens for DSPS need to be designed to resynchronize the circadian system. There is a high incidence of relapse, however, after discontinuation of treatment, especially if patients are unable to maintain a rigid sleep/wake schedule. Czeisler and colleagues[120] delayed the sleep times of adult patients by 3 hours each day over a period of 5 to 6 days until the desired sleep time was reached. An alternative approach is to have the patient get up and stare into a bright light box for 30 minutes first thing in the morning to "reset the clock." However, studies using light exposure to re–entrain subjects have reported mixed findings.[117,121]

Another proposed treatment for DSPS is the administration of melatonin. Melatonin is an endogenous hormone that plays a role in the control of the circadian system[122] and potentially in the initiation of sleep.[123,124] Exogenously administered melatonin has been reported to have both chronobiotic (phase-shifting)[125] and soporific (sleep-inducing) properties.[126] As a treatment for DSPS, melatonin exerts its effects primarily by shifting the timing of the circadian system and has been demonstrated to be successful in re-entraining sleep/wake rhythms in people with jet lag and people who perform shift work.[127]

The efficacy of melatonin treatment for DSPS has been examined in a number of studies. Phase advance of the sleep/wake cycle was reported after daily administration of melatonin for up to 6 weeks.[76,128–130] After termination of the treatment, however, the melatonin-induced phase advances were reversed and subjects returned to being phase delayed. Although melatonin administration may be an effective treatment for DSPS, it should be used with caution. As yet, there is no established dose of melatonin to be administered for effective results, and the timing of administration is also important to achieve phase shifts in the desired direction.[131] In addition, the safety of melatonin administration, particularly in adolescents and young adults, is not established. Melatonin levels are high during puberty,[132] and melatonin has been implicated in reproductive development and seasonal breeding in several species. Additionally, studies on the safety of long-term melatonin administration have not been performed. Therefore, at present, melatonin should be thought of as a research tool and not a clinical solution.

Sleep-Disordered Breathing

SDB, or obstructive sleep apnea, is a condition in which the pharynx intermittently and repetitively collapses during sleep. Arterial oxygen levels decrease and carbon dioxide levels increase until a subconscious arousal from sleep occurs. The pharyngeal dilator muscles then contract, the pharynx opens, air rushes in under pressure creating a loud snoring sound, ventilation resumes, and blood gas abnormalities are corrected. SDB in adolescents and young adults leads to the same daytime sequelae related to excessive daytime sleepiness as seen with insufficient sleep (sleep restriction).

The most common cause of sleep apnea in this age range is enlarged tonsils and adenoids. The epidemic of childhood weight problems, however, has resulted in obesity becoming a major cause of SDB in children as well as adults. Other contributing factors include retrognathia, nasal obstruction,[133] evening alcohol ingestion, family history of sleep apnea,[134] black race,[134] and history of wheezing and cough.[134]

The profile of an adolescent or young adult with sleep apnea is of someone who snores loudly and frequently, has been observed to have episodes of apnea during sleep, has awakened choking, and is excessively sleepy. Clues on physical examination that would help the physician suspect SDB include enlarged tonsils, retrognathia, mouth breathing, and upper-body obesity.

The true prevalence of SDB in this age range is unknown because of a lack of studies and lack of consensus about minimum criteria for diagnosis. Part of the problem is that some studies have included younger children as well as adolescents.[135] Although an obstructive-apnea index (the number of episodes of obstructive apnea per hour of sleep) greater than or equal to 1 per hour may be diagnostic of SDB in younger children,[136] the threshold may be higher in adolescents and young adults. Acebo and colleagues[137] reported that an obstructive apnea index of 1 per hour was normal in 13-year-old boys and girls and in 22-year-olds.[137] In fact, in this study of normal subjects, an apnea index up to 3.6 in young boys and 4.5 in young men was considered to be normal.

Hui and colleagues[138] evaluated 1910 freshman at the Chinese University of Hong Kong and found that 26% snored, 11% reported impaired performance ability, and 42% reported daytime sleepiness. A limited number of these college students underwent all-night sleep studies, leading to a calculation of 0.1% prevalence of SDB in this population. In contrast, Sanchez-Armengol and colleagues[139] studied 101 adolescents 12 to 16 years of age. Of this population, 29% snored, 14% were excessively sleepy, and 3% had SDB.

The diagnosis of sleep apnea requires overnight assessment by PSG, typically in a sleep laboratory. Once sleep apnea is diagnosed, treatment options include removal of the tonsils and adenoids if they are enlarged, weight reduction if overweight or obese, and/or nightly continuous positive airway

pressure therapy to prevent intermittent upper-airway collapse.[140]

Narcolepsy and Idiopathic Hypersomnia

Narcolepsy is a neurologic disorder associated with inappropriate control of REM sleep. Recent studies have suggested that the pathophysiology of narcolepsy involves depletion of the neuropeptide hypocretin known as orexin.[141] The true prevalence of narcolepsy is unknown, but 4 to 10 people per 10 000 in the United States may have the disorder.

Core symptoms of narcolepsy reflect the components of REM sleep, specifically loss of muscle tone and an extremely active cortex during sleep, leading to vivid dreams. Patients with narcolepsy may have sleep attacks in which they inappropriately doze off. Many will have cataplexy, which is a sudden loss of muscle tone typically precipitated by anger or laughter. In severe cases, the patient may lose all tone and collapse to the floor. Symptoms may even present as unexplained syncope. If left alone, the patient will fall asleep and be in REM sleep. The presence of cataplexy is diagnostic of narcolepsy.[142] People with narcolepsy may also experience sleep-onset paralysis as they are starting to fall asleep; they suddenly become paralyzed while they are still awake. Sleep paralysis may also occur on awakening, but this may happen in people without narcolepsy as well, either sporadically or on a familial basis. Patients with narcolepsy may also experience hypnagogic hallucinations (vivid, dreamlike visual images) before falling asleep. Only a minority of patients present with the complete tetrad of symptoms.[91,143]

Although the symptoms of narcolepsy typically begin during adolescence and young adulthood, adults with narcolepsy frequently report that the diagnosis was not established for several more years.[144] Frequently, adolescents with narcolepsy have behavioral and emotional disturbances. Dahl and colleagues[91] found that 12 of 16 adolescents with narcolepsy had emotional problems, and 4 patients were misdiagnosed as having a psychiatric disorder. Delayed and mistaken diagnoses may contribute to adult psychosocial dysfunction.[143,145]

A definitive diagnosis of narcolepsy can be made if cataplexy is present. Testing for narcolepsy includes overnight PSG to exclude other causes of daytime sleepiness, such as SDB. In addition, patients will undergo MSLT testing the following day. There is no specific test for cataplexy. Adolescents with narcolepsy will be pathologically sleepy with a mean sleep latency across all naps of less than 6 minutes, compared with a normal mean sleep latency of 15 minutes. Patients with narcolepsy, as well as patients with insufficient sleep, may demonstrate REM sleep in at least 2 of the naps, whereas normal subjects have no REM sleep.

Treatment includes stimulant drugs such as methylphenidate and dextroamphetamine to decrease daytime sleepiness, wake-promoting agents such as modafinil, and REM-suppressant agents such as tricyclic antidepressants and serotonin reuptake inhibitors to control cataplexy. Recently, sodium oxybate has become available to prevent cataplexy.[146] In addition, education, counseling, and working closely with both family and school personnel are essential. Regular sleep/wake schedules need to be established, and daytime restorative naps may be helpful.

"Idiopathic hypersomnia" is a term used to describe patients who are excessively sleepy for no apparent cause and who do not have cataplexy.[147] Despite adequate sleep time for age and despite a normal all-night PSG result, these patients have MSLT results in the sleepy range, yet do not demonstrate any episodes of REM sleep in individual naps or any of the associated symptoms of narcolepsy. It is possible that these patients may be found to have narcolepsy in the future. Patients with idiopathic hypersomnia are frequently treated with stimulant medications such as methylphenidate and dextroamphetamine, although the response to treatment is usually less effective than it is with narcolepsy.

Periodic Limb Movement During Sleep and RLS

Periodic limb movements during sleep are repetitive contractions of the anterior tibialis muscles occurring during sleep. Although more common in aging adults, leg movements may also be seen in adolescents and young adults. Periodic limb movements may be an incidental finding on all-night PSG, but they can also be a cause of subconscious sleep disruption, leading to daytime sleepiness, or a trigger for full awakenings and subsequent insomnia.

A related disorder is RLS, in which patients complain of an uncontrollable feeling in their lower legs at rest, either lying or sitting. The sufferer may become so uncomfortable that he or she has to move around or get up and walk to control the symptoms. Symptoms will typically disappear when the patient starts moving around. Restless-legs complaints are more common with increasing age but may be seen in younger patients as well, as with certain medical conditions such as renal failure and diabetes mellitus or under special circumstances such as pregnancy. Although most patients with restless-legs complaints will have periodic limb movements during sleep, the inverse correlation is very uncommon. RLS has been associated with insomnia and recently has been found to be associated with ADHD in children and adolescents.[87–89]

Treatment typically is directed at increasing central nervous system dopamine concentrations with agents such as carbidopa-levodopa, pergolide, or pramipexole. Gabapentin and benzodiazepines are also used to treat RLS.

Effect of Medications/Substances

Many common medications may have a marked effect on sleep and sleep patterns. A detailed summary is beyond the scope of this review. Examples include the use of extremely long-acting stimulants for ADHD. These agents may paradoxically increase sleepiness and augment problems with attention, concentration, and mood during the daytime. By causing overstimulation, these agents may actually have a negative effect on sleep and decrease actual sleep time. Similarly, medications used for depression may have a profound effect on sleep quality.

TABLE 1. "BEARS": A Sample Sleep History

B =	Bedtime problems (Do you have any problems falling asleep at bedtime?)
E =	Excessive daytime sleepiness (Do you feel sleepy a lot during the day? In school? While driving?)
A =	Awakenings during the night (Do you wake up a lot at night?)
R =	Regularity and duration of sleep (What time do you usually go to bed on school nights? Weekends? How much sleep do you usually get?)
S =	Sleep-disordered breathing (Parent: Does your teenager snore loudly or nightly? Patient: Has anyone ever told you that you snore loudly at night?)

Even over-the-counter cold and allergy medications may be overstimulating (eg, pseudoephedrine) or oversedating (eg, diphenhydramine). Adolescents or young adults abusing prescription or illegal drugs are at high risk of significant adverse sleep effects.

Alcohol is a potent short-term sedating substance.

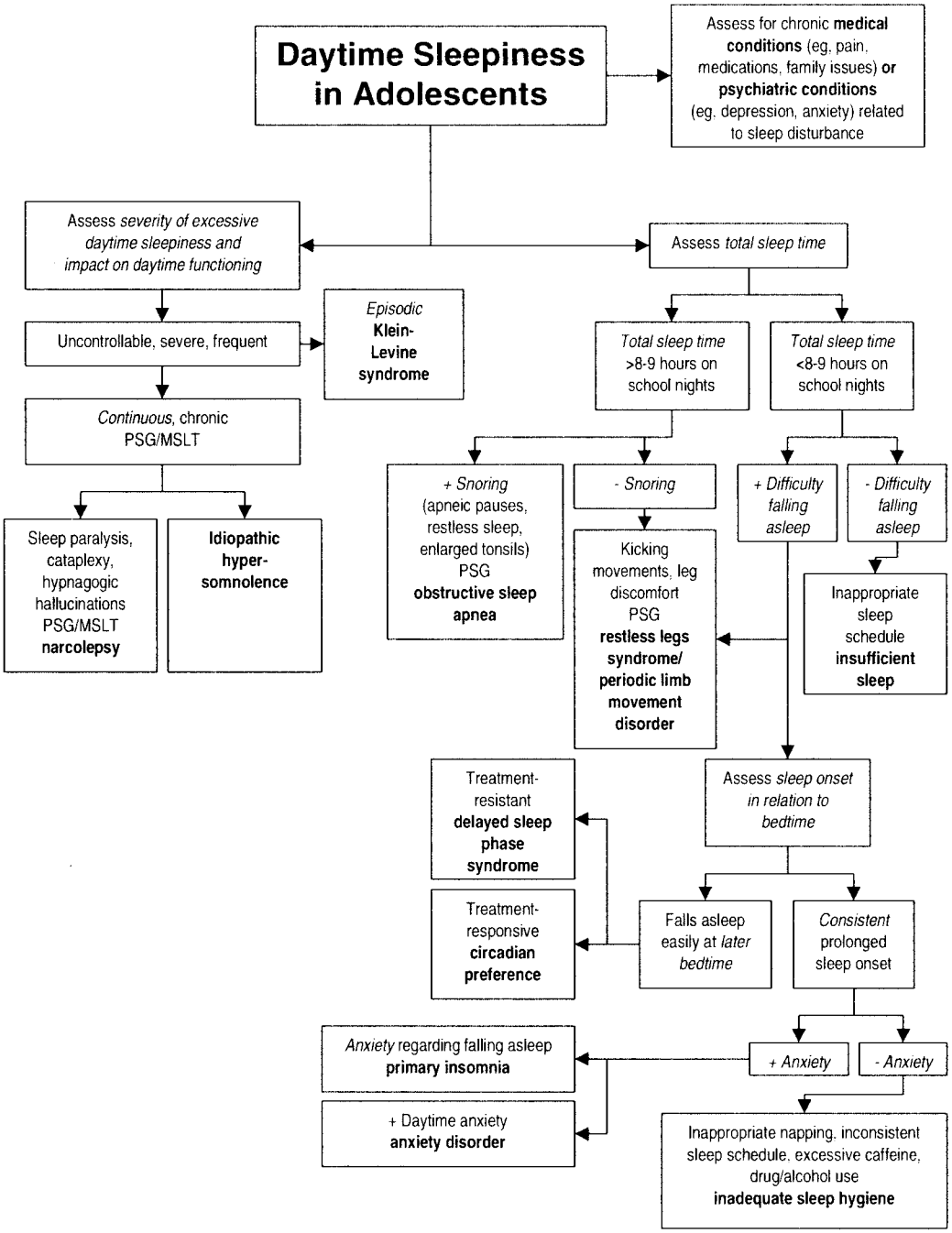

Fig 1. Sample clinical assessment flowchart. PSG indicates polysomnography; MSLT, Multiple Sleep Latency Test. (Reproduced with permission from Mindell JA, Owens JA. *A Clinical Guide to Pediatric Sleep: Diagnosis and Management of Sleep Problems*. Philadelphia, PA: Lippincott Williams & Wilkins; 2003:56.)

Although it may induce sleep, once the blood alcohol concentrations have dropped low enough, one may develop acute rebound insomnia. In addition, alcohol causes pharyngeal dilator muscle relaxation and hence precipitates snoring and even sleep apnea in susceptible individuals.[148,149]

Caffeine is ubiquitous in coffee, tea, chocolate, and soft drinks and may lead to insomnia or subconscious sleep disruption and subsequent daytime drowsiness, which in turn may lead to an increased need for caffeine the next day. Excessive use of caffeine, nicotine, or stimulants under conditions of sleepiness may provide apparent short-term gain but long-term negative consequences on sleep and circadian health.

IMPLICATIONS FOR CLINICAL PRACTICE

Excessive sleepiness is a significant problem in adolescents and young adults. In most cases, it results from insufficient sleep caused by insufficient time in bed and is associated with intrinsic changes in the sleep/wake cycle as well as extrinsic pressures to go to bed later and get up earlier. At a minimum, clinicians evaluating individuals in this age range need to ask questions routinely about sleep patterns and how much sleep an individual is receiving as well as whether there are any sleep-related symptoms. Specific tools such as the "BEARS" Pediatric Sleep History (Table 1) have been used in younger children and adolescents[150] and can serve as a template for the development of a routine review of systems for clinicians in asking sleep questions. This instrument is designed to provide a practical and user-friendly vehicle for incorporating pediatric sleep history into the standard histories and physical examinations in both outpatient and inpatient settings. The "BEARS" instrument is divided into 5 major sleep domains and provides a comprehensive screen for the major sleep disorders affecting children in the 2- to 18-year age range. Each sleep domain has a set of age-appropriate "trigger questions" for use in the clinical interview.

The key message for clinicians is that insufficient sleep (time in bed) occurs commonly but that this is not the only process that may be present. Consideration, therefore, needs to be given to possible depression, obstructive sleep apnea, insomnia, narcolepsy, and other sleep disorders as well as to medications or stimulants such as caffeine as the cause of impaired sleep quality and excessive daytime sleepiness.

There is not an established and validated algorithm that all clinicians use for diagnosing and treating sleep disorders in this age range. One sample assessment tool is shown in Fig 1. Treatment should be directed at any potentially reversible process. At a minimum, adolescents and young adults need to be counseled about normal age-appropriate sleep needs and the detrimental effects of sleep loss on performance and overall health.

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POSITION PAPER

Executing Juvenile Offenders: A Fundamental Failure of Society

Position Paper of the Society for Adolescent Medicine

The Society for Adolescent Medicine (SAM) and the American Academy of Pediatrics (AAP) have the protection of the health and well-being of adolescents as a primary goal. With this joint policy statement, SAM and AAP express our strong opposition to the juvenile death penalty and call upon the United States Supreme Court, the federal government, and states to abolish the practice of executing juvenile offenders.

SAM and AAP have previously affirmed the importance of ensuring the health and well-being of young people who are involved in the juvenile and criminal justice systems [1,2]. It is well established that the vast majority of adolescents involved in these systems suffer from serious psychological and physical health problems and are more likely than the general adolescent population to have been victims of child abuse or neglect and to have experienced school failure or learning disabilities [1–3].

For more than a century, the juvenile justice system has been based on the principle that young people who commit crimes should have an opportunity for rehabilitation and treatment. The imposition of the death penalty for juvenile offenders represents the ultimate rejection of that principle. The execution of offenders who were under age 18 at the time of their crime is expressly prohibited by international law in several treaties, such as the United Nations' Convention on the Rights of the Child, the American Convention on Human Rights, the International Covenant on Civil and Political Rights, and the Geneva Convention Relative to the Protection of Civilian Persons in Time of War, and numerous resolutions and reports by other international bodies such as the European Union, the United Nations Economic and Social Council, and the United Nations Sub-Commission on Human Rights [4–6].

The Society for Adolescent Medicine and the American Academy of Pediatrics add our voices to the emerging national and international consensus opposing the death penalty for juvenile offenders. SAM and the AAP are committed to working with other professionals to address the comprehensive health care needs of young people in the context of their families, schools, and communities. We view the execution of juvenile offenders as the most fundamental failure of society to provide young people with the supports they need to grow up to lead healthy, responsible, and productive lives.

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Policy Statement—Expert Witness Participation in Civil and Criminal Proceedings

abstract

The interests of the public and both the medical and legal professions are best served when scientifically sound and unbiased expert witness testimony is readily available in civil and criminal proceedings. As members of the medical community, patient advocates, and private citizens, pediatricians have ethical and professional obligations to assist in the administration of justice. The American Academy of Pediatrics believes that the adoption of the recommendations outlined in this statement will improve the quality of medical expert witness testimony in legal proceedings and, thereby, increase the probability of achieving outcomes that are fair, honest, and equitable. Strategies for enforcing guidance and promoting oversight of expert witnesses are proposed. *Pediatrics* 2009;124:428–438

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expert witness, legal and ethical standards, oversight, peer review

ABBREVIATIONS
AAP—American Academy of Pediatrics
FRE—Federal Rule of Evidence

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BACKGROUND

The American Academy of Pediatrics (AAP) first articulated policy on appropriate medical expert witness testimony in 1989 and was among the first medical specialty societies to do so.[1] The statement was revised in 1994[2] to incorporate additional provisions on expert witness testimony guidelines from the Council of Medical Specialty Societies.[3] A 2002 revision outlined responsible practices that physicians should follow to safeguard their objectivity in preparing and presenting expert witness testimony. Key legal concepts were explained, and the role of the expert witness in the litigation process (pretrial and trial) was described.[4] This latest AAP iteration expands the requirements and qualifications for experts testifying in civil and criminal cases, the latter primarily relating to cases involving alleged child abuse and/or neglect. The importance of expert witness testimony in the process of determining civil liability, child safety, or criminal culpability and its unique significance in pediatric cases are also stressed. Recent efforts to improve the quality of medical expert witness testimony are described. The known strengths or weaknesses of these programs are noted. Enforcement of policy recommendations are sought for the first time.

WHAT IS EXPERT TESTIMONY?

The expert witness plays an essential role under the US system of jurisprudence. Courts rely on expert witness testimony in most civil and criminal cases to explain scientific matters that may or may not be understood by jurors and judges. Standards of admissibility of expert witness testimony vary depending on state and federal rules of proce-

dure and evidence. Although most state laws conform to both the Federal Rules of Procedure and Federal Rules of Evidence (FRE),[5] some do not. The same testimony from a given expert witness, therefore, might be admissible in some state courts but not in federal court, and vice versa. FRE 702 authorizes a judge to admit expert testimony into evidence if it assists the jury or the judge to "understand the evidence or to determine a fact in issue." FRE 703 permits a qualified expert to give testimony based on data of others, provided that the data are of the kind customarily used by the expert's peers. FRE 704 permits an expert to opine on the ultimate factual issue.

In a malpractice case, testimony of an expert witness differs from that of other witnesses. "Witnesses of fact" (those testifying because they have personal knowledge of the incident or are persons involved in the lawsuit) typically restrict their testimony to the facts of the case at issue. The expert witness is given more latitude. The expert witness is allowed to compare the applicable standards of care with the facts of the case and interpret whether the evidence indicates a deviation from the standards of care. Without the expert's explanation of the range of acceptable treatment modalities within the standard of care and interpretation of medical facts, juries may not have the technical expertise needed to distinguish malpractice (an adverse event caused by negligent or "bad" care) from maloccurrence (an unavoidable adverse event or "bad outcome").[6] An expert must be qualified. Although the rules vary among jurisdictions about whether the expert must be of the same specialty as the defendant, the expert, nevertheless, must demonstrate to the judge sufficient knowledge and expertise about the issue to qualify as an expert.

LEGAL AND ETHICAL STANDARDS OF TESTIMONY

The judge acts as the gatekeeper in deciding the qualifications of the expert as well as the relevance and reliability of the testimony. The 2 main standards used by judges in determining relevance and reliability are referred to as the Daubert and Frye standards.[7,8] The Daubert standard (expanded in later cases known as Joiner[9] and Kumho[10]) was established by the US Supreme Court in the 1993 case *Daubert v Merrell Dow Pharmaceuticals Inc*. This standard is used in federal courts and has been adopted by many states for use in state courts. Under the *Daubert* decision, a judge will act as the gatekeeper for expert testimony in determining whether the opinion is both relevant and reliable. The judge can, but is not required to, assess testimony according to 4 guidelines in determining whether it is reliable: (1) whether the expert's theory or technique can be (or has been) tested; (2) whether the theory or technique has been subjected to peer review or publication; (3) the known or potential error rate of the theory; and (4) whether there is general acceptance in the relevant scientific community. The latter "general-acceptance" standard is at the core of the Frye standard of expert testimony established more than 80 years ago.[8] The Frye standard is still used in some states. Other states use a hybrid of the Daubert and Frye standards. Under the Daubert standard, trial judges are to focus on the reasoning or scientific validity of the methodology, not the conclusion of the methodology. Once the judge permits expert testimony to be admitted into evidence, it is the role of the jury to determine the "weight" (or importance) of the testimony. The *Daubert* court noted that challenges to questionable testimony are to be contested via cross-examination and the presentation of contrary evidence.[7]

The effect of the *Daubert* decision in reducing "junk science" from being admitted into evidence continues to be debated.[11] Yet, it seems to have benefited, rather than harmed, the process.[12] The importance of standards for admissibility of expert testimony at the trial level is underscored by the fact that appellate courts can only consider an "abuse-of-discretion" standard in reviewing a trial judge's decision to admit or exclude expert testimony (ie, defers to the trial judge's rulings unless overtly erroneous).[9] Critics have voiced concern over judicial discretionary power in admitting experts simply because some judges may lack the requisite scientific or medical background to interpret potentially complex medical issues.[13]

Attorneys may request experts to state that their testimony is being given "within a reasonable degree of medical certainty." This rubric is not universally defined and has been interpreted differently by the courts.[14,15] Also, it is not a standard required in all jurisdictions.[16] Ideally, expert witnesses should be unbiased conveyers of information. The pivotal factor in the medical tort process is the integrity of the expert witness testimony. It should be reliable, objective, and accurate and provide a truthful analysis of the standard of care. Regrettably, not all medical experts testify within these boundaries.[17] The medical community has long been aware that not all experts testify within scientific standards and ethical guidelines.[17,18] However, more research is needed to determine how invasive improper expert testimony is in the legal process. In a study of expert witnesses in lawsuits against neurologists over a 10-year period, significant errors of fact or interpretation and incorrect statements were noted to be common.[19] One study of charac-

teristics of expert witnesses in neurologic birth injury cases noted that a small group of physicians provided a disproportionate percentage of expert testimony in cases and that there may be suboptimal expertise and possible bias in testimony.[20]

WHAT IS MEDICAL MALPRACTICE?

Medical malpractice law is based on concepts drawn from tort and contract law. It is commonly understood as liabilities arising from the delivery of medical care. Causes of action can be based on negligence, insufficient informed consent, intentional misconduct, breach of a contract (ie, guaranteeing a specific therapeutic result), defamation, divulgence of confidential information, or failure to prevent foreseeable injuries to third parties. Medical negligence is the predominant theory of liability in medical malpractice actions.

According to *Black's Law Dictionary*,[21] negligence is defined as "the failure to exercise the standard of care that a reasonably prudent person would have exercised in a similar situation." To establish negligence, the plaintiff must prove all of the following elements: (1) the existence of the physician's duty to the plaintiff, usually based on the existence of the physician-patient relationship; (2) the applicable standard of care and its violation (ie, breach of the duty); (3) damages (a compensable injury); and (4) a legally causal connection between the violation of the standard of care and the injury. In a medical malpractice case, experts may be asked to provide an opinion about 1 or all of these elements of a malpractice case. Experts should not testify about all of these elements if they are not within their area of expertise (eg, it may not be appropriate for a pediatrician to testify about whether a cesarean delivery should have been performed to prevent a brachial plexus injury).

Besides negligence, a medical malpractice lawsuit may also include an allegation of insufficient informed consent. Informed consent includes a discussion with a noncoerced patient or parent who has decision-making capacity. The discussion should include the benefits versus the risks of proposed and alternative tests or treatments and the option of no treatment. When insufficient informed consent is an aspect of the case, the expert should be familiar with the standards of informed consent in the particular state involved. There are 2 main standards of providing informed consent that have been implemented by either judicial decision or statute: the "reasonable-patient" standard versus the "reasonable-physician" standard (also known as "community" or "professional" standard).[22] In the former standard, the physician must disclose the treatments and risks that a reasonable patient/person would want disclosed (at trial, typically decided by the jury but may require expert testimony). In the latter standard, the physician must disclose the treatments and risks that a reasonable physician would disclose to the patient (at trial, typically requires expert testimony). In some circumstances in some jurisdictions, failure to obtain informed consent can result in a claim of "battery" (intentional, unauthorized touching of a person).[22,23]

HOW ARE STANDARDS OF CARE DETERMINED?

In the law of negligence, the standard of care is generally thought of as "that degree of care which a reasonably prudent person should exercise in same or similar circumstances."[21] If the defendant's conduct falls outside the standards, then he or she may be found liable for any damages that resulted from this conduct. In medical negligence disputes, the defendant's medical decision-making and practice are compared with the applicable standard of care. Generally, this is understood to be "that reasonable and ordinary care, skill, and diligence as physicians and surgeons in good standing in the same general line of practice, ordinarily have and exercise in like cases."[21] Many courts have held that the increased specialization of medicine and establishment of national board certification is more significant than geographic differences in establishing the standard of care. These courts contend that board-certified medical or surgical specialists should adhere to standards of their respective specialty boards (ie, a national standard). However, this recognition of specialty-based standards has critics, because it does not account for rural and other underserved communities or access to specialized health care facilities.[24] Thus, some jurisdictions continue to use a "locality" standard in which the physician is held to the standards of like physicians in the community.[24] Some states require out-of-state experts to demonstrate that they have familiarity with the "local" standard of care.

WAS THE STANDARD OF CARE BREACHED?

In medical liability cases, the role of the expert witness is often to establish standards of care applicable to the case at issue. The expert may also be asked to opine about any deviation from acceptable standards. When care has been deemed "substandard," the expert witness may be asked to opine whether that deviation from the standard of care could have been the proximate (ie, legal) cause of the patient's alleged injury. Because courts and juries depend on medical experts to make medical standards understandable, the testimony should be clear,

coherent, and consistent with the standards applicable at the time of the incident. Although experts may testify as to what they think the most appropriate standard of care was at the time of occurrence, they should know and consider alternative acceptable standards. These alternatives may be raised during direct testimony or under cross-examination. Expert witnesses should not consider new evidence, guidelines, or studies that were not available to the treating physicians at the time of the occurrence. Expert witnesses should not define the standard so narrowly that it only encompasses their opinion on the standard of care to the exclusion of other acceptable treatment options available at the time of the incident.

MEDICAL ERRORS VERSUS NEGLIGENCE

The Institute of Medicine's sentinel report on medical errors, *To Err Is Human*: *Building a Safer Health System*,[25] provides a helpful framework for understanding the many factors involved in medical interventions and how their permutations can affect patient outcome. Whenever a medical intervention is undertaken, several outcomes can occur—the patient's condition can improve, stay the same, or deteriorate. These same outcomes are possible even when the medical treatment is performed properly. A negative outcome alone is not sufficient to indicate professional negligence. It is essential that the trier of the case (either jury or judge) understand that negligence cannot be inferred solely from an unexpected result, a bad result, failure to cure, failure to recover, or any other circumstance that shows merely a lack of success.

BURDEN OF PROOF

In a medical malpractice case, the plaintiff bears the burden of proof and must convince a jury by a "preponderance of the evidence" that its theory of the case is more probably true than alternative theories. A "preponderance of the evidence" means more than 50% likely. Thus, jurors in a medical malpractice case must be persuaded that the evidence presented by the plaintiff is more plausible than any counterargument offered by the defendant.[26] The plaintiff and defense attorneys will present their respective experts, each side hoping their witnesses will appear more knowledgeable, objective, and credible than their counterparts. In a criminal case, the prosecutor bears the burden of proof, and the guilt must be proven by the much higher standard of "beyond a reasonable doubt."

PRETRIAL ROLE OF EXPERT TESTIMONY

In medical malpractice, expert witness testimony may be used to evaluate the merits of a malpractice claim before filing legal action. Some states have enacted laws that require that a competent medical professional in the same area of expertise as the defendant review the claim and be willing to testify that the standard of care was breached.[27] This may require a filing of an affidavit or certificate of merit that malpractice has occurred. Some states have deemed this system unconstitutional, claiming that legitimate plaintiffs may be denied access to the legal system solely on procedural, rather than substantive, grounds.[28]

Some states use review panels to prescreen medical malpractice cases. These panels typically consist of a physician, attorney, and lay representative. However, state laws that govern the timing and process for review panels can vary. Depending on the state, the review can take place before or after the claim has been filed. Review-panel findings can be binding or nonbinding. The opinion of the review panel may or may not be admissible should the matter proceed to litigation. The continuing future role of these panels has been questioned.[29]

Those who are seeking regulation of expert witness testimony have noted that the expert opinions provided during this early stage of the legal process are subject to even less scrutiny and accountability than testimony provided later. Critics believe that the lack of oversight of experts during the pretrial reviews allows too many nonmeritorious cases to proceed, thereby defeating the purpose of having pretrial reviews.[30]

EXPERT REPORTS AND DEPOSITION

The purpose of "discovery" is to identify all the facts related to the case. Discovery is applicable to both fact witnesses and expert witnesses. The deposition of key fact witnesses is a very important facet of the discovery process in malpractice cases. A deposition is a witness's recorded testimony, given under oath, while being questioned by attorneys for the parties in the case. Throughout the deposition process, attorneys gather information on what fact witnesses will say and assess the relative effectiveness of their testimony as well as their demeanor (eg, clarity, believability, arrogance, sincerity). Crucial decisions in determining the next phase of the case (eg, seeking a settlement, going to trial, moving for dismissal/summary judgment) are often based on the strength of the testimony. Experts can also be deposed. Rather than through depositions, written reports of the experts are typically shared between the 2 parties before trial. However, some states may not require disclosure of the identity of the expert or even disclosure of the report. Most medical malpractice lawsuits that are re-

solved in favor of the plaintiff are typically settled during or at the conclusion of the discovery phase.[31]

UNIQUE FACTORS IN PEDIATRIC CASES

In theory, expert witness testimony from the plaintiff and the defense should give the jury enough of a technical understanding of the medical care provided and its appropriateness to determine if the preponderance of the evidence proves the defendant liable for the plaintiff's injury. In cases that reach trial, some authorities note that jurors can generally be effective in assessing expert testimony.[32] However, other aspects of the proceedings may unduly influence triers of the case. This is particularly true in cases that involve children. Because people tend to have a natural sympathy for children, the focus of the trial has the potential to become the plaintiff rather than the evidence. A jury might be influenced by the needs of, for example, a family with a neurologically impaired infant or a ventilator-dependent teenager.

Patients who experience long-term consequences of injuries attributable to medical negligence should be appropriately and promptly compensated. However, using malpractice awards to compensate patients for adverse outcomes not caused by medical negligence is not the intent of the system. Whether society at large should provide more assistance to families faced with such tragic circumstances is a policy decision. Wanting to assist the families of children with disabilities or injuries regardless of whether the physician committed any medical error may seem altruistic to the jury, but in fact, it is an inappropriate outcome. To prevent unjust results, objective expert witness testimony is needed.

CRIMINAL CASES

Pediatricians often serve as experts in civil child protection cases (in which custody of children may be at issue) and in criminal cases of alleged child abuse and neglect. The new subspecialty of "child abuse pediatrics" approved by the AAP and the American Board of Pediatrics sets high standards for professional competence and conduct in this area. Pediatricians who are not board certified in child abuse pediatrics may still be called to testify in cases of abuse and neglect if they have special knowledge and experience that qualifies them to explain medical issues to the court, both as experts and as fact witnesses. Pediatricians who are inexperienced in evaluating children suspected of abuse or neglect should be cautious of providing an expert opinion because of the devastating outcome of a wrongful conviction based on inaccurate testimony. This is a high-risk area for expert testimony, and even experienced professionals have been engaged in controversy.[33] If a general pediatrician feels uncomfortable in testifying in these cases, consultation with subspecialists in child abuse pediatrics should be strongly considered.

IMPROVING THE QUALITY OF EXPERT TESTIMONY

Various branches of organized medicine and some state medical licensure boards have implemented programs to help curb unscientific expert witness testimony. Strategies for regulating expert witness testimony generally fall under the principles of education, prevention, peer review, and sanctioning.

Education

Continuing medical education about the expert witness process is needed at all levels of pediatric experience.[34] The 2006 AAP graduating resident survey revealed that only 25% of residents reported that their training program provided adequate education on the expert witness process.[35] Educational programs at both the national and state levels are critical for this effort. One strategy for effective programs is to use false or unscientific testimony from closed cases for teaching purposes in continuing medical education venues. This strategy is particularly effective when biased or false testimony played an important role in the outcome of the case. It illustrates the power of expert witness testimony in malpractice litigation and can be an excellent teaching technique to present acceptable and optimal treatment modalities that should have been introduced by the experts.

Prevention

Despite the critical importance of the expert witness, no uniform standards on credentialing of experts currently exist. One specialty society has initiated a process to certify experts.[36] Imposing eligibility restrictions on those who provide expert witness testimony might be a way to prevent irresponsible testimony. By 2006, approximately 22 states had measures requiring minimum qualifying standards for physician experts.[37] Some states have proposed or enacted legislation or regulations that tighten the qualifications for medical experts to more closely match those of the defendant physician (eg, geographic factors, specialty training, certification, percentage of time spent on direct patient care, etc).[38,39]

Other preventive measures decrease financial incentives for serving as an expert witness, which is especially applicable to witnesses who travel extensively to provide expert ser-

vices ("itinerant" witnesses). Examples include recommending caps on the percentage of annual revenue that a medical expert can derive from testimony fees or establishing fee schedules for expert witness testimony that are based on a set hourly rate (determined to be reasonable or comparable to other medical consulting services). The medical profession has deemed it unethical for expert witnesses to base their fees for testifying contingent on the outcome of the case.[40–42] Other suggestions for preventing itinerant experts include the sponsoring by medical specialty societies of expert scientific panels and court-appointed medical experts (permitted under FRE 706). A few medical societies have proposed that, for physicians to serve as experts in malpractice cases, they are required to join their medical society (even those from out-of-state). Thus, all experts testifying in that state would be potentially subject to disciplinary action of the local medical organization. Some states require an expert to hold a medical license in that state. Some states consider expert testimony as part of the "practice of medicine," with possible sanctioning by the licensing board for improper testimony.[43] The American Medical Association House of Delegates has discussed a series of resolutions aimed at curtailing improper testimony by physicians and in 1998 adopted the position that the provision of expert witness testimony should be considered the practice of medicine and should be subject to peer review.[44] Adopting this approach not only makes medical licensure a requirement for providing expert witness testimony but also puts physicians on notice about potential actions against their medical license for giving false, biased, or unscientific testimony. Because licensing boards already function as disciplinary bodies, they may be an appropriate setting for judging the appropriateness of physician conduct, which can include expert testimony.[45] However, not all courts have agreed that medical expert witness testimony is engaging in the practice of medicine.[46]

Peer Review

Specialty medical organizations have established programs in which a panel of peers will review and critique the content of expert witness testimony.[47–50] Sometimes, the testimony and the peer analysis, along with commentary, are published in scientific journals. Some specialty societies, such as the American Association of Neurologic Surgeons (www.aans.org/about/membership/professional_conduct10_06.pdf), maintain libraries of expert witness testimony that are accessible by legal counsel of their members. There are obstacles to an effective peer-review process, including costs, time, and possibility of lawsuits against peer reviewers.[51–53] Any oversight process must be fair and objective and ensure due process. Peer review has lead to sanctioning of experts.

Sanctioning

The most aggressive method of curbing irresponsible testimony is to discipline physicians whose expert opinions are deemed to be biased, inaccurate, incomplete, or unscientific. Disciplinary actions can even result in the physician being expelled from membership in professional organizations. Such actions have been upheld by the appellate courts.[54]

There have been lawsuits against expert witnesses for alleged improper testimony. Historically, the principle of witness immunity has shielded experts from legal reprisal that is based on the nature of their testimony.[55,56] To bring greater accountability to expert witness testimony in malpractice cases, some legal authorities have sought to have a distinction drawn between expert witnesses and witnesses of fact relating to immunity.[55] These critics postulate that because experts testify voluntarily and receive significant compensation for their services, general witness immunity should not apply to them. Various courts have responded differently to this concept.

Additional proposals that may affect or improve the expert witness system include mediation and arbitration[57,58]; specialized health courts[59]; an internal dispute-resolution process within the hospital[60]; standardizing and regulating expert medical case review, analysis, and testimony[61]; adopting a "data-based standard of care in allegations of medical negligence"[62]; use of third-party experts[63]; and encouraging academic institutions to be accountable for the testimony of their faculty members.[64] At least 1 federal judge has suggested that judges may be more willing to use third-party experts if the experts were more easily accessible and their fairness and impartiality could be ensured by professional oversight and discipline.[65]

Because of the increasing complexity and uncertainty surrounding the issue of expert testimony by physicians, the medical community must proceed cautiously. Although courts have upheld the right of specialty organizations to discipline a member for improper testimony, any disciplinary process is fraught with risks and must be fair and objective and ensure due process. An expert witness disciplinary program that is too aggressive may be seen as organized medicine's discouragement of physicians from testifying. Some courts have been punitive about efforts to quash potential experts from testifying.[66] The physician community

will need to remain firmly committed to reviewing and sanctioning false statements by medical experts for both the defense and the plaintiff or prosecutor. It has been suggested that fear of sanctions could dissuade physicians from fulfilling their civic and professional duty to participate as experts in legal processes. One concern is that a decrease in the number of physicians willing to provide expert witness testimony may be associated with greater reliance on "professional" witnesses. Beyond the considerable legal risks, disciplinary programs are labor intensive and may be expensive to implement and maintain. Because disciplinary programs can be beyond what a state or local organization can shoulder, specialty societies are often urged to provide this service for their members on a nationwide basis.[47,67] Continual attempts to improve the expert witness process should affect the delivery of future medical care by reducing the number of lawsuits and litigation costs and ensuring adequate physician supply in those specialties with high exposure to malpractice lawsuits.[68]

RECOMMENDATIONS

The AAP recognizes that physicians have the professional, ethical, and legal duty to assist in the legal process when medical issues are involved. Physicians who serve as expert witnesses have an obligation to present complete, accurate, and unbiased information to assist the triers of facts to understand the scientific issues so that they can arrive at a fair and equitable result. At this time, the best strategies for improving the quality of medical expert witness testimony must include strengthening the qualifications for serving as a medical expert, educating pediatricians about standards for experts, and providing more specific guidelines for physician conduct throughout the legal process. To that end, the following recommendations are offered.

Advocacy and Education

The AAP believes that the establishment of certain minimal qualifications for physicians who serve as expert witnesses will improve the quality of testimony and promote just and equitable verdicts. Therefore, the AAP supports the following efforts.

1. Implement the recommendations of this statement through legislative or regulatory reform of expert witness testimony (eg, establish minimal qualifications for expert witnesses).
2. Educate pediatricians (during residency training and through continuing medical education) and provide them with the skills and knowledge base needed for them to provide objective, scientific, and ethical expert witness testimony in legal proceedings.
3. Implement additional specialized education as well as oversight safeguards for experts participating in the criminal law process because of heightened concerns for convictions based on inaccurate expert testimony in criminal cases.
4. Aid in the establishment of expert panels to study, standardize, and disseminate elements of expert testimony that have been inadequately addressed (eg, define "within a reasonable degree of medical certainty," establish the role of evidence-based medicine in expert opinions, opine whether expert testimony should be considered "the practice of medicine").

Relevant Qualifications

Physicians should limit their participation as medical experts to cases in which they have genuine expertise. The following qualifications must be met (and verified) to demonstrate relevant education, certification, and experience.

1. Physician expert witnesses must hold a current, valid, and unrestricted medical license in the state in which they practice medicine.
2. Physician expert witnesses should be certified by the relevant board recognized by the American Board of Medical Specialties or a board recognized by the American Osteopathic Association or by a board with equivalent standards. Alternatively, the expert should be capable of demonstrating sufficient training or clinical experience in the clinical area at issue to be qualified and accepted as an expert by the relevant specialty board(s).
3. Physician expert witnesses must have been actively engaged in clinical practice in the medical specialty or area of medicine about which they testify, including knowledge of or experience in performing the skills and practices at issue to the lawsuit. Alternatively, the expert should be able to demonstrate updated competence in the profession within a reasonable time period contiguous to the alleged act. Evidence of updated competence could include medical student or resident teaching, relevant publications, or research.
4. Unless retired from clinical practice, most of the expert's professional time should not be devoted to expert witness work. If retired, the physician should render expert opinions on cases that occurred at the time he or she was in active practice.
5. Physician expert witnesses should not give false, misleading, or misrepresentative details about their qualifications.

Standards of Testimony

Physician expert witnesses should take all necessary steps to provide thorough, fair, objective, and impartial review of the medical facts. To meet that obligation, physicians who agree to testify as experts in medical malpractice cases should conduct themselves as follows.

1. Regardless of the source of the request for testimony (plaintiff or defendant), physician expert witnesses should lend their knowledge, experience, and best judgment to all relevant facts of the case.
2. Physician expert witnesses should take necessary steps to ensure that they have access to all documents used to establish the facts of the case and the circumstances surrounding the occurrence. If all medical records are unavailable for review, experts should consider recusing themselves from serving in an expert capacity.
3. Physician expert witnesses should not exclude relevant information for any reason and certainly not to create a perspective that favors the plaintiff or the defendant.
4. The physician expert should be comfortable with his or her testimony regardless of whether it is to be used by the plaintiff or defendant.

Standards of Care

The physician expert witness should be familiar with the medical standards of care at the time of the incident at issue. A physician who is unfamiliar with the medical standards would not meet the recommended qualifications of an expert.

1. Before testifying, the physician expert witness should thoroughly review and understand the current concepts and practices related to that standard as well as the concepts and practices related to that standard at the time of the incident that led to the lawsuit.
2. The testimony presented should reflect generally accepted standards within the specialty or area of practice about which the physician expert witness is testifying, including those held by a significant minority.
3. When a variety of acceptable treatment modalities exist, this should be stated candidly and clearly.
4. In states where the standard of practice is based on the "locality rule," the physician expert witness must be knowledgeable about local practice and procedure at the time of the incident at issue.
5. Expert witness testimony should not condemn performance that clearly falls within generally accepted practice standards or condone performance that clearly falls outside accepted practice standards.
6. An expert should respect the privacy and confidentiality of the process as required by law.

Assessing Breach of Care and Proximal Cause

Physician expert witnesses must exercise care in assessing the relationship between the breach in the standard of care and the patient's condition, because deviation from a practice standard may not be the cause of the patient outcome at issue. Thus, physician expert witnesses should base distinctions between medical malpractice and medical maloccurrence on science, not on unique theories of causation that would not be deemed reliable according to the Daubert, Frye, or other applicable standards.

Ensuring That Testimony Is Proper

Physician expert witnesses:

1. Must take all necessary precautions to ensure that the expert work is relevant, reliable, honest, unbiased and based on sound scientific principles.
2. Know that transcripts of depositions and courtroom testimony are public records and may be reviewed by others outside the courtroom.

Ethical Business Practices

The business practices (eg, marketing, contractual agreements, and payment for services) associated with the provision of expert witness testimony must be conducive to remaining nonpartisan and objective throughout the legal proceedings.

1. Contractual agreements between physician expert witnesses and attorneys should be structured in a way that promotes fairness, accuracy, completeness, and objectivity.
2. Compensation for expert witness work should be reasonable and commensurate with the time and effort involved and prevailing market value.
3. Compensation for expert witness work must not be contingent on the outcome of the case.

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CLINICAL REPORT

Exposure to Nontraditional Pets at Home and to Animals in Public Settings: Risks to Children

Guidance for the Clinician in Rendering Pediatric Care

Larry K. Pickering, MD, Nina Marano, DVM, MPH, Joseph A. Bocchini, MD, Frederick J. Angulo, DVM, PhD, and the Committee on Infectious Diseases

ABSTRACT

Exposure to animals can provide many benefits during the growth and development of children. However, there are potential risks associated with animal exposures, including exposure to nontraditional pets in the home and animals in public settings. Educational materials, regulations, and guidelines have been developed to minimize these risks. Pediatricians, veterinarians, and other health care professionals can provide advice on selection of appropriate pets as well as prevention of disease transmission from nontraditional pets and when children contact animals in public settings. *Pediatrics* 2008;122:876–886

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
nontraditional pets, exotic animals, farm animals, pets, reptiles, rodents, indigenous wildlife

Abbreviations
FDA—Food and Drug Administration
AVMA—American Veterinary Medical Association
NASPHV—National Association of State and Public Health Veterinarians
CSTE—Council of State and Territorial Epidemiologists
CDC—Centers for Disease Control and Prevention

INTRODUCTION

The majority of households in the United States own 1 or more pets. In national surveys conducted by the American Pet Products Manufacturers Association, the percentage of US households that have 1 or more pets increased from 56% in 1998 to 63% (71.1 million homes) in 2007.[1] Dogs are owned by 44.8 million households, cats are owned by 38.4 million, freshwater fish are owned by 14.2 million, birds are owned by 6.4 million, small animals are owned by 6.0 million, horses are owned by 4.3 million, and saltwater fish are owned by 0.8 million. Total US pet industry expenditure in 2007 is estimated at $40.8 billion.[1] In recent years, the number of families that have chosen nontraditional pets has increased.[1]

Many pet owners and people in the process of choosing a pet often are unaware of the potential risks posed by certain animals, especially nontraditional pets. These risks are associated with changes in physical and behavioral characteristics as young animals reach maturity. Pediatricians, veterinarians, and other health care professionals are in a unique position to offer advice on proper pet selection, to provide information about safe pet ownership and responsibility, and to minimize risks to infants and children.

In addition to exposure to animals in their homes, children may come in contact with animals in a variety of public settings.[2] Although there are many benefits to experiences with animals outside the home, contact with animals in public settings also can be associated with significant risks to children, including infections and injuries. These potential risks are enhanced when there is an inadequate understanding of disease transmission, methods of preventing transmission, animal behavior, or appropriate facilities for animals.

This report deals with the potential exposure of infants, children, and adolescents to nontraditional pets in the home and to animals in public settings. The objectives of this report are to (1) summarize information regarding emerging and reemerging infectious diseases, injuries, and allergies associated with exposure to nontraditional pets in the home and to animals in a variety of public settings, (2) outline regulations and recommendations applicable to these exposures, and (3) define measures to minimize or prevent illness and injury in children from exposure to these animals and cite resources for additional information for health care professionals and families.

METHODS

To identify original research publications and review articles dealing with infections, injury, and allergies in children resulting from nontraditional pets, including exotic animals, in the home and from animals in public settings, a search of the National Library of Medicine's Medline database was performed by using PubMed, and the Cochrane Library was searched for articles published between 1975 and 2007. The terms "nontraditional pets," "exotic animals," "farm

TABLE 1 **Animals That Are Considered Nontraditional Pets and/or Animals That May Be Encountered in Public Settings**

Categories	Examples
Amphibians	Frogs, toads, newts, salamanders
Fish	Many types
Mammals: wildlife	Raccoons, skunks, foxes, coyotes, civet cats, tigers, lions, bears, nonhuman primates
Domesticated livestock	Cattle, pigs, goats, sheep
Equines	Horses, mules, donkeys, zebras
Weasels	Ferrets, minks, sables, skunks
Lagomorphs	Rabbits, hares, pikas
Rodents	Mice, rats, hamsters, gerbils, guinea pigs, chinchillas, gophers, lemmings, squirrels, chipmunks, prairie dogs, hedgehogs
Feral animals	Cats, dogs, horses, swine
Reptiles	Turtles, lizards, iguanas, snakes, alligators

animals," "pets," "wildlife hybrids," "indigenous wildlife," "reptiles," and "rodents" were selected as Medical Subject Headings (MeSH), and text words were combined in the search strategy. In addition, the "related links" option on PubMed was used. References in all relevant published articles, including reviews, letters, commentaries, and Web sites, also were reviewed to identify original research.

Studies were assessed as to whether they should be included in this review on the basis of their reporting or summarizing original data that examined infections or injuries in children resulting from nontraditional pets in the home or animals in public settings. Previously published recommendations to prevent infections and injuries were reviewed.

For the purpose of this report, nontraditional pets include exotic animals, defined either as imported, nonnative species or species that originally were nonnative but now are bred in the United States; indigenous wildlife; and wildlife hybrids (wildlife crossbred with domestic animals producing offspring known as hybrids). The definition of nontraditional pets includes reptiles and certain species of mammals.

NONTRADITIONAL PETS

Nontraditional pets are increasing in popularity among a pet-loving public as lifestyle choices of owners dictate the need for smaller or more unusual pets. Table 1 provides examples of animals that are considered nontraditional pets as well as animals to which children may be exposed in public settings.

Since 1992, the number of exotic animals available in the United States has increased 75%.[1] In 2005, 87 991 mammals (including 29 species of rodents), 1.3 million reptiles, and 203 million fish were imported legally into the United States. The US Fish and Wildlife Service estimates that in 2002, 365 000 birds were imported legally. Reptiles are now in 4.4 million homes.[1] In addition, there is a worldwide illegal trade of exotic animals, estimated at $6 to $10 billion dollars annually,[3–5] only exceeded by the trafficking of arms and drugs. This illegal trade subverts rules established by regulatory agencies to reduce introduction of disease and potentially dangerous animals through importation restriction, inspection, and/or quarantine.[5]

A number of public health concerns are related to human contact with nontraditional pets and, specifically, to exotic animals. Most imported nonnative species are caught in the wild rather than bred in captivity. Health screening often is not performed before shipment of these animals to the United States, and there is mixing of animal species in holding locations, including animals that might be ill or incubating illness or carriers of potential pathogens. In addition, the significant wildlife black market, through which a large number of exotic animals enter the United States, compounds the risks of introduction of zoonoses.[6]

Despite the popularity of nontraditional pets, after making the initial decision to acquire a nontraditional pet, owners may discover that they are unable to provide the animal with the environment or nutrition required for a healthy life and often subsequently abandon or release the animal into the wild, which poses risks for zoonotic disease and injury to people and other animals.

ZOONOSES ASSOCIATED WITH NONTRADITIONAL PETS

Zoonotic diseases or zoonoses are infections transmitted between other vertebrate animals and humans. Most emerging infectious diseases in humans are zoonotic in origin.[6–9] A list of 1415 human pathogens demonstrates that 61% are known to be zoonotic, and pathogens with multiple host species are twice as likely to be associated with an emerging infectious disease.[8] From 1980 to 2003, more than 35 new infectious diseases have emerged in humans, many of which are zoonoses.[9] The leading causes of their emergence are human behavior (travel and leisure activities, preferences for pet ownership) and modifications of natural habitats, including expansion of human populations and encroachment on wildlife habitats, changes in food-production processes, changes in agricultural practices, and global trade in wildlife.[5,6,9] Domestic animals and humans may acquire zoonotic pathogens from nontraditional pets. Wild animals also can serve as reservoirs for transmission of zoonotic agents to domesticated animals and to humans.[7] An outbreak of tularemia in US wild-caught prairie dogs held in a commercial facility in Texas led to human transmission.[10] Some of the infected animals were distributed to a pet shop in Texas and were exported as far away as the Czech Republic.

Exotic animals imported to the United States have been associated with introduction of infectious agents otherwise not present in the United States. Contact between animals from different areas of the world can lead to the appearance of disease in a new species and establishment of a pathogen in a new geographic area. An example occurred in 2003 when human monkeypox was introduced into the United States. Investigators determined that the source of monkeypox was importation of African Gambian rats, which, in turn, ultimately infected prairie dogs being sold as pets, which infected humans in close contact with the prairie dogs.[11] In this case, prompt recognition and public health efforts controlled this outbreak and may have been respon-

sible for preventing establishment of monkeypox in North America.

Zoonotic transmission of infections by household pets or animals with which children come in contact in their homes or public settings is a common event. Infections can be caused by bacteria, viruses, fungi, and parasites. Transmission may be direct or indirect through contact, aerosols, bites or scratches, contamination of the environment, food or water, or disease-carrying vectors. Animals may become ill or, more commonly, are asymptomatic carriers of specific organisms and may contaminate the environment to which children are exposed. Infants and children younger than 5 years are at the greatest risk, in part because they have less-than-optimal hygiene practices, attraction to or curiosity about animals, and developing immune systems[12] but also because these infections tend to be more severe in infants and young children. People of all ages with primary or secondary immunodeficiencies are at risk of more severe disease, as are pregnant women and elderly people.[13]

Reptiles

Among nontraditional pets, reptiles pose a particular risk because of high carriage rates of *Salmonella* species, the intermittent shedding of *Salmonella* organisms in their feces, and persistence of *Salmonella* organisms in the environment.[12,14–16] The US Food and Drug Administration (FDA) ban on commercial distribution of turtles with shells less than 4 inches long in 1975 resulted in an important and sustained reduction of human *Salmonella* infections as a result of prevention of transmission of *Salmonella* from these reptiles, although illegal distribution of small turtles with subsequent disease in humans continues to occur.[17,18] Amphibians also can serve as a source of salmonellosis in households.[12] Six percent of all sporadic *Salmonella* infections in the United States (11% among people younger than 21 years)—approximately 74 000 cases annually—are the result of direct or indirect contact with reptiles or amphibians.[12]

Rodents

Multistate outbreaks of salmonellosis attributable to contact with hamsters[19] and other rodents[20] purchased from retail pet stores have been described. Hamsters also have been associated with outbreaks of disease attributable to lymphocytic choriomeningitis virus.[21] Hedgehogs, originally from Europe, Asia, and Africa and now estimated to be in approximately 40 000 US households, have proven to be an important source of *Salmonella* serotype Tilene in the United States.[22] Other *Salmonella* serotypes as well as *Yersinia pseudotuberculosis*, *Mycobacterium marinum,* and rabies also have been shown to be zoonotic diseases carried by hedgehogs.

The natural reservoir of plague is wild rodents, with humans becoming infected through bites of infected rodent fleas and through handling infected animals, especially rodents, lagomorphs, and domestic cats.[23,24] In parts of the United States where plague is endemic, people with rodent-seeking animals can be exposed to *Yersinia pestis* through direct contact with plague-infected pets or their fleas.[24] People who live in areas where plague is endemic should follow a flea-control program designed by their veterinarians to keep their cats and dogs free from fleas.

Skin infections also can be acquired from nontraditional pets and include ringworm, monkeypox, orf, cutaneous anthrax, tularemia, erysipeloid, ectoparasites, and endoparasites.[25–30] Hedgehogs pose a significant risk, because their spines readily penetrate skin and can be the source of *M marinum* and *Y pseudotuberculosis* infections.[22]

Nonhuman Primates

Herpes B virus (cercopithecine herpesvirus 1) is a zoonotic agent that can be found in macaque monkeys that are kept as pets or displayed in public exhibits. The virus is endemic in macaque monkeys, which may remain asymptomatic or may develop mild oral lesions. Herpes B virus infections in humans have been reported after animal bites, scratches, or percutaneous inoculation with infected material or splashes to mucous membranes. Human infections most often result in fatal meningoencephalitis.[31]

Fish

Mycobacterial infections are among the major zoonoses that can be transmitted by aquarium fish,[32] but other organisms have been reported after exposure to aquarium water, usually sporadically or in immunocompromised people. These organisms include *Aeromonas* species, *Vibrio* species, *Edwardsiella* species, *Salmonella* species, *Streptococcus iniae,* and *Erysipelothrix rhusiopathiae*.[33]

Other Sources of Infection

Infection attributable to *Salmonella* species can be acquired from other sources. Outbreaks of *Salmonella* species infections in people who have been in contact with chicks and other baby poultry purchased at agricultural feed stores have been reported.[34] Parents who purchase these birds for their children generally are not aware that *Salmonella* infections can be transmitted from poultry to humans. In addition to direct exposure to animals, exposure to animal-derived pet food treats and pet food has resulted in human infections attributable to *Salmonella*.[35,36] Animals may become colonized with *Salmonella* after ingesting contaminated pet food treats or raw meats. These animals may remain asymptomatic and become unrecognized sources of contamination in the household. Handling of pet food treats by humans may result in infection.[36] In the United States, pet treats are regulated by the FDA. *Salmonella*-contaminated pet treats are considered adulterated under the Federal Food, Drug, and Cosmetic Act (21 USC §301–399). The American Pet Products Manufacturers Association published guidelines to educate its members about risks of contamination of pet treats.[37] In 2004, the FDA initiated annual nationwide testing of pet treats for *Salmonella* species.

TABLE 2 **Potential Exposures of Children to Animals in Public Settings**

Area	Animal Involved	Organism
Metropolitan zoo	Elephants, giraffes, rhinoceroses, buffaloes	*M tuberculosis*[56,57]
	Komodo dragons	*Salmonella* serotype *enteritidis*[15]
County or state agricultural fairs	Cattle, calves	*E coli* O157:H7[38,45,51,64]
	Cattle	*Campylobacter* species[50]
	Reptiles	*Salmonella* species[14]
	Goats	Rabies[62,64]
Farm tours or visits	Cattle, calves	*E coli* O157[38–40,43,44,46,47,52,62]
	Raw milk	*Campylobacter* species, *Salmonella* species[64]
	Calves	*Cryptosporidium* species, *E coli* O157:H7, *Salmonella* species, *Campylobacter* species[48]
	Sheep, goats, calves	*Cryptosporidium* species[38,53–55,64]
	Sheep	Orf[25]
Livestock exhibits	Cattle	*E coli* O157[45]
Pet stores	Hamsters, mice, rats	*Salmonella* species[20]
	Kittens	Rabies[61]
	Hamsters	Tularemia,[10] lymphocytic choriomeningitis[21]
	Prairie dogs	Monkeypox[11]
Petting zoos	Cattle, sheep, goats	*E coli* O157[38,42,49,64]
	Rabbits	*Giardia* species[64]
	Bear cubs	Rabies[63]
Rodeo events	Ponies	Rabies[60]
Fish tanks	Fish	*Mycobacterium* species,[32] *Salmonella* species[33]
Agricultural feed store	Baby poultry (chicks, ducklings, goslings, turkeys)	*Salmonella* species[34]

DISEASES ASSOCIATED WITH ANIMALS IN PUBLIC SETTINGS

Infants and children can come in contact with numerous different animal species (Table 1) in a number of public settings (Table 2), potentially resulting in millions of human-animal interactions annually. Public animal exhibits can be permanent, such as zoos and science museums; temporary, such as in shopping malls, schools, or community events; or recurring, such as agricultural fairs and petting zoos.[38] Petting zoos are common at agricultural fairs, animal parks, and other public events. Although numerous positive benefits of human-animal contacts exist, including opportunities for education and entertainment, infectious diseases, injuries, and other health problems associated with these venues are well documented. Infections with enteric bacteria and parasites pose the highest risk of human disease from animals in public settings. Although ruminant livestock (cattle, sheep, and goats) are the major source of infection, poultry, rodents, and other domestic and wild animals are also potential sources.[2]

From 1991 to 2005, more than 55 outbreaks of human disease, the most common of which were enteric, involved animals in public settings.[3] Serious infections with *Escherichia coli* O157:H7 have been associated with multiple animals in public settings.[39–52] The primary reservoir of *E coli* O157:H7 is ruminant livestock, which are colonized asymptomatically. In many studies, the primary route of transmission has been foodborne,[46] but person-to-person spread, direct animal contact, and contact with environmental items contaminated by animals are common.[41] In 2004 and 2005, there were 3 *E coli* O157:H7 outbreaks, accounting for 173 cases from 3 states associated with direct and indirect animal contact at petting zoos.[42] Outbreaks[14] and sporadic cases of salmonellosis and outbreaks of cryptosporidiosis[53–55] have been described after visits to farms at which visitors had either direct or indirect contact with animals. Additional illnesses include salmonellosis, campylobacteriosis, tuberculosis, rabies, orf virus infection, giardiasis, tularemia, ringworm, and infected bites or wounds.[10,15,25,48,50,56,57] Direct contact with animals (especially young animals), contamination of the environment or food or water sources, inadequate hand-washing facilities or lack of education about hand hygiene, and inappropriate layout and maintenance of facilities at animal exhibits have been implicated as sources of or reasons for infection in these public settings.[2] As an example, in a study of observations of practices at petting zoos in Canada, hand-hygiene facilities were provided but often not used, items that would come into contact with mouths of infants and children (pacifiers, infant bottles, sippy cups) were carried into the petting zoos, and education about hygiene was lacking.[58] The recommendation to wash hands immediately after leaving an animal exhibit is the single most important prevention step to reduce the risk of disease transmission, even if an animal is not touched.

RABIES

Rabies is a fatal viral zoonosis and a serious public health problem.[59,60] Although human rabies deaths caused by animal contact in public exhibits have not been reported, exposure to rabid mammals at pet stores,[61] county fairs,[62] petting zoos,[63,64] and rodeo events[64] have required extensive public health investigations and med-

ical follow-up. For example, raccoon-variant rabies in pet rabbits and a guinea pig have led to postexposure prophylaxis of adults and children.[65] Prevention of rabies in domestic cats, dogs, and ferrets can be achieved by regular rabies immunization and reimmunization.[59,60] Control of rabies among wildlife reservoirs is difficult, and use of licensed oral vaccines for mass immunization of free-ranging wildlife depends on the circumstances surrounding each animal rabies outbreak and is restricted to use in state and federal rabies-control programs.[59] No parenteral rabies vaccine is licensed for use in wild animals or hybrids. Because of the risk of rabies in wild animals (especially raccoons, skunks, coyotes, foxes, and bats), the American Veterinary Medical Association (AVMA), National Association of State and Public Health Veterinarians (NASPHV), and Council of State and Territorial Epidemiologists (CSTE) recommend enactment and enforcement of state laws that prohibit importation, distribution, and/or relocation of these animals. The AVMA has recommended that wild animals or hybrids not be kept as pets (www.avma.org/careforanimals/animatedjourneys/petselection/consider.asp).

INJURIES AND ALLERGIES

Infants and children younger than 5 years are at increased risk of injuries associated with animal interactions because of their size and behavior. Bites, scratches, kicks, falls, and crush injuries of hands or feet or from being pinned between an animal and a fixed object can occur at home or during exposure to animals in a public setting. Serious and fatal injuries can be caused by a large animal or an animal with aggressive behavior. Some nontraditional pets are chosen when they are young and small without consideration that they may grow into dangerous, aggressive adults. For example, iguanas sold shortly after birth measure less than 8 inches but grow to several feet in 2 to 3 years, and baby chicks become full-grown chickens and have a life span of up to 20 years.

An estimated 4 to 5 million animal bites occur in the United States annually. Although approximately 90% of bites are from dogs or cats, severe and fatal bites can occur from large or aggressive nontraditional pets. Animal bites or scratches often become infected. Infectious organisms, depending on the biting animal, include *Pasteurella multocida*, *Francisella tularensis*, *Capnocytophaga canimorsus*, *Streptobacillus moniliformis*, *Spirillum minor*, *Bartonella henselae*, leptospira, and herpes B virus. Tularemia occurred in a 3-year-old child who was bitten by an infected hamster that was purchased at a pet store.[30] Reptiles can produce injuries by bites, with claws, or with tails. Severe hand injury[29] and cellulitis[26] have been reported after green iguana bites. Unprovoked attacks by ferrets on children, particularly infants sleeping or lying down, can be severe, with mutilation of the ears or nose.[66,67] Attacks on sleeping infants are similar to those inflicted by rats.[68]

Although the frequency is not known, the potential for having an allergy to nontraditional pets is likely to be significant. The American Academy of Allergy Asthma & Immunology estimates that approximately 15% of the population experiences allergies to dogs and cats.[69] Allergy to animals usually is attributable to sensitization to their dander, scales, fur, feathers, body waste, or saliva. Flea bites also can lead to allergic manifestations. Hives have been described in people who have contact with hedgehogs.[70] Although scaly animals are not as likely to be as allergenic as furry animals, there are case reports of allergic rhinitis, asthma, and contact hypersensitivity reactions to iguanas. In 1 case, a person with respiratory allergic symptoms was found to be allergic to iguana scales.[28] In addition, an iguana bite–induced hypersensitivity reaction has been reported.[29]

REPORTABLE DISEASES ACQUIRED FROM NONTRADITIONAL PETS AND ANIMALS IN PUBLIC SETTINGS

Many national and state-notifiable diseases can be transmitted from animals. Public health officials at state health departments and personnel from the Centers for Disease Control and Prevention (CDC) collaborate in determining which infectious diseases should be notifiable nationally; states determine which diseases are reportable within their borders. A disease may be added to the national or state list as a new pathogen emerges, or a disease may be removed from the list as disease incidence decreases. Because disease reporting varies according to state, specific requirements should be obtained from the appropriate state health department. Provisional data are published weekly in the *Morbidity and Mortality Weekly Report*, and final data are published each year by the CDC in the annual "Summary of Notifiable Diseases," which can be found online (www.cdc.gov/ncphi/disss/nndss/phs/infdis.htm). These data are necessary for the study of epidemiologic trends and development of disease-prevention policies. Physicians and other health care professionals should report suspected cases of human illness to local and state health departments as soon as possible, especially when the patient has a history of visiting an animal exhibit during the incubation period.

IMPORTATION LAWS AND REGULATIONS REGARDING EXOTIC ANIMALS

Addressing importation and regulation of animals in the United States is complex. No single federal agency has the authority to limit importation, interstate distribution, movement, sale, or ownership of exotic animals in the United States. Federal agencies that do have regulatory authority over some aspects of the exotic-animal trade as it relates to their individual mission include the CDC, the Animal and Plant Health Inspection Service of the US Department of Agriculture, the FDA, and the US Fish and Wildlife Service. There also is a patchwork of state bans, permits, and tracking systems for exotic animals. Agencies responsible for enforcing regulations vary among states.

Among the federal agencies, the CDC is responsible for regulations regarding importation of dogs and cats; nonhuman primates, small turtles, terrapins, and tortoises; African rodents; civets; and birds from countries with H5NI influenza. In addition, CDC regulations in-

clude etiologic agents, hosts, and vectors, under which importation of bats is regulated. The US Fish and Wildlife Service requires permits to import fish, reptiles, spiders, wild birds, rabbits, bears, wild members of the cat family, and other wild or endangered animals. The FDA regulates interstate transactions involving turtles, molluscan shellfish, psittacine birds, prairie dogs, and African rodents. Many states also have laws that make it illegal to own or keep certain wild animals or a variety of exotic pets, including nonhuman primates.

The Animal Welfare Act (7 USC §2131-216) covers the sale and exhibition of wild/exotic animals and the wholesale distribution of pet animals. Wholesale breeders, dealers, exhibitors, and research laboratories are covered by this act. Birds, rats, and mice are exempted; dogs, cats, and other animals have limited coverage; and cold-blooded species such as reptiles are not regulated under this act. Small retail breeders and pet shops that sell only domestic pet animals are not regulated under this act; these animals usually are covered by local (state, county) anticruelty laws and, in some instances, by local animal regulations or public health laws. The US Department of Agriculture has issued a position statement on risks of ownership of large, wild, and exotic cats (www.aphis.usda.gov/animal_welfare/downloads/big_cat/position.pdf).

CDC efforts are underway to galvanize partner agencies into further actions to enhance protection of humans from zoonotic diseases. A meeting of stakeholder organizations was held at the CDC in 2006, a summary of which was published in the *Federal Register*.[71] The AVMA, CSTE, and NASPHV have each issued position statements calling for a coordinated federal approach to better control of infectious disease risks associated with the exotic-animal trade (these publications are available through the Web sites of the respective organizations). Uniform importation laws, better quarantine and surveillance methods for animals coming into the country, and prevention of illegal wildlife trade are necessary components of an overall plan to protect the public.

PREVENTION MEASURES AND THE ROLE OF PEDIATRICIANS AND VETERINARIANS

Pediatricians and veterinarians play an important role in guiding parents and their children about mitigation of risks associated with ownership of nontraditional pets or contact with animals in public settings. Parents and pet owners typically lack knowledge about the multiple modes of transmission of zoonotic infectious diseases from pets. Although pediatricians recognize the importance of anticipatory guidance about pet-related hazards, only 5% reported that they regularly educated patients or families about pet-associated salmonellosis or toxoplasmosis.[72]

Pediatricians and veterinarians together can remind parents, children, and pet owners about the importance of measures to avoid illness. Simple and effective advice includes frequent hand-washing and avoiding direct contact with animals and their environments. This is particularly important with animals from which transmission of enteric pathogens is a risk, including young ruminants, young poultry, reptiles, rodents, amphibians, and animals that are ill. Young children always should be supervised closely when in contact with animals in public settings. The NASPHV has developed an excellent compendium with standardized recommendations for use by public health officials, veterinarians, animal venue operators, animal exhibitors, and others who are concerned with disease control and minimizing risks associated with animals in public settings.[2]

To reduce the possibility of injury, health care professionals should remind pet owners about matching the size and temperament of a pet to the age and behavior of their infant or child, providing close supervision of younger children, and educating all children about appropriate human-animal interactions.

The decision to obtain a nontraditional pet by parents with children in the household is often not discussed with a physician or veterinarian. However, as trusted sources of health care information, pediatricians and veterinarians are in a unique position to offer information and advice to families considering the purchase of a nontraditional pet or to families who already have a nontraditional pet in the household. Informational brochures and posters available for display in physician and veterinarian offices could allow for parent education without significantly increasing time of a visit. Parents can be made aware of Web sites that provide guidelines for safe pet selection and appropriate handling of pets. Proper pet health maintenance, immunization, flea and tick control, deworming, and diet and activity can minimize the risk of infection or injury and ensure the health of the pet. Referral to a veterinarian also can be helpful when parents are contemplating purchase of a nontraditional animal. Veterinarians can provide information about appropriate pet selection, the size of an animal when it attains adulthood, the temperament and husbandry needs of an animal, and suitability as a pet.

A history of contact with pets in the home or animals in public settings should be part of every well-child evaluation and especially should be part of an evaluation of a suspected infectious disease. A history of nontraditional pets in the home or contact with animals in public settings can lead to specific testing and additional management recommendations and occasionally will result in early identification of an unusual infection from another part of the world.

AVAILABLE RECOMMENDATIONS AND GUIDELINES

Recommendations from several organizations dealing with nontraditional pets and animals in public settings have been developed and are summarized in Table 3. In addition, Table 4 provides Web-site addresses for health care professionals and parents at which information for prevention of human disease from nontraditional pets and animals in public settings can be found. Recommendations for prevention of enteric disease transmission from animal contact in public settings resulted from outbreaks of *E coli* O157:H7 at farms open to the public at which animal contact and inadequate hand hygiene occurred.[40] The NASPHV and CDC have established recommendations to prevent disease outbreaks associated with animals in public settings.[2] The CDC has issued

TABLE 3 Guidelines for Prevention of Human Diseases From Nontraditional Pets at Home and Exposure to Animals in Public Settings

- General
  - Wash hands immediately after contact with animals, animal products, or their environment
  - Supervise hand-washing for children younger than 5 y
  - Wash hands after handling animal-derived pet treats
  - Never bring wild animals home, and never adopt wild animals as pets
  - Teach children never to handle unfamiliar, wild, or domestic animals even if the animals appear friendly
  - Avoid rough play with animals to prevent scratches or bites
  - Children should not be allowed to kiss pets or put their hands or other objects into their mouths after handling animals
  - Do not permit nontraditional pets to roam or fly freely in the house or allow nontraditional or domestic pets to have contact with wild animals
  - Do not permit animals in areas where food or drink are prepared or consumed
  - Administer rabies vaccine to mammals as appropriate
  - Keep animals clean and free of intestinal parasites, fleas, ticks, mites, and lice
  - People at increased risk of infection or serious complications of salmonellosis (eg, children younger than 5 y, older adults, and immunocompromised hosts) should avoid contact with animal-derived pet treats
- Animals visiting schools and child-care facilities
  - Designate specific areas for animal contact
  - Display animals in enclosed cages or under appropriate restraint
  - Do not allow food in animal-contact areas
  - Always supervise children, especially those younger than 5 y, during interaction with animals
  - Obtain a certificate of veterinary inspection for visiting animals and/or proof of rabies immunization according to local or state requirements
  - Properly clean and disinfect all areas where animals have been present
  - Consult with parents or guardians to determine special considerations needed for children who are immunocompromised or who have allergies or asthma
  - Animals not recommended in schools, child-care settings, and hospitals include nonhuman primates, inherently dangerous animals (lions, tigers, cougars, bears, wolf-dog hybrids), mammals at high risk of transmitting rabies (bats, raccoons, skunks, foxes, and coyotes), aggressive animals or animals with unpredictable behavior, stray animals with unknown health history, reptiles, and amphibians
  - Ensure that people who provide animals for educational purposes are knowledgeable regarding animal handling and zoonotic disease issues
- Public settings
  - Venue operators must know about risks of disease and injury
    - Venue operators and staff must maintain a safe environment
  - Venue operators and staff must educate visitors about the risk of disease and injury and provide appropriate preventive measures
- Animal specific
  - Children younger than 5 y and immunocompromised people should avoid contact in public settings with reptiles, amphibians, rodents, ferrets, baby poultry (chicks, ducklings), and any items that have been in contact with these animals or their environments
  - Reptiles, amphibians, rodents, ferrets, and baby poultry (chicks, ducklings) should be kept out of households that contain children younger than 5 y, immunocompromised people, or people with sickle cell disease and should not be allowed in child-care centers
  - Reptiles, amphibians, rodents, and baby poultry should not be permitted to roam freely throughout a home or living area and should not be permitted in kitchens or other food-preparation areas
  - Disposable gloves should be used when cleaning fish aquariums, and aquarium water should not be disposed in sinks used for food preparation or for obtaining drinking water
  - Mammals at high risk of transmitting rabies (bats, raccoons, skunks, foxes, and coyotes) should not be touched by children

recommendations for preventing transmission of *Salmonella* organisms from reptiles to humans[18] and information regarding health risks from *Salmonella* species posed by contact with baby poultry.[34] Guidelines for prevention of zoonoses in immunosuppressed people also are available.[13,73]

The AVMA supports the view that exotic animals, wildlife, and wildlife–domestic animal hybrids do not make good pets. These animals are dangerous and are a hazard to human health, other animals, and the environment. The AVMA also recommends that ferret owners have knowledge about the species and stress that no one who is incapable of removing himself or herself from the bite of a ferret should be left unattended with a ferret. Measures to control and prevent psittacosis in humans and birds were published by a committee formed by the NASPHV and were endorsed by the AVMA,[74] the CSTE, and the Association of Avian Veterinarians.

Guidelines for animals that might have contact with children in a child-care setting have been published by the National Resource Center for Health and Safety in Child Care and Early Education.[75] These guidelines state that any pet or animal present at the facility, indoors or outdoors, should be in good health; show no evidence of carrying any disease; be fully immunized; and be maintained on a flea-, tick-, and worm-control program. A current (time-specified) certificate from a veterinarian should be on file in the facility and state that the specific pet meets these conditions. All contact between animals and children should be supervised by a caregiver who is close enough to remove the child immediately if the animal shows signs of distress or the child shows signs of treating the animal inappropriately. The caregiver should instruct children on safe procedures to follow when in close proximity to these animals (eg, not to provoke or startle animals or touch them when they are near their food). Potentially aggressive animals should not be in the same physical space with children. The facility should not keep or bring in turtles, iguanas, lizards, or other reptiles; ferrets; psittacine birds; or any wild or dangerous animals. Recommendations for hand-

TABLE 4 **Web Sites With Information on Prevention of Human Diseases Transmitted From Nontraditional Pets and Wild Animals**

Health care professionals	
CDC Health Pets Healthy People site for resources and recommendations related to animal contact	www.cdc.gov/healthypets/health_prof.htm
FDA tips on keeping pets and people healthy	www.fda.gov/fdac/features/2004/104_pets.html
CDC and Healthcare Infection Control Practices Advisory Committee guidelines for infection control in health care facilities	www.cdc.gov/ncidod/dhqp/pdf/guidelines/Enviro_guide_03.pdf
Guidelines for veterinarians for prevention of zoonotic transmission of ascarids and hookworms of dogs and cats	www.cdc.gov/ncidod/dpd/parasites/ascaris/prevention.htm
Educational materials for physician offices/parents	
CDC search engine for diseases associated with specific animals	www.cdc.gov/healthypets/browse_by_animal.htm
Department of Public Health, Commonwealth of Massachusetts recommendations for petting zoos, petting farms, animal farms, and other events and exhibits where contact between animals and people is permitted	www.mass.gov/dph/cdc/epii/rabies/petzoo.htm
NASPHV report of standardized recommendations for public health officials, veterinarians, animal venue operators, animal exhibitors, visitors to animal venues and exhibits, and others concerned with disease control and with minimizing risks associated with animals in public settings	www.nasphv.org/documentsCompendia.html and www.cdc.gov/mmwr/preview/mmwrhtml/rr5605a1.htm
NASPHV safety at animal exhibits and hand-washing posters	www.nasphv.org/documentscompendiaAnimals.html
CDC information on health risks posed by contact with baby poultry	www.cdc.gov/healthypets/easter_chicks.htm
Guidance for pet selection	
CDC information about health-related risks of owning and caring for animals	www.cdc.gov/healthypets
Guidance for minimizing risk of disease transmission	
CDC Pet-Scription: guidelines for staying healthy while enjoying your pet and for animal-specific diseases	www.cdc.gov/healthypets/petscription_gen.htm
CDC regulations for importation of pets, other animals, and animal products into the United States	www.cdc.gov/ncidod/dq/animal/index.htm
NASPHV recommendations on hand-washing, venue design, animal care and management, and risk communications regarding disease and injury prevention associated with animals in public settings	www.nasphv.org/documentsCompendia.html and www.nasphv.org/Documents/AnimalsInPublicSettings.pdf
Association of Zoos & Aquariums guide to accreditation of zoological parks and aquariums	www.aza.org/Accreditation/Documents/AccredGuide.pdf and www.aza.org/Accreditation/Documents/AccredStandPol.pdf

washing by staff, volunteers, and children as well as maintenance of animals housed on the premises are provided in the guidelines.[75] In addition to exposures to animals within a center, child-care and school field trips can result in disease. A field trip to a petting zoo at which hand-hygiene facilities were not adequate resulted in 44 cases of *E coli* O157:H7 infection in British Columbia.[76] Guidelines for infection control in health care facilities are not part of this document but are available (www.cdc.gov/ncidod/dhqp/pdf/guidelines/Enviro_guide_03.pdf).

FUTURE

In 2006, the CDC hosted a meeting dealing with infectious disease risks associated with exotic-animal importation and trade. The CSTE, NASPHV, and AVMA—3 organizations involved in the issue of infectious disease risks associated with the exotic-animal trade—presented policy statements of their organizations or calls to action. There was a consensus that rules and regulations need to be strengthened and standardized to reduce risks associated with exotic pets and that federal and state efforts are needed to eliminate illegal wildlife trade. In addition, the Zoonoses Education Coalition organized by the CDC aims to increase partnerships between government and industry. An effort is underway by a number of regulatory and public health agencies and veterinary organizations to address issues raised by legal and illegal importation of exotic animals and to develop a comprehensive set of regulations to protect the public (J. McQuiston, DVM [veterinary epidemiologist, Viral and Rickettisial Zoonoses Branch, National Center for Zoonotic, Vector-Borne, and Enteric Diseases, CDC], verbal personal communication, August 2007).

SUMMARY

Most nontraditional pets pose a risk to the health of young children, and their acquisition and ownership should be discouraged in households with young children. Exposures to animals in public settings also pose specific risks. Parents need to be educated about the increased risks of exposure to nontraditional pets and animals in public settings for infants and for children younger than 5 years and for immunosuppressed people of all ages and should be made aware of the general recommendations for reduction of risks of infection, injury, and allergy. Resources are available for physicians, veterinarians, and parents, and recommendations, including specific guidelines for reducing the risk of *Salmonella* infection from reptiles, are offered by a number of organizations. In addition, physicians and veterinarians are encouraged to work together to educate one another and to communicate a common message to pet owners regarding the benefits and risks of pet ownership and of contact with animals outside the home. Joint training seminars and joint sponsorship of health-communication campaigns in pediatrician and veterinarian offices would greatly increase awareness in pet owners. The "One Medicine" initiative supported by the AVMA

to increase veterinary collaboration with counterparts in human medicine is an excellent step forward to benefit clinical medicine and public health and will build and reinforce partnerships between the 2 professions to reduce human illness and injury related to contact with animals.[77]

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—The Eye Examination in the Evaluation of Child Abuse

abstract

FREE

Retinal hemorrhage is an important indicator of possible abusive head trauma, but it is also found in a number of other conditions. Distinguishing the type, number, and pattern of retinal hemorrhages may be helpful in establishing a differential diagnosis. Identification of ocular abnormalities requires a full retinal examination by an ophthalmologist using indirect ophthalmoscopy through a pupil that has been pharmacologically dilated. At autopsy, removal of the eyes and orbital tissues may also reveal abnormalities not discovered before death. In previously well young children who experience unexpected apparent life-threatening events with no obvious cause, children with head trauma that results in significant intracranial hemorrhage and brain injury, victims of abusive head trauma, and children with unexplained death, premortem clinical eye examination and postmortem examination of the eyes and orbits may be helpful in detecting abnormalities that can help establish the underlying etiology. *Pediatrics* 2010;126:376–380

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KEY WORDS

eye examination, child abuse, abusive head trauma, retinal hemorrhage

ABBREVIATIONS

ALTE—apparent life-threatening event
AHT—abusive head trauma

BACKGROUND

When a previously well child experiences an apparent life-threatening event (ALTE) or unexpected death without obvious cause, pediatricians and other physicians must attempt to identify the etiology. In the case of an ALTE, one should consider diagnoses such as gastroesophageal reflux, seizures, other central nervous system disease, metabolic disease, breath-holding, and abusive head trauma (AHT). Retinal examinations have been used with limited success for screening ALTE victims for possible AHT.[1,2] Victims of AHT present to medical care with a wide range of symptoms, from mild irritability and vomiting to unexplained coma or seizures.[3] It has been estimated that approximately 4% to 6% of abused children present first to an ophthalmologist,[4] and the most common ocular manifestation of abuse is retinal hemorrhage. Some children present with a false history of trauma, and others present with only the symptoms that resulted from their abuse. Unsuspecting physicians misdiagnose the condition of up to one-third of symptomatic victims, depending on their age, severity of symptoms, and family composition.[5] When a child dies unexpectedly, considerations include previously undiagnosed or new systemic disease, sudden infant death syndrome, and covert abusive injury.

Retinal hemorrhages have been recognized as a key indicator of abusive head injury for more than 30 years, particularly in association with severe repetitive acceleration-deceleration forces with or without blunt head impact, in children younger than 5 years.[6,7] Because retinal

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hemorrhage rarely results in visual compromise, there may be no external indicators of eye injury unless the vision is significantly impaired by damage to the optic nerve or occipital cortex or there is retinal detachment, significant vitreous hemorrhage, or other severe disruption of the intraocular contents. Both eyes need to have significant visual compromise for a child to become visually symptomatic. Therefore, one cannot rely on ocular signs or symptoms to determine which children might benefit from ophthalmologic consultation and postmortem eye removal. Likewise, retinal examinations should not be limited to patients who are victims of suspected AHT. Searching for retinal hemorrhages as diagnostic criteria for AHT only in infants with suspected abuse creates a selection bias.

Although health care professionals other than ophthalmologists may be skilled at detecting the absence or presence of retinal hemorrhage,[8] a full view of the retina and characterization of the number, types, and patterns of the hemorrhages requires consultation by an opthalmologist using indirect ophthalmoscopy, preferably with a dilated pupil. Even when there may be a concern about transiently obliterating pupillary reactivity in the face of a need to monitor neurologic status acutely, techniques such as dilation of 1 eye at a time, use of short-acting mydriatics, and use of a lens that affords some view through an undilated pupil can be employed to allow indirect ophthalmoscopy, preferably within the first 24 hours and ideally within 72 hours after the child's acute presentation. Even if the need for eye examination is realized after 72 hours, ophthalmologic consultation may still be useful to identify persistent abnormalities such as hemorrhages, retinoschisis, and papilledema.

The range of retinal hemorrhage findings in AHT and accidental trauma is broad, and the severity of the findings can be informative of etiology. For example, retinal hemorrhage—predominantly intraretinal, in small numbers, and confined to the posterior pole of the retina—can be seen after significant accidental head injury or in AHT.[6,9] More dramatic retinal hemorrhages—multilayered, too numerous to count, and extending to the edge of the retina (ora serrata)—can be seen after AHT, normal birth, fatal extreme accidental injury (such as motor vehicle accidents), and perhaps after fatal head crush injury.[6,10–13] Ocular fundus examination can also reveal findings of systemic illness that may shed light on the etiology of a child's symptoms, such as a cherry-red spot in metabolic disease, retinal vascular abnormalities in Menkes disease, papilledema, and retinal manifestations of leukemia or bacterial endocarditis. There are no known retinal ocular findings in sudden infant death syndrome, although routine ocular examination has not been common practice in these cases.[6,14]

Excluding retinal hemorrhages that are associated with vaginal delivery, AHT is the leading cause of retinal hemorrhages in infants. The association of retinal hemorrhage and AHT has been demonstrated repeatedly in clinical studies.[15–17] Although retinal hemorrhages in AHT can be unilateral or bilateral and vary in degree, the severity of retinal hemorrhage often parallels the severity of brain injury.[18,19] Because intraretinal hemorrhages may resolve quickly, a retinal examination is not a substitute for brain imaging when screening physically abused infants who have no neurologic symptoms for AHT.[20]

The ophthalmologist is in a unique position to detail the hemorrhagic retinopathy. The indirect ophthalmoscope provides a wide and stereoscopic field of view and enables the ophthalmologist to examine the anterior aspects of the retina to the ora serrata, which is not possible using a direct ophthalmoscope even if the pupils are dilated. Eye examination for this purpose should be performed by an ophthalmologist. Attention must be paid to special features, such as the presence of traumatic macular retinoschisis, because these features may have particular diagnostic significance for abuse.

Autopsy is a unique opportunity for examination not only of the eye and its contents but also of the orbital tissues, which may yield findings helpful in differential diagnosis. This is particularly true when a child dies before clinical ophthalmologic consultation can be obtained. Even when premortem ophthalmoscopy is performed, postmortem examination is necessary for viewing the orbital tissues. When possible, examination by a trained ocular pathologist or ophthalmologist with experience in interpreting ocular pathology is ideal. Postmortem eye and orbital tissue examination is another means of documenting retinal hemorrhage and retinoschisis but may also reveal hemosiderin deposition from previous events and orbital findings, such as hemorrhage into the fat, muscles, and cranial nerve sheaths as well as intradural hemorrhage, all of which may have diagnostic significance in identifying abused children.[21]

One obstacle to postmortem examination of the eyes and orbits has been a societal distaste or resistance that, in some cases, has led to fear among pathologists of legal repercussion. This may reflect a cultural or emotional objection specifically to eye removal. There might be a misconception that eye or orbital removal will alter the appearance of the body postmortem at a funeral viewing when this is not, in fact, the case. Techniques allow

for proper removal of the eye and orbits without disfigurement.[6] Although consent is not routinely obtained for coroner cases/forensic autopsies, there may be situations or jurisdictions in which specific consent for eye and orbital tissue removal may be sought. If a substitute decision-maker refuses this procedure, it may be necessary to seek legal intervention to allow the procedure to be performed.

STATEMENT OF THE PROBLEM

Although a retinal examination may suggest the etiology for ALTEs and previously unexplained early childhood deaths, premortem clinical ophthalmologic consultation and postmortem removal of the eyes and orbital tissues are not routine practice in some centers. Those who fail to conduct these procedures, particularly when there is no other explanation for the life-threatening event or death, risk losing an important opportunity to gain valuable information. Information gained in such an evaluation might lead to identifying an etiology and, in the case of a surviving child, prevent death by preventing further abuse or recognizing other disease.

In recent years, 3 important trends have emerged in the understanding of hemorrhagic retinopathy in young children. First, there has been a continued and dramatic increase in the evidence supporting the diagnostic specificity of severe hemorrhagic retinopathy as an indicator of AHT, in particular, severe repeated acceleration-deceleration with or without blunt head impact. Extensive literature worldwide, including clinical studies,[7] animal models,[22] and computer modeling,[23,24] well beyond the scope of this report, support this theory. It seems that vitreoretinal traction and orbital injury sustained during the unique repetitive acceleration-deceleration mechanism that distinguishes this form of abuse from single-impact trauma is the critical factor in causing retinal hemorrhage.[8] Factors such as hypoxia, anemia, and intracranial pressure may play important secondary roles in modulating the appearance of retinal hemorrhages but do not, in and of themselves, result in such a retinopathy.[6] Further research is needed to better define the role of these and other factors as our understanding of the pathophysiology and diagnostic specificity of retinal hemorrhage continues to evolve.

Second, there has been increasing recognition of the importance of detailing the appearance of the hemorrhagic retinopathy rather than simply using the term "retinal hemorrhage" generically. The differential diagnosis of a few intraretinal hemorrhages surrounding the optic nerve is vastly greater than that for "too-numerous-to-count" multilayered retinal hemorrhages that extend to the ora serrata.

Third, there continue to be novel reports of causes of retinal hemorrhage and other ocular findings in young children. These hypothesis-generating observations allow practitioners to broaden and at the same time narrow differential diagnosis. For example, mild posterior pole retinal hemorrhages have been described in osteogenesis imperfecta[25] as well as head trauma sufficient to cause epidural hemorrhage,[9] and more severe hemorrhage was observed in 2 cases of fatal head crush injury.[10,11] Only with more widespread use of ophthalmologic consultation and postmortem ocular and orbital examination can such entities be discovered and fit into the differential diagnostic process appropriately. Photodocumentation, when available, has also proven to be an important ophthalmic procedure for documenting retinal abnormalities for both clinical and educational purposes.

Full ophthalmic examination by an ophthalmologist and/or postmortem eye removal and pathologic examination can be a critical part of the diagnostic evaluation of previously well children who have experienced an unexplained ALTE or death and also for children who have disorders in which there are known associations with ophthalmic findings, particularly AHT.

GUIDANCE FOR PEDIATRICIANS

Ophthalmologic consultation should be part of the diagnostic evaluation of all previously well children younger than 5 years who experience an unexplained death or unexplained ALTE or have a systemic disorder known to have ocular manifestations.

- All infants and young children who present with significant intracranial hemorrhage should have an ophthalmologic consultation. Retinal examination is particularly important when there is a suspicion of AHT, but some retinal hemorrhages may occasionally also be found in infants and children with other causes of intracranial hemorrhage.
- Ophthalmologic examination should include, whenever possible, full indirect ophthalmoscopic examination through a dilated pupil. Descriptions of findings should be detailed and include the number, type, extent, and pattern of retinal hemorrhages, if present. Retinal abnormalities may be photographed after the clinical examination when a camera is available. When indicated, the examination should include slit-lamp inspection of the anterior segment to identify signs of trauma (eg, hyphema).
- Because findings such as retinal hemorrhage may be transient, it is desirable that the ophthalmologic consultation take place preferably

within 24 hours after the patient presents for medical care and ideally within 72 hours.

- A retinal examination is not an appropriate screening test for brain injury in neurologically asymptomatic potential victims of abuse. Such children should undergo brain imaging as the appropriate screen.
- When pharmacologic dilation is felt to be undesirable, as for children with severe unstable central nervous system injury, timely ophthalmologic consultation is still needed. An attempt should still be made to view the retina and optic nerve through the use of direct ophthalmoscopy, small pupil indirect ophthalmoscopic techniques, sequential pharmacologic dilation, and/or fast-acting mydriatics (eg, phenylephrine 2.5%).
- When a previously well child younger than 5 years dies without explanation, regardless of whether a premortem retinal examination was conducted, the eyes and orbital tissues should be removed en bloc at autopsy per published techniques.[26] When possible, an examination by an ocular pathologist or ophthalmologist with experience in interpreting ocular pathology is preferable.
- Postmortem eye removal may not be indicated in children who have clearly died from witnessed severe accidental head trauma or otherwise readily diagnosed systemic medical conditions.
- Ophthalmologic examination and/or postmortem eye and orbital tissue removal should be performed in all cases in which a child is alleged to have suffered significant morbidity secondary to a short fall or other minor trauma disproportionate to the clinical injury and consistent with child abuse.

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POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Eye Examination in Infants, Children, and Young Adults by Pediatricians

ABSTRACT. Early detection and prompt treatment of ocular disorders in children is important to avoid lifelong visual impairment. Examination of the eyes should be performed beginning in the newborn period and at all well-child visits. Newborns should be examined for ocular structural abnormalities, such as cataract, corneal opacity, and ptosis, which are known to result in visual problems. Vision assessment beginning at birth has been endorsed by the American Academy of Pediatrics, the American Association for Pediatric Ophthalmology and Strabismus, and the American Academy of Ophthalmology. All children who are found to have an ocular abnormality or who fail vision assessment should be referred to a pediatric ophthalmologist or an eye care specialist appropriately trained to treat pediatric patients.

INTRODUCTION

Eye examination and vision assessment are vital for the detection of conditions that result in blindness, signify serious systemic disease, lead to problems with school performance, or at worst, threaten the child's life. Through careful evaluation of the ocular system, retinal abnormalities, cataracts, glaucoma, retinoblastoma, strabismus, and neurologic disorders can be identified, and prompt treatment of these conditions can save a child's vision or even life. Examination of the eyes should be performed beginning in the newborn period and at all well-child visits. Visual acuity measurement should be performed at the earliest possible age that is practical (usually at approximately 3 years of age). Early detection and prompt treatment of ocular disorders in children is important to avoid lifelong permanent visual impairment.

TIMING OF EXAMINATION AND SCREENING

Children should have an assessment for eye problems in the newborn period and then at all subsequent routine health supervision visits. These should be age-appropriate evaluations as described in subsequent sections. Infants and children at high risk of eye problems should be referred for specialized eye examination by an ophthalmologist experienced in treating children. This includes children who are very premature; those with family histories of congenital cataracts, retinoblastoma, and metabolic or genetic diseases; those who have significant developmental delay or neurologic difficulties; and those with systemic disease associated with eye abnormalities. Because children do not complain of visual difficulties, visual acuity measurement (vision screening) is an important part of complete pediatric eye care and should begin at 3 years of age. To achieve the most accurate testing possible, the most sophisticated test that the child is capable of performing should be used (Table 1).[1,2] The frequency of examinations recommended is in accordance with the American Academy of Pediatrics "Recommendations for Preventive Pediatric Health Care."[2] Any child unable to be tested after 2 attempts or in whom an abnormality is suspected or detected should be referred for an initial eye evaluation by an ophthalmologist experienced in the care of children.

PROCEDURES FOR EYE EVALUATION

Eye evaluation in the physician's office should include the following:

Birth to 3 Years of Age

1. Ocular history
2. Vision assessment
3. External inspection of the eyes and lids
4. Ocular motility assessment
5. Pupil examination
6. Red reflex examination

3 Years and Older

1 through 6, plus:

7. Age-appropriate visual acuity measurement
8. Attempt at ophthalmoscopy

TABLE 1. Eye Examination Guidelines*

Function	Recommended Tests	Referral Criteria	Comments
Ages 3–5 Years			
Distance visual acuity	Snellen letters Snellen numbers Tumbling E HOTV Picture tests –Allen figures –LEA symbols	1. Fewer than 4 of 6 correct on 20-ft line with either eye tested at 10 ft monocularly (ie, less than 10/20 or 20/40) or 2. Two-line difference between eyes, even within the passing range (ie, 10/12.5 and 10/20 or 20/25 and 20/40)	1. Tests are listed in decreasing order of cognitive difficulty; the highest test that the child is capable of performing should be used; in general, the tumbling E or the HOTV test should be used for children 3–5 years of age and Snellen letters or numbers for children 6 years and older. 2. Testing distance of 10 ft is recommended for all visual acuity tests. 3. A line of figures is preferred over single figures. 4. The nontested eye should be covered by an occluder held by the examiner or by an adhesive occluder patch applied to eye; the examiner must ensure that it is not possible to peek with the nontested eye.
Ocular alignment	Cross cover test at 10 ft (3 m)	Any eye movement	Child must be fixing on a target while cross cover test is performed.
	Random dot E stereo test at 40 cm	Fewer than 4 of 6 correct	
	Simultaneous red reflex test (Bruckner test)	Any asymmetry of pupil color, size, brightness	Direct ophthalmoscope used to view both red reflexes simultaneously in a darkened room from 2 to 3 feet away; detects asymmetric refractive errors as well.
Ocular media clarity (cataracts, tumors, etc)	Red reflex	White pupil, dark spots, absent reflex	Direct ophthalmoscope, darkened room. View eyes separately at 12 to 18 inches; white reflex indicates possible retinoblastoma.
6 years and older			
Distance visual acuity	Snellen letters Snellen numbers Tumbling E HOTV Picture tests -Allen figures -LEA symbols	1. Fewer than 4 of 6 correct on 15-ft line with either eye tested at 10 ft monocularly (ie, less than 10/15 or 20/30) or 2. Two-line difference between eyes, even within the passing range (ie, 10/10 and 10/15 or 20/20 and 20/30)	1. Tests are listed in decreasing order of cognitive difficulty; the highest test that the child is capable of performing should be used; in general, the tumbling E or the HOTV test should be used for children 3–5 years of age and Snellen letters or numbers for children 6 years and older. 2. Testing distance of 10 ft is recommended for all visual acuity tests. 3. A line of figures is preferred over single figures. 4. The nontested eye should be covered by an occluder held by the examiner or by an adhesive occluder patch applied to eye; the examiner must ensure that it is not possible to peek with the nontested eye.
Ocular alignment	Cross cover test at 10 ft (3 m)	Any eye movement	Child must be fixing on a target while cross cover test is performed.
	Random dot E stereo test at 40 cm	Fewer than 4 of 6 correct	
	Simultaneous red reflex test (Bruckner test)	Any asymmetry of pupil color, size, brightness	Direct ophthalmoscope used to view both red reflexes simultaneously in a darkened room from 2–3 feet away; detects asymmetric refractive errors as well.
Ocular media clarity (cataracts, tumors, etc)	Red reflex	White pupil, dark spots, absent reflex	Direct ophthalmoscope, darkened room. View eyes separately at 12 to 18 inches; white reflex indicates possible retinoblastoma.

* Assessing visual acuity (vision screening) represents one of the most sensitive techniques for the detection of eye abnormalities in children. The American Academy of Pediatrics Section on Ophthalmology, in cooperation with the American Association for Pediatric Ophthalmology and Strabismus and the American Academy of Ophthalmology, has developed these guidelines to be used by physicians, nurses, educational institutions, public health departments, and other professionals who perform vision evaluation services.

Ocular History

Parents' observations are valuable. Questions that can be asked include:

- Does your child seem to see well?
- Does your child hold objects close to his or her face when trying to focus?
- Do your child's eyes appear straight or do they seem to cross or drift or seem lazy?
- Do your child's eyes appear unusual?
- Do your child's eyelids droop or does 1 eyelid tend to close?
- Have your child's eye(s) ever been injured?

Relevant family histories regarding eye disorders or preschool or early childhood use of glasses in parents or siblings should be explored.

Vision Assessment

Age 0 to 3 Years

Vision assessment in children younger than 3 years or any nonverbal child is accomplished by evaluating the child's ability to fix and follow objects.[3,4] A standard assessment strategy is to determine whether each eye can fixate on an object, maintain fixation, and then follow the object into various gaze positions. Failure to perform these maneuvers indicates significant visual impairment. The assessment should be performed binocularly and then monocularly. If poor fix and following is noted binocularly after 3 months of age, a significant bilateral eye or brain abnormality is suspected, and referral for more formal vision assessment is advisable.[5] It is important to ensure that the child is awake and alert, because disinterest or poor cooperation can mimic a poor vision response.

Visual Acuity Measurement or Vision Screening (Older Than 3 Years)

Various tests are available to the pediatrician for measuring visual acuity in older children. Different picture tests, such as LH symbols (LEA symbols) and Allen cards, can be used for children 2 to 4 years of age. Tests for children older than 4 years include wall charts containing Snellen letters, Snellen numbers, the tumbling E test, and the HOTV test (a letter-matching test involving these 4 letters).[6] A study of 102 pediatric practices revealed that 53% use vision testing machines.[3] Because testing with these machines can be difficult for younger children (3–4 years of age), pediatricians should have picture cards and wall charts available.

Photoscreening

Using this technique, a photograph is produced by a calibrated camera under prescribed lighting conditions, which shows a red reflex in both pupils. A trained observer can identify ocular abnormalities by recognizing characteristic changes in the photographed pupillary reflex.[7] When performed properly, the technique is fast, efficient, reproducible, and highly reliable. Photoscreening is not a substitute for accurate visual acuity measurement but can provide significant information about the presence of sight-threatening conditions, such as strabismus, refractive errors, media opacities (cataract), and retinal abnormalities (retinoblastoma). Photoscreening techniques are still evolving. (For further information, see also the American Academy of Pediatrics policy statement, "Use of Photoscreening for Children's Vision Screening."[8])

External Examination (Lids/Orbit/Cornea/Iris)

External examination of the eye consists of a penlight evaluation of the lids, conjunctiva, sclera, cornea, and iris. Persistent discharge or tearing may be attributable to ocular infection, allergy, or glaucoma, but the most common cause is lacrimal duct obstruction. It often manifests during the first 3 months as persistent purulent discharge out of 1 or both eyes. Topical or oral antibiotics should be given, and lacrimal sac massage should be attempted. Because these same findings are often seen in congenital glaucoma, failure to promptly resolve after treatment or the presence of cloudy or asymmetrically enlarged corneas should prompt ophthalmologic referral for additional evaluation.

Unilateral ptosis can cause amblyopia by inducing astigmatism, even if the pupil is not occluded. Patients with this condition require ophthalmic evaluation. Bilateral ptosis may be associated with significant neurologic disease, such as myasthenia. Additional investigation by a child neurologist and pediatric ophthalmologist is warranted.

Ocular Motility

The assessment of ocular alignment in the preschool and early school-aged child is of considerable importance. The development of strabismus in children may occur at any age and can represent serious orbital, intraocular, or intracranial disease. The corneal reflex test, cross cover test, and random dot E stereo test are useful in differentiating true strabismus from pseudostrabismus (see Appendix 1). The most common cause of pseudostrabismus is prominent epicanthal lid folds that cover the medial portion of the sclera on both eyes, giving the impression of crossed eyes (esotropia). Detection of an eye muscle imbalance or inability to differentiate strabismus from pseudostrabismus necessitates a referral.

Pupils

The pupils should be equal, round, and reactive to light in both eyes. Slow or poorly reactive pupils may indicate significant retinal or optic nerve dysfunction. Asymmetry of pupil size, with 1 pupil larger than the other, can be attributable to a sympathetic disorder (Horner syndrome) or a parasympathetic abnormality (third nerve palsy, Adie syndrome). Small differences can occur normally and should be noted in the chart for reference in case of subsequent head injury. Larger pupil asymmetries (>1 mm) can be attributable to serious neurologic disorders and need additional investigation.

Red Reflex Test (Monocular and Binocular, Bruckner Test)

The red reflex test can be used to detect opacities in the visual axis, such as a cataract or corneal abnor-

mality, and abnormalities of the back of the eye, such as retinoblastoma or retinal detachment. When both eyes are viewed simultaneously, potentially amblyogenic conditions, such as asymmetric refractive errors and strabismus, also can be identified. The test should be performed in a darkened room (to maximize pupil dilation). The direct ophthalmoscope is focused on each pupil individually approximately 12 to 18 inches away from the eye, and then both eyes are viewed simultaneously at approximately 3 feet away. The red reflex seen in each eye individually should be bright reddish-yellow (or light gray in darkly pigmented, brown-eyed patients) and identical in both eyes. Dark spots in the red reflex, a blunted dull red reflex, lack of a red reflex, or presence of a white reflex are all indications for referral. After assessing each eye separately, the eyes are viewed together with the child focusing on the ophthalmoscope light (Bruckner test, see Appendix 1). As before, any asymmetry in color, brightness, or size is an indication for referral, because asymmetry may indicate an amblyogenic condition.

Visual Acuity Measurement (Vision Screening)

Visual acuity testing is recommended for all children starting at 3 years of age.[6] In the event that the child is unable to cooperate for vision testing, a second attempt should be made 4 to 6 months later. For children 4 years and older, the second attempt should be made in 1 month. Children who cannot be tested after repeated attempts should be referred to an ophthalmologist experienced in the care of children for an eye evaluation. Appendix 1 provides a detailed explanation of the techniques available for visual acuity measurement in children.

Ophthalmoscopy

Ophthalmoscopy may be possible in very cooperative 3- to 4-year-olds who are willing to fixate on a toy while the ophthalmoscope is used to evaluate the optic nerve and retinal vasculature in the posterior pole of the eye.

RECOMMENDATIONS

1. All pediatricians and other providers of health care to children should be familiar with the joint eye examination guidelines of the American Association for Pediatric Ophthalmology and Strabismus, the American Academy of Ophthalmology, and the American Academy of Pediatrics.
2. Every effort should be made to ensure that eye examinations are performed using appropriate testing conditions, instruments, and techniques.
3. Newborns should be evaluated for ocular structural abnormalities, such as cataract, corneal opacities, and ptosis, which are known to result in vision problems, and all children should have their eyes examined on a regular basis.[1]
4. The results of vision assessments, visual acuity measurements, and eye evaluations, along with instructions for follow-up care, should be clearly communicated to parents.[2]
5. All children who are found to have an ocular abnormality or who fail vision screening should be referred to a pediatric ophthalmologist or an eye care specialist appropriately trained to treat pediatric patients.

APPENDIX 1. TESTING PROCEDURES FOR ASSESSING VISUAL ACUITY

The child should be comfortable and in good health at the time of the examination. It is often convenient to have younger children sit on a parent's lap. If possible, some preparation before the actual testing situation is helpful, and parents can assist by demonstrating the anticipated testing procedures for their child. Children who have eyeglasses generally should have their vision tested while wearing the eyeglasses. Eyeglasses prescribed for use only

while reading should not be worn when distance acuity is being tested.

Consideration must be given to obtaining good occlusion of the untested eye; cardboard and paddle occluders have been found inadequate for covering the eye because they allow "peeking." Commercially available occluder patches provide complete occlusion necessary for appropriate testing.[1] Vision testing should be performed at 10 feet (except Allen cards) and in a well-lit area. When ordering wall charts, be sure to indicate that a 10-foot testing distance will be used.

Visual Acuity Tests

Snellen Acuity Chart

When performing visual acuity testing, test the child's right eye first by covering the left. A child who has corrective eyeglasses should be screened wearing the eyeglasses. Tell the child to keep both eyes open during testing. If the child fails the practice line, move up the chart to the next larger line. If the child fails this line, continue up the chart until a line is found that the child can pass. Then move down the chart again until the child fails to read a line. After the child has correctly identified 2 symbols on the 10/25 line, move to the critical line (10/20 or 20/40 equivalent). To pass a line, a child must identify at least 4 of the 6 symbols on the line correctly. Repeat the above procedure covering the right eye.

Tumbling E

For children who may be unable to perform vision testing by letters and numbers, the tumbling E or HOTV test may be used. Literature is available from the American Academy of Ophthalmology (*Home Eye Test*, American Academy of Ophthalmology, PO Box 7424, San Francisco, CA 94109, 415/561-8500 or http://www.aao.org) and Prevent Blindness America (*Preschoolers Home Eye Test*, Prevent Blindness America, 500 East Remington Rd, Schaumburg, IL 60173, 847/843-2020 or http://www.preventblindness.com) for home use by parents to prepare children for the tumbling E test. This literature contains the practice Es, a tumbling E wall chart, and specific instructions for parents.

HOTV Test (Matching Test)

An excellent test for children who are unable to perform vision testing by verbally identifying letters and numbers is the HOTV matching test. This test consists of a wall chart composed only of Hs, Os, Ts, and Vs. The child is provided an 8½ × 11-inch board containing a large H, O, T, and V. The examiner points to a letter on the wall chart, and the child points to (matches) the correct letter on the testing board. This can be especially useful in the 3- to 5-year-old who is unfamiliar with the alphabet.

Allen Cards

The Allen card test consists of 4 flash cards containing 7 schematic figures: a truck, house, birthday cake, bear, telephone, horse, and tree. When viewed at 20 feet, these figures represent 20/30 vision. It is important that a child identify verbally or by matching all 7 pictures before actual visual testing. Testing should only be performed with the figures that the child readily identified. Perform initial testing with the child having both eyes open, viewing the cards at 2 to 3 feet away. Present 1 or 2 figures to ensure that the child understands the testing procedure. Then begin walking backward 2 to 3 feet at a time, presenting different pictures to the child. Continue to move backward as long as the child directly calls out the figures presented. When the child begins to miss the figures, move forward several feet to confirm that the child is able to identify the figures at the shorter distance. To calculate an acuity score, the furthest distance at which the child is able to identify the pictures accurately is the numerator and 30 is the denominator. Therefore, if a child were able to identify pictures accurately at 15 feet, the visual acuity would be recorded as 15/30. This is equivalent to 30/60, 20/40, or 10/20. To perform this test in the same way as for HOTV testing, a "matching panel" of all of the Allen figures may be prepared on a copy machine.

LH Symbols (LEA Symbols)

The LH symbol test is slightly different from the Allen card test in that it is made up of flash cards held together by a spiral binding. The flash cards contain large examples of a house, apple, circle, and square; these should be presented to the child before formal vision testing to see if they can be correctly identified. Unlike the Allen cards, the LH symbol test contains flash cards with more than 1 figure per card and with smaller figure sizes so that testing may be performed at 10 feet. Recorded on each card is the symbol size and visual acuity value for a 10-foot testing distance. The visual acuity is determined by the smallest symbols that the child is able to identify accurately at 10 feet. For example, if the child is able to identify the 10/15 symbol at 10 feet, the child's visual acuity is 10/15 or 20/30.

If it is not possible to perform testing at 10 feet, move closer to the child until he or she correctly identifies the largest symbol. At this point, proceed down in size to the smallest symbols the child is consistently able to correctly identify. The vision is recorded as the smallest symbol identified (bottom number) at the testing distance (top number). For example, correctly identifying the 10/15 symbols at 5 feet is recorded as 5/15 or 20/60. Likewise, identifying the 10/30 symbols at 2 feet is 2/30 or 20/300 (both the bottom and top numbers can be multiplied or divided by the same number to give an equivalent vision.) A "matching panel" is provided with the LH test and may be helpful in testing very young children. At least 3 of 4 figures should be identified for each size or distance.

Testing Procedures for Assessing Ocular Alignment

Corneal Light Reflex Test

A penlight may be used to evaluate light reflection from the cornea. The light is held approximately 2 feet in front of the face to have the child fixate on the light. The corneal light reflex (small white dot) should be present symmetrically and appear to be in the center of both pupils. A reflex that is off center in 1 eye may be an indication of an eye muscle imbalance. A slight nasal displacement of the reflex is normal, but a temporal displacement is almost never seen unless the child has a strabismus (esotropia).

Simultaneous Red Reflex Test (Bruckner Test)

This test can detect amblyogenic conditions, such as unequal refractive errors (unilateral high myopia, hyperopia, or astigmatism), as well as strabismus and cataracts. When both eyes are viewed simultaneously through the direct ophthalmoscope in a darkened room from a distance of approximately 2 to 3 feet with the child fixating on the ophthalmoscope light, the red reflexes seen from each eye should be equal in size, brightness, and color. If 1 reflex is different from the other (lighter, brighter, or bigger), there is a high likelihood that an amblyogenic condition exists. Any child with asymmetry should be referred for additional evaluation. Examples of normal and abnormal Bruckner test appearances are available from the AAP. "See Red" cards are available for purchase at http://www.aap.org/sections/ophthal.htm.

Cross Cover Test

To perform the cross cover test, have the child look straight ahead at an object 10 feet (3 meters) away. This could be an eye chart for older children or a colorful noise-making toy for younger children. As the child looks at a distant object, cover 1 eye with an occluder and look for movement of the uncovered eye. As an example, if the occluder is covering the left eye, movement is looked for in the uncovered right eye. This movement will occur immediately after the cover is placed in front of the left eye. If the right eye moves outward, the eye was deviated inward or esotropic. If the right eye moves inward, it was deviated outward or exotropic. After testing the right eye, test the left eye for movement in a similar manner. If there is no apparent misalignment of either eye, move the cover back and forth between the 2 eyes, waiting about 1 to 2 seconds between movements. If after moving the occluder, the uncovered eye moves in or out to take up fixation, a strabismus is present. Any movement in or out when shifting the cover indicates a strabismus is present, and a referral should be made to an ophthalmologist.

Random Dot E Stereo Test

The random dot E stereo test measures stereopsis. This is different from the light reflex test or the cover test, which detects physical misalignment of the eyes. Stereopsis can be absent in patients with straight eyes. An ophthalmologic evaluation is necessary to detect the causes of poor stereo vision with straight eyes. To perform the

random dot E stereo test, the cards should be held 16 inches from the child's eyes. Explain the test to the child. Show the child the gray side of the card that says "model" on it. Hold the model E in the direction at which the child can read it correctly. Have the child touch the model E to understand better that the picture will stand out. A child should be able to indicate which direction the legs are pointing. Place the stereo glasses on the child. If the child is wearing eyeglasses, place the stereo glasses over the child's glasses. Make sure the glasses stay on the child and the child is looking straight ahead. The child should be shown both the stereo blank card and the raised and recessed E card simultaneously. Hold each card so you can read the back. The blank card should be held so you can read it. The E card should be held so you can read the word "raised." Both cards must be held straight. Do not tilt the cards toward the floor or the ceiling—this will cause darkness and glare. Ask the child to look at both cards and to point to or touch the card with the picture of the E. The E must be presented randomly, switching from side to side. The child is shown the cards up to 6 times. To pass the test, a child must identify the E correctly in 4 of 6 attempts.

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Ted D. Sigrest, MD, and the Committee on Hospital Care

Facilities and Equipment for the Care of Pediatric Patients in a Community Hospital

ABSTRACT. Many children who require hospitalization are admitted to community hospitals that are more accessible for families and their primary care physicians but vary substantially in their pediatric resources. The intent of this clinical report is to provide basic guidelines for furnishing and equipping a pediatric area in a community hospital.

ABBREVIATIONS. AAP, American Academy of Pediatrics; JCAHO, Joint Commission on Accreditation of Healthcare Organizations.

BACKGROUND

Of the 6.4 million admissions of children to hospitals in the United States in 1997, approximately 24% were to children's hospitals. Another 35% were admissions to large, primarily urban pediatric units in municipal or regional medical centers. The remaining 41% of pediatric admissions were to community hospitals that are more accessible and convenient for patients' families and physicians.[1] These smaller hospitals vary in their equipment, staffing, diagnostic resources, and treatment capabilities for pediatric patients. Some smaller hospitals may have no permanently designated pediatric beds and few, if any, staff dedicated exclusively to the care of children. In these smaller facilities, services may be provided by physicians and health care professionals with widely varying levels of expertise in children's health care.

As the number of hospitalized children and average length of stay have decreased, hospitals have been compelled to reassess their commitment to the maintenance of pediatric inpatient units. Some have elected to discontinue their pediatric programs. Others have decreased their services to children, but to remain competitive, continue to attempt to meet patient and community needs. The purpose of this clinical report is to provide guidelines for the basic facilities and equipment needed to adequately care for children in community hospitals with the realization that there are significant budgetary constraints to be acknowledged in the provision of these services. Detailed information on the facilities and equipment needed to care for newborns can be found in the American Academy of Pediatrics (AAP) *Guidelines for Perinatal Care* (see "Resources" section).

THE FACILITY

In addition to recommendations of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) for facilities used in the provision of care to hospitalized patients, the following is a list of basic facility needs for the care of children from birth to 18 years of age:

- Single- or double-occupancy rooms that comply with guidelines for prevention of nosocomial infections[2] and that are large enough to accommodate parents who stay with their children.
- Patient room configuration and bed positioning that allow convenient observation and supervision of patients by nursing staff, especially if parents are not available.
- Covered electrical outlets, childproof window locks and door latches, padding of sharp edges, and nonslip, easily maintained floor surfaces.
- Age-appropriate furniture, including cribs equipped with safe overhead restraints and beds with covered mechanical or electrical controls.
  - —Beds, cribs, and other furniture should meet Consumer Product Safety Commission standards (http://www.cpsc.gov).
- Area set aside for play, entertainment, education, and other child life activities.
- Separate treatment room for patient assessment and procedures.

Interior design and decor are not addressed in this statement. Information about child-friendly, developmentally appropriate environments may be obtained from the Institute for Family-Centered Care (see "Resources" section).

EQUIPMENT

Essential medical equipment for pediatric care is included in the following list. Additional information on pediatric resuscitation equipment is included in the AAP policy statement "Guidelines for Pediatric Emergency Care Facilities"[3] and in standard pediatric emergency care textbooks.[4]

- Resuscitation cart containing pediatric-specific supplies
  —Common pediatric emergency drugs should be readily accessible and plainly labeled. Drug dosing by weight or length should be easily referenced.
  —The resuscitation cart should also have an appropriate assortment of the various sizes of pediatric oxygen masks, endotracheal tubes, laryngoscope blades, oropharyngeal and nasopharyngeal airways, and self-inflating bags (ie, Ambu bags [Ambu International, Linthicum, MD]) with various sizes of masks. A size-appropriate backboard for resuscitation should be available.
    - A cardiac defibrillator designed for pediatric use with paddles for infants and children.
      —A chart for appropriate joule dosages for weight should be readily available.
    - Cardiorespiratory monitors appropriate for the level of pediatric care provided.
    - Respiratory equipment in appropriate sizes for infants and children.
      —Necessary items include oxygen masks, nasal cannulas, tubing, self-inflating (Ambu) bags and masks, oropharyngeal and nasopharyngeal airways, suctioning equipment and catheters, nebulizers with pediatric-sized face masks, spacer devices and masks for metered-dose inhalers, pulse oximeters with appropriate infant and pediatric probes, and infant and pediatric tracheostomy supplies.
- Intravenous catheters, phlebotomy equipment, and lumbar puncture trays that are size appropriate; extremity warmers, such as chemical packs that warm via exothermic reaction, for improving peripheral blood flow and facilitating blood sampling in infants; papoose boards, adequately padded, of at least 2 sizes for immobilization of infants and children.
- Common neonatal and pediatric intravenous solutions, such as small vials of 10% dextrose, 100 and 250 mL bags of common pediatric intravenous solutions such as 5% dextrose with one-half normal saline or lactated Ringer's solution, 5% dextrose with one-quarter normal saline or lactated Ringer's solution, and intravenous infusion pumps designed for pediatric use with precise administration of small infusion rates.
- Scales and stadiometers for infants and older children.
- Pediatric-appropriate dietary supplies, such as common newborn formulas, pediatric nutritional supplements, and dietary choices that appeal to children; appropriately sized assortment of orogastric and nasogastric feeding tubes and enteral feeding pumps designed for precise administration of small infusion rates.
- Pediatric urine collection devices and appropriately sized urinary catheters.
- Mercury-free thermometers and blood pressure devices (various sizes of blood pressure cuffs).
- Pediatric orthopedic equipment, including wheelchairs, crutches, slings, and splints.
- Infant incubators for small infants with temperature control problems.
- Portable lamps for bedside procedures.
- Developmentally appropriate books, toys, games, and when economically feasible, electronic media such as videocassette players and computers.
  —Toys and equipment should be safe for use by children with impaired mobility.
  —Infection control should be a priority, with all toys, equipment, and play surfaces regularly cleaned with appropriate germicidal solutions.
  —Computers that are available for pediatric patient use should have Internet access limited to child-appropriate sites.

SUPPORT SERVICES

The following therapeutic and diagnostic facilities should be available on a 24-hour basis:

- Routine radiograph imaging, with a radiologist available for reading of emergency films.
  —Availability of computed tomography is strongly recommended.
- Clinical laboratory services appropriate for neonatal and pediatric needs, including hematologic profiles, blood chemistries, blood gas studies, microbiologic profiles, and standard urine studies.
  —Equipment should be available to process all commonly ordered tests such as complete blood cell counts and renal and hepatic function tests using samples of less than 1 mL ("micro" samples).
  —Minimum amounts of blood, urine, and cerebrospinal fluid required for tests should be obtained and posted in the hospital laboratory and pediatric areas.
  —Response times should be appropriate for timely diagnosis and treatment of the child's condition.
  —Topical anesthetics should be available and used before obtaining blood samples whenever possible.
- Pharmacy services providing age- and size-appropriate drug administration and dosing.
  —Commonly used oral suspensions should be immediately available. The equipment necessary to create pediatric liquid formulations, including pill crushers, suspension agents, and flavoring solutions, should be available. Pediatric oral suspension delivery devices, such as oral medication syringes and pacifiers that deliver liquid medications, should be available.
  —Doses of antibiotics that are known to cause ototoxicity or nephrotoxicity, such as vancomycin, tobramycin, and gentamycin, should be calculated using computer programs or calculations based on appropriate neonatal or pediatric pharmacokinetic models. Serum drug concentrations should be obtained to optimize dosage amounts and intervals. Clinical judgment should be used before ordering multiple serum concentrations if the antibiotic is to be discontinued with negative cultures or oral antibiotics

are to be started as soon as the patient is afebrile.
—Current references for pediatric drug dosing and drug interactions should be easily available. A liaison with a tertiary care children's hospital pharmacy is advised to help minimize the possibility of adverse consequences in off-label use of drugs and drug dosing.

The following services should be available as needed: social work services; pastoral services; sign and foreign language interpretation; and respiratory, physical, occupational, and speech therapy. Professionals providing these services should have adequate training and continuing education provided in the pediatric applications of their respective fields. If a child is hospitalized for more than 2 school days, a designated hospital employee, such as nurse, social worker, or child life specialist, should serve as a liaison with the child's school to assist the parents in providing for the child's educational needs. Child life services are recommended whenever feasible.[5] These specialists provide a valuable service in addressing the psychosocial concerns of children and families during hospitalization and provide support for the concept of family-centered care in the medical setting.

CONTINUING EDUCATION

All health care professionals in a pediatric area should be familiar with the unique and changing physical and psychosocial needs of children. Continuing education should be provided to reinforce these concepts. Nurses and physicians should have current certification in pediatric life support techniques. All should know the location of carts and equipment for cardiopulmonary resuscitation and mock codes should be conducted on a regular basis. Instruction on the use of cardiorespiratory monitors and their alarms should be provided on an ongoing basis. If patients are provided with monitors that feature electrocardiogram readouts, appropriate training should be provided. Education sessions and mock codes should be documented for review by hospital quality assurance committees and the JCAHO.

REFERRAL NETWORKS

Community hospitals and physicians providing care for children must have well-established referral networks for timely consultation by pediatric subspecialists and, when necessary, for transfer of patients to a pediatric center that offers more advanced levels of care. This includes access to an air and ground transportation system that is responsive and appropriately equipped and staffed to care for children of all ages. Guidelines for regionalization of care and transfer of injured patients have been published by the AAP[6] and the American College of Surgeons.[7]

ADMISSION AND TRANSFER CRITERIA

Because community hospitals vary significantly in their resources for providing pediatric care, there is no single set of criteria for admission and transfer of pediatric patients that has universal applicability. Each institution must assess its own capabilities and limitations in light of its mission and then formulate guidelines. Once guidelines for transfer of patients have been established, those for admission become less difficult to define. This challenging process requires input from all members of the health care team, including hospital administration. The goal is to ensure that each patient in the facility receives the optimal care that is most appropriate for his or her medical and psychosocial needs.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Robert W. Block, MD; Nancy F. Krebs, MD; and the Committee on Child Abuse and Neglect, and the Committee on Nutrition

Failure to Thrive as a Manifestation of Child Neglect

ABSTRACT. Failure to thrive is a common problem in infancy and childhood. It is most often multifactorial in origin. Inadequate nutrition and disturbed social interactions contribute to poor weight gain, delayed development, and abnormal behavior. The syndrome develops in a significant number of children as a consequence of child neglect. This clinical report is intended to focus the pediatrician on the consideration, evaluation, and management of failure to thrive when child neglect may be present. Child protective services agencies should be notified when the evaluation leads to a suspicion of abuse or neglect. ***Pediatrics*** **2005;116:1234–1237;** ***failure to thrive, development, child neglect, abuse, nutrition.***

ABBREVIATION. FTT, failure to thrive.

INTRODUCTION

Failure to thrive (FTT) in infants and children results from inadequate nutrition to maintain physical growth and development. An infant or child becoming malnourished as the result of parental or caregiver neglect creates concern about child maltreatment.[1] In its extreme form, FTT secondary to neglect may be fatal. This clinical report is not intended to be a thorough review of FTT but serves as a guide for the assessment, management, and support of children with FTT as a manifestation of child neglect.

DEFINITION OF FTT

FTT is a significantly prolonged cessation of appropriate weight gain compared with recognized norms for age and gender after having achieved a stable pattern (eg, weight-for-age decreasing across 2 major percentile channels from a previously established growth pattern; weight-for-length $<$ 80% of ideal weight). This is often accompanied by normal height velocity.[2,3] Despite these accepted definitions, caution must be applied when diagnosing FTT on the basis of percentile shifts, because growth variants are common.[4] Actual weight $<$70% of predicted weight-for-length requires urgent attention. It is recognized now that earlier distinctions between organic and nonorganic FTT are overly simplistic and not clinically appropriate,[5] because many patients exhibit components of both. See the *Pediatric Nutrition Handbook*[3] from the American Academy of Pediatrics for a thorough discussion of FTT.

INCIDENCE AND CAUSAL FACTORS

The fundamental cause of FTT is nutritional deficiency. Poverty is the greatest single risk factor for FTT worldwide and in the United States.[6,7] FTT can be unintentional, occurring with breastfeeding difficulties, errors in formula preparation, poor diet selection, or improper feeding technique. FTT can also be caused by organic diseases including but not limited to cystic fibrosis, cerebral palsy, HIV infection or AIDS, inborn errors of metabolism, celiac disease, renal disease, lead poisoning, or major cardiac disease. FTT may result if caregivers who are referred for assistance fail to avail themselves of community resources and/or assistance.[8] FTT is often multifactorial, involving some combination of infant organic disease, subtle neurologic and/or behavioral problems, dysfunctional parenting behaviors, and parent-child interactional difficulties.[9] Feeding difficulties, oral-motor dysfunction, food aversion, and/or appetite control often compound the problem.[10,11] The malnutrition in children with FTT can lead not only to impaired growth but also to long-term deficits in intellectual, social, and psychological functioning.[12,13]

When FTT is caused by child neglect, certain risk factors are often present. When considering neglect, the pediatrician should assess each risk factor in the context of each family's unique situation. The parent(s) of an infant with FTT may exhibit inadequate adaptive social interactional behavior and less positive affective behavior. The parent may be an adolescent or may have a history of abuse as a child.[14,15] The infant with FTT is often born preterm or with low birth weight and may have been separated from caregivers because of prolonged hospitalization during the perinatal period. Family and social factors that may contribute to neglect include the lack of available extended family to help with child rearing, social isolation of the family, substance abuse, family violence, single parenthood, and employment instability. Parents in middle-class and affluent circumstances or parents engaged in career development or activities away from home also may lack the emotional strength or maturity to nurture their infants

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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appropriately.[14,15] Any of these factors may lead to inconsistent feeding patterns with decreased nutrition, decreased growth, and additional family stress.[16] In toddlers and older children, decrements in the rate of growth in weight and height are more frequently ignored or too easily ascribed to intercurrent illness. Pediatricians should be aware of the potential for neglect of children of any age.

Infant-caregiver attachment issues may be an important component of FTT. Disturbances in attachment may predict several problems in infant and child development.[17] FTT is not synonymous with disturbed attachment; many children fail to thrive without attachment disturbances, and many children with attachment disturbances grow normally. Nevertheless, many factors contributing to FTT (poverty, maternal depression, neglect) also increase the risk of attachment disturbances. Because infants with FTT may be at risk of clinical disturbances of attachment, pediatricians should consider consultation with mental health professionals who can assist in evaluating infant-caregiver attachment.[18–20]

Psychosocial short stature, a variant of FTT, has been described as short stature out of proportion to the decreased weight. This syndrome is thought to result from major emotional and psychological trauma. It has been associated with pituitary and hypothalamic dysfunction, possibly with interactions with nutrient deficiencies, which is frequently reversible when the child is placed in a nurturing environment.[21]

ASSESSMENT

Most children with FTT can be assessed by a general pediatrician with the help of professionals in other disciplines. The clinical evaluation for FTT should include a comprehensive history, physical examination, feeding observation, and a home visit by an appropriate health professional. For breastfed infants, an observation of feeding should include an evaluation of the mother's breastfeeding technique and the infant's response to feeding and be conducted by a professional specifically trained in lactation counseling and assessment. Laboratory and radiologic studies are frequently unnecessary. A multidisciplinary approach involving nursing, social services, and dietetics personnel is essential when children with FTT fail to recover and sustain normal growth velocity after treatment interventions.[22,23]

History

A thorough review of the child's family history should include genetic conditions, growth histories, endocrine disorders, caregivers' knowledge of normal growth and development, family function, eating patterns, types of food available in the home, and family stressors. The child's parents should be queried about personal history of abuse, eating disorders, psychopathology, alcohol use, drug use, domestic violence, and stress; their social skills, nutritional beliefs, and positive assets also should be considered in the evaluation.

The child's medical history should include a general review of systems, current medications, allergy history, feeding history, 72-hour dietary record, gastrointestinal symptoms, travel history, feeding routines, feeding skills, time required to feed, behavior during feedings, sleep patterns, developmental history, daily routine, gestational and prenatal history, and history of organic disease. Information obtained from all child care providers should include a history of eating patterns, interactions, social skills, responses to the providers, and family concerns.

Physical Examination

The physical examination should include documentation of past and present growth parameters, including head circumference, using appropriate growth charts. General examination should include a search for major and minor anomalies, careful neurologic examination, assessment of suck-swallow coordination, and observation of the child's developmental skills and responses and interactive behaviors with parents and examiners.

Feeding Observation

A feeding observation can be performed in the office but is enhanced as part of a home visit. Feeding behavior, the child's oral interest or aversion, and parent-child interactions before, during, and after feeding should be observed and recorded.

Laboratory Testing

When history, comprehensive physical examination, feeding observations, and home visitation do not reveal an obvious cause of FTT, laboratory testing may be performed to rule out organic disease and ascertain nutritional deficits. Testing should be performed if there are concerns arising from the history or physical examination; however, the yield of positive laboratory data are $<1\%$.[23]

RECOGNITION OF FTT SECONDARY TO NEGLECT OR ABUSE

The risk factors that should alert the pediatrician to the possibility of neglect as the cause of FTT include:

- parental depression, stress, marital strife, divorce;
- parental history of abuse as a child;
- mental retardation and psychological abnormalities in the parent(s);
- young and single mothers without social supports;
- domestic violence;
- alcohol or other substance abuse;
- previous child abuse in the family;
- social isolation and/or poverty;
- parents with inadequate adaptive and social skills;
- parents who are overly focused on career and/or activities away from home;
- failure to adhere to medical regimens;
- lack of knowledge of normal growth and development; and/or
- infant with low birth weight or prolonged hospitalization.

Moreover, concerns of abuse or neglect should be raised during the course of intervention and monitored if the following become evident:

- Intentional withholding of food from the child;
- Strong beliefs in health and/or nutrition regimens that jeopardize a child's well-being; and/or
- Family that is resistant to recommended interventions despite multidisciplinary team approach.

TREATMENT AND MANAGEMENT

FTT in the young infant and toddler must be considered a medical emergency if the growth curve documents weight <70% of the predicted weight-for-length.[15] Guidelines on management of less severe cases of FTT are listed in the *Pediatric Nutrition Handbook*[3] from the American Academy of Pediatrics. Because early malnutrition can have severe deleterious effects on early brain development, prompt recognition of severe cases is essential.[24] After resolution of urgent, life-threatening medical conditions, the priority in an evaluation of FTT is a period of observation of at least several weeks to monitor intake, output, growth, feeding style, interactions, and infant/child characteristics. Historically, this has taken place in a hospital but may be better situated in a home environment, possibly including a foster home, until the cause of the FTT is determined.

Despite current economic and managed care constraints, inpatient care is justified for a child with severe FTT and/or if abuse or neglect is suspected. In contrast to other children, a child with FTT secondary to neglect may eagerly eat in the protective and predictable hospital environment. Liberal intake and above-average weight gain observed in the hospital support a diagnosis of neglect as an underlying cause of the FTT. When appropriate, pediatricians should advocate for inpatient care with managed care plan personnel, because hospitalization has been shown to significantly improve outcome in some cases.[25] However, FTT needs to be considered a chronic process, and interventions need to be long-term.

Severely malnourished children may be anorectic and weak. The institution of adequate caloric intake may be difficult. Moreover, institution of increased feedings may initiate significant metabolic problems, known as refeeding syndrome. Guidelines for diagnosis and management of this condition are available elsewhere.[26] Nutritional guidance and occupational and/or oral-motor evaluation by a speech therapist regarding effective feeding techniques are invaluable. Parents should be involved in all aspects of the treatment program and should be provided with support and education, empowering them to fulfill the care plan.

Suspicion of child maltreatment must lead to a report to the appropriate child protective services agency. The pediatrician must adequately document interventions that have been attempted, specific instructions to parents, evidence of parental understanding of the instructions, evidence of parental understanding of the potential adverse consequences to the child, and evidence of parental failure to adhere to nutritional and feeding recommendations.

Intervention by child protective services agencies may increase parental compliance or allow for additional support services such as child care, counseling, and home visitation. If aggressive interdisciplinary intervention fails to correct the weight to safe levels (>80% of predicted weight-for-length) and maintain weight gain, then placement in foster care may be the only alternative. Education and training of foster parents regarding feeding and the importance of close social interaction are mandatory. The involvement of the pediatrician during all phases of protective service intervention is essential.

GUIDANCE FOR THE PEDIATRICIAN

1. Pediatricians are encouraged to recognize that child neglect is among the many causes of FTT.
2. Pediatricians are strongly encouraged to consider child abuse and neglect and to report cases of FTT that do not resolve with appropriate interventions.

CONCLUSIONS

FTT usually can be evaluated by the office-based pediatrician with minimal laboratory tests and medical interventions. However, for infants with FTT who are suspected to be victims of abuse and neglect, aggressive multidisciplinary intervention is required in either an inpatient or outpatient setting. Close follow-up from a multidisciplinary team and home visitors who are respectful and supportive of the family are important components of assessment and treatment. FTT as a consequence of abuse or neglect must be considered in families with profiles indicating a high risk of abuse and in families that consistently fail to adhere to the recommended interventions or are unable to maintain a safe environment for their child.

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VIAGRA INGREDIENT MAY AID CHILDREN WITH LUNG DISORDER

"Earlier this month, Pfizer Inc. began shipping to pharmacies a round, white pill called Revatio, a treatment for a rare and life-threatening condition called pulmonary hypertension. The drug, which dilates some of the body's key blood vessels, was approved in June for treating adults with PH, and Pfizer is now studying whether it also can help children with the debilitating illness. In early tests, the drug helped ill children increase by about 60% the distance they could walk in six minutes. But there's another side to Revatio you'd never guess by looking at it. When the same active ingredient, sildenafil, comes at higher doses in a diamond-shaped blue pill, the drug is known by a different name—Viagra . . . Pfizer is now enrolling 332 youngsters, ages 1 to 16, in a placebo-controlled trial to find out if Revatio is as safe and effective in children with the lung disease as in adults."

Chase M. *Wall Street Journal*. August 29, 2005

Noted by JFL, MD

AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Falls From Heights: Windows, Roofs, and Balconies

ABSTRACT. Falls of all kinds represent an important cause of child injury and death. In the United States, approximately 140 deaths from falls occur annually in children younger than 15 years. Three million children require emergency department care for fall-related injuries. This policy statement examines the epidemiology of falls from heights and recommends preventive strategies for pediatricians and other child health care professionals. Such strategies involve parent counseling, community programs, building code changes, legislation, and environmental modification, such as the installation of window guards and balcony railings.

ABBREVIATIONS. CPSC, US Consumer Product Safety Commission; AAP, American Academy of Pediatrics.

INTRODUCTION

After motor vehicle–related injuries, falls of all kinds are the second leading cause of death from unintentional injury in the United States, accounting for more than 13 000 deaths during 1998 among persons of all ages, 126 of which were children 14 years and younger.[1] Falls are the leading cause of nonfatal injury, with several hundred thousand hospitalizations annually and almost 9 million persons treated in emergency departments who do not require hospitalization.[2] Although falls are the most common cause of childhood injury, these injuries are rarely fatal, in contrast with a high rate of fall-related mortality among the elderly.[1,3,4] Fatalities occur primarily when children fall from great heights (greater than 2 stories or 6.7 m [22 ft]), or when the head of a child hits a hard surface, such as concrete. Falls from heights greater than 2 stories can include falls from roofs, windows, and balconies.[5–7] The purpose of this statement is to review the epidemiology of falls from heights in children and to suggest strategies for prevention.

Falls from heights are a major problem in urban areas, especially for children living in multiple-story, often deteriorating, low-income housing.[5–7] In some urban areas, falls have represented up to 20% of the deaths of children from unintentional injury, as compared with an average of 1% to 4% nationally.[1,8,9] The majority of fall-related fatalities among children are associated with falls from heights, most from 3 stories or higher. Falls from 1 or 2 stories are more frequently nonfatal, but second-story falls may cause serious injuries (D. Tinsworth, US Consumer Product Safety Commission [CPSC], written communication, June 13, 1994).[5,7] The falls from greater heights tend to cluster in the summer months, presumably because windows are more likely to be open and children are more likely to be playing on fire escapes, roofs, and balconies.[5,7,8,10] Although the average age of patients injured in falls from heights is approximately 5 years, the age distribution is bimodal; preschool children usually fall from windows, and older boys fall from dangerous play areas, such as rooftops and fire escapes.[5,6,8,11] African American and Latino children are overrepresented in published series of falls from heights in which race or ethnicity is reported, probably reflecting their increased likelihood of living in urban, multiple-story low-income housing.[11,12] Overall, fall-related injuries to boys outnumber those to girls by approximately 1.5:1 to 2:1, as with most other injuries.[5,7,8,10–16]

The nature of the injuries to children when they fall from heights has been studied extensively.[11,13–17] Data from the CPSC on the approximately 4700 children who were examined in emergency departments because of falls from windows during 1993 indicate that 90% fall from the first and second stories and that 45% had injuries defined by the CPSC as "serious," such as fractures, internal injuries, concussions, intracranial hematomas, and intracranial hemorrhages. Of those injured, 28% were admitted to the hospital compared with 4% for all consumer product–related injuries reported to the CPSC during 1993. Approximately one third of children sustained only minor injuries, such as contusions, abrasions, and lacerations.[11] These are usually young children who fall 1 or 2 stories. Fractures are the most common of the serious injuries and the radius, ulna, and femur are the most frequent sites.[11,16,17] Rib, spine, pelvis, and calcaneus fractures are much less common among children than among adults. Children tend to use their arms to protect their heads, and they have relatively flexible bones.[11,15,17] Multiple fractures are common, especially those resulting from falls from greater heights. Craniocerebral trauma is frequent, particularly in fatal falls.[15,17] Abdominal and chest injuries are relatively uncommon in falls from 1 or 2 stories, but they are more frequent in falls from greater heights and in fatal falls.[5,10,15,17] In general, the greater the height from which the child falls, the more severe the injury. However, the nature of the surface onto which the child falls (concrete and trash are most common; softer surfaces improve outcome[13,14,18]) and the degree to which the fall is broken on the way down modify the pattern and sever-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

ity of injuries.[5,6,11,14–16,18] Children younger than 3 years are much less likely to have serious injuries than older children who fall the same distance. It is thought that, because younger children have more fat and cartilage and less muscle mass than older children, they better dissipate the energy transferred by the fall.[11]

Because witnessed falls of 2 stories or less usually do not result in serious injury, child abuse should be considered in children with serious injuries from falls that were reportedly from lower levels, especially if the fall was unwitnessed.[19–22] One large series reported that about one fourth of the falls were "not accidents"; some children jumped to avoid beatings or fires, some were pushed by siblings or parents, and some attempted suicide (all the suicide attempts were adolescents).[14]

Permanent physical sequelae—primarily orthopedic problems related to fractures and neurologic problems ranging from mild to severe—occur in 4% to 22% of children who survive serious falls.[10,11,13,14,17] One study reported a significant incidence of posttraumatic psychiatric and behavior problems.[14]

The economic costs of these injuries from falls are considerable. In Los Angeles County, where falls are possibly less frequent than in the northeast, the annual hospital charges from 1986 to 1988 were more than $600 000, or about $5000 per child admitted with fall-related injury; almost half of these charges were paid by public assistance.[14] Data compiled by the National Center for Health Statistics National Hospital Ambulatory Medical Care Survey for 1992–1994 revealed a national cost of $958 million for emergency care for children who were seen for falls. Although fewer than 3% were falls from buildings or extreme heights, they would still account for almost $10 million annually, including 26% paid by Medicaid.[23]

Case series have reported predisposing factors for fall injuries: a history of previous major unintentional injury to the patient or siblings; neurologic disorders, such as seizures, developmental delay or hyperactivity; and documented parental neglect.[5,8,10] The families of the victims are more likely than the general population to experience social and demographic factors such as poverty, single-parent households, inadequate child care, and acute stressors such as recent moves, illnesses, and job changes.[8] Some central-city residents may have moved recently from rural areas and may be unfamiliar with the hazards of living in multiple-story dwellings.[5]

PREVENTION

A number of strategies, some of which have documented effectiveness, have been suggested to prevent children falling from heights. Parent counseling has been effective in preventing infant falls and other injuries and should be part of any prevention program.[20,22,24–26]

Considerable success has been reported with modification of the physical environment. Spacing of railings determines how well they function to prevent falls from balconies, decks, porches, and bleachers. Widely spaced rails are ineffective barriers because they permit a child's body to slip through.[27] Virtually all children younger than 6 years can slip through a 6-in opening, and none older than 1 year can pass through a 4-in opening.[27] This information resulted in the adoption of the 4-in spacing by all 3 of the regional building code organizations in the United States. To prevent falls from balconies, the building codes in many communities now require railings through which a child cannot pass.[28] All local building codes dealing with new construction should be made to conform with the national codes that currently recommend 4-in openings between vertical (not horizontal) bars. Because the codes apply only to new construction, retrofitting of older dwellings also should be encouraged. Most codes specify railing heights of 36 in. Although an increase of railing height to 4 to 5 ft would add protection, aesthetic concerns are likely to impede any efforts for change.

Outside fire escapes are unnecessary in modern buildings that use fire-resistant techniques such as internal fire stairs, but it is unlikely that outdoor escapes can be eliminated from older housing, and is it unlikely that urban housing will be air-conditioned, reducing the need to open windows during hot weather. Providing safe ground-level play areas with climbing equipment has been suggested as a strategy for avoiding the falls from heights related to children playing on fire escapes and roofs.[6]

Because the majority of serious injuries are related to falls from windows,[13,14,17] strategies designed to prevent these falls should have a substantial effect. Modern window screens, although easily removable to allow for escape during residential fires, are designed to keep insects out of the house and do not provide a barrier to falls.[24] "Child safety" window screens made of steel are available and are used in new construction in some areas. These screens can withstand 67.5 kg (150 lb) of pressure, similar to the standard for window guards, and need replacing less often, but adding them to existing construction would be costly.

The installation of window guards is a proven preventive strategy. In 1976, the New York City Board of Health, noting that window falls accounted for 12% of deaths from unintentional injury of children younger than 15 years, passed a law requiring the owners of multiple-story dwellings to provide window guards in apartments where children 10 years and younger reside. This law was passed after the implementation of a pilot program combining education with the provision of free window guards. The pilot program resulted in a 35% reduction in deaths attributable to falls from windows and a 50% reduction in incidents; no child fell from a window equipped with a window guard.[7] The mandatory program resulted in a reduction of up to 96% in admissions to local hospitals for the treatment of window-fall-related injuries.[14] Follow-up through 1993 revealed a continuing downward trend.[29] Education is important for teaching the appropriate installation of window guards. Despite the proven effectiveness of window guards, other major cities have been slow to adopt similar codes. The building

code in Chicago requires window guards if the height of the window sill is less than 2 ft above the floor, but enforcement is reportedly ineffective.[10] A voluntary ordinance in Boston encourages but does not mandate landlords to install window guards. The first 2 years' data after initiating this program showed an 83% decrease in hospitalizations for the treatment of injuries attributable to falls from windows, and there were no deaths, compared with 3 deaths during the 2 years preceding the program.[30] A survey of building codes in several states found no regulations requiring window guards, although New Jersey has since passed a law similar to that of New York City.[31] Some states prohibit or limit window guards in the interest of providing fire egress.[13]

One survey of hardware stores found that the only devices available were specifically designed and advertised to keep intruders out; they were recommended for use on first floor windows.[13] These devices were expensive (approximately $50) and difficult to install.[13] Security devices are designed to keep people out, and window guards are designed to keep people in—except for necessary egress in the event of fire. It is easier to find inexpensive window guards (starting at $6) in cities where window guards are required, especially when public health programs have developed networks of stores that offer them. Window stops are available that prevent sliding windows from opening more than 4 inches. They are available at hardware stores for around $2 and are easy to install. Window guards can be obtained to fill the entire opening of a sliding or casement window. However, currently designed window guards are best suited for double-hung (sash-hung) windows. If the guard does not fill the entire opening of the window, additional devices, "L-stops," also are recommended to restrict the opening of the window above the top bar of the guard to no more than 4.5 in. L-stops are not to be used on windows designated for egress, that is, windows that are located less than 75 ft above the ground.[32]

Fire protection professionals have great concerns about the use of *fixed* window bars (security bars) that prevent egress or access by fire fighters. It is important to install *operable* window guards that can be released or removed without the use of a separate key or excessive force. Operable guards must be too difficult for a child to release but easy enough for an adult or teenager to release. Examples of operable guards include built-in bars that appear automatically as the window is raised, guards on a hinge that swing in when a "pin" is released, and a slide-out model that requires the simultaneous depression of 2 pins for removal. Fire codes in some communities prohibit the use of fixed bars on emergency and fire escape windows. Organizations of fire protection professionals decry their use, especially on first and second floors, but data are scarce that would permit the risk-benefit consideration of the use of operable guards, especially on higher floors.[33] Recent data on the New York City experience showed no increase in the number of deaths attributable to residential fires (in fact, there was a decrease) after the introduction of window guards as required by city ordinance.[29]

RECOMMENDATIONS

1. Pediatricians should give the following anticipatory guidance about prevention of falls from heights to parents of children who live in multiple-story dwellings:
   - Supervise small children at all times, especially if windows are open.
   - Install locks on windows to prevent sliding windows not intended for egress from opening more than 4 in.
   - Open double-hung windows from the top only.
   - Fixed guards, commonly used to prevent intrusion, should not be used, because they may prevent egress in the case of fire.
   - Install operable window guards on second- and higher-story windows (unless prohibited by local fire regulations). Window screens are designed to keep insects out, but because they are not strong enough to keep children inside, they will not prevent falls from windows.
   - Discourage or prohibit children from playing on fire escapes, roofs, and balconies, especially those that are not adequately fenced with vertical bars that have openings of 4 in or less. Encourage the use of ground-level safe play areas, such as public parks and playgrounds. Ideally, these areas have been inspected and found safe by a nationally certified playground inspector.
   - Avoid placing furniture, on which children may climb, near windows or on balconies.
2. Pediatricians should advocate for community-wide programs to encourage the use of window guards. Public health authorities, in conjunction with fire prevention officials, should guide such programs so that regulations may be based on concerns about both fire safety and fall prevention.
3. The American Academy of Pediatrics (AAP), state chapters, and local pediatricians should work with manufacturers of windows and window guards to encourage them to develop and make more widely available additional products that can prevent falls and allow egress in fires. Examples are windows that cannot be pushed out or up by a child and window guards with safety catches that can be operated only by adults.
4. Legislation requiring landlords to install releasable window guards or window stops above the ground floor in multiple-story dwellings where children live should be developed. Community outreach and education are important components of programs to prevent falls from heights. In many cities, the local government housing authority, a major landlord for low-income people, along with the AAP state chapters and local pediatricians, should take the lead in encouraging the installation of window guards.
5. Building codes should ensure that balconies, decks, porches, bleachers, roofs, and fire escapes have railings with vertical openings not greater than 4 in.

6. Local communities and recreation departments should develop strategies to reduce the number of children playing in dangerously high places. Such strategies might include the expansion of safe public playground activities, including child care and recreational programs, as well as attempts to make streets and public areas safer for children by implementing programs such as neighborhood watch and crime prevention.
7. Whenever possible, grass or shrubbery should be planted at the bases of tall buildings to soften the impact surface.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT
Guidance for the Clinician in Rendering Pediatric Care

Deborah Borchers, MD, and Committee on Early Childhood, Adoption, and Dependent Care

Families and Adoption: The Pediatrician's Role in Supporting Communication

ABSTRACT. Each year, more children join families through adoption. Pediatricians have an important role in assisting adoptive families in the various challenges they may face with respect to adoption. The acceptance of the differences between families formed through birth and those formed through adoption is essential in promoting positive emotional growth within the family. It is important for pediatricians to be informed about adoption and to share this knowledge with adoptive families. Parents need ongoing advice with respect to adoption issues and need to be supported in their communication with their adopted children.

ABBREVIATION. AAP, American Academy of Pediatrics.

CHANGING PICTURE OF ADOPTION

There are various types of adoption. In domestic adoptions and some intercountry adoptions, biological families may have continued contact of varying degrees with the child for whom they have chosen an adoption plan, ranging from complete confidentiality to unlimited direct contact.[1] A child may be adopted into a family of the same ethnicity and/or race or into a family with members of different groups.[1] Many children are adopted after having spent time with a family through the foster care system, often after lengthy stays in multiple homes.[1,2] Kinship permanency may be established by grandparents, aunts or uncles, siblings, or other relatives through legalized guardianships or adoptions or through informal nonlegalized agreements within a family.[1] Intercountry adoptions, which also may involve adoptions across ethnic and racial lines, also are increasing in number.[1]

Adoptive families are changing. Increasing numbers of single-parent families, blended families, families with gay or lesbian parents, and families with older parents are providing homes to children through adoption. More children are being placed long-term with relatives, who may or may not formalize the relationship through adoption.[1] Children may have had multiple sets of foster parents before their adoption, some of whom may maintain contact with the child after the adoption. Marked increases in the number of adoptions of children with special needs have been seen in the last 2 decades.[3] There are fewer newborns and more older children being placed for adoption. Sibling groups are often placed together. Many of the children who are in need of adoptive families have complex medical, developmental, behavioral, educational, and psychological challenges. These may be the result of biological or environmental stressors experienced while the child was living with the biological family or may have been initiated or exacerbated while the child was in temporary care.[4]

Modern technology has changed the face of adoption. Although not commonly viewed as such, surrogate parenthood and embryo adoptions are adoptive relationships.[1] The Internet has led to wider dissemination of information about children waiting for permanent families and has established a new system of support among adoptive families. Information about adoption on the Internet may not always be reliable, however, and the broad and instant reach of the World Wide Web also allows great potential for unethical practices in adoption.[5]

MEDICAL ISSUES

Children who join their families through adoption must have a comprehensive medical evaluation to identify medical needs. Standards for the medical care of children in foster care have been published by the American Academy of Pediatrics (AAP)[6] and District II of the AAP.[7] For children adopted internationally, this evaluation includes but is not limited to screening tests and assessment of immunization status as recommended by the AAP Committee on Infectious Diseases in the *Red Book*.[8] Acute and chronic medical problems, vision and hearing loss, and developmental delays should be identified and addressed. Behavioral and emotional concerns need to be evaluated aggressively with appropriate therapy initiated. Pediatricians should help families in accessing mental health and developmental services when needed.

Pediatricians may be asked to review preadoption medical and mental health records to help families understand the current and potential future medical,

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

developmental, and mental health needs of children they plan to adopt. This may include conditions related to complications of pregnancy, poor nutrition, prematurity, lack of prenatal care, and genetic diseases. In counseling families, all attempts should be made to obtain a complete medical and psychological history of the child, particularly in assessing potential special needs of a child. Through comprehensive preplacement assessment, parents should assess their resources and abilities to meet a particular child's needs. With the help of pediatricians, families then may be better able to negotiate adequate adoption subsidies including but not limited to educational needs and mental health insurance coverage.[9]

DEVELOPMENTAL UNDERSTANDING OF ADOPTION

Although parents and children gain so much in becoming a part of an adoptive family, children who join their families through adoption often experience issues of loss relevant to adoption.[10] Although these feelings of loss may be more rooted in societal expectations of genetically based attachments rather than in any inherent biological loss, they nonetheless are experienced by many adopted people.[11]

Just as a child's thinking and self-concept change at various stages of development, so does a child's understanding of the meaning of adoption. Until 3 years of age, most children do not realize there is a difference between their adoptive family and families in which children are reared by their biological parents.[12] From the time a child is adopted, it is appropriate for families to use language on a routine basis that relates to adoption, laying the groundwork for children to later understand these abstract concepts. There are many books on adoption for even young children. Through the use of available resources as well as pictures about a child's own adoption story, parents should relate to children the story of how their family came to be. These foundations are important in the later development of positive attitudes about adoption, a child's birth parents, and himself or herself.[13]

By about 3 years of age, however, children become self-absorbed and may believe that they magically cause all things that happen to them.[13] Children love to hear their adoption stories. At this age, most children begin to ask questions about what adoption means, yet children adopted at a very young age do not understand that they have another family besides the family with whom they live. Separation issues may be more pronounced than they are in peers, especially with children who remember the loss of biological or foster parents, siblings, or other relatives.[13] Children at this age may feel responsible for the loss of their first family as well as for the repeated losses through moves in and out of foster care. They may fear that their adoptive parents will abandon them in the same way once their hidden flaws are discovered.[13] Some children may express yearnings to have been "in the belly" of their adoptive mother.[12]

By the time children enter kindergarten, they realize that most of their peers are not adopted. They also learn that some children may be living with biological parents in circumstances that are similar to those experienced by their own biological parents (eg, single-parent families or conditions of poverty). This, once again, may lead children to feel responsible for their biological parents' decision not to raise them.

School-aged children continue to face issues associated with adoption, although often they deal with them by going "underground." Although children in this stage may not ask questions or initiate discussion of issues related to adoption, they still are most likely thinking about them.[13] When children are 6 to 12 years of age, they realize that, in gaining an adoptive family, they have also lost a biological family.[14] At the same time, school-aged children may identify with their biological families, fantasizing about what life would have been like if an adoption plan had not been made for them. During middle childhood, children (particularly children adopted across racial and/or cultural lines) may become upset by the differences they notice in comparison with other children and may experience denial of these differences as well as of the adoption itself.[13] Self-esteem issues may also complicate emotions and the thinking process during these years, because some children may wonder what flaw in them resulted in their biological parents making an adoption plan. This may be particularly true if the biological parent(s) chose to rear a sibling.

During preschool and elementary school years, peer and school problems may or may not be the manifestation for underlying adoption issues. Behaviors commonly identified as characteristic of attention-deficit/hyperactivity disorder may actually be signs of posttraumatic stress disorder, reactive attachment disorder, bipolar disorder, or sensory integration disorder. Some school assignments may be problematic for children who have joined their family through adoption. Children who have lived in foster care or in another country may not have pictures of themselves from birth or at an early age. Family tree assignments may be difficult, because children may be unsure of how to demonstrate their relationship to their biological family, adoptive family, and foster families. Information about biological ancestors also may be unavailable to the child for such a project. Tracing genetic traits through generations may be difficult even for children who have an ongoing relationship with their biological families. For children adopted by an extended family member, these simple learning assignments may create anxiety by highlighting family differences.[1,13] Communication with educators about adoption issues at this age, as at other ages, may be necessary to help children deal with some of these difficult school assignments and insensitive comments about adoption, family circumstances, culture, race, and ethnicity.

As adolescents develop their identity and begin the task of separation and individuation, adoption issues commonly become very important. At 12 to 16 years of age, many adolescents become angry over the differences between their own life experiences

and society's norm of an intact family. Adolescents may continue to fantasize about their "perfect" biological family. Older adolescents may also struggle with dating issues (as do all adolescents), but in these particular relationships, they may look to identify with their biological families even more. This may include engaging in risk-taking behaviors similar to those that may have led to their conception, such as unprotected sex, or those that played a part in the biological parent's (or parents') decision to make an adoption plan, such as substance abuse. Adolescents may try on identities similar to those of their biological families whether known or imagined. This may include changes in physical appearance, religion, and customs.[13] As adolescents head toward emancipation from their family, separation may come to the forefront. A child who was adopted at an early age may experience emotional uncertainty at the thought of moving away from the adoptive family and home.[13]

LOSSES IN ADOPTION

All members of the adoption triad—the child, the adoptive family, and the biological family—are affected by losses. Children in closed adoptions may lose the sense of their own original identity as well as ties to those with whom they share genetic links. Even children in open and kinship adoptions are aware of the way in which their families are different and will process this knowledge in different ways at different ages. Adoption may also represent loss to adoptive parents. Some adoptive parents have faced infertility, so they too may grieve the loss of genetic links to their child. In confidential adoptions, biological parents have an obvious loss of a relationship with the child they have conceived. Even in open adoption relationships, biological parents may feel the loss of not being in a parenting role with a child they conceived. Some pediatricians may also be involved in supporting a pregnant adolescent who makes an adoption plan. Through understanding and acknowledgment of these losses, adoptive families, children, and biological families are able to adapt better and build healthier families.[15]

COMMUNICATING ABOUT ADOPTION WITH CHILDREN

Even before a child understands the words "adoption," "adopted," and "biological family" or "birth family," it is important that these words be a part of a family's natural conversation, whether the adoption is open or confidential, kinship, or foster-adoptive placement.[13] Families should be discouraged from "waiting until just the right minute" to tell children that they were adopted, because this may leave children feeling betrayed and wondering what else their parents may have hidden from them.[13] Children may also learn information from peers or neighbors, which may impair the trust between parent(s) and child. It is important to share with even very young children their adoption story, starting with their birth, not the adoptive family's initiation of the adoption process.[14] An honest approach in the discussion of a child's biological family and the adoption process will give a child permission to ask questions or to make statements about adoption and at the same time will take away the veil of secrecy that often implies that being adopted is a negative condition.[12]

Some information in a child's past may be private or difficult for the parent to share with the child. Open discussion with a child is important in building bridges of trust and security within a family. Even the most difficult information, such as previous sexual or physical abuse or having been conceived in the context of rape or incest, eventually should be shared with a child at a developmentally appropriate age.[13] The child and parents should be counseled regarding the child's privacy about facts pertinent to the adoption. The parents and the child need to be cautioned that once information is shared, it cannot be taken back.[14] Parents should guide children in what they will share with strangers, friends, and extended family. Facts shared with children about their adoption should always be accurate, and adoptive parents should admit when information is not available.[13] As children age, they should have control over telling their adoption history outside the family.[13]

Some parents who have dealt with infertility may be uncomfortable with the reality that their child has another family, another set of parents.[14] Thus, issues of loss in the adoptive family may continue after the child is adopted into the family.[12] Avoidance of discussion about the biological family will deprive children of the opportunity to ask questions, openly fantasize, or understand having a family outside of the one in which they live and may give children the perception that their thoughts and questions about adoption are bad.[13] It is important to tell a child that he or she was not "given up" but rather that the biological family made an adoption plan in the best interest of the child's future and to the best of their abilities at the time. As children grow in their understanding of the relationship with their biological family, they may become concerned that just as they were "rejected" by their biological family, their adoptive family may also reject them.[12,13] Adoptive parents may need to verbalize their commitment to their child frequently. A "life book," a compilation of all (difficult and happy) that is known about a child's history, can be an effective tool for parents to use in helping a child to process all the thoughts and feelings about his or her adoption story.

RACIAL, ETHNIC, AND CULTURAL DIFFERENCES

Children adopted by parents of a different race, ethnicity, or cultural background may have other concerns specific to their identities. Even children as young as 3 or 4 years of age will be aware of the physical differences between themselves and members of other racial groups.[16] When these children live in communities where they are members of an ethnic minority, the differences in racial identity will be easily apparent to classmates, other parents, and strangers. As these children enter preschool and elementary school, peers may ask questions about their biological and cultural heritage. As children

reach the developmental stage of wanting to be just like their peers, these questions may provoke a variety of responses. Some of these responses might seem to the casual observer to be out of proportion for the information requested. Some remarks may be taunting or intrusive.[13] Children may encounter racist remarks for the first time, particularly in situations in which they are not physically or emotionally safeguarded by their parents.

Families need to acknowledge openly the racial differences that exist between their child and themselves. Relationships with others of the same race or ethnic group, including adults and children, may be very helpful to a child.[16] Whenever possible, an adopted child should be given the opportunity to learn more about the heritage of the country of his birth or of his ethnic group.[13,16] Role-playing with children with respect to stereotypes and racist statements may help them to feel in control when they encounter inevitable comments from strangers, friends, or extended family members.[15] Parents who have not experienced racism personally may need to pay extra attention to teaching their children effective ways to respond to racism.

SPECIAL ISSUES IN KINSHIP ADOPTION

For children who are placed for foster care or adoption within their biological family, separation issues are lessened. At the same time, these relationships present particular challenges for a family. There may be a reluctance of other family members to confirm the adoptive parents as the child's actual parents, and reference may be made within the family setting to a child's "real" parents. Boundaries must be set regarding the type of contact, timing, and granting of parental responsibility to the biological parents. All family members may need to be reminded that the adoptive parent is the responsible parent. Family gatherings may provide particular challenges, especially in cases in which the biological parents' rights have been involuntarily terminated. Many kinship adopters have limited contact with support groups, and there may be a tendency to "keep it in the family," especially with respect to the open discussion of family secrets that led to the placement of the child with a family member. Grandparents who become adoptive parents may grieve the loss of the vision of their own children as parents while coping with the stresses of raising children again and dealing with the circumstances of the reason the child was placed with them.

It is important that pediatricians provide support to these families, particularly in the area of validating the adoptive parents' rights to make decisions for the child. Kinship adoptive parents may be reluctant to share with the child painful information involved in the circumstances leading to the separation from the biological parents. Failing to share the truth with the child will only lead to damaged trust and increase anxiety for the child. The biological parents and kinship adoptive parents must communicate about the sharing of information and what language will be used, keeping in mind the child's developmental stage. Through contact with local child welfare agencies and other community resources, financial assistance, respite care, and support services for families with a kinship adoptive placement, whether formal or informal, may be available.[13]

DIFFICULT TIMES

"Anniversary reactions" often occur in adopted children at certain times of the year.[13] On Mother's Day, children may think about the many mothers they have had, including their adoptive mother, biological mother, and foster mothers.[13] On birthdays and adoption days, children may seem depressed and withdrawn instead of joyful. These anniversaries may trigger thoughts of the biological family, and children may wonder whether their biological parents still love them or even think about them. Sensitivity, particularly at these significant times, may help a child in dealing with difficult adoption issues.[13]

SEARCHING FOR BIOLOGICAL FAMILY AND CULTURAL TIES

As children age into adolescence and adulthood, adoptive children may wish to seek out more information about their biological families.[10] Individuals who joined their families through international adoption may choose to make a trip to the country of their birth. Domestic adoptees may pursue reunification with biological relatives through a reunion registry, may choose to reestablish ties in a lapsed open adoption, or may develop a stronger interest in understanding kinship ties. Although some adoptive parents may view their child's searching for his or her biological family as a sign of rejection, it is actually a sign of healthy emotional growth in the search for an identity.[14] All members of the adoption triad may need the help of mental health professionals to work through these situations. Pediatricians are encouraged to become aware of local community resources for adoptive families, including resources for locating information about biological families, support groups, adoption conferences and services, and mental health professionals.

MODELING POSITIVE ADOPTION LANGUAGE

Pediatricians are encouraged to model positive adoption language for all families. Adoptive families are "real" families; siblings who joined a family through adoption are "real siblings." Biological parents do not "give up a child for adoption," which might imply to the child that he or she was of less worth and was given away. Rather, they "make an adoption plan for a child." A biological mother should not be identified as a "natural parent," as this implies that adoptive families are "unnatural." A child's racial identity, adoption, or birth in another country should never be the identifying characteristics for any child. It is never appropriate to ask how much a child "cost." In modeling positive adoption language, pediatricians can use vocabulary that reflects respect and permanency about children and their families.[13]

As more children each year become part of permanent families through adoption, it is becoming in-

creasingly important for pediatricians to be aware of and knowledgeable about adoption. Pediatricians play an important role in helping families deal with the differences, the losses, and the many other issues surrounding the adoption of a child. Pediatricians are encouraged to have a greater understanding about adoption to be able to advise and support parents as they communicate about adoption with their children. It is also important for a pediatrician to remind families of the importance of forthright communication about adoption. Open acknowledgment of the adoptive relationship helps to nurture a child's self-esteem as he or she grows in the understanding of what it means to join a family through adoption. Effective communication about adoption is important for the long-term mental and physical health and well being of each child and family.

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RESOURCES

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT
Guidance for the Clinician in Rendering Pediatric Care

William L. Coleman, MD, Craig Garfield, MD, and the Committee on Psychosocial Aspects of Child and Family Health

Fathers and Pediatricians: Enhancing Men's Roles in the Care and Development of Their Children

ABSTRACT. Research substantiates that fathers' interactions with their children can exert a positive influence on their children's development. This report suggests ways pediatricians can enhance fathers' caregiving involvement by offering specific, culturally sensitive advice and how pediatricians might change their office practices to support and increase fathers' active involvement in their children's care and development. ***Pediatrics*** **2004;113:1406–1411;** ***father's roles, families, child care, pediatrician's roles.***

Over the last 30 years, fathers' roles in caring for their children have been expanded by rapid and profound socioeconomic changes and by society's evolving perceptions and expectations of fathers' roles. "Father" in the United States means more than "wage earner" or "provider" and now can include stay-at-home dad, caregiver of child, and sharer of child care responsibilities. It even may include a grandfather caring for his grandchild. There is increasing recognition of the benefit to the child of the father's role in providing love and support to the mother or, when the spouse is not the biological mother, the partner. Recent increases in immigration and growing cultural diversity are 2 more sources of change in the roles, expectations, and involvement of fathers. A father may be a biological, foster, or adoptive father; he may be a stepfather, grandfather, adolescent father, father figure, or coparent father in a gay relationship; and he may be custodial or noncustodial, resident or nonresident, near or far. For purposes of this report, father is defined broadly as the male identified as most involved in caregiving and committed to the well-being of the child regardless of living situation or biological relation.

In response to changing expectations, diversity, and changing demographics (ie, more fathers assuming increased child care responsibilities), pediatricians need to broaden their understanding of fathers' roles and fathers' own expectations and appropriately modify their clinical style and office practices to accommodate and support fathers' expanding roles.

A substantial proportion of children in America (ie, 30% of white children, 42% of Hispanic children, and 69% of black children) are born to unwed mothers.[1] In these cases, pediatricians especially need to remind mothers of fathers' unique influence on a child's development, regardless of whether the parents are married, and encourage mothers to include fathers in the next visit(s) and in the care of the child. In addition to the common caregiving tasks, each father makes different and unique contributions to the child-father relationship and to family functioning. Validating, nurturing, and capitalizing on the father's contributions to the child's well-being and to the parents' relationship are major goals for those involved in caring for children.

Despite new expectations, related responsibilities, and evidence-based knowledge (scientific studies) regarding fatherhood, many men still enter fatherhood with little idea of their new role and how it will affect their own lives. They may be unprepared for the challenges of fatherhood yet excited to take up the task. Some may lack role models or previous experience with caregiving responsibilities; others may fail to realize the importance of their involvement to their children and families. Consequently, fathers may or may not be motivated to learn. With appropriate encouragement and specific supports, however, many fathers may become avid, successful learners and providers. Pediatricians are perceived as ideal teachers, role models, moral authorities, and supporters of families in this stage of the family life cycle at which men become fathers.

Pediatricians are necessarily concerned with both the child's and family's well-being, knowing full well that families are the single greatest and most enduring influence on children. They are uniquely positioned to enhance the father's involvement, inform the family about the father's special influence on his children's development, and encourage the father to support the other parent. In so doing, pediatricians enhance and support the multiple roles of fathers in their child's development, the father-child relationship, and healthy family functioning and well-being.

GOALS

The goals of this clinical report are to:

1. Describe the socioeconomic forces that have changed society's expectations of fathers' roles;

2. Explain how fathers' interactions with their children uniquely influence their children's development; and
3. Offer pediatricians specific advice on:
   - How to help fathers increase their caregiving and involvement;
   - How to help fathers and mothers support each other's roles as parents; and
   - How to change their clinical styles and office practices to promote, support, and increase fathers' active involvement in their children's care and development.

THE INCREASING PRESENCE OF FATHERS IN THE LIVES OF CHILDREN: SOCIOECONOMIC FORCES

Pediatricians see more fathers today than they have in the past as more fathers in 2-parent families or in shared-custody arrangements are spending more time with their children and beginning to attend more office visits. This national trend has the potential to strengthen the father-child relationship, stimulate the child's development, ease the mother's or partner's workload, and strengthen the overall family functioning. Several factors contribute to this trend.

- The number of father-only households (no wife or partner in the home) increased almost 25% from 1995 to 1998, to 2.1 million households.[2] The 2000 US Census revealed father-only households increased to 4.3 million, or 4.2% of US households. In Illinois alone, the number of children living in father-only households increased by 109%, from 47 000 in 1985 to 98 000 in 1995.[3] Although the total number is small, the rate of change is significant. Additionally, father-only households seem to be headed by fathers who are highly involved in their children's lives at home and school.[4]
- Economic shifts over the past 30 years increasingly place women in the workplace, often in higher paying jobs than their male partners. Subsequently, many men spend more time at home taking care of their children. For example, most mothers prefer the father to be the child care provider if the mother cannot provide the care.[5] Additionally, married men are likely to be the primary caregivers of their children during the mother's working hours if the family is poor, if the father is unemployed or working part-time, or if the children are younger.[6]
- The average amount of time fathers in 2-parent families spend with their children, directly engaged or accessible, has increased in the last decade to 2.5 hours per weekday and 6.3 hours per weekend.[7]
- In divorced families, a plan for shared-custody arrangements developed by both parents during divorce proceedings increases opportunities for the father to be more involved in his children's care.
- Changing technology in the marketplace, telecommuting from home, and making use of flexible work hours provides more opportunities for fathers to spend more time with their children and families.
- The media and popular culture reflect and positively reinforce fathers' increased involvement in the care and development of their children. Father birthing classes have sprung up in hospitals across the country. General parent magazines, special magazines, Web sites, and newspapers (both paper and Web based) increasingly are targeted at fathers and champion men who have taken to the "daddy track." Many daily and Sunday newspapers feature comic strips based on fathers' involvement and good-hearted foibles at home. Several celebrities, Paul Reiser, Bill Cosby, and Al Roker included, have written books describing their experiences.[8–10] This media emphasis, coupled with cultural image changes and products such as infant-joggers and snugglies that encourage men's participation, reflect the growing trend of fathers caring for and interacting with their children. Meanwhile, scholarly works continue focusing attention on the role and importance of fathers in their children's social and emotional well-being.[11–19]

FATHERS' INFLUENCE ON THEIR CHILDREN'S DEVELOPMENT: SCIENTIFIC EVIDENCE

Fathers' interactions exert a powerful influence on every domain of their children's functioning beginning at infancy. Recent research substantiates how fathers impact their children's social, emotional, and cognitive development. For example, in the first few days of life, many newborn infants turn their heads preferentially to their father's voices versus the voice of a stranger.[20] Premature infants who experience increased visits from their fathers have improved weight gain during hospitalization and score higher during the first 18 months of life on adaptive-behavior and social-development tests, even after controlling for levels of prematurity and hospital stay.[21] In a study of premature black infants, the father's involvement enhanced the child's cognitive and behavioral outcomes.[22]

Mothers and fathers influence their children in similar ways with regard to development of morality, competence in social interactions, academic achievement, and mental health. However, father involvement is of a different nature than mother involvement. In terms of relative frequency, fathers devote more time to playing with their children than do mothers. When children are young (0-4 years old), fathers tend to engage in more tactile physical and stimulating activities. As children enter middle childhood (the school-aged years), fathers engage in more recreational activities such as walks and outings as well as private talks. Fathers also have a strong influence on their children's gender role development and are important role models for both girls and boys.[23,24]

The long-term effects of fathers' direct involvement in the care of their children manifest through childhood and adolescence. For children with a father figure, those who described greater father support had a stronger sense of social competence and fewer depressive symptoms.[25] Although time spent with children is usually less for fathers compared

with mothers, studies show that shared activities between fathers and their children are independently associated with improved academic performance.[7,26] Adolescents who perceive their fathers as encouraging and involved in their lives have higher college entrance examination scores, reach higher economic and educational attainment, show less delinquent behavior, and possess greater psychologic well-being.[27,28]

THE FATHER'S ROLE IN FAMILY FUNCTIONING

Fathers positively influence the behavior and relationships of the mother or other parent, siblings, and other family members. For example, fathers play an important role in the initiation, support, continuation, and ultimate ongoing success of breastfeeding.[29–35] Father involvement also stabilizes and promotes healthy family functioning. Fathers, as much as mothers, can and often do provide affection, nurturing, and comfort to their children. As teachers, disciplinarians, and role models, fathers assume some of the responsibility for teaching their children what they need to know for life-survival skills and for school learning. These lessons may come in the form of teaching about letters, numbers, and shapes; helping the school-aged child with homework; coaching the child in an athletic skill or hobby; teaching manners and social skills; and encouraging a healthy lifestyle. Rituals that involve special time with fathers, such as homework, play, sports activities, bathing routines, bedtime rituals, household chores, shopping, or reading together, also help strengthen the father-child bond. Such involvement may even prove to be protective. In families in which even mild levels of maternal depression exist, for example, a nurturing father-child relationship counteracts behavioral and interactional problems often associated with maternal depression.[36–38]

THE FATHER'S ROLE IN SUPPORTING THE OTHER PARENT IN THEIR RELATIONSHIP

The emotional support a father provides to the other parent helps in practical ways with the care of children. Parents who feel loved, appreciated, and supported as spouses or partners tend to parent with more demonstrations of love, approval, and support and communicate better with their children. Maintaining and nourishing the spousal or partner relationship helps improve the marriage and parenthood (eg, remembering special occasions, bestowing compliments, demonstrating affection, and taking time together as partners).[39–43] When parents are separated or unmarried, a positive, supportive relationship with the mother or other parent is an important predictor of children's successful adjustment to their family structure.

In general, mothers' support and encouragement of fathers is a key predictor of fathers' involvement with their children.[44,45] Mothers may actively oppose or quietly resist involvement or sharing household responsibilities for reasons of efficiency (things are done faster if she does it), quality (she does a better job), sympathy (not wanting to bother the father), admiration (he has done enough), anger (a by-product or after-effect of marital estrangement), or cultural beliefs in gender roles.[45] Thus, in some cases, fathers may desire more involvement, but mothers themselves may discourage greater paternal involvement. Mothers who feel supported themselves as mothers are more likely to support and encourage the father's involvement in the care of the child.

In families experiencing divorce, the relationships between father, mother, and children can become especially strained.[46] Divorce affects children's relationships with their parents and their sense of trust, acceptance, and support, creating feelings of loss and sadness.[47] The quality of the parents' pre- and post-divorce relationship plays a significant role in the child's emotional and social response and the father's involvement with his children. The quality of a father's parenting has been found to be inversely related to sibling conflict, adolescent depression, delinquent behavior, and affiliation with deviant peers.[48] Yet, there is a negative relationship between divorce and the quality of father's parenting; in other words, divorce can lead to less quality parenting by fathers, compounding the aforementioned problems.

There are situations, however, in which divorce can improve paternal involvement. In these situations, positive changes in the father-child bond are a result of increased opportunities to relate to the child in a conflict-free atmosphere.[49] Fathers may find themselves in the role of primary caregiver and, for the first time, engaging the health care system. Keeping both parents apprised of the child's health and involved in the child's life as well as keeping track of the emerging important adult figures in the child's life becomes part of the pediatrician's responsibilities.

THE PEDIATRICIAN'S ROLE

Many fathers want to be more involved in caring for their children. Pediatricians can help fathers learn to play a variety of roles in the family. Expanding on more than the stereotypical roles of the father as financial supporter and offering glimpses into the possibility and benefit of more roles for fathers suggests to the family that these roles are not in competition with those of mothers. In fact, these fathers' roles enhance and support mothers' roles. Furthermore, a father's additional roles serve to support the overall needs of the family and make parenthood more gratifying for both parents. Professionals caring for children need to be aware of these roles and of the greater social and cultural backdrops against which these roles may be played. A father from one family may be expected culturally to meet with the pediatrician and direct most conversations, and another father from a different culture may be expected to meet his child's pediatrician rarely or never. Given these family, social, and cultural variants, it is still largely true that pediatricians seldom get to know fathers as well as they do mothers.

Pediatricians usually see mothers and children in the office and may not be accustomed to or even comfortable with seeing fathers. Pediatricians can easily adapt their practices to accommodate fathers. The following advice will guide pediatricians in en-

couraging a father's involvement and participation in office visits by letting him know he is welcome in the office and the health care system more generally. Pediatricians are encouraged to make special efforts to engage fathers who are separated from the family.

Pediatricians who understand parental expectations and the family's cultural traditions and values and who respectfully explore and encourage the father-child relationship in pediatric visits are more likely to form a good rapport with fathers and make them feel welcome, which in turn conveys to fathers that they are important to their child's development and encourages them to be more active in the care and activities of their children. Encouragement from the child's advocate, the pediatrician, is a powerful message to fathers about their expanded and critical roles in their children's lives.

In this report we have explained some of the socioeconomic factors that place fathers in a changing, often more prominent position in the care and development of their children and in their support of the spousal or partner relationship. Compelling recent evidence reveals that fathers' involvement with their children will continue to increase as more women enter the workforce and men seek greater involvement at home. Pediatricians are uniquely qualified and placed to help fathers by encouragement, by practical advice, and by educating men, women, and their families about the benefits of positive father involvement for 1) the care and development of their children, 2) the other parent's well-being, and 3) healthy family functioning.

ADVICE FOR PEDIATRICIANS

Make Your Practice More Father-Friendly

1. Offer flexible and extended office hours (eg, late afternoons, evenings, weekends, and early mornings) to accommodate parents and encourage their attendance.
2. Actively encourage fathers to come in for at least one of the initial well-infant or acute-illness visits in the infant's first 2 months of life and more if possible.
3. Welcome fathers and express appreciation for their attendance. Speak directly to the father as well as the mother or partner and solicit his opinions. Encourage office staff and nurses to include fathers in the office-visit appointment.
4. Introduce yourself to the father and the mother or other parent. Politely explore the father's relationship to the other parent (eg, married, living together), his cultural traditions, and his own personal beliefs about his role in caring for the child. Assess differences in parenting beliefs and help them negotiate if necessary.
5. Learn something about the father's role and beliefs (eg, how he was parented, expectations and hopes for his children, his previous marriages, other children and how he parented them). Keep the discussions focused on the parenting context and the father's roles and beliefs; minimize small talk.
6. Actively engage the father in the office. For example, tell the father: "As your child's pediatrician, I want to know you and work with you and your child's [mother or other parent] to offer the best care for your child."
7. If the father is not involved in the dialogue, address him directly, asking him if he has specific questions or concerns. Solicit his opinions about child rearing, sharing responsibilities, and his perceived roles. Ask each parent about his or her transition to parenthood. For example, ask: "How is parenting going for each of you?"
8. Ask the parents how they support each other as parents, spouses or partners, and individuals.
9. Recognize that mothers and fathers may not always agree on how best to raise a child. For example, parents may disagree on the approach to discipline or issues of firearm safety. Pediatricians can serve as a mediator in such discussions, meeting with both parents or caregivers together to discuss these and other behavior-management issues and should avoid (whenever possible) siding with one parent or the other on important parenting issues.
10. Participate in educational opportunities (eg, courses, continuing medical education activities, medical literature) devoted to fathers' role issues, parental depression, and family functioning to enhance training and education in this area.

Understand the Family

1. Explore the family composition, cultural beliefs, overall mental and physical health, and delegation and discussions of child care tasks within the family. If parents are not both in the household, discuss living and custody arrangements as well.
2. In addition to discussing the feelings of joy and fulfillment having a child can bring, also be prepared to discuss issues of the allocation of child and sibling care and the common experiences that siblings and parents encounter with conflict, jealousy, and normal disappointments in connection with the arrival of a new infant.
3. Be sensitive to and informed about diverse cultural and ethnic values and customs, especially "traditional" father roles. Pediatricians can determine the extent of the father's responsibilities and presence at home by respectfully exploring these issues with parents.
4. Use a "parenting history" to help parents understand their behaviors by understanding how they themselves were parented. Parents often adopt a parenting style to compensate for their own childhood deficiencies or to emulate childhood experiences depending on their own parenting experiences.
5. Discuss how the couple is adapting to parenthood (with each child). Asking questions such as "How is your relationship (or the family) adjusting to the new infant?" or "How is it living with a teenager?" opens the door to reflection and discussion and can remind parents of the importance of their own partner relationship and the need to nurture and maintain it. Encourage parents to continue to dedicate time for adult activities without children.

Empower, Engage, and Inform Fathers of the Importance of Their Involvement

1. Remind the family that fathers are not only workers or breadwinners and mothers or partners are not only nurturers or primary providers of child care. They share these roles, complementing one another, often to the benefit of the child.
2. As early as in the delivery room or nursery and if culturally appropriate, fathers can be given responsibilities for caring for and making decisions regarding the child.
3. Encourage fathers to assume some roles in the care of the child, and encourage the mother to let the father be involved and learn from his own mistakes. Early time alone with the child helps a father gain confidence and develop his own style of interaction and provides a mother or other parent with much-needed time alone.
4. Determine how comfortable the father is with his parenting skills and whether he has concerns.
5. Explore with the father ways to decrease maternal stress. This might include his helping with meals or household chores, the involvement of other family members with household tasks, or the hiring of household help.
6. Identify institutions and policies that facilitate fathers' involvement and work-family balance. Encourage child care centers, support groups, and schools to involve and include fathers. Promote the use of policies such as the Family Medical Leave Act (codified at 29 CFR §825 [1993]) and flexible work schedules as ways to balance employment and family responsibilities.

Reinforce the Father's Support of the Mother or Partner

1. Inform the family about the normal elation, fatigue, and challenges of being a father. Discuss openly the usual interruptions in sleep for the whole family, the decreases in energy, the alterations in time together as a couple and individual free time, and the changes in intimacy and the sexual relationship. This may be the first time some fathers will have discussed these issues openly.
2. Look for signs of maternal depression (postpartum depression in the newborn period) and be able to offer resources to help.
3. Explore marital stress and inquire about the marriage or partner relationship. For example, you may ask: "How has the birth of this infant affected your relationship?"; "To whom do you turn for advice and support?"; and/or "Would you like a referral to talk to someone else who can help (individual or couples therapy and/or medication)?"
4. Educate fathers about the practicalities of breastfeeding and how to support mothers' nursing.
5. Encourage fathers to provide or protect time for mothers to have time to be alone, exercise, meet friends, or simply relax.

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SUGGESTED WEB SITE RESOURCES ON FATHERING

US Dept of Health and Human Services Fatherhood Initiative. Available at: http://fatherhood.hhs.gov/index.shtml
Fathering Magazine. Available at: www.fathermag.com
National Fatherhood Initiative. Available at: www.fatherhood.org
Center for Successful Fathering. Available at: www.fathering.org
National Center for Fathering. Available at: www.fathers.com
Slowlane.com: The Online Resource for Stay at Home Dads. Available at: www.slowlane.com
Bootcamp for New Dads. Available at: www.newdads.com
Dads Can. Available at: www.dadscan.org
National Center on Fathers and Families. Available at: www.ncoff.gse.upenn.edu
Illinois Fatherhood Initiative. Available at: www.4fathers.org

American Academy of Pediatrics
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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Fever and Antipyretic Use in Children

abstract

Fever in a child is one of the most common clinical symptoms managed by pediatricians and other health care providers and a frequent cause of parental concern. Many parents administer antipyretics even when there is minimal or no fever, because they are concerned that the child must maintain a "normal" temperature. Fever, however, is not the primary illness but is a physiologic mechanism that has beneficial effects in fighting infection. There is no evidence that fever itself worsens the course of an illness or that it causes long-term neurologic complications. Thus, the primary goal of treating the febrile child should be to improve the child's overall comfort rather than focus on the normalization of body temperature. When counseling the parents or caregivers of a febrile child, the general well-being of the child, the importance of monitoring activity, observing for signs of serious illness, encouraging appropriate fluid intake, and the safe storage of antipyretics should be emphasized. Current evidence suggests that there is no substantial difference in the safety and effectiveness of acetaminophen and ibuprofen in the care of a generally healthy child with fever. There is evidence that combining these 2 products is more effective than the use of a single agent alone; however, there are concerns that combined treatment may be more complicated and contribute to the unsafe use of these drugs. Pediatricians should also promote patient safety by advocating for simplified formulations, dosing instructions, and dosing devices. *Pediatrics* 2011;127:580–587

Janice E. Sullivan, MD, Henry C. Farrar, MD, and the SECTION ON CLINICAL PHARMACOLOGY AND THERAPEUTICS, and COMMITTEE ON DRUGS

KEY WORDS
fever, antipyretics, children

ABBREVIATIONS
NSAID—nonsteroidal anti-inflammatory drug

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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INTRODUCTION

Fever is one of the most common clinical symptoms managed by pediatricians and other health care providers and accounts, by some estimates, for one-third of all presenting conditions in children.[1] Fever in a child commonly leads to unscheduled physician visits, telephone calls by parents to their child's physician for advice on fever control, and the wide use of over-the-counter antipyretics.

Parents are frequently concerned with the need to maintain a "normal" temperature in their ill child. Many parents administer antipyretics even though there is either minimal or no fever.[2] Approximately one-half of parents consider a temperature of less than 38°C (100.4°F) to be a fever, and 25% of caregivers would give antipyretics for temperatures of less than 37.8°C (100°F).[1,3] Furthermore, 85% of parents (n = 340) reported awakening their child from sleep to give antipyretics.[1] Unfortunately, as many as one-half of parents administer incorrect doses of antipyretics; approximately 15% of parents give supratherapeutic doses of acetaminophen or ibuprofen.[4] Caregivers who under-

stand that dosing should be based on weight rather than age or height of fever are much less likely to give an incorrect dose.[4]

Physicians and nurses are the primary source of information on fever management for parents and caregivers, although there are some disparities between the views of parents and physicians regarding antipyretic treatment.[1] The most common indications for initiating antipyretic therapy by pediatricians are a temperature higher than 38.3°C (101°F) and improving the child's overall comfort.[5] Although only 13% of pediatricians specifically cite discomfort as the primary indication for antipyretic use,[6] this intent is generally implied in their recommendations. Most pediatricians (80%) believe that a sleeping ill child should not be awakened solely to be given antipyretics.[5]

Antipyretic therapy will remain a common practice by parents and is generally encouraged and supported by pediatricians. Thus, pediatricians and health care providers are responsible for the appropriate counseling of parents and other caregivers about fever and the use of antipyretics.[7]

PHYSIOLOGY OF FEVER

It should be emphasized that fever is not an illness but is, in fact, a physiologic mechanism that has beneficial effects in fighting infection.[8–10] Fever retards the growth and reproduction of bacteria and viruses, enhances neutrophil production and T-lymphocyte proliferation, and aids in the body's acute-phase reaction.[11–14] The degree of fever does not always correlate with the severity of illness. Most fevers are of short duration, are benign, and may actually protect the host.[15] Data show beneficial effects on certain components of the immune system in fever, and limited data have revealed that fever actually helps the body recover more quickly from viral infections, although the fever may result in discomfort in children.[11,16–18] Evidence is inconclusive as to whether treating with antipyretics, particularly ibuprofen alone or in combination with acetaminophen, increases the risks of complications with certain types of infections.[19,20] Potential benefits of fever reduction include relief of patient discomfort and reduction of insensible water loss, which may decrease the occurrence of dehydration. Risks of lowering fever include delayed identification of the underlying diagnosis and initiation of appropriate treatment and drug toxicity.

There is no evidence that children with fever, as opposed to hyperthermia, are at increased risk of adverse outcomes such as brain damage.[7,9,21–23] Fever is a common and normal physiologic response that results in an increase in the hypothalamic "set point" in response to endogenous and exogenous pyrogens.[9,23] In contrast, hyperthermia is a rare and pathophysiologic response with failure of normal homeostasis (no change in the hypothalamic set point) that results in heat production that exceeds the capability to dissipate heat.[9,23] Characteristics of hyperthermia include hot, dry skin and central nervous system dysfunction that results in delirium, convulsions, or coma.[23] Hyperthermia should be addressed promptly, because at temperatures above 41°C to 42°C, adverse physiologic effects begin to occur.[7,9,24] Studies of health care workers, including physicians, have revealed that most believe that the risk of heat-related adverse outcomes is increased with temperatures above 40°C (104°F), although this belief is not justified.[5,23,25–27] A child with a temperature of 40°C (104°F) attributable to a simple febrile illness is quite different from a child with a temperature of 40°C (104°F) attributable to heat stroke. Thus, extrapolating similar outcomes from these different illnesses is problematic.

TREATMENT GOALS

A discussion of the use of antipyretics in febrile children must begin with consideration of the therapeutic end points. When counseling families, physicians should emphasize the child's comfort and signs of serious illness rather than emphasizing normothermia. A primary goal of treating the febrile child should be to improve the child's overall comfort. Most pediatricians observe, with some supporting data from research, that febrile children have altered activity, sleep, and behavior in addition to decreased oral intake.[28] Unfortunately, there is a paucity of clinical research addressing the extent to which antipyretics improve discomfort associated with fever or illness. It is not clear whether comfort improves with a normalized temperature, because external cooling measures, such as tepid sponge baths, can lower the body temperature without improving comfort.[7,29] The use of alcohol baths is not an appropriate cooling method, because there have been reported adverse events associated with systemic absorption of alcohol.[30] Furthermore, antipyretics have other clinical outcomes, including analgesia, which may enhance their overall clinical effect. Regardless of the exact mechanism of action, many physicians continue to encourage the use of antipyretics with the belief that most of the benefits are the result of improved comfort and the accompanying improvements in activity and feeding, less irritability, and a more reliable sense of the child's overall clinical condition. Because these are the most important benefits of antipyretic therapy, it is of paramount importance that parental counseling focus on monitoring of activity, observing for signs of seri-

ous illness, and appropriate fluid intake to maintain hydration.

The desire to improve the overall comfort of the febrile child must be balanced against the desire to simply lower the body temperature. It is well documented that there are significant concerns on the part of parents, nurses, and physicians about potential adverse effects of fever that have led to a description in the literature of "fever phobia."[31] The most consistently identified serious concern of caregivers and health care providers is that high fevers, if left untreated, are associated with seizures, brain damage, and death.[1,25,32,33] It is argued that by creating undue concern over these presumed risks of fever, for which there is no clearly established relationship, physicians are promoting an exaggerated desire in parents to achieve normothermia by aggressively treating fever in their children.

There is no evidence that reducing fever reduces morbidity or mortality from a febrile illness. Possible exceptions to this could be children with underlying chronic diseases that may result in limited metabolic reserves or children who are critically ill, because these children may not tolerate the increased metabolic demands of fever.[34] Finally, there is no evidence that antipyretic therapy decreases the recurrence of febrile seizures.[22,35,36]

Despite insufficient evidence, many pediatricians recommend the routine practice of pretreatment with acetaminophen or ibuprofen before a patient receives immunizations to decrease the discomfort associated with the injections and subsequently at the injection sites and to minimize the febrile response.[9,17,37–39] In addition, results of 1 recent study suggested the possibility of decreased immune response to vaccines in patients treated early with antipyretics.[40]

Although the available literature is limited on the actual risks of fever and the benefits of antipyretic therapy, it is recognized that improvement in patient comfort is a reasonable therapeutic objective. Furthermore, at this time, there is no evidence that temperature reduction, in and of itself, should be the primary goal of antipyretic therapy.

Acetaminophen

After sufficient evidence emerged of an association between salicylates and Reye syndrome, acetaminophen essentially replaced aspirin as the primary treatment of fever. Acetaminophen doses of 10 to 15 mg/kg per dose given every 4 to 6 hours orally are generally regarded as safe and effective. Typically, the onset of an antipyretic effect is within 30 to 60 minutes; approximately 80% of children will experience a decreased temperature within that time (Table 1).

Although alternative dosing regimens have been suggested,[41–43] no consistent evidence has indicated that the use of an initial loading dose by either the oral (30 mg/kg per dose) or rectal (40 mg/kg per dose) route improves antipyretic efficacy. The higher rectal dose is often used in intraoperative conditions but cannot be recommended for use in routine clinical care.[44,45] The use of higher loading doses in clinical practice would add potential risks for dosing confusion leading to hepatotoxicity; therefore, such doses are not recommended.

Although hepatotoxicity with acetaminophen at recommended doses has been reported rarely, hepatoxicity is most commonly seen in the setting of an acute overdose. In addition, there is significant concern over the possibility of acetaminophen-related hepatitis in the setting of a chronic overdose. The most commonly reported scenarios are those of children receiving multiple supratherapeutic doses (ie, >15 mg/kg per dose) or frequent administration of appropriate single doses at intervals of less than 4 hours, which has resulted in doses of more than 90 mg/kg per day for several days.[46,47] Giving an adult preparation of acetaminophen to a child may result in supratherapeutic dosing. In 1 case series,[46] half of the children with hepatotoxicity had received adult preparations of acetaminophen.

One safety concern is the effect of acetaminophen on asthma-related symptoms; although asthma has also been associated with acetaminophen use, causality has not been demonstrated.[48–51]

Ibuprofen

The use of ibuprofen to manage fever has been increasing, because it seems to have a longer clinical effect related to lowering of the body temperature

TABLE 1 Antipyretic Information

Variable	Acetaminophen	Ibuprofen
Decline in temperature, °C	1–2	1–2
Time to onset, h	<1	<1
Time to peak effect, h	3–4	3–4
Duration of effect, h	4–6	6–8
Dose, mg/kg	10–15 every 4 h	10 every 6 h
Maximum daily dose, mg/kg	90 mg/kg[a]	40 mg/kg
Maximum daily adult dose, g/d	4	2.4
Lower age limit, mo[b]	3	6

Data represent approximate averages from referenced sources.[42,43,52,54,71,82]

[a] Label is for 75 mg/kg; 90 mg/kg per day should be limited to less than 3 consecutive days.[83–85]

[b] Unless specifically recommended by a health care provider for the younger patient and, then, only after the infant has been examined by a health care provider.

(Table 1). Studies in which the effectiveness of ibuprofen and acetaminophen were compared have yielded variable results; the consensus is that both drugs are more effective than placebo in reducing fever and that ibuprofen (10 mg/kg per dose) is at least as effective as, and perhaps more effective than, acetaminophen (15 mg/kg per dose) in lowering body temperature when either drug is given as a single or repetitive dose.[52–57] Data also show that the height of the fever and the age of the child (rather than the specific medication used) may be the primary determinants of the efficacy of antipyretic therapy; those who have a higher fever and are older than 6 years show decreased efficacy or response to antipyretic therapy.[54] Studies that compare the effect of ibuprofen versus acetaminophen on children's behavior and comfort are generally lacking.

There is no evidence to indicate that there is a significant difference in the safety of standard doses of ibuprofen versus acetaminophen in generally healthy children between 6 months and 12 years of age with febrile illnesses.[58] Similar to other nonsteroidal anti-inflammatory drugs (NSAIDs), ibuprofen can potentially cause gastritis,[59,60] although no data suggest that this is a common occurrence when used on an acute basis, such as during a febrile illness.[58] However, there have been case reports of bleeding, gastritis, and ulcers of the stomach, duodenum, and esophagus associated with many NSAIDs, including ibuprofen, even when used in typical antipyretic and analgesic doses.[59,60] Ibuprofen does not seem to worsen asthma symptoms.

Concern has been raised over the nephrotoxicity of ibuprofen. In numerous case reports, children with febrile illnesses developed renal insufficiency when treated with ibuprofen or other NSAIDs. Thus, caution is encouraged when using ibuprofen in children with dehydration or with complex medical illnesses.[61–63] In children with dehydration, prostaglandin synthesis becomes an increasingly important mechanism for maintaining appropriate renal blood flow. The use of ibuprofen or any NSAID interferes with the renal effects of prostaglandins, which reduces renal blood flow and potentially precipitates or worsens renal dysfunction.[61,63] However, it is not possible to determine the actual incidence of ibuprofen-related renal insufficiency after short-term use, because it has not been systematically investigated or reported.[64] Children who are at greatest risk of ibuprofen-related renal toxicity are those with dehydration, cardiovascular disease, preexisting renal disease, or the concomitant use of other nephrotoxic agents.[62] Another potential group at risk is infants younger than 6 months because of the possibility of differences in ibuprofen pharmacokinetics and developmental differences in renal function.[65] Data are inadequate to support a specific recommendation for the use of ibuprofen for fever or pain in infants younger than 6 months (there are dosing data for neonatal closure of patent ductus arteriosus[66,67]), although the package insert states to "ask a doctor" for guidance on its use in this population. Another potential risk associated with the use of ibuprofen is the possible association between ibuprofen and varicella-related invasive group A streptococcal infection.[68,69] However, at the time of this report, data were insufficient to support a causal relationship between ibuprofen and invasive group A streptococcal disease.

Alternating or Combination Therapy

A practice frequently used to control fever is the alternating or combined use of acetaminophen and ibuprofen. In a convenience sample survey of 256 parents or caregivers, 67% reported alternating acetaminophen and ibuprofen for fever control, 81% of whom stated that they had followed the advice of their health care provider or pediatrician.[70] Although 4 hours was the most frequent interval, parents reported alternating therapy every 2, 3, 4, and 6 hours, which suggests that there is no consensus on dosing instructions.

At the time of this report, 5 studies had been identified that compared alternating ibuprofen and acetaminophen versus either acetaminophen or ibuprofen as single agents.[71–75] Initially, changes in temperature were similar for all groups in these studies, regardless of therapy. However, 4 or more hours after the initiation of treatment, lower temperature was consistently observed in the combination-treatment groups. For example, 6 and 8 hours after the initiation of the study, a greater percentage of children were afebrile in the combination group (83% and 81%, respectively) compared with those in the group that received ibuprofen alone (58% and 35%, respectively).[71] Only 1 study[72] evaluated issues related to stress and comfort and found lower stress scores and less time missed from child care in the combination-treatment group. Another study[73] showed a trend toward a normalization of fever-related symptoms by 24 and 48 hours after institution of therapy, but these trends disappeared by day 5.

Although the aforementioned studies provide some evidence that combination therapy may be more effective at lowering temperature, questions remain regarding the safety of this practice as well as the effectiveness in improving discomfort, which is the primary treatment end point. The possibility that parents will either not receive or not understand dosing instructions, combined with the wide array of formulations that contain

these drugs, increases the potential for inaccurate dosing or overdosing.[76,77] Finally, this practice may only promote the fever phobia that already exists.

Although there is some evidence that combination therapy may result in a lower body temperature for a greater period of time, there is no evidence that combination therapy results in overall improvement in other clinical outcomes. Also, these studies have not contained adequate numbers of subjects to fully evaluate the safety of this practice. Therefore, there is insufficient evidence to support or refute the routine use of combination treatment with both acetaminophen and ibuprofen. Practitioners who choose to follow this practice should counsel parents carefully regarding proper formulation, dosing, and dosing intervals and emphasize the child's comfort instead of reduction of fever.

INSTRUCTIONS FOR CAREGIVERS

It is critically important for pediatricians to clearly describe the appropriate use (ie, formulation, dose, and dosing interval) of acetaminophen and ibuprofen to caregivers (Table 1). Child safety will be further enhanced by clear labeling and the development of simplified dosing methods, standardized drug concentrations, and standardized delivery devices.[78–80] Cough-and-cold products that contain acetaminophen and ibuprofen should not be given to children because of the possibility that parents may unintentionally give their child simultaneous doses of an antipyretic and a cough-and-cold medication that contains the same antipyretic. In addition, there is a lack of proven efficacy for this class of combination products for children. For children who require liquid preparations, physicians should encourage families to only use 1 formulation. Acetaminophen is the most common single ingredient implicated in emergency department visits for medication overdoses among children, and more than 80% of these emergency visits are a result of unsupervised ingestions[81]; therefore, proper handling and storage of antipyretics should be encouraged.

SUMMARY

Appropriate counseling on the management of fever begins by helping parents understand that fever, in and of itself, is not known to endanger a generally healthy child. In contrast, fever may actually be of benefit; thus, the real goal of antipyretic therapy is not simply to normalize body temperature but to improve the overall comfort and well-being of the child. Acetaminophen and ibuprofen, when used in appropriate doses, are generally regarded as safe and effective agents in most clinical situations. However, as with all drugs, they should be used judiciously to minimize the risk of adverse drug effects and toxicity. Combination therapy with acetaminophen and ibuprofen may place infants and children at increased risk because of dosing errors and adverse outcomes, and these potential risks must be carefully considered. When counseling a family on the management of fever in a child, pediatricians and other health care providers should minimize fever phobia and emphasize that antipyretic use does not prevent febrile seizures. Pediatricians should focus instead on monitoring for signs/symptoms of serious illness, improving the child's comfort by maintaining hydration, and educating parents on the appropriate use, dosing, and safe storage of antipyretics. To promote child safety, pediatricians should advocate for a limited number of formulations of acetaminophen and ibuprofen and for clear labeling of dosing instructions and an included dosing device for antipyretic products.

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American Academy of Pediatrics
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POLICY STATEMENT

Financing Graduate Medical Education to Meet the Needs of Children and the Future Pediatrician Workforce

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Workforce

ABSTRACT

This policy statement articulates the positions of the American Academy of Pediatrics on graduate medical education and the associated costs and funding mechanisms. It reaffirms the policy of the American Academy of Pediatrics that graduate medical education is a public good and is an essential part of maintaining a high-quality physician workforce. The American Academy of Pediatrics advocates for lifelong learning across the continuum of medical education. This policy statement focuses on the financing of one component of this continuum, namely residency education. The statement calls on federal and state governments to continue their support of residency education and advocates for stable means of funding such as the establishment of an all-payer graduate medical education trust fund. It further proposes a portable authorization system that would allocate graduate medical education funds for direct medical education costs to accredited residency programs on the basis of the selection of the program by qualified student or residents. This system allows the funding to follow the residents to their program. Recognizing the critical workforce needs of many pediatric medical subspecialties, pediatric surgical specialties, and other pediatric specialty disciplines, this statement maintains that subspecialty fellowship training and general pediatrics research fellowship training should receive adequate support from the graduate medical education financing system, including funding from the National Institutes of Health and other federal agencies, as appropriate. Furthermore, residency education that is provided in freestanding children's hospitals should receive a level of support equivalent to that of other teaching hospitals. The financing of graduate medical education is an important and effective tool to ensure that the future pediatrician workforce can provide optimal heath care for infants, children, adolescents, and young adults.

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Key Words

graduate medical education trust fund, Balanced Budget Act, Children's Hospital Graduate Medical Education Payment Program, direct graduate medical education, freestanding children's hospitals, graduate medical education, indirect medical education, Medicaid, Medicare, portable authorization system, residents, Title VII

Abbreviations

GME— graduate medical education
DGME— direct GME
DRG— diagnosis-related groups
IME—indirect medical education
BBA—Balanced Budget Act of 1997
CHGME PP—Children's Hospital Graduate Medical Education Payment Program
PPS—prospective payment system
NIH—National Institutes of Health

GRADUATE MEDICAL EDUCATION (GME) AS A PUBLIC GOOD

To assure the American public of the competence of its physicians, the path to independent practice of aspiring physicians is a long and arduous one. After graduation from college, a medical student will spend 4 years in medical school, of which approximately 2 years are spent in patient-care settings under close supervision by faculty. After receiving their medical degrees, pediatricians spend an additional 3 to 6 years in residency and subspecialty fellowship training (collectively referred to as graduate medical education [GME]). Pediatricians, thus, spend up to 10 years in medical training to be eligible for board certification in their field. Pediatric surgical specialists likewise spend 5 to 7 years in residency and an additional 1 to 3 years in postgraduate surgical training before entering practice. During GME, these physicians provide essential health care services under supervision and thus facilitate access to care for children.

Residency or GME has been accepted by our society as an essential part of maintaining a high-quality physician workforce.[1] After earning a medical degree, US physicians are required by law in every state to complete an additional 1 to 3 years of GME before receiving a license to practice medicine.[2] This demanding educational process is unique to the medical profession.

Resident physicians provide valuable medical services, frequently to underserved populations and to patients with complex illnesses, under the supervision of experienced physicians. Thus, GME is a public good that ensures the sustained availability of highly skilled physicians and directly provides essential clinical services rendered by resident physicians.

There are many costs associated with GME. Direct costs include salaries and benefits, as well as the overhead costs

of practice for the resident physician, such as licensing fees, medical liability insurance, clinical facility expenses, such as utilities and maintenance, and administrative costs. Because residents must be under supervision for their education, there is also the expense of faculty time for education and supervision. Finally, because they are medical school graduates providing valued health care services, residents also receive salary and fringe benefits, although at a fraction of the income of physicians in independent practice.

In addition, the sponsoring institution incurs indirect costs of training residents. Residents may be less efficient and may perform more diagnostic testing, additional procedures, and require more staff support. Residents, often located at tertiary care centers, may also care for more complex patients. Leaders in managed care believe that services at teaching hospitals cost 5% to 10% more than those at nonteaching hospitals.[3] Thus, for almost 4 decades, the US government has explicitly funded GME, primarily through the Medicare and Medicaid programs.

GRADUATE MEDICAL EDUCATION (GME) AND THE MEDICARE TRUST FUND

GME financing has become a major issue for both Medicare reform and the physician workforce. Medicare is the major explicit financier of GME[4] and related activities in the United States, making payments of more than $8.5 billion each year to teaching hospitals. By virtue of their nonelderly patient populations, freestanding children's hospitals do not receive significant reimbursements from Medicare. However, because 70% of pediatric residents are trained outside of freestanding children's hospitals, Medicare still has the major role in financing pediatric residency training, and its policies on financing for GME, therefore, significantly influence the overall workforce in pediatrics.

Before the enactment of Medicare, GME programs were funded primarily by the sponsoring teaching hospital through patient-care revenues. With the passage of Medicare in 1965, teaching hospitals received pass-through from Part A for the costs of GME, including resident salaries, benefits, and overhead, which are now referred to as direct GME (DGME) payments. In 1965, Congress recognized that hospitals with educational activities enhanced the quality of care offered and that the cost of this education should be borne by society. In the reports accompanying the Medicare legislation, Congress declared[5]:

> Educational activities enhance the quality of care in an institution, and it is intended, until the community undertakes to bear such education costs in some other way, that a part of the net cost of such activities (including stipends of trainees, as well as compensation of teachers and other costs) should be borne to an appropriate extent by the hospital insurance program.

With the implementation of the Medicare diagnosis-related groups (DRG) payment system in 1983, teaching hospitals were given an adjustment factor to their reimbursement rate on the basis of their resident-to-bed ratio.[6] Congress described the purpose of the indirect medical education (IME) adjustment as follows:

> This adjustment is provided in light of doubts . . . about the ability of the DRG case classification system to account fully for factors such as severity of illness of patients, requiring the specialized services and treatment programs provided by teaching institutions and the additional costs associated with the teaching of residents . . . The adjustment for indirect medical education costs is only a proxy to account for a number of factors that may legitimately increase costs in teaching hospitals.[7,8]

In 2001, DGME payments were approximately $3 billion, and in fiscal year 2006, Medicare IME payments were estimated at approximately $5.6 billion. Congress has reduced the IME adjustment several times since its inception, with the most recent prescribed cuts occurring as part of the Medicare Modernization Act of 2003.[9]

There are several important consequences of Medicare's primary role in GME. First, Medicare subsidizes GME as part of the expense of caring for Medicare patients. Thus, freestanding children's hospitals (technically referred to as "Medicare prospective payment system-exempt" hospitals) received, on average, only approximately $374 per resident from Medicare in fiscal year 1997, because they care for very few Medicare patients; predominantly pediatric end-stage renal disease patients. These hospitals must seek other sources of funding for their GME programs. However, many pediatric residents train in general hospitals that receive both DGME and IME payments for these residents; thus, Medicare's GME policies still have a major effect on pediatric residency education. Second, Medicare Part A pays for hospital services. Medicare payment for associated GME costs, therefore, is based on hospital-based services provided by residents. Thus, these reimbursement policies are a major financial disincentive for resident education in nonhospital settings. The Balanced Budget Act of 1997 (BBA) allowed hospitals to count residents in nonhospital settings in determining the IME if the hospital substantially incurs all of the cost of training in that setting[10]; however, it is not clear that this change has increased ambulatory care training. Finally, Medicare provides GME support to any hospital with an accredited residency program. For years, this entitlement created a tremendous financial incentive for hospitals to increase the number of residency positions to increase Medicare reimbursement rates and to benefit from the clinical services provided by the residents. Increasingly fewer resident positions have gone unfilled during the past decade because of the high demand for residency positions in the United States by international medical graduates. Historically, Medicare's GME financing policies constituted an open-ended federal subsidy, although in 1997 Congress also placed a cap on the number of residency positions that Medicare would fund at each hospital. This cap has not only limited the growth of GME positions in the country but also frozen the geographic distribution of GME positions since its implementation. In 2005, the Centers for Medicare and Medicaid Services, authorized by the Medicare Modernization Act of 2003, made a one-time redistribution of resident slots. Hospitals that did not fill all of their resident slots under their BBA cap relinquished them to a subset of those hospitals that

had more resident slots than their BBA cap permitted to be eligible for Medicare GME reimbursement.

The nation's system of GME financing has a tremendous impact on the pediatric workforce and the education of future pediatricians.

CHILDREN'S HOSPITAL GRADUATE MEDICAL EDUCATION PAYMENT PROGRAM (CHGME PP)

The Children's Hospital Graduate Medical Education Payment Program (CHGME PP) was authorized for 2 years by the Health Research and Quality Act of 1999[11] and reauthorized for 4 more years by the Child Health Act of 2000.[12] The program helps Medicare prospective payment system (PPS)-exempt children's hospitals, which, because of their low Medicare patient volume, do not receive significant Medicare GME payments. Only Medicare PPS-exempt children's hospitals that have their own Medicare provider number are eligible for the program.

With enactment of this legislation, Congress recognized that, until comprehensive GME financing reform occurs, CHGME PP funding is essential to provide Medicare PPS-exempt children's hospitals a level of federal GME support equivalent to the Medicare GME support provided to all teaching hospitals. Without it, in today's health care market, Medicare-PPS children's hospitals, which train nearly 30% of all pediatricians, nearly 50% of all pediatric subspecialists, and the majority of pediatric research scientists, would be at significant risk, which would jeopardize the nation's future pediatric workforce.

The Health Resources and Services Administration administers the CHGME PP. It makes DGME and IME payments to ~60 eligible children's hospitals during the federal fiscal year. Congress authorized one third of the funding to go toward DGME payments and the remaining two thirds to go toward IME payments. The DGME payment is based on a standardized national average per resident amount and the average number of Medicare-weighted.* full-time equivalent residents, subject to the resident cap and rolling average established under the BBA. The IME payment varies by hospital, depending on the number of Medicare-unweighted full-time equivalent residents, the area-wage index of the metropolitan area in which the hospital is located, the complexity of its patient population, the volume of patients, the number of Medicare-approved beds, and its teaching intensity.

Unlike Medicare GME funding, Congress must appropriate funds annually for the CHGME PP. From fiscal year 2002 to fiscal year 2004, Congress fully funded the CHGME PP; however, cuts were made in subsequent years. Congress appropriated $303 million for the CHGME PP in fiscal year 2004, $301 million in fiscal year 2005, and $297 million in fiscal year 2006. Given the duration of residency training, the uncertainty of CHGME PP funding levels from year to year is highly problematic.

*When determining the number of full-time-equivalent (FTE) residents for GME funding purposes, Medicare-weighted resident FTEs count residents beyond their initial residency period (i.e. fellows) as 0.5 FTE per current Medicare rules. For Medicare-unweighted counts, all residents (including fellows) are counted equally as 1 FTE.

OTHER SOURCES OF GME FUNDING

Medicaid

Although Medicare is by far the largest explicit national funder of GME, there are other major sources of GME financing. In 2005, Medicaid provided approximately $3.2 billion for GME-related expenses; however, the amount varies widely from state to state and policies for GME use are highly variable. In 2005, 47 states and the District of Columbia paid for GME at some level out of Medicaid funds. Under state budgeting pressures and rising Medicaid costs as of 2005, 4 of these states have decreased the amount of Medicaid funding for GME, and 6 have considered eliminating Medicaid funding for GME altogether. In addition, an increasing number of states are linking Medicaid GME funds to state policy goals regarding the distribution of the health care workforce. It has even been proposed that the federal government not provide Medicaid funds to states for GME.

In total, 46 states and the District of Columbia contributed to GME through their Medicaid fee-for-service programs in 2005. Thirty-one of the states that paid for GME under fee-for-service programs did so through hospital per-case or per-diem rates. Of the 35 states and the District of Columbia that reported capitated Medicaid arrangements, 14 made explicit Medicaid GME payments to teaching hospitals or teaching programs; 10 others included the payments by incorporating them into the capitated rates negotiated in Medicaid managed care contracts with teaching hospitals.[13]

Title VII Programs

Training Grants in Primary Care Medicine and Dentistry, a provision of Title VII of the Public Health Service Act, provide the authority and funding for faculty development, academic administrative units, predoctoral training, and intensive primary care training for residents in diverse ambulatory settings. Title VII helps fund residency education in general pediatrics, internal medicine, and family practice, but this funding was cut by $154.3 million in 2006.

Additional Federal Sources for GME Funding

A number of federal agencies sponsor residency training opportunities and funding outside the normal mechanisms of Medicare, Medicaid, Title VII, and the Children's Hospital GME Payment Program. The National Institutes of Health (NIH), for example, sponsors a limited number of subspecialty training positions, and through research grants, provides funding for some resident research activities. In addition to clinical areas of expertise, the NIH's National Library of Medicine offers predoctoral and postdoctoral research training in biomedical informatics, as well as support for librarians, scientists, health professionals, and others who wish to obtain cross-training to become in-context information specialists. The Agency for Health Care Research and Quality likewise offers a variety of training programs to support predoctoral work. Finally, the Maternal and Child Health Bureau operates a comprehensive program of training opportunities through its MCH Training Pro-

gram, which funds public and private nonprofit institutions of higher learning to provide leadership training in maternal and child health. Although this is not a comprehensive list of training opportunities, it serves to demonstrate the breadth of experiences offered through a number of less well-known federal programs.

Private or Industry-Sponsored GME Funding

More recently, pharmaceutical and medical device companies have supported a few GME positions in particular specialties. In 2006, a program to fund additional dermatology GME positions with funds from both the specialty society and pharmaceutical companies was announced. The program was withdrawn when concerns were raised about the potential influence of industry on residents. The Accreditation Council for Continuing Medical Education (ACCME) has developed and revised Standards of Commercial Support and has grappled with many of the same issues that GME is starting to face.[14] The experiences gleaned from the continuing medical education community can be applied to GME policy development pertaining to funding issues, and thereby further solidify the relationship between these components of lifelong learning.

Cross Subsidy From Patient Care Revenue

The largest source of funding for GME in all specialties, however, continues to be cross-subsidies from patient-care revenue from private payers; however, these funds are not specifically designated for GME. In 2001, the US Bureau of Health Professions estimated Medicare provides 40%, Medicaid provides 10%, and the Bureau of Health Professions provides 1% of GME financing; 49% of GME financing is provided by "other" sources.[15]

Transparency and Decoupling Indirect Medical Education (IME)

Congress recognized the need to increase payment to tertiary care hospitals that care for more severely ill, complex patients because of the limitations of the DRG payment methodology.[16] The ratio of residents to beds was used as a proxy for determining which hospitals cared for these patients. Unfortunately, until there were BBA caps, hospitals were also given a financial incentive to increase the number of residency positions irrespective of whether they cared for more complex patients. Calculating IME on the basis of resident numbers creates financial incentives which can distort GME and the physician workforce. Thus, another mechanism may be more effective at addressing costs because of patient complexity without inducing these unintended consequences.

Care for indigent patients, clinical research, and specialized services and technology for complex patients continue to be important regional and national needs that need adequate financing. Disproportionate share funding provides some support for indigent care at many teaching hospitals serving large proportions of unfunded or public sector patients. However, these funds have also been reduced over time by the BBA. Additional mechanisms should be developed to support the costs of these missions.

Given the substantial public funding directed toward GME, the products of this funding may face increased scrutiny. Traditional measures, such as the knowledge and skills of those being trained, will continue to be relevant. Greater accountability for the quality of care being delivered within GME-funded teaching settings is also likely. Finally, it will be increasingly important to demonstrate that GME funding results in an appropriate supply of physicians, trained in needed specialties and geographically distributed to ensure that the health needs of diverse populations across all U.S. communities are well served.

AN ALL-PAYER GME TRUST FUND

Although society in general and all payers, including Medicare, benefit from GME, Medicare and Medicaid cannot and should not continue to be the only payers to designate substantive funding specifically to support GME. The participation of all payers, both public and private, in financing GME should be encouraged, and a mechanism should be developed to ensure an equitable and openly acknowledged contribution from all parties. Medicare would be able to reduce its burden in financing GME if the private sector began to pay its fair share.

An all-payer GME trust fund has been proposed that will create many benefits.[17] A national GME trust fund could eliminate distortions in the physician workforce caused by the current Medicare funding methodology and develop mechanisms for financing residency positions that will best meet the evolving physician workforce needs of the United States. The total number of residency positions financed can be based on national workforce needs. Funding could be more flexible to support education in ambulatory and community sites for residents in primary care specialties. Also, GME support could be provided to all specialties, including pediatrics, pediatric medical subspecialties, and pediatric surgical specialties, on the basis of need.

Some concerns about a national all-payer GME trust fund include an increase in the cost of employment-based and directly purchased health insurance; these costs are currently being partially borne by Medicare and other payers who support GME. An all-payer trust fund could potentially reduce a teaching hospital's incentive to care for Medicare patients; however, it is very unlikely that a teaching hospital would adopt such a strategy or policy given the dominant role of Medicare as a payer.

Allocation of funds also could be a divisive issue. A centralized planning body that allocates GME funds to each hospital and/or specialty could become highly politicized and also may be insensitive to signals from the health care market, leading to the training of an excessive number of physicians in certain specialties. Use of a market mechanism may be more flexible and responsive to actual societal requirements for physicians.

DISTRIBUTING GME FUNDS TO MEET WORKFORCE NEEDS AND DEMANDS

Using a market mechanism for distributing GME funds has many advantages.[18] Such a system would be responsive to market demand for physicians and make residency programs and their sponsoring institutions more responsive to the educational needs of their residents. This system also may improve accountability of GME expenditures.

A proposed market mechanism would be a portable authorization system that would allocate GME funds for direct medical education costs to accredited residency programs on the basis of the selection of the program by qualified students or residents; thus, the funding would follow the residents to their program. The total number of positions to be funded would be set by a public-private health care workforce policy body on the basis of national workforce requirements. A portable authorization system will not directly address geographic maldistribution of physicians. Thus, continuing support for programs such as the National Health Service Corps and state-level scholarship, loan forgiveness, and incentive programs remain essential to address this problem.

FINANCING PEDIATRIC SUBSPECIALTY GME

Pediatric medical subspecialists and surgical specialists have an essential role in improving pediatric care by generating new knowledge through clinical and basic science research, in educating other pediatric practitioners, and in providing specialized pediatric services. Because of concerns about an excessive number of adult subspecialty physicians, Medicare GME support for subspecialty training was cut in both amount and duration of support, and some have advocated eliminating support altogether. However, not all subspecialties have an excess of physicians, and there is a need for more physicians in some pediatric subspecialties. Thus, stable and reasonable mechanisms of support for subspecialty GME are required.

IF PUBLIC SUPPORT OF GME IS NOT SUSTAINED

Budgetary pressures on the Medicare trust fund and on federal and state governments have led to greater efforts to reduce or eliminate public funding for GME. Policy makers note that Congress intended that the Medicare hospital trust fund's role as the primary funding agent of GME was to be temporary. Elimination of public funding for GME would mean that residency education would have to be supported by cross-subsidies from patient care revenues, leading to a greater focus on service delivery and revenue generation, and resulting in less teaching and less oversight by faculty. Given the high educational debt already owed by medical school graduates, charging tuition for GME would put medical education out of reach for students from poor or middle-class backgrounds and could drive students away from more poorly reimbursed specialties, such as primary care, and from communities with underserved populations.

CONCLUSIONS

GME benefits society through the education of highly skilled physicians and the delivery of clinical services by resident physicians. All payers should support the direct costs of GME through a national GME trust fund. In the absence of an all-payer national GME system, Medicare and Medicaid funding for GME should be maintained, and the CHGME PP should be fully funded. The services of resident physicians who are fully licensed should be reimbursed by all payers for who do not explicitly fund their share of GME costs. Distribution of GME funds across specialties and across training settings should be linked to the health workforce needs of the population. GME programs should be prepared to demonstrate accountability for the quality of resident education/training and the quality of care provided by the residents.

RECOMMENDATIONS

1. Because GME is a public good, federal and state governments should continue their support of GME.

Strategies

A. Until an all-payer GME trust fund is established, the CHGME PP should be fully funded by the federal government at a level of funding that would approach what Medicare provides in DME and IME payments, per resident on average, to all teaching hospitals.

B. Medicare DGME and IME adjustment funding should be maintained.

C. Chapters of the American Academy of Pediatrics should lobby for Medicaid GME funding in their states.

2. Health care services provided by licensed residents should be reimbursed.

Strategy

A. Physicians who are fully licensed and in GME programs should be permitted to bill payers for health care services they provide if the payer does not explicitly fund their share of GME costs.

3. All health care payers, including Medicare and Medicaid, should contribute equitably to a fund that supports the direct costs of GME, including resident salaries and benefits, faculty teaching time, and overhead and patient care expenses directly related to residency education.

Strategies

A. A GME trust fund should be established that is supported by all payers and overseen by a sound, independent, national physician-workforce-planning body with pediatric representation.

B. Subspecialty fellowship training and general pediatrics research fellowship training should receive adequate support from the GME financing system, including funding from the NIH and other federal agencies, as appropriate.

C. Any mechanism for distributing GME funds should ensure that resident physicians are educated in specialties that reflect the needs of the population and should also be sensitive to promoting the educational needs of resident physicians to ensure quality health care in the future. A portable authorization system for use by graduates of accredited US medical schools and other qualified recipients is a potential mechanism to distribute funds to residency programs to finance the direct costs of GME.

4. GME programs in Medicare PPS-exempt children's hospitals should receive a level of support per resident equivalent to that of other teaching hospitals for their GME activities.

Strategies

A. To ensure quality pediatric GME with stable funding, the CHGME PP should be funded as an entitlement or through multiyear, guaranteed appropriation, rather than an annual discretionary appropriations process.

B. Education programs in Medicare PPS-exempt children's hospitals should be included in a reformed national GME financing system.

5. The distribution of GME funds needs to be directed to cover the costs of educational activities and to satisfy public demands for transparency and accountability.

Strategies

A. GME funding should be paid to the entities that incur the costs of residency education, including community sites.

B. GME funds must be directed toward GME, and should not be included in capitation payments for clinical services.

C. Distribution of Medicare IME funds should be uncoupled from the number of residents at a teaching hospital. Funds that primarily support noneducational missions of teaching hospitals, including indigent care, clinical research, and specialized services and treatment programs, should be distributed through alternative mechanisms that provide stable funding for these important missions.

D. Applying the experiences from the Accreditation Council for Continuing Medical Education and the continuing medical education community, the Accreditation Council for GME, the American Medical Association, and other organizations involved in GME should work together to develop guidelines for industry support of GME that assures the quality of GME and protects residents from undue industry influence during residency education.

E. The Accreditation Council on GME and its Pediatric Review Committee and the American Board of Pediatrics should collect educational outcome data to assess the quality of GME and its relationship to GME funding.

6. GME funding should be used to help achieve pediatric workforce goals, as determined by the pediatric community.

Strategies

A. Funding for primary care training programs, such as Title VII, needs to be increased to meet the needs of children in underserved communities.

B. Flexibility in GME funding should be increased to enhance diversity and address geographic maldistribution by mechanisms such as revisiting the BBA caps on residency programs.

C. Because pediatric subspecialty physicians play a critical role in the development and application of new knowledge in health care for children and the education of future pediatricians, mechanisms should be in place to ensure adequate support to educate an appropriate supply of subspecialty physicians.

D. Financial disincentives to education in ambulatory care sites, particularly in underserved communities, should be eliminated.

E. The relationship between GME funding policy and the pediatrician workforce should be studied.

7. Representatives from pediatrics must be active participants in all significant deliberations and decision-making processes pertaining to GME financing.

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American Academy of Pediatrics
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POLICY STATEMENT

Financing of Pediatric Home Health Care*

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Child Health Financing, Section on Home Care

ABSTRACT

In certain situations, home health care has been shown to be a cost-effective alternative to inpatient hospital care. National health expenditures reveal that pediatric home health costs totaled $5.3 billion in 2000. Medicaid is the major payer for pediatric home health care (77%), followed by other public sources (22%). Private health insurance and families each paid less than 1% of pediatric home health expenses. The most important factors affecting access to home health care are the inadequate supply of clinicians and ancillary personnel, shortages of home health nurses with pediatric expertise, inadequate payment, and restrictive insurance and managed care policies. Many children must stay in the NICU, PICU, and other pediatric wards and intermediate care areas at a much higher cost because of inadequate pediatric home health care services. The main financing problem pertaining to Medicaid is low payment to home health agencies at rates that are insufficient to provide beneficiaries access to home health services. Although home care services may be a covered benefit under private health plans, most do not cover private-duty nursing (83%), home health aides (45%), or home physical, occupational, or speech therapy (33%) and/or impose visit or monetary limits or caps. To advocate for improvements in financing of pediatric home health care, the American Academy of Pediatrics has developed several recommendations for public policy makers, federal and state Medicaid offices, private insurers, managed care plans, Title V officials, and home health care professionals. These recommendations will improve licensing, payment, coverage, and research related to pediatric home health services.

INTRODUCTION

The home of the pediatric patient is an appropriate and often preferred site for the provision of health care services to address a wide range of conditions. According to national estimates,[1] more than 500 000 children use home health services in the United States.* Children receiving home health care have a diverse array of diagnoses, severity levels, and complications. The 4 most common diagnoses are cerebral palsy, failure to thrive, developmental delay, and preterm birth, accounting for approximately 15% of the pediatric home health population. Although many children receiving home health care depend on technology, the vast majority do not.[2] Research also reveals that young children are more likely to receive home health care than are older children and adolescents.[1]

Over the past 20 to 30 years, the demand for pediatric in-home services has grown substantially as a result of several factors including the increased survival of preterm infants, trauma patients, and those treated in PICUs; medical and surgical

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* The Medical Expenditure Panel Survey[1] reports that in 2000, 560 464 children 0 to 18 years of age had home health expenditures. National estimates were based on relatively small sample sizes. The National Survey of Children With Special Health Care Needs (www.cdc.gov/nchs/about/major/slaits/cshcn.htm) reports that 505 459 children with special needs 0 to 18 years of age needed home health care in 2001.

Key Words
pediatric home health care, financing pediatric home health, coverage, payment

Abbreviations
AAP—American Academy of Pediatrics
TEFRA—Tax Equity and Fiscal Responsibility Act
SCHIP—State Children's Health Insurance Program

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treatment advances; miniaturization and simplification of life-sustaining equipment; family preferences for home versus hospital care; and cost-containment pressures to limit or avoid hospital stays. Moreover, home health care has been shown to be a cost-effective alternative to inpatient hospital care.[3–5] Today, the range of services provided to children in the home has broadened to include not only rehabilitative care but also intravenous administration of antimicrobial agents and other medications, parenteral nutrition, nasogastric or enterostomy feedings, peritoneal dialysis, wound care, oxygen and mechanically assisted ventilation, chronic pain management, complex medical and surgical care, psychosocial support, respite, and hospice care. Registered nurses are the primary providers of pediatric home health care under the direct supervision of the physician.[6] Other health professionals providing in-home care to children are physical and occupational therapists, speech pathologists, medical social workers, nutritionists, licensed practical/vocational nurses, home health aides, and personal care aides.

National health expenditure data reveal that pediatric home health costs totaled $5.3 billion in 2000. This represents one fifth of all home health expenditures but less than 1% of all children's health expenditures. On average, the per-child cost of home health care was $9421 and ranged from a low of $70 to a high of $136 969. By far, Medicaid was the major payer of pediatric home health care (77%), followed by other public sources (22%). Private health insurance and families each paid less than 1% of pediatric home health expenditures.[1]

The American Academy of Pediatrics (AAP) recognizes the growing trend to provide health care services for children in their homes. The AAP has issued a policy statement for the provision of home health care services[6] and also a guide on the management of pediatric patients in the home.[2] To advocate for improvements in the financing of pediatric home health care, the AAP has developed this financing policy statement for its members, public policy makers, federal and state Medicaid officials, private insurers, managed care officials, Title V officials, and home health care professionals. It contains recommendations for improving public and private insurance coverage, payment, and authorization policies.

GENERAL ACCESS PROBLEMS

Access to pediatric home health care services is inadequate throughout most of the United States. The most important factors affecting access to home health care are the inadequate supply of clinicians and ancillary personnel, shortages of home health nurses with pediatric expertise, inadequate payment, and restrictive insurance and managed care policies.[7] As a result, many home health agencies and hospital-run home health programs have reduced or eliminated their pediatric home health capacity in the last few years.

Unfortunately, health care financing policies have not kept pace with the changing demand and complexity of pediatric home health care. As a result, children requiring home health services are at risk of receiving inadequate care at home and experiencing life-threatening disease and other medical complications; serious injury; more frequent readmission to hospitals; higher health care costs; and excessive family burden. Many children must stay in the NICU, PICU, or other pediatric wards and intermediate care areas at a much higher cost because of inadequate pediatric home health care services.

MEDICAID LIMITATIONS

Because more than three fourths of all pediatric home health expenditures are paid for by Medicaid, understanding the limitations of Medicaid's home health care policies is critical. Unlike private health insurance, Medicaid provides a comprehensive home health benefit for children that includes part-time or intermittent nursing services, home health aide services, medical supplies and equipment, and, at states' option, physical, occupational, and speech therapy. Although states are able to limit the amount, duration, and scope of coverage of home health services for adults, these limits, because of requirements in the Early Periodic Screening, Diagnostic, and Treatment (EPSDT) service, cannot apply to children, provided the services are determined by the state to be medically necessary. In addition, states wanting to enhance their home health benefit package or increase eligibility to children from higher-income families can seek a home and community-based waiver. Fifty states are currently implementing such waivers. States also have the option of extending regular Medicaid eligibility to children who would have been eligible for Supplemental Security Income and Medicaid if they received their care in a nursing home or hospital under the "Katie Beckett" or Tax Equity and Fiscal Responsibility Act (TEFRA) eligibility option,[8] and 20 states have elected to use this option.

The main financing problem that pertains to Medicaid is low payment. Specifically, Medicaid agencies have been criticized for paying home health agencies at rates that are insufficient to provide beneficiaries with access to home health services. In many states, families complain that they are unable to secure nurses to fill all of the hours determined to be medically necessary. Correspondingly, home health agencies report difficulties recruiting and retaining qualified nurses because of low payment rates, payment delays, and restrictive policies regarding overtime. Not surprisingly, many home health agencies simply do not accept Medicaid referrals. Faced with these problems, families have attempted to hire their own independent nurses but have reportedly confronted significant payment obstacles. In addition, pedi-

atricians report that state Medicaid agencies and their contracted managed care organizations seldom allow them to bill for home visits, telephone care payment, or the time required for oversight and coordination of home health care plans despite the existence of codes for these services.

Other complaints about pediatric Medicaid concern restrictive interpretations of medical necessity and benefit definitions that follow adult home health care standards. Still other complaints include excessive paperwork and time required for authorization, retrospective denials, and increasingly long waits to gain eligibility for home, community-based, and TEFRA waivers, particularly in the last few years with state budget difficulties.

STATE CHILDREN'S HEALTH INSURANCE PROGRAM LIMITATIONS

Among states operating non-Medicaid State Children's Health Insurance Program (SCHIP) plans, home health coverage is much more generous than private health insurance. Of the 36 states with non-Medicaid SCHIP plans, only 1 state does not cover home health services. Approximately one quarter of these states impose visit limits, and copayments or coinsurance are rarely charged.[9] Little has been written about SCHIP authorization and payment limits, but because most SCHIP plans rely on the same administrative infrastructure as Medicaid, more stringent limits seem inevitable.

PRIVATE HEALTH INSURANCE LIMITATIONS

The extent of home health coverage under employer-sponsored health insurance plans is not well known. A 1998–1999 study of commonly sold health maintenance organization and preferred provider organization products in each state found that almost all plans covered home health services. However, 83% did not cover private-duty nursing, 45% did not cover home health aides, and more than one third did not cover home-based physical, occupational, or speech therapy. In this study, almost half of the plans imposed visit (typically 60 visits) or monetary limits, and the most often used cap was $5000. Condition exclusions were also imposed in two thirds of plans, usually for impairments not caused by illness or injury and less often for developmental disabilities and neurologic or mental health disorders.[10]

Children covered in nongroup plans seldom have home health coverage. Many of these children's parents seek support from their state's Title V program for children with special health care needs and, depending on the child's condition and family income, may be eligible for gap-filling home health services. It is not unusual for families with inadequate private insurance coverage to terminate employment to gain Medicaid eligibility for their child.

Many private health insurance carriers and managed care plans, especially those with strong case management programs, will authorize home health care when it is perceived to be a cost-effective alternative to institutionalization or outpatient treatment. However, authorizations are often for less than the services deemed medically necessary by the child's physician and the home health care agency. As with Medicaid, authorization delays and retroactive denials are common in the private health insurance industry.

RECOMMENDATIONS

Licensure

To ensure that eligible children have access to high-quality pediatric home health care, all states should regulate in-home services through comprehensive licensure laws that define and regulate the provision of all home health services performed by appropriately licensed and pediatric-trained personnel and all personal care services paid for by third-party payers. Until all states have effective licensure laws and regulations for home health agencies, the Joint Commission on Accreditation of Healthcare Organizations and/or Community Health Accreditation Program should enforce the credentialing requirement for contracts with all third-party payers, including Medicaid. Licensure laws should include the following requirements:

1. All home health services must be provided under a physician-approved plan of care that is reviewed every 60 days and revised as often as required by changes in the patient's condition.
2. The roles of attending physicians, home health agency clinical staff, and insurance and plan case managers should be clearly differentially defined. All agency personnel must have training to meet the needs of patients.
3. Physicians, home health agencies, third-party payers, and managed care plans should use the recommendations published by the AAP in *Guidelines for Pediatric Home Health Care*[2] for the purpose of determining the frequency and duration of home health services. Because few scientific studies have been conducted on the effectiveness of home health care for specific pediatric conditions, medical necessity standards should be based on professional standards of care for children or consensus pediatric expert opinion. Coverage of home health care should not be denied unless there is conclusive scientific evidence that proves that the prescribed home health care is ineffective.[11]
4. Licensure for unique community-based programs that compliment care in the home should be adopted to meet the child's needs and provide access to necessary health services. This includes, but is not limited

to, medical day care, respite care, educational centers, and transitional care (hospital-to-home care).

Payment

1. Insurers and plans must adequately reimburse home health agencies, nurses, and physicians for pediatric home health visits and home care planning and oversight. Home health care payments must be increased to permit home health agencies to attract and retain appropriately credentialed clinicians and ancillary personnel for pediatric intermittent care and shift care (private duty) as well as to cover the indirect costs of clinical management and support for in-home staff. Payment adjustments must also take into account the costs associated with preparation and continuing education of nurses in pediatric competencies, intensive care, and technological skills.
2. Insurers and plans must permit physicians to bill for prolonged oversight services, telephone calls, and online consultations to ensure comprehensive and continuous care for vulnerable children when direct patient contact is unnecessary. In addition, insurers and health plans must reimburse for case management to help maintain a medical home.[12]
3. Payment must be offered to home health agencies, nurses, and physicians that is sufficient to enable them to deliver pediatric home health care consistent with pediatric medical standards.
4. The Centers for Medicare and Medicaid Services must conduct a comprehensive analysis of the adequacy of each state's Medicaid home health care payment rates, taking into consideration the complexity of the states' current pediatric home health care patients.
5. Payment for durable medical equipment must not be bundled into payment for visits or into prospective payment arrangements for intermittent care.
6. Payment for community-based care must be provided by Medicaid, SCHIP, and/or private health insurance companies when cost-effectiveness is evident.

Coverage

1. Private health insurers and non-Medicaid SCHIP plans must be encouraged to offer more comprehensive coverage of home health services for children (including foster children), including private-duty nursing, home health aides, therapies, durable medical equipment, and respite care.
2. Enrollment caps and waiting periods in Medicaid and TEFRA must be reduced or eliminated for children who are medically in need of home health services.
3. Arbitrary limits on the number of days of coverage must be eliminated. Services should not be discontinued without the order of a physician.
4. Public and private third-party payers must clarify and standardize their coverage plans/benefit packages for children who need pediatric in-home services with input from the AAP, including the definitions of "medical necessity" and "home and community-based." Medical necessity must be defined to include services that assist in achieving, maintaining, or restoring health and functional capacity; are appropriate for the age and developmental status; and will take into account the specific needs of the child.
5. New and expanded funding mechanisms must be established to support respite care for families with children who have complex medical problems that require long-term home care and families who must continue to work, preferably through Medicaid and Title V. Respite care for primary caregivers must be included in all pediatric home health care benefits.[13] Coverage for "respite" inpatient stays must also be covered at the appropriate level of care when there are no available qualified home health professionals within the geographic area.
6. Coverage of hospice and palliative services must be available in all pediatric home health care benefit packages so that parents of terminally ill children can obtain therapeutic services for their child even though the odds of survival are minimal.
7. Early intervention services must be covered as prescribed by a physician.
8. Medical day care must be covered.

Research

1. The adequacy of Medicare's prospective payment system for home health care should be examined as a model for financing of pediatric home health care under Medicaid and private insurance.
2. A comprehensive analysis of the adequacy of public and private payment rates for pediatric home health care should be conducted.
3. A study of the impact of inadequate access to pediatric home care should be conducted as it relates to hospital and other health care service utilization, rehospitalization rates, costs, family stress, and family satisfaction. Also, a study should be performed to determine if access to quality pediatric home health care will reduce overall costs of care.
4. A study that demonstrates the benefits of home care in relation to the Olmsted Act, which requires states to provide community-based services to individuals for whom institutional care is inappropriate, should be conducted.

5. Support for ongoing development of pediatric home health care standards, including a definition of medical necessity, should be encouraged.

CONCLUSIONS

Pediatric home care involves the delivery of medical care in the home to children who are ill, recovering, or disabled. It can be as simple as dressing changes or as complex as providing mechanical ventilation. The benefits of home care for children are many, including having the child cared for in the familiar surroundings of a home environment, continued access to social support such as friends and siblings, better growth and development, and less cost compared with continued hospitalization. Implementing the recommendations outlined in this statement will enhance access to high-quality pediatric home health care.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Fireworks-Related Injuries to Children

ABSTRACT. An estimated 8500 individuals, approximately 45% of them children younger than 15 years, were treated in US hospital emergency departments during 1999 for fireworks-related injuries. The hands (40%), eyes (20%), and head and face (20%) are the body areas most often involved. Approximately one third of eye injuries from fireworks result in permanent blindness. During 1999, 16 people died as a result of injuries associated with fireworks. Every type of legally available consumer (so-called "safe and sane") firework has been associated with serious injury or death. In 1997, 20 100 fires were caused by fireworks, resulting in $22.7 million in direct property damage. Fireworks typically cause more fires in the United States on the Fourth of July than all other causes of fire combined on that day. Pediatricians should educate parents, children, community leaders, and others about the dangers of fireworks. Fireworks for individual private use should be banned. Children and their families should be encouraged to enjoy fireworks at public fireworks displays conducted by professionals rather than purchase fireworks for home or private use.

ABBREVIATION. CPSC, US Consumer Product Safety Commission.

OVERVIEW

Fireworks are devices designed for the purpose of producing a visible or audible effect by combustion, deflagration, or detonation.[1] Every year, US residents celebrate the Fourth of July and other festive occasions with fireworks. As a result, in 1999, an estimated 8500 individuals, approximately 45% of them children younger than 15 years, sustained fireworks-related injuries requiring emergency medical treatment.[2,3] Since 1994, the annual number of people receiving emergency medical treatment for fireworks-related injuries has decreased by about one third.[3,4] The hands (40%), eyes (20%), and head and face (20%) are the body areas most often involved.[2] About one third of eye injuries from fireworks result in permanent blindness.[5] Burns account for more than half of fireworks-related injuries,[2] and lacerations, contusions, and abrasions are also common.[1,2,6–8] During 1999, 16 people died as a result of injuries associated with fireworks.[2]

Under regulations promulgated by the US Consumer Product Safety Commission (CPSC) in 1976, any firecracker containing more than 50 mg of explosive material is banned, although aerial devices may contain up to 130 mg of powder charge. In addition, CPSC regulations include fuse burn time limits, cautionary labeling requirements, and criteria to prevent tipover and blowout of devices. Additional regulations address requirements for certain reloadable tube and aerial shell fireworks and the stability of multiple-tube devices.[4]

Consumer fireworks, formerly known as "Class C" fireworks and often inappropriately referred to as "safe and sane" fireworks, include fountains and candles that shoot out sparks or flaming balls, rockets with sticks (called "bottle rockets," because it is customary to stand them in a soda bottle for ignition), other rockets, firecrackers, sparklers, and smoke devices. These are permitted under federal regulation, and their sale is regulated by state and local authorities.[7] At present, 10 states ban all consumer fireworks, and 5 additional states ban all consumer fireworks except sparklers, "snakes," or other novelty items.[9]

In addition to ongoing injury surveillance, the CPSC conducts a special study each year of fireworks-related injuries requiring emergency medical care that occur around the Fourth of July.[2,4,6] The 1999 CPSC study found that one third of the fireworks-related injuries were caused by firecrackers, approximately 10% of which were illegal. Almost 20% of the injuries were from rockets. Notably, sparklers, which are mistakenly believed to be safe by many consumers, caused 10% of these fireworks-related injuries.[2] Although most sparkler-related injuries are minor burns and corneal abrasions, sparklers can reach temperatures greater than 1000°F at the tip and can cause serious burns by igniting clothing.[1,5,8] One study found that two thirds of injuries from sparklers occurred among children 5 years and younger.[8] A case-control study designed to control for the popularity of various devices found firecrackers and aerial devices to be associated with the greatest risk of injury. It also found that the highest chance of injury requiring hospitalization occurred with illegal and homemade devices.[7] Half of the fireworks-related eye injuries and an even higher proportion of those resulting in permanent blindness or enucleation are caused by bottle rockets.[5] Every type of consumer firework has been associated with serious injury or death.[1,8]

Malfunctions of consumer fireworks account for only a small percentage of injuries. In one study, the injured child was a bystander in 26% of cases, and adult supervision was present in 54% of cases.[8] Therefore, not letting children ignite fireworks and

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

providing adult supervision while using fireworks are inadequate injury prevention strategies.

In addition to medical and related costs directly and indirectly attributable to fireworks injuries, fireworks cause significant property damage. In 1997, 20 100 fires, which resulted in $22.7 million in direct property damage, were caused by fireworks.[10] In a typical year, fireworks cause more fires in the United States on the Fourth of July than all other causes of fire combined on that day.[10] The considerable losses of life, health, and property are almost entirely preventable by the removal of all fireworks from the hands of everyone except professional pyrotechnicians. Injuries resulting from public fireworks displays are rare. States that ban all consumer fireworks have significantly lower rates of fireworks-related injuries and fires.[1,5] Where local jurisdictions ban fireworks, there is frequent crossover to nearby communities that permit them, so the effectiveness of such local regulation is limited.[8] Education does not appear to decrease the rate of injuries in states where consumer fireworks are permitted.[7]

RECOMMENDATIONS

1. Pediatricians should educate parents, children, community leaders, and others about the dangers of fireworks. Children and their families should be counseled to attend public fireworks displays rather than purchase fireworks for home use.
2. Public sales, including those by mail or Internet order, of all fireworks should be prohibited. Ideally, this should be done on a national level by federal law or CPSC regulation. International importation of fireworks for private use should also be banned. Sales to professional pyrotechnicians for the purpose of creating public displays would be exempt.
3. The private use of fireworks should be banned. Pediatricians should work to increase the number of communities and states that ban the private use of all fireworks.
4. Accurate surveillance and reporting of fireworks-related injuries, deaths, and fires must be continued.
5. Additional research should be conducted to identify factors that have contributed to the recent decrease in the number of fireworks-related injuries. This information would be helpful in efforts to promote continued improvement in this and perhaps other injury problems.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Genetics

Folic Acid for the Prevention of Neural Tube Defects

ABSTRACT. The American Academy of Pediatrics endorses the US Public Health Service (USPHS) recommendation that all women capable of becoming pregnant consume 400 μg of folic acid daily to prevent neural tube defects (NTDs). Studies have demonstrated that periconceptional folic acid supplementation can prevent 50% or more of NTDs such as spina bifida and anencephaly. For women who have previously had an NTD-affected pregnancy, the Centers for Disease Control and Prevention (CDC) recommends increasing the intake of folic acid to 4000 μg per day beginning at least 1 month before conception and continuing through the first trimester. Implementation of these recommendations is essential for the primary prevention of these serious and disabling birth defects. Because fewer than 1 in 3 women consume the amount of folic acid recommended by the USPHS, the Academy notes that the prevention of NTDs depends on an urgent and effective campaign to close this prevention gap.

ABBREVIATIONS. NTDs, neural tube defects; USPHS, US Public Health Service; CDC, Centers for Disease Control and Prevention; MRC, Medical Research Council; IOM, Institute of Medicine; AAP, American Academy of Pediatrics.

BACKGROUND

Neural tube defects (NTDs) are among the most common birth defects contributing to infant mortality and serious disability. NTDs, which include anencephaly, spina bifida, and encephalocele, occur in approximately 1 of 1000 births in the United States.[1] An estimated 4000 pregnancies are affected with NTDs each year. More than one third of these pregnancies are spontaneously lost or electively terminated; thus, about 2500 infants per year are born with an NTD. The results of 2 randomized controlled trials and several observational studies showed that 50% or more of NTDs can be prevented if women consume a folic acid–containing supplement before and during the early weeks of pregnancy[2,3] in addition to the folate in their diet. Based on a synthesis of these data, the US Public Health Service (USPHS) and Centers for Disease Control and Prevention (CDC) recommendations were developed.[4,5] Because the evidence for folic acid prevention evolved over time, there are two separate recommendations: one for women who have no history of a previous NTD-affected pregnancy and one for women who have had a previous NTD-affected pregnancy.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

WOMEN WITH NO HISTORY OF A PREVIOUS NTD-AFFECTED PREGNANCY

Of children with an NTD, 95% are born to couples with no family history of these defects. Evidence to date suggests that supplementation with a multivitamin containing 400 (0.4 mg) μg of folic acid prevents the occurrence of >50% of NTDs when it is taken before conception and continued throughout the first trimester of pregnancy.[5] The USPHS recommends that all women of childbearing age who are capable of becoming pregnant take 400 μg of folic acid daily.[5] Implementing this recommendation may provide the opportunity for primary prevention of 50% or more of these serious disabling birth defects. Regular and ongoing ingestion of folic acid by women of childbearing age is necessary because approximately half of the pregnancies in the United States are unplanned,[6] and neural tube closure occurs during the first 4 weeks of gestation.[7] Despite the publication of the USPHS recommendation in September 1992, a 1998 poll showed that 70% of women aged 18 to 45 years still are not following the USPHS recommendation.[8]

WOMEN WHO HAVE HAD A PREVIOUS NTD-AFFECTED PREGNANCY

Among US couples who have had a child with an NTD, the recurrence risk is 2% to 3% in subsequent pregnancies.[9] In 1991, the Medical Research Council (MRC) Vitamin Study Group reported the results of a well-designed, prospective, randomized trial of folic acid supplementation for the prevention of NTDs in pregnancies of women who had a previous child with an NTD, and the CDC published its recommendations for consumption of 4000 (4 mg) μg of folic acid.[4] The results of the MRC study conclusively demonstrated that a daily dosage of 4000 μg of folic acid, in addition to folate in the diet, before and during early pregnancy resulted in a 71% reduction of recurrence of NTDs. The addition of other vitamins to the dosage of folic acid did not reduce the risk further. Use of multivitamins without folic acid did not result in a reduced risk for NTDs. The MRC study did not explore the possible benefit of a dosage lower than 4000 μg of folic acid. However, an earlier nonrandomized study conducted in the United Kingdom suggested that a lower dosage, 360 μg daily, resulted in a comparable reduction of recurrence of NTDs.[10] Although adverse maternal or fetal effects of a daily 4000 μg dosage of folic acid were

not detected by the MRC study, the small size of the study groups precluded detection of uncommon adverse effects.

FOLATE AND FOLIC ACID

Folic acid, also known as pteroylmonoglutamic acid, is a synthetic compound used in dietary supplements and fortified foods. The term *folate* includes all compounds that have the vitamin properties of folic acid—including folic acid and naturally occurring compounds in food.[11] The average diet in the United States contains 200 μg of naturally occurring food folate, which is less bioavailable than folic acid.[12] Additional intake of foods rich in folate could raise the average intake, but it has not been demonstrated that increased consumption of food folate would prevent NTDs as effectively as a daily vitamin supplement containing 400 μg of folic acid. A small comparison study suggests that blood folate concentrations are increased much more by folic acid supplementation than by naturally occurring food folate in the diet.[13] Economic and social circumstances may make an adequate increase in dietary folate difficult or unlikely, and the behavioral change required among a large fraction of women may take years to achieve.

Folic acid is a water-soluble vitamin that has no known toxicity. However, higher doses of folic acid can correct the anemia of vitamin B_{12} deficiency (pernicious anemia), which might be an important clue to the presence of vitamin B_{12} deficiency in some instances. Folic acid does not prevent the neurologic consequences of vitamin B_{12} deficiency, and, for this reason, the USPHS recommendation cautioned that intake of folate should be not >1000 μg per day. However, the Institute of Medicine (IOM) Food and Nutrition Board recently set the tolerable upper intake limit of synthetic folic acid at 1000 μg, thus eliminating food folate from the calculation.[14] Because pernicious anemia rarely occurs before the age of 50 years, it is likely to be rare among women consuming folic acid during the reproductive years. Folic acid has been consumed by about a quarter of all women for many years and extensively during later pregnancy without apparent adverse effects; however, studies that definitively address the question of maternal and fetal safety of folic acid are not available.

The IOM Food and Nutrition Board's recommended dietary allowance (RDA) for folate is 400 μg for adults and 600 μg for pregnant women.[14] To reduce the risk for NTDs, the IOM recommended that women capable of becoming pregnant consume 400 μg of folic acid daily from fortified foods, vitamin supplements, or a combination of the two. This is in addition to the naturally occurring folate obtained from a varied diet.[14] The majority of multivitamin preparations contain 400 μg of folic acid. These preparations are available over the counter and are already being taken by about 30% of nonpregnant women aged 18 to 45 years in the United States.[8] Tablets containing folic acid alone are available over the counter in dosages up to 800 μg but the availability is very limited when compared with multivitamin preparations. Folic acid tablets in a 1000 μg dose are available by prescription only. This preparation is most frequently utilized by women who are taking 4000 μg because of a previous NTD-affected pregnancy.

In March 1996, the Food and Drug Administration mandated that enriched cereal-grain products be fortified with 140 μg of folic acid per 100 g of flour.[15] This measure increases the proportion of women who consume the USPHS-recommended daily dosage of 400 μg of folic acid only an additional 3%, because this fortification level will provide the average woman only an additional 100 μg of folic acid per day (unpublished data, 1992).

RECOMMENDATIONS

1. ***Prevention for Women With No History of a Previous NTD-Affected Pregnancy.*** The American Academy of Pediatrics (AAP) endorses the USPHS recommendation that all women of childbearing age who are capable of becoming pregnant should consume 400 (0.4 mg) μg of folic acid daily. Because of the high rate of unplanned pregnancies in the United States, the AAP encourages efforts at devising a program of food fortification to provide all women a daily intake of 400 μg of folic acid. In the absence of optimal fortification, the AAP encourages women to consume 400 μg of folic acid daily in addition to eating a healthy diet. At present, the most convenient, inexpensive, and direct way to meet the recommended dosage is by taking a multivitamin containing 400 μg of folic acid, but efforts to increase the availability of folic acid-only supplements should be encouraged for women who prefer not to take multivitamins. Because the risk for NTDs is not totally eliminated by folic acid use, routine prenatal screening for NTDs is still advisable.
2. ***Prevention for Women Who Have Had a Previous NTD-Affected Pregnancy.*** Women with a history of a previous pregnancy resulting in a fetus with an NTD should be advised of the results of the MRC study. During times in which a pregnancy is not planned, these high-risk women should consume 4000 (4 mg) μg of folic acid per day. However, they should be offered treatment with 4000 μg of folic acid per day starting 1 month before the time they plan to become pregnant and throughout the first 3 months of pregnancy, unless contraindicated. Women should be advised not to attempt to achieve the 4000 μg daily dosage of folic acid by taking over-the-counter or prescription multivitamins containing folic acid because of the possibility of ingesting harmful levels of other vitamins, for example, Vitamin A.[17] It should be noted that 4000 μg of folic acid did not prevent all NTDs in the MRC study. Therefore, high-risk patients should be cautioned that folic acid supplementation does not preclude the need for counseling or consideration of prenatal testing for NTDs.
3. ***Prevention for Other High-Risk Persons.*** No intervention or observational studies address prevention for other high-risk persons. Women with a close

relative (eg, sibling, niece, or nephew) who has an NTD (risk is approximately 0.3% to 1.0%), women with type 1 diabetes mellitus (risk is approximately 1%), women with seizure disorders being treated with valproic acid or carbamazepine (risk is approximately 1%), and women or their partners who have an NTD (risk may be 2% to 3%)[18] and are planning a pregnancy should discuss with their physician the risk for an affected child and the advantages and disadvantages of increasing their daily periconceptional folic acid intake to 4000 μg.

4. ***Public Health Programs: Supplementation, Surveillance, and Food Fortification.*** The AAP recommends that the Department of Health and Human Services expeditiously devise and implement an educational program to prevent folic acid–preventable NTDs throughout the use of supplements, fortified foods, or a combination of both. The program should support surveillance of effectiveness and adverse outcomes to further refine the effective folate dose and mechanisms of actions. In light of the recent IOM recommendation, the AAP also encourages additional efforts at devising a program of food fortification with folic acid to provide all women capable of becoming pregnant a daily intake of 400 μg of folic acid.

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AMERICAN ACADEMY OF PEDIATRICS

Section on Otolaryngology and Bronchoesophagology

Follow-up Management of Children With Tympanostomy Tubes

ABSTRACT. The follow-up care of children in whom tympanostomy tubes have been placed is shared by the pediatrician and the otolaryngologist. Guidelines are provided for routine follow-up evaluation, perioperative hearing assessment, and the identification of specific conditions and complications that warrant urgent otolaryngologic consultation. These guidelines have been developed by a consensus of expert opinions.

PROPOSED GUIDELINES

1. The initial postoperative follow-up examination of the child in whom a tympanostomy tube has been placed should be performed by the otolaryngologist to verify the patency and functional status of the tube. This postoperative visit is usually performed within the first month after placement of the tube. Problems related to tubal patency and function can be addressed at this visit, past or present communication needs can be assessed, and a strategy can be outlined regarding the management of future otitis media episodes.
2. The baseline hearing status of any child who has middle ear disease severe enough to warrant the placement of a tympanostomy tube needs to be determined. An audiologic evaluation should be performed postoperatively if normal hearing was not established preoperatively. The techniques and goals of the audiologic evaluation vary depending on the age and cooperation level of the child. Children who are too young to be tested by behavioral audiologic means (generally children 6 months and younger) can be assessed by otoacoustic emission or brainstem auditory evoked response testing. Children with persistent conductive or sensorineural hearing loss after placement of tympanostomy tubes require additional diagnostic workup.
3. Because the average functional duration of a standard "short-term" ventilation tube has been estimated to range between 6 and 18 months with a mean of 13 months, follow-up examinations of children with tympanostomy tubes should be performed at intervals no longer than 6 months. Such interval ear examinations may be performed by the otolaryngologist or the pediatrician with documented communication (eg, letter, fax, e-mail) between the 2 physicians regarding the child's otologic status.
4. Complete tympanic membrane healing, adequate eustachian tube function, and normal hearing after extrusion or removal of the tympanostomy tube should be established before discharge from the otolaryngologist's care.
5. Some children with tympanostomy tubes may require referral to the otolaryngologist before planned interval examinations. These include but are not limited to:

   - Children with chronic, recurrent, or unresponsive otorrhea;
   - Children with hearing deterioration, balance difficulties, or persistent otalgia;
   - Children in whom perforation, cholesteatoma, or other structural disease of the tympanic membrane is suspected (distinguishing such from myringosclerosis can sometimes be difficult);
   - Symptomatic children with documented tympanostomy tube obstruction from cerumen, dry secretions, or granulation tissue;
   - Symptomatic children in whom a previously placed tympanostomy tube cannot be visualized;
   - Children in whom an extruded tympanostomy tube cannot be removed from the ear canal;
   - Children with a documented medialized tympanostomy tube (a tube that has migrated into the middle ear space);
   - Children who have retained a tympanostomy tube for more than 2 years;
   - Children whose ears are difficult to examine because of external ear canal stenosis, as seen in some children with Down syndrome and other craniofacial syndromes; and
   - Children with preexisting sensorineural hearing loss, documented language or developmental delay, or special needs in whom the additional conductive hearing compromise associated with a nonfunctional tympanostomy tube could be particularly debilitating.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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ERRATUM

Several errors occurred in a figure in the policy statement "Health Care Supervision for Children With Williams Syndrome," which appeared in the May 2001 issue of *Pediatrics* (2001;107:1192–1204). In Fig 2, first column, the 11th row heading under Medical Evaluation should read "Musculoskeletal Eval," and the 12th row heading should read "Pneumovax." In the footnotes, the explanation with the double dagger should read "If hypercalciuria is found, 2 repeated urine studies of the calcium-creatinine ratio (morning and afternoon) should be performed. If the level is still elevated, repeat measurement of the serum calcium level and perform renal ultrasonography for nephrocalcinosis. Assess dietary calcium intake.[21]" The explanation for the abbreviation O should read "Objective . . ."

AMERICAN ACADEMY OF PEDIATRICS

Committee on Child Abuse and Neglect and Committee on Bioethics

Forgoing Life-Sustaining Medical Treatment in Abused Children

ABSTRACT. A decision to forgo life-sustaining medical treatment (LSMT) for a critically ill child injured as the result of abuse should be made using the same criteria as those used for any critically ill child. The parent or guardian of an abused child may have a conflict of interest when a decision to forgo LSMT risks changing the legal charge faced by a parent, guardian, relative, or acquaintance from assault to manslaughter or homicide. If a physician suspects that a parent or guardian is not acting in a child's best interest, further review and consultation should be sought in hopes of resolving the conflict. A guardian ad litem who will represent the child's interests regarding LSMT should be appointed in all cases in which a parent or guardian may have a conflict of interest.

ABBREVIATIONS. LSMT, life-sustaining medical treatment; AAP, American Academy of Pediatrics.

Pediatricians, pediatric subspecialists, and pediatric surgeons caring for a severely abused child who is supported with life-sustaining medical treatment (LSMT) face many difficult decisions. One potential concern may be how to proceed when the child apparently will survive with seriously disabling neurologic deficits or with continued reliance on LSMT, such as a ventilator. Moreover, a parent or guardian may have a conflict of interest when a decision to forgo LSMT risks changing the legal charge faced by a parent, guardian, relative, or acquaintance from assault to manslaughter or homicide.

Conflict of interest from a parent or guardian should not arise if a child is declared brain-dead. The declaration of death based on brain death criteria is not dependent on the cause of the brain injury. Brain death is a clinical determination based on established criteria, supplemented (if necessary) by cerebral flow studies, electroencephalograms, and other ancillary tests.[1,2] In cases of abuse, given the likelihood of criminal prosecution, it may be prudent to supplement the clinical determination of brain death with an ancillary test, such as a cerebral flow study.

FORGOING LSMT

LSMT encompasses all interventions that may prolong the life of the patient. These may include cardiopulmonary resuscitation, respiratory and circulatory support, artificially administered nutrition and hydration, and medications, such as antibiotics.[3] Decisions to forgo LSMT for a critically ill child whose injuries are the result of abuse should be made using the same criteria as those used for any critically ill child. These criteria include the reasonable medical certainty that LSMT will fail to maintain the child's life or the disproportionate burden of treatment in the face of irremediable and severe brain or other injury.[3–6] The primary consideration in forgoing LSMT ought to be the best interest of the child after carefully weighing the benefits and burdens of continued treatment. Decisions to forgo LSMT in cases of severe brain injury should not be limited to children in a persistent vegetative state.[3,6]

RESOLUTION OF CONFLICT

The parent or guardian may be suspected or accused of the assault or may be protecting a friend or family member who is suspected or accused of the assault. If a physician suspects that a parent or guardian is not acting in a child's best interest, it is appropriate to seek further review and consultation in hopes of resolving the conflict. The hospital ethics committee may be one mechanism of conflict resolution. However, the complex legal issues may force the conflict into court.[7] Even so, an ethics committee consultation may be useful to assure the hospital administration and other interested parties that the hospital staff has pursued all possible avenues before asking for a court hearing. The hospital attorney also will need to be aware of the conflict to safeguard the interests of the hospital.

Parents and guardians often retain the right of making medical decisions, such as forgoing cardiopulmonary resuscitation or other LSMT, despite being suspected, accused, or even convicted of child abuse. Court proceedings that appoint a guardian ad litem for the purpose of protecting the abused child often limit the role of the guardian to determine appropriate placement of the child after discharge. A separate court proceeding may be necessary to ask for the appointment of a guardian ad litem for medical decisions—an appointment made necessary given the parent or guardian's conflict of interest for making such decisions. The physician should impress on the judge that the request for the appointment of a guardian ad litem does not prejudge the question of forgoing LSMT and that the guardian ad litem could not make an informed decision without visiting the child's bedside to obtain a first-hand understanding of the child's condition.

Prosecutors may not support a decision to forgo LSMT out of concern that the case against the alleged abuser may be weakened. Furthermore, because the

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

prosecutor may bring a charge of manslaughter or murder after the child's death, the prosecutor has an apparent conflict of interest in arguing before the court in favor of forgoing LSMT. It also may be difficult to find a judge who is willing to hear a request for appointing a guardian ad litem for medical decision-making, given the notoriety that such cases often bring. Finally, the application of pertinent child abuse laws varies from state to state, county to county, and judge to judge, making it difficult to predict with any certainty the outcome of such court proceedings. The American Academy of Pediatrics (AAP) recommends the appointment of a guardian ad litem in all cases of child abuse requiring LSMT in which a parent or guardian may have a conflict of interest.

FAMILY SUPPORT

Decisions to forgo LSMT should be based on complete and compassionate communication with the family. The AAP endorses the role of parents of children receiving LSMT in helping to make these determinations, even if one or both parents are suspected of causing the injury.[3,6] Regardless of the cause, nature, and extent of a child's injuries and of the ongoing court proceedings, the parent(s) or guardian(s) should be treated with respect, compassion, and due consideration for privacy. As should be the case for all critically ill children, appropriate support for the parents should be offered, including a bereavement counselor, chaplain, or other persons identified by the parents as providing important psychological and spiritual support.[8]

TISSUE AND ORGAN DONATION

Although forgoing LSMT does not require the permission of the medical examiner or the district attorney, the medical examiner should be involved early and before the removal of LSMT in child abuse cases. There may be physical evidence, such as photographs of the injuries, that preferably would be obtained before the child's death.

Federal and state regulations require that the parent or guardian be given the option of tissue and organ donation. However, the permission of the medical examiner is absolutely necessary for tissue and organ procurement to take place, as valuable evidence may be altered or lost in the process. If tissue and organ donation are options, the physician should introduce the idea and then request that a person who is trained and comfortable in discussing tissue and organ donation describe the options and answer the family's questions. In addition, the medical examiner should be encouraged to attend the tissue and organ procurement to ensure that appropriate evidence is collected rather than routinely deny permission for procurement.[9,10]

RECOMMENDATIONS

1. Pediatricians, pediatric subspecialists, and pediatric surgeons should be aware of the legal and ethical issues in caring for children who have been seriously injured as a result of abuse.
2. Regardless of the cause, nature, and extent of a child's injuries, the parent(s) or guardian(s) should be involved, as appropriate, in all aspects of the child's care and treated with respect and due consideration for their privacy.
3. Decisions to forgo LSMT for a critically ill child whose injuries are the result of abuse should be made using the same guidelines as those used for any critically ill child.
4. A guardian ad litem for medical decision making should be appointed in all cases of child abuse requiring LSMT in which a parent, guardian, or prosecutor of the alleged abuser may have a conflict of interest.
5. The medical examiner's office should be involved early and before forgoing LSMT. Local procedures for collecting evidence and performing postmortem examinations should be developed to allow for organ and tissue donation.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Clinical Report—Forgoing Medically Provided Nutrition and Hydration in Children

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KEY WORDS
ethics, fluids, nutrition, withholding life-sustaining treatment, children, hydration, end-of-life decision-making

ABBREVIATIONS
AAP—American Academy of Pediatrics
CNS—central nervous system
CAPTA—Child Abuse Prevention and Treatment Act

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

There is broad consensus that withholding or withdrawing medical interventions is morally permissible when requested by competent patients or, in the case of patients without decision-making capacity, when the interventions no longer confer a benefit to the patient or when the burdens associated with the interventions outweigh the benefits received. The withdrawal or withholding of measures such as attempted resuscitation, ventilators, and critical care medications is common in the terminal care of adults and children. In the case of adults, a consensus has emerged in law and ethics that the medical administration of fluid and nutrition is not fundamentally different from other medical interventions such as use of ventilators; therefore, it can be forgone or withdrawn when a competent adult or legally authorized surrogate requests withdrawal or when the intervention no longer provides a net benefit to the patient. In pediatrics, forgoing or withdrawing medically administered fluids and nutrition has been more controversial because of the inability of children to make autonomous decisions and the emotional power of feeding as a basic element of the care of children. This statement reviews the medical, ethical, and legal issues relevant to the withholding or withdrawing of medically provided fluids and nutrition in children. The American Academy of Pediatrics concludes that the withdrawal of medically administered fluids and nutrition for pediatric patients is ethically acceptable in limited circumstances. Ethics consultation is strongly recommended when particularly difficult or controversial decisions are being considered. *Pediatrics* 2009;124:813–822

INTRODUCTION

Decisions to withhold or withdraw life-sustaining treatment from critically or terminally ill children are commonly made in US and Canadian hospitals.[1–4] Most children who die in American hospitals do so after critical care interventions are withheld or withdrawn.[5–8] The American Academy of Pediatrics (AAP) has stated that it supports allowing the withholding and withdrawing of a medical intervention when the projected burdens of the intervention outweigh the benefits to the child.[9] The AAP has also stated that treatment decisions regarding an infant should be based on the judgment that the infant will derive net benefit, concluding that medical treatment that is judged to be harmful, of no benefit, or "futile" is inappropriate and should not be offered or provided.[10] Although decisions about withholding or withdrawing treatments when death is at hand are difficult, a broad consensus has

emerged that decisions to withhold or withdraw medical interventions are ethically and legally acceptable in many circumstances, and these decisions fall within the authority of parents or guardians in consultation with the child's physician.[9] Nevertheless, the withholding or withdrawing of the medical provision of fluids and nutrition for children remains controversial, in large measure because of the strong emotional and social symbolism associated with feeding children. At the same time, there are situations in which medical provision of fluids and nutrition may fail to benefit a child or create a level of burden that cannot be justified by whatever benefit might accrue. In the treatment of adults, the President's Commission[11] and a number of professional organizations, including the American Medical Association,[12] the American Academy of Neurology,[13] the American Nurses Association,[14] the Hospice and Palliative Nurses Association,[15] and the American Academy of Hospice and Palliative Medicine,[16] support the authority of adult patients or their surrogate decision-makers to withhold or withdraw medically administered fluids and nutrition. The American College of Physicians has declared the medical administration of fluids and nutrition to be a medical intervention subject to the same principles of decision-making as all other medical interventions.[17] Appellate court decisions also consistently equate the decision-making process surrounding medically provided fluids and nutrition with other forms of medical treatment, supporting the authority of surrogates to forgo or withdraw medically provided fluids and nutrition when there is no longer net benefit to the patient.[18] The AAP statement on forgoing life-sustaining treatment mentions medically provided fluids and nutrition among interventions that can be withheld.[9] Nevertheless, pediatricians are often uncertain about the ethical and legal propriety of these decisions, the conditions under which such a decision would be appropriate, and how to communicate about this issue with families, colleagues, and staff. The purpose of this report is to review the medical, social, ethical, and legal issues involved in these decisions and to provide guidance to parents, guardians, and clinicians regarding the conditions under which medically provided fluids and nutrition can be withheld or withdrawn from infants, children, and adolescents who lack decision-making capacity.

USE OF TERMINOLOGY AND SCOPE OF REPORT

Medically provided fluids and nutrition are commonly used in pediatric practice for a wide variety of acute and chronic conditions. Fluids and nutrition provided through intravenous catheters and nasogastric, nasojejunal, and gastrostomy tubes have saved and maintained the lives of countless children. In this report, the provision of fluids and nutrition via medical devices is distinguished from the provision of food and drink to children who are capable of eating and drinking. The AAP considers it a fundamental principle that children who are hungry or thirsty, who are capable of oral intake, and for whom there are no medical contraindications to eating and drinking should be given food and fluids by mouth. The focus of this clinical report is children who depend on fluids and nutrition delivered through medical devices for their survival.

Given this focus, we will use the term "medically provided nutrition" rather than "food" and "withholding medically provided nutrition" rather than "starvation." The term "food" elicits images of eating, chewing, tasting, and swallowing along with the pleasures and social connotations that accompany those actions, failing to distinguish these from the technical process of delivering hydration and nutrition through medical devices. Receiving fluids and nutrition through a tube or intravenous catheter is not the same as eating a meal. Likewise, the term "starvation" fails to accurately characterize the experience of patients for whom medically provided fluids and nutrition are withheld, implying an element of suffering that is rarely present when medically provided nutrition is withdrawn.[19] When medically provided fluids and nutrition are withheld, death does not occur from starvation but as a result of dehydration and the patient's underlying condition. Reports on adult patients who have died after refusing nutrition and hydration have consistently shown that these patients do not appear to suffer but experience peaceful deaths.[20–23] In fact, before the development of medical means for providing nutrition or hydration, the cessation of eating and drinking frequently represented the means by which elderly individuals experienced a "natural" death from old age.[24]

ETHICAL DECISION-MAKING

The clear consensus that has emerged over the last few decades is that medical interventions can be withheld or withdrawn when refused by competent patients or by surrogate decision-makers on behalf of patients who lack decision-making capacity. Surrogate decision-makers are expected to base their decisions on what they believe the patient would have wanted or, in the absence of knowledge of the patient's wishes, a determination of the relative benefits and burdens.

The contemporary test in pediatrics for whether an intervention is ethically appropriate is the best-interest standard—a weighing of expected burdens and benefits of that intervention for a particular child. Although the

benefits, risks, and burdens to family, care providers, and society are relevant considerations in many cases, the primary focus should always be on the child's welfare. Other considerations may become determinative when the intervention offers minimal or no benefit to the child.

A number of commentators have argued that fluids and nutrition are different from other medical interventions, because they represent basic forms of care that can never be withheld or withdrawn, especially from children.[25–29] A mother's letdown reflex at the cry of her infant illustrates the deep and complex bond between parent and child and the importance of feeding offspring as an integral element of nurturing them. Food and water are essential to life, play an important role in social and cultural rituals, and are frequently used to reward, punish, or demonstrate love. For many people, having a well-fed child is a sign of a "good" parent, along with keeping their child warm, clean, and safe.[30,31]

Although the important symbolic meaning of feeding and eating is acknowledged, the provision of fluids and nutrition via medical technology is different in important ways from providing food or drink to a hungry or thirsty child.[23] Children who cannot eat and drink, cannot experience the pleasure of chewing and tasting, cannot enjoy the social aspects of sharing food and the social pleasures of mealtime, cannot detect hunger or thirst, or cannot experience nurturing through feeding have different needs that may or may not be met through the medical provision of fluids and nutrition. The medical provision of fluids and nutrition requires tubes, pumps, special formulas, monitoring for adverse effects and complications, and, frequently, surgical procedures.

Medically provided fluids and nutrition represent medical interventions. Similar to most other medical interventions, the medical provision of fluids and nutrition carries with it the potential for adverse effects and discomfort, including dyspnea, fluid overload, widespread edema with potential skin breakdown, systemic and local infection, fluid and electrolyte imbalance, thrombosis, pain, organ damage, and nutritional excesses and deficiencies. The rate of complications of enteral feeding can be as high as 76%.[32,33]

Similar to other medical interventions, medically provided fluids and nutrition may or may not be appropriate, depending on the goals of treatment.[34] Although the benefits of this technology commonly outweigh its risks when used temporarily as an aid to healing or to maintain a quality of life acceptable to patients and their families, the consideration of burdens and benefits remains the basis for determining the appropriateness of this and all other medical interventions. Therefore, medically provided fluids and nutrition can be withheld or withdrawn under the same 2 conditions that justify the withholding or withdrawing of other medical interventions:

- when a competent person has refused the intervention; or
- in the case of persons who have never possessed decision-making capacity or the absence of some indication of a previously competent patient's preferences, when a surrogate decision-maker, in consultation with the physician, has come to the conclusion that the expected burdens of the intervention to the patient exceed the potential benefit to the patient.

Any determination of relative burdens and benefits related to medically provided fluids and nutrition must occur within the context of other decisions about the appropriate level of medical support, provision of comfort care, and the goals of medical interventions given the patient's underlying condition. This report will not discuss the situation of the person with decision-making capacity who has chosen to forgo medically provided fluids and nutrition, because the response to that situation is clear, and it is infrequently encountered in pediatric practice. However, there are several situations in which medically provided fluids and nutrition might fail to provide a net benefit to the pediatric patient.

SITUATIONS IN WHICH THE BURDENS OF TREATMENT OUTWEIGH THE BENEFITS

The provision of medically provided fluids and nutrition is morally optional if it does not provide a net benefit to the child. This section will discuss several situations in which medically provided fluids and nutrition may not provide net benefit to a child. These situations are offered as examples and are not intended to encompass every possible scenario in which medically provided fluids and nutrition might fail to provide net benefit to a child. The argument that medically provided fluids and nutrition may be forgone in such children is not an argument that it should or must be forgone. In the absence of net benefit to the child, other considerations become relevant, and parents should be granted wide discretion in providing or withholding medically provided fluids and nutrition.

Some children may be unable to eat and drink permanently as the result of severe congenital or acquired central nervous system (CNS) injuries. For children with sufficient awareness to experience benefits from continued existence, long-term medically provided nutritional support might be potentially beneficial. However, for children who never possessed consciousness or fail to regain consciousness, questions may arise about whether long-

term medically provided nutrition and hydration ultimately benefit the child. Although medically provided fluids and nutrition may be beneficial while the diagnosis and prognosis remain uncertain and treatment is provided in hope of recovery, the decision to continue medically provided fluids and nutrition should be based on whether the child ultimately derives a net benefit from the continuation of treatment.[29]

Children who are rendered comatose from a severe CNS injury or disease may transition to a persistent vegetative state, "a clinical condition of complete unawareness of the self and environment, accompanied by sleep-wake cycles with either complete or partial preservation of hypothalamic and brainstem autonomic functions," within several weeks.[35] A defining characteristic of individuals in a persistent vegetative state is the complete lack of awareness of themselves or their environment. Such patients are incapable of experiencing either pleasure or suffering and, thus, do not consciously experience any benefit from continued existence. Recent estimates suggest that there are between 14 000 and 35 000 adult and pediatric patients who are in a vegetative state.[36] Some individuals in a vegetative state may recover consciousness, although the probability decreases substantially over time, and most of the few patients who emerge from a vegetative state remain severely disabled.[37] The term "permanent vegetative state" describes patients who remain vegetative for 12 months after traumatic injury or 3 months after a nontraumatic injury, most commonly an anoxic-ischemic event.[38]

Because individuals in a persistent vegetative state are unaware of themselves and their environment, the provision of medically provided fluids and nutrition does not confer them benefit and may be withdrawn. Emerging social standards seem to support a decision to withhold or withdraw fluids and nutrition from a person in a persistent vegetative state. Population surveys suggest that most Americans would not want medically provided nutrition and hydration should they themselves be in a persistent vegetative state,[39–46] and most physicians knowledgeable in this domain support the option of withdrawing fluids and nutrition for those in a persistent vegetative state.[47] The application of a "reasonable-person" standard would suggest that a large majority of people would not want to be kept alive in a persistent vegetative state via any means, including medically provided fluids and nutrition, and that surrogate decision-makers should, therefore, be permitted to forgo such interventions on their behalf.[48–50] It would be a form of age discrimination to impose on children the burdens and quality of life rejected by the majority of adults merely because they had not achieved legally independent status before their catastrophic injury.

This rationale does not necessarily apply to children in a "minimally conscious state," a relatively new term for patients who have limited consciousness. In this condition, individuals have reproducible ability to respond to some limited environmental stimuli, sometimes exhibiting behaviors such as following a simple command, intelligible verbalization, appropriate smiling or crying, or reaching for an object. These patients have some intermittent awareness of themselves and their surroundings and presumably can experience pleasure and pain, although it may be impossible for observers to assess subjective experiences such as suffering.[51] It is difficult or impossible to understand the subjective experiences of individuals who exist in this condition, and it may be impossible to draw firm conclusions about long-term prognosis. Therefore, it is difficult to draw general conclusions about whether individuals in this state would or would not benefit from long-term technical support.[52] Because these individuals represent a group for whom it might be particularly difficult to assess level of awareness and determine prognosis, decisions regarding the withdrawal or withholding of medical interventions on their behalf should be made carefully, and caution must be exercised that judgments are not inappropriately influenced by prejudice regarding disability.

Infants with congenital CNS malformations or prenatal injury who never possessed the capacity to feed orally represent a third group of neurologically impaired children. Examples include infants with anencephaly, hydranencephaly, or profound perinatal asphyxia resulting in an inability to suck. Artificial fluids and nutrition may be essential to support many such infants until a diagnosis and prognosis are confirmed. If the diagnosis and prognosis indicate that the infant will never possess conscious awareness and the capacity to feed orally, some would argue that the risks and potential burdens of medically provided fluids and nutrition could easily outweigh what minimal benefit they would offer the child.[53]

In any of these groups of children with profound neurologic impairment, continued survival might be considered a benefit by the family members, and they may, therefore, choose to maintain their child's medically provided nutrition and hydration on that basis. Conversely, the mere physical existence of a child who will never recover consciousness or the ability to interact with his or her environment may produce great sorrow and suffering for some parents, siblings, and extended family without any perceived compensatory benefit. Therefore, medical provision of fluids and nutrition in these

circumstances cannot be said to benefit the child (who will never personally be capable of experiencing the benefit of existence) and may not promote the interests of the child's family. Therefore, it is not ethically mandatory to provide medically administered fluids and nutrition to a child in a permanent vegetative state or other condition that results in a permanent lack of conscious awareness. For individuals and parents who do not wish to forgo medically provided fluids and nutrition for ethical, religious, cultural, or medical reasons, a decision to maintain these support measures should be honored. Although a decision to forgo medically provided fluids and nutrition is ethically permissible in some circumstances, it would almost never be ethically required, and parents should be allowed wide discretion in making this decision.

Medically provided fluids and nutrition can also be withheld or withdrawn from children with other medical conditions when the burdens of such interventions are likely to exceed any potential benefits. In the final stages of the dying process, many individuals will lose their ability to take fluids or nutrition by mouth because of compromised mentation, sedation, and/or weakness. If a child is capable of experiencing thirst or hunger, fluids and nutrition can be an essential element of palliative care. However, anorexia is common at the end of life. A clear consensus has emerged on the basis of research and clinical reports that seriously ill or dying patients experience little if any discomfort on withdrawal of tube feedings, parenteral nutrition, or intravenous hydration.[54,55] In fact, the adult experience suggests that fasting, particularly in the setting of terminal illness, may carry significant benefits that include the release of endorphins and creating a feeling of well-being, ketone production leading to hunger reduction, and clearer thinking.[32]

Parents and care providers may wish to consider withholding fluids and nutrition in the setting of terminal illness when medically provided fluids and nutrition do not serve the goals of promoting comfort (eg, in some children with end-stage malignancies who are unable or unwilling to take oral fluids or food). In these circumstances, medically provided fluids and nutrition may not be comforting for the child and may only serve to prolong the dying process.[56] Indeed, providing fluids and nutrition in these circumstances may increase discomfort, and fasting might enhance the well-being of the patient through ketosis and endorphin production, decreasing symptoms such as nausea, vomiting, diarrhea, coughing, respiratory secretions, and urine output and decreasing the metabolic rate.[32] Furthermore, the provision of some forms of fluids and nutrition may be accompanied by other burdens such as ongoing hospitalization rather than home care and blood draws to monitor electrolyte balance, liver function, and evidence of sepsis. Palliative care measures to manage symptoms related to decreased oral intake, such as dry mouth or decreased oral hygiene, are well established and effective.[57]

Infants with a severe gastrointestinal malformation or a disease that is destructive to a large portion of the gastrointestinal tract leading to total intestinal failure represent another group for whom parents or legal guardians might be provided the option of withholding or withdrawing medically provided fluids and nutrition. Although administration of total parenteral nutrition may help such children live for years, long-term total parenteral nutrition, particularly in the absence of any bowel function, is associated with a high rate of complications such as infection and hepatic dysfunction.[58,59] More definitive treatments, such as bowel transplants, are currently associated with a significant rate of severe morbidity and mortality in young children.[60,61] Because in some cases the burdens may outweigh the benefits to the child, withdrawal of medically provided fluids and nutrition is an acceptable, although difficult, option to consider, particularly when technical complications, such as no further central line access sites, confront the caregivers.[29,58] For these patients, it is critical to ensure meticulous attention to prevention and treatment of discomfort.

Other conditions that are incompatible with long-term survival and for which significant burden is associated with continued existence or available treatment options might also create situations in which medically provided fluids and nutrition may ethically be withheld or withdrawn from a child. For example, some infants are born with heart defects that are ultimately incompatible with survival beyond a few months and for which transplant is the only therapeutic option. Parents may decide not to pursue the transplant, choosing instead to optimize their child's comfort during his or her short life. In these cases, medically provided fluids and nutrition may not serve the interests of the child. In particular, when congestive heart failure is present, medically provided fluids and nutrition can induce or worsen fluid overload, leading to dyspnea, uncomfortable abdominal distention and associated nausea and vomiting, chest pain, and massive edema with skin breakdown. Should parents and care providers choose to limit medically provided fluids and nutrition, a comprehensive palliative care regimen would be particularly important for minimizing the suffering of the child.

OTHER ETHICAL CONSIDERATIONS

Although withholding or withdrawing medically provided nutrition and hydration may be in a particular child's interests, children with disabilities must also be protected from discrimination. Many children benefit from medically provided fluids and nutrition. Some individuals and groups worry that "crossing a line" and permitting the withdrawal of medically provided fluids and nutrition in any cases will place these vulnerable children at risk of being neglected or devalued as social standards change. They are concerned that if it seems acceptable to withhold fluids and nutrition in children in a persistent vegetative state today, it may become acceptable in the future to withhold them from children with less severe conditions who might be considered burdensome to families or society. Although this "slippery slope" concern is important, it is not sufficiently weighty to preclude the withdrawal of fluids and nutrition in well-defined circumstances. Prohibiting the withdrawal of fluids and nutrition in all cases to ensure protection against discrimination would subject some children to unwanted and burdensome interventions. Because these difficult decisions to withdraw or withhold medically provided fluids and nutrition are explicitly justified on the basis of the welfare of the child, the risk of abuse is substantially reduced. Disability alone is not a sufficient reason to forgo medically provided fluids and nutrition. Decisions about medically provided fluids and nutrition should be made on the same basis that all other medical decisions are made—a determination that, ultimately, the patient would experience sufficient benefit from the intervention to justify any accompanying burdens. That is, it would not be ethically justifiable to withdraw fluids and nutrition from a child who was clearly benefiting from these measures to reduce burdens on the family, society, or the health care system.

One commonly expressed concern about the withdrawal of fluids and nutrition is that it might cause significant suffering. The clinical data (cited in the previous section) do not support this concern. For patients in a persistent vegetative state or with other conditions marked by the absence of conscious awareness, there can be no experience of suffering. For children in a terminal phase of illness, "forced" feedings or nutrition may cause more discomfort than their withdrawal, particularly when symptoms are carefully addressed through palliative measures.

A final ethical consideration concerns the role of parents or guardians in decision-making about the withdrawal of life-sustaining measures. Parents who are seeking their children's best interests are usually the best decision-makers for their children. Because of the value-laden nature of the decision to withdraw fluids and nutrition, this option should only be pursued with the full knowledge and support of a child's parents or legal guardian. Typically, decisions of this nature are not urgent, so parents, guardians, and care providers can wait to ensure the prognosis is correct and have time to fully consider all of the options and the ramifications of each available option. Parents may want to consult with others, including extended family, clergy, and friends. Parents also may want and should be encouraged to seek second or third opinions about the prognosis and the medical or ethical aspects of their options. Ethics consultation may help address the ethical issues and should be available to families. Decision-making in this situation should be accompanied by a discussion about limiting other interventions (such as cardiopulmonary resuscitation and routine blood draws), the practical aspects and logistics of withdrawing medically provided fluids and nutrition, and how comfort will be ensured for everyone involved. The decision to withhold or withdraw medically provided fluids or nutrition should be understood as an important entry point into a broader palliative care plan.[62–64]

It is also important to emphasize that care providers must work within their own ethical standards, and pediatricians and other health care providers should not be required to participate in treatment plans to which they have personal ethical objections. However, when such an option is legal and ethical by societal standards, parents must be made aware of the option and a referral must be made to caregivers who can assist them to further explore and carry out their wishes. On the other hand, although parental permission for the withdrawal of fluids and nutrition is essential, it is not sufficient if care providers do not believe such a choice is ethically permissible. Care providers may require support in understanding the reasons behind a parent's decision. Ethics consultation or ethics committee involvement may be valuable in these situations. In rare situations in which caregivers have a strong basis for believing that continuing or initiating medically provided fluids and nutrition would be, on balance, excessively burdensome to a child and parents do not support the withholding or withdrawing of medically provided fluids and nutrition, health care providers should seek the involvement of an ethics consultant or ethics committee. Difficult choices are best made when there is consensus between the parents and care providers about the best course of care, and the involvement of an ethics consultant, ethics committee, or palliative care consultant may be especially helpful when

there is disagreement surrounding the appropriateness of medically provided fluids and nutrition.

LEGAL CONSIDERATIONS

Most legal cases that have addressed the issue of withholding or withdrawing fluids and nutrition have involved adults, but several principles developed in these cases apply equally in the pediatric setting. One area of legal consensus is that medically provided nutrition and hydration are medical treatments and may be withheld or withdrawn under the same conditions as any other form of treatment.[65–67] Virtually every court case at the federal appellate level has concluded that provision of artificial nutrition and hydration is a medical procedure, that it may be forgone under appropriate circumstances as may any other procedure, and that the fact that it involves basic sustenance is not relevant to whether it must be administered or may be forgone.[65] In *Cruzan v Director, Missouri Department of Health*, for example, the US Supreme Court affirmed the view that medically provided fluids and nutrition are medical interventions that can be refused by a competent adult.[68] The court thus rejected the "exceptionalism" often afforded to medically provided fluids and nutrition.

Federal regulations relevant to this debate emerged after the public controversy over the case of "Baby Doe" in 1983. Baby Doe was an infant with trisomy 21 who died after the decision by his parents to withhold surgical repair of esophageal atresia. In response, Congress amended the Child Abuse Prevention and Treatment Act (CAPTA) in 1984 to include language requiring state child protective services agencies to have reporting mechanisms for the withholding of treatment from infants with severe disabilities.

The CAPTA stipulates that medical treatment need not be provided "other than appropriate nutrition, hydration, and medication" when, in the physicians' reasonable judgment, any of 3 circumstances apply: (1) the infant is chronically and irreversibly comatose; (2) the provision of such treatment would merely prolong dying, not be effective in ameliorating or correcting all of the infant's life-threatening conditions, or would be "futile" in terms of the infant's survival; or (3) the treatment would be "virtually futile" and "inhumane."[69] Although this language seems to advocate for the provision of appropriate fluids and nutrition in most cases, the AAP argues that medically provided nutrition and hydration are "appropriate" when they serve the interests of the child—in other words, when they are expected to offer a level of benefit to the child that exceeds the potential burden to the child. The purpose of this report is to define the appropriate use of medically provided fluids and nutrition, and in that sense, the CAPTA seems consistent with the guidelines provided in this report.[70] Furthermore, the Baby Doe regulations include no direct enforcement mechanism but make states' receipt of federal child abuse prevention program funds contingent on having a reporting mechanism in place. Therefore, the regulations are directed to state-funded child abuse prevention programs and were not intended as standards of physician or institutional liability.[29]

Although there is no federal prohibition of carefully made decisions to withhold or withdraw medically provided fluids and nutrition from children, individual states may have specific regulations or case law that address this issue. Physicians should be familiar with state laws that may influence their decisions regarding the withholding or withdrawing of medically provided fluids and nutrition (state AAP chapters, state medical associations, or the AAP Division of State Government Affairs can offer assistance in obtaining this information).

CONCLUSIONS

It is ethically permissible to withdraw medically provided fluids and nutrition from infants, children, and adolescents in selected circumstances. As a general rule, medically provided fluids and nutrition can be withheld or withdrawn from a child when there is consensus that the provision of fluids and nutrition do not confer a net benefit to the child. In addition, the AAP offers the following general principles:

1. Children capable of safely eating and drinking who show signs of wanting to eat or drink should be provided food and fluids.
2. Medically provided fluids and nutrition constitute a medical intervention that may be withheld or withdrawn for the same types of reasons that justify the medical withholding or withdrawing of other medical treatments.
3. Decisions about whether medical interventions should be provided to a child, including medically provided fluids and nutrition, should be based on whether the intervention provides net benefit to the child.
4. The primary focus in decision-making should be the interests of the child.
5. Although withholding or withdrawing medically provided fluids and nutrition may be morally permissible, it is not morally required.
6. Medically provided fluids and nutrition may be withdrawn from a child who permanently lacks awareness and the ability to interact with the environment. Examples of such children include children in a persistent vegetative state or children with anencephaly. The diagnosis and prognosis should be

confirmed by a qualified neurologist or other specialist with expertise in the evaluation of children with these conditions.

7. Medically provided fluids and nutrition can be withdrawn from children when such measures only prolong and add morbidity to the process of dying. In these situations, continued fluids and nutrition often provide very limited, if any, benefit and may cause substantial discomfort. Some examples of children in this group include those with terminal illnesses in the final stages of dying, infants born with heart defects that are ultimately incompatible with survival beyond a few months and for which transplant is the only therapeutic option, infants with renal agenesis, or infants with a severe gastrointestinal malformation or a disease that is destructive to a large portion of the gastrointestinal tract, leading to total intestinal failure, and whose parents have opted for palliative care rather than intestinal transplant.
8. Parents or guardians should be fully involved in shared decision-making with the physician and health care team and should support the decision to withhold or withdraw medically provided fluids and nutrition. Parents should be reassured that their child will be kept comfortable and should be informed about the likely course of events, including broad estimates of when the child's death is anticipated. Comprehensive palliative care measures for the child, including appropriate sedation and oral hygiene, should be provided in this situation.
9. Ethics consultation is strongly recommended when particularly difficult or controversial decisions are being considered.

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POLICY STATEMENT

AACAP/CWLA FOSTER CARE MENTAL HEALTH VALUES SUBCOMMITTEE- POLICY STATEMENT

PREAMBLE

In the past few years, significant attention has been given to the growing number of children who suffer needlessly because their emotional, behavioral, and developmental needs are not being met. All of us are being urged to take seriously the task of preventing mental health and/or substance use problems and providing services and supports for treating mental illness and/or substance use in children.

Over the last few years, the Surgeon General's Report on Children's Mental Health and the UN Convention on the Rights of the Child have emphasized that treatment should be considered a basic right for children who suffer from an emotional/mental health/substance use problem and their families. This year, President Bush issued an executive order, the "New Freedom Initiative" (NFI) of June 18th, 2001, to identify and remove existing barriers to community living for persons with disabilities, including children with severe emotional disturbances. The NFI highlights the importance of "no wrong door" for accessing services and creating opportunity for children to receive community-based services within their local service systems. The President's announced plan to establish a National Commission on Mental Health will further support addressing the unmet emotional/mental health needs of children.

Children served by the foster care system are coping with the events that precipitated their coming into care, while enduring the personal grief and trauma that accompany the loss of a family. Currently, over 500,000 children reside in foster care in the United States, and 85% of them are estimated to have an emotional disorder and/or substance use problem. Recognizing our common interest, the American Academy of Child and Adolescent Psychiatry (AACAP) and the Child Welfare League of America (CWLA) began an initiative in March 2001, to improve the design, delivery, and outcomes of the mental health and substance use services provided to children in foster care and their families. AACAP and CWLA have been joined by over 30 consumer and professional organizations, which have contributed their expertise and resources to this initiative.

Our examination of the problem and the seriousness, intensity, prevalence, and urgency of the unmet needs of these children and their families substantiates our commitment to this initiative. Drawing on the values and principles already developed through such efforts as the systems of care, which focused on service delivery to children with serious emotional disturbances, the values and principles delineated in this document will guide our efforts to improve policies and practices in the various child-serving systems that

serve children in foster care and their families. We believe such values and principles will drive practice in addressing the mental health and substance use needs of children and their families. This in turn will lead to other reforms in how local communities and the formal systems intersect around mental health, substance use, and child welfare issues to ensure and promote the well-being of children in foster care and their families.

Our mutual interest is the emotional/mental health of children and their families. We must develop innovative and evidence-based assessment tools to identify children's emotional and/or behavioral problems as early as possible and to ensure that all children and their families have access to and receive evidence-based, effective mental health and substance use prevention/treatment services, and supports. We believe it is our professional responsibility to provide the most timely, appropriate, and effective prevention/treatment services and supports to children and their families to ensure the best outcomes. Key strategies for accomplishing these goals are:

- keeping children and their families involved whenever possible;
- providing the children with services and supports in their own community;
- responding to their needs with staff who understand their culture and programs that are culturally relevant to children and their families; and
- treating their mental health and substance use needs in a timely manner with professionals trained in the most effective prevention/treatment approaches.

To this end, we agree to support and advocate for providing mental health and substance use prevention strategies, assessments, treatments, services, and supports designed for children in the foster care system and their families that abide by the following values and principles:

I. **Values**
Overarching Discussion Points:

- Values are infused into a piece of work; principles are the key points that support the infused values.
- Values are what drive the process. Principles result from the values; they make the process operational.
- Values are the "why"; principles are the "how."
- The values focus should be on mental health and substance use issues of children in foster care and their families.

E. Suggested value concepts should support a child-focused approach to ensure that mental health and substance use services and supports are an integral component within foster care.

VALUE: **CHILD-FOCUSED MENTAL HEALTH AND SUBSTANCE USE SERVICES AND SUPPORTS**
Discussion Points:

- Issues of attachment are considered significant to the emotional/mental health of children in all placement decisions.

- The trauma children endure when moved from placement to placement is not conducive to normal development. It can adversely impact children and families.
- When children are placed outside of the home it is important for services and/or supports to be provide not only to the child but also to the family of origin.
- When placing children outside of the home, it is essential to help them create developmentally meaningful new attachments, while at the same time maintaining existing attachments whenever possible.
- Children's view of how their emotional/mental health will be impacted by placement decisions should be represented (either by the child through their words or behavior or through representation by an adult whose primary role is to offer the child's perspective) in all proceedings in keeping with the age and maturity of the child.
- The current child welfare system tends to be focused initially on the physical safety of the child while not adequately considering the impact of removal and placements on the child's emotional/mental health. To do so could prevent further emotional/mental health problems.
- Practice Guidelines must be established to address not only the safety issues but also the emotional/mental/behavioral health need of children.
- Foster care providers need information and resources to address the mental health and substance use needs of the children they serve. A process for monitoring that services are delivered in a timely and appropriate manner is necessary.
- It is important that, while in care, the child and the birth family maintain contact. Assessment decisions need to be made to determine if the birth family can be in immediate and continuing contact (face to face visitation and/or by telephone) in order to decrease the severity of separation trauma. In addition, whenever possible, the birth parents and foster parents and/or other agency caregiver(s) should communicate with each other to maximize continuity and mutuality in accomplishing therapeutic goals.
- Providing mental health intervention at the time of the initial placement and while in care is a means of preventing attachment disorders and/or the progression of already existing mental health and substance use problems. To ensure the child's emotional well-being, assessments should be performed at regular intervals to determine if there are attachment issues emerging to be considered while the child is in care, when moving to another placement and/or moving to their permanent placement (i.e. home, adoption, long-term foster home).

- Reunification with the family of origin may not always be the best option for the child and other options must be considered to ensure the physical and emotional well-being of the child.

F. Suggested value concepts should support a family-driven approach to ensure that mental health and substance use services and supports are an integral component within foster care.

VALUE: **FAMILY-DRIVEN MENTAL HEALTH AND SUBSTANCE USE SERVICES AND SUPPORTS**

Discussion Points:

- For child welfare services, a family-driven policy that does not compromise the child's safety is necessary.
- The foster care system is currently focused on the child. To really meet the needs of the child, it should place greater emphasis on the family of origin. This family-centered approach could result in a major change of cultural/mindset within the current child welfare system.
- The child welfare system is concerned with safety, permanency, and well-being. Every child should have a safe home as soon as possible preferably, but not necessarily with the family of origin.
- To every extent possible, the biological family should be involved even when it is not the custodial family.

G. Suggested value concepts should support a community-based approach.

VALUE: **INTEGRATION, COLLABORATION AND COORDINATION OF COMMUNITY-BASED MENTAL HEALTH AND SUBSTANCE USE SERVICES AND SUPPORTS WITH THE FOSTER CARE SYSTEM**

Discussion Points:

- Mental health and substance use (behavioral health) services and supports should be readily available to children in foster care and their families.
- Identify best practices in providing mental health and substance use services and supports to children in foster care and their families.
- Health and behavioral health care providers must have a clear and defined role, driven by professional expertise and values, in treating children in foster care and their families.
- To ensure child safety and achieve quality services and supports for children and their families, it is crucial to expand and increase the input of both community members and expert professionals.
- In the child welfare system, the child is placed in a foster care environment, which is expected to address the child's safety and well-being. There may be difference in how states define safety.

How local communities participate in setting the community standards further impacts the differences in definition.

- The child's comprehensive health assessment must include the elements of the EPSDT screening and assessment, such as physical, dental, substance use, and mental health evaluations. It must also address issues of co-morbidity.
- Foster parents must be informed of the mental health and substance use needs of the child that they are caring for. They must also be provided with education and information as to effective ways these needs can be met to support the key role foster parents have addressing the mental health and substance use needs of the child.

H. Suggested values concepts should demonstrate sensitivity to cultural competency issues

VALUE: **CULTURALLY COMPETENT, SENSITIVE, RELEVANT, AND STRENGTH-BASED MENTAL HEALTH AND SUBSTANCE USE SERVICES AND SUPPORTS THAT ARE PROVIDED BY KNOWLEDGABLE AND SKILLED STAFF AND SERVICE PROVIDERS WHO ARE AWARE AND UNDERSTAND THE CULTURAL DIVERSITY OF THAT COMMUNITY.**

Discussion Points:

- It is crucial that assessment tools and mental health and substance use services and supports be not only culturally competent, but also culturally sensitive and relevant to children and their families.
- Assessments and mental health and substance use treatment/service/support planning should take into account the strengths of the children and their families.
- Assessment and mental health and substance use treatment/services/supports should take into account the cultural status, economic status, and the diversity of the community and the population being served.
- There should be culturally competent policies and professional competence in procedures, outreach, advocacy, and training throughout the service delivery system.
- To facilitate rapport and successful outcomes, the team engaging and delivering services/supports to children and their families should, to the extent possible, represent the diversity of the community and the population served.
- Cultural competence, sensitivity and relevance is demonstrated through the array of services, the design and delivery system, and by recognizing the importance of existing community-based, informal support networks such as churches, extended kinship networks, and social organizations.

I. Suggested value concepts should support timely access to effective evidence-based quality services and supports

VALUE: **TIMELY, EFFECTIVE, EVIDENCE-BASED, OUTCOME-DRIVEN MENTAL HEALTH AND SUBSTANCE USE SERVICES AND SUPPORTS**

Discussion Points:

- The grief and trauma children experience when they are placed into and within the foster care system must be taken into account when assessing their needs and providing services and supports. An initial mental health and substance use screening should be done within 24 hours of placement. The mental health and substance use screen is intended to identify children in urgent need of emergency mental health and substance use services. This screening would also assess the internalized and externalized levels of distress in the child regarding the separation from their family of origin. A triage intervention to address the child's feelings regarding the separation and help the child cope should be provided as quickly as possible based on the severity and intensity.
- All children in foster care and their families must have a comprehensive mental health and substance use assessment once the child is stabilized but minimally within the timeframes of EPSDT. The assessments should always address the attachment issues for the child as long as the child is in care and be done in a timely fashion especially when there is transition from placement to placement.
- The child welfare system must take into account the difference between a child having a mental disorder and/or substance use problem and a child requiring mental health and substance use intervention to prevent a future disorder and address both. Currently, a mental health and/or substance use assessment is often not done until there is a crisis.
- Just as it is necessary for periodic reviews to be done on individual case plans, it is necessary for systems and providers to perform effective, evidence-based, outcome-driven reviews of results to demonstrate progress in achieving the goals for the children and their families.
- To provide compassionate, relevant services it is essential to reach for and use feedback from the children and their families about the effectiveness of the services offered to address their needs and goals.

II. **Principles generated by the above values**

The principles outlined in this section are infused by the core values mentioned above and provide greater detail for how they are to be implemented.

. **Service coordination and case/care management**

- Coordination/integration among mental health, substance use, physical health, developmental disabilities, legal services, educational services, and child welfare services is essential.
- Children in the foster care system deserve coordinated mental health and substance use services that are designed, screened, assessed, and delivered as part of their foster care services plan.
- Coordination at the systems level can ensure the most appropriate use of limited resources and eliminate the fragmentation currently experienced with different funding streams for the needed services and supports.
- Many children and youth coming into foster care have co-occurring mental health and substance use issues. Service coordination should be provided to ensure that their substance use needs are assessed and treatment services and supports are provided concurrently with the mental health services and supports.
- Coordination must also include the services children are receiving and the services the family member(s) are receiving.
- Coordination should take place to ensure that family members who require services/supports are receiving them.
- Information must be shared on a regular basis among organizations/agencies providing services/support to the child and/or their family. Every effort must be made to eliminate barriers, while complying with the confidentiality requirements in HIPAA. This information should follow the child from placement to placement.

A. **Prevention and early identification**

- Prevention and early identification programs and supports for potential mental health and substance use issues are vital to children in the foster care system and their families.
- Young children (0-3yrs) are of particular concern given they make up a significant percentage of the population of children who are placed in the foster care system. Evidence-based prevention and early intervention programs should be targeted to this population.
- Assessments for children entering the foster care system should include screening for potential mental health and substance use issues.
- While in foster care, children should be reassessed for potential mental health and substance use problems at specific intervals (minimally EPSDT timeframes) or as indicated, so that prevention and/or treatment services and supports can be provided as early as possible. It is recommended that a referral be made for a mental health and substance use assessment by an appropriately trained professional.

B. **Planned and coordinated transitions among agencies and providers and between children, families, and adult systems**

- μ# Children and their families can suffer significant negative impact when transitions and/or discharges are not successful. Therefore, coordination, communication, and effective planning are necessary whenever children are involved in one of the following: changing providers and/or agencies, returning home, changing levels of care, changing placements or moving to their permanent placement, and/or transitioning to self-sufficiency or being transferred to another service system.
- μ# Youth in care making the transition to self-sufficiency may need services provided by the adult system, such as mental health and/or substance use services and housing, financial, health, dental, and educational and/or employment assistance. It is therefore important that effective coordination take place between these child and adult systems.
- μ# Key to ensuring successful transitions and discharges are early planning, ongoing coordination of services to address all needs, effective monitoring of plan implementation, and appropriate sharing of the case record information at the time of transition/discharge.
- μ# Each child leaving the child welfare system must have a developmentally and age appropriate transition and/or discharge plan. Such planning must provide the skills, information, services, and supports that allow young people to successfully transition to adulthood, where they can provide for their own permanency, safety, and well-being.
- μ# Transition can have a significant impact on the child and their family. Therefore, to ensure successful transitions, it is important that the child's needs and wishes (expressed either verbally or through behavior) be considered and take precedence over the system's needs whenever possible. If a child experiences more than two placements, the child welfare system should have a process in place to review the reasons and the impact to the child to ensure attachment issues and the child's mental health and substance use needs are being adequately addressed/considered.
- μ# To minimize the potential negative impact of changes/turnover in workers, it is recommended training be provided to workers on such issues as the impact of removal from home and/or transitions on children and their ability to form attachments, assessing the trauma of removal/placements on the child, effective interventions for dealing with attachment trauma, and signs for when a child should be referred for mental health and substance use treatment/services/supports.

C. **Human rights and responsibilities regarding protection and advocacy**

- μ# All children in foster care have the right to have their views expressed directly through their words and behavior to the extent that is developmentally and age appropriate or have representation

by an adult whose primary role is to offer the child's perspective for the following:

1. Have access to and be provided with quality mental health and substance use services and supports.
2. Have a say in which mental health and substance use services and supports will be of assistance to them based on their own strengths and needs.
3. Have a say in the development, monitoring, and revision of their mental health and substance use treatment plan, which is in keeping with their permanency plan and the family service plan.
4. Have a say in what mental health and substance use services and supports are or are not working for them.
5. Refuse mental health and substance use services and supports unless their refusal would put them at risk of harm.
6. Be provided mental health and substance use services and supports in the least intrusive community-based environment that is possible.
7. Retain their constitutional rights when placed in foster care.
8. Have input into the impact of placement decisions on their emotional/mental health.
9. When very young or developmentally immature, have representation to ensure consideration of the impact of placement decisions on their emotional/mental health.
10. Maintain frequent and regular, ongoing contact with sibling(s) and other family members when the family cannot be maintained as a single unit.

μ# All families with children placed in foster care (except when parental rights are terminated or other legal decisions take precedence while weighing the best interests of the child) have the right to:

1. Have a say and participate in which mental health and substance use treatment services and supports will be of assistance to them and their child based on their strengths and needs.
2. Have a say and participate in the development, monitoring, and revisions of their child's mental health and substance use treatment plan, which is in keeping with their child's permanency plan and their own family service plan.
3. Have a say and participate in decisions about what mental health and substance use services and supports are or are not working for them.
4. Refuse their own mental health and substance use services and supports, when their refusal would not put their child at risk of harm.

5. Have access to and be provided with quality mental health and substance use services and supports.
6. Be provided mental health and substance use services and supports in the least intrusive environment possible.
7. Retain their constitutional rights when their child/children are placed in foster care.

- Through a release of information form, emancipated youth and family members can provide consent on who gets what information.
- Children and their families have the right to be treated in compliance with federal, state, and local policies and standards.
- Children and their families have the right to seek advocacy support.
- Children and their families have the right to make complaints/raise concerns about the mental health and substance use services and supports that they are receiving without retribution. All agencies/providers should have a defined process for how such complaints/concerns can be raised and addressed.
- Children and their families have the right to receive services that are culturally competent/relevant and to choose providers who respect and value their language, culture, and spiritual beliefs.
- Children and their families have the right to access to the courts to address any concerns they might have about the mental health and substance use services they are receiving or believe they should be receiving.

D. **Nondiscrimination in access to services for children in care**

- Discrimination in the provision of services on the basis of race, religion, ethnicity, language, gender, age, sexual preference, marital status, national origin, or disability whether or not illegal.
- Providers should deliver mental health and substance use services and supports to children and their families in compliance with the Americans with Disabilities Act.
- Families can choose mental health and substance use service providers who respect and value their language, culture, and spiritual beliefs.
- As emphasized in the Surgeon General's Report on Children's Mental Health, it is important for public and private providers to ensure services are provided and accessible without any discrimination, including interpreters when necessary.

E. **A comprehensive and accessible array of services**

- Given the complexity of serving children and their families, it is crucial to have a comprehensive array of services available. This would include traditional, faith-based, and non-traditional mental health and substance use services and supports as well as formal and informal supports and services.

- This service array should be appropriate to address the circumstances and treatment needs of children and their families.
- Services chosen from the array should be age and developmentally appropriate.
- This service array should support children and their families in the community whenever possible.
- This service array should take into account the ongoing developing strengths of children and their families.

F. **Individualized service planning**

- Service planning to address the mental health and substance use needs of children should be individualized and include the following:
    1. mental health and substance use services and supports focused on the strengths, desires, interests, values, and goals of the child and the family,
    2. an assessment of the specific and particular mental health substance use needs of the child and the services/supports the family requires to deal with and support a child with these mental health and substance use needs,
    3. measures to address issues of emotional distress arising as a consequence of all placement transitions,
    4. consistency with the permanency plan for the child and the family service plan,
    5. informal as well as formal mental health and substance use services/supports, and
    6. goals articulated in such a way that one can measure progress towards the goals identified by the child and family.
- This individualized service plan should include the continuation of treatment when the child is reunified with his or her family. If a child is not receiving treatment services/supports at the time of reunification then it is an important time to initiate any treatment services that are needed as part of the reintegration process.
- This individualized service plan should be developed in partnership with the child and family and other professionals working with them.
- This individualized service plan should be regularly reviewed and updated to reflect the progress of the child or lack thereof, with input from the child and family when appropriate.
- This individualized service plan should include the discharge and transition plans.

G. **Services in the least intrusive community-based environment**

- Service planning to address the mental health and substance use needs of children should focus on providing these services and supports for children and their families at the appropriate level and

intensity and in the least intrusive environment to increase the child's functioning and physical stability.

- Every effort should be made to keep children in their home community whenever possible. Issues of risk to the child take precedence over the placement that is least intrusive/restrictive even if that means removing a child from their home.
- When services are being designed and developed there should be an easily accessed array of community-based services that support children receiving treatment in the least intrusive manner. Sometimes this might be over a widespread region, in particular in rural areas where it is not financially feasible to have all services in each local community.
- When services are being designed and developed there should be family and community input into the planning process.
- When children need to be placed outside the home community, it is essential that treatment/services/supports be provided to maintain the family connection when there is no indication to the contrary.

H. **Family participation in ALL aspects of planning, service delivery, and evaluation**

- Family is defined (using the Federation of Families definition) as including biological, foster, and adoptive parents, grandparents and their partners, as well as kinship care givers and others who have primary responsibility for providing love, guidance, food, shelter, clothing, supervision, and protection for children and adolescents.
- It is important for the family to be actively invited as part of the engagement process at ALL levels of planning, service delivery, and evaluation: e.g., the system level, organizational level, and individual child level.
- It is important for the family to be appreciated and involved in activities involving the child whenever possible.
- Families should be given the choice as to whether or not they participate.
- The family preference(s) and choice(s) should be considered in all planning for their child outside of situations, which might put the child at risk of harm.
- Families should be provided with advocacy and representation that increases education/communication to families.

I. **Integrated services with coordinated planning across the child-serving system**

- Children in the foster care system with mental health and substance use issues and their families are often involved with multiple child-serving organizations and systems. They require and deserve well coordinated planning and integration of services to address their complex needs.
- To ensure the most appropriate and effective integrated service delivery for children in the foster care system with mental health

and substance use issues and their families, services should be planned and coordinated across the child-serving systems.

- Often children in the foster care system initially access services through primary care. The EPSDT screening process should facilitate integration and coordination of services to meet the identified needs.
- Even when funding streams can not be combined, there is greater potential for integrating services when planning is coordinated across the child-serving systems. Such integrated planning would make better use of limited dollars and reduce the potential duplication of services while increasing the availability of services and supports for the child and family.
- When there are multiple systems involved, it is important for there to be consistency in planning across the various systems to ensure the child and/or family does not hear conflicting messages or has treatment approaches that are counter-indicated. It is the responsibility of all systems to work to mitigate the burden caused by uncoordinated planning between agencies and families.
- The goal is for there to be one document where the plans of various other child-servicing systems are incorporated into the foster care system case plan. The plan should be reasonable, useful, and respectful

GLOSSARY OF TERMS

CHILD - Refers to any child placed in out of home care.

CHILD-FOCUSED - A system is child-focused when both the physical and emotional well-being of the child is central to all levels of decision-making, and a process is in place for resolving conflicts between these two domains. The child's own views expressed, where possible, directly through the child's words and behaviors or, as required, through representation by an adult whose primary role is to offer the child's perspective should be represented along with the viewpoint of members of the child's family (as defined in this document).

CHILD SAFETY - A child is considered safe when an analysis of all available information leads to the conclusion that the child in his of her current living arrangement is not in immediate danger of serious harm, and no safety interventions are necessary.

CULTURAL COMPETENCE - A system is considered culturally competent when there is professional and formalized competence throughout the system in: policies, procedures, outreach, and advocacy efforts, and training. Cultural competence, sensitivity and relevance is demonstrated through the array of services, delivery, framework, and the recognition of the importance of existing community-based, informal support networks such as churches, extended kinship networks, and social organizations. Cultural Competence is demonstrated when there are knowledgeable and skilled staff and service

providers who are aware of cultural issues within the diversity of the community and who reflect and understand the diversity of that community.

FAMILY - Families can include biological, foster and adoptive parents, grandparents and their partners, as well as kinship care givers and other who have primary responsibility for providing love, guidance, food, shelter, clothing, supervision, and protection for children and adolescents. It is the extent of daily interaction and responsibility for a child, not a legal construct that identifies an individual as a family member.

FAMILY-DRIVEN - A system is family-driven when the family (kin and extended) is involved in all levels of decision making. Identification, outreach and engagement of the family receiving services in the foster care system is required so that family experiences and perspectives collectively drive the planning, work and outcome for the foster child.

PREVENTION AND EARLY INTERVENTION - Is inclusive of the following three components:

> **Primary Prevention**: Efforts to avert mental health and substance use problems altogether. For children these efforts include interventions directed at parents and educators and/or other professionals involved with children.
> **Secondary Prevention**: Efforts to detect mental health and/or substance use problems in their early stages of development and to apply techniques to reduce the severity and duration of incipient problems.
> **Tertiary Prevention**: Attempts to arrest further deterioration in individuals who already suffer from severe mental health and/or substance use problems (disorders). Treatment can be considered tertiary prevention.[1]

SYSTEM OF CARE - A system consisting of mental health, substance use, social services, education, medical, physical health, primary care, juvenile justice, and other professional organizations and other formal and informal services/support that work together with the family to meet the child's needs.

SUBSTANCE USE - Refers to the use of alcohol, illicit drugs and the misuse of prescription drugs.

[1] Basis of definition derived from: "Children's Mental Health: Problems and Services." The Congress of the United States, Office of Technology. Washington D.C., 1986. Pg. 151-152.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Policy Statement—The Future of Pediatrics: Mental Health Competencies for Pediatric Primary Care

abstract

Pediatric primary care clinicians have unique opportunities and a growing sense of responsibility to prevent and address mental health and substance abuse problems in the medical home. In this report, the American Academy of Pediatrics proposes competencies requisite for providing mental health and substance abuse services in pediatric primary care settings and recommends steps toward achieving them. Achievement of the competencies proposed in this statement is a goal, not a current expectation. It will require innovations in residency training and continuing medical education, as well as a commitment by the individual clinician to pursue, over time, educational strategies suited to his or her learning style and skill level. System enhancements, such as collaborative relationships with mental health specialists and changes in the financing of mental health care, must precede enhancements in clinical practice. For this reason, the proposed competencies begin with knowledge and skills for systems-based practice. The proposed competencies overlap those of mental health specialists in some areas; for example, they include the knowledge and skills to care for children with attention-deficit/hyperactivity disorder, anxiety, depression, and substance abuse and to recognize psychiatric and social emergencies. In other areas, the competencies reflect the uniqueness of the primary care clinician's role: building resilience in all children; promoting healthy lifestyles; preventing or mitigating mental health and substance abuse problems; identifying risk factors and emerging mental health problems in children and their families; and partnering with families, schools, agencies, and mental health specialists to plan assessment and care. Proposed interpersonal and communication skills reflect the primary care clinician's critical role in overcoming barriers (perceived and/or experienced by children and families) to seeking help for mental health and substance abuse concerns. *Pediatrics* 2009;124:410–421

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KEY WORDS
mental health, competencies, primary care, medical home, children, adolescents, education, training, substance abuse

ABBREVIATIONS
PCCs—primary care clinicians
DSM-PC—*Diagnostic and Statistical Manual for Primary Care*
DSM-IV—Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
CAM—complementary and alternative (integrative) medicine
AAP—American Academy of Pediatrics
ACGME—Accreditation Council for Graduate Medical Education
ADHD—attention-deficit/hyperactivity disorder

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INTRODUCTION

The purposes of this policy statement are to articulate competencies—skills, knowledge, and attitudes—needed by primary care clinicians (PCCs) to address the mental heath problems prevalent among children and adolescents in the United States and to promote use of the competencies in guiding residency education and continuing education of PCCs.

Definitions and Scope

The term "mental" throughout this statement is intended to encompass "behavioral," "neurodevelopmental," "psychiatric," "psychological," "emotional," and "substance abuse," as well as family context[1–6] and community-related concerns such as child abuse and neglect, separation or divorce of parents, domestic violence, parental or family mental health issues, natural disasters, school crises, military deployment of children's loved ones, and the grief and loss accompanying any of these issues or the illness or death of family members. The term also encompasses somatic manifestations of mental health issues, such as eating disorders and functional gastrointestinal symptoms. This is not to suggest that the full range or severity of all mental health problems falls within the scope of pediatric primary care practice but, rather, that children and adolescents may suffer from the full range and severity of mental health conditions and psychosocial stressors. As such, children with mental health needs, similar to children with special physical and developmental needs, are children for whom pediatricians, family physicians, pediatric nurse practitioners, and physician assistants provide a medical home.[7]

The *Diagnostic and Statistical Manual for Primary Care* (DSM-PC) classification system[8] distinguishes between developmental variations (behaviors that may raise concern but are within the range of expected behaviors for the age of the child), problems (behaviors serious enough to disrupt functioning but not to a level severe enough to warrant the diagnosis of a disorder), and disorders (as defined by the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* [DSM-IV][9]). Because the PCC has a role in providing reassurance and/or care for children with behaviors in each of these categories, all fall within the scope of this document. Authors have used the term "concerns" when referring to behavioral issues not differentiated into 1 of these categories.

Many PCCs engage in mental health screening, assessment, diagnosis, and treatment. The term "mental health specialists" is intended to distinguish PCCs from those who specialize in the assessment and care of children and adolescents with mental health concerns. Thus, the term "mental health specialists," as used in this report, includes physicians and nonphysicians such as psychiatrists, clinical psychologists, clinical social workers, licensed professional substance abuse counselors, nurses with advanced psychiatric training, family therapists, neurologists, early intervention specialists, developmental-behavioral pediatricians, and adolescent medicine specialists. Each of these disciplines has specific training and licensing requirements. Other individuals outside the mental health profession who have an effect on the mental health of children include teachers, counselors, coaches, religious leaders, and community and extended family members. Providers of complementary and alternative (integrative) medicine (CAM), both licensed and unlicensed, also may address children's mental health, and a large number of families self-select CAM treatments for their children's mental health conditions.[10–14] A growing body of literature describes the potential benefits of CAM approaches[15–17] and risks of CAM therapies, including interactions of herbal remedies and dietary supplements with prescription medications.[18,19] Although 1 randomized, controlled trial of St John's wort was conducted with adolescents with depression,[20,21] most studies of herbal medication for mental health disorders have been completed in adults. These developments underscore the importance of knowing the medical evidence and considering CAM therapies and CAM providers in the context of pediatric mental health care.

Need for Statement

The need for this statement was driven by the following forces:

- the recognition that adverse psychosocial experiences in childhood have lifelong adverse effects on mental and physical health and on psychosocial status[22–25];
- the high prevalence of mental health disorders and substance abuse among children and adolescents: an estimated 10% to 11% of children and adolescents have both a mental health disorder and evidence of functional impairment[26];
- the prevalence of children who do not meet DSM-IV criteria for a disorder but who have clinically significant impairment ("problems" in DSM-PC terminology[8]), which is estimated to be equal to twice the prevalence of children with severe emotional disorders[26–28];
- the prevalence of mental health concerns in pediatric populations[29,30];
- the recognition that fully half of the adults in the United States with a mental health disorder had symptoms by the age of 14 years[31];
- the low percentage of children receiving care for their mental health or substance abuse problems (~20%)[26,32];
- the shortage and inaccessibility of specialty mental health services,[33] especially for underserved children from low-income families who do not fall within the target population of public/community mental health services;
- the disproportionate effects of unmet mental health needs on minority populations[34];

- the recognition that unidentified mental health comorbidities, such as anxiety and depression, are a significant force driving utilization of medical services[35]; and
- the growing realization (articulated in the President's New Freedom Commission Report[36]; *Mental Health: A Report of the Surgeon General*[26]; the Future of Pediatric Education II (FOPE II)[37] study; and *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents, Third Edition*[38]; and by American Academy of Pediatrics [AAP] members [annual leadership forum resolutions]) that PCCs have a critical role to play in meeting children's mental health needs; in fact, at least 1 state is now requiring, by court order, universal mental health screening by PCCs for all children on Medicaid in that state.[39]

RATIONALE FOR COMPETENCIES

Uniqueness of the PCC's Role

PCCs have a role in mental health care that differs substantively from that of mental health specialists, many of whom may be unfamiliar with problems as they present in primary care. The recommended competencies reflect these differences. Children and families who seek care from a mental health specialist do so because they have recognized a mental health need or because some crisis has compelled them. Children and families seeking care at primary care offices typically have not framed the visit as "mental health"–related. They may be seeking routine health supervision, acute care for a physical complaint, help with a challenging behavior, or simply reassurance. Ideally, PCCs would elicit psychosocial and mental health concerns from children and families in each of these situations. They would find ways to support and help the family that is resistant to seeking mental health care and to recognize those emergent situations that compel an immediate intervention. If and when a family is ready to address a problem, PCCs may choose to assess and manage the child himself or herself—in roles similar to those of mental health specialists—or they may choose to guide the family toward appropriate referral sources. Whether providing mental health services alone or collaboratively, PCCs would monitor the child and family's functioning and progress in care, applying chronic care principles as they would for other children and youth with special health care needs.[40] PCCs ideally would be able to provide these mental health services within the constraints of a busy practice without compromising the efficiency and financial viability of the practice.

The Primary Care Advantage

The AAP recognizes the unique strengths of PCCs and the opportunities inherent in the primary care setting—"the primary care advantage"[41]—on which mental health competencies can build:

- a longitudinal, trusting, and empowering therapeutic relationship with children and family members;
- the family-centeredness of the medical home[1–6,42,43];
- unique opportunities to prevent future mental health problems through promoting healthy lifestyles, anticipatory guidance, and timely intervention for common behavioral, emotional, and social problems encountered in the typical course of infancy, childhood, and adolescence (as described in *Bright Futures*)[38,44,45];
- understanding of common social, emotional, and educational problems in the context of a child's development and environment[38];
- experience working with specialists in the care of children with special health care needs and serving as coordinator and case manager through the medical home; and
- familiarity with chronic care principles and practice-improvement methods.

Framework for Behavioral and Mental Health Competencies

In 1999, the Accreditation Council for Graduate Medical Education (ACGME) initiated the Outcome Project.[46] Through it, the ACGME established competencies to serve as the framework for residency curricula, organized into 6 domains: systems-based practice; patient care; medical knowledge; practice-based learning and improvement; interpersonal and communication skills; and professionalism. The competencies proposed in this report build on the ACGME framework with the expectation that they will be useful in setting goals for personal and professional growth in pediatric practice, for future board certification and recertification, and for residency training. Because achievement of system changes necessarily precedes other enhancements in mental health practice, the table of proposed mental health competencies for pediatric PCCs (Appendix 1) departs from the usual ACGME sequence, which includes systems-based practice as the final set of competencies, and instead begins with competencies for systems-based practice.

Assumptions

Traditional concepts of mental health care build on the assumption that treatment must follow diagnosis of a disorder; however, this approach offers only partial help for most children with mental health problems seen in primary care—those with significant dysfunction in the absence of a specific diagnosis.[27] The primary care setting

offers the unique opportunity for patient-clinician interaction to positively influence the clinical outcome of emerging problems, problems that do not meet the criteria of a DSM-IV disorder, and mild or undiagnosed disorders ("problems" in the DSM-PC classification[8]). The proposed competencies assume that PCCs can, in many instances, have a positive effect on a child's mental health problems without knowing precisely the child's diagnosis and in situations in which the child's symptoms do not meet the criteria of a DSM-IV disorder.[47–49]

"Generic" mental health skills proposed in this report are drawn from the literature on "common factors" in mental health care—techniques used to increase patients' optimism, feelings of well-being, and willingness to work toward improvement, regardless of the specific diagnosis or problem identified.[50–56] Other skills target symptoms that occur commonly across multiple mental health problems—feelings of anger, ambivalence, and hopelessness—and the family conflicts frequently associated with these problems. These skills come from family therapy,[6] cognitive therapy,[57] motivational interviewing,[52] family engagement,[58] family-focused pediatrics,[42,43] and solution-focused therapy.[59]

The proposed competencies further assume that collaboration—among PCCs and staff members within the primary care practice and between the PCC/practice and families, mental health specialists, educators, case managers, social service workers, juvenile justice staff, and other agency personnel—is a central requirement in caring for children with mental health problems. Collaboration between PCCs and mental health specialists may take the form of a referral with formal exchange of information, a special referral relationship with regular communication, meeting(s) to discuss cases, meeting(s) of both the PCC and mental health specialist(s) with patients, or full integration of mental health and primary care services.[60] Models in which a licensed mental health specialist is integrated into a primary care practice have shown promise in improving access to services and treatment adherence, increasing efficiency and effectiveness of care, decreasing medical costs, increasing patient functioning and productivity, and improving patient and provider satisfaction.[61–64] A regional network of child psychiatrists[65] offering real-time telephone consultation and referral to PCCs in Massachusetts enhances the capacity of PCCs to care for children with diagnostic comorbidity, complicated attention-deficit/hyperactivity disorder (ADHD), anxiety, and depression. The proposed competencies reflect the importance of clinicians' staying abreast of collaborative approaches applicable to their particular setting and applying the growing body of evidence evaluating the effectiveness of various models.

A final assumption is that PCCs can expand their capacity beyond managing ADHD to care effectively for children with other commonly occurring pediatric mental health problems: anxiety, depression, and substance abuse.[63,66–68] By routinely screening for mental health problems, recognizing symptoms early, educating children and families about self-management strategies, and offering first-line treatment, PCCs have the potential to improve the lives of many children and their families who might otherwise not receive mental health care or receive care only after problems become more severe and impairing.[38] In the case of children with a chronic medical condition and comorbid anxiety and depression, mental health care may also result in improvements in their physical health and decreases in their utilization of emergency department and hospital services.[35]

PROPOSED COMPETENCIES

The proposed competencies are detailed in Appendix 1. A summary follows.

Systems-Based Practice

Systemic changes will necessarily precede other enhancements in mental health practice. Competencies in this area will empower clinicians to work with other mental health advocates toward improving the organizational and financial base of care and, with that base in place, to establish effective coding and billing practices that will sustain mental health services.[69,70]

Another skill set involves building collaborative relationships with individuals and agencies that provide mental health services and with organizations that represent youth and families who are experiencing mental illness. These relationships will enable clinicians to address service gaps, define respective roles, and coordinate services. A final set of systems-based competencies involves selecting tools and establishing systems within the practice to normalize and systematize integration of mental health and to apply medical home principles and the chronic care model to children with mental health problems.

Patient Care

Competencies in this area include clinical skills to build resilience, promote healthy lifestyles, and prevent or mitigate mental health problems in children; identify risk factors and emerging mental health problems in children and their families; screen for mental health issues; conduct an assessment of a child presenting with mental health concerns or a positive screening test; overcome barriers (perceived and/or experienced by children and their families) in seeking help for mental health

concerns; provide guidance to families on managing common behavioral problems and coping with adverse life events; and recognize mental health emergencies. A critical patient care skill is integrating child and family strengths, needs, and preferences; the use of clinicians' own skills (interpersonal, relational, assessment, diagnosis and management); and available resources into developing a care plan for children with mental health problems, involving mental health specialists when appropriate. The proposed competencies suggest that PCCs develop the capacity to provide care to children with ADHD, anxiety, depression, and substance abuse.

Medical Knowledge

This set of competencies focuses on applying current science to the mental health screening and assessment process and to decision-making about pharmacologic and psychosocial interventions in primary care. Foundational elements include the diagnostic classification of mental health variations, problems, and disorders in primary care (DSM-PC)[8] and the evidence base for screening, therapeutic interventions, and behavior change science, as applied to mental health practice.

Practice-Based Learning and Improvement

This skill set enables the clinician to set and achieve learning and practice-improvement goals. Components include development of office protocols for the assessment and care of children with mental health problems and implementation of a quality-improvement program.

Interpersonal and Communication Skills

These skills are central to effective mental health practice within the rapid pace of a primary care practice, including common-factors approaches that are effective across a range of mental health conditions (see "Assumptions"). They also encompass effective exchange of information between PCCs and others involved in the care of the child and family.[71]

Professionalism

These skills build on respect for children and their families and sensitivity to cultural differences. In addition to facilitating child-clinician and family-clinician empathic relationships, which are the heart of effective mental health practice, they enable the clinician to discuss such issues as confidentiality and his or her own professional limitations.[72,73]

RECOMMENDATIONS

PCCs should:

- partner with parents, mental health specialists, and AAP chapter and national leaders to achieve competencies in systems-based practice, such as advocating with insurers for appropriate payment, and with policy makers for funding of mental health services[74,75];
- build relationships with mental health specialists with whom they can collaborate in enhancing their mental health knowledge and skills;
- with necessary system changes in place (eg, payment, collaborative relationships), adopt the goal of achieving the full complement of mental health competencies outlined in Appendix 1;
- advocate for innovations in residency training and continuing medical education activities to increase the knowledge base and skill level of PCCs in accordance with these competencies; and
- pursue educational strategies suited to their own learning style and skill level for achieving the mental health competencies.

EDUCATIONAL STRATEGIES AND IMPLEMENTATION CHALLENGES

These competencies are put forward as goals for all clinicians who serve children. Some clinicians have achieved many, if not most, of these competencies through development of their own knowledge and skills. Some achieve competence through collaborative practice with mental health specialists, as described above. Some are just setting out to achieve competence in mental health practice.

The AAP recognizes the serious maldistribution of mental health resources for children and their families. There are many areas of the country where specialty mental health services are unavailable or inaccessible; in these settings, clinicians may feel a sense of urgency to achieve and apply the full set of mental health competencies. Where mental health specialty services are more readily available, PCCs have the opportunity to establish collaborative relationships with mental health specialist(s), such as a mental health specialists colocated within the primary care setting, a psychiatrist consulting via telephone or videoconference, a mental health specialist providing cognitive behavioral therapy to a child being treated by the PCC with an antidepressant drug, or any number of other collaborative models.[60–63] Such relationships serve to educate the PCC and enhance services to children in their mutual care.

Achieving the proposed competencies will require new educational approaches as well as systems changes. With the exception of ADHD,[76,77] little evidence is available to guide PCCs in the unique aspects of their role as mental health care providers, and few experts in mental health/substance abuse have experience practicing in busy primary care settings within the context of primary care's average 16.3-minute[78] visits and payment realities.

Strategies for Residency Education

Just as mental health practice in primary care settings is collaborative, the process of training PCCs for primary care practice will necessarily be collaborative. Content experts (eg, developmental-behavioral pediatricians, child psychiatrists, adolescent medicine specialists, clinical psychologists, nurses with advanced psychiatric training, social workers) can join with primary care experts—clinicians who are effective in delivering primary medical care and managing children's chronic conditions in partnership with families—to train the next generation of PCCs. For academic generalists who have not received mental health training, collaboration with mental health specialist(s) to train PCCs will be particularly important. This training might take the form of coprecepting in residency continuity clinics, partnering to conduct inpatient rounds, and codeveloping didactic programs. While benefiting from the content expertise of their mental health colleagues, pediatric academicians will have the opportunity to model the collaborative, multidisciplinary relationships that underlie effective mental health practice.

Data from the 2007 AAP Graduating Residents Survey suggest that completion of an elective child psychiatry rotation and more training in mental health assessment, education, and treatment related to children are associated with greater confidence in identifying and treating pediatric mental health problems.[79] Additional research will be necessary to determine which educational methodologies are associated with the best outcomes. These findings have significant implications for the apportionment of time to mental health training within pediatric residency programs. Clearly, the 1-month developmental-behavioral pediatric rotation (often shortened by vacation time) is insufficient to accommodate necessary additions to the curriculum.

Strategies for Education of Experienced Clinicians

Experienced PCCs will benefit from approaches that build on skills they have developed over years of working with children and families. Wissow et al[49] have demonstrated that experienced PCCs can, in appropriate circumstances, provide evidence-based care of children with mental health and substance abuse problems or disorders of mild severity and functional impairment across diagnostic categories. Children treated by PCCs trained in mental health communication techniques have shown modest but significant improvement in mental health functioning, and their parents showed reduction in distress, compared with children treated by clinicians who did not receive training in mental health care.[49] Additional research will be necessary to adapt these techniques to the training of less-experienced clinicians.

Collaborative office rounds have been established in various communities for the purpose of enhancing mental health knowledge and skills of PCCs and their communication with mental health specialists.[80,81] One- to 2-hour sessions typically involve psychiatrists and/or developmental-behavioral pediatricians and PCCs in a case-based discussion.

Several groups of mental health educators have developed comprehensive training to prepare mental health specialists and primary care professionals for their respective roles in collaborative practice.[82,83] The AAP Task Force on Mental Health is collecting information about such trainings on its Web site (www.aap.org/mentalhealth) and has begun the process of keying proposed educational sessions at the National Conference and Exhibition and other AAP events to the mental health competencies put forward in this document. Clinicians may also work toward enhancing mental health competence by monitoring their psychosocial care in maintenance of certification by using such quality-improvement programs as eQIPP (Education in Quality Improvement for Pediatric Practice) and developing relevant pay-for-performance and quality indicators for health plans.

The most fundamental of all the proposed mental health competencies is the capacity to assess one's own knowledge and skills in mental health care and to establish a mechanism to update them, addressing the gaps that inevitably accompany gains in science. A growing number of educational resources developed by the AAP, the American Academy of Family Physicians, the National Association of Pediatric Nurse Practitioners, the American Psychiatric Association, the National Association of Social Workers, the American Academy of Child and Adolescent Psychiatry, and the American Psychological Association are available on their respective Web sites (Appendix 2). A powerful educational strategy is the cross-fertilization that occurs through a PCC's relationship with mental health specialists—authentic collaboration in the assessment and management of children in their mutual care and regular exchange of information about the child's and family's progress. This type of collaboration, together with openness to applying new science, will be essential for achieving and maintaining competence in mental health practice.

CONCLUSIONS

Attainment of the mental health competencies proposed in this report is a future goal, not a current expectation. It will require systemic changes,

new methods of financing, practice enhancements, new (or honed) skills, access to reliable sources of information about existing evidence and new science, and innovative educational methods. These changes will be incremental and will require substantial investments by the AAP and its partner organizations and by clinicians working at both the community and practice levels. Gains are also likely to be substantial, including the improved well-being of children and their families and enhanced satisfaction of PCCs.

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APPENDIX 1 Proposed Mental Health Competencies for Pediatric PCCs

"Systems-based practice": clinicians providing primary care to children and adolescents should be able to do the following

"Improve the organizational and financial base of care"

1. Apply collaborative strategies applicable to advocating with insurers and payers for appropriate payment to PCCs and mental health specialists for their mental health services
2. Utilize appropriate coding and billing practices to support mental health services

"Build community collaborations"

3. Establish collaborative relationships with support groups; professionals available within the community (eg, early intervention specialists, school personnel, child care professionals, mental health specialists); and/or community agencies (eg, departments of social services, juvenile justice system, nonprofit agencies providing mental health and substance abuse services to children and families) and define respective roles in assessment, treatment, coordination of care, exchange of information, and family support
4. Participate in multidisciplinary meetings, appropriately applying such skills as reflective listening, mediation, and leadership skills
5. Apply collaborative approaches involving parents and mental health specialists to advocate for services and educational resources relevant to the full range of children's/adolescents' and families' mental health needs, including those of special populations, such as abused children, children in foster care, homeless children, children of international political refugees and other recent immigrants, children with physical or mental disabilities, children displaced by disasters, children of separated and divorced parents, children of parents deployed for military service, and youth involved in the juvenile justice system

"Enhance the practice"

6. Establish systems within their practice to support mental health services; elements include
   a. a directory of mental health and substance abuse referral sources and family support resources in the region
   b. established procedures for
      promoting healthy lifestyles, including exercise, sleep, optimal nutrition, stress management, decreasing exposure to environmental toxins and stressors, and seeking support within the community
      eliciting a history of patients' involvement in mental health specialty care
      requesting consent to collect information from collateral sources such as mental health professionals, schools, and social service agencies
      obtaining and documenting the child's and family's psychosocial history
      managing psychiatric emergencies
      screening for occult mental health problems
   c. registries of patients with mental health problems (including children for whom psychopharmacologic agents have been prescribed and children/families not prepared to take action on mental health concerns)
   d. evidence-based protocols and monitoring/tracking mechanisms for the care of children with mental health problems
   e. culturally and linguistically appropriate educational materials on mental health topics for children and families
   f. tools for facilitating coding and billing specific to mental health
7. Establish a practice environment that normalizes integration of mental health and incorporates medical home principles for the care of children with mental health concerns as for children and youth with other special health care needs

"Patient care": clinicians providing primary care to children and adolescents should be able to do the following

1. Promote mental health resilience through reinforcing child and family strengths and counseling families in healthy lifestyles (eg, nutrition, exercise, play, limited screen time, sleep, family time, stress management, decreased exposure to environmental toxins, and promotion of social capital)
2. Integrate a brief psychosocial update into acute care visits
3. Select, use, and interpret tools appropriate to the primary care setting for such purposes as screening for mental health problems, functional assessment of children and families, collection of information from collateral sources (eg, schools, agencies, juvenile justice system, other health professionals), and diagnostic assessment
4. Conduct history, physical assessment, and observations of parent-child interaction indicated by presenting mental health concerns and/or positive screening test(s) results
5. Differentiate normal behavioral variations, mental health problems and disorders, physical conditions with mental health manifestations, and adverse medication effects
6. Identify potential behavioral, mental health, and/or learning differences/problems reflected in report cards, academic test results, Individualized Family Service Plans, or Individualized Education Plans
7. Recognize common mental health comorbidities in children with physical and cognitive disabilities, chronic medical conditions, and mental health disorders
8. Plan diagnostic assessment, alone or in collaboration with mental health specialists, of children and youth with special health care needs who have comorbid mental health issues; infants and young children manifesting difficulties with communication and/or attachment; and children and adolescents presenting with anxious or avoidant behaviors, inattention and hyperactivity, depressive or withdrawn behaviors, oppositional or aggressive behaviors, problems with eating, substance use, exposure to trauma or loss, learning differences, and poor academic performance
9. Analyze results from mental health screening, history, and physical assessment to determine a child's/family's need for further assessment and/or intervention
10. Provide guidance to families on managing common mental health problems; on coping with adverse life events such as parental separation and illness or death of a loved one; and on use of educational resources appropriate to their literacy level and cultural and individual needs
11. Recognize mental health emergencies, severe functional impairment, and complex mental health symptoms that require mental health specialty care
12. Assist families in seeking and using care of a mental health specialist and/or facility that provides evidence-based services appropriate to a child's/family's needs and preferences
13. Develop a contingency or crisis plan for a child or adolescent with an urgent mental health problem
14. Apply strategies to monitor adverse and positive effects of nonpharmacologic and pharmacologic therapy
15. Integrate child/family strengths, needs, and preferences; clinician's own skills; and available resources into development of a care plan for children with mental health problems, alone or in collaboration with mental health specialists (including further assessment; child/family education about the condition[s]; evidence-based nonpharmacologic and, if indicated, pharmacologic interventions; communication with family and collaborating professionals; monitoring mechanisms; and routine health supervision)

APPENDIX 1 Continued

16. Initiate the process of care, alone or in collaboration with other clinicians, for children experiencing functional impairment from ADHD, anxiety, depression, or substance use/abuse, as desired by the child or family

"Medical knowledge": clinicians providing primary care to children and adolescents should be able to do the following

1. Access current data about the safety and efficacy of common pharmacologic and psychosocial interventions in children and adolescents
2. Access current data about interactions between prescription drugs and dietary supplements commonly used for mental health problems
3. Apply the DSM-PC criteria for the diagnoses of ADHD, major depressive disorder, and other disorders for which the clinician considers pharmacologic therapy
4. Use evidence-based interventions for children and adolescents with anxiety disorders (including posttraumatic stress disorder), ADHD, depression, and substance abuse
5. Apply principles of behavior-change science to mental health practice

"Practice-based learning and improvement": clinicians providing primary care to children and adolescents should be able to do the following

1. "Identify strengths, deficiencies, and limits in one's own knowledge and expertise" concerning mental health and substance abuse assessment and care
2. "Set learning and improvement goals"
3. "Identify and perform appropriate learning activities"
4. "Locate, appraise, and assimilate evidence from scientific studies related to their patients' problems"
5. "Use information technology to optimize learning"
6. Apply learning to development of office protocols for the assessment and care of children with mental health disorders
7. "Systematically analyze practice, using quality improvement methods, and implement changes with the goal of practice improvement" in mental health care

"Interpersonal and communication skills": clinicians providing primary care to children and adolescents should be able to do the following

1. Elicit mental health concerns from a child or adolescent and family
2. Explore the cultural context of a child and family's symptoms or concerns
3. Collaborate with child/adolescent and family to establish the agenda for an outpatient visit involving a mental health issue
4. Identify and address barriers preventing a child and/or family from seeking or accepting help for a mental health problem (eg, sense of hopelessness, inadequate insurance or financial resources, family conflict, stigma)
5. Manage resistance or anger in child/adolescent and/or family
6. Apply motivational interviewing techniques, family engagement strategies, and behavioral contracts to seek consensus on a mental health plan of action and to prepare the family for a mental health consultation
7. Interpret to families current evidence related to the safety and efficacy of relevant therapeutic options
8. Promote healthy lifestyles that contribute to mental health
9. "Communicate effectively with physicians, other health professionals, health-related agencies" and educators in the mutual care of children and adolescents
10. Clarify and discuss psychological test results, mental health findings, and concerns to children, adolescents, and families in language that is appropriate for age, education level, and cultural norms
11. Bring a mental health visit to a close in a supportive, efficient manner

"Professionalism": clinicians providing primary care to children and adolescents should be able to do the following

1. "Demonstrate compassion, integrity, and respect" for all children and family members
2. Demonstrate sensitivity to cultural differences and family preferences in addressing mental health concerns
3. Establish clear expectations in children, adolescents, and their families about conditional confidentiality (specific to state laws), exchange of protected health information, and business practices
4. Discuss one's professional limitations in knowledge and skills as part of the referral process

The ACGME has published "general competencies," which in some cases overlap those outlined in this document but bear restatement in the context of mental health care. ACGME wording is shown in quotes. The AAP recognizes that achievement of the competencies proposed in this table is a long-term goal, requiring training and resources that have yet to be developed. The AAP is committed to the development of the resources and training needed to assist pediatricians in achieving these competencies.

APPENDIX 2 Web Resources for Treatment and Referral Decisions for Primary Care

1. American Academy of Pediatrics Children's Mental Health in Primary Care Web site. Available at: www.aap.org/mentalhealth.
2. National Institute on Drug Abuse (NIDA) (provides resources on substance abuse and mental health issues). Available at: www.nida.nih.gov.
3. American Academy of Child and Adolescent Psychiatry (AACAP) (access to practice parameters on a variety of mental health topics). Available at: www.aacap.org/cs/root/member_information/practice_information/practice_parameters/practice_parameters.
4. Hawaii State Department of Health (evidence-based child and adolescent psychosocial interventions). Available at: www.hawaii.gov/health/mental-health/camhd/library/webs/ebs/ebs-index.html.
5. GeneralPediatrics.com (many links, especially to child psychiatry and practice parameters). Available at: www.generalpediatrics.com.
6. National Guideline Clearinghouse (a public resource for evidence-based clinical practice guidelines; an initiative of the Agency for Healthcare Research and Quality, US Department of Health and Human Services). Available at: www.guideline.gov.
7. University of Buffalo School of Social Work (provides a description of the signs and symptoms of disorders that affect children and adolescents, as well as current evidence-based practices for each disorder). Available at: www.socialwork.buffalo.edu/conted/EBP/index.htm.
8. Substance Abuse and Mental Health Services Administration (SAMHSA) National Registry of Evidence-Based Programs and Practices (a searchable online registry of mental health and substance abuse interventions reviewed and rated by independent reviewers). Available at: www.nrepp.samhsa.gov.

Please note: *Errata have been published for this article. To view the errata, please click here and here.*

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General Recommendations on Immunization

Recommendations of the Advisory Committee on Immunization Practices (ACIP)

INSIDE: Continuing Education Examination

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

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CONTENTS

Disclosure of Relationship

CDC, our planners, and our presenters wish to disclose they have no financial interests or other relationships with the manufacturers of commercial products, suppliers of commercial services, or commercial supporters.

This report will not include any discussion of the unlabeled use of a product or a product under investigational use with the exception of the discussion of:

1. The nonsimultaneous administration of yellow fever vaccine and inactivated vaccines.
2. Progressive neurologic disorders are a precaution for the use of tetanus-reduced diphtheria acellular pertussis vaccine for adolescents and adults.
3. Contact allergy to latex is neither a contraindication nor a precaution to the use of meningococcal vaccine in the absence of an anaphylactic allergy.
4. Meningococcal conjugate vaccine should be administered intramuscularly, but if administered subcutaneously, repeating the dose is unnecssary.
5. Use of immune globulin, intravenous for postexposure prophylaxis or varicella.
6. Use of VariZIG for postexposure prophylaxis of varicella (unlicensed).

General Recommendations on Immunization

Recommendations of the Advisory Committee on Immunization Practices (ACIP)

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Summary

This report is a revision of General Recommendations on Immunization and updates the 2002 statement by the Advisory Committee on Immunization Practices (ACIP) (CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices and the American Academy of Family Physicians. MMWR 2002;51[No. RR-2]). This report is intended to serve as a general reference on vaccines and immunization. The principal changes include 1) expansion of the discussion of vaccination spacing and timing; 2) an increased emphasis on the importance of injection technique/age/body mass in determining appropriate needle length; 3) expansion of the discussion of storage and handling of vaccines, with a table defining the appropriate storage temperature range for inactivated and live vaccines; 4) expansion of the discussion of altered immunocompetence, including new recommendations about use of live-attenuated vaccines with therapeutic monoclonal antibodies; and 5) minor changes to the recommendations about vaccination during pregnancy and vaccination of internationally adopted children, in accordance with new ACIP vaccine-specific recommendations for use of inactivated influenza vaccine and hepatitis B vaccine. The most recent ACIP recommendations for each specific vaccine should be consulted for comprehensive discussion. This report, ACIP recommendations for each vaccine, and other information about vaccination can be accessed at CDC's National Center for Immunization and Respiratory Diseases (proposed) (formerly known as the National Immunization Program) website at http//:www.cdc.gov/nip.

Introduction

This report provides technical guidance about common vaccination concerns for clinicians and other health-care providers who administer vaccines to infants, children, adolescents, and adults. Vaccine recommendations are based on characteristics of the immunobiologic product, scientific knowledge about the principles of active and passive immunization, epidemiology and burden of diseases (i.e., morbidity, mortality, costs of treatment, and loss of productivity), vaccine safety considerations, cost analysis of preventive measures, published and unpublished studies, and expert opinion of public health officials and specialists in clinical and preventive medicine.

The material in this report was prepared for publication by the National Center for Immunization and Respiratory Diseases, Anne Schuchat, MD, Director; and the Immunization Services Division, Lance E. Rodewald, MD, Director.
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Benefits and risks are associated with using all immunobiologics (i.e., an antigenic substance or antibody-containing preparation). No vaccine is completely safe or effective. Benefits of vaccination include partial or complete protection against infection for the vaccinated person and overall benefits to society as a whole. Benefits include protection from symptomatic illness, improved quality of life and productivity, and prevention of death. Societal benefits include creation and maintenance of herd immunity against communicable diseases, prevention of disease outbreaks, and reduction in health-care–related costs. Vaccination risks range from common, minor, and local adverse effects to rare, severe, and life-threatening conditions. Therefore, recommendations for vaccination practices balance scientific evidence of benefits for each person and to society against the potential costs and risks for vaccination for the individual and programs.

Standards for child and adolescent vaccination practices and standards for adult vaccination practices (*1,2*) have been published to assist with implementing vaccination programs and maximizing their benefits. Any person or institution that provides vaccination services should adopt these standards to improve vaccination delivery and protect infants, children, adolescents, and adults from vaccine-preventable diseases.

To maximize the benefits of vaccination, this report provides general information about immunobiologics and provides practical guidelines about vaccine administration and technique. To minimize risk from vaccine administration, this report delineates situations that warrant precautions or contraindications to using a vaccine. These recommendations are intended for use in the United States because vaccine availability and use and epidemiologic circumstances differ in other countries. Individual circumstances might warrant deviations from these recommendations.

The relative balance of benefits and risks can change as diseases are controlled or eradicated. For example, because wild poliovirus transmission has been interrupted in the United States since 1979, the only indigenous cases of paralytic poliomyelitis reported since that time have been caused by live oral poliovirus vaccine (OPV) (*3*). In 1999, to eliminate the risk for vaccine-associated paralytic poliomyelitis (VAPP), exclusive use of inactivated poliovirus vaccine (IPV) was recommended for routine vaccination in the United States. However, because of superior ability to induce intestinal immunity and to prevent spread among close contacts, OPV remains the vaccine of choice for areas where wild poliovirus is still present (*4*). Until worldwide eradication of poliovirus is accomplished, continued vaccination of the U.S. population against poliovirus will be necessary.

Timing and Spacing of Immunobiologics

General Principles for Vaccine Scheduling

Optimal response to a vaccine depends on multiple factors, including the nature of the vaccine and the age and immune status of the recipient. Recommendations for the age at which vaccines are administered are influenced by age-specific risks for disease, age-specific risks for complications, ability of persons of a certain age to respond to the vaccine, and potential interference with the immune response by passively transferred maternal antibody. Vaccines are recommended for members of the youngest age group at risk for experiencing the disease for whom efficacy and safety have been demonstrated.

Certain products, including inactivated vaccines, toxoids, recombinant subunit, and polysaccharide conjugate vaccines, require administering 2 or more doses for development of an adequate and persisting antibody response. Tetanus and diphtheria toxoids require periodic reinforcement or booster doses to maintain protective antibody concentrations. Unconjugated polysaccharide vaccines do not induce T-cell memory, and booster doses are not expected to produce substantially increased protection. Conjugation with a protein carrier improves the effectiveness of polysaccharide vaccines by inducing T-cell–dependent immunologic function. Vaccines that stimulate both cell-mediated immunity and neutralizing antibodies (e.g., live-attenuated virus vaccines) usually can induce prolonged immunity, even if antibody titers decline over time (*5*). Subsequent exposure to infection usually does not lead to viremia but to a rapid anamnestic antibody response.

Approximately 90%–95% of recipients of a single dose of certain live vaccines administered by injection at the recommended age (i.e., measles, rubella, and yellow fever) have protective antibody (generally within 2 weeks of the dose). For varicella and mumps vaccines, 80%–85% of vaccinees are protected after a single dose. However, because a limited proportion of recipients (5%–15%) of measles-mumps-rubella (MMR) or varicella vaccine fail to respond to 1 dose, a second dose is recommended to provide another opportunity to develop immunity (*6*). The majority of persons who fail to respond to the first dose of MMR or varicella vaccine respond to a second dose (*7,8*).

The Recommended Childhood and Adolescent Immunization Schedule and the Recommended Adult Immunization Schedule are revised annually. Physicians and other healthcare providers should ensure that they are following the most up-to-date schedules, which are available from CDC's National Center for Immunization and Respiratory Diseases (proposed) website (http://www.cdc.gov/nip).

Spacing of Multiple Doses of the Same Antigen

Vaccination providers should adhere as closely as possible to recommended vaccination schedules. Recommended ages and intervals between doses of multidose antigens provide optimal protection or have the best evidence of efficacy. Recommended vaccines and recommended intervals between doses are provided in this report (Table 1).

In certain circumstances, administering doses of a multidose vaccine at shorter than the recommended intervals might be necessary. This can occur when a person is behind schedule and needs to be brought up-to-date as quickly as possible or when international travel is impending. In these situations, an accelerated schedule can be implemented that uses intervals between doses shorter than those recommended for routine vaccination. Although the effectiveness of all accelerated schedules has not been evaluated in clinical trials, ACIP believes that when accelerated intervals are used, the immune response is acceptable and will lead to adequate protection. The accelerated or minimum intervals and ages that can be used for scheduling catch-up vaccinations are provided in this report (Table 1). Vaccine doses should not be administered at

TABLE 1. Recommended and minimum ages and intervals between vaccine doses of routinely recommended vaccines*

Vaccine and dose no.	Recommended age for this dose	Minimum age for this dose	Recommended interval to next dose	Minimum interval to next dose
Hepatitis B (HepB)-1[À]	Birth	Birth	1ï 4 months	4 weeks
HepB-2	1ï 2 months	4 weeks	2ï 17 months	8 weeks
HepB-3[Ä]	6ï 18 months	24 weeks	ð	ð
Diphtheria-tetanus-acellular pertussis (DTaP)-1[À]	2 months	6 weeks	2 months	4 weeks
DTaP-2	4 months	10 weeks	2 months	4 weeks
DTaP-3	6 months	14 weeks	6ï 12 months[Æ]	6 months[Æ]*
DTaP-4	15ï 18 months	12 months	3 years	6 months[Æ]
DTaP-5	4ï 6 years	4 years	ð	ð
Haemophilus influenzae type b (Hib)-1[À,ÀÀ]	2 months	6 weeks	2 months	4 weeks
Hib-2	4 months	10 weeks	2 months	4 weeks
Hib-3[ÄÄ]	6 months	14 weeks	6ï 9 months[Æ]	8 weeks
Hib-4	12ï 15 months	12 months	ð	ð
Inactivated poliovirus (IPV)-1[À]	2 months	6 weeks	2 months	4 weeks
IPV-2	4 months	10 weeks	2ï 14 months	4 weeks
IPV-3	6ï 18 months	14 weeks	3ï 5 years	4 weeks
IPV-4	4ï 6 years	18 weeks	ð	ð
Pneumococcal conjugate (PCV)-1[ÀÀ]	2 months	6 weeks	2 months	4 weeks
PCV-2	4 months	10 weeks	2 months	4 weeks
PCV-3	6 months	14 weeks	6 months	8 weeks
PCV-4	12-15 months	12 months	ð	ð
Measles-mumps-rubella (MMR)-1[ÆÆ]	12ï 15 months	12 months	3ï 5 years	4 weeks
MMR-2[ÆÆ]	4ï 6 years	13 months	ð	ð
Varicella (Var)-1[ÆÆ]	12ï 15 months	12 months	3ï 5 years	12 weeks***
Var-2[ÆÆ]	4ï 6 years	15 months	ð	ð
Hepatitis A (HepA)-1[À]	12-23 months	12 months	6ï 18 months[Æ]	6 months[Æ]
HepA-2	18ï 41 months	18 months	ð	ð
Influenza inactivated[ÀÀÀ]	6-59 months	6 months[ÄÄÄ]	1 month	4 weeks
Influenza live attenuated[ÀÀÀ]	ð	5 years	6ï 10 weeks	6 weeks
Meningococcal conjugate[À]	11ï 12 years	11 years	ð	ð
Meningococcal polysaccharide (MPSV)-1	ð	2 years	5 years[ÄÄÄ]	5 years[ÆÆÆ]
MPSV-2****	ð	7 years	ð	ð
Tetanus-diphtheria	11ï 12 years	7 years	10 years	5 years
Tetanus-diphtheria acellular pertussis (Tdap)[ÀÀÀÀ]	≥11 years	10 years	ð	ð
Pneumococcal polysaccharide (PPV)-1	ð	2 years	5 years	5 years
PPV-2[ÄÄÄÄ]	ð	7 years	ð	ð
Human papillomavirus (HPV)-1[ÆÆÆÆ]	11ï 12 years	9 years	2 months	4 weeks
HPV-2	11ï 12 years (+2 months)	109 months	4 months	12 weeks
HPV-3	11ï 12 years (+6 months)	112 months	ð	ð
Rotavirus (RV)-1*****	2 months	6 weeks	2 months	4 weeks
RV-2	4 months	10 weeks	2 months	4 weeks
RV-3	6 months	14 weeks	ð	ð
Zoster[ÀÀÀÀÀ]	60 years	60 years	ð	

* Combination vaccines are available. Use of licensed combination vaccines is preferred over separate injections of their equivalent component vaccines (**Source:** CDC. Combination vaccines for childhood immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP), the American Academy of Pediatrics (AAP), and the American Academy of Family Physicians (AAFP). MMWR 1999;48[No. RR-5]). When administering combination vaccines, the minimum age for administration is the oldest age for any of the individual components; the minimum interval between doses is equal to the greatest interval of any of the individual components.

TABLE 1. (*Continued*) Recommended and minimum ages and intervals between vaccine doses of routinely recommended vaccines*

Vaccine and dose no.	Recommended age for this dose	Minimum age for this dose	Recommended interval to next dose	Minimum interval to next dose

† Combination vaccines containing the Hepatitis B component are available (HepB-Hib, DTaP-HepB-IPV, and HepA-HepB). These vaccines should not be administered to infants aged <6 weeks because of the other components (i.e., Hib, DTaP, HepA, and IPV).

‡ HepB-3 should be administered at least 8 weeks after HepB-2 and at least 16 weeks after HepB-1 and should not be administered before age 24 weeks.

§ Calendar months.

** The minimum recommended interval between DTaP-3 and DTaP-4 is 6 months. However, DTaP-4 need not be repeated if administered at least 4 months after DTaP-3.

†† For Hib and PCV, children receiving the first dose of vaccine at age ≥7 months require fewer doses to complete the series (CDC. Recommended childhood and adolescent immunization scheduleð United States, 2006. MMWR 2005; 54 [Nos. 51 & 52]:Q1-Q4).

‡‡ If PRP-OMP (Pedvax-HibÈ, Merck Vaccine Division) was administered at age 2 and 4 months, a dose at age 6 months is not required.

§§ Combination measles-mumps-rubella-varicella (MMRV) vaccine can be used for children aged 12 monthsï 12 years.

*** The minimum interval from VAR-1 to VAR-2 for persons beginning the series at age ≥13 years is 4 weeks.

††† Two doses of influenza vaccine are recommended for children aged <9 years who are receiving the vaccine for the first time. Children aged <9 years who have previously received influenza vaccine, and persons aged ≥9 years require only 1 dose per influenza season.

‡‡‡ The minimum age for inactivated influenza vaccine varies by vaccine manufacturer. Only Fluzone (manufactured by sanofi pasteur) is approved for children aged 6ï 35 months. The minimum age for Fluvirin (manufactured by Novartis) is 4 years. For Fluarix and FluLeval (manufactured by GlaxoSmithKline), the minimum age is 18 years.

§§§ Certain experts recommend a second dose of MPSV 3 years after the first dose for persons at increased risk for meningococcal disease.

**** A second dose of meningococcal vaccine is recommended for persons previously vaccinated with MPSV who remain at high risk for meningococcal disease. MCV4 is preferred when revaccinating persons aged 11ï 55 years, but a second dose of MPSV is acceptable. (**Source:** CDC. Prevention and control of meningococcal disease: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 2005;54[No. RR-7]).

†††† Only 1 dose of Tdap is recommended. Subsequent doses should be administered as Td. If vaccination to prevent tetanus and/or diphtheria disease is required for children aged 7ï 9 years, Td should be administered (minimum age for Td is 7 years). For one brand of Tdap, the minimum age is 11 years. The preferred interval between Tdap and a previous dose of Td is 5 years. In persons who have received a primary series of tetanus-toxoidï containing vaccine, for management of a tetanus-prone wound, the minimum interval after a previous dose of any tetanus-containing vaccine is 5 years.

‡‡‡‡ A second dose of PPV is recommended for persons at highest risk for serious pneumococcal infection and those who are likely to have a rapid decline in pneumococcal antibody concentration. Revaccination 3 years after the previous dose can be considered for children at highest risk for severe pneumococcal infection who would be aged <10 years of age at the time of revaccination. (**Source:** CDC. Prevention of pneumococcal disease: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1997;46[No. RR-8]).

§§§§ HPV is approved only for females aged 9ï 26 years.

***** The first dose of RV must be administered at age 6ï 12 weeks. The vaccine series should not be started at age ≥13 weeks. RV should not be administered to children aged ≥33 weeks regardless of the number of doses received at age 6ï 32 weeks.

†††††† Herpes zoster vaccine is approved as a single dose for persons who are aged ≥60 years with a history of varicella.

intervals less than these minimum intervals or earlier than the minimum age.*

In clinical practice, vaccine doses occasionally are administered at intervals less than the minimum interval or at ages younger than the minimum age. Doses administered too close together or at too young an age can lead to a suboptimal immune response. However, administering a dose a limited number of days earlier than the minimum interval or age is unlikely to have a substantially negative effect on the immune response to that dose. Therefore, ACIP recommends that vaccine doses administered 4 or fewer days before the minimum interval or age be counted as valid.† However, because of its unique schedule, this recommendation does not apply to the rabies vaccine (*9*). Doses administered 5 or more days earlier than the minimum interval or age of any vaccine should not be counted as valid doses and should be repeated as age-appropriate. The repeat dose should be spaced after the invalid dose by the recommended minimum interval (Table 1). For example, if *Haemophilus influenzae* type b (Hib) doses one and two were administered only 2 weeks apart, because the minimum interval from dose one to dose two is 4 weeks, dose two is invalid and should be repeated. The repeat dose should be administered 4 or more weeks after the invalid (second) dose. The repeat dose would be counted as the second valid dose. Doses administered 5 or more days before the minimum age should be repeated on or after the child reaches the minimum age and 4 or more weeks after the invalid dose. For example, if the first dose of varicella vaccine were administered at age 10 months, the repeat dose would be administered no earlier than the child's first birthday. If the first dose of varicella vaccine were administered at age 11 months and 2 weeks, the repeat dose could be administered 2 weeks after the first birthday.

Certain vaccines produce increased rates of local or systemic reactions in certain recipients when administered too frequently (e.g., adult tetanus-diphtheria toxoid [Td]; pedi-

*During measles outbreaks, if cases are occurring among infants aged <12 months, measles vaccination of infants as young as 6 months can be undertaken as an outbreak control measure. However, doses administered at ages <12 months should not be counted as part of the series (**Source**: CDC. Measles, mumps, and rubella vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1998;47[No. RR-8]).

†In certain situations, local or state requirements might mandate that doses of selected vaccines be administered on or after specific ages. For example, a school entry requirement might not accept a dose of MMR or varicella vaccine administered before the child's first birthday. ACIP recommends that physicians and other health-care providers comply with local or state vaccination requirements when scheduling and administering vaccines.

atric diphtheria-tetanus toxoid [DT]; tetanus toxoid; and tetanus, reduced diphtheria acellular pertussis vaccine for adolescents and adults) (*10,11*). Such reactions might result from formation of antigen-antibody complexes. Optimal record keeping, maintaining patient histories, and adhering to recommended schedules can decrease the incidence of such reactions without adversely affecting immunity.

Simultaneous Administration

Experimental evidence and extensive clinical experience provide the scientific basis for administering vaccines simultaneously (i.e., during the same office visit, not combined in the same syringe). Simultaneously administering all vaccines for which a person is eligible is critical, including for childhood vaccination programs, because simultaneous administration increases the probability that a child will be vaccinated fully at the appropriate age (*1*). A study conducted during a measles outbreak demonstrated that approximately one third of measles cases among unvaccinated but vaccine-eligible preschool children could have been prevented if MMR had been administered at the same visit when another vaccine was administered (*12*). Simultaneous administration also is critical when preparing for foreign travel and/or if uncertainty exists that a person will return for further doses of vaccine.

Simultaneously administering the most widely used live and inactivated vaccines have produced seroconversion rates and rates for adverse reactions similar to those observed when the vaccines are administered separately (*13–16*). Routinely administering all age-appropriate doses of vaccines simultaneously is recommended for children for whom no specific contraindications exist at the time of the visit. Administering combined MMR (or measles-mumps-rubella-varicella [MMRV] vaccine) yields safety and immunogenicity results similar to administering individual measles, mumps, and rubella vaccines at different sites. Therefore, no medical basis exists for administering these vaccines separately for routine vaccination instead of the preferred MMR combined vaccine (*6*). Administering separate antigens would result in a delay in protection for the deferred components. Response to MMR and varicella vaccines administered on the same day is identical to vaccines administered a month apart (*17*), and administration of MMRV combined vaccine is similar to administration of MMR and varicella vaccines on the same day (*18*). No evidence exists that oral rotavirus vaccine (RV) interferes with live vaccines administered by injection or intranasally (e.g., MMR and live-attenuated influenza vaccine [LAIV]). RV can be administered simultaneously or at any interval before or after injectable or intranasal live vaccines (*19*). No data exist about the immunogenicity of oral Ty21a typhoid vaccine when administered concurrently or within 30 days of other live virus vaccines. In the absence of such data, if typhoid vaccination is warranted, administration should not be delayed because of administration of live-attenuated virus vaccines (*20*).

Simultaneously administering pneumococcal polysaccharide vaccine (PPV) and inactivated influenza vaccine elicits a satisfactory antibody response without increasing the incidence or severity of adverse reactions (*21*). Simultaneously administering PPV and inactivated influenza vaccine is recommended for all persons for whom both vaccines are indicated.

Hepatitis B vaccine (HepB) administered with yellow fever vaccine is as safe and immunogenic as when these vaccines are administered separately (*22*). Measles and yellow fever vaccines have been administered safely at the same visit and without reduction of immunogenicity of each of the components (*23,24*).

Depending on vaccines administered in the first year of life, children aged 12–15 months might receive up to nine injections during a single visit (MMR, varicella, Hib, pneumococcal conjugate, diphtheria and tetanus toxoids and acellular pertussis [DTaP], IPV, hepatitis A, HepB, and influenza [seasonal] vaccines). To reduce the number of injections at the 12–15-month visit, the IPV and HepB series can be expedited and completed before the child's first birthday. MMRV can be administered as soon as possible on or after the first birthday and the fourth dose of DTaP administered at age 15 months. The majority of children aged 1 year who have received 2 (polyribosylribitol phosphate-meningococcal outer membrane protein [PRP-OMP]) or 3 (PRP-tetanus [PRP-T], diphtheria CRM197 [CRM, cross-reactive material] protein conjugate [HbOC]) previous doses of Hib vaccine and 3 previous doses of DTaP and pneumococcal conjugate vaccine (PCV) have had protection (*25,26*). The third (PRP-OMP) or fourth (PRP-T, HbOC) dose of the Hib series, and the fourth doses of DTaP and PCV are critical in boosting antibody titer and ensuring continued protection (*26–29*). However, the booster dose of the pneumococcal conjugate series can be deferred until age 15–18 months for children who are likely to return for future visits. The fourth dose of DTaP is recommended at age 15–18 months but can be administered as early as age 12 months under certain circumstances (*27*). For infants at low risk for infection with hepatitis B virus (i.e., the mother tested negative for hepatitis B surface antigen [HBsAg] at the time of delivery), the HepB series can be completed at any time for children aged 6–18 months. With use of certain HepB combination vaccines (i.e., combination Hib-HepB vaccine), the minimum age of administration of the final dose is 12 months because of the minimum age requirement for the last dose of the Hib series (*30*). Recommended spacing of doses should be maintained (Table 1).

Use of combination vaccines can reduce the number of injections required at an office visit. Licensed combination vaccines can be used whenever any components of the combination are indicated and its other components are not contraindicated and if licensed by the Food and Drug Administration (FDA) for that dose in the series. Use of licensed combination vaccines is preferred to separate injection of their equivalent component vaccines to reduce the number of injections and missed opportunities to protect through vaccination (*31*). Only combination vaccines licensed by FDA should be used. Individual vaccines should never be mixed in the same syringe unless they are approved specifically for mixing by FDA. Only one vaccine (DTaP and PRP-T Hib vaccine, marketed as TriHIBit® [manufactured by sanofi pasteur]) is licensed by FDA for mixing in the same syringe. This vaccine should not be used for primary vaccination in infants aged 2, 4, and 6 months, but it can be used as the last dose of the Hib vaccine series on or after age 12 months.

Nonsimultaneous Administration

No evidence exists that inactivated vaccines interfere with the immune response to other inactivated vaccines or to live vaccines. An inactivated vaccine can be administered either simultaneously or at any time before or after a different inactivated vaccine or live vaccine (Table 2).

Data are limited about interference between live vaccines. The immune response to one live-virus vaccine might be impaired if administered within 30 days of another live-virus vaccine (*32,33*). In a study conducted in two U.S. health maintenance organizations, persons who received varicella vaccine <30 days after MMR vaccination had an increased risk for varicella vaccine failure (i.e., varicella disease in a vaccinated person) of 2.5-fold compared with persons who received varicella vaccine before or >30 days after MMR (*34*). In comparison, another study determined that the response to yellow fever vaccine is not affected by monovalent measles vaccine administered 1–27 days earlier (*23*). The effect of nonsimultaneously administering rubella, mumps, varicella, and yellow fever vaccines is unknown.

TABLE 2. Guidelines for spacing of live and inactivated antigens

Antigen combination	Recommended minimum interval between doses
Two or more inactivated*	Can be administered simultaneously or at any interval between doses
Inactivated and live	Can be administered simultaneously or at any interval between doses
Two or more live intranasal or injectable[Â]	4-week minimum interval, if not administered simultaneously

*Certain experts suggest a 1-month interval between tetanus toxoid, reduced diphtheria toxoid, and reduced acellular pertussis vaccine and quadrivalent meningococcal conjugate vaccine if they are not administered simultaneously.

[Â]Live oral vaccines (e.g., Ty21a typhoid vaccine and rotavirus vaccine) can be administered simultaneously or at any interval before or after inactivated or live injectable vaccines.

Source: American Academy of Pediatrics. Pertussis. In: Pickering LK, Backer, CJ, Long SS, McMillan J, eds., Red Book: 2006 Report of the Committee on Infectious Diseases. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics.

To minimize the potential risk for interference, injectable or nasally administered live vaccines not administered on the same day should be administered >4 weeks apart whenever possible (Table 2). If injectable or nasally administered live vaccines are separated by <4 weeks, the vaccine-administered second should not be counted as a valid dose and should be repeated. The repeat dose should be administered >4 weeks after the last invalid dose. Yellow fever vaccine can be administered at any time after single-antigen measles vaccine. Oral vaccines (Ty21a typhoid vaccine and RV) can be administered simultaneously or at any interval before or after other live vaccines (injectable or intranasal) if indicated.

Spacing of Vaccines and Antibody-Containing Products

Live Vaccines

Ty21a typhoid, yellow fever, and LAIV vaccines can be administered at any time before, concurrent with, or after administering any immune globulin, hyperimmune globulin, or intravenous immune globulin (IGIV). Blood (e.g., whole blood, packed red blood cells, and plasma) and other antibody-containing blood products (e.g., immune globulin, hyperimmune globulin, and IGIV) can inhibit the immune response to measles and rubella vaccines for 3 or more months. The effect of blood and immune globulin preparations on the response to mumps and varicella vaccines is unknown, but commercial immune globulin preparations contain antibodies to these viruses. Blood products available in the United States are unlikely to contain a substantial amount of antibody to yellow fever vaccine virus. The length of time that interference with injectable live vaccination (except yellow fever vaccine) can persist after the antibody-containing product is a function of the amount of antigen-specific antibody contained in the product (*35–37*). Therefore, after an antibody-containing product is received, live vaccines (except yellow fever vaccine, oral Ty21a typhoid vaccine, and LAIV) should be delayed until the passive antibody has degraded (Table 3). If a dose of injectable live-virus vaccine (except yellow fever vaccine) is administered after an antibody-containing product but at an interval shorter than recommended in this report, the vaccine dose should be repeated unless serologic testing is feasible and indicates a response to the vac-

TABLE 3. Guidelines for administering antibody-containing products* and vaccines

Simultaneous administration

Combination	Recommended minimum interval between doses
Antibody-containing products and inactivated antigen	Can be administered simultaneously at different sites or at any time interval between doses.
Antibody-containing products and live antigen	Should not be administered simultaneously.[À] If simultaneous administration of measles-containing vaccine or varicella vaccine is unavoidable, administer at different sites and revaccinate or test for seroconversion after the recommended interval.

Nonsimultaneous administration

Product administered		
First	Second	Recommended minimum interval between doses
Antibody-containing products	Inactivated antigen	Not applicable
Inactivated antigen	Antibody-containing products	Not applicable
Antibody-containing products	Live antigen	Dose-related[À,Ä,Æ]
Live antigen	Antibody-containing products	2 weeks[À]

* Blood products containing substantial amounts of immunoglobulin include intramuscular and intravenous immune globulin, specific hyperimmune globulin (e.g., hepatitis B immune globulin, tetanus immune globulin, varicella zoster immune globulin, and rabies immune globulin), whole blood, packed red cells, plasma, and platelet products.

[À] Yellow fever, oral Ty21a typhoid vaccine, and live-attenuated influenza vaccine are exceptions to these recommendations. These live-attenuated vaccines can be administered at any time before, after, or simultaneously with an antibody-containing product without substantially decreasing the antibody response.

[Ä] Rotavirus vaccine (RV) should be deferred for 6 weeks after receipt of an antibody-containing product if possible. However, if the 6-week deferral would cause the first dose of RV to be scheduled for age ≥13 weeks, a shorter deferral interval should be used to ensure the first dose of RV is administered no later than age 13 weeks.

[Æ] The duration of interference of antibody-containing products with the immune response to the measles component of measles-containing vaccine, and possibly varicella vaccine, is dose-related.

cine. The repeat dose or serologic testing should be performed after the interval indicated for the antibody-containing product (Table 4).

Although passively acquired antibodies can interfere with the response to rubella vaccine, the low dose of anti-Rho(D) globulin administered to postpartum women has not been demonstrated to reduce the response to the RA27/3 strain rubella vaccine (*38*). Because of the importance of rubella and varicella immunity among childbearing-aged women (*6,39*), the postpartum vaccination of women without evidence of immunity to rubella or varicella with single-antigen rubella, MMR, varicella, or MMRV vaccine should not be delayed because of receipt of anti-Rho(D) globulin or any other blood product during the last trimester of pregnancy or at delivery. These women should be vaccinated immediately after delivery and, if possible, tested 3 or more months later to ensure immunity to rubella and, if appropriate, to measles (*6*).

Interference can occur if administering an antibody-containing product becomes necessary after administering MMRV or its individual components. Usually, vaccine virus replication and stimulation of immunity will occur 1–2 weeks after vaccination. If the interval between administering any of these vaccines and subsequent administration of an antibody-containing product is <14 days, vaccination should be repeated after the recommended interval (Tables 3 and 4), unless serologic testing indicates an antibody response. RV should be deferred for 6 weeks after receipt of an antibody-containing product if possible. However, if the 6-week deferral would cause the first dose of RV to be scheduled for a child aged ≥13 weeks, a shorter deferral interval should be used to ensure the first dose of RV is administered no later than age 13 weeks (*19*).

A humanized mouse monoclonal antibody product (palivizumab) is available for prevention of respiratory syncytial virus infection among infants and young children. This product contains only antibody to respiratory syncytial virus and will not interfere with immune response to currently licensed live or inactivated vaccines.

Inactivated Vaccines

Antibody-containing products interact less with inactivated vaccines, toxoids, recombinant subunit, and polysaccharide vaccines than with live vaccines (*40*). Therefore, administering inactivated vaccines and toxoids either simultaneously with or at any interval before or after receipt of an antibody-containing product should not substantially impair development of a protective antibody response (Table 3). The vaccine or toxoid and antibody preparation should be administered at different sites by using the standard recommended dose. Increasing the vaccine dose volume or number of vaccinations is not indicated or recommended.

TABLE 4. Suggested intervals between administration of antibody-containing products for different indications and measles-containing vaccine and varicella-containing vaccine*

Product/indication	Dose, including mg immunoglobulin G (IgG)/ kg body weight*	Recommended interval before measles or varicella-containing vaccine administration (months)
Respiratory syncytial virus immune globulin (IG) monoclonal antibody (Synagis[Ê])[Â]	15 mg/kg intramuscularly (IM)	None
Tetanus IG	250 units (10 mg IgG/kg) IM	3
Hepatitis A IG		
Contact prophylaxis	0.02 mL/kg (3.3 mg IgG/kg) IM	3
International travel	0.06 mL/kg (10 mg IgG/kg) IM	3
Hepatitis B IG	0.06 mL/kg (10 mg IgG/kg) IM	3
Rabies IG	20 IU/kg (22 mg IgG/kg) IM	4
Measles prophylaxis IG		
Standard (i.e., nonimmunocompromised) contact	0.25 mL/kg (40 mg IgG/kg) IM	5
Immunocompromised contact	0.50 mL/kg (80 mg IgG/kg) IM	6
Blood transfusion		
Red blood cells (RBCs), washed	10 mL/kg negligible IgG/kg intravenously (IV)	None
RBCs, adenine-saline added	10 mL/kg (10 mg IgG/kg) IV	3
Packed RBCs (hematocrit 65%)[Ä]	10 mL/kg (60 mg IgG/kg) IV	6
Whole blood (hematocrit 35%ï 50%)[Ä]	10 mL/kg (80ï 100 mg IgG/kg) IV	6
Plasma/platelet products	10 mL/kg (160 mg IgG/kg) IV	7
Cytomegalovirus intravenous immune globulin (IGIV)	150 mg/kg maximum	6
IGIV		
Replacement therapy for immune deficiencies[Æ]	300ï 400 mg/kg IV[Æ]	8
Immune thrombocytopenic purpura	400 mg/kg IV	8
Postexposure varicella prophylaxis**	400 mg/kg IV	8
Immune thrombocytopenic purpura	1000 mg/kg IV	10
Kawasaki disease	2 g/kg IV	11

* This table is not intended for determining the correct indications and dosages for using antibody-containing products. Unvaccinated persons might not be fully protected against measles during the entire recommended interval, and additional doses of immune globulin or measles vaccine might be indicated after measles exposure. Concentrations of measles antibody in an immune globulin preparation can vary by manufacturer's lot. Rates of antibody clearance after receipt of an immune globulin preparation also might vary. Recommended intervals are extrapolated from an estimated half-life of 30 days for passively acquired antibody and an observed interference with the immune response to measles vaccine for 5 months after a dose of 80 mg IgG/kg.

[Â] Contains antibody only to respiratory syncytial virus

[Ä] Assumes a serum IgG concentration of 16 mg/mL.

[Æ] Measles and varicella vaccinations are recommended for children with asymptomatic or mildly symptomatic human immunodeficiency virus (HIV) infection but are contraindicated for persons with severe immunosuppression from HIV or any other immunosuppressive disorder.

** The investigational product VariZIG, similar to licensed VZIG, is a purified human immune globulin preparation made from plasma containing high levels of anti-varicella antibodies (immunoglobulin class G [IgG]). When indicated, health-care providers should make every effort to obtain and administer VariZIG. In situations in which administration of VariZIG does not appear possible within 96 hours of exposure, administration of immune globulin intravenous (IGIV) should be considered as an alternative. IGIV also should be administered within 96 hours of exposure. Although licensed IGIV preparations are known to contain anti-varicella antibody titers, the titer of any specific lot of IGIV that might be available is uncertain because IGIV is not routinely tested for antivaricella antibodies. The recommended IGIV dose for postexposure prophylaxis of varicella is 400 mg/kg, administered once. For pregnant women who cannot receive VariZIG within 96 hours of exposure, clinicians can choose either to administer IGIV or closely monitor the women for signs and symptoms of varicella and institute treatment with acyclovir if illness occurs. (**Source:** CDC. A new product for postexposure prophylaxis available under an investigational new drug application expanded access protocol. MMWR 2006;55:209ï 10).

Interchangeability of Vaccines from Different Manufacturers

Certain vaccines are available from different manufacturers, and these vaccines usually are not identical in antigen content or amount or method of formulation. Manufacturers use different production processes, and their products might contain different concentrations of antigen per dose or a different stabilizer or preservative.

Available data indicate that infants who receive sequential doses of different Hib conjugate, HepB, and hepatitis A (HepA) vaccines produce a satisfactory antibody response after a complete primary series (*41–44*). All brands of Hib conjugate, HepB,[§] and HepA vaccines are interchangeable within

[§] The exception is the 2-dose HepB vaccination series for adolescents aged 11–15 years. Only Recombivax HB® (Merck Vaccine Division) should be used in this schedule. Engerix-B® (GlaxoSmithKline) is not approved by FDA for this schedule.

their respective series. If different brands of Hib conjugate vaccine are administered, 3 doses are considered adequate for the primary series among infants. If PRP-OMP is used, the primary series consists of 2 doses. After completing the primary series, any Hib conjugate vaccine can be used for the booster dose at age 12–18 months.

Data are limited about the safety, immunogenicity, and efficacy of using acellular pertussis (e.g., DTaP) vaccines from different manufacturers for successive doses of the pertussis series. Data from one study indicate that, for the first 3 doses of the DTaP series, 1–2 doses of Tripedia® followed by Infanrix® for the remaining doses(s) is comparable to 3 doses of Tripedia with regard to immunogenicity, as measured by antibodies to diphtheria, tetanus, and pertussis toxoid, and filamentous hemagglutinin (*45*). However, in the absence of a clear serologic correlate of protection for pertussis, the relevance of these immunogenicity data for protection against pertussis is unknown. Whenever feasible, the same brand of DTaP vaccine should be used for all doses of the vaccination series. If vaccination providers do not know or have available the type of DTaP vaccine previously administered to a child, any DTaP vaccine should be used to continue or complete the series. For vaccines in general, vaccination should not be deferred because the brand used for previous doses is not available or is unknown (*27,46*).

Lapsed Vaccination Schedule

Vaccination providers should administer vaccines as close to the recommended intervals as possible. However, longer-than-recommended intervals between doses do not reduce final antibody concentrations, although protection might not be attained until the recommended number of doses has been administered. With the exception of oral typhoid vaccine, an interruption in the vaccination schedule does not require restarting the entire series of a vaccine or toxoid or addition of extra doses.

Unknown or Uncertain Vaccination Status

Vaccination providers frequently encounter persons who do not have adequate documentation of vaccinations. Providers should only accept written, dated records as evidence of vaccination. With the exception of influenza vaccine and PPV (*47,48*), self-reported doses of vaccine without written documentation should not be accepted. Although vaccinations should not be postponed if records cannot be found, an attempt to locate missing records should be made by contacting previous health-care providers, reviewing state or local immunization information systems (IIS), and searching for a personally held record. If records cannot be located, these persons should be considered susceptible and should be started on the age-appropriate vaccination schedule. Serologic testing for immunity is an alternative to vaccination for certain antigens (e.g., measles, rubella, hepatitis A, and tetanus).

Contraindications and Precautions

Contraindications and precautions to vaccination dictate circumstances when vaccines should not be administered. The majority of precautions are temporary, and the vaccination can be administered later. A contraindication is a condition in a recipient that increases the risk for a serious adverse reaction. A vaccine should not be administered when a contraindication is present. For example, administering influenza vaccine to a person with an anaphylactic allergy to egg protein could cause serious illness in or death of the recipient.

National standards for pediatric vaccination practices have been established and include true contraindications and precautions to vaccination (Table 5) (*1*). The only contraindication applicable to all vaccines is a history of a severe allergic reaction after a previous dose of vaccine or to a vaccine constituent (unless the recipient has been desensitized). In addition, severely immunocompromised persons should generally not receive live vaccines. Children who experience encephalopathy within 7 days after administration of a previous dose of diphtheria and tetanus toxoids and whole-cell pertussis vaccine (DTP), DTaP, or Tdap not attributable to another identifiable cause should not receive further doses of a vaccine that contains pertussis. Because of the theoretical risk for the fetus, women known to be pregnant should generally not receive live-attenuated virus vaccines.

A precaution is a condition in a recipient that might increase the risk for a serious adverse reaction or that might compromise the ability of the vaccine to produce immunity (e.g., administering measles vaccine to a person with passive immunity to measles from a blood transfusion). A person might experience a more severe reaction to the vaccine than would have otherwise been expected; however, the risk for this happening is less than expected with a contraindication. In general, vaccinations should be deferred when a precaution is present. However, a vaccination might be indicated in the presence of a precaution because the benefit of protection from the vaccine outweighs the risk for an adverse reaction. For example, caution should be exercised in vaccinating a child with DTaP who, within 48 hours of receipt of a previous dose of DTP or DTaP, experienced fever of >104°F (>40.5°C); had persistent, inconsolable crying for 3 or more hours; collapsed or experienced a shock-like state; or had a seizure <3 days after receiving the previous dose of DTP or DTaP. How-

TABLE 5. Contraindications and precautions* to commonly used vaccines

Vaccine	True contraindications and precautions*	Untrue (vaccines can be administered)
General for all routine vaccines, including diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP); pediatric diphtheria-tetanus toxoid (DT); adult tetanus-diphtheria toxoid (Td); tetanus-reduced-diphtheria toxoid and acellular pertussis vaccine (Tdap), inactivated poliovirus vaccine (IPV); measles-mumps-rubella vaccine (MMR); *Haemophilus influenzae* type b vaccine (Hib); hepatitis A vaccine; hepatitis B vaccine; varicella vaccine; Rotavirus vaccine, pneumococcal conjugate vaccine (PCV); inactivated influenza vaccine (TIV); live-attenuated influenza vaccine (LAIV) pneumococcal polysaccharide vaccine (PPV); meningococcal conjugate vaccine (MCV4); meningococcal polysaccharide vaccine (MPSV); human papillomavirus vaccine (HPV); and herpes zoster vaccine (HZ)	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precautions** Moderate or severe acute illness with or without fever	Mild acute illness with or without fever Mild-to-moderate local reaction (i.e., swelling, redness, and soreness); low-grade or moderate fever after previous dose Lack of previous physical examination in well-appearing person Current antimicrobial therapy† Convalescent phase of illness Preterm birth (hepatitis B vaccine is an exception in certain circumstances)† Recent exposure to an infectious disease History of penicillin allergy, other nonvaccine allergies, relatives with allergies, receiving allergen extract immunotherapy Breast feeding
DTaP	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component Encephalopathy (e.g., coma, decreased level of consciousness; prolonged seizures) not attributable to another identifiable cause within 7 days of administration of previous dose of DTP or DTaP Progressive neurologic disorder, including infantile spasms, uncontrolled epilepsy, progressive encephalopathy: defer DTaP until neurologic status clarified and stabilized **Precautions** Temperature of ≥105ÁF (≥40.5ÁC) for ≤48 hours after vaccination with a previous dose of DTP or DTaP Collapse or shock-like state (i.e., hypotonic hyporesponsive episode) ≤48 hours after receiving a previous dose of DTP/DTaP Seizure ≤3 days after receiving a previous dose of DTP/DTaP§ Persistent, inconsolable crying lasting ≥3 hours within 48 hours after receiving a previous dose of DTP/DTaP Guillain-Barr® syndrome (GBS) <6 weeks after previous dose of tetanus toxoid-containing vaccine Moderate or severe acute illness with or without fever	Temperature of ≤104ÁF (<40.5ÁC), fussiness, or mild drowsiness after a previous dose of diphtheria toxoid-tetanus toxoid-pertussis vaccine (DTP/DTaP) Family history of seizures§ Family history of sudden infant death syndrome Family history of an adverse event after DTP or DTaP administration Stable neurologic conditions (e.g., cerebral palsy, well-controlled seizure disorder, developmental delay)
DT, Td	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precautions** GBS <6 weeks after previous dose of tetanus toxoid-containing vaccine Moderate or severe acute illness with or without fever	

TABLE 5. (*Continued*) Contraindications and precautions* to commonly used vaccines

Vaccine	True contraindications and precautions*	Untrue (vaccines can be administered)
Tdap	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component Encephalopathy (e.g., coma, decreased level of consciousness, and prolonged seizures) not attributable to another identifiable cause within 7 days of administration of previous dose of DTP, DTaP or Tdap **Precautions** Moderate or severe acute illness with or without fever GBS ≤6 weeks after a previous dose of tetanus toxoid containing vaccine Progressive or unstable neurological disorder, uncontrolled seizures or progressive encephalopathy until a treatment regimen has been established and the condition has stabilized History of arthus-type hypersensitivity reactions following a previous dose of tetanus toxoid-containing vaccine. Defer vaccination until at least 10 years have elapsed since the last tetanus toxoid-containing vaccine	Temperature of >104ÁF (>40.5ÁC) for ≤48 hours after vaccination with a previous dose of DTP or DTaP Collapse or shock-like state (i.e., hypotonic hyporesponsive episode) ≤48 hours after receiving a previous dose of DTP/DTaP Seizure ≤3 days after receiving a previous dose of DTP/DTaPÆ Persistent, inconsolable crying lasting ≥3 hours within 48 hours after receiving a previous dose of DTP/DTaP History of extensive limb swelling after DTP/DTaP/Td that is not an arthus-type reaction Stable neurologic disorder Brachial neuritis Latex allergy that is not anaphylactic Breast feeding Immunosuppression
IPV	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precautions** Pregnancy Moderate or severe acute illness with or without fever	Previous receipt of one or more doses of oral polio vaccine
MMR**	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component Pregnancy Known severe immunodeficiency (e.g., hematologic and solid tumors; receiving chemotherapy; congenital immunodeficiency; long-term immunosuppressive therapy;ÄÄ or patients with human immunodeficiency virus [HIV] infection who are severely immunocompromised) **Precautions** Recent (≤11 months) receipt of antibody-containing blood product (specific interval depends on product)ÆÆ History of thrombocytopenia or thrombocytopenic purpura Moderate or severe acute illness with or without fever	Positive tuberculin skin test Simultaneous tuberculosis skin testingÄÄ Breast feeding Pregnancy of recipientÕs mother or other close or household contact Recipient is childbearing-age female Immunodeficient family member or household contact Asymptomatic or mildly symptomatic HIV infection Allergy to eggs
Hib	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component Aged <6 weeks **Precautions** Moderate or severe acute illness with or without fever	

TABLE 5. (*Continued*) Contraindications and precautions* to commonly used vaccines

Vaccine	True contraindications and precautions*	Untrue (vaccines can be administered)
Hepatitis B	**Contraindication** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precautions** Infant weighing <2000 g[Ä] Moderate or severe acute illness with or without fever	Pregnancy Autoimmune disease (e.g., systemic lupus erythematosis or rheumatoid arthritis)
Hepatitis A	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precautions** Pregnancy Moderate or severe acute illness with or without fever	
Varicella	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component Substantial suppression of cellular immunity Pregnancy **Precautions** Recent (≤11 months) receipt of antibody-containing blood product (specific interval depends on product)[ÆÆE] Moderate or severe acute illness with or without fever	Pregnancy of recipientŝ mother or other close or household contact Immunodeficient family member or household contact*** Asymptomatic or mildly symptomatic HIV infection Humoral immunodeficiency (e.g., agamma-globulinemia)[ÀÀÀ]
PCV	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precaution** Moderate or severe acute illness with or without fever	
TIV	**Contraindication** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precaution** Moderate or severe acute illness with or without fever	Nonsevere (e.g., contact) allergy to latex or thimerosal Concurrent administration of coumadin or aminophylline
LAIV	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component Pregnancy Known severe immunodeficiency (e.g., hematologic and solid tumors; receiving chemotherapy; congenital immunodeficiency; long-term immunosuppressive therapy;[ÀÀ] or patients with human immunodeficiency virus [HIV] infection who are severely immunocompromised) Previous history of GBS Certain chronic medical conditions[ÄÄÄ] **Precaution** Moderate or severe acute illness with or without fever	

TABLE 5. (*Continued*) Contraindications and precautions* to commonly used vaccines

Vaccine	True contraindications and precautions*	Untrue (vaccines can be administered)
PPV	**Contraindication** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precaution** Moderate or severe acute illness with or without fever	History of invasive pneumococcal disease or pneumonia
MCV4	**Contraindications** Severe allergic reaction (e.g., anaphylaxis) after a previous vaccine dose or to a vaccine component **Precautions** Moderate or severe acute illness with or without fever History of Guillain-Barr® syndrome (if not at high risk for meningococcal disease)	
MPSV	**Contraindications** Severe allergic reaction after a previous dose or to a vaccine component **Precautions** Moderate or severe acute illness with or without fever	
HPV	**Contraindications** Severe allergic reaction after a previous dose or to a vaccine component **Precautions** Moderate or severe acute illness with or without fever Pregnancy	
Rotavirus	**Contraindications** Severe allergic reaction after a previous dose or to a vaccine component **Precautions** Moderate or severe acute illness with or without fever Immunosuppression Receipt of an antibody-containing blood product within 6 weeks[ÆÆ] Preexisting gastrointestinal disease Previous history of intussusception	Preterm births Immunosuppression in household contacts Pregnant household contacts

* Events or conditions listed as precautions should be reviewed carefully. Benefits of and risks for administering a specific vaccine to a person under these circumstances should be considered. If the risk from the vaccine is believed to outweigh the benefit, the vaccine should not be administered. If the benefit of vaccination is believed to outweigh the risk, the vaccine should be administered. Whether and when to administer DTaP to children with proven or suspected underlying neurologic disorders should be decided on a case-by-case basis.

[À] Antibacterial drugs and mefloquine might interfere with Ty21a oral typhoid vaccine, and certain antiviral drugs might interfere with varicella-containing and live-attenuated influenza virus vaccine.

[Ä] Hepatitis B vaccination should be deferred for infants weighing <2000 g if the mother is documented to be hepatitis B surface antigen (HBsAg)-negative at the time of the infantÕs birth. Vaccination can commence at chronological age 1 month. For infants born to HBsAg-positive women, hepatitis B immunoglobulin and hepatitis B vaccine should be administered at or soon after birth, regardless of weight.

[Æ] Acetaminophen or other appropriate antipyretic can be administered to infants and children with a history of previous seizures at the time of DTaP vaccination and every 4 hours for 24 hours thereafter to reduce the possibility of postvaccination fever (**Source:** American Academy of Pediatrics. Active immunization. In: Pickering LK, Baker CJ, Long SS, McMillan J. eds. 2006 red book: report of the Committee on Infectious Diseases. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006).

** MMR and varicella vaccines can be administered on the same day. If not administered on the same day, these vaccines should be separated by at least 28 days.

[ÀÀ] Substantially immunosuppressive steroid dose is considered to be ≥2 weeks of daily receipt of ≥20 mg or ≥2 mg/kg body weight of prednisone or equivalent.

[ÄÄ] Measles vaccination might suppress tuberculin reactivity temporarily. Measles-containing vaccine can be administered on the same day as tuberculin skin testing. If testing cannot be performed until after the day of MMR vaccination, the test should be postponed for ≥4 weeks after the vaccination. If an urgent need exists to skin test, do so with the understanding that reactivity might be reduced by the vaccine.

[ÆÆ] See text for details

TABLE 5. (*Continued*) Contraindications and precautions* to commonly used vaccines

Vaccine	True contraindications and precautions*	Untrue (vaccines can be administered)

*** If a vaccinee experiences a presumed vaccine-related rash 7ï 25 days after vaccination, avoid direct contact with immunocompromised persons for the duration of the rash, if possible.

ÀÀÀVaccine should be deferred for the appropriate interval if replacement IG products are being administered (Table 4).

ÄÄÄFor details, see CDC. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2006;55:No. RR-10.

ÆÆÆRotavirus vaccine (RV) should be deferred for 6 weeks after receipt of an antibody-containing product if possible. However, if the 6-week deferral would cause the first dose of RV to be scheduled for age ≥13 weeks, a shorter deferral interval should be used to ensure the first dose of RV is administered no later than age 13 weeks.

ever, administering a pertussis-containing vaccine should be considered if the risk for pertussis is increased (e.g., during a pertussis outbreak) (*27*). These precautions do not apply to administration of tetanus-reduced-diphtheria-acellular-pertussis vaccine for adolescents and adults. The presence of a moderate or severe acute illness with or without a fever is a precaution to administration of all vaccines (Table 5).

Clinicians or other health-care providers might inappropriately consider certain conditions or circumstances to be true contraindications or precautions to vaccination. This misconception results in missed opportunities to administer recommended vaccines (*49*). Likewise, clinicians and other health-care providers might fail to understand what constitutes a true contraindication or precaution and might administer a vaccine when it should be withheld. This practice can result in an increased risk for an adverse reaction to the vaccine. Among the most common conditions often inappropriately considered contraindications are diarrhea, minor upper-respiratory tract illnesses (including otitis media) with or without fever, mild-to-moderate local reactions to a previous dose of vaccine, current antimicrobial therapy, and the convalescent phase of an acute illness (Table 5).

The decision to administer or delay vaccination because of a current or recent acute illness depends on severity of symptoms and etiology of the disease. All vaccines can be administered to persons with minor acute illness (e.g., diarrhea or mild upper-respiratory tract infection with or without fever). Studies indicate that failure to vaccinate children with minor illnesses can seriously impede vaccination efforts (*50–52*). Among persons whose compliance with medical care cannot be ensured, use of every opportunity to provide appropriate vaccinations is critical.

The safety and efficacy of vaccinating persons who have mild illnesses have been documented (*53–56*). Vaccination should not be delayed because of the presence of mild respiratory tract illness or other acute illness with or without fever.

Persons with moderate or severe acute illness should be vaccinated as soon as the acute illness has improved, after screening for contraindications. This precaution avoids superimposing adverse effects of the vaccine on the underlying illness or causing diagnostic confusion between manifestations of the underlying illness and possible adverse effects of vaccination.

Routine physical examinations and procedures (e.g., measuring temperatures) are not prerequisites for vaccinating persons who appear to be healthy. Asking the parent or guardian if the child is ill and then postponing vaccination for children with moderate-to-severe illness or proceeding with vaccination if no contraindications exist are appropriate procedures in childhood vaccination programs.

A family history of seizures or other central nervous system disorders is not a contraindication to administration of pertussis or other vaccines. However, delaying pertussis vaccination for infants and children with a history of previous seizures until the child's neurologic status has been assessed is prudent. Pertussis vaccine should not be administered to infants with evolving neurologic conditions until the condition has stabilized (Table 5) (*27*).

Vaccine Administration

Infection Control and Sterile Technique

Persons administering vaccines should follow appropriate precautions to minimize risk for spread of disease. Hands should be cleansed with an alcohol-based waterless antiseptic hand rub or washed with soap and water between each patient contact (*57*). Occupational Safety and Health Administration (OSHA) regulations do not require gloves to be worn when administering vaccinations, unless persons administering vaccinations are likely to come into contact with potentially infectious body fluids or have open lesions on their hands. Needles used for injections must be sterile and disposable to minimize the risk for contamination. A separate needle and syringe should be used for each injection. Changing needles between drawing vaccine from a vial and injecting it into a recipient is not necessary. Different vaccines should never be mixed in the same syringe unless specifically licensed for such use, and no attempt should be made to transfer between syringes.

To prevent inadvertent needle-stick injury or reuse, needles and syringes should be discarded immediately after use in labeled, puncture-proof containers located in the same room where the vaccine is administered. Needles should not be recapped before being placed in the container. Safety needles or needle-free injection devices should be used if available to reduce the risk for injury.

Injection Route and Injection Site

With the exception of Bacillus Calmette-Guerin (BCG) vaccine, injectable vaccines are administered by the intramuscular and subcutaneous route. The method of administration of injectable vaccines is determined, in part, by the presence of adjuvants in some vaccines. The term adjuvant refers to a vaccine component distinct from the antigen that enhances the immune response to the antigen. The majority of vaccines containing an adjuvant (e.g., DTaP, DT, Td, Tdap, PCV, Hib, HepA , HepB, and human papillomavirus [HPV]) should be injected into a muscle because administration subcutaneously or intradermally can cause local irritation, induration, skin discoloration, inflammation, and granuloma formation. Anthrax vaccine, an inactivated vaccine with adjuvant, is an exception to this rule and is recommended to be administered subcutaneously. Routes of administration are recommended by the manufacturer for each immunobiologic (Table 6). Deviation from the recommended route of administration might reduce vaccine efficacy (*58,59*) or increase local adverse reactions (*60–62*).

Intramuscular Injections and Needle Length

Injectable immunobiologics should be administered where local, neural, vascular, or tissue injury is unlikely. Use of longer needles has been associated with less redness or swelling than occurs with shorter needles because of injection into deeper muscle mass (*60*). Appropriate needle length depends on age and body mass.

TABLE 6: Dose and route of administration for selected vaccines

Vaccines	Dose	Route
Diphtheria, tetanus, pertussis (DTaP, DT, Td, Tdap)	0.5 mL	Intramuscular (IM)
Diphtheria, tetanus, acellular pertussis, inactivated polio, hepatitis B vaccine (DTaP-IPV-HepB)	0.5 mL	IM
Diphtheria, tetanus, acellular pertussis, *haemophilus influenza* type b vaccine (DTaP-Hib)	0.5 mL	IM
Haemophilus influenzae type b (Hib)	0.5 mL	IM
Haemophilus influenzae type b ï Hepatitis B (Hib-HepB)	0.5 mL	IM
Hepatitis A (HepA)	≤18 yrs: 0.5 mL ≥19 yrs: 1.0 mL	IM
HepB	≤19 yrs: 0.5 mL* ≥20 yrs: 1.0 mL	IM
HepA/HepB	≥18 yrs: 1.0 mL	IM
Influenza, live attenuated	0.5 mL	Intranasal spray
Influenza, trivalent inactivated	6ï 35 mos: 0.25 mL ≥3 yrs: 0.5 mL	IM
Measles, mumps, rubella	0.5 mL	Subcutaneous (SC)
Measles, mumps, rubella, varicella	0.5 mL	SC
Meningococcal conjugate	0.5 mL	IM
Meningococcal polysaccharide	0.5 mL	SC
Pneumococcal conjugate	0.5 mL	IM
Pneumococcal polysaccharide	0.5 mL	IM or SC
Human papillomavirus	0.5 mL	IM
Polio, inactivated	0.5 mL	IM or SC
Rotavirus	2.0 mL	Oral
Varicella	0.5 mL	SC
Zoster	0.7 mL	SC

* Persons aged 11ï 15 years can be administered Recombivax HB^{È} (Merck) 1.0 mL (adult formulation) on a 2-dose schedule.
Adapted from: Immunization Action Coalition (http://www.immunize.org).

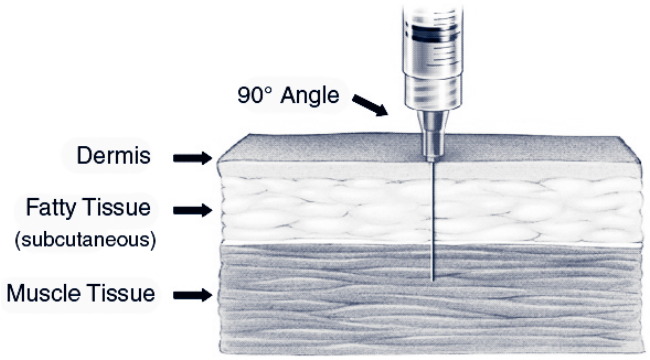
For all intramuscular injections, the needle should be long enough to reach the muscle mass and prevent vaccine from seeping into subcutaneous tissue, but not so long as to involve underlying nerves, blood vessels, or bone (*59,63–65)*. Vaccinators should be familiar with the anatomy of the area into which they are injecting vaccine. Intramuscular injections are administered at a 90-degree angle to the skin, preferably into the anterolateral aspect of the thigh or the deltoid muscle of the upper arm, depending on the age of the patient (Table 7).

Decision on needle size and site of injection must be made for each person on the basis of the size of the muscle, the thickness of adipose tissue at the injection site, the volume of the material to be administered, injection technique, and the depth below the muscle surface into which the material is to be injected (Figure 1). Aspiration before injection of vaccines or toxoids (i.e., pulling back on the syringe plunger after needle insertion, before injection) is not required because no large blood vessels exists at the recommended injection sites.

Infants (Aged <12 Months)

For the majority of infants, the anterolateral aspect of the thigh is the recommended site for injection because it provides a large muscle mass (Figure 2). The muscles of the buttock have not been used for administration of vaccines in infants and children because of concern about potential injury to the sciatic nerve, which is well documented after injection of antimicrobial agents into the buttock. If the gluteal muscle must be used, care should be taken to define the ana-

FIGURE 1. Intramuscular needle insertion



Adapted from California Immunization Branch

FIGURE 2. Intramuscular/subcutaneous site of administration: anterolateral thigh

Adapted from Minnesota Department of Health

TABLE 7. Needle length and injection site of intramuscular injections

Age	Needle length	Injection site
	Birthï 18 years	
Newborn*	5/8" (16mm)[À]	Anterolateral thigh
Infant 1ï 12 months	1" (25mm)	Anterolateral thigh
Toddler 1 ï 2 years	1"ï 1 1/4" (25ï 32 mm) 5/8"[À]ï 1" (16ï 25 mm)	Anterolateral thigh[Ä] Deltoid muscle of the arm
Child/adolescent 3ï 18 years	5/8"[À]ï 1" (16ï 25 mm) 1"ï 1 1/4" (25ï 32 mm)	Deltoid muscle of the arm[Ä] Anterolateral thigh
	Aged ≥19 Years	
Sex/weight	**Needle length**	**Injection site**
Male and female <60 kg (130 lbs)	1" (25mm)[Æ]	Deltoid muscle of the arm
Female 60ï 90 kg (130ï 200 lbs)	1"ï 1İ ò(25ï 38 mm)	
Male 60ï 118 kg (130ï 260 lbs)		
Female >90 kg (200 lbs)	1İ ò(38 mm)	
Male >118 kg (260 lbs)		

* Newborn = first 28 days of life.
[À] If skin stretched tight, subcutaneous tissues not bunched.
[Ä] Preferred site.
[Æ] Certain experts recommend a 5/8" (16 mm) needle for males and females who weigh <60 kg (130 lbs).
Adapted from: Poland GA, Borrud A, Jacobsen RM, et al. Determination of deltoid fat pad thickness: implications for needle length in adult immunization. JAMA 1997;277: 1709ï 11.

tomic landmarks.[¶] Injection technique is the most important parameter to ensure efficient intramuscular vaccine delivery. If the subcutaneous and muscle tissue are bunched to minimize the chance of striking bone (*63*), a 1-inch needle is required to ensure intramuscular administration in infants. For the majority of infants, a 1-inch, 22–25-gauge needle is sufficient to penetrate muscle in an infant's thigh. For newborn (first 28 days of life) and premature infants, a 5/8 inch long needle usually is adequate if the skin is stretched flat between thumb and forefinger and the needle inserted at a 90-degree angle to the skin (*65*).

Toddlers and Older Children (Aged 12 Months–10 Years)

The deltoid muscle should be used if the muscle mass is adequate. The needle size for deltoid site injections can range from 22–25 gauge and from 5/8 to 1 inch on the basis of the size of the muscle and the thickness of adipose tissue at the injection site (Figure 3). A 5/8-inch needle is adequate only for the deltoid muscle and only if the skin is stretched flat between thumb and forefinger and the needle inserted at a 90-degree angle to the skin. For toddlers, the anterolateral thigh can be used, but the needle should be at least 1 inch in length.

Adolescents and Adults (Aged >11 Years)

For adults and adolescents, the deltoid muscle is recommended for routine intramuscular vaccinations. The anterolateral thigh also can be used. For men and women weighing <130 lbs (<60 kg) a 5/8–1-inch needle is sufficient to ensure intramuscular injection. For women weighing 130–200 lbs (60–90 kg) and men 130–260 lbs (60–118kg), a 1–1½-inch needle is needed. For women weighing >200 lbs (>90 kg) or men weighing >260 lbs (>118 kg), a 1½-inch needle is required (Table 7) (*64*).

[¶]If the gluteal muscle is chosen, injection should be administered lateral and superior to a line between the posterior superior iliac spine and the greater trochanter or in the ventrogluteal site, the center of a triangle bounded by the anterior superior iliac spine, the tubercle of the iliac crest, and the upper border of the greater trochanter.

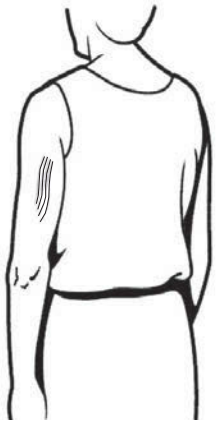
FIGURE 3. Intramuscular site of administration: deltoid

Adapted from Minnesota Department of Health

Subcutaneous Injections

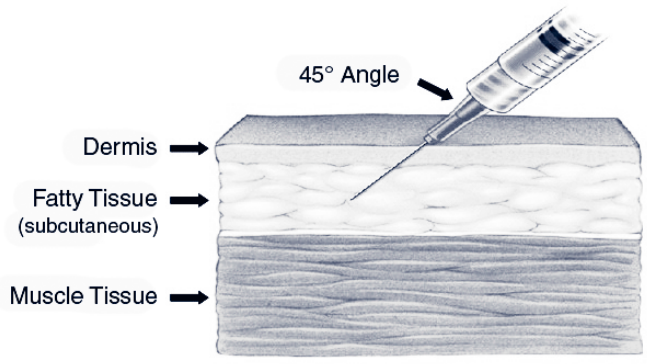
Subcutaneous injections are administered at a 45-degree angle usually into the thigh for infants aged <12 months and in the upper-outer triceps area of persons aged ≥12 months. Subcutaneous injections can be administered into the upper-outer triceps area of an infant, if necessary. A 5/8-inch, 23–25-gauge needle should be inserted into the subcutaneous tissue (Figures 4 and 5).

FIGURE 4. Subcutaneous site of administration: triceps



Adapted from Minnesota Department of Health

FIGURE 5. Subcutaneous needle insertion



Adapted from California Immunization Branch

Multiple Vaccinations

If multiple vaccines are administered at a single visit, administration of each preparation at a different anatomic site is desirable. For infants and younger children, if more than two vaccines must be injected in a single limb, the thigh is the preferred site because of the greater muscle mass; the injections should be sufficiently separated (i.e., 1 inch or more if possible) so that any local reactions can be differentiated (*60,66*). For older children and adults, the deltoid muscle can be used for more than one intramuscular injection. If a vaccine and an immune globulin preparation are administered simultaneously (e.g., Td/Tdap and tetanus immune globulin [TIG], HepB and hepatitis B immunoglobulin [HBIG]), separate anatomic sites should be used for each injection. The location of each injection should be documented in the patients' medical record.

Jet Injection

Jet injectors (JIs) are needle-free devices that drive liquid medication through a nozzle orifice, creating a narrow stream under high pressure that penetrates skin to deliver a drug or vaccine into intradermal, subcutaneous, or intramuscular tissues (*67,68*). JIs have the potential to reduce the frequency of needle-stick injuries to health-care workers (*69*) and to overcome the improper reuse and other drawbacks of needles and syringes in economically developing countries (*70–72*). JIs have been safe and effective for administering different live and inactivated vaccines for viral and bacterial diseases (*72*). The immune responses generated are equivalent to, and occasionally greater than, immune responses induced by needle injection. However, local reactions or injury (e.g., redness, induration, pain, blood, and ecchymosis at the injection site) can be more frequent when vaccines are delivered by JIs compared with needle injection (*68,72*).

In the 1990s, a new generation of JIs was introduced with disposable cartridges serving as dose chambers and nozzle (*72*). With the provision of a new sterile cartridge for each patient and correct use, these devices avoid the safety concerns for multiple-use–nozzle devices (*72–76*). These devices should be used in accordance with their labeling for intradermal, subcutaneous, or intramuscular administration.

Methods for Alleviating Discomfort and Pain Associated with Vaccination

Comfort measures, such as distraction (e.g., playing music or pretending to blow away the pain), ingestion of sweet liquids, breast feeding, cooling of the injection site, and topical or oral analgesia, can help infants or children cope with the discomfort associated with vaccination (*77,78*). Pretreatment (30–60 minutes before injection) with 5% topical lidocaine-prilocaine emulsion can decrease the pain of vaccination by causing superficial anesthesia (*79,80*). Evidence indicates that this cream does not interfere with the immune response to MMR (*81*). Topical lidocaine-prilocaine emulsion should not be used on infants aged <12 months who are receiving treatment with methemoglobin-inducing agents because of the possible development of methemoglobinemia (*82*).

Acetaminophen has been used among children to reduce the discomfort and fever associated with DTP vaccination (*83*). However, acetaminophen can cause formation of methemoglobin and might interact with lidocaine-prilocaine cream if used concurrently (*82*). Use of a topical refrigerant (vapocoolant) spray immediately before vaccination can reduce the short-term pain associated with injections and can be as effective as lidocaine-prilocaine cream (*84*).

Nonstandard Vaccination Practices

Recommendations for route, site, and dosage of immunobiologics are derived from data from clinical trials, from practical experience, and from theoretical considerations. ACIP discourages variations from the recommended route, site, volume, or number of doses of any vaccine.

Variation from the recommended route and site can result in inadequate protection. In adults but not in infants (*85*), the immunogenicity of HepB is substantially lower when the gluteal rather than the deltoid site is used for administration (*58*). HepB administered intradermally can result in a lower seroconversion rate and final titer of hepatitis B surface antibody than when administered by the deltoid intramuscular route (*86,87*). HepB administered by any route other than intramuscularly, or in adults at any site other than the deltoid or anterolateral thigh, should not be counted as valid and should be repeated. Similarly, doses of rabies vaccine administered in the gluteal site should not be counted as valid doses and should be repeated (*88*). Meningococcal conjugate vaccine (MCV4) should be administered intramuscularly; however, revaccination is not necessary when administered subcutaneously (*89*). Inactivated influenza vaccine is immunogenic when administered in a lower than standard dose by the intradermal (ID) route to healthy adult volunteers (*90*). However, the immunogenicity for persons aged ≥60 years is inadequate, and variance from the recommended route and dose is not recommended.

Live-attenuated injectable vaccines (e.g., MMR, varicella, and yellow fever) and certain inactivated vaccines (e.g., meningococcal polysaccharide and anthrax) are recommended by the manufacturers to be administered by subcutaneous injec-

tion. PPV and IPV are recommended by the manufacturer to be administered by the subcutaneous or intramuscular route. Response to vaccines recommended by the subcutaneous route probably will not be affected if the vaccines are administered by the intramuscular rather than subcutaneous route. Repeating doses of vaccine administered by the intramuscular route rather than by the subcutaneous route is not necessary.

Administering volumes smaller than that recommended (e.g., split doses) can result in inadequate protection. Using larger than recommended dosages can be hazardous because of excessive local or systemic concentrations of antigens or other vaccine constituents. Using reduced doses administered at multiple immunization visits that equal a full dose or using smaller divided doses are not endorsed or recommended. Any vaccination using less than the standard dose should not be counted, and the person should be revaccinated according to age, unless serologic testing indicates that an adequate response has been achieved.

Preventing Adverse Reactions

Vaccines are intended to produce active immunity to specific antigens. An adverse reaction is an untoward effect that occurs after a vaccination that is extraneous to the vaccine's primary purpose of producing immunity. Vaccine adverse reactions are classified by three general categories: local, systemic, and allergic (*91*). Local reactions are usually the least severe and most frequent. Systemic reactions (e.g., fever) occur less frequently than local reactions. Serious allergic reactions (e.g., anaphylaxis) are the most severe and least frequent. Severe adverse reactions are rare.

Persons who administer vaccines should screen their patients for contraindications and precautions to the vaccine before each dose of vaccine is administered (Table 5). Screening can be facilitated by consistent use of screening questionnaires, which are available from certain state vaccination programs and other sources (e.g., the Immunization Action Coalition at http://www.immunize.org).

Syncope (vasovagal or vasodepressor reaction) can occur after vaccination, most commonly among adolescents and young adults. During 1990–2004, a total of 3,168 reports to Vaccine Adverse Event Reporting System (VAERS) were coded as syncope; 35% of these episodes were reported among persons aged 10–18 years (CDC, unpublished data, 2005). Approximately 14% of reported syncopal episodes resulted in hospitalization because of injury or medical evaluation. Serious injury, including skull fracture and cerebral hemorrhage, has resulted from syncopal episodes after vaccination (*92*). A review of syncope after vaccination indicated that 63% of syncopal episodes occurred ≤5 minutes after vaccination, and 89% occurred within 15 minutes after vaccination (*93*). Although syncopal episodes are uncommon and severe allergic reactions are rare, vaccine providers should strongly consider observing patients for 15 minutes after they are vaccinated (*94*). If syncope develops, patients should be observed until the symptoms resolve.

Managing Acute Vaccine Reactions

Although rare after vaccination, the immediate onset and life-threatening nature of an anaphylactic reaction require that all personnel and facilities providing vaccinations have procedures in place for managing a reaction. All vaccine providers should be familiar with the office emergency plan and be certified in cardiopulmonary resuscitation. Epinephrine and equipment for maintaining an airway should be available for immediate use.

Anaphylaxis usually begins within minutes of vaccine administration (*95,96*). Rapidly recognizing and initiating treatment are required to prevent possible progression to cardiovascular collapse. If flushing, facial edema, urticaria, itching, swelling of the mouth or throat, wheezing, difficulty breathing, or other signs of anaphylaxis occur, the patient should be placed in a recumbent position with the legs elevated. Treatment options for management of anaphylaxis using pharmaceuticals have been recommended (Table 8) (*94,97*). Maintenance of an airway and oxygen administration might be necessary. Arrangements should be made for immediate transfer to an emergency facility for further evaluation and treatment.

Occupational Safety Regulations

Bloodborne diseases (e.g., hepatitis B, hepatitis C, and human immunodeficiency virus [HIV]) are occupational hazards for physicians and other health-care providers. To reduce the incidence of needle-stick injury and the consequent risk for bloodborne diseases acquired from patients, the Needlestick Safety and Prevention Act was enacted in November 2000. The Act directed OSHA to strengthen its existing bloodborne pathogen standards. Those standards were revised and became effective in April 2001 (*69*). These federal regulations require that safer injection devices (e.g., needle-shielding syringes or needle-free injectors) be used for injectable vaccination in all clinical settings. The rules also require that records be kept documenting injuries caused by medical sharps and that nonmanagerial employees be involved in the evaluation and selection of safer devices to be procured.

Needle-shielding or needle-free devices that might satisfy the occupational safety regulations for administering inject-

TABLE 8. Treatment of anaphylaxis with intramuscular or oral pharmaceuticals

Drug	Dosage
Child	
Primary regimen	
Epinephrine 1:1000 (aqueous) (1 mg/mL)*	0.01 mg/kg up to 0.5 mg (administer 0.01 mL/kg/dose up to 0.5 mL) intramuscularly (IM) repeated every 10ï 20 minutes up to 3 doses
Secondary regimen	
Diphenhydramine	1ï 2 mg/kg oral, IM, or intraveneously (IV), every 4ï 6 hours (maximum single dose: 100 mg)
Hydroxyzine	0.5ï 1 mg/kg oral, IM, every 4ï 6 hours (maximum single dose: 100 mg)
Prednisone	1.5ï 2 mg/kg oral (maximum single dose: 60 mg); use corticosteroids as long as needed
Adult	
Primary regimen	
Epinephrine 1:1000 (aqueous)*	0.01 mg/kg up to 0.5 mg (give 0.01 mL/kg/dose up to 0.5 mL) IM repeated every 10ï 20 minutes up to 3 doses
Secondary regimen	
Diphenhydramine	1ï 2 mg/kg up to 100 mg IM or oral, every 4ï 6 hours

* If agent causing anaphylactic reaction was administered by injection, epinephrine can be injected into the same site to slow absorption.
Adapted from American Academy of Pediatrics. Passive immunization. In: Pickering LK, Baker CJ, Long SS, McMillan J. Red Book: 2006 Report of the Committee on Infectious Diseases. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006, Immunization Action Coalition. Medical Management of Anaphylaxis in Adult Patients. Available at http://www.immunize.org/catg.d/p3082.pdf, and Mosbyís Drug Consult 2005.

able vaccines are available in the United States (*72,98,99*).** Additional information about implementation and enforcement of these regulations is available from OSHA (http://www.osha.gov/pls/oshaweb).

Storage and Handling of Immunobiologics

Failure to adhere to recommended specifications for storage and handling of immunobiologics can reduce their potency, resulting in an inadequate immune response in the recipient. Recommendations in the product package inserts, including methods for reconstitution of the vaccine, should be followed carefully. Vaccine quality is the shared responsibility of all handlers of vaccines from the time a vaccine is manufactured until administration. All vaccines should be inspected upon delivery and monitored during storage to ensure that the cold chain has been maintained. Vaccines should continue to be stored at recommended temperatures immediately upon receipt until use.

Storage Temperature

The majority of recommended vaccines require storage temperatures of 35°F–46°F (2°C–8°C), and they must not be exposed to freezing temperatures (*100*). Certain vaccines are sensitive to freezing temperatures because they contain an aluminum adjuvant (e.g., anthrax, DTaP, DT, Td, Tdap, Hib [PRP-OMP], HepA, HepB, PCV, rabies, and HPV) that precipitates when exposed to temperatures of ≤32°F (≤0°C) (*100,101*). Other vaccines (e.g., MMR, varicella, MMRV, LAIV, and yellow fever) lose potency when exposed to increased temperature because they contain live viruses (Table 9).

Vaccine storage units must be carefully selected, used properly, and consistently monitored to ensure that recommended temperatures are maintained. Refrigerators without freezers and stand-alone freezers (either manual defrost or automatic defrost) usually perform best at maintaining the precise temperatures required for vaccine storage, and such single-purpose units sold for home use are less expensive alternatives to medical specialty equipment (*100*). A combination refrigerator/freezer unit sold for home use is acceptable for storage of limited quantities of vaccines if the refrigerator and freezer compartments each have a separate external door. In these units, a freezer thermostat usually controls the freezer temperature and a refrigerator thermostat controls the volume of freezer temperature air entering the refrigerator, possibly resulting in different temperature zones within the refrigerator. In such units, vaccines should not be stored on the top shelf near the cold air outlet from the freezer to the refrigerator (usually located at the top of the refrigerator compartment). Any refrigerator or freezer used for vaccine storage must maintain the required temperature range year-round, be large enough to hold the year's largest inventory, and be dedicated to storage of biologics. Before use of the refrigerator for vaccine storage, the temperature should be measured in various

**Internet sites with device listings are identified for information purposes only. CDC, the U.S. Public Health Service, and the Department of Health and Human Services do not endorse any specific device or imply that the devices listed would all satisfy the needle-stick prevention regulations.

TABLE 9. Vaccine storage temperature recommendations

Vaccines	Vaccine storage temperature	Diluent storage temperature	Instructions
Diphtheria-tetanus, or pertussis-containing vaccines	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent*	Aluminum adjuvant ï irreversible loss of potency with exposure to freezing temperature
Haemophilus influenzae type b conjugate vaccines (Hib)	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	Several vaccine types with different thermo-stability profilesÀ
Hepatitis A and hepatitis B vaccines	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent	Aluminum adjuvant ï irreversible loss of potency with exposure to freezing temperature
Inactivated polio vaccine	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent	Data on thermostability properties of this vaccine are lacking
Meningococcal conjugate vaccine	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent	Data on thermostability properties of this vaccine are lacking. Do not expose to light
Meningococcal polysaccharide vaccine	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	Data are lacking on ideal pre-reconstitution storage requirements. After reconstitution, vaccine should be stored at 35Áï 46ÁF (2ÁCï 8ÁC).Do not freeze	Freeze dried (lyophilized) vaccine. Data on the effect of freezing temperatures on potency are lacking
Pneumococcal conjugate vaccine	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent	Aluminum adjuvant ï irreversible loss of potency with exposure to freezing temperatures
Pneumococcal polysaccharide vaccine	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent	Data on thermostability properties of this vaccine are lacking
Measles, mumps, and rubella vaccine in the lyophilized (freeze-dried) stateÄ	35Áï 46ÁF (2ÁCï 8ÁC) Lyophilized (freeze dried) vaccine can be stored at freezer temperature	35Áï 77ÁF (2ÁCï 25ÁC) Can be refrigerated or stored at room temperature	Protect from light or temperatures above the recommended range
Measles, mumps, rubella, and varicella vaccine	≤5ÁF (≤15ÁC)	35Áï 77ÁF (2ÁCï 25ÁC) Can be refrigerated or stored at room temperature	Protect from light
Trivalent inactivated influenza vaccine	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent	Data on the thermostability properties of this vaccine are lacking
Live-attenuated influenza vaccine	≤5ÁF (≤15ÁC)	No diluent	Do not expose to temperatures above the recommended range
Varicella vaccine	≤5ÁF (≤15ÁC)	35Áï 77ÁF (2ÁCï 25ÁC) Can be refrigerated or stored at room temperature	Do not expose to light or temperatures above the recommended range
Herpes zoster vaccine	≤5ÁF (≤15ÁC)	35Áï 77ÁF (2ÁCï 25ÁC) Can be refrigerated or stored at room temperature	Protect from light
Rotavirus	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent	Protect from light
Human papillomavirus vaccine	35Áï 46ÁF (2ÁCï 8ÁC) Do not freeze	No diluent	Protect from light

*DTaPï Tripedia[È] is sometimes used as a diluent for ActHib[È]

[À]ActHIB[È] (Aventis Pasteur, Lyon, France) in the lyophilized state is not expected to be affected detrimentally by freezing temperatures, although no data are available.

[Ä]MMR in the lyophilized state is not affected detrimentally by freezing temperatures.

Adapted from Atkinson WL, Pickering LK, Watson JC, Peter G. General Immunization Practices. In: Plotkin SA, Orenstein WA, eds. Vaccine. 4th ed. Philadelphia: Elsevier; 2004. p. 1357-86 and CDC. Guidelines for maintaining and managing the vaccine cold chain. MMWR 2003;52:1023ï 5.

locations within the refrigerator compartment to document that a stable temperature can be maintained (Table 9) within the compartment (*102*). The refrigerator temperature should be set at the midpoint of the recommended range (i.e., 40°F [5°C]) (*103,104*). Frequent opening and closing of doors can cause fluctuations of storage temperature; food, beverages, and clinical specimens should not be stored in vaccine storage units.

Temperature Monitoring

Temperature monitoring is a critical component of cold chain management. One person in the office should be assigned primary responsibility for maintaining temperature logs (Figure 6), with a second person assigned as backup. Temperatures for both the refrigerator and freezer should be documented twice a day and recorded. The backup person should review the log each week. Temperature logs should be maintained for 3 years unless state or local statutes mandate a longer time period. An automated monitoring system that alerts staff when a temperature deviation occurs is optimal. However, even if an automated monitoring system is used, temperatures should still be manually checked and recorded twice a day.

Thermometers should be placed in a central location in each compartment near the vaccine. Different types of thermometers can be used, including standard fluid-filled, minimum-maximum, and continuous chart recorder thermometers (Table 10). Standard fluid-filled thermometers are the simplest and least expensive products, but some models might

FIGURE 6. Sample temperature log

Temperature Log for Vaccines (Fahrenheit) **Month/Year:**_____ **Days 1–15**

***Instructions:** Place an "X" in the box that corresponds with the temperature. The hatched zones represent unacceptable temperature ranges. If the temperature recorded is in the hatched zone: 1. **Store the vaccine** under proper conditions as quickly as possible, 2. **Call the vaccine manufacturer(s)** to determine whether the potency of the vaccine(s) has been affected, 3. **Call the immunization program at your local health department** for further assistance: (_____) _____, and 4. **Document the action taken** on the reverse side of this log.

Day of Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Exact Time															
°F Temp	am pm	am pm	am pm	am pm	am pm	am pm	am pm	am pm	am pm	am pm	am pm	am pm	am pm	am pm	am pm
≥49°															
48°															
47°															
46°															
45°															
44°															
43°															
42°															
41°															
40°															
39°															
38°															
37°															
36°															
35°															
34°															
33°															
32°															
31°															
30°															
29°															
≤28°															
≥8°															
7°															
6°															
5°															
4°															
≤3°															
Room temp															
Staff Initials															

Refrigerator temperature

Freezer temp

Take immediate action if temperature is in shaded section*

Take immediate action if temperature is in shaded section*

Adapted by the Immunization Action Coalition courtesy of the Michigan Department of Community Health

www.immunize.org/catg.d/p3039.pdf • Item #P3039 (11/05)

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Source: http://www.immunize.org/catg.d/p3039.pdf

TABLE 10. Comparison of thermometers used to monitor vaccine temperatures

Thermometer type	Advantages	Disadvantages
Standard fluid-filled	Å Inexpensive and simple to use Å Thermometers encased in biosafe liquids can reflect vaccine temperatures more accurately than those directly exposed to the air	Å Accurate within a range of (+/-1ÁC) Å No information about duration of out-of-temperature exposure Å No information on minimum/maximum temperatures Å Cannot be recalibrated at routine intervals Å Inexpensive models might perform poorly
Minimum-maximum	Å Inexpensive Å Monitors temperature range	Å Accurate within a range of (+/-1ÁC.) Å No information about the duration of out-of-range temperature Å Cannot be recalibrated at routine intervals
Continuous chart recorder	Å Most accurate Å Continuous 24-hour readings of temperature range and duration Å Can be recalibrated at regular intervals	Å Most expensive Å Requires most training and maintenance

Adapted from CDC. Guidelines for maintaining and managing the vaccine cold chain. MMWR 2003;52:1023ï 25; and Langley A, Grant S, eds. Proceedings of the National Vaccine Storage Workshop; June 28-30, 2003; Brisbane, Australia. Maroochydore Queensland Health; 2004.

perform poorly. Product temperature thermometers (i.e., those encased in biosafe liquids) generally reflect refrigerator temperature more accurately. Minimum-maximum thermometers monitor the temperature range. Continuous chart recorder thermometers monitor temperature range and duration and can be recalibrated at specified intervals. All thermometers used for monitoring vaccine storage temperatures should be calibrated and certified by an appropriate agency (e.g., National Institute of Standards and Technology or the American Society for Testing and Materials). Because all thermometers are calibrated as part of the manufacturing process, this recommendation refers to a second calibration process that occurs after manufacturing but before marketing and is documented with a certificate that comes with the product.

Response to Out-of-Temperature-Range Storage

An out-of-range temperature reading should prompt immediate action. A plan should be developed to transfer vaccine to a predesignated alternative emergency storage site if a temperature problem cannot be resolved immediately (i.e., unit unplugged or door left open). Vaccine should be marked "do not use" and moved to the alternate site. After the vaccine has been moved, determine if the vaccine is still useable by contacting the manufacturer or state/local health department. Changes to vaccine exposed to temperatures outside of the recommended range and that affects its immunogenicity usually are not apparent visually.

Expiration Dates and Windows

All vaccines have an expiration date determined by the manufacturer that must be observed. When vaccines are removed from storage, physicians and health-care providers should note whether an expiration window exists for vaccine stored at room temperature or at an intermediate temperature. For example, live-attenuated influenza vaccine that is stored frozen must be discarded after 60 hours at refrigerator temperature. An expiration window also applies to vaccines that have been reconstituted. For example, after reconstitution, MMR vaccine must be administered within 8 hours and must be kept at refrigerator temperature during this time. Doses of expired vaccines that are administered inadvertently generally should not be counted as valid and should be repeated. Additional information about expiration dates is available at http://www.cdc.gov/nip.

Multidose Vials

Certain vaccines (i.e., DT, Td, Typhoid Vi, meningococcal polysaccharide vaccine [MPSV], TIV, JE, MMR, IPV, and yellow fever) might be distributed in multidose vials. For multidose vials that do not require reconstitution, after entering the vial, the remaining doses in a multidose vial can be administered until the expiration date printed on the vial or vaccine packaging if the vial has been stored correctly and the vaccine is not visibly contaminated, unless otherwise specified by the manufacturer. Multidose vials that require reconstitution must be used within an interval specified by the manufacturer. After reconstitution, the new expiration date should be written on the vial.

Prefilling Syringes

ACIP discourages the routine practice of prefilling syringes because of the potential for administration errors. The majority of vaccines have a similar appearance after being drawn into a syringe. Vaccine doses should not be drawn into a syringe until immediately before administration. When the syringes are filled, the type of vaccine, lot number, and date of filling must be labeled on each syringe, and the doses should be administered as soon as possible after filling. In certain circumstances in which a single vaccine type is being used (e.g., in advance of a community influenza vaccination campaign), filling a small number of syringes can be considered. Unused syringes filled by the end user (i.e., not filled by the manufacturer) should be discarded at the end of the vaccination session. In addition to administration errors, prefilling of syringes is a concern because FDA does not license administration syringes for vaccine storage. When in doubt about the appropriate handling of a vaccine, vaccination providers should contact the manufacturer.

As a general rule, vaccines that have been mishandled or stored at inappropriate temperatures should not be administered. Guidance for specific situations is available from the state health department or CDC. For certain vaccines (i.e., MMR, MMRV, or varicella vaccine), a serologic test can be performed and, if evidence of immunity can be documented for all antigens, revaccination is not necessary.

Altered Immunocompetence

General Principles

Altered immunocompetence is a term often used synonymously with immunosuppression and immunocompromise that includes conditions commonly classified as primary immunodeficiency and secondary immunodeficiency.

Primary immunodeficiencies generally are inherited and include conditions defined by an absence or quantitative deficiency of cellular and/or humoral components that provide immunity. Examples include congenital immunodeficiency diseases (e.g., X-linked agammaglobulinemia), severe combined immunodeficiency disease, and chronic granulomatous disease. Secondary immunodeficiency generally is acquired and is defined by loss or qualitative deficiency in cellular and humoral immune components that occurs as a result of a disease process or its therapy. Examples of secondary immune deficiency include HIV infection, hematopoetic malignancies, treatment with radiation, and treatment with immunosuppressive drugs, including alkylating agents and antimetabolites. The degree to which immunosuppressive drugs cause clinically significant immunodeficiency generally is dose-related and varies by drug. Primary and secondary immunodeficiencies might display a combination of deficits in both cellular and humoral immunity. In this report, the general term altered immunocompetence also will be used to include conditions such as asplenia and chronic renal disease and treatments with therapeutic monoclonal antibodies (specifically the tumor-necrosis-factor alpha inhibitors) (*105–110*) and prolonged high-dose corticosteroids.

Determination of altered immunocompetence is important to the vaccine provider because the incidence or severity of certain vaccine-preventable diseases is higher in persons with altered immunocompetence; therefore, certain vaccines (e.g., inactivated influenza and pneumococcal vaccines) are recommended specifically for persons with these diseases (*47,111–113*). Vaccines might be less effective during the period of altered immunocompetence. Live vaccines generally should be deferred until immune function has improved. Inactivated vaccines administered during the period of altered immunocompetence might need to be repeated after immune function has improved. Finally, persons with altered immunocompetence might be at increased risk for an adverse reaction after administration of live-attenuated vaccines because of reduced ability to mount an effective immune response.

The degree of altered immunocompetence in a patient should be determined by a physician. The challenge for clinicians and other health-care providers is in assessing the safety and effectiveness of vaccines for conditions associated with primary or secondary immunodeficiency, especially when new therapeutic modalities are being used and information about the safety and effectiveness of vaccines has not been characterized fully in persons receiving these drugs (Table 11). Laboratory studies can be useful for assessing the effects of a disease or drug on the immune system. Tests useful to assess humoral immunity include immunoglobulin (and immunoglobulin subset) levels and specific antibody levels (tetanus, diphtheria, and response to pneumococcal vaccine). Tests that demonstrate the status of cellular immunity include lymphocyte numbers (i.e., a complete blood count with differential), a test that delineates concentrations and proportions of lymphocyte subsets (i.e., B and T-lymphocytes, CD4+ versus CD8+ lymphocytes), and tests that measure T-lymphocyte proliferation in response to specific or nonspecific stimuli (e.g., lymphocyte proliferation assays) (*114–115*). The ability to characterize a drug or disease condition as affecting cellular or humoral immunity is only the first step; using this information to draw inferences about whether particular vaccines are indicated or whether caution is advised with use of live or

TABLE 11. Vaccination of persons with primary and secondary immune deficiencies

Category	Specific immunodeficiency	Contraindicated vaccines*	Risk-specific recommended vaccines*	Effectiveness and comments
Primary				
B-lymphocyte (humoral)	Severe antibody deficiencies (e.g., X-linked agammaglobulinemia and common variable immunodeficiency)	Oral poliovirus (OPV)[À] Smallpox Live-attenuated influenza vaccine (LAIV) BCG Ty21a (live oral typhoid)	Pneumococcal Influenza (TIV) Consider measles and varicella vaccination	The effectiveness of any vaccine will be uncertain if it depends only on the humoral response; intravenous immune globulin interferes with the immune response to measles vaccine and possibly varicella vaccine
	Less severe antibody deficiencies (e.g., selective IgA deficiency and IgG subclass deficiency)	OPV[À] Other live-vaccines appear to be safe	Pneumococcal Influenza (TIV)	All vaccines probably effective. Immune response may be attenuated
T-lymphocyte (cell-mediated and humoral)	Complete defects (e.g., severe combined immunodeficiency [SCID] disease, complete DiGeorge syndrome)	All live vaccines [Ä,Æ]	Pneumococcal Influenza (TIV)	Vaccines may be ineffective
	Partial defects (e.g., the majority of patients with DiGeorge syndrome, Wiskott-Aldrich syndrome, ataxia- telangiectasia)	All live vaccines [Ä,Æ]	Pneumococcal Meningococcal *Haemophilus influenza* type b (Hib) (if not administered in infancy) Influenza (TIV)	Effectiveness of any vaccine depends on degree of immune suppression
Complement	Deficiency of early components (C1, C2, C3, and C4)	None	Pneumococcal Meningococcal Influenza (TIV)	All routine vaccines probably effective
	Deficiency of late components (C5-C9) and C3, properdin, factor B	None	Pneumococcal Meningococcal Influenza (TIV)	All routine vaccines probably effective
Phagocytic function	Chronic granulomatous disease, leukocyte adhesion defect, and myeloperoxidase deficiency	Live bacterial vaccines[Ä]	Pneumococcal** Influenza (TIV) (to decrease secondary bacterial infection)	All inactivated vaccines safe and probably effective Live viral vaccines probably safe and effective
Secondary				
	Human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS)	OPV Smallpox BCG LAIV Withhold MMR and varicella in severely immunocompromised persons	Influenza (TIV) Pneumococcal Consider Hib (if not administered in infancy) and meningococcal vaccination.	Measles, mumps, rubella (MMR, varicella, and all inactivated vaccines, including inactivated influenza, might be effective[ÄÄ]
	Malignant neoplasm, transplantation, immunosuppressive or radiation therapy	Live viral and bacterial, depending on immune status	Influenza (TIV) Pneumococcal	Effectiveness of any vaccine depends on degree of immune suppression

TABLE 11. (*Continued*) Vaccination of persons with primary and secondary immune deficiencies

Category	Specific immunodeficiency	Contraindicated vaccines*	Risk-specific recommended vaccines*	Effectiveness and comments
Secondary				
	Asplenia	None	Pneumococcal Meningococcal Hib (if not administered in infancy)	All routine vaccines probably effective.
	Chronic renal disease	LAIV	Pneumococcal Influenza (TIV) Hepatitis B	All routine vaccines probably effective.

* Other vaccines that are universally or routinely recommended should be administered if not contraindicated.
† OPV is no longer available for routine use in the United States.
§ Live bacterial vaccines: BCG, and Ty21a *Salmonella typhi* vaccine.
¶ Live viral vaccines: MMR, OPV, LAIV, yellow fever, and varicella, including MMRV and HZ vaccine, and vaccinia (smallpox). Smallpox vaccine is not recommended for children or the general public.
†† Pneumococcal vaccine is not indicated for children with chronic granulomatous disease.
§§ HIV-infected children should receive IG after exposure to measles, and can receive varicella and measles vaccine if CD4+ lymphocyte count is >15%.
Modified from American Academy of Pediatrics. Passive Immunization. In: Pickering LK, ed. Red Book: 2006 Report of the Committee on Infectious Diseases. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006, and CDC. Use of vaccines and immune globulins in persons with altered immunocompetence: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1993:42 (No. RR-4).

inactivated vaccines is more complicated and might require consultation with an infectious disease or immunology specialist.

Altered Immunocompetence as an Indication to Receive a Vaccine

Persons with altered immunocompetence generally are advised to receive TIV and polysaccharide-based vaccines (i.e., PCV, PPV, MCV4, MPSV, and Hib vaccines) on the basis of demonstrated effectiveness and an increased risk for disease if the vaccine is withheld.

Pneumococcal Vaccines

Two types of vaccine against invasive pneumococcal disease are available in the United States: PCV and PPV. PCV is routinely recommended for all children beginning at age 2 months. PCV is not recommended for persons aged >59 months. PPV is approved for persons aged ≥2 years with certain underlying medical conditions (including altered immunocompetence) and routinely for persons aged ≥65 years. Complete recommendations on use of PCV and PPV are available in the Recommended Child and Adolescent Immunization Schedule and the Recommended Adult Immunization Schedule (*113,116*).

Influenza Vaccine

Two types of influenza vaccine are available in the United States: TIV and LAIV. Vaccination with TIV is indicated specifically for persons with altered immunocompetence, including HIV infection. LAIV usually is contraindicated for persons with altered immunocompetence, although healthy persons with anatomic or functional asplenia and household and other close contacts of persons with altered immunocompetence can receive this vaccine.

Meningococcal Vaccine

Two types of meningococcal vaccine are available in the United States: MCV4 and MPSV. Persons with asplenia, C3 complement deficiency (*117*), or terminal complement component deficiency are at increased risk for meningococcal disease and should receive MCV4 or MPSV. Persons with HIV infection can elect to receive MCV4 or MPSV. MCV4 is licensed for persons aged 11–55 years[††]; children aged 2–10 years or persons aged ≥56 years should receive MPSV.

Haemophilus influenzae type b Vaccine

Hib conjugate vaccines are available in single or combined antigen preparations. Hib vaccine is recommended routinely for all children through age 59 months. However, a single dose of Hib vaccine also can be considered for asplenic older children, adolescents, and adults who did not receive the vaccine series in childhood. Clinicians and other health-care providers might consider use of Hib vaccine among persons with HIV infection who did not receive the vaccine as an infant or in childhood (*112*).

[††] A supplement to the original MCV4 vaccine Biologics License Agreement was submitted to FDA in March 2005, for use of MCV4 in children aged 2–10 years.

Vaccination of Contacts of Persons with Altered Immunocompetence

Household and other close contacts of persons with altered immunocompetence should receive all age-appropriate vaccines, with the exception of live OPV and smallpox vaccine. MMR, varicella, and rotavirus vaccines should be administered to susceptible household and other close contacts of immunocompromised patients when indicated. MMR vaccine viruses are not transmitted to contacts, and transmission of varicella vaccine is rare (*6,118*). No special precautions are needed unless the varicella vaccine recipient has a rash after vaccination, in which case direct contact with susceptible household contacts should be avoided until the rash resolves (*8,119*). To minimize potential rotavirus transmission, all members of the household should employ hand hygiene measures after contact with feces of a rotavirus-vaccinated infant for at least 1 week (*19*). Household and other close contacts of persons with altered immunocompetence should receive annual influenza vaccination. LAIV can be administered to otherwise eligible contacts (*47*).

Vaccination with Inactivated Vaccines

All inactivated vaccines can be administered safely to persons with altered immunocompetence whether the vaccine is a killed whole organism or a recombinant, subunit, toxoid, polysaccharide, or polysaccharide protein-conjugate vaccine. If inactivated vaccines are indicated for persons with altered immunocompetence, the usual doses and schedules are recommended. However, the effectiveness of such vaccinations might be suboptimal.

Except for influenza vaccine, which should be administered annually (*47*), vaccination during chemotherapy or radiation therapy should be avoided if possible because antibody response might be suboptimal. However, administration of inactivated vaccines during chemotherapy or radiation is not contraindicated. Patients vaccinated within 2 weeks before starting immunosuppressive therapy or while receiving immunosuppressive therapy should be considered unvaccinated and should be revaccinated at least 3 months after therapy is discontinued if immune competence has been restored.

Vaccination with Live-Attenuated Vaccines

Severe complications have followed vaccination with live-attenuated viral and live-attenuated bacterial vaccines among persons with altered immunocompetence (*120–127*). Persons with most forms of altered immunocompetence should not receive live vaccines (MMR, varicella vaccine, LAIV, yellow fever vaccine, oral typhoid, BCG, and rotavirus) except in certain circumstances. Patients with leukemia, lymphoma, or other malignancies whose disease is in remission and whose chemotherapy has been terminated for at least 3 months can receive live-virus vaccines.

Children with defects in phagocyte function (e.g., chronic granulomatous disease or myeloperoxidase deficiency) can receive live-attenuated viral vaccines in addition to inactivated vaccines, but should not receive live-attenuated bacterial vaccines (e.g., BCG and Ty21a oral typhoid vaccine). Children with deficiencies in complement or with asplenia can receive live-attenuated viral and live-attenuated bacterial vaccines (*94*).

Persons with severe cell-mediated immune deficiency should not receive live attenuated vaccines. However, children with HIV infection are at increased risk for complications of primary varicella and herpes zoster compared with immunocompetent children (*118,128*). Limited data among HIV-infected children (specifically CDC class N1, N2, A1, A2, B1, or B2) with age-specific $CD4^+$ lymphocyte percentages of >15% indicate that varicella vaccine is immunogenic, effective, and safe (*129*). Varicella vaccine should be considered for children meeting these criteria. Eligible children should receive 2 doses of varicella vaccine with a 3-month interval between doses (*118*).

Persons with HIV infection are at increased risk for severe complications if infected with measles. No severe or unusual adverse events have been reported after measles vaccination among HIV-infected persons who did not have evidence of severe immunosuppression (*130–133*). Therefore, MMR vaccination is recommended for all asymptomatic HIV-infected persons who do not have evidence of severe immunosuppression (age-specific $CD4^+$ lymphocyte percentages of >15%) and for whom measles vaccination would otherwise be indicated. Similarly, MMR vaccination should be considered for mildly symptomatic (Pediatric Category A1, A2 or Adolescent/adult Category A) (*129,134*) HIV-infected persons who do not have evidence of severe immunosuppression (age-specific CD4+ lymphocyte percentages of >15%) for whom measles vaccination would otherwise be indicated.

HIV-infected persons who are receiving regular doses of IGIV might not respond to varicella vaccine or MMR or its individual component vaccines because of the continued presence of passively acquired antibody. However, because of the potential benefit, MMR and varicella vaccines should be considered approximately 2 weeks before the next scheduled dose of IGIV (if not otherwise contraindicated), although an optimal immune response might not occur depending on the dose and interval since the previous dose of IGIV. Unless serologic testing indicates that specific antibodies have been produced,

vaccination should be repeated (if not otherwise contraindicated) after the recommended interval (Table 4). An additional dose of IGIV should be considered for persons on maintenance IGIV therapy who are exposed to measles or varicella 3 or more weeks after administering a standard dose (100–400 mg/kg body weight) of IGIV.

Persons with impaired humoral immunity (e.g., hypogammaglobulinemia or dysgammaglobulinemia) should receive varicella vaccine (*118,135*). However, the majority of persons with these disorders also receive periodic doses of IGIV. Appropriate spacing should be maintained between administration of IGIV and varicella vaccine to prevent an inadequate response to vaccination caused by the presence of neutralizing antibodies from the IGIV. Household and other close contacts of persons with altered immunocompetence should receive all age appropriate vaccines, with the exception of live OPV and smallpox vaccine.

Recipients of Hematopoietic Stem Cell Transplant

Hematopoietic stem cell transplantation (HSCT) results in immunosuppression from the hematopoietic ablative therapy preceding transplant, from drugs used to prevent or treat graft-versus-host disease, and in certain cases from the underlying disease process necessitating transplantation (*136*). HSCT involves ablation of the bone marrow with reimplantation of the person's own stem cells or stem cells from a donor. Antibody titers to vaccine-preventable diseases (e.g., tetanus, poliovirus, measles, mumps, rubella, and encapsulated bacteria) decline 1–4 years after autologous or allogeneic HSCT if the recipient is not revaccinated. HSCT recipients of all ages are at increased risk for certain vaccine-preventable diseases, including diseases caused by encapsulated bacteria (i.e., pneumococcal, meningococcal, and Hib infections). As a result, HSCT recipients should be revaccinated routinely after HSCT, regardless of the source of the transplanted stem cells (*136*). Revaccination with inactivated vaccines should begin 12 months after HSCT, except inactivated influenza vaccine, which should be administered beginning at least 6 months after HSCT and annually thereafter for the life of the patient. PPV should be administered at 12 and 24 months after HSCT. Data are limited about the use of heptavalent PCV in this population. Sequential administration of 2 doses of heptavalent pneumococcal conjugate vaccine followed by a dose of pneumococcal polysaccharide vaccine (with 8 weeks between doses) can be considered, especially for children aged <60 months. A 3-dose regimen of Hib vaccine should be administered at ages 12, 14, and 24 months after transplantation for all age groups (*136*). MMR vaccine should be administered 24 months after transplantation if the HSCT recipient is immunocompetent. Because of insufficient experience using varicella vaccine among HSCT recipients, physicians should assess the immune status of each recipient on a case-by-case basis and determine the risk for infection before using these vaccines. If a decision is made to vaccinate with varicella vaccine, the vaccine should be administered a minimum of 24 months after transplantation if the HSCT recipient is presumed to be immunocompetent (*137*).

Situations in Which Some Degree of Immunodeficiency Might be Present

Asplenia and use of corticosteroids or certain drugs have the potential to be immunosuppressive and in each, some degree of altered immunocompetence is presumed to exist.

Anatomic or Functional Asplenia

Persons with anatomic (e.g., surgical removal or congenital absence) or functional (as occurs with sickle cell disease) asplenia are at increased risk for infection by encapsulated bacteria, especially with *S. pneumoniae* (pneumococcus), *N. meningitidis* (meningococcus), and Hib (*26,48,117*). Persons with anatomic or functional asplenia should receive pneumococcal vaccine, depending on their age and previous pneumococcal vaccination status, as recommended (*29,48,113,116*).

Meningococcal vaccine is recommended for persons with anatomic or functional asplenia. Children aged 2–10 years and persons aged ≥56 years should receive MPSV. MCV4 is approved for persons aged 11–55 years[††] and is preferred for persons in this age group, but MPSV is an acceptable alternative (*117*). A second dose of MPSV can be considered at least 5 years after the initial dose. The duration of immunity after MCV4 is not known, but is thought to be long-lasting like other conjugate vaccines, and revaccination is not recommended.

No efficacy data are available on which to base a recommendation about use of Hib vaccine for older children and adults with the chronic conditions associated with an increased risk for Hib disease. However, studies suggest good immunogenicity in patients who have sickle cell disease or have had splenectomies; administering Hib vaccine to these patients is not contraindicated (*112*).

Pneumococcal, meningococcal, and Hib vaccines should be administered at least 2 weeks before elective splenectomy, if possible. If vaccines are not administered before surgery, they should be administered as soon as the person's condition stabilizes after the procedure.

Corticosteroids

The amount of systemically absorbed corticosteroids and the duration of administration needed to suppress the immune system of an otherwise immunocompetent person are not well defined. Corticosteroid therapy usually is not a contraindication to administering live-virus vaccine when administration is short-term (i.e., <2 weeks); a low-to-moderate dose (<20 mg or prednisone or equivalent per day); long-term, alternate-day treatment with short-acting preparations; maintenance physiologic doses (replacement therapy); or administered topically (skin or eyes), inhaled, or by intra-articular, bursal, or tendon injection (*138*). No evidence of increased severity of reactions to live-attenuated vaccines has been reported among persons receiving corticosteroid therapy by aerosol, and such therapy is not a reason to delay vaccination. The immunosuppressive effects of steroid treatment vary, but the majority of clinicians consider a dose equivalent to either >2 mg/kg of body weight or 20 mg/day of prednisone or equivalent for persons who weigh >10 kg when administered for ≥2 weeks as sufficiently immunosuppressive to raise concern about the safety of vaccination with live-virus vaccines (*112,138*). Corticosteroids used in greater than physiologic doses also can reduce the immune response to vaccines. Vaccination providers should wait at least 1 month after discontinuation of high dose systemically absorbed corticosteroid therapy administered for more than 2 weeks before administering a live-virus vaccine.

Other Immunosuppressive Drugs

Whenever feasible, clinicians should provide all indicated vaccines to all persons before initiation of chemotherapy, before treatment with other immunosuppressive drugs, and before radiation or splenectomy. Persons receiving chemotherapy or radiation for leukemia and other hematopoetic malignancies, solid tumors, or after solid organ transplant should be assumed to have altered immunocompetence. Live-attenuated vaccines should not be administered for at least 3 months after such immunosuppressive therapy. Inactivated vaccines administered during chemotherapy might need to be readministered after immune competence is regained. Persons vaccinated before chemotherapy for leukemia, lymphoma, other malignancies, or radiation generally are thought to retain immune memory after treatment, although revaccination following chemotherapy for acute lymphoblastic leukemia might be indicated (*139*). Revaccination of a person after chemotherapy or radiation therapy is not thought to be necessary if the previous vaccination occurred before therapy and not during the therapy, with the exception of recipients of HSCT, who should be revaccinated as recommended previously. Determination of the level of immune memory and the need for revaccination should be made by the treating physician.

Inactivated vaccines can be administered during low dose intermittent or maintenance therapy of immunosuppressive drugs. The safety and efficacy of live-attenuated vaccines during such therapy is unknown. Physicians should carefully weigh the risks for and benefits of providing injectable live vaccines to adult patients on low-dose therapies for chronic autoimmune disease. The safety and efficacy of live-attenuated vaccines administered concurrently with recombinant human immune mediators and immune modulators is unknown. Evidence that use of therapeutic monoclonal antibodies, especially the antitumor necrosis factor agents adalimumab, infliximab, and etanercept, causes reactivation of latent tuberculosis infection and tuberculosis disease and predisposes to other opportunistic infections suggests caution in the use of live vaccines in patients receiving these drugs (*105–110*). Until additional information becomes available, avoidance of live attenuated vaccines during intermittent or low dose chemotherapy or other immunosuppressive therapy is prudent, unless the benefit of vaccination outweighs the hypothetical increased risk for an adverse reaction after vaccination.

Special Situations

Concurrently Administering Antimicrobial Agents and Vaccines

With limited exceptions, using an antimicrobial agent is not a contraindication to vaccination. Antimicrobial agents have no effect on the response to live-attenuated vaccines, except live oral Ty21a typhoid vaccine, and have no effect on inactivated, recombinant subunit, or polysaccharide vaccines or toxoids. Ty21a typhoid vaccine should not be administered to persons receiving antimicrobial agents until 24 hours after any dose of antimicrobial agent (*20*).

Antiviral drugs used for treatment or prophylaxis of influenza virus infections have no effect on the response to inactivated influenza vaccine (*47*). However, live-attenuated influenza vaccine should not be administered until 48 hours after cessation of therapy using antiviral influenza drugs. If feasible, antiviral medication should not be administered for 2 weeks after LAIV administration (*47*). Antiviral drugs active against herpesviruses (e.g., acyclovir or valacyclovir) might reduce the efficacy of live-attenuated varicella vaccine. These drugs should be discontinued at least 24 hours before administration of varicella-containing vaccines, if possible.

The antimalarial drug mefloquine could affect the immune response to oral Ty21a typhoid vaccine if both are taken si-

multaneously (*140*). To minimize this effect, administering Ty21a typhoid vaccine at least 24 hours before or after a dose of mefloquine is prudent.

Tuberculosis Screening and Skin Test Reactivity

Measles illness, severe acute or chronic infections, HIV infection, and malnutrition can create a relatively anergic state during which the tuberculin skin test (TST) (previously referred to as purified protein derivative [PPD] skin test) might give a false negative reaction (*141–143*). Although any live attenuated measles vaccine can theoretically suppress TST reactivity, the degree of suppression is probably less than that occurring from acute infection from wild-type measles virus. Although routine TST screening of all children is no longer recommended, TST screening is sometimes needed at the same time as administering a measles-containing vaccine (e.g., for well-child care, school entrance, or for employee health reasons).

TST and measles-containing vaccine can be administered at the same visit (preferred option). Simultaneously administering TST and measles-containing vaccine does not interfere with reading the TST result at 48–72 hours and ensures that the person has received measles vaccine.

If the measles-containing vaccine has been administered recently, TST screening should be delayed for at least 4 weeks after vaccination. A delay in performing TST will remove the concern of any theoretical but transient suppression of TST reactivity from the vaccine.

TST screening can be performed and read before administering the measles-containing vaccine. This option is the least favored because it will delay receipt of the measles-containing vaccine.

No data exist for the potential degree of TST suppression that might be associated with other injectable, live-attenuated virus vaccines (e.g., varicella and yellow fever). However, in the absence of data, following guidelines for measles-containing vaccine when scheduling TST screening and administering other live-attenuated virus vaccines is prudent. If the opportunity to vaccinate might be missed, vaccination should not be delayed only because of these theoretical considerations. Because of similar concerns about smallpox vaccine and TST suppression, a TST should not be performed until four weeks after smallpox vaccination (*144*).

TST reactivity in the absence of tuberculosis disease is not a contraindication to administration of any vaccine, including live-attenuated virus vaccines. Tuberculosis disease is not a contraindication to vaccination, unless the person is moderately or severely ill. Although no studies have reported the effect of MMR vaccine on persons with untreated tuberculosis, a theoretical basis exists for concern that measles vaccine might exacerbate the disease tuberculosis (*6*). As a result, before administering MMR to persons with untreated active tuberculosis, initiating antituberculosis therapy is advisable (*7*). Considering if concurrent immunosuppression (e.g., immunosuppression caused by HIV infection) is a concern before administering live attenuated vaccines also is prudent.

Severe Allergy to Vaccine Components

Vaccine components can cause allergic reactions among certain recipients. These reactions can be local or systemic and can include mild-to-severe anaphylaxis or anaphylactic-like responses (e.g., generalized urticaria or hives, wheezing, swelling of the mouth and throat, difficulty breathing, hypotension, and shock). Allergic reactions might be caused by the vaccine antigen, residual animal protein, antimicrobial agents, preservatives, stabilizers, or other vaccine components (*145*). Components of each vaccine are listed in the respective package insert. An extensive listing of vaccine components, their use, and the vaccines that contain each component has been published *(146)* and is also available from CDC's National Center for Immunization and Respiratory Diseases (proposed) (http://www.cdc.gov/nip).

The most common animal protein allergen is egg protein, which is found in influenza and yellow fever vaccines, which are prepared using embryonated chicken eggs. Ordinarily, persons who are able to eat eggs or egg products safely can receive these vaccines; persons with histories of anaphylactic or anaphylactic-like allergy to eggs or egg proteins should generally not receive these vaccines. Asking persons if they can eat eggs without adverse effects is a reasonable way to determine who might be at risk for allergic reactions from receiving yellow fever and influenza vaccines. A regimen for administering influenza vaccine to children with egg hypersensitivity and severe asthma has been developed (*147*).

Measles and mumps vaccine viruses are grown in chick embryo fibroblast tissue culture. Persons with a serious egg allergy can receive measles- or mumps-containing vaccines without skin testing or desensitization to egg protein (*6*). Rubella and varicella vaccines are grown in human diploid cell cultures and can safely be administered to persons with histories of severe allergy to eggs or egg proteins. The rare serious allergic reactions after measles or mumps vaccination or MMR are not believed to be caused by egg antigens, but to other components of the vaccine (e.g., gelatin) (*148–151*). MMR, MMRV, and their component vaccines and other vaccines contain hydrolyzed gelatin as a stabilizer. Extreme caution should be used when administering vaccines that contain

gelatin to persons who have a history of an anaphylactic reaction to gelatin or gelatin-containing products. Before administering gelatin-containing vaccines to such persons, skin testing for sensitivity to gelatin can be considered. However, no specific protocols for this approach have been published.

Certain vaccines contain trace amounts of antimicrobial agents or other preservatives (e.g., neomycin or thimerosal) to which patients might be severely allergic. The information provided in the vaccine package insert should be reviewed carefully before deciding if the rare patient with such allergies should receive the vaccine. No licensed vaccine contains penicillin or penicillin derivatives.

Certain vaccines contain trace amounts of neomycin. Persons who have experienced anaphylactic reactions to neomycin should not receive these vaccines. Most often, neomycin allergy is a contact dermatitis, a manifestation of a delayed type (cell-mediated) immune response, rather than anaphylaxis (*152,153*). A history of delayed type reactions to neomycin is not a contraindication for administration of these vaccines.

Thimerosal is an organic mercurial compound in use since the 1930s and is added to certain immunobiologic products as a preservative. A joint statement issued by the U.S. Public Health Service and the American Academy of Pediatrics (AAP) in 1999 (*154*) and agreed to by the American Academy of Family Physicians (AAFP) later in 1999, established the goal of removing thimerosal as soon as possible from vaccines routinely recommended for infants. Although no evidence exists of any harm caused by low levels of thimerosal in vaccines and the risk was only theoretical (*155*), this goal was established as a precautionary measure.

The public is concerned about the health effects of mercury exposure of any type, and the elimination of mercury from vaccines was judged a feasible means of reducing an infant's total exposure to mercury in a world where other environmental sources of exposure are more difficult or impossible to eliminate (e.g., common foods like tuna). Since mid-2001, vaccines routinely recommended for infants have been manufactured without thimerosal as a preservative. Live-attenuated vaccines have never contained thimerosal. Thimerosal-free formulations of inactivated influenza vaccine are available. Inactivated influenza vaccine also is available in formulations with trace thimerosal, in which thimerosal no longer functions as a preservative, and in formulations that contain thimerosal. Thimerosal that acts as a preservative is present in certain other vaccines that can be administered to children (e.g., Td and DT). Information about the thimerosal content of vaccines is available from FDA (http://www.fda.gov/cber/vaccine/thimerosal.htm).

Receiving thimerosal-containing vaccines might lead to induction of allergy. However, limited scientific basis exists for this assertion (*145*). Allergy to thimerosal usually consists of local delayed type hypersensitivity reactions (*156–158*). Thimerosal elicits positive delayed type hypersensitivity patch tests in 1%–18% of persons tested, but these tests have limited or no clinical relevance (*159–160*). The majority of persons do not experience reactions to thimerosal administered as a component of vaccines even when patch or intradermal tests for thimerosal indicate hypersensitivity (*160*). A localized or delayed type hypersensitivity reaction to thimerosal is not a contraindication to receipt of a vaccine that contains thimerosal.

Latex Allergy

Latex is sap from the commercial rubber tree. Latex contains naturally occurring impurities (e.g., plant proteins and peptides) that might be responsible for allergic reactions. Latex is processed to form natural rubber latex and dry natural rubber. Dry natural rubber and natural rubber latex might contain the same plant impurities as latex but in lesser amounts. Natural rubber latex is used to produce medical gloves, catheters, and other products. Dry natural rubber is used in syringe plungers, vial stoppers, and injection ports on intravascular tubing. Synthetic rubber and synthetic latex also are used in medical gloves, syringe plungers, and vial stoppers. Synthetic rubber and synthetic latex do not contain natural rubber or natural latex and do not contain the impurities linked to allergic reactions. Latex or dry natural rubber used in vaccine packaging is generally noted in the manufacturer's package insert.

The most common type of latex sensitivity is contact-type (type 4) allergy, usually as a result of prolonged contact with latex-containing gloves (*161*). However, injection-procedure–associated latex allergies among patients with diabetes mellitus have been described (*162–164*). Allergic reactions (including anaphylaxis) after vaccination procedures are rare (*165*). Only one known report of an allergic reaction after administering HepB to a patient with known severe allergy (anaphylaxis) to latex has been published (*166*).

If a person reports a severe (anaphylactic) allergy to latex, vaccines supplied in vials or syringes that contain natural rubber should not be administered unless the benefit of vaccination outweighs the risk for a potential allergic reaction. For latex allergies other than anaphylactic allergies (e.g., a history of contact allergy to latex gloves), vaccines supplied in vials or syringes that contain dry natural rubber or natural rubber latex can be administered.

Vaccination of Preterm Infants

In the majority of cases, infants born prematurely, regardless of birthweight, should be vaccinated at the same chronological age and according to the same schedule and precautions as full-term infants and children. Birthweight and size are not factors in deciding whether to postpone routine vaccination of a clinically stable preterm infant (*167–171*), except for HepB. The full recommended dose of each vaccine should be used. Divided or reduced doses are not recommended (*173*).

Decreased seroconversion rates might occur among certain preterm infants with low birthweights (i.e., <2,000 g) after administration of HepB at birth (*173*). However, by chronological age 1 month, all preterm infants, regardless of initial birth weight or gestational age, are likely to respond as adequately as older and larger infants (*174–176*). Preterm infants born to HBsAg-positive mothers and mothers with unknown HBsAg status must receive immunoprophylaxis with HepB and HBIG within 12 hours after birth. If these infants weigh <2,000 g at birth, the initial vaccine dose should not be counted towards completion of the HepB series, and 3 additional doses of HepB should be administered, beginning when the infant is aged 1 month. Preterm infants weighing <2,000 g and born to HBsAg-negative mothers should receive the first dose of the HepB series at chronological age 1 month or at hospital discharge. (*30*)

Breast Feeding and Vaccination

Neither inactivated nor live vaccines administered to a lactating woman affect the safety of breast feeding for women or their infants. Breast feeding does not adversely affect immunization and is not a contraindication for any vaccine, with the exception of smallpox vaccine. Limited data indicate that breast feeding can enhance the response to certain vaccine antigens (*177*). Breast-fed infants should be vaccinated according to recommended schedules (*178–180*).

Although live vaccines multiply within the mother's body, the majority have not been demonstrated to be excreted in human milk (*181*). Although rubella vaccine virus might be excreted in human milk, the virus usually does not infect the infant. If infection does occur, it is well-tolerated because the virus is attenuated (*182*). Inactivated, recombinant, subunit, polysaccharide, conjugate vaccines and toxoids pose no risk for mothers who are breast feeding or for their infants.

Vaccination During Pregnancy

Risk for a developing fetus from vaccination of the mother during pregnancy primarily is theoretical. No evidence exists of risk from vaccinating pregnant women with inactivated virus or bacterial vaccines or toxoids (*183,184*). Live vaccines pose a theoretical risk to the fetus. Benefits of vaccinating pregnant women usually outweigh potential risks when the likelihood of disease exposure is high, when infection would pose a risk to the mother or fetus, and when the vaccine is unlikely to cause harm.

Recommendations for vaccination during pregnancy can be found in the adult immunization schedule (*113*). Pregnant women should receive Td vaccine if indicated. Previously vaccinated pregnant women who have not received a Td vaccination within the last 10 years should receive a booster dose. Pregnant women who are not vaccinated or only partially immunized against tetanus should complete the primary series (*28,112*). Women for whom the vaccine is indicated but who have not completed the recommended 3-dose series during pregnancy should receive follow-up after delivery to ensure the series is completed. Pregnant adolescents and adults who received the last tetanus-containing vaccine <10 years previously are generally recommended to receive Tdap after delivery. To prevent neonatal tetanus, pregnant adolescents who received the last dose of tetanus-toxoid containing vaccine ≥10 years previously should generally receive Td in preference to Tdap while they are pregnant (*28*), although Tdap is not contraindicated during pregnancy.

Women in the second and third trimesters of pregnancy are at increased risk for hospitalization from influenza. Therefore, routine influenza vaccination is recommended for all women who will be pregnant (in any trimester) during influenza season (usually November–March in the United States) (*47*).

IPV can be administered to pregnant women who are at risk for exposure to wild-type poliovirus infection (*4*). HepB is recommended for pregnant women at risk for hepatitis B virus infection (*30*). HepA, pneumococcal polysaccharide, meningococcal conjugate, and meningococcal polysaccharide vaccines should be considered for women at increased risk for those infections (*48,117,185*). Pregnant women who must travel to areas where the risk for yellow fever is high should receive yellow fever vaccine because the limited theoretical risk from vaccination is substantially outweighed by the risk for yellow fever infection (*24,186*).

Pregnancy is a contraindication for smallpox (vaccinia), measles, mumps, rubella, and varicella-containing vaccines. Smallpox (vaccinia) vaccine is the only vaccine known to cause harm to a fetus when administered to a pregnant woman. In addition to the vaccinee herself, smallpox (vaccinia) vaccine should not be administered to a household contact of a pregnant woman (*144*). Although of theoretical concern, no cases of congenital rubella or varicella syndrome or abnormalities

attributable to fetal infection have been observed among infants born to susceptible women who received rubella or varicella vaccines during pregnancy (*6,187*). Because of the importance of protecting women of childbearing age against rubella and varicella, reasonable practices in any vaccination program include asking women if they are pregnant or might become pregnant in the next 4 weeks; not vaccinating women who state that they are or plan to be pregnant; explaining the theoretical risk for the fetus if MMR, varicella, or MMRV vaccine were administered to a women who is pregnant; and counseling women who are vaccinated not to become pregnant during the 4 weeks after MMR, varicella, or MMRV vaccination (*6,39,188*). Routine pregnancy testing of women of childbearing age before administering a live-virus vaccine is not recommended (*6*). If vaccination of an unknowingly pregnant woman occurs or if she becomes pregnant within 4 weeks after MMR or varicella vaccination, she should be counseled about the theoretical basis of concern for the fetus; however, MMR or varicella vaccination during pregnancy should not be regarded as a reason to terminate pregnancy (*6,8,189*).

Persons who receive MMR vaccine do not transmit the vaccine viruses to contacts (*6*). Transmission of varicella vaccine virus to contacts is extremely rare (*118*). MMR and varicella vaccines should be administered when indicated to the children and other household contacts of pregnant women (*6,8*).

All pregnant women should be evaluated for immunity to rubella and varicella and be tested for the presence of HBsAg in every pregnancy (*6,30,39*). Women susceptible to rubella and varicella should be vaccinated immediately after delivery. A woman found to be HBsAg-positive should be followed carefully to ensure that the infant receives HBIG and begins the hepatitis B vaccine series no later than 12 hours after birth and that the infant completes the recommended HepB vaccine series on schedule (*30*). No known risk exists for the fetus from passive immunization of pregnant women with immune globulin preparations.

Persons Vaccinated Outside the United States, Including Internationally Adopted Children

The ability of a clinician to determine that a person is protected on the basis of their country of origin and their records alone is limited. Vaccines administered outside the United States can generally be accepted as valid if the schedule was similar to that recommended in the United States (i.e., minimum ages and intervals). Only written documentation should be accepted as evidence of previous vaccination. Written records are more likely to predict protection if the vaccines, dates of administration, intervals between doses, and the person's age at the time of vaccination are comparable to U.S. recommendations. Although vaccines with inadequate potency have been produced in other countries (*190,191*), the majority of vaccines used worldwide is produced with adequate quality control standards and are potent.

The number of U.S. families adopting children from outside the United States has increased substantially in recent years (*192*). Adopted children's birth countries often have vaccination schedules that differ from the recommended childhood immunization schedule in the United States. Differences in the U.S. immunization schedule and those used in other countries include the vaccines administered, the recommended ages of administration, and the number and timing of doses.

Data are inconclusive about the extent to which an internationally adopted child's vaccination record reflects the child's protection. A child's record might indicate administration of MMR vaccine when only single-antigen measles vaccine was administered. A study of children adopted from orphanages in the People's Republic of China, Russia, and Eastern Europe determined that 67% of children with documentation of more than 3 doses of DTP before adoption had nonprotective titers to these antigens. By contrast, children adopted from these countries who received vaccination in the community (not only from orphanages) and who possessed records of 1 or more doses of DTP exhibited protective titers 67% of the time (*193*). However, antibody testing was performed by using a hemagglutination assay, which tends to underestimate protection and cannot directly be compared with antibody concentration (*194*). Data are likely to remain limited for countries other than the People's Republic of China, Russia, and Eastern Europe because of the limited number of adoptees from other countries.

Clinicians and other health-care providers can follow one of multiple approaches if a question exists about whether vaccines administered to an international adoptee were immunogenic. Repeating the vaccinations is an acceptable option. Doing so usually is safe and avoids the need to obtain and interpret serologic tests. If avoiding unnecessary injections is desired, judicious use of serologic testing might be helpful in determining which vaccinations are needed. For some vaccines, the most readily available serologic tests cannot document protection against infection. These recommendations provide guidance on possible approaches to evaluation and revaccination for each vaccine recommended universally for children in the United States (Table 12). Clinicians and other health-care providers should ensure that household contacts of internationally adoptees are adequately vaccinated, particularly for measles and hepatitis B.

TABLE 12. Approaches to the evaluation and vaccination of internationally adopted children with no or questionable vaccination records

Vaccine	Recommended approach	Alternative approach
Measles, mumps, and rubella (MMR)	Revaccinate with MMR	Serologic testing for immunoglobulin G (IgG) antibody to measles, mumps, and rubella
Haemophilus influenzae type b (Hib)	Age-appropriate revaccination	ð
Hepatitis A	Age-appropriate revaccination	Serologic testing for IgG antibody to hepatitis A virus
Hepatitis B (Hep B)	Age-appropriate revaccination and serologic testing for HBsAg*	ð
Poliovirus	Revaccinate with inactivated poliovirus vaccine (IPV)	Serologic testing for neutralizing antibody to poliovirus types 1, 2, and 3 (limited availability)
Diphtheria and tetanus toxoids and acellular pertussis (DTaP)	Revaccination with DTaP, with serologic testing for specific IgG antibody to tetanus and diphtheria toxins in the event of a severe local reaction	Children whose records indicate receipt of ≥3 doses: serologic testing for specific IgG antibody to diphtheria and tetanus toxins before administering additional doses (see text), or administer a single booster dose of DTaP, followed by serological testing after 1 month for specific IgG antibody to diphtheria and tetanus toxins with revaccination as appropriate
Varicella	Age-appropriate vaccination of children who lack evidence of varicella immunity	ð
Pneumococcal conjugate	Age-appropriate vaccination	ð

* Very rarely, Hep B vaccine can give a false positive HBsAg result up to 18 days following vaccination; therefore, blood should be drawn to test for HBsAg before vaccinating (CDC. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: Recommendations of the Advisory Committee on Immunization Practices [ACIP]; Part I: Immunization in Infants, Children, and Adolescents. MMWR 2005;54[No. RR-16]).

MMR Vaccine

The simplest approach to resolving concerns about MMR vaccination among internationally adopted children is to revaccinate with 1 or 2 doses of MMR vaccine, depending on the child's age. Serious adverse events after MMR vaccinations are rare (*6*). No evidence indicates that administering MMR vaccine increases the risk for adverse reactions among persons who are already immune to measles, mumps, or rubella as a result of previous vaccination or natural disease. Doses of measles-containing vaccine administered before the first birthday should not be counted as part of the series (*6*). Alternatively, serologic testing for immunoglobulin G (IgG) antibody to vaccine viruses indicated on the vaccination record can be considered. Serologic testing is widely available for measles and rubella IgG antibody. A child whose record indicates receipt of monovalent measles or measles-rubella vaccine on or after the first birthday and who has protective antibody against measles and rubella should receive 1 or 2 doses of MMR or MMRV as age-appropriate to ensure protection against mumps and varicella (and rubella if measles vaccine alone had been used). If a child whose record indicates receipt of MMR at age ≥12 months has a protective concentration of antibody to measles, no additional vaccination is needed unless required for school entry.

Hib Vaccine

Interpretation of a serologic test to verify protection from Hib bacteria for children vaccinated >2 months previously can be difficult to interpret. Because the number of vaccinations needed for protection decreases with age and adverse events are rare (*26*), age-appropriate vaccination should be provided. Hib vaccination is not recommended routinely for children aged ≥5 years (*116*).

Hepatitis A Vaccine

Children without documentation of HepA vaccination or serologic evidence of immunity should be vaccinated on arrival if aged ≥12 months (*185*).

Hepatitis B Vaccine

Children not known to be vaccinated for hepatitis B should receive an age-appropriate series of HepB. A child whose records indicate receipt of 3 or more doses of vaccine can be considered protected, and additional doses are not needed if 1 or more doses were administered at age ≥24 weeks. Chil-

dren who received their last HepB dose at age <24 weeks should receive an additional dose at age ≥24 weeks. Children who have received fewer than 3 doses of vaccine should complete the series at the recommended intervals and ages.

All foreign-born persons and immigrants, refugees, and internationally adopted children born in Asia, the Pacific Islands, Africa, and other regions in which HBV is highly endemic should be tested for HBsAg, regardless of vaccination status. Those determined to be HBsAg-positive should be monitored for development of liver disease. Household members of HBsAg-positive children or adults should be vaccinated if not already immune.

Poliovirus Vaccine

The simplest approach is to revaccinate internationally adopted children with IPV according to the U.S. schedule. Adverse events after IPV are rare (*4*). Children appropriately vaccinated with 3 doses of OPV in economically developing countries might have suboptimal seroconversion, including to type 3 poliovirus (*180*). Serologic testing for neutralizing antibody to poliovirus types 1, 2, and 3 can be obtained commercially and at certain state health department laboratories. Children with protective titers against all three types do not need revaccination and should complete the schedule as age-appropriate.

DTaP Vaccine

Vaccination providers can revaccinate a child with DTaP vaccine without regard to recorded doses; however, one concern about this approach is that data indicate increased rates of local adverse reactions after the fourth and fifth doses of DTP or DTaP (*46*). If a revaccination approach is adopted and a severe local reaction occurs, serologic testing for specific IgG antibody to tetanus and diphtheria toxins can be measured before administering additional doses. Protective concentration[§§] indicates that further doses are unnecessary and subsequent vaccination should occur as age-appropriate. No established serologic correlates exist for protection against pertussis.

For a child whose record indicates receipt of 3 or more doses of DTP or DTaP, serologic testing for specific IgG antibody to both diphtheria and tetanus toxin before additional doses is a reasonable approach. If a protective concentration is present, recorded doses can be considered valid, and the vaccination series should be completed as age-appropriate. Indeterminate antibody concentration might indicate immunologic memory but antibody waning; serology can be repeated after a booster dose if the vaccination provider wants to avoid revaccination with a complete series.

Alternately, for a child whose records indicate receipt of 3 or more doses, a single booster dose can be administered, followed by serologic testing after 1 month for specific IgG antibody to both diphtheria and tetanus toxins. If a protective concentration is obtained, the recorded doses can be considered valid and the vaccination series completed as age-appropriate. Children with indeterminate concentration after a booster dose should be revaccinated with a complete series.

Varicella Vaccine

Varicella vaccine is not administered in the majority of countries. A child who lacks reliable evidence of varicella immunity should be vaccinated as age-appropriate (*8,116*).

Pneumococcal Vaccines

PCV and PPV are not administered in the majority of countries and should be administered as age-appropriate or as indicated by the presence of underlying medical conditions (*29,48*).

Vaccinating Persons with Bleeding Disorders and Persons Receiving Anticoagulant Therapy

Because of the risk for hematoma formation after injections, intramuscular injections are often avoided among persons with bleeding disorders by using the subcutaneous or intradermal routes for vaccines that are administered normally by the intramuscular route. HepB administered intramuscularly to 153 persons with hemophilia by using a 23-gauge needle or smaller, followed by steady pressure to the site for 1–2 minutes, resulted in a 4% bruising rate with no patients requiring factor supplementation (*195*). Whether antigens that produce more local reactions (e.g., pertussis) would produce an equally low rate of bruising is unknown.

When HepB or any other intramuscular vaccine is indicated for a patient with a bleeding disorder or a person receiving anticoagulant therapy, the vaccine should be administered intramuscularly if, in the opinion of a physician familiar with the patient's bleeding risk, the vaccine can be administered with reasonable safety by this route. If the patient receives antihemophilia or similar therapy, intramuscular vaccinations can be scheduled shortly after such therapy is administered. A fine needle (23 gauge or smaller) should be used for the vaccination and firm pressure applied to the site, without rubbing, for at least 2 minutes. The patient or family should be instructed concerning the risk for hematoma from the injection.

[§§]Enzyme immunoassay tests are available. Physicians should contact the laboratory performing the test for interpretive standards and limitations. Protective concentrations for antibody to diphtheria and tetanus toxins are defined as ≥0.1 IU/mL.

Vaccination Records

Consent to Vaccinate

The National Childhood Vaccine Injury Act of 1986 (42 U.S.C. § 300aa-26) requires that all health-care providers in the United States who administer any vaccine covered by the Act[¶] must provide a copy of the relevant, current edition of the vaccine information materials that have been produced by CDC before administering each dose of the vaccine. Vaccine information statements (VIS) are available at http://www.cdc.gov/nip/publications/VIS/default.htm and http://www.immunize.org/vis. VIS must be provided to the parent or legal representative of any child or to any adult to whom the physician or other health-care provider intends to administer the vaccine. The act does not require that a signature be obtained, but documentation of consent is recommended or required by certain state or local authorities.

Provider Records

Documentation of patient vaccinations helps ensure that persons in need of a vaccine receive it and that adequately vaccinated patients are not administered excess doses, possibly increasing the risk for local adverse events (e.g., tetanus toxoid). Serologic test results for vaccine-preventable diseases (e.g., those for rubella screening and antibody to hepatitis B surface antigen) and documented episodes of adverse events also should be recorded in the permanent medical record of the vaccine recipient.

Health-care providers who administer vaccines covered by the National Childhood Vaccine Injury Act are required to ensure that the permanent medical record of the recipient (or a permanent office log or file) indicates the date the vaccine was administered; the vaccine manufacturer; the vaccine lot number; and the name, address, and title of the person administering the vaccine. In addition, the provider is required to record the edition date of the VIS distributed and the date those materials were provided. In the Act, the term health-care provider is defined as any licensed health-care professional, organization, or institution, whether private or public (including federal, state, and local departments and agencies), under whose authority a specified vaccine is administered. This same information should be kept for all vaccines, not just for those required by the National Childhood Vaccine Injury Act.

[¶]As of May 2006, vaccines covered by the act include diphtheria, tetanus, pertussis, measles, mumps, rubella, poliovirus, HepB, Hib, varicella, pneumococcal conjugate, HepA, trivalent inactivated influenza vaccine, and pentavalent RV.

Patients' Personal Records

Official childhood vaccination records have been adopted by every state, territory, and the District of Columbia to encourage uniformity of records and to facilitate assessment of vaccination status by schools and child care centers. The records also are key tools in vaccination education programs aimed at increasing parental and patient awareness of the need for vaccines. A permanent vaccination record card should be established for each newborn infant and maintained by the parent or guardian. In certain states, these cards are distributed to new mothers before discharge from the hospital. Using vaccination record cards for adolescents and adults also is encouraged. Standardized adult vaccination records are available at http://www.immunize.org.

Immunization Information Systems

IISs are confidential, population-based, computerized information systems that collect and consolidate vaccination data from multiple health-care providers within a geographic area. IISs are a critical tool that can increase and sustain increased vaccination coverage by consolidating vaccination records of children from multiple providers, generating reminder and recall vaccination notices for each child, and providing official vaccination forms and vaccination coverage assessments (*196*). A fully operational IIS also can prevent duplicate vaccinations, limit missed appointments, reduce vaccine waste, and reduce staff time required to produce or locate vaccination records or certificates. The National Vaccine Advisory Committee strongly encourages development of community- or state-based IISs and recommends that vaccination providers participate in these systems whenever possible (*196*). One of the national health objectives for 2010 is 95% participation of children aged <6 years in a fully operational population-based IIS (objective 20.1) (*197*).

Reporting Adverse Events after Vaccination

Modern vaccines are safe and effective; however, adverse events have been reported after administration of all vaccines (*91*). These events range from frequent, minor, local reactions to extremely rare, severe, systemic illness (e.g., anaphylaxis). Establishing evidence for cause-and-effect relations on the basis of case reports and case series alone is impossible because temporal association alone does not necessarily indicate causation. Unless the symptom or syndrome that occurs after vaccination is clinically or pathologically distinctive, more detailed epidemiologic studies to compare the incidence of

the event among vaccinees with the incidence among unvaccinated persons are necessary. Reporting adverse events to public health authorities, including serious events, is a key stimulus to developing studies to confirm or refute a causal association with vaccination. More complete information about adverse reactions to a specific vaccine is available in the ACIP recommendations for that vaccine and in a specific statement on vaccine adverse reactions (*91*).

The National Childhood Vaccine Injury Act requires health-care providers to report selected events occurring after vaccination to VAERS. Events for which reporting is required appear in the Reportable Events Table.*** Persons other than health-care providers also can report adverse events to VAERS. All clinically significant adverse events other than those that must be reported or that occur after administration of vaccines not covered by the Act also should be reported to VAERS, even if the physician or other health-care provider is uncertain they are related causally to vaccination. VAERS forms and instructions are available in the FDA Drug Bulletin by contacting VAERS (800-822-7967), or from the VAERS website (http://www.vaers.hhs.gov/vaers.htm).

National Vaccine Injury Compensation Program

The National Vaccine Injury Compensation Program, established by the National Childhood Vaccine Injury Act, is a no-fault system in which persons thought to have suffered an injury or death as a result of administration of a covered vaccine can seek compensation. The program became operational on October 1, 1988, and is intended as an alternative to civil litigation under the traditional tort system in that negligence need not be proven. Claims arising from covered vaccines must first be adjudicated through the program before civil litigation can be pursued.

The program relies on a Reportable Events Table listing the vaccines covered by the program and the injuries, disabilities, illnesses, and conditions (including death) for which compensation might be awarded. The table defines the time during which the first symptom or substantial aggravation of an injury must appear after vaccination. Successful claimants receive a legal presumption of causation if a condition listed in the table is proven, thus avoiding the need to prove actual causation in an individual case. Claimants also can prevail for conditions not listed in the table if they prove causation. Injuries after administration of vaccines not listed in the legislation authorizing the program are not eligible for compensation through the program. Additional information is available from the National Vaccine Injury Compensation Program, Health Resources and Services Administration, Parklawn Building, Room 11C-26, 5600 Fishers Lane, Rockville, MD 20857; telephone: 800-338-2382; Website: http://www.hrsa.gov/osp/vicp.

Persons wanting to file a claim for vaccine injury should contact the following: U.S. Court of Federal Claims, 717 Madison Place, N.W., Washington, DC 20005; telephone: 202-357-6400.

Benefit and Risk Communication

Parents, guardians, legal representatives, and adolescent and adult patients should be informed about the benefits of and risks for vaccines in understandable language. Opportunity for questions should be provided before each vaccination. Discussion of the benefits of and risks for vaccination is sound medical practice and is required by law.

The National Childhood Vaccine Injury Act requires that vaccine information materials be developed for each vaccine covered by the Act. These materials, known as Vaccine Information Statements, must be provided by all public and private vaccination providers each time a vaccine is administered. Copies of Vaccine Information Statements are available from state health authorities responsible for vaccination, or they can be obtained from CDC's National Center for Immunization and Respiratory Disease (proposed) website (http://www.cdc.gov/nip). Translations of Vaccine Information Statements into languages other than English are available from certain state vaccination programs and from the Immunization Action Coalition website (http://www.immunize.org).

Health-care providers should anticipate that certain parents or patients will question the need for or safety of vaccination, refuse certain vaccines, or even reject all vaccinations. A limited number of persons might have religious or personal objections to vaccinations. Others might want to enter into a dialogue about the risks for and benefits of certain vaccines. Having a basic understanding of how patients view vaccine risk and developing effective approaches in dealing with vaccine safety concerns when they arise is imperative for vaccination providers.

Each person understands and reacts to vaccine information on the basis of different factors, including previous experience, education, personal values, method of data presentation, perceptions of the risk for disease, perceived ability to control those risks, and their risk preference. Increasingly, through the media and nonauthoritative Internet sites, decisions about risk are based on inaccurate information. Only through direct dialogue with parents and by using available

***The Reportable Events Table can be obtained from the Vaccine Injury Compensation Program Internet site at http://vaers.hhs.gov/reportable.htm.

resources can health-care providers prevent acceptance of media reports and information from nonauthoritative Internet sites as scientific fact.

When a parent or patient initiates a discussion about a vaccine controversy, the health-care provider should discuss the specific concerns and provide factual information, using appropriate language. Effective, empathetic vaccine risk communication is essential in responding to misinformation and concerns, recognizing that for certain persons, risk assessment and decision-making are difficult and confusing. Certain vaccines might be acceptable to the resistant parent. Their concerns should then be addressed using the VIS and offering other resource materials (e.g., information available on the National Center for Immunization and Respiratory Diseases (proposed) website [http://www.cdc.gov/nip]).

Although a limited number of providers might exclude from their practice those patients who question or refuse vaccination, the more effective public health strategy is to identify common ground and discuss measures that need to be followed if the patient's decision is to defer vaccination. As part of a strong recommendation, health-care providers can reinforce key points about each vaccine, including safety, and emphasize risks encountered by unvaccinated children. Parents should be advised of state laws pertaining to school or child-care entry, which might require that unvaccinated children be excluded from school or child care during outbreaks. Documentation of these discussions in the patient's record, including the refusal to receive certain vaccines (i.e., informed refusal), might reduce any potential liability if a vaccine-preventable disease occurs in the unvaccinated patient.

Vaccination Programs

The best way to reduce vaccine-preventable diseases is to have a highly immune population. Universal vaccination is a critical part of quality health care and should be accomplished through routine and intensive vaccination programs implemented in physicians' offices and in public health clinics. Programs should be established and maintained in all communities to ensure vaccination of all children at the recommended age. In addition, appropriate vaccinations should be available for all adolescents and adults.

Physicians and other pediatric vaccination providers should adhere to the standards for child and adolescent vaccination practices (*1*). These standards define appropriate vaccination practices for both the public and private sectors. The standards provide guidance on practices that will result in eliminating barriers to vaccination. These include practices aimed at eliminating unnecessary prerequisites for receiving vaccinations, eliminating missed opportunities to vaccinate, improving procedures to assess vaccination needs, enhancing knowledge about vaccinations among parents and providers, and improving the management and reporting of adverse events. In addition, the standards address the importance of recall and reminder systems and using assessments to monitor clinic or office vaccination coverage levels. Physicians and other health-care providers should simultaneously administer as many vaccine doses as possible, as indicated on the Recommended Child and Adolescent Immunization Schedule (*116*).

Standards of practice also have been published to increase vaccination coverage among adults (*2*). These standards include ensuring vaccine availability, routine review of vaccination status, communicating risks for and benefits to the patient, using standing orders, and recommending simultaneous administration of all indicated doses according to the Recommended Adult Immunization Schedule (*113*).

Every visit to a physician or other health-care provider can be an opportunity to update a patient's vaccination status with needed vaccinations. Official health agencies should take necessary steps, including, when appropriate, developing and enforcing child care and school vaccination requirements, to ensure that students at all grade levels (including college) and children in day care centers are protected against vaccine-preventable diseases. Agencies also should encourage institutions (e.g., hospitals and long-term–care facilities) to adopt policies about the appropriate vaccination of patients, residents, and employees (*198*).

Dates of vaccination (day, month, and year) should be recorded on institutional vaccination records (e.g., records kept in schools and day care centers). These records will facilitate assessments that a primary vaccination series has been completed according to an appropriate schedule and that needed booster doses have been administered at the appropriate time.

The independent, nonfederal Task Force on Community Preventive Services (the Task Force), whose membership is appointed by CDC, provides public health decision-makers with recommendations on population-based interventions to promote health and prevent disease, injury, disability, and premature death. The recommendations are based on systematic reviews of the scientific literature about effectiveness and cost-effectiveness of these interventions. In addition, the Task Force identifies critical information about the other effects of these interventions and the applicability to specific populations and settings and the potential barriers to implementation. This information is available at http://www.thecommunityguide.org.

Beginning in 1996, the Task Force systematically reviewed published evidence on the effectiveness and cost-effectiveness

of population-based interventions to increase coverage of vaccines recommended for routine use among children, adolescents, and adults. A total of 197 articles were identified that evaluated a relevant intervention, met inclusion criteria, and were published during 1980–1997. Reviews of 17 specific interventions were published in 1999 (*199–202*). Using the results of their review, the Task Force made recommendations about the use of these interventions (*202*). Several interventions were identified and recommended on the basis of published evidence. The interventions and the recommendations are summarized in this report (Table 13).

Vaccine Information Sources

In addition to these general recommendations, other sources are available that contain specific and updated vaccine information.

CDC-INFO Contact Center

The CDC-INFO contact center is supported by CDC's National Center for Immunization and Respiratory Diseases (proposed) and provides public health-related information, including vaccination information, for health-care providers and the public, 24 hours a day, seven days a week (Telephone [English and Spanish]: 800-232-4636; Telephone [TTY]: 800-232-6348).

CDC's National Center for Immunization and Respiratory Diseases (proposed)

CDC's National Center for Immunization and Respiratory Diseases (proposed) website provides direct access to immunization recommendations of ACIP, vaccination schedules, vaccine safety information, publications, provider education and training, and links to other vaccination-related websites (http://www.cdc.gov/nip).

MMWR

ACIP recommendations regarding vaccine use, statements of vaccine policy as they are developed, and reports of specific disease activity are published by CDC in the *MMWR* series. Electronic subscriptions are free (http://www.cdc.gov/subscribe.html). Printed subscriptions are available at

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402-9235
202-512-1800

TABLE 13. Summary of recommendations for interventions to improve coverage of vaccines recommended for routine use among children, adolescents, and adults*

Intervention	Recommendations
Interventions that increase community demand for immunization	
Client reminder or recall systems	Strongly recommended
Multicomponent interventions, including education	Strongly recommended
School, day care, and college-entry requirements	Recommended
Community education alone	Insufficient evidence
Clinic-based education	Insufficient evidence
Patient or family incentives or sanctions	Insufficient evidence
Client-held medical records	Insufficient evidence
Interventions that enhance access to vaccination services	
Reducing out-of-pocket costs	Strongly recommended
Enhancing access through the U.S. Department of Agriculture's Women, Infants, and Children program	Recommended
Home visits, outreach, and case management	Recommended
Enhancing access at day care centers	Insufficient evidence
Enhancing access at schools	Recommended
Expanding access in health-care settings	Recommended as part of multicomponent interventions only
Interventions that target providers	
Reminder or recall systems	Strongly recommended
Assessment and feedback	Strongly recommended
Standing orders	Strongly recommended
Provider education alone	Insufficient evidence

* Adapted from Task Force on Community Preventive Services. Recommendations regarding interventions to improve vaccination coverage in children, adolescents and adults. Am J Prev Med 2000;18:92ï 6, and Task Force on Community Preventive Services. Recommendations to improve targeted vaccination coverage among high-risk adults. Am J Prev Med 2005;28:231ï 7.

American Academy of Pediatrics (AAP)

Every 3 years, AAP issues the *Red Book: Report of the Committee on Infectious Diseases*, which contains a composite summary of AAP recommendations concerning infectious diseases and immunizations for infants, children, and adolescents (Telephone: 888-227-1770; Website: http://www.aap.org).

American Academy of Family Physicians (AAFP)

Information from the professional organization of family physicians is available at http://www.aafp.org.

Immunization Action Coalition

This source provides extensive free provider and patient information, including translations of Vaccine Information Statements into multiple languages. Printed materials are reviewed by CDC for technical accuracy (http://www.immunize.org and http://vaccineinformation.org).

National Network for Immunization Information

This information source is an affiliation of the Infectious Diseases Society of America, the Pediatric Infectious Diseases Society, AAP, the American Nurses Association, the AAFP, the National Association of Pediatric Nurse Practitioners, the American College of Obstetricians and Gynecologists and the University of Texas Medical Branch. This source seeks to provide the public, health professionals, policy makers, and the media with up-to-date, scientifically valid information (http://www.immunizationinfo.org).

Vaccine Education Center

Located at the Children's Hospital of Philadelphia, this source provides patient and provider information (http://www.vaccine.chop.edu).

Institute for Vaccine Safety

Located at Johns Hopkins University School of Public Health, this source provides information about vaccine safety concerns and objective and timely information to physicians and health-care providers and parents (http://www.vaccinesafety.edu).

Group on Immunization Education of the Society of Teachers of Family Medicine

This organization provides information for clinicians, including the free personal digital assistant software called "Shots" which includes the childhood and adult schedule for Palm OS and for Windows handhelds (http://www.immunizationed.org).

State and Local Health Departments

State and local health departments provide technical advice through hotlines, electronic mail, and Internet sites, including printed information regarding vaccines and immunization schedules, posters, and other educational materials.

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Abbreviations Used in This Publication

AAFP	American Academy of Family Physicians
AAP	American Academy of Pediatrics
ACIP	Advisory Committee on Immunization Practices
DT	pediatric diphtheria-tetanus toxoid
DTaP	pediatric diphtheria and tetanus toxoids and acellular pertussis vaccine
DTP	pediatric diphtheria and tetanus toxoids and whole-cell pertussis vaccine
EIA/ELISA	enzyme immunoassay
FDA	Food and Drug Administration
GBS	Guillain-Barré syndrome
HBIG	hepatitis B immune globulin
HbOC	Haemophilus influenzae type b-diphtheria CRM197 (CRM, cross-reactive material) protein conjugate
HBsAg	hepatitis B surface antigen
Hib	*Haemophilus influenzae* type b
HIV	human immunodeficiency virus
HPV	human papillomavirus
HSCT	hematopoietic stem cell transplant
IgG	immunoglobulin G
IGIV	intravenous immune globulin
IPV	inactivated poliovirus vaccine
JI	jet injector
MCV4	meningococcal conjugate vaccine
MMR	measles, mumps, rubella vaccine
MMRV	measles-mumps-rubella-varicella vaccine
MPSV	meningococcal polysaccharide vaccine
OPV	oral poliovirus vaccine
OSHA	Occupational Safety and Health Administration
PCV	pneumococcal conjugate vaccine
PPD	purified protein derivative
PRP-OMP	Haemophilus influenzae type b-polyribosylribitol phosphate-meningococcal outer membrane protein conjugate
PPV	pneumococcal polysaccharide vaccine
RV	pentavalent rotavirus vaccine
Td	adult tetanus-diphtheria toxoid
Tdap	Tetanus reduced diphtheria acellular pertussis vaccine for adolescents and adults
TST	tuberculin skin test
VAERS	Vaccine Adverse Event Reporting System
VAPP	vaccine-associated paralytic poliomyelitis
VICP	Vaccine Injury Compensation Program
VIS	Vaccine Information Statement

Definitions Used in This Report

Adverse event. An untoward event that occurs after a vaccination that might be caused by the vaccine product or vaccination process. It includes events that are 1) vaccine-induced: caused by the intrinsic characteristic of the vaccine preparation and the individual response of the vaccinee; these events would not have occurred without vaccination (e.g., vaccine-associated paralytic poliomyelitis); 2) vaccine-potentiated: the events would have occurred anyway, but were precipitated by the vaccination (e.g., first febrile seizure in a predisposed child); 3) programmatic error: the event was caused by technical errors in vaccine preparation, handling, or administration; 4) coincidental: the event was associated temporally with vaccination by chance or caused by underlying illness. Special studies are needed to determine if an adverse event is a reaction to the vaccine or the result of another cause (**Sources:** Chen RT. Special methodological issues in pharmacoepidemiology studies of vaccine safety. In: Strom BL, ed. Pharmacoepidemiology. 3rd ed. Sussex, England: John Wiley & Sons; 2000:707–32; and Fenichel GM, Lane DA, Livengood JR, Horwitz SJ, Menkes JH, Schwartz JF. Adverse events following

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Adverse reaction. An undesirable medical condition that has been demonstrated to be caused by a vaccine. Evidence for the causal relation is usually obtained through randomized clinical trials, controlled epidemiologic studies, isolation of the vaccine strain from the pathogenic site, or recurrence of the condition with repeated vaccination (i.e., rechallenge); synonyms include side effect and adverse effect.

Immunobiologic. Antigenic substances (e.g., vaccines and toxoids) or antibody-containing preparations (e.g., globulins and antitoxins) from human or animal donors. These products are used for active or passive immunization or therapy. The following are examples of immunobiologics:

Vaccine. A suspension of live (usually attenuated) or inactivated microorganisms (e.g., bacteria or viruses) or fractions thereof administered to induce immunity and prevent infectious disease or its sequelae. Some vaccines contain highly defined antigens (e.g., the polysaccharide of *Haemophilus influenzae* type b or the surface antigen of hepatitis B); others have antigens that are complex or incompletely defined (e.g., *Bordetella pertussis* antigens or live-attenuated viruses).

Toxoid. A modified bacterial toxin that has been made nontoxic, but retains the ability to stimulate the formation of antibodies to the toxin.

Immune globulin. A sterile solution containing antibodies, which are usually obtained from human blood. It is obtained by cold ethanol fractionation of large pools of blood plasma and contains 15%–18% protein. Intended for intramuscular administration, immune globulin is primarily indicated for routine maintenance of immunity among certain immunodeficient persons and for passive protection against measles and hepatitis A.

Intravenous immune globulin. A product derived from blood plasma from a donor pool similar to the immune globulin pool, but prepared so that it is suitable for intravenous use. Intravenous immune globulin is used primarily for replacement therapy in primary antibody-deficiency disorders, for treatment of Kawasaki disease, immune thrombocytopenic purpura, hypogammaglobulinemia in chronic lymphocytic leukemia, and certain cases of human immunodeficiency virus infection (Table 4).

Hyperimmune globulin (specific). Special preparations obtained from blood plasma from donor pools preselected for a high antibody content against a specific antigen (e.g., hepatitis B immune globulin, varicella-zoster immune globulin, rabies immune globulin, tetanus immune globulin, vaccinia immune globulin, cytomegalovirus immune globulin, botulism immune globulin).

Monoclonal antibody. An antibody product prepared from a single lymphocyte clone, which contains only antibody against a single antigen.

Antitoxin. A solution of antibodies against a toxin. Antitoxin can be derived from either human (e.g., tetanus immune globulin) or animal (usually equine) sources (e.g., diphtheria and botulism antitoxin). Antitoxins are used to confer passive immunity and for treatment.

Vaccination and immunization. The terms vaccine and vaccination are derived from vacca, the Latin term for cow. Vaccine was the term used by Edward Jenner to describe material used (i.e., cowpox virus) to produce immunity to smallpox. The term vaccination was used by Louis Pasteur in the 19th century to include the physical act of administering any vaccine or toxoid. Immunization is a more inclusive term, denoting the process of inducing or providing immunity by administering an immunobiologic. Immunization can be active or passive. Active immunization is the production of antibody or other immune responses through administration of a vaccine or toxoid. Passive immunization means the provision of temporary immunity by the administration of preformed antibodies. Although persons often use the terms vaccination and immunization interchangeably in reference to active immunization, the terms are not synonymous because the administration of an immunobiologic cannot be equated automatically with development of adequate immunity.

Advisory Committee on Immunization Practices

Membership List, February 2006

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MMWR™

Morbidity and Mortality Weekly Report

Recommendations and Reports | December 1, 2006 / Vol. 55 / No. RR-15

Continuing Education Activity Sponsored by CDC

General Recommendations on Immunization: Recommendations of the Advisory Committee on Immunization Practices (ACIP)

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DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION

Goals and Objectives

This *MMWR* provides general guidelines on immunization. The goal of this report is improve vaccination practices in the United States. Upon completion of this educational activity, the reader should be able to 1) identity valid contraindications for commonly used vaccines, 2) identify the minimum spacing between doses for vaccines routinely used in the United States, 3) describe recommended methods for administration of vaccines, and 4) identify evidence-based interventions shown to improve vaccination rates among children.

To receive continuing education credit, please answer all of the following questions.

1. If a second dose of a live virus vaccine is determined to be invalid, when should another dose be administered?
- A. As soon as possible.
- B. 28 days after the most recent valid dose.
- C. 28 days from the invalid dose or a minimum interval from the invalid dose, whichever is longer.
- D. A minimum interval from the most recent valid dose.
- E. Never. You must start the series over.

2. Which of the following is a permanent contraindication for all vaccines?
- A. Progressive neurologic disorder.
- B. Pregnancy.
- C. Severe allergic reaction to a previous dose of vaccine.
- D. Family history of asthma.
- E. Fever.

3. Which factor is an important criterion for needle length for a subcutaneous injection?
- A. Body mass.
- B. Site of injection.
- C. Sex.
- D. Age.
- E. None of the above.

4. Which test is NOT considered a suitable test to assess the level of altered immunocompetence?
- A. Immunoglobulin subclasses.
- B. Pertussis titers.
- C. Lymphocyte proliferation assays.
- D. T-cell counts.
- E. Antibody response to adult tetanus-diphtheria toxoid antigen.

5. The combination measles-mumps-rubella-varicella (MMRV) vaccine...
- A. is an inactivated vaccine.
- B. is contraindicated in pregnancy.
- C. is recommended if a person has a contraindication to one of the single-antigen vaccines (like monovalent varicella vaccine).
- D. must be refrigerated.
- E. requires more injections than measles-mumps-rubella (MMR) vaccine.

6. Which of the following strategy is not specifically recommended to improve vaccination coverage in children?
- A. Provision of vaccines at child care centers.
- B. Enhancing access to vaccines at schools.
- C. Laws requiring vaccines for school entry.
- D. Enhancing access to vaccines through the Women, Infants, and Children program.
- E. Reminder and recall systems.

7. The minimum intervals for vaccines should be used...
- A. to schedule a patient's next visit.
- B. to avoid simultaneous administration of vaccines.
- C. to catch-up children that are behind on vaccine doses.
- D. to avoid giving two injections at the same site.
- E. by vaccine registries to construct recall messages for providers.

8. Which is an acceptable way of alleviating the pain and discomfort of children as part of the vaccination process?
- A. Combining acetaminophen with topical EMLA therapy.
- B. Distraction methods (e.g., blowing away the pain).
- C. Telling children that vaccination doesn't hurt.
- D. Assurance that most adverse reactions are mild.
- E. None of the above.

9. Which of the following is a contraindication to MMR vaccine?
- A. Positive tuberculin skin test (TST) skin test.
- B. Simultaneous testing using TST.
- C. Allergy to eggs.
- D. Pregnancy.
- E. A household contact with altered immunocompetence.

10. If a storage unit has been found to be maintained at temperatures outside the recommended range for the vaccines contained within, which of the following would be an appropriate action?
- A. Discard all vaccines contained in the unit.
- B. Continue using the vaccine after it has been transferred to another storage unit.
- C. Mark the vaccine "Do not use" until more can be determined about the usability of the vaccine.
- D. Shorten the expiration date by 1 month.
- E. Recalibrate the thermometer.

11. Which best describes your professional activities?
- A. Physician.
- B. Nurse.
- C. Health educator.
- D. Office staff.
- E. Other.

12. I plan to use these recommendations as the basis for …(*Indicate all that apply.*)
- A. health education materials.
- B. insurance reimbursement policies.
- C. local practice guidelines.
- D. public policy.
- E. other.

13. Overall, the length of the journal report was…
- A. much too long.
- B. a little too long.
- C. just right.
- D. a little too short.
- E. much too short.

14. After reading this report, I am confident I can identify valid contraindications for commonly used vaccines.
- A. Strongly agree.
- B. Agree.
- C. Undecided.
- D. Disagree.
- E. Strongly disagree.

15. After reading this report, I am confident I can identify the minimum spacing between doses for vaccines routinely used in the United States.
A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

16. After reading this report, I am confident I can describe recommended methods for administration of vaccines.
A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

17. After reading this report, I am confident I can identify evidence-based interventions shown to improve vaccination rates among children.
A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

18. The learning outcomes (objectives) were relevant to the goals of this report.
A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

19. The instructional strategies used in this report (text, tables, and figures) helped me learn the material.
A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

20. The content was appropriate given the stated objectives of the report.
A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

21. The content expert(s) demonstrated expertise in the subject matter.
A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree

22. Overall, the quality of the journal report was excellent.
A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

(Continued on pg CE-4)

Detach or photocopy.

***MMWR* Response Form for Continuing Education Credit**
December 1, 2006/Vol. 55/No. RR-15

General Recommendations on Immunization: Recommendations of the Advisory Committee on Immunization Practices (ACIP)

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Failure to complete these items can result in a delay or rejection of your application for continuing education credit.

Check One
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☐ CNE Credit
☐ CHES Credit
☐ CPE Credit

Last Name (**print or type**) First Name

Street Address or P.O. Box

Apartment or Suite

City State ZIP Code

Phone Number Fax Number

E-Mail Address

Fill in the appropriate blocks to indicate your answers. Remember, you must answer all of the questions to receive continuing education credit!

1.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	15.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
2.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	16.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
3.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	17.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
4.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	18.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
5.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	19.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
6.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	20.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
7.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	21.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
8.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	22.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
9.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	23.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
10.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	24.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
11.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	25.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E
12.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	26.	[ ]A	[ ]B			
13.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E	27.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E [ ]F
14.	[ ]A	[ ]B	[ ]C	[ ]D	[ ]E						

Signature ***Date I Completed Exam***

23. These recommendations will improve the quality of my practice.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

24. The availability of continuing education credit influenced my decision to read this report.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

25. The *MMWR* format was conducive to learning this content.

A. Strongly agree.
B. Agree.
C. Undecided.
D. Disagree.
E. Strongly disagree.

26. Do you feel this course was commercially biased? (*Indicate yes or no; if yes, please explain in the space provided.*)

A. Yes.
B. No.

27. How did you learn about the continuing education activity?

A. Internet.
B. Advertisement (e.g., fact sheet, *MMWR* cover, newsletter, or journal).
C. Coworker/supervisor.
D. Conference presentation.
E. *MMWR* subscription.
F. Other.

Correct answers for questions 1–10: 1. C; 2. C; 3. E; 4. B; 5. B; 6. A; 7. C; 8. B; 9. D; 10. C.

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American Academy of Pediatrics

Policy Statement

Pediatrics Volume 79, Number 5 May, 1987, p 835

Generic Prescribing, Generic Substitution, and Therapeutic Substitution (RE7091)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Drugs

Pressures generated by a constellation of professional, consumer, legislative, and health care provider groups in this era of increasing health care costs have led to enactment of generic substitution laws in 50 states. The general acceptance of this concept, despite conflicting evidence that it has reduced the cost of prescription items to the consumer, has led to the concept of therapeutic substitution. Considerable confusion exists among health care professionals regarding the precise meaning of these concepts.

Generic prescribing is the prescribing of a drug by a physician using the generic name. This leaves the choice of brand to the dispensing pharmacist. Generic substitution is a pharmacist-initiated act by which a different brand or an unbranded drug product is dispensed instead of a drug brand that was prescribed by the physician. This means substituting the same chemical entity in the same dosage form for one marketed by a different company. Therapeutic substitution is a pharmacist-initiated act by which a pharmaceutical or therapeutic alternate for the physician-prescribed drug is dispensed without consulting the physician. This denotes replacement of the prescribed drug with a chemically different drug within the same therapeutic category, eg, hydrochlorothiazide for furosemide; ranitidine for cimetidine; chloramphenicol for erythromycin.

In 1976, the AAP Committee on Drugs published a commentary in *Pediatrics* (1976;57:275-277) on generic prescribing and concluded that "the lack of data on bioavailability and bioequivalence in children precludes blanket support of generic prescribing for infants and children." The Committee recently reviewed this issue and concluded that the situation has changed little during the past decade. The Committee supports prescribing the least costly drug if therapeutic efficacy and safety are not compromised. This may involve generic prescribing when, based on the physician's knowledge and experience, the generic choices are considered to be therapeutically equivalent. Because the physician is ultimately responsible for the care of the patient, the choice and/or selection of the drug must be under the physician's control

Generic substitution is based on the supposition that therapeutic equivalence, palatibility, and equivalent safety/adverse reactions exist among the various brands of a prescribed drug. However, there is little evidence to support the assumption of bioequivalence for most therapeutic agents in infants and children. Therefore, the Committee does not support a blanket recommendation for generic substitution.

The Committee strongly opposes therapeutic substitution. Therapeutic substitution constitutes abrogation by the physician of prescribing prerogatives to the dispensing pharmacist. Therapeutic decisions reached by physicians are based on a complex body of medical information relevant to a specific patient. Therapeutic failure or toxicity may result from substitution of a drug that is chemically different from that prescribed by the physician.

RECOMMENDATIONS

1. The Committee on Drugs of the American Academy of Pediatrics supports the concept of prescribing the least costly medication if safety and efficacy are not compromised.
2. Generic prescribing may be appropriate when, in the judgment of the physician, different brands of the same drug will provide equivalent efficacy and safety.
3. The Committee does not support a blanket recommendation for generic substitution.
4. The Committee opposes therapeutic substitution and any legislation that would permit it.

Barry H. Rumack, MD
Wayne Snodgrass, MD
Stephen P. Spielberg, MD, PhD

Reaffirmed 6/93, 5/96, 6/99.
The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

AHA Scientific Statement

Genetic Basis for Congenital Heart Defects: Current Knowledge

A Scientific Statement From the American Heart Association Congenital Cardiac Defects Committee, Council on Cardiovascular Disease in the Young

Endorsed by the American Academy of Pediatrics

Mary Ella Pierpont, MD, PhD, Chair; Craig T. Basson, MD, PhD, FAHA; D. Woodrow Benson, Jr, MD, PhD, FAHA; Bruce D. Gelb, MD; Therese M. Giglia, MD; Elizabeth Goldmuntz, MD; Glenn McGee, PhD; Craig A. Sable, MD; Deepak Srivastava, MD; Catherine L. Webb, MD, MS, FAHA

Abstractð The intent of this review is to provide the clinician with a summary of what is currently known about the contribution of genetics to the origin of congenital heart disease. Techniques are discussed to evaluate children with heart disease for genetic alterations. Many of these techniques are now available on a clinical basis. Information on the genetic and clinical evaluation of children with cardiac disease is presented, and several tables have been constructed to aid the clinician in the assessment of children with different types of heart disease. Genetic algorithms for cardiac defects have been constructed and are available in an appendix. It is anticipated that this summary will update a wide range of medical personnel, including pediatric cardiologists and pediatricians, adult cardiologists, internists, obstetricians, nurses, and thoracic surgeons, about the genetic aspects of congenital heart disease and will encourage an interdisciplinary approach to the child and adult with congenital heart disease. **(*Circulation*. 2007;115:3015-3038.)**

Key Words: AHA Scientific Statements ■ congenital heart disease ■ genetics

The goal of this review is to provide more information for clinicians on the expanding knowledge of the involvement of genetic contributions to the origin of congenital heart disease (CHD). There has been a long-standing clinical view that most CHD occurs as isolated cases. On the basis of studies of recurrence and transmission risks, a hypothesis of multifactorial etiology was proposed.[1] In this type of inheritance, the genetic predisposition of the individual interacts with the environment to cause the congenital heart defect. In recent years, separate environmental[2] and genetic causes have been identified. Classic mendelian transmission of congenital heart defects in some families has been described in the literature. In the past decade, molecular genetic studies have exploited these observations of families with multiple affected individuals and have provided insights into the genetic basis of several forms of CHD, such as atrial septal defect or patent ductus arteriosus.[3,4] These initial discoveries demonstrate that the genetic contribution to CHD has been significantly underestimated in the past. This review includes descriptions of the currently available diagnostic tools and their applications. Some syndromes, including DiGeorge syndrome, Williams-Beuren syndrome, Alagille syndrome, Noonan syndrome (NS), and Holt-Oram syndrome, have been highlighted in the text for the purpose of illustrating some of these new technologies. For further clinical details, interested readers are referred to a genetics textbook such as *Smithõs Recognizable Patterns of Human Malformation*.[5]

In reading this review, it is important to remember that human cardiovascular genetics is in the early phase of gene discovery; consequently, the field is changing rapidly. Ge-

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on February 23, 2007. A single reprint is available by calling 800-242-8721 (US only) or writing the American Heart Association, Public Information, 7272 Greenville Ave, Dallas, TX 75231-4596. Ask for reprint No. 71-0376. To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com.

Expert peer review of AHA Scientific Statements is conducted at the AHA National Center. For more on AHA statements and guidelines development, visit http://www.americanheart.org/presenter.jhtml?identifier=3023366.

Circulation **is available at http://www.circulationaha.org** **DOI: 10.1161/CIRCULATIONAHA.106.183056**

netic testing of embryos, fetuses, children, and adults, in both research and clinical settings, is expanding more quickly than are regulatory and surveillance programs. As part of these changes, clinically available genetic tests for various forms of CHD move from the research laboratory to the bedside or clinic at variable speeds. The pace of discovery is such that todayôs state of the art quickly becomes outdated. As a means of keeping abreast of the latest genes and availability of testing, the reader is referred to online resources such as Online Mendelian Inheritance in Man (http://www.ncbi.nlm.nih.gov/omim/) and GeneTests (http://www.genetests.org/), which are updated regularly.

Prevalence of CHD

Cardiac malformations present at birth are an important component of pediatric cardiovascular disease and constitute a major percentage of clinically significant birth defects, with an estimated prevalence of 4 to 50 per 1000 live births. For example, it is estimated that 4 to 10 liveborn infants per 1000 have a cardiac malformation, 40% of which are diagnosed in the first year of life.[6,7] The true prevalence, however, may be much higher. For example, bicuspid aortic valve, the most common cardiac malformation, is usually excluded from this estimate. Bicuspid aortic valve is associated with considerable morbidity and mortality later in life and by itself occurs in 10 to 20 per 1000 in the general population.[8] Recent studies are finding a high degree of heritability of bicuspid aortic valve, alone and with other cardiovascular anomalies, especially left ventricular outflow tract obstructive disorders.[9ï11] When isolated aneurysm of the atrial septum and persistent left superior vena cava, each of which occurs in 5 to 10 per 1000 live births, are taken into account, the incidence of cardiac malformations approaches 50 per 1000 live births.[12] The incidence of ventricular septal defect (VSD) has also been demonstrated to be as high as 5% in 2 independent cohorts of 5000 serial newborns and 5000 serial premature infants in Israel.[13,14] In light of the above considerations, an incidence of CHD of 50 per 1000 live births is a conservative estimate.[15,16]

In the year 2000, the prevalence of CHD in the pediatric population was estimated at approximately 623 000 (320 000 with simple lesions, 165 000 with moderately complex disease, and 138 000 with highly complex CHD).[16] Tremendous advances in medical and surgical care of children with CHD over the past decade have made survival into adulthood a reality. At the time of the Bethesda Conference in 2000, an estimated total of 787 000 adults were living with CHD (368 800 with simple disease, 302 500 with moderately complex disease, and 117 000 with highly complex disease).[17,18] This assessment of prevalence in the adult population is likely low, because many adult patients, particularly minorities, have been lost to follow-up. It has been estimated that the population of adults with CHD is growing by ≈5% per year, which predicts that the total adult CHD population likely reached 1 million by 2005.[19] This means that the number of adults living with CHD has for the first time surpassed the number of children with CHD. Clearly, it is imperative that many disciplines within the medical community, including adult cardiologists and thoracic surgeons, internists, obstetricians, family practitioners, and ancillary healthcare personnel, acquire an understanding of CHD and its inheritance so that proper lifetime care can be provided for this burgeoning patient population, which to date has been largely unfamiliar to all but pediatricians and pediatric cardiologists.

Importance of Identifying the Genetic Basis of CHD

Extraordinary diagnostic precision and definitive therapies with relatively low morbidity and mortality characterize the state of the art in the management of most CHD (eg, the arterial switch operation for transposition of the great arteries or device closure of intracardiac shunts). These types of therapies indicate that more and more individuals with CHD are going to live to adulthood and may have the opportunity to reproduce. Although there have been tremendous advances in diagnosis and treatment of CHD, our knowledge of the causes of CHD has been limited but has advanced in recent years. Despite the many advanced therapies currently available for a number of heart defects, significant morbidity and mortality are still associated with some types of CHD, for example, hypoplastic left heart syndrome. Improved understanding of possible causes will permit insight into the pathobiological basis of the congenital heart problem and allow definition of disease risk, 2 critical elements for disease prevention. For the clinician caring for a child with CHD, it is very important to determine whether there is an underlying genetic pattern (eg, deletions, duplications, or mutations), for the following reasons: (1) there may be other important organ system involvement; (2) there may be prognostic information for clinical outcomes; (3) there may be important genetic reproductive risks the family should know about; and (4) there may be other family members for whom genetic testing is appropriate. The following sections describe currently available techniques for evaluating infants and children with CHD.

Current Genetic Techniques for Evaluation of Congenital Heart Defects

Congenital heart defects often occur in the setting of multiple congenital anomalies, including abnormal facial features, or in association with limb anomalies, other organ malformations, developmental abnormalities, or growth abnormalities. We now have a number of genetic tests that can assist the clinician in diagnosing genetic alterations in the child with CHD. These include cytogenetic techniques, fluorescence in situ hybridization (FISH), and DNA mutation analysis. After discussion of these techniques, some syndromes that illustrate the use of these genetic techniques will be highlighted, and finally, a suggested approach for comprehensive assessment of these children is provided with an algorithm.

Chromosome Analysis

Before the availability of advanced cytogenetic techniques such as FISH, standard chromosome analysis revealed chromosomal aberration in 8% to 13% of neonates with CHD.[20] With improved resolution in cytogenetic analysis and the availability of molecular techniques, the prevalence of chromosomal abnormalities in selected congenital heart defects is now estimated to be much higher.[21] In contrast, of all children with chromosomal abnormalities, at least 30% have a con-

genital heart defect, with the incidence varying from that of the general population to nearly 100%, as in trisomy 18.[22] Therefore, chromosomal analyses in children with various types of CHD, especially if they have other organ system anomalies, is currently an important part of their medical evaluation (Appendix 1).

The standard metaphase karyotype (450 to 550 bands) is diagnostic for many chromosomal disorders, especially those of chromosome number such as trisomy (trisomy 21) or monosomy (45,X or Turner syndrome). A more sensitive test, high-resolution banding, evaluates chromosomes in prometaphase, which allows for the visualization of a greater number of bands (550 to 850 bands) than the standard karyotype. This technique better defines chromosomal structural abnormalities such as duplications, translocations between chromosomes, and interstitial or terminal deletions.[23] In most centers, 7 to 14 days is required for standard karyotyping and up to 3 weeks for high-resolution banding. More advanced cytogenetic techniques, such as FISH, are required to diagnose more subtle structural abnormalities, such as microdeletions, tiny duplications, and/or subtle translocations. FISH probes (see below) for chromosomes 13, 18, and 21 are currently available for use on interphase (nondividing) cells to diagnose chromosomal trisomies in a more timely fashion, ie, 1 to 2 days, as would be helpful if one of these trisomies were suspected in a neonate.[24]

Chromosomes can be analyzed from a number of sources, including peripheral blood lymphocytes, cord blood, skin fibroblasts, amniotic fluid, chorionic villi, and bone marrow, with peripheral blood most commonly used. Prior blood product transfusions are not likely to interfere with chromosome testing considering the small volume of the transfusion in relation to the total blood volume of the patient, and especially if leukoreduced and/or irradiated blood products have been used.[25]

Amniotic fluid cells are the primary means of prenatal chromosomal diagnosis. Amniocentesis is routinely performed at 15 to 16 weeksô gestation. Amniotic fluid cells, however, take 1 to 2 weeks to grow and harvest before karyotyping can be done. Chorionic villus sampling involves the biopsy of tissue from the villous area of the chorion transcervically or transabdominally, between 10 and 12 weeksô gestation. These results are usually available in 10 to 14 days. The major advantage of chorionic villus sampling compared with midtrimester amniocentesis is that chorionic villus sampling allows the results to be available at an earlier stage of the pregnancy, which reduces the period of uncertainty.

In the current era of in vitro fertilization, preimplantation genetic diagnosis for chromosomal abnormalities/aneuploidies and single-gene defects has recently become possible.[26] Preimplantation genetic diagnosis provides chromosomal and mutational analysis of blastocysts that result from in vitro fertilization before implantation. Preimplantation genetic diagnosis is primarily used by patients choosing assisted reproductive services who have concerns regarding risks of specific genetic disorders. The techniques used for prenatal or preimplantation diagnosis have inherent risks and benefits, which should be discussed on an individual basis with the treating physician. For more detail, the reader is referred to recent reviews of prenatal or preimplantation diagnosis.[27,28]

FISH Technology

FISH is a method by which biotinylated test and control DNA probes are hybridized with metaphase chromosomes to determine whether 1 (deletion), 2 (normal), or 3 (duplication) copies of the test region are present.[29] Specific DNA probes can be located by fluorescence microscopy and will identify well-known deletion syndromes such as del 5p (cri-du-chat). Other fluorescent DNA probes are useful in determining microdeletion syndromes that cannot be detected visually. Several disorders, including Williams-Beuren, Alagille, and the 22q11 deletion syndromes, have been associated with a consistent microdeletion that frequently can be detected only by FISH technology. This technology is widely available in almost every cytogenetics laboratory for the syndromes noted.

Telomere Analysis by Subtelomere FISH

Tiny deletions, duplications, or subtle translocations involving the most distal ends of each chromosome (telomeres) may be quite difficult to detect by standard or high-resolution karyotype techniques. Newly developed fluorescent DNA probes for many interstitial chromosomal regions now provide the ability to detect abnormalities that involve the subtelomere-telomere regions (subtelomere FISH). The distal segments of the chromosomal telomeres are composed of telomere-associated repeat sequences, and these extend 100 to 300 kb from the terminal repeat sequences.[30] Chromosome-specific unique sequences are present in these terminal regions, and fluorescent DNA probes can be specifically targeted to these areas. The subtelomere regions are thought to contain a very high concentration of genes; thus, rearrangements in these regions may have a significant impact on the phenotype of the individual.[31] Subtelomere FISH probes with fluorescent DNA have been commercially developed for each end of the chromosome arms except for the short arms of the acrocentric (centromere near 1 end) chromosomes.[32] If the karyotype is normal in a patient with dysmorphic facial features, congenital anomalies, developmental delay, and mental retardation, then the clinician should consider ordering subtelomere FISH studies for further genetic evaluation.

Cardiac malformations reported to date in children with subtelomere chromosomal rearrangements include aortic arch anomalies, VSD, atrial septal defect, mitral valve insufficiency, and concomitant pulmonary stenosis with VSD.[33,34] Most of the published studies of subtelomere abnormalities indicate that a 4% to 9% prevalence of subtle chromosome rearrangements can be detected in children or adults with microcephaly, hydrocephaly, tracheoesophageal fistula, skeletal anomalies, multiple congenital anomalies, polycystic kidney, duodenal atresia, syndactyly, epilepsy, mental retardation, developmental delay, and/or dysmorphic facial features.[30,35]

The use of subtelomeric FISH analysis has significant utility in individuals with normal karyotypes, especially if there are multiple congenital anomalies that include mental

retardation or CHD.[36] By finding a tiny deletion, duplication, or unbalanced translocation, further investigation of other family members can uncover the exact genetic risks faced by the family and the affected individual. As many as 50% of families can have other individual members with subtelomeric abnormalities.[37] Because some polymorphic variants and cross-hybridizations of subtelomeric FISH probes are known,[30] families in whom a subtelomeric abnormality is identified should be seen by a medical genetics specialist to provide appropriate evaluation and counseling.

Methods of Gene Discovery

Initial strategies of gene discovery were directed toward isolating a protein of interest, sequencing a portion of it, and then cloning the gene that produces that protein. This approach works well for disorders for which the function of the target protein is obvious and facilitates its identification, eg, Pompe disease (acid α-glucosidase deficiency). Currently, disease gene discovery can be accomplished by positional cloning, a candidate gene approach, or a combination of these 2 methods.[38] Positional cloning has been referred to as reverse genetics. In this paradigm, investigators study families with affected individuals to identify a position on a chromosome that must contain the disease gene of interest, utilizing linkage analysis. That disease gene is then identified from among the set of all genes residing in that chromosomal region through cloning techniques. An example of the successful use of this strategy was the identification of the *NKX2.5* gene, for which the locus was defined from linkage analysis of large families.[3] Some investigators have used this approach to identify a CHD gene in a syndromic disorder that is a single-gene trait. This approach is far less robust for finding disease genes when the disorder arises in a more complex genetic fashion or is heterogeneous, for example, patent ductus arteriosus.[4] This may be the case for many forms of CHD. Using the candidate gene approach, investigators look for mutations in genes that encode proteins with relevance to the process in question. For CHD, this means that genes that control the formation and development of the heart (also known as cardiogenic genes) are candidates. A combination of these 2 methods, or the positional candidate approach, uses linkage analysis or identification of karyotypic abnormalities to find a region of a chromosome likely to contain the gene of interest. Candidate genes (cardiogenic) in that particular chromosomal region are then evaluated for mutations.

DNA Mutation Analysis

The cytogenetic methods described above identify large changes in chromosome number or structure. However, in certain disorders, changes occur at the level of a single gene and must be detected by alternative techniques. Genes are complex structures that include not only regions coding for the protein itself but also other sequences involved in regulation of gene activity. Currently, the coding region for the protein is evaluated for sequence changes for which the biological significance of an altered coding sequence can generally be interpreted. In contrast, the regulatory domains are not usually studied for sequence changes, because the regulatory domains for the gene may not be known, and the biological significance of the altered sequence is difficult to interpret.

Mutation analysis identifies changes in the coding sequence of the gene, including small deletions, insertions, or substitutions of nucleotides that alter the encoded amino acid and consequently protein structure. Most methods employ polymerase chain reactionï based assays. Indirect screening methods, such as denaturing high-performance liquid chromatography[39] or single-strand conformation polymorphism,[40] have been used extensively. More expensive exon-by-exon sequencing of genomic DNA has recently emerged. Additionally, newer, more cost-effective direct sequence analysis methods have become available.[41] Such testing is usually done on DNA obtained from peripheral blood lymphocytes, but other tissues, such as skin, liver, muscle, buccal cells, or saliva, can be used, depending on their availability. DNA testing technology does have some limitations. For example, several types of mutations, including large deletions, other chromosomal structural abnormalities, and some changes that cause splicing errors, are difficult to detect by these approaches.

Once a sequence variation is identified, it is important to consider whether this variation is disease related. The basic criteria used to establish the disease-causing potential of the nucleotide sequence change are that it (1) is predicted to alter the gene coding sense, gene splice site, or regulatory region of the encoded protein; (2) segregates with disease in a kindred; and (3) is not found in unrelated, unaffected control chromosomes. The occurrence of a change in an evolutionarily conserved sequence domain provides additional support that the sequence change is disease causing. Although each of these criteria should be met by any disease-causing mutation, supporting evidence will come from the demonstration that affected individuals from other unrelated families have mutations in the same gene.

Another major problem is the interpretation of the biological importance of mutations. In many instances, little is known of the role of the normal gene product in cardiac development or function, and in some instances, genes were not known to have any role in the heart before mutation identification (eg, in Alagille syndrome). To date, a variety of mutations that cause pediatric cardiovascular disease, including missense and frameshift mutations, have been identified. The extent and heterogeneity of the genes and the mutations identified thus far suggest that they are associated with a variety of pathogenetic mechanisms, including loss of expression, inactivation, or loss of function or gain of function of the mutated allelic products. The challenge of the future is to define the pathogenesis of disease-causing mutations, which in turn will provide opportunities to develop diagnostic and therapeutic strategies as alternatives to those now used.

Loci and Genes Associated With Congenital Heart Defects Identified to Date

Deletion Syndromes Identified by FISH Technology

DiGeorge Syndrome

DiGeorge syndrome was originally considered to be a rare developmental field defect encompassing derivatives of the branchial arch/pharyngeal pouch system.[42,43] The syndrome is characterized by aplasia or hypoplasia of the thymus, aplasia or hypoplasia of the parathyroid glands, cardiac malformations, and specific facial features. Infants present with CHD, hypocalcemia, immunodeficiency, and facial dysmorphia. Ten to twenty percent of patients with DiGeorge syndrome have visible alterations that result in the loss of the proximal long arm of 1 copy of chromosome 22.[44] On FISH, ≈90% of patients with the DiGeorge phenotype have a microdeletion of part of 1 copy of chromosome 22.[45] The prevalence of the 22q11 deletion has been estimated at 1 per 5950 live births.[46]

Subsequently, it has been shown that patients with the clinical diagnosis of DiGeorge, velocardiofacial (Shprintzen), or conotruncal anomaly face syndromes most often share a common genetic origin, namely, a 22q11 deletion.[47] Not all patients with the clinical features of these syndromes have a 22q11 deletion, consistent with heterogeneous causes for the clinical features. For instance, some patients with similar clinical features may have a small deletion of the short arm of chromosome 10, or some of these features may also result from maternal diabetes mellitus or maternal alcohol use.

The clinical features of the 22q11 deletion syndrome are highly variable between affected individuals, even when they are related.[48] The most common features include cardiovascular anomalies, palate anomalies, feeding disorders, speech and learning disabilities, renal anomalies, and behavioral disorders. Other abnormalities may include hypocalcemia, immunodeficiency, skeletal abnormalities, and growth hormone deficiency. Typical facial features may also include tubular nose, hypoplastic alae nasi, bulbous tip nose, low-set and/or dysplastic ears, and myopathic facies. A 22q11 deletion is inherited in an autosomal dominant fashion from a parent in approximately 6% to 28% of cases.[48] In many familial cases, one of the parents is found to have a 22q11 deletion only after their child with CHD has been diagnosed as affected. All parents affected with 22q11 deletions are then found on further analysis to have subtle syndromic features that were not recognized previously.[48,49] Also, given that approximately 6% to 28%[48] of parents are found to carry the deletion, this has significant implications for future pregnancies, because there is a 50% chance that the deletion-bearing chromosome from an affected parent will be transmitted to the offspring. This is very important information for genetic family counseling.

The most common cardiovascular defects associated with a 22q11 deletion include tetralogy of Fallot, interrupted aortic arch type B, truncus arteriosus, conoventricular VSDs, and aortic arch anomalies.[50–52] Pulmonary stenosis, atrial septal defects, heterotaxy syndrome, and hypoplastic left heart syndrome have also been reported.

TABLE 1. Estimated 22q11 Deletion Frequency in Congenital Heart Disease

Cardiac Defect	Estimated Deletion Frequency, %	Reference(s)
Interrupted aortic arch	50–89	56, 57
VSDs	10	58
With normal aortic arch*	3	
With aortic arch anomaly†	45	
Truncus arteriosus	34–41	51, 56, 59–61
Tetralogy of Fallot	8–35	51, 56, 59, 61, 62
Isolated aortic arch anomalies	24	55
Double-outlet right ventricle	<5	51, 56, 59
Transposition of the great arteries	<1	51, 59

*Left-sided aortic arch with normal branching pattern.

†Includes right aortic arch and/or abnormal branching pattern, cervical location, and/or discontinuous branch pulmonary arteries.

Several studies have demonstrated that a 22q11 deletion is commonly found in a subset of patients with specific types of CHD (Table 1). Individuals with both a cardiac defect and an aortic arch anomaly (right aortic arch, cervical location, or abnormal branching pattern) are more likely to have a 22q11 deletion, as are a subset of patients with tetralogy of Fallot associated with absent pulmonary valve syndrome or aortopulmonary collaterals.[53–55] Children with double-outlet right ventricle or transposition of the great arteries are rarely found to have a 22q11 deletion (Table 1).[51,55–62]

It is important to identify the cardiac patient with a 22q11 deletion by FISH testing to evaluate for associated noncardiac features of the syndrome in a timely fashion and to offer accurate genetic counseling. Additionally, a higher operative mortality in some individuals with a 22q11 deletion has been documented,[63,64] and the clinician and surgeon should be aware of this when planning surgery and postoperative care, particularly as related to calcium metabolism or immunologic issues.

Discussions have centered around which cardiac patients should be routinely tested for a 22q11 deletion and at what age. It appears reasonable to test all infants with interrupted aortic arch type B or truncus arteriosus for a 22q11 deletion given the high frequency of a 22q11 deletion in those patients (Table 1). Using the same logic, data also support the testing of all infants with tetralogy of Fallot and one of the following associated features: absent pulmonary valve syndrome, aortic arch anomalies (including right aortic arch), pulmonary artery anomalies, or aortopulmonary collaterals (Table 1).[53–55] A high frequency of 22q11 deletion also supports testing of patients with both perimembranous VSD and associated aortic arch abnormalities[58] or those with isolated aortic arch abnormalities[55] (Table 1).

Much debate on testing strategies has focused on infants with tetralogy of Fallot who have a normal aortic arch and branching pattern. This subset comprises a large patient population, of which 6% are estimated to have a 22q11 deletion.[51] To clinically detect the deletion-bearing patient, the infant should be evaluated for hypocalcemia, thymic size, typical facial features, palate anatomy, or nasal regurgitation

TABLE 2. Age-Related Features of the 22q11 Deletion Syndrome

Newborn/infant age group
Specific types of congenital heart disease (interrupted aortic arch, truncus arteriosus, tetralogy of Fallot, VSD, aortic arch anomaly)
Aortic arch anomaly or discontinuous branch pulmonary arteries
Overt or submucous cleft palate, high arched palate, bifid uvula
Absent, hypoplastic, or abnormally located thymus
Hypocalcemia
Nasal regurgitation of feeds
Feeding disorders/failure to thrive/gastroesophageal reflux
Facial dysmorphia (especially abnormal ear or nose)
Toddler/school-aged child
Findings detailed above
Feeding disorders
Delayed emergence in speech
Hypernasal speech
Learning disabilities
Behavioral disorders, including attention deficit hyperactivity disorder (ADHD)
Adolescent/adult
Findings detailed above
Psychiatric disorders, including bipolar disorders and/or schizophrenia

with feeding on a routine examination (Table 2). The older child with a suspected 22q11 deletion could be evaluated for speech and learning disabilities, endocrine abnormalities, immune dysfunction, or other recognized syndromic abnormalities (Table 2). However, clinical assessment for syndrome features alone of the at-risk individual may not consistently identify the infant carrying a 22q11 deletion. Therefore, more routine FISH testing of at-risk infants is likely warranted.

In particular, facial features may be the only associated syndromic finding in the newborn and can be difficult to detect in that age group.[62] Such patients may be uncommon and would presumably be identified at an older age when other syndromic features and symptoms became more apparent. But these data also argue for a more comprehensive testing strategy to identify all infants with tetralogy of Fallot and a 22q11 deletion. Ultimately, early diagnosis of the patient with a 22q11 deletion allows for appropriate treatment of associated noncardiac anomalies, including appropriate handling of blood products at the time of surgery (leukocyte-depleted and cytomegalovirus-negative blood for the immunocompromised patient). In addition, accurate and timely genetic counseling can be provided to the family, including information on recurrence issues. Other family members can then be tested appropriately. Therefore, early FISH testing in patients with specific types of CHD is currently suggested as outlined in Table 3.

Finally, prenatal testing for a 22q11 deletion should be strongly considered in the fetus with either interrupted aortic arch, truncus arteriosus, tetralogy of Fallot, VSD (perimembranous, conoseptal hypoplasia, or malalignment types only), or aortic arch anomaly.[51,55,58] In the fetus, it is much more difficult to diagnose the 22q11 deletion syndrome by clinical appearance alone, because other features, such as facial dysmorphia, will not be sufficiently apparent to exclude the diagnosis. Appropriate genetic and family counseling is of critical importance in this situation.

TABLE 3. Suggested Testing Strategy for a 22q11 Deletion in the Congenital Heart Disease Population

All newborns/infants with:
IAA
TA
TOF
VSD* with AAA
Isolated AAA
Discontinuous branch pulmonary arteries
Any newborn/infant/child with CHD and another feature of the 22q11 deletion syndrome
Any child/adolescent/adult with TOF, TA, IAA, VSD, or AAA not previously tested who has 1 other feature of the 22q11 deletion syndrome (see Table 2)
All fetuses with IAA, TAA, TOF, VSD, or AAA (if amniocentesis performed for diagnostic purposes)
Consider all newborns/infants with VSD with normal aortic arch

IAA indicates interrupted aortic arch; TA, truncus arteriosus; TOF, tetralogy of Fallot; and AAA, aortic arch anomaly.

*Perimembranous, conoseptal hypoplasia or malalignment VSD.

Williams-Beuren Syndrome

Williams-Beuren syndrome (Williams syndrome) is an autosomal dominant disorder characterized by specific cardiovascular defects, infantile hypercalcemia, skeletal and renal anomalies, cognitive deficits, ñsocial personality,ò and elfin facies. Most cases arise de novo due to a chromosomal microdeletion. As with other deletion syndromes, Williams syndrome has a broad range of clinical presentations. Typical cardiovascular anomalies include supravalvular aortic stenosis, often in conjunction with supravalvular pulmonary stenosis and peripheral pulmonary stenosis. These arterial abnormalities constitute an elastin arteriopathy or vasculopathy caused by deletion of the elastin gene.[65] The degree of cardiovascular involvement and the involvement of the pulmonic or aortic vessels varies widely. The supravalvular aortic stenosis has been shown to progress in many cases, whereas the supravalvular pulmonary stenosis or peripheral pulmonary artery stenosis usually regresses with time.[66,67]

Approximately 90% of individuals with a clinical diagnosis of Williams syndrome have been found by FISH to have a microdeletion at chromosome 7q11.23.[65,68] Molecular analyses comparing clinical phenotype to genotype have demonstrated that this syndrome is a contiguous gene-deletion syndrome, ie, the deletion or alteration of specific genes in the deleted region corresponds with specific clinical features. Deletion of 1 copy of the elastin gene corresponds with the development of vascular manifestations of this disorder. Deletion of different genes in the region accounts for different manifestations of the disorder. Larger deletions, particularly deletions visible cytogenetically, can be associated with more severe clinical phenotypes, including seizures, which

TABLE 4. Clinical Features of Williams-Beuren Syndrome

Cardiovascular
Supravalvular aortic stenosis
Pulmonary arterial stenosis
Multiple arterial stenoses
Aortic/mitral valve defects
Adult systemic hypertension
Distinctive facies
Periorbital fullness
Stellate iris pattern
Full lips/wide mouth
Elfin appearance
Ophthalmologic
Strabismus
Hyperopia
Neurological
Mental retardation/cognitive disability
Unique personality
Hyperacusis
Feeding difficulties
Infantile failure to thrive
Adult height <third percentile
Endocrine
Hypercalcemia
Hypercalciuria
Hypothyroidism
Adult diabetes mellitus
Renal/bladder disorders
Chronic urinary tract infections
Structural anomalies
Nephrocalcinosis

are not typically seen in Williams syndrome. Given the clinical variability of Williams syndrome and the fact that many aspects of Williams syndrome are not particularly evident in a young infant or child, especially characteristic facial features, it is appropriate to consider testing all patients with supravalvular aortic or pulmonic stenosis for this specific microdeletion by FISH at the time of diagnosis of the cardiac disease. In addition, if peripheral pulmonary stenosis persists beyond infancy, it is also appropriate to assess these patients with FISH analysis for the Williams syndrome critical region.

Early diagnosis of Williams syndrome is important to initiate treatment for other potential medical problems (Table 4). In particular, hypercalcemia, which often occurs in the first year of life along with hypercalciuria, can be treated with appropriate diet or medication. Because hypercalcemia can be a risk factor for the development of nephrocalcinosis, making this diagnosis is important for prevention of extensive kidney damage, which can lead to renal failure. Screening for thyroid and renal anomalies will uncover anomalies that are unsuspected clinically.[69] Routine follow-up of blood pressure measurements is needed because at least half of adults with Williams syndrome have systemic hypertension, and this can often be detected in childhood or adolescent years.[70] Early identification of Williams syndrome is also essential for planning educational strategies that can enhance learning and development in children with Williams syndrome. The detection of a deletion also adds diagnostic certainty for the family and the responsible clinician. Appropriate testing of other family members and genetic counseling can then occur.

Single-Gene Disorders

In the past 15 years, considerable progress has been made toward identifying molecular genetic causes of selected congenital heart defects. As illustrated in the first part of Table 5, a number of selected congenital heart defects have been found to be associated with mutations in a variety of single genes.[3,4,71–104] Some cardiac defects are related to mutations in >1 gene. It is highly likely that additional single-gene abnormalities (mutations) will be defined in the future. DNA testing for most of the genes for isolated congenital heart defects is unavailable except on a research basis at this time; however, testing of some of these genes is transitioning from the research laboratory to clinical availability. The clinician is advised to consult the Gene Tests Web site (http://www.genetests.org), a publicly funded medical genetics information resource, for updates on what testing is currently available.

The identification of causative gene mutations for genetic syndromes is also occurring at a rapid pace. A select group of syndromes in which the underlying single gene has been discovered is also listed in Table 5. For illustration purposes, Alagille syndrome, NS, and Holt-Oram syndrome will be discussed in greater detail. These single-gene disorders reflect the recent identification of genes responsible for congenital heart defects and for multiple other clinical features.

Alagille Syndrome

Alagille syndrome, an autosomal dominant disorder, was originally defined as the presence of bile duct paucity on liver biopsy in conjunction with 3 of the 5 following characteristics: cholestasis; cardiovascular, skeletal, or ocular anomalies; or typical facial features. Cardiovascular anomalies occur in >90% of individuals with Alagille syndrome.[79] The most common cardiovascular features include peripheral pulmonary hypoplasia, tetralogy of Fallot, and pulmonary valve stenosis, although left-sided lesions and septal defects are also seen. Liver disease is highly variable from patient to patient and also within affected members of the same family.[105] It is characterized by a paucity of intrahepatic bile ducts and can include chronic cholestasis, minimal liver enzyme elevation, hypercholesterolemia, or liver failure. Additional clinical features of Alagille syndrome are listed in Table 6.

A subset of Alagille patients (3% to 7%) have deletions of chromosome 20p12 detectable by karyotype or FISH analysis.[106] The gene *JAG1*, which encodes a Notch ligand protein product, has been mapped into the commonly deleted region of 20p12. Mutations of *JAG1* have been identified in patients with a broad spectrum of clinical phenotypes of Alagille syndrome, including patients with a predominant cardiac phenotype.[89]

TABLE 5. Genes Associated With Congenital Heart Defects in the Young

Condition	Gene(s)	Chromosome Location	Reference(s)
Congenital heart defects			
Familial congenital heart disease (ASD, atrioventricular block)	*NKX2.5(CSX)*	5q34-q35	3, 71–74
D-TGA, DORV	*CFC1*	2q21	75, 76
D-TGA	*PROSIT240*	12q24	77
Tetralogy of Fallot	*ZFPM2/FOG2*	8q23	78
	NKX2.5	5q34-q35	72
	JAG1	20p12	79
Atrioventricular septal defect	*CRELD1*	3p21	80
ASD/VSD	*GATA4*	8p23	81
Heterotaxy	*ZIC3*	Xq26	82
	CFC1	2q21	75, 76
	ACVR2B	3p21.3-p22	83
	LEFTYA	1q42.1	84
Supravalvar aortic stenosis	*ELN*	7q11	85, 86
Syndromes			
Holt-Oram syndrome	*TBX5*	12q24	87, 88
Alagille syndrome (PPS)	*JAG1*	20p12	89
Char syndrome (PDA)	*TFAP2B*	6p12	4
Noonan syndrome	*PTPN11*	12q24	90, 91
	KRAS	12p1.21	92
	SOS1	2p21	115, 116
CHARGE association	*CHD7*	8q12	93, 94
Ellis-van Creveld	*EVC, EVC2*	4p16	95, 96
Marfan syndrome	*FBN1*	15q21.1	97
Marfan-like syndrome	*TGFBR2*	3p22	98, 99
Cardiofaciocutaneous syndrome	*KRAS*	12p12.1	100
	BRAF	7q34	100
	MEK1	15q21	101
	MEK2	7q32	101
Costello syndrome	*HRAS*	11p15.5	102–104

ASD indicates atrial septal defect; D-TGA, D-transposition of great arteries; DORV, double-outlet right ventricle; PPS, peripheral pulmonary stenosis; PDA, patent ductus arteriosus; and CHARGE, coloboma, heart anomaly, choanal atresia, retardation, and genital and ear anomalies.

Patients suspected of having Alagille syndrome should undergo a karyotype and FISH analysis to check for a 20p12 rearrangement or deletion. Karyotype and FISH analysis are readily available in most cytogenetics laboratories, and the finding of a deletion or chromosomal rearrangement can be diagnostic for Alagille syndrome. If this diagnosis is confirmed by the cytogenetic testing, the child can be evaluated for other important features of Alagille syndrome, such as liver disease or additional vascular involvement.[107] In addition, the cytogenetic results will most likely have a significant impact on the reproductive decisions some families will make in the future.

More than 90% of individuals with the classic phenotype of Alagille syndrome have a *JAG1* mutation when the most sensitive and rigorous methods for mutation detection are used.[108] *JAG1* mutation analysis is now clinically available for those patients whose karyotype and FISH analyses are normal. Growing evidence suggests that patients with a strong family history of right-sided defects, such as peripheral pulmonary stenosis, valvar pulmonary stenosis, or tetralogy of Fallot, who do not otherwise fulfill the criteria for Alagille syndrome may also be appropriate for testing in this specific region.[109,110] The finding of peripheral pulmonary stenosis or hypoplasia of the branch pulmonary arteries in a child, alone or in combination with tetralogy of Fallot, should prompt consideration of testing for Alagille syndrome. All patients with documented *JAG1* mutations or suspected Alagille syndrome should have cardiac, hepatic, ophthalmologic (anterior chamber defects, pigmentary retinal anomalies, posterior embryotoxon), orthopedic (butterfly vertebrae), hematologic (bleeding tendency), and renal (structural, cysts, tubular acidosis) evaluations.[111] The finding of a *JAG1* mutation in an individual establishes the diagnosis and allows for further testing of appropriate family members in whom the diagnosis

TABLE 6. Clinical Features of Alagille Syndrome

Cardiovascular
Pulmonary artery stenosis or hypoplasia
Tetralogy of Fallot
Valvar pulmonary stenosis
Atrial septal defect
Labile systolic hypertension
Liver
Persistent cholestasis/jaundice
Hepatic ductular hypoplasia
Hepatocellular carcinoma
Hypercholesterolemia
Abnormal liver function tests
Distinctive facies
Triangular face
Prominent forehead and chin
Hypertelorism
Ophthalmologic
Posterior embryotoxon
Axenfeld anomaly
Ectopic pupils
Pigmentary retinopathy
Neurological
Normal intelligence to moderate mental retardation
Hoarse voice
Endocrine
Delayed puberty
Growth retardation
Hypothyroidism
Renal
Horseshoe kidney
Renal compromise
Other
Butterfly vertebra
Conductive hearing loss

has not yet been suspected. This is helpful to make appropriate arrangements for comprehensive evaluation of clinical issues and to provide appropriate genetic counseling to the family regarding recurrence risk.

Noonan Syndrome

NS is a genetic multiple malformation disorder that includes short stature, typical facial dysmorphism, webbed neck, chest deformity, and cardiovascular abnormalities.[112] The cardiac involvement is observed in 80% to 90% of affected individuals, with valvar pulmonic stenosis and hypertrophic cardiomyopathy being the most common.[112,113] Other congenital heart defects observed in NS are secundum atrial septal defect, atrioventricular septal defect, mitral valve abnormalities, aortic coarctation, and tetralogy of Fallot. Other noncardiac features of NS include cryptorchidism, bleeding diathesis, and developmental delay. Additional features are listed in Table 7. Population prevalence has been estimated at

TABLE 7. Clinical Features of Noonan Syndrome

Cardiovascular
Congenital heart defects
Pulmonic stenosis
Atrioventricular septal defects
Aortic coarctation
Secundum atrial septal defects
Mitral valve defects
Tetralogy of Fallot
VSDs
Patent ductus arteriosus
Hypertrophic cardiomyopathy
Dysmorphic features
Epicanthal folds
Ptosis
Down-slanting palpebral fissures
Triangular facies
Low-set, thickened pinnae
Light-colored irides
Curly, coarse hair
Webbed neck with low posterior hairline
Skeletal
Short stature
Pectus excavatum and/or carinatum
Cubitus valgus
Scoliosis
Vertebral anomalies
Genitourinary
Cryptorchidism
Developmental
Developmental delay
Attention deficit/hyperactivity disorder
Feeding difficulties
Hematologic
Bleeding diathesis
Von Willebrand disease
Factor XI, XII, XIII deficiency
Thrombocytopenia, amegakaryocytic
Leukemia
Juvenile myelomonocytic
Acute lymphoblastic
Ophthalmologic
Strabismus
Myopia
Other
Hearing loss, sensorineural
Dental malocclusion
High-arched palate
Lymphatic
Lymphedema
Lymphangiectasia

1 per 1000 to 1 per 2500 live births. The trait is inherited in an autosomal dominant fashion, although a substantial fraction of cases are sporadic.

NS is genetically heterogeneous, which means that there are at least 3 NS disease genes, *PTPN11*, *SOS1*, and *KRAS*.[92,114–116] With genetic linkage analysis and then positional candidacy, an NS disease gene on chromosome 12 was identified.[90] It is *PTPN11*, which encodes a protein tyrosine phosphatase called SHP-2. SHP-2 plays an important role in signal transduction for a wide variety of biological processes, including the formation of the semilunar valves.[117,118] Mutations in the *PTPN11* gene are observed in 40% to 50% of NS patients and are more prevalent among familial cases and among NS patients with pulmonary valve stenosis.[91] NS patients with hypertrophic cardiomyopathy are unlikely to harbor a *PTPN11* mutation. Otherwise, there does not appear to be a strong correlation between the presence or absence of a *PTPN11* mutation and most other aspects of the NS phenotype (eg, mental retardation). Disease penetrance is nearly complete among those with *PTPN11* mutations, although phenotypic variability within families can be substantial.

Clinical mutation testing for *PTPN11*, *SOS1*, and *KRAS* is now available in the United States and elsewhere. These DNA tests can confirm the diagnosis of NS but cannot exclude it due to the genetic heterogeneity (ie, the individual could harbor a mutation in another NS gene that has not been identified as yet). Molecular confirmation is useful in borderline cases, especially in neonates and adults in whom the facial features of NS may not be obvious. Prenatal testing can be done when the fetus is at risk for inheriting a defined *PTPN11* mutation from an affected parent. Similar testing of suspicious prenatal, sporadic cases (eg, a fetus with cystic hygroma and pulmonic stenosis) suffers from the uncertainty that arises from the genetic heterogeneity.

There are 3 NS-related conditions for which *PTPN11* mutations can be found: LEOPARD syndrome, Noonan-like with multiple giant cell lesions, and certain hematopoietic disorders. LEOPARD syndrome is also a multiple malformation disorder; the name is an acronym that designates the cardinal features: multiple lentigines, electrocardiographic conduction abnormalities, ocular hypertelorism, pulmonic stenosis, abnormal genitalia, retardation of growth, and sensorineural deafness. A high percentage of affected individuals have *PTPN11* mutations with certain missense defects that appear to be specific for LEOPARD syndrome rather than NS.[119,120] Noonan-like with multiple giant cell lesions includes all of the features of NS plus the giant cell lesions of bone. The proclivity for involving the maxilla with expansile lesions leads to this disorder being a form of cherubism. Cardiac involvement appears to be highly similar to NS. Unlike LEOPARD syndrome, the *PTPN11* mutations have no specificity in predicting this disorder versus NS.[91,120]

Holt-Oram Syndrome

Holt-Oram syndrome is an autosomal dominant ñheart-handò syndrome that is characterized by congenital heart defects in patients with upper-limb deformities.[122] This syndrome occurs in approximately 1 per 100 000 individuals, and although it can be inherited in a mendelian fashion, a significant portion of cases are sporadic.[123] All patients have preaxial radial ray malformation (eg, triphalangeal, hypoplastic, or absent thumb and/or radial dysplasia), and three fourths of patients have septation (atrial and/or ventricular) defects and/or progressive atrioventricular conduction disease.[124–126] Human genetic linkage analyses and positional cloning studies of affected families revealed that Holt-Oram syndrome is caused by mutations in the *TBX5* transcription factor gene (chromosome 12q24.1).[87,124,126,127] The *TBX5* transcription factor has proven to be a key regulator, particularly in combination with other transcription factors such as *NKX2.5* and *GATA-4*, of gene expression during embryogenesis, and loss of its activity markedly impairs development of the heart and limb.[81,128,129]

Although there is significant genetic heterogeneity to the broader class of heart-hand syndromes,[130] there is little if any genetic heterogeneity among Holt-Oram patients. Mutational analyses of the *TBX5* gene-coding regions will detect mutations in approximately three fourths of such patients, and the remainder are likely to have mutations in regulatory regions or to have deletions/insertions not detectable by current mutational analysis.[131] Some studies find that fewer than half of Holt-Oram patients have *TBX5* mutations, which suggests genetic heterogeneity.[126,127,132] However, these studies have been confounded by aggregation of patients who have other heart-hand syndromes with those who have Holt-Oram.[133] Thus, careful and detailed clinical evaluations of the cardiovascular and other organ systems are essential to distinguish other such clinical syndromes (eg, Rothmund-Thomson syndrome, Okihiro syndrome, thrombocytopenia absent radius syndrome, and VACTERL association [vertebral anomalies, anal atresia, cardiac defect, tracheoesophageal fistula, renal abnormalities, and limb abnormalities]) that share features with Holt-Oram syndrome but are nonetheless clinically and genetically distinct.[134–136]

Key to the accurate diagnosis of Holt-Oram syndrome is the uniform presence of upper-limb radial ray defects, which may be symmetrical or asymmetrical (even unilateral) regardless of the presence or absence of cardiovascular disease. Such limb deformity, for example, altered structure of a single carpal bone, may be quite subtle and only detectable radiographically, but individuals without such radial ray defects do not have Holt-Oram syndrome.[124,137] Other limb malformations (eg, syndactyly of digits other than the thumb, polydactyly, or lower-limb defects), craniofacial abnormalities, and/or evidence of noncardiac visceral organ abnormalities (including heterotaxy) make Holt-Oram syndrome unlikely.[124,125,131,138] Most Holt-Oram structural cardiac defects are either ostium secundum atrial septal defects or muscular VSDs. Complex congenital heart defects have been seen in Holt-Oram syndrome patients with *TBX5* mutations, but they are rare events.[87,88,139] Therefore, the demonstration of ostium primum atrial septal defects, membranous VSDs, or congenital valvular disease should at least prompt further detailed clinical evaluations of other organ systems and consideration of other diagnoses.

Among those individuals with Holt-Oram syndrome, most will have *TBX5* mutations that are nonsense or frameshift

mutations that are predicted to produce a 50% reduction in *TBX5* gene dosage, that is, haploinsufficiency. Interestingly, there have been several reports[140–142] of individuals with duplications of chromosome 12q segments encompassing *TBX5* (and therefore potentially *TBX5* overexpression), and such patients have clinical phenotypes that overlap with Holt-Oram syndrome.[87] A minority of Holt-Oram syndrome is due to missense *TBX5* mutations that do not alter the geneôs dosage. Although large family-based studies have suggested that many such missense *TBX5* mutations have their greatest impact on either heart or limb development, compared with haploinsufficient *TBX5* mutations that markedly deform both organ systems, these genotype-phenotype associations are not necessarily evident in the individual patient with Holt-Oram syndrome and are not clinically useful for predicting the individual patientôs phenotype.[88,132]

Thus, in the setting of careful clinical evaluations of patients with suspected Holt-Oram syndrome, there is a rather limited role for *TBX5* mutational analyses. When diagnostic clarity is not achieved clinically, *TBX5* mutational analyses can provide adjunctive information. However, due to technical limitations of genetic assays used, the absence of a detected *TBX5* mutation in an individual with a typical clinical presentation does not preclude a diagnosis of Holt-Oram syndrome. Thus, the most valuable setting for *TBX5* genetic testing may be in establishing diagnoses for family members of a patient with previously established Holt-Oram syndrome and a known *TBX5* mutation. For instance, McDermott et al[131] used genetic testing to rule out Holt-Oram syndrome in an individual with tetralogy of Fallot whose cousin had well-established Holt-Oram syndrome. *TBX5* genetic testing has also been a useful addition to our assisted reproductive armamentarium.[26] When in vitro fertilization is used as a reproductive strategy for an individual affected by Holt-Oram syndrome, blastocysts can be subjected to preimplantation genetic testing in vitro before their transfer back to the mother. If the affected parentôs *TBX5* mutation is established before the in vitro fertilization cycle is begun, mutational analyses can occur in a sufficiently rapid and sensitive fashion that they can be the basis for embryo selection to achieve offspring who will not carry the *TBX5* mutation and will therefore be unaffected by Holt-Oram syndrome.

Nonsyndromic Single-Gene Disorders

Studies have recently shown that nonsyndromic CHD can result from single-gene defects. Schott et al[3] identified mutations in *NKX2.5* in 4 kindreds with atrial septal defects and atrioventricular conduction delay without other apparent syndromic features. The mutations were found only in affected individuals, were not present in control samples, and were demonstrated to change protein structure or function. Given that some members of these kindreds had either isolated atrioventricular conduction delay or other types of CHD, investigators subsequently studied additional kindred and sporadic cases with isolated atrioventricular conduction delay or CHD for *NKX2.5* mutations. These studies identified likely disease-related mutations in a subset of cases with atrioventricular conduction delay and additional sequence alterations in patients with selected types of CHD.[71,72,143–145] The gene changes in patients with sporadic CHD were not identified in control subjects, and it was difficult to demonstrate their functional significance; thus, their relationship to the disease may not be proved. These studies demonstrate the complexity of the biological interpretation of some alterations and the likely complexity of the genetic contribution to CHD.

Investigators have also identified mutations of *GATA4* in 2 kindreds with septal defects and no apparent syndromic features.[81] Once again, the mutations identified were found in affected individuals but not in control samples and were shown to confer changes in protein function. Mutations in additional kindreds and subjects with septal defects have been reported subsequently.[146–148] It remains to be seen whether mutations of *GATA4* will be identified widely in patients with septal defects or in other sporadic cases of CHD; however, these studies highlight the utility of studying large kindreds to identify novel disease genes for CHD, and they demonstrate that single-gene disorders may be found in a subset of CHD. In addition, these studies identify critical molecular pathways involved in cardiovascular development and disease, given that the proteins encoded by *NKX2.5*, *GATA4*, and *TBX5* are known to interact with one another in experimental systems.

Many cases of nonsyndromic CHD are unlikely to result from simple single-gene disorders. Instead, many cases of CHD are likely the result of multiple genetic alterations that increase susceptibility to CHD and interact with environmental factors. Already there is evidence of decreased penetrance and marked variability in expressivity of identical genetic alterations. For example, only 40% to 50% of children with trisomy 21 have CHD, and patients with a 22q11 deletion or even a single-gene defect (eg, *JAG1*) can present with markedly variable features. Such variable expressivity and penetrance is presumably explained by other genetic and environmental factors. These observations and the marked genetic heterogeneity already evident demonstrate the complexity of deciphering the genetic basis of CHD.

Evaluation for Genetic Basis in Children With CHD

Chromosome analysis and FISH testing for specific deletions are now accepted tools for the clinician. If the clinician finds a specific chromosome abnormality, it will provide the family with a clear explanation of the cause, allow the clinician to provide appropriate counseling about recurrence or lack of recurrence, and prompt the physician to investigate other potential medical problems known to be associated with the particular chromosomal anomaly.

Despite the rapidly advancing fund of knowledge, a genetic defect can only be identified through available testing in a minority of patients with CHD.[149] Many of these children have abnormalities of other organ systems that indicate the presence of a known phenotype. In some cases, there may be a single-gene defect for which no testing is clinically available. In other instances, polygenic inheritance with or without an additive environmental component may be implicated. A complete understanding of the interactions between abnormal cardiac physiology and derangements in other organs is important for appropriate management and counseling in such patients. Therefore, it is useful for the physician caring

for these patients to have an algorithm based on the initial presentation to assess for the presence of noncardiac abnormalities (Appendix 2).

The approach to the newly diagnosed patient with CHD should include routine examination of all relatives for a potential genetic contribution. Identification of some genetic causes of CHD has highlighted the importance of obtaining an accurate medical history of other family members and documenting an extended pedigree. In some forms of cardiovascular disease, for example, hypertrophic cardiomyopathy and Marfan syndrome, the familial nature (autosomal dominant inheritance) is well recognized; however, for other problems, for example, bicuspid aortic valve, family clustering has not been widely appreciated in the past. Recent studies have shown that a familial bicuspid aortic valve is likely to be inherited as an autosomal dominant condition with reduced penetrance.[9,150] There is a 24% prevalence of bicuspid aortic valve in first-degree relatives of patients with left ventricular outflow tract obstruction.[150] Increasingly, medical practice is evolving toward a recommendation that other family members undergo clinical evaluation, which may include an electrocardiogram and echocardiogram.

Specific assessment for physical features is warranted. The physical examination should focus on dysmorphic facies, eye and ear abnormalities, limb reduction defects, polydactyly, other skeletal defects, gastrointestinal and urologic defects, and neurological status. This assessment may be more difficult in the newborn who is intubated and/or sedated, and it may be more fruitful before rather than after cardiac surgery. In these situations, it is helpful and important to have a geneticist perform a complete examination to help uncover more subtle abnormalities. Other consultants, for example, from neurology, ophthalmology, orthopedic surgery, and otolaryngology, may be needed based on the suspected diagnoses.

Chest radiographs are performed in all newborn inpatients and many older patients who are diagnosed with CHD. Particular attention should be paid to skeletal defects and cardiac aortic arch, pulmonary, liver, and stomach situs. Additional radiographic tests that may also be indicated include abdominal/renal ultrasound, upper gastrointestinal series, liver-spleen scan, head ultrasound, and brain computed tomography or magnetic resonance imaging.

Cytogenetic testing should be considered in the following situations:

1. Any infant or child with the phenotype of a recognizable chromosomal syndrome (eg, trisomy 21 or 18)
2. Because not all chromosomal abnormalities result in a clinically recognizable syndrome, any infant or child with a congenital heart defect combined with (a) dysmorphic features, (b) growth retardation that cannot be explained by the heart defect, (c) developmental delay or mental retardation, or (d) multiple congenital anomalies
3. Infants or children with a family history of multiple miscarriages and/or siblings with birth defects
4. If major cardiac and/or other visceral organ malformations are documented by prenatal ultrasound and/or fetal echocardiogram

Genetic consultation is recommended in the presence of mental retardation, multiple congenital anomalies, or facial dysmorphia or if the standard karyotype is normal despite the clinical suspicion of a genetic abnormality (ie, normal karyotype in the presence of dysmorphism, mental retardation, and/or multiple congenital anomalies that include cardiac defects). In this situation, high-resolution banding or more advanced cytogenetic techniques may be indicated (FISH for specific defects or telomeric and subtelomeric probes). In addition, chromosome analysis is warranted as described above. Consultation with a clinical geneticist is recommended when a chromosomal abnormality is discovered so that appropriate counseling and evaluation of family members may be undertaken.

It is anticipated that the emphasis in the evaluation of patients with CHD will increasingly focus on the family in addition to the patient. Given the regularity with which the phenomenon of variable expression (ie, phenotype variation in individuals carrying the same gene mutation) is being recognized, the evaluations may need to be very comprehensive. For example, the evaluation may extend to noncardiac organs (eg, upper-extremity [Holt-Oram syndrome, *TBX5* mutations] and liver, skeleton, or eyes [Alagille syndrome, *JAG1* mutations]).

Impact on Patients and Families

For individuals with CHD and their families, identification of a genetic cause is very beneficial. This allows confidence in the diagnosis and allows the physician to explain the exact genetic mechanisms to the family. It also alerts the clinician to investigate other organ systems that may be involved in the syndrome and broadens the context of evaluation from the individual to other family members. In instances where a genetic cause such as Alagille syndrome has been identified in a family, genotyping may be very useful for stratifying ñasymptomaticò family members into groups who should have cardiac evaluations and those for whom it is not necessary. Genotype-negative individuals have a low risk of developing pediatric cardiovascular disease, and clinical evaluation of such patients is not warranted. On the other hand, serial evaluation of genotype-positive individuals is essential to monitor development of the phenotype.

Ethical Considerations

Predictive genetic testing of children and adolescents has been the subject of numerous recommendations.[151ï153] Although there is no universal agreement about acceptable practices in pediatric genetic testing, consensus exists that pediatric genetic testing should not take place unless there are clinical benefits to be reaped as a direct result of testing before the patient reaches the age of majority. In addition, the struggle to obtain the pediatric analogue of informed consent is particularly important in genetic testing, in part because the long-term social and legal risks of genetic testing for pediatric patients are difficult to predict, and the risks are more difficult for a child to judge. On the other hand, genetic testing may determine a genetic mechanism of disease that provides an important opportunity for genetic counseling that benefits the entire family.

Summary

Ongoing research is now demonstrating that variations or alterations in genes contribute to the origin of CHD to a greater degree than previously suspected. This review has summarized the current knowledge of the genetics of CHD and has provided guidelines and algorithms to aid the clinician in making diagnoses and planning care. Many types of genetic testing are currently clinically available; other testing is still in the research phase. Awareness of this rapidly advancing field is important for all clinicians, and a multidisciplinary team approach to the child with CHD is necessary for comprehensive, state-of-the-art care. In addition to physicians and surgeons with expertise in CHD, a geneticist is a highly important member of this team.

Patients with CHD require multidisciplinary care. Their families deserve up-to-date genetic information as it relates to their childôs prognosis and to the kindredôs risk for future inheritance of genetic abnormalities associated with cardiac defects. Obstetricians will have involvement in these issues if prenatal echocardiography demonstrates CHD or if preimplantation genetic diagnosis and in vitro fertilization are requested. Pediatricians require knowledge about these issues in caring for multiple organ systems in children with genetic syndromes that include CHD. Families of these children will need information about recurrence risk. Pediatric cardiologists and pediatric cardiac surgeons are currently well equipped to care for patients with CHD, but they need to constantly update their understanding of the contribution of genetic abnormalities to these birth defects. As children grow into adulthood, internists, obstetricians, cardiologists, and thoracic surgeons will step in to care for CHD as it is superimposed on adult medical issues.

Research discoveries regarding the genetics and inheritance of CHD are rapidly occurring. As in all genetic research, ethical considerations for children with heart disease demand thorough and thoughtful reflection. It is hoped that dissemination of the information in the present report will result in improved diagnoses and care for children and adults with congenital cardiac disease. Through multidisciplinary care and research, the goal to prevent and improve clinical outcomes in CHD will guide future investigations.

Appendix 1

Representative Chromosomal Disorders Associated With Congenital Heart Defects

Chromosomal Disorder	Main Features	Percent With CHD	Heart Anomaly	Reference(s)
Deletion 4p (Wolf-Hirschhorn syndrome)	Pronounced microcephaly, widely spaced eyes, broad nasal bridge (Greek helmet appearance), downturned mouth, micrognathia, preauricular skin tags, elongated trunk and fingers, severe mental retardation and seizures; 1/3 die in infancy	50–65	ASD, VSD, PDA, LSVC, aortic atresia, dextrocardia, TOF, tricuspid atresia	22, 154
Deletion 5p (cri-du-chat)	Catlike cry, prenatal and postnatal growth retardation, round face, widely spaced eyes, epicanthal fold, simian crease, severe mental retardation, long survival	30–60	VSD, ASD, PDA	22, 155, 156
Deletion 7q11.23 (Williams-Beuren syndrome)	Infantile hypercalcemia, skeletal and renal anomalies, cognitive deficits, "social" personality, elfin facies	53–85	Supravalvar AS and PS, PPS	67, 157, 158
Trisomy 8 mosaicism	Skeletal/vertebral anomalies, widely spaced eyes, broad nasal bridge, small jaw, high arched palate, cryptorchidism, renal anomalies (50%), long survival	25	VSD, PDA, CoA, PS, TAPVR, truncus arteriosus	22, 159–162
Deletion 8p syndrome	Microcephaly, growth retardation, mental retardation, deep-set eyes, malformed ears, small chin, genital anomalies in males, long survival	50–75	AVSD, PS, VSD, TOF	163–165
Trisomy 9	Severe prenatal and postnatal growth retardation, marked microcephaly, deep-set eyes, low-set ears, severe mental retardation; 2/3 die in infancy	65–80	PDA, LSVC, VSD, TOF/PA, DORV	22, 166
Deletion 10p	Frontal bossing, short down-slanting palpebral fissures, small low-set ears, micrognathia, cleft palate, short neck, urinary/genital, upper-limb anomalies	50	BAV, ASD, VSD, PDA, PS, CoA, truncus arteriosus	22, 167, 168
Deletion 11q (Jacobsen syndrome)	Growth retardation, developmental delay, mental retardation, thrombocytopenia, platelet dysfunction, widely spaced eyes, strabismus, broad nasal bridge, thin upper lip, prominent forehead	56	HLHS, valvar AS, VSD, CoA, Shone's complex	169
Trisomy 13 (Patau syndrome)	Polydactyly, cleft lip and palate, scalp defects, hypotelorism, microphthalmia or anophthalmia, colobomata of irides, holoprosencephaly, microcephaly, deafness, profound mental retardation, rib abnormalities, omphalocele, renal abnormalities, hypospadias, cryptorchidism, uterine abnormalities; 80% die in first year	80	ASD, VSD, PDA, HLHS, laterality defects, atrial isomerism	170, 171
Trisomy 18 (Edwards syndrome)	IUGR, polyhydramnios, micrognathia, short sternum, hypertonia, rocker-bottom feet, overlapping fingers and toes, TEF, CDH, omphalocele, renal anomalies, biliary atresia, profound mental retardation; 90% die in first year	90–100	ASD, VSD, PDA, TOF, DORV, D-TGA, CoA, BAV, BPV, polyvalvular nodular dysplasia	22, 172, 173
Deletion 20p12 (Alagille syndrome)	Bile duct paucity, cholestasis, skeletal or ocular anomalies, broad forehead, widely spaced eyes, underdeveloped mandible	85–94	Peripheral PA, hypoplasia, TOF, PS, (left-sided heart lesions and septal defects less common)	79, 174
Trisomy 21 (Down syndrome)	Hypotonia, hyperextensibility, epicanthal fold, simian crease, clinodactyly of fifth finger, brachydactyly, variable mental retardation, premature aging	40–50	AVSD, VSD, ASD, (TOF, D-TGA less common)	22, 175–180
Deletion 22q11 (DiGeorge, velocardiofacial, and conotruncal anomaly face syndrome)	Hypertelorism, micrognathia, low-set posteriorly rotated ears, "fish mouth," thymic and parathyroid hypoplasia, hypocalcemia, feeding/speech/learning/behavioral disorders, immunodeficiency, palate/skeletal/renal anomalies	75	IAA-B, truncus arteriosus, isolated aortic arch anomalies, TOF, conoventricular VSD	181, 182
Monosomy X (Turner syndrome, 45,X)	Lymphedema of hands and feet, widely spaced hypoplastic nipples, webbed neck, primary amenorrhea, short stature, normal intelligence	25–35	CoA, BAV, valvar AS, HLHS, aortic dissection	22, 183–187
Klinefelter syndrome (47,XXY)	Usually normal appearing, tall stature, small testes, delayed puberty, emotional and behavioral problems common, variable mental retardation	50	MVP, venous thromboembolic disease, PDA, ASD	22, 188

CHD indicates congenital heart defects; ASD, atrial septal defect; VSD, ventricular septal defect; PDA, patent ductus arteriosus; LSVC, persistent left superior vena cava; TOF, tetralogy of Fallot; AS, aortic stenosis; PS, pulmonic stenosis; PPS, peripheral pulmonary stenosis; CoA, coarctation of the aorta; TAPVR, total anomalous pulmonary venous return; AVSD, atrioventricular septal defect; TOF/PA, tetralogy of Fallot with pulmonary atresia; DORV, double-outlet right ventricle; BAV, bicuspid aortic valve; HLHS, hypoplastic left heart syndrome; IUGR, intrauterine growth retardation; TEF, tracheoesophageal fistula; CDH, congenital diaphragmatic hernia; D-TGA, D-transposition of the great arteries; BPV, bicuspid pulmonary valve; PA, pulmonary artery; IAA-B, interrupted aortic arch type B; and MVP, mitral valve prolapse.

Appendix 2

Genetic Algorithms for Cardiac Defects

I. Pulmonary outflow obstruction
- A. Pulmonary valve stenosis
  - 1. Noonan syndrome
    - a) Autosomal dominant
    - b) 25% to 70% of cases result from de novo mutation
    - c) More likely if pulmonary valve is dysplastic
    - d) Also associated with hypertrophic cardiomyopathy (right and/or left ventricle)
    - e) Noncardiac phenotype features
      - (1) Male or female
      - (2) Short stature
      - (3) Broad or webbed neck
      - (4) Unusual chest shape
      - (5) Characteristic facies
      - (6) Developmental delay
      - (7) Cryptorchidism
    - f) Genetic testing clinically available
      - (1) *PTPN11* gene mutation analysis
      - (2) *KRAS* gene mutation analysis
      - (3) *SOS1* gene mutation analysis
  - 2. Alagille syndrome (see below)
  - 3. Costello syndrome
    - a) Sporadic occurrence
    - b) Also associated with hypertrophic cardiomyopathy
    - c) Noncardiac phenotype features
      - (1) Failure to thrive
      - (2) Feeding difficulties
      - (3) Mental retardation
      - (4) Increased risk of malignancy
      - (5) Coarse facial features with thick lips
      - (6) Loose skin
      - (7) *HRAS* mutations
  - 4. LEOPARD syndrome
    - a) Autosomal dominant
    - b) Noncardiac phenotype features
      - (1) Hearing loss
      - (2) Lentigines
      - (3) Short stature
      - (4) Similarities with Noonan syndrome
    - c) Genetic testing clinically available
      - (1) *PTPN11* gene mutation analysis
  - 5. Other chromosomal anomalies
    - a) Deletions of chromosome 1p, 8p, 10p, 22q
    - b) Duplications of chromosome 6q, 15q, 19q
    - c) Trisomy 8
- B. Pulmonary artery branch stenosis
  - 1. Alagille syndrome
    - a) Autosomal dominant
    - b) 50% to 60% of cases result from de novo mutation
    - c) Noncardiac phenotype features
      - (1) Bile duct paucity
      - (2) Cholestasis
      - (3) Eye findings (posterior embryotoxon)
      - (4) Vertebral anomalies
      - (5) Characteristic facies
      - (6) Growth retardation
    - d) Genetic testing clinically available:
      - (1) Microdeletion in chromosome locus 20p12 detectable by FISH
      - (2) *JAG1* gene mutation analysis
  - 2. Williams-Beuren syndrome (see below)
  - 3. Other
    - a) Congenital rubella
    - b) Ehlers-Danlos syndrome
    - c) Noonan syndrome (see above)
    - d) LEOPARD syndrome (see above)
- C. Pulmonary valve atresia (intact ventricular septum)
  - 1. Ring 9 chromosome abnormality

II. Aortic outflow obstruction
- A. Aortic valve stenosis
  - 1. Chromosome abnormalities
    - a) Deletion of chromosome 11q (Jacobsen syndrome)
    - b) Autosomal trisomies (13, 18)
    - c) Deletion of 10q
    - d) Duplications of 1q, 2p, 2q, 6q, 11q
  - 2. Noonan syndrome (see above)
  - 3. Turner syndrome (see below)
- B. Supravalvular aortic stenosis
  - 1. Williams-Beuren syndrome
    - a) Autosomal dominant
    - b) Most cases result from de novo mutation
    - c) Noncardiac phenotype features
      - (1) Characteristic elfin facies
      - (2) Loquacious personality
      - (3) Hypercalcemia
      - (4) Developmental delay/cognitive defects
      - (5) Connective tissue abnormalities
      - (6) Renal anomalies
      - (7) Thyroid disorder
    - d) Genetic testing clinically available:
      - (1) Microdeletion in chromosome 7q11 (elastin gene) detectable by FISH (>95% of cases)
    - e) Rare translocations involving 7q11 locus
  - 2. Isolated supravalvular aortic stenosis, Eisenberg type
    - a) Distinct entity from Williams syndrome
    - b) Abnormal facies and mental retardation absent
    - c) Elastin gene mutations
- C. Coarctation of the aorta
  - 1. Turner syndrome
    - a) Noncardiac phenotype features
      - (1) Female
      - (2) Unusual chest shape
      - (3) Widely spaced nipples
      - (4) Webbed neck
      - (5) Lymphedema
      - (6) Short stature
      - (7) Streak ovaries

Appendix 2. Continued

- b) Karyotype is diagnostic: 45,X or mosaics (45,X/46,XX)
- 2. Other chromosomal abnormalities
  - a) Deletion of 18p
  - b) Duplications of 4p, 4q, 6q, 10p
  - c) Autosomal trisomies 8, 9
- 3. Familial aggregation of left-sided obstructive heart defects
  - a) Frequent occurrence in first-degree relatives (9.4%)

D. Aortic atresia/hypoplastic left heart syndrome

- 1. Chromosomal anomalies
  - a) Deletion of 11q (Jacobsen syndrome)
  - b) Turner syndrome
  - c) Trisomy 13, 18
  - d) Deletion of 4p (Wolf-Hirschhorn)
- 2. Familial aggregation of left-sided obstructive heart defects
  - a) Frequent association with bicuspid aortic valve in a parent (5%)
  - b) Sibling recurrence risk (2% to 9%)
  - c) Proposed inheritance patterns
    - (1) Multifactorial
    - (2) Autosomal dominant with reduced penetrance
    - (3) Autosomal recessive

E. Bicuspid aortic valve

- 1. Very common cardiac anomaly (incidence 0.9% to 1.36% in population)
- 2. Association with familial aggregation of left-sided obstructive heart defects
  - a) Frequent finding of bicuspid aortic valve in parents of children with other left-sided obstructive anomalies
  - b) Frequent association of cardiac anomalies in first-degree relatives (19.3%)
- 3. Familial bicuspid aortic valve
  - a) Autosomal dominant with reduced penetrance
  - b) Prevalence 24% in first-degree relatives
- 4. Turner syndrome (see above)
- 5. Chromosomal anomalies
  - a) Autosomal trisomies 13, 18
  - b) Deletion 10p
  - c) Duplication 6q

III. Laterality defects (heterotaxy, asplenia/polysplenia)

A. Phenotype

- 1. Asplenia syndrome (also known as right atrial isomerism)
  - a) Cardiac defects
    - (1) Right atrial isomerism
    - (2) Complex conotruncal defects
    - (3) AVSD
    - (4) Anomalous location of inferior vena cava (on same side as abdominal aorta)
  - b) Pattern of visceral organs
    - (1) Asplenia: 99% of patients, more severe than polysplenia
    - (2) Bilateral “right-sidedness”
    - (3) Symmetrical liver
    - (4) Gastrointestinal malrotation
    - (5) Right-sided stomach
    - (6) Genitourinary, bronchopulmonary, axial skeletal, and central nervous system abnormalities
- 2. Polysplenia syndrome (also known as left atrial isomerism)
  - a) Cardiac defects
    - (1) Left atrial isomerism
    - (2) Septal defects
    - (3) Interrupted inferior vena cava
    - (4) Bilateral superior vena cavae
    - (5) Partial anomalous pulmonary venous return
  - b) Pattern of visceral organs
    - (1) Polysplenia: 90% of patients
    - (2) Bilateral “left-sidedness”
    - (3) Symmetrical or inverted (larger lobe on left) liver
    - (4) Gastrointestinal malrotation
    - (5) Two or more spleens, can be functionally asplenic
    - (6) Extrahepatic biliary atresia
    - (7) Genitourinary, bronchopulmonary, axial skeletal, and central nervous system abnormalities

B. Genotype

- 1. No well-described genetic syndromes with clinical testing available
- 2. Reported chromosomal abnormalities
  - a) Autosomal
    - (1) Chromosome 2 (*CFC1* gene encoding CRYPTIC protein)
    - (2) Chromosome locus 6q (*HTX3* gene)
  - b) X-linked: locus Xq26.2 (*ZIC3* gene)

IV. Atrial septal abnormalities

A. Secundum ASD

- 1. Holt-Oram syndrome
  - a) Autosomal dominant
  - b) Variable expression
  - c) Also associated with VSD, variable other defects
  - d) Noncardiac phenotype features
    - (1) No sex predilection
    - (2) Variable preaxial limb defects
    - (3) Absent, hypoplastic, or triphalangeal thumbs
  - e) Mutations of *TBX5* gene on 12q24.1
- 2. Familial ASD and progressive atrioventricular block
  - a) Autosomal dominant
  - b) No demographics known
  - c) Variable onset of conduction abnormality
  - d) Other cardiac anomalies can include VSD, tetralogy of Fallot, and others
  - e) No noncardiac features reported
  - f) Mutations or haploinsufficiency of *NKX2.5* gene on chromosome 5
- 3. Familial ASD without progressive atrioventricular block
  - a) Other cardiac anomalies can include VSD or pulmonary stenosis
    - (1) *GATA 4* mutations
- 4. Ellis-van Creveld syndrome
  - a) Autosomal recessive
  - b) Often single atrium
  - c) Noncardiac features
    - (1) Male or female
    - (2) Polydactyly
    - (3) Deformity of upper lip
    - (4) Dwarfism with narrow thorax

Appendix 2. Continued

(5) Mutations have been described in Ellis-van Creveld gene at 4p16.1
5. Noonan syndrome (see above)
6. Other chromosomal abnormalities
a) Deletions of 1, 4, 4p, 5p, 6, 10p, 11, 13, 17, 18, and 22
b) Trisomy 18, 21
c) Klinefelter syndrome
7. Other syndromes
a) Rubinstein-Taybi syndrome
b) Kabuki syndrome
c) Williams syndrome
d) Goldenhar syndrome
e) Thrombocytopenia–absent radius syndrome
f) Marfan syndrome (rare)

B. Single atrium (see Ellis-van Creveld syndrome)
C. Ostium primum ASD (see atrioventricular septal abnormalities)

V. Ventricular septal abnormalities
A. VSD
1. Holt-Oram syndrome (see under ASD)
2. Familial ASD and progressive atrioventricular block (see ASD)
3. Familial ASD without progressive atrioventricular block
a) Other cardiac anomalies can include VSD or pulmonary stenosis
b) *GATA 4* mutation
4. Chromosome abnormalities
a) Deletions of many chromosomes
b) Duplications of many chromosomes
c) Autosomal trisomies 13, 18, and 21
5. Other syndromes
a) Rubinstein-Taybi syndrome
b) Goldenhar syndrome
c) VACTERL association
d) Costello syndrome
e) Williams syndrome (see above)
f) Kabuki syndrome
g) Cornelia de Lange syndrome
h) Apert syndrome
i) Carpenter syndrome

VI. Atrioventricular septal abnormalities
A. AVSD, partial and complete
1. Autosomal trisomies
a) Down syndrome
(1) 60% of infants with AVSD have Down syndrome
b) Occurs also in trisomy 13 and 18
2. Other chromosome abnormalities
a) Deletions of 3p25, 8p2, 22q
b) Duplications of 10q, 11q, 22q
3. Isolated AVSD
a) Autosomal dominant AVSD
(1) Partial and complete
(2) Gene locus mapped to 1p21p31
4. Other syndromes
a) Holt-Oram syndrome (see above)
b) Noonan syndrome (see above)
c) Chondrodysplasias
d) Smith-Lemli-Opitz syndrome
e) Ellis-van Creveld syndrome (see above)
f) Hydrolethalus

VII. Patent ductus arteriosus
A. Familial patent ductus arteriosus
1. Char syndrome
a) Autosomal dominant
b) Noncardiac phenotypic features
(1) Characteristic facies
(2) Aplasia/hypoplasia of middle phalanges of fifth fingers
c) Variable expression
d) Mutations of *TFAP2B*

VIII. Conotruncal defects
A. Tetralogy of Fallot (51 entries in OMIM)
1. 22q11 deletion syndrome
a) Clinical features of DiGeorge/velocardiofacial/conotruncal anomaly face syndromes
b) Associated with a chromosome 22q11 deletion
c) Familial inheritance approximately 6% to 28%, autosomal dominant
d) Most are de novo deletions of 22q11
e) Highly variable clinical presentation
f) Most common noncardiac defects include
(1) Hypocalcemia
(2) Hypoplastic/aplastic thymus
(3) Immune deficiency
(4) Palate anomalies, including velopharyngeal insufficiency
(5) Feeding disorders
(6) Speech disabilities
(7) Learning disabilities
(8) Behavioral/psychiatric disorders
(9) Facial dysmorphia
g) Genetic testing available
(1) FISH for deletion 22q11
(2) Chromosome analysis for translocation or other 22q rearrangement
2. Alagille syndrome (see pulmonary artery branch stenosis)
3. Cat-eye syndrome
a) Associated with duplication of chromosomal region 22pter22q11
b) Most arise de novo
c) Highly variable clinical presentation
d) Most common noncardiac anomalies include
(1) Anal atresia
(2) Coloboma
(3) Microphthalmia
(4) Cleft palate
(5) Renal anomalies
(6) Facial dysmorphia, particularly misshapen ears
e) Genetic testing available
(1) FISH for extra marker 22 chromosome
4. Nearly 50 other syndromes in which tetralogy of Fallot is diagnosed (for details, search OMIM for tetralogy of Fallot)
a) Chromosomal abnormalities

Appendix 2. Continued

(1) Deletions of many chromosomes
(2) Duplications of many chromosomes
B. Truncus arteriosus/interruption of the aortic arch
1. 22q11 deletion syndrome (see above)
2. Trisomy 8
3. Deletion 10p
C. Transposition of the great arteries (D-TGA, L-TGA)
1. Chromosome abnormalities
a) Trisomy 18, 21
b) 22q11 deletion syndrome (very rarely)
c) Many other partial deletions of different chromosomes
D. Double-outlet right ventricle
1. Chromosome abnormalities
a) Autosomal trisomies 9, 13, 18
b) Duplication 2p, 12p
c) 22q11 deletion syndrome (very rarely)
IX. Tricuspid atresia
A. Most cases are sporadic
B. Familial occurrences reported but rare
1. In siblings
2. In association with a conotruncal malformation or annular hypoplasia in family members
C. Chromosome abnormalities reported but rare
1. Deletions: 22q11, 4p (Wolf-Hirsch3horn syndrome)
2. Duplications: partial duplication 22 (Cat-eye syndrome)
D. Targeted mutation of gene encoding Fog-2 in mice resulted in tricuspid atresia, thereby suggesting a genetic basis for the disease
X. Ebstein anomaly
A. Most cases are sporadic
B. Familial occurrences reported but rare
1. In siblings and other family members
2. In association with other mitral valve abnormalities in family members
3. In association with familial atrial standstill
C. Chromosome abnormalities reported but rare
1. Trisomy 21
2. Rearrangements of chromosome 11q in association with renal malformation and Pierre Robin sequence
D. Animal studies implicate several possible candidate genes on chromosome 17q
XI. Total anomalous pulmonary venous return
A. Most cases are sporadic
B. Familial occurrences reported
1. In siblings, twins, parents/children, first cousins
2. Chromosome 4p13-q12, autosomal dominant, variable expressivity, reduced penetrance in large Utah-Idaho family
3. Familial scimitar syndrome
C. Trisomy 8

LEOPARD syndrome indicates syndrome consisting of cardinal features of multiple lentigines, electrocardiographic conduction abnormalities, ocular hypertelorism, pulmonic stenosis, abnormal genitalia, retardation of growth, and sensorineural deafness; AVSD, atrioventricular septal defect; ASD, atrial septal defect; OMIM, Online Mendelian Inheritance in Man; and TGA, transposition of the great atries.

Clinical testing is not yet available for many of the syndromes listed in this appendix.

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American Medical Association ethical opinion

E-8.061 Gifts to Physicians from Industry

Many gifts given to physicians by companies in the pharmaceutical, device, and medical equipment industries serve an important and socially beneficial function. For example, companies have long provided funds for educational seminars and conferences. However, there has been growing concern about certain gifts from industry to physicians. Some gifts that reflect customary practices of industry may not be consistent with the Principles of Medical Ethics. To avoid the acceptance of inappropriate gifts, physicians should observe the following guidelines:

(1) Any gifts accepted by physicians individually should primarily entail a benefit to patients and should not be of substantial value. Accordingly, textbooks, modest meals, and other gifts are appropriate if they serve a genuine educational function. Cash payments should not be accepted. The use of drug samples for personal or family use is permissible as long as these practices do not interfere with patient access to drug samples. It would not be acceptable for non-retired physicians to request free pharmaceuticals for personal use or use by family members.

(2) Individual gifts of minimal value are permissible as long as the gifts are related to the physicianôs work (eg, pens and notepads).

(3) The Council on Ethical and Judicial Affairs defines a legitimate "conference" or "meeting" as any activity, held at an appropriate location, where (a) the gathering is primarily dedicated, in both time and effort, to promoting objective scientific and educational activities and discourse (one or more educational presentation(s) should be the highlight of the gathering), and (b) the main incentive for bringing attendees together is to further their knowledge on the topic(s) being presented. An appropriate disclosure of financial support or conflict of interest should be made.

(4) Subsidies to underwrite the costs of continuing medical education conferences or professional meetings can contribute to the improvement of patient care and therefore are permissible. Since the giving of a subsidy directly to a physician by a companyôs representative may create a relationship that could influence the use of the companyôs products, any subsidy should be accepted by the conferenceôs sponsor who in turn can use the money to reduce the conferenceôs registration fee. Payments to defray the costs of a conference should not be accepted directly from the company by the physicians attending the conference.

(5) Subsidies from industry should not be accepted directly or indirectly to pay for the costs of travel, lodging, or other personal expenses of physicians attending conferences or meetings, nor should subsidies be accepted to compensate for the physiciansô time. Subsidies for hospitality should not be accepted outside of modest meals or social events held as a part of a conference or meeting. It is appropriate for faculty at conferences or meetings to accept reasonable honoraria and to accept reimbursement for reasonable travel, lodging, and meal expenses. It is also

appropriate for consultants who provide genuine services to receive reasonable compensation and to accept reimbursement for reasonable travel, lodging, and meal expenses. Token consulting or advisory arrangements cannot be used to justify the compensation of physicians for their time or their travel, lodging, and other out-of-pocket expenses.

(6) Scholarship or other special funds to permit medical students, residents, and fellows to attend carefully selected educational conferences may be permissible as long as the selection of students, residents, or fellows who will receive the funds is made by the academic or training institution. Carefully selected educational conferences are generally defined as the major educational, scientific or policy-making meetings of national, regional, or specialty medical associations.

(7) No gifts should be accepted if there are strings attached. For example, physicians should not accept gifts if they are given in relation to the physicianôs prescribing practices. In addition, when companies underwrite medical conferences or lectures other than their own, responsibility for and control over the selection of content, faculty, educational methods, and materials should belong to the organizers of the conferences or lectures. (II)

Issued June 1992 based on the report "Gifts to Physicians from Industry," adopted December 1990 (JAMA. 1991; 265: 501); Updated June 1996 and June 1998.

Clarification of Opinion 8.061

Scope Opinion 8.061, ñGifts to Physicians from Industry,ò is intended to provide ethical guidance to physicians. Other parties involved in the health care sector, including the pharmaceutical, devices, and medical equipment industries and related entities or business partners, should view the guidelines as indicative of standards of conduct for the medical profession. Ultimately, it is the responsibility of individual physicians to minimize conflicts of interest that may be at odds with the best interest of patients and to access the necessary information to inform medical recommendations.

The guidelines apply to all forms of gifts, whether they are offered in person, through intermediaries, or through the Internet. Similarly, limitations on subsidies for educational activities should apply regardless of the setting in which, or the medium through which, the educational activity is offered.

General Questions (a) Do the guidelines apply only to pharmaceutical, device, and equipment manufacturers?

"Industry" includes all "proprietary health-related entities that might create a conflict of interest."

Guideline 1 Any gifts accepted by physicians individually should primarily entail a benefit to patients and should not be of substantial value. Accordingly, textbooks, modest meals, and other gifts are appropriate if they serve a genuine educational function. Cash payments should not be accepted. The use of drug samples for personal or family use is permissible as long as these practices do not interfere with patient access to drug samples. It would not be acceptable for non-retired physicians to request free pharmaceuticals for personal use or for use by family members.

(a) May physicians accept gram stain test kits, stethoscopes, or other diagnostic equipment?

Diagnostic equipment primarily benefits the patient. Hence, such gifts are permissible as long as they are not of substantial value. In considering the value of the gift, the relevant measure is not the cost to the company of providing the gift. Rather, the relevant measure is the cost to the physician if the physician purchased the gift on the open market.

(b) May companies invite physicians to a dinner with a speaker and donate $100 to a charity or medical school on behalf of the physician?

There are positive aspects to the proposal. The donations would be used for a worthy cause, and the physicians would receive important information about patient care. There is a direct personal benefit to the physician as well, however. An organization that is important to the physician-and one that the physician might have ordinarily felt obligated to make a contribution to-receives financial support as a result of the physicianôs decision to attend the meeting. On balance, physicians should make their own judgment about these inducements. If the charity is predetermined without the physicianôs input, there would seem to be little problem with the arrangement.

(c) May contributions to a professional societyôs general fund be accepted from industry?

The guidelines are designed to deal with gifts from industry which affect, or could appear to affect, the judgment of individual practicing physicians. In general, a professional society should make its own judgment about gifts from industry to the society itself.

(d) When companies invite physicians to a dinner with a speaker, what are the relevant guidelines?

First, the dinner must be a modest meal. Second, the guideline does allow gifts that primarily benefit patients and that are not of substantial value. Accordingly, textbooks and other gifts that primarily benefit patient care and that have a value to the physician in the general range of $100 are permissible. When educational meetings occur in conjunction with a social event such as a meal, the educational component must have independent value, such as a presentation by an authoritative speaker other than a sales representative of the company. Also, the meal should be a

modest one similar to what a physician routinely might have when dining at his or her own expense. In an office or hospital encounter with a company representative, it is permissible to accept a meal of nominal value, such as a sandwich or snack.

(e) May physicians accept vouchers that reimburse them for uncompensated care they have provided?

No. Such a voucher would result directly in increased income for the physician.

(f) May physicians accumulate "points" by attending several educational or promotional meetings and then choose a gift from a catalogue of education options?

This guideline permits gifts only if they are not of substantial value. If accumulation of points would result in physicians receiving a substantial gift by combining insubstantial gifts over a relatively short period of time, it would be inappropriate.

(g) May physicians accept gift certificates for educational materials when attending promotional or educational events?

The Council views gift certificates as a grey area which is not per se prohibited by the guidelines. Medical textbooks are explicitly approved as gifts under the guidelines. A gift certificate for educational materials, ie, for the selection by the physician from an exclusively medical textbook catalogue, would not seem to be materially different. The issue is whether the gift certificate gives the recipient such control as to make the certificate similar to cash. As with charitable donations, preselection by the sponsor removes any question. It is up to the individual physician to make the final judgment.

(h) May physicians accept drug samples or other free pharmaceuticals for personal use or use by family members?

The Councilôs guidelines permit personal or family use of free pharmaceuticals (i) in emergencies and other cases where the immediate use of a drug is indicated, (ii) on a trial basis to assess tolerance, and (iii) for the treatment of acute conditions requiring short courses of inexpensive therapy, as permitted by Opinion 8.19, "Self-Treatment or Treatment of Immediate Family Members." It would not be acceptable for physicians to accept free pharmaceuticals for the long-term treatment of chronic conditions.

(i) May companies invite physicians to a dinner with a speaker and offer them a large number of gifts from which to choose one?

In general, the greater the freedom of choice given to the physician, the more the offer seems like cash. A large number of gifts presented to physicians who attend a dinner would therefore be inappropriate.

There is no precise way of deciding an appropriate upper limit on the amount of choice that is acceptable. However, it is important that a specific limit be chosen to ensure clarity in the guidelines. A limit of eight has been chosen because it permits flexibility but prevents undue freedom of choice. Each of the choices must have a value to the physicians of no more than $100.

(j) May physicians charge for their time with industry representatives or otherwise receive material compensation for participation in a detail visit?

Guideline 1 states that gifts in the form of cash payments should not be accepted. Also, Guideline 6 makes clear that, in the context of the industry-physician relationship, only physicians who provide genuine services may receive reasonable compensation. When considering the time a physician spends with an industry representative, it is the representative who offers a service, namely the presentation of information. The physician is a beneficiary of the service. Overall, these guidelines do not view that physicians should be compensated for the time spent participating in educational activities, nor for time spent receiving detail information from an industry representative.

Guideline 2 Individual gifts of minimal value are permissible as long as the gifts are related to the physicianôs work (eg, pens and notepads).

(a) May physicians, individually or through their practice group, accept electronic equipment, such as hand held devices or computers, intended to facilitate their ability to receive detail information electronically?

Although Guideline 2 recognizes that gifts related to a physicianôs practice may be appropriate, it also makes clear that these gifts must remain of minimal value. It is not appropriate for physicians to accept expensive hardware or software equipment even though one purpose only may pertain to industry-related activities of a modest value.

Guideline 3 The Council on Ethical and Judicial Affairs defines a legitimate "conference" or "meeting" as any activity, held at an appropriate location, where (a) the gathering is primarily dedicated, in both time and effort, to promoting objective scientific and educational activities and discourse (one or more educational presentation(s) should be the highlight of the gathering), and (b) the main incentive for bringing attendees together is to further their knowledge on the topic(s) being presented. An appropriate disclosure of financial support or conflict of interest should be made.

Guideline 4 Subsidies to underwrite the costs of continuing medical education conferences or professional meetings can contribute to the improvement of patient care and therefore are permissible. Since the giving of a subsidy directly to a physician by a companyôs sales representative may create a relationship which could influence the use of the companyôs products, any subsidy should be accepted by the conferenceôs sponsor who in turn can use the money to reduce the conferenceôs registration fee. Payments to defray the costs of a conference should not be accepted directly from the company by the physicians attending the conference.

(a) Are conference subsidies from the educational division of a company covered by the guidelines?

Yes. When the Council says "any subsidy," it would not matter whether the subsidy comes from the sales division, the educational division, or some other section of the company.

(b) May a company or its intermediary send physicians a check or voucher to offset the registration fee at a specific conference or a conference of the physicianôs choice?

Physicians should not directly accept checks or certificates which would be used to offset registration fees. The gift of a reduced registration should be made across the board and through the accredited sponsor.

Guideline 5 Subsidies from industry should not be accepted directly or indirectly to pay for the costs of travel, lodging, or other personal expenses of physicians attending conferences or meetings, nor should subsidies be accepted to compensate for the physiciansô time. Subsidies for hospitality should not be accepted outside of modest meals or social events held as a part of a conference or meeting. It is appropriate for faculty at conferences or meetings to accept reasonable honoraria and to accept reimbursement for reasonable travel, lodging, and meal expenses. It is also appropriate for consultants who provide genuine services to receive reasonable compensation and to accept reimbursement for reasonable travel, lodging, and meal expenses. Token consulting or advisory arrangements cannot be used to justify the compensation of physicians for their time or their travel, lodging, and other out-of-pocket expenses.

(a) If a company invites physicians to visit its facilities for a tour or to become educated about one of its products, may the company pay travel expenses and honoraria?

This question has come up in the context of a rehabilitation facility that wants physicians to know of its existence so that they may refer their patients to the facility. It has also come up in the context of surgical device or equipment manufacturers who want physicians to become familiar with their products.

In general, travel expenses should not be reimbursed, nor should honoraria be paid for the visiting physicianôs time since the presentations are analogous to a pharmaceutical companyôs educational or promotional meetings. The Council recognizes that medical devices, equipment, and other technologies may require, in some circumstances, special evaluation or training in proper usage which can not practicably be provided except on site. Medical specialties are in a better position to advise physicians regarding the appropriateness of reimbursement with regard to these trips. In cases where the company insists on such visits as a means of protection from liability for improper usage, physicians and their specialties should make the judgment. In no case would honoraria be appropriate and any travel expenses should be only those strictly necessary.

(b) If the company invites physicians to visit its facilities for review and comment on a product, to discuss their independent research projects, or to explore the potential for collaborative research, may the company pay travel expenses and an honorarium?

If the physician is providing genuine services, reasonable compensation for time and travel expenses can be given. However, token advisory or consulting arrangements cannot be used to justify compensation.

(c) May a company hold a sweepstakes for physicians in which five entrants receive a trip to the Virgin Islands or airfare to the medical meeting of their choice?

No. The use of a sweepstakes or raffle to deliver a gift does not affect the permissibility of the gift. Since the sweepstakes is not open to the public, the guidelines apply in full force.

(d) If a company convenes a group of physicians to recruit clinical investigators or convenes a group of clinical investigators for a meeting to discuss their results, may the company pay for their travel expenses?

Expenses may be paid if the meetings serve a genuine research purpose. One guide to their propriety would be whether the National Institute of Health (NIH) conducts similar meetings when it sponsors multi-center clinical trials. When travel subsidies are acceptable, the guidelines emphasize that they be used to pay only for "reasonable" expenses. The reasonableness of expenses would depend on a number of considerations. For example, meetings are likely to be problematic if overseas locations are used for exclusively domestic investigators. It would be inappropriate to pay for recreation or entertainment beyond the kind of modest hospitality described in this guideline.

(e) How can a physician tell whether there is a "genuine research purpose?"

A number of factors can be considered. Signs that a genuine research purpose exists include the facts that there are (1) a valid study protocol, (2) recruitment of physicians with appropriate

qualifications or expertise, and (3) recruitment of an appropriate number of physicians in light of the number of study participants needed for statistical evaluation.

(f) May a company compensate physicians for their time and travel expenses when they participate in focus groups?

Yes. As long as the focus groups serve a genuine and exclusive research purpose and are not used for promotional purposes, physicians may be compensated for time and travel expenses. The number of physicians used in a particular focus group or in multiple focus groups should be an appropriate size to accomplish the research purpose, but no larger.

(g) Do the restrictions on travel, lodging, and meals apply to educational programs run by medical schools, professional societies, or other accredited organizations which are funded by industry, or do they apply only to programs developed and run by industry?

The restrictions apply to all conferences or meetings which are funded by industry. The Council drew no distinction on the basis of the organizer of the conference or meeting. The Council felt that the gift of travel expenses is too substantial even when the conference is run by a non-industry sponsor. (Industry includes all "proprietary health-related entities that might create a conflict of interest.")

(h) May company funds be used for travel expenses and honoraria for bona fide faculty at educational meetings?

This guideline draws a distinction between attendees and faculty. As was stated, "[i]t is appropriate for faculty at conferences or meetings to accept reasonable honoraria and to accept reimbursement for reasonable travel, lodging, and meal expenses."

Companies need to be mindful of the guidelines of the Accreditation Council on Continuing Medical Education. According to those guidelines, "[f]unds from a commercial source should be in the form of an educational grant made payable to the CME sponsor for the support of programming."

(i) May travel expenses be reimbursed for physicians presenting a poster or a "free paper" at a scientific conference?

Reimbursement may be accepted only by bona fide faculty. The presentation of a poster or a free paper does not by itself qualify a person as a member of the conference faculty for purposes of these guidelines.

(j) When a professional association schedules a long-range planning meeting, is it appropriate for industry to subsidize the travel expenses of the meeting participants?

The guidelines are designed to deal with gifts from industry which affect, or could appear to affect, the judgment of individual practicing physicians. In general, a professional society should make its own judgment about gifts from industry to the society itself.

(k) May continuing medical education conferences be held in the Bahamas, Europe, or South America?

There are no restrictions on the location of conferences as long as the attendees are paying their own travel expenses.

(l) May travel expenses be accepted by physicians who are being trained as speakers or faculty for educational conferences and meetings?

In general, no. If a physician is presenting as an independent expert at a CME event, both the training and its reimbursement raise questions about independence. In addition, the training is a gift because the physicianôs role is generally more analogous to that of an attendee than a participant. Speaker training sessions can be distinguished from meetings (See 5d) with leading researchers, sponsored by a company, designed primarily for an exchange of information about important developments or treatments, including the sponsorôs own research, for which reimbursement for travel may be appropriate.

(m) What kinds of social events during conferences and meetings may be subsidized by industry?

Social events should satisfy three criteria. First, the value of the event to the physician should be modest. Second, the event should facilitate discussion among attendees and/or discussion between attendees and faculty. Third, the educational part of the conference should account for a substantial majority of the total time accounted for by the educational activities and social events together. Events that would be viewed (as in the succeeding question) as lavish or expensive should be avoided. But modest social activities that are not elaborate or unusual are permissible, eg, inexpensive boat rides, barbecues, entertainment that draws on the local performers. In general, any such events which are a part of the conference program should be open to all registrants.

(n) May a company rent an expensive entertainment complex for a evening during a medical conference and invite the physicians attending the conference?

No. The guidelines permit only modest hospitality.

(o) If physicians attending a conference engage in interactive exchange, may their travel expenses be paid by industry?

No. Mere interactive exchange would not constitute genuine consulting services.

(p) If a company schedules a conference and provides meals for the attendees that fall within the guidelines, may the company also pay for the costs of the meals for spouses?

If a meal falls within the guidelines, then the physicianôs spouse may be included.

(q) May companies donate funds to sponsor a professional societyôs charity golf tournament?

Yes. But it is sensible if physicians who play in the tournament make some contribution themselves to the event.

(r) If a company invites a group of consultants to a meeting and a consultant brings a spouse, may the company pay the costs of lodging or meals of the spouse? Does it matter if the meal is part of the program for the consultants?

Since the costs of having a spouse share a hotel room or join a modest meal are nominal, it is permissible for the company to subsidize those costs. However, if the total subsidies become substantial, then they become unacceptable.

Guideline 6 Scholarship or other special funds to permit medical students, residents, and fellows to attend carefully selected educational conferences may be permissible as long as the selection of students, residents, or fellows who will receive the funds is made by the academic or training institution. Carefully selected educational conferences are generally defined as the major educational, scientific, or policy-making meetings of national, regional, or specialty medical associations.

(a) When a company subsidizes the travel expenses of residents to an appropriately selected conference, may the residents receive the subsidy directly from the company?

Funds for scholarships or other special funds should be given to the academic departments or the accredited sponsor of the conference. The disbursement of funds can then be made by the departments or the conference sponsor.

(b) What is meant by "carefully selected educational conferences?"

The intent of Guideline 6 is to ensure that financial hardship does not prevent students, residents, and fellows from attending major educational conferences. For example, we did not want to deny cardiology fellows the opportunity to attend the annual scientific meeting of the American College of Cardiology or orthopedic surgery residents the opportunity to attend the annual scientific meeting of the American Academy of Orthopedic Surgeons. However, it was not the

intent of the guideline to permit reimbursement of travel expenses in other circumstances, such as when conferences or symposia are designed specifically for students, residents, or fellows.

Funds are limited to travel and lodging expenses for attendance at major educational, scientific, or policy-making meetings of national, regional, or specialty medical associations.

Guideline 7 No gifts should be accepted if there are strings attached. For example, physicians should not accept gifts if they are given in relation to the physicianôs prescribing practices. In addition, when companies underwrite medical conferences or lectures other than their own, responsibility for and control over the selection of content, faculty, educational methods, and materials should belong to the organizers of the conferences or lectures.

(a) May companies send their top prescribers, purchasers, or referrers on cruises?

No. There can be no link between prescribing or referring patterns and gifts. In addition, travel expenses, including cruises, are not permissible.

(b) May the funding company itself develop the complete educational program that is sponsored by an accredited continuing medical education sponsor?

No. The funding company may finance the development of the program through its grant to the sponsor, but the accredited sponsor must have responsibility and control over the content and faculty of conferences, meetings, or lectures. Neither the funding company nor an independent consulting firm should develop the complete educational program for approval by the accredited sponsor.

(c) How much input may a funding company have in the development of a conference, meeting, or lectures?

The guidelines of the Accreditation Council on Continuing Medical Education on commercial support of continuing medical education address this question.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Global Climate Change and Children's Health

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Environmental Health

ABSTRACT

There is broad scientific consensus that Earth's climate is warming rapidly and at an accelerating rate. Human activities, primarily the burning of fossil fuels, are very likely (>90% probability) to be the main cause of this warming. Climate-sensitive changes in ecosystems are already being observed, and fundamental, potentially irreversible, ecological changes may occur in the coming decades. Conservative environmental estimates of the impact of climate changes that are already in process indicate that they will result in numerous health effects to children. The nature and extent of these changes will be greatly affected by actions taken or not taken now at the global level.

Physicians have written on the projected effects of climate change on public health, but little has been written specifically on anticipated effects of climate change on children's health. Children represent a particularly vulnerable group that is likely to suffer disproportionately from both direct and indirect adverse health effects of climate change. Pediatric health care professionals should understand these threats, anticipate their effects on children's health, and participate as children's advocates for strong mitigation and adaptation strategies now. Any solutions that address climate change must be developed within the context of overall sustainability (the use of resources by the current generation to meet current needs while ensuring that future generations will be able to meet their needs). Pediatric health care professionals can be leaders in a move away from a traditional focus on disease prevention to a broad, integrated focus on sustainability as synonymous with health.

This policy statement is supported by a technical report that examines in some depth the nature of the problem of climate change, likely effects on children's health as a result of climate change, and the critical importance of responding promptly and aggressively to reduce activities that are contributing to this change.

BACKGROUND

"Warming of the climate system is unequivocal."[1] According to the National Climatic Data Center, all records indicate that during the past century, global surface temperatures have increased at a rate near 0.6°C per century (1.1°F per century); this trend has been 3 times larger since 1976.[2] Human activity, particularly the burning of fossil fuels, has very likely (>90% probability) driven this rise by greatly increasing atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases (GHGs).[1]

There is strong consensus among expert scientists that Earth is undergoing rapid, global climate change,[1,3] although there remains uncertainty about how rapidly and extensively the climate will change in the future. Overall scientific predictions agree, however, that temperatures and sea level will continue to rise

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climate change, global warming, child, pediatric, health, sustainable development

Abbreviation
GHG— greenhouse gas

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throughout the 21st century.[1,4] Even if GHG emissions were abruptly reduced to zero, the planet would continue to warm for decades until the energy stored in the system equilibrates.[5] The possibility of reaching a tipping point at which abrupt, large, and irreversible change could be superimposed on current trends adds both urgency and further ambiguity to the situation.[6] Current human activities are accelerating these changes, and future human activities will affect their trajectories; the window of opportunity for successful mitigation, therefore, may be very short.[7] Actions made in the coming decade will have a profound effect on global health and, in particular, on children's health.

DIRECT EFFECTS OF CLIMATE CHANGE ON CHILDREN'S HEALTH

Because of their physical, physiologic, and cognitive immaturity, children are often most vulnerable to adverse health effects from environmental hazards.[8] As the climate changes, environmental hazards may shift and possibly increase (Fig 1), and children are likely to suffer disproportionately from these changes.[9] Anticipated direct health consequences of climate change include injury and death from extreme weather events and natural disasters, increases in climate-sensitive infectious diseases, increases in air pollution–related illness, and more heat-related, potentially fatal, illness. Within all of these categories, children have increased vulnerability compared with other groups (see the accompanying technical report[10]).

INDIRECT EFFECTS OF CLIMATE CHANGE AND IMPLICATIONS FOR FUTURE GENERATIONS

Additional effects of climate change, with profound implications for the health and welfare of future generations of children, are anticipated. Food availability could be reduced as land and ocean food productivity patterns shift and species diversity declines.[11] Water availability will change and become too abundant in some regions (flooding) and much reduced in others (drought).[12] Coastal populations will be forced to move because of the rising sea level. Large-scale, forced migrations are conceivable, driven by abrupt climate change, natural disaster, or political instability over resource availability.[13]

The speed with which global GHG emissions can be reduced will have a significant effect on the rate and degree of warming, but even the most optimistic scenarios describe continued warming into the next century.[1,5] As climate change progresses, social and political institutions must respond with aggressive mitigation and flexible adaptation strategies to preserve and protect public health, particularly for children.

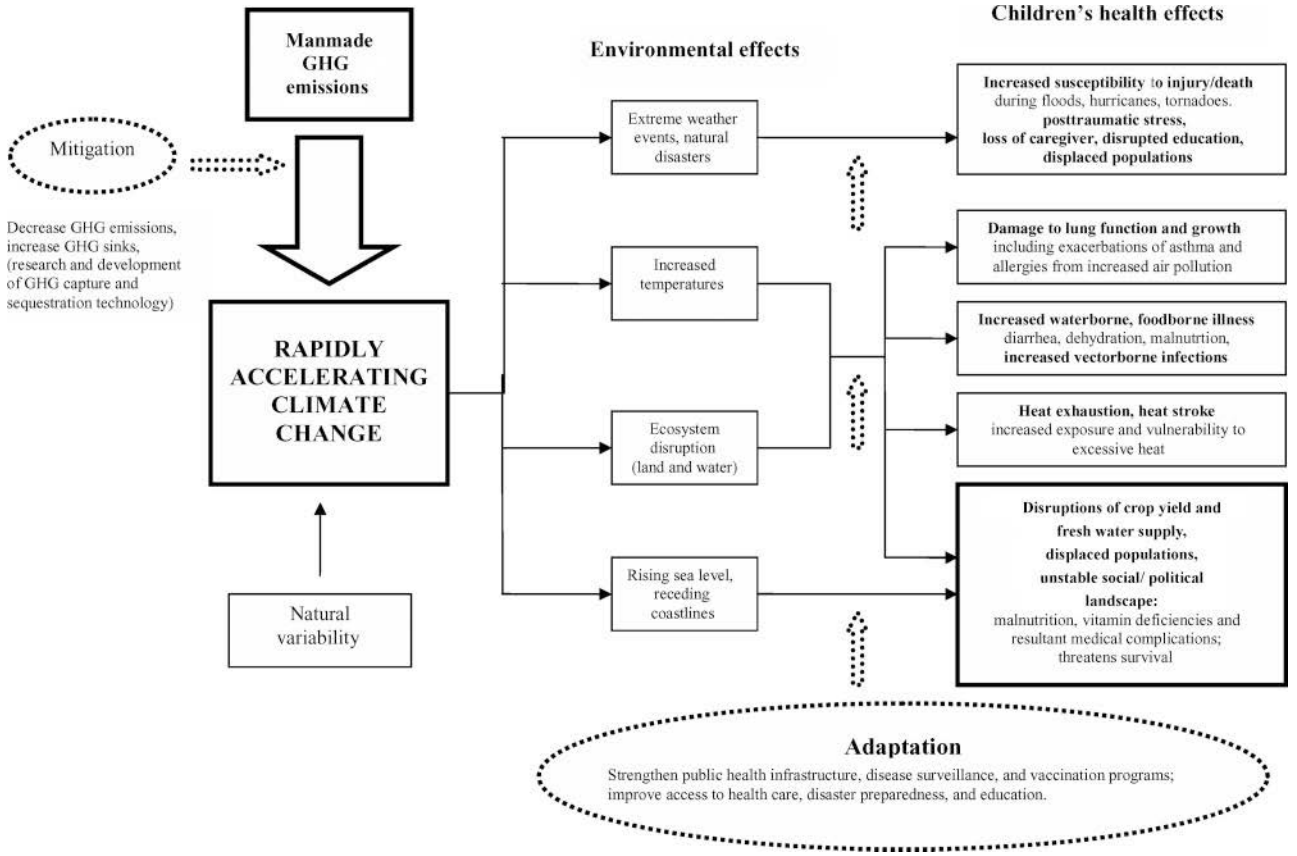

FIGURE 1
Potential effects of global climate change on child health. (Adapted from McMichael et al[18] and Haines and Patz[19].)

MITIGATION AND ADAPTATION STRATEGIES

Strategies to address the effects of climate change (mitigation and adaptation) are concepts that focus on both primary and secondary prevention strategies in pediatric health care (Fig 1). Mitigation (primary prevention) involves reducing GHG concentrations in the atmosphere with the goal of reducing climate change. Adaptation (secondary prevention) involves developing public health strategies to minimize and, in some cases, eliminate local and regional adverse health outcomes that are anticipated from climate change.

A wide variety of governmental and nongovernmental organizations have developed detailed lists of mitigation and adaptation strategies, from international conventions such as the Kyoto Protocol[14] to individual actions such as reducing automobile use.[15]

However, any solutions that address climate change must be developed within the context of overall sustainable development (the use of resources by the current generation to meet current needs while ensuring that future generations will be able to meet their needs). Given the health implications of climate change for current and future generations of children, the disease-prevention role for pediatric health care professionals includes advocating for environmental sustainability.

RECOMMENDATIONS TO PEDIATRICIANS

Pediatricians are dedicated to the promotion and protection of children's health. Climate change threatens the health, welfare, and future of current and subsequent generations of children. Pediatricians can incorporate considerations of the effects of climate change on health into their professional practice and personal lives in many ways, including patient education, lifestyle practices, and political advocacy. Some possible approaches might include the following.

1. Recognize and educate yourself about the links between child health and climate change. Existing anticipatory guidance already incorporates many issues that can help mitigate climate change. For example, encouraging families and children to walk or ride bicycles more may reduce automobile emissions.
2. Advocate for comprehensive local and national policies that address climate change to improve the health of children now and in the future. Educate elected officials on the health risks to children from climate change; write letters to the editor, attend public meetings, or provide expert testimony. Work with local schools, child care centers, community organizations, and businesses on projects that will help reduce GHGs. Support policies to expand parks and green spaces, strengthen public transport, improve sidewalks and bicycle lanes, and create local award systems for energy-efficient businesses, buildings, organizations, and households.
3. Serve as a role model for practices that promote environmental sustainability. Emphasize energy conservation in your workplace, encourage and model reduced dependency on automobile travel, and consider the environmental and energy costs when making major purchases for your practice or institution.
4. Help to build and support coalitions across disciplines and institutions to search for novel, comprehensive approaches to mitigate and adapt to climate change in your community and region. Work with local and state health departments to strengthen public health infrastructure, disease surveillance and reporting, and disaster preparedness.
5. Work to ensure that concepts related to the pediatric health implications of climate change are part of pediatric training and curricula.

RECOMMENDATIONS TO GOVERNMENT

Government at all levels, from the smallest municipalities to the national and international levels, should implement aggressive policies to halt man-made contributions to climate change and to mitigate its impact on children's health.

1. Develop aggressive, long-term policies to reduce the major contributing factors to global climate change.
2. Invest in prudent and vital preparations for our public health care systems, including immunization programs and disease surveillance, reporting, and tracking.
3. Give specific attention to the needs of children in emergency management and disaster response.[13,16]
4. Support education and public awareness of the threats from climate change and their implications for public and children's health now and in the future.
5. Fund interdisciplinary research to develop, implement, and measure outcomes of innovative strategies to both mitigate and adapt to climate change, particularly in areas with direct implications for children's health.

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TECHNICAL REPORT

Global Climate Change and Children's Health

Katherine M. Shea, MD, MPH, and the Committee on Environmental Health

ABSTRACT

There is a broad scientific consensus that the global climate is warming, the process is accelerating, and that human activities are very likely (>90% probability) the main cause. This warming will have effects on ecosystems and human health, many of them adverse. Children will experience both the direct and indirect effects of climate change. Actions taken by individuals, communities, businesses, and governments will affect the magnitude and rate of global climate change and resultant health impacts. This technical report reviews the nature of the global problem and anticipated health effects on children and supports the recommendations in the accompanying policy statement on climate change and children's health.

INTRODUCTION

Scientists[1] and governments[2] concur that Earth is warming; rapid global climate change is underway, and human activities are very likely (>90% probability) the main cause. Adverse human health and ecosystem consequences are anticipated,[3] and some are already being measured. Physicians have written on the projected effects of climate change on public health,[4,5] but little has been written specifically about anticipated effects of climate change on children's health.[6]

Children represent a particularly vulnerable group that is likely to suffer disproportionately from both direct and indirect adverse health effects of climate change.[7] Pediatric health care professionals must understand the escalating nature of these threats, anticipate their effects on children's health, and participate as children's advocates for strong mitigation and adaptation strategies now and at all levels, from local to global.[8] This technical report examines both direct and indirect threats to children's health and futures related to climate change.*

NATURE OF THE GLOBAL PROBLEM

"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperature, widespread melting of snow and ice, and rising global mean sea level."[1] According to the National Climatic Data Center, all records indicate that during the past century, global surface temperatures have increased at a rate near 0.6°C per century (1.1°F per century), but the trend has been 3 times larger since 1976.[9] The results of this warming on regional climate are not uniform. In general, land-surface temperatures are increasing faster than sea-surface temperatures.[9] The climate in latitudes between 40°N and 70°N is warming more quickly than that in lower latitudes, and some areas (eg, the southeastern United States) are actually cooling. Changes in precipitation that occur with climate change

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*Since the writing of this technical report, the full reports of the 4th Assessment by the Intergovernmental Panel on Climate Change have become available, and additional studies have been published that include more detailed historical and current data documenting global climate change.

All technical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
climate change, global warming, child, pediatric, health, sustainable development

Abbreviation
GHG— greenhouse gas

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are also nonuniform.[10] Since 1900, precipitation has increased 5% globally, but it has increased 0.5% to 1% per decade in northern midlatitudes and decreased 0.3% per decade in subtropical latitudes.[11] In contrast, snowfall in the northern hemisphere has decreased by 10% since 1966.[11]

Examples of the effects of climate change have been widely reported.[11] Glaciers are in rapid retreat, and Arctic sea ice is melting.[12] As a result of thermal expansion, sea level has increased 1 to 2 mm/year over the past 100 years.[11] Oceans are acidifying as atmospheric carbon dioxide (CO_2) is absorbed by the marine buffer system.[13] Ecosystems and individual species are being affected in a variety of ways.[14] Changes in temperature affect the density and range of species; natural history traits such as migration, flowering, and egg laying; morphology such as body size and behavior; and genetic frequency shifts. In an analysis of 143 studies that span decades of observation,[15] more than 80% of 1468 species (mollusks to mammals and grasses to trees) are currently showing significant changes in temperature-sensitive species traits.

There is strong consensus among expert scientists that Earth is undergoing rapid, global climate change,[1,16] although there remains uncertainty about how rapidly and extensively the climate will change in the future. Given the range of possibilities, the Intergovernmental Panel on Climate Change has developed a suite of scenarios for different levels of mitigation and adaptation in response to anthropogenic (man-made) global climate change; all their cases predict that temperatures and sea level will continue to rise throughout the 21st century.[17] Recent analyses describe thermal inertia in Earth's climate system such that even if greenhouse gas (GHG) emissions were abruptly reduced to zero, the planet would continue to warm for decades until the energy stored in the system equilibrates.[18] The possibility of reaching a tipping point at which abrupt, large, and irreversible change could be superimposed on current trends adds both urgency and further ambiguity to the situation.[19] In this context, it is critical to understand that current human activities are accelerating climate change and that future human activities will affect their trajectories.[20]

ANTHROPOGENIC CAUSES OF THE CHANGE

The greenhouse effect is necessary to life on Earth as we know it (Fig 1). Without heat-trapping GHGs such as water vapor, CO_2, and other natural components of the atmosphere, Earth would be a lifeless, frozen planet (average temperature: −18°C) instead of the diverse biosphere we know today.[11] Since the onset of the industrial age, however, human activity has dramatically enhanced the greenhouse effect by rapidly adding large amounts of GHGs to the atmosphere (Table 1 [note that the United States leads total country and per-capita emissions]). Three GHGs, CO_2, methane, and nitrous oxide, are responsible for approximately 88% of the anthropogenic influences that enhance the greenhouse effect and have increased 35%, 155%, and 18%, respectively, since 1750 (the beginning of the industrial era).[21] Rates of increase in GHGs are accelerating, up 20% since 1990.

CO_2 is the most important GHG and is responsible for more than 60% of human-enhanced increases and more than 90% of rapid increase in the past decade.[21] Most CO_2 emissions are from the burning of fossil fuels such as coal, oil, and gas. Rising CO_2 is also related, to a lesser extent, to deforestation, which eliminates an important carbon sink (carbon sinks are reservoirs that absorb or take up released carbon from another part of the carbon cycle; the 4 major sinks on the planet are the atmo-

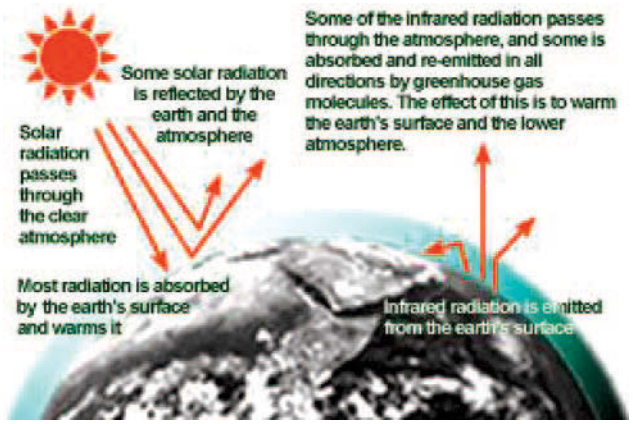

FIGURE 1
The greenhouse effect. Energy from the sun drives Earth's weather and climate and heats its surface; in turn, the earth radiates energy back into space. Atmospheric greenhouse gases (water vapor, CO_2, and other gases) trap some of the outgoing energy, retaining heat somewhat like the glass panels of a greenhouse. Without this natural "greenhouse effect," temperatures would be much lower than they are now, and life as known today would not be possible. Instead, thanks to GHGs, Earth's average temperature is a more hospitable 60°F. However, problems may arise when the atmospheric concentration of GHGs increases. (Source: US Environmental Protection Agency [http://yosemite.epa.gov/oar/globalwarming.nsf/content/climate.html].)

TABLE 1 **2004 Carbon Dioxide Emissions From Fossil Fuel**

Region and Country[a]	Total Emissions, Million Metric Tons	Emissions Per Capita, Metric Tons
North America	6886.88	15.99
United States	5912.21	20.18
Central and South America	1041.45	2.35
Europe[b]	4653.43	7.96
Eurasia[b]	2550.75	8.88
Russia	1684.84	11.70
Middle East[b]	1319.70	7.24
Africa[b]	986.55	1.13
Asia and Oceania	9605.81	2.69
China	4707.28	3.62
India	1112.84	1.04
Japan	1262.10	9.91
World Total	27 043.57	4.24

[a] Itemized if country's emissions exceed 1000 million metric tons.
[b] No single country in the region exceeds 1000 million metric tons.
Source: Energy Information Administration (www.eia.doe.gov/environment.html).

sphere, the terrestrial biosphere [eg, trees and freshwater systems], oceans, and sediments).[21] Currently, the atmosphere contains approximately 370 ppm of CO_2, which is the highest concentration in 420 000 years and perhaps as long as 2 million years.[11] Estimates of CO_2 concentrations at the end of the 21st century range from 490 to 1260 ppm, or a 75% to 350% increase above preindustrial concentrations.[11]

The importance of the magnitude of GHG emissions is linked to the rate of release. In the distant geologic past, similar concentrations of atmospheric CO_2 have occurred, but they accumulated over a 10 000-year period, allowing for the slow, global biogeochemical cycles to adjust to the increases. Current emissions are being added to the atmosphere at 300 times this rate.[11] This confluence of speed and quantity of emissions has created the current, unprecedented rapid climate change.

CLIMATE CHANGE–ASSOCIATED HEALTH EFFECTS ON CHILDREN

Human health is affected by the condition of the physical environment.[22] Because of their physical, physiologic, and cognitive immaturity, children are often most vulnerable to adverse health effects from environmental hazards.[23] As the climate changes, environmental hazards will change and often increase, and children are likely to suffer disproportionately from these changes.[8] Anticipated health threats from climate change include extreme weather events and weather disasters, increases in certain infectious diseases, air pollution, and thermal stress. Within all of these categories, children have increased vulnerability compared with other groups. These direct health threats are discussed in this section, with an emphasis on children in the United States.[24] Indirect threats are discussed briefly in "Long-term and Indirect Climate Change-Associated Health Threats to Children" below.

Extreme Weather Events and Weather Disasters

The Intergovernmental Panel on Climate Change predicts that it is "likely" or "extremely likely" that climate change will cause increased frequency and intensity of extreme weather events and weather disasters.[25] Often, these events are categorized as floods, storms, and droughts. Floods represented 43% of weather-related disasters between 1992 and 2001 and are the most frequent weather-related disaster. Although less prevalent, droughts and their associated famines are the most deadly weather-related disasters.[3] Developed countries such as the United States have systematically increased the risk to populations from flood events by developing coastlines and flood plains. In the United States, hurricanes and tornadoes may be the most dramatic and visible weather disasters. Evidence suggests that the frequency of category 4 and 5 hurricanes has increased over the past 30 years, but the observation period is still too short to attribute this change to increased sea-surface temperature and climate change with high confidence.[26]

The health consequences associated with extreme weather events include death, injury, increases in infectious diseases, and posttraumatic mental health and behavior problems.[27] Few studies have specifically examined such consequences in children. Globally, 66.5 million children annually were affected by disasters between 1990 and 2000.[28] Children everywhere are at risk of injury and death from storms and floods.[29] In the developed world, infectious disease outbreaks follow natural disasters when sanitation, sewage treatment, and water-purification plants become damaged or overwhelmed, refrigeration and cooking facilities are disrupted, and people are unusually crowded in temporary shelter. These outbreaks are usually mild and well controlled, which is in contrast to the aftermath of similar catastrophes in developing nations, where disease outbreaks can be deadly.[24] Mosquito-borne and other vector-borne illnesses may also be increased when storms or floods create large amounts of standing water suitable for breeding. Mental and emotional distress documented for children and adolescents after weather disasters include posttraumatic stress disorder and high rates of sleep disturbance, aggressive behavior, sadness, and substance use/abuse.[29] Some studies have suggested that children have more persistent symptoms than adults who experience the same disaster,[30] but more studies specific to children's experience are required.[31] Community support services[32] and early therapeutic intervention and postdisaster counseling[33,34] can significantly reduce the medium- and long-term mental health burden on children. Experiences with Hurricane Katrina demonstrated the difficulties with tracking children's whereabouts, keeping children and caregivers together, and special needs of hospitalized infants and children during and after major natural disasters.[35]

Infectious Diseases

Globally, infectious diarrhea is the second-leading cause of death in young children; water-borne gastroenteritis is projected to increase under conditions of global warming. Currently, the World Health Organization estimates that, approximately 1.62 million children younger than 5 years die of diarrhea annually, and most cases are attributable to contaminated water.[36] Although children in developed countries are unlikely to die of water-borne infections, they may suffer illness that is attributable indirectly to climate change. Events associated with El Nino serve as a model for global warming by altering weather for periods of several years in the direction of a hotter climate. During El Nino events, rates of hospitalizations of children for diarrhea increase.[37] (In 1 study, the rate of hospitalizations of children for diarrhea increased 8% per degree centigrade of temperature increase.[38]) Water-borne disease outbreaks in the United

States exhibit a positive correlation with excess precipitation events, which are likely to increase with climate change; over a 45-year period, 68% of water-borne illness outbreaks have been associated with precipitation above the 80th percentile.[39] Foodborne illness correlates positively with ambient temperature and is also likely to increase as the climate warms.[37,40,41]

Vector-borne infections are affected by climate change.[42] Both the hosts (eg, rodents, insects, snails) and the pathogens (eg, bacteria, viruses, parasites) can be sensitive to climatic variables such as temperature, humidity, and rainfall. The ability to predict disease rates related to climate change is complicated by a large number of additional variables such as topography, land use, urbanization, human population distribution, level of economic development, and public health infrastructure.[43] There is no easy formula that predicts climate change–related infection risk with confidence.

Malaria is a climate-sensitive vector-borne illness to which children are particularly vulnerable. According to the World Health Organization, malaria currently causes 350 million to 500 million illnesses annually and more than 1 million deaths.[44] Because they lack specific immunity, children experience disproportionately high levels of both morbidity and mortality from malaria; 75% of malaria deaths occur in children younger than 5 years. The young are also more susceptible to cerebral malaria, which can lead to lifelong neurologic damage in those who survive. In areas of sub-Saharan Africa, the death rate from malaria in children 0 to 4 years of age is 9.4 in 1000 vs 0.13 in 1000 in those older than 14 years.[45] More than 3 billion people live in malaria-prone areas today. Climate change is expanding the range of host mosquitoes to higher altitudes and higher latitudes, and warmer temperatures speed the development of the parasite within the host vector.[46] Small children will be most affected by the expansion of malaria zones and the success or failure of societal response to this change.

Three vector-borne diseases that affect the United States illustrate ways in which climate change can enhance disease burden: West Nile virus infection, Lyme disease, and hantavirus pulmonary syndrome.

West Nile virus infection was first reported in the United States in New York in 1999. Although it is still not known how it entered the United States, once introduced, it spread rapidly. A series of warm winters failed to kill the mosquito vectors. Warmer summers amplified the life cycle of the mosquitoes and increased the viral load. Drought and rain cycles, particularly as they affected urban landscapes, increased the contact of the bridging mosquito vectors with birds and humans.[46] Human populations with no herd immunity were highly susceptible to infection. In 1999, there were 62 human cases of West Nile virus infection, all reported from New York state. In 2003, there were 9862 human cases reported from 45 states and the District of Columbia.[47] Although this infection is primarily of concern for the elderly rather than children, the rapid spread illustrates the challenge of infection control in a warming climate.

The prevalence of Lyme disease has been increasing in the United States since it became a reportable disease in 1992.[48] The geographic distribution of *Ixodes* species ticks, the vectors for this bacterial infection, is expanding as well. Researchers in Sweden have documented a correlation between the expanding range for *Ixodes* ticks and climate change.[49] Children 5 to 14 years of age and adults 50 to 59 years of age are most likely to contract the illness. Lyme disease, although rarely fatal, occasionally causes long-term morbidity and represents another example of a disease that is likely to increase further as the climate warms.

Finally, the 1993 outbreak of hantavirus pulmonary syndrome in the southwest United States has been linked to the El Nino conditions of 1991–1992, with increased rainfall and pine nut production, which favored population growth among rodent vectors.[50] With a case fatality rate of 36%,[51] it is of concern that warmer climates may enhance vector populations further. As with most infectious diseases, human adaptations can reduce exposure risk and disease burden.[52]

Ambient Air Pollution

Air pollution is well established as a short-term contributor to hospital use[53] and premature death. Air pollutants such as fine particulates, nitrogen oxides, sulfur oxides, and ozone are likely to increase as countries adapt to hotter temperatures by using more energy to drive air conditioning and fans. The anticipated global population of 9 billion by 2050 will also be associated with increased energy demands, which, if met by burning more fossil fuels, will exacerbate both ambient air pollution and GHG emissions.[54] Children are especially vulnerable to both short-term illness and long-term damage from ambient air pollution, because their lungs are developing and growing, they breathe at a higher rate than adults, and they spend more time outdoors engaging in vigorous physical activity.[55] Air pollution (such as ozone and particulate matter) causes respiratory and asthma hospitalizations, school absences, increased respiratory symptoms, and decrements in lung function.[55] Formation of ozone, in particular, is known to increase with increasing temperature, even without increases in the precursor primary pollutants (volatile organic hydrocarbons and oxides of nitrogen).[56] Children who are active in outdoor sports in communities with high ozone are at increased risk of developing asthma.[57] In addition, high levels of particulate matter and other copollutants affect the ability of children's lungs to grow regardless of history of asthma.[58] Rates of preterm births, low birth weight, and infant mortality are increased in

communities with high levels of particulate air pollution.[55]

A second change that is being observed is the temperature-related increases in pollen production and other aeroallergens in some regions and some cities. Increased temperature causes increases in amounts of pollens produced by some plants[59] and can also affect spatial distribution and density of plants, fungi, and molds that produce aeroallergens.[60] To the extent that exposure to aeroallergens contributes to the incidence, prevalence, and severity of asthma, atopy, and other respiratory disease, climate change will affect the pattern of disease in children. Some investigators have argued that part of the current global increase in childhood asthma can be explained by increased exposure to aeroallergens driven by climate change.[61]

Thermal Stress

For all organisms, there exists a range of ideal temperature above and below which mortality increases. Humans are no exception, although temperature-mortality relationships vary significantly by latitude, climatic zone, and level of socioeconomic development.[3] As ambient temperatures increase, the frequency of heat waves will increase. It is expected that there will be fewer cold-related deaths in a warmer world,[62] but whether this will offset the expected increase in heat-related deaths is unknown. Populations that live in temperate climates, such as in the United States and Europe, are likely to be hard hit initially, because global warming is most dramatic in these latitudes and there has been little time for populations to acclimatize to changes in temperature. Observations on heat and mortality have been reported for decades[63] and have gained recent attention with the heat waves of 2003 in Europe[64] and of 2006 in Europe and North America.[63,65] Heat-related deaths and hospitalizations are most common in the elderly, especially if they are ill.[66,67] One study has found that infants and young children may represent a second, albeit smaller, higher-risk group,[68] but effects on children have not been studied adequately. In addition, children spend more time outside, especially playing sports in the heat of the afternoon, which puts them at increased risk of heat stroke and heat exhaustion.[69] Increased outdoor time during hot weather may also put children at increased risk of UV radiation–related skin damage, including basal cell carcinoma and malignant melanoma.[70] Some data indicate that heat-related mortality in the United States has decreased in recent years, in part associated with increasing percentage of homes with air conditioners.[71] It is currently unknown how effective adaptation and acclimatization will be in preventing excess heat-related deaths and illness.[72,73]

LONG-TERM AND INDIRECT CLIMATE CHANGE-ASSOCIATED HEALTH THREATS TO CHILDREN

Long-term and indirect effects on children's health from climate change will depend on how the climate continues to change over the next decades and what sorts of mitigation and adaptation strategies are adopted now.[17] How quickly and comprehensively GHG emissions can be stabilized and then reduced will have a significant effect on the rate and degree of warming, but even the most optimistic scenarios describe continued warming through the end of this century.[17] Food availability may be affected as land and ocean food-productivity patterns shift.[74] Water availability may change and become much reduced in some regions, including during summer in the snow run-off–dependent American west coast.[75] Coastal populations will be forced to move because of rises in sea level, and massive forced migrations, driven by abrupt climate change, natural disaster, or political instability over resource availability, are conceivable.[24] In addition, world population is expected to grow by 50% to 9 billion by 2050, which would place additional stress on ecosystem services and increase the demand for energy, fresh water, and food.[54] As these changes evolve, social and political institutions will need to respond with aggressive mitigation strategies and flexible adaptation strategies to preserve and protect public health, particularly for children.

MITIGATION AND ADAPTATION STRATEGIES

Strategies to address the effects of climate change, known as mitigation and adaptation, are concepts that parallel the focus on both primary and secondary prevention strategies in pediatric health care. These strategies are discussed briefly here. The prevention or minimization of the effects of climate change on children's health is beyond the control of an individual pediatrician. Yet, pediatricians can play important public roles as advocates by individual example and through community participation, political involvement, or collective advocacy at the local, state, and national levels.[76,77]

Broadly, mitigation policies (Table 2) for reduction of atmospheric GHG include reducing emissions through energy efficiency and use of renewable energy sources, increasing carbon sinks by forest preservation and reforestation, and development of GHG-capture and -sequestration technologies (carbon sequestration is the fixation of atmospheric CO_2 in a carbon sink through an active process). Adaptation involves developing public health strategies to minimize adverse health outcomes that are anticipated from climate change. These strategies include improved disease surveillance and reporting, improved weather forecasting and early warning systems, advanced emergency management and disaster-preparedness programs, development and dissemination of appropriate vaccines and medicines, and public health education and preparedness. Category-specific examples

TABLE 2 **Some Examples of Mitigation Strategies**

	International	National and State	Community	Business, Nonprofits, Professional Societies	Individuals
Reduce emissions and increase use of renewable energy sources	Impose carbon-emissions caps by treaty	Create GHG inventory	LEED certification of public buildings	Energy audit of office and work toward LEED certification[a]	Drive less, use public transport, carpool
	Support clean, renewable technologies in developing countries	Impose carbon-emissions caps at national and/or state level	Energy audits and renovations for all public buildings	Reward carpoolers or employees who use public transport or walk/bike to work	Use vehicles that get the highest gas mileage
	Support research, development, and use of clean, renewable fuels	Increase solar, wind, energy-efficient biofuels, and other renewable energy sources	Efficient lighting in public spaces	Promote energy conservation	Perform energy audit of home or business and make associated changes
	Promote energy conservation	Invest in research, development, and use of clean, renewable fuels	Reward businesses and home owners for energy efficiency	Buy Energy Star office equipment	Buy Energy Star appliances
		Raise corporate average fuel efficiency standards for vehicles	Maximize public transport, ticket idling cars, tax individual parking spaces, create bike lanes, and enforce high-occupancy vehicle lanes	Support telecommuting and flexible hours	Buy local foods
		Promote energy conservation	Develop sustainability awards	Video and teleconference meetings	Engage in energy-conservation efforts
		Augment public transportation options	Promote energy conservation	Consider buying carbon offsets for travel to meetings[b]	Switch to compact fluorescent bulbs
Increase (protect) sinks	Arrest deforestation	Identify, protect, and restore carbon sinks	Plant trees	Increase green space	Plant trees and shrubs
	Restore forests and wilderness	Protect national forests and wilderness areas	Reward construction of green roofs	Add plants and trees in parking areas	Support parks and greenways
			Build parks and green space		
Carbon trapping and sequestration	Support research and development	Support research and development	Support research and development	Support research and development	Support through personal investments

This information here is not exhaustive. Many strategies have been proposed and overlap among sectors. Additional information can be found at www.grida.no/climate/ipcc_tar/wg3/index.htm, http://epa.gov/climatechange/wycd/index.html, and www.princeton.edu/~cmi.

LEED indicates Leadership in Energy and Environmental Design.

[a] The LEED Green Building Rating System is a nationally accepted benchmark for the design, construction, and operation of high-performance green buildings. LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their building's performance. LEED promotes a whole-building approach to sustainability by recognizing performance in 5 key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

[b] Reduction of individual GHG production can be accomplished by buying carbon offsets whereby, in this principle, an individual or business can pay someone to reduce or remove GHG production in that company's name. For example, if a company agrees to buy 10 tons of carbon offsets, the seller guarantees that 10 fewer tons of GHG will enter the atmosphere.

can be found at www.grida.no/climate/ipcc_tar/wg2/646.htm#tab18-2. These adaptation strategies include policy and legislative actions, engineering responses, and personal behavior change.

Effective implementation of mitigation and adaptation strategies must involve actions from the global to local levels by governments, corporations, communities, and individuals. Furthermore, climate change is part of generalized global change, which includes population growth, land use, economic change, and evolving technology; all have effects on individual human and public health (Fig 2). Any solutions that address climate change must be developed within the context of overall sustainable development (the use of resources by the current generation to meet current needs while ensuring that future generations will be able to meet their needs). Protecting the health of current and future generations requires a fundamental shift in thinking for health professionals[78]; pediatricians, as advocates for children's health, can be leaders in a move away from a traditional focus on disease prevention to a broader, more integrated focus that encompasses sustainability as synonymous with health. Given the health implications for current and future generations of children, the disease-prevention role for pediatric health care professionals includes advocating for environmental sustainability.

SUMMARY

This technical report describes the broad scientific consensus that man-made climate change has begun

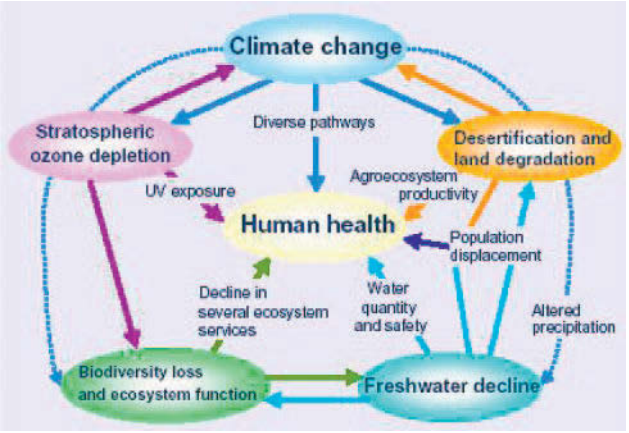

FIGURE 2
Global drivers that affect human health. Large-scale and global environmental hazards to human health include climate change, stratospheric ozone depletion, loss of biodiversity, changes in hydrological systems and the supplies of fresh water, land degradation, and stresses on food-producing systems. (Source: World Health Organization [www.who.int/globalchange/en/index.html].)

and is accelerating. The major cause of this change is the rapid release of CO_2 from burning of fossil fuel. All predictions indicate that climate change will continue for at least a century, but the trajectory of that change depends on human responses. There are anticipated effects on human health from extreme weather events, infectious diseases, air pollution, and heat stress. Although little research thus far has concentrated on the pediatric age group, it is likely that children will suffer disproportionately from climate change.[6] Furthermore, the state of the world of future children is uncertain and depends on actions taken to mitigate and adapt to climate change and other global-scale trends. Pediatric health care professionals are in an ideal position to advocate for action, not only to address climate change but also, more broadly, to ensure sustainability. Specific recommendations for pediatricians and governments are enumerated in the American Academy of Pediatrics policy statement[79] on climate change and children's health, which accompanies this technical report.

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FEDERATION OF PEDIATRIC ORGANIZATIONS

Graduate Medical Education and Pediatric Workforce Issues and Principles

Task Force on Graduate Medical Education Reform

The following principles were crafted by a special Task Force on GME convened by the American Academy of Pediatrics to develop policies and principles concerning GME and pediatric workforce issues. The Task Force met in the Washington office of the Academy on September 4, 1993. These principles have been reviewed at a meeting on September 9, 1993, revised and approved by the Federation of Pediatric Organizations. The Federation component organizations include: the Ambulatory Pediatric Association; American Academy of Pediatrics; American Board of Pediatrics; American Pediatric Society; Association of Medical School Pediatric Department Chairmen; Association of Pediatric Program Directors; and Society for Pediatric Research. These principles represent the consensus opinion of the American pediatric community comprising both academic and practicing physicians and residents.

OVERVIEW

The United States is presently poised to enact a universal health care program that could include the coverage of an additional 12 million children and adolescents. The passage of such a proposal might eliminate financial barriers to needed health care for many children and generate an increase in demand for primary care physicians. These children and adolescents will need quality health care, the provision of which is very complex. Pediatricians are the most appropriate providers of primary care for infants, children and adolescents. Today, nearly two-thirds of office (physician) visits made by children aged 5 years and younger are to pediatricians.

There is presently a national shortage and geographic maldistribution of pediatricians the effects of which could be acutely aggravated by health care reform. The federated pediatric community agrees that there is a need for increased support for primary care specialties as a whole, and pediatrics in particular. In contrast to adult medicine and surgery, the overwhelming majority of pediatricians practice primary care medicine; less than 20 percent of certified pediatricians are certified in subspecialties and even fewer are practicing subspecialties exclusively. Currently, and for the past decade, over 60 percent of graduating pediatric residents still choose to enter primary care.

It is important to recognize the need for training of pediatric generalists and pediatric subspecialists to meet the unique clinical, research and educational needs of child and adolescent populations in the next century. There will be an increased demand for subspecialists (in the face of existing shortages) due to the complex illnesses faced by children and adolescents—congenital anomalies, pediatric AIDS, derivatives of substance abuse, etc. Some pediatric fellowship training—such as general academic pediatrics, adolescent medicine, behavioral pediatrics, developmental pediatrics—is often undertaken to enhance the pediatrician's ability to provide optimal primary care services and many graduates of such programs actually practice primary care.

Population and incidence of disease limit the numbers of pediatric subspecialty patients and, because of this, the number and distribution of subspecialists the country needs. There is currently an acute shortage of certain pediatric subspecialties (i.e., pediatric gastroenterologists, pediatric hematologist/oncologists and pediatric endocrinologists). In contrast to adult specialists, pediatric subspecialists are not usually found in private practice.

NATIONAL HEALTH CARE WORKFORCE COMMISSION

The federated pediatric community recommends that an independent National Health Care Workforce Commission be established, insulated from the political process and with broad representation from the primary care community, including pediatrics. This National Health Care Workforce Commission would be responsible for:

- projecting the aggregate need of the medical care workforce for the health care delivery system;
- determining the necessary number of residency positions on a national basis (including the number of International Medical Graduates (IMGs)) and maintaining the appropriate number of generalists and subspecialists;
- allocating residency positions by specialty and subspecialty with regard to medical personnel and population needs;
- implementing appropriate incentives to reinforce the selection of primary care;
- conducting on-going research that will ensure the availability of appropriate data on which to base workforce decisions;
- evaluating and monitoring the efficacy of all recommendations and their implementation; ensuring that the process allows for flexibility, particularly during the transition period; and reevaluating recommendations as appropriate.

The federated pediatric community recommends that this independent and autonomous National Health Care Workforce Commission have features of both the Federal Reserve Board and the Defense Base Closure and Alignment Commission. The statute creating this National Workforce Commission would require that its recommendations be sent to the President for approval or disapproval, and then require the Congress to take an "up" or "down" vote on its package of recommendations without amendment. Its decisions, if accepted in this manner, are binding as statute.

The composition of the National Commission should be balanced and should reflect the entire primary care community as well as include representation from non-primary care disciplines. Its membership should include practicing physicians, medical educators, allied health professionals, i.e., nurse practitioners and physicians assistants, hospital administrators and consumers.

The federated pediatric community believes that training and service needs should be disconnected. Therefore, distribution of residency training positions should be based on the quality of the training program. However, until there is appropriate distribution of training positions based on quality and primary care/specialty needs, we recognize that some service issues must still be considered.

The federated pediatric community believes that the ACGME and the RRC should maintain their current function and focus on quality, and should not be involved in the allocation of residency training positions.

ALLOCATION OF GME SLOTS

The principal goal of the federated pediatric community is to increase the number of primary care pediatricians. We support the need to prepare more generalists. Accordingly, whatever mechanism for allocating residency positions is selected must assure that there are at least as many residency positions in pediatrics as currently exists. We recognize the need to decrease the total number of GME training slots overall, while simultaneously increasing the number of primary care slots. However, reliable data for projecting future physician need are not available, particularly the need for pediatric generalists and subspecialists.

While the goal of limiting the number of filled first year resident positions to 110 percent of the number of US medical school graduates may be a reasonable initial target, the federated pediatric community believes that the National Health Care Workforce Commission should ultimately establish the total number of residency positions, including IMGs.

The federated pediatric community supports the limitation of residency positions only if it is implemented subsequent to the allocation of slots across specialties and pursuant to the recommendations of the National Health Care Workforce Commission. The pediatric community is deeply concerned that, in some parts of the country, IMGs currently provide a significant portion of pediatric care especially in urban hospitals in under-served communities. In these communities, ImGs may provide more than 50 percent of care. The health of children in these communities must not be compromised by the reduction of residency positions while awaiting alternative health care providers.

The federated pediatric community believes the phasing in period, accompanied by transition funding, is vitally important to hospitals that lose a larger percentage of their residency positions through the allocation process or with the assignment of residents to ambulatory care sites.

PAYMENT FOR GME

The federated pediatric community concurs with the Physician Payment Review Commission's (PPRC) 1993 Annual Report to Congress in its support of the concept that "all payers should share the costs of graduate medical education."

Within the limits of the national goals established by the National Commission, the pediatric community is in favor of maintaining as much flexibility of choice by resident applicants as possible. Operating under the allocation of residency slots established by the National Health Care Workforce Commission, the federated pediatric community supports a continuation of the current matching system.

One option to assist in assuring a distribution of residency specialties that will meet the future health needs of the nation is to explore the use of a voucher/certificate system given to medical students in conjunction with the National Resident Matching Program as suggested in a 1985 Report by the Task Force on Academic Health Centers of The Commonwealth Fund. Alternatively, funds could be allocated directly to programs or to regional or local consortia as proposed by the PPRC and the Council on Graduate Medical Education. Any one of these proposals would help assure that monies for medical education are used for that purpose.

Whatever the mechanism, it is preferable that the funds are allocated in a manner that facilitates the training of primary care physicians, including expanding the training venues outside of the hospital setting.

INCENTIVES, INCLUDING WEIGHTING OF PRIMARY CARE POSITIONS

The federated pediatric community believes that primary care residents should receive total compensation that is equal to or greater than other residency positions in the institution.

The federated pediatric community believes that the use of differential weights in calculating payments for primary care residency positions could provide an incentive for teaching institutions to increase the number of primary care residency positions. However, these weights must be large enough to encourage the development of additional primary care positions and education sites outside of the teaching hospital. Funding must be specifically designated for this purpose.

This short term strategy must be accompanied by long term incentives for medical students, residents, and physicians (especially under-represented minor-

ity groups) to choose primary care. A full array of support for primary care should be considered including: expansion of the National Health Services Corp; continuation and expansion of primary care training programs, such as Title VII; loan forgiveness in return for practicing in identified under-served areas; loan repayment based on a percentage of earnings; forbearance and deferment of low interest loans for entering primary care; development and implementation by all payers of a pediatric RBRVS and increased payment for pediatric services; increased funding for primary care research and other system-wide supports for pediatric and other primary care specialties including the reduction in administrative burden to primary care physicians.

RETRAINING

Unlike adult medicine and surgery, retraining for pediatricians is not a significant issue because all pediatricians are initially trained as generalists and some take additional training in a subspecialty. Renewal of subspecialty certification in pediatrics also requires recertification in general pediatrics. However, the federated pediatric community strongly believes that the setting of standards for retraining other specialists in fields which include the care of children must involve the federated pediatric community. This is to ensure that the same quality of care is provided to all children and adolescents.

CONCLUSION

The Federation of Pediatric Organizations supports designing a program to ensure quality health care to all children by developing appropriate guidelines and funding for GME.

FEDERATION OF PEDIATRIC ORGANIZATIONS

The Ambulatory Pediatric Association (APA) is an organization of individuals dedicated to research, education and service in general pediatrics addressing the needs of children and their families.

The **American Academy of Pediatrics** (AAP) is an organization of 47,000 physicians dedicated to health, safety and well-being of infants, children, adolescents and young adults.

The **American Board of Pediatrics'** (ABP) purpose, through the certification process, is to provide assurance to the public and to the medical profession that a certified pediatrician has successfully completed an accredited education program, an evaluation, including an examination, and possess the knowledge, skills, and experience requisite to the provision of high-quality care in pediatrics.

The **American Pediatric Society** (APS) is an organization bringing together academic pediatricians for the advancement of the study of child health and illness, for the promotion of health and the prevention of illness, and for the advancement of pediatric education and research, and for the recognition of those who by their contributions to pediatrics, have aided in its advancement.

The **Association of Pediatric Program Directors** (APPD) is an organization of individuals responsible for residency training programs in pediatrics. The mission of the Association is to advance and enhance the graduate medical education of pediatricians.

The **Association of Medical School Pediatric Department Chairmen** (AMSPDC) is an organization of chairs of medical school pediatric departments who are responsible for the conduct of teaching, patient care, research and service within American medical schools and their clinical services.

The **Society for Pediatric Research** (SPR) is an international society for scientists whose purpose is to encourage investigation of a broad range of areas involving the health and well being of children.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Guidance for the Administration of Medication in School

abstract

Many children who take medications require them during the school day. This policy statement is designed to guide prescribing health care professionals, school physicians, and school health councils on the administration of medications to children at school. All districts and schools need to have policies and plans in place for safe, effective, and efficient administration of medications at school. Having full-time licensed registered nurses administering all routine and emergency medications in schools is the best situation. When a licensed registered nurse is not available, a licensed practical nurse may administer medications. When a nurse cannot administer medication in school, the American Academy of Pediatrics supports appropriate delegation of nursing services in the school setting. Delegation is a tool that may be used by the licensed registered school nurse to allow unlicensed assistive personnel to provide standardized, routine health services under the supervision of the nurse and on the basis of physician guidance and school nursing assessment of the unique needs of the individual child and the suitability of delegation of specific nursing tasks. Any delegation of nursing duties must be consistent with the requirements of state nurse practice acts, state regulations, and guidelines provided by professional nursing organizations. Long-term, emergency, and short-term medications; over-the-counter medications; alternative medications; and experimental drugs that are administered as part of a clinical trial are discussed in this statement. This statement has been endorsed by the American School Health Association. *Pediatrics* 2009;124:1244–1251

COUNCIL ON SCHOOL HEALTH

KEY WORDS
medications, school, unlicensed assistive personnel, delegate, self-administer

ABBREVIATIONS
RN—registered nurse
AAP—American Academy of Pediatrics
UAP—unlicensed assistive personnel
OTC—over-the-counter

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INTRODUCTION

School boards and districts are responsible for policies and procedures for administration of medications to students who require them during the school day. The health circumstances that require medication are diverse. Medical advances have enabled many students with special health care needs or chronic health conditions to be included in classes with their peers.[1] Some schools struggle to balance the need for health care services for increasing numbers of children with special health care needs with the current resources available to provide those services.[2–12]

The presence in schools of a full-time licensed registered school nurse is strongly endorsed.[13] Registered nurses (RNs) have the knowledge and skills required for the delivery of medication, the clinical knowledge of the student's health, and the responsibility to protect the health

and safety of all students. The use of untrained school staff to administer medications to children with special health care needs creates risks, not only of medical liability for the school and the licensed registered school nurse but also of medication error for the student.[14–16] To ensure the health and safety of students, all schools should have a full-time licensed RN who has the knowledge and skills required for the delivery of medication and the assessment of student health.[17,18]

This policy statement has been endorsed by the American School Health Association.

TRAINED UNLICENSED ASSISTIVE PERSONNEL

When a school nurse is not available at all times, the American Academy of Pediatrics (AAP), the National Association of School Nurses, and the American Nurses Association recommend trained and supervised unlicensed assistive personnel (UAP) who have the required knowledge, skills, and composure to deliver specific school health services under the guidance of a licensed RN. UAP duties are delegated by a licensed RN.[19,20] Training and supervision of UAP are necessary for providing safe, accurate, and timely administration of medication. Delegation is a tool that may be used by the licensed registered school nurse to allow UAP to provide standardized routine health services under the supervision of the nurse and on the basis of physician guidance and school nursing assessment of the unique needs of the individual child and the suitability of delegation of specific nursing tasks. Any delegation of nursing duties must be consistent with the requirements of state nurse practice acts, state regulations, and guidelines provided by professional nursing organizations. Delegation of nursing duties is the responsibility of the certified licensed school nurse or licensed RN. The nurse determines which nursing services can be delegated and then selects, trains, and evaluates the performance of UAP; audits school medication records and documents; and conducts refresher classes throughout the school year.[21–23] The training, certification, and supervision of UAP should be determined by national and state nursing organizations and state nurse practice laws. Delegation is an ongoing process and a management tool, not a once-a-year event.

UAP training is typically limited and specific for medication-administration tasks and cannot replace a nursing assessment. In most circumstances, a medication UAP should be an ancillary health office staff member (health assistant/aide) who is also trained in basic first aid and district health office procedures. On rare occasions when a member of the health office staff (RN, licensed practice nurse, or UAP health assistant/aide) is not available, other willing volunteer school staff may be trained by the licensed RN to assume specific limited tasks such as single-dose medication delivery or life-saving emergency medication administration. In those instances, it is important for school districts to identify and satisfactorily address medical liability issues for the school district, the nurse, and the voluntary nonmedical staff member who is serving temporarily as UAP.

SCHOOL POLICY AND PROCEDURES

Section 504 of the Rehabilitation Act and the Individuals With Disabilities Education Act (IDEA) provide protection for students with disabilities by requiring schools to make reasonable accommodations and to allow for safe inclusion of these students in school programs.[24–27] These federal laws apply only to schools that receive federal funds, do not cover all students who require medications during the school day (eg, short-term needs), and are not specific about how administration of medications should be conducted in school. The AAP supports state laws, regulations, or standards that establish more specific policies for administration of medications that apply to all of the state's school districts. State standards can limit discrepancies among school districts within the state and reduce confusion for parents and prescribing health care professionals. School boards and school superintendents are responsible for establishing policies and detailed procedures for the safe administration of medication in the school setting. When state standards are insufficient, school health professionals, consulting physicians, and school health councils can work with AAP chapters to promote improved state standards and assist with local policies and procedures. Individual school districts also might wish to seek legal advice as they assume the responsibility for giving medication during school hours and during activities at school before or after school hours. Liability coverage should be provided for the staff, including nurses, teachers, athletic staff, principals, superintendents, and members of the school board.[15] Any student who must take medication during regular school hours should do so in compliance with all federal and state laws and school district policies.

Guidance for pediatricians, school physicians, and school health consultants is consistent with policy declarations of the National Association of School Nurses[28] and the American Nurses Association.[20] The following are recommendations for school districts in implementing medication-administration policies and procedures.[29]

- Protect student safety and prevent medication errors. Nursing services

at school, whether emergent, urgent, or routine, require the creation of a confidential, timely, and accurate record of the service provided.

- Identify the licensed health professional (certified or registered school nurse or school physician) on the school staff who supervises and is responsible for the safe keeping and accessibility and administration of medications, including documentation and a system of accountability for students who carry and self-administer their medications.
- Use a systematic review of documentation of medication-administration records for quality improvement, especially to reduce medication errors and to verify controlled substance counts.
- Create an ongoing training and certification program for UAP who perform specific nursing services when delegated and supervised by the licensed school RN or school physician.
- Establish and follow effective communication systems that support the school's nursing plan (individualized health plans, etc) and promote accurate implementation of the prescriber's instructions for the medical management of a designated student's health needs.
- Require a written medication form, signed by the authorized prescriber and parent, with the name of the student, the drug, the dose, approximate time it is to be taken, and the diagnosis or reason the medication is needed. This requirement applies for all prescription medications.
- Require written parental approval if over-the-counter (OTC) medications are permitted. Limit the duration that an OTC medication is administered at school.[30] Use of OTC medications over an extended time period warrants an authorized prescriber's oversight and authorization.
- Protect student health information confidentiality as outlined in the Family Education Rights and Privacy Act[31,32] and the Health Insurance Portability and Accountability Act.[33]
- Train, delegate, and supervise appropriate UAP who have the knowledge and skills to administer or assist in the administration of medication to students when assessed to be appropriate by the supervising and delegating licensed registered school nurse or school physician in compliance with applicable state laws and regulations.
- Permit responsible students to carry and self-administer emergency medications for those conditions authorized by school policies and regulations, which also describe students'/parents' rights and responsibilities.[34,35]
- Provide and encourage parents to provide spare life-saving medications in the health office for students who carry and self-administer emergency medications in the event that the life-saving medication cannot be located when a student is in need of the medicine.
- Make provisions for secured and immediate access to emergency medications at school at all times, including before and after school hours and during students' off-campus school-sponsored activities.[35–39]

ADMINISTRATION OF LONG-TERM MEDICATIONS

Long-term medications are those needed to manage a student's symptoms or promote health over an extended period of time. Many students who require long-term medications are children with special health care needs whose school attendance and participation in school activities depend on the administration of the prescribed treatment. Asthma, attention-deficit/hyperactivity disorder, seizures, heart conditions, cerebral palsy, and diabetes mellitus are among the common conditions that require medication at school.[40–42] Although not common, students infected with HIV may require multiple medications during the school day. In most cases, school nurses will develop individualized health plans for children with special health care needs.[43]

School nurses should review all school medication orders, establish liaisons with the student's health care professionals, administer medication, and/or provide effective training and supervision of UAP who are delegated to administer medication.[13,44] Requests to administer nonstandard medications (eg, doses in excess of manufacturer guidelines; alternative, homeopathic, or experimental medications; nutritional supplements) do not have to be honored by a school nurse. However, a school nurse has a professional obligation to promptly record the request and resolve the conflict with the parent, the prescriber, and/or, when needed, the school physician.[45]

EMERGENCY AND URGENT MEDICATIONS

Emergency and urgent medications are often given by nonoral routes and are administered to initiate treatment or amelioration of a disease or condition that may be life-threatening or cause grave morbidity. The complexity and urgency of this intervention is the focus of the AAP policy statement "Medical Emergencies Occurring at School,"[36] which describes prevention and mitigation of emergent events and stresses the role of the school nurse in providing this nursing service at school. The school nurse is the professional most likely to train school staff, to create a liaison with com-

munity emergency response teams and other health care professionals, and to assist, in coordination with the school physician, the school administration in development of policies and administrative regulations concerning medical emergencies.[17,34,36,37,46–48] State laws or regulations designate the roles and responsibilities of school staff in this situation. They may specifically limit or expand the role of UAP in emergency care settings. Some states have legislated authority to create protocols and procedures through which school staff are identified, trained, and certified to initiate medical care in a medically urgent or emergent situation and to address concerns of liability for nursing services provided under such conditions.[49–51]

Immediate access to emergency medications (eg, autoinjectable epinephrine, albuterol, rectal diazepam, and glucagon) is a high priority and is crucial to the effectiveness of these lifesaving interventions. To maintain medication security and safety and provide for timely treatment, local procedures must specify where medications will be stored, who is responsible for the medication, who will regularly review and replace outdated medication, and who will carry the medication for field trips. In addition to unlicensed health office staff, other school staff may be trained, designated, and supervised as emergency UAP to be "first responders" to a student who experiences a medical emergency.

Schools also need an adequate supply of emergency medications in the event of a school lock-down or evacuation. Parent-supplied extra medication and/or school-supplied stock medications (including but not limited to autoinjectable epinephrine and albuterol inhalers) are among the emergency or urgent care medications that need to be available in these circumstances.[37,38,52]

SECURITY AND STORAGE OF MEDICATIONS

All prescription medications brought to school should be in original containers appropriately labeled by the pharmacist or physician. Except for self-carry medications, they should be stored securely in accordance with manufacturer directions. Controlled substances must be double-locked.[53] The school nurse, licensed practice nurse, or delegated, trained UAP must be available and have access to the medications at all times during the school day. All medications should be returned to the parents at the end of the school year or disposed of in accordance with existing laws, regulations, or standards. Care should be taken not to flush any drugs into the water system unnecessarily.

STUDENT SELF-CARRYING AND SELF-ADMINISTRATION OF PRESCRIBED MEDICATIONS

A responsible student should be permitted to carry medication for urgent or emergency need when it does not require refrigeration or security, according to policies determined by the school in accordance with laws, regulations, and standards.[34,54] Controlled substances and those at risk of drug abuse or sale to others are not appropriate for self-carrying. The student's personal health care professional, the parents, and the school nurse and school physician should collaboratively determine the ability of a student to appropriately self-administer the prescribed medication in a responsible and secure manner. School personnel must also permit the student to possess and take the medication once a determination has been made that the student is mature enough to carry and self-administer the medication. Some schools use self-administration agreements or have given a "medication pass" to students, verifying school permission for the student to carry and take medication. The student's ability to appropriately self-administer the prescribed medication must be evaluated by the school nurse at regular intervals to ensure safety and correctness of administration. For elementary school–aged children, the self-administration of a dose of medication should be reported to school personnel as soon as the self-administered dose is given for documentation and assessment of need for additional assistance. Medications carried by students should be either on the person of the student, as in a dedicated "fanny pack," or in possession of a supervising adult who will return the medication pack to the student as needed or when the student moves on to a new location. Medications should not be left unattended.

OTC MEDICATIONS

School administrators and health personnel should consider whether the benefits of administration of OTC medications outweigh the risks. Some states and school districts apply the same standards for OTC as for prescription medications. Others permit parent-recommended OTC medications or dietary supplements to be administered without a physician order. Either approach can be problematic. Providing parent-approved short-term medications, such as pain relievers, antiinflammatory medications, and antihistamines, for example, may provide symptomatic improvement for the student, which enables attendance for learning and causes less classroom disruption. However, this practice can result in liability for a school district, because nonprescribed medications have potential to cause harm or adverse effects that may impede learning. There are also issues of school safety and security of drug use (eg, sharing of medication between classmates when OTC medications are not stored in the school health office). On the other hand, the social realities of parents who work, often in jobs that do

not allow for medical leave to attend to their children's illnesses, may require that they send their children to school with mild illnesses. It can be difficult to obtain physician authorization for OTC medications. Because of these realities, it may be necessary to consider allowing the administration of nonprescribed, parent-recommended medications for students during the school day on a short-term basis. The relative value of OTC medications for the specific population should guide policies. Cold and cough OTC medicines have not been shown to be effective in children younger than 6 years and are not appropriate for use at school without a physician order.[55] When OTC medications are permitted, school physicians and school nurses should develop standing protocols or standing orders that support 1-time verbal parental permission for specific OTC medications (eg, acetaminophen and ibuprofen).[28,30,56]

ADDITIONAL CIRCUMSTANCES

Alternative medications, such as herbal or homeopathic medications, are not tested by the US Food and Drug Administration for safety or effectiveness. Lack of safety information for these medications limits their appropriate use at school.[57] State and district medication policies should be used for alternative medications. These medications should never be administered without a written physician order. State and district policies should also address experimental medications and medications administered at doses in excess of manufacturer guidelines.[58]

RECOMMENDATIONS

Recommendations for Pediatricians and Other Child Health Professionals

The AAP recommends that pediatricians and other prescribing pediatric health care professionals take the following actions when writing prescriptions for students:

1. Prescribe medications for administration at school only when necessary. Many short-term and long-term medications can be given before and after school.
2. Learn about local school nursing services, medication policies and forms, and self-administration procedures.
3. Write specific, clear, and detailed instructions on dated, standardized school medication forms. Consider that the "need to treat" may be delegated to UAP.
4. Carefully assess and declare in writing your recommendation concerning students' self-carrying/self-administration on the basis of your patient demonstrating the appropriate developmental, physical, and intellectual capacity to self-carry and/or self-administer an emergency medication at school (see National Asthma Education and Prevention Program guidance[34]).
5. Collaborate with school physicians and school nurses and encourage parental collaboration.
6. Promote student health by advocating for coordinated school health programs.
7. Advocate for improved communication systems among schools, families, and pediatricians that support medication-administration services for students at school.
8. Advocate for improved school medication data collection and reporting by schools and school nurses.
9. Participate on your district's school health council. School health councils offer an opportunity for the development of collaborative liaisons among school administrators, licensed school health staff, and community health professionals.

Recommendations for Public Advocacy

The AAP recommends that pediatricians and other child health professionals and their state professional organizations take the following actions:

1. Participate on or support the creation of a district school health council to promote student health and improved communications in a coordinated school health program;
2. Work with state departments of health and/or education, state and local school boards, and school districts to ensure the development and funding of adequate school health program staffing and sound school medication policies and procedures as outlined in this statement; and
3. Support state laws, regulations, or standards that establish specific policies for the safe and effective administration of medications in schools that apply to all state school districts.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Psychosocial Aspects of Child and Family Health

Guidance for Effective Discipline

ABSTRACT. When advising families about discipline strategies, pediatricians should use a comprehensive approach that includes consideration of the parent–child relationship, reinforcement of desired behaviors, and consequences for negative behaviors. Corporal punishment is of limited effectiveness and has potentially deleterious side effects. The American Academy of Pediatrics recommends that parents be encouraged and assisted in the development of methods other than spanking for managing undesired behavior.

Parents often ask pediatricians for advice about the provision of appropriate and effective discipline. In fact, 90% of pediatricians report that they include advice about discipline when providing anticipatory guidance to families.[1] The American Academy of Pediatrics held a consensus conference on corporal punishment, the report of which was published in *Pediatrics* and serves as one major source of information for this statement.[2]

The word discipline, which comes from the root word disciplinare—to teach or instruct—refers to the system of teaching and nurturing that prepares children to achieve competence, self-control, self-direction, and caring for others.[3] An effective discipline system must contain three vital elements: 1) a learning environment characterized by positive, supportive parent–child relationships; 2) a strategy for systematic teaching and strengthening of desired behaviors (proactive); and 3) a strategy for decreasing or eliminating undesired or ineffective behaviors (reactive). Each of these components needs to be functioning adequately for discipline to result in improved child behavior.

DEVELOPMENTAL APPROACH TO DISCIPLINE

The earliest discipline strategy is passive and occurs as infants and their caregivers gradually develop a mutually satisfactory schedule of feeding, sleeping, and awakening. Biologic rhythms tend to become more regular and adapt to family routines. Signals of discomfort, such as crying and thrashing, are modified as infants acquire memories of how their distress has been relieved and learn new strategies to focus attention on their emerging needs.[4]

The main parental discipline for infants is to provide generally structured daily routines but also to learn to recognize and respond flexibly to the infant's needs. As infants become more mobile and initiate more contact with the environment, parents must impose limitations and structure to create safe spaces for them to explore and play. Equally important, parents must protect them from potential hazards (eg, by installing safety covers on electric outlets and by removing dangerous objects from their reach) and introduce activities that distract their children from potential hazards. Such proactive behaviors are central to discipline for toddlers. Communicating verbally (a firm no) helps prepare the infant for later use of reasoning, but parents should not expect reasoning, verbal commands, or reprimands to manage the behavior of infants or toddlers.

As children grow older and interact with wider, more complex physical and social environments, the adults who care for them must develop increasingly creative strategies to protect them and teach them orderly and desirable patterns of behavior. As a result of consistent structure and teaching (discipline), children integrate the attitudes and expectations of their caregivers into their behavior. Preschoolers begin to develop an understanding of rules, and their behavior is guided by these rules and by the consequences associated with them. As children become school age, these rules become internalized and are accompanied by an increasing sense of responsibility and self-control. Responsibility for behavior is transferred gradually from the caregiving adult to the child, and is especially noticeable during the transition to adolescence. Thus, parents must be prepared to modify their discipline approach over time, using different strategies as the child develops greater independence and capacity for self-regulation and responsibility. The process can be more challenging with children who have developmental disabilities and may require additional or more intense strategies to manage their behavior.

STRATEGIES FOR EFFECTIVE DISCIPLINE

Effective discipline requires three essential components: 1) a positive, supportive, loving relationship between the parent(s) and child, 2) use of positive reinforcement strategies to increase desired behaviors, and 3) removing reinforcement or applying punishment to reduce or eliminate undesired behaviors. All components must be functioning well for discipline to be successful.

Promoting Optimal Parent–Child Relationships and Reinforcing Positive Behaviors

For discipline techniques to be most effective, they must occur in the context of a relationship in which children feel loved and secure. In this context, parents' responses to children's behavior, whether approving or disapproving, are likely to have the greatest effect because the parents' approval is important to the children. Parental responses within the context of loving and secure relationships also provide chil-

dren with a sense that their environment is stable and that a competent adult is taking care of them, which leads to the development of a sense of personal worth. As children respond to the positive nature of the relationship and consistent discipline, the need for frequent negative interactions decreases, and the quality of the relationship improves further for both parents and children. To this end, the best educators of children are people who are good role models and about whom children care enough to want to imitate and please. Certain conditions in the parent–child relationship have been found to be especially important in promoting positive child behavior, including:

- maintaining a positive emotional tone in the home through play and parental warmth and affection for the child[5];
- providing attention to the child to increase positive behavior (conversely ignoring, removing, or withholding parent attention to decrease the frequency or intensity of undesirable behaviors).[6] For older children, attention includes being aware of and interested in their school and other activities;
- providing consistency in the form of regular times and patterns for daily activities and interactions to reduce resistance, convey respect for the child, and make negative experiences less stressful[7];
- responding consistently to similar behavioral situations to promote more harmonious parent–child relationships and more positive child outcomes[8]; and
- being flexible, particularly with older children and adolescents, through listening and negotiation to reduce fewer episodes of child noncompliance with parental expectations.[8] Involving the child in decision-making has been associated with long-term enhancement in moral judgment.[9]

These factors are important in developing a positive, growth-enhancing relationship between parent and child. Even in the best relationships, however, parents will need to provide behavioral limits that their children will not like, and children will behave in ways that are unacceptable to parents. Disagreement and emotional discord occur in all families, but in families with reinforcing positive parent–child relationships and clear expectations and goals for behavior, these episodes are less frequent and less disruptive.

Rewarding Desirable or Effective Behaviors

The word discipline usually connotes strategies to reduce or eliminate undesirable behaviors. However, more successful child-rearing systems use procedures to both increase desirable behaviors and decrease undesirable behaviors. Eliminating undesirable behavior without having a strategy to stimulate more desirable behavior generally is not effective. The most critical part of discipline involves helping children learn behaviors that meet parental expectations, are effective in promoting positive social relationships, and help them develop a sense of self-discipline that leads to positive self-esteem. Behaviors that the parents value and want to encourage need to be identified by the parents and understood by their children.

Many desirable behavioral patterns emerge as part of the child's normal development, and the role of adults is to notice these behaviors and provide positive attention to strengthen and refine them. Other desirable behaviors are not part of a child's natural repertoire and need to be taught, such as sharing, good manners, empathy, study habits, and behaving according to principles despite the fact that immediate rewards for other behaviors (eg, lying or stealing) may be present. These behaviors must be taught to children through modeling by parents and shaping skills through parental attention and encouragement. It is much easier to stop undesired behaviors than to develop new, effective behaviors. Therefore, parents must identify the positive behaviors and skills that they want for their children and make a concerted effort to teach and strengthen these behaviors.

Strategies for parents and other caregivers that help children learn positive behaviors include:

- providing regular positive attention, sometimes called special time (opportunities to communicate positively are important for children of all ages);
- listening carefully to children and helping them learn to use words to express their feelings;
- providing children with opportunities to make choices whenever appropriate options exist and then helping them learn to evaluate the potential consequences of their choice;
- reinforcing emerging desirable behaviors with frequent praise and ignoring trivial misdeeds; and
- modeling orderly, predictable behavior, respectful communication, and collaborative conflict resolution strategies.[10]

Such strategies have several potential benefits: the desired behavior is more likely to become internalized, the newly learned behavior will be a foundation for other desirable behaviors, and the emotional environment in the family will be more positive, pleasant, and supportive.

Reducing and Eliminating Undesirable Behavior

When undesirable behavior occurs, discipline strategies to reduce or eliminate such behavior are needed.[11] Undesirable behavior includes behavior that places the child or others in danger, is noncompliant with the reasonable expectations and demands of the parents or other appropriate adults (eg, teachers), and interferes with positive social interactions and self-discipline. Some of these behaviors require an immediate response because of danger or risk to the child. Other undesirable behaviors require a consistent consequence to prevent generalization of the behavior to other situations. Some problems, particularly those that involve intense emotional exchanges, may be handled best by taking a break from the situation and discussing it later when emotions have subsided, developing alternative ways to handle the situation (removing attention), or, in many cases, avoiding these situations altogether.

Extinction including time-out and removal of privileges, and punishment are two common discipline approaches that have been associated with reducing undesired behavior. These different strategies, sometimes both confusingly called punishment, are effective if applied appropriately to specific behaviors. Although they both reduce undesired behavior, they work in very different ways and have very different short- and long-term effects. For both strategies, the following factors may increase the effectiveness:

- clarity on the part of the parent and child about what the problem behavior is and what consequence the child can expect when this behavior occurs;
- providing a strong and immediate initial consequence when the targeted behavior first occurs;
- consistently providing an appropriate consequence each time a targeted problematic behavior occurs;
- delivering instruction and correction calmly and with empathy; and
- providing a reason for a consequence for a specific behavior, which helps children beyond toddler age to learn the appropriate behavior[12] and improves their overall compliance with requests from adults.[13]

Occasionally, the consequence for an undesired behavior is immediate, without parental involvement (eg, breaking one's own toy), and may be effective in teaching children to change their behavior. When this consequence is combined with parental reprimand, there is an increase in the likelihood that the child's behavior will be affected for future similar situations.

Time-Out or Removal of Privileges

Time-out and removal of privileges are approaches that involve removing positive reinforcement for unacceptable behavior. For young children, time-out usually involves removing parental attention and praise (ignoring) or being placed in a chair for a specified time with no adult interaction. For older children and adolescents, this strategy usually involves removing privileges or denying participation in activities (eg, grounding for an evening with no TV or loss of driving privileges). To be effective, this strategy requires that a valued privilege or reinforcer is removed. In preschool children, time-out (removal of positive parental attention) has been shown to increase compliance with parental expectations from ~25% to 80%,[12] and similar effectiveness is seen when used appropriately with older children.[14] To be effective, however, time-out must be used consistently, for an appropriate duration, not excessively, and with strategies for managing escape behavior in place before the time-out is imposed. To be successful, time-out requires effort and practice on the part of the parents and, in some cases, requires specific education with a professional.

Several aspects of time-out must be considered to ensure effectiveness. When time-out is first implemented, it usually will result in increased negative behavior by the child, who will test the new limit with a display of emotional behavior, sometimes approaching a temper tantrum. The parent who accepts this normal reaction and does not respond to the child's behavior will find that outbursts become less frequent and that the targeted undesirable behavior also diminishes or disappears. When time-out is used appropriately, the child's feelings are neither persistent nor damaging to self-esteem, despite the intensity of the reaction. However, if the parent engages in verbal or physical interaction with the child during this disruptive behavior, the emotional outburst, as well as the behavior originally targeted, not only will persist, but may worsen. Second, time-out often is not effective immediately, although it is highly effective as a long-term strategy. Third, it is often difficult emotionally for a parent to ignore the child during periods of increased negative behaviors or when the child begins pleading and bargaining for time-out to end. The inability of parents to deal with their own distress during a time-out is one of the most common reasons for its failure.

PUNISHMENT

Punishment is defined as the application of a negative stimulus to reduce or eliminate a behavior. There are two types typically used with children: punishment involving verbal reprimands and disapproval and punishment involving physical pain, as in corporal punishment.

Verbal Reprimands

Many parents use disapproving verbal statements as a form of punishment to alter undesired behavior. When used infrequently and targeted toward specific behaviors, such reprimands may be transiently effective in immediately halting or reducing undesirable behaviors. However, if used frequently and indiscriminately, verbal reprimands lose their effectiveness and become reinforcers of undesired behavior because they provide attention to the child. Verbal reprimands given by parents during time-out are a major cause of reduced effectiveness of this form of discipline. Verbal reprimands should refer to the undesirable behavior and not slander the child's character.

Corporal Punishment

Corporal punishment involves the application of some form of physical pain in response to undesirable behavior. Corporal punishment ranges from slapping the hand of a child about to touch a hot stove to identifiable child abuse, such as beatings, scaldings, and burnings. Because of this range in the form and severity of punishment, its use as a discipline strategy is controversial. Although significant concerns have been raised about the negative effects of physical punishment and its potential escalation into abuse, a form of physical punishment—spanking—remains one of the strategies used most commonly to reduce undesired behaviors, with >90% of American families reporting having used spanking as a means of discipline at some time.[15] Spanking, as discussed here, refers to striking a child with an open

hand on the buttocks or extremities with the intention of modifying behavior without causing physical injury. Other forms of physical punishment, such as striking a child with an object, striking a child on parts of the body other than the buttocks or extremities, striking a child with such intensity that marks lasting more than a few minutes occur, pulling a child's hair, jerking a child by the arm, shaking a child, and physical punishment delivered in anger with intent to cause pain, are unacceptable and may be dangerous to the health and well-being of the child. These types of physical punishment should never be used.

Despite its common acceptance, and even advocacy for its use,[16] spanking is a less effective strategy than time-out or removal of privileges for reducing undesired behavior in children. Although spanking may immediately reduce or stop an undesired behavior, its effectiveness decreases with subsequent use. The only way to maintain the initial effect of spanking is to systematically increase the intensity with which it is delivered, which can quickly escalate into abuse. Thus, at best, spanking is only effective when used in selective infrequent situations.

The following consequences of spanking lessen its desirability as a strategy to eliminate undesired behavior.

- Spanking children <18 months of age increases the chance of physical injury, and the child is unlikely to understand the connection between the behavior and the punishment.
- Although spanking may result in a reaction of shock by the child and cessation of the undesired behavior, repeated spanking may cause agitated, aggressive behavior in the child that may lead to physical altercation between parent and child.
- Spanking models aggressive behavior as a solution to conflict and has been associated with increased aggression in preschool and school children.[17]
- Spanking and threats of spanking lead to altered parent–child relationships, making discipline substantially more difficult when physical punishment is no longer an option, such as with adolescents.
- Spanking is no more effective as a long-term strategy than other approaches,[18] and reliance on spanking as a discipline approach makes other discipline strategies less effective to use.[19] Time-out and positive reinforcement of other behaviors are more difficult to implement and take longer to become effective when spanking has previously been a primary method of discipline.
- A pattern of spanking may be sustained or increased. Because spanking may provide the parent some relief from anger, the likelihood that the parent will spank the child in the future is increased.[20]

Parents who spank their children are more likely to use other unacceptable forms of corporal punishment.[21] The more children are spanked, the more anger they report as adults, the more likely they are to spank their own children, the more likely they are to approve of hitting a spouse, and the more marital conflict they experience as adults.[20] Spanking has been associated with higher rates of physical aggression, more substance abuse, and increased risk of crime and violence[22] when used with older children and adolescents.

RECOMMENDATIONS

Because of the negative consequences of spanking and because it has been demonstrated to be no more effective than other approaches for managing undesired behavior in children, the American Academy of Pediatrics recommends that parents be encouraged and assisted in developing methods other than spanking in response to undesired behavior.

The Pediatrician's Role

Encouraging alternative methods may evoke strong responses from some parents and pediatricians because 90% of parents in the United States spank their children, and most adults were spanked when they were children. A survey indicated that ≤59% of pediatricians support the use of corporal punishment, at least in certain situations.[1] Support for spanking is higher in response to a child who runs into the street than it is as a punishment for hitting another child, even though the adult reaction of fear is the most effective deterrent in the former. As with other adults, pediatricians have learned much of their parenting skills from their own parents, who likely used spanking, and find their parents' practices more acceptable than other methods.[23] Changing discipline methods in the United States is likely to take time and to occur gradually, but it should be a goal of pediatricians and parents.

Discussing discipline with parents can be difficult and emotionally charged because opinions about these practices are formed in childhood. This learning occurred under emotional circumstances and is affected by parents' needs to justify their own parents' practices. Also, some religious groups take strong positions on this issue, often in favor of corporal punishment. In addition, discipline practices are under public scrutiny because of the increasing recognition of child abuse, which pediatricians are required to report. As a result, parents may be cautious about discussing their discipline practices. One effective way to start a discussion is by making an observation about the child's behavior during a health care visit and asking about the child's behavior at home. If parents comment negatively about their child's behavior, the severity of the problem should be determined. Eliciting specific examples of disciplinary encounters and responding nonjudgmentally to them are key to understanding the degree of behavioral disturbance[24] and the appropriateness of parental response. Asking about the parents' childhood experiences with discipline, their decision about how they would discipline as parents, and what other key people in their lives say about how they should discipline their children can be beneficial to understanding the parents' philosophy about discipline. It is important to obtain information about all

three aspects of the system of discipline (parent–child relationship, shaping and teaching desired behavior, and reducing undesired behavior) to determine which aspects may require intervention.[3] Generally, a visit with all the key caregiving adults is most effective when there is a problem, although this may not be necessary in cases involving minor discipline problems.[25] Parenting is difficult; parents deserve information, encouragement, and support over time.

Specific Physician Activities

When counseling families about discipline, physicians need to[26]:

1. be clear about what constitutes acceptable discipline;
2. avoid displaying strong emotions during the visit;
3. work to understand the parents' justification of their current practices and address their reasoning when presenting alternatives (offer privacy from children during this discussion);
4. demonstrate interest and expertise in child development and behavior during general visits to develop credibility for future discussions about discipline;
5. use good interviewing skills to show empathy;
6. let the family lead in individualizing a plan and choosing among techniques presented that are acceptable to them. Address the views of other influential family members;
7. look for examples of the parents' effective discipline approach; help them gain strength and generalize from those to other situations. Suggest ways to modify the family's techniques to make them more effective and appropriate;
8. follow up on the discipline discussion in subsequent conversations, by phone or in person;
9. discuss discipline during well-child visits when the child is young to help parents establish reasonable behavioral control. It is preferable to work toward preventing problems, because established negative behaviors often are extremely difficult to change;
10. identify parenting programs and individual counselors who are available in your community for parents with more difficult parenting problems; and
11. participate in public education and advocacy to change cultural attitudes about discipline.

The aspects of the system of discipline presented herein are effective when used at home, in out-of-home child care, at school, and in laboratory settings. Parents can be taught the use of appropriate discipline effectively through reading[27]; at-home family review of videotapes presenting behavioral situations[28]; individual instruction by a nurse in a health care setting[29]; individual or family counseling with a competent professional; group didactic teaching; or group instruction with modeling, role-playing, videotapes, or direct feedback about their parent–child interactions.[30] The intensity and duration of intervention needed to produce a change in family interaction depend on the severity of the child's behavior problems and on other stresses in the family, rather than on income level or social class. Studies have shown generalization from laboratory settings to the home, school,[28] and untreated sibling behavior, and across time. Pediatricians must be creative, persistent, and hopeful to generate change in the gradual manner in which it is likely to occur. A broader view of discipline needs to include the entire social structure. For example, cultures with children with relatively few behavior problems have been characterized by clear role definitions, clear expectations for the child's active work role in the family, very stable family constellations, and involvement of other community members in child care and supervision.[31] Advocacy by pediatricians for other supports within communities also is desirable.

SUPPLEMENTARY INFORMATION

1. Parents are more likely to use aversive techniques of discipline when they are angry or irritable, depressed, fatigued, and stressed. In 44% of those surveyed, corporal punishment was used ≥50% of the time because the parent had lost it. Approximately 85% expressed moderate to high anger, remorse, and agitation while punishing their children.[21] These findings challenge most the notion that parents can spank in a calm, planned manner. It is best not to administer any punishments while in a state of anger.
2. Spanking of young children is highly correlated with continued spanking of school and adolescent children.[20] More than half of 13- and 14-year-olds are still being hit an average eight times per year.[17] Parents who have relied on spanking do not seem to shift strategies when the risks of detrimental effects increase with developmental age, as has been argued.
3. Spanking of preschool boys by fathers with whom the child identified only moderately or little resulted in increased aggressive behavior by those children.[17]
4. Corporal punishment in two-parent, middle class families occurred weekly in 25%, was associated with the use of an object occasionally in 35% and half of the time in 17%, caused considerable pain at times in 12%, and inflicted lasting marks at times in 5%.[21] Thus, striking children in the abusive range is neither rare nor confined to families of lower socioeconomic class, as has been asserted.
5. Although children may view spanking as justified and symbolic of parental concern for them, they rate spanking as causing some or much pain in more than half of cases and generally experience anger at the adult as a result. Despite this, children come to accept spanking as a parent's right at an early age, making changes in adult acceptance of spanking more difficult.[21]
6. The more children are hit, the more anger they report as adults, the more they hit their own children when they are parents, the more likely they are to approve of hitting and to actually hit

their spouses, and the greater their marital conflict.[20]

7. Although 93% of parents justify spanking, 85% say that they would rather not if they had an alternative in which they believed.[21] One study found that 54% of mothers said that spanking was the wrong thing to have done in at least half of the times they used it.[20] This ambivalence likely results in inconsistent use, which limits further its effectiveness as a teaching tool.
8. Although spanking has been shown to be effective as a back-up to enforce a time-out location, it was not more effective than use of a barrier as an alternative.[32]
9. Even controlling for baseline antisocial behavior, the more 3- to 6-year-old children were hit, the worse their behavior when assessed 2 years later.[20]
10. Actions causing pain such as spanking can acquire a positive value rather than the intended adversive value.[31] Children who expect pain may actually seek it through escalating misbehaviors.
11. Parents who spank are more likely to use other forms of corporal punishment and a greater variety of verbal and other punitive methods.[22] When punishment fails, parents who rely on it tend to increase the intensity of its use rather than to change strategies.

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ERRATUM

In the policy statement entitled "Guidance for Effective Discipline" (April 1998;101:723-728), the names of two former committee members whose contributions were crucial were not included in the list of authors. We apologize for not crediting the following individuals:

Martin T. Stein, MD, Chairperson, Committee on Psychosocial Aspects of Child and Family Health, 1992-1996

Ellen C. Perrin, MD, Member, Committee on Psychosocial Aspects of Child and Family Health, 1990-1996

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Guideline for the Evaluation of Cholestatic Jaundice in Infants: Recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition

Abstract

For the primary care provider, cholestatic jaundice in infancy, defined as jaundice caused by an elevated conjugated bilirubin, is an uncommon but potentially serious problem that indicates hepatobiliary dysfunction. Early detection of cholestatic jaundice by the primary care physician and timely, accurate diagnosis by the pediatric gastroenterologist are important for successful treatment and a favorable prognosis. The Cholestasis Guideline Committee of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition has formulated a clinical practice guideline for the diagnostic evaluation of cholestatic jaundice in the infant. The Cholestasis Guideline Committee, consisting of a primary care pediatrician, a clinical epidemiologist (who also practices primary care pediatrics), and five pediatric gastroenterologists, based its recommendations on a comprehensive and systematic review of the medical literature integrated with expert opinion. Consensus was achieved through the Nominal Group Technique, a structured quantitative method.

The Committee examined the value of diagnostic tests commonly used for the evaluation of cholestatic jaundice and how those interventions can be applied to clinical situations in the infant. The guideline provides recommendations for management by the primary care provider, indications for consultation by a pediatric gastroenterologist, and recommendations for management by the pediatric gastroenterologist.

The Cholestasis Guideline Committee recommends that any infant noted to be jaundiced at 2 weeks of age be evaluated for cholestasis with measurement of total and direct serum bilirubin. However, breast-fed infants who can be reliably monitored and who have an otherwise normal history (no dark urine or light stools) and physical examination may be asked to return at 3 weeks of age and, if jaundice persists, have measurement of total and direct serum bilirubin at that time.

This document represents the official recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition on the evaluation of cholestatic jaundice in infants. The American Academy of Pediatrics has also endorsed these recommendations. These recommendations are a general guideline and are not intended as a substitute for clinical judgment or as a protocol for the care of all patients with this problem.

BACKGROUND

Cholestatic jaundice, characterized by elevation of serum *conjugated* bilirubin, is an uncommon but potentially serious condition that indicates hepatobiliary dysfunction. Early detection of cholestatic jaundice by the primary care provider and timely, accurate diagnosis by the pediatric gastroenterologist are important for successful treatment and a favorable prognosis. In contrast, *physiologic jaundice* and *breast milk jaundice*, common causes of jaundice in the first weeks of life, are caused by an elevation of serum *unconjugated* bilirubin. Both are self-limited maturational disorders observed in many infants in the first weeks of life.

Cholestatic jaundice affects approximately 1 in every 2,500 infants (1,2), and is thus infrequently seen by most providers of medical care to infants. However, distinguishing jaundice caused by cholestasis from noncholestatic conditions is critical because cholestatic jaundice is much more likely to have a serious etiology that needs prompt diagnosis and therapy. The most common causes of cholestatic jaundice in the first months of life are biliary atresia and neonatal hepatitis, which account for most cases. Neonatal hepatitis has referred to a histologic appearance of widespread giant cell transformation. Although giant cell transformation is recognized to be nonspecific and may be associated with infectious, metabolic, and syndromic disorders, this term is used to be consistent with the older literature reviewed for this guideline. Alpha-1 antitrypsin deficiency causes another 5% to 15% of cases (1,2). The remaining cases are caused by a variety of other disorders, including extrahepatic obstruction from common duct gallstone or choledochal cyst; metabolic disorders such as tyrosinemia, galactosemia, and hypothyroidism; inborn errors of bile acid metabolism; Alagille syndrome; infection; and other rare disorders (Table 1).

Infants with cholestatic jaundice caused by bacterial sepsis, galactosemia, hypopituitarism, or gallstone often appear acutely ill. These disorders require early diagnosis and urgent treatment. However, many infants with cholestatic jaundice appear otherwise healthy and grow normally. The benign appearance of such an infant may lull the parents or physician into believing that the jaundice is physiologic or caused by breast-feeding, when in fact it may be caused by biliary atresia. Biliary atresia occurs in 1 in 10,000 to 19,000 infants (3ï 6) (Elliott EJ, Australian Pediatric Surveillance Unit, Extra-hepatic Biliary Atresia Study Group, personal communication,

TABLE 1. *Most likely causes of cholestasis in the younger-than 2-month-old infant*

Obstructive cholestasis
Biliary atresia
Choledochal cyst
Gallstones or biliary sludge
Alagille syndrome
Inspissated bile
Cystic fibrosis
Neonatal sclerosing cholangitis
Congenital hepatic fibrosis/Caroliôs disease
Hepatocellular cholestasis
Idiopathic neonatal hepatitis
Viral infection
Cytomegalovirus
HIV
Bacterial infection
Urinary tract infection
Sepsis
Syphilis
Genetic/metabolic disorders
α1-antitrypsin deficiency
Tyrosinemia
Galactosemia
Hypothyroidism
Progressive familial intrahepatic cholestasis (PFIC)
Cystic fibrosis
Panhypopituitarism
Toxic/secondary
Parenteral nutrition-associated cholestasis

2001). Substantial observational evidence suggests that earlier diagnosis and surgical repair lead to better outcomes for this disorder (7). The Kasai portoenterostomy appears to have the greatest likelihood of re-establishment of bile flow and the longest term survival of the infantôs native liver when performed before the age of 45 to 60 days (7ï 10). Early diagnosis of many of the other conditions that cause cholestasis may also lead to better outcomes because better support of the infant may avoid complications of liver disease (11).

Despite these data showing that early diagnosis is potentially life saving, referral for evaluation of cholestatic jaundice frequently occurs after 45 to 60 days of age (12). In recognition of this, and noting that no evidence-based guideline for its evaluation currently exists, the Cholestasis Guideline Committee was formed by the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) to develop a clinical practice guideline for the diagnostic evaluation of cholestasis in infants.

METHODS

The Cholestasis Guideline Committee consisted of a general pediatrician, a clinical epidemiologist who also practices general pediatrics, and five pediatric gastroenterologists. The team addressed the problem of jaundice caused by conjugated hyperbilirubinemia in the 2- to 8-week-old infant. The guideline is intended to assist primary care pediatricians, neonatologists, family practitioners, nurse practitioners, physicianôs assistants, pediatric gastroenterologists, and pediatric surgeons with the process of diagnosis of infants with cholestatic jaundice, and is specifically intended to decrease the time from initial presentation to diagnosis because of the importance of early diagnosis and treatment of biliary atresia. The targeted settings include primary care outpatient settings, as well as specialty referral facilities. This guideline is not intended for the care of the ill premature infant in the intensive care setting.

Cholestasis was defined as reduced bile formation or flow resulting in the retention of substances normally excreted into bile. Conjugated hyperbilirubinemia is the most common marker; issues regarding the specifics of bilirubin measurement are detailed below. A desirable outcome was defined as optimal treatment of the underlying conditions. Optimal treatment requires timely diagnosis of the cause of the jaundice, minimizing unnecessary diagnostic testing and consultation, and minimizing delay in diagnosis of time-sensitive conditions, such as biliary atresia.

The guideline development process was intended to incorporate the best available evidence from the medical literature, in combination with expert consensus when available evidence was limited. Using expert opinion, an initial diagnostic algorithm was developed, including a set of potentially useful diagnostic tests for infants with cholestatic jaundice. To develop evidence-based estimates of the sensitivity, specificity, and accuracy of the diagnostic tests under consideration, Medline (1966ï 2002) was searched without language restriction using the terms listed in Table 2. Unpublished literature was not sought.

Abstracts for articles found in each search were reviewed for relevance. After editorials, letters, and review articles were eliminated, original studies that appeared to address the accuracy and reliability of the tests in question for the diagnosis of biliary atresia were retrieved in full and independently reviewed by two committee members, using previously published criteria for the validity of studies of diagnostic tests (13) (Table 3). The key criteria include an independent, blind comparison of the diagnostic test to a criterion standard, performed in nonselected, consecutive patients at risk for the condition of

TABLE 2. *Search strategies*

Biopsy: biliary atresia/ti,ab,sh and (biopsy or biopsy, needle)
GGT: biliary atresia/ti,ab,sh and gamma glutamyl transferase
Radionuclide scan: biliary atresia/RI
ERCP: biliary atresia/ti,ab,sh and explode cholangiopancreatography, endoscopic retrograde
Lipoprotein X: biliary atresia/ti,ab,sh and lipoprotein X
Ultrasound: biliary atresia/ti,ab,sh and (ultrasound or sonography or ultrasonography)
Duodenal aspirate: biliary atresia/ti,ab,sh and (intestinal secretions/sh or intubation, gastrointestinal)

TABLE 3. *Validity criteria for studies of diagnostic tests*

1. Was the diagnostic standard adequate?
2. Was the test compared independently and blindly to the diagnostic (ñcriterionò) standard?
3. Were the referral pattern and patient population described?
4. Was there an adequate spectrum of disease in tested patients?
5. Was the test clearly described?
6. Was observer variation in test results addressed?

interest. Studies were considered to meet minimum criteria for validity if the test was performed in consecutive patients and did not appear to influence the determination of the final diagnosis. Each article was assigned a score based on these criteria, and the quality of evidence underlying each of the recommendations made by the Cholestasis Guideline Committee was determined according to the scheme shown in Table 4.

The final algorithm (Fig. 1) is based on the evidence found for each test, combined with expert opinion and consensus when the published evidence was insufficient. Recommendations are summarized in Table 5. Consensus was achieved through the nominal group technique (14).

The guidelines were then reviewed by primary care physicians in community and academic practices. In addition, the guidelines were distributed to the NASPGHAN membership for review and comment and were officially endorsed by the NASPGHAN Executive Council. This document represents the official recommendations of NASPHGAN on the evaluation of cholestatic jaundice of the infant. The American Academy of Pediatrics has also endorsed these recommendations. This review and recommendations are a general guideline and are not intended as a substitute for clinical judgment or as a protocol for the care of all patients with this problem.

TABLE 4. *Coding scheme for quality of evidence*

Level of evidence	Criterion for this level
Level A	Recommendation based on 2 or more studies that compared the test to a criterion standard in an independent, blind manner in an unselected population of infants similar to those addressed in the guideline.
Level B	Recommendation based on a single study that compared the test to a criterion standard in an independent, blind manner in an unselected population of infants similar to those addressed in the guideline.
Level C	Recommendation based on lower quality studies or studies for which inadequate information is provided to assess quality, together with expert opinion and consensus of the committee.
Level D	No studies available; recommendation based on expert opinion and consensus of the committee.

Table 5. *Recommendations*

Recommendation	Level of evidence
It is recommended that any infant noted to be jaundiced at 2 weeks of age be clinically evaluated for cholestasis with measurement of total and direct serum bilirubin. However, breast-fed infants who can be reliably monitored and who have an otherwise normal history (no dark urine or light stools) and physical examination may be asked to return at 3 weeks of age and, if jaundice persists, have measurement of total and direct serum bilirubin at that time.	C
Retest any infant with an acute condition or other explanation for jaundice whose jaundice does not resolve with appropriate management of the diagnosed condition.	D
Ultrasound is recommended for infants with cholestasis of unknown etiology.	A
Liver biopsy is recommended for most infants with cholestasis of unknown etiology.	A
GGTP and lipoprotein X are not routinely recommended in the evaluation of cholestasis in young infants.	C
Scintigraphy and duodenal aspirate are not routinely recommended but may be useful in situations in which other tests are not readily available.	A
MRCP and ERCP are not routinely recommended, although ERCP may be useful in experienced hands.	C

INITIAL EVALUATION OF THE JAUNDICED INFANT

The initial recognition and evaluation of any infant with possible cholestasis depends upon physicians and other providers of medical care to infants. The age limits of 2 weeks to 8 weeks of age used in this guideline were selected because they represent times when primary care providers typically examine healthy infants. As the evaluation proceeds, the tests to accurately diagnose cholestasis fall increasingly in the province of the referral center and pediatric gastroenterologist. Different care models or differing relationships between primary physicians and referral centers may alter the point at which the responsibility for the evaluation shifts from primary care to specialist. The goal remains the early detection and efficient diagnostic evaluation of cholestasis in infants.

No screening test can predict which infant will experience cholestasis (15). Thus, the detection of cholestasis rests on the clinical recognition of jaundice, pale stools, and/or dark urine by the parent or primary care provider. Each of these findings is an imperfect method of detecting cholestasis. Jaundice at 2 weeks of age is a relatively common finding, observed in 2.4% to 15% of newborns (16,17). Most such infants have unconjugated hyperbilirubinemia because of breast milk jaundice, a benign condition, although a recent report documents occasional kernicterus in otherwise healthy-appearing infants (18). In one study, jaundice was found in 9% of breast-fed infants at 4 weeks of age, but in fewer than 1 in 1,000

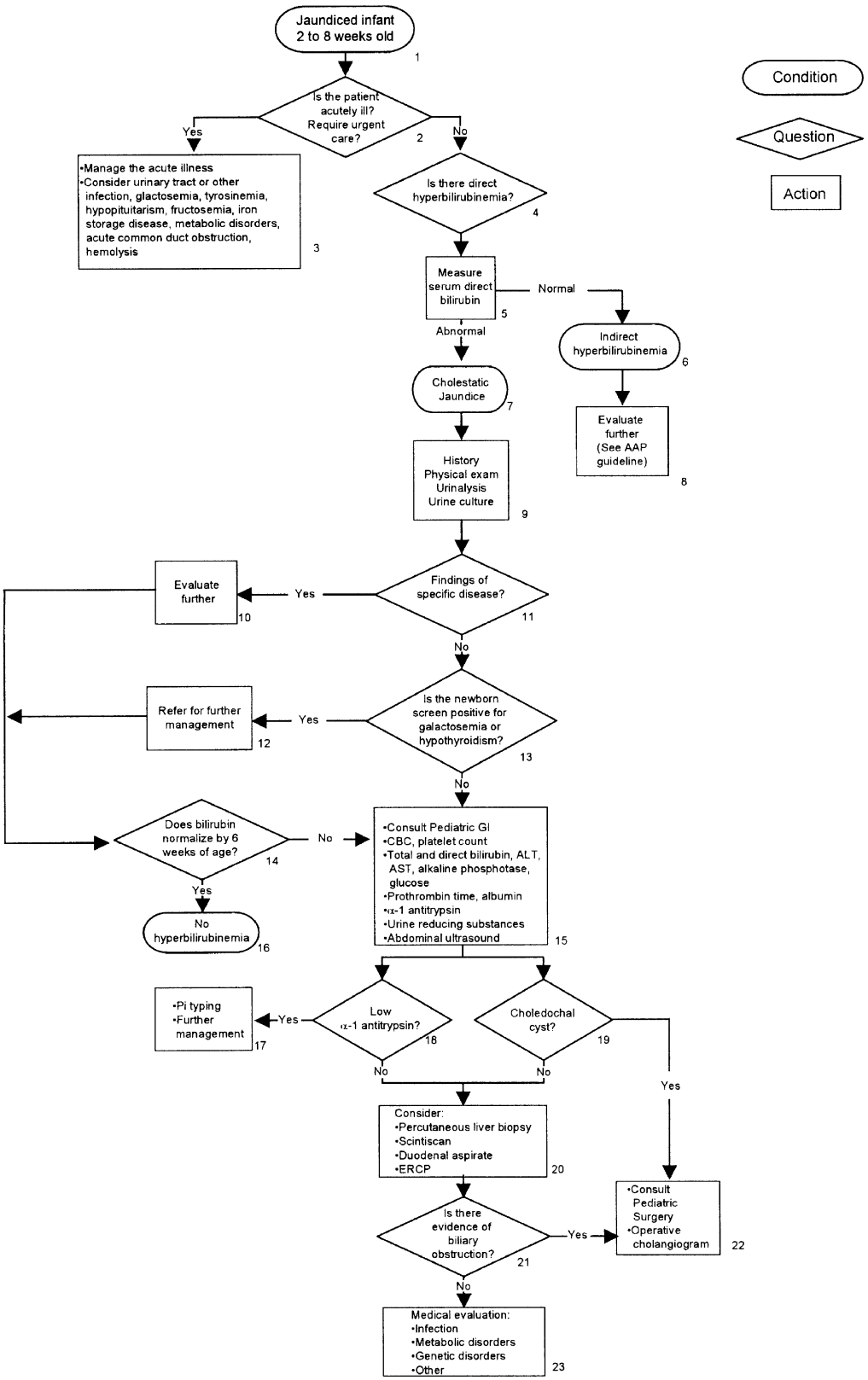

FIG. 1. Cholestasis clinical practice guideline. Algorithm for a 2- to 8-week-old infant. (North American Society for Pediatric Gastroenterology, Hepatology & Nutrition Cholestasis Guideline Committee.)

bottle-fed infants (19). Testing of all jaundiced newborns at the 2-week visit will detect cholestasis in relatively few infants (for every 60 to 375 infants with visible jaundice, 1 will have cholestasis). However, the next scheduled health maintenance visit generally does not occur until 2 months of age, beyond the optimal time for intervention in biliary atresia.

The report of pale stools by the parent or observation of clay colored stool by the physician raises the suspicion of cholestasis. In one study of 3,629 infants, 4 passed pale stools during the first 4 weeks of life, none more than three times. None of these infants had liver disease. The high specificity of persistent pale stools means that this finding almost certainly indicates disease when it is present. However, infants with biliary atresia have been noted to have pigmented stools at presentation, and stool color is variable in other conditions causing cholestasis (20). Parents do not appear to be reliable observers of stool color: even when the specific question ñWhat color is your babyôs stool?ò was added to a booklet received by all parents for well care, the average age for definitive care for infants with biliary atresia was not improved (4). A scoring card displaying color photographs of normal and abnormal stools modestly improved case finding in a subsequent program (21).

Dark urine is also a nonspecific indicator of increased conjugated bilirubin. No studies could be found that addressed the utility of this sign for case finding. Literature review did not identify any studies that defined specificity or sensitivity for the findings of jaundice, pale stools, or dark urine in combination. Thus, the clinician must continue to test for cholestasis when these findings are present, despite the low yield. The American Academy of Pediatrics practice parameter on the management of hyperbilirubinemia in the healthy term newborn recommends testing for conjugated hyperbilirubinemia if jaundice is accompanied by dark urine or light stool or if it persists beyond 3 weeks (22).

The Cholestasis Guideline Committee recommends that any infant noted to be jaundiced at 2 weeks of age be evaluated for cholestasis with measurement of total and direct serum bilirubin. However, breast-fed infants who can be reliably monitored and who have an otherwise normal history (no dark urine or light stools) and physical examination (Table 6) may be asked to return at 3 weeks of age and, if jaundice persists, have measurement of total and direct serum bilirubin at that time.

Bacterial infections, including urinary tract infection, are a well known cause of concomitant conjugated hyperbilirubinemia, probably because of the effect of bacterial endotoxin on bile formation (23,24). Otherwise asymptomatic jaundiced infants may have urinary tract infection, particularly if the onset of jaundice occurs after 8 days of age (25). Jaundice caused by an acute infection resolves when the acute illness has been addressed. Because jaundice is more likely to be related to the underlying illness, rather than primary liver disease, in the acutely ill infant, management is oriented to the underlying acute illness.

Because either conjugated or unconjugated hyperbilirubinemia may be present in a jaundiced infant who does not appear acutely ill, measurement of serum bilirubin that includes both total and direct (conjugated) bilirubin is recommended. The most commonly used laboratory determination (the diazo or van den Bergh method) does not specifically measure conjugated bilirubin but reports direct bilirubin. For methodological reasons, the higher the total bilirubin (even if it is all unconjugated), the higher the reported direct bilirubin (26ï 28). Measurements of direct bilirubin may vary significantly both within and between laboratories (29ï 32). The methods used may also influence the measurement of conjugated bilirubin (33ï 35). A specific measurement of conjugated bilirubin, such as that obtained with the Ektachem system, is optimal. Because canalicular excretion of bilirubin can be rate limiting to overall clearance, infants with high nonconjugated bilirubin may retain some conjugated bilirubin. Therefore, in the presence of elevated total bilirubin, conjugated bilirubin levels are considered abnormal when values greater than 1.0 mg/dL are reported (36). Practitioners whose laboratories use the Ektachem system could use a value of conjugated bilirubin greater than 1.0 to define cholestasis, regardless of total bilirubin. For this guideline, we defined an abnormal direct bilirubin as a value greater than 1.0 mg/dL if the total bilirubin is less than 5 mg/dL, or a value of direct bilirubin that represents more than 20% of the total bilirubin if the total bilirubin is greater than 5 mg/dL. It is important to be aware of the potential for error in these measurements and consult with the laboratory if the measurements are inconsistent with the appearance of the patient. Urine testing has also been used to diagnose cholestasis: assay of sulfated bile acids in urine was found in a single study to distinguish control infants from those with cholestasis, but this test is not generally available (37).

INITIAL EVALUATION OF THE INFANT WITH CONJUGATED HYPERBILIRUBINEMIA

For infants with only unconjugated hyperbilirubinemia, practitioners can refer to the previously published guideline on management of unconjugated hyperbilirubinemia from the American Academy of Pediatrics (22). If the conjugated serum bilirubin is elevated, cholestasis is present. The further evaluation of an infant with cholestasis is a matter of some urgency. Because biliary atresia is one of the possible causes of cholestasis, the goal of management is to complete the diagnostic evaluation, or at least to exclude biliary atresia, by 45 to 60 days of age. History and physical examination can help guide the diagnostic process for the infant with cholestasis. Some findings on history or physical examination

TABLE 6. *History and physical findings to consider for the differential diagnosis of infants with conjugated hyperbilirubinemia (see Box 9 of Figure 1)*

Topic	Specific question	Implication
History	Similar problem with parents or among siblings	Occurrence in other family members implies autosomal dominant inheritance, and occurrence in sibs implies genetic disease or nongenetic recurrence pattern: e.g., α-1AT deficiency, progressive familial intrahepatic cholestasis (PFIC), Alagilleôs, cystic fibrosis
	Consanguinity	Risk for autosomal recessive inheritance
	Maternal infection that can affect baby	TORCH infections, occasionally HBV, others
	Cholestasis of pregnancy	May be seen in PFIC
	Fetal ultrasound (yes/no; findings)	Choledochal cyst and bowel anomalies (e.g., duplication cysts) that can cause jaundice
	Past ABO or Rh disease, or Rh negative	Hemolysis
	Birth weight	SGA implies fetal involvement and weighs against biliary atresia
	Neonatal infection, including UTI, sepsis and viral infection	Often associated with conjugated hyperbilirubinemia
	Feeding history and history of weight gain	Neonatal hepatitis can cause FTT; metabolic disease (e.g., galactosemia and hereditary fructose intolerance) can cause anorexia, FTT, and jaundice. Panhypopituitarism
	Bowel historyð vomiting, stooling	Vomitingð metabolic disease, pyloric stenosis, bowel obstruction (atresia, annular pancreas); delayed stoolingð CF, hypothyroidism; diarrheað infection, metabolic disease, PFIC1, CF; clay colored stoolð biliary obstruction
	Source of nutrition	Breast or formula; composition of formula: galactose containingð galactosemia, fructose or sucrose containingð hereditary fructose intolerance
	Disposition	Irritable: may be associated with some metabolic disorders; ñgreat baby, sleeps all the time, never awake,ò lethargicð hypothyroidism or panhypopituitarism
	Urine colorð preferably directly observed	Dark urineð conjugated hyperbilirubinemia
	Stool color (useful to have reference such as yellow paint strip from paint dealer); preferably directly observed	Pale or clay colored; cholestasis, rule out obstruction
	Excessive bleeding	Coagulopathy; vitamin K deficiency
Physical findings	Vital signs; weight, length, OFC; weight for length	
	Global assessment of general health	
	Global assessment of nutritional status	Acute illness
	HEENT	Dysmorphic findingsð Alagilleôs syndrome, scleral icterus (qualitatively different in cholestasis versus nonconjugated jaundice), fundoscopic (intrauterine infection)
		Slit-lamp findings (Alagille syndrome, cataracts) snuffles
	Chest/heart	Evidence of pneumoniað neonatal infection
		Evidence of heart failureð Congestive hepatopathy
		Murmurs or other evidence of congenital heart diseaseð biliary atresia, Alagilleôs syndrome
	Abdomen	Distention
		Ascites
		Abdominal wall vasculature
		Liver size (exactly measured)
		Liver consistency
		Spleen size (below costal margin)
		Spleen consistency
		Masses
		Umbilical hernia
	Diaper exam	Dark urineð conjugated hyperbilirubinemia
		Pale or clay colored stoolð cholestasis, rule out obstruction
	Skinð bruising, petechiae, rashes	
	Neurologicð general assessment of vigor, tone, and symmetry	

will lead the clinician to other diagnostic possibilities. For example, 3% of infants with severe ABO hemolytic disease have conjugated hyperbilirubinemia that may persist until 2 weeks of age; thus, further observation may suffice for these infants (38). Table 6 describes abnormalities that may be present on history and physical examination and their potential significance. Abnormalities suggestive of a particular disease entity would lead

to more focused diagnostic evaluation, rather than further investigation of cholestasis. It is important to evaluate or repeat the newborn screen for galactosemia and hypothyroidism because these conditions can present with conjugated hyperbilirubinemia and require urgent management to prevent serious sequelae (39ï 42). Keeping in mind that the diagnosis of one disease does not preclude the presence of another, additional evaluation is necessary if the jaundice does not resolve with treatment of these specific conditions.

Consultation with a pediatric gastroenterologist is essential for infants with conjugated hyperbilirubinemia of unknown cause. The nature of this consultation may vary among practice settings. A telephone consultation may be particularly useful for practitioners at some distance from specialty care. Of the tests listed in Box 15 of the algorithm (Fig. 1), which should be ordered and where they should be performed is likely to vary, depending on which of the tests are readily available to the referring physician, and on whether examination of the patient by the specialist will be delayed. If the level of serum alpha-1 antitrypsin is found to be low, Pi typing is indicated. If an obvious extrinsic obstruction (such as choledochal cyst) is present, referral for surgery is warranted. Of the tests listed at this decision point, the ultrasound is the most operator dependent, and thus may be most appropriately performed at the referral center by more experienced personnel. In many practice settings, all of the listed tests would be best obtained by immediate referral of the patient for evaluation by the pediatric gastroenterologist. In the evaluation for infants with possible biliary atresia, it is optimal for an experienced pediatric surgeon to also be involved.

Ultrasonography is useful to identify anatomic abnormalities such as choledochal cyst. The finding of a small or absent gallbladder may suggest extrahepatic biliary atresia, but reported sensitivities as low as 73% indicate that ultrasound cannot be used to rule out this diagnosis. Several reports of high sensitivity and specificity of the ñtriangular cordò sign on ultrasound suggest that this test may be useful in the diagnosis of extrahepatic biliary atresia.(43ï 45) Again, this appears to be operator dependent. Despite these limitations, we recommend ultrasonography for the evaluation of the infant with cholestasis of unknown etiology.

Gamma glutamyl transpeptidase (GGT) has been used in the past to distinguish biliary atresia from neonatal hepatitis, but wide variability in levels makes interpretation of test results difficult. Especially in the older infant with cholestasis, a very low GGT level may be useful to exclude obstruction and, in conjunction with an elevated alkaline phosphatase level, suggests genetic and metabolic causes of intracellular cholestasis. The degree of elevation of GGT is not useful in discriminating the etiology of the cholestasis. The evidence supporting the use of ultrasound and GGT is summarized in Table 7.

FURTHER EVALUATION OF THE INFANT WITH CHOLESTASIS

Once it is established that cholestasis is present, the principal diagnostic concern is the differentiation of hepatocellular from obstructive cholestasis, of disorders of physiology from disorders of anatomy, and of disease that is managed medically from disease that is managed surgically. The tests that have been used to make this differentiation and about which we were able to find at least some evidence regarding their value were percutaneous liver biopsy, hepatobiliary radionuclide scan, and duodenal aspirate. Evidence and citations for the use of these tests are summarized in Table 7.

Percutaneous Liver Biopsy

Most studies of percutaneous liver biopsy are retrospective analyses using as a gold standard the clinical course or surgical or autopsy results. Biopsy interpretation is pathologist dependent, and requires experience that many general pathologists lack. Review of all of the studies of biopsy revealed that 50% to 99% of patients with biliary atresia are correctly identified with biopsy. Biliary atresia is incorrectly suspected from the biopsy in 0% to 46%.

In 1974, Brough and Bernstein (46) demonstrated the diagnostic usefulness of the percutaneous liver biopsy and established the diagnostic criteria that are in current use. They compared the original pathologic diagnosis in 181 consecutive patients to the ultimate diagnosis based on surgical findings and long-term follow-up. The original diagnosis was correct in 148 patients (93.7%), a high level of accuracy. More importantly, the type of error seen in the 10 patients with incorrect diagnoses would not lead to missed diagnosis of biliary atresia. In only one patient with biliary atresia was the original biopsy interpreted as hepatitis, which would lead to delay in the diagnosis and loss of important time before surgical correction. The remaining nine were suspected of having biliary atresia but actually had hepatitis. In this report, liver biopsy had a very high sensitivity (99%) and specificity (92%) for the diagnosis of biliary atresia, with somewhat less specificity for the diagnosis of neonatal hepatitis. Unfortunately, 23 patients were lost to follow-up, which reduces the value of this study. The highest quality subsequent studies performed using the Brough and Bernstein criteria demonstrate very good sensitivity and specificity for biliary atresia.

The interpretation of a single liver biopsy in a child with neonatal cholestasis is also limited by the dynamics of disease. Many cholestatic conditions express themselves differently with time. Liver biopsy specimens obtained early in the course of biliary atresia may be indistinguishable from hepatitis (47). In addition to being able to visualize the hepatocanalicular cholestasis and injury,

TABLE 7. *Diagnostic tests to distinguish EHBA from other causes of cholestasis (Box 21 of Figure 1)*

Procedure	Quality of evidence	Sensitivity* for obstruction	Specificity* for obstruction	Likelihood ratio* for obstruction	Likelihood ratio* for nonobstructive cholestasis	Time delay	Risk	Commentsð other diagnoses, issues relevant to this test
Ultrasound 44ï 46, 51ï 71	A	73%ï 100% for small or absent GB 83%ï 100% for ñtriangular cordò sign	67%ï 100% for small or absent GB 98%ï 100% for ñtriangular cordò sign	2.2ï infinite 41.5ï infinite	2.5ï infinite 5.8ï infinite	Minimal	Minimal	Procedure is operator dependent; primarily useful to rule out anatomic abnormalities such as choledochal cyst, rather than make a diagnosis of EHBA.
GGTP 47, 56, 72ï 81	C	78%ï 86%	67%ï 100%	2.4ï infinite	3.0ï 7.1	Minimal	Minimal	Variety of cut-off values used, no study with clearly independent comparison; most studies show considerable overlap.
Percutaneous biopsy 47, 56, 62, 69, 74, 82ï 89	A	89%ï 99%	82.5%ï 98%	5.2ï 49.5	7.5ï 98	1ï 3 days	Very low	Paucity of intrahepatic bile ducts, giant cell transformation, metabolic and storage diseases, PFIC, infection, neonatal sclerosing cholangitis can be diagnosed with this test. Most patients will require this test; should be interpreted by a pathologist experienced with pediatric liver disease. Sensitivity may be higher in expert hands.
Radionuclide scanning 53, 54, 56, 62, 65, 69, 74, 82, 86, 89ï 109	A	83%ï 100%	33%ï 100%	1.3ï infinite	2ï infinite	3ï 5 days for phenobarbital priming	Minimal	Most studies with sensitivity of 100%, so obstruction extremely unlikely if excretion found. Disadvantage of test is time delay and cost.
Duodenal aspirate 62, 82, 88, 97, 110ï 114	A	91%ï 100%	43%ï 100%	1.6ï infinite	4.8ï infinite	none	Minimal	Obstruction extremely unlikely if bile found in duodenal fluid. May require fluoroscopy for tube placement; test is invasive.
MRCP 71, 115ï 119	C	100% 2 studies	60% 1 study	2.5 (imprecise)	Infinite (imprecise)		Minimal	Requires deep sedation or general anesthesia; very few adequate studies.
ERCP 88, 120ï 127	C	100% 1 study	100% 1 study	Infinite	Infinite	?	Unknown	Requires sophisticated instrumentation and expertise not currently widely available; numbers based on a single study with a single endoscopist.
Lipoprotein X 79, 128ï 136	Not discussed	30%ï 88%	81%ï 100%	1.5ï infinite	2.7ï 8.3		Minimal	Test no longer available, most studies very small with poor description of methods.

Sensitivity, range of values from highest quality studies.

Specificity, range of values from highest quality studies.

LR, the ratio of the likelihood of a test result in patients who have a disease compared with the likelihood of the same test result in those without the disease; can be calculated as sensitivity (1-specificity). See Jaeschke et al[14] for details. In this table, the range is based on the sensitivity and specificity from highest quality studies.

the liver biopsy also can provide disease-specific findings. Examples include PAS-positive granules in alpha-1 antitrypsin deficiency, ductal paucity in Alagille syndrome, necroinflammatory duct lesions in sclerosing cholangitis, and other findings that are relatively specific for metabolic and storage diseases.

The evidence indicates that liver biopsy can be performed safely and expeditiously in young infants and is useful in establishing specific diagnoses (48). The Cholestasis Guideline Committee recommends that a liver biopsy be performed in most infants with undiagnosed cholestasis, to be interpreted by a pathologist with expertise in pediatric liver disease. A percutaneous liver biopsy is recommended before performing a surgical procedure to diagnose biliary atresia. If the biopsy is done early in the course of the disease (before 6 weeks of age), the biopsy may have to be repeated if the results are equivocal.

Scintigraphy

Injected radioactive material is normally excreted into the intestine within a predictable period of time. Nonvisualization of radioactivity within the intestine (in the scanning field comprising the intestines) 24 hours after injection is considered to be an abnormal result, indicating biliary obstruction or hepatocellular dysfunction. In the studies reviewed, a variety of radiolabeled scintigraphic agents were used, the diagnostic criteria varied greatly, and no blinded comparisons were found between scintigraphy and a gold standard for diagnosis. Although it is thought that the precision of the test can be improved by administering phenobarbital for several days before imaging, no studies are available to confirm or refute this hypothesis. In the available studies, the sensitivity of scintigraphy for the diagnosis of biliary atresia is high; virtually all patients with complete biliary obstruction showed no excretion on scintiscan. A few patients with a negative test (tracer evident in the intestine) later experienced biliary atresia, presumably because of disease evolving from incomplete to complete obstruction. Specificity of scintigraphy for biliary atresia or other obstructive processes is low; many patients without anatomic obstruction will not excrete tracer. Although the high sensitivity for biliary atresia makes this a fairly good single test for detecting disease, it is time consuming and expensive and does have significant false-positive and false-negative results. The Cholestasis Guideline Committee concludes that hepatobiliary scintigraphy generally adds little to the routine evaluation of the cholestatic infant but may be of value if other means for excluding biliary obstruction are not available.

Duodenal Aspirate

Limited data indicate that duodenal aspirate analysis for bilirubin concentration can identify patients with biliary obstruction with a sensitivity similar to that of scintiscan. In this test, fluid is obtained from the duodenum, either by placing a tube or a string in the duodenum, and analyzed for bilirubin concentration. A positive test for obstruction is one in which the bilirubin concentration of the aspirate is no greater than serum concentration. This would appear to be a low-tech, inexpensive alternative to scintiscan, yet it is not commonly used, probably because it is time and labor intensive, invasive, and inconvenient. The Cholestasis Guideline Committee concludes that the duodenal aspirate test may be useful in situations in which other tests to detect biliary obstruction are not available.

Magnetic Resonance Cholangiopancreatography

The few reports available to date have studied a very small number of patients, and although the results are encouraging, firm conclusions are not possible. Magnetic resonance cholangiopancreatography (MRCP) requires deep sedation or general anesthesia. Additional technical advancement and clinical experience are necessary before MRCP can be used in the evaluation of cholestatic infants. The Cholestasis Guideline Committee concludes that this test cannot be routinely recommended based on the currently available data.

Endoscopic Retrograde Cholangiopancreatography

Endoscopic retrograde cholangiopancreatography (ERCP) is an evolving technology that has been increasingly used in some tertiary referral centers to diagnose the cause of cholestasis in young infants. ERCP involves endoscopic intubation of the biliary (and pancreatic) ducts via the ampulla of Vater with a small tapered catheter and injection of contrast material to facilitate radiologic visualization of the ductal systems. A small pediatric side-viewing duodenoscope has enhanced the capability to perform this procedure in young infants. Most endoscopists prefer to perform this procedure with the patient under general anesthesia.

The data supporting the use of ERCP for the evaluation of the cholestatic infant are sparse. Many of the reports simply document the use of the prototype smaller side-viewing instrument for these patients. Operators report mixed success with the procedure to distinguish biliary atresia from neonatal hepatitis and other forms of nonoperative cholestasis. Most tertiary centers use ERCP to sort as surgical or nonsurgical cases that remain equivocal after liver biopsy. No controlled studies have been conducted to compare endoscopic techniques. In larger studies, sensitivity and specificity are excellent, but failed cannulation and/or visualization are reported in more than 10%. Patient populations vary from young infants to older infants (before or after 60 to 90 days of age). No controlled study has been done to demonstrate

that ERCP will alter the final diagnosis. A cost-benefit analysis of ERCP has not been performed, but it is possible that the procedure could obviate the need for surgical exploration in some infants. ERCP in pediatric patients has been recommended only at facilities with appropriate support staff and specialists with expertise in this procedure in young infants (49).

The Cholestasis Guideline Committee concludes that ERCP is not frequently used because of the cost of instrumentation and the need for technical expertise. The usefulness of ERCP appears to be center and operator dependent. Clinicians with the appropriate expertise and instrumentation will find the test a useful adjunct in the evaluation of the difficult-to-diagnose cause of cholestasis in an infant in whom laparotomy is being contemplated. The Committee recommends that a liver biopsy be obtained before subjecting an infant to ERCP. Under selected circumstances, ERCP can clarify the cause of neonatal cholestasis and obviate the need for laparotomy. ERCP can be recommended in selected cases at facilities with appropriate support staff and specialists with expertise in this procedure in young infants.

Lipoprotein X

This test is no longer widely available; the few studies on this subject are of poor quality and suggest poor sensitivity and specificity for differentiating biliary atresia from neonatal hepatitis. The Cholestasis Guideline Committee recommends that this test not be performed.

CONCLUSION

The rapid and effective diagnosis of the cause of cholestasis in an infant is challenging. The initial detection of these infants remains in the domain of the primary care provider and depends on the recognition of jaundice past the age of 2 weeks or recognition of abnormal stool or urine color. Laboratory testing for cholestasis should include direct (conjugated) bilirubin. A direct bilirubin value greater than 1.0 mg/dL if the total bilirubin is less than 5 mg/dL or a direct bilirubin more than 20% of the total bilirubin if the total bilirubin is greater than 5 mg/dL is considered abnormal. The relative rarity of cholestatic jaundice in contrast to unconjugated hyperbilirubinemia in this age range dictates that many jaundiced infants will be tested to find a few with elevated direct bilirubin. It is recommended that primary care providers continue to screen for cholestasis, despite its rarity, because of the gravity of the consequences of missed diagnosis.

The Cholestasis Guideline Committee recommends that any infant noted to be jaundiced at 2 weeks of age be evaluated for cholestasis with measurement of total and direct serum bilirubin. However, breast-fed infants who can be reliably monitored and who have an otherwise normal history (no dark urine or light stools) and physical examination may be asked to return at 3 weeks of age and, if jaundice persists, have measurement of total and direct serum bilirubin at that time.

Identification of cholestasis warrants a prompt effort to accurately diagnose the cause. In an ill appearing infant, the primary cause of the acute problem should be sought and treated. Cholestasis that does not resolve with resolution of the acute problem requires thorough evaluation. In a well appearing infant, cholestasis should be evaluated without delay because this condition has etiologies that are both serious and treatable. Patients with extrahepatic biliary atresia often appear well at initial presentation, and in these patients there is evidence that early diagnosis and surgical bile drainage is associated with longer survival of the native liver.

Most of the diagnostic tests that are used to determine the etiology of cholestasis in infants are operator dependent and variable in utility, and most are not commonly performed outside of referral centers. Although specific circumstances may support the performance of diagnostic testing at a referring hospital, most practitioners will need to use the diagnostic expertise of a referral center. Diagnostic workup by referring hospitals may be most useful to quickly exclude some of the many causes of cholestasis.

For all diagnostic tests reviewed, the sensitivity and specificity varied widely. Percutaneous liver biopsy had the greatest diagnostic accuracy in published studies. However, because of the dynamic and progressive nature of extrahepatic biliary atresia, even this test can be misleading. Scintigraphy appears to be primarily useful in excluding extrahepatic obstruction, consistent with the diagnosis of extrahepatic biliary atresia. Sonographic evaluation is currently useful for excluding anatomic abnormalities but may have a greater value in the future if descriptions of new findings (such as the ñtriangular cordò sign) are corroborated. ERCP may have a role in centers with pediatric gastroenterologists experienced in its use. Too little experience with MRCP has been reported to analyze its utility. Duodenal aspirate or string test may be useful in remote sites or if other testing is not readily available.

In summary, the diagnosis of neonatal cholestasis is an urgent matter. This guideline and algorithm have been developed to assist in this process. No single pathway appears to be clearly superior for the diagnosis of conditions leading to cholestasis. A guide is provided here for clinicians who are challenged with the prospect of detecting and evaluating the rare infant with cholestasis. Vigilance is crucial in detecting these patients, selecting appropriate and timely diagnostic testing based on the resources available in their own institutions, and referring the infant to a pediatric gastroenterologist who can provide the essential diagnostic and treatment modalities for optimal outcome. The scarcity and relatively low

quality of research found in this area indicate that further research is needed.

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SPECIAL ARTICLE

Guidelines for Adolescent Depression in Primary Care (GLAD-PC): I. Identification, Assessment, and Initial Management

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Endorsements: The Canadian Paediatric Society, the Society for Adolescent Medicine, the Canadian Association for Adolescent Health, the National Association for Pediatric Nurse Practitioners, the Society for Developmental and Behavioral Pediatrics, the American Academy of Child and Adolescent Psychiatry, the Canadian Academy of Child Psychiatry, the Canadian Psychiatric Association, the College of Family Medicine of Canada, the National Alliance on Mental Illness, the Mental Health Association of New York City, the National Mental Health Association (now known as Mental Health America), the Depression and Bipolar Support Alliance, and the Federation of Families for Children's Mental Health have endorsed these guidelines. Endorsements from the American Academy of Pediatrics and the Canadian Psychological Association are pending. The American Academy of Family Physicians, the American Medical Association, and the American Psychological Association have been involved in the development of the guidelines but do not endorse external guidelines.

ABSTRACT

OBJECTIVES. To develop clinical practice guidelines to assist primary care clinicians in the management of adolescent depression. This first part of the guidelines addresses identification, assessment, and initial management of adolescent depression in primary care settings.

METHODS. By using a combination of evidence- and consensus-based methodologies, guidelines were developed by an expert steering committee in 5 phases, as informed by (1) current scientific evidence (published and unpublished), (2) a series of focus groups, (3) a formal survey, (4) an expert consensus workshop, and (5) draft revision and iteration among members of the steering committee.

RESULTS. Guidelines were developed for youth aged 10 to 21 years and correspond to initial phases of adolescent depression management in primary care, including identification of at-risk youth, assessment and diagnosis, and initial management. The strength of each recommendation and its evidence base are summarized. The identification, assessment, and initial management section of the guidelines includes recommendations for (1) identification of depression in youth at high risk, (2) systematic assessment procedures using reliable depression scales, patient and caregiver interviews, and *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria, (3) patient and family psychoeducation, (4) establishing relevant links in the community, and (5) the establishment of a safety plan.

CONCLUSIONS. This part of the guidelines is intended to assist primary care clinicians in the identification and initial management of depressed adolescents in an era of great clinical need and a shortage of mental health specialists but cannot replace clinical judgment; these guidelines are not meant to be the sole source of guidance for adolescent depression management. Additional research that addresses the identification and initial management of depressed youth in primary care is needed, including empirical testing of these guidelines.

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Key Words
depression, primary care, guidelines

Abbreviations
PC—primary care
RCT—randomized, controlled, clinical trial
GLAD-PC—Guidelines for the Management of Adolescent Depression in Primary Care
MDD—major depressive disorder
DSM-IV—*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*

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MAJOR DEPRESSION IN adolescents is recognized as a serious psychiatric illness with extensive acute and chronic morbidity and mortality.[1,2] Research shows that only 50% of adolescents with depression are diagnosed before they reach adulthood.[3] In primary care (PC), as many as 2 in 3 depressed youth are not identified by their PC clinicians and do not receive any kind of care.[4,5] Even when diagnosed by PC physicians, only half of these patients are treated appropriately.[3] Furthermore, rates of completion of specialty mental health referral for youth with a recognized emotional disorder from general medical settings are quite low (J. V. Campo, MD, written communication, 2006).

In view of the shortage of mental health clinicians and barriers to children having access to mental health professionals, the well-documented need for PC clinicians to learn how to manage this condition, the increasing evidence base available to guide clinical practice, increased selective serotonin reuptake inhibitor–prescribing rates in pediatric PC,[6,7] and new evidence that a multifaceted approach with mental health consultation may improve the management of depression in PC settings,[8–11] guidelines may be a necessary first step in the identification and management of depression in adolescents in PC. Unfortunately, no depression-management guidelines have been developed for use in the PC setting in the United States or Canada.

Although additional randomized, controlled, clinical trial (RCT) information is urgently needed to guide PC clinicians in optimal management approaches, such studies often take years to complete, and many critical PC adolescent depression-management questions have not been, and will likely never be, addressed in completed or ongoing studies. To address this gap and meet the needs of PC clinicians and families who are on the "front lines" with few mental health resources available, this report and its companion article[12] constitute the first-ever evidence- and expert consensus–derived guidelines to guide PC clinicians' management of adolescent depression. These guidelines are also accompanied by a toolkit (available at no cost for download at www.glad-pc.org; see Appendix).

Over the last 3 years, the Center for the Advancement of Children's Mental Health at Columbia University and the Sunnybrook Health Sciences Center at the University of Toronto joined forces with the New York Forum for Child Health, New York District II and New York Chapters 1 through 3 of the American Academy of Pediatrics and, more recently, the REACH Institute, along with leading experts across the United States and Canada, to address the need for a synthesis of knowledge in this area. The result of this initiative was the development of the Guidelines for the Management of Adolescent Depression in Primary Care (GLAD-PC). These guidelines are based on available research and consensus of experts in depression and in PC.

In this article, we present the summary result of literature reviews of the available data and the recommendations on the identification and assessment of depression in PC settings; in our accompanying report,[12] we present the results of the reviews and recommendations on treatment (psychotherapy, psychopharmacology, and pediatric counseling) and ongoing management. Although very few studies have addressed adolescent depression identification and management in PC settings, many PC clinicians are already attempting to change their clinical practices; thus, a great need exists to develop and disseminate methods and tools for assisting PC clinicians in managing adolescent depression.

Major depressive disorder (MDD) is a specific diagnosis described in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV),[13] which includes symptoms of low mood, anhedonia, and other neurovegetative symptoms (ie, insomnia, decreased concentration, low energy, etc). Other types of depression exist, including dysthymia, subthreshold forms, or those that occur as part of bipolar disorder or other mental illness. Although the evidence for the psychopharmacology recommendations in the accompanying article[12] focus exclusively on MDD, the recommendations around identification, assessment, and initial management can be applied to other forms of depression as well.

Our guidelines also distinguish between mild, moderate, and severe forms of MDD. The DSM-IV depression criteria include 9 specific symptoms that have been shown to cluster together, run in families, and have a genetic basis,[14–18] and a large body of evidence accumulated over time now supports the internal consistency of depressive symptoms and the validity of the major depression construct, based on the validational criteria for all psychiatric diagnoses.[14] According to the DSM-IV, severity of depressive disorders can be based on symptom count. This commonly used method to define depression severity has been used in large population-based studies[19] and may be particularly relevant in PC settings in which less-severe clinical presentations of depression may be more common. Thus, mild depression may be characterized on the basis of lower scores in standardized depression scales with shorter duration of symptoms or meeting minimal criteria for depression. Following the DSM-IV, mild depression might be defined as 5 to 6 symptoms that are mild in severity. Furthermore, the patient might experience only mild impairment in functioning.

In contrast, depression might be deemed to be severe if a patient experiences all of the depressive symptoms listed in the DSM-IV. Depression might also be considered severe if the patient experiences severe impairment in functioning. Moderate depression falls between these 2 categories. In general, however, even if not all 9 DSM-IV–defined symptoms of depression are present, for the purposes of these guidelines, an adolescent who meets at

least 5 criteria for the diagnosis of MDD should be considered to be in the severe category if he or she presents with a specific suicide plan, clear intent, or recent attempt; psychotic symptoms; or severe impairment in functioning (such as being unable to leave home).

These guidelines were developed for PC clinicians who are in a position to identify and assist depressed youth in their practice settings. Although the age range of 10 to 21 years may encompass preteens, adolescents, and young adults in specific instances, this age range was chosen to include those who might be developmentally "adolescent." Research that supports adult depression guidelines includes adults 18 years and older. Much of the adolescent depression research focuses on children 18 years and younger. However, because adolescent medicine clinicians and school health clinicians often see patients until they are 21 years old, we have included the older adolescents. However, a primary caregiver faced with an adolescent between the ages of 18 and 21 can choose to use either adult or adolescent depression guidelines on the basis of the developmental status of the adolescent and their own comfort and familiarity with each set of guidelines.

METHODS

The following recommendations were developed on the basis of a synthesis of expert consensus- and evidence-based research-review methodologies. We compiled the necessary information to develop these recommendations in 5 phases.

1. To understand the problems and obstacles faced by PC clinicians regarding the management of adolescent depression, we first conducted focus groups with PC clinicians and youth patients and their family members to review issues pertinent to the PC management of depression.
2. Systematic literature reviews were conducted in each of 5 key areas in which recommendations were subsequently developed. Whenever possible, these reviews focused on identifying empirical evidence that was developed within child/adolescent PC settings. When PC studies were unavailable, research from specialty mental health care was reviewed. In all 5 review instances, the GLAD-PC Steering Group first determined the existence of all high-quality, previously published, systematic evidence-based reviews that met the following criteria: (*a*) clear definition of search terms from Medline, including words and word roots; (*b*) explicit delineation of years searched; (*c*) exclusion of non–English-language studies; (*d*) physical review and reading of search-identified titles and abstracts; and (*e*) selection, review, and reading of possibly relevant articles before determination of final inclusion. When more than 1 systematic evidence-based review was identified for a given area, all reviews were drawn on to identify relevant articles for potential inclusion. More than 1 systematic evidence-based review was available for the areas of efficacy of psychotherapeutic interventions for youth MDD and efficacy of pharmacologic treatments for youth MDD. For all reviews, when appropriate, we updated the review for any ensuing years transpired since the latest review by using these same 5 methods. When systematic reviews were not available for a given area, the GLAD-PC team conducted a systematic review by using Medline (from inception to 2004/2005) and the criteria described above. Reviews were guided by members of the GLAD-PC Steering Committee, which comprised leading experts in each of these areas.

   To address the first key area regarding the identification and assessment of adolescent depression in PC, a systematic evidence review was conducted to identify all available evidence about adolescent depression identification in PC, as well as information regarding current practices. This review has since been published.[20] Because of limited information about depression assessment and screening measures in PC specifically, we also reviewed adolescent-screening instruments/tools previously used in psychiatric or community populations. Beginning from 2 previous systematic evidence reviews,[21,22] the GLAD-PC team performed an additional systematic review from 1998 to 2004.

   To address the second key area regarding the initial management of adolescent depression in PC, a systematic evidence review was conducted to identify all available evidence about interventions for adolescent depression in PC and has since been published as well.[23] Other evidence for the initial management of adolescent depression in PC came from systematic evidence reviews that addressed the chronic illness model, systems of care, and safety planning for suicidal patients.
3. On the basis of the questions and issues identified during the focus groups and the literature reviews, we developed a survey to answer questions regarding critical issues in PC management of adolescent depression that have not been answered in the empirical literature. The survey questions were developed and reviewed by clinical and research experts in the area of mental health and PC. Using this survey, research and clinical experts were surveyed on their depression assessment and management recommendations. Depression clinical/research experts ($N = 81$) from Canada and the United States were asked to complete the 34-item study survey. Of these items, 3 questions dealt with the identification and diagnosis of depression. Subjects were chosen by using 1 of 4 criteria: (*a*) membership in child and adolescent psychiatric organizations in Canada and the United States including their academies of child and adoles-

cent psychiatry; (*b*) recipient of federal grants for related research; (*c*) lead author of at least 2 articles on clinical research in the area from 1999 to 2004 on the basis of Medline citations; or (*d*) key PC clinical and research leader with expertise in the area of guideline development and/or emotional and behavioral disorders that present in PC settings. Complete survey results ($n = 76$) will be presented in a subsequent peer-reviewed article and are available from the authors on request.[24]

4. An expert consensus workshop was held in July 2004 with 81 North American experts on depression, clinical pediatrics, quality improvement, mental health policy, and health economics. Published data from the literature review, unpublished high-quality research currently in process of publication, and the results of the survey were presented to guide the initial discussion and consensus process.
5. Guidelines were developed on the basis of multiple iterations shared among a small group of core writers, guidance of the larger steering committee, and ultimate input of all consensus-conference attendees to obtain full ownership of the final product. The results of this process are presented below.

On the basis of the 5-step method, 2 guidelines were developed to address different areas of adolescent depression management in PC settings: (1) identification, assessment, and initial management and (2) treatment and ongoing management. This part of the guidelines focuses on identification, assessment, and initial management. Each section of both guidelines is composed of individual recommendations followed by a brief rationale that refers to available empirical findings and experts' consensus opinion on which the recommendations were based. Each recommendation is graded on the basis of the Oxford Centre for Evidence-Based Medicine grade of evidence (A–D) system (see www.cebm.net/levels_of_evidence.asp). In addition, the strength of each recommendation, in terms of the extent to which experts agreed that the recommendation is highly appropriate and a "first-line" practice, was reached for each recommendation. Recommendation strength was rated in 4 categories: very strong (>90% agreement), strong (>70% agreement), fair (>50% agreement), and weak (<50% agreement). The recommendations in the guidelines were developed only in areas of management that had at least "strong agreement" among experts.

RESULTS

Literature Reviews: Identification and Assessment

Twenty-five articles were located that discussed specific identification methods for adolescent depression in pediatric PC. Only 10 of these articles presented psychometric data of any kind, such as sensitivity, specificity, positive predictive value, negative predictive value, and area under the curve (a full table is available in the published review[20]). One of the 25, plus an additional 5 survey articles, dealt with current identification practices by PC physicians. According to those data, most PC clinicians rely on the use of presenting complaints and family concerns to identify depressed youth.[25] Likewise, other surveys confirmed that very few pediatric providers have instituted a systematic assessment or case-finding tool to identify adolescent depression.[26,27]

Despite clinicians' principal reliance on adolescent and parental chief complaints and physician interview in current practice, the authors of the review found that the use of these methods alone underidentify adolescent depression.[20] Even physicians who are trained in the use of mnemonics to guide interviews underidentify adolescent depression.[28] Instead, only by asking patients directly about depression and suicide (versus relying on them to volunteer the information) does one reliably improve case finding and the psychometric quality of diagnostic data.[29–32] Using systematic assessment methods with depression-specific questions seems to provide the best identification results.[27–29,33]

Many steps are involved in implementing systematic depression-identification procedures within a busy practice setting (eg, training office staff in the use of procedures, adjusting other paperwork demands to fit the depression-identification procedures, ensuring that providers review the information, teaching providers how to use the information, and determining whether the procedures actually benefit youth). Although no study has documented the feasibility and outcomes of taking all of these steps within a single study, evidence from the review cited above as well as a recently published pilot study,[34] suggests that each of these steps can be implemented in real-world settings (ie, training office staff[27,28,30,33–37], ensuring PC providers review any results[27,28,32–34,37], and establishing that appropriate counseling and/or needed mental health referrals are made[33,39]). Finally, and perhaps most importantly, although no study compared outcomes between screened and not-screened groups, 1 study did demonstrate that an identification program in PC when combined with high-quality depression treatment actually yields better outcomes than treatment-as-usual conditions[8] (when no high-quality depression treatment is available).

Because of limited information about depression assessment and screening measures in PC specifically, we also reviewed adolescent-screening instruments/tools previously used in psychiatric or community populations. Beginning from 2 previous systematic evidence reviews,[21,22] the GLAD-PC team performed an additional systematic review for the years 1998–2004 and found 15 studies with psychometric performance data on depression instruments in English-speaking adolescents. A table that presents these 15 studies, the gold-standard

diagnostic assessment used, sensitivity, specificity, positive predictive value, negative predictive value, prevalence, and study population is available on request. Commonly used adolescent-screening instruments included the Beck Depression Inventory,[40] the Reynolds Adolescent Depression Screen,[41] and the Mood and Feelings Questionnaire.[42] Sensitivities of these more common instruments ranged from .70 to .90, and specificities ranged from .39 to .90. In addition, the Kutcher Adolescent Depression Scale, a newer 6- item instrument, had sensitivity and specificity of .81 and .86, respectively, in a school population with a positive predictive value of .39 and a negative predictive value of .98 given a 10% prevalence.[43]

In summary, no perfect depression screening/assessment tool exists, but a number of adolescent depression assessment instruments do possess adequate psychometric properties to commend their use in depression detection and assessment. Thus, it is reasonable to expect that depression detection in PC can be improved by the use of self- or parent-report checklists. Reliance on adolescent self-report depression checklists alone will lead to substantial numbers of false-positive and false-negative cases. Instead, optimal diagnostic procedures should combine the use of depression-specific screening tools as diagnostic aids buttressed by follow-up clinical interviews in which one obtains information from other informants (eg, parents) and reconciles discrepant information to arrive at an accurate diagnosis and impairment assessment before treatment. For more information about rating scales and cutoff scores, please refer to the GLAD-PC toolkit (available at www.glad-pc.org; see Appendix).

Initial Management of Adolescent Depression

A GLAD-PC review of adolescent depression interventions performed in PC[23] found 4 articles that directly discussed interventions for adolescent depression in PC, only 1 of which reported an intervention by a PC staff member as opposed to a mental health worker.[44] This identified RCT[44] evaluated the effectiveness of a PC-delivered consultation intervention that invited teens from 8 general practices in Britain to discuss their health concerns with a PC nurse who provided individual consultations. In addition to discussing adolescents' general health concerns, the PC nurses offered mental health referrals when they deemed it appropriate. Posthoc analyses indicated that among teens with high Center for Epidemiological Studies Depression Scale for Children (CES-DC) scores, those who were randomly assigned to the PC nurse consultation had lower CES-DC scores on follow-up than adolescents with high CES-DC scores who were not randomly assigned to the consultation, which suggests that a PC-delivered intervention may be useful in addressing depression symptoms and/or similar emotional issues (because these patients were not diagnosed with a depressive disorder per se), perhaps by the consultation itself or by the resulting referral to mental health.

Although the study discussed above was the only one that dealt with an intervention by a PC provider for adolescent depression, the large multisite trial conducted by Asarnow et al[8] showed that improving links between PC and mental health will result in better outcomes for depressed adolescents who present in PC.

In addition, on behalf of the GLAD-PC team, Stein et al[23] reviewed the literature on psychosocial interventions for anticipatory guidance. No RCTs or evidence-based reviews were found.[23] Citing earlier literature reviews in the area of injury prevention[45] and anticipatory guidance[46]; Stein et al[23] found some limited evidence that anticipatory guidance strategies such as education and counseling in the PC setting can be effective.

Another area reviewed by Stein et al[23] involved psychosocial interventions for improved adherence. An evidence review by Lemanek et al[47] on asthma adherence suggested that some educational and behavioral strategies are "probably efficacious" in creating change. In addition, a study that used cognitive behavioral strategies suggested that diabetic adherence can also be improved.[47]

In addition, our team searched the Cochrane database for systematic reviews of all types of interventions implemented in the adherence arena. These reviews[48–50] suggested that only complex, multifaceted approaches that included convenient care, patient education, reminders, reinforcement, counseling, and additional supervision by a member of the care team were effective in improving adherence in different chronic medical conditions including asthma, hypertension, diabetes, and adult depression. These complex models have also moved beyond the somewhat paternalistic traditional model to a model of shared decision-making between the provider and patient.[51] However, improvements in treatment outcomes remain small even with these complex and resource-intensive interventions.[49] In the pediatric literature, research regarding adherence commonly involved interventions that targeted both patients and their families.[52] Several key components have been identified that may improve compliance/adherence, including patient self-management/monitoring, patient/family education/support, and the setting and documentation of achievement of management goals.[53,54] The identification and periodic review of short- and long-term goals provides an individualized plan that both the provider and the patient and family can follow over time.[53,54] However, current research evidence suggests that more complex interventions that include shared decision-making between provider and patient are likely to have the greatest impact on both adherence and treatment outcomes. This kind of coordinated care has been designated the PC medical home and is discussed further in this section.[55]

Factors that pertain to the linkages between/among organizations have been studied as well. For example, the concept of "system of care" was first described in 1986 in a monograph by Stroul and Friedman[56] and used to support the Children and Adolescent Service System Program; their monograph outlined the ideal model for an integrated system of care for children and youth with severe emotional disturbances. Over the last 2 decades, numerous examples of comprehensive, coordinated, community-based systems of care have been implemented and evaluated.[57–60] Most of them showed no improvement in patient outcomes but significant improvement in other areas such as patient/family satisfaction, decreased wait time, and more appropriate care.[57–60]

In the chronic care medical literature, PC professionals have been encouraged to provide a medical home for their patients with chronic conditions. In effect, professionals are expected to remain accessible to patients and families through periods of quiescence and medical crises, coordinate care with other health care professionals, advocate with third-party payers, and provide continuity of care to prevent long-term consequences of chronic illnesses.[61–63] A review of the evidence for the medical home was conducted by Cooley,[55] who found that although no studies of the outcomes of the broad application of the medical home exist, some evidence exists for positive outcomes for different aspects of the concept. Again, no RCTs exist that we could find. In 1 study, children without a medical home were twice as likely to delay or forego needed care and to have unmet health care service needs.[64] Two other reviews focused on the impact of coordination of care and continuity of care.[65,66] As a recent vaccination study demonstrated, just having a medical home available to a patient does not necessarily mean that the patient will make full use of the available services.[67] Thus, as outlined in a recent American Academy of Pediatrics policy statement,[68] the medical home must provide care coordination and help patients to make use of available resources.

Although the "system of care" focuses on the overall coordination of care involving many agencies that are involved in the care of youth (child welfare services, schools, etc), a crucial link in that system and for adolescent depression is that between mental health and PC. Currently, no specific literature addresses the issue of referral to specialty care of adolescent patients with depression (such as which subgroups of patients would benefit from referral to mental health professionals). Studies have been conducted with adults with depression that demonstrate that increased collaborative care between mental health and PC professionals is needed to improve the care of patients with depression in PC.[11,69–71] The adult literature shows the importance of a close working relationship between mental health specialists and PC clinicians in the PC setting.[11,69] Different models of collaboration have been shown to be effective in the adult depression literature, including the use of case managers in PC practices and consultation by on-site mental health clinicians. Other models include shared care and telephone consultation on an ad hoc basis. Although these models suggest improved outcomes for both clinicians and patients, there are significant barriers to the successful implementation of these collaborative models, including funding deficiencies and shortage of mental health providers. Financial and other incentives for both PC and mental health clinicians to develop these models and obtain the training needed to function within these models are essential. Increased development of skills needed for collaborative care and training in mental health may also be addressed at earlier stages of training such as during residency for both PC and mental health clinicians.

Safety Planning

Safety planning with depressed suicidal or potentially suicidal adolescent patients usually consists of instructing the family to remove lethal means, instructing the family to monitor for risk factors for suicide, engaging the potentially suicidal adolescent in his or her treatment, providing adolescents with mutually agreeable and available emergency contacts should they find themselves with increasing suicidality, and establishing clear follow-up. Our review of the literature found no trials that have studied the impact of or how to conduct any of these aspects of safety planning with depressed adolescents. No studies have examined the benefits or risks of a safety contract. Some studies have suggested that limiting access to firearms or other lethal means can decrease suicide by those methods,[72–75] but the evidence is still unclear as to whether, on a broader population level, restricting access to certain lethal methods results in an overall decrease of suicide rates. In addition, a study by Brent et al[76] found that families of depressed adolescents are frequently noncompliant with recommendations to remove firearms from the house. Yet, a small prospective follow-up of patients seen in an emergency department for mental health concerns found that the majority of families removed or secured lethal means (firearms, alcohol, prescription medications, and over-the-counter medications) after injury-prevention education in the emergency department, whereas no families who did not receive injury-prevention education did so.[76] Some limited evidence suggests that quick and consistent follow-up with a team approach will be most helpful in increasing compliance and engagement among suicidal patients.[78,79]

GUIDELINES

Identification

Recommendation 1: Patients with depression risk factors (such as history of previous episodes, family history, other psychiatric

disorders, substance abuse, trauma, psychosocial adversity, etc) should be identified (grade of evidence: C; strength of recommendation: very strong) and systematically monitored over time for the development of a depressive disorder (grade of evidence: C; strength of recommendation: very strong).

Although most PC clinicians believe it is their responsibility to identify depression in their adolescent patients, evidence suggests that only a fraction of these youth are identified when they present in PC settings, and only 50% of depressed adolescents are diagnosed before reaching adulthood.[3,25] As part of overall health care, PC clinicians should routinely monitor the psychosocial functioning of all youth, because problems in psychosocial functioning may be an early indication of a variety of problems, including depression. For those at known increased risk for depression, PC clinicians should use systematic, effective identification strategies. Risk factors that clinicians may use to identify those who are at high risk for depression include a personal history and/or family history of (1) depression, (2) bipolar disorder, (3) suicide-related behaviors, (4) substance abuse, and (5) other psychiatric illness, or (6) significant psychosocial stressors such as family crises, physical and sexual abuse and neglect, and other trauma history. Research evidence shows that patients who present with such risk factors are likely to experience future depressive episodes.[17,80–86] Patients who have been treated for depression or suicidality in the past should continue to be monitored. PC clinicians should systematically evaluate adolescents at high risk for depression during health care visits (ie, well-child visits, urgent care visits). This systematic assessment should take place at least once a year, but frequent somatizers may need to be assessed more often.

Identification methods of youth at high risk may involve tools such as standardized written instruments, either generalized (eg, Guidelines for Adolescent Preventive Services and Strength and Difficulties Questionnaire) or specific emotional symptom checklists (eg, Beck Depression Inventory, Kutcher Adolescent Depression Scale). Although mnemonic-based interviews (eg, HEADSS: home, education/employment, activities, drugs, sexuality, suicide/depression) may also be used routinely during visits to guide the direct interview, systematic and scheduled use of psychometrically reliable and practical methods such as brief symptom checklists or validated depression scales are a preferred adjunct.

Assessment/Diagnosis

Recommendation 1: PC clinicians should evaluate for depression in adolescents at high risk as well as those who present with emotional problems as the chief complaint (grade of evidence: B; strength of recommendation: very strong). Clinicians should assess for depressive symptoms on the basis of diagnostic criteria established in the DSM-IV or International Classification of Diseases, 10th Revision *(grade of evidence: B; strength of recommendation: very strong) and should use standardized depression tools to aid in the assessment (grade of evidence: A; strength of recommendation: very strong).*

PC clinicians should probe for the presence of any of several depressive disorders, including MDD, dysthymia, and depression not otherwise specified by using systematic, rigorous assessment methods. Standardized instruments should be used to help with diagnosis but should not replace direct interview by the clinician.[87–89] Because adolescents with depression may not be able to clearly identify depressed mood as their presenting complaint, providers need to be aware of common presenting symptoms that may signal MDD. These symptoms may include insomnia, weight loss, decline in academic functioning, family conflict, and other symptoms of depressive disorders.[90] The *Diagnostic and Statistical Manual for Primary Care*[91] can help PC clinicians distinguish between transient depressive responses and depressive disorders.

Recommendation 2: Assessment for depression should include direct interviews with the patients and families/caregivers (grade of evidence: B; strength of recommendation: very strong) and should include the assessment of functional impairment in different domains (grade of evidence: B; strength of recommendation: very strong) and other existing psychiatric conditions (grade of evidence: B; strength of recommendation: very strong).

Evidence of the core symptoms of depression and functional impairment should be obtained from the youth and from families/caregivers separately.[92–94] The involvement of the family is critical in all phases of management and should be included in the assessment for depressive disorders. Family relationships also may affect the presentation of depression in adolescents. Cultural background of the patients and their families also must be considered during the assessment, because it can affect the presentation of core symptoms.[95] Collateral information from other sources (such as teachers) may also be obtained to aid in the assessment. Given the high rates of comorbidities, clinicians should assess for the existence of comorbid conditions that may affect the diagnosis and treatment of the depressive disorder.[2,17,96,97] These comorbidities may include 1 or more of the following conditions: substance abuse, anxiety disorder, attention-deficit/hyperactivity disorder, bipolar disorder, physical abuse, sexual abuse, and trauma. Instruments that assess for a range of common comorbid mental health conditions should be considered also. Clinicians should also assess for impairment in key areas of functioning including school, home, and peer settings.[98] Subjective distress should be assessed also. Regardless of the diagnostic impression or any additional treatment plans, a safety assessment must be completed by the clinician (see recommendation 4 in "Initial Management of Depression").

Initial Management of Depression

Recommendation 1: Clinicians should educate and counsel families and patients about depression and options for the management of the disorder (grade of evidence: C; strength of recommendation: very strong). Clinicians should also discuss limits of confidentiality with the adolescent and family (grade of evidence: D; strength of recommendation: very strong).

Management should be based on a plan developed with the understanding that depression is often a recurring condition. As seen in studies of depression interventions, families and patients need to be educated about the causes and symptoms of depression, impairments associated with it, and the expected outcomes of treatment.[23,99–101] Information should be provided at a developmentally appropriate level, in a way that the patient and family can understand the nature of the condition and the management plan. Communication that is developmentally appropriate should facilitate the ability of parents and patients to work with the clinician to develop an effective and achievable treatment plan. To establish a strong therapeutic alliance, the clinician should also take into account cultural factors that may affect the diagnosis and management of this disorder.[95] Clinicians should also be aware of the negative reactions of family members to a possible diagnosis of depression in the teen (ie, sadness, anger, denial). Sample materials are available in the GLAD-PC toolkit and include resources for patients and parents. Because the symptoms of depression can also affect many areas of an adolescent's life, other ongoing partnerships may need to be established with personnel in schools and other settings (extracurricular activities). Confidentiality must also be discussed with the adolescent and his or her family. Adolescents and their families should be aware of the limits of confidentiality, including the need to involve parents or legal authorities when the risk of harm to the adolescent or others may be imminent. Clinicians should be aware of state laws regarding confidentiality (eg, see www.advocatesforyouth.org/publications/iag/confhlth.htm for additional information).

Recommendation 2: Clinicians should develop a treatment plan with patients and families (grade of evidence: C; strength of recommendation: very strong) and set specific treatment goals in key areas of functioning, including home, peer, and school settings (grade of evidence: D; strength of recommendation: very strong).

From studies of chronic disorders in youth, it is suggested that better adherence to treatment is associated with the identification and tracking of specific treatment goals and outcomes. Written action plans in asthma management have produced evidence for improved outcomes.[102] If a patient presents with moderate-to-severe depression or has persistent depressive symptoms, treatment goals and outcomes should be identified and agreed upon, based on close collaboration with the patient and family at the time of treatment initiation. Treatment goals may include the establishment of a regular exercise routine, adequate nutrition, and regular meetings to resolve issues at home. In the adult depression literature, monitoring seems most effective when implemented through designated case managers who monitor patients' clinical status and treatment-plan adherence.[9] The benefits of such programs may be enhanced through the use of electronic medical charts and the development of patient registries.

Recommendation 3: The PC clinician should establish relevant links/collaboration with mental health resources in the community (grade of evidence: B; strength of recommendation: very strong), which may include patients and families who have dealt with adolescent depression and are willing to serve as resources to other affected adolescents and their family members (grade of evidence: D; strength of recommendation: very strong).

A major gap in the management of chronic disorders in young people is the lack of linkages between relevant services that make up the system of care for an individual youth.[103] Furthermore, family-based interventions have been shown to help youth with mental illness.[104] Therefore, establishing relevant links/collaboration with mental health resources in the local community, including peer support groups, advocacy groups, and traditional community- or hospital-based mental health services whenever these services are available, is essential to ensure timely and effective access to needed services.[8,105] Such linkages may include prearranged agreement regarding referral, exchange of clinical information, points of contact, etc. Where appropriate (eg, rural areas), clinicians should also establish links with paraprofessionals who may provide the bulk of counseling and supportive services in underserved areas.

Recommendation 4: All management must include the establishment of a safety plan, which includes restricting lethal means, engaging a concerned third party, and developing an emergency communication mechanism should the patient deteriorate, become actively suicidal or dangerous to others, or experience an acute crisis associated with psychosocial stressors, especially during the period of initial treatment when safety concerns are highest (grade of evidence: C; strength of recommendation: very strong).

Suicidality, including ideation, behaviors, or attempts, is common among adolescents with depression. In studies of completed suicide, more than 50% of the victims had a diagnosis of depression.[106] Therefore, clinicians who manage this disorder must develop an emergency communication mechanism for handling increased suicidality or acute crises. After assessing a suicidal patient for suicidality, the clinician must obtain information from a third party, assess that adequate adult supervision and support are available, have an adult agree to help remove lethal medications and firearms from the premises, warn the patient of the disin-

hibiting effects of drugs and alcohol, put contingency planning in place, and establish follow-up within a reasonable period of time.[72,107] This plan should be developed with adolescents (and with their families/caregivers if possible) and should include a list of persons/services for the adolescent to contact in case of acute crisis or increased suicidality. The establishment of this plan is especially important during the period of diagnosis and initial treatment when safety concerns are highest. Clinicians may also work with schools to develop an emergency plan for all students who may experience an acute suicidal crisis. This global approach may prevent, in some instances, having to label a specific child suicidal when providers are merely trying to ensure that safety measures are in place in case the child decompensates. Components of a safety plan may also include a list of persons who are aware of the adolescents' issues and will be able to assist if contacted during an acute crisis.

DISCUSSION

Although not definitive and subject to modification on the basis of ongoing accumulation of additional evidence, this part of the guidelines is intended to address the lack of recommendations regarding the screening, diagnosis, and initial management of depression in adolescents aged 10 to 21 years in PC settings in the United States and Canada. As such, these guidelines are intended to assist clinicians in family medicine, pediatrics, nursing, and internal medicine who may be the first (and sometimes only) clinicians to identify, manage, and possibly treat adolescent depression. These guidelines may also be helpful to allied health professionals who care for adolescents.

Although not all the steps involved in identifying, diagnosing, and initially managing the care for adolescent depression in PC have been (or even can be) subject to rigorous RCTs, there is sound reason to believe that existing tools and management protocols for adolescent depression can be applied in the PC setting. Although more research is needed, our review suggests that these components of the identification and initial management of adolescent depression in PC can be done. The recommendations were developed on the basis of areas that had at least "strong agreement" among experts. However, there were other controversial areas that were not addressed in these recommendations, such as universal screening. New emerging evidence may affect the inclusion of such areas in future iterations of these guidelines and the accompanying toolkit.

Should These Guidelines Be Universally Deployed?

One might question whether PC clinicians should identify and diagnose the problem of adolescent depression if the lack of psychiatric services prevents them from referring these youth.[108] This caution notwithstanding, the increasingly prevailing recommendation is that as a minimum, PC clinicians should be provided the necessary guidance to support their initial management of adolescent depression.[109,110] Nonetheless, because practitioners and their clinical practice settings vary widely in their degree of "readiness" in identifying and managing adolescent depression, it is likely that a good deal of time and flexibility will be required before these guidelines are adopted systematically or as a universal requirement. It is conceivable that integrated health care systems with electronic medical charts, tracking systems, and access to specialty mental health back-up and consultation will be most "ready" and able to fully implement the guidelines. The second part of the guidelines, the companion article,[12] addresses the treatment of this disorder. Practices that do identify adolescent depression and have nowhere to refer the patients may benefit from the guidance offered in the next set of recommendations.

Preparatory Steps

Because the management of adolescent depression may constitute a new or major challenge for some PC practices, a number of important considerations should be kept in mind when preparing to implement the guidelines, given the findings from studies in the adult literature, input from our focus groups with clinicians, families and patients, and the experience of members of the GLAD-PC Steering Committee. Specifically, PC clinicians who manage adolescent depression should pursue (1) additional education regarding issues such as advances in screening, diagnosis, treatment, and follow-up, liability, consent, confidentiality, and billing, (2) practice and systems changes such as office staff training and "buy-in," electronic medical charts, and automated tracking systems, whenever available, and (3) establishing linkages with mental health services.

Linkages with community mental health resources are necessary to both meet the learning needs of the PC clinician and facilitate consultation/referral of difficult cases. Practice and systems changes are useful in increasing clinicians' capacity to ensure monitoring and follow-up of patients with depression. For example, staff training may help prioritize calls from adolescent patients who may not state the nature of their call. Specific tools and/or templates have been developed that offer examples of how to efficiently identify, monitor, track, and refer teens with depression. These materials are available in the GLAD-PC toolkit (available at www.glad-pc.org). The toolkit addresses how each of the recommendations might be accomplished without each practice necessarily having to "reinvent the wheel."

CONCLUSIONS

Review of the evidence suggests that PC clinicians who have appropriate training and are attempting to deliver comprehensive health care should be able to identify and initiate management of adolescent depression. This

will likely require real changes in existing systems of care. As health care models such as the medical home indicate, comprehensive health care must include assessment and coordination of care for both physical and behavioral health. This first part of the guidelines for adolescent depression in PC may enable providers to pull together the current best evidence and attempt to initiate the best available high-quality care, even in instances in which they are not in a position to treat such youth. Mounting evidence suggests that pediatric providers can and should identify and coordinate depression care for their adolescent population.

APPENDIX: PART I TOOLKIT ITEMS

- Screening/assessment instruments (ie, Columbia Depression Scale)
- Information sheet on the developmental considerations in the diagnosis of depression
- Assessment algorithm/flow sheet (Fig 1)
- Fact sheet/family educational materials
- Educational materials on suicide prevention/safety planning

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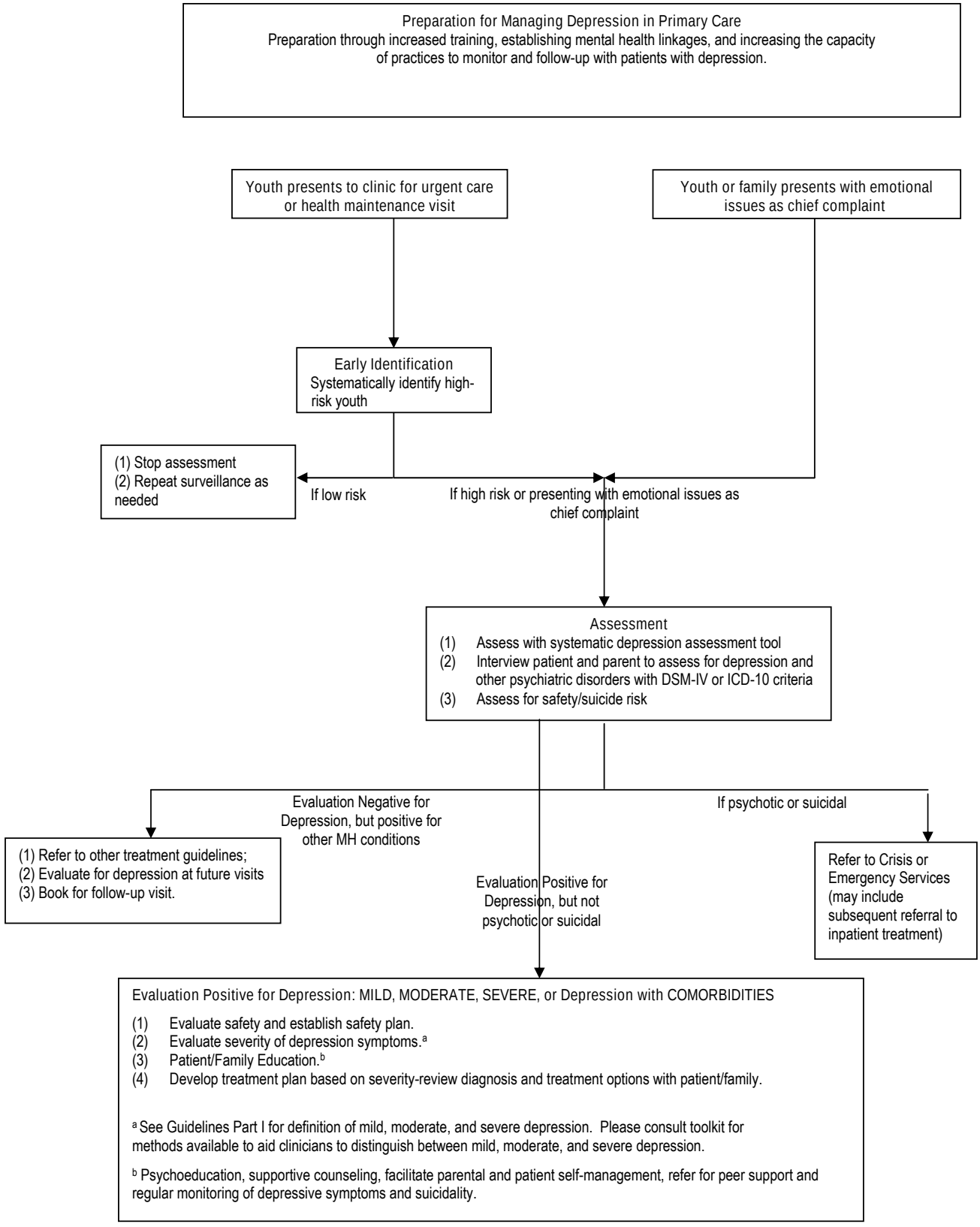

FIGURE 1
Clinical assessment flowchart.

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SPECIAL ARTICLE

Guidelines for Adolescent Depression in Primary Care (GLAD-PC): II. Treatment and Ongoing Management

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Endorsements: The Canadian Paediatric Society, the Society for Adolescent Medicine, the Canadian Association for Adolescent Health, the National Association for Pediatric Nurse Practitioners, the Society for Developmental and Behavioral Pediatrics, the American Academy of Child and Adolescent Psychiatry, the Canadian Academy of Child Psychiatry, the Canadian Psychiatric Association, the College of Family Medicine of Canada, the National Alliance on Mental Illness, the Mental Health Association of New York City, the National Mental Health Association (now known as Mental Health America), the Depression and Bipolar Support Alliance, and the Federation of Families for Children's Mental Health have endorsed these guidelines. Endorsements from the American Academy of Pediatrics and the Canadian Psychological Association are pending. The American Academy of Family Physicians, the American Medical Association, and the American Psychological Association have been involved in the development of the guidelines but do not endorse external guidelines.

ABSTRACT

OBJECTIVES. To develop clinical practice guidelines to assist primary care clinicians in the management of adolescent depression. This second part of the guidelines addresses treatment and ongoing management of adolescent depression in the primary care setting.

METHODS. Using a combination of evidence- and consensus-based methodologies, guidelines were developed in 5 phases as informed by (1) current scientific evidence (published and unpublished), (2) a series of focus groups, (3) a formal survey, (4) an expert consensus workshop, and (5) revision and iteration among members of the steering committee.

RESULTS. These guidelines are targeted for youth aged 10 to 21 years and offer recommendations for the management of adolescent depression in primary care, including (1) active monitoring of mildly depressed youth, (2) details for the specific application of evidence-based medication and psychotherapeutic approaches in cases of moderate-to-severe depression, (3) careful monitoring of adverse effects, (4) consultation and coordination of care with mental health specialists, (5) ongoing tracking of outcomes, and (6) specific steps to be taken in instances of partial or no improvement after an initial treatment has begun. The strength of each recommendation and its evidence base are summarized.

CONCLUSIONS. These guidelines cannot replace clinical judgment, and they should not be the sole source of guidance for adolescent depression management. Nonetheless, the guidelines may assist primary care clinicians in the management of depressed adolescents in an era of great clinical need and a shortage of mental health specialists. Additional research concerning the management of youth with depression in primary care is needed, including the usability, feasibility, and sustainability of guidelines and determination of the extent to which the guidelines actually improve outcomes of youth with depression.

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Key Words
adolescents, depression, primary care, guidelines

Abbreviations
PC—primary care
MDD—major depressive disorder
AACAP—American Academy of Child and Adolescent Psychiatry
PCP—primary care provider
GLAD-PC—Guidelines for Adolescent Depression in Primary Care
FDA—Food and Drug Administration
RCT—randomized, controlled trial
CES-DC—Center for Epidemiological Studies Depression Scale for Children
MAOI—monoamine oxidase inhibitor
CBT—cognitive behavioral therapy
SSRI—selective serotonin reuptake inhibitor
IPT—interpersonal psychotherapy
CI—confidence interval

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STUDIES HAVE SHOWN that up to 9% of teenagers meet criteria for depression at any one time, with as many as 1 in 5 teens having a history of depression at some point during adolescence.[1–5] In primary care (PC) settings, point prevalence rates are likely higher, with rates up to 28%.[6–10] Taken together, epidemiologic and PC-specific studies have suggested that despite relatively high rates, major depressive disorder (MDD) in youth is underidentified and undertreated in PC settings.[11]

Because of barriers to adolescents receiving specialty mental health services, only a small percentage of depressed adolescents are treated by mental health professionals.[12] As a result, PC settings have become the de facto mental health clinics for this population, although most PC clinicians feel inadequately trained, supported, or reimbursed for the management of this disorder.[13–18] Although MDD management guidelines have been developed for specialty care settings (eg, see the American Academy of Child and Adolescent Psychiatry [AACAP] practice parameters[19]) or for related problems such as suicidal ideation or attempts,[20] it is clear that significant practice and clinician differences exist between the primary and specialty care settings that do not allow a simple transfer of guidelines from one setting to another.

Recognizing this gap in clinical guidance for PC providers (PCPs), a group of researchers from the United States and Canada established the Guidelines for Adolescent Depression in Primary Care (GLAD-PC), a North American collaborative, to develop guidelines for the management of adolescent depression in the PC setting. The development process of GLAD-PC is described in detail in our companion report.[21] This article describes the recommendations regarding treatment, ongoing management, and follow-up along with the supporting empirical evidence for those recommendations. Our companion article provides the corresponding evidence and resulting recommendations for depression identification, assessment and diagnosis, and initial management before the formal onset of specific treatments.[21]

METHODS

A full description of the methodology used for the development of GLAD-PC is included in our companion article.[21] In brief, the expert collaborative used a mix of qualitative (focus groups, expert consensus) and quantitative (survey, literature reviews) methods to inform the development of GLAD-PC. In view of space limitations, only the results of the literature reviews regarding available evidence pertaining to treatment, ongoing management, and follow-up procedures are presented in this article.

Literature Reviews

The literature-review approach used for all of the reviews was as follows. First, the GLAD-PC team identified the existence of high-quality, previously published, systematic evidence-based reviews that met the following criteria: (1) explicit definition of search terms and years covered; (2) exhaustive search of Medline; (3) reading of abstracts to determine relevance, followed by review of entire articles from relevant abstracts; (4) restriction to English-language journals only; (5) restriction to empirical articles; and (6) identification of any otherwise omitted citations from the reference sections from key reviews. In areas where there were no carefully executed and well-described systematic literature reviews had been recently conducted (ie, Food and Drug Administration [FDA], Cochrane), the GLAD-PC team conducted a systematic review for primary studies for each area by using Medline (from inception to 2004/2005 based on the 5 criteria described above.

Three literature reviews were conducted for the GLAD-PC recommendations presented in this article: (1) nonspecific psychosocial interventions in pediatric PC,[22] (2) antidepressant treatment,[23] and (3) the use of psychotherapy. For the first review, Stein et al[22] searched the literature (Medline, PsycINFO, and the Cochrane database) for articles that examined evidence for psychosocial interventions delivered in the PC setting. The reference lists of all relevant articles were searched for additional studies. In addition, experts in the field were consulted to identify additional studies. Given the paucity of randomized, controlled trials (RCTs) identified earlier in a review by Bower et al[24] in 2001, studies with simple before-and-after comparisons were also included.

In the second review, we examined the efficacy and safety of antidepressant medications in the pediatric population (aged 7–18). The studies were identified in 2 stages. Given the thorough reanalyses of safety data on both published and unpublished clinical trials completed by the FDA, all RCTs included in the FDA safety report were reviewed.[25] Second, to ensure that additional studies not reported to the FDA were not missed, Medline and PsycINFO were searched. For a full description of the review, please refer to the published review.[23]

In the final review, we searched the literature for depression trials that examined the efficacy of psychotherapy. The search included all forms of psychotherapy including both individual and group-based therapies. We not only identified individual studies but also high-quality systematic reviews given the extensive empirical literature in this area. Additional details on each of these searches, including search terms, number of abstracts selected, etc, are available from the authors on request.

Expert Consensus

Expert consensus was reached through 2 stages. First, expert participants completed a survey regarding adolescent depression management. Subsequently, the expert participants then met in a 2-day workshop to review the survey results to reach consensus on key issues regard-

ing identification and treatment of adolescent depression in PC. Overall, the guidelines only included recommendations that the experts agreed are highly appropriate and "first-line" practices.

RESULTS: LITERATURE REVIEWS

Psychosocial Interventions in PC

On behalf of the GLAD-PC team, Stein et al[22] reviewed the evidence for the efficacy of PC-delivered psychosocial interventions. The studies identified were divided into 2 categories of evidence: direct and indirect. Direct evidence included data from studies that evaluated interventions specific for adolescent depression, and indirect evidence included data from studies that examined PC interventions for adults with depression and PC interventions for other psychosocial problems in the pediatric population. Additional details about the review can be found in the Stein et al report.[22]

The literature review identified 4 articles that focused on depression interventions in the PC setting for adolescents,[26–29] all of which showed positive outcomes for the PC-delivered interventions. Walker et al conducted an RCT to evaluate the effectiveness of a PC-delivered consultation intervention that involved teens from 8 general practices in Britain. Teens were invited to discuss their health concerns with PC nurses who provided individual consultations.[22,26] The PC nurses also offered mental health referrals when appropriate. In those with high Center for Epidemiological Studies Depression Scale for Children (CES-DC) scores, those who were randomly assigned to PC nurse consultation had lower CES-DC scores on follow-up than adolescents with high CES-DC scores who were not randomly assigned to the consultation. The results suggest that PC-delivered intervention may be helpful in reducing depressive symptomology as measured by the CES-DC.

Stein et al[22] also identified 6 additional studies that focused on PC counseling, 4 that focused on improved patient outcomes for adult depression, and 2 that focused on improved parent-child relationships in postpartum depression. The adult depression in PC literature has shown that psychosocial support by a physician, nurse, or other staff, in the context of 15-minute problem-solving therapy, improves outcomes in depressed adults.[30–32]

With the pediatric PC literature, findings revealed that authors of previous studies have attempted to train pediatricians in various types of counseling such as anticipatory guidance or preventive counseling in a number of disorder areas. Before the Stein et al review,[22] the most recently published systematic review on the impact of psychosocial interventions in pediatric PC was conducted by Bower et al.[24] These investigators reviewed 25 studies in pediatric PC that demonstrated tremendous variability in the problems treated, clinician interventions, and outcomes studied.[24] As noted by Stein et al,[22] most studies did not compare the intervention group to a control group, and those that were RCTs did not provide enough information to judge the design. Thus, one must be cautious in stating that the "innovative" PC interventions were superior to usual care, although some positive effects were found. However, as shown in a review by Bass et al,[33] 18 studies have demonstrated positive effects of injury-prevention counseling in pediatric PC, and Stein et al[22] reviewed additional studies that suggested that modest educational counseling performed by pediatric PC staff can be useful.

Antidepressant Treatment

The treatment review for antidepressant safety and efficacy included RCTs of antidepressants in youth under the age of 19 with depression. This review has also been published elsewhere.[23] This GLAD-PC–initiated review identified 8 peer-reviewed articles in this area, including 4 trials with fluoxetine,[34–37] 1 with sertraline,[38] 1 with citalopram,[38] 1 with paroxetine,[39] and 1 with venlafaxine.[40] Older antidepressants (ie, monoamine oxidase inhibitors [MAOIs], tricyclic antidepressants) were not included in our review because the current controversy and the recent FDA review only involved newer classes of antidepressants and because of the known lack of efficacy (ie, tricyclic antidepressants) and clinical trials data (ie, MAOIs) for other classes of older antidepressants.[40] Finally, because of the continuing controversy around the disclosure of unpublished clinical research data, unpublished studies included in the FDA review were also reviewed. There were no completed yet unpublished studies identified that were excluded in the FDA analyses. For additional details regarding this review, see the Cheung et al report.[23]

Overall, both individual clinical trial evidence and evidence from systematic reviews support the use of antidepressants in adolescents with MDD. Bridge et al[41] conducted a meta-analysis of the clinical trials data and calculated the numbers needed to treated and numbers needed to harm. They concluded that 6 times more teens would benefit from treatment with antidepressants than would be harmed.[41] In reviewing the individual studies, the percentage of subjects who responded to antidepressants ranged from 47% to 69% and 33% to 57% for those on placebo (see Table 1). The majority of these studies found a significant difference between those on medication versus those on placebo. Overall, fluoxetine has had the largest number of studies with positive results, whereas paroxetine has had the largest number of studies with negative results.[34–37,39,42,43] However, methodologic differences may have played a role in these differing results.[23] The largest study, the Treatment for Adolescent Depression Study, involved subjects who were randomly assigned to receive placebo, cognitive behavioral therapy (CBT) alone, fluoxetine alone, or

TABLE 1 **Response Rates in RCTs of Antidepressants Based on Clinical Global Impression**

Medication	Drug, %	Placebo, %	*P*
Fluoxetine (March et al[36] [2004])[a]	56	33	.02
Fluoxetine (Emslie et al[89] [1997])	52	36.8	.03
Fluoxetine (Emslie et al[62] [2002])	61	35	.001
Paroxetine (Keller et al[39] [2001])[b]	66	48	.02
Paroxetine[c]	69	57.3	NS
Paroxetine[c]	65	46	.005
Citalopram (Wagner et al[38] [2004])	47	45	NS
Sertraline (Wagner et al[90] [2003])	63	53	.05
Escitalopram (Wagner et al[91] [2007])	63	52	NS

NS indicates not significant.
[a] Fluoxetine alone compared with placebo.
[b] Paroxetine compared with placebo.
[c] GlaxoSmithKline, unpublished data.

CBT with fluoxetine.[36] Subjects assigned to receive CBT with fluoxetine or fluoxetine alone showed significantly greater improvement in their depressive symptoms compared with those who received placebo or were treated with CBT alone (also see "Cognitive Behavioral Therapy").

Finally, available evidence from several large RCTs[23] suggests that adverse effects do emerge in depressed youth who are treated with antidepressants. Adverse effects (ie, nausea, headaches, behavioral activation, etc) occur in up to 93% of the subjects treated with these medications and in up to 75% of those treated with placebo when subjects are asked about specific adverse effects. Therefore, routine monitoring of the development of adverse events is critical for depressed youth who are treated with antidepressants.

Authors of several recent studies have used population data to evaluate the risks versus benefits of prescribing antidepressants. Olfson et al[44] focused specifically on youth aged 10 to 19 years; their study revealed decreased suicide rates in geographic areas where the rates of newer antidepressant prescriptions are increasing. Gibbons et al[45] reported similar findings when they conducted a study of children aged 5 to 14. Several other studies have focused on general populations that included significant numbers of children and adolescents.[46–49] Although one Australian study did identify a link between increased prescription rates of newer antidepressants and increased suicide rates in adolescents and young adults aged 15 to 24,[46] other American and international studies have indicated an inverse relationship between rates of selective serotonin reuptake inhibitor (SSRI) prescriptions and rates of suicide in adolescent populations.[48,49]

Still other studies have used large databases to carry out naturalistic studies of possible associations between antidepressant use and suicidality.[50–53] In the only 1 of these studies that focused exclusively on youth, Valuck et al[50] conducted a propensity-adjusted retrospective cohort study to examine links between antidepressant treatment and suicide attempts in depressed adolescents (aged 12–18) by using a community sample of managed care enrollees. They found no increase in suicide rates with treatment with SSRIs, other antidepressants, or multiple antidepressants after a diagnosis of MDD, finding instead that treatment for at least 6 months reduced the likelihood of suicide attempts compared with treatment for less than 8 weeks.

Psychotherapy

The final review conducted examined the efficacy of psychotherapy such as CBT, interpersonal psychotherapy (IPT), and nonspecific interventions such as counseling and support. Through our search, we were able to identify both individual studies and several high-quality meta-analyses/reviews that were recently conducted to examine the efficacy of psychotherapy in adolescent depression. A full description of the review is available from the authors on request.

Cognitive Behavioral Therapy

In 1998, Reinecke et al[54] and Harrington et al[55] conducted reviews of CBT trials and found improved outcomes. In addition to the above-mentioned meta-analytical studies, several systematic narrative reviews of CBT studies have been conducted. The most recent and comprehensive of these reviews was conducted by Compton et al[56] and included 12 studies published between 1990 and 2002. Although some of these studies showed negative results, Compton et al conclude that, in sum, they provided solid evidence of the effectiveness of CBT conducted by trained therapists for mild-to-moderate depression.

The effectiveness of CBT for adolescents with moderate to moderately severe depression was evaluated recently in the multicenter Treatment for Adolescents With Depression Study, which randomly assigned 439 depressed 12- to 17-year-olds to treatment with CBT, fluoxetine, CBT plus fluoxetine, or placebo.[36] According to Clinical Global Impressions severity scores, the post-treatment response rate to 15 sessions of CBT over 12 weeks (43.2% [95% confidence interval [CI]: 34–52]) was not significantly different ($P = .40$) from placebo (34.8% [95% CI: 26–44]). The authors attributed this relatively low response rate, in part, to the fact that the study population suffered from more severe and chronic depression than participants in previous studies and to a high rate of psychiatric comorbidity in their study participants.[36] Along with the fairly robust placebo-response rate, it is also possible that the nonspecific therapeutic aspects of this medication management could have successfully competed with the specific effects of the CBT intervention. As a consequence, one cannot and should not conclude that CBT was ineffective.

Although the Compton et al[56] review of studies pro-

vided evidence for the efficacy of CBT in specialty mental health clinics for adolescents with mild-to-moderate depression, more recent studies have helped determine the effectiveness of CBT in "real-world" situations. In 2003, Puskar et al[57] evaluated whether a group CBT intervention conducted in a high school by a masters-level nurse could improve depressive symptoms among 89 rural students with Reynold's Adolescent Depression Screen scores of ≥60. The 46 students who completed 10 weekly CBT group sessions had significantly better mean depressive scores immediately after treatment and at 6 months than those (n = 43) who were randomly assigned to receive usual care. In contrast, Kerfoot et al[58] studied the impact of training social workers in CBT methods (versus treatment as usual) on 52 depressed youth. The study showed no differences in depression scores across the 2 interventions, which was partially attributed to high drop-out rates.[58]

In yet another study with more difficult adolescents, Rohde et al[59] recently assessed the effectiveness of CBT in treating adolescents with comorbid MDD and conduct disorder by recruiting 13- to 17-year-olds (N = 93). After randomly assigning them to a CBT-based "Coping With Depression" course or a life skills tutoring control condition, 39% of the adolescents who "completed" the CBT course recovered compared with only 19% of the adolescents who participated in the life skills tutoring control group (odds ratio: 2.66; 95% CI: 1.03–6.85).

Finally, in the Youth Partners-in-Care study, Asarnow et al[27] evaluated the effectiveness of a quality improvement intervention that involved increasing access of PC clinicians and depressed youth to CBT and antidepressant medication. Participants (N = 418) were randomly assigned to usual care "enhanced" by an education intervention or the quality improvement intervention.[27] At the study's 6-month end point, subjects in the intervention group were significantly improved according to the study's 2 primary outcome variables as measured by the Center for Epidemiological Study Depression Scale. The intervention group had lower Center for Epidemiological Study Depression Scale scores and fewer youth scored in the severe range at the end of the study. Given the fact that the intervention and usual-care groups differed significantly only in their use of CBT (53% vs 36%, respectively; OR: 2.2; 95% CI: 1.3–3.9; P = .007), much of the intervention groups' improvement can be attributed to the availability of this treatment modality for patients screened and identified in PC settings.

Interpersonal Therapy

In terms of IPT, only a handful of studies have been conducted. First, Mufson et al[28] assigned 48 depressed adolescents to IPT for adolescents (IPT-A) or clinical monitoring. Those who received IPT-A reported fewer depressive symptoms and improved overall functioning. In the Rossello and Bernal[60] study, 71 depressed Puerto Rican adolescents were randomly assigned to receive IPT, CBT, or be placed on a waiting list. After 12 weeks, both IPT- and CBT-treated adolescents reported significantly fewer depressive symptoms. In the most recent study, 63 depressed adolescents (any depressive disorder) were randomly assigned to receive either 16 weeks of IPT-A or a treatment-as-usual condition (supportive counseling).[61] Subjects who were treated with IPT-A showed significantly greater symptom reduction and improved overall functioning.

GUIDELINES

Each of the recommendations listed below was graded on the basis of the level of supporting research evidence from the literature and the extent to which experts agreed that it is highly appropriate in PC. The level of supporting evidence for each recommendation is based on the Oxford Centre for Evidence-Based Medicine grades of evidence (A–D) system (see www.cebm.net/levels_of_evidence.asp).

Recommendation strength based on expert consensus was rated in 4 categories: very strong (>90% agreement), strong (>70% agreement), fair (>50% agreement), and weak (<50% agreement). The recommendations in the guidelines were developed only in areas of management that had at least "strong agreement" among experts (see Fig 1 for the treatment algorithm).

Treatment

Recommendation 1: After initial diagnosis, in cases of mild depression, clinicians should consider a period of active support and monitoring before starting other evidence-based treatment (grade of evidence: B; strength of recommendation: very strong).

After a preliminary diagnostic assessment, in cases of mild depression, clinicians should consider a period of active support and monitoring before recommending treatment (from 6 to 8 weeks of weekly or biweekly visits for active monitoring). Evidence from RCTs of antidepressants and CBT show that a sizable percentage of patients respond to nondirective supportive therapy and regular symptom monitoring.[34–40,62–65] However, if symptoms persist, treatment with antidepressants or psychotherapy should be offered. Active support and monitoring is also essential for cases in which depressed patients and/or their families/caregivers refuse other treatments. Active support and counseling for adolescents by pediatric PC clinicians have been evaluated for several different disorders including substance abuse and sleep disorders.[22]

Furthermore, expert opinion based on extensive clinical experience and qualitative research with families, patients, and clinicians indicate that these strategies are a crucial component of management by PC clinicians. For additional guidance on how to provide active sup-

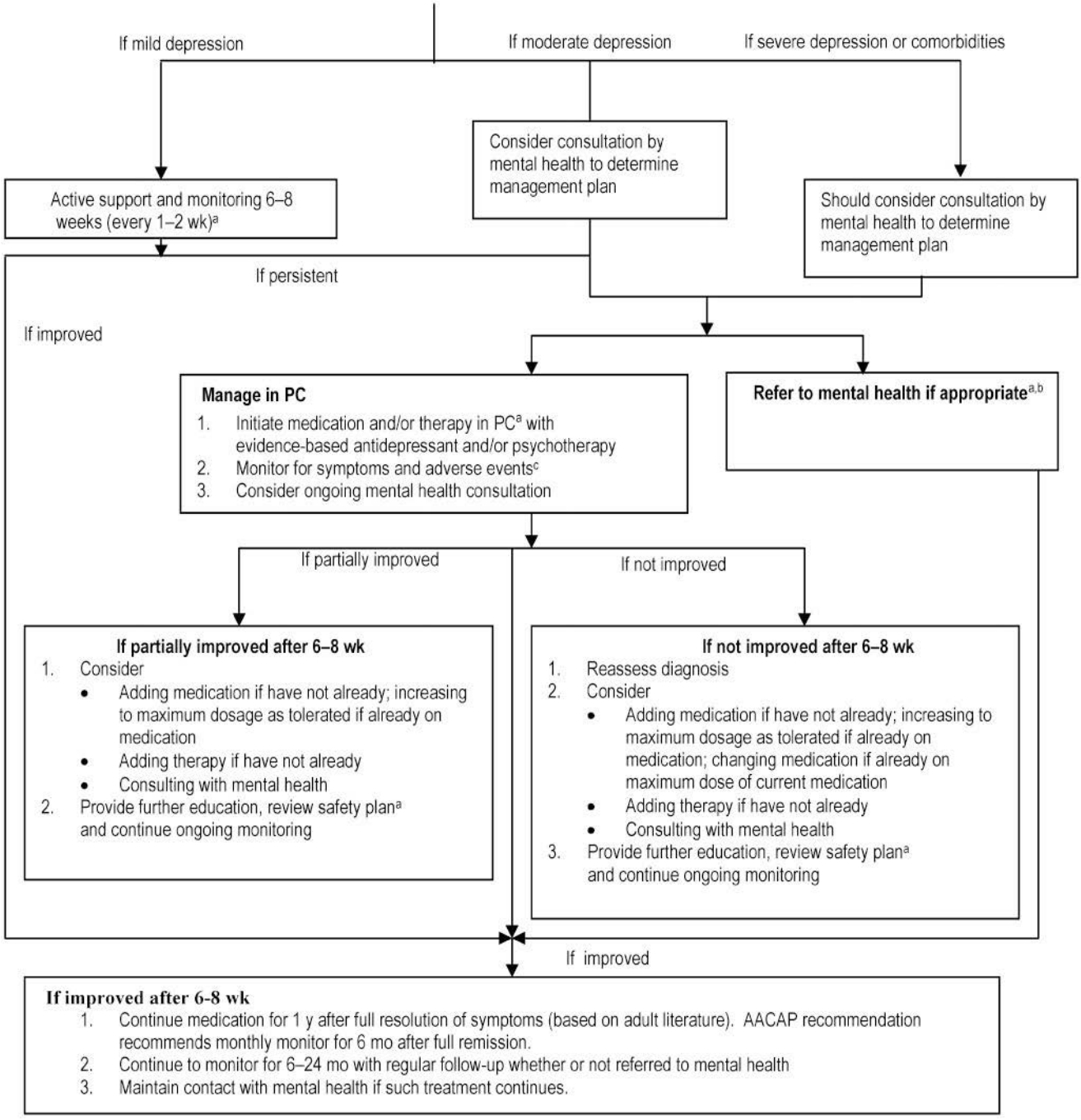

FIGURE 1

Clinical management flowchart. [a] Provide psychoeducation, provide supportive counseling, facilitate parental and patient self-management, refer for peer support, and regularly monitor for depressive symptoms and suicidality. [b] Negotiate roles/responsibilities between PC and mental health and designate case coordination responsibilities; continue to monitor in PC after referral; and maintain contact with mental health. [c] Clinicians should monitor for changes in symptoms and emergence of adverse events such as increased suicidal ideation, agitation, or induction of mania. For monitoring guidelines, refer to the GLAD-PC toolkit.

port, please refer to the GLAD-PC toolkit (available at www.glad-pc.org).

For moderate or severe cases, the clinician should recommend treatment, crisis intervention (as indicated), and mental health consultation immediately without a period of active monitoring.

Recommendation 2: If a PC clinician identifies an adolescent with moderate or severe depression or complicating factors/conditions such as coexisting substance abuse or psychosis, consultation with a mental health specialist should be considered (grade of evidence: C; strength of recommendation: strong). Appropriate roles and responsibilities for ongoing management by the PC and mental health clinicians should be communicated and agreed upon (grade of evidence: C; strength of rec-

ommendation: strong). The patient and family should be consulted and approve the roles of the PC and mental health professionals (grade of evidence: D; strength of recommendation: strong).

In adolescents with severe depression or comorbidities such as substance abuse, clinicians should consider consultation with mental health professionals and refer to such professionals when deemed necessary. In cases of moderate depression with or without comorbid anxiety, clinicians should consider consultation by mental health and/or treatment in the PC setting. Although the access barriers to mental health services need to be addressed by policy makers to make necessary mental health consultations more feasible, available, and affordable in underserviced areas, clinical judgment must prevail in the meantime; thus, the need for consultation should be based on the clinician's judgment. PC clinicians must also take into consideration the treatment preferences of patients/families, the severity and urgency of the case presentation, and the physician's level of training and experience.

Active support and treatment should also be started in cases in which there is a lengthy waiting list for mental health services. Once a referral is made, the PC clinician must remain involved in the follow-up. In particular, roles and responsibilities should be agreed upon between the PC clinician and mental health clinician(s), including the designation of case coordination responsibilities.[66–72]

Recommendation 3: PC clinicians should recommend scientifically tested and proven treatments (ie, psychotherapies such as CBT or IPT and/or antidepressant treatment such as SSRIs) whenever possible and appropriate to achieve the goals of the treatment plan (grade of evidence: A; strength of recommendation: very strong).

After providing education and support to the patient and family, the range of effective treatment including medications, psychotherapies, and family support options should be considered. The patient and family should be assisted to arrive at a treatment plan that is both acceptable and implementable while taking into account their preferences and availability of treatment services. The treatment plan should be customized according to the severity of disease, risk of suicide, and the existence of comorbid conditions. The GLAD-PC toolkit will provide more detailed guidance around the factors that may influence a treatment choice (ie, a patient with psychomotor retardation may not be able to actively engage in psychotherapy). The management of depression in youth is an emerging field, and new treatments may become available. However, common-sense approaches such as the prescription of physical exercise and adequate nutrition should also be used in the management of these patients.

As an aside, the majority of CBT and IPT studies that included patients with MDD also included patients with depression not otherwise specified, subthreshold depressive symptoms, or dysthymic disorder. In contrast, medication RCTs for depression in adolescents generally only included subjects with MDD. Thus, although these guidelines address the treatment of depression generally, medication-specific guidelines apply only to fully expressed MDD.

Psychotherapies

Both CBT and IPT have been adapted to address depression in adolescents and have been shown to be effective in treating adolescents with MDD in tertiary care and in community settings.[28,61,73] CBT has been used in the PC setting with positive preliminary results.[27,29] However, the results of a recent RCT demonstrated superior efficacy of combination therapy (medication and CBT) versus CBT alone.[36] For a brief description of the 2 therapies, see Table 2.

Antidepressant Treatment

Previous research has shown that up to 25% of pediatric PC clinicians and 42% of family physicians in the United States had recently prescribed SSRIs for more than 1 adolescent under the age of 18.[13] When indicated by clinical presentation (clear diagnosis of MDD with no comorbid conditions) and patient/family preference, an SSRI should be used. The selection of the specific SSRI should be based on the optimum combination of safety and efficacy data. The patient and family should be informed about the possible adverse effects (clinicians may use a checklist) including possible switch to mania or the development of behavioral activation or suicidal-behavior. Once the antidepressant is started, and if tolerated, the clinician should ensure an adequate trial up to the maximum dose and duration.

Table 3 lists recommended antidepressants and dos-

TABLE 2 Components of CBT and IPT for Adolescents

Therapy	Key Components
CBT	Thoughts influence behaviors and feelings, and vice versa. Treatment targets a patient's thoughts and behaviors to improve his or her mood.
	Essential elements of CBT include increasing pleasurable activities (behavioral activation), reducing negative thoughts (cognitive restructuring), and improving assertiveness and problem-solving skills to reduce feelings of hopelessness. CBT for adolescents may include sessions with parents/caregivers to review progress and increase compliance with CBT-related tasks.
IPT-A	Interpersonal problems may cause or exacerbate depression, and that depression, in turn, may exacerbate interpersonal problems. Treatment targets a patient's interpersonal problems to improve both interpersonal functioning and his or her mood.
	Essential elements of IPT include identifying an interpersonal problem area, improving interpersonal problem-solving skills, and modifying communication patterns.
	Parents/caregivers are involved in sessions during specific phases of the therapy.

TABLE 3 **SSRI Titration Schedule**

Medication	Starting Dose, mg/d	Increments, mg	Effective Dose, mg	Maximum Dose, mg	Contraindication
Citalopram	10	10	20	60	MAOIs
Fluoxetine	10	10–20	20	60	MAOIs
Fluvoxamine	50	50	150	300	MAOIs
Paroxetine	10	10	20	60	MAOIs
Sertraline	25	12.5–25	50	200	MAOIs
Escitalopram	5	5	10	20	MAOIs

ages for use in youth with depression. These recommendations are based on the expert survey results and were also reviewed by our expert consensus panel. Generally, the effective dosages for antidepressants in adolescents are lower than would be found in adult guidelines. Note that only fluoxetine has been approved by the FDA for use in children and adolescents with depression. Clinicians should know the potential drug interactions with SSRIs. Further information on the use of antidepressants are described in the GLAD-PC toolkit. In addition, all SSRIs, with the exception of fluoxetine, should be slowly tapered when discontinued because of the risk of withdrawal effects. Details regarding the initial selection of a specific SSRI and possible reasons for initial drug choice can be found in the GLAD-PC toolkit.

Contact (either in person or by telephone with either the clinician or member of the clinical staff) should take place after the initiation of treatment to review the patient's and family's understanding of and adherence to the treatment plan. Issues such as the current status of the patient and the patient's/family's access to educational materials regarding depression should be discussed during follow-up conversations. For relevant educational resources for patients and/or families, refer to the GLAD-PC toolkit.

Recommendation 4: PC clinicians should monitor for the emergence of adverse events during antidepressant treatment (SSRIs) (grade of evidence: B; strength of recommendation: very strong).

Recent reanalyses of safety data from clinical trials of antidepressants have led to a black-box warning from the FDA regarding the use of these medications in children and adolescents and a recommendation for close monitoring. The exact wording of the FDA recommendation is, "all pediatric patients being treated with antidepressants for any indication should be observed closely for clinical worsening, suicidality, and unusual changes in behavior, especially during the initial few months of a course of drug therapy, or at times of dose changes, either increases or decreases."

Although the frequency of monitoring has been controversial, the FDA further suggested that, "*Ideally, such observation would include at least weekly face-to-face contact with patients or their family members or caregivers during the first 4 weeks, then at biweekly visits for the next 4 weeks, then at 12 weeks, and as clinically indicated beyond 12 weeks. Additional contact by telephone may be appropriate between face-to-face visits.*" It should be noted, however, that there is no empirical evidence to support the requirement of weekly face-to-face meetings per se for the first 4 weeks after initiating antidepressant treatment. In fact, evidence from large population-based surveys show high reliability of telephone interviews with adolescent subjects for the diagnosis of depression.[74,75] Although obtaining a diagnosis is not the same as the elicitation of adverse events while in treatment, this evidence suggests that telephone contact may be just as effective in monitoring for adverse events. A regular and frequent monitoring schedule should be developed, and care should be taken to obtain input from the adolescents and families to ensure compliance with the monitoring strategy.[76,77] Recommendations endorsed by the AACAP have also highlighted the lack of research evidence to support weekly face-to-face visits. However, the AACAP does recommend that providers attempt to follow the FDA guidelines until other research findings become available.

ONGOING MANAGEMENT

Recommendation 1: Systematic and regular tracking of goals and outcomes from treatment should be performed, including assessment of depressive symptoms and functioning in several key domains: home, school, and peer settings (grade of evidence: D; strength of recommendation: very strong).

Goals should include both improvement in functioning status and resolution of depressive symptoms. Tracking of goals and outcomes from treatment should include function in several important domains (ie, home, school, peers). Evidence from large RCTs demonstrates that depressive symptoms and functional impairments may not improve at the same rate with treatment.[23,36] Therefore, symptoms and functioning should be tracked regularly during the course of treatment with information gathered from both the patients and their families when possible.

According to expert consensus, patients should be seen within 1 week of the initiation of treatment. At every visit, clinicians should inquire about ongoing depressive symptoms, risk of suicide, possible adverse effects from treatment (including the use of specific ad-

verse-effect scales), adherence to treatment, and new or ongoing environmental stressors.

Recently, Emslie et al[63] examined medication maintenance after response. The researchers randomly assigned those pediatric patients who had responded to fluoxetine by 19 weeks to placebo or to medication continuation for an additional 32 weeks. Of the 20 subjects who were randomly assigned to the 32-week medication relapse-prevention arm, 10 were exposed to fluoxetine for 51 weeks. Significantly fewer relapses occurred in the group of subjects who were randomly assigned to medication maintenance, which suggests that longer medication-continuation periods, possibly 1 year, may be necessary for relapse prevention. In addition, Emslie et al[63] found the greatest risk of relapse to be in the first 8 to 12 weeks after discontinuing medication, which suggests that after stopping an antidepressant, close follow-up should be encouraged for at least 2 to 3 months.

With the limited evidence in children and adolescents and the emerging evidence in the adult literature that suggests antidepressant medication should be continued for 1 year, the GLAD-PC and AACAP experts concluded that medication should be maintained for 6 to 12 months after the full resolution of depressive symptoms.[19,78]

However, regardless of the length of treatment, all patients should be monitored on a monthly basis for 6 to 12 months after the full resolution of symptoms.[19] If the depressive episode is a recurrence, clinicians are encouraged to monitor patients for up to 2 years given the high rates of recurrence as demonstrated in the adult literature, in which maintenance treatment in those with recurrent depression continue for up to 2 years after the full resolution of symptoms. Clinicians should obtain consultation from mental health if a teen develops psychosis, suicidal or homicidal ideation, or new or worsening of comorbid conditions.

Recommendation 2: Diagnosis and initial treatment should be reassessed if no improvement is noted after 6 to 8 weeks of treatment (grade of evidence: B; strength of recommendation: very strong). Mental health consultation should be considered (grade of evidence: D; strength of recommendation: very strong).

If improvement is not seen within 6 to 8 weeks of treatment, mental health consultation should be considered. Evidence of improvement may include reduction in the number of depressive symptoms, improved functioning in social or school settings, or improvement spontaneously reported by the adolescent and/or parent/caregiver. The clinician should also reassess the initial diagnosis, choice and adequacy of initial treatment, adherence to treatment plan, presence of comorbid conditions (eg, substance abuse) or bipolar symptoms that may influence treatment effectiveness, and new external stressors. If a patient has no response to maximum therapeutic dose of an antidepressant medication, the clinician should consider changing the medication. Alternatively, if the patient's condition fails to improve on antidepressant medication or therapy alone, the addition of, or switch to, the other modality should be considered.

Recommendation 3: For patients who achieve only partial improvement after PC diagnostic and therapeutic approaches have been exhausted (including exploration of poor adherence, comorbid disorders, and ongoing conflicts or abuse), a mental health consultation should be considered (grade of evidence: D; strength of recommendation: very strong).

If a patient only partially improves with treatment, mental health consultation should be considered. The clinician should also review the diagnosis and explore possible causes of partial response such as poor adherence to treatment, comorbid disorders, or ongoing conflicts and/or abuse. These causes may need to be managed first before changes to the treatment plan are made.

If a patient has been treated with an SSRI (maximum tolerated dosage) and has shown only partial improvement, the addition of an evidence-based psychotherapy should be considered if it has not previously been conducted. Other considerations may include the addition of another medication, an increase of the dosage above FDA-approved ranges, or a switch to another medication, preferably in consultation with a mental health professional. Likewise, if a patient's condition fails to improve after a trial of either CBT or IPT and has not yet begun medication, the clinician should consider a trial of SSRI antidepressant treatment. Strong consideration should also be given to a referral to mental health services.

Recommendation 4: PC clinicians should actively support depressed adolescents who are referred to mental health to ensure adequate management (grade of evidence: D; strength of recommendation: very strong). PC clinicians may also consider sharing care with mental health agencies/professionals when possible (grade of evidence: B; strength of recommendation: very strong). Appropriate roles and responsibilities regarding the provision and coordination of care should be communicated and agreed upon by the PC clinician and the mental health specialist (grade of evidence: D; strength of recommendation: very strong).

PC clinicians should continue follow-up with adolescents with depression who have been referred to mental health services for assessment and/or management. When possible, PC clinicians may consider sharing management of depressed adolescents with mental health agencies/professionals. There is emerging evidence from the adult literature about the greater effectiveness of "shared-care" models for the management of depression in the PC setting.[67–72,79–81] Similar evidence from case reports in the pediatric literature is emerging.[82]

DISCUSSION

The recommendations regarding treatment and ongoing management highlight the need for PC professionals to become familiar with the use of empirically tested treatments for adolescent depression including both antidepressants and psychotherapy. In particular, antidepressant treatments can be useful in certain clinical situations in the PC setting. However, in many of these clinical scenarios, PCPs need to ensure that there is systematic and regular follow-up and adequate mental health support if needed. The need for systematic follow-up, whether by the PCP or by a mental health provider, is especially important in light of the recent FDA warnings regarding the emergence of adverse events with antidepressant treatment.

Psychotherapy is also recommended as first-line treatment for depressed adolescents in the PC setting. Although the provision of psychotherapy may be less feasible and practical within the constraints (ie, time, availability of trained staff) of PC settings, there is some evidence that quality improvement projects that involve psychotherapy can improve the care of depressed adolescents.[27]

Another critical recommendation of the guidelines is the need for PCPs to establish connections to available mental health resources in the community, because PCPs will undoubtedly encounter complex cases in which mental health consultation or shared care may be required. Furthermore, increased coordination of care involving different providers are linked to improved outcomes for youth with both general medical and mental health disorders.[35,83–86] However, to increase linkages between PCPs and mental health specialists, changes in many existing health care systems need to occur (eg, mental health specialists to set aside time and be reimbursed for brief telephone consultations to PCPs).

The GLAD-PC was developed on the basis of the needs of PC clinicians who are faced with the challenge of caring for depressed adolescents and encounter many barriers including the shortage of mental health resources in most community settings. Although it is clear that more evidence and research in this area are needed, these guidelines represent a necessary step toward improving the care of depressed adolescents in the PC setting. Similar guidelines have also been produced for other health care contexts such as in the United Kingdom (www.nice.org.uk/pdf/CG028NICEguideline.pdf). The GLAD-PC and the toolkit reflects the coming together of available evidence and the consensus of a large number of experts representing a broad spectrum of specialties and advocacy organizations within the North American health care context. However, no improvements in care will be achieved if changes do not occur in the health care systems that would allow for increased training in mental health for PC clinicians and in collaborative models for both PC and specialty care clinicians. Therefore, it is critical that training programs for PCPs increase their focus on mental health issues and that trainees in both PC and specialty care areas be helped to hone their skills in working in collaborative care models. For providers who are currently practicing, continuing education for primary and specialty care professionals must strengthen skills in collaborative work, and specifically, for PCPs, increase skills and knowledge in the management of depression.

Limitations

Although these guidelines cover a range of issues regarding the management of adolescent depression in the PC setting, there were other controversial areas that were not addressed in these recommendations. These included such issues as universal screening, using a second antidepressant when patients' conditions fail to respond to an initial antidepressant, and the treatment of subthreshold symptoms. New emerging evidence may impact on the inclusion of such areas in future iterations of the guidelines and the accompanying toolkit. Many of these recommendations are made in the face of absence of evidence or lower levels of evidence.

Future Directions

Ample evidence exists to indicate that guidelines alone are insufficient in closing the gaps between recommended versus actual practices.[87,88] Thus, it will be necessary to identify effective methods for disseminating information and to provide assistance in changing practice to PC clinicians. Future studies of these guidelines must build on this work by piloting and evaluating methods, tools, and strategies to facilitate the adoption of these guidelines for the management of adolescent depression in PC settings. These studies must also explore optimal methods for helping clinicians and their organizations/practices address the range of obstacles that may interfere with adoption of necessary practices to yield sustainable management of adolescent depression in PC settings. Also, of course, such studies must show not only changes in PC clinicians' adolescent depression management but also improvements in outcomes of youth with depression.

Many jurisdictions have recognized the need to increase collaborative care to address the care of adolescents with mental illness. In Canada and the United States, models of care that involve mental health and PC are being implemented. However, the empirical support for these models is modest; therefore, additional research is urgently needed. Work has already begun in Massachusetts to implement GLAD-PC in pediatric practices with funding from AACAP. The findings from this and other studies will build the empirical base for new models of care in the pediatric setting.

APPENDIX: PART II TOOLKIT ITEMS

- Algorithm/flow sheet (Fig 1)
- Treatment choices: active support guide, psychotherapy guide, and medication guide and dosage charts
- Referral information
- Authorization to disclose protected health information between PCP and mental health professional
- Follow-up scripts for management
- Fact sheet/family education materials
- Self-management tools

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ERRATA

Cheung AH, Zuckerbrot RA, Jensen PS, Ghalib K, Laraque D, Stein REK, and the GLAD-PC Steering Group. Guidelines for Adolescent Depression in Primary Care (GLAD-PC): II Treatment and Ongoing Management. PEDIATRICS 2007;120:e1313–e1326.

An error occurred in the article by Cheung et al., titled "Guidelines for Adolescent Depression in Primary Care - (GLAD PC): II Treatment and Ongoing Management" published in the November 2007 issue of *Pediatrics* (doi: 10.1542/peds.2006-1395). On page number e1319, Table 2, the authors did not acknowledge that the content of Table 2 is borrowed from "Columbia Treatment Guidelines (2002). Depressive Disorders (Version 2). Columbia University, Department of Child and Adolescent Psychiatry, New York, NY."

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American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Joint Policy Statement—Guidelines for Care of Children in the Emergency Department

AMERICAN ACADEMY OF PEDIATRICS
COMMITTEE ON PEDIATRIC EMERGENCY MEDICINE
AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
PEDIATRIC COMMITTEE
EMERGENCY NURSES ASSOCIATION
PEDIATRIC COMMITTEE

KEY WORD
pediatric emergency preparedness

ABBREVIATIONS
ED—emergency department
EMS—emergency medical services
EMSC—emergency medical services for children
QI—quality improvement
PI—performance improvement

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abstract

Children who require emergency care have unique needs, especially when emergencies are serious or life-threatening. The majority of ill and injured children are brought to community hospital emergency departments (EDs) by virtue of their geography within communities. Similarly, emergency medical services (EMS) agencies provide the bulk of out-of-hospital emergency care to children. It is imperative, therefore, that all hospital EDs have the appropriate resources (medications, equipment, policies, and education) and staff to provide effective emergency care for children. This statement outlines resources necessary to ensure that hospital EDs stand ready to care for children of all ages, from neonates to adolescents. These guidelines are consistent with the recommendations of the Institute of Medicine's report on the future of emergency care in the United States health system. Although resources within emergency and trauma care systems vary locally, regionally, and nationally, it is essential that hospital ED staff and administrators and EMS systems' administrators and medical directors seek to meet or exceed these guidelines in efforts to optimize the emergency care of children they serve. This statement has been endorsed by the Academic Pediatric Association, American Academy of Family Physicians, American Academy of Physician Assistants, American College of Osteopathic Emergency Physicians, American College of Surgeons, American Heart Association, American Medical Association, American Pediatric Surgical Association, Brain Injury Association of America, Child Health Corporation of America, Children's National Medical Center, Family Voices, National Association of Children's Hospitals and Related Institutions, National Association of EMS Physicians, National Association of Emergency Medical Technicians, National Association of State EMS Officials, National Committee for Quality Assurance, National PTA, Safe Kids USA, Society of Trauma Nurses, Society for Academic Emergency Medicine, and The Joint Commission. *Pediatrics* 2009;124:1233–1243

INTRODUCTION

This policy statement delineates guidelines and the resources necessary to prepare hospital emergency departments (EDs) to serve pediatric patients. Adoption of these guidelines should facilitate the delivery of emergency care for children of all ages and, when appropriate, timely transfer to a facility with specialized pediatric services. This policy is an update of previously published guidelines.[1,2]

This statement has been endorsed by the Academic Pediatric Association, American Academy of Family Physicians, American Academy of Physician Assistants, American College of Osteopathic Emergency Phy-

sicians, American College of Surgeons, American Heart Association, American Medical Association, American Pediatric Surgical Association, Brain Injury Association of America, Child Health Corporation of America, Children's National Medical Center, Family Voices, National Association of Children's Hospitals and Related Institutions, National Association of EMS Physicians, National Association of Emergency Medical Technicians, National Association of State EMS Officials, National Committee for Quality Assurance, National PTA, Safe Kids USA, Society of Trauma Nurses, Society for Academic Emergency Medicine, and The Joint Commission.

BACKGROUND

The National Hospital Ambulatory Medical Care Survey reported that in 2006, there were approximately 3833 EDs in the United States. Most of these EDs routinely care for patients of all ages.[3–6] Of the 119 million ED visits in the United States in 2006, almost 20% were for children.[5,6]

In 1993, after nearly a decade of efforts to integrate the needs of children into emergency medical services (EMS) systems, the Institute of Medicine was asked to provide an independent review of emergency medical services for children (EMSC) and report to the nation on the state of the continuum of care for children within the EMS system.[7] Summary recommendations of that report concluded that all agencies with jurisdiction over hospitals "require that hospital emergency departments . . . have available and maintain equipment and supplies appropriate for the emergency care of children" and that they "address the issues of categorization and regionalization in overseeing and development of EMSC and its integration into state and regional EMS systems."

Published data have suggested that compliance with national guidelines is low and that many EDs in the United States and Canada still do not have some of the basic equipment and supplies needed to care for children of all ages.[8–10] Middleton and Burt,[6] in the emergency pediatric services and equipment supplement of the 2002–2003 National Hospital Ambulatory Medical Care Survey, reported that only 6% of US EDs have all of the recommended pediatric supplies and equipment as outlined in previously published national guidelines. Gausche-Hill et al[10] reported similar results in a nationwide survey of EDs in the United States and cited reasons for the lack of equipment availability in many EDs (including lack of awareness, with only 59% of ED managers being aware of the published guidelines) and relative lack of pediatric experience among the workforce, with limited exposure to critically ill or injured pediatric patients at many US hospitals. In fact, 50% of EDs care for fewer than 10 pediatric patients per day; therefore, pediatric planning by these facilities is crucial.[10]

Access to optimal emergency care for children is affected by the lack of availability of equipment, appropriately trained staff to care for children, and policies and procedures that ensure timely transfer to definitive care.[11] Although advances have been made that promote access to emergency care for children, improved awareness of the pediatric resources available to hospitals, in addition to the development of regionalized and coordinated emergency and trauma care systems, may optimize access and outcomes for many acutely ill and injured children.[12,13]

The Institute of Medicine, in a comprehensive report on the state of emergency care in the United States in 2006, made a strong recommendation for regionalized systems of care and further recommended that hospitals and EMS systems appoint qualified coordinators for pediatric emergency care.[12] Only 18% of EDs in the United States currently appoint a physician coordinator, and 12% appoint a nursing coordinator for pediatric emergency care. EDs that do appoint these positions tend to be more prepared as measured by compliance with guidelines on the care of children in the ED published by the American College of Emergency Physicians and American Academy of Pediatrics.[10]

The Health Resources and Services Administration-EMSC program has also advocated for such regionalized systems, and in response to the need to document outcomes of the program's activities, performance measures for states and territories were outlined in 2009.[14] These performance measures call for the existence of a statewide, territorial, or regional standardized system that recognizes hospitals that are able to stabilize and/or manage pediatric medical emergencies and trauma. Target dates have been set for states to comply with these performance measures. Clearly, much work is left to be done to promote and measure pediatric preparedness in all EDs in the United States and for emergency and trauma care systems to be ready to meet the needs of children in disasters.

The following guidelines are intended for all hospital EDs that provide emergency care 24 hours a day, 7 days a week that are continuously staffed by a physician. Children may be cared for in other emergency settings, such as freestanding EDs or urgent care centers, critical access hospitals[15] or stand-by emergency facilities, retail-based clinics, and primary care office practices. These care settings are not addressed in this document, but administrators, physicians, nurses, and other health care providers who staff

these settings should ensure that these facilities maintain the necessary equipment, medications, and supplies and are staffed appropriately to care for pediatric patients. Pediatric emergency-preparedness guidelines have been created for urgent care centers as well as for offices of primary care providers.[16,17]

These guidelines provide current information on equipment, medications, supplies, and personnel considered essential for managing pediatric emergencies in EDs. This statement also offers guidelines for the administration and coordination of pediatric care in the ED; pediatric emergency care quality improvement (QI), performance improvement (PI), and patient safety activities; policies, procedures, and protocols for pediatric care; and key ED support services. It is expected that all EDs in the United States that are staffed by a physician 24 hours a day, 7 days a week can meet or exceed these guidelines and that some hospitals, such as pediatric critical care centers or children's hospitals with greater resources, will develop and implement even more comprehensive guidelines and share their expertise with their local and regional communities. New technology and research will require that such emergency drug, equipment, and supply lists be kept current and that updated recommendations be readily available to hospitals that provide emergency care to children.

I. GUIDELINES FOR ADMINISTRATION AND COORDINATION OF THE ED FOR THE CARE OF CHILDREN

A. A physician coordinator for pediatric emergency medicine is appointed by the ED medical director.
   1. The physician coordinator has the following qualifications:
      a. Meets the qualifications for credentialing by the hospital as a specialist in emergency medicine or pediatric emergency medicine. It is recognized that physicians in these specialties may not always be available in some communities; in these areas, the physician coordinator must meet the qualifications for credentialing by the hospital as a specialist in pediatrics or family medicine and demonstrate, through experience or continuing education, competence in the care of children in emergency settings, including resuscitation.
      b. Has special interest, knowledge, and skill in emergency medical care of children as demonstrated by training, clinical experience, or focused continuing medical education.
      c. Maintains competency in pediatric emergency care (see "III. GUIDELINES FOR QI/PI IN THE ED").
      d. May be a staff physician who is currently assigned other roles in the ED or may be shared through formal consultation agreements with professional resources from a hospital that is capable of providing definitive pediatric care.
   2. The physician coordinator is responsible for the following:
      a. Promoting and verifying adequate skill and knowledge of ED staff physicians and other ED health care providers (ie, physician assistants and advanced practice nurses) in the emergency care and resuscitation of infants and children.
      b. Overseeing ED pediatric QI, PI, patient safety, injury and illness prevention, and clinical care activities.
      c. Assisting with development and periodic review of ED policies and procedures and standards for medications, equipment, and supplies to ensure adequate resources for children of all ages.
      d. Serving as liaison/coordinator to appropriate in-hospital and out-of-hospital pediatric care committees in the community (if they exist).
      e. Serving as liaison/coordinator to a definitive care hospital (such as a regional pediatric referral hospital and trauma center), EMS agencies, primary care providers, health insurers, and any other medical resources needed to integrate services for the continuum of care of the pediatric patient.
      f. Facilitating pediatric emergency education for ED health care providers and out-of-hospital providers affiliated with the ED.
      g. Ensuring that competency evaluations completed by the staff are pertinent to children of all ages.
      h. Ensuring that pediatric needs are addressed in hospital disaster/emergency-preparedness plans.
      i. Collaborating with the nursing coordinator to ensure adequate staffing, medications, equipment, supplies, and other resources for children in the ED.

B. A nursing coordinator for pediatric emergency care is appointed by the ED nursing director.

1. The nursing coordinator has the following qualifications:
   a. Is a registered nurse (RN) who possesses special interest, knowledge, and skill in the emergency medical care of children as demonstrated by training, clinical experience, or focused continuing nursing education.
   b. Maintains competency in pediatric emergency care (see "III. GUIDELINES FOR QI/PI IN THE ED").
   c. Is credentialed and has competency verification per the hospital policies and guidelines to provide care to children of all ages.
   d. May be a staff nurse who is currently assigned other roles in the ED, such as clinical nurse specialist, or may be shared through formal consultation agreements with professional resources from a hospital that is capable of providing definitive pediatric care.
2. The nursing coordinator is responsible for the following:
   a. Facilitating ED pediatric QI/PI activities.
   b. Serving as liaison to appropriate in-hospital and out-of-hospital pediatric care committees.
   c. Serving as liaison to inpatient nursing as well as to a definitive care hospital, a regional pediatric referral hospital and trauma center, EMS agencies, primary care providers, health insurers, and any other medical resources needed to integrate services for the continuum of care of the pediatric patient.
   d. Facilitating, along with hospital-based educational activities, ED nursing continuing education in pediatrics and ensuring that pediatric-specific elements are included in orientation for new staff members.
   e. Ensuring that initial and annual competency evaluations completed by the ED nursing staff are pertinent to children of all ages.
   f. Promoting pediatric disaster preparedness for the ED and participating in hospital disaster-preparedness activities.
   g. Promoting patient and family education in illness and injury prevention.
   h. Providing assistance and support for pediatric education of out-of-hospital providers who are affiliated with the ED.
   i. Working with clinical leadership to ensure the availability of pediatric equipment, medications, staffing, and other resources through the development and periodic review of ED standards, policies, and procedures.
   j. Collaborating with the physician coordinator to ensure that the ED is prepared to care for children of all ages, including children with special health care needs.

II. PHYSICIANS, NURSES, AND OTHER HEALTH CARE PROVIDERS WHO STAFF THE ED

A. Physicians who staff the ED have the necessary skill, knowledge, and training in the emergency evaluation and treatment of children of all ages who may be brought to the ED, consistent with the services provided by the hospital.
B. Nurses and other ED health care providers have the necessary skill, knowledge, and training in providing emergency care to children of all ages who may be brought to the ED, consistent with the services offered by the hospital.
C. Baseline and periodic competency evaluations completed for all ED clinical staff, including physicians, are age specific and include evaluation of skills related to neonates, infants, children, adolescents, and children with special health care needs. Competencies are determined by each institution's medical staff privileges policy.

III. GUIDELINES FOR QI/PI IN THE ED

A pediatric patient care-review process is integrated into the QI/PI plan of the ED according to the following guidelines:

A. Components of the process interface with out-of-hospital, ED, trauma, inpatient pediatric, pediatric critical care, and hospital-wide QI or PI activities.
B. The QI/PI plan of the ED shall include pediatric-specific indicators. Minimum components of the QI/PI process should include collecting and analyzing data to discover variances, defining a plan for improvement, and evaluating the success of the QI/PI plan with measures that are outcome based.
C. Pediatric clinical-competency evaluations should be developed as a part of the local credentialing process for all licensed ED staff (eg, sedation and analgesia, airway management [Appendix 1]). Competencies should be age specific and include those for neonates, infants, children, adolescents, and children with special health care needs.

D. Mechanisms should be in place to monitor professional performance, credentialing, continuing education, and clinical competencies, including integration of findings from QI audits and case reviews.

IV. GUIDELINES FOR IMPROVING PEDIATRIC PATIENT SAFETY IN THE ED

The delivery of pediatric care should reflect an awareness of unique pediatric patient safety concerns[18,19] and should include the following policies or practices:

A. Children should be weighed in kilograms, with the exception of children who require emergent stabilization, and the weight should be recorded in a prominent place on the medical record, such as with the vital signs.
   1. For children who require resuscitation or emergency stabilization, a standard method for estimating weight in kilograms should be used (eg, length-based system).

B. Infants and children should have a full set of vital signs recorded to include temperature, heart rate, and respiratory rate. Blood pressure and pulse oximetry monitoring should be available for children of all ages on the basis of illness and injury severity.

C. A process should be in place for identifying abnormal vital signs according to the age of the patient and for notifying the physician of abnormal values obtained.

D. Processes for safe medication storage, prescribing, and delivery should be established[20,21] and should include the use of precalculated dosing guidelines for children of all ages.

E. Infection-control practices, including hand hygiene and use of personal protective equipment, should be implemented and monitored.

F. Pediatric emergency services should be culturally and linguistically appropriate,[22] and the ED should provide an environment that is safe for children and supports patient- and family-centered care.[23]

G. Patient-identification policies, consistent with the Joint Commission national patient safety goals, should be implemented and monitored.[24]

H. Policies for the timely reporting and evaluation of patient safety events and for the disclosure of medical errors or unanticipated outcomes should be implemented and monitored, and education and training in disclosure should be available to care providers who are assigned this responsibility.[18,19]

V. GUIDELINES FOR POLICIES, PROCEDURES, AND PROTOCOLS FOR THE ED

A. Policies, procedures, and protocols for the emergency care of children are developed and implemented; staff should be educated accordingly; and they should be monitored for compliance and periodically updated. These resources should include, but are not limited to, the following:
   1. Illness and injury triage.
   2. Pediatric patient assessment and reassessment.
   3. Documentation of pediatric vital signs, abnormal vital signs, and actions to be taken for abnormal vital signs.
   4. Immunization assessment and management of the underimmunized patient.[25]
   5. Sedation and analgesia for procedures, including medical imaging.[26,27]
   6. Consent (including situations in which a parent is not immediately available).[28]
   7. Social and mental health issues.
   8. Physical or chemical restraint of patients.
   9. Child maltreatment (physical and sexual abuse, sexual assault, and neglect) and domestic violence mandated reporting criteria, requirements, and processes.
   10. Death of the child in the ED.[29,30]
   11. Do-not-resuscitate orders.
   12. Family-centered care,[31–35] including:
      a. Involving families in patient care decision-making and in medication safety processes.
      b. Family presence during all aspects of emergency care, including resuscitation.[35,36]
      c. Education of the patient, family, and regular caregivers.
      d. Discharge planning and instruction.
      e. Bereavement counseling.
   13. Communication with the patient's medical home or primary health care provider.[37]
   14. Medical imaging policies that address age- or weight-appropriate dosing for children receiving studies that impart ionizing radiation, consistent with as-low-as-reasonably-achievable (ALARA) principles.[38]
   15. All-hazard disaster-preparedness plan that addresses the following pediatric issues[12,39–41]:
      a. Availability of medications, vaccines, equipment, and appropriately trained providers for children in disasters.
      b. Pediatric surge capacity for both injured and noninjured children.
      c. Decontamination, isolation, and

quarantine of families and children of all ages.

d. A plan that minimizes parent-child separation and includes system tracking of pediatric patients, allowing for the timely reunification of separated children with their families.

e. Access to specific medical and mental health therapies, as well as social services, for children in the event of a disaster.

f. Disaster drills, which should include a pediatric mass-casualty incident at least every 2 years.

g. Care of children with special health care needs.

h. A plan that includes evacuation of pediatric units and pediatric specialty units.

B. Hospitals should have written pediatric interfacility transfer procedures that include the following pediatric components of transfer[42]:

1. Defined process for initiation of transfer, including the roles and responsibilities of the referring facility and referral center (including responsibilities for requesting transfer and communication).

2. Transport plan for delivering children safely and in a timely manner to the appropriate facility that is capable of providing definitive care.

3. Process for selecting the appropriate care facility for pediatric specialty services not available at the hospital. These specialty services may include:

a. Medical subspecialty and surgical specialty care.

b. Critical care.

c. Reimplantation (replacement of severed digits or limbs).

d. Trauma and burn care.

e. Psychiatric emergencies.

f. Obstetric and perinatal emergencies.

g. Child maltreatment (physical and sexual abuse and assault).

h. Rehabilitation for recovery from critical medical or traumatic conditions.

4. Process for selecting the appropriately staffed transport service to match the patient's acuity level (eg, level of care required by patient, equipment needed in transport) and appropriate for children with special health care needs.

5. Process for patient transfer (including obtaining informed consent).

6. Plan for transfer of patient information (eg, medical record and copy of signed transport consent), personal belongings of the patient, and provision of directions and referral institution information to family.

7. Process for return transfer of the pediatric patient to the referring facility as appropriate.

VI. GUIDELINES FOR ED SUPPORT SERVICES

A. The radiology department should have the skills and capability to provide imaging studies of children and have the equipment necessary to do so and must have guidelines for reducing radiation exposure that are age and size specific.[38]

1. The radiology capability of hospitals may vary from 1 institution to another; however, the radiology capability of a hospital must meet the needs of the children in the community it serves.

2. A process should be established for the referral of children to appropriate facilities for radiologic procedures that exceed the capability of the hospital.

3. A process should be in place for the timely review, interpretation, and reporting by a qualified radiologist for medical imaging studies.

B. The laboratory should have the skills and capability to perform laboratory tests for children of all ages, including obtaining samples, and should have the availability of microtechnique for small or limited sample size.

1. The clinical laboratory capability must meet the needs of the children in the community it serves.

2. There should be a clear understanding of what the laboratory capability is for any given community and definitive plans for referring children to the appropriate facility for laboratory studies should be in place.

VII. GUIDELINES FOR EQUIPMENT, SUPPLIES, AND MEDICATIONS FOR THE CARE OF PEDIATRIC PATIENTS IN THE ED

A. Pediatric equipment, supplies, and medications should be appropriate for children of all ages and sizes and shall be easily accessible, clearly labeled, and safely and logically organized.

B. Resuscitation equipment and supplies shall be located in the ED; trays and other items may be housed in other departments (such as the newborn nursery or central supply) as long as the items are immediately accessible to the ED staff. A mobile pedi-

TABLE 1 Guidelines for Medications for Use in Pediatric Patients in EDs

Resuscitation Medications	Other Drug Groups
Atropine	Activated charcoal
Adenosine	Topical, oral, and parenteral analgesics
Amiodarone	Antimicrobial agents (parenteral and oral)
Antiemetic agents	Anticonvulsant medications
Calcium chloride	Antidotes (common antidotes should be accessible to the ED)[a]
Dextrose (D10W, D50W)	Antipyretic drugs
Epinephrine (1:1000; 1:10 000 solutions)	Bronchodilators
Lidocaine	Corticosteroids
Magnesium sulfate	Inotropic agents
Naloxone hydrochloride	Neuromuscular blockers
Procainamide	Sedatives
Sodium bicarbonate (4.2%, 8.4%)	Vaccines
	Vasopressor agents

For a more complete list of medications used in a pediatric ED, see ref.[44] D10W indicates dextrose 10% in water; D50W, dextrose 50% in water.

[a] For less frequently used antidotes, a procedure for obtaining them should be in place.

atric crash cart is strongly recommended.

C. ED staff shall be appropriately educated on the location of all items.

D. Each ED shall have a method of daily verification of proper location and function of equipment and supplies.

E. Medication chart, length-based tape, medical software, or other systems shall be readily available to ED staff to ensure proper sizing of resuscitation equipment and proper dosing of medications.

F. Table 1 and Appendix 2 outline medications, equipment, and supplies that are necessary for the care of children in the ED.

SUMMARY

The 2006 Institute of Medicine report *Emergency Care for Children: Growing Pains* uses the word "uneven" to describe the current status of pediatric emergency care in the United States.[12] Although programs such as EMSC have led toward improvement in the level of pediatric emergency readiness in many communities,[43] there remains a significant opportunity for further progress nationwide. The updated guidelines offered in this policy statement are intended to serve as a resource for clinical and administrative leadership of hospital EDs as they endeavor to improve their readiness for children of all ages. An important first step in ensuring readiness is the identification of both a physician and a nurse coordinator for pediatric emergency care.

All hospital EDs must be continually prepared to receive, accurately assess, and, at a minimum, stabilize and safely transfer acutely ill or injured children, which is necessary even for hospitals located in communities with readily accessible pediatric tertiary care centers and regionalized systems for pediatric trauma and critical care. The vast majority of children who require emergency services in the United States receive this care in a non–children's hospital ED, with 50% of EDs providing care for fewer than 10 children per day.[10] This relatively infrequent exposure of hospital-based emergency care professionals to seriously ill or injured children represents a substantial barrier to the maintenance of essential skills and clinical competency. Recognition of the unique needs of the ill and/or injured children served by a hospital, including children with special health care needs; the commitment to better meeting those needs through adoption of these guidelines; and the ongoing commitment to evaluating care quality and safety and maintaining pediatric emergency care competencies should provide a strong foundation for pediatric emergency and all-hazard disaster readiness.

APPENDIX 1: CLINICAL AND PROFESSIONAL COMPETENCY

Demonstration and maintenance of pediatric clinical competency may be achieved through a number of continuing education mechanisms including participation in local educational programs, professional organization conferences, and national life-support programs (ie, Pediatric Advanced Life Support [PALS], Advanced Pediatric Life Support [APLS]: The Pediatric Emergency Medicine Course, Emergency Nursing Pediatric Course [ENPC]) or through scheduled mock codes or patient simulation, team training exercises, or experiences in other clinical settings such as the operating room (ie, airway management).

Potential areas for the development of pediatric competency and professional performance evaluations may include but should not be limited to:

1. Triage
2. Illness and injury assessment and management
3. Pain assessment and treatment, including sedation and analgesia
4. Airway management
5. Vascular access
6. Critical care monitoring
7. Neonatal and pediatric resuscitation
8. Trauma care
9. Burn care
10. Mass-casualty events
11. Patient- and family-centered care

12. Medication delivery and device/equipment safety
13. Team training and effective communication

APPENDIX 2: GUIDELINES FOR EQUIPMENT AND SUPPLIES FOR USE IN PEDIATRIC PATIENTS IN THE ED

General Equipment

- Patient warming device
- Intravenous blood/fluid warmer
- Restraint device
- Weight scale, in kilograms only (not pounds), for infants and children
- Tool or chart that incorporates both weight (in kilograms) and length to assist physicians and nurses in determining equipment size and correct drug dosing (by weight and total volume), such as a length-based resuscitation tape
- Pain-scale–assessment tools appropriate for age

Monitoring Equipment

- Blood pressure cuffs (neonatal, infant, child, adult-arm and thigh)
- Doppler ultrasonography devices
- Electrocardiography monitor/defibrillator with pediatric and adult capabilities including pediatric-sized pads/paddles
- Hypothermia thermometer
- Pulse oximeter with pediatric and adult probes
- Continuous end-tidal CO_2 monitoring device*

*End-tidal CO_2 monitoring is considered the optimal method of assessing for and monitoring of endotracheal tube placement in the trachea; however, for low-volume hospitals, adult and pediatric CO_2 colorimetric detector devices could be substituted. Clinical assessment alone is not appropriate.

Respiratory Equipment and Supplies

- Endotracheal tubes
  - Uncuffed: 2.5 and 3.0 mm
  - Cuffed or uncuffed: 3.5, 4.0, 4.5, 5.0, and 5.5 mm
  - Cuffed: 6.0, 6.5, 7.0, 7.5, and 8.0 mm
- Feeding tubes (5F and 8F)
- Laryngoscope blades (curved: 2 and 3; straight: 0, 1, 2, and 3)
- Laryngoscope handle
- Magill forceps (pediatric and adult)
- Nasopharyngeal airways (infant, child, and adult)
- Oropharyngeal airways (sizes 0–5)
- Stylets for endotracheal tubes (pediatric and adult)
- Suction catheters (infant, child, and adult)
- Tracheostomy tubes (sizes 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5 mm)
- Yankauer suction tip
- Bag-mask device (manual resuscitator), self-inflating (infant size: 450 mL; adult size: 1000 mL)
- Clear oxygen masks (standard and nonrebreathing) for an infant, child, and adult
- Masks to fit bag-mask device adaptor (neonatal, infant, child, and adult sizes)
- Nasal cannulas (infant, child, and adult)
- Nasogastric tubes (sump tubes): infant (8F), child (10F), and adult (14F–18F)
- Laryngeal mask airway† (sizes 1, 1.5, 2, 2.5, 3, 4, and 5)

†Laryngeal mask airways could be shared with anesthesia but must be immediately accessible to the ED.

Vascular Access Supplies and Equipment

- Arm boards (infant, child, and adult sizes)
- Catheter-over-the-needle device (14–24 gauge)
- Intraosseous needles or device (pediatric and adult sizes)
- Intravenous catheter–administration sets with calibrated chambers and extension tubing and/or infusion devices with ability to regulate rate and volume of infusate
- Umbilical vein catheters (3.5F and 5.0F)‡
- Central venous catheters (4.0F–7.0F)
- Intravenous solutions to include: normal saline; dextrose 5% in normal saline; and dextrose 10% in water

Fracture-Management Devices

- Extremity splints, including femur splints (pediatric and adult sizes)
- Spine-stabilization method/devices appropriate for children of all ages§

Specialized Pediatric Trays or Kits

- Lumbar-puncture tray including infant (22-gauge), pediatric (22-gauge), and adult (18- to 21-gauge) lumbar-puncture needles
- Supplies/kit for patients with difficult airway conditions (to include but not limited to supraglottic airways of all sizes, such as the laryngeal mask airway,[2] needle cricothyrotomy supplies, surgical cricothyrotomy kit)
- Tube thoracostomy tray

‡Feeding tubes (size 5F) may be used as umbilical venous catheters but are not ideal. A method for securing the umbilical catheter, such as an umbilical tie, should also be available.

§A spinal stabilization device should be a device that can also stabilize the neck of an infant, child, or adolescent in a neutral position.

- Chest tubes to include infant, child, and adult sizes (infant: 10F–12F; child, 16F–24F; adult, 28F–40F)
- Newborn delivery kit (including equipment for initial resuscitation of a newborn infant: umbilical clamp, scissors, bulb syringe, and towel)
- Urinary catheterization kits and urinary (indwelling) catheters (6F–22F)

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Clinical Report—Guidelines for the Determination of Brain Death in Infants and Children: An Update of the 1987 Task Force Recommendations

abstract

FREE

OBJECTIVE: To review and revise the 1987 pediatric brain death guidelines.

METHODS: Relevant literature was reviewed. Recommendations were developed using the GRADE system.

CONCLUSIONS AND RECOMMENDATIONS: (1) Determination of brain death in term newborns, infants and children is a clinical diagnosis based on the absence of neurologic function with a known irreversible cause of coma. Because of insufficient data in the literature, recommendations for preterm infants less than 37 weeks gestational age are not included in this guideline.

(2) Hypotension, hypothermia, and metabolic disturbances should be treated and corrected and medications that can interfere with the neurologic examination and apnea testing should be discontinued allowing for adequate clearance before proceeding with these evaluations.

(3) Two examinations including apnea testing with each examination separated by an observation period are required. Examinations should be performed by different attending physicians. Apnea testing may be performed by the same physician. An observation period of 24 hours for term newborns (37 weeks gestational age) to 30 days of age, and 12 hours for infants and chi (> 30 days to 18 years) is recommended. The first examination determines the child has met the accepted neurologic examination criteria for brain death. The second examination confirms brain death based on an unchanged and irreversible condition. Assessment of neurologic function following cardiopulmonary resuscitation or other severe acute brain injuries should be deferred for 24 hours or longer if there are concerns or inconsistencies in the examination.

(4) Apnea testing to support the diagnosis of brain death must be performed safely and requires documentation of an arterial $Paco_2$ 20 mm Hg above the baseline and ≥ 60 mm Hg with no respiratory effort during the testing period. If the apnea test cannot be safely completed, an ancillary study should be performed.

(5) Ancillary studies (electroencephalogram and radionuclide cerebral blood flow) are not required to establish brain death and are not a substitute for the neurologic examination. Ancillary studies may be us d to assist the clinician in making the diagnosis of brain death (i) when components of the examination or apnea testing cannot be completed safely due to the underlying medical condition of the patient; (ii) if there is uncertainty about the results of the neurologic examination; (iii) if a medication effect may be present; or (iv) to reduce the inter-examination observation period. When ancillary studies are used, a second clinical examination and apnea test should be performed and components that can be completed must remain consistent with brain death. In this instance the observation interval may be shortened and the second neurologic examination and apnea test (or all components that are able to be completed safely) can be performed at any time thereafter.

(6) Death is declared when the above criteria are fulfilled. *Pediatrics* 2011;128: e720–e740

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KEY WORDS

apnea testing, brain death, cerebral blood flow, children, electroencephalography, infants, neonates, pediatrics

ABBREVIATIONS

EEG—electroencephalogram
CBF—cerebral blood flow
CT—computed tomography
MRI—magnetic resonance imaging
ETT—endotracheal tube
CPAP—continuous positive airway pressure
ICP—intracranial pressure
ECS—electrocerebral silence

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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INTRODUCTION

In 1987, guidelines for the determination of brain death in children were published by a multi-society task force.[1,2] These consensus based guidelines were developed because existing guidelines from the President's Commission failed to adequately address criteria to determine brain death in pediatric patients. They emphasized the importance of the history and clinical examination in determining the etiology of coma so that correctable or reversible conditions were eliminated. Additionally, age-related observation periods and the need for specific neurodiagnostic tests were recommended for children younger than 1 year of age. In children older than 1 year, it was recommended that the diagnosis of brain death could be made solely on a clinical basis and laboratory studies were optional. Little guidance was provided to determine brain death in neonates less than 7 days of age because of limited clinical experience and lack of sufficient data.

These guidelines generally have been accepted and used to guide clinical practice; however they have not been reviewed nor revised since originally published. Several inherent weaknesses have been recognized including: (1) limited clinical information at the time of publication; (2) uncertainty concerning the sensitivity and specificity of ancillary testing; (3) biological rationale for the use of age-based criteria; and (4) little direction as to whether, when and how the diagnosis of brain death could be made in neonates. Despite national and legal acceptance of the concept of brain death, these limitations have resulted in the lack of a standardized approach to determining brain death in children.[3–9] These issues are not unique to infants and children[10] nor limited to the United States. The American Academy of Neurology published guidelines to determine brain death in adults in 1995 which have been revised in 2010.[11,12] Additionally, guidelines to determine brain death in adults and children have been published in Canada.[13]

The Society of Critical Care Medicine (SCCM) and the Section on Critical Care and Section on Neurology of the American Academy of Pediatrics (AAP), in conjunction with the Child Neurology Society (CNS), formed a multidisciplinary committee of medical and surgical subspecialists under the auspices of the American College of Critical Care Medicine (ACCM) to review and revise the 1987 guidelines. Its purpose was to review the neonatal and pediatric literature from 1987, including any prior relevant literature, and update recommendations regarding appropriate examination criteria and use of ancillary testing to diagnose brain death in neonates, infants and children. The committee was also charged with developing a checklist to provide guidance and standardization to document brain death. Uniformity in the determination of brain death should allow physicians to pronounce brain death in pediatric patients in a more precise and orderly manner and ensure that all components of the examination are performed and appropriately documented.

Tables 1–3 of this publication contain the committee's updated recommendations, the GRADE classification system, and clinical and neurologic examination criteria for brain death. Appendices 1–7 provide additional information concerning the diagnosis of brain death in children. Appendix 1 (check list) and Appendix 2 (pharmacological data for the time interval to testing after medication discontinuation) provide additional resources to aid the clinician in diagnosing brain death. Appendix 3 summarizes data regarding apnea testing. Appendices 4–6 provide data on the diagnostic yield of ancillary testing, specifically electroencephalography (EEG), and radionuclide cerebral blood flow (CBF) studies. Appendix 7 compares the 1987 guideline's criteria to the revised recommendations. Appendix 8 provides an algorithm for the determination of brain death in infants and children.

This update affirms the definition of death as stated in the 1987 pediatric guidelines. This definition had been established by multiple organizations including the American Medical Association, the American Bar Association, the National Conference of Commissioners on Uniform State Laws, the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research and the American Academy of Neurology as follows: "An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions, or (2) irreversible cessation of all functions of the entire brain, including the brainstem, is dead. A determination of death must be made in accordance with accepted medical standards."[1]

METHODS

A multidisciplinary committee composed of physicians and nurses with expertise in pediatrics, pediatric critical care, neonatology, pediatric neurology and neurosurgery, nuclear medicine, and neuroradiology was formed by the SCCM and the AAP to update the guidelines for the diagnosis of pediatric brain death. The committee was divided into three working groups, each charged with reviewing the literature on brain death in neonates, infants and children for the following specific areas: (1) examination criteria and observation periods; (2) ancillary testing; and (3) declaration of death by medical personnel including legal and ethical implications.

A Medline search of relevant literature published from January 1987 to June

TABLE 1 Summary Recommendations for the Diagnosis of Brain Death in Neonates, Infants, and Children

Recommendation	Evidence Score	Recommendation Score
1. Determination of brain death in neonates, infants and children relies on a clinical diagnosis that is based on the absence of neurologic function with a known irreversible cause of coma. Coma and apnea must coexist to diagnose brain death. This diagnosis should be made by physicians who have evaluated the history and completed the neurologic examinations.	High	Strong
2. Prerequisites for initiating a brain death evaluation		
a. Hypotension, hypothermia, and metabolic disturbances that could affect the neurological examination must be corrected prior to examination for brain death.	High	Strong
b. Sedatives, analgesics, neuromuscular blockers, and anticonvulsant agents should be discontinued for a reasonable time period based on elimination half-life of the pharmacologic agent to ensure they do not affect the neurologic examination. Knowledge of the total amount of each agent (mg/kg) administered since hospital admission may provide useful information concerning the risk of continued medication effects. Blood or plasma levels to confirm high or supratherapeutic levels of anticonvulsants with sedative effects that are not present should be obtained (if available) and repeated as needed or until the levels are in the low to mid therapeutic range.	Moderate	Strong
c. The diagnosis of brain death based on neurologic examination alone should not be made if supratherapeutic or high therapeutic levels of sedative agents are present. When levels are in the low or in the mid-therapeutic range, medication effects sufficient to affect the results of the neurologic examination are unlikely. If uncertainty remains, an ancillary study should be performed.	Moderate	Strong
d. Assessment of neurologic function may be unreliable immediately following cardiopulmonary resuscitation or other severe acute brain injuries and evaluation for brain death should be deferred for 24 to 48 hours or longer if there are concerns or inconsistencies in the examination.	Moderate	Strong
3. Number of examinations, examiners and observation periods		
a. Two examinations including apnea testing with each examination separated by an observation period are required.	Moderate	Strong
b. The examinations should be performed by different attending physicians involved in the care of the child. The apnea test may be performed by the same physician, preferably the attending physician who is managing ventilator care of the child.	Low	Strong
c. Recommended observation periods:		
(1) 24 hours for neonates (37 weeks gestation to term infants 30 days of age)	Moderate	Strong
(2) 12 hours for infants and children ($>$ 30 days to 18 years).		
d. The first examination determines the child has met neurologic examination criteria for brain death. The second examination, performed by a different attending physician, confirms that the child has fulfilled criteria for brain death.	Moderate	Strong
e. Assessment of neurologic function may be unreliable immediately following cardiopulmonary resuscitation or other severe acute brain injuries and evaluation for brain death should be deferred for 24 to 48 hours or longer if there are concerns or inconsistencies in the examination.	Moderate	Strong
4. Apnea testing		
a. Apnea testing must be performed safely and requires documentation of an arterial $Paco_2$ 20 mm Hg above the baseline $Paco_2$ and $\geq$ 60 mm Hg with no respiratory effort during the testing period to support the diagnosis of brain death. Some infants and children with chronic respiratory disease or insufficiency may only be responsive to supranormal $Paco_2$ levels. In this instance, the $Paco_2$ level should increase to $\geq$ 20 mm Hg above the baseline $Paco_2$ level.	Moderate	Strong
b. If the apnea test cannot be performed due to a medical contraindication or cannot be completed because of hemodynamic instability, desaturation to $<$ 85%, or an inability to reach a $Paco_2$ of 60 mm Hg or greater, an ancillary study should be performed.	Moderate	Strong
5. Ancillary studies		
a. Ancillary studies (EEG and radionuclide CBF) are not required to establish brain death unless the clinical examination or apnea test cannot be completed	Moderate	Strong
b. Ancillary studies are not a substitute for the neurologic examination.	Moderate	Strong
c. For all age groups, ancillary studies can be used to assist the clinician in making the diagnosis of brain death to reduce the observation period or when (i) components of the examination or apnea testing cannot be completed safely due to the underlying medical condition of the patient; (ii) if there is uncertainty about the results of the neurologic examination; or (iii) if a medication effect may interfere with evaluation of the patient. If the ancillary study supports the diagnosis, the second examination and apnea testing can then be performed. When an ancillary study is used to reduce the observation period, all aspects of the examination and apnea testing should be completed and documented.	Moderate	Strong
d. When an ancillary study is used because there are inherent examination limitations (ie, i to iii), then components of the examination done initially should be completed and documented.	High	Strong
e. If the ancillary study is equivocal or if there is concern about the validity of the ancillary study, the patient cannot be pronounced dead. The patient should continue to be observed until brain death can be declared on clinical examination criteria and apnea testing, or a follow-up ancillary study can be performed to assist with the determination of brain death. A waiting period of 24 hours is recommended before further clinical reevaluation or repeat ancillary study is performed. Supportive patient care should continue during this time period.	Moderate	Strong
6. Declaration of death		
a. Death is declared after confirmation and completion of the second clinical examination and apnea test.	High	Strong
b. When ancillary studies are used, documentation of components from the second clinical examination that can be completed must remain consistent with brain death. All aspects of the clinical examination, including the apnea test, or ancillary studies must be appropriately documented.	High	Strong
c. The clinical examination should be carried out by experienced clinicians who are familiar with infants and children, and have specific training in neurocritical care.	High	Strong

The "evaluation score" is based on the strength of the evidence available at the time of publication.
The "recommendation score" is the strength of the recommendations based on available evidence at the time of publication. Scoring guidelines are listed in Table 2.

TABLE 2 Grading of Recommendations Assessment, Development and Evaluation (GRADE) System[14-18]

1. Classification of evidence	
Grade	
A. High	Further research is very unlikely to change our confidence in the estimate of effect
B. Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate
C. Low	Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate
D. Very low	Any estimate of effect is very uncertain
2. Recommendations: The strength of a recommendation reflects the extent to which we can be confident that desirable effects of an intervention outweigh undesirable effects.	
Strong	When the desirable effects of an intervention clearly outweigh the undesirable effects, or clearly do not. (a) For patients—most people in your situation would want the recommended course of action and only a small proportion would not (b) For clinicians—most patients should receive the recommended course of action (c) For policy makers—the recommendation can be adopted as a policy in most situations
Weak	Evidence suggests that desirable and undesirable effects are closely balanced or the quality of evidence is low. (a) For patients—most people in your situation would want the recommended course of action, but many would not (b) For clinicians—you should recognize that different choices will be appropriate for different patients and you must help each patient to arrive at a management decision consistent with his or her values and preferences. (c) For policy makers—policy making will require substantial debate and involvement of many stakeholders
No specific recommendations	The advantages and disadvantages of the recommendations are equivalent or where there is insufficient evidence on which to formulate a recommendation

2008 was conducted. Key words included: brain death, neurologic death, neonatal, pediatric, cerebral blood flow, electroencephalography, apnea test, and irreversible coma with the subheading, "children." Additional articles cited in the post 1987 literature that were published prior to 1987 were also reviewed if they contained data relevant to this guideline. Abstracts and articles were independently reviewed and summarized by at least two individuals on each committee. Data were summarized into five categories: clinical examination, apnea testing, observation periods, ancillary tests, and other considerations.

Methodological issues regarding analysis of evidence warrant further discussion as they directly affected the decision of how information and recommendations about brain death are presented. No randomized control trials examining different strategies regarding the diagnosis of brain death exist. Standard evidence-based approaches for guidelines used by many organizations attempting to link the "strength of the evidence" to the "strength of the recommendations" therefore cannot be used in this instance. There is, however, considerable experiential consensus within observational studies in the pediatric population. Grading of Recommendations Assessment, Development and Evaluation (GRADE), a recently developed standardized methodological consensus-based approach, allows panels to evaluate the evidence and opinions and make recommendations.[14–17] GRADE uses 5 domains to judge the balance between the desirable and undesirable effect of an intervention. *Strong recommendations* are made when there is confidence that the desirable effects of adherence to a recommendation outweigh the undesirable effects. *Weak recommendations* indicate that the desirable effects of adherence to a recommendation probably outweigh the undesirable effects, but the panel is less confident. *No specific recommendations* are made when the advantages and disadvantages of alternative courses of action are equivalent or where there is insufficient evidence on which to formulate a recommendation.[15,18] Table 2 outlines the GRADE methodology used in formulating recommendations for this guideline. Each committee member assigned a GRADE score for (i) the strength of evidence linked to a specific recommendation and (ii) indicated (*a*) "yes," (*b*) "no" or (*c*) "uncertain" for each of the six recommendations listed at the end of this report. By a priori consensus, the committee decided that a "strong" recommendation could only be made if greater than 80% of the committee members voted "yes"

TABLE 3 Neurologic Examination Components to Assess for Brain Death in Neonates, Infants and Children* Including Apnea Testing

Reversible conditions or conditions that can interfere with the neurologic examination must be excluded prior to brain death testing.
See text for discussion

1. **Coma. The patient must exhibit complete loss of consciousness, vocalization and volitional activity.**
   - Patients must lack all evidence of responsiveness. Eye opening or eye movement to noxious stimuli is absent.
   - Noxious stimuli should not produce a motor response other than spinally mediated reflexes. The clinical differentiation of spinal responses from retained motor responses associated with brain activity requires expertise.
2. **Loss of all brain stem reflexes including:**

Midposition or fully dilated pupils which do not respond to light.
Absence of pupillary response to a bright light is documented in both eyes. Usually the pupils are fixed in a midsize or dilated position (4–9 mm). When uncertainty exists, a magnifying glass should be used.

Absence of movement of bulbar musculature including facial and oropharyngeal muscles.
Deep pressure on the condyles at the level of the temporomandibular joints and deep pressure at the supraorbital ridge should produce no grimacing or facial muscle movement.

Absent gag, cough, sucking, and rooting reflex
The pharyngeal or gag reflex is tested after stimulation of the posterior pharynx with a tongue blade or suction device. The tracheal reflex is most reliably tested by examining the cough response to tracheal suctioning. The catheter should be inserted into the trachea and advanced to the level of the carina followed by 1 or 2 suctioning passes.

Absent corneal reflexes
Absent corneal reflex is demonstrated by touching the cornea with a piece of tissue paper, a cotton swab, or squirts of water. No eyelid movement should be seen. Care should be taken not to damage the cornea during testing.

Absent oculovestibular reflexes
The oculovestibular reflex is tested by irrigating each ear with ice water (caloric testing) after the patency of the external auditory canal is confirmed. The head is elevated to 30 degrees. Each external auditory canal is irrigated (1 ear at a time) with ~10 to 50 mL of ice water. Movement of the eyes should be absent during 1 minute of observation. Both sides are tested, with an interval of several minutes.

3. **Apnea. The patient must have the complete absence of documented respiratory effort (if feasible) by formal apnea testing demonstrating a $Paco_2$ ≥ 60 mm Hg and ≥ 20 mm Hg increase above baseline.**
   - Normalization of the pH and $Paco_2$, measured by arterial blood gas analysis, maintenance of core temperature > 35°C, normalization of blood pressure appropriate for the age of the child, and correcting for factors that could affect respiratory effort are a prerequisite to testing.
   - The patient should be preoxygenated using 100% oxygen for 5–10 minutes prior to initiating this test.
   - Intermittent mandatory mechanical ventilation should be discontinued once the patient is well oxygenated and a normal $Paco_2$ has been achieved.
   - The patient's heart rate, blood pressure, and oxygen saturation should be continuously monitored while observing for spontaneous respiratory effort throughout the entire procedure.
   - Follow up blood gases should be obtained to monitor the rise in $Paco_2$ while the patient remains disconnected from mechanical ventilation.
   - If no respiratory effort is observed from the initiation of the apnea test to the time the measured $Paco_2$ ≥ 60 mm Hg and ≥ 20 mm Hg above the baseline level, the apnea test is consistent with brain death.
   - The patient should be placed back on mechanical ventilator support and medical management should continue until the second neurologic examination and apnea test confirming brain death is completed.
   - If oxygen saturations fall below 85%, hemodynamic instability limits completion of apnea testing, or a $Paco_2$ level of ≥ 60 mm Hg cannot be achieved, the infant or child should be placed back on ventilator support with appropriate treatment to restore normal oxygen saturations, normocarbia, and hemodynamic parameters. Another attempt to test for apnea may be performed at a later time or an ancillary study may be pursued to assist with determination of brain death.
   - Evidence of any respiratory effort is inconsistent with brain death and the apnea test should be terminated.
4. **Flaccid tone and absence of spontaneous or induced movements, excluding spinal cord events such as reflex withdrawal or spinal myoclonus.**
   - The patient's extremities should be examined to evaluate tone by passive range of motion assuming that there are no limitations to performing such an examination (eg, previous trauma, etc) and the patient observed for any spontaneous or induced movements.
   - If abnormal movements are present, clinical assessment to determine whether or not these are spinal cord reflexes should be done.

* Criteria adapted from 2010 American Academy of Neurology criteria for brain death determination in adults (Wijdicks et al, 2010).

for a recommendation and that a "weak" recommendation was made if greater than 60% but less than 80% voted "yes." "No recommendation" was made if less than 60% of the committee voted "yes" for a specific recommendation. Table 1 summarizes GRADE recommendations and evidence scores.

The committee believes these revised diagnostic guidelines, summarized in Table 1 and a standardized checklist form (Appendix 1), will assist physicians in determining and documenting brain death in children. This should ensure broader acceptance and utilization of such uniform criteria. The committee recognizes that medical judgment of involved pediatric specialists will direct the appropriate course for the medical evaluation and diagnosis of brain death. The committee also recognizes that no national brain death law exists. State statutes and policy may restrict determination of brain death in certain circumstances. Physicians should become familiar with laws and policies in their respective institution. The committee also recognizes that variability exists for the age designation of pediatric trauma patients. In some states, the age of the pediatric trauma patient is defined as less than 14 years of age.

Trauma and intensive care practitioners are encouraged to follow state/local regulations governing the specified age of pediatric trauma patients. The committee believes these guidelines to be an important step in protecting the health and safety of all infants and children. These revised guidelines and accompanying checklist are intended to provide a framework to promote standardization of the neurologic examination and use of ancillary studies based on the evidence available to the committee at the time of publication.

TERM NEWBORNS (37 WEEKS GESTATIONAL AGE) TO CHILDREN 18 YEARS OF AGE

Definition of Brain Death and Components of the Clinical Examination (*Recommendation 1, Table 1 and Table 3*)

Brain death is a clinical diagnosis based on the absence of neurologic function with a known diagnosis that has resulted in irreversible coma. Coma and apnea must coexist to diagnose brain death. A complete neurologic examination that includes the elements outlined in Table 3 is mandatory to determine brain death with all components appropriately documented.

Prerequisites for Initiating a Clinical Brain Death Evaluation (*Recommendations 2a–d, Table 1*)

Determination of brain death by neurologic examination should be performed in the setting of normal age-appropriate physiologic parameters. Factors potentially influencing the neurologic examination that must be corrected before examination and apnea testing include: (1) shock or persistent hypotension based on normal systolic or mean arterial blood pressure values for the patient's age. Systolic blood pressure or MAP should be in an acceptable range (systolic BP not less than 2 standard deviations below age appropriate norm) based on age; (2) hypothermia; (3) severe metabolic disturbances capable of causing a potentially reversible coma including electrolyte/glucose abnormalities; (4) recent administration of neuromuscular blocking agents; and (5) drug intoxications including but not limited to barbiturates, opioids, sedative and anesthetic agents, antiepileptic agents, and alcohols. Placement of an indwelling arterial catheter is recommended to ensure that blood pressure remains within a normal range during the process of diagnosing brain death and to accurately measure $Paco_2$ levels during apnea testing.

Hypothermia is used with increasing frequency as an adjunctive therapy for individuals with acute brain injury.[19–22] Hypothermia has also been used following cardiac arrest to protect the brain because it reduces cerebral metabolic activity.[23–26] The clinician caring for critically ill infants and children should be aware of the potential impact of therapeutic modalities such as hypothermia on the diagnosis of brain death. Hypothermia is known to depress central nervous system function[27–29] and may lead to a false diagnosis of brain death. Hypothermia may alter metabolism and clearance of medications that can interfere with brain death testing. Efforts to adequately rewarm before performing any neurologic examination and maintain temperature during the observation period are essential. The 1987 guidelines stated that the patient must not be significantly hypothermic however no definition was provided.[1] It is reasonable that the core body temperature at the time of brain death examination be as close to normal to reproduce normal physiologic conditions. A core body temperature of $>35°C$ (95°F) should be achieved and maintained during examination and testing to determine death. This temperature is consistent with current adult guidelines and is relatively easy to achieve and maintain in children.[11,13]

Severe metabolic disturbances can cause reversible coma and interfere with the clinical evaluation to determine brain death. Reversible conditions such as severe electrolyte imbalances, hyper or hyponatremia, hyper or hypoglycemia, severe pH disturbances, severe hepatic or renal dysfunction or inborn errors of metabolism may cause coma in a neonate or child.[28,29] These conditions should be identified and treated before evaluation for brain death, especially in situations where the clinical history does not provide a reasonable explanation for the neurologic status of the child.

Drug intoxications including barbiturates, opioids, sedatives, intravenous and inhalation anesthetics, antiepileptic agents, and alcohols can cause severe central nervous system depression and may alter the clinical examination to the point where they can mimic brain death.[28,29] Testing for these drugs should be performed if there is concern regarding recent ingestion or administration. When available, specific serum levels of medications with sedative properties or side effects should be obtained and documented to be in a low to mid therapeutic range before neurologic examination for brain death testing. Longer acting or continuous infusion of sedative agents can also interfere with the neurologic evaluation. These medications should be discontinued. Adequate clearance (based on the age of the child, presence of organ dysfunction, total amount of medication administered, elimination half-life of the drug and any active metabolites) should be allowed before the neurologic examination. In some instances this may require waiting several half-

lives and rechecking serum levels of the medication before conducting the brain death examination. If neuromuscular blocking agents have been used, they should be stopped and adequate clearance of these agents confirmed by use of a nerve stimulator with documentation of neuromuscular junction activity and twitch response. Other unusual causes of coma such as neurotoxins, and chemical exposure (ie, organophosphates, and carbamates) should be considered in rare cases where an etiology for coma has not been established. Recommendations of time intervals before brain death evaluation for many of the commonly used medications administered to critically ill neonates and children are listed in Appendix 2.

Clinical criteria for determining brain death may not be present on admission and may evolve during hospitalization. Assessment of neurologic function may be unreliable immediately following resuscitation after cardiopulmonary arrest[30–33] or other acute brain injuries and serial neurologic examinations are necessary to establish or refute the diagnosis of brain death. Additionally, initial stabilization may take several hours during which time correcting metabolic disturbances and identifying and treating reversible conditions that may imitate brain death can be accomplished. It is reasonable to defer neurologic examination to determine brain death for 24 hours or longer if dictated by clinical judgment of the treating physician in such circumstances. If there are concerns about the validity of the examination (eg, flaccid tone or absent movements in a patient with high spinal cord injury or severe neuromuscular disease) or if specific examination components cannot be performed due to medical contraindications (eg, apnea testing in patients with significant lung injury, hemodynamic instability, or high spinal cord injury), or if examination findings are inconsistent, continued observation and postponing further neurologic examinations until these issues are resolved is warranted to avoid improperly diagnosing brain death. An ancillary study can be pursued to assist with the diagnosis of brain death in situations where certain examination components cannot be completed.

Neuroimaging with either computed tomography (CT) or magnetic resonance imaging (MRI) should demonstrate evidence of an acute central nervous system injury consistent with the profound loss of brain function. It is recognized that early after acute brain injury, imaging findings may not demonstrate significant injury. In such situations, repeat studies are helpful in documenting that an acute severe brain injury has occurred. CT and MRI are not considered ancillary studies and should not be relied on to make the determination of brain death.

Number of Examinations, Examiners and Observation Periods (*Recommendations 3a–e, Table 1*)

Number of Examinations and Examiners

The 1987 guidelines recommended observation periods between brain death examinations based on age and the results of neurodiagnostic testing.[1] Two examinations and EEG's separated by at least 48 hours were recommended for infants 7 days to 2 months. Two examinations and EEG's separated by at least 24 hours were recommended for children 2 months to 1 year. A repeat EEG was not necessary if a cerebral radionuclide scan or cerebral angiography demonstrated no flow or visualization of the cerebral arteries. For children older than 1 year, an observation period of 12 hours was recommended and ancillary testing was not required when an irreversible cause existed. The observation period in this age group could be decreased if there was documentation of electrocerebral silence (ECS) or absent cerebral blood flow (CBF).[1] The general consensus was the younger the child, the longer the waiting period unless ancillary studies supported the clinical diagnosis of brain death and if so, the observation period could be shortened.

The current committee supports the 1987 guideline recommending performance of two examinations separated by an observation period. The committee recommends that these examinations be performed by different attending physicians involved in the care of the child. Children being evaluated for brain death may be cared for and evaluated by multiple medical and surgical specialists. The committee recommends that the best interests of the child and family are served if at least two different attending physicians participate in diagnosing brain death to ensure that (i) the diagnosis is based on currently established criteria, (ii) there are no conflicts of interest in establishing the diagnosis and (iii) there is consensus by at least two physicians involved in the care of the child that brain death criteria are met. The committee also believes that because the apnea test is an objective test, it may be performed by the same physician, preferably the attending physician who is managing ventilator care of the child.

Duration of Observation Periods

A literature review of 171 children diagnosed as brain dead found that 47% had ventilator support withdrawn an average of 1.7 days after the diagnosis of brain death was made.[34] Seventy-nine children (46%) in whom support was continued after declaration of brain death suffered a cardiac arrest an average of 22.7 days later. The re-

maining children died by an unknown mechanism (5%), or made an incomplete (1%) or complete recovery (0.5%). Review of the children who survived indicates they did not fulfill brain death criteria by accepted medical standards. The age range of the children in this study included preterm and term neonates and older infants and children up to 18 years of age. These data and the reports of more recent studies[35,36] suggest that there is likely no biological justification for using different durations of observation to diagnose brain death in infants greater than one month of age. In fact, there are no reports of children recovering neurologic function after meeting adult brain death criteria based on neurologic examination findings.[37] Although some authors have reported apparent reversibility of brain death, further review of these cases reveals these children would not have fulfilled brain death criteria by currently accepted US medical standards.[38]

Based on the above data, currently available literature and clinical experience, the committee recommends the observation period between examinations should be 24 hours for neonates (37 weeks up to 30 days), and 12 hours for infants and children (> 30 days to 18 years). The first examination determines the child has met neurologic examination criteria for brain death. The second examination confirms brain death based on an unchanged and irreversible condition. Timing of the first clinical brain death examination, reduction of the observation period, and use of ancillary studies are discussed in separate sections of this guideline.

Apnea Testing (*Recommendations 4a,b, Table 1*)

Apnea testing should be performed with each neurologic examination to determine brain death in all patients unless a medical contraindication exists. Contraindications may include conditions that invalidate the apnea test (such as high cervical spine injury) or raise safety concerns for the patient (high oxygen requirement or ventilator settings). If apnea testing cannot be completed safely, an ancillary study should be performed to assist with the determination of brain death.

The normal physiologic threshold for apnea (minimum carbon dioxide tension at which respiration begins) in children has been assumed to be the same as in adults with reports demonstrating that $Paco_2$ levels in the normal range (24–38 mm Hg) may be adequate to stimulate ventilatory effort in children with residual brainstem function.[39] Although expert opinion has suggested a range of $Paco_2$ levels from 44 to 60 mm Hg for apnea testing in adults, the general consensus in infants and children has been to use 60 mm Hg as a threshold.[40–42] Appendix 3 summarizes data from 4 studies (3 being prospective) on 106 apnea tests in 76 children 2 months old to 17 years with suspected brain death.[39–42] 73 of 76 children had no spontaneous ventilatory effort. In 3 of these studies mean $Paco_2$ values were 59.5 ± 10.2, 68.1 ± 17.7, and 63.9 ± 21.5 mm Hg; in the fourth study, mean $Paco_2$ values were not reported, only the range (ie, 60–116 mm Hg).[39–42] Three children exhibited spontaneous respiratory effort with measured $Paco_2$ levels < 40 mm Hg.[39,42] Serial measurements of $Paco_2$ were done in most studies and 15 minutes was the usual end point of testing although patients may have had apnea for longer periods. The maximum rate of $Paco_2$ increase usually occurred within 5 minutes. Sixty five children had no ventilatory effort during the apnea test. After completion of apnea testing, support was withdrawn in all of these patients. Patient outcome was not reported for one study although these 9 children all had absent brainstem reflexes for a period of > 72 hours.[41] In one study 4/9 patients had phenobarbital levels that were interpreted as not affecting the results of apnea testing.[41]

There are three case reports discussing irregular breaths or minimal respiratory effort with a Pco_2 > 60 mm Hg in children who otherwise met criteria for brain death.[43–45] Two children died, one after meeting all criteria for brain death including a second apnea test. The remaining child survived and was supported in a chronic care facility with a tracheostomy, chronic mechanical ventilation and a gastrostomy tube. One other report describes a 3-month-old who met all criteria for brain death including 2 apnea tests with serial Pco_2's of 69.3 mm Hg and 62.1 mm Hg respectively. This infant was declared dead on hospital day 5. This infant developed irregular spontaneous respirations at a rate of two to three breaths per minute 38 days later which continued while receiving mechanical ventilator support until death on day 71.[46] Review of this case and others remind us to be cautious in applying brain death criteria in young infants. However, these cases should not be considered to represent reversible deficits or failure of current brain death criteria.[47]

Technique for Apnea Testing

Apnea testing in term newborns, infants, and children is conducted similar to adults. Normalization of the pH and $Paco_2$, measured by arterial blood gas analysis, maintenance of core temperature > 35°C, normalization of blood pressure appropriate for the age of the child, and correcting for factors that could affect respiratory effort are a prerequisite to testing. The patient must be preoxygenated using 100% oxygen for 5–10 minutes before initiating this test. Intermittent manda-

tory mechanical ventilation should be discontinued once the patient is well oxygenated and a normal $Paco_2$ has been achieved. The patient can then be changed to a T piece attached to the endotracheal tube (ETT), or a self-inflating bag valve system such as a Mapleson circuit connected to the ETT. Tracheal insufflation of oxygen using a catheter inserted through the ETT has also been used, however caution is warranted to ensure adequate gas excursion and to prevent barotrauma. High gas flow rates with tracheal insufflation may also promote CO_2 washout preventing adequate $Paco_2$ rise during apnea testing. Continuous positive airway pressure (CPAP) ventilation has been used during apnea testing. Many current ventilators automatically change from a CPAP mode to mandatory ventilation and deliver a breath when apnea is detected. It is also important to note that spontaneous ventilation has been falsely reported to occur while patients were maintained on CPAP despite having the trigger sensitivity of the mechanical ventilator reduced to minimum levels.[48] Physician(s) performing apnea testing should continuously monitor the patient's heart rate, blood pressure, and oxygen saturation while observing for spontaneous respiratory effort throughout the entire procedure. $Paco_2$, measured by blood gas analysis, should be allowed to rise to $\geq$ 20 mm Hg above the baseline $Paco_2$ level and $\geq$ 60 mm Hg. If no respiratory effort is observed from the initiation of the apnea test to the time the measured $Paco_2 \geq 60$ mm Hg and ≥ 20 mm Hg above the baseline level, the apnea test is consistent with brain death. The patient should be placed back on mechanical ventilator support and medical management should continue until the second neurologic examination and apnea test confirming brain death is completed. If oxygen saturations fall below 85%, hemodynamic instability limits completion of apnea testing, or a $Paco_2$ level of $\geq$ 60 mm Hg cannot be achieved, the infant or child should be placed back on ventilator support with appropriate treatment to restore normal oxygen saturations, normocarbia, and hemodynamic parameters. In this instance, another attempt to test for apnea may be performed at a later time or an ancillary study may be pursued to assist with determination of brain death. Evidence of any respiratory effort that is inconsistent with brain death and the apnea test should be terminated and the patient placed back on ventilatory support.

Ancillary Studies (*Recommendations 5a–e, Table 1*)

The committee recommends that ancillary studies are not required to establish brain death and should not be viewed as a substitute for the neurologic examination. Ancillary studies may be used to assist the clinician in making the diagnosis of brain death (i) when components of the examination or apnea testing cannot be completed safely due to the underlying medical condition of the patient; (ii) if there is uncertainty about the results of the neurologic examination; (iii) if a medication effect may be present; or (iv) to reduce the inter-examination observation period. The term "ancillary study" is preferred to "confirmatory study" since these tests assist the clinician in making the clinical diagnosis of brain death. Ancillary studies may also be helpful for social reasons allowing family members to better comprehend the diagnosis of brain death.

Four-vessel cerebral angiography is the gold standard for determining absence of CBF. This test can be difficult to perform in infants and small children, may not be readily available at all institutions, and requires moving the patient to the angiography suite potentially increasing risk of exacerbating hemodynamic and respiratory instability during transport of a critically ill child outside of the intensive care unit. Electroencephalographic documentation of electrocerebral silence (ECS) and use of radionuclide CBF determinations to document the absence of CBF remain the most widely used methods to support the clinical diagnosis of brain death in infants and children. Radionuclide CBF testing must be performed in accordance with guidelines established by the Society of Nuclear Medicine and the American College of Radiology.[49,50] EEG testing must be performed in accordance with standards established by the American Electroencephalographic Society.[51] Interpretation of ancillary studies requires the expertise of appropriately trained and qualified individuals who understand the limitations of these studies to avoid any potential misinterpretation.

Similar to the neurologic examination, hemodynamic and temperature parameters should be normalized before obtaining EEG or CBF studies. Pharmacologic agents that could affect the results of testing should be discontinued (Appendix 2) and levels determined as clinically indicated. Low to mid therapeutic levels of barbiturates should not preclude the use of EEG testing.[48] Evidence suggests that radionuclide CBF study can be used in patients with high dose barbiturate therapy to demonstrate absence of CBF.[52,53]

Diagnostic Yield of the EEG in Suspected Brain Dead Children

Appendix 4 summarizes EEG data from 12 studies in 485 suspected brain dead children in all age groups.[34,54–65] The data show that 76% of all children who were evaluated with EEG for brain death on the first EEG had ECS. Multiple EEGs increased the yield to 89%. For those children who had ECS on their

first EEG, 64/66 patients (97%) had ECS on a follow-up EEG. The first exception was a neonate who had a phenobarbital level of 30 μg/mL when the first EEG was performed.[65] The second exception was a 5 year old head trauma patient who was receiving pentobarbital and pancuronium at the time of the initial EEG.[62] This patient also had a CBF study performed demonstrating flow. In retrospect, these two patients would not have met currently accepted standards for brain death based on pharmacologic interference with EEG testing. Additionally, of those patients with EEG activity on the first EEG, 55% had a subsequent EEG that showed ECS. The remaining 45% either had persistent EEG activity or additional EEGs were not performed. All died (spontaneously or by withdrawal of support). Only one patient survived from this entire group of 485 patients, a neonate with an elevated phenobarbital level whose first EEG showed photic response and survived severely neurologically impaired.

Diagnostic Yield of Radionuclide CBF Studies in Suspected Brain Dead Children

Appendix 5 summarizes CBF data from 12 studies in 681 suspected brain dead children in all age groups.[36,54,55,57,59,60,63,64–68] Different but well standardized and conventional radionuclide cerebral angiography methods were used. Absent CBF was found in 86% of children who were clinically brain dead and the yield did not significantly change if more than one CBF study was done (89%). Appendix 5 also summarizes follow-up data on children whose subsequent CBF study showed no flow. 24/26 patients (92%) had no flow on follow-up CBF studies when the first study showed absent flow. The two exceptions where flow developed later were newborns. The first newborn had minimal flow on the second study and ventilator support was discontinued. The other newborn developed flow on the second study and had some spontaneous respirations and activity. A phenobarbital level two days after the second CBF study with minimal flow was 8 μg/mL.[65]

In those patients with preserved CBF on the first CBF study, 26% (9/34) had a second CBF study that showed no flow. The remaining 74% either had preserved flow or no further CBF studies were done and all but one patient died (either spontaneously or by withdrawal of support). Only one patient survived with severe neurologic impairment from this entire group of patients—the same neonate as noted previously with no CBF on the first study but presence of CBF on the second study.

Diagnostic Yield of the Initial EEG Versus Radionuclide CBF Studies in Brain Dead Children

Appendix 6 summarizes the comparative diagnostic yield of EEG versus CBF determinations in children who had both studies done as part of the initial brain death evaluation. Data from the 12 studies cited in Appendices 4 and 5 were stratified by 3 age groups: (i) all children ($n = 149$); (ii) newborns (< 1 month of age, $n = 30$); and (iii) children age > 1 month to 18 years ($n = 119$).[36,54–56,58–68]

The data in Appendices 4 and 5 show that the yield from the initial CBF studies was higher (86%) than from the initial EEG (76%) but no differences were present for any CBF study (89%) vs any EEG study (89%). In contrast the data in Appendix 6 for all children show that when both studies are initially performed, the diagnostic yield is the same (70% had ECS; and 70% showed absent CBF). The diagnostic yield for children greater than 1 month of age was similar for both tests (EEG with ECS, 78%; no CBF, 71%). For newborns, EEG with ECS was less sensitive (40%) than absence of CBF (63%) when confirming the diagnosis of brain death but even in the CBF group the yield was low.

In summary, both of these ancillary studies remain accepted tests to assist with determination of brain death in infants and children. The data suggest that EEG and CBF studies are of similar confirmatory value. Radionuclide CBF techniques are increasingly being used in many institutions replacing EEG as an ancillary study to assist with the determination of brain death in infants and children.[5,69] Other ancillary studies such as the Transcranial Doppler study and newer tests such as CT angiography, CT perfusion using arterial spin labeling, nasopharyngeal somatosensory evoked potential studies, MRI-MR angiography, and perfusion MRI imaging have not been studied sufficiently nor validated in infants and children and cannot be recommended as ancillary studies to assist with the determination of brain death in children at this time.

Repeating Ancillary Studies

If the EEG study shows electrical activity or the CBF study shows evidence of flow or cellular uptake, the patient cannot be pronounced dead at that time. The patient should continue to be observed and medically treated until brain death can be declared solely on clinical examination criteria and apnea testing based on recommended observation periods, or a follow-up ancillary study can be performed to assist and is consistent with the determination of brain death, or withdrawal of life-sustaining medical therapies is made irrespective of meeting criteria for brain death. A waiting period of 24 hours is recommended before further ancillary testing, using a radionuclide CBF study, is performed allowing adequate clearance of Tc-99m.[49,50] While no evidence exists for a recommended

waiting period between EEG studies, a waiting period of 24 hours is reasonable and recommended before repeating this ancillary study.

Shortening the Observation Period

If an ancillary study, used in conjunction with the first neurologic examination, supports the diagnosis of brain death, the inter-examination observation interval can be shortened and the second neurologic examination and apnea test (or all components that can be completed safely) can be performed and documented at any time thereafter for children of all ages.

SPECIAL CONSIDERATIONS FOR TERM NEWBORNS (37 WEEKS GESTATION) TO 30 DAYS OF AGE (*RECOMMENDATIONS 1–5, TABLE 1*)

Preterm and term neonates younger than 7 days of age were excluded from the 1987 Task Force guidelines. The ability to diagnose brain death in newborns is still viewed with some uncertainty primarily due to the small number of brain-dead neonates reported in the literature[54,65,70] and whether there are intrinsic biological differences in neonatal brain metabolism, blood flow and response to injury. The newborn has patent sutures and an open fontanelle resulting in less dramatic increases in intracranial pressure (ICP) after acute brain injury when compared with older patients. The cascade of events associated with increased ICP and reduced cerebral perfusion ultimately leading to herniation are less likely to occur in the neonate.

Clinical Examination

Limited data are available regarding the clinical examination for brain death in preterm and term infants.[70] It has been recognized that examination of the preterm infant less than 37 weeks gestation to determine if they meet brain death criteria may be difficult because of the possibility that some of the brainstem reflexes may not be completely developed and that it is also difficult to assess the level of consciousness in a critically ill, sedated and intubated neonate. Because of insufficient data in the literature, recommendations for preterm infants less than 37 weeks gestational age were not included in this guideline. However, as discussed in the following section on observation periods, the available data suggest that recovery of neurologic function is unlikely when a term newborn is diagnosed with brain death. Based on review of the literature, the task force supports that brain death can be diagnosed in term newborns (37 weeks gestation) and older, provided the physician is aware of the limitations of the clinical examination and ancillary studies in this age group. It is important to carefully and repeatedly examine term newborns, with particular attention to examination of brainstem reflexes and apnea testing. As with older children, assessment of neurologic function in the term newborn may be unreliable immediately following an acute catastrophic neurologic injury or cardiopulmonary arrest. A period of 24 hours or longer is recommended before evaluating the term newborn for brain death.

Apnea Testing

Neonatal studies reviewing $Paco_2$ thresholds for apnea are limited. However, data from 35 neonates who were ultimately determined to be brain dead revealed a mean $Paco_2$ of 65 mm Hg suggesting that the threshold of 60 mm Hg is also valid in the newborn.[35] Apnea testing in the term newborn may be complicated by the following: (1) Treatment with 100% oxygen may inhibit the potential recovery of respiratory effort.[71,72] (2) Profound bradycardia may precede hypercarbia and limit this test in neonates. A thorough neurologic examination must be performed in conjunction with the apnea test to make the determination of death in any patient. If the apnea test cannot be completed as previously described, the examination and apnea test can be attempted at a later time, or an ancillary study may be performed to assist with determination of death. Ancillary studies in newborns are less sensitive than in older children. There are no reported cases of any neonate who developed respiratory effort after meeting brain death criteria.

Observation Periods in Term Newborns

There is some experience concerning the duration of observation periods in neonates being evaluated for brain death. A review of 87 newborns revealed that the duration of coma from insult to brain death was 37 hours and the duration of time from the initial neurologic examination being indicative of brain death to final confirmation was 75 hours. The overall average duration of brain death in these neonates was about 95 hours or almost 4 days.[37] 53 neonates less than 7 days of age donating organs for transplantation had a total duration of brain death including time to transplantation that averaged 2.8 days; for neonates 1–3 weeks of age, the duration of brain death was approximately 5.2 days.[37] None of these patients recovered any neurologic function. These data suggest that once the diagnosis of brain death is made in newborns, recovery is unlikely. Based on data extracted from available literature and clinical experience the committee recommends the observation period between examinations should be 24 hours for term newborns (37 weeks) to 30 days of age.

Ancillary Studies

Ancillary studies performed in the newborn $<$ 30 days of age are limited.[70] As summarized in Appendix 6, ancillary studies in this age group are less sensitive in detecting the pres-

ence/absence of brain electrical activity or cerebral blood flow than in older children. Of the two studies, detecting absence of CBF (63%) was more sensitive than demonstration of ECS (40%) in confirming the diagnosis of brain death, however even in the CBF study group the sensitivity was low.[70]

EEG activity is of low voltage in newborns raising concerns about a greater chance of having reversible ECS in this age group. In a retrospective review of 40 newborns with ECS, 9/10 with ECS on the initial EEG showed ECS on repeated studies.[70] The remaining patient had a phenobarbital level of 30 μg/mL at the time of the initial EEG, probably accounting for the initial ECS. Several other cases have been reported with initial ECS but careful review found that the patients were not clinically brain dead. Based on available data it is likely that if the initial EEG shows ECS (assuming an absence of correctable conditions) in a newborn who meets all clinical criteria for brain death, then it is an accurate and reliable predictor of brain death and repeat EEG studies are not indicated.

CBF in viable newborns can be extremely low because of the decreased level of brain metabolic activity.[50] However earlier studies using stable xenon computed tomography measurements of CBF have shown that the level of CBF in brain dead children is much lower than that seen in viable newborns.[73,74]

The available data suggest that ancillary studies in newborns are less sensitive than in older children. This can pose an important clinical dilemma in this age group where clinicians may have a greater level of uncertainty about performing a valid neurologic examination. There is a greater need to have more reliable and accurate ancillary studies in this age group. Awareness of this limitation would suggest that longer periods of observation and repeated neurologic examinations are needed before making the diagnosis of brain death and also that as in older infants and children, the diagnosis should be made clinically and based on repeated examinations rather than relying exclusively on ancillary studies.

DECLARATION OF DEATH (FOR ALL AGE GROUPS) (*RECOMMENDATIONS 6a–c, TABLE 1 AND APPENDIX 8 ALGORITHM*)

Death is declared after the second neurologic examination and apnea test confirms an unchanged and irreversible condition. An algorithm (Appendix 8) provides recommendations for the process of diagnosing brain death in children. When ancillary studies are used, documentation of components from the second clinical examination that can be completed, including a second apnea test, must remain consistent with brain death. All aspects of the clinical examination, including the apnea test, or ancillary studies must be appropriately documented. A checklist outlining essential examination and testing components is provided in Appendix 1. This checklist also provides standardized documentation to determine brain death.

ADDITIONAL CONSIDERATIONS (FOR ALL AGE GROUPS)

In today's modern pediatric and neonatal intensive care units, critical care practitioners and other physicians with expertise in neurologic injury are routinely called on to declare death in infants and children. Because the implications of diagnosing brain death are of great consequence, examination should be conducted by experienced clinicians who are familiar with neonates, infants and children and have specific training in neurocritical care. These physicians must be competent to perform the clinical examination and interpret results from ancillary studies. Qualified clinicians include: pediatric intensivists and neonatologists, pediatric neurologists and neurosurgeons, pediatric trauma surgeons, and pediatric anesthesiologists with critical care training. Adult specialists should have appropriate neurologic and critical care training to diagnose brain death when caring for the pediatric patient from birth to 18 years of age. Residents and fellows should be encouraged to learn how to properly perform brain death testing by observing and participating in the clinical examination and testing process performed by experienced attending physicians. It is recommended that both neurologic examinations be performed and documented by an attending physician who is qualified and competent to perform the brain death examination.

These revised pediatric brain death diagnostic guidelines are intended to provide an updated framework in an effort to promote standardization of the neurologic examination and use of ancillary studies. A standardized checklist (Appendix 1) will help to ensure that all components of the examination, and ancillary studies if needed, are completed and documented appropriately. Pediatric specialists should be invited to participate in the development of institutional guidelines to ensure that the brain death examination is conducted consistently each time the diagnosis is being considered. A comparison of the 1987 pediatric brain death guidelines and 2011 update for neonatal and pediatric brain death guidelines are listed in Appendix 7.

Diagnosing brain death must never be rushed or take priority over the needs of the patient or the family. Physicians are obligated to provide support and guidance for families as they face difficult end-of-life decisions and attempt to understand what has happened to their child. It is the responsibility of the physician to guide and direct families during the treatment of their child. Communication with families must be clear and concise using simple termi-

nology so that parents and family members understand that their child has died. Permitting families to be present during the brain death examination, apnea testing and performance of ancillary studies can assist families in understanding that their child has died. The family must understand that once brain death has been declared, their child meets legal criteria for death. Families may otherwise become confused or angry if discussions regarding withdrawal of support or medical therapies are entertained after declaration of death. It should be made clear that once death has occurred, continuation of medical therapies, including ventilator support, is no longer an option unless organ donation is planned. Appropriate emotional support for the family should be provided including adequate time to grieve with their child after death has occurred. Consultation or referral to the medical examiner or coroner may be required by state law in certain situations when death occurs.

FUTURE DIRECTIONS

Development of a national database to track infants and children who are diagnosed as brain dead should be strongly considered. Information compiled from this database would increase our knowledge about brain death, especially in neonates.

1. Studies comparing traditional ancillary studies to newer methods to assess CBF and neurophysiologic function should be pursued. Further information about ancillary studies, waiting periods, and research regarding validity of newer ancillary studies is needed for future recommendations to assist with determination of brain death in children.
2. Cerebral protective therapies such as hypothermia may alter the natural progression of brain death and their impact should be reviewed as more information becomes available. The clinician caring for critically ill infants and children should be aware of the potential impact of new therapeutic modalities on the diagnosis of brain death.
3. While each institution and state may have specific guidelines for the determination of brain death in infants and children, we should work with national medical societies to achieve a uniform approach to declaring death that can be incorporated in all hospital policies.[75] This will help eliminate confusion among medical personnel thereby fostering further trust from the community of patients and families that we serve.
4. Additional information or studies are required to determine if a single neurologic examination is sufficient for neonates, infants, and children to determine brain death as currently recommended for adults over 18 years of age.[12,76]

ENDORSEMENTS AND APPROVALS

This document has been reviewed and endorsed by the following societies:

American Academy of Pediatrics

Sub sections:

Section on Critical Care

Section on Neurology

American Association of Critical Care Nurses

Child Neurology Society

National Association of Pediatric Nurse Practitioners

Society of Critical Care Medicine

Society for Pediatric Anesthesia

Society of Pediatric Neuroradiology

World Federation of Pediatric Intensive and Critical Care Societies

American Academy of Neurology affirms the value of this manuscript.

The following societies have had the opportunity to review and comment on this document

American Academy of Pediatrics

Sub sections:

Committee on Bioethics

Committee on Child Abuse and Neglect

Committee on Federal Government Affairs

Committee on Fetus and Newborn

Committee on Hospital Care

Committee on Medical Liability and Risk Management

Committee on Pediatric Emergency Medicine

Committee on Practice and Ambulatory Medicine

Committee on State Government Affairs

Council on Children With Disabilities

Section on Anesthesiology and Pain Medicine

Section on Bioethics

Section on Child Abuse and Neglect

Section on Critical Care

Section on Emergency Medicine

Section on Hospital Medicine

Section on Neurology

Section on Perinatal Pediatrics

Section on Neurological Surgery

Section on Pediatric Surgery

The Pediatric Section of the American Association of Neurosurgeons and the Congress of Neurologic Surgeons have been provided the opportunity to review this document

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APPENDIX 1 Check List for Documentation of Brain Death

Brain Death Examination for Infants and Children

Two physicians must perform independent examinations separated by specified intervals.

Age of Patient	Timing of first exam	Inter-exam. interval
Term newborn 37 weeks gestational age and up to 30 days old	☐ First exam may be performed 24 hours after birth OR following cardiopulmonary resuscitation or other severe brain injury	☐ At least 24 hours ☐ Interval shortened because ancillary study (section 4) is consistent with brain death
31 days to 18 years old	☐ First exam may be performed 24 hours following cardiopulmonary resuscitation or other severe brain injury	☐ At least 12 hours OR ☐ Interval shortened because ancillary study (section 4) is consistent with brain death

Section 1. PREREQUISITES for brain death examination and apnea test

A. IRREVERSIBLE AND IDENTIFIABLE Cause of Coma (Please check)

☐ Traumatic brain injury ☐ Anoxic brain injury ☐ Known metabolic disorder ☐ Other (Specify) _____

B. Correction of contributing factors that can interfere with the neurologic examination	Examination One		Examination Two	
a. Core Body Temp is over 95° F (35° C)	☐ Yes	☐ No	☐ Yes	☐ No
b. Systolic blood pressure or MAP in acceptable range (Systolic BP not less than 2 standard deviations below age appropriate norm) based on age	☐ Yes	☐ No	☐ Yes	☐ No
c. Sedative/analgesic drug effect excluded as a contributing factor	☐ Yes	☐ No	☐ Yes	☐ No
d. Metabolic intoxication excluded as a contributing factor	☐ Yes	☐ No	☐ Yes	☐ No
e. Neuromuscular blockade excluded as a contributing factor	☐ Yes	☐ No	☐ Yes	☐ No

If ALL prerequisites are marked YES, then proceed to section 2. OR

_____ confounding variable was present. Ancillary study was therefore performed to document brain death. (Section 4).

Section 2. Physical Examination (Please check) NOTE: SPINAL CORD REFLEXES ARE ACCEPTABLE	Examination One Date/ time: _____		Examination Two Date/ Time: _____	
a. Flaccid tone, patient unresponsive to deep painful stimuli	☐ Yes	☐ No	☐ Yes	☐ No
b. Pupils are midposition or fully dilated and light reflexes are absent	☐ Yes	☐ No	☐ Yes	☐ No
c. Corneal, cough, gag reflexes are absent	☐ Yes	☐ No	☐ Yes	☐ No
Sucking and rooting reflexes are absent (in neonates and infants)	☐ Yes	☐ No	☐ Yes	☐ No
d. Oculovestibular reflexes are absent	☐ Yes	☐ No	☐ Yes	☐ No
e. Spontaneous respiratory effort while on mechanical ventilation is absent	☐ Yes	☐ No	☐ Yes	☐ No

The _____ (specify) element of the exam could not be performed because _____

Ancillary study (EEG or radionuclide CBF) was therefore performed to document brain death. (Section 4).

Section 3. APNEA Test	Examination One Date/ Time_____	Examination Two Date/ Time_____
No spontaneous respiratory efforts were observed despite final $PaCO_2 \geq 60$ mm Hg and a ≥ 20 mm Hg increase above baseline. (Examination One) No spontaneous respiratory efforts were observed despite final $PaCO_2 \geq 60$ mm Hg and a ≥ 20 mm Hg increase above baseline. (Examination Two)	Pretest $PaCO_2$: _____ Apnea duration: _____min Posttest $PaCO_2$: _____	Pretest $PaCO_2$: _____ Apnea duration: _____min Posttest $PaCO_2$: _____

Apnea test is contraindicated or could not be performed to completion because _____

Ancillary study (EEG or radionuclide CBF) was therefore performed to document brain death. (Section 4).

Section 4. ANCILLARY testing is required when (1) any components of the examination or apnea testing cannot be completed; (2) if there is uncertainty about the results of the neurologic examination; or (3) if a medication effect may be present. Ancillary testing can be performed to reduce the inter-examination period however a second neurologic examination is required. Components of the neurologic examination that can be performed safely should be completed in close proximity to the ancillary test	Date/Time: _____
☐ Electroencephalogram (EEG) report documents electrocerebral silence OR	☐ Yes ☐ No
☐ Cerebral Blood Flow(CBF) study report documents no cerebral perfusion	☐ Yes ☐ No

Section 5. Signatures

Examiner One

I certify that my examination is consistent with cessation of function of the brain and brainstem. Confirmatory exam to follow.

_____ _____

(Printed Name) (Signature)

_____ _____ _____ _____

(Specialty) (Pager #/License #) (Date mm/dd/yyyy) (Time)

Examiner Two

☐ I certify that my examination ☐ and/or ancillary test report ☐ confirms unchanged and irreversible cessation of function of the brain and brainstem. The patient is declared brain dead at this time.

Date/Time of death: _____

_____ _____

(Printed Name) (Signature)

_____ _____ _____ _____

(Specialty) (Pager #/License #) (Date mm/dd/yyyy) (Time)

APPENDIX 2 Medications Administered to Critically Ill Pediatric Patients and Recommendations for Time Interval to Testing After Discontinuation

Medication	Infants/Children Elimination ½ life	Neonates Elimination ½ life
Intravenous induction, anesthetic, and sedative agents		
Thiopental	Adults: 3–11.5 hours (shorter ½ life in children)	
Ketamine	2.5 hours	
Etomidate	2.6–3.5 hours	
Midazolam	2.9–4.5 hours	4–12 hours[77–80]
Propofol	2–8 minutes, Terminal ½ life 200 minutes (range 300–700 minutes)	
Dexmedetomidine	Terminal ½ life 83–159 minutes[79–81]	Infants have faster clearance[81–83]
Antiepileptic drugs		
Phenobarbital	Infants: 20–133 hours* Children: 37–73 hours*	45–500 hours*[79,84,85]
Pentobarbital	25 hours*	
Phenytoin	11–55 hours*	63–88 hours*
Diazepam	1 month–2 years: 40–50 hours 2 years–12 years: 15–21 hours 12–16 years: 18–20 hours	50–95 hours[79,86,87]
Lorazepam	Infants: 40.2 hours (range 18–73 hours) Children: 10.5 hours (range 6–17 hours)	40 hours[86]
Clonazepam	22–33 hours	
Valproic Acid	Children > 2 months: 7–13 hours* Children 2–14 years: Mean 9 hours; range 3.5–20 hours	10–67 hours*
Levetiracetam	Children 4–12 years: 5 hours	
Intravenous narcotics		
Morphine sulfate	Infants 1–3 months: 6.2 hours (5–10 hours) 6 months–2.5 years: 2.9 hours (1.4–7.8 hours) Children: 1–2 hours	7.6 hours (range 4.5–13.3 hours)[79,89–91]
Meperidine	Infants < 3 months: 8.2–10.7 hours (range 4.9–31.7 hours) Infants 3–18 months: 2.3 hours Children 5–8 years: 3 hours	23 hours (range 12–39 hours)
Fentanyl	5 months–4.5 years: 2.4 hours (mean) 0.5–14 years: 21 hours (range 11–36 hours for long term infusions)	1–15 hours
Sufentanil	Children 2–8 years: 97 ± 42 minutes	382–1162 minutes
Muscle relaxants		
Succinylcholine	5–10 minutes Prolonged duration of action in patients with pseudocholinesterase deficiency or mutation	
Pancuronium	110 minutes	
Vecuronium	41 minutes	65 minutes
Atracurium	17 minutes	20 minutes
Rocuronium	3–12 months: 1.3 ± 0.5 hours 1 to < 3 years: 1.1 ± 0.7 hours 3 to < 8 years: 0.8 ± 0.3 hours Adults: 1.4–2.4 hours	

Modified from Ashwal and Schneider.[57]

Metabolism of pharmacologic agents may be affected by organ dysfunction and hypothermia.

Physicians should be aware of total amounts of administered medication that can affect drug metabolism and levels.

* Elimination ½ life does not guarantee therapeutic drug levels for longer acting medications or medications with active metabolites. Drug levels should be obtained to ensure that levels are in a low to mid therapeutic range prior to neurologic examination to determine brain death. In some instances this may require waiting several half-lives and rechecking serum levels of the medication before conducting the brain death examination.

APPENDIX 3 Apnea Testing in Pediatric Brain Death

Author	*n*	Age Range	$Paco_2$	Comments
Rowland (1984)[41]	9 children, 16 apnea tests performed	4 months–13 years	Range: 60–116 mm Hg after 15 minutes of apnea	No spontaneous respiratory effort noted in any patient during testing. Phenobarbital levels of 10,11.6,18,25 mg/dL were measured in 4 patients,
Outwater & Rockoff (1984)[40]	10 children	10 months–13 years	Mean 59.5 ± 10.2 mm Hg after 5 minutes of apnea	No spontaneous respiratory effort noted in any patient during testing or after support was withdrawn
Riviello (1988)[39]	19 children	2 months–15 years	Mean 63.9 ± 21.5 mm Hg	2 children with Pco_2 levels of 24 mm Hg and 38 mm Hg had spontaneous respirations during the apnea test. All other children had no spontaneous respiratory effort noted after support was withdrawn.
Paret (1995)[42]	38 children, 61 apnea tests performed	2 months–17 years	Mean 68.07 ± 17.66 after 5 minutes Mean 81.8 ± 20.2 after 10 minutes Mean 86.88 ± 25.6 after 15 minutes	1 child had spontaneous respiratory effort with a $Paco_2$ of 49 mm Hg. This patient was retested 24 hours later and had no respiratory effort.

APPENDIX 4 EEG in Pediatric Brain Death: Diagnostic Yield From First Versus Any Study

Study	Total # Pts in Study	% Patients With ECS on EEG#1	% Patients With ECS on Any EEG	% Pts With ECS on f/u EEG When First EEG Had ECS	% Pt With ECS on Later EEGs When First EEG Had Activity
Ruiz-Garcia et al, 2000 (60)	125	72% (88/122)	91% (111/122)	NA	68% (23/34)
Drake et al, 1986[55]	61	70% (33/47)	91% (43/47)	100% (17/17)	71% (10/14)
Parker et al, 1995[36]	60	100% (9/9)	100% (9/9)	NA	NA
Alvarez et al, 1988[56]	52	100% (52/52)	100% (52/52)	100% (28/28)	NA
Ashwal, 1993[54]	52	85% (28/33)	85% (28/33)	100% (3/3)	0% (0/1)
Ruiz-Lopez et al, 1999[61]	51	48% (14/29)	72% (21/29)	NA	47% (7/15)
Ashwal & Schneider, 1989[65]	18	50% (9/18)	78% (14/18)	88% (7/8)	56% (5/9)
Holzman et al, 1983[62]	18	61% (11/18)	67% (12/18)	67% (2/3)	14% (1/7)
Ashwal et al, 1977[58]	15	67% (10/15)	73% (11/15)	100% (2/2)	20% (1/5)
Coker et al, 1986[59]	14	100% (11/11)	100% (11/11)	100% (5/5)	NA
Furgiuele et al, 1984[63]	11	100% (10/10)	100% (10/10)	NA	NA
Okuyaz et al, 2004[64]	8	100% (8/8)	100% (8/8)	NA	NA
Total	485	76% (283/372)	89% (330/372)	97% (64/66)	55% (47/85)

EEG Electroencephalogram.
ECS Electrocerebral silence.

APPENDIX 5 CBF in Pediatric Brain Death: Diagnostic Yield From First Versus Any Study

Study	Total # of Pts in Study	CBF#1: % Patients With Absent CBF*	% Patients With Absent CBF on Any Study**	% Pts With No CBF on f/u Study When First Study Had Shown No CBF	% Pt With No CBF on Later Study When First Study Had CBF Present
Shimizu et al, 2000[66]	228	100% (27/27)	100% (27/27)	NA	NA
Ruiz-Garcia et al, 2000[60]	125	92% (83/90)	92% (83/90)	NA	NA
Drake et al, 1986[55]	61	68% (32/47)	81% (38/47)	100% (17/17)	40% (6/15)
Parker et al, 1995[36]	60	87% (26/30)	87% (26/30)	NA	NA
Coker et al, 1986[59]	55	100% (55/55)	100% (55/55)	NA	NA
Ashwal, 1993[54]	52	86% (19/22)	86% (19/22)	NA	NA
Ahmann et al, 1987[67]	32	83% (6/6)	83% (6/6)	NA	NA
Ashwal &Schneider, 1989[65]	18	65% (11/17)	65% (11/17)	71% (5/7)	0% (0/3)
Holzman et al, 1983[62]	18	39% (7/18)	44% (8/18)	100% (2/2)	9% (1/11)
Ashwal et al, 1977[58]	15	100% (11/11)	100% (11/11)	NA	NA
Schwartz et al, 1984[68]	9	100% (9/9)	100% (9/9)	NA	NA
Okuyaz et al, 2004[64]	8	75% (6/8)	100% (8/8)	NA	100% (2/2)
Total	681	86% (292/340)	89% (301/340)	92% (24/26)	26% (9/34)

* # pts with no CBF on first study/# pts with first CBF study.
** # pts with no CBF on any study/# pts with any CBF.
CBF Cerebral blood flow.

APPENDIX 6 EEG and CBF Diagnostic Screening Yield by Age Groups

	ECS	EEG$^+$	Total	Diagnostic Screening Yield
All children (n = 149)*				
No CBF	86	18	104	% pt with ECS = 70%
CBF$^+$	19	26	45	% pts with no CBF = 70%
Total	105	44	149	
Just newborns (< 1 month of age; n = 30)**				
No CBF	8	11	19	% pt with ECS = 40%
CBF$^+$	4	7	11	% pts with no CBF = 63%
Total	12	18	30	
Children (> 1 month of age; n = 119)***				
No CBF	78	7	85	% pt with ECS = 78%
CBF$^+$	15	19	34	% pts with no CBF = 71%
Total	93	26	119	

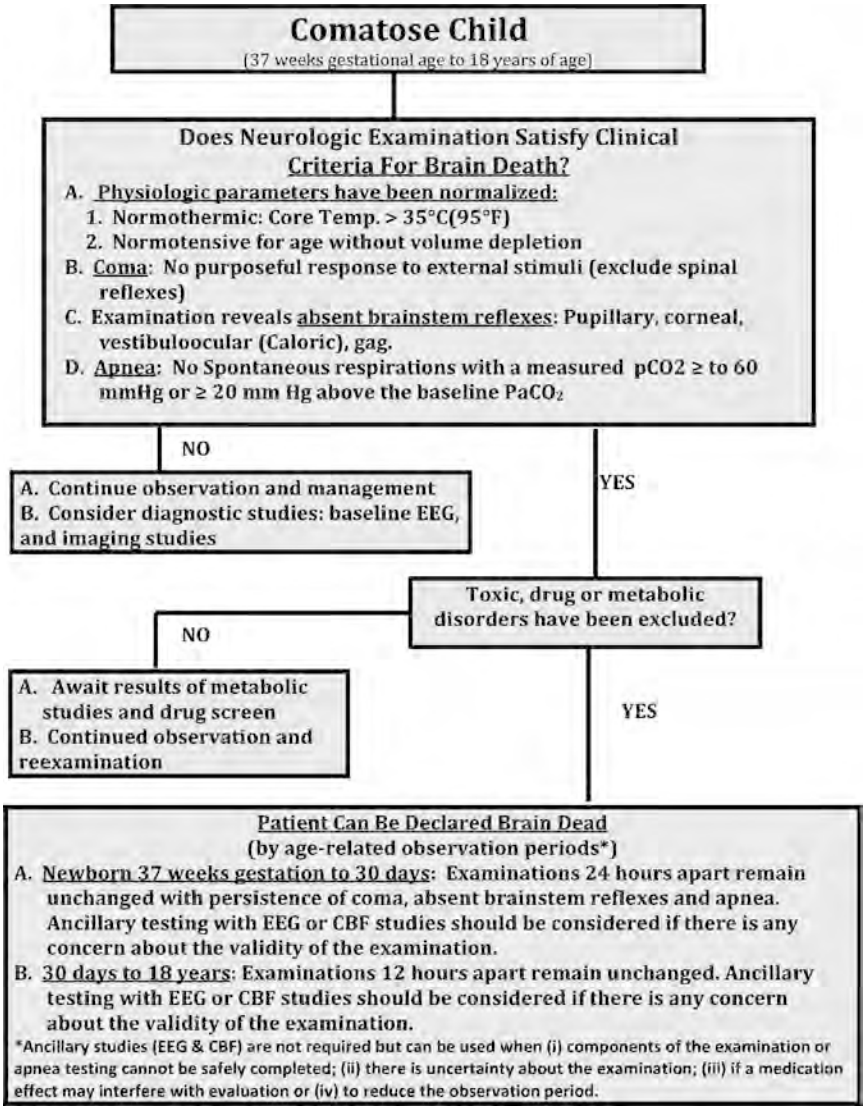
* Data extracted from references cited in Appendix 4,5.
** Data extracted from references cited in Ashwal S.[35]
*** Data represent the differences between "All children" and "just newborns" groups.
ECS Electrocerebral silence.
CBF Cerebral blood flow.
EEG$^+$ Activity on EEG.
CBF$^+$ Cerebral blood flow present.

APPENDIX 7 Comparison of 1987 Pediatric Brain Death Guidelines and the Updated Guideline for Determination of Brain Death in Infants and Children

	1987	Updated Guidelines
Waiting period before initial brain death examination	Not specified	24 hours following cardiopulmonary resuscitation or severe acute brain injury is suggested if there are concerns about the neurologic examination or if dictated by clinical judgment
Clinical examination	Required	Required
Core body temperature	Not specified	> 35°C (95°F)
Number of examinations	Two exams 2nd examination not necessary in 2 months–1 year age group if initial examination, EEG and concomitant CBF consistent with brain death	Two exams, irrespective of ancillary study results (if ancillary testing is being done in lieu of initial examination elements that cannot be safely performed, the components of the second examination that can be done must be completed)
Number of examiners	Not specified	Two (Different attending physicians must perform the first and second exam)
Observation interval between neurologic examinations	Age dependent ● 7 days–2 months: 48 hours ● 2 months–1 year: 24 hours ● >1 year: 12 hours (24 hrs if HIE)	Age Dependent ● Term newborn (37 weeks gestation) to 30 days of age: 24 hours ● 31 days–18 years: 12 hours
Reduction of observation period between exams	Permitted only for > 1 year age group if EEG or CBF consistent with brain death	Permitted for both age groups if EEG or CBF consistent with brain death
Apnea testing	Required, number of tests ambiguous	Two apnea tests required unless clinically contraindicated
Final Pco_2 threshold for apnea testing	Not specified	≥60 mm Hg and ≥20 mm Hg above the baseline $Paco_2$
Ancillary study recommended	● Age dependent 7 days–2 months: 2 EEGs separated by 48 hrs ● 2 months–1 year: 2 EEG's separated by 24 hours. CBF can replace the need for 2nd EEG ● >1 year: No testing required	Not required except in cases where the clinical examination and apnea test cannot be completed ● Term newborn (37 weeks gestation) to 30 days of age: EEG or CBF are less sensitive in this age group. CBF may be preferred. ● >30 days–18 years: EEG and CBF have equal sensitivity
Time of death	Not specified	Time of the second examination and apnea test (or completion of ancillary study and the components of the second examination that can be safely completed)

EEG Electroencephalogram.
CBF Cerebral blood flow.
HIE Hypoxic ischemic encephalopathy.

APPENDIX 8 Algorithm to Diagnose Brain Death in Infants and Children



APPENDIX 9 Taskforce Organization

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Hospital Care and Section on Critical Care

SOCIETY OF CRITICAL CARE MEDICINE

Pediatric Section Admission Criteria Task Force

Guidelines for Developing Admission and Discharge Policies for the Pediatric Intensive Care Unit

ABSTRACT. These guidelines were developed to provide a reference for preparing policies on admission to and discharge from pediatric intensive care units. They represent a consensus opinion of physicians, nurses, and allied health care professionals. By using this document as a framework for developing multidisciplinary admission and discharge policies, use of pediatric intensive care units can be optimized and patients can receive the level of care appropriate for their condition.

ABBREVIATION. PICU, pediatric intensive care unit.

It should be understood that critically ill pediatric patients should be admitted to designated pediatric critical care beds.[1] The following are recommended as guidelines for admission and discharge for pediatric intensive care units (PICUs). The purpose of these guidelines is to provide a reference for admitting and subsequently discharging critically ill pediatric patients. Because of continuing developments in pediatric critical care, periodic review of these criteria is necessary.

These guidelines must be adapted and modified to each institution's policies and procedures regarding the nature and scope of the critical illnesses seen in that institution[1] and the interhospital transfer arrangements of each institution.

Physiologic parameters should be added to these guidelines by each institution so that patients may be triaged appropriately in and out of the intensive care unit.

PREPARING GUIDELINES FOR INDIVIDUAL UNITS

The following listing is not meant to be inclusive, nor is it necessary for every PICU to admit all patients with every condition listed. However, the following has been prepared for the multiprofessional team developing such criteria to consider when developing admission and discharge policies.

In addition, accrediting agencies have recommended that physiologic limits be placed wherever possible in preparing admission and discharge policies. For example, a "potassium of 6.0 mEq/L" may be selected to indicate admission to the intensive care unit rather than simply "hyperkalemia."

ADMISSION CRITERIA

Respiratory System

Patients with severe or potentially life-threatening pulmonary or airway disease. Conditions include, but are not limited to:

1. Endotracheal intubation or potential need for emergency endotracheal intubation and mechanical ventilation, regardless of etiology;
2. Rapidly progressive pulmonary, lower or upper airway, disease of high severity with risk of progression to respiratory failure and/or total obstruction;
3. High supplemental oxygen requirement ($F_{IO_2} \geq 0.5$), regardless of etiology;
4. Newly placed tracheostomy with or without the need for mechanical ventilation;
5. Acute barotrauma compromising the upper or lower airway;
6. Requirement for more frequent or continuous inhaled or nebulized medications than can be administered safely on the general pediatric patient care unit (according to institution guidelines).

Cardiovascular System

Patients with severe, life-threatening, or unstable cardiovascular disease. Conditions include, but are not limited to:

1. Shock;
2. Postcardiopulmonary resuscitation;
3. Life-threatening dysrhythmias;
4. Unstable congestive heart failure, with or without need for mechanical ventilation;
5. Congenital heart disease with unstable cardiorespiratory status;
6. After high-risk cardiovascular and intrathoracic procedures;
7. Need for monitoring of arterial, central venous, or pulmonary artery pressures;
8. Need for temporary cardiac pacing;

Neurologic

Patients with actual or potential life-threatening or unstable neurologic disease. Conditions include, but are not limited to:

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

1. Seizures, unresponsive to therapy or requiring continuous infusion of anticonvulsive agents;
2. Acutely and severely altered sensorium where neurologic deterioration or depression is likely or unpredictable, or coma with the potential for airway compromise;
3. After neurosurgical procedures requiring invasive monitoring or close observation;
4. Acute inflammation or infections of the spinal cord, meninges, or brain with neurologic depression, metabolic and hormonal abnormalities, and respiratory or hemodynamic compromise or the possibility of increased intracranial pressure;
5. Head trauma with increased intracranial pressure;
6. Preoperative neurosurgical conditions with neurologic deterioration;
7. Progressive neuromuscular dysfunction with or without altered sensorium requiring cardiovascular monitoring and/or respiratory support;
8. Spinal cord compression or impending compression;
9. Placement of external ventricular drainage device.

Hematology/Oncology

Patients with life-threatening or unstable hematologic or oncologic disease or active life-threatening bleeding. Conditions include, but are not limited to:

1. Exchange transfusions;
2. Plasmapheresis or leukopheresis with unstable clinical condition;
3. Severe coagulopathy;
4. Severe anemia resulting in hemodynamic and/or respiratory compromise;
5. Severe complications of sickle cell crisis, such as neurologic changes, acute chest syndrome, or aplastic anemia with hemodynamic instability;
6. Initiation of chemotherapy with anticipated tumor lysis syndrome;
7. Tumors or masses compressing or threatening to compress vital vessels, organs, or airway.

Endocrine/Metabolic

Patients with life-threatening or unstable endocrine or metabolic disease. Conditions include, but are not limited to:

1. Severe diabetic ketoacidosis requiring therapy exceeding institutional patient care unit guidelines. (If hemodynamic or neurologic compromise, see specific section);
2. Other severe electrolyte abnormalities, such as:
   - Hyperkalemia, requiring cardiac monitoring and acute therapeutic intervention
   - Severe hypo- or hypernatremia
   - Hypo- or hypercalcemia
   - Hypo- or hyperglycemia requiring intensive monitoring
   - Severe metabolic acidosis requiring bicarbonate infusion, intensive monitoring, or complex intervention
   - Complex intervention required to maintain fluid balance
3. Inborn errors of metabolism with acute deterioration requiring respiratory support, acute dialysis, hemoperfusion, management of intracranial hypertension, or inotropic support.

Gastrointestinal

Patients with life-threatening or unstable gastrointestinal disease. Conditions include, but are not limited to:

1. Severe acute gastrointestinal bleeding leading to hemodynamic or respiratory instability;
2. After emergency endoscopy for removal of foreign bodies;
3. Acute hepatic failure leading to coma, hemodynamic, or respiratory instability.

Surgical

Postoperative patients requiring frequent monitoring and potentially requiring intensive intervention. Conditions include, but are not limited to:

1. Cardiovascular surgery;
2. Thoracic surgery;
3. Neurosurgical procedures;
4. Otolaryngologic surgery;
5. Craniofacial surgery;
6. Orthopedic and spine surgery;
7. General surgery with hemodynamic or respiratory instability;
8. Organ transplantation;
9. Multiple trauma with or without cardiovascular instability;
10. Major blood loss, either during surgery or during the postoperative period.

Renal System

Patients with life-threatening or unstable renal disease. Conditions include, but are not limited to:

1. Renal failure;
2. Requirement for acute hemodialysis, peritoneal dialysis, or other continuous renal replacement therapies in the unstable patient;
3. Acute rhabdomyolysis with renal insufficiency.

Multisystem and Other

Patients with life-threatening or unstable multisystem disease. Conditions include, but are not limited to:

1. Toxic ingestions and drug overdose with potential acute decompensation of major organ systems;
2. Multiple organ dysfunction syndrome;
3. Suspected or documented malignant hyperthermia;
4. Electrical or other household or environmental (eg, lightning) injuries;
5. Burns covering >10% of body surface (institutions with burn units only; institutions without such units will have transfer policy to cover such patients).

Special Intensive Technologic Needs

Conditions that necessitate the application of special technologic needs, monitoring, complex intervention, or treatment including medications associated with the disease that exceed individual patient care unit policy limitations.

DISCHARGE/TRANSFER CRITERIA

Patients in the PICU will be evaluated and considered for discharge based on the reversal of the disease process or resolution of the unstable physiologic condition that prompted admission to the unit, and it is determined that the need for complex intervention exceeding general patient care unit capabilities is no longer needed.

Transfer/discharge will be based on the following criteria:

1. Stable hemodynamic parameters;
2. Stable respiratory status (patient extubated with stable arterial blood gases) and airway patency;
3. Minimal oxygen requirements that do not exceed patient care unit guidelines;
4. Intravenous inotropic support, vasodilators, and antiarrhythmic drugs are no longer required or, when applicable, low doses of these medications can be administered safely in otherwise stable patients in a designated patient care unit;
5. Cardiac dysrhythmias are controlled;
6. Intracranial pressure monitoring equipment has been removed;
7. Neurologic stability with control of seizures;
8. Removal of all hemodynamic monitoring catheters;
9. Chronically mechanically ventilated patients whose critical illness has been reversed or resolved and who are otherwise stable may be discharged to a designated patient care unit that routinely manages chronically ventilated patients, when applicable, or to home;
10. Routine peritoneal or hemodialysis with resolution of critical illness not exceeding general patient care unit guidelines;
11. Patients with mature artificial airways (tracheostomies) who no longer require excessive suctioning;
12. The health care team and the patient's family, after careful assessment, determine that there is no benefit in keeping the child in the PICU or that the course of treatment is medically futile.[2]

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Guidelines for the Ethical Conduct of Studies to Evaluate Drugs in Pediatric Populations

abstract

The proper ethical conduct of studies to evaluate drugs in children is of paramount importance to all those involved in these types of studies. This report is an updated revision to the previously published guidelines from the American Academy of Pediatrics in 1995. Since the previous publication, there have been great strides made in the science and ethics of studying drugs in children. There have also been numerous legislative and regulatory advancements that have promoted the study of drugs in children while simultaneously allowing for the protection of this particularly vulnerable group. This report summarizes these changes and advances and provides a framework from which to guide and monitor the ethical conduct of studies to evaluate drugs in children. *Pediatrics* 2010;125:850–860

THE NEED TO STUDY DRUGS IN CHILDREN

The performance of research studies to evaluate drugs in children is critical for determining the safety and efficacy of medications in children. Without this type of research, medication use in children will be limited to extrapolation from adult studies or off-label use for indications that have not been studied in children, thereby putting children at increased risk of adverse effects. Growth and maturation can alter the kinetics, end-organ responses, and toxicities of drugs used in infants, children, and adolescents compared with adults. Without proper drug studies in children, children may not benefit from and may even be harmed by drugs that are available to adults. Also, certain disorders affect children primarily, necessitating drug testing on appropriately aged subjects. It is morally imperative, therefore, to formally study drugs in children so that they can enjoy appropriate access to existing and new therapeutic agents.

Since enactment of the exclusivity program in the US Food and Drug Administration (FDA) Modernization Act in 1997 (Pub L No. 105–115), drug studies in children have greatly increased in number. The reauthorization of this exclusivity program as the Best Pharmaceuticals for Children Act in 2002 (Pub L No. 107–109) and again in 2007 (Pub L No 10–85) and the enactment of the Pediatric Research Equity Act (Pub L No. 108–155) have allowed for increased motivation for pharmaceutical companies and other sponsors to partner with investigators to carry out drug trials in children.[1] Increased interest in pediatric drug research has been accompanied by increased numbers of pediatric drug-research studies and increased variability of the studies. Achieving proper balance between the overall good that comes from perform-

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KEY WORDS
ethics, drugs, children

ABBREVIATIONS
FDA—Food and Drug Administration
AAP—American Academy of Pediatrics
COI—conflict(s) of interest
IRB—institutional review board
DHHS—Department of Health and Human Services
DSMC—data- and safety-monitoring committee

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ing these studies and the need to protect children as research subjects is a challenge. This report provides a framework from which to guide and monitor the ethical conduct of studies to evaluate drugs in children.

THE NEED FOR ETHICAL GUIDELINES

Historically, ethical guidelines to protect human subjects of scientific investigation were developed in recognition of past exploitation of human subjects and the acknowledged need to protect individual human rights. Federal regulations governing the protection of human subjects were published in 1974 and revised in 2005.[2] The American Academy of Pediatrics (AAP) first published "Guidelines for the Ethical Conduct of Studies to Evaluate Drugs in Pediatric Populations" in 1977[3] and revised the document in 1995.[4] Federal regulations that specifically addressed research in children were published in 1978,[5] 1983,[6] 2001,[7] and 2005.[8]

In the landmark Belmont report of 1978,[9] 3 basic ethical principles for the protection of all human subjects were outlined:

1. Respect for persons
   - Individuals should be treated as autonomous agents.
   - Persons with diminished autonomy are entitled to protection.
2. Beneficence
   - Human subjects should not be harmed.
   - Research should maximize possible benefits and minimize possible harms.
3. Justice
   - The benefits and risks of research must be distributed fairly.

The conduct of research in children carries with it all the ethical obligations of research in adults as well as additional obligations and protections. Children are an especially vulnerable population, and respect for children is a critical guide for research in this population. This situation imposes special considerations when inviting participation in studies, assessing risks and benefits, and ensuring equitable participation in and benefits of clinical research.

RESEARCH-PROPOSAL DESIGN

Proposals for clinical investigation of drugs in children must include measures to protect the interests of children and must:

1. Be scientifically sound and significant, with value to children in general and, in most cases, to the individual child subject. Outcomes should be meaningful and measurable, with adequate control or normative data for comparison and there should be appropriate power analysis to ensure enrollment of an adequate number of subjects to answer the research question and strategies for dealing with potential problems with recruitment and retention.
2. Be directed by investigators who operate in a state of scientific uncertainty; that is, the investigators should have true uncertainty about which of the treatments being compared in the research study is superior.
3. Include a robust plan to monitor safety during the study.
4. Take into consideration the unique physiology, anatomy, psychology, pharmacology, social situation, and special needs of children and their families.
5. Minimize risk while maximizing benefit.
6. Take into account the racial, ethnic, gender, and socioeconomic characteristics of children and their parents and, when appropriate, include input from the community or appropriate advocacy representatives.
7. Conform to all local, regional, and national regulatory guidelines and laws.

Timing of Pediatric Studies

The timing of the initiation of pediatric studies should be governed by a risk/benefit analysis that incorporates all relevant information on the drug under study as well as considerations related to the disease that is targeted for treatment and the availability of alternative therapies. Because the large majority of compounds that enter phase 1 trials in adults never receive regulatory approval because of safety concerns and/or inadequate proof of efficacy, the risk/benefit ratio is high at that stage of development (Table 1). In general, drugs should be tested for safety, pharmacokinetics, and at least initial indications of efficacy in adults before being tested in children. It may often be appropriate to defer pediatric testing until adult testing has reached phase 3 or beyond, when substantial data are available on the safety and efficacy of a drug in adults.

The severity of a disease and the availability of alternative therapies may influence the risk/benefit analysis and, thereby, support the earlier initiation of pediatric studies. For example, for a disease that is severe or life-threatening in children and for which no alternative, proven therapy exists, it may be reasonable to initiate pediatric studies relatively early. Similarly, it may be appropriate to initiate pediatric studies relatively early for children with severe or life-threatening disease for whom all accepted therapies have failed.

When a pediatric disease has no close analogy in adults, as may be the case for some genetic/metabolic conditions that typically result in death before

TABLE 1 FDA Definitions of Phase 1, 2, and 3 Studies

Phase 1 clinical studies
Phase 1 includes the initial introduction of an investigational new drug into humans. These studies are closely monitored and may be conducted in patients but are usually conducted in healthy volunteer subjects. These studies are designed to determine the metabolic and pharmacologic actions of the drug in humans, the side effects associated with increasing doses, and, if possible, to gain early evidence on effectiveness. During Phase 1, sufficient information about the drug's pharmacokinetics and pharmacological effects should be obtained to permit the design of well-controlled, scientifically valid, Phase 2 studies.
Phase 1 studies also evaluate drug metabolism, structure-activity relationships, and the mechanism of action in humans. These studies also determine which investigational drugs are used as research tools to explore biological phenomena or disease processes. The total number of subjects included in Phase 1 studies varies with the drug but is generally in the range of 20 to 80.
In Phase 1 studies, the Center for Drug Evaluation and Research (CDER) can impose a clinical hold (ie, prohibit the study from proceeding or stop a trial that has started) for reasons of safety or because of a sponsor's failure to accurately disclose the risk of study to investigators. Although the CDER routinely provides advice in such cases, investigators may choose to ignore any advice regarding the design of Phase 1 studies in areas other than patient safety.
Phase 2 clinical studies
Phase 2 includes the early controlled clinical studies conducted to obtain some preliminary data on the effectiveness of the drug for a particular indication or indications in patients with the disease or condition. This phase of testing also helps determine the common short-term side effects and risks associated with the drug. Phase 2 studies are typically well-controlled, closely monitored, and conducted in a relatively small number of patients, usually involving several hundred people.
Phase 3 clinical studies
Phase 3 studies are expanded controlled and uncontrolled trials. They are performed after preliminary evidence suggesting effectiveness of the drug has been obtained in Phase 2, and are intended to gather the additional information about effectiveness and safety that is needed to evaluate the overall benefit-risk relationship of the drug. Phase 3 studies also provide an adequate basis for extrapolating the results to the general population and transmitting that information in the physician labeling. Phase 3 studies usually include several hundred to several thousand people.

www.fda.gov/Drugs/Development/ApprovalProcess/HowDrugsareDevelopedandApproved/ApprovalApplications/InvestigationalNewDrugINDApplication/ucm176522.htm.

adulthood, it may not be possible to obtain adult efficacy data before the initiation of pediatric testing. However, the possibility of adult testing in analogous, if not identical, patients, such as heterozygote carriers of a metabolic disorder, should be considered. Even when there is no analogous adult condition, it may still be reasonable to obtain initial safety data in adults before the initiation of any pediatric testing.

Registering and Reporting the Results of Clinical Trials in Children

It is unethical to unnecessarily repeat clinical drug trials in children. Therefore, all clinical trials should be registered before initiation (www.clinicaltrials.gov), and any results (including negative findings) should be published or otherwise made available to all researchers and the public.

THE INVESTIGATOR

The investigator's competence and ethical conduct are the most important safeguards for the protection of the child as a research subject. The investigator must:

- have the qualifications and expertise to carry out the study to completion;
- understand the developmental and ethical issues involved in research with children;
- have scientific uncertainty with regard to the research question being asked;
- understand the pathophysiologic features of pediatric illnesses and how they evolve with age;
- understand the adverse effects of drugs, drug interactions, and pediatric drug formulations;
- strive to prevent bias from affecting the design, conduct, or reporting of the results of the research study;
- ensure adequate disclosure of all conflicts of interest (COI) related to the research to the subjects and their families;
- be an effective communicator and present a balanced view of the risks and benefits of the research when seeking participation in the study;
- vigorously guard against scientific misconduct; and
- maintain complete records and comply with all regulatory, legal, and ethical standards for research in children.

If the investigator is a junior investigator, there should be evidence of appropriate mentorship and oversight by a more senior investigator or oversight committee.

INSTITUTIONAL REVIEW BOARDS

The primary responsibility of the institutional review board (IRB) is to protect the rights of the research subject. This responsibility includes interpreting the federal guidelines and determining whether each study is designed ethically in compliance with the federal regulations, local and state law, and local IRB directives. Any individual or institution under whose auspices clinical research is conducted must ensure that the research protocol is reviewed by an appropriately constituted IRB. The specific regulatory criteria for IRB approval of research are listed in Table 2.

All IRBs that review proposals for investigations in children must include members with pediatric expertise who are knowledgeable about the special medi-

TABLE 2 Criteria for IRB Approval of Research

1. Risks to subjects are minimized. Are procedures consistent with sound research design used? Do procedures not unnecessarily expose subjects to risk? Whenever possible, are procedures already being performed for diagnostic or treatment purposes? Note: consider only those risks and benefits that may result from the research (as distinguished from risks and benefits of therapies that participants would receive even if not participating in the research).
2. Risks to subjects are reasonable in relation to anticipated benefits, if any, to subjects and to the importance of the knowledge that may reasonably be expected to result. Consider only those risks and benefits that may result from the research and not possible long-range effects of the knowledge gained.
3. Selection of subjects is equitable. Consider the purposes and setting of the research, paying special attention to any vulnerable populations.
4. Informed consent will be prospectively obtained and documented (unless the IRB approves a waiver of this requirement).
5. Adequate provisions exist to monitor the data and ensure subject safety.
6, Adequate provisions exist to protect the privacy of subjects and maintain confidentiality of data.
7. The influence of payments on equitable selection and amount, method, and timing of compensation is not coercive or do not present undue influence to potential subjects. Also, consider whether completion bonuses are reasonable and do not unduly induce subjects to remain in the study when they otherwise would withdraw.
8. If some or all subjects are likely to be vulnerable to coercion or undue influence, additional safeguards exist to protect their rights and welfare.

cal, psychological, ethical, and social needs of child research subjects.[10] Members of the IRB are assumed to be reasonable individuals who act in the best interest of the prospective subjects.

The IRB should establish a mechanism to ensure that no child is enrolled in more studies than is consistent with his or her welfare. There may be reasons to enroll the same child in more than 1 study simultaneously. In most instances, this does not jeopardize the child's welfare or safety, but in some situations, the child's participation in more than 1 study may be detrimental to the child or may confound the scientific validity of the studies.

ETHICAL ISSUES OF PARTICULAR CONCERN IN DRUG INVESTIGATIONS IN PEDIATRIC POPULATIONS

Determination of Benefits and Risks

Federal law (Title 45, Protection of Human Subjects [21 CFR 50, Subpart D]) requires that IRBs review clinical investigations that involve children and approve only those that satisfy 1 of the following conditions[1]: clinical investigations involving no greater-than-minimal risk[7]; clinical investigations involving greater-than-minimal risk but presenting the prospect of direct benefit to clinical subjects[8]; or clinical investigations involving greater-than-minimal risk and no prospect of direct benefit to individual subjects but likely to yield generalizable knowledge about the subjects' disorder or condition.[7,8] If the proposed research does not satisfy 1 of these 3 conditions, there is a fourth condition of child research that includes research that is not otherwise approvable but presents opportunities to understand, prevent, or alleviate a serious problem that affects the health or welfare of children. Research that falls into this fourth category requires review and approval by the FDA and/or US Department of Health and Human Services (DHHS).[7,8]

The categories for approving research in children are presented in more detail in Table 3. Regulations stratify the levels of research risk for children into minimal and a minor increase over minimal. These risks include the known and predictable risks of the drug being studied as determined from previous animal and human studies in addition to the inherent risks of the research procedures themselves. In addition, there is always the risk of a heretofore unrecognized complication or adverse event from any drug being studied. Thus, all drug-study protocols in children must be scrutinized carefully for all potential risks, including those that are not necessarily a concern in adult studies. These risks include discomfort; inconvenience; fear; pain; separation from parents, family, or friends; effects on growth and development; and size and volume of biological samples being collected. The type and number of invasive tests must be minimized and scientifically sound, and creative methods to obtain needed information noninvasively must be sought.

With the growing number of pediatric drug studies, IRBs need to be familiar with the various research-design methods that minimize risk to the child. Examples include limiting research under some circumstances to pharmacokinetic and safety data, combining this approach with pharmacodynamic data, and minimizing the volume of blood withdrawn through the use of sensitive assays, pediatric-enabled laboratories, and population pharmacokinetic approaches.[11] The minimization of risk in pediatric studies also includes the requirement that those conducting the study be properly trained and experienced in studying the pediatric population, including in the evaluation and management of potential pediatric adverse events.[12] Minimizing risk requires careful design of pediatric studies. Every attempt should be made to minimize the number of subjects and procedures, consistent with good study design. Data-monitoring mechanisms should be in place for all drug studies in children to ensure that a study can be rapidly terminated should an unexpected hazard be identified.[10]

TABLE 3 Categories of Research

Category 1: Research not involving greater-than-minimal risk to children
- To approve this category of research, the IRB must make the following determinations:
  - the research presents no greater-than-minimal risk to the children; and
  - adequate provisions are made for soliciting the assent of the children and the permission of their parents or guardians

Category 2: Research involving greater-than-minimal risk but presenting the prospect of direct benefit to the individual child subjects involved in the research
- To approve research in this category, the IRB must make the following determinations:
  - the risk is justified by the anticipated benefits to the subjects;
  - the relation of the anticipated benefit to the risk presented by the study is at least as favorable to the subjects as that provided by available alternative approaches; and
  - adequate provisions are made for soliciting the assent of the children and the permission of their parents or guardians

Category 3: Research involving greater-than-minimal risk and no prospect of direct benefit to the individual child subjects involved in the research but likely to yield generalizable knowledge about the subject's disorder or condition
- To approve research in this category, the IRB must make the following determinations:
  - the risk of the research represents a minor increase over minimal risk;
  - the intervention or procedure presents experiences to the child subjects that are reasonably commensurate with those inherent in their actual, or expected, medical, dental, psychological, social, or educational situations;
  - the intervention or procedure is likely to yield generalizable knowledge about the subject's disorder or condition that is of vital importance for the understanding or amelioration of the disorder or condition; and
  - adequate provisions are made for soliciting the assent of the children and the permission of their parents or guardians

Category 4: Research that requires a special level of DHHS or FDA review beyond that provided by the IRB
- Research that the IRB believes does not meet the conditions of the above-listed categories but finds that the research presents a reasonable opportunity to further the understanding, prevention, or alleviation of a serious problem that affects the health or welfare of children
- If the IRB believes that the research does not meet the requirements of the categories listed above but finds that it presents a reasonable opportunity to further the understanding, prevention, or alleviation of a serious problem that affects the health or welfare of children, it may refer the protocol to DHHS or FDA for review; the research may proceed only if, after consulting with a panel of experts in pertinent disciplines (eg, science, medicine, education, ethics, law) and after an opportunity for public review and comment, it is determined that either (1) the research, in fact, satisfies the conditions of category 1, 2, or 3 or (2) the following:
  - the research presents a reasonable opportunity to further the understanding, prevention, or alleviation of a serious problem that affects the health or welfare of children;
  - the research will be conducted in accordance with sound ethical principles; and
  - adequate provisions are made for soliciting the assent of children and the permission of their parents or guardians

Data- and Safety-Monitoring Committees

Because children are a potentially fragile population, they deserve the highest standards for monitoring safety during a drug study. It is not possible to foresee all risks related to a drug study in children, and unexpected events can and do occur. Therefore, an independent data- and safety-monitoring committee (DSMC) should be created for all phase 3 drug trials conducted in children. A DSMC may also be necessary for some phase 1 and 2 trials as well, especially those that include blinding. In phase 1 and 2 studies without a DSMC, a robust data-monitoring plan must be in place.

Informed Permission/Consent/Assent

No drug research may be performed in humans without the informed permission/consent/assent of the subject and an individual who is legally qualified to act on behalf of the subject unless the need for permission/consent/assent is waived by the IRB. DHHS and FDA regulations are similar in their definition of parental permission. Subpart D of both regulations define permission as the agreement of parent(s) or guardian(s) to participation of their child or ward in research (DHHS) or a clinical investigation (FDA). A parent is defined as a child's biological or adoptive parent, and a guardian is defined as an individual who is authorized under applicable state or local law to consent on behalf of a child to general medical care. For a child to participate in a clinical study, parents or guardians must agree to (ie, permit) their child's participation in research.[11]

Permission Process

Parental permission is treated much the same as informed consent for adults, with the exception of some additional requirements.[7,8] All the general and required elements for adult consent apply to parental permission. Information provided to the subjects and/or parents must be written in language that is easily understood by the consenter, permission giver, and assenter. If the document is not written in an easily understood language, the information must be provided in a language that is understood, or an interpreter must be provided. The IRB must approve the procedure by which the prospective consenter, permission giver, or assenter is informed. Table 4 provides an outline of required content for written consent. In addition to obtaining permission from a parent or guardian, IRBs are required to determine that adequate provisions have been made for soliciting the assent of the child.[10] The requirement for permission is based on the premise of protecting a population whose mem-

TABLE 4 Required Contents of Written Consent Specified in DHHS Regulations

I. Basic elements of informed consent
- A. A statement that the study involves research, an explanation of the purposes of the research and the expected duration of the subject's participation, a description of the procedures to be followed, and identification of any procedures that are experimental
- B. A description of any reasonably foreseeable risks or discomforts to the subject
- C. A description of any benefits to the subject or to others that may reasonably be expected from the research
- D. A disclosure of appropriate alternative procedures or courses of treatment, if any, that might be advantageous to the subject
- E. A statement describing the extent, if any, to which confidentiality of records identifying the subject will be maintained and that notes the possibility that the FDA may inspect the records
- F. For research involving more-than-minimal risk, an explanation as to whether any compensation and any medical treatments are available if injury occurs and, if so, of what they consist or where further information may be obtained
- G. An explanation of whom to contact for answers to pertinent questions about the research and the rights of the research subjects and whom to contact in the event of a research-related injury to the subject
- H. A statement that participation is voluntary, that refusal to participate involves no penalty or loss of benefits to which the subject is otherwise entitled, and that the subject may discontinue participation at any time without penalty or loss of benefits to which the subject is otherwise entitled

II. Additional elements of informed consent: when appropriate, 1 or more of the following elements of information shall also be provided to each subject
- A. A statement that the particular treatment or procedure may involve risks to the subject (or the embryo or fetus, if the subject is pregnant or may become pregnant) that are currently unforeseeable
- B. Anticipated circumstances under which the subject's participation may be terminated by the investigator without regard to the subject's consent
- C. Any costs to the subject that may result from participation in the research
- D. The consequences of a subject's decision to withdraw from the research and procedures for orderly termination of participation by the subject
- E. A statement that significant new findings developed during the course of the research that may relate to the subject's willingness to continue participation will be provided to the subject
- F. The approximate number of subjects involved in the study

bers may not be capable of protecting themselves. Research that involves children that falls in categories 3 and 4 as described in Table 3 requires permission of both parents.[7,8] The regulations allow an exception to this requirement if 1 parent is deceased, unknown, incompetent, or not reasonably available or when only 1 parent has legal responsibility for the care and custody of the child.

Waiver of Permission

There are 2 situations in which parental permission may be modified or waived entirely under the federal regulations that do not involve an FDA-regulated product. The first waiver is for research that involves only minimal risk, does not negatively affect the welfare of the subjects, and cannot be practically performed without the waiver. The second waiver is applicable when getting permission will not function to protect the child. If a determination is made by the IRB that a research protocol is designed for conditions or for a subject population for which parental or guardian permission is not a reasonable requirement to protect the subjects (eg, neglected or abused children), it may waive the consent requirements. This situation is conditional, provided an appropriate mechanism for protecting the children who will participate is substituted, and the waiver is not inconsistent with federal, state, or local law. FDA regulations did not adopt this second waiver. The only waiver of parental permission that the FDA considers is for emergent and life-threatening situations (discussed in the next paragraph, "Emergency Research").[11]

Emergency Research

Federal regulations allow the conduct of research studies to test emergency treatments on patients with specific life-threatening medical conditions when patients cannot give informed consent because of their conditions and their family is not available to provide consent. Emergency research studies approved under this regulation must hold out the prospect of direct benefit to the subject. The exception for obtaining informed consent applies to emergency research that (1) involves human subjects who have life-threatening medical conditions for which available treatments are unproven or unsatisfactory, (2) involves subjects who, because of their conditions (eg, unconsciousness), cannot give informed consent, and (3) to be effective, must be initiated before consent can be obtained from the subject's legally authorized representative. An investigational new drug (IND) application or investigational device exemption (IDE) is required. Studies that involve an exception from the informed-consent requirements may proceed only after a sponsor has received previous written authorization from the FDA and the IRB has found and documented that the specific conditions have been met. Additional requirements for emergency research studies include developing and implementing a plan for community consultation and public disclosure before the start of the study and a mechanism for contacting and providing information to the subject's legally authorized representative or family member within the therapeutic window or at the earliest feasible opportunity. If subjects are

enrolled before consent is obtained, there must be an opportunity for family members to object to a subject's continued participation in the study.

Permission for Studies With Life-Threatening Illness

The study team and IRB need to carefully evaluate studies that require parents to make decisions when their child has a life-threatening illness. This situation creates dilemmas for parents when they are required to make emotionally charged decisions related to their child's health. It is important for the study team to acknowledge the parents' emotional state, lack of medical knowledge, and inexperience with clinical trials. During the initial consent process and throughout the study, clinical research staff who obtain consent from parents should educate them about their child's disease and how clinical trials work. They should clearly explain all potential risks and not overstate potential benefits. They should also outline in detail any potential financial costs that may be associated with the study.

Assent of the Child

Age of Assent

According to federal regulations, assent is defined as a child's affirmative agreement to participate in research, and further clarification is given that "mere failure to object should not, absent affirmative agreement, be construed as assent."[8] Federal regulations do not specify an age at which assent ought to be possible. The AAP recommends that active agreement by a minor (not qualified to give consent) to participate in a research study generally applies to children who have reached an intellectual age of at least 7 years. More recently, it was suggested that assent is generally applicable to developmentally normal children between 8 and 14 years of age.[12] It is up to the IRB to determine if children are capable of assent. Regulations state that adequate provisions are needed for soliciting assent when the child is capable, but little guidance exists to determine this capacity other than evaluating the child's age, maturity, and psychological state; as a practical matter, many IRBs require assent for children older than 7 years. The IRB can waive the requirement for child assent if the capability of some or all of the children is so limited that they cannot reasonably be consulted, if the intervention or procedure involved in the research holds out the prospect of direct benefit to the health or well-being of the children and is available only in the context of the research, or if the research meets the same conditions as those for waiver or alteration of informed consent in research involving adults.[11] For example, this waiver could be used in research with infants, children with illnesses that require mechanical ventilation, or children with severe developmental delay.

Delivery of Assent

The assent process for children requires ongoing discussion and evaluation throughout the trial. In situations in which children either do not give initial assent or withdraw assent for participation, researchers should not ignore a child's wishes.[13] If the IRB has determined that assent is required for a study and the child dissents from participating in research, the child's decision prevails even if his or her parents or guardian have granted permission.

The Consenting Minor

Generally, adolescents are considered to be between 12 and 18 years of age (dependent on region).[10] When obtaining assent from older adolescents, it is reasonable to assume that an adequate assent process would be viewed the same as the informed-consent process for adults, although parental permission is still required. The legal definition of adolescents groups them with children. Federal regulations define children as persons who have not attained the legal age for consent to treatments or procedures under the applicable law of jurisdiction in which the research will be conducted.[8] Under this definition, not all adolescents who are under the legal age of majority are defined as children. In common practice, the applicable law of the jurisdiction is state law, but it could include federal statutes. Childhood is not defined by age but by local laws that govern medical treatment, age of majority, and emancipation status.

Emancipated and Mature Minors

Because there is precedent that allows emancipated minors, and in some cases mature minors, to consent to clinical research, it is important that this group of youth be defined. Emancipation is governed by individual state law. Typical conditions that states use to establish the status of an emancipated minor are marriage, military service, parenthood, runaways who refuse to identify themselves, or court order. Therefore, for purposes of pediatric clinical research, emancipation, whatever the causal event, is taken to mean that the child becomes an adult in the eyes of the state; that is, all rules that govern parental custody or control are severed, which could include parental permission for research participation, to the extent that states follow a broader range of emancipation effects.[14] Investigators and IRBs considering recruitment of adolescents into research studies can obtain consent from only those adolescents considered adults, for all purposes under state law, as emancipated minors. Emancipated minors may give permission for their children. In research that involves an emancipated minor or a mature minor, the investigator and the

local IRB must be careful to protect the welfare of the minor subject. In cases in which minors are legally authorized to provide independent consent for particular treatments, parental permission is not required.

An emancipated minor is effectively an adult in the eyes of the law and is, therefore, capable of partaking in any medical research that would otherwise include adults. The capacity of the mature (but not emancipated) minor to partake in medical research depends on individual state laws, the type of research, and the risk/benefit ratio. The risk should be minimal, and answers to the scientific questions being asked must not be obtainable by using another group of adolescents whose parental permission and involvement are required. The research must be aimed at preventing or treating the medical condition for which the adolescent can legally give consent. For example, a researcher may investigate drug compliance in mature minors being treated for sexually transmitted diseases. Whether there are ethical reasons not to allow such research to proceed with adolescent consent would need to be addressed on a case-by-case basis. The investigator should determine if the parents can be informed by asking the minor's permission to involve the parents.

Withdrawal of Consent

The parent, emancipated minor, or mature minor has the right to revoke permission/consent at any time during the study. The child who gave assent also has the right to withdraw assent. If the investigator identifies reluctance in the parents or child about continued participation in a research protocol, the child's continuation in the study should be reevaluated. The same principles that govern permission/assent/consent also govern its withdrawal.

Institutionalized Children

Children who are institutionalized because of special care requirements or under the supervision of a court or social welfare agency acting in lieu of a court should rarely be considered for inclusion in research studies, because institutionalization may deprive them of some of the safeguards necessary for the conduct of ethical investigations. In general, these children should only be involved in studies of special conditions unique to them or to the type of institution in which they reside. They should have access to experimental drug therapy when the research therapy is the only treatment available for the illness that affects them. Access to experimental therapy may be allowed under a compassionate use protocol.

SPECIFIC ASPECTS OF PROTOCOL DESIGN

Advocate Group

Extra measures to protect the rights of special populations, such as institutionalized children or children with chronic progressive or lethal diseases, may involve special advocacy groups. Such groups may include parents of children in the institution at which the study is being conducted, health care professionals, lawyers, clergy, and other community representatives as appropriate. An advocacy group may assist in the overall design of the study as it relates to the rights, clinical condition, and needs of the targeted special population. Such a group could also facilitate communication with the subjects and their parents to help ensure that they understand the more complex or difficult aspects of the study, such as the implications of a randomized, controlled trial. The advocacy groups, however, must not act as a coercive influence on the subject or parents.

Distributive Justice

Insofar as possible, subjects enrolled in clinical investigations should represent a cross-section of society. A study should not rely exclusively or disproportionately on any socioeconomic, racial, gender, or ethnic group unless this type of selection is a necessary part of the investigation, such as in a study of sickle cell anemia. The distribution of risks, inconveniences, and benefits from research studies must be equitable throughout societal groups. This equity is important from both an ethical and scientific standpoint, because data obtained from 1 ethnic or socioeconomic group may not be applicable to other populations.

Recruitment

Payment of Providers

Recruitment of subjects to participate in a clinical research protocol often is vital to the successful completion of a study and involves identifying potential research subjects. Potential research subjects frequently are identified and recruited by health care workers who are providing their care. However, providing staff members or hospital personnel with a direct financial incentive for enrolling a research subject has the potential to add a strong element of undue influence or coercion to the recruitment and consent process. Therefore, a monetary "finder's fee" or other financial incentive for recruiting or referring children to clinical investigations should be prohibited.

Advertisements

Advertising for volunteers to enroll in a study may be necessary for recruitment. The content of an advertisement as well as the proposed distribution of the advertisement should be reviewed by the IRB before its dissemination. Advertisements should not explicitly or implicitly misconstrue the risks and benefits from participation in a study.

Payment for Participation of Children in Research

Compensation for participation in research is a common practice for research studies that involve both children and adults. A number of different types of compensation are used in clinical studies, including material or monetary compensation such as reimbursement for travel, parking, food expenses, overnight lodging, telephone calls, child care that a family might incur because of research participation, or inconvenience. IRBs are required to review proposals to pay research subjects with minimal guidance from federal regulations, which do not specifically address the issue of payment to research subjects. The amount paid to study subjects varies tremendously from site to site, even for the same multisite studies. It also varies from study to study, even at the same institution for similar tasks.[15]

Offering payment in studies that enroll children requires parents, investigators, and IRBs to weigh the importance of several competing values.[16] Incentive payments may be essential to the recruitment and retention of pediatric study subjects. In addition, prohibiting payments might jeopardize some important research. Finally, the obligation to treat all patients fairly might include compensating them for their time, effort, and discomfort and for their contribution to the social good. These objectives are all important and need to be balanced between the need to protect children from the potential harms of clinical research and to ensure that parents remain free from influences that might tempt them to enroll a child in a research protocol that is not consistent with the best interests of the child.[14,17] Payments to parents for their child's research participation could potentially sway parents to decide in favor of participation, because there is no personal risk to them.[18] This problem can be mitigated by keeping payments reasonable and minimal.[15] The investigators and the IRB must be certain that the compensation offered is fair and does not become an undue inducement for participation of the child subject.

When untoward medical events occur as a result of participating in a study, the institution and its investigators are obligated to provide emergency care. The extent to which emergency care and subsequent medical care will or will not be provided free of charge must be clearly stated in the consent form.

COI and Disclosure

Given the current efforts to increase the number of children in clinical research studies, it is critical that research be conducted ethically so that the outcomes provide adequate labeling of new medicines for children and that evidenced-based medicine will not be overshadowed by COI. The Office of Research Integrity (ORI) has provided a simple definition of COI: a situation in which financial or other personal considerations have the potential to compromise or bias professional judgment and objectivity.[19] These considerations include relationships with pharmaceutical companies or other entities that have an interest in the product (drug or device) under investigation.

Institutions that perform drug research in children should consider the appointment of COI committees that are independent of IRBs. These committees can require that clinical studies be reviewed for conflicts before submission to the IRB. COI committees govern a variety of activities at universities, including research. They are charged with reviewing conflicts in clinical studies and, if a conflict is present, determine how that conflict can be managed, reduced, or eliminated. Options include public disclosure of significant financial interests, independent monitoring of research, modification of the research plan, blinding of data or those who analyze the data, monitoring of the research by independent reviewers, conduct of all or part of the research by another nonconflicted member of the research team or by a third party, divestiture of financial interests that present COI, or severance of relationships that present COI.

Until recently, there has been little guidance available on how to appropriately disclose COI. The Conflict of Interest Notification Study (COINS), funded by the National Heart, Lung, and Blood Institute, was initiated to provide data to IRBs, COI committees, and other policy makers to assist them in deciding how, when, and what to disclose to potential research subjects. The study group developed disclosure language concerning different financial interests commonly found in clinical research.[20] The generic disclosure language states: "The person leading this medical research study might benefit financially from this study. The Institutional Review Board and a committee at ABC University have reviewed the possibility of a financial benefit. They believe that the possible financial benefit to the person leading the research is not likely to affect your safety and/or scientific quality of the study. If you would like more information, please ask the researchers or the study coordinator."

The new model language also includes specific language for situations in which there may be risks to the study subjects. The Conflict of Interest Notification Study team categorized this additional language by the 9 types of financial interests that are most commonly encountered in the clinical research setting: salary support; money received outside of the study; payment for each subject enrolled;

finder's fees restricted to research uses; unrestricted finders' fees; researchers holding a patent; university holding a patent; researchers owning equity; and university owning equity. Contractual agreements between sponsors and investigators should ensure that reports and publications of research results accurately and objectively represent the results and will not be constrained by any proprietary interests of the sponsor.

Placebo and Control Groups

Placebo and control groups can be used in pediatric studies if their use does not place children at increased risk. The conditions under which placebos may be ethically used in drug research in children include the following:

1. when there is no commonly accepted therapy for the condition and the agent under study is the first one that may modify the course of the disease process;
2. when the commonly used therapy for the condition is of questionable efficacy;
3. when the commonly used therapy for the condition carries with it a high frequency of undesirable adverse effects and the risks may be significantly greater than the benefits;
4. when the placebo is used to identify incidence and severity of adverse effects produced by adding a new treatment to an established regimen; or
5. when the disease process is characterized by frequent, spontaneous exacerbations and remissions and the efficacy of the therapy has not been demonstrated.

Long-term Prospective Studies of the Safety of a Drug

When investigational drugs are administered to children, the effects may be latent and may not be predicted from any previous studies. This concern is not unique to children; it also applies to studies of investigational drugs in adults. Thus, studies of certain drugs given to pediatric patients may require a mechanism for follow-up of the research subjects.

CONCLUSIONS

This report is intended to provide a format that allows for the participation and protection of child subjects in drug research. Research that involves children carries with it additional responsibilities for the investigator, IRB, and sponsor. The additional responsibilities should not be reasons for the pharmaceutical company or other sponsor, IRB, or the investigator to exclude children from drug research and its potential benefits.

The AAP believes it is unethical to deny children appropriate access to existing and new therapeutic agents. It is the combined responsibility of the pediatric community, pharmaceutical industry, and regulatory agencies to design, approve, and conduct high-quality studies in children. It is the responsibility of the general public to support the necessary research to ensure that all children have access to important medication and receive optimal therapy.

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CONTENTS

(Continued on next page)

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Abstract

Gastroesophageal reflux (GER), defined as passage of gastric contents into the esophagus, and GER disease (GERD), defined as symptoms or complications of GER, are common pediatric problems encountered by both primary and specialty medical providers. Clinical manifestations of GERD in children include vomiting, poor weight gain, dysphagia, abdominal or substernal pain, esophagitis and respiratory disorders. The GER Guideline Committee of the North American Society for Pediatric Gastroenterology and Nutrition has formulated a clinical practice guideline for the management of pediatric GER. The GER Guideline Committee, consisting of a primary care pediatrician, two clinical epidemiologists (who also practice primary care pediatrics) and five pediatric gastroenterologists, based its recommendations on an integration of a comprehensive and systematic review of the medical literature combined with expert opinion. Consensus was achieved through Nominal Group Technique, a structured quantitative method.

The Committee examined the value of diagnostic tests and treatment modalities commonly used for the management of GERD, and how those interventions can be applied to clinical situations in the infant and older child. The guideline provides recommendations for management by the primary care provider, including evaluation, initial treatment, follow-up management and indications for consultation by a specialist. The guideline also provides recommendations for management by the pediatric gastroenterologist.

This document represents the official recommendations of the North American Society for Pediatric Gastroenterology and Nutrition on the evaluation and treatment of gastroesophageal reflux in infants and children. The American Academy of Pediatrics has also endorsed these recommendations. The recommendations are summarized in a synopsis within the article. This review and recommendations are a general guideline and are not intended as a substitute for clinical judgment or as a protocol for the management of all patients with this problem.

SYNOPSIS

This clinical practice guideline was developed to assist the primary and specialist medical provider in the evaluation and management of gastroesophageal reflux in infants and children. Recommendations are based on an integration of a comprehensive and systematic review of the medical literature combined with expert opinion. The guideline is not intended for the management of neonates less than 72 hours old, premature infants or infants and children with either neurologic impairments or anatomic disorders of the upper gastrointestinal tract. The recommendations are a general guideline and are not intended as a substitute for clinical judgment or as a protocol for the management of all patients with this problem.

Gastroesophageal reflux (GER), defined as the passage of gastric contents into the esophagus, and GER disease (GERD), defined as symptoms or complications of GER, are common pediatric problems. Clinical manifestations of GERD in children include vomiting, poor weight gain, dysphagia, abdominal or substernal pain, esophagitis and respiratory disorders. The following section summarizes the conclusions and recommendations of the GER Guideline Committee of the North American Society for Pediatric Gastroenterology and Nutrition on the value of diagnostic tests and treatment modalities commonly used for the management of GERD, and how those interventions can be applied to clinical situations in the infant and older child.

Diagnostic Approaches

History and Physical Examination. In most infants with vomiting, and in most older children with regurgitation and heartburn, a history and physical examination are sufficient to reliably diagnose GER, recognize complications, and initiate management.

Upper GI Series. The upper gastrointestinal (GI) series is neither sensitive nor specific for the diagnosis of GER, but is useful for the evaluation of the presence of anatomic abnormalities, such as pyloric stenosis, malrotation and annular pancreas in the vomiting infant, as well as hiatal hernia and esophageal stricture in the older child.

Esophageal pH Monitoring. Esophageal pH monitoring is a valid and reliable measure of acid reflux. Esophageal pH monitoring is useful to establish the presence of abnormal acid reflux, to determine if there is a temporal association between acid reflux and frequently occurring symptoms, and to assess the adequacy of therapy in patients who do not respond to treatment with acid suppression. Esophageal pH monitoring may be normal in some patients with GERD, particularly those with respiratory complications.

Endoscopy and Biopsy. Endoscopy with biopsy can assess the presence and severity of esophagitis, strictures and Barrett's esophagus, as well as exclude other disorders, such as Crohn's disease and eosinophilic or infectious esophagitis. A normal appearance of the esophagus during endoscopy does not exclude histopathological esophagitis; subtle mucosal changes such as erythema and pallor may be observed in the absence of esophagitis. Esophageal biopsy is recommended when endoscopy is performed to detect microscopic esophagitis and to exclude causes of esophagitis other than GER.

Empiric Medical Therapy. A trial of time-limited medical therapy for GER is useful for determining if GER is causing a specific symptom.

Treatment Options

Diet Changes in the Infant. There is evidence to support a one- to two-week trial of a hypoallergenic formula in formula fed infants with vomiting. Milk-thickening agents do not improve reflux index scores but do decrease the number of episodes of vomiting.

Positioning in the Infant. Esophageal pH monitoring has demonstrated that infants have significantly less GER when placed in the prone position than in the supine position. However, prone positioning is associated with a higher rate of the sudden infant death syndrome (SIDS). In infants from birth to 12 months of age with GERD, the risk of SIDS generally outweighs the potential benefits of prone sleeping. Therefore, non-prone positioning during sleep is generally recommended. Supine positioning confers the lowest risk for SIDS and is preferred. Prone positioning during sleep is only considered in unusual cases where the risk of death from complications of GER outweighs the potential increased risk of SIDS. When prone positioning is necessary, it is particularly important that parents be advised not to use soft bedding, which increases the risk of SIDS in infants placed prone.

Positioning in the Child & Adolescent. In children older than one year it is likely that there is a benefit to left side positioning during sleep and elevation of the head of the bed.

Lifestyle Changes in the Child & Adolescent. It is recommended that children and adolescents with GERD avoid caffeine, chocolate and spicy foods that provoke symptoms. Obesity, exposure to tobacco smoke and alcohol are also associated with GER. It is not known whether lifestyle changes have an additive benefit in patients receiving pharmacological therapy.

Acid-suppressant Therapy. Histamine-$_2$ receptor antagonists (H_2RAs) produce relief of symptoms and mucosal healing. Proton pump inhibitors (PPIs), the most effective acid suppressant medications, are superior to H_2RAs in relieving symptoms and healing esophagitis. Chronic antacid therapy is generally not recommended since more convenient and safe alternatives (H_2RAs and PPIs) are available.

Prokinetic Therapy. Cisapride is available in the USA only through a limited-access program. Cisapride reduces the frequency of symptoms, including regurgitation and vomiting. However, because of concerns about the potential for serious cardiac arrhythmias in patients receiving cisapride, appropriate patient selection and monitoring as well as proper use, including correct dosage (0.2 mg/kg/dose QID) and avoidance of co-administration of contraindicated medications, are important. Other prokinetic agents have not been shown to be effective in the treatment of GERD in children.

Surgical Therapy. Case series indicate that surgical therapy generally results in favorable outcomes. The potential risks, benefits and costs of successful prolonged medical therapy versus fundoplication have not been well studied in infants or children in various symptom presentations.

Evaluation and Management of Infants and Children with Suspected GERD

The approach to the evaluation and management of infants and children with GERD depends upon the presenting symptoms or signs. Below is a summary of conclusions and recommendations derived from an integration of the research evidence with clinical experience for various clinical presentations. Where there are no

randomized studies, the recommendations are based on the consensus opinion of the GER Guideline Committee.

The Infant with Recurrent Vomiting. In the infant with recurrent vomiting, a thorough history and physical examination, with attention to warning signals, is generally sufficient to allow the clinician to establish a diagnosis of uncomplicated GER (the "happy spitter"). An upper GI series is not required unless there are signs of gastrointestinal obstruction. Other diagnostic tests may be indicated if there are symptoms of poor weight gain, excessive crying, irritability, disturbed sleep, feeding or respiratory problems. In the infant who has uncomplicated GER, parental education, reassurance and anticipatory guidance are recommended. Generally no other intervention is necessary. Thickening of formula and a brief trial of a hypoallergenic formula are other treatment options. If symptoms worsen or do not improve by 18 to 24 months of age, re-evaluation for complications of GER is recommended. Generally this includes an upper GI series and consultation with a pediatric gastroenterologist.

The Infant with Recurrent Vomiting and Poor Weight Gain. In the infant with vomiting and poor weight gain it is recommended that the adequacy of calories and the effectiveness of swallowing be assessed. If there is poor weight gain despite adequate caloric intake, a diagnostic evaluation to uncover other causes of vomiting or weight loss is generally indicated. Tests may include a complete blood count, electrolytes, bicarbonate, urea nitrogen, creatinine, alanine aminotransferase, ammonia, glucose, urinalysis, urine ketones and reducing substances, and a review of newborn screening tests. An upper GI series to evaluate anatomy is also recommended. Treatment options include thickening of formula, a trial of a hypoallergenic formula, increasing the caloric density of the formula, acid suppression therapy, prokinetic therapy and, in selected cases, prone positioning. Further management options include endoscopy with biopsy, hospitalization, tube feedings and rarely surgical therapy. Careful follow-up is necessary to assure adequate weight gain.

The Infant with Recurrent Vomiting and Irritability. Normal infants typically fuss or cry intermittently for an average of two hours daily, which may be perceived as excessive by some parents. A symptom diary may be useful to determine the extent to which the infant is irritable and has disturbed sleep. As in all infants with vomiting, other causes of vomiting need to be excluded. Expert opinion suggests two diagnostic and treatment strategies. Empiric treatment with either a sequential or simultaneous two-week trial of a hypoallergenic formula and acid suppression may be initiated. If there is no improvement, either esophageal pH monitoring to determine the adequacy of therapy or upper endoscopy with biopsy to diagnose esophagitis may be performed. If there is no response to therapy and these studies are normal, it is unlikely that GER is contributing to symptoms. Alternatively, evaluation could begin with esophageal pH monitoring to determine if episodes of irritability and sleep disturbance are temporally associated with acid reflux.

The Child or Adolescent with Recurrent Vomiting or Regurgitation. In otherwise normal children who have recurrent vomiting or regurgitation after the age of 2 years, management options include an upper GI series, upper endoscopy with biopsy, and prokinetic therapy.

Heartburn in the Child or Adolescent. For the treatment of heartburn in children or adolescents, lifestyle changes accompanied by a two- to four-week therapeutic trial of an H_2RA or PPI are recommended. If symptoms persist or recur, the child can be referred to a pediatric gastroenterologist for upper endoscopy with biopsy and in some cases long-term therapy.

Esophagitis. In the infant or child with esophagitis, initial treatment consists of lifestyle changes and H_2RA or PPI therapy. In patients with only histopathological esophagitis, the efficacy of therapy can be monitored by the degree of symptom relief. In patients with erosive esophagitis, repeat endoscopy is recommended to assure healing.

Dysphagia or Odynophagia. In the child with dysphagia (difficulty swallowing) or odynophagia (painful swallowing), a barium esophagram is recommended. If the initial history is suggestive of esophagitis, upper endoscopy may be performed as the initial diagnostic test. Treatment without prior diagnostic evaluation is not recommended. In the infant with feeding refusal, because a large variety of disorders may contribute to infant feeding difficulties, empiric therapy for GER is generally not recommended. However, if there are other signs or symptoms suggestive of GERD then a time-limited course of medical therapy can be considered.

Apnea or Apparent Life-threatening Events (ALTE). In patients with ALTEs recurrent regurgitation or emesis is common. However, investigations in unselected patients with ALTE have not demonstrated a convincing temporal relationship between esophageal acidification and apnea or bradycardia. There are no randomized studies to evaluate the usefulness of esophageal pH monitoring in infants with ALTE. In patients with frequent ALTE in which the role of GER is uncertain, esophageal pH monitoring may be useful to determine if there is a temporal association of acid reflux with ALTE. The evidence suggests that infants with ALTE and GER may be more likely to respond to anti-reflux therapy when there is gross emesis or oral regurgitation at the time of the ALTE, when episodes occur in the awake infant, and when the ALTE is characterized by obstructive apnea. Therapeutic options include thickened feedings and prokinetic and acid suppressant therapy. Since most infants improve with medical management, surgery is considered only in severe cases.

Asthma. In patients where symptoms of asthma and GER coexist, and in infants and toddlers with chronic vomiting or regurgitation and recurrent episodes of cough and wheezing, a three-month trial of vigorous acid suppressant therapy of GER is recommended. In patients with persistent asthma without symptoms of GER, esophageal pH monitoring is recommended in selected patients who are more likely to benefit from GER therapy. These include patients with radiographic evidence of recurrent pneumonia; patients with nocturnal asthma more than once a week; and patients requiring either continuous oral corticosteroids, high-dose inhaled corticosteroids, more than two bursts per year of oral corticosteroids or those with persistent asthma unable to wean medical management. If esophageal pH monitoring demonstrates an increased frequency or duration of esophageal acid exposure, a trial of prolonged medical therapy for GER is recommended.

Recurrent Pneumonia. GER can cause recurrent pneumonia in the absence of esophagitis or when esophageal pH monitoring is normal. There is insufficient evidence to provide recommendations for a uniform approach to diagnosis and treatment. Diagnostic evaluation may include flexible bronchoscopy with pulmonary lavage for lipid-laden macrophages, nuclear scintigraphy and assessment of airway protective mechanisms during swallowing.

Upper Airway Symptoms. Hoarseness, chronic cough, stridor and globus sensation can be associated with GER in infants and children. There is insufficient evidence to provide recommendations for diagnosis and treatment.

1. Background

Gastroesophageal reflux (GER), defined as passage of gastric contents into the esophagus, is a normal physiologic process that occurs throughout the day in healthy infants, children, and adults (1–4). Most episodes of reflux are brief and asymptomatic, not extending above the distal esophagus. Regurgitation is defined as passage of refluxed gastric contents into the oral pharynx. Vomiting is defined as expulsion of the refluxed gastric contents from the mouth. GER occurs during episodes of transient relaxation of the lower esophageal sphincter or inadequate adaptation of the sphincter tone to changes in abdominal pressure (5,6). The strength of the lower esophageal sphincter, the primary antireflux barrier, is normal in the vast majority of children with GER (5,6).

Gastroesophageal reflux disease (GERD) occurs when gastric contents reflux into the esophagus or oropharynx and produce symptoms (Table 1). The pathogenesis of GERD is multifactorial and complex, involving the frequency of reflux, gastric acidity, gastric emptying, esophageal clearing mechanisms, the esophageal mucosal barrier, visceral hypersensitivity, and airway responsiveness. To date no medical treatment targets the primary mechanism of GER, transient relaxation of the lower esophageal sphincter. The primary goals of therapy are to relieve the patient's symptoms, promote normal weight gain and growth, heal inflammation caused by refluxed gastric contents (esophagitis), and prevent respiratory and other complications associated with chronic reflux of gastric contents.

During infancy GER is common and is most often manifest as vomiting. Recurrent vomiting occurs in 50% of infants in the first three months of life, in 67% of four month old infants, and in 5% of 10 to 12 month old infants (7). Vomiting resolves spontaneously in nearly all of these infants (8). Parents do not usually perceive vomiting as a problem when it occurs no more often than once daily, but they are more likely to be concerned when vomiting is more frequent, the volume of vomitus is large, or when the infant cries frequently or with vomiting.

TABLE 1. *Complications of gastroesophageal reflux*

Symptoms
Recurrent vomiting
Weight loss or poor weight gain
Irritability in infants
Regurgitation
Heartburn or chest pain
Hematemesis
Dysphagia or feeding refusal
Apnea or ALTE
Wheezing or stridor
Hoarseness
Cough
Abnormal neck posturing (Sandifer syndrome)
Findings
Esophagitis
Esophageal stricture
Barrett's esophagus
Laryngitis
Recurrent pneumonia
Hypoproteinemia
Anemia

A small minority of infants develop GERD with symptoms including anorexia, dysphagia (difficulty swallowing), odynophagia (painful swallowing), arching of the back during feedings, irritability, hematemesis, anemia or failure to thrive. GER is one of the causes of apparent life-threatening events (ALTE) in infants and has been associated with chronic respiratory disorders including reactive airways disease, recurrent stridor, chronic cough and recurrent pneumonia in infants.

In preschool age children GER may manifest as intermittent vomiting. Older children are more likely to have the adult-type pattern of chronic heartburn or regurgitation with reswallowing. Esophagitis in older children may present as dysphagia or food impaction. Rarely, esophageal pain causes stereotypical, repetitive stretching and arching movements that are mistaken for atypical seizures or dystonia (Sandifer syndrome) (9,10). More severe inflammation may cause chronic blood loss with anemia, hematemesis, hypoproteinemia or melena (11). If the inflammation is untreated, circumferential scarring or strictures may form. Chronic inflammation may also result in replacement of distal esophageal mucosa with a metaplastic potentially malignant specialized epithelium known as a Barrett's mucosa (12). GER is common in children with asthma, but recurrent aspiration pneumonia due to GER is uncommon except in the neurologically impaired child. Hoarseness has also been associated with GER in children.

Little is known about the prevalence or natural history of GERD in children and adolescents. Numerous disorders can present with the same symptoms and signs as GER or GERD. Diagnostic and therapeutic approaches vary with the age of the patient and the presenting sign or symptom. Although GER is a common pediatric problem, no evidence-based guidelines for its evaluation and treatment currently exist. Therefore, the GER Guideline Committee was formed by the North American Society for Pediatric Gastroenterology and Nutrition (NASPGN) to develop a clinical practice guideline for the management of GER and GERD in infants and children.

The GER Guideline Committee consists of a primary care pediatrician, two clinical epidemiologists who are also primary care pediatricians and five pediatric gastroenterologists. This clinical practice guideline is designed to assist primary care providers, pediatric gastroenterologists, pediatric surgeons, pediatric pulmonologists and pediatric otolaryngologists in the management of children with GER in both inpatient and outpatient settings. The guideline is not intended for the management of neonates less than 72 hours old, premature infants or infants and children with either neurologic impairments

or anatomic disorders of the upper gastrointestinal tract. The management of infants less than two years of age was considered separately from the management of children and adolescents two to 18 years of age. The desirable outcome of optimal management was defined as improvement or resolution of the presenting symptoms and complications of GER, with interventions that have few or no adverse effects, and with resultant resumption of functional health. Cost effectiveness was not considered because of a lack of information in pediatric patients.

This document represents the official recommendations of the North American Society for Pediatric Gastroenterology and Nutrition on the evaluation and treatment of gastroesophageal reflux in infants and children. The American Academy of Pediatrics has also endorsed these recommendations. This review and recommendations are a general guideline and are not intended as a substitute for clinical judgment or as a protocol for the management of all patients with this problem.

2. Methods

In order to develop an evidence-based guideline the following search strategy was used. Articles on diagnosis, treatment, and complications were searched separately. Articles published in English between January 1966 and March 1999 on GER in children were searched using Ovid and PubMed. Letters, abstracts, editorials, case reports, reviews, and articles related to premature infants and children with neurological impairments were excluded. The search strategies for diagnosis yielded 169 articles, 129 articles after exclusion criteria were applied, while the search strategy for treatment yielded 770 articles. After exclusion criteria were applied, there were 23 articles related to non-pharmacological treatment (positioning and dietary changes), 42 to pharmacological treatment (prokinetics and acid-suppressants) and 70 to surgical treatment (fundoplication). Searches on specific complications of GER yielded the following: 140 before and 20 after application of exclusion criteria for apnea and apparent life-threatening events; 91 before and 27 after exclusion criteria for asthma; 18 before and 9 after exclusion criteria for eosinophilic esophagitis; and 83 before and 34 after exclusion criteria for pulmonary disease. Subsequently, additional articles were identified and reviewed. When the pediatric literature was insufficient, the adult literature was also considered.

Articles were evaluated using published criteria (13,14). To evaluate inter-rater reliability, both clinical epidemiologists independently reviewed twenty-nine of the therapy articles on respiratory complications. Concordance using the criteria was 48% with all differences attributable to case series (Level IIa) and descriptive studies (Level III) evidence. If case series and large case reports were considered equivalent, the concordance was 100%. The Committee based its recommendations on integration of the literature review with expert opinion. Consensus was achieved through Nominal Group Technique, a structured, quantitative method (15). Using the methods of the Canadian Preventive Services Task Force (16), the quality of evidence of each of the recommendations made by the GER Guideline Committee was determined and is summarized in the Appendix.

In the following sections we examine the effectiveness of diagnostic tests and treatment modalities commonly utilized for the management of GERD. Subsequent sections indicate how those interventions can be applied to various clinical situations in the infant and older child.

3. Diagnostic Approaches

Although many tests have been used for the diagnosis of GER, few objective studies compare the various diagnostic approaches. More importantly, it is not known whether tests can predict when an individual patient will improve with either medical or surgical therapy for GERD. A test may be useful to document the occurrence of GER, to detect complications of GER, to establish a causal relationship between GER and symptoms, to evaluate therapy or to exclude other causes of symptoms. Since each test is designed to answer a particular question, it is valuable only when used in the appropriate clinical situation.

3.1 History and Physical Examination

A review of the medical literature found no reports comparing the history and physical examination to diagnostic tests. In two pediatric studies of persistent GER there was no relationship between symptoms and the presence of esophagitis (17,18). Nonetheless, based upon expert opinion, in most infants with vomiting and most older children with regurgitation and heartburn, a history and physical examination are sufficient to reliably diagnose GER, recognize complications, and initiate management.

3.2 Barium Contrast Radiography

The upper gastrointestinal (GI) series is useful to detect anatomic abnormalities, such as pyloric stenosis, malrotation, hiatal hernia and esophageal stricture. When compared to esophageal pH monitoring, the upper GI series is neither sensitive nor specific for the diagnosis of GER. The sensitivity, specificity and positive predictive value of the upper GI series range from 31% to 86%, 21% to 83%, and 80% to 82% respectively when compared to esophageal pH monitoring (19–24). The brief duration of the upper GI series results in false negative results, while the frequent occurrence of non-pathological reflux results in false positive results. Thus, the upper GI series is not a useful test to reliably determine the presence or absence of GER.

3.3 Esophageal pH Monitoring

Esophageal pH monitoring, used widely as an index of esophageal acid exposure, measures the frequency and duration of episodes of acid reflux (25). The test is performed by the transnasal placement of a microelectrode into the lower esophagus, which measures and records intraesophageal pH. Most clinicians utilize computerized devices that record intraesophageal pH every 4 to 8 seconds (26,27). Computerized analysis calculates the number and duration of reflux episodes (28). An episode of acid reflux is usually defined as esophageal pH <4 for a specified minimum duration, usually 15 to 30 seconds (29).

The recording device, diet, position and activity during the study affect the measurement of esophageal pH. Location of the probe sensor also affects the results; the distal esophagus is normally exposed to more acid than the proximal esophagus. There is technical and biological variability on sequential 24-hour pH monitoring studies, but this variability appears to affect the interpretation of results in only a small number of patients (30–32). Abbreviated studies of fewer than 12 hours are less reproducible than longer studies (33,34).

Asymptomatic episodes of acid reflux occur in normal infants, children, adolescents and adults. In a study of 509 normal infants, 0 to 11 months of age, there were 31 ± 21 episodes of acid reflux per day; the upper limit of normal was 73 episodes daily (2). In three studies of 48 children, 0 to 9 years of age, the mean upper limit of normal was 25 daily (29,35,36) and in 50 normal adults it was 45 daily (37). The mean upper limit of normal for the number of episodes of acid reflux lasting 5 minutes or longer was 9.7 in infants, 6.8 in children and 3.2 in adults. The percentage of the total time that the esophageal pH is <4, also called the reflux index, is considered the most valid measure of reflux because it reflects the cumulative exposure of the esophagus to acid. The mean upper limit of normal of the reflux index was 11.7% in infants 0 to 11 months (2), 5.4% in children 0 to 9 years old (29,35,36), and approximately 6% in 432 normal adults (38). These studies indicate that acid reflux is a physiologic process that is more common in normal infants in the first year of life than it is in normal older children and adults. Based on the above studies, it is recommended that the upper limit of normal of the reflux index be defined as up to 12% in the first year of life and up to 6% thereafter.

The presence of endoscopic and histopathological esophagitis is strongly associated with abnormal esophageal pH monitoring. In pediatric patients with endoscopic esophagitis (ulcerations or erosions) or biopsy proven esophagitis, approximately 95% will have an abnormal reflux index (39–41). However, not all patients with GER have esophagitis. In the selected populations of patients reported, esophagitis is present in 50% of patients with positive esophageal pH monitoring studies (39–41) and the severity of esophagitis does not correlate with the reflux index (42). Proximal esophageal and pharyngeal pH monitoring have not been proven to be more useful than lower esophageal pH monitoring alone for determining which patients are at risk for upper airway complications of GER (3,43,44).

Esophageal pH monitoring can be used to detect abnormal acid reflux in selected clinical situations. Esophageal pH monitoring can determine if a patient's symptom is temporally associated with acid reflux by calculating the symptom index. The symptom index is the ratio of the number of episodes of a symptom (e.g., heartburn) that occur concurrent with acid reflux divided by the total number of episodes of that symptom. In adults, symptom index scores ≥ 0.5 suggest a relationship between heartburn and gastroesophageal reflux; in these cases, symptoms have successfully been controlled with acid suppression therapy (45). One study using the symptom index in infants compared behavior with episodes of acid reflux (46). Esophageal pH monitoring is also useful to assess the adequacy of the dosage of acid suppression therapy in children being treated with a proton pump inhibitor (47) and may be useful to determine if a patient may be at increased risk for airway complications of GER. For example, approximately 60% of children with asthma, poorly responsive to conventional treatment, had abnormal esophageal pH monitoring studies (48–50).

Esophageal pH monitoring does not detect non-acidic reflux episodes such as occur post-prandially in infants. In some patients, esophageal pH monitoring may be within the range of normal but brief episodes of GER may cause complications such as ALTE, cough or aspiration pneumonia.

In summary, esophageal pH monitoring is a valid and reliable measure of acid reflux. Esophageal pH monitoring establishes the presence of abnormal acid reflux, to determine if there is a temporal association between acid reflux and frequently occurring symptoms, and to assess the adequacy of therapy in patients who do not respond to treatment with acid suppressants

3.4 Endoscopy and Biopsy

Endoscopy enables both visualization and biopsy of the esophageal epithelium. Endoscopy and biopsy can determine the presence and severity of esophagitis, strictures and Barrett's esophagus, as well as exclude other disorders, such as Crohn's disease, webs and eosinophilic or infectious esophagitis. A normal appearance of the esophagus during endoscopy does not exclude histopathological esophagitis. The subtle mucosal changes of erythema and pallor may be observed in the absence of esophagitis (18,42,51). Endoscopic visualization of esophageal erosions or ulceration correlates with histopathological esophagitis, but the severity of endoscopic and histopathological changes may not correlate since the lesion can be patchy and biopsies sample only a small

portion of the mucosal surface. Endoscopic grading systems for the severity of erosive esophagitis, such as the Los Angeles criteria (52), have not yet been validated in pediatric patients but may provide more uniform definitions of severity, if applied. Other findings, such as the presence of vertical lines (53) also correlate with histopathological esophagitis in children. Because there is a poor correlation between endoscopic appearance and histopathology, esophageal biopsy is recommended when diagnostic endoscopy is performed.

In normal infants and children, eosinophils and neutrophils are not present in the esophageal epithelium (40,54). Basal zone hyperplasia (>20% to 25% of total epithelial thickness) and increased papillary length (>50% to 75% of epithelial thickness) have been found to correlate with increased acid exposure (40,55). The available pediatric data suggest that intraepithelial eosinophils or neutrophils as well as morphometric measures of basal cell layer thickness and papillary height are valid indicators of reflux esophagitis. It has been proposed that a high number of eosinophils in the esophageal epithelium (>7 to 24 per high power field) suggest the diagnosis of eosinophilic esophagitis (56,57).

3.5 Scintigraphy

A nuclear scintiscan is performed by the oral ingestion or instillation of technetium-labeled formula or food into the stomach. The areas of interest, the stomach, esophagus and lungs, are scanned for evidence of GER and aspiration. Unlike esophageal pH monitoring, the nuclear scan can demonstrate reflux of non-acidic gastric contents. Scintigraphy also provides information about gastric emptying, which may be delayed in children with GERD (58–60). However, a lack of standardized techniques and the absence of age-specific normative data limit the value of this test. Episodes of aspiration may be detected during a one-hour study or on images obtained up to 24 hours after the feeding is administered (61). A negative test does not exclude the possibility of infrequently occurring aspiration (62).

The reported sensitivity and specificity of the nuclear scan for the diagnosis of GER are 15% to 59% and 83% to 100%, respectively, when compared to esophageal pH monitoring (19,63–65). This lack of correlation most likely reflects the difference in techniques of the two tests. Scintigraphy measures both acid and non-acid reflux in the initial postprandial period, whereas esophageal pH monitoring measures acid reflux for prolonged periods up to 24 hours and protocols used for analysis often exclude the postprandial recording times (64,66). The role of nuclear scintigraphy in the diagnosis and management of GERD in infants and children is unclear.

3.6 Empiric Therapy

A trial of time-limited medical therapy for GER is useful for determining if GER is causing a specific symptom. Empiric therapy is widely used (67) but has not been validated for any symptom presentation in pediatric patients. Empiric treatment trials with omeprazole have been reported for cough (68,69), heartburn (70,71), non-cardiac chest pain (72) and dyspepsia (73) in adult patients.

4. Treatment Options

Treatment options are classified as lifestyle changes and pharmacological or surgical therapies. Lifestyle changes for infants include alterations in formula composition and sleep positioning. Lifestyle changes in adolescents include dietary modifications, altered sleep position, weight reduction and smoking cessation (74). Medications buffer gastric acid, reduce gastric acid secretion or alter gastrointestinal motility. Surgical therapy includes operative techniques that reduce or eliminate GER.

4.1 Lifestyle Changes

4.1.1 Feeding Changes in Infants. In most infants, symptoms of GER do not decrease when there is a change from one milk formula to another. However, a subset of infants with vomiting has cow's milk protein allergy (75). In these infants, elimination of cow's milk protein from the diet resulted in decreased vomiting within 24 hours. Two successive, blind challenges corroborated the diagnosis of cow's milk protein allergy-induced vomiting in infants (76,77). A similar study found that IgG anti-ß-lactoglobulin, a major antigenic determinant in cow's milk, was present in infants allergic to cow's milk protein with symptom reduction following the elimination of cow's milk (78,79). There is, therefore, evidence to support a one to two week trial of a hypoallergenic formula in formula fed infants with vomiting. There are no studies that evaluate the therapeutic value of a soy-protein formula for this indication, nor are there studies that evaluate whether sensitization to soy proteins causes vomiting. Similarly, there are no studies that examine whether sensitization to maternal dietary proteins passed into human breast milk leads to vomiting in breast fed infants. The role of breast feeding versus formula feeding in the treatment of GERD is uncertain. One study (80) measured esophageal acidification in breast-fed and formula-fed healthy term neonates aged 2 to 8 days during various sleep states. During active sleep, but not other sleep states, formula fed infants had an increased number of reflux episodes and increased esophageal acid exposure compared to breast fed infants.

Milk-thickening agents do not improve reflux index scores (81,82) but do decrease the number of episodes of vomiting (81–83). In the United States of America (USA), thickening is usually achieved with the addition of rice cereal to formula (83). When thickening an infant formula with a caloric density of 20 kcal per ounce, the

addition of one tablespoonful of rice cereal per ounce of formula increases the caloric density to approximately 34 kcal per ounce, whereas the addition of one tablespoonful of rice cereal per two ounces of formula increases the caloric density to approximately 27 kcal per ounce. When formula is thickened it is necessary to cross-cut the nipple to allow for adequate flow. Thickened formula may increase coughing during feedings (84). Newer formulas that contain carob flour or locust bean gum as thickening agents are now available in Europe. These formulas have been reported to decrease vomiting and esophageal acid exposure when compared with unthickened formula (85) and formula thickened with rice cereal (86). A formula with added rice starch is now available in the USA and Canada but there are no published studies regarding its efficacy for the treatment of GERD in infants.

Infants who are underweight due to GERD may gain weight when the caloric density of their feedings is increased. Some infants require more aggressive intervention such as overnight nasogastric tube feeding to promote weight gain (87). Rarely, patients require nasojejunal tube feeding to promote growth and prevent vomiting or aspiration. Although these approaches to therapy of GERD are widely utilized, there are no controlled studies comparing these treatment approaches to pharmacological or surgical treatments.

4.1.2 Positioning Therapy for Infants. Esophageal pH monitoring has demonstrated that infants have significantly less GER when placed in the prone position than in the supine position. In a study of 79 infants and children (11.6 ± 27 months old) with symptomatic GER, the reflux index during sleep was 24% in the supine position and 8% in the prone position (88). In a study of 60 asymptomatic newborns (1 to 10 days old) kept in one position for 17 hours, the reflux index was 5% when supine and 1% when prone (89). In a randomized crossover design study of 24 infants <5 months of age, each infant was evaluated in each of four positions (prone, supine, left, right) in both horizontal and 30 degree upright positions. The reflux index was significantly higher in the supine (15%) than in the prone (7%) position (90). There is conflicting evidence whether there is less reflux in infants placed prone at a 30-degree angle compared to prone flat (88–91). The amount of reflux is similar in the supine 30-degree angle and in the supine flat positions (88,90). The prone position is superior to semi-supine positioning in an infant seat, which exacerbates GER (92).

One sudy of 60 asymptomatic newborns showed similar reflux in the left, right and supine positions, which was more reflux than in the prone position (89). In contrast, in a study of 24 infants <5 months old, the left side position was similar to the prone position and led to less reflux than the right side and supine positions (90). In adults reflux occurs less often in the left lateral decubitus (left side down) than in the right lateral decubitus (right side down) position (93,94).

Prone positioning has been recommended for the treatment and prevention of GER in infants. However, this advice conflicts with the recent recognition that prone positioning is associated with a higher rate of the sudden infant death syndrome (SIDS). The Nordic epidemiological SIDS study demonstrated that the odds ratio of SIDS mortality was 13.9 for the prone position and 3.5 for the side position when compared to the supine position (95). Another study demonstrated that the SIDS mortality per 1000 live births was 4.4 in the prone position and <0.1 for the non-prone position (96). In California the SIDS rate declined from 1.2 to 0.7 per 1000 live births after a public health campaign to promote back sleeping (97). Evidence suggests that universal use of the supine position would likely markedly reduce SIDS (98). The side position appears to be unstable, because infants turn during sleep from side to prone. Prone sleeping results in longer uninterrupted sleep periods, and supine sleeping in more arousability, frequent awakening and crying during the night.

In view of the recent evidence describing the successful prevention of SIDS with supine positioning, it is now appropriate to modify the earlier advocacy of prone positioning for GERD. In infants from birth to 12 months with GERD, the risk of SIDS generally outweighs the potential benefits of prone sleeping. Therefore, consistent with the new recommendations of the American Academy of Pediatrics, non-prone positioning during sleep is recommended (99). Supine positioning confers the lowest risk for SIDS and is preferred. Prone positioning is acceptable while the infant is awake, particularly in the postprandial period. Prone positioning during sleep is only considered in unusual cases where the risk of death from complications of GER outweighs the potential increased risk of SIDS. When prone positioning is necessary, it is particularly important that parents be advised not to use soft bedding, which increases the risk of SIDS in infants placed prone (odds ratio 1.7) (100,101).

The efficacy of positioning therapy in children older than one year has not been studied. It is likely that there is a benefit to left side positioning and elevation of the head of the bed, as in adults (102–104).

4.1.3 Lifestyle Changes in Children and Adolescents. Lifestyle changes are often recommended to adults with gastroesophageal reflux. These include dietary modification, avoidance of alcohol, weight loss, and cessation of smoking. Most of the studies investigating these factors have been performed in adults; thus, their applicability to children remains indeterminate. A review of the pediatric and adult literature may be summarized as follows. The current evidence does not support a recommendation to decrease fat intake to treat GER (105–112). However, the limited evidence available supports the recommendation that children and adolescents with GERD avoid caffeine, chocolate and spicy

foods that provoke symptoms (113–124). Similarly there is evidence that obesity, exposure to tobacco smoke and alcohol are associated with GER (125–148). It is not known whether lifestyle changes have an additive benefit in patients receiving pharmacological therapy.

4.2 Pharmacological Therapies

The purpose of the two major pharmacological treatments for GERD, acid suppressants and prokinetic agents, is to reduce the amount of acid refluxate to which the esophagus or respiratory tract is exposed, thereby preventing symptoms and promoting healing. The aim of acid suppressants is to reduce esophageal acid exposure by either neutralizing gastric acid or decreasing secretion. The aim of prokinetic agents is to reduce the amount of refluxate by improving contractility of the body of the esophagus, increasing pressure in the lower esophageal sphincter, decreasing the frequency of transient lower esophageal sphincter relaxations and accelerating gastric emptying.

Studies of pharmacological therapies for the treatment of GERD in children are difficult to compare because of heterogeneous patient populations, variable drug doses and duration of therapy, and a lack of standard outcome variables. The majority of studies published to date have used two outcome assessments: symptom responses and change in results of esophageal pH monitoring. Many studies are confounded by multiple treatments including lifestyle changes and other drugs. For purposes of this guideline, double blind single drug studies or randomized comparison studies of pharmacological therapies were reviewed. When no such studies were available, other studies were considered. Recommended drug doses and the common adverse effects of these medications are listed in Table 2.

4.2.1 Acid Suppressants. Acid suppressants act to decrease esophageal acid exposure by reducing the quantity of gastric acid. The antisecretory agents, histamine-2 receptor antagonists (H_2RAs) and proton pump inhibitors (PPIs), reduce the secretion of gastric acid, whereas antacids neutralize gastric acid. Because of their superior efficacy and convenience, antisecretory agents have largely superceded antacids and surface agents in the treatment of GERD. Generally PPIs produce a greater reduction in acid secretion and have a longer duration of action than H_2RAs.

4.2.1.1 Histamine-2 Receptor Antagonists. H_2RAs act to decrease acid secretion by inhibiting the histamine-$_2$ receptor on the gastric parietal cell. In one study in infants ranitidine treatment, 2 mg per kg per dose BID, reduced by 44% the duration that gastric pH was <4, and with TID dosing the reduction was 90% (149). Ranitidine 5 mg/kg per dose orally has been shown to increase gastric pH for 9 to 10 hours in infants (150). Tolerance to intravenous ranitidine and escape from its acid inhibitory effect within six weeks has been observed (151).

Numerous randomized controlled trials in adults have demonstrated that cimetidine, ranitidine and famotidine

TABLE 2. *Drugs demonstrated to be effective in gastroesophageal reflux disease*

Type of medication	Recommended oral dosage	Adverse effects/precautions
Histamine$_2$ receptor antagonists		
Cimetidine	40mg/kg/day divided TID or QID (adult dose: 800–1200 mg/dose BID or TID)	rash, bradycardia, dizziness, nausea, vomiting, hypotension, gynecomastia, reduces hepatic metabolism of theophylline and other medications, neutropenia, thrombocytopenia, agranulocytosis, doses should be decreased with renal insufficiency
Nizatidine	10 mg/kg/day divided BID. (adult dose: 150 mg BID or 300 mg qhs)	headaches, dizziness, constipation, diarrhea, nausea, anemia, urticaria, doses should be decreased with renal insufficiency
Ranitidine	5 to 10 mg/kg/day divided TID (Adult dose: 300mg BID)	headache, dizziness, fatigue, irritability, rash, constipation, diarrhea, thrombocytopenia, elevated transaminases, doses should be decreased with renal insufficiency
Famotidine	1 mg/kg/day divided BID (adult dose: 20 mg BID)	headaches, dizziness, constipation, diarrhea, nausea, doses should be decreased with renal insufficiency
Proton pump inhibitors		
Omeprazole	1.0 mg/kg/day divided qd or BID (adult dose 20 mg qd)	headache, diarrhea, abdominal pain, nausea, rash, constipation, vitamin B12 deficiency
Lanzoprazole	No pediatric dose available (adult dose: 15–30 mg qd)	headache, diarrhea, abdominal pain, nausea, elevated transaminase, proteinuria, angina, hypotension
Pantoprazole	No pediatric dose available. (adult dose: 40 mg qd)	headache, diarrhea, abdominal pain, nausea
Rabeprazole	No pediatric dose available (adult dose: 20 mg qd)	headache, diarrhea, abdominal pain, nausea
Prokinetic		
Cisapride	0.8 mg/kg/day divided QID. (adult dose: 10–20 mg QID)	rare cases of serious cardiac arrhythmia (FDA recommends ECG before administration) beware of drug interactions do not use in patients with liver, cardiac or electrolyte abnormalities (FDA recommends K+, Ca++, Mg++ and creatinine before administration)

are superior to placebo for relief of symptoms and healing of esophageal mucosa (152–154). However, the efficacy of H_2RAs is much greater for mild esophagitis than for severe esophagitis (155). One randomized placebo-controlled trial in infants and children with erosive esophagitis demonstrated the efficacy of H_2RA therapy (156) in 32 children who received either cimetidine 30–40 mg/kg per day or placebo. The cimetidine treated group had significant improvement in clinical and histopathology scores, but there was no improvement in the placebo group. Another randomized placebo controlled study in 24 children with mild to moderate esophagitis demonstrated that nizatidine 10 mg/kg per day was more effective than placebo for the healing of esophagitis and symptom relief (157). There are case series that provide additional support for the efficacy of H_2RAs in infants and children (158–161). Although no randomized controlled studies in children demonstrate the efficacy of ranitidine or famotidine for the treatment of esophagitis, expert opinion is that these agents appear to be as effective as cimetidine and nizatidine.

4.2.1.2 Proton Pump Inhibitors. Proton pump inhibitors (PPIs), the most effective acid suppressant medications, covalently bond and deactivate the H+, K+–ATPase pumps (162). To be activated PPIs require acid in the parietal cell canaliculus, and they are most effective when the parietal cell is stimulated by a meal following a fast (162). Optimal effectiveness is achieved when the PPI is administered one–half hour before breakfast so that peak plasma concentrations coincide with the mealtime. If given twice daily, the second dose is best administered one–half hour before the evening meal. Concomittant administration of H_2RAs can inhibit efficacy. A steady state of acid suppression is not achieved for several days. There are limited data on the pharmacology of PPIs in infants and children. In one study, doses of omeprazole of 10 to 60 mg (0.7 to 3.3 mg/kg) daily were required to normalize esophageal pH monitoring, and a starting dose of 0.7 mg/kg per day was recommended (47). In other case series reporting successful omeprazole treatment of esophagitis, doses of 0.5 or 0.6 mg/kg daily were administered for 6 to 13 weeks (163–166).

Numerous randomized controlled trials in adults have demonstrated that PPIs are superior to H_2RAs in relieving symptoms and healing esophagitis (152). PPIs are effective in patients with esophagitis refractory to high–dose H_2RA therapy (167,168), and are more effective than H_2RAs in maintaining remission of erosive esophagitis (169). There are currently no reported placebo controlled trials of PPIs in infants or children. However, one randomized controlled trial of 25 infants and children with reflux esophagitis found comparable effectiveness of omeprazole (40 mg per 1.73 m^2 surface area) and very high dose ranitidine (20 mg/kg/day) in reducing symptoms and improving histopathology and esophageal pH monitoring (170). In addition, in multiple case series of pediatric patients refractory to previous treatment regimens including H_2RAs, omeprazole appeared to be highly effective in the treatment of severe esophagitis, resulting in both symptomatic and endoscopic improvement while on treatment (47,163–166). Other proton pump inhibitors, lansoprazole, pantoprazole and rabeprazole, have been introduced recently but studies of their efficacy in infants and children have not yet been reported. Esophageal pH monitoring can be performed to assess the adequacy of the dosage but target values for either esophageal acid exposure or gastric pH that assure therapeutic efficacy are not known. Long term safety studies in adults treated with omeprazole for a mean of 6.5 years (range 1.4 to 11.2 years) show omeprazole is highly effective and safe for the control of reflux esophagitis in adults (171). Despite omeprazole therapy, 12% of the patients who did not have Barrett's esophagus at baseline developed Barrett's metaplasia during follow–up. Similar studies of the efficacy and safety of long term treatment have not been performed in pediatric patients.

One approach to acid reducing therapy, called *step-up* therapy, is to begin treatment with an H_2RA at standard dosage, following with a PPI at standard dosage and then a PPI at higher dosage if necessary to achieve improvement (47). An alternative approach, called *step-down* therapy, is to begin treatment with a PPI at higher dosage to achieve improvement, following with a PPI at standard dosage and then an H_2RA to maintain improvement. Studies in adults indicate that the step-down approach may be more cost effective (171) and has been recommended in a recently published evidence-based guideline for adult patients (172), but there are no published studies comparing these two strategies in children.

The current evidence supports the recommendation to use antisecretory therapy for the treatment of reflux esophagitis. The effectiveness of acid reducing therapy for other manifestations of GERD is not well documented in children. However, since these agents reduce esophageal acid exposure they are likely to be a useful treatment of GER-related respiratory disorders (see sections 5.5 to 5.9).

4.2.1.3 Antacids. The aim of antacids, which act by neutralizing gastric acid, is to reduce esophageal acid exposure and thereby reduce symptoms of heartburn, alleviate esophagitis and prevent acid-triggered respiratory symptoms. Intensive high-dose antacid therapy (magnesium hydroxide and aluminum hydroxide; 700 mmol/1.73 m2/day) has been shown to be as effective as cimetidine for the treatment of peptic esophagitis in children aged 2 to 42 months (173,174). However, treatment with aluminum-containing antacids significantly increases plasma aluminum levels in infants (175,176). Plasma aluminum levels measured in infants receiving these agents approach levels previously noted to cause osteopenia, microcytic anemia, and neurotoxicity in pediatric patients (177–179). There are no published studies evaluating the efficacy or safety of commercially

available antacids containing either magnesium hydroxide alone or calcium carbonate. Antacid therapy is commonly used for the short-term relief of intermittent symptoms of GER in children and adolescents. Although there appears to be little risk to this approach, it has not been formally studied. Because more convenient and safe alternatives are available, chronic antacid therapy is generally not recommended.

4.2.2 Prokinetic Therapy. Transient lower esophageal sphincter relaxations, which are prolonged relaxations unaccompanied by a swallow, are considered the most important pathophysiological mechanism of GER. Other mechanisms are free reflux and strain-induced reflux, when abdominal pressure exceeds the pressure of the lower esophageal sphincter. Although prokinetic agents appear to increase lower esophageal sphincter pressure, a number of studies have failed to demonstrate that prokinetic agents reduce the frequency of episodes of acid reflux, suggesting that they do not reduce the frequency of transient relaxations of the lower esophageal sphincter. The rationale for prokinetic therapy in the treatment of GERD is based on evidence it enhances esophageal peristalsis and accelerates gastric emptying.

Since regurgitation and vomiting are common symptoms in infants and children with reflux, even in the absence of erosive esophagitis, prokinetic agents may have a special role in the treatment of GER in infants and children with conditions where acid suppressants are unlikely to be helpful. Double blind single drug studies and randomized comparison studies of cisapride, metoclopramide, bethanecol and domperidone have been performed in infants and children with GER. Cisapride appears to be a marginally effective prokinetic agent for the treatment of GERD, whereas the effectiveness in children of other prokinetic agents is unproven.

Cisapride is a mixed serotonergic agent that facilitates the release of acetylcholine at synapses of the myenteric plexus. Six randomized controlled trials of cisapride therapy in infants less than two years of age have demonstrated improvement in symptoms or esophageal pH monitoring or both when compared to placebo (180–185). Modest improvement in clinical symptoms, with a reduction in the frequency and volume of vomiting, has been reported in four of five studies where duration of therapy was at least four weeks (180–182,184,186). Improvement occurred more often in infants who regurgitated or vomited after every meal or more than six times daily (182,184,186). One study reported complete resolution of vomiting in less than 20 percent of treated infants (182). In all studies a significant percentage of patients receiving placebo also improved, and in one study vomiting resolved in 14 percent of placebo-treated patients (182).

Randomized controlled trials using prolonged esophageal pH monitoring have demonstrated that cisapride therapy is superior to placebo in reducing esophageal acid exposure and enhancing esophageal acid clearance following reflux. All studies reported statistically significant improvement compared to baseline measurements of one or more of the following parameters: reflux index (percentage of the time that esophageal pH was less than 4), mean duration of reflux episodes, and number of episodes longer than 5 minutes (180–187). Cisapride improved symptom scores, esophageal histopathology, and pulmonary function in patients with reflux esophagitis and respiratory complications (50,180,181). This may be due to reduced esophageal acid exposure and enhanced esophageal acid clearance.

Metoclopramide is an antidopaminergic agent with cholinomimetic and mixed serotonergic effects. In adults the effects of metoclopramide on esophageal motility and clinical efficacy have been equivocal (188) and the addition of metoclopramide to ranitidine therapy for treatment of GERD resulted in no better efficacy and increased the number of adverse events (189). Four randomized controlled studies of at least two weeks duration on the efficacy of metoclopramide in the treatment of GER in children have been reported. Two of four studies reported a decrease in the frequency and volume of vomiting (190,191), whereas in two other studies metoclopramide was no better or worse than placebo (192,193). The reported effects on esophageal pH monitoring of acute and steady-state dosing of metoclopramide have also been contradictory, with both positive (187,194,195) and negative results (192,193,196). Adverse effects of metoclopramide, which are not uncommon, include central nervous system complications such as parkinsonian reactions and tardive dyskinesia, which may be irreversible (197).

Bethanechol, a direct cholinergic agonist, has been studied in two controlled trials of 6 weeks duration. In one study bethanechol was superior to placebo in reducing the frequency and volume of vomiting, but prolonged esophageal pH monitoring was not performed (198). The other study, which compared bethanechol to antacids, found no difference between the two treatments in clinical outcome or esophageal pH monitoring (199). Of three reports regarding domperidone therapy, one study found improvement in both clinical symptoms and pH score following two weeks of therapy (191), while two studies reported no improvement in either outcome measure following four and eight weeks of therapy (200,201).

In conclusion, there is evidence to support the use of cisapride when a prokinetic is indicated for the treatment of GERD in infants and children. However, because of concerns about the potential for serious cardiac arrhythmias in patients receiving cisapride, appropriate patient selection and monitoring as well as proper use, including correct dosage and avoidance of co-administration of contraindicated medications, are important (202). Despite these concerns, the use of cisapride can be considered for the treatment of selected infants with vomiting and poor weight gain, ALTE or asthma who have failed lifestyle and antisecretory therapy. In some children over

2 years of age with asthma or with recurrent vomiting that is adversely affecting lifestyle cisapride therapy may also be considered. Cisapride recently was withdrawn from the USA market due to these safety concerns and therefore in order to receive cisapride patients must be enrolled in a limited access protocol that requires repeated venipuncture and electrocardiograms, making the use of cisapride a less practical option. There is insufficient evidence that other prokinetic agents are effective in the treatment of GERD in infants and children.

4.2.3 Surface Agents. Sodium alginate forms a surface gel that decreases the regurgitation of gastric contents into the esophagus and protects the esophageal mucosa. Randomized comparison studies have demonstrated conflicting outcomes for both symptoms (203,204) and esophageal pH monitoring (205,206). The formulation utilized for most published studies is not available in the USA.

Sucralfate gel acts by adhering to peptic lesions, and protects the esophageal mucosal surface. In adults sucralfate (1 g po QID) decreases symptoms and promotes healing in patients with non-erosive esophagitis (207). The only randomized comparison study in children demonstrated that sucralfate is as effective as cimetidine for treatment of esophagitis (208). Sucralfate is an aluminum complex, and the potential adverse effects of aluminum in infants and children need to be considered. The available data are inadequate for determining the safety or efficacy of sucralfate in the treatment of GERD in children.

4.3 Surgical Treatment for GERD

Surgery is often considered for the child with GERD who has persistence of symptoms following medical management or who is unable to be weaned from medical therapy. The Nissen fundoplication is the most popular of the many surgical procedures that have been used. Recently experience with laparoscopic procedures has been reported. Results and complication rates do not appear to vary by procedure.

The literature concerning surgical treatment of GERD in children consists of a large number of descriptive papers composed of case series (209–221). The methodology for patient selection and outcome was not always well defined. Patients usually had surgery for failed medical management. There are no published randomized controlled trials. Because most series extended over many years, medical management in earlier patients was often limited to life style changes such as positional therapy and thickened feedings. Some patients received H_2RAs but few if any patients received PPIs. Most did not receive a prokinetic agent and those that did often received metoclopramide. Thus many of the patients did not receive optimal medical therapy by today's standards. Outcome measures were often vague or unspecified. The groups were heterogeneous without adjustment for co-morbid conditions. Many (if not most) of the surgically treated patients were neurologically impaired. A variety of surgical procedures were used. The addition of a pyloroplasty was variable. The outcome was sometimes defined by symptoms and at other times by postoperative tests.

Success rates (complete relief of symptoms) from 57% to 92% have been reported. Mortality related to operation in large series has ranged from 0% to 4.7%. Unrelated death rates from co-morbid conditions were 0% to 21%. The reported overall complication rates have varied between 2.2% and 45%. The most commonly reported complications include breakdown of the wrap (0.9% to 13%), small bowel obstruction (1.3% to 11%), gas bloat syndrome (1.9% to 8%), infection (1.2% to 9%), atelectasis or pneumonia (4.3% to 13%), perforation (2% to 4.3%), persistent esophageal stricture (1.4% to 9%) and esophageal obstruction (1.4% to 9%). Other complications not reported in enough detail to estimate complication rates include dumping syndrome (222,223), incisional hernia and gastroparesis. Reoperation rates were 3% to 18.9%. The results of pediatric series of laparoscopic fundoplications suggest that the results and complication rates are similar to those of the open procedure, but hospitalization is shortened (224,225).

These case series indicate overall favorable outcomes. The potential risks, benefits and costs of successful prolonged medical therapy versus surgical therapy have not been well-studied in infants or children with various symptom presentations. If chronic esophagitis is the primary indication for possible GERD surgery, an upper endoscopy with biopsy and prolonged esophageal pH monitoring study is recommended to demonstrate conclusively that esophagitis is due to GER, rather than other etiologies, such as eosinophilic esophagitis. If airway symptoms are the primary indication for surgery, review of diagnostic studies including radiographic studies, bronchoalveolar lavage, esophageal pH monitoring studies and swallowing studies may all impact on the decision to proceed with surgery, which may be beneficial in some patients even when esophageal pH monitoring is normal (226).

5. Evaluation and Management of Infants and Children with Suspected GERD

The approach to evaluation and management of infants and children with GERD depends upon the presenting symptoms or signs. The following sections discuss the evidence that supports a relationship between a particular clinical disorder and GER in pediatric patients. The approach to determining if GER is causing disease in a patient and the management of pediatric patients with specific symptom presentations is then reviewed. Recommendations are based upon the available evidence

and the consensus opinion of the GER Guidelines Guideline Committee.

5.1 Recurrent Vomiting

The diagnostic challenge for the practitioner is to distinguish between vomiting due to GER and vomiting caused by other disorders. Numerous disorders can present with recurrent vomiting that mimics GERD (see Table 3). Laboratory and radiographic investigation may be necessary to exclude other causes of vomiting. The infant with recurrent vomiting is discussed separately from the older child with recurrent vomiting.

5.1.1 The Infant with Recurrent Vomiting. In the infant with recurrent vomiting, a thorough history and physical examination (Table 4), with attention to warning signals that suggest other diagnosis (Table 5), is generally sufficient to allow the clinician to establish a diagnosis of uncomplicated GER (Figure 1). An upper GI series or other diagnostic test is not required unless gastrointestinal obstruction is suspected. Other diagnostic tests may be indicated if there are symptoms of poor weight gain, excessive crying, irritability, disturbed sleep, feeding or respiratory problems.

5.1.2 The Infant with Uncomplicated GER (Figure 1). The classical presentation of uncomplicated GER in infants is effortless, painless vomiting in a well appearing child with normal growth, often referred to as the "happy spitter'. Generally, only parental education, reassurance and anticipatory guidance are necessary for management of the infant who has uncomplicated GER. Parents are advised about potential complications, including poor weight gain, excessive crying, and feeding or respiratory problems. Some infants with cow milk allergy have symptoms that are indistinguishable from GER. Therefore, a one to two week trial of a hypoallergenic formula may be reasonable (section 4.1.1). Thickening of formula may also be considered as an option for therapy. Continuation of supine positioning is recommended. There is no evidence that pharmacological therapy affects the natural history of uncomplicated GER in infants.

Recurrent vomiting due to GER generally decreases in frequency over the first year of life and resolves by 12 months of age (8). If symptoms worsen or do not improve by 18 to 24 months of age, further evaluation is recommended, including an upper GI series and consultation with a pediatric gastroenterologist is recommended (see section 5.1.5).

5.1.3 The Infant with Recurrent Vomiting and Poor Weight Gain (Figure 2). The infant with recurrent vomiting and poor weight gain is a distinct clinical entity that is not to be confused with the happy spitter. While the history and physical examination, as well as the detection of warning signals, is identical to that described for the infant with recurrent vomiting (section 5.1.1), the finding of growth failure is a crucial factor that alters clinical management. No well-controlled studies of diagnostic or therapeutic strategies for these infants are available, and the following approach is based on expert opinion. Other causes of poor weight gain are first considered. It is recommended that the adequacy of calories being offered and ingested be assessed, by careful evaluation of the dietary history, approach to formula preparation and effectiveness of swallowing. If problems are

TABLE 3. *Differential diagnosis of vomiting in infants and children*

Gastrointestinal obstruction
pyloric stenosis
malrotation with intermittent volvulus
intermittent intussusception
intestinal duplication
Hirschsprung disease
antral/duodenal web
foreign body
incarcerated hernia
Gastrointestinal disorders
achalasia
gastroparesis
gastroenteritis
peptic ulcer disease
gastroesophageal reflux
eosinophilic esophagitis/ gastroenteritis
food allergy or intolerance
inflammatory bowel disease
pancreatitis
appendicitis
Neurologic
hydrocephalus
subdural hematoma
intracranial hemorrhage
mass lesion
Infectious
sepsis
meningitis
urinary tract infection
pneumonia
otitis media
hepatitis
Metabolic/endocrine
galactosemia
hereditary fructose intolerance
urea cycle defects
amino and organic acidemias
congenital adrenal hyperplasia
maple syrup urine disease
Renal
obstructive uropathy
renal insufficiency
Toxic
lead
iron
Vitamin A or D
medications (ipecac, digoxin, theophylline, etc.)
Cardiac
congestive heart failure

TABLE 4. *History in the child with suspected gastroesophageal reflux disease*

Feeding history
Amount/frequency (overfeeding)
Type (preparation errors)
Changes
Position/burping
Behavior during feedings
choking, gagging, coughing, arching
discomfort, feeding refusal
Pattern of vomiting
Frequency/amount
Painful
Forceful
Hematemesis
Association with fever, lethargy, diarrhea
Past medical history
Prematurity
Growth and development (MR/CP/Dev Delay)
Surgery
Hospitalization
Newborn screen (galactosemia, maple sugar urine disease, congenital adrenal hyperplasia)
Recurrent illness (croup/stridor, pneumonia, wheeze, hoarseness, excessive fussiness/crying, hiccups)
Apnea
Inadequate weight gain
Psycho-social history
Stress
Family history
Significant Illness
GI (familial pattern to obstructive disorders, celiac)
Other (metabolic, allergy)
Growth chart
Length, weight
Head circumference
Warning signs (see Table 5)

identified, these are addressed such that adequate caloric intake is assured. Parents may need to be instructed to not limit formula intake. If problems are identified and ameliorated, close follow-up will determine if further evaluation is indicated. See section 5.4 regarding the infant who is unable or refuses to ingest formula.

TABLE 5. *Warning signals in the vomiting infant*

Bilious vomiting
GI bleeding: hematemesis, hematochezia
Forceful vomiting
Onset of vomiting after 6 months of life
Failure to thrive
Diarrhea
Constipation
Fever
Lethargy
Hepatosplenomegaly
Bulging fontanelle
Macro/microcephaly
Seizures
Abdominal tenderness, distention
Genetic disorders (eg: Trisomy 21)
Other chronic disorders (eg: HIV)

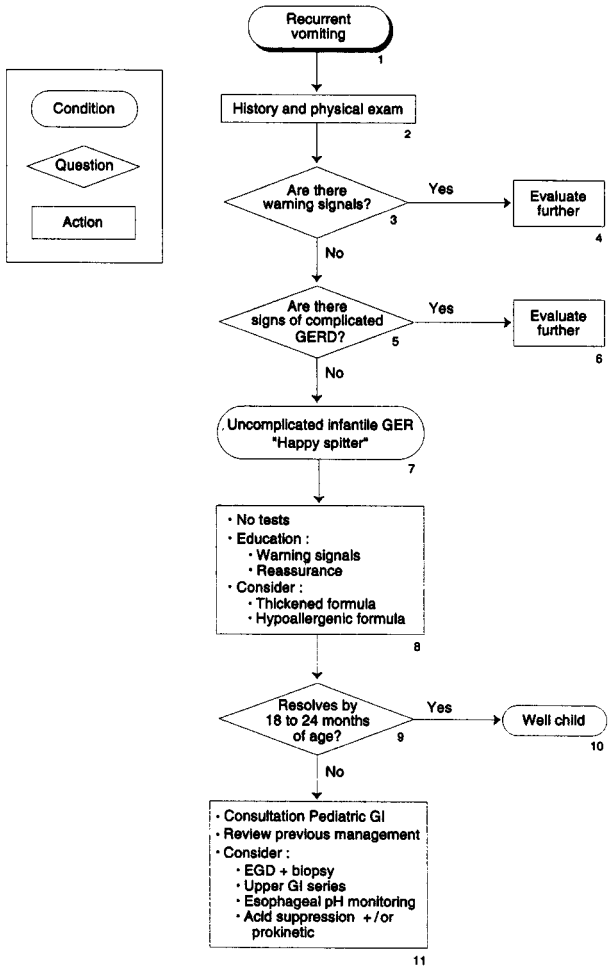

FIG. 1. An algorithm for the management of an infant with uncomplicated GER (the "happy spitter"). (Pediatric GI = pediatric gastroenterologist; EGD = esophagogastroduodenoscopy; UGI = upper gastrointestinal series radiography).

If an infant with vomiting is not gaining weight despite ingesting adequate calories then further diagnostic evaluation is necessary. Tests to uncover other causes of vomiting (such as a complete blood count, electrolytes, bicarbonate, urea nitrogen, creatinine, alanine aminotransferase, ammonia, glucose, urinalysis, urine ketones and reducing substances, and review of newborn screening for galactosemia and maple sugar urine disease) are considered. An upper GI series to evaluate anatomy is also recommended.

When no abnormalities are found, management options include medical therapy, observation in the hospital and endoscopy with biopsy. Initial medical therapeutic options include thickening of the formula, a trial of a hypoallergenic formula, acid suppression therapy, prokinetic therapy and consideration of prone positioning. Hospitalization to observe the parent-child interaction

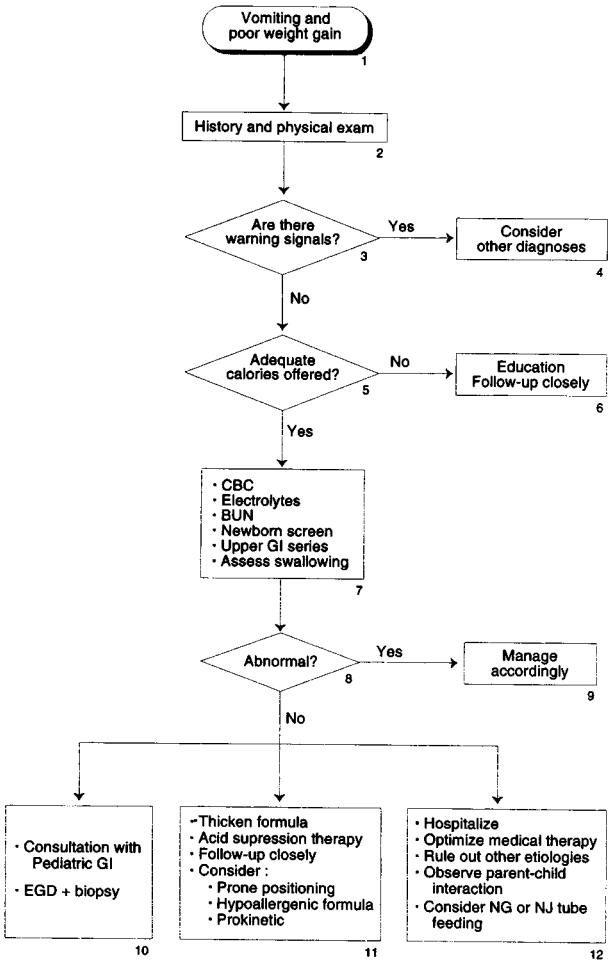

FIG. 2. An algorithm for the management of an infant with vomiting and poor weight gain. (CBC = complete blood count; BUN = blood urea nitrogen; NG = nasogastric; NJ = nasojejunal).

and to optimize medical management may be indicated in more severe cases. Endoscopy with biopsy may be useful to determine if esophagitis is present and to delineate other causes of vomiting or poor weight gain. Other options to improve caloric intake in the infant with vomiting include increasing the caloric density of the formula, and nasogastric or transpyloric tube feedings (87). Rarely surgical therapy may be indicated. Careful follow-up is necessary to assure adequate weight gain (85). If weight gain is sustained, the patient can be expected to have decreasing requirements for interventions as the amount of vomiting and regurgitation decrease with age.

5.1.4 The Infant with Recurrent Vomiting and Irritability. Vomiting, irritability and disturbed sleep in a child less than one year of age may be due to GERD. These non-specific symptoms also occur in normal infants and are associated with a wide range of conditions. Although crying is a quantifiable measure of irritability, normal infants typically fuss or cry intermittently for an average of two hours daily. Substantial individual variation occurs; some infants cry as much as six hours per day. The duration of crying typically peaks at six weeks of age (227). One parent may consider crying to be normal while another would describe the same behavior as extreme irritability. Similarly, the sleeping patterns of infants show individual and maturational variation as does the parental perceptions of normal infant sleep patterns (228).

Evidence supporting the theory that reflux causes esophageal pain and hence irritability or sleep disturbance in infancy is largely extrapolated from studies in adults (45,229,230). Very few pediatric studies address this issue. Using simultaneous video and esophageal pH monitoring, one study (46) showed an association between grimacing and reflux episodes. However, another pediatric study showed no correlation between excessive crying and esophagitis (18) and another noted no increase in irritability or back arching in infants with pathologic reflux (231). In two small studies, an association between excessive irritability and sleep disturbance in infants with abnormal pH probe studies was observed. One study found more nighttime waking, delayed onset of sleeping and greater daytime sleeping in infants with GER as compared to population norms but not when compared to a control group of infants with normal pH probe findings (232). Another study demonstrated no increase in sleep disturbances in those infants with pathologic reflux (231). One study of five infants with colic and esophagitis showed that treatment with cimetidine decreased crying from 3.7 to 1.2 hours after a week of treatment, which was significantly different from 13 children with colic who did not have esophagitis and who were not treated (233).

No studies address the best approach to evaluation of infants with vomiting and irritability or disturbed sleep. As in all infants with vomiting, other causes of vomiting need to be excluded (section 5.1.1 and Table 3). A symptom diary (234) may be useful to determine the extent to which the infant is irritable and has disturbed sleep. In addition, it is important to assure that the infant is receiving adequate feedings, since hunger may also result in irritability. Expert opinion suggests two diagnostic and treatment strategies, neither of which has been validated. The first approach is to empirically treat potential etiologies, beginning with a simultaneous or sequential two-week trial of a hypoallergenic formula and/or acid suppression (Section 5.1). If neither therapy succeeds in reducing symptoms, either esophageal pH monitoring to determine the adequacy of acid suppression (see section 3.3) or upper endoscopy with biopsy to diagnose esophagitis (see section 3.4) may be performed. If these studies are normal, and no response to empiric therapy has occurred, it is unlikely that GER is contributing to the symptoms. An alternative approach is to perform esophageal pH monitoring to determine if episodes of irritability or sleep disturbance are temporally associated with

acid reflux by calculating a symptom index (see section 3.3). One study suggested that simultaneous video monitoring was helpful (46). Time limited therapy can be initiated if episodes of GER provoke symptoms.

5.1.5 Management of the Child Over 2 Years of Age with Recurrent Regurgitation or Vomiting. No published studies describe the management of a group of otherwise normal children who have recurrent regurgitation or vomiting after the age of 2 years. These children usually vomit, or regurgitate and reswallow, between once a day and once a week. The vomiting is not associated with pain or discomfort, is not posttussive, and is non-bloody and non-bilious. Often the vomiting occurs postprandially or with exertion. This type of vomiting can be a nuisance or in some instances may disrupt a child's normal participation in childhood activities. Expert opinion suggests that in most patients an upper GI series be performed to exclude an anatomic abnormality. Some experts also recommend upper endoscopy with biopsy, although in many cases there will be no abnormalities. If vomiting persists and the child remains otherwise asymptomatic, a therapeutic trial of a prokinetic agent may be considered. If a good response to the prokinetic agent occurs, long-term therapy is an option. The small risks must be balanced with the potential improved quality of life in the individual and the family. In very unusual circumstances where the vomiting does not improve with pharmacological therapy and produces serious adverse effects on the patient's lifestyle, surgical therapy is a consideration.

5.2 Management of the Child with Heartburn or Chest Pain (Figure 3)

Heartburn or substernal burning pain may be caused by GER in the presence or absence of esophagitis (235). Other causes of chest pain include cardiac, respiratory, musculoskeletal, medication induced or infectious etiologies. In older children and adolescents the description and localization of esophageal pain is similar to adults, but in younger children symptom description and localization may be atypical. Regurgitation of sour fluid into the mouth may be present. No randomized, placebo-controlled studies evaluating the efficacy of either lifestyle or pharmacological therapy for the treatment of heartburn in children or adolescents have been published. Expert opinion suggests the use of management approaches similar to those described in adult patients. Initial interventions of lifestyle changes, avoidance of precipitating factors, accompanied by a two to four week therapeutic trial of an H_2RA or PPI are recommended (172,236–238). If no improvement occurs, the child can be referred to a pediatric gastroenterologist for upper endoscopy with biopsy. If the child improves, therapy can be administered for two to three months. If symptoms recur as therapy is discontinued, referral for upper endoscopy to determine the presence and severity of esophagitis is recommended. Because persistent symptoms of heartburn may have a substantial negative impact on a patient's quality of life, long-term therapy can be continued with either a PPI or H_2RA to provide relief from symptoms even in the absence of esophagitis (70,239). Episodic meal-induced heartburn in older children may be treated with antacids or an H_2RA, as in adults (240).

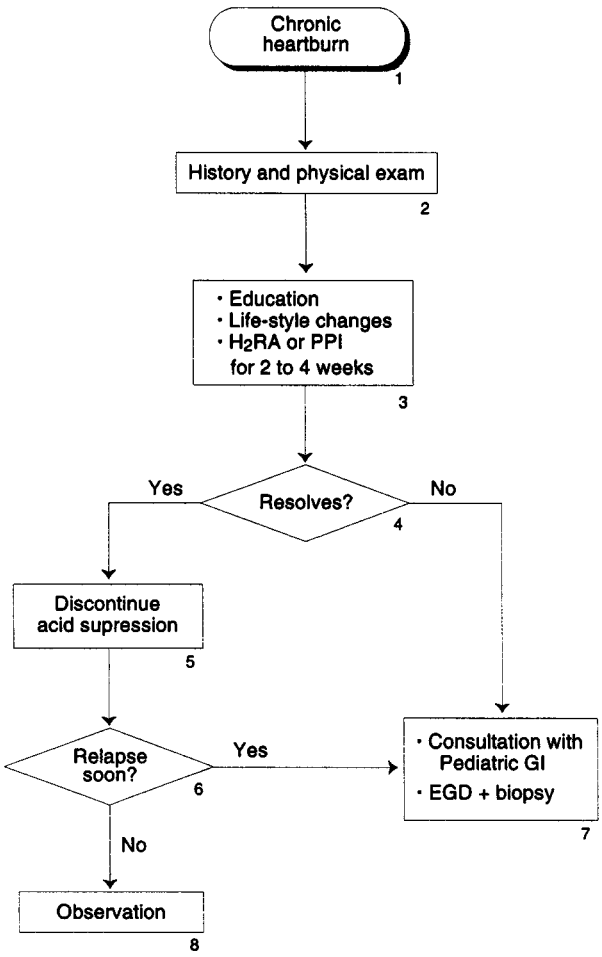

FIG. 3. An algorithm for the management of a child or adolescent with chronic heartburn. (H_2RA = histamine-$_2$ receptor antagonist; PPI = proton pump inhibitor).

5.3 The Infant or Child with Esophagitis (Figure 4)

The typical features of reflux esophagitis are described in section 3.5. Initial treatment consists of lifestyle changes and H_2RA or PPI therapy Initialtherapy. Initial treatment with a PPI results in a more rapid rate of symptom relief and healing compared to treatment with an H_2RA (152). If patients have previously been treated for GERD, medical therapy can be optimized by either the

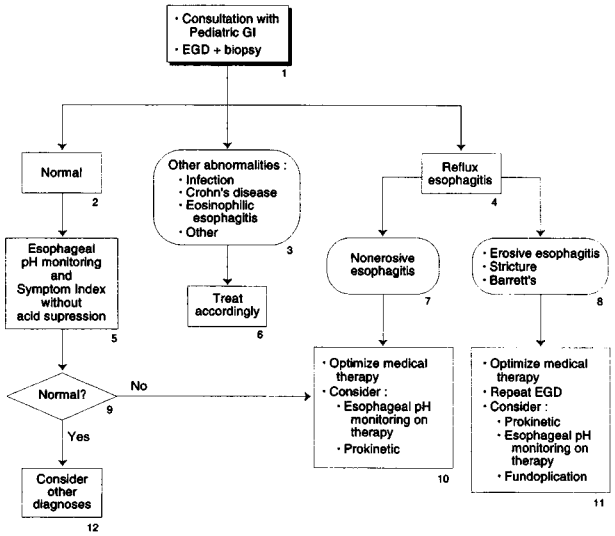

FIG. 4. An algorithm for the continued management of a child or adolescent with esophagitis.

addition of a PPI or a higher dose of PPI (47,241). In one pediatric study, cisapride alone was effective for treatment of histologic esophagitis (181). However, in adults a comparison of the efficacy of a PPI alone versus a combination of a PPI and cisapride did not show a statistically significant difference (169).

Expert opinion suggests that in infants and children with only histologic esophagitis, the efficacy of therapy can be monitored by the degree of symptom relief, whereas in patients with erosive esophagitis, repeat endoscopy is recommended to assure healing. Complete healing may prevent complications including esophageal stricture, Barrett's esophagus or esophageal adenocarcinoma, although no data are available to support this contention. High dose, long-term PPI therapy or surgical therapy may be considered when Barrett's esophagus or esophageal stricture is also present.

If patients do not respond to therapy there are two potential explanations to explore: either the diagnosis is incorrect or treatment is inadequate. The possibility of another diagnosis, such as eosinophilic esophagitis may be considered (56,57). If the clinical presentation and histopathology are consistent with a diagnosis of reflux esophagitis, then the evaluation of adherence to and adequacy of therapy is recommended. Esophageal pH monitoring while the patient is *on therapy* will determine if higher doses of acid reducing medications are needed. If the diagnosis is uncertain, esophageal pH monitoring while the patient is *off therapy* may be useful since a normal study would suggest that esophagitis is less likely to be due to GER.

When surgical therapy is considered, the potential complications of anti-reflux surgery are balanced with the nuisance, risks, effectiveness and cost of long-term pharmacological therapy. There are no studies comparing long term outcomes of medical versus surgical therapy in infants and children since the introduction of PPIs.

5.4 The Infant with Feeding Refusal or the Child with Dysphagia

Esophagitis may cause discomfort or pain (odynophagia) or difficulty (dysphagia) with eating in infants, children and adults. The older child or adult is able to describe sensations that aid in discriminating between oropharyngeal disorders and esophageal disorders. Mouth or pharyngeal pain, poor coordination of bolus formation, coughing or apnea during feeding suggests oropharyngeal anatomical or functional problems. Complaints of chest pain or food being stuck in the chest generally indicate that there is an esophageal disorder, although the sensory discrimination of the site of obstruction is often inaccurate. Reflux esophagitis appears to be one of the more common causes of these symptoms in children, being diagnosed in 12 of 16 children reported in one retrospective series (242).

In the older child or adolescent with symptoms suggestive of an esophageal cause of dysphagia or odynophagia, diagnostic evaluation usually begins with a radiographic contrast study (barium esophagram) to identify anatomic abnormalities, such as strictures or vascular rings, and motility disorders, such as achalasia. Upper endoscopy with biopsy is also usually performed. If esophagitis is present, treatment of the underlying cause of esophagitis (e.g., reflux esophagitis, pill esophagitis or eosinophilic esophagitis) generally leads to symptom resolution. There are no studies evaluating this proposed diagnostic approach in older children or adolescents; however, in a study of young adults (243), the barium esophagram revealed a cause of symptoms in 70% of patients. If the initial history is suggestive of esophagitis, upper endoscopy may be performed as the initial diagnostic test. Treatment without prior diagnostic evaluation is generally not recommended.

In infants, although case series have described an association of feeding difficulties with signs and symptoms of GER (244–246), none has demonstrated that GER is causally related to the feeding difficulties or that feeding improves following treatment. Because a large variety of disorders may contribute to infant feeding difficulties (247), empiric therapy for GER is generally not recommended in children with feeding difficulties. However, if there are other signs or symptoms suggestive of GERD (section 5.1.1) then a time-limited course of medical therapy can be considered.

5.5 The Infant with Apnea or ALTE

An apparent life-threatening event (ALTE) is defined as an episode occurring in an infant that is frightening to

the observer and characterized by a combination of apnea, change in color (cyanosis, pallor, rubor, plethora), change in muscle tone (limpness, stiffness), or choking and gagging that requires intervention by the caretaker (248). The first event usually occurs between one and two months, and rarely after 8 months of age (249,250). There is evidence that ALTEs can recur (250–252), and that infants with an ALTE are at risk for a subsequent sudden death (252–258). ALTEs can be caused by intentional suffocation, cardiac, central nervous system and infectious disorders, and can be due to upper airway obstruction or central apnea as well as GER.

In patients with ALTEs the prevalence of recurrent regurgitation or emesis is 60% to 70% (249,252), and 40% to 80% of patients have abnormal esophageal pH monitoring (259–261). Case reports have described ALTEs triggered by overt regurgitation into the oropharynx or by aspiration of refluxed gastric contents (262–264). Gross emesis or oral regurgitation has been correlated with either prolonged apnea (>20 seconds), or with shorter apnea and bradycardia, but the majority of prolonged apnea episodes in these patients were not associated with regurgitation (265). The first report of simultaneous recordings of esophageal pH, heart rate, chest wall movement and nasal airflow demonstrated that reflux could precede apnea (262). In selected patients with a history of ALTE, esophageal acid infusion has been shown to induce obstructive apnea (262) or oxygen desaturation (259), suggesting that one mechanism by which GER may trigger an ALTE is acid stimulation of laryngeal, pharyngeal, or esophageal chemoreceptors with resultant laryngospasm.

Despite these early reports and the demonstrated potential for GER to cause apnea, subsequent investigations in unselected patients with ALTE have not demonstrated a convincing temporal relationship between esophageal acidification and apnea or bradycadia (260, 261, 266-272). Although several studies reported an occasional correlation of GER with short mixed central apneas (5 to 15 sec) (266,269,271), all of the patients reported also had episodes of apnea which were unrelated to episodes of GER, suggesting a primary impairment in the regulation of respiration. The most convincing relationship between GER and episodes of obstructive or mixed apnea has been in infants in whom the episodes occurred while the patient was awake, supine and within one hour of a feeding. One study performed simultaneous recording of esophageal pH, heart rate, chest wall movement and nasal airflow to demonstrate a relationship between GER and obstructive or mixed apnea in 8 of 15 such patients (273).

At present there is no evidence that the characteristics of an ALTE or polysomnographic diagnostic study can predict which infants are at risk for future life-threatening episodes or sudden death. In one study of 182 infants with ALTE followed for two months, the coexistence of GER and ALTE did not predict the risk for a subsequent episode of prolonged apnea or bradycardia. SIDS has rarely been reported to occur in patients with a previous ALTE and documented GER (261,274); in none of these patients was a previous correlation between esophageal acidification and a cardiopulmonary event recorded.

Similarly there are no randomized studies to evaluate the usefulness of esophageal pH monitoring in infants with ALTE. In patients with frequent ALTE in which the role of GER is uncertain, esophageal pH monitoring may be useful to determine if there is a temporal association of acid reflux with ALTE. For adequate interpretation of esophageal pH monitoring in this situation, simultaneous recording of heart rate, chest wall impedance, nasal airflow and oxygen saturation is necessary to detect obstructive apnea.

The evidence suggests that infants with ALTE and GER may be more likely to respond to anti-reflux therapy when there is gross emesis or oral regurgitation at the time of the ALTE, when episodes occur in the awake infant, and when the ALTE is characterized by obstructive apnea. The effectiveness of medical therapy of GER-associated ALTEs has not been adequately studied. To reduce overt emesis and inhibit acid reflux, therapeutic options include thickened feedings and prokinetic and acid suppressant therapy. Surgical therapy has been reported to be effective in preventing recurrent ALTE and death in heterogeneous groups of patients (263,274), but there are no studies comparing surgery to medical management. Since most infants improve with medical management, surgery is considered only in severe cases. Caution should be exercised when diagnosing and treating GER as a presumptive cause of ALTE. Antireflux surgery has been performed for GER in infants with ALTE that was subsequently determined to be due to repetitive intentional suffocation (275).

5.6 The Infant or Child with Asthma (Figure 5)

Asthma affects an estimated 4.8 million children (276), 5% of whom have persistent asthma, defined as a frequency greater than 2 or 3 times weekly. Although a direct causal relationship between GER and asthma is rare, a number of animal and human studies have suggested that GER may contribute to asthma severity. Proposed pathogenetic mechanisms include direct aggravation of airway inflammation by aspiration of gastric contents, or airway hyperresponsiveness triggered by aspiration of minute amounts of acid into the lower airway (277–279). Esophageal acidification as an independent variable has minimal effect on pulmonary function (277). However, esophageal acid exposure in asthmatic patients may contribute to airway hyperresponsiveness and variable airflow obstruction (280).

Symptoms of GER are common in children with asthma (281). A high percentage of children with persis-

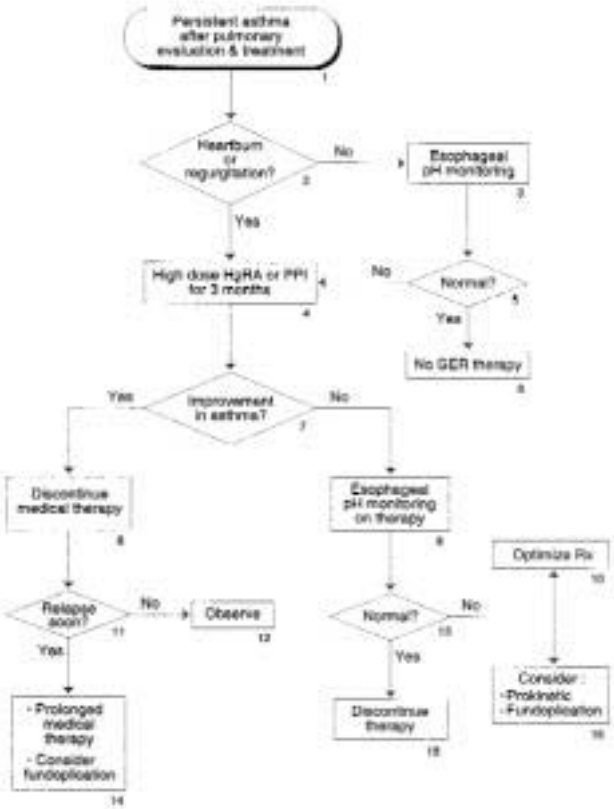

FIG. 5. An algorithm for the management of a child or adolescent with persistent asthma and suspected GER. See also Figure 3. (Rx = therapy).

tent asthma have gastroesophageal reflux detectable by abnormal esophageal pH monitoring. The reported prevalence ranges from 25% to 75%. Of 668 patients studied in 13 series, 407 or 61% were reported to have abnormal pH studies utilizing a variety of scoring techniques (48–50,65,282–290). There was a similar prevalence of GER (53%) in three studies of infants less than 2 years of age (49,282,283). Approximately 50% of patients with persistent asthma and abnormal esophageal pH monitoring have no or minimal clinical symptoms of GER, such as vomiting, regurgitation, or heartburn (48, 50,282,284,288). There is no consistent evidence that specific asthma symptoms or response to asthma therapy correlates with abnormal esophageal pH monitoring.

A number of cohort comparisons have been performed in patients with GER symptoms or positive esophageal pH probe monitoring. These studies demonstrate that prolonged medical treatment of GER improves clinical symptoms of persistent asthma and reduces required doses of bronchodilator and anti-inflammatory medications. From four case series reporting on a total of 168 patients, 63% had clinical improvement or reduced dosages of bronchodilator and anti-inflammatory medications following a variety of medical approaches (50,284, 288,291). Improvement of respiratory variables has been described in infants less than one year of age (291) and older children with or without atopy (50). Reported successful therapies have included positional therapy and thickened formula without medication (284,288), cisapride (50), and H_2RA (292). There are no studies of combined prokinetic and antisecretory therapy to treat GER in patients with asthma. Adult studies suggest that duration of therapy is very important, and aggressive acid suppression for at least 3 months may be necessary to reduce respiratory symptoms (68) (293,294). No studies address the empiric treatment of asthma in patients without GER symptoms or with normal esophageal pH monitoring.

More striking results have been reported following antireflux surgery. Eighty-five percent of 258 patients reported in 6 case series improved clinically as assessed by decreased frequency and severity of asthmatic attacks and reduced dosages of bronchodilator and anti-inflammatory medications (213,284,288,291,295,296). Although details were often not provided, it appears that all the patients had severe persistent asthma requiring frequent oral steroids or high dose inhaled steroid prior to surgery. The diagnosis of GER was most often confirmed by esophageal pH monitoring. Indications for antireflux surgery included evidence of recurrent pneumonia, failed time-limited medical antireflux management, dependence on aggressive medical management, and non-respiratory complications (persistent vomiting, vomiting with growth retardation, severe esophagitis). Subjective improvement in asthma after fundoplication was correlated with a clear history of reflux symptoms preceding the onset of asthma symptoms, a positive response to medical therapy prior to surgery, a history of recurrent pneumonia, and nocturnal attacks of asthma. Failure of medical antireflux management did not preclude a favorable response to surgical antireflux management. Adult surgical series have shown similar improvements in symptoms and reductions of medication use following surgery but without dramatic improvement in pulmonary function tests (297).

Thus there is substantial published evidence that GER is a potential contributor to symptoms of persistent asthma. The true incidence of GER in children with asthma is not known, as the reported data is from selected referred groups of patients with persistent asthma. The available evidence does not support therapy of GER in all patients with persistent asthma who fail to respond to standard asthma therapy. However, a trial of vigorous, prolonged medical therapy of GER is recommended for children when symptoms of asthma and GERD (e.g., heartburn, regurgitation) co-exist, and in infants and toddlers with chronic vomiting or regurgitation and recurrent episodes of cough and wheezing.

If a patient with persistent asthma does not have symptoms of GER, esophageal pH monitoring is recommended in selected patients who are more likely to benefit from GER therapy. This includes patients with ra-

diographic evidence of recurrent pneumonia; patients with nocturnal asthma more than once a week; and patients requiring either continuous oral corticosteroids, high-dose inhaled corticosteroids, more than two bursts per year of oral corticosteroids or those with persistent asthma unable to wean medical management. If esophageal pH monitoring demonstrates an increased frequency or duration of esophageal acid exposure, a trial of prolonged medical therapy for GER is recommended.

Currently there is insufficient pediatric evidence to establish the optimal medical therapy for GER in patients with asthma. It is recommended that a three month trial of vigorous antisecretory therapy and possibly cisapride be considered. It is recommended that outcome variables be determined prior to initiating therapy and be monitored during therapy. Outcome variables include heartburn and regurgitation; frequency of asthma symptoms (coughing, dyspnea, wheezing, and chest tightness); frequency and severity of acute exacerbations; frequency of nocturnal symptoms and breathlessness; symptom scores; quick-relief beta2-agonist use; changes in spirometry measurements (FEV1, FVC, FEV1/FVC) in older children; and subjective measures of quality of life. Antireflux surgery is considered in patients with persistent asthma and recurrent pneumonia, patients requiring prolonged medical therapy and patients with nonrespiratory complications of GER such as persistent vomiting, vomiting with growth retardation and severe esophagitis.

5.7 Recurrent Pneumonia and GER

GER-related aspiration pneumonia may arise in the absence of esophagitis. The incidence of GER and recurrent pneumonia in otherwise normal infants and children (288,290) (298) is difficult to establish due to the heterogeneity of the patients in reported studies, which include a large number of children with neurological disabilities and anatomic disorders of the upper intestinal tract. Several reports show that pediatric patients with recurrent pneumonia and GER improve after receiving medical or surgical GER therapy (296,299). In addition, many patients with idiopathic pulmonary fibrosis have GER (300), suggesting that repeated small episodes of aspiration of gastric contents can eventually cause severe compromise of pulmonary function. These clinical reports as well as clinical experience indicate that GER can cause recurrent pneumonia and chronic pulmonary fibrosis.

Before considering GER as a potential cause of recurrent pneumonia, it is important to exclude other causes, such as an anatomic abnormality, aspiration during swallowing, foreign body, cystic fibrosis or immunodeficiency (301). Determining whether GER is causing recurrent pneumonia in an individual patient is difficult but certain patient populations are prone to aspiration. The presence of neuromuscular disease (302) or a history of esophageal or laryngeal anatomic abnormalities increases the risk of aspiration during swallowing and following episodes of GER. The incidence of GER-related recurrent aspiration in otherwise normal infants and children is unknown but it appears to be rare.

Normal esophageal pH monitoring does not exclude GER as a cause of aspiration pneumonia. The addition of an upper esophageal or pharyngeal pH recording does not improve the ability of pH monitoring to determine which patients are at risk for aspiration as a complication of GER (43). Presumably, patients with even rare episodes of reflux of gastric contents into the pharynx are at risk for aspiration if airway protective reflexes are abnormal. A variety of tests may be useful to evaluate these protective mechanisms.

Flexible bronchoscopy with pulmonary lavage for lipid laden alveolar macrophages has been utilized to detect aspiration (303,304). However, lipid-laden macrophages may be present in normal individuals so their presence in pulmonary lavage lacks sensitivity and specificity for determining if the cause of pulmonary disease is aspiration. Recent efforts to improve the sensitivity and specificity utilize careful protocols that score the lipid content of over 100 macrophages, but considerable overlap exists between normal controls, patients with other causes of pulmonary disease and those with a history consistent with aspiration (305–308). If bronchoscopy with pulmonary lavage demonstrates a large percentage of lipid-laden macrophages, aspiration is more likely, but this test does not discriminate between aspiration that occurs during swallowing and that following GER. The lack of specificity of the test requires that the results be interpreted in the context of other clinical findings.

Nuclear scintigraphy can detect episodes of aspiration when follow-up images are obtained up to 24 hours after the feeding is administered. A positive test demonstrates that aspiration occurred but a negative test does not exclude the possibility that GER with aspiration occurs infrequently (section 3.5). Despite the potential utility of scintigraphy, no data are available regarding its predictive value in management of children or adults with suspected aspiration pneumonia.

Evaluation of airway protection mechanisms during feeding may also be helpful since patients who aspirate during feedings are also likely to aspirate refluxate. One study in neurologically disabled children showed that recurrent pneumonia was more likely in those with an abnormal swallowing study (309). Thus, a videofluoroscopic swallowing study (VSS) or fiberendoscopic swallowing evaluation (FEEST), particularly with neurosensory testing, may help identify at risk patients (310–313).

Often the clinician must make management decisions based on inconclusive information. If the patient has severely impaired lung function, it may be necessary to proceed with antireflux surgery in an attempt to prevent

further pulmonary damage, despite a lack of definitive proof that GER is causing pulmonary disease in the individual patient. The potential benefits of surgery are balanced with the recognition of potential complications (section 4.3). Alternatively, if minimal pulmonary disease is present, consideration of medical therapy with careful follow-up of pulmonary function can be considered. No controlled studies demonstrate the benefits of any medical therapy in preventing progression of chronic pulmonary disease caused by GER in children, but lifestyle and pharmacological agents are options.

5.8 The Infant or Child with Upper Airway Symptoms or Signs

Airway symptoms of hoarseness (314), chronic cough (315,316) and globus sensation (the sensation of a lump in the throat) (317,318) have been associated with GER in adult patients. Characteristic reflux-induced findings of airway erythema, edema, nodularity, ulceration, granuloma and cobblestoning have been described (319,320). The sensitivity and specificity of descriptive laryngoscopic findings for the identification of GER-induced disease are unknown in both pediatric and adult patients. These symptoms or signs usually occur in the absence of classical symptoms of GER such as heartburn or chest pain. In adult GER patients, increased acid exposure in the proximal esophagus (321) and pharynx (322) has been observed in those with airway symptoms of cough or frequent throat clearing. Gastropharyngeal reflux was more prevalent in a small study of children with recurrent laryngotracheitis compared to control patients (323). An increased frequency of episodes of awake GER in children with hoarseness has been suggested in one pediatric case series (324). One case report documents a temporal association of GER episodes and cough in an infant (325). Another case series suggests that GER may contribute to either the pathogenesis of subglottic stenosis or may compromise surgical results (326), while another notes increased pharyngeal reflux in children with laryngomalacia (44).

Several uncontrolled treatment studies in adults have demonstrated improvements in laryngeal symptoms and findings following aggressive medical therapy for GER, with recurrence of symptoms when treatment was discontinued (68,69,320,327,328). Improvement in symptoms of hoarseness after GER therapy was reported in one child (329). Another uncontrolled case series describes improvement in a variety of upper airway symptoms in pediatric patients following treatment of GER with a variety of therapies (330). One study demonstrates a marked reduction in cough symptoms in adults with GER following laparoscopic fundoplication (331). There are no randomized placebo controlled treatment trials evaluating the efficacy of GER therapy of laryngeal symptoms in adults or children. Adult data suggest that if a therapeutic trial is considered, it must be prolonged (longer than three months) to adequately assess efficacy (68). If there is clinical improvement, followed by a recurrence off therapy, it is reasonable to suspect a role for GER in the pathogenesis of symptoms in an individual patient.

In summary, several studies describe the presence of GER in children with either chronic or recurrent laryngeal symptoms. The evaluation of suspected GER-associated laryngeal symptoms is complicated by a lack of a uniform interpretation of laryngeal findings. Nonetheless laryngoscopy is generally indicated to rule out potential anatomic abnormalities of airway protection such as a laryngeal cleft. At this time, there is insufficient evidence and experience in children to provide recommendations for a uniform approach to diagnosis and treatment.

5.9 Other Disorders Potentially Associated with GER

Multiple case reports suggest an association between GER and a variety of other disorders. One study suggested that adolescents with GER had an increased incidence of erosion of enamel on the lingual surfaces of their teeth (332). However, another study showed no increased incidence of dental erosions in adolescents with abnormal esophageal pH monitoring (333).

GER has been suggested as a potential contributing factor in recurrent sinus disease, pharyngitis and otitis media. One uncontrolled case series of children with chronic sinusitis suggested that treatment of GER dramatically reduced the need for sinus surgery in children (334). Another demonstrated that in children with recurrent rhinopharyngitis, there was an increased number of episodes with the pharyngeal pH falling to below 6 in affected patients compared to controls (335). However, the occurrences of ear and sinus infections were similar in infants with or without GER (8). No data demonstrate an association of otitis media and GER. However, otalgia has been associated with GER in children and was reported to improve with treatment of GER (336).

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Appendix A. *Summary of recommendations for diagnostic approaches and the quality of the evidence*

Section	Recommendations	Quality of evidence*
	Diagnostic approaches	
3.1	In most cases a history and physical examination are sufficient to reliably diagnose GER and initiate management.	III
3.2	The upper GI series is neither sensitive nor specific for the diagnosis of GER, but is useful for the evaluation of the presence of anatomic abnormalities, such as pyloric stenosis, malrotation and annular pancreas in the vomiting infant, as well as hiatal hernia and esophageal stricture in the older child.	III
3.3	Esophageal pH monitoring is a valid and reliable measure of acid reflux.	II-2
3.4	Endoscopy and biopsy can determine the presence and severity of esophagitis, strictures and Barrett's esophagus, as well as exclude other disorders. Esophageal biopsy is recommended when endoscopy is performed to detect inapparent esophagitis and to exclude causes of esophagitis other than GER.	II-2
3.5	The role of nuclear scintigraphy (milk scan) in the diagnosis and management of GERD in infants and children is unclear.	III
3.6	A trial of time–limited medical therapy for GER is useful for determining if GER is causing a specific symptom.	III

* Categories of the Quality of Evidence [16]
I Evidence obtained from at least one properly designed randomized controlled study.
II-1 Evidence obtained from well–designed cohort or case–controlled trials without randomization.
II-2 Evidence obtained from well–designed cohort or case–control analytic studies, preferably from more than one center or research group.
II-3 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940's) could also be regarded as this type of evidence.
III Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

Appendix B. *Summary of recommendations for treatment options and the quality of the evidence*

Section	Recommendation	Quality of evidence*
	Treatment options	
4.1.1	There is evidence to support a one to two week trial of a hypoallergenic formula in formula fed infants with vomiting.	I
4.1.1	Milk–thickening agents do not improve reflux index scores but do decrease the number of episodes of vomiting.	I
4.1.2	Esophageal pH monitoring has demonstrated that infants have significantly less GER when placed in the prone position than in the supine position.	I
4.1.2	Prone positioning is associated with a higher rate of the sudden infant death syndrome (SIDS). In infants from birth to 12 months of age with GERD, the risk of SIDS generally outweighs the potential benefits of prone sleeping. Therefore, non–prone positioning during sleep is generally recommended.	I
4.1.2	In children older than one year it is likely that there is a benefit to left side positioning and elevation of the head of the bed.	I
4.1.3	It is recommended that children and adolescents with GERD avoid caffeine, chocolate and spicy foods that provoke symptoms. Obesity, exposure to tobacco smoke and alcohol are also associated with GER.	III
4.2.1.1	Histamine–$_2$ receptor antagonists (H_2RAs) produce relief of symptoms and mucosal healing. Proton pump inhibitors (PPIs), the most effective acid suppressant medications, are superior to H_2RAs in relieving symptoms and healing esophagitis.	I
4.2.1.3	Since more convenient and safe alternatives are available (H_2RAs and PPIs), chronic antacid therapy is generally not recommended.	III
4.2	Cisapride reduces the frequency of regurgitation and vomiting. However, because of concerns about the potential for serious cardiac arrhythmias in patients receiving cisapride, appropriate patient selection and monitoring as well as proper use, including correct dosage (0.2 mg/kg/dose QID) and avoidance of co–administration of contraindicated medications, are important. Cisapride is available in the USA only through a limited–access program. Other prokinetic agents have not been shown to be effective in the treatment of GERD in children.	I
4.3	Case series indicate that surgical therapy generally results in favorable outcomes. The potential risks, benefits and costs of successful prolonged medical therapy versus fundoplication have not been well studied in infants or children with varying symptom presentations.	II-3 III

Appendix C. *Summary of recommendations for the evaluation and management of infants and children with suspected GERD and the quality of the evidence*

Section	Recommendation	Quality of evidence*
	Evaluation and management of infants and children with possible GERD	
5.1.1	In the infant with recurrent vomiting, a thorough history and physical examination with attention to warning signals is generally sufficient to allow the clinician to establish a diagnosis of uncomplicated GER.	III
5.1.2	In the infant who has uncomplicated GER, parental education, reassurance and anticipatory guidance are recommended. Generally, no other intervention is necessary. Thickening of formula and a short trial of a hypoallergenic formula are other treatment options. If symptoms worsen or do not improve by 18 to 24 months of age, re–evaluation for complications of GER is recommended.	III
5.1.3	In the vomiting infant with poor weight gain in whom adequate calories are being offered, it is recommended that tests be performed to uncover other causes of vomiting, including an upper GI series to evaluate anatomy and swallowing. Management options include thickening the formula, increasing the caloric density of the formula, acid suppression therapy, prokinetic therapy and, in selected cases, prone positioning. Further management options include endoscopy with biopsy, hospitalization, tube feedings and rarely surgical therapy.	III
5.1.4	In infants with vomiting and irritability, potentially harmful interventions are undertaken with caution because pathological findings are so infrequent. One approach to management is initial empiric therapy; an alternate approach is initial diagnostic evaluation.	III
5.1.5	In otherwise normal children who have recurrent vomiting after the age of 2 years, management options include an upper GI series and upper endoscopy with biopsy. Prokinetic therapy is also an option.	II-2 III
5.2	For the treatment of heartburn in children or adolescents, lifestyle changes accompanied by a two– to four–week therapeutic trial of an H_2RA or PPI are recommended. If symptoms persist or recur, the child can be referred to a pediatric gastroenterologist for upper endoscopy with biopsy and in some cases long–term therapy.	III
5.3	In the infant or child with esophagitis, initial treatment consists of lifestyle changes and H_2RA or PPI therapy. In patients with only histologic esophagitis, the efficacy of therapy can be monitored by the degree of symptom relief. In patients with erosive esophagitis, repeat endoscopy is recommended to assure healing.	I
5.4	In the child with dysphagia or odynophagia, a barium esophagram is recommended. If the initial history is suggestive of esophagitis, upper endoscopy may be performed as the initial diagnostic test. Treatment without prior diagnostic evaluation is not recommended. In the infant with feeding refusal, because a large variety of disorders may contribute to infant feeding difficulties, empiric therapy for GER is generally not recommended. However, if there are other signs or symptoms suggestive of GERD then a time–limited course of medical therapy can be considered.	III
5.5	In the infant with apnea or an apparent life–threatening event, if symptoms occur frequently and the role of GER is uncertain, esophageal pH monitoring may be useful to determine if there is a temporal association of acid reflux with ALTE. Therapeutic options include thickened feedings and prokinetic and acid suppressant therapy. Since most infants improve with medical management, surgery is considered only in severe cases.	II-2 III
5.6	In patients where symptoms of asthma and esophagitis co–exist, and in infants and toddlers with chronic vomiting or regurgitation and recurrent episodes of cough and wheezing, a three–month trial of vigorous acid suppressant therapy of GER is recommended. If patients with persistent asthma do not have symptoms of GER, esophageal pH monitoring is recommended in selected patients who are more likely to benefit from GER therapy.	III

American Academy of Pediatrics

Policy Statement

Pediatrics Volume 93, Number 3 March, 1994, p 532-536

Guidelines on Forgoing Life-Sustaining Medical Treatment (RE9406)

Committee on Bioethics

Most children who become ill, even those with life-threatening disorders, recover to lead satisfying lives. Nonetheless, the course of disease may at times cause health care professionals and families to consider whether continued treatment truly represents the best option. Sometimes limiting or stopping life support seems most appropriate, especially if treatment only preserves biological existence or if the overall goal of therapy has shifted to the maintenance of comfort. Based on the existing consensus in ethics and law, the following guidelines for professionals caring for children suggest elements in decisions to forgo life-sustaining medical treatment (LSMT).[1-4]

Decisions to withhold or withdraw LSMT may seriously tax the intellectual and emotional reserves of all parties. Patients, families, physicians, and other members of the medical care team should have access to and feel free to use ethics consultants or ethics committees in addition to the other resources on which they usually rely.[5,6]

PRELIMINARY NOTATIONS

Life-sustaining medical treatment encompasses all interventions that may prolong the life of patients. Although LSMT includes the dramatic measures of contemporary practice such as organ transplantation, respirators, kidney (dialysis) machines, and vasoactive drugs, it also includes less technically demanding measures such as antibiotics, insulin, chemotherapy, and nutrition and hydration provided intravenously or by tube.[7]

The term "forgo" refers to both stopping a treatment already begun as well as not starting a treatment. Although many health care professionals feel reluctant to discontinue life-sustaining treatments, most philosophical and legal commentators find no important ethical or legal distinction between not instituting a treatment and discontinuing treatment already initiated. Fear about stopping therapy may keep clinicians from beginning treatments that may help some patients, particularly when great uncertainty prevails. A better course often includes initiating interventions that, if they later prove unhelpful, may be stopped. Continuing nonbeneficial treatment harms many patients and may constitute a legal, as well as moral, wrong. Those who feel culpable and emotionally strained when faced with withdrawing treatment deserve sympathy and one should be sensitive to those upset by decisions to stop therapy. However, ethical theory and legal practice provide reasons to start or stop treatments based primarily on the relative benefits and burdens for the patient.[8]

Generally, parents give permission for the treatment of children who cannot do so themselves. (See "Decision Making for Patients Who Lack Decision-Making Capacity.") However, the American Academy of Pediatrics emphasizes that physicians and parents should give great weight to clearly expressed views of child patients regarding LSMT, regardless of the legal particulars.

For such serious matters as LSMT, the medical plan usually should conform to the values and choices of the patient and his or her family. In some circumstances, only one parent will be reasonably available before some decisions must be implemented. In other situations, although only a single parent will have actual guardianship or legal responsibility, the clinician may have moral and psychological reasons to consider the views of the other biological parent. In yet other instances, surrogates besides the parents will have decision-making authority; these may include other family members appointed guardians by a court, guardians ad litem, or representatives of child protective agencies maintaining custody of the child.

Decision-making capacity and the legal term "competency" refer to the ability of a person to make decisions at particular times under particular circumstances. One formulation of this overall capacity involves three essential elements: (1) the ability to understand and communicate information relevant to a decision; (2) the ability to reason and deliberate concerning the decision; and (3) the ability to apply a set of values to a decision that may involve conflicting elements.[9] Each potential decision maker regarding LSMT should manifest these abilities. However, children should have the opportunity to participate in decisions about LSMT to whatever extent their abilities allow.

Many decisions regarding life support for children call for the use of the "best interests" standard. This involves weighing the benefits and burdens of LSMT. The benefits may include prolongation of life (understanding that the continuation of biological existence without consciousness may not be a benefit); improved quality of life after the LSMT has been applied (including reduction of pain or disability); and increased "physical pleasure, emotional enjoyment, and intellectual satisfaction" (as cited in a ruling by the New Jersey Supreme Court).[10,p295]

The burdens of LSMT may include intractable pain; irremediable disability or helplessness; emotional suffering; invasive and/or inhumane interventions designed to sustain life; or other activities that severely detract from the patient's quality of life. (The phrase "quality of life" refers to the experience of life as viewed by the patient, ie, how the patient, not the parents or health care providers, perceives or evaluates his or her existence. The American Academy of Pediatrics specifically rejects attempts to equate quality of life with the notion of "social worth" as judged

by others. Such equations have unfortunately tainted discussions of limiting LSMT for children. Avoidance of the term quality of life would, however, ignore its widespread use.)

STATEMENT OF GENERAL PRINCIPLES

Presumption in Favor of Treatment

The American Academy of Pediatrics believes that physicians should provide life-sustaining medical care in conformity with current medical, ethical, and legal norms. Physicians should remember that two broad principles guide the implementation of therapy. First, beneficence suggests that clinicians justify the use of treatments based on the benefits they provide, not simply on the ability to employ them. The related notion of nonmaleficence reminds physicians to consider potential harm to patients. Harm includes obvious physical problems such as pain but may also include psychological, social, and economic consequences. Second, self-determination or autonomy accepts the likelihood that different persons may judge benefits differently. Our social system generally grants patients and families wide discretion in making their own decisions about health care and in continuing, limiting, declining, or discontinuing treatment, whether life-sustaining or otherwise. Medical professionals should seek to override family wishes only when those views clearly conflict with the interests of the child.

Right to Decide and To Be Informed

Whether they are child patients, parents, or other surrogates, health care decision makers have the ethical and legal right to adequate information about reasonably available diagnostic and therapeutic options (including risks, benefits, nature, and purpose of the options).

Right to Refuse Treatment

As a general rule, children who meet statutory criteria for emancipation and those who have been judged mature for purposes of medical decisions may refuse unwanted medical intervention. Most courts that have considered the issue also recognize that incompetent patients, including children, need not receive all possible treatments in each case.[10] As noted previously, society generally presumes that parents should exercise the right to refuse medical treatment when nonautonomous children cannot do so for themselves.

Decisions to Forgo Are Particular to Specific Treatment

A decision to limit, decline, discontinue, or otherwise forgo a particular treatment or procedure applies specifically to that treatment or procedure. Such decisions do not imply that any other procedures or treatments are to be forgone, without a specific decision to do so. Thus, the decision to forgo use of antibiotics in the case of suspected infection does not mean that the patient should not receive oxygen, analgesics, or range-of-motion therapy aimed at providing comfort. Similarly, a do-not-resuscitate order should never signal the abandonment of a patient. When doubts exist regarding the appropriateness of particular treatments, the parties should ask themselves if the therapies of concern further the overall treatment plan. Such a plan should encompass the general goals of treatment, including its scope and limits, and the means suited to achieving those goals.

Preservation of Respect for the Patient

The needs of the child must remain primary, and measures necessary to assure comfort must be maintained at all times. Comfort measures include appropriate nursing and hygienic care as well as analgesics.

Physicians' Obligations

Individual physicians who generally decline to participate in the limitation or withdrawal of therapy should communicate their position to patients and families as soon as that information becomes relevant. When physicians do not wish to participate in forgoing LSMT, they have a legal duty to arrange for care by another physician before removing themselves from the relationship.

Availability of Guidelines to Patients and/or Families

Educational material with substantially the same message as these guidelines should be made available, whenever relevant, to patients and/or their families.

Presumption Against Judicial Review

Families and health care professionals should work together to make decisions for patients who lack decision-making capacity. Recourse to the courts should be reserved for occasions when adjudication is clearly required by law or when concerned parties have disagreements that they cannot resolve, despite appropriate consultation, concerning matters of substantial importance.[11]

GUIDES FOR DECISION MAKING

Informing for Decision Making

Physicians have the responsibility to provide the patient, parents, or other appropriate decision makers with adequate information about applicable therapeutic and diagnostic options.

This information should include the risks, discomforts, side effects, and estimated financial and other costs of treatment alternatives, the potential benefits, and the likelihood, if known, of whether the treatment will succeed.

The physician should also provide advice about which option(s) to choose. That is, physicians should do more than offer a "menu" of choices--they should recommend what they believe is the best option for the patient under the circumstances and give any reasons, based on

medical, experiential, or moral factors, for such judgments. However, physicians should remind families that they may accept or reject the physician's recommendations.

The physician should elicit questions; provide truthful and complete answers to such questions; attempt to ascertain whether or not the decision maker understands the information and advice provided; and attempt to enhance understanding as needed.

The understanding of options by patients, parents, or other decision makers will often increase over time. Therefore, decision making should be treated as a process, rather than as an event. This implies, in part, that patients and/or their surrogates may change their minds as they develop an appreciation of the clinical situation and its meaning for their lives.

Withholding of Information From Patients, Parents, or Other Decision Makers

There is a strong presumption that all information needed to make an appropriate decision about health care (including a decision to forgo LSMT) should be provided to the patient, parents, or surrogates. Experience and study suggest that most patients, family members, or other decision makers want to hear the reality of their situation.[12,13] Open and honest communication reduces tension in the physician-patient relationship.

Information may not be withheld on the grounds that it might cause the patient or surrogate to decline a recommended treatment or to choose a treatment that the physician does not wish to provide. Nor may information be withheld because its disclosure might upset the patient, parents, or other decision maker.

Physicians may withhold information when a competent patient clearly indicates that he or she does not wish to have the information provided, and the physician has previously offered to provide such information. Some commentators believe that parents or other surrogates do not have the same prerogative to refuse information or decline participation in decision making.[14]

Physicians may withhold information if they believe the information would pose an immediate and/or serious threat to a patient's or surrogate's health or life. These circumstances will occur rarely, if ever. A physician who withholds information assumes the burden of supporting the decision not to make customary disclosures. The physician should withhold only the specific information that might produce a threat. Even when immediate full disclosure may produce harm, the physician may succeed in providing partial information gradually, until full disclosure has occurred.

When the physician purposely limits disclosure, he or she should document the reasons in the medical record.

Collaborative Physician-Patient (or Physician-Surrogate) Decision Making

When the attending physician believes the treatment no longer confers a benefit and should be forgone, the patient, parents, or other surrogate should be so informed. Children, even those of early school years, often appreciate their medical situations far better than their family members, guardians, or health care providers believe.15 In many cases, young children deserve to hear the general conclusions of decisions that will affect their continued survival. Children should not be deprived of opportunities to say goodbyes to loved ones. Well-meaning attempts to shield children from this information may result in the breakdown of open communication and trust between patients and those caring for them.

Under some circumstances, child patients and their parents will not agree on the best plan of action. Such situations defy easy rules-of-thumb. The parties must consider, among other concerns, the facts and gravity of the situation; the maturity, knowledge, and intelligence of the child; and the reasons for and strength of the feelings of other family members. The parties should consider seeking consultative help from the following: (1) child psychiatrists, family therapists, or similar professionals skilled in behavioral assessment and counseling; (2) ethics consultants or an ethics committee; (3) other sources of family support, including religious advisers; and, if necessary, (4) the courts.

Physician-Patient (or Physician-Surrogate) Disputes

Patients or surrogates may not compel a physician to provide any treatment that, in the professional judgment of that physician, is unlikely to benefit the patient.[16] However, physicians should not use their views that a treatment provides no benefit (one that they therefore do not wish to offer) as a reason for circumventing possibly difficult discussions with patients. For example, the medical judgment that cardiopulmonary resuscitation will not succeed (that resuscitation is "futile") in a patient with severely injured lungs from bronchopulmonary dysplasia or necrotizing bronchiolitis should not serve as an excuse to avoid talking about do-not-resuscitate orders. Hospitals should have policies addressing intractable differences between staff and patients or families.

If the patient or surrogate makes a decision that the physician cannot accept in good conscience, the physician should arrange transfer of the patient's care to another physician or hospital willing to accept the decision.

If the physician can make no such arrangements, action by the physician to continue or forgo treatment without extensive consultation seems unwise. Such disputes deserve careful consideration of their ethical, legal, and administrative implications. Only in the rare situations in which extended counseling efforts fail, and no physician or facility will accept the patient, should physicians or hospitals refer these cases to the courts.

Consultation With Family

Professionals who care for children should strongly encourage their patients to discuss LSMT with their families and with other close friends and advisers well in advance of the need for decisions. However, when requested to do so, medical professionals should respect the privacy and confidentiality of patients legally entitled to make their own decisions (emancipated minors or those judged mature), including decisions about LSMT. Physicians should honor the desire of patients and parents to prevent disclosure of medically related information to members of the extended family in all but the most unusual circumstances.

DECISION MAKING FOR PATIENTS WHO LACK DECISION-MAKING CAPACITY

The following sections delineate concerns about decision-making capacity and standards to be applied when patients lack such capacity. Many medical professionals who care for children, as a matter of course, take the views of the children about treatment seriously. However, the gravity of decisions about LSMT requires careful, explicit attention to the wishes and feelings of the children, regardless of the legal status of the patients.

Definitions

The definition of emancipated minor varies somewhat from state to state. Generally, legislation defines emancipated minors as those who have graduated from high school, members of the armed forces, those who are married, those who are pregnant or parents, or those who live apart and are financially independent from their parents.

The legal notion of mature minor varies even more. Many courts and some legislatures recognize that individual children, beginning at approximately age 14 years, may be assessed sufficiently mature to make decisions, including some medical ones, for themselves.

The substituted judgment standard refers to situations in which surrogates can make inferences about the preferences of previously competent patients. When such a patient's wishes are known or can be deduced, surrogates should replicate the decision that the patient would have made under the circumstances. Thus, this legal standard applies for children who are emancipated or considered mature.

Presumption of Capacity: Decision-Making Capacity in General

In the case of conscious and alert emancipated minors or those judged mature minors, the ethical and legal presumption of capacity should govern, unless countervailing evidence arises to call the presumption into question.

The professional staff may question a patient's capacity if they suspect or diagnose conditions such as delirium, dementia, depression, mental retardation, psychosis, intoxication, stupor, or coma. Lack of decision-making capacity can be transient and specific to a particular decision. Therefore, patients who suffer from any of these conditions may not lack capacity at all times for all purposes, and the staff may need to reassess decision-making capacity from time to time.

Refusal of specific treatment that most patients would agree to does not alone mean the patient lacks decision-making capacity, but such refusals may serve as a basis for inquiring into the patient's decision-making capacity.

Standards for Decision Making for Patients Lacking Decision-Making Capacity

A surrogate must make health care decisions for patients who lack decision-making capacity.

The substituted judgment standard should be used for children who are emancipated or mature when their wishes are known or may be deduced.

The best interests standard serves as the basis for decisions for patients who have never achieved decision-making capacity, including infants and young children. This standard does not easily apply to patients in whom a permanently unconscious state has been reliably diagnosed. It is difficult to claim that their continued life benefits them, although we cannot say with certainty that they suffer any burden. Physicians and families should also consider whether continued treatment conforms with respect for the meaning of human life and accords with the interests of others, such as family members and other loved ones.

Formal Assessment of Capacity

As a rule, the attending physician should assess and document the capacity of a patient to make or assist in making decisions about forgoing treatment. Formal developmental, psychiatric, or other consultation may help determine the patient's abilities and the appropriateness of the child's participation in making decisions.

Advance Directives

Legal uncertainty surrounds the status of "living wills" or durable power-of-attorney documents executed by minors, even those recognized as emancipated or mature. Thus, in most situations, children will not have formal advance directive documents even under the Federal Patient Self-Determination Act.[17] However, physicians and others should accord considerable weight to the feelings minor children may have expressed before losing the capacity to communicate clearly regarding LSMT. If the patient has executed a living will or any other form of advance directive for health care, that document should serve as strong evidence of the patient's wishes.

Pediatricians should encourage parents of dying children to plan alternatives to calling emergency medical personnel if the family does not desire resuscitation.

DOCUMENTATION OF DECISIONS AND ENTRY OF ORDERS

The American Academy of Pediatrics recommends explicit documentation, in the form of clear orders and explanatory progress notes in the medical record, to encourage involved health care providers to adhere closely to the goals of treatment agreed on by the patient, parents, or other decision maker, and the patient's physician.

Orders

Physicians should encourage hospitals to develop and maintain written policies permitting the forgoing of life-supporting treatment of patients, including children, in appropriate circumstances. Such policies should state that when it has been determined that a particular LSMT is to be forgone, the attending physician or a designee must write an order in the patient's medical record. Telephone orders alone are not acceptable under most circumstances. The attending physician has the responsibility to elicit and consider the views of other members of the professional staff regarding treatment limitations before entering orders limiting LSMT. He or she should discuss the meaning of any order limiting treatment with the staff and ensure that all involved understand such orders and their implications.

Progress Notes

At the time an order limiting LSMT is written, the attending physician should write a companion entry in the progress notes including the following information: diagnosis, prognosis, patient's or other decision-maker's wishes, the content of discussions with involved parties, any disagreements or unresolved issues, and the recommendations of the treating team and consultants.

Acceptable Orders

Each situation deserves individual consideration. This usually requires detailed orders appropriate to the specific case. However, physicians may indicate the following orders to facilitate communication.

No Specified Limits on Therapy

These patients will receive all medically appropriate interventions, including treatment of cardiopulmonary arrest. All patients are assumed to be in this category unless it is otherwise noted in the patient's orders and explained in progress notes.

Limited Therapy

These patients receive medically indicated treatment but have specific interventions, diagnostic or therapeutic, forgone as noted in the patient's orders and explained in progress notes. For example, one may omit cardiopulmonary resuscitation, provide all reasonable therapies for respiratory disease, but forgo tracheal intubation and/or mechanical ventilation, or provide "comfort measures only," such as nursing care plus appropriate analgesia and sedation. Interventions already begun may be withdrawn. Forgoing specific measures does not preclude initiation or continuation of other indicated diagnostic tests or therapies.

ACKNOWLEDGMENTS

This document draws extensively on a framework developed by Meisel and others.[1] The American Academy of Pediatrics statement focuses on the special issues that pertain to children and clarification of substantive matters beyond the largely procedural approach in that article.

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---------- This statement has been approved by the Council on Child and Adolescent Health.
The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

American Academy of Pediatrics

Policy Statement

Pediatrics Volume 96, Number 1 July, 1995, p 161-164

Guidelines for Home Care of Infants, Children, and Adolescents With Chronic Disease (RE9530)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Children With Disabilities

Many infants, children, and adolescents with long-term, serious health problems require frequent and/or prolonged hospitalizations that separate them from their home environment. Hospitalization interferes with the ability to form the normal, interpersonal family and community relationships that are important for normal growth and development. Caring for a child at home may be a desirable alternative to hospital-based care.

Caring for a child at home, with all the necessary assistance, is more supportive of the family's traditional caretaking and nurturing role, but home care should be initiated only when consonant with the best interests of the child and family and if adequate resources and support are available. Combining the benefits of home care with appropriate medical treatment and support requires the development of innovative programs among hospitals, physicians, parents, home care professionals, and communities.

Although many home health care programs for patients with chronic disease exist, objective data about their efficiency, risks, benefits, and costs are limited. Where documentation exists,[1,2] home care can be shown to be a successful, cost-effective method of health care delivery. Careful planning and coordination of family, hospital, home care providers, and community resources, however, are essential for successful home health care programs, and guidelines for program development and assessment are needed.

The goal of a home health care program for infants, children, or adolescents with chronic conditions is the provision of comprehensive, cost-effective health care within a nurturing home environment that maximizes the capabilities of the individual and minimizes the effects of the disabilities. This may be established to prevent hospitalization or reduce the length of hospitalization.

PROGRAM DEVELOPMENT

Comprehensive planning should minimize physical and emotional risk to the patient, adverse effects on the family members, or unforeseen financial burdens. Because of the many factors to be considered, planning should be done by a multidisciplinary Home Health Care Team. This team should include (when available): parents; a primary care pediatrician; other physicians (eg, hospital physicians, subspecialists, other community physicians); nurses; occupational, physical, respiratory, and speech therapists; child development specialists; educational specialists; nutritionists; social workers; teachers; home care providers (eg, home health aide and equipment provider); case managers; and insurers. The team must initially develop the Home Health Care Program, which provides comprehensive care recommendations (the treatment plan) and arrangements based on each individual patient's demonstrated needs (the resources to be utilized, including equipment and service providers). Many of the resources used in the Home Health Care Program may be an extension of existing hospital services.

After the Home Health Care Program is established, each child and family identified for the program needs an Individualized Home Care Plan (IHCP). The family (or other primary caregivers) and the primary care pediatrician must play a major role in developing, implementing, and monitoring the plan, with appropriate subspecialists, when necessary, identified early in this process. A home care service coordinator to support and coordinate the IHCP should be selected (jointly by the team and the family) for each patient. The coordinator, working in conjunction with the primary care pediatrician, works closely with the family, identifying and assisting with their needs in caring for the child at home, including family training about illness, treatment, and advocacy, and assisting families in developing service coordination skills. This family oriented advocate could be an appropriately trained parent of a child with chronic illness who has experience in home care-related issues and concerns. Every effort should be made to identify a single care coordinator for the child and family, even if this requires serving the needs of several programs/systems. If this is not possible, it is essential that a communication system be developed with unique and shared responsibilities delineated for each care coordinator.

IMPLEMENTATION

Patient Selection

Eligibility for home health care should be based on a comprehensive analysis of the Home Health Care Program capabilities, whether the child's therapeutic needs can be met by home care, the potential benefits and risks, and the available resources. Families should not face excessive pressure to enroll their children in a home care program if this move would be detrimental to the child or family. The patient should participate in the development of the IHCP to the extent possible, with the following factors considered for patient selection.

1. Patient Factors. Underlying any potential for home care in chronic disease is the patient's medical stability vis-a-vis the capacity of the Home Health Care Program to provide backup and emergency care. Previous experience with home care in similar situations should be reviewed. As part of the initial discharge planning process, plans should be made to explore home care as an option to begin when the patient's condition is as stable as possible.
2. Family and Home Factors. If possible, each family should have at least two members trained and fully able to care for the child in the home. In some situations, two or more trained adults are essential to assure medical safety. The family should provide evidence of sufficient parental/family involvement, proven capability in performing medical and nursing tasks, and an appropriate home situation (eg, physical environment, safety, and geographic location) for the child's medical safety to be reasonably assured. Respite services should be part of the plan as well as emergency staffing in case the care provider is ill. Specialized day care should be explored as well.
3. Community Factors. A primary care pediatrician or other provider should be involved in the development of the IHCP before hospital discharge, be knowledgeable about the plan, and agree to participate by providing primary medical care. This physician oversees the medical aspects of the plan after hospital discharge, communicates with the attending physician at the hospital and other involved physicians, and reviews the safety of the plan. The service coordinator must assure the availability of appropriate home health care providers, equipment, and other special needs (eg, oxygen suppliers). Essential equipment must either be portable or available at each site that the child attends. Reasonable contingency plans for emergencies (eg, power and equipment backup for those with life-support devices and appropriate transportation), including clear delineation of the unique and shared medical care responsibilities among physicians on the team, must be available. The "team leader," generally the primary care pediatrician, should be identified.
4. Home Care Trial. In order to identify any omissions or lack of clarity in the IHCP, a successful trial of care by the future home health care providers within the hospital setting (using emergency backup by the regular hospital staff) is recommended before discharge. Family members should use equipment and supplies that will be used at home first in the hospital so that they can become familiar and proficient with their use. Any differences between hospital use and home use should be addressed before hospital discharge. The trial should enable the family and other regular caregivers to develop self-confidence and avoid overdependency upon hospital staff.

IHCP DEVELOPMENT

Careful review of the patient's status and needs in the hospital should be made by each professional participating in the patient's care. Each discipline should formulate goals and objectives for the patient and develop daily program components to meet these goals in the home. Thereafter, a meeting should occur to formulate an integrated daily IHCP with specific responsibilities delineated, including the establishment of financial responsibility. This plan includes the following: 1) designation of a home care service coordinator, 2) involvement of a primary care physician who will provide "the medical home," 3) family access to a telephone, 4) specific physician orders for medications, treatments, medical follow-up, and medical tests as appropriate, 5) a plan for monitoring the home care plan that includes designation of the "team leader" and specific responsibilities of the service coordinator and primary care physician, 6) a mechanism for making adjustments to the plan when needed, 7) a defined backup system for medical emergencies, 8) regular or special educational services for school-aged children and early intervention services for eligible infants and toddlers, and 9) criteria procedures for transition from home care, when appropriate.

Educational Services

Planning for early intervention and/or educational services should stress the importance of educating children in an environment with peers that promotes and maintains socialization. With school systems providing education in the least restrictive environment, the child's Individual Educational Plan should incorporate therapeutic and nursing care that is coordinated with the daily IHCP. A child should not be denied necessary home care services because he or she is entitled to school-based services.

Equipment and Supplies

Equipment and supplies that are appropriate for use in the home must be selected and secured according to each patient's needs. Community suppliers must guarantee continuous availability, maintenance, emergency repair, and replacement of this equipment. Financial reimbursement to the family for necessary equipment, supplies, and maintenance should not be denied because the care of the patient is transferred from the hospital to the home. Any need for equipment changes, including manufacturer recalls, should be arranged in conjunction with the service coordinator and the family. Equipment performance should be documented and tracked by the manufacturer.

Child and Caregiver Training

Critical components of the IHCP are education and training for the family and other caregivers, including the child to the greatest extent possible, professional and paraprofessional health care providers, school personnel (if the child will be attending school), and all emergency personnel. Before discharge from the hospital, the family rather than the hospital staff should provide as much of the child's care as possible. The family must learn to recognize and record changes in the child's condition that would require consultation and/or modification of care. The patient, especially if an adolescent, should be encouraged to take responsibility for self-care to the extent appropriate. Although it may require time, restraint, and patience, the hospital staff should assume a supportive, rather than primary, role in this stage of the child's care. The plan should also incorporate outreach education for staff at local hospitals and community-based home care providers.

Cost

The Home Health Care Team should evaluate the projected cost of the child's IHCP and the available methods of financial support and resolve funding problems before hospital discharge of the patient. There should be continuing review and dialogue among the Home Health Care Team, insurers, and public programs to help assure the financial coverage of home care. Creative financing approaches include negotiated

arrangements among a diversity of health care and social service funding sources.

Effects of Home Care on the Child and the Family

During the development of the child's IHCP, a number of issues related to the potential effects of having a severely ill child at home need to be explored with the family, including issues of privacy, physical burdens of care, impact upon other family members such as siblings, time demands of home care, role of the parents in coordinating care, and the social and financial aspects including issues of confidentiality. Assessment should include impact of home care on family dynamics, activities, and schedules including work-related responsibilities. Discussions with the family should explore possible approaches to these issues before discharge, and the family should feel comfortable with their choices.

PROGRAM MAINTENANCE

Before discharge and at intervals during the child's home care program, there should be a coordinated review of the patient's and family's needs, how the family is managing, the progress toward the home care goals, and other available relevant information. The service coordinator and the family should conduct the program review, soliciting input from all involved providers. This is particularly important since the child's and family's needs will likely change over time, both medically and socially. The type and frequency of the child's specialized therapy should be reviewed, and any new issues that arise should be evaluated. Home care case management conferences are recommended at periodic intervals. They should include all community-based providers and case managers.

PROGRAM EVALUATION AND OUTCOME

A review of all patients in the Home Health Care Program and an assessment of data from similar programs should be done by the Home Health Care Team on an ongoing basis. Feedback data for review should be obtained from several sources (eg, the child, the parents, the community, local care providers, and school personnel). Sharing experiences will lead to the continued refinement of the Home Health Care Program. Principles of program review should include the analysis and improvement of key clinical and social outcomes, with evaluation of the ultimate value of the care provided. Follow-up and outcome assessments need to be based on the following: 1) survival, 2) the need for subsequent hospitalizations and other morbidity, 3) developmental progress, 4) course of the underlying disease, 5) actual utilization of resources as compared with expected utilization, 6) financial experience (cash flow and continued availability of benefits), and 7) effects on family members, including siblings. As with all elements of family-centered care, input from family members into this process is essential.

ALTERNATIVES

The use of intermediate or chronic care facilities may be considered as an alternative to home care. The choice of home care or alternative care must be based upon a thorough evaluation of the needs and wishes of the family and the expected course of the illness. Most effective care planning requires the development of a continuum of care options and the evaluation of alternate types of care. The home is one community-based alternative. Components comprise a spectrum of care that may be required over time depending on changing circumstances.

CONCLUSION

Home health care programs for infants, children, or adolescents with chronic disease may offer the advantages of supporting the child's growth and development in a more nurturing family environment without compromising comprehensive health care delivered in a cost-effective manner. Since the number of children with chronic diseases that may be appropriate for home care is increasing (eg, technology-dependent children, children with human immunodeficiency virus infection), this issue affects all pediatricians. Careful analysis, shared experience, and future controlled studies will help support the appropriateness and cost-effectiveness of home health care programs in the care of patients with chronic disease. The central role of the family in this process must be recognized and continuously supported, with appropriate ongoing assistance as the needs of the child and family change over time.

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This statement has been approved by the Council on Child and Adolescent Health. *The recommendations in this statement do not indicate an exclusive course of treatment or standard of medical care. Variations, taking into account individual circumstances, may be appropriate.*

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

CLINICAL REPORT

Guidelines for Monitoring and Management of Pediatric Patients During and After Sedation for Diagnostic and Therapeutic Procedures: An Update

Guidance for the Clinician in Rendering Pediatric Care

AMERICAN ACADEMY OF PEDIATRICS
AMERICAN ACADEMY OF PEDIATRIC DENTISTRY
Charles J. Coté, MD, Stephen Wilson, DMD, MA, PhD, the Work Group on Sedation

ABSTRACT

The safe sedation of children for procedures requires a systematic approach that includes the following: no administration of sedating medication without the safety net of medical supervision; careful presedation evaluation for underlying medical or surgical conditions that would place the child at increased risk from sedating medications; appropriate fasting for elective procedures and a balance between depth of sedation and risk for those who are unable to fast because of the urgent nature of the procedure; a focused airway examination for large tonsils or anatomic airway abnormalities that might increase the potential for airway obstruction; a clear understanding of the pharmacokinetic and pharmacodynamic effects of the medications used for sedation, as well as an appreciation for drug interactions; appropriate training and skills in airway management to allow rescue of the patient; age- and size-appropriate equipment for airway management and venous access; appropriate medications and reversal agents; sufficient numbers of people to carry out the procedure and monitor the patient; appropriate physiologic monitoring during and after the procedure; a properly equipped and staffed recovery area; recovery to presedation level of consciousness before discharge from medical supervision; and appropriate discharge instructions. This report was developed through a collaborative effort of the American Academy of Pediatrics and the American Academy of Pediatric Dentistry to offer pediatric providers updated information and guidance in delivering safe sedation to children.

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
sedation, guidelines, procedures, adverse events, outcomes, accidents, prevention, monitoring, drug interactions, pediatric, children

Abbreviations
AAP—American Academy of Pediatrics
AAPD—American Academy of Pediatric Dentistry
ASA—American Society of Anesthesiologists
EMS—emergency medical services
ECG—electrocardiography
LMA—laryngeal mask airway

INTRODUCTION

Invasive diagnostic and minor surgical procedures on pediatric patients outside the traditional operating room setting have increased in the last decade. As a consequence of this change and the increased awareness of the importance of providing analgesia and anxiolysis, the need for sedation for procedures in physician offices, dental offices, subspecialty procedure suites, imaging facilities, emergency departments, and ambulatory surgery centers has also markedly increased.[1–37] In recognition of this need for both elective and emergency use of sedation in nontraditional settings, the American Academy of Pediatrics (AAP) and American Academy

of Pediatric Dentistry (AAPD) have published a series of guidelines for the monitoring and management of pediatric patients during and after sedation for a procedure.[38–42] The purpose of this updated statement is to unify the guidelines for sedation used by medical and dental practitioners, add clarifications regarding monitoring modalities, provide new information from medical and dental literature, and suggest methods for further improvement in safety and outcomes. With the revision of this document, the Joint Commission on Accreditation of Healthcare Organizations, the American Society of Anesthesiologists (ASA), the AAP, and the AAPD will use similar language to define sedation categories and the expected physiologic responses.[41–44]

This revised statement reflects the current understanding of appropriate monitoring needs both during and after sedation for a procedure.[4,5,12,19,21,22,26,45–53] The monitoring and care outlined in these guidelines may be exceeded at any time on the basis of the judgment of the responsible practitioner. Although intended to encourage high-quality patient care, adherence to these guidelines cannot guarantee a specific patient outcome. However, structured sedation protocols designed to incorporate the principles in this document have been widely implemented and shown to reduce morbidity.[29,32–34,37,54,55] These guidelines are proffered with the awareness that, regardless of the intended level of sedation or route of administration, the sedation of a pediatric patient represents a continuum and may result in respiratory depression and loss of the patient's protective reflexes.[43,56–59]

Sedation of pediatric patients has serious associated risks, such as hypoventilation, apnea, airway obstruction, laryngospasm, and cardiopulmonary impairment.[2,6,22,45,46,54,60–69] These adverse responses during and after sedation for a diagnostic or therapeutic procedure may be minimized, but not completely eliminated, by a careful preprocedure review of the patient's underlying medical conditions and consideration of how the sedation process might affect or be affected by these conditions.[54] Appropriate drug selection for the intended procedure as well as the presence of an individual with the skills needed to rescue a patient from an adverse response are essential. Appropriate physiologic monitoring and continuous observation by personnel not directly involved with the procedure allow for accurate and rapid diagnosis of complications and initiation of appropriate rescue interventions.[46,51,54]

The sedation of children is different from the sedation of adults. Sedation in children is often administered to control behavior to allow the safe completion of a procedure. A child's ability to control his or her own behavior to cooperate for a procedure depends both on his or her chronologic and developmental age. Often, children younger than 6 years and those with developmental delay require deep levels of sedation to gain control of their behavior.[57] Therefore, the need for deep sedation should be anticipated. Children in this age group are particularly vulnerable to the sedating medication's effects on respiratory drive, patency of the airway, and protective reflexes.[46] Studies have shown that it is common for children to pass from the intended level of sedation to a deeper, unintended level of sedation.[56,59,70] For older and cooperative children, other modalities, such as parental presence, hypnosis, distraction, topical local anesthetics, and guided imagery, may reduce the need for or the needed depth of pharmacologic sedation.[31,71–81]

The concept of rescue is essential to safe sedation. Practitioners of sedation must have the skills to rescue the patient from a deeper level than that intended for the procedure. For example, if the intended level of sedation is "minimal," practitioners must be able to rescue the patient from "moderate sedation"; if the intended level of sedation is "moderate," practitioners must have the skills to rescue the patient from "deep sedation"; and if the intended level of sedation is "deep," practitioners must have the skills to rescue the patient from a state of "general anesthesia." The ability to rescue means that practitioners must be able to recognize the various levels of sedation and have the skills necessary to provide appropriate cardiopulmonary support if needed. Sedation and anesthesia in a nonhospital environment (private physician or dental office or freestanding imaging facility) may be associated with an increased incidence of "failure to rescue" the patient should an adverse event occur, because the only backup in this venue may be to activate emergency medical services (EMS).[46,82] Rescue therapies require specific training and skills.[46,54,83,84] Maintenance of the skills needed to perform successful bag-valve-mask ventilation is essential to successfully rescue a child who has become apneic or developed airway obstruction. Familiarity with emergency airway management procedure algorithms is essential.[83–87] Practitioners should have an in-depth knowledge of the agents they intend to use and their potential complications. A number of reviews and handbooks for sedating pediatric patients are available.[32,48,55,88–93] These guidelines are intended for all venues in which sedation for a procedure might be performed (hospital, surgical center, freestanding imaging facility, dental facility, or private office).

There are other guidelines for specific situations and personnel that are beyond the scope of this document. Specifically, guidelines for the delivery of general anesthesia and monitored anesthesia care (sedation or analgesia), outside or within the operating room by anesthesiologists or other practitioners functioning within a department of anesthesiology, are addressed by policies developed by the ASA and by individual departments of anesthesiology.[94] Also, guidelines for the sedation of patients undergoing mechanical ventilation in a critical

care environment or for providing analgesia for patients postoperatively, patients with chronic painful conditions, and hospice care are also beyond the scope of this document.

DEFINITION OF TERMS USED IN THIS REPORT

- Pediatric patients: all patients through 21 years of age, as defined by the AAP.
- Must/shall: an imperative need or duty that is essential, indispensable, or mandatory.
- Should: the recommended need and/or duty.
- May/could: freedom or liberty to follow a suggested or reasonable alternative.
- Medical supervision/medical personnel: a currently licensed practitioner of medicine, surgery, or dentistry trained in the administration of medications used for procedural sedation and the management of complications associated with these medications.
- Encouraged: a suggested or reasonable action to be taken.
- ASA physical status classification: guidelines for classifying the baseline health status according to the ASA (see Appendix 1).
- Minimal sedation (formerly anxiolysis): a drug-induced state during which patients respond normally to verbal commands; although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected.
- Moderate sedation (formerly conscious sedation or sedation/analgesia): a drug-induced depression of consciousness during which patients respond purposefully to verbal commands (eg, "open your eyes," either alone or accompanied by light tactile stimulation, such as a light tap on the shoulder or face, not a sternal rub). For older patients, this level of sedation implies an interactive state; for younger patients, age-appropriate behaviors (eg, crying) occur and are expected. Reflex withdrawal, although a normal response to a painful stimulus, is not considered as the only age-appropriate purposeful response (ie, it must be accompanied by another response, such as pushing away the painful stimulus, to confirm a higher cognitive function). With moderate sedation, no intervention is required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained. However, in the case of procedures that may themselves cause airway obstruction (eg, dental or endoscopic), the practitioner must recognize an obstruction and assist the patient in opening the airway. If the patient is not making spontaneous efforts to open their airway to relieve the obstruction, then the patient should be considered to be deeply sedated.
- Deep sedation (deep sedation/analgesia): a drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully (see discussion of reflex withdrawal above) after repeated verbal or painful stimulation (eg, purposefully pushing away the noxious stimuli). The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. Cardiovascular function is usually maintained. A state of deep sedation may be accompanied by partial or complete loss of protective airway reflexes.
- General anesthesia: a drug-induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to independently maintain ventilatory function is often impaired. Patients often require assistance in maintaining a patent airway, and positive-pressure ventilation may be required because of depressed spontaneous ventilation or drug-induced depression of neuromuscular function. Cardiovascular function may be impaired.

GOALS OF SEDATION

The goals of sedation in the pediatric patient for diagnostic and therapeutic procedures are to (1) guard the patient's safety and welfare; (2) minimize physical discomfort and pain; (3) control anxiety, minimize psychological trauma, and maximize the potential for amnesia; (4) control behavior and/or movement to allow the safe completion of the procedure; and (5) return the patient to a state in which safe discharge from medical supervision, as determined by recognized criteria, is possible (Appendix 2).

These goals can best be achieved by selecting the lowest dose of drug with the highest therapeutic index for the procedure. It is beyond the scope of this document to specify which drugs are appropriate for which procedures; however, the selection of the fewest number of drugs and matching drug selection to the type and goal of the procedure are essential for safe practice.[53,88,91–93,95–97] For example, analgesic medications such as opioids are indicated for painful procedures. For nonpainful procedures, such as computed tomography or MRI, sedatives/hypnotics are preferred. When both sedation and analgesia are desirable (eg, fracture reduction), either single agents with analgesic/sedative properties or combination regimens are commonly used. Anxiolysis and amnesia are additional goals that should be considered in selection of agents for particular patients. However, the potential for an adverse outcome may be increased when 3 or more sedating medications are administered.[45,98] Knowledge of each drug's time of onset, peak response, and duration of action is essential. Although the concept of titration of drug to effect is critical, one must know whether the previous dose has taken full

effect before administering additional drug. Such management will improve safety and outcomes. Drugs with long durations of action (eg, chloral hydrate, intramuscular pentobarbital, phenothiazines) will require longer periods of observation even after the child achieves currently used recovery and discharge criteria.[45,99,100] This concept is particularly important for infants and toddlers transported in car safety seats who are at risk of resedation after discharge because of residual prolonged drug effects with the potential for airway obstruction.[45,46]

GENERAL GUIDELINES

Candidates

Patients who are in ASA classes I and II (Appendix 1) are frequently considered appropriate candidates for minimal, moderate, or deep sedation. Children in ASA classes III and IV, children with special needs, and those with anatomic airway abnormalities or extreme tonsillar hypertrophy present issues that require additional and individual consideration, particularly for moderate and deep sedation.[51] Practitioners are encouraged to consult with appropriate subspecialists and/or an anesthesiologist for patients at increased risk of experiencing adverse sedation events because of their underlying medical/surgical conditions.

Responsible Person

The pediatric patient shall be accompanied to and from the treatment facility by a parent, legal guardian, or other responsible person. It is preferable to have 2 or more adults accompany children who are still in car safety seats if transportation to and from a treatment facility is provided by one of the adults.[101]

Facilities

The practitioner who uses sedation must have immediately available facilities, personnel, and equipment to manage emergency and rescue situations. The most common serious complications of sedation involve compromise of the airway or depressed respirations resulting in airway obstruction, hypoventilation, hypoxemia, and apnea. Hypotension and cardiopulmonary arrest may occur, usually from inadequate recognition and treatment of respiratory compromise. Other rare complications may also include seizures and allergic reactions. Facilities that provide pediatric sedation should monitor for, and be prepared to treat, such complications.

Back-up Emergency Services

A protocol for access to back-up emergency services shall be clearly identified with an outline of the procedures necessary for immediate use. For nonhospital facilities, a protocol for ready access to ambulance service and immediate activation of the EMS system for life-threatening complications must be established and maintained. It should be understood that the availability of EMS services does not replace the practitioner's responsibility to provide initial rescue in managing life-threatening complications.

On-Site Monitoring and Rescue Equipment

An emergency cart or kit must be immediately accessible. This cart or kit must contain equipment to provide the necessary age- and size-appropriate drugs and equipment to resuscitate a nonbreathing and unconscious child. The contents of the kit must allow for the provision of continuous life support while the patient is being transported to a medical facility or to another area within a medical facility. All equipment and drugs must be checked and maintained on a scheduled basis (see Appendices 3 and 4 for suggested drugs and emergency life support equipment to consider before the need for rescue occurs). Monitoring devices, such as electrocardiography (ECG) machines, pulse oximeters (with size-appropriate oximeter probes), end-tidal carbon dioxide monitors, and defibrillators (with size-appropriate defibrillator paddles), must have a safety and function check on a regular basis as required by local or state regulation.

Documentation

Documentation before sedation shall include, but not be limited to, the guidelines that follow.

1. Informed consent: the patient record shall document that appropriate informed consent was obtained according to local, state, and institutional requirements.[102]
2. Instructions and information provided to the responsible person: the practitioner shall provide verbal and/or written instructions to the responsible person. Information shall include objectives of the sedation and anticipated changes in behavior during and after sedation. Special instructions shall be given to the responsible adult for infants and toddlers who will be transported home in a car safety seat regarding the need to carefully observe the child's head position to avoid airway obstruction. Transportation in a car safety seat poses a particular risk for infants who have received medications known to have a long half-life, such as chloral hydrate, intramuscular pentobarbital, or phenothiazine.[45,46,100,103] Consideration for a longer period of observation shall be given if the responsible person's ability to observe the child is limited (eg, only 1 adult who also has to drive). Another indication for prolonged observation would be a child with an anatomic airway problem or a severe underlying medical condition. A 24-hour telephone number for the practitioner or his or her associates shall be provided to all patients and their families. Instructions shall include limitations of activities and appropriate dietary precautions.

Dietary Precautions

Agents used for sedation have the potential to impair protective airway reflexes, particularly during deep sedation. Although a rare occurrence, pulmonary aspiration may occur if the child regurgitates and cannot protect his or her airway. Therefore, it is prudent that, before sedation, the practitioner evaluate preceding food and fluid intake. It is likely that the risk of aspiration during procedural sedation differs from that during general anesthesia involving tracheal intubation or other airway manipulation.[104,105] However, because the absolute risk of aspiration during procedural sedation is not yet known, guidelines for fasting periods before elective sedation should generally follow those used for elective general anesthesia. For emergency procedures in children who have not fasted, the risks of sedation and the possibility of aspiration must be balanced against the benefits of performing the procedure promptly (see below). Additional research is needed to better elucidate the relationships between various fasting intervals and sedation complications.

Before Elective Sedation

Children receiving sedation for elective procedures should generally follow the same fasting guidelines as those for general anesthesia (Table 1). It is permissible for routine necessary medications to be taken with a sip of water on the day of the procedure.

Before Emergency Sedation

The practitioner must always balance the possible risks of sedating nonfasted patients with the benefits and necessity for completing the procedure. In this circumstance, the use of sedation must be preceded by an evaluation of food and fluid intake. There are few published studies with adequate statistical power to provide guidance to the practitioner regarding safety or risk of pulmonary aspiration of gastric contents during procedural sedation.[104–109] When protective airway reflexes are lost, gastric contents may be regurgitated into the airway. Therefore, patients with a history of recent oral intake or with other known risk factors, such as trauma, decreased level of consciousness, extreme obesity, pregnancy, or bowel motility dysfunction, require careful evaluation before administration of sedatives. When proper fasting has not been ensured, the increased risks of sedation must be carefully weighed against its benefits, and the lightest effective sedation should be used. The use of agents with less risk of depressing protective airway reflexes may be preferred.[110] Some emergency patients requiring deep sedation may require protection of the airway before sedation.

TABLE 1 **Appropriate Intake of Food and Liquids Before Elective Sedation**

Ingested Material	Minimum Fasting Period, h
Clear liquids: water, fruit juices without pulp, carbonated beverages, clear tea, black coffee	2
Breast milk	4
Infant formula	6
Nonhuman milk: because nonhuman milk is similar to solids in gastric emptying time, the amount ingested must be considered when determining an appropriate fasting period	6
Light meal: a light meal typically consists of toast and clear liquids. Meals that include fried or fatty foods or meat may prolong gastric emptying time; both the amount and type of foods ingested must be considered when determining an appropriate fasting period	6

Source: American Society of Anesthesiologists. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures—a report of the American Society of Anesthesiologists. Available at: www.asahq.org/publicationsAndServices/NPO.pdf.

Use of Immobilization Devices

Immobilization devices such as papoose boards must be applied in such a way as to avoid airway obstruction or chest restriction. The child's head position and respiratory excursions should be checked frequently to ensure airway patency. If an immobilization device is used, a hand or foot should be kept exposed, and the child should never be left unattended. If sedating medications are administered in conjunction with an immobilization device, monitoring must be used at a level consistent with the level of sedation achieved.

Documentation at the Time of Sedation

1. Health evaluation: before sedation, a health evaluation shall be performed by an appropriately licensed practitioner and reviewed by the sedation team at the time of treatment for possible interval changes. The purpose of this evaluation is to not only document baseline status but also determine if patients present specific risk factors that may warrant additional consultation before sedation. This evaluation will also screen out patients whose sedation will require more advanced airway or cardiovascular management skills or alterations in the doses or types of medications used for procedural sedation.

   A new concern for the practitioner is the widespread use of medications that may interfere with drug absorption or metabolism and, therefore, enhance or shorten the effect time of sedating medications. Herbal medicines (eg, St John's wort or echinacea), may alter drug pharmacokinetics through inhibition of the cytochrome P450 system, resulting in prolonged drug effect and altered (increased or decreased) blood drug concentrations.[111–116] Kava may increase the effects of sedatives by potentiating

γ-aminobutyric acid inhibitory neurotransmission, and valerian may itself produce sedation that apparently is mediated through modulation of γ-aminobutyric acid neurotransmission and receptor function.[117,118] Drugs such as erythromycin, cimetidine, and others may also inhibit the cytochrome P450 system, resulting in prolonged sedation with midazolam as well as other medications competing for the same enzyme systems.[119–122] Medications used to treat HIV infection, some anticonvulsants, and some psychotropic medications may also produce clinically important drug-drug interactions.[123–125] Therefore, carefully obtaining a drug history is a vital part of the safe sedation of children. The clinician should consult various sources (a pharmacist, textbooks, online services, or handheld databases) for specific information on drug interactions.[126]

The health evaluation should include:

- obtaining age and weight
- obtaining a health history, including (1) allergies and previous allergic or adverse drug reactions; (2) medication/drug history, including dosage, time, route, and site of administration for prescription, over-the-counter, herbal, or illicit drugs; (3) relevant diseases, physical abnormalities, and neurologic impairment that might increase the potential for airway obstruction, such as a history of snoring or obstructive sleep apnea[127,128]; (4) pregnancy status; (5) a summary of previous relevant hospitalizations; (6) history of sedation or general anesthesia and any complications or unexpected responses; and (7) relevant family history, particularly that related to anesthesia
- a review of systems with a special focus on abnormalities of cardiac, pulmonary, renal, or hepatic function that might alter the child's expected responses to sedating/analgesic medications
- determination of vital signs, including heart rate, blood pressure, respiratory rate, and temperature (for some children who are very upset or noncooperative, this may not be possible, and a note should be written to document this occurrence)
- a physical examination, including a focused evaluation of the airway (tonsillar hypertrophy, abnormal anatomy [eg, mandibular hypoplasia]) to determine if there is an increased risk of airway obstruction[54,129,130]
- a physical status evaluation (ASA classification [see Appendix 1])
- obtaining name, address, and telephone number of the child's medical home

For hospitalized patients, the current hospital record may suffice for adequate documentation of presedation health; however, a brief note shall be written documenting that the chart was reviewed, positive findings were noted, and a management plan was formulated. If the clinical or emergency condition of the patient precludes acquiring complete information before sedation, this health evaluation should be obtained as soon as is feasible.

2. Prescriptions: when prescriptions are used for sedation, a copy of the prescription or a note describing the content of the prescription should be in the patient's chart along with a description of the instructions that were given to the responsible person. *Prescription medications intended to accomplish procedural sedation must not be administered without the benefit of direct supervision by trained medical personnel.* Administration of sedating medications at home poses an unacceptable risk, particularly for infants and preschool-aged children traveling in car safety seats.[46]

Documentation During Treatment

The patient's chart shall contain a time-based record that includes the name, route, site, time, dosage, and patient effect of administered drugs. Before sedation, a "time out" should be performed to confirm the patient's name, procedure to be performed, and site of the procedure.[43] During administration, the inspired concentrations of oxygen and inhalation sedation agents and the duration of their administration shall be documented. Before drug administrations, special attention must be paid to calculation of dosage (ie, mg/kg). The patient's chart shall contain documentation at the time of treatment that the patient's level of consciousness and responsiveness, heart rate, blood pressure, respiratory rate, and oxygen saturation were monitored until the patient attained predetermined discharge criteria (see Appendix 2). A variety of sedation-scoring systems are available and may aid this process.[70,100] Adverse events and their treatment shall be documented.

Documentation After Treatment

The time and condition of the child at discharge from the treatment area or facility shall be documented; this should include documentation that the child's level of consciousness and oxygen saturation in room air have returned to a state that is safe for discharge by recognized criteria (see Appendix 2). Patients receiving supplemental oxygen before the procedure should have a similar oxygen need after the procedure. Because some sedation medications are known to have a long half-life and may delay a patient's complete return to baseline or pose the risk of resedation,[45,103,131,132] some patients might benefit from a longer period of less-intense observation (eg, a step-down observation area) before discharge from medical supervision.[133] Several scales to evaluate recovery have been devised and validated.[70,134,135] A re-

cently described and simple evaluation tool may be the ability of the infant or child to remain awake for at least 20 minutes when placed in a quiet environment.[100]

CONTINUOUS QUALITY IMPROVEMENT

The essence of medical error reduction is a careful examination of index events and root-cause analysis of how the event could be avoided in the future.[136–140] Therefore, each facility should maintain records that track adverse events such as desaturation, apnea, laryngospasm, the need for airway interventions including jaw thrust or positive pressure ventilation, prolonged sedation, unanticipated use of reversal agents, unintended or prolonged hospital admission, and unsatisfactory sedation/analgesia/anxiolysis. Such events can then be examined for assessment of risk reduction and improvement in patient satisfaction.

PREPARATION AND SETUP FOR SEDATION PROCEDURES

Part of the safety net of sedation is to use a systematic approach so as to not overlook having an important drug, piece of equipment, or monitor immediately available at the time of a developing emergency. To avoid this problem, it is helpful to use an acronym that allows the same setup and checklist for every procedure. A commonly used acronym that is useful in planning and preparation for a procedure is **SOAPME**:

S (suction)—size-appropriate suction catheters and a functioning suction apparatus (eg, Yankauer-type suction)

O (oxygen)—adequate oxygen supply and functioning flow meters/other devices to allow its delivery

A (airway)—size-appropriate airway equipment (nasopharyngeal and oropharyngeal airways, laryngoscope blades [checked and functioning], endotracheal tubes, stylets, face mask, bag-valve-mask or equivalent device [functioning])

P (pharmacy)—all the basic drugs needed to support life during an emergency, including antagonists as indicated

M (monitors)—functioning pulse oximeter with size-appropriate oximeter probes[141,142] and other monitors as appropriate for the procedure (eg, noninvasive blood pressure, end-tidal carbon dioxide, ECG, stethoscope)

E (equipment)—special equipment or drugs for a particular case (eg, defibrillator)

SPECIFIC GUIDELINES FOR INTENDED LEVEL OF SEDATION

Minimal Sedation

Minimal sedation (formerly anxiolysis) is a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and coordination may be impaired, ventilatory and cardiovascular functions are unaffected. Children who have received minimal sedation generally will not require more than observation and intermittent assessment of their level of sedation. Some children will become moderately sedated despite the intended level of minimal sedation; should this occur, the guidelines for moderate sedation will apply.[56]

Moderate Sedation

Moderate sedation (formerly conscious sedation or sedation/analgesia) is a drug-induced depression of consciousness during which patients respond purposefully to verbal commands or light tactile stimulation (see "Definition of Terms Used in This Report"). No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained. The caveat that loss of consciousness should be unlikely is a particularly important aspect of the definition of moderate sedation. The drugs and techniques used should carry a margin of safety wide enough to render unintended loss of consciousness highly unlikely. Because the patient who receives moderate sedation may progress into a state of deep sedation and obtundation, the practitioner should be prepared to increase the level of vigilance corresponding to what is necessary for deep sedation.[56]

Personnel

The Practitioner

The practitioner responsible for the treatment of the patient and/or the administration of drugs for sedation must be competent to use such techniques, provide the level of monitoring provided in these guidelines, and manage complications of these techniques (ie, to be able to rescue the patient). Because the level of intended sedation may be exceeded, the practitioner must be sufficiently skilled to provide rescue should the child progress to a level of deep sedation. The practitioner must be trained in, and capable of providing, at the minimum, bag-valve-mask ventilation to be able to oxygenate a child who develops airway obstruction or apnea. Training in, and maintenance of, advanced pediatric airway skills is required; regular skills reinforcement is strongly encouraged.

Support Personnel

The use of moderate sedation shall include provision of a person, in addition to the practitioner, whose responsibility is to monitor appropriate physiologic parameters and to assist in any supportive or resuscitation measures if required. This individual may also be responsible for assisting with interruptible patient-related tasks of short duration.[44] This individual must be trained in and capable of providing pediatric basic life support. The support person shall have specific assignments in the event of an emergency and current knowledge of the emergency cart inventory. The practitioner and all ancillary personnel should participate in periodic reviews and practice drills of the facility's emergency protocol to ensure proper function of the equipment and coordination of staff roles in such emergencies.

Monitoring and Documentation

Baseline

Before administration of sedative medications, a baseline determination of vital signs shall be documented.

For some children who are very upset or noncooperative, this may not be possible, and a note should be written to document this happenstance.

During the Procedure

The practitioner shall document the name, route, site, time of administration, and dosage of all drugs administered. There shall be continuous monitoring of oxygen saturation and heart rate and intermittent recording of respiratory rate and blood pressure; these should be recorded in a time-based record. Restraining devices should be checked to prevent airway obstruction or chest restriction. If a restraint device is used, a hand or foot should be kept exposed. The child's head position should be checked frequently to ensure airway patency. A functioning suction apparatus must be present.

After the Procedure

The child who has received moderate sedation must be observed in a suitably equipped recovery facility (ie, the facility must have functioning suction apparatus as well as the capacity to deliver more than 90% oxygen and positive-pressure ventilation [eg, bag and mask with oxygen capacity as described previously]). The patient's vital signs should be recorded at specific intervals. If the patient is not fully alert, oxygen saturation and heart rate monitoring shall be used continuously until appropriate discharge criteria are met (see Appendix 2). Because sedation medications with a long half-life may delay the patient's complete return to baseline or pose the risk of resedation, some patients might benefit from a longer period of less-intense observation (eg, a step-down observation area in which multiple patients can be observed simultaneously) before discharge from medical supervision (see also "Documentation" for instructions to families).[45,103,131,132] A recently described and simple evaluation tool may be the ability of the infant or child to remain awake for at least 20 minutes when placed in a quiet environment.[100] Patients who have received reversal agents, such as flumazenil or naloxone, will also require a longer period of observation, because the duration of the drugs administered may exceed the duration of the antagonist, which can lead to resedation.

Deep Sedation

Deep sedation is a drug-induced depression of consciousness during which patients cannot be easily aroused but respond purposefully after repeated verbal or painful stimulation (see "Definition of Terms Used in This Report"). The state and risks of deep sedation may be indistinguishable from those of general anesthesia.

Personnel

There must be 1 person available whose only responsibility is to constantly observe the patient's vital signs, airway patency, and adequacy of ventilation and to either administer drugs or direct their administration. At least 1 individual must be present who is trained in, and capable of, providing advanced pediatric life support and who is skilled in airway management and cardiopulmonary resuscitation; training in pediatric advanced life support is required.

Equipment

In addition to the equipment previously cited for moderate sedation, an ECG monitor and a defibrillator for use in pediatric patients should be readily available.

Vascular Access

Patients receiving deep sedation should have an intravenous line placed at the start of the procedure or have a person skilled in establishing vascular access in pediatric patients immediately available.

Monitoring

A competent individual shall observe the patient continuously. The monitoring shall include all parameters described for moderate sedation. Vital signs, including oxygen saturation and heart rate, must be documented at least every 5 minutes in a time-based record. The use of a precordial stethoscope or capnograph for patients who are difficult to observe (eg, during MRI or in a darkened room) to aid in monitoring adequacy of ventilation is encouraged.[143] The practitioner shall document the name, route, site, time of administration, and dosage of all drugs administered. The inspired concentrations of inhalation sedation agents and oxygen and the duration of administration shall be documented.

Postsedation Care

The facility and procedures followed for postsedation care shall conform to those described for moderate sedation.

SPECIAL CONSIDERATIONS

Local Anesthetic Agents

All local anesthetic agents are cardiac depressants and may cause central nervous system excitation or depression. Particular attention should be paid to dosage in small children.[64,66] To ensure that the patient will not receive an excessive dose, the maximum allowable safe dosage (eg, mg/kg) should be calculated before administration. There may be enhanced sedative effects when the highest recommended doses of local anesthetic drugs are used in combination with other sedatives or narcotics (see Tables 2 and 3 for limits and conversion tables of commonly used local anesthetics).[64,144–157] In general, when administering local anesthetic drugs, the practitioner should aspirate frequently to minimize the likelihood that the needle is in a blood vessel; lower doses should be used when injecting into vascular tissues.[158]

TABLE 2 **Commonly Used Local Anesthetic Agents: Doses, Duration, and Calculations**

Local Anesthetic	Maximum Dose With Epinephrine, mg/kg[a]		Duration of Action, min[b]
	Medical	Dental	
Esters			
Procaine	10.0	6	60–90
Chloroprocaine	20.0	12	30–60
Tetracaine	1.5	1	180–600
Amides			
Lidocaine	7.0	4.4	90–200
Mepivacaine	7.0	4.4	120–240
Bupivacaine	3.0	1.3	180–600
Levobupivacaine	3.0	2	180–600
Ropivacaine	3.0	2	180–600
Articaine		7	60–230

Maximum recommended doses and duration of action are shown. Note that lower doses should be used in very vascular areas.

[a] These are maximum doses of local anesthetics combined with epinephrine; lower doses are recommended when used without epinephrine. Doses of amides should be decreased by 30% for infants younger than 6 months. When lidocaine is being administered intravascularly (eg, during intravenous regional anesthesia), the dose should be decreased to 3 to 5 mg/kg; long-acting local anesthetic agents should not be used for intravenous regional anesthesia.

[b] Duration of action depends on concentration, total dose, and site of administration; use of epinephrine; and the patient's age.

TABLE 3 **Local Anesthetic Percent Concentration: Conversion to mg/mL**

Concentration, %	mg/mL
3.0	30.0
2.5	25.0
2.0	20.0
1.0	10.0
0.5	5.0
0.25	2.5
0.125	1.25

Pulse Oximetry

The new-generation pulse oximeters are less susceptible to motion artifacts and may be more useful than older oximeters that do not contain the updated software.[159–163] Oximeters that change tone with changes in hemoglobin saturation provide immediate aural warning to everyone within hearing distance. It is essential that any oximeter probe is properly positioned; clip-on devices are prone to easy displacement, which may produce artifactual data (underestimation or overestimation of oxygen saturation).[141,142]

Capnography

Expired carbon dioxide monitoring is valuable to diagnose the simple presence or absence of respirations, airway obstruction, or respiratory depression, particularly in patients sedated in less-accessible locations, such as MRI or computerized axial tomography devices or darkened rooms.[47,49,50,143,164–173] The use of expired carbon dioxide monitoring devices is encouraged for sedated children, particularly in situations where other means of assessing the adequacy of ventilation are limited. Several manufacturers have produced nasal cannulae that allow simultaneous delivery of oxygen and measurement of expired carbon dioxide values.[164,165] Although these devices can have a high degree of false-positive alarms, they are also very accurate for the detection of complete airway obstruction or apnea.[166,168,173]

Adjuncts to Airway Management and Resuscitation

The vast majority of sedation complications can be managed with simple maneuvers, such as providing supplemental oxygen, opening the airway, suctioning, and using bag-mask-valve ventilation. Occasionally, endotracheal intubation is required for more prolonged ventilatory support. In addition to standard endotracheal intubation techniques, a number of new devices are available for the management of patients with abnormal airway anatomy or airway obstruction. Examples include the laryngeal mask airway (LMA), the cuffed oropharyngeal airway, and a variety of kits to perform an emergency cricothyrotomy.

The largest clinical experience in pediatrics is with the LMA, which is available in a variety of sizes and can even be used in neonates. Use of the LMA is now being introduced into advanced airway training courses, and familiarity with insertion techniques can be life-saving.[174,175] The LMA can also serve as a bridge to secure airway management in children with anatomic airway abnormalities.[176,177] Practitioners are encouraged to gain experience with these techniques as they become incorporated into pediatric advanced life support courses.

An additional emergency device with which to become familiar is the intraosseous needle. Intraosseous needles are also available in several sizes and can be life-saving in the rare situation when rapid establishment of intravenous access is not possible. Familiarity with the use of these adjuncts for the management of emergencies can be obtained by keeping current with resuscitation courses, such as Pediatric Advanced Life Support and Advanced Pediatric Life Support or other approved programs.

Patient Simulators

Advances in technology, particularly patient simulators that allow a variety of programmed adverse events such as apnea, bronchospasm, laryngospasm, response to medical interventions, and printouts of physiologic parameters, are now available. The use of such devices is encouraged to better train medical professionals to respond more appropriately and effectively to rare events.[178–180]

Monitoring During MRI

The powerful magnetic field and the generation of radio frequency emissions necessitate the use of special equipment to provide continuous patient monitoring throughout the MRI procedure. Pulse oximeters capable of continuous function during scanning should be used in any sedated or restrained pediatric patient. Thermal injuries can result if appropriate precautions are not

taken; avoid coiling the oximeter wire and place the probe as far from the magnetic coil as possible to diminish the possibility of injury. Electrocardiogram monitoring during MRI has been associated with thermal injury; special MRI-compatible ECG pads are essential to allow safe monitoring.[181–184] Expired carbon dioxide monitoring is strongly encouraged in this setting.

Nitrous Oxide

Inhalation sedation/analgesia equipment that delivers nitrous oxide must have the capacity of delivering 100% and never less than 25% oxygen concentration at a flow rate appropriate to the size of the patient. Equipment that delivers variable ratios of nitrous oxide to oxygen and that has a delivery system that covers the mouth and nose must be used in conjunction with a calibrated and functional oxygen analyzer. All nitrous oxide-to-oxygen inhalation devices should be calibrated in accordance with appropriate state and local requirements. Consideration should be given to the National Institute of Occupational Safety and Health Standards for the scavenging of waste gases.[185] Newly constructed or reconstructed treatment facilities, especially those with piped-in nitrous oxide and oxygen, must have appropriate state or local inspections to certify proper function of inhalation sedation/analgesia systems before any delivery of patient care.

Nitrous oxide in oxygen with varying concentrations has been successfully used for many years to provide analgesia for a variety of painful procedures in children.[15,186–210] The use of nitrous oxide for minimal sedation is defined as the administration of nitrous oxide (50% or less) with the balance as oxygen, without any other sedative, narcotic, or other depressant drug before or concurrent with the nitrous oxide to an otherwise healthy patient in ASA class I or II. The patient is able to maintain verbal communication throughout the procedure. It should be noted that although local anesthetics have sedative properties, for purposes of this guideline, they are not considered sedatives in this circumstance. If nitrous oxide in oxygen is combined with other sedating medications, such as chloral hydrate, midazolam, or an opioid, or if nitrous oxide is used in concentrations more than 50%, the likelihood for moderate or deep sedation increases.[211,212] In this situation, the clinician must be prepared to institute the guidelines for moderate or deep sedation as indicated by the patient's response.[213]

WORK GROUP ON SEDATION

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APPENDIX 1 ASA Physical Status Classification

Class I	A normally healthy patient
Class II	A patient with mild systemic disease (eg, controlled reactive airway disease)
Class III	A patient with severe systemic disease (eg, a child who is actively wheezing)
Class IV	A patient with severe systemic disease that is a constant threat to life (eg, a child with status asthmaticus)
Class V	A moribund patient who is not expected to survive without the operation (eg, a patient with severe cardiomyopathy requiring heart transplantation)

APPENDIX 2 Recommended Discharge Criteria

1. Cardiovascular function and airway patency are satisfactory and stable.
2. The patient is easily arousable, and protective reflexes are intact.
3. The patient can talk (if age appropriate).
4. The patient can sit up unaided (if age appropriate).
5. For a very young or handicapped child incapable of the usually expected responses, the presedation level of responsiveness or a level as close as possible to the normal level for that child should be achieved.
6. The state of hydration is adequate.

APPENDIX 3 Drugs That May Be Needed to Rescue a Sedated Patient

Albuterol for inhalation
Ammonia spirits
Atropine
Diphenhydramine
Diazepam
Epinephrine (1:1000, 1:10 000)
Flumazenil
Glucose (25% or 50%)
Lidocaine (cardiac lidocaine, local infiltration)
Lorazepam
Methylprednisolone
Naloxone
Oxygen
Fosphenytoin
Racemic epinephrine
Rocuronium
Sodium bicarbonate
Succinylcholine

The choice of emergency drugs may vary according to individual or procedural needs.
Source: American Society of Anesthesiologists, Task Force on Sedation and Analgesia by Non-anesthesiologists. *Anesthesiology.* 2002;96:1004–1017

APPENDIX 4 Emergency Equipment That May Be Needed to Rescue a Sedated Patient

- Intravenous equipment
  - Assorted intravenous catheters (eg, 24-, 22-, 20-, 18-, and 16-gauge)
  - Tourniquets
  - Alcohol wipes
  - Adhesive tape
  - Assorted syringes (eg, 1, 3, 5, and 10 mL)
  - Intravenous tubing
    - Pediatric drip (60 drops per mL)
    - Pediatric burette
    - Adult drip (10 drops per mL)
    - Extension tubing
    - 3-way stopcocks
  - Intravenous fluid
    - Lactated Ringer solution
    - Normal saline solution
    - $D_5$0.25 normal saline solution
  - Pediatric intravenous boards
  - Assorted intravenous needles (eg, 25-, 22-, 20-, and 18-gauge)
  - Intraosseous bone marrow needle
  - Sterile gauze pads
- Airway Management Equipment
  - Face masks
    - Infant, child, small adult, medium adult, large adult
  - Breathing bag and valve set
  - Oropharyngeal airways
    - Infant, child, small adult, medium adult, large adult
  - Nasopharyngeal airways
    - Small, medium, large
  - LMAs (1, 1.5, 2, 2.5, 3, 4, and 5)
  - Laryngoscope handles (with extra batteries)
  - Laryngoscope blades (with extra light bulbs)
    - Straight (Miller) No. 1, 2, and 3
    - Curved (Macintosh) No. 2 and 3
  - Endotracheal tubes
    - 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, and 6.0 uncuffed and 6.0, 7.0, and 8.0 cuffed
  - Stylettes (appropriate sizes for endotracheal tubes)
  - Surgical lubricant
  - Suction catheters (appropriate sizes for endotracheal tubes)
  - Yankauer-type suction
  - Nasogastric tubes
  - Nebulizer with medication kits
  - Gloves (sterile and nonsterile, latex-free)

The choice of emergency equipment may vary according to individual or procedural needs. The practitioner is referred to the SOAPME acronym described in the text in preparation for sedating a child for a procedure.

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Section on Hematology/Oncology

Guidelines for Pediatric Cancer Centers

ABSTRACT. Since the American Academy of Pediatrics published guidelines for pediatric cancer centers in 1986 and 1997, significant changes in the delivery of health care have prompted a review of the role of tertiary medical centers in the care of pediatric patients. The potential effect of these changes on the treatment and survival rates of children with cancer led to this revision. The intent of this statement is to delineate personnel and facilities that are essential to provide state-of-the-art care for children and adolescents with cancer. This statement emphasizes the importance of board-certified pediatric hematologists/oncologists, pediatric subspecialty consultants, and appropriately qualified pediatric medical subspecialists and pediatric surgical specialists overseeing the care of all pediatric and adolescent cancer patients and the need for facilities available only at a tertiary center as essential for the initial management and much of the follow-up for pediatric and adolescent cancer patients. ***Pediatrics*** **2004;113:1833–1835;** ***cancer, pediatrics, hematology, oncology, cancer center.***

INTRODUCTION

A pediatric cancer center must have the staff and facilities to ensure that the pediatric patient with cancer will receive the best care that is available for his or her diagnosis. The medical staff at such a center is composed of the primary care pediatrician, pediatric medical subspecialists, and pediatric surgical specialists—hematologists/oncologists, surgeons, urologists, neurologists, neurosurgeons, orthopedic surgeons, radiation oncologists, pathologists, child life specialists, and diagnostic radiologists. These physicians and nurse practitioners, pediatric nurses, social workers, pharmacists, nutritionists, and other allied health professionals serve as a multidisciplinary team committed to the care of the child or adolescent with cancer.

In the United States, the oncologic care of the child or adolescent with cancer should be coordinated by a pediatric hematologist/oncologist who is board certified in the subspecialty of pediatric hematology and oncology by the American Board of Pediatrics. Other subspecialists should be similarly board certified when applicable.

Oncologic care should be provided in a pediatric center that has the following personnel, facilities, and capabilities.

Personnel

- Communication with the primary pediatrician, which is essential in the provision of family-centered supportive care
- Board-certified pediatric hematologists/oncologists
- Pediatric oncology nurses who are certified in chemotherapy, knowledgeable about pediatric protocols, and experienced in the management of complications of therapy
- Board-certified radiologists with specific expertise in the diagnostic imaging of infants, children, and adolescents
- Board-certified surgeons with expertise in pediatric general surgery
- Surgical specialists with pediatric expertise (ie, training and certification, if available) in neurosurgery, urology, orthopedics, ophthalmology, otolaryngology, dentistry, and gynecology
- A board-certified radiation oncologist trained and experienced in the treatment of infants, children, and adolescents
- A board-certified pathologist with special training in the pathology of hematologic malignancies and solid tumors of children and adolescents
- Board-certified pediatric subspecialists available to participate actively in all areas of the care of the child with cancer, including anesthesiology, intensive care, infectious diseases, cardiology, neurology, endocrinology and metabolism, genetics, gastroenterology, child and adolescent psychiatry, nephrology, and pulmonology
- Pediatric physical and mental rehabilitation services including pediatric physiatry
- Pediatric (oncology) social worker(s), pediatric psychologists, child life specialists, and access to family support group services
- Pediatric nutrition experts with the capability of preparing, administering, and monitoring total parenteral nutrition

Facilities

- An immediately accessible and fully staffed, onsite pediatric intensive care unit
- Up-to-date diagnostic imaging facilities to perform radiography, computed tomography, magnetic resonance imaging, ultrasonography, radionuclide imaging, and angiography; positron-emission tomography scanning and other emerging technologies are desirable

- Up-to-date radiation-therapy equipment with facilities for treating pediatric patients
- A hematopathology laboratory capable of performing cell-phenotype analysis using flow cytometry, immunohistochemistry, molecular diagnosis, and cytogenetics and access to blast colony assays and polymerase chain reaction-based methodology
- Access to hemodialysis and/or hemofiltration and apheresis for collection and storage of hematopoietic progenitor cells

Capabilities

- A clinical chemistry laboratory with the capability to monitor antibiotic and antineoplastic drug levels
- A blood bank capable of providing a full range of products including irradiated, cytomegalovirus-negative, and leucodepleted blood components
- A pharmacy capable of accurate, well-monitored preparation and dispensing of antineoplastic agents and investigational agents
- Capability of providing sufficient isolation of patients from airborne pathogens, which could include high-efficiency particulate air (HEPA) filtration or laminar flow and positive/negative pressure rooms
- Access to stem cell transplant services
- Educational and training programs for health care professionals including the primary care physician
- Coordination of services including home health, pain management, palliative, and end-of-life care
- A regularly scheduled multidisciplinary pediatric tumor board
- An established program designed to provide long-term, multidisciplinary follow-up of successfully treated patients at the original treatment center or by a team of health care professionals who are familiar with the potential adverse effects of treatment for childhood cancer
- Membership or affiliation with the Children's Oncology Group to provide access to state-of-the-art clinical trials; availability of support for coordination to track patients' progress and maintain clinical trials data
- Capability of providing parent, caregiver, and patient education
- Full-time access to translation services to ensure accurate translation and effective communication among all health care professionals and the patient and family
- An ongoing program of assessment of care for continuing quality improvement and safety
- A formal program for cancer education for the family and instruction on self-management

ROLE OF CENTERS IN DIAGNOSIS AND TREATMENT

Approximately 12 000 new cases of cancer are diagnosed in children younger than 20 years annually in the United States.[1,2] Cancer remains the second most frequent cause of death, after injury, in children older than 3 months.[3]

Great progress has been made in the development of successful treatment programs for children and adolescents with cancer. These improvements have been possible because of the availability of pediatric cancer treatment centers with collective expertise in the clinical management of children with cancer and the existence of a network of experienced investigators and allied health professionals who recognize the central importance of randomized clinical trials as the best available method for identifying more successful treatment strategies and who have the resources to evaluate new treatment modalities as they become available.

The importance of comprehensive, multidisciplinary treatment in improving patient outcome in a cost-effective manner has been well documented for children with acute lymphoblastic leukemia,[4] non–Hodgkin lymphoma,[5,6] brain tumors,[7,8] rhabdomyosarcoma,[5,8] Wilms' tumor,[9,10] and Ewing sarcoma.[5] Almost 80% of these children can be treated successfully if modern diagnostic and therapeutic approaches are initiated expeditiously.[2] Early detection, accurate diagnosis, and appropriate treatment depend on a multidisciplinary treatment approach to children and adolescents with cancer, an approach that is uniquely available at a pediatric cancer center. The roles of specialized nursing, pharmacy, rehabilitation, and paramedical personnel and access to increasingly complex equipment and facilities are critical to improving long-term survival and quality of life.

The center-based pediatric hematologist/oncologist is the coordinator for the diagnosis and treatment of most children and adolescents with cancer. Pediatric hematology/oncology is an established specialty with specific training requirements that lead to subspecialty board eligibility. Because most pediatric tumors show a striking response to specific regimens of intensive chemotherapy, pediatric hematologists/oncologists are necessarily resolute in carrying out therapies that can have devastating morbidity and appreciable mortality. For these therapies to be administered safely, a pediatric hematologist/oncologist who is trained and experienced in the management of children and adolescents with cancer and who has extensive knowledge of the relevant drug indications and toxicities must coordinate this care.

The pediatric hematologist/oncologist must be assisted by skilled nurses, social workers, pharmacists, nutritionists, and psychologists who specialize in pediatric oncology. Professional organizations such as the Association of Pediatric Oncology Nurses and Association of Pediatric Oncology Social Workers facilitate the professional growth and education of these individuals. Diagnostic radiologists and radiation oncologists with specific training and interest in pediatric oncology should be available at the pediatric cancer center. Principles of surgery that are unique to childhood tumors have evolved, and in fields such as general (pediatric) surgery, urology, neurology, and orthopedics, the presence of surgeons whose sole (or major) effort is directed toward pediatric oncology has become indispensable in achieving maximum survival.

A pathologist experienced in pediatric oncology is an essential member of the multidisciplinary team at the pediatric cancer center. State-of-the-art diagnosis of many pediatric hematologic malignancies and tumors requires immunochemistry and/or molecular techniques. Because solid tumors in children and adolescents are rare in the experience of most pathologists, an incorrect histologic diagnosis may be given when initial surgical management occurs at a nonspecialized hospital. Ideally, the diagnostic biopsy should be performed at the cancer center, at which the facilities are available to order and obtain all the special studies that would be appropriate and would obviate the need for subjecting the patient to repeat procedures.

PRACTICE OF PEDIATRIC ONCOLOGY OUTSIDE RECOGNIZED CENTERS

The clinical results in children with cancer have been shown to be superior when specialized diagnostic, supportive, and specific care is given at a pediatric cancer center.[4–10] After diagnosis has been established and the treatment plan has been determined by the pediatric cancer center, certain aspects of care may be continued in the office of a primary care pediatrician for selected children. When such a plan for shared treatment is undertaken, it must be with the understanding that the child will be referred back to the pediatric cancer center if complications develop or there is recurrence of the tumor. For many children, the facilities and expertise available at the pediatric cancer center are required for all aspects of therapy. However, it must be emphasized that the primary care pediatrician should retain an important supportive role for the patient with cancer and his or her family, which requires excellent regular communication between the oncologist and the pediatrician.

SUMMARY

On the basis of the effectiveness of pediatric cancer centers in treating children and adolescents with cancer, the American Academy of Pediatrics recommends the following:

- Children and adolescents with newly suspected and/or recurrent malignancy should be referred to a pediatric cancer center for prompt and accurate diagnosis and management.
- Children and adolescents with newly diagnosed and/or recurrent malignancies should have their treatment coordinated by a board-certified pediatric hematologist/oncologist; treatment should be prescribed and initiated at a pediatric cancer center but may be continued at a center not specialized in the care of the pediatric oncology patient under the continuing oversight of the center's multidisciplinary team.
- Multidisciplinary team members should have pediatric expertise within their specialty area.

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AMERICAN ACADEMY OF PEDIATRICS

Section on Cardiology and Cardiac Surgery

Guidelines for Pediatric Cardiovascular Centers

ABSTRACT. Pediatric cardiovascular centers should aim to provide high-quality therapeutic outcomes for infants and children with congenital and acquired heart diseases. This policy statement describes critical elements and organizational features of centers in which high-quality outcomes have the greatest likelihood of occurring. Center elements include noninvasive diagnostic modalities, cardiac catheterization, cardiovascular surgery, and cardiovascular intensive care. These elements should be organizationally united in centers in which pediatric cardiac physician specialists and specialized pediatric staff work together to achieve and surpass existing quality-of-care benchmarks.

ABBREVIATIONS. AAP, American Academy of Pediatrics; ECMO, extracorporeal membrane oxygenator; ICU, intensive care unit; ICAEL, Intersocietal Commission for the Accreditation of Echocardiography Laboratories; VAD, ventricular assist device.

INTRODUCTION

This policy statement supersedes "Guidelines for Pediatric Cardiology Diagnostic and Treatment Centers" published by the American Academy of Pediatrics (AAP) in 1991.[1] The objective of the 1991 statement was to describe the clinical and physical environment in which the pediatric patient with heart disease could undergo accurate and safe diagnostic and therapeutic procedures. Over the past decade, there have been changes in technology and clinical practice that render many aspects of the 1991 guidelines incomplete or obsolete. Recognizing the broadened scope of interaction between medical and surgical disciplines, this revised policy statement redesignates the pediatric cardiology center as the "pediatric cardiovascular center." The aim of this statement is to describe the configuration and critical elements of the pediatric cardiovascular center in which high-quality outcomes have the greatest likelihood of occurring.

CENTER CONFIGURATION

A pediatric cardiovascular center should be able to provide all of the sophisticated diagnostic services and the full range of treatments, interventions, and surgeries needed to produce high-quality outcomes in all pediatric patients with congenital and acquired heart diseases. Physicians and staff should function as a team and should include adequate numbers of qualified pediatric cardiologists, pediatric cardiovascular surgeons, pediatric cardiovascular anesthesiologists, pediatric intensive care physicians, and/or neonatologists with special expertise in the care of cardiac patients, and additional pediatric specialists required for the overall care of patients. Diagnostic elements should include a fully equipped pediatric echocardiography laboratory, a pediatric cardiac catheterization and electrophysiology laboratory, and appropriate additional facilities and capabilities for comprehensive laboratory and noninvasive diagnostic evaluations of critically ill children. Therapeutic components should include a pediatric cardiac catheterization laboratory equipped for interventional cardiology and transcatheter radiofrequency ablations, a cardiac operating suite suitable for surgical treatment of all pediatric cardiovascular patients, an extracorporeal membrane oxygenator (ECMO), and a cardiac intensive care unit (ICU) or pediatric ICU and/or neonatal ICU equipped and staffed to care for pediatric cardiovascular patients.

Pediatric cardiology practices, which do not have the configuration and the elements of a pediatric cardiovascular center, may provide triage and emergency care, care of strictly medical cardiovascular conditions, and ongoing joint management (together with a center) of patients after surgery or catheter interventions at the center. This statement does not make specific recommendations regarding such practices.

NONINVASIVE DIAGNOSTIC ELEMENTS

A pediatric echocardiographic laboratory is principal among a center's noninvasive diagnostic elements. Existing data suggest that pediatric patients are not optimally served in laboratories primarily geared for adult echocardiography[2,3]; thus, most pediatric cardiology programs should have dedicated pediatric echocardiography laboratories. The AAP endorses accreditation by the Intersocietal Commission for the Accreditation of Echocardiography Laboratories (ICAEL) and adherence to the guidelines promulgated by the American College of Cardiology and the American Heart Association[4] as means to ensure pediatric echocardiography laboratory standards are met. For ICAEL accreditation of pediatric transthoracic, transesophageal, or fetal echocardiography, a laboratory must show that it has state-of-the-art equipment and facilities suitable for children, follows good technique in recording and reporting examinations, and is staffed by physicians and technicians trained in pediatric echocardiography. The ICAEL mandates that the laboratory and its mobile or satellite locations are supervised by a medical

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

director (pediatric cardiologist) and a technical director (pediatric echocardiography technician) and sets standards for training and experience of these individuals. The medical director and other physicians who interpret echocardiograms and/or perform fetal or transesophageal echocardiography and technicians who staff the laboratory or its peripheral sites must meet the American Society of Echocardiography's guidelines for appropriate training[5–7] and must also satisfy ICAEL requirements for ongoing experience.

Pediatric cardiovascular centers should adhere to American Heart Association guidelines for exercise testing in pediatric patients.[8] Because equipment and expertise appropriate for pediatric patients are needed, in most clinical settings, establishment of a pediatric exercise laboratory separate from existing adult laboratories is appropriate. Pediatric exercise laboratories must have a knowledgeable physician director and staff with competence in exercise testing and interpretation in young patients with disorders of varying severity.[9] Pediatric resuscitative equipment must be immediately available to the laboratory.

Additional essential noninvasive elements of a pediatric cardiovascular center, which should be directed by a pediatric cardiologist, include electrocardiography, holter monitoring, transient arrhythmia monitoring, and pacemaker evaluation. Proper application of these tests requires appropriate physician expertise and personnel familiar with the unique requirements of pediatric patients.

Pediatric cardiovascular centers should also have access to tilt-table testing and additional imaging capabilities, such as magnetic resonance imaging and computed tomography. This equipment may be shared with adult patient departments. However, if shared, a pediatric cardiologist with expertise in the pediatric cardiovascular applications of these modalities should collaborate with other specialists to ensure diagnostic-quality pediatric cardiovascular studies.

CARDIAC CATHETERIZATION

The American College of Cardiology and the Society for Cardiac Angiography and Interventions have developed catheterization laboratory standards (including recommendations for pediatric catheterization laboratories).[10] The AAP endorses these standards with respect to the recommendations regarding pediatric cardiac catheterization laboratories.

Cardiac catheterization continues to be a definitive diagnostic modality that provides hemodynamic, anatomic, and electrophysiologic data critical for patient care. Transcatheter therapeutic interventions have become common but more complicated.[11,12] Furthermore, transcatheter radiofrequency ablation has become the standard definitive treatment of pathologic tachycardias. Because of the expanded role of cardiac catheterization, high-quality catheterization services are more important than they were in the past.

A number of factors help to ensure high-quality pediatric cardiac catheterization care. A board-certified pediatric cardiologist who has additional fellowship training (or qualifying experience) in pediatric catheterization and interventional procedures should direct the pediatric catheterization laboratory. The pediatric catheterization laboratory director should have responsibility for all aspects of the administration and function of the laboratory (including quality assessment and quality improvement activities). In addition to technicians trained in pediatric catheterization, staffing of every procedure should include a minimum of 1 board-certified (or board-eligible) pediatric cardiologist and 1 pediatric nurse with training and experience in pediatric airway management and sedation.

The pediatric catheterization laboratory should have biplane imaging equipment with a moveable C-arm, immediate replay capabilities (preferably digital), a physiologic recorder, a blood gas analyzer, a pulse oximeter, an infant warming device, pacing catheters and an external pacemaker, a defibrillator and an emergency cart, and a comprehensive inventory of pediatric catheters, devices, and expendables. There should be an appropriate ICU available to care for patients before and after cardiac catheterization, and interventional procedures require the availability of in-hospital pediatric cardiac surgery backup.

Each cardiac catheterization program should strive to achieve high-quality outcomes with low morbidity and mortality. Data should be gathered prospectively to document quality of care. There should be systematic review of all case outcomes and procedural complications at regular catheterization quality assurance conferences. Recent studies of pediatric catheterization demonstrate that catheterization-related mortality rates much less than 1% are achievable (with mortality essentially confined to emergency cases in neonates and high-risk interventional cases). In addition, an incidence of major complications (defined as potentially life-threatening events) less than 3% is also attainable.[13,14] Another study showed that fewer than 4% of transcatheter interventional procedures should require surgical intervention because of complications.[15] Furthermore, in radiofrequency ablation procedures, data show that permanent complete heart block rates less than 2% are common.[16] All pediatric cardiac catheterization laboratories should strive to achieve and exceed these benchmarks.

In pediatric cardiac catheterization and intervention, data relating outcomes and laboratory or operator case volume are not currently available. However, data indicate that coronary interventional outcomes are improved if operators exceed a certain number of individual cases annually.[17] Given the wide range of procedures performed and the variety of rare diagnoses treated in pediatric cardiology, pediatric cardiology centers performing a small number of catheterizations should restrict the activity to 1 or 2 cardiologists so that operators maintain their clinical skills.

CARDIOVASCULAR SURGERY

In 1991, the American College of Surgeons published guidelines for minimal standards in cardiac

surgery, including recommendations with respect to hospitals operating on children with congenital heart disease.[18] These recommendations are outdated.

In the current era, hospital mortality rates less than 1% are achievable for simpler forms of congenital heart disease (eg, atrial septal defect, ventricular septal defect, coarctation of the aorta), and significant postoperative morbidity among such patients has been rare.[19–22] For more complex lesions, risks are greater. However, for lesions such as tetralogy of Fallot, complete atrioventricular canal defect, and transposition of the great arteries without additional complicating defects or conditions, hospital mortality rates less than 5% are attainable.[19,23–25] Patients who have more complex disease or who are more ill experience higher morbidity and mortality but have usually been best served in experienced surgical environments with consistent excellent outcomes among patients with more complicated illness. Furthermore, to offer patients a full range of surgical treatments, centers have offered pediatric cardiac transplant (as centers certified by the United Network for Organ Sharing) or have been closely affiliated with a certified transplant center. All pediatric cardiovascular centers should strive to achieve and surpass these benchmarks and should provide or have available heart replacement services.

A major objective of this statement is to describe the surgical environment associated with high-quality outcomes. Surgical outcomes are enhanced by early patient referral, definitive anatomic and physiologic diagnosis, and optimal preoperative and postoperative care. Parental counseling and planning of the timing and nature of surgical intervention should be accomplished by a team skilled in the care and treatment of pediatric heart disease and responsible for the care of the patient. Team members should include cardiac surgeons, cardiologists, anesthesiologists, intensive care physicians, neonatologists, nurses, and perfusionists.

Expert, experienced congenital heart surgeons are required for staffing a pediatric cardiovascular surgical program. Surgical training (after cardiac surgery residency) requires 2 years of pediatric cardiac surgery fellowship and additional years working as a junior staff surgeon in a pediatric and congenital heart program with high volume and demonstrated high-quality outcomes.

A dedicated team of anesthesiologists, perfusionists, operating room nurses, and technicians should be available to support all pediatric cardiovascular surgical procedures. Anesthesiologists should have pediatric and pediatric cardiac anesthetic training and experience with expertise in dealing with the problems arising from complicated interactions between the cardiac pathophysiology, surgical procedures, and anesthetic techniques. Perfusionists should be dedicated to the pediatric cardiovascular surgery program and have training, knowledge, and experience with small body perfusion, ECMO, and ventricular assist devices (VADs), including set up, delivery, and maintenance of these systems. Operating room nurses should be dedicated pediatric cardiovascular operating room nurses with training, knowledge, and experience in pediatric cardiac operative techniques and requirements. Likewise, technicians should be appropriately trained and experienced permanent members of the operating team.

One or more operating rooms should be specifically designated and designed for pediatric cardiovascular procedures. Each room should be large and should include a positive-pressure climate control system capable of maintaining humidity at 55% and changing room temperature by 20°F within 15 to 20 minutes. The operating room is best located near the postoperative ICU. The operating room should be equipped with a cardiopulmonary bypass machine, which can deliver precise volumes at low flows against varying impedance with minimal blood trauma. Anesthetic equipment should be suitable for the smallest patients and appropriate also for adult patients.

Clinical data on patients who undergo cardiac surgery should be recorded prospectively in a comprehensive database. A quality assurance program responsible for monitoring and evaluating surgical outcomes should be in place. This program should also review individual deaths and major complications.

CARDIOVASCULAR INTENSIVE CARE

Although cardiac intensive care may be required for patients before surgery, before or after cardiac catheterization, and for medical conditions, the highest level of care is most often required for patients after cardiac surgery. Thus, the ICU providing care for cardiovascular patients should be a cardiac unit organized specifically to provide postoperative care for pediatric heart patients or it should be a pediatric ICU that satisfies AAP guidelines for level I pediatric ICUs[26] (currently being revised) and/or a subspeciality neonatal ICU that satisfies guidelines for perinatal care.[27] Pediatric ICUs and subspeciality neonatal ICUs should be organized to routinely provide postoperative care for pediatric heart patients.

The ICU should be equipped and staffed to provide the following services 24 hours a day, 7 days a week: respiratory support, using the full range of mechanical ventilators and gases (such as nitric oxide and carbon dioxide); complete hemodynamic and cardiac rhythm monitoring and recording; cardiac pacing; open- and closed-chest resuscitation and operating; and ECMO and VADs. Blood gas and basic biochemistry laboratory determinations, radiologic services, echocardiography, and cardiac catheterization should also be available 24 hours a day, 7 days a week.

The ICU staff should include a medical director who should have fellowship training, experience, and specific expertise in the postoperative care of pediatric heart patients. Physicians with primary responsibility for cardiovascular patient care should provide in-house supervision of the unit 24 hours a day, 7 days a week. Coverage by pediatric cardiac surgeons and pediatric cardiologists capable of performing complete echocardiographic assessments

and cardiac catheterization should be available 24 hours a day, 7 days a week. In addition, pediatric subspecialty physicians and surgeons with expertise in critical disease of all other organ systems should be readily available for consultation. ICU nurses should have training and experience in the postoperative intensive care of pediatric heart patients. The nursing staff should be dedicated to the ICU and sufficient to provide 1-to-1 coverage of all high-acuity patients. Appropriate additional staff, such as respiratory therapy technicians, should also be available 24 hours a day, 7 days a week.

RELATIONSHIP OF THE PEDIATRIC CARDIOVASCULAR CENTER TO THE HEALTH CARE ENVIRONMENT

Pediatric cardiovascular centers are established and constituted to provide high-quality cardiac care for pediatric patients. Centers are usually components of pediatric tertiary health care systems. As such and by definition, centers should support and complement related tertiary pediatric programs and centers.

Even more importantly, pediatric cardiovascular centers serve patients within family, school, and community environments. To deliver high-quality cardiac care, centers should partner with primary health care systems and practitioners in cardiovascular disease. Center physicians, particularly pediatric cardiologists, should maintain ongoing dialogue with pediatricians and other primary care practitioners regarding individual patient care plans and problems; case management should be a joint project. In addition, center physicians, in cooperation with the primary care practice team, should be responsible for education of and communication with families and school and community authorities regarding all aspects of patients' cardiovascular care. Other personnel in pediatric cardiovascular centers, such as nurse practitioners, social workers, and patient care representatives, may also be instrumental in these relationships and activities.

QUALITY OF CARE

Existing evidence suggests that certain practices promote high-quality outcomes. Thus, pediatric cardiovascular centers should strive to 1) participate in a regional health care network, 2) use modern information technology, and 3) maintain adequate case volumes to achieve and demonstrate high-quality therapeutic outcomes.

Early experience with regional networks for perinatal and neonatal care and pioneering efforts in regionalizing infant cardiac care by 11 pediatric cardiac centers in 6 states (the New England Regional Infant Cardiac Program) suggest that participation in a regional network of health care providers results in improved outcomes for mothers, infants, and children with heart disease.[28–30] Furthermore, the Northern New England Cardiovascular Disease Study Group has shown that regional intervention, including feedback of outcome data, training in continuous quality improvement techniques, and site visits to other medical centers, improves hospital mortality rates associated with coronary artery bypass surgery.[31] In pediatric cardiology, the Pediatric Cardiac Care Consortium has demonstrated the feasibility of quality improvement as the result of participation in a physician-directed clinical database.[32] Moreover, in many areas of health care, regionalization has been shown to improve access while decreasing costs, numbers of hospital beds, and inpatient days and average length of stay.[33–35]

Improvements in quality of care have been linked to information technology and automated information and decision support systems. There is evidence to suggest that the number of preventable errors can be decreased by use of better information systems that disseminate knowledge about drugs and make drug and patient information readily accessible in a timely manner.[36] Furthermore, computerized drug order entry systems have been shown to decrease the number of errors[37]; computerized laboratory data can alert clinicians to abnormal lab values[38]; and the use of a computerized physician order entry, in which physicians enter and transmit medication orders online, can prevent medication errors attributable to misinterpretation of handwritten orders.[39]

Finally, pediatric heart surgery is one of several classes of procedures for which lower mortality rates have been demonstrated at high-volume hospitals.[40] The relation of in-hospital mortality rates to case volume for congenital heart surgery has been examined in studies using statewide administrative data.[41–44] All have shown a significant correlation between improvement in severity-adjusted mortality rate and increasing institutional case volume. However, institutional case volume explains only a relatively small fraction of the variability in outcomes among pediatric heart surgery programs, and uncommon outcomes such as mortality are difficult to measure with statistical precision for smaller programs. Thus, although "high volume" ensures a certain degree of quality, there is no consistent relationship between quality and "low volume." It is probable that a number of low-volume centers have consistent and excellent results, but the identifiers of these centers have not been elucidated. Quality indicators other than in-hospital mortality rates must be developed to aid in the validation of quality, especially in smaller centers.

CONCLUSION

The quality of outcomes in pediatric cardiovascular centers is the most important measure of center activity. Although outcome assessment in pediatric cardiovascular surgery and intervention is currently rudimentary, basic outcome benchmarks are available and have been incorporated into the guidelines in this statement. Additional outcomes research is ongoing, and future guidelines will require modification to accommodate the results of this research. Nevertheless, the AAP recommends that pediatric cardiovascular centers document and analyze their individual outcomes, strive to achieve and surpass existing quality benchmarks, and commit to contin-

uous quality improvement methodology in all of their programs.

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Recommendations of CDC, the Infectious Disease Society of America, and the American Society of Blood and Marrow Transplantation

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES
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Contents

Contents — Continued

Contents — Continued

Abbreviations Used in This Publication

ANC	absolute neutrophil count
BAL	bronchoalveolar lavage
CDA	chlorodeoxyadenosine
CJD	Creutzfeldt-Jakob disease
CMV	cytomegalovirus
CRV	community-acquired respiratory virus
DNA	deoxyribonucleic acid
EBV	Epstein-Barr virus
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
G-CSF	granulocyte colony-stimulating factor (filgastrim)
GM-CSF	granulocyte-macrophage colony-stimulating factor (sargramostim)
GVHD	graft-versus-host disease
HCW	health-care worker
HEPA filter	high-efficiency (>90%) particulate air filter
Hib	*Haemophilus influenzae* type b
HIV	human immunodeficiency virus
HLA	human lymphocyte antigen
HSCT	hematopoietic stem cell transplant; for this report, includes all blood- and marrow-derived hematopoietic stem cell transplants
HSV	herpes simplex virus
HTLV	human T-lymphotropic virus
IgA	immunoglobulin A
IgG	immunoglobulin G
IgM	immunoglobulin M
IVIG	intravenous immunoglobulin
LAF	laminar air flow
LD	Legionnaires' disease
LRI	lower respiratory infection
MIC	minimum inhibitory concentration
MRSA	methicillin-resistant *Staphylococcus aureus*
nvCJD	new variant Creutzfeldt-Jakob disease
OI	opportunistic infection
PCP	*Pneumocystis carinii* pneumonia
PCR	polymerase chain reaction
PZA/RIF	pyrazinamide/rifampin
RNA	ribonucleic acid
RSV	respiratory syncytial virus
TB	*Mycobacteria tuberculosis*
TMP-SMZ	trimethoprim-sulfamethasaxole
TST	tuberculin skin test
UCB	umbilical cord blood
URI	upper respiratory infection
VRE	vancomycin-resistant *Enterococcus*
VZIG	varicella-zoster immunoglobulin
VZV	varicella-zoster virus

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Guidelines for Preventing Opportunistic Infections Among Hematopoietic Stem Cell Transplant Recipients

Recommendations of CDC, the Infectious Disease Society of America, and the American Society of Blood and Marrow Transplantation

Summary

CDC, the Infectious Disease Society of America, and the American Society of Blood and Marrow Transplantation have cosponsored these guidelines for preventing opportunistic infections (OIs) among hematopoietic stem cell transplant (HSCT) recipients. The guidelines were drafted with the assistance of a working group of experts in infectious diseases, transplantation, and public health. For the purposes of this report, HSCT is defined as any transplantation of blood- or marrow-derived hematopoietic stem cells, regardless of transplant type (i.e., allogeneic or autologous) or cell source (i.e., bone marrow, peripheral blood, or placental or umbilical cord blood). Such OIs as bacterial, viral, fungal, protozoal, and helminth infections occur with increased frequency or severity among HSCT recipients. These evidence-based guidelines contain information regarding preventing OIs, hospital infection control, strategies for safe living after transplantation, vaccinations, and hematopoietic stem cell safety. The disease-specific sections address preventing exposure and disease for pediatric and adult and autologous and allogeneic HSCT recipients. The goal of these guidelines is twofold: to summarize current data and provide evidence-based recommendations regarding preventing OIs among HSCT patients. The guidelines were developed for use by HSCT recipients, their household and close contacts, transplant and infectious diseases physicians, HSCT center personnel, and public health professionals. For all recommendations, prevention strategies are rated by the strength of the recommendation and the quality of the evidence supporting the recommendation. Adhering to these guidelines should reduce the number and severity of OIs among HSCT recipients.

INTRODUCTION

In 1992, the Institute of Medicine (*1*) recommended that CDC lead a global effort to detect and control emerging infectious agents. In response, CDC published a plan (*2*) that outlined national disease prevention priorities, including the development of guidelines for preventing opportunistic infections (OIs) among immunosuppressed persons. During 1995, CDC published guidelines for preventing OIs among persons infected with human immunodeficiency virus (HIV) and revised those guidelines during 1997 and 1999 (*3–5*). Because of the success of those guidelines, CDC sought to determine the need for expanding OI prevention activities to other immunosuppressed populations. An informal survey of hematology, oncology, and infectious disease specialists at transplant centers

and a working group formed by CDC determined that guidelines were needed to help prevent OIs among hematopoietic stem cell transplant (HSCT)* recipients.

The working group defined OIs as infections that occur with increased frequency or severity among HSCT recipients, and they drafted evidence-based recommendations for preventing exposure to and disease caused by bacterial, fungal, viral, protozoal, or helminthic pathogens. During March 1997, the working group presented the first draft of these guidelines at a meeting of representatives from public and private health organizations. After review by that group and other experts, these guidelines were revised and made available during September 1999 for a 45-day public comment period after notification in the *Federal Register*. Public comments were added when feasible, and the report was approved by CDC, the Infectious Disease Society of America, and the American Society of Blood and Marrow Transplantation. The pediatric content of these guidelines has been endorsed also by the American Academy of Pediatrics. The hematopoietic stem cell safety section was endorsed by the International Society of Hematotherapy and Graft Engineering.

The first recommendations presented in this report are followed by recommendations for hospital infection control, strategies for safe living, vaccinations, and hematopoietic stem cell safety. Unless otherwise noted, these recommendations address allogeneic and autologous and pediatric and adult HSCT recipients. Additionally, these recommendations are intended for use by the recipients, their household and other close contacts, transplant and infectious diseases specialists, HSCT center personnel, and public health professionals.

Using These Guidelines

For all recommendations, prevention strategies are rated by the strength of the recommendation (Table 1) and the quality of the evidence (Table 2) supporting the recommendation. The principles of this rating system were developed by the Infectious Disease Society of America and the U.S. Public Health Service for use in the guidelines for preventing OIs among HIV-infected persons (*3–6*). This rating system allows assessments of recommendations to which adherence is critical.

BACKGROUND

HSCT is the infusion of hematopoietic stem cells from a donor into a patient who has received chemotherapy, which is usually marrow-ablative. Increasingly, HSCT has been used to treat neoplastic diseases, hematologic disorders, immunodeficiency syndromes, congenital enzyme deficiencies, and autoimmune disorders (e.g., systemic lupus erythematosus or multiple sclerosis) (*7–10*). Moreover, HSCT has become standard treatment for selected conditions (*7,11,12*). Data from the International Bone Marrow Transplant Registry and the Autologous Blood and Marrow Transplant Registry indicate that approximately 20,000 HSCTs were performed in North America during 1998 (Statistical

*For this report, HSCT is defined as any transplantation of blood- or marrow-derived hematopoietic stem cells, regardless of transplant type (e.g., allogeneic or autologous) or cell source (e.g., bone marrow, peripheral blood, or placental/umbilical cord blood). In addition, HSCT recipients are presumed immunocompetent at ≥24 months after HSCT if they are not on immunosuppressive therapy and do not have graft-versus-host disease (GVHD), a condition that occurs when the transplanted cells recognize that the recipient's cells are not the same cells and attack them.

Center of the International Bone Marrow Transplant Registry and Autologous Blood and Marrow Transplant Registry, unpublished data, 1998).

HSCTs are classified as either allogeneic or autologous on the basis of the source of the transplanted hematopoietic progenitor cells. Cells used in allogeneic HSCTs are harvested from a donor other than the transplant recipient. Such transplants are the most effective treatment for persons with severe aplastic anemia (*13*) and offer the only curative therapy for persons with chronic myelogenous leukemia (*12*). Allogeneic donors might be a blood relative or an unrelated donor. Allogeneic transplants are usually most successful when the donor is a human lymphocyte antigen (HLA)-identical twin or matched sibling. However, for allogeneic candidates who lack such a donor, registry organizations (e.g., the National Marrow Donor Program) maintain computerized databases that store information regarding HLA type from millions of volunteer donors (*14–16*). Another source of stem cells for allogeneic candidates without an HLA-matched sibling is a mismatched family member (*17,18*). However, persons who receive allogeneic grafts from donors who are not HLA-matched siblings are at a substantially greater risk for graft-versus-host disease (GVHD) (*19*). These persons are also at increased risk for suboptimal graft function and delayed immune system recovery (*19*). To reduce GVHD among allogeneic HSCTs, techniques have been developed to remove T-lymphocytes, the principal effectors of GVHD, from the donor graft. Although the recipients of T-lymphocyte–depleted marrow grafts generally have lower rates of GVHD, they also have greater rates of graft rejection, cytomegalovirus (CMV) infection, invasive fungal infection, and Epstein-Barr virus (EBV)-associated posttransplant lymphoproliferative disease (*20*).

The patient's own cells are used in an autologous HSCT. Similar to autologous transplants are syngeneic transplants, among whom the HLA-identical twin serves as the donor. Autologous HSCTs are preferred for patients who require high-level or marrow-ablative chemotherapy to eradicate an underlying malignancy but have healthy, undiseased bone marrows. Autologous HSCTs are also preferred when the immunologic antitumor effect of an allograft is not beneficial. Autologous HSCTs are used most frequently to treat breast cancer, non-Hodgkin's lymphoma, and Hodgkin's disease (*21*). Neither autologous nor syngeneic HSCTs confer a risk for chronic GVHD.

Recently, medical centers have begun to harvest hematopoietic stem cells from placental or umbilical cord blood (UCB) immediately after birth. These harvested cells are used primarily for allogeneic transplants among children. Early results demonstrate that greater degrees of histoincompatibility between donor and recipient might be tolerated without graft rejection or GVHD when UCB hematopoietic cells are used (*22–24*). However, immune system function after UCB transplants has not been well-studied.

HSCT is also evolving rapidly in other areas. For example, hematopoietic stem cells harvested from the patient's peripheral blood after treatment with hematopoietic colony-stimulating factors (e.g., granulocyte colony-stimulating factor [G-CSF or filgastrim] or granulocyte-macrophage colony-stimulating factor [GM-CSF or sargramostim]) are being used increasingly among autologous recipients (*25*) and are under investigation for use among allogeneic HSCT. Peripheral blood has largely replaced bone marrow as a source of stem cells for autologous recipients. A benefit of harvesting such cells from the donor's peripheral blood instead of bone marrow is that it eliminates the need for general anesthesia associated with bone marrow aspiration.

GVHD is a condition in which the donated cells recognize the recipient's cells as nonself and attack them. Although the use of intravenous immunoglobulin (IVIG) in the

routine management of allogeneic patients was common in the past as a means of producing immune modulation among patients with GVHD, this practice has declined because of cost factors (*26*) and because of the development of other strategies for GVHD prophylaxis (*27*). For example, use of cyclosporine GVHD prophylaxis has become commonplace since its introduction during the early 1980s. Most frequently, cyclosporine or tacrolimus (FK506) is administered in combination with other immunosuppressive agents (e.g., methotrexate or corticosteroids) (*27*). Although cyclosporine is effective in preventing GVHD, its use entails greater hazards for infectious complications and relapse of the underlying neoplastic disease for which the transplant was performed.

Although survival rates for certain autologous recipients have improved (*28,29*), infection remains a leading cause of death among allogeneic transplants and is a major cause of morbidity among autologous HSCTs (*29*). Researchers from the National Marrow Donor Program reported that, of 462 persons receiving unrelated allogeneic HSCTs during December 1987–November 1990, a total of 66% had died by 1991 (*15*). Among primary and secondary causes of death, the most common cause was infection, which occurred among 37% of 307 patients (*15*).*

Despite high morbidity and mortality after HSCT, recipients who survive long-term are likely to enjoy good health. A survey of 798 persons who had received an HSCT before 1985 and who had survived for >5 years after HSCT, determined that 93% were in good health and that 89% had returned to work or school full time (*30*). In another survey of 125 adults who had survived a mean of 10 years after HSCT, 88% responded that the benefits of transplantation outweighed the side effects (*31*).

Immune System Recovery After HSCT

During the first year after an HSCT, recipients typically follow a predictable pattern of immune system deficiency and recovery, which begins with the chemotherapy or radiation therapy (i.e., the conditioning regimen) administered just before the HSCT to treat the underlying disease. Unfortunately, this conditioning regimen also destroys normal hematopoiesis for neutrophils, monocytes, and macrophages and damages mucosal progenitor cells, causing a temporary loss of mucosal barrier integrity. The gastrointestinal tract, which normally contains bacteria, commensal fungi, and other bacteria-carrying sources (e.g., skin or mucosa) becomes a reservoir of potential pathogens. Virtually all HSCT recipients rapidly lose all T- and B-lymphocytes after conditioning, losing immune memory accumulated through a lifetime of exposure to infectious agents, environmental antigens, and vaccines. Because transfer of donor immunity to HSCT recipients is variable and influenced by the timing of antigen exposure among donor and recipient, passively acquired donor immunity cannot be relied upon to provide long-term immunity against infectious diseases among HSCT recipients.

During the first month after HSCT, the major host-defense deficits include impaired phagocytosis and damaged mucocutaneous barriers. Additionally, indwelling intravenous catheters are frequently placed and left in situ for weeks to administer parenteral medications, blood products, and nutritional supplements. These catheters serve as another portal of entry for opportunistic pathogens from organisms colonizing the skin (e.g., coagulase-negative *Staphylococci*, *Staphylococcus aureus*, *Candida* species, and *Enterococci*) (*32,33*).

*Presently, no updated data have been published.

Engraftment for adults and children is defined as the point at which a patient can maintain a sustained absolute neutrophil count (ANC) of >500/mm^3 and sustained platelet count of ≥20,000, lasting ≥3 consecutive days without transfusions. Among unrelated allogeneic recipients, engraftment occurs at a median of 22 days after HSCT (range: 6–84 days) (*15*). In the absence of corticosteroid use, engraftment is associated with the restoration of effective phagocytic function, which results in a decreased risk for bacterial and fungal infections. However, all HSCT recipients and particularly allogeneic recipients, experience an immune system dysfunction for months after engraftment. For example, although allogeneic recipients might have normal total lymphocyte counts within ≥2 months after HSCT, they have abnormal CD4/CD8 T-cell ratios, reflecting their decreased CD4 and increased CD8 T-cell counts (*27*). They might also have immunoglobulin G ($IgG)_2$, IgG_4, and immunoglobulin A (IgA) deficiencies for months after HSCT and have difficulty switching from immunoglobulin M (IgM) to IgG production after antigen exposure (*32*). Immune system recovery might be delayed further by CMV infection (*34*).

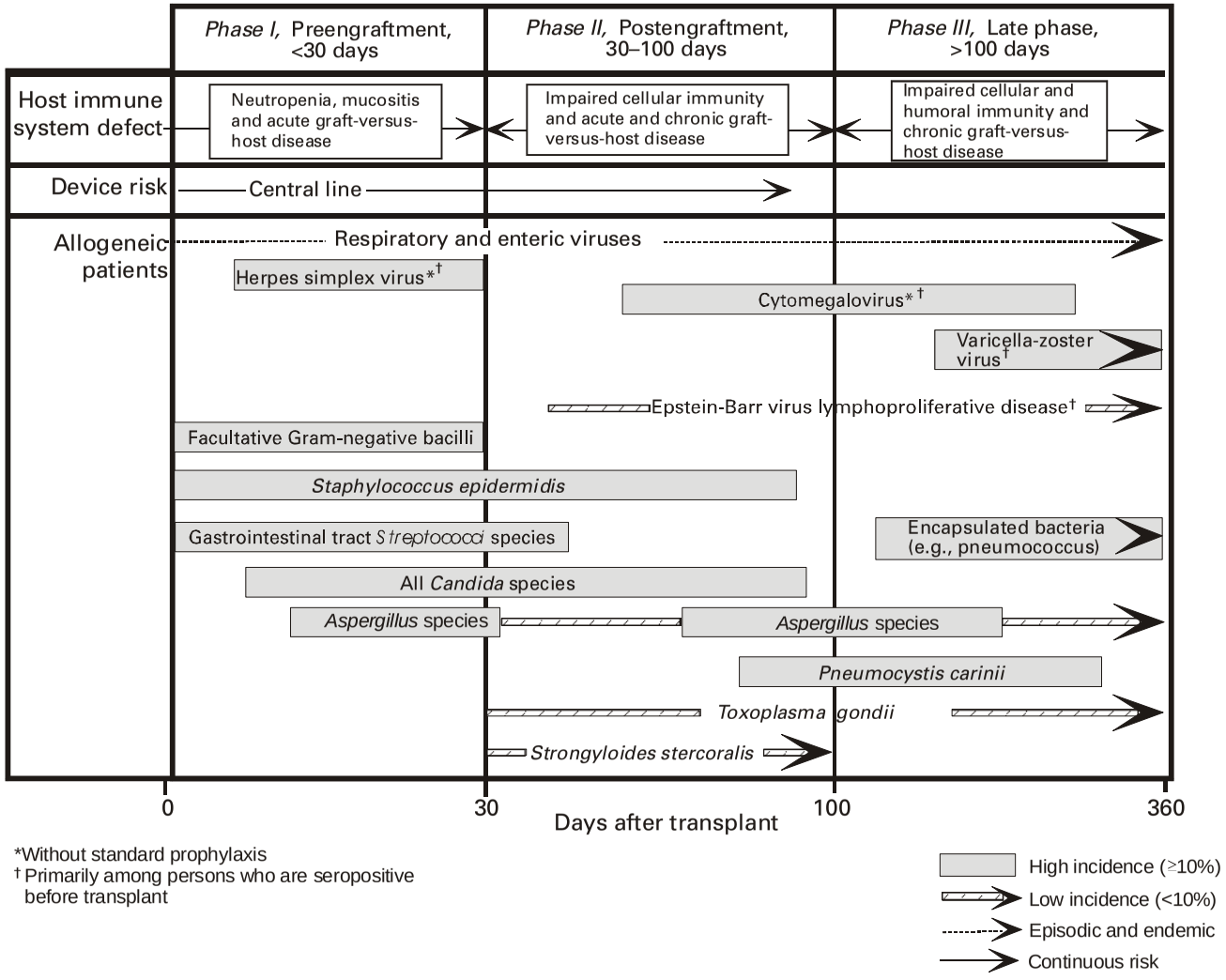
During the first ≥2 months after HSCT, recipients might experience acute GVHD that manifests as skin, gastrointestinal, and liver injury, and is graded on a scale of I–IV (*32,35,36*). Although autologous or syngeneic recipients might occasionally experience a mild, self-limited illness that is acute GVHD-like (*19,37*), GVHD occurs primarily among allogeneic recipients, particularly those receiving matched, unrelated donor transplants. GVHD is a substantial risk factor for infection among HSCT recipients because it is associated with a delayed immunologic recovery and prolonged immunodeficiency (*19*). Additionally, the immunosuppressive agents used for GVHD prophylaxis and treatment might make the HSCT recipient more vulnerable to opportunistic viral and fungal pathogens (*38*).

Certain patients, particularly adult allogeneic recipients, might also experience chronic GVHD, which is graded as either limited or extensive chronic GVHD (*19,39*). Chronic GVHD appears similar to autoimmune, connective-tissue disorders (e.g., scleroderma or systemic lupus erythematosus) (*40*) and is associated with cellular and humoral immunodeficiencies, including macrophage deficiency, impaired neutrophil chemotaxis (*41*), poor response to vaccination (*42–44*), and severe mucositis (*19*). Risk factors for chronic GVHD include increasing age, allogeneic HSCT (particularly those among whom the donor is unrelated or a non-HLA identical family member) (*40*), and a history of acute GVHD (*24,45*). Chronic GVHD was first described as occurring >100 days after HSCT but can occur 40 days after HSCT (*19*). Although allogeneic recipients with chronic GVHD have normal or high total serum immunoglobulin levels (*41*), they experience long-lasting IgA, IgG, and IgG subclass deficiencies (*41,46,47*) and poor opsonization and impaired reticuloendothelial function. Consequently, they are at even greater risk for infections (*32,39*), particularly life-threatening bacterial infections from encapsulated organisms (e.g., *Stre. pneumoniae*, *Ha. influenzae*, or *Ne. meningitidis*). After chronic GVHD resolves, which might take years, cell-mediated and humoral immunity function are gradually restored.

Opportunistic Pathogens After HSCT

HSCT recipients experience certain infections at different times posttransplant, reflecting the predominant host-defense defect(s) (Figure). Immune system recovery for HSCT recipients takes place in three phases beginning at day 0, the day of transplant.

FIGURE. Phases of opportunistic infections among allogeneic HSCT recipients



Phase I is the preengraftment phase (<30 days after HSCT); phase II, the postengraftment phase (30–100 days after HSCT); and phase III, the late phase (>100 days after HSCT). Prevention strategies should be based on these three phases and the following information:

- **Phase I, preengraftment.** During the first month posttransplant, HSCT recipients have two critical risk factors for infection — prolonged neutropenia and breaks in the mucocutaneous barrier resulting from the HSCT preparative regimens and frequent vascular access required for patient care. Consequently, oral, gastro-intestinal, and skin flora are sources of infection. Prevalent pathogens include *Candida* species, and as neutropenia continues, *Aspergillus* species. Additionally, herpes simplex virus (HSV) reactivation can occur during this phase. During preengraftment, the risks for infection are the same for autologous or allogeneic patients, and OIs can appear as febrile neutropenia. Although a recipient's first fever during preengraftment is probably caused by a bacterial pathogen, rarely is an organism or site of infection identified. Instead, such infections are usually treated preemptively or empirically (*48*) until the neutropenia resolves (*49*). Growth factors can be administered during phase I to decrease neutropenia duration and complications (e.g., febrile neutropenia) (*50*).

- **Phase II, postengraftment.** Phase II is dominated by impaired cell-mediated immunity for allogeneic or autologous recipients. Scope and impact of this defect for allogeneic recipients are determined by the extent of GVHD and its immunosuppressive therapy. After engraftment, the herpes viruses, particularly CMV, are critical pathogens. At 30–100 days after HSCT, CMV causes pneumonia, hepatitis, and colitis and potentiates superinfection with opportunistic pathogens, particularly among patients with active GVHD. Other dominant pathogens during this phase include *Pneumocystis carinii* and *Aspergillus* species.

- **Phase III, late phase.** During phase III, autologous recipients usually have more rapid recovery of immune system function and, therefore, a lower risk for OIs than do allogeneic recipients. Because of cell-mediated and humoral immunity defects and impaired reticuloendothelial system function, allogeneic patients with chronic GVHD and recipients of alternate donor allogeneic transplants are at risk for certain infections during this phase. Alternate donors include matched unrelated, UCB, or mismatched family-related donors. These patients are at risk for infections that include CMV, varicella-zoster virus (VZV), EBV-related posttransplant lymphoproliferative disease, community-acquired respiratory viruses (CRV), and infections with encapsulated bacteria (e.g., *Ha. influenzae* and *Stre. pneumoniae*). Risk for these infections is approximately proportional to the severity of the patient's GVHD during phases II and III. Patients receiving mismatched allogeneic transplants have a higher attack rate and severity of GVHD and, therefore, a higher risk for OIs during phases II and III than do patients receiving matched allogeneic HSCTs. In contrast, patients undergoing autologous transplantation are primarily at risk for infection during phase I.

Preventing infections among HSCT recipients is preferable to treating infections. However, despite recent technologic advances, more research is needed to optimize health outcomes for HSCT recipients. Efforts to improve immune system reconstitution, particularly among allogeneic transplant recipients, and to prevent or resolve the immune dysregulation resulting from donor-recipient histoincompatibility and GVHD remain

substantial challenges for preventing recurrent, persistent, or progressive infections among HSCT patients.

BACTERIAL INFECTIONS

General Recommendations

Preventing Exposure

Because bacteria are carried on the hands, health-care workers (HCWs) and others in contact with HSCT recipients should routinely follow appropriate hand-washing practices to avoid exposing recipients to bacterial pathogens (AIII).

Preventing Disease

Preventing Early Disease (0–100 Days After HSCT). Routine gut decontamination is not recommended for HSCT candidates (51–53) (DIII). Because of limited data, no recommendations can be made regarding the routine use of antibiotics for bacterial prophylaxis among afebrile, asymptomatic neutropenic recipients. Although studies have reported that using prophylactic antibiotics might reduce bacteremia rates after HSCT (51), infection-related fatality rates are not reduced (52). If physicians choose to use prophylactic antibiotics among asymptomatic, afebrile, neutropenic recipients, they should routinely review hospital and HSCT center antibiotic-susceptibility profiles, particularly when using a single antibiotic for antibacterial prophylaxis (BIII). The emergence of fluoquinolone-resistant coagulase-negative *Staphylococci* and *Es. coli* (51,52), vancomycin-intermediate *Sta. aureus* and vancomycin-resistant *Enterococcus* (VRE) are increasing concerns (54). Vancomycin should not be used as an agent for routine bacterial prophylaxis (DIII). Growth factors (e.g., GM-CSF and G-CSF) shorten the duration of neutropenia after HSCT (55); however, no data were found that indicate whether growth factors effectively reduce the attack rate of invasive bacterial disease.

Physicians should not routinely administer IVIG products to HSCT recipients for bacterial infection prophylaxis (DII), although IVIG has been recommended for use in producing immune system modulation for GVHD prevention. Researchers have recommended routine IVIG* use to prevent bacterial infections among the approximately 20%–25% of HSCT recipients with unrelated marrow grafts who experience severe

*Since November 1997, the United States has had a shortage of intravenous immunoglobulin (IVIG) (**Source:** CDC. Availability of immune globulin intravenous for treatment of immune deficient patients—United States, 1997–1998. MMWR 1999:48[8];159–162). Physicians who have difficulty obtaining IVIG should contact the following sources:

- American Red Cross Customer Service Center, (800) 261-5772;
- Alpha Therapeutic Corporation, (800) 421-0008;
- Baxter Healthcare Corporation, (847) 940-5955;
- Bayer Pharmaceutical Division, (800) 288-8370;
- Aventis Behring Customer Support, (800) 683-1288;
- Novartis Pharmaceuticals Corporation, (973) 781-8300, or the IVIG Emergency Hotline, (888) 234-2520; or
- Immune Deficiency Foundation, (800) 296-4433.

Physicians who are unable to obtain IVIG for a licensed indication from one of these sources should contact the Product Shortage Officer at the Food and Drug Administration's Center for Biologics Evaluation and Research, Office of Compliance, (301) 827-6220, for assistance.

hypogamma-globulinemia (e.g., IgG < 400 mg/dl) within the first 100 days after transplant (CIII). For example, recipients who are hypogammaglobulinemic might receive prophylactic IVIG to prevent bacterial sinopulmonary infections (e.g., from *Stre. pneumoniae*) (*8*) (CIII). For hypogammaglobulinemic allogeneic recipients, physicians can use a higher and more frequent dose of IVIG than is standard for non-HSCT recipients because the IVIG half-life among HSCT recipients (generally 1–10 days) is much shorter than the half-life among healthy adults (generally 18–23 days) (*56–58*). Additionally, infections might accelerate IgG catabolism; therefore, the IVIG dose for a hypogammaglobulinemic recipient should be individualized to maintain trough serum IgG concentrations >400–500 mg/dl (*58*) (BII). Consequently, physicians should monitor trough serum IgG concentrations among these patients approximately every 2 weeks and adjust IVIG doses as needed (BIII) (Appendix).

Preventing Late Disease (>100 Days After HSCT). Antibiotic prophylaxis is recommended for preventing infection with encapsulated organisms (e.g., *Stre. pneumoniae*, *Ha. influenzae*, or *Ne. meningitidis*) among allogeneic recipients with chronic GVHD for as long as active chronic GVHD treatment is administered (*59*) (BIII). Antibiotic selection should be guided by local antibiotic resistance patterns. In the absence of severe demonstrable hypogammaglobulinemia (e.g., IgG levels < 400 mg/dl, which might be associated with recurrent sinopulmonary infections), routine monthly IVIG administration to HSCT recipients >90 days after HSCT is not recommended (*60*) (DI) as a means of preventing bacterial infections.

Other Disease Prevention Recommendations. Routine use of IVIG among autologous recipients is not recommended (*61*) (DII). Recommendations for preventing bacterial infections are the same among pediatric or adult HSCT recipients.

Recommendations Regarding *Stre. pneumoniae*

Preventing Exposure

Appropriate care precautions should be taken with hospitalized patients infected with *Stre. pneumoniae* (*62,63*) (BIII) to prevent exposure among HSCT recipients.

Preventing Disease

Information regarding the currently available 23-valent pneumococcal polysaccharide vaccine indicates limited immunogenicity among HSCT recipients. However, because of its potential benefit to certain patients, it should be administered to HSCT recipients at 12 and 24 months after HSCT (*64–66*) (BIII). No data were found regarding safety and immunogenicity of the 7-valent conjugate pneumococcal vaccine among HSCT recipients; therefore, no recommendation regarding use of this vaccine can be made.

Antibiotic prophylaxis is recommended for preventing infection with encapsulated organisms (e.g., *Stre. pneumoniae* , *Ha. influenzae* , and *Ne. meningitidis*) among allogeneic recipients with chronic GVHD for as long as active chronic GVHD treatment is administered (*59*) (BIII). Trimethoprim-sulfamethasaxole (TMP-SMZ) administered for *Pneumocystis carinii* pneumonia (PCP) prophylaxis will also provide protection against pneumococcal infections. However, no data were found to support using TMP-SMZ prophylaxis among HSCT recipients solely for the purpose of preventing *Stre. pneumoniae* disease. Certain strains of *Stre. pneumoniae* are resistant to TMP-SMZ and penicillin. Recommendations for preventing pneumococcal infections are the same for allogeneic or autologous recipients.

As with adults, pediatric HSCT recipients aged ≥2 years should be administered the current 23-valent pneumococcal polysaccharide vaccine because the vaccine can be effective (BIII). However, this vaccine should not be administered to children aged <2 years because it is not effective among that age population (DI). No data were found regarding safety and immunogenicity of the 7-valent conjugate pneumococcal vaccine among pediatric HSCT recipients; therefore, no recommendation regarding use of this vaccine can be made.

Recommendations Regarding *Streptococci viridans*

Preventing Exposure

Because *Streptococci viridans* colonize the oropharynx and gut, no effective method of preventing exposure is known.

Preventing Disease

Chemotherapy-induced oral mucositis is a potential source of *Streptococci viridans* bacteremia. Consequently, before conditioning starts, dental consults should be obtained for all HSCT candidates to assess their state of oral health and to perform any needed dental procedures to decrease the risk for oral infections after transplant (*67*) (AIII).

Generally, HSCT physicians should not use prophylactic antibiotics to prevent *Streptococci viridans* infections (DIII). No data were found that demonstrate efficacy of prophylactic antibiotics for this infection. Furthermore, such use might select antibiotic-resistant bacteria, and in fact, penicillin- and vancomycin-resistant strains of *Streptococci viridans* have been reported (*68*). However, when *Streptococci viridans* infections among HSCT recipients are virulent and associated with overwhelming sepsis and shock in an institution, prophylaxis might be evaluated (CIII). Decisions regarding the use of *Streptococci viridans* prophylaxis should be made only after consultation with the hospital epidemiologists or infection-control practitioners who monitor rates of nosocomial bacteremia and bacterial susceptibility (BIII).

HSCT physicians should be familiar with current antibiotic susceptibilities for patient isolates from their HSCT centers, including *Streptococci viridans* (BIII). Physicians should maintain a high index of suspicion for this infection among HSCT recipients with symptomatic mucositis because early diagnosis and aggressive therapy are currently the only potential means of preventing shock when severely neutropenic HSCT recipients experience *Streptococci viridans* bacteremia (*69*).

Recommendations Regarding *Ha. influenzae* type b

Preventing Exposure

Adults with *Ha. influenzae* type b (Hib) pneumonia require standard precautions (*62*) to prevent exposing the HSCT recipient to Hib. Adults and children who are in contact with the HSCT recipient and who have known or suspected invasive Hib disease, including meningitis, bacteremia, or epiglottitis, should be placed in droplet precautions until 24 hours after they begin appropriate antibiotic therapy, after which they can be switched to standard precautions. Household contacts exposed to persons with Hib disease and who also have contact with HSCT recipients should be administered rifampin prophylaxis according to published recommendations (*70,71*); prophylaxis for household contacts of

a patient with Hib disease are necessary if all contacts aged <4 years are not fully vaccinated (BIII) (Appendix). This recommendation is critical because the risk for invasive Hib disease among unvaccinated household contacts aged <4 years is increased, and rifampin can be effective in eliminating Hib carriage and preventing invasive Hib disease (*72–74*). Pediatric household contacts should be up-to-date with Hib vaccinations to prevent possible Hib exposure to the HSCT recipient (AII).

Preventing Disease

Although no data regarding vaccine efficacy among HSCT recipients were found, Hib conjugate vaccine should be administered to HSCT recipients at 12, 14, and 24 months after HSCT (BII). This vaccine is recommended because the majority of HSCT recipients have low levels of Hib capsular polysaccharide antibodies ≥4 months after HSCT (*75*), and allogeneic recipients with chronic GVHD are at increased risk for infection from encapsulated organisms (e.g., Hib) (*76,77*). HSCT recipients who are exposed to persons with Hib disease should be offered rifampin prophylaxis according to published recommendations (*70*) (BIII) (Appendix).

Antibiotic prophylaxis is recommended for preventing infection with encapsulated organisms (e.g., *Stre. pneumoniae*, *Ha. influenzae*, or *Ne. meningitidis*) among allogeneic recipients with chronic GVHD for as long as active chronic GVHD treatment is administered (*59*) (BIII). Antibiotic selection should be guided by local antibiotic-resistance patterns. Recommendations for preventing Hib infections are the same for allogeneic or autologous recipients. Recommendations for preventing Hib disease are the same for pediatric or adult HSCT recipients, except that any child infected with Hib pneumonia requires standard precautions with droplet precautions added for the first 24 hours after beginning appropriate antibiotic therapy (*62,70*) (BIII). Appropriate pediatric doses should be administered for Hib conjugate vaccine and for rifampin prophylaxis (*71*) (Appendix).

VIRAL INFECTIONS

Recommendations Regarding Cytomegalovirus

Preventing Exposure

HSCT candidates should be tested for the presence of serum anti-CMV IgG antibodies before transplantation to determine their risk for primary CMV infection and reactivation after HSCT (AIII). Only Food and Drug Administration (FDA) licensed or approved tests should be used. HSCT recipients and candidates should avoid sharing cups, glasses, and eating utensils with others, including family members, to decrease the risk for CMV exposure (BIII).

Sexually active patients who are not in long-term monogamous relationships should always use latex condoms during sexual contact to reduce their risk for exposure to CMV and other sexually transmitted pathogens (AII). However, even long-time monogamous pairs can be discordant for CMV infections. Therefore, during periods of immunocompromise, sexually active HSCT recipients in monogamous relationships should ask partners to be tested for serum CMV IgG antibody, and discordant couples should use latex condoms during sexual contact to reduce the risk for exposure to this sexually transmitted OI (CIII).

After handling or changing diapers or after wiping oral and nasal secretions, HSCT candidates and recipients should practice regular hand washing to reduce the risk for CMV exposure (AII). CMV-seronegative recipients of allogeneic stem cell transplants from CMV-seronegative donors (i.e., R-negative or D-negative) should receive only leukocyte-reduced or CMV-seronegative red cells or leukocyte-reduced platelets (<1 x 10^6 leukocytes/unit) to prevent transfusion-associated CMV infection (*78*) (AI). However, insufficient data were found to recommend use of leukocyte-reduced or CMV-seronegative red cells and platelets among CMV-seronegative recipients who have CMV-seropositive donors (i.e., R-negative or D-positive).

All HCWs should wear gloves when handling blood products or other potentially contaminated biologic materials (AII) to prevent transmission of CMV to HSCT recipients. HSCT patients who are known to excrete CMV should be placed under standard precautions (*62*) for the duration of CMV excretion to avoid possible transmission to CMV-seronegative HSCT recipients and candidates (AIII). Physicians are cautioned that CMV excretion can be episodic or prolonged.

Preventing Disease and Disease Recurrence

HSCT recipients at risk for CMV disease after HSCT (i.e., all CMV-seropositive HSCT recipients, and all CMV-seronegative recipients with a CMV-seropositive donor) should be placed on a CMV disease prevention program from the time of engraftment until 100 days after HSCT (i.e., phase II) (AI). Physicians should use either prophylaxis or preemptive treatment with ganciclovir for allogeneic recipients (AI). In selecting a CMV disease prevention strategy, physicians should assess the risks and benefits of each strategy, the needs and condition of the patient, and the hospital's virology laboratory support capability.

Prophylaxis strategy against early CMV (i.e., <100 days after HSCT) for allogeneic recipients involves administering ganciclovir prophylaxis to all allogeneic recipients at risk throughout phase II (i.e., from engraftment to 100 days after HSCT). The induction course is usually started at engraftment (AI), although physicians can add a brief prophylactic course during HSCT preconditioning (CIII) (Appendix).

Preemptive strategy against early CMV (i.e., <100 days after HSCT) for allogeneic recipients is preferred over prophylaxis for CMV-seronegative HSCT recipients of seropositive donor cells (i.e., D-positive or R-negative) because of the low attack rate of active CMV infection if screened or filtered blood product support is used (BII). Preemptive strategy restricts ganciclovir use for those patients who have evidence of CMV infection after HSCT. It requires the use of sensitive and specific laboratory tests to rapidly diagnose CMV infection after HSCT and to enable immediate administration of ganciclovir after CMV infection has been detected. Allogeneic recipients at risk should be screened ≥1 times/week from 10 days to 100 days after HSCT (i.e., phase II) for the presence of CMV viremia or antigenemia (AIII).

HSCT physicians should select one of two diagnostic tests to determine the need for preemptive treatment. Currently, the detection of CMV pp65 antigen in leukocytes (antigenemia) (*79,80*) is preferred for screening for preemptive treatment because it is more rapid and sensitive than culture and has good positive predictive value (*79–81*). Direct detection of CMV-DNA (deoxyribonucleic acid) by polymerase chain reaction (PCR) (*82*) is very sensitive but has a low positive predictive value (*79*). Although CMV-DNA PCR is less sensitive than whole blood or leukocyte PCR, plasma CMV-DNA PCR is useful

during neutropenia, when the number of leukocytes/slide is too low to allow CMV pp65 antigenemia testing.

Virus culture of urine, saliva, blood, or bronchoalveolar washings by rapid shell-vial culture (*83*) or routine culture (*84,85*) can be used; however, viral culture techniques are less sensitive than CMV-DNA PCR or CMV pp65 antigenemia tests. Also, rapid shell-viral cultures require ≥48 hours and routine viral cultures can require weeks to obtain final results. Thus, viral culture techniques are less satisfactory than PCR or antigenemia tests. HSCT centers without access to PCR or antigenemia tests should use prophylaxis rather than preemptive therapy for CMV disease prevention (*86*) (BII). Physicians do use other diagnostic tests (e.g., hybrid capture CMV-DNA assay, Version 2.0 [*87*] or CMV pp67 viral RNA [ribonucleic acid] detection) (*88*); however, limited data were found regarding use among HSCT recipients, and therefore, no recommendation for use can be made.

Allogeneic recipients ≤100 days after HSCT (i.e., during phase II) should begin preemptive treatment with ganciclovir if CMV viremia or any antigenemia is detected or if the recipient has ≥2 consecutively positive CMV-DNA PCR tests (BIII). After preemptive treatment has been started, maintenance ganciclovir is usually continued until 100 days after HSCT or for a minimum of 3 weeks, whichever is longer (AI) (Appendix). Antigen or PCR tests should be negative when ganciclovir is stopped. Studies report that a shorter course of ganciclovir (e.g., for 3 weeks or until negative PCR or antigenemia occurs) (*89–91*) might provide adequate CMV prevention with less toxicity, but routine weekly screening by pp65 antigen or PCR test is necessary after stopping ganciclovir because CMV reactivation can occur (BIII).

Presently, only the intravenous formulation of ganciclovir has been approved for use in CMV prophylactic or preemptive strategies (BIII). No recommendation for oral ganciclovir use among HSCT recipients can be made because clinical trials evaluating its efficacy are still in progress. One group has used ganciclovir and foscarnet on alternate days for CMV prevention (*92*), but no recommendation can be made regarding this strategy because of limited data. Patients who are ganciclovir-intolerant should be administered foscarnet instead (*93*) (BII) (Appendix). HSCT recipients receiving ganciclovir should have ANCs checked ≥2 times/week (BIII). Researchers report managing ganciclovir-associated neutropenia by adding G-CSF (*94*) or temporarily stopping ganciclovir for ≥2 days if the patient's ANC is <1,000 (CIII). Ganciclovir can be restarted when the patient's ANC is ≥1,000 for 2 consecutive days. Alternatively, researchers report substituting foscarnet for ganciclovir if a) the HSCT recipient is still CMV viremic or antigenemic or b) the ANC remains <1,000 for >5 days after ganciclovir has been stopped (CIII) (Appendix). Because neutropenia accompanying ganciclovir administration is usually brief, such patients do not require antifungal or antibacterial prophylaxis (DIII).

Currently, no benefit has been reported from routinely administering ganciclovir prophylaxis to all HSCT recipients at >100 days after HSCT (i.e., during phase III). However, persons with high risk for late CMV disease should be routinely screened biweekly for evidence of CMV reactivation as long as substantial immunocompromise persists (BIII). Risk factors for late CMV disease include allogeneic HSCT accompanied by chronic GVHD, steroid use, low CD4 counts, delay in high avidity anti-CMV antibody, and recipients of matched unrelated or T-cell–depleted HSCTs who are at high risk (*95–99*). If CMV is still detectable by routine screening ≥100 days after HSCT, ganciclovir should be continued until CMV is no longer detectable (AI). If low-grade CMV antigenemia (<5 positive cells/slide) is detected on routine screening, the antigenemia test should be repeated in 3 days

(BIII). If CMV antigenemia indicates ≥5 cells/slide, PCR is positive, or the shell-vial culture detects CMV viremia, a 3-week course of preemptive ganciclovir treatment should be administered (BIII) (Appendix). Ganciclovir should also be started if the patient has had ≥2 consecutively positive viremia or PCR tests (e.g., in a person receiving steroids for GVHD or who received ganciclovir or foscarnet at <100 days after HSCT). Current investigational strategies for preventing late CMV disease include the use of targeted prophylaxis with antiviral drugs and cellular immunotherapy for those with deficient or absent CMV-specific immune system function.

If viremia persists after 4 weeks of ganciclovir preemptive therapy or if the level of antigenemia continues to rise after 3 weeks of therapy, ganciclovir-resistant CMV should be suspected. If CMV viremia recurs during continuous treatment with ganciclovir, researchers report restarting ganciclovir induction (*100*) or stopping ganciclovir and starting foscarnet (CIII). Limited data were found regarding the use of foscarnet among HSCT recipients for either CMV prophylaxis or preemptive therapy (*92,93*).

Infusion of donor-derived CMV-specific clones of CD8+ T-cells into the transplant recipient is being evaluated under FDA Investigational New Drug authorization; therefore, no recommendation can be made. Although, in a substantial cooperative study, high-dose acyclovir has had certain efficacy for preventing CMV disease (*101*), its utility is limited in a setting where more potent anti-CMV agents (e.g., ganciclovir) are used (*102*). Acyclovir is not effective in preventing CMV disease after autologous HSCT (*103*) and is, therefore, not recommended for CMV preemptive therapy (DII). Consequently, valacyclovir, although under study for use among HSCT recipients, is presumed to be less effective than ganciclovir against CMV and is currently not recommended for CMV disease prevention (DII).

Although HSCT physicians continue to use IVIG for immune system modulation, IVIG is not recommended for CMV disease prophylaxis among HSCT recipients (DI). Cidofovir, a nucleoside analog, is approved by FDA for the treatment of AIDS-associated CMV retinitis. The drug's major disadvantage is nephrotoxicity. Cidofovir is currently in FDA phase 1 trial for use among HSCT recipients; therefore, recommendations for its use cannot be made.

Use of CMV-negative or leukocyte-reduced blood products is not routinely required for all autologous recipients because most have a substantially lower risk for CMV disease. However, CMV-negative or leukocyte-reduced blood products can be used for CMV-seronegative autologous recipients (CIII). Researchers report that CMV-seropositive autologous recipients be evaluated for preemptive therapy if they have underlying hematologic malignancies (e.g., lymphoma or leukemia), are receiving intense conditioning regimens or graft manipulation, or have recently received fludarabine or 2-chlorodeoxyadenosine (CDA) (CIII). This subpopulation of autologous recipients should be monitored weekly from time of engraftment until 60 days after HSCT for CMV reactivation, preferably with quantitative CMV pp65 antigen (*80*) or quantitative PCR (BII).

Autologous recipients at high risk who experience CMV antigenemia (i.e., blood levels of ≥5 positive cells/slide) should receive 3 weeks of preemptive treatment with ganciclovir or foscarnet (*80*), but CD34+-selected patients should be treated at any level of antigenemia (BII) (Appendix). Prophylactic approach to CMV disease prevention is not appropriate for CMV-seropositive autologous recipients. Indications for the use of CMV prophylaxis or preemptive treatment are the same for children or adults.

Recommendations Regarding EBV

Preventing Exposure

All transplant candidates, particularly those who are EBV-seronegative, should be advised of behaviors that could decrease the likelihood of EBV exposure (AII). For example, HSCT recipients and candidates should follow safe hygiene practices (e.g., frequent hand washing [AIII] and avoiding the sharing of cups, glasses, and eating utensils with others) (*104*) (BIII), and they should avoid contact with potentially infected respiratory secretions and saliva (*104*) (AII).

Preventing Disease

Infusion of donor-derived, EBV-specific cytotoxic T-lymphocytes has demonstrated promise in the prophylaxis of EBV-lymphoma among recipients of T-cell–depleted unrelated or mismatched allogeneic recipients (*105,106*). However, insufficient data were found to recommend its use. Prophylaxis or preemptive therapy with acyclovir is not recommended because of lack of efficacy (*107,108*) (DII).

Recommendations Regarding HSV

Preventing Exposure

HSCT candidates should be tested for serum anti-HSV IgG before transplant (AIII); however, type-specific anti-HSV IgG serology testing is not necessary. Only FDA-licensed or -approved tests should be used. All HSCT candidates, particularly those who are HSV-seronegative, should be informed of the importance of avoiding HSV infection while immunocompromised and should be advised of behaviors that will decrease the likelihood of HSV exposure (AII). HSCT recipients and candidates should avoid sharing cups, glasses, and eating utensils with others (BIII). Sexually active patients who are not in a long-term monogamous relationship should always use latex condoms during sexual contact to reduce the risk for exposure to HSV as well as other sexually transmitted pathogens (AII). However, even long-time monogamous pairs can be discordant for HSV infections. Therefore, during periods of immunocompromise, sexually active HSCT recipients in such relationships should ask partners to be tested for serum HSV IgG antibody. If the partners are discordant, they should consider using latex condoms during sexual contact to reduce the risk for exposure to this sexually transmitted OI (CIII). Any person with disseminated, primary, or severe mucocutaneous HSV disease should be placed under contact precautions for the duration of the illness (*62*) (AI) to prevent transmission of HSV to HSCT recipients.

Preventing Disease and Disease Recurrence

Acyclovir. Acyclovir prophylaxis should be offered to all HSV-seropositive allogeneic recipients to prevent HSV reactivation during the early posttransplant period (*109–113*) (AI). Standard approach is to begin acyclovir prophylaxis at the start of the conditioning therapy and continue until engraftment occurs or until mucositis resolves, whichever is longer, or approximately 30 days after HSCT (BIII) (Appendix). Without supportive data from controlled studies, routine use of antiviral prophylaxis for >30 days after HSCT to prevent HSV is not recommended (DIII). Routine acyclovir prophylaxis is not indicated for

HSV-seronegative HSCT recipients, even if the donors are HSV-seropositive (DIII). Researchers have proposed administration of ganciclovir prophylaxis alone (*86*) to HSCT recipients who required simultaneous prophylaxis for CMV and HSV after HSCT (CIII) because ganciclovir has in vitro activity against CMV and HSV 1 and 2 (*114*), although ganciclovir has not been approved for use against HSV.

Valacyclovir. Researchers have reported valacyclovir use for preventing HSV among HSCT recipients (CIII); however, preliminary data demonstrate that very high doses of valacyclovir (8 g/day) were associated with thrombotic thrombocytopenic purpura/hemolytic uremic syndrome among HSCT recipients (*115*). Controlled trial data among HSCT recipients are limited (*115*), and the FDA has not approved valacyclovir for use among recipients. Physicians wishing to use valacyclovir among recipients with renal impairment should exercise caution and decrease doses as needed (BIII) (Appendix).

Foscarnet. Because of its substantial renal and infusion-related toxicity, foscarnet is not recommended for routine HSV prophylaxis among HSCT recipients (DIII).

Famciclovir. Presently, data regarding safety and efficacy of famciclovir among HSCT recipients are limited; therefore, no recommendations for HSV prophylaxis with famciclovir can be made.

Other Recommendations

HSV prophylaxis lasting >30 days after HSCT might be considered for persons with frequent recurrent HSV (CIII) (Appendix). Acyclovir can be used during phase I for administration to HSV-seropositive autologous recipients who are likely to experience substantial mucositis from the conditioning regimen (CIII). Antiviral prophylaxis doses should be modified for use among children (Appendix), but no published data were found regarding valacyclovir safety and efficacy among children.

Recommendations Regarding VZV

Preventing Exposure

HSCT candidates should be tested for the presence of serum anti-VZV IgG antibodies (AIII). However, these tests are not 100% reliable, particularly among severely immunosuppressed patients. Researchers recommend that a past history of varicella accompanied by a positive titer is more likely to indicate the presence of immunity to VZV than a low positive titer alone. All HSCT candidates and recipients, particularly those who are VZV-seronegative, should be informed of the potential seriousness of VZV disease among immunocompromised persons and advised of strategies to decrease their risk for VZV exposure (*116–122*) (AII).

Although researchers report that the majority of VZV disease after HSCT is caused by reactivation of endogenous VZV, HSCT candidates and recipients who are VZV-seronegative, or VZV-seropositive and immunocompromised, should avoid exposure to persons with active VZV infections (*123*) (AII). HCWs, family members, household contacts, and visitors who are healthy and do not have a reported history of varicella infection or who are VZV-seronegative should receive VZV vaccination before being allowed to visit or have direct contact with an HSCT recipient (AIII). Ideally, VZV-susceptible family

members, household contacts, and potential visitors of immunocompromised HSCT recipients should be vaccinated as soon as the decision is made to perform HSCT. The vaccination dose or doses should be completed ≥4 weeks before the conditioning regimen begins or ≥6 weeks (42 days) before the HSCT is performed (BIII).

HSCT recipients and candidates undergoing conditioning therapy should avoid contact with any VZV vaccine recipient who experiences a rash after vaccination (BIII). When this rash occurs, it usually appears 14–21 days after VZV vaccination (median: 22 days; range: 5–35 days) (personal communication from Robert G. Sharrar, M.D., Merck & Co., Inc.). However, to date, no serious disease has been reported among immunocompromised patients from transmission of VZV vaccine virus, and the VZV vaccine strain is susceptible to acyclovir.

All HSCT recipients with VZV disease should be placed under airborne and contact precautions (*62*) (AII) to prevent transmission to other HSCT recipients. Contact precautions should be continued until all skin lesions are crusted. Airborne precautions should be instituted 10 days after exposure to VZV and continued until 21 days after last exposure or 28 days postexposure if the patient received varicella-zoster immunoglobulin (VZIG)* (*62*) (AI) because a person infected with VZV can be infectious before the rash appears.

Preventing Disease

VZIG. VZV-seronegative HSCT recipients should be administered VZIG as soon as possible but ideally within 96 hours after close or household contact with a person having either chickenpox or shingles if the HSCT recipient is not immunocompetent (i.e., allogeneic patient <24 months after HSCT, ≥24 months after HSCT and on immunosuppressive therapy, or having chronic GVHD) (AII). Researchers report VZIG administration for VZV exposure as described for HSCT recipients who were VZV-seropositive before HSCT (CIII).

Because of the high morbidity of VZV-associated disease among severely immunocompromised HSCT recipients and until further data are published, HSCT physicians should administer VZIG to all VZV-seronegative HSCT recipients or candidates undergoing conditioning therapy who are exposed to a VZV vaccinee having a varicella-like rash (BIII). Researchers also report VZIG administration for this situation for VZV-seropositive HSCT recipients and candidates undergoing conditioning therapy (CIII). These recommendations are made because the vaccinee might be unknowingly incubating wild-type varicella, particularly during the first 14 days after varicella vaccination, and because vaccine-strain VZV has been rarely transmitted by VZV vaccinees with vesicular rashes postvaccination (*121*).

If VZV-seronegative HSCT recipients or candidates undergoing conditioning therapy are closely exposed to varicella >3 weeks after receiving VZIG, they should be administered another dose of VZIG (*120*) (BIII). Researchers also recommend VZIG administration for this condition for VZV-seropositive HSCT recipients and candidates undergoing conditioning therapy (CIII).

*VZIG is distributed by FFF Enterprises, Inc., under contract with the American Red Cross, except in Massachusetts where it is distributed by the Massachusetts Public Health Biologic Laboratories (now a unit of the University of Massachusetts) (*19*). FFF Enterprises, Inc., can be contacted at

FFF Enterprises, Inc.
41093 County Center Drive
Temecula, CA 92591
Phone: (800) 522-4448

Antiviral Drugs. Any HSCT recipient or candidate undergoing conditioning therapy who experiences a VZV-like rash (particularly after exposure to a person with wild-type varicella or shingles) should receive preemptive intravenous acyclovir until ≥2 days after all lesions have crusted (BIII) (Appendix). Any HSCT recipient or candidate undergoing conditioning therapy who experiences a VZV-like rash after exposure to a VZV vaccinee with a rash should be administered intravenous acyclovir preemptively to prevent severe, disseminated VZV disease (BII). Acyclovir should be administered until 2 days after all lesions have crusted.

Long-term acyclovir prophylaxis to prevent recurrent VZV infection (e.g., during the first 6 months after HSCT) is not routinely recommended (*124–126*) (DIII); however, this therapy could be considered for use among HSCT recipients with severe, long-term immunodeficiency (CIII). When acyclovir resistance occurs among patients, HSCT physicians should use foscarnet for preemptive treatment of VZV disease (*127*) (BIII). Researchers report valacyclovir use for preventing HSV among HSCT recipients (CIII). However, preliminary data demonstrate that very high doses of valacyclovir (8 g/day) were associated with thrombotic thrombocytopenic purpura/hemolytic uremic syndrome among HSCT recipients (*115*). Controlled trial data regarding HSCT recipients are limited (*115*), and the FDA has not approved valacyclovir for use among HSCT recipients. Physicians wishing to use valacyclovir among HSCT recipients with renal impairment should exercise caution and decrease doses as needed (BIII) (Appendix). No data were found demonstrating safety and efficacy of preemptive treatment of famciclovir against herpes zoster among HSCT recipients. Consequently, no recommendation for its use can be made.

Live-Attenuated VZV Vaccine. VZV vaccine use is contraindicated among HSCT recipients <24 months after HSCT (*128*) (EIII). Use of VZV vaccine among HSCT recipients is restricted to research protocols for recipients ≥24 months after HSCT who are presumed immunocompetent. Further research is needed to determine the safety, immunogenicity, and efficacy of VZV vaccine among HSCT recipients.

Other Recommendations

An inactivated VZV vaccine has been used investigationally among HSCT recipients (*129*); however, more studies are needed before a recommendation regarding its use can be made. Recommendations for VZV prevention are the same for allogeneic or autologous recipients. Recommendations for preventing VZV disease among pediatric or adult HSCT recipients are the same, except that appropriate dose adjustments for VZIG should be made for pediatric HSCT recipients (AIII) (Appendix).

Recommendations Regarding CRV Infections: Influenza, Respiratory Syncytial Virus, Parainfluenza Virus, and Adenovirus

Preventing Exposure

Preventing CRV exposure is critical in preventing CRV disease (*130,131*). To prevent nosocomial CRV transmission, HSCT recipients and their HCWs should always follow HSCT infection control guidelines (AIII). To minimize the risk for CRV transmission, HCWs and visitors with upper respiratory infection (URI) symptoms should be restricted from

contact with HSCT recipients and HSCT candidates undergoing conditioning therapy (AIII). At a minimum, active clinical surveillance for CRV disease should be conducted on all hospitalized HSCT recipients and candidates undergoing conditioning therapy; this clinical surveillance should include daily screening for signs and symptoms of CRV (e.g., URI or lower respiratory infection [LRI]) (AIII). Viral cultures of asymptomatic HSCT candidates are unlikely to be useful. HSCT recipients with URI or LRI symptoms should be placed under contact precautions to avoid transmitting infection to other HSCT candidates and recipients, HCWs, and visitors until the etiology of illness is identified (*62*) (BIII). Optimal isolation precautions should be modified as needed after the etiology is identified (AIII). HSCT recipients and candidates, their family members and visitors, and all HCWs should be informed regarding CRV infection control measures and the potential severity of CRV infections among HSCT recipients (*130–140*) (BIII). Physicians have routinely conducted culture-based CRV surveillance among HSCT recipients; however, the cost effectiveness of this approach has not been evaluated.

Influenza vaccination of family members and close or household contacts is strongly recommended during each influenza season (i.e., October–May) starting the season before HSCT and continuing ≥24 months after HSCT (*141*) (AI) to prevent influenza exposure among the recipients or candidates. All family members and close or household contacts of HSCT recipients who remain immunocompromised ≥24 months after HSCT should continue to be vaccinated annually as long as the HSCT recipient's immunocompromise persists (*141*) (AI). Seasonal influenza vaccination is strongly recommended for all HCWs of HSCT recipients (*142,143*) (AI).

If HCWs, family members, or other close contacts of HSCT recipients receive influenza vaccination during an influenza A outbreak, they should receive amantadine or rimantadine chemoprophylaxis for 2 weeks after influenza vaccination (BI) while the vaccinee experiences an immunologic response to the vaccine. Such a strategy is likely to prevent transmission of influenza A to HCWs and other close contacts of HSCT recipients, which could prevent influenza A transmission to HSCT recipients themselves. However, if a nosocomial outbreak occurs with an influenza A strain that is not contained in the available influenza vaccine, all healthy family members, close and household contacts, and HCWs of HSCT recipients and candidates should be administered influenza A chemoprophylaxis with amantadine or rimantadine until the end of the outbreak (*141*) (BIII).

In 1999, two neuroaminidase inhibitors (zanamivir and oseltamivir) were approved for treatment of influenza, but are not currently approved for prophylaxis. To date, experience is limited regarding use of zanamivir or oseltamivir in the treatment or prophylaxis of influenza among HSCT settings. However, HCWs, family members, or other close contacts can be offered a neuroaminidase inhibitor (e.g., zanamivir or oseltamivir) using the same strategies outlined previously, if a) rimantadine or amantadine cannot be tolerated, b) the outbreak strain of influenza A is amantadine or rimantadine-resistant, or c) the outbreak strain is influenza B (*144–147*) (BI). Zanamivir can be administered to persons aged ≥12 years, and oseltamivir can be administered to persons aged ≥18 years. Patients with influenza should be placed under droplet and standard precautions (AIII) to prevent transmission of influenza to HSCT recipients. HCWs with influenza should be excused from patient care until they are no longer infectious (AIII).

Preventing Disease

HSCT physicians should determine the etiology of a URI in an HSCT recipient or candidate undergoing conditioning therapy, if possible, because respiratory syncytial

virus (RSV), influenza, parainfluenza, and adenovirus URIs can progress to more serious LRI, and certain CRVs can be treated (BIII). Appropriate diagnostic samples include nasopharyngeal washes, swabs or aspirates, throat swabs, and bronchoalveolar lavage (BAL) fluid. HSCT candidates with URI symptoms at the time conditioning therapy is scheduled to start should postpone their conditioning regimen until the URIs resolve, if possible, because certain URIs might progress to LRI during immunosuppression (*131,133,137,138*) (BIII).

Recommendations Regarding Influenza. Life-long seasonal influenza vaccination is recommended for all HSCT candidates and recipients, beginning during the influenza season before HSCT and resuming ≥6 months after HSCT (*142*) (BIII). Influenza vaccinations administered to HSCT recipients <6 months after HSCT are unlikely to be beneficial and are not recommended (*142*) (DII). HSCT recipients <6 months after HSCT should receive chemoprophylaxis with amantadine or rimantadine during community or nosocomial influenza A outbreaks (BIII). These drugs are not effective against influenza B. Additionally, antiviral-resistant strains of influenza can emerge during treatment with amantadine or rimantadine and transmission of resistant strains can occur (*148,149*). During such outbreaks, HSCT recipients 6–24 months after HSCT, or >24 months after HSCT and still substantially immunocompromised (i.e., receiving immunosuppressive therapy, have had a relapse of their underlying disease, or have GVHD) and who have not yet received a current influenza vaccination, should be vaccinated against influenza immediately (BIII). Additionally, to allow sufficient time for the patient to experience an immunologic response to influenza vaccine, chemoprophylaxis with amantadine or rimantadine can be used for these HSCT recipients for 2 weeks after vaccination during a nosocomial or community influenza A outbreak (CIII). Influenza A chemoprophylaxis with amantadine or rimantadine has been recommended for all influenza A-exposed HSCT recipients <24 months after HSCT or ≥24 months after HSCT and substantially immunocompromised regardless of vaccination history, because of their likely suboptimal immunologic response to influenza vaccine (*142,143*). However, no recommendation regarding such chemoprophylaxis can be made because of lack of data.

To prevent severe disease, early preemptive therapy with amantadine or rimantadine has been reported for HSCT recipients with unexplained acute URI or LRI symptoms during a community or nosocomial outbreak of influenza A (*141*). However, the effectiveness in preventing influenza-related complications and the safety of this strategy have not been evaluated among HSCT recipients. Therefore, data are insufficient to make a recommendation.

Neuroaminidase inhibitors (zanimivir and oseltamivir), intravenous and aerosol ribavirin, and combination drug therapy (e.g., rimantadine or amantadine with ribavirin or interferon) (*143,150–153*) have been proposed for investigational, preemptive treatment to prevent severe influenza disease among HSCT recipients. However, because of lack of data, no recommendation for use of these strategies among HSCT recipients can be made.

Recommendations Regarding RSV. Respiratory secretions of any hospitalized HSCT candidate or recipient who experiences signs or symptoms of CRV infection should be tested promptly by viral culture and rapid diagnostic tests for RSV (BIII). If two diagnostic samples taken ≥2 days apart do not identify a respiratory pathogen despite persistence

of respiratory symptoms, BAL and further testing are advised (BIII). This testing is critical because of the high morbidity and case fatality of RSV disease among HSCT recipients (*154,155*). HSCT recipients, particularly those who are preengraftment and at highest risk for severe RSV pneumonia, should have their illness diagnosed early (i.e., during RSV URI), and their illness should be treated aggressively to prevent fatal RSV disease (BIII).

Although a definitive, uniformly effective preemptive therapy for RSV infection among HSCT recipients has not been identified, certain strategies have been proposed, including use of aerosolized ribavirin (*155,156*), RSV antibodies (i.e., passive immunization with high RSV-titered IVIG or RSV immunoglobulin) in combination with aerosolized ribavirin (*137,157*), and RSV monoclonal antibody (*158*). Clinical trials are currently underway to evaluate the efficacy of these strategies. No recommendation regarding the optimal method for RSV prevention and preemptive therapy can be made because of limited data. Further, current data do not support use of intravenous ribavirin for preemptive therapy for RSV pneumonia among HSCT recipients (*60*) (DIII), and no commercially licensed vaccines against RSV are currently available.

Recommendations Regarding Parainfluenza Virus and Adenovirus. Immunoprophylaxis, chemoprophylaxis, and preemptive treatment for parainfluenza virus and adenovirus infections among HSCT recipients have been proposed (*159,160*). However, no recommendation can be made in these guidelines because of insufficient data. No commercially licensed vaccines against parainfluenza or adenovirus are currently available.

Other Disease Prevention Recommendations

The recommendations for preventing CRV infections and their recurrence are the same for allogeneic or autologous recipients. Generally, these recommendations apply to children or adults (*161–164*), but with appropriate adjustments in antiviral drug and influenza vaccine doses for children (Appendix).

For pediatric HSCT recipients and candidates aged >6 months, annual seasonal influenza vaccination is recommended HSCT (BIII). Children aged <9 years who are receiving influenza vaccination for the first time require two doses administered ≥1 months apart (AI). Healthy children who receive influenza vaccination for the first time might not generate protective antibodies until 2 weeks after receipt of the second dose of influenza vaccine. Therefore, during an influenza A outbreak, pediatric recipients aged <9 years, ≥6 months after HSCT, and receiving their first influenza vaccination, should be administered ≥6 weeks of influenza A chemoprophylaxis after the first dose of influenza vaccine (*141*) (BIII) (Appendix). Amantadine and rimantadine are not FDA-approved for children aged <1 year (*141,161*) (DIII).

To prevent RSV disease, researchers report substituting RSV-IVIG for IVIG during RSV season (i.e., November–April) for pediatric recipients (i.e., children aged <18 years) who receive routine IVIG therapy (*164*) (i.e., those with hypogammaglobulinemia) (CIII) (Appendix). Other researchers report that pediatric recipients with RSV can be considered for preemptive therapy (e.g., during URI or early LRI) with aerosolized ribavirin (CIII), although this therapy remains controversial (*164*) (Appendix). Droplet and contact precautions for the duration of illness are required for pediatric recipients for the duration of adenovirus (*62*) (AIII).

FUNGAL INFECTIONS

General Recommendations

Preventing Exposure

Limited data were found that demonstrate to what extent preventing fungal exposures is effective in preventing infection and disease. However, HSCT recipients and candidates undergoing conditioning therapy have been advised to avoid contact with certain areas and substances, including foods, that might increase a patient's risk for fungal exposures (CII). Specific precautions have included avoiding areas of high dust exposure (e.g., excavation sites, areas of building construction or renovation, chicken coops, and caves), occupations involving soil, and foods that contain molds (e.g., blue cheese).

Preventing Disease

Growth factors (e.g., GM-CSF and G-CSF) shorten the duration of neutropenia after HSCT (*165*); however, no data were found that indicate which growth factors effectively reduce the attack rate of invasive fungal disease. Therefore, no recommendation for use of growth factors solely for prophylaxis against invasive fungal disease can be made.

Topical antifungal drugs, which are applied to the skin or mucosa (e.g., nystatin or clotrimazole), might reduce fungal colonization in the area of application. However, these agents have not been proven to prevent generation of locally invasive or disseminated yeast infections (e.g., candidiasis) or mold infections (e.g., aspergillosis) and are not recommended for their prophylaxis (DII). Performing fungal surveillance cultures is not indicated for asymptomatic HSCT recipients (*166,167*) (DII), but cultures should be obtained from symptomatic HSCT recipients (BIII).

Recommendations Regarding Yeast Infections

Preventing Exposure

Invasive candidiasis is usually caused by dissemination of endogenous *Candida* species that have colonized a patient's gastrointestinal tract (*168*). Consequently, methods of preventing exogenous yeast exposure usually do not prevent invasive yeast infections after HSCT. However, because *Candida* species can be carried on the hands, HCWs and others in contact with HSCT recipients should follow appropriate hand-washing practices to safeguard patients from exposure (AIII).

Preventing Disease

Allogeneic recipients should be administered fluconazole prophylaxis to prevent invasive disease with fluconazole-susceptible *Candida* species during neutropenia, particularly among centers where *Can. albicans* is the predominant cause of invasive fungal disease preengraftment (AI) (Appendix). Because candidiasis occurs during phase I (*169*), fluconazole (400 mg/day by mouth or intravenously) should be administered (*169,170*) from the day of HSCT until engraftment (AII). However, fluconazole is not effective against

certain *Candida* species, including *Can. krusei* (*171*) and *Can. glabrata* and is, therefore, not recommended for their prevention (DI). Further studies are needed to determine the optimal duration of fluconazole prophylaxis. Preliminary studies have reported that low-dose fluconazole prophylaxis (100–200 mg/day by mouth) among neutropenic patients has variable efficacy in preventing candidiasis (*172*). Therefore, this therapy is not recommended for HSCT recipients (DII). Oral, nonabsorbable antifungal drugs, including oral amphotericin B (500 mg suspension every 6 hours), nystatin, and clotrimazole troches, might reduce superficial colonization and control local mucosal candidiasis, but have not been demonstrated to reduce invasive candidiasis (CIII).

Other Recommendations

HSCT candidates with candidemia or invasive candidiasis can safely receive transplants (*173*) if a) their infection was diagnosed early and treated immediately and aggressively with amphotericin B or alternatively with appropriate doses of fluconazole if the organism is susceptible; and b) evidence of disease control is reported (e.g., by serial computed tomography scans) before the transplant (BIII). Such patients should continue receiving therapeutic doses of an appropriate antifungal drug throughout phase I (BII) and until a careful review of clinical, laboratory, and serial computed tomography scans verifies resolution of candidiasis (BII).

Because autologous recipients generally have an overall lower risk for invasive fungal infection than allogeneic recipients, certain autologous recipients do not require routine antiyeast prophylaxis (DIII). However, researchers recommend administering antiyeast prophylaxis to a subpopulation of autologous recipients with underlying hematologic malignancies (e.g., lymphoma or leukemia) and who have or will have prolonged neutropenia and mucosal damage from intense conditioning regimens or graft manipulation, or have received fludarabine or 2-CDA recently (BIII). Recommendations regarding preventing invasive yeast infections among pediatric or adult HSCT recipients are the same, except that appropriate dose adjustments for prophylactic drugs should be made for pediatric recipients (Appendix).

Recommendations Regarding Mold Infections

Preventing Exposure

Nosocomial mold infections among HSCT recipients result primarily from respiratory exposure to and direct contact with fungal spores (*174*). Ongoing hospital construction and renovation have been associated with an increased risk for nosocomial mold infection, particularly aspergillosis, among severely immunocompromised patients (*175–177*). Therefore, whenever possible, HSCT recipients who remain immunocompromised should avoid hospital construction or renovation areas (AIII). When constructing new HSCT centers or renovating old ones, hospital planners should ensure that rooms for HSCT patients have an adequate capacity to minimize fungal spore counts through use of

- high-efficiency (>90%) particulate air (HEPA) filtration (*140,178,179*) (BIII);
- directed room airflow (i.e., positive air pressure in patient rooms in relation to corridor air pressure) so that air from patient rooms flows into the corridor (*180*) (BIII);

- correctly sealed rooms, including correctly sealed windows and electrical outlets (*140*) (BIII);
- high rates of room air exchange (i.e., >12 air changes/hour) (*140,178*) (BIII); and
- barriers between patient care and renovation or construction areas (e.g., sealed plastic) that prevent dust from entering patient care areas and that are impermeable to *Aspergillus* species (*175,179*) (BIII).

Additionally, HSCT centers should be cleaned with care, particularly after hospital renovation or construction, to avoid exposing HSCT recipients and candidates to mold spores (*174,176*) (BIII).

Preventing Disease

No regimen has been reported to be clearly effective or superior in preventing aspergillosis, and therefore, no recommendation can be made. Further studies are needed to determine the optimal strategy for aspergillosis prevention. Moderate-dose (0.5 mg/kg/day) amphotericin B (*181–184*), low-dose (0.1–0.25 mg/kg/day) amphotericin B (*185–187*), intranasal amphotericin B spray (*188*), lipid formulations of amphotericin B (*182,189*), and aerosolized amphotericin B (*190*) have been administered for aspergillosis prophylaxis, but data are limited regarding the safety and efficacy of these formulations among HSCT recipients. Additionally, itraconazole capsules are not recommended for fungal prophylaxis among HSCT recipients (*191*) (DII) for three reasons. First, itraconazole capsules are poorly absorbed gastrointestinally, particularly among patients who are fasting (*192*) or receiving cytotoxic agents (*193*). Second, persons taking itraconazole capsules do not achieve steady-state serum levels for 2 weeks (*188,194*), and when achieved, these levels are lower than the average *Aspergillus* species minimum inhibitory concentration (MIC) among HSCT recipients (*195*). Third, itraconazole has adverse interactions with other drugs (e.g., antiepileptics, rifampin, oral hypoglycemics, protease inhibitors, vinca alkaloids, cyclosporine, methylprednisolone, and warfarin-like anticoagulants) (*196*). Trials assessing the efficacy of the recently licensed cyclodextrin oral solution and intravenous formulations of itraconazole in preventing invasive fungal disease among HSCT recipients are in progress; however, no recommendations regarding its use for *Aspergillus* species infection prophylaxis can be made. For HSCT recipients whose respiratory specimens are culture positive for *Aspergillus* species, acute invasive aspergillosis should be diagnosed presumptively (*197*) and treated preemptively and aggressively (e.g., with intravenous amphotericin) (AIII).

The risk for aspergillosis recurrence has been high among allogeneic recipients with preexisting invasive aspergillosis. Previously, allogeneic HSCTs were avoided among persons with uncontrolled, proven aspergillosis. However, HSCT center personnel have recently reported successful allogeneic or autologous HSCT among a limited number of persons who have had successfully treated, prior invasive pulmonary aspergillosis (*198–200*). Because of limited data, no recommendations regarding strategies for preventing aspergillosis recurrence can be made.

PROTOZOAL AND HELMINTHIC INFECTIONS

Recommendations Regarding PCP

Preventing Exposure

Although a possible cause of PCP is reactivation of latent infection among immunocompromised persons, cases of person-to-person transmission of PCP have been reported (*201–206*). Generally, standard precautions should be used for patients with PCP (*62*) (BIII), but researchers have reported patients with PCP being isolated (*201,204*) and contact precautions being used if evidence existed of person-to-person transmission in the institution (CIII). This subject remains controversial, and until further data are published, HSCT recipients should avoid exposure to persons with PCP (*62*) (CIII).

Preventing Disease and Disease Recurrence

Physicians should prescribe PCP prophylaxis for allogeneic recipients throughout all periods of immunocompromise (*207*) after engraftment. Prophylaxis should be administered from engraftment until 6 months after HSCT (AII) for all patients, and >6 months after HSCT for the duration of immunosuppression for those who a) are receiving immunosuppressive therapy (e.g. prednisone or cyclosporine) (AI), or b) have chronic GVHD (BII). However, PCP prophylaxis can be initiated before engraftment if engraftment is delayed (CIII). Researchers report an additional 1- to 2-week course of PCP prophylaxis before HSCT (i.e., day –14 to day –2) (CIII).

Preferred PCP prophylaxis is TMP-SMZ (AII); however, if TMP-SMZ is administered before engraftment, the associated myelosuppression could delay engraftment, and patients might experience sensitivity to the drug. Every effort should be made to keep such patients on the drug, including assessment of desensitization therapy, although data regarding this technique among HSCT recipients are limited. For patients who cannot tolerate TMP-SMZ, physicians can choose to use alternative PCP prophylaxis regimens (e.g., dapsone) (*208*) (BIII). Use of aerosolized pentamidine (*209*) is associated with the lowest PCP prevention rates and should only be used if other agents cannot be tolerated. Atovaquone is a possible alternative drug for PCP prophylaxis among dapsone-intolerant persons with HIV infection (*210*); however, no recommendation regarding use of atovaquone among HSCT recipients can be made because of lack of data. Although data are limited, concomitant use of leucovorin (folinic acid) and TMP-SMZ is not recommended (*211,212*) (DIII). A patient's history of PCP should not be regarded as a contraindication to HSCT (*213*) (DIII).

Recurrent PCP among HSCT recipients is rare; however, patients with continued immunosuppression should remain on PCP prophylaxis until their immunosuppression is resolved (AI). The regimen recommended for preventing toxoplasmosis recurrence among HSCT recipients (i.e., TMP-SMZ) will also prevent PCP recurrence.

Other Recommendations

PCP prophylaxis should be considered for autologous recipients who have underlying hematologic malignancies (i.e., lymphoma or leukemia), are receiving intense conditioning regimens or graft manipulation, or have recently received fludarabine or 2-CDA

(*207,214*) (BIII). PCP prophylaxis should be administered ≥6 months after HSCT if substantial immunosuppression or immunosuppressive therapy (e.g., steroids) persists (CIII). Use of PCP prophylaxis among other autologous recipients is controversial (CIII). Generally, indications for PCP prophylaxis are the same among children or adults, but pediatric doses should be used (Appendix).

Recommendations Regarding *Toxoplasma gondii*

Preventing Exposure

All HSCT recipients should be provided information regarding strategies to reduce their risk for *Toxoplasma* species exposure. Researchers report that potential donors for allogeneic HSCT be tested for *To. gondii* antibodies (*215,216*) by using FDA-licensed or -approved screening tests that include IgG antibody testing because *To. gondii* has been reported to be transmitted by leukocyte transfusion (*217*) and HSCT (*218,219*) (CIII).

Preventing Disease and Disease Recurrence

Because most toxoplasmosis among HSCT recipients is caused by disease reactivation, researchers report that candidates for allogeneic HSCT can be tested for IgG antibody to determine whether they are at risk for disease reactivation after HSCT (*215,216,218*) (CIII). However, the value of such testing is controversial because a limited number of patients who were seronegative for *To. gondii* pretransplant experienced the infection posttransplant (*220*). If testing is performed, only FDA-licensed or -approved screening tests should be used.

Researchers recommend toxoplasmosis prophylaxis for seropositive allogeneic recipients with active GVHD or a prior history of toxoplasmic chorioretinitis (*221,222*), but data demonstrating efficacy are limited (CIII). The optimal prophylactic regimen for toxoplasmosis among HSCT recipients has not been determined, but a proposed drug is TMP-SMZ (BII), although allogeneic recipients have experienced break-through clinical disease despite TMP-SMZ prophylaxis (*218*). For patients who are TMP-SMZ–intolerant, a combination of clindamycin, pyramethamine, and leucovorin can be substituted for *To. gondii* prophylaxis (Appendix). After therapy for toxoplasmosis, HSCT recipients should continue receiving suppressive doses of TMP-SMZ or an alternate regimen for the duration of their immunosuppression (BIII) (Appendix).

Other Recommendations

Recipients of autologous transplants are at negligible risk for toxoplasmosis reactivation (*218*). No prophylaxis or screening for toxoplasmosis infection is recommended for such patients (DIII). Indications for toxoplasmosis prophylaxis are the same among children or adults, but pediatric doses should be used among children (Appendix).

Recommendations Regarding *Strongyloides stercoralis*

Preventing Exposure

Allogeneic recipients should avoid contact with outhouses and cutaneous exposure to soil or other surfaces that might be contaminated with human feces (*223*) (AIII). Allogeneic recipients who work in settings (e.g., hospitals or institutions) where they could be

exposed to fecal matter should wear gloves when working with patients or in areas with potential fecal contamination (AIII).

Preventing Disease and Disease Recurrence

Travel and residence histories should be obtained for all patients before HSCT to determine any exposures to high-risk areas (e.g., such moist temperate areas as the tropics, subtropics, or the southeastern United States and Europe) (*223*) (BIII). HSCT candidates who have unexplained peripheral eosinophilia or who have resided in or traveled to areas endemic for strongyloidiasis, even during the distant past, should be screened for asymptomatic strongyloidiasis before HSCT (BIII). Serologic testing with an enzyme-linked immunosorbent assay is the preferred screening method and has a sensitivity and specificity of >90% (*223,224*) (BIII). FDA-licensed or -approved screening tests should be used. Although stool examinations for strongyloidiasis are specific, the sensitivity obtained from ≥3 stool examinations is 60%–70%; the sensitivity obtained from concentrated stool exams is, at best, 80% (*223*). A total of ≥3 stool examinations should be performed if serologic tests are unavailable or if strongyloidiasis is clinically suspected in a seronegative patient (BIII).

HSCT candidates whose screening tests before HSCT are positive for *Strongyloides* species, and those with an unexplained eosinophilia and a travel or residence history indicative of exposure to *Strongyloides stercoralis* should be empirically treated before transplantation (*225,226*), preferably with ivermectin (BIII), even if seronegative or stool-negative (Appendix).

To prevent recurrence among HSCT candidates with parasitologically confirmed strongyloidiasis, cure after therapy should be verified with ≥3 consecutive negative stool examinations before proceeding with HSCT (AIII). Data are insufficient to recommend a drug prophylaxis regimen after HSCT to prevent recurrence of strongyloidiasis. HSCT recipients who had strongyloidiasis before or after HSCT should be monitored carefully for signs and symptoms of recurrent infection for 6 months after treatment (BIII).

Other Recommendations

Hyperinfection strongyloidiasis has not been reported after autologous HSCT; however, the same screening precautions should be used among autologous recipients (BIII). Indications for empiric treatment for strongyloidiasis before HSCT are the same among children or adults except for children weighing <15 kg, for whom the preferred drug is thiabendazole (BIII) (Appendix).

Recommendations Regarding *Trypanosoma cruzi*

Preventing Exposure

HSCT physicians should be aware that *Trypanosoma cruzi*, the etiologic agent of Chagas' disease, can be transmitted congenitally, through blood transfusion (*227*), and possibly through HSCT. Additionally, treatment for persons infected with *Tr. cruzi* is not always effective, even during the acute stage of infection (*227*). Therefore, potential donors who were born, received a blood transfusion, or ever lived for ≥6 months in a Chagas' disease endemic area (e.g., parts of South and Central America and Mexico) should be screened serologically for anti-*Tr. cruzi* serum IgG antibody (*228*) (BIII). Persons who lived <6 months in a Chagas'-endemic area but who had high-risk living

conditions (e.g., having had extensive exposure to the Chagas' disease vector — the reduviid bug — or having lived in dwellings with mud walls, unmilled logs and sticks, or a thatched roof) should also be screened for evidence of *Tr. cruzi* infection (BIII). Because Chagas' disease can be transmitted congenitally, researchers report that any person with extensive multigenerational maternal family histories of cardiac disease (e.g., cardiomegaly and arrhythmias) should be screened serologically for serum IgG anti-*Tr. cruzi* antibodies (*227*) (CIII). To decrease the risk for misdiagnosis by false-positive or false-negative serologic tests, *Tr. cruzi* screening should consist of ≥2 conventional serologic tests (e.g., enzyme immunoassay, indirect hemagglutination, indirect fluorescent antibody) or ≥1 conventional serologic tests, followed by a confirmatory serologic test (e.g., radioimmunoprecipitation assay) (*229*) (BIII). Persons with active Chagas' disease should not serve as HSCT donors (DIII). Researchers also recommend deferral of HSCT donation for a past history of Chagas' disease (CIII).

Preventing Disease

HSCT candidates who are at risk for being infected with *Tr. cruzi* should be screened for serum IgG anti-*Tr. cruzi* antibody (*228*) (BIII). *Tr. cruzi* seropositivity is not a contraindication to HSCT (*228,230*). However, if an acute illness occurs in a *Tr. cruzi*-seropositive HSCT recipient, particularly during neutropenia, *Tr. cruzi* reactivation should be included in the differential diagnosis (*230*) (BIII). Researchers have proposed use of beznidazole or nifurtimox for preemptive therapy or prophylaxis of recurrent *Tr. cruzi* among seropositive HSCT recipients (*230,231*), but insufficient data were found to make a recommendation.*

Other Recommendations

Recommendations are the same for autologous or allogeneic recipients. However, recurrence of Chagas' disease is probably less likely to occur among autologous recipients because of the shorter duration of immunosuppression. Recommendations are the same among children or adults.

HOSPITAL INFECTION CONTROL

Room Ventilation

HSCT center personnel should follow published guidelines for hospital room design and ventilation (*140,180*) (BIII). HSCT centers should also prevent birds from gaining access to hospital air-intake ducts (*140,174*) (AII). All allogeneic recipients should be placed in rooms with >12 air exchanges/hour (*232,233*) and point-of-use HEPA filters that are capable of removing particles ≥0.3 µm in diameter (*140,178,180,233*) (AIII). Correct filtration is critical in HSCT centers with ongoing construction and renovation (*179*). When portable HEPA filters are used as adjuncts to the primary ventilation system, they must be placed centrally in patient rooms so that space is available around all surfaces to allow free air circulation (BIII). The need for environmental HEPA filtration for autologous recipients has not been established. However, HEPA-filtered rooms should

*For additional information regarding the epidemiology of Chagas' disease, contact CDC/National Center for Infectious Diseases/Division of Parasitic Diseases, (770) 488-7760.

be evaluated for autologous recipients if they experience prolonged neutropenia, a substantial risk factor for nosocomial aspergillosis (CIII).

A laminar air flow (LAF) room contains filtered air that moves in parallel, unidirectional flow — the air enters the room from one wall and exits the room on the opposite wall (*232*). Although LAF has been demonstrated to protect patients from infection during aspergillosis outbreaks related to hospital construction (*234,235*), the value of routine LAF room use for all HSCT recipients is doubtful because substantial overall survival benefit has not been reported (*236*). During 1983, LAF rooms were preferred for allogeneic recipients with aplastic anemia and HLA-identical sibling donors because use of regular rooms was associated with a mortality rate that was approximately four times higher than for those recipients treated in LAF rooms (*237*). However, the survival of aplastic anemia HSCT recipients during the late 1990s exceeds that reported during the early 1980s, and no studies have been done to determine whether HSCT recipients with aplastic anemia still have an improved survival rate when treated in an LAF room. Therefore, HSCT centers need not construct LAF rooms for each HSCT recipient. Use of LAF rooms, if available, is optional (CII).

Hospital rooms should have directed airflow so that air intake occurs at one side of the room and air exhaust occurs at the opposite side (*140*) (BIII). Each hospital room should also be well-sealed (e.g, around windows and electrical outlets) (*140*) (BIII). To provide consistent positive pressure in the recipient's room, HSCT centers should maintain consistent pressure differentials between the patient's room and the hallway or anteroom at >2.5 Pa (i.e., 0.01 inches by water gauge) (*232,233*) (BIII). Generally, hospital rooms for HSCT recipients should have positive room air pressure when compared with any adjoining hallways, toilets, and anterooms, if present.

Anterooms should have positive air pressure compared with hallways (*180*). An exception is the HSCT recipient with an active disease that has airborne transmission (e.g., pulmonary or laryngeal *Mycobacteria tuberculosis* [TB] or measles). These HSCT patients should be placed in negative isolation rooms (*62*) (BIII), and a room with an anteroom is recommended for such patients (*180*) (BIII).

Whenever possible, HSCT centers should have self-closing doors to maintain constant pressure differentials among the HSCT recipients' room and anterooms, if available, and hallways (*233*) (BIII). To enable the nursing staff to observe the HSCT recipient even when the doors are closed, windows can be installed in either the door or the wall of the HSCT recipient's room (*233*) (CIII).

HSCT centers should provide backup emergency power and redundant air-handling and pressurization systems to maintain a constant number of air exchanges and room pressurization in the center when the central ventilation system is shut off for maintenance and repair (*238*) (BIII). Additionally, infection control personnel should work with maintenance personnel to develop protocols to protect HSCT centers at all times from bursts of mold spores that might occur when air-handling systems are restarted after routine maintenance shut-downs (BIII).

Construction, Renovation, and Building Cleaning

Construction and Renovation

Hospital construction and renovation have been associated with an increased risk for nosocomial fungal infection, particularly aspergillosis, among severely immunocompromised patients (*175,176*). Therefore, persons responsible for HSCT center

construction or renovation should consult published recommendations regarding environmental controls during construction (*239,240*) (AIII).

Whenever possible, HSCT recipients, HCWs, and visitors should avoid construction or renovation areas (*240*) (AIII). Also, equipment and supplies used by HSCT recipients or their HCWs should not be exposed to construction or renovation areas (*240*). When planning for construction or renovation, the HSCT center should include plans for intensified aspergillosis-control measures (AIII). Construction and renovation infection control planning committees should include engineers, architects, housekeeping staff, infection control personnel, the director of the HSCT center, the administration, and safety officers (*241*) (BIII).

When constructing new HSCT centers, planners should ensure that patient rooms will have adequate capacity to minimize fungal spore counts by following room ventilation recommendations. During outdoor construction and demolition, the intake air should be sealed (BIII), if possible; if not, filters should be checked frequently. Additionally, to protect HSCT patient care areas during fire drills and emergencies, weather stripping should be placed around stairwell doors, or alternatively, the stairwell air should be filtered to the level of safety of the adjacent hospital air (BIII). False ceilings should be avoided whenever possible (*174*) (BII). If use of false ceilings cannot be avoided, the area above false ceilings should be vacuumed routinely to minimize dust and, therefore, fungal exposure to patients (*174*) (BIII).

During hospital construction or renovation, hospitals should construct rigid, dustproof barriers with airtight seals (*242*) between patient care and construction or renovation areas to prevent dust from entering patient care areas; these barriers (i.e., sealed drywall) should be impermeable to *Aspergillus* species (*140,175,176,179,240*) (BIII). If impervious barriers cannot be created around the construction or renovation area, patients should be moved from the area until renovation or construction is complete and the area has been cleaned appropriately (*176*) (BIII). HSCT centers should direct pedestrian traffic occurring near construction or renovation areas away from patient care areas to limit the opening and closing of doors or other barriers that might cause dust dispersion, entry of contaminated air, or tracking of dust into patient areas (*140*), particularly those in the HSCT center (*176*) (BIII). If possible, specific corridors, entrances, and exits should be dedicated to construction use only (*240*). An elevator to which patients do not have access also should be dedicated to construction use only (*240*). Construction workers, whose clothing might be contaminated with *Aspergillus* species spores, should use the construction elevator and avoid contact with patients, patient care areas, other elevators, and nonconstruction areas (BIII).

Hospital construction or renovation areas should have negative air pressure relative to that in adjacent patient care areas, if no contraindications exist for such pressure differential (*140,176,179,240,242*) (BIII). Ideally, air from the construction or renovation areas should be exhausted to the outside of the hospital (*176*) (BIII) or if recirculated, it should be HEPA-filtered first (BIII).

Researchers have proposed that HSCT recipients wear the N95 respirator to prevent mold exposure during transportation near hospital construction or renovation areas (CIII) because the N95 respirators are regarded as effective against any aerosol. However, to be maximally effective, N95 respirators must be fit-tested and all users must be trained. With correct personnel fit-testing and training, N95 respirators reliably reduce aerosol exposure by 90%. Without fit-testing and training, aerosol exposure would be reduced but not necessarily by 90% (*243*). For patients who cannot use or tolerate an

N95 respirator, researchers have proposed using the powered air purifying respirator (*244,245*), which can be used by patients in wheelchairs. Limitations of the powered air purifying respirator include its cost and that it is not appropriate for young children and infants. General limitations of using respirators are that no commercially available respirator, including N95, has been tested specifically for its efficacy in reducing exposure to *Aspergillus* species in hospital construction or renovation areas, and no studies have been done that assess the usefulness and acceptability of using respirators among HSCT recipients. Standard surgical masks provide negligible protection against mold spores and are not recommended for this indication (DIII).

Newly constructed or renovated areas should be cleaned before patients are allowed to enter them (*140,176*) (AIII). Decontamination of fungal-contaminated areas that cannot be extracted and replaced should be done using copper-8-quinolate (*179*) (BIII). Also, areas above false ceilings located under or adjacent to construction areas should be vacuumed (*174*) (BIII). Additionally, the ventilation, direction of airflow, and room pressurization should be tested and correctly adjusted before patients are allowed to enter (BIII).

Cleaning

HSCT centers should be cleaned ≥1 times/day with special attention to dust control (BIII). Exhaust vents, window sills, and all horizontal surfaces should be cleaned with cloths and mop heads that have been premoistened with an FDA- or Environmental Protection Agency (EPA)-registered hospital disinfectant (BIII). Thorough cleaning during and after any construction activity, including minor renovation projects, is critical (BIII).

HSCT center personnel should prohibit exposures of patients to such activities as vacuuming or other floor or carpet vacuuming that could cause aerosolization of fungal spores (e.g., *Aspergillus* species) (*140*) (AIII). Accordingly, doors to patient rooms should be closed when vacuuming HSCT center corridors. All vacuum cleaners used in the HSCT center should be fitted with HEPA filters. An FDA- or EPA-registered disinfectant (*246,247*) should be used daily for environmental disinfection and when wet vacuuming is performed in the HSCT center (BIII). If an HSCT center provides care for infants, phenolic disinfectants can be used to clean the floors only if the compound is diluted according to the product label; but phenolic compounds should not be used to clean basinets or incubators (*246*) (DIII).

Water leaks should be cleaned up and repaired as soon as possible but within 72 hours to prevent mold proliferation in floor and wall coverings, ceiling tiles, and cabinetry in and around all HSCT patients care areas (BIII). If cleanup and repair are delayed ≥72 hours after the water leak, the involved materials should be assumed to contain fungi and handled accordingly. Use of a moisture meter to detect water penetration of walls should be used whenever possible to guide decision-making (*238*) (BIII). For example, if the wall does not have <20% moisture content ≥72 hours after water penetration, it should be removed (BIII). Design and selection of furnishings should focus on creating and maintaining a dust-free environment. Flooring and finishes (i.e., wall coverings, window shades, and countertops) used in HSCT centers should be scrubbable, nonporous, easily disinfected, and they should collect minimal dust (BIII).

Isolation and Barrier Precautions

HSCT center personnel should follow published guidelines for hospital isolation practices, including CDC guidelines for preventing nosocomial infections (*62,140,248*) (AIII).

However, the efficacy of specific isolation and barrier precautions in preventing nosocomial infections among HSCT recipients has not been evaluated.

HSCT recipients should be placed in private (i.e., single-patient) rooms (BIII). If contact with body fluids is anticipated, standard precautions should be followed (AIII). These precautions include hand washing and wearing appropriate gloves, surgical masks or eye and face protection, and gowns during procedures and activities that are likely to generate splashes or sprays of blood, body fluids, secretions or excretions, or cause soiling of clothing (*62*). When indicated, HSCT recipients should also be placed on airborne, droplet, or contact precautions in addition to standard precautions (*62*) (AIII). Careful observation of isolation precautions is critical in preventing transmission of infectious agents among HSCT recipients, HCWs, visitors, and other HSCT recipients. Physicians are cautioned that HSCT recipients might have a prolonged or episodic excretion of organisms (e.g., CMV).

Researchers have proposed that HSCT recipients wear surgical mask and gloves when exiting their hospital rooms before engraftment (CIII). All HSCT recipients who are immunocompromised (phases I–III of immune system recovery) and candidates undergoing conditioning therapy should minimize the time spent in crowded areas of the hospital (e.g., waiting areas and elevators) (BIII) to minimize potential exposure to persons with CRV infections.

Hand Hygiene

Hand washing is the single-most critical and effective procedure for preventing nosocomial infection (*62*). All persons, but particularly HCWs, should wash their hands before entering and after leaving the rooms of HSCT recipients and candidates undergoing conditioning therapy (*62,249*) or before and after any direct contact with patients regardless of whether they were soiled from the patient, environment, or objects (AI). HSCT recipients should be encouraged to practice safe hand hygiene (e.g., washing hands before eating, after using the toilet, and before and after touching a wound) (BIII). Hand washing should be done with an antimicrobial soap and water (AIII); alternatively, use of hygienic hand rubs is another acceptable means of maintaining hand hygiene (*250,251*). If gloves are worn, HCWs should put them on in the patient's room after hand washing and then discard them in the same patient's room before washing hands again after exiting the room. When worn, gloves should always be changed between patients or when soiled before touching a clean area (e.g., change gloves after touching the perineum and before going to a "clean" area) (AIII). Appropriate gloves should be used by all persons when handling potentially contaminated biological materials (AII). Items worn on the hands and fingers (e.g., rings or artificial nails [*248,252*]) and adhesive bandage strips, can create a nidus for pathogenic organisms that is difficult to clean. Thus, HCWs should avoid wearing such items whenever possible (BII).

Equipment

All HSCT center personnel should sterilize or disinfect and maintain equipment and devices using only EPA-registered compounds as directed by established guidelines (*140,180,246,247,253–256*) (AIII). HSCT center personnel should monitor opened and unopened wound-dressing supplies (e.g., adhesive bandages [*257,258*] and surgical and elastic adhesive tape [*259*]) to detect mold contamination and prevent subsequent cutaneous transmission to patients (BII).

Monitoring should consist of discarding all bandages and wound dressings that are out of date, have damaged packaging, or are visually contaminated by construction debris or moisture (BIII). When arm boards are used to provide support for intravenous lines, only sterile dressing materials should be used (*260*), and arm boards should be changed frequently (e.g., daily) (BIII). Additionally, unsterile tongue depressors inserted into a piece of foam tubing should not be used as splints for intravenous and arterial catheter sites because these have been associated with an outbreak of fatal invasive nosocomial *Rhizopus microsporus* among preterm (i.e., very low-birth–weight) infants (*261*) (DII). HSCT centers should not install carpeting in hallways outside (DII) or in patient rooms (DIII) because contaminated carpeting has been associated with outbreaks of aspergillosis among HSCT recipients (*262,263*).

Plants, Play Areas, and Toys

Although to date, exposure to plants and flowers has not been conclusively reported to cause fungal infections among HSCT recipients, most researchers strongly recommend that plants and dried or fresh flowers should not be allowed in the rooms of hospitalized HSCT candidates undergoing conditioning therapy and HSCT recipients (phases I–III of immune system recovery) because *Aspergillus* species have been isolated from the soil of potted ornamental plants (e.g., cacti), the surface of dried flower arrangements, and fresh flowers (*140,174,178,264*) (BIII).

Play areas for pediatric HSCT recipients and candidates undergoing conditioning therapy should be cleaned and disinfected ≥1 times/week and as needed (BIII). Only toys, games, and videos that can be kept clean and disinfected should be allowed in the HSCT center (BIII). HSCT centers should follow published recommendations for washing and disinfecting toys (*265*) (BIII). All HSCT center toys, games, and videos should be routinely and thoroughly washed or wiped down when brought into the HSCT center and thereafter ≥1 times/week and as needed by using a nontoxic FDA- or EPA-registered disinfectant (*246,247,265*) followed by a water rinse (BIII). Cloth or plush toys should be washed in a hot cycle of a washing machine or dry-cleaned ≥1 times/week and as needed (BIII). Alternatively, machine washing in a cold cycle is acceptable if laundry chemicals for cold water washing are used in proper concentration (*265*). Hard plastic toys should be scrubbed with warm soapy water using a brush to clean crevices, rinsed in clean water, immersed in a mild bleach solution, which should be made fresh daily, for 10–20 minutes, rinsed again, and allowed to air dry (*246*). Alternatively, hard plastic toys can be washed in a dishwasher or hot cycle of a washing machine (BIII). Broviac dolls* should be disassembled upon completion of play and washed with a nontoxic FDA- or EPA-registered disinfectant (*246,247*), rinsed with tap water, and allowed to air dry before other children are allowed to play with them (BIII). Toys that cannot be washed, disinfected, or dry-cleaned after use should be avoided (BIII). Infants, toddlers, and children who put toys in their mouths should not share toys (*265*) (DIII). For children in isolation, researchers recommend the following:

- Disposable play items should be offered whenever possible (BIII).
- Before returning a washable toy used in an isolation room to the pediatric play room for use by another child, it should be cleaned again as previously described (BIII).

*Broviac dolls are used to demonstrate medical procedures (e.g., insertion of catheters) to children to lessen their fears.

- When a child is taken out of isolation, toys, games, and videos used during the period of isolation and that might serve as fomites for infection should be thoroughly disinfected with a nontoxic FDA- or EPA-registered disinfectant (*246,247,265*) (BIII). After use in isolation rooms, cloth or plush toys should be placed in a plastic bag and separated from unused toys. All cloth or plush toys used in isolation rooms should be washed in a washing machine or dry-cleaned before being used in a nonisolation room (BIII). Toys that cannot be disinfected or dry-cleaned after use in an isolation room should be discarded (BIII).

Water-retaining bath toys have been associated with an outbreak of *Pseudomonas aeruginosa* in a pediatric oncology ward (*266*); therefore, these toys should not be used by immunocompromised HSCT recipients and candidates (DII). Occupational and physical therapy items should be cleaned and disinfected as previously described (BIII). Soil-based materials (e.g., clay or potting soil) should be avoided (BIII).

HCWs

HSCT center personnel should have a written comprehensive policy regarding their immunizations and vaccinations, and that policy should meet current CDC, Advisory Committee on Immunization Practices, and Healthcare Infection Control Practices Advisory Committee recommendations (*267*) (BIII). Immunizations are needed to prevent transmission of vaccine-preventable diseases to HSCT recipients and candidates undergoing conditioning therapy. All HCWs with diseases transmissible by air, droplet, and direct contact (e.g., VZV, infectious gastroenteritis, HSV lesions of lips or fingers, and URIs) should be restricted from patient contact and temporarily reassigned to other duties (AI). HSCT center personnel should follow published recommendations regarding the duration of work restrictions for HCWs with infectious diseases (*268,269*) (BIII). HSCT center HCWs with bloodborne viruses (e.g., HIV or hepatitis B or C viruses) should not be restricted from patient contact (DIII) as long as they do not perform procedures that pose a high risk for injury that could result in patient exposure to the HCW's blood or body fluids. Work exclusion policies should be designed to encourage HCWs to report their illnesses or exposures (AII).

HSCT Center Visitors

Hospitals should have written policies for screening HSCT center visitors, particularly children, for potentially infectious conditions. Such screening should be performed by clinically trained HCWs (BII). Visitors who might have communicable infectious diseases (e.g., URIs, flu-like illnesses, recent exposure to communicable diseases, an active shingles rash whether covered or not, a VZV-like rash within 6 weeks of receiving a live-attenuated VZV vaccine, or a history of receiving an oral polio vaccine within the previous 3–6 weeks) should not be allowed in the HSCT center or allowed to have direct contact with HSCT recipients or candidates undergoing conditioning therapy (AII). No absolute minimum age requirement for HSCT center visitors exists; however, all visitors must be able to understand and follow appropriate hand washing and isolation precautions (AIII). The number of HSCT center visitors at any one time should be restricted to a number that permits the nursing staff to perform appropriate screening for contagious diseases and adequate instruction and supervision of hand washing, glove and mask use, and biosafety precautions (BIII).

Patient Skin and Oral Care

To optimize skin care, HSCT recipients should take daily showers or baths during and after transplantation (BIII), using a mild soap (BIII). Skin care during neutropenia should also include daily inspection of skin sites likely to be portals of infection (e.g., the perineum and intravascular access sites) (BIII). HSCT recipients and candidates undergoing conditioning therapy should maintain good perineal hygiene to minimize loss of skin integrity and risk for infection (BIII). To facilitate this precaution, HSCT center personnel should develop protocols for patient perineal care, including recommendations for gentle but thorough perineal cleaning after each bowel movement and thorough drying of the perineum after each urination (BIII). Females should always wipe the perineum from front to back after using the toilet to prevent fecal contamination of the urethra and urinary tract infections (AIII). Moreover, to prevent vaginal irritation, menstruating immunocompromised HSCT recipients should not use tampons (DIII) to avoid the risk for cervical and vaginal abrasions. Additionally, the use of rectal thermometers, enemas, suppositories, and rectal exams are contraindicated among HSCT recipients to avoid skin or mucosal breakdown (DIII).

All HSCT candidates and their caregivers should be educated regarding the importance of maintaining good oral and dental hygiene for at least the first year after HSCT to reduce the risk for oral and dental infections (AIII). For example, HSCT candidates should be informed that establishment of the best possible periodontal health before HSCT is a substantial step in avoiding short- and long-term oral infections and that maintenance of safe oral hygiene after HSCT can minimize the severity of infections and facilitate healing of mucositis, particularly before engraftment (BIII).

All HSCT candidates should receive a dental evaluation and relevant treatment before conditioning therapy begins (*270,271*) (AIII). Likely sources of dental infection should be vigorously eliminated (*271*) (AIII). For example, teeth with moderate to severe caries should be restored; ill-fitting dental prostheses should be repaired; and teeth compromised by moderate to severe periodontal disease should be extracted (*271*). Ideally, 10–14 days should elapse between the completion of tissue-invasive oral procedures and onset of conditioning therapy to allow for adequate healing and monitoring for postsurgical complications (AIII).

HSCT recipients with mucositis and HSCT candidates undergoing conditioning therapy should maintain safe oral hygiene by performing oral rinses 4–6 times/day with sterile water, normal saline, or sodium bicarbonate solutions (*270*) (AIII). HSCT recipients and candidates should brush their teeth ≥2 times/day with a soft regular toothbrush (*270*) (BIII). If the recipient cannot tolerate these brushings, use of an ultrasoft toothbrush or toothette (i.e., foam swab on a stick), can be used (CIII), but physicians should be aware that using the latter products are less desirable than using soft regular or ultrasoft toothbrushes because the toothettes remove less dental debris (*270*). Using toothpaste is optional, depending on the recipient's tolerance (*270*) (CIII). HSCT recipients and candidates undergoing conditioning therapy who are skilled at dental flossing should floss daily if this can be done without trauma (BIII). Routine dental supervision is advised to monitor and guide the patient's maintenance of oral and dental hygiene (BIII). To decrease the risk for mechanical trauma and infection of oral mucosa, fixed orthodontic appliances and space maintainers should not be worn from the start of conditioning therapy until preengraftment mucositis resolves, and these devices should not be worn during any subsequent periods of mucositis (*270*) (DIII). Dental and transplant teams and

the patient's community dentist should coordinate removal of these appliances and long-term rehabilitation of any oral lesions (BIII). However, patients who normally wear removable dental prostheses might be able to wear them during conditioning therapy before HSCT and during mucositis after HSCT, depending on the degree of tissue integrity at the denture-bearing sites and the ability of the patient to maintain denture hygiene on a daily basis (CIII).

Preventing Bacterial Intravascular Catheter-Related Infections

HSCT center personnel are advised to implement published guidelines for preventing intravascular device-related infections (*33*) (AIII). Contact with tap water at the central venous catheter site should be avoided (BIII). For long-term central venous access among children, HSCT physicians can use a totally implantable device among children aged <4 years if the anticipated duration of vascular access is >30 days (CII). However, such a device among children aged <4 years is not generally used as the actual HSCT infusion site because a) problems with skin fragility contraindicate repeated punctures over the port site and b) the port device might have an insufficient number of lumens for optimal patient management immediately after HSCT.

To prevent bloodstream infections associated with needleless intravenous access devices, HSCT recipients should a) cover and protect the catheter tip or end cap during bathing or showering to protect it from tap water contamination, b) change the device in accordance with manufacturers' recommendations, if available, and c) have a caregiver perform intravenous infusions whenever possible (*272,273*) (BII). Also, HSCT recipients and their caregivers should be educated regarding proper care of needleless intravenous access devices (*272*) (BII). No recommendation regarding the use of antibiotic-impregnated central venous catheters among HSCT recipients can be made because of lack of data.

Control of Specific Nosocomial Infections

Recommendations Regarding Legionella *Species*

HSCT physicians should always include Legionnaires' disease (LD) in the differential diagnosis of pneumonia among HSCT recipients (*140*) (AIII). Appropriate tests to confirm LD include a) culturing sputum, BAL, and tissue specimens; b) testing BAL specimens for *Legionellae* by direct fluorescent antibody; and c) testing for *Legionella pneumophila* serogroup 1 antigen in urine. The incubation period for LD is usually 2–10 days; thus, laboratory-confirmed legionellosis that occurs in a patient who has been hospitalized continuously for ≥10 days before the onset of illness is regarded as a definite case of nosocomial LD, and a laboratory-confirmed infection that occurs 2–9 days after hospital admission is a possible case of nosocomial LD (*140*). When a case of laboratory-confirmed nosocomial LD (*274,275*) is identified in a person who was in the inpatient HSCT center during all or part of the 2–10 days before illness onset, or if two or more cases of laboratory-confirmed LD occur among patients who had visited an outpatient HSCT center, hospital personnel should

- report the case(s) to the local or state health department if the disease is reportable in that state or if assistance is needed (*140*) (AIII); and

- in consultation with the hospital infection control team, conduct a thorough epidemiologic and environmental investigation to determine the likely environmental source(s) of *Legionella* species (e.g., showers, tap water faucets, cooling towers, and hot water tanks) (*274,276*) (AI).

The source of *Legionella* infection should be identified and decontaminated or removed (AIII). Extensive hospital investigations of an isolated case of possible nosocomial LD might not be indicated if the patient has had limited contact with the inpatient center during most of the incubation period (CIII). Because HSCT recipients are at much higher risk for disease and death from legionellosis compared with other hospitalized persons (*274*), periodic routine culturing for *Legionellae* in water samples from the center's potable water supply could be regarded as part of an overall strategy for preventing LD in HSCT centers (CIII). However, the optimal methodology (i.e., frequency or number of sites) for environmental surveillance cultures in HSCT centers has not been determined, and the cost-effectiveness of this strategy has not been evaluated. Because HSCT recipients are at high risk for LD and no data were found to determine a safe concentration of *Legionellae* organisms in potable water, the goal, if environmental surveillance for *Legionellae* is undertaken, should be to maintain water systems with no detectable organisms (AIII). Physicians should suspect legionellosis among HSCT recipients with nosocomial pneumonia even when environmental surveillance cultures do not yield *Legionellae* (AIII). If *Legionella* species are detected in the water supplying an HSCT center, the following should be done until *Legionella* species are no longer detected by culture:

- The water supply should be decontaminated (*140*) (AII).
- HSCT recipients should be given sponge baths with water that is not contaminated with *Legionella* species (e.g., not with the HSCT center's *Legionella* species-contaminated potable water system) (BIII).
- Patients should not take showers in LD-contaminated water (DIII).
- Water from faucets containing LD-contaminated water should not be used in patient rooms or the HSCT center and outpatient clinic to avoid creating infectious aerosols (CIII).
- HSCT recipients should be given sterile water instead of tap water for drinking, brushing teeth, or flushing nasogastric tubes during Legionellosis outbreaks (BIII).

HSCT center personnel should use only sterile water (i.e., not distilled unsterile water) for rinsing nebulization devices and other semicritical respiratory-care equipment after cleaning or disinfecting and for filling reservoirs of nebulization devices (*140*) (BII). HSCT centers should not use large-volume room air humidifiers that create aerosols (e.g., by Venturi principle, ultrasound, or spinning disk) and, thus, are actually nebulizers (*140*) (DI) unless these humidifier or nebulizers are sterilized or subjected to daily high-level disinfection and filled with sterile water only (*140*) (CIII).

When a new hospital with an HSCT center is constructed, the cooling towers should be placed so that the tower drift is directed away from the hospital's air-intake system, and the cooling towers should be designed so that the volume of aerosol drift is minimized (*140*) (BII). For operational hospital cooling towers, hospitals should

- install drift eliminators,

- regularly use an effective biocide,
- maintain cooling towers according to the manufacturer's recommendations, and
- keep adequate maintenance records (*140*) (BII).

HSCT physicians are encouraged to consult published recommendations regarding preventing nosocomial Legionellosis (*140,277*) (BIII). No data were found to determine whether drinking tap water poses a risk for *Legionella* exposure among HSCT recipients in the absence of an outbreak.

Recommendations Regarding Methicillin-Resistant Sta. aureus

HSCT center HCWs should follow basic infection control practices (e.g., hand washing between patients and use of barrier precautions, including wearing gloves whenever entering the methicillin-resistant *Sta. aureus* [MRSA] infected or colonized patient's room); these practices are essential for MRSA control (*62*) (AII). If MRSA is a substantial problem in the HSCT center and evidence exists of ongoing MRSA transmission, MRSA infected or colonized patients should be treated as a cohort (e.g., cared for exclusively by a limited number of HCWs) (BIII). HSCT transplant recipients with recurrent *Sta. aureus* infections should undergo extensive evaluation for persistent colonization, including cultures of nares, groin, axilla, and ostomy sites (e.g., tracheostomy or gastrointestinal tube) (BIII). For patients with recurrent MRSA infection, elimination of the carrier state should be attempted by applying a 2% mupirocin calcium ointment to the nares (BIII), although this strategy has been only marginally effective in certain institutions (*278*) (Appendix). High-level mupirocin-resistant MRSA has been reported in Europe, the Middle East, and South America (*279–283*) but is uncommon in the United States. As with any antibiotic, incorrect or overuse of mupirocin can result in mupirocin-resistant *Staphylococci*; therefore, mupirocin use should be reserved for infection control strategies only (*279,280*). For patients who fail mupirocin, physicians have used bacitracin, TMP-SMZ, or rifampin administered with another antibiotic, but no standardized protocol using these drugs for this indication has been evaluated and no recommendations can be made because of lack of data. Selection of a systemic antibiotic should be guided by susceptibility patterns.

Intravascular cannulas or other implantable devices that are infected or colonized with MRSA should be removed (AIII). Patients with MRSA should be placed under contact precautions until all antibiotics are discontinued and until three consecutive cultures, taken ≥1 weeks apart, are negative (*62*) (BIII). Screening cultures for MRSA include the anterior nares, any body site previously positive for MRSA, and any wounds or surgical sites.

Recommendations Regarding Staphylococcus *Species with Reduced Susceptibility to Vancomycin*

All HSCT centers should have sufficient laboratory capability to identify all *Staphylococci* isolates and their susceptibility patterns to antibiotics, including vancomycin (*284,285*) (AIII). Additionally, all HSCT center personnel should conduct routine surveillance for the emergence of *Staphylococcus* species strains with reduced susceptibility to vancomycin (*285,286*) (AIII). Reduced susceptibility should be considered for all *Sta. aureus* strains that have a vancomycin MIC of ≥4 µg/mL and all coagulase-negative

Staphylococci that have a vancomycin MIC of ≥8 µg/mL. If repeat testing of the organism in pure culture confirms the genus, species, and elevated vancomycin MICs, the following steps should be taken (*287*):

- The laboratory should immediately contact hospital infection control personnel, the patient's clinical center, and the patient's attending physician, as well as the local or state health department, and CDC's Hospital Infections Program Help Desk ([404] 639-6106 or [800] 893-0485) (*284,285,287,288*) (AIII).
- The HSCT center's infection control personnel, in collaboration with appropriate authorities (i.e., state and local health departments and CDC) should promptly initiate an epidemiologic and laboratory investigation (*287,288*) (AIII) and follow published guidelines for the control of such species (*285,287,288*) (BIII).
- Medical and nursing staff should
  - — institute contact precautions (e.g., wearing of gown and gloves, using antibacterial soap for hand washing, and wearing masks when contamination of the HCW with secretions is likely) as recommended for multidrug-resistant organisms (*62,284,287*);
  - — minimize the number of persons with access to colonized or infected patients (*287*); and
  - — treat as a cohort colonized or infected patients (e.g., care for them exclusively with a limited number of HCWs) (*286,287*) (AIII).
- If a patient in an HSCT center is colonized or infected with *Staphylococci* that have reduced susceptibility to vancomycin, the infection control personnel should follow published guidelines for the control of such species (*285,287,288*) (BIII).

Avoiding overuse and misuse of antibiotics will decrease the emergence of *Staphylococcus* species with reduced susceptibility to vancomycin (*286,287*). Therefore, medical and ancillary staff members who are responsible for monitoring antimicrobial use patterns in the facility should routinely review vancomycin-use patterns (*284,285,287*) (AIII). Additionally, HSCT center personnel should institute prudent use of all antibiotics, particularly vancomycin, to prevent the emergence of *Staphylococcus* with reduced susceptibility to vancomycin (*284,285,287–289*) (AII). Intravascular cannulas or other implantable devices that are infected or colonized with *Staphylococcus* species strains with reduced susceptibility to vancomycin should be removed (AIII).

Recommendations Regarding VRE

Use of intravenous vancomycin is associated with VRE emergence. Vancomycin and all other antibiotics, particularly antianaerobic agents (e.g., metronidazole and third-generation cephalosporins) must be used judiciously (*284,290–292*) (AII). Oral vancomycin use can be limited by treating recurrences of *Cl. difficile* diarrhea with oral metronidazole instead of vancomycin (BIII). Physicians have placed patients with a history of VRE or VRE colonization into continuous isolation during clinic visits and hospitalizations; however, this practice is controversial because certain non-HSCT recipients might clear VRE from their stools. No recommendation regarding use of continuous

isolation among HSCT recipients can be made because of lack of data. To control VRE exposure, strict adherence to the following standard infection control measures is necessary (*292*) (AI):

- Wash hands with antibacterial soap before entering and after leaving HSCT recipients' rooms, particularly those who have VRE colonization or infection; alternatively, wash hands with a waterless antiseptic agent (e.g., an alcohol-based rinse or gel) (*250*).
- Whenever possible, treat as a cohort patients who are known to be colonized or infected with VRE (*290*).
- Disinfect patient rooms and equipment (*291,293*), including surfaces of the hospital ward environment (e.g., floors, walls, bed frames, doors, bathroom surfaces) with an FDA- or EPA-registered disinfectant (*246,247*). A nontoxic disinfectant should be used for pediatric areas (BIII).
- Place patients with VRE under contact precautions until all antibiotics are discontinued (CIII) and repeated cultures are negative (*62*) (BIII). HCWs should always wear gloves when in the VRE patient or carrier's room and discard gloves in the patient's room before exiting.

No evidence exists that treating VRE carriers is beneficial; therefore, chronic antibiotic treatment of carriers is not recommended (DIII). HSCT recipients and candidates should be screened for VRE colonization at the time of interfacility transfer to allow for immediate institution of appropriate infection control practices and to minimize transmission of VRE between and within facilities (*294*) (BII). However, the role of outpatient surveillance in VRE control is unknown; such surveillance is costly and should not be undertaken in nonoutbreak settings (DIII). A history of having resolved VRE bacteremia or being a VRE carrier are not contraindications to HSCT (BIII).

Recommendations Regarding Cl. difficile

HSCT physicians should follow published recommendations for preventing and controlling *Cl. difficile* disease, including minimizing the duration of antibiotic therapy and number of antibiotics used for any indication (*295,296*) (AIII). All patients with *Cl. difficile* disease should be placed under contact precautions for the duration of illness (*62*) (AII). All HCWs who anticipate contact with a *Cl. difficile*-infected patient or the patient's environment or possessions should put on gloves before entering the patient's room (*62,295–298*) and before handling the patient's secretions and excretions (AI). During *Cl. difficile* outbreaks, HSCT center personnel should restrict use of antibiotics (e.g., clindamycin) (*299*) (BII). To prevent transmission of *Cl. difficile* to patients during nosocomial *Cl. difficile* outbreaks, HSCT center HCWs should a) use disposable rectal thermometers or tympanic thermometers; b) disinfect gastrointestinal endoscopes with 2% glutaraldehyde immersion for 10 minutes or use an equivalent disinfectant strategy (*255,256*); and c) perform surface sterilization of the hospital ward environment (e.g., floors, walls, bed frames, doors, bathroom surfaces) with an FDA- or EPA-registered sterilant (e.g., phosphate-buffered sodium hypochlorite solution [1,660 ppm available chloride]; unbuffered hypochlorite solution [500 ppm available chloride]; 0.04% formaldehyde and 0.03% glutaraldehyde [*255,295,300*]; or ethylene oxide [*247,296*]) (BII). Additionally, physicians should treat patients with *Cl. difficile* disease with antibiotics as recommended in published reports (*62,295*) (BII).

Certain researchers also recommend antibiotic treatment of *Cl. difficile* carriers (*301*). However, other researchers have reported that treatment of asymptomatic *Cl. difficile* carriers with metronidazole is not effective and that treatment with vancomycin is only effective temporarily (i.e., <2 months after treatment) (*302*). Consequently, no recommendation regarding treatment of asymptomatic *Cl. difficile* carriers can be made. Similarly, although symptomatic *Cl. difficile* disease recurrence or relapse occurs among 7%–20% of patients (*295*), data are insufficient to make a recommendation for preventing multiple *Cl. difficile* relapses.

The following practices are not recommended for *Cl. difficile* control:

- routine stool surveillance cultures for *Cl. difficile* for asymptomatic patients or HCWs, even during outbreaks (DIII);
- culturing HCWs' hands for *Cl. difficile* (DIII); or
- treating patients presumptively for *Cl. difficile* disease pending toxin results (DIII), unless the patient is very sick with a compatible syndrome or the hospital has a high prevalence of *Cl. difficile* (CIII).

Prophylactic use of lyophilized *Saccharomyces boulardii* to reduce diarrhea among antibiotic recipients is not recommended because this therapy is not associated with a substantial reduction in diarrhea associated with *Cl. difficile* disease (*303*) and has been associated with *Saccharomyces boulardii* fungemia (*304*) (DII).

Recommendations Regarding CRV Infections

Physicians should institute appropriate precautions and infection control measures for preventing nosocomial pneumonia among hospitalized HSCT recipients and candidates undergoing conditioning therapy, particularly during community or nosocomial CRV outbreaks (*140*) (AIII). Patients with URI or LRI symptoms should be placed under a) contact precautions for most viral respiratory infections including varicella; b) droplet precautions for influenza or adenovirus; or c) airborne precautions for measles or varicella to avoid transmitting infection to other HSCT candidates and recipients as well as to HCWs and visitors (BIII). Identifying HSCT recipients with RSV infection and placing them under contact precautions immediately (AIII) to prevent nosocomial transmission is critical. When suctioning the respiratory tract of patients with URI or LRI symptoms, HCWs should wear gowns, surgical masks, and eye protection to avoid contamination from the patient's respiratory secretions. All protective clothing (e.g., gown, gloves, surgical mask, and eye protection) should be put on when entering a patient's room and discarded in the same room before exiting; protective clothing should always be changed between patient rooms (*140*) (AIII). When caring for an HSCT recipient or candidate undergoing conditioning therapy with URI or LRI, HCWs and visitors should change gloves and wash hands a) after contact with a patient; b) after handling respiratory secretions or objects contaminated with secretions from one patient and before contact with another patient, object, or environmental surface; and c) between contacts with a contaminated body site and the respiratory tract of or respiratory device used on the same patient (*140*) (AII). This practice is critical because most respiratory infections are usually transmitted by contact, particularly by hand to nose and eye. Therefore just wearing a mask, without appropriate hand washing, glove-wearing, or use of eye protection is insufficient to prevent transmission of CRV infections.

Researchers have proposed that HSCT recipients or candidates undergoing conditioning therapy be placed under contact precautions during nosocomial outbreaks (*131*) (CIII). Even when no nosocomial or community outbreak of CRV infections exists, all persons who enter the HSCT center should be screened daily for URI symptoms, including visitors and HCWs (BIII). Researchers also describe systems where HCWs provide daily verification (e.g., using sign-in sheets) that they are free of URI symptoms before being allowed to provide HSCT patient care. HCWs and visitors with URI symptoms should be restricted from contact with HSCT recipients and candidates undergoing conditioning therapy to minimize the risk for CRV transmission (*131*) (AIII). All HCWs with URI symptoms should be restricted from patient contact and reassigned to nonpatient care duties until the HCW's symptoms resolve (BIII). Visitors with URI symptoms should be asked to defer their visit to the HSCT center (*131*) until their URI symptoms resolve (BIII).

Respiratory secretions of any hospitalized HSCT candidate or recipient with signs or symptoms of CRV infection should be tested promptly by viral culture and rapid diagnostic tests for CRV (BIII). Appropriate samples include nasopharyngeal washes, swabs, aspirates, throat swabs, and BAL fluid. This practice is critical because preemptive treatment of certain CRVs (e.g., influenza and RSV) (*133*) might prevent severe disease and death among HSCT recipients. Viral shedding among HSCT recipients with CRV infection has been reported to last ≤4 months for influenza (*143*), ≤2 years for adenovirus (*305,306*), and ≤22 days for RSV (*136*); however, RSV viral shedding has been reported to last 112 days in a child with severe combined immunodeficiency (*307*). Therefore, to prevent nosocomial transmission of CRV (*136*), HSCT center HCWs should recognize that prolonged CRV shedding can occur when determining the duration of appropriate precautions for CRV-infected HSCT recipients or candidates undergoing conditioning therapy (CIII). HSCT centers should use serial testing by using cultures from nasopharyngeal swabs, throat swabs or aspirates, or rapid antigen tests to help determine whether patients have stopped shedding influenza virus (BIII). Researchers have proposed that HSCT physicians conduct routine CRV surveillance among HSCT recipients to detect outbreaks and implement infection control measures as early as possible (CIII). During RSV season, HSCT recipients and candidates with signs or symptoms should be tested for RSV infection (i.e., the presence of RSV antigen in respiratory secretions tested by enzyme-linked immunosorbent assay and viral culture) starting with admission to the HSCT center. All patients who are RSV-antigen positive should be treated as a cohort during nosocomial RSV outbreaks because this practice reduces nosocomial RSV transmission (*130,131*) (BII). Symptomatic HCWs should be excluded from patient contact until symptoms resolve. HCWs and visitors with infectious conjunctivitis should be restricted from direct patient contact until the drainage resolves (i.e., usually, 5–7 days for adenovirus) and the ophthalmology consultant concurs that the infection and inflammation have resolved (*268*) (AII) to avoid possible transmission of adenovirus to HSCT recipients.

Preventing CRV exposure among HSCT recipients after hospital discharge is more challenging because of high CRV prevalence. Preventive measures should be individualized in accordance with the immunologic status and tolerance of the patient. In outpatient waiting rooms, patients with CRV infections should be separated to the extent possible from other patients (BIII).

Recommendations Regarding TB

HSCT candidates should be screened for TB by careful medical history and chart review to ascertain any history of prior TB exposure (AIII) because immunocompromised persons have higher risk for progression from latent TB infection to active disease (*244*). Also, physicians can administer a tuberculin skin test (TST) using the Mantoux method with five tuberculin units of purified protein derivative (CIII); but because of a patient's immunocompromise, this test might not be reliable. If a TST is administered, either the Tubersol® or Aplisol® formulation of purified protein derivative can be used (*244,308*). Persons with a recently positive TST or a history of a positive TST and no prior preventive therapy should be administered a chest radiograph and evaluated for active TB (*309*) (AI). For immunocompromised persons, a positive TST is defined as ≥5 mm of induration (*309,310*) because of their decreased ability to mount a delayed hypersensitivity response (CIII). Because immunosuppressive therapy decreases the sensitivity of the TST, HSCT physicians should not rely solely on the TST to determine whether latent TB infection is present and whether preventive therapy should be administered to HSCT recipients or candidates (DIII). Instead, a full 9-month course of isonicotinic acid hydrazide preventive therapy should be administered to immunocompromised HSCT recipients or candidates who have been substantially exposed to someone with active, infectious (i.e., sputum-smear positive) pulmonary or laryngeal TB, regardless of the HSCT recipient's or candidate's TST status (*309*) (BIII). A full 9-month course of isonicotinic acid hydrazide preventive therapy should also be administered to HSCT recipients or candidates with a positive TST who were not previously treated and have no evidence of active TB disease (*309*) (AIII) (Appendix). Routine anergy screening might not be reliable among HSCT recipients and candidates undergoing conditioning therapy and, therefore, is not recommended (DIII). An HSCT should not be canceled or delayed because of a positive TST (DIII).

Use of a 2-month course of a daily pyrazinamide/rifampin (PZA/RIF) regimen has been recommended as an alternate preventive therapy for persons with TB (*309*). However, limited data were found regarding safety and efficacy of this regimen among non-HIV–infected persons. Furthermore, rifampin has substantial drug interactions with certain medications, including cyclosporine, tacrolimus (FK506), corticosteroids, fluconazole, and pain medications. Therefore, routine use of the 2-month PZA/RIF prophylactic regimen among HSCT recipients is not recommended (DIII). However, this regimen can be used for HSCT candidates who are not at risk for serious rifampin drug interactions and whose HSCT is not scheduled until ≥2 weeks after completion of the 2-month PZA/RIF course (CIII). This delay will diminish the possibility of adverse effects of rifampin on drugs used for routine HSCT OI prophylaxis (e.g., fluconazole) (*311*). An HSCT candidate or recipient who has been exposed to an active case of extrapulmonary, and therefore, noninfectious TB does not require preventive therapy (DIII).

HSCT center personnel should follow guidelines regarding the control of TB in healthcare facilities (*244,245*), including instituting airborne precautions and negative-pressure rooms for patients with suspected or confirmed pulmonary or laryngeal TB (*62,244*) (AII). HCWs should wear N95 respirators, even in isolation rooms, to protect themselves from possible TB transmission from patients with active pulmonary or laryngeal TB, particularly during cough-inducing procedures (*62,244,245,312*) (AIII). To be maximally effective, respirators (e.g., N95) must be fit-tested, and all respirator users

must be trained to use them correctly (*243*) (AIII). Unless they become soiled or damaged, changing N95 respirators between patient rooms is not necessary (DIII). Bacillus of Calmette and Guérin vaccination is contraindicated among HSCT candidates and recipients because it might cause disseminated or fatal disease among immunocompromised persons (*313,314*) (EII). No role has been identified for chronic suppressive therapy or follow-up surveillance cultures among HSCT recipients who have a history of successfully treated TB (DIII).

Infection Control Surveillance

HSCT center personnel are advised to follow standard guidelines for surveillance of antimicrobial use and nosocomial pathogens and their susceptibility patterns (*315*) (BIII). HSCT center personnel should not perform routine fungal or bacterial cultures of asymptomatic HSCT recipients (*166,167*) (DII). In the absence of epidemiologic clusters of infections, HSCT center personnel should not perform routine periodic bacterial surveillance cultures of the HSCT center environment or of equipment or devices used for respiratory therapy, pulmonary-function testing, or delivery of inhalation anesthesia (*140*) (DIII). Researchers recommend that hospitals perform routine sampling of air, ceiling tiles, ventilation ducts, and filters to test for molds, particularly when construction or renovation occurs near or around the rooms of immunocompromised patients (*167,174*) or when clinical surveillance demonstrates a possible increase in mold (i.e., aspergillosis) cases (CIII). Strategies that might decrease fungal spores in the ventilation system include eliminating access of birds (i.e., primarily pigeons) to air-intake systems, removing bird droppings from the air-intake ducts, and eliminating moss from the hospital roof (*174*). Furthermore, in the absence of a nosocomial fungal outbreak, HSCT centers need not perform routine fungal cultures of devices and dust in the rooms of HSCT recipients and candidates undergoing conditioning therapy (DIII). HSCT center personnel should routinely perform surveillance for the number of aspergillosis cases occurring among HSCT recipients, particularly during hospital construction or renovation (BIII). A two-fold or greater increase in the attack rate of aspergillosis during any 6-month period indicates that the HSCT center environment should be evaluated for breaks in infection control techniques and procedures and that the ventilation system should be investigated carefully (*174*) (BIII).

STRATEGIES FOR SAFE LIVING AFTER HSCT — PREVENTING EXPOSURE AND DISEASE

Avoiding Environmental Exposures

HSCT recipients and candidates undergoing conditioning therapy, particularly allogeneic recipients, and parents of pediatric HSCT recipients and candidates should be educated regarding strategies to avoid environmental exposures to opportunistic pathogens (AIII).

Preventing Infections Transmitted by Direct Contact

HSCT recipients and candidates should wash their hands thoroughly (i.e., with soap and water) and often. For example, hands should be washed

- before eating or preparing food;
- after changing diapers;
- after gardening or touching plants or dirt;
- after touching pets or animals;
- after touching secretions or excretions or items that might have had contact with human or animal stool (e.g., clothing, bedding, toilets, or bedpans);
- after going outdoors; and
- before and after touching wounds (*249*) (AIII).

Conscientious hand washing is critical during the first 6 months after HSCT and during other periods of substantial immunosuppression (e.g., GVHD, systemic steroid use, or relapse of the underlying disease for which the transplant was performed) (AIII). Pediatric HSCT recipients and candidates should be supervised by adults during hand washing to ensure thorough cleaning (*316*) (BIII). Hand washing should be performed with an antimicrobial soap and water (AIII); alternatively, use of hygienic hand rubs is an acceptable means of maintaining hand hygiene (*250,251*). HSCT recipients who visit or live on farms should follow published recommendations for preventing cryptosporidiosis (*5,316,317–319*) (BIII).

Preventing Respiratory Infections

To prevent respiratory infections after hospital discharge, HSCT recipients should observe the following precautions:

- Frequent and thorough hand washing is critical (BIII), but HSCT recipients should also avoid touching their mucus membranes, unless they have washed their hands first, to avoid inoculating themselves with CRV.
- HSCT recipients should avoid close contact with persons with respiratory illnesses (BIII). When close contact is unavoidable, those persons with respiratory illnesses should be encouraged to wash their hands frequently and to wear surgical masks or, at a minimum, smother their sneezes and coughs in disposable tissues. Alternatively, the HSCT recipient can wear a surgical mask (CIII).
- HSCT recipients should avoid crowded areas (e.g., shopping malls or public elevators) where close contact with persons with respiratory illnesses is likely (BIII).
- HSCT candidates or recipients should be advised that certain activities and occupations (e.g., work in health-care settings, prisons, jails, or homeless shelters) can increase their risk for TB exposure (BIII). In deciding whether a patient should continue activities in these settings, physicians should evaluate the patient's specific duties, the precautions used to prevent TB exposure in the workplace, and the prevalence of TB in the community. The decision to continue or terminate such activities should be made jointly between patient and physician (BIII). HSCT recipients should avoid exposure to persons with active tuberculosis, particularly during the first 6 months after HSCT and during other periods of substantial immunosuppression (e.g., GVHD, systemic steroid use, or relapse of the underlying disease for which the transplant was performed) (BIII).

Researchers report that allogeneic recipients should avoid construction or excavation sites or other dust-laden environments for the first 6 months after HSCT and during other periods of substantial immunosuppression (e.g., GVHD, systemic steroid use, or relapse of the underlying disease for which the transplant was performed) to avoid exposures to molds (CIII). Researchers also report that outpatient HSCT recipients should be advised of travel routes to the HSCT center that will avoid or minimize exposure to construction sites (CIII).

Coccidioidomycosis is uncommon after allogeneic HSCT; however, researchers report that HSCT recipients traveling to or residing in coccidioidomycosis-endemic areas (e.g., the American southwest, Mexico, and Central and South America) should avoid or minimize exposure to disturbed soil, including construction or excavation sites, areas with recent earthquakes, farms, or other rural areas (CIII). Histoplasmosis (*Histoplasma capsulatum*) after allogeneic HSCT is also rare; however, researchers report that HSCT recipients in histoplasmosis-endemic areas should avoid exposure to chicken coops and other bird-roosting sites and caves for the first 6 months after HSCT and during periods of substantial immunosuppression (e.g., GVHD, systemic steroid use, or relapse of the underlying disease for which the transplant was performed) (CIII).

Smoking tobacco and exposure to environmental tobacco smoke are risk factors for bacterial and CRV infections among healthy adults and children (*320–325*); consequently, logic dictates that physicians advise HSCT recipients not to smoke and to avoid exposure to environmental tobacco smoke (CIII). However, no data were found that specifically assess whether smoking or environmental smoke exposure are risk factors for OIs among HSCT recipients. Researchers have reported that marijuana smoking might be associated with generation of invasive pulmonary aspergillosis among immunocompromised persons, including HSCT recipients (*326–329*). Therefore, HSCT recipients should refrain from smoking marijuana to avoid *Aspergillus* species exposure (*326,330–334*) (BIII).

Preventing Infections Transmitted Through Direct Contact and Respiratory Transmission

Researchers have proposed that immunocompromised HSCT recipients and candidates who are undergoing conditioning therapy avoid gardening or direct contact with soil, plants, or their aerosols to reduce exposure to potential pathogens (e.g., *To. gondii*, *Hi. capsulatum*, *Cryptococcus neoformans*, *Nocardia* species, and *Aspergillus* species) (CIII). HSCT recipients, particularly allogeneic recipients, could wear gloves while gardening or touching plants or soil (*335*) (CIII), and they should avoid creating plant or soil aerosols (BIII). Additionally, they should always wash their hands afterwards (*335*) and care for skin abrasions or cuts sustained during soil or plant contact (AIII).

Persons whose occupations involve animal contact (e.g., veterinarians, pet store employees, farmers, or slaughterhouse workers) could be at increased risk for toxoplasmosis and other zoonotic diseases. Although data are insufficient to justify a general recommendation against HSCT recipients working in such settings, these exposures should be avoided during the first 6 months after HSCT and during other periods of substantial immunosuppression (e.g., GVHD, systemic steroid use, or relapse of the underlying disease for which the transplant was performed) (BIII).

Safe Sex

Sexually active HSCT recipients should avoid sexual practices that could result in oral exposure to feces (*5,316*) (AIII). Sexually active patients who are not in long-term

monogamous relationships should always use latex condoms during sexual contact to reduce their risk for exposure to CMV, HSV, HIV, hepatitis B and C, and other sexually transmitted pathogens (AII). However, even long-time monogamous partners can be discordant for these infections. Therefore, during periods of immunocompromise, sexually active HSCT recipients in such relationships should consider using latex condoms during sexual contact to reduce the risk for exposure to these sexually transmitted infections (CIII).

Pet Safety

Preventing Pet-Transmitted Zoonotic Infections

HSCT physicians should advise recipients and candidates undergoing conditioning therapy of the potential infection risks posed by pet ownership; however, they should not routinely advise HSCT recipients to part with their pets, with limited exceptions. Generally, immunocompromised HSCT recipients and candidates undergoing conditioning therapy should minimize direct contact with animals (*336,337*), particularly those animals that are ill (e.g., with diarrhea) (*335*) (BIII). Immunocompromised persons who choose to own pets should be more vigilant regarding maintenance of their pet's health than immunocompetent pet owners (BIII). This recommendation means seeking veterinary care for their pet early in the pet's illness to minimize the possible transmission of the pet's illness to the owner (*335*) (BIII). Feeding pets only high-quality commercial pet foods reduces the possibility of illness caused by spoiled or contaminated foods, thus reducing the possibility of transmitting illness from the pet to the HSCT recipient. If eggs, poultry, or meat products are given to the pet as supplements, they should be well-cooked. Any dairy products given to pets should be pasteurized (*335*) (BIII). Pets should be prevented from drinking toilet bowl water and from having access to garbage; pets should not scavenge, hunt, or eat other animals' feces (*335*) (BIII).

If HSCT recipients have contact with pets or animals, they should wash their hands after handling them (particularly before eating) and after cleaning cages; HSCT recipients should avoid contact with animal feces to reduce the risk for toxoplasmosis, cryptosporidiosis, salmonellosis, and campylobacteriosis (*335*) (BIII). Adults should supervise hand washing of pediatric HSCT recipients (BIII). Immunocompromised HSCT recipients and candidates should not clean pet litter boxes or cages or dispose of animal waste (DIII). If this cannot be avoided, patients should wear disposable gloves during such activities and wash their hands thoroughly afterwards (BIII). Immunocompromised HSCT recipients and candidates should avoid adopting ill or juvenile pets (e.g., aged <6 months for cats) (*335*) and any stray animals (*5,316*) (BIII). Any pet that experiences diarrhea should be checked by a veterinarian for infection with *Cryptosporidium* (*5,316*), *Giardia* species (*335*), *Salmonella*, and *Campylobacter* (*5,335,337*) (BIII).

Immunocompromised HSCT recipients and candidates should not have contact with reptiles (e.g., snakes, lizards, turtles, or iguanas) (DII) to reduce their risk for acquiring salmonellosis (*335,338–341*). Additionally, patients should be informed that salmonellosis can occur from fomite contact alone (*342*). Therefore, HSCT recipients and candidates should avoid contact with a reptile, its food, or anything that it has touched, and if such contact occurs, recipients and candidates should wash their hands thoroughly afterwards (AIII). Immunocompromised HSCT recipients and candidates should avoid contact with ducklings and chicks because of the risk for acquiring *Salmonella* or

Campylobacter species infections (*338,343*) (BIII). Immunocompromised HSCT recipients and candidates should avoid contact with exotic pets (e.g., nonhuman primates) (BIII). Bird cage linings should be cleaned regularly (e.g., daily) (*337*). All persons, but particularly immunocompromised HSCT candidates and recipients, should wear gloves whenever handling items contaminated with bird droppings (*337*) (BIII) because droppings can be a source of *Cryptococcus neoformans*, *Mycobacterium avium*, or *Hi. capsulatum*. However, routine screening of healthy birds for these diseases is not recommended (*335*) (DIII). To minimize potential exposure to *Mycobacterium marinum*, immunocompromised HSCT recipients and candidates should not clean fish tanks (DIII). If this task cannot be avoided, patients should wear disposable gloves during such activities and wash their hands thoroughly afterwards (*335,337*) (BIII).

Preventing Toxoplasmosis

The majority of toxoplasmosis cases in the United States is acquired through eating undercooked meat (*335,337*). However, all HSCT recipients and candidates, particularly those who are *To. gondii* seronegative, should be informed of the risks for contracting toxoplasmosis from cat feces (BIII), but need not be advised to give away their cats (DII). For households with cats, litter boxes should not be placed in kitchens, dining rooms, or other areas where food preparation and eating occur (*335*). Additionally, litter boxes should be cleaned daily by someone other than the HSCT recipient during the first 6 months after HSCT and during periods of substantial immunosuppression (e.g., GVHD, steroid use, or relapse of the underlying disease for which the transplant was performed) to reduce the risk for transmitting toxoplasmosis to the HSCT recipient (BIII). Daily litter box changes will minimize the risk for fecal transmission of *To. gondii* oocysts, because fecal oocysts require ≥2 days of incubation to become infectious. If HSCT recipients perform this task during the first 6 months after HSCT and during subsequent periods of substantial immunocompromise (e.g., during GVHD, systemic steroid use, or relapse of the underlying neoplastic disease for which the transplant was performed), they should wear disposable gloves (*335*). Gloves should be discarded after a single use (BIII). Soiled, dried litter should be disposed of carefully to prevent aerosolizing the *To. gondii* oocysts (BIII). Cat feces (but not litter) can be flushed down the toilet (BIII). Also, persons who clean cat litter, particularly HSCT recipients, should wash their hands thoroughly with soap and water afterwards to reduce their risk for acquiring toxoplasmosis (BIII).

HSCT recipients and candidates with cats should keep their cats inside (BIII) and should not adopt or handle stray cats (DIII). Cats should be fed only canned or dried commercial food or well-cooked table food, not raw or undercooked meats, to eliminate the possibility of causing an illness that could be transmitted from the cat to the HSCT recipient (BIII). Pet cats of HSCT recipients do not need to be tested for toxoplasmosis (EII). Playground sandboxes should be kept covered when not in use to prevent cats from soiling them (BIII). HSCT recipients and candidates undergoing conditioning therapy should avoid drinking raw goat's milk to decrease the risk for acquiring toxoplasmosis (BIII).

Water and Other Beverage Safety

Although limited data were found regarding the risks for and epidemiology of *Cryptosporidium* disease among HSCT recipients, HSCT recipients are prudent to avoid possible exposures to *Cryptosporidium* (BIII) because it has been reported to cause

severe, chronic diarrhea, malnutrition, and death among other immunocompromised persons (*5,318,319*). HSCT recipients should avoid walking, wading, swimming, or playing in recreational water (e.g., ponds or lakes) that is likely to be contaminated with *Cryptosporidium*, *Es. coli* O157:H7 (*344–346*), sewage, or animal or human waste (BII). HSCT recipients should also avoid swallowing such water (e.g., while swimming) (*5,344,346*) as well as any water taken directly from rivers and lakes (*5,316*) (AIII).

HSCT recipients should not use well water from private wells or from public wells in communities with limited populations (DIII) because tests for microbial contamination are performed too infrequently (e.g., in certain locations, tests are performed ≤1 times/month) to detect sporadic bacterial contamination. However, drinking well water from municipal wells serving highly populated areas is regarded as safe from bacterial contamination because the water is tested ≥2 times/day for bacterial contamination. If HSCT recipients consume tap water, they should routinely monitor mass media (e.g., radio, television, or newspapers) in their area to immediately implement any boil-water advisories that might be issued for immunocompromised persons by state or local governments (BIII). A boil-water advisory means that all tap water should be boiled for ≥1 minutes before it is consumed. Tap water might not be completely free of *Cryptosporidium*. To eliminate the risk for *Cryptosporidium* exposure from tap water, HSCT recipients can boil tap water for ≥1 minutes before consuming it (e.g., drinking or brushing teeth) (*5*) (CIII). Alternately, they can use certain types of water filters (*316*) or a home distiller (*317*) to reduce their risk for *Cryptosporidium* (*5*) and other waterborne pathogens (CIII). If a home water filter* is used, it should be capable of removing particles ≥1 µm in diameter, or filter by reverse osmosis. However, the majority of these filters are not capable of removing smaller microbes (e.g., bacteria or viruses), and therefore, should only be used on properly treated municipal water. Further, the majority of these devices would not be appropriate for use on an unchlorinated private well to control viral or bacterial pathogens. Bottled water can be consumed if it has been processed to remove *Cryptosporidium* by one of three processes — reverse osmosis, distillation, or 1-µm particulate absolute filtration. To confirm that a specific bottled water has undergone one of these processes, HSCT recipients should contact the bottler directly.†

Patients can take other precautions in the absence of boil-water advisories to further reduce their risk for cryptosporidiosis. These extra precautions include avoiding fountain beverages and ice made from tap water at restaurants, bars, and theaters (*5*), fruit drinks made from frozen concentrate mixed with tap water, and iced tea or coffee made with tap water (*317*). Drinks that are likely to be *Cryptosporidium* safe for HSCT recipients include nationally distributed brands of bottled or canned carbonated soft drinks and beers (*5*); commercially packaged noncarbonated drinks that contain fruit juice; fruit juices that do not require refrigeration until after opening (e.g., those that are stored unrefrigerated on grocery shelves) (*5*); canned or bottled soda, seltzer or fruit drinks; steaming hot (≥175 F) tea or coffee (*317*); juices labeled as pasteurized; and nationally distributed brands of frozen fruit juice concentrate that are reconstituted with water from

*For a list of filters certified under NSF Standard 053 for cyst (i.e., *Cryptosporidium*) removal, contact the NSF International consumer line at (800) 673-8010 or <http://www.nsf.org/notice/crypto.html>.

† The International Bottled Water Association can be contacted at (703) 683-5213 from 9 a.m. to 5 p.m. EST or anytime at their Internet site (<http://www.bottledwater.org>) to obtain contact information regarding water bottlers.

a safe source (*5*). HSCT recipients should not drink unpasteurized milk or fruit or vegetable juices (e.g., apple cider or orange juice) to avoid infection with *Brucella* species, *Es. coli* O157:H7, *Salmonella* species, *Cryptosporidium*, and others (*319,347–351*) (DII).

Food Safety

HSCT candidates and household or family members who prepare food for them after HSCT should review food safety practices that are appropriate for all persons (*352*) (AIII), and food preparers should be educated regarding additional food safety practices appropriate for HSCT recipients. This review and education should be done before the conditioning regimen (i.e., chemotherapy and radiation) begins (BIII). Adherence to these guidelines will decrease the risk for foodborne disease among HSCT recipients.

Food Safety Practices Appropriate for All Persons

Raw poultry, meats, fish, and seafood should be handled on separate surfaces (e.g., cutting board or counter top) from other food items. Food preparers should always use separate cutting boards (i.e., one for poultry and other meats and one for vegetables and remaining cutting or carving tasks) (AIII), or the board(s) should be washed with warm water and soap between cutting different food items (AIII). To prevent foodborne illnesses caused by *Campylobacter jejuni* and *Salmonella enteritidis*, which can cause severe and invasive infections among immunocompromised persons (*353,354*), uncooked meats should not come in contact with other foods (BIII).

After preparing raw poultry, meats, fish, and seafood and before preparing other foods, food handlers should wash their hands thoroughly in warm, soapy water. Any cutting boards, counters, knives, and other utensils used should be washed thoroughly in warm, soapy water also (AIII). Food preparers should keep shelves, counter tops, refrigerators, freezers, utensils, sponges, towels, and other kitchen items clean (AIII). All fresh produce should be washed thoroughly under running water before serving (*355*) (AIII). Persons preparing food should follow published U.S. Department of Agriculture recommendations regarding safe food thawing (*356*) (BIII).

Persons cooking food for HSCT recipients should follow established guidelines for monitoring internal cooking temperatures for meats (*357*) (AII). The only method for determining whether the meat has been adequately cooked is to measure its internal temperature with a thermometer because the color of the meat after cooking does not reliably reflect the internal temperature. Different kinds of meat should be cooked to varying internal temperatures, all ≥150 F (AII). Specifically, the U.S. Department of Agriculture recommends that poultry be cooked to an internal temperature of 180 F; other meats and egg-containing casseroles and souffles should be cooked to an internal temperature of ≥160 F. Cold foods should be stored at <40 F; hot foods should be kept at >140 F (BIII). Food preparers should

- wash their hands before and after handling leftovers (AIII);
- use clean utensils and food-preparation surfaces (AIII);
- divide leftovers into small units and store in shallow containers for quick cooling (AII);
- refrigerate leftovers within 2 hours of cooking (AII).
- discard leftovers that were kept at room temperature for >2 hours (AIII);

- reheat leftovers or heat partially cooked foods to ≥165 F throughout before serving (AII);
- bring leftover soups, sauces, and gravies to a rolling boil before serving (AIII); and
- follow published guidelines for cold storage of food (*352*) (AII).

Additional Food Safety Practices Appropriate for HSCT Recipients

HSCT recipients' diets should be restricted to decrease the risk for exposure to foodborne infections from bacteria, yeasts, molds, viruses, and parasites (BIII). Currently, a low microbial diet is recommended for HSCT recipients (*358,359*) (BIII). This diet should be continued for 3 months after HSCT for autologous recipients. Allogeneic recipients should remain on the diet until all immunosuppressive drugs (e.g., cyclosporine, steroids, and tacrolimus) are discontinued. However, the HSCT physician should have final responsibility for determining when the diet can be discontinued safely. Only one study has reported that dietary changes (e.g., consuming yogurt) have decreased the risk for mycotic infections (e.g., candidal vaginitis) (*360*) (Table 3). HSCT recipients should not eat any raw or undercooked meat, including beef, poultry, pork, lamb, venison or other wild game, or combination dishes containing raw or undercooked meats or sweetbreads from these animals (e.g., sausages or casseroles) (AII). Also, HSCT recipients should not consume raw or undercooked eggs or foods that might contain them (e.g., certain preparations of hollandaise sauce, Caesar and other salad dressings, homemade mayonnaise, and homemade eggnog) because of the risk for infection with *Salmonella enteritidis* (*354*) (AII). HSCT recipients should not consume raw or undercooked seafood (e.g., oysters or clams) to prevent exposure to *Vibrio* species, viral gastroenteritis, and *Cryptosporidium parvum* (*361–364*) (AII).

HSCT recipients and candidates should only consume meat that is well-done when they or their caretakers do not have direct control over food preparation (e.g., when eating in a restaurant) (AI). To date, no evidence exists in the United States that eating food at a fast food restaurant is riskier than eating at a conventional sit-down restaurant. Generally, HSCT candidates undergoing conditioning therapy and HSCT recipients with neutropenia (i.e., ANC < 1,000/ml^3), GVHD, or immunosuppression should avoid exposures to naturopathic medicines that might contain molds (*365*) (DIII). HSCT recipients wishing to take naturopathic medications are advised to use them only as prescribed by a licensed naturopathic physician working in consultation with the recipient's transplant and infectious disease physicians (CIII).

Travel Safety

Travel to developing countries can pose substantial risks for exposure to opportunistic pathogens for HSCT recipients, particularly allogeneic recipients chronically immunosuppressed. HSCT recipients should not plan travel to developing countries without consulting their physicians (AIII), and travel should not occur until the period of severe immunosuppression has resolved. Generally, allogeneic recipients should not plan travel to developing countries for 6–12 months after HSCT, particularly if GVHD has occurred. Autologous recipients can travel to developing countries 3–6 months after HSCT if their physicians agree.

HSCT recipients should be informed regarding strategies to minimize the risk for acquiring foodborne and waterborne infections while traveling. They should obtain updated, detailed health information for international travelers from health organizations (*366,367*) (AIII). Generally, while traveling in developing countries, HSCT recipients should avoid consuming the following (BIII):

- raw fruits and vegetables,
- tap water or any potentially untreated or contaminated water,
- ice made from tap water or any potentially contaminated water,
- unpasteurized milk or any unpasteurized dairy products,
- fresh fruit juices,
- food and drinks from street vendors, and
- raw or undercooked eggs.

Steaming hot foods, fruits peeled by oneself, bottled and canned processed drinks, and hot coffee or tea are probably safe (*367,368*). Travelers should plan for treating their drinking water while in developing countries. If bottled water is not available, boiling is the best method of making water safe. However, if boiling water is not feasible, the traveler should carry supplies for disinfecting water (e.g., commercially available iodine disinfection tablets or a portable water filter) (*366,368*).

Antimicrobial prophylaxis for traveler's diarrhea is not recommended routinely for HSCT recipients traveling to developing countries (DIII) because traveler's diarrhea is not known to be more frequent or more severe among immunocompromised hosts. However, HSCT physicians who wish to provide prophylaxis to HSCT recipients who are traveling can prescribe a fluoroquinolone (e.g., ciprofloxacin hydrochloride) or TMP-SMZ (CIII), although resistance to TMP-SMZ is now common and resistance to fluoroquinolones is increasing in tropical areas (Appendix). Researchers recommend using bismuth subsalicylate to prevent traveler's diarrhea among adults (*366*). However, no data were found regarding safety and efficacy among HSCT recipients, and salicylates are not recommended for use among persons aged <18 years because salicylates are associated with Reye's syndrome (*369*).

HSCT recipients' immunization status should be assessed and their vaccinations updated as needed before travel (*366*). Influenza chemoprophylaxis with rimantadine or amantadine can be used for immunocompromised HSCT recipients who are traveling outside the continental United States and who could be exposed to influenza A (CIII).

HSCT RECIPIENT VACCINATIONS

Antibody titers to vaccine-preventable diseases (e.g., tetanus, polio, measles, mumps, rubella, and encapsulated organisms) decline during the 1–4 years after allogeneic or autologous HSCT (*66,370–373*) if the recipient is not revaccinated. Clinical relevance of decreased antibodies to vaccine-preventable diseases among HSCT recipients is not immediately apparent because a limited number of cases of vaccine-preventable diseases are reported among U.S. recipients. However, vaccine-preventable diseases still pose risks to the U.S. population. Additionally, evidence exists that certain vaccine-preventable diseases (e.g., encapsulated organisms) can pose increased risk for HSCT

recipients (*66*); therefore, HSCT recipients should be routinely revaccinated after HSCT so that they can experience immunity to the same vaccine-preventable diseases as others (Table 4).

HSCT center personnel have developed vaccination schedules for HSCT recipients (*374*). One study determined that HSCT center personnel used 3–11 different vaccination schedules per vaccine (*374*); consequently, the study authors requested national guidelines for doses and timing of vaccines after HSCT to eliminate confusion among HSCT center personnel regarding how to vaccinate their patients. To address this need, an interim vaccination schedule for HSCT recipients was drafted in collaboration with partner organizations, including CDC's Advisory Committee on Immunization Practices. The purpose of the vaccination schedule in these guidelines is to provide guidance for HSCT centers (Table 4). Although limited data were found regarding safety and immunogenicity (e.g., serologic studies of antibody titers after vaccination) among HSCT recipients, no data were found regarding vaccine efficacy among HSCT recipients (e.g., which determine whether vaccinated HSCT recipients have decreased attack rates of disease compared with unvaccinated HSCT recipients). Because certain HSCT recipients have faster immune system recovery after HSCT than others, researchers have proposed that different vaccination schedules be recommended for recipients of different types of HSCT. However, to date, data are too limited to do so. Therefore, the same vaccination schedule is recommended for all HSCT recipients (e.g., allogeneic, autologous, and bone marrow, peripheral, or UCB grafts) until additional data are published. In the tables, vaccines have only been recommended for use among HSCT recipients if evidence exists of safety and immunogenicity for those recipients. Vaccination of family members, household contacts, and HCWs are also recommended to minimize exposure of vaccine-preventable diseases among HSCT recipients (Tables 5–8).

HEMATOPOIETIC STEM CELL SAFETY

With allogeneic HSCT, the life of the recipient might depend on the timely selection of an acceptable HLA-matched donor. Only a limited number of HLA-matched donors might be identified; hence, the transplant physician often has to accept a higher risk for transmission of an infectious agent through HSCT than would be permitted for routine blood transfusion. This section provides strategies for the HSCT physician to minimize transmission of infectious diseases, whenever possible, from donors to recipients.*† Whether to select a donor who is at risk for or who has an infectious disease transmissible by HSCT, should be determined on a case-by-case basis (AIII) and is the final responsibility of the HSCT physician (AIII). If the only possible donor is at risk for or known to be infected with a bloodborne pathogen and the patient is likely to succumb rapidly from his or her disease if an HSCT is not received, the physician must carefully weigh the risks and benefits of using potentially infected donor cells. No person should be denied a potentially life-saving HSCT procedure solely on the basis of the risk for an infectious disease. However, HSCT physicians should avoid transplanting any infected or infectious donor hematopoietic stem cell product unless no other stem cell product can be obtained and

*The U.S. Public Health Service is reexamining the current donor deferral recommendations regarding risk behaviors for donors of organs, cells, tissues, xenotransplantation, and reproductive cells and tissue, including semen, and revisions to these guidelines could become necessary as the research evolves.

† Guidelines for screening UCB donors and their mothers are evolving and will not be addressed in this document.

the risk for death from not undergoing transplantation is deemed to be greater than the risk for morbidity or death from the infection that could potentially be transmitted (DII). If such a product is selected for use, it should be done on a case-by-case basis (*375*) and the following should be noted in the recipient's chart:

- knowledge and authorization of the recipient's HSCT physician regarding the potential for transmission of an infectious agent during HSCT, and
- advance informed consent from the recipient or recipient's legal guardian acknowledging the possible transmission of an infectious agent during the transplantation (AIII).

Subsequently, the HSCT physician should include the infectious agent in the differential diagnosis of any illness that the HSCT recipient experiences so that the infection, if transmitted, can be diagnosed early and treated preemptively, if possible. Infectious products (except those in which CMV seropositivity is the only evidence of infectiousness) should be labeled as being a biohazard or as untested for biohazards, as applicable. Tissue intended for autologous use should be labeled "For Autologous Use Only — Use Only for (Patient's Name)."

Preventing Transmission of Infections from HSCT Donors to Recipients

All prospective HSCT donors should be evaluated through a physical history and examination to determine their general state of health and whether they pose a risk for transmitting infectious diseases to the recipient (*376*). To detect transmissible infections, all HSCT donor collection site personnel should follow up-to-date published guidelines and standards for donor screening (e.g., medical history), physical exam, and serologic testing (*377–383*) (AIII). Initial donor screening and physical exam should be performed ≤8 weeks before the planned donation (BIII). Donor serologic testing should be done ≤30 days before donation to detect potentially transmissible infections (BII); additionally, researchers recommend that donors be retested ≤7 days before collection. If testing is done >7 days before donation, donor screening should be repeated to ensure that no new risk behaviors have occurred during the interval between the original screening and the time of donation (BIII). This practice is critical because if new behavioral risk factors have occurred, the potential donor might need to be deferred. Screening and testing should be done on all allogeneic or syngeneic donors (AIII). Screening and testing of autologous donors is recommended to ensure the safety of laboratory personnel and to prevent cross contamination (BIII). If autologous donors are not tested, their autologous units should be specially labeled and handled as if potentially infected (BIII). For donors screened in the United States, FDA-licensed or -approved tests should be used in accordance with the manufacturers' instructions (AIII), and the donor samples should be tested in laboratories certified by the Clinical Laboratory Improvement Amendments of 1988 (AIII).

All HSCT donors should be in good general health (*376*) (BIII). Acute or chronic illness in the prospective donor should be investigated to determine the etiology. Generally, persons who are ill should not be HSCT donors (DIII). A flu-like illness in a prospective donor at the time of evaluation or between the time of evaluation and donation should prompt evaluation of and serologic testing for infections that might pose a risk to the

recipient (e.g., EBV, CMV, *To. gondii*) (BIII). Persons with a positive serum EBV-viral capsid antigen IgM but negative serum EBV-viral capsid antigen IgG should not serve as donors for allogeneic T-cell–depleted HSCT, particularly for unrelated or mismatched transplants, until their serum EBV-viral capsid antigen IgG becomes positive (DIII). Persons with acute toxoplasmosis should not donate until the acute illness has resolved (DII); however, physicians should be aware that persons who are asymptomatically seropositive for *To. gondii* might transmit this infection through HSCT (*218*).

Prospective donors with symptoms of active TB should be evaluated for that disease (*383*) (BIII). Prospective donors with active TB should not donate (EIII) until the TB is well-controlled (e.g., no longer contagious as determined by the donor's primary physician) after appropriate medical therapy. However, no known risk exists from transplanting marrow from an untreated, tuberculin-positive donor who has no evidence of active disease. Screening potential donors for TB with Mantoux skin tests (DIII) is not necessary. Prospective HSCT donors who reside in or have traveled to areas endemic for rickettsia or other tickborne pathogens and who are suspected of having an acute tickborne infection should be temporarily deferred as donors until infection with these pathogens is excluded (DIII). Relevant pathogens include *Rickettsia rickettsii*, *Babesia microti* and other *Babesia* species, *Coxiella burnetii*, and the Colorado tick fever virus, which are the etiologic agents of Rocky Mountain spotted fever, babesiosis, Q fever, and Colorado tick fever, respectively; these pathogens have been reported to be transmitted by blood transfusion (*384–388*). Researchers recommend deferral for a past history of Q fever or babesiosis because these infections can be chronic and the babesiosis parasite might persist despite appropriate therapy (*389*) (CIII). Additionally, researchers have recommended deferring persons with acute human ehrlichiosis (e.g., human active human granulocytic ehrlichiosis [*390*], human monocytic ehrlichiosis, as well as any infections from *Ehrlichia ewingii*) from HSCT donation (CIII).

The medical history of the prospective HSCT donor should include the following:

- History of vaccinations (*377*) during the 4 weeks before donation (AII). If the potential donor is unsure of vaccinations received, his or her records should be reviewed. HSCT donation should be deferred for 4 weeks after the donor receives any live-attenuated vaccine (e.g., rubeola [measles], mumps, rubella [German measles], oral polio, varicella, yellow fever, and oral typhoid vaccines) (EIII). This deferral will avoid the possibility of infusing a live infectious agent into an HSCT recipient. HSCT donation need not be deferred for persons who have recently received toxoid or killed (i.e., inactivated), recombinant viral, bacterial, or rickettsial vaccines as long as the donor is asymptomatic and afebrile (*389*) (BIII). Such vaccines include tetanus toxoid, diphtheria toxoid, hepatitis A and B, cholera, influenza (i.e., killed intramuscular vaccine), meningococcal, paratyphoid, pertussis, plague, polio (i.e., inactivated polio vaccine), rabies, typhoid (i.e., inactivated intramuscular vaccine), or typhus vaccines (*389*).

- Travel history (BIII) to determine whether the donor has ever resided in or traveled to countries with endemic diseases that might be transmitted through HSCT (e.g., malaria). Permanent residents of nonendemic countries who have traveled to an area that CDC regards as endemic for malaria can be accepted as HSCT donors if 1 year has elapsed since the donor's departure from the endemic area and if the donor has been free of malaria symptoms, regardless of whether he or she received antimalarial chemoprophylaxis. Because cases of

HSCT-transmitted malaria have been reported (*391,392*), persons who have had malaria and received appropriate treatment should be deferred from HSCT donation for 3 years after becoming asymptomatic. Immigrants, refugees, citizens, or residents for ≥5 years of endemic countries can be accepted as HSCT donors if 3 years have elapsed since they departed the malarious area and if they have been free of malaria symptoms.

- History of Chagas' disease and leishmaniasis. Persons with active Chagas' disease or leishmaniasis should not serve as HSCT donors (DIII) because these diseases can be transmitted by transfusion (*227,229,231,393–395*). Researchers also recommend deferral of HSCT donation if a past history exists of either of these diseases because the parasite can persist despite therapy (*227–229,231, 389,393–395*) (CIII).

- History of any deferral from plasma or blood donation. The reason for such a deferral (*376*) and whether it was based on a reported infectious disease or behavioral or other risk factor should be investigated (BIII).

- History of viral hepatitis. A person with a history of viral hepatitis after his or her eleventh birthday should be excluded from HSCT donation (BIII).

- History of blood product transfusion, solid organ transplantation, or transplantation of tissue within the last 12 months (BIII). Such persons should be excluded from HSCT donation (DIII). Xenotransplant product recipients and their close contacts should be indefinitely deferred from donating any blood products, including hematopoietic stem cells, whole blood, or other blood components including plasma, leukocytes, and tissues (*396*) (AIII). Close contacts to be deferred from donations include persons who have engaged repeatedly in activities that could result in an intimate exchange of body fluids with a xenotransplantation product recipient. Such close contacts could include sexual partners, household members who share razors or toothbrushes, and HCWs or laboratory personnel with repeated percutaneous, mucosal, or other direct exposures.

- History of risk factors for classic Creutzfeldt-Jakob disease (CJD), including any blood relative with Creutzfeldt-Jakob disease, receipt of a human pituitary-derived growth hormone or receipt of a corneal or dura mater graft (*383,397–399*) (BIII). Potential HSCT donors should also be screened for new variant Creutzfeldt-Jakob Disease (nvCJD) risk factors, including a history of cumulative travel or residence in the United Kingdom for ≥6 months during 1980–1996 or receipt of injectable bovine insulin since 1980, unless the product was not manufactured since 1980 from cattle in the United Kingdom (*398*) (BIII). The clinical latency period for iatrogenic, classic CJD can be >30 years (*398*), and transmission of classic CJD by blood products is highly unlikely (*398*). Although no classic or nvCJD has ever been reported among HSCT recipients, persons with a history of classic or nvCJD risk factors should be excluded from donation for unrelated HSCT (DIII) if a choice exists between two otherwise equally suitable donors. The risk for transmitting classic or nvCJD from an HSCT donor to a recipient is unknown, but researchers believe that persons with nvCJD risk

factors could be at higher risk for transmitting nvCJD to HSCT recipients than persons with classic CJD risk factors.

- Past medical history that indicates the donor has clinical evidence of or is at high risk for acquiring a bloodborne infection (e.g., HIV-1 or -2, human T-lymphotropic virus [HTLV]-I or -II, hepatitis C, or hepatitis B) (*381,383*), including
  - — men who have had sex with another man during the preceding 5 years (*381,383*) (BIII);
  - — persons who report nonmedical intravenous, intramuscular, or subcutaneous injection of drugs during the preceding 5 years (*381*) (BIII);
  - — persons with hemophilia or related clotting disorders who have received human-derived clotting factor concentrates (*381*) (BIII);
  - — persons who have engaged in sex in exchange for money or drugs during the preceding 5 years (*381*) (BIII);
  - — persons who have had sex during the preceding 12 months with any person described previously (*381*) or with a person known or suspected to have HIV (*381*) or hepatitis B infections (BIII);
  - — persons who have been exposed during the preceding 12 months to known or suspected HIV, hepatitis B- or C-infected blood through percutaneous inoculation or through contact with an open wound, nonintact skin, or mucous membrane (*381*) (BIII);
  - — inmates of correctional systems (*379–381*) and persons who have been incarcerated for >72 consecutive hours during the previous 12 months (BIII);
  - — persons who have had or have been treated for syphilis or gonorrhea during the preceding 12 months (*376,379,380*) (BIII); and
  - — persons who within 12 months have undergone tattooing, acupuncture, ear or body piercing (*380,400,401*) in which shared instruments are known to have been used (BIII) or other nonsterile conditions existed.

Persons reporting any of these past medical histories should be excluded from donation (DIII).

The following serologic tests should be performed for each prospective donor:

- HIV-1 antigen, anti-HIV-1 and -2, anti-HTLV-I and -II, hepatitis B surface antigen, total antihepatitis B core antigen, antihepatitis C, anti-CMV, and a serologic test for syphilis (*376,379,380,383*) (AIII). Potential donors who have repeatedly reactive screening tests for HIV-1 antigen, anti-HIV-1 or -2, anti-HTLV-I or -II, antihepatitis C, hepatitis B surface antigen, or antihepatitis B core antigen should be excluded as HSCT donors (*381*) (EII). Persons who refuse infectious disease testing should also be excluded as HSCT donors (*381*) (EIII).
- Investigational nucleic acid tests to detect hepatitis C virus RNA and HIV RNA are currently being used in the United States to screen blood donors and could be

used for screening HSCT donors. If nucleic acid tests are approved by FDA, these tests should be incorporated into routine screening regimens for HSCT donors. When nucleic acid testing is done for HIV and hepatitis C investigationally, a positive result should exclude the potential donor.

All infectious disease testing and results should be reported to the HSCT physician before the candidate's conditioning regimen begins (*381*) (AIII). Bone marrow should be collected using sterile technique in a medically acceptable setting and according to standard operating procedures (AIII).

HSCT transplant center personnel should keep accurate records of all HSCT received and the disposition of each sample obtained (*381*). These tracking records must be separate from patients' medical records (e.g., in a log book) so that this information is easily obtainable. Recorded information should include the donor identification number, name of procurement of distribution center supplying the HSCT, recipient-identifying information, name of recipient's physician, and dates of a) receipt by the HSCT center and b) either transplantation to the recipient or further distribution (*381*) (AIII). All centers for donation, transplantation, or collection of hematopoietic stem cells should keep records of donor screening and testing, and HSCT harvesting, processing, testing, cryopreservation, storage, and infusion or disposal of each aliquot of donated hematopoietic progenitor cells for ≥10 years after the date of implantation, transplantation, infusion, or transfer of the product (*378*) (AIII). However, if that date is not known, records should be retained ≥10 years after the product's distribution, disposition, or expiration, whichever is latest.

Pediatric Donors

Children aged >18 months who are born to mothers with or at risk for HIV infection, who have not been breast-fed during the past 12 months, and whose HIV antibody tests, physical examination, and medical records do not indicate evidence of HIV infection can be accepted as donors (*381*) (BIII). Children aged <18 months who are born to mothers with or at risk for HIV infection and who have not been breast-fed by an HIV-infected woman during the past 12 months can be accepted as donors only if HIV infection has been excluded according to established criteria (*402*) (BIII). Children who have been breast-fed by an HIV-infected woman during the past 12 months should be excluded as stem cell donors regardless of HIV infection status (AIII). The mother and, if possible, the father of all pediatric stem-cell donors who are at risk for perinatal transmission of HIV and other bloodborne infections, should be interviewed by a health-care professional competent to elicit information regarding risk factors for possible bloodborne infection in the potential pediatric donor (AIII). Children who meet any of the adult donor exclusion criteria should not become HSCT donors (*381*) (EIII).

Preventing Infection from Extraneous Contamination of Donated Units

Personnel of donation, collection, or transplantation centers, cell-processing laboratories, and courier services should follow current standards for detecting and preventing extrinsic bacterial and fungal contamination of collected stem cell units at the collection

site, during processing and transportation, and at the transplant center (*376*) (AIII). Quality improvement programs and procedure manuals of collection centers, cell-processing laboratories, and transplant programs should include strategies for preventing transplant-associated infections. For example, collection centers should use aseptic techniques when collecting marrow, peripheral blood, and UCB hematopoietic stem cells (*376,378*) (AIII). Whenever possible, closed systems should be used for pooling hematopoietic stem cells during a collection procedure (BIII) because higher rates of microbial contamination seen in marrow harvests versus blood stem cell collections can be caused by use of open collecting systems (*375,403,404*). The highest risk for extraneous microbial contamination of hematopoietic stem cells occurs during extensive manipulation and processing in the laboratory (*404,405*). Potential sources include unprotected hands and laboratory equipment and freezers (*406*), particularly the liquid phases of liquid nitrogen freezers (*407*). Therefore, stem cell processing should be performed according to current standards (*378*) using approved manufacturing practices (AIII). Hematopoietic stem cell units thawed in a water bath should be enclosed in a second bag (i.e., double-bagged technique) to prevent contamination of the ports or caps from unsterile bath water (*407*) (BIII). Additionally, water baths should be cleaned routinely (BIII) and certain researchers have proposed that the bath contain sterile water (*407*) (CIII). Researchers also report sterilizing liquid nitrogen freezers before initial use for hematopoietic stem cell storage (*407*) until fungal and bacterial cultures are negative (CIII).

Cell-processing laboratory personnel should implement programs to detect extrinsic bacterial or fungal contamination of collected stem cell units, ideally before transplantation (AIII). Although repeated cultures are costly (*408*), donated hematopoietic stem cells should be cultured for aerobic bacteria and fungi ≥1 times during initial processing and freezing (BIII). Researchers also have proposed adding anaerobic bacterial cultures and culturing twice, once at the end of processing, and once after thawing just before use (*407*) (CIII). If bacterial culture results are positive, antibiotic-susceptibility tests should be performed (BIII). Results of cultures and antibiotic-susceptibility tests should be provided to the transplant physician before release of a cryopreserved marrow or blood stem cell unit, and as soon as feasible for transplants infused before completion of culture incubation (BIII).

Collection center, cell-processing laboratory, and transplant program personnel should maintain active surveillance of infections among persons who have received hematopoietic stem cells from those facilities to collect data regarding the number of infections after HSCT that might have been caused by exogenous contamination of donor stem cells (BIII) because this type of infection has been reported (*405*).

In Utero or Fetal HSCT

No national standards exist for in utero or fetal HSCT, and the overall risks for transmitting infections to a fetus through HSCT (*409,410*) have not been determined. However, in addition to precautions appropriate for adult recipients, physicians performing in utero or fetal HSCT are advised to evaluate potential donors for evidence of active infectious diseases that could cause serious congenital infections (e.g., rubella, varicella, CMV, syphilis, or *To. gondii*) in the fetus (CIII).

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Viral Infections

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Fungal Infections

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Hospital Infection Control

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Strategies for Safe Living After HSCT — Prevention of Exposure and Disease

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HSCT Recipient Vaccinations

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Hematopoietic Stem Cell Safety

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TABLE 1. Evidence-based rating system used to determine strength of recommendations

Category	Definition	Recommendation
A	Strong evidence for efficacy and substantial clinical benefit	Strongly recommended
B	Strong or moderate evidence for efficacy, but only limited clinical benefit	Generally recommended
C	Insufficient evidence for efficacy; or efficacy does not outweigh possible adverse consequences (e.g., drug toxicity or interactions) or cost of chemoprophylaxis or alternative approaches	Optional
D	Moderate evidence against efficacy or for adverse outcome	Generally not recommended
E	Strong evidence against efficacy or of adverse outcome	Never recommended

Source: Adapted from CDC. 1999 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus. MMWR 1999;48(RR-10):1–66.

TABLE 2. Evidence-based rating system used to determine quality of evidence supporting recommendation

Category	Definition
I	Evidence from at least one well-executed randomized, controlled trial
II	Evidence from at least one well-designed clinical trial without randomization; cohort or case-controlled analytic studies (preferably from more than one center); multiple time-series studies; or dramatic results from uncontrolled experiments
III	Evidence from opinions of respected authorities based on clinical experience, descriptive studies, or reports of expert committees

Source: Adapted from CDC. 1999 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus. MMWR 1999;48(RR-10):1–66.

TABLE 3. Foods that pose a high risk for hematopoietic stem cell transplant (HSCT) recipients and safer substitutions

Foods That Pose a High Risk	Safer Substitutions
Raw and undercooked eggs* and foods containing them (e.g., french toast, omelettes, salad dressings, egg nog, and puddings)	Pasteurized or hard boiled eggs
Unpasteurized dairy products (e.g., milk, cheese, cream, butter, and yogurt)	Pasteurized dairy products
Fresh-squeezed, unpasteurized fruit and vegetable juices	Pasteurized juices
Unpasteurized cheeses or cheeses containing molds	Pasteurized cheeses
Undercooked or raw poultry, meats, fish, and seafood cooked fish, and seafood	Cooked poultry, well-done meats,
Vegetable sprouts (e.g., alfalfa, bean, and other seed sprouts)†	Should be avoided
Raw fruits with a rough texture (e.g., raspberries)§	Should be avoided
Smooth raw fruits	Should be washed under running water, peeled, or cooked
Unwashed raw vegetables¶	Should be washed under running water, peeled, or cooked
Undercooked or raw tofu	Cooked tofu (i.e., cut into ≤1-inch cubes and boiled for ≥5 minutes in water or broth before eating or using in recipes)
Raw or unpasteurized honey	Should be avoided
Deli meats, hot dogs, and processed meats**	Should be avoided unless further cooked
Raw, uncooked grain products	Cooked grain products including bread, cooked, and ready-to-eat cold cereal, pretzels, popcorn, potato chips, corn chips, tortilla chips, cooked pasta, and rice
Maté tea††	Should be avoided
All moldy and outdated food products	Should be avoided
Unpasteurized beer (e.g., home-brewed and certain microbrewery beer)	Pasteurized beer (i.e., retail bottled or canned, or draft beer that has been pasteurized after fermentation)
Raw, uncooked brewers yeast	Should be avoided; HSCT recipients should avoid any contact with raw yeast (e.g., they should not make bread products themselves)
Unroasted raw nuts	Cooked nuts
Roasted nuts in the shell	Canned or bottled roasted nuts or nuts in baked products

* **Source:** CDC. Outbreaks of *Salmonella* serotype enteritidis infection associated with consumption of raw shell eggs—United States, 1994–1995. MMWR 1996; 45(34):737–42.

† **Source:** Taormina PJ, Beuchat LR, Slutsker L. Infections associated with eating seed sprouts: an international concern. Emerg Infect Dis 1999;5(5):626–34.

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†† **Source:** Kusminsky G, Dictar M, Arduino S, Zylberman M, Sanchez Avalos JC. Do not drink Maté: an additional source of infection in South American neutropenic patients. Bone Marrow Transplant 1996;17(1):127.

TABLE 4. Recommended vaccinations for hematopoietic stem cell transplant* (HSCT) recipients, including both allogeneic and autologous recipients

For these guidelines, HSCT recipients are presumed immunocompetent at ≥24 months after HSCT if they are not on immunosuppressive therapy and do not have graft-versus-host disease (GVHD).

Vaccine or toxoid	Time after HSCT			Rating
	12 months	14 months	24 months	
Inactivated vaccine or toxoid				
Diphtheria, tetanus, pertussis				
Children aged <7 years*	Diphtheria toxoid-tetanus toxoid-pertussis vaccine (DTP) or diphtheria toxoid-tetanus toxoid (DT)†	DTP or DT	DTP or DT	BIII
Children aged ≥7 years§	Tetanus-diphtheria toxoid (Td)	Td	Td	BII
Haemophilus influenzae type b (Hib) conjugate¶	Hib conjugate	Hib conjugate	Hib conjugate	BII
Hepatitis (HepB)**	HepB	HepB	HepB	BIII
23-valent pneumococcal polysaccharide (PPV23)††	PPV23	—	PPV23	BIII
Hepatitis A§§	Routine administration not indicated			Not rated because of limited data
Influenza¶¶	Lifelong, seasonal administration, beginning before HSCT and resuming at ≥6 months after HSCT			BII
Meningococcal***	Routine administration not indicated			Not rated because of limited data
Inactivated polio (IPV)†††	IPV	IPV	IPV	BII
Rabies§§§	Routine administration not indicated			Not rated because of limited data
Lyme disease	Routine administration not indicated; limited data regarding safety, efficacy, or immunogenicity among HSCT recipients			Not rated because of limited data
Live-attenuated vaccine				
Measles-mumps-rubella (MMR)¶¶¶ ***†	—	—	MMR	BIII
Varicella vaccine §§§§	Contraindicated for HSCT recipients			EIII
Rotavirus vaccine	Not recommended for any person in the United States¶¶¶¶			EII

TABLE 4. (*Continued*) Recommended vaccinations for hematopoietic stem cell transplant* (HSCT) recipients, including both allogeneic and autologous recipients

* Studies report that an HSCT recipient can be primed if the donor has had primary vaccination series. Studies also report that a recipient's antibody titer before HSCT might affect the titer 1 year after HSCT (**Source**: Lum LG. Kinetics of immune reconstitution after human marrow transplantation. Blood 1987;69[2]:369–80). No data were found regarding safety and immunogenicity of pertussis vaccination among HSCT recipients.

† DT should be used whenever a contraindication exists to pertussis vaccination.

§ HSCT recipients should be revaccinated with tetanus-diphtheria toxoids every 10 years, as routinely recommended for all adolescents and adults (**Sources**: CDC. Diphtheria, tetanus, and pertussis: recommendations of vaccine use and other prevention measures; recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1991;40[No. RR-10]:1–28; and CDC. Use of vaccines and immunoglobulin in persons with altered immunocompetence: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1993;42[No. RR-4]:1–18).

¶ Hib conjugate vaccine is recommended for HSCT recipients of any age (**Sources**: CDC. Recommendations for use of *Haemophilus* b conjugate vaccines and a combined diphtheria, tetanus, pertussis, and *Haemophilus* b vaccine: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1993;42[No. RR-13]:1–15; and CDC. Use of vaccines and immunoglobulin in persons with altered immunocompetence: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1993;42[No. RR-4]:1–18).

** Hepatitis B vaccination is recommended for all susceptible persons aged ≤18 years and for adults who have risk factors for hepatitis B virus infection (**Sources**: CDC. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination; recommendations of the Immunization Practices Advisory Committee [ACIP]. MMWR 1991;40[No. RR-13]:1–25; and CDC. Notice to readers: update; recommendations to prevent hepatitis B virus transmission—United States. MMWR 1995;44[30]:574–5). ACIP hepatitis B vaccination recommendations indicate that high doses (40 µg/dose) are recommended for adult dialysis patients and other immunocompromised adults (**Source**: CDC. Notice to readers: update; recommendations to prevent hepatitis B virus transmission—United States. MMWR 1995;44[30]:574–5). No data were found regarding immunocompromised children and their response to higher doses of vaccine. Postvaccination testing for antibody to hepatitis B surface antigen is recommended 1–2 months after the third vaccine dose to ensure protection among immunocompromised persons (**Source**: CDC. Notice to readers: update; recommendations to prevent hepatitis B virus transmission—United States. MMWR 1995;44[30]:574–5). Persons who do not respond to the primary vaccine series should complete a second 3-dose series.

†† The 23-valent pneumococcal polysaccharide vaccine might not be protective against pneumococcal infection among HSCT recipients. The second dose of vaccine is not a booster dose, but provides a second chance for immunologic response among persons who failed to respond to the first dose (**Source**: Guinan EC, Molrine DC, Antin JH, et al. Polysaccharide conjugate vaccine responses in bone marrow transplant patients. Transplant 1994;57[5]:677–84). Adjunctive antibiotic prophylaxis against encapsulated organisms, including pneumococcal disease, is recommended for allogeneic recipients with chronic GVHD (**Source**: Bortin MM, Horowitz MM, Gale RP, et al. Changing trends in allogeneic bone marrow transplantation for leukemia in the 1980s. JAMA 1992; 268[5]:607–12). No data were found regarding safety and immunogenicity of the 7-valent conjugate pneumococcal vaccine among HSCT recipients; therefore, no recommendation regarding use of this vaccine can be made.

§§ No data were found regarding immunogenicity, safety, and efficacy of hepatitis A vaccine among HSCT recipients. Researchers report that hepatitis A vaccination can be used for investigational use among HSCT recipients aged ≥24 months at ≥12 months after HSCT and who are at increased risk for hepatitis A or its adverse consequences (e.g., persons with chronic liver disease, including chronic GVHD, and children living in areas with consistently elevated hepatitis A incidence) (**Source**: CDC. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1999;48[No. RR-12]:1–37).

¶¶ Children aged <9 years receiving influenza vaccination for the first time require two doses. Children aged ≤12 years should receive only split-virus influenza vaccine. Persons aged >12 years can receive whole- or split-virus vaccine. ACIP's and the American Academy of Pediatrics' dosing schedule should be used (**Sources**: American Academy of Pediatrics. Influenza. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2000:351–9; and CDC. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 2000;49[No. RR-3]:1–38). For optimal influenza prevention, both vaccination and influenza chemoprophylaxis should be used among HSCT recipients.

*** Administration of meningococcal vaccine should be evaluated for HSCT recipients who live in endemic areas or areas experiencing outbreaks (**Source**: CDC. Control and prevention of meningococcal disease and control and prevention of serogroup C meningococcal disease: evaluation and management of suspected outbreaks. MMWR 1997;46[No. RR-5]:1–21). However, meningococcal vaccine immunogenicity and efficacy among HSCT recipients have not been studied.

††† Inactivated polio virus vaccine is immunogenic among HSCT recipients, although no data were found regarding efficacy and more data are needed regarding optimal methods and timing of immunization (**Sources**: Henning KJ, White MH, Sepkowitz KA, Armstrong D. National survey of immunization practices following allogeneic bone marrow transplantation. JAMA 1997;277[14]:1148–51; and CDC. Poliomyelitis prevention in the United States: introduction of a sequential vaccination schedule of inactivated poliovirus vaccine followed by oral poliovirus vaccine; recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1997;46[No. RR-3]:1–25).

TABLE 4. (*Continued*) Recommended vaccinations for hematopoietic stem cell transplant* (HSCT) recipients, including both allogeneic and autologous recipients

§§§ Clinicians can administer preexposure rabies vaccine to HSCT recipients with potential occupational exposures to rabies (**Source**: CDC. Human rabies prevention—United States, 1999: recommendations of the Advisory Committee on Immunization Practices [ACIP] MMWR 1999;48[No. RR-1]:1–21; and published erratum, MMWR 1999;48[1]:16). However, the safety and immunogenicity of rabies vaccination among HSCT recipients has not been studied. Preexposure rabies vaccination should probably be delayed until 12–24 months after HSCT. Administration of rabies vaccine with human rabies immunoglobulin postexposure can be administered anytime after HSCT as indicated. Existing ACIP and American Academy of Pediatrics guidelines for postexposure human rabies immunoglobulin and vaccine administration should be followed, which include administering 5 doses of rabies vaccine administered on days 0, 3, 7, 14, and 28 postexposure (**Sources**: American Academy of Pediatrics. Rabies. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:475–82; and CDC. Human rabies prevention—United States, 1999: recommendations of the Advisory Committee on Immunization Practices [ACIP] MMWR 1999;48[No. RR-1]:1–21; published erratum, MMWR 1999;48[1]:16).

¶¶¶ The first dose of measles-mumps-rubella vaccine should be administered ≥24 months after HSCT if the HSCT recipient is presumed immunocompetent. The second measles-mumps-rubella dose is recommended 6–12 months later (BIII); however, the benefit of a second dose among HSCT recipients has not been evaluated. During outbreaks, the second dose can be administered 4 weeks after the first dose (**Source**: CDC. Use of vaccines and immunoglobulin in persons with altered immunocompetence: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1993;42[No. RR-4]:1–18).

**** The half-life of intravenous immunoglobulin is decreased among HSCT recipients, but its effect on vaccine immunogenicity has not been evaluated. ACIP's and the American Academy of Pediatrics' recommendations regarding intervals between administration of immunoglobulin preparations for various indications and vaccines containing live measles virus should be used (**Sources**: American Academy of Pediatrics. Measles. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2000:385–96; CDC. Measles, mumps, and rubella—vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1998;47[No. RR-8]:1–48; and CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1994;43[No. RR-1]:1–38).

†††† Use of live vaccines (e.g., measles-mumps-rubella) is indicated only among immunocompetent persons and is contraindicated for recipients after HSCT who are not presumed immunocompetent (**Sources**: CDC. Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1996;45[No. RR-11]:1–36; and CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1994;43[No. RR-1]:1–38). Further research is needed to determine the safety, immunogenicity, and efficacy of varicella vaccine among HSCT recipients.

§§§§ To protect HSCT recipients from varicella exposure, all varicella-susceptible health-care workers, family members, and close contacts of the recipient should be vaccinated against varicella (**Source**: American Academy of Pediatrics. Varicella-zoster infections. In: Pickering LK, ed. 2000 red book: report of the committee on Infectious diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:624–38).

¶¶¶¶ **Source**: CDC. Withdrawal of rotavirus vaccine recommendation. MMWR 1999;48[43]:1007.

Additional Notes: All indicated nonlive vaccines should be administered to HSCT recipients regardless of HSCT type or presence of GVHD. Live-attenuated vaccines, (e.g., measles-mumps-rubella, varicella, Bacillus Calmette-Guérin, yellow fever, and oral typhoid vaccines) should not be administered to any HSCT recipient with active GVHD or immunosuppression (**Source**: CDC. Role of BCG [Bacillus of Calmette and Guérin] vaccine in the prevention and control of tuberculosis in the United States: a joint statement by the Advisory Council for the Elimination of Tuberculosis and the Advisory Committee on Immunization Practices. MMWR 1996;45[No. RR-4]:1–18). To date, no adverse events have been reported (e.g., exacerbation of GVHD) among vaccinated HSCT recipients. However, data regarding immunization among HSCT recipients are limited and further studies are needed to evaluate safety, efficacy, and immunogenicity of the proposed HSCT immunization schedule. Use of combination vaccines is encouraged (**Source**: CDC. Combination vaccines for childhood immunization: recommendations of the Advisory Committee on Immunization Practices [ACIP], the American Academy of Pediatrics [AAP], and the American Academy of Family Physicians [AAFP]. MMWR 1999;48[No. RR-5]:1–15). No contraindications to simultaneous administration of any vaccines exist, except cholera and yellow fever. Adverse events after vaccination should be reported promptly to the Vaccine Adverse Event Reporting System (VAERS), P.O. Box 1100, Rockville, MD 20849-1100. Forms and information can be obtained from VAERS ([800] 822-7967). If the HSCT recipient has lapsed immunizations after HSCT (i.e., has missed one or more vaccine doses), the immunization schedule does not have to be restarted. Instead, the missing vaccine dose should be administered as soon as possible or during the next scheduled clinic appointment.

Table 5. Vaccinations for family, close contacts, and health-care workers (HCWs) of hematopoietic stem cell transplantation (HSCT) recipients*

Vaccine	Recommendations for use	Rating
Hepatitis A†	Routine vaccination is recommended for persons at increased risk for hepatitis A or its adverse consequences (e.g., persons with chronic liver disease or persons traveling to hepatitis A-endemic countries) and for children aged ≥24 months living in areas with consistently elevated hepatitis A incidence.†	BII
Influenza§ ¶	Household contacts — Vaccination is strongly recommended during each influenza season (i.e., October–May) beginning in the season before the transplant and continuing to ≥24 months after HSCT. All household contacts of immunocompromised HSCT recipients should be vaccinated annually as long as these conditions persist.	AI
	HCWs and home caregivers — Annual vaccination is strongly recommended during each influenza season.	AI
Polio**	Vaccination is not routinely recommended for adults but should be administered when polio vaccination is indicated according to published Advisory Committee on Immunization Practices guidelines; when polio vaccine is administered, inactivated polio vaccine should be used.	AI
Measles-mumps-rubella††	Vaccination is recommended for all persons who are aged ≥12 months and who are not pregnant or immunocompromised.	AI
Rotavirus§§	Contraindicated because intussusception has been reported among infants during the first 1–2 weeks after rotavirus vaccination with substantially increased frequency.	EII
Varicella¶¶	Vaccination should be administered to all susceptible HCWs, household contacts, and family members who are aged ≥12 months and who are not pregnant or immunocompromised. When varicella vaccination is administered to persons aged ≥13 years, 2 doses are required, administered 4–8 weeks apart.	AIII

* This vaccination schedule refers only to vaccine-preventable diseases that are spread person-to-person.

† **Source**: CDC. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48(No. RR-12):1–37.

§ Children aged <9 years receiving influenza vaccination for the first time require 2 doses. Children aged ≤12 years should receive only split-virus influenza vaccine. Persons aged >12 years can receive whole- or split-virus vaccine (**Sources**: CDC. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 2000;49[No. RR-3]:1–38; and CDC. Immunization of health care workers: recommendations of the Advisory Committee on Immunization Practices [ACIP] and the Hospital Infection Control Practices Advisory Committee. MMWR 1997;46[No. RR-18]:1–42).

¶ If HCWs, family members, or other close contacts of HSCT recipients receive influenza vaccination during an influenza A outbreak, they should also receive amantadine or rimantadine chemoprophylaxis for 2 weeks after the influenza vaccination (BI) while the vaccinee develops an immunologic response to the vaccine. However, if a nosocomial outbreak occurs with an influenza A strain that is not contained in the available influenza vaccine, HCWs, family members, and other close contacts of HSCT recipients and candidates should be administered influenza A chemoprophylaxis with amantadine or rimantadine until the end of the outbreak (**Source**: CDC. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 2000;49[No. RR-3]:1–38) (BIII). HCWs, family members, or other close contacts can be offered a neuroaminidase inhibitor (e.g., zanamivir or oseltamivir) using the same strategies outlined previously, if one or more of the following exists: a) rimantadine or amantadine cannot be tolerated; b) the outbreak strain of influenza A is amantadine- or rimantadine-resistant; or c) the outbreak strain is influenza B (**Sources**: Monto AS, Robinson DP, Herlocher ML, Hinson JM Jr, Elliott MJ, Crisp A. Zanamivir in the prevention of influenza among healthy adults: a randomized controlled trial. JAMA 1999;282[1]:31–5; Hayden FG, Atmar RL, Schilling M, et al. Use of the selective oral neuraminidase inhibitor oseltamivir to prevent influenza. New Engl J Med 1999;341[18]:1336–43; Hayden FG, Gubareva L, Klein T, et al. Inhaled zanamivir for preventing transmission of influenza in families [Abstract LB-2]. In: Final program, abstracts and exhibits addendum, 38th Interscience Conference on Antimicrobial Agents and Chemotherapy. Washington, DC: American Society for Microbiology, 1991:1; and CDC. Neuraminidase inhibitors for treatment of influenza A and B infections. MMWR 1999;48[No. RR-14]:1–10) (BI). Zanamivir can be administered to persons aged ≥12 years, and oseltamivir can be administered to persons aged ≥18 years.

** **Caution**: Vaccine-strain polio virus in oral polio vaccine can be transmitted person-to-person; therefore, oral polio vaccine administration is contraindicated among household contacts of immunocompromised persons. If oral polio vaccine is inadvertently administered to a household contact of an HSCT recipient, ACIP's and the American Academy of Pediatrics' recommendations should be followed to minimize close contact with the immunocompromised person for 4–6 weeks after vaccination (**Sources**: American Academy of Pediatrics. Poliovirus infections. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2000:465–70; CDC. Immunization of health care workers: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control

Table 5. (*Continued*) Vaccinations for family, close contacts, and health-care workers (HCWs) of hematopoietic stem cell transplantation (HSCT) recipients*

Practices Advisory Committee. MMWR 1997;46[No. RR-18]:1–42; and CDC. Poliomyelitis prevention in the United States: introduction of a sequential vaccination schedule of inactivated poliovirus vaccine followed by oral poliovirus vaccine; recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1997;46[No. RR-3]:1–25). Although vaccine-associated paralytic poliomyelitis has not been reported among HSCT recipients after exposure to household contacts inadvertently vaccinated with oral polio vaccine, inactivated polio vaccine should be used among family members, close contacts, and HCWs to avoid person-to-person transmission of vaccine-strain polio virus (**Source**: CDC. Poliomyelitis prevention in the United States: introduction of a sequential vaccination schedule of inactivated poliovirus vaccine followed by oral poliovirus vaccine; recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1997;46[No. RR-3]:1–25).

†† No evidence exists that live-attenuated vaccine-strain viruses in measles-mumps-rubella vaccine have ever been transmitted from person-to-person, except rubella vaccine virus from a nursing mother to her infant (**Source**: CDC. Measles, mumps, and rubella—vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1998;47[No. RR-8]:1–48).

** HCWs, family members, close contacts and visitors who do not have a documented history of varicella-zoster infection or who are seronegative should receive this vaccination before being allowed to visit or have direct contact with an HSCT recipient (AIII). Ideally, varicella-zoster–susceptible HCWs, family members, household contacts, and potential visitors of immunocompromised HSCT recipients should be vaccinated as soon as the decision to perform an HSCT is made. The vaccination dose or doses should be completed ≥4 weeks before the conditioning regimen begins or ≥6 weeks (42 days) before contact with the HSCT recipient is planned (BIII). If a varicella vaccinee develops a postvaccination rash within 42 days of vaccination, the vaccinee should avoid contact with HSCT recipients until all rash lesions are crusted or the rash has resolved (**Sources**: CDC. Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1996;45[No. RR-11]:1–36; and CDC. Immunization of health care workers: recommendations of the Advisory Committee on Immunization Practices [ACIP] and the Hospital Infection Control Practices Advisory Committee. MMWR 1997;46[No. RR-18]:1–42).

TABLE 6. Vaccinations for hematopoietic stem cell transplant (HSCT) recipients traveling to areas endemic for selected vaccine-preventable diseases

Vaccine	Recommendations for use	Rating
Bacillus of Calmette and Guérin (live-attenuated vaccine)	Use of live-attenuated vaccine is contraindicated among HSCT recipients at <24 months after HSCT and among all persons who are immunocompromised.* No data were found regarding use among HSCT recipients.	EIII
Cholera	Vaccination is not indicated. No data were found regarding safety and immunogenicity among HSCT recipients.†	DIII
Hepatitis A	No data were found regarding immunogenicity, safety, or efficacy of hepatitis A vaccine among HSCT recipients; therefore, intramuscular immunoglobulin use is preferred for hepatitis A prophylaxis among HSCT recipients. However, administration of intramuscular immunoglobulin does not replace avoidance behaviors (e.g., careful selection of food and water).§ Researchers recommend that hepatitis A vaccination be evaluated for investigational use among HSCT recipients aged ≥24 months; however, no recommendation can be made because of limited data.	Not rated because of limited data
Japanese B encephalitis	No data were found regarding safety, immunogenicity, or efficacy among HSCT recipients.¶	Not rated because of limited data
Lyme disease	No data were found regarding safety, immunogenicity, or efficacy among HSCT recipients.	Not rated because of limited data
Meningococcal vaccine	Vaccine should be administered to HSCT recipients traveling to endemic areas or to areas experiencing outbreaks.** However, meningococcal vaccine immunogenicity and efficacy have not been studied among HSCT recipients.	Not rated because of limited data
Plague	No data were found regarding safety, immunogenicity, or efficacy among HSCT recipients.††	Not rated because of limited data
Polio (inactivated polio vaccine only)	Booster dose can be administered as indicated.§§	CIII
Rabies	Researchers recommend that administration of a preexposure series be evaluated for persons at ≥12 months after HSCT if they anticipate travel to endemic areas.¶¶ However, no data were found regarding safety, immunogenicity, or efficacy among HSCT recipients.	Not rated because of limited data
Typhoid, oral (live-attenuated vaccine)	Use of oral typhoid vaccine (live-attenuated strain) is contraindicated among HSCT recipients at <24 months after HSCT and among those who are immunocompromised.*** No data were found regarding safety, immunogenicity, or efficacy among HSCT recipients.	EIII
Typhoid (intramuscular)	No data were found regarding safety, immunogenicity, or efficacy among HSCT recipients.	Not rated because of limited data
Yellow fever (live-attenuated vaccine)	Use of live-attenuated vaccine is contraindicated among HSCT recipients at <24 months after HSCT and among all immunocompromised persons.††† No data were found regarding safety, immunogenicity, or efficacy among HSCT recipients.	EIII

* **Source**: CDC. Role of BCG [Bacillus of Calmette and Guérin] vaccine in the prevention and control of tuberculosis in the United States: a joint statement by the Advisory Council for the Elimination of Tuberculosis and the Advisory Committee on Immunization Practices. MMWR 1996;45(No. RR-4):1–18.

† **Source**: CDC. Recommendations of the Immunization Practices Advisory Committee: cholera vaccine. MMWR 1988;37(40):617–8; 623–4.

§ **Source**: CDC. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48(No. RR-12):1–37.

¶ **Source**: CDC. Inactivated Japanese encephalitis virus vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1993;42(No. RR-1):1–15.

** **Source**: CDC. Control and prevention of meningococcal disease and control and prevention of serogroup C meningococcal disease: evaluation and management of suspected outbreaks. MMWR 1997;46(No. RR-5):1–21.

TABLE 6. (*Continued*) Vaccinations for hematopoietic stem cell transplant (HSCT) recipients traveling to areas endemic for selected vaccine-preventable diseases

†† **Source**: CDC. Prevention of plague: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1996;45(No. RR-14):1–15.

§§ **Source**: CDC. Poliomyelitis prevention in the United States: introduction of a sequential vaccination schedule of inactivated poliovirus vaccine followed by oral poliovirus vaccine; recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1997;46(No. RR-3):1–25.

¶¶ **Source**: CDC. Human rabies prevention—United States, 1999: recommendations of the Advisory Committee on Immunization Practices (ACIP) MMWR 1999;48(No. RR-1):1–21; published erratum, MMWR 1999;48(1):16.

*** **Source**: CDC. Typhoid immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1994;43(No. RR-14):1–7.

††† **Source**: CDC. Yellow fever vaccine: recommendations of the Immunization Practices Advisory Committee (ACIP). MMWR 90;39(No. RR-6):1–6.

Additional Note: Specific advice for international travelers, including information regarding endemic diseases by country, is available through CDC's automated travelers' hotline at (404) 332-4559; by facsimile at (404) 335-4565; on the Internet at <http://www.cdc.gov>; and by file transfer protocol at <ftp.cdc.gov>.

TABLE 7. Use of passive immunization for hematopoietic stem cell transplant (HSCT) recipients exposed to vaccine-preventable diseases

Preparation	Recommendations for Use	Rating
Cytomegalovirus immunoglobulin	Not recommended for prophylaxis among HSCT recipients because of its lack of efficacy.*	DI
Hepatitis B immunoglobulin	Immunocompromised persons who have percutaneous or permucosal exposure to hepatitis B virus should receive 2 doses administered 1 month apart. For immunocompetent persons, the need for postexposure prophylaxis depends on the vaccination history and antibody to hepatitis B surface antigen response status of the exposed person.†	CIII
Human rabies immunoglobulin	Should be administered with rabies vaccine at anytime after HSCT as indicated for postexposure rabies prophylaxis. Existing Advisory Committee on Immunization Practices guidelines for postexposure should be followed, with 5 doses of rabies vaccine administered on days 0, 3, 7, 14, and 28 postexposure.§	CIII
Respiratory syncytial virus immunoglobulin¶	Because of high rates of case fatality from respiratory syncytial virus pneumonia among HSCT recipients, HSCT physicians can administer HSCT recipients with upper or lower respiratory infection preemptive therapy with a high titer of neutralizing antibodies to prevent severe disease and death until controlled trials can be performed.**	CIII
Respiratory syncytial virus monoclonal antibody	Physicians can use respiratory syncytial virus monoclonal antibody†† investigationally as preemptive therapy (Appendix).	Not rated because of limited data
Tetanus immunoglobulin	Postexposure vaccination should be administered with or without tetanus immunoglobulin as indicated for tetanus exposure§§ that occurs anytime after HSCT.	CIII
Varicella-zoster immunoglobulin¶¶	Ideally, should be administered to HSCT recipients ≤96 hours after close contact with a person with varicella or shingles if the HSCT recipient is at a) <24 months after HSCT or b) ≥24 months after HSCT and still immunocompromised. Administration can extend the varicella incubation period from 10–21 days to 10–28 days. If the HSCT recipient experiences a varicella-zoster virus-like rash after contact with or exposure to a person with varicella or herpes zoster, antiviral drug therapy should be administered until ≥2 days after all lesions have crusted.***	AII
Intramuscular immunoglobulin	Should be administered to hepatitis A-susceptible HSCT recipients who anticipate hepatitis A exposure, (e.g., during travel to endemic areas) and for postexposure prophylaxis as indicated.††† Should also be administered after measles exposure among HSCT recipients who were not vaccinated against measles after HSCT.§§§	BIII
Intravenous immunoglobulin¶¶¶	Can be administered to HSCT recipients with severe hypogammaglobulinemia (immunoglobulin G < 400 mg/dl) ≤100 days after HSCT to prevent bacterial infections**** (Appendix).	CIII

* **Source**: Boeckh M, Bowden R. Cytomegalovirus infection in marrow transplantation. In: Buckner CD, ed. Technical and biological components of marrow transplantation. Boston, MA: Kluwer Academic Publishers, 1995:97–136.

† **Source**: CDC. Immunization of health care workers: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee. MMWR 1997;46(No. RR-18):1–42.

§ **Sources**: American Academy of Pediatrics. Rabies. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:475–82; and CDC. Human rabies prevention—United States, 1999: recommendations of the Advisory Committee on Immunization Practices (ACIP) MMWR 1999;48(No. RR-1):1–21; published erratum, MMWR 1999;48(1):16.

TABLE 7. (*Continued*) Use of passive immunization for hematopoietic stem cell transplant (HSCT) recipients exposed to vaccine-preventable diseases

¶ Researchers recommend substituting respiratory syncytial virus immunoglobulin for intravenous immunoglobulin for HSCT recipients on replacement intravenous immunoglobulin therapy during respiratory syncytial virus season (i.e., November–April) (**Source**: American Academy of Pediatrics. Respiratory syncytial virus. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:483–7) (CIII). However, no data were found demonstrating safety and efficacy of respiratory syncytial virus immunoglobulin use among HSCT recipients.

§§ **Source**: CDC. Diphtheria, tetanus, and pertussis: recommendations of vaccine use and other prevention measures; recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1991;40(No. RR-10):1–28.

¶¶ If intravenous immunoglobulin replacement therapy (>250 mg/kg) has been administered <2 weeks before varicella or zoster rash exposure, varicella-zoster immunoglobulin administration is probably not required. Varicella-zoster immunoglobulin is distributed by the American Red Cross, except in Massachusetts, where it is distributed by the Massachusetts Public Health Biologic Laboratories (now a unit of the University of Massachusetts) (**Source**: CDC. Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR 1996;45[No. RR-11]:1–36).

*** **Source**: CDC. Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1996;45(No. RR-11):1–36.

††† **Source**: CDC. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48(No. RR-12):1–37.

§§§ **Sources**: CDC. Measles, mumps, and rubella—vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1998;47(No. RR-8):1–48; and Eibl MM, Wedgwood RJ. Intravenous immunoglobulin: a review. Immunodeficiency Reviews 1989;1:1–42.

¶¶¶ When administered, serum immunoglobulin G levels should be monitored regularly (e.g., every 2 weeks).

**** **Sources**: Antman KH, Rowlings PA, Vaughn WP, et al. High-dose chemotherapy with autologous hematopoietic stem cell support for breast cancer in North America. J Clin Oncol 1997;15(5):1870–9; and Wolff SN, Fay JW, Herzig RH, et al. High-dose weekly intravenous immunoglobulin to prevent infections in patients undergoing autologous bone marrow transplantation or severe myelosuppressive therapy. Ann Intern Med 1993;118(12):937–42.

Additional Notes: Intravenous immunoglobulin can be obtained from the American Red Cross Blood Services, although shortages occasionally occur. Physicians who have difficulty obtaining urgently needed intravenous immunoglobulin and other immunoglobulin products are advised to contact any of the following:

- American Red Cross Customer Service Center, (800) 261-5772;
- Alpha Therapeutic Corporation, (800) 421-0008;
- Baxter Healthcare Corporation, (847) 940-5955;
- Bayer Pharmaceutical Division, (800) 288-8370;
- Aventis Behring Customer Support, (800) 683-1288;
- Novartis Pharmaceuticals Corporation, (973) 781-8300, or the Intravenous Immunoglobulin Emergency Hotline, (888) 234-2520; or
- Immune Deficiency Foundation, (800) 296-4433.

Physicians who are unable to obtain intravenous immunoglobulin for a licensed indication from one of these sources should contact the Product Shortage Officer at the Food and Drug Administration's Center for Biologics Evaluation and Research, Office of Compliance, (301) 827-6220, for assistance. Patients with immunoglobulin E anti-immunoglobulin A antibodies are at high risk for experiencing anaphylaxis from immunoglobulin administration (**Source**: Burks AW, Sampson HA, Buckley RH. Anaphylactic reactions after gamma globulin administration in patients with hypogammaglobulinemia. New Engl J Med 1986;314[9]:560–4). Therefore, persons with immunoglobulin A deficiency should not be administered standard immunoglobulin preparations (DIII; BIII). However, researchers report that use of immunoglobulin A-depleted immunoglobulin preparations can be used with caution in these persons (**Sources**: Burks AW, Sampson HA, Buckley RH. Anaphylactic reactions after gamma globulin administration in patients with hypogammaglobulinemia. New Engl J Med 1986;314[9]:560–4; Siberry GK, Iannone R, eds. Harriet Lane handbook: a manual for pediatric house officers. 15th ed.; St. Louis, MO: Mosby, Inc., 2000:339;739; and Stiehm ER. Human intravenous immunoglobulin in primary and secondary antibody deficiencies [Review]. Pediatr Infect Dis J 1997;16[7]:696–707).

TABLE 8. Vaccine information

Vaccine or toxoid	Trade name	Manufacturer/ telephone number	Storage recommendation
Diphtheria toxoid-tetanus toxoid-pertussis vaccine	Tripedia®	Aventis Pasteur, Inc. (800) Vaccine	Store at 2–8 C (36–46 F); do not freeze
	Infanrix®	SmithKline Beecham (800) 877-1158	
	Acel-Imune®	Wyeth-Lederle (800) 572-8221	
	Certiva®	North American Vaccine (888) 628-2829	
Diphtheria toxoid-tetanus toxoid-pertussis vaccine–*Haemophilus influenzae* type b	Tetramune®	Wyeth-Lederle (800) 572-8221	Store at 2–8 C (36–46 F); do not freeze
	DTP/ACTHib®	Aventis Pasteur, Inc. (800) Vaccine	
	TriHibit®		
Tetanus-diphtheria toxoid (adult) and Diphtheria-tetanus toxoid (pediatric)	Generic	Aventis Pasteur, Inc. (800) Vaccine Wyeth-Lederle (800) 572-8221	Store at 2–8 C (36–46 F); do not freeze
Haemophilus influenzae type b	ACTHib®	Aventis Pasteur, Inc. (800) Vaccine	Store at 2–8 C (36–46 F); do not freeze
	HibTiter®	Wyeth-Lederle (800) 572-8221	
	PedvaxHIB®	Merck Human Health Division (800) MerckRX (ordering) (800) NSCmerc (questions)	
	OmniHIB®	SmithKline Beecham (800) 877-1158	
Haemophilus influenzae type b-Hepatitis B	COMVAX®	Merck Human Health Division (800) MerckRX (ordering) (800) NSCmerc (questions)	Store at 2–8 C (36–46 F); do not freeze
Inactivated polio vaccine	IPOL®	Aventis Pasteur, Inc. (800) Vaccine	
Measles-mumps-rubella Measles-rubella Mumps-rubella Measles Mumps Rubella	M-M-R II® M-R-Vax II® Biavax II® Attenuvax® Mumpsvax® Meruvax II®	Merck Human Health Division (800) MerckRX (ordering) (800) NSCmerc (questions)	Store at 2–8 C (36–46 F); freezing is permissible
Varicella	Varivax®		Maintain in a frozen state of –15 C (5 F) or colder
Hepatitis A	Vaqta® Havix®	SmithKline Beecham (800) 877-1158	Store at 2–8 C (36–46 F); do not freeze
Hepatitis B	Engerix-B® Recombivax B®	Merck Human Health Division (800) MerckRX (ordering) (800) NSCmerc (questions)	Store at 2–8 C (36–46 F); do not freeze
Influenza	Fluzone®	Aventis Pasteur, Inc. (800) Vaccine	Store at 2–8 C (36–46 F); do not freeze
	Fluvirin®	Celltech Medeva Pharmaceutical (800) 234-5535	
	Flu-Shield®	Wyeth-Ayerst Laboratories (800) 358-7443	
	Fluogen®	Monarch Pharmaceuticals (888) 358-6436	
Japanese encephalitis	JE-VAX	Research Foundation for Microbial Diseases of Osaka University, Japan; Distributed by Aventis Pasteur, Inc. (800) Vaccine SmithKline Beecham	Store at 2–8 C (36–46 F); do not freeze

TABLE 8. (*Continued*) Vaccine information

Vaccine or toxoid	Trade name	Manufacturer/ telephone number	Storage recommendation
Lyme disease	LYMErix™	(800) 877-1158	Store at 2–8 C 36–46 F); do not freeze
Pneumococcal 23-valent	Pru-Immune-23®	Wyeth-Lederle (800) 572-8221	Store at 2–8 C (36–46 F); do not freeze
	Pneumovax 23®	Merck Human Health Division (800) MerckRX (ordering) (800) NSCmerc (questions)	
Meningococcal	Menomune-A/C/Y/W-135®	Aventis Pasteur, Inc. (800) Vaccine	Store at 2–8 C (36–46 F); do not freeze
Rabies	Generic	BioPort Corporation (517) 327-1500; distributed by SmithKline Beecham (800) 877-1158	Store at 2–8 C (36–46 F); do not freeze
	Imovax Rabies® and Imovax Rabies ID®	Aventis Pasteur, Inc. (800) Vaccine	
	RabAvert™	Chiron Corporation (800) 244-7668	
Typhoid	Typhoid Vaccine U.S. P.	Wyeth-Lederle (800) 572-8221	
Typhoid Vi polysaccharide	Typhim Vi™	Aventis Pasteur, Inc. (800) Vaccine	

Notes: Persons needing additional vaccine information or CDC's Advisory Committee on Immunization Practices guidelines can contact the CDC Immunization Hotline at (800) CDC-SHOT ([800] 232-7468) or at <http:// www.cdc.gov/nip>. Adverse events after vaccination should be reported promptly to the Vaccine Adverse Event Reporting System (VAERS), P.O. Box 1100, Rockville, MD 20849-1100. Forms and information can be obtained from VAERS at (800) 822-7967.

Appendix

Dosing Charts for Preventing Opportunistic Infections Among Hematopoietic Stem Cell Transplant Recipients

I. Preventive regimens for adult or adolescent hematopoietic stem cell transplant (HSCT) recipients

Pathogen: Cytomegalovirus

Indication	First choice	Alternatives
Universal prophylaxis for cytomegalovirus disease among all allogeneic adult or adolescent HSCT recipients at risk throughout phase II (i.e., from engraftment to day 100 after HSCT)	Ganciclovir, 5 mg/kg/dose intravenously every 12 hours for 5–7 days, followed by 5–6 mg/kg intravenously daily for 5 days/week from engraftment until day 100 after HSCT (AI)	Foscarnet, 60 mg/kg intravenously every 12 hours for 7 days, followed by 90–120 mg/kg intravenously daily until day 100 after HSCT (CIII)
Or preemptive cytomegalovirus treatment administered <100 days after HSCT to all allogeneic adult or adolescent HSCT recipients at risk: Start ganciclovir when the patient experiences any level of cytomegalovirus antigenemia or viremia or has ≥2 consecutively positive cytomegalovirus-DNA polymerase chain reaction tests	Ganciclovir, 5 mg/kg/dose intravenously every 12 hours for 7–14 days, followed by 5 mg/kg/day for 5 days/week until day 100 after HSCT or for a minimum of 3 weeks, whichever is longer (AI); or administer ganciclovir for a total of 3–6 weeks; antigen or polymerase chain reaction tests should be negative when ganciclovir is stopped; reinstitute ganciclovir if subsequent weekly cytomegalovirus antigenemia screening tests become positive (BI)	
Preemptive treatment for cytomegalovirus seropositive autologous adult or adolescent HSCT recipients at <100 days after HSCT: Start ganciclovir when antigenemia is ≥5 cells/slide, but CD34+-selected patients should be treated at any level of antigenemia*	Ganciclovir, 5 mg/kg/dose intravenously every 12 hours for 7 days, followed by 5 mg/kg/day intravenously for 5 days/week for 2 weeks (BII)	
Preemptive treatment of allogeneic adult or adolescent HSCT recipients >100 days after HSCT: Start ganciclovir when a) antigenemia is ≥5 cells/slide or b) the patient has had ≥2 consecutively positive viremia or polymerase chain reaction tests (e.g., in a person receiving steroids for graft-versus-host disease or who received ganciclovir or foscarnet at <100 days after HSCT)	Ganciclovir, 5 mg/kg/dose intravenously every 12 hours for 7 days, followed by 5 mg/kg/day intravenously for 5 days/week for 2 weeks (BIII)	

* **Source**: Holmberg LA, Boeckh M, Hooper H, et al. Increased incidence of cytomegalovirus disease after autologous CD34-selected peripheral blood stem cell transplantation [Clinical observations, interventions, and therapeutic trials]. Blood 1999;94(12):4029–35.

Notes: Patients who do not tolerate standard doses of ganciclovir should be administered foscarnet. Ganciclovir and foscarnet doses should be modified for renal impairment. Prehydration is required for foscarnet administration.

Pathogen: Herpes simplex virus

Indication	First choice	Alternatives
Prevention of herpes simplex virus reactivation among seropositive adult or adolescent HSCT recipients: Start acyclovir at the beginning of conditioning therapy and continue until engraftment or until mucositis resolves (i.e., approximately 30 days after HSCT for allogeneic HSCT recipients)	Acyclovir, 200 mg by mouth 3 times/day or 250 mg/m^2/dose infused over 1 hour intravenously every 12 hours (BIII)	Valacyclovir, 500 mg by mouth daily (CIII)

Note: For patients requiring prophylaxis for cytomegalovirus and herpes simplex virus after engraftment, ganciclovir alone provides effective prophylaxis for both pathogens.

Pathogen: Varicella-zoster virus

Indication	First choice	Alternatives
Prevention of varicella-zoster virus disease after exposure among adult or adolescent HSCT recipients who are at <24 months after HSCT or who are at ≥24 months after HSCT and on immunosuppressive therapy or have chronic graft-versus-host disease: Ideally, administer prophylaxis within 96 hours (preferably, within 48 hours) after close contact with a person who has chickenpox or shingles	Varicella-zoster immunoglobulin, 5 vials (1.25 ml each or 625 units total) intramuscularly (AII)	None

Pathogen: Influenza

Indication	First choice	Alternatives
Prevention of influenza A or B among adult or adolescent HSCT recipients	Lifelong annual seasonal (i.e., October–May) influenza vaccination starting before HSCT and restarting 6 months after HSCT (BIII); whole- or split-virus influenza vaccine, 0.5 ml/dose intramuscularly	None
Prophylaxis and preemptive treatment among all HSCT recipients during community and nosocomial outbreaks of influenza A	Rimantadine, 100 mg by mouth 2 times/day (CIII)	Amantadine, 100 mg by mouth 2 times/day (CIII)

Notes: Rimantadine dose should be reduced for patients with impaired renal function or for severely impaired hepatic function. Amantadine dose should be reduced for renal impairment.

Pathogen: Bacterial infections, general prophylaxis

Indication	First choice	Alternatives
Prevention of bacterial infections among allogeneic adult or adolescent HSCT recipients with severe hypogammaglobulinemia (i.e., serum immunoglobulin G level < 400 mg/dl) at <100 days after HSCT	Intravenous immunoglobulin, 500 mg/kg/week (CIII)	None

Notes: Patients with immunoglobulin E anti-immunoglobulin A antibodies are at high risk for experiencing anaphylaxis from immunoglobulin administration (**Source**: Burks AW, Sampson HA, Buckley RH. Anaphylactic reactions after gamma globulin administration in patients with hypogammaglobulinemia. New Engl J Med 1986;314[9]:560–4). Therefore, persons with immunoglobulin A deficiency should not receive standard immunoglobulin products (**Source**: Siberry GK, Iannone R, eds. Harriet Lane handbook: a manual for pediatric house officers. 15th ed.; St. Louis, MO: Mosby, Inc., 2000:339;739) (DIII). However, researchers have reported that use of immunoglobulin A-depleted immunoglobulin preparations can be used with caution among these persons (**Sources**: Burks AW, Sampson HA, Buckley RH. Anaphylactic reactions after gamma globulin administration in patients with hypogammaglobulinemia. New Engl J Med 1986;314[9]:560–4; Stiehm ER. Human intravenous immunoglobulin in primary and secondary antibody deficiencies [Review]. Pediatr Infect Dis J 1997;16[7]:696–707; and American Academy of Pediatrics. Passive immunization. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:41–53). Researchers also propose checking serum immunoglobulin G levels every 2 weeks among patients receiving intravenous immunoglobulin replacement therapy.

Pathogen: *Streptococcus pneumoniae*

Indication	First choice	Alternatives
Prevention of pneumococcal disease among adult or adolescent HSCT recipients	23-valent pneumococcal polysaccharide vaccine at 12 and 24 months after HSCT (BIII)	None

Note: Penicillin-resistant *Streptococcus pneumoniae* is increasing in the United States.

Pathogen: *Haemophilus influenzae* type b

Indication	First choice	Alternatives
Prevention of invasive *Haemophilus influenzae* type b (Hib) disease among adult or adolescent HSCT recipients	Hib conjugate vaccine administered at 12, 14, and 24 months after HSCT (BII)	None
Generally, HSCT recipients who are household contacts of a person with Hib disease should be administered rifampin prophylaxis* (BIII); however, prophylaxis is not needed for adult or adolescent HSCT recipients who are household contacts of a person with Hib disease if all household contacts aged <4 years are fully vaccinated	Rifampin 600 mg by mouth daily for 4 days (BIII)	

* **Source**: American Academy of Pediatrics. *Haemophilus influenzae* infections. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:262–72.

Pathogen: Methicillin-resistant *Staphylococcus aureus*

Indication	First choice	Alternatives
Elimination of methicillin-resistant *Staphylococcus aureus* carrier state among adults or adolescents to prevent this disease among chronic carriers	Mupirocin calcium ointment 2%; use a cotton-tipped applicator or equivalent to apply to nares 2 times/day for 5 days or to wounds daily for 2 weeks	None

Pathogen: *Candida* species

Indication	First choice	Alternatives
Prophylaxis for disease from fluconazole-susceptible *Candida* species among a) allogeneic adult or adolescent HSCT recipients or b) autologous adult or adolescent HSCT recipients with lymphoma or leukemia and who have or will have prolonged neutropenia and mucosal damage from intense conditioning regimens or graft manipulation or who have recently received fludarabine or 2-chlorodeoxyadenosine: Administer prophylaxis from the day of transplantation (i.e., day 0) until engraftment (i.e., approximately 30 days after HSCT) or until 7 days after the absolute neutrophil count > 1,000 cells/mm^3	Fluconazole, 400 mg by mouth or intravenously daily (AI)	None

Pathogen: *Pneumocystis carinii*

Indication	First choice	Alternatives
Prophylaxis for *Pneumocystis carinii* pneumonia among a) all allogeneic adult or adolescent HSCT recipients or b) autologous adult or adolescent HSCT recipients with underlying hematologic malignancies (e.g., lymphoma or leukemia) or for those receiving intense conditioning regimens or graft manipulation or for those who have recently received fludarabine or 2-chlorodeoxyadenosine:* Administer prophylaxis from time of engraftment for ≥6 months after HSCT; continue >6 months after HSCT for the duration of immunosuppression for all persons who a) are receiving immunosuppressive therapy (e.g., prednisone or cyclosporine) or who b) have chronic graft-versus-host disease	Trimethoprim-sulfamethoxazole, 1 double-strength tablet by mouth daily or 1 single-strength tablet by mouth daily or 1 double-strength tablet by mouth 3 times/week (AII); researchers also recommend administering prophylaxis for 1–2 weeks before HSCT (i.e., day –14 to –2) (CIII)	Dapsone, 50 mg by mouth 2 times/day or 100 mg by mouth daily (BIII) or pentamidine, 300 mg every 3–4 weeks by Respirgard II™ nebulizer (CIII)

* **Source**: Tuan IZ, Dennison D, Weisdorf DJ. *Pneumocystis carinii* pneumonitis after bone marrow transplantation. Bone Marrow Transplant 1992;10(3):267–72.

Note: Patients who are receiving sulfadiazine-pyrimethamine for toxoplasmosis therapy are protected against *Pneumocystis carinii* and do not need additional prophylaxis.

Pathogen: *Toxoplasma gondii*

Indication	First choice	Alternatives
Prophylaxis of *Toxoplasma gondii* disease among seropositive allogeneic adult or adolescent HSCT recipients: Start after engraftment and administer as long as patients remain on immunosuppressive therapy (i.e., generally, until 6 months after HSCT)	Trimethoprim-sulfamethoxazole, 1 double-strength tablet by mouth daily or 1 single-strength tablet by mouth daily or 1 double-strength table by mouth 3 times/week (AII)	For those persons who are intolerant of trimethoprim-sulfamethoxazole, the following drugs can be substituted: Clindamycin, 300–450 mg by mouth every 6–8 hours; plus pyrimethamine, 25–75 mg by mouth daily; plus leucovorin, 10–25 mg by mouth 4 times/day (CIII)

Note: Among allogeneic HSCT recipients, clinical toxoplasmosis has occurred despite the use of trimethoprim-sulfamethoxazole for *Pneumocystis carinii* prophylaxis (**Source**: Slavin MA, Meyers JD, Remington JS, Hackman RC. *Toxoplasma gondii* infection in marrow transplant recipients: a 20 year experience. Bone Marrow Transplant 1994;13[5]:549–57).

Pathogen: *Strongyloides* species

Indication	First choice	Alternatives
Prevention of strongyloidiasis hyperinfection among adult or adolescent HSCT candidates whose HSCT screening tests are positive for *Strongyloides* species or who have an unexplained eosinophilia and a travel or residence history suggestive of exposure to *Strongyloides stercoralis*: Administer prophylaxis before HSCT	Ivermectin, 200 µg/kg by mouth daily for 2 consecutive days* (BIII); 1 tablet = 6 mg; doses administered as follows: Body weight (kg) — Oral dose <15 — Not recommended ≥15–24 — ½ tablet 25–35 — 1 tablet 36–50 — 1½ tablets 51–65 — 2 tablets 66–79 — 2½ tablets ≥80 — 200 µg/kg	Albendazole, 400 mg by mouth daily for 3 days or thiabendazole, 25 mg/kg by mouth 2 times/day for 2 days (BIII); maximum dose, 3 g/24 hours

*__Sources__: Liu LX, Weller PF. Strongyloidiasis and other intestinal nematode infections [Review]. Infect Dis Clin North Am 1993;7(3):655–82; and Naquira C, Jimenez G, Guerra JG, et al. Ivermectin for human strongyloidiasis and other intestinal helminths. Am J Trop Med Hyg 1989;40:304–9.

Notes: Among immunocompromised patients, multiple courses at 2-week intervals might be required; however, cure might not be achievable. Safety and efficacy of ivermectin has not been established during pregnancy. Albendazole and thiabendazole are contraindicated during pregnancy.

Pathogen: Traveler's diarrhea

Indication	First choice	Alternatives
Prophylaxis among adult or adolescent HSCT recipients who are immunocompromised and who plan to travel in developing countries	Ciprofloxacin, 500 mg by mouth daily for the duration of stay in developing countries (BIII) or bismuth subsalicylate, 2 oz by mouth 4 times/day or 2 tablets by mouth 4 times/day; can be administered for ≤3 weeks to prevent travelers' diarrhea in adults aged >18 years only	Trimethoprim-sulfamethoxazole, 1 double-strength tablet by mouth daily for the duration of stay in developing country (CIII)

Notes: Use of aspirin-containing products including bismuth subsalicylate is contraindicated in persons aged <18 years unless prescribed by a physician because these products have been associated with Reye's syndrome (**Source**: Belay E, Bresee JS, Holman RC, Khan AS, Shahriari A, Schonberger LB. Reye's syndrome in the United States from 1981 through 1997. New Engl J Med 1999;340[18]:1377–82). Ciprofloxacin, norfloxacin, and ofloxacin are not approved for use among children aged <18 years.

Pathogen: *Mycobacteria tuberculosis*

Indication	First choice	Alternatives
Prevention of *Mycobacteria tuberculosis* among a) highly immunocompromised adult or adolescent HSCT recipients or candidates who have been substantially exposed to someone with active, infectious (e.g., sputum smear positive) pulmonary or laryngeal tuberculosis, regardless of the HSCT recipient's or candidate's tuberculin skin test status, or b) adult or adolescent HSCT recipients or candidates with a positive tuberculin skin test and who were not previously treated and have no evidence of active tuberculosis disease	Isoniazid, 5 mg/kg/day by mouth or intramuscularly for 9 months (i.e., for ≥270 doses);* maximum dose, 300 mg/day, and pyridoxine (vitamin B_6), 25–50 mg by mouth daily for 9 months; administer to nutritionally deficient HSCT recipients and candidates while on isoniazid preventive therapy to reduce the occurrence of isoniazid-induced neuropathy* (BIII)	None

*__Source__: CDC. Prevention and treatment of tuberculosis among patients infected with human immunodeficiency virus: principles of therapy and revised recommendations. MMWR 1998;47(No. RR-20):1–58.

Notes: A twice-weekly schedule of isoniazid and pyridoxine can be administered (CIII). The twice-weekly isoniazid dose is 15 mg/kg by mouth or intramuscularly (maximum dose, 900 mg). The twice-weekly pyridoxine dose is 50–100 mg by mouth. A 2-month pyrazinamide/rifampin preventive therapy regimen can be used for HSCT candidates who are not at risk for serious rifampin drug interactions and whose HSCT is not scheduled until ≥2 weeks after the 2-month course is completed (**Sources**: CDC. Notice to readers: use of short-course tuberculosis preventive therapy regimens in HIV-seronegative persons. MMWR 1998;47[42]:911–2; and CDC. Prevention and treatment of tuberculosis among patients infected with human immunodeficiency virus: principles of therapy and revised recommendations. MMWR 1998;47[No. RR-20]:1–58) (CIII). The usual pyrazinamide dose is 15–30 mg/kg/day by mouth or 50–70 mg/kg/dose by mouth 2 times/week (maximum daily pyrazinamide dose, 2.0 gm; maximum twice-weekly dose, 3.5 gm). Rifampin dose is 10 mg/kg/day by mouth or intravenously or 10 mg/kg/dose administered 2 times/week by mouth or intravenously (maximum rifampin dose, 600 mg). Routine use of a 2-month pyrazinamide/rifampin preventive therapy regimen is not recommended after HSCT because of the risk for serious rifampin drug interactions (DIII). Persons who have been exposed to rifampin- and isoniazid-resistant tuberculosis should be placed on preventive therapy regimens that involve ≥2 antituberculosis drugs to which the infecting strain is susceptible, and a tuberculosis specialist should be consulted (**Source**: CDC. Prevention and treatment of tuberculosis among patients infected with human immunodeficiency virus: principles of therapy and revised recommendations. MMWR 1998;47[No. RR-20]:1–58) (BIII). A tuberculosis specialist should also be consulted for patients who are intolerant to isoniazid (AIII). All intermittent dosing strategies should be administered as directly observed therapy (AIII).

II. Preventive regimens for pediatric hematopoietic stem cell transplant (HSCT) recipients

Pathogen: Cytomegalovirus

Indication	First choice	Alternatives
Universal prophylaxis for cytomegalovirus disease among all allogeneic pediatric HSCT recipients at risk throughout phase II (i.e., from engraftment to day 100 after HSCT)	Ganciclovir, 5 mg/kg/dose intravenously every 12 hours for 5–7 days, followed by 5 mg/kg/dose intravenously daily for 5 days/week from engraftment until day 100 after HSCT (AI)	Foscarnet, 60 mg/kg intravenously every 12 hours for 14 days, followed by 90–120 mg/kg/day until day 100 after HSCT (CIII)
Or preemptive cytomegalovirus treatment administered <100 days after HSCT to all allogeneic pediatric HSCT recipients at risk: Start ganciclovir when the patient experiences any level of cytomegalovirus antigenemia or viremia or has ≥2 consecutively positive cytomegalovirus-DNA polymerase chain reaction tests	Ganciclovir, 5 mg/kg/dose intravenously every 12 hours for 7–14 days, followed by 5 mg/kg/day for 5 days/week until day 100 after HSCT or for a minimum of 3 weeks, whichever is longer (AI); or administer ganciclovir for a total of 3–6 weeks; antigen or polymerase chain reaction tests should be negative when ganciclovir is stopped; reinstitute ganciclovir if subsequent weekly cytomegalovirus antigenemia screening tests become positive (BI)	
Preemptive treatment for cytomegalovirus seropositive autologous pediatric HSCT recipients at <100 days after HSCT: Start ganciclovir when antigenemia is ≥5 cells/slide, but CD34+-selected patients should be treated at any level of antigenemia*	Ganciclovir, 5 mg/kg/dose intravenously every 12 hours for 7 days, followed by 5 mg/kg/day intravenously for 5 days/week for 2 weeks (BII)	
Preemptive treatment of allogeneic pediatric HSCT recipients >100 days after HSCT: Start ganciclovir when a) antigenemia is ≥5 cells/slide or b) the patient has had ≥2 consecutively positive viremia or polymerase chain reaction tests (e.g., in a person receiving steroids for graft-versus-host disease or who received ganciclovir or foscarnet at <100 days after HSCT)	Ganciclovir, 5 mg/kg/dose intravenously every 12 hours for 7 days, followed by 5 mg/kg/day intravenously for 5 days/week for 2 weeks (BIII)	

* **Source**: Holmberg LA, Boeckh M, Hooper H, et al. Increased incidence of cytomegalovirus disease after autologous CD34-selected peripheral blood stem cell transplantation [Clinical observations, interventions, and therapeutic trials]. Blood 1999;94(12):4029–35.

Notes: Patients who do not tolerate standard doses of ganciclovir should be administered foscarnet. Ganciclovir and foscarnet doses should be modified for renal impairment. Prehydration is required for foscarnet administration.

Pathogen: Herpes simplex virus

Indication	First choice	Alternatives
Prevention of herpes simplex virus reactivation among seropositive pediatric HSCT recipients: Start acyclovir at the beginning of conditioning therapy and continue until engraftment or until mucositis resolves (i.e., approximately 30 days after HSCT for allogeneic HSCT recipients)	Acyclovir, 250 mg/m^2/dose intravenously every 8 hours (BIII) or 125 mg/m^2/dose intravenously every 6 hours (CIII)	Acyclovir 600–1,000 mg/24 hours by mouth, divided in 3–5 doses/day

Note: For patients requiring prophylaxis for cytomegalovirus and herpes simplex virus after engraftment, ganciclovir alone provides effective prophylaxis for both pathogens. Valacyclovir is not approved for use among children.

Pathogen: Varicella-zoster virus

Indication	First choice	Alternatives
Prevention of varicella-zoster virus disease after exposure among pediatric HSCT recipients who are at <24 months after HSCT or who are at ≥24 months after HSCT and on immunosuppressive therapy or have chronic graft-versus-host disease: Ideally, administer prophylaxis within 96 hours (preferably, within 48 hours) after close contact with a person who has chickenpox or shingles	Varicella-zoster immunoglobulin, 125 units (1.25 ml)/10 kg (22 lbs) of body weight administered intramuscularly; maximum dose, 625 units or 5 vials (All); doses administered as follows: Body weight (kg) — Dose — Number of vials 0–10 — 125 units — 1 10.1–20 — 250 units — 2 20.1–30 — 375 units — 3 30.1–40 — 500 units — 4 >40 kg — 625 units — 5	Limited data demonstrate that a 1-week course of high-dose acyclovir might prevent varicella

Pathogen: Influenza

Indication	First choice	Alternatives
Prevention of influenza A and B among pediatric HSCT recipients	Lifelong annual seasonal (i.e., October–May) influenza vaccination before HSCT and resuming ≥6 months after HSCT (BIII); doses administered as follows: Age: 6–35 mo — Number of doses: 0.25 ml — Type of influenza vaccine: Split-virus* 3–8 years — 0.5 ml — Split-virus* 9–12 years — 0.5 ml — Split-virus >12 years — 0.5 ml — Whole- or split-virus	None
Prophylaxis and preemptive treatment of influenza A among pediatric HSCT recipients during nosocomial or community influenza A outbreaks	Rimantadine, for children aged 1–9 years, 5 mg/kg/day once daily or divided in 2 doses (CIII); maximum daily dose, 150 mg; for children aged ≥10 years (weight, <40 kg), 5 mg/kg/day by mouth, divided in 2 doses; for children aged ≥10 years (weight, ≥40 kg), 100 mg by mouth 2 times/day	Amantadine, for children aged 1–9 years, 5 mg/kg/day; maximum daily dose, 150 mg; for children aged ≥10 years (weight, <40 kg), 5 mg/kg/day by mouth, divided in 2 doses; for children aged ≥10 years (weight, ≥40 kg), 100 mg by mouth 2 times/day; maximum daily dose, 200 mg

* Children aged <9 years receiving influenza vaccination for the first time require 2 doses of vaccine spaced ≥1 months apart.

Notes: Neither rimantadine nor amantadine are Federal Drug Administration-approved for children aged <1 year. Rimantadine and amantadine doses should be reduced for patients with impaired renal function.

Pathogen: Respiratory syncytial virus

Indication	First choice	Alternatives
Prophylaxis for respiratory syncytial virus (RSV) lower respiratory infection among hypogammaglobulinemic pediatric HSCT recipients	RSV intravenous immunoglobulin can be administered in place of intravenous immunoglobulin during RSV season (i.e., November–April in the United States) for pediatric HSCT recipients who are on routine intravenous immunoglobulin therapy* (e.g., those with hypogammaglobulinemia) (CIII); usual RSV intravenous immunoglobulin dose is 750 mg/kg/month or a 1-mg/1-mg dosing substitution of RSV intravenous immunoglobulin for intravenous immunoglobulin can be used for patients who normally require high intravenous immunoglobulin doses to maintain serum immunoglobulin G > 400 mg/dl; can administer more frequently than monthly as needed to keep serum immunoglobulin G > 400 mg/dl	None
Preemptive treatment of RSV upper respiratory infection or early lower respiratory infection among pediatric HSCT recipients	Aerosolized ribavirin,* 6 g/300 ml sterile water to make a concentration of 20 mg/ml; administer 18 hours/day for 10 days in a tent (CIII); for HSCT recipients with lower respiratory infections who cannot tolerate a tent or who have RSV upper respiratory infection, administer ribavirin as 2 g for 2 hours every 8 hours by face mask for 10 days; use small particle aerosol generator model SPAG-2	

*__Source__: American Academy of Pediatrics. Respiratory syncytial virus. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Disease. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000: 483–7.

__Notes__: RSV intravenous immunoglobulin is contraindicated among patients with immunoglobulin A deficiency or who might have allergic reactions or anaphylaxis when receiving blood products containing immunoglobulin A (DIII). RSV monoclonal antibody is under investigational use among HSCT recipients for treatment with ribavirin but not for prophylaxis.

Pathogen: Bacterial infections, general prophylaxis

Indication	First choice	Alternatives
Prevention of bacterial infections among allogeneic pediatric HSCT recipients with severe hypogammaglobulinemia (i.e., serum immunoglobulin G level < 400 mg/dl) at <100 days after HSCT	Intravenous immunoglobulin 400 mg/kg/month; increase dose or frequency as needed to keep serum immunoglobulin G levels > 400 mg/dl (CIII)	None

Notes: Patients with immunoglobulin E anti-immunoglobulin A antibodies are at high risk for experiencing anaphylaxis from immunoglobulin administration (**Source**: Burks AW, Sampson HA, Buckley RH. Anaphylactic reactions after gamma globulin administration in patients with hypogammaglobulinemia. New Engl J Med 1986;314[9]:560–4). Therefore, persons with immunoglobulin A deficiency should not receive standard immunoglobulin products (**Source**: Siberry GK, Iannone R, eds. Harriet Lane handbook: a manual for pediatric house officers. 15th ed.; St. Louis, MO: Mosby, Inc., 2000:339;739) (DIII). However, researchers report that use of immunoglobulin A-depleted immunoglobulin preparations can be used with caution in these persons (**Sources**: Burks AW, Sampson HA, Buckley RH. Anaphylactic reactions after gamma globulin administration in patients with hypogammaglobulinemia. New Engl J Med 1986;314[9]:560–4; Siberry GK, Iannone R, eds. Harriet Lane handbook: a manual for pediatric house officers. 15th ed.; St. Louis, MO: Mosby, Inc., 2000:339;739; Stiehm ER. Human intravenous immunoglobulin in primary and secondary antibody deficiencies [Review]. Pediatr Infect Dis J 1997;16[7]:696–707; American Academy of Pediatrics. Passive immunization. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:41–53). Researchers also propose checking serum immunoglobulin G levels every 2 weeks for patients receiving intravenous immunoglobulin replacement therapy.

Pathogen: *Streptococcus pneumoniae*

Indication	First choice	Alternatives
Prevention of pneumococcal disease among pediatric HSCT recipients	23-valent pneumococcal polysaccharide vaccine at 12 and 24 months after HSCT (BIII)	None

Notes: The 23-valent pneumococcal polysaccharide vaccine should not be administered to children aged <2 years because of lack of efficacy (DI). Penicillin-resistant *Streptococcus pneumoniae* is increasing in the United States.

Pathogen: *Haemophilus influenzae* type b

Indication	First choice	Alternatives
Prevention of invasive *Haemophilus influenzae* type b (Hib) disease among pediatric HSCT recipients	Hib conjugate vaccine administered at 12, 14, and 24 months after HSCT (BII)	None
Generally, pediatric HSCT recipients who are household contacts of a person with Hib disease should be administered rifampin prophylaxis* (BIII); however, prophylaxis is not needed for pediatric HSCT recipients who are household contacts of a person with Hib disease if all household contacts aged <4 years are fully vaccinated	Rifampin, administered as follows: Age — Dose 0–1 mo — 10 mg/kg by mouth daily for 4 days >1 mo — 20mg/kg by mouth daily for 4 days Maximum dose, 600 mg/day (BIII)	None

* **Source**: American Academy of Pediatrics. *Haemophilus influenzae* infections. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:262–72.

Pathogen: Methicillin-resistant *Staphylococcus aureus*

Indication	First choice	Alternatives
Elimination of methicillin-resistant *Staphylococcus aureus* carrier state among pediatric patients to prevent this disease among chronic carriers	Mupirocin calcium ointment 2%; use a cotton-tipped applicator or equivalent to apply to nares 2 times/day for 5 days or to wounds daily for 2 weeks*	Bacitracin is regarded safe for use among children, and the dose is the same as for mupirocin; however, no standardized protocol has been evaluated

* Safety of mupirocin calcium ointment 2% use among children aged <12 years has not be established.

Pathogen: *Candida* species

Indication	First choice	Alternatives
Prophylaxis for disease from fluconazole-susceptible *Candida* species among a) allogeneic pediatric HSCT recipients or b) autologous pediatric HSCT recipients with lymphoma or leukemia and who have or will have prolonged neutropenia and mucosal damage from intense conditioning regimens or graft manipulation or who have recently received fludarabine or 2-chlorodeoxyadenosine: Administer prophylaxis from the day of transplantation (i.e., day 0) until engraftment (i.e., approximately 30 days after HSCT) or until 7 days after the absolute neutrophil count > 1,000 cells/mm^3	Fluconazole, for children aged 6 months–13 years, administer 3–6 mg/kg/day by mouth or intravenously (AI); maximum dose, 600 mg/day; for children aged >13 years, administer 400 mg by mouth or intravenously daily (AI)	None

Pathogen: *Pneumocystis carinii*

Indication	First choice	Alternatives
Prophylaxis for *Pneumocystis carinii* pneumonia among a) all allogeneic pediatric HSCT recipients or b) autologous pediatric HSCT recipients with underlying hematologic malignancies (e.g., lymphoma or leukemia) or for those receiving intense conditioning regimens or graft manipulation or for those who have recently received fludarabine or 2-chlorodeoxyadenosine:* Administer prophylaxis from time of engraftment for ≥6 months after HSCT; continue >6 months after HSCT for the duration of immunosuppression for all persons who a) are receiving immunosuppressive therapy (e.g., prednisone or cyclosporine) or who b) have chronic graft-versus-host disease	Trimethoprim-sulfamethoxazole, 150 mg trimethoprim/750 mg sulfamethoxazole/m^2/day by mouth in 2 divided doses 3 times/week on consecutive days (AII); or a single dose by mouth 3 times/week on consecutive days; or by mouth in 2 divided doses daily for 7 days; or by mouth in 2 divided doses 3 times/week on alternate days; researchers also report administering prophylaxis for 1–2 weeks before HSCT (i.e., day –14 to –2) (CIII)	Dapsone, for HSCT recipients aged ≥1 months, 2 mg/kg (maximum dose, 100 mg) by mouth daily (BIII); or intravenous pentamidine, 4 mg/kg every 2–4 weeks; or aerosolized pentamidine, for HSCT recipients aged ≤5 years, 9 mg/kg/dose; or for HSCT recipients aged >5 years, 300 mg; should be administered every month by Respirgard II™ nebulizer (CIII)

* **Source**: Tuan IZ, Dennison D, Weisdorf DJ. *Pneumocystis carinii* pneumonitis after bone marrow transplantation. Bone Marrow Transplant 1992;10(3):267–72.

Notes: Trimethoprim-sulfamethoxazole is not recommended for patients aged <2 months because of risk for kernicterus. Patients who are receiving sulfadiazine-pyrimethamine for toxoplasmosis therapy are protected against *Pneumocystis carinii* and do not need additional prophylaxis.

Pathogen: *Toxoplasma gondii*

Indication	First choice	Alternatives
Prophylaxis of *Toxoplasma gondii* disease among seropositive allogeneic pediatric HSCT recipients: Start after engraftment and administer as long as patients remain on immunosuppressive therapy (i.e., generally, until 6 months after HSCT)	Trimethoprim-sulfamethoxazole, 150 mg trimethoprim/750 mg sulfamethoxazole/m^2/day by mouth in 2 divided doses 3 times/week on consecutive days (AII); or a single dose by mouth 3 times/week on consecutive days; or by mouth in 2 divided doses daily for 7 days; or by mouth in 2 divided doses 3 times/weekly on alternate days	For those persons who are intolerant of trimethoprim-sulfamethoxazole, the following drugs can be substituted: Clindamycin, 20–30 mg/kg/day by mouth, divided in 4 divided doses daily; plus pyrimethamine, 1 mg/kg by mouth daily; plus leucovorin, 5 mg by mouth every 3 days (CIII)

Note: Trimethoprim-sulfamethoxazole is not recommended for patients aged <2 months because of risk for kernicterus. Among allogeneic HSCT recipients, clinical toxoplasmosis has occurred despite the use of trimethoprim-sulfamethoxazole for *Pneumocystis carinii* prophylaxis (**Source**: Slavin MA, Meyers JD, Remington JS, Hackman RC. *Toxoplasma gondii* infection in marrow transplant recipients: a 20 year experience. Bone Marrow Transplant 1994;13[5]:549–57).

Pathogen: *Strongyloides* species

Indication	First choice	Alternatives
Prevention of strongyloidiasis hyperinfection among pediatric HSCT candidates whose HSCT screening tests are positive for *Strongyloides* species or who have an unexplained eosinophilia and a travel or residence history suggestive of exposure to *Strongyloides stercoralis*: Administer prophylaxis before HSCT	Ivermectin, 200 µg/kg by mouth daily for 2 consecutive days* (BIII); 1 tablet = 6 mg; doses administered as follows: Body weight (kg) — Oral dose <15 — Not recommended ≥15–24 — ½ tablet 25–35 — 1 tablet 36–50 — 1½ tablets 51–65 — 2 tablets 66–79 — 2½ tablets ≥80 — 200 µg/kg	Thiabendazole, 25 mg/kg 2 times daily for 2 days; maximum dose, 3 g/24 hours

* **Sources**: Liu LX, Weller PF. Strongyloidiasis and other intestinal nematode infections [Review]. Infect Dis Clin North Am 1993;7(3):655–82; and Naquira C, Jimenez G, Guerra JG, et al. Ivermectin for human strongyloidiasis and other intestinal helminths. Am J Trop Med Hyg 1989;40:304–9.

Notes: Ivermectin safety among children weighing <15 kg has not been established. Among immunocompromised patients, multiple courses of ivermectin at 2-week intervals might be required; however, cure might not be achievable. Safety and efficacy of ivermectin has not been established during pregnancy. Thiabendazole is contraindicated during pregnancy.

Pathogen: Traveler's diarrhea

Indication	First choice	Alternatives
Prophylaxis among pediatric HSCT recipients who are immunocompromised and who plan to travel in developing countries	Trimethoprim-sulfamethoxazole, 150 mg trimethoprim/750 mg sulfamethoxazole/m^2/day by mouth, divided in 2 doses 3 times/ week on consecutive days (CIII); can be administered for duration of stay in developing country	Trimethoprim-sulfamethoxazole, single dose by mouth 3 times/ week on consecutive days

Notes: Use of aspirin-containing products including bismuth subsalicylate is contraindicated in persons aged <18 years unless prescribed by a physician because these products have been associated with Reye's syndrome (**Source**: Belay E, Bresee JS, Holman RC, Khan AS, Shahriari A, Schonberger LB. Reye's syndrome in the United States from 1981 through 1997. New Engl J Med 1999;340[18]:1377–82). Trimethoprim-sulfamethoxazole is not recommended for patients aged <2 months because of risk for kernicterus. Resistance to trimethoprim-sulfamethoxazole is common in tropical areas. Usual doses of trimethoprim-sulfamethoxazole for *Pneumocystis carinii* pneumonia prophylaxis should provide limited protection against traveler's diarrhea.

Pathogen: ***Mycobacteria tuberculosis***

Indication	First choice	Alternatives
Prevention of *Mycobacteria tuberculosis* among a) highly immunocompromised pediatric HSCT recipients or candidates who have been exposed to someone with active, infectious (e.g., sputum smear positive) pulmonary or laryngeal tuberculosis, regardless of the HSCT recipient's or candidate's tuberculin skin test status, or b) pediatric HSCT recipients or candidates with a positive tuberculin skin test and who were not previously treated and have no evidence of active tuberculosis disease	Isoniazid, 10–20 mg/kg/day by mouth or intramuscularly for 9 months (i.e., for ≥270 doses);* maximum dose, 300 mg/day, and pyridoxine (vitamin B_6), 1–2 mg/kg/day by mouth daily for 9 months; dose required might vary by age and condition;† administer to nutritionally deficient HSCT recipients and candidates while on isoniazid preventive therapy to reduce the occurrence of isoniazid-induced neuropathy* (BIII)	None

* **Sources**: American Academy of Pediatrics. Tuberculosis. In: Pickering LK, ed. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics;2000:593–613; CDC. Prevention and treatment of tuberculosis among patients infected with human immunodeficiency virus: principles of therapy and revised recommendations. MMWR 1998;47(No. RR-20):1–58; and CDC. Notice to readers: use of short-course tuberculosis preventive therapy regimens in HIV-seronegative persons. MMWR 1998;47(42):911–2.

† **Source**: Siberry GK, Iannone R, eds. Harriet Lane handbook: a manual for pediatric house officers. 15th ed.; St. Louis, MO: Mosby, Inc., 2000:834–5.

Notes: A twice-weekly schedule of isoniazid and pyridoxine can be administered (CIII). The twice-weekly isoniazid dose is 20–40 mg/kg by mouth or intramuscularly (maximum dose, 900 mg). A 2-month pyrazinamide/rifampin preventive therapy regimen can be used for HSCT candidates who are not at risk for serious rifampin drug interactions and whose HSCT is not scheduled until ≥2 weeks after the 2-month course is completed. Rifampin dose is 10–20 mg/kg/day by mouth or intravenously or 10–20 mk/kg/dose by mouth or intravenously, administered 2 times/week (maximum pyrazinamide dose, 3.5 g; maximum rifampin dose, 600 mg) (**Sources**: CDC. Notice to readers: use of short-course tuberculosis preventive therapy regimens in HIV-seronegative persons. MMWR 1998;47[42]:911–2; and CDC. Prevention and treatment of tuberculosis among patients infected with human immunodeficiency virus: principles of therapy and revised recommendations. MMWR 1998;47[No. RR-20]:1–58.) (CIII). The usual pyrazinamide dose is 15–30 mg/kg/day by mouth or 50–70 mg/kg/dose by mouth 2 times/week (maximum) (maximum daily pyrazinamide dose, 2 g). Routine use of a 2-month pyrazinamide/rifampin preventive therapy regimen is not recommended after HSCT because of the risk for serious rifampin drug interactions (DIII). Persons who have been exposed to rifampin- and isoniazid-resistant tuberculosis should be placed on preventive therapy regimens that involve ≥2 antituberculosis drugs to which the infecting strain is susceptible (**Source**: CDC. Prevention and treatment of tuberculosis among patients infected with human immunodeficiency virus: principles of therapy and revised recommendations. MMWR 1998;47[No. RR-20]:1–58), and a tuberculosis specialist should be consulted (BIII). A tuberculosis specialist should also be consulted for patients who are intolerant to isoniazid (AIII). All intermittent dosing strategies should be administered as directly observed therapy (AIII).

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Recommendations and Reports

Continuing Education Activity Sponsored by CDC

Guidelines for Preventing Opportunistic Infections Among Hematopoietic Stem Cell Transplant Recipients: Recommendations of CDC, the Infectious Disease Society of America, and the American Society of Blood and Marrow Transplantation

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Goals and Objectives

This *MMWR* provides guidelines for preventing opportunistic infections (OIs) among hematopoietic stem cell transplant (HSCT) recipients. The goals of these guidelines are to summarize current data regarding preventing opportunistic infections among HSCT recipients and provide evidence-based recommended strategies for preventing these OIs. Upon completion of this educational activity, the reader should be able to identify strategies for a) preventing exposure and disease from bacterial, viral, fungal, protozoa, and helminth infections and b) hospital infection control, safe living, vaccinations, and hematopoietic stem cell safety.

To receive continuing education credit, please answer all of the following questions.

1. What are the three phases of immune system recovery after HSCT?

A. Phase I, –45–21 days; phase II, 30–100 days; and phase III, >100 days.
B. Phase I, 0–21 days; phase II, 30–90 days; and phase III, >90 days.
C. Phase I, 0–30 days; phase II, 30–120 days; and phase III, >120–365 days.
D. Phase I, <30 days; phase II, 30–100 days; and phase III, >100 days.
E. None of the above.

2. Which opportunistic infections commonly occur during phase I?

A. Cytomegalovirus, *Pneumocystis carinii* pneumonia, and aspergillosis.
B. Cytomegalovirus, *Pneumocystis carinii* pneumonia, and varicella-zoster virus.
C. Herpes simplex virus, cytomegalovirus, and *Candida* species.
D. Herpes simplex virus, *Candida* species, and aspergillosis.
E. Herpes simplex virus, aspergillosis, and varicella-zoster virus.

3. HSCT recipients should avoid eating which of the following foods?

A. Raw or undercooked meat.
B. Unpasteurized dairy products.
C. Vegetable sprouts.
D. Soft cheese.
E. All of the above.

4. Which of the following statements is true regarding vaccinations that HSCT recipients should receive?

A. Diphtheria and tetanus toxoids at 12, 14, and 24 months after HSCT.
B. Measles, mumps, rubella vaccinations at 12 and 24 months after HSCT.
C. Pneumococcal vaccinations at 12, 14, and 24 months after HSCT.
D. Varicella-zoster immunoglobulin at 24 months after HSCT.
E. Oral polio vaccine at 12, 14, and 24 months after HSCT.

5. Recommended aspergillosis prophylaxis is . . .

A. Fluconazole, 400 mg by mouth or intravenously daily.
B. Fluconazole, 200 mg by mouth or intravenously daily.
C. Amphotericin B, 1 mg/kg/day intravenously.
D. Itraconazole capsules, 200 mg by mouth daily.
E. None of the above.

6. Which of the following statements is not true regarding use of laminar air flow rooms in HSCT centers?

A. Substantial survival benefit has been reported for all HSCT recipients.
B. Substantial survival benefit has been reported for allogeneic HSCT recipients with aplastic anemia and human lymphocyte antigen-identical sibling donors.
C. Patients are protected from infection during aspergillosis outbreaks related to hospital construction.
D. Use of laminar air flow rooms for HSCT recipients is optional.

7. The number of recommended air exchanges per hour in an HSCT recipient's hospital room is . . .

A. <6.
B. <8.
C. <10.
D. >12.
E. ≥15.

8. Patient rooms in HSCT centers should have negative air pressure when compared with hallways and anterooms.

A. True.
B. False.

9. HSCT recipients should be cared for routinely by using . . .

A. standard precautions.
B. airborne precautions.
C. droplet precautions.
D. contact precautions.
E. all of the above.

10. The single-most critical and effective procedure for preventing nosocomial infection is . . .

A. following isolation precautions.
B. following ventilation precautions.
C. hand washing.
D. environmental disinfection.
E. excluding visitors experiencing illness from the HSCT center.

11. An HSCT recipient can be exposed safely to visitors with . . .

A. an upper respiratory infection.
B. a covered shingles rash.
C. a varicella-zoster virus-like rash occurring ≤4 weeks after the person has received a varicella-zoster virus vaccination.
D. a history of oral polio vaccination within the previous 3–6 weeks.
E. a history of vaccination with inactivated polio vaccine within the previous 3–6 weeks.

12. When constructing cooling towers for a new hospital with an HSCT center, all of the following should be done to prevent legionellosis except . . .

A. installing drift eliminators.
B. regularly using an effective biocide.
C. maintaining the cooling towers according to the manufacturer's directions.
D. locating the cooling towers so that drift is directed towards the hospital's air-intake system.
E. keeping adequate maintenance records.

13. Which of the following animals is a safe pet for HSCT recipients?

A. Reptile.
B. Duckling.
C. Nonhuman primate.
D. Cat aged ≥6 months.
E. Stray dog.

In questions 14–17, match the recommended prophylaxis drug with the pathogen it protects against.

14. Acyclovir.
15. Foscarnet.
16. Dapsone.
17. Fluconazole.

A. *Candida* species.
B. *Aspergillus* species.
C. Herpes simplex virus.
D. Cytomegalovirus.
E. *Pneumocystis carinii*.

Correct answers for questions 1–17.

1. D; 2. D; 3. E; 4. A; 5. E; 6. A; 7. D; 8. B; 9. A; 10. C; 11. E; 12. D; 13. D; 14. C; 15. D; 16. E; 17. A.

18. Indicate your work setting.

A. State/local health department.
B. Other public health setting.
C. Hospital clinic/private practice.
D. Managed care organization.
E. Academic institution.
F. Other.

19. Which best describes your professional activities?

A. Patient care — emergency/urgent care department.
B. Patient care — inpatient.
C. Patient care — primary-care clinic or office.
D. Laboratory/pharmacy.
E. Public health.
F. Other.

20. I plan to use these recommendations as the basis for . . . (*Indicate all that apply.*)

A. health education materials.
B. insurance reimbursement policies.
C. local practice guidelines.
D. public policy.
E. other.

21. Each month, approximately how many patients do you see?

A. None.
B. 1–5.
C. 6–20.
D. 21–50.
E. 51–100.
F. >100.

22. How much time did you spend reading this report and completing the exam?

A. 2–2.5 hours.
B. More than 2.5 hours but fewer than 3 hours.
C. 3–3.5 hours.
D. More than 3.5 hours but fewer than 4 hours.
E. More than 4.5 hours.

23. After reading this report, I am confident I can identify strategies for preventing exposure and disease from bacterial infections among HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

24. After reading this report, I am confident I can identify strategies for preventing exposure and disease from viral infections among HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

25. After reading this report, I am confident I can identify strategies for preventing exposure and disease from fungal infections among HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

26. After reading this report, I am confident I can identify strategies for preventing exposure and disease from protozoa infections among HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

27. After reading this report, I am confident I can identify strategies for preventing exposure and disease from helminth infections among HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

28. After reading this report, I am confident I can identify strategies for hospital infection control for HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

29. After reading this report, I am confident I can identify strategies for safe living for HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

30. After reading this report, I am confident I can identify strategies for vaccinations for HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

31. After reading this report, I am confident I can identify strategies for hematopoietic stem cell safety for HSCT recipients.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

32. The objectives are relevant to the goal of this report.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

33. The figure, tables, and appendix are useful.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

34. Overall, the presentation of the report enhanced my ability to understand the material.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

35. These recommendations will affect my practice.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

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October 20, 2000/Vol. 49/No. RR-10

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Fill in the appropriate blocks to indicate your answers. Remember, you must answer <u>all</u> of the questions to receive continuing education credit!

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34. [ ] A [ ] B [ ] C [ ] D [ ] E
35. [ ] A [ ] B [ ] C [ ] D [ ] E

Signature ***Date I Completed Exam***

In this report, Clare A. Dykewicz, M.D., M.P.H., and Harold W. Jaffe, M.D., have included a discussion regarding products that are not labeled for use or are still investigational.

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MMWR

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Guidelines for the Prevention of Intravascular Catheter-Related Infections

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ABSTRACT. These guidelines have been developed for practitioners who insert catheters and for persons responsible for surveillance and control of infections in hospital, outpatient, and home health-care settings. This report was prepared by a working group comprising members from professional organizations representing the disciplines of critical care medicine, infectious diseases, health-care infection control, surgery, anesthesiology, interventional radiology, pulmonary medicine, pediatric medicine, and nursing. The working group was led by the Society of Critical Care Medicine (SCCM), in collaboration with the Infectious Disease Society of America (IDSA), Society for Healthcare Epidemiology of America (SHEA), Surgical Infection Society (SIS), American College of Chest Physicians (ACCP), American Thoracic Society (ATS), American Society of Critical Care Anesthesiologists (ASCCA), Association for Professionals in Infection Control and Epidemiology (APIC), Infusion Nurses Society (INS), Oncology Nursing Society (ONS), Society of Cardiovascular and Interventional Radiology (SCVIR), American Academy of Pediatrics (AAP), and the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC) and is intended to replace the *Guideline for Prevention of Intravascular Device-Related Infections* published in 1996. These guidelines are intended to provide evidence-based recommendations for preventing catheter-related infections. Major areas of emphasis include 1) educating and training health-care providers who insert and maintain catheters; 2) using maximal sterile barrier precautions during central venous catheter insertion; 3) using a 2% chlorhexidine preparation for skin antisepsis; 4) avoiding routine replacement of central venous catheters as a strategy to prevent infection; and 5) using antiseptic/antibiotic impregnated short-term central venous catheters if the rate of infection is high despite adherence to other strategies (ie, education and training, maximal sterile barrier precautions, and 2% chlorhexidine for skin antisepsis). These guidelines also identify performance indicators that can be used locally by health-care institutions or organizations to monitor their success in implementing these evidence-based recommendations. *Pediatrics* 2002; 110(5). URL: http://www.pediatrics.org/cgi/content/full/110/5/e51; *catheter-related bloodstream infections, intensive care unit, central venous catheter, peripherally inserted central catheter, guidelines.*

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ABBREVIATIONS. CRBSI, catheter-related bloodstream infections; HICPAC, Healthcare Infection Control Practices Advisory Committee; CDC, Centers for Disease Control and Prevention; ICU, intensive care unit; BSI, bloodstream infection; CVC, central venous catheter; PICC, peripherally inserted central catheter; NNIS, National Nosocomial Infection Surveillance; RR, relative risk; CI, confidence interval; IV, intravenous; FDA, US Food and Drug Administration; VRE, vancomycin-resistant enterococcus; VCH, vancomycin/ciprofloxacin/heparin; VH, vancomycin/heparin.

INTRODUCTION

This report provides health-care practitioners with background information and specific recommendations to reduce the incidence of intravascular catheter-related bloodstream infections (CRBSI). These guidelines replace the *Guideline for Prevention of Intravascular Device-Related Infections*, which was published in 1996.[1]

The *Guidelines for the Prevention of Intravascular Catheter-Related Infections* have been developed for practitioners who insert catheters and for persons who are responsible for surveillance and control of infections in hospital, outpatient, and home health-care settings. This report was prepared by a working group composed of professionals representing the disciplines of critical care medicine, infectious diseases, health-care infection control, surgery, anesthesiology, interventional radiology, pulmonary medicine, pediatrics, and nursing. The working group was led by the Society of Critical Care Medicine (SCCM), in collaboration with Infectious Disease Society of America (IDSA), Society for Healthcare Epidemiology of America (SHEA), Surgical Infection Society (SIS), American College of Chest Physicians (ACCP), American Thoracic Society (ATS), American Society of Critical Care Anesthesiologists (ASCCA), Association for Professionals in Infection Control and Epidemiology (APIC), Infusion Nurses Society (INS), Oncology Nursing Society (ONS), Society of Cardiovascular and Interventional Radiology

APPENDIX A

Examples of Clinical Definitions for Catheter-Related Infections Localized Catheter Colonization

Significant growth of a microorganism (>15 CFU) from the catheter tip, subcutaneous segment of the catheter, or catheter hub

Exit Site Infection

Erythema or induration within 2 cm of the catheter exit site, in the absence of concomitant BSI and without concomitant purulence

Clinical Exit Site Infection (or Tunnel Infection)

Tenderness, erythema, or site induration >2 cm from the catheter site along the subcutaneous tract of a tunneled (eg, Hickman, Broviac) catheter, in the absence of concomitant BSI

Pocket Infection

Purulent fluid in the subcutaneous pocket of a totally implanted intravascular catheter that might or might not be associated with spontaneous rupture and drainage or necrosis of the overlaying skin, in the absence of concomitant BSI

Infusate-Related BSI

Concordant growth of the same organism from the infusate and blood cultures (preferably percutaneously drawn) with no other identifiable source of infection

CRBSI

Bacteremia/fungemia in a patient with an intravascular catheter with at least 1 positive blood culture obtained from a peripheral vein, clinical manifestations of infections (ie, fever, chills, and/or hypotension), and no apparent source for the BSI except the catheter. One of the following should be present: a positive semiquantitative (>15 CFU/catheter segment) or quantitative (>103 CFU/catheter segment catheter) culture whereby the same organism (species and antibiogram) is isolated from the catheter segment and peripheral blood; simultaneous quantitative blood cultures with a >5:1 ratio CVC versus peripheral; differential period of CVC culture versus peripheral blood culture positivity of >2 hours.

Surveillance Definitions for Primary BSIs, NNIS System

Laboratory-Confirmed BSI

Should meet at least 1 of the following criteria:

Criterion 1: Patient has a recognized pathogen cultured from 1 or more blood cultures, and the pathogen cultured from the blood is not related to an infection at another site.

Criterion 2: Patient has at least 1 of the following signs or symptoms: fever (>100.4°F [>38°C]), chills, or hypotension, and at least 1 of the following:

1. Common skin contaminant (eg, diphtheroids, *Bacillus* species, *Propionibacterium* species, coagulase-negative staphylococci, micrococci) cultured from 2 or more blood cultures drawn on separate occasions
2. Common skin contaminant (eg, diphtheroids, *Bacillus* species, *Propionibacterium* species, coagulase-negative staphylococci, micrococci) cultured from at least 1 blood culture from a patient with an intravenous line, and the physician institutes appropriate antimicrobial therapy
3. Positive antigen test on blood (eg, *Hemophilus influenzae*, *Streptococcus pneumoniae*, *Neisseria meningitides*, group B streptococcus)
   and signs and symptoms with positive laboratory results are not related to an infection at another site.

Criterion 3: Patient aged <1 year has at least 1 of the following signs or symptoms: fever (>100.4°F [>38°C]), hypothermia (<98.6°F [<37°C]), apnea, or bradycardia, and at least 1 of the following:

1. Common skin contaminant (eg, diphtheroids, *Bacillus* species, *Propionibacterium* species, coagulase-negative staphylococci, micrococci) cultured from 2 or more blood cultures drawn on separate occasions
2. Common skin contaminant (eg, diphtheroids, *Bacillus* species, *Propionibacterium* species, coagulase-negative staphylococci, micrococci) cultured from at least 1 blood culture from a patient with an intravenous line, and the physician institutes appropriate antimicrobial therapy
3. Positive antigen test on blood (eg, *H influenzae*, *S pneumoniae*, *N meningitides*, group B streptococcus)
   and signs and symptoms with positive laboratory results are not related to an infection at another site.

Clinical Sepsis

Should meet at least 1 of the following criteria:

Criterion 1: Patient has at least 1 of the following clinical signs with no other recognized cause: fever (>100.4°F [>38°C]), hypotension (systolic pressure <90 mmHg), or oliguria (<20 mL/h), and blood culture not done or no organisms or antigen detected in blood and no apparent infection at another site, and physician institutes treatment for sepsis.

Criterion 2: Patient aged <1 year has at least 1 of the following clinical signs or symptoms with no other recognized cause: fever (>100.4°F [>38°C]), hypothermia (<98.6°F [<37°C]), apnea, or bradycardia, and blood culture not done or no organisms or antigen detected in blood and no apparent infection at another site, and physician institutes treatment for sepsis.

Catheter-Associated BSI

Defined by the following:

- Vascular access device that terminates at or close to the heart or 1 of the great vessels. An umbilical artery or vein catheter is considered a central line.
- BSI is considered to be associated with a central line if the line was in use during the 48-hour period before development of the BSI. If the time interval between onset of infection and device use is >48 hours, then there should be compelling evidence that the infection is related to the central line.

Arterial or Venous Infection

Included are arteriovenous graft, shunt, fistula, or intravenous cannulation. Should meet at least 1 of the following criteria:

Criterion 1: Patient has organisms cultured from arteries or veins removed during a surgical operation and blood culture not done or no organisms cultured from blood.

Criterion 2: Patient has evidence of arterial or venous infection seen during a surgical operation or histopathologic examination.

Criterion 3: Patient has at least 1 of the following signs or symptoms with no other recognized cause: fever (>100.4°F [>38°C]), pain, erythema, or heat at involved vascular site and >15 CFUs cultured from an intravascular cannula tip using a semiquantitative culture method and blood culture not done or no organisms cultured from blood.

Criterion 4: Patient has purulent drainage at the involved vascular site and blood culture not done or no organisms cultured from blood.

Criterion 5: Patient aged <1 year has at least 1 of the following signs or symptoms with no other recognized cause: fever (>100.4°F [>38°C]), hypothermia (<98.6°F [<37°C]), apnea, bradycardia, lethargy, or pain, erythema or heat at involved vascular site and >15 colonies cultured from intravascular cannula tip using semiquantitative method and blood culture not done or no organisms cultured from blood.

(SCVIR), American Academy of Pediatrics (AAP), and the Healthcare Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control and Prevention (CDC). The recommendations presented in this report reflect consensus of HICPAC and other professional organizations.

INTRAVASCULAR CATHETER-RELATED INFECTIONS IN ADULT AND PEDIATRIC PATIENTS: AN OVERVIEW

Background

Intravascular catheters are indispensable in modern-day medical practice, particularly in intensive care units (ICUs). Although such catheters provide necessary vascular access, their use puts patients at risk for local and systemic infectious complications, including local site infection, CRBSI, septic thrombophlebitis, endocarditis, and other metastatic infections (eg, lung abscess, brain abscess, osteomyelitis, and endophthalmitis).

Health-care institutions purchase millions of intravascular catheters each year. The incidence of CRBSI varies considerably by type of catheter, frequency of catheter manipulation, and patient-related factors (eg, underlying disease and acuity of illness). Peripheral venous catheters are the devices most frequently used for vascular access. Although the incidence of local or bloodstream infections (BSIs) associated with peripheral venous catheters is usually low, serious infectious complications produce considerable annual morbidity because of the frequency with which such catheters are used. However, the majority of serious catheter-related infections are associated with central venous catheters (CVCs), especially those that are placed in patients in ICUs. In the ICU setting, the incidence of infection is often higher than in the less acute in-patient or ambulatory setting. In the ICU, central venous access might be needed for extended periods of time; patients can be colonized with hospital-acquired organisms; and the catheter can be manipulated multiple times per day for the administration of fluids, drugs, and blood products. Moreover, some catheters can be inserted in urgent situations, during which optimal attention to aseptic technique might not be feasible. Certain catheters (eg, pulmonary artery catheters and peripheral arterial catheters) can be accessed multiple times per day for hemodynamic measurements or to obtain samples for laboratory analysis, augmenting the potential for contamination and subsequent clinical infection.

The magnitude of the potential for CVCs to cause morbidity and mortality resulting from infectious complications has been estimated in several studies.[2] In the United States, 15 million CVC days (ie, the total number of days of exposure to CVCs by all patients in the selected population during the selected time period) occur in ICUs each year.[2] If the average rate of CVC-associated BSIs is 5.3 per 1,000 catheter days in the ICU,[3] approximately 80,000 CVC-associated BSIs occur in ICUs each year in the United States. The attributable mortality for these BSIs has ranged from no increase in mortality in studies that controlled for severity of illness,[4–6] to 35% increase in mortality in prospective studies that did not use this control.[7,8] Thus, the attributable mortality remains unclear. The attributable cost per infection is an estimated $34,508–$56,000,[5,9] and the annual cost of caring for patients with CVC-associated BSIs ranges from $296 million to $2.3 billion.[10]

A total of 250,000 cases of CVC-associated BSIs have been estimated to occur annually if entire hospitals are assessed rather than ICUs exclusively.[11] In this case, attributable mortality is an estimated 12%–25% for each infection, and the marginal cost to the health-care system is $25,000 per episode.[11]

Therefore, by several analyses, the cost of CVC-associated BSI is substantial, both in terms of morbidity and in terms of financial resources expended. To improve patient outcome and reduce health-care costs, strategies should be implemented to reduce the incidence of these infections. This effort should be multidisciplinary, involving health-care professionals who insert and maintain intravascular catheters, health-care managers who allocate resources, and patients who are capable of assisting in the care of their catheters. Although several individual strategies have been studied and shown to be effective in reducing CRBSI, studies using multiple strategies have not been conducted. Thus, it is not known whether implementing multiple strategies will have an additive effect in reducing CRBSI, but it is logical to use multiple strategies concomitantly.

Terminology and Estimates of Risk

The terminology used to identify different types of catheters is confusing, because many clinicians and researchers use different aspects of the catheter for informal reference. A catheter can be designated by the type of vessel it occupies (eg, peripheral venous, central venous, or arterial); its intended life span (eg, temporary or short-term versus permanent or long-term); its site of insertion (eg, subclavian, femoral, internal jugular, peripheral, and peripherally inserted central catheter [PICC]); its pathway from skin to vessel (eg, tunneled versus nontunneled); its physical length (eg, long versus short); or some special characteristic of the catheter (eg, presence or absence of a cuff, impregnation with heparin, antibiotics or antiseptics, and the number of lumens). To accurately define a specific type of catheter, all of these aspects should be described (Table 1).

The rate of all catheter-related infections (including local infections and systemic infections) is difficult to determine. Although CRBSI is an ideal parameter because it represents the most serious form of catheter-related infection, the rate of such infection depends on how CRBSI is defined.

Health-care professionals should recognize the difference between surveillance definitions and clinical definitions. The surveillance definitions for catheter-associated BSI includes all BSIs that occur in patients with CVCs, when other sites of infection have been excluded (Appendix A). That is, the surveillance definition overestimates the true incidence of CRBSI because not all BSIs originate from a catheter. Some bacteremias are secondary BSIs from undocumented

TABLE 1. Catheters Used for Venous and Arterial Access

Catheter Type	Entry Site	Length	Comments
Peripheral venous catheters (short)	Usually inserted in veins of forearm or hand	<3 in	Phlebitis with prolonged use; rarely associated with bloodstream infection
Peripheral arterial catheters	Usually inserted in radial artery; can be placed in femoral, axillary, brachial, posterior tibial arteries	<3 in	Low infection risk; rarely associated with bloodstream infection
Midline catheters	Inserted via the antecubital fossa into the proximal basilic or cephalic veins; does not enter central veins	3–8 in	Anaphylactoid reactions have been reported with catheters made of elastomeric hydrogel; lower rates of phlebitis than short peripheral catheters
Nontunneled CVCs	Percutaneously inserted into central veins (subclavian, internal jugular, or femoral)	8 cm or longer, depending on patient size	Account for majority of CRBSI
Pulmonary artery catheters	Inserted through a Teflon introducer in a central vein (subclavian, internal jugular, or femoral)	30 cm or longer, depending on patient size	Usually heparin bonded; similar rates of bloodstream infection as CVC; subclavian site preferred to reduce infection risk
PICCs	Inserted into basilic, cephalic, or brachial veins and enter the superior vena cava	20 cm or longer, depending on patient size	Lower rate of infection than nontunneled CVCs
Tunneled CVCs	Implanted into subclavian, internal jugular, or femoral veins	8 cm or longer, depending on patient size	Cuff inhibits migration of organisms into catheter tract, lower rate of infection than nontunneled CVC
Totally implantable	Tunneled beneath skin and have devices subcutaneous port accessed with a needle; implanted in subclavian or internal jugular vein	8 cm or longer, depending on patient size	Lowest risk for CRBSI; improved patient self-image; no need for local catheter site care; surgery required for catheter removal
Umbilical catheters	Inserted into either umbilical vein or umbilical artery	6 cm or less, depending on patient size	Risk for CRBSI similar to catheters placed in umbilical vein versus artery

sources (eg, postoperative surgical sites, intra-abdominal infections, and hospital-associated pneumonia or urinary tract infections). Thus, surveillance definitions are really definitions for catheter-associated BSIs. A more rigorous definition might include only those BSIs for which other sources were excluded by careful examination of the patient record, and where a culture of the catheter tip demonstrated substantial colonies of an organism identical to those found in the bloodstream. Such a clinical definition would focus on catheter-related BSIs. Therefore, to accurately compare a health-care facility's infection rate to published data, comparable definitions also should be used.

CDC and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) recommend that the rate of catheter-associated BSIs be expressed as the number of catheter associated BSIs per 1,000 CVC days.[12,13] This parameter is more useful than the rate expressed as the number of catheter-associated infections per 100 catheters (or percentage of catheters studied), because it accounts for BSIs over time and therefore adjusts risk for the number of days the catheter is in use.

Epidemiology and Microbiology

Since 1970, CDC's National Nosocomial Infection Surveillance System (NNIS) has been collecting data on the incidence and etiologies of hospital-acquired infections, including CVC-associated BSIs in a group of nearly 300 US hospitals. The majority of hospital-acquired BSIs are associated with the use of a CVC, with BSI rates being substantially higher among patients with CVCs than among those without CVCs. Rates of CVC-associated BSI vary considerably by hospital size, hospital service/unit, and type of CVC. During 1992–2001, NNIS hospitals reported ICU rates of CVC-associated BSI ranging from 2.9 (in a cardiothoracic ICU) to 11.3 (in a neonatal nursery for infants weighing <1,000 g) BSIs per 1,000 CVC days (Table 2).[14]

The relative risk (RR) of catheter-associated BSI also has been assessed in a meta-analysis of 223 prospective studies of adult patients.[11] RR of infection was best determined by analyzing rates of infection both by BSIs per 100 catheters and BSIs per 1,000 catheter days. These rates, and the NNIS-derived data, can be used as benchmarks by individual hos-

TABLE 2. Pooled Means of the Distribution of CVC-Associated Bloodstream Infection Rates in Hospitals That Report to the NNIS System, January 1992 to June 2001

Type of ICU	Number of ICUs	Catheter Days	Pooled Mean/ 1000 Catheter Days
Coronary	102	252 325	4.5
Cardiothoracic	64	419 674	2.9
Medical	135	671 632	5.9
Medical/surgical			
Major teaching	123	579 704	5.3
All others	180	863 757	3.8
Neurosurgical	47	123 780	4.7
Nursery, high risk			
≤1000 g	138	438 261	11.3
1001–1500 g	136	213 351	6.9
1501–2500 g	132	163 697	4.0
>2500 g	133	231 573	3.8
Pediatric	74	291 831	7.6
Surgical	153	900 948	5.3
Trauma	25	116 709	7.9
Respiratory	7	21 265	3.4

Issued August 2001.[290,291]

pitals to estimate how their rates compare with other institutions. Rates are influenced by patient-related parameters, such as severity of illness and type of illness (eg, third-degree burns versus postcardiac surgery), and by catheter-related parameters, such as the condition under which the catheter was placed (eg, elective versus urgent) and catheter type (eg, tunneled versus nontunneled or subclavian versus jugular).

Types of organisms that most commonly cause hospital-acquired BSIs change over time. During 1986–1989, coagulase-negative staphylococci, followed by *Staphylococcus aureus*, were the most frequently reported causes of BSIs, accounting for 27% and 16% of BSIs, respectively (Table 3).[15] Pooled data from 1992 through 1999 indicate that coagulase-negative staphylococci, followed by enterococci, are now the most frequently isolated causes of hospital-acquired BSIs.[12] Coagulase-negative staphylococci account for 37%[12] and *S aureus* account for 12.6% of reported hospital-acquired BSIs.[12] Also notable was the susceptibility pattern of *S aureus* isolates. In 1999, for the first time since NNIS has been reporting susceptibilities, >50% of all *S aureus* isolates from ICUs were resistant to oxacillin.[12]

In 1999, enterococci accounted for 13.5% of BSIs, an increase from 8% reported to NNIS during 1986–1989. The percentage of enterococcal ICU isolates resistant to vancomycin also is increasing, escalating from 0.5% in 1989 to 25.9% in 1999.[12]

Candida spp caused 8% of hospital-acquired BSIs reported to NNIS during 1986–1989,[15,16] and during 1992–1999.[12,17,18] Resistance of *Candida* spp to commonly used antifungal agents is increasing. Although NNIS has not reported the percentage of BSIs caused by non-*albicans* species or fluconazole susceptibility data, other epidemiologic and clinical data document that fluconazole resistance is an increasingly relevant consideration when designing empiric therapeutic regimens for CRBSIs caused by yeast. Data from the Surveillance and Control of Pathogens of Epidemiologic Importance (SCOPE) Program documented that 10% of *C albicans* bloodstream isolates from hospitalized patients were resistant to fluconazole.[17] Additionally, 48% of *Candida* BSIs were caused by non-*albicans* species, including *C glabrata* and *C krusei*, which are more likely than *C albicans* to demonstrate resistance to fluconazole and itraconazole.[18,19]

Gram-negative bacilli accounted for 19% of catheter-associated BSIs during 1986–1989[15] compared with 14% of catheter-associated BSIs during 1992–1999.[12] An increasing percentage of ICU-related isolates are caused by *Enterobacteriaceae* that produce extended-spectrum β-lactamases (ESBLs), particularly *Klebsiella pneumoniae*.[20] Such organisms not only are resistant to extended-spectrum cephalosporins, but also to frequently used, broad spectrum antimicrobial agents.

TABLE 3. Most Common Pathogens Isolated From Bloodstream Infections [12,15]

Pathogen	1986–1989 (%)	1992–1999 (%)
Coagulase-negative staphylococci	27	37
S aureus	16	13
Enterococcus	8	13
Gram-negative rods	19	14
E coli	6	2
Enterobacter	5	5
P aeruginosa	4	4
K pneumoniae	4	3
Candida species	8	8

Pathogenesis

Migration of skin organisms at the insertion site into the cutaneous catheter tract with colonization of the catheter tip is the most common route of infection for peripherally inserted, short-term catheters.[21,22] Contamination of the catheter hub contributes substantially to intraluminal colonization of long-term catheters.[23–25] Occasionally, catheters might become hematogenously seeded from another focus of infection. Rarely, infusate contamination leads to CRBSI.[26]

Important pathogenic determinants of catheter-related infection are 1) the material of which the device is made and 2) the intrinsic virulence factors of the infecting organism. In vitro studies demonstrate that catheters made of polyvinyl chloride or polyethylene are likely less resistant to the adherence of microorganisms than are catheters made of Teflon, silicone elastomer, or polyurethane.[27,28] Therefore, the majority of catheters sold in the United States are no longer made of polyvinyl chloride or polyethylene. Some catheter materials also have surface irregularities that enhance the microbial adherence of certain species (eg, coagulase-negative staphylococci, *Acinetobacter calcoaceticus*, and *Pseudomonas aeruginosa*[29–31]); catheters made of these materials are especially vulnerable to microbial colonization and subsequent infection. Additionally, certain catheter materials are more thrombogenic than others, a characteristic that also might predispose to catheter colonization and catheter-related infection.[31,32] This association has led to emphasis on preventing catheter-related thrombus as an additional mechanism for reducing CRBSI.

The adherence properties of a given microorganism also are important in the pathogenesis of catheter-related infection. For example, *S aureus* can adhere to host proteins (eg, fibronectin) commonly present on catheters.[33,34] Also, coagulase-negative staphylococci adhere to polymer surfaces more readily than do other pathogens (eg, *Escherichia coli* or *S aureus*). Additionally, certain strains of coagulase-negative staphylococci produce an extracellular polysaccharide often referred to as "slime."[35,36] In the presence of catheters, this slime potentiates the pathogenicity of coagulase-negative staphylococci by allowing them to withstand host defense mechanisms (eg, acting as a barrier to engulfment and killing by polymorphonuclear leukocytes) or by making them less susceptible to antimicrobial agents (eg, forming a matrix that binds antimicrobials before their contact with the organism cell wall).[37] Certain *Candida* spp, in the presence of glucose-containing fluids, might produce slime similar to that of their bacterial counterparts, potentially explaining

the increased proportion of BSIs caused by fungal pathogens among patients receiving parenteral nutrition fluids.[38]

STRATEGIES FOR PREVENTION OF CATHETER-RELATED INFECTIONS IN ADULT AND PEDIATRIC PATIENTS

Quality Assurance and Continuing Education

Measures to minimize the risk for infection associated with intravascular therapy should strike a balance between patient safety and cost effectiveness. As knowledge, technology, and health-care settings change, infection control and prevention measures also should change. Well-organized programs that enable health-care providers to provide, monitor, and evaluate care and to become educated are critical to the success of this effort. Reports spanning the past two decades have consistently demonstrated that risk for infection declines following standardization of aseptic care,[39–43] and that insertion and maintenance of intravascular catheters by inexperienced staff might increase the risk for catheter colonization and CRBSI.[43,44] Specialized "IV teams" have shown unequivocal effectiveness in reducing the incidence of catheter-related infections and associated complications and costs.[45–45] Additionally, infection risk increases with nursing staff reductions below a critical level.[48]

Site of Catheter Insertion

The site at which a catheter is placed influences the subsequent risk for catheter-related infection and phlebitis. The influence of site on the risk for catheter infections is related in part to the risk for thrombophlebitis and density of local skin flora.

Phlebitis has long been recognized as a risk for infection. For adults, lower extremity insertion sites are associated with a higher risk for infection than are upper extremity sites.[49–51] In addition, hand veins have a lower risk for phlebitis than do veins on the wrist or upper arm.[52]

The density of skin flora at the catheter insertion site is a major risk factor for CRBSI. Authorities recommend that CVCs be placed in a subclavian site instead of a jugular or femoral site to reduce the risk for infection. No randomized trial satisfactorily has compared infection rates for catheters placed in jugular, subclavian, and femoral sites. Catheters inserted into an internal jugular vein have been associated with higher risk for infection than those inserted into a subclavian or femoral vein.[22,53,54]

Femoral catheters have been demonstrated to have relatively high colonization rates when used in adults.[55] Femoral catheters should be avoided, when possible, because they are associated with a higher risk for deep venous thrombosis than are internal jugular or subclavian catheters.[56–60] and because of a presumption that such catheters are more likely to become infected. However, studies in pediatric patients have demonstrated that femoral catheters have a low incidence of mechanical complications and might have an equivalent infection rate to that of nonfemoral catheters.[61–63] Thus, in adult patients, a subclavian site is preferred for infection control purposes, although other factors (eg, the potential for mechanical complications, risk for subclavian vein stenosis, and catheter-operator skill) should be considered when deciding where to place the catheter. In a meta-analysis of eight studies, the use of bedside ultrasound for the placement of CVCs substantially reduced mechanical complications compared with the standard landmark placement technique (RR = 0.22; 95% confidence interval [CI] = 0.10–0.45).[64] Consideration of comfort, security, and maintenance of asepsis as well as patient-specific factors (eg, preexisting catheters, anatomic deformity, and bleeding diathesis), RR of mechanical complications (eg, bleeding and pneumothorax), the availability of bedside ultrasound, and the risk for infection should guide site selection.

Type of Catheter Material

Teflon or polyurethane catheters have been associated with fewer infectious complications than catheters made of polyvinyl chloride or polyethylene.[27,65,66] Steel needles used as an alternative to catheters for peripheral venous access have the same rate of infectious complications as do Teflon catheters.[67,68] However, the use of steel needles frequently is complicated by infiltration of intravenous (IV) fluids into the subcutaneous tissues, a potentially serious complication if the infused fluid is a vesicant.[68]

Hand Hygiene and Aseptic Technique

For short peripheral catheters, good hand hygiene before catheter insertion or maintenance, combined with proper aseptic technique during catheter manipulation, provides protection against infection. Good hand hygiene can be achieved through the use of either a waterless, alcohol-based product[69] or an antibacterial soap and water with adequate rinsing.[70] Appropriate aseptic technique does not necessarily require sterile gloves; a new pair of disposable nonsterile gloves can be used in conjunction with a "no-touch" technique for the insertion of peripheral venous catheters. However, gloves are required by the Occupational Safety and Health Administration as standard precautions for the prevention of bloodborne pathogen exposure.

Compared with peripheral venous catheters, CVCs carry a substantially greater risk for infection; therefore, the level of barrier precautions needed to prevent infection during insertion of CVCs should be more stringent. Maximal sterile barrier precautions (eg, cap, mask, sterile gown, sterile gloves, and large sterile drape) during the insertion of CVCs substantially reduces the incidence of CRBSI compared with standard precautions (eg, sterile gloves and small drapes).[22,71] Although the efficacy of such precautions for insertion of PICCs and midline catheters has not been studied, the use of maximal barrier precautions also is probably applicable to PICCs.

Skin Antisepsis

In the United States, povidone iodine has been the most widely used antiseptic for cleansing arterial catheter and CVC-insertion sites.[72] However, in one

study, preparation of central venous and arterial sites with a 2% aqueous chlorhexidine gluconate lowered BSI rates compared with site preparation with 10% povidone-iodine or 70% alcohol.[73] Commercially available products containing chlorhexidine have not been available until recently; in July 2000, the US Food and Drug Administration (FDA) approved a 2% tincture of chlorhexidine preparation for skin antisepsis. Other preparations of chlorhexidine might not be as effective. Tincture of chlorhexidine gluconate 0.5% is no more effective in preventing CRBSI or CVC colonization than 10% povidone iodine, as demonstrated by a prospective, randomized study of adults.[74] However, in a study involving neonates, 0.5% chlorhexidine reduced peripheral IV colonization compared with povidone iodine (20/418 versus 38/408 catheters; $p = 0.01$).[75] This study, which did not include CVCs, had an insufficient number of participants to assess differences in BSI rates. A 1% tincture of chlorhexidine preparation is available in Canada and Australia, but not yet in the United States. No published trials have compared a 1% chlorhexidine preparation to povidone-iodine.

Catheter Site Dressing Regimens

Transparent, semipermeable polyurethane dressings have become a popular means of dressing catheter insertion sites. Transparent dressings reliably secure the device, permit continuous visual inspection of the catheter site, permit patients to bathe and shower without saturating the dressing, and require less frequent changes than do standard gauze and tape dressings; the use of these dressings saves personnel time.

In the largest controlled trial of dressing regimens on peripheral catheters, the infectious morbidity associated with the use of transparent dressings on approximately 2,000 peripheral catheters was examined.[65] Data from this study suggest that the rate of colonization among catheters dressed with transparent dressings (5.7%) is comparable to that of those dressed with gauze (4.6%) and that no clinically substantial differences exist in either the incidences of catheter-site colonization or phlebitis. Furthermore, these data suggest that transparent dressings can be safely left on peripheral venous catheters for the duration of catheter insertion without increasing the risk for thrombophlebitis.[65]

A meta-analysis has assessed studies that compared the risk for catheter-related BSIs for groups using transparent dressings versus groups using gauze dressing.[76] The risk for CRBSIs did not differ between the groups. The choice of dressing can be a matter of preference. If blood is oozing from the catheter insertion site, gauze dressing might be preferred.

In a multi-center study, a chlorhexidine-impregnated sponge (Biopatch) placed over the site of short-term arterial and CVCs reduced the risk for catheter colonization and CRBSI.[77] No adverse systemic effects resulted from use of this device.

Catheter Securement Devices

Sutureless securement devices can be advantageous over suture in preventing catheter-related BSIs. One study, which involved only a limited number of patients and was underpowered, compared a sutureless device with suture for the securement of PICCS; in this study, CRBSI was reduced in the group of patients that received the sutureless device.[78]

In-Line Filters

In-line filters reduce the incidence of infusion-related phlebitis.[79,80] No data support their efficacy in preventing infections associated with intravascular catheters and infusion systems. Proponents of filters cite several potential benefits to using these filters, including 1) reducing the risk for infection from contaminated infusate or proximal contamination (ie, introduced proximal to the filter); 2) reducing the risk for phlebitis in patients who require high doses of medication or in those in whom infusion-related phlebitis already has occurred; 3) removing particulate matter that might contaminate IV fluids[81]; and 4) filtering endotoxin produced by gram-negative organisms in contaminated infusate[82] These theoretical advantages should be tempered by the knowledge that infusate-related BSI is rare and that filtration of medications or infusates in the pharmacy is a more practical and less costly way to remove the majority of particulates. Furthermore, in-line filters might become blocked, especially with certain solutions (eg, dextran, lipids, and mannitol), thereby increasing the number of line manipulations and decreasing the availability of administered drugs.[83] Thus, for reducing the risk for CRBSI, no strong recommendation can be made in favor of using in-line filters.

Antimicrobial/Antiseptic Impregnated Catheters and Cuffs

Certain catheters and cuffs that are coated or impregnated with antimicrobial or antiseptic agents can decrease the risk for CRBSI and potentially decrease hospital costs associated with treating CRBSIs, despite the additional acquisition cost of an antimicrobial/antiseptic impregnated catheter.[84] All of the studies involving antimicrobial/antiseptic impregnated catheters have been conducted using triple-lumen, noncuffed catheters in adult patients whose catheters remained in place <30 days. Although all of the studies have been conducted in adults, these catheters have been approved by FDA for use in patients weighing >3 kg. No antiseptic or antimicrobial impregnated catheters currently are available for use in weighing <3 kg.

Chlorhexidine/Silver Sulfadiazine

Catheters coated with chlorhexidine/silver sulfadiazine only on the external luminal surface have been studied as a means to reduce CRBSI. Two meta-analyses[2,85] demonstrated that such catheters reduced the risk for CRBSI compared with standard noncoated catheters. The mean duration of catheter placement in one meta-analysis ranged from 5.1 to

11.2 days.[86] The half-life of antimicrobial activity against *S epidermidis* is 3 days in vitro for catheters coated with chlorhexidine/silver sulfadiazine; this antimicrobial activity decreases over time.[87] The benefit for the patients who receive these catheters will be realized within the first 14 days.[86] A second-generation catheter is now available with chlorhexidine coating both the internal and external luminal surfaces. The external surface has three times the amount of chlorhexidine and extended release of the surface bound antiseptics than that in the first generation catheters. The external surface coating of chlorhexidine is combined with silver-sulfadiazine, and the internal surface is coated with chlorhexidine alone. Preliminary studies indicate that prolonged anti-infective activity provides improved efficacy in preventing infections.[88] Although rare, anaphylaxis has been reported with the use of these chlorhexidine/silver sulfadiazine catheters in Japan.[89] Whether patients will become colonized or infected with organisms resistant to chlorhexidine/silver sulfadiazine has not been determined.[86]

Chlorhexidine/silver sulfadiazine catheters are more expensive than standard catheters. However, one analysis has suggested that the use of chlorhexidine/silver sulfadiazine catheters should lead to a cost savings of $68 to $391 per catheter[90] in settings in which the risk for CRBSI is high despite adherence to other preventive strategies (eg, maximal barrier precautions and aseptic techniques). Use of these catheters might be cost effective in ICU patients, burn patients, neutropenic patients, and other patient populations in which the rate of infection exceeds 3.3 per 1,000 catheter days.[86]

Minocycline/Rifampin

In a multicenter randomized trial, CVCs impregnated on both the external and internal surfaces with minocycline/rifampin were associated with lower rates of CRBSI when compared with the first-generation chlorhexidine-silver sulfadiazine impregnated catheters.[91] The beneficial effect began after day 6 of catheterization. None of the catheters were evaluated beyond 30 days. No minocycline/rifampin-resistant organisms were reported. However, in vitro data indicate that these impregnated catheters could increase the incidence of minocycline and rifampin resistance among pathogens, especially staphylococci. The half-life of antimicrobial activity against *S epidermidis* is 25 days with catheters coated with minocycline/rifampin, compared with 3 days for the first-generation catheters coated with chlorhexidine/silver sulfadiazine in vitro.[87] In vivo, the duration of antimicrobial activity of the minocycline/rifampin catheter is longer than that of the first-generation chlorhexidine/silver sulfadiazine catheter.[91] No comparative studies have been published using the second-generation chlorhexidine/silver sulfadiazine catheter. Studies are needed to evaluated whether the improved performance of the minocycline/rifampin catheters results from the antimicrobial agents used or from the coating of both the internal and external surfaces. As with chlorhexidine/silver sulfadiazine catheters, some clinicians have recommended that the minocycline/rifampin catheters be considered in patient populations when the rate of CRBSI exceeds 3.3 per 1,000 catheter days.[86] Others suggest that reducing all rates of CRBSI should be the goal.[92] The decision to use chlorhexidine/silver sulfadiazine or minocycline/rifampin impregnated catheters should be based on the need to enhance prevention of CRBSI after standard procedures have been implemented (eg, educating personnel, using maximal sterile barrier precautions, and using 2% chlorhexidine skin antisepsis) and then balanced against the concern for emergence of resistant pathogens and the cost of implementing this strategy.

Platinum/Silver

Ionic metals have broad antimicrobial activity and are being used in catheters and cuffs to prevent CRBSI. A combination platinum/silver impregnated catheter is available in Europe and has recently been approved by FDA for use in the United States. Although these catheters are being marketed for their antimicrobial properties, no published studies have been presented to support an antimicrobial effect.

Silver Cuffs

Ionic silver has been used in subcutaneous collagen cuffs attached to CVCs.[93] The ionic silver provides antimicrobial activity and the cuff provides a mechanical barrier to the migration of microorganisms along the external surface of the catheter. In studies of catheters left in place ≥20 days, the cuff failed to reduce the incidence of CRBSI.[94,95] Two other studies of short-term catheters could not demonstrate efficacy because of the minimal number of CRBSIs observed.[93,96]

Systemic Antibiotic Prophylaxis

No studies have demonstrated that oral or parenteral antibacterial or antifungal drugs might reduce the incidence of CRBSI among adults.[97–99] However, among low birth weight infants, two studies have assessed vancomycin prophylaxis; both demonstrated a reduction in CRBSI but no reduction in mortality.[100,101] Because the prophylactic use of vancomycin is an independent risk factor for the acquisition of vancomycin-resistant enterococcus (VRE),[102] the risk for acquiring VRE likely outweighs the benefit of using prophylactic vancomycin.

Antibiotic/Antiseptic Ointments

Povidone-iodine ointment applied at the insertion site of hemodialysis catheters has been studied as a prophylactic intervention to reduce the incidence of catheter-related infections. One randomized study of 129 hemodialysis catheters demonstrated a reduction in the incidence of exit-site infections, catheter-tip colonization, and BSIs with the routine use of povidone-iodine ointment at the catheter insertion site compared with no ointment at the insertion site.[103]

Several studies have evaluated the effectiveness of mupirocin ointment applied at the insertion sites of CVCs as a means to prevent CRBSI.[104–106] Although mupirocin reduced the risk for CRBSI,[106] mupirocin ointment also has been associated with mupirocin

resistance,[107,108] and might adversely affect the integrity of polyurethane catheters.[109,110]

Nasal carriers of *S aureus* have a higher risk for acquiring CRBSI than do noncarriers.[103,111] Mupirocin ointment has been used intranasally to decrease nasal carriage of *S aureus* and lessen the risk for CRBSI. However, resistance to mupirocin develops in both *S aureus* and coagulase-negative staphylococci soon after routine use of mupirocin is instituted.[107,108]

Other antibiotic ointments applied to the catheter insertion site also have been studied and have yielded conflicting results.[112–114] In addition, rates of catheter colonization with *Candida* spp might be increased with the use of antibiotic ointments that have no fungicidal activity.[112,114] To avoid compromising the integrity of the catheter, any ointment that is applied to the catheter insertion site should be checked against the catheter and ointment manufacturers' recommendations regarding compatibility.

Antibiotic Lock Prophylaxis

To prevent CRBSI, antibiotic lock prophylaxis has been attempted by flushing and filling the lumen of the catheter with an antibiotic solution and leaving the solution to dwell in the lumen of the catheter. Three studies have demonstrated the usefulness of such prophylaxis in neutropenic patients with long-term catheters.[115–117] In two of the studies, patients received either heparin alone (10 U/ml) or heparin plus 25 micrograms/ml of vancomycin. The third study compared vancomycin/ciprofloxacin/heparin (VCH) to vancomycin/heparin (VH) and then to heparin alone. The rate of CRBSI with vancomycin-susceptible organisms was significantly lower (VCH, $p = 0.022$; VH, $p = 0.028$) and the time to the first episode of bacteremia with vancomycin-susceptible organisms was substantially longer (VCH, $p = 0.036$; VH, $p = 0.011$) in patients receiving either vancomycin/ciprofloxacin/heparin or vancomycin/heparin compared with heparin alone.[115–117] One study involving a limited number of children revealed no difference in rates of CRBSI between children receiving a heparin flush compared with those receiving heparin and vancomycin.[118] However, because the use of vancomycin is an independent risk factor for the acquisition of VRE,[102] this practice is not recommended routinely.

An anticoagulant/antimicrobial combination comprising minocycline and ethylenediaminetetraacetic acid (EDTA) has been proposed as a lock solution because it has antibiofilm and antimicrobial activity against gram-positive, gram-negative, and *Candida* organisms,[119] as well as anticoagulant properties. However, no controlled or randomized trials have demonstrated its efficacy.

Anticoagulants

Anticoagulant flush solutions are used widely to prevent catheter thrombosis. Because thrombi and fibrin deposits on catheters might serve as a nidus for microbial colonization of intravascular catheters,[120,121] the use of anticoagulants might have a role in the prevention of CRBSI.

In a meta-analysis evaluating the benefit of heparin prophylaxis (3 U/ml in TPN, 5,000 U every 6 or 12 hours flush, or 2,500 U low molecular weight heparin subcutaneously) in patients with short-term CVCs, the risk for catheter-related central venous thrombosis was reduced with the use of prophylactic heparin.[122] However, no substantial difference in the rate for CRBSI was observed. Because the majority of heparin solutions contain preservatives with antimicrobial activity, whether any decrease in the rate of CRBSI is a result of the reduced thrombus formation, the preservative, or both is unclear.

The majority of pulmonary artery, umbilical, and central venous catheters are available with a heparin-bonded coating. The majority are heparin-bonded with benzalkonium chloride, which provides the catheters with antimicrobial activity[123] and provides an anti-thrombotic effect.[124]

Warfarin also has been evaluated as a means for reducing CRBSI by reducing thrombus formation on catheters.[125,126] In patients with long-term CVCs, low-dose warfarin (ie, 1 mg/day) reduced the incidence of catheter thrombus. No data demonstrate that warfarin reduces the incidence of CRBSI.

Replacement of Catheters

Peripheral Venous Catheters

Scheduled replacement of intravascular catheters has been proposed as a method to prevent phlebitis and catheter-related infections. Studies of short peripheral venous catheters indicate that the incidence of thrombophlebitis and bacterial colonization of catheters increases when catheters are left in place >72 hours.[66,67,127] However, rates of phlebitis are not substantially different in peripheral catheters left in place 72 hours compared with 96 hours.[128] Because phlebitis and catheter colonization have been associated with an increased risk for catheter-related infection, short peripheral catheter sites commonly are rotated at 72–96-hour intervals to reduce both the risk for infection and patient discomfort associated with phlebitis.

Midline Catheters

Midline catheters have been associated with lower rates of phlebitis than short peripheral catheters and with lower rates of infection than CVCs.[129–131] In one prospective study of 140 midline catheters, their use was associated with a BSI rate of 0.8 per 1,000 catheter-days.[131] No specific risk factors, including duration of catheterization, were associated with infection. Midline catheters were in place a median of 7 days, but for as long as 49 days. Although the findings of this study suggested that midline catheters can be changed only when there is a specific indication, no prospective, randomized studies have assessed the benefit of routine replacement as a strategy to prevent CRBSI associated with midline catheters.

CVCs, Including PICCs and Hemodialysis Catheters

Catheter replacement at scheduled time intervals as a method to reduce CRBSI has not lowered rates.

Two trials have assessed a strategy of changing the catheter every 7 days compared with a strategy of changing catheters as needed.[132,133] One of these studies involved 112 surgical ICU patients needing CVCs, pulmonary artery catheters, or peripheral arterial catheters,[132] whereas the other study involved only subclavian hemodialysis catheters.[133] In both studies, no difference in CRBSI was observed in patients undergoing scheduled catheter replacement every 7 days compared with patients whose catheters were replaced as needed.

Scheduled guidewire exchanges of CVCs is another proposed strategy for preventing CRBSI. The results of a meta-analysis of 12 randomized controlled trials assessing CVC management failed to prove any reduction of CRBSI rates through routine replacement of CVCs by guidewire exchange compared with catheter replacement on an as-needed basis.[134] Thus, routine replacement of CVCs is not necessary for catheters that are functioning and have no evidence of causing local or systemic complications.

Catheter replacement over a guidewire has become an accepted technique for replacing a malfunctioning catheter or exchanging a pulmonary artery catheter for a CVC when invasive monitoring no longer is needed. Catheter insertion over a guidewire is associated with less discomfort and a significantly lower rate of mechanical complications than are those percutaneously inserted at a new site[135]; in addition, this technique provides a means of preserving limited venous access in some patients. Replacement of temporary catheters over a guidewire in the presence of bacteremia is not an acceptable replacement strategy, because the source of infection is usually colonization of the skin tract from the insertion site to the vein.[22,135] However, in selected patients with tunneled hemodialysis catheters and bacteremia, catheter exchange over a guidewire, in combination with antibiotic therapy, might be an alternative as a salvage strategy in patients with limited venous access.[136–139]

Hemodialysis Catheters

The use of catheters for hemodialysis is the most common factor contributing to bacteremia in dialysis patients.[140,141] The RR for bacteremia in patients with dialysis catheters is sevenfold the risk for patients with primary arteriovenous fistulas.[142] Despite the National Kidney Foundation's effort to reduce the number of hemodialysis patients maintained with catheter access, catheter use increased from 12.7% in 1995 to 22.2% in 1999.[143] Rates for bacteremia per 100 patient months were 0.2 for arteriovenous fistulas, 0.5 for grafts, 5.0 for cuffed catheters, and 8.5 for noncuffed catheters (CDC, unpublished data, 1999).

To reduce the rate of infection, hemodialysis catheters should be avoided in favor of arteriovenous fistulas and grafts. If temporary access is needed for dialysis, a cuffed catheter is preferable to a noncuffed catheter, even in the ICU setting, if the catheter is expected to stay in place for >3 weeks.[11,144]

Pulmonary Artery Catheters

Pulmonary artery catheters are inserted through a Teflon introducer and typically remain in place an average of 3 days. The majority of pulmonary artery catheters are heparin bonded, which reduces not only catheter thrombosis but also microbial adherence to the catheter.[145] Meta-analysis indicates that standard nonheparin-bonded pulmonary artery catheter rates of CRBSI are 5.5 per 1,000 catheter days; for heparin-bonded pulmonary artery catheters, this rate is 2.6 per 1,000 catheter days.[11] Because the majority of pulmonary artery catheters are heparin-bonded, the RR of infection with these catheters is similar to that of CVC (2.6 versus 2.3 per 1,000 catheter days).[11]

A prospective study of 442 pulmonary artery catheters demonstrated an increased risk for CRBSI after 5 days (0/442 CRBSI before 5 days versus 5/442 CSBSI after 5 days; $P < 0.001$).[146] A prospective observational study of 71 pulmonary artery catheters demonstrated higher infection rates in catheters left in place longer than 7 days (2% before 7 days versus 16% after 7 days; $P = 0.056$).[147] However, no studies indicate that catheter replacement at scheduled time intervals is an effective method to reduce CRBSI.[132,135] In patients who continue to require hemodynamic monitoring, pulmonary artery catheters do not need to be changed more frequently than every 7 days. No specific recommendation can be made regarding routine replacement of catheters that need to be in place for >7 days.

Pulmonary artery catheters are usually packaged with a thin plastic sleeve that prevents touch contamination when placed over the catheter. In a study of 166 catheters, patients who were randomly assigned to have their catheters self-contained within this sleeve had a reduced risk for CRBSI compared with those who had a pulmonary artery catheter placed without the sleeve ($P = 0.002$).[148]

Peripheral Arterial Catheters

Peripheral arterial catheters are usually inserted into the radial or femoral artery and permit continuous blood pressure monitoring and blood gas measurements. The rate of CRBSI is comparable to that of temporary CVCs (2.9 versus 2.3 per 1,000 catheter days).[11] One study of peripheral arterial catheters demonstrated no difference in infection rates between changing catheters at scheduled times and changing arterial catheters on an as-needed basis.[132] One observational study of 71 arterial catheters revealed that 10 local infections and four CRBSIs occurred in patients who had peripheral arterial catheters in place for >4 days compared with one local infection and no CRBSIs in patients whose catheters were in place <4 days ($P < 0.05$).[147] Because the risk for CRBSI is likely similar to that of short-term CVCs, arterial catheters can be approached in a similar way. No specific recommendation can be made regarding replacement of catheters that need to be in place for >5 days.

APPENDIX B. Summary of Recommended Frequency of Replacements for Catheters, Dressings, Administration Sets, and Fluids

Catheter	Replacement and Relocation of Device	Replacement of Catheter Site Dressing	Replacement of Administration Sets	Hang Time for Parenteral Fluids
Peripheral venous catheters	In adults, replace catheter and rotate site no more frequently than every 72–96 h. Replace catheters inserted under emergency basis and insert a new catheter at a different site within 48 h. In pediatric patients, do not replace peripheral catheters unless clinically indicated.	Replace dressing when the catheter is removed or replaced or when the dressing becomes damp, loosened, or soiled. Replace dressings more frequently in diaphoretic patients. In patients who have large bulky dressings that prevent palpation or direct visualization of the catheter insertion site, remove the dressing and visually inspect the catheter at least daily and apply a new dressing.	Replace IV tubing, including add-on devices, no more frequently than at 72-h intervals unless clinically indicated. Replace tubing used to administer blood, blood products, or lipid emulsions within 24 h of initiating the infusion. No recommendation for replacement of tubing used for intermittent infusions. Consider short extension tubing connected to the catheter to be a portion of the device. Replace such extension tubing when the catheter is changed.	No recommendation for the hang time of IV fluids, including non–lipid-containing parenteral nutrition fluids. Complete infusion of lipid-containing parenteral nutrition fluids (eg, 3-in-1 solutions) within 24 h of hanging the fluid. Complete infusion of lipid emulsions alone within 12 h of hanging the fluid. Complete infusions of blood products within 4 h of hanging the product.
Midline catheters	No recommendation for the frequency of the catheter replacement	As above.	As above.	As above.
Peripheral arterial catheters	In adults, do not replace catheters routinely to prevent catheter-related infection. In pediatric patients, no recommendation for the frequency of catheter replacement. Replace disposable or reusable transducers at 96-hour intervals. Replace continuous flush device at the time the transducer is replaced.	Replace dressing when the catheter is replaced; when the dressing becomes damp, loosened, or soiled; or when inspection of the site is necessary.	Replace the IV tubing at the time the transducer is replaced (ie, 96-h intervals).	Replace the flush solution at the time the transducer is replaced (ie, 96-h intervals).
CVCs including peripherally inserted central catheters and hemodialysis catheters*	Do not routinely replace catheters.	Replace gauze dressings every 2 d and transparent dressings every 7 d on short-term catheters. Replace the dressing when the catheter is replaced; when the dressing becomes damp, loosened, or soiled; or when inspection of the site is necessary.	Replace IV tubing and add-on devices no more frequently than at 72-h intervals. Replace tubing used to administer blood products or lipid emulsions within 24 h of initiating the infusion.	No recommendation for the hang time of IV fluids, including non–lipid-containing parenteral nutrition fluids. Complete infusions of lipid-containing fluids within 24 h of hanging the fluid.
Pulmonary artery catheters	Do not replace catheter to prevent catheter-related infection.	As above.	As above.	As above.
Umbilical catheters	Do not routinely replace catheters.	Not applicable.	Replace IV tubing and add-on devices no more frequently than at 72-h intervals. Replace tubing used to administer blood products or lipid emulsions within 24 h of initiating the infusion.	No recommendations for the hang time of IV fluids, including non–lipid-containing parenteral nutrition fluids. Complete infusion of lipid-containing fluids within 24 h of hanging the fluid.

* Includes nontunneled catheters, tunneled catheters, and totally implanted devices.

Replacement of Administration Sets

The optimal interval for routine replacement of IV administration sets has been examined in three well-controlled studies. Data from each of these studies reveal that replacing administration sets no more frequently than 72 hours after initiation of use is safe and cost-effective.[149–151] Data from a more recent study demonstrated that rates of phlebitis were not substantially different if administration sets were left in place 96 hours compared with 72 hours.[128] When a fluid that enhances microbial growth is infused (eg, lipid emulsions and blood products), more frequent changes of administration sets are indicated, because these products have been identified as independent risk factors for CRBSI.[152–158]

Stopcocks (used for injection of medications, administration of IV infusions, and collection of blood samples) represent a potential portal of entry for microorganisms into vascular access catheters and IV fluids. Stopcock contamination is common, occurring in 45% and 50% in the majority of series. Whether such contamination is a substantial entry point of CRBSI has been difficult to prove.

"Piggyback" systems are used as an alternative to stopcocks. However, they also pose a risk for contamination of the intravascular fluid if the device entering the rubber membrane of an injection port is exposed to air or comes into direct contact with nonsterile tape used to fix the needle to the port. Modified piggyback systems have the potential to prevent contamination at these sites.[159]

Needleless Intravascular Catheter Systems

Attempts to reduce the incidence of sharp injuries and the resultant risk for transmission of bloodborne infections to health-care workers have led to the design and introduction of needleless infusion systems. When the devices are used according to manufacturers' recommendations, they do not substantially affect the incidence of CRBSI.[160–167]

Multidose Parenteral Medication Vials

Parenteral medications commonly are dispensed in multidose, parenteral medication vials that might be used for prolonged periods for one or more patients. Although the overall risk for extrinsic contamination of multidose vials is likely minimal,[168] the consequences of contamination might result in life-threatening infection.[169,170] Single-use vials are frequently preservative-free and might pose a risk for contamination if they are punctured several times.

SPECIAL CONSIDERATIONS FOR INTRAVASCULAR CATHETER-RELATED INFECTIONS IN PEDIATRIC PATIENTS

Prevention of CRBSI in children requires additional considerations, although only certain studies have been performed specifically in children. Pediatric data have been derived largely from studies in neonatal or pediatric ICUs and pediatric oncology patients.

Epidemiology

As in adults, the majority of BSIs in children are associated with the use of an intravascular catheter. From 1995 through 2000, the pooled mean catheter-associated BSI rate for all pediatric ICUs reporting data to NNIS was 7.7 per 1,000 catheter days.[171,172] Umbilical catheter and CVC-associated BSI rates for neonatal ICUs ranged from 11.3 per 1,000 catheter days in children with birth weight <1,000 g to 4.0 per 1,000 catheter days in children whose birth weight was >2,500 g.[171] Catheter utilization rates were comparable in adult and pediatric ICUs.[172,173]

Microbiology

As in adults, the majority of CRBSIs in children are caused by coagulase-negative staphylococci. During 1992–1999, these bacteria accounted for 37.7% of BSIs in pediatric ICUs reporting to NNIS.[12] Exposure to lipids has been identified as an independent risk factor for development of coagulase-negative staphylococcal bacteremia in very low birth weight infants (ie, those weighing <1,000 g) (odds ratio [OR] = 9.4; 95% CI = 1.2–74.2),[155] as well as candidemia in the neonatal ICU (OR = 5.33; 95% CI = 1.23–48.4).[154] Gram-negative bacteria accounted for 25% of BSIs reported in pediatric ICUs,[172] whereas enterococci and *Candida* spp accounted for 10% and 9%, respectively.[172]

Peripheral Venous Catheters

As in adults, the use of peripheral venous catheters in pediatric patients might be complicated by phlebitis, infusion extravasation, and catheter infection.[174] Catheter location, infusion of parenteral nutritional fluids with continuous IV lipid emulsions, and length of ICU stay before catheter insertion have all increased pediatric patients' risk for phlebitis. However, contrary to the risk in adults, the risk for phlebitis in children has not increased with the duration of catheterization.[174,175]

Peripheral Arterial Catheters

In a prospective study of 340 peripheral arterial catheters in children, the following two risk factors for catheter-related infection were identified: 1) use of an arterial system that permitted backflow of blood into the pressure tubing and 2) duration of catheterization.[176] Although a correlation was found between duration of arterial catheterization and risk for catheter colonization, the risk remained constant for 2–20 days at 6.2%.[176]

Umbilical Catheters

Although the umbilical stump becomes heavily colonized soon after birth, umbilical-vessel catheterization often is used for vascular access in newborn infants. Umbilical vessels can be cannulated easily and permit both collection of blood samples and measurement of hemodynamic status. The incidences of catheter colonization and BSI are similar for umbilical vein catheters and umbilical artery catheters. In several studies, an estimated 40%–55% of umbilical artery catheters were colonized and 5%

resulted in CRBSI; umbilical vein catheters were associated with colonization in 22%–59% of cases[177–179] and with CRBSI in 3%–8% of cases.[178] Although CRBSI rates are similar for umbilical catheters in the high position (ie, above the diaphragm) compared with the low position (ie, below the diaphragm and above the aortic bifurcation), catheters placed in the high position result in a lower incidence of vascular complications without an increase in adverse sequelae.[178]

Risk factors for infection differ for umbilical artery and umbilical vein catheters. In one study, neonates with very low birth weight who also received antibiotics for >10 days were at increased risk for umbilical artery CRBSIs.[178] In comparison, those with higher birth weight and receipt of parenteral nutrition fluids were at increased risk for umbilical vein CRBSI. Duration of catheterization was not an independent risk factor for infection of either type of umbilical catheter.

CVCs

Because of the limited vascular sites in children, attention should be given to the frequency with which catheters are replaced in these patients. In a study in which survival analysis techniques were used to examine the relation between the duration of central venous catheterization and complications in pediatric ICU patients, all of the patients studied (n = 397) remained uninfected for a median of 23.7 days.[180] In addition, no relation was found between duration of catheterization and the daily probability of infection ($r = 0.21$; $P > 0.1$), suggesting that routine replacement of CVCs likely does not reduce the incidence of catheter-related infection.[180]

Catheter Site Care

Although data regarding the use of the chlorhexidine-impregnated sponge (Biopatch in children are limited, one randomized, controlled study involving 705 neonates reported a substantial decrease in colonized catheter tips in infants in the Biopatch group compared with the group that had standard dressings (15% versus 24%; RR = 0.6; 95% CI = 0.5–0.9), but no difference in the rates of CRBSI or BSI without a source. Biopatch was associated with localized contact dermatitis in infants of very low birth weight. Of 98 neonates with very low birth weight, 15 (15%) developed localized contact dermatitis; four (1.5%) of 237 neonates weighing >1,000 g developed this reaction ($P < 0.0001$). Infants with gestational age <26 weeks who had CVCs placed at age <8 days were at increased risk for having localized contact dermatitis, whereas no infants in the control group developed this local reaction.[181]

Performance Indicators

Performance indicators for reducing CRBSI are 1) implementation of educational programs that include didactic and interactive components for those who insert and maintain catheters; 2) use of maximal sterile barrier precautions during catheter placement; 3) use of chlorhexidine for skin antisepsis; and 4) rates of catheter discontinuation when the catheter is no longer essential for medical management. The impact these recommendations will have on individual institutions should be evaluated using specific performance indicators.

RECOMMENDATIONS FOR PLACEMENT OF INTRAVASCULAR CATHETERS IN ADULTS AND CHILDREN

These recommendations are designed to reduce the infectious complications associated with intravascular catheter use. Recommendations should be considered in the context of the institution's experience with catheter-related infections, experience with other adverse catheter-related complications (eg, thrombosis, hemorrhage, and pneumothorax), and availability of personnel skilled in the placement of intravascular devices. Recommendations are provided for 1) intravascular-catheter use in general; 2) specific devices; and 3) special circumstances (ie, intravascular-device use in pediatric patients and CVC use for parenteral nutrition and hemodialysis access). Recommendations regarding the frequency of replacing catheters, dressings, administration sets, and fluids also are provided (Appendix B).

As in previous guidelines issued by CDC and HICPAC, each recommendation is categorized on the basis of existing scientific data, theoretical rationale, applicability, and economic impact. The CDC/HICPAC system for categorizing recommendations is as follows:

Category IA. Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

Category IB. Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies, and a strong theoretical rationale.

Category IC. Required by state or federal regulations, rules, or standards.

Category II. Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

Unresolved issue. Represents an unresolved issue for which evidence is insufficient or no consensus regarding efficacy exists.

I. Health-care worker education and training
   A. Educate health-care workers regarding the indications for intravascular catheter use, proper procedures for the insertion and maintenance of intravascular catheters, and appropriate infection-control measures to prevent intravascular catheter-related infections.[39,43,45–47,182–187] **Category IA**
   B. Assess knowledge of and adherence to guidelines periodically for all persons who insert and manage intravascular catheters.[39,43,46,182,188] **Category IA**
   C. Ensure appropriate nursing staff levels in ICUs to minimize the incidence of CRBSIs.[48,189,190] **Category IB**

II. Surveillance
   A. Monitor the catheter sites visually or by palpation through the intact dressing on a reg-

ular basis, depending on the clinical situation of individual patients. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or BSI, the dressing should be removed to allow thorough examination of the site[1,191–193] **Category IB**

B. Encourage patients to report to their healthcare provider any changes in their catheter site or any new discomfort. **Category II**

C. Record the operator, date, and time of catheter insertion and removal, and dressing changes on a standardized form. **Category II**

D. Do not routinely culture catheter tips.[8,194,195] **Category IA**

III. Hand hygiene

A. Observe proper hand-hygiene procedures either by washing hands with conventional antiseptic-containing soap and water or with waterless alcohol-based gels or foams. Observe hand hygiene before and after palpating catheter insertion sites, as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter. Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained[43,70,196–200] **Category IA**

B. Use of gloves does not obviate the need for hand hygiene.[43,198,199] **Category IA**

IV. Aseptic technique during catheter insertion and care

A. Maintain aseptic technique for the insertion and care of intravascular catheters.[22,71,201,202] **Category IA**

B. Wear clean or sterile gloves when inserting an intravascular catheter as required by the Occupational Safety and Health Administration Bloodborne Pathogens Standard. **Category IC.** Wearing clean gloves rather than sterile gloves is acceptable for the insertion of peripheral intravascular catheters if the access site is not touched after the application of skin antiseptics. Sterile gloves should be worn for the insertion of arterial and central catheters.[201,203] **Category IA**

C. Wear clean or sterile gloves when changing the dressing on intravascular catheters. **Category IC**

V. Catheter insertion

Do not routinely use arterial or venous cutdown procedures as a method to insert catheters.[204–206] **Category IA**

VI. Catheter site care

A. Cutaneous antisepsis

1. Disinfect clean skin with an appropriate antiseptic before catheter insertion and during dressing changes. Although a 2% chlorhexidine-based preparation is preferred, tincture of iodine, an iodophor, or 70% alcohol can be used.[73,75,207,208] **Category IA**
2. No recommendation can be made for the use of chlorhexidine in infants aged <2 months. **Unresolved issue**
3. Allow the antiseptic to remain on the insertion site and to air dry before catheter insertion. Allow povidone iodine to remain on the skin for at least 2 minutes, or longer if it is not yet dry before insertion.[73,75,207,208] **Category IB**
4. Do not apply organic solvents (eg, acetone and ether) to the skin before insertion of catheters or during dressing changes.[209] **Category IA**

VII. Catheter-site dressing regimens

A. Use either sterile gauze or sterile, transparent, semipermeable dressing to cover the catheter site.[146,210–212] **Category IA**

B. Tunneled CVC sites that are well healed might not require dressings. **Category II**

C. If the patient is diaphoretic, or if the site is bleeding or oozing, a gauze dressing is preferable to a transparent, semi-permeable dressing.[146,210–212] **Category II**

D. Replace catheter-site dressing if the dressing becomes damp, loosened, or visibly soiled.[146,210] **Category IB**

E. Change dressings at least weekly for adult and adolescent patients depending on the circumstances of the individual patient.[211] **Category II**

F. Do not use topical antibiotic ointment or creams on insertion sites (except when using dialysis catheters) because of their potential to promote fungal infections and antimicrobial resistance.[107,213] **Category IA** (See Central Venous Catheters, Including PICCs, Hemodialysis, and Pulmonary Artery Catheters, in Adult and Pediatric Patients, Section II.I.)

G. Do not submerge the catheter under water. Showering should be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the catheter (eg, if the catheter and connecting device are protected with an impermeable cover during the shower.[214,215] **Category II**

VIII. Selection and replacement of intravascular catheters

A. Select the catheter, insertion technique, and insertion site with the lowest risk for complications (infectious and noninfectious) for the anticipated type and duration of IV therapy.[22,55,59,216–218] **Category IA**

B. Promptly remove any intravascular catheter that is no longer essential.[219,220] **Category IA**

C. Do not routinely replace central venous or arterial catheters solely for the purposes of reducing the incidence of infection.[134,135,221] **Category IB**

D. Replace peripheral venous catheters at least every 72–96 hours in adults to prevent phlebitis.[128] Leave peripheral venous catheters in place in children until IV therapy is com-

pleted, unless complications (eg, phlebitis and infiltration) occur.[174,175,222,223] **Category IB**

E. When adherence to aseptic technique cannot be ensured (ie, when catheters are inserted during a medical emergency), replace all catheters as soon as possible and after no longer than 48 hours.[22,71,201,202] **Category II**

F. Use clinical judgment to determine when to replace a catheter that could be a source of infection (eg, do not routinely replace catheters in patients whose only indication of infection is fever). Do not routinely replace venous catheters in patients who are bacteremic or fungemic if the source of infection is unlikely to be the catheter.[224] **Category II**

G. Replace any short-term CVC if purulence is observed at the insertion site, which indicates infection.[224,225] **Category IB**

H. Replace all CVCs if the patient is hemodynamically unstable and CRBSI is suspected.[224,225] **Category II**

I. Do not use guidewire techniques to replace catheters in patients suspected of having catheter-related infection.[134,135] **Category IB**

IX. Replacement of administration sets[a], needleless systems, and parenteral fluids

A. Administration sets

1. Replace administration sets, including secondary sets and add-on devices, no more frequently than at 72-hour intervals, unless catheter-related infection is suspected or documented.[23,149–151] **Category IA**
2. Replace tubing used to administer blood, blood products, or lipid emulsions (those combined with amino acids and glucose in a 3-in-1 admixture or infused separately) within 24 hours of initiating the infusion.[158,226–229] **Category IB**. If the solution contains only dextrose and amino acids, the administration set does not need to be replaced more frequently than every 72 hours.[226] **Category II**
3. Replace tubing used to administer propofol infusions every 6 or 12 hours, depending on its use, per the manufacturer's recommendation.[230] **Category IA**

B. Needleless intravascular devices

1. Change the needleless components at least as frequently as the administration set.[160–162,164–167] **Category II**
2. Change caps no more frequently than every 72 hours or according to manufacturers' recommendations.[160,162,165,166] **Category II**
3. Ensure that all components of the system are compatible to minimize leaks and breaks in the system.[163] **Category II**
4. Minimize contamination risk by wiping the access port with an appropriate antiseptic and accessing the port only with sterile devices.[162,163,165] **Category IB**

C. Parenteral fluids

1. Complete the infusion of lipid-containing solutions (eg, 3-in-1 solutions) within 24 hours of hanging the solution.[156–158,226,229] **Category IB**
2. Complete the infusion of lipid emulsions alone within 12 hours of hanging the emulsion. If volume considerations require more time, the infusion should be completed within 24 hours.[156–158] **Category IB**
3. Complete infusions of blood or other blood products within 4 hours of hanging the blood.[231–234] **Category II**
4. No recommendation can be made for the hang time of other parenteral fluids. **Unresolved issue**

X. IV-injection ports

A. Clean injection ports with 70% alcohol or an iodophor before accessing the system[164,235,236] **Category IA**

B. Cap all stopcocks when not in use.[235] **Category IB**

XI. Preparation and quality control of IV admixtures

A. Admix all routine parenteral fluids in the pharmacy in a laminar-flow hood using aseptic technique.[237,238] **Category IB**

B. Do not use any container of parenteral fluid that has visible turbidity, leaks, cracks, or particulate matter or if the manufacturer's expiration date has passed.[237] **Category IB**

C. Use single-dose vials for parenteral additives or medications when possible.[237,239] **Category II**

D. Do not combine the leftover content of single-use vials for later use.[237,239] **Category IA**

E. If multidose vials are used

1. Refrigerate multidose vials after they are opened if recommended by the manufacturer. **Category II**
2. Cleanse the access diaphragm of multidose vials with 70% alcohol before inserting a device into the vial.[236] **Category IA**
3. Use a sterile device to access a multidose vial and avoid touch contamination of the device before penetrating the access diaphragm.[235,240] **Category IA**
4. Discard multidose vial if sterility is compromised.[235,240] **Category IA**

XII. In-line filters

Do not use filters routinely for infection-control purposes.[80,241] **Category IA**

XIII. IV-therapy personnel

Designate trained personnel for the insertion

[a]Administration sets include the area from the spike of tubing entering the fluid container to the hub of the vascular access device. However, a short extension tube might be connected to the catheter and might be considered a portion of the catheter to facilitate aseptic technique when changing administration sets.

and maintenance of intravascular catheters.[46,47,210,242] **Category IA**

XIV. Prophylactic antimicrobials
Do not administer intranasal or systemic antimicrobial prophylaxis routinely before insertion or during use of an intravascular catheter to prevent catheter colonization or BSI.[97,98,108,243] **Category IA**

PERIPHERAL VENOUS CATHETERS, INCLUDING MIDLINE CATHETERS, IN ADULT AND PEDIATRIC PATIENTS

I. Selection of peripheral catheter
   A. Select catheters on the basis of the intended purpose and duration of use, known complications (eg, phlebitis and infiltration), and experience of individual catheter operators.[67,68,244] **Category IB**
   B. Avoid the use of steel needles for the administration of fluids and medication that might cause tissue necrosis if extravasation occurs.[67,68] **Category IA**
   C. Use a midline catheter or PICC when the duration of IV therapy will likely exceed 6 days.[244] **Category IB**

II. Selection of peripheral-catheter insertion site
   A. In adults, use an upper- instead of a lower-extremity site for catheter insertion. Replace a catheter inserted in a lower-extremity site to an upper-extremity site as soon as possible.[67,245] **Category IA**
   B. In pediatric patients, the hand, the dorsum of the foot, or the scalp can be used as the catheter insertion site. **Category II**
   C. Replacement of catheter
      1. Evaluate the catheter insertion site daily, by palpation through the dressing to discern tenderness and by inspection if a transparent dressing is in use. Gauze and opaque dressings should not be removed if the patient has no clinical signs of infection. If the patient has local tenderness or other signs of possible CRBSI, an opaque dressing should be removed and the site inspected visually. **Category II**
      2. Remove peripheral venous catheters if the patient develops signs of phlebitis (eg, warmth, tenderness, erythema, and palpable venous cord), infection, or a malfunctioning catheter.[66] **Category IB**
      3. In adults, replace short, peripheral venous catheters at least 72–96 hours to reduce the risk for phlebitis. If sites for venous access are limited and no evidence of phlebitis or infection is present, peripheral venous catheters can be left in place for longer periods, although the patient and the insertion sites should be closely monitored.[66,128,247] **Category IB**
      4. Do not routinely replace midline catheters to reduce the risk for infection.[131] **Category IB**
      5. In pediatric patients, leave peripheral venous catheters in place until IV therapy is completed, unless a complication (eg, phlebitis and infiltration) occurs.[174,175,222,223] **Category IB**

III. Catheter and catheter-site care
Do not routinely apply prophylactic topical antimicrobial or antiseptic ointment or cream to the insertion site of peripheral venous catheters.[107,213] **Category IA**

CVCs, INCLUDING PICCs, HEMODIALYSIS, AND PULMONARY ARTERY CATHETERS, IN ADULT AND PEDIATRIC PATIENTS

I. Surveillance
   A. Conduct surveillance in ICUs and other patient populations to determine CRBSI rates, monitor trends in those rates, and assist in identifying lapses in infection-control practices.[3,12,16,247–250] **Category IA**
   B. Express ICU data as the number of catheter-associated BSIs per 1,000 catheter-days for both adults and children and stratify by birth weight categories for neonatal ICUs to facilitate comparisons with national data in comparable patient populations and healthcare settings.[3,12,16,247–250] **Category IB**
   C. Investigate events leading to unexpected life-threatening or fatal outcomes. This includes any process variation for which a recurrence would likely present an adverse outcome.[13] **Category IC**

II. General principles
   A. Use a CVC with the minimum number of ports or lumens essential for the management of the patient.[251–254] **Category IB**
   B. Use an antimicrobial or antiseptic-impregnated CVC in adults whose catheter is expected to remain in place >5 days if, after implementing a comprehensive strategy to reduce rates of CRBSI, the CRBSI rate remains above the goal set by the individual institution based on benchmark rates (Table 2) and local factors. The comprehensive strategy should include the following three components: educating persons who insert and maintain catheters, use of maximal sterile barrier precautions, and a 2% chlorhexidine preparation for skin antisepsis during CVC insertion.[84–86,90,91,255] **Category IB**
   C. No recommendation can be made for the use of impregnated catheters in children. **Unresolved issue**
   D. Designate personnel who have been trained and exhibit competency in the insertion of catheters to supervise trainees who perform catheter insertion.[39,43,46,182,187,188] **Category IA**
   E. Use totally implantable access devices for patients who require long-term, intermittent vascular access. For patients requiring frequent or continuous access, a PICC or

tunneled CVC is preferable.[256,257] **Category II**

F. Use a cuffed CVC for dialysis if the period of temporary access is anticipated to be prolonged (eg, >3 weeks).[144,258] **Category IB**

G. Use a fistula or graft instead of a CVC for permanent access for dialysis.[142] **Category IB**

H. Do not use hemodialysis catheters for blood drawing or applications other than hemodialysis except during dialysis or under emergency circumstances. **Category II**

I. Use povidone-iodine antiseptic ointment at the hemodialysis catheter exit site after catheter insertion and at the end of each dialysis session only if this ointment does not interact with the material of the hemodialysis catheter per manufacturer's recommendation.[103,114,144] **Category II**

III. Selection of catheter insertion site

A. Weigh the risk and benefits of placing a device at a recommended site to reduce infectious complications against the risk for mechanical complications (eg, pneumothorax, subclavian artery puncture, subclavian vein laceration, subclavian vein stenosis, hemothorax, thrombosis, air embolism, and catheter misplacement).[22,55,59,218] **Category IA**

B. Use a subclavian site (rather than a jugular or a femoral site) in adult patients to minimize infection risk for nontunneled CVC placement.[22,55,59,60] **Category IA**

C. No recommendation can be made for a preferred site of insertion to minimize infection risk for a tunneled CVC.[61–63] **Unresolved issue**

D. Place catheters used for hemodialysis and pheresis in a jugular or femoral vein rather than a subclavian vein to avoid venous stenosis if catheter access is needed.[259–263] **Category IA**

IV. Maximal sterile barrier precautions during catheter insertion

A. Use aseptic technique including the use of a cap, mask, sterile gown, sterile gloves, and a large sterile sheet, for the insertion of CVCs (including PICCS) or guidewire exchange.[22,71] **Category IA**

B. Use a sterile sleeve to protect pulmonary artery catheters during insertion.[148] **Category IB**

V. Replacement of catheter

A. Do not routinely replace CVCs, PICCs, hemodialysis catheters, or pulmonary artery catheters to prevent catheter-related infections.[132,134,135] **Category IB**

B. Do not remove CVCs or PICCs on the basis of fever alone. Use clinical judgment regarding the appropriateness of removing the catheter if infection is evidenced elsewhere or if a noninfectious cause of fever is suspected.[224,264] **Category II**

C. Guidewire exchange

1. Do not use guidewire exchanges routinely for nontunneled catheters to prevent infection.[135,265] **Category IB**
2. Use a guidewire exchange to replace a malfunctioning nontunneled catheter if no evidence of infection is present.[135,265] **Category IB**
3. Use a new set of sterile gloves before handling the new catheter when guidewire exchanges are performed.[22,71] **Category II**

VI. Catheter and catheter-site care

A. General measures

Designate one port exclusively for hyperalimentation if a multilumen catheter is used to administer parenteral nutrition.[266] **Category II**

B. Antibiotic lock solutions

Do not routinely use antibiotic lock solutions to prevent CRBSI. Use prophylactic antibiotic lock solution only in special circumstances (eg, in treating a patient with a long-term cuffed or tunneled catheter or port who has a history of multiple CRBSIs despite optimal maximal adherence to aseptic technique).[115,116,267,268] **Category II**

C. Catheter-site dressing regimens

1. Replace the catheter-site dressing when it becomes damp, loosened, or soiled or when inspection of the site is necessary.[65,146,211] **Category IA**
2. Replace dressings used on short-term CVC sites every 2 days for gauze dressings and at least every 7 days for transparent dressings, except in those pediatric patients in which the risk for dislodging the catheter outweighs the benefit of changing the dressing.[211] **Category IB**
3. Replace dressings used on tunneled or implanted CVC sites no more than once per week, until the insertion site has healed.[211] **Category IB**
4. No recommendation can be made regarding the necessity for any dressing on well-healed exit sites of long-term cuffed and tunneled CVCs. **Unresolved issue**

D. No recommendation can be made for the use of chlorhexidine sponge dressings to reduce the incidence of infection. **Unresolved issue**

E. Do not use chlorhexidine sponge dressings in neonates aged <7 days or of gestational age <26 weeks.[181] **Category II**

F. No recommendation can be made for the use of sutureless securement devices. **Unresolved issue**

G. Ensure that catheter-site care is compatible with the catheter material.[109,110] **Category IB**

H. Use a sterile sleeve for all pulmonary artery catheters.[148] **Category IB**

ADDITIONAL RECOMMENDATIONS FOR PERIPHERAL ARTERIAL CATHETERS AND PRESSURE MONITORING DEVICES FOR ADULT AND PEDIATRIC PATIENTS

I. Selection of pressure monitoring system
Use disposable, rather than reusable, transducer assemblies when possible.[269–273] **Category IB**

II. Replacement of catheter and pressure monitoring system
   A. Do not routinely replace peripheral arterial catheters to prevent catheter-related infections.[132,147,221,274] **Category II**
   B. Replace disposable or reusable transducers at 96-hour intervals. Replace other components of the system (including the tubing, continuous-flush device, and flush solution) at the time the transducer is replaced.[22,270] **Category IB**

III. Care of pressure monitoring systems
   A. General measures
      1. Keep all components of the pressure monitoring system (including calibration devices and flush solution) sterile.[269,275–277] **Category IA**
      2. Minimize the number of manipulations of and entries into the pressure monitoring system. Use a closed-flush system (ie, continuous flush), rather than an open system (ie, one that requires a syringe and stopcock), to maintain the patency of the pressure monitoring catheters.[272,278] **Category II**
      3. When the pressure monitoring system is accessed through a diaphragm rather than a stopcock, wipe the diaphragm with an appropriate antiseptic before accessing the system.[272] **Category IA**
      4. Do not administer dextrose-containing solutions or parenteral nutrition fluids through the pressure monitoring circuit.[272,279,280] **Category IA**
   B. Sterilization or disinfection of pressure monitoring systems
      1. Use disposable transducers.[272,279–282] **Category IB**
      2. Sterilize reusable transducers according to the manufacturers' instructions if the use of disposable transducers is not feasible.[272,279–282] **Category IA**

RECOMMENDATIONS FOR UMBILICAL CATHETERS

I. Replacement of catheters
   A. Remove and do not replace umbilical artery catheters if any signs of CRBSI, vascular insufficiency, or thrombosis are present.[283] **Category II**
   B. Remove and do not replace umbilical venous catheters if any signs of CRBSI or thrombosis are present.[283] **Category II**
   C. No recommendation can be made for treating through an umbilical venous catheter suspected of being infected. **Unresolved issue**
   D. Replace umbilical venous catheters only if the catheter malfunctions. **Category II**

II. Catheter-site care
   A. Cleanse the umbilical insertion site with an antiseptic before catheter insertion. Avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (eg, povidone-iodine) can be used.[75,177,178,284,285] **Category IB**
   B. Do not use topical antibiotic ointment or creams on umbilical catheter insertion sites because of the potential to promote fungal infections and antimicrobial resistance.[107,213] **Category IA**
   C. Add low doses of heparin (0.25–1.0 F/ml) to the fluid infused through umbilical arterial catheters.[286–288] **Category IB**
   D. Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place >5 days.[283,289] **Category II**
   E. Umbilical venous catheters should be removed as soon as possible when no longer needed but can be used up to 14 days if managed aseptically.[290,291] **Category II**

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AMERICAN COLLEGE OF RHEUMATOLOGY
POSITION STATEMENT

SUBJECT: Guidelines for Referral of Children and Adolescents to Pediatric Rheumatologists

PRESENTED BY: Pediatric Section of the American College of Rheumatology

BACKGROUND:

This document was developed to provide a general understanding of the reasons for involving a pediatric rheumatologist in patient care and to identify circumstances when referral to a pediatric rheumatologist is appropriate. The ultimate objective in providing medical care for children with rheumatic diseases is to achieve the best possible health outcome in the most cost-effective setting.

Rheumatic diseases are an important cause of disability in childhood. Proper diagnosis and early aggressive intervention can minimize both short and long term morbidity of these conditions. Without proper therapy, acute rheumatic fever, systemic lupus erythematosus, dermatomyo-sitis, progressive systemic sclerosis, and many forms of vasculitis can be fatal. Other conditions such as juvenile rheumatoid arthritis and spondyloarthropathies which do not acutely threaten life, can be associated with lifetime disability. Rheumatic diseases in childhood differ from those in adults. There are important age related impacts of the diseases on the developing immune, neurologic and musculoskeletal systems. These chronic diseases have profound psychosocial effects on patients and their families.

The goals of treatment of childhood rheumatologic diseases are to control disease activity, preserve normal physical, social and emotional growth and development, minimize chronic disability and deformity, and achieve remission of disease. In pediatric rheumatic diseases, findings on physical examination often take precedence over laboratory findings in the establishment of a diagnosis and a treatment plan. Children and adolescents are often difficult to evaluate due to their development and behavioral stages; therefore the importance of a skilled examiner cannot be over emphasized.

Pediatric rheumatologists are physicians who specialize in providing comprehensive care to children with rheumatologic diseases and their families. They are pediatricians who have completed an additional 2-3 years of specialized training in pediatric rheumatology and are usually Board Certified in Pediatric Rheumatology. (In some cases these physicians may have been trained initially as internists rather than pediatricians). Pediatric rheumatologists are specifically trained to be highly skilled in: 1) differential diagnosis in children and adolescents; 2) efficient use of diagnostic interventions in children and adolescents; 3) selecting the most appropriate therapy (including other consultative services) for children and adolescents with rheumatic diseases; 4) monitoring long term therapy for effectiveness and side effects unique to children and adolescents; 5) achieving favorable outcomes in terms of control of rheumatologic diseases and prevention of disability; 6) coordination of care for children and adolescents with multisystem diseases; and 7) dealing with chronically ill children, adolescents and their families.

Most pediatric rheumatologists are located at University centers and work with a multi-disciplinary team that includes one or more pediatric rheumatologists and other health care professionals who specialize in the treatment of rheumatologic diseases, such as registered nursed, physical therapists, occupational therapists and social workers. A pediatric rheumatology center will also have available the services frequently needed by these patients such as nutrition, pediatric orthopedics, pediatric nephrology, pediatric ophthalmology, pediatric cardiology, child psychology/psychiatry, maxillo-facial surgery, pediatric dermatology, and physiatry.

The major strength of the multidisciplinary team is facilitating the achievement of the goals of treatment of childhood rheumatic diseases in the least costly setting In those geographic areas of the country where visits to a pediatric rheumatologist or center can only be accomplished one to two times per year, a local adult rheumatologist may be part of this treatment team as well. Due to the limited availability of pediatric rheumatology services in many areas of the country, adult rheumatologists who have training and experience in pediatric rheumatology should also be utilized as part of the multidisciplinary team to facilitate the achievement of the goals of treatment of childhood rheumatic diseases.

POSITION

Children and adolescents with the following diseases or in the following situations may benefit from referral to a pediatric rheumatologist:

- 1. Patients with unclear diagnoses
    - Prolonged fever
    - Loss of function
        - inability to attend school
        - regression in physical skills
    - Normal laboratory findings but local or generalized pain and/or swelling
    - Abnormal laboratory findings but symptoms and/or examination do not fit clinical criteria for a specific rheumatic disease
    - Complaints not consistent with laboratory findings or physical examination
    - Unexplained physical findings such as rash, fever, arthritis, anemia, weakness, weight loss, fatigue or anorexia
    - Unexplained musculoskeletal pain
    - Undefined autoimmune disease
- 2. Diagnostic evaluation and long-term management of:
    - Juvenile rheumatoid arthritis
    - Mixed connective tissue disease
    - Scleroderma ï systemic and localized
    - Spondyloarthropathies
        - ankylosing spondylitis
        - Reiterôs syndrome
        - psoriatic arthritis
        - arthritis associated with inflammatory bowel
    - Chronic vasculitis
        - Polyarteritis nodosa
        - Wegnerôs granulomatosis
        - Behcetôs syndrome
        - Takayasuôs arteritis
        - hypocomplementemic vasculitis
        - hypersensitivity vasculitis

- Systemic lupus erythematosus
- Anti-phospholipid syndrome
- Cerebral vasculitis
- Sarcoidosis
- Juvenile Dermatomyositis
- Lyme disease with arthritis
- Sjº grenÕs Syndrome
- Chronic recurrent multifocal osteomyelitis
- Neonatal onset multisystem inflammatory disease
- Post-infectious arthritis
- Post-infectious vasculitis
- Relapsing polychondritis

- 3. Confirm diagnosis and help formulate and/or participate in a treatment plan for the following conditions:

    - Henoch-Schonlein Purpura
    - Apophysitis
    - Reactive (post infectious) arthritis
    - Osteochondroses
    - Serum sickness
    - Growing pains
    - Kawasaki disease
    - Iritis
    - Acute rheumatic fever
    - Erythromelalgia
    - Fibromyalgia
    - RaynaudÕs disease
    - Reflex sympathetic dystrophy
    - Cold induced injury
    - Pain syndromes
    - Osteoporosis
    - Over use syndromes; hypermobility
    - Osteoarthritis
    - Complex autoimmune hemolytic anemia
    - Periodic fever syndromes
    - Complex autoimmune thrombocytopenia

4. Diagnostic or treatment plan evaluation for autoimmune disorders associated with other primary diseases such as: immunodeficiency, neoplasm, infectious disease, endocrine disorders, genetic and metabolic diseases, post-transplantation, cystic fibrosis and arthritis associated with birth defects.

5. Provide second opinion or confirmatory evaluation when requested in certain cases where primary care physicians request expert opinion for families requiring subspecialty input to cope with disease process, accept treatment plan, allay anxiety and provide education.

APPROVAL DATE: 11/11/97

AMERICAN ACADEMY OF PEDIATRICS

Surgical Advisory Panel

Guidelines for Referral to Pediatric Surgical Specialists

ABBREVIATION. AAP, American Academy of Pediatrics.

The Surgical Advisory Panel of the American Academy of Pediatrics (AAP), in response to a recommendation from the AAP Subspecialty Work Group and with the collaboration of the Surgical Sections of the AAP, has created referral guidelines intended to serve as voluntary practice parameters to assist general pediatricians in determining when and where to refer their patients to pediatric surgical specialists. It is recognized that the guidelines here may be difficult to achieve. Communities vary. Specialties overlap, and more than 1 type of pediatric or other surgical specialist may be qualified to manage a particular problem. Many complex pediatric problems are optimally managed by a medical-surgical team rather than an individual surgical specialist. This does not negate the value of the guidelines, however, because the child who needs specialized surgical care is best served by the skills of the appropriate pediatric surgical specialist.

Major congenital anomalies, malignancies, major trauma, and chronic illnesses in infants and children should be managed by pediatric medical and surgical specialists at pediatric referral centers. Such centers dedicated to children can provide expertise in many areas, including the pediatric medical and surgical specialties, pediatric radiology, pediatric anesthesiology, pediatric pathology, and pediatric intensive care. The optimal management of the child with complex problems, chronic illness, or disabilities requires coordination, communication, and cooperation of the pediatric surgical specialist with the child's primary care pediatrician or physician.

When a surgical condition has been identified, ideally, a pediatric surgical specialist should be called to address the issues related to this condition with the family and the respective pediatrician. In rural areas where it would be a hardship to the family and the child to travel long distances, the family in conjunction with the primary care pediatrician/physician should weigh the advantages of traveling to a center with a pediatric surgical specialist for surgical care. The primary care pediatrician or physician should consider calling the pediatric surgical specialist to discuss whether a consultation is advised in cases where, geographically, the specialist is not near.

Finally, however, it should be noted that the guidelines are voluntary standards for practice management. Each pediatrician must make an independent judgment in each case on the basis of facts and circumstances presented to him or her.

PEDIATRIC GENERAL SURGERY REFERRAL GUIDELINES

A pediatric surgeon has completed a 5-year residency training in general surgery, plus a 2-year fellowship in pediatric surgery. He or she is certified by the American Board of Surgery in both General Surgery and in Pediatric Surgery. For purposes of developing these guidelines, the following age group definitions are used: infant (0–1 year), child (2–12 years), and adolescent (13–18 years).

- Patients 5 years or younger who may need surgical care should be cared for by a pediatric surgeon.
- Infants and children with perforated appendicitis should be cared for by a pediatric surgeon. If a nonpediatric surgeon makes the diagnosis or suspects the diagnosis of perforated appendicitis in a child, the child should be transferred to the care of a pediatric surgeon.
- Seriously injured infants and children may be stabilized at a local hospital and then should be transferred to a pediatric trauma center.
- Infants, children, and adolescents with solid malignancies should be cared for from the outset by a pediatric surgeon or pediatric surgical specialist and a pediatric medical cancer specialist.
- Minimally invasive procedures (eg, laparoscopy, thoracoscopy) in infants and children should be performed by a pediatric surgeon trained in these techniques.
- Infants and children with medical conditions that increase operative risk (eg, congenital heart disease) who must undergo a common surgical procedure (eg, hernia repair) should be cared for by a pediatric surgeon.

In the interest of good patient care, it is suggested that a general surgeon who cares for pediatric surgical problems not listed in the above categories should have had a minimum 6-month rotation as a junior or senior resident during his or her general surgical residency on a pediatric surgical service run by a pediatric surgeon. Emphasis in the training rotation should be on surgery of children older than 5 years.

A general surgeon performing surgery on children not listed in the above categories should care for a sufficient number of children annually to maintain a high level of competence and should annually attend pediatric surgery postgraduate courses and meetings.

PEDIATRIC OTOLARYNGOLOGY REFERRAL GUIDELINES

A pediatric otolaryngologist has completed a 4- to 5-year residency in otolaryngology/head and neck surgery and is certified by the American Board of Otolaryngologic Surgery. In addition, he or she has completed 1 or 2 years of fellowship training in pediatric otolaryngology. For purposes of developing these guidelines, the following age group definitions are used: infant (0–1 year), child (2–12 years), and adolescent (13–18 years).

The following patients should be referred to a pediatric otolaryngologist:

- Infants, children, and adolescents with congenital malformations of head and neck structures, including the ear, nasal passages, oral cavity, and laryngotracheal airway.
- Infants and children with sensory impairments, including conductive or sensorineural hearing loss, vertiginous disorders, unilateral and bilateral true vocal fold paralysis, facial nerve paralysis, and oromotor dysfunction as evidenced by speech, swallowing, or drooling problems.
- Infants and children with acquired otolaryngologic disorders involving the ear (eg, cholesteatoma), the pharynx (eg, obstructive adenotonsillar hypertrophy), the laryngotracheal airway (eg, postintubation laryngotracheal stenosis), the aerodigestive tract (eg, foreign body aspirations), and the facial skeleton (eg, maxillofacial trauma).
- Infants, children, and adolescents with neoplasms or vascular malformations of the head and neck structures, including the laryngotracheal airway.
- Infants and children with medical conditions that increase operative risk (eg, congenital heart disease) who must undergo a common otolaryngologic procedure (eg, adenotonsillectomy).
- Infants and children requiring operative airway endoscopy for the evaluation of stridor.

The following patients are preferably managed by a pediatric otolaryngologist:

- Infants and children with complicated infections that may require surgery involving the ear (eg, otitis media with effusion and hearing change), the nose and paranasal sinuses (eg, chronic rhinosinusitis), the pharynx (eg, recurrent adenotonsillitis), the airway (eg, epiglottitis), and the neck (eg, retropharyngeal abscess).

ENDOSCOPY REFERRAL GUIDELINES

Specialists in several pediatric surgical and pediatric medical fields are trained to perform endoscopic procedures in infants and children. For purposes of developing these guidelines, the following age group definitions are used: infant (0–1 year) and child (2–12 years).

- Endoscopy of the airways (eg, bronchoscopy, laryngoscopy) in infants and children should be performed by a pediatric surgeon or a pediatric otolaryngologist or an appropriately trained pediatric medical specialist, which may include a pediatric pulmonologist or a pediatric intensivist.
- Esophagoscopy in infants and children should be performed by a pediatric surgeon, a pediatric otolaryngologist, or a pediatric gastroenterologist.
- Endoscopy of the gastrointestinal tract distal to the esophagus (eg, esophagogastroduodenoscopy, colonoscopy) in infants and children should be performed by a pediatric surgeon or a pediatric gastroenterologist.

PEDIATRIC OPHTHALMOLOGY REFERRAL GUIDELINES

A pediatric ophthalmologist has completed a residency in ophthalmology, is certified by the American Board of Ophthalmological Surgery, and has completed additional training in pediatric ophthalmology. For purposes of developing these guidelines, the following age group definitions are used: infant (0–1 year), child (2–12 years), and adolescent (13–18 years).

Pediatric patients with the following conditions should be referred to a pediatric ophthalmologist:

- Children 7 years or younger who are nonverbal or unable to read letters and in whom there is reason to suspect eye disease.
- Infants or children with retinoblastoma or other tumors of the eye and orbital area.
- Infants or children with known or suspected cataracts, glaucoma, or blindness.
- Infants or children diagnosed with, or at risk of, retinopathy of prematurity.
- Infants or children with congenital or genetic ocular anomalies or infections (eg, aniridia, toxoplasmosis).
- Infants or children with systemic syndromes, metabolic disorders, or chromosomal abnormalities with possible ocular involvement (eg, juvenile rheumatoid arthritis, galactosemia, diabetes mellitus, Marfan syndrome, Down syndrome).
- Infants or children suspected of being abused and in whom there is a possibility of eye injury.

Pediatric patients with the following conditions are preferably managed by a pediatric ophthalmologist:

- Infants with congenital nystagmus and children with early onset nystagmus.
- Children with strabismus or amblyopia (ie, dimness of vision without detectable organic lesion of the eye) or risk factors for strabismus or amblyopia (eg, family history of amblyopia, orbital or eyelid hemangioma).

- Children with a family history of congenital or genetic ocular anomalies (eg, aniridia), infections (eg, toxoplasmosis), tumors (eg, retinoblastoma), or a family history of systemic or metabolic syndromes (eg, juvenile rheumatoid arthritis, galactosemia, diabetes mellitus), chromosomal abnormalities (eg, Down syndrome), or other disorders with possible ocular involvement.
- Infants or children with exposure during gestation to drugs or other substances (including alcohol) that may cause congenital anomalies of the eyes.
- Infants or children with poor vision or delayed attainment of vision-related developmental milestones and infants and children with severe refractive errors or a strong family history of severe refractive errors.
- Infants or children with ocular or periocular inflammation not responding to initial topical and/or systemic antibiotic therapy or not clearing within 3 weeks of treatment and children with suspected herpes simplex or zoster infections involving the eye or a history of these infections involving the eye.

PEDIATRIC UROLOGY REFERRAL GUIDELINES

A pediatric urologist has completed a residency in urology and is certified by the American Board of Urologic Surgery and has completed additional training in a pediatric urology fellowship. In select situations, a urologist may have gained a lifetime of pediatric experience but started practice before such fellowships were available. For purposes of developing these guidelines, the following group definitions are used: infant (0–1 year), child (2–12 years), and adolescent (13–18 years).

- Undescended testicles and elective congenital hydrocele/hernia are optimally corrected in infancy or early childhood; the operation should be performed by a pediatric urologist or surgical specialist.
- Hypospadias is usually repaired in infancy or early childhood; the operation should be performed by a pediatric urologist.
- Complex congenital urologic problems (eg, duplex systems, ureterocele, bladder exstrophy, moderate or severe vesicoureteral reflux, posterior urethral valves) should preferably be managed by a pediatric urologist.
- Solid malignancies of the kidney, bladder, and testicle should be treated from the outset by a pediatric urologist or surgical specialist in conjunction with a pediatric medical cancer specialist.
- Intersex (ambiguous genitalia) conditions should be comanaged from the outset by the primary care pediatrician and a pediatric urologist or surgical specialist. The management team should include a pediatric endocrinologist and a psychologist in consultation with the primary care pediatrician and pediatric urologist or surgical specialist.
- Cystoscopic procedures in infants and children preferably should be performed by a pediatric urologist.
- A pediatric urology consultation should be considered when a child has prolonged, severe daytime voiding difficulty.
- A pediatric urologist should be involved in the care of children with spinal cord disorders (eg, myelomeningocele, spinal cord injuries).
- Infants or children with major urologic injuries should be stabilized at the nearest medical center and then transported to a pediatric trauma center.
- Infants or children with testicular torsion should be evaluated at the nearest medical center and operated on promptly.

When a urinary tract abnormality has been identified prenatally, a pediatric urologist or surgeon should be consulted as a member of the fetal treatment team.

PEDIATRIC ORTHOPEDIC SURGERY REFERRAL GUIDELINES

A pediatric orthopedic surgeon has completed a residency in orthopedics and completed an additional fellowship in pediatric orthopedics. An orthopedic tumor surgeon has completed a residency in orthopedics, plus additional training in orthopedic oncology and devotes his or her practice to patients with cancer of the bones and joints. For purposes of developing these guidelines, the following age group definitions are used: infant (0–1 year), child (2–12 years), and adolescent (13–18 years).

- Malignant bone tumors should be managed by an orthopedic tumor surgeon, in conjunction with a pediatric medical cancer specialist.
- Benign bone tumors should be managed by a pediatric orthopedic surgeon or an orthopedic tumor surgeon.
- Congenital deformities of the upper extremity should be managed by a pediatric orthopedic surgeon or a pediatric hand surgeon.

The following patients may be best cared for by a pediatric orthopedic surgeon:

- Infants with serious malformations of the limbs (eg, idiopathic clubfoot, congenital limb deficiency).
- Children and adolescents with significant limb deformity secondary to metabolic bone disease or other types of growth arrest.
- Infants, children, and adolescents with developmental dysplasia of the hip. (Screening for developmental dysplasia of the hip is performed by the primary care pediatrician.)
- Infants, children, and adolescents with bone or joint infection (eg, osteomyelitis, septic arthritis), in conjunction with the primary care pediatrician and pediatric infectious disease specialist.
- Children with Perthes disease (ie, osteochondritis of the femoral head).
- Children and adolescents with slipped capital femoral epiphysis.
- Infants, children, and adolescents with severe scoliosis or limb length discrepancy.

- Infants, children, and adolescents with deformity or gait abnormality secondary to neuromuscular conditions (eg, cerebral palsy).
- Infants, children, and adolescents with complex fractures and dislocations.

PEDIATRIC NEUROLOGICAL SURGERY REFERRAL GUIDELINES

A pediatric neurosurgeon is a board-certified neurosurgeon who has completed a fellowship in pediatric neurosurgery after completing a residency in general neurosurgery and is certified by the American Board of Pediatric Neurologic Surgery. For purposes of developing these guidelines, the following age group definitions are used: infant (0–1 year), child (2–12 years), and adolescent (13–18 years).

In the interest of good patient care, it is suggested that any general neurosurgeon who will manage pediatric neurosurgical problems not listed in the categories below should have had a minimum 6-month rotation as a junior or senior resident during his or her general neurosurgical residency on a pediatric neurosurgical service run by a trained pediatric neurosurgeon. Attendance at pediatric neurosurgical conferences and meetings at least every 12 months is also necessary for the general neurosurgeon caring for pediatric neurosurgical patients.

- Patients 5 years or younger who may need neurosurgical care for congenital anomalies or neoplasms of the brain or spinal cord should be cared for by a pediatric neurosurgeon.
- Infants and children with injuries to the head, spinal cord, or peripheral nerves may be stabilized at a local hospital and should then be transferred to a pediatric trauma center with pediatric neurosurgical coverage.
- Infants, children, and adolescents with brain tumors should be cared for from the outset by pediatric neurosurgical and pediatric medical cancer specialists.
- Infants, children, and adolescents with tumors of the spinal cord or peripheral nerves should be cared for from the outset by pediatric neurosurgical and pediatric medical cancer specialists.
- Infants and children with deformities of the cranium (eg, craniosynostosis) or spine (eg, spina bifida) should be cared for by a pediatric neurosurgeon.
- Infants and children with hematomas/hygromas of the brain should be cared for by a pediatric neurosurgeon.
- Infants and children with abscesses of the brain or spinal cord should be cared for by a pediatric neurosurgeon, in conjunction with the primary pediatrician and a pediatric infectious disease specialist.
- Infants with myelomeningocele are preferably cared for by a pediatric neurosurgeon (as part of a medical-surgical team).
- Infants with hydrocephalus are preferably cared for by a pediatric neurosurgeon.
- Infants and children with medical conditions that increase operative risk (eg, congenital heart disease) who must undergo a common neurosurgical procedure (eg, shunt for hydrocephalus) should be cared for by a pediatric neurosurgeon.
- Neuroendoscopy procedures in infants and children should be performed by a pediatric neurosurgical endoscopist.

PEDIATRIC PLASTIC SURGERY REFERRAL GUIDELINES

A pediatric plastic surgeon is certified by the American Board of Plastic Surgery. He or she has completed the requirements of residency training for board certification in plastic surgery (usually a total of 6 or more years of surgical and surgical specialty training), plus additional training in pediatric plastic surgery. For purposes of developing these guidelines, the following age group definitions are used: infant (0–1 year), child (2–12 years), and adolescent (13–18 years).

- Infants and children with congenital malformations of head and neck structures including the face and skull (eg, cleft lip and palate, craniosynostosis) should be referred to a pediatric plastic surgeon.
- Infants and children with congenital malformations of the limbs (eg, syndactyly) should be referred to a pediatric plastic surgeon.
- Infants, children, and adolescents who are seriously burned or injured should be stabilized at a local hospital and then transferred to a pediatric burn/trauma center with a pediatric plastic surgeon as part of the treatment team.
- Infants, children, and adolescents with large cutaneous pigmented or vascular lesions (eg, nevi, port wine stains, arteriovenous malformations) should be referred to a pediatric plastic surgeon.
- Infants, children, and adolescents with large soft-tissue tumors that, when excised, leave defects requiring tissue transfer or reconstruction are preferably cared for by a pediatric plastic surgeon.
- The pediatric plastic surgeon is optimally part of a multispecialty team (with pediatricians and other pediatric surgical specialists) in management of conditions such as myelomeningocele or complex problems requiring tissue expansion or microsurgical procedures.

Because the care of infants, children, and adolescents changes and advances rapidly, these guidelines should be updated at regular intervals.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Gynecologic Examination for Adolescents in the Pediatric Office Setting

Paula K. Braverman, MD, Lesley Breech, MD, and THE COMMITTEE ON ADOLESCENCE

KEY WORDS
pelvic examination, Pap smear, sexually transmitted infections, menstrual disorders, pubertal development

ABBREVIATIONS
STI—sexually transmitted infection
AAP—American Academy of Pediatrics
NAAT—nucleic acid amplification test

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abstract

FREE

The American Academy of Pediatrics promotes the inclusion of the gynecologic examination in the primary care setting within the medical home. Gynecologic issues are commonly seen by clinicians who provide primary care to adolescents. Some of the most common concerns include questions related to pubertal development; menstrual disorders such as dysmenorrhea, amenorrhea, oligomenorrhea, and abnormal uterine bleeding; contraception; and sexually transmitted and non–sexually transmitted infections. The gynecologic examination is a key element in assessing pubertal status and documenting physical findings. Most adolescents do not need an internal examination involving a speculum or bimanual examination. However, for cases in which more extensive examination is needed, the primary care office with the primary care clinician who has established rapport and trust with the patient is often the best setting for pelvic examination. This report reviews the gynecologic examination, including indications for the pelvic examination in adolescents and the approach to this examination in the office setting. Indications for referral to a gynecologist are included. The pelvic examination may be successfully completed when conducted without pressure and approached as a normal part of routine young women's health care. *Pediatrics* 2010;126: 583–590

INTRODUCTION

Gynecologic issues are commonly seen by clinicians who provide primary care to adolescents. Some of the most common problems include questions related to pubertal development; menstrual disorders such as dysmenorrhea, amenorrhea, oligomenorrhea, and abnormal uterine bleeding; contraception; and sexually transmitted infections (STIs) and non–STIs. Approximately one-half of adolescents attending high school have been sexually active, which places them at risk for STIs and pregnancy.[1] Younger adolescents often have questions about pubertal development, and the gynecologic examination is a key element in assessing pubertal status and documenting physical findings.

The American Academy of Pediatrics (AAP) promotes the inclusion of the pelvic examination in the primary care setting within the medical home. The examination can be a positive experience when conducted without pressure and approached as a normal part of routine young women's health care. At a minimum, examination of the external genitalia should be included as part of the annual comprehensive physical examination of children and adolescents of all ages. Routinely explaining and including this examination normalizes the experience rather

than setting it apart as something that is only performed as an exception. Most adolescents do not need an internal examination involving a speculum or bimanual examination. However, for cases in which more extensive examination is needed, the primary care office is often the best setting for pelvic examination. The primary care clinician, who has established rapport, trust, and a comfort level with the patient, is allowed to prepare the patient in advance and to more successfully address preconceived negative attitudes and fears.

Although pediatric residency training includes instruction in performing the pelvic examination, many pediatricians may not use these skills in their current practice setting. The purpose of this report is to provide pediatricians with background information regarding indications for the pelvic examination, along with information about the equipment and supplies needed and techniques used in performing the examination in the primary care office setting.

INDICATIONS FOR THE PELVIC EXAMINATION

Fewer adolescents require a complete screening pelvic examination because of recent changes in recommendations for the initiation and follow-up of abnormal Papanicolaou (Pap) test results, as well as newer tests available to screen for STIs, which can be performed on urine specimens, vaginal swabs, or cervical samples. However, there are instances in which the pelvic examination is a crucial part of the medical evaluation. The goals of a pelvic examination are primarily to screen for and diagnose diseases and abnormalities but also to provide education about gynecologic issues and reassure the patient about normal, healthy anatomy. Because of previous negative experiences or inaccurate information relayed by peers or family members, the adolescent may be fearful or anxious about the examination. It is important to proactively allay any fears before performing the examination. Issues that need to be addressed up front with the patient include fear of discovering a disease or abnormality, possible pain or discomfort, embarrassment in undressing or exposing the genital area, and uneasiness with the examiner, particularly when the clinician is male or a trainee. Clinicians should always be sensitive to the possibility of past or current sexual abuse, which can affect the patient's comfort with the examination and her preference regarding the gender of the examiner. When performed in a thoughtful and sensitive manner, the pelvic examination can be a positive experience. In some cases, it may be helpful to have the patient make an appointment specifically for the pelvic examination to ensure that the provider does not feel rushed in the midst of a busy day of clinical practice.

Indications for the pelvic examination are listed in Table 1. In the past, a history of sexual activity was an automatic indication for a full pelvic examination to perform Pap tests and STI testing and to act as a prerequisite to prescribing hormonal contraception. Certainly, the external genitalia of all patients should be examined to confirm normal anatomy, assess pubertal development, and look for evidence of abnormal lesions, infection, or trauma. However, with the availability of urine-based and vaginal-swab STI testing, examination with a speculum in an asymptomatic patient is not necessary for diagnosing asymptomatic STIs.[2,3] Other non–sexually transmitted vaginal infections, such as bacterial vaginosis and yeast infections, can also be diagnosed with a vaginal swab obtained by either the provider or the patient.[4,5]

TABLE 1 Indications for a Pelvic Examination

Persistent vaginal discharge
Dysuria or urinary tract symptoms in a sexually active female
Dysmenorrhea unresponsive to nonsteroidal anti-inflammatory drugs
Amenorrhea
Abnormal vaginal bleeding
Lower abdominal pain
Contraceptive counseling for an intrauterine device or diaphragm
Perform Pap test
Suspected/reported rape or sexual abuse
Pregnancy

Previous recommendations to perform Pap tests at the onset of sexual activity have changed. Current guidelines state that the first Pap test should be performed at 21 years of age, except if a patient has immune suppression or infection with HIV, in which case annual Pap tests are started with the onset of sexual activity. Adolescents who had been screened previously and had documented cervical intraepithelial neoplasia (CIN) 2 or 3 or carcinoma would require continued screening as outlined in the new recommendations.[6]

Cervical cancer generally develops several decades after initial exposure to human papillomavirus (HPV) and is rare in women younger than 21 years. Although many sexually active adolescents are exposed to HPV, and some develop abnormal cervical cells, these changes resolve without intervention in the vast majority of adolescents. Furthermore, there are indications that interventions for abnormal cervical cytology in this age group cause unnecessary anxiety and have the potential to contribute to pregnancy complications in the future.

A speculum or bimanual examination is now considered unnecessary before prescribing most forms of contraception. The package insert for oral contraceptive pills specifically states that a gynecologic examination is not necessary. The rationale is that there is

nothing that would be found on the pelvic examination that would be a contraindication to prescribing oral contraceptive pills. The same reasoning can be applied to the contraceptive patch, ring, progestin-releasing implant, and medroxyprogesterone injections. A urine-based pregnancy test and STI screen can be performed, if indicated, before a clinician prescribes hormonal contraception. The 2 exceptions would be an intrauterine device (IUD) or diaphragm, for which anatomic variation could affect insertion or appropriate sizing of the device.

A complete pelvic examination is always indicated in cases of suspected or reported rape or sexual abuse and/or as part of the evaluation of lower abdominal pain. In the case of lower abdominal pain, the examination is performed to identify the source of pain, which may be caused by pelvic inflammatory disease, ovarian mass or torsion, and/or normal or ectopic pregnancy. When rape or sexual abuse has occurred in the previous 72 hours, a pelvic examination should be performed in a clinical setting along with the physical examination to identify and document evidence of trauma and to collect and safeguard forensic specimens obtained in a standardized manner. The necessary supplies, equipment, and staff knowledge and skills may not be available in the primary care office setting; therefore, some patients may need referral to a specialized medical center.

Persistent symptomatic vaginal discharge is another indication for a speculum examination. Although nucleic acid amplification tests (NAATs) can be used on non–clean-catch urine samples to detect *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections, cervical or vaginal specimens may be more sensitive, depending on the test that is used.[2] Although vaginal swab specimens obtained during the speculum examination can be used to diagnose trichomoniasis, bacterial vaginosis, and yeast infection, a blind vaginal swab is sufficient for obtaining an adequate sample for diagnosing these infections. Visualizing the cervix also allows for assessment for the presence of mucopurulent discharge and friability, which have been associated with the diagnosis of chlamydia and gonorrhea. The speculum examination is also important for ruling out other causes of discharge, such as a foreign body or a cervical abnormality such as a large ectropion.

Another indication for a complete pelvic examination is menstrual disorders, including dysmenorrhea that is unresponsive to first-line therapy with nonsteroidal anti-inflammatory drugs (NSAIDs) and/or hormonal therapy, amenorrhea, and abnormal vaginal bleeding. In these instances, the pelvic examination is important for confirming normal anatomy, isolating the source of pain, ruling out lesions or masses, and identifying sources of vaginal/uterine bleeding. A complete pelvic examination with a speculum may not be necessary for all adolescents with abnormal vaginal bleeding if it is determined that the clinical scenario is that of an individual with heavy and/or prolonged menses within the first few years after menarche who promptly responds to medical management and does not have any indication of trauma or history of sexual activity or abuse.

PREPARATION FOR THE PELVIC EXAMINATION

Before performing a pelvic examination, it is important to explain the components of the examination to the patient and to show the patient the equipment that will be used. Allowing the patient to touch the speculum to demonstrate that it is smooth and will not injure her can be reassuring. Use of anatomic models, pictures in handouts, and pamphlets that describe the examination are valuable adjuncts. The amount of detail included depends on the age and maturity level of the patient. Depending on the patient's preference, having the patient's mother or another trusted female, such as a relative, present for both the preexamination preparation and the examination itself can sometimes be helpful and reassuring to the patient.

It is important to reassure the patient that nothing will be done without telling her first and that, although the examination may be uncomfortable, it should not be painful in the absence of pelvic abnormality. Patients should be encouraged to give feedback to the clinician during the examination if they are not comfortable, either physically or emotionally. The patient should be reminded that she is in control of her body and that it is fine to say, "Wait a minute," "Stop," or "That's not comfortable." For a cooperative patient, the examination can be completed in 10 to 15 minutes. However, the examination should be performed only when there is adequate time allotted, particularly if it is the patient's first examination or if the patient has had a previous negative experience. If the patient does not appear to be tolerating the examination, it should be stopped and tried again at a later time to minimize negative experiences. In addition to explaining some relaxation techniques to the patient, pressing on the perineal muscle without inserting a finger in the vagina and having the patient practice contracting and relaxing that area can be helpful in later successfully inserting the speculum or a finger during the bimanual examination.

Before performing the examination, the patient should be asked to empty her bladder. This will minimize any pain or discomfort, particularly dur-

ing the bimanual examination. The pelvic examination should be performed in the lithotomy position on an examination table with stirrups. Although frog-leg or knee-chest position is used to examine younger girls, the use of stirrups is preferred when performing a speculum examination to allow for proper insertion and positioning of the speculum. The room should be set up to ensure privacy with a curtain or locked door, and gowns and draping should be provided. Chaperones are strongly recommended, with the permission of the patient, even when the patient and clinician are the same gender, to help avoid any false accusations of impropriety. The chaperone can also serve as the assistant to the clinician, which improves efficiency in collecting specimens.

The equipment needed to perform a pelvic examination is listed in Table 2 and includes materials used to perform Pap tests and STI/non-STI cervicitis/vaginitis evaluation. Warm running water is helpful to provide lubrication for the speculum before insertion. Jelly lubricants should not be used on the speculum, because they interfere with the results of Pap tests and STI tests. The jelly lubricant is reserved for the bimanual examination, which is always performed after the speculum examination is completed. Nonlatex gloves are needed, particularly for those who have latex sensitivity or allergy. A variety of specula of varying widths should be available. The pediatric/infant speculum should never be used on a pubertal female, because it does not have the required 4-in length to reach the cervix. The speculum commonly used in a sexually active female is the Pederson speculum, which is 7/8 in wide. In cases of virginal adolescents or those who cannot relax their vaginal muscles, the Huffman speculum can be useful, because it is narrower, with a width of 0.5 in, but has the required length. Use of the Graves speculum should be avoided, because its width can cause unnecessary discomfort. Plastic disposable specula are available in the appropriate sizes. Specula with self-contained lighting can be useful, because they make visualization easier.

TABLE 2 Materials and Equipment Needed for the Pelvic Examination

Room with warm running water
Room with a curtain or locked door
Examination table with stirrups
Adequate adjustable light source
Nonlatex gloves
Water-soluble lubricant
Gowns, drapes
Speculum: Pederson, Huffman
Pap test materials: liquid-based or slide, cytobrush, paddle, fixative
Culture/antigen tests for STIs: chlamydia, gonorrhea, trichomoniasis
Urine pregnancy tests
Swabs: cotton, calcium alginate, Dacron
Microscopy materials: glass slides and cover slips, saline solution, 10% potassium hydroxide
pH paper
Tampons/pads
Tissues

In light of existing barriers to reproductive health services for adolescents with disabilities, the need for access to appropriate screening and sexual education cannot be overstated. Young women with physical disabilities may require modification of the physical approach to the examination because of limb, pelvic, or spine deformity or immobility. The teenager with physical, behavioral, or developmental disability may require a referral to a gynecologist and possibly an examination under anesthesia. The same may apply to patients who are unable or unwilling to cooperate. All efforts should be made to perform the examination in the office setting, but forcing a patient to undergo pelvic examination is always contraindicated (refer to the AAP clinical report on sexuality of disabled children and adolescents[7]).

PERFORMING THE PELVIC EXAMINATION AND COMMON FINDINGS

External Genitalia

The first part of the pelvic examination is inspection of the pubic hair, noting Tanner stage (sexual maturity rating) and the presence of any lesions, including pubic lice, nits, folliculitis, and other inflammatory lesions such as hidradenitis suppurativa. Folliculitis presents as papules and pustules primarily in the pubic hair region. They can be mildly tender and are usually smaller than hidradenitis suppurativa, which causes larger, tender, draining lesions that represent recurrent infection of apocrine glands. Folliculitis is particularly common with the increased popularity of shaving pubic hair. Teenagers need to be counseled that shaving should be performed carefully with adequate lubrication to minimize trauma. In addition, although not as common as in other body locations, some teenagers will have genital piercings. Teenagers should be counseled on proper hygiene and potential medical complications of piercing in the genital area, particularly those that involve the clitoris.

The external genitalia are examined next to assess for signs of inflammation, including redness or swelling, as well as any pigmentary changes, including hypopigmentation, which can be seen in lichen sclerosis or vitiligo. Clitoral size should be evaluated after retracting the clitoral hood, and the width should be $<$10 mm. An enlarged clitoris can indicate elevated androgens associated with a problem at the level of the ovary or adrenal gland. The hymen should be assessed for patency and configuration, including the presence of an imperforate, microperforate, or cribriform hymen or hymenal band, which may impair uterine blood flow or preclude use of tampons. A

pubertal female with an imperforate hymen should be referred promptly to a gynecologist to prevent accumulation of blood in the vagina and upper genital tract. Other abnormalities, such as a vertical or transverse vaginal septum, would be an indication for further evaluation to rule out other genital tract anomalies. If there are any questions about patency of the vagina, a saline-soaked cotton swab can be gently inserted to demonstrate patency. The Bartholin glands are located in the posterior vestibule at the 4 and 8 o'clock positions. When infected, they present with swelling, erythema, and tenderness that can extend into the entire labia minora. Although any vaginal organism can infect the glands, they are commonly infected by STI pathogens, including gonorrhea and chlamydia. The Skene glands are located on each side of the urethra, and infection can present as erythematous areas lateral to the urethra. Insertion of a finger into the vagina and anterior pressure may produce discharge from the ducts.

Any lesions, including papules, vesicles, pustules, ulcers, fissures, and warts, should be noted. These could be signs of an STI or other dermatologic conditions. In addition, any signs of trauma, including laceration, should be noted. Ulcers found on the external genitalia as well as in the vagina are commonly caused by herpes simplex virus (HSV), syphilis, or chancroid, which are sexually transmitted. Although lymphogranuloma venereum can present with an ulcer, it is an uncommon STI in the United States.[8] Because HSV and syphilis are the most common cause of genital ulcers in the United States, a viral culture for HSV and serologic tests for syphilis should be performed for suspicious lesions. Some ulcers are not acquired sexually, including aphthous spectrum ulcers and those caused by Epstein-Barr virus infection.[9] Genital warts (condylomata acuminata) can present as flat or exophytic and are attributable to human papillomavirus. Condylomata lata are flesh-colored papules on mucous membranes, which can be confused with warts but are filled with spirochetes and are a manifestation of secondary syphilis.[8]

The presence of any blood coming from the vagina should be noted; vaginal discharge should be assessed, including amount, color, and odor. The perianal area should be included in the external examination with specific reference to evidence of trauma, discharge, or warts. Inguinal nodes should be palpated for size, tenderness, and consistency. Enlarged painful nodes could be an indication of an STI, including syphilis or herpes simplex virus.

Speculum Examination

The speculum examination is performed after completion of the external examination. Although not always necessary, a single finger can be inserted along the posterior vaginal wall before insertion of the speculum to locate the cervix. Lubricating the speculum with warm water can facilitate insertion of the speculum, and anterior pressure should be avoided during the insertion process to prevent pain along the urethra. If the speculum is completely inserted before opening the blades, the cervix frequently is easily viewed without much further manipulation. Opening the speculum before inserting it the complete length of the vagina can be painful. Once inserted, the vaginal walls should be inspected for discharge and lesions.

The cervix should be completely visualized to note the presence of any lesions as well as the presence or absence of an ectropion (transition between the columnar and squamous epithelium) on the exocervix. The ectropion is a normal developmental finding of the adolescent cervix in which the squamocolumnar junction is on the exocervix. This usually regresses into the cervical canal with advancing gynecologic age. When prominent, the ectropion can cause significant vaginal discharge. Friability and hyperemia of the cervix can indicate infection with an STI. White plaques on the cervix that cannot be removed with a swab could indicate condyloma acuminata, and red punctate lesions (strawberry cervix) may be seen with trichomoniasis. The cervix has a bluish hue, known as cervical cyanosis or Chadwick sign, in pregnancy.

During the speculum examination, samples are obtained for laboratory and office-based analysis. If the office has a microscope, vaginal pool samples can be examined immediately to diagnosis yeast infection, bacterial vaginosis, or trichomoniasis. Samples are obtained from the pooled vaginal secretions for wet prep, potassium hydroxide examination, and vaginal pH testing. A cotton swab is used to collect vaginal secretions, which can be placed in a tube with 1 mL of normal saline solution and then used to prepare a glass slide for microscopic examination. Alternatively, the slide can be directly smeared with the swab, after which a drop of saline or potassium hydroxide is added. With the wet saline solution preparation, the clinician looks for an increased number of white blood cells as an indication of infection; clue cells (bacterial-covered epithelial cells), which are a sign of bacterial vaginosis; moving flagellated trichomonads; and hyphae or budding yeast. Potassium hydroxide preparation is helpful for identifying yeast not seen on the saline-solution preparation. Ideally, the wet mount should be read as soon as the pelvic examination is completed to increase the likelihood of detecting trichomonads. In the case

of bacterial vaginosis, when the vaginal secretions are mixed with potassium hydroxide, there is a characteristic fishy odor, known as a positive whiff test, because of the amines that are present in the discharge. The normal vaginal pH should be <4.5; pH is elevated with bacterial vaginosis and trichomoniasis. An easy method for measuring pH is to dip the pH paper in the secretions left on the tip of the speculum after it is removed and then to read the color change within 10 seconds. Other tests that are commercially available include cards that measure pH and for the presence of amines, which may be helpful in the diagnosis of bacterial vaginosis. The wet mount can miss trichomoniasis 30% to 50% of the time; culture, nucleic acid probe, or antigen-based rapid testing may be more sensitive in detecting this infection.[3] Clinicians can consult with their referral laboratory about performing the wet-mount or potassium-hydroxide examination if a microscope is not available in the office or if Clinical Laboratory Improvement Act compliance is an issue.

When indicated, Papanicolaou tests are obtained by using a Papanicolaou paddle, which is rotated 360° to sample the entire exocervix, and a cytobrush is used to collect an endocervical specimen. The cytobrush can cause bleeding, which may be more prominent in patients with an STI. The patient should be warned about the possibility of some light bleeding or spotting after the Pap test. Liquid-based Pap tests are preferred, because they produce fewer inadequate readings and false-negative results. An additional benefit of liquid-based Pap tests is that, in some cases, STI testing can be performed on the same specimen. Alternatively, direct smearing of a slide, which is immediately fixed before air drying, is still used in many laboratories. It is important to verify with the cytology laboratory whether they use 1- or 2-slide Pap tests in which the endocervical or ectocervical specimens are either placed on 1 slide or separated. Any nonulcerative lesions of the cervix should be evaluated with a Pap test, and any patient with unknown suspicious lesions should be referred to a gynecologist for further evaluation regardless of the Pap test result. The Pap test is performed before obtaining the endocervical swab for STI testing.

Cervical specimens should be obtained for gonorrhea and chlamydia testing by using an NAAT, culture, or DNA probe (nonamplified DNA testing). Some of the NAATs for gonorrhea and chlamydia have also been approved for vaginal swab specimens. In cases of sexual abuse or rape, cultures may be legally required for gonorrhea and chlamydia instead of the NAAT. For non-NAATs including culture, an endocervical specimen must be obtained for chlamydia, because this organism, unlike gonorrhea, is an intracellular organism that infects columnar cells. The NAATs are the most sensitive tests for chlamydia, but depending on transport issues, culture for gonorrhea may be equivalent to an NAAT. Testing using NAATs should not be performed sooner than 3 weeks after treatment for chlamydia or gonorrhea because of the possibility of false-positive results. Blind vaginal swab for *Trichomonas* testing is equivalent to a specimen obtained during speculum examination.[2,3,5]

Once the speculum examination is completed, the speculum is closed and then carefully removed with posterior pressure while avoiding pinching the sides of the vaginal wall. The speculum should never be removed in the open position.

Bimanual Examination

The bimanual examination is performed by inserting 1 or 2 fingers into the vagina with a water-based lubricant on the gloved hand. The cervix is assessed for consistency. The normal nonpregnant cervix is firm, while the cervix of a gravid uterus is softer. The cervix should be gently moved to assess for cervical motion tenderness, which indicates pelvic infection or inflammation. It is important to remember that adolescents, particularly those not experienced with the examination, commonly mistake movement or pressure for pain. Distinguishing between discomfort and true pain can be challenging. The uterus is then palpated for size and tenderness. The nonpregnant uterus is small and firm, whereas at 10 to 12 weeks' gestation, it is the size of a grapefruit and is softer, globular, and starting to protrude from the pelvis. The uterus starts becoming larger and softer between 8 and 10 weeks' gestation. The adnexa (ovaries) are then assessed for pain or masses. Normal ovaries are usually barely palpable.

When the examination is completed, the patient should be given time to remove any excess lubricant and offered tampons or pads for bleeding. The findings and recommendations are then discussed once the patient is dressed.

The common gynecologic abnormalities that are identified during pelvic examination are listed in Table 3.

REASONS TO REFER TO A GYNECOLOGIST

The role of the pediatrician is to recognize abnormalities that warrant referral to a gynecologist and to identify common infections that can be treated without referral. The types of conditions that should be referred to a gynecologist are listed in Table 4 and include masses, chronic pelvic pain, pregnancy, menstrual disorders unresponsive to medical management,

TABLE 3 Common Gynecologic Findings Seen on Gynecologic Examination

External genitalia
Bartholin gland abscess
Skene gland infection
Genital ulcers/fissures
Warts: condyloma acuminata
Papular lesions (condylomata lata from syphilis)
Molluscum contagiosum
Urethral prolapse
Folliculitis
Hidradenitis suppurativa
Vulvitis
Pigmentary changes
Papillomatosis
Cervix
Ectropion
Strawberry cervix
Human papillomavirus/condyloma
Cervical polyp
Cervical ulcers
Vagina
Ulcers
White adherent plaques: *Candida* species
Condyloma acuminata

TABLE 4 Reasons to Refer to a Gynecologist

Adnexal mass
Vulvar or cervical lesion of undetermined etiology
Possible genital tract anomaly (imperforate hymen, duplicated upper tracts, absence of vagina, uterus)
Abnormal Pap test result requiring colposcopy
Acute pelvic pain with possible ovarian torsion, ectopic pregnancy, tubo-ovarian abscess, adnexal mass
Pelvic inflammatory disease (if the clinician is not comfortable with management)
Chronic pelvic pain
Dysmenorrhea unresponsive to medical therapy
Abnormal vaginal bleeding unresponsive to medical therapy or with severe anemia
Intrauterine device insertion
Pregnancy

unknown vulvar or cervical lesions, abnormal Pap test results requiring colposcopy, and genital anomalies. Recently, changes were made in the recommendations for follow-up of abnormal Pap test results. As opposed to high-grade lesions, low-grade lesions and atypical squamous cells of undetermined significance should now be followed up by repeat Pap tests at 1-year intervals. Colposcopy is recommended only if the abnormality persists or becomes a high-grade lesion over a 2-year period.[6]

CONCLUSIONS

Many gynecologic issues can be managed by the primary care clinician without performing a speculum or bimanual examination. For conditions that require a complete pelvic examination, the patient may prefer to have it performed in a familiar setting rather than being referred to another provider. There are instances in which the pelvic examination must be performed during a problem visit and cannot be deferred to a separate, dedicated appointment time slot. These urgent situations may affect office costs in terms of physician and assistant time. However, providing urgent examinations will provide more comprehensive continuity of care for the patient. Specific details concerning billing and coding, including billing for confidential services, can be found in other AAP publications and policy statements.[10–13] With appropriate backup from a gynecologist, most medical gynecologic issues can be managed by the clinician in the primary care office setting.

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OTHER SUGGESTED READINGS

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Head Lice

abstract

FREE

Head lice infestation is associated with limited morbidity but causes a high level of anxiety among parents of school-aged children. Since the 2002 clinical report on head lice was published by the American Academy of Pediatrics, patterns of resistance to products available over-the-counter and by prescription have changed, and additional mechanical means of removing head lice have been explored. This revised clinical report clarifies current diagnosis and treatment protocols and provides guidance for the management of children with head lice in the school setting. *Pediatrics* 2010;126:392–403

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KEY WORDS
head lice, infestation, school, children

ABBREVIATIONS
DDT—dichlorodiphenyltrichloroethane
OTC—over-the-counter
FDA—Food and Drug Administration

INTRODUCTION

Head lice (pediculosis capitis) have been companions of the human species since antiquity. In the United States, head lice infestation is common among children 3 to 12 years of age. Before the development of modern insecticides, various botanical treatments, inorganic poisons, and petroleum products were used to treat head lice infestation.[1] Shaving heads was also quite effective. The development of dichlorodiphenyltrichloroethane (DDT) after World War II offered a significant advancement in treatment and continues to be used in some developing countries.[2] Because of environmental concerns regarding DDT, other pharmaceutical agents, including lindane, pyrethrin, permethrin, and malathion, were developed to replace DDT.[3] Resistance to each of these pediculicides has developed. Inadequate treatment can sometimes be mistaken for drug resistance, and careful scrutiny is needed in making that determination.

A 1997 report estimated that approximately 6 to 12 million infestations occur each year in the United States,[4] but this number was based on sales of pediculicides and is most likely an overestimation. Anecdotal reports from the 1990s estimated annual direct and indirect costs totaling $367 million, including remedies and other consumer costs, lost wages, and school system expenses. More recently, treatment costs have been estimated at $1 billion.[5] Head lice are not a health hazard or a sign of poor hygiene and, in contrast to body lice, are not responsible for the spread of any disease.

Historically, diagnosis of head lice infestations by parents and other non–health care personnel and the easy availability of safe and effective over-the-counter (OTC) pediculicides for self-treatment essentially removed the physician from the treatment process. However, the potential for misdiagnosis and the resulting improper use of pediculicides raise concerns about unsafe use of these products, specifically when no lice are present or when products are used excessively.[6,7] In addition, the emergence of resistance to available products and the

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development of new products, many without proof of efficacy or safety, call for increased physician involvement in the diagnosis and treatment of head lice. Optimal treatments are safe and effective, rapidly pediculicidal, ovicidal, easy to use, and affordable and incorporate a resistance-prevention strategy.[8] Because lice infestation is so benign, treatments must prove safe to ensure that the adverse effects of therapy are not worse than the infestation.

ETIOLOGIC AGENT

The adult head louse is 2 to 3 mm long (the size of a sesame seed), has 6 legs, and is usually tan to grayish-white in color. The female lives up to 3 to 4 weeks and, once mature, can lay up to 10 eggs per day. These tiny eggs are firmly attached to the base of the hair shaft within approximately 4 mm of the scalp with a glue-like substance produced by the louse. Viable eggs camouflaged with pigment to match the hair color of the infested person often are seen more easily at the posterior hairline. Empty egg casings (nits) are easier to see because they appear white against darker hair. (Note that some experts refer to "eggs" as containing the developing nymph and use "nits" to refer to empty egg casings; others use the term "nits" to refer to both eggs and the empty casings.) The eggs are incubated by body heat and typically hatch in 8 to 9 days, but hatching can vary from 7 to 12 days depending on whether the ambient climate is hot or cold. Once it hatches, a nymph leaves the shell casing and passes through a total of 3 nymph stages (instars) during the next 9 to 12 days and then reaches the adult stage. The female louse can mate and begin to lay viable eggs approximately 1.5 days after becoming an adult. If not treated, this cycle may repeat itself approximately every 3 weeks.[9] The louse feeds by injecting small amounts of saliva with vasodilatory and anticoagulation properties and sucking tiny amounts of blood from the scalp every few hours. Itching results from sensitization to components of the saliva. With a first case of head lice, itching may not develop for 4 to 6 weeks, because it takes that amount of time for sensitivity to result. Head lice usually survive for less than 1 day away from the scalp at room temperature, and their eggs cannot hatch at an ambient temperature lower than that near the scalp.[2]

CLINICAL DISEASE

Head lice, unlike body lice, do not transmit any disease agent.[4,10] Itching can develop in a sensitized individual. Rarely, scratching may cause impetigo or other skin infection, which can lead to local adenopathy.

EPIDEMIOLOGY

In the United States, head lice infestation is most common among preschool- and elementary school-aged children. Caregivers and household members of people infested with head lice can also be at increased risk. All socioeconomic groups are affected, and head lice infestations are common in many parts of the world. In some remote communities in Central and South America, nearly all inhabitants have at least a few head lice.[11] In Australia, the prevalence in schoolchildren is 13%, with a range between schools of 0% to 28%[12]; in Brazil, the prevalence is 43% in a slum and 28% in a fishing village[13]; in China, the prevalence is 14%, with a range of 0% to 52%[14]; and in the United Kingdom, the prevalence is 2%, with an annual incidence of 37%.[15] Head lice infestation is not significantly influenced by hair length or by frequent brushing or shampooing. However, in the United States, where daily brushing is routine for many, infested individuals rarely have more than a dozen live lice, whereas individuals in cultures with different grooming practices often have a hundred or more live lice.

TRANSMISSION

Lice cannot hop or fly; they crawl. However, there are reports that combing dry hair can build up enough static electricity to physically eject an adult louse from an infested scalp more than 1 m.[3] Transmission in most cases occurs by direct contact with the head of an infested individual.[16] Indirect spread through contact with personal belongings of an infested individual (combs, brushes, hats) is much less likely but may occur rarely.[17] Lice found on combs are likely to be injured or dead,[18] and a healthy louse is not likely to leave a healthy head unless there is a heavy infestation.[19] This is further illustrated by 2 studies from Australia. In 1 study, examination of carpets on 118 classroom floors found no lice despite more than 14 000 live lice found on the heads of 466 children using these classrooms.[20] In a second study, live lice were found on only 4% of pillowcases used by infested volunteers.[21] Thus, the major focus of control activities should be to reduce the number of lice on the head and to lessen the risks of head-to-head contact.

DIAGNOSIS

The gold standard for diagnosing head lice is finding a live louse on the head, which can be difficult because lice avoid light and can crawl quickly. Studies have revealed that diagnosis of infestation by using a louse comb is quicker and more efficient.[22] Some experts have suggested using a lubricant (water, oil, or conditioner) to "slow down" the movement of lice and eliminate the possibility of static electricity.[23] The tiny eggs may be easier to spot, especially at the nape of the neck or behind the ears, within 1 cm of the scalp. It is important not to confuse eggs or nits with dandruff, hair casts,

or other hair debris, all of which have been misdiagnosed as nits. Nits are more difficult to remove, because they are firmly attached to the hair shaft. It is also important not to confuse live eggs with dead or empty egg cases (nits). Many presumed "lice" and "nits" submitted by physicians, nurses, teachers, and parents to a laboratory for identification were found to be artifacts such as dandruff, hairspray droplets, scabs, dirt, or other insects (eg, aphids blown by the wind and caught in the hair).[7] In general, eggs found more than 1 cm from the scalp are unlikely to be viable, although some researchers in warmer climates have found viable eggs farther from the scalp.[2] A viable egg will develop an "eye spot" that is evident on microscopic examination several days after being laid.[2]

PREVENTION

It is probably impossible to prevent all head lice infestations. Young children come into head-to-head contact with each other frequently. It is prudent for children to be taught not to share personal items such as combs, brushes, and hats. However, no one should refuse to wear protective headgear because of fear of head lice. In environments where children are together, adults should be aware of the signs and symptoms of head lice infestation, and infested children should be treated promptly to minimize spread to others.

TREATMENT

Never initiate treatment unless there is a clear diagnosis of head lice. The ideal treatment for lice would be completely safe, free of harmful chemicals, readily available without a prescription, easy to use, and inexpensive. When recommending a treatment, pediatricians should take into account effectiveness and safety, local patterns of resistance (if known), ease of use, and cost. Published reviews of available efficacy studies and comparative trials of pediculicides have used different inclusion criteria and reached different conclusions.[1,24] A Cochrane review concerning pediculicides was published in 1999 and updated in 2001[25] but was withdrawn in 2007,[26] and a substantial update is underway. Many of the cited studies were completed before the development of resistance to available pediculicides or were conducted in areas where the lice were naive to pediculicides.

Therapy could be initiated with OTC permethrin 1% or pyrethrins when resistance to these products is not suspected. Malathion 0.5% can be used in people who are 24 months of age or older when resistance to permethrin or pyrethrins is documented or when treatment with these products fails despite their correct use. Other treatments can be considered for people who cannot afford or who wish to avoid pediculicides. The pediatrician (or someone in the community, such as the school nurse) should be skilled in the identification of an active infestation with head lice to avoid treating patients unnecessarily or falsely identifying "resistance" in the community to a certain product. Improper application of the pediculicide should be considered first as a cause of treatment failure.

Finally, it should be noted that these recommendations are intended for use by pediatricians and other practitioners in the United States. Malathion is not available in Canada, and the Canadian Paediatric Society recently updated its position statement on head lice infestation.[27] Pediatricians who work in other countries, especially developing countries in which head lice are naive to pediculicides, should use products or methods that are most economical, effective, and safe. The following products and methods can be effective for treating head lice.

Pediculicides

Permethrin (1%)

Permethrin has been the most studied pediculicide in the United States and is the least toxic to humans.[1] Introduced in 1986 as a prescription-only treatment, 1% permethrin lotion was approved for OTC use in 1990 and is marketed as a "crème rinse" (Nix [Pfizer Consumer Health Care Group, New York, NY]). One percent permethrin lotion is currently recommended as one of the drugs of choice for head lice.[28] Permethrin is a synthetic pyrethroid with extremely low mammalian toxicity. Reported adverse effects include pruritus, erythema, and edema. Permethrin is less allergenic than pyrethrins and does not cause allergic reactions in individuals with plant allergies. The product is applied to damp hair that is first shampooed with a nonconditioning shampoo and then towel dried. It is left on for 10 minutes and then rinsed off. Permethrin leaves a residue on the hair that is designed to kill nymphs emerging from the 20% to 30% of eggs not killed with the first application.[29] However, conditioners and silicone-based additives present in almost all currently available shampoos impair permethrin adherence to the hair shaft and reduce its residual effect.[8] Therefore, it is suggested that the application be repeated in 7 to 10 days if live lice are seen. Many experts now recommend routine re-treatment, preferably on day 9.[8,30] An alternate treatment schedule on days 0, 7, and 13 to 15 has been proposed for nonovicidal products.[31] Resistance to 1% permethrin has been reported,[8,32–35] but the prevalence of this resistance is not known.

Pyrethrins Plus Piperonyl Butoxide

Manufactured from natural extracts from the chrysanthemum, pyrethrins are formulated with piperonyl butoxide (RID [Bayer, Morristown, NJ], A-200

[Hogil Pharmaceutical Corp, Purchase, NY], R & C [GlaxoSmithKline, Middlesex, United Kingdom], Pronto [Del Laboratories, Uniondale, NY], Clear Lice System [Care Technologies, Darien, CT]). Pyrethrins are neurotoxic to lice but have extremely low mammalian toxicity. Pyrethrins should be avoided in people who are allergic to chrysanthemums. The labels warn against possible allergic reaction in patients who are sensitive to ragweed, but modern extraction techniques minimize the chance of product contamination, and reports of true allergic reactions have been rare.[36] These products are available in shampoo or mousse formulations that are applied to dry hair and left on for 10 minutes before rinsing out. No residual pediculicidal activity remains after rinsing. In addition, none of these natural pyrethrins are totally ovicidal (newly laid eggs do not have a nervous system for several days); 20% to 30% of the eggs remain viable after treatment,[29] which necessitates a second treatment to kill newly emerged nymphs hatched from eggs that survived the first treatment. Previous recommendations have been to re-treat in 7 to 10 days; however, new evidence based on the life cycle of lice suggests that re-treatment at day 9 is optimal. An alternate schedule of 3 treatments with nonovicidal products on days 0, 7, and 13 to 15 has been proposed.[31] Although pyrethrins were extremely effective when introduced in the mid-1980s, recent study results have indicated that efficacy has decreased substantially because of development of resistance.[6] The prevalence of resistance has not been systematically studied but seems to be highly variable from community to community and country to country.

Malathion (0.5%)

The organophosphate (cholinesterase inhibitor) 0.5% malathion (Ovide [Taro Pharma, Hawthorne, NY]) was reintroduced for the treatment of head lice in the United States in 1999 after being taken off the market twice, most recently in 1986, because of problems related to prolonged application time, flammability, and odor. It is available only by prescription as a lotion that is applied to dry hair, left to air dry, then washed off after 8 to 12 hours, although some study results have suggested effectiveness when left on for as short a time as 20 minutes.[37] Head lice in the United Kingdom and elsewhere have shown resistance to malathion preparations, which have been available for decades in those countries.[38,39] The current US formulation of malathion (Ovide lotion, 0.5%) differs from the malathion products available in Europe in that it contains terpineol, dipentene, and pine needle oil, which themselves have pediculicidal properties[25] and may delay development of resistance. Malathion has high ovicidal activity,[29] and a single application is adequate for most patients. However, the product should be reapplied in 7 to 9 days if live lice are still seen. A concern is the high alcohol content of the product (78% isopropyl alcohol), which makes it highly flammable. Patients and their parents, therefore, should be instructed to allow the hair to dry naturally; not to use a hair dryer, curling iron, or flat iron while the hair is wet; and not to smoke near a child receiving treatment. Safety and effectiveness of malathion lotion have not been established in children younger than 6 years, and the product is contraindicated in children younger than 24 months. Because malathion is a cholinesterase inhibitor, there is a theoretical risk of respiratory depression if accidentally ingested, although no such cases have been reported.

Benzyl Alcohol 5%

Benzyl alcohol 5% (Ulesfia [Sciele Pharma, Atlanta, GA]) was approved by the US Food and Drug Administration (FDA) in April 2009 for treatment of head lice in children older than 6 months. The product is not neurotoxic and kills head lice by asphyxiation. Two studies demonstrated that more than 75% of the subjects treated were free of lice 14 days after initial treatment. The most common adverse reactions after treatment included pruritus, erythema, pyoderma, and ocular irritation. Benzyl alcohol is available by prescription and is not ovicidal: package instructions state that it is to be applied topically for 10 minutes and repeated in 7 days,[40] although as with other nonovicidal products, consideration should be given to retreating in 9 days or using 3 treatment cycles (days 0, 7, and 13–15), as mentioned previously.

Lindane (1%)

On the market since 1951 for the medical treatment of lice and scabies, lindane (Kwell [Reed & Carnick, Jersey City, NJ]) is an organochloride that has central nervous system toxicity in humans; several cases of severe seizures in children using lindane have been reported.[9,41–44] For the treatment of head lice, it is available only by prescription as a 1% lindane shampoo that should be left on for no more than 4 minutes, and a repeat application should be performed in 9 to 10 days. It has low ovicidal activity (30%–50% of eggs are not killed[29]), and resistance has been reported worldwide for many years.[3,45] For these reasons, it should be used cautiously.[30] The FDA has warned that lindane shampoo should only be used for patients who cannot tolerate or whose infestation has failed to respond to first-line treatment with safer medications for the treatment of head lice. The FDA has issued a public health advisory concerning the use of lindane, which emphasized that it is a second-line treatment, is contraindicated for use in neonates, and should be used with extreme caution in chil-

dren and in individuals who weigh less than 50 kg (110 lb) and in those who have HIV infection or take certain medications that can lower the seizure threshold.[46] Lindane is no longer recommended by the American Academy of Pediatrics (*Red Book* 2009[47]) or the *Medical Letter* for use as a pediculicide. The use of lindane has been banned in California.

Removal of Topical Pediculicides

All topical pediculicides should be rinsed from the hair over a sink rather than in the shower or bath to limit skin exposure and with warm rather than hot water to minimize absorption attributable to vasodilation.[48]

Topical Reactions

Itching or mild burning of the scalp caused by inflammation of the skin in response to topical pharmaceutical agents can persist for many days after lice are killed and is not a reason for re-treatment. Topical corticosteroids and oral antihistamines may be beneficial for relieving these signs and symptoms.

Scabicides Used Off-label for Lice

Permethrin (5%)

Five percent permethrin (Elimite [Allergan, Irvine, CA]) is available by prescription only as a cream, usually applied overnight for scabies for infants as young as 2 months. It has anecdotally been recommended for the treatment of head lice that seem to be recalcitrant to other treatments.[49] No randomized case-control studies have reported efficacy to date. The results of 1 study suggested that lice resistant to 1% permethrin will not succumb to higher concentrations.[34] Permethrin 5% is not currently approved by the FDA for use as a pediculicide.

Crotamiton (10%)

This product is available by prescription only as a lotion (Eurax [Westwood-Squibb Pharmaceuticals, Buffalo, NY]), usually used to treat scabies. One study showed it to be effective against head lice when applied to the scalp and left on for 24 hours before rinsing out.[50] Other reports have suggested that 2 consecutive nighttime applications safely eradicate lice from adults.[51] Safety and absorption in children, adults, and pregnant women have not been evaluated. Crotamiton is not currently approved by the FDA for use as a pediculicide.

Oral Agents Used Off-Label for Lice

Ivermectin

This product (Stromectol [Merck & Co, West Point, PA]) is an anthelmintic agent structurally similar to macrolide antibiotic agents but without antibacterial activity. A single oral dose of 200 μg/kg, repeated in 10 days, has been shown to be effective against head lice.[52,53] Most recently, a single oral dose of 400 μg/kg repeated in 7 days has been shown to be more effective than 0.5% malathion lotion.[54] Ivermectin may cross the blood/brain barrier and block essential neural transmission; young children may be at higher risk of this adverse drug reaction. Therefore, ivermectin should not be used for children who weigh less than 15 kg.[55,56] Ivermectin is also available as a 1% topical preparation that is applied for 10 minutes and has shown promising results that warrant further testing.[6] However, neither form of ivermectin is currently approved by the FDA as a pediculicide.

Sulfamethoxazole-Trimethoprim

The oral antibiotic agent sulfamethoxazole-trimethoprim (Septra [GlaxoSmith-Kline], Bactrim [Roche Laboratories, Nutley, NJ], and generic cotrimoxazole) has been cited as effective against head lice.[57] It is postulated that this antibiotic agent kills the symbiotic bacteria in the gut of the louse or perhaps has a direct toxic effect on the louse. The results of 1 study indicated increased effectiveness when sulfamethoxazole-trimethoprim was given in combination with permethrin 1% when compared with permethrin 1% or sulfamethoxazole-trimethoprim alone; however, the treatment groups were small.[58] Rare severe allergic reactions (Stevens-Johnson syndrome) to this medication make it a potentially undesirable therapy if alternative treatments exist.[9] It is not currently approved by the FDA for use as a pediculicide.

"Natural" Products

Essential oils have been widely used in traditional medicine for the eradication of head lice, but because of the variability of their constitution, the effects may not be reproducible.[59] Several products are marketed for treatment of head lice and are in wide use. As natural products, they are not required to meet FDA efficacy and safety standards for pharmaceuticals. Hair-Clean 1-2-3 (Quantum Health, Eugene, OR) [anise, ylang-ylang, coconut oils, and isopropyl alcohol] was found to be at least as effective as the permethrin product Nix by 1 investigator.[2] Although many plants naturally produce insecticides for their own protection that may be synthesized for use by humans, such as pyrethroids, some of these insecticidal chemicals produce toxic effects as well. The safety and efficacy of herbal products are currently not regulated by the FDA the same as medications.

Occlusive Agents

Occlusive agents applied to suffocate the lice are widely used but have not been evaluated for effectiveness in randomized, controlled trials. A "petrolatum shampoo" consisting of 30 to 40 g of standard petroleum jelly massaged on the entire surface of the hair and scalp and left on overnight with a

shower cap has been suggested. Diligent shampooing is usually necessary for at least the next 7 to 10 days to remove the residue. It is thought that the viscous substance obstructs the respiratory spiracles of the adult louse as well as the holes in the operculum of the eggs and blocks efficient air exchange.[60] Another interpretation is that the intense, daily attention to hair grooming results in removal of all the lice and nits. Hair pomades are easier to remove but may not kill eggs, and treatment should be repeated weekly for 4 weeks.[61] Other occlusive substances have been suggested (mayonnaise, tub margarine, herbal oils, olive oil), but to date, only anecdotal information is available concerning effectiveness. One study that examined several "home remedies" (vinegar, isopropyl alcohol, olive oil, mayonnaise, melted butter, and petroleum jelly) revealed that the use of petroleum jelly caused the greatest egg mortality, allowing only 6% to hatch.[62]

A 2004 study reported a 96% "cure" rate with a suffocation-based pediculicide lotion applied to the hair, dried on with a hand-held hair dryer, left on overnight, and washed out the next morning. The process must be repeated once per week for 3 weeks. The product contained no neurotoxins and did not require nit removal or extensive house cleaning.[63] The study was criticized for being uncontrolled, with no blinding, randomization, or comparison group.[64] The lotion used in the study was later identified as Cetaphil cleanser [Galderma Laboratories, Fort Worth, TX],[65] and instructions for its use are available on the Internet.[66] It has not been approved by the FDA for use as a pediculicide.

Dimethicone lotion (4% long-chain linear silicone in a volatile silicone base) in two 8-hour treatments 1 week apart eradicated head lice in 69% of participants in the United Kingdom.[67] In the United States, the OTC product LiceMD (Combe Inc, White Plains, NY) contains dimethicone. Isopropyl myristate 50% (Resultz [Nycomed Canada Inc, Oakville, Ontario, Canada]), a hair rinse that dissolves the waxy exoskeleton of the louse, which leads to dehydration and death of the louse, has recently become available in Canada.[68,69]

Desiccation

The LouseBuster is a custom-built machine (available commercially in late 2009) that uses one 30-minute application of hot air in an attempt to desiccate the lice. One study showed that subjects had nearly 100% mortality of eggs and 80% mortality of hatched lice.[70] The machine is expensive, and the operator requires special training in its use. A regular blow-dryer should not be used in an attempt to accomplish this result, because investigators have shown that wind and blow-dryers can cause live lice to become airborne and, thus, potentially spread to others in the vicinity.

Other Agents

Flammable or toxic substances such as gasoline or kerosene should never be used. Products intended for animal use should not be used to treat head lice in humans.

Manual Removal

Removal of nits immediately after treatment with a pediculicide is not necessary to prevent spread, because only live lice cause an infestation. Individuals may want to remove nits for aesthetic reasons or to decrease diagnostic confusion. Because none of the pediculicides are 100% ovicidal, manual removal of nits (especially the ones within 1 cm of the scalp) after treatment with any product is recommended by some. Nit removal can be difficult and tedious.[71] Fine-toothed "nit combs" are available to make the process easier.[72,73] Studies have suggested that lice removed by combing and brushing are damaged and rarely survive.[16] In the United Kingdom, community campaigns have been launched using "bug-buster" combs and ordinary shampoo,[74,75] with everyone being instructed to shampoo hair twice per week for 2 weeks and to vigorously comb out wet hair each time. The wet hair seems to slow down the lice. Combing dry hair does not seem to have the same effect; a study conducted in Australia in which children combed their hair daily at school with an ordinary comb determined that it was not effective.[76] Some have postulated that vigorous dry combing or brushing in close quarters may even spread lice by making them airborne via static electricity. One study showed that manual removal is not as effective as pediculicides and does not improve results, even when used as an adjunct to pediculicide treatment.[77]

There are battery-powered "electronic" louse combs with oscillating teeth (Quantum MagiComb) that claim to remove live lice and nits as well as combs that resemble small "bug zappers" (LiceGuard Robi-Comb [ARR Health Technologies, Needham, MA]) that claim to kill live lice.[78] No randomized, case-controlled studies have been performed with either type of comb. Their instructions warn not to use on people with a seizure disorder or a pacemaker.

Some products are available that claim to loosen the "glue" that attaches nits to the hair shaft, thus making the process of "nit-picking" easier. Vinegar or vinegar-based products (Clear Lice Egg Remover Gel [Care Technologies]) are intended to be applied to the hair for 3 minutes before combing out the nits. No clinical benefit has been demonstrated.[9,61] This product has not been tested with and is not recommended for use with permethrin, because it may interfere with

permethrin's residual activity. A variety of other products, from acetone and bleach to vodka and WD-40 (WD-40 Company, San Diego, CA), have proved to be ineffective in loosening nits from the hair shaft[61] and present an unacceptable risk to the patient. It seems that nature has protected the louse by making the nit sheath similar in composition to the hair, so that agents designed to unravel the nit sheath can also damage human hair.[79]

Although effective for removing lice and eggs, shaving the head generally is not recommended, because it can be distressing to a child or parent.

New Products

As new products are introduced, it is important to consider effectiveness, safety, expense, availability, patient preference, and ease of application. Assessment of the severity of the infestation, the number of recurrences, the local levels of resistance to available pediculicides, and the potential for transmission are also critical when recommending newer products.[35]

Pediculicide Resistance

No currently available pediculicide is 100% ovicidal, and resistance to lindane, pyrethrins, permethrin, and the UK formulation of malathion has been reported.[38,39,41,80–83] This resistance is not unanticipated, because insects develop resistance to products over time. The actual prevalence of resistance to particular products is not known and can be regional. It is important that health care professionals recommend safe and effective products. When faced with a persistent case of head lice after using a pharmaceutical pediculicide, health care professionals must consider several possible explanations, including:

- misdiagnosis (no active infestation or misidentification);
- lack of adherence (patient unable or unwilling to follow treatment protocol);
- inadequate treatment (not using sufficient product to saturate hair);
- reinfestation (lice reacquired after treatment);
- lack of ovicidal or residual killing properties of the product (eggs not killed can hatch and cause self-reinfestation); and/or
- resistance of lice to the pediculicide.

If resistance is proven, and an active infestation is documented, benzyl alcohol 5% can be prescribed if the patient is older than 6 months, or malathion 0.5% can be prescribed if the patient is older than 24 months if safe use can be reasonably ensured. For younger patients, or if the parent cannot afford or does not wish to use a pediculicide, manual removal via wet combing or an occlusive method may be recommended, with emphasis on careful technique and the use of 2 to 4 properly timed treatment cycles.

ENVIRONMENTAL INTERVENTIONS

If a person is identified with head lice, all household members should be checked for head lice, and those with live lice or nits within 1 cm of the scalp should be treated. In addition, it is prudent to treat family members who share a bed with the person with infestation, even if no live lice are found. Fomite transmission is less likely than transmission by head-to-head contact[9]; however, it is prudent to clean hair care items and bedding used by the individual with infestation. One study revealed that head lice can transfer to pillowcases at night, but the incidence is low (4%). Changing just the pillowcase could minimize this risk of head lice transmission.[21] Only items that have been in contact with the head of the person with infestation in the 24 to 48 hours before treatment should be considered for cleaning, given the fact that louse survival off the scalp beyond 48 hours is extremely unlikely. Such items may include clothing, headgear, furniture, carpeting, and rugs. Washing, soaking, or drying items at temperatures greater than 130°F will kill stray lice or nits. Furniture, carpeting, car seats, and other fabrics or fabric-covered items can be vacuumed. Although head lice are able to survive for prolonged periods in chlorinated water, it is unlikely that there is a significant risk of transmission in swimming pools. One study revealed that submerged head lice became immobile and remained in place on 4 people infested with head lice after 30 minutes of swimming.[84] Pediculicide spray is not necessary and should not be used. Viable nits are unlikely to incubate and hatch at room temperatures; if they did, the nymphs would need to find a source of blood for feeding within hours of hatching. Although it is rarely necessary, items that cannot be washed can be bagged in plastic for 2 weeks, a time when any nits that may have survived would have hatched and nymphs would die without a source for feeding. Herculean cleaning measures are not beneficial.

CONTROL MEASURES IN SCHOOLS

Screening

Screening for nits alone is not an accurate way of predicting which children are or will become infested, and screening for live lice has not been proven to have a significant effect on the incidence of head lice in a school community over time.[2,12,24] In addition, such screening has not been shown to be cost-effective. In a prospective study of 1729 schoolchildren screened for head lice, only 31% of the 91 children with nits had concomitant live lice. Only 18% of those with nits alone converted to having an active infestation during 14 days of observation.[85]

Although children with at least 5 nits within 1 cm of the scalp were significantly more likely to develop an infestation than were those with fewer nits (32% vs 7%), only one-third of the children at higher risk converted to having an active infestation. School exclusion of children with nits alone would have resulted in many of these children missing school unnecessarily. In addition, head lice infestations have been shown to have low contagion in classrooms.[86] Using anecdotal information that described the implementation of a "zero-tolerance" program at an elementary school, 1 source reported an average of 20 missed days per student dismissed for infestation.[5] Another study evaluated how often schoolchildren were inappropriately diagnosed and treated. Children without infestation received applications of pyrethroid-based OTC products almost as often as children with active infestations (62% vs 70%). Noninfested children were excluded from school because of presumed lice infestation more frequently than were children who were infested.[7] The results of several descriptive studies have suggested that education of parents in diagnosing and managing head lice may be helpful.[86–89] Because of the lack of evidence of efficacy, routine classroom or school-wide screening should be discouraged.

It may be useful to provide information periodically about the diagnosis, treatment, and prevention of head lice to the families of all children. Parents should be encouraged to check their children's heads for lice regularly and if the child is symptomatic. School screenings do not take the place of these more careful parental checks.[18,89–91] It may be helpful for the school nurse or other trained person to check a student's head if he or she is demonstrating symptoms.

Management on the Day of Diagnosis

Because a child with an active head lice infestation likely has had the infestation for 1 month or more by the time it is discovered and poses little risk to others from the infestation, he or she should remain in class but be discouraged from close direct head contact with others. If a child is diagnosed with head lice, confidentiality must be maintained. The child's parent or guardian should be notified that day by telephone or by having a note sent home with the child at the end of the school day stating that prompt, proper treatment of this condition is in the best interest of the child and his or her classmates. Common sense should prevail when deciding how "contagious" an individual child may be (a child with hundreds versus a child with 2 live lice). It may be prudent to check other children who were most likely to have had direct head-to-head contact with the infested child. In an elementary school, 1 way to deal with the problem is to notify the parents or guardians of children in an infested child's classroom, encouraging all children to be checked at home and treated, if appropriate, before returning to school the next day. Some experts argue that because of the relatively high prevalence of head lice in young school-aged children, it may make more sense to alert parents only if a high percentage of children in a classroom are infested. Other experts feel strongly that these "alert letters" cause unnecessary public alarm and reinforce the notion that a head lice infestation indicates a failure on the school's part rather than a community problem.[92] However, studies examining the efficacy of alert letters are not available; consequently, some schools choose to design guidelines that they believe best meet the needs of their student population, understanding that although a head lice infestation may not pose a public health risk, it may create a public relations dilemma for a school.

Criteria for Return to School

A child should not be restricted from school attendance because of lice, because head lice have low contagion within classrooms.[86] Some schools have had "no-nit" policies under which a child was not allowed to return to school until all nits were removed. However, most researchers agree that no-nit policies should be abandoned.[93] International guidelines established in 2007 for the effective control of head lice infestations stated that no-nit policies are unjust and should be discontinued, because they are based on misinformation rather than objective science.[94] The American Academy of Pediatrics and the National Association of School Nurses[95] discourage no-nit policies. However, nit removal may be considered for the following reasons:

- nit removal can decrease diagnostic confusion;
- nit removal can decrease the possibility of unnecessary re-treatment; and
- some experts recommend removal of nits within 1 cm of the scalp to decrease the small risk of self-reinfestation.

A knowledgeable school nurse, if present, can perform a valuable service by rechecking a child's head if requested to do so by a parent. In addition, the school nurse can offer extra help to families of children who are repeatedly or chronically infested. In rare instances, it may be helpful to make home visits or involve public health nurses to ensure that treatment is being conducted effectively. No child should be allowed to miss valuable school time because of head lice. Numerous anecdotal reports exist of children missing weeks of school and even being forced to repeat a grade because of head lice.[2,7,9,91]

Reassurance of Parents, Teachers, and Classmates

The school can be most helpful by making available accurate information about the diagnosis, treatment, and prevention of head lice in an understandable form to the entire school community. Information sheets in different languages and visual aids for families with limited literacy skills should be made available by schools and/or local health departments. If pediatricians and schools take the lead and react calmly, parents will be able to focus on appropriate treatment without becoming unduly upset.

Child Care and "Sleepover" Camps

Little information is available on the incidence and control of head lice outside of the school-aged population and outside of school. Because head lice are most readily transmitted by direct head-to-head contact, child care centers and camps where children share sleeping quarters may allow for easier spread. Reminding parents of the importance of carefully checking a child's head before and after a sleepover experience may be helpful.

SUMMARY OF KEY POINTS

1. No healthy child should be excluded from or allowed to miss school time because of head lice. No-nit policies for return to school should be abandoned.
2. Pediatricians should be knowledgeable about head lice infestations and treatments; they should take an active role as information resources for families, schools, and other community agencies.
3. Unless resistance to these products has been proven in the community, 1% permethrin or pyrethrins can be used for treatment of active infestations.
4. Instructions on the proper use of products should be carefully communicated. Because current products are not completely ovicidal, applying the product at least twice, at proper intervals, is recommended if permethrin or pyrethrin products are used or if live lice are seen after malathion therapy. Manual removal of nits immediately after treatment with a pediculicide is not necessary to prevent spread. In the school setting, nit removal may be considered to decrease diagnostic confusion.
5. If resistance to available OTC products has been proven in the community, if the patient is too young, or if parents do not wish to use a pediculicide, consider recommending "wet-combing" or an occlusive method (such as petroleum jelly or Cetaphil), with emphasis on careful technique, and repeating for at least 2 weekly cycles.
6. Benzyl alcohol 5% can be used for children older than 6 months, or malathion 0.5% can be used for children 2 years old or older, in areas where resistance to permethrin or pyrethrins has been demonstrated or for a patient with a documented infestation that has failed to respond to appropriately administered therapy with permethrin or pyrethrins.
7. New products should be evaluated for safety and effectiveness.
8. School personnel involved in detection of head lice infestation should be appropriately trained. The importance and difficulty of correctly diagnosing an active head lice infestation should be emphasized. Schools should examine any lice-related policies they have with this in mind.
9. Head lice screening programs have not been proven to have a significant effect over time on the incidence of head lice in the school setting and are not cost-effective. Parent education programs may be helpful in the management of head lice in the school setting.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Genetics

Health Care Supervision for Children With Williams Syndrome

ABSTRACT. This set of guidelines is designed to assist the pediatrician to care for children with Williams syndrome diagnosed by clinical features and with regional chromosomal microdeletion confirmed by fluorescence in situ hybridization.

ABBREVIATIONS. WS, Williams syndrome; FISH, fluorescence in situ hybridization.

INTRODUCTION

Williams syndrome (WS, also Williams-Beuren syndrome), now recognized to be caused by a microdeletion of chromosome 7, is a multisystem disorder first identified as a distinct clinical entity in 1961.[1] It is present at birth and affects boys and girls equally. As routine genetic amniocentesis does not typically detect chromosome microdeletions, children with WS usually come to the attention of pediatricians during infancy or childhood. Initially thought to be a rare genetic disorder, increased awareness of the clinical features and establishment of a reliable diagnostic test have revealed WS to be one of the more commonly recognized genetic disorders in childhood. Williams syndrome is characterized by dysmorphic facies (100%), cardiovascular disease (most commonly supravalvar aortic stenosis [80%]), mental retardation (75%), a characteristic cognitive profile (90%), and idiopathic hypercalcemia (15%)[2–5] (Table 1).

The diagnosis historically has been made on the basis of clinical criteria (Fig 1), but recently it has been shown that 99% of patients with WS have a hemizygous submicroscopic deletion of 7q11.23 detectable by fluorescence in situ hybridization (FISH).[6–8] Chromosome analysis and the Williams Syndrome Chromosomal Region FISH test are recommended for confirmation of the diagnosis. (A child with the clinical features of WS and a negative FISH result should be referred to a clinical geneticist for further evaluation.) The deleted portion of the chromosome includes the *ELN* gene that codes for the structural protein elastin, an important component of the elastic fibers found in the connective tissue of many organs. The *elastin* deletion explains some of the characteristics of WS, such as some of the facial features, hoarse voice, bladder and bowel diverticula, cardiovascular disease, and orthopedic problems. The pathogenesis of other characteristics, such as hypercalcemia, mental retardation, and unique personality traits, remains unexplained. One possibility is that the loss of 1 or more genes contiguous to the *ELN* gene contributes to the phenotype.

The pediatrician can use knowledge of the clinical manifestations (Table 1) and natural history of WS to anticipate medical problems and to educate the family. Most children with WS are described as having similar facial features.[4,9] Although these features are often subtle, they tend to become more distinctive with advancing age. Facial features often include periorbital fullness, short nose with bulbous nasal tip, long philtrum, wide mouth, full lips, and mild micrognathia. Infants have full cheeks and a flat facial profile, whereas older children and adults often have a long narrow face and a long neck.[10,11] Blue- and green-eyed children with WS have a prominent "starburst" pattern to their irides (stellate iris).[12] Mild prenatal growth deficiency and a postnatal growth rate about 75% of normal are consistently observed features of the condition.[8,13]

The majority of children with WS have cardiovascular anomalies.[1,2,4] The most common cardiovascular defect is supravalvar aortic stenosis, an often progressive condition that may require surgical repair.[10,11] Peripheral pulmonary artery stenosis is often present in infancy and usually improves over time. Coarctation of the aorta, renal artery stenosis, and systemic hypertension are complications that when present may worsen over time.[4,11,14,15] Because the elastin protein is an important component of elastic fibers in the arterial wall, any artery may become narrowed.

Idiopathic infantile hypercalcemia is an intriguing feature of WS that can contribute to the presence of extreme irritability, vomiting, constipation, and muscle cramps associated with this condition.[4,9] Symptomatic hypercalcemia usually resolves during childhood, but lifelong abnormalities of calcium and vitamin D metabolism may persist. Hypercalciuria is common and predisposes to nephrocalcinosis. The cause of the abnormality in calcium metabolism is unknown.

An infant with WS often has difficulty feeding and may be brought for medical care because of gastroesophageal reflux, colic, or failure to thrive.[4,9,16] Other medical problems include Chiari I malformation, strabismus,[12] hyperopia,[12] chronic otitis media, hypodontia, malocclusion, bowel or bladder diverticula, hernias, joint laxity, joint contractures,[17] kyphosis, lordosis, renal or urinary tract malformations,[14,15] hypothyroidism, and rectal prolapse.

Children with WS have a unique cognitive and

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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TABLE 1. Medical Problems in Williams Syndrome* by Organ System and Age

Organ System	Incidence (%)	Age		
		Infancy	Childhood	Adult
Ocular and visual				
Esotropia	50	x		
Hyperopia	50		x	x
Auditory				
Chronic otitis media	50	x	x	
Hypersensitivity to sound	90	x	x	x
Dental				
Malocclusion	85		x	x
Microdontia	95		x	x
Cardiovascular				
Any abnormality (total)	80	x	x	x
SVAS	75	x	x	x
SVPS	25	x	x	x
PPS	50	x		
Renal artery stenosis	45	x	x	x
Other arterial stenosis	20		x	x
VSD	10	x		
Hypertension	50		x	x
Genitourinary				
Structural anomaly	20	x	x	x
Enuresis	50		x	
Nephrocalcinosis	<5	x	x	x
Recurrent urinary tract infections	30			x
Gastrointestinal				
Feeding difficulties	70	x	x	
Constipation	40	x	x	x
Colon diverticula	30		x	x
Rectal prolapse	15	x	x	
Integument				
Soft lax skin	90	x	x	x
Inguinal hernia	40	x		
Umbilical hernia	50	x		
Prematurely gray hair	90			x
Musculoskeletal				
Joint hypermobility	90	x	x	
Joint contractures	50	x	x	x
Radioulnar synostosis	20	x	x	x
Kyphosis	20			x
Lordosis	40		x	x
Awkward gait	60		x	x
Calcium				
Hypercalcemia	15	x		x
Hypercalciuria	30	x	x	x
Endocrine				
Hypothyroidism	2	x	x	x
Early puberty (but rarely true precocious puberty)	50		x	
Diabetes mellitus	15			x
Obesity	30			x
Neurologic				
Hyperactive deep tendon reflexes	75		x	x
Chiari I malformation	10	x	x	x
Hypotonia (central)	80	x	x	
Hypertonia (peripheral)	50		x	x
Cognitive				
Developmental delay	95	x	x	
Mental retardation	75		x	x
Borderline intellectual functioning	20		x	x
Normal intelligence	5		x	x
Impaired visuospatial constructive cognition	95		x	x
Behavioral				
Attention-deficit hyperactivity disorder	70		x	
Generalized anxiety disorder	80		x	x

* Percentages based on the following: 1) review of rates of complications in several reports of series of patients with Williams syndrome, and 2) database of 315 children and adults with Williams syndrome evaluated by Colleen A. Morris, MD. SVAS indicates supravalvar aortic stenosis; SVPS, supravalvular pulmonic stenosis, PPS, peripheral pulmonary artery stenosis; and VSD, ventricular septal defect.

behavioral profile.[3,5,18] Cognitive, motor, and language delay are universal, and in 75% of the children, mental retardation is ultimately diagnosed.[19,20] Older children demonstrate a relative strength in language and auditory memory, with a significant weakness in visuospatial cognition.[5,18] Behavioral problems may include hypersensitivity to sound, sleep problems, attention-deficit/hyperactivity disorder,[20] and anxiety. Overfriendliness and an empathetic nature are commonly observed.[17]

Scored Points*

Growth (Past or Present Evidence of) ***If 3 of 5 items are checked, score 1 point*** _____

[ ] Post-term birth > 41 wk gestation
[ ] Prolonged colic > 4 m irritability
[ ] Failure to thrive/height and weight < 5th percentile
[ ] Chronic constipation
[ ] Vomiting or gastroesophageal reflux

Behavior and Development ***If 3 of 6 items are checked, score 1 point*** _____

[ ] Overly friendly personality
[ ] Visuospatial problems
[ ] Hypersensitivity to sound
[ ] Delayed speech acquisition, followed by excessive talking
[ ] Anxiety
[ ] Developmental delay or mental retardation

Facial Features ***If 8 of 17 items are checked, score 3 points*** _____

[ ] Bitemporal narrowing
[ ] Broad brow
[ ] Epicanthal folds or flat nasal bridge
[ ] Periorbital fullness
[ ] Strabismus (present or past)
[ ] Stellate lacy iris pattern
[ ] Short nose or anteversion of nares
[ ] Bulbous or full nasal tip
[ ] Full cheeks
[ ] Malar hypoplasia (flat cheek bones)
[ ] Long philtrum
[ ] Full prominent lips
[ ] Small, widely spaced teeth
[ ] Malocclusion
[ ] Wide mouth
[ ] Small jaw
[ ] Prominent ear lobes

Cardiovascular Problems (by Echocardiography) (a) ***If 1 of 2 items are checked, score 5 points*** _____

[ ] SVAS†
[ ] Peripheral pulmonary artery stenosis

Cardiovascular Problems (b) ***If 1 of 3 items are checked, score 1 point*** _____

[ ] Other congenital heart disease
[ ] Hypertension
[ ] Cardiac murmur

Connective Tissue Abnormality ***If 2 of 6 items are checked, score 2 points*** _____

[ ] Hoarse voice
[ ] Long neck or sloped shoulders
[ ] Inguinal hernia
[ ] Joint limitation or laxity
[ ] Bowel or bladder diverticula
[ ] Rectal prolapse

Calcium Studies ***If 1 of 2 items are checked, score 2 points*** _____

[ ] Hypercalcemia
[ ] Hypercalciuria

Total Points: _____

* If the score is < 3, a diagnosis of Williams syndrome is unlikely. If the score is ≥ 3, FISH studies should be considered. (Mean score for Williams syndrome was 9 [standard deviation = 2.86]. The scoring system is based on a study of 107 persons with Williams syndrome [confirmed by FISH] evaluated by Colleen A. Morris, MD; Frank Greenberg, MD; Paige Kaplan, MD; Martin Levinson, MD; and Barbara Pober, MD; with data analysis by Carolyn B. Mervis, PhD and Byron F. Robinson, MA; presented at the 1994 Williams Syndrome Association Convention; July 31, 1994; San Diego, CA.)

† If supravalvar aortic stenosis (SVAS) is present, referral to a geneticist and FISH studies are recommended.

Fig 1. Williams syndrome diagnostic scoring table: clinical diagnosis.

The medical care of children with WS requires an understanding of the natural history of the disorder, awareness of potential clinical complications, and ongoing assessment and periodic review at appropriate ages (Fig 2). Because the clinical manifestations during the neonatal period are variable, the diagnosis may not be suspected during early infancy. Accordingly, this statement includes a series of evaluations that should be considered at the time the diagnosis is suspected clinically; the diagnosis

	Infancy (NB - 1 Year)					Early Childhood (1-5 Years)						Late Childhood	Adolescence
	Neonatal	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	24 mos	3 yr	4 yr	5-13 yrs Annual	13-21 yrs Annual
Diagnosis													
Karyotype/FISH Review†	•												
Phenotype Review†	•												
Recurrence Risks†	•												
Anticipatory Guidance													
Early Intervention	•	•	•	•	•	•	•	•	•				
Family Support	•	•	•	•	•	•	•	•	•	•	•	•	•
Support Groups†	•	•				•						• ¶	
Long-term Planning						•						• ¶	• ¶
Sexuality												•	•
Therapy (pt, ot, speech)										§ **		§ **	§ **
Medical Evaluation													
Growth feeding	o	o	o	o	o	o	o	o	o	o	o	o	o
Thyroid Screening	o ‖											o #	o #
Hearing Screening			s/o			s/o ‡			s/o ‡		s/o ‡	s/o ¶	s/o ¶
Vision Screening	s/o	s/o	s/o	s/o	s/o ‡	s/o			s/o	s/o	s/o ‡	s/o §	s/o §
2-Arm Blood Pressure	o			o		o			o	o	o	o	o
Cardiology Evaluation†	**					**			**	**	†	** ¶ §	** ¶ §
UA/BUN/Cr†	o					o			o	o	o	o #	o #
Urine Ca/Cr†	o ††					o				o		o ¶	o ¶
Serum Calcium†	o								o			o	o
Renal Ultrasonography†	o												
Musculaskeletal Eval	o					o			o	o	o	o	o
Pneumorax									•				
Psychosocial													
Development	s/o	s/o	s/o	s/o	s/o	s/o	s/o	s/o	s/o	s/o	s/o	s/o	s/o
School Performance										o	o	o	o
Socialization						s			s			s	s

*Assure compliance with the AAP "Recommendations for Preventive Pediatric Health Care
†Or at time of diagnosis
‡Discuss referral to specialist
§As needed
**Referral

‖Per state law
¶Once in this age group
#Every 2 years
††If hypercalciuria found, 2 repeat carine calcium (am and pm) should be sent. If still positive, repeat serum calcium, renal ultrasound for nephrocalcinosis and initiate dietary counseling
• = To be performed
S = Subjective (by history)
O = Ojbective (by a standard testing method)

Fig 2. Health supervision for children with Williams syndrome*.

should be confirmed by FISH analysis. The evaluations include the following:

- Complete physical and neurologic examination
- Growth parameters plotted on WS growth charts (Fig 3A–F)
- Cardiology evaluation
  –Full clinical evaluation by a cardiologist with expertise and experience in pediatric patients that includes 4-limb blood pressure measurements and echocardiography
- Genitourinary system evaluation
  –Ultrasonography of bladder and kidneys
  –Renal function studies (serum urea nitrogen and creatinine levels)
  –Urinalysis
- Calcium determinations (serum calcium, spot urine calcium, and creatinine levels) (Table 2)
- Thyroid function tests
- Ophthalmologic evaluation
- Multidisciplinary developmental evaluation (older than 2 years)
- FISH to determine ELN deletion

Referral to a clinical geneticist should be considered for individualized assessment and recommendations; a more extensive discussion of the clinical manifestations, natural history, recurrence risks, and future reproductive options; and evaluation of genetic risks for other family members.

SPECIAL CONSIDERATIONS FOR THE CHILD DIAGNOSED WITH WS

1. Do *not* give multivitamin preparations to children with WS because of the potential deleterious effects of vitamin D. Recommend diligent use of sunscreen to minimize autologous production of vitamin D.
2. Perform periodic cardiovascular evaluations, even after a baseline examination with normal findings.
3. Baseline cardiology evaluation should be performed by a cardiologist with pediatric expertise and experience.
4. Screen for the development of hypertension periodically according to guidelines of the American Academy of Pediatrics.
5. Establish a medical home with clear emphasis on continuity of care and the role of the family members as partners in the ongoing management and care of the child.

HEALTH SUPERVISION FROM BIRTH TO 1 YEAR (INFANCY)

Examination

1. Review and note clinical features and confirm diagnosis with FISH analysis
2. Routine health maintenance examinations and baseline evaluation
3. Growth and developmental evaluations using WS growth charts (Fig 3A–F)
4. Baseline cardiology evaluation by a cardiologist with pediatric expertise and experience
5. Review feeding issues (reflux, refusal, disordered suck or swallow, vomiting or symptoms of colic).
6. Consider pediatric ophthalmologic evaluation for strabismus, amblyopia, and refractive errors
7. Check for inguinal hernia
8. Objective hearing assessment at 6 to 12 months (recurrent otitis media is common)
9. Blood pressure measurement (both arms) annually and careful evaluation of femoral pulses
10. Early recognition and management of constipation
11. Pediatric anesthesia consultation for any child requiring surgery (several reports of unexpected deaths have been associated with the administration of anesthesia)[22]

Laboratory

1. Williams Syndrome Chromosomal Region FISH to confirm clinical diagnosis
2. Serum creatinine level
3. Urinalysis
4. Calcium levels
   a. Serum*
   b. Spot urine test to determine calcium-creatinine ratio†
5. Thyroid screen for newborns (according to state mandate)
6. Baseline ultrasonographic examination of the bladder and kidneys

Anticipatory Guidance

1. Individual support for the family (by family, friends, clergy), support groups, or both (see list)
2. Review increased risk for otitis media
3. Feeding (difficulty in transition to textured foods)
4. Do *not* prescribe multivitamin preparations containing vitamin D
5. Refer to early childhood intervention program

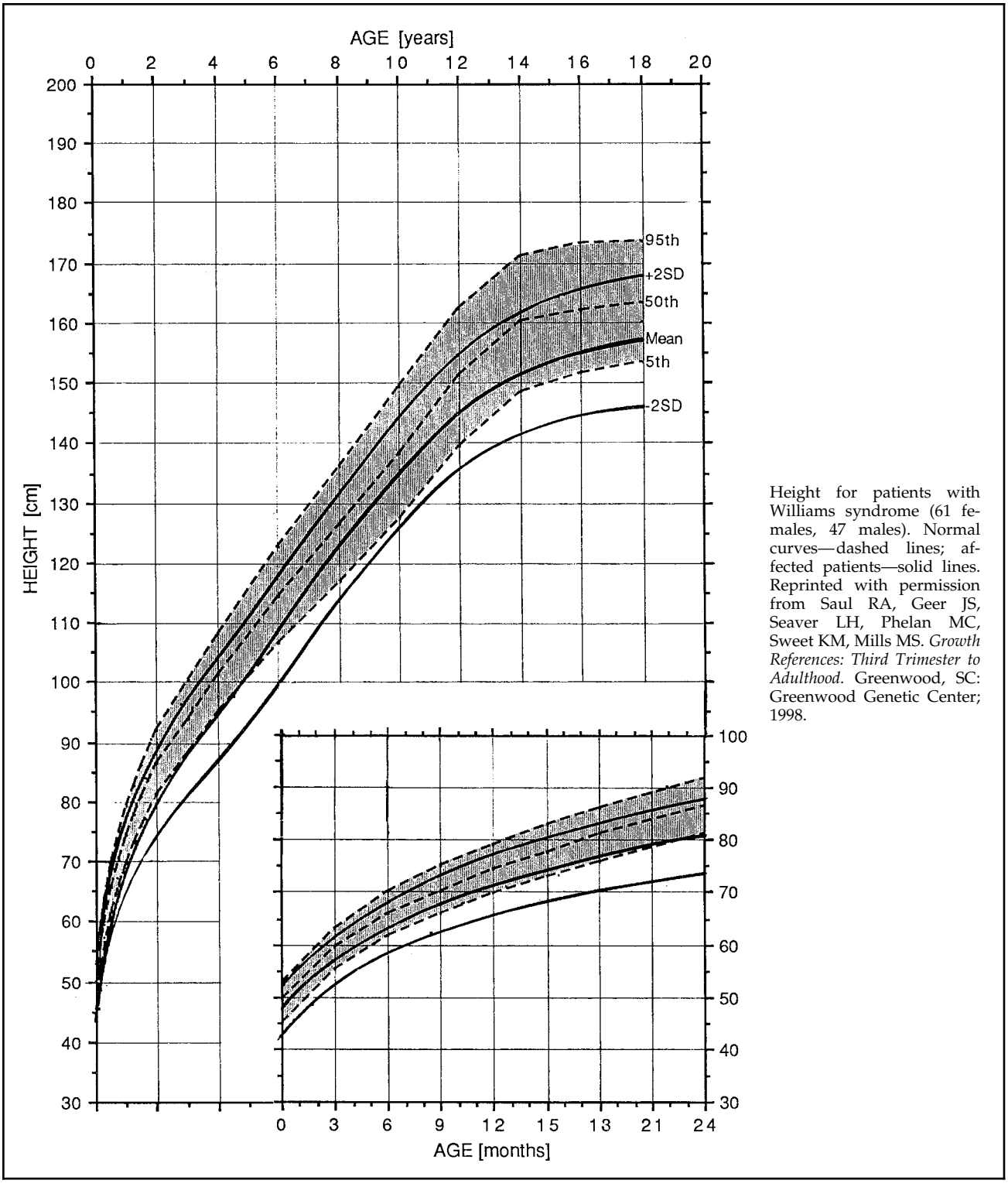
HEALTH SUPERVISION FROM 1 TO 5 YEARS (EARLY CHILDHOOD)

Examination

1. Annual health maintenance examinations and baseline evaluation (including careful auscultation of chest and abdomen for murmurs or bruits)
2. Developmental evaluation and growth evaluation using WS growth charts (Fig 3A–F)
3. Annual cardiology evaluation from 1 to 5 years
4. Feeding issues: watch for rectal prolapse and avoid constipation with stool softeners if necessary
5. Annual hearing and vision screening; objective audiologic evaluation and an ophthalmologic evaluation before age 3 years
6. Orthopedic issues: musculoskeletal and neurologic assessments to evaluate joints, muscle tone, spasticity, and hyperactive reflexes[17]

*If hypercalcemia is found, dietary calcium restriction should be implemented and diet should be monitored in conjunction with a pediatric dietician/nutritionist. Referral to a pediatric renal specialist should be considered.

†If hypercalciuria is found, 2 repeated urine studies of the calcium-creatinine ratio (morning and afternoon) should be performed. If the level is still elevated, repeat measurement of the serum calcium level and perform renal ultrasonography for nephrocalcinosis. Assess dietary calcium intake.[21]



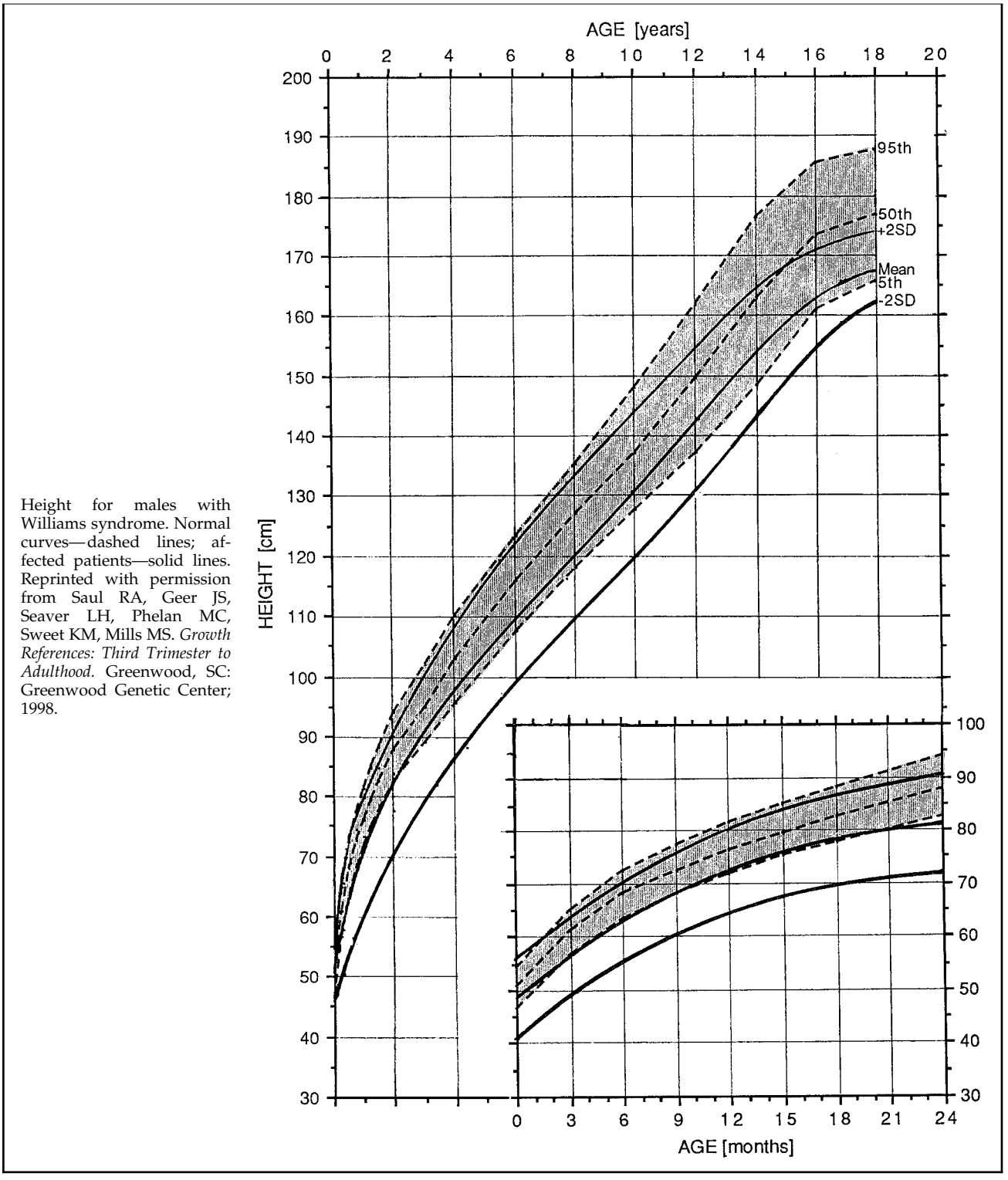
Height for patients with Williams syndrome (61 females, 47 males). Normal curves—dashed lines; affected patients—solid lines. Reprinted with permission from Saul RA, Geer JS, Seaver LH, Phelan MC, Sweet KM, Mills MS. *Growth References: Third Trimester to Adulthood*. Greenwood, SC: Greenwood Genetic Center; 1998.

Fig 3A. Williams syndrome—stature, females.

7. Pediatric anesthesia consultation for any child requiring surgery (several reports of unexpected deaths have been associated with the administration of anesthesia)[22]
8. Annual blood pressure measurement (both arms) and careful examination of femoral pulses
9. Multidisciplinary developmental assessment and treatment in early intervention programs (0–3 years) or school based programs (3 years and older)[1,5,19]
10. Dental referral

Laboratory

1. Yearly urinalysis
2. Annual total calcium measurement if the level was elevated at baseline or as needed if the child becomes symptomatic; if level was normal, measure every 2 to 3 years
3. Urinary calcium-creatinine ratio every 2 years
4. Thyroid function test every 4 years



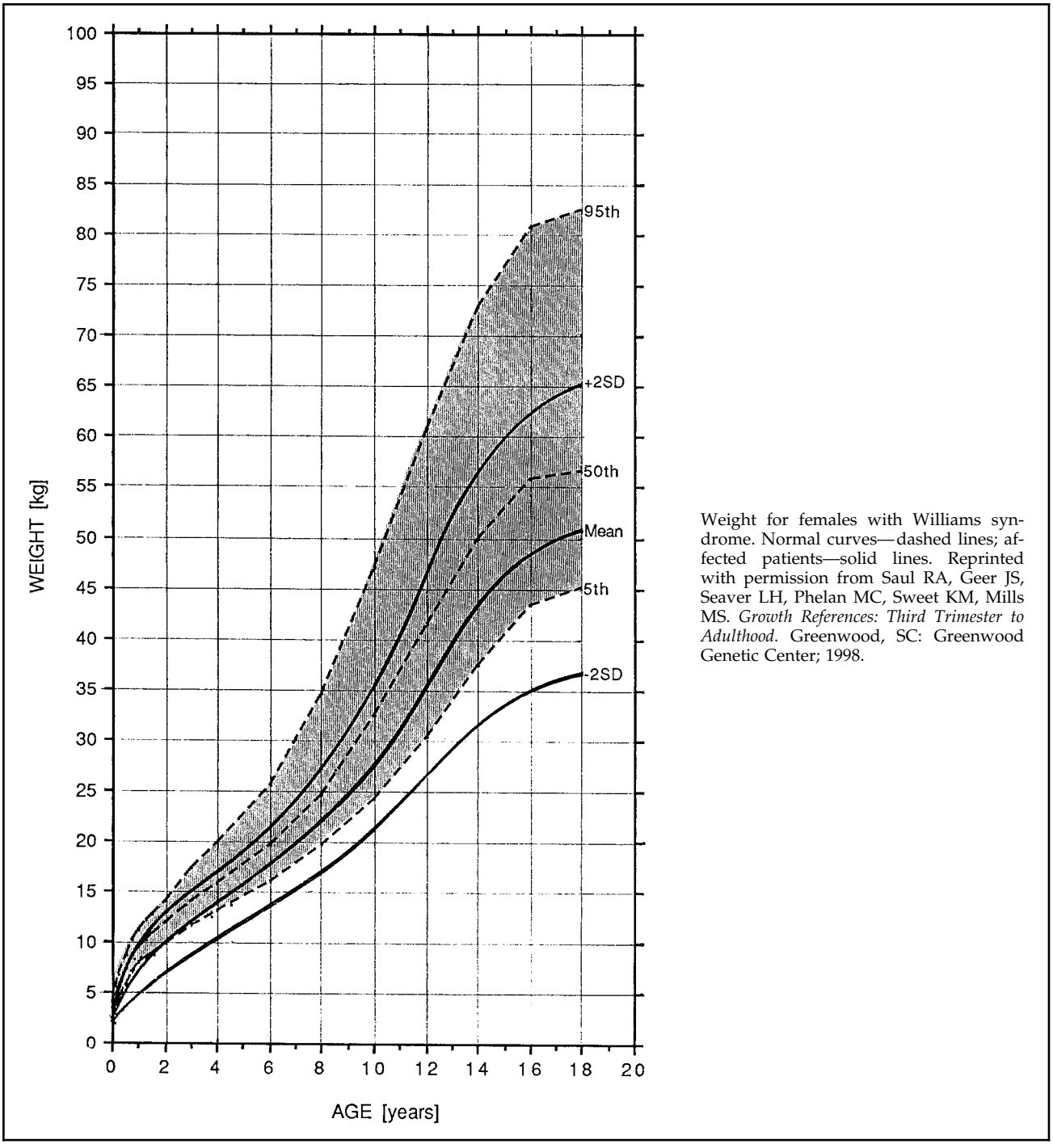
Height for males with Williams syndrome. Normal curves—dashed lines; affected patients—solid lines. Reprinted with permission from Saul RA, Geer JS, Seaver LH, Phelan MC, Sweet KM, Mills MS. *Growth References: Third Trimester to Adulthood.* Greenwood, SC: Greenwood Genetic Center; 1998.

Fig 3B. Williams syndrome—stature, males.

5. Serum creatinine level every 4 years

Anticipatory Guidance

1. Individual support for the family (by family, friends, clergy), support groups, or both
2. Review increased risk for otitis media
3. Ongoing feeding and dietary assessments
4. Therapy as needed (physical, speech and language, and occupational, including sensory integration)
5. Review constipation as a possible problem
6. Children with unexplained fever should be evaluated for urinary tract infection
7. Discuss developmental status, early intervention programs, and preschool programs



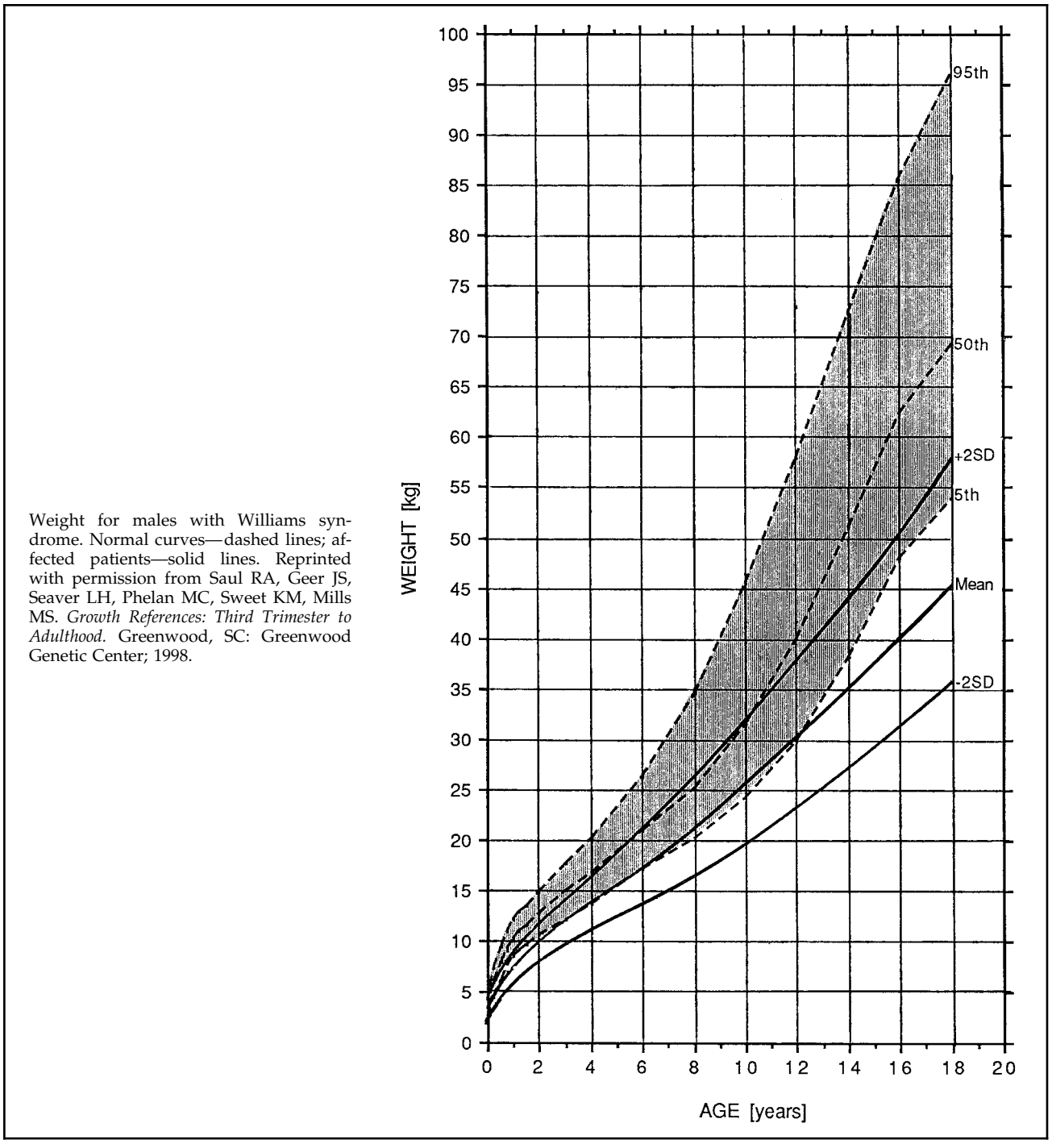
Weight for females with Williams syndrome. Normal curves—dashed lines; affected patients—solid lines. Reprinted with permission from Saul RA, Geer JS, Seaver LH, Phelan MC, Sweet KM, Mills MS. *Growth References: Third Trimester to Adulthood*. Greenwood, SC: Greenwood Genetic Center; 1998.

Fig 3C. Williams syndrome—weight, females.

HEALTH SUPERVISION FROM 5 YEARS TO 12 YEARS (LATE CHILDHOOD)

Examination

1. Annual health maintenance examinations and baseline evaluation
2. Developmental evaluation and growth evaluation using WS growth charts (Fig 3A–F)
3. Annual blood pressure measurements (both arms) and careful evaluation of femoral pulses
4. Cardiology evaluation as indicated by previous clinical findings. If results of previous evaluations are negative, repeated cardiology evaluation (for arterial stenoses, hypertension) should be performed at puberty
5. Ophthalmologic evaluation for strabismus and hyperopia
6. Orthopedic problems (eg, joint limitation, kyphosis, lordosis, scoliosis, and spasticity)



Weight for males with Williams syndrome. Normal curves—dashed lines; affected patients—solid lines. Reprinted with permission from Saul RA, Geer JS, Seaver LH, Phelan MC, Sweet KM, Mills MS. *Growth References: Third Trimester to Adulthood.* Greenwood, SC: Greenwood Genetic Center; 1998.

Fig 3D. Williams syndrome—weight, males.

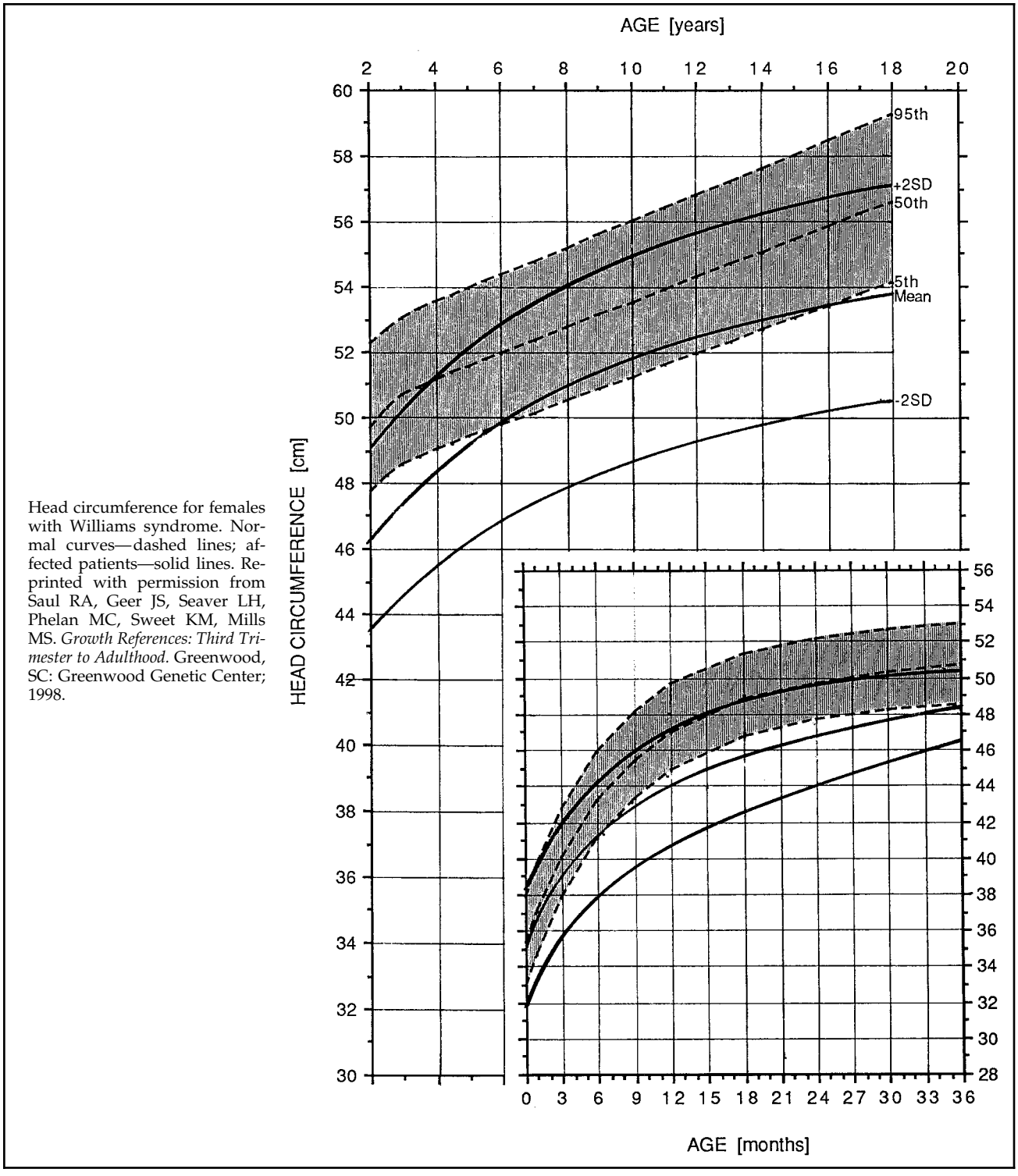
7. Hearing and vision screening annually
8. Pediatric anesthesia consultation for any child requiring surgery (several reports of unexpected deaths have been associated with the administration of anesthesia[22])
9. School readiness and placement and Individual Educational Plan at 5 years
10. Developmental and psychoeducational assessment; formal evaluation for attention-deficit hyperactivity disorder, anxiety, or both and discussion of treatment options[23]

Laboratory

1. Yearly urinalysis
2. Thyroid function tests every 4 years
3. Annual total calcium level if baseline result was elevated or child becomes symptomatic; otherwise measure level every 4 years
4. Urinary calcium-creatinine ratio every 2 years
5. Serum creatinine level every 2 to 4 years

Anticipatory Guidance

1. School readiness and placement



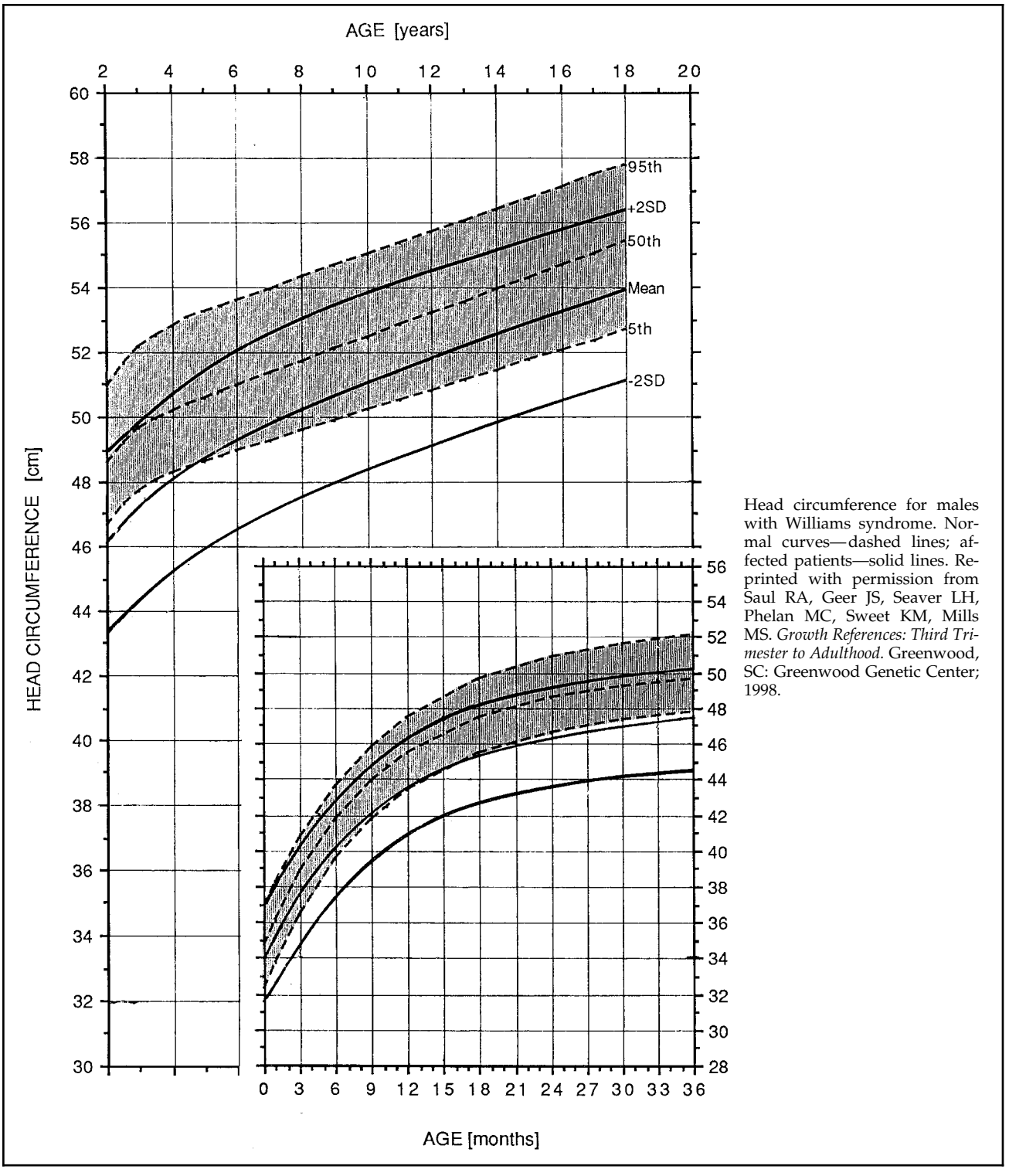
Head circumference for females with Williams syndrome. Normal curves—dashed lines; affected patients—solid lines. Reprinted with permission from Saul RA, Geer JS, Seaver LH, Phelan MC, Sweet KM, Mills MS. *Growth References: Third Trimester to Adulthood.* Greenwood, SC: Greenwood Genetic Center; 1998.

Fig 3E. Williams syndrome—head circumference, females.

2. Therapy as needed (physical, speech and language, and occupational, including sensory integration)
3. Long-term vocational planning
4. Discuss sexuality and adolescence; puberty is often early in WS, but true precocious puberty is rare
5. Discuss diet and exercise as obesity may become apparent in late childhood
6. Discuss treatment options for anxiety (counseling, relaxation techniques, and medications)
7. Estate planning for parents of a child with special needs

HEALTH SUPERVISION FROM 13 YEARS TO 18 YEARS (ADOLESCENCE)

Progressive medical problems including hypertension, progressive joint limitations, recurrent urinary



Head circumference for males with Williams syndrome. Normal curves—dashed lines; affected patients—solid lines. Reprinted with permission from Saul RA, Geer JS, Seaver LH, Phelan MC, Sweet KM, Mills MS. *Growth References: Third Trimester to Adulthood.* Greenwood, SC: Greenwood Genetic Center; 1998.

Fig 3F. Williams syndrome—head circumference, males.

tract infections, and gastrointestinal problems are common beginning in this age group and continuing throughout adult life.

Examination

1. Annual health maintenance examinations and baseline evaluation; blood pressure measurement (both arms)
2. Developmental evaluation and growth evaluation using WS growth charts (Fig 3A–F)
3. Cardiology evaluation if indicated by previous clinical findings
4. Pediatric anesthesia consultation for any child requiring surgery (several reports of unexpected deaths have been associated with the administration of anesthesia[22])
5. Consider ophthalmologic evaluation for hyperopia
6. Orthopedic problems (eg, joint limitation, kyphosis, lordosis, scoliosis, and spasticity)

TABLE 2. Normal Values for Random Urinary Calcium-Creatinine Ratios[21]

Age	Calcium-Creatinine Ratio (mg/mg ratio) (95th Percentile for Age)
<7 mo	0.86
7–18 mo	0.6
19 mo–6 y	0.42
Adults	0.22

7. Hearing and vision screening annually
8. Developmental and psychoeducational assessment; school placement and resource enhancement; vocational training; social skills training for peer interaction[10,11]
9. Gastrointestinal issues: consider diverticulitis and diverticulosis, cholelithiasis, and chronic constipation in adolescents with abdominal pain
10. Screen for generalized anxiety disorder[19]

Laboratory

1. Yearly urinalysis
2. Thyroid function test every 4 years
3. Total calcium level only if adolescent becomes symptomatic, otherwise, every 4 years
4. Urinary calcium-creatinine ratio every 2 years
5. Bladder and renal ultrasonography at puberty and every 5 years thereafter
6. Serum creatinine level every 2 to 4 years

Anticipatory Guidance

1. School placement
2. Therapy as needed (physical, occupational, speech, and language)
3. Discuss diagnosis with the adolescent; support groups for the adolescent (see American Academy of Pediatrics statement on "Transition of Care Provided for Adolescents With Special Needs")[24]
4. Discuss sexuality and reproductive issues
5. Encourage career counseling
6. Foster independence
7. Assist in transition to adult care (especially for cardiology care). Many pediatricians feel comfortable continuing to provide primary care well into young adulthood
8. Encourage daily exercise to include range of motion
9. Encourage prompt medical attention for urinary tract or gastrointestinal symptoms
10. Mental health issues

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RESOURCES FOR PARENTS

March of Dimes, 1275 Mamaroneck Ave, White Plains, NY 10605; Telephone: 914/428–7100; http. //www.modimes.org

The Williams Syndrome Association, PO Box 297, Clawson, MI 48017; Telephone: 248/541–3630; http://www.williams-syndrome.org

Williams Syndrome Foundation, University of California, Irvine, CA 92679; Telephone: 949/824–7259; http://www.wsf.org

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Health Care for Youth in the Juvenile Justice System

COMMITTEE ON ADOLESCENCE

KEY WORDS
juvenile justice, correctional health care, juvenile detention, mental health, substance abuse, reproductive health, financing of health care

ABBREVIATIONS
SES—socioeconomic status
TBI—traumatic brain injury
TB—tuberculosis
SYRP—Survey of Youth in Residential Placement
NCCHC—National Commission on Correctional Health Care
STI—sexually transmitted infection
CDC—Centers for Disease Control and Prevention

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abstract

FREE

Youth in the juvenile correctional system are a high-risk population who, in many cases, have unmet physical, developmental, and mental health needs. Multiple studies have found that some of these health issues occur at higher rates than in the general adolescent population. Although some youth in the juvenile justice system have interfaced with health care providers in their community on a regular basis, others have had inconsistent or nonexistent care. The health needs of these youth are commonly identified when they are admitted to a juvenile custodial facility. Pediatricians and other health care providers play an important role in the care of these youth, and continuity between the community and the correctional facility is crucial. This policy statement provides an overview of the health needs of youth in the juvenile correctional system, including existing resources and standards for care, financing of health care within correctional facilities, and evidence-based interventions. Recommendations are provided for the provision of health care services to youth in the juvenile correctional system as well as specific areas for advocacy efforts. *Pediatrics* 2011; 128:1219–1235

INTRODUCTION

Youth in the juvenile correctional system are a high-risk population[1–3] who, in many cases, have unmet physical, developmental, and mental health needs. Multiple studies have found that some of these health issues occur at higher rates than in the general adolescent population.[3,4–6] Although some youth in the juvenile justice system have interfaced with health care providers in their community on a regular basis, others have had inconsistent or nonexistent care. The health needs of these youth are commonly identified when they are admitted to a juvenile custodial facility. On-site correctional health care providers must not only try to identify these health issues but also determine if there has been active medical management in the community. Pediatricians and other health care providers play an important role in the care of these youth, and continuity between the community and the correctional facility is crucial.

EPIDEMIOLOGY OF JUVENILE ARRESTS

In 2008, 11 million juveniles younger than 18 years were arrested.[7] Two-thirds of those arrested were referred to juvenile court, and 10% were referred to the adult criminal court system. One-third of all juveniles arrested were female. Gender differences exist in patterns of arrest-related charges such that adolescent girls are more likely to have runaway and prostitution/vice offenses, whereas boys have a

higher proportion of arrests in all other categories (eg, violent and property crimes). Girls are also more likely than adolescent boys to fight with family members and become involved in domestic disturbances.[8] Racial differences were seen in juvenile arrest patterns. Although black youth only represent 16% of the 10- to 17-year-old population in the United States, they represented 52% of the Violent Crime Index arrests and 33% of the Property Crime Index arrests (see Table 1). The greatest racial disparities were seen with some of the most serious crimes—murder, robbery, and assault.[9]

Reasons for these racial disparities are complex and involve social context as well as individual characteristics and are not well understood. When comparing minority youth to white youth, differing opinions exist about the relative contributions of several factors including possible differential involvement in various offenses and inequalities in the treatment of minority youth compared with white youth once within the juvenile justice system.[10] Youth arrests and delinquent behavior have been related to lower socioeconomic status (SES), family disruption (marital separation, divorce), living in households with only 1 biological parent, less residential stability (length of time living in 1 location), poorer neighborhood collective efficacy (capacity of residents to achieve social control over the environment), and educational failure.[11–13] Overall, poverty is likely to be the underlying factor that most influences trends in juvenile crime.[13]

SES plays a significant role for black and Hispanic youth, because they are more likely to live in poverty than their white counterparts.[13] Educational failure is correlated with unemployment/underemployment. Studies have found that employment can prevent or reduce delinquent behavior. Lower educational attainment is most likely to affect black and Hispanic youth, who have higher dropout rates than their white counterparts.[13] Family structure influences youth socialization and the capability to control the youth's behavior.[12] Family structure, itself, is not the cause of a youth's behavior. Rather it is linked to other factors, as illustrated by the correlation between single-parent households and increased probability of living in poverty.[13] Black youth are most likely to be living in a single-parent household, and Hispanic youth are less likely than white youth to be living with both parents.[13]

Not all juvenile arrests result in a custodial placement in either a short-term detention facility (usually ≤3 months) awaiting adjudication or a longer-term postadjudication residential facility. Custody rates are higher for male adolescents than female adolescents. Girls are more likely to be held for technical violations, such as violating the terms of probation, or status offenses, such as running away, rather than more serious illegal activities[9] (see Table 1). Data on custody rates are similar to data on arrest rates, which demonstrate disproportionate contact of minority youth with law enforcement. Although minority youth represent only 39% of the US juvenile population, they represented 65% of the national juvenile custody population in 2006.[9] These data become particularly relevant when considering unmet mental and physical health needs, because poorer health status is related to lower SES, and lower SES is more likely to be found among minority youth (see "Sociodemographic Factors and Health Status").

In 2006, the median time in custodial placement was 65 days, including both short-term and long-term facilities. Eighty percent of postadjudicated youth were in the facility for at least 30 days, and 57% were in the facility for at least 90 days. Twelve percent were still in placement at 1 year.[9] A significant number of youth are incarcerated for a period of time that would permit health care providers to diagnose, assess, and treat them for identified health problems.

TABLE 1 Definitions of Crimes, Offenses, and Violations

Violent Crime Index
Murder and nonnegligent manslaughter
Forcible rape
Robbery
Aggravated assault
Property Crime Index
Burglary
Larceny-theft
Motor vehicle theft
Arson
Status offense: an offense that is illegal for a minor but would not be criminal if committed by an adult
Runaway
Truancy
Curfew violation
Underage drinking
Technical violation: violation of a court order
Probation violation
Curfew violation

SOCIODEMOGRAPHIC FACTORS AND HEALTH STATUS

The categories of health needs of youth in the correctional system are similar to those of their peers in the community. They include dermatologic, respiratory, dental, gastrointestinal, genitourinary, and metabolic problems as well as developmental and mental health issues. Other categories are influenced, in part, by the youth's engagement in high-risk behaviors such as violence, substance abuse, and sexual activity, which may be more prevalent than those of their peers in the general population.[5,14] Some health issues result from living in impoverished and abusive environments (eg, traumatic brain injury [TBI], lead exposure, positive tuberculosis [TB] test results, and poor dental care). Others are acquired health problems (eg, hy-

pertension, diabetes) that are neglected or remain undiagnosed.[15] In some instances, youth have had inadequate health care, because they have been runaways or living in inconsistent living situations that do not allow for continuity of care.

Underlying the poorer health status of youth in the juvenile justice system is SES. Just as lower SES is correlated with juvenile delinquency, lower SES—specifically, income inequality—has been shown to correlate with teen births, overweight, and mental health problems.[16] Minority youth, including black and Hispanic youth, who are overrepresented in the juvenile justice system in the United States, are more likely to live in lower-SES environments and have been found to have overall poorer health care than their white counterparts. Studies have shown significant disparities between white and minority youth aged 0 through 17 years in insurance coverage, lack of a usual source of care, use of the emergency department, and not receiving adequate mental health care, dental care, or prescription medications.[17] Factors other than SES may also be important. A recent review of the literature confirmed racial/ethnic disparities in adolescent health care. However, the results also suggested that some disparities are not totally understood and seem to be independent of SES.[18]

EXTENT OF MEDICAL PROBLEMS

Few studies have provided a broad national perspective on the health needs of youth in the juvenile correctional system in the United States. The most recently published information is from the Survey of Youth in Residential Placement (SYRP).[3] The findings in this report are based on interviews with a nationally representative sample of 7073 youth in custody during the spring of 2003. The information was obtained by using audio computer-assisted self-interview methodology and included youth at both short-term detention and longer-term residential treatment facilities. The survey revealed high rates of mental health and substance abuse problems as well as traumatic experiences with documented rates that exceeded those of the general adolescent population. More than two-thirds of youth in this survey reported a health care need, including injury, problems with vision or hearing, dental needs, or "other illness."

Although more than 20 years old, another study with a national scope was conducted in 1991 by the National Commission on Correctional Health Care (NCCHC).[5] The study included 1801 youth from 39 short-term or long-term correctional facilities in the United States. These youth had higher rates of substance abuse, trauma, unprotected sexual activity, history of sexually transmitted infections (STIs), suicidal ideation, and reported violence than those in a general high school population.

In the following sections, the data regarding general physical health issues are reviewed, and mental health and substance use/abuse diagnoses are addressed.

GENERAL PHYSICAL HEALTH ISSUES

In addition to the SYRP and NCCHC studies, 3 other studies that involved either a single facility or a region have provided important information. Two studies similarly found that approximately half of youth in these facilities had an identified medical problem. The first study, the results of which were published in 1980, included youth admitted during an 11-year period to a secure detention facility in New York[15]; the second study, the results of which were published in 2000, included youth from 15 detention and longer-term facilities in the Maryland Juvenile Justice System.[19] The third study involved youth admitted to a detention center in Alabama in the mid-1990s and found that although most youth (76.9%) denied preexisting conditions or complaints at the time of admission, 10.6% had a medical condition that required medical follow-up after release.[20]

There are a few specific health concerns that require particular attention in this population.

Dental

The preponderance of dental needs was documented in a 30-year-old study in a detention center in New York, in which almost all of the youth (90%) required dental care.[15] A more recent study of youth in a juvenile detention center in Dallas County, Texas, conducted between 1999 and 2003,[21] found that among a random sampling of 419 dental screenings of 12- to 17-year-olds, half of them had untreated decay and fewer than one-fifth had preventive sealants. High-urgency dental problems defined as infection, tooth or jaw fracture, pulpitis, or severe periodontal disease with bleeding were found in 6.2% of the subjects. Moderate-urgency conditions, including cavitated asymptomatic decay or moderate gingivitis were found in 13.1%. One of the challenges noted by the authors was the inability to provide comprehensive treatment plans except in the case of long-term detainees.

Injury

Traumatic injuries are commonly identified in this population.[3,5,15,19,20,22] These injuries are caused by multiple etiologies that range from accidental to deliberate. The Maryland study[19] found that almost one-fifth of the youth experienced an injury including burns, head trauma, and musculoskeletal

injury, and that 12% of these youth had not had previous treatment. As demonstrated in the NCCHC study, interpersonal violence is an important cause of injury in this population.[5] Approximately 70% of the surveyed youth had been involved in at least 1 fight during the previous year, and one-quarter of them had experienced an injury that required medical attention. Three-quarters of youth in the NCCHC study reported fights that involved a weapon. There was a relationship between substance use and physical fights, use of weapons, and gang membership.

More details are described in the report of a study from a secure residential facility in North Carolina that examined the types of traumatic injuries experienced by 10- to 17-year-old youth.[22] More than half of the youth had an injury that required medical attention. One-third of the injuries were related to sports, 20% related to fights, 13% self-inflicted, 9% related to suicide attempts, 8% vocational, 3% related to horseplay, and 11% attributed to "other." The most common traumatic injury was musculoskeletal (one-third). One-quarter of the injuries were significant enough to necessitate referral for further evaluation to an outside facility.

A previous history of TBI is particularly significant in this population, because it can affect mental health and behavioral issues. Studies of detained adolescents have found high rates of TBI. Compared with youth without TBI, those with a positive history were more likely to have a psychiatric diagnosis, report earlier onset of criminal behavior and substance use, have more lifetime substance use problems, have more previous-year criminal acts, report lifetime suicidality, and demonstrate impulsivity or fearlessness in the year preceding incarceration.[23,24]

Tuberculosis

Residents of correctional facilities have among the highest rates of TB infection and are housed in an environment with an increased risk of exposure. For those reasons, it is recommended that adolescents in correctional facilities be screened annually for TB. A positive Mantoux skin test result is considered to be 10 mm or greater, which is a lower threshold than that for an adolescent without additional risk factors.[25]

Reproductive Health

Sexual Activity/Contraception

The 1991 NCCHC study[5] remains one of the best nationally representative samples evaluating sexual activity and contraceptive use among incarcerated youth. The study used a survey method based on the Centers for Disease Control and Prevention (CDC)'s Youth Risk Behavior Surveillance System, which allowed for comparison with a general high school population. Incarcerated youth reported higher rates of sexual activity and were more likely to report 4 or more lifetime sexual partners. Incarcerated youth also had much lower self-reported use of contraception or condoms at their most recent sexual intercourse.

STIs/HIV

Data from the CDC's 2009 Sexually Transmitted Disease Surveillance Report[26] demonstrated that youth in the juvenile detention system have among the highest rates of STIs (Table 2). Similar data were collected in another study that represented 12 juvenile correction facilities in 5 jurisdictions between 1996 and 1999.[27] Because of unprotected sex with multiple partners, prostitution, or injection drug use, youth in correctional facilities are also at increased risk of HIV and hepatitis C virus infection. In addition, they are at risk of hepatitis B virus infection when the vaccination series is incomplete. High rates of STIs, alcohol and drug use, and lack of consistent condom use also contribute to increased risk of HIV infection.[28–34]

TABLE 2 STI Rates Among Incarcerated Adolescents Aged 12 to 18 Years, 2009[26]

Disease	Overall Positivity, %	
	Female	Male
Chlamydia	14.8	6.6
Gonorrhea	3.9	1.0

Chlamydia data are from 83 juvenile detention facilities for women and 123 facilities for men. Gonorrhea data are from 71 juvenile detention facilities for women and 118 facilities for men.

Although the risk of STIs/HIV infection is high in incarcerated youth, many facilities fail to screen for either STIs or HIV. A study that used 2004 data from the Juvenile Residential Facility Census[35] found that only 18.5% of the facilities offered STI testing for all adolescents on admission and that 8.3% of the facilities did not even have STI testing available. Some facilities only provided STI testing services when requested by the youth or deemed medically necessary, which is especially problematic, because STIs are commonly asymptomatic. Even fewer facilities tested all youth for HIV or hepatitis C virus infection, and these tests were much less likely to be available.[35] One of the challenges associated with HIV testing by traditional methods is that it involves a blood draw and use of an outside laboratory. Youth may refuse phlebotomy and can be released from a short-term detention setting before obtaining the results. Currently available rapid HIV tests provide the option of a less invasive oral test and can provide results within 20 minutes while the youth waits. Providing opt-out HIV testing is recommended by the CDC as a part of routine health care, even in correctional facilities.[36]

Pregnancy/Fatherhood

The SYRP found that 14% of incarcerated youth have children; males (15%) were more likely to have fathered a child compared with 9% of females who reported having a child.[37] This rate is much higher than that of the general population of 12- to 20-year-olds, in which 2% of males and 6% of females have children. In addition, 12% of incarcerated youth were expecting a child. Overall, one-fifth of youth were currently a parent or expecting a child.[37]

These recent national data confirm previous reports in which incarcerated teenagers report higher pregnancy rates than those in the general adolescent population; more than one-third of the females report ever having been pregnant.[38,39] An analysis of data from the 2004 Juvenile Facilities Census[40] revealed that at least 2.1% of girls are pregnant while in juvenile justice residential facilities at any particular point in time. One study found that one-quarter of males had fathered a pregnancy, and 40% of those fathers reported responsibility for more than 1 pregnancy.[41] The 2004 Juvenile Facilities Census[40] found that only 15% to 17% of facilities test all girls for pregnancy on admission. Although a small proportion (4.5%–6.6%) fail to even provide pregnancy tests, the remainder of the facilities test only when it is medically necessary or requested by the adolescent.

For youth who are pregnant while incarcerated, there are additional challenges. As found in the 2004 Juvenile Facilities Census, almost one-quarter of the facilities do not offer access to obstetric services.[40] Similarly, another study that involved 430 short-term and long-term facilities from 41 states[42] found that prenatal services were lacking in one-third of them, and 60% reported at least 1 obstetric complication. Pregnancy among incarcerated teenagers is complicated by other existing problems including substance abuse, posttraumatic stress disorder, previous sexual abuse, and additional considerations regarding postdelivery options.[43] In addition to altered activity schedules and changes in menu options related to the higher caloric requirements of pregnancy, postpartum depression and other psychological problems require particular attention. Because most juvenile justice facilities do not have arrangements for infant residency or visitation, the adolescent and her family may be expected to make a plan for foster care placement.

MENTAL HEALTH

Overview

The available literature indicates that the prevalence of psychiatric and substance abuse disorders among youth in correctional facilities exceeds that of the general adolescent population.[3,44,45] In a review of the worldwide literature from the 1960s through the 1990s, Roberts et al[46] determined that the mean prevalence of psychiatric disorders in the general adolescent population was 16.5% (range: 6.2%–41.3%). In comparison, prevalence rates in the juvenile justice population range from 50% to 100% when disruptive behavior disorders are included.[47]

Inclusion of disruptive behavior disorders, such as conduct disorder, in the psychiatric disorder prevalence estimates is controversial, because most teenagers would not be incarcerated unless they came to the attention of authorities because of significant disruptive behaviors. To some extent, engaging in disruptive behavior is part of normal adolescent development. Multiple studies have found that most adolescents in the general population participate in behaviors that would be considered delinquent.[48] These behaviors, which include imitation of antisocial models/styles and social reinforcement, are usually transient. Most of the adolescent offenders (85%) known to the criminal justice system stop offending by the age of 28 years. Furthermore, severe, persistent antisocial behavior over time is only found in approximately 5% of males.[48]

The wide range in the prevalence of mental health disorders among youth in the juvenile justice system is indicative, in part, of the limitations of the studies in the literature. These limitations include the use of nonstandardized measures and different diagnostic tools; noncomparable sociodemographic variables; data that are not generalizable because they are specific to an individual facility, state, or other locale; variation in the timing of the evaluation from the detention setting to after adjudication; and bias when samples only include youth referred for psychiatric evaluation.[45,47,49,50] It is also important to consider the fact that for some youth, when mental health resources in the community are not sufficient, the juvenile justice system may be the placement of last resort by default.[51]

Prevalence of Psychiatric and Substance Use Disorders

Until the SYRP report, the 1991 NCCHC study was the only published study that included a national sampling of multiple juvenile custodial sites in the United States. In the NCCHC study, all of the mental health and substance use behaviors were self-reported through a modified version of the CDC's Youth Risk Behavior Surveillance instrument. The data from that survey are summarized in Table 3. The more recent SYRP study[3] found that at least half of youth reported problems with anxiety, anger, and loneliness, and approximately one-fifth had a previous suicide attempt. In addition, only 56% of the general population of 12- through 20-year-olds report a lifetime use of alcohol,

TABLE 3 Mental Health and Substance Use Data From the 1991 NCCHC Study[5]

Category	Male ($n = 1574$), %	Female ($n = 219$), %	Total Sample ($N = 1801$), %[a]
Suicidal ideation previous year	19	40	—
Suicidal plan previous year	17	37	—
Suicide attempt previous year	13	35	—
Tried smoking	—	—	87
Smoked whole cigarette by age 12 y	—	—	51
Alcohol use, >20 d lifetime	49	55	—
Cocaine use	30	42	—
Marijuana use, >40 times	—	—	40
Injected drugs	10	20	—
Use of other illegal drugs[b]	13	26	—

[a] Not all youth indicated gender on the survey.

[b] Other illegal drugs used 10 or more times in lifetime: lysergic acid diethylamide (LSD), phencyclidine (PCP), ecstasy, hallucinogenic mushrooms, speed, ice, heroin, and pills without prescription.

compared with 74% of youth in custody, and only 40% of the general population has used any illegal drug compared with 85% of youth in custody. Details from the SYRP are summarized in Table 4.

Although the NCCHC and SYRP reports have provided information on youth from multiple sites across the United States, these 2 studies are limited by only providing information based on youth self-report rather than from diagnostic evaluation tools. Between 2002 and 2006, the results of several studies that were designed to eliminate some of the previous study-design problems were published. The authors of these reports, Teplin et al,[50] Wasserman et al,[52,53] and Shufelt and Cocozza,[49] used randomly selected youth; the Diagnostic Interview Schedule for Children (DISC) as a standardized screening and assessment instrument; and included more ethnically/racially diverse samples. These studies yielded a smaller prevalence range of 45.7% to 70.4% for having either a psychiatric and/or substance use disorder (see Tables 5 and 6). The studies by Teplin et al[50] and Shufelt and Cocozza,[49] specifically, were able to show that the high rates of psychiatric illness were not just a reflection of disruptive behavior disorders. Both studies found similar results: 60.9% (Teplin et al) and 66.3% (Shufelt and Cocozza) had either a psychiatric or substance use disorder when conduct disorder was not included among the diagnoses. When Shufelt and Cocozza removed substance abuse disorders from the analysis, 45.5% of the youth still had a mental health diagnosis. In general, substance abuse is concerning, because youth who start using and abusing drugs during early adolescence are more likely to have serious delinquency and longer deviant careers, antisocial personality disorders later in life, and more risk behaviors. Overall substance abuse is associated with poor academic performance and more psychiatric disorders.[54]

Multiple studies worldwide have found that youth with psychiatric diagnoses can have more than 1 psychiatric diagnosis (comorbidity) or co-occurring psychiatric and substance abuse disorders.[39,49,50,55–61] The study by Shufelt and Cocozza[49] found that 79% of those with a psychiatric diagnosis had 2 or more diagnoses. In another study with youth in the juvenile justice system, McClelland et al[62] found that approximately half of the youth had multiple substance use disorders; 80% of those with an alcohol use disorder also abused other drugs, and half of those with a drug disorder also abused alcohol. Co-occurring psychiatric and substance use disorders were found in the Shufelt and Cocozza study, in which 60.8% of those with a psychiatric diagnosis also had a substance use disorder. In that study, co-occurring substance use and psychiatric disorders were more common when there was a history of disruptive behaviors or symptoms suggestive of mood disorders. Because co-occurring major psychiatric and substance use disorders are common and develop in a close time frame, more dual-diagnosis treatment programs are needed to simultaneously address both issues.

TABLE 4 Lifetime Substance Use Data From the SYRP[3]

Substance	% of Youth in Custody
Alcohol	74
Marijuana or hashish	84
Cocaine or crack	30
Ecstasy	26
Acid or lysergic acid diethylamide (LSD)	19
Inhalants	19
Heroin	7

Racial/Ethnic Differences

Racial/ethnic differences in the diagnosis of mental health disorders have been found in multiple studies. The well-designed study by Teplin et al[50] found that incarcerated black youth have the lowest rate of mental health diagnoses, non-Hispanic white youth have the highest rate, and the rate for Hispanic youth falls between that of these 2 groups. However, as discussed in the literature, interpreting rates of mental health diagnoses and then evaluating racial/ethnic disparity within the juvenile justice system may be problematic. Concern has been raised that minority youth may be more likely to have their behavior interpreted as criminal rather than in need of mental health service.[47] In addition, minority youth may be more reluctant to admit to experiences with mental illness, or they or their families may have a cultural bias against seeking care.[63,64]

TABLE 5 Design of Selected Studies That Evaluated Psychiatric and Substance Use Diagnoses in Youth in the Juvenile Justice System[49,50,52,53]

Author	Year Conducted	Location	No. of Subjects
Teplin et al[50]	1995–1998	Cook County Juvenile Detention Center	1829
Wasserman et al[53]	1998	Texas: probation intake in 8 counties	991
Wasserman et al[52]	2001	New Jersey and Illinois secure placement	292
Shufelt and Cocozza[49]	2006	Louisiana, Texas, and Washington: 29 programs and facilities	>1400

Gender Differences

Gender differences are also evident. Females are more likely than males to have any psychiatric diagnosis and, specifically, to have higher rates of mood and anxiety disorders (Table 6). With respect to substance use disorders, in general, males and females have similar rates, but the study by Teplin et al[50] found that females are more likely than males to use substances other than alcohol and marijuana. Although both genders experience sexual (10%–24%) and physical (11%–58%) abuse,[6] all forms of abuse, including emotional abuse, are more common in girls. As such, posttraumatic stress disorder is also more commonly diagnosed in females. Long-term outcomes for delinquent adolescent females reveal greater persistence of emotional problems and worse outcomes complicated by relationship and parenting issues, drug problems, and suicidality.[65]

Suicide

Suicide and suicidality have been a long-standing concern for juveniles in confinement. The 1991 NCCHC report and the 2003 SYRP both revealed high rates of suicidal ideation among incarcerated youth. In addition, 2 nationally representative studies explored suicidality in more detail. One study, the results of which were published in 2006,[66] found that suicide was the leading cause of death in juvenile justice facilities in the United States between 2000 and 2002. A second report, published in 2009[67] and entitled "Characteristics of Juvenile Suicide in Confinement," described the results of a retrospective evaluation of all identifiable juvenile deaths in confinement from 1995 to 1999. For the deaths related to suicide, the mechanism was hanging in all but 1 case. There were several important findings in this report. Sixty percent of the suicides occurred between 3 PM and midnight, which included a time frame in which youth were most likely to be around other people. Suicides were also most common during waking hours for those confined to their rooms. In addition, the potential for suicidality among these youth should have been recognized by staff, because 70% had been assessed by a mental health professional— half of them within the previous 6 days. Two-thirds of them had a diagnosis of depression, and half were taking a psychotropic medication. Seventy percent of the youth had a history of suicidal ideation, and almost half had had a previous suicide attempt. Precipitating factors were identified more than half of the time and included fear of transfer or placement, recent death of a family member, failure in the program, recent suicide in the facility, and parental failure or threats not to visit.

Recent studies[6,68] found that facilities with suicide-prevention training and suicide risk screening shortly after admission to the facility had a lower suicide rate. This is an area for improvement, because the 2009 study[6,67] found that only one-fifth of the facilities had the 7 key components deemed necessary for suicide prevention. These components include written protocols, intake screening, suicide-prevention training, safe housing, observation, mortality review, and cardiopulmonary resuscitation certification. The report also discussed the need to further evaluate room confinement, including the role of isolation in suicidal behavior.

TABLE 6 Estimated Rates of Mental Health Disorders in Incarcerated Youth From Studies Conducted Between 1995 and 2006[49,50,52,53]

Disorder	Rate Males %	Rate Females %
Any mental health disorder	45–69	50–81
Any mood disorder	6–19	13–29
Major depressive	5–13	11–22
Any anxiety disorder[a]	17–26	29–56
Generalized anxiety	2–7	3–7
Panic disorder	0.3–5	2–3
Obsessive compulsive	5–8	6–11
Separation anxiety disorder[b]	13–25	19–33
Any disruptive behavior[c]	20–45	20–51
ADHD	1–17	0.5–21
Oppositional-defiant	3–15	11–18
Conduct disorder	18–38	17–41
Any substance abuse	26–51	22–55

All subcategories under the "any" headings are from refs [50], [52], and [53]. ADHD indicates attention-deficit/hyperactivity disorder.

[a] Only Teplin et al[50] (2002) included "separation anxiety" in the data for the "any anxiety" category.

[b] Separation anxiety disorder subcategory data are from Teplin et al[50] (2002) and Wasserman et al[53] (2005).

[c] Teplin et al[50] (2002) did not include attention-deficit/hyperactivity disorder under the "any disruptive behavior" category; it was reported as a separate category.

Psychotropic Medications

National data are lacking on the use of psychotropic medications for youth in the juvenile justice system. However, as summarized by Desai et al,[44] 2 studies representing data from 2 states found that psychotropic medications were used for approximately half of the youth in detention facilities and more than two-thirds of youth in longer-term facilities. The fact that the majority of youth are prescribed these medications emphasizes the need for psychiatric services to appropriately diagnose and manage these youth. Mental health services are needed at the time of admission to a correctional facility for youth who are already on psychotropic medications and to evaluate youth who may need to initiate medications. In addition, subsequent evaluation is needed to decide whether ongoing use is needed during confinement. Attitudes of the parents and youth need to be considered when prescribing these medications, and continuity of care between community prescribing physicians and the juvenile justice facility is crucial.

The American Academy of Child and Adolescent Psychiatry has published a document that addresses mental health assessment and treatment for youth in the correctional system.[69] In this document, the authors recommend that psychotropic medication should only be used as part of an individually developed comprehensive treatment plan. Medication should augment other treatment interventions including individual, group, and family therapy along with behavioral interventions such as regular exercise, improved sleep hygiene, and staff/family support. The need for previously prescribed medications should be assessed on the basis of current symptoms and level of functioning. New medications should be used cautiously after review of potential risks and benefits, adverse effects, and alternatives with both the youth and the parent/guardian when the youth is a minor.

SCREENING AND ASSESSMENT FOR MENTAL HEALTH AND SUBSTANCE ABUSE DISORDERS

Ideally, youth with mental health and substance abuse problems would be identified and treated in the community rather than being first identified and addressed within the juvenile justice system. One recent study found that improvement in mental health services could reduce involvement with the juvenile justice system, particularly among youth with the most serious offenses.[70] One author[71] suggested that substance use screening before admission to detention might allow community diversion of some youth, optimize treatment choice, and minimize restrictive detention. However, optimal screening procedures have not been established, and many communities have limited availability of psychiatric and substance abuse services.

To better address the mental health needs of youth in the juvenile justice system, a panel of experts[72] was convened to create guidelines and a road map for best practices in the juvenile justice setting. The recommendations included a (1) valid and reliable mental health screening within 24 hours of admission, (2) a more extensive assessment by a mental health professional as soon as possible to determine needs, (3) use of multiple sources of information (records, family, schools, etc), (4) rescreening before release and preparation for transition out of custody, and (5) regular repeat screenings while in custody. These recommendations are consistent with existing standards from the NCCHC.

One of the commonly used screening tools for mental health and substance abuse specifically developed for the juvenile justice system is the Massachusetts Youth Screening Instrument–Second Version (MAYSI-2). This 52-item screening instrument takes 10 minutes to complete and is validated as a self-report response tool that requires no clinical expertise to administer, score, or interpret; is low cost and can be used by a range of ages, different ethnic groups, and both genders; and has good psychometric properties.[73] This tool can be completed by using audio computer-assisted technology for youth who have literacy problems. The MAYSI-2 is designed as a screening tool only, and staff trained in mental health should be available for further assessment. This tool should never take the place of well-trained staff who can recognize symptoms of mental health disorders and substance use withdrawal.

There is no standardized approach used in the juvenile justice system to screen for substance use/abuse. It is important to screen for the use or abuse of alcohol, tobacco, and the gamut of other drugs, including illicit, prescription, and nonproprietary substances. Possible methods include self-report, which is the least expensive method but requires youth to understand the questions and have accurate recall and honest disclosure. Bioassays with urine or hair are most commonly used by detention facilities and are easy to collect. However, although these tests provide objective data, urine is only sensitive for most drugs used in the previous 2 to 3 days. Hair analysis has significant problems including external contamination, which can lead to false-positive results and differences in binding for different drugs and with different types of hair.[54]

Specific screening for substance use was addressed in a recent report from the Office of Juvenile Justice and Delin-

quency Prevention.[13] Only 61% of juvenile facilities screened all youth for substance abuse, and 19% reported no screening. An additional 20% only screened youth identified by court or probation officers or facility staff. Other reasons to assess were if they had drug- or alcohol-related charges or by parent/youth request. Approximately one-third of the youth were screened on the day of admission, and another one-third were screened 1 to 7 days after admission. Three-quarters of the facilities that conducted screenings used staff-administered questions, and 55% used self-report by standardized instruments or checklist inventories. Overall, 73% of the facilities used urine-based drug screening; however, one-third of all facilities only tested a subset of admitted youth or only when use was suspected or a request was made by the court or probation officer.

ON-SITE PSYCHIATRIC AND SUBSTANCE ABUSE SERVICES

The decision to initiate or change medical treatment of psychiatric disorders in detention is challenging,[74] but acute symptoms may need to be treated with some urgency. Medications should be used to manage symptoms and minimize distress but not to manage behaviors alone. As discussed in the practice parameter from the American Academy of Child and Adolescent Psychiatry, it is ideal to determine the youth's legal disposition and placement before initiating or changing medication regimens.[69] Unlike in longer-term, postadjudication facilities, the length of stay in detention is usually too short for most counseling interventions to treat major psychiatric disorders. However, trained personnel can provide observational data, and short-term counseling interventions can provide support and facilitate the use of problem-solving strategies to prevent problem-escalating interpersonal behaviors. A more extensive evaluation may also be required before making a disposition to residential or community-based mental health treatment. Family involvement is critical at that stage, because it is the key determinant of treatment engagement and success. Whenever the youth is returning to the community, an essential part of the disposition is to include identification of a behavioral health home and care plan.

In 2002,[13] 53% of the facilities that reported mental health evaluation data had in-house mental health professionals who evaluated all admitted youth. Another one-third evaluated some youth. Facilities that provided mental health treatment on-site were more likely to also have a mental health professional evaluate all the youth. Larger facilities were more likely than smaller ones to screen all youth for suicide risk and to evaluate all youth for mental health needs. Privately operated facilities (62%) were more likely to evaluate all youth than were public facilities (41%).

Two-thirds of the facilities that reported substance abuse services provided them on-site; the majority (97%) of them provided drug education, and two-thirds provided individual or group therapy with a substance abuse treatment professional. However, it was also common (60%) for the counseling to be provided by someone not specifically trained in substance abuse treatment. Only 2 of 10 facilities had ongoing specialized treatment for substance abuse, and 1 in 10 had no substance abuse treatment services. Most facilities used in-house services, whereas only 20% relied on off-site services.[13]

HEALTH CARE STANDARDS: THE NCCHC

Standards for care of youth in a juvenile correctional facility have been published by the NCCHC, which also serves as an accreditation organization.[75,76] The latest version of the standards for youth was published in 2011.[76] These standards are used for facility accreditation but are valuable to help inform facilities about both the minimal and ideal health care for incarcerated youth. The currently published standards do not specifically distinguish between detention centers, which typically involve shorter lengths of stay, and longer-term postadjudication residential facilities. However, at a minimum, the standards state that all youth should be screened immediately on arrival at the intake facility by qualified health care professionals or health-trained staff to identify and meet *urgent health needs* and to screen for any potentially *contagious conditions* or dangerous behaviors such as *suicidal ideation*. The subsequent length of stay would determine further evaluation.

According to the standards, all youth must receive a *comprehensive health assessment within 7 days* of arrival with hands on assessment by a physician, physician assistant, or nurse practitioner. This assessment includes a complete medical, dental, and mental health history, review and update of immunizations, screening for TB, measurement of vital signs, physical examination, and genitourinary examination, including a gynecologic assessment, as indicated by gender, age, and risk factors. The need for laboratory and/or diagnostic tests for *communicable diseases*, including STIs, are determined by the responsible physician.

A *mental health screening* that provides a full assessment by qualified mental health professionals or mental health staff using a structured interview is to be conducted within 14 days of admission and includes past history, suicidal behavior, victimization,

exposure to traumatic events, substance use, violent behavior, cerebral trauma or seizures, and psychotropic medication. In addition, an oral health screening is to be performed by a dentist or health care professional trained by the dentist within 7 days of admission, and an oral examination is to be performed by a dentist within 60 days of admission.

Facilities are required to provide an opportunity for the adolescent to request health care on a daily basis, and all requests must be triaged within 24 hours. The facility must provide 24-hour emergency mental health and dental services. Discharge planning must include arrangements for follow-up or referrals to community providers and a supply of current medications to last until that follow-up can occur.

A recently published study[35] that assessed whether juvenile detention facilities follow the standards set out by the NCCHC found significant deficits when comparing reported practices to published standards. Data were analyzed from the Juvenile Residential Facilities Census (2000, 2004) and Census of Juveniles in Residential Placement (2003), which are conducted by the Office of Juvenile Justice and Delinquency Prevention of the US Department of Justice. Most juvenile correctional facilities are not accredited by the NCCHC, and in the absence of mandatory accreditation, it is not clear whether most facilities would fail to meet the standards or just choose not to be accredited. Data from 2004 showed that overall, fewer than half of the facilities were compliant with recommended health screening and assessments. Few detention facilities met even minimal levels of care, although better care was seen as the length of stay increased.

CONTINUITY OF CARE

Continuity of care, both on entering the facility and when transitioning back to the community, is crucial for youth in the juvenile corrections system. However, continuity of care is a challenge. One study[20] found that fewer than half of families showed interest in care deemed important by the on-site medical staff, and a large proportion of families were not successfully contacted. These youth had nonideal medical care before admission; only half of the youth had care in the previous year, and only one-third of them were able to identify a source of regular medical care. The juvenile justice system may be the only place where these youth have received a recent comprehensive medical history or physical examination.[15]

As custodial placement comes to an end, transitions are difficult, particularly for youth who have experienced disruption and failure and who have limited internal resiliency and external support. Transitions of communities, residences, schools, programs, therapists, friends, and family members as well as adjustment to a less restrictive environment can be difficult. Continuity of care starts at the time of admission to the facility. If the youth already has a primary care provider, it is crucial for the medical staff to be able to contact that clinician to verify previous diagnoses and treatment. For cases in which the youth does not have a primary care provider, resources to establish primary care should be provided. Providing summaries of medical care for the primary care provider, appropriate subspecialist, or mental health specialist on discharge back to the community is also extremely important. In some cases, a chronic medical condition may be first diagnosed while the youth is in custody. Facilitating the transition to a provider who can ensure continuity is key, because it is not uncommon for youth to return to the correctional facility with unmet chronic health needs. For some conditions, such as STIs or TB, public health facilities may be able to help with follow-up.[75]

COMMUNITY-BASED INTERVENTIONS FOR INCARCERATED YOUTH

Traditional cognitive behavioral therapy (CBT) is helpful for both internalizing and externalizing behaviors, including anger management, depression, and posttraumatic stress disorder. However, it may not be the best choice for many delinquent youth. There are several promising interventions that have been shown to be effective in treating youth with mental health issues. In some cases, these interventions have been shown to reduce recidivism.[77] Programs that broadly address multiple domains, including the adolescents' family, school, peers, and community, are the most effective. These programs are intensive and highly structured and include social skill development, behavior management, attitude adjustment, and cognitive perceptions. Many of these programs are community-based interventions conducted in the youth's home environment and directly engage the family members. Examples include multisystemic therapy, functional family therapy, and wraparound therapy. In another program, multidimensional treatment foster care, youth are placed with families trained to provide a structured therapeutic environment as an alternative to incarceration. The biological family is taught the system with the goal of returning the youth home. Multisystemic therapy and functional family therapy have been found to be particularly effective for youth with co-occurring mental health and substance use disorders. Some of the challenges with implementing these

programs are the high initial upfront costs and the labor-intensive nature of the interventions.

When assessing interventions, it is also important to note that the Girls Study Group[78] found that interventions for boys may not directly translate to girls. Protective factors, such as caring adults, school success, school connectedness, and religiosity, may be less effective for girls who have experienced physical and sexual assault, neglect, and neighborhood disadvantage. More research is needed to understand the interaction between risk and protective factors in girls to best design successful intervention programs. Programs for girls need to address victimization, which is commonly found in these youth.

As evidenced by the interventions described above, the approach in the juvenile court system is generally *rehabilitative* rather than *punitive*. The Office of Juvenile Justice and Delinquency Prevention[79] advocates a comprehensive strategy that includes supporting the adolescent's family and engaging core institutions, such as schools, businesses, and religious organizations, in helping to develop mature and responsible youth. This strategy utilizes the principle that delinquency prevention is the most effective approach while recognizing that there is a need for graduated sanctions that protect the community. The best prevention involves targeting risk factors for delinquency, such as drugs and firearms in the community, family conflict, abuse and neglect, poor commitment to school, and negative peer influences, while focusing on protective factors such as a resilient individual temperament; close relationships with family, teachers, other adults, and peers; and promoting school success and avoidance of drugs and crime. Reentry plans need to address education, mentoring, prosocial activities, and positive community involvement.

EDUCATIONAL NEEDS

As summarized in the recently published findings of the SYRP, educational difficulties and low commitment to academics are risk factors for delinquency.[3] In this nationally representative survey, one-fifth of the youth reported that they were not enrolled in school at the time they entered custody. This rate is 4 times higher than that for the general population. In addition, 61% had been expelled or suspended, compared with 8% of the general population. Although only 28% of youth in the general population are functioning below grade level, 48% of those in custody reported being below the level expected for their age. Similarly, a higher percentage (25%) of youth in custody reported being held back in school, compared with 11% among peers in the general population. Although the majority (92%) of youth reported attending school while in custody, only half of these youth reported that the school program was of good quality, and most youth did not spend as many hours in school as did the general population.

Learning disabilities are also much more common among youth in custody; rates of 30% have been reported by youth in custody, which is 7 times higher than that of the general population. Despite the requirements of the federal Individuals With Disabilities Education Act, which states that youth in custody must be identified and given special education services, even in short-term facilities, only 46% reportedly receive these services. The SYRP report concluded that there is a need to obtain more information on how custodial facilities address educational needs, including an assessment of the curricula used, the provision of special educational services, and whether individual educational needs are being met for each youth in custody.

JUVENILE TRANSFER LAWS/DEATH PENALTY

In the past decade, an increasing number of states have enacted laws that require that juvenile cases be transferred to adult courts for certain offenses.[80] A parallel increase has been seen in the number of juveniles incarcerated in adult facilities for certain felonies. When convicted in adult court, these juveniles commonly receive longer sentences than those sentenced in juvenile courts. Although these laws were enacted with the thought that they would be a deterrent for juvenile crimes, 6 studies, conducted in 5 different states, with approximately 500 to more than 5000 participants each, showed the opposite effect. Compared with youth retained in the juvenile court system, recidivism rates were higher for juveniles whose cases were transferred to adult criminal court. This was particularly true for violent offenders for whom transfer may actually be promoting rather than deterring further criminal involvement.

Juveniles in adult prisons report learning more about criminal behavior from adult inmates and having fear of victimization; these juveniles were least likely to say they would not reoffend. Juveniles incarcerated in adult prisons compared with juvenile facilities have an eightfold increase in suicide, fivefold increase in being sexually assaulted, and twofold increase in likelihood of being attacked with a weapon by other inmates or beaten by staff.[80] Adult facilities have much less emphasis on rehabilitation and family support than do juvenile facilities, and juveniles have expressed both resentment and a feeling of injustice when tried and punished in the adult system.

At the extreme, issues of whether to invoke the death penalty for adolescents have been debated in the past. In 2004, the American Academy of Pediatrics and the Society for Adolescent Health and Medicine issued a joint statement opposing the death penalty for juvenile offenders.[81] In 2005, the Supreme Court ruled that it was unconstitutional to impose capital punishment of individuals who committed crimes as a juvenile.[82] Age 18 was determined to be the age for death-penalty eligibility. This age was based on currently available scientific research that indicates that juveniles do not have the cognitive maturity or sense of responsibility found in adults. This was echoed in the most recent ruling by the Supreme Court in May 2010, in which life without the possibility of parole was not permitted for juveniles who committed nonhomicide crimes.[83]

FINANCING

Financing of health care for incarcerated adolescents presents many challenges.[84–86] All incarcerated persons are entitled to health care under the US Constitution (see *Estelle v Gamble*, 429 US 97); however, such a constitutional guarantee does not include access to federally funded health benefits programs such as Medicaid or the Children's Health Insurance Program (CHIP), and it does not apply to private health insurance plans. Section 1905 of the federal Social Security Act specifically prohibits federal money from being used for medical care of inmates in a federal institution and has been applied equally to adolescents.

There is also a federal prohibition on the use of Medicaid benefits for any month during which the individual is a resident of a public institution. Many states have terminated Medicaid benefits rather than suspend them to avoid improper use of federal funds. Because financing for medical care in juvenile justice facilities then largely relies on state and local resources, the extent of medical care provided can be limited. When Medicaid benefits are terminated, there is also commonly a lag in reinstatement when the youth is released back into the community. This occurs even when screening for eligibility is offered before release and application assistance is provided. Although current law allows states to suspend rather than terminate benefits for incarcerated youth, many states do not follow this procedure for administrative or other reasons.[84–86] Other states have passed legislation specifically to address this issue and require that Medicaid be suspended and not terminated for at least 6 months while in detention.[87] Ideally, continuation and utilization of active benefits while the youth is incarcerated or detained would ensure that correctional facilities can provide more comprehensive medical care. Continuation of active benefits would also facilitate continuity of care and may prevent some recidivism, especially for those with mental illnesses that require medication.[84–86] In order for Medicaid benefits to remain active for youth in the juvenile justice system, federal law must be amended to ensure both continuation of benefits and funding for the federal government share of Medicaid. Advocacy is needed at both the federal and state levels to ensure provision of necessary medical services for these youth.

RECOMMENDATIONS

The current and predicted ongoing shortage of child and adolescent psychiatrists, the separation of mental health and drug and alcohol treatment services and personnel, the limited access to health care dollars for youth in detention, and the institutional variability in procedures and human and monetary resources will continue to provide a challenge to meet a reasonable standard of health care for this population. The following recommendations are provided for caring for youth in the juvenile correctional system.

1. Delivery of Medical Care

Youth incarcerated in the juvenile corrections system should receive the same level and standards of medical and mental health care as nonincarcerated youth accessing care in their communities.

a. *Health care services should be equivalent to those recommended by guidelines of the American Academy of Pediatrics (Bright Futures [see www.brightfutures.aap.org]).* Although the extent of health services provided during the period of incarceration may be mitigated by the length of stay in the facility, shorter-term facilities, at a minimum, should focus on the identification and treatment of immediate medical and psychiatric issues such as injury; infectious diseases (TB, scabies, lice); alcohol, tobacco, and other drug use/addiction, including withdrawal; psychiatric emergencies including suicidal ideation; and identification of chronic medical or mental health problems that require continuation of daily medications.

b. *For youth incarcerated for more than 1 week or in longer-term facilities, recommended pediatric and adolescent comprehensive preventive services should be provided.* In addition to a comprehensive history and physical examination, youth should receive a dental screening and mental health screening for psychiatric illness and substance use/abuse. Assessments should focus on developmental and psychosocial issues. Immunizations should be provided as recommended by the American

Academy of Pediatrics and the Advisory Committee on Immunization Practices of the CDC. The Vaccines for Children (VFC) program is a resource from which eligible youth can access vaccines. Additional evaluation, including for neurologic, genetic, and developmental disorders, should be ordered by medical personnel as clinically indicated. Clinicians caring for incarcerated youth should have training and expertise in pediatrics or adolescent medicine.

c. *Evaluation should include screening for infectious diseases resulting from unprotected sexual activity.* In view of the high rate of risk-taking behaviors, STI screening should be included for the most common pathogens (*Neisseria gonorrhoeae*, *Chlamydia trachomatis*). The 2010 sexually transmitted disease (STD) treatment guidelines from the CDC recommend universal screening of all female adolescents for both *N gonorrhoeae* and *C trachomatis* at intake to juvenile detention facilities.[88] The 2010 STD guidelines also recommend screening sexually active young men for *C trachomatis* in clinical settings in which there is a high prevalence, such as in correctional facilities. Although not specifically recommended in the 2010 STD guidelines, periodic assessment of the local prevalence of *N gonorrhoeae* would be ideal with initiation of screening in male adolescents when prevalence rates indicate that screening would be cost-beneficial. Urine-based nucleic acid amplification testing provides a convenient, noninvasive option for screening. Depending on community prevalence, screening for syphilis should be included. HIV testing should be offered to all sexually active youth per current CDC recommendations.[36,88] Completion of the hepatitis B immunization series should be confirmed. Screening for hepatitis C with serologic testing should be considered for high-risk youth, including those who have a history of injection drug use, are HIV-positive, or have signs or symptoms of liver disease, per current CDC recommendations.[89] Juveniles with signs or symptoms of hepatitis should also be tested for serologic markers for acute infection with hepatitis A and hepatitis B. For most youth, the first Papanicolaou test is not indicated until 21 years of age . If clinically indicated per published guidelines, a pelvic examination should be performed for a Papanicolaou test (see pelvic examination and male reproductive health statements).[90,91]

d. *Screening of pubertal girls should include pregnancy testing.* Because of the high rates of sexual activity, all pubertal girls should be screened for pregnancy. Nonjudgmental counseling regarding options should be provided for pregnant youth, and accessibility to prenatal services should be provided on-site or in the community. Prenatal vitamins, including iron and folate supplementation, should be provided to all pregnant girls at the time pregnancy is diagnosed and continued throughout the course of the pregnancy. For both female and male youth who are parents, parenting classes should be included in the educational offerings.

e. *On-site mental health and substance abuse professionals should be available to provide both evaluation and treatment services.* Mental health services can be provided by staff either hired by the facilities or through a contractual arrangement with an outside community provider. Services should include psychiatric services to facilitate continuation of medications from the community mental health provider and ongoing evaluation and treatment. Psychiatrists should have training in child and adolescent psychiatry and preferably be board certified. Tobacco-, alcohol-, and drug-cessation programs should be available during the period of incarceration. Attention should be paid on an ongoing basis to the medical and mental health status of youth, because new issues can arise during their time in confinement. Correctional staff should receive training in suicide prevention, and specific attention should be paid to youth confined to their rooms in the housing unit. The practice parameter from the American Academy of Child and Adolescent Psychiatry provides specific recommendations on therovision of mental health services within the juvenile correctional system.[69]

f. *Regular physical activity and nutritionally balanced meal plans appropriate for adolescents should be provided in all facilities.* Given the current national epidemic of obesity, attention to these aspects of a healthy lifestyle is even more critical.

g. *Pediatricians should encourage all correctional care facilities to adopt and comply with the NCCHC's "Standards for Health Services in Juvenile Detention and Confinement Facilities."*[76] Accreditation is encouraged as a means to reach desired levels of health care. Information regarding accreditation can be found at www.ncchc.org.

2. Developmentally Appropriate Confinement Facilities

Children and adolescents should be housed in facilities that are able to ad-

dress their specific developmental needs.

a. Pediatricians, adolescent health care specialists, mental health professionals, and drug and alcohol treatment providers should be consulted about health care policies and procedures governing all correctional care facilities in which children and adolescents are incarcerated.

b. Children and adolescents should be detained or incarcerated only in facilities with developmentally appropriate programs and staff trained to deal with their unique social, educational, recreational, and supervisory needs.

c. If children and adolescents must be housed in adult facilities, they should have routine access to the same developmentally appropriate environment and be separated by sight and sound from the adult population.

3. Integration of Available Systems of Care

a. *Coordination between juvenile justice system health care providers and community providers is essential.* Health care information elicited in the juvenile corrections setting should, at a minimum, be shared with the adolescent and, as appropriate (when not violating confidentiality), with the parent/legal guardian to allow for continuity of care and prevent unnecessary duplication of services. Pediatricians are a crucial link in the process of ensuring continuity of care between the community and the juvenile correctional system. Information should also be shared between the relevant community providers and correctional health care staff both on admission and at the time of release to ensure continuity of care. If the youth does not have a medical home, correctional staff should make every effort to identify a medical home within the community for that youth. Pediatricians should also coordinate with probation officers who are frequently entrusted with ensuring appropriate follow-up once the youth reenters the community.

b. *Electronic medical records available within the community should also be accessible by correctional health care staff.* Existing publicly accessed databases, such as state immunization data banks, should be used to document care provided in correctional facilities. With the evolving use of electronic medical records, consideration should be given to the need to share information between correctional institutions and community providers to ensure continuity of care.

c. *All youth incarcerated in the juvenile corrections systems should maintain eligibility for their existing health insurance benefits. Uninsured youth should be able to be enrolled in Medicaid while incarcerated.* Both Medicaid and private insurance should be available for all youth without suspension or termination during incarceration and without a lag for reinstatement on reentry into the community. Youth without insurance coverage before incarceration should be automatically made eligible for Medicaid at the time of incarceration so that access to appropriate care may be facilitated. Advocacy is needed at both the federal and state levels to amend existing regulations and ensure the provision of necessary medical services for these youth.

4. Treatment and Intervention

a. *Evidence-based mental health and substance abuse treatment interventions that have been shown to reduce recidivism should be adopted to improve long-term outcomes for incarcerated youth.* Pediatricians should advocate for adequate funding for implementation of programs such as multisystemic therapy and functional family therapy with the recognition that an increased investment in the short-term will lead to cost savings in terms of improved long-term outcomes.

b. *Resources should be invested in interventions that address the risk and protective factors involved with juvenile delinquency.* There should be emphasis on investing in interventions that address the related family and community factors associated with delinquency. Specific emphasis should be placed on factors that will improve SES such as educational achievement and employment, because these factors are highly correlated with both juvenile delinquency and overall health status.

c. *More nationally representative data are needed on the health needs of youth in the juvenile justice system.* Funding is needed to collect nationally representative data on youth involved in the correctional system to better inform programming needs and desired outcomes and help guide the choice of appropriate cost-effective interventions.

5. Advocacy

Pediatricians should work with their AAP chapters, the juvenile justice sections of their state judiciary and bar associations, and state and local governmental officials.

a. Pediatricians should advocate to ensure that the appropriate legislation and funding is available to provide for medical, educational, and behavioral health needs of juve-

niles while confined and on reentry into the community.

b. Pediatricians should advocate for adequate health insurance for all medical and behavioral health services for youth both during and after incarceration to ensure that resources are available to provide adequate and continuous care.

c. Pediatricians should support both efforts to decrease the number of youth incarcerated by advocating for interventional programs in the community that address risk and protective factors and legislation that requires education of law enforcement officers about at-risk youth and teaches skills to manage interactions with these youth.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Health Equity and Children's Rights

abstract

Many children in the United States fail to reach their full health and developmental potential. Disparities in their health and well-being result from the complex interplay of multiple social and environmental determinants that are not adequately addressed by current standards of pediatric practice or public policy. Integrating the principles and practice of child health equity—children's rights, social justice, human capital investment, and health equity ethics—into pediatrics will address the root causes of child health disparities.

Promoting the principles and practice of equity-based clinical care, child advocacy, and child- and family-centered public policy will help to ensure that social and environmental determinants contribute positively to the health and well-being of children. The American Academy of Pediatrics and pediatricians can move the national focus from documenting child health disparities to advancing the principles and practice of child health equity and, in so doing, influence the worldwide practice of pediatrics and child health. All pediatricians, including primary care practitioners and medical and surgical subspecialists, can incorporate these principles into their practice of pediatrics and child health. Integration of these principles into competency-based training and board certification will secure their assimilation into all levels of pediatric practice. *Pediatrics* 2010;125:838–849

INTRODUCTION

The American Academy of Pediatrics (AAP) is dedicated to reducing health disparities and increasing health care equity for children and adolescents. Toward this end, health care equity was established as a universal principle of its agenda for children in 2005. In 2008, the AAP included health equity in its strategic plan and agenda that expanded this universal principle to focus on other factors that influence children's health and well-being in addition to health care. The AAP continues to expand its programs and policies to address child health disparities through practice, advocacy, education, research, and policy formulation, primarily through initiatives related to ensuring access for all children to quality, patient-centered, and culturally effective medical care. These efforts are critical and must continue but are not sufficient to achieve health equity for all children. The fundamental determinants of children's health and well-being, and subsequently the health and well-being of the adults they will become, are rooted in social, environmental, and behavioral factors that lie beyond the purview of the health care system.[1,2]

COUNCIL ON COMMUNITY PEDIATRICS AND COMMITTEE ON NATIVE AMERICAN CHILD HEALTH

KEY WORDS

disparities, equity, health equity, child health equity, children's rights, UN Convention on the Rights of the Child, social justice, social capital, ethics

ABBREVIATIONS

AAP—American Academy of Pediatrics
UN—United Nations

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Health disparities in children, as summarized in an upcoming AAP technical report on racial and ethnic disparities,[3] will remain all too prevalent until these determinants are addressed through a national agenda on child health equity—an agenda informed by the global children's rights movement.[4,5] The AAP and pediatricians have critical roles to play in designing, building, participating in, and sustaining this national agenda. To fulfill these roles, pediatrics and pediatricians must expand beyond a focus on health care and health disparities to engage the broader context of child health equity. This policy statement defines the principles and practice of child health equity as a foundation and framework to support and guide the work of pediatrics and pediatricians in the delivery of clinical services, child advocacy, and policy formulation.

BACKGROUND INFORMATION

Differences between groups in status and outcomes are referred to as disparities. Disparities are often described in relation to socioeconomic position, ethnicity, race, geography, gender, and age or in the context of a combination of these and other factors. This is particularly true with respect to child health disparities in the United States, which are routinely defined as a function of multifactorial determinants.[6–8]

The distinction between the terms "disparity" and "inequity" is critically important. Whereas the term "disparity" only defines differences between groups, "inequity" describes the causes of disparities in the context of the social, economic, civil-political, cultural, and environmental conditions that are required to generate parity and equality. Inequities result in disparities in health status that are "unfair, unjust, avoidable and unnecessary."[9] By definition, these are amenable to change.[9]

Disparities in the well-being of children in the United States are growing.[10–13] These racial, ethnic, gender, and class-based disparities have profound implications for the welfare of children in the United States and for the adults they will become.[14–19] The sources of these disparities are deeply rooted in inequities in social and environmental determinants of health (eg, poverty, income inequality, maldistribution of educational and other resources, racism, and environmental injustice) and the failure of public policies to address them.[20–26] The number of children being marginalized by our society is escalating, and child poverty and other indicators of children's well-being rank the United States among the lowest of the industrialized nations in the world.[27,28]

STATEMENT OF THE PROBLEM

If we are to succeed in our efforts to eliminate disparities in the health and well-being of children and ensure that all children reach their full potential, the root causes of health disparities must be addressed. The principles of child health equity— children's rights, social justice, human capital investment, and health equity ethics—provide insight into these root causes and reveal the tools, skills, and strategies required to eliminate health disparities through equity-based clinical care, child advocacy, and policy formulation. Pediatricians and pediatrics have important roles to play in these endeavors, which will require substantive changes in our approach to training, clinical practice, child advocacy, policy formulation, and research.

RATIONALE

Inequities in the social and environmental determinants of children's health in the United States are pervasive and cumulative, affecting children from conception through adolescence. Children who experience inequities may fail to reach their full potential,[15–19] which is detrimental not only to them, their families, and the community but also to society in general. The gradient of inequities within societies is directly related to the degree of disparities.[2,29,30] Socially divided societies pay a cost in community cohesion, drug and alcohol abuse, mental health problems, children's physical development, crime, and other social problems.[31]

Why Do Health Disparities in Children Matter?

Eliminating health disparities would make a significant difference in the overall health of children. If health disparities in the United States were eliminated, such that all children had the same risks of adverse outcomes as those of the most economically privileged, the prevalence of poor outcomes (eg, low birth weight, cerebral palsy, intellectual disabilities, psychological problems, child abuse, disabilities attributable to intentional and unintentional injuries) would be reduced by 60% to 70%.[32–37]

Inequities in children's health also lead to disparities in adult health and well-being.[15–19] These inequities contribute to chronic adult illnesses and to the intergenerational perpetuation of poverty and ill health found in many communities (eg, obesity, diabetes, cardiovascular disease, poor educational outcomes, unemployment, poverty, early death, etc).[15–19,38,39] The burden of disease in low-income children and adults is costly, which puts huge pressures on health care systems.[40] Improving health equity for children should be among our highest priorities as a national strategy for improving the health and productivity of children and adults and decreasing health care costs.

Which Children Are Most at Risk?

Many children in the United States are marginalized by socioeconomic depri-

vation, social exclusion, racism, and discrimination. Populations of children at particular risk include those who are:

- living in severe and chronic poverty[7,20–23];
- from racial and ethnic minority groups[10–13];
- affected by drug and alcohol abuse[41,42];
- in foster care and public institutions[43,44];
- disabled and living with special health care needs that impair functions[45,46];
- living with violence[46–48];
- incarcerated in adult facilities or juvenile detention[49,50];
- from homeless families and/or live as homeless teenagers[51–53];
- from immigrant and refugee families[54–56]; and
- uninsured and/or without access to health, mental health, and dental care.[57,58]

The factors that lead to marginalization, social exclusion, and poverty are often coassociated.[25] For example, disability and racial and ethnic minority status are associated with poverty[6–10]; disabled children are at higher risk of abuse[59]; and family stress that arises from poverty and poor health is associated with family breakdown, violence, and homelessness.[32,47,48,51,52] In the United States, the effects of racism beyond its association with poverty cannot be ignored.[7]

Children who experience multiple compounding risk factors are most likely to have their rights ignored and/or abused. Examples include violence against children in foster care,[60] discrimination against immigrant and refugee children,[61] inadequate mental health services for children in detention,[49,50] and the experience of children in the judicial and juvenile justice systems.[49,50,62,63]

Relevance of Child Health Equity

Life-course epidemiology and science have advanced our understanding of the mechanisms by which the complex ecology of social and environmental determinants generate and perpetuate child health disparities.[14–19] They are thought to result from the cumulative exposure to risk counterbalanced by protective factors over the life course. There seem to be critical periods in the life course, most notably during pregnancy and early childhood, when risk and protective exposures have the greatest effect on health.[14–19,25] Rapid changes in the demography of US children, transitions in the epidemiology of children's health and illness,[64] and advances in life-course epidemiology and science[14–19] establish the imperative for a new paradigm for conceptualizing and addressing the health and well-being of children. Social and environmental degradation,[20–23,31,32] discrimination and marginalization of children,[7,8] and climate change and globalization[65–68] are among the factors that contribute to this transformation of children and childhood and the millennial morbidities that affect them.[69]

The relevance and importance of child health equity to the well-being of children, families, communities, and society in the United States and throughout the world cannot be overstated. These and other societal transitions will require new and expanded roles and functions of pediatricians if pediatrics is to remain viable and relevant to the health and well-being of children.

CHILD HEALTH EQUITY

Child health equity, as conceptualized in this policy statement, is composed of 4 elements: children's rights, social justice, human capital investment, and health equity ethics. The principles encompassed within these components provide perspective and knowledge that can be integrated into the practice of primary care and subspecialty pediatrics and child health. They can be operationalized as tools, skills, and strategies for promoting children's health, address health disparities, and advance equity in child health.

Children's Rights and the United Nations Convention on the Rights of the Child

The United Nations (UN) Convention on the Rights of the Child (Convention) and the integration of its principles into the practice of pediatrics provide powerful tools and strategies to respond to the root causes of contemporary child health morbidities and disparities.[70] The articles of the Convention define the rights of children in the context of their social, economic, cultural, and civil-political status in society. In its entirety, the Convention redefines childhood, the status of children in society, and what constitutes children's health and well-being. The Convention establishes a template for child advocacy, a holistic approach to fulfilling children's needs, an inventory of optimal health outcomes, and a guide for health systems research. (See Table 1 for a list of rights contained in the Convention.) Consistent with the philosophy and policies of the AAP related to the medical home and family-centered care,[71,72] the Convention references the family as the fundamental group of society, affirms the principle of respect for family autonomy, and obligates societies to fulfill the rights of children by providing families with access to the resources they require to meet the needs of their children.[73]

The rights defined by the Convention establish the essential and holistic conditions required to ensure that children

TABLE 1 Relating the Taxonomy of Children's Rights to the Principles of Medical Ethics

Taxonomy of Rights	Inventory of Rights	Ethics Principles	Indicators
Economic	Adequate standard of living Social security Protection from economic exploitation	Justice: distributive and allocative	Is there a morally defensible system for allocating resources?
Cultural	Respect for language, culture, and religion Abolition of traditional practices likely to be prejudicial to a child's health	Autonomy	Do children feel that they are respected?
Social	Promotion of a child's best interests Life, survival, and development Best possible health and access to health care Education Play Family life or alternative care Family reunification Fullest social inclusion for disabled children Support for parents to ensure protection of children's rights	Beneficence	Do participants in the policy-making process act with charity and kindness?
Protective	Protection from abuse and exploitation Protection from armed conflict Protection from harmful drugs Protection from trafficking Rehabilitative care after abuse or neglect	Nonmaleficence	Is the dictate of "primum no nocere" adhered to in decisions made related to the child?
Civil and political	Heard and taken seriously Freedom from discrimination in the exercise of rights Freedom of religion, association, and expression Privacy and information Respect for physical and personal integrity Freedom from all forms of violence, torture, or other cruel, inhuman, or degrading treatment Due process in the law Recognition of the importance of treating the child with respect within the justice system Not to be detained arbitrarily	Autonomy	Do children consider themselves participants in their environment?

achieve an optimal state of well-being. Respect for all the rights embodied in the Convention is required to achieve this goal. No rights take priority over others.[70,74] Although the United States is 1 of only 2 countries in the world that has not ratified the Convention (Somalia being the other), the Convention's articles are, nevertheless, as relevant to American children and society as they are to children elsewhere. As presented in following sections detailing the implications of an equity-based approach to practice, the promotion and protection of children's rights can be used to guide the work of pediatricians as clinicians and child advocates and the AAP in its public-policy endeavors to improve children's health and reduce health disparities.

Social Justice

Social justice refers to the fair distribution of resources. Resource distribution results from public- and private-sector policy decisions in venues and institutions at all levels of society. Pediatricians and the AAP can work to ensure that the best interests of children (Convention, article 3) are considered whenever and wherever policy decisions are made that relate to resource distribution (eg, in clinical practice, hospitals, schools, and communities), even if these decisions seem to have little relevance to children. They also can ensure that all such decisions do not discriminate against children on the basis of race, ethnicity, economic status, gender, disability, and/or immigration status (Convention, article 2).[70] Examples of social justice issues that relate directly and indirectly to the distribution of resources that affect the health and well-being of children are listed in Table 2. Pediatricians and child health professionals, in collaboration with colleagues from other child-serving professions, community leaders, parents, children, youth, and young adults transitioning from pediatric to adult care, have critical roles to play in pol-

TABLE 2 Examples of Social Justice Issues That Affect Children's Health and Well-being

Access to healthy housing
Child-friendly neighborhood development
Land use that considers the best interest of children
Access to recreational facilities
Convenient and affordable transportation
Sufficient education resources
Freedom from gender discrimination
Required resources for disabled children
Adequate hospital budgets
Access to quality prekindergarten and early learning resources
Child- and infant-friendly hospitals
Appropriate physician reimbursement
Safe workplace conditions for adolescents

icy development if social justice related to children is to prevail.

Human Capital Investment

Capital investment in children reflects the moral and ethical commitment of society and communities to invest resources required to improve the health and well-being of all children and decrease disparities. The return on this capital investment can be measured in a traditional context of monetary value, but a new currency also must emerge as equity-based measures of health and well-being.[75,76] Capital investment in children is conceptualized as being composed of 5 forms of capital: social, economic, environmental, educational, and personal capital.

Social Capital

Social capital establishes value for human relationships that affect children. In this regard, a working definition relevant to pediatricians is that social capital relates to social relationships in the family, institutions, and communities (eg, schools, clubs, and faith-based institutions) and among peers that positively influence the health and well-being of children.

Research has shown that a higher level of social capital in families and communities is associated with better health outcomes for children. Runyan et al[77–79] have demonstrated the positive effects of social capital in moderating the impact of violence and unfavorable social environments on child health outcomes. Newly developed tools and approaches to care, including the medical home,[71,80] family-centered care,[72] psychosocial and environmental screening, Bright Futures,[81] and social capital scales,[72] can help pediatricians and others understand the concept of social capital and integrate its principles into practice.[82,83]

Economic Capital

Economic investment of a country or community's wealth in children has a direct effect on the health and well-being of children.[84–91] Children who live in poverty have poorer health and outcomes related to virtually every measure of well-being.[7,20–23] Income inequality also seems to have a negative effect on child and adult health.[84,85] Public policies that transfer wealth directly to families, and in particular to children, in the form of cash subsidies or services (eg, child care, medical care, food support, extended paid maternity leave, child allowances, housing subsidies) have a positive effect on children.[86,88] Indirect investment in children through expansion of the Earned Income Tax Credit, for example, has the potential to lift families out of poverty and improve the well-being of children.[87] Comparisons between economically developed countries consistently show a direct relationship between wealth transfer and children's well-being.[88,89] The timing of this investment is critically important, with the largest return resulting from investment in young children and families.[90,91]

Environmental Capital

The environment in which children grow and develop has a profound influence on their health and well-being as children and into adulthood. Given our rapidly advancing knowledge of early brain development,[14,19,92,93] the differential effects of the physical environment on the developing child,[94–96] epigenetics,[94,96] the prevalence of environmental injustice,[96] and the potential effects of climate change on children,[65–67,97–100] it is incumbent on society to consider the environment and environmental justice in the context of child health equity.

Educational Capital

Education is a fundamental right of children.[70] Policies related to access to quality education, particularly early learning,[90,91,101,102] and those related to children with special needs[91] reflect the transfer of educational capital (resources) to children. Such policies are important measures of equity.[28,75] The return on the investment in early education has been well defined.[90,91] The effects of education on health outcomes and measures of child and adult well-being have been similarly documented.[90,91,103]

Personal Capital

Investment in the dignity of children and ensuring that all children, without discrimination, have a legitimate and realistic expectation to enjoy optimal health and fulfill their dreams and aspirations depends on equitable public policy. Investment in the personal capital of children and families is a fundamental issue of equity, a reflection of the values of a community and a measure of its humanity. It is also an investment in the health and well-being of an individual over his or her life course—from infancy through adulthood—and an essential component of the role of pediatricians as they care for and mentor the patients whom they serve.

Translation of Principles of Human-Capital Investment Into Practice

Contextualizing child advocacy as the expansion of capital investment in children through clinical care, community development, and policy generation provides new strategies for pediatricians and the AAP to improve the health and well-being of all children. Using social capital as an example, at the clinical interface, pediatricians can include questions about the child's network of social relationships as part of routine anticipatory guidance and counsel parents about the importance of these relationships to their children. Referrals to mentoring, athletics, quality child care, and other resources

in the community can be made. At the community and policy levels, pediatricians can work with all sectors of the community to advocate for and generate public policies that ensure equitable access and quality improvements in early learning and after-school programs, scouting and Boys and Girls Clubs, community centers and recreational programs, and other resources that will increase children's social capital.

Other examples of the translation of the principles of human capital investment into practice include identifying and responding to clinical issues resulting from (1) a family's lack of access to basic needs (financial capital), (2) detrimental environmental exposures (environmental capital), (3) inadequate educational services for children with special needs (educational capital), and (4) a child's poor sense of self-efficacy and lack of a vision for the future (personal capital). Pediatricians and the AAP are in a unique position to advocate for expanded capital investments in children at the individual and community levels. At the public-policy level, the AAP can work individually and with other child advocacy organizations to ensure that all forms of capital are invested in children as a matter of public- and private-sector policy.

Health Equity Ethics

Health equity ethics adapts and applies the traditional principles of medical ethics, (eg, justice, beneficence, nonmaleficence, and autonomy) to a child rights framework.[104] It defines an expanded set of rights-based ethical principles that can be used as a tool for the consideration and analysis of issues related to the components of child health equity.

The principles of medical ethics relate directly to the 4 primary principles of children's rights, as defined by the UN Convention on the Rights of the Child: nondiscrimination (article 2), best interests (article 3), survival and development (article 6), and providing a voice and listening to children (article 12).[70] Table 3 relates the 4 core principles of children's rights to the 4 principles of medical ethics. Table 1 presents an inventory of the rights defined by the articles in the UN Convention, cross-referenced with the 4 principles of medical ethics. Table 1 also lists examples of indicators that could be used to measure policies that affect these rights. With this matrix, a rights-based perspective can be integrated into ethical decision-making, including the work of hospital ethics committees, to address issues that go beyond primarily biomedical concerns, enrich dialogue and discussion, and provide new tools for clinical practice, child advocacy, and policy formulation.[105]

TABLE 3 Relating the Core Principles of the UN Convention on the Rights of the Child to the Principles of Medical Ethics

Children's Rights Principles	Medical Ethics Principles
Article 2: Nondiscrimination	Justice
Article 3: Best interests	Beneficence
Article 6: Survival and development	Nonmaleficence
Article 12: Providing children a voice and listening to them	Autonomy

IMPLICATIONS FOR PRACTICE

The principles and practice of child health equity provide tangible knowledge, tools, skills, and strategies that can be applied by pediatricians to clinical care, child advocacy, and the formulation of public policies. The principles provide a foundation and framework to better prepare clinicians and child-serving institutions to ensure the fulfillment of children's rights to:

- child- and family-centered pediatric practices and institutions that consider the best interests of all children without discrimination when decisions are made[70–72,106–109];
- confidentiality, privacy, and dignity[70,107–109];
- have a voice and be listened to, particularly in clinical decision making and informed consent[70,107–109];
- information that is available in a language and at a developmental level they will understand[70,107–109];
- access to a full continuum of health care without discrimination on the basis of (1) insurance, refugee, and/or immigration status,[51–58] (2) disabilities,[33,36,46] and/or (3) placement in foster care, the juvenile justice system, or other public venues[43,44,49,50];
- optimal pain control and symptom management, sedation for invasive procedures, and palliative and end-of-life care that conform with international rights-based standards of care for child health practices[108,109];
- optimal nutrition, including breastfeeding, through compliance with international standards for infant nutrition[106,110] and by providing mothers with the information and resources required to ensure that they have the capacity and option to make and implement decisions that are in the best interests of their infants and children[106];
- evidence-based health care;
- access to psychosocial and mental health services, including education and recreation in the hospital setting[107–109]; and
- protection from all forms of violence and exploitation.[70,107–108]

For child-serving institutions, admission and discharge, quality improvement, and other practice and organizational policies and protocols should reflect this equity- and rights-based approach to care. All staff, including physicians, nurses, paraprofessionals, and support personnel, should be

oriented and trained to implement them. Ethics committees should integrate the principles of health equity and children's rights into their deliberations, and a children's charter, modeled after the charter adopted by the European Association for Children in Hospital (EACH),[108] should be developed and displayed by all practices and institutions that care for children.[107–109] The EACH charter enumerates the rights-based standards of care that are required to be fulfilled by health care institutions that serve children in Europe.

With respect to clinical care, pediatricians can implement the principles of health equity to address the root social and environmental causes of childhood morbidity, as well as the prevention and treatment of the illnesses they cause. An equity-based pediatric practice would approach:

- well-child care by promoting Bright Futures' emphasis on nurturing environments for all children and adolescents[81];
- asthma and lead poisoning in the context of a child's right to adequate housing and protection from environmental exposures[70,94–96];
- obesity and diabetes as a function of a child's right to breastfeed and access quality food and recreation[70,106,110];
- injury as a right to protection from environmental exposures and the consideration and promotion of the best interests of children when decisions are being made about the built environment[70,94–96,111];
- school failure as a child's right to access quality early learning environments that foster optimal development through childhood, child care, and school-based services[70,90,91];
- developmental, behavioral, and mental health problems as a child's right to nurturing home and family environments that protect them from chronic traumatic stress, and access to early prevention, diagnostic, and therapeutic services[70]; and
- dental disease as a child's right to adequate nutrition and access to dental care.[70]

The role of all pediatricians thus expands from the provision of clinical care to include child advocacy at the clinical and community levels to address root causes of childhood illnesses and morbidities. Multiple tools are available to support clinicians in this regard,[70,75,80–82,106–120] although additional training will be required to prepare them to implement this new practice paradigm. Practice standards must evolve to support this equity-based practice paradigm, and reimbursement strategies must be pursued to ensure that the economics of practice support this approach to care. Pediatricians and organized medicine must work to make this a reality, as they have succeeded in the past to advance universal health insurance systems for children, expand specialized insurance coverage and services for vulnerable populations of children, ensure reimbursement for well-child care, and, most recently, advance enhanced payment for patient-centered care.

The extent to which pediatricians become directly involved with the formulation of public policy will vary, but all must be prepared to support their peers, the AAP, and other child-serving institutions, organizations, and professional societies in their public policy endeavors in respect of children and families. Pediatricians have many available partners in these endeavors in the fields of law, social work, economics, business, and public health, as well as parents, children, youth, and transitioning adults.

RECOMMENDATIONS

The AAP and pediatricians have synergistic roles to play to ensure that social and environmental determinants of health are addressed through clinical practice, child advocacy, and policy formulation to promote health and eliminate inequities that result in child health disparities. This is an explicit goal of the US Department of Health and Human Services *Healthy People 2010* initiative.[116]

American Academy of Pediatrics

Health equity contributes to optimal child health and reduction of health disparities through the generation of appropriate public policies, health-enhancing public programs, and a clinical focus on issues of children's rights, social justice, the environment, and human capital investment. Through education and training in the relevance of the components of child health equity to clinical care, child advocacy, medical education, research, and policy formulation; and the integration of the principles and practice of child health equity into its endeavors to advance health outcomes for children, the AAP can influence all aspects of child health practice, improve children's health, and decrease health disparities.

Toward this end, the AAP, in collaboration with the public and private sector and community, state, and national organizations and institutions, will advocate at all levels of society for:

1. Integration of the principles and practice of child health equity into AAP policies and endeavors.
2. Consideration of the best interests of children by policy makers when legislation and decisions are being made that could potentially affect children.[70,106–111]
3. Access to linguistic and developmentally appropriate information

required by children and families for them to be informed decision makers concerning issues that affect them and their communities.[70,107–109]

4. Children's participation and involvement in decision making regarding issues that affect them.[70,107–109]
5. Equitable access to relevant health services for all children.[70]
6. Exploration of the use of the principles of child health equity and the articles of the UN Convention on the Rights of the Child to frame and measure private- and public-sector clinical care, advocacy, and policy formulation.[70]
7. Routine use of child health impact assessments to determine the potential effects of legislation and policy decisions on children's health and well-being.[115]
8. Examination of administrative models for protecting children's rights, such as the appointment of independent children's rights commissioners (ombudspersons) who are accessible to all children and families to ensure that children (*a*) are not discriminated against, (*b*) have their best interests considered by decision makers, (*c*) have access to information and a voice in their communities, and (*d*) have all their rights, as delineated in the UN Convention, fulfilled.[117]
9. Development of child-friendly cities. The Child Friendly Cities movement is a global effort, similar in some respects to "America's Promise," to establish communities in which the voices, needs, priorities, and rights of children are an integral part of public policies, programs, and decisions.[111,121]
10. The reduction of child poverty; racism; individual, structural, and institutional discrimination; gender inequities; and environmental injustice through legislative advocacy and policy development.[31,90,91,93,96,118]
11. Legislation to support parents and parenting at home, in the workplace, and in the community.[70,73,90,91]
12. Development of national health equity indicators that are linked to the social and environmental determinants of children's health.[75,76,113,119,120]
13. Implementation of a national child health equity research initiative to develop evidence-based interventions that target the social and environmental determinants of children's health.[122]
14. Development of competencies and curricula for training professionals in child health equity.[114]
15. Ratification of the UN Convention on the Rights of the Child.[70,123] The AAP, in collaboration with other national and international organizations, should work with the UN Committee on the Rights of the Child to ensure that the implementation of the articles of the Convention reflect new scientific knowledge and respond to the evolving needs of children.

Clinical Practice

Pediatricians have an important role to play at all levels of clinical practice and child advocacy to improve the health of children and reduce health disparities. Pediatricians can identify and intervene to shape the social and environmental determinants that affect the health of their patients. They can work with communities to provide support to families and ensure the equitable delivery of health services. As influential members of communities, pediatricians can access the media and decision makers to advocate for changes in the environments in which children live. They also can use their close links with local authorities and community services to ensure that policies are implemented and work to the benefit of all children.

Toward these ends, pediatricians can support efforts to:

1. Integrate the principles of child health equity (eg, children's rights, social justice, human-capital investment, and health-equity ethics) into their practices.
2. Use individual clinical encounters as opportunities to screen and address the social, economic, educational, environmental, and personal-capital needs of the children and families they serve.
3. Use the principles of child health equity as the foundation for child advocacy and policy development.
4. Raise awareness of the relevance of social and environmental determinants to children's health and well-being in their communities and among legislators and other policy makers.
5. Decrease child health disparities through the implementation of the principles and practice of child health equity.

SUMMARY

To eliminate discrimination and improve the health of all children, reduce child health disparities, and advance child health equity, the root social and environmental determinants of children's health must be identified and mitigated. There is an extensive evidence base that links the social epidemiology of these determinants to children's well-being. Advances in life-course sciences have expanded our knowledge of how these determinants affect the biology of children's health and the trajectory of adult health outcomes. The principles and practice of child health equity—children's rights, social justice, human capital investment, and health equity ethics—provide perspective and knowledge to

reorient pediatricians and pediatrics to the importance of social and environmental determinants to the well-being of children. They provide the tools, skills, and strategies to eliminate health disparities and ensure that every child reaches his or her full potential for health and development.

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American Academy of Pediatrics
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Policy Statement—Health Information Technology and the Medical Home

abstract

FREE

The American Academy of Pediatrics (AAP) supports development and universal implementation of a comprehensive electronic infrastructure to support pediatric information functions of the medical home. These functions include (1) timely and continuous management and tracking of health data and services over a patient's lifetime for all providers, patients, families, and guardians, (2) comprehensive organization and secure transfer of health data during patient-care transitions between providers, institutions, and practices, (3) establishment and maintenance of central coordination of a patient's health information among multiple repositories (including personal health records and information exchanges), (4) translation of evidence into actionable clinical decision support, and (5) reuse of archived clinical data for continuous quality improvement. The AAP supports universal, secure, and vendor-neutral portability of health information for all patients contained within the medical home across all care settings (ambulatory practices, inpatient settings, emergency departments, pharmacies, consultants, support service providers, and therapists) for multiple purposes including direct care, personal health records, public health, and registries. The AAP also supports financial incentives that promote the development of information tools that meet the needs of pediatric workflows and that appropriately recognize the added value of medical homes to pediatric care. *Pediatrics* 2011;127:978–982

COUNCIL ON CLINICAL INFORMATION TECHNOLOGY

KEY WORDS

health information technology, medical home, pediatrics, electronic health record, medical record, data

ABBREVIATIONS

AAP—American Academy of Pediatrics
EHR—electronic health record

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INTRODUCTION

The Medical Home, the Strategic Plan of the American Academy of Pediatrics, and Health Information Management

The medical home[1] model is the central organizing principle for health care management for all children, including those with special health care needs.[2] The ideal medical home (1) translates evidence into high-quality pediatric care that is measurable, (2) provides coordinated pediatric primary and specialty care for all children, and (3) sustains pediatric practice through fair payment, cost-efficiency, and recognition of the value of pediatric primary care. The medical home model supports the strategic plan of the American Academy of Pediatrics (AAP)[3] by unifying evidence-based practice and the business of pediatric care through patient/family-provider relationships that are based on trust and effective, reliable information management.

Medical Home Information Functions

The medical home must centralize and support the primary care relationship between the patient/family and health care provider through

well-designed and well-implemented health information management. Critical information-management functions that support and enhance medical home principles include:

- establishment and maintenance of assurance (confidentiality, integrity, availability, currency, continuity, and accuracy) of patient health information;
- comprehensive organization and management of patient-care information (eg, encounter data, prescriptions, referrals, medication reconciliations) over a patient's lifetime and across all providers and services (eg, pharmacies, laboratories, imaging services, consultants, and other providers); comprehensive and accurate collection of social, demographic, and genetic histories (including family trees) with linkage to maternal and perinatal/natal data; and translation of evidence into patient-centered care plans that implement and track care;
- timely measurement of clinical effectiveness of care and effects on patient health outcomes;
- secure communication of clinical and business functions (documentation, coding, billing, accounting) among providers, the patient/family, and other members of the health care team (including insurance companies);
- education and sharing of health knowledge, information, and data for informed and shared decision-making by patients/families; and
- reuse of accrued and aggregated clinical data and experience for quality improvement, practitioner assessment, maintenance of certification, research, and program-planning in a manner that does not compromise patient confidentiality and does not require additional consent or assent.

Supporting Medical Homes With Information Technology

Improving the Continuity of Care

Medical home information-management systems must facilitate accurate, real-time collection, storage, retrieval, review, and communication of patient health information over time and across providers. For pediatrics, the core of such systems is a lifelong, electronic health record (EHR). Basic requirements for the content of an EHR for general[4] and inpatient[5] pediatric care have been articulated. Ambulatory medical home information systems must support:

- longitudinal tracking and continuity of health maintenance and chronic disease management via clinical decision-support tools that adequately meet the needs of pediatric care;
- coordination and comanagement of care provided to children with special health care needs during complex episodes that require numerous providers (primary care providers, specialists, inpatient care) via real-time communications and health information networks;
- patient transfers that span different care episodes (ie, ambulatory care to emergency care, emergency care to inpatient or critical care, critical care to rehabilitation care, inpatient care to home), including comprehensive and systematic communication of health information required for all care before, during, and after transfers between providers via structured care-transition tools and processes;
- patient-care transitions between medical homes—such as transitions from pediatric to adult medical homes[6]—via universal (ie, vendor/technology-neutral) portability standards for patient records among different medical home information systems;
- continuous quality improvement of all health care processes and provider performance over the entire patient life span via adoption and use of inclusive standardized age-specific (prenatal to elderly) data and measures; and
- information assurance: (*a*) confidentiality (authentication and authorization) as required by local and national regulations and pertinent legislation for all pediatric populations (including adolescents and children in foster care); (*b*) content and source integrity through audit trails and disaster recovery and notification protocols; and (*c*) real-time availability of patient information to care providers who need it, whenever they need it.

Real-time availability of patient information from the medical home to other entities (ie, to patients, families, pharmacies, laboratories, hospitals, emergency departments, immunization information systems, registries, other practices) requires the establishment of secure and compliant health care information communications networks. Such networks and all tools (eg, personal health records, electronic prescribing, ambulatory order entry, secure messaging, and data entry) that access patient information from the medical home must support information assurance in transit (and at rest) between entities or electronic applications.

Improving the Efficiency and Safety of Care

Medical home information systems must help enhance the efficiency and cost-effectiveness of care. Systems can help improve efficiency through reduction (if not elimination) of unnec-

essary service duplications, such as redundant laboratory testing or imaging studies, by centralizing and making available past and current results to authorized providers in a just-in-time fashion.

Automation of repetitive tasks, such as electronic prescribing and clinical decision support (electronic checklists, reminders, and alerts) for ongoing scheduled clinical tasks, such as timely immunization administration, must improve efficiency, reliability, and resilience of health care processes by removing barriers and ambiguities that lead to failures and patient harm. Medical home processes in need of this type of improvement include medication-tracking and reconciliation (especially during patient transfers and care transitions and product recalls), vaccine management and catch-up (especially during shortages), and medical and durable equipment management for children with special health care needs.

To maximize the efficiency and safety of pediatric care, information systems must connect and facilitate clear communication among all partners within the care network. In addition to having easy access to the physical networks that facilitate communication, all entities within the care network must support information-interchange standards (such as the ASTM/HL7 Continuity of Care Record/Document[7]) that include relevant concepts (eg, weight-based [mg/kg] medication dosing) that meet the needs of pediatric patients and their care.

Improving the Quality of Care

Medical home information systems must support continuous quality improvement. Systems must facilitate:

- timely translation of evidence into actionable practice protocols;
- consistent and measurable delivery of evidence-based clinical care; and
- continuous collection and reporting of quality indicators based on clinical data.

As care quality is increasingly defined by indicators on the basis of clinical practice data (as opposed to claims data) by payers and regulators, information systems must be designed and implemented to collect and display, process, and report measures derived directly from clinical care and outcomes data. To provide true measures of clinical effectiveness and cost-effectiveness, it will become necessary to design systems and measures that link performance indicators to "episodes of care" that go beyond simple "encounters."

To translate current evidence into practice, systems must support incorporation of current guidelines into actionable practice tools. Tools such as checklists and clinical decision support must be incorporated into electronic encounter forms and other clinician interfaces that can collect performance data that demonstrate the impact of guideline implementation within specific care settings.

Finally, as a potential source of ongoing accrued clinical data, medical home information systems must make such clinical data available to support quality improvement on multiple levels: to provide data for performance feedback (for continuous professional development and maintenance of certification) at the level of the individual clinician; to develop and refine clinical decision support and to assess performance (data for programs such as eQIPP [Education in Quality Improvement for Pediatric Practice][8]) at the practice level; and to pool data from individual medical home information systems (to health information exchanges) for public health research and planning at community and population levels.

RECOMMENDATIONS

The AAP supports:

1. Development, implementation, and widespread deployment of a comprehensive electronic infrastructure to support pediatric information-management functions of the family-centered medical home. These functions include (*a*) management and tracking of patient health and services over a patient's lifetime across multiple providers, (*b*) comprehensive, efficient, and timely transfer of health data for safe patient transitions among providers, institutions, and practices, (*c*) establishment of central coordination of a patient's health information among multiple repositories (including personal health records and information exchange), (*d*) translation of evidence into actionable protocols and clinical decision support, and (*e*) reuse of archived clinical data for continuous quality improvement and public health research.
2. Formal and centralized advocacy in legislative and technical arenas to promote the development, implementation, and widespread adoption of tools to support pediatric information functions in medical home information systems, including (*a*) pediatric-specific quality measures based on clinical data, (*b*) data standards that facilitate electronic collection, processing, and reporting of pediatric-specific and pediatric-appropriate clinical data from medical homes for quality improvement for practices, continuous professional development of providers, regulatory reporting, and population-based health research, and (*c*) health information exchanges that connect medical homes to other sectors of the health care environment.
3. Universal portability of health information to other entities including per-

sonal health records, pharmacy, laboratory, and imaging information systems; other patient electronic information systems (regardless of vendor); and registries for research and resource management.

4. Creation of financial incentives to (*a*) promote adoption of the medical home model in primary and specialty care, (*b*) design, implement, and deploy health information technologies that meet pediatric requirements for quality and safety, and (*c*) promote widespread universal adoption of such technologies (including education and training) into medical home information systems.

Barriers to Overcome

Challenges to these recommendations include:

- Need for universal bidirectional interoperability of systems—As interconnected systems evolve, there is increasing need to create and maintain bidirectional exchange of data from EHRs to practice-management and billing/scheduling systems, insurance information systems, and health information exchanges. Interoperability is vulnerable to loss when systems change; therefore, universal standards for maintaining data-sharing among systems are needed.
- Need for centralized leadership—As the movement to increase adoption of EHRs and associated health information technology accelerates, so does the need for a central organizing entity for pediatric-specific technical, legislative, and advocacy efforts. Such an entity must work to align incentives and help pediatric practices navigate the changes that will be required to promote family-centered medical homes and health information technology adoption. These evolving needs will require the AAP[9] to work in partnership with practices, vendors, and other stakeholders in the best interests of child health to build national and regional health information networks that meet the needs of pediatric care. An important area for initial technical work is in the development of a pediatric EHR format as part of the Child Health Insurance Reauthorization Act (CHIPRA).[10] The AAP has established the Child Health Informatics Center[11] to lead in some of these efforts.
- Financial uncertainty—Pediatric practices bear the risks and costs of health information technology adoption but do not currently see financial returns on those investments. Therefore, financial incentives and assurances that mitigate risks of adoption and that provide return on investments to practices are needed if wider pediatric adoption of health information technology is the target goal. Federal efforts include providing financial incentives for "meaningful use" of "certified products" that extend to all pediatric practices.[12]
- Privacy, security, and information ownership—Privacy laws, designed to provide patients with particular and well-recognized benefits, pose implementation challenges for providing assurance of confidentiality, integrity, and availability of pediatric patient data. In addition to jurisdictional variations in laws surrounding patient privacy, there are technical, political, and ethical issues surrounding information management for children with conditions such as HIV or rare diseases, adolescent privacy and confidentiality issues, and of confidential data stored in health information exchanges. In addition, the progressive management, regulation, and ownership of archived personal health information and its reuse as children reach the age of majority are unclear.
- Practitioner resistance—The technical challenges in implementing electronic information systems in ambulatory settings are daunting for many practices, especially smaller ones. The work and cost of selecting and implementing a system is compounded by the work and cost of converting existing practice data and infrastructure to fit an electronic record, and the loss of productivity during deployment may deter many practices from adoption. In addition, practices are vulnerable to changes in health information technology vendor choices that may require additional costly changes as markets change.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT
Guidance for the Clinician in Rendering Pediatric Care

Tracy L. Trotter, MD; Judith G. Hall, OC, MD; and the Committee on Genetics

Health Supervision for Children With Achondroplasia

ABSTRACT. Achondroplasia is the most common condition associated with disproportionate short stature. Substantial information is available concerning the natural history and anticipatory health supervision needs in children with this dwarfing disorder. Most children with achondroplasia have delayed motor milestones, problems with persistent or recurrent middle-ear dysfunction, and bowing of the lower legs. Less often, infants and children may have serious health consequences related to hydrocephalus, craniocervical junction compression, upper-airway obstruction, or thoracolumbar kyphosis. Anticipatory care should be directed at identifying children who are at high risk and intervening to prevent serious sequelae. This report is designed to help the pediatrician care for children with achondroplasia and their families. ***Pediatrics*** **2005;116:771–783;** ***achondroplasia, short stature, children, health supervision.***

ABBREVIATIONS. OFC, occipital-frontal circumference; CT, computed tomography.

INTRODUCTION

This clinical report is designed to assist the pediatrician in caring for children with achondroplasia confirmed by radiographs and physical features. Although pediatricians usually first see children with achondroplasia during infancy, occasionally they are called on to advise a pregnant woman who has been informed of the prenatal diagnosis of achondroplasia or asked to examine a newborn to help establish the diagnosis. Therefore, this report offers advice for these situations as well.

Substantial new information has appeared since publication of the first policy statement on health supervision of children with achondroplasia.[1] In particular, a great deal has been learned about the molecular genetics of the disorder.[2] In addition, a more complete understanding of how certain serious complications can be minimized or avoided has accrued.[3] The new information is incorporated into this report, which is a revision of the original policy statement.

Achondroplasia is the most common condition associated with severe disproportionate short stature.[4] The diagnosis can usually be made on the basis of clinical characteristics and very specific features on radiographs, which include contracted base of the skull, square shape of the pelvis with a small sacrosciatic notch, short pedicles of the vertebrae, rhizomelic (proximal) shortening of the long bones, trident hands, a normal-length trunk, proximal femoral radiolucency, and (by midchildhood) a characteristic chevron shape of the distal femoral epiphysis. Other rhizomelic dwarfing disorders such as hypochondroplasia and thanatophoric dysplasia are part of the differential diagnosis, but achondroplasia usually can be distinguished from them because the changes in hypochondroplasia are milder and the changes in thanatophoric dysplasia are much more severe and invariably lethal. Achondroplasia is an autosomal dominant disorder, but approximately 75% of cases represent new dominant mutations. Achondroplasia is caused by mutation in the gene that codes for the fibroblast growth factor receptor type 3 (*FGFR3*).[5–7] Because virtually all of the causal mutations occur at exactly the same place within the gene,[7] molecular testing is straightforward. It is not necessary to perform molecular testing in every child with a clinical diagnosis of achondroplasia. However, *FGFR3* testing should be performed in children who are in any way atypical or in circumstances in which differentiation from similar disorders, such as hypochondroplasia, is not certain. Such children also should be referred for clinical genetic evaluation.

A great deal is known about the natural history of achondroplasia that can be shared with the family.[3,8] The average adult height in achondroplasia is approximately 4 ft for men and women (Figs 1 and 2).[9] The most common complication, occurring in adulthood, is related to lumbosacral spinal stenosis with compression of the spinal cord or nerve roots.[10,11] This complication is usually treatable by surgical decompression if it is diagnosed at an early stage.

Most children with achondroplasia do well. However, children affected with achondroplasia commonly have delayed motor milestones (Fig 3),[12,13] otitis media, and bowing of the lower legs.[14] Less commonly, infants and children may have serious health consequences related to hydrocephalus, craniocervical junction compression, upper-airway obstruction, or thoracolumbar kyphosis. Although they are less common, anticipatory care should be directed at identifying children who are at high risk and intervening to prevent serious sequelae. Most individuals with achondroplasia are of normal intelligence and are able to lead independent and pro-

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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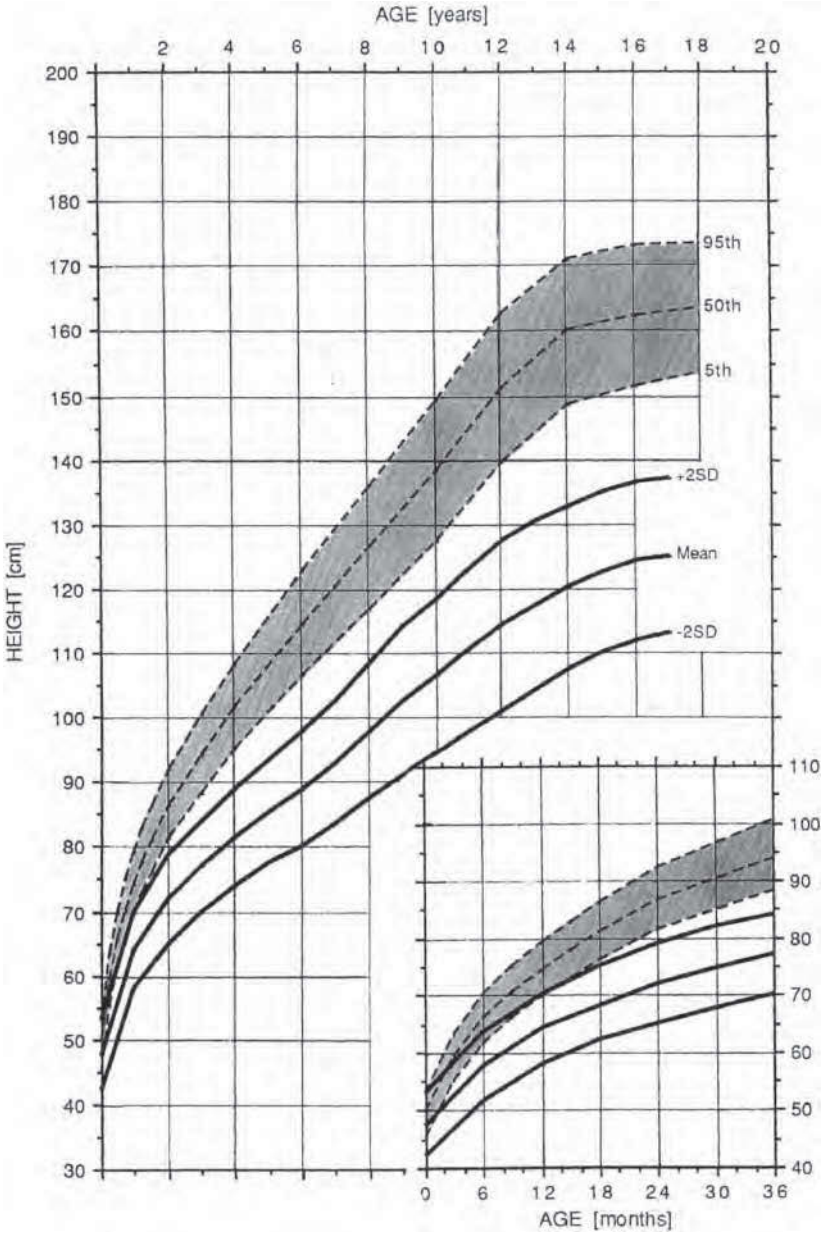

Fig 2. Height for females with achondroplasia (mean ± 2.8 standard deviation) compared with normal standard curves. The graph was derived from 214 females. (Saul RA, Seaver LH, Sweet KM, Geer JS, Phelan MC, Mills CM. *Growth References: Third Trimester to Adulthood.* 2nd ed. Greenwood, SC: Greenwood Genetic Center; 1998: 107–110.)

parents are usually knowledgeable about the disorder, the inheritance, and the prognosis for the offspring. More often, diagnosis of achondroplasia is first suspected late in gestation on the basis of long-bone foreshortening incidentally discovered by ultrasonography. With the frequent use of ultrasonography, many cases of achondroplasia are first identified prenatally (after 26 weeks of gestational age). However, disproportionately short limbs are observed in a heterogeneous group of conditions. Misdiagnosis and inaccurate prenatal counseling of families is common.[16] Confirmation of diagnosis based on ultrasonographic features characteristic of achondroplasia can be provided by molecular testing (*FGFR3* mutational testing) of prenatal specimens. If no such confirmation has yet been completed, caution should be exercised when counseling the family. In this circumstance, the pediatrician should discuss the tentative nature of the diagnosis and alternatives that may explain the identified features. The pediatrician should also discuss the natural history of achondroplasia, because it is the most likely explanation for the findings. In cases in which the diagnosis is unequivocally established either because of the familial nature of the disorder or by prenatal molecular diagnosis (chorionic villus sampling at 11–13 weeks' gestation or amniocentesis after 15 weeks' gestation), the pediatrician may consider the following steps as appropriate.

1. Review, confirm, and demonstrate laboratory or imaging studies leading to the diagnosis.
2. Explain the mechanisms for occurrence of achondroplasia in the fetus and the recurrence risk for the family.
3. Remember that at least 75% of cases of achondroplasia occur in families in which both parents have average stature. In those cases, achondroplasia in the offspring occurs because of a mutation in the gene.

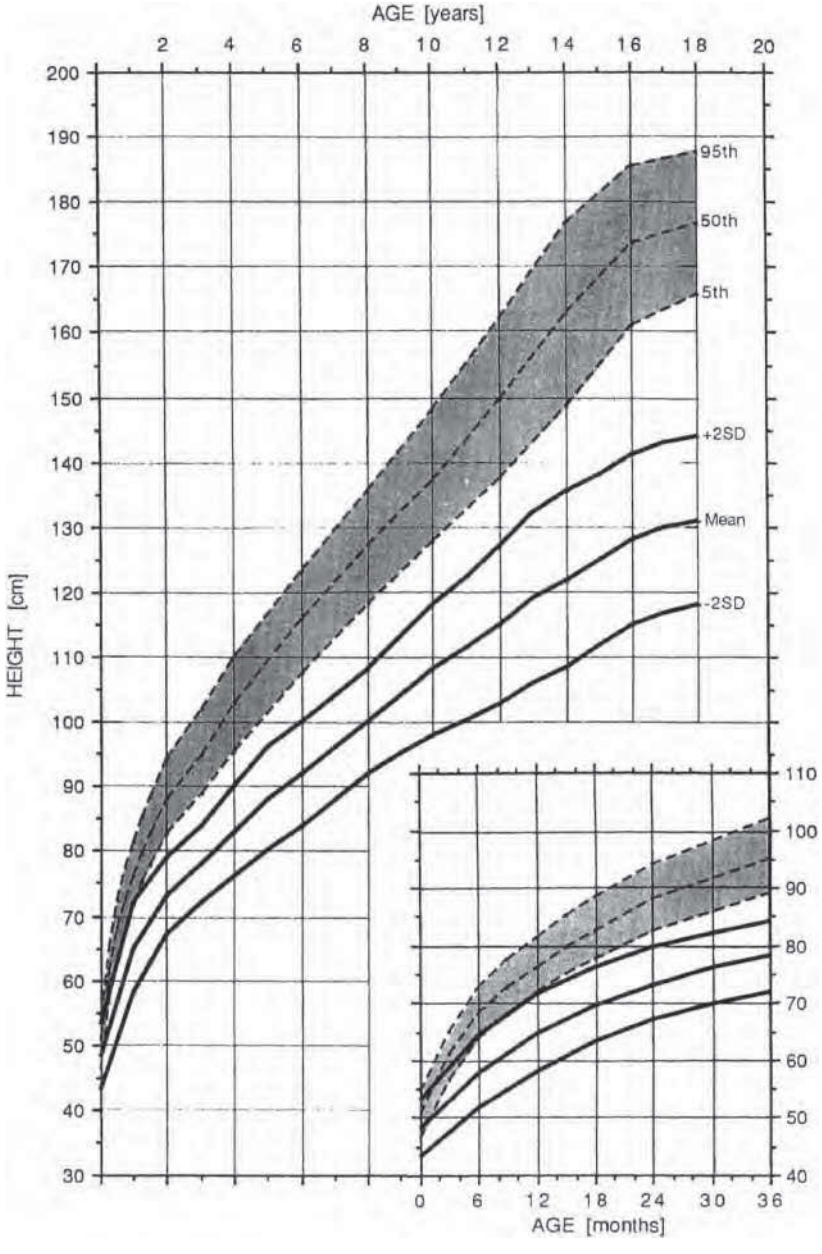

Fig 1. Height for males with achondroplasia (mean ± 2.8 standard deviation) compared with normal standard curves. The graph was derived from 189 males. (Saul RA, Seaver LH, Sweet KM, Geer JS, Phelan MC, Mills CM. *Growth References: Third Trimester to Adulthood.* 2nd ed. Greenwood, SC: Greenwood Genetic Center; 1998: 107–110.)

ductive lives.[15] Because of their disproportionate short stature, however, a number of psychosocial problems can arise. Families can benefit from anticipatory guidance and the opportunity to learn from other families with children of disproportionate short stature.

The consensus-based guidance in this report is designed to help the pediatrician care for children with achondroplasia and their families. Issues that need to be addressed at various ages are discussed (Table 1). These suggestions are not appropriate for other chondrodysplasias, because each type has its own natural history, complications, and specific guidelines. Irrespective of the availability of the guidance in this report, it is important that pediatricians and parents also consult a physician with special experience and expertise concerning achondroplasia early in the child's life, because this report only provides generally applicable suggestions that must be tailored to a particular child's condition and needs.

THE PRENATAL VISIT

Pediatricians may be called on to counsel expectant parents whose fetus has achondroplasia or is suspected to have achondroplasia because of recognition on ultrasonography of disproportionate small stature. In some settings, the pediatrician will be the primary resource for counseling a family. At other times, counseling may already have been provided to the family by a clinical geneticist and/or the obstetrician. Because of a previous relationship with the family, however, the pediatrician may be called on to review this information and assist the family in the decision-making process.

The diagnosis of achondroplasia in the fetus is made most often with certainty when 1 or both parents have this condition. In this circumstance, the

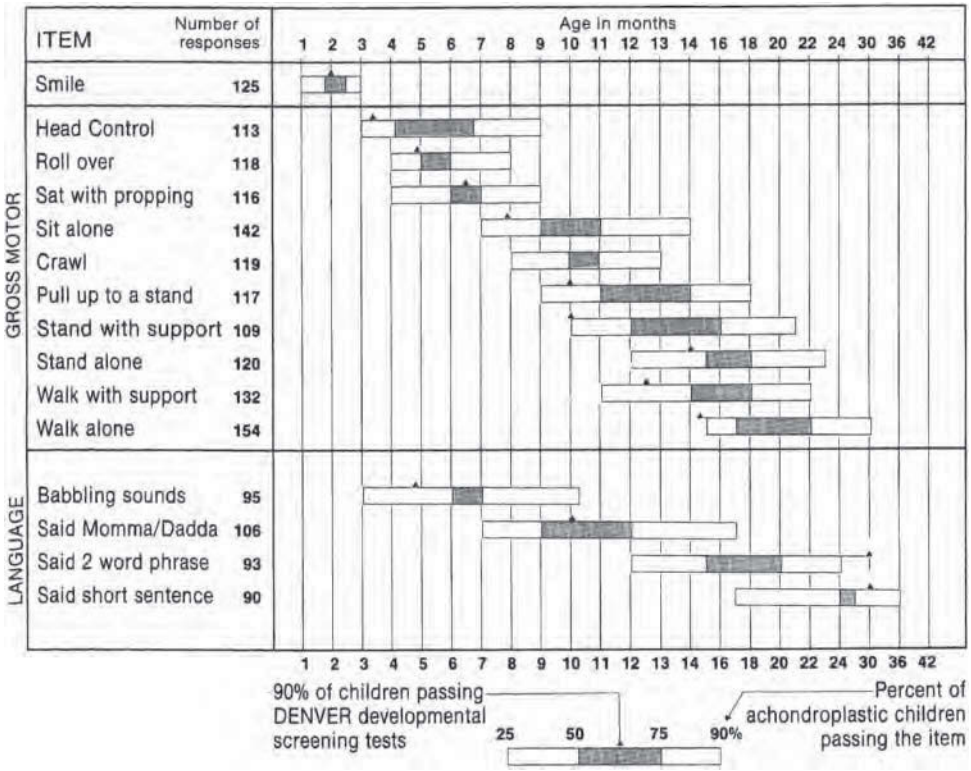

Fig 3. Developmental screening tests in achondroplasia. The bar scale shows the percentage of achondroplastic children passing the item; the black triangle on top of the bar shows the age at which 90% of normal children pass the same item. The graphs were derived from 197 affected individuals, obtained by questionnaire. (Reproduced with permission from *Am J Med Genet*. 1981;9:19-23.)

4. Review the natural history and manifestations of achondroplasia, including variability.[3]
5. Discuss additional studies that should be performed, particularly those to confirm the diagnosis in the newborn period. If miscarriage, stillbirth, or termination occurs, confirmation of diagnosis is important for counseling family members about recurrence.
6. Review currently available treatments and interventions. This discussion needs to include the efficacy, complications, adverse effects, costs, and other burdens of these treatments. Discuss possible future treatments and interventions.
7. Explore the options available to the family for the management and rearing of the child using a nondirective approach. In cases of early prenatal diagnosis, these options may include discussion of pregnancy termination, continuation of pregnancy and rearing of the child at home, foster care, or adoption. If adoption is planned to another family, contact may be made with the Little People of America adoption service.[17]
8. If the mother is affected with achondroplasia, inform her that a cesarean delivery must be performed because of the characteristic small pelvis.[18] A mother affected with achondroplasia may develop respiratory compromise during the third trimester of pregnancy, so baseline pulmonary function studies should be performed. Homozygous achondroplasia can be diagnosed prenatally with molecular testing of the fetus, by either chorionic villus sampling or amniocentesis. A pregnancy at risk of homozygosity should be followed with ultrasonographic measurements at 14, 16, 18, 22, and 32 weeks of gestation to distinguish homozygosity or heterozygosity from normal growth patterns in the fetus.
9. When both parents are of disproportionate short stature, assess the possibility of double heterozygosity[19] or homozygosity for achondroplasia. Some forms of double heterozygosity lead to life-threatening problems[19]; infants with homozygous achondroplasia usually are stillborn or die shortly after birth.[20]

HEALTH SUPERVISION FROM BIRTH TO 1 MONTH OF AGE: NEWBORNS

Examination

1. Confirm the diagnosis by radiographic studies (the diagnosis of approximately 20% of patients with achondroplasia has been delayed in the past because it was not suspected on physical examination in the newborn period, and consequently, no radiographs were obtained).
2. Document measurements, including occipitalfrontal circumference (OFC), body length, and body weight; plot these measurements on achondroplasia-specific growth charts (Figs 1, 2, and 4–7). Review the phenotype with the parents and discuss the specific findings with both parents whenever possible.
3. The OFC should be measured at every pediatric contact during the first year (Figs 4 and 5).

TABLE 1. Achondroplasia Guidelines for Health Supervision

	Prenatal	Infancy, 1 mo to 1 y of Age					Early Childhood, 1 to 5 y of Age						Late Childhood	Adolescence
		Neonatal	2 mo	4 mo	6 mo	9 mo	12 mo	15 mo	18 mo	24 mo	3 y	4 y	5 to 13 y, Annual	13 to 21 y, Annual
Diagnosis														
Radiography		Whenever the diagnosis is suspected												
Review phenotype		Whenever the diagnosis is suspected												
Review proportions		Whenever the diagnosis is suspected												
Molecular testing [*FGFR3*]	See text	When diagnosis is not certain												
Genetic counseling														
Early intervention		X												
Recurrence risks		X					X							X
Reproductive options							X						X	X
Family support		X					X			X			X	X
Support groups		X					X			X			X	X
Long-term planning							X			X			X	X
Medical evaluation														
Growth/weight/OFC		X	X	X	X	X	X	X		X		X	X	X
Orthopedic consult														
Neurology consult														
Hearing							X R			X R		X R	X R	
Social readiness							S			S		S	S	
Orthodontics												R	R	R
Speech								S/O	S/O	S/O	S/O	O	O	
Medical evaluation														
Radiography, only to make diagnosis or if complication														
CT/MRI brain/cervical spine		X												
Polysomnography		X	As indicated											
Social adjustment														
Psychosocial					S		S			S			S	S
Behavior and development		S/O	S/O	S/O	S/O		S/O	S/O	S/O	S/O			S/O	S/O
School											O		O	O
Sexuality														X

These guidelines ensure compliance with AAP recommendations for preventive pediatric health care. *FGFR3* indicates fibroblast growth factor receptor type 3; X, to be performed; S, subjective, by history; O, objective, by a standard testing method; R, discuss referral to a specialist; 3 , continue to monitor.

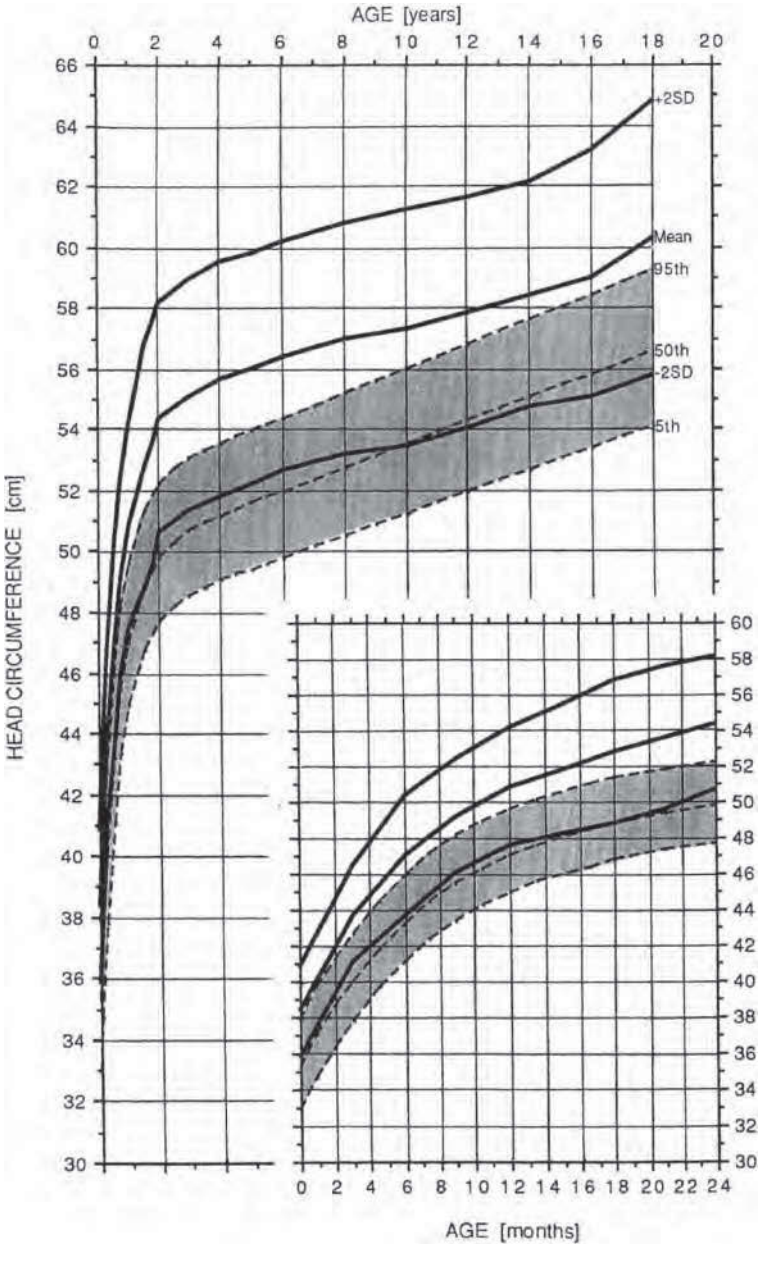

Fig 4. Head circumference for males with achondroplasia compared with normal curves (dashed lines). The graph was derived from 189 males. (Saul RA, Seaver LH, Sweet KM, Geer JS, Phelan MC, Mills CM. *Growth References: Third Trimester to Adulthood.* 2nd ed. Greenwood, SC: Greenwood Genetic Center; 1998: 107–110.)

Anticipatory Guidance

1. Discuss the specific findings of achondroplasia with the parents, including the following:
   - Autosomal dominant inheritance: approximately 75% of cases are new mutations. Germline mosaicism (in which some germ cells are derived from a normal cell line and some are from a cell line with a mutation) has been reported, but the risk of recurrence in sporadic cases is less than 1%.[21–23]
   - Most individuals with achondroplasia have normal intelligence and normal life expectancy.
   - Although serious problems may arise during infancy, such problems affect only 5% to 10% of infants with achondroplasia.
   - Growth hormones, other drug therapies, and food or vitamin supplements are not effective in significantly increasing stature. Growth-hormone therapy may result in a transient increase in growth rate. However, the salutary effects diminish with continued treatment. No study has clearly demonstrated a significant benefit with respect to ultimate adult stature.[24,25] If elected, such treatment should be considered only within a research setting. Extended limb lengthening using a variety of techniques has been used far more elsewhere than in North America. It can result in substantial increases in ultimate height.[26,27] However, it is arduous, not without risk, and costly. Most families alternatively choose to modify the environment to accommodate the child rather than the converse.
   - Special achondroplasia growth curves and infant development charts have been developed (Figs 1–7); the final expected adult height for

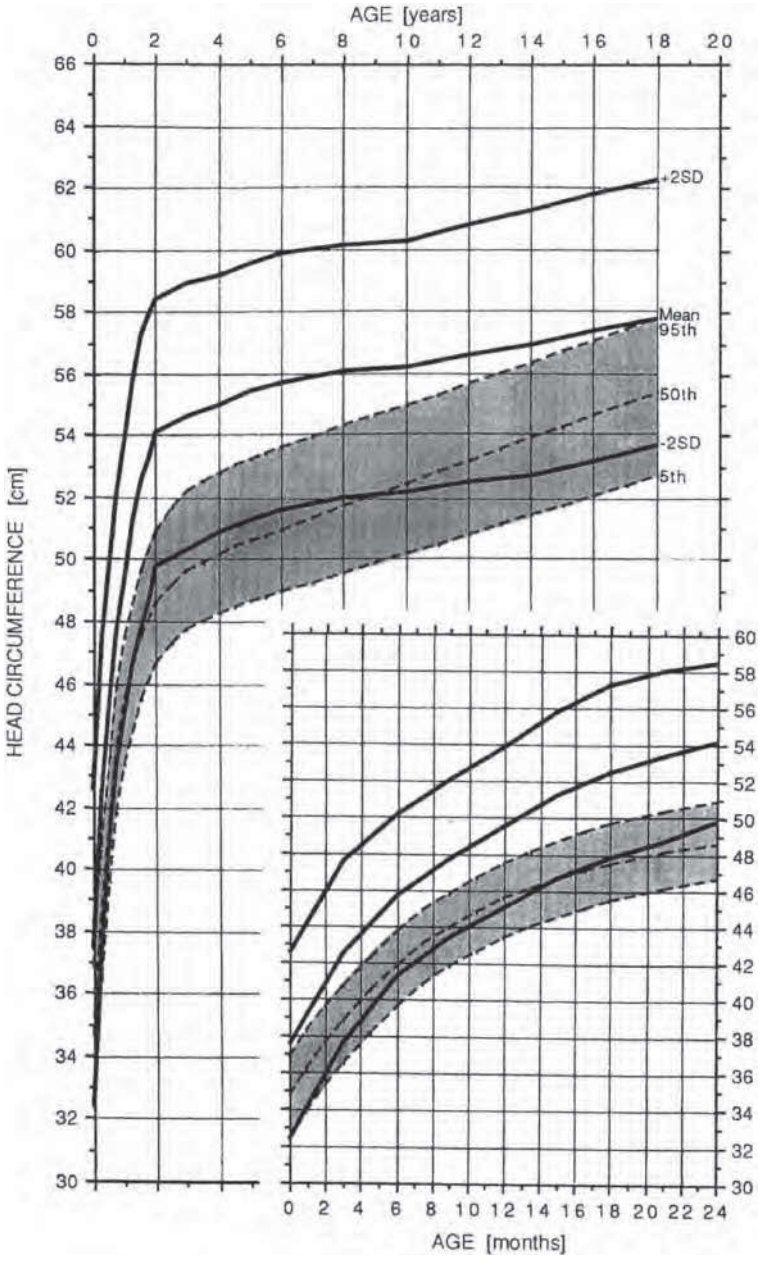

Fig 5. Head circumference for females with achondroplasia compared with normal curves (dashed lines). Data were derived from 145 females. (Saul RA, Seaver LH, Sweet KM, Geer JS, Phelan MC, Mills CM. *Growth References: Third Trimester to Adulthood.* 2nd ed. Greenwood, SC: Greenwood Genetic Center; 1998: 107–110.)

persons with achondroplasia is approximately 4 ft.[9]

2. Discuss the following possible severe medical complications and methods of prevention:
   - Unexpected infant death occurs, in the absence of aggressive evaluation, in approximately 2% to 5% of all infants with achondroplasia.[28,29] This seems to result from central apnea arising secondary to compression of arteries at the level of the foramen magnum.[28] In addition, the universally small foramen magnum may result in a high cervical myelopathy.[30,31] However, with appropriate assessment and intervention, both risks can be minimized.[31] Parents should be advised to use an infant seat or infant carrier that has a firm back that supports the neck and to use a rear-facing car safety seat for as long as possible. They should be counseled to avoid use of products like mechanical swings and carrying slings to limit uncontrolled head movement around the small foramen magnum. There are instances in which infants with achondroplasia who showed no clinical abnormality by examination and who were asymptomatic have died from this complication. Given this, and because it can be life saving, care of every infant with achondroplasia should include assessment for craniocervical junction risks, which includes careful neurologic history and examination, neuroimaging, and polysomnography.[31] Neuroimaging can be by computed tomography (CT) with thin cuts and bone windows[31] or magnetic resonance imaging (MRI),[32,33] each of which has benefits and disadvantages: CT allows direct comparison of foramen magnum size with published achondroplasia standards and often can be accomplished without sedation or anesthesia but does not allow direct visualization of the

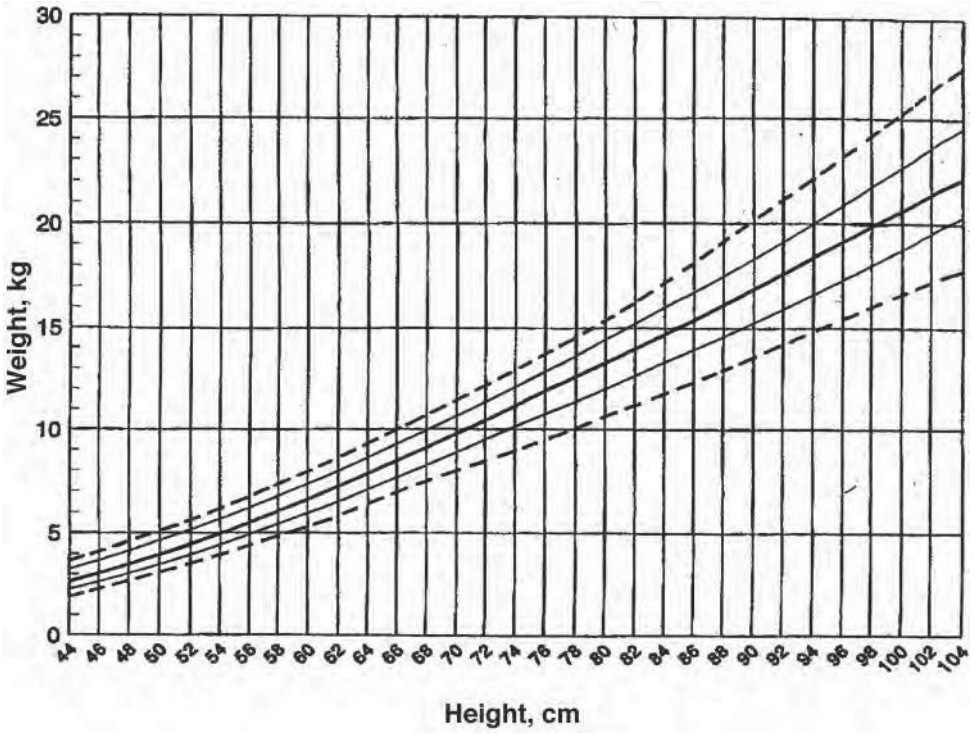

Fig 6. Height-by-weight standards in achondroplasia: males. (Reproduced with permission from *Am J Med Genet*. 1996;62:255-261.)

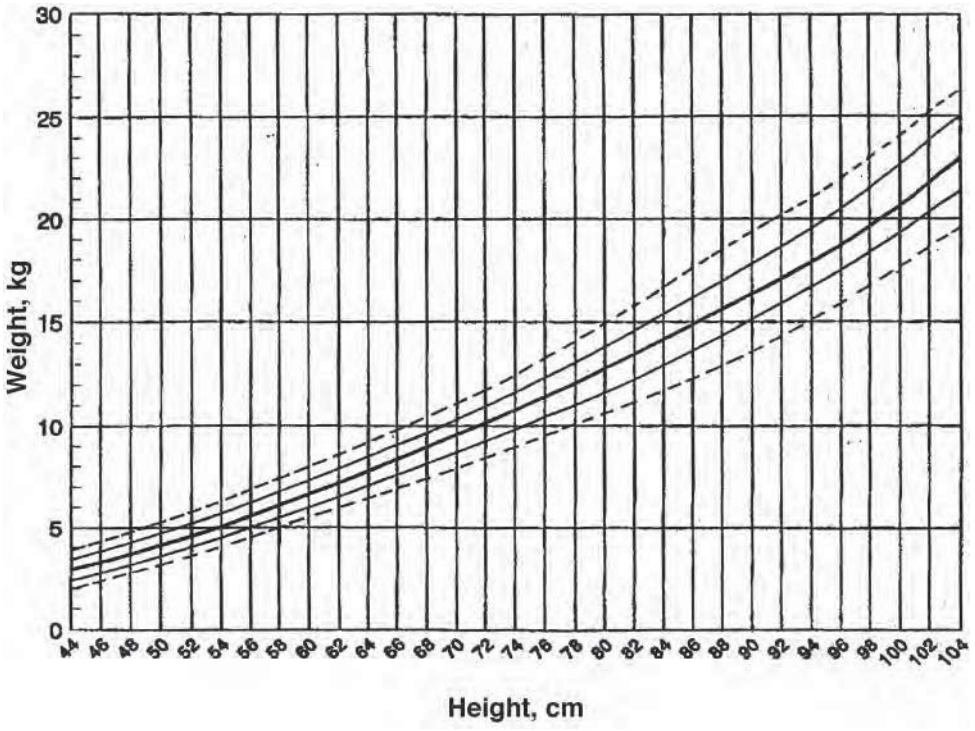

Fig 7. Height-by-weight standards in achondroplasia: females. (Reproduced with permission from *Am J Med Genet*. 1996;62:255-261.)

neural elements of interest; MRI provides such a direct assessment of the brainstem and upper cervical spinal cord, but no standards for estimation of foraminal size by MRI are available, and currently it cannot be performed routinely without sedation. Rapid development of imaging technology suggests that alternative methods may become appropriate in the future.

- If severe problems are found (eg, marked abnormality by neurologic examination, such as profound hypotonia or sustained ankle clonus; markedly diminished foramen magnum size compared with achondroplasia standard; substantial deformation of the upper cervical spinal cord; hypoxemic episodes with minimal oxygen saturations below 85%[31]), referral to a neurosur-

geon or other physician skilled and experienced in the care and treatment of neurologic problems in children with achondroplasia should be initiated.[34]

- Hydrocephalus is a lifelong risk but is most likely to develop during the first 2 years.[35] OFC should be monitored carefully during this time. If the OFC is large or crosses percentiles on the achondroplasia-specific head-circumference chart, it is appropriate to refer the infant to a pediatric neurologist or pediatric neurosurgeon. Baseline CT or MRI (performed in conjunction with imaging of the craniocervical junction) is valuable if there is concern about possible hydrocephalus. Repeating neuroimaging to assess change in ventricular size should be considered if there is acceleration of head growth compared with achondroplasia standards or if other signs like bulging, hard fontanelle, or symptoms of unusual lethargy or intractable irritability develop. Both ventriculomegaly and excessive extra-axial fluid are common benign accompaniments of achondroplasia[35] and should not be misinterpreted as indicative of need for shunt placement. Neural ultrasonography may be used to follow these clinical findings.
- Restrictive pulmonary disease occurs in less than 5% of children with achondroplasia who are younger than 3 years.[36] Living at high elevation markedly increases the risk that restrictive problems will develop. If there are signs of respiratory distress or evidence of poor weight gain despite adequate caloric intake, pulse oximetry (during feeding, when crying, and at rest) should be considered to monitor oxygenation.
- Most infants with achondroplasia develop a thoracolumbar kyphosis. More severe kyphosis is associated with unsupported sitting before there is adequate trunk muscle strength.[37,38] Parents should be counseled to avoid unsupported sitting and to avoid devices that cause curved sitting or "C sitting," such as "umbrella-style" strollers and soft canvas seats during the first year of life. Use of feeder seats for upright positioning should be recommended. If severe kyphosis appears to be developing, consider a pediatric orthopedic surgical assessment to determine if bracing is needed.[38]
- The common complication of spinal stenosis rarely occurs in childhood but manifests in older individuals with numbness, weakness, and altered deep tendon reflexes.[30] Severe thoracolumbar kyphosis is one mechanism that can give rise to spinal stenosis. It is for this reason that unsupported sitting before there is adequate trunk muscle strength is discouraged.
- Anesthesia risk:[39] if an individual with achondroplasia needs to have anesthesia and surgery, the following should be considered:
  (*a*) Care must be taken in manipulation of the neck, because uncontrolled neck movement (as may occur with intubation) could lead to unintentional spinal cord compression secondary to constriction of the foramen magnum.
  (*b*) Care should be taken to ensure that medication dosages are appropriate for size.
  (*c*) Access to veins is sometimes difficult because of lack of full extension at the elbow.
  (*d*) Generally, spinal anesthesia should be avoided, particularly when there is kyphosis or severe lumbar lordosis, because of limited space within the spinal canal.
  (*e*) General anesthesia should be strongly considered for cesarean delivery for pregnant women with achondroplasia (they will all require caesarian delivery because of contracted pelves), because use of epidural anesthesia in these women requires special skill and expertise.[40]/P

3. Discuss the potential psychosocial implications for both parent and child related to disproportionate short stature. Refer the affected individual or the parent of an affected individual to a support group such as Little People of America (also see "Resources for New Parents"). If parents do not wish to join a group, they may want to meet with or talk to other affected individuals or parents. Remind parents that most individuals with achondroplasia lead productive, independent lives.
4. Discuss with the parents how to tell their family and friends about their child's growth problem.
5. Supply the parents with educational books and pamphlets (see "Resources for New Parents").
6. Discuss the realistic functional problems for affected individuals.
7. Discuss individual resources for support, such as family, clergy, social workers, psychologists, and friends.
8. Review the prenatal diagnosis and recurrence risks for subsequent pregnancies.

HEALTH SUPERVISION FROM 1 MONTH TO 1 YEAR OF AGE: INFANCY

Examination

1. For infants not diagnosed in the newborn period, arrange for neuroimaging and polysomnography at the time of diagnosis.
2. Assess growth and development in comparison only with children with achondroplasia (Figs 1–7).
3. Perform physical examination.
4. Review head growth on achondroplasia-specific head-circumference charts.
5. Refer the infant to a pediatric neurologist or pediatric neurosurgeon if head size is disproportionately large or crosses percentiles, if there are signs or symptoms of hydrocephalus, or if there are indicators of possible craniocervical junction compression, including excessively brisk reflexes, asymmetric reflexes, ankle clonus, extreme hypotonia, or early hand preference.[10,35]
6. Consider repeating neuroimaging studies if there is acceleration of head growth, severe persisting hypotonia, or any signs of craniocervical junction compression.[31–34] Growth of the foramen magnum may be compared with achondroplasia-specific standards.[41]

7. Check motor development and discuss development; note on the milestone charts for achondroplasia. Expect motor delay but not social or cognitive delay.[12,13] Check for serous otitis media. Review risk at 6 to 12 months of age. Formal behavioral audiometric assessment should be completed at 9 to 12 months of age. Language delay may be present secondary to conductive hearing loss.
8. Continue to monitor for progression of kyphosis at the thoracolumbar junction. It is recommended that parents avoid carrying a child with achondroplasia in curled-up (C-sitting) positions. Certain types of child carriers, mechanical swings, jumpers, and umbrella-style strollers tend to increase risk for gibbus. Unsupported sitting should be avoided.[37,38] Parents and therapists should be instructed to provide back support during the first year of life. If severe kyphosis appears to be developing, consider pediatric orthopedic surgical assessment to determine if bracing is needed.[38]
9. Be aware that external rotation of the hips is commonly present and usually disappears spontaneously when the child begins to bear weight. This finding does not require bracing for the infant.

Anticipatory Guidance

1. Review the personal support available to the family.
2. Review contact with support groups.
3. Observe the emotional status of parents and intrafamily relationships.
4. Discuss early-intervention services and the importance of normal socializing experiences with other children.
5. Ask the parents whether they have educated their family members about achondroplasia; discuss sibling adjustment.
6. Review the increased risk of serous otitis media because of short eustachian tubes. Indicate that an ear examination is appropriate with any persistent or severe upper respiratory tract infection or when parents suspect that ear pain may be present.
7. Advise parents to avoid infant carriers that curl up the infant. This does not apply to car safety seats, which should always be used during automobile travel. A rear-facing car safety seat should be used to the highest weight allowed by a convertible seat (25–30 lb).
8. Discuss filing for Supplemental Security Income benefits as appropriate.

HEALTH SUPERVISION FROM 1 TO 5 YEARS OF AGE: EARLY CHILDHOOD

Examination

1. Assess the child's growth and development as plotted on the achondroplasia growth charts.
2. Continue to follow rate of head growth on the achondroplasia-specific head-circumference charts.
3. Continue to watch for thoracolumbar gibbus (kyphosis). Discuss avoiding the use of walkers, jumpers, or backpack carriers. Any kyphosis present should disappear as the child begins to bear weight. Lumbar lordosis usually develops but rarely requires specific intervention. Weight bearing and walking may occur late; however, they are expected by 2 to 2.5 years of age. When weight bearing begins, the external rotation of the hips should self-correct to a normal orientation within 6 months.
4. Anticipate some bowing of the legs. Many children will also have instability of the soft tissues surrounding the knee and internal tibial torsion. If positional deformity and instability leads to difficulty walking, a thrust at the knee (uncontrolled lateral or medial movement with weight bearing), or chronic pain, consult a pediatric orthopedist.[14]
5. Check the child's hips for hip-flexion contractures. Prescribe exercises that may decrease lumbar lordosis and hip-flexion contractures if indicated. Check the hips for external rotation. Refer the child to a pediatric orthopedist if necessary.
6. Screen hearing each year. If otologic history, hearing screening, or speech development raise concerns about hearing, formal audiologic assessment should be obtained.
7. Perform speech evaluation at no later than 2 years of age. If speech is delayed, conductive hearing loss attributable to chronic serous otitis media should be excluded.
8. Watch for obstructive sleep apnea secondary to smaller-than-average airway size plus physiologic adenoidal hypertrophy.[42–44] Most children with achondroplasia snore. However, if obstructive apnea or disordered breathing in sleep is suspected (increased retraction, glottal stops, choking, intermittent breathing, apnea, deep compensatory sighs, secondary enuresis, recurrent night-time awakening or emesis), then additional pulmonary evaluation and polysomnography are indicated.
9. Be aware that gastroesophageal reflux may be more common in children with achondroplasia and may be more common in those with neurorespiratory complications.[45] If reflux is severe, in addition to usual treatments, consider referral to a pediatric specialist with experience in treating gastroesophageal reflux in infants and children.
10. Do not misinterpret greater-than-average sweating as indicative of serious medical problems; it is normal in children with achondroplasia.
11. In rare instances in which diagnosis of achondroplasia is delayed beyond 1 year of age, determine if neuroimaging is needed on the basis of clinical signs and symptoms.

Anticipatory Guidance

1. Consider adapting the home so that the child can become independent (eg, lower the light switches, use lever door handles and lever sink faucets, make the toilet accessible, and supply step stools) (see "Resources for Parents").
2. Determine if an occupational therapy consultation is needed.

3. Discuss adapting age-appropriate clothing with snapless, easy-opening fasteners and tuckable loops.
4. Discuss adaptation of toys, especially tricycles, to accommodate short limbs.
5. Discuss adaptation of toilets to allow comfortable, independent use, with an extended wand for wiping if needed.
6. Discuss the use of a stool during sitting so that the child's feet are not hanging. Feet need support while the child is sitting at a desk, in a chair, or on the toilet. A cushion behind the child's back may be required for good posture and to prevent chronic back pain. Counsel parents for optimal protection to use a convertible rear-facing car safety seat to the highest weight and height allowed by the manufacturer of the seat.[46] A rear-facing seat provides the best support protection and positioning angle for a child with macrocephaly and skeletal dysplasia. Parents may benefit from suggestions for behavioral intervention to promote continuing the rear-facing position as long as possible.[47]
7. Review weight control and eating habits to avoid obesity, which often becomes a problem in mid- to late childhood.[48]
8. Discuss orthodontic bracing in the future and the possible need for early orthodontic assessment to consider palatal expansion.
9. Encourage the family to develop activities in which the child can take part; avoid gymnastics, diving, trampolines, and collision sports.
10. Discuss how to talk with the child and friends or family members about short stature.
11. Encourage preschool attendance so that the child can learn to socialize in an age-appropriate way, and work with parents to prepare the teacher and the other children so that the child is not given unnecessary special privileges.
12. Discuss toileting at school and special preparations needed by the school because of the child's short stature (see "Resources for Parents").

HEALTH SUPERVISION FROM 5 TO 13 YEARS OF AGE: LATE CHILDHOOD

Examination

1. Assess and review the child's growth, development, and social adaptation.
2. Plot measures on achondroplasia weight-by-height grids (Figs 6 and 7).
3. Review weight control.[48] The child may need to restrict food intake and eat less than an average-sized child eats.
4. Complete a general and neurologically oriented physical examination.
5. Check deep tendon reflexes yearly for asymmetry or increased reflexes that suggest spinal stenosis.
6. Continue to assess history for possible obstructive sleep apnea.
7. Test hearing each year.

Anticipatory Guidance

1. Determine school readiness.
2. Discuss preparation of the school and teacher for a child with short stature (see "Resources for Parents").
3. Prepare the child for others' questions and curiosity. Be sure the child can explain why he or she is short and can ask for help in an appropriate way. Children with achondroplasia usually are included in the regular education program.
4. Suggest adaptive aids for the school to cope with heavy doors, high doorknobs, reaching for the blackboard, foot support, and a regular-sized desk. Also, be sure that the child can use the restroom independently (see "Resources for Parents").
5. Counsel parents to use a child safety seat with a full harness to the highest weight allowed by the manufacturer of the seat and then to transition to the belt-positioning booster seat for optimal seatbelt positioning.[46]
6. Review socialization and foster independence.
7. Discuss contact with support groups. They are especially valuable at this age.
8. Consider obtaining an orthopedic evaluation when the child is approximately 5 years of age to make appropriate treatment plans if necessary.
9. Emphasize correct posture and encourage the child to consciously decrease lumbar lordosis by "tucking the buttocks under." If lordosis is severe, consider physical therapy referral to teach lower abdominal muscle strengthening and pelvic rotation.
10. Develop an activity program with acceptable activities such as swimming and biking. The child should avoid gymnastics and collision sports because of the potential for neurologic complications secondary to cervical spinal stenosis. If soccer is played, heading should be prohibited.
11. Review orthodontic and speech status.

HEALTH SUPERVISION FROM 13 TO 21 YEARS OR OLDER: ADOLESCENCE TO EARLY ADULTHOOD

Examination

1. Continue to record growth parameters.
2. Review weight control and diet.
3. Monitor for any signs or symptoms of nerve compression and check deep tendon reflexes, tone, and sensory findings, if indicated.
4. Continue to assess history for possible obstructive sleep apnea.

Anticipatory Guidance

1. Check on social adaptation.
2. Discuss the diagnosis with the adolescent to be sure that he or she has the vocabulary and the understanding of the genetic nature of achondroplasia.
3. Discuss contraception. The importance and use of contraception should be discussed with both males and females. Women with achondroplasia usually are fertile. Oral contraception should not be used long-term, because women with achondroplasia may have an increased risk of uterine fibroids, which may be aggravated by oral con-

traceptives. However, using a diaphragm is difficult because of the short arms in achondroplasia. Finding the appropriate long-term contraception may require consultation with a knowledgeable gynecologist. Women with achondroplasia often develop respiratory compromise late in pregnancy; thus, baseline respiratory function studies are recommended early in pregnancy. All pregnant women with achondroplasia will require caesarian delivery because of their small pelvic outlet. Because of spinal stenosis, spinal anesthesia is not recommended, and most women with achondroplasia should have general anesthesia for their cesarean delivery. If the partner of the woman with achondroplasia is of average stature, there will be a 50% risk of the infant having achondroplasia. If the partner also has short stature, the specific recurrence risk and the possibility of a severely affected infant must be determined so that the pregnancy and neonate can be managed properly. Prenatal diagnosis should be discussed to facilitate the management of the pregnancy for optimal outcome.[18]

4. Review orthodontic status.
5. Continue weight counseling.[48,49]
6. Encourage the family and affected person to set career and life goals high and appropriate, as for other members of the family. Assist in adapting to an independent life and in obtaining a driver's license. Drivers usually require a vehicle that is adapted with pedal extenders; extenders that can be easily mounted and removed as needed are available. Families may wish to work with a driver-rehabilitation specialist who is qualified to assess the driver's transportation needs and who can provide them with a list of appropriate vehicle modifications. Names of qualified evaluators can be obtained by contacting a local rehabilitation center or the Association for Driver Rehabilitation Specialists (609-844-4433).[50] For most it will be necessary to provide a letter of justification for disabling of the air bag, because even with pedal extenders, marked arm foreshortening will preclude positioning at an appropriate distance from the air bag (10–12 in).[47] Individuals who want to have an air bag on-off switch must read an informational brochure and submit an official request to the National Highway Traffic Safety Administration (888-DASH-2-DOT [www.nhtsa.dot.gov]). Approval does not guarantee, however, that the request will be honored by a vehicle dealer.[51]
7. Discuss college, vocational planning and training, and other plans after high school.
8. Foster independence.
9. Continue to encourage participation in social activities and support groups. It is particularly useful during this age period.
10. Assist in transition to adult care.

RESOURCES FOR PARENTS

Little People of America, Inc.
PO Box 65030
Lubbock, TX 79464-5030
www.lpaonline.org
Parent Coordinators: Grady and Mary Quick
4240 Oak Grove Dr
Carrollton, TX 75010

Books and Pamphlets

Kuklin S. *Thinking Big: The Story of a Young Dwarf*. New York, NY: Lothrop, Lee & Shepard Books; 1986

Campbell J, Dorren N. *It's a Whole New View: A Beginner's Guide for New Parents of a Child With Dwarfism*. Lubbock, TX: Little People America Inc; 1998 (available without charge from Little People of America at the address listed above)

To Celebrate: Understanding Developmental Differences in Young Children With Achondroplasia and *Little People, Big Schools—Preparing the School for Your Young Child With Short Stature*. Madison, WI: Midwest Regional Bone Dysplasia Clinic; 1997 (both available at cost from Midwest Regional Bone Dysplasia Clinic, University of Wisconsin, 1500 Highland Ave, Madison, WI 53705-2280)

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ERRATA

Pediatrics 2005;116;1615-
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ERRATA

An error appeared in the Experience and Reason—Briefly Recorded by Tan et al, titled "Isolated Sulfite Oxidase Deficiency: A Case Report With a Novel Mutation and Review of the Literature" that was published in the September 2005 issue of *Pediatrics* (2005;116:757–766). On page 758, the last line in column 2, the authors wrote: "The patient was homozygous for a novel 4-base pair deletion (c.2037-2040delTAGA) in exon 3 that led to a frameshift and resulted in a prematurely truncated protein." This sentence should have read as follows: "The patient was homozygous for a novel 4-base pair deletion (c.1142-1145delTAGA) in exon 3 that led to a frameshift and resulted in a prematurely truncated protein." The same error appears on page 763, Table 1, column 22 in the Mutations in SUOX row. The table currently reads: "c2037-2040delTAGA." It should read: "c.1142-1145delTAGA." The authors state that to the best of their knowledge, this remains a new, previously unreported mutation, and this error in nomenclature does not alter the substance nor the importance of the publication in any way.

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An error occurred in the AAP clinical report by Trotter et al, titled "Health Supervision for Children With Achondroplasia" that was published in the September 2005 issue of *Pediatrics* (2005;116:771–783). Figures 1, 2, 4, and 5 were credited incorrectly. The credit for figures 1, 2, 4, and 5 should read: Saul RA, Seaver LH, Sweet KM, Geer JS, Phelan MC, Mills CM. *Growth References: Third Trimester to Adulthood.* 2nd ed. Greenwood, SC: Greenwood Genetic Center; 1998: 107–110.

doi:10.1542/peds.2005-2461

An error appeared in the commentary by Cherry titled "Pertussis Vaccines for Adolescents and Adults" that was published in the September 2005 issue of *Pediatrics* (2005;116:755–756). On page 756, in Table 1 in the column under Boostrix for the entry 2-Phenoxyethanol, the 2.5 mg should be removed and replaced by a dash (—).

TABLE 1. Composition per 0.5-mL Dose of Adacel and Boostrix

Antigen	Adacel	Boostrix
Diphtheria toxoid	2 Lf	2.5 Lf
Tetanus toxoid	5 Lf	5 Lf
Pertussis toxin toxoid	2.5 μg	8 μg
Filamentous hemagglutinin	5 μg	8 μg
Pertactin	3 μg	2.5 μg
Fimbriae 2/3	5 μg	—
Aluminum	0.3 mg	0.3 mg
2-Phenoxyethanol	0.6%	—

Lf indicates flocculation units.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Health Supervision for Children With Down Syndrome

Marilyn J. Bull, MD, and the COMMITTEE ON GENETICS

ABBREVIATIONS

BAER—brainstem auditory evoked response
TSH—thyroid-stimulating hormone
CRP—C-reactive protein

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abstract

FREE

These guidelines are designed to assist the pediatrician in caring for the child in whom a diagnosis of Down syndrome has been confirmed by chromosome analysis. Although a pediatrician's initial contact with the child is usually during infancy, occasionally the pregnant woman who has been given a prenatal diagnosis of Down syndrome will be referred for review of the condition and the genetic counseling provided. Therefore, this report offers guidance for this situation as well. *Pediatrics* 2011;128:393–406

INTRODUCTION

Children with Down syndrome have multiple malformations, medical conditions, and cognitive impairment because of the presence of extra genetic material from chromosome 21.[1,2] Although the phenotype is variable, there typically are multiple features that enable the experienced clinician to suspect the diagnosis. Among the more common physical findings are hypotonia, small brachycephalic head, epicanthal folds, flat nasal bridge, upward-slanting palpebral fissures, Brushfield spots, small mouth, small ears, excessive skin at the nape of the neck, single transverse palmar crease, and short fifth finger with clinodactyly and wide spacing, often with a deep plantar groove between the first and second toes. The degree of cognitive impairment is variable and may be mild (IQ of 50–70), moderate (IQ of 35–50), or occasionally severe (IQ of 20–35). There is a significant risk of hearing loss (75%); obstructive sleep apnea (50%–79%); otitis media (50%–70%); eye disease (60%), including cataracts (15%) and severe refractive errors (50%); congenital heart defects (50%); neurologic dysfunction (1%–13%); gastrointestinal atresias (12%); hip dislocation (6%); thyroid disease (4%–18%)[3–6]; and, less commonly, transient myeloproliferative disorder (4%–10%) and later leukemia (1%) and Hirschsprung disease (<1%) (Table 1). The social quotient may be improved with early-intervention techniques, although the level of function is exceedingly variable. Children with Down syndrome often function more effectively in social situations than would be predicted on the basis of cognitive assessment results.

In approximately 95% of children with Down syndrome, the condition is sporadic because of nonfamilial trisomy 21, in which there are 47 chromosomes with a free extra chromosome 21 being present. In approximately 3% to 4% of persons with the Down syndrome phenotype, the extra chromosomal material is the result of an unbalanced translocation between chromosome 21 and another acrocentric chromosome, usually chromosome 14. Approximately three-quarters of these

TABLE 1 Medical Problems Common in Down Syndrome

Condition	%
Hearing problems	75
Vision problems	60
Cataracts	15
Refractive errors	50
Obstructive sleep apnea	50–75
Otitis media	50–70
Congenital heart disease	40–50
Hypodontia and delayed dental eruption	23
Gastrointestinal atresias	12
Thyroid disease	4–18
Seizures	1–13
Hematologic problems	
Anemia	3
Iron deficiency	10
Transient myeloproliferative disorder	10
Leukemia	1
Celiac disease	5
Atlantoaxial instability	1–2
Autism	1
Hirschsprung disease	<1

unbalanced translocations are de novo, and the remainder result from familial translocations. If the child has a translocation, a balanced translocation must be excluded in the parents. When there is a translocation in a parent, additional familial studies and genetic counseling should be provided. In the remaining 1% to 2% of persons with the Down syndrome phenotype, a mix of 2 cell lines is present: one normal and the other with trisomy 21. This condition is called mosaicism. Persons with mosaicism may be more mildly affected than persons with complete trisomy 21 or translocation chromosome 21, but this is not always the case, and their condition may include any of the associated medical problems and be indistinguishable from trisomy 21. Recurrence risks for families with an affected child depend on many factors, and families benefit from counseling by a clinical genetic professional.

Medical management, home environment, early intervention, education, and vocational training can significantly affect the level of functioning of children and adolescents with Down syndrome and facilitate their transition to adulthood. The following outline is designed to help the pediatrician provide care for children with Down syndrome and their families in the medical home. It is organized by the issues that need to be addressed in various age groups (see Appendix 1).

Several areas require ongoing assessment throughout childhood and should be reviewed at every physician visit and at least annually. These areas include:

- personal support available to family;
- participation in a family-centered medical home;
- age-specific Down syndrome–related medical and developmental conditions;
- financial and medical support programs for which the child and family may be eligible;
- injury and abuse prevention with special consideration of developmental skills; and
- nutrition and activity to maintain appropriate weight.

THE PRENATAL VISIT

The American College of Obstetricians and Gynecologists recommends that all pregnant women, regardless of age, be offered the option of diagnostic testing for Down syndrome and consider less invasive screening options.[7,8] Screening options have improved significantly with the introduction of first-trimester screening, which incorporates maternal age, nuchal translucency ultrasonography, and measurement of maternal serum human chorionic gonadotropin (β-hCG) and pregnancy-associated plasma protein A (PAPP-A). Second-trimester screening is available for patients who first seek medical care in the second trimester or in locations where first-trimester screening is not available. The second-trimester screening, often called the quad screen, incorporates maternal age risk with measurement of maternal serum hCG, unconjugated estriol, α-fetoprotein (AFP), and inhibin levels. The detection rate of Down syndrome by first-trimester screening is 82% to 87%, by second-trimester screening is 80%, and by combined first- and second-trimester screening (referred to as integrated screening) is approximately 95%. These screening tests are reported to have a 5% false-positive rate.[9–12]

Pediatricians may be asked to counsel a family whose fetus has been identified with or is at increased risk of Down syndrome. In some settings, the pediatrician may be the primary resource for counseling. At other times, counseling may have been provided for the family by a certified genetic counselor, a clinical geneticist, obstetrician, or developmental-behavioral pediatrician. In addition, parents may have received information from a Down syndrome program, a national Down syndrome organization, or an Internet site. Because the pediatrician often has a previous relationship with the family, he or she should be prepared to review this information and assist in the decision-making process. When asked, the pediatrician should discuss the following topics with the family:

1. The prenatal laboratory studies that lead to the diagnosis and any fetal imaging studies that have been or will be performed.
2. The mechanism for occurrence of the disorder in the fetus and the potential recurrence rate for the family as provided by genetic counseling.
3. The prognosis and phenotypic manifestations, including the wide range of variability seen in infants and children with Down syndrome. Families benefit from hearing a fair and balanced perspective, including the many positive outcomes of

children with Down syndrome and their effect on the family.

4. Any additional studies performed that may refine the estimation of the prognosis (eg, fetal echocardiogram, ultrasonographic examination for gastrointestinal tract malformations). Consultation with an appropriate medical subspecialist, such as a pediatric cardiologist or a pediatric surgeon, should occur prenatally if abnormal findings are detected.
5. Currently available treatments and interventions. This discussion needs to include the efficacy, potential complications and adverse effects, costs, and other burdens associated with treatments. Discuss early-intervention resources, parent support programs, and any appropriate future treatments.
6. The options available to the family for management and rearing of the child should be discussed using a nondirective approach. In cases of early prenatal diagnosis, this may include discussion of pregnancy continuation or termination, raising the child in the family, foster care placement, and adoption.
7. Availability of genetic counseling or meeting with a genetics professional.

If the pregnancy is continued:

1. Develop a plan for delivery and neonatal care with the obstetrician and the family. As the pregnancy progresses, additional studies should be performed if available, if recommended by subspecialty consultants, and/or if desired by the family for modifying this management plan (eg, detection of a complex heart defect by echocardiography).
2. Offer parent-to-parent contact and information about local and national support organizations.
3. Offer referral to a clinical geneticist for a more extended discussion of clinical outcomes and variability, recurrence rates, future reproductive options, and evaluation of the risks for other family members.

HEALTH SUPERVISION FROM BIRTH TO 1 MONTH: NEWBORN INFANTS

Examination

The first step in evaluating a newborn infant for trisomy 21 is a careful review of the family history and prenatal information, particularly if prenatal chromosome studies were performed. Previous children born with trisomy 21 or developmental differences or pregnancies that ended in miscarriage may be significant clues that a family may carry a balanced translocation that predisposes them to having children with trisomy 21. For children who have had the diagnosis made prenatally, a formal copy of the chromosome report should be obtained. This report allows the clinician to confirm the diagnosis, review the results with the family, and add the formal diagnosis to the child's medical record. If the results of prenatal testing are not available, a blood sample should be obtained for postnatal cytogenetic analysis to confirm the diagnosis and rule out a chromosome translocation.

A physical examination is the most sensitive test in the first 24 hours of life to diagnose trisomy 21 in an infant. If the clinician feels that enough criteria are present on physical examination, then a blood sample should be sent for chromosome evaluation. The clinician should alert the laboratory and request rapid results. A study that uses fluorescent in situ hybridization (FISH) technology should be available within 24 to 48 hours to facilitate diagnosis and parent counseling. A FISH study can only indicate that an extra copy of chromosome 21 is present; it cannot detect translocations. Therefore, a positive FISH-test result should be confirmed by a complete chromosome analysis to identify translocations that may have implications for further reproductive counseling for the parents and possibly other family members.

The mother should be allowed to recover from the immediate delivery of the infant and have her partner or support person present before the diagnosis is given. The information should be relayed in a private setting by the physicians involved, optimally by the primary care provider for the infant and the delivering physician.[13] It is recommended that hospitals coordinate the delivery of the information and offer a private hospital room pending confirmation of the diagnosis.

An important aspect of providing information about Down syndrome to families includes first congratulating parents on the birth of their infant. Obstetricians and pediatricians should coordinate their messaging and inform parents of their suspicion immediately, in a private setting and, where appropriate, with both parents together. Physicians should use their experience and expertise in providing support and guidance for families. Clinicians should ensure a balanced approach rather than their personal opinions, give current printed materials, and offer access to other families who have children with Down syndrome and support organizations if locally available. It is important that clinicians be cognizant of the realities and possibilities for healthy, productive lives of people with Down syndrome in society.[13]

Confirm the laboratory diagnosis of Down syndrome and review the karyotype with the parents when the final result is available. Discuss the specific findings with both parents whenever possible, and talk about the potential clinical manifestations associated with the syndrome. These topics

should be reviewed again at a subsequent meeting. Parents should be referred for genetic counseling if it was not conducted prenatally.

Newborn care is often provided in a hospital setting by a physician who will not be the primary care provider, and extreme care is required to be certain that a smooth transition occurs for the family.

Discuss and Review

- Hypotonia.
- Facial appearance, and acknowledge the presence of familial characteristics.
- Feeding issues. Children with Down syndrome can usually nurse, and many can breastfeed successfully. Occasionally, some will need early supplementation until a successful nursing pattern is established. Some infants will also sleep for prolonged periods and need to be awakened to feed to maintain adequate calorie intake.

Evaluate for

- Heart defects (~50% risk). Perform an echocardiogram, to be read by a pediatric cardiologist, regardless of whether a fetal echocardiogram was performed. Refer to a pediatric cardiologist for evaluation any infant whose postnatal echocardiogram results are abnormal.
- Feeding problems. Refer all infants who have marked hypotonia as well as infants with slow feeding, choking with feeds, recurrent pneumonia, or other recurrent or persistent respiratory symptoms and unexplained failure to thrive for a radiographic swallowing assessment.[14,15]
- Cataracts at birth by looking for a red reflex. Cataracts may progress slowly and, if detected, need prompt evaluation and treatment by an ophthalmologist with experience in managing the child with Down syndrome.
- Congenital hearing loss, with objective testing, such as brainstem auditory evoked response or otoacoustic emission, at birth, according to the universal newborn hearing screening guidelines. Complete any needed follow-up assessment by 3 months.[16,17]
- Duodenal atresia or anorectal atresia/stenosis by performing a history and clinical examination.
- Apnea, bradycardia, or oxygen desaturation in a car safety seat for infants who are at increased risk because they have had cardiac surgery or are hypotonic. A car safety seat evaluation should be conducted for these infants before hospital discharge.[18]
- Constipation. If constipation is present, evaluate for restricted diet or limited fluid intake, hypotonia, hypothyroidism, or gastrointestinal tract malformation, including stenoses or Hirschsprung disease, for which there is an increased risk.
- Gastroesophageal reflux, which is usually diagnosed and managed clinically. If severe or contributing to cardiorespiratory problems or failure to thrive, refer for subspecialty intervention.
- Stridor, wheezing, or noisy breathing. If severe or contributing to cardiorespiratory problems or feeding difficulty, refer to pediatric pulmonologist to assess for airway anomalies. Tracheal anomalies and small tracheal size may also make intubation more difficult.
- Hematologic abnormalities. Obtain a complete blood cell count. Leukemoid reactions, or transient myeloproliferative disorder (TMD). TMD is found almost exclusively in newborn infants with Down syndrome and is relatively common in this population (10%).[19] TMD usually regresses spontaneously within the first 3 months of life, but there is an increased risk of later onset of leukemia for these patients (10%–30%).[20] Polycythemia is also common in infants with Down syndrome (18%–64%)[21] and may require careful management. Infants with TMD and polycythemia should be followed according to subspecialty consultation recommendations. Parents of infants with TMD should be counseled regarding the risk of leukemia and made aware of the signs, including easy bruising, petechiae, onset of lethargy, or change in feeding patterns. Leukemia is more common in children with Down syndrome than in the general population but still rare (1%).
- Congenital hypothyroidism (1% risk). Obtain thyroid-stimulating hormone (TSH) concentration if state newborn screening only measures free thyroxine (T4); congenital hypothyroidism can be missed if only the T4 concentration is obtained in the newborn screening. Many children with Down syndrome have mildly elevated TSH and normal free T4 levels. Management of children with abnormal thyrotropin or T4 concentrations should be discussed with a pediatric endocrinologist.

Anticipatory Guidance Given at Least Once Between Birth and 1 Month of Age

- Discuss increased susceptibility to respiratory tract infection. Children with signs and symptoms of lower respiratory tract infection should be evaluated acutely by a medical provider, and in the presence of cardiac or chronic respiratory disease, aggressive treatment should be instituted.[14] Children with comorbid conditions who qualify should have respiratory syncytial virus prophylaxis.[22]

- Discuss with parents the importance of cervical spine-positioning precautions to avoid excessive extension or flexion to protect the cervical spine during any anesthetic, surgical, or radiographic procedure.[23,24]
- Discuss efficacy of early intervention and availability of early-intervention services and therapies in the community. Initiate referral as appropriate.[25]
- Inform the family of the availability of support and advice from parents of other children with Down syndrome.
- Supply names of Down syndrome support groups and current books and pamphlets (see "Resources for Parents").
- Discuss the strengths of the child and positive family experiences.
- Discuss the individual resources for support, such as family, clergy, and friends.
- Talk about how and what to tell siblings, other family members, and friends. Review methods of coping with long-term disabilities.
- Review the recurrence risk in subsequent pregnancies and the availability of prenatal diagnosis as provided in genetic counseling.
- Discuss treatments that are considered complementary and alternative. Parents need an opportunity to learn objectively which therapies are safe and which are potentially dangerous (eg, cell therapy that may transmit slow viruses and fat-soluble vitamins that can cause toxicity). Several articles and Internet sites evaluate the legitimacy of claims that are made.[26–28]
- Renal and urinary tract anomalies have been reported to occur at increased frequency among persons with Down syndrome, and screening for these anomalies for all children with Down syndrome has been suggested.[29] Until studies confirm this finding and document that screening improves outcomes, routine renal and urologic screening is not recommended.

HEALTH SUPERVISION FROM 1 MONTH TO 1 YEAR: INFANCY

Physical Examination and Laboratory Studies

Review the risk of serous otitis media (50%–70%). Review the previous hearing evaluation (brainstem auditory evoked response [BAER, ABR] or otoacoustic emission). If the child passed the screening study, rescreen at 6 months of age for confirmation. If the infant failed to pass screening studies, refer to an otolaryngologist who is comfortable with examining infants with stenotic external canals to determine if a middle-ear abnormality is present. Tympanometry may be necessary if the tympanic membrane is poorly visualized. Middle-ear disease should be treated promptly. Once a clear ear is established, a diagnostic BAER should be performed to accurately establish hearing status. In children with stenotic canals, in which the tympanic membranes cannot be seen, refer to an otolaryngologist for examination under an office microscope. Interval ear examinations should be performed by the otolaryngologist every 3 to 6 months until the tympanic membrane can be visualized by the pediatrician and tympanometry can be performed reliably. A behavioral audiogram may be attempted at 1 year of age, but many children will not be able to complete the study and may need additional testing by BAER.[30,31]

- At least once during the first 6 months of life, discuss with parents symptoms of obstructive sleep apnea, including heavy breathing, snoring, uncommon sleep positions, frequent night awakening, daytime sleepiness, apneic pauses, and behavior problems that could be associated with poor sleep. Refer to a physician with expertise in pediatric sleep disorders for examination and further evaluation of a possible sleep disorder if any of the above-mentioned symptoms occur.[32,33]
- At each well-child visit, discuss with parents the importance of maintaining the cervical spine in a neutral position during any anesthetic, surgical, or radiographic procedure to minimize the risk of spinal cord injury and review the signs and symptoms of myelopathy. Perform careful history and physical examination, and pay attention for myelopathic signs and symptoms.
- Within the first 6 months of life, refer to a pediatric ophthalmologist or ophthalmologist with expertise and experience with infants with disabilities to evaluate for strabismus, cataracts, and nystagmus.[34] Check the infant's vision at each visit and use developmentally appropriate subjective and objective criteria. If lacrimal duct obstruction is present, refer for evaluation for surgical repair of drainage system if not resolved by 9 to 12 months of age.[35]
- Verify results of newborn thyroid-function screen if not previously performed. Because of increased risk of acquired thyroid disease, repeat measurement of TSH at 6 and 12 months of age and then annually.
- Monitor infants with cardiac defects, typically ventricular or atrioventricular septal defects that cause intracardiac left-to-right shunts, for symptoms and signs of congestive heart failure as pulmonary vascular resistance decreases and pulmonary blood flow increases. Tachypnea, feeding difficulties, and poor weight gain may

indicate heart failure. Medical management, including nutritional support, may be needed until the infant can undergo cardiac surgery to repair the defects. For patients with large ventricular septal defects and without obstruction to pulmonary blood flow, repair should be performed before 4 months of age to limit the potential for development of pulmonary hypertension and associated complications. Infants and children with Down syndrome are also at increased risk of pulmonary hypertension even in the absence of intracardiac structural defects.

- Obtain hemoglobin concentration beginning at 1 year of age and annually thereafter. Children with Down syndrome have been shown to have significantly lower dietary intakes of iron than their typically developing peers.[36] Increased erythrocyte mean corpuscular volume (MCV) has been reported in 45% of patients with Down syndrome with and without heart disease, and when MCV is decreased, it occurs at approximately the same time as anemia.[37] Therefore, MCV is not useful in screening for the diagnoses of iron deficiency, lead toxicity, or thalassemia in children with Down syndrome. Serum ferritin concentration is a sensitive parameter for assessment of iron stores in healthy subjects but is an acute-phase reactant and may be increased in the presence of chronic inflammation or infection and should be evaluated together with C-reactive protein (CRP) concentration. An elevated CRP level is an indication that a normal ferritin level may be falsely elevated and is not a reliable indication of normal iron status. Serum ferritin and CRP or reticulocyte hemoglobin (CHr) concentrations should be obtained at annual visits for patients who are at increased risk of iron deficiency on the basis of a history of decreased iron intake.[38–42]
- Monitor for signs of neurologic dysfunction that may occur. Children with Down syndrome have an increased risk of seizures, including infantile spasms (1%–13%)[43,44] and other conditions including Moyamoya disease.[45]
- Administer immunizations, including influenza vaccine and other vaccines recommended for all children, unless there are specific contraindications.[46]

Anticipatory Guidance

- Monitor weight and follow weight-for-height trends at each health care visit. Review the infant's growth and plot it by using the standard growth charts of the National Center for Health Statistics or the World Health Organization.[47] The previously used Down syndrome-specific growth charts no longer reflect the current population styles and body proportion. Until new charts are developed, patterns of growth and weight gain should be followed on the available standard growth charts and should include use of weight for height and BMI.[48]
- Review availability of Down syndrome support groups at least once in the first year of life (see "Resources for Parents").
- Assess the emotional status of parents and intrafamilial relationships at each well-child visit. Educate and support siblings and discuss sibling adjustments.
- Review connection to early-intervention services and their relationship to the strengths and needs of the infant and family at each well-child visit.
- Review the family's understanding of the risk of recurrence of Down syndrome and the availability of prenatal diagnosis at least once in the first year of life and more often if judged necessary by the clinician. Refer for genetic counseling if not already provided.
- Be prepared to discuss and answer questions about treatments that are considered complementary and alternative at each well-child visit.

HEALTH SUPERVISION FROM 1 TO 5 YEARS: EARLY CHILDHOOD

- Obtain a history and perform a physical examination, and give attention to growth and developmental status at every well-child visit.
- Review the risk of hearing loss associated with serous otitis media. For a child who passed diagnostic hearing testing, additional screening or behavioral audiogram and tympanometry should be performed every 6 months until normal hearing levels are established bilaterally by ear-specific testing (usually after 4 years of age). Subsequently, behavioral hearing tests should be performed annually. If normal hearing is not established by behavioral testing, additional screening by otoacoustic emissions or diagnostic BAER should be performed with sedation if necessary. Children who demonstrate a hearing loss should be referred to an otolaryngologist who is comfortable with the examination of children with stenotic ear canals. The risk of serous otitis media between 3 and 5 years of age is approximately 50% to 70%.
- Check the child's vision, and use developmentally appropriate subjective and objective criteria at each well-child visit. Refer the child annually to a pediatric ophthalmologist or ophthalmologist with special expertise and experience with children with disabilities. Children with Down syndrome have a 50%

risk of refractive errors that lead to amblyopia between 3 and 5 years of age. Addressing refractive errors and strabismus at an early age can help prevent amblyopia and encourage normal visual development.[34,49–51]

Atlantoaxial Instability

Discuss with parents, at least biennially, the importance of cervical spine-positioning precautions for protection of the cervical spine during any anesthetic, surgical, or radiographic procedure. Perform careful history and physical examination with attention to myelopathic signs and symptoms at every well-child visit or when symptoms possibly attributable to spinal cord impingement are reported. Parents should also be instructed to contact their physician for new onset of symptoms of change in gait or use of arms or hands, change in bowel or bladder function, neck pain, stiff neck, head tilt, torticollis, how the child positions his or her head, change in general function, or weakness.

The Asymptomatic Child

Children with Down syndrome are at increased risk of atlantoaxial subluxation. However, the child must be 3 years of age to have adequate vertebral mineralization and epiphyseal development for accurate radiographic evaluation of the cervical spine.[52] Plain radiographs do not predict well which children are at increased risk of developing spine problems, and normal radiographs do not provide assurance that a child will not develop spine problems later.[53,54] For these reasons, routine radiologic evaluation of the cervical spine in asymptomatic children is not recommended. Current evidence does not support performing routine screening radiographs for assessment of potential atlantoaxial instability in asymptomatic children.[55–64] Parents should be advised that participation in some sports, including contact sports such as football and soccer and gymnastics (usually at older ages), places children at increased risk of spinal cord injury[65] and that trampoline use should be avoided by all children with or without Down syndrome younger than 6 years and by older children unless under direct professional supervision.[66,67] Special Olympics has specific screening requirements for participation in some sports.[68]

The Symptomatic Child

Any child who has significant neck pain, radicular pain, weakness, spasticity or change in tone, gait difficulties, hyperreflexia, change in bowel or bladder function, or other signs or symptoms of myelopathy must undergo plain cervical spine radiography in the neutral position.[55,65] If significant radiographic abnormalities are present in the neutral position, no further radiographs should be taken and the patient should be referred as quickly as possible to a pediatric neurosurgeon or pediatric orthopedic surgeon with expertise in evaluating and treating atlantoaxial instability. If no significant radiographic abnormalities are present, flexion and extension radiographs may be obtained before the patient is promptly referred.[23,62,63]

- Measure TSH annually or sooner if child has symptoms that could be related to thyroid dysfunction.
- For children on a diet that contains gluten, at each preventative care visit review for symptoms potentially related to celiac disease, including diarrhea or protracted constipation, slow growth, unexplained failure to thrive, anemia, abdominal pain or bloating, or refractory developmental or behavioral problems.[69–71] For those with symptoms, obtain a tissue transglutaminase immunoglobulin A (IgA) level and simultaneous quantitative IgA. The quantitative IgA is important, because a low IgA level will result in a false-negative tissue transglutaminase IgA result. Refer patients with abnormal laboratory values for specialty assessment. There is no evidence showing routine screening of asymptomatic individuals as being beneficial. There are neither data nor consensus that would indicate whether patients with persistent symptoms who had normal laboratory values on initial evaluation should have further laboratory tests.
- Discuss symptoms of obstructive sleep apnea, including heavy breathing, snoring, restless sleep, uncommon sleep positions, frequent night awakening, daytime sleepiness, apneic pauses, and behavior problems, that could be associated with poor sleep at each well-child visit. There is poor correlation between parent report and polysomnogram results.[33,72] Therefore, referral to a pediatric sleep laboratory for a sleep study or polysomnogram for all children with Down syndrome by 4 years of age is recommended. Refer to a physician with expertise in pediatric sleep any child with signs or symptoms of obstructive sleep apnea or abnormal sleep-study results. Discuss obesity as a risk factor for sleep apnea.[34] It is recognized that access to a pediatric sleep laboratory or specialist may be limited for some populations and geographic areas.
- Maintain follow-up with a pediatric cardiologist for patients with cardiac lesions even after complete repair to monitor for recurrent/residual lesions as well as development of pulmonary hypertension.
- Monitor for neurologic dysfunction, including seizures.
- Obtain hemoglobin concentration

annually. Also, obtain serum ferritin and CRP concentrations for any child at risk of iron deficiency.

Anticipatory Guidance

- Review early intervention, including physical therapy, occupational therapy, and speech therapy, at all health maintenance visits.
- Discuss at the 30-month visit the transition from early intervention to preschool, which occurs at 36 months of age. Help the family understand the change from the Individualized Family Service Plan (IFSP) in early intervention to the Individualized Education Plan (IEP) through public education.
- Discuss with caregivers at every visit the child's behavioral and social progress. Refer children who may have autism, attention-deficit/hyperactivity disorder, or other psychiatric or behavioral problems for appropriate evaluation and intervention as soon as suspected. Autism and other behavioral problems occur with increased frequency in children with Down syndrome, and symptoms may manifest as early as 2 or 3 years of age.[73–76]
- Provide influenza vaccine annually. Children with chronic cardiac or pulmonary disease should be given the 23-valent pneumococcal polysaccharide vaccine (PPS23) at 2 years or older.[22]
- Reassure parents that delayed and irregular dental eruption patterns are common and that hypodontia occurs with increased frequency (23%).[77,78]
- Encourage and model use of accurate terms for genitalia and other private body parts (penis, vulva) any time these body parts are discussed or examined. Model respect for body rights by reminding patients that their body is their own and explain to the child what you will do before moving into child's personal space or performing a procedure. Remind patient and family that the only reason anyone should be looking at or touching private body parts is for health (doctor office visits) or hygiene (bathing or showering).[79]
- On at least 1 well-child visit educate parents about increased risk of sexual exploitation, and remind them that likely perpetrators are people their child knows and trusts, not strangers.
- At least once between 1 and 5 years of age, as with discussion in the first year of life, discuss future pregnancy planning and review risk of recurrence of Down syndrome and availability of prenatal diagnosis.
- Assess the child's behavior and talk about behavioral management, sibling adjustments, socialization, and recreational skills.
- Encourage families to establish optimal dietary and physical exercise patterns that will prevent obesity.
- Be prepared to discuss and answer questions about treatments that are considered complementary and alternative.

HEALTH SUPERVISION FROM 5 TO 13 YEARS: LATE CHILDHOOD

- Obtain a history and perform a physical examination with attention to growth and developmental status at each annual well-child visit.
- Monitor growth patterns, especially BMI, and emphasize healthy diet and lifestyle for preventing obesity.
- Obtain annual ear-specific audiologic evaluation.
- Obtain ophthalmologic evaluation every 2 years.
- Measure TSH annually; the risk of hypothyroidism increases with age.
- Individualize cardiology follow-up on the basis of history of cardiac defects.
- Obtain hemoglobin concentration annually and serum ferritin and CRP or reticulocyte hemoglobin concentrations at annual visits for any child at risk of iron deficiency on the basis of history of decreased iron intake.
- For children on a diet that contains gluten, review for symptoms potentially related to celiac disease at every health maintenance visit and evaluate if indicated.
- At each well-child visit, discuss with parents the importance of universal precautions for protection of the cervical spine during any anesthetic, surgical, or radiographic procedure. Perform careful history and physical examination with attention to myelopathic signs and symptoms. Parents should also be instructed to contact their physician immediately for new onset of symptoms of myelopathy.
- Counsel parents that some sports place children at increased risk of spinal cord injury.[65–67]
- Monitor for neurologic dysfunction, including seizures.
- Very dry skin, which may be a sign of hypothyroidism, and other skin problems are particularly common in patients with Down syndrome. Therefore, be attentive to these dermatologic problems and discuss them with the patient and family.
- Discuss symptoms related to obstructive sleep apnea at every well-child visit, including snoring, restless sleep, daytime sleepiness, nighttime awakening, behavior problems, and abnormal sleep position. Refer to a physician with expertise in pediatric sleep any child with signs or symptoms of obstructive sleep apnea or abnormal sleep-

study results. Discuss obesity as a risk factor of sleep apnea.

Anticipatory Guidance at Every Health Maintenance Visit

- Review the child's development and appropriateness of school placement and developmental intervention.
- Discuss socialization, family status, and relationships, including financial arrangements, health insurance, and guardianship.
- Discuss the development of age-appropriate social skills, self-help skills, and development of a sense of responsibility.
- Monitor for behavior problems that interfere with function in the home, community, or school. Attention problems, attention-deficit/hyperactivity disorder, obsessive compulsive behaviors, noncompliant behavior, and wandering off are some of the common behavior concerns reported. Psychiatric disorders seen in typically developing children may also occur. Evaluate for medical problems that can be associated with behavior changes, including thyroid abnormalities, celiac disease, sleep apnea, gastroesophageal reflux, and constipation. Intervention strategies depend on the child's age, the severity of the problem, and the setting in which the problem occurs. Referral to community treatment programs, psychosocial services for consultative care, or behavioral specialists experienced in working with children with special needs may be necessary. The use of medication for behavior management should be discussed between the primary care physician and specialists involved in the child's care, because children with Down syndrome may be more sensitive to certain medications. Although there has been little research to directly address the use of psychotropic medications among children with Down syndrome, anecdotal reports indicate that such children may differ in their response to medications.
- Counsel families regarding the transition from elementary to middle school, when major change often occurs, from 1 to many teachers and from 1 class to changing classes. Prepare them to facilitate adjustment at a time when the academic disparity becomes greater and full inclusion becomes more difficult.
- Refer children who may have autism for appropriate evaluation and intervention as soon as suspected.
- Continue to assess, monitor, and encourage independence with hygiene and self-care. Encourage parents to teach, model, and respect privacy at home and in the community. Discuss appropriate management of sexual behaviors such as masturbation.
- Discuss progression of physical and psychosocial changes through puberty and issues of fertility and contraception.[79,80] Remind parents that physical development usually follows patterns similar to those found in the general population, but the child with Down syndrome will likely need more preparation in understanding and managing them.[81]
- Discuss the need for gynecologic care in the pubescent girl. Talk with the patient and her family about the recurrence risk of Down syndrome (50%) were she to become pregnant.[82,83] Although males with Down syndrome are usually infertile, there have been rare instances in which a male has reproduced.[83–85] Birth control and prevention of sexually transmitted diseases should be discussed with patients and their families. Families may wish to discuss sterilization, and the pediatrician may review the topic in the American Academy of Pediatrics policy statement "Sterilization of Minors With Developmental Disabilities."[86]
- Be prepared to discuss and answer questions regarding treatments that are considered complementary and alternative.

HEALTH SUPERVISION FROM 13 TO 21 YEARS OR OLDER: ADOLESCENCE TO EARLY ADULTHOOD

Physical Examination and Laboratory Values

- Measure hemoglobin concentration annually.
- Measure TSH concentration annually.
- Obtain annual ear-specific audiologic evaluation.
- For children on a diet that contains gluten, review for symptoms potentially related to celiac disease at every health maintenance visit, and evaluate if indicated.
- Individualize cardiology follow-up on the basis of history of cardiac defects. Discuss symptoms related to obstructive sleep apnea, including snoring, restless sleep, daytime sleepiness, nighttime awakening, behavior problems, and sleep position at every health maintenance visit. Refer to a physician with expertise in pediatric sleep any child with signs or symptoms of obstructive sleep apnea or an abnormal sleep-study result. Discuss the risk factor of obesity for sleep apnea.
- Discuss with parents and the patient at every visit the importance of cervical spine-positioning precautions for protection of the cervical spine during any anesthetic, surgical, or radiographic procedure. Perform careful history and physical

examination with attention to myopathic signs and symptoms. Parents and patients should also be instructed to contact their physician immediately for new onset of symptoms of myopathy.

- Counsel parents that some sports place children at increased risk of spinal cord injury.[65–67]
- Monitor for signs of other neurologic dysfunction, including seizures.
- Obtain ophthalmologic evaluation every 3 years. Check for onset of cataracts, refractive errors, and keratoconus, which can cause blurred vision, corneal thinning, or corneal haze and is typically diagnosed after puberty.
- Examine annually for acquired mitral and aortic valvular disease in older patients with Down syndrome. An echocardiogram should be obtained if there is a history of increasing fatigue, shortness of breath, or exertional dyspnea or abnormal physical examination findings, such as a new murmur or gallop. Discuss skin, hair, and scalp care at each preventive health care visit.

Anticipatory Guidance at Every Health Maintenance Visit

- Discuss issues related to transition into adulthood, including guardianship and long-term financial planning from early adolescence. Potential adult morbidities including apparent tendency toward premature aging and increased risk of Alzheimer disease may also be discussed.[87]
- Monitor growth patterns, especially BMI, and counsel regarding healthy diet and a structured exercise program.
- Discuss behavioral and social states and refer patients who have chronic behavioral problems or manifest acute deterioration in function for specialized evaluation and intervention.[88,89]
- Discuss appropriateness of school placement, and emphasize planning for transition to adulthood and adequate vocational training within the school curriculum.[90,91]
- Talk with the female patient and her family about the recurrence risk of Down syndrome should she become pregnant.
- Continue to assess, monitor, and encourage independence with hygiene and self-care. Provide guidance on healthy, normal, and typical sexual development and behaviors. Emphasize the need for understandable information, and encourage opportunities for advancing comprehension of sexuality. Discuss the need for contraception and prevention of sexually transmitted diseases and the degree of supervision required. Advocate for the least invasive and least permanent method of birth control and be familiar with local law and resources to assist the family in their decision-making regarding questions about sterilization.[86]
- Make recommendations and provide or refer for routine gynecologic care if not already provided. Discuss premenstrual behavioral problems and management of menses.[92]
- Discuss group homes and independent living opportunities, workshop settings, and other community-supported employment.
- Discuss intrafamily relationships, financial planning, and guardianship.
- Facilitate transition to adult medical care.[93]

FUTURE CONSIDERATIONS

Many issues related to the development and health of people with Down syndrome remain to be evaluated, and research agendas for addressing both public health and basic science topics have been developed. Knowledge in several topics of great importance to the care of children with Down syndrome could be enhanced through population-based research. A rigorous evidence-based review of screening and treatment for atlantoaxial instability, for example, is needed,[94] and continuing research is critical for directing the care for optimal outcomes of persons with Down syndrome.[1,95,96]

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RESOURCES FOR PARENTS

National Down Syndrome Society: www.ndss.org.

National Down Syndrome Congress: www.ndsccenter.org.

Canadian Down Syndrome Society: www.cdss.ca.

March of Dimes: www.marchofdimes.com.

Down Syndrome International Education: www.downsed.org.

Brighter Tomorrows-Supporting Families: www.brightertomorrows.org.

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APPENDIX 1 Health Supervision for Children With Down Syndrome

	Prenatal	Birth–1 mo	1 mo–1 y	1–5 y	5–13 y	13–21 y
Counseling regarding prenatal screening test & imaging results						
Plan for delivery						
Referral to geneticist						
Parent-to-parent contact, support groups, current books and pamphlets						
Physical exam for evidence of trisomy 21						
Chromosomal analysis to confirm dx						
Discuss risk of recurrence of Down syndrome						
Echocardiogram						
Radiographic swallowing assessment if marked hypotonia, slow feeding, choking with feeds, recurrent or persistent respiratory sx, FTT						
Eye exam for cataracts						
Newborn hearing screen and follow-up						
Hx and PE assessment for duodenal or anorectal atresia						
Reassure parents delayed and irregular dental eruption, hypodontia are common						
If constipation, evaluate for limited diet or fluids, hypotonia, hypothyroidism, GI malformation, Hirschsprung		**Any visit**				
CBC to R/O transient myeloproliferative disorder, polycythemia						
Hb annually; CRP & ferritin or CHr if possible risk iron deficiency or Hb <11 g.				**Annually**		
Hemoglobin						**Annually**
TSH (may be part of newborn screening)			**6 and 12 mo**	**Annually**		
Discuss risk of respiratory infection						
If cardiac surgery or hypotonic: evaluate apnea, bradycardia, or oxygen desaturation in car seat before discharge						
Discuss complementary & alternative therapies		**All health maint. visits**				
Discuss cervical spine positioning, especially for anesthesia or surgical or radiologic procedures		**All health maint. visits**				
Review signs and symptoms of myopathy		**All health maint. visits**				
If myopathic signs or symptoms: obtain neutral position spine films and, if normal, obtain flexion & extension films & refer to pediatric neurosurgeon or orthopedic surgeon with expertise in evaluating and treating atlanto-axial instability		**Any visit**				
Instruct to contact physician for change in gait, change in use of arms or hands, change in bowel or bladder function, neck pain, head tilt, torticollis, or new-onset weakness				**Biennially**		
Advise risk of some contact sports, trampolines				**All health maint. visits**		
Audiology evaluation at 6 mo						
If normal hearing established, behavioral audiogram and tympanometry until bilateral ear specific testing possible. Refer child with abnormal hearing to ot				**Every 6 mo**		
If normal ear-specific hearing established, behavioral audiogram				**Annually**		
Assess for obstructive sleep apnea Sx				**All health maint. visits**		
Sleep study by age 4 years						
Ophthalmology referral to assess for strabismus, cataracts, and nystagmus						
Refer to pediatric ophthalmologist or ophthalmologist with experience with Down syndrome				**Annually**	**Every 2 y**	**Every 3 y**
If congenital heart disease, monitor for signs & Sx of Congestive heart failure		**All visits**				
Assess the emotional status of parents and intrafamilial relationships		**All health maint. visits**				
Check for Sx of celiac disease; if Sx present, obtain tissue transglutaminase IgA & quantitative IgA				**All health maint. visits**		
Early intervention: physical, occupational, and speech therapy				**Health maint. visits**		
At 30 months, discuss transition to preschool and development of IEP						
Discuss behavioral and social progress				**Health maint. visits**		
Discuss self-help skills, ADHD, OCD, wandering off, transition to middle school					**Health maint. visits**	
If chronic cardiac or pulmonary disease, 23-valent pneumococcal vaccine at age >2 y						
Reassure regarding delayed and irregular dental eruption						
Establish optimal dietary and physical exercise patterns				**Health maint. visits**		
Discuss dermatologic issues with parents						
Discuss physical and psychosocial changes though puberty, need for gynecologic care in the pubescent female						
Facilitate transition: guardianship, financial planning, behavioral problems, school placement, vocational training, independence with hygiene and self-care, group homes, work settings						**Health maint. visits**
Discuss sexual development and behaviors, contraception, sexually transmitted diseases, recurrence risk for offspring						**Health maint. visits**
		Do once at this age				
		Do if not done previously				
		Repeat at indicated intervals				

Maint. indicates maintenance; dx, diagnosis; sx, symptoms; FTT, failure to thrive; Hx, history; PE, physician examination; GI, gastrointestinal; CBC, complete blood count; R/O, rule out; Hb, hemoglobin; ot, occupational therapy; CHr, reticulocyte hemoglobin; IgA, immunoglobulin A; IEP, Individualized Education Plan; ADHD, attention-deficit/hyperactivity disorder; OCD, obsessive compulsive disorder.

ERRATA

American Academy of Pediatrics. Health Supervision for Children with Down Syndrome. *Pediatrics.* 2011;128(2):393–406

An error occurred in the American Academy of Pediatrics clinical report "Health Supervision for Children with Down Syndrome" published in the August 2011 issue of *Pediatrics* (2011;128[2]:393-406; originally published online July 25, 2011; doi10.1542/2011-1605). In Appendix 1 on page 406, the 24th row of the first column should read "If myelopathic signs or symptoms:" rather than "If myopathic signs or symptoms:". We regret the error.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Health Supervision for Children With Fragile X Syndrome

abstract

FREE

Fragile X syndrome (an *FMR1*–related disorder) is the most commonly inherited form of mental retardation. Early physical recognition is difficult, so boys with developmental delay should be strongly considered for molecular testing. The characteristic adult phenotype usually does not develop until the second decade of life. Girls can also be affected with developmental delay. Because multiple family members can be affected with mental retardation and other conditions (premature ovarian failure and tremor/ataxia), family history information is of critical importance for the diagnosis and management of affected patients and their families. This report summarizes issues for fragile X syndrome regarding clinical diagnosis, laboratory diagnosis, genetic counseling, related health problems, behavior management, and age-related health supervision guidelines. The diagnosis of fragile X syndrome not only involves the affected children but also potentially has significant health consequences for multiple generations in each family. *Pediatrics* 2011;127:994–1006

INTRODUCTION

This set of guidelines was designed to assist pediatricians in caring for children with fragile X syndrome after a diagnosis has been confirmed by DNA analysis. Fragile X syndrome (secondary to an abnormality in the fragile X mental retardation 1 [*FMR1*] gene) is the most commonly inherited form of mental retardation. The disorder affects the child and potentially the mother and other family members. These guidelines, therefore, discuss issues pertinent to the clinical manifestations of this disorder in younger and older people. The multiple manifestations in different age groups have led to fragile X syndrome being designated as one in the spectrum of *FMR1*-related disorders.[1]

Awareness that mental retardation has a sex-linked component, with an excess of males affected, has existed for more than a century.[2] This observation led to the suggestion that genes affecting cognition were located on the X chromosome. In 1943, Martin and Bell[3] reported that mental retardation segregated as an X-linked gene in a family in which both males and females were affected. Twenty-six years later, in 1969, Lubs[4] reported a distinctive fragile site on the X chromosome, which required culture media deficient in folic acid to be induced on a chromosome analysis, that segregated with mental retardation in 3 generations of a family. This is now known as the fragile X chromosome. In 1977, the relationship of this fragile site at band q27.3 on the long arm of the X chromosome (Xq27.3) to X-linked mental retardation was confirmed, and fragile X syndrome, as a clinical entity, was defined. Since

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KEY WORDS

fragile X syndrome, *FMR1*–related conditions, mental retardation, health guidelines

ABBREVIATIONS

FMR1—fragile X mental retardation 1 gene
CGG—cytosine-guanine-guanine
FMRP—fragile X mental retardation 1 protein
mGluR—metabotropic glutamate receptor
POI—primary ovarian insufficiency
FXTAS—fragile X–associated tremor/ataxia syndrome

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that time, the clinical and molecular features of the condition have been more clearly delineated. Several literature sources are available for additional information.[1,5–7] New information regarding the role of the protein product in synaptic plasticity in the brain is under investigation.[8]

The clinical phenotype of fragile X syndrome, including cognitive abilities, is variable, and physical features often are nonspecific in nature, especially in young children. The disorder has been described in every ethnic group and has an estimated prevalence of 1 in 3700 white males and 1 in 2500 black males.[1] Clinical manifestations of fragile X syndrome also may occur in heterozygous females, in whom the prevalence is estimated to be 1 in 7000.

Molecular Basis of Fragile X Syndrome

Cytogenetic assay for fragile X syndrome is no longer regarded to be sufficiently precise for clinical diagnostic use. In 1991, the *FMR1* gene was mapped to the fragile site at Xq27.3.[5,9] *FMR1* harbors a novel, unstable CGG (cytosine-guanine-guanine) trinucleotide repeat within the 5′-untranslated region of the gene, which accounts both for the fragile site and the genetic peculiarities associated with the region. The CGG repeat is highly polymorphic in the general population. The normal range is from 5 to 40, and 30 CGG repeats represents the most common number found within the gene. Full mutations, which cause fragile X syndrome, are the consequence of unstable expansion of the repeats, which results in a CGG number that exceeds 200. A full mutation results in hypermethylation of *FMR1*, which leads to gene-silencing and a decrease in the production of the fragile X mental retardation 1 protein (FMRP). The most important factor that determines the clinical severity of fragile X syndrome is the degree of *FMR1* methylation and gene-silencing rather than the length of expansion reflected by the number of CGG repeats, which explains why 2 people with the same number of expanded CGG repeats but different FMRP levels will have different clinical presentations, because methylation may differ. Classically, in a person with a full mutation, the repeat number is massively expanded. Premutations, which have a CGG repeat number that ranges from 55 to 200, are meiotically unstable in the female. Premutations are unmethylated, are transcriptionally active, and produce FMRP, although possibly in lower amounts than normal alleles. Repeats in the range of 45 to 54 are considered to be intermediate or "gray-zone" alleles and are not considered to be predisposed to meiotic instability.[1] Molecular clinical correlations have demonstrated that variation in the clinical phenotype of affected people is related to the presence of mosaicism of methylation status, which results in preservation of some gene function and partial expression of FMRP. Although most instances of fragile X syndrome result from CGG expansion into the full mutation range, a rare point mutation within the *FMR1* gene or deletion in *FMR1* can produce the typical phenotype of fragile X syndrome as well.

Clinical Phenotype

The clinical phenotype in males with fragile X syndrome can be subtle, and its detection in the prepubertal period can be difficult. In fact, it was reported from a parent survey that 24% of families with a child in whom fragile X syndrome was diagnosed had seen a health care provider more than 10 times before fragile X testing was performed.[10] Often, it is the presence of development delay, mental retardation, or specific behavioral patterns that leads to suspicion of fragile X syndrome; mean age at diagnosis is 32 months. The classical facial appearance that includes a prominent forehead, a long, narrow face, a prominent jaw, and protuberant ears becomes more evident late in childhood or in early adolescence. The palate frequently is highly arched, and cleft palate has been reported. Dental crowding and malocclusion are common. Strabismus may be present, and refractive errors, including hyperopia and astigmatism, are present in 23% to 50% of cases. Nystagmus and ptosis also are occasional ocular findings. Macro-orchidism is observed in more than 80% of adolescent and adult males with fragile X syndrome; mean testicular volume is approximately 50 mL (normal mean testicular volume: $<$25 mL). Macro-orchidism is less common in prepubertal boys. Fragile X syndrome also has a connective tissue dysplasia, and findings may include soft velvet-like skin; joint hypermobility, especially in the fingers; pes planus; congenital hip dislocation; scoliosis and clubfoot; and, in adults, occasionally mitral valve prolapse.[6] Feeding problems are common, and gastroesophageal reflux has been reported for one-third of affected infants. Chronic otitis media, seen in 60% to 80% of cases, has its onset early in life, and recurrent otitis media is present in 23% of males with fragile X syndrome. Seizures have been reported in approximately 13% to 18% of affected males and 5% of females with a full mutation, and there may be relative macrocephaly. Birth weight in affected people typically is normal. Accelerated linear growth with tall stature is common throughout childhood; however, growth velocity tends to slow in adolescence, and 26% of adult men with fragile X syndrome have a height that is equal to or less than the 5th percentile.[6](p27–28)

A subgroup of males with the full mutation has been described in which the clinical phenotype is reminiscent of Prader-Willi syndrome.[11] Affected males have extreme obesity, short stature, stubby hands and feet, and diffuse hyperpigmentation.

Cognitive Profile

Fragile X syndrome should be suspected in a boy with developmental delay and hypotonia in early childhood. Cognitive deficits frequently result in moderate-to-severe mental retardation; the average IQ is approximately 40 in an adult man with a completely methylated full mutation. Males who are less severely affected can have incomplete methylation resulting in some gene product and present with only mild intellectual deficits or learning problems. In addition, slowing in the acquisition of cognitive skills can occur with age.

Language delay also is evident in early childhood. A child with fragile X syndrome may not begin to speak until 2 to 3 years of age. Although vocabulary and syntax may be less involved, deficits in conversational speech are frequent.

In females with a full mutation, the cognitive profile is similar to that of males, but there is wider phenotypic variability, especially in relation to IQ scores. Intellectual abilities range from normal to significant mental retardation, and the majority of females with a full mutation have a normal or borderline IQ. The milder phenotype in affected females correlates with the degree of X inactivation of the X chromosome that contains the CGG expansion during lyonization. A more severe phenotype would be anticipated when there is skewed X inactivation (eg, when the majority of X chromosomes randomly inactivated are those with a normal CGG repeat number), thus preferentially activating the X chromosome with an expanded CGG repeat number.

Neurobiology

Gross abnormalities have not been observed in the brains of people with fragile X syndrome on autopsy. Although diffuse brain atrophy and white matter abnormalities have been noted on MRI, routine neuroimaging of the brain is not indicated. At the cellular level, longer and thinner dendritic spines on which most of the synapses occur have been detected, which suggests a possible misregulation in their development and maturation. FMRP has an important role in the regulation of protein synthesis at a local level in the dendrites of neurons. Protein synthesis in dendritic spines is important for synaptic transmission, synaptic plasticity, learning, and memory. A proposed role for FMRP at the synapse is that it is a negative regulator of protein synthesis stimulated by group 1 metabotropic glutamate receptor (mGluR) activation.[8] Therefore, fragile X syndrome is at least partially a result of exaggerated responses to mGluR stimulation.

Behavioral Phenotype

Behavioral problems occur in more than 50% of affected patients and are generally out of proportion with the affected child's cognitive level, compared with children with other developmental disorders who are functioning at similar intellectual levels.[6,7] In general, behavioral difficulties can be separated into a few symptom clusters. Features of attention-deficit/hyperactivity disorder, including hyperactivity, inattentiveness, distractibility, restlessness, and impulsivity, are present in 80% of patients with fragile X syndrome. Affected children also can exhibit anxiety-related symptoms including obsessive-compulsive–like and perseverative behaviors. Emotional lability is common. Aggressive and self-injurious behaviors can occur, related to a difficult temperament, with irritability and frequent temper tantrums. Hypersensitivity to sensory stimuli can lead to heightened and prolonged arousal in situations in which there is excessive auditory, visual, or tactile stimuli. This behavior can lead to an increase in tantrums, hyperactivity, oppositionality, and restricted verbal output. On the other hand, affected males often have a good sense of humor, are persistent and hardworking, and have an endearing quality. Features of autism may be present in early childhood, including stereotypies such as hand-flapping, biting, perseverative speech, poor eye contact, and lack of interest in social interaction. Autism is present in 30% of people with a full mutation, and pervasive developmental disorder–not otherwise specified has been reported in another 20% to 30% of affected children. Fragile X syndrome also is found in approximately 2% to 6% of people with autism. Psychiatric comorbidity also is frequently observed in affected people and includes oppositional defiant disorder, separation anxiety, and obsessive-compulsive disorder. Females with a full mutation tend to have a higher risk of emotional problems compared with the general population. In fact, shyness, social avoidance, social anxiety, mood lability, and depression may be presenting features in a female with the full mutation.

Premutation

Both females and males with a CGG repeat number that ranges from 55 to 200 are considered to carry a premutation. The prevalence of a premutation has been estimated to be approximately 1 in 259 in females and 1 in 813 in males. People carrying the premutation originally were believed to be clinically normal, because the *FMR1* gene is not methylated with a CGG repeat number below 200, which results in FMRP activity. However, it is now recognized that carriers of a premutation can present with 1 or more distinct

clinical disorders: mild cognitive and/or behavioral deficits; primary ovarian insufficiency (POI); and a neurodegenerative disorder in older adult premutation carriers, especially males, called fragile X–associated tremor/ataxia syndrome (FXTAS). In contrast to decreased messenger RNA (mRNA) in people with a full mutation and absence of FMRP, mRNA levels are elevated and FMRP is present in people with a premutation.

A minority of female carriers of a premutation have mild physical features of fragile X syndrome, which can include prominent ears or hypermobile finger joints. Emotional problems also may be present, including anxiety, obsessional thinking, schizotypy, and/or depression. It was observed recently that depression and interpersonal sensitivity were more likely to occur in females with a premutation with more than 100 CGG repeats than in those with fewer repeats.[12] These emotional findings are likely to represent a mild form of the anxiety and perseverative thinking that occurs in those with a full mutation and may be the result of a mild deficit in FMRP found in the upper half of the premutation range. Males with a premutation are prone to have attentional problems, executive dysfunctions, social deficits, and obsessive-compulsive behavior.[13]

A disorder unique to female carriers of a premutation is POI (previously referred to as premature ovarian failure [POF]), in which there is cessation of menses before 40 years of age.[14–17] This disorder is seen in approximately 20% of women who carry a premutation allele, in contrast to approximately 1% in the general population. Subclinical ovarian dysfunction that leads to elevated follicle-stimulating hormone levels is seen in another 25% of adult women younger than 40 years with a premutation. An increased risk of twinning also exists for conceptions in a woman with a premutation.

Recently, a new phenotype that develops in the later years of the majority of adult men who carry a premutation (rarely reported in female premutation carriers) has emerged, designated FXTAS.[18,19] A progressive intention tremor develops after 50 years of age and is typically followed by ataxia. Associated features include a peripheral neuropathy; parkinsonian manifestations; autonomic dysfunction such as incontinence, impotence, and orthostatic hypotension; progressive cognitive impairments that involve loss of memory and deficits in executive function; and psychological features including disinhibition, anxiety, mood lability, irritability, outbursts, depression, and isolation. Some patients progress to having dementia. This neurodegenerative disorder seems pathogenetically distinct from fragile X syndrome and is probably related to *FMR1* messenger RNA levels that are elevated in premutation carriers. FXTAS has not been observed in males with a full mutation. Maternal grandfathers of affected males should be counseled and evaluated as appropriate for adult-onset movement disorders.

The expansion of the number of CGG repeats occurs during reproduction in a female with a premutation. This may be a small expansion to a slightly larger CGG repeat number in the premutation range, or it may result in a massive expansion into a full mutation. The risk of expansion to a full mutation is determined by the size of the mother's premutation. As the CGG repeat number increases, so does the risk of expansion to a full mutation (Table 1). Therefore, the larger the number of repeats, the more likely it will expand to a full mutation in an offspring. To date, no offspring with a full mutation has been described when the CGG repeat number is less than 59. Because the number of CGG repeats in a female with a premutation has the potential to increase through several generations of a family, the risk of expansion to a full mutation also increases.

TABLE 1 Risk of Expansion to a Full Mutation in Male Offspring Based on the CGG Repeat Number in the Mother[1,34]

CGG Repeat Number	Risk for Expansion to a Full Mutation, %
59–69	37
70–79	65
80–89	70
90–99	95
≥100	100

A premutation will be transmitted to all female offspring of a male with a premutation. In these females, the CGG repeat number is similar to their fathers' repeat number or may expand slightly. However, the CGG repeat number may undergo expansion when a female with a premutation reproduces, which could result in an offspring with a full mutation and fragile X syndrome. A premutation in a male will not be transmitted to his male offspring, because the son inherits his father's Y chromosome.

Who Should Be Tested for Fragile X Syndrome

Because children with fragile X syndrome may not have apparent physical features, any child who presents with developmental delay, borderline intellectual abilities, or mental retardation or has a diagnosis of autism without a specific etiology should undergo molecular testing for fragile X syndrome to determine the number of CGG repeats (Fig 1). Approximately 2% to 6% of these patient populations will be found to have an *FMR1* mutation. The family should be made aware of the implications of the testing for other family members and given the option of genetic counseling before testing. Array comparative genomic hybridization (or array

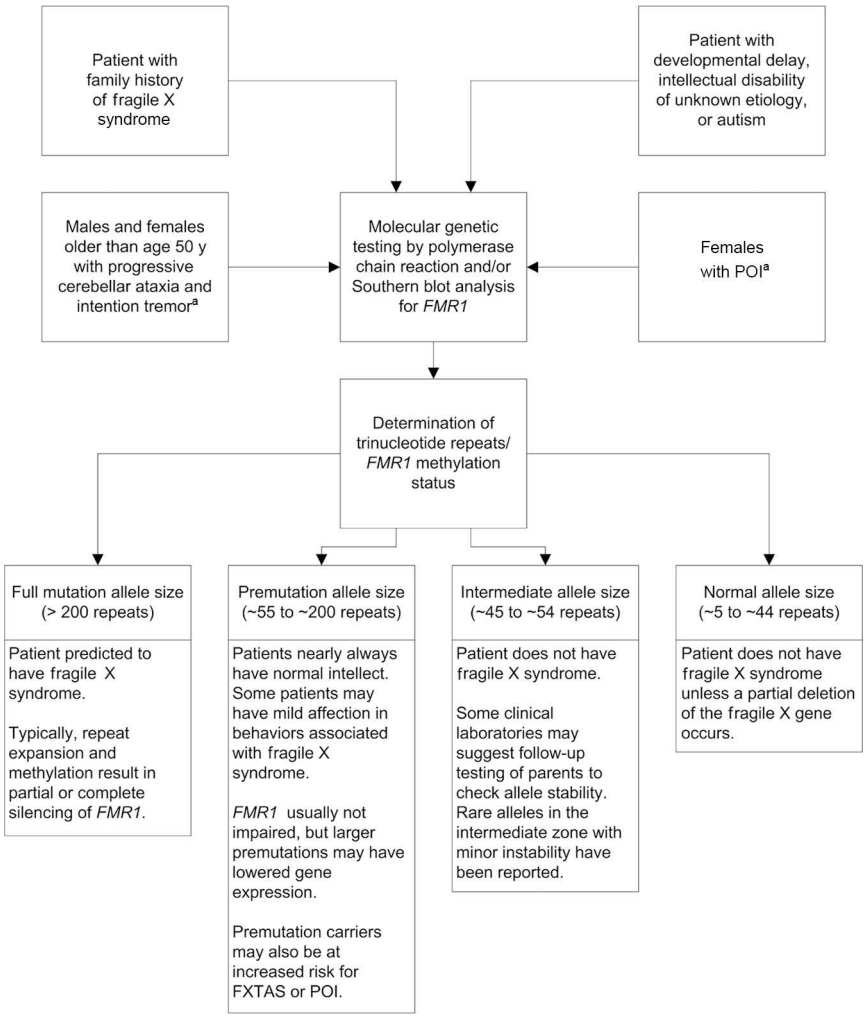

FIGURE 1

Testing algorithm for fragile X syndrome and *FMR1*-related disorders. [a] Adults to be considered for *FMR1* molecular testing. (Adapted with permission from Saul RA, Tarleton JC. *FMR1*-related disorders. *GeneReviews* [online]. October 28, 2010. Available at: www.ncbi.nlm.nih.gov/books/NBK1384. Copyright, University of Washington, Seattle, 1997–2010.)

testing) should also be considered. Phenotypic checklists have also been created for use in males with developmental delay of undetermined etiology to help identify candidates for fragile X molecular testing. These checklists slightly increase the diagnostic yield, especially when used in concert with targeted family fragile X history questionnaires. Fragile X testing should also be considered in patients in whom there is suspected, but not molecularly proven, Sotos syndrome or Prader-Willi syndrome. On the other hand, fragile X testing, is not routinely warranted for children with isolated attention-deficit/hyperactivity disorder.

When evaluating a family with fragile X syndrome, questions also should address whether there are people with mild emotional and/or learning problems, POI, and/or features of FXTAS. Because people with a premutation are at risk of having these conditions, molecular testing is suggested for asymptomatic siblings of a child with fragile X syndrome and for other family members at risk of carrying the mutation. In family members found to have a premutation allele (55–200 CGG repeats), developmental testing may be indicated, and in older people, monitoring is warranted for POI and FXTAS.

Management of a Child With Fragile X Syndrome

Diagnosing fragile X syndrome is beneficial to the family, because it establishes the reason why a child has cognitive deficits and/or behavioral problems. Establishing a diagnosis of fragile X syndrome also will allow parents and/or caregivers to gain an understanding of the disorder and how it affects the child's development and behavior. Diagnosis also will allow the family to focus on appropriate management strategies that will maximize their child's potential. Formal assessment tools are available to assist with a behavior-management plan. Current approaches to therapy are supportive and symptom based. Psychopharmacologic intervention to modify behavioral problems in a child with fragile X syndrome may represent an important adjunctive therapy when combined with other supportive strategies including speech therapy, occupational therapy, special educational services, and behavioral interventions. Medication management may be indicated to modify attentional deficits, problems with impulse control, and hyperactivity. Anxiety-related symptoms, including obsessive-compulsive tendencies with perseverative behaviors, also may be present and require medical intervention. Emotional lability and episodes of aggression and self-injury may be a danger to the child and others around him or her; therefore, the use of medication(s) to modify these symptoms also may significantly improve an affected child's ability to participate more successfully in activities in home and school settings.

Several classes of medications alone or in combination have proven to be beneficial in managing behavior problems in fragile X syndrome.[7,20] Stimulants target hyperactivity, inattention, and impulsivity, and two-thirds to three-quarters of symptomatic children with fragile X syndrome benefit from the use of methylphenidate. However, in some affected people, stimulants may exacerbate anxiety, mood lability, or aggressive tendencies. The α-2-adrenergic agonists clonidine and guanfacine have been effective in treating hyperactivity, hyperarousal to sensory stimuli, impulsivity, and aggressive behaviors in approximately 70% of young boys with fragile X syndrome. These agents may be especially helpful in a child who is younger than 5 years and does not tolerate or respond to stimulants. Clonidine also is effective for the management of sleep disturbances,[21] and melatonin may be beneficial for regulating sleep patterns.[22]

Selective serotonin-reuptake inhibitors can be useful in the management of mood disorders, anxiety, obsessive-compulsive behaviors, tantrums, and aggression in people with fragile X syndrome. Atypical antipsychotics generally are reserved for people with fragile X syndrome who exhibit more extreme behaviors, particularly aggression, marked mood lability, self-injury, and other undesired behaviors. Parent reports of improvement in mood stabilization, attention, and academic performance have been described with aripiprazole, which should be used at low doses to avoid agitation induced by higher doses.[23] However, adverse effects can include excessive weight gain, sedation, nausea, constipation, diabetes, and tardive dyskinesia.[24]

Current psychopharmacologic therapy for fragile X syndrome is supportive or symptom-based, and no therapy exists that is specifically directed at improving cognitive ability in patients with fragile X syndrome. However, because excessive mGLuR signaling plays a role in the fragile X syndrome phenotype, drugs that target mGLuR may be an effective treatment in this disorder. As more information regarding specific dendritic functions of FMRP are elucidated, pharmacologic investigations will likely be designed to address specific neurochemical and synaptic deficits generated by the absence of FMRP, targeting cognitive deficits and also leading to improvements in behavior.[7,25]

Factors in the environment also may influence adaptive behaviors, cognitive abilities, and behavioral symptoms of patients with fragile X syndrome. For instance, in 1 study, behavioral symptoms in children with fragile X syndrome who resided in a nurturing home environment displayed few autistic behaviors, better adaptive behavior, and higher IQ.[26]

Genetic Counseling

Fragile X syndrome and *FMR1*-related disorders (ie, POI and FXTAS) are inherited in an X-linked dominant manner with often complex expression. Genetic counseling is recommended for all family members who are affected or at risk of having a premutation or an offspring with a full mutation. Genetic counseling is critical to provide information regarding the inheritance pattern and variability of the clinical phenotype in people being affected with both a full mutation and premutation and to offer the option of pursuing molecular testing. Options for reproductive planning can be discussed in anticipation of family planning for adults at risk of having an affected child. In addition to seeking help from professionals who are knowledgeable of the condition, information to assist families also can be obtained from support organizations and through contact with parents who have a similarly affected child.

The mother of a child with an *FMR1* mutation is almost always a carrier of a premutation or full mutation. Females who are premutation carriers may have inherited the premutation from their father or from their mother who also carries a premutation. Women with a premutation are at risk of premature ovarian insufficiency and at small risk of FXTAS. They carry a 50% risk of transmitting an abnormal gene, which either contains a premutation copy number (55–200) or a full mutation (>200) in each pregnancy. Rarely, a decrease in the number of CGG repeats has been reported when the abnormal allele is transmitted from a woman with a premutation to her daughter. The risk of expansion of a premutation in a mother to a full mutation in her offspring correlates with the number of CGG repeats in her mutation. Therefore, the higher the number of repeats in the mother, the greater likelihood of expansion to a full mutation in her offspring (Table 1).

Males who are premutation carriers are referred to as transmitting males. During reproduction, all of their daughters will inherit a premutation, but their sons will not inherit the premutation, because they inherit a Y chromosome. All daughters of transmitting males are unaffected premutation carriers. Transmitting males also need to be aware of the risk of developing FXTAS after the fifth decade of life.

Males with a full mutation, in most instances, have mental retardation and decreased fertility. The FMRP plays a role in spermatogenesis, and in 1 study it was found that in later stages of spermatogenesis, men with fragile X syndrome had significantly malformed spermatids and a reduction in normally differentiated spermatids, which may cause reduced fertility. A full

mutation cannot be maintained during spermatogenesis; therefore, the sperm contains only expanded *FMR1* gene CGG repeat sizes in the premutation range.

Both males and females can have mosaicism as a result of either full mutation/premutation mosaicism or methylation/unmethylation mosaicism. In men, only a premutation will be transmitted to their female offspring.[27] Women with a full mutation are at 50% risk of having male or female offspring with a full mutation.

Genetic counseling is more problematic when CGG repeats are in the range of 41 to 58 in the *FMR1* allele. This is viewed as a "gray zone," because unstable alleles of this size have been reported, but expansion is unlikely. To date, the smallest repeat number to expand to a full mutation in a single generation was 59 CGG repeats.

Because fragile X syndrome can be difficult to diagnose in a child, various studies have documented that 50% of families with males with fragile X syndrome may have their second child before the diagnosis is established in the first child.[3,28–30] Families with an affected male have indicated that early diagnosis would have influenced their reproductive decision-making. After a diagnosis was made, 73% of families reported that the diagnosis of fragile X syndrome affected their decision to have another child, and 43% of the families surveyed had a second child with a full mutation. Therefore, detection of fragile X syndrome not only would enable at-risk families to receive accurate reproductive counseling for the immediate and extended family but also could allow for appropriate intervention beginning in infancy. Recently, a pilot study in South Carolina on newborn filter-paper blood screens to perform testing for fragile X syndrome was completed and established the potential feasibility of such a screening process.[31] Various policy issues still need to be considered.[32]

THE PRENATAL VISIT

In some instances, pediatricians may be called on to counsel an expectant couple whose fetus has been determined to have fragile X syndrome or when there is a family history of the condition. In some settings, the pediatrician may be the primary resource for counseling parents and family members. The pediatrician should:

1. Review the diagnostic studies that led to establishment of the diagnosis.
2. Explain the cause of fragile X syndrome in the fetus and the potential for a recurrence risk.
3. Review the clinical manifestations, the variability seen in fragile X syndrome, and the long-term prognosis.
4. Review currently available treatments and interventions. This discussion should include the efficacy, potential complications and adverse effects, and costs or other burdens of these treatments.
5. Explore, using a nondirective approach, the options available to the family for treatment and rearing of the child. In cases of prenatal diagnosis, this approach may include discussion of pregnancy continuation or termination, rearing the child at home, foster care placement, or adoption.

It is strongly encouraged that this counseling be done in conjunction with genetic counseling or referral to a genetic counselor or clinical geneticist to provide a more in-depth discussion of fragile X syndrome, including the associated medical conditions, prognosis, management strategies, recurrence risk, future reproductive options, and recommendations for evaluating at-risk family members.

Health care providers should ensure that children with fragile X syndrome are afforded the standard care for all children as outlined in the American Academy of Pediatrics "Recommendations for Preventive Pediatric Health Care"[33] and specific fragile X syndrome health supervision guidelines according to their age (Table 2).

HEALTH SUPERVISION FROM BIRTH TO 1 MONTH: NEWBORNS (TABLE 2)

Examination

1. Examine the neonate for any orthopedic abnormalities, especially congenital hip dysplasia and clubfoot.
2. Review the molecular testing results with the family. In this age group, the diagnosis will only have been made if there was a confirmed family history or if it was previously established in utero. Although the typical phenotype of fragile X syndrome generally will not be present in the neonate, review the clinical manifestations and characteristic patterns of growth and development and problems associated with this condition, which may become more apparent with time. Evaluate the neonate's occipitofrontal circumference, which may be increased, and begin to monitor head-growth velocity.
3. Monitor for feeding difficulties and symptoms of gastroesophageal reflux.

Anticipatory Guidance

1. Review the support groups and services that are available to the child and family. Supply written materials on fragile X syndrome and provide the address and telephone number of organizations involved in fragile X syndrome (eg, National Fragile X Foundation [www.

TABLE 2 Fragile X Syndrome: Guidelines for Health Supervision

	Infancy to 1 y			Early Childhood, 1–5 y	Late Childhood, 5–12 y	Adolescence to Early Adulthood, ≥13 y
	Newborn	1–6 mo	6–12 mo			
Examination						
Ocular	●[a]	●[a]	●[a]	●[a]	●	●
Ear, nose, throat	—	●[b]	●[b]	●[b]	●	●
Skeleton	●[c]	—	—	—	●	●
Cardiac	—	—	—	—	●[d]	●[d]
Measure testes	—	—	—	●	●	●
Development	●	●	●[e]	●	●	●
Neurologic	—	—	●[f]	●	●[g]	●
Behavior	●[h]	●[h]	●[h]	●[h]	●[i]	●[i]
Anticipatory guidance						
Genetics	●[j]	●	●	●	●[k]	●[k]
Psychosocial	●[l]	●[l]	●[l]	●[l]	●[l]	—
Support groups	●	●	●	●	●	●
Early intervention, physical and other therapies	—	●	●	●	●	●
Behavior	●	●	●	●	●[m,n]	●[m,n]
Education	—	—	—	●[o]	●[p]	●[p]

Health care providers should ensure that, in addition to the specific guidelines provided here, patients with fragile X syndrome are afforded the standard care for all children as outlined in the American Academy of Pediatrics "Recommendations for Preventive Pediatric Health Care."[33] ● indicates to be performed; —, not applicable.

[a] Strabismus may occur anytime between birth and 4 years of age.

[b] Serous otitis can occur throughout childhood, and the resulting hearing loss can further impair speech development. Pressure-equalizing tubes may be needed.

[c] Joint laxity, hip dislocation, or clubfoot may be seen.

[d] Mitral valve prolapse is possible.

[e] Irritability, hypotonia, and tantrums may begin to be seen.

[f] Seizures more commonly occur in this age group.

[g] Assess for atypical seizures, especially when any neurologic symptoms exist or if intellectual function decreases.

[h] Infants with fragile X syndrome are often described as stiff and irritable and may feed poorly.

[i] Violent outbursts may appear in this age group.

[j] Review molecular testing and discuss risks within the family; genetic counseling is strongly encouraged.

[k] Review risk to offspring of the affected person.

[l] Family support and issues of what to tell others are important at the time of diagnosis regardless of the child's age.

[m] Address sexual issues.

[n] Ask parents about violent outbursts.

[o] Review the preschool program with regard to special educational needs and future placement.

[p] Discuss the need for planning for vocational training.

FragileX.org], FRAXA Research Foundation [www.FRAXA.org]).

2. Discuss resources available for support, such as family clergy, mental health professionals, families who have an affected child residing in the area, and friends.
3. Discuss how and what to tell family members and friends about the neonate's condition.
4. Review the recurrence risk for subsequent pregnancies; discuss options for family planning, including prenatal and preimplantation genetic diagnosis; or refer for formal genetic counseling to address these issues.
5. Review the family history regarding evaluation of other family members at risk of having a premutation or full mutation, or refer for formal genetic counseling to address these issues.

HEALTH SUPERVISION FROM 1 MONTH TO 1 YEAR: INFANCY (TABLE 2)

Examination

Early growth and development may be normal, although neurologic abnormalities and delayed development may be present. Monitor the infant for the following problems:

1. Hypotonia that frequently results in mild motor delay.
2. Irritability, which is usually secondary to sensory problems, including tactile hypersensitivity.
3. Feeding problems, which are common in infancy, and the presence of vomiting secondary to gastroesophageal reflux.

Anticipatory Guidance

1. Monitor growth parameters closely.
2. If feeding problems are severe, pursue diagnostic evaluations to determine if they are the result of oral motor problems and/or gastroesophageal reflux. If gastroesophageal reflux is identified, initiate appropriate management strategies or refer the infant for further evaluation by a pediatric gastroenterologist. If oral motor problems exist, refer the infant to an appropriate

interventionist to initiate feeding therapy.

3. Review the available resources to provide the infant with early-intervention services and assist the individualized family service plan team in providing the most appropriate services to maximize the infant's developmental potential. Parents should consider applying for Supplemental Security Income (SSI) through the Social Security Administration.

HEALTH SUPERVISION FROM 1 TO 5 YEARS: EARLY CHILDHOOD (TABLE 2)

Examination

1. Perform an ophthalmologic evaluation or arrange for ophthalmologic referral to check for strabismus and refractive errors, especially hyperopia and astigmatism, which are seen in 25% to 50% of affected children. Also monitor for ptosis and nystagmus, which are seen occasionally.
2. Evaluate the child for orthopedic problems related to connective tissue dysplasia, such as pes planus (80% of affected children), hypermobile joints, and scoliosis. Pronated feet require treatment with orthotics if a gait disturbance exists or there is uneven wearing of shoes.
3. Examine the child for inguinal hernias, especially at 1 to 3 years of age.
4. Assess the child's history for seizures or staring episodes and obtain an electroencephalogram if clinically indicated.
5. Monitor the child for recurrent otitis media (60%–80% of affected children), which could be associated with conductive hearing loss, and also for recurrent sinusitis (23% of affected children). Monitor the child's audiologic status yearly.
6. Receptive and expressive communication should be monitored closely, because language delay is usually evident by 2 years of age. An occupational therapy evaluation also may be indicated and should include an assessment of sensory integration abilities. A complete psychological evaluation that includes IQ testing is an important part of the developmental evaluation of the preschool-aged child with fragile X syndrome. Affected children require early developmental services to facilitate language, motor, and cognitive skills. These services are mandated by federal law and should be followed by enrollment in a developmental preschool and supplemented with special education services. Occupational and speech-language therapy should be incorporated into the program and should include continued attention to language, motor, and cognitive skills up to and including kindergarten. Computer technology with software programs that enhance language skills and early academic abilities, including reading and mathematics, can be incorporated into special education programming. Inclusion in a preschool setting is achievable with appropriate supports.
7. Monitor the child's emotional and behavioral status closely. Tantrums and hyperactivity frequently develop in the second year of life, especially related to transitioning and excessive sensory stimuli. Evidence of anxiety and depression as well as the presence of aggression and obsessive-compulsive behaviors may develop during this time period. Manifestations of autism, such as hand-flapping, self-injury, poor eye contact, lack of social engagement, and absent joint attention may be present before 3 years of age and necessitate further evaluation. Excessive sensory stimulation should be avoided when possible, including exposure to large crowds and loud noises; earphones can be used in such settings to allow the child to listen to a favorite tape or calming music to avoid behavioral outbursts. Significant behavior problems, such as tantrums, oppositional behavior, or severe hyperactivity, usually benefit from intervention by a psychologist or other behavioral specialist. Behavioral intervention techniques that emphasize the importance of decreasing excessive sensory stimuli and using positive behavioral reinforcement and the use of behavioral charting are beneficial.
8. Psychopharmacologic interventions can be helpful. The use of stimulant medication to treat hyperactivity, short attention span, and impulsivity decreases symptoms in approximately 60% to 70% of affected children but may be more effective for a child who is of school age than of preschool age. At a younger age, antihypertensive medications, such as clonidine or guanfacine, may have a better calming effect and improve hyperactivity and hyperarousal. For treatment of anxiety, social phobia, obsessive-compulsive tendencies, depression, and aggression, use of a selective serotonin-reuptake inhibitor is safe and can be effective. Monitoring for the development of akathisia (motor restlessness) is important. In addition, in the presence of severe mood instability and/or aggression that are unresponsive to a selective serotonin-reuptake inhibitor or stimulant medication, use of an atypical antipsychotic agent to provide mood stabilization may be indi-

cated. Approximately 10% of people with fragile X syndrome develop psychotic symptoms often associated with severe paranoia, which also may lead to aggressive behavior.

9. Linear growth during this period should be monitored closely, and linear growth velocity should be similar to that of unaffected children.
10. Structural changes of the face may start to become evident in preschool years and include a long face, high forehead, high arched palate, and prominent ears. Facial changes can result in dental crowding and malocclusion, and regular dental evaluation is recommended.
11. Occasionally, in affected children, obstructive sleep apnea occurs, which may be related, in part, to facial changes but also can be the result of the connective tissue dysplasia and hypotonia of facial and pharyngeal muscles. Excessive snoring, restless sleep, or fatigue during the day should signal the need for further evaluation of the child's sleep problem with evaluation of adenoidal size and the child's sleep pattern by using polysomnography.
12. Delayed toilet-training is common during this age range and is likely to reflect the child's cognitive status.

Anticipatory Guidance

The pediatrician should review the child's preschool placement and ancillary services that complement the program. Inclusion with typically developing children should be considered when appropriate and may require supervision in that setting. Consider a formal developmental evaluation and discuss the role of behavior/psychological intervention when indicated.

1. Determine if behaviors such as hyperactivity, aggression, self-injury, and tantrums warrant medication management.
2. Seizures are an important clinical manifestation that occurs in approximately 20% of people with fragile X syndrome and usually have their onset in early childhood. Appropriate evaluation and treatment is indicated when suspicion of seizures is present.
3. Auscultation of the heart should be performed and blood pressure should be obtained at all clinic visits. The presence of a murmur or click should indicate the need for further evaluation by a pediatric cardiologist, and elevated blood pressure will require monitoring and a determination of whether medical treatment is indicated.
4. Delays in toilet-training can be helped by behavioral interventions including the use of a music video to facilitate toilet-training for people with developmental disabilities.[6](p291)
5. Review the future reproductive plans of the parents and discuss recurrence risk and family-planning options when indicated.

HEALTH SUPERVISION FROM 5 TO 12 YEARS: LATE CHILDHOOD (TABLE 2)

1. Macro-orchidism usually begins to develop at approximately 9 years of age, and the testes will increase in size throughout puberty (mean testicular volume in adulthood: ~50 mL). Testicular volume should be measured with an orchidometer, and boys should be assessed for the presence of a hernia, which occurs in approximately 15% of males with a full mutation. Assure the parents that macro-orchidism has no relation to sexual function and that it is not a sign of precocious puberty.
2. Girls with the full mutation should be monitored for the development of precocious puberty, which has been reported occasionally. Although the cause in most instances is unknown, hypothalamic dysfunction has been described with fragile X syndrome and may be the cause of precocious puberty.
3. Continuing to monitor the child's developmental status is critical for making certain that cognitive, speech and language, and motor needs are being addressed. Being provided with reports of interval progress in school is useful in determining the effectiveness of the child's programming and whether modifications or further evaluation are indicated.
4. Hyperactivity frequently will persist throughout childhood and is present in approximately 70% to 80% of affected boys and 30% to 50% of girls with a full mutation. Addressing this problem behaviorally and/or in combination with medication management may be indicated.
5. Monitor the child for obsessive-compulsive behaviors, especially because they may blend in with perseverative or repetitive behaviors and not be recognized. Anxiety—especially social anxiety—frequently is present, particularly in children who do not have hyperactivity or impulsivity. Pursuing appropriate management strategies to address the child's emotional needs is important for effective adaptation in the home and school settings.
6. Cognitive impairments result in mental retardation in most boys who have a full mutation that is fully methylated (average IQ: ~40). Occasionally, males with a full mutation are higher functioning because of incomplete methylation of FMRP as a result of mosaicism. Approximately 50% of females with a full

mutation have cognitive deficits (IQ range: 70–84). Recognition of cognitive impairments and adaptive functioning deficits should signal the need for pursuing appropriate support services in the school setting to meet the child's needs.

7. In addition to delayed toilet-training, enuresis is common in both boys and girls with fragile X syndrome. Although affected children are not considered to be at increased risk of recurrent urinary tract infections, the connective tissue dysplasia may predispose to dilatation of the ureters and vesicoureteral reflux.[6](p27) Further evaluation of the urinary tract through radiographic and ultrasonographic studies is indicated in the presence of a urinary tract infection, and referral to a nephrologist or urologist is indicated if urinary tract infections are recurrent in nature or a structural abnormality or reflux is identified. Behavioral strategies should be implemented in the presence of nighttime enuresis. In addition, treatment of enuresis may also require the use of behavior-modification techniques and an alarm system. If unsuccessful, medication management with agents such as imipramine, oxybutynin (an anticholinergic agent), or desmopressin acetate (an analog antidiuretic hormone) should be considered. Only occasionally will children require medication for this problem. Macro-orchidism will be maintained throughout adult life and does not require intervention.
8. Because of the connective tissue dysplasia, children should be monitored for scoliosis, which occurs in approximately 20% of affected children. However, when present, it is usually mild and does not require treatment.

HEALTH SUPERVISION FROM 13 TO 21 YEARS OR OLDER: ADOLESCENCE TO EARLY ADULTHOOD (TABLE 2)

1. Hyperactivity may decrease during adolescence, but attentional problems and impulsivity frequently persist and may continue to need to be addressed behaviorally and medically.
2. Assess adolescents for seizures, especially atypical seizures, particularly if intellectual performance is decreasing, although seizures tend to decrease during this time period.
3. Reassure parents that macro-orchidism will persist. Males (especially with a premutation or mosaicism) and females with fragile X syndrome can reproduce. Only a premutation will be present in the sperm of a male who has a full mutation, in contrast to other tissues, because a full mutation cannot be maintained in spermatogenesis; therefore, fertility is decreased in males.
4. The adolescent growth spurt may be slightly less compared with unaffected children, although the timing is normal. Psychosocial development, physical sexual development,[35] and fertility should be discussed, as well as the need for appropriate supervision and birth control. Counseling should be tailored appropriately to cognitive level.
5. Genetic mechanisms responsible for fragile X syndrome should be discussed with people with full mutations and premutations, and the risk of having an affected offspring should be reviewed. Males who are of reproductive age and have nonmosaic full mutations are infertile. Females with full mutations are fertile. Females with premutations are at increased risk of premature ovarian insufficiency, whereas females with full mutations are not. Males who are premutation carriers have no known fertility problems.
6. Determine if behavioral problems continue to represent a concern, and pursue behavioral/psychological intervention if indicated.
7. Discuss the availability and need for vocational training and group home placement if appropriate.
8. Monitor for a cardiac murmur or click; if either is heard, pursue a cardiology evaluation (see recommendation 1 in "Health Supervision in Adulthood").
9. Facilitate transition to adult medical care as appropriate or desired.
10. Agencies that serve people with developmental disabilities are present in most states and may provide respite for parents, adult day care programs, and personal assistance and nursing services as needed.

HEALTH SUPERVISION IN ADULTHOOD (TABLE 2)

During the transition from pediatric to adult medical care, the pediatrician can be a valuable source of information to the affected person's new primary care physician and/or obstetrician/gynecologist. The following information about fragile X syndrome can be communicated to facilitate the care of an affected adult:

1. Mitral valve prolapse occurs in approximately 50% of affected adults. Mild aortic root dilatation also has been reported, although it has not been documented to enlarge. In addition, hypertension is common in adulthood.
2. Up to 20% of women with a premutation will develop premature menopause before 40 years of age.
3. There is a greater risk of emotional problems in affected females, espe-

cially at times of hormonal changes or estrogen deficiency, such as menopause, the postpartum period, and during menstrual periods.

4. Genetic counseling should be provided to review the risk for having an offspring with either a premutation or full mutation and options available for family planning. An increased risk of twinning also should be discussed with females who have a premutation.
5. Men and, to a lesser degree, women with a premutation are at increased risk of developing FXTAS after 50 years of age. Awareness of this risk, particularly in a man with a premutation, warrants close monitoring for symptoms, especially when approaching 50 years of age.

People with fragile X syndrome and *FMR1*–related disorders face challenges throughout their entire lives. Therefore, coordinating medical, developmental, and behavioral services with available community resources can maximize the potential for affected people and minimize the stressors faced by other family members.

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CLINICAL REPORT

Health Supervision for Children With Neurofibromatosis

Guidance for the Clinician in Rendering Pediatric Care

Joseph H. Hersh, MD, and the Committee on Genetics

ABSTRACT

Neurofibromatosis 1 is a multisystem disorder that primarily involves the skin and nervous system. Its population prevalence is 1 in 3500. The condition usually is recognized in early childhood, when cutaneous manifestations are apparent. Although neurofibromatosis 1 is associated with marked clinical variability, most affected children do well from the standpoint of their growth and development. Some features of neurofibromatosis 1 are present at birth, and others are age-related abnormalities of tissue proliferation, which necessitate periodic monitoring to address ongoing health and developmental needs and to minimize the risk of serious medical complications. This clinical report provides a review of the clinical criteria needed to establish a diagnosis, the inheritance pattern of neurofibromatosis 1, its major clinical and developmental manifestations, and guidelines for monitoring and providing intervention to maximize the growth, development, and health of an affected child.

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Key Words
neurofibromatosis, neurofibromatosis 1, cafe-au-lait spots, neurofibroma, optic glioma

Abbreviations
NF1—neurofibromatosis type 1
NF2—neurofibromatosis type 2
NIH—National Institutes of Health
CLS— cafe-au-lait spot
UBO— unidentified bright object

INTRODUCTION

This clinical report was designed to assist the pediatrician in caring for the child in whom the diagnosis of neurofibromatosis has been made. The pediatrician's first contact with the child is usually during infancy. However, neurofibromatosis occasionally is diagnosed in the fetus during pregnancy, and the parents are referred for advice. Therefore, guidance is also offered for the pediatrician in advising expectant parents whose fetus is affected by neurofibromatosis.

At least 2 distinct types of neurofibromatosis are recognized: neurofibromatosis 1 (NF1 [previously known as von Recklinghausen disease or generalized neurofibromatosis]) and neurofibromatosis 2 (NF2 [previously known as either central or bilateral acoustic neurofibromatosis]). Only issues concerning the diagnosis and management of NF1 are addressed in this clinical report.[1–10]

NF1 is a multisystem disorder in which some features may be present at birth and others are age-related manifestations. It affects approximately 1 in 3500 individuals.[11,12] A National Institutes of Health (NIH) Consensus Development Conference[9,13,14] regarding NF1 demarcated the following 7 features, of which 2 or more are required to establish the diagnosis of NF1:

1. six or more cafe-au-lait spots (CLSs) equal to or greater than 5 mm in longest diameter in prepubertal patients and 15 mm in longest diameter in postpubertal patients;
2. two or more neurofibromas of any type or 1 plexiform neurofibroma;
3. freckling in the axillary or inguinal regions;
4. optic glioma (optic pathway glioma);
5. two or more Lisch nodules (iris hamartomas);
6. a distinctive osseous lesion, such as sphenoid wing dysplasia or cortical thinning of the cortex of long bones, with or without pseudoarthrosis; and
7. a first-degree relative (parent, sibling, or child) with NF1 according to the aforementioned criteria.

In addition, although areas of increased T2 signal intensity are commonly identified on MRI of the brain, they do not represent an obligatory feature of NF1 and do not have any clinical significance. Therefore, the NIH Consensus Development Conference did not recommend routine neuroimaging of the brain as a means of establishing a diagnosis of NF1.[13,14]

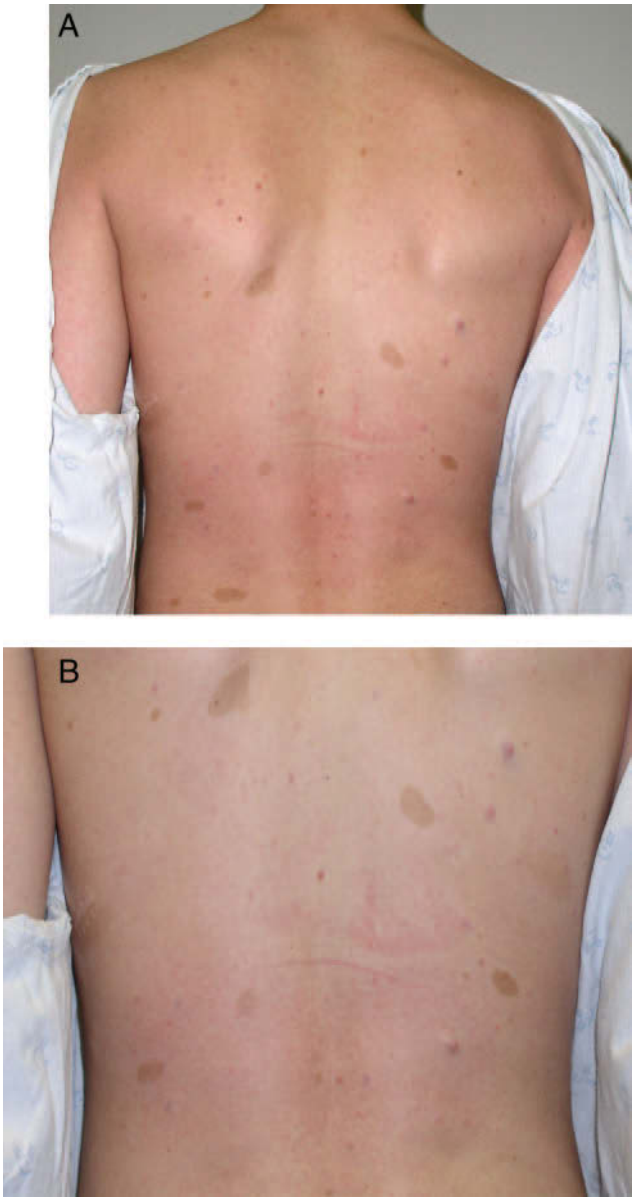

FIGURE 1
Multiple CLSs over the back. Note the dermal neurofibromas below the right scapula and right side of the lower back.

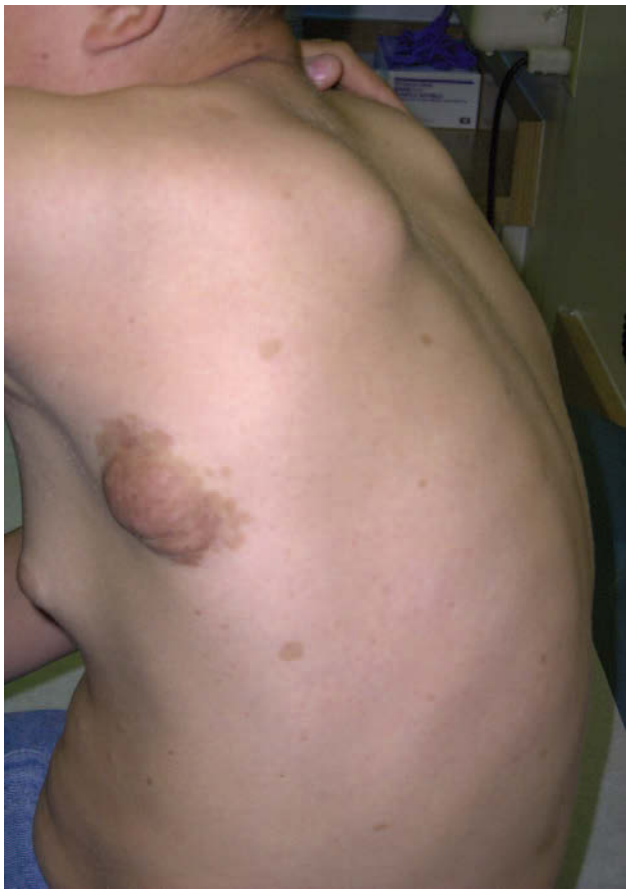

FIGURE 2
Large plexiform neurofibroma adjacent to the left axilla.

Diagnosis in nonfamilial pediatric cases, which represent 50% of those affected with NF1, may be difficult, because certain clinical features are age dependent.[15] For the same reason, the severity of NF1 in later life may be underestimated for an affected child.

CLSs usually represent the initial clinical manifestation of NF1 and may be present at birth or first appear in infancy (Fig 1). Although approximately 80% of those with NF1 will have more than 5 CLSs by 1 year of age,[12] occasionally these characteristic lesions are not present. CLSs tend to increase in number and size throughout early childhood.

Plexiform neurofibromas, which are found in at least 25% of individuals with NF1,[16] usually are congenital and, if located on the face, trunk, or extremities, can result in disfigurement (Fig 2). Early in life, the lesions may only be recognized as soft tissue enlargement or a patch of cutaneous hyperpigmentation with or without hypertrichosis. Tibial dysplasia, when present, occurs at birth and is manifested by anterolateral bowing of the lower leg (Fig 3). Its presence requires early orthopedic intervention because of the risk of fracture and development of pseudoarthrosis that results from healing, which occurs in approximately 2% to 3% of children with NF1.[12,17] Skinfold freckling (Fig 4) that develops in early childhood, typically between the ages of 3 and 5 years, usually is the second feature noted in children with NF1 and is present in three fourths of affected individuals.[15] Dermal neurofibromata usually first appear in the prepubertal period but may develop at a much earlier age and are present in virtually all affected individuals by adulthood (Fig 5). They become evident as skin nodules or tags located in cutaneous or subcutaneous tissues, as depressions in the skin with overlying purplish discoloration, or as firm nodules or cords in the deeper subcutaneous tissue. Increase in size and number of dermal neurofibromas coincide with puberty and pregnancy, but intermittent growth can persist throughout the life of an individual with NF1.[12] Plexiform neurofibromas may present as subcutaneous masses that involve deep tissues. These lesions can be found in all

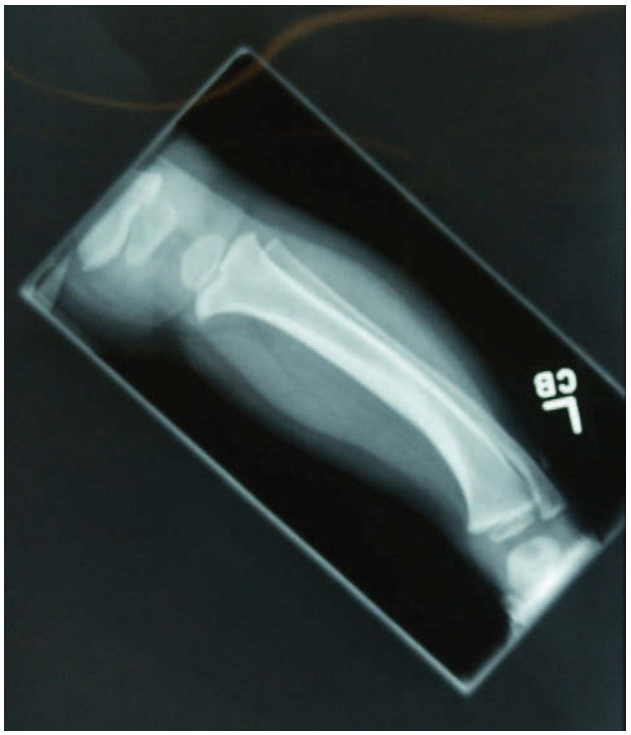

FIGURE 3
Anterior bowing of the left tibia.

organ systems, giving rise to specific symptoms depending on size, location, and degree of encroachment on surrounding tissues. Marked growth of these lesions can occur anytime in childhood, followed by long periods of quiescence.[12] Optic pathway gliomas are present in up to 15% of children with NF1 and represent the most common central nervous system tumor related to this disorder (Fig 6). They develop in children younger than 6 years. Although their natural history is often indolent, in approximately one third of patients with NF1, optic pathway tumors become symptomatic, and in approximately 5% of cases, the lesion results in visual loss, severe proptosis, and/or hydrocephalus.[18–20] Precocious puberty also can be an occasional complication when the

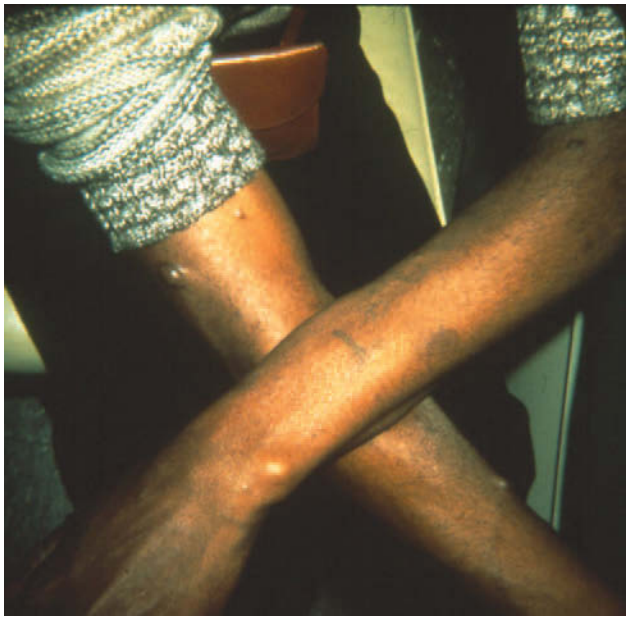

FIGURE 5
Dermal neurofibromas over both arms.

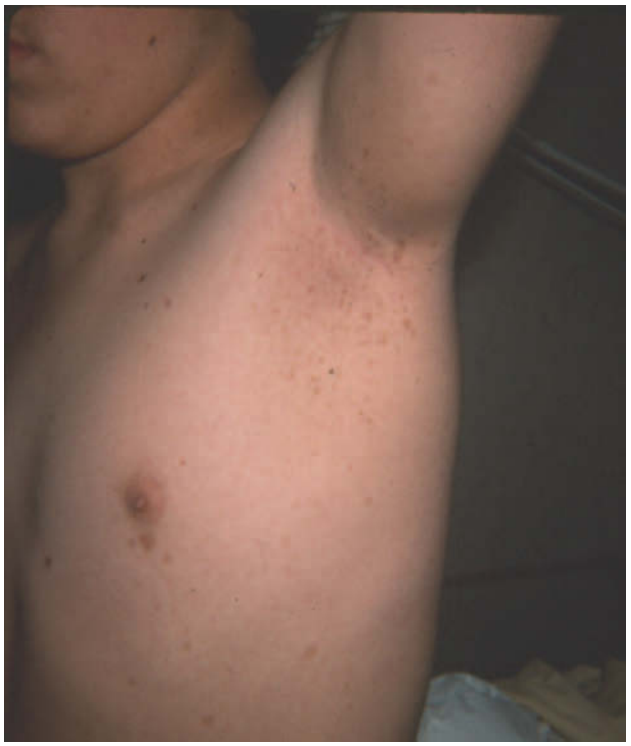

FIGURE 4
Axillary freckling.

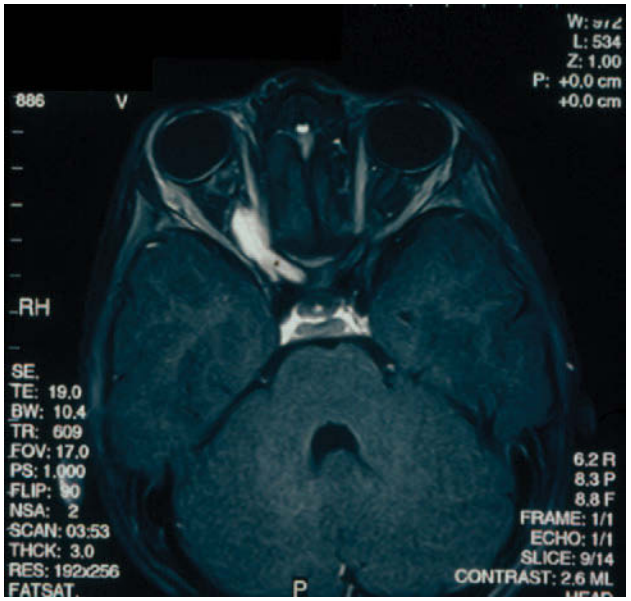

FIGURE 6
Optic glioma affecting the left optic pathway.

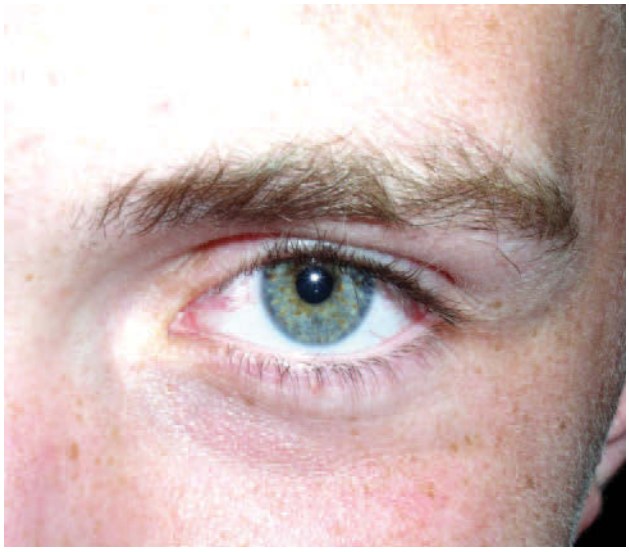

FIGURE 7
Multiple Lisch nodules.

optic pathway tumor involves the optic chiasm.[20,21] In the small proportion of symptomatic tumors in which clinically significant growth or progressive visual loss develops, treatment is necessary.[22] Treatment with carboplatin and vincristine sulfate has been effective in preventing further increase in tumor size and preserving remaining vision.[23] On the basis of the natural history of optic pathway tumors, the National Neurofibromatosis Foundation Optic Pathway Task Force previously has recommended against routine neuroimaging for all children with NF1; rather, yearly eye examination by either a pediatric ophthalmologist or an ophthalmologist who is knowledgeable of the ocular manifestations of NF1 has been advocated for all young children with NF1.[19,23] Lisch nodules (iris hamartomas)[12] usually develop in early adolescence, but they do not have any clinical significance (Fig 7). The sphenoid bones comprise multiple ossification centers that fuse to become the essential components of the orbits. Approximately 5% of individuals with NF1 have sphenoid wing dysplasia, which is usually unilateral. The abnormality can lead to proptosis, and approximately one half of patients with NF1 with sphenoid wing dysplasia will develop ipsilateral temporal-orbital plexiform neurofibroma.[12]

COMPLICATIONS

Although most individuals with NF1 are mildly affected, a risk of significant morbidity and life-threatening problems exists and cannot be predicted on the basis of findings in childhood. Serious complications of NF1 can result from direct involvement of multiple organ systems by plexiform neurofibromas. In addition, the lifelong risk of malignancy in affected individuals is increased. Malignant peripheral nerve sheath tumors represent the most common neoplasm, occurring in approximately 5% to 10% of individuals with NF1.[12,24] They usually develop in adulthood and are heralded by the presence of pain or rapid growth of a plexiform or deep nodular neurofibroma; however, similar manifestations can occur with a benign lesion. Other malignancies occur less frequently in patients with NF1, including pheochromocytoma, rhabdomyosarcoma, leukemia, and brain tumors other than optic gliomas.[12,25,26] Other associations exist with NF1, such as vascular changes. Macrocephaly affects most individuals with NF1.[27] Short stature occurs in one third of individuals with NF1 and does not seem to be related to disease severity. Height-growth velocity is normal for both genders during childhood, but the pubertal growth spurt is slightly reduced.[27] Growth charts made specifically for children with NF1 are available.[27,28] Neurofibromas develop in the gastrointestinal tract in a small proportion of patients with NF1 and usually present after early childhood. They may cause bleeding and anemia or signs of functional or mechanical obstruction. Rare forms of intraabdominal secretory or nonsecretory neoplasms also represent low-frequency associations. Evaluation for gastrointestinal complications should be pursued in the presence of unexplained anemia or weight loss, abdominal bloating, sudden or persistent abdominal pain, chronic diarrhea, signs of malabsorption, gastrointestinal bleeding, or recurrent emesis.[29,30] Seizures occur in 6% to 7% of cases.[12] Although electroencephalographic abnormalities are commonly reported, electroencephalography is not routinely recommended. If seizures are present, an intracranial tumor must be excluded, although usually no etiology is found. Nonossifying fibromas of the long bones and especially the distal femur and proximal tibia, on occasion, occur in adolescence or adulthood and can result in fracture. Therefore, a screening radiograph of both knees may be considered in early adolescence to provide appropriate intervention for individuals in whom lesions are detected.[31] Scoliosis is present in 10% to 30% of NF1 cases. Both idiopathic and dystrophic forms occur[12] and can lead to diminished pulmonary function. Variability in progression, however, makes it difficult to determine the prognosis once scoliosis is detected, and close monitoring is necessary after it has been discovered. An increased risk for osteoporosis in adulthood also exists.[32] Hypertension affects approximately 4% of individuals with NF1. Although essential hypertension is the most common cause of hypertension, in NF1 it can also result from renovascular disease, tumors that secrete vasoactive compounds, and coarctation of the aorta.[12] Therefore, monitoring blood pressure on a yearly basis is indicated, and if hypertension is found, additional evaluation and treatment or referral to an appropriate specialist for management is indicated.

NF1 is associated with an increased incidence of mental retardation (4%–8%)[33]; however, in most instances, intellectual abilities are in the average to low-average range. In contrast, specific learning disabilities are observed in as many as 40% to 60% of affected children,[12,34] and impaired performance on at least 1 test of academic achievement is present in 65% of children with NF1.[33] Deficits in visual-spatial-perceptual skills can result in reading and spelling difficulties. Poor fine-motor coordination can lead to problems with handwriting. Attention-deficit/hyperactivity disorder also occurs

more frequently in children with NF1. Children with NF1 have a higher likelihood of being hypotonic and of having subtle neurologic abnormalities that affect balance and gait.[33,35,36] Speech problems also may occur, and an association with velopharyngeal insufficiency exists.[37]

The reported incidence of complications in NF1 varies from study to study, mostly because of biased patient selection by age and specialty referral but also because of inconsistent diagnostic criteria and variable use of imaging techniques. Generally, complications are overestimated, because most studies involve patients in hospitals or referral clinics.[38] Approximately one third of patients with NF1 develop serious complications, and approximately one half are mildly affected. However, because of the extreme degree of variability even within a family and the progressive nature of NF1, it is not possible to determine the prognosis after establishing a diagnosis, especially at a young age.

GENETICS

NF1 is inherited in an autosomal dominant fashion. In approximately one half of patients, the condition is caused by a new mutation in that conception. In such instances, neither parent has any clinical features of NF1, and risk for recurrence of NF1 is likely not to exceed 1%. Rare instances of recurrence from phenotypically unaffected parents are attributed to germ-line or somatic mosaicism. However, individuals with NF1 caused by a new mutation are at a 50% risk of transmitting the gene to each of their offspring. The NF1 gene has a high penetrance rate; therefore, an individual who carries the mutation can be expected to have clinical manifestations of the disorder. Some individuals are mosaic for an NF1 mutation and may have localized signs, referred to as "segmental neurofibromatosis." These individuals may be at risk of transmitting the mutant gene to their offspring if the germ line includes cells with the mutation, which results in an increased risk of NF1 in their offspring.

The NF1 gene is located on the long arm of chromosome 17 at band q11.2.[39–41] Neurofibromin, the protein product of the normal gene, acts as a tumor suppressor by downregulating another cell protein, Ras, that enhances cell growth and proliferation.[12,42,43] A wide variety of mutations have been identified within the NF1 gene, which give rise to diminished function of neurofibromin in affected persons. Detection of mutations in the NF1 gene by DNA analysis has proven to be complex because of the gene's large size, presence of pseudogenes, and great variety of possible abnormalities. Molecular technology that is capable of detecting 95% of mutations in NF1 is now available,[44] but it is typically not indicated because a diagnosis of NF1 in 95% of cases can be established on the basis of clinical findings alone by 11 years of age.[28] However, when there is uncertainty regarding a definitive diagnosis, for instance, in the presence of some of the clinical manifestations of NF1, such as only CLSs, but not enough to establish a clinical diagnosis, consideration should be given to seeking genetic consultation and determining whether genetic testing is indicated at that time to expedite a diagnosis. Molecular testing also may represent an option in those instances when a couple in which one person has NF1 is seeking prenatal diagnosis. Although establishing a diagnosis is achievable when a mutation has been detected in an affected partner, determining its possible clinical effects after establishing a diagnosis in utero is not.

CLINICAL MANAGEMENT

The multiorgan occurrence of neurofibromas and their complications often requires care from a variety of medical subspecialists and surgical specialists. The medical home has the opportunity and responsibility to coordinate such care. In addition, patients with more than minimal manifestations of NF1 may benefit from referral to a multidisciplinary neurofibromatosis clinic for primary or specialty care or to a physician with expertise in the care of individuals with NF1. Such clinics and/or physicians are valuable consultation resources for medical homes that care for affected patients.

Longitudinal care for NF1 is aimed at the early detection and symptomatic treatment of complications as they occur. Some of the medical problems, such as hypertension resulting from renal artery stenosis, can be managed successfully if detected early. Enlarging plexiform neurofibromas may be managed surgically, although regrowth may occur. In addition, surgical removal of a plexiform neurofibroma, especially when it compromises an essential organ system, may not be possible because of an inaccessible site or infiltration into surrounding tissue. In most instances, management of most malignancies including leukemia is the same as for children without NF1. On the other hand, outcome of treatment of malignant peripheral nerve sheath tumors is poor. Therefore, early suspicion that there may be malignant degeneration of a plexiform neurofibroma is critical from a prognostic standpoint.

In providing medical supervision to a child with NF1, general clinical evaluation through the medical home should be provided regularly, but the frequency should increase to address disease complications. Therefore, recommendations for ongoing assessment and periodic review throughout life (Table 1), including the following:

1. Evaluate the child for new neurofibromas and progression of lesions. Examine the skin carefully for signs of plexiform neurofibromas that may impinge on or infiltrate underlying structures.
2. Check the child's blood pressure yearly to determine if there is evidence of hypertension, which occurs more frequently with NF1 and could be secondary to renal artery stenosis, aortic stenosis, and pheochromocytoma, the latter being more common in adults. A variety of vascular hypertrophic lesions may be found.
3. Evaluate neurodevelopmental progress of an affected child.
4. Obtain a formal ophthalmologic evaluation yearly.
5. Evaluate the child for skeletal changes. Look for scoliosis, vertebral angulation, and limb abnormalities,

TABLE 1 **Health Supervision Guidelines for Children With Neurofibromatosis**

	Prenatal	Infancy (1 mo to 1 y)					Early Childhood (1 to 5 y)						Late Childhood (5 to 13 y), Annual[a]	Adolescence (13 to 21 y), Annual[a]
		Neonatal	2 mo	4 mo	6 mo	9 mo	12 mo	15 mo	18 mo	24 mo	3 y[a]	4 y[a]		
Diagnosis														
DNA analysis	X[b]													
Phenotype review	X[c]	X												
Genetic counseling	X[c]	X												X[d]
Reproductive options for parents														
Adoption/termination	X													
Future reproductive planning		X					X			X			X[d]	
Anticipatory guidance														
Family support	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Support groups	X	X	X				X						X[d]	X[d]
Long-term planning	X	X					X						X[d]	X[d]
Sexual and reproductive issues													X[d]	X
Medical evaluation and treatment[e]														
Growth		O	O	O	O	O	O	O	O	O	O	O	O	O
Blood pressure		O	O	O	O	O	O	O	O	O	O	O	O	O
Skin examination		O	O	O	O	O	O	O	O	O	O	O	O	O
Bone examination/scoliosis		O	O	O	O	O	O	O	O	O	O	O	O	O
Neurologic examination		O	O	O	O	O	O	O	O	O	O	O	O	O
Vision screening		S/O	S/O	S/O	S/O	S/O	S/O[f]	S	S	S/O[f]	S/O[f]	S/O[f]	S/O[f]	S/O[f]
Hearing screening		S	S	S	S	S	S/O[f]	S	S	S	S	S/O[f]	S/O	S/O
Sexual maturation													O	O
Diagnostic imaging examinations[e]														
Psychosocial evaluation														
Development and behavior		S/O	S/O	S/O	S/O	S/O	S/O	S/O	S/O	S/O	S/O	S/O[f]	S/O	S/O
Preschool program											S	S		
School placement/performance													S/O	S/O
Psychological/social adjustment							S	S	S	S	S	S	S	S
Intrafamily relationships		S			S		S	S	S	S	S	S	S	S

X indicates to be performed; S, subjective, by history; O, objective, by a standard testing method.

[a] Advise semiannual visits, as indicated.

[b] See "Discussion."

[c] Or at the time of diagnosis.

[d] Once in this time period.

[e] As needed for significant abnormalities and/or new signs.

[f] Refer to subspecialist.

particularly tibial dysplasia. Sometimes localized hypertrophy of a leg, arm, or other part of the body results from plexiform neurofibromata. Nonossifying fibromas of the long bones infrequently occur in adolescence or adulthood and have been associated with fracture; although a screening radiograph of the knees in adolescence has been suggested as a routine study, evidence is not sufficient to support routine screening at this time.

6. If any unexplained complications occur or if cutaneous lesions appear to be growing rapidly, refer the patient to the appropriate subspecialist for further evaluation.
7. Refer to the review of NF1 at www.genetests.org to obtain rapid access to updated clinical information on the condition.
8. Recommend available resources for patients with NF1 (eg, neurofibromatosis clinics, support groups, and families of children with NF1). Books, pamphlets, and Web-site addresses can be obtained from the Children's Tumor Foundation (www.ctf.org). The Children's Tumor Foundation can also provide additional information and clinic locations.

THE PRENATAL VISIT

At times, the pediatrician may be asked to counsel a family when one of the parents-to-be is affected and the fetus is at risk or has been diagnosed prenatally to have NF1 by DNA testing. In this situation, the family most likely already has been counseled about the disorder and its inheritance pattern. However, the pediatrician may be called on to review the information and assist the family in the decision-making process. When appropriate, pediatricians who have experience in the care of individuals with NF1 may wish to have a discussion with the family, or those with less experience may seek consultation from a geneticist to provide more in-depth information to:

1. review the results of the prenatal diagnostic study;
2. explain the mechanism for occurrence of the disorder in the fetus and the risk of recurrence;
3. review the clinical manifestations, variability, progressive nature, and prognosis of the disorder;
4. review the various forms of treatment and intervention that are currently available, including their efficacy, complications, and adverse effects;
5. discuss the options available to the family for management and rearing of the child (in cases of early prenatal diagnosis, this may include discussion of available options after in utero diagnosis, including continuation of the pregnancy or its termination, and discussion of appropriate management strategies and options for child rearing after delivery);
6. when appropriate, consider referral to a clinical geneticist for a more in-depth discussion of clinical findings, recurrence risk, future reproductive options, and evaluation of risks of disease for other family members; and
7. inform the family that, in many parts of the country, there are specialty neurofibromatosis clinics that are available for guidance, therapy, and consultation.

HEALTH SUPERVISION FROM BIRTH TO 1 MONTH: NEWBORN INFANTS

Examination

1. Confirm the diagnosis by the presence of cutaneous manifestations. CLSs may be present, and in 10% to 15% of neonates, a plexiform neurofibroma will be recognized. However, the clinician must be aware that a normal examination at this age does not exclude the diagnosis of NF1.
2. All first-degree relatives should be advised to have a physical examination, including a slit-lamp examination to look for Lisch nodules, which are found in >90% of adults with this disorder but are uncommon in children younger than 5 years.
3. Some specialists recommend an initial MRI study to determine if an optic glioma is present when the diagnosis of NF1 is made.[1,18] In addition to being able to identify an optic pathway glioma, if present at this age, areas of increased signal intensity on T2-weighted images, also known as unidentified bright objects (UBOs), which are present in approximately 60% of affected children, also can be detected. These lesions are well circumscribed and nonenhancing, and they are located in the brainstem, cerebellum, basal ganglia, and thalamus. An association between UBOs and learning disabilities or cognitive deficits may exist. The lesions are not space occupying and tend to disappear in adulthood. Although potentially helpful in establishing an early diagnosis when clinical findings are equivocal, because of the lack of specificity and the inability to consistently identify UBOs, the benign nature of most optic gliomas, and the need to sedate the child, neuroimaging of the brain may not be warranted. Therefore, the NIH Consensus Development Conference[13] did not recommend computed tomography or MRI studies for asymptomatic patients with NF1 and generally recommended special studies only when they were clinically indicated. Neuroimaging of the brain, on the other hand, would seem to be indicated for a small percentage of the NF1 population for whom a deletion of the entire NF1 gene and flanking DNA is found.[40,45] Affected individuals have a distinct phenotype, including facial dysmorphism, a large number of neurofibromas, severe cognitive impairment, and, frequently, evidence of structural brain anomalies.

Anticipatory Guidance

1. Review the natural history and genetics of NF1.
2. Advise the parents to report any unusual or new symptoms.

3. Stress the need for regularly scheduled visits, including careful cutaneous, skeletal, and neurologic examinations and evaluation of blood pressure.
4. Emphasize the need for a yearly ophthalmologic evaluation.

HEALTH SUPERVISION FROM 1 MONTH TO 1 YEAR: INFANCY

Examination

1. Compare the infant's growth and development with figures on growth charts.[27,28] As a group, children with NF1 are shorter than average but have a larger head size. Rarely, aqueductal stenosis can cause obstructive hydrocephalus, but in most children with NF1, the basis for macrocephaly is likely to be increased brain volume.
2. Examine the patient for the presence of CLSs. Inform the family that new ones may appear, and preexisting CLSs often increase in size. Reassure the family that CLSs have no functional significance.
3. Check for proptosis, a rapidly increasing head size, and focal neurologic signs.
4. Perform a careful physical examination and look for skeletal abnormalities, especially in the spine and legs. This is particularly important before the child begins to bear weight because of the risk of cortical thinning of the long bones, which increases the likelihood of fracture.
5. Refer the infant for formal ophthalmologic evaluation and to other appropriate specialists and subspecialists, as indicated.
6. Check the infant's neurodevelopmental progress at each visit.

Anticipatory Guidance

1. Review the family's psychological support and intrafamilial relationships.
2. Advise the parents to use sunscreen after the child reaches 6 months of age. Sun exposure deepens pigment in CLSs. Although this is usually of cosmetic significance only, melanoma and basal cell carcinoma have been reported in adults with NF1; however, the risk for developing these malignancies is not known to be increased for patients with NF1.[25]
3. If appropriate, review future pregnancy planning with the affected infant's parents.

HEALTH SUPERVISION FROM 1 TO 5 YEARS: EARLY CHILDHOOD

Examination

1. Examine the child for neurofibromata and the presence of skinfold freckling, which can appear in any intertriginous area. Assure parents that CLSs and freckling only have cosmetic significance.
2. Consider taking photographs to document lesion size for future reference.
3. Evaluate the child's vision and recommend that the child undergo an ophthalmologic examination annually throughout childhood.
4. If there are visual changes, persistent headaches, seizures, marked increase in head size, or a plexiform neurofibroma of the head, obtain a brain MRI.
5. Assess the child's speech and motor skills for deficits that require further assessment. Hypernasal speech attributable to velopharyngeal insufficiency can be present, and there may be delayed expressive language development.
6. Monitor blood pressure yearly.

Anticipatory Guidance

1. Review the child's preschool program.
2. Obtain appropriate developmental evaluations of the child for assessment of learning, speech/language, and motor abilities if developmental concerns are raised. The child may benefit from preschool services, speech/language and/or motor therapy, and special education programming to address delays. With NF1, the risk of hearing impairments is not increased appreciably.
3. Discuss indications for surgery, as appropriate. If there is a change in the size of superficial neurofibromata or evidence of a space-occupying internal lesion, refer the child to a neurofibromatosis clinic or other appropriate subspecialists.
4. Pruritus can occur in young children and may be found to be associated with cutaneous neurofibromata. However, antipruritic medications are not helpful in relieving symptoms.

HEALTH SUPERVISION FROM 5 TO 13 YEARS: LATE CHILDHOOD

Examination

1. Examine the child for skin tumors causing disfigurement and obtain a consultation with a specialist if surgery is desired to improve appearance or function. Severe cosmetic disfigurement is seen more often in adults than in children.
2. Evaluate the child for signs of puberty. Premature onset of sexual maturation or delayed puberty may occur. If sexual precocity is present, evaluate the child for the presence of an optic glioma or hypothalamic lesion.[18,21]
3. Check for signs of learning disabilities and attention-deficit/hyperactivity disorder.
4. Review the child's social adjustment.
5. Monitor the child's ophthalmologic status yearly under 8 years of age, followed by complete eye examination every 2 years.[23]

6. Monitor blood pressure yearly.

Anticipatory Guidance

1. Review the child's development and appropriateness of school placement.
2. Refer the child to a clinical psychologist or child psychiatrist for further evaluation and therapy should problems with self-esteem related to his or her physical findings or developmental problems exist.
3. Review the effects of puberty on the disease.
4. Discuss the possibility of the growth of neurofibromata during adolescence and pregnancy.
5. Counsel the parents about how and when to discuss the diagnosis with their child.

HEALTH SUPERVISION FROM 13 TO 21 YEARS OR OLDER: ADOLESCENCE TO EARLY ADULTHOOD

Examination

1. Examine the adolescent for signs of abnormal pubertal development.
2. Perform a thorough skin examination to evaluate for and determine the status of plexiform neurofibromata and a complete neurologic examination to check for findings that might suggest the presence of deep plexiform neurofibromata.
3. Obtain a surgical consultation with a specialist if signs of pressure on deep structures are found.
4. Continue monitoring blood pressure yearly.
5. Continue opthalmological examination every 2 years until 18 years of age.[23]

Anticipatory Guidance

1. Discuss the genetics of NF1 or refer the adolescent for genetic counseling.
2. Discuss sexuality.
3. Discuss birth control, including the risks and benefits of birth control pills, and reproductive options.
4. Discuss the effect of pregnancy on NF1, if appropriate. Women with NF1 may have complications during pregnancy because of enlargement of the neurofibromata[46,47] and, not uncommonly, eruption of more dermal neurofibromas.
5. Review prenatal diagnosis by using available molecular DNA studies and discuss its applicability to the patient with NF1 or refer the patient to a geneticist for further discussion of diagnostic options.
6. Facilitate transition to adult medical care.

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RESOURCES

For further information please contact the Children's Tumor Foundation, 95 Pine St, 16th Floor, New York, NY 10005; telephone: 800-323-7938 or 212-344-6633; Web sites: www.ctf.org or www.genetests.com.

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Health Supervision for Children With Prader-Willi Syndrome

Shawn E. McCandless, MD, and THE COMMITTEE ON GENETICS

KEY WORDS
Prader-Willi syndrome, Prader-Labhart-Willi syndrome, uniparental disomy, genetic testing

ABBREVIATIONS
PWS—Prader-Willi syndrome
UPD—uniparental disomy
GH—growth hormone
IGF—insulin-like growth factor

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abstract

FREE

This set of guidelines was designed to assist the pediatrician in caring for children with Prader-Willi syndrome diagnosed by clinical features and confirmed by molecular testing. Prader-Willi syndrome provides an excellent example of how early diagnosis and management can improve the long-term outcome for some genetic disorders. *Pediatrics* 2011;127:195–204

INTRODUCTION

Prader-Willi syndrome (PWS) (also Prader-Labhart-Willi syndrome) is a recognizable pattern of physical findings with significant cognitive, neurologic, endocrine, and behavioral abnormalities caused by lack of expression of genes from an imprinted region of the paternally inherited chromosome 15q11-q13, near the centromere. Originally described in 1958,[1] PWS was the first recognized disorder related to genomic imprinting in humans[2] and provides an excellent example of how early diagnosis and meticulous management can markedly improve the long-term outcome for people with some genetic disorders. PWS affects both genders equally and occurs in people from all geographic regions; its estimated incidence is 1 in 15 000 to 1 in 25 000 live births.[3,4] Affected infants uniformly have significant hypotonia, early feeding problems, and difficulty with weight gain. Later, a second phase of the disorder ensues with hyperphagia (excessive appetite for food), which leads to obesity and characteristic behavior problems. Without adequate weight control and management of eating behaviors, massive obesity and associated complications of diabetes, obstructive sleep apnea, and right-sided heart failure occur; death typically occurs in the fourth decade of life. With careful weight control, people with PWS can remain healthy well into older adult life, and some people are known to live into their seventh decade.

The findings of PWS are listed in Table 1. Clinical diagnostic criteria have been developed and validated[5] (Table 2), but now that reliable molecular testing is readily available, these clinical criteria should be considered guidelines to help define people for whom further diagnostic testing is indicated.[6] In general, PWS should be considered in any infant with significant hypotonia, particularly in the setting of poor feeding, reduced spontaneous arousal for feeding, and hypogonadism (undescended testes, small phallus, or small clitoris). In older children, the diagnosis should be considered when there is impaired satiety for food, especially with rapid weight gain. Likewise, poor linear growth, especially in the presence of excessive caloric intake, should also raise suspicion for PWS. Hypogonadism, hypotonia, developmental

TABLE 1 Clinical Findings in PWS

Fetal
Breech position
Reduced fetal activity
Polyhydramnios
Growth
Short stature
Failure to thrive in infancy
Central obesity
Head and neck
Dolichocephaly
Narrow bitemporal diameter
Almond-shaped eyes
Strabismus
Up-slanting palpebral fissures
Myopia
Hyperopia
Thin upper lip
Small-appearing mouth
Down-turned corners of mouth
Thick, viscous (reduced) saliva
Enamel hypoplasia
Early dental caries
Dental crowding and malocclusion
Ocular
Strabismus
Nystagmus
Cataracts (rare)
Retinal hypopigmentation
Foveal hypoplasia
Hyperopia
Myopia
Respiratory
Hypoventilation
Obstructive sleep apnea
Central sleep apnea
Gastrointestinal
Feeding problems in infancy
Gastroesophageal reflux
Decreased vomiting
Genitourinary
Small penis
Scrotal hypoplasia
Cryptorchidism
Hypoplastic labia minora
Hypoplastic clitoris
Skeletal
Osteoporosis
Osteopenia
Scoliosis
Kyphosis
Small hands and feet
Narrow hands with straight ulnar border
Clinodactyly
Skin, nails, hair
Hypopigmentation
Blonde to light-brown hair
Frontal hair upsweep
Neurologic
Severe neonatal hypotonia that improves with age
Poor neonatal suck and swallow reflexes
Poor gross motor coordination
Poor fine motor coordination
Mild-to-moderate mental retardation
Learning disabilities
Increased risk of seizures
Global developmental delay
Speech-articulation problems
Hyperphagia

TABLE 1 Continued

Sleep
Snoring/obstructive sleep apnea
Central apnea during sleep
Excessive daytime sleepiness
Early-morning waking
Night-awakening for food-seeking
Voice
Hypernasal speech
Weak or squeaky cry in infancy
Endocrine
Hyperinsulinemia
GH deficiency
Hypogonadotropic hypogonadism
Diabetes mellitus (type 2)
Behavior/mental health
Skin picking
Rectal picking
Food related behavioral problems
Temper tantrums
Difficulty with transitions
Stubbornness
Obsessive behaviors
Perseverant speech
Obsessive-compulsive disorder
Psychosis
Elopement
Miscellaneous
Temperature instability
High pain threshold
Unusual skill with jigsaw puzzles

delays, speech-articulation defects, and characteristic physical appearance should all raise the index of suspicion. Significant neonatal hypotonia is present in essentially all children for whom molecular testing eventually confirms the diagnosis of PWS[7]; therefore, this history should be actively sought during evaluation of older children.

These guidelines are intended to be suggestions for health care providers when assisting in the provision of a comprehensive medical home for children and adults with PWS. They are based on a thorough review of the pertinent medical literature and incorporate experimental data and the experience of clinicians with expertise in caring for people with PWS. As with all chronic medical conditions, establishing a medical home is essential to the smooth and effective provision of care to the individual person and support to his or her family, which is best achieved when the primary care provider and consultants communicate effectively and clearly delineate their respective roles in the care of the person.

GENETICS AND GENOMICS OF PWS

PWS is associated with lack of expression of several genes on the paternally inherited chromosome 15. This region contains genes that are normally "imprinted," which means that they are differentially expressed (used to make RNA and proteins) depending on whether the chromosome was inherited from the father or the mother. On the maternally inherited chromosome 15, these genes are transcriptionally silenced by hypermethylation of their promoter regions. Therefore, only the paternally inherited chromosome produces the gene products. These changes are referred to as "epigenetic," because they do not involve a

TABLE 2 Suggested Criteria for Prompting Molecular Testing for PWS

Age at Assessment	Features Sufficient to Prompt DNA Testing
Birth to 2 y	Significant hypotonia with poor suck and difficulty with weight gain
2–6 y	Congenital hypotonia with history of poor suck; global developmental delay
6–12 y	History of congenital hypotonia with poor suck (hypotonia often persists), global developmental delay, and excessive eating (hyperphagia; obsession with food) with central obesity if uncontrolled
13 y through adulthood	Cognitive impairment, usually mild mental retardation, excessive eating (hyperphagia; obsession with food) with central obesity if uncontrolled, and hypothalamic hypogonadism and/or typical behavior problems (including temper tantrums and obsessive-compulsive features)

Adapted from Gunay-Aygun M, Schwartz S, Heeger S, O'Riordan MA, Cassidy SB. *Pediatrics*. 2001;108(5). Available at: www.pediatrics.org/cgi/content/full/108/5/e92.

change in the sequence of the DNA but, instead, involve a change to the genomic structure that affects regulation of expression.

The part of chromosome 15 involved in PWS contains several segments of duplicated DNA that predispose to rearrangements, either deletion or duplication, of the PWS region. Absence of the paternally inherited contribution of the PWS region of chromosome 15 leads to lack of the gene products and causes the findings of PWS. In contrast, several other genes in the region are silenced by methylation on the paternally inherited allele. Absence of the maternally inherited contribution of this region causes Angelman syndrome, a completely different disorder caused by lack of expression of a single gene in the region (*UBE3A*).

A short sequence of DNA in the region called the "imprinting center" seems to control switching and maintenance of the imprinting pattern, which is critical, because half of a male's copies of chromosome 15 carry the silenced genes inherited from his mother. When he, in turn, passes copies of his mother's chromosome 15 to his own offspring, those genes must be reactivated, which "switches" the imprint.

It becomes clear, then, that there are multiple mechanisms by which a person may end up with no functional (transcriptionally active) copies of the genes in this critically important region of chromosome 15 and, thus, have PWS.

1. The most common situation (~70% of cases) is that the paternally inherited chromosome 15 contains a microdeletion of 3 to 4 megabases of genetic material spanning the PWS region.
2. In approximately 20% of cases, the affected infant has maternal uniparental disomy (UPD), which means that the child inherited both copies of chromosome 15 from the mother and no copy from the father.
3. Imprinting errors, which occur in 5% or fewer cases, involve a defect of the process of switching the imprint when the father passes on a copy of the chromosome 15 that he inherited from his mother.
4. Finally, PWS has been described as a result of a balanced translocation involving chromosome 15 that moves the genes in the region away from the imprinting center.

Several recent reports suggested that the essential PWS phenotype may be caused by loss of the imprinted HBII-85 cluster of small nucleolar RNAs (snoRNAs), which, if confirmed, will be one of the first developmental disorders shown to be caused by loss of microRNA.[8,9]

The PWS region of chromosome 15 is flanked by segments of duplicated DNA, which predisposes to deletion, or duplication, during recombination in meiosis. This seems to be the reason for the high frequency of the typical deletion in PWS and in some other recurrent microdeletions. It is important to recognize that the normal chromosome structure in the region plays a significant role in the development of the genetic defect; thus, PWS has been described as a "genomic disorder" to distinguish it from other genetic disorders that are specifically caused by an alteration in the sequence of the DNA.[10]

UPD is thought to result most often from meiotic nondisjunction that leads to trisomy for chromosome 15 and, thus, is associated with increased maternal age. Trisomy 15 is the most common trisomy at the time of conception but can only survive if there is a second mitotic division error after fertilization that eliminates 1 of the 3 chromosomes 15. If the paternally contributed chromosome is lost, the embryo will revert to having the normal 2 copies of chromosome 15, both of which originate from the mother. Alternatively, the sperm could have no copy of chromosome 15 as a result of a paternal meiotic error, and the resulting conceptus would have only 1 chromosome 15. Such an embryo would also be spontaneously aborted unless a second, mitotic error occurred after fertilization that duplicates the maternally contributed chromosome 15. In either case, an infant born from such a pregnancy would be missing the paternally contributed chromosome 15 and, therefore, would only have inactive, maternally imprinted copies of the genes in the PWS region.

The third mechanism, an "imprinting error," leads to a situation in which the imprinted (silenced) genes that the father inherited from his mother cannot be reactivated. The infant inherits 1 copy of chromosome 15 from each parent, but the PWS region is fully methylated on both copies of chromosome 15 and, thus, is silenced in both copies. This mechanism, although rare, is important to identify, because the inability to switch the imprint can be an inherited trait, which means that a man with an inherited imprinting defect has up to a 50% recurrence risk with each pregnancy to sire another child with PWS. The rare case of PWS attributable to a balanced translocation also may have an increased recurrence risk if the father carries the same translocation on the chromosome 15 he inherited from his mother. Neither deletion nor UPD is known to be associated with increased recurrence risk.

Although subtle differences have been shown between groups of people with deletions compared with UPD,[11–16] for the most part, there are no major differences in phenotype among the various causes. The exception is the finding of hypopigmentation, which is most notable in people with PWS who have a deletion of the *OCA2* gene (a

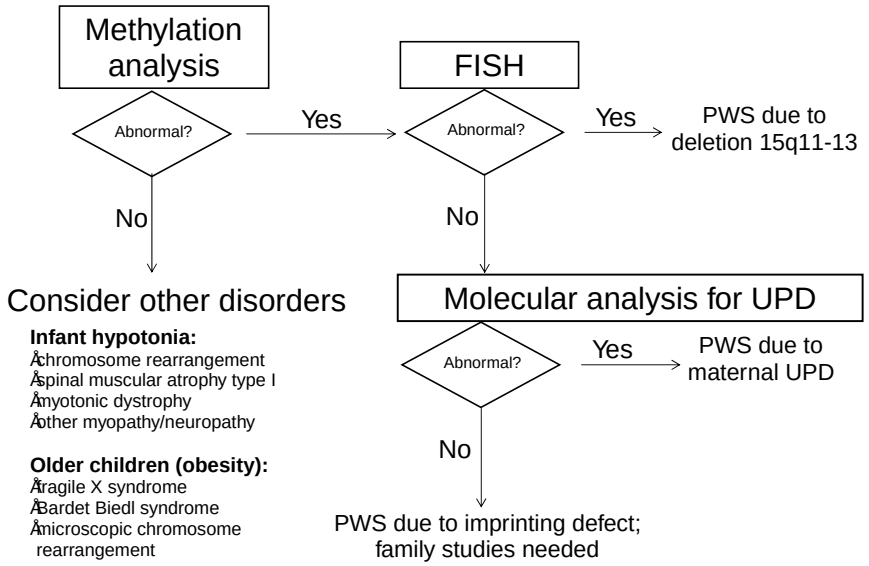

FIGURE 1
Flowchart of recommended molecular testing strategy for PWS.

nonimprinted gene in the PWS region of chromosome 15 associated with autosomal recessive oculocutaneous albinism type II).[17,18] Recently, some authors suggested that there may be subtle differences in neurocognitive development in children with deletions depending on the location of the proximal break point.[19] Others have not observed such a difference[13]; therefore, the clinical utility of defining the break points is not clear at this time.

DIAGNOSTIC TESTING

Diagnostic testing for PWS, as outlined in Fig 1, should begin with methylation analysis to confirm the absence of paternally imprinted genes in the PWS region of chromosome 15. When only a maternal methylation pattern is seen, PWS is confirmed, but additional testing is needed to identify the specific cause, which allows for appropriate counseling regarding recurrence risk. The recurrence risk for spontaneous deletions or UPD is low (<1%), whereas the recurrence risk of imprinting mutations can be as high as 50%. If the methylation analysis is consistent with PWS and the karyotype and fluorescence in situ hybridization (FISH) reveal no evidence of deletion or balanced rearrangement, the next step is to obtain blood from the parents and the child to evaluate for UPD. If biparental inheritance is discovered in the face of abnormal methylation and normal FISH results, then, by process of elimination, the cause is assumed to be an imprinting defect. The possible role of testing for defects of the HBII-85 small nucleolar RNA cluster remains to be elucidated.

SPECIAL CONSIDERATIONS FOR THE INFANT AND CHILD IN WHOM PWS IS DIAGNOSED

Nutrition

Maintenance of adequate and appropriate nutrition is central to the care of people with PWS at every age. Infants may require support of feeding for several months. Caloric needs may be, but are not always, somewhat reduced in infants with PWS, and infants with PWS typically do not spontaneously demand feedings. Therefore, the infant's diet must be adjusted as needed to maintain appropriate weight gain as determined by frequent weight checks. Increased caloric density of feedings is often helpful. Later, after hyperphagia begins, the diet must be quite calorically restricted, often to as little as 60% of the calories that similarly sized children without PWS might require for adequate growth. This diet requires careful attention to the balance of essential nutrients, which is often best achieved by referral and regular follow-up with a dietitian who is knowledgeable about PWS.

Feeding Tubes (Nasogastric or Gastrostomy Tubes)

Infants with PWS have poor feeding because of weak suck, easy fatigability, and low muscle tone. The need for assisted feeding is nearly universal in the first 4 to 6 months; use of nursing systems with 1-way valves and manual assistance of sucking, originally designed for infants with cleft palate (eg, Haberman nipple, Pigeon feeder), can greatly reduce reliance on feeding tubes. Nasogastric tubes, when needed, are generally well tolerated and rarely required for more than 3 to 6 months. The use of a gastrostomy tube (generally with placement of a button-style device) can be avoided in most cases, but if, after considering the risks and benefits of both approaches, a decision to use a gastrostomy tube is made, the device should be promptly removed when no longer needed. Poor feeding is a transient problem in PWS, and the increased abdominal fat mass with reduced muscle that characterizes this disorder ensures a cosmetically disfiguring scar at the site of the gastrostomy tube (families sometimes refer to this as the "second belly-button"). These 2 factors, relatively specific to PWS, may significantly alter the risk/benefit analysis regarding the approach to tube feedings compared with the decision-making process for children with disabilities attributable to other causes.

Endocrine Considerations and Recombinant Human Growth Hormone

Generalized hypothalamic insufficiency is characteristic of PWS and manifests as dysregulation of the hypothalamic-pituitary axis (including growth hormone [GH], thyroid function, and possibly regulation of the adrenal cortex), appetite, thermoregulation, and respiratory control. Recent work demonstrated the possibility that centrally mediated adrenal insufficiency may be an underrecognized contributor to premature deaths among people with PWS.[20,21] It is recommended that early-morning serum adrenocorticotropic hormone and cortisol concentrations be evaluated when the child is well and repeated during any severe illness. Consideration should be given to prophylactic therapy with hydrocortisone during rare episodes of critical illness in children with PWS, pending measurement of adrenocorticotropic hormone and serum cortisol. Discussion with a pediatric endocrinologist is helpful in determining whether provocative testing is indicated in early childhood.

GH insufficiency is considered to be universal in PWS, so provocative diagnostic testing is not required in the face of reduced growth velocity. In the first year of life, reduced growth velocity may not be readily identified, but both controlled clinical trials[22,23] and clinical experience have demonstrated that there is often significant response to treatment with GH, primarily in improved lean mass, improved motor development, and normalization of body habitus. Decisions about use of GH therapy and management are best made in consultation with a pediatric endocrinologist. Although GH treatment has been approved by the US Food and Drug Administration for children with PWS older than 2 years with documented growth failure, clinical experience has suggested that treatment can begin at as early as 2 to 3 months of age. It is important that parents be thoroughly informed about the potential benefits and the potential for undesired effects. Specifically, there have been several deaths in children as young as 3 years with PWS within 6 months of initiating GH therapy. The role of GH in those deaths, if any, is not known. Adenotonsillar hypertrophy and obstructive apnea may occur during GH therapy; therefore, current recommendations for management include polysomnography (sleep study) before and 6 to 10 weeks after beginning GH treatment, regardless of age. Polysomnography results are frequently abnormal in people with PWS, and both central and obstructive hypopnea are common.[24] Evidence of obstructive sleep apnea should be managed according to accepted standards of care[25] (this American Academy of Pediatrics clinical practice guideline was published in 2002 and has not been updated) and, specifically, should lead to referral to an otolaryngologist for evaluation of airway, increased effort to reduce weight, and consideration of delaying (or stopping) GH treatment until polysomnography results improve. It has also been suggested that GH could be associated with unexpected death by increasing resting energy expenditure (through increased muscle bulk) in children with underlying abnormalities of central respiratory drive attributable to PWS, although there is a suggestion in the literature that treatment with GH may be associated with modest improvement in the central respiratory drive.[26]

There is mounting evidence from controlled clinical trials that GH therapy in children improves linear growth, lean mass and lean-to-fat ratio,[27] and respiratory drive,[26,28] and there has been suggestion of beneficial effects on bone density[27,29] and possible stabilization of behavior decline.[30] Studies are in progress to evaluate the use of GH in adults with PWS.[31] However, there is nothing to suggest that endogenous GH insufficiency improves in later life; therefore, it is reasonable to consider continuing therapy into adulthood. Pretreatment laboratory evaluation to document sequelae of GH insufficiency, to exclude other causes of slow linear growth in people with PWS, and to define baseline parameters related to potential complications of therapy often includes:

- polysomnography;
- measurement of plasma insulin-like growth factor 1 (IGF1), IGF-binding protein 3 (IGFBP3), thyroxine, and thyrotropin levels, a complete blood count, and a basic metabolic profile (with calcium); and
- left hand and wrist radiography for bone age (in older children).

Follow-up should include:

- repeat polysomnography 6 to 10 weeks after initiation of therapy (consider repeating in 1 year and any time at which there are new or worsening symptoms);
- monitoring of IGF1 at least twice yearly, dosing GH to keep IGF1 in physiologic range; and
- monitoring of head circumference at each visit, because GH treatment can cause abnormal growth of the head, especially if the fontanelles are open when GH is started.

Behavioral Food Controls

After the onset of hyperphagia, children with PWS may develop a wide range of food-related behaviors, including actively seeking food, eating nonfood items (eg, animal chow, spoiled food, decorative items that look like food, searching in garbage cans, etc), stealing money to buy food, and even running away from home to

search for food in a wider area. Control of these behaviors is complex but centers on strategies to limit access to food (eg, locks on cabinets and refrigerators), limit exposures that make the child think about food (eg, birthday treats sitting on the teacher's desk during the school day), and instill confidence that the next meal will be served on time by scrupulously maintaining mealtime routines. Relatives and social contacts must be educated to realize that "sneaking" food to the child with PWS is not an appropriate method of demonstrating affection, and, in fact, undermines the child's nutritional regimen and sense of well-being.

Hypogonadism

Both males and females are affected, although the primary external manifestations in females (clitoral and labia minora hypoplasia) may not be obvious with cursory evaluation. A therapeutic trial of human chorionic gonadotropin (hCG) is indicated for treatment of undescended testes before surgery, because avoidance of general anesthesia is desirable for infants with low muscle tone and potential for underlying respiratory compromise. Added benefits of a course of hCG may include increased scrotal size and partial normalization of phallus length, thereby improving surgical outcomes for undescended testes and facilitating later standing micturition.

Behavior Management

As the child with PWS ages, there is a progression of behavioral issues, many of which can be anticipated, identified early, and managed prospectively. Early childhood is often characterized by rigidity, particularly related to daily routines and long-term persistence of temper tantrums and oppositional behaviors typical of the normally developing 2-year-old. Later, perseverant speech and compulsive behaviors, particularly skin-picking, become prominent. In later childhood and the early adolescent years, food-seeking behaviors may increase and are often associated with lying, and occasionally stealing, to obtain food. Some teenagers with PWS have a disturbing tendency to sneak off to search for food, which is potentially quite dangerous and difficult to manage. Typical of the adolescent years, the teenager with PWS is often overly confident of his or her ability to handle risks and dangerous situations. It is important to recognize that teenagers with PWS deal with many of the same neurodevelopmental and hormonal issues that all adolescents encounter, and, similar to their typically developing peers, many of their behavioral issues seem to stabilize, although not disappear entirely, as they reach adulthood.

Management of the many complex behavioral issues is best accomplished through an active partnership of the parents, the primary care provider, and a developmental/behavioral specialist (pediatrician or psychologist). Behavioral management that focuses on rewarding desired behaviors and ignoring, when possible, undesirable behaviors seems to be most effective. Early recognition of developing behavior problems is critical for maximizing the effectiveness of such an approach. Parents should be counseled that offering food as a reward or withholding food as a punishment is almost always counterproductive and should be avoided. Positive reinforcers are generally not difficult to identify, and reward systems that use small, short-term goals that progress to larger goals are quite effective.

Finally, young adults with PWS seem to be prone to a variety of compulsive behaviors including smoking cigarettes, and some of them develop frank obsessive-compulsive disorder. Likewise, a significant minority of young adults with PWS develop depression, anxiety, and, in some cases, true psychosis. Parents should be counseled to identify early indicators of these processes to facilitate appropriate medical intervention.

HEALTH SUPERVISION FROM BIRTH TO 1 MONTH: NEWBORN INFANTS

Evaluation

- Confirm the diagnosis of PWS (Fig 1) and review the implications of the molecular testing results with the parents.
- Review history for:
  - growth and development;
  - feeding problems; and
  - symptoms of obstructive apnea.
- Physical examination should include evaluation of:
  - hypotonia, and
  - hypogonadism.

Anticipatory Guidance

- Review the phenotype, discuss the specific findings with both parents whenever possible, and talk about potential clinical manifestations associated with the syndrome; these issues may have to be reviewed again at a subsequent meeting.
- Point out both early and late feeding issues and the dichotomous nature of feeding problems (ie, too little as a neonate, too much as an older child), and, as appropriate, discuss use of nasogastric feedings with increased caloric-density formula to minimize volume and use of special nipples/feeders (eg, Pigeon feeder, Haberman nipple, other nursers designed to reduce work of sucking). Special attention should be paid to:
  - avoidance of prolonged oral feeding time (usually not >20 minutes per feeding);
  - transition from tube feeding;

  - maintenance of adequate caloric intake; and
  - development of appropriate eating habits; discuss the importance of normal fat and calorie intake for brain development (some parents may start restricting too early).
- Refer infants to early-intervention services in the community.
- Discuss the importance of stimulating the infant, because he or she is likely to be undemanding.
- Inform the family of the availability of support and advice from the parents of other children with PWS.
- Supply contact information for PWS support groups (see "Resources for Parents").
- Point out the strengths of the child and positive family experiences.
- Discuss individual resources for support, such as family, clergy, and friends.
- Talk about how and what to tell other family members and friends; review methods of coping with long-term disabilities.
- Review the recurrence risk in subsequent pregnancies and the availability of prenatal diagnosis and genetic counseling.
- Give overview of the long-term management plan.

HEALTH SUPERVISION FROM 1 MONTH TO 1 YEAR: INFANCY

Evaluation

- Review and note clinical features and confirm diagnosis, if not done previously.
- Review routine health maintenance.
- Plot growth by using standard pediatric growth charts, and pay special attention to weight-for-length measurements.
- Monitor time/work of feeding and caloric density of foods to maintain appropriate growth.
- Perform developmental evaluation, and refer to early-intervention services (if not already done).
- Evaluate boys for undescended testes (or cryptorchidism) and inguinal hernia; consider trial of human chorionic gonadotropin injections (may be performed in conjunction with pediatric endocrinologist); refer to pediatric urologist or a urologist who has special expertise and experience with infants with disabilities if the infant's testes are abnormal.
- Check the infant's vision at each visit by using developmentally appropriate subjective and objective criteria; if evidence of strabismus or other concern arises, refer the infant to a pediatric ophthalmologist or an ophthalmologist who has special expertise and experience with infants with disabilities.
- Administer vaccines recommended for all children unless there are specific contraindications.
- Assess the emotional status of parents and intrafamily relationships; educate and support siblings and discuss sibling adjustments.

Anticipatory Guidance

- Review feeding issues (see above) and the infant's growth and development relative to other children with PWS.
- Review GH deficiency and review benefits and potential risks of GH therapy; consider referral to pediatric endocrinology specialist.
- Discuss:
  - need for careful dietary management later in childhood;
  - probability of mild-to-moderate cognitive impairment;
  - benefits of early behavioral monitoring and establishment of routines; and
  - importance of limit-setting and enforcement.
- At 6 to 12 months of age, review the psychological support and intrafamily relationships, including long-term planning, financial planning, and guardianship; reinforce need for parents to work in partnership, and discuss early relationship-counseling for parents if problems arise.
- Review early-intervention services relative to the strengths and needs of the infant and family.
- Review the family's understanding of the risk of recurrence of PWS and the availability of prenatal diagnosis.
- Discuss increased risk of seizures during childhood (5%–10% of those with PWS), which may be associated with fever and are generally responsive to monotherapy.

HEALTH SUPERVISION FROM 1 TO 5 YEARS: EARLY CHILDHOOD

Evaluation

- Obtain a history and perform a physical examination with attention to growth and developmental status. PWS-specific growth curves should only be used for children who are not treated with GH; regular curves should be used for children who are treated with GH.
- Feeding issues: monitor food intake and behaviors, and consider referral to dietitian who has experience with PWS; calorie needs must be based on growth rate and are usually less than those for similarly sized children without PWS.
- Annual hearing and vision screening evaluation before 3 years of age; refer the child to a pediatric ophthalmologist or ophthalmologist

who has special expertise and experience with children with disabilities for a thorough evaluation for ocular findings during the second or third year of life or earlier if there is evidence of cataracts, nystagmus, or strabismus.

- Evaluate annually for scoliosis, and regularly assess muscle tone; refer to pediatric orthopedist for management of scoliosis as indicated.
- Discuss reduced salivation and increased caries risk by 1 year of age; refer to a pediatric dentist or a general dentist who has special training to manage children with special needs; consider need for more-frequent dental cleanings (every 3–4 vs every 6 months) because of the increased caries risk.
- Ask about symptoms related to obstructive sleep apnea, including snoring, restless sleep, and excessive daytime sleepiness; refer to a sleep or pulmonary specialist as indicated.

Anticipatory Guidance

- Review early intervention, including physical therapy, occupational therapy, and speech therapy, in the preschool program and discuss future school placement and performance.
- Assess the child's behavior, discuss behavioral management, and ask specifically about common behaviors seen in those with PWS (eg, skin-picking, temper tantrums, food-seeking, etc), which may begin during this period.
- Discuss sibling adjustments, socialization, and recreational skills.
- Encourage families to establish optimal dietary and physical exercise patterns to prevent obesity; schedule annual (or more often) meetings with dietitian to review caloric intake and suggest ways to provide less calorically dense foods.
- Discuss need for all family members, child care providers, and school staff members to learn about the disorder, the need for strict food management, and development of routines.
- Discuss future pregnancy planning, risk of recurrence of PWS, and prenatal diagnosis; remind parents of positive aspects for typically functioning children of having a sibling with special needs.

HEALTH SUPERVISION FROM 5 TO 13 YEARS: LATE CHILDHOOD

Evaluation

- Obtain a history, and perform a physical examination with attention to growth and developmental status; evaluate for scoliosis.
- Specifically evaluate for behavior issues that may arise in this age group, including binge-eating, running away, and worsening of skin-picking.
- Perform vision screening annually with attention to recurrence of strabismus.
- Perform thyroid-screening tests every 2 to 3 years or if symptomatic.
- Look for signs of premature adrenarche (which often occurs without progression of other aspects of precocious puberty; thus, reassurance is often the only intervention needed).
- Discuss management of skin-picking (primarily behavioral; medications, including topiramate, are used only in the most severe cases).

Anticipatory Guidance

- Review the child's development and appropriateness of school placement and developmental intervention.
- Continue to stress the need for dietary management and daily exercise to avoid obesity.
- Discuss socialization, family status, and relationships, including financial arrangements and guardianship; begin discussion of adult living arrangements; advise parents to consider joining waiting list for placement in a group home specifically organized for people with PWS and recognize that placement may take several years (or more).
- Discuss the development of age-appropriate social and self-help skills and the development of a sense of responsibility.
- Discuss psychosexual development, physical and sexual development, menstrual hygiene and management, fertility, and contraception; explain that people with PWS often have strong feelings of desire for an infant.
- Discuss symptoms related to obstructive sleep apnea, including snoring and restless sleep, and evaluate for signs of excessive daytime sleepiness; refer to a sleep or pulmonary specialist as indicated.
- Discuss increased pain tolerance common in people with PWS, particularly with regard to evaluating for illness or injury; special attention should be given to risk of intestinal necrosis after binge-eating, because the high pain tolerance can mask symptoms and delay treatment, which can lead to death; people with PWS rarely vomit, so parents should be aware that vomiting after binge-eating can be an ominous sign.

HEALTH SUPERVISION FROM 13 TO 21 YEARS OR OLDER: ADOLESCENCE TO EARLY ADULTHOOD

Evaluation

- Perform physical examination with particular emphasis on evidence of:
  - heart failure;
  - peripheral edema;

  - skin-picking (perianal areas and intertriginous folds should be examined); and
  - scoliosis.
- Evaluate diet, caloric intake, and exercise program, and stress obesity prevention; initiate weight-loss strategy if needed.
- Vision screening should be performed annually.
- Look for early signs of developing psychosis or increasing obsessive-compulsive behaviors seen in a minority of patients (risk is apparently higher in cases attributable to UPD than deletion, but may occur with either of them).
- Evaluate pubertal status and consider referral to pediatric endocrinology for discussion about pros and cons of sex hormone therapy.

Anticipatory Guidance

- Discuss skin care, especially in the presence of truncal obesity.
- Discuss issues related to transition into adulthood.
- Discuss possible compulsive behaviors, including use of tobacco.
- Discuss appropriateness of school placement, and emphasize adequate vocational training within the school curriculum while keeping in mind the special issues related to the need to scrupulously avoid exposure to opportunities to obtain food.
- Provide information on how to recognize the signs of psychosis.
- Discuss the need for gynecologic care for pubescent girls. Talk about the risk of Angelman syndrome (attributable to deletion of maternally inherited chromosome 15q11-13) with the patient and her family if she were to become pregnant; review the fact that there have been 2 case reports in which a woman has reproduced. Men with PWS are assumed to be infertile, although the possibility of fertility should always be considered.
- Discuss sexuality and socialization, the need for and degree of supervision and/or the need for contraception.
- Explain to the patient and her family the risk of genetic abnormalities if she were to become pregnant.
- Discuss group homes and independent-living opportunities specifically for people with PWS, workshop settings, and other community-supported employment (group homes specifically designed for people with PWS are desirable, but they often have long waiting lists, so applying during the adolescent years is helpful in securing a spot for the future).
- Discuss intrafamily relationships, financial planning, and guardianship.
- Facilitate transfer to adult medical care.

TRANSITION TO ADULT CARE

- Identify health care providers in the community who are willing to learn about the special situations of people with PWS; ideally, use providers with training or experience in the care of people with special needs.
- Regular evaluation is needed for:
  - weight control (maintenance or loss);
  - diabetes;
  - hypertension;
  - sleep apnea;
  - heart failure;
  - peripheral edema; and
  - behavior management, including the use of medications such as selective serotonin-reuptake inhibitors.
- Some providers may continue to care for the person with PWS through adult life (eg, the medical geneticist); when new providers are needed, the transferring physician should clearly communicate the person's needs, and care should overlap until all providers, as well as patients and their family, are comfortable with the care needed.

RESOURCES FOR PARENTS

Prader-Willi Syndrome Association, 8588 Potter Park Dr, Suite 500, Sarasota, FL 34238; telephone: 800-926-4797 or 941-312-0400; fax: 941-312-0142; Web: www.pwsausa.org

Foundation for Prader-Willi Research Canada (formerly Canadian Prader-Willi Syndrome Organization), 19-13085 Yonge St, Suite 370, Richmond Hill, Ontario, Canada L4E 0K2; telephone: 866-99-FPWRC (866-993-7972); Web: www.onesmallstep.ca

Foundation for Prader-Willi Research, 104 Hume Ave, Alexandria, VA 22301; telephone: 703-683-7500; fax: 703-836-0959; Web: www.fpwr.org

International Prader-Willi Syndrome Organisation, Web: www.ipwso.org

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AMERICAN ACADEMY OF PEDIATRICS

Section on Hematology/Oncology

Committee on Genetics

Health Supervision for Children With Sickle Cell Disease

ABSTRACT. Sickle cell disease (SCD) is a group of complex genetic disorders with multisystem manifestations. This statement provides pediatricians in primary care and subspecialty practice with an overview of the genetics, diagnosis, clinical manifestations, and treatment of SCD. Specialized comprehensive medical care decreases morbidity and mortality during childhood. The provision of comprehensive care is a time-intensive endeavor that includes ongoing patient and family education, periodic comprehensive evaluations and other disease-specific health maintenance services, psychosocial care, and genetic counseling. Timely and appropriate treatment of acute illness is critical, because life-threatening complications develop rapidly. It is essential that every child with SCD receive comprehensive care that is coordinated through a medical home with appropriate expertise.

ABBREVIATIONS. SCD, sickle cell disease; HbS, sickle hemoglobin; HbF, fetal hemoglobin; HbSS, sickle cell anemia; HbSC, sickle-hemoglobin C disease; HbF, fetal hemoglobin; HPLC, high-performance liquid chromatography; AAP, American Academy of Pediatrics; CNS, central nervous system; CBC, complete blood cell; TCD, transcranial Doppler; HbA_2, hemoglobin A_2; MCV, mean corpuscular volume; Hib, *Haemophilus influenzae* type b; TIA, transient ischemic attack.

INTRODUCTION

The term sickle cell disease (SCD) describes a group of complex, chronic disorders characterized by hemolysis, unpredictable acute complications that can rapidly become life-threatening, and the variable development of chronic organ damage. Expert, comprehensive medical care decreases morbidity and prolongs life expectancy for individuals with SCD.[1–5] Many children with SCD in the United States receive much of their medical care from pediatricians. This statement is intended to provide pediatricians in primary care and subspecialty practice with an overview of the essential components of comprehensive care for children with SCD and their families. A detailed discussion of the treatment of individual acute and chronic complications of SCD is beyond the scope of these guidelines but is available elsewhere.[6–11]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

OVERVIEW OF GENETICS AND PATHOPHYSIOLOGY

SCD is an autosomal recessive genetic disorder characterized by the presence of sickle hemoglobin (HbS) in red blood cells. Heterozygous individuals have sickle cell trait, a generally benign, asymptomatic genetic carrier state. Homozygous and compound heterozygous individuals have symptomatic disease. Four genotypes—sickle cell anemia (HbSS), sickle-hemoglobin C disease (HbSC), and 2 types of sickle β-thalassemia ($S\beta^+$-thalassemia and $S\beta^o$-thalassemia)—account for most SCD in the United States. Less common forms of SCD are caused by coinheritance of HbS with other hemoglobin variants, such as hemoglobin D-Punjab. Genes for SCD are common in persons of African, Mediterranean, Middle Eastern, and Indian ancestry and persons from the Caribbean and parts of Central and South America. SCD is the most prevalent disorder identified by neonatal blood screening, with approximately 2000 affected infants born in the United States each year.[12] Overall, the incidence of SCD exceeds that of most other serious genetic disorders, including cystic fibrosis and hemophilia.

The protean clinical manifestations of SCD result from variable degrees of hemolysis and intermittent episodes of vascular occlusion that cause tissue ischemia and acute and chronic organ dysfunction. Consequences of hemolysis may include chronic anemia, jaundice, predisposition to aplastic crisis, cholelithiasis, and delayed growth and sexual maturation. Vaso-occlusion and tissue ischemia can result in acute and chronic injury to virtually every organ of the body. Important clinical manifestations of SCD during childhood and adolescence are shown in Table 1. Generally, children with HbSS and $S\beta^o$-thalassemia are more severely affected than are children with HbSC or $S\beta^+$-thalassemia. However, each genotype is characterized by marked and largely unpredictable variability in clinical expression and severity.[13–16]

NEONATAL SCREENING AND DIAGNOSIS

Most infants with SCD are healthy at birth and become symptomatic later in infancy or childhood after fetal hemoglobin (HbF) levels decrease. Most infants with SCD born in the United States are now identified by routine neonatal screening.[9,17,18] Affected infants not identified through neonatal screening generally present clinically during infancy or early childhood with painful swelling of the hands

TABLE 1. Important Clinical Manifestations of SCD During Childhood and Adolescence

Acute Manifestations
Bacterial sepsis or meningitis*
Recurrent vaso-occlusive pain (dactylitis, musculoskeletal or abdominal pain)
Splenic sequestration*
Aplastic crisis*
Acute chest syndrome*
Stroke*
Priapism
Hematuria, including papillary necrosis
Chronic manifestations
Anemia
Jaundice
Splenomegaly
Functional asplenia
Cardiomegaly and functional murmurs
Hyposthenuria and enuresis
Proteinuria
Cholelithiasis
Delayed growth and sexual maturation
Restrictive lung disease*
Pulmonary hypertension*
Avascular necrosis
Proliferative retinopathy
Leg ulcers
Transfusional hemosiderosis*

* Potential cause of mortality.

and feet (dactylitis), pneumococcal sepsis or meningitis, severe anemia and acute splenic enlargement (splenic sequestration), acute chest syndrome, pallor, jaundice, or splenomegaly. Clinical presentations in older children include anemia, severe or recurrent musculoskeletal or abdominal pain, aplastic crisis, acute chest syndrome, splenomegaly or splenic sequestration, and cholelithiasis.

Forty-four states, the District of Columbia, Puerto Rico, and the Virgin Islands currently provide universal neonatal screening for SCD; screening is available by request in the other 6 states. It is essential that pediatricians be familiar with their particular state's screening program, that a screening sample always be obtained before any blood transfusion (regardless of gestational or postnatal age),[19] and that the results of neonatal screening tests be routinely and promptly documented for all infants.[18] In states that have not yet implemented universal screening, neonatal screening for SCD should be requested for all high-risk infants (those of African, Mediterranean, Middle Eastern, Indian, Caribbean, and Central and South American ancestry). Any high-risk infant not screened at birth, or for whom neonatal screening results cannot be documented, should be screened by hemoglobin electrophoresis as soon as possible after birth. For infants with positive screening results, confirmatory testing should be accomplished before 2 months of age so that parental education, penicillin prophylaxis, and arrangements for comprehensive care can be promptly initiated.[9,18]

Confirmatory testing of infants with positive neonatal screening results and diagnosis of older patients who present with symptoms require hemoglobin separation by electrophoresis (cellulose acetate and citrate agar), isoelectric focusing, and/or high-performance liquid chromatography (HPLC).[18] In selected cases, DNA analysis or testing of parents can be helpful. Neonatal screening and diagnostic test results for the 4 most common genotypes of SCD are shown in Table 2. Solubility testing has no place in the diagnosis of SCD, because it does not differentiate SCD from sickle cell trait and because high levels of HbF cause false-negative results in infants with SCD.

OVERVIEW OF COMPREHENSIVE CARE

SCD is a complex disorder with multisystem manifestations that requires specialized comprehensive care to achieve an optimal outcome. Appropriate treatment requires the active involvement of health care professionals with expertise in the management and treatment of SCD, usually a pediatric hematologist-oncologist working in conjunction with a multidisciplinary team.

TABLE 2. SCD: Neonatal Screening and Diagnostic Test Results

Disorder	Approximate Percentage of US Patients With SCD	Neonatal Screening Results*	Hemoglobin Separation by Age 6 Weeks*	Serial CBC and Reticulocyte Counts	Hematologic Studies by Age 2 Years		
					MCV†	HbA_2‡ (%)	HbF (%)
HbSS	65	FS	FS	Hemolysis and anemia by age 6–12 mo	Normal or increased§	<3.6§	<25
HbSC	25	FSC	FSC	Mild or no anemia by age 2 y	Normal or decreased	NA‖	<15
$S\beta^+$-thalassemia	8	FSA or FS¶	FSA	Mild or no anemia by age 2 y	Normal or decreased	>3.6	<25
$S\beta^\circ$-thalassemia	2	FS	FS	Hemolysis and anemia by age 6–12 mo	Decreased	>3.6	<25

Table shows typical results—exceptions occur. Rare forms of SCD, such as SD-Punjab, SO-Arab, SC-Harlem, $S\delta\beta$-thalassemia, SE, and SLepore, not included.

* Hemoglobins reported in order of quantity (eg, FSA = F>S>A).

† Normal or reference range of MCV is > 70 fL at age 6–12 mo; lower limits of reference range subsequently increase with age to 80 fL during adolescence.

‡ HbA_2 results vary somewhat depending on laboratory methodology.

§ HbSS with coexistent α-thalassemia may show decreased MCV and HbA_2 >3.6%; however, neonatal screening results from such infants usually show Bart's hemoglobin.

‖ NA = not applicable—quantity of HbA_2 usually not measured in presence of HbC.

¶ Quantity of HbA at birth is sometimes insufficient for detection.

Medical Home

It is essential that every child with SCD receive care that is provided and coordinated through an appropriate medical home.[17] For many patients, the most appropriate medical home is a multidisciplinary sickle cell clinic that coordinates all aspects of comprehensive care in collaboration with the child's primary care pediatrician or that provides specialty and primary care in 1 setting. In other cases, the medical home may be provided by a knowledgeable primary care pediatrician or other health care professional from whom patients receive day-to-day care, with periodic referrals to sickle cell specialists for comprehensive evaluations and for the management and treatment of severe, life-threatening complications. Some SCD programs support primary care pediatricians by conducting outreach clinics in communities distant from tertiary care centers. The location of the medical home and the extent to which the care outlined in this statement is provided by the primary care pediatrician versus the multidisciplinary SCD team will vary among patients and communities and will depend in part on the expertise of the primary care pediatrician, access to a multidisciplinary SCD team, family preference, and the frequency and severity of disease manifestations. Appropriate management of many aspects of SCD requires time and expertise beyond levels provided by most primary care pediatricians. In some cases, ongoing access to the pediatric hematologist-oncologist and other subspecialists may require advocacy by the primary care pediatrician with managed care organizations or other payers.[5]

Family and Patient Education

Identification of an infant with SCD through neonatal screening provides an opportunity to educate parents and other caregivers about the child's disorder before symptoms develop.[9,18] Initially, the focus should include the genetics (including the availability of carrier testing and prenatal diagnosis) and basic pathophysiology of SCD and the importance of regularly scheduled health maintenance visits, penicillin prophylaxis, and immunizations, including pneumococcal vaccines. Education about the need for urgent medical evaluation for and treatment of febrile illness, acute splenic sequestration, aplastic crisis, and acute chest syndrome is critical. Education about splenic sequestration includes the need to seek medical attention immediately if the child is pale and listless and instruction about abdominal palpation for determining spleen size. Recognition and appropriate management of dactylitis and other painful events should be reviewed. As the child ages, other topics such as stroke, enuresis, priapism, cholelithiasis, delayed puberty, proliferative retinopathy, avascular necrosis of the hip or shoulder, and leg ulcers are introduced. During middle childhood and adolescence, education is increasingly directed toward the patient in addition to the parents, and during adolescence, it includes the genetic basis of SCD and issues related to contraception, carrier testing of partners, genetic counseling, and prenatal diagnosis. The ultimate goal is to enable families to functionally cope with the child's complex chronic illness and enhance the child's potential for successful transition to adulthood.

Health Maintenance

In addition to ensuring compliance with "Recommendations for Preventive Pediatric Health Care" of the American Academy of Pediatrics (AAP),[20] the following SCD-related issues should be addressed periodically.

Prophylactic Medications

All infants with HbSS and Sβ^o-thalassemia should receive penicillin V potassium prophylaxis, 125 mg orally, twice a day, initiated by 2 months of age.[6,9,21,22] The dose is increased to 250 mg orally, twice a day, at 3 years of age and continued at least until the fifth birthday.[22,23] Erythromycin prophylaxis may be used as an alternative for children with suspected or proven penicillin allergy. The routine use of penicillin prophylaxis for infants and children with HbSC and Sβ^+-thalassemia is controversial.[24] Folic acid supplementation is also controversial.[25]

Immunizations

Timely administration of routine immunizations recommended by the AAP is essential.[26] Children with SCD should receive the 7-valent pneumococcal conjugate and 23-valent pneumococcal polysaccharide vaccines.[22,27] Yearly influenza immunization is recommended.[28] The AAP *2000 Red Book* also recommends immunization with quadrivalent meningococcal polysaccharide vaccine.[28]

Comprehensive Medical Evaluations

All patients should have regularly scheduled comprehensive medical evaluations to review previous disease manifestations, document important baseline physical findings and laboratory values, monitor growth and development, detect early signs of chronic organ damage, and develop individualized patient care plans.[18] Blood pressure should be evaluated in light of the observation that values for persons with SCD are somewhat lower than for hematologically normal individuals.[29] Relatively elevated blood pressures have been associated with an increased risk of stroke and may warrant additional evaluation and treatment.[29] Other potential problems include splenomegaly and the detection and treatment of central nervous system (CNS) disease, proliferative retinopathy, restrictive lung disease, pulmonary hypertension, cholelithiasis, proteinuria, avascular necrosis of the hip or shoulder, and leg ulcers. School performance should be monitored for evidence of neurodevelopmental problems. Comprehensive evaluations also provide an ideal setting for providing age-appropriate family and patient education and for evaluating and addressing psychosocial issues. The frequency of comprehensive evaluations will vary somewhat depending on the patient's age, genotype, and disease manifestations.

Some patients will develop complications or show laboratory or imaging evidence of disease manifes-

tations that warrant more intense, specific therapy, such as chronic transfusions, hydroxyurea, or hematopoietic stem cell transplantation. The usual goal of chronic transfusions is to suppress erythropoiesis and provide normal red blood cells to maintain the percentage of the patient's cells (ie, those containing HbS) at less than 30%.[6,30,31] This approach significantly decreases the risk of recurrent stroke and other SCD-related complications, such as vaso-occlusive pain and acute chest syndrome.[30–32] Strategies for preventing and treating transfusion complications, including alloimmunization to minor red blood cell antigens and hemosiderosis, need to be carefully considered.[6,30,33–37] Daily oral administration of hydroxyurea increases HbF levels, decreases leukocyte counts, and decreases the frequency of episodes of pain and acute chest syndrome.[38] Hydroxyurea may be appropriate for selected children and adolescents with frequent or severe disease manifestations but requires frequent monitoring for myelotoxicity and other drug-related complications by a physician with expertise in SCD and chemotherapy.[39] Successful stem cell transplantation provides a hematologic cure for SCD,[40] but its use has been limited by the paucity of HLA-matched sibling donors and by the challenge of balancing SCD severity criteria with transplantation-related morbidity and mortality.[41] The clinical course of each patient with SCD should be regularly reviewed by a pediatric hematologist-oncologist generally at the time of comprehensive evaluations, and the possibilities of chronic transfusions, hydroxyurea, and stem cell transplantation should be considered.

Acute Illness

Acute illness characterized by relatively common childhood signs and symptoms, such as fever, cough, abdominal pain, pallor, and limp, can rapidly become life-threatening. Unfortunately, delayed or inadequate evaluation and treatment of acute illness remains an important cause of preventable morbidity and mortality.[42] Thus, it is imperative that every child with SCD have a plan for around-the-clock access to a medical facility where knowledge and perspective about SCD is available and where evaluation and treatment can be promptly delivered.[9,18] For example, a child with fever or pallor and listlessness should always be initially evaluated, if possible, at a site where complete blood cell (CBC) and reticulocyte counts, blood cultures, intravenous antibiotics, and red blood cell transfusions are readily available. Health care professionals who treat acute illness need ready access to baseline information about the patient (eg, SCD genotype, the presence or absence of splenomegaly, and baseline CBC and reticulocyte counts). Strategies for ensuring the availability of baseline information about individual patients include computerized patient databases and the provision of baseline information directly to patients and families on medical alert cards or on emergency information forms recommended by the AAP.[43] The goal of ensuring timely medical treatment for acute illness also is facilitated by providing anticipatory guidance to patients and families about early recognition, appropriate medical evaluation, and treatment of common acute complications.[9,18]

Examples of acute illnesses that require urgent evaluation and treatment are outlined briefly below. More than one of these acute complications may be present simultaneously, and the information provided here lacks many important details about the management of each. Additional details are provided in references cited throughout this statement. Because blood transfusions play a central role in the treatment of some acute complications, the patient's red blood cell antigen phenotype should be determined ahead of time if minor antigen-matched red blood cells, selected to prevent alloimmunization, are available locally.[6,30,33–35]

Fever

Because patients with SCD develop splenic dysfunction at as early as 3 months of age, they are at high risk for septicemia and meningitis with pneumococci and other encapsulated bacteria.[44] Thus, all patients with temperature greater than 38.5°C require rapid triage and physical assessment, urgent CBC and reticulocyte counts, blood culture (plus cerebrospinal fluid analysis and other cultures as indicated), and prompt administration of a broad-spectrum parenteral antibiotic, such as ceftriaxone sodium, cefuroxime, or cefotaxime sodium.[6,9,11] Because of its long half-life, ceftriaxone is usually chosen for selected cases in which outpatient management with close follow-up may be appropriate.[45] The presence of a focus of infection (eg, viral upper respiratory illness, otitis media) does not alter the urgency of administering parenteral antibiotics. Because of the prevalence of resistant pneumococci,[46] vancomycin hydrochloride should be added for proven or suspected meningitis and other severe illness. Infections such as osteomyelitis that are often caused by *Staphylococcus aureus* or other organisms, such as *Salmonella* species, should be treated with a broad-spectrum antibiotic and vancomycin pending the results of bacteriologic culture and sensitivities. Other acute complications of SCD, such as acute chest syndrome, splenic sequestration, and aplastic crisis, need to be excluded during febrile illness.

Pain

Unpredictable episodes of severe and sometimes excruciating pain are characteristic of SCD.[16,47] Many uncomplicated episodes of pain can be managed at home with oral fluids; oral analgesics, such as ibuprofen, acetaminophen, and codeine; and comfort measures, such as heating pads. When home management measures fail to adequately alleviate pain, it is essential that patients receive rapid triage, physical assessment, and aggressive, appropriately monitored analgesia.[47] For severe pain, parenteral opioids, such as morphine, are indicated and usually administered by scheduled around-the-clock dosing or patient-controlled analgesia.[6,47] Opioids should not be withheld because of the unfounded fear of addiction. Other issues include maintenance of adequate (but avoidance of excessive) hydration, monitoring of oxygenation and cardiopulmonary status,

use of incentive spirometry to encourage deeper inspiratory effort,[48] and close observation for the development of other complications, particularly acute chest syndrome.[49,50] During episodes of severe pain, life-threatening complications may develop rapidly and often are heralded by relatively sudden clinical changes, such as an increasing oxygen requirement, altered mental status, or decreasing hemoglobin level or platelet count.[49–51]

Acute Chest Syndrome

Acute chest syndrome is an illness characterized by a new infiltrate identified on a chest radiograph, accompanied or preceded by lower respiratory tract symptoms and/or hypoxemia.[49,50] The syndrome may be present initially during an acute illness or may develop after 2 to 3 days of severe vaso-occlusive pain. Acute chest syndrome is also a common complication of general anesthesia and surgery.[52] Causes include infection (viral and bacterial, including *Mycoplasma* or *Chlamydia* species), pulmonary infarction, and pulmonary fat embolism.[50] Patients may deteriorate rapidly with progression to pulmonary failure and death. Early recognition and aggressive treatment with oxygen, analgesics, antibiotics, and often simple or exchange transfusions are essential and may be life saving.[6,30,49,50,53] The availability of a pediatric intensive care unit is critical in some cases.

Splenic Sequestration

Splenic sequestration is an acute illness characterized by an acutely enlarging spleen and hemoglobin level more than 2 g/dL below the patient's baseline value.[6,9] Mild to moderate thrombocytopenia is often present. Severe cases progress rapidly to shock and death. Prompt recognition and treatment with red blood cell transfusions may be life saving.[30] Surgical splenectomy to prevent recurrence is often recommended after recovery from life-threatening or recurrent episodes of sequestration.[6]

Aplastic Crisis

Aplastic crisis is characterized by an exacerbation of the patient's baseline anemia with a substantially decreased reticulocyte count, typically less than 1%.[6,9] Most cases are caused by acute infection with human parvovirus B19, usually without the characteristic rash. Less commonly, parvovirus infection causes other acute complications of SCD that may occur with aplastic crisis, including severe pain, bone marrow necrosis, acute chest syndrome, splenic sequestration, and stroke.[6] Recognition requires comparison of CBC and reticulocyte counts obtained during acute illness with baseline values. Red blood cell transfusions are often needed to prevent heart failure in patients with uncomplicated aplastic crisis or to urgently treat other coexistent complications.[30] Because parvovirus is contagious, isolation from at-risk persons,[28] such as pregnant health care professionals and those with immunodeficiency or chronic hemolysis, and testing of siblings with SCD for concurrent and subsequent aplastic crisis are recommended.

Stroke

Any acute neurologic symptom other than mild headache, even if transient, requires urgent evaluation. Common presenting symptoms and signs of stroke include hemiparesis, aphasia or dysphasia, seizures, monoparesis, severe headache, cranial nerve palsy, stupor, and coma.[54] Initial evaluation includes CBC and reticulocyte counts and noncontrast computed tomography or magnetic resonance imaging to exclude hemorrhage.[6] Red blood cell minor antigen phenotype, if not previously documented, should be determined so that transfusions can be matched to prevent alloimmunization.[29,30,33–35] Magnetic resonance angiography to document large vessel vasculopathy is often performed. Treatment includes anticonvulsants if necessary, other supportive care for seizures or increased intracranial pressure if present, and a program of chronic transfusions, usually initiated acutely by partial exchange transfusion or erythrocytapheresis.[6,30] Ischemic CNS injury can also present with nonfocal or "soft" signs, such as developmental delays or poor school performance.[55] Children at highest risk of stroke can be identified by screening with transcranial Doppler (TCD) ultrasonography.[56] Those with positive findings on TCD ultrasonography may be candidates for primary stroke prevention with chronic transfusions.[57]

Priapism

Priapism is a prolonged painful erection of the penis that commonly occurs in children and adolescents with SCD, often starting during the early morning hours.[58] It occurs in 2 forms: 1) stuttering episodes that last fewer than 2 to 4 hours but are often recurrent and may precede a severe episode, and 2) severe episodes that last more than 2 to 4 hours and may eventually result in impotence. Severe episodes require urgent evaluation and treatment that may include hydration, analgesics, aspiration and irrigation by a urologist, and sometimes blood transfusions.[59]

Psychosocial Care

Comprehensive care includes periodic psychosocial assessments and access to services needed to optimize the patient's and family's adaptation to chronic illness.[6,18] Personal and cultural beliefs about illness and existing stresses and support systems may greatly impact the ability to cope with SCD. Patient support groups and community-based organizations can be important resources. Relevant issues include health insurance coverage, transportation for health care, and education of school personnel about SCD.

GENETIC EDUCATION AND COUNSELING

The pediatrician may be called on to provide education and counseling to a couple at risk of having a child with SCD. In some cases, such couples will be identified by the diagnosis of SCD, sickle cell trait, hemoglobin C trait, or β-thalassemia minor in a previous child. In other cases, couples may be identified

because of ethnic background or previous laboratory testing. It is important that education and genetic counseling be provided by professionals with expertise in genetics and in the clinical manifestations and treatment of SCD.[9,18] The availability of prenatal diagnosis using DNA analysis of samples obtained from chorionic villous sampling or amniocentesis should be discussed. In many cases, referral to a hematologist-oncologist or a clinical geneticist or obstetrician associated with a prenatal diagnosis center is appropriate. The pediatrician may be called on to review the information and to support the family in the decision-making process.

Education and counseling should include review of autosomal recessive inheritance and the provision of accurate information about genetic risk and the clinical course, medical complications, and treatment of the specific SCD genotype relevant to the family. Genetic risk cannot be assumed from the diagnosis of SCD in a previous child or from the family's memory of test results; documentation of adequate parental testing is essential. Such testing includes a CBC count and hemoglobin separation by electrophoresis (cellulose acetate and citrate agar), isoelectric focusing, and/or HPLC.[18] Most individuals with heterozygous β-thalassemia show a decreased mean corpuscular volume (MCV) and increased levels of hemoglobin A_2 (HbA_2) and/or HbF. Thus, accurate quantitation of HbF by alkali denaturation, radial immunodiffusion, or HPLC and of HbA_2 by column chromatography or HPLC is needed if the MCV is decreased or borderline decreased.[18] Solubility testing is inadequate and should never be used for carrier testing, in part because it will not identify individuals with hemoglobin C trait or β-thalassemia. The results of parental testing should be reviewed by an individual with expertise in the diagnosis of hemoglobinopathies.

Adolescents with SCD should receive accurate information about the genetic transmission of SCD and the availability of carrier testing for partners, genetic counseling, and prenatal diagnosis. They should be counseled about avoiding unwanted pregnancies and offered appropriate contraceptive services. When an adolescent with SCD becomes pregnant, comanagement by a hematologist with expertise in SCD and by a high-risk obstetrician is essential. Options for partner testing, genetic counseling, and prenatal diagnosis should be reviewed. Pregnancy is often associated with an increased frequency of complications of SCD, but most appropriately managed pregnancies in women with SCD have a successful outcome for the mother and infant.[60,61]

HEALTH SUPERVISION FROM BIRTH TO 1 YEAR OF AGE: INFANCY

Family Education

1. Review the results of neonatal screening and confirmatory testing (Table 2).
2. Discuss the basic pathophysiology and genetics of SCD, including the availability of carrier testing and prenatal diagnosis.
3. Review the importance of regularly scheduled health maintenance visits, penicillin prophylaxis, and immunizations, including pneumococcal vaccines.
4. Discuss the need for urgent medical evaluation for and treatment with parenteral antibiotics of febrile illness (temperature greater than 38.5°C).
5. Discuss signs and symptoms of acute splenic sequestration and teach abdominal palpation for determining spleen size.
6. Discuss recognition and appropriate management of dactylitis and other painful events.
7. Discuss the significance of respiratory symptoms possibly indicative of acute chest syndrome.
8. Recommend avoidance of exposure to pet reptiles to decrease the risk of salmonellosis.[62]
9. Discuss medical home options (primary care pediatrician vs comprehensive sickle cell program). Stress the need for coordinated care and communication among the family, pediatrician, and subspecialists. The roles and responsibilities of family and providers should be discussed and defined.
10. Provide written materials to reinforce education.

Health Maintenance

1. Begin prophylactic administration of penicillin V potassium, 125 mg orally, twice a day, by 2 months of age for infants with HbSS and Sβ^o-thalassemia.[6,9,21,22,27] The routine use of penicillin prophylaxis for infants with HbSC and Sβ^+-thalassemia is controversial.[24]
2. Provide routine immunizations, including *Haemophilus influenzae* type b (Hib) and 7-valent pneumococcal conjugate vaccines, beginning at 2 months of age.[22,26–28] Yearly influenza immunization is recommended for children 6 months and older.[28]
3. Provide comprehensive medical evaluations every 2 to 4 months. Critical issues during the first year include the documentation of spleen size and baseline CBC and reticulocyte counts, which may change significantly as HbF levels decrease. Baseline information should be provided to parents. Red blood cell minor antigen phenotype should be determined if transfusions that may be needed for treatment of acute illness can be matched to prevent alloimmunization.[30,34,35] Develop and modify as needed an individualized patient care plan.

Acute Illness

1. Develop a plan for around-the-clock access to a medical facility that can provide urgent evaluation for and treatment of acute illness characterized by fever (temperature greater than 38.5°C), pallor, lethargy, abdominal distention or enlarging spleen size, or tachypnea or other signs of respiratory illness.
2. Arrange immediate access at the acute care facility to baseline information about the patient.
3. Anticipate and address any insurance barriers to the receipt of appropriate care for acute illness.

Psychosocial Care

1. Explore personal beliefs about illness and existing sources of stress and support.
2. Review insurance coverage and provide assistance with application for public support, if applicable.
3. Discuss transportation issues, particularly for episodes of acute illness.
4. Provide information regarding support groups and other community-based organizations.

HEALTH SUPERVISION FROM 1 TO 5 YEARS OF AGE: EARLY CHILDHOOD

Family Education

1. Review disease manifestations to date, if any, and the parents' response.
2. Review the importance of penicillin prophylaxis, if applicable, and of urgent medical evaluation for and treatment of febrile illness (temperature greater than 38.5°C).
3. Review signs, symptoms, and appropriate management of splenic sequestration and other anemic crisis, dactylitis and other manifestations of pain, and acute chest syndrome.
4. Discuss CNS manifestations of SCD and stress the importance of urgent evaluation for signs or symptoms suggestive of stroke or transient ischemic attack (TIA). Discuss screening with TCD ultrasonography, if available.
5. Discuss enuresis and relationship to SCD.
6. Discuss activities, including the need to avoid temperature extremes and to maintain adequate hydration.
7. Recommend avoidance of exposure to pet reptiles to decrease the risk of salmonellosis.[62]
8. Reinforce the rationale and importance of periodic comprehensive evaluations.
9. Reconsider the patient's medical home model depending on family preference and frequency and severity of complications.

Health Maintenance

1. Continue prophylactic administration of penicillin V potassium, 125 mg orally, twice a day, for children with HbSS and $S\beta^0$-thalassemia.[6,9,21,22,27] At 3 years of age, increase the dosage to 250 mg orally, twice a day.[22,27] The routine use of penicillin prophylaxis for children with HbSC and $S\beta^+$-thalassemia is controversial.[24]
2. Complete immunization with Hib and 7-valent pneumococcal conjugate vaccines.[22,26–28] Administer the 23-valent pneumococcal polysaccharide vaccine at 2 and 5 years of age but no earlier than 6 to 8 weeks after the last dose of pneumococcal conjugate vaccine.[22,27] Yearly influenza immunization is recommended.[28]
3. Provide comprehensive medical evaluations at least every 6 to 12 months and modify the patient's care plan as needed. Important issues include growth and development; jaundice; sleep apnea; cardiopulmonary status, including systemic hypertension and functional heart murmurs; spleen size; and neurologic status.
4. Document baseline CBC and reticulocyte counts (every 6–12 months for patients with HbSS and $S\beta^0$-thalassemia and at least yearly for patients with HbSC and $S\beta^+$-thalassemia).
5. Baseline renal and liver function tests, urinalysis, chest radiography, pulse oximetry, electrocardiography, echocardiography, and/or TCD ultrasonography may be indicated.

Acute Illness

1. Develop a plan for around-the-clock access to a medical facility that can provide urgent evaluation for and treatment of acute illness characterized by fever (temperature greater than 38.5°C), pallor, lethargy, abdominal distention or enlarging spleen size, tachypnea or other signs of respiratory illness, or any neurologic sign or symptom.
2. Arrange immediate access at the acute care facility to baseline information about the patient.
3. Anticipate and address any insurance barriers to the receipt of appropriate care for acute illness.

Psychosocial Care

1. Explore personal beliefs about illness and existing sources of stress and support.
2. Review insurance coverage and provide assistance with application for public support, if applicable.
3. Discuss transportation issues, particularly for episodes of acute illness.
4. Provide information regarding support groups and other community-based organizations.
5. Discuss child care or preschool arrangements and offer to assist in educating child care providers or educators about SCD.

HEALTH SUPERVISION FROM 5 TO 13 YEARS OF AGE: LATE CHILDHOOD

Patient and Family Education

1. Review disease manifestations to date and patient's and family's response.
2. Stress the continued importance of urgent medical evaluation for and treatment of febrile illness (temperature greater than 38.5°C).
3. Review home management of painful events.
4. Reinforce anticipatory guidance regarding anemic crisis (including splenic sequestration for patients with HbSC and $S\beta^+$-thalassemia), acute chest syndrome, stroke, and TIA. Discuss screening with TCD ultrasonography, if available.
5. For boys, discuss priapism, initial home management, and the need for urgent evaluation for and treatment of prolonged episodes.
6. Discuss enuresis, if applicable, and its relationship to SCD.
7. Discuss issues related to activity, including participation in athletics, avoidance of temperature extremes, and maintenance of hydration.
8. Recommend avoidance of exposure to pet reptiles to decrease the risk of salmonellosis.[62]

9. Reinforce the rationale and importance of periodic comprehensive evaluations.
10. Reconsider the patient's medical home model depending on family preference and frequency and severity of complications.

Health Maintenance

1. Continuation of prophylactic administration of penicillin V potassium, 250 mg orally, twice a day, after the fifth birthday may be appropriate in selected patients, including those with a history of invasive pneumococcal infection or surgical splenectomy.[22,23,27,28]
2. Administer Hib and 7-valent pneumococcal conjugate vaccines if not previously immunized. Administer second 23-valent pneumococcal polysaccharide vaccine at 5 years of age but no earlier than 3 years after the first pneumococcal polysaccharide vaccine and 6 to 8 weeks after the last pneumococcal conjugate vaccine.[22,27] A third dose of pneumococcal polysaccharide vaccine may be given no earlier than 5 years after the second pneumococcal polysaccharide vaccine and 6 to 8 weeks after the last pneumococcal conjugate vaccine. Yearly influenza immunization is recommended.[28]
3. Provide comprehensive medical evaluations every 6 to 12 months and modify the patient's care plan as needed. Important issues include growth and development; sleep apnea; cardiopulmonary status, including systemic hypertension and functional heart murmurs; hepatosplenomegaly; cholelithiasis; proteinuria; pubertal development; enuresis; avascular necrosis of the hip and shoulder; and neurologic status. Screening for proliferative retinopathy with periodic retinal examinations beginning at 10 years of age is often recommended, especially for patients with HbSC.
4. Document baseline CBC and reticulocyte counts at least yearly.
5. Baseline pulse oximetry, renal and hepatic function tests, chest radiography, pulmonary function tests, electrocardiography, echocardiography, and/or TCD ultrasonography may be indicated.
6. Abdominal ultrasonography to detect cholelithiasis may be indicated.

Acute Illness

1. Develop a plan for around-the-clock access to a facility that can provide urgent evaluation for and treatment of acute illness characterized by fever (temperature greater than 38.5°C), pallor, lethargy, abdominal distention or enlarging spleen size, tachypnea or other signs of respiratory illness, prolonged priapism, or any neurologic sign or symptom.
2. Arrange immediate access at the acute care facility to baseline information about the patient.
3. Anticipate and address any insurance barriers to the receipt of appropriate care for acute illness.

Psychosocial Care

1. Explore personal beliefs about illness and existing sources of stress and support.
2. Review insurance coverage and provide assistance with application for public support, if applicable.
3. Discuss transportation issues, particularly for episodes of acute illness.
4. Provide information regarding support groups and other community-based organizations.
5. Review school attendance and performance and consider formal neurocognitive testing.
6. Offer assistance with education of school personnel about SCD.

HEALTH SUPERVISION FROM 13 TO 21 YEARS AND OLDER: ADOLESCENCE TO EARLY ADULTHOOD

Patient and Family Education

1. Review disease manifestations to date and patient's and family's response.
2. Discuss the nature of SCD with the patient and review concerns and issues related to the impact of the disease throughout adolescence.
3. Review principles of pain management.
4. Review need for urgent medical evaluation for and treatment of febrile illness (temperature greater than 38.5°C).
5. Provide anticipatory guidance regarding anemic crisis (including splenic sequestration for HbSC and $S\beta^+$-thalassemia), acute chest syndrome, stroke, TIA, and priapism.
6. Discuss sexuality and the availability of contraception options, such as barriers, intramuscular medroxyprogesterone, and low-dose estrogen oral contraceptives.
7. Discuss genetics, including partner testing, genetic counseling, and prenatal diagnosis.
8. Discuss issues related to physical activity, including athletics, avoidance of temperature extremes, and maintenance of hydration.
9. Discuss the importance of avoiding drugs, such as alcohol, tobacco, and cocaine, which may precipitate or exacerbate complications of SCD.
10. Discuss chronic manifestations of the disease, including proliferative retinopathy, cholelithiasis, avascular necrosis of the hip and shoulder, leg ulcers, and delayed growth and puberty.
11. Recommend avoidance of exposure to pet reptiles to decrease the risk of salmonellosis.[62]
12. Reinforce rationale and importance of periodic comprehensive evaluations.
13. Reconsider patient's medical home model depending on patient and family preference and frequency and severity of complications.
14. Discuss options for adult-oriented health care providers and develop with the patient a plan for transition from pediatric to adult medical care.

Health Maintenance

1. Yearly influenza immunization is recommended.[28]
2. Provide comprehensive medical evaluations every 6 to 12 months and modify the patient's care

plan as needed. Important issues include adolescent maturation and development; sleep apnea; cardiopulmonary status, including systemic hypertension, restrictive lung disease, and pulmonary hypertension; hepatosplenomegaly; cholelithiasis; proteinuria; pubertal development; avascular necrosis; and neurologic status. Periodic retinal examinations are often recommended, especially for patients with HbSC.
3. Document baseline CBC and reticulocyte counts at least yearly.
4. Baseline pulse oximetry, renal and liver function tests, chest radiography, pulmonary function tests, electrocardiography, and/or echocardiography may be indicated.
5. Abdominal ultrasonography to detect cholelithiasis may be indicated.

Acute Illness

1. Develop a plan for around-the-clock access to a facility that can provide urgent evaluation for and treatment of acute illness characterized by fever (temperature greater than 38.5°C), pallor, lethargy, abdominal distention or enlarging spleen size, tachypnea or other signs of respiratory illness, prolonged priapism, or any neurologic sign or symptom.
2. Arrange immediate access at the acute care facility to baseline information about the patient.
3. Anticipate and address any insurance barriers to the receipt of appropriate care for acute illness.

Psychosocial Care

1. Explore personal beliefs about illness and existing sources of stress and support.
2. Review insurance coverage and provide assistance with application for public support, if applicable.
3. Discuss transportation issues, particularly for episodes of acute illness.
4. Provide information regarding support groups and other community-based organizations.
5. Review school attendance and performance and consider formal neurocognitive testing.
6. Offer assistance with education of school personnel about SCD.
7. Discuss educational and vocational goals.

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Hearing Assessment in Infants and Children: Recommendations Beyond Neonatal Screening

abstract

Congenital or acquired hearing loss in infants and children has been linked with lifelong deficits in speech and language acquisition, poor academic performance, personal-social maladjustments, and emotional difficulties. Identification of hearing loss through neonatal hearing screening, regular surveillance of developmental milestones, auditory skills, parental concerns, and middle-ear status and objective hearing screening of all infants and children at critical developmental stages can prevent or reduce many of these adverse consequences. This report promotes a proactive, consistent, and explicit process for the early identification of children with hearing loss in the medical home. An algorithm of the recommended approach has been developed to assist in the detection and documentation of, and intervention for, hearing loss. *Pediatrics* 2009;124:1252–1263

KEY POINTS

1. Every child with 1 or more risk factors on the hearing risk assessment should have ongoing developmentally appropriate hearing screening and at least 1 diagnostic audiology assessment by 24 to 30 months of age.
2. Periodic objective hearing screening of all children should be performed according to the recommendations for preventive periodic health care.[1]
3. Any parental concern about hearing loss should be taken seriously and requires objective hearing screening of the patient.
4. All providers of pediatric health care should be proficient with pneumatic otoscopy and tympanometry. However, it is important to remember that these methods do not assess hearing.
5. Developmental abnormalities, level of functioning, and behavioral problems (ie, autism/developmental delay) may preclude accurate results on routine audiometric screening and testing. In this situation, referral to an otorhinolaryngologist and a pediatric audiologist who has the necessary equipment and expertise to test infants and young children should be made.
6. The results of abnormal screening should be explained carefully to parents, and the child's medical record should be flagged to facilitate tracking and follow-up.

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KEY WORD
hearing screening, hearing loss, audiology

ABBREVIATIONS
AAP—American Academy of Pediatrics
OAE—otoacoustic emission
ABR—auditory brainstem response
VRA—visual reinforced audiometry

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account, individual circumstances may be appropriate.

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7. Any abnormal objective screening result requires audiology referral and definitive testing.
8. A failed infant hearing screening or a failed screening in an older child should always be confirmed by further testing.
9. Abnormal hearing test results require intervention and clinically appropriate referral, including otolaryngology, audiology, speech-language pathology, genetics, and early intervention.

INTRODUCTION

Failure to detect congenital or acquired hearing loss in children may result in lifelong deficits in speech and language acquisition, poor academic performance, personal-social maladjustments, and emotional difficulties. Early identification of hearing loss and appropriate intervention within the first 6 months of life have been demonstrated to ameliorate many of these adverse consequences and facilitate language acquisition.[2] Supportive evidence is outlined in the Joint Committee on Infant Hearing's "Year 2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs," which was endorsed by the American Academy of Pediatrics (AAP).[3] This evidence also is part of the rationale for the AAP statement "Newborn and Infant Hearing Loss: Detection and Intervention,"[4] which endorses universal hearing screening and reviews the primary objectives, important components, and recommended screening methods and parameters that characterize an effective universal hearing screening program. Furthermore, the AAP statement "Recommendations for Preventive Pediatric Health Care"[1] promotes objective newborn hearing screening as well as periodic hearing screening for every child through adolescence (Table 1).

TABLE 1 Recommendations for Preventive Pediatric Health Care[1]

Stage	Age	Sensory Screening: 6. Hearing
Infancy	Prenatal	
	Newborn	[a]
	3–5 d[1]	[b]
	By 1 mo	[b]
	2 mo	[b]
	4 mo	[b]
	6 mo	[b]
	9 mo	[b]
Early childhood	12 mo	[b]
	15 mo	[b]
	18 mo	[b]
	24 mo	[b]
	30 mo	[b]
	3 y	[b]
	4 y	[a]
Middle childhood	5 y	[a]
	6 y	[a]
	7 y	[b]
	8 y	[a]
	9 y	[b]
	10 y	[a]
Adolescence	11 y	[b]
	12 y	[b]
	13 y	[b]
	14 y	[b]
	15 y	[b]
	16 y	[b]
	17 y	[b]
	18 y	[b]
	19 y	[b]
	20 y	[b]
	21 y	[b]

[a] To be performed.
[b] Risk assessment, with appropriate action to follow if positive.

All providers of pediatric health care need to recognize children who are at risk of or who suffer from congenital or acquired hearing loss, be prepared to screen their hearing, and assist the family and arrange for proper referral and treatment by identifying available hearing resources within their communities. In addition, the pediatric health care professional can play an important role in communication with the child's schoolteacher and/or nurse and special education professionals to facilitate proper accommodation and education once a hearing deficit has been confirmed.

This clinical report replaces the previous 2003 clinical report and seeks to promote a proactive, consistent, and explicit process for the early identification of children with hearing loss in the medical home. To assist in the detection and documentation of and intervention for hearing loss, an algorithm of the recommended approach with key points has been developed (Fig 1), as have several tables.

RISK INDICATORS FOR HEARING LOSS

Some degree of hearing loss (Table 2) is present in 1 to 6 per 1000 newborn infants.[5] Most children with congenital hearing loss are potentially identifiable by newborn and infant hearing screening. However, some congenital hearing loss may not become evident until later in childhood. Hearing loss also can be acquired during infancy or childhood for various reasons. Infectious diseases, especially meningitis, are a leading cause of acquired hearing loss. Trauma to the nervous system, damaging noise levels, and ototoxic drugs can all place a child at risk of developing acquired hearing loss.[6,7] Otitis media is a common cause of usually reversible hearing loss. Certain physical findings, historical events, and developmental conditions may indicate a potential hearing problem. These conditions include, but are not limited to, anomalies of the ear and other craniofacial structures, significant perinatal events, and global developmental or speech-language delays. All older infants and children should be screened for risk factors involving hearing problems. A summary of high-risk indicators for hearing loss and developmental milestones are included in Tables 3 and 4, respectively. All infants with a risk indicator for hearing loss, regardless of surveillance findings, should be referred for an audiologic assessment at least once by 24 to 30 months of age, even if the child passed the newborn hearing screening. Children with risk indicators that are highly associated with delayed-onset hearing loss, such as hav-

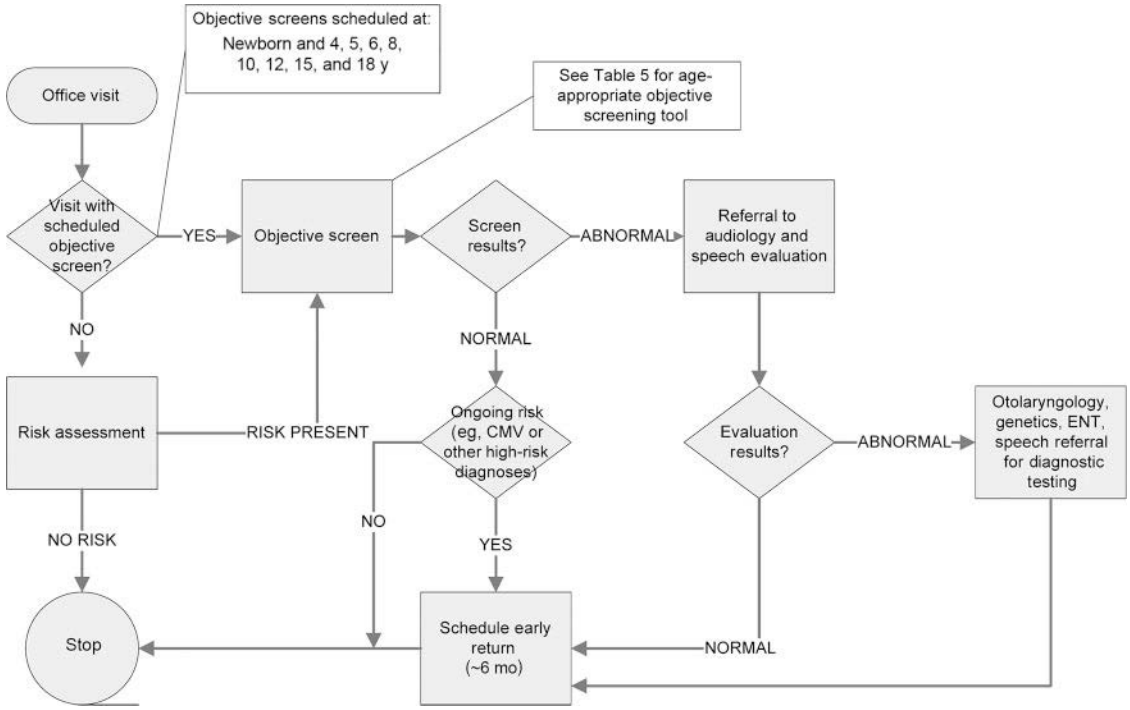

FIGURE 1
Hearing-assessment algorithm within an office visit. CMV indicates cytomegalovirus; ENT, ear, nose, and throat.

ing received extracorporeal membrane oxygenation or having cytomegalovirus infection, should have more frequent audiological assessments. Key point 1: Every child with 1 or more risk factors on the hearing risk assessment should have ongoing developmentally appropriate hearing screening and at least 1 diagnostic audiology assessment by 24 to 30 months of age (Table 1).

Although questionnaires and checklists are useful for identifying a child at risk of hearing loss, studies have shown that only 50% of children with hearing loss are identified by the comprehensive use of such questionnaires.[8,9] Key point 2: Periodic objective hearing screening of all children should be performed according to the recommendations for preventive periodic health care[1] (Table 1).

If a parent or caregiver is concerned that a child might have hearing loss, the pediatrician needs to assume that such is true until the child's hearing has been evaluated objectively. Parental concern is of greater predictive value than the informal behavioral examination performed in the physician's office.[10] Parents often report suspicion of hearing loss, inattention, or erratic response to sound before hearing loss is confirmed.[11] One study showed that parents were as much as 12 months ahead of physicians in identifying their child's hearing loss.[3] Key point 3: Any parental concern about hearing loss should be taken seriously and requires objective hearing screening of the patient.

TABLE 2 Definitions of Hearing Loss

Hearing Loss	Definition
Mild	On average, the most quiet sounds that people can hear with their better ear are between 20 and 40 dB. People who suffer from mild hearing loss have some difficulties keeping up with conversations, especially in noisy surroundings.
Moderate	On average, the most quiet sounds heard by people with their better ear are between 40 and 70 dB. People who suffer from moderate hearing loss have difficulty keeping up with conversations when not using a hearing aid.
Severe	On average, the most quiet sounds heard by people with their better ear are between 70 and 95 dB. People who suffer from severe hearing loss will benefit from powerful hearing aids, but often they rely heavily on lip reading, even when they are using hearing aids. Some also use sign language.

Adapted from: European Group on Genetics of Hearing Impairment. Martini A, ed. European Commission Directorate, Biomedical and Health Research Programme (HEAR) Infoletter 2, November 1996;8.

PHYSICAL EXAMINATION

Thorough physical examination is an essential part of evaluating a child for hearing loss. Findings on head and neck examination associated with potential hearing loss include heterochromia of the irises, malformation of the auricle or ear canal, dimpling or skin tags around the auricle, cleft lip or palate, asymmetry or hypoplasia of the facial structures, and microcephaly.[12] Hypertelorism and abnormal pig-

TABLE 3 American Academy of Pediatrics Joint Committee on Infant Hearing Year 2007 Position Statement[3]: Risk Indicators Associated With Permanent Congenital, Delayed-Onset, and/or Progressive Hearing Loss in Childhood

1	Caregiver concern[a] regarding hearing, speech, language, or developmental delay.
2	Family history[a] of permanent childhood hearing loss.
3	Neonatal intensive care of more than 5 days or any of the following regardless of length of stay: ECMO[a], assisted ventilation, exposure to ototoxic medications (gentamicin and tobramycin) or loop diuretics (furosemide/Lasix), and hyperbilirubinemia[19] that requires exchange transfusion.
4	In utero infections such as CMV[a], herpes, rubella, syphilis, and toxoplasmosis.
5	Craniofacial anomalies, including those that involve the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies.
6	Physical findings, such as white forelock, that are associated with a syndrome known to include a sensorineural or permanent conductive hearing loss.
7	Syndromes associated with hearing loss or progressive or late-onset hearing loss[a], such as neurofibromatosis, osteopetrosis, and Usher syndrome; other frequently identified syndromes include Waardenburg, Alport, Pendred, and Jervell and Lange-Nielson.
8	Neurodegenerative disorders[a], such as Hunter syndrome, or sensory motor neuropathies, such as Friedreich ataxia and Charcot-Marie-Tooth syndrome.
9	Culture-positive postnatal infections associated with sensorineural hearing loss[a], including confirmed bacterial and viral (especially herpes viruses and varicella) meningitis.
10	Head trauma, especially basal skull/temporal bone fracture[a] that requires hospitalization.
11	Chemotherapy[a].
12	Recurrent or persistent otitis media for at least 3 months.

Risk indicators that are marked with [a] are of greater concern for delayed onset hearing loss. ECMO indicates extracorporeal membrane oxygenation; CMV, cytomegalovirus.

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mentation of the skin, hair, or eyes also may be associated with hearing loss, as in Waardenburg syndrome. The presence of renal abnormalities (Alport syndrome), cardiac anomalies (prolonged QT interval in Jervell and Lange-Nielsen syndrome), and other syndromes should also prompt evaluation of hearing. Abnormalities of the eardrum should alert the physician to the possibility of hearing loss. Cerumen impactions can obscure the tympanic membrane, preventing an accurate examination, and may cause hearing loss. Dense cerumen impactions should be removed before diagnostic testing. A leading cause of acquired hearing loss is otitis media with effusion. Temporary hearing loss has been demonstrated during episodes of acute otitis media. The child with repeated or chronic otitis media with effusion is at high risk of acquired hearing loss and should undergo comprehensive hearing evaluation.[13,14] Key point 4: All providers of pediatric health care should be proficient with pneumatic otoscopy and tympanometry. However, it is important to remember that these methods do not assess hearing.

TOOLS FOR OBJECTIVE HEARING SCREENING

In addition to universal newborn hearing screening and regular surveillance of developmental milestones, auditory skills, parental concerns, and middle-ear status, objective screenings for hearing loss should be performed periodically on all infants and children in accordance with the schedule outlined in the AAP statement "Recommendations for Preventive Pediatric Health Care"[1] (Table 1). The technology used for hearing screening should be age appropriate. The child also should be comfortable with the testing situation; young children may need preparation. A variety of objective tools have been developed for screening tests. The choice of tool to use in screening depends on the child's age, degree of cooperation, and available resources. Screenings should be conducted in a quiet area where visual and auditory distractions are minimal. For children for whom screening is not possible because of developmental level, referral to a pediatric audiologist should be initiated for appropriate physiologic and/or behavioral audiological assessment. Various tests performed by audiologists are outlined in Table 5.

Tympanograms

Conductive hearing loss may be the most common cause of infant hearing screening failures.[15] Objective middle-ear assessment can best be performed by tympanometry. Tympanometry measures relative changes in tympanic membrane movement as air pressure is varied in the external auditory canal. Tympanograms (Fig 2) can most simply be classified as types A, B, and C depending on the curve shape relative to 0 as the pressure is changed (www.audiologyonline.com/askexpert/display_question.asp?question_id=451).

The presence of a type A, high-peaked tympanogram significantly decreases the probability that middle-ear effusion is the cause of hearing loss. A type B, flat tympanogram has the highest probability of the presence of middle-ear effusion or tympanic membrane perforation, which are both likely to cause some degree of hearing loss. A type C tympanogram, with a peak shifted toward negative pressure, has a low probability of middle-ear fluid and associated hearing loss. Type B and C tympanograms require clinical correlation and possibly further evaluation and treatment. Traditionally, tympanograms have been obtained by using low-frequency probe tones. These tones have been historically inaccurate for infants younger than 6 months. The use of a high-frequency probe tone (1000 Hz) was recently shown to be a better measure of middle-ear status in infants and young

TABLE 4 Developmental Milestones in the First 2 Years of Life

Milestone	Average Age of Attainment, mo	Developmental Implications
Gross motor		
Head steady in sitting	2.0	Allows more visual interaction
Pull to sit, no head lag	3.0	Muscle tone
Hands together in midline	3.0	Self-discovery
Asymmetric tonic neck reflex gone	4.0	Child can inspect hands in midline
Sits without support	6.0	Increasing exploration
Rolls back to stomach	6.5	Truncal flexion, risk of falls
Walks alone	12.0	Exploration, control of proximity to parents
Runs	16.0	Supervision more difficult
Fine motor		
Grasps rattle	3.5	Object use
Reaches for objects	4.0	Visuomotor coordination
Palmar grasp gone	4.0	Voluntary release
Transfers object hand to hand	5.5	Comparison of objects
Thumb-finger grasp	8.0	Able to explore small objects
Turns pages of book	12.0	Increasing autonomy during book time
Scribbles	13.0	Visuomotor coordination
Builds tower of 2 cubes	15.0	Uses objects in combination
Builds tower of 6 cubes	22.0	Requires visual, gross, and fine motor coordination
Communication and language		
Smiles in response to face, voice	1.5	Child more active social participant
Monosyllabic babble	6.0	Experimentation with sound, tactile sense
Inhibits to "no"	7.0	Response to tone (nonverbal)
Follows 1-step command with gesture	7.0	Nonverbal communication
Follows 1-step command without gesture (eg, "Give it to me")	10.0	Verbal receptive language
Speaks first real word	12.0	Beginning of labeling
Speaks 4–6 words	15.0	Acquisition of object and personal names
Speaks 10–15 words	18.0	Acquisition of object and personal names
Speaks 2-word sentences (eg, "Mommy shoe")	19.0	Beginning grammaticization, corresponds with vocabulary of ≥50 words
Cognitive		
Stares momentarily at spot where object disappeared (eg, yarn ball dropped)	2.0	Lack of object permanence (out of sight, out of mind)
Stares at own hand	4.0	Self-discovery, cause and effect
Bangs 2 cubes	8.0	Active comparison of objects
Uncovers toy (after seeing it hidden)	8.0	Object permanence
Egocentric pretend play (eg, pretends to drink from cup)	12.0	Beginning symbolic thought
Uses stick to reach toy	17.0	Able to link actions to solve problems
Pretend play with doll (gives doll bottle)	17.0	Symbolic thought

Modified from: Behrman RE, Jenson HB, Kliegman R, eds. *Nelson Textbook of Pediatrics*. 16th ed. Philadelphia, PA: Saunders; 2003.

children. These tympanograms are generally not classified as A, B, or C but rather as peak or no peak.

Evoked Otoacoustic Emissions

Evoked otoacoustic emissions (OAEs) are acoustic signals generated from within the cochlea that travel in a reverse direction through the middle-ear space and tympanic membrane out to the ear canal. These signals are generated in response to an auditory stimulus, either clicks or tone bursts. The signals may be detected with a very sensitive microphone/probe system placed in the external ear canal. The OAE test allows for individual ear assessment, can be performed quickly at any age, and does not depend on whether the child is asleep or awake. Mild degrees of motion artifact do not interfere with test results; however, screening results are frequently influenced by the presence of middle-ear pathologic abnormalities. The OAE test is an effective screening measure for middle-ear abnormalities and for moderate or more severe degrees of hearing loss, because normal OAE responses are not obtained if hearing thresholds are approximately 30- to 40-dB hearing levels or higher. The automated OAE screener provides a pass-fail report; no test interpretation by an audiologist is required. The OAE test does not further quantify hearing loss or hearing threshold level. The OAE test also does not assess the integrity of the neural transmission of sound from the eighth nerve to the brainstem and, therefore, will miss auditory neuropathy and other neuronal abnormalities. Infants with such abnormalities will have normal OAE test results but abnormal auditory brainstem response (ABR) test results. A "failed" OAE test only implies that a hearing loss of more than 30 to 40 dB may exist or that the middle-ear status is abnormal.

Automated ABR

One objective physiologic means of screening hearing is the automated ABR. This instrument measures cochlear response in the 1- to 4-kHz range with a broadband click stimulus in each ear. Many ABR screening instruments incorporate built-in artifact rejection for myogenic, electrical, and environmental noise interference, which ensures that data collection is halted if testing conditions are unfavorable. The automated screener provides a pass-fail report; no test interpretation by an audiologist is required. A "fail" report on an automated ABR implies a hearing level of worse than 40 dB. Automated ABR can test each ear individually and can be performed on children of any age. Motion artifacts interfere with test results. For this reason, the test

TABLE 5 Audiologic Tests for Infants and Children

Developmental Age of Child	Auditory Test/ Average Time	Type of Measurement	Test Procedures	Advantages	Limitations
All ages	Evoked OAEs/10-min test	Physiologic test specifically measuring cochlear (outer hair cell) response to presentation of a stimulus; stimuli may be clicks (transient evoked OAEs) or tone pairs (distortion product OAEs)	Small probe containing a sensitive microphone is placed in the ear canal for stimulus delivery and response detection	Ear-specific results; not dependent on whether patient is asleep or awake; quick test time; screening test	Infant or child must be relatively inactive during the test; not a comprehensive test of hearing, because it does not assess cortical processing of sound; OAEs are very sensitive to middle-ear effusions and cerumen or vernix in the ear canal
Birth to 9 mo	Automated ABR/15-min test	Electrophysiologic measurement of activity in auditory nerve and brainstem pathways	Placement of electrodes on child's head detects neurologic response to auditory stimuli presented through earphones or ear inserts 1 ear at a time	Ear-specific results; responses not dependent on patient cooperation; screening test	Infant or child must remain quiet during the test (sedation is often required); not a comprehensive test of hearing, because it does not assess cortical processing of sound
9 mo to 2.5 y	VRA/15- to 30-min test	Behavioral tests measuring responses of the child to speech and frequency-specific stimuli presented through speakers or insert earphones	Technique conditions the child to associate speech or frequency-specific stimuli with a reinforcer, such as a lighted toy or video clips; VRA requires a calibrated, sound-treated room	Assesses auditory perception of child; diagnostic test.	When performed with speakers, only assesses hearing of the better ear; not ear specific; if VRA is performed with insert, earphones can rule out a unilateral hearing loss
2.5 to 4 y	Play audiometry/ 15–30 min	Behavioral test of auditory thresholds in response to speech and frequency-specific stimuli presented through earphones and/ or bone vibrator	Child is conditioned to respond when stimulus tone is heard, such as to put a peg in a pegboard or drop a block in a box	Ear-specific results; assesses auditory perception of child; screening or diagnostic test.	Attention span of child may limit the amount of information obtained
4 y to adolescence	Conventional audiometry/ 15- to 30-min test	Behavioral test measuring auditory thresholds in response to speech and frequency-specific stimuli presented through earphones and/ or bone vibrator	Patient is instructed to raise his or her hand when stimulus is heard	Ear-specific results; assesses auditory perception of patient; screening or diagnostic test	Depends on the level of understanding and cooperation of the child
All ages	Diagnostic ABR	Electrophysiologic measurement of activity in auditory nerve and brainstem pathways	Placement of electrodes on child's head detects auditory stimuli presented through insert earphones 1 ear at a time	Ear-specific results; multiple frequencies are tested, creating a map of hearing loss similar to an audiogram; responses not dependent on patient cooperation; diagnostic test	Infant or child must remain quiet during the test (sedation is often required); not a true test of hearing, because it does not assess cortical processing of sound
All ages	Tympanometry	Relative change in middle-ear compliance as air pressure is varied in the external auditory canal	Small probe placed in the ear canal and pressure varied in the ear canal	Tests for possible middle-ear pathology and pressure-equalization tube function	Not a test of hearing; depends on ear canal seal; high-frequency tone probe needed for infants younger than 6 mo

Adapted with permission from: Bachmann KR, Arvedson JC. *Pediatr Rev.* 1998;19(5):155–165.

is performed best in infants and young children while they are sleeping. If the test cannot be performed because of motion artifact, sedation may be necessary. The ABR is currently used in many newborn screening programs.

ABR and OAEs are tests of auditory pathway structural integrity but are not true tests of hearing. Even if ABR or OAE test

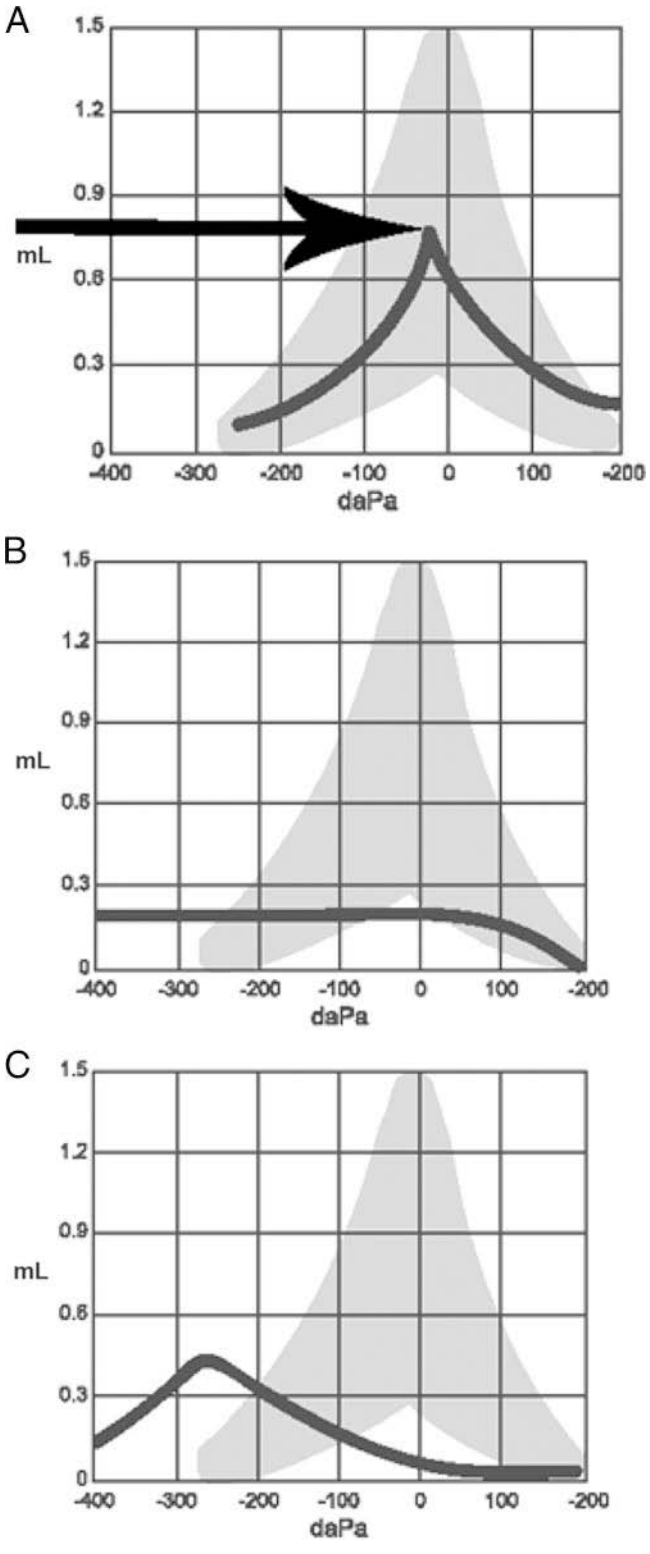

FIGURE 2
Tympanograms. Type A: normal. Type B: abnormal, needs medical attention. Type C, borderline normal; monitor; may need medical attention.

results are normal, hearing cannot be definitively considered normal until a child is mature enough for a reliable behavioral audiogram to be obtained. Behavioral pure-tone audiometry remains the standard for hearing evaluation. Hearing thresholds at specific frequencies can be determined, and the degree of hearing loss can be assigned. If there are distractions or the room is not sound treated, pure-tone audiometry in the office should be considered solely a screening test.

Play Audiometry

Children 2 to 4 years of age are screened or tested more appropriately by play audiometry. These children are conditioned to respond to an auditory stimulus through play activities, such as dropping a block when a sound is heard through earphones. Air-conduction hearing threshold levels of greater than 20 dB at any of these frequencies indicate possible hearing loss, and referral to a pediatric audiologist should be made.

Conventional Screening Audiometry

For children aged 4 years and older, conventional screening audiometry can be used. The child is asked to raise his or her hand when a sound is heard. The test should be performed in a quiet environment using earphones, because ambient noise can affect test performance significantly, especially at lower frequencies (ie, 500 and 1000 Hz). Each ear should be tested at 500, 1000, 2000, and 4000 Hz. Air-conduction hearing threshold levels of greater than 20 dB at any of these frequencies indicate possible hearing loss, and referral to a pediatric audiologist should be made.

If the child does not pass the screening, earphones should be removed and instructions carefully repeated to the child to ensure proper understanding and attention to the test and then rescreened with the earphones repositioned. A child whose repeat test shows hearing thresholds of greater than 20 dB at any of these frequencies, especially if there is no pathologic abnormality of the middle ear on physical

examination, should be referred for formal hearing testing. Key point 5: Developmental abnormalities, level of functioning, and behavioral problems (ie, autism/developmental delay) may preclude accurate results on routine audiometric screening and testing. In this situation, referral to an otorhinolaryngologist and a pediatric audiologist who has the necessary equipment and expertise to test infants and young children should be made (Table 5). Key point 6: The results of abnormal screening should be explained carefully to parents, and the child's medical record should be flagged to facilitate tracking and follow-up.

It is important to remember that a "fail" report on any 1 of a combination of tests warrants additional testing. It is also important to remember that failure of speech, language, and hearing screening assessments warrants additional testing (Tables 6–9).

TABLE 6 Ten Ways to Recognize Hearing Loss: Adolescents (11- to 21-Year Visits)

1.	Do you have a problem hearing over the telephone?
2.	Do you have trouble following the conversation when two or more people are talking at the same time?
3.	Do people complain that you turn the TV volume up too high?
4.	Do you have to strain to understand conversation?
5.	Do you have trouble hearing in a noisy background?
6.	Do you find yourself asking people to repeat themselves?
7.	Do many people you talk to seem to mumble (or not speak clearly)?
8.	Do you misunderstand what others are saying and respond inappropriately?
9.	Do you have trouble understanding the speech of women and children?
10.	Do people get annoyed because you misunderstand what they say?

Adapted from: National Institute on Deafness and Other Communication Disorders. *Ten Ways to Recognize Hearing Loss.* Bethesda, MD: National Institute of Health; 2006. NIH publication 01-4913. Available at: www.nidcd.nih.gov/health/hearing/10ways.asp.

Comprehensive Audiological Evaluation Using Physiologic and/or Behavioral Testing

The ABR test may be used as a diagnostic tool by audiologists for more definitive diagnosis of hearing loss. Usually performed in children in natural sleep up to approximately 3 to 6 months of age and then under sedation for older infants, diagnostic ABR can provide not only a general level of hearing but also frequency-specific hearing data. Diagnostic ABR is performed with different frequency tone bursts and across varying sound levels to effectively estimate an audiogram. Diagnostic ABR can also be performed with bone conduction to separate conductive from sensorineural hearing loss. Diagnostic ABR is often the definitive test used by audiologists in children and infants who are unable to cooperate with other methods of hearing testing. Audiologic evaluation using ABR or auditory steady-state response provides frequency-specific hearing thresholds by air and bone conduction in each ear separately. ABR is the gold standard for determination of hearing thresholds in infants younger than 6 months and in children who cannot be tested behaviorally.

Children as young as 6 to 24 months can be tested by means of visual reinforced audiometry (VRA). This technique conditions the child to associate speech or frequency-specific sound with a reinforcement stimulus such as a lighted toy or animated toy or video clips. VRA is performed by an audiologist with experience testing young children. This testing is not readily applied in screening programs, because infants younger than 6 months' developmental age cannot perform the task, and sound-treated rooms are needed. The results of VRA can approximate those of conventional audiometry.

Children with unilateral or mild hearing loss also should be evaluated further. Studies have shown such children to be similarly at risk of adverse communication skills as well as difficulties with social, emotional, and educational development.[16]

FOLLOW-UP AND DIAGNOSTIC TESTING

Key point 7: Any abnormal objective screening result requires audiology referral and definitive testing. Screening will only result in benefit for the patient if abnormal test results are confirmed and appropriate intervention is provided. Most studies that have evaluated the success rate of infant hearing screening programs have described a fairly high rate of failure to confirm a failed screen with definitive testing. A similar problem could also occur in screening older infants and children. Improving the physician's involvement not only in screening but also in arranging and confirming appropriate follow-up testing and intervention is necessary to achieve optimal speech, language, and hearing.

Key point 8: A failed infant hearing screening or a failed screening in an older child should always be confirmed by further testing. Audiologists may repeat the audiometric test as described above in a sound booth and using a variety of other tests. ABR can also be used for definitive testing of the auditory system. A diagnostic ABR is usually performed under sedation or general anesthesia in children aged approximately 3 to 6 months and older. The test is performed with frequency-specific stimuli and presentation levels to approximate hearing threshold levels. Diagnostic ABR provides information that is accurate enough to allow for therapeutic intervention. Hearing aids can be fitted with information obtained from a diagnostic ABR. Audiologic assessment and intervention is

TABLE 7 Developmental/Behavioral Screening Tools

Resource	Description	Age Range	Where to Find
General developmental screening tools			
Ages & Stages Questionnaire (ASQ)	A series of 19 questionnaires used to screen infants and young children for developmental delays during the first 5 y of life	4–60 mo	www.brookespublishing.com/tools/asq/index.htm
Ages & Stages Questionnaire: Social-Emotional (ASQ:SE)	A series of 19 questionnaires used to screen infants and young children at risk for social or emotional difficulties, to identify behaviors of concern to caregivers, and to identify any need for further assessment	6–60 mo	www.brookespublishing.com/tools/asqse/index.htm
Parents' Evaluation of Developmental Status (PEDS)	A method for detecting developmental and behavioral-emotional problems in children	Birth to 8 y	www.pedstest.com
Parents' Evaluation of Developmental Status-Developmental Milestones (PEDS:DM)	A collection of 6–8 items per age/encounter designed to replace informal milestones checklists with highly accurate items known to predict developmental status	Birth to 11 y	www.pedstest.com/dm
Autism-specific screening tools			
Checklist for Autism in Toddlers (CHAT)	A screening tool for early detection of autism	18 to ≥24 mo	www.autismresearchcentre.com/tests/chat_test.asp
Checklist for Autism in Toddlers (CHAT), Denver Modifications	CHAT scoring modifications	18 to ≥24 mo	
Checklist for Autism in Toddlers-23 (CHAT-23)	Combination of M-CHAT and CHAT items	16–86 mo	
Childhood Asperger Syndrome Test (CAST)	A parental questionnaire to screen for autism spectrum conditions	4–11 y	www.autismresearchcentre.com/tests/cast_test.asp
Modified Checklist for Autism in Toddlers (M-CHAT)	23-item scale pointing to express interest, responsiveness to name, interest in peers, showing behavior, response to joint attention, social imitation	16–48 mo	http://depts.washington.edu/dbpeds/Screening%20Tools/MCHAT.doc
Pervasive Developmental Disorders Screening Test-II, Primary Care Screener (PDDST-II PCS)	A parental questionnaire to screen for autism spectrum conditions	18–48 mo	www.pearson-uk.com/product.aspx?*n*=1315&skey=2960
Autism-specific or psychosocial screening tools			
Pediatric intake form from *Bright Futures*	Questionnaire to help gather a general understanding of the history, functioning, questions and concerns of the family	Birth to 21 y	www.brightfutures.org/mentalhealth/pdf/professionals/ped_intake_form.pdf
ADHD screening tools			
Vanderbilt rating forms	Parent- and teacher-completed forms that help a clinician diagnosis ADHD and to categorize the problem into 1 of its various subtypes	6–12 y	www.brightfutures.org/mentalhealth/pdf/professionals/bridges/adhd.pdf
AAP ADHD toolkit	A comprehensive toolkit developed from evidence-based guidelines for the diagnosis and treatment of children with ADHD; this resource toolkit contains a wide array of screening, diagnosis, treatment, and support materials for clinicians and other health care professionals	6–12 y	www.aap.org

ADHD indicates attention-deficit/hyperactivity disorder.

an ongoing process. The child requires regular audiologic reevaluations to determine if there is fluctuating or progressive hearing loss. Middle-ear monitoring is also essential. Hearing aid selection, fitting, verification, and validation require ongoing and regular visits with the audiologist. Candidacy for cochlear implantation should be considered when there is limited residual hearing or when progress with amplification is insufficient. Recommendations to the family regarding cochlear implantation should be based on a team evaluation that includes audiology, otology, psychology, speech-language pathology, and other intervention personnel.

Most providers of pediatric health care realize the importance of referring to an otolaryngologist, an audiologist, and a speech-language pathologist. Less recognized is the potential

TABLE 8 Guidelines for Children with Abnormal Speech Development

Age, mo	Referral Guidelines for Children With "Speech" Delay
12	No differentiated babbling or vocal imitation
18	No use of single words
24	Single-word vocabulary of ≤10 words
30	Fewer than 100 words; no evidence of 2-word combinations; unintelligible
36	Fewer than 200 words; no use of telegraphic sentences; clarity <50%
48	Fewer than 600 words; no use of single sentences; clarity ≤80%

Source: Matkin ND. *Pediatr Rev.* 1984;6:151.

TABLE 9 Guidelines for Children With Suspected Hearing Loss

Age, mo	Normal Development
0–4	Should startle to loud sounds, quiet to mother's voice, momentarily cease activity when sound is presented at a conversational level
5–6	Should correctly localize to sound presented in a horizontal plane, begin to imitate sounds in own speech repertoire or at least reciprocally vocalize with an adult
7–12	Should correctly localize to sound presented in any plane, should respond to name, even when spoken quietly
13–15	Should point toward an unexpected sound or to familiar objects or persons when asked
16–18	Should follow simple directions without gesture or other visual cues; can be trained to reach toward an interesting toy at midline when a sound is presented
19–24	Should point to body parts when asked; by 21 mo, can be trained to perform play audiometry

Source: Matkin ND. *Pediatr Rev.* 1984;6:151.

benefit of genetic and ophthalmologic evaluation of children and infants with sensorineural hearing loss.[17]

Especially in young infants and children, referral to an otolaryngologist for a complete diagnostic assessment is essential. More than 90% of the children with permanent hearing loss are born to "hearing" parents, resulting in a sense of urgency for parents of newly identified children with hearing loss to seek out answers regarding etiology, risk of progression, implications, and other questions. If children are indeed identified with sensorineural hearing loss, a variety of diagnostic tests can be recommended depending on the patient's history and physical examination. Otolaryngologists may play a role in diagnosis and treating middle-ear fluid or other middle-ear disorders as well as assisting in the definitive diagnosis of the cause of sensorineural hearing loss.[18] Diagnostic testing may include imaging of the temporal bone to identify structural defects; genetic tests, such as for abnormalities of the *Connexin* gene; and, occasionally, evaluation for other metabolic defects. Evaluation by a geneticist and genetic testing can be important for diagnosis as well as for providing the family with information for future planning purposes.

The hearing health care team (comprising the audiologist, otolaryngologist, teachers of the child with hearing impairment, speech-language pathologists, and other educational and medical personnel) should assist the family with intervention for hearing loss. Interventions may include observation with increased attention to speech and language development, hearing aids, auditory-assisted systems for the school environment, or more invasive surgical hearing devices such as cochlear implants or bone-anchored hearing aids. The goal is to provide families with appropriate options so that they may make well-informed decisions. Interventions should be driven by family desires and guided by accurate and timely information from all hearing-related health care professionals. Family goals and expectations are influenced by culture, parental education, level of income, availability of local resources, language in the home, and more. The role of the hearing health care team is to assist families in identifying all the options available to them and to support them throughout the ongoing decision-making processes that will occur throughout the child's development. All members of the hearing health care team, in conjunction with parents and on the basis of informed choice, should recognize that no decision regarding intervention is "final," and periodic opportunities should be identified for discussion regarding progress, alternative interventions, and new developments.

Medical follow-up includes ongoing evaluation and management of the adequacy of hearing rehabilitation; observation for potential complications of hearing rehabilitation, such as otitis externa and cerumen impactions; and monitoring for appropriate speech and language development.

Speech and language evaluation by a speech-language pathologist with training in working with children with hearing loss is also important for documentation of baseline speech and language skills and implementing a program of intervention that reflects the family's choice regarding language development.

At least one third of children with hearing loss will have an additional coexisting condition.[3] Because many causes of hearing loss are associated with abnormal ophthalmologic findings, formal ophthalmologic evaluation is appropriate, not only to assist with the diagnosis but also to optimize vision. A diagnosis of Usher syndrome with associated progressive hearing and vision loss may influence communication choices.

Children with hearing loss should also be monitored for developmental and behavioral problems (attention-deficit/hyperactivity disorder, autism, learning disabilities) and referred for

additional evaluation when necessary. Health care professionals can use screening tools to evaluate young children periodically for such concerns (Table 7) and refer for additional evaluation when concerns arise.

A medical professional should participate as an active member of a family's hearing health care team after diagnosis and provide input to assist in the adequacy of the rehabilitative efforts to monitor the child for progression and additional disabilities.

HEARING REFERRAL RESOURCES

Key point 9: Abnormal hearing test results require intervention and clinically appropriate referral, including otolaryngology, audiology, speech-language pathology, genetics, and early intervention. Pediatric health care professionals should maintain a list of referral resources available in their community for children with hearing loss and should advocate for increasing options and choices for families. Otolaryngologists, audiologists, and speech-language pathologists with special training and experience in treating children should be consulted for specific diagnosis, counseling, and treatment. Pediatric health care professionals should collaborate to refer the child for comprehensive educational counseling and treatment services. Communication among professionals caring for a child with hearing loss is essential to ensure appropriate case management.

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Medical Position Statement: The North American Society for Pediatric Gastroenterology and Nutrition

Helicobacter pylori Infection in Children: Recommendations for Diagnosis and Treatment

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Helicobacter pylori infects at least 50% of the worldôs human population (1). However, most individuals infected with *H. pylori* do not experience symptoms or have signs of recognizable disease. In most children, the presence of *H. pylori* infection does not lead to clinically apparent disease, even when the organism colonizing the gastric mucosa causes chronic active gastritis (2). Knowledge about *H. pylori* infection is evolving, particularly in the pediatric age group for which there are still large gaps in knowledge.

Additional multicenter, randomized, placebo-controlled treatment trials in children infected by *H. pylori* are critically needed to definitively characterize the effect of *H. pylori* eradication treatment during childhood on symptoms and gastroduodenal mucosal disease.

There is compelling evidence that this organism is associated with a significant proportion of duodenal ulcers and, to a lesser extent, with gastric ulcers in children (3). There are epidemiologic data linking chronic *H. pylori* infection, probably beginning in childhood, with the development of gastric adenocarcinoma and gastric lymphoma (4). Findings in recently reported animal models support the role of *H. pylori* in the pathogenesis of gastric cancers (5).

There are many studies describing the prevalence of *H. pylori* infection. Most epidemiologic studies of *H. pylori* infection have been performed in adults who had been infected for many years before clinical symptoms appeared (6). The incidence of *H. pylori* infection in industrialized countries is estimated to be approximately 0.5% of the susceptible population per year. In contrast, there is a significantly higher estimated incidence of *H. pylori* infection in developing countries of approximately 3% to 10% per year (7). The limited data on the incidence of *H. pylori* infection in children consist largely of retrospective seroprevalence studies.

Humans appear to be the primary natural reservoir of *H. pylori* infection. Other reservoirs that have been proposed include water, domestic cats, and houseflies (8ï 10). The risk factors described for acquiring infection include residence in a developing country, poor socioeconomic conditions, family overcrowding, and possibly an ethnic or genetic predisposition. In North America, the prevalence rates of *H. pylori* among Asian-Americans, African-Americans and Hispanics are similar to those of residents of developing countries (11). The route of transmission of *H. pylori* in humans is not known but is postulated to be fecal-oral, gastric-oral (in vomitus), or oral-oral (12).

Although *H. pylori* infection may be acquired during childhood, there are limited guidelines regarding its diagnosis and treatment in children and adolescents. Such evidence-based consensus guidelines are needed for both primary care and specialty medical providers to ensure judicious use of diagnostic testing and appropriate therapeutic regimens for the management of children with *H. pylori* infection. Therefore, the North American Society for Pediatric Gastroenterology and Nutrition (NASPGN) appointed the *Helicobacter pylori* Infection Guideline Committee to develop a clinical practice guideline for the child with *H. pylori* infection.

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These clinical practice guidelines are designed to assist primary care physicians, nurse practitioners, physician assistants, and pediatric gastroenterologists in the evaluation and treatment of suspected or diagnosed *H. pylori*ï associated disease. The desired outcomes of these recommendations are the detection of children and adolescents with *H. pylori* who need treatment. These recommendations are applicable to children in developed countries where the prevalence of infection is low but may not be directly relevant to children living in communities where there is a higher frequency of gastric colonization by *H. pylori*. These recommendations have been endorsed by the Executive Council of NASPGN and by the American Academy of Pediatrics. They are general guidelines to assist medical care providers in the diagnosis and treatment of *H. pylori* infection in children. They are not intended as a substitute for clinical judgment or as a protocol for the management of all patients.

In its deliberations, the committee addressed four issues about *H. pylori* infection in children: How reliable are tests to detect *H. pylori*? When is testing for *H. pylori* indicated? When is treatment of *H. pylori* infection indicated? What is the preferred treatment of *H. pylori*? A summary of the recommendations of the *H. pylori* Infection Guideline Committee is presented in Table 1.

METHODS

The *H. pylori* Infection Guideline Committee consisted of a primary care pediatrician, a clinical epidemiologist, and seven pediatric gastroenterologists. To develop evidence-based guidelines, articles published in English from January 1966 through May 1999 on *H. pylori* in children were searched. Articles on diagnosis and treatment were sought separately. Letters, editorials, case reports, abstracts, and reviews were excluded. Evidence tables were prepared based on 16 articles on clinical presentation, 9 articles on diagnostic studies, and 30 articles on therapy. Subsequently, additional articles were identified and reviewed. When the pediatric literature was insufficient, the adult literature was also considered. Articles were evaluated using published criteria (13). The Committee based its recommendations on an integration of a review of the medical literature and expert opinion. Consensus was achieved by using the nominal group technique, a structured quantitative method, as described previously (14,15). By using the methods of the Canadian Preventive Services Task Force (16), the quality of evidence of each of the recommendations made by the committee was determined and is summarized (Table 1).

HOW RELIABLE ARE TESTS FOR *H. PYLORI* INFECTION?

Several invasive and noninvasive tests are available to detect *H. pylori* infection (Table 2). An ideal test for *H. pylori* is noninvasive or minimally invasive, highly accurate, inexpensive, and readily available and enables differentiation between active or past infection with the

TABLE 1. *Summary of recommendations and the quality of the supporting evidence*

Recommendations	Quality of evidence[a]
How reliable are tests for *H. pylori* infection?	
Currently, the diagnosis of *H. pylori*-mediated disease can be made reliably only through the use of endoscopy with biopsy.	II, III
Presently available commercial serologic tests are frequently unreliable for screening children for the presence of *H. pylori* infection.	II
Urea breath testing, although promising, has not been studied sufficiently in children.	II
When is testing indicated?	
It is recommended that testing be performed in children with endoscopically diagnosed, or radiographically definitive, duodenal or gastric ulcers.	I
It is recommended that children with recurrent abdominal pain, in the absence of documented ulcer disease, not be tested for *H. pylori* infection.	II
Testing for *H. pylori* infection is not recommended in asymptomatic children.	II
Routine screening of children with a family history of gastric cancer or recurrent peptic ulcer disease is not recommended.	II
Testing following treatment of documented *H. pylori* is recommended, especially with complicated peptic ulcer disease (i.e., bleeding, perforation, or obstruction). For patients who remain symptomatic after treatment, it is recommended that endoscopy and biopsy be performed to evaluate for the persistence of *H. pylori*-associated peptic ulcer disease.	I, II
If pathological evidence of MALT lymphoma is documented, then testing for *H. pylori* is recommended.	II
When is treatment of *H. pylori* infection indicated?	
Eradication treatment is recommended for children who have a duodenal ulcer or gastric ulcer identified at endoscopy and *H. pylori* detected on histology.	I
A prior history of documented duodenal or gastric ulcer disease is an indication for treatment if active *H. pylori* infection is documented.	I
There is no compelling evidence for treating children with *H. pylori* infection and non-ulcer dyspepsia or functional recurrent abdominal pain.	III
Treatment is not recommended for *H. pylori*-infected children residing in chronic care facilities; children with unexplained short stature; or children at increased risk for acquisition of infection, including asymptomatic children who have a family member with either peptic ulcer disease or gastric cancer.	III
What is the preferred treatment of *H. pylori* infections in children?	
It is recommended that treatment consist of three or four medications, given once or twice daily, for one to two weeks.	I

[a] Categories of the quallity of evidence: I Evidence obtained from at least one properly designed randomized controlled study. II-1 Evidence obtained from well-designed cohort or case-controlled trials without randomization. II-2 Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group. II-3 Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940ôs) could also be regarded as this type of evidence. III Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

TABLE 2. *Tests for* Helicobacter pylori *and* Helicobacter-*related disorders*

Invasive tests requiring endoscopy
Biopsies and histology
Rapid urease testing
Bacterial culture
Polymerase chain reaction of bacterial DNA
Non-invasive tests
Serum and whole blood antibody
Saliva antibody
Urine antibody
Stool antigen
Urea breath testing

organism. In addition, such a test enables discrimination between the presence of *H. pylori* infection and *H. pylori*ï associated disease. Because no such ideal test currently exists, the advantages and drawbacks of tests that are available require critical appraisal and must be assessed for their suitability for use in children.

Failure to reach an accurate diagnosis carries considerable financial and social costs including the expense of more tests, repeated visits to health care providers, inappropriate treatment, and missed school or work. A definitive test, even if it is expensive, may result in overall cost savings (17).

It is important to emphasize that the accuracy of a diagnostic test is greatly impacted by the prevalence of *H. pylori* in the population tested. There is a need for studies to assess the accuracy and potential utility of various noninvasive diagnostic tests in populations in North America that differ in demographic factors that may influence the prevalence and natural history of *H. pylori* infection (18).

Invasive Testing Through Endoscopy

Biopsies and Histopathology

The definitive diagnosis of *H. pylori* and the evidence of the consequences of infection can be made reliably only by endoscopy with multiple biopsy specimens obtained in one or more regions of the stomach including antrum, body, and transition zones (i.e., cardia and incisura). Histology provides information regarding the presence of *H. pylori* and the severity and topographic distribution of gastritis including the presence of atrophic gastritis, intestinal metaplasia, and mucosa-associated lymphoid tissue (MALT) lymphoma (3). As in adults, biopsy specimens obtained in the prepyloric antrum have the highest yield in *H. pylori* infection. Tissue specimens often are also obtained from the body and the transition zones of the stomach, particularly if the patient has recently taken acid-suppressing medication (19). It is recommended that multiple biopsies be performed in children with endoscopically documented peptic ulcer disease or peptic ulcer suspected as a result of radiographic study. The optimal staining of biopsy sections is best determined by local expert pathologists. Endoscopic examination of and specimens obtained in the esophagus, stomach, and duodenum also provide information about other upper gastrointestinal disorders that may be the cause of clinical symptoms including, for example, esophagitis and peptic ulcer disease that is not due to *H. pylori*.

There are drawbacks to diagnostic gastrointestinal endoscopy. It is a relatively invasive procedure requiring sedation or anesthesia. Furthermore, the test remains relatively expensive in many centers, and access to an endoscopist with specific pediatric expertise is limited in many geographic areas.

Rapid Urease Testing of Biopsy Tissues

Urease testing (CLO, TriMed, Kansas City, MO; *Hp*-Fast, GI Supply, Division of ChekMed Systems Inc., Camphill, PA; PyloriTek, Horizons International, Aguadilla, Puerto Rico) provides indirect identification of *H. pylori* infection within a few hours of endoscopy (20). However, these tests have a poor positive predictive value (as low as 50%) in children, even though the negative predictive value is high (97ï 98%) (20,21). The accuracy of the test is dependent on the number of tissue specimens tested, the location of biopsy sites, bacterial load, and previous usage of antibiotics and proton pump inhibitors, as well as the prevalence of *H. pylori* in the population tested.

Bacterial Culture

Culture of *H. pylori* from the gastric mucosa provides an opportunity to obtain a profile of antibiotic sensitivity that could identify potential treatment failure due to antibiotic resistance (22). Culture also provides a bacterial strain for use in epidemiologic studies to examine associations of virulence characteristics with disease outcome. However, bacterial culture for *H. pylori* is relatively expensive and success rates for recovery of the organism in many clinical laboratories are low (23). Currently, standardization of culture procedures has not been established, and bacterial cultures are only obtained routinely in research settings.

Polymerase Chain Reaction

Polymerase chain reaction (PCR) is a highly sensitive technique that can be used to detect the presence of *H. pylori* in body fluids (e.g., gastric juice and stool), tissues (e.g., gastric mucosa), and water (24). Testing of *H. pylori* genomic DNA by PCR can be used to advance knowledge at the molecular levelð for example, by providing information about point mutations conferring resistance to antibiotics and about putative bacterial virulence factors. However, PCR is expensive, the assay

is difficult to set up, specificity may be compromised by inadvertent contamination, and it is not widely available outside the research laboratory.

Noninvasive Testing

Immunoassay Tests to Detect H. pylori *Antibodies*

Enzyme-linked immunosorbent assays (ELISAs) to detect *H. pylori* antibodies are relatively inexpensive and easy to implement in the clinical setting. Many tests are available for use to test whole blood, plasma, or serum. However, compared with histology, the sensitivity and specificity of serologic assays are poor in both adults and children unless used in the populations in which they were initially developed (25). In general, the accuracy of serum-based immunoassays and whole-blood tests for use in the physicianôs office in symptomatic children in developed countries is poor, with a range of sensitivity of only 60% to 70% (26ï 28). Furthermore, age-related cutoff values for commercial immunologic tests have not been established for children. One immunoassay developed in a research center to detect *H. pylorii* specific immunoglobulin (Ig)G in children was 91% sensitive compared with sensitivity of less than 70% in three commercially available assays (28). In areas with low prevalence of *H. pylori* infection, such as in developed countries, testing of serum and whole blood is not sufficiently accurate to diagnose *H. pylori* infection in children. Accordingly, treatment regimens based on the results of these tests cannot be recommended. Serologic tests may not be used reliably to verify eradication of *H. pylori*, because antibody titers can remain positive for months, despite resolution of infection.

Saliva and Urine Tests for H. pylori *Antibodies*

Similar to serologic tests, saliva-based tests also detect the presence of *H. pylorii* specific IgG antibodies. The tests are easy to perform, painless, and inexpensive. Saliva tests are less sensitive than assays of serum or whole blood (29). The protein concentration of saliva appears to affect the accuracy of test results. Urine-based assays are easy to perform, require minimal labor for collection, and are painless (30). However, these assays are highly variable and are not yet commercially available. Therefore, saliva and urine assays for the detection of *H. pylori* antibodies cannot be recommended.

Stool Test for H. pylori *Antigens*

Testing of *H. pylori* antigens in stools has shown promising results in adults for the noninvasive diagnosis of gastric infection using a commercially available kit (31). Testing for *H. pylori* antigens in feces also appears to be accurate for use in monitoring the success of eradication therapy. However, patients may be reluctant to collect stool specimens. In addition, refrigerated stools are more difficult to test. Additional pediatric studies evaluating the accuracy of stool antigen testing for both initial diagnosis and posttreatment follow-up are required before specific recommendations can be considered (32).

Urea Breath Testing

Urea breath tests are noninvasive and have high sensitivity and specificity (>95%) both in adults (33) and children (34,35). The test requires the ingestion of either radiolabeled ^{14}C-urea or urea tagged with the stable isotope ^{13}C. Test results may be influenced by concurrent use of antibiotics and acid-suppressing medications and by the presence of other urease-producing organisms present in the oral cavity. Test parameters are currently laboratory-specific (e.g., dosages for differing ages of children, cutoff values, duration of fasting, use of a test meal, times of sampling, and timing of posttherapy testing) and have not been well standardized for children (36). In addition, urea breath testing is technically more difficult to perform in small children and infants, with failure rates in collection up to 10%, especially outside the clinical research setting (34).

In summary, the diagnosis of *H. pylorii* associated diseases currently can be made reliably only by endoscopy with biopsies. The most commonly used noninvasive test to screen adults for *H. pylori* infection is serology. Unfortunately, currently available commercial serologic tests are frequently unreliable for screening children for the presence of *H. pylori* infection. Current whole-blood, saliva, and urinary immunoassays are insufficiently sensitive or specific to be effective as diagnostic tools. Insufficient data are available in children to confirm the accuracy of the recently approved *H. pylori* stool antigen test. The urea breath test has the promise to provide noninvasive and accurate diagnosis of *H. pylori* infection; but currently, there is insufficient evidence that it can be used to reliably diagnose or exclude *H. pylorii* associated diseases.

WHEN IS TESTING INDICATED?

The primary goal of testing is to diagnose the cause of clinical symptoms and not simply to detect the presence of *H. pylori* infection. Testing is not helpful unless it will alter the management of the disease.

A variety of invasive and noninvasive tests exist for the detection of *H. pylori* infection, but their degree of sensitivity and specificity vary, as do their suitability for clinical use in children. Thus, there is potential for inappropriate testing or misuse of tests in children.

Endoscopically Diagnosed or Radiographically Definitive Peptic Ulcer

The causal relationship between *H. pylori* infection and primary duodenal ulcers is compelling (37). Therefore, it is recommended that testing for the presence of *H. pylori* infection be performed in children with endoscopically diagnosed or radiographically definitive duodenal ulcer. Although the data in children are less complete, evidence from studies in adults (38) supports the recommendation that testing for *H. pylori* also be performed in subjects with a documented gastric ulcer.

Abdominal Pain Unrelated to Peptic Ulcers

Several lines of evidence, including serologic surveys, endoscopic evaluations, and treatment trials indicate that *H. pylori* is not a frequent cause of recurrent abdominal pain in children. There have been six studies performed in North America, Europe, and Australia, with 2715 children evaluated by esophagogastroduodenoscopy and biopsy, serology, or urea breath test (39ï 44). Although 5% to 17% of children with abdominal pain had evidence of infection with *H. pylori*, 5% to 29% of children without abdominal pain were also infected with *H. pylori*. There are no convincing data to support routine testing of children with recurrent abdominal pain (39ï 45). Investigators have also looked for specific symptom patterns in *H. pylori*ï infected children, but none so far has been detected (46ï 50). Future studies are needed to determine whether subsets of children with abdominal pain can be identified in whom signs and symptoms are caused by *H. pylori* infection. It is recommended that children with recurrent abdominal pain, in the absence of documented ulcer disease, not be tested for *H. pylori* infection.

Asymptomatic Children, Including Those at Increased Risk of Acquiring *H. pylori* Infection

There are no compelling data to support routine testing in asymptomatic children. Testing for *H. pylori* infection is not recommended in children without clinical symptoms, including those residing in long-term care facilities, children with short stature, and those at increased risk of acquiring *H. pylori* infection. In addition, purported extraintestinal manifestations of *H. pylori* infection have not been demonstrated in a convincing fashion (51). Accordingly, a test-and-treat approach is not recommended in these circumstances.

Family History of Gastric Cancer or Recurrent Peptic Ulcer Disease

No currently available data support routine testing in children with a positive family history of diseases related to *H. pylori* infection (52). Epidemiologic evidence indicates that there is a link between gastric cancers (both adenocarcinoma and lymphoma) and *H. pylori* infection. However, no studies have shown that *H. pylori* eradication during childhood prevents subsequent development of gastric malignancies. Until evidence is available to better define the role of *H. pylori* in a variety of gastric cancers and the role of *H. pylori* eradication in disease prevention, routine screening of children with a family history of gastric cancer or recurrent peptic ulcer disease is not recommended.

Histologic Evidence of Lymphoma

In the rare circumstance in which histopathologic evidence of MALT lymphoma is documented in a child, testing for *H. pylori* is recommended.

Follow-up of Therapy for *H. pylori* Infection

Testing to confirm eradication of infection and the resolution of associated symptoms and disease sequelae is advisable in selected children. Guidelines in adults recommend testing after treatment of complicated peptic ulcer (52), but studies in children are limited. As such, few data are available on the effectiveness of therapy in children, testing after treatment is recommended in those with complicated peptic ulcer disease (i.e., bleeding, perforation, or obstruction) or lymphoma. For patients who remain symptomatic, it is recommended that endoscopy and biopsy be performed to evaluate for the persistence of *H. pylori*-associated peptic ulcer disease. For patients with an uncomplicated ulcer who are asymptomatic after completion of eradication therapy, testing for persistence of infection is not necessary. However, some physicians advocate the use of urea breath testing in this clinical setting.

WHEN IS TREATMENT OF *H. PYLORI* INFECTION INDICATED?

Eradication therapy is recommended for children who have both known active *H. pylori* infection and symptomatic gastrointestinal disease. Known active *H. pylori* infection is defined as identification of the organisms by histopathologic examination or as a positive culture from endoscopic gastric biopsy. Serology is not a reliable test for active disease, because it may indicate past but not current infection with *H. pylori*.

There are no randomized controlled trials in children that determine the precise clinical settings in which eradication therapy is indicated. Although additional studies in children are needed (53), the available evidence supports the following recommendations.

Duodenal and Gastric Ulcers

Eradication treatment is recommended for children who have a duodenal ulcer or gastric ulcer identified at endoscopy and *H. pylori* documented by histopathology. A prior history of duodenal or gastric ulcer disease is also an indication for treatment if active *H. pylori* infection is documented. If a definitive ulcer is present on contrast radiography (e.g., an ulcer crater is present), eradication therapy is indicated if either a noninvasive or invasive test result is positive for *H. pylori*.

Lymphoma

The rare child with pathologic evidence of MALT lymphoma and *H. pylori* infection should be treated with eradication therapy. Further studies of pediatric patients with lymphoma should be performed to monitor the recurrence, progression, or remission of the tumor after therapy.

Atrophic Gastritis With Intestinal Metaplasia

Eradication treatment is recommended for the rare child who has pathologically proven atrophic gastritis with intestinal metaplasia, according to the updated Sydney classification of gastritis (54), plus coexisting *H. pylori* infection. Because of the preneoplastic nature of these pathologic changes, follow-up endoscopy is recommended to confirm that the *H. pylori* infection has been eradicated and to ensure that there is no subsequent progression of gastric mucosal disease.

Gastritis Without Peptic Ulcer Disease

The finding of *H. pylori*ï associated gastritis in the absence of peptic ulcer disease during diagnostic endoscopy poses a dilemma for the endoscopist. The decision to treat *H. pylori*ï associated gastritis without duodenal or gastric ulcer in this situation is subject to the judgment of the clinician and deliberations with the patient and family. Studies in adults on the effect of eradication treatment on abdominal symptoms have produced conflicting results (55ï 58). There are no randomized controlled trials in children. The long-term impact of the eradication of *H. pylori* and the healing of gastritis on the subsequent development of peptic ulcer disease, adenocarcinoma, or lymphoma is uncertain. Although there is a small lifetime risk of development of peptic ulcer disease associated with *H. pylori* gastritis, there are no randomized controlled trials demonstrating that eradication of *H. pylori* results in prevention of peptic ulcer disease. In addition, there are no data showing that eradication therapy influences the long-term risk for development of gastric cancers. Antibiotic treatment can result in adverse drug reactions, promote antibiotic resistance, and increase the cost of care. Therefore, the *H. pylori* Infection Guideline Committee concludes that there is insufficient evidence to support either initiating or withholding eradication treatment in this situation.

Recurrent Abdominal Pain and Asymptomatic Children

There is no compelling evidence, at the present time, for treating children with *H. pylori* infection and either nonulcer dyspepsia or functional recurrent abdominal pain. There is also no convincing evidence currently available that asymptomatic children who have a family member with *H. pylori* infection, peptic ulcer, or gastric cancer need treatment.

WHAT IS THE PREFERRED TREATMENT OF *H. PYLORI* INFECTION IN CHILDREN?

The optimum treatment regimen for eradicating *H. pylori* in children has not been determined (59). Effective therapy in adults is defined as successful eradication of *H. pylori* infection in a minimum of 80% of treated subjects (60). Although it appears that treatment options that have been effective in adults will also be efficacious in children, controlled studies in pediatric populations are needed to confirm or refute this supposition. Unfortunately, the limited data currently available in children are open-label, case series and uncontrolled, anecdotal observations that do not meet the minimum criteria for determining efficacy. In vitro sensitivity of *H. pylori* to a specific drug does not guarantee that the bacterium will be effectively eradicated from the human stomach. Therefore, current treatment strategies to eradicate *H. pylori* have been developed primarily by trial-and-error methodology (61).

The single most important determinant of successful eradication therapy is compliance with the prescribed combination treatment regimen (62). There are well-described treatment failures due to suboptimal compliance. To enhance adherence to the treatment regimen, the number of medications prescribed, the frequency of administration, and the duration of therapy are best kept to the minimum required for successful treatment.

It is recommended that initial treatment consist of three medications, administered twice daily, for 1 to 2 weeks (63). Specifically, as shown in Table 3, three first-line therapy options are recommended for use in children and adolescents. For patients in whom initial treatment has failed, two other options are recommended, including one option with four medications. It is recommended that monotherapy and two-drug regimens be avoided, because they are ineffective and increase the likelihood

TABLE 3. *Recommended eradication therapies for* H. pylori *disease in children*

First-line options	Medications	Dosage
1	amoxicillin	50 mg/kg/day up to 1 g bid
	clarithromycin	15 mg/kg/day up to 500 mg bid
	proton pump inhibitor: omeprazole (or comparable acid inhibitory doses of another PPI)	1 mg/kg/day up to 20 mg bid
2	amoxicillin	50 mg/kg/day up to 1 g bid
	metronidazole	20 mg/kg/dayï 500 mg bid
	proton pump inhibitor: omeprazole (or comparable acid inhibitory doses of another PPI)	1 mg/kg/day up to 20 mg bid
3	clarithromycin	15 mg/kg/day up to 500 mg bid
	metronidazole	20 mg/kg/day up to 500 mg bid
	proton pump inhibitor: omeprazole (or comparable acid inhibitory doses of another PPI)	1 mg/kg/day up to 20 mg bid
Second-line options		
4	bismuth subsalicylate	1 tablet (262 mg) qid *or* 15 ml (17.6 mg/mL qid)
	metronidazole	20 mg/kg/dayï 500 mg bid
	proteon pump inhibitor: omeprazole (or comparable acid inhibitory doses of another PPI)	1 mg/kg/day up to 20 mg bid
	pus, an additional antibiotic: amoxicillin	50 mg/kg/day up to 1 g bid
	or tetracycline[a]	50 mg/kg/day up to 1 g bid
	or clarithromycin	15 mg/kg/dayï 500 mg bid
5	ranitidine bismuth-citrate	1 tablet qid
	clarithromycin	15 mg/kg/dayï 500 mg bid
	metronidazole	20 mg/kg/dayï 500 mg bid

Initial treatment should be provided in a twice daily regimen (to enhance compliance) for 7 to 14 days.

[a] Only for children 12 years of age or older.

bid, twice daily; qid, four times daily.

of acquired antibiotic resistance (64). Primary antimicrobial resistance also can result in treatment failure even when a three- or four-drug regimen is used. Resistance of *H. pylori* to nitroimidazoles causes an increase in the rate of treatment failures in regimens using metronidazole. An increasing prevalence of resistance to clarithromycin, documented in the past few years, particularly in Europe, could eventually impair the therapeutic effectiveness of this antibiotic in *H. pylori* treatment regimens. Results in some studies suggest that prior therapy with a proton pump inhibitor also reduces the effectiveness of eradication treatment protocols. Studies are needed to determine the relative importance of these risk factors in pediatric populations.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

George J. Cohen, MD, and the Committee on Psychosocial Aspects of Child and Family Health

Helping Children and Families Deal With Divorce and Separation

ABSTRACT. More than 1 million children each year experience their parents' divorce. For these children and their parents, this process can be emotionally traumatic from the beginning of parental disagreement and rancor, through the divorce, and often for many years thereafter. Pediatricians are encouraged to be aware of behavioral changes in their patients that might be signals of family dysfunction so they can help parents and children understand and deal more positively with the issue. Age-appropriate explanation and counseling is important so children realize that they are not the cause of, and cannot be the cure for, the divorce. Pediatricians can offer families guidance in dealing with their children through the troubled time as well as appropriate lists of reading material and, if indicated, can refer them to professionals with expertise in the emotional, social, and legal aspects of divorce and its aftermath.

INTRODUCTION

Each year, more than 1 million children experience the divorce of their parents. In 1995, less than 60% of US children were living with both biologic parents, almost 25% were living with their mother only, approximately 4% were living with their father only, and the rest were living with stepfamilies, adoptive families, or foster families (including other relatives). It is estimated that there are 500 000 new divorced fathers each year. Divorce rates peaked in 1979–1981 at 5.3 per 1000 persons and decreased by 1995 to 4.4 per 1000 persons. Approximately 50% of first marriages and 60% of second marriages end in divorce.[1,2]

Divorce and separation may be solutions to a discordant marriage, and any decrease in intrafamily hostility may be constructive; however, for many children and their parents, tensions continue and the entire divorce process is a long, searing experience. Divorce is the termination of the family unit, and thus, it is often characterized by painful losses.[3] Approximately half of all children do not see their fathers after divorce, and relatively few have spent a night in their fathers' homes in the past month.[4]

The divorce itself is usually not the first major change in the affected child's life. Parental conflict before the separation often leads to internalizing and externalizing behavior problems, even in preschoolers.[5] Children's sense of loss is ongoing and may increase, especially on holidays, birthdays, and special school events and when trying to integrate new family relationships. Other losses for the child or adolescent relate to changes in home, extended family, school, playmates, financial status, and parental work schedules.[6,7]

Up to half of children show a symptomatic response during the first year after their parents divorce. Risk factors for continuing childhood difficulty include ongoing parental discord, maternal depression, psychiatric disorders in either parent, and poverty.[5,7–10] Long-term follow-up studies indicate that divorce may limit or delay children's capacity for intimacy and commitment as young adults.[11–13]

CHILDREN'S REACTIONS

The clinical manifestations of divorce in children depend on many variables, including the child's age; the predivorce level of the family's psychosocial functioning; the parents' ability in the midst of their own anger, loss, and discomfort to focus on their child's feelings and needs; and the child's temperament and temperamental fit of parents with their children.[5,10,14,15]

- Infants and children younger than 3 years may reflect their caregivers' distress, grief, and preoccupation; they often show irritability, increased crying, fearfulness, separation anxiety, sleep and gastrointestinal problems, aggression, and developmental regression.[8,14,16]
- At 4 to 5 years of age, children often blame themselves for the breakup and parental unhappiness, become more clingy, show externalizing behavior (acting out), misperceive the events of the divorce situation, fear that they will be abandoned, and have more nightmares and fantasies.[10,17]
- School-aged children may be moody or preoccupied; show more aggression, temper, and acting-out behavior; seem uncomfortable with gender identity; and feel rejected and deceived by the absent parent. School performance may decrease, and they may agonize about their divided loyalties and feel that they should be punished.[9,10,14,16]

- Adolescents may feel decreased self-esteem and may develop premature emotional autonomy to deal with negative feelings about the divorce and their deidealization of each parent. Their anger and confusion often lead to relationship problems, substance abuse, decreased school performance, inappropriate sexual behavior, depression, and aggressive and delinquent behavior.[18–20]
- At all ages, children frequently have psychosomatic symptoms as a response to anger, loss, grief, feeling unloved, and other stressors. They may try to play 1 parent against the other because they need to feel in control and test rules and limits. However, they are likely to feel guilty and responsible for the separation and feel that they should try to restore the marriage.

PARENTS' REACTIONS

Parents also suffer detrimental effects from divorce and manifest a variety of negative and uncomfortable reactions. Mothers are likely to react to daily stressors as well as untoward major events; to consume more alcohol; to use more mental health services for depression, anxiety, or feelings of humiliation; and to feel overwhelmed and less capable as parents. Fathers often feel pushed away, are likely to seem less accepting of their children, and also may develop depression, anxiety, and substance abuse. Grandparents as well often perceive a decreased quality of relationship with their grandchildren, with custody arrangements being more influential in determining visiting schedules than is geographic distance.[10,18,21–25]

MODIFYING FACTORS

Although divorce may be associated with a variety of negative reactions in all members of the family, protective and risk factors have been identified. Predivorce parental rancor, along with children's misunderstanding of the significant changes in their lives and their feelings of guilt for the separation, are likely to lead to greater emotional difficulties. Poor education, poverty, and parents' mental health problems may be more important negative factors than the separation itself. Inconsistent discipline, the child's sense of vulnerability, and rejection by a parent are likely to cause adjustment problems, particularly in children with difficult temperament traits, such as low emotionality or high impulsivity. Factors that lead to better outcomes include positive child temperament and an optimistic view of the future, consistent parental discipline, parental acceptance and warmth, and maintenance of as normal a routine as possible.[5,8,10,17,18,24,26–29]

THE PEDIATRICIAN'S ROLE

Prevention

Pediatricians may only be able to learn about divorce or separation from the children's behavioral changes, family moves, and changes in family financial responsibility. Inquiring about family stressors, including marital difficulties, can be a routine part of the pediatric health supervision visit. When pediatricians counsel the family regarding issues of child development and behavior, areas of marital discord or stress are often uncovered. Addressing these stressors directly or referring for marital counseling is appropriate and may preserve the marital relationship. Pediatricians must consider their own attitudes and ethical positions concerning divorce, especially if they have experienced divorce in their own families, and they must be as objective as possible in counseling children and parents. If the marriage is to end, early interventions can aim to decrease parental hostility and assist the child and parents in coping with family disruptions to come.

In cases of marital discord, the potential role of pediatricians in the area of prevention cannot be underestimated. The pediatrician faces 2 preventive tasks: preserving the intact family when appropriate or decreasing morbidity related to separations that occur.

Anticipatory Guidance

The pediatrician can assess the child's reactions, the parents' reactions and levels of hostility, their abilities to meet the child's physical and emotional needs, their support systems, and any indication of parental mental illness.[30,31]

Understanding the child's experience of divorce is essential if the pediatrician is to advise the family. The works of several authors can be particularly helpful.[17,20,32–35] Wallerstein[36] correctly notes that the family divorce is a process, not simply a single event. Consequently, a child's adjustment occurs in stages.

The event of acute parental separation, which precedes the legal divorce by months or years, is typically the time of highest vulnerability for the child. Parental distress is high. One parent is absent and often temporarily lost to the child. The custodial parent may find parenting responsibilities more difficult because of his or her own distress. At a time when children's needs are increased, parents are at an emotional disadvantage and are often less able to address the needs of their children.

Decreasing school performance, behavioral difficulties, social withdrawal, and somatic complaints are common reactions of children and accompaniments of divorce that require intervention. Profound sadness is typical, and depression is not uncommon.

A parent conference at this stage might be scheduled. The pediatrician can meet with the parents together ideally, or separately if necessary, to assess the current situation, assist in future planning for the children's needs, and reestablish an ongoing, working doctor-patient relationship with each parent. If one parent is not able or willing to confer with the pediatrician, the conference must be with the custodial parent. The pediatrician may offer the noncustodial parent an opportunity to discuss the separation as it affects the child. It is important that the pediatrician understand and respect possible individual parent preferences for a man or woman as the counselor, whether the counselor is the pediatrician or an expert to whom the pediatrician refers the family.

The discussion can begin by inquiring how each member of the family is doing at this time of family stress. Do both parents have adequate support systems, such as extended family, clergy, or a personal physician to help meet their own physical and emotional needs? Are there supports that can help parents in their parenting roles? What is the apparent emotional reaction of the children? It may be helpful to interpret these reactions to the parents on the basis of the child's developmental level and perspective.

Pediatricians can help parents understand their children's reactions and encourage them to discuss the divorce process with their children. Parents can be helped to answer the children's questions honestly at their level of understanding. The children's routines of school, extracurricular activities, contact with family and friends, discipline, and responsibilities should remain as normal as possible. Children should be given permission for their feelings and opportunities to express them. They must understand that they did not cause the divorce and cannot bring the parents back together. Hopefully, they can be told that each parent will continue to love and care for them. The pediatrician can offer families pertinent written material on divorce directed at parents and children (see reading lists at the end of this report).

Custody options can be discussed, and the parents' plan may be explored. It is often helpful to remind parents that they together know better than anyone else their children's needs after divorce and that their knowledge of their own children makes them remarkably more qualified than outsiders, including those in the legal system, to develop a good plan. When consensus cannot be reached or disagreement exists, methods of conflict resolution can be discussed. The pediatrician must insist on being the child's advocate and not take the side of either parent. However, if living with either parent seems to present a risk of abuse or neglect for the child, the pediatrician must contact child protective services and possibly seek advice from his or her own attorney. Seductive behavior by a parent toward the pediatrician can be rebuffed politely but firmly. Custody arrangements should be planned always with the children's best interests in mind. Legal custody and parental rights and responsibilities can vary in their physical and legal arrangements from sole 1-parent custody, to various forms of shared arrangements, to equal or joint custody.[35] Varying statutory requirements exist to protect the interests of children. The reader is referred to the American Academy of Pediatrics statement "The Child in Court."[37]

More important for the child's mental health than the type of custody is the quality of parenting that the child receives through the divorce and postdivorce periods as well as the child's own resilience. Regardless of the type of custody arrangement, it is important that the pediatrician be given a copy of the divorce decree or be informed in writing by both parents of who is responsible for informed consent, who is to pay for the child's health care, and with whom the pediatrician may discuss health information about the child. If the noncustodial parent has visiting rights, it is important that immunization and other pertinent health records be given to both parents in case of an emergency or urgent situation. Parents should inform the child's school of the change in the family structure, request that report cards be sent to both parents, and identify which parent has authority to grant permission for the child's school-related activities.

Long-term Follow-up

Although many children have long-lasting emotional and adjustment problems associated with their parents' divorce, most adjust and function well over time, particularly those who have supportive relationships and a positive temperament and receive professional counseling.[2,20,32–34] Pediatricians must recognize that a divorce is a process and not an event; substantive periods of change during the process can demand new adjustments on the part of children. Although the legal divorce is an important event for parents, it may be an insignificant event to a younger child who knows little of the legal process or a very significant event for the older child who experiences further proof that his parents will not reconcile. Among troublesome issues for children may be the parents' dating and sexual activities. Parental discretion and truthfulness are important for the maintenance of respect for the parents. Stepfamilies introduce another adjustment challenge for children and their parents.

As children develop and mature, their emotions, behaviors and needs with regard to the divorce are likely to change. A custody arrangement that made sense for a younger child may need adjustment for a preadolescent or adolescent. In addition, Wallerstein[36] describes the "sleeper effect" on some early adolescents. With their advancing maturity, awakening sexuality, and important steps toward their own adulthood, their parents' divorce is reinterpreted and requires rediscussion and readjustment. Many behavioral and emotional reactions from the separation can be reawakened at times of subsequent loss, at anniversaries, with the child's advancing maturity, and with the need to adjust to new and different family structures.[36] Ideally, the pediatrician will be able to maintain a professional relationship with both parents so as to continue to help them care for their children in a comfortable and positive manner.

ADVICE FOR ASSISTING CHILDREN AND FAMILIES

- Be alert to warning signs of dysfunctional marriage and impending separation.
- Discuss family functioning in anticipatory guidance and offer advice pertinent to divorce as appropriate.
- Always be the child's advocate, offering support and age-appropriate advice to the child and parents regarding reactions to divorce, especially guilt, anger, sadness, and perceived loss of love.
- Try to maintain positive relationships with both parents rather than taking sides. If there is evidence of an abusive situation, referral to child protective services is indicated.

- Encourage open discussion about separation and divorce with and between parents, emphasizing ways to deal with children's reactions and identifying appropriate reading materials.
- Refer families to mental health resources with expertise in divorce if necessary.
- Become familiar with the *Diagnostic and Statistical Manual for Primary Care (DSM-PC) Child and Adolescent Version*[38] and review the diagnostic criteria carefully so that a specific and appropriate diagnosis is used when helping children and families deal with separation and divorce (Appendix 1).

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Appendix 1. Reimbursement and *DSM-PC* Diagnoses Related to Family Divorce

The *Diagnostic and Statistical Manual for Primary Care (DSM-PC) Child and Adolescent Version*[38] provides diagnoses appropriate to the management of family divorce in pediatric practice. The *DSM-PC* defines diagnoses regarding specific problems of the child as well as situations that impact the child's health and well-being. The *DSM-PC* diagnostic codes are consistent with codes found in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*. All *DSM-PC* codes conform to the coding of the *International Classification of Diseases, Ninth Revision (ICD-9)*.

The situational diagnosis code for family divorce is v61.0. Additional situations may also be managed within the context of the pediatric encounter with the child and can be specifically coded, such as marital discord (v61.1) or domestic violence (v62.8).

Multiple diagnoses for children impacted by family divorce can be found in *DSM-PC*. Clinicians are encouraged to review the diagnostic criteria carefully so that a specific and appropriate diagnosis is used.

If the child's difficulty appears to be acutely related to issues of adjustment and the adjustment to stress is marked by specific symptoms, various adjustment disorders might be considered appropriate diagnoses, including the following:

- Adjustment disorder with depressed mood (309.0);
- Adjustment disorder with anxiety (309.24);
- Adjustment disorder with mixed anxiety and depressed mood (309.28); and
- Adjustment disorder with disturbance of conduct (309.3).

Newly occurring symptoms suggestive of attention-deficit/hyperactivity disorder at the time of parental separation might, with time and further evaluation, more properly be diagnosed as adjustment disorder with anxiety.

Many children will endure their family change with varying levels of sadness. Some will meet the diagnostic criteria for depression, depressive disorder (NOS 311.0), or major depressive disorder (296.12 × or 293.3 ×). The *DSM-PC* also defines a "sadness variation" (v65.45) or "sadness problem" (v40.3).

Appropriate current procedural terminology codes to bill for work performed with children with these diagnoses might be 99213–5 (expanded, detailed, or complex problem). These codes are time sensitive. Note that these codes may be used whether or not the patient is present; thus, they can be used for time spent speaking with parents alone. Telephone case management codes (99371–3) and preventive counseling codes (99401–4) may also be appropriate procedure codes, although many primary care practitioners report difficulty in obtaining reimbursement for these services from third-party payers.

Appropriate diagnostic and procedure coding as well as documentation are essential to reimbursement for the important additional services that primary care and specialty pediatricians provide to children and families in the context of family divorce.

Helping the Student with Diabetes Succeed

A Guide for School Personnel

U.S. Department of Health and Human Services

A Joint Program of the National Institutes of Health and the Centers for Disease Control and Prevention

NATIONAL DIABETES EDUCATION PROGRAM

This guide was produced by the National Diabetes Education Program (NDEP), a federally sponsored partnership of the National Institutes of Health, the Centers for Disease Control and Prevention, and more than 200 partner organizations. The following organizations support its use by school personnel:

American Academy of Pediatrics

American Association for Health Education

American Association of Diabetes Educators

American Diabetes Association

American Dietetic Association

American Medical Association

Barbara Davis Center for Childhood Diabetes

Centers for Disease Control and Prevention

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Juvenile Diabetes Research Foundation International

Lawson Wilkins Pediatric Endocrine Society

National Association of Elementary School Principals

National Association of School Nurses

National Association of Secondary School Principals

National Association of State Boards of Education

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Table of Contents

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Foreword

Major research advances have been made in diabetes management and control during the past decade. Several landmark research studies have proved conclusively that aggressive treatment to lower blood glucose (sugar) levels can help prevent or delay diabetes-related complications affecting the eyes, kidneys, nerves, and cardiovascular system. In addition, advances in medical research and technology have produced an array of treatment and management tools that have made it easier for people with diabetes to check their blood glucose levels and to control them.

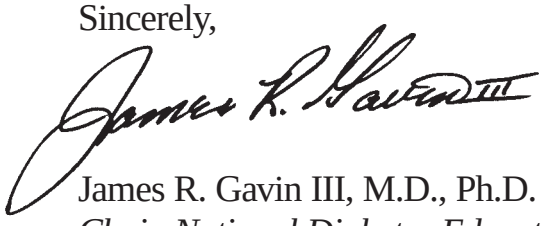
For young people with diabetes, these advances mean a brighter and healthier future. Blood glucose levels that are well managed have the potential to help young people not only to stave off the long-term complications of diabetes but also to feel better and to be happier and more productive at school and at play. Accordingly, students with diabetes need a supportive environment to help them take care of their diabetes throughout the school day and at school-sponsored activities.

The National Diabetes Education Program (NDEP) developed this guide to educate and inform school personnel about diabetes, how it is managed, and how each member of the school staff can help meet the needs of students with the disease. School principals, administrators, nurses, teachers, coaches, bus drivers, health care, and lunchroom staff all play a role in making the school experience safe and sound for students with diabetes.

The NDEP convened an expert panel comprised of health care professionals, federal agency staff, and representatives from key diabetes, pediatric medicine, and educational organizations to develop this comprehensive guide and to help disseminate it throughout the country.

We hope that schools will take advantage of the important information contained in this guide, share it with school staff, parents, and students, and use it to ensure that all students with diabetes are educated in a medically safe environment and have the same access to educational opportunities as their peers.

Sincerely,



James R. Gavin III, M.D., Ph.D.
Chair, National Diabetes Education Program
May 2003

Introduction

More than 17 million Americans have diabetes. In your work with children and youth in the school setting, it is likely that you already have, or will have, a student with diabetes in your care. Diabetes is one of the most common chronic diseases in school-aged children, affecting about 151,000 young people in the United States, or about 1 in every 400 to 500 young people under 20 years of age. Each year, more than 13,000 youths are diagnosed with type 1 diabetes. In addition, health care providers are finding more and more children and teens with type 2 diabetes, even though the disease is usually diagnosed in adults over age 40.

Diabetes is a serious chronic disease that impairs the bodyôs ability to use food for energy. It is the sixth-leading cause of death by disease in the United States. Long-term complications include heart disease, stroke, blindness, kidney disease, and amputation of the foot or leg. Although there is no cure, the disease can be managed and complications delayed or prevented.

Diabetes must be managed 24 hours a day, 7 days a week. For students with type 1 diabetes, and for some with type 2 diabetes, that means careful monitoring of their blood glucose (sugar) levels throughout the school day and administering multiple doses of insulin therapyð now prescribed for most young people with diabetes. As a result, the school health team, which includes the school nurse, teachers, office personnel, and other school staff members, plays an important role in helping students manage their diabetes.

Effective diabetes management is crucial

- for the immediate safety of students with diabetes
- for the long-term health of students with diabetes
- to ensure that students with diabetes are ready to learn and to participate fully in school activities and
- to minimize the possibility that diabetes-related emergencies will disrupt classroom activities.

The school nurse, teachers, office personnel, and other school staff members play an important role in helping students manage their diabetes.

The purpose of this guide is to educate school personnel about diabetes and to share a set of practices that enable schools to ensure a safe learning environment for students with diabetes.

The purpose of this guide is to educate school personnel about diabetes and to share a set of practices that enable schools to ensure a safe learning environment for students with diabetes, particularly the student who uses insulin to control the disease (all students with type 1 and some with type 2 diabetes). **The team approach to school-based diabetes management presented in this guide builds on what schools already are doing for children with other chronic diseases.** Current practices and use of existing resources have been adapted for the student with diabetes.

The practices shared in this guide are not necessarily required by the federal laws enforced by the U.S. Department of Education for each student with diabetes. This guide can be used, however, in determining how to address the needs of students with diabetes. The individual situation of any particular student with diabetes will affect what is legally required for that particular student. Additionally, the guide does not address state and local laws, as the requirements of these laws may vary from state to state and school district to school district. This guide should be used in conjunction with federal as well as state and local laws.

At its core, effective school-based diabetes management requires two things:

- **All school staff members who have responsibility for a student with diabetes should receive training that provides a basic understanding of the disease** and the studentôs needs, how to identify medical emergencies, and which school staff members to contact with questions in case of an emergency.
- **A small group of school staff members should receive training from a qualified health care professional such as a physician or a nurse in student-specific routine and emergency care** so that a staff member is always available for younger or less-experienced students who require assistance with their diabetes management (e.g., administering insulin, checking their blood glucose, or choosing an appropriate snack) and for all students with diabetes in case of an emergency. This group may be comprised of the school nurse and other school staff who are not health care professionals. The non-medical personnel are called ñtrained diabetes personnelò in this guide. Other terminology may be used in your school.

Organized in four sections, the guide includes background information and tools for school personnel to help students manage diabetes effectively.

SECTION 1, Diabetes Primer for School Personnel, provides overview information about diabetes, describes how the disease is managed, and reviews the components for planning and implementing effective diabetes management in school. **The Primer should be copied and distributed to all school personnel who may be responsible for the safety of students with diabetes.** School nurses are the likely leaders in distributing this information and providing the background and education that other school personnel will need. This leadership may vary, however, from one school system to another because of state laws, staffing levels, and other considerations.

SECTION 2, Actions for School Personnel, Parents, and Students, lays out the roles and responsibilities of individual school personnel, parents, and students. **The pages in this section should be copied and distributed to school staff members, parents, and students with diabetes** so that they understand their respective roles in diabetes management.

SECTION 3, Tools for Effective Diabetes Management, contains two important tools for helping schools implement effective diabetes management, a sample Diabetes Medical Management Plan and a sample Quick Reference Emergency Plan for a student with diabetes. **The Quick Reference Emergency Plan should be distributed to all personnel who have responsibility for the student with diabetes** during the school day and during school-sponsored activities.

SECTION 4, School Responsibilities Under Law, was developed by the U.S. Department of Education. This section provides an overview of federal laws that address schoolsôresponsibilities to students with diabetes, including confidentiality requirements. In applying the laws, schools must consider each student on an individualized basis; what is appropriate for one student may not be appropriate for another student.

The **APPENDICES** contain additional resources and information for diabetes management in the school setting. The **Resources** section lists government, professional, and voluntary organizations that can be contacted for more information about diabetes and youth. The **Glossary** provides additional explanations of the medical and technical terms used in this guide. The **American Diabetes Associationôs position statement** on ñCare for Children with Diabetes in the School and Day Care Settingò lays out the diabetes medical communityôs recommendations that are the basis for this guide.

School personnel are encouraged to **visit the National Diabetes Education Programôs website, www.ndep.nih.gov**, to download a comprehensive online resource directory on Diabetes in Children and Adolescents.

www.ndep.nih.gov

3

To obtain additional copies of this guide and other diabetes information, please call the National Diabetes Education Program at 1-800-438-5383 or visit the programôs website at www.ndep.nih.gov to download copies.

Section 1 DIABETES PRIMER

Copy and distribute this section to all school personnel who may be responsible for the safety of students with diabetes.

Section 1 DIABETES PRIMER FOR School Personnel

WHAT IS DIABETES?

Diabetes is a chronic disease in which the body does not make or properly use insulin, a hormone needed to convert sugar, starches, and other food into energy. People with diabetes have increased blood glucose (sugar) levels because they lack insulin, have insufficient insulin, or are resistant to insulinôs effects. High levels of glucose build up in the blood and spill into the urine; as a result, the body loses its main source of fuel.

When insulin is no longer made, it must be obtained from another sourceð insulin shots or an insulin pump. When the body does not use insulin properly, oral medications may be taken instead of, or in addition to, insulin shots. **Neither insulin nor other medications, however, are cures for diabetes: they only help control the disease.**

Taking care of diabetes is important. If not treated, diabetes can lead to serious health problems. The disease can affect the blood vessels, eyes, kidneys, nerves, gums, and teeth, and it is the leading cause of adult blindness, lower limb amputations, and kidney failure. People with diabetes also have a higher risk of heart disease and stroke. Some of these problems can occur in teens and young adults who develop diabetes during childhood. The good news is that research shows that these problems can be greatly reduced or delayed by keeping blood glucose levels near normal.

Taking care of diabetes is important. If not treated, diabetes can lead to serious health problems.

WHAT ARE THE TYPES OF DIABETES?

There are two main types of diabetes: type 1 and type 2 are described below. A third typeð gestational diabetesð occurs only during pregnancy and ends after delivery. Women who have had gestational diabetes, however, are more likely to develop type 2 diabetes later in life.

Type 1 Diabetes

Type 1 diabetes is a disease of the immune system, the bodyôs system for fighting infection. In people with type 1 diabetes, the immune system attacks the beta cells (the insulin-producing cells of the pancreas) and destroys them. Because the pancreas can no longer produce insulin, people with type 1 diabetes need to take insulin daily to live. Type 1 diabetes can occur at any age, but it occurs most often in children and young adults.

- **Symptoms.** The symptoms of type 1 diabetes usually develop over a short period of time. They include increased thirst and urination, constant hunger, weight loss, and blurred vision. Affected children also may feel very tired all the time. If not diagnosed and treated with insulin, the child with type 1 diabetes can lapse into a life-threatening condition known as diabetic ketoacidosis (KEY-toe-asi-DOE-sis), or DKA.
- **Risk factors.** Although scientists have made much progress in predicting who is at risk for type 1 diabetes, they do not yet know what triggers the immune systemôs attack on beta cells. They believe that type 1 diabetes is due to a combination of genetic and environmental factors. Researchers are working to identify these factors and to stop the autoimmune process that leads to type 1 diabetes.

Type 1 Diabetes INFO

Symptoms:

- Increased thirst and urination
- Constant hunger
- Weight loss
- Blurred vision
- Fatigue

Risk Factors:

- Genetics
- Environment

Type 2 Diabetes

INFO

Symptoms:

- Fatigue
- Increased thirst and urination
- Nausea
- Rapid weight loss
- Blurred vision
- Frequent infections
- Slow healing of wounds or sores

Risk Factors:

- Being overweight
- Having a family member who has type 2 diabetes
- Being African American, Hispanic/Latino American, American Indian, Asian American or Pacific Islander American

Type 2 Diabetes

The first step in the development of type 2 diabetes is often a problem with the bodyôs response to insulin, or insulin resistance. For reasons scientists do not completely understand, the body cannot use its insulin very well. This means that the body needs increasing amounts of insulin to control blood glucose. The pancreas tries to make more insulin, but after several years, insulin production may drop off.

Type 2 diabetes used to be found mainly in overweight adults ages 40 or older. Now, as more children and adolescents in the United States become overweight and inactive, type 2 diabetes occurs more often in young people. To control their diabetes, children with type 2 diabetes may need to take oral medication, insulin, or both.

- **Symptoms.** Type 2 diabetes develops slowly in some children, but quickly in others. Symptoms may be similar to those of type 1 diabetes. A child or teen can feel very tired, thirsty, or nauseated and have to urinate often. Other symptoms include rapid weight loss, blurred vision, frequent infections, yeast infections, and slow healing of wounds or sores. High blood pressure may be a sign of insulin resistance. In addition, physical signs of insulin resistance, such as acanthosis nigricans (A-can-tho-sis NIG-reh-cans), may appear; here the skin around the neck or in the armpits or groin appears dark, thick, and velvety.

  On the other hand, some children or adolescents with type 2 diabetes show no symptoms at all when they are diagnosed. For that reason, it is important for parents and caregivers to talk to their health care providers about screening children or teens at high risk for diabetes.

- **Risk factors.** Being overweight and having a family member who has type 2 diabetes are the key risk factors for type 2 diabetes. In addition, type 2 diabetes is more common in certain racial or ethnic groups, such as African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Pacific Islander Americans. For children and teens at risk, health care providers can encourage, support, and educate the entire family to make lifestyle changes that may delayð or preventð the onset of type 2 diabetes. Such changes may include reaching a healthy weight and then maintaining it and engaging in regular physical activity.

WHAT IS EFFECTIVE DIABETES MANAGEMENT?

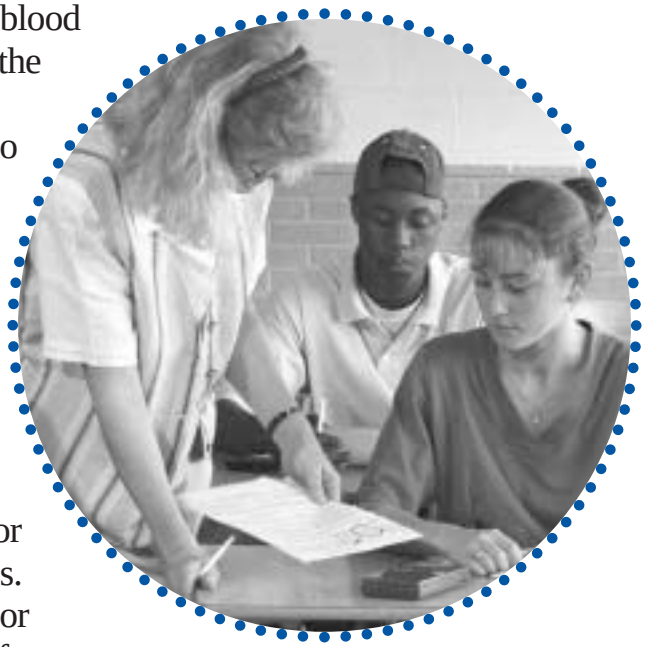
The goal of effective diabetes management is to control blood glucose levels by keeping them within a target range that is determined for each child. Optimal blood glucose control helps to promote normal growth and development and allows for optimal learning. Effective diabetes management is needed to prevent the immediate dangers of blood glucose levels that are too high or too low. As noted earlier, research has shown that maintaining blood glucose levels within the target range can prevent or delay the long-term complications of diabetes, such as heart attack, stroke, blindness, kidney failure, nerve disease, and amputations of the foot or leg.

The key to optimal blood glucose control is to carefully balance food, exercise, and insulin or medication. As a general rule, food makes blood glucose levels go up, and exercise and insulin make blood glucose levels go down. Several other factors, such as growth and puberty, mental stress, illness, or injury also can affect blood glucose levels.

The key to optimal blood glucose control is to carefully balance food, exercise, and insulin or medication.

3 **With all of these factors coming into play, maintaining good blood glucose control is a constant juggling actð 24 hours a day, 7 days a week.**

Students with diabetes must check (or test) their blood glucose levels throughout the day by using a blood glucose meter. The meter gives a reading of the level of glucose in the blood at the time it is being checked. If blood glucose levels are too low (hypoglycemia) or too high (hyperglycemia), students can then take corrective action, such as eating, modifying their activity level, or administering insulin. **Low blood glucose levels, which can be life-threatening, present the greatest immediate danger to people with diabetes (see hypoglycemia, pages 17i 19).**



Many students will be able to handle all or almost all of their diabetes care by themselves. Others, because of age, developmental level, or inexperience, will need help from school staff.

The school nurse is the most appropriate person in the school setting to provide care for a student with diabetes.

The school nurse is the most appropriate person in the school setting to provide care for a student with diabetes. Many schools, however, do not have a full-time nurse, and sometimes a single nurse must cover a large number of schools. Moreover, even when a nurse is assigned to a school full time, this staff member may not always be available during the school day, during extracurricular activities, or on field trips. Yet, because diabetes management is needed 24 hours a day, 7 days a weekð and diabetes emergencies can happen at any timeð school personnel should be prepared to provide diabetes care at school and at all school-sponsored activities in which a student with diabetes participates. In this case, the school nurse or another qualified health professional should be involved with training of appropriate staff and providing professional supervision and consultation regarding routine and emergency care of the student.

3 All students with diabetes will need help with emergency medical care.

Effective school-based diabetes management requires two things:

1. **All school staff members who have responsibility for students with diabetes should receive training that provides a basic understanding of the disease** and the studentsôneeds, how to identify medical emergencies, and whom to contact in case of an emergency.
2. **A few school staff members should receive training from a qualified health care professional in student-specific routine and emergency diabetes care tasks** so that at least one staff member is always available for younger, less experienced students and for any student with diabetes in case of an emergency.

The diabetes medical community has found that nonmedical personnel (called ñtrained diabetes personnelò in this guide) can be trained and supervised to safely provide and assist with diabetes care tasks in the school setting, including blood glucose monitoring, insulin and glucagon administration, and urine ketone testing. These nonmedical school staff members should be trained and monitored by the school nurse or a qualified health professional. Assignment of diabetes care tasks must take into account state laws that may be relevant in determining what tasks may be performed by nonmedical personnel.

HOW CAN A SCHOOL PLAN AND IMPLEMENT EFFECTIVE DIABETES MANAGEMENT?

Collaboration, cooperation, and planning are key elements in developing and implementing successful diabetes management at school. **As is true for children with other chronic diseases, students with diabetes are more likely to succeed in school when students, parents, school nurses, principals, teachers, other school personnel, and the studentôs health care providers (or personal health care team) work together to ensure effective diabetes management.** Your school probably has similar plans and systems in place for children with other health considerations.

To work collaboratively, a school health team should be assembled that includes people who are knowledgeable about diabetes, the school environment, and federal and state education and nursing laws. Team members could include the student, parents/guardian, the school nurse and other health personnel, administrators, the principal, the studentôs teacher(s) and guidance counselor, and other relevant staff.

The school health team works together to implement the Diabetes Medical Management Plan (see pages 49-52) developed by the studentôs personal health care team and family. The team decides who needs to receive appropriate medical information about the child, who will be the trained diabetes personnel and who will monitor them, and what tasks will be delegated. In addition, the school health team should be part of the group that develops and implements the studentôs Section 504 Plan, Individualized Education Program (IEP), or other education plan that addresses the studentôs developmental and educational needs so that diabetes can be managed safely and effectively in school.

Three federal laws address the schoolôs responsibilities to help students with diabetes:

- Section 504 of the Rehabilitation Act of 1973 (Section 504)
- Americans with Disabilities Act of 1990 (ADA)
- Individuals with Disabilities Education Act (IDEA)

These federal laws provide a framework for planning and implementing effective diabetes management in the school setting. School administrators and nursing personnel also should determine whether there are applicable state and local

School Health TEAM

- Student with diabetes
- Parents/guardian
- School nurse
- Other school health personnel
- Principal
- Office staff
- Studentôs teacher(s)
- Guidance counselor
- Other relevant staff

laws that should be factored into helping the student with diabetes (see pages 14ï 15 and Section 4 for additional information on these federal laws).

Written plans outlining each studentôs diabetes management help students, their families, school staff, and the studentôs health care providers know what is expected of them. These expectations should be laid out in writing in the following documents:

- *Diabetes Medical Management Plan,* developed by the studentôs personal health care team and family, contains the prescribed diabetes health care regimen, tailored for each student.
- *Quick Reference Emergency Plan,* based on the information provided in the studentôs Diabetes Medical Management Plan, describes how to recognize hypoglycemia and hyperglycemia and what to do as soon as signs or symptoms of these conditions are observed.
- *Education plans, such as the Section 504 Plan or Individualized Education Program (IEP),* explain what accommodations, education aids, and services are needed for each student with diabetes.
- *Other documents may be generated when a school nurse is involved,* such as a nursing care plan and instructions to staff (see page 36).

The Diabetes Medical Management Plan describes the diabetes regimen developed by the student's personal health care team and family.

Diabetes Medical Management Plan

The Diabetes Medical Management Plan describes the diabetes care regimen developed by the studentôs personal health care team and family and should be signed by the studentôs physician or other member of the health care team (see Section 3 for a sample plan). Although this guide uses the term ñDiabetes Medical Management Plan,ò school districts may use other terms for this document. While this plan is not required by Section 504, the ADA, or the IDEA, the information in it can be useful in addressing the requirements of these federal laws.

Information in the Diabetes Medical Management Plan may include the following:

- Date of diagnosis
- Current health status

- Emergency contact information
- Studentôs willingness and ability to perform self-management tasks at school
- List of diabetes equipment and supplies
- Specific medical orders
  - Blood glucose monitoring
  - Insulin, glucagon, and other medications to be given at school
  - Meal and snack plan
  - Exercise requirements
  - Additional monitoring
- Typical signs, symptoms, and prescribed treatment for hypoglycemia
- Typical signs, symptoms, and prescribed treatment for hyperglycemia

The Diabetes Medical Management Plan should be reviewed and updated each school year or upon a change in the studentôs prescribed regimen, level of self-management, school circumstances (e.g., a change in schedule), or at the request of the student or parents/guardian. Information from this plan is used by the school nurse to develop the studentôs nursing care plan and may be incorporated into the 504, IEP, or other education plan.

Quick Reference Emergency Plan

The Quick Reference Emergency Plan is based on the information provided in the studentôs Diabetes Medical Management Plan; the school nurse will usually coordinate its development. The plan summarizes how to recognize and treat hypoglycemia and hyperglycemia and should be distributed to all personnel who have responsibility for students with diabetes (see Section 3 for a sample plan). Although this guide uses ñQuick Reference Emergency Plan,ò school districts might use other names.

The Quick Reference Emergency Plan summarizes how to recognize and treat hypoglycemia and hyperglycemia.

Education Plans

The school health team, including the student and parents/guardian, must agree on how the Diabetes Medical Management Plan will be implemented and what medical accommodations, educational aids, and services may be needed for the student. This information might be included in a Section 504 Plan, an IEP, or other education plan.

A ñ504 Planò is the commonly used term for a plan of services developed under Section 504 of the Rehabilitation Act. An IEP is required for students who receive special education and related services under the Individuals with Disabilities Education Act (IDEA). The information in the Diabetes Medical Management Plan can be used in developing either a Section 504 Plan or an IEP, but should not be a substitute for these plans.

3 The 504 Plan, IEP, or other education plan lays out what medical accommodations, educational aids, and services the student may need.

Each student with diabetes has different needs, but the education-related plans developed for such students are likely to address the following common elements:

- Where and when blood glucose monitoring and treatment will take place
- Identity of trained diabetes personnel who are trained to conduct blood glucose checking, insulin and glucagon administration, and treatment of hypoglycemia and hyperglycemia
- Location of the studentôs diabetes management supplies
- Free access to the restroom and water fountain
- Nutritional needs, including provisions for meals and snacks
- Full participation in all school-sponsored activities and field trips, with coverage provided by trained diabetes personnel
- Alternative times for academic exams if the student is experiencing hypoglycemia or hyperglycemia
- Permission for absences, without penalty, for doctorsôappointments and diabetes-related illness
- Maintenance of confidentiality and the studentôs right to privacy

It is strongly recommended that this information be agreed upon before each school year begins (or upon diagnosis of diabetes) and that it be written down and signed by a representative of the school and the parents/guardian. This assures that school staff members, parents, and students know their responsibilities. Parents must be notified in a timely manner of any proposed changes in the provision of services and be included in related discussions.

This approach to planning and implementing effective diabetes management in school can promote a better understanding of schoolsôresponsibilities and can prepare staff members to act in the best interest of students with diabetes.

WHAT ARE THE ELEMENTS OF EFFECTIVE DIABETES MANAGEMENT IN SCHOOL?

Diabetes management means monitoring or checking blood glucose levels throughout the day, following an individualized meal plan, getting regular physical activity, and administering insulin and/or medications to help keep blood glucose levels in the target range and to help prevent the onset of hypoglycemia or hyperglycemia. Additional elements of diabetes management in school include planning for events outside the usual school day, planning for appropriate disposal of materials that come in contact with blood, and dealing with the emotional and social aspects of living with diabetes.

Monitoring Blood Glucose

One of the most important parts of diabetes management is regular monitoring or checking of blood glucose levels. Monitoring involves pricking the skin with a lancet at the fingertip, forearm, or other test site to obtain a drop of blood and placing the drop on a special test strip that is inserted in a glucose meter. The meter gives the current blood glucose level.

Physicians generally recommend that students check their blood glucose during the school day, usually before eating snacks or lunch, before physical activity, or when there are symptoms of hypoglycemia or hyperglycemia. In young children, symptoms may be subtle; blood glucose should be checked whenever symptoms are suspected. Many students can check their own

Elements of Effective DIABETES MANAGEMENT

- Monitoring blood glucose
- Understanding hypoglycemia
- Understanding hyperglycemia
- Following an individualized meal plan
- Getting regular physical activity
- Administering insulin
- Planning for special events
- Planning for disasters and emergencies
- Dealing with emotional and social issues

blood glucose level; others will need supervision; and others will need to have this task performed by a school nurse or trained diabetes personnel.

It is extremely important for students to be able to check their blood glucose levels and respond to levels that are too high or too low as quickly as possible. Accordingly, if recommended by the studentôs physician, **it is medically preferable to permit students to check their blood glucose level and respond to the results in the classroom, at any other campus location, or at any school activity.** Taking immediate action is important so that the symptoms donôt get worse and the student doesnôt miss time in the classroom.

Blood glucose monitoring does not present a danger to other students or staff members when there is a plan for proper disposal of lancets and other materials that come into contact with blood. The family and the school should agree on the plan, which should be consistent with standard Universal Precautions and local waste-disposal laws. Disposal may be in a container kept at school or in the studentôs personal container, a heavy-duty plastic or metal container with a tight-fitting lid. Check with the studentôs personal health care team about health and safety requirements in your area.

Students Usually Check Their

BLOOD GLUCOSE

- Before eating snacks or meals
- Before physical activity
- When they have symptoms of high or low blood glucose

Advantages of Checking Blood Glucose Levels Any Time and Any Place

- The student can achieve better blood glucose control to prevent long-term complications of high blood glucose and acute complications of high and low blood glucose.
- It is safer for students because less time is lost between recognizing symptoms, confirming low blood glucose, and obtaining treatment with a fast-acting sugar source followed by a snack or meal.
- The student gains independence in diabetes management when the blood glucose meter is easily accessible and checks can be conducted as needed.
- The student experiences less stigma as blood glucose monitoring loses its mystery when handled as a regular occurrence.
- The student spends less time out of class.

Understanding Hypoglycemia (Low Blood Glucose)

HYPOglycemia means LOW blood glucose.

Hypoglycemia, also called ñlow blood glucoseò or ñlow blood sugar,ò is one of the most frequent complications of diabetes and can happen very suddenly. Hypoglycemia occurs when a studentôs blood glucose level falls too low, usually as a result of administering too much insulin, skipping or delaying meals or snacks, not eating enough food as prescribed in the meal plan, exercising too long or too intensely, or a combination of two or more of these factors. It is more likely to occur before lunch, at the end of the school day, or during or after physical education classes.

3 Hypoglycemia, which often cannot be prevented, is the greatest immediate danger to students with diabetes.

Hypoglycemia usually can be treated easily and effectively. If it is not treated promptly, however, hypoglycemia can lead to unconsciousness and convulsions and can be life threatening. Early recognition of its symptoms and prompt treatment, in accordance with the studentôs Diabetes Medical Management Plan, are necessary for preventing severe symptoms that may place the student in danger. This information, contained in the Quick Reference Emergency Plan, should be provided to all school personnel who have responsibility for the student with diabetes (see sample plan on page 53).

Hypoglycemia is not always completely preventable, and not all students, especially young children, will recognize its symptoms with every episode. Therefore, school personnel should be familiar with the symptoms and treatment so that an urgent problem can be handled appropriately.

Hypoglycemia can impair thinking abilities and sometimes can be mistaken for misbehavior. If a student has a sudden change in behavior, becomes lethargic, combative, or unconscious, or is having a seizure or convulsion, presume that the student has hypoglycemia. Treat the situation as a hypoglycemic emergency and check the studentôs blood glucose level immediately. If a blood glucose meter

Hypoglycemia occurs when a student's blood glucose level falls too low, usually as a result of

-] Administering too much insulin
-] Skipping or delaying meals or snacks
-] Not eating enough food as prescribed in the meal plan
-] Exercising longer and more intensely
-] Or a combination of these factors

is not available in the immediate area, or if the blood glucose level is otherwise unknown, treat the student for hypoglycemia.

3 The student should never be left alone or sent anywhere alone when experiencing hypoglycemia.

As soon as symptoms of hypoglycemia are observed, give the student a quick-acting sugar product equivalent to 15 grams of carbohydrate, as specified in the Quick Reference Emergency Plan. This may include: 3 or 4 glucose tablets, 3 teaspoons (or three-fourths of a tube) of glucose gel, 4 ounces of juice, or 6 ounces (half a can) of non-diet soda. Recheck the studentôs blood glucose level 10 to 15 minutes after treatment. Repeat treatment if the blood glucose level still falls below the studentôs target range.

Symptoms of hypoglycemia, which are different for each student and may vary from episode to episode, can include:

Mild/Moderate Symptoms

-] shaky
-] sweaty
-] hungry
-] pale
-] headache
-] blurry vision
-] sleepy
-] dizzy
-] confused
-] disoriented
-] uncoordinated
-] irritable or nervous
-] changed personality
-] inability to concentrate
-] weak
-] lethargic
-] changed behavior

Severe Symptoms

-] inability to swallow
-] having a seizure or convulsions
-] unconscious

Severe hypoglycemia is rare at school and generally can be prevented with prompt treatment when the early signs of low blood glucose are recognized. When hypoglycemia is severe, the school nurse or trained diabetes personnel must respond immediately. Symptoms may include inability to swallow, unconsciousness, unresponsiveness, seizure activity, convulsions, or jerking movements. At this point, never attempt to give the student food or a drink or to put anything in the mouth because it could cause choking.

If students become unconscious or experience convulsions or seizures, position them on their side to prevent choking. Immediately contact the school nurse or trained diabetes personnel, who will administer an injection of glucagon (see next page), if

How to Treat Hypoglycemia

Mild/Moderate Symptoms:

As soon as symptoms are observed, give the student a quick-acting sugar product, such as:

-] 3 or 4 glucose tablets
-] 3 teaspoons of glucose gel
-] 4 ounces of juice
-] 6 ounces of non-diet soda

Severe Symptoms:

-] Position the student on his/her side
-] Contact the school nurse or trained diabetes personnel
-] Administer glucagon, as prescribed
-] Call 911
-] Call studentôs parents

indicated in the studentôs Diabetes Medical Management Plan. While the glucagon is being administered, another school staff member should call for emergency medical assistance and then notify the parents/guardian. If glucagon is not authorized, staff should call 911 immediately.

Glucagon is a hormone that raises blood glucose levels by causing the release of glycogen (a form of stored carbohydrate) from the liver. It is administered when the studentôs blood glucose level gets so low that the student passes out, experiences seizures, or cannot swallow. Although it may cause nausea and vomiting when the student regains consciousness, glucagon can be a life-saving treatment that cannot harm a student.

The studentôs parents/guardian should supply the school with a glucagon emergency kit. This kit usually contains a bottle (vial) of glucagon in powder form and a pre-filled syringe with special liquid; the two are mixed just before a glucagon injection is given. Glucagon may be stored at room temperature. The school nurse and trained diabetes personnel must have ready access to the glucagon emergency kit at all times.

Understanding Hyperglycemia (High Blood Glucose)

HYPERglycemia means HIGH blood glucose.

Hyperglycemia, also called ñhigh blood glucose,ò is a serious manifestation of diabetes that may be caused by too little insulin, illness, infection, injury, stress or emotional upset, ingestion of food that has not been covered by the appropriate amount of insulin, or decreased exercise or activity. High blood glucose symptoms include increased thirst, frequent urination, nausea, blurry vision, and fatigue. Over a long period of time, even moderately high blood glucose levels can lead to serious complications, such as heart disease, blindness, kidney failure, and amputations. In the short term, hyperglycemia can impair cognitive abilities and adversely affect academic performance.

Hyperglycemia does not usually result in acute problems. If, however, the student fails to take insulin, if a pump malfunctions and delivers less insulin, or if either physical or emotional stress

Hyperglycemia INFO

Symptoms:

-] Increased thirst
-] Frequent urination
-] Nausea
-] Blurry vision
-] Fatigue

causes the insulin not to work effectively, there will be a breakdown of fat, causing ketones to form (see below).

At first, ketones will be cleared by the kidneys into the urine, but if there are more than the kidneys can handle, they will build up in the blood and may result in diabetic ketoacidosis (DKA). This complication will cause a fruity breath odor, nausea, vomiting, stomach pain, and, if untreated, deep breathing and increasing sleepiness. Students who use insulin pumps can go into DKA within hours if their pumps stop delivering insulin appropriately.

DKA can be prevented if the student's urine is checked for ketones during times of illness, especially if vomiting occurs, or whenever the blood glucose level exceeds the target range provided in the Diabetes Medical Management Plan. The test involves dipping a special strip into the urine and comparing the resulting color to a color chart.

Treatment of hyperglycemia may involve drinking extra water or diet drinks or administering supplemental insulin in accordance with the Diabetes Medical Management Plan.

How to Treat Hyperglycemia

-] Drink extra water or diet drinks
-] Administer supplemental insulin
-] Monitor blood glucose levels closely

3 **Free and unrestricted access to liquids and the restroom must be provided, as high blood glucose levels increase urination and may lead to dehydration if the student cannot replace the fluids.**

The student's blood glucose level should be monitored closely until it returns to the target range, as outlined in the Diabetes Medical Management Plan. If treatment does not lower blood glucose levels and clear the ketones, if vomiting occurs, or if the student is lethargic or experiences breathing difficulties, call the parents/guardian or call for medical assistance if they cannot be reached. Treatment guidelines for ketones and when to call parents should be listed in the student's Diabetes Medical Management Plan. Information about the symptoms and treatment of hyperglycemia, contained in the Quick Reference Emergency Plan, should be provided to all school personnel who have responsibility for the student with diabetes (see sample plan on page 54).

Administering Insulin

Students with type 1 diabetes, and some students with type 2 diabetes, require insulin to be given at regular times each day. Some students may need additional or corrective dosages of insulin to treat hyperglycemia or to cover a rise in blood glucose levels. The Diabetes Medical Management Plan specifies the dosage, delivery system, and schedule for insulin administration, which will differ for each student. The nursing care plan, 504, IEP, or other education plan, which are based on the Diabetes Medical Management Plan, specify who will administer prescribed insulin and under what circumstances.

Today, new types of insulin and new delivery systems help keep blood glucose levels within the target range. These options may require closer monitoring and possibly more assistance for the student with diabetes.

Insulin has three characteristics:

Onset is the length of time before insulin reaches the bloodstream and begins lowering blood glucose.

Peak time is the time during which insulin is at its maximum strength in terms of lowering blood glucose.

Duration is the number of hours insulin continues to lower blood glucose levels.

There are several types of insulin that are used in combination to treat people with diabetes. These different types of insulin have been manufactured either to have immediate (rapid-acting or short-acting insulin), intermediate, or long (basal insulin) onset of action and duration of action in the body. A coordinated combination of insulins is used to allow for adequate treatment of diabetes at meals, snacks, during periods of physical activity, and through the night.

Opened vials of insulin may be left at room temperature for 30 days after opening, but will keep for 3 months if refrigerated. Unopened vials should be stored in the refrigerator and are good until the expiration date.

The **three most common ways to administer insulin** are with a syringe, an insulin pen, or an insulin pump.

Insulin syringes available today make it easier to draw up the proper dosage, and shorter, smaller needles make injections easier and relatively painless.

Insulin has three characteristics:

-] Onset
-] Peak time
-] Duration

The three most common ways to deliver insulin:

-] Insulin syringe
-] Insulin pen
-] Insulin pump

An insulin pen looks like a fountain pen. The pen holds a cartridge of insulin, and a needle is screwed onto its tip just before use. Insulin pens are convenient and most appropriate when children need a single type of insulin.

An insulin pump is a computerized device that looks like a pager and is usually worn on the studentôs waistband or belt. The pump is programmed to deliver small, steady doses of insulin throughout the day; additional doses are given to cover food or high blood glucose levels. The pump holds a reservoir of insulin that is attached to a system of tubing called an infusion set. Most infusion sets are started with a guide needle, then the plastic cannula (a tiny, flexible plastic tube) is left in place, taped with dressing, and the needle is removed. The cannula is usually changed every 2 or 3 days or when blood glucose levels remain above target range. More students are opting for insulin pump therapy as a means to keep blood glucose levels in better control.

Some students who need insulin during the school day are able to administer it on their own; others will need supervision; and others will need someone to administer the insulin for them. The school nurse and/or trained diabetes personnel should provide this help in accordance with the Diabetes Medical Management Plan and the nursing care plan. School personnel who are responsible for the studentôs care should be knowledgeable about the use and operation of that studentôs insulin delivery system. Information about insulin administration should appear in the studentôs Diabetes Medical Management Plan, nursing care plan, and education plan (504, IEP, or other education plan).

In the event a school nurse is not available to administer insulin, a nurse or another qualified health care professional should teach, monitor, and supervise trained diabetes personnel to administer insulin. Further, when the school nurse is not available to administer insulin and insulin is administered by other trained diabetes personnel, additional safety precautions may be taken, such as verification of the dose by two trained diabetes personnel before administration.

Following an Individualized Meal Plan

The nutritional needs of a student with diabetes do not differ from the needs of a student without diabetes. Both should eat a variety of foods to maintain normal growth and development. The major difference is that the timing, amount, and content of the food that the student with diabetes eats are carefully matched to the action of the insulin.

The studentôs meal plan is designed to balance nutritional needs with the insulin regimen and physical activity level. **There are usually no forbidden foods for people with diabetes.** The family and personal health care team create an individualized meal plan based upon carbohydrate counting or an exchange system.

Carbohydrate counting involves calculating the number of grams of carbohydrate or choices of carbohydrate the student eats. This information, which can be obtained from nutrition information on food labels, is used to determine the amount of insulin the student needs to control blood glucose for any given meal or snack.

The **exchange system** groups foods in six different lists, each with a set nutritional value. A meal plan is prepared that recommends several exchanges or servings from each food group for each meal and snack. The exchange list ensures that the meal plan is consistent in portion size and nutrient content while offering a wide variety of foods from each group. Students using this approach consume a prescribed number of exchanges at meal and snack times.

The student's meal plan is designed to balance the student's nutritional needs with his or her insulin routine and physical activity level.

The exchange lists include the following food groups:

] Bread/starch] Fruit] Milk] Vegetables
] Meat/protein foods] Fats

With some insulin regimens, it is important to maintain consistency in the timing and content of meals and snacks. The student should eat lunch at the same time each day. Snacks are often necessary for a child with diabetes and must be eaten to balance the peak times of insulin action. **A missed or delayed snack could result in hypoglycemia.** The student also must have immediate access to a quick-acting form of glucose, such as juice, glucose

tablets or gel, or regular soda to treat hypoglycemia. The student's nursing care plan or education plan (504, IEP, or other education plan) should show the timing of meals and snacks and an alternative plan for unusual or unforeseen circumstances.

Getting Regular Physical Activity

Exercise and physical activity are critical parts of diabetes management. Everyone can benefit from regular exercise, but it is even more important for a student with diabetes. In addition to maintaining cardiovascular fitness and controlling weight, physical activity can help to lower blood glucose levels.

Students with diabetes should participate fully in physical education classes and team sports. To maintain blood glucose levels within their target ranges during extra physical activity, students will make adjustments in their insulin and food intake. To prevent hypoglycemia, they also may need to check their blood glucose levels more frequently while engaging in physical activity.

3 Students with diabetes should participate fully in physical education classes and team sports.

Physical education instructors and sports coaches must be able to recognize and assist with the treatment of hypoglycemia. A quick-acting source of glucose and the student's glucose meter should always be available, along with plenty of water.

Students using pumps may disconnect from the pump for sports activities. If they keep the pump on, they may set a temporary, reduced rate of insulin while they are playing. School personnel should provide the student with a safe location for storing the pump when the student does not wear it. The student's Diabetes Medical Management Plan, nursing care plan, 504 Plan, IEP, or other education plan should include specific instructions.

Planning for Special Events, Field Trips, and Extracurricular Activities

With proper planning, students with diabetes can participate fully in all school-related activities.

Meeting the needs of students with diabetes requires advance planning for special events, such as classroom parties, field trips, and school-sponsored extracurricular activities held before or after school. With proper planning for coverage by trained diabetes personnel and possible adjustments to their insulin regimen and meal plan, students with diabetes can participate fully in all school-related activities.

While there are usually no forbidden foods in a meal plan for children or teens with diabetes, school parties often include foods high in carbohydrates and fats. Providing more nutritious snacks will be healthier for all students and encourage good eating habits. The parents/guardian should decide whether the student with diabetes should be given the same food as other students or food the parents provide. Parents should be given advance notice of parties to incorporate special foods in the meal plan or to adjust the insulin regimen.

Students often view a field trip as one of the most interesting and exciting activities of the school year, and students with diabetes must be allowed to have these school-related experiences. Although it is not unusual to invite parents to chaperone field trips, parental attendance is **not** a prerequisite for participation by the student with diabetes. **Trained diabetes personnel should accompany the student with diabetes** and ensure that all the studentôs supplies are brought along with the student and that there are snacks and supplies to treat hypoglycemia.

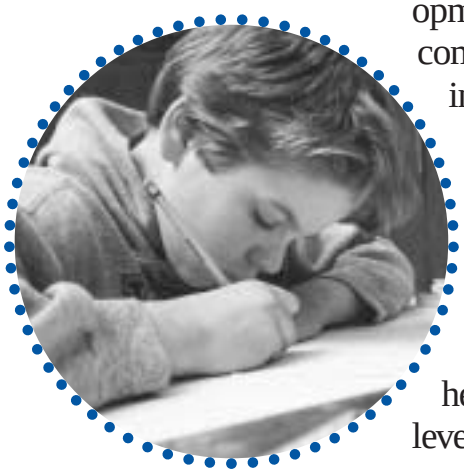
The plan for coverage and care during extracurricular activities sponsored by the school that take place outside of school hours should be carefully set out in the studentôs 504, IEP, or other education plan. As with field trips, trained diabetes personnel must be available at these activities.

Planning for Disasters and Emergencies

To be prepared in the event of natural disasters or emergencies when students need to stay at school, the parents/guardian must provide an emergency supply kit. This kit should contain enough supplies for 72 hours, including the following items as appropriate:

- Blood glucose meter, testing strips, lancets, and batteries for the meter
- Urine ketone strips
- Insulin and supplies
- Insulin pump and supplies, including syringes
- Other medications
- Antiseptic wipes or wet wipes
- Fast-acting source of glucose
- Carbohydrate-containing snacks
- Hypoglycemia food supplies (enough for 3 episodes): quick-acting sugar and carbohydrate/protein snacks
- Glucagon emergency kit

Dealing with Emotional and Social Issues



Students with diabetes must deal not only with the usual developmental issues of growing up but also with learning to manage this complex disease. Diabetes can affect every facet of life, complicating the task of mastering normal developmental challenges.

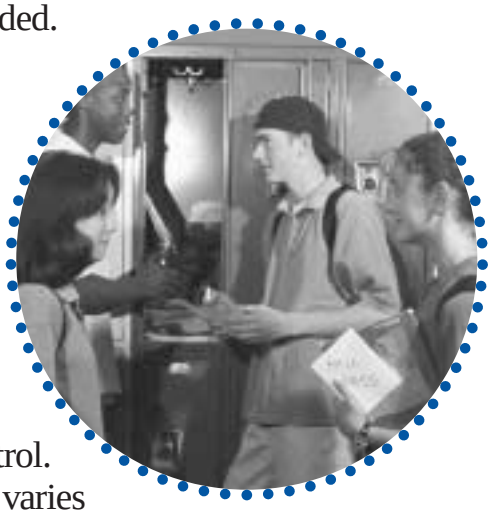
For the most part, children do not want to be singled out or made to feel different from their peers. Diabetes care tasks, however, can set them apart and make them feel angry or resentful about their disease. Sometimes, children and teens feel pressured to please caretakers and yet cannot consistently comply with their requests. To appease concerned parents or health care providers, some children report fictitious glucose levels or do not take all their insulin.

Children react differently to having diabetes. They may be accepting, resentful, open to discussing it, or attempt to hide it. Often, the same child will experience all of these feelings over time. School personnel should be aware of the studentôs feelings about having diabetes and identify ways to ensure the student is treated the same as others.

Diabetes can be a focal point for conflict within families. One of the biggest tasks for children and adolescents is to become increasingly independent from their parents, but diabetes may compromise independence because parents are concerned about their childrenôs ability to perform self-care and take responsibility for it. Parents, who are ultimately responsible for their childrenôs well-being, may be reluctant to allow normal independence in children or teens who have not been able to take care of themselves properly. This parental concern can lead to increasing struggles with dependence, oppositional behavior, and rebellion. Some adolescent girls, for example, may rebel by not following their insulin regimen because they want to lose weight or avoid gaining weight.

Diabetes care tasks can set children and teens apart from their peers and make them feel resentful or angry about their disease.

Increasingly, depression is being recognized as quite common among children and teens generally, and even more so in those with diabetes. Health care providers and school personnel must be aware of emotional and behavioral issues and refer students with diabetes and their families for counseling and support as needed.



WHY IS DIABETES SELF-MANAGEMENT IMPORTANT?

While it is very important to provide students with assistance and supervision of their diabetes care as needed, it is equally important to enable students to take on the responsibility of learning diabetes self-management and control. The age for transfer of responsibility from caregiver to child varies from child to child and from task to task because children develop and mature at different rates. Studentsôability to participate in self-care also depends upon their willingness to do so. As students are ready, they can assume more responsibility for their care.

Studentsô competence and capability for performing diabetes-related tasks are determined by the school health care team and the parents/guardian. **Diabetes care depends upon self-management.** Ultimately, each person with diabetes becomes responsible for all aspects of self-care, including blood glucose monitoring and insulin administration. Regardless of their level of self-management, however, all students with diabetes may require assistance when blood glucose levels are out of the target range.

WHY IS DIABETES MANAGEMENT TRAINING ESSENTIAL FOR SCHOOL PERSONNEL?

Diabetes management training teaches school nurses and staff members how to provide necessary care for students with diabetes during the school day and school-sponsored extracurricular activities. Training should occur before the beginning of the school year, when a student is diagnosed with diabetes, when a student with diabetes is enrolled in the school, or when appropriate. There also should be regular refresher sessions.

There are two levels of training appropriate for school personnel. The first level of training is for school staff members who have primary responsibility for students with diabetes (e.g., teachers and coaches), but who donôt perform diabetes care tasks such as blood glucose monitoring or insulin or glucagon administration. This training should include:

- General overview of diabetes and typical health care needs of a student with diabetes
- Recognition of hypoglycemia and hyperglycemia
- Identity of school nurses and/or trained diabetes personnel and how to contact them for help

The second level of training is for school personnel who will perform routine and emergency care (school nurses and trained diabetes personnel) and should include the following content based on current standards of care for children and youth with diabetes recommended by the American Diabetes Association:

- General overview of typical health care needs of a student with diabetes and how these needs are addressed in the studentôs written care plans

- Explanation/overview of type 1 and type 2 diabetes
- The effect of balancing insulin, food, and exercise upon a studentôs blood glucose levels
- Procedures for routine care of individual students, including blood glucose monitoring, insulin administration, urine ketone testing, and recording results
- Signs and symptoms of hypoglycemia and hyperglycemia and the short- and long-term risks of these conditions
- Treatment of hypoglycemia and hyperglycemia
- Glucagon administration
- Managing nutrition and exercise in the school setting
- Tools, supplies, and equipment required for diabetes care and their storage
- Legal rights and responsibilities of schools and parents/guardian

More information on diabetes can be found in the Resource List beginning on page 61.

WHERE CAN I LEARN MORE ABOUT DIABETES?

The Resource List beginning on page 61 includes a list of the major organizations (and their websites) that offer related information, resources, and training.

Section 2 ACTIONS

Section 2 ACTIONS

FOR School Personnel, Parents, and Students

The health, safety, and educational progress of a student with diabetes depend on cooperation and collaboration between the family and school staff members. Working together, they form the school health team that implements the provisions of the studentôs written plans and provides the necessary assistance in the school environment (see Diabetes Primer, page 11).

When available, the school nurse is the most appropriate person to plan diabetes care in the school and oversee implementation of the studentôs written plans. When a school nurse is not available, the diabetes medical community has found that nonmedical personnel (ñtrained diabetes personnelò) can be trained and supervised to safely provide and assist with diabetes care tasks in the school setting, including blood glucose monitoring, insulin and glucagon administration, and urine ketone testing. Assignment of diabetes care tasks must take into account state and local laws addressing what tasks may be performed by nonmedical school personnel.

The responsibilities of each key school staff member are described in the pages that follow, along with those of the parents/guardian and the student. One person may fill more than one role. For example, a teacher or a coach also may be one of the trained diabetes personnel. The recommended actions on the following pages do not represent legal checklists of what people must do to comply with relevant federal, state, and local laws. Rather, they are steps that school personnel, parents, and students should take to ensure effective diabetes management.

The following pages should be copied and distributed to everyone involved along with the studentôs Quick Reference Emergency Plan (see pages 53ï54). All substitute and appropriate after-school personnel should receive information relevant to their position.

ACTIONS for the School District Administrator

(Superintendent, 504 coordinator, or other school administrator responsible for coordinating student services)

- **Provide leadership** in developing district policy related to all aspects of diabetes management at school that is consistent with the standards of care* recommended for children with diabetes, including delegation of responsibilities, required staff training, medication administration policy, and blood glucose monitoring. Obtain input from local or regional experts.
- **Support implementation of district policy.** Support school district health professionals and other school administrators regarding: 1) development, coordination, and implementation of diabetes management training; 2) ongoing quality control and improvement of these training programs; and 3) development and implementation of a program to monitor the performance of those who receive training.
- **Arrange for training of school personnel.** Arrange for a health care professional, such as the school nurse or a diabetes-trained public health nurse, to provide training and ongoing monitoring for trained diabetes personnel.
- **Allocate sufficient resources** to manage students with diabetes.
- **Monitor schools** attended by students with diabetes for compliance with district policy.
- **Meet with members of the school health team as needed.** Address issues of concern about the provision of diabetes care by the school district, as appropriate.
- **Respect the studentôs confidentiality and right to privacy.**
- **Learn about diabetes** by reviewing the materials contained in this guide.
- **Understand and implement the federal and state laws** that may apply to students with diabetes, including Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act, and the Individuals with Disabilities Education Act (see Section 4).

*The American Diabetes Association (ADA) publishes ñStandards of Care for Diabetes Managementò annually in the journal *Diabetes Care*. These standards also appear on the associationôs website, www.diabetes.org. See the ADAôs position statement on ñCare of Children with Diabetes in the School and Day Care Settingò on pages 73ï 77.

Please copy and distribute to the Principal, School Administrator, or Designee.

ACTIONS for the Principal, School Administrator, or Designee

- **Participate in developing and implementing school policy** related to diabetes management at school and implement school district policy.
- **Allocate sufficient resources to manage students with diabetes.**
- **Develop and implement a system to inform school health services** of the pending enrollment of a student with diabetes.
- **Promote a supportive learning environment** for students with diabetes. Treat these students the same as other students except to respond to medical needs.
- **Meet annually with the school health team.** Arrange and attend a meeting of the school health team members (student, family, school nurse, 504/IEP coordinator, teacher(s), and other staff members who have primary responsibility for the student) before the school year starts, or when the child is newly diagnosed, to discuss medical accommodations and educational aids and related services the student needs.
- **Identify all staff members** who have responsibility for the student with diabetes.
- **Arrange for diabetes management training** for the school nurse, trained diabetes personnel, and other staff members with responsibility for students with diabetes. Inform staff members about how and when they should contact trained diabetes personnel. Ensure that trained diabetes personnel are available at all times when the student is on or off campus for school-sponsored activities and events.
- **Alert all school-related staff members** who teach or supervise a student with diabetes. Ensure that they, including the bus driver, are familiar with the accommodations and emergency procedures contained in the studentôs Diabetes Medical Management Plan, 504 Plan, IEP, or other education plan.
- **Alert all substitute personnel.** Ensure that they are aware of the needs and emergency procedures for students with diabetes.
- **Work with the school health team to implement the studentôs written plans,** including the Diabetes Medical Management Plan, and monitor compliance.

Continued on next page

ACTIONS for the Principal, School Administrator, or Designee *Continued*

- **Implement school policy on availability of trained staff.** The school nurse or at least one of the schoolôs trained diabetes personnel must be available when the student with diabetes is on campus or is a participant in off-campus school-sponsored activities and events.
- **Respect the studentôs confidentiality and right to privacy.**
- **Help develop and implement on-campus as well as off-campus emergency protocols.**
- **Include diabetes awareness as part of health or cultural education.**
- **Support and facilitate** ongoing communication between parents/guardian of students with diabetes and school staff.
- **Learn about diabetes** by reviewing the materials contained in this guide.
- **Be able to recognize and respond to signs and symptoms of hypoglycemia and hyperglycemia** in accordance with the studentôs Quick Reference Emergency Plan, which includes knowing when and how to contact the school nurse or trained diabetes personnel.
- **Understand the federal and state laws** that may apply to students with diabetes, including Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act, and the Individuals with Disabilities Education Act; understand procedures for implementation (see Section 4).

Please copy and distribute to the School Nurse.

ACTIONS for the School Nurse

When a school nurse is assigned to the school (or school district), that person is the key school staff member who coordinates provision of health care services for a student with diabetes at school and at school-related activities. When notified that a student with diabetes is enrolled in the school, annually or more often as necessary, the school nurse will:

- **Obtain and review the studentôs current Diabetes Medical Management Plan** from the personal health care provider and pertinent information from the family.
- **Facilitate the initial school health team meeting** to discuss implementing the studentôs Diabetes Medical Management Plan and participate in the development and implementation of the studentôs 504 Plan, IEP, or other education plan. Monitor compliance with these plans and facilitate follow-up meetings of the school health team to discuss concerns, receive updates, and evaluate the need for changes to the studentôs plans, as appropriate.
- **Conduct a nursing assessment of the student and develop a nursing care plan.** Many school nurses already have systems set up to develop nursing care plans for students with chronic diseases. The plan for students with diabetes is based on assessment of the student, input from the parents/guardian and the student, and the Diabetes Medical Management Plan. For example, the nursing care plan will identify specific functional problems, establish a goal to overcome each problem, and delineate tasks or interventions to help reach the goals.
- **Conduct ongoing, periodic assessments of students with diabetes and update the nursing care plans.**
- **Coordinate development of the studentôs Quick Reference Emergency Plan** and provide copies to staff members who have responsibility for the student throughout the school day (e.g., teachers, coach, PE instructor, lunchroom staff, and bus driver).
- **Obtain materials and medical supplies necessary for diabetes care tasks** from the parents/guardian and arrange a system for notifying the student or parents/guardian when supplies need to be replenished.
- **Plan and implement diabetes management training** for the trained diabetes personnel and any other staff members with responsibility for the student with diabetes who require such training. Ensure that all those mentioned in the 504 Plan, IEP, or other education plan know their roles in carrying out the plan, how their roles relate to each other, and when and where to seek help.
- **Participate in diabetes management training** provided by health care professionals with expertise in diabetes and attend other continuing education offerings to attain and/or maintain knowledge about current standards of care for children with diabetes.

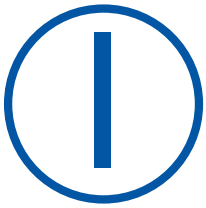
Continued on next page

ACTIONS for the School Nurse *Continued*

- **Review the information about diabetes in this guide.**
- **Distribute the Diabetes Primer in this guide to all school personnel** who have responsibility for students with diabetes.
- **Train (or oversee training of), assess competence, and monitor trained diabetes personnel** in carrying out the health care procedures defined in the Diabetes Medical Management Plan, 504 Plan, IEP, or other education plan.
- **Perform routine and emergency diabetes care tasks,** including blood glucose monitoring, urine ketone testing, insulin administration, and glucagon administration.
- **Practice universal precautions and infection control procedures** during all student encounters.
- **Maintain accurate documentation** of contacts with students and family members; communications with the student's health care provider; any direct care given, including medication administration; and the training and monitoring of trained diabetes personnel.
- **Collaborate with other co-workers** (e.g., food service) and agencies (e.g., outside nursing agencies, school bus transportation services) as necessary to provide health care services.
- **With parental permission, act as liaison between the school and the student's health care provider** regarding the student's self-management at school.
- **Communicate to parents/guardian any concerns about the student's diabetes management or health,** such as acute hypoglycemia episodes, hyperglycemia, general attitude, and emotional issues.
- **Promote and encourage independence and self-care** consistent with the student's ability, skill, maturity, and developmental level.
- **Respect the student's confidentiality and right to privacy.**
- **Act as an advocate** for students to help them meet their diabetes health care needs.
- **Provide education and act as a resource on managing diabetes** at school to the student, family, and school staff. Establish and maintain an up-to-date resource file of pamphlets, brochures, and other publications for school personnel.
- **Assist the classroom teacher** with developing a plan for substitute teachers.
- **Assist the PE instructor** with managing the student's exercise program at school.
- **Be knowledgeable about federal, state, and local laws and regulations** that pertain to managing diabetes at school (see Section 4).

Please copy and distribute to Trained Diabetes Personnel.

ACTIONS for Trained Diabetes Personnel



With proper supervision and training, and where state laws do not prohibit it, nonmedical personnel can help students manage their diabetes safely at school. This guide uses the term ñtrained diabetes personnel,ò but some schools use other names. Trained diabetes personnel may include school staff members, health aides, and licensed practical nurses. Depending on the size of the school, at least two people should be trained to perform diabetes care tasks and be trained diabetes personnel.

If a school has a nurse, the nurse takes the lead in providing diabetes care. Either the school nurse or at least one of the trained diabetes personnel should be on site throughout the school day and during school-sponsored activities that take place before or after school in which a student with diabetes participates.

- **Understand the studentôs Diabetes Medical Management Plan, 504 Plan, IEP, or other education plan.**
- **Understand the studentôs Quick Reference Emergency Plan.**
- **Attend the studentôs school health team meetings** to gain understanding of the overall goal of care.
- **Participate in diabetes management training.**
- **Learn about diabetes** by reviewing materials contained in this guide.
- **Perform routine and emergency diabetes care tasks,** including blood glucose monitoring, urine ketone testing, insulin administration, and glucagon administration after receiving training under the direction of the school nurse or other assigned health care professional.
- **Practice universal precautions and infection control procedures** in all student encounters.
- **Participate in planned evaluations of care.**
- **Document care provided** according to standards and requirements outlined by school policy.
- **Observe and record student health and behavior,** noting any changes over time.
- **Communicate directly and regularly with the school nurse or the supervising health care professional.**
- **Consult with appropriate members of the studentôs school health team** when questions arise or the studentôs health status changes.

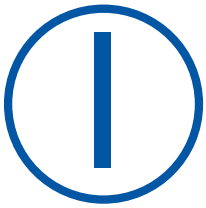
Continued on next page

ACTIONS for Trained Diabetes Personnel *Continued*

- **Respect the studentôs confidentiality and right to privacy.**
- **Be available** on campus during regular school hours and when the student participates in school-sponsored extracurricular activities held before or after school.
- **Accompany the student on field trips or off-campus school-sponsored sports events** and activities, as determined by the 504 Plan, IEP, or other education plan.
- **Provide support and encouragement to the student.**
- **Help ensure that the student has a supportive learning environment** and is treated the same as students without diabetes, except to respond to medical needs.

Please copy and distribute to the Teacher.

ACTIONS for the Teacher



- **Participate in the school health team meeting(s).** The teacher(s) who has primary responsibility for the student participates in the school health team meeting(s) when the Diabetes Medical Management Plan, 504 Plan, IEP, or other education plans are discussed.
- **Work with the school health team to implement written care plans,** including the Diabetes Medical Management Plan, 504 Plan, IEP, or other education plan.
- **Recognize that a change in the studentôs behavior could be a symptom of blood glucose changes.** Be aware that a student who has low blood sugar, even mildly low, may briefly have some cognitive impairment. If changes occur, respond in accordance with the studentôs Quick Reference Emergency Plan.
- **Be prepared to recognize and respond to the signs and symptoms of hypoglycemia and hyperglycemia** in accordance with the studentôs Quick Reference Emergency Plan, which specifies when and how to contact the school nurse or trained diabetes personnel.
- **Provide a supportive environment for the student** to manage diabetes effectively and safely at school, which includes eating snacks for routine diabetes management and to treat low blood glucose levels, having bathroom privileges and access to drinking water, monitoring blood glucose, and administering insulin and other medications.
- **Provide classroom accommodations for the student with diabetes,** as indicated in the studentôs 504 Plan, IEP, or other education plan.
- **Provide instruction to the student** if it is missed because of absence for diabetes-related care.
- **Provide information for substitute teachers** that communicates the day-to-day needs of the student and the Quick Reference Emergency Plan.
- **Notify the parents/guardian in advance of changes in school schedule,** such as class parties, field trips, and other special events.
- **Communicate with the school nurse, trained diabetes personnel, or parents regarding any concerns about the student.**
- **Attend diabetes management training,** if designated as trained diabetes personnel.
- **Learn about diabetes** by reviewing the materials contained in this guide.
- **Treat the student with diabetes the same as other students,** except to meet medical needs.
- **Respect the studentôs confidentiality and right to privacy.**

*Please copy and distribute to the Coach and Physical Education Instructor.**

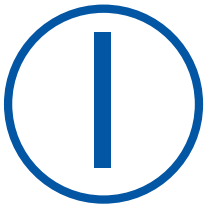
ACTIONS for the Coach and Physical Education Instructor

- **Encourage exercise and participation in physical activities and sports for students with diabetes** as well as for other students.
- **Treat the student with diabetes the same as other students,** except to meet medical needs.
- **Encourage the student to have personal supplies readily accessible.** Make sure blood glucose monitoring equipment is available at all activity sites.
- **Allow the student to check blood glucose levels** as outlined in the 504 Plan, IEP, or other education plan.
- **Understand and be aware that hypoglycemia can occur during and after physical activity**.
- **Recognize that a change in the studentôs behavior could be a symptom of blood glucose changes.**
- **Be prepared to recognize and respond to the signs and symptoms of hypoglycemia and hyperglycemia** and take initial actions in accordance with the studentôs Quick Reference Emergency Plan, which specifies when and how to contact the school nurse or trained diabetes personnel.
- **To treat hypoglycemia, provide the student with immediate access to a fast-acting form of glucose,** as outlined in the Quick Reference Emergency Plan.
- **Consider taping a fast-acting form of glucose (e.g., 3 or 4 glucose tablets or hard candies) to a clipboard or include it in the First Aid pack** that goes out to physical education activities, practices, and games.
- **Learn about diabetes** by reviewing materials contained in this guide.
- **Provide input to the studentôs school health team as needed.**
- **Communicate with the school nurse and/or trained diabetes personnel regarding any observations or concerns about the student.**
- **Provide information for the substitute PE instructor** that communicates the daily needs of the student and the Quick Reference Emergency Plan.
- **Respect the studentôs confidentiality and right to privacy.**

*If appropriate, please distribute this information to the playground/campus supervisor.

Please copy and distribute to the Food Service Manager, Lunchroom Staff, or Lunchroom Monitor.

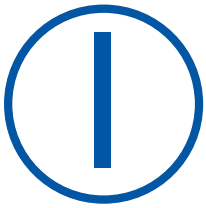
ACTIONS for the Food Service Manager, Lunchroom Staff, or Lunchroom Monitor



- **Obtain a copy of the studentôs written meal plan** from the Diabetes Medical Management Plan.
- **Obtain a copy of the studentôs Quick Reference Emergency Plan** and keep it in a known, yet secure, place in the lunchroom.
- **Provide a lunch menu and lunch schedule in advance to parents** along with the nutrition content of menu selections, including grams of carbohydrate and fat.
- **Understand and be aware that hypoglycemia can occur before lunch.** Supervisory lunch personnel may need to encourage the student to eat appropriate foods.
- **Be prepared to recognize and respond to the signs and symptoms of hypoglycemia and hyperglycemia** and take actions in accordance with the studentôs Quick Reference Emergency Plan.
- **Recognize that a studentôs behavior change could be a symptom of blood glucose changes.**
- **Learn about the various kinds of diabetes meal and snack plans.** Know which type of meal plan the student follows.
- **Recognize that eating meals and snacks on time is a critical component of diabetes management.** Failure to eat lunch on time could result in low blood glucose, especially if a student has missed a morning snack or has had a physically strenuous or otherwise active morning at school.
- **Ensure that the student has timely access to food and sufficient time to finish.**
- **Know where supplies to treat hypoglycemia are kept** (e.g., with the student or another place).
- **Treat the student with diabetes the same as other students,** except to respond to medical needs.
- **Provide input to the studentôs school health team when requested.**
- **Communicate with the school nurse and/or trained diabetes personnel regarding any concerns about the student.**
- **Respect the studentôs confidentiality and right to privacy.**

Please copy and distribute to the Bus Driver.

ACTIONS for the Bus Driver



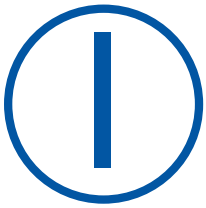
- **At the beginning of the school year, identify any students on the bus who have diabetes.**
- **Obtain a copy of the studentôs Quick Reference Emergency Plan** and keep it on the bus in a known, yet secure, place. Leave the plan readily available for substitute drivers.
- **Understand and be aware that although hypoglycemia normally occurs at the end of the day, it may happen at the beginning of the day** if the student has not eaten breakfast.
- **Recognize that a studentôs behavior change could be a symptom of blood glucose changes.**
- **Be prepared to recognize and respond to the signs and symptoms of hypoglycemia and hyperglycemia** and take initial actions in accordance with the studentôs Quick Reference Emergency Plan, which specifies when and how to contact trained diabetes and emergency personnel.
- **Keep supplies to treat low blood glucose on the bus and be aware of where the students with diabetes normally keep their supplies.**
- **Treat the student with diabetes the same as other students,** except to respond to medical needs.
- **Allow the student to eat snacks on the bus.**
- **Provide input to the studentôs school health team when requested.**
- **Communicate with the school nurse and/or trained diabetes personnel regarding any concerns about the student.**
- **Respect the studentôs confidentiality and right to privacy.**

Please copy and distribute to the Guidance Counselor or School Psychologist.

ACTIONS for the Guidance Counselor or School Psychologist

- **Work with school staff to promote a supportive learning environment.**
- **Ensure that the student with diabetes is treated the same as students without diabetes,** except to respond to medical needs.
- **Be aware of and be prepared to respond to the emotional needs of the student.** Children react differently to having diabetes. Some are accepting and open to discussing it; others are resentful and may attempt to hide it. Often, a single child will experience both kinds of feelings. Be aware of the studentôs feelings about having diabetes and identify ways to ensure the student is treated the same as other students.
- **Recognize that students with chronic illnesses such as diabetes may rebel by discontinuing all or part of their medical regimen.** Adolescent girls, for example, may not follow their insulin regimen because they want to lose weight or to avoid gaining weight.
- **Be aware that some students may not wish to share information about their diabetes with other students or school staff,** particularly if it makes them feel different from others.
- **Promote and encourage independence and self-care** that are consistent with the studentôs ability, skill, maturity, and development.
- **Provide input to the studentôs school health team** when requested.
- **Communicate with the school nurse and/or trained diabetes personnel regarding any concerns about the student.**
- **Respect the studentôs confidentiality and right to privacy.**

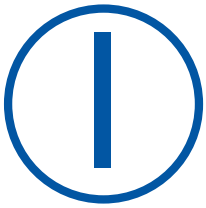
ACTIONS for the Parents or Guardian



- **Inform the school principal that your child has diabetes** when the student enrolls in school or is newly diagnosed with the disease.
- **Provide accurate and current emergency contact information.**
- **Provide the signed Diabetes Medical Management Plan** to the school nurse or other member of the school health team.
- **Attend and participate in the initial and annual meetings of the school health team** (includes student, parents, school nurse, principal, 504 coordinator, teachers, and other school personnel who have responsibility for the student with diabetes) to discuss implementing the studentôs Diabetes Medical Management Plan, to review medical accommodations and educational aids the student may need, and to develop a 504 Plan, IEP, or other education plan.
- **Provide specific information about your childôs diabetes** and performance of diabetes-related tasks at home to the school health team.
- **Permit sharing of medical information** necessary for the studentôs safety between the school and the studentôs personal health care providers.
- **Inform school staff of any changes in the studentôs health status.**
- **Provide all supplies and equipment necessary for implementing your childôs Diabetes Medical Management Plan, 504 Plan, IEP, or other education plan,** including blood glucose monitoring equipment, supplies for insulin administration and urine ketone testing, snacks, fast-acting glucose, and a glucagon emergency kit. As appropriate, provide these supplies to school personnel. Replenish supplies as needed.
- **Provide and maintain all supplies and equipment necessary to accommodate the studentôs long-term needs (72 hours) in case of an emergency.**
- **Inform appropriate school staff (principal, teachers, coaches, and others) when the student plans to participate in school-sponsored activities** that take place before or after school so that health care coverage can be coordinated to ensure the health and safety of the student with diabetes.
- **Understand the federal, state, and local laws** that address the schoolôs responsibilities to students with diabetes.

Please copy and distribute to Students with Diabetes who are able to take responsibility for their self-management.

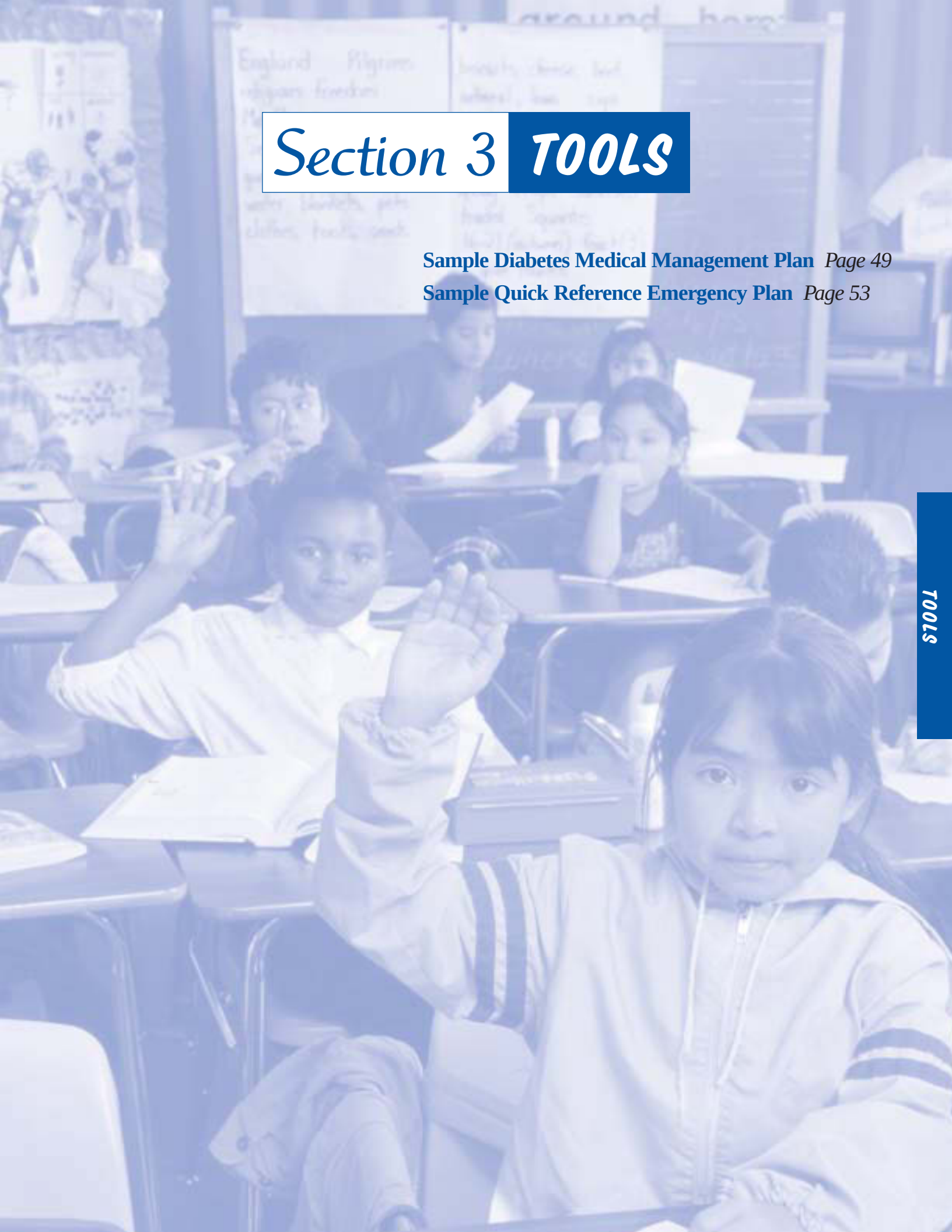
ACTIONS for the Student with Diabetes



- **Participate in the school meeting** to discuss your Diabetes Medical Management Plan, 504 Plan, IEP, or other education plan, as appropriate.
- **Always wear a medical alert ID** and carry a fast-acting source of glucose.
- **Tell teachers and other school staff members if you feel symptoms** of low or high blood glucose, especially if you need help.
- **Work with school staff members if you need help** checking your blood glucose, getting insulin, or eating the right amount of food at the right time during the school day.
- **Take charge of your diabetes care at school** if your written school plans allow you to. This may include:
  -] checking and writing down blood glucose levels
  -] figuring out the right insulin doses
  -] giving yourself insulin
  -] throwing away needles, lancets, and other supplies you have used in the right place
  -] eating meals and snacks as planned
  -] treating low blood sugar
  -] carrying diabetes equipment and supplies with you at all times

Things You Need to Know:

1. **What** your written school plans say to help you manage your diabetes, which person at school will help you, and what is expected of you.
2. **Who** to contact and what to do when you are having a low blood sugar reaction.
3. **When** you should check your blood glucose levels, give yourself insulin, have a snack, and eat lunch.
4. **Where** your diabetes supplies are stored, if you donôt carry them, and who to contact when you need to use them.



Section 3 TOOLS

Section 3 TOOLS FOR Effective Diabetes Management in Schools

This section contains examples of two important tools to help the school health team in managing the student with diabetes:

The **Sample Diabetes Medical Management Plan** is completed by the studentôs parents/guardian and personal health care team and can be used as the basis for developing education plans and nursing care plans for students with diabetes.

The **Sample Quick Reference Emergency Plan** addresses management of hypoglycemia and hyperglycemia emergencies. This plan should be completed for each student with diabetes and both pages should be copied and distributed to all relevant personnel, in accordance with the studentôs Diabetes Medical Management Plan, 504 Plan, IEP, or other education plan.

Date of Plan: _____

Diabetes Medical Management Plan

Effective Dates: _____

This plan should be completed by the studentôs personal health care team and parents/guardian. It should be reviewed with relevant school staff and copies should be kept in a place that is easily accessed by the school nurse, trained diabetes personnel, and other authorized personnel.

Studentôs Name: _____

Date of Birth: _____ Date of Diabetes Diagnosis: _____

Grade: _____ Homeroom Teacher: _____

Physical Condition: a Diabetes type 1 a Diabetes type 2

Contact Information

Mother/Guardian: _____

Address: _____

_____

Telephone: Home _____ Work _____ Cell _____

Father/Guardian: _____

Address: _____

_____

Telephone: Home _____ Work _____ Cell _____

Studentôs Doctor/Health Care Provider:

Name: _____

Address: _____

_____

Telephone: _____ Emergency Number: _____

Other Emergency Contacts:

Name: _____

Relationship: _____

Telephone: Home _____ Work _____ Cell _____

Notify parents/guardian or emergency contact in the following situations:

_____

_____

_____

Blood Glucose Monitoring

Target range for blood glucose is a 70-150 a 70-180 a Other _____

Usual times to check blood glucose _____

Times to do extra blood glucose checks (*check all that apply*)

a before exercise
a after exercise
a when student exhibits symptoms of hyperglycemia
a when student exhibits symptoms of hypoglycemia
a other (explain):_____

Can student perform own blood glucose checks? a Yes a No

Exceptions: _____

Type of blood glucose meter student uses: _____

Insulin

Usual Lunchtime Dose

Base dose of Humalog/Novolog /Regular insulin at lunch (circle type of rapid-/short-acting insulin used) is _____ units or does flexible dosing using _____ units/ _____ grams carbohydrate.
Use of other insulin at lunch: (circle type of insulin used): intermediate/NPH/lente _____ units or basal/Lantus/Ultralente _____ units.

Insulin Correction Doses

Parental authorization should be obtained before administering a correction dose for high blood glucose levels. a Yes a No

_____ units if blood glucose is _____ to _____ mg/dl
_____ units if blood glucose is _____ to _____ mg/dl
_____ units if blood glucose is _____ to _____ mg/dl
_____ units if blood glucose is _____ to _____ mg/dl
_____ units if blood glucose is _____ to _____ mg/dl

Can student give own injections? a Yes a No
Can student determine correct amount of insulin? a Yes a No
Can student draw correct dose of insulin? a Yes a No

_____ Parents are authorized to adjust the insulin dosage under the following circumstances:_____

_____

For Students With Insulin Pumps

Type of pump:_____ Basal rates: _____ 12 am to _____
_____ _____ to _____
_____ _____ to _____

Type of insulin in pump:_____

Type of infusion set:_____

Insulin/carbohydrate ratio:_____ Correction factor: _____

Diabetes Medical Management Plan *Continued*

Student Pump Abilities/Skills:	*Needs Assistance*
Count carbohydrates	a Yes a No
Bolus correct amount for carbohydrates consumed	a Yes a No
Calculate and administer corrective bolus	a Yes a No
Calculate and set basal profiles	a Yes a No
Calculate and set temporary basal rate	a Yes a No
Disconnect pump	a Yes a No
Reconnect pump at infusion set	a Yes a No
Prepare reservoir and tubing	a Yes a No
Insert infusion set	a Yes a No
Troubleshoot alarms and malfunctions	a Yes a No

For Students Taking Oral Diabetes Medications

Type of medication:_____ Timing: _____

Other medications:_____ Timing: _____

Meals and Snacks Eaten at School

Is student independent in carbohydrate calculations and management? a Yes a No

Meal/Snack	*Time*	*Food content/amount*
Breakfast	_____	_____
Mid-morning snack	_____	_____
Lunch	_____	_____
Mid-afternoon snack	_____	_____
Dinner	_____	_____

Snack before exercise? a Yes a No

Snack after exercise? a Yes a No

Other times to give snacks and content/amount:_____

Preferred snack foods: _____

Foods to avoid, if any: _____

Instructions for when food is provided to the class (e.g., as part of a class party or food sampling event):

_____

_____

Exercise and Sports

A fast-acting carbohydrate such as_____ should be available at the site of exercise or sports.

Restrictions on activity, if any:_____

Student should not exercise if blood glucose level is below_____ mg/dl or above_____ mg/dl or if moderate to large urine ketones are present.

Hypoglycemia (Low Blood Sugar)

Usual symptoms of hypoglycemia: _____

_____

Treatment of hypoglycemia: _____

_____

Glucagon should be given if the student is unconscious, having a seizure (convulsion), or unable to swallow. Route_____, Dosage_____, site for glucagon injection: _____arm, _____thigh, _____other.

If glucagon is required, administer it promptly. Then, call 911 (or other emergency assistance) and the parents/guardian.

Hyperglycemia (High Blood Sugar)

Usual symptoms of hyperglycemia: _____

_____

Treatment of hyperglycemia: _____

_____

Urine should be checked for ketones when blood glucose levels are above _____ mg/dl.

Treatment for ketones: _____

Supplies to be Kept at School

_____Blood glucose meter, blood glucose test strips, batteries for meter
_____Lancet device, lancets, gloves, etc.
_____Urine ketone strips
_____Insulin vials and syringes
_____Insulin pump and supplies
_____Insulin pen, pen needles, insulin cartridges
_____Fast-acting source of glucose
_____Carbohydrate containing snack
_____Glucagon emergency kit

Signatures

This Diabetes Medical Management Plan has been approved by:

_____ _____
Studentôs Physician/Health Care Provider Date

I give permission to the school nurse, trained diabetes personnel, and other designated staff members of _____ school to perform and carry out the diabetes care tasks as outlined by _____ôs Diabetes Medical Management Plan. I also consent to the release of the information contained in this Diabetes Medical Management Plan to all staff members and other adults who have custodial care of my child and who may need to know this information to maintain my childôs health and safety.

Acknowledged and received by:

_____ _____
Studentôs Parent/Guardian Date

_____ _____
Studentôs Parent/Guardian Date

Quick Reference Emergency Plan
for a Student with Diabetes

Hypoglycemia
(Low Blood Sugar)

Photo

Studentôs Name

Grade/Teacher Date of Plan

Emergency Contact Information:

Mother/Guardian			**Father/Guardian**		
Home phone	Work phone	Cell	Home phone	Work phone	Cell

School Nurse/Trained Diabetes Personnel **Contact Number(s)**

Never send a child with suspected low blood sugar anywhere alone.

Causes of Hypoglycemia
- ÅToo much insulin
- ÅMissed food
- ÅDelayed food
- ÅToo much or too intense exercise
- ÅUnscheduled exercise

Onset
- ÅSudden

Symptoms

Mild
- ÅHunger
- ÅShakiness
- ÅWeakness
- ÅPaleness
- ÅAnxiety
- ÅIrritability
- ÅDizziness
- ÅSweating
- ÅDrowsiness
- ÅPersonality change
- ÅInability to concentrate
- ÅOther: _____ _____

Circle studentôs usual symptoms.

Moderate
- ÅHeadache
- ÅBehavior change
- ÅPoor coordination
- ÅBlurry vision
- ÅWeakness
- ÅSlurred Speech
- ÅConfusion
- ÅOther _____ _____

Circle studentôs usual symptoms.

Severe
- ÅLoss of consciousness
- ÅSeizure
- ÅInability to swallow

Circle studentôs usual symptoms.

Actions Needed

Notify School Nurse or Trained Diabetes Personnel. If possible, check blood sugar, per Diabetes Medical Management Plan. When in doubt, always TREAT FOR HYPOGLYCEMIA.

Mild
- ÅStudent may/may not treat self.
- ÅProvide quick-sugar source.
  3-4 glucose tablets
  or
  4 oz. juice
  or
  6 oz. regular soda
  or
  3 teaspoons of glucose gel
- ÅWait 10 to 15 minutes.
- ÅRecheck blood glucose.
- ÅRepeat food if symptoms persist or blood glucose is less than _____.
- ÅFollow with a snack of carbohydrate and protein (e.g., cheese and crackers).

Moderate
- ÅSomeone assists.
- ÅGive student quick-sugar source per MILD guidelines.
- ÅWait 10 to 15 minutes.
- ÅRecheck blood glucose.
- ÅRepeat food if symptoms persist or blood glucose is less than _____.
- ÅFollow with a snack of carbohydrate and protein (e.g., cheese and crackers).

Severe
- ÅDonôt attempt to give anything by mouth.
- ÅPosition on side, if possible.
- ÅContact school nurse or trained diabetes personnel.
- ÅAdminister glucagon, as prescribed.
- ÅCall 911.
- ÅContact parents/guardian.
- ÅStay with student.

Quick Reference Emergency Plan

for a Student with Diabetes

Hyperglycemia (High Blood Sugar)

Photo

Studentôs Name

Grade/Teacher Date of Plan

Emergency Contact Information:

Mother/Guardian			**Father/Guardian**		
Home phone	Work phone	Cell	Home phone	Work phone	Cell

School Nurse/Trained Diabetes Personnel **Contact Number(s)**

Causes of Hyperglycemia

- ÅToo much food
- ÅToo little insulin
- ÅDecreased activity
- ÅIllness
- ÅInfection
- ÅStress

Onset

- ÅOver timeð several hours or days

Symptoms

Mild

- ÅThirst
- ÅFrequent urination
- ÅFatigue/sleepiness
- ÅIncreased hunger
- ÅBlurred vision
- ÅWeight loss
- ÅStomach pains
- ÅFlushing of skin
- ÅLack of concentration
- ÅSweet, fruity breath
- ÅOther: _____

Circle studentôs usual symptoms.

Moderate

- ÅMild symptoms plus:
- ÅDry mouth
- ÅNausea
- ÅStomach cramps
- ÅVomiting
- ÅOther:_____

Circle studentôs usual symptoms.

Severe

- ÅMild and moderate symptoms plus:
- ÅLabored breathing
- ÅVery weak
- ÅConfused
- ÅUnconscious

Circle studentôs usual symptoms.

Actions Needed

- ÅAllow free use of the bathroom.
- ÅEncourage student to drink water or sugar-free drinks.
- ÅContact the school nurse or trained diabetes personnel to check urine or administer insulin, per studentôs Diabetes Medical Management Plan.
- ÅIf student is nauseous, vomiting, or lethargic, ____ call the parents/guardian or ____ call for medical assistance if parent cannot be reached.

Section 4 LAWS

School Responsibilities Under Federal Law

The federal laws described in this section apply to a schoolôs responsibility to help students manage diabetes, including confidentiality requirements. A particular student with diabetes could be covered under only one law or more than one law. For information on getting copies of the laws, see page 57.

Section 504 of the Rehabilitation Act of 1973 (Section 504) and Americans with Disabilities Act of 1990 (ADA)

Section 504 prohibits recipients of federal funds from discriminating against people on the basis of disability. Title II of the ADA prohibits discrimination on the basis of disability by public entities, regardless of whether the public entities receive federal funds. Public school districts that receive federal funds are covered by both Title II and Section 504 and the obligations of public schools to students with disabilities under each law are generally the same. For schools, these laws are enforced by the Office for Civil Rights (OCR) in the U.S. Department of Education.

Section 504 outlines a process for schools to use in determining whether a student has a disability and in determining what services a student with a disability needs. This evaluation process must be tailored individually, since each student is different and his or her needs will vary. Historically, students with diabetes have been covered by Section 504 and the ADA.

Under Section 504, students with disabilities must be given an equal opportunity to participate in academic, nonacademic, and extracurricular activities. The regulations also require school districts to identify all students with disabilities and to provide them with a free appropriate public education (FAPE). Under Section 504, FAPE is the provision of regular or special education and related aids and services designed to meet the individual educational needs of students with disabilities as adequately as the needs of nondisabled students are met.

However, a student does not have to receive special education services in order to receive related aids and services under Section 504. Administering insulin or glucagon, providing assistance in checking blood glucose levels, and allowing the student to eat snacks in school are a few examples of related aids and services that schools may have to provide for a particular student with diabetes. The most common practice is to include these related aids

and services as well as any needed special education services in a written document, sometimes called a ñSection 504 Plan.ò

Private schools that receive federal funds may not exclude an individual student with a disability if the school can, with minor adjustments, provide an appropriate education to that student. Private, nonreligious schools are covered by Title III of the ADA.

Individuals with Disabilities Education Act (IDEA)

IDEA provides federal funds to assist state educational agencies and, through them, local educational agencies in making special education and related services available to eligible children with disabilities. IDEA is administered by the Office of Special Education Programs (OSEP) in the Office of Special Education and Rehabilitative Services (OSERS) in the U.S. Department of Education.

A child with a disability must meet the criteria of one or more of 13 disability categories and need special education and related services. The IDEA category of ñother health impairmentò includes diabetes as one of the health conditions listed. To qualify under IDEA, the studentôs diabetes also must adversely affect educational performance to the point that the student requires special education and related services, as defined by state law. An example of a child with diabetes who may qualify under IDEA is a student who may have difficulty paying attention or concentrating in the learning environment because of recurring high or low blood glucose levels that adversely affect the studentôs educational performance.

IDEA requires school districts to find and identify children with disabilities and to provide them a free appropriate public education (FAPE). Under IDEA, FAPE means special education and related services that meet state standards and are provided in conformity with an individualized education program (IEP). The IDEA regulations specify how school personnel and parents, working together, develop and implement an IEP.

Each childôs IEP must include the supplementary aids and services to be provided for, or on behalf of, the child and a statement of the program modifications or supports for school personnel that will be provided for the child to make progress and be involved in the general curriculum. Administering insulin or glucagon, providing assistance in checking blood glucose levels, and allowing the student to eat snacks in school are a few examples of related services, supplementary aids and services, or program modifications or supports that schools could provide for a particular student with diabetes who is eligible under IDEA.

Generally, if a child with diabetes needs only a related service and not special education services as defined by state law, that child is not a child with a disability under IDEA and therefore is not eligible for any services under IDEA. Such a child might still be eligible for services under Section 504.

Family Education Rights and Privacy Act (FERPA)

FERPA generally prohibits schools from disclosing personally identifiable information in a studentôs education record, unless the school obtains the consent of the studentôs parent or the eligible student (a student who is 18 years old or older or who attends an institution of postsecondary education). FERPA does allow schools to disclose this information, without obtaining consent, to school officials, including teachers, who have legitimate educational interests in the information, including the educational interests of the child. Schools that do this must include in their annual notification to parents and eligible students the criteria for determining who constitutes a school official and what constitutes a legitimate educational interest. Additionally, under FERPA, schools may not prevent the parents of students, or eligible students themselves, from inspecting and reviewing the studentôs education records.

How can I get copies of the federal laws?

The statutes are found in the United States Code (U.S.C.). The regulations implementing the statutes are found in the Code of Federal Regulations (CFR).

- Section 504 of the Rehabilitation Act of 1973, 29 U.S.C. 794, implementing regulations at 34 CFR Part 104. Available at www.ed.gov/ocr/disability.html.
- Title II of the Americans with Disabilities Act of 1990, 42 U.S.C. 12134 et seq., implementing regulations at 28 CFR Part 35. Available at www.ed.gov/ocr/disability.html.
- To obtain copies of the Section 504 and Title II regulations, you also may contact the Customer Service Team of the Office for Civil Rights, U.S. Department of Education, at (202) 205ï 5413 or toll-free at 1ï 800ï 421ï 3481. For TTY, call 1ï 877ï 521ï 2172.
- Individuals With Disabilities Education Act, 20 U.S.C. 111 et seq., implementing regulations at 34 CFR Part 300. Available at www.ed.gov/offices/OSERS/OSEP.
- For copies of the IDEA regulations, you also may contact EdPubs at 1ï 877ï 433ï 7827.
- Family Education Rights and Privacy Act (FERPA), 20 U.S.C.1232g, implementing regulations at 34 CFR Part 99. Available at www.ed.gov/offices/OM/fpco.

How can I get more information?

The Office for Civil Rights (OCR) and the Office of Special Education Programs (OSEP) in the U.S. Department of Education can answer questions and provide technical assistance. For more information from OCR, contact OCRôs Customer Service Team at (202) 205ï 5413 or toll-free at 1ï 800ï 421ï 3481. For TTY, call 1ï 877ï 521ï 2172. Information is also available on the OCR website, www.ed.gov/ocr. You may also contact one of OCRôs 12 Enforcement Offices around the country. Contact information is available from the OCR Customer Service Team and from the OCR website. For more information from OSEP, call (202) 205ï 5507 or (202) 205ï 5637 for TTY. More information about FERPA is available at www.ed.gov/offices/OM/fpco.

APPENDICES

RESOURCE LIST
Help for Students with Diabetes

American Academy of Family Physicians (AAFP)
The AAFP is the national member organization of family doctors. Its website includes articles about the link between obesity and diabetes in young people and how to help children lose weight.

11400 Tomahawk Creek Parkway
Leawood, KS 66211
Phone: (913) 906ï 6000
www.aafp.org

American Academy of Pediatrics (AAP)
The AAP is a professional membership organization committed to the attainment of optimal physical, mental, and social health and well-being for all infants, children, adolescents, and young adults.

141 Northwest Point Boulevard
Elk Grove Village, IL 60007ï 1098
Phone: (847) 434ï 4000
www.aap.org

American Association for Health Education (AAHE)
The AAHE serves health educators and other professionals who promote the health of all people through education and other systematic strategies. Programming focuses on health promotion in schools (K-12), health care, public and community agencies, business/industry, and professional preparation. AAHE is one of six national associations within the American Alliance for Health, Physical Education, Recreation and Dance.

1900 Association Drive
Reston, VA 20191
Toll-free: 1ï 800ï 213ï 7193, Ext. 437
www.aahperd.org/aahe

American Association of Diabetes Educators (AADE)
The AADE is a multidisciplinary organization for health professionals who provide diabetes education and care. The AADE website provides diabetes links, including information about diabetes in children and adolescents.

100 West Monroe Street, Suite 400
Chicago, IL 60603
Toll-free: 1ï 800ï TEAMï UP4
(1ï 800ï 832ï 6874)
www.aadenet.org

American Council on Exercise (ACE)

The ACE is a nonprofit organization that promotes active, healthy lifestyles and their positive effects on the mind, body, and spirit. Its programs are directed to youths as well as adults.

4851 Paramount Drive
San Diego, CA 92123
Phone: (858) 535ï 8227
www.acefitness.org

American Diabetes Association (ADA)

The ADAôs mission is to prevent and cure diabetes and improve the lives of people with diabetes. Founded in 1940, the association conducts programs in all 50 states and the District of Columbia, reaching hundreds of communities across the country. The ADA is a nonprofit organization that provides diabetes research, information and advocacy. The association offers a variety of programs focused on young people with diabetes.

1701 North Beauregard Street
Alexandria, VA 22311
Toll-free: 1ï 800ï DIABETES
(1ï 800ï 342ï 2383)
www.diabetes.org

For information about ADAôs training curriculum for school personnel:
www.diabetes.org/schooltraining

American Dietetic Association (ADA)

The ADA is a member organization for registered dietitians and registered technicians representing special interests, including public health, sports nutrition, medical nutrition therapy, diet counseling for weight control, cholesterol reduction, and diabetes. More than 5,000 dietitians now belong to the ADAôs specialty group on Diabetes Care and Education.

120 South Riverside Plaza, Suite 2000
Chicago, IL 60606ï 6995
Toll-free: 1ï 800ï 877ï 1600
Consumer referral: 1ï 800ï 366ï 1655
www.eatright.org

American Medical Association (AMA)

The AMA is the nationôs leader in promoting professionalism in medicine and setting standards for medical education, practice, and ethics. As the largest physician membership organization in the United States, the AMA is at the forefront of every major development in medicine and is a steadfast and influential advocate for physicians and their patients. The AMA works tirelessly to promote the art and science of medicine and the betterment of public health.

American Medical Association
Science, Quality and Public Health Group
515 N. State Street
Chicago, IL 60610
Phone: (312) 464ï 4908

American School Health Association (ASHA)

The mission of the ASHA is to promote and improve the well-being of children and youth by supporting comprehensive school health programs. In addition to a journal, the association produces a book for school nurses and families on managing school-age children with chronic health conditions.

Route 43, P.O. Box 708
Kent, OH 44240
Phone: (330) 678ï 1601
www.ashaweb.org

Barbara Davis Center for Childhood Diabetes

The Barbara Davis Center for Childhood Diabetes is the largest diabetes and endocrine care program in Colorado with unique facilities and resources for clinicians, clinical researchers, and basic biomedical scientists working to help patients with type 1 diabetes. The center provides state-of-the-art clinical diabetes care to a majority of children and many adults within the Rocky Mountain Region.

4200 East Ninth Avenue
Box B -140
Denver, Colorado 80262
Phone: (303) 315ï 8796
www.barbaradaviscenter.org

Centers for Disease Control and Prevention (CDC)

The CDC serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the United States. CDC divisions with special relevance to diabetes in students are the Division of Diabetes Translation, the Division of Nutrition and Physical Activity, and the Division of Adolescent and School Health.

4770 Buford Highway, NE
Atlanta, GA 30341
Toll-free: 1ï 800-311ï 3435
www.cdc.gov

Division of Diabetes Translation
Toll-free: 1ï 877ï CDCï DIAB
(1ï 877ï 232ï 3422)
www.cdc.gov/diabetes

Division of Nutrition and Physical Activity
www.cdc.gov/nccdphp/dnpa

Division of Adolescent and School Health
www.cdc.gov/nccdphp/dash

Disability Rights Education and Defense Fund (DREDF)

DREDF is a national law and policy center dedicated to protecting and advancing the civil rights of people with disabilities through legislation, litigation, advocacy, technical assistance, and education and training of attorneys, advocates, persons with disabilities, and parents and children with disabilities.

2212 Sixth Street
Berkeley, CA 94710
Phone: (510) 644ï 2555
www.dredf.org

Diabetes Exercise and Sports Association

This nonprofit service organization is dedicated to enhancing the quality of life for people with diabetes through exercise.

1647-B West Bethany Home Road
Phoenix, AZ 85015
Toll-free: 1ï 800ï 898ï 4322
www.diabetes-exercise.org

Educational Resources Information Center (ERIC)

The ERIC is a federally funded, nonprofit information network designed to provide ready access to education literature for teachers and parents.

1307 New York Avenue, NW, Suite 300
Washington, DC 20005ï 4701
Toll-free: 1ï 800ï 822ï 9229
www.eric.ed.gov

Indian Health Service (IHS)
IHS National Diabetes Program

The mission of the IHS is to develop, document, and sustain a public health effort to prevent and control diabetes in American Indian and Alaskan Native communities.

5300 Homestead Road, NE
Albuquerque, NM 87110
Phone: (505) 248ï 4182
www.ihs.gov

Joslin Diabetes Center

The Joslin Diabetes Center and its affiliates offer a full range of services for children and adults with diabetes, including programs to help youngsters with diabetes and their families to better manage the disease.

1 Joslin Place
Boston, MA 02215
Toll-free: 1ï 800ï JOSï LIN1
(1ï 800ï 567ï 5461)
www.joslin.harvard.edu

Juvenile Diabetes Research Foundation International (JDRF)

The mission of JDRF is to find a cure for diabetes and its complications through the support of research.

120 Wall Street
New York, NY 10005ï 4001
Toll-free: 1ï 800ï 533ï CURE
(1ï 800ï 533ï 2873)
www.jdrf.org

Lawson Wilkins Pediatric Endocrine Society (LWPES)

The LWPES is a membership organization that promotes the acquisition and dissemination of knowledge of endocrine and metabolic disorders from conception through adolescence. The LWPES website provides links with information about diabetes in children and adolescents.

867 Allardice Way
Stanford, CA 94305
Phone: (650) 494ï 3133
www.lwpes.org

National Association of Elementary School Principals (NAESP)

The NAESP promotes advocacy and support for elementary and middle level principals and other education leaders in their commitment to all children.

Linkages to Learning
1615 Duke Street
Alexandria, VA 22314
Toll-free: 1ï 800ï 38ï NAESP
(1ï 800ï 386ï 2377)
www.naesp.org

National Association of School Nurses (NASN)

The NASN is a nonprofit organization that represents school nurses; it offers continuing education, issues briefs, holds an annual conference, provides legislative updates and position statements, and other materials.

1416 Park Street, Suite A
Castle Rock, CO 80109
Toll-free: 1ï 866ï NASNï SNS
(1ï 866ï 627ï 6767)
www.nasn.org

For information about the National Association of School Nursesôand the Pediatric Adolescent Diabetes Research Foundationôs ñP.E.D.S.ò (Pediatric Education for Diabetes in Schools) training workshop and manual, contact NASN.

National Association of Secondary School Principals (NASSP)

The NASSP is a membership organization of middle level and high school principals, assistant principals, and aspiring school leaders from across the United States and around the world. NASSPôs motto is ñpromoting excellence in school leadership,ò and the association provides members with various programs and services to guide them in administration, supervision, curriculum planning, and staff development to achieve that goal.

1904 Association Drive
Reston, VA 20191
(703) 860ï 0200
www.principals.org

National Association of State Boards of Education (NASBE)

The NASBE is a nonprofit association that represents state and territorial boards of education. NASBEôs principal objectives include strengthening state leadership in educational policymaking, promoting excellence in the education of all students, advocating equality of access to educational opportunity, and assuring continued citizen support for public education.

277 South Washington Street, Suite 100
Alexandria, VA 22314
Phone (703) 684ï 4000
www.nasbe.org

National Center on Physical Activity and Disability (NCPAD)

The NCPAD provides information about current research, local programs, adapted equipment, recreation and leisure facilities, and many other aspects of physical activity for persons with disabilities, including children and adolescents with diabetes.

1640 West Roosevelt Road
Chicago, IL 60608
Toll-free: 1ï 800ï 900ï 8086
www.ncpad.org

National Education Association (NEA) Health Information Network

The NEA Health Information Network is the nonprofit health affiliate of the National Education Association, the nationôs largest labor organization representing 2.3 million public school employees. The mission of the NEA Health Information Network is to ensure that all public school employees, students, and their communities have the health information and skills to achieve excellence in education.

1201 16th Street, NW
Suite 521
Washington, DC 20036ï 3290
Phone: (202) 833ï 4000
www.neahin.org

National Information Center for Children and Youth with Disabilities

This national information and referral clearinghouse on special education and disability-related issues provides information about local, state, or national disability groups and gives technical assistance to parents and professionals.

P.O. Box 1492
Washington, DC 20013ï 1492
Toll-free: 1ï 800ï 695ï 0285
www.nichcy.org

National Institute of Child Health and Human Development (NICHD), National Institutes of Health

The NICHD conducts and supports laboratory, clinical, and epidemiologic research on the reproductive, neurobiologic, developmental, and behavioral processes that determine and maintain the health of children, adults, families, and populations.

31 Center Drive, MSC 2425
Bethesda, MD 20892ï 2425
Phone: (301) 496ï 5133
www.nichd.nih.gov

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health

The NIDDK conducts and supports research on many of the most serious diseases affecting public health. The Institute supports much of the clinical research on the diseases of internal medicine and related subspecialty fields as well as many basic science disciplines.

National Diabetes Education Program (NDEP)

The NDEP is a federally sponsored program of the National Institutes of Health and the Centers for Disease Control and Prevention, involving over 200 public and private partners to improve diabetes treatment and outcomes for people with diabetes, promote early diagnosis, and prevent diabetes.

1 Diabetes Way
Bethesda, MD 20892ï 3600
Toll-free: 1ï 800ï 438ï 5383
www.ndep.nih.gov

National Diabetes Information Clearinghouse (NDIC)

The NDIC is a service of the National Institute of Diabetes and Digestive and Kidney Diseases that provides information about diabetes to people with diabetes, their families, health care professionals, and the public.

1 Information Way
Bethesda, MD 20892ï 3560
Toll-free: 1ï 800ï 860ï 8747
www.niddk.nih.gov

Pediatric Endocrinology Nursing Society (PENS)

The PENS is a nonprofit professional nursing organization with the goal of advancing pediatric endocrine nursing. Its website features articles about diabetes-related topics, including insulin pump therapy, obesity in children, and development of a pediatric diabetes education program for home health nurses.

P.O. Box 2933
Gaithersburg, MD 20886ï 2933
Phone: Not available. All contact is through mail or email.
Email: Through website under Contact PENS.
www.pens.org

U. S. Department of Agriculture (USDA)

The USDA supports several programs of importance to students with diabetes: the Center for Nutrition Policy and Promotion, the Food and Nutrition Information Center, and the Food and Nutrition Service.

Center for Nutrition Policy and Promotion

www.usda.gov/cnpp

Food and Nutrition Information Center

www.nal.usda.gov/fnic

Food and Nutrition Service

www.fns.usda.gov/fns

U.S. Department of Education*

The mission of the Department of Education is to ensure equal access to education and to promote educational excellence throughout the nation.

400 Maryland Avenue, SW
Washington, DC 20202

Office for Civil Rights (OCR)
Toll-free: 1ï 800ï 421ï 3481
TTY: 1ï 877ï 521ï 2172
www.ed.gov/ocr

Office of Special Education Programs (OSEP)
Phone: (202) 205ï 5507
TTY: (202) 205ï 5637
www.ed.gov/offices/OSERS/OSEP

A detailed listing of organizations and programs related to children and adolescents with diabetes and related conditions may be found in

"Resource Directory: Diabetes in Children and Adolescents".

The directory is available on the NDEP website:

WWW.NDEP.NIH.GOV

* Resources, including websites, are mentioned in this guide as examples and are only a few of the many appropriate resource materials available. Other materials mentioned are provided as resources and examples for the readerôs convenience. Listing of materials and resources in this guide should not be construed or interpreted as an endorsement by the U.S. Department of Education of any private organization or business listed herein.

GLOSSARY
of Diabetes Terms

A

Americans with Disabilities Act. A federal law enacted in 1990 to protect people with disabilities from discrimination. Under this law, diabetes can be considered a disability.

Autoimmune disease. A disorder in which the immune system mistakenly attacks and destroys body tissue that it believes to be foreign. In type 1 diabetes, an autoimmune disease, the immune system attacks and destroys the insulin-producing beta cells.

B

Blood glucose level. The amount of glucose in the blood. The recommended blood glucose levels for most people with diabetes are from about 80 to 120 before a meal, 180 or less after a meal, and between 100 and 140 at bedtime.

Blood glucose meter. A device that measures how much glucose is in the blood. A specially coated test strip containing a fresh sample of blood (obtained by pricking the skin, usually the finger, with a lancet) is inserted in the meter, which then measures the amount of glucose in the blood.

Blood glucose monitoring. The act of checking the amount of glucose in the blood. Also called self-monitoring of blood glucose.

C

Carbohydrates. One of the three main classes of foods and a source of energy for the body. Carbohydrates are mainly sugars and starches that the body breaks down into glucose. Foods high in carbohydrates raise blood glucose levels. Carbohydrate foods include: breads, crackers, and cereals; pasta, rice, and grains; vegetables; milk and yogurt; fruit, juice, and sweetened sodas; and table sugar, honey, syrup, and molasses.

Complications of diabetes. Harmful effects that may happen when a person has diabetes. Short-term complications resulting from poorly controlled or uncontrolled diabetes include hypoglycemia (low blood glucose) and hyperglycemia (high blood glucose). Long-term complications, which may develop when a person has had diabetes for a long time, include blindness, amputation of feet or legs, kidney disease, heart disease, stroke, and nerve damage.

D

Diabetes Medical Management Plan. Describes the medical orders or diabetes regimen developed by the student's health care provider and family.

Diabetic Coma. A severe emergency in which a person is not conscious because his or her blood glucose is too low or too high. See also hyperglycemia; hypoglycemia; and diabetic ketoacidosis.

Diabetic ketoacidosis (DKA). A condition that occurs due to insufficient insulin in the body. This can be due to illness, incorrect doses of insulin, or omitting insulin injections. The acidic state that follows causes fruity smelling breath, deep and rapid breathing, stomach pain, nausea, vomiting, and sleepiness. DKA can lead to coma and death if not treated promptly.

Fast-acting glucose. Foods containing simple sugar that are used to raise blood glucose levels quickly during a hypoglycemic episode.

Glucagon. A hormone that raises the level of glucose in the blood. Glucagon, given by injection, is used to treat severe hypoglycemia.

Glucose. A simple sugar found in the blood. It is the bodyôs main source of energy.

Glucose tablets or gel. Special products that deliver a pre-measured amount of pure glucose. They are a fast-acting form of glucose used to counteract hypoglycemia.

Hormone. A chemical produced by an organ that travels in the blood to affect other organs.

Hyperglycemia. A high level of glucose in the blood. High blood glucose can be due to a mismatch in insulin, food, and exercise. Symptoms include thirst, frequent urination, blurred vision, and fatigue.

Hypoglycemia. A low level of glucose in the blood. Low blood glucose is most likely to occur during or after exercise, if too much insulin is present, or not enough food is consumed. Symptoms include feeling shaky, having a headache, or being sweaty, pale, hungry, or tired.

Individualized Education Program (IEP). A program designed for students covered by the Individuals with Disabilities Education Act (IDEA).

Individuals with Disabilities Education Act (IDEA). A federal law that provides funds to states to support special education and related services for children with disabilities, administered by the Office of Special Education Programs in the U.S. Department of Education. To be eligible for services under IDEA, a studentôs diabetes must impair his or her educational performance so that he or she requires special education and related services.

Insulin. A hormone produced by the pancreas that helps the body use glucose for growth and energy. There are several types of insulin that are used in combination to treat people with diabetes. These different types of insulin have been manufactured either to have immediate (rapid-acting or short-acting insulin), intermediate, or long

(basal insulin) onset of action and duration of action in the body. A coordinated combination of insulins is used to allow for adequate treatment of diabetes at meals, snacks, during periods of physical activity, and through the night.

Insulin injections. The process of putting insulin into the body with a needle and syringe or an insulin pen.

Insulin pen. A pen-like device used to put insulin into the body.

Insulin pump. A device that delivers a continuous supply of insulin. The insulin is delivered in a steady, measured dose through a system of plastic tubing (infusion set). Most infusion sets are started with a guide needle, then the plastic cannula (a tiny, flexible plastic tube) is left in place, taped with dressing, and the needle is removed.

Insulin resistance. A condition in which the body does not respond normally to the action of insulin. Many people with type 2 diabetes have insulin resistance.

Ketoacidosis. See Diabetic ketoacidosis.

Ketones (ketone bodies). Chemicals that the body makes when there is not enough insulin in the blood and the body must break down fat for its energy. Ketones can poison and even kill body cells. When the body does not have the help of insulin, ketones build up in the blood and ñspillò over into the urine so that the body can get rid of them. Ketones that build up in the body for a long time lead to serious illness and coma. See also: Diabetic ketoacidosis.

Lancet. A fine, sharp-pointed needle used by people with diabetes for pricking their skin to obtain a sample of blood for blood glucose monitoring.

Metabolism. The term for the way cells chemically change food so that it can be used to keep the body alive.

Medical alert identification. An identification card and necklace or bracelet indicating the student has diabetes and giving an emergency number to call.

Mg/dL. Milligrams per deciliter. This term is used in blood glucose monitoring to describe how much glucose is in a specific amount of blood.

Nursing Care Plan. A plan developed by the school nurse used to implement the studentôs diabetes medical management plan. The plan describes functional problem areas, sets goals for overcoming problems, and lists tasks/interventions to meet the goals.

P

Pallor. Abnormal paleness of the skin.

Palpitations. Abnormally rapid or violent beating of the heart.

Pancreas. The organ behind the lower part of the stomach that makes insulin.

Peak effect time. Time when insulin has its major impact on reducing blood glucose levels. See also Insulin.

Q

Quick Reference Emergency Plan. This plan provides school personnel with essential information on how to recognize and treat hypoglycemia or hyperglycemia.

S

Section 504 of the Rehabilitation Act. A federal law that prohibits recipients of federal funds from discriminating against people on the basis of disability.

Syringe. A device used to inject medications such as insulin into body tissue.

T

Target range. A selected level for blood glucose values that the person with diabetes tries to maintain. The target range is usually determined by the physician in consultation with the patient (or parents, if the patient is a child). See also blood glucose levels.

Test strips. Specially designed strips used in blood glucose meters or in urine testing.

Trained Diabetes Personnel. Nonmedical personnel who have basic diabetes knowledge and have received training in diabetes care, including the performance of blood glucose monitoring, insulin and glucagon administration, recognition and treatment of hypoglycemia and hyperglycemia, and performance of urine ketone testing.

U

Urine ketone testing. A procedure for measuring the level of ketones in the urine.

Care of Children With Diabetes in the School and Day Care Setting

AMERICAN DIABETES ASSOCIATION

Diabetes is one of the most common chronic diseases of childhood, with a prevalence of ~1.7 affected individuals per 1,000 people aged <20 years (1–4). In the U.S., ~13,000 new cases are diagnosed annually in children (4–7). There are about 125,000 individuals <19 years of age with diabetes in the U.S. (8). The majority of these young people attend school and/or some type of day care and need knowledgeable staff to provide a safe school environment (9–12). Both parents and the health care team should work together to provide school systems and day care providers with the information necessary to allow children with diabetes to participate fully and safely in the school experience.

DIABETES AND THE LAW

— Federal laws that protect children with diabetes include Section 504 of the Rehabilitation Act of 1973, the Individuals with Disabilities Education Act of 1991 (originally the Education for All Handicapped Children Act of 1975), and the Americans with Disabilities Act. Under these laws, diabetes has been considered to be a disability, and it is illegal for schools and/or day care centers to discriminate against children with disabilities. In addition, any school that receives federal funding or any facility considered open to the public must reasonably accommodate the special needs of children with diabetes. Indeed, federal law requires an individualized assessment of any child with diabetes. The required accommodations should be provided within the child's usual school setting with as little disruption to the school's and the child's routine as possible and allowing the child full participation in all school activities.

Despite these protections, children in the school and day care setting still face discrimination. For example, some day care centers may refuse admission to children with diabetes, and children in the classroom may not be provided the assistance necessary to monitor blood glucose and may be prohibited from eating needed snacks. The American Diabetes Association works to ensure the safe and fair treatment of children with diabetes in the school and day care setting (13–15).

Diabetes care in schools

Appropriate diabetes care in the school and day care setting is necessary for the child's immediate safety, long-term well being, and optimal academic performance. The Diabetes Control and Complications Trial showed a significant link between blood glucose control and the later development of diabetes complications, with improved glycemic control decreasing the risk of these complications (16,17). To achieve glycemic control, a child must monitor blood glucose frequently, follow a meal plan, and take medications. Insulin is usually taken in multiple daily injections or through an infusion pump. Crucial to achieving glycemic control is an understanding of the effects of physical activity, nutrition therapy, and insulin on blood glucose levels.

To facilitate the appropriate care of the student with diabetes, school and day care personnel must have an understanding of diabetes and must be trained in its management and in the treatment of diabetes emergencies. Knowledgeable trained personnel are essential if the student is to avoid the immediate health risks of low blood glucose and to achieve the metabolic control required to decrease risks for later development of diabetes complications. Studies have shown that the majority of school personnel have an inadequate understanding of diabetes and that parents of children with diabetes lack confidence in their teachers' ability to manage diabetes effectively (12,18,19). Consequently, diabetes education must be targeted toward day care providers, teachers, and other school personnel who interact with the child, including school administrators, school coaches, school nurses, health aides, bus drivers, secretaries, etc.

The purpose of this position statement is to provide recommendations for the management of children with diabetes in the school and day care setting.

GENERAL GUIDELINES FOR THE CARE OF THE CHILD IN THE SCHOOL AND DAY CARE SETTING

I. Diabetes Health Care Plan

An individualized Diabetes Health Care Plan should be developed by the parent/guardian, the student's diabetes care team, and the school or day care provider. Inherent in this process are delineated responsibilities assumed by all parties, including the parent/guardian, the school personnel, and the student. These responsibilities are outlined in this position statement. The Diabetes Health Care Plan should address the specific needs of the child and provide specific instructions for each of the following:

1. Blood glucose monitoring, including the frequency and circumstances requiring testing.

The recommendations in this paper are based on the evidence reviewed in the following publications: Diabetes Control and Complications Trial Research Group: The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med* 329:977–986, 1993; and Diabetes Control and Complications Trial Research Group: The effect of intensive diabetes treatment on the development and progression of long-term complications in adolescents with insulin-dependent diabetes mellitus. *J Pediatr* 125:177–188, 1994.

The initial draft of this paper was prepared by Georgeanna Klingensmith, MD, Francine Kaufman, MD, *Desmond Schatz*, MD, and *William Clarke*, MD. The paper was peer-reviewed, modified, and approved by the Professional Practice Committee and the Executive Committee, November 1998. Most recent review/ revision, 2000.

2. Insulin administration (if necessary), including doses/injection times prescribed for specific blood glucose values and the storage of insulin.
3. Meals and snacks, including food content, amounts, and timing.
4. Symptoms and treatment of hypoglycemia (low blood glucose), including the administration of glucagon if recommended by the student's treating physician.
5. Symptoms and treatment of hyperglycemia (high blood glucose).
6. Testing for ketones and appropriate actions to take for abnormal ketone levels, if requested by the student's health care provider.

Figure 1 includes a sample Diabetes Health Care Plan. For detailed information on the symptoms and treatment of hypoglycemia and hyperglycemia, refer to the *Medical Management of Type 1 Diabetes* (20). A brief description of diabetes targeted to school and day care personnel is included in the APPENDIX; it may be helpful to include this information as an introduction to the Diabetes Health Care Plan.

II. Responsibilities of the various care providers

A. The parent/guardian should provide the school or day care provider with the following:

1. All materials and equipment necessary for diabetes care tasks, including blood glucose testing, insulin administration (if needed), and urine or blood ketone testing. The parent/guardian is responsible for the maintenance of the blood glucose testing equipment (i.e., cleaning and performing controlled testing per the manufacturer's instructions) and must provide materials necessary to ensure proper disposal of materials. A separate logbook should be kept at school with the diabetes supplies for the staff or student to record test results; blood glucose values should be transmitted to the parent/guardian for review as often as requested.
2. Supplies to treat hypoglycemia, including a source of glucose and a glucagon emergency kit, if indicated in the Diabetes Health Care Plan.
3. Information about diabetes and the performance of diabetes-related tasks.
4. Emergency phone numbers for the parent/guardian and the diabetes care team so that the school can contact these individuals with diabetes-related questions and/or during emergencies.
5. Information about the student's meal/snack schedule. The parent should work with the school to coordinate this schedule with that of the other students as closely as possible. For young children, instructions should be given for when food is provided during school parties and other activities.

B. The school or day care provider should provide the following:

1. Training to all adults who provide education/care for the student on the symptoms and treatment of hypoglycemia and hyperglycemia and other emergency procedures. An adult and back-up adult(s) trained to *1*) perform fingerstick blood glucose monitoring and record the results; *2*) take appropriate actions for blood glucose levels outside of the target ranges as indicated in the student's Diabetes Health Care Plan; and *3*) test the urine or blood for ketones, when necessary, and respond to the results of this test.
2. Immediate accessibility to the treatment of hypoglycemia by a knowledgeable adult. The student should remain supervised until appropriate treatment has been administered, and the treatment should be available as close to where the student is as possible.
3. If indicated by the child's developmental capabilities and the Diabetes Health Care Plan, an adult and back-up adult(s) trained in insulin administration.
4. An adult and back-up adult(s) trained to administer glucagon, in accordance with the student's Diabetes Health Care Plan.
5. A location in the school to provide privacy during testing and insulin administration, if desired by the student and family, or permission for the student to check his or her blood glucose level and to take appropriate action to treat hypoglycemia in the classroom or anywhere the student is in conjunction with a school activity, if indicated in the student's Diabetes Health Care Plan.
6. An adult and back-up adult(s) responsible for the student who will know the schedule of the student's meals and snacks and work with the parent/guardian to coordinate this schedule with that of the other students as closely as possible. This individual also will notify the parent/guardian in advance of any expected changes in the school schedule that affect the student's meal times or exercise routine. Young children should be reminded of snack times.
7. Permission for the student to see school medical personnel upon request.
8. Permission for the student to eat a snack anywhere, including the classroom or the school bus, if necessary to prevent or treat hypoglycemia.
9. Permission to miss school without consequences for required medical appointments to monitor the student's diabetes management. This should be an excused absence with a doctor's note, if required by usual school policy.
10. Permission for the student to use the restroom and have access to fluids (i.e., water) as necessary.
11. An appropriate location for insulin and/or glucagon storage, if necessary.

An adequate number of school personnel should be trained in the necessary diabetes procedures (e.g., blood glucose monitoring, insulin and glucagon administration) and in the appropriate response to high and low blood glucose levels to ensure that at least one adult is present to perform these procedures in a timely manner while the student is at school, on field trips, and during extracurricular activities or other school-sponsored events. These school personnel need not be health care professionals.

The student with diabetes should have immediate access to diabetes supplies at all times, with supervision as needed. Provisions similar to those described above must be available for field trips, extracurricular activities, other school-sponsored events, and on transportation provided by the school or day care facility to enable full participation in school activities.

It is the school's legal responsibility to provide appropriate training to school

Diabetes Care Plan for _____ **(name of student)** _____ **School** _____ **Effective Dates:** _____
To be completed by parents/health care team and reviewed with necessary school staff. Copies should be kept in student's classrooms and school records.

Date of Birth: _____ **Grade:** _____ **Homeroom Teacher:** _____

Contact Information:
Parent/guardian #1: _____ Address: _____
Telephone - Home: _____ Work: _____ Cell Phone: _____
Parent/guardian #2: _____ Address: _____
Telephone - Home: _____ Work: _____ Cell Phone: _____
Student's Doctor/Health Care Provider: _____ Telephone: _____
Nurse Educator: _____ Telephone: _____
Other emergency contact: _____ Relationship: _____
Telephone - Home: _____ Work: _____ Cell Phone: _____
Notify parent/guardian in the following situations: _____

Blood Glucose Monitoring
Target range for blood glucose: _____ mg/dl to _____ mg/dl
Type of blood glucose meter student uses: _____
Usual times to test blood glucose: _____
Times to do extra tests (check all that apply):
_____ Before exercise
_____ After exercise
_____ Other (explain): _____
_____ When student exhibits symptoms of hyperglycemia
_____ When student exhibits symptoms of hypoglycemia
Can student perform own blood glucose tests? Yes No Exceptions: _____
School personnel trained to monitor blood glucose level and dates of training: _____

Insulin
Times, types, and dosages of insulin injections to be given during school:

Time	Type(s)	Dosage
_____	_____	_____
_____	_____	_____
_____	_____	_____

School personnel trained to assist with insulin injection and dates of training: _____
Can student give own injections? Yes No
Can student determine correct amount of insulin? Yes No
Can student draw correct dose of insulin? Yes No

For Students with Insulin Pumps:
Type of pump: _____
Insulin/carbohydrate ratio: _____
Correction factor: _____
Is student competent regarding pump? Yes No
Can student effectively troubleshoot problems (e.g., ketosis, pump malfunction)? Yes No
Comments: _____

Meals and Snacks Eaten at School (The carbohydrate content of the food is important in maintaining a stable blood glucose level.)

	Time	Food content/amount
Breakfast	_____	_____
A.M. snack	_____	_____
Lunch	_____	_____
P.M. snack	_____	_____
Dinner	_____	_____

Snack before exercise? Yes No _____
Snack after exercise? Yes No _____
Other times to give snacks and content/amount: _____
A source of glucose, such as _____, should be readily available at all times.
Preferred snack foods: _____
Foods to avoid, if any: _____
Instructions for when food is provided to the class, e.g., as part of a class party or food sampling: _____

Hypoglycemia (Low Blood Sugar)
Usual symptoms of hypoglycemia: _____
Treatment of hypoglycemia: _____
School personnel trained to administer glucagon and dates of training: _____
Glucagon should be given if the student is unconscious, having a seizure (convulsion), or unable to swallow. If required, glucagon should be administered promptly and then 911 (or other emergency assistance) and parents should be called.

Hyperglycemia (High Blood Sugar)
Usual symptoms of hyperglycemia: _____
Treatment of hyperglycemia: _____
Circumstances when urine or blood ketones should be tested: _____
Treatment for ketones: _____

Exercise and Sports
A snack such as _____ should be readily available at the site of exercise or sports.
Restrictions on activity, if any: _____
Student should not exercise if blood glucose is below _____ mg/dl.

Supplies and Personnel
Location of supplies: Blood glucose monitoring equipment: _____ Insulin administration supplies: _____
Glucagon emergency kit: _____ Ketone testing supplies: _____
Snack foods: _____
Personnel trained in the symptoms and treatment of low and high blood sugar and dates of training: _____

Signatures
Reviewed by: [student's health provider/ date] Acknowledged/received by: [guardian/date] Acknowledged/received by: [school representative/date]

Figure 1—*Diabetes Health Care Plan.*

Table 1—*Resources for teachers, child care providers, parents, and health professionals*

Children with Diabetes: Information for Teachers & Child-Care Providers, Alexandria, VA, American Diabetes Association, 1999 (brochure); available online at www.diabetes.org/ada/teacher.asp.
Your School & Your Rights: Protecting Children with Diabetes Against Discrimination in Schools and Day Care Centers, Alexandria, VA, American Diabetes Association, 2000 (brochure); available online at http://www.diabetes.org/main/type1/parents_kids/away/scrights.jsp.*
Your Child Has Type 1 Diabetes: What You Should Know, Alexandria, VA, American Diabetes Association, 1999 (brochure); available online at http://www.diabetes.org/main/community/advocacy/type1.jsp*
Treating Diabetes Emergencies: What You Need to Know, Alexandria, VA, American Diabetes Association, 1995 (video); 1-800-232-6733.
Complete Guide to Diabetes, Alexandria, VA, American Diabetes Association, 1999; 1-800-232-6733.
Raising a Child with Diabetes: A Guide for Parents, Alexandria, VA, American Diabetes Association, 2000; 1-800-232-6733.
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*These documents are available in the American Diabetes Association's Education Discrimination Packet by calling 1-800-DIABETES.

staff on diabetes-related tasks and in the treatment of diabetes emergencies. This training should be provided by health care professionals with expertise in diabetes unless the student's health care provider determines that the parent/guardian is able to provide the school personnel with sufficient oral and written information to allow the school to have a safe and appropriate environment for the child. If appropriate, members of the health care team should provide instruction and materials to the parent/guardian to facilitate the education of school staff. Educational materials from the American Diabetes Association and other sources targeted to school personnel and/or parents are available. Table 1 includes a listing of appropriate resources.

III. Expectations of the student in diabetes care

Children and youths should be able to implement their diabetes care at school with parental consent to the extent that is appropriate for the student's development and his or her experience with diabetes. The extent of the student's ability to participate in diabetes care should be agreed upon by the school personnel, the parent/guardian, and the health care team, as necessary. The ages at which children are able to perform self-care tasks are very individual and variable, and a child's capabilities and willingness to provide self-care should be respected.

1. *Preschool and day care.* The preschool child is usually unable to perform diabetes tasks independently. By 4 years of age, children may be expected to generally cooperate in diabetes tasks.
2. *Elementary school.* The child should be expected to cooperate in all diabetes tasks at school. By age 8 years, most children are able to perform their own fingerstick blood glucose tests with supervision. By age 10, some children can administer insulin with supervision.
3. *Middle school or junior high school.* The student should be able to administer insulin with supervision and perform self-monitoring of blood glucose under usual circumstances when not experiencing a low blood glucose level.
4. *High school.* The student should be able to perform self-monitoring of blood glucose under usual circumstances when not experiencing low blood glucose levels. In high school, adolescents should be able to administer insulin without supervision.

At all ages, individuals with diabetes may require help to perform a blood glucose test when the blood glucose is low. In addition, many individuals require a reminder to eat or drink during hypoglycemia and should not be left unsupervised until such treatment has taken place and the blood glucose value has returned to the normal range.

MONITORING BLOOD GLUCOSE IN THE CLASSROOM — It is best for a student with diabetes to obtain a blood glucose level and to respond to the results as quickly and conveniently as possible. This is important to avoid medical problems being worsened by a delay in testing/treatment and to minimize educational problems caused by missing instruction in the classroom. Accordingly, as stated earlier, a student should be permitted to monitor his or her blood glucose level and take appropriate action to treat hypoglycemia in the classroom or anywhere the student is in conjunction with a school activity, if preferred by the student and indicated in the student's Diabetes Health Care Plan. However, some students desire privacy during testing and this preference should also be accommodated.

In summary, with proper planning and the education and training of school personnel, children and youth with diabetes can fully participate in the school experience. To this end, the family, the health care team, and the school should work together to ensure a safe learning environment.

APPENDIX: BACKGROUND INFORMATION ON DIABETES FOR SCHOOL PERSONNEL — Diabetes is a serious, chronic disease that impairs the body's ability to use food. Insulin, a hormone produced by the pancreas, helps the body

convert food into energy. In people with diabetes, either the pancreas does not make insulin or the body cannot use insulin properly. Without insulin, the body's main energy source—glucose—cannot be used as fuel. Rather, glucose builds up in the blood. Over many years, high blood glucose levels can cause damage to the eyes, kidneys, nerves, heart, and blood vessels.

The majority of school-aged youth with diabetes have type 1 diabetes. People with type 1 diabetes do not produce insulin and must receive insulin through either injections or an insulin pump. Insulin taken in this manner does not cure diabetes and may cause the student's blood glucose level to become dangerously low. Type 2 diabetes, the most common form of the disease typically afflicting obese adults, has been shown to be increasing in youth (21). This may be due to the increase in obesity and decrease in physical activity in young people. Students with type 2 diabetes may be able to control their disease through diet and exercise alone or may require oral medications and/or insulin injections. All people with type 1 and type 2 diabetes must carefully balance food, medications, and activity level to keep blood glucose levels as close to normal as possible.

Low blood glucose (hypoglycemia) is the most common immediate health problem for students with diabetes. It occurs when the body gets too much insulin, too little food, a delayed meal, or more than the usual amount of exercise. Symptoms of mild to moderate hypoglycemia include tremors, sweating, lightheadedness, irritability, confusion, and drowsiness. A student with this degree of hypoglycemia will need to ingest carbohydrates promptly and may require assistance. Severe hypoglycemia, which is rare, may lead to unconsciousness and convulsions and can be life-threatening if not treated promptly.

High blood glucose (hyperglycemia) occurs when the body gets too little insulin, too much food, or too little exercise; it may also be caused by stress or an illness such as a cold. The most common symptoms of hyperglycemia are thirst, frequent urination, and blurry vision. If untreated over a period of days, hyperglycemia can cause a serious condition called diabetic ketoacidosis (DKA), which is characterized by nausea, vomiting, and a high level of ketones in the blood and urine. For students using insulin infusion pumps, lack of insulin supply may lead to DKA more rapidly. DKA can be life-threatening and thus requires immediate medical attention.

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American Academy of Pediatrics
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POLICY STATEMENT

High-Deductible Health Plans and the New Risks of Consumer-Driven Health Insurance Products

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Child Health Financing

ABSTRACT

Consumer-driven health care is the most noteworthy development in health insurance since the widespread adoption of health maintenance organizations and preferred provider organizations in the 1980s. The most common consumer-driven health plan is the high-deductible health plan, which is essentially a catastrophic health insurance plan, often linked with tax-advantaged spending accounts, with very high deductibles, fewer benefits, and higher cost-sharing than conventional health maintenance organization or preferred provider organization plans. The financial risks are significant under high-deductible health plans, especially for low- to moderate-income families and for families whose children have special health care needs. Of concern for pediatricians are the potential quality risks that are predictable in high-deductible health plans, in which families are likely to delay or avoid seeking care, especially preventive care (if it is not exempted from the deductible), when they are faced with paying for care before the deductible is met. This policy statement provides background information on the most common consumer-driven health plan model, discusses the implications for pediatricians and families, and offers recommendations pertaining to health plan product design, education, practice administration, and research.

INTRODUCTION

Consumer-driven health care is the most noteworthy development in health insurance since the widespread adoption of health maintenance organizations (HMOs) and preferred provider organizations (PPOs) in the 1980s. Faced with unsustainable premium increases and heightened competition, employers are experimenting with new products, referred to as consumer-driven health plans (CDHPs).[1] The potential benefit of a CDHP is to increase the control consumers have over their health care spending and to empower them to use published information to guide their care options. The most commonly sold CDHP is a high-deductible health plan (HDHP), which essentially is a catastrophic health insurance plan, often linked with tax-advantaged spending accounts, with very high deductibles, fewer benefits, and higher cost-sharing than conventional HMO and PPO plans. HDHPs offer a new strategy for sharing risk and responsibility for health care costs among employers and employees.[2] HDHPs also represent a major shift from defined benefits to defined contributions.[3] At this time, there is insufficient information to ascertain the specific effects of HDHPs on children's access to care and the operation of the medical home; however, there is concern that

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Key Words
consumer-driven health plan, financing, high-deductible health plans, health savings account, preventive health care

Abbreviations
HMO—health maintenance organization
PPO—preferred provider organization
CDHP—consumer-driven health plan
HDHP—high-deductible health plan
HRA—health reimbursement account
HSA—health savings account
AAP—American Academy of Pediatrics

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children from low- to moderate-income families and children with special health care needs may be at risk if covered under HDHPs.

This policy statement provides background information on the most common CDHP model—the HDHP paired with a tax-advantaged spending account—and the latest research on these new insurance products. The statement also discusses the implications for pediatricians and families and offers recommendations pertaining to product design, education, practice administration, and research.

BACKGROUND

HDHPs were established by the Medicare Prescription Drug Improvement and Modernization Act of 2003. Currently, qualified HDHPs are health insurance plans with at least a $2000 deductible for family coverage and a total annual out-of-pocket maximum, including deductible, copays, and other cost-sharing, that cannot exceed $10 000 per family.[4] The spending account—either a health reimbursement account (HRA) or a health savings account (HSA)—is used to pay for a portion of health care expenses until the plan's high deductible is met; then, the HDHP functions like a PPO plan.[5]

The 2 common spending accounts differ in terms of ownership, requirements to be tied to an HDHP, discretion to carry over unused amounts into subsequent years, and portability (see Table 1). Briefly, the HRA is owned and solely funded by the employer.[6] It is typically offered with an HDHP but also can be offered with an HMO or PPO. The employer has discretion about the amount of funds to be carried over, and HRAs are not portable.[7] The HSA is owned by the employee, although the employer can contribute. It can only be used with an HDHP that has a deductible up to $5150 per family.[7] Money can be carried over from year to year, and the HSA is portable.[7]

Research shows that very large and very small employers as well as individuals in the nongroup market are most interested in offering and purchasing HDHPs. Early research suggests that healthier and wealthier individuals are more likely to purchase HDHPs than their counterparts. Individuals and families in higher tax brackets, especially those who are healthy, can benefit from this method to save for medical expenses, and possibly retirement, with pretax dollars.

According to the 2005 National Employers Health Benefits Survey[8] sponsored by the Kaiser Family Foundation and the Health Research and Education Trust, 20% of employers are offering an HDHP, up from only 5% in 2003. A minority of firms that offer HDHPs (1 in 5) offer either an HRA contribution (10%) or an HSA-qualified plan (12%). In firms that offer HRAs, approximately 25% of employees participate (1.6 million employees or 2% of all covered workers). On average, employer contributions to HRAs amount to $1556. In firms that offer HSAs, approximately 15% of employees participate (810 000 employees or 1.2% of all covered workers). Average annual employer contributions to HSAs amount to $1185, with one third of employers making no contributions. It is unclear what the average amount that employees contribute is.

Table 2 illustrates the cost differences between HDHPs and PPOs for an average family. Although the proportion of employers currently offering HDHPs with spending accounts is small, the expected growth is predicted to be sizeable. According to the 2005 National Employer Health Benefits Survey, 2% to 4% of firms reported that they were very likely to offer HDHPs next year, and 22% to 25% reported that they were somewhat likely to offer them.[9]

PREVENTIVE CARE AND HDHPs

Generally, an HDHP cannot provide any benefits before the deductible is satisfied, but there is an exception for preventive care. Referred to as the "safe harbor for preventive benefits," HDHPs with HSAs are permitted, but not required, to offer preventive care without meeting the deductible.[9] According to the Internal Revenue Code, preventive care is defined as routine well-child care and immunizations; periodic health evaluations, including tests and diagnostic procedures ordered in conjunction with routine examinations, such as annual physicals; mental health and substance abuse screening; vision and hearing screening; screenings for various pediatric conditions (ie, developmental delay, congenital hypothyroidism, lead concentration, phenylketonuria, and scoliosis); metabolic, nutritional, and endocrine screening; infectious disease screening; and maintenance drugs used by chronically ill patients.[10] Despite this important provision, the 2005 National Employer Health Benefits Survey found that only 30% of employers who offer an HDHP with an HSA covered preventive care before the deductible was met, thus eroding the relationship between the medical home and the family.[9]

TABLE 1 **Comparison of HRA and HSA**

Plan	Tax Savings	Funded by	Annual Rollover of Unused Funds	Portable
HRA	Yes	Employer	At the employer's discretion	At the employer's discretion
HSA	Yes (funds may be invested and earn interest tax free)	Can be both employer and employee	Yes	Yes

TABLE 2 **Comparison of Premiums and Deductibles in HDHP and PPOs**

Plan for Average Family of 4 Members	Average Annual Premiums, $	Average Annual Deductible, $
HDHP with HRA	8530	3686
HDHP with HSA	7909	4070
PPO	11 090	646

IMPLICATIONS FOR PEDIATRICIANS AND FAMILIES

HDHPs carry potentially significant coverage, financial, quality, and practice risks for pediatricians as well as families. Among the coverage restrictions, HDHPs typically offer less generous coverage for certain services (eg, drugs, mental health) compared with PPOs or HMOs.[10] Physician and hospital coverage is likely to be the same, although not necessarily in terms of cost-sharing.[8] It is often difficult to assess the coverage risks associated with preventive care, because the service may or may not be exempt from the deductible; also, information on periodicity and content may not be extensively described in consumer materials. Another more significant coverage risk of HDHPs is the potential for "destabilization" of employer-sponsored health insurance if more employers and families purchase HDHPs instead of HMOs and PPOs, which typically offer more comprehensive benefits.

The financial risks are significant under HDHPs, especially for low- to moderate-income families and for families whose children have special health care needs.[7] Because visits by children with special health care needs to specialists are not considered preventive care, parents will need to tap into their HSA or HRAs to pay for these visits as well as any laboratory tests, imaging, therapies, and other essential health care services. Once the HSA or HRA is depleted, parents will need to pay out-of-pocket until they have reached their deductible. Thus, children with special health care needs may not receive all their recommended care, and/or their families may have considerable out-of-pocket expenses. Clearly, families face greater exposure to financial risk with higher deductibles, use of coinsurance versus copays, and higher out-of-pocket maximums.[11] In addition, families may face higher per-service charges because there is not a "middle man" negotiating provider discounts.[12] Under managed care plans, discounted fees are provided in exchange for the potential for increased volume, prompt payment, and streamlined claims processing. These favorable discounts may not be available under HDHPs. In general, HDHPs with spending accounts could potentially be advantageous only if certain conditions were met—for example, if the family had few health problems, the premium was priced low, preventive care was not counted toward the deductible, benefits needed by the family were covered with affordable cost-sharing, and few services were used by the family.[13]

Of concern to pediatricians are the potential quality risks that are predictable in HDHPs in which families are likely to delay or avoid seeking care when they are faced with paying for care before the deductible is met.[14] Lower rates of preventive care and immunizations, less compliance with recommended treatment, less continuity of care, and lower use of acute and chronic care services are very real concerns.[15] HDHPs have the potential to adversely decrease access to medical homes and result in more episodic, high-priced care. Faced with difficult choices, families may seek to "load up" on a scheduled visit to save money or delay care until after the deductible is met. In the end, families will have to make many more decisions about the cost-versus-quality trade-offs, relying on Internet-based information, online patient support tools, and nurse help lines.[1]

Although decision-support tools have been identified as a special feature of HDHPs, a recent US Government Accountability Office report[16] noted that tools provided by insurance carriers to assist consumers in assessing the price and quality of health care providers and services do not provide sufficient information to allow enrollees to fully assess the cost and quality trade-offs of health care–purchasing decisions. Of concern are the methods that insurers and third-party agencies use to rate the quality of care of providers. Relying on claims data, for example, represents a flawed approach to judging quality.

A variety of pediatric practice risks are starting to emerge with HDHPs. Among them are greater administrative and collection costs and bad debt for practices.[17] This is attributable in part to the fact that some HDHP administrators have notified families not to pay the physician charges at the time of service, instead waiting for explanation of benefit statements to assess deductibles and savings account balances. Importantly, pediatricians are likely to be asked more about the costs of their services as well as the content and value of specific services.[13] In addition, families in these plans will likely request more telephone and e-mail assistance to avoid making in-person visits.

RECOMMENDATIONS

The following recommendations focus on the different groups of people and organizations affected by CDHPs. These groups include the insurance companies and third-party payers designing the plans, the families purchasing the plans, and the employers providing the plans. Also included are recommendations for physicians and practices to prepare for CDHPs.

HDHP Design

- Coverage should be provided for preventive services including, but not limited to, well-child care, immunizations, and appropriate screenings.

- Preventive services should be "first-dollar" coverage (ie, covered before the deductible is met).
- Allowed reimbursement amounts for preventive services should be age adjusted to provide adequate payment for preventive health care recommended by the American Academy of Pediatrics (AAP).
- Physicians should be allowed to collect copays and payment for nonpreventive services at the time of visit. Methods to make this simpler, such as real-time debit cards for HSAs, should be developed. Vendors should implement integrated, real-time claims-adjudication processes to help clinicians obtain payment for services from the patient more quickly.
- Payment for services before the deductible has been met should be at billed charges. If a contracted fee schedule is used, it should be adjusted to reflect the increased billing and administration costs incurred by the physician.
- Consideration should be given to payment for telephone and e-mail services, because telephone and e-mail advice will be in greater demand.

Education

- Increase pediatricians' awareness of the prevalence of HDHPs in their geographic area and their varied cost-sharing requirements and benefit designs.
- Communicate to employers the importance of covering preventive care outside the deductible and the importance of receiving preventive care in the medical home.
- Publicize to employers, patients, and the public the average costs of preventive care services, including the increased frequency of examinations and number of vaccines required during the first 2 years of life and the increased amount of time required for adolescent care.
- Consider new educational strategies to assist families when insurance decisions are made, and focus on deductible levels, preventive care coverage, cost-sharing protections, provider networks, spending accounts, and payment arrangements.

Practice Management

- Publicize the practice's policy about collecting payment for services at the time of the visit.
- Communicate the costs and reasons for preventive, acute, follow-up, and chronic medical care.
- Establish billing policies for telephone and e-mail services.
- Prepare for greater administration/collection burdens and bad debts.
- Use AAP Hassle Factor forms (available online at the Member Center at www.aap.org/moc [under "more resources"]) to inform state and national AAP leaders of issues and problems.

Quality Improvement Measures

- HDHPs should adhere to providing quality data information to consumers on the basis of measurement standards developed by accrediting organizations.
- Quality data should be based on measures that are evidence based, relevant to patient outcomes, and statistically valid and reliable.

Research

- Encourage, support, and promote research to assess the value and benefits of preventive pediatric services and promote research to evaluate the effects that HDHPs have on children's and adolescents' access to care and family satisfaction with care and cost of care.
- Examine the effect of HDHPs on the use of medical services, including preventive, acute, and chronic care.

CONCLUSIONS

CDHPs offer the opportunity of more consumer involvement in the decision to purchase specific health care items. However, of notable concern are the effects of this process on children receiving necessary and highly cost-effective preventive care and on lower- or middle-income parents, who will have to pay for a substantial amount of their children's health care out-of-pocket.

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POLICY STATEMENT

HIV Testing and Prophylaxis to Prevent Mother-to-Child Transmission in the United States

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric AIDS

ABSTRACT

Universal HIV testing of pregnant women in the United States is the key to prevention of mother-to-child transmission of HIV. Repeat testing in the third trimester and rapid HIV testing at labor and delivery are additional strategies to further reduce the rate of perinatal HIV transmission. Prevention of mother-to-child transmission of HIV is most effective when antiretroviral drugs are received by the mother during her pregnancy and continued through delivery and then administered to the infant after birth. Antiretroviral drugs are effective in reducing the risk of mother-to-child transmission of HIV even when prophylaxis is started for the infant soon after birth. New rapid testing methods allow identification of HIV-infected women or HIV-exposed infants in 20 to 60 minutes. The American Academy of Pediatrics recommends documented, routine HIV testing for all pregnant women in the United States after notifying the patient that testing will be performed, unless the patient declines HIV testing ("opt-out" consent or "right of refusal"). For women in labor with undocumented HIV-infection status during the current pregnancy, immediate maternal HIV testing with opt-out consent, using a rapid HIV antibody test, is recommended. Positive HIV antibody screening test results should be confirmed with immunofluorescent antibody or Western blot assay. For women with a positive rapid HIV antibody test result, antiretroviral prophylaxis should be administered promptly to the mother and newborn infant on the basis of the positive result of the rapid antibody test without waiting for results of confirmatory HIV testing. If the confirmatory test result is negative, then prophylaxis should be discontinued. For a newborn infant whose mother's HIV serostatus is unknown, the health care professional should perform rapid HIV antibody testing on the mother or on the newborn infant, with results reported to the health care professional no later than 12 hours after the infant's birth. If the rapid HIV antibody test result is positive, antiretroviral prophylaxis should be instituted as soon as possible after birth but certainly by 12 hours after delivery, pending completion of confirmatory HIV testing. The mother should be counseled not to breastfeed the infant. Assistance with immediate initiation of hand and pump expression to stimulate milk production should be offered to the mother, given the possibility that the confirmatory test result may be negative. If the confirmatory test result is negative, then prophylaxis should be stopped and breastfeeding may be initiated. If the confirmatory test result is positive, infants should receive antiretroviral prophylaxis for 6 weeks after birth, and the mother should not breastfeed the infant. *Pediatrics* 2008;122:1127–1134

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human immunodeficiency virus, HIV, perinatal transmission, antiretroviral, prophylaxis, prevention, testing

Abbreviations
MTCT—mother-to-child transmission
AAP—American Academy of Pediatrics
ARV—antiretroviral
CDC—Centers for Disease Control and Prevention
EIA—enzyme immunoassay
IFA—immunofluorescent antibody
ZDV—zidovudine
ACOG—American College of Obstetricians and Gynecologists
USPHS—US Public Health Service

INTRODUCTION

Continuing technologic and medical advances in the diagnosis, prevention, and treatment of pediatric HIV infection require ongoing assessment and review of recommendations relating to pediatric HIV infection, including recommendations regarding prenatal and perinatal HIV counseling and testing. Current guidelines are consistent in their recognition of the importance of universal HIV testing of pregnant women in the United States as the key to prevention of mother-to-child transmission (MTCT) (also referred to as vertical or perinatal transmission) of HIV. The American Academy of Pediatrics (AAP) continues to support these guidelines. This policy statement updates the data that support the guidelines and suggests ways to continue improving the implementation of the recommendations for universal testing during routine prenatal care.

WHY IS A NEW STATEMENT NEEDED NOW?

There is continued MTCT of HIV in the United States; 397 infants were infected through MTCT in 1999–2001 in areas conducting enhanced perinatal surveillance.[1] These infant infections occurred despite the availability of efficacious

interventions for preventing such transmission (antiretroviral [ARV] prophylaxis to mother and infant, elective cesarean delivery before the onset of labor and before rupture of membranes, and complete avoidance of breastfeeding).[2] In recent years, lack of identification of maternal HIV-infection status has been the primary reason for new infant HIV infections; effective interventions cannot be implemented unless maternal HIV status is known. Rapid HIV antibody testing methods now allow identification of HIV-infected women or HIV-exposed infants in 20 to 60 minutes[3–5] (see also www.cdc.gov/hiv/topics/testing/rapid/index.htm). Studies have demonstrated the effectiveness of ARV prophylaxis for preventing MTCT of HIV, even when prophylaxis is initiated after the birth of the infant.[6–10] New guidelines from the Centers for Disease Control and Prevention (CDC) strengthen the recommendations for routine HIV testing during pregnancy.[11] This report summarizes the recommendations of the AAP regarding HIV testing and prophylaxis to prevent MTCT of HIV, which are consistent with and supportive of the CDC recommendations.

HIV TESTING

For adults and children 18 months or older, "conventional testing" of blood for the presence of antibodies against HIV is performed by using a screening enzyme immunoassay (EIA). If the initial EIA result is positive, the laboratory repeats the EIA on the same blood sample, and if the repeat result is positive, the remainder of the blood is used to perform a confirmatory test, either immunofluorescent antibody (IFA) or Western blot assay. Because children younger than 18 months may have a positive HIV antibody test result because of the presence of passively acquired maternal antibody, assays that directly detect HIV DNA or RNA (generically referred to as HIV nucleic acid amplification tests) are required for diagnosis of HIV infection in children younger than 18 months.[12,13] Results of conventional HIV antibody tests and HIV nucleic acid amplification tests usually require hours to days to be returned.

"Rapid" HIV antibody tests have been available since 2002.[3,5,14] These are screening tests, which means that a positive test result requires confirmation with an IFA or Western blot assay. The rapid antibody test is more sensitive and more specific than the conventional EIA, so a conventional EIA is not used as the confirmatory test for a rapid HIV antibody test.[15] In 1 study of the feasibility and benefit of use of the rapid test in pregnant women already in labor when they presented to health care professionals, the positive predictive value of the rapid test was shown to be higher than that of the conventional EIA.[4] That study of 4849 women (HIV prevalence: 7 in 1000) demonstrated that for the conventional EIA, the sensitivity was 100%, specificity was 99.8%, and the positive predictive value was 76%, whereas for the rapid HIV test, the sensitivity was 100%, specificity was 99.9%, and the positive predictive value was 90%.[4]

Although it is usually recommended that all HIV antibody screening tests be confirmed before HIV-specific treatments are started, this can take several weeks, because there is often a delay between availability of the results of the screening test and results of the confirmatory IFA or Western blot assay. This is not problematic for a woman identified early in pregnancy, because initiation of ARV prophylaxis against MTCT generally is not started until the second trimester. However, it is a problem for a woman who is late in pregnancy or in labor or is being tested immediately postpartum. In such instances, time is of the essence in initiating ARV prophylaxis to prevent MTCT. Therefore, when women have positive results of rapid antibody screening late in pregnancy, during labor, or within the first few hours of delivery of the infant, ARV prophylaxis to prevent MTCT should be instituted promptly on the basis of the positive results of the screening test. A maternal blood sample for a confirmatory HIV antibody assay should be obtained and sent for testing.[4,16,17] Prophylaxis should be stopped if the confirmatory test result is negative.

BENEFITS OF HIV TESTING

HIV testing during pregnancy allows identification of HIV infection in women who might not know they are infected. This is important for the health of the woman, because knowledge of her HIV-infection status will allow appropriate evaluation, including $CD4^+$ T-lymphocyte count and HIV viral load quantification, initiation of comprehensive care, and appropriate ARV treatment. HIV antibody testing early in pregnancy has the added benefit of allowing the most effective interventions to prevent MTCT of HIV to be initiated, including ARV prophylaxis, planning an appropriate mode of delivery (elective cesarean delivery or vaginal delivery, depending on maternal viral load near delivery), and avoidance of breastfeeding. HIV antibody testing later in pregnancy, or even after delivery of the newborn infant, still allows initiation of effective ARV interventions that can reduce the risk of MTCT of HIV.

Benefits of HIV Testing Early in Pregnancy

Single-Drug ARV Prophylaxis and MTCT of HIV

The 3-part 1994 Pediatric AIDS Clinical Trials Group study 076 (PACTG 076) regimen is the starting point for understanding ARV prophylaxis and the prevention of MTCT of HIV. Among nonbreastfeeding pregnant women with HIV infection and a $CD4^+$ T-lymphocyte count of greater than 200 cells per mm^3, oral zidovudine (ZDV) prophylaxis initiated after the first trimester, followed by administration of intravenous ZDV beginning at the onset of labor and continued until the cord is clamped, combined with 6 weeks of oral ZDV administered to the infant (2 mg/kg per dose every 6 hours), reduces the rate of MTCT of HIV from 25% to 8%.[18] Among nonbreastfeeding pregnant women with HIV infection, initiation of ZDV prophylaxis before the 28th week of pregnancy is associated with a lower risk of in utero transmission of HIV than is prophylaxis initiated at 35 weeks of pregnancy.[19]

Combination ARV Regimens and MTCT of HIV

Regimens that include combinations of 3 ARV drugs are more effective for prevention of MTCT of HIV than is

ZDV alone.[20,21] For nonbreastfeeding pregnant women with HIV infection, successful combination therapy with 3 ARV drugs and resultant reduction of maternal plasma virus load to below the limits of detection on sensitive assays (the goal of standard ARV therapy) is associated with rates of MTCT of HIV of less than 1%.[22–24] Current US Public Health Service (USPHS) guidelines for prevention of MTCT of HIV recommend use of combination ARV regimens including at least 3 ARV drugs during pregnancy and labor for all pregnant women with HIV infection. ARV drugs are discontinued after delivery unless the mother requires ARV therapy for her own health, in which case ARV therapy would be continued following guidelines for nonpregnant HIV-infected adults.[25,26] Intravenous ZDV should be administered to the pregnant woman during labor until the cord is clamped, with the other ARV drugs in the regimen continued orally during labor, and all infants should receive 6 weeks of ZDV prophylaxis.[25]

The full 6-week course of infant ARV prophylaxis, and careful instructions for its administration, should be provided to the family before discharge from the hospital. A prescription and recommendations to purchase ZDV for use by the infant are not adequate to ensure appropriate prophylaxis. In some states, infants may not be registered for insurance for a few weeks after birth, so even if the family has insurance, coverage may not be immediately available to pay for health care costs for the infant. Some families have health insurance that covers inpatient costs but not prescription medications. Outpatient pharmacies may not stock the infant-dosage form of ZDV. At hospital discharge, the family should be supplied with the medication itself, along with careful instructions for its administration, not just a prescription.

Mode of Delivery and MTCT of HIV

Elective cesarean delivery (performed before onset of labor and before rupture of membranes) can prevent MTCT of HIV[27] and is associated with at least a 50% decrease in the risk of MTCT among HIV-infected women either not receiving ARV drugs or receiving ZDV alone.[28] Although several studies have suggested that elective cesarean delivery performed before labor onset and before rupture of membranes may remain effective among HIV-infected women with low virus load (low either intrinsically off ARV therapy or low because of administration of combination ARV regimens during pregnancy), further research is required to definitively demonstrate whether elective cesarean delivery can further reduce the risk of MTCT of HIV for women being successfully treated with combinations of 3 or more ARV drugs (eg, virus load undetectable on sensitive assays while on a combination 3-drug ARV regimen).[29] Current American College of Obstetricians and Gynecologists (ACOG)[30] and USPHS guidelines for prevention of MTCT recommend elective cesarean delivery at 38 weeks' gestation for all HIV-infected pregnant women with HIV RNA levels greater than 1000 copies per mL near the time of delivery (or who have unknown viral load), regardless of the type of maternal ARV prophylaxis being received.[14,25]

Breastfeeding

Breastfeeding confers approximately 9% to 15% excess risk of MTCT of HIV. In the United States, because safe infant feeding alternatives exist, women with HIV infection should not breastfeed regardless of maternal ARV use.[31,32]

Benefits of HIV Testing in the Peripartum and Newborn Periods

When HIV antibody testing is performed before or during pregnancy, if a woman is found to be infected with HIV, it is possible to use all 3 known efficacious interventions for prevention of MTCT of HIV (prepartum and intrapartum maternal and postpartum infant ARV prophylaxis, elective cesarean delivery, and avoidance of breastfeeding). However, if HIV diagnostic testing is not performed until the peripartum or postpartum periods, then only 2 of the 3 interventions can be implemented (intrapartum maternal and postpartum infant ARV prophylaxis and avoidance of breastfeeding). Although ARV prophylaxis initiated during pregnancy is most effective at reducing MTCT of HIV, prophylaxis initiated for the pregnant woman at the time of labor and continued to the infant after birth, or even prophylaxis only administered to the infant after birth, can reduce the risk of MTCT of HIV compared with no prophylaxis.[6,7,10] Moreover, identification of HIV exposure allows the pediatrician to offer advice on appropriate alternatives to breastfeeding, follow-up testing, and prophylaxis against opportunistic infections for the infant as well as referral of the mother for care of her HIV infection.[12]

For the woman with HIV infection identified at the time of labor, maternal prophylaxis with intravenous ZDV, together with infant prophylaxis with 6 weeks of ZDV, is associated with an approximately 60% lower risk of MTCT of HIV[7] compared with no prophylaxis. For infants whose mothers received no ARV therapy during pregnancy or labor, prompt (optimally as soon as possible after birth but certainly within 12 hours after birth) prophylaxis of the infant with ZDV alone for 6 weeks is associated with a 50% reduction in the risk of MTCT of HIV compared with no prophylaxis.[7]

In certain situations, some experts combine the 6-week infant ZDV prophylaxis regimen with additional ARV drugs. Such situations might include infants born to mothers who received prenatal ARV drugs but had suboptimal viral suppression at delivery, particularly if the infant was delivered vaginally; infants born to mothers who have received only intrapartum ARV drugs; infants born to mothers who have received no prepartum or intrapartum ARV drugs; and infants born to mothers with known drug-resistant virus. Whether combining ZDV with other ARV drugs provides additional efficacy for prevention of MTCT of HIV has not been proven in clinical trials. In addition, appropriate ARV drug formulations and dosing regimens for neonates are incompletely defined for many drugs, and there are minimal data about the safety of combination ARV drugs in the neonate. Therefore, use of combination infant ARV prophylaxis involves complex balancing of potential benefits in terms of prevention of MTCT of HIV and risks in

terms of toxicity to the infant. The USPHS guidelines for prevention of MTCT of HIV include extensive discussion of considerations for infant ARV prophylaxis regimens for different clinical scenarios and should be reviewed for specific recommendations.[25] If infant prophylaxis with ARV drugs in addition to ZDV is being considered, decisions and choice of ARV drugs should be determined in consultation with a practitioner who is experienced in care of infants with HIV infection.

Other Considerations

Early identification of HIV-exposed infants allows (1) appropriate testing to identify HIV-infection status of the infant, (2) counseling of the mother regarding the risk of HIV transmission through breastfeeding and institution of appropriate infant feeding, and (3) prophylaxis with trimethoprim-sulfamethoxazole to prevent *Pneumocystis jiroveci* infection for infants whose HIV-infection status has not been determined or are identified as being HIV infected.[12]

SUMMARY: PROPHYLAXIS AND TREATMENT OF PREGNANT WOMEN WITH HIV INFECTION AND THEIR INFANTS

Guidelines for initiation of ARV therapy for pregnant women are the same as for nonpregnant HIV-infected adults and follow the USPHS "Guidelines for the Use of Antiretroviral Agents in HIV-1-Infected Adults and Adolescents"[26] except that the choice of ARV drugs includes special considerations related to pregnancy and fetal drug exposure as described in the "Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in the United States."[25] For women who need immediate initiation of ARV therapy for their own health, treatment should be initiated as soon as possible, including in the first trimester. For women who do not require treatment for their own health, the effectiveness of ARV prophylaxis depends on the timing of institution of such prophylaxis. For women identified as being HIV infected early in pregnancy, generally 3 ARV drugs are recommended for prophylaxis during their pregnancy and should be continued until the time of delivery. Delaying initiation of prophylaxis until after the first trimester can be considered if treatment of HIV infection is not needed for the woman's own health, intravenous ZDV is administered to the pregnant woman at the time of labor and continued until the cord is clamped, and the other ARV components of the regimen are continued orally during labor. Oral ZDV is administered to the infant for the first 6 weeks of life.[25] For women identified as being HIV infected during labor, intravenous ZDV is recommended together with infant ARV prophylaxis. For infants born to women who have not received prepartum or intrapartum ARV therapy, prophylaxis of the infant with 6 weeks of ZDV is recommended. In the latter 2 situations, some experts may administer additional ARV drugs to the mother and/or infant. The USPHS guidelines for prevention of MTCT of HIV should be consulted for detailed discussion of these more complex situations, and decisions for maternal and infant prophylaxis and therapy in such situations should be made in consultation with a practitioner who is experienced in care of infants with HIV infection.[25]

RISKS OF HIV TESTING IN THE PRENATAL AND NEWBORN PERIODS

A positive HIV antibody test result for an infant identifies HIV infection in the mother and HIV exposure (with possible infection) of the infant. Therefore, even if testing is only performed on the infant after birth, if the infant is found to be HIV-seropositive, the infant's mother will be identified as having HIV infection, which can be associated with personal psychological trauma and societal stigma if the mother does not know that she is infected. Linkage of the newly identified HIV-infected mother to appropriate psychosocial supports and to HIV care programs is important. If the test result is found to be a false-positive, this psychological harm will have occurred needlessly. Thus, the fact that confirmatory testing is required to definitively diagnose HIV infection of the mother, and the need for rapid presumptive treatment of the infant to prevent MTCT should she be HIV infected, should be explained to the mother when performing rapid testing during labor or after delivery. ARV administration to the mother and/or infant may be associated with infant drug toxicity,[33–35] and if the rapid test result is not confirmed to be positive, the benefit/risk ratio may not favor prophylaxis. However, the infant should have received only 1 to 2 days of ARV prophylaxis in such a situation, and short-term toxicity of ARV drugs is limited. Expedited confirmatory testing should be performed to ensure that results are reported quickly so that the duration of infant exposure to ARV drugs is minimized.

CONSENT FOR HIV TESTING

Opt-out consent (documented patient notification, with testing to take place unless rejected by the patient) is associated with higher testing percentages than opt-in consent,[36–38] and universal HIV screening of pregnant women with opt-out consent is recommended by the CDC,[11] the ACOG,[14] and the AAP.[39] As part of its recommendation, the CDC states that HIV screening should be included in the routine panel of prenatal screening tests for all pregnant women and that separate written consent for HIV testing should not be required. The CDC also states that general consent for medical care should be considered sufficient to encompass consent for HIV care.[11] In states where laws or regulations require written informed maternal consent for testing ("opt-in" consent), practitioners should obtain appropriate consent as required. A compendium of state HIV-testing laws can be found at www.ucsf.edu/hivcntr.

In states where laws and regulations require written informed maternal consent for testing, practitioners should work to modify the laws or regulations to permit opt-out consent. Such an advocacy effort is best undertaken with a broad coalition of interested parties throughout the state, including state and local health departments, the state AAP chapter, representatives of the ACOG and the American Academy of Family Physi-

cians, nursing groups, community groups interested in maternal health, and AIDS activist organizations.

Mandatory HIV testing of the newborn infant whose mother has not been tested during pregnancy or in the immediate postpartum period has been associated with high rates of prenatal testing in New York state[7] and may act as a safety net for identifying infants who would not have been tested otherwise. There has not been a study to compare the percentage of women tested before delivery in programs with mandatory newborn testing compared with those with opt-out consent policies. Therefore, an evidence-based recommendation for or against mandatory newborn testing cannot be made. A few states have passed laws that require HIV testing of newborn infants without maternal consent when the HIV-infection status of the mother is unknown. In states where legislation aimed at mandating testing of newborn infants has been proposed, issues have been raised regarding the ethics and legality of this approach, because it diagnoses HIV infection in the mother without her consent for testing. In addition, concerns have been raised about the costs of such screening programs, given the already high numbers of mothers and newborn infants tested in voluntary (opt-out) programs. Regardless of the form of consent used in testing programs, it is important that the results of infant testing be returned as rapidly as possible so that ARV prophylaxis for the infant can be started promptly if needed. Infant ARV prophylaxis is likely to be less effective in the prevention of MTCT of HIV when started later than 12 hours after birth. Optimal prevention of MTCT of HIV requires identification of the mother's HIV status during pregnancy.

TIMING OF TESTING IN PREGNANCY

As noted, testing of the pregnant woman early in pregnancy is recommended to allow informed and timely therapeutic decisions concerning health care for her and for prevention of MTCT of HIV.[11] A second HIV test during the third trimester has been shown to be cost-effective under certain conditions,[40] and the CDC recommends that a second test be performed late in pregnancy but at <36 weeks' gestation for women who are in areas of high incidence, for women delivering in hospitals with HIV prevalence in pregnant women of at least 1 in 1000, and for women at high risk of acquiring HIV (women with a sexually transmitted infection diagnosed during pregnancy, injection drug users and their partners, women who exchange sex or money for drugs, women who are sex partners of HIV-infected persons, women who have had a new or more than 1 sex partner during pregnancy, or women with signs/symptoms of acute HIV infection).[11] However, because risk-based and prevalence-based testing programs may be difficult to implement, some practitioners and hospitals choose to test all pregnant women a second time late in pregnancy, even in the absence of specific prevalence or risk data. Because of the high levels of viral replication observed with acute HIV infection, women who become infected with HIV during pregnancy have a particularly high risk of transmitting HIV to their infants. For women whose HIV status is unknown at the time of presentation in labor, testing should be timed so that results are available to allow predelivery administration of prophylaxis if indicated. For a newborn infant whose mother's HIV status is unknown, testing should be performed quickly enough so that results can be available for infant ARV prophylaxis to begin within 12 hours of birth, as stated previously.[11]

CONCLUSIONS

Universal HIV testing of pregnant women is standard care in the United States. Identification of HIV infection early in pregnancy allows the greatest ability to treat the pregnant woman for her HIV infection for her own health and to prevent MTCT of HIV. Rapid HIV antibody testing allows for timely identification of HIV infection in women even late in pregnancy, during labor, or in the immediate postpartum period as well as HIV exposure in their newborn infants. The results can be available quickly enough to implement successful ARV interventions that can reduce MTCT of HIV when administered to the mother started later in pregnancy or in labor or to the infant when administered within the first few hours of life.

RECOMMENDATIONS

1. Information about HIV infection, prevention of MTCT of HIV, and HIV antibody testing should be provided routinely as part of a comprehensive program of health care for pregnant women.
2. Documented, routine HIV antibody testing should be performed for all pregnant women in the United States after notifying the patient that testing will be performed, unless the patient declines HIV testing (opt-out consent or right of refusal). All HIV antibody testing should be performed in a manner consistent with state and local laws.
3. In states where laws and regulations require written informed maternal consent for testing, health care professionals should work to modify the laws or regulations to permit opt-out consent.
4. All programs for the detection of HIV infection in pregnant women and their infants should periodically evaluate the proportion of women who are not tested. Programs in which an unacceptably high proportion of women do not receive HIV antibody testing should examine the reasons and make appropriate program modifications as needed.
5. Repeat HIV antibody testing is recommended in the third trimester, preferably before 36 weeks' gestation, for women in states with high HIV prevalence in women 15 to 45 years of age, for women delivering in hospitals with HIV prevalence of 1 or more in 1000 pregnant women screened, or for women at increased risk of acquiring HIV (women with a sexually transmitted infection diagnosed during pregnancy, injection drug users and their partners, women who exchange sex or money for drugs, women who are sex partners of HIV-infected per-

sons, women who have had a new or more than 1 sex partner during pregnancy, or women with signs/symptoms of acute HIV infection). Because prevalence-based testing may be difficult to implement and individual risk assessment is unreliable and the risk of MTCT of HIV is high in women who first acquire HIV infection during pregnancy, some experts recommend that repeat HIV screening be considered for all pregnant women in the third trimester.

6. For women in labor with undocumented HIV-infection status during the current pregnancy, maternal HIV antibody testing with opt-out consent, using a rapid HIV antibody test, is recommended. For women with a positive HIV rapid antibody test result, ARV prophylaxis should be administered to the mother and newborn infant on the basis of the positive rapid antibody test result without waiting for results of confirmatory HIV testing, and breastfeeding should not occur. Assistance with the immediate initiation of hand and pump expression to stimulate milk production should be offered to the mother, given the possibility that the confirmatory test results may be negative. If confirmatory test results are negative, prophylaxis should be stopped and breastfeeding may be initiated.
7. Rapid HIV antibody testing should be available on a 24-hour basis at all facilities with an obstetric unit and/or newborn nursery of any level.
8. The health care professional for the newborn infant needs to be informed promptly of maternal HIV serostatus so that appropriate care and testing of the newborn infant can be accomplished and so that ARV prophylaxis can be administered to HIV-exposed infants. The infant medical chart needs to contain documentation of the maternal HIV-infection status. Presence of maternal HIV-infection status on the maternal and infant record should be a standard measure of the adequacy of hospital care for the mother and infant.
9. For newborn infants whose mother's HIV serostatus is unknown, the newborn infant's health care professional should order rapid HIV antibody testing to be performed for the mother or the newborn, with appropriate consent as required by state or local law. Results should be reported to health care professionals quickly enough to allow effective ARV prophylaxis to be administered, if indicated, to the infant as soon as possible after birth but certainly by 12 hours after birth. ARV prophylaxis for the newborn infant should be administered promptly on the basis of a positive rapid antibody test result without waiting for results of confirmatory HIV testing. Breastfeeding should be avoided. Confirmatory testing should be performed, and assistance with hand and pump expression to stimulate milk production should be offered to the mother, given the possibility that the confirmatory test results may be negative. If confirmatory test results are negative (indicating that the infant was not truly exposed to HIV), then ARV prophylaxis should be stopped and breastfeeding may be initiated. If the confirmatory test result is positive, infants should receive ARV prophylaxis for 6 weeks after birth, and they should not breastfeed. Prophylaxis is most effective if administered within 12 hours of birth but may still be effective when administered as late as at 48 hours of life.
10. The full 6-week course of infant ARV prophylaxis, and careful instructions for its administration, should be provided to the family before discharge from the hospital. Payment for this should be covered by all third-party payers.
11. If the mother or infant has a positive test result for HIV antibody, the infant should not breastfeed.
12. In the absence of parental availability for consent to test the newborn infant for HIV antibody, the newborn infant should be tested, ideally within the first 12 hours of life. State and local jurisdictions need to develop procedures to facilitate the rapid evaluation and testing of the infant.
13. For infants of unknown HIV exposure status at the first health supervision visit, HIV antibody testing with appropriate consent should be performed to guide appropriate care and follow-up testing if needed.
14. Care of the mother, fetus, newborn, and child with perinatal exposure to HIV should be performed in consultation with specialists in obstetric and pediatric HIV infection.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on School Health

Home, Hospital, and Other Non–School-based Instruction for Children and Adolescents Who Are Medically Unable to Attend School

ABSTRACT. The American Academy of Pediatrics recommends that school-aged children and adolescents obtain their education in school in the least restrictive setting, that is, the setting most conducive to learning for the particular student. However, at times, acute illness or injury and chronic medical conditions preclude school attendance. This statement is meant to assist evaluation and planning for children to receive non–school-based instruction and to return to school at the earliest possible date.

ABBREVIATIONS. IDEA, Individuals with Disabilities Education Act of 1997; AAP, American Academy of Pediatrics; IEP, individual education plan.

All school-aged children are entitled to obtain their education in a school setting. This recommendation exists not only because of legal mandates, but also because of the social and developmental advantages the school setting provides all children, including those with special needs.[1–3] Federal and state legislation clearly dictate that the most appropriate setting for education is the school; this setting should provide the least restrictive environment possible so children can achieve their maximum potential.[3–5]

Homebound instruction is governed by federal and state laws, but implementation may vary not only from state to state, but also from one school district to another. It must be clear that homebound instruction is meant for acute or catastrophic health problems that confine a child or adolescent to home or hospital for a prolonged but defined period of time and is not intended to relieve the school or parent of the responsibility for providing education for the child in the least restrictive environment. This is defined by the Individuals with Disabilities Education Act (IDEA) of 1997 and Section 504 of the Rehabilitation Act of 1973.[5,6] The responsibility of public schools is further defined by the 1999 Supreme Court ruling in *Cedar Rapids Community School District v Garrett F.*[7] Individual pediatricians and state chapters of the American Academy of Pediatrics (AAP) should make themselves aware of how these laws are being implemented in their local communities and states and use them when indicated to keep children in school.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Some children, by virtue of acute or chronic medical problems, are unable to attend school on a regular basis. The problems include a diverse set of maladies, such as recovery from surgery, trauma, prolonged recuperation from medical illness, chronic disease, and mental health conditions. Documentation of the student's inability to attend school should be provided by the primary care physician, who should serve as the student's medical home, providing comprehensive care in a setting of continuity in a culturally sensitive environment. This may require the assistance of the appropriate subspecialist, and, in the case of mental health issues, input from the psychiatrist, psychologist, or mental health counselor. The primary care physician must, in collaboration with the school district homebound education team, specify the anticipated duration of the homebound instruction. The need for homebound instruction should be reviewed at the end of that period.

When referral is made because of a mental health diagnosis, this referral should be made for a reasonable period, and psychiatric confirmation should be obtained. There should be evidence that counseling and/or medication is being provided. The rationale is that mental health issues may be less well-defined and more difficult to document. In cases in which there is a difficult diagnosis, such as chronic fatigue syndrome or fibromyalgia, without objective evidence of medical illness, an independent consult should be obtained before acceptance for homebound instruction.

Clearly defined school policies for non–school-based instruction should be established. Absence from school for any period will disrupt the educational process and should prompt the school administrator, school nurse, child's primary care physician, or child's parent to request non–school-based instruction. This non–school-based instruction should be considered as soon as possible for a child who may be absent for a prolonged period (eg, cystic fibrosis) or for a child repeatedly absent for brief periods (eg, hospitalization for acute asthma).[4,8] Information should be exchanged among the school, parents, and primary care physician to select the most appropriate type of non–school-based instruction for the child. For the hospitalized child, educational goals should be addressed in the discharge plan.

The following parameters should be considered during planning for a program of non–school-based instruction. First, non–school-based instruction should attempt, at a minimum, to mirror the progress the

child would make in the classroom. Second, the pediatrician should assess whether the child and teacher place each other at medical risk (eg, contagious disease). Third, a parent or other responsible adult should be available during instruction. Finally, instruction hours and contacts should be based on the health status of the student and on available resources.

The school should identify a team to review the pertinent data for the child with the family and appropriate school administrators. This team could be linked to the IEP (individual education plan) team required by IDEA. Discussions should include review of relevant medical data, consideration of all educational options, a specific duration for services, and a plan for returning the child to the classroom. The decision for non–school-based instruction must be reviewed yearly by the school team with the goal of maintaining academic progress and returning the child to school as soon as possible.

Frequent or intermittent absences attributable to recurring illnesses, such as recurrent asthma or sickle cell vaso-occlusive crises, present a situation requiring frequent communication among parents, school administrators, and the primary care physician. This situation needs to be anticipated, and plans should be made, because there is often a delay between requests for and implementation of non–school-based instruction.

Other important issues include the following: the need to assess community resources to support return to school (transportation), the option of part-time school attendance, and in-school resources needed to allow an early return to school.

CONCLUSION

For children who are unable to attend school, education should be available in an alternative setting, such as a rehabilitation center, hospital, or the home. However, if special services, such as transportation, are provided, most children with medically fragile conditions or who require technological support can attend school. For these children, placement in the least restrictive environment that is medically feasible is the best way to normalize the learning environment.

Alternative educational settings are not intended to replace regular school-based instruction or relieve the school of the responsibility of providing meaningful program adaptations for children with special needs or medically fragile conditions. Pediatricians acting as child advocates by serving as school health advisors or as primary care physicians in the community must ensure that appropriate non–school-based instruction is initiated when necessary and that the child is returned to the regular school setting as soon as possible.

It is beyond the scope of this statement to discuss the complex range of federal, state, and local laws and systems for special education and related services for children and adolescents in public schools. Readers are referred to previous AAP statements for additional background material.[9,10]

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Honoring Do-Not-Attempt-Resuscitation Requests in Schools

COUNCIL ON SCHOOL HEALTH AND COMMITTEE ON BIOETHICS

KEY WORDS
do not attempt resuscitation, individualized health care plan, school nurses

ABBREVIATIONS
CPR—cardiopulmonary resuscitation
DNAR—do not attempt resuscitation
AAP—American Academy of Pediatrics
EMS—emergency medical services
CCC—complex chronic condition
IEP—individualized education plan
IHCP—individualized health care plan

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abstract

Increasingly, children and adolescents with complex chronic conditions are living in the community. Federal legislation and regulations facilitate their participation in school. Some of these children and adolescents and their families may wish to forego life-sustaining medical treatment, including cardiopulmonary resuscitation, because they would be ineffective or because the risks outweigh the benefits. Honoring these requests in the school environment is complex because of the limited availability of school nurses and the frequent lack of supporting state legislation and regulations. Understanding and collaboration on the part of all parties is essential. Pediatricians have an important role in helping school nurses incorporate a specific action plan into the student's individualized health care plan. The action plan should include both communication and comfort-care plans. Pediatricians who work directly with schools can also help implement policies, and professional organizations can advocate for regulations and legislation that enable students and their families to effectuate their preferences. *Pediatrics* 2010;125:1073–1077

INTRODUCTION

In a groundbreaking statement in 1974, the American Heart Association declared that cardiopulmonary resuscitation (CPR) is not indicated for all patients. Cases of terminal, irreversible illness in which death is an expected outcome do not necessarily merit CPR.[1] Do-not-resuscitate (DNR) orders developed out of efforts to identify patients who do not wish to receive CPR. The terminology eventually changed to "do not attempt resuscitation" (DNAR), acknowledging that resuscitation is not always successful. Some contemporary authors have proposed replacing the term "DNAR" with "allow natural death" (AND) to indicate the positive goal. DNAR orders are physician orders, in contrast to patient directives. In 1994, the American Academy of Pediatrics (AAP) issued guidelines on foregoing life-sustaining medical treatment, including CPR, for children and adolescents.[2] The AAP believes it is ethically acceptable to forego CPR when it is unlikely to be effective or when the risks outweigh the benefits, including the parents' and child's assessment of the child's quality of life.

DNAR orders are not orders to "do nothing," nor do they represent a decrease in the quality or intensity of care. DNAR orders should be implemented in the context of palliative care, including plans for managing pain and other symptoms, as well as addressing emotional and spiritual needs. Components may include disease-directed treatment

but should always include anticipatory and aggressive symptom control. Spiritual, psychological, and social needs are addressed through delineation of the preferred site for dying, the desired conditions of care, who will provide such care, and even who may be in attendance.[3,4]

Although DNAR orders have become accepted within inpatient health care facilities, such as hospitals and nursing homes, there have been challenges to coordinating end-of-life care in other settings, particularly in situations in which the use of CPR is an established standard of care, such as for emergency medical services (EMS). In the late 1980s, states developed mechanisms, such as bracelets and standardized order forms, to alert EMS personnel to patients who did not wish to receive CPR.[5] These mechanisms have various names including prehospital, out-of-hospital, portable, or durable DNAR policies. A task force in Oregon, for example, developed an order form that they referred to as "physician orders for life-sustaining treatment," which specified patients' preferences regarding 4 separate types of medical treatment: antibiotics, nutrition, hydration, and CPR.[6] To encourage compliance, policies may provide immunity from criminal and civil liability and disciplinary action to particular categories of individuals if they act in good faith. Although common, such laws and regulations are not universal and frequently do not apply to children and teenagers.[7]

Increasingly, children and adolescents with life-limiting conditions are living in the community and attending school. Some may wish to forego CPR. It is estimated that on any given day, 2500 adolescents and 1400 preadolescent children are within 6 months of dying from a complex chronic condition (CCC). Although in the United States, deaths attributable to CCCs have decreased over time across all pediatric age groups, those who are dying from a CCC are increasingly likely to do so away from a medical facility. In Washington State, the percentage of older children and young adults with a CCC who died at home increased from 21% in 1980 to 43% in 1998.[8] Concern about the potential ineffectiveness of CPR applied out-of-hospital is justified. The authors of a recent review summarized representative studies by stating that "[s]urvival to hospital discharge typically occurs for $<$10% of these children, and many have severe neurologic sequelae."[9] Some individuals with a CCC and their families may, therefore, wish to forego CPR.

HONORING DNAR REQUESTS IN THE SCHOOL SETTING

Recent health care and societal trends have made it possible for children with CCCs to attend school, which in turn has raised the issue of accommodating students' and families' preferences regarding health care in this context. The Individuals with Disabilities Education Act of 1997 (IDEA) and section 504 of the Rehabilitation Act of 1973 ensured that children with health care needs will be accommodated in school. As a result, more students with CCCs have been able to attend school, despite inherent medical risks and requirements that accompany them. Attending school may be particularly important for children and adolescents with life-limiting conditions. For example, it may permit them to accomplish crucial developmental tasks such as socializing with their peer group. In 2000, the AAP issued a statement advocating that pediatricians assist parents who desire a DNAR order to develop a consensual agreement with school officials about goals and procedures for in-school medical treatment.[10]

Although the law mandates that the school district accommodate students with CCCs by providing supplementary aid and health care services, fulfilling the spirit of the law under all circumstances can prove challenging. The Individuals with Disabilities Education regulations exempt schools from providing "medical services" while stipulating that the provision of intermittent care necessary for the student's participation cannot be used as grounds for exclusion. To fully integrate students with educational, health, or mental health challenges, schools use an individualized education plan (IEP) and/or a 504 plan. These plans, developed collaboratively by the student, family, and school district, articulate the services to be provided to accommodate the child. Within this process, health care needs can be addressed by an individualized health care plan (IHCP), which also may include an emergency care plan. These plans represent an important framework for extending health care into the school environment, because they are integrated with the student's educational IEP or 504 plan. The essential role of the licensed school nurse in the development and implementation of a student's IHCP is supported by the AAP.[11] The IHCP is a crucial factor for the participation of children and adolescents with CCCs in school, and it offers them the opportunity to remain in school.[12]

Although DNAR requests in schools are becoming more accepted, a minority of school districts have adopted policies on this topic. The percentage of schools in which health services staff were reported to follow DNAR orders increased from 29.7% in 2000 to 46.2% in 2006 according to a Centers for Disease Control and Prevention survey.[13] Another study revealed that 80% of the nation's 50 largest school districts and districts in 31 additional state capitals did not have a policy, regulation, or

protocol supporting a student's DNAR order in 2005.[7] For a DNAR order to be applied within the school setting requires more than just the cooperation of the school district. Without an overarching local or state regulatory or legal framework, honoring the request and not performing CPR potentially represents a liability for the staff members who honor them.

After the AAP policy statement on DNAR orders in schools was published in 2000, articles and commentaries from physicians, lawyers, school nurses, and school administrators raised several concerns.[14,15] Some argued that schools are not medical facilities. Without education, their staff members have a limited understanding of a child's medical condition, care requirements, or expected course. In a cardiac or respiratory arrest situation, school staff members lack the training and perspective regarding when to effectuate a DNAR request. Faced with developing symptoms that may culminate in cardiac or respiratory arrest in a child, they may be uncertain how to proceed. A student's arrest may not be the result of the underlying disease process but rather caused by another, reversible cause. Some individuals also may voice an unwillingness to "stand around and do nothing" for legal or moral reasons. In addition, an arrest is a startling event to witness and potentially traumatic for bystanders when CPR is withheld.

It is important for the pediatrician to understand, acknowledge, and address these concerns openly and sympathetically. The DNAR order directs laypeople trained in CPR to forego using their resuscitation skills in the case of an arrest, irrespective of its etiology. The student's IHCP should direct the staff to provide specified comfort-care measures such as holding him or her, providing supplemental oxygen, or keeping the student warm. Notification of the school nurse and/or activation of EMS may both provide staff much-needed support and the student a broader range of interventions, if warranted. Parents and adolescents need to acknowledge these realities as part of their permission and assent. Pediatricians and school nurses should collaborate to develop plans that can be successfully implemented in the school environment.

Several commentators have expressed concern regarding the effect of withholding CPR on the other students. The implementation of DNAR requests in schools is not, however, the only situation that may engender distress for bystanders. Witnessing unsuccessful CPR may also be traumatic.[16] Action plans should specify a location to which staff can move the student in case of an arrest. In addition, many schools have developed counseling resources for a wide variety of potentially traumatic events.

The legal context in which such planning occurs is complex, and pediatricians and school staff members who honor a DNAR request may not be explicitly protected by the law.[7,14] (Similar issues related to EMS personnel are beyond the scope of this statement.) The ability to honor DNAR requests in schools may be influenced by a variety of factors including state statutes or regulation, judicial decisions, state attorney general's or local prosecutor's actions, and local school district policy or procedures. Although most states permit physicians to write out-of-hospital DNAR orders, few states provide legal authority for advance health care directives by minors. Even fewer states provide explicit legal protection against liability for school personnel who honor a student's DNAR request. Because of the complexity and fluidity of state laws and regulations, pediatricians should contact the AAP Division of State Government Affairs for current information. They should also contact local school districts for information about related policies and procedures.

Pediatricians, therefore, need to respect the school staff's concerns when approaching them on behalf of a family who desires to forego CPR. Still, as results of a study by Kimberly et al[7] illustrated, 1 of 5 school districts that reported having a DNAR policy are in states that do not offer explicit legal indemnification, a finding corroborated by the School Health Policies and Programs Study of the Centers for Disease Control and Prevention.[13] Creating a legal framework in which schools and their personnel are immune from liability when complying with a DNAR request in good faith is a crucial step toward furthering acceptance of DNAR requests in schools.

Even when medical justification and legal indemnification exist at the local and state levels, the schools still need support in adopting policies on DNAR orders. The pediatrician's best ally when approaching the school staff is the school nurse. Although school nurses typically are the health authorities within schools, staffing restrictions may limit their availability during an arrest. Thus, individuals without formal clinical training may be the first personnel at the scene and, therefore, need guidance. To ensure the effectiveness of the DNAR plan within the child's IHCP, the pediatrician may need to help school and local EMS staff to understand its implementation.[17] One means of promoting an informed and prepared population for the circumstances surrounding a DNAR order is to incorporate teaching about DNAR orders within training on CPR.

THE PEDIATRICIAN'S ROLES

Pediatricians and their professional organizations have a variety of potential roles in supporting patients and

their families in their efforts to achieve school integration, especially in the face of life-limiting conditions. Primary care providers and subspecialists who serve as a medical home frequently participate in the development of IEP and/or 504 plans. When appropriate, they can help the school nurse to integrate a DNAR request into the student's IHCP. The pediatrician can assist the family to educate the relevant parties about the child or adolescent's condition, potential complications, and health care goals. It is crucial that physicians be open and sympathetic when listening to the concerns of others about dealing with a potential arrest situation. The most effective tool a physician can offer school staff members is a specific action plan (see Table 1). Presentation of the order to the EMS team, along with the child's use of a medical identification bracelet indicating the DNAR status, will ensure recognition of the child's and family's wishes for end-of-life care. In the unusual event that a student with a standing DNAR order does experience cardiac or respiratory arrest at school, the communication plan and physician's clearly written comfort-care plan will be critical for directing staff actions in lieu of starting CPR. The AAP supports adequate physician reimbursement for these important services,[18] which may be reported as part of the care plan oversight codes (*Current Procedural Terminology*[19] [CPT] codes 99339–99340).

Pediatricians who work directly with schools as school physicians or consultants can help school nurses, administrators and staff, the school board, the district's legal counsel, and EMS personnel understand these issues and participate in developing appropriate school policies (see Table 2). Pediatricians who create CPR-training resources should consider including information regarding requests to withhold interventions. Pediatricians and their professional organizations can assist these efforts by advocating for regulations and laws to support families and their children's wishes by protecting all individuals who act in accord with a DNAR request.

TABLE 1 Components of a DNAR Order

The DNAR order within the IHCP should outline the child's needs and provide specific directives for the staff to follow in the event of a cardiac or respiratory arrest. The elements of the plan should include:
Identification of staff members who should be informed of and educated about the IHCP and the DNAR order
The location to which the child will be moved if serious distress or sudden death should occur at school or plans to remove onlookers from the area if the child cannot be moved
Which comfort measures should be offered to the child
Protocols for notification of the prearranged EMS provider
Protocols for notification of the family and primary care physician
Protocols that define steps to take should the child die in school
Designation of the clinician who will pronounce the child's death (physician, nurse practitioner, or physician assistant)
A specific plan for removing the body from the school to a local health care facility or designated funeral home, including such details as the type of vehicle to be used, where it will park at the school, who will clear the corridors, and what kind of transport equipment will be required to move the body to the waiting vehicle

TABLE 2 Factors Shared by School Districts That Honor DNAR Orders

Presence of a district policy on the approach to the child with a DNAR order
Special consideration to meeting the needs both of the child and family and the other students and staff
A process for ensuring privacy during the event, such that students and staff other than those designated in the IHCP are removed from the scene
Involvement of the child's primary care clinician, the district's legal counselor, and the local EMS provider to reach an agreement on the care that EMS is able to provide
Reconciliation of all state statutes, including those on pronouncement, involvement of the medical examiner, and the procedure for limiting EMS actions at the scene
A process for conveying the plan to the school's staff with the assistance of the school nurse
Postevent planning for assisting the school's community to deal with the death of a student

RECOMMENDATIONS

1. Whether in a medical facility or in the community, the family of a child or adolescent with a CCC should be able to direct their caregivers to withhold CPR when its application is unlikely to be effective or when the risks outweigh the benefits.
2. Pediatricians should work with school nurses to incorporate the student's and family's preferences within the student's IHCP, including not only the decision to forego CPR but also a clearly written, specific approach for providing him or her comfort care. Physicians should receive adequate reimbursement for providing these important services.
3. Pediatricians, particularly those contracted by school districts, can support patients and their families by encouraging school administrators and staff members to implement a policy that accommodates health care preferences, including DNAR orders, at the school-district and school-building levels.
4. Organizations that develop training materials on CPR are encouraged to include information about the possible outcomes of CPR and about the option of withholding resuscitation as part of their curriculum.
5. For decisions to forego CPR to be respected outside the hospital environment, pediatricians, pediatric medical subspecialists and surgical specialists, AAP chapters, and

local leaders will need to advocate for regulations and laws that respect the rights of families and, when appropriate, children and adolescents to direct end-of-life care. Such laws should protect the school, school staff members, and EMS staff members who act in accordance with a decision by the family of a student with a CCC to forego CPR.

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POLICY STATEMENT

Hospital Discharge of the High-Risk Neonate

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Fetus and Newborn

ABSTRACT

This policy statement updates the guidelines on discharge of the high-risk neonate first published by the American Academy of Pediatrics in 1998. As with the earlier document, this statement is based, insofar as possible, on published, scientifically derived information. This updated statement incorporates new knowledge about risks and medical care of the high-risk neonate, the timing of discharge, and planning for care after discharge. It also refers to other American Academy of Pediatrics publications that are relevant to these issues. This statement draws on the previous classification of high-risk infants into 4 categories: (1) the preterm infant; (2) the infant with special health care needs or dependence on technology; (3) the infant at risk because of family issues; and (4) the infant with anticipated early death. The issues of deciding when discharge is appropriate, defining the specific needs for follow-up care, and the process of detailed discharge planning are addressed as they apply in general to all 4 categories; in addition, special attention is directed to the particular issues presented by the 4 individual categories. Recommendations are given to aid in deciding when discharge is appropriate and to ensure that all necessary care will be available and well coordinated after discharge. The need for individualized planning and physician judgment is emphasized. *Pediatrics* 2008;122:1119–1126

INTRODUCTION

The decision of when to discharge an infant from the hospital after a stay in the NICU is complex.[1] This decision is made primarily on the basis of the infant's medical status but is complicated by several factors. These factors include the readiness of families for discharge, differing opinions about what forms of care can be provided at home, and pressures to contain hospital costs by shortening the length of stay. Insofar as possible, determination of the readiness for discharge should be based on peer-reviewed scientific evidence. Shortening the length of a hospital stay may benefit the infant and family by decreasing the period of separation of infant and parents; moreover, the infant may benefit from shortening its exposure to the risks of hospital-acquired morbidity. However, the overriding concern is that infants may be placed at risk of increased mortality and morbidity by discharge before physiologic stability is established. Infants born preterm with low birth weight who require neonatal intensive care experience a much higher rate of hospital readmission and death during the first year after birth compared with healthy term infants.[2–5] Careful preparation for discharge and good follow-up after discharge may reduce these risks. It takes time for the family of a high-risk infant to prepare to care for their infant in a home setting and to obtain the necessary support services and mobilize community resources. With increased survival of very preterm and very ill infants, many infants are discharged with unresolved medical issues that complicate their subsequent care. Infants are often discharged requiring more care and closer follow-up than was typical in the past. In addition, societal and economic forces have come to bear on the timing and process of discharge and follow-up care. As a result, health care professionals need guidance in assessing readiness for discharge and planning for subsequent care. This policy statement, therefore, addresses 4 broad categories of high-risk infants: (1) the preterm infant; (2) the infant with special health care needs or dependence on technology; (3) the infant at risk because of family issues; and (4) the infant with anticipated early death. This policy statement updates a previous guideline published by the American Academy of Pediatrics in 1998.[1]

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Key Words
discharge, high risk, premature, neonate, infant

Abbreviation
SIDS—sudden infant death syndrome

CATEGORIES OF HIGH-RISK INFANTS

The Preterm Infant

Historically, preterm infants were discharged only when they achieved a certain weight, typically 2000 g (5 lb). However, randomized clinical trials[6–8] have shown that earlier discharge is possible without adverse health effects

when preterm infants are discharged on the basis of physiologic criteria rather than body weight. Although the population characteristics, the nature and results of the outcome measures, and the content of the early discharge programs in these studies varied, the common elements included:

- physiologic stability;
- an active program of parental involvement and preparation for care of the infant at home;
- arrangements for health care after discharge by a physician or other health care professional who is experienced in the care of high-risk infants; and
- an organized program of tracking and surveillance to monitor growth and development.

The 3 physiologic competencies that are generally recognized as essential before hospital discharge of the preterm infant are oral feeding sufficient to support appropriate growth, the ability to maintain normal body temperature in a home environment, and sufficiently mature respiratory control. These competencies are achieved by most preterm infants between 36 and 37 weeks' postmenstrual age,[7,9] but maturation of respiratory control to a point that allows safe discharge may take longer, occasionally up to 44 weeks' postmenstrual age.[10,11] Although interrelated, not all competencies are achieved by the same postnatal age in a given infant. The pace of maturation is influenced by the birth weight, the gestational age at birth, and the degree and chronicity of neonatal illnesses. Infants born earlier in gestation and with more complicated medical courses tend to take longer to achieve these physiologic competencies.

Home monitors are rarely indicated for detection of apnea solely because of immature respiratory control, in part because infants with immature respiratory control, in general, are still hospitalized until they are no longer at risk of apnea of prematurity. Use of a home monitor does not preclude the need for demonstrated maturity of respiratory control before discharge and should not be used to justify discharge of infants who are still at risk of apnea. Home monitors are not indicated for prevention of sudden infant death syndrome (SIDS) in preterm infants,[12] although preterm infants are at increased risk of SIDS.[13] Formal laboratory analyses of breathing patterns (ie, "pneumograms") are of no value in predicting SIDS[12] and are not helpful in identifying patients who should be discharged with home monitors.

Preterm infants should be placed supine for sleeping,[14–17] just as term infants should, and the parents of preterm infants should be counseled about the importance of supine sleeping in preventing SIDS. Hospitalized preterm infants should be kept predominantly in the supine position, at least from the postmenstrual age of 32 weeks onward, so that they become acclimated to supine sleeping before discharge. Supine positioning for sleep has led to an increase in positional skull deformity, especially in preterm infants but also in term infants[16,18,19]; although only cosmetic, these deformities can be quite disturbing to parents. Ways of safely preventing and treating deformation of the skull have been identified and are the subject of further investigation.[15,18,20]

Late-preterm infants, those born between 34 and 37 weeks' gestation, are at increased risk of having feeding problems and hyperbilirubinemia after discharge. These problems can be minimized but not wholly prevented by careful discharge planning and close follow-up after discharge.[21]

The Infant With Special Health Care Needs or Dependence on Technology

In recent years, increasing numbers of children with unresolved medical problems or special health care needs have been discharged requiring some form of supportive technology.[22] For newborn infants, the main types of technological support needed are nutritional support and respiratory support, including supplemental oxygen. This discussion will focus on nutritional and respiratory support, although other forms of home technological support are sometimes needed, including intravenous medications, bladder catheterization, and renal replacement therapy.

For most preterm infants and those with complex medical problems, oral feeding is best learned in the hospital under the care of expert physicians, nurses, and feeding therapists. Gavage feeding has been used safely in the home setting for infants who are not able to feed well enough by breast or bottle.[23–25] This practice has a limited role and should be considered only when feeding is the last issue requiring continued hospitalization. Not all parents are capable of safely managing home gavage feedings. When little or no progress is being made with oral feeding skills and long-term tube feeding seems inevitable, placement of a feeding gastrostomy tube provides another alternative method of feeding.[26] Unless precluded by neurologic deficits that threaten airway defense, oral feeding should be continued along with tube feeding so that oral feeding skills can continue to develop. Ordinarily, gavage or gastrostomy tube feedings are used to complement what is eaten orally to ensure adequate total intake. Home intravenous nutritional support is sometimes needed when enteral feeding is not possible or is limited by short-bowel syndrome or poor gastrointestinal function. Parenteral nutrition in the home requires careful assessment of the caregivers and home environment, thorough education of caregivers, and the support of a well-qualified home-care company.[27]

Home oxygen therapy for infants with bronchopulmonary dysplasia has been used as a means of achieving earlier hospital discharge while avoiding the risks of growth failure and cor pulmonale resulting from marginal oxygenation.[28–33] Sufficient oxygen should be delivered to maintain oxygen saturation at an acceptable level during a range of activities.[34–36] Infants who are discharged on supplemental oxygen are often also discharged on a cardiorespiratory monitor or pulse oximeter in case the oxygen should become dislodged or the supply depleted. Reducing or stopping supplemental oxygen should be supervised by the physician or other

health care professional and attempted only when the infant demonstrates normal oxygen saturation, good growth velocity, and sufficient stamina for a full range of activity.[36] Tracheostomy is sometimes required for neonates with upper airway abnormalities or occasionally for infants who cannot be weaned from assisted ventilation.[37–40] Good parental teaching and coordinated multidisciplinary follow-up care are essential for these infants. Infants who require home ventilation should also be on a cardiorespiratory monitor in case the airway should become obstructed, but the home ventilator should also have a disconnect alarm to alert caregivers to ventilator disconnection. Home ventilation requires qualified personnel to provide bedside care; in most cases, home-nursing support will be needed for at least part of the day.

The Infant at Risk Because of Family Issues

Preterm birth and prolonged hospitalization are known family stressors and risk factors for subsequent family dysfunction and child abuse.[41–43] In addition to preterm birth and prolonged hospital stay, birth defects and disabling conditions are also risk factors.[44] Maternal factors include lower educational level, lack of social support, marital instability, and fewer prenatal care visits.[41,42] In 1 study, significantly fewer family visits during the stay in the NICU had occurred for infants in whom subsequent maltreatment was documented.[41] Parental substance abuse is another factor that places the infant at risk, both because of adverse effects on the developing fetus in utero and because of possible postnatal exposure to drugs through breastfeeding or by inhalation. Moreover, the drug-seeking behaviors of parents may compromise the safety of the child's environment. Sequelae such as attachment disturbances, behavioral and developmental disorders, and child maltreatment have been observed frequently among children born to substance abusers.

Identifying effective strategies to help protect the infant who is at increased risk because of family reasons has been elusive. Most interventions have focused on multidisciplinary teams that provide follow-up monitoring, including home visits.[45] However, the efficacy of these interventions has been difficult to demonstrate. At the very least, it is hoped that an organized approach to planning for discharge can identify infants who require extra support or whose home environments present unacceptable risks.

The Infant With Anticipated Early Death

For many infants with incurable, terminal disorders, the best place to spend the last days or weeks of life is at home.[46] In these situations, the family provides most of the care, often with support by staff from a community hospice organization. In rare instances, withdrawal of assisted ventilation can occur in the home.[47] In preparing to discharge an infant for home hospice care, several aspects must be considered in addition to the usual factors.[48] These preparations include arrangements for medical follow-up and home-nursing visits; management of pain and other distressing symptoms; arrangements for home oxygen or other equipment and supplies; providing the family with information on bereavement support for the parents, siblings, and others; discussion of possible resources for respite of caregivers; and assistance in addressing financial issues. If appropriate, a letter should be provided for the family to show to other caregivers or emergency medical workers indicating that the child should not be resuscitated. The focus of planning efforts should be to enhance the quality of the infant's remaining life for the benefit of both the infant and his or her family.

TIMING OF DISCHARGE

The appropriate time for discharge is when the infant demonstrates the necessary physiologic maturity (in the case of the preterm infant), discharge planning and arrangements for follow-up and any home care have been completed, and the parents have received the necessary teaching and have demonstrated their mastery of the essential knowledge and skills. In selected cases, an infant may be discharged before one of the infant's physiologic competencies has been met, provided the health care team and the parents agree that this is appropriate and suitable plans have been made to provide additional support needed to ensure safe care at home, such as tube feeding, cardiorespiratory monitoring, or home oxygen. The standard, default criterion remains that the infant should be sufficiently mature to need no such assistance at home. The decision to facilitate earlier discharge by providing such additional support should be made only as a mutual decision by the health care team and the parents.

Before discharge, the eyes of qualifying infants should be examined at specified times by an ophthalmologist with expertise in the diagnosis of retinopathy of prematurity.[49] The infant's hearing should be evaluated[50,51]; the results of the newborn metabolic screen should be reviewed[52]; appropriate immunizations should be given, if not given previously; and palivizumab should be given to qualifying infants during respiratory syncytial virus season.[53,54]

Sometimes infants are transferred to a hospital closer to home so that the family may visit more easily. This is appropriate provided appropriate medical care is available in the receiving hospital, including capabilities for ophthalmologic examinations to screen for retinopathy of prematurity and the experience and resources for planning discharge and follow-up care.

DISCHARGE PLANNING

High-risk infants should receive primary medical care from a physician with expertise in the care of patients who have spent time in the NICU, often in partnership with 1 or more specialized clinics in the discharging medical center. To ensure continuity of care after discharge, infants with unresolved medical issues that persist after their hospital stay, such as bronchopulmonary dysplasia or feeding dysfunction, should be comanaged by a neonatologist or other medical subspecialist from the hospital at which most of the care was provided. The

subspecialist provides consultation to the primary physician about issues such as the weaning and discontinuation of supplemental oxygen. Most high-risk infants should also be enrolled in a follow-up clinic that specializes in the neurodevelopmental assessment of high-risk infants. This neurodevelopmental follow-up is sometimes integrated with the child's visits to the neonatologist. Standardized assessments should be performed in the follow-up clinic at specific ages through early childhood.[55–57]

The care of each high-risk neonate after discharge must be coordinated carefully to provide ongoing multidisciplinary support of the family. The discharge-planning team should include parents, the neonatologist, neonatal nurses and nurse practitioners, and the social worker. Other professionals, such as surgical specialists and pediatric medical subspecialists, respiratory, physical, occupational, and speech therapists, infant educators, nutritionists, home-health care company staff, and others may be included as needed.

Discharge planning should begin early in the hospital course. The goal of the discharge plan is to ensure successful transition to home care. Essential discharge criteria are a physiologically stable infant, a family who can provide the necessary care with appropriate support services in the community, and a primary care physician who is prepared to assume the responsibility with appropriate backup from specialist physicians and other professionals as needed.[55,56] Six critical components must be included in discharge planning.

1. Parental Education

Parental contact and involvement in the care of the infant should be encouraged from the time of admission. The participation of the parents in whatever way possible from the beginning has a positive effect on their confidence in handling the infant and readiness to assume full responsibility for the infant's care at home.

The development of an individualized teaching plan helps parents to acquire the skills and judgment needed to care for their infant. A written checklist or outline of the specific areas and tasks to be mastered increases the likelihood that parents and other caregivers will receive complete instructions and experience. Caregivers and parents must understand that the infant's immaturity and medical status will require increased care and vigilance at home beyond that of the usual parental role. Thus, ample time for teaching the parents and caregivers the techniques and the rationale for each item in the care plan is essential. Requesting return demonstrations by the parents of their new knowledge, parent rooming-in, and telephone follow-up by hospital staff all facilitate parental education and adaptation to their infant's care. Although it is important for the parents to understand that their child may need extra care and surveillance, the infant's fragility should not be overstated. If this occurs, the parents may become excessively protective, which can restrict the child's social development and lead to behavior problems.[58] Parents should be coached in communicating about the infant with any older siblings, who may not fully understand the infant's condition and may even imagine themselves to be responsible for the vulnerable state of their younger brother or sister.

Insofar as possible, at least 2 responsible caregivers should be identified and learn the necessary care for each infant. The demands of home care can be physically and emotionally draining, especially at first, for infants who require frequent feeding. Young mothers who do not live with a parent or the father of the infant have been shown to be especially vulnerable to the strains of home care. Even in a 2-parent family, the primary caregiver may become ill and need relief.

2. Completion of Appropriate Elements of Primary Care in the Hospital

Preparing the infant for transition to primary care begins early in the hospitalization with administration of immunizations at the recommended postnatal ages, regardless of prematurity or medical condition,[59] completion of metabolic screening,[52] assessment of hearing by an acceptable electronic measurement,[50,51] and baseline neurodevelopmental and neurobehavioral assessment. For infants at risk, appropriate funduscopic examination for retinopathy of prematurity should be performed by an ophthalmologist who is skilled in the evaluation of the retina of the preterm infant.[49] Assessment of hematologic status is recommended for all infants because of the high prevalence of anemia after neonatal intensive care. Very preterm infants and those who have received parenteral nutrition for prolonged periods may be at risk of hypoproteinemia, vitamin deficiencies, and bone mineralization abnormalities; therefore, evaluation for nutritional or metabolic deficiencies may be indicated. When discharge is near, the high-risk infant should be evaluated to ensure physiologic stability in an appropriate car seat or car bed.[60–62]

3. Development of Management Plan for Unresolved Medical Problems

Review of the hospital course and the active problem list of each infant and careful physical assessment will reveal any unresolved medical issues and areas of physiologic function that have not reached full maturation. From such a review, the diagnostic studies required to document the current clinical status of the infant can be identified and management can be continued or adjusted as appropriate. The intent should be to ensure implementation of appropriate home-care and follow-up plans.

4. Development of the Comprehensive Home-Care Plan

Although the content of the home-care plan may vary with the infant's diagnoses and medical status, the common elements include (1) identification and preparation of the in-home caregivers, (2) formulation of a plan for nutritional care and administration of any required medications, (3) development of a list of required equipment and supplies and accessible sources, (4) identification and mobilization of the primary care physician, the necessary and qualified home-care personnel and community support services, (5) assessment of the adequacy of the physical facilities within the home, (6) development

of an emergency care and transport plan, and (7) assessment of available financial resources to ensure the capability to finance home-care costs. The input of the primary care physician in formulating the home-care plan of the technology-dependent infant is essential. Many infants, particularly extremely preterm and technology-dependent infants, require continued care by multiple specialists and subspecialists, who should be included in the predischarge assessment and discharge planning.

5. Identification and Involvement of Support Services

The infant's optimal outcome ultimately depends on the capacity and effort of the family. The psychological, social, economic, and educational condition and needs of the family should be addressed from the beginning of the infant's hospitalization, noting strengths that can support the infant's continued adaptation, growth, and development and any risk factors that may contribute to an adverse infant outcome. The availability of social support is essential for the success of every parent's adaptation to the home care of a high-risk infant. Before discharge and periodically thereafter, a review of the family's needs, coping skills, use of available resources, financial problems, and progress toward goals in the home care of their infant should be evaluated. After the social support needs of the family have been identified, an appropriate, individualized intervention plan using available community programs, surveillance, or alternative care placement of the child may be implemented.

6. Determination and Designation of Follow-Up Care

In general, the attending neonatologist or other discharging physician has the responsibility for coordination of follow-up care, although in some institutions this responsibility may be delegated to another professional. A primary care physician (or "medical home") should be identified well before discharge to facilitate the coordination of follow-up care planning between the staff responsible for planning the discharge and the primary health care professionals. Pertinent information about the nursery course, including a discharge summary, and the home-care plan should be given to the primary care physician before the infant's discharge. In specialty center units, the primary care attending physician should work with the neonatologist in coordinating the discharge planning.

Arrangements for an initial appointment with the primary care physician should be made before discharge. Specific follow-up appointments with each involved surgical specialist and pediatric medical subspecialist should be made, giving attention to grouping the appointments as much as possible for the convenience of the family. A plan should be developed and discussed for emergency care and transportation to a hospital, should it be necessary.

Periodic evaluation of the developmental progress of every infant is essential for identifying deviations in neurodevelopmental progress at the earliest possible point, thereby facilitating entry into early intervention programs. The primary care physician with appropriate skills, the pediatric medical subspecialist, or clinic personnel may provide longitudinal developmental follow-up. When need for input from multiple disciplines is identified before discharge, a clinic that provides multidisciplinary care, usually in an academic or tertiary center, may be the least cumbersome option for the family.

SPECIAL CONSIDERATIONS

Many infants are transported to hospitals nearer to their family homes for convalescent care. In these hospitals, the discharge-planning process should follow the same principles as those outlined previously in this statement for an infant being discharged from a subspecialty center. It is especially important that periodic examination by a qualified ophthalmologist be available for infants who still require evaluation for retinopathy of prematurity.

In caring for the discharged high-risk infant, use of community resources, both public and private, should be encouraged. The goal should be to provide coordinated care and family support. Efficient teamwork by health care professionals is imperative. Home-nursing visits are often indicated. When this is so, it is important to use experienced nurses who are qualified to perform the required assessments. When choosing a home-care company or agency for technology-dependent infants, it is essential that previous performance and existing quality-control programs be considered.

RECOMMENDATIONS

The following recommendations are offered as a framework for guiding decisions about the timing of discharge. It is prudent for each institution to establish guidelines that ensure a consistent approach yet allow some flexibility on the basis of physician and family judgment. It is of foremost importance that the infant, family, and community be prepared for the infant to be safely cared for outside the hospital.

Infant Readiness for Hospital Discharge

The infant is considered ready for discharge if, in the judgment of the responsible physician, the following have been accomplished:

- A sustained pattern of weight gain of sufficient duration has been demonstrated.
- The infant has demonstrated adequate maintenance of normal body temperature fully clothed in an open bed with normal ambient temperature (20–25°C).
- The infant has established competent feeding by breast or bottle without cardiorespiratory compromise.
- Physiologically mature and stable cardiorespiratory function has been documented for a sufficient duration.
- Appropriate immunizations have been administered.
- Appropriate metabolic screening has been performed.

- Hematologic status has been assessed and appropriate therapy has been instituted, if indicated.
- Nutritional risks have been assessed and therapy and dietary modification has been instituted, if indicated.
- Hearing evaluation has been completed.
- Funduscopic examinations have been completed, as indicated.
- Neurodevelopmental and neurobehavioral status has been assessed and demonstrated to the parents.
- Car seat evaluation has been completed.
- Review of the hospital course has been completed, unresolved medical problems have been identified, and plans for follow-up monitoring and treatment have been instituted.
- An individualized home-care plan has been developed with input from all appropriate disciplines.

Family and Home Environmental Readiness

Assessment of the family's caregiving capabilities, resource availability, and home physical facilities has been completed as follows:

- identification of at least 2 family caregivers and assessment of their ability, availability, and commitment;
- psychosocial assessment for parenting strengths and risks;
- a home environmental assessment that may include on-site evaluation; and
- review of available financial resources and identification of adequate financial support.

In preparation for home care of the technology-dependent infant, it is essential to complete an assessment documenting availability of 24-hour telephone access, electricity, safe in-house water supply, and adequate heating. Detailed financial assessment and planning are also essential. Parents and caregivers should have demonstrated the necessary capabilities to provide all components of care, including:

- feeding, whether by breast, bottle, or an alternative technique, including formula preparation, if required;
- basic infant care, including bathing; skin, cord, and genital care; temperature measurement; dressing; and comforting;
- infant cardiopulmonary resuscitation and emergency intervention;
- assessment of clinical status, including understanding and detection of the general early signs and symptoms of illness as well as the signs and symptoms specific to the infant's condition;
- infant safety precautions, including proper infant positioning during sleep and proper use of car seats or car bed;
- specific safety precautions for the artificial airway, if any; feeding tube; intestinal stoma; infusion pump; and other mechanical and prosthetic devices, as indicated;
- administration of medications, specifically proper storage, dosage, timing, and administration and recognition of potential signs of toxicity;
- equipment operation, maintenance, and problem solving for each mechanical support device required; and
- the appropriate technique for each special care procedure required, including special dressings for infusion entry site, intestinal stoma, or healing wounds; maintenance of an artificial airway; oropharyngeal and tracheal suctioning; and physical therapy, as indicated.

Specific modification of home facilities must have been completed if needed to accommodate home-care systems. Plans must be in place for responding to loss of electrical power, heat, or water and for emergency relocation mandated by natural disaster.

Community and Health Care System Readiness

An emergency intervention and transportation plan have been developed and emergency medical services providers have been identified and notified, if indicated.

Follow-up care needs have been determined, appropriate providers have been identified, and appropriate information has been exchanged, including the following:

- A primary care physician has been identified and has accepted responsibility for care of the infant.
- Surgical specialty and pediatric medical subspecialty follow-up care requirements have been identified and appropriate arrangements have been made.
- Neurodevelopmental follow-up requirements have been identified and appropriate referrals have been made.
- Home-nursing visits for assessment and parent support have been arranged, as indicated by the complexity of the infant's clinical status and family capability, and the home-care plan has been transmitted to the home health agency.
- For breastfeeding mothers, information on breastfeeding support and availability of lactation counselors has been provided.

The determination of readiness for care at home of an infant after neonatal intensive care is complex. Careful balancing of infant safety and well-being with family needs and capabilities is required while giving consideration to the availability and adequacy of community resources and support services. The final decision for discharge, which is the responsibility of the attending physician, must be tailored to the unique constellation of issues posed by each infant's situation.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

The Hospital Record of the Injured Child and the Need for External Cause-of-Injury Codes

ABSTRACT. Proper record-keeping of emergency department visits and hospitalizations of injured children is vital for appropriate patient management. Determination and documentation of the circumstances surrounding the injury event are essential. This information not only is the basis for preventive counseling, but also provides clues about how similar injuries in other youth can be avoided. The hospital records have an important secondary purpose; namely, if sufficient information about the cause and mechanism of injury is documented, it can be subsequently coded, electronically compiled, and retrieved later to provide an epidemiologic profile of the injury, the first step in prevention at the population level. To be of greatest use, hospital records should indicate the "who, what, when, where, why, and how" of the injury occurrence and whether protective equipment (eg, a seat belt) was used. The pediatrician has two important roles in this area: to document fully the injury event and to advocate the use of standardized external cause-of-injury codes, which allow such data to be compiled and analyzed.

OVERVIEW

In 1996, injuries accounted for 64% of deaths in children and teenagers 1 to 19 years of age.[1] The National Center for Health Statistics estimates that for every injury death occurring in the United States, about 18 hospitalizations and 250 emergency department visits occur for people of all ages.[2] Information about the external cause of injury fatalities, in general, is more accurate and precise than is information about the external cause of nonfatal injuries.

Several problems exist with nonfatal injury data. First, national morbidity estimates are based on a representative statistical sample of the US population. The data cannot be disaggregated to the state or local level. Second, national estimates of morbidity data are not always reported in a timely manner. Third, not all states have statewide hospital discharge data systems that actively gather information concerning the specific external cause of injury. In communities without ready access to local cause-specific injury data that are coded, hospital administrators, public health officials, and safety advocates are impeded in their attempts to prioritize and plan appropriate services for their communities, such as emergency medical services, acute and rehabilitative inpatient and outpatient services, and primary prevention activities. Lack of local data makes it difficult to identify high-risk groups and environmental hazards that are specific to a given community. This in turn impedes efforts to develop and implement targeted, population-specific prevention programs.

The first logical step for local injury programs should be a review of local morbidity data. Ideally these data should be available in a readily accessible and electronic form. Data must be of high quality, with ascertainment of all cases or a statistically representative sample of all cases.

INJURY SURVEILLANCE SYSTEMS

Three types of ongoing injury surveillance systems are 1) the national vital statistics registry, 2) hospital discharge data systems, and 3) local emergency department data systems. The national mortality reporting system (vital statistics) serves as a model because data collection, coding, compilation, and reporting have been in use longer and are more refined than are morbidity-based systems. Vital records are collected by each county and state health department by compiling data from death certificates. The underlying and contributing causes of death, as certified by the physician, are coded (as of January 1, 1999) using the *International Classification of Diseases*, 10th revision (*ICD*-10).[3] Under this system (and its predecessor, *ICD*-9),[4] fatal injuries can receive two types of codes: an external cause-of-injury code and one or more diagnosis codes. The external cause-of-injury code specifies both the mechanism (eg, motor vehicle, fire, fall) and the intent (unintentional, suicide, homicide, or undetermined). The diagnosis code specifies the anatomic site and nature of the injury; for example, a skull fracture or an open wound of the chest.

In *ICD*-9 (effective 1979–1998), the codes for external causes of injury are referred to as E-codes. The nature of injury codes were often referred to as "N-codes." With *ICD*-10, however, the use of the term "E-code" should be replaced with "external cause-of-injury" code because the referent chapters now are prefaced with the letters "V," "W," "X," and "Y" and the codes range from V01 to Y89. Similarly in *ICD*-10, the nature of injury codes are prefaced with the letters "S" and "T" and codes range from S00 to T98.

A comparable classification system exists for coding nonfatal injuries, known as the *Clinical Modification of the ICD* (*ICD CM*).[5] Currently, the 9th revision is in effect. *ICD*-10 *CM* will most likely become effective after October 1, 2001. *ICD*-10 *CM* will likely have twice the number of external cause-of-injury

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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codes as the *ICD-9 CM*, allowing for more precise and specific codes.

The combined use of diagnosis and external cause-of-injury codes is a highly specific way to classify injuries. For example, a facial fracture resulting from a bicycle injury can be distinguished from a similar fracture resulting from a fight. Information about the diagnosis, cause, and place of occurrence is needed to plan effective injury-prevention programs.

PROBLEMS WITH CURRENT MORBIDITY-REPORTING SYSTEMS

Two major problems exist with current morbidity-reporting systems. First, documentation of the injury event in the hospital record often is incomplete or even absent. For example, physicians and nurses treating a patient in the emergency department or hospital may note that a playground injury occurred but neglect to define the particular circumstances of the injury, eg, whether the injury was sustained because the child fell from a height, the distance of the fall, the type of equipment involved, the surface on to which the child fell, whether anyone else was present or involved in the occurrence, and whether the playground was in a schoolyard, at a private residence, or in a public recreation area. The record does not indicate the "who, what, when, where, why, and how" of the injury occurrence, probably because the caregivers focus their efforts on the immediate treatment of the injury. The hospital record should document key patient identification data such as the child's name, date of birth, sex, race, ethnicity, address, and telephone number. To maximize the use of hospital records, physicians, nurses, and other health care professionals should record the time, place, nature, and mechanism of injury; whether the injury was inflicted intentionally; contributing risk factors (eg, the use of alcohol or other drugs); whether protective equipment was used; whether any other persons were injured in the event; and whether the injury was work-related. If the primary (intake) record does not include such information, reconstructing the event later is difficult, even by direct interview.

The second problem is that medical records department personnel may not assign the hospital record an external cause-of-injury code. As of October 1997, 42 states had statewide hospital discharge data systems, but only 23 had mandatory external cause-of-injury code reporting for injury-related hospital discharges.[6] Based on a 1996 national survey of emergency department visits by patients of all ages, it is estimated that >34 million injury-related visits were made that year.[7] However, only nine states currently have mandates that require the reporting of external cause-of-injury codes for injury-related emergency department visits.[6] Voluntary reporting by external cause-of-injury code is incomplete and possibly biased by the number of diagnostic codes assigned; patient characteristics (eg, age, sex, or race); the nature and severity of the injury; and the type of hospital (eg, size, location).[8] As a result, compilations based on voluntary external cause-of-injury coding may not reflect all injuries accurately. Mandatory reporting of external cause-of-injury codes would improve the quality of the estimates of external causes of injury morbidity in the United States.

BENEFITS TO BE GAINED

Administrators of hospitals and managed care organizations can expect to gain several direct benefits from universal reporting of injuries by external cause-of-injury code. The improvement in population-based case ascertainment and accuracy if reporting is implemented by *all* hospitals would allow for planning, implementation, and evaluation of acute care and rehabilitation services (eg, bed, staffing, and emergency department needs) and would provide data needed to assess the financial effect of different types of injuries. Public health officials would have the necessary data to identify risk factors and high-risk populations to target primary prevention programs and to provide improved prehospital care. Pediatricians and other advocates would learn which injury issues warrant the most attention in their community. For example, the Indian Health Service, which has included external cause-of-injury codes in its hospital discharge data for >20 years, combined such information with police reports to identify a narrow stretch of roadway in Cherokee, NC, where motor vehicle–pedestrian collisions were occurring at a high rate. The roadway was modified, thereby virtually eliminating the problem.[9] Improved external cause-of-injury code data would help state and federal injury experts track national and state objectives for injury prevention according to goals established by *Healthy People 2000*.[10] Policy-makers could study more readily the effects of local and state injury-prevention legislation, such as laws mandating the installation of residential smoke detectors, use of safety belts and motorcycle helmets, and the recision of the 55-mph speed limit. Mandatory reporting of external cause-of-injury codes for hospital discharge data has been endorsed by the Council of State and Territorial Epidemiologists, the American Public Health Association, the American College of Emergency Medicine, the National Center for Health Statistics, the National Center for Injury Prevention and Control of the Centers for Disease Control and Prevention,[11] and the American Academy of Pediatrics,[12] as well as many state and local health departments.

The administrative costs associated with the external cause-of-injury coding of inpatient hospital records are relatively small.[13] It takes ≤3 minutes to assign an external cause-of-injury code to each injury record and, because only 9% of hospital discharges are injury-related,[14] most inpatient records would not require external cause-of-injury coding. Also, because many large hospitals already assign external cause-of-injury codes (by mandate or voluntarily) to the hospital admission records, the additional cost of external cause-of-injury coding all hospital discharge records may not be excessive.

RECOMMENDATIONS

Proper coding of injuries is critical for establishing priorities for child and adolescent injury-prevention programs. Pediatricians can serve their patients and communities well by documenting the injury event

thoroughly in the hospital record and by encouraging the expanded reporting of external cause-of-injury codes. The American Academy of Pediatrics recommends the following specific steps:

1. Pediatricians and other health care professionals who treat injured children and adolescents should obtain a thorough history of the cause of injury and document it in the hospital record. Appropriate documentation should include the who, what, when, where, why, and how of each injury event. Medical school and residency training should teach these history-taking skills, as well as the importance of standardized classification systems for injuries and diseases.
2. External cause-of-injury codes should be recorded in the hospital record for each hospital admission and emergency department visit in which an injury is the principal diagnosis or is related directly to the principal diagnosis.
3. Pediatricians should support state legislation or regulation to mandate the use of external cause-of-injury codes (as well as diagnostic codes) in hospital discharge data systems. External cause-of-injury codes should not replace other required data and should have designated separate fields in discharge databases.
4. Pediatricians should work with other medical and public health professionals to expand efforts to improve documentation, coding, collection, monitoring, and dissemination of injury data. Managed care organizations and other health insurance companies also may be interested in cost-of-injury data.
5. Pediatricians, other health care professionals, and injury-control researchers should work with hospital records personnel to become familiar with standardized uniform coding procedures, definitions, and guidelines for external cause-of-injury coding.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Hospital Stay for Healthy Term Newborns

COMMITTEE ON FETUS AND NEWBORN

KEY WORDS
newborn, hospital, discharge

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abstract

The hospital stay of the mother and her healthy term newborn infant should be long enough to allow identification of early problems and to ensure that the family is able and prepared to care for the infant at home. The length of stay should also accommodate the unique characteristics of each mother-infant dyad, including the health of the mother, the health and stability of the infant, the ability and confidence of the mother to care for her infant, the adequacy of support systems at home, and access to appropriate follow-up care. Input from the mother and her obstetrician should be considered before a decision to discharge a newborn is made, and all efforts should be made to keep mothers and infants together to promote simultaneous discharge. *Pediatrics* 2010;125:405–409

BACKGROUND

The hospital stay of the mother and her healthy term newborn infant (mother-infant dyad) should be long enough to allow identification of early problems and to ensure that the family is able and prepared to care for the infant at home. Many cardiopulmonary problems related to the transition from an intrauterine to an extrauterine environment usually become apparent during the first 12 hours after birth.[1] However, detection of significant jaundice,[2] ductal-dependant cardiac lesions,[3,4] gastrointestinal obstruction,[5] and other problems may require a longer period of observation by skilled and experienced health care professionals.[6] The average length of stay of the mother-infant dyad after delivery declined steadily from 1970 until the mid-1990s.[7] Early newborn discharge was implemented in the 1990s, but in response to the ensuing debate on the care and safety of mothers and their infants, most states and the US Congress enacted legislation that ensured hospital stay for up to 48 hours for a vaginal delivery and up to 96 hours after birth by cesarean delivery. Several subsequent studies have reported that the postpartum-length-of-stay legislation has led to an increase in postpartum length of stay, but the impact of this increase in length of stay on the rate of neonatal readmissions has been inconsistent.[7–10]

Risk of Readmission

Criteria for newborn discharge include physiologic stability, family preparedness and competence to provide newborn care at home, availability of social support, and access to the health care system and resources. An inadequate assessment by health care providers

in any of these areas before discharge can place an infant at risk and may result in readmission. In several large epidemiologic studies, readmission rates were used to assess the adequacy of the newborn hospital length of stay. In these reports, readmissions after an early discharge varied from no increase to a significant increase.[7,11–14] However, the differences in the definition of early discharge, postdischarge follow-up and support, and the timing of readmissions make it difficult to compare the results. In some of these studies the risk factors for readmission to identify infants who may benefit from either a longer hospital stay or close postdischarge follow-up were also evaluated. These studies identified jaundice, dehydration, and feeding difficulties as the most common reasons for readmission.[14,15] Other frequently reported risk factors for readmission were Asian race, primiparity, associated maternal morbidities, shorter gestation or lower birth weight, instrumented vaginal delivery, male gender, and small size for gestational age.[11,13–16] Close follow-up and better coordination of postdischarge care were important factors in decreasing the readmission rates.[11,15]

Readiness for Discharge

Readiness for discharge of a healthy term infant is traditionally determined by pediatricians after a review of the mother's and family members' ability to provide care to a newborn infant at home. However, perceptions of readiness or unreadiness at the time of discharge often differ among pediatricians, obstetricians, and mothers.[17] Factors associated with perceptions of unreadiness for newborn discharge include first live birth, maternal history of chronic disease or illness after birth, in-hospital neonatal illness, intent to breastfeed, mothers with inadequate prenatal care and poor social support, and black non-Hispanic maternal race.[12,17] Although no specific clinical tool is currently available to evaluate mothers' or families' perception of readiness for discharge after delivery, the American Academy of Pediatrics Safe and Healthy Beginnings toolkit contains a discharge-readiness checklist that can aid clinicians with preparation of a newborn for discharge. This tool was tested by 22 clinical practice teams during the Safe and Healthy Beginnings improvement project and focuses on risk for severe hyperbilirubinemia, breastfeeding support, and coordination of care to improve care for newborns.[18] Nonetheless, all efforts should be made to keep mothers and infants together to promote simultaneous discharge. To accomplish this, a pediatrician's decision to discharge a newborn should be made jointly with input from the mother, her obstetrician, and other health care providers such as nursing staff and social workers who are involved in the care of mother and her infant.

RECOMMENDATIONS

The length of stay of a healthy term newborn should be based on the unique characteristics of each mother-infant dyad, including the health of the mother, the health and stability of the infant, the ability and confidence of the mother to care for her infant, the adequacy of support systems at home, and access to appropriate follow-up care. Input from the mother and her obstetrician and nursing staff should be considered before a decision to discharge a newborn is made, and all efforts should be made to keep mothers and infants together to promote simultaneous discharge. It is recommended that the following minimum criteria be met before discharge of a term newborn, defined as an infant born between 37 and 41 completed weeks of gestation.

1. Clinical course and physical examination at discharge have not revealed abnormalities that require continued hospitalization.
2. The infant's vital signs are documented as being within normal ranges, with appropriate variations based on physiologic state, and stable for the 12 hours preceding discharge. These ranges include a respiratory rate below 60 per minute and no other signs of respiratory distress, a heart rate of 100 to 160 beats per minute, and axillary temperature of 36.5°C to 37.4°C (97.7–99.3°F) measured properly in an open crib with appropriate clothing.[19–21]
3. The infant has urinated regularly and passed at least 1 stool spontaneously.
4. The infant has completed at least 2 successful consecutive feedings, with assessment to verify that the infant is able to coordinate sucking, swallowing, and breathing while feeding.
5. There is no significant bleeding at the circumcision site.
6. The clinical risk of development of subsequent hyperbilirubinemia has been assessed, and appropriate management and/or follow-up plans have been instituted as recommended in American Academy of Pediatrics clinical practice guidelines for management of hyperbilirubinemia.[2]
7. The infant has been adequately evaluated and monitored for sepsis on the basis of maternal risk factors and in accordance with current guidelines for prevention of perinatal group B streptococcal disease.[22]
8. Maternal blood test and screening results are available and have been reviewed, including:

- maternal syphilis and hepatitis B surface antigen status; and
- screening tests, including a test for HIV, performed in accordance with state regulations.

9. Infant blood tests are available and have been reviewed such as cord or infant blood type and direct Coombs test results, as clinically indicated.[2]
10. Initial hepatitis B vaccine has been administered according to the current immunization schedule.[23]
11. Newborn metabolic and hearing screenings have been completed per hospital protocol and state regulations.
12. The mother's knowledge, ability, and confidence to provide adequate care for her infant have been assessed for competency regarding:
    - breastfeeding or bottle feeding (the breastfeeding mother and infant should be assessed by trained staff regarding breastfeeding position, latch-on, and adequacy of swallowing)[24];
    - the importance and benefits of breastfeeding for both mother and infant;
    - appropriate urination and defecation frequency for the infant;
    - cord, skin, and genital care, including circumcision care, for the infant;
    - the ability to recognize signs of illness and common infant problems, particularly jaundice; and
    - infant safety (such as use of an appropriate car safety seat, supine positioning for sleeping, maintaining a smoke-free environment, and room sharing).[24–26]
13. Family, environmental, and social risk factors have been assessed, and the mother and her other family members have been educated about safe home environment. If risk factors are identified, discharge should be delayed until they are resolved or a plan to safeguard the infant is in place. This plan may involve discussions with social services and/or state agencies such as child protective services. These risk factors include but are not limited to:
    - untreated parental substance abuse or positive urine toxicology results in the mother or newborn;
    - history of child abuse or neglect;
    - mental illness in a parent who is in the home;
    - lack of social support, particularly for single, first-time mothers;
    - mothers who live in a shelter, a rehabilitation home, or on the street;
    - history of domestic violence, particularly during this pregnancy;
    - communicable illness in a parent or other members of the household[27]; and
    - adolescent mother, particularly if other above-listed conditions apply.
14. A medical home for continuing medical care for the infant has been identified and a plan for timely communication of pertinent clinical information to the medical home is in place. For newborns discharged less than 48 hours after delivery, an appointment should be made for the infant to be examined by a licensed health care professional, preferably within 48 hours of discharge based on risk factors but no later than 72 hours in most cases.[10,11,15,28,29] If this cannot be ensured, discharge should be deferred until a mechanism for follow-up evaluation is identified. The follow-up visit can take place in a home or clinic setting as long as the health care professional who examines the infant is competent in newborn assessment and the results of the follow-up visit are reported to the infant's physician or his or her designee on the day of the visit.
15. Barriers to adequate follow-up care for the newborn, such as lack of transportation to medical care services, lack of easy access to telephone communication, and non–English-speaking parents, have been assessed and, whenever possible, assistance has been given to the family to make suitable arrangements to address them. The purpose of the follow-up visit is to:
    - weigh the infant; assess the infant's general health, hydration, and extent of jaundice; identify any new problems; review feeding pattern and technique; and obtain historical evidence of adequate urination and defecation patterns for the infant;
    - assess quality of mother-infant attachment and details of infant behavior;
    - reinforce maternal or family education in infant care, particularly regarding infant feeding and safety such as breastfeeding, back to sleep, and child safety seats;
    - review the results of outstanding laboratory tests, such as newborn metabolic screens, performed before discharge;
    - perform screening tests in accordance with state regulations

and other tests that are clinically indicated, such as bilirubin measurement;

- verify the plan for health care maintenance, including a method for obtaining emergency services, preventive care and immunizations, periodic evaluations and physical examinations, and necessary screenings; and
- assess for parental well-being including postpartum depression in the mother.

16. Obstetrical care, newborn nursery care, and follow-up care should be considered independent services to be reimbursed as separate packages and not as part of a global fee for maternity-newborn labor and delivery services.

CONCLUSIONS

Each mother-infant dyad should be evaluated individually to determine the optimal time of discharge. The timing of discharge should be the decision of the physician caring for the infant and based on these guidelines. Local implementation of these guidelines is best accomplished through the collaborative efforts of all parties concerned. Institutions should develop guidelines in collaboration with appropriate community agencies, and third-party payers, to establish hospital-stay and follow-up programs for healthy term infants that implement these recommendations.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness

Human Immunodeficiency Virus and Other Blood–borne Viral Pathogens in the Athletic Setting

ABSTRACT. Because athletes and the staff of athletic programs can be exposed to blood during athletic activity, they have a very small risk of becoming infected with human immunodeficiency virus, hepatitis B virus, or hepatitis C virus. This statement, which updates a previous position statement of the American Academy of Pediatrics,[1] discusses sports participation for athletes infected with these pathogens and the precautions needed to reduce the risk of infection to others in the athletic setting. Each of the recommendations in this statement is dependent upon and intended to be considered with reference to the other recommendations in this statement and not in isolation.

ABBREVIATIONS. HIV, human immunodeficiency virus; HBV, hepatitis B virus; HCV, hepatitis C virus; CI, 95% confidence interval; AAP, American Academy of Pediatrics; OSHA, Occupational Safety and Health Administration.

During sports participation, the blood of an athlete who is infected with human immunodeficiency virus (HIV), hepatitis B virus (HBV), or hepatitis C virus (HCV) may occasionally contaminate the skin or mucous membranes of other athletes or the staff of athletic programs. Common sense suggests that this likelihood is greatest in contact sports, but transmission can potentially occur indirectly or in noncontact sports. Even in contact sports, the very limited available data indicate that bleeding wounds are not necessarily common.[2]

HIV INFECTION

The risk of HIV infection via skin or mucous membrane exposure to blood or other infectious bodily fluids during sports participation is very low. The most relevant research has been conducted with health care workers, for whom the risk from skin or mucous membrane exposure is less than the risk from parenteral exposure, which is .2% to .3% per exposure (95% confidence interval [CI], .1%–.5%).[3] The risk from exposure to mucous membranes or damaged skin determined from pooling 6 prospective studies was 1 infection in 1007 exposures, or .1% (95% CI, .01%–.5%). Such transmission appears to require, in addition to a portal of entry, prolonged exposure to large quantities of blood.[3] Transmission through intact skin has not been documented: no HIV infections occurred after 2712 such exposures in 1 large prospective study (95% CI, 0%–.1%).[3] Transmission of HIV in sports has not been documented. One unsubstantiated report describes possible transmission during a collision between professional soccer players.[4]

HBV INFECTION

The HBV is more easily transmitted via exposure to infected blood than is HIV.[3] In 2 studies of health care professionals who had percutaneous exposure to HBV-infected blood, the risk of infection was 27% and 45%; approximately 25% of cases were symptomatic. The risk of infection was greater if the blood was positive for HBV e antigen. The health care workers received immune serum globulin, and so some of them were protected from infection.[5,6] Transmission of infection by contamination of mucous membranes or broken skin with infected blood has been documented, but the magnitude of risk has not been quantified.[3]

Although transmission of HBV is apparently rare in sports, 2 reports document such transmission. An asymptomatic high school sumo wrestler who had a chronic infection transmitted HBV to other members of his team.[7] An epidemic of HBV infection occurred through unknown means among Swedish athletes participating in track finding (orienteering).[8] The epidemiologists concluded that the most likely route of infection was the use of water contaminated with infected blood to clean wounds caused by branches and thorns.

An effective way of preventing HBV transmission in the athletic setting is through immunization of athletes. The American Academy of Pediatrics (AAP) recommends that all children and adolescents be immunized.[9] Clinicians and the staff of athletic programs should aggressively promote immunization.

HCV INFECTION

Although the transmission risks of HCV infection are not completely understood, the risk of infection from percutaneous exposure to infected blood is estimated to be 10 times greater than that of HIV but lower than that of HBV.[3] Transmission via contamination of mucous membranes or broken skin also probably has a risk intermediate between that for blood infected with HIV and HBV.[3]

The recommendations in this statement are based upon present available knowledge. They do not indicate an exclusive course of treatment or serve as a standard of medical care. Laws vary from state to state and state law may dictate a different course of action for the physician or those in charge of an athletic program. Variations, taking into account individual circumstances, may also be appropriate.

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SUMMARY

Because of the very low probability of transmission of their infection to other athletes, athletes infected with HIV, HBV, or HCV should be allowed to participate in all sports.

CONFIDENTIALITY AND OTHER LEGAL ISSUES

Confidentiality about an athlete's infection with a blood–borne pathogen is necessary to prevent exclusion of the athlete from sports because of inappropriate fear among others in the program. Except for the reporting required by law, the patient (and parent or guardian if the patient is a minor) must give informed consent for clinicians to share information about these medical conditions with a school or sports organization. Testing of athletes for these viral infections is not indicated. Infected athletes should be told that they have a very small risk of infecting other competitors. This risk, although unknown for any sport, is probably greatest in wrestling and boxing. Infected athletes can be encouraged not to participate in these activities or in others in which contamination of skin or mucous membranes with blood is relatively likely. This may also be protective for infected athletes themselves, reducing their possible exposure to blood–borne pathogens other than the one(s) with which they are infected.

The AAP opposes boxing as a sport for youth. Pediatricians should counsel athletes not to participate in this sport, whatever their infection status.

Athletic programs should inform athletes and parents that athletes have a very small but finite risk of contracting a blood–borne infection from another athlete. This is part of the duty to warn about risks of participation that is the responsibility of all athletic programs.

Pediatricians can avoid reporting the presence of infections with blood–borne pathogens by making it clear on the preparticipation form or elsewhere that they support the AAP policy, "Human Immunodeficiency Virus and Other Blood–borne Pathogens in the Athletic Setting," and that the AAP policy acknowledges that the physician should respect the right of infected athletes to confidentiality.

The US Supreme Court has not ruled specifically on the legality of excluding from competition an athlete who has a chronic infection with a blood–borne viral pathogen but has held that a person infected with a contagious disease may be handicapped and therefore entitled to protection from unlawful discrimination. On the basis of this authority, when considering whether an athlete infected with a blood–borne viral pathogen can be excluded from competition, an inquiry would have to be made "based on reasonable medical judgements given the state of medical knowledge" into whether the athlete poses a significant risk of communicating the disease to others in the competition that cannot be eliminated by reasonable accommodation.[10,11]

PREVENTION OF INFECTION

Strict safety precautions are particularly important for those persons in athletic programs who provide first aid and have repeated exposure to blood or other bodily fluids visibly contaminated with blood. Specific precautions are discussed in Recommendation 10 below. Other discussions of safety precautions appropriate for sports programs, with some additional information, are available elsewhere.[10,12–14]

EDUCATION OF ATHLETES

Coaches, athletic trainers, and health care professionals can expand discussions about the risks of transmission of blood–borne viral pathogens during sports participation to teach athletes about how these pathogens are transmitted and how to prevent infection.

RECOMMENDATIONS

1. Athletes infected with HIV, HBV, or HCV should be allowed to participate in all competitive sports.
2. The physician should respect the right of infected athletes to confidentiality. This includes not disclosing the patient's infection status to other participants or the staff of athletic programs.
3. Athletes should not be tested for blood–borne pathogens because they are sports participants.
4. Pediatricians are encouraged to counsel athletes who are infected with HIV, HBV, or HCV that they have a very small risk of infecting other competitors. Infected athletes can consider choosing a sport in which this risk is apparently relatively low. This may be protective for other participants and for infected athletes themselves, reducing their possible exposure to blood–borne pathogens other than the one(s) with which they are infected. Wrestling and boxing, a sport opposed by the AAP, probably have the greatest potential for contamination of injured skin by blood.
5. Athletic programs should inform athletes and their parents that the program is operating under the policies in Recommendations 1 through 3 and that the athletes have a very small risk of becoming infected with a blood–borne pathogen.
6. Clinicians and the staff of athletic programs should aggressively promote HBV immunization among athletes and among coaches, athletic trainers, equipment handlers, laundry personnel, and any other persons at risk of exposure to athletes' blood as an occupational hazard. All athletes should, if possible, receive HBV immunization; >95% of those who receive this immunization will be protected against infection.[9]
7. Each coach and athletic trainer must receive training in first aid and emergency care and in the prevention of transmission of blood–borne pathogens in the athletic setting. These staff members can then help to implement recommendations made here.
8. Coaches and members of the health care team should educate athletes about the precautions described in these recommendations and about the greater risks of transmission of HIV and other blood–borne pathogens through sexual ac-

tivity and needle sharing during the use of illicit drugs, including anabolic steroids. Athletes should be told not to share personal items, such as razors, toothbrushes, and nail clippers that might be contaminated with blood.

9. In some states, depending on state law, schools may need to comply with Occupational Safety and Health Administration (OSHA) regulations[13] for the prevention of transmission of blood–borne pathogens. The athletic program must determine what rules apply. Compliance with OSHA regulations is a reasonable and recommended precaution even if this is not specifically required by the state.
10. The following precautions should be adopted in sports with direct body contact and other sports in which an athlete's blood or other bodily fluids visibly tinged with blood may contaminate the skin or mucous membranes of other participants or staff members of the athletic program. Even if these precautions are adopted, the risk that a participant or staff member may become infected with a blood–borne pathogen in the athletic setting will not be entirely eliminated.
    - Athletes must cover existing cuts, abrasions, wounds, or other areas of broken skin with an occlusive dressing before and during participation. Caregivers should cover their own damaged skin to prevent transmission of infection to or from an injured athlete.
    - Disposable, water-impervious vinyl or latex gloves should be worn to avoid contact with blood or other bodily fluids visibly tinged with blood and any object such as equipment, bandages, or uniforms contaminated with these fluids. Hands should be cleaned with soap and water or an alcohol-based antiseptic handwash as soon as possible after gloves are removed.
    - Athletes with active bleeding should be removed from competition as soon as possible and the bleeding stopped. Wounds should be cleaned with soap and water. Skin antiseptics may be used if soap and water are not available. Wounds must be covered with an occlusive dressing that remains intact during further play before athletes return to competition.
    - Athletes should be advised to report injuries and wounds in a timely fashion before or during competition.
    - Minor cuts or abrasions that are not bleeding do not require interruption of play but can be cleaned and covered during scheduled breaks. During these breaks, if an athlete's equipment or uniform fabric is wet with blood, the equipment should be cleaned and disinfected (see below), or the uniform should be replaced.
    - Equipment and playing areas contaminated with blood must be cleaned until all visible blood is gone and then disinfected with an appropriate germicide such as a freshly-made bleach solution containing 1 part bleach in 10 parts of water. The decontaminated equipment or area should be in contact with the bleach solution for at least 30 seconds. The area may be wiped with a disposable cloth after the minimum contact time or be allowed to air dry.[9]
    - Emergency care must not be delayed because gloves or other protective equipment is not available. If the caregiver does not have the appropriate protective equipment, a towel may be used to cover the wound until an off-the-field location is reached where gloves can be used during more definitive treatment.
    - Breathing (Ambu) bags and oral airways should be available for giving resuscitation. Mouth-to-mouth resuscitation is recommended only if this equipment is not available.[12]
    - Equipment handlers, laundry personnel, and janitorial staff must be trained in proper procedures for handling washable or disposable materials contaminated with blood.[9, 12]

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AMERICAN ACADEMY OF PEDIATRICS

AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS

Human Immunodeficiency Virus Screening

JOINT STATEMENT OF THE AMERICAN ACADEMY OF PEDIATRICS AND THE AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS

ABBREVIATIONS. HIV, human immunodeficiency virus; IOM, Institute of Medicine; AIDS, acquired immunodeficiency syndrome; AAP, American Academy of Pediatrics; ACOG, American College of Obstetricians and Gynecologists.

The problem of perinatal transmission of human immunodeficiency virus (HIV) infection was first appreciated in 1982. In 1991, the Institute of Medicine (IOM) recommended a policy of routine counseling and offering testing (with specific informed consent) for HIV infection to all pregnant women. Since 1991, there have been major advances in the treatment of HIV infection, including demonstration in 1994 of the efficacy of zidovudine to reduce perinatal transmission. The US Public Health Service subsequently issued guidelines for use of zidovudine to reduce perinatal transmission and for counseling and voluntary testing for pregnant women. Dramatic declines in reported pediatric acquired immunodeficiency syndrome (AIDS) cases have been observed as a consequence of implementation of these guidelines. However, for a variety of reasons, screening pregnant women in the United States has been far from universal and infected infants continue to be born to undiagnosed infected women. Further reduction in the rate of perinatal HIV infection will require wider application of both screening to identify infected women, and treatments that have demonstrated efficacy in reducing vertical transmission.

The IOM recently completed a study of interventions that would be helpful to further reduce the rate of perinatal HIV infection in the United States (*Reducing the Odds*). They have recommended that "the United States adopt a national policy of universal HIV testing, with patient notification, as a routine component of prenatal care." Early diagnosis of HIV infection in pregnant women allows them to institute effective antiretroviral therapy for their own health and to reduce the risk of HIV transmission to their infants. The use of "patient notification" provides women the opportunity to decline to be tested but eliminates the obligation to provide extensive pretest counseling, which has been a barrier to testing in many settings. Care providers would be charged with responsibility for the details of how the notification would take place. The IOM has recommended universal testing for two reasons. First, attempts to identify those "at risk" for infection inevitably fail to identify some infected individuals. Second, universal testing of all pregnant women avoids stereotyping and stigmatizing any social or ethnic group. The IOM recognizes in its report that many states now have laws requiring a formal, and in many cases written, informed consent process before testing. They recommend that the federal government adopt policies that will encourage these states to change their laws.

The American Academy of Pediatrics (AAP) and the American College of Obstetricians and Gynecologists (ACOG) strongly support efforts to further reduce the rate of perinatal transmission of HIV in the United States. We therefore support the recommendation of the IOM for universal HIV testing with patient notification as a routine component of prenatal care. If a patient declines testing, this should be noted in the medical record. We recognize that current laws in some states may prevent implementation of this recommendation at this time. We encourage our members and Fellows to include counseling as a routine part of care, but not as a prerequisite for and barrier to prenatal HIV testing.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Human Milk, Breastfeeding, and Transmission of Human Immunodeficiency Virus in the United States

Committee on Pediatric AIDS

ABBREVIATIONS. HIV, human immunodeficiency virus; AAP, American Academy of Pediatrics; OSHA, Occupational Safety and Health Administration.

THE PROBLEM

Physicians caring for infants born to women infected with human immunodeficiency virus (HIV) or at risk for HIV infection are likely to be involved in making recommendations concerning the appropriateness of breastfeeding or the use of expressed human milk. Because the number of women with HIV infection in the reproductive age range is increasing rapidly, the importance of understanding the potential risk of HIV transmission to infants via human milk is critical.

BACKGROUND

Breastfeeding provides numerous health benefits to infants. Besides being an excellent source of nutrition, human milk protects against morbidity and mortality from infectious diseases of bacterial, viral, and parasitic origin, and the act of breastfeeding establishes a bond between mother and infant. Human milk also has a low likelihood of contamination by environmental pathogens. The American Academy of Pediatrics (AAP) strongly supports the promotion of breastfeeding of infants.[1]

It is well-known that HIV, the virus that causes acquired immunodeficiency syndrome, can be transmitted from mother to infant during pregnancy as well as during the peripartum period. In addition, recent reports from throughout the world have documented the transmission of HIV through human milk.[2–4] Despite the multiple anti-infectious, protective substances that have been identified in human milk, HIV may be recovered from human milk and has been shown to be the source of HIV infection in some infants.[3]

Research studies are presently investigating factors associated with infectivity as well as the potential protective elements of breast milk. Such factors include potential differences in the virus content of colostrum and early human milk compared with later milk, the relationship of the duration of breastfeeding to transmission, the role of the immature gastrointestinal tract of the young infant in viral transmission, and the potential protective effect of HIV-specific immune globulins in human milk[4] and of human milk glycosaminoglycans, which appear to inhibit HIV binding to the CD4 molecule.[5]

Currently no randomized clinical trials are available that accurately document the incremental risk of HIV transmission through breastfeeding over that occurring during the intrauterine and intrapartum periods. Evaluation of populations that vary only by method of infant feeding have been limited to date, due to the homogeneity of feeding practices in current cohorts, with breastfeeding the norm in developing countries and formula feeding the norm in industrialized countries.

Although some studies do not indicate an increased risk of transmission of HIV by human milk,[6] a recent meta-analysis of data from cohort studies in which some infants were breastfed and others were exclusively bottlefed indicated an increased risk of transmission attributable to breastfeeding.[7] Mothers who develop primary HIV infection while nursing may pose an especially high risk for transmitting the infection via human milk because the infant potentially is exposed to secretions or cells containing a higher virus burden.[8] In the meta-analysis, the risk of transmission by breastfeeding from mothers who developed primary infection during the postpartum period was 29% (95% confidence interval, 16% to 42%).[7]

The interpretation of the results from the meta-analysis has caused a great deal of controversy. This approach to data analysis indicates that the incremental risk of transmission by breastfeeding from mothers with established infection before pregnancy is 14% (95% confidence interval, 7% to 22%).[7] Recent reports note the incremental risk of transmitting HIV infection to the breastfeeding infant to range from 3% to 12% in various African populations.[9,10]

The use of expressed human milk for nutrition of sick, premature, and recuperating neonates in intensive care units has become commonplace, and some mothers may express milk for their infants in a child care setting. Breast milk is not included in the Occupational Safety and Health Administration (OSHA) standards definition of "other potentially infectious materials."[11] Although human milk has been implicated in perinatal transmission of HIV and the hepatitis B surface antigen has been found in the milk of mothers infected with HBV,[12] contact with breast milk does not constitute occupational exposure as defined by the OSHA standards. The determination

The recommendations in this statement do not indicate an exclusive course of treatment or procedure to be followed. Variations, taking into account individual circumstances, may be appropriate.

that human breast milk has not been implicated in the transmission of HIV[13] or the hepatitis B virus to workers, was based on separate findings of the Centers for Disease Control and Prevention, and the World Health Organization.[13] Gloves are not recommended for the routine handling of expressed human milk; but should be worn by health care workers in situations where exposures to breast milk might be frequent or prolonged, for example, in milk banking.[13]

Whatever the actual risk of HIV transmission through breastfeeding is in the United States, the potential for infection through human milk exists and must be examined in the context of the prevalence of HIV in women of childbearing age, the low incidence of breastfeeding in populations with the highest incidence of HIV infection, and the known general benefits of human milk.

CONCLUSIONS

When making recommendations concerning feeding options for infants, health care providers in the United States must balance the potential for transmission of HIV through human milk with the known benefits of breastfeeding. Additional epidemiologic studies are needed to assess accurately the actual risk of HIV transmission to infants from human milk in the United States. However, because HIV transmission via human milk is possible, knowledge of the HIV serostatus of pregnant women is important to determine whether breastfeeding is appropriate.

RECOMMENDATIONS

The World Health Organization has developed recommendations for breastfeeding in the developing world.[13] The following recommendations are made by the AAP for the United States, where infectious diseases and malnutrition are not major causes of infant mortality and where safe alternatives to breastfeeding are available.

1. Women and their health care providers need to be aware of the potential risk of transmission of HIV infection to infants during pregnancy and in the peripartum period, as well as through human milk.
2. The AAP recommends documented, routine HIV education, and routine testing with consent of all women seeking prenatal care so that each woman will know her HIV status and the methods available both to prevent the acquisition and transmission of HIV and to determine whether it is appropriate to breastfeed.
3. At the time of delivery, provision of education about HIV and testing with consent of all women whose HIV status during this pregnancy is unknown are recommended. Knowledge of the woman's HIV status assists in counseling on breastfeeding and helps each woman understand the benefits to herself and her infant of knowing her serostatus and the behaviors that would decrease the likelihood of acquisition and transmission of HIV.
4. Women who are known to be HIV-infected must be counseled not to breastfeed or provide their milk for the nutrition of their own or other infants.
5. In general, women who are known to be HIV-seronegative should be encouraged to breastfeed. However, women who are HIV-seronegative but at particularly high risk of seroconversion (injection drug users and sexual partners of known HIV-positive persons or active drug users) should be provided education about HIV with an individualized recommendation concerning the appropriateness of breastfeeding. In addition, during the perinatal period, information should be provided on the potential risk of transmitting HIV through human milk and about methods to reduce the risk of acquiring HIV infection.
6. Each woman whose HIV status is unknown should be informed of the potential for HIV-infected women to transmit HIV during the peripartum period and through human milk and the potential benefits to her and her infant of knowing her HIV status and how HIV is acquired and transmitted. The health care provider needs to make an individualized recommendation to assist the woman in deciding whether to breastfeed.
7. Neonatal intensive care units should develop policies that are consistent with the above recommendations for the use of expressed human milk for the nutrition of neonates. Current OSHA standards do not require gloves for the routine handling of expressed human milk.[11] However, gloves should be worn by health care workers in situations where exposure to breast milk might be frequent or prolonged, for example, in milk banking.[13]
8. Human milk banks should follow the guidelines developed by the United States Public Health Service, which includes screening all donors for HIV infection and assessing risk factors that predispose to infection, as well as pasteurization of all milk specimens.

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AMERICAN ACADEMY OF PEDIATRICS

TECHNICAL REPORT

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Human Milk, Breastfeeding, and Transmission of Human Immunodeficiency Virus Type 1 in the United States

ABSTRACT. Transmission of human immunodeficiency virus type 1 (HIV-1) through breastfeeding has been conclusively demonstrated. The risk of such transmission has been quantified, the timing has been clarified, and certain risk factors for breastfeeding transmission have been identified. In areas where infant formula is accessible, affordable, safe, and sustainable, avoidance of breastfeeding has represented one of the main components of mother-to-child HIV-1 transmission prevention efforts for many years. In areas where affordable and safe alternatives to breastfeeding may not be available, interventions to prevent breastfeeding transmission are being investigated. Complete avoidance of breastfeeding by HIV-1-infected women has been recommended by the American Academy of Pediatrics and the Centers for Disease Control and Prevention and remains the only means by which prevention of breastfeeding transmission of HIV-1 can be absolutely ensured. This technical report summarizes the information available regarding breastfeeding transmission of HIV-1.

ABBREVIATIONS. HIV-1, human immunodeficiency virus type 1; CDC, Centers for Disease Control and Prevention; AAP, American Academy of Pediatrics; CI, confidence interval; WHO, World Health Organization; UNICEF, United Nations Children's Fund; UNAIDS, the Joint United Nations Program on HIV/AIDS; OR, odds ratio; RR, relative risk; SLPI, secretory leukocyte protease inhibitor.

INTRODUCTION

The benefits of breastfeeding are well recognized and include significantly decreased infant morbidity and mortality rates by providing optimal nutrition, by protecting against common childhood infections such as gastrointestinal and respiratory tract infections, and by promoting child spacing.[1–6] Breastfeeding is particularly important in resource-poor regions of the world, where limited access to clean water increases the risk of diarrheal disease if replacement feeding is used. However, human immunodeficiency virus type 1 (HIV-1) is transmitted through human milk, leading to the dilemma that use of replacement feeding in resource-poor settings, although protecting the infant against HIV-1 infection, also could place the infant at risk of mortality from other infections. Shortly after the first report of transmission of HIV-1 through breastfeeding,[7] the Centers for Disease Control and Prevention (CDC) recommended that HIV-1-infected women in the United States avoid breastfeeding,[8] because replacement feeding is safe, affordable, and culturally acceptable. The CDC and the American Academy of Pediatrics (AAP)[9] have continued to recommend counseling HIV-1-infected women in the United States not to breastfeed or provide their milk for the nutrition of their own or other infants. Avoidance of breastfeeding remains an important component of mother-to-child HIV-1 transmission prevention efforts in the United States,[10] where perinatal transmission of HIV-1 has been substantially decreased.[11] However, in areas of the world where breastfeeding is the norm and safe replacement feeding generally is not possible, the enormous and unremitting epidemic of mother-to-child transmission of HIV-1 continues.[12] Research efforts focused on the continuing problem of breastfeeding transmission in much of the world have yielded additional information regarding mechanisms of HIV-1 transmission through breastfeeding as well as the timing of and risk factors for such transmission. This technical report summarizes the available information regarding transmission of HIV-1 through human milk. Complete avoidance of breastfeeding by HIV-1-infected women remains the only means by which prevention of breastfeeding transmission of HIV-1 can be absolutely ensured.

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

EVIDENCE OF BREASTFEEDING TRANSMISSION OF HIV-1

Over nearly 2 decades, the understanding of mother-to-child HIV-1 transmission through breastfeeding has increased tremendously. Beginning with the earliest clinical evidence of breastfeeding transmission of HIV-1 (case reports), additional information regarding breastfeeding transmission has come from both other epidemiologic studies (descriptive and analytic) and laboratory studies.

Evidence From Epidemiologic Studies

Descriptive Studies

In 1985, Ziegler and colleagues[7] in Australia described the case of an HIV-1-infected infant who apparently acquired the infection after being breastfed by his previously healthy mother, who received a postpartum transfusion of HIV-1-contaminated blood. Over the next several years, this report was confirmed by other case reports from around the world.[13–26] In general, these case reports described acquisition of HIV-1 infection by children of breastfeeding mothers, with the mothers being at low risk of HIV-1 infection and presumed HIV-1-seronegative until acquisition of infection after delivery, usually through HIV-1-contaminated blood transfusions. On the basis of a case series of 10 breastfeeding women, the estimated risk of breastfeeding transmission among women with acquisition of HIV-1 infection after delivery was 27% (95% confidence interval [CI]: 6%–61%).[27] Because of viremia associated with primary infection with HIV-1 and the presumably high viral load concomitantly in human milk, women who breastfeed during primary infection with HIV-1 could represent a particularly high-risk group. Therefore, the generalizability of the implications of these case reports to breastfeeding women with HIV-1 infection acquired before delivery, who represent most HIV-1-infected breastfeeding women, was not clear. However, on the basis of these case reports and because of concern that women with chronic HIV-1 infection also could be at risk of transmitting HIV-1 to their infants through breastfeeding, in 1985 the CDC issued the recommendation that HIV-1-infected women avoid breastfeeding.[8]

Studies of mother-to-child transmission of HIV-1 in different countries around the world yielded transmission rates, in the absence of interventions to decrease transmission, ranging from 13% to 42%.[28] The finding that transmission rates were generally higher in countries where virtually all mothers breastfeed compared with countries such as the United States, where breastfeeding by HIV-1-infected women is unusual,[29,30] suggested the possibility that breastfeeding transmission accounted for some of the discrepancy in rates between different settings.

Observational, Analytic Studies

Higher rates of HIV-1 infection among breastfed children compared with formula-fed children were reported in several studies.[31–35] On the basis of a systematic review of published studies meeting criteria allowing the determination of the quantitative risk of breastfeeding transmission of HIV-1,[36] the estimated risk of transmission of HIV-1 through breastfeeding by mothers who acquired HIV-1 infection postnatally was 29% (95% CI: 16%–42%). Similar analysis of published studies with mothers who had chronic HIV-1 infection resulted in an estimated further risk of transmission through breastfeeding (in addition to in utero and/or intrapartum transmission) of 14% (95% CI: 7%–22%).

On the basis of the information available at the time, consensus statements from the World Health Organization (WHO) in 1987[37] and 1992[38] included recommendations that were intended to result in the greatest likelihood of prevention of infant mortality and of mother-to-child transmission of HIV-1 through breastfeeding in different regions of the world. These recommendations were that breastfeeding should be advised for women, including HIV-1-infected women, in areas of the world where most infant deaths were attributable to infections and malnutrition. In addition, it was recommended that in other areas of the world where infectious diseases were not the main causes of infant death, HIV-1-infected women be advised not to breastfeed but instead to use safe feeding alternative(s) for their infants.

Prospective cohort studies published in the mid-1990s[39–42] provided estimates of the excess risk of HIV-1 transmission attributable to breastfeeding ranging from 4% to 22%. In 1997[43] and 1998,[44–46] the WHO along with the United Nations Children's Fund (UNICEF) and the Joint United Nations Program on HIV/AIDS (UNAIDS) issued revised recommendations regarding breastfeeding and HIV-1 transmission. These recommendations called for giving women access to HIV-1 counseling and testing as well as information that would allow them to make fully informed decisions regarding infant feeding.

Interventional, Analytic Study

A randomized clinical trial of breastfeeding versus formula feeding among HIV-1-infected women in Kenya demonstrated HIV-1 transmission through breastfeeding.[47] This trial enrolled 425 HIV-1-infected pregnant women. Compliance was higher in the breastfeeding arm (any use of human milk, 96%) compared with the formula-feeding arm (complete avoidance of human milk, 70%). The median duration of breastfeeding was 17 months. The cumulative probability of HIV-1 infection in the children at 24 months of age was significantly higher in the breastfed children (36.7% [95% CI: 29.4%–44.0%] in the breastfeeding arm vs 20.5% [95% CI: 14.0%–27.0%] in the formula-feeding arm [$P = .001$]). Most breastfeeding transmission occurred early (75% by 6 months of age), but transmission continued throughout the duration of human milk exposure.

Individual Patient Data Meta-analysis

The objectives of the Breastfeeding and HIV-1 International Transmission Study, a meta-analysis of individual patient data from randomized, placebo-controlled clinical trials conducted in Africa, are to estimate the contribution of breastfeeding to the overall risk of mother-to-child transmission of HIV-1, to clarify the timing of breastfeeding transmission, and to identify determinants of late postnatal transmission through breastfeeding.[48] The large sample size and the application of uniform definitions across trials in this meta-analysis should provide more reliable and precise estimates than have previous studies of the risk and timing of late postnatal transmission of HIV-1 through breastfeeding.

Laboratory Studies

Early reports indicated HIV-1 could be detected in human milk from HIV-1-infected women.[49–52] Subsequent studies confirmed the detection of HIV-1 in human milk as both cell-free virus and cell-associated virus.[53–56] HIV-1 proviral DNA has been detected in human milk cells in 44% to 58% of samples in different studies,[53,55–58] with detection of HIV-1 DNA associated with lower maternal $CD4^+$ cell counts and severe deficiency of vitamin A (a micronutrient deficiency associated with diminished epithelial integrity and systemic immunity).[59] In a study in Kenya, cell-free virus (HIV-1 RNA) was detectable in 39% of human milk samples,[60] with the prevalence being higher in mature milk (47%) than in colostrum (27%). A higher human milk viral load is associated with a higher risk of mother-to-child transmission.[61,62] In South Africa, HIV-1 RNA was detectable in 63% of samples, with higher human milk viral load being associated with a greater risk of transmission of HIV-1 to the infant (odds ratio [OR] = 2.82 [95% CI = 1.22%–6.51%] for each log increase in viral load).[63] Similarly, a higher plasma viral load is associated with higher probability of breastfeeding transmission per liter of milk ingested by the infant.[62] The viral load in different body fluids (plasma, human milk, and genital secretions) is correlated.[64]

RISK FACTORS FOR BREASTFEEDING TRANSMISSION OF HIV-1

Because breastfeeding transmission of HIV-1 does occur, and because avoidance of breastfeeding is impossible in many settings, identification of risk factors for transmission of HIV-1 through breastfeeding is important to design interventions to prevent such transmission. Potential risk factors for breastfeeding transmission of HIV-1 include duration of breastfeeding as well as characteristics of the mother, the infant, and the human milk or type of breastfeeding (Table 1).

Duration of Breastfeeding

The cumulative risk of breastfeeding transmission of HIV-1 has been estimated. In a study conducted in Malawi, the cumulative risk of infection for infants of HIV-1-infected mothers continuing to breastfeed after 1 month of age was 3.5% at the end of 5 months, 7.0% at the end of 11 months, 8.9% at the end of 17 months, and 10.3% at the end of 23 months.[65] A pooled analysis of individual data from prospective cohort studies of HIV-1-infected women and their children[66] incorporated data from studies in Rwanda, the Ivory Coast, and Kenya, where breastfeeding is the norm. Late postnatal transmission (defined as acquisition of HIV-1 infection after 2.5 months of age) occurred among 49 of 902 children (5%). The overall estimated risk of breastfeeding transmission was 3.2% per 100 child-years of breastfeeding (95% CI: 3.1%–3.8%). With information regarding the timing of breastfeeding transmission available for 20 of the 49 children, the cumulative probability of acquisition of late postnatal transmission was 0.6% (95% CI: 0.2%–2.2%) at 6 months of age, 0.95% (95% CI: 0.4%–2.5%) at 9 months of age, 2.5% (95% CI: 1.3%–4.7%) at 12 months of age, 6.3% (95% CI: 3.9%–9.95%) at 18 months of age, 7.4% (95% CI: 4.5%–12.1%) at 24 months of age, and 9.2% (95% CI: 5.3%–15.5%) at 36 months of age. Differences in the cumulative risk of transmission between these 2 studies could be related to different definitions of late postnatal transmission (acquisition after 1 month of age in the Malawi study and after 2.5 months of age in the pooled analysis).

Longer durations of breastfeeding by mothers infected with HIV-1 are associated with an increased risk of HIV-1 transmission to their infants. In Italy,[35] univariate analyses suggested a higher likelihood of HIV-1 infection among breastfed children (compared with bottle-fed children), with an increasing likelihood of HIV-1 infection with increasing duration of breastfeeding (OR = 2.16 [95% CI: 1.17%–4.00%] for children breastfed for 20 days or less, increasing to OR = 6.41 [95% CI: 2.98%–13.79%] for children breastfed more than 92 days). In a small study in South Africa, a 15% increased risk of HIV-1 transmission was observed with breastfeeding compared with formula feeding, and the data suggested higher transmission rates with longer durations of breast-

TABLE 1. Potential Risk Factors for Human Milk Transmission of HIV-1

Category	Risk Factor
Duration of breastfeeding	Longer duration
Maternal characteristics	Younger age
	Higher parity
	Lower $CD4^+$ count
	Higher peripheral blood viral load
	Breast abnormalities
	Breast abscess
	Mastitis
	Nipple lesions
Infant characteristics	Oral candidiasis
Human milk characteristics	Higher viral load
	Lower concentrations of antiviral substances (eg, lactoferrin, lysozyme, SLPI, epidermal growth factor)
	Lower concentration of virus-specific cytotoxic T-lymphocytes
	Lower secretory IgA
	Lower IgM
Exclusivity of breastfeeding	Mixed breastfeeding

IgA indicates immunoglobulin A, IgM, immunoglobulin M.

feeding.[67] In a meta-analysis of published data from prospective cohort studies of HIV-1-infected women and their children,[68] 499 HIV-1-infected women who breastfed their children were identified. The estimated risk of breastfeeding transmission of HIV-1 was 16% (95% CI: 9%–22%). Among breastfed infants, 47% of HIV-1 infections were attributable to breastfeeding. Breastfeeding transmission occurred in 21% (10%–22%) of those who breastfed for a median length of 3 or more months and 13% (95% CI: 4%–21%) among infants who breastfed for a median of less than 2 months.

Characteristics of the Mother and Infant

Characteristics of the mother and infant have been associated with increased risk of breastfeeding transmission of HIV-1. Maternal factors associated with breastfeeding transmission of HIV-1 include younger maternal age and higher parity,[65] maternal HIV-1 disease stage, and breast abnormalities. More advanced maternal disease stage, as manifested by low $CD4^+$ cell counts, is a risk factor for postnatal transmission of HIV-1,[61,63,69] along with higher maternal peripheral blood or human milk viral load.[61–63] An early case report of the temporal association of acquisition of HIV-1 infection by the child of an HIV-1-infected woman with a breast abscess suggested the ingestion of inflammatory cells related to the bacterial infection of the breast contributes to breastfeeding transmission of HIV-1.[70] Later studies confirmed the association of transmission of HIV-1 through breastfeeding with maternal breast abnormalities, such as breast abscesses, mastitis, and nipple lesions. In Kenya, mastitis and breast abscesses were associated with late postnatal transmission of HIV-1 (relative risk [RR] = 21.8 [95% CI: 2.3%–211.0%] and RR = 51.6 [95% CI: 4.7%–571.0%], respectively).[68] In Malawi, women with increased human milk sodium concentrations consistent with subclinical mastitis had higher human milk viral loads than did women without increased human milk sodium concentrations.[61] In another study in Kenya, maternal nipple lesions (OR = 2.3 [95% CI: 1.1%–5.0%]) and mastitis (OR = 2.7 [95% CI: 1.1%–6.7%]) were each associated with an increased risk of postnatal transmission.[69] Oral candidiasis before 6 months of age is associated with late postnatal transmission (OR = 2.8 [95% CI: 1.3%–6.2%]).[69] Results of a study in the Ivory Coast suggested maternal breast abscesses and cracked nipples, as well as oral candidiasis in infants, were risk factors for late postnatal transmission of HIV-1 through breastfeeding.[42]

Characteristics of Human Milk or Type of Breastfeeding

In addition to higher human milk viral load, characteristics of human milk possibly associated with a higher risk of breastfeeding transmission of HIV-1 include lower concentrations of antiviral substances, such as lactoferrin,[71,72] lysozyme, secretory leukocyte protease inhibitor (SLPI),[73] and epidermal growth factor,[74] as well as lesser specific, local immune responses to HIV-1. Interestingly, HIV-1-infected women with subclinical mastitis, higher human milk viral loads, and higher rates of mother-to-child transmission had higher human milk concentrations of lysozyme and SLPI than did HIV-1-infected women without subclinical mastitis.[75] However, SLPI concentrations in human milk have not been found by other investigators to be associated with HIV-1 transmission through breastfeeding.[76] It has been suggested that epidermal growth factor in colostrum helps to make the gastrointestinal tract less permeable to viral infection.[74] Higher mother-to-child transmission of HIV-1 has been associated with lower human milk concentrations of secretory immunoglobulin A and immunoglobulin M during the first several weeks of life in some[55] but not all studies.[77]

When feeding patterns among infants born to HIV-1-infected women in Brazil were analyzed, neither a history of colostrum intake nor a history of mixed feeding (human milk with other milk, tea, or juice) was associated with transmission.[78] However, in South Africa, data from a randomized clinical trial of vitamin A supplementation to prevent mother-to-child transmission were reanalyzed to evaluate a possible association between feeding patterns among infants of breastfeeding HIV-1-infected mothers and mother-to-child transmission.[79,80] In this study, breastfeeding was categorized as exclusive or mixed (ie, without or with water, other fluids, and food). Women who chose to breastfeed were counseled to consider exclusive breastfeeding. Follow-up visits after birth, during which an infant feeding history was obtained, occurred at 1 week, 6 weeks, and 3 months of age and every 3 months thereafter. By 15 months of age, children who ever breastfed were more likely to have become HIV-1-infected (31.6%) than were children who never breastfed (19.4% [$P = .007$]). Of children who ever breastfed, those who exclusively breastfed until at least 3 months of age but no longer than 6 months of age had a lower estimated transmission point estimate than did those with mixed feeding, but the confidence limits for these point estimates overlap (exclusive: 24.7% [95% CI: 16.0%–34.4%]; mixed: 35.9% [95% CI: 26.7%–45.1%]). The authors proposed that the mechanism of their findings was that contaminated fluids and foods given to infants with mixed breastfeeding damaged the bowel and facilitated the entry of HIV-1 into tissues. The results of this hypothesis-generating study have prompted several investigators to pursue new studies of exclusive breastfeeding to assess more carefully the risk of HIV-1 transmission according to feeding modality.

POTENTIAL INTERVENTIONS TO PREVENT BREASTFEEDING TRANSMISSION OF HIV-1

There are several potential interventions to prevent breastfeeding transmission of HIV-1 (Table 2). The first is conceptually the simplest: complete avoidance of human milk. If breastfeeding does occur, several interventions could potentially prevent transmission of HIV-1 through human milk. First, early weaning (eg, at 6 months of age) will limit the duration of exposure to human milk. Other interventions to potentially prevent breastfeeding transmis-

TABLE 2. Proven or Potential Interventions to Prevent Human Milk Transmission of HIV-1

Risk Factor for Transmission	Associated Intervention
Longer exposure to human milk from an HIV-1-infected woman	Complete avoidance of breastfeeding Early weaning
Greater maternal infectivity (eg, higher maternal viral load in peripheral blood and in human milk)	Maternal antiretroviral therapy while breastfeeding
Factors facilitating viral transfer from mother to child (eg, mixed breastfeeding)	Avoidance of mixed breastfeeding (encouragement of exclusive breastfeeding)
Infant susceptibility to infection	Improvement of infant defenses against infection (eg, with passive immunization or with antiretroviral prophylaxis to breastfeeding infants)

sion of HIV-1 can be categorized as follows: decreasing human milk viral load (eg, with maternal antiretroviral therapy or by treating human milk by pasteurization or other means), preventing or treating factors facilitating transfer of HIV-1 from mother to child (eg, preventing or treating maternal breast abnormalities and infant candidiasis, avoiding mixed breastfeeding), and improving infant defenses against HIV-1 infection (eg, by passive or active immunization or antiretroviral prophylaxis to breastfeeding infants). Recent WHO recommendations[81] reaffirm previous recommendations for all HIV-1-infected mothers to receive counseling, including provision of general information about risks and benefits of various infant feeding options and specific guidance in selecting the option most likely to be suitable for their situation, and call for mothers to be supported in the their choices regarding their infants' feeding.

Complete Avoidance of Breastfeeding

Complete avoidance of breastfeeding (eg, by using infant formula) is an intervention of obvious utility in settings where it is feasible (ie, where clean water is available), affordable, and culturally acceptable. The randomized clinical trial of breastfeeding versus formula feeding demonstrated breastfeeding by HIV-1-infected women causes more mother-to-child transmission than does formula feeding.[47] However, although transmission of HIV-1 was much higher in the children of women randomized to breastfeeding versus formula feeding (36.7% vs 20.5% at 2 years of age [$P = .001$]), the 2 groups experienced similar rates of mortality during the first 2 years of life.[82] Mortality rates at 24 months of age were 24.4% (95% CI: 18.2%–30.7%) among children whose mothers were randomized to breastfeeding and 20.0% (95% CI: 14.4%–25.6%) among those children whose mothers were randomized to formula feeding. Additionally, infants in the breastfeeding arm had better nutritional status than did those in the formula feeding arm, particularly during the first 6 months of life, although the overall prevalence of malnutrition was not different in the 2 study groups. The better growth of breastfed infants during the first 6 months of life highlights the importance of nutritional counseling for mothers who decide to give formula to their children, and the WHO recommends that HIV-1-infected women who decide not to breastfeed their children should receive specific guidance and support during at least the first 2 years of their children's lives to ensure adequate replacement feeding.[81]

Interventions Among Breastfeeding Women

Before considering specific interventions to prevent breastfeeding transmission of HIV-1, it is important to consider the potential effects of breastfeeding on the HIV-1-infected woman herself. One such potential effect is an increased mortality rate among breastfeeding HIV-1-infected women.

Potential Consequences of Breastfeeding for the Mother

The results of 2 studies evaluating the risk of mortality among HIV-1-infected women according to infant feeding modality (breastfeeding compared with formula feeding) have been conflicting. Data from the randomized clinical trial of breastfeeding versus formula feeding in Kenya were analyzed to assess maternal mortality according to infant feeding modality.[83] Analysis of maternal mortality was by intention to treat (ie, by randomized assignment of mothers to breastfeeding or formula feeding). Maternal mortality over the 2-year period after delivery was higher among those in the breastfeeding group (18 deaths among 197 [9%]) compared with those in the formula feeding group (6 deaths among 200 [3%]; $P = .009$). The cumulative probability of maternal death at 24 months after delivery was 10.5% in the breastfeeding group and 3.8% in the formula group ($P = .02$). The relative risk of death for mothers assigned to breastfeeding compared with those assigned to formula feeding was 3.2 (95% CI: 1.3%–8.1% [$P = .01$]), and the attributable risk of maternal death attributable to breastfeeding was 69%. There were significant associations between $CD4^+$ lymphocyte counts and maternal death as well as between viral load and maternal death. The authors hypothesized that a combination of the metabolic demands of breastfeeding on HIV-1-infected women (who already might have borderline nutritional status) and of HIV-1 infection itself could be associated with substantial nutritional impairment, which could result in an increased risk of death. Indeed, women in the breastfeeding group had greater weight loss after delivery than did women in the formula-feeding group.

Data from a second study, a randomized clinical trial of vitamin A supplementation in South Africa, were analyzed to assess maternal mortality among HIV-1-infected women according to infant feeding modality (breastfeeding or not breastfeeding).[84] In this trial, mothers chose whether to breastfeed or not (ie, there was no randomization regarding infant

feeding modality). Of 566 mothers whose data were analyzed, 410 breastfed their infants and 156 never breastfed. No differences in maternal mortality rates according to infant feeding modality were observed. Over a mean follow-up period after delivery of 10 months, 0.49% (2 of 410) of women who ever breastfed were known to have died, compared with 1.92% (3 of 156) of those who never breastfed. Morbidity among those who breastfed for more than 3 months was similar to that of women who breastfed for less than 3 months.

The reasons for the differences in the results of these 2 studies are not clear, and additional research is needed in this area. With a pooled sample size of several thousand HIV-1-infected women, the Breastfeeding and HIV-1 International Transmission Study[48] represents a unique resource for further exploration of the issue of maternal mortality and infant feeding modality.

Early Weaning

If complete avoidance of human milk is not possible, early weaning from human milk (eg, at 6 months of age), if feasible, would limit exposure to HIV-1-infected human milk while allowing the child to experience benefits of breastfeeding. Human milk provides sufficient nutritional requirements for optimal growth and development for approximately the first 6 months of life[85–87] (although vitamin D and iron supplementation may be required before 6 months of age in some infants[88]). Although human milk remains a valuable source of nutrition for many months thereafter, it is possible for children to be weaned successfully from human milk and provided other sources of nutrition after 6 months of age. The increased risk of morbidity and mortality associated with replacement feeding (because of malnutrition and infectious diseases other than HIV-1) is especially high during the first 6 months of life and decreases in magnitude thereafter.[89] Assessment of the feasibility of early weaning involves consideration of an individual woman's situation and local circumstances. For many women, early weaning of their children from human milk is not possible because of financial or other constraints. Early weaning from human milk is being evaluated in trials in Zambia[90] and Botswana.[91] The WHO recommends that HIV-1-infected women who decide to wean their children from human milk early receive specific guidance and support during at least the first 2 years of their children's lives to ensure adequate replacement feeding.[81]

Decreasing Viral Load in Human Milk

Maternal Antiretroviral Therapy

Several studies in Africa are planned to evaluate antiretroviral therapy for HIV-1-infected women during breastfeeding for the prevention of breastfeeding transmission of HIV-1. In observational and interventional studies, the effectiveness and efficacy of maternal combination antiretroviral therapy for prevention of mother-to-child transmission, especially breastfeeding transmission, will be assessed.

Treating Human Milk

Treatment of human milk with chemical agents or heat to inactivate HIV-1 has been investigated. Sodium dodecyl sulfate, a microbicidal agent active against HIV-1 and other viruses, does not alter protein content of human milk and can be efficiently removed from human milk samples.[92] In one study, allowing expressed human milk to stand at room temperature for 6 hours did not destroy proviral DNA, but boiling expressed human milk appeared to decrease HIV-1 infectivity of the milk.[93] Pasteurization of human milk,[94,95] including using devices that can be used in a home setting,[96–98] can decrease the infectious titer of cell-free HIV-1 and HIV-1-infected cells by more than 5 logs and 6 logs, respectively.[95] Use of any or all of these methodologies would not be feasible in many settings and may not be culturally acceptable. Additionally, although they decrease human milk viral load, these methodologies are unlikely to eliminate HIV-1 from milk completely. Finally, with any treatment to inactivate HIV-1, the extent to which the treatment diminishes the protective or nutritional components of human milk must be carefully assessed.

Preventing or Treating Factors Related to Facilitation of Transfer of HIV-1 From Mother to Child

Preventing or Treating Maternal Breast Abnormalities and Infant Candidiasis

In light of the evidence of the association of maternal breast abnormalities and breastfeeding transmission, the WHO recommends that HIV-1-infected women who breastfeed receive education and counseling to ensure good breastfeeding technique to decrease the risk of development of such conditions, and if such conditions arise, be treated as quickly and completely as possible.[81] Similarly, infant candidiasis should be treated promptly. One program underway in Zimbabwe involves education of women who choose to breastfeed. Individual counseling, if provided, concerns the following subjects: exclusive breastfeeding until the infant is 4 to 6 months of age followed by rapid weaning, proper positioning during breastfeeding, prompt seeking of medical care if breast abnormalities develop or if the infant develops oral candidiasis or other lesions, avoiding breastfeeding from a breast affected by abnormalities, and safe sex practices while breastfeeding.

Avoiding Mixed Breastfeeding

Exclusive breastfeeding during the first 4 to 6 months of life is associated with greater benefits than is mixed feeding in terms of morbidity and mortality from infectious diseases other than HIV-1.[99,100] The suggestive, but not definitive, results of analyses of feeding modality among breastfeeding children of HIV-1-infected women indicating a lower risk of transmission with exclusive breastfeeding compared with mixed breastfeeding[79,80] have prompted the development of additional studies[90,91] to evaluate further the role of exclusive versus mixed breastfeeding in vertical transmission of HIV-1. However, exclusive breastfeeding is not the norm in Africa and other

parts of the world. For example, only approximately half of Indian children younger than 4 months of age are exclusively breastfed.[101] In Zimbabwe, only 39% of infants were exclusively breastfed during the first 3 months of life, and only 7% were exclusively breastfed between 4 and 6 months of age.[102] Despite this, programs to promote exclusive breastfeeding have had some success. For example, the prevalence of exclusive breastfeeding at 5 months of age increased from 6% to 70% with home-based counseling by peer counselors (mothers from the local community with training for 10 days) in Bangladesh.[103] The Section on Breastfeeding of the American Academy of Pediatrics supports exclusive breastfeeding for approximately the first 6 months after birth.[87]

Improving Infant Defenses Against HIV-1 Infection

Passive Immunization

In some animal studies, the presence of circulating antibodies to HIV-1 in infants has been associated with a decreased risk of mother-to-child transmission of HIV-1.[104–108] Therefore, it has been hypothesized that passive immunization with anti-HIV-1 antibodies may decrease the likelihood of mother-to-child transmission of HIV-1 in humans. A clinical trial of HIV-1 immune globulin was conducted in the United States, but because of the unexpectedly low mother-to-child transmission rate among the study population with universal receipt of zidovudine prophylaxis, this trial was discontinued early.[109] Another randomized clinical trial of HIV-1 immune globulin with nevirapine versus 2 different regimens of nevirapine is planned in Uganda.

Active Immunization

Research regarding active immunization of infants to prevent postnatal acquisition of HIV-1 infection through breastfeeding is ongoing. Infant studies to evaluate the safety and immunogenicity of HIV-1 vaccines are underway in the United States and are planned in Africa.[110] Because no vaccine will produce immediate immunity, the goal is to provide protection against early postnatal transmission through administration of antiretroviral drugs or through passive immunization of the infant until an adequate immune response is induced in the infant by the HIV-1 vaccine.

Antiretroviral Prophylaxis to Breastfeeding Infants

The efficacy of continued administration of antiretroviral prophylaxis to breastfeeding infants is being investigated in several studies in India and different parts of Africa. These studies are evaluating administration of different antiretroviral drugs to the infant for varying lengths of time. Antiretroviral drugs being evaluated include zidovudine, lamivudine, and nevirapine. The planned duration of infant prophylaxis in these studies ranges from 1 week to 6 months of age. Preliminary results of some of these studies have been released.[91,111–113]

CONCLUSIONS

HIV-1 transmission through breastfeeding has been demonstrated conclusively. Additionally, the risk of such transmission has been quantified, the timing has been clarified, certain risk factors for breastfeeding transmission have been identified, and interventions to prevent breastfeeding transmission are being developed. Additional research is needed to characterize more completely the mechanism(s) of human milk transmission of HIV-1. Complete avoidance of breastfeeding by HIV-1-infected women remains the only means by which prevention of breastfeeding transmission of HIV-1 can be absolutely ensured. In settings such as the United States, with virtually universal access to clean water and with widespread cultural acceptance of formula feeding as an alternative to breastfeeding, avoidance of breastfeeding by HIV-1-infected women is possible. In other parts of the world where breastfeeding is the norm, affordable, feasible, and culturally acceptable interventions to decrease the risk of breastfeeding transmission of HIV-1 are urgently needed.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Pediatric AIDS

Identification and Care of HIV-Exposed and HIV-Infected Infants, Children, and Adolescents in Foster Care

ABSTRACT. As a consequence of the expanding human immunodeficiency virus (HIV) epidemic and major advances in medical management of HIV-exposed and HIV-infected persons, revised recommendations are provided for HIV testing of infants, children, and adolescents in foster care. Updated recommendations also are provided for the care of HIV-exposed and HIV-infected persons who are in foster care.

ABBREVIATIONS. HIV, human immunodeficiency virus; AAP, American Academy of Pediatrics; PCR, polymerase chain reaction.

An estimated 500 000 children and adolescents in the United States are in foster care.[1] Entrance to the foster care system may occur as a consequence of parental substance abuse, neglect, physical abuse, sexual abuse, or loss of biologic parent(s) resulting from abandonment, incarceration, disability, or death. As many as 78% of children in foster care have a parent with a history of substance abuse, and as many as 94% of infants in foster care are born to women who abuse substances.[2] The number of women with human immunodeficiency virus (HIV) infection has increased substantially, and most of these women are of childbearing age. Approximately 7000 births occur annually in the United States to HIV-infected women, and most of these women have been infected through heterosexual contact or as a consequence of drug use.[3] Seroprevalence of HIV infection in pregnancy nationwide is 1.7 per 1000 pregnant women, and in New York, where all newborns are tested for the HIV antibody, seroprevalence is 4 per 1000 pregnant women.[4] An inner-city study found that newborns placed in foster care at the time of hospital discharge were 8 times more likely to have been born to HIV-infected women than were newborns discharged to the care of their mothers.[5]

In addition to the increased risk of perinatally acquired HIV infection for those in foster care, children and adolescents in foster care may have been sexually abused, placing them at risk for acquisition of HIV infection. Adolescents who use drugs or are sexually active are also at risk for acquisition of HIV infection, and adolescent risky behavior may precede placement in foster care or may occur while in foster care. Although advances in antiretroviral therapy for adults have helped decrease the projections of 80 000 to 150 000 children and adolescents orphaned in the United States by the death of their mother to acquired immunodeficiency syndrome by the year 2000,[6,7] many HIV-infected women will still not survive to raise their offspring to adulthood, and their children may enter the foster care system as a consequence of maternal disability or death. Data from the Pediatric Spectrum of Disease project revealed that 45% of children born to HIV-infected women resided with a primary caregiver who was not the biological parent.[8]

Advances in the management of HIV infection include prenatal and postnatal administration of zidovudine to reduce the risk of infection of the infant, recommendations for initiation of *Pneumocystis carinii* pneumonia prophylaxis by 6 weeks of age for all infants born to HIV-infected women, variations in immunization recommendations for infected persons and infants at risk of infection, and recommendations for consideration of early and aggressive combination antiretroviral therapy for those who are infected.[9–11] The American Academy of Pediatrics (AAP) therefore issues recommendations in accordance with these recent advances to address the identification and care of HIV-exposed and HIV-infected infants, children, and adolescents in foster care.

HIV TESTING OF A CHILD IN FOSTER CARE WHO IS 1 YEAR OF AGE OR YOUNGER

The AAP, the American College of Obstetricians and Gynecologists, and the US Public Health Service have recommended that all pregnant women in the United States receive counseling about HIV infection and the benefits to the mother and her infant of knowing her serologic status and that all pregnant women should undergo routine testing for HIV.[12–14] The Institute of Medicine recently recommended a nationwide policy of HIV testing during pregnancy (with right of refusal).[4] In addition, if the mother's HIV status was not determined during pregnancy, the AAP recommends that, after birth of the infant, the pediatrician discuss with the mother the benefits to the infant of knowing the mother's serologic status and recommend testing at that time.[12]

The management of the HIV-exposed infant is complex and includes continuation of zidovudine prophylaxis during the first 6 weeks after birth, initiation of prophylaxis for *Pneumocystis carinii* pneumonia by 6 weeks of age in all infants born to HIV-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

infected women, monitoring of hematologic and immunologic parameters, specific laboratory testing to determine HIV infection status (DNA polymerase chain reaction [PCR] or viral culture), and variations in immunization recommendations.[9] Advances in laboratory diagnosis (DNA PCR and viral culture for HIV) enable physicians to determine infant infection status by 28 days of age in as many as 96% of infants born to HIV-infected women.[15,16] Published data suggest that RNA PCR may prove useful for early identification of infant infection status.[17,18] Prompt identification of infected infants permits early initiation of aggressive antiretroviral therapy with the potential to prevent the rapid progression of illness seen in some HIV-infected infants.

Thus, to provide appropriate medical care for the infant, it is necessary that foster care agencies obtain information about HIV exposure status, if known, for infants placed in foster care. If the maternal serologic status is unknown, the HIV exposure status of infants in foster care, including infants placed in foster care at nursery discharge and infants placed in foster care who are 1 year of age or younger, should be determined by testing the infants for HIV antibody. When the authority to consent to medical care has been transferred from the biological parents to a foster care agency, and the HIV-exposure status of the infant is unknown, the agency should provide consent for HIV testing of the infant and have an established mechanism to facilitate testing and to allow exchange of confidential information with appropriate persons (eg, physician, nurse, caseworker coordinating care for the foster child, biological parents, and the foster parents). Occasionally, legal restrictions may prevent testing of the infant in foster care without maternal consent. In such cases, the physician may need to consult with the foster care agency and legal authorities. Efforts should be made to educate the biological mother, if available, of the potential benefits to herself and to her infant of knowing maternal serologic status. Communication of information about any positive test results to the biological parent(s) or the foster parent(s) should occur in a health care setting with appropriate social service support available at the time of the meeting. Infants who are identified as HIV-exposed (born to an HIV-infected woman) should be managed in accordance with established guidelines.[9]

HIV TESTING OF CHILDREN IN FOSTER CARE WHO ARE OLDER THAN 1 YEAR

HIV-infected children may remain asymptomatic for years or have mild nonspecific symptoms (anemia, poor growth, developmental delay) that are not recognized as secondary to HIV infection. In a cohort of HIV-infected children, 32 (17.7%) of 181 HIV-infected children were first diagnosed at 4 years of age or older.[19] In another cohort of 42 perinatally infected long-term survivors between the ages of 9 and 15 years, 36 had no symptoms until after the age of 4 years.[20] Two children with perinatally acquired HIV infection have remained asymptomatic for almost 13 years.[21,22] In addition, transfusion-acquired HIV infection may be associated with an asymptomatic or a minimally symptomatic phase of illness, thus delaying diagnosis of HIV infection.[23] Because of the increasing recognition of HIV infection among older children, foster care agencies should create policies to facilitate testing of older children. Testing for HIV should be performed for all children in foster care with symptoms or physical findings compatible with HIV infection and for all children with a sibling or parent who is HIV-infected. Because factors that lead to placement of children in foster care frequently are associated with an increased risk of HIV infection in the child and parents, determining the status of all older children who are in the foster care system whose maternal serologic status is unknown may be prudent.

Diagnosis of HIV infection is made in a child 18 months of age or older when antibody testing by enzyme-linked immunosorbent assay and the Western blot technique is positive or when the child meets diagnostic criteria for the younger infant (positive HIV-specific diagnostic assays, ie, DNA PCR or viral culture on 2 separate blood specimens from the infant). Results of tests should be provided by the child's physician to foster parents, biological parents (if possible), foster care agency, and the child (if old enough to comprehend and if disclosure is appropriate to the developmental level of the child).[24]

HIV TESTING OF SEXUALLY ABUSED CHILDREN

Annually, more than 125 000 children and adolescents are sexually abused in the United States, and sexual abuse has been the mode of acquisition of HIV infection in at least 26 children younger than 13 years.[25] As part of sexual abuse evaluation, laboratory testing when performed should include HIV testing. Testing for HIV should be performed at the time of the initial assessment with repeated serologic testing at 6 weeks, 3 months, and 6 months after the incident of sexual abuse for children whose initial test results are negative.[26] Testing also should be repeated if symptoms suggestive of HIV infection occur. Foster care agencies should develop mechanisms to ensure that initial and follow-up serologic tests are obtained when indicated.

HIV TESTING OF ADOLESCENTS IN FOSTER CARE

HIV-infected adolescents may be unaware of their infection status. Adolescents in foster care, just as those who are not in the foster care system, may acquire HIV infection as a consequence of their own sexual activity or illicit drug use or may have been infected by previous sexual abuse or, rarely, by perinatal transmission. Adolescents who have been victims of sexual abuse are more likely to engage subsequently in sexual behavior that may place them at increased risk for acquiring HIV infection and other sexually transmitted diseases.[27] Homeless adolescents frequently engage in prostitution in exchange for money, food, or shelter, and a period of homelessness may occur before an adolescent is placed in foster care. In a New York City shelter for homeless adolescents, 6% of the residents were seropositive.[28] Intravenous drug use has long been recognized as a risk factor for HIV infection. Cocaine use also has

been reported as a risk factor for HIV infection because it may involve the exchange of sex for drugs or engaging in risky sexual behavior while under the influence of the drug.[29,30] It is important, though, to recognize that the epidemiology of HIV infection is changing and that there is an increased incidence of HIV transmission in the adolescent population through homosexual and heterosexual contact.

For adolescents in foster care (as for adolescents who are not in foster care), HIV testing should be recommended for those who have symptoms or physical findings suggestive of HIV infection and for those who have any of the following known risk factors for HIV infection: a sibling, or parent who is HIV infected, a current or past sexual partner who is HIV-infected or at increased risk of HIV infection; receipt of a blood transfusion before 1985; a history of sexual abuse; a diagnosis of a sexually transmitted disease; or a history of illicit substance use or abuse. In addition, HIV testing should be considered for all adolescents in foster care who are sexually active or have a history of sexual activity and for those whose medical history and family history are unavailable or inadequate for assessment of the aforementioned risk factors. Evaluation should be performed in the context of provision of comprehensive adolescent health care, and all adolescents should receive education and counseling from a health care professional about prevention of transmission of HIV infection.

All states allow adolescents to consent to confidential evaluation and treatment for sexually transmitted diseases.[31] In some states, adolescents may legally consent to confidential HIV testing and treatment. Testing of the adolescent should be performed with assent of the adolescent.[32] If testing of the adolescent is performed in association with evaluation for sexual abuse or because of high-risk behavior, foster care agencies and physicians providing such care should ensure that appropriate follow-up testing is obtained. Communication of positive test results to the adolescent should occur in the health care setting. State regulations may require consent of the adolescent for disclosure of test results to other individuals or agencies participating in the adolescent's care.

ISSUES RELATED TO THE CARE OF HIV-EXPOSED AND HIV-INFECTED INFANTS, CHILDREN, AND ADOLESCENTS IN FOSTER CARE

Provision of Medical Care

Foster care agencies should periodically review, with physician guidance, the agency policies pertaining to the care of HIV-exposed infants and HIV-infected infants, children, and adolescents. In addition, periodic review should occur of policies related to acquisition and communication of medical information and other confidential information for those in foster care, including infants placed in foster care at the time of hospital discharge. It is the responsibility of the discharging physician to provide records, including confidential HIV-related information, to the physician designated to assume care or to the agency for provision to the physician who will assume care. Similarly, when a child or adolescent initially is placed in foster care, the agency should contact the physician providing care to obtain complete medical records and determine if there are acute or chronic medical problems that require medical follow-up, the immunization status, and whether the person is taking medication.

Maintenance of a "medical home" is important in the care of all foster children and is particularly beneficial for those with chronic health problems, such as HIV infection.[33] Foster care agencies should ensure, in the event of a change in physicians, that complete medical and immunization records are transferred to the new physician. Agencies providing foster care should minimize or eliminate barriers to sharing confidential information among counselors, mental health professionals, caseworkers, and the physician providing care to the child or adolescent. Comprehensive care for HIV-exposed infants and HIV-infected infants, children, and adolescents requires coordination of care among multiple health care professionals and social service agencies. Use of the "health passport" (a booklet summarizing medical information, including illnesses, medications, immunizations, family history, and names of current and previous physicians) for children in foster care can assist in communication of information if the child changes physicians or is placed in a new foster home.[34]

With the increasing identification of HIV infection among pregnant women, there also has been increasing use of prophylactic zidovudine to reduce the risk of perinatal HIV infection.[35] This regimen is considered safe for mother and child.[36] However, the long-term consequences of in utero exposure to zidovudine and other antiretroviral agents are unknown. It is critical that information about in utero exposure to antiretroviral drugs be included in the medical records of infants born to HIV-infected women. All such infants, whether infected or uninfected, should receive long-term follow-up.

Owing to rapid advances in management of HIV infection, involvement in clinical trials may provide benefit to HIV-exposed infants and HIV-infected infants, children, and adolescents in foster care. In addition, clinical trials that do not involve a therapeutic agent but provide long-term follow-up of HIV-exposed and HIV-infected children and adolescents provide important benefits. Agencies providing foster care should have established procedures for access to studies and to clinical trials.

Foster Parent Education

Foster care agencies should provide education about HIV to all foster parents as part of their initial training. Such education should be updated periodically and should include infection control guidelines for use in the home setting.[37] Foster parents should be aware that there may be HIV-infected infants, children, and adolescents in foster care whose HIV status is unknown. Foster parents providing care to HIV-exposed infants should be educated about all issues in the management of the HIV-exposed infant that usually are discussed with the biological parent.[9]

Because provision of medical care for HIV-ex-

posed infants and HIV-infected infants, children, and adolescents is complex and requires frequent office visits, foster care agencies should develop procedures to ensure that those in foster care are seen at intervals deemed appropriate by the physician. If an HIV-exposed or HIV-infected child in foster care is transferred to a different foster home, the physician should be notified promptly (preferably before the transfer) to enable the physician to adequately inform the new foster parents about the child's health care needs, provide ongoing medication, and assist with additional education of new foster parents about HIV infection.

Permanency Planning

Although many children born to HIV-infected women are already in foster care or in the care of relatives outside the foster care system before the onset of debilitating complications in the mother or maternal death, infected women may not have made plans for provision of care for their children. In addition to determining who will provide care, it is necessary that provisions be made for long-term access to health care (physical and psychological) for HIV-infected offspring and for uninfected offspring. Permanency planning is a coordinated effort involving health care professionals, mental health professionals, social workers, foster care agencies, legal personnel, the biological family, and the designated "second family."[38]

CONCLUSION

These recommendations about HIV testing of infants, children, and adolescents in foster care and for enhanced coordination of care by physicians and foster care agencies are made to provide maximal opportunity for those in foster care to benefit from the dramatic medical advances in the care of HIV-exposed and HIV-infected infants, children, and adolescents.

RECOMMENDATIONS

1. Physicians and foster care agencies should be jointly responsible for the determination of HIV exposure status and HIV infection status for all infants in foster care. If maternal serologic status during the most recent pregnancy is unknown, and the state has guardianship and the authority to consent to medical care, the infant should be tested for HIV antibody. Infants exposed to HIV should be managed in accordance with established guidelines.[9]
2. Testing for HIV should be performed for all children in foster care who have:
   - symptoms or physical findings suggestive of HIV infection;
   - been sexually abused;
   - a sibling who is HIV-infected; or
   - a parent who is HIV-infected or is at increased risk of HIV infection.

   Testing for HIV also should be considered for all foster children whose maternal serologic status is unknown.
3. Testing for HIV (with assent of the adolescent) is recommended for all adolescents in foster care who have:
   - symptoms or physical findings suggestive of HIV infection;
   - a sibling who is HIV-infected;
   - a parent who is HIV-infected or at increased risk of HIV infection:
   - a current or past sexual partner who is HIV-infected or at increased risk of HIV infection;
   - received a transfusion before 1985;
   - a history of sexual abuse or a diagnosis of sexually transmitted disease; or
   - a history of illicit substance use or abuse.

   Testing for HIV also should be considered for all adolescents in foster care who are sexually active or have a history of sexual activity and for those whose medical history and family history are unavailable or inadequate for assessment of the aforementioned risk factors.
4. Physicians and foster care agencies should take joint responsibility to ensure appropriate exchange of complete medical records and confidential information necessary for the management of infants, children, and adolescents in foster care.
5. All foster parents should receive education about HIV infection, and the content of such education should be updated regularly.
6. All foster parents should be informed of the HIV exposure or infection status of infants and children in their care. Disclosure of adolescent HIV status should legally require the consent of the adolescent.
7. Foster care agencies should have established procedures to provide access for HIV-infected and HIV-exposed foster children to treatment-related and non–treatment-related clinical trials.

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CLINICAL REPORT

Identification and Evaluation of Children With Autism Spectrum Disorders

Guidance for the Clinician in Rendering Pediatric Care

Chris Plauché Johnson, MD, MEd, Scott M. Myers, MD, and the Council on Children With Disabilities

ABSTRACT

Autism spectrum disorders are not rare; many primary care pediatricians care for several children with autism spectrum disorders. Pediatricians play an important role in early recognition of autism spectrum disorders, because they usually are the first point of contact for parents. Parents are now much more aware of the early signs of autism spectrum disorders because of frequent coverage in the media; if their child demonstrates any of the published signs, they will most likely raise their concerns to their child's pediatrician. It is important that pediatricians be able to recognize the signs and symptoms of autism spectrum disorders and have a strategy for assessing them systematically. Pediatricians also must be aware of local resources that can assist in making a definitive diagnosis of, and in managing, autism spectrum disorders. The pediatrician must be familiar with developmental, educational, and community resources as well as medical subspecialty clinics. This clinical report is 1 of 2 documents that replace the original American Academy of Pediatrics policy statement and technical report published in 2001. This report addresses background information, including definition, history, epidemiology, diagnostic criteria, early signs, neuropathologic aspects, and etiologic possibilities in autism spectrum disorders. In addition, this report provides an algorithm to help the pediatrician develop a strategy for early identification of children with autism spectrum disorders. The accompanying clinical report addresses the management of children with autism spectrum disorders and follows this report on page 1162 [available at www.pediatrics.org/cgi/content/full/120/5/1162]. Both clinical reports are complemented by the toolkit titled "*Autism: Caring for Children With Autism Spectrum Disorders*: *A Resource Toolkit for Clinicians*," which contains screening and surveillance tools, practical forms, tables, and parent handouts to assist the pediatrician in the identification, evaluation, and management of autism spectrum disorders in children.

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Key Words
autism, autism spectrum disorders, Asperger syndrome, pervasive developmental disorders, fragile X syndrome, joint attention, self-injurious behaviors, theory of mind, neuropathologic abnormalities

Abbreviations
ASD—autism spectrum disorder
AD—autistic disorder
DSM—*Diagnostic and Statistical Manual of Mental Disorders*
AS—Asperger syndrome
PDD-NOS—pervasive developmental disorder–not otherwise specified
PCP—primary care pediatrician
AAP—American Academy of Pediatrics
IDEA—Individuals With Disabilities Education Act
MR—mental retardation
GDD—global developmental delay
ADHD—attention-deficit/hyperactivity disorder
FISH—fluorescence in situ hybridization
MMR—measles-mumps-rubella
JA—joint attention
ToM—theory of mind
SLP—speech-language pathologist
CHAT—Checklist for Autism in Toddlers
M-CHAT, Modified Checklist for Autism in Toddlers
CAST—Childhood Asperger Syndrome Test
EEG—electroencephalography

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INTRODUCTION

Public and physician awareness of autism has increased markedly in the new millennium because of increased media coverage and a rapidly expanding body of knowledge published in professional journals. Professionals who specialize in autism have proliferated over the past 2 decades and have introduced the terminology "autism spectrum disorders" (ASDs) to reflect the broader spectrum of clinical characteristics that now define autism.[1,2] ASDs represent 3 of the pervasive developmental disorders defined in the *Diagnostic and Statistical Manual of Mental*

Disorders, Fourth Edition (DSM-IV),[3] and the newer *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR)[4]: autistic disorder (AD), Asperger syndrome (AS [this terminology will be used in this report, although "Asperger's disorder" is used in the aforementioned publications]), and pervasive developmental disorder–not otherwise specified (PDD-NOS). In addition to being a spectrum disorder, autism has wide variability with respect to the presence and intensity of symptoms, even within the DSM-IV-TR categories, which indicates that there may be additional subtypes.

ASDs are not rare; many primary care pediatricians (PCPs) care for several children with ASDs. In fact, a survey completed in 2004 revealed that 44% of PCPs reported that they care for at least 10 children with ASDs; however, only 8% stated that they routinely screened for ASDs.[5] Another survey indicated that although PCPs were aware of the current DSM-IV-TR diagnostic criteria, they sometimes held beliefs about ASDs that were outdated.[6] It is critical that PCPs recognize the early signs of ASDs and be aware of new data that support better outcomes in children whose conditions are diagnosed early and who participate in appropriate intervention programs.[7–11] Because it is a chronic condition, the PCP also needs to feel comfortable with the ongoing care of children with ASDs within the context of the medical home. To support PCPs in the identification and care of children with ASD, the American Academy of Pediatrics (AAP) has developed and distributed several documents:

- The "*Autism A.L.A.R.M.*"[12]: a flyer that highlights the prevalence of autism, the importance of screening and listening to parents' concerns, and the urgency of making simultaneous referrals to specialists in ASDs and early intervention programs to promote improved outcomes.
- "*Is Your One-Year-Old Communicating With You?*"[13]: a brochure that focuses on early identification of social communication deficits and behavior problems that may be associated with developmental disorders, primarily ASDs. This brochure is intended for distribution to all parents of infants at the 9- or 12-month well-child visit. It encourages parents to share any concerns they have about their infant's language development and social skills with the pediatrician as early as possible.
- "*Understanding Autism Spectrum Disorders*"[14]: a 48-page introductory booklet for parents of children in whom an ASD has been diagnosed recently or is suspected strongly.

In addition, the AAP has developed an ASD toolkit and resource guide to assist the PCP with implementation of the principles discussed herein.

Although ASDs are neurodevelopmental conditions with strong genetic underpinnings, their exact etiology is unknown. In 1943, Leo Kanner, a psychiatrist at Johns Hopkins University, first described autism in a small group of children who demonstrated extreme aloofness and total indifference to other people.[15] In 1944, Hans Asperger, an Austrian pediatrician who was unaware of Kanner's work, published an article[16] that described children who demonstrated symptoms similar to those of Kanner's patients, with the exception that verbal and cognitive skills were higher. The term "infantile autism" first appeared as a diagnostic label in the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* (DSM-III).[17] Since then, terminology has changed and diagnostic criteria have broadened.[18] Diagnostic criteria for AS were not included in the DSM until the fourth edition (DSM-IV). The most recent criteria for AD and AS (Asperger's disorder) are found in the DSM-IV-TR[4] (Tables 1 and 2, respectively). PDD-NOS, the remaining ASD, is described in the DSM-IV-TR as a subthreshold diagnostic term used when a child demonstrates severe and pervasive impairments in reciprocal social skills associated with deficits in language skills or with the presence of stereotypic behaviors or restricted interests or activities but does not meet full criteria for AD or AS. Although Rett syndrome and childhood disintegrative disorder are included in the DSM-IV-TR listings, they are not considered ASDs but should be considered in the differential diagnosis of each child, depending on the presenting signs and symptoms.

EPIDEMIOLOGY

Authors of studies published early in the new millennium concluded that the best estimate of current prevalence of ASDs in Europe and North America is approximately 6 per 1000.[19–27] In 2000, the Centers for Disease Control and Prevention organized the Autism and Developmental Disabilities Monitoring Network, a multisite, records-based surveillance program, to study the prevalence of ASDs. The network uses systematic screening of developmental evaluation records for autistic behaviors rather than depending on a medical or educational diagnostic label of an ASD. In 2007, the network reported ASD rates for 8-year-old children ranging from 1 in 303 to 1 in 94 for 2 time periods (2000 and 2002) in a total of 14 sites in the United States; the average rate was 1 in 150 or 6.6 per 1000 8-year-olds.[28–31] Although these studies reflect a 10-fold increase from studies published a half-century ago that chiefly targeted AD alone, most of the newer studies also included individuals with AS and PDD-NOS. One of the few studies that analyzed the prevalence in regard to type of ASD revealed that in Canada, where the overall rate was 6.5 per 1000, the individual rates were 2.2 per 1000 for AD, 1.0 per 1000 for AS, and 3.3 per 1000 for PDD-NOS.[27] Studies have varied in design, and

TABLE 1 Diagnostic Criteria for 299.00: AD

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):
   (1) qualitative impairment in social interaction, as manifested by at least two of the following:
      (a) marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
      (b) failure to develop peer relationships appropriate to developmental level
      (c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (eg, by a lack of showing, bringing, or pointing out objects of interest)
      (d) lack of social or emotional reciprocity
   (2) qualitative impairments in communication as manifested by at least one of the following:
      (a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
      (b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
      (c) stereotyped and repetitive use of language or idiosyncratic language
      (d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level
   (3) restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:
      (a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
      (b) apparently inflexible adherence to specific, nonfunctional routines or rituals
      (c) stereotyped and repetitive motor mannerisms (eg, hand or finger flapping or twisting, or complex whole-body movements)
      (d) persistent preoccupation with parts of objects
B. Delays or abnormal functioning in at least one of the following areas, with onset before 3 years old: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.
C. The disturbance is not better accounted for by Rett's Disorder or childhood disintegrative disorder.

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TABLE 2 Diagnostic Criteria for 299.80: Asperger's Disorder (Referred to as AS in This Report)

A. Qualitative impairment in social interaction, as manifested by at least two of the following:
   (1) marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
   (2) failure to develop peer relationships appropriate to developmental level
   (3) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (eg, by a lack of showing, bringing, or pointing out objects of interest to other people)
   (4) lack of social or emotional reciprocity
B. Restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least 1 of the following:
   (1) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
   (2) apparently inflexible adherence to specific, nonfunctional routines or rituals
   (3) stereotyped and repetitive motor mannerisms (eg, hand or finger flapping or twisting, or complex whole-body movements)
   (4) persistent preoccupation with parts of objects
C. The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.
D. There is no clinically significant general delay in language (eg, single words used by 2 years old, communicative phrases used by 3 years old).
E. There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behavior (other than in social interaction), and curiosity about the environment in childhood.
F. Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia.

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case-ascertainment strategies make comparisons difficult.[20–22,24,31–34]

With recent heightened public awareness, parents are more likely to raise a concern specifically about autism.[35–37] In addition, as screening tools and more reliable evaluation instruments have been developed, professionals have become increasingly proficient in recognizing and diagnosing ASD. Apart from greater awareness and better ascertainment, additional reasons for the apparent increase have been debated hotly in the lay media; in fact, the publicized "autism epidemic" may be one of the most challenging public health issues today.

The prevalence of autism and, more recently, ASDs is closely linked to a history of changing criteria and diagnostic categories. Autism first appeared as a separate entity with specific criteria in the DSM-III in 1980.[17] In 1987, the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised* (*DSM-III-R*)[38] listed broadened AD criteria and the new subthreshold category of PDD-NOS, both of which promoted inclusion of milder cases. Later, these changes received criticism for being too inclusive and for promoting overdiagnosis.[39] The DSM-IV[3] criteria published in 1994 reflected the result of years of analyses to reduce the overinclusiveness of the DSM-III-R criteria; however, it included AS for the first time, which, in effect, broadened the range of disorders. Studies have revealed that the DSM-IV criteria have better specificity (0.87) than DSM-III-R criteria.[40] The DSM-IV-

TR[4] criteria for AD and AS are unchanged; however, the text description of PDD-NOS was edited slightly to increase specificity. Collaboration with European groups that worked on the revised *International Statistical Classification of Diseases and Related Health Problems* (10th edition)[41] promoted better conformity between the 2 classification systems.

AD did not become a diagnosis for which children became eligible to receive special education services until passage of the Individuals With Disabilities Education Act (IDEA) in 1990.[42] Before the IDEA was enacted, children were labeled as having conditions such as mental retardation (MR), learning disability, speech impairment, or emotional disturbance to obtain eligibility for services.[43] Hence, after passage of the IDEA, the resulting increase in the number of children served under the AD category reflected both newly diagnosed young children entering the school system and older children who were previously eligible for special services under a different educational label. This reflects the phenomenon of "diagnostic substitution," whereby the number of children receiving special education under other categories (primarily MR, speech impairment, and learning disabilities) has decreased over the same time period. In addition, some increase in prevalence may be attributable to inaccuracies in diagnosis for a number of reasons, including labeling biases when schools used less rigorous criteria than those needed for a DSM diagnosis,[44–48] when educational funding trends influenced diagnosis,[49] and/or when parents of children with marginal criteria advocated for the AD label to qualify for supplementary services (eg, year-round schooling) described in the IDEA amendments.[50,51] The impact of these factors on current prevalence estimates has been controversial and illustrates the reason why educational administrative data reported in some studies that receive media attention should not be considered for epidemiologic studies.[47,48,52–56]

Just at the time when school eligibility laws were changing, the Americans With Disabilities Act of 1990[57] was passed, obliging states to administer their programs in the most integrated settings appropriate to the needs of the person with disabilities. This was the culmination of a long series of state and federal legislation that promoted closure of institutions and encouraged governments to support families in their efforts to raise their children with disabilities at home. Thus, children with autism, especially those with comorbid MR and behavior problems who might have been institutionalized in the past, began to attend community schools and to be "counted" in educational prevalence data.

Other factors that may also be contributing to the perceived increase in prevalence include the recent identification of children with genetic disorders unrelated to ASDs who also sometimes can meet criteria for an ASD, such as Down syndrome[58,59] and CHARGE (coloboma, heart disease, choanal atresia, retarded growth and development and/or central nervous system anomalies, genital anomalies and/or hypogonadism, and ear anomalies and/or deafness) syndrome.[60] Finally, diagnosis of an ASD may be made in an older family member with milder symptoms that were previously unrecognized until after the diagnosis of a younger child.[61]

Regardless of the study, the year conducted, or the reported rate of prevalence, more boys than girls are consistently found to be affected with ASDs, with male-to-female ratios ranging from 2:1 to 6.5:1.[24,28,29,34,62] The male-to-female ratio is even higher for high-functioning autism and AS, ranging from 6:1 to as high as 15:1.[63] (In recognition of these statistics and for the sake of brevity, this report uses masculine pronouns.)

ETIOLOGY

ASDs are biologically based neurodevelopmental disorders that are highly heritable.[64] Despite this fact, the exact cause still is unknown. Finding the cause has been daunting because of genetic complexity and phenotypic variation. ASDs are complex heritable disorders that involve multiple genes and demonstrate great phenotypic variation. Estimates of recurrence risks, based on family studies of idiopathic ASDs, are approximately 5% to 6% (range: 2%–8%) when there is an older sibling with an ASD and even higher when there are already 2 children with ASDs in the family.[65–68]

In a minority of cases (<10%), ASDs may be associated with a medical condition or a known syndrome.[20,21] Although ASDs are believed to be mainly genetic in origin, environmental factors may modulate phenotypic expression.[64,69] Advanced paternal age[70,71] and maternal age[71,72] have been shown to be associated with an increased risk of having offspring with ASDs, possibly because of de novo spontaneous mutations and/or alterations in genetic imprinting. Environmental exposures may act as central nervous system teratogens in early gestational life.[73] Some researchers have suggested that an epigenetic mechanism (heritable changes in gene expression that occur without changes in DNA sequence) may be responsible.[74] Thus, it has become more and more apparent that the etiology is multifactorial with a variety of genetic and, to a lesser extent, environmental factors playing a role.[75]

Two major strategies have been used in the search for the ASD genes: targeted cytogenetic/molecular studies and whole-genome screens of families of children with ASD.[76–79] The first strategy depends on developing a hypothesis regarding the pathogenesis of ASDs, focusing on a potential candidate gene and testing it genetically for an association with ASDs. Candidate genes in ASDs include, among others, those that seem to play a role in brain development (eg, cerebellar Purkinje cell proliferation) or neurotransmitter function (eg, serotonin).[80] The second strategy uses an indirect method and does

not require investigators to make assumptions regarding the mechanism of inheritance. Instead, families with multiple members who demonstrate an ASD (multiplex families) are studied to identify recurring DNA markers (break points, translocations, duplications, and deletions) present in affected members but not in unaffected members. Unfortunately, progress in determining a genetic etiology using this method has been impaired, because the phenotypic end points of ASDs are not well defined. Changing DSM criteria and inconsistent ascertainment strategies, which results in a hazy delineation between affected versus unaffected family members, obscure outcomes and challenge interpretation of results.[67] This phenotypic heterogeneity has challenged molecular searches for the ASD gene(s) despite several genome-wide screens of the International Molecular Genetic Study of Autism Consortium and multicenter collaborative efforts over the past couple of decades.[78,81–84] Although at least 1 autism-linked abnormality has been found on almost every chromosome, sites on a few chromosomes (X, 2, 3, 7, 15, 17, and 22) seem to be more promising than others.[67,68,75,79,85–90] Maternally derived 15q duplications are common; depending on the investigator, yields vary from 1% to 10%,[91] with most in the range of 1% to 3%.[92,93] Patients with these duplications may not display dysmorphic features, but they often have hypotonia and/or global developmental delay (GDD) and may develop seizures later. The abnormality can often be identified on high-resolution karyotype analysis. Other less common abnormalities have also been reported.[94]

Finally, the male predominance noted above also suggests a genetic role in the inheritance of autism. Several genetic processes can lead to male predominance, including causative genes located on the X chromosome (X-linked disorders) and imprinted genes, but the reason for male predominance in autism is not completely understood.[95]

In a discussion of etiology, subtyping ASDs as either idiopathic or secondary is helpful.[67,79,95] For the purposes of this discussion, the term "idiopathic" ASDs refers to cases in which children meet criteria for ASDs but do not have a comorbid associated medical condition known to cause ASDs. Most individuals with an ASD have the idiopathic type. Children with idiopathic ASDs demonstrate variable behavioral phenotypes, are somewhat less likely to have comorbid GDD/MR, and generally do not have dysmorphic features that herald a recognizable syndrome. Nevertheless, twin and family studies have revealed that idiopathic ASDs are heritable and have a recurrence rate of 5% to 6%.[67,94,95] The term "secondary" ASDs refers to cases with an identifiable syndrome or medical disorder known to be associated with ASDs. Whereas earlier reviews reported that the proportion of individuals with ASDs who have a comorbid syndrome or medical condition was 10% to 20%,[2,96–98] the proportion has decreased to less than 10% when using more recent data sets.[79,89,95,99–101] In a meta-analysis of 23 epidemiologic studies, Chakrabarti and Fombonne[20,21] revealed that a recognizable condition was identified in only 6% of those with a confirmed ASD. The rate of coexisting MR (cognitive impairment associated with an IQ of <70) in children with ASDs seemed to decrease from 90% before the 1990s to less than 50% after 2000,[28,29,34,35,102,103] possibly because of improved methods in testing intelligence in this population and to the increased awareness of children with ASD with milder features and higher functioning. This trend is important, because coexisting severe MR, especially in the presence of dysmorphic features, increases the likelihood of identifying a known disorder.[89,104–108] Neurogenetic syndromes that seem to play a causative role or otherwise are associated with ASDs include, but are not limited to:

- Fragile X syndrome[109,110]: Fragile X syndrome is the most common known genetic cause of AD and of MR in males. The phenotype includes MR, macrocephaly, large pinnae, large testicles (particularly after puberty), hypotonia, and joint hyperextensibility. Identifying a patient with fragile X syndrome is important for genetic counseling purposes, because the diagnosis has implications for other family members. Depending on the prevalence of comorbid MR in study subjects with ASD, the etiologic yield of fragile X syndrome–DNA testing has ranged from 0% to 8%, with a median of approximately 3% to 4%.[99,109,111] On the other hand, as many as 30% to 50% of individuals with genetically confirmed fragile X syndrome will demonstrate some characteristics of ASDs.[102,110]
- Neurocutaneous disorders: Tuberous sclerosis[112–116] is characterized by hypopigmented macules (sometimes requiring a Wood's lamp examination for visualization in young children), fibroangiomata, kidney lesions, central nervous system hamartomas, seizures, MR, and autistic and/or attention-deficit/hyperactivity disorder (ADHD)–like behaviors. Although tuberous sclerosis is a dominant disorder (with genes located at 9q and 16p), most cases represent new mutations. Although it is the most common neurocutaneous disorder, neurofibromatosis is less likely to be associated with ASDs. It also is autosomal-dominant, with half of cases representing new mutations of the neurofibromatosis 1 gene on 17q.[117] It is characterized by café au lait macules and freckling in the axillary and inguinal regions, neurofibromas, and ocular Lisch nodules. Although most patients have a benign course and normal intelligence, a small subset of individuals have MR and behavioral features that are consistent with ASDs.
- Phenylketonuria[118]: phenylketonuria now is a rare cause of ASDs and MR in the United States, because it

is preventable as a result of newborn screening and dietary intervention.

- Fetal alcohol syndrome[119]: Children who are exposed to alcohol during gestation have an increased risk of ASDs in addition to other neurodevelopmental disorders.
- Angelman syndrome[93,94,120–123]: Angelman syndrome is associated with loss of the maternally expressed ubiquitin-protein ligase gene (*UBE3A*) on 15q through deletion, paternal uniparental disomy, or imprinting errors. Children with Angelman syndrome present with GDD (and often are nonverbal), hypotonia in early childhood, wide-based ataxic gait, seizures, and progressive spasticity. Angelman syndrome associated with a deletion of 15q can be detected with fluorescence in situ hybridization (FISH) testing; however, when it results from uniparental disomy, methylation studies are necessary.
- Rett syndrome[124–127]: Rett syndrome usually presents with a classic phenotype and should be considered in all females who demonstrate autistic-like regression, especially if they have microcephaly, seizures, and hand-wringing stereotypies. Retrospective videos have revealed early subtle motor symptoms during the first year of life.[128] Now that it is possible to confirm this diagnosis with DNA testing (methyl CpG-binding protein 2 [*MECP2*]) in approximately 80% of cases, it has become apparent that there is a spectrum of severity, and some patients may present with atypical features including those consistent with ASDs. Rett syndrome is much less common in males, and the presentation is more varied. Some males die in infancy as a result of neonatal encephalopathy; others with comorbid Klinefelter syndrome (as well as a few males [in isolated case reports] with a normal number of sex chromosomes) demonstrate more classic symptoms.[129,130]
- Smith-Lemli-Opitz syndrome[131]: Smith-Lemli-Opitz syndrome is a rare (1 in 20 000) autosomal-recessive disorder caused by a metabolic error in cholesterol biosynthesis. Although most patients present with multiple congenital anomalies, failure to thrive, and MR, some may present with subtle physical features such as webbing (syndactyly) of the second and third toes, mild hypotonia, and autistic features. Recurrence risk is 25%; thus, appropriate genetic counseling is important.

Whether the aforementioned conditions play a direct or indirect etiologic role or simply are associated with ASDs, they still represent a small minority of patients with ASDs. Conversely, a few children with genetic syndromes that are characterized by features quite different from ASDs also may meet DSM-IV-TR criteria. For example, recent studies have reported that 6% to 7% of children with Down syndrome (typically characterized by relatively good social skills compared with those in other domains)[59] and almost 50% of children with CHARGE syndrome (associated with mutations of the *CHD7* gene[132]) meet criteria for one of the ASDs.[60] There have also been a few isolated reports of a mitochondrial and/or metabolic abnormality (eg, carnitine deficiency) being associated with an ASD, but the significance of these reports is not clear.[133]

Increased and decreased levels of T lymphocytes, immunoglobulins, and antibrain autoantibodies in the systemic circulation have been reported.[134] These have been observed chiefly in retrospective case studies of patients with idiopathic ASDs, but systematic prospective studies have confirmed neither their existence nor their relevance.[87] Prospective studies have revealed that, except for a few individuals with recurrent infections, healthy children with ASDs generally have normal immune function.[135] Some studies have reported increased rates of autoimmune disorders in families of children with ASDs,[136] particularly in the mothers (eg, thyroid disorders[137] and psoriasis[138]); however, the relevance of these common disorders to ASDs in children is unknown. Furthermore, studies have shown no increase in autoimmune disorders of the central nervous system, and patients with ASDs did not themselves exhibit autoimmune disorders.[139] The contribution of possible immunologic dysfunction remains to be further defined.

Environmental Issues

Regardless of the mechanism, a review of studies published in the past 50 years revealed convincing evidence that most cases of ASDs result from interacting genetic factors.[67,95] However, the expression of the autism gene(s) may be influenced by environmental factors.[66,67,69,140] Although currently under investigation, these factors may represent a "second-hit" phenomenon that primarily occurs during fetal brain development. That is, environmental factors may modulate already existing genetic factors responsible for the manifestation of ASDs in individual children.

Prenatal Period

Because many of the developmental brain abnormalities known to be associated with ASDs occur during the first and second trimesters of pregnancy,[141,142] environmental factors (eg, teratogens, such as thalidomide and valproic acid)[73] are more likely to play a role in the fetus via maternal factors. It is possible that maternal illness (eg, rubella) during pregnancy plays a role.[143,144] Recently, the possible association between fetal testosterone concentration and certain autistic behaviors such as abnormal social relationships and restricted interests at 4 years of age was investigated.[145]

Perinatal Period

The effects of birth weight, duration of gestation, and events around the time of birth have been investigated also, but findings have not been consistent.[72,146–152] A significant association between term newborn encephalopathy and children later diagnosed with ASD was reported recently.[72,150] Badawi et al[150] reported that 5% of survivors of newborn encephalopathy were diagnosed with an ASD, which represented an almost sixfold increase compared with matched controls. This increase may represent a genetically derived predisposition (which makes the infants vulnerable to both encephalopathy and ASD) or an independent mechanism.

Postnatal Period

Etiologic possibilities occurring after birth have been proposed—in particular, measles-mumps-rubella (MMR) vaccine[153] and mercury-containing vaccines.[154–156] In 2001, the Institute of Medicine[157] reviewed epidemiologic population-based studies and concluded that there was no evidence of a causal association between the MMR vaccine and autism. Studies that examined the association between MMR vaccine and autism since the publication of that review have supported this conclusion.[27,95,103,158–161] Questions also have been raised about the effects of environmental mercury exposure (including mercury-containing vaccines) on brain development in ASDs and other developmental disabilities.[154–156] Mercury, in its organic form, is a known neurotoxin with neurologic sequelae, including motor impairment and visual and intellectual deficits, depending on the age at exposure and the type of mercury. There is no evidence to date that children with neurodevelopmental disabilities, including autism, in the United States have increased mercury concentrations or environmental exposures.[162] Using large data sets from the United States, Sweden, and Denmark, to date, no consistent association has been found between thimerosal-containing vaccines and neurodevelopmental outcomes or prevalence of ASDs.[27,95,162–164] Despite evidence to the contrary, a recent survey of parents of children with ASDs revealed that 54% believed that their child's ASD was caused by immunizations; 53% thought it was caused by genetics.[165]

Although the previous discussion reveals the wide variety of conditions known to be associated with ASDs, currently, an etiologic investigation of the individual child with an ASD infrequently identifies a known cause in the absence of GDD/MR, dysmorphic features, a positive family history, and/or a focal neurologic examination.[2,20,21,89,101,106–108]

NEUROPATHOLOGY AND NEUROIMAGING

In recent years, intense research efforts have focused on elucidating the neurobiological basis of ASDs. A growing body of evidence from neuropathology and neuroimaging studies indicates that there are fundamental differences in brain growth and organization in people with ASDs that have their origin in the prenatal period but extend through early childhood and into adulthood.

Neuropathologic studies of brain tissue from people with autism have revealed several abnormalities[166–171] including:

- reduced numbers of Purkinje cells in the cerebellum;
- abnormal maturation of the forebrain limbic system, including reduced neuronal size, increased cell-packing density, and decreased complexity of the neuropil (ie, the complex net of axonal, dendritic, and glial branching in which the nerve cell is embedded);
- abnormalities in frontal and temporal lobe cortical minicolumns, which are more numerous, smaller, and less compact in their cellular configuration and demonstrate reduced neuropil space in the periphery[167];
- developmental changes in cell size and number in the nucleus of the diagonal band of Broca, deep cerebellar nuclei, and inferior olive; and
- brainstem abnormalities and neocortical malformations (eg, heterotopias).[171]

The most consistent neuropathologic findings suggest pathology that arises in utero. The association of increased risk of ASDs associated with prenatal exposure to teratogens, such as thalidomide and valproic acid, suggests that early insults during critical periods of brain development (as early as 20–24 days after conception in the case of thalidomide) may be sufficient to cause ASDs.[171] However, all of these neuropathologic findings are based on detailed study of a relatively small number of brains, and further investigation is required. Limited availability of brain tissue from people with well-characterized ASDs and age-matched controls has impeded neuropathologic investigations. Efforts to remedy this are underway with the establishment of the Autism Tissue Project (1-800-272-4622 [for physicians] or 1-877-333-0999 [for families]; www.memoriesofhope.org).[168]

Kanner, in his initial clinical description of autism, noted large head size in several of his patients.[15] Increased head circumference has since been shown to be a common physical finding in children with ASDs, and 20% to 30% have macrocephaly, defined as a head circumference that measures more than 2 SDs above the mean.[172,173] MRI studies have supported the finding of increased brain volume in children with ASDs, with 90% of toddlers with ASDs having larger-than-normal brain volumes in 1 study.[174,175] Postmortem brain weights also are increased.[166] Children later diagnosed with an ASD have been shown, as a group, to have average or below-average head circumference at birth, with acceleration in brain growth during the first year of

life, leading to above-average head circumference or overt macrocephaly.[176,177] Fewer adults with ASDs have been found to exhibit increased brain size compared with controls, indicating that there may be deceleration of brain growth at some point beyond early childhood.[176,178,179] It is interesting to note that increased blood concentrations of brain-derived neurotrophic factor and several other neurotrophins have been detected in newborn infants who are later diagnosed with ASDs.[180] This finding, if replicated, may have implications regarding the mechanism of early brain overgrowth. Age-related differences in serotonin synthesis capacity also have been demonstrated between children with ASDs and children in control groups,[181] which leads to speculation regarding the neurotrophic role of serotonin in abnormal brain growth and organization in children with ASDs.

In addition to whole-brain volume differences, specific regional gray- and white-matter volumetric differences have been described. The frontal, limbic, basal ganglia, and cerebellar regions have been implicated most consistently.[172,182–184] Abnormalities in sulcal and gyral anatomy have been found by using surface-mapping techniques.[185,186] The regional gray- and white-matter volume differences also seem to be age related, although larger cross-sectional studies and longitudinal studies are needed to clarify the meaning of these findings.

A variety of functional MRI studies during cognitive tasks or in response to visual or auditory stimuli suggest that individuals with ASDs use different cognitive strategies and, in some cases, different brain areas to process certain types of information.[182,187] For example, functional neuroimaging techniques have indicated the presence of abnormalities in face recognition and executive functioning in adults with high-functioning ASDs.[188] Hypoactivation of the fusiform gyrus in face-recognition tasks has been one of the most consistent findings[187] and, in concert with abnormalities in amygdala activation, may relate to the abnormalities in gaze fixation that are seen in people with ASDs.[189] Functional MRI evidence has also been used to postulate impaired "connectivity" between various cortical regions in the brains of people with ASDs.[190–192] Most recently, some investigators have attempted to explain deficits in empathy, imitation, and language as abnormalities in the functioning of mirror neuron systems.[193] These systems are a newly discovered subset of cells found in several areas of the brain that seem to fire when an individual simply observes another's actions—that is, it seems they directly reflect actions performed by another in the observer's brain. They also may play a role in the ability to recognize and empathize with or "mirror" the feelings of others. These functional brain differences provide intriguing links between the neuroanatomical substrate and the characteristic clinical features of people with ASDs.

Although neuroimaging research has identified volumetric and other abnormalities in groups of patients with ASDs compared with controls, a reliable marker has not been identified, and routine clinical neuroimaging for individuals with ASDs is not recommended.[106,107,183,194]

CLINICAL SIGNS

Whereas severe social skills deficits and restricted, repetitive, and stereotyped patterns of behavior, interests, and activities are core features of all ASDs, significant language delays are characteristic of only AD and PDD-NOS.[3,4] One of the most challenging aspects in recognizing ASDs is the wide heterogeneity of features in individual children. There is no pathognomonic feature; however, a few of the early social deficits (eg, delayed or absent joint attention [JA]) seem to be fairly reliable red flags for ASDs. The autism spectrum encompasses an extremely heterogeneous phenotype with indistinct end points, especially at the mild end of the spectrum. The severity of each of the core deficits varies significantly among children with ASDs.

Although the social deficits occur earlier and may be more specific, they can be subtle and less often recognized or articulated by parents. Speech delays usually prompt parents to raise concerns to their child's PCP. Most parents become concerned between 15 and 18 months of age but may delay discussing their concerns with their child's physician for several months.[35,195–198] Recently, the media and public agencies have raised public awareness about the importance of recognizing the early signs, including those present during the first years of life. This being the case, it is anticipated that parents may begin to voice concerns to their infant's pediatrician earlier and that these concerns may now target the often earlier-appearing social deficits. Presentations can differ widely from one child to the next; some are perceived by parents as "different" during the first few months of life, others present with delayed speech development during the second year of life, and still others may appear to be normal only to regress and lose skills after the first year of life.[199,200] AS in children may go unnoticed until they are of school age, when teachers notice difficulties with peer interactions. Expanded reviews regarding early signs are available.[201–203]

Social Skills Deficits

Although more specific than language deficits, social deficits appearing in the first 2 years of life often have escaped parent recognition.[204–206] Children with ASDs universally demonstrate deficits in social relatedness defined as the inherent drive to connect with others and share complementary feeling states.[207] Children with ASDs often do not appear to seek connectedness; they are content being alone, ignore their parents' bids for attention, and seldom make eye contact or bid for others' attention with gestures or vocalizations. In later

years, they have difficulty sharing the emotional state of others in cooperative games and group settings and may have few, if any, friends.

Deficits in JA seem to be one of the most distinguishing characteristics of very young children with ASDs.[198,208–216] JA is a normal, spontaneously occurring behavior whereby the infant shows enjoyment in sharing an object (or event) with another person by looking back and forth between the two. Later, gestures and/or speech also can be used to engage another's attention with regard to the objects and events simply for the enjoyment of sharing the experiences. Just like other developmental skills, development of JA skills is stepwise; it occurs in stages beginning in the first few months of life. Similar to language skills, receptive JA skills usually are mastered before expressive ones. JA begins with joyous smiling in recognition of and response to a parent or familiar caregiver's smiles and vocalizations. At approximately 8 months of age, an infant will follow the parent's gaze and look in the same direction when a parent looks away (ie, to check the time). Children begin to "follow a point" at approximately 10 to 12 months of age. If a parent points in the direction of an interesting object or event and says, "Look!" the typically developing child will look in the intended direction and then, after seeing the object/event, look back at the parent in acknowledgment and shared expression. Infants with ASD may not follow a point, even when one tries repeatedly in a loud voice calling their name or uses physical prompts, such as touching the child's shoulder before pointing.[204] They may look in the indicated direction eventually, but this is not followed by shared looking and expression.

At approximately 12 to 14 months of age, the typically developing child will begin himself to initiate a point, at first to request a desired object that is out of reach and, a couple of months later, to draw the parent's attention to share an interesting object, person, or event. Depending on his speech skills, he may utter simple sounds ("uh") or actual words while pointing. Pointing to request an object is called "protoimperative pointing." Deficits vary, as some children with ASDs may make rudimentary pointing efforts by opening and closing their hand while it is raised in the direction of the desired item but without any back-and-forth looking between it and the caregiver. Another frequent strategy is to take the parent's hand to lead him or her to the object. At 14 to 16 months of age, the typically developing child will begin to point simply to "comment" about or "share" an interesting object/event (which is called "protodeclarative pointing"). As he points, he will look alternatively between the object/event of interest and the parent. It is the shared social experience, not the tangible object/event, that the child seeks. Children with ASDs consistently fail to point to "comment" at age-appropriate times, and when they do, they are less likely to show positive affect and connectedness during the act. Some high-functioning children with ASDs may point to label objects, shapes, and colors that they have learned in a rote fashion, but this often is done without any intent of communicating in a social context and is not considered JA. Mastery of JA seems to be necessary for functional language development; in fact, mastery of protodeclarative pointing seems to be a reliable predictor of functional language development within 1 year.[7,217–219] JA skills progress to involve ongoing back-and-forth bids for attention and social interactions with multiple emotional expressions, sounds, words, and other gestures.

Orienting to social stimuli—in particular, turning consistently to respond to one's own name—is an early skill (8–10 months of age) that often is deficient in children with ASDs.[215,220] However, it is not specific to children with ASDs, because children with hearing impairments also may fail to orient to their name. In fact, parents of children later diagnosed with ASDs often raise a concern about hearing. Hearing seems "selective" in that children with ASDs may hear and attend well to environmental sounds but not to human voices.[221] Social referencing[222] is the ability to recognize the emotional states of others as they respond to various stimuli. When faced with a novel situation, a typically developing infant might look to his mother for an indication of delight, anger, or fear in her facial expression. His facial expression then usually will mimic hers, although he may not fully understand the situation. A child with an ASD engages in less imitation.[223]

Because children with ASDs lack fundamental social skill building blocks, they may be less likely to develop appropriate peer relationships according to age and language ability. They may have few or no friends, and when they do, the relationships may evolve around the child's own special interests. Another factor that impedes lasting friendships is impaired central coherence or the inability to interpret stimuli in a global way.[224,225] Instead, they focus on the parts, make less use of context, and miss the "big picture," which makes social interactions challenging. They also have difficulties understanding the perspective of others or lack "theory-of-mind" (ToM) skills. ToM is the awareness that others have thoughts and emotions that are independent from one's own; it is the ability that allows one to infer states of mind on the basis of external behavior.[226,227] Typically developing children begin to have some sense of mental states of others by 4 years of age.[197,228,229] Because of ToM impairments, children with ASDs have difficulties with empathy, sharing, and comforting. Baron-Cohen[230] coined the term "mindblindedness" when referring to persons with ASDs who demonstrate severe ToM deficits.

Communication Deficits

Most children who are later diagnosed with AD and PPD-NOS present to their PCP with "speech delay," al-

though this may change as parents are becoming more aware of social milestones. As noted previously, most parents sense something is wrong by the time the child is 18 months old.[195–198] Lack of speech has been considered a hallmark of AD, especially when it is associated with the lack of desire to communicate and lack of nonverbal compensatory efforts such as gestures. However, children with milder symptoms, especially those with normal cognitive skills, may have some speech. Their speech may not be functional or fluent and may lack communicative intent. It can be scripted (from favorite videos or television programs) and stereotypic. Echolalia, sometimes called "parroting," is the repetition of another person's speech. Echolalia is classified as "immediate" when the child repeats vocalizations promptly after hearing them or "delayed" when there is a time lapse (hours, days, weeks). Typically developing children pass through a "vocabulary-burst stage," when brief periods of immediate echolalia are not unusual.[197] On the other hand, echolalia in children with ASDs may persist throughout the life span and consist of a mixture of immediate and delayed varieties. Utterances of children with ASDs may be more clearly articulated, have a more monotone quality, and/or consist of larger verbal "chunks" (ie, entire television advertisement jingles, video reenactments, or recitations of nursery rhymes) than those of typically developing children. Sometimes, echolalia may even give the impression of "advanced" speech because of sophisticated vocabulary, grammar, and syntax. The clinician should be careful to differentiate between typical and autistic echolalia; usually, a formal evaluation by a speech-language pathologist (SLP) is needed. Such an assessment also may reveal a dissociation between these "advanced" expressive skills and delayed receptive ones in that the child may be unable to follow simple 1-step commands, which is a 12- to 14-month-old skill. Some parents will note that their child seems overly "independent" because, rather than ask for desired objects, he uses advanced motor skills to obtain them himself (ie, moving a stool to a counter top to obtain an object at an age younger than typically expected). Some children with ASDs become quite skilled at rotely labeling colors, shapes, numbers, and letters of the alphabet, yet they are unable to point to them when asked to do so by another or incorporate the labels into functional language. A few may later develop hyperlexia or advanced verbal reading without corresponding comprehension skills.

Some children with ASDs say "pop-up words" without any apparent stimulus or communicative intent. They are spontaneous and inconsistent, although sometimes they may occur during acutely stressful situations. These words are said out of context for a short period of time (days or weeks) and then, as suddenly as they might pop up for no apparent reason, they disappear.[197,119] Children with ASDs also may develop "language" in overlearned or gestalt phrases that are acquired and spoken almost as a single "giant-word" (ie, Whatisit? Idontknow). At the same time, they are unable to combine words in novel or original phrases or sentences that convey true meaning.

Although lack of speech, scripted speech, parroting without communicative intent, and pop-up and giant words are common classic presentations, earlier prespeech deficits often exist that, if detected, could facilitate earlier diagnosis.* These deficits include:

- lack of appropriate gaze;
- lack of warm, joyful expressions with gaze;
- lack of the alternating to-and-fro pattern of vocalizations between infant and parent that usually occurs at approximately 6 months of age (ie, infants with ASDs usually continue vocalizing without regard for the parent's speech);
- lack of recognition of mother's (or father's or consistent caregiver's) voice;
- disregard for vocalizations (ie, lack of response to name), yet keen awareness for environmental sounds;
- delayed onset of babbling past 9 months of age;
- decreased or absent use of prespeech gestures (waving, pointing, showing);
- lack of expressions such as "oh oh" or "huh";
- lack of interest or response of any kind to neutral statements (eg, "Oh no, it's raining again!")

The AAP brochure "*Is Your One-Year-Old Communicating With You?*"[13] was developed to help raise parent and physician awareness of these earlier social communication milestones and to promote recognition of symptoms of ASDs before 18 months of age.

Regression

Approximately 25% to 30% of children with ASDs begin to say words but then stop speaking, often between the ages of 15 and 24 months.[199,200,208] Regression of skills in children with ASDs may also include loss of gestural communication (wave, point, etc) and social skills (eg, eye contact and response to praise) or a combination of both. Regression can be gradual or sudden, and it may be superimposed on subtle preexisting developmental delays or atypical development, such as an unusually intense interest in objects or other nonsocial stimuli during the first year of life.[205] Although it may be tempting to attribute regression to environmental stressors (eg, birth of a new sibling or a move to a new house), this results in a delay in diagnosis. Regression is a well-documented hallmark of ASDs and should always alert the PCP to consider ASDs.

*Refs 197, 204, 213, 214, 219, and 222.

Asperger Syndrome

Children with AS may have mild or limited speech delays (see the DSM-IV-TR[4] criteria in Table 2) and escape recognition until preschool or early school age, when their inability to make friends becomes a concern. Although often unnoticed, language development usually is atypical. Children with AS often are quite verbal about a certain topic of interest, but they are unable to express simple feelings or recognize the feelings and viewpoints of others. Speech may be fluent but limited to only a few topics, typically those that hold a strong, all-consuming interest for the child. Speech also can be overly formal (pedantic), which is a reason why children with AS sometimes are described as "little professors."[227] Children with AS also have deficits in the social use of language (pragmatics): how to choose a topic of conversation; understanding and producing appropriate tempo, facial expression, and body language during conversation; turn taking; recognizing when the partner has lost interest in a topic; knowing when to start, sustain, and end a conversation on the basis of listener cues; knowing when and how to repair a communication breakdown; and using the appropriate degree of formality and politeness.[197,227] Children with AS especially have difficulty sustaining a conversation on a topic that is initiated by another. Language may seem odd, self-centered, and not listener responsive and results in a monotone monologue. They may demonstrate unique delivery of speech (prosody) in regard to intonation, volume, rhythm, pitch, and personal space that also tends to disregard listener needs. Children with AS may have difficulty with abstract reasoning and discussion of thoughts and opinions of others. Inability to discern and judge the conversational intents of others, especially when their conversation includes words or phrases with ambiguous meanings, impairs their ability to understand metaphors, humor, teasing idioms, irony, lies, jokes, and faux pas.[226,227,229] Older children with high-functioning AD or PDD-NOS and fluent speech also may demonstrate some of the above-mentioned language characteristics.

Play Skills

Lack of, or significantly delayed, pretend play skills coupled with persistent sensory-motor and/or ritualistic play are characteristic of ASDs. Some children with severe ASDs may never progress past the sensory-motor play stage. They mouth, twirl, bang, and manipulate objects in a stereotypic or ritualistic manner. The play of children with ASDs often is repetitive and lacks creativity and imitation.[3,4] Typical examples include spinning the wheels or lining up cars instead of "driving" them, arranging crayons instead of coloring with them, or stacking blocks in the same sequence time after time. Often they prefer to play with common objects (string, sticks, rocks, or ballpoint pens) rather than store-bought toys with the exception of trains or characters from favorite videos and television shows. Puzzles, especially shape-matching ones and computerized "puzzle games," also are quite popular.[222] Children with ASDs often are content to play alone for hours, requiring little attention or supervision. Often this "play" is either constructive (puzzles, computer games, and blocks), ritualistic (lining objects up or sorting/matching shapes or colors) or sensory-motor (mouthing, banging, twirling) in nature. Children with ASDs may seem to enjoy chase games and roughhousing, but it is often the sensory-motor aspects of these activities, rather than their social aspects, that are enjoyable. They have trouble interacting in groups and cooperating in the social rules of more sophisticated games. Often they are left out, ignored, and at high risk of being victimized and bullied by peers.[231]

Restricted, Repetitive, and Stereotyped Patterns of Behavior, Interests, and Activities

Children with ASDs can demonstrate atypical behaviors in a variety of areas including peculiar mannerisms, unusual attachments to objects, obsessions, compulsions, self-injurious behaviors, and stereotypies. Stereotypies are repetitive, nonfunctional, atypical behaviors such as hand flapping, finger movements, rocking, or twirling.[3,4,203] Although most stereotypies are harmless, they are problematic in that they may prevent the child from accomplishing a task or learning new skills. Although stereotypies are distinctive and obvious, they are not specific to children with ASDs, because many children with profound MR and/or severe sensory deficits also demonstrate stereotypies. Even typically developing toddlers, especially before the onset of fluent language, may flap their arms briefly when they are excited or frustrated. Stereotypies associated with ASDs often do not appear until after 3 years of age[232] and commonly manifest as finger flicking, unusual eye gazing, habitual toe walking, and/or persistent sniffing and licking of nonfood items.

Although most children, at some time during their early development, form attachments with a stuffed animal, special pillow, or blanket, children with ASDs may prefer hard items (ballpoint pens, flashlight, keys, action figures, etc). Moreover, the attachment is more persistent, in that they may insist on holding the object at all times, although these are rarely, if at all, used in real "play." Whereas younger children with ASDs may have restricted interests in regards to objects, the restricted interests in those with AS more often relate to topics and facts.[227] For example, rather than carrying a toy train at all times, there is an obsession with train schedules. Sometimes the item/topic of interest may be typical for any child, but it is the degree of interest that is abnormal. For example, similar to typically developing children, a child with an ASD may be fascinated with dinosaurs, but he knows far more details about them and persists in playing or discussing them to the exclusion of all else.

Perseveration, or continuation of speech or play to an exceptional degree or beyond a desired point, is common in children with ASDs. Children with ASDs may protest vigorously when forced to transition from an activity or topic of interest or when a usual routine is changed. Without warning, these protests may quickly escalate to severe and prolonged temper tantrums characterized by aggression or self-injurious behaviors.

Self-injurious behaviors (head banging, skin picking, eye poking, hand biting) are stereotypies that may cause bodily harm and are more common in children with severe GDD/MR (intellectual disabilities) or ASDs with comorbid GDD/MR.[233] Self-injurious behaviors may be precipitated by frustration during unsuccessful communication attempts, transitions, anxiety in new environments, boredom, depression, fatigue, sleep deprivation, or pain. The presence of self-injurious behaviors, aggression, and other extreme behaviors may prevent the child from participating in integrated activities in the community with typically developing peers and cause significant family stress.

Additional Coexisting Conditions That Are Not Core Features in the DSM-IV-TR

Cognitive Abnormalities (GDD/MR or Intellectual Disability, Learning Differences, and Splinter/Savant Skills)

The prevalence of comorbid GDD/MR or intellectual disability (the appropriate term depends on age and availability of both a standardized IQ score and a formal assessment of adaptive skills) with ASDs was estimated to be approximately 90% before 1990.[62] On the basis of later studies published in the 1990s, consensus guidelines reported the prevalence as approximately 70% to 75%.[1,2,106,107,234] Prevalence studies published in the new millennium have reported rates of ASDs with comorbid GDD/MR of just under 50%,[28,29,34,103] whereas 2 English studies reported rates as low as 26% to 29%.[20,21] Better ascertainment of children without cognitive deficits (in particular AS, which by definition is characterized by normal intelligence), improved professional training, and more effective strategies/tools for evaluating cognitive abilities in children with ASDs all may contribute to the decreasing prevalence of comorbid GDD/MR.

One unique characteristic of ASDs is the "unevenness" of skills. Abilities may be significantly delayed in some areas of development yet "advanced" in others, often because of exceptional focusing, memory, calculation, music, or art abilities.[235] They may be labeled as "splinter skills" when they serve no purpose in day-to-day life and do not improve functional outcomes. Rarely, highly developed talents or savant skills may promote a vocation that provides financial independence and, occasionally, national recognition.[236–238]

Sensory-Motor Symptoms

Although sensory symptoms (eg, hyperacusis) are more frequent and prominent in children with ASDs, there is no evidence that sensory symptoms differentiate children with ASDs from children with other developmental disabilities.[239] Children with ASDs may demonstrate simultaneous hyposensitivities and hypersensitivities for stimuli within the same sensory modality.[240] For example, they may seem overly sensitive to certain environmental noises but lack response to human voice, or they may visually inspect the details of an object but not notice the comings and goings of other people in the room. Others may have oral aversions and/or total-body "tactile defensiveness" to soft touch (fabric bumps on socks and sweatshirts) or hugs yet be insensitive to pain.[241] Sensory factors related to food, such as texture, color, and taste, may lead to highly restricted diets. More research is needed to operationalize the concept of sensory integration and possible interventions and define its role in ASDs.

In addition to unusual motor stereotypies that serve as defining characteristics of ASDs discussed previously, some children with ASDs also may demonstrate atypical motor development, poor coordination, or deficits in praxis (motor planning, execution, and sequencing).[240] Some investigators believe that, although not a defining characteristic by DSM standards, motor clumsiness is a distinguishing characteristic of AS.[86,242] Finally, some children may appear to be "hyperactive" and motor driven with an exterior focus of attention and actually meet criteria for comorbid ADHD (although current DSM-IV-TR criteria exclude making the diagnosis of ADHD in the presence of an ASD).[8,240,243] Other children may be hypoactive and withdrawn and have an interior focus of attention.[240]

In summary, ASDs are characterized by a broad array of clinical features; some are more specific to ASDs than others (JA deficits versus stereotypies). Familiarity with the early social and preverbal communication deficits will help the PCP recognize ASDs earlier, which should, in turn, facilitate the prompt initiation of appropriate interventions.

SURVEILLANCE AND SCREENING

Because the prevalence of ASDs is approximately 6 to 7 per 1000 in the United States,[28,29] PCPs are likely to provide care for children with ASDs. Early identification of ASDs is important, because it allows early intervention, etiologic investigation, and counseling regarding recurrence risk. The medical home is an important setting for surveillance and screening to detect ASDs and other developmental disorders. In the past, it was not unusual for parents' initial concerns to be dismissed and for diagnosis and intervention to be delayed.[195,196,244,245] In a recent study in metropolitan Atlanta, Georgia, the mean age of the first evaluation for 115 8-year-old chil-

dren with ASDs was 48 months, and the mean age of the first ASD diagnosis was 61 months.[35]

The goal of this clinical report is to help pediatricians identify children at an earlier age who are at risk of an ASD. An ASD-specific surveillance and screening algorithm (Fig 1) has been developed to facilitate the identification process. It builds on the developmental surveillance and screening algorithm for pediatric preventive care visits that was published in the 2006 policy statement "Identifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening."[246]

General Developmental Surveillance and Screening

According to the AAP policy statement "Identifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening,"[246] "surveillance" is the ongoing process of identifying children who may be at risk of developmental delays, and "screening" is the use of standardized tools at specific intervals to support and refine the risk. As an analogy, whereas surveillance represents a "moving picture" of the child's unfolding development, screening represents "snapshots" of the child's development at specific times. Developmental surveillance should occur at every preventive visit throughout childhood and includes the following components: eliciting and attending to the parents' concerns; maintaining a developmental history; making accurate and informed observations of the child; identifying the presence of risk and protective factors; and documenting the process and findings.[246] Research has revealed that parents have valid concerns about their children's development, although careful interpretation of the concerns is needed.[247,248] However, parental concerns may not be shared if the PCP does not ask about the child's development, and lack of parental concern about development does not imply typical development.[247–250] Therefore, a systematic surveillance strategy must be used for all children.[246] Screening with a standardized developmental tool should be performed whenever concerns are raised through the ongoing surveillance process. The AAP also recommends that all children be screened with a standardized developmental tool at specific intervals (ie, at the 9-, 18-, and 24- or 30-month visits) regardless of whether a concern has been raised or a risk has been identified during the surveillance process (see the AAP developmental screening and surveillance algorithm[246]).

Surveillance for ASD

Surveillance at the first preventive care visit (Fig 1, *Steps 1a* and *2*) should begin with a family history to determine if there are any family members, especially a sibling, who have been diagnosed with ASDs. Because the risk of having symptoms of ASDs in younger siblings of children with ASDs is approximately 10 times higher, the pediatrician needs to be extra vigilant in monitoring for early abnormal signs. Studies of infant siblings with ASDs have revealed that very subtle early signs do exist and can be perceived during the first year of life.[204,205] Until recently, most knowledge regarding very early signs was obtained from retrospective systematic reviews of home videos, particularly first birthday party videos.[251] Studies of home videos at earlier ages have provided additional retrospective information that reveals subtle abnormalities in infants who were thought to be typically developing and later diagnosed as having regressive autism.[205] Several groups of investigators are following younger siblings of children diagnosed with ASDs and providing prospective information as symptoms emerge in these infants at high risk.[204] Preliminary results support the feasibility of recognizing subtle signs of ASDs in infants at high risk.[204,206,213,214,252,253] Some of the very early signs reported by several investigators include extremes of temperament and behavior (ranging from marked irritability to alarming passivity); poor eye contact; poor response to other's voices, especially to one's name being called[252]; poor attempts at interactive play; more interest in looking at objects than people; delayed pointing to request or share; decreased to-and-fro babbling and jargoning; and lack of warm, joyful, reciprocating expressions.

Surveillance should include asking parents open-ended questions about their concerns regarding the child's development and behavior (*Step 2*). Parental concerns about inconsistent hearing or unusual responsiveness also are important; for example, parents may notice that the child responds consistently to a quiet sound, such as the crinkle of a plastic snack bag, but not to a human voice calling his name. In addition, parent concerns may be stimulated by comments made by other care providers such as child care staff or preschool teachers. Recently, however, the public media have significantly increased awareness of ASDs and sometimes has stimulated unnecessary concerns. The AAP patient education brochure "*Is Your One-Year-Old Communicating With You?*"[13] can be distributed to all parents at their child's 9- or 12-month preventive visit to educate them about early social communication milestones to help them identify valid areas of concern.

Surveillance also includes asking age-specific questions about whether certain developmental milestones have been attained. When this approach is used, it is important to include social and emotional milestones in addition to the traditional motor, language, and problem-solving milestones[254,255] (see www.firstsigns.org). To recognize ASDs as early as possible, it is important to ask about the development of verbal and nonverbal communication, reciprocal social interaction (including eye contact, JA and social referencing, and sharing of interests or achievements), and representational or pretend play skills. The American Academy of Neurology and

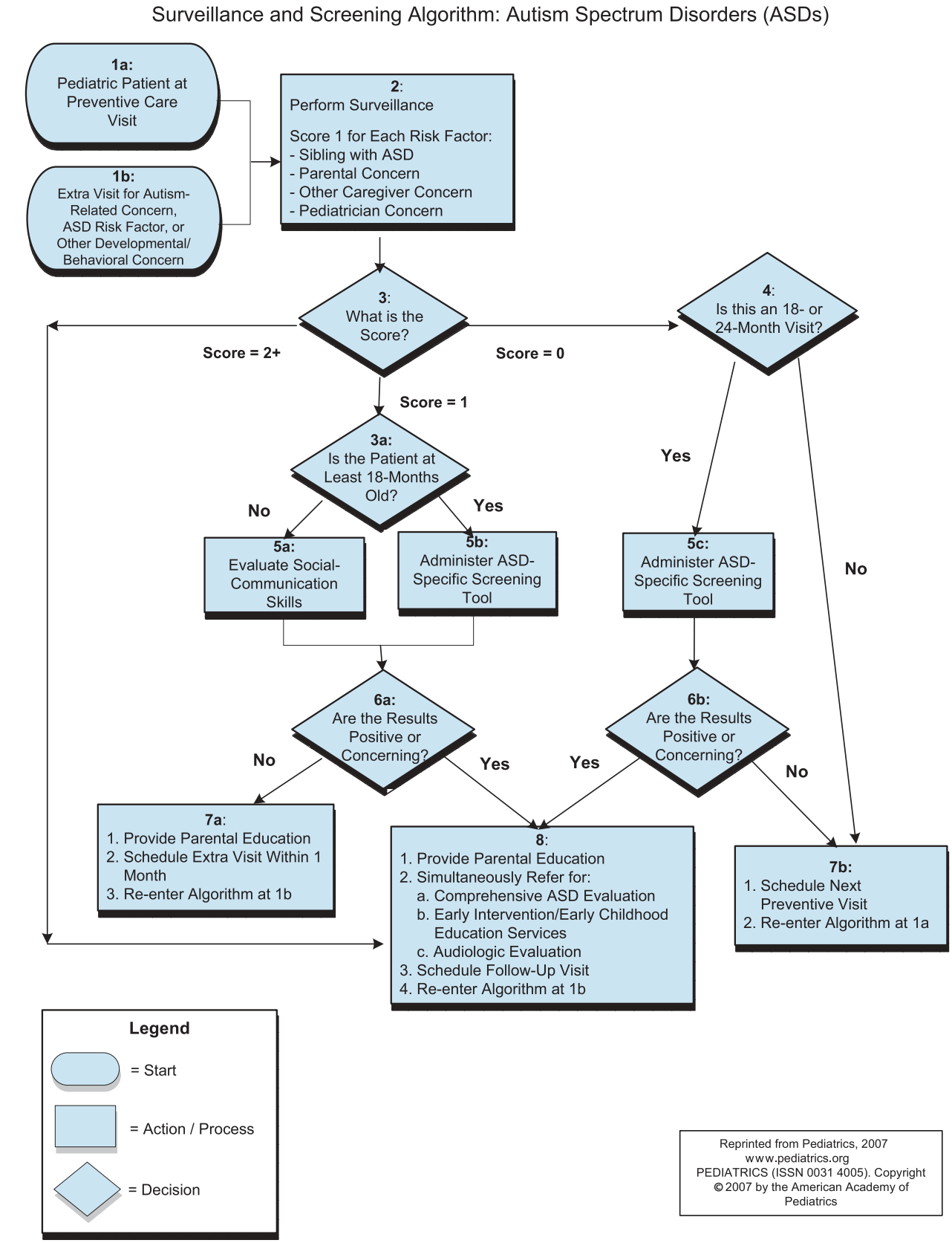

FIGURE 1
Surveillance and screening algorithm: ASDs.

Surveillance and Screening Algorithm: Autism Spectrum Disorders (ASDs)

1a: Pediatric Patient at Preventive Care Visit

1a - Developmental concerns, including those about social skill deficits, should be included as one of several health topics addressed at each pediatric preventive care visit through the first 5 years of life. *(Go to step 2)*

1b: Extra Visit for Autism-Related Concern, ASD Risk Factor, or Other Developmental/ Behavioral Concern

1b ï At the parentsô request, or when a concern is identified in a previous visit, a child may be scheduled for a ñproblem-targetedò clinic visit because of concerns about ASD. Parent concerns may be based on observed behaviors, social or language deficits, issues raised by other caregivers, or heightened anxiety produced by ASD coverage in the media. *(Go to step 2)*

2:
Perform Surveillance

Score 1 for Each Risk Factor:
- Sibling with ASD
- Parental Concern
- Other Caregiver Concern
- Pediatrician Concern

2 - Developmental surveillance is a flexible, longitudinal, continuous, and cumulative process whereby health care professionals identify children who may have developmental problems. There are 5 components of developmental surveillance: eliciting and attending to the parentsô concerns about their childôs development, documenting and maintaining a developmental history, making accurate observations of the child, identifying the risk and protective factors, and maintaining an accurate record and documenting the process and findings. The concerns of parents, other caregivers, and pediatricians all should be included in determining whether surveillance suggests that the child may be at risk of an ASD. In addition, younger siblings of children with an ASD should also be considered at risk, because they are 10 times more likely to develop symptoms of an ASD than children without a sibling with an ASD. Scoring risk factors will help determine the next steps. *(Go to step 3)*

For more information on developmental surveillance, see ñIdentifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screeningò (*Pediatrics* 2006;118:405-420).

3: What is the Score?

3 - Scoring risk factors:

- If the child does not have a sibling with an ASD and there are no concerns from the parents, other caregivers, or pediatrician: Score=0 *(Go to step 4)*
- If the child has only 1 risk factor, either a sibling with ASD or the concern of a parent, caregiver, or pediatrician: Score=1 *(Go to step 3a)*
- If the child has 2 or more risk factors: Score=2+ *(Go to step 8)*

3a: Is the Patient at Least 18-Months Old?

3a ï

- If the childôs age is <18 months, *Go to step 5a*
- If the childôs age is ³18 months, *Go to step 5b*

4: Is this an 18- or 24-Month Visit?

4 ï In the absence of established risk factors and parental/provider concerns (score=0), a level-1 ASD-specific tool should be administered at the 18- and 24-month visits. *(Go to step 5c)* If this is not an 18- or 24-month visit, *(Go to step 7b).*

Note: In the AAP policy, ñIdentifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screeningò, a general developmental screen is recommended at the 9-, 18-, and 24-or 30-month visits and an ASD screening is recommended at the 18-month visit. This clinical report also recommends an ASD screening at the 24-month visit to identify children who may regress after 18 months of age.

5a: Evaluate Social-Communication Skills

5a - If the childôs age is <18 months, the pediatrician should use a tool that specifically addresses the clinical characteristics of ASDs, such as those that target social-communication skills. *(Go to step 6a)*

5b: Administer ASD-Specific Screening Tool

5b - If the childôs age is ³18 months, the pediatrician should use an ASD-specific screening tool. *(Go to step 6a)*

5c: Administer ASD-Specific Screening Tool

5c ï For all children ages 18 or 24 months (regardless of risk factors), the pediatrician should use an ASD-specific screening tool. *(Go to step 6b)*

AAP-recommended strategies for using ASD screening tools: ñ*Autism: Caring for Children with Autism Spectrum Disorders: A Resource Toolkit for Cliniciansò(in press)**

6a: Are the Results Positive or Concerning?

6a ï When the result of the screening is *negative*, *Go to step 7a*

When the result of the screening is *positive*, *Go to step 8*

6b: Are the Results Positive or Concerning?

6b ï When the result of the ASD screening (at 18- and 24-month visits) is *negative, Go to step 7b*

When the result of the ASD screening (at 18- and 24-month visits) is *positive*, *Go to step 8*

7a:
1. Provide Parental Education
2. Schedule Extra Visit Within 1 Month
3. Re-enter Algorithm at 1b

7a ï If the child demonstrates risk but has a negative screening result, information about ASDs should be provided to parents. The pediatrician should schedule an extra visit within 1 month to address any residual ASD concerns or additional developmental/ behavioral concerns after a negative screening result. The child will then re-enter the algorithm at 1b. A ñwait-and-seeò approach is discouraged. If the only risk factor is a sibling with an ASD, the pediatrician should maintain a higher index of suspicion and address ASD symptoms at each preventive care visit, but an early follow-up within 1 month is not necessary unless a parental concern subsequently arises.

7b:
1. Schedule Next Preventive Visit
2. Re-enter Algorithm at 1a

7b ï If this is not an 18- or 24-month visit, or when the result of the ASD screening is *negative*, the pediatrician can inform the parents and schedule the next routine preventive visit. The child will then re-enter the algorithm at 1a.

8:
1. Provide Parental Education
2. Simultaneously Refer for:
   a. Comprehensive ASD Evaluation
   b. Early Intervention/Early Childhood Education Services
   c. Audiologic Evaluation
3. Schedule Follow-up Visit
4. Re-enter Algorithm at 1b

8 ï If the screening result is *positive* for possible ASD in step 6a or 6b, the pediatrician should provide peer reviewed and/or consensus-developed ASD materials. Because a positive screening result does not determine a diagnosis of ASD, the child should be referred for a comprehensive ASD evaluation, to early intervention/early childhood education services (depending on childôs age), and an audiologic evaluation. A categorical diagnosis is not needed to access intervention services. These programs often provide evaluations and other services even before a medical evaluation is complete. A referral to intervention services or school also is indicated when other developmental/behavioral concerns exist, even though the ASD screening result is negative. The child should be scheduled for a follow-up visit and will then re-enter the algorithm at 1b. All communication between the referral sources and the pediatrician should be coordinated.

AAP information for parents about ASDs includes: ñ*Is Your One-Year-Old Communicating with You?**ò and ñ*Understanding Autism Spectrum Disorders.**ò

*Available at www.aap.org

FIGURE 1
Continued

Child Neurology Society practice parameter on screening and diagnosis of autism[107] suggests that the following "red flags" are absolute indications for immediate evaluation:

- no babbling or pointing or other gesture by 12 months;
- no single words by 16 months;
- no 2-word spontaneous (not echolalic) phrases by 24 months; and
- loss of language or social skills at any age.

Pediatricians should become concerned (*Step 2*) if the answers to these questions reveal deficits or delays in milestones or if behaviors typical of ASD are observed during an office visit.

In older, more developmentally advanced children, including many with AS, surveillance questions (*Step 2*) may elicit concerns about social interaction difficulties related to more subtle communication problems, such as pragmatic language impairment and lack of understanding of nonliteral forms of communication (figures of speech, humor, sarcasm, metaphor, etc), difficulty taking the perspective of another (resulting in inappropriate or offensive behavior, gullibility, and lack of common sense), and obsession with facts, details, or collections. Pragmatic language refers to the use of language in social interaction and includes instinctive rules governing factors, such as topic maintenance and turn taking in conversation, how sentences are made to fit in with the flow of a conversation, how unspoken premises are inferred, how degrees of formality and politeness are signaled, and prosody (modulation of the intonation, rhythm, volume, timing, and stress of the voice). The parents may note that the child lacks true friendships and is viewed as odd, eccentric, or "weird" by his 'peers.

In addition, during the well-child visit, the PCP may try to interact with the patient by using a few simple strategies depending on the child's age. For example, the PCP can note the response when calling the child's name at the 12-month well-child visit, and/or the JA milestone of "following a point" can be elicited at the 12-, 18-, and 24-month well-child visits as part of routine developmental surveillance. In the latter, the pediatrician points to an object at a distance, such as a picture on the wall or a mobile, while making a verbal request for the child to look. Whereas a typically developing child would look in the direction of the point and then afterward engage in eye contact with the physician or the parent, a child with an ASD may appear to be oblivious to the PCP's gesture and verbal request. This is true even if the PCP increases the intensity of the stimulus by calling louder, adding the child's name, or touching the child's shoulder first and then pointing and exclaiming, "Look!" The child may still fail to respond even if the parent repeats the maneuvers. With an older, higher-functioning child, the PCP may enter into conversation with the child to determine if he has difficulty interpreting a figure of speech, telling a joke, or explaining why a joke is funny. In addition, the PCP may ask a question or two about one of the child's areas of interest to observe a response that is characteristic of AS, such as a long-winded, overly precise, or pedantic reply. Any of these responses should raise the concern of a PCP.

Each concern raised by a parent, other caregiver, or the pediatrician constitutes a separate risk factor, as does a positive family history of a sibling with an ASD (*Step 2*). To determine how to proceed, the pediatrician should assess the number of risk factors (*Step 3*). Possible scores include 0, 1, 2, 3, or 4.

1. If no concerns have been raised during the course of the preventive visit and the child is not the sibling of a child who has already been diagnosed with an ASD, then the PCP should proceed to *Step 4*. ASD-specific screening is indicated only if the visit is the 18- or 24-month preventive visit. See *Step 5c* below.
2. If the child's only risk factor is having a sibling with an ASD, then the PCP should make sure the parents are aware of early signs of ASDs and continue to monitor carefully.[253] If the parents call with a concern between scheduled routine preventive visits, the child should be seen within 1 or 2 weeks and reenter the algorithm at *Step 1b* for a "targeted visit" to address concerns about ASDs. If the score = 1 as a result of a single concern (parent, other caregiver, or PCP), the PCP should screen the child formally with a standardized tool; the choice of tool will depend on the child's age (*Step 3a*) (see "Screening Tools for Implementation of *Step 5*").
3. If 2 or more risk factors are identified, then the PCP should proceed directly to *Step 8*, which includes several activities that should be accomplished simultaneously and without delay.

Screening for ASDs (*Steps 5a–5c*)

Physician estimates of the developmental status of children are much less accurate when only clinical impressions, rather than formal screening tools, are used,[256,257] yet a minority of PCPs use formal developmental screening instruments,[258,259] and few pediatricians specifically screen for ASDs.[5] A standardized screening tool should be administered at any point when concerns about ASDs are raised spontaneously by a parent or as a result of clinician observations or surveillance questions about social, communicative, and play behaviors (*Steps 5a* and *5b*).[246,260] In the general developmental screening and surveillance policy statement discussed previously, the AAP also recommended administering a standardized autism-specific screening tool on all children at the 18-month preventive care visit (*Step 5c*).[246] The AAP Autism Expert Panel responded to the statement with a com-

mentary[260] that suggested a repeat screening be performed at 24 months of age (*Step 5c*) to identify those who may regress after 18 months of age.

Screening Tools for Implementation of *Step 5*

A variety of general developmental screening tools are available to practitioners.[246] General developmental screening tools are appropriate for use with unselected primary care populations and are likely to detect ASDs in many young children because of associated language and cognitive delays, but they do not differentiate children with ASDs from those with other developmental disorders, and data are not available on sensitivity for detection of ASDs. Tools to screen specifically for ASDs also have been designed (Table 3), but they have not yet been validated on children younger than 18 months. The PCP should remember that screening tools are likely to be overinclusive, so children with developmental and behavioral disorders other than ASDs also might have positive screening results. Similar to other developmental screening measures, ASD-specific screening tools may rely entirely on parent report, or they may require direct observation and engagement by the clinician. Parent-report tools often have the advantage of being brief, inexpensive, and practical in the office setting. The people who know the child best are surveyed and can describe the child's behavior over time in a variety of settings rather than being constrained to sampling behavior in one setting at one point in time.

Step 5a*: Tools for Use in "at-Risk" Children Younger Than 18 Months*

Although several tools are in development for screening children younger than 18 months, none are available yet for routine clinical use. The Infant/Toddler Checklist from the Communication and Symbolic Behavior Scales Developmental Profile[261] (which can be downloaded at www.brookespublishing.com/store/books/wetherby-csbsdp/CSBSDP_Checklist.pdf) may be particularly well suited for identifying 6- to 24-month-old children who are at risk of ASDs, because it focuses on social and communication skills. It is anticipated that this and other screening tools under investigation as possible ASD-specific tools for use in infants younger than 18 months may prove valuable in identifying children at high risk and will become available to clinicians in the near future.[213,262,263]

Step 5b*: Tools for at-Risk Children 18 Months and Older*

ASD-specific screening tools are available for children 18 months and older, and many of them are age specific. Recently, such tools have been classified as "level 1" or "level 2" screening tools.[264] Level 1 screening tools are administered to all children within the context of a primary care medical home and are designed to differentiate children who are at risk of ASDs from the general population, especially those with typical development. Level 2 screening tools are used more often in early intervention programs or developmental clinics that serve children with a variety of developmental problems; they help to differentiate children who are at risk of ASDs from those at risk of other developmental disorders such as GDD or specific language impairment. Level 2 screening tools generally require more time and training to administer, score, and interpret than level 1 measures. There is considerable overlap between the concept of a level 2 screening tool and that of a diagnostic instrument.[264,265] Level 2 screening measures may be used as part of a diagnostic evaluation, but they should not be used in isolation to make a diagnosis.

Properties of some level 1 and 2 ASD screening tools are reviewed in Table 3. Reported sensitivity and specificity values are included, but in most cases, sensitivity and specificity of the instruments have been determined only in clinical samples or in populations that included a mixture of clinical and population-based samples, and they must be interpreted with caution. Estimates of sensitivity and specificity of developmental screening tests may be unstable, and they are not the only criteria that should be used to assess validity.[266] In low-prevalence conditions, such as ASDs, the positive predictive value of screening tools will be low even with good sensitivity and specificity, whereas the negative predictive value will be quite high. Many of the existing ASD-specific screening measures are being revised or further evaluated, and new tools are being developed to address some of their weaknesses.

Some measures, such as the Checklist for Autism in Toddlers (CHAT),[267] Modified Checklist for Autism in Toddlers (M-CHAT),[268] and Pervasive Developmental Disorders Screening Test-II Primary Care Screener,[269] were designed specifically for early detection of ASDs in young children. The CHAT and M-CHAT are level 1 screening tools that are available at no cost to practitioners for use in primary care (Table 3).

For older children who are diagnosed later with AS, school personnel often raise concerns to the parents. Staff may then administer a published AS-specific tool. Although many level 2 screening tools have been marketed for use in older children who have been identified as being at risk of AS, further study is needed before any one of them can be recommended as superior to others.[270] See Table 3 for characteristics of selected AS screening tools.

Step 5c*: Tools for Screening Children Without Risk Factors at the 18- and 24-Month Preventive Visit*

Level 1 ASD tools described in *Step 5b* also are appropriate for routine screening of young children without any identified risk.

Among the tools designed for screening the elementary school–aged population, only the Childhood Asperger Syndrome Test (CAST) has been assessed in a

TABLE 3 **Selected Level 1 and 2 ASD Screening Measures**

Screening Tool	Age	Format (No. of Items)	Time to Complete, min	Reported Sensitivity	Reported Specificity	Selected Key References	Availability
Level 1[a]							
CHAT	18–24+ mo	Parent interview or questionnaire and interactive (parent: 9; clinician: 5)	5	0.18–0.38[b]; 0.65[c]	0.98–1.0[b]; 1.0[c]	Baron-Cohen et al,[267] Baron-Cohen et al,[272] Baird et al,[19] Scambler et al[273]	Download: www.autismresearchcentre.com/tests/chat_test.asp
CHAT, Denver Modifications	18–24+ mo	Parent interview or questionnaire and interactive (parent: 9; clinician: 5)	5	0.85[c]	1.0[c]	Scambler et al[273]	CHAT scoring modifications; available in Scambler et al[273]
Checklist for Autism in Toddlers-23 (CHAT-23)	16–86 mo (all had mental ages of 18–24 mo)	Parent interview or questionnaire and interactive (parent: 23, clinician: 5)	10	0.84–0.93[c] (part A); 0.74[c] (part B)	0.77–0.85[c] (part A); 0.91[c] (part B)	Wong et al[274]	Combination of M-CHAT and CHAT items; protocol available in Wong et al[274]
CAST	4–11 y	Questionnaire completed by parent (37)	10	0.88–1.0[d]	0.97–0.98[d]	Scott et al,[275] Williams et al,[235] Williams et al[276]	Download: www.autismresearchcentre.com/tests/cast_test.asp
M-CHAT	16–48 mo	Questionnaire completed by parent (23)	5–10	0.85[d]	0.93[d]	Dumont-Matthieu and Fein,[277] Robins et al[268]	Download: www.dbpeds.org/media/mchat.pdf or www.firstsigns.org/downloads/m-chat.pdf; for scoring: www.firstsigns.org/downloads/m-chat_scoring.PDF
Pervasive Developmental Disorders Screening Test-II, Primary Care Screener (PDDST-II PCS)	18–48 mo	Questionnaire completed by parent (22)	10–15	0.92[c]	0.91[c]	Siegel[269]	Purchase: PsychCorp/Harcourt Assessment (www.harcourtassessment.com)
Level 2							
Asperger Syndrome Diagnostic Scale (ASDS)	5–18 y	Questionnaire completed by parent, teacher, or clinician (50)	10–15	0.85[c]		Myles et al,[278] Campbell[270]	Purchase: Pro-Ed (www.proedinc.com)
Autism Behavior Checklist (ABC)	≥18 mo	Behavioral checklist completed by interviewer (57)	10–20	0.38–0.58[c]	0.76–0.97[c]	Krug et al[279]	Purchase: Pro-Ed (www.proedinc.com) as part of the Autism Screening Instrument for Educational Planning (ASIEP-2)
Autism Quotient (AQ)–Adolescent Version	11–16 y	Questionnaire completed by parent (50)	15	0.89[c]	1.0[c]	Baron-Cohen et al[280]	Download: www.autismresearchcentre.com/tests/aq_adolescent_test.asp
Autism Spectrum Screening Questionnaire (ASSQ)	6–17 y	Questionnaire completed by parent (27)	10	0.62–0.82[c] (parent); 0.65–0.70[c] (teacher)		Ehlers et al[281]	Questions are included as an appendix in Ehlers et al[281]
Childhood Autism Rating Scale (CARS)	>2 y	Behavioral checklist completed by trained interviewer/observer (15)	Variable	0.92–0.98[c]; 0.94[c]	0.85[c]	Eaves and Milner,[282] Perry et al,[283] Schopler et al[284], Sevin et al[285]	Purchase: Western Psychological Services (www.wpspublish.com)
Gilliam Asperger's Disorder Scale (GADS)	3–22 y	Questionnaire completed by parent, teacher, or clinician (32)	10			Gilliam,[286] Campbell[270]	Purchase: Pro-Ed (www.proedinc.com)
Gilliam Autism Rating Scale–2nd Edition (GARS-2)	3–22 y	Questionnaire completed by parent or teacher (42)	5–10			Gilliam[287]	Purchase: Pro-Ed (www.proedinc.com)

TABLE 3 **Continued**

Screening Tool	Age	Format (No. of Items)	Time to Complete, min	Reported Sensitivity	Reported Specificity	Selected Key References	Availability
Krug Asperger's Disorder Index (KADI)	6–21 y	Questionnaire completed by parent or clinician (32)	15–20	0.78[c]	0.94[c]	Krug and Arick,[288] Campbell[270]	Purchase: Pro-Ed (www.proedinc.com)
Pervasive Developmental Disorders Screening Test-II, Developmental Clinic Screener (PDDST-II, DCS)	18–48 mo	Questionnaire completed by parent (14)	10–15	0.73[c]	0.49[c]	Siegel[269]	Purchase: PsychCorp/Harcourt Assessment (www.harcourtassessment.com)
Pervasive Developmental Disorders Screening Test-II, Autism Clinic Severity Screener (PDDST-II, ACSC)	18–48 mo	Questionnaire completed by parent (12)	10–15	0.58[c]	0.60[c]	Siegel[269]	Purchase: PsychCorp/Harcourt Assessment (www.harcourtassessment.com)
Screening Tool for Autism in Two-Year-Olds (STAT)	24–36 mo	Interactive, requires specific training (12)	20	0.92[d]	0.85[d]	Stone et al,[289] Stone et al[290]	Author: Wendy Stone, PhD (triad@vanderbilt.edu)
Social Communication Questionnaire (SCQ) (formerly the Autism Screening Questionnaire [ASQ])	≥4 y	Questionnaire completed by parent (40)	5–10	0.85–0.96[c]	0.67–0.80[c]	Berument et al,[291] Rutter et al[292]	Purchase: Western Psychological Services (www.wpspublish.com)

The measures were selected on the basis of availability of some published psychometric properties (in English) with scoring instructions and pass/fail cutoffs or the equivalent.

[a] Level 1 tools are most likely to be used in primary care settings.

[b] Population-based sample.

[c] Clinical sample.

[d] Clinical and population-based samples.

Adapted from Coonrod EE, Stone WL. Screening for autism in young children. In: Volkmar FR, Paul R, Klin A, Cohen D, eds. *Handbook of Autism and Pervasive Developmental Disorders*. 3rd ed. Vol 2. Hoboken, NJ: John Wiley & Sons; 2005:707–729; Campbell JM. Diagnostic assessment of Asperger's disorder: a review of five third-party rating scales. *J Autism Dev Disord*. 2005;35:25–35; and Rutter M, Bailey A, Lord C, et al. *The Social Communication Questionnaire (SCQ) Manual*. Los Angeles, CA: Western Psychological Services; 2003.

large, unselected population as a level 1 screening tool.[271] The authors concluded that the CAST is useful as a screening test for ASDs in epidemiologic research but that there is not enough evidence to recommend it for routine screening in the general population as part of a public health program.[271] In addition, the AAP does not currently recommend universal screening of school-aged children with a level 1 AS-specific tool.

See Appendix 1 for reimbursement codes.

Results of Screening (*Steps 6a* and *6b*)

If the screening result for an at-risk child is negative in *Step 6a*, the PCP should proceed to *Step 7a*, provide parent educational materials (such as the AAP brochure, "*Is Your One-Year-Old Communicating With You?*"[13] or the AAP parent booklet, "*Understanding Autism Spectrum Disorders*"[14]) and schedule an extra visit (*Step 1b*) within 1 month to address residual concerns. If the only risk factor is having a sibling with an ASD, an extra visit is not necessary unless the parents become concerned after the visit. When the screening result is negative for children without risk at the 18- or 24-month preventive visit (*Step 6b*), the PCP should proceed to *Step 7b* and schedule the next routine preventive care visit (*Step 1a*). If the screening result is positive (*Steps 6a* or *6b*) or 2 or more risk factors are present at *Step 3*, the PCP should proceed to *Step 8*, at which simultaneous activities should take place in an expedient manner. The PCP should consider the possibility that the child with a negative ASD screening result may have another developmental disorder that would warrant further investigation and referral to resources similar to those listed in *Step 8*.

When surveillance does not identify any risk factors and the visit is not an 18- or 24-month visit (*Step 4*), no screening is recommended, and the PCP may proceed directly to *Step 7b*.

Step 8: Activities Needed When Multiple Risk Factors Are Present or When the ASD Screening Result Is Positive

Activities described herein will depend on certain community characteristics, especially in regard to obtaining a comprehensive evaluation. Depending on the number of ASD experts in a given community, the interval wait for an appointment may be long. Thus, it is important that the PCP simultaneously accomplish all of *Steps 8.1* through *8.4* while the family is waiting for a specialty appointment to confirm or rule out an ASD diagnosis.

Step 8.1*: Provide Parental Education*

If the PCP feels fairly certain that the child has a developmental disorder that falls somewhere in the autism spectrum, it will be helpful to give the parents reading materials. As discussed in the introduction to this report, the AAP has published "*Understanding Autism Spectrum Disorders*," an educational booklet for parents with this intent.[14] The comprehensive evaluation will progress more efficiently if the parents are more knowledgeable about the characteristic clinical symptoms of ASDs and can report them more accurately. Some PCPs are reticent to share their concerns with parents, fearful that premature "labeling," although it is tentative, might cause undo stress and anxiety on the part of the family. However, sincerity, honesty, and admitting uncertainty is appreciated by most parents. On the other hand, concealing a concern and taking a "wait-and-see" approach rarely is appreciated; in fact, this strategy often breeds parental discontent and, worse, resentment and anger. With the recent high visibility in the media, most parents (unlike before the 1990s) now are aware of ASDs and may suspect it and search the Internet for information. It is important that they receive peer-reviewed and consensus-driven information that is evidence based and that they understand how to interpret Web-site information that is not peer reviewed.

Step 8.2.a: *ASD Comprehensive Evaluation*

For some children, the diagnosis might be quite obvious to the PCP who is using the DSM-IV-TR criteria as a guide. In others, the diagnosis may be challenging, especially when externalizing behavioral symptoms are mild or variable and/or there are associated comorbid disorders. Ideally, the definitive diagnosis of an ASD should be made by a team of child specialists with expertise in ASDs. Unfortunately, teams are not available in every locale, and when they are, long waiting lists may exist. Most communities will have at least 1 pediatric subspecialist (eg, child neurologist, developmental pediatrician, psychiatrist) with at least some expertise in making an ASD diagnosis. Other professionals, such as child psychologists, SLPs, pediatric occupational therapists, and social workers with expertise in ASDs, can be helpful by performing independent evaluations, often using standardized tools that can assist in the diagnostic process, especially when no team or pediatric "expert" is available. Child psychologists with appropriate training and experience can make the diagnosis independently and often do so, especially in school systems. Recently, the American Speech-Language-Hearing Association published guidelines that stated that an SLP with expertise in ASDs can make the diagnosis independently when other resources are not available.[294,295] Older children who first present with symptoms of AS after school entry often are first recognized and evaluated by the school district's educational diagnostic team and subsequently, but unfortunately not always, referred to a health care professional.

If it seems fairly certain, on the basis of general developmental screening and/or available psychometric testing with standardized tools, that the child also has GDD or intellectual disability, then the PCP might order high-resolution karyotype and DNA testing for fragile X

syndrome. If the child has clinical features (history, family history, physical examination) that are characteristic of a specific genetic or neurologic disorder that can be easily confirmed by a specific laboratory test, then the PCP may want to proceed with that test. On the other hand, the PCP may opt to refer the child to pediatric subspecialists for assistance with an etiologic workup and/or a search for coexisting conditions. Depending on availability and the nature of the concern(s), the PCP should consider a referral to a developmental pediatrician, a geneticist, and/or a child neurologist.[104,296] See the next section for a more extensive discussion of the components of a comprehensive evaluation.

Step 8.2.b: *Early Intervention/Early Childhood Education Services*

As soon as an infant or toddler is suspected of having a delay or being at risk of a delay or developmental disorder such as an ASD, he should be referred immediately to an early intervention program (a government-subsidized public program designed to serve children with special needs and/or developmental delays from the time the problem is identified until the third birthday). If the child has had his third birthday, the referral should be made to the special education department in the local school. Among other professionals, assessment teams will almost always include SLPs and occupational therapists who can develop appropriate intervention plans without a categorical diagnosis. Intervention is important and often can be effective, even if it begins as generic speech therapy (ie, therapy that addresses most forms of language delay) and general developmental strategies. This intervention plan can be revised later to a more specific ASD intervention protocol (such as teaching JA) once the diagnosis is made. Experienced therapists often recognize ASD symptomatology and use strategies tailored to the child's individual deficits, even without a definitive ASD diagnosis.

Step 8.2.c: *Audiology Evaluation*

All children with language delays, including those suspected of having ASDs, should undergo an audiologic evaluation, even if the neonatal screening result was normal. This testing may be challenging to accomplish, because children with ASDs often are uncooperative for behavioral audiometry, the test most frequently used with toddlers. If the attempt is unsuccessful, an auditory brainstem response or brainstem auditory evoked-response test can be ordered; it is likely that sedation will be required. Sedation may be challenging, because some children with ASDs may respond paradoxically to sedatives.

Steps 8.3 *and* **8.4:** *Schedule Follow-up Visit and Reenter Algorithm*

The child should be scheduled for a targeted follow-up visit within 1 month and reenter the algorithm at *Step 1b* to determine the status of the aforementioned referrals and to discuss any additional parental concerns once they have had the opportunity to read and learn more about ASDs.

COMPREHENSIVE EVALUATION (SEE *STEP 8.2.a*)

There are 3 major diagnostic challenges in the comprehensive assessment of a child with a suspected ASD: determining the child's overall level of functioning; making the categorical diagnosis of an ASD; and determining the extent of the search for an associated etiology. To accomplish these 3 goals, a comprehensive evaluation should include the following components[212,297,298]:

1. Health, developmental, and behavioral histories that include at least a 3-generation family pedigree and a review of systems.
2. Physical examination including a thorough search for dysmorphic features and neurologic abnormalities and a Wood's lamp examination of the skin.
3. Developmental and/or psychometric evaluation (depending on age/skill level) to determine the child's overall level of functioning and whether a discrepancy between motor-adaptive problem-solving and social communication skills is evident.[299,300]
4. Determination of the presence of a categorical DSM-IV-TR diagnosis, preferably with standardized tools that operationalize the DSM criteria.
5. Assessment of the parents' knowledge of ASDs, coping skills, and available resources and supports.
6. A laboratory investigation to search for a known etiology or coexisting condition guided by information obtained in *Steps 1* through *5*.

When appropriate, the evaluation should include information from multiple sources, because the child's performance may vary among settings and caregivers. Depending on level of comfort, the PCP may opt to refer to an experienced pediatric subspecialist, such as a neurologist, geneticist, or developmental pediatrician, to further evaluate the child, especially when there is an abnormal neurologic finding, seizures, regression, dysmorphic features, and/or a complex family history.

Laboratory testing for children with ASDs (component 6 above) is controversial. Newer technology has been developed since publication of the 2001 AAP statement and technical report[1,2]; however, some tests are not yet clinically available. Various specialists hold differing opinions about the definition of a "positive yield," defined herein as a positive test result that indicates a known autism-related etiology (eg, a positive result on

DNA testing for fragile X syndrome or a karyotype revealing a mutation at 9q or 16p indicating tuberous sclerosis). They also promote varying clinical indications for extensive molecular testing and neuroimaging when the clinical validity of a positive finding is yet unknown in many cases.[301] Some investigators have reported a positive yield when, in fact, the identified abnormality was nonspecific, did not relate to a known autism-related etiology, and did not affect counseling and/or management (eg, delayed myelinization on MRI).[302] Medical symptoms should be evaluated on a case-by-case basis; rather than reflect an etiology, an abnormal test result may indicate that a child with an ASD has a coexisting condition (eg, a gastrointestinal disorder). Thus, an abnormal laboratory test result does not necessarily indicate a positive yield but may, indeed, indicate a condition that needs medical attention (see the AAP clinical report "Management of Children With Autism Spectrum Disorders"[303]). Reporting it as a positive yield makes it difficult to translate research methodology into recommendations that will help the clinician in the care of any given patient.

The yield of an etiologic investigation may be more highly correlated with the presence or absence of coexisting GDD/MR (intellectual disability) rather than with an isolated ASD. In fact, the presence of autism in a cohort of children with GDD/MR (intellectual disability) decreased the chance of a positive yield.[304] Depending on the population characteristics, specific test(s) studied, and the decision-making process by which they were ordered (ie, as a screening technique for all study patients with ASDs versus a targeted test indicated by a specific clinical finding), positive yields range from as low as 0%[101,305,306] to as high as 25% to 40%,[307–309] but most yield rates fall between 2% and 10%.† It is difficult to compare studies because of variability in the workups, analysis in terms of GDD/MR or other phenotypic variables, and interpretation of positive test results (eg, delayed myelinization on MRI) or symptoms (eg, gastrointestinal) that are not definitively associated with ASDs.[310]

Although the original ASD-specific consensus guidelines published between 1999 and 2001[1,2,106,107] have been helpful in guiding the etiology-search strategy in children with ASDs, the presence of coexisting GDD/MR (intellectual disability) in a cohort of children with ASD (especially severe GDD/MR or intellectual disability associated with dysmorphic features) is more highly correlated with a positive yield and a recognizable syndrome.[108] Thus, guidelines that address the etiologic workup of children with GDD/MR[104,296,311,312] also should be considered when evaluating a child with both an ASD and GDD/MR but not necessarily a child with an isolated ASD.

Among laboratory tests, high-resolution chromosome analysis by G-banding and molecular testing for fragile X syndrome have the highest yield in determining etiology in patients with ASDs.‡ Some investigators have suggested a battery of additional screening cytogenetic and molecular studies for all patients with ASDs regardless of gender, presence or absence of coexisting GDD/MR, dysmorphic features, or family history.[309] However, current data do not support extensive testing of all children with ASDs in clinical settings. Published studies have begun to address some of the newer molecular genetic techniques that have revolutionized genetic testing by detecting microdeletions, duplications, and rearrangements not visible with high-resolution chromosomal testing. Targeted FISH studies can be used to screen for deletions or duplications, such as those associated with chromosomes 15q and 22q.[305,310] A relatively recent use of FISH technology is genome-wide subtelomere screening, which detects clinically significant abnormalities in 2.5% of individuals with unexplained GDD/MR.[313] This technology can detect a wide variety of abnormalities, including some such as 22q13.3 deletion, that have been reported in a subset of children with ASDs.[314,315] Several studies that examined the yield of subtelomere FISH screening in ASD failed to detect a single abnormality, which suggests that it may not be helpful in the routine evaluation of these patients.[89,305] However, additional studies are needed. Comparative genomic hybridization-microarray analysis is a promising tool that may become standard of care in the future, but this technique has not been evaluated systematically in children with ASDs.

Screening neurologic tests also have been suggested—for example, electroencephalography (EEG [routine and/or prolonged sleep studies]) for all children with ASDs.[316] Although nonspecific abnormalities have been found in most children, the significance of these abnormalities is not clear, and additional research is needed to determine if intervention is of any value. Thus, there is no evidence to support universal screening EEG without a clinical indication.[317,318] An EEG should be considered for children who demonstrate clinical signs that might represent seizures and for children with clear language regression. However, EEGs in children that demonstrate "classic autistic regression" between 12 and 24 months are often nonspecific and not helpful in the diagnostic process. Previously published guidelines contain clear recommendations that screening MRIs on all children who present with ASDs, including those with isolated macrocephaly, are not necessary.[106,107,194] Given the heterogeneity of ASDs, the likelihood of multiple etiologies, and the questionable clinical validity of an extensive battery of screening tests on all children with ASDs, more evidence is needed before a battery of genetic and neurologic testing becomes standard of care.

†Refs 20, 23, 33, 89, 97, 101, 105, 302, and 310.

‡Refs 20, 23, 33, 89, 101, 105, 302, and 310.

Although for the individual patient, it is important to differentiate an idiopathic ASD (with a recurrence rate of 5%–6% [range: 2%–8%]) from an ASD-associated syndrome that may have a higher or lower recurrence rate, there is no simple 1-size-fits-all search strategy.[1,2,106,107,300] Instead, the search should be guided by clinical judgment based on history (eg, health, birth, developmental, behavioral, family) and clinical presentation (eg, comorbid MR, regression, seizures, neurodevelopmental findings, dysmorphic features, comorbid medical conditions). The importance of dysmorphic features and/or neurologic abnormalities in predicting a positive yield particularly has been emphasized.[108] Family characteristics (eg, insurance status, concern about the child's discomfort, or interest in pursuing a "no-stone-left-unturned" etiologic workup) also may affect parental decisions regarding the extent of the workup. Finally, the availability of technology, the need for and feasibility of sedation, managed care cost/benefit guidelines, and physician motivation each may play a role. There are certainly many advantages to having a diagnosis, including genetic counseling and provision of recurrence risks of known syndromes, the possibility of a specific treatment strategy, counseling regarding the natural history of a known disorder, anticipation of a later associated comorbid disorder, prevention of secondary disorders, availability of prenatal diagnosis, access to public support systems, access to syndrome-specific parent support groups, and, in some cases, the psychological benefits of knowing that empower parents to move on and focus on habilitative interventions.

A "search strategy" might be conceptualized as consisting of 3 levels.

1. Studies that should be considered for all young children with ASDs (ie, an audiology evaluation; however, school-based hearing screening may be adequate in the older child with AS and no significant language or learning deficits).

2. Studies that should be considered in all children with both an ASD and coexisting GDD/MR or intellectual disability (ie, high-resolution karyotype [650 bands] and DNA testing for fragile X syndrome). Although a high-resolution karyotype might reveal larger duplications, some clinicians believe that FISH testing for 15q duplications also might be indicated.[92,93] In the future, a microarray analysis may replace high-resolution karyotyping. A methyl CpG-binding protein 2 (*MECP2*) analysis should be considered in females who present with regression and autistic features that are also consistent with Rett syndrome.[310]

3. Targeted studies (eg, EEG, metabolic studies, MRI) should be considered when specific clinical findings are identified by history or physical examination (eg, seizures, cyclic vomiting and lethargy associated with mild illnesses and/or unusual odors, hypopigmented macules). Identification of more subtle indicators and their corresponding appropriate laboratory tests might be facilitated by referral to a geneticist, pediatric neurologist, and/or developmental pediatrician.

Ongoing multisite studies are investigating specific test protocols. Such evaluations are not recommended as clinical standard of care at this time until analysis of the data indicates which of the extended tests, if any, are indicated and for which ASD populations. These research protocols include many tests that are investigational, have unknown medical validity, and currently are not available for clinical use. Some of these tests include functional neuroimaging, immunologic studies, metabolic testing, fibroblast karyotypes, neuroligin gene testing, mitochondrial gene sequencing, genomic microarrays, and identification of endophenotypes.[90,319] Although these tests may not be relevant in clinical practice, they do have the potential to expand the fund of knowledge about ASDs, reveal more specific ASD subtypes, and provide a better understanding of coexisting disorders and future prognosis. As the fund of knowledge regarding genetic markers for ASDs expands and technology continues to become more sophisticated, the yield of these laboratory investigations may eventually prove to be useful in the routine clinical evaluation of children with idiopathic ASDs. For now, the existing dichotomy regarding the extent of testing in research versus clinical settings is challenging.[301] Existing data do not support routine application of any particular test battery, nor do they suggest that tests currently under investigation be routinely performed on all children with ASDs at this time.

Prognosis

Although prognosis is one of the parents' most pressing concerns at the time of diagnosis, it depends on many factors and usually cannot be predicted during early childhood, especially in children younger than 3 years.[320] Important early predictors include JA skills, functional play skills,[321] cognitive abilities, and severity of ASD symptoms.[322–334] Recent studies have revealed that although most children diagnosed with AD retain their diagnosis at 9 years of age,[208] many, especially those with PDD-NOS, improve, and a minority have optimal outcomes; that is, they have normal intelligence and function reasonably well in mainstream classrooms without an aid but still exhibit residual clinical signs of social awkwardness, restrictive interests, or mild, infrequent stereotypies. Some may show signs of ADHD, language-based learning disabilities, or other learning challenges.[8–11,217] Poorer outcomes are associated with lack of JA by 4 years of age and lack of functional speech by 5 years of age,[7,217] MR, seizures (especially with onset during adolescence), comorbid medical (eg, tuberous sclerosis) or psychiatric (eg, schizophrenia) disorders, and severe autistic symptoms, especially when associated with extreme "aloofness." Factors associated with better out-

comes include early identification resulting in early enrollment in appropriate intervention programs[7,332] and successful inclusion in regular educational and community settings with typically developing peers.

Adult outcomes seem to correlate better with level of cognitive-adaptive functioning than with the severity of autistic symptoms. People with normal intelligence/adaptive functioning and milder autistic symptoms generally have the best outcomes, those with MR or intellectual disability and severe autistic symptoms have the worst outcomes within the continuum, and those with normal cognitive-adaptive skills and severe autistic symptoms generally do better than those with MR or intellectual disability and mild autistic symptoms,[328,333] which reaffirms the contribution of intelligence rather than degree of atypicality (autistic symptoms). However, within the subgroup of children with normal intelligence, the degree of atypicality then becomes more important in determining prognosis. Many believe that people with AS have better outcomes than those with other ASDs. This may be true, because by definition, all those with AS have normal intelligence. One adult outcome study found that although those with AS tend to have a greater likelihood of earning a college degree than those with high-functioning autism/PDD-NOS, the college education did not significantly affect employment or marriage status.[331,334]

Genetic Counseling

Genetic counseling regarding recurrence risk in siblings is important even when the etiologic evaluation is negative, because the recurrence risk is approximately 5% to 6% (range: 2%–8%) in a family with 1 child with an idiopathic ASD.[67,68] The prevalence of abnormality in siblings is even higher, perhaps 20%, when the broader phenotype or milder constellation of similar social, communication, and behavioral abnormalities is considered.[68] If there are already 2 siblings with ASDs in a family, it is likely that the recurrence risk for a strictly defined ASD in subsequent offspring is well above 8% and may approach 25%, but there is insufficient evidence to be more precise.[68] It is important to discuss the recurrence risk promptly after diagnosis to provide parents with this information before they conceive another child.[67] When an etiology is determined, the recurrence risk may be lower or higher than the risk in idiopathic ASD, depending on the syndrome or condition identified, and prenatal diagnosis may be possible.

GUIDANCE FOR PEDIATRICIANS REGARDING THE IDENTIFICATION AND EVALUATION OF CHILDREN WITH ASDs

In summary, most PCPs can expect to care for several children with ASDs in the context of the medical home.[5] No two children with ASDs will be exactly alike; each will have his or her own constellation of diagnostic and management challenges. The PCP has an important role in the early identification of children with ASDs. PCPs should do the following:

1. Conduct surveillance at every well-child visit. Be a good listener and recognize the early subtle red flags that indicate the possibility of an ASD. Be especially vigilant for younger siblings of a child who has already been diagnosed with an ASD.[253]
2. Screen at 18[246,260] and 24[260] months and any other time when parents raise a concern about a possible ASD. Although no screening tool is perfect, choose and become comfortable with at least 1 tool for each age group and use it consistently. Before 18 months of age, screening tools that target social and communication skills may be helpful in systematically looking for early signs of ASDs.[261]
3. If an ASD-specific screening result is negative but either the parents or the PCP remain somewhat concerned, then the PCP should schedule the child for an early, targeted clinic visit to address these persistent concerns.
4. Act on a positive screening result or when a child demonstrates 2 or more risk factors. Do not take a "wait-and-see" approach. Depending on the age of the child, simultaneously refer for all 3: comprehensive ASD evaluation; early intervention/early childhood education services; and an audiologic evaluation. Do not wait for a definitive diagnosis of an ASD to refer for developmental services; early intervention can be beneficial even if it targets the child's unique deficits. The intervention strategy can be modified if needed when the child is determined to have an ASD.

The science of ASDs is expanding rapidly. Newer tools are under development and should become available to clinicians so that children can be screened and evaluated more efficiently and with greater accuracy in the future.

The reader is referred to the accompanying AAP clinical report, "Management of Children With Autism Spectrum Disorders,"[303] to learn more about specific techniques and challenges in caring for children with ASDs within the context of a pediatric medical home.

APPENDIX 1: REIMBURSEMENT FOR SCREENING ACTIVITIES

Reimbursement for the administration of developmental and ASD-specific screening tools is an important aspect of screening. Developmental screening tests, including ASD-specific tests that are completed by a parent or nonphysician staff member and are reviewed and interpreted by the physician, can be billed appropriately by using *Current Procedural Terminology* (CPT) code 96110.[246]

Tools that include a direct clinical observation component have the benefit of providing some potentially more objective information, and aspects of behavior that parents may not have noticed can be sampled. Extended

screening tests that include a direct testing component can be billed appropriately by using CPT code 96111.[246]

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Clinical Report—Identification and Management of Eating Disorders in Children and Adolescents

abstract

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The incidence and prevalence of eating disorders in children and adolescents has increased significantly in recent decades, making it essential for pediatricians to consider these disorders in appropriate clinical settings, to evaluate patients suspected of having these disorders, and to manage (or refer) patients in whom eating disorders are diagnosed. This clinical report includes a discussion of diagnostic criteria and outlines the initial evaluation of the patient with disordered eating. Medical complications of eating disorders may affect any organ system, and careful monitoring for these complications is required. The range of treatment options, including pharmacotherapy, is described in this report. Pediatricians are encouraged to advocate for legislation and policies that ensure appropriate services for patients with eating disorders, including medical care, nutritional intervention, mental health treatment, and care coordination. *Pediatrics* 2010;126: 1240–1253

INTRODUCTION

Increases in the incidence and prevalence of anorexia nervosa (AN), bulimia nervosa (BN), and other eating disorders in children and adolescents make it critically important that pediatricians be familiar with early detection and appropriate management of these disorders. Results of epidemiologic studies have indicated that the numbers of children and adolescents with eating disorders increased steadily from the 1950s onward.[1–4] During the past decade, the prevalence of obesity in children and adolescents has also increased dramatically,[5–9] accompanied by further emphasis on dieting and weight loss among children and adolescents.[10–15]

The epidemiology of eating disorders has gradually changed; there is an increasing prevalence of eating disorders in males[16–19] and minority populations in the United States[20–23] as well as in countries in which eating disorders had not been commonly seen.[3,4,24,25] Of particular concern is the increasing prevalence of eating disorders at progressively younger ages.[19,26,27] A recent analysis by the Agency for Healthcare Research and Quality revealed that from 1999 to 2006, hospitalizations for eating disorders increased most sharply—119%—for children younger than 12 years.[19]

It is estimated that approximately 0.5% of adolescent girls in the United States have AN, that approximately 1% to 2% meet diagnostic criteria for BN, and that up to 5% to 10% of all cases of eating disorders occur in males. A large number of people with eating disorders do not meet the strict criteria set forth in the American Psychiatric Association's

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KEY WORDS
anorexia nervosa, bulimia nervosa, eating disorders

ABBREVIATIONS
AN—anorexia nervosa
BN—bulimia nervosa
DSM-IV-TR—*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Text Revision*
HPA—hypothalamic-pituitary-adrenal
SSRI—selective serotonin-reuptake inhibitor

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Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR) for AN or BN and are labeled as having "partial syndromes" or "eating disorder not otherwise specified" (ED NOS).[28] There are many more patients with ED NOS than there are patients with AN or BN; the prevalence is estimated to be between 0.8% and 14%, depending on the definition used.[29] These patients often experience the same physical and psychological consequences as do those who reach the threshold for diagnosis of AN or BN.[28–34] Athletes and performers, particularly those who participate in sports and activities that reward a lean body habitus (eg, gymnastics, running, wrestling, dance, modeling) may be at particular risk of developing partial-syndrome eating disorders.[35,36]

The etiology of eating disorders is multifactorial, and there is increasing evidence from both family and twin studies for a strong genetic component that is shared between AN and BN.[37,38] The mechanism(s) by which genetic factors influence risk have not been elucidated, but various hypotheses have been proposed. Genetic predisposition to various trait disturbances such as behavioral rigidity, perfectionism, or harm avoidance may be more salient than genetic influences on eating, hunger, or satiety.[39–41] Genetic effects seem to be "activated" by puberty,[42–44] and there is strong evidence for genetic-environment interactions.[39,40]

Dieting has also been implicated as a potent proximal risk factor in the development of disordered eating and eating disorders.[45–47] In 1 community-based study, dieters at 5-year follow-up were at significantly higher risk of disordered eating behaviors (eg, vomiting or using diet pills or laxatives) than nondieters and were also at increased risk of obesity.[47] In another large community cohort, dieters were 5 times more likely to develop an eating disorder and severe dieters were 18 times more likely to develop an eating disorder than nondieters.[48]

Neuroendocrine abnormalities have been implicated in the etiology of eating disorders. Leptin is a circulating hormone produced in adipose tissue and seems to have a significant role in mediating the neuroendocrine effects of AN. Leptin concentrations are sensitive to the acute metabolic effects of decreased intake and energy deficits, and decreased circulating leptin concentrations reflect depleted stores of body fat.[49–51] Physical hyperactivity is a common feature of AN and sometimes manifests as restlessness, athleticism, or compulsive exercise. This hyperactivity also seems to be mediated by leptin.[51]

Physical hyperactivity associated with weight loss seems to occur in animals as well, apparently mediated by hyperactivity of the hypothalamic-pituitary-adrenal (HPA) axis. Syndromes that resemble AN, characterized by food refusal, physical overactivity, and extreme weight loss, occur in pigs, sheep, and goats bred for leanness.[52] Caloric restriction coupled with environmental stress produces animal models for binge-eating.[53] These animals overeat dramatically despite nutritional satiety and normal energy status, which strongly suggests that reward circuits are being activated rather than metabolic needs being satisfied.[43,53]

In community-based studies of adolescents, disturbances of body image and overconcern about body shape are common, although the prevalence of eating disorders remains low.[54] These results reinforce the likelihood of epigenetic effects in which the development of eating disorders reflects the intersection between genetic predisposition, environmental triggers, and personal experience.

SCREENING FOR EATING DISORDERS IN PRACTICE

Primary care providers are in a unique position to detect the onset of eating disorders at the earliest stages and to stop their progression.[32,33] Pediatricians should screen for eating disorders as part of annual health supervision or during preparticipation sports examinations by monitoring weight and height longitudinally and paying careful attention to potential signs and symptoms of disordered eating.

Screening questions about eating patterns and body image should be asked of all preteens and adolescents. The *Bright Futures* guidelines provide examples for addressing this issue with adolescents of different ages.[55] The SCOFF questionnaire, although validated only in adults, can provide a framework for screening (Table 1).[56] Weight, height, and BMI should be determined regularly and plotted on appropriate growth charts. Deviations from normal are easier to identify visually, because nutritional insufficiency may be manifest by falloff in either height or weight percentiles rather than actual weight loss. Growth charts are available for plotting changes in weight, height, and BMI over time and for comparing individual measurements with age-appropriate population norms.

Any evidence of excessive weight concern, inappropriate dieting, or a pattern of weight loss requires further attention, as does primary or secondary

TABLE 1 The SCOFF Questionnaire[56]

1. Do you make yourself **sick** because you feel uncomfortably full?
2. Do you worry you have lost **control** over how much you eat?
3. Have you recently lost **>1 stone** (6.3 kg or 14 lb) in a 3-mo period?
4. Do you believe yourself to be **fat** when others say you are too thin?
5. Would you say that **food** dominates your life?

One point should be given for every "yes" answer; a score of ≥2 indicates a likelihood of AN or BN.

amenorrhea or a failure to achieve appropriate increases in weight or height in growing children. In each of these situations, careful assessment for the possibility of an eating disorder and close monitoring at intervals as frequent as every 1 to 2 weeks may be needed until the situation is clarified. Adolescent girls who seek physician care for weight, shape, or eating concerns have been shown to be at significantly higher risk of a subsequent diagnosis of AN.[57]

A number of studies have shown that most adolescent girls express concerns about being overweight, and many may diet inappropriately.[10–12,14] Most of these children and adolescents do not have an eating disorder. On the other hand, it is known that patients with eating disorders often try to hide their illness, so simple denials by the adolescent do not exclude the possibility of an eating disorder. Obtaining collateral history from a parent may help identify abnormal eating attitudes or behaviors, although parents may, at times, be unaware or in denial as well. When an adolescent is referred to a pediatrician because parents, friends, or school personnel suspect the possibility of an eating disorder, it is likely that disordered eating is present. Pediatricians must, therefore, not be lulled into a false sense of security if the adolescent denies all symptoms. Table 2 outlines questions that are useful in eliciting a history of eating disorders, and Table 3 delineates possible physical findings in children and adolescents with eating disorders.

DSM-IV-TR criteria[28] for the diagnosis of AN and BN are outlined in Table 4. These criteria focus on the weight loss, attitudes and behaviors, and amenorrhea displayed by patients with eating disorders. Limitations of these criteria, especially as they relate to children and adolescents, have been discussed extensively in the literature,[54,58–61] and revisions to these criteria have been proposed for the fifth edition of the manual.[60,61] Alternative schema for the classification of eating disorders in children have been described to better reflect the range of eating issues seen.[58,62]

Younger patients (<13 years of age) with eating disorders are more likely to have premorbid psychopathology (depression, obsessive-compulsive disorder, or other anxiety disorders) and are less likely to have binge/purge behaviors associated with their illness. The predominance of females is far less; among the youngest patients with eating disorders, males and females may be equally affected. Weight loss often occurs at a faster rate than in older patients. Still, studies have shown that more than half

TABLE 2 History

Specific history
What is the most you ever weighed? How tall were you then? When was that?
What is the least you ever weighed in the past year? How tall were you then? When was that?
What do you think is your healthy weight?
What would you like to weigh?
Exercise: how much, how often, level of intensity? How stressed are you if you miss exercising?
Current eating habits: adequacy of intake, portion sizes, food restrictions, picky eating, fluid intake, ritualized eating habits? Recent vegetarianism? Excessive noncaloric fluid intake?
24-h diet history?
Calorie-counting? Fat gram–counting? Carbohydrate-counting?
Any binge-eating? Frequency? Triggers?
Purging history?
Use of diuretics, laxatives, diet pills, or ipecac? Ask about elimination pattern, constipation, diarrhea. Any vomiting? Frequency? Timing in relation to meals?
Any previous therapy? What kind and how long? What was and was not helpful?
Symptoms of hyperthyroidism, diabetes, malignancy, infection, inflammatory bowel disease?
Family history: obesity, eating disorders, depression, other mental illness (especially anxiety disorders and obsessive-compulsive disorder), substance abuse by parents or other family members?
Menstrual history: age at menarche? Regularity of cycles? Last menstrual period?
Use of cigarettes, drugs, alcohol?
Use of anabolic steroids (especially in boys)?
Use of stimulants?
Involvement with proanorexia ("pro-ana") or probulimia ("pro-mia") Web sites
History of physical or sexual abuse?
Review of symptoms
Dizziness, presyncope, syncope, fatigue?
Pallor, easy bruising or bleeding?
Cold intolerance? Cold extremities?
Palpitations, chest pain, shortness of breath? Exercise intolerance?
Hair loss, lanugo, dry skin?
Fullness, bloating, abdominal pain, epigastric burning?
Vomiting, symptoms of gastroesophageal reflux?
Change in bowel habits? Diarrhea, constipation, rectal bleeding?
Weakness, muscle cramps?
Menstrual irregularities?

TABLE 3 Physical Examination Findings Sometimes Seen in Children and Adolescents With Eating Disorders

Sinus bradycardia; other cardiac arrhythmias
Orthostatic changes in pulse (>20 beats per min) or blood pressure (>10 mm Hg)
Hypothermia
Cachexia; facial wasting
Cardiac murmur (one-third with mitral valve prolapse)
Dull, thinning scalp hair
Sialoadenitis (parotitis most frequently reported)
Angular stomatitis; palatal scratches; oral ulcerations; dental enamel erosions
Dry, sallow skin; lanugo
Bruising/abrasions over the spine related to excessive exercise
Delayed or interrupted pubertal development
Atrophic breasts; atrophic vaginitis (postpubertal)
Russell sign (callous on knuckles from self-induced emesis)
Cold extremities; acrocyanosis; poor perfusion
Carotenemia (orange discoloration of the skin, particularly palms and soles)
Edema of the extremities
Flat or anxious affect

TABLE 4 Diagnosis of AN, BN, and Eating Disorders Not Otherwise Specified, From DSM-IV-TR[28]

AN

1. Refusal to maintain body weight at or above a minimally normal weight for age and height (ie, weight loss that leads to maintenance of body weight 85% of that expected or failure to make expected weight gain during period of growth and leads to a body weight of 85% of that expected).
2. Intense fear of gaining weight or becoming fat, even though underweight
3. Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of current body weight
4. In postmenarcheal females, amenorrhea (ie, the absence of at least 3 consecutive menstrual cycles)

Types

- Restricting type: no regular bingeing or purging (self-induced vomiting or use of laxatives and diuretics)
- Binge-eating/purging type: regular bingeing or purging behavior

BN

1. Recurrent episodes of binge-eating characterized by (*a*) eating, in a discrete period of time, an amount of food that is definitely larger than most people would eat in a similar period of time and under similar circumstances and (*b*) a sense of lack of control over eating during the episode
2. Recurrent inappropriate compensatory behavior to prevent weight gain, such as self-induced vomiting, misuse of laxatives, diuretics, enemas, or other medications; fasting; or excessive exercise
3. The binge-eating and inappropriate compensatory behaviors both occur, on average, at least twice per week for 3 mo
4. Self-evaluation unduly influenced by body shape or weight
5. The disturbance does not occur exclusively during episodes of AN

Types

- Purging type: the person has regularly engaged in self-induced vomiting or misuse of laxatives, diuretics, or enemas
- Nonpurging type: the person has used other inappropriate compensatory behaviors, such as fasting or excessive exercise, but has not regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics, or enemas

Eating disorder not otherwise specified

Disorders of eating that do not meet the criteria for either AN or BN; examples include

- All criteria for AN are met except the patient has regular menses
- All criteria for AN are met except that despite significant weight loss, weight remains in the normal range
- All criteria for BN are met except that binge-eating and inappropriate compensatory behaviors occur less frequently than twice per week or for a duration of <3 mo
- A patient with normal body weight who regularly engages in inappropriate compensatory behavior after eating small amounts of food (eg, self-induced vomiting after eating 2 cookies)

TABLE 5 Differential Diagnosis of Eating Disorders

Gastrointestinal disorders
Inflammatory bowel disease
Celiac disease
Infectious diseases
Chronic infections (human immunodeficiency virus infection, tuberculosis, others)
Endocrine disorders
Hyperthyroidism (hypothyroidism)
Diabetes mellitus
Other endocrine disorders (eg, hypopituitarism, Addison disease)
Other psychiatric disorders
Obsessive-compulsive disorder and anxiety disorders
Substance abuse
Other disorders
Central nervous system lesions (including malignancies)
Other cancers
Superior mesenteric artery syndrome (more commonly a consequence of severe weight loss)

of all children and adolescents with eating disorders may not fully meet all DSM-IV-TR criteria for AN or BN because they do not articulate body-image dissatisfaction or because their inadequate nutrition is manifest by growth failure rather than weight loss to less than 85% of expected weight.[63,64] These patients experience the same medical and psychological consequences of their disorders as do patients who meet criteria for AN or BN. Indeed, because the sequelae of weight loss (or failure to gain weight appropriately) may have even more worrisome implications for younger patients, relaxation of the diagnostic criteria for children and adolescents has been proposed in the development of the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* to facilitate earlier diagnosis and treatment.[61]

INITIAL EVALUATION OF THE PATIENT WITH DISORDERED EATING

When screening raises suspicion of an eating disorder, initial evaluation includes establishing the diagnosis, evaluating medical and nutritional status, determining severity, and performing an initial psychosocial evaluation. This comprehensive evaluation is often performed in the pediatric primary care setting, and primary care clinicians who feel competent and comfortable in performing this assessment are encouraged to do so. Others should refer to appropriate medical subspecialists and mental health personnel to ensure that a complete evaluation is performed. A differential diagnosis for the adolescent with symptoms of an eating disorder can be found in Table 5.

Because eating disorders can affect every organ system and the medical complications can be serious or even life-threatening, a comprehensive history should be taken and a comprehensive physical examination should be performed. The most frequently seen medical complications are listed in Table 6 and are detailed in the following section.

Most laboratory results will be normal in patients with eating disorders; however, normal laboratory results do not exclude serious illness or medical instability in these patients. Still, an initial laboratory assessment should include a complete blood cell count; measurement of serum electrolytes, calcium, magnesium, and glucose; liver function tests; urinalysis; and measurement of thyrotropin level. Additional studies (eg, urine pregnancy test, serum luteinizing and follicle-stimulating hormones, serum prolactin, and se-

TABLE 6 Medical Complications That Result From Eating Disorders

General
Dehydration
Hypokalemia
Hypomagnesemia
Hyponatremia
Irreversible cardiomyopathy and myositis (ipecac toxicity)
Amenorrhea and menstrual irregularities
Low bone mineral density; osteoporosis
Cognitive deficits
Mood symptoms
Obsessive/compulsive symptoms
Suicide
Caloric restriction and weight loss
Inability to maintain body temperature
Prolonged corrected QT interval or increased QT dispersion (uncommon but may predispose patient to sudden death)
Dysrhythmias (including supraventricular beats and ventricular tachycardia, with or without exercise)
Other electrocardiographic abnormalities
Mitral valve prolapse
Pericardial effusions
Delayed gastric emptying and impaired gastrointestinal tract motility
Constipation
Bloating; postprandial fullness
Hypoglycemia
Hypercholesterolemia
Abnormal liver function test results
Sterile pyuria
Anemia, leukopenia; thrombocytopenia
Sick-euthyroid syndrome
Growth retardation
Cortical atrophy
Vomiting-related
Hypochloremic metabolic alkalosis (vomiting)
Esophagitis
Gastroesophageal reflux
Dental erosions
Mallory-Weiss tears
Esophageal or gastric rupture (rare)
Aspiration pneumonia (rare)
Laxative-related
Hyperchloremic metabolic acidosis (laxative abuse)
Hyperuricemia
Hypocalcemia
Fluid retention (may gain up to 10 lb in 24 h) with laxative withdrawal
Refeeding
Diaphoresis and night sweats
Polyuria and nocturia
Peripheral edema
Refeeding syndrome

rum estradiol) may be indicated for patients with amenorrhea. Bone densitometry, using age-appropriate software, should also be considered for those with amenorrhea for more than 6 to 12 months. Other studies including erythrocyte-sedimentation rate, screening for celiac disease, or radiographic imaging, such as computed tomography or MRI of the brain or studies of the upper or lower gastrointestinal system, should be considered if there are uncertainties about the diagnosis. An electrocardiogram should be performed for any patient with cardiovascular signs or symptoms, for any patient with electrolyte abnormalities, or for any patient with significant purging or weight loss.

The initial mental health assessment should include an evaluation of the patient's obsession with food and weight, his or her understanding of the diagnosis, and his or her willingness to receive help. The patient's social functioning at home, in school, and with friends should be assessed. Psychiatric comorbidity is common with eating disorders and is often previously undiagnosed.[34,65] The pediatrician should identify other potential psychiatric diagnoses (such as depression, anxiety, or obsessive-compulsive disorder), which may be a cause or consequence of disordered eating. Use of tobacco, alcohol, or illicit drugs or misuse of prescription or over-the-counter medications may also complicate the management of eating disorders. Suicidal ideation and history of physical or sexual abuse or violence should also be assessed. Suicide attempts and completed suicide are relatively common, particularly for patients who have binge/purge or purging behavior and are a major contributor to eating disorder–associated mortality. Death from suicide is 50 times more likely in patients with AN,[66] and 25% to 35% of patients with BN report a history of attempted suicide.[34]

The parents' reaction to the illness should also be assessed. Parental indifference or denial of the problem or inconsistent views about treatment may affect the course of the illness and recovery.

Determining where and by whom the patient will be treated is an important and practical component of the initial evaluation. Patients with limited nutritional, medical, and psychological dysfunction can be managed in the pediatrician's office in conjunction with outpatient nutrition and mental health support. Patients who are more ill often require more intensive services, ideally delivered by a specialized multidisciplinary team, and sometimes in day-treatment, hospital, or residential settings.

MEDICAL COMPLICATIONS IN PATIENTS WITH EATING DISORDERS

Medical complications associated with eating disorders are listed in Table 5, and details of these complications have been described in many reviews.[32,33,67–74] Significant complications are seen in both outpatients and inpatients.[75] Most of the medical complications of eating disorders resolve with refeeding and/or resolution of purging.[70] However, there is increasing concern that some complications—particularly growth retardation, structural brain changes, and low bone mineral density—may, with time, become irreversible.[72] Malnutrition underlies many of the somatic symptoms seen initially, and these changes are often adaptive to the associated energy deficits. Over time, adaptation fails and signs and symptoms reflect the inability to compensate for inadequate nutrition. Metabolic rate decreases, body temperature can no longer be maintained, and nearly every organ system is compromised.[70,75,76]

Common cardiovascular signs and symptoms include orthostasis with blood pressure and/or pulse changes, bradycardia, and poor peripheral perfusion characterized by cold extremities, delayed capillary refill, and sometimes

acrocyanosis. Conduction abnormalities may occur as a result of myocardial atrophy and are thought to be the most common proximal cause of death with AN. Repolarization abnormalities, characterized by QTc prolongation and/or increased QT dispersion, are reported with widely variable prevalence and seem to be more frequent in older patients and with increasing duration of illness.[77] Repolarization abnormalities are potentially life-threatening and should be managed aggressively. Pericardial effusion, a functional mitral valve prolapse, myocardial dysfunction, and emetine (ipecac-related) cardiomyopathy are all seen less frequently. Congestive heart failure can occur during refeeding, particularly in the setting of electrolyte abnormalities.[72,73,78]

Gastrointestinal complaints are common and sometimes precede diagnosis of the eating disorder. Delayed gastric emptying and increased intestinal transit time often contribute to subjective descriptions of bloating and postprandial fullness, which can further compromise nutritional restoration. In patients who vomit, symptoms of gastroesophageal reflux are common, and upper gastrointestinal bleeding sometimes occurs. Severe bleeding secondary to Mallory-Weiss tears of the esophagus is rare. Constipation is common and often difficult to manage. Nutritional strategies, stool softeners, or polyethylene glycol 3350 (Miralax) are the treatments of choice; stimulant laxatives should be avoided. Rectal prolapse sometimes occurs in the setting of constipation and/or laxative abuse. Hepatic transaminase levels are often elevated as a consequence of malnutrition and are not usually indicative of viral hepatitis. Hypertrophy of the salivary glands often occurs and may be a clue to binge-eating and/or vomiting. Esophageal or gastric rupture are catastrophic but rare complications that usually occur during refeeding.[73]

Fluid and electrolyte abnormalities may occur as a result of purging or with increasing cachexia. Dehydration can be seen in any patient with an eating disorder and can sometimes lead to orthostatic symptoms, presyncope, or syncope. Chronic dehydration and the body's effort to conserve water may induce a pseudohyperaldosteronism, which also leads to hypokalemia. However, significant deficits in total body potassium and the associated risk of arrhythmia may exist even with a normal serum potassium level. Patients with vomiting may have a hypochloremic metabolic alkalosis because of chronic loss of hydrochloric acid. Patients who abuse laxatives may have a hyperchloremic metabolic acidosis related to bicarbonate wasting. Dilutional hyponatremia can be seen in patients who "water load" instead of eating or to misrepresent their weight at outpatient visits. Hypomagnesemia that results from inadequate intake is associated with sudden cardiac death, may interfere with potassium repletion in patients who are hypokalemic, and sometimes contributes to refeeding syndrome.[70] Edema, sometimes significant, may be seen as a result of hypoproteinemia, during refeeding, or in association with laxative abuse.[70]

Endocrine dysfunction is common and includes hypothyroidism, hypercortisolism, and disturbances of the HPA axis, which result in hypogonadotropic hypogonadism, luteal phase abnormalities, and anovulation. Euthyroid-sick syndrome (low free thyroxine, normal thyrotropin) is the most common thyroid abnormality and is reversible with refeeding. Supplemental thyroid hormone is not indicated. Activation of the HPA axis has been clearly demonstrated. In addition to its deleterious effects on growth, thyroid function, and the reproductive system, HPA hyperactivity also contributes to the appetite suppression and physical overactivity that characterize eating disorders.[79] Hypothalamic suppression causing amenorrhea is attributable not only to weight loss but also to physical overactivity, emotional stress, and the metabolic changes associated with acute energy deficits[70,75]; it sometimes precedes weight loss.[70] Hypothalamic secretion of gonadotropins reverts to a prepubertal pattern that reverses with refeeding.[70] Amenorrhea is an important marker for increased risk of low bone mineral density and osteoporosis (discussed in a later paragraph),[80–83] and an intriguing recent report suggested that amenorrhea is also associated with the cognitive impairments seen with AN.[84]

Common skin changes include lanugo, dry scaly skin, and yellow discoloration related to carotenemia. Acrocyanosis can be seen when perfusion is poor. Hair and nail changes are often seen as well, and angular stomatitis may be related to either vomiting or vitamin deficiencies.[70]

Growth retardation, short stature, and pubertal delay may all be seen in prepubertal and peripubertal children and adolescents with eating disorders.[75,85] Many endocrine abnormalities contribute to this growth failure; abnormal thyroid function, abnormal adrenal function, low levels of sex steroids, and uncoupling of growth hormone from insulin-like growth factor 1 (IGF-1) have all been implicated.[72] Catch-up growth has been inconsistently reported in the literature; younger patients may have greater and more permanent effects on growth.[72,86]

Low bone mineral density is a frequent complication of eating disorders in both male and female patients. It is worrisome not only because of the increased risk of pathologic fractures

but also because of its potential to be irreversible and compromise skeletal health across the entire life span. The pathophysiology of abnormal bone mineralization in the eating disorders is likely to be multifactorial; proposed mechanisms include deficiencies of gonadal steroids (estrogen and/or testosterone), deficiencies of calcium and vitamin D, reduction in lean muscle mass and its mechanical effects on bone, and excesses of endogenous glucocorticoids related to hyperactivity of the HPA axis. The reversibility of skeletal changes is unclear and probably varies on the basis of disease severity, the timing of illness and recovery, and perhaps genetic factors. Because adolescence is a critical period for bone mineralization, younger patients with AN are at higher risk of skeletal changes than are older patients. Treatment strategies, such as supplemental estrogen, bisphosphonates, calcium, and vitamin D replacement, have not been shown to be consistently effective, are not a substitute for nutritional recovery, and are not recommended for routine use.[72,87,88]

Volume deficits in both gray and white matter of the brain and associated increases in the cerebrospinal fluid space occur with weight loss in AN and are proportional to weight loss. Brain changes may be associated with elevated cortisol concentrations related to HPA-axis dysfunction, analogous to changes now being reported in other psychiatric disorders such as posttraumatic stress disorder.[89] Cognitive impairment has been demonstrated across the wide range of neuropsychological domains but does not seem to be directly proportional to structural brain changes.[84] Functional imaging studies of the brain show decreases in both global and localized brain activity, but it is unknown whether these decreases precede or are a consequence of weight loss or whether they are reversible.[90] Normalization of white matter occurs with refeeding; however, gray matter changes seem to persist despite weight recovery.[84,89]

TREATMENT CONTINUUM FOR CHILDREN AND ADOLESCENTS WITH EATING DISORDERS

Most adolescent patients with eating disorders will be treated in outpatient settings. Pediatricians play an important role in the management of these patients, assessing treatment progress, screening for and managing medical complications, and coordinating care with nutrition and mental health colleagues. Some pediatricians in primary care practice will feel comfortable in coordinating care; others will choose to refer some or all patients with eating disorders to those with special expertise. Depending on the availability of local resources, these providers may be a specialty eating disorders program, an adolescent medicine specialist, a psychiatrist, or another mental health provider.[32,91]

Collaborative Outpatient Care

Most children and adolescents with eating disorders will be managed in an outpatient setting by a multidisciplinary team coordinated by a pediatrician or medical subspecialist with expertise in the care of children and adolescents with eating disorders. Pediatricians generally work with nursing, nutrition, and mental health colleagues in provision of the medical, nutrition, and mental health care required by these patients.

It is generally accepted that medical stabilization and nutritional rehabilitation are the most important determinants of short-term outcomes and are essential for correcting cognitive deficits to allow for effective mental health interventions. Components of nutritional rehabilitation required in the management of patients with eating disorders have been presented in several reviews.[32,33,92–95] In the United States, oral refeeding is clearly the preferred modality for nutritional rehabilitation. However, for patients who are unwilling or unable to eat, supplements or nasogastric feeding may be life-saving.

Meals and snacks generally are reintroduced or improved in a stepwise manner for those with AN, which leads, in most cases, to an eventual intake of 2000 to 3000 kcal (or more) per day and a weight gain of 0.25 to 1 kg per week. Smaller, more frequent meals; increasing the caloric density of foods; and substituting nutrient fluids (eg, fruit juice) for water can sometimes help patients overcome the postprandial fullness and psychological barriers associated with the substantial increase in caloric intake that is required. Patients with abdominal complaints from acquired nutritionally mediated lactase deficiency may benefit from supplemental lactase. Meals are changed to ensure ingestion of 2 to 3 servings of protein per day. Daily fat intake should be slowly shifted toward a goal of 30 to 50 g per day. The stereotypical and obsessional eating habits favored by many patients with eating disorders and the observation that similar levels of weight loss and malnutrition can lead to dramatically different medical consequences suggest that deficiencies of specific micronutrients may share responsibility with protein-calorie malnutrition for the medical consequences in eating disorders.[70] Food variety should be encouraged, and a multivitamin should be recommended. Behavioral interventions are often required to encourage reluctant (and often resistant) patients to meet necessary caloric intake and weight-gain goals.[96–99]

Ranges for treatment goal weight should be individualized and based on age, height, pubertal stage, premorbid

weight, and previous growth trajectory. Furthermore, for growing children or adolescents, the goal weight range should be reevaluated at regular intervals (eg, every 3 to 6 months) on the basis of changing age and height. In postmenarcheal girls, resumption of menses provides an objective measure of biological health[100]; in 1 recent study, resumption of menses occurred at a mean BMI percentile of 27; 75% of the girls resumed menstruating once they had achieved and sustained approximately the 40th percentile for BMI.[101] Resumption of menses can also be used to refine the treatment goal weight.

Family-Based ("Maudsley") Therapy

Over the past decade, specialized eating disorder–focused family-based interventions, based on work originally performed at the Maudsley Hospital in London, have gained attention in the treatment of adolescent AN because of promising short-term and long-term outcomes. Although the etiologic underpinnings of this treatment approach have lost much of their support over time (ie, it is no longer believed that eating disorders are caused mainly by family dysfunction), family-based interventions, nevertheless, remain an effective and evidence-based treatment strategy for adolescent AN in both open trials and randomized controlled studies.[102–105] Family-based interventions are typically described as having 3 phases. In the first phase, parents, supported by the therapist, take responsibility to make certain that their adolescent is eating adequately and limiting other pathologic weight-control behaviors. In the second phase, substantial weight recovery has already occurred, and the adolescent is helped to gradually resume responsibility for his or her own eating. In the final phase of treatment, weight has been restored, and the therapy shifts to address the more general issues of adolescent development and how they may have been derailed by the eating disorder.[102] A manual for providers[106] and a family-support manual[107] are now available. Unfortunately, family-based treatment by experienced providers is not available in all communities. Nevertheless, the essential principles of family-based treatment can still be encouraged by community providers in their work with patients and families.[105] Family-based treatment may not be suitable for all patients; caution has been advised for families in which there is parental psychopathology or hostility toward the affected child, for older patients, or for patients who are the most medically compromised.[102,104] Additional randomized controlled studies of family-based treatment, including studies of long-term outcomes, are still needed. Family-based approaches are now being evaluated for the treatment of BN as well.[108]

Treatment of BN in adolescents has been poorly studied, and there is little evidence to guide treatment recommendations. For adults, BN-focused cognitive behavioral therapy is the treatment of choice. Pharmacotherapy (see "Pharmacotherapy") has been helpful as well.

Day-Treatment Programs

Day-treatment programs (day hospitalization, partial hospitalization) have been developed to provide an intermediate level of care for patients with eating disorders who require more than outpatient care but less than 24-hour hospitalization.[109–112] These programs have been used in an attempt to prevent the need for hospitalization; in some cases, they are used as a "step-down" from inpatient to outpatient care. Day-treatment programs are less costly and more accessible than traditional hospitalization. In addition, they allow for more family and social support and for recovery to occur in a more naturalistic environment that may be more generalizable.[109] Day treatment typically involves 8 to 10 hours of care (including meals, therapy, groups, and other activities) by a multidisciplinary staff 5 days/week. Evaluation of day-treatment programs has been characterized by small samples and the difficulty in undertaking randomized controlled trials.[113] Still, short-term outcomes have generally been reported to be good.[110,113,114] A recent study that used a range of outcome measures, including BMI and measurement of binge-purge behavior, demonstrated day treatment to be highly effective in the treatment of both restrictive and binge-purge AN and BN. Furthermore, these results were sustained or improved over 18 months of follow-up.[113]

Hospital-Based Treatment

Hospital-based treatment for eating disorders is less common when intensive outpatient or day-treatment programs are available. Hospitalization is much more frequently required for adolescent patients with AN than for patients with BN. Criteria for hospitalization of children and adolescents with eating disorders have been enumerated by the Society for Adolescent Medicine and are listed in Table 7.[32] Similar criteria are endorsed in the American Psychiatric Association's practice guideline for the treatment of patients with eating disorders[33] and by other organizations.[115] These criteria acknowledge that hospitalization may be required because of medical or psychiatric needs or when there is failure of outpatient treatment to achieve medical, nutritional, or psychiatric goals. Unfortunately, many third-party payers in the United States do not adhere to these criteria and make it difficult for some children and adolescents with eating disorders to receive the

TABLE 7 Criteria for Hospital Admission for Children, Adolescents, and Young Adults With Eating Disorders[32]

AN
<75% ideal body weight or ongoing weight loss despite intensive management
Refusal to eat
Body fat < 10%
Heart rate < 50 beats per min daytime; <45 beats per min nighttime
Systolic pressure < 90 mm Hg
Orthostatic changes in pulse (>20 beats per min) or blood pressure (>10 mm Hg)
Temperature < 96°F
Arrhythmia
BN
Syncope
Serum potassium concentration < 3.2 mmol/L
Serum chloride concentration < 88 mmol/L
Esophageal tears
Cardiac arrhythmias including prolonged QTc
Hypothermia
Suicide risk
Intractable vomiting
Hematemesis
Failure to respond to outpatient treatment

recommended level of care.[116,117] Children and adolescents have the best prognosis if their disease is treated rapidly and aggressively (an approach that may not be as effective for adults with a more long-term, protracted course).[91] Hospitalization, when indicated, allows for medical stabilization, adequate weight gain, and establishment of safe and healthy eating habits and improves the prognosis for children and adolescents. Discharge of hospitalized patients too soon often results in medical complications, a worse clinical course, and readmission. In 1 study, patients with AN who were discharged while still underweight had a 50% readmission rate compared with a rate of less than 10% for patients who had reached at least 90% of their recommended average body weight before discharge.[118]

The pediatrician involved in the treatment of hospitalized patients must be prepared to provide nutrition via a nasogastric tube or even intravenously when necessary. In hospitalized male adolescents, supplemental nighttime nasogastric feedings have been shown to significantly increase both weight gain and improvement in BMI compared with oral refeeding alone.[119]

Refeeding syndrome may occur in severely malnourished patients, particularly in the setting of aggressive nutritional rehabilitation. Refeeding syndrome refers to a constellation of metabolic, cardiovascular, neurologic, and hematologic complications primarily related to shifts of phosphate from extracellular to intracellular spaces in the setting of total body phosphorus depletion. The syndrome is most common in hospitalized patients during the first week of hospitalization and patients who are receiving supplemental enteral or parenteral nutrition. Cautious refeeding, careful monitoring of serum electrolyte, magnesium, phosphorus, and glucose levels, and a low threshold for phosphorus supplementation prevent the development of refeeding syndrome.[71,72,120–123] Refeeding syndrome is unusual after the first 2 weeks of nutritional rehabilitation or in patients being treated in the outpatient setting.

Pharmacotherapy

No medications have been approved by the US Food and Drug Administration for the treatment of AN.[124] Pharmacotherapy is sometimes prescribed but is typically targeted at comorbid symptoms of depression and anxiety. Selective serotonin-reuptake inhibitors (SSRIs) are most often used but may not be effective in severely malnourished patients. There is also limited evidence for the use of SSRIs for relapse prevention in AN.[125] In recent case reports and open-label trials, atypical neuroleptic agents, predominantly olanzapine (Zyprexa), have been noted to improve both weight gain and dysfunctional thinking in patients with AN.[126] A recently completed randomized, double-blind, placebo-controlled trial in adults showed a significant increase in weight gain in those who were taking olanzapine and a concomitant decrease in obsessive symptoms, although the effect size was modest.[127] Further evaluation of the effectiveness of these agents is underway, and caution is warranted because of the risk of developing insulin resistance and metabolic syndrome.

In contrast to AN, several pharmacologic agents have been demonstrated to be effective for the treatment of BN. Although only fluoxetine has been approved by the Food and Drug Administration, other SSRIs, serotonin/norepinephrine-reuptake inhibitors (eg, venlafaxine), and tricyclic antidepressants have also been shown to decrease binge-eating and purging in BN.[124,128] Topiramate has been shown to significantly decrease binge-eating and may be an option for patients who do not respond to or are not able to tolerate SSRIs.[129] Other drugs, including naltrexone and ondansetron (Zofran), are being used with some success in BN, although data are lacking to recommend their use more broadly.[130]

Hormonal supplementation, although capable of restoring menstruation, has not been shown to reliably improve bone mineral density and is not a substitute for nutritional rehabilitation and restoration of positive energy balance.

PROGNOSIS

The prognosis of eating disorders in adolescents has varied widely in the literature, and outcomes have depended on methodology, definitions of recovery, and duration of follow-up in the studies reported.[131] Adolescent outcomes are significantly better than the outcomes reported in adults. Longitudinal reports reflect a more optimistic and less hopeless outcome; followed over time, the majority of patients fully recover, and an even

larger proportion have a behavioral cure (normal eating, normal weight, and resumption of menses). However, these results accrue only after more than 10 years of follow-up; therefore, patients, their families, and clinicians must be prepared to remain engaged in what may sometimes be a protracted treatment process.[132–134]

Strober et al[132] conducted an important study in which 95 people who had been hospitalized for AN as adolescents were followed for 10 to 15 years. By the end of follow-up, 86.3% had achieved partial or complete recovery, and there were no deaths. However, the median time to partial recovery was 57.4 months, and the median time to full recovery (met by >75% of the study population) was 79.1 months. A study from Germany produced similar findings; at 10-year follow-up, 69% of the patients (including 7 boys) had achieved full recovery, and there were no deaths. Again, however, the course was protracted and the authors pointed out a high rate of residual psychiatric disorders even after full recovery from AN.[135]

Patients with an earlier age of onset seem to have a better prognosis.[85,134] Other characteristics associated with a better prognosis include shorter duration of symptoms and a better parent-child relationship. Purging behavior, physical hyperactivity, more significant weight loss, and disease chronicity are all associated with a less favorable prognosis.[134] Even after recovery, there are high rates of residual psychiatric illness—predominantly depression and anxiety—that persist.[133,136,137] A meta-analysis of 119 AN outcome studies showed little improvement in the success of treatment over the 5 decades reviewed.[133]

Mortality rates for adolescents with both AN and BN are lower than those that have historically been reported.[133,134] In a recent meta-analysis, the mortality rate among adolescents with AN was reported to be 1.8% compared with a mortality rate of 5.9% when adults and adolescents were considered together.[134] Mortality, when it does occur, is most often attributable to the complications of starvation or to suicide.[66]

PEDIATRICIANS' ROLE IN PREVENTION AND ADVOCACY

Efforts to prevent eating disorders can take place both in practice and community settings, such as schools. Primary care pediatricians can help families and children learn to apply the principles of proper nutrition and physical activity and to avoid an unhealthy emphasis on weight and dieting.[138] In addition, pediatricians can screen to detect the early onset of disordered eating and be careful to avoid seemingly innocuous statements (such as "you could stand to lose a little weight") that are sometimes reported by patients to have triggered the onset of their eating disorder. At the community level, there is general agreement that changes in the cultural approaches to weight, dieting, and body image will be required to decrease the growing numbers of children and adolescents at risk of developing eating disorders. This cultural shift is made more challenging by the increasing prevalence of obesity and the competing responsibility to address its health risks as well.[15]

A variety of successful programs for preventing eating pathology have been developed for various settings.[139] The largest effect sizes were seen in programs targeted at high-risk populations, in programs that were interactive rather than didactic, and in programs aimed at older adolescents. Content varied even in the most successful programs, which suggests that a variety of approaches may be effective. Multisession programs were more effective than single-session programs,[140] and there has even been some concern that single-session programs may be counterproductive.[141–146] An important question currently being asked is whether we can work simultaneously toward the prevention of eating disorders and obesity.[15]

Reimbursement issues continue to limit the access of many patients with eating disorders to appropriate services. Availability of mental health services, lack of mental health parity, and service "carve-outs" all have been barriers to patients and families who seek clinically necessary treatment and seem to be disproportionately problematic for patients with eating disorders. Despite evidence of its effectiveness, family-based treatment is not available in many communities. Through advocacy, pediatricians can help support health care reform efforts that will ensure that children and adolescents with eating disorders are able to receive necessary care.

GUIDANCE FOR PEDIATRICIANS

1. Pediatricians need to be knowledgeable about the risk factors and early signs and symptoms of disordered eating and eating disorders.
2. When counseling families on preventing obesity, pediatricians should focus on healthy eating and building self-esteem while still addressing weight concerns. Care needs to be taken not to inadvertently enable excessive dieting, compulsive exercise, or other potentially unhealthy weight-management strategies.
3. Pediatricians should be encouraged to calculate and plot weight, height, and BMI by using age- and gender-appropriate charts and assess menstrual status in girls at annual health supervision visits.
4. Pediatricians should screen patients for disordered eating

and related behaviors and be prepared to intervene when necessary.

5. Pediatricians should monitor or refer patients with eating disorders for medical and nutritional complications.
6. Pediatricians need to be familiar with treatment resources in their communities so that they can coordinate or facilitate multidisciplinary care.
7. Pediatricians can play a role in primary prevention during office visits and through school-based and community interventions with a focus on education, early screening, and advocacy.
8. Pediatricians are encouraged to advocate for legislation and policy changes that ensure appropriate services for patients with eating disorders, including medical care, nutritional intervention, mental health treatment, and care coordination, in settings that are appropriate for the severity of the illness.

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POLICY STATEMENT

Identifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on Children With Disabilities
Section on Developmental Behavioral Pediatrics
Bright Futures Steering Committee
Medical Home Initiatives for Children With Special Needs Project Advisory Committee

ABSTRACT

Early identification of developmental disorders is critical to the well-being of children and their families. It is an integral function of the primary care medical home and an appropriate responsibility of all pediatric health care professionals. This statement provides an algorithm as a strategy to support health care professionals in developing a pattern and practice for addressing developmental concerns in children from birth through 3 years of age. The authors recommend that developmental surveillance be incorporated at every well-child preventive care visit. Any concerns raised during surveillance should be promptly addressed with standardized developmental screening tests. In addition, screening tests should be administered regularly at the 9-, 18-, and 30-month visits. (Because the 30-month visit is not yet a part of the preventive care system and is often not reimbursable by third-party payers at this time, developmental screening can be performed at 24 months of age. In addition, because the frequency of regular pediatric visits decreases after 24 months of age, a pediatrician who expects that his or her patients will have difficulty attending a 30-month visit should conduct screening during the 24-month visit.) The early identification of developmental problems should lead to further developmental and medical evaluation, diagnosis, and treatment, including early developmental intervention. Children diagnosed with developmental disorders should be identified as children with special health care needs, and chronic-condition management should be initiated. Identification of a developmental disorder and its underlying etiology may also drive a range of treatment planning, from medical treatment of the child to family planning for his or her parents.

INTRODUCTION

Early identification of developmental disorders is critical to the well-being of children and their families. It is an integral function of the primary care medical home[1] and an appropriate responsibility of all pediatric health care professionals. Delayed or disordered development can be caused by specific medical conditions

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Key Words
development, developmental disorders, developmental screening, disabilities, children with special health care needs, early intervention, medical home

Abbreviations
AAP—American Academy of Pediatrics
CPT—*Current Procedural Terminology*

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and may indicate an increased risk of other medical complications. Delayed or disordered development may also indicate an increased risk of behavior disorders or associated developmental disorders. Early identification should lead to further evaluation, diagnosis, and treatment. Early intervention is available for a wide range of developmental disorders; their prompt identification can spur specific and appropriate therapeutic interventions. Identification of a developmental disorder and its underlying etiology may also affect a range of treatment planning, from medical treatment of the child to family planning for his or her parents.

Current detection rates of developmental disorders are lower than their actual prevalence, which suggests that the challenges to early identification of children with developmental disorders have not been overcome.[2–4] A recent survey of American Academy of Pediatrics (AAP) members revealed that despite publication of the 2001 policy statement "Developmental Surveillance and Screening of Infants and Young Children"[5] and national efforts to improve developmental screening in the primary care setting, few pediatricians use effective means to screen their patients for developmental problems.[2] This 2006 statement replaces the 2001 policy statement and provides an algorithm as a strategy to support health care professionals in developing a pattern and practice of attention to development that can and should continue well beyond 3 years of age.

We recommend that developmental surveillance, as described later, be incorporated at every well-child visit. Any concerns raised during surveillance should be promptly addressed. In addition, standardized developmental screening tests should be administered regularly at the 9-, 18-, and 30-month* visits. Pediatric health care professionals may also find it useful to conduct school-readiness screening before the child's attendance at preschool or kindergarten. These recommendations represent our consensus; further research to evaluate the effectiveness of the proposed approach and available screening tools is encouraged. Separate recommendations aimed at the screening of children for behavioral and emotional disorders are also under consideration by the AAP and are not included in this document.

The detection of developmental disorders is an integral component of well-child care. Title V of the Social Security Act (42 USC Chapter 7, Subchapter V §§701-710 [1989]) and the Individuals With Disabilities Education Improvement Act (IDEA) of 2004 (Pub L No. 108-446) reaffirm the mandate for child health professionals to provide early identification of, and intervention for, children with developmental disabilities through community-based collaborative systems. The medical home is the ideal setting for developmental surveillance and screening of children and adolescents. Parents expect their medical home, as the site of their child's continuous and comprehensive care, to be interested in children's development throughout childhood and adolescence, to competently identify developmental strengths and weaknesses, and to be knowledgeable of available community resources to facilitate referrals when needed.

Developmental screening is included in the AAP "Recommendations for Preventive Pediatric Health Care"[6] or "periodicity schedule" and is further recommended by the 2 current AAP compilations of well-child care guidelines: *Bright Futures*[7] and *Guidelines for Health Supervision III*.[8] In collaboration with other experts in child health care, the AAP is currently revising *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*. It is hoped that the third edition of *Bright Futures* being developed by the AAP and the revised periodicity schedule will be consistent with the recommendations of this document.

Note Regarding Language

Within the context of this document, clear distinctions have been drawn among (1) surveillance, the process of recognizing children who may be at risk of developmental delays, (2) screening, the use of standardized tools to identify and refine that recognized risk, and (3) evaluation, a complex process aimed at identifying specific developmental disorders that are affecting a child. These definitions build on existing definitions.[9] In a further effort to ensure clarity throughout the document, we have purposefully avoided the term "assessment." Although the Individuals With Disabilities Education Improvement Act of 2004—and others—use "assessment" as a synonym for "evaluation," this usage is not universally shared.

"Developmental delay" is used in this statement for the condition in which a child is not developing and/or achieving skills according to the expected time frame. The terms "delayed development," "disordered development," and "developmental abnormality" are used synonymously. "Developmental disorder" and "developmental disability" refer to a childhood mental or physical impairment or combination of mental and physical impairments that result in substantial functional limitations in major life activities.[10]

THE ALGORITHM†

1. Pediatric Patient at Preventive Care Visit

Developmental concerns should be included as one of several health topics addressed at each pediatric pre-

*Because the 30-month visit is not yet a part of the preventive care system and is often not reimbursable by third-party payers at this time, developmental screening can be performed at 24 months of age. In addition, because the frequency of regular pediatric visits decreases after 24 months of age, a pediatrician who expects that his or her patients will have difficulty attending a 30-month visit should conduct screening during the 24-month visit.

†Numbers and headings refer to steps in the algorithm (Fig 1).

ventive care visit throughout the first 5 years of life (see Fig 1).[6] Many children are born with risk factors that predispose them to delayed development and developmental disorders; other children will show delayed or disordered development in early childhood, which if undetected and untreated, can contribute to early school failure and attendant social and emotional problems. Some children will have delayed development attributable to a specific medical condition for which medical treatments may be indicated. Early therapeutic intervention may be available for a wide range of developmental disorders.

2. Perform Surveillance

Developmental surveillance is a flexible, longitudinal, continuous, and cumulative process whereby knowledgeable health care professionals identify children who may have developmental problems. Surveillance can be useful for determining appropriate referrals, providing patient education and family-centered care in support of healthy development, and monitoring the effects of developmental health promotion through early intervention and therapy.

A great breadth and depth of information is considered in comprehensive developmental surveillance; it is important to note, however, that much of this information (eg, static risk factors such as low birth weight, results of previous screenings) will accumulate within the child's health record, where it can be reviewed and flagged as necessary before the visit.

There are 5 components of developmental surveil-

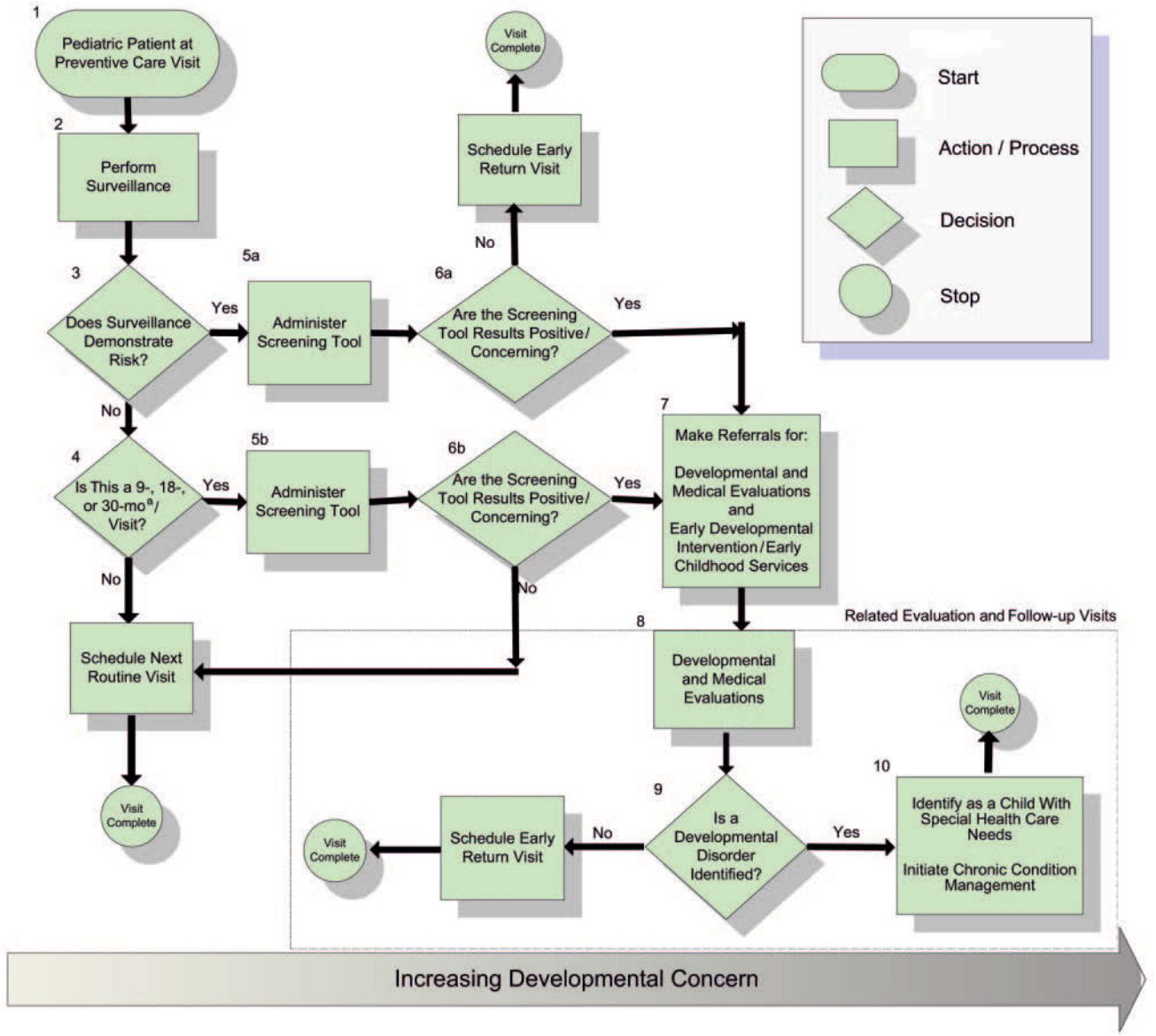
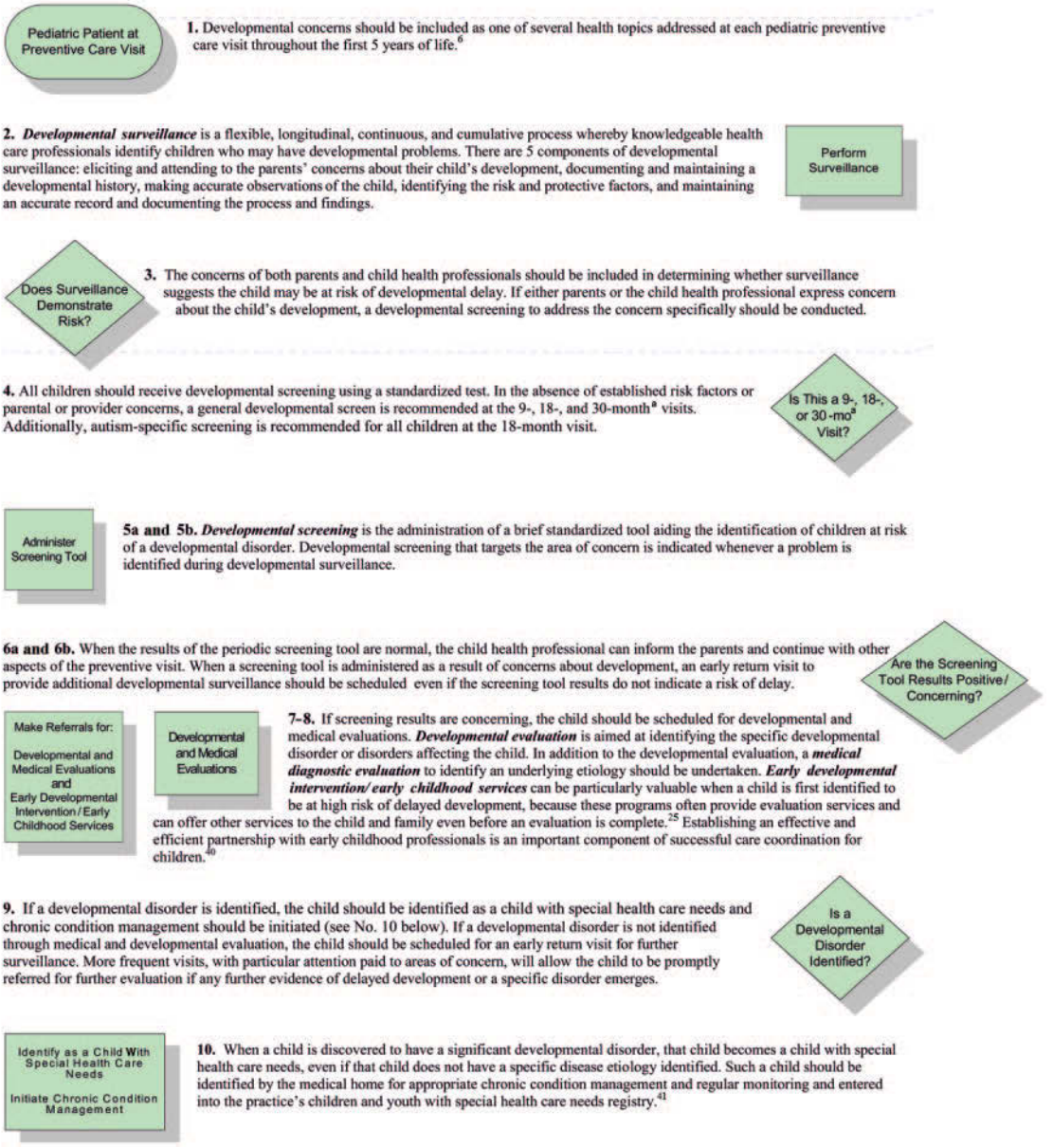


FIGURE 1

Developmental surveillance and screening algorithm within a pediatric preventive care visit. [a] Because the 30-month visit is not yet a part of the preventive care system and is often not reimbursable by third-party payers at this time, developmental screening can be performed at 24 months of age.



lance: eliciting and attending to the parents' concerns about their child's development; documenting and maintaining a developmental history; making accurate observations of the child; identifying risk and protective factors; and maintaining an accurate record of documenting the process and findings.

Eliciting and Attending to the Parents' Concerns

Parents and child health professionals have valuable observation skills, and they share the goal of ensuring optimal health and developmental outcome for the child. In the optimal situation, the child health professional elicits parental observations, experiences, and concerns and recognizes that parental concerns mandate serious attention. The literature suggests that posing simple questions to parents related to concerns about the child's development, learning, or behavior can elicit quality information.[11–13] Health care professionals might ask, for example, "Do you have any concerns about your child's development? Behavior? Learning?" Asking parents specifically about their child's behavior can yield valuable information regarding development, because parents do not necessarily differentiate between behavior and development, and developmental delays often manifest through behavior. The absence of parental concern does not preclude the possibility of serious developmental delays.[14] The health care professional must attend to all aspects of developmental surveillance.

Maintaining a Developmental History

"What changes have you seen in your child's development since our last visit?" A developmental history, updated through this or similar questions, should be a component of any history taken during a well-child visit and can assist a child health professional in identifying developmental abnormalities that warrant further investigation. Age-specific queries, such as asking whether the child is walking or pointing, are also valuable.

In addition to attending to delayed development—whereby children acquire skills more slowly than their peers—child health professionals should give equal consideration to other developmental abnormalities.[15] Deviations in development, whereby children develop skills out of the usual sequence, are recognized in disorders such as cerebral palsy and autism. Dissociation—differing rates of development in different developmental spheres—commonly occurs with developmental disorders. Children with mental retardation or autistic spectrum disorders, for example, commonly display normal motor skills and delayed language development. Conversely, children with cerebral palsy of the spastic diplegic type often display delayed motor skills with normal language function. Regression, the loss of developmental skills, is a very serious developmental problem suggestive of an active, ongoing neurologic problem.

Making Accurate and Informed Observations of the Child

As trained and experienced professionals, pediatricians and other child health professionals have the expertise and comparative knowledge to identify developmental concerns. A careful physical and developmental examination within the context of the preventive care visit is integral to developmental surveillance.[16] Limited evidence suggests that observation of the parent-child interaction may aid in identifying children with delayed development.[17]

Identifying the Presence of Risk and Protective Factors

A risk assessment is an important part of developmental surveillance. Environmental, genetic, biological,[16,18] social, and demographic factors[19] can increase a child's risk for delays in development. Multiple risk factors can amplify each other.[20,21] Children with established risk factors may be referred directly for developmental evaluation or may require developmental surveillance at more frequent intervals than children without risk factors.

Child health professionals should identify protective factors as well as risk factors in children's lives. Strong connections within a loving, supportive family, along with opportunities to interact with other children and grow in independence in an environment with appropriate structure, are important assets in a child's life. These factors, associated with resiliency in older children, are important components in each family's story.[22]

Documenting the Process and Findings

Medical charts, in paper or electronic form, should document all surveillance and screening activities during preventive care visits. In addition, specific actions taken or planned, such as scheduling an earlier follow-up visit, scheduling a visit to discuss developmental concerns more fully, or referrals to medical specialists or early childhood programs and specialists, should also be noted. A paper medical chart might contain a "developmental growth chart" on which the results of developmental surveillance and formal screens are recorded in relationship to the child's age and the dates at the time the findings were obtained. An electronic chart, on the other hand, may allow for the development of a form on which developmental findings and plans are recorded and from which prompts for further action may occur automatically. Recent technologies that automate developmental risk assessments within the waiting room through computer-interpreted paper forms or information kiosks are also increasingly commonplace. We encourage continued development and scientific evaluation of these technologies given their potential to facilitate the process of developmental surveillance and screening.

3. Does Surveillance Demonstrate Risk?

The concerns of both parents and child health professionals should be included in determining whether surveillance suggests that the child may be at risk of developmental problems. If parents or the child health professional express concern about the child's development, a developmental screening to address the concern specifically should be conducted. This screening may require a separate visit; if so, the visit should be held as soon as possible.

Reassurance has a role in the clinical encounter but varies depending on the progress and outcome of developmental surveillance. Reassurance should be rooted in and reference the findings of developmental surveillance. If, for example, developmental surveillance indicates that the child is at low risk of a developmental disorder, reassurance can be offered with caution and a planned outcome. Specific, simple, age-specific developmental goals can be identified, and parents can be encouraged to schedule recheck appointments if the child is not attaining those goals. In reassuring the parents, the pediatrician should emphasize the importance of continual surveillance and screening.

4. Is This a 9-, 18-, or 30-Month* Visit?

All children, most of whom will not have identifiable risks or whose development appears to be proceeding typically, should receive periodic developmental screening using a standardized test. In the absence of established risk factors or parental or provider concerns, a general developmental screen is recommended at the 9-,

TABLE 1 Developmental Screening Tools

	Description	Age Range	No. of Items	Administration Time	Psychometric Properties[a]	Scoring Method	Cultural Considerations	Purchase/Obtainment Information	Key References
General developmental screening tool									
Ages & Stages Questionnaires (ASQ)	Parent-completed questionnaire; series of 19 age-specific questionnaires screening communication, gross motor, fine motor, problem-solving, and personal adaptive skills; results in pass/fail score for domains	4–60 mo	30	10–15 min	Normed on 2008 children from diverse ethnic and socioeconomic backgrounds, including Spanish speaking; sensitivity: 0.70–0.90 (moderate to high); specificity: 0.76–0.91 (moderate to high)	Risk categorization; provides a cutoff score in 5 domains of development that indicates possible need for further evaluation	English, Spanish, French, and Korean versions available	Paul H. Brookes Publishing Co: 800/638-3775; www.brookespublishing.com	Squires J, Potter L, Bricker D. *The ASQ User's Guide*. 2nd ed. Baltimore, MD: Paul H. Brookes Publishing Co; 1999
Battelle Developmental Inventory Screening Tool, 2nd ed (BDI-ST)	Directly administered tool; designed to screen personal-social, adaptive, motor, communication, and cognitive development; results in pass/fail score and age equivalent; can be modified for children with special needs	Birth to 95 mo	100	10–15 min (<3 y old) or 20–30 min (≥3 y old)	Normed on 2500 children, demographic information matched 2000 US Census data; additional bias reviews performed to adjust for gender and ethnicity concerns; sensitivity: 0.72–0.93 (moderate to high); specificity: 0.79–0.88 (moderate)	Quantitative; scaled scores in all 5 domains are compared with cutoffs to determine need for referral	English and Spanish versions available	Riverside Publishing Co: 800/323-9540; www.riverpub.com	Newborg J. *Battelle Developmental Inventory*. 2nd ed. Itasca, IL: Riverside Publishing; 2004
Bayley Infant Neurodevelopmental Screen (BINS)	Directly administered tool; series of 6 item sets screening basic neurologic functions; receptive functions (visual, auditory, and tactile input); expressive functions (oral, fine, and gross motor skills); and cognitive processes; results in risk category (low, moderate, high risk)	3–24 mo	11–13	10 min	Normed on ~1700 children, stratified on age, to match the 2000 US Census; sensitivity: 0.75–0.86 (moderate); specificity: 0.75–0.86 (moderate)	Risk categorization; children are graded as low, moderate, or high risk in each of 4 conceptual domains by use of 2 cutoff scores	English and Spanish versions available	Psychological Corp: 800/211-8378; www.harcourtassessment.com	Aylward GP. *Bayley Infant Neurodevelopmental Screener*. San Antonio, TX: Psychological Corp; 1995; Aylward GP, Verhulst SJ, Bell S. Predictive utility of the BSID-II Infant Neurodevelopmental Screener (BINS) risk status classifications: clinical interpretation and application. *Dev Med Child Neurol*. 2000; 42:25–31
Brigance Screens-II	Directly administered tool; series of 9 forms screening articulation, expressive and receptive language, gross motor, fine motor, general knowledge and personal social skills and preacademic skills (when appropriate); for 0–23 mo, can also use parent report	0–90 mo	8–10	10–15 min	Normed on 1156 children from 29 clinical sites in 21 states; sensitivity: 0.70–0.80 (moderate); specificity: 0.70–0.80 (moderate)	All results are criterion based; no normative data are presented	English and Spanish versions available	Curriculum Associates Inc: 800/225-0248; www.curriculumassociates.com	Glascoe FP. *Technical Report for the Brigance Screens*. North Billerica, MA: Curriculum Associates Inc; 2005; Glascoe FP. The Brigance Infant-Toddler Screen (BITS): standardization and validation. *J Dev Behav Pediatr*. 2002;23: 145–150
Child Development Inventory (CDI)	Parent-completed questionnaire; measures social, self-help, motor, language, and general development skills; results in developmental quotients and age equivalents for different developmental domains; suitable for more in-depth evaluation	18 mo–6 y	300	30–50 min	Normative sample included 568 children from south St Paul, MN, a primarily white, working class community; Doig et al included 43 children from a high-risk follow-up program, which included 69% with high school education or less and 81% Medicaid; sensitivity: 0.80–1.0. (moderate to high); specificity: 0.94–0.96 (high)	Quantitative; provides age equivalents in each domain as well as SDs	English and Spanish versions available	Behavior Science Systems Inc: 612/850-8700; www.childdevrev.com	Ireton H. *Child Development Inventory Manual*. Minneapolis, MN: Behavior Science Systems Inc; 1992; Doig KB, Macias MM, Saylor CF, Craver JR, Ingram PE. The Child Development Inventory: a developmental outcome measure for follow-up of the high risk infant. *J Pediatr*. 1999;135:358–362

TABLE 1 **Continued**

	Description	Age Range	No. of Items	Administration Time	Psychometric Properties[a]	Scoring Method	Cultural Considerations	Purchase/Obtainment Information	Key References
Child Development Review-Parent Questionnaire (CDR-PQ)	Parent-completed questionnaire; professional-completed child development chart measures social, self-help, motor, and language skills	18 mo to 5 y	6 open-ended questions and a 26-item possible-problems checklist to be completed by the parent, followed by 99 items crossing the 5 domains, which may be used by the professional as an observation guide or parent-interview guide	10–20 min	Standardized with 220 children aged 3–4 y from primarily white, working class families in south St Paul, MN; sensitivity: 0.68 (low); specificity: 0.88 (moderate)	Risk categorization; parents' responses to the 6 questions and problems checklist are classified as indicating (1) no problem; (2) a possible problem; or (3) a possible major problem	English and Spanish versions available	Behavior Science Systems Inc	Ireton H. *Child Development Review Manual*. Minneapolis, MN: Behavior Science Systems; 2004
Denver-II Developmental Screening Test	Directly administered tool; designed to screen expressive and receptive language, gross motor, fine motor, and personal-social skills; results in risk category (normal, questionable, abnormal)	0–6 y	125	10–20 min	Normed on 2096 term children in Colorado; diversified in terms of age, place of residence, ethnicity/cultural background, and maternal education; sensitivity: 0.56–0.83 (low to moderate); specificity: 0.43–0.80 (low to moderate)	Risk categorization; pass or fail for each question, and these responses are compared with age-based norms to classify children as in the normal range, suspect, or delayed	English and Spanish versions available	Denver Developmental Materials: 800/419-4729; www.denverii.com	Frankenburg WK, Camp BW, Van Natta PA. Validity of the Denver Developmental Screening Test. *Child Dev*. 1971;42:475–485; Glascoe FP, Byrne KE, Ashford LG, Johnson KL, Chang B, Strickland B. Accuracy of the Denver-II in developmental screening. *Pediatrics*. 1992;89:1221–1225
Infant Development Inventory	Parent-completed questionnaire; measures social, self-help, motor, and language skills	0–18 mo	4 open-ended questions followed by 87 items crossing the 5 domains	5–10 min	Studied in 86 high-risk 8-mo-olds seen in a perinatal follow-up program and compared with the Bayley scales; sensitivity: 0.85 (moderate); specificity: 0.77 (moderate)	Risk categorization; delayed or not delayed	English and Spanish versions available	Behavior Science Systems Inc	Creighton DE, Sauve RS. The Minnesota Infant Development Inventory in the developmental screening of high-risk infants at 8 mo. *Can J Behav Sci*. 1988;20 (special issue):424–433
Parents' Evaluation of Developmental Status (PEDS)	Parent-interview form; designed to screen for developmental and behavioral problems needing further evaluation; single response form used for all ages; may be useful as a surveillance tool	0–8 y	10	2–10 min	Standardized with 771 children from diverse ethnic and socioeconomic backgrounds, including Spanish speaking; sensitivity: 0.74–0.79 (moderate); specificity: 0.70–0.80 (moderate)	Risk categorization; provides algorithm to guide need for referral, additional screening, or continued surveillance	English, Spanish, Vietnamese, Arabic, Swahili, Indonesian, Chinese, Taiwanese, French, Somali, Portuguese, Malaysian, Thai, and Laotian versions available	Ellsworth & Vandermeer Press LLC: 888/729-1697; www.pedstest.com	
Language and cognitive screening tools									
Capute Scales (also known as Cognitive Adaptive Test/Clinical Linguistic Auditory Milestone Scale [CAT/CLAMS])	Directly administered tool; measures visual-motor/problem solving (CAT), and expressive and receptive language (CLAMS); results in developmental quotient and age equivalent	3–36 mo	100	15–20 min	Standardized on 1055 North American children aged 2–36 mo; correlations high with Bayley Scales of Infant Development; sensitivity: 0.21–0.67 in low-risk population (low) and 0.05–0.88 in high-risk populations (low to high); specificity: 0.95–1.00 in low-risk population (high) and 0.82–0.98 in high-risk populations (moderate to high)	Quantitative (developmental age levels and quotient)	English, Spanish, and Russian versions available	Paul H. Brookes Publishing Co	Voigt RG, Brown FR III, Fraley JK, et al Concurrent and predictive validity of the cognitive adaptive test/clinical linguistic and auditory milestone scale (CAT/CLAMS) and the Mental Developmental Index of the Bayley Scales of Infant Development. *Clin Pediatr (Phila)*. 2003;42:427–432

Communication and Symbolic Behavior Scales-Developmental Profile (CSBS-DP): Infant Toddler Checklist	Standardized tool for screening of communication and symbolic abilities up to the 24-mo level; the Infant Toddler Checklist is a 1-page parent-completed screening tool	6–24 mo	24	5–10 min	Standardized on 2188 North American children aged 6-24 mo; correlations: 0.39–0.75 with Mullen Scales at 2 y of age; sensitivity: 0.76–0.88 in low- and at-risk children at 2 y of age (moderate); specificity: 0.82–0.87 in low- and at-risk children at 2 y of age (moderate)	Risk categorization (concern/no concern)	English version available	Paul H. Brookes Publishing Co	Wetherby AM, Prizant BM. *Communication and Symbolic Behavior Scales: Developmental Profile*. Baltimore, MD: Paul H. Brookes Publishing Co; 2002
Early Language Milestone Scale (ELM Scale-2)	Assesses speech and language development from birth to 36 mo	0–36 mo	43	1–10 min	Small cross-sectional standardization sample of 191 children; 235 children for speech intelligibility item; sensitivity: 0.83–1.00 in low- and high-risk populations (moderate to high); specificity: 0.68–1.00 in low- and high-risk populations (low to high)	Quantitative (age equivalent, percentile, standard score)	English version available	Pro-Ed Inc: 800/897-3202; www.proedinc.com	Coplan J. *Early Language Milestone Scale*. Austin, TX: Pro-Ed Inc; 1993; Coplan J, Gleason JR. Test-retest and interobserver reliability of the Early Language Milestone Scale, second edition. *J Pediatr Health Care*. 1993;7:212–219
Motor screening tools									
Early Motor Pattern Profile (EMPP)	Physician-administered standard examination of movement, tone, and reflex development; simple 3-point scoring system	6–12 mo	15	5–10 min	Single published report of 1247 high-risk infants; sensitivity: 0.87–0.92 (moderate to high); specificity: 0.98 (high)	Risk categorization (normal/suspect/abnormal)	English version available	See key references	Morgan AM, Aldag JC. Early identification of cerebral palsy using a profile of abnormal motor patterns. *Pediatrics*. 1996;98:692–697
Motor Quotient (MQ)	Uses simple ratio quotient with gross motor milestones for detecting delayed motor development	8–18 mo	11 total milestones; 1 per visit	1–3 min	Single published report of 144 referred children; sensitivity: 0.87 (moderate); specificity: 0.89 (moderate)	Quantitative (developmental age levels and quotient)	English version available	See key references	Capute AJ, Shapiro BK. The motor quotient: a method for the early detection of motor delay. *Am J Dis Child*. 1985;139:940–942
Autism screening tools									
Checklist for Autism in Toddlers (CHAT)	Parent-completed questionnaire or interview and directly administered items designed to identify children at risk of autism from the general population	18–24 mo	14 (No. of questions/items [averaged])	5 min	Original standardization sample included 41 siblings of children with autism and 50 controls 18 mo of age in Great Britain; 6-y follow-up on 16 235 children validated using ADI-R and ICD-10 criteria resulted in low sensitivity, high specificity; revised version in process of being normed ("Q-CHAT"); sensitivity: 0.38–0.65 (low); specificity: 0.98–1.0 (high)	Risk categorization (pass/fail)	English version available	Public domain: www.nas.org.uk/profess/chat	Baird G, Charman T, Baron-Cohen S, et al. A screening instrument for autism at 18 mo of age: a 6-y follow-up study. *J Am Acad Child Adolesc Psychiatry*. 2000;39:694–702; Baron-Cohen S, Allen J, Gillberg C. Can autism be detected at 18 mo? The needle, the haystack, and the CHAT. *Br J Psychiatry*. 1992;161:839–843
Modified Checklist for Autism in Toddlers (M-CHAT)	Parent-completed questionnaire designed to identify children at risk of autism from the general population	16–48 mo	23 (No. of questions/items [averaged])	5–10 min	Standardization sample included 1293 children screened, 58 evaluated, and 39 diagnosed with an autistic spectrum disorder; validated using ADI-R, ADOS-G, CARS, DSM-IV; sensitivity: 0.85–0.87 (moderate); specificity: 0.93–0.99 (high)	Risk categorization (pass/fail)	English, Spanish, Turkish, Chinese, and Japanese versions available	Public domain: www.firstsigns.com	Dumont-Mathieu T, Fein D. Screening for autism in young children: the Modified Checklist for Autism in Toddlers (M-CHAT) and other measures. *Ment Retard Dev Disabil Res Rev*. 2005;11:253–262; Robins DL, Fein D, Barton ML, Green JA. The Modified Checklist for Autism in Toddlers: an initial study investigating the early detection of autism and pervasive developmental disorders. *J Autism Dev Disord*. 2001;31:131–144

TABLE 1 **Continued**

	Description	Age Range	No. of Items	Administration Time	Psychometric Properties[a]	Scoring Method	Cultural Considerations	Purchase/Obtainment Information	Key References
Pervasive Developmental Disorders Screening Test-II (PDDST-II), Stage 1-Primary Care Screener	Parent-completed questionnaire designed to identify children at risk of autism from the general population	12-48 mo	22 (No. of questions/items [averaged])	10-15 min to complete; 5 min to score	Validated using extensive multimethod diagnostic evaluations on 681 children at risk of autistic spectrum disorders and 256 children with mild-to-moderate other developmental disorders; no sensitivity/specificity data reported for screening of an unselected sample; sensitivity: 0.85-0.92 (moderate to high); specificity: 0.71–0.91 (moderate to high)	Risk categorization (pass/fail)	English version available	Psychological Corp	Siegel B. *Pervasive Developmental Disorders Screening Test-II (PDDST-II): Early Childhood Screener for Autistic Spectrum Disorders.* San Antonio, TX: Harcourt Assessment Inc; 2004
Pervasive Developmental Disorders Screening Test-II (PDDST-II), Stage 2-Developmental Clinic Screener	Parent-completed questionnaire; designed to detect children at risk of autism from other developmental disorders	12–48 mo	14 (No. of questions/items [averaged])	10–15 min to complete; 5 min to score	Validated using extensive multimethod diagnostic evaluations on 490 children with confirmed autistic spectrum disorder (autism, pervasive developmental disorder-not otherwise specified, or Asperger syndrome) and 194 children who were evaluated for autistic spectrum disorder but who did not receive a diagnosis on the autistic spectrum; no sensitivity/specificity data reported for screening of an unselected sample; sensitivity: 0.69–0.73 (moderate); specificity: 0.49–0.63 (low)	Risk categorization (pass/fail)	English version available	Psychological Corp	Siegel B. *Pervasive Developmental Disorders Screening Test-II (PDDST-II): Early Childhood Screener for Autistic Spectrum Disorders.* San Antonio, TX: Harcourt Assessment Inc; 2004
Screening Tool for Autism in Two-Year-Olds (STAT)	Directly administered tool; designed as second-level screen to detect children with autism from other developmental disorders; assesses behaviors in 4 social-communicative domains: play, requesting, directing attention, and motor imitation	24–35 mo	12 (No. of questions/items [averaged])	20 min	Two samples were used: for development phase, 3 children with autism, 33 without autism; for validation sample, 12 children with autism, 21 without autism; validated using CARS, ADOS-G, and DSM-IV criteria; second-level screen; requires training workshop before administration; sensitivity: 0.83–0.92 (moderate to high); specificity: 0.85–0.86 (moderate)	Risk categorization	English version available	Wendy Stone, PhD, author: triad@vanderbilt.edu	Stone WL, Coonrod EE, Ousley OY. Brief report: Screening Tool for Autism in Two-Year-Olds (STAT): development and preliminary data. *J Autism Dev Disord.* 2000;30:607–612; Stone WL, Coonrod EE, Turner LM, Pozdol SL. Psychometric properties of the STAT for early autism screening. *J Autism Dev Disord.* 2004;34:691–701; Stone WL, Ousley OY. *STAT Manual: Screening Tool for Autism in Two-Year-Olds.* unpublished manuscript, Vanderbilt University, 1997
Social Communication Questionnaire (SCQ) (formerly Autism Screening Questionnaire-ASQ)	Parent-completed questionnaire; designed to identify children at risk of autistic spectrum disorders from the general population; based on items in the ADI-R	≥4 y	40 (No. of questions/items [averaged])	5–10 min	Validated using the ADI-R and DSM-IV on 200 subjects (160 with pervasive developmental disorder, 40 without pervasive developmental disorder); for use in children with mental age of at least 2 y and chronologic age ≥4 y; available in 2 forms: lifetime and current; sensitivity: 0.85 (moderate); specificity: 0.75 (moderate)	Risk categorization (pass/fail)	English and Spanish versions available	Western Psychological Corp: www.wpspublish.com	Rutter M, Bailey A, Lord C. *The Social Communication Questionnaire (SCQ) Manual.* Los Angeles, CA: Western Psychological Services; 2003

The AAP does not approve/endorse any specific tool for screening purposes. This list is not exhaustive, and other tests may be available. ADI-R indicates Autism Diagnostic Interview-R; ICD-10, *International Classification of Diseases, 10th revision*; ADOS-G, Autism Diagnostic Observation Schedule-Generic; CARS, Childhood Autism Rating Scale; DSM-IV, *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*.

[a] Sensitivity and specificity were categorized as follows: low = 69 or below; moderate = 70 to 89; high = 90 or above.

18-, and 30-month* visits. Consideration of a number of factors, including the time available to focus on developmental concerns during a routine pediatric visit, led to these recommended ages.

- Nine months of age: At 9 months of age, many issues involving motor skills development can be reliably identified. A 9-month screening provides an additional opportunity to attend to the child's visual and hearing abilities. Early communication skills may be emerging—evidence suggests symptoms of autism, such as lack of eye contact, orienting to name being called, or pointing, may be recognizable in the first year of life.[23,24] Early intervention to address specific developmental disorders is available to infants from birth and should be accessed to address any delays detected at 9 months.[25] At-risk 9-month-old infants should also be referred to early intervention programs if not previously referred. The 9-month preventive care visit also provides a good opportunity for the child health professional to educate parents about developmental screening and to encourage parents to pay special attention to communication and language skills. Social and nonverbal communication, including vocalizations and gestures, are important aspects of emerging communication that can be assessed at 9 months. Because of the rapid development of motor, language, and cognitive skills, parents should be encouraged to express any concerns they have about their child's progress rather than waiting until the 18-month visit. The AAP brochure *Is Your One-Year Old Communicating With You?*[26] might be distributed at the 9-month visit to educate parents about communication and target any concerns they have. (If practices have eliminated the 9-month visit, this screening should be performed at the 12-month visit.)
- Eighteen months of age: Delays in communication and language development are often evident by 18 months of age. Mild motor delays that were undetected at the 9-month screening may be more apparent at 18 months of age. Medical interventions for motor disorders have been shown to be effective in children at 18 months of age, and effective early intervention for delayed language development is also available.[27] In addition to a general developmental screening tool, an autism-specific tool should be administered to all children at the 18-month visit.[28] Symptoms of autism are often present at this age, and effective early intervention strategies are available.[29]
- Thirty months* of age: By 30 months of age, most motor, language, and cognitive delays may be identified with screening instruments, leading to evaluation of and intervention for those children with delayed development. A 30-month visit focusing on child development and developmental screening would allow the health care provider to devote special attention to this area. Therefore, addition of this preventive care visit to the periodicity schedule is being considered by Bright Futures.

When child health professionals use only clinical impressions rather than formal screening, estimates of children's developmental status are much less accurate.[30] Including developmental screening tools at targeted developmental ages is intended to enhance the precision of the developmental surveillance process. These recommended ages for developmental screening are suggested only as a starting point for children who appear to be developing normally; surveillance should continue throughout childhood, and screenings should be conducted anytime that concerns are raised by parents, child health professionals, or others involved in the care of the child. At the 4-year visit, a screening for school readiness is appropriate.

5a and 5b: Administer Screening Tool

Developmental screening is the administration of a brief standardized tool that aids the identification of children at risk of a developmental disorder. Many screening tools can be completed by parents and scored by nonphysician personnel; the physician interprets the screening results.

Developmental screening does not result in either a diagnosis or treatment plan but rather identifies areas in which a child's development differs from same-age norms. Developmental screening that targets the area of concern is indicated whenever a problem is identified during developmental surveillance. Because development is dynamic in nature and surveillance and screening have limits, periodic screening with a validated instrument should occur so that a problem not detected by surveillance or a single screening can be detected by subsequent screening. Repeated and regular screening is more likely than a single screening to identify problems, especially in later-developing skills such as language. Waiting until a young child misses a major milestone such as walking or talking may result in late rather than early recognition, increasing parental dissatisfaction and anxiety and depriving the child and family of the benefits of early identification and intervention.

Table 1 provides a list of developmental screening tools; a discussion of how to choose an appropriate screening tool is included in "Implementing the Algorithm."

6a and 6b: Are the Screening-Tool Results Positive/Concerning?

When the results of the periodic screening tool are normal, the child health professional can inform the parents and continue with other aspects of the preventive visit. Normal screening results provide an opportunity to focus on developmental promotion. However, when a screening tool is administered because of con-

cerns about development, an early return visit to provide additional developmental surveillance should be scheduled even if the screening-tool results do not indicate a risk of delay.

7. Make Referrals for Developmental and Medical Evaluations and Early Developmental Intervention/Early Childhood Services

If screening results are concerning, the child should be scheduled for developmental and medical evaluations. These evaluations may occur at a different visit or series of visits or often in a different setting by other professionals. The separate box in which these steps are placed in the algorithm (Fig 1) is intended to represent the possibility that these actions will occur at a different time and location. However, they should be scheduled as quickly as possible, and professionals should coordinate activities and share findings.

8. Developmental and Medical Evaluations

Developmental Evaluation

When developmental surveillance or screening identifies a child as being at high risk of a developmental disorder, diagnostic developmental evaluation should be pursued. This evaluation is aimed at identifying the specific developmental disorder or disorders affecting the child, thus providing further prognostic information and allowing prompt initiation of specific and appropriate early childhood therapeutic interventions.

Children with neurodevelopmental disorders also often have other associated developmental or behavior disorders.[31–33] Identification of these disorders can lead to further evaluation and treatment. Pediatric subspecialists such as neurodevelopmental pediatricians, developmental and behavioral pediatricians, child neurologists, pediatric physiatrists, or child psychiatrists can perform the developmental diagnostic evaluation, as can other early childhood professionals in conjunction with the child's primary care provider. Such early childhood professionals include early childhood educators, child psychologists, speech-language pathologists, audiologists, social workers, physical therapists, and occupational therapists, ideally working with families as part of an interdisciplinary team and with the medical home.

Medical Evaluation

In addition to the developmental evaluation, a medical diagnostic evaluation to identify an underlying etiology should be undertaken. This evaluation should consider biological, environmental, and established risk factors for delayed development.[34–37] Vision screening and objective hearing evaluation; review of newborn metabolic screening and growth charts; and an update of environmental, medical, family, and social history for additional risk factors are integral to this evaluation.

A comprehensive medical evaluation is essential whenever a delay is confirmed. This evaluation varies somewhat with the risk factors and findings and may include brain imaging, electroencephalogram (EEG), genetic testing, and/or metabolic testing.[37]

Identification of an etiology may provide parents with a greater depth of understanding of their child's disability. Identifying an etiology also can affect various aspects of treatment planning, including specific prognostic information, genetic counseling around recurrence risk and family planning, specific medical treatments for improved health and function of the child, and therapeutic intervention programming.[38] An underlying etiology will be identified in approximately one quarter of cases of delayed development, with higher rates (>50%) in children with global developmental delays and motor delays and lower rates (<5%) in children with isolated language disorders.[39]

This evaluation can be performed by a trained and skilled pediatrician; a pediatric subspecialist such as a neurodevelopmental pediatrician, child neurologist, or developmental/behavioral pediatrician; or through affiliated medical professionals such as pediatric geneticists or physiatrists. The primary care provider within the medical home should develop an explicit comanagement plan with the specialist(s).

Early Developmental Intervention/Early Childhood Services

Early intervention programs can be particularly valuable when a child is first identified to be at high risk of delayed development, because these programs often provide evaluation services and can offer other services to the child and family even before an evaluation is complete.[25] These services can include developmental therapies, service coordination, social work services, assistance with transportation and related costs, family training, counseling, and home visits. The diagnosis of a specific developmental disorder is not necessary for an early intervention referral to be made. Child health professionals should realize that a community-based early intervention evaluation may not address children with specific medical risks, and further developmental and medical evaluation will often be necessary for children with established delays.

Establishing an effective and efficient partnership with early childhood professionals is an important ingredient of successful care coordination for children within the medical home. The partnership is built on shared interest in the developmental outcomes of children and recognition of the different skill sets of child health professionals and educators. For additional information regarding care coordination, see the AAP policy statement "Care Coordination in the Medical Home: Integrating Health and Related Systems of Care for Children With Special Health Care Needs."[40]

Given the variety of community settings in which health care is provided, the pediatrician may consult

early childhood professionals who work in specialized health care centers, university centers, early intervention programs, early childhood educational programs, or private practices. Whenever possible, communities should coordinate resources; this is especially true in preventing delays in care or unnecessary duplication of service.

The child's medical charts, whether electronic or paper, should be organized to create a system that guarantees continuity of care, especially when the child is referred to specialists and/or community agencies. In addition, a means of incorporating information about a child's developmental status from sources outside the medical home should be available. The child health care chart should be designed to alert the clinician if further attention is needed between regular periodic visits.

9. Is a Developmental Disorder Identified?

If a developmental disorder is identified, the child should be identified as a child with special health care needs, and chronic-condition management should be initiated (see No. 10 below). If a developmental disorder is not identified through medical and developmental evaluation, the child should be scheduled for an early return visit for further surveillance, as mentioned previously. More frequent visits, with particular attention paid to areas of concern, will allow the child to be promptly referred for further evaluation if any additional evidence of delayed development or a specific disorder emerges.

10. Identify as a Child With Special Health Care Needs and Initiate Chronic-Condition Management

When a child is discovered to have a significant developmental disorder, that child becomes a child with special health care needs even if that child does not have a specific disease etiology identified. Such a child should be identified by the medical home for appropriate chronic-condition management and regular monitoring and entered into the practice's children and youth with special health care needs registry.[41] Every primary care practice should create a registry for the children in the practice who have special health care needs.

The medical home provides a triad of key primary care services including preventive care, acute illness management, and chronic-condition management. A program of chronic-condition management provides proactive care for children and youth with special health care needs, including condition-related office visits, written care plans, explicit comanagement with specialists, appropriate patient education, and effective information systems for monitoring and tracking.

Management plans should be based on a comprehensive needs assessment conducted with the family. Management plans should include relevant, measurable, and valid outcomes. These plans must be reviewed on a regular basis and updated as necessary. The child health professional should actively participate in all care-coordination activities for children who have complex health conditions in addition to developmental problems. Decisions regarding appropriate therapies and their scope and intensity should be determined in consultation with the child's family, therapists, and educators (including early intervention or school-based programs) and should be based on knowledge of the scientific evidence for their use.

Children with established developmental disorders often benefit from referral to community-based family support services such as respite care, parent-to-parent programs, and advocacy organizations. Some children may qualify for additional benefits such as supplemental security income, public insurance, waiver programs, and state programs for children and youth with special health care needs (Title V). Parent organizations, such as Family Voices, and condition-specific associations can provide parents with information and support and can also provide an opportunity for advocacy.

IMPLEMENTING THE ALGORITHM

Choosing Developmental Screening Tools

Although all developmental screening tools are designed to identify children with potentially delayed development, each one approaches the task in a different way. There is no universally accepted screening tool appropriate for all populations and all ages. Currently available screening tools vary from broad general developmental screening tools to others that focus on specific areas of development, such as motor or communication skills. Their psychometric properties vary widely in characteristics such as their standardization, the comparison group used for determining sensitivity and specificity, and population risk status.

Broad screening tools should address developmental domains including fine and gross motor skills, language and communication, problem solving/adaptive behavior, and personal-social skills. Screening tools also must be culturally and linguistically sensitive. Many screening tools are available, and the choice of which tool to use depends on the population being screened, the types of problems being screened for in that population, administration and scoring time, any administration training time, the cost of the tool, and the possibilities for adequate payment.

Screening tests should be both reliable and valid, with good sensitivity and specificity.

- Reliability is the ability of a measure to produce consistent results.
- The validity of a developmental screening test relates to its ability to discriminate between a child at a determined level of risk for delay (ie, high, moderate) and the rest of the population (low risk).

- Sensitivity is the accuracy of the test in identifying delayed development.
- Specificity is the accuracy of the test in identifying individuals who are not delayed.

If a test incorrectly identifies a child as delayed, it will result in overreferrals. If a test incorrectly identifies a child as normal, it results in underreferrals. For developmental screening tests, scoring systems must be developed that minimize underreferrals and overreferrals. Trade-offs between sensitivity and specificity occur when devising these scoring systems. Sensitivity and specificity levels of 70% to 80% have been deemed acceptable for developmental screening tests.[42] These values are lower than generally accepted for medical screening tests because of the challenges inherent in measuring child development and the absence of specific curative and clearly effective treatments. However, combining developmental surveillance and periodic screening increases the opportunity for identification of undetected delays in early development. Overidentification of children using standardized screening tools may indicate that this group of children includes some with below-average development and/or significant psychosocial risk factors.[43] These children may benefit from other community programs as well as closer monitoring of their development by their families, pediatric health professionals, and teachers or caregivers.

Table 1 provides a list of developmental screening tools and their psychometric testing properties. These screening tools vary widely in their psychometric properties. This list is not exhaustive; other standardized, published tools are available. We look forward to further evaluation/validation of available screening instruments as well as the continued development of new tools with stronger properties. Child health professionals are encouraged to familiarize themselves with a variety of screening tools and choose those that best fit their populations, practice needs, and skill level.

Incorporating Surveillance and Screening in the Medical Home

A quality-improvement approach may be the most effective means of building surveillance and screening elements into the process of care in a pediatric office.[44] Improving developmental screening and surveillance should be regarded as a "whole-office" endeavor and not simply a matter of clinician continuing education or the addition of tasks to well-child visits. Front-desk procedures, such as appropriate scheduling for screening visits and procedures for flagging children with established risk factors, need to be explicitly designed by the office staff. Nonphysician staff may need training in the administration of developmental screening tools. The input of consumers is crucial to developing an effective system and can be accomplished by adding a parent to an office planning team, by using parent focus groups, or by administering parent questionnaires. Specific to developmental screening could be consumer opinion about preferences for completing questionnaires in the office or before the visit, how they would like to be informed about the results of screening, how parents of children with identified conditions associated with developmental delay would like to have their children's development monitored, or feedback on parental satisfaction with their child's developmental screening or feedback on the referral process.

Screening Payment

Separate *Current Procedural Terminology* (CPT)[45] codes (see Table 2) exist for developmental screening (96110: developmental testing; limited) and testing (96111: developmental testing; extended). The relative values for these codes are published in the Medicare Resource-Based Relative Value Scale and reflect physician work, practice expenses, and professional liability expenses. Table 2 outlines the appropriate codes to use when billing for the processes described in the algorithm. Health plans are encouraged to adhere to CPT guidelines and provide coverage and payment for developmental screening and testing.

Billing processes related to developmental screening and surveillance should be carefully reviewed to ensure that appropriate CPT codes are used to document screening procedures and ensure proper payment. CPT code 96110 for limited developmental testing does not include any payment for medical provider services. The expectation is that a nonphysician will administer the screening tool to the parent and then score their responses. The physician reviews and interprets the screening results; the physician's work is included in the evaluation and management code used for the child's visit. Medicaid may not pay separately for developmental screening when provided as part of early and periodic screening, diagnostic, and treatment services. If non-Medicaid carriers are involved, the preventive care code is used with the modifier 25 appended and 96110 listed for each screening tool administered. The CPT code 96111, extended developmental testing, includes medical provider work. This code would more appropriately be used when the medical provider observes the child performing a task and demonstrating a specific developmental skill.

The codes in Table 2 may be applicable to the phases of developmental surveillance, screening, and evaluation described in the proposed algorithm (Fig 1).

SUMMARY

Developmental surveillance should be a component of every preventive care visit. Standardized developmental screening tools should be used when such surveillance

TABLE 2 **CPT Codes for Developmental Screening**

Services/Step in Algorithm	Notes	CPT Code	Comments
Pediatric preventive care visit	All preventive care visits should include developmental surveillance; screening is performed as needed or at periodic intervals	99381–99394 (EPSDT[a])	
Developmental screening	The expectation is that the screening tool will be completed by a parent or nonphysician staff member and reviewed by the physician	96110	Limited developmental testing, with interpretation and report
Developmental/medical evaluation	If performed by the physician as an outpatient office visit	99210–99215[b] or 96110; or 96111 if objective developmental testing is performed	99214 is used for evaluations performed by the physician that are detailed and moderately complex or take at least 25 min (with over half spent counseling); 99215 is used for evaluations that are comprehensive and highly complex or take >40 min (with over half spent counseling) 99244 is used for "moderate activities" of up to 60 min; 99245 is used for "high" activity of up to 80 min
	Outpatient consultation; typically performed by a tertiary, local out-of-office referral source or another physician with the requisite skills in the same practice as the referring physician; the request for consultation must be recorded in the patient's chart; services/procedures and consulting physician's impressions must be recorded; time spent counseling and coordinating care should be specifically documented; these codes include "reporting" of the consulting physician, if completed by letter or office notes	99241–99245	
	If a more extensive report is developed, this code is used; these costs may not be reimbursable	99080	
Developmental disorder identified	For follow-up visits with the patient and parents to complete the consultation or to discuss the results of the initial consultation; for rendering opinions and addressing questions, not assuming care; once care is assumed, established office-visit coding is used	99241–99245	
Identify as a child with special health care needs, and initiate chronic-condition management	Children with special health care needs are likely to require expanded time and a higher level of medical decision-making found in these "higher-level" outpatient codes; these codes are appropriate for services in the office and for outpatient facility services for established patients; these codes may be reported using time alone as the factor if more than half of the reported time is spent in counseling	99211–99215	99213; 99214; 99215 (see above)
Prolonged services	At any point during the algorithm when outpatient office or consultation codes are used, prolonged physician service codes may be reported in addition when visits require considerably more time than typical for the base code alone; both face-to-face and non–face-to-face codes are available in CPT	99354	99354 for first 30–74 min of outpatient face-to-face prolonged services
		99355	99355 for each additional 30 min
		99358	99358 for first 30–74 min of non–face-to-face prolonged services
		99359	99359 for each additional 30 min
Extended developmental testing/evaluation	Used for extended developmental testing typically provided by the medical provider (often up to 1 h) including the evaluation interpretation and report	96111	Reported in addition to evaluation and management (E/M) services provided on the same date

[a] EPSDT (Early and Periodic Screening, Diagnosis, and Treatment) is the federal Medicaid program for preventive services. States may require physicians to use different codes to report these services. In general, for non-Medicaid commercial insurers, the evaluation and management CPT codes for preventive medicine services (99381-99394) are used for the basic service (history, physical examination, and counseling/anticipatory guidance), with separate CPT codes reported additionally for the additional screening of hearing, vision, development, laboratory services, and immunization administration.
[b] CPT evaluation and management code levels are selected on the basis of the amount of physician work (history, physical examination, and medical decision-making) and/or time used in the encounter.

identifies concerns about a child's development and for children who appear to be at low risk of a developmental disorder at the 9-, 18-, and 30-month* visits.

When a child has a positive screening result for a developmental problem, developmental and medical evaluations to identify the specific developmental disorders and related medical problems are warranted. In addition, children who have positive screening results for developmental problems should be referred to early developmental intervention and early childhood services and scheduled for earlier return visits to increase developmental surveillance.

Children diagnosed with developmental disorders should be identified as children with special health care needs; chronic-condition management for these children should be initiated.

RECOMMENDATIONS

For the Medical Home

1. Perform developmental surveillance at every preventive visit throughout childhood, and ensure that such surveillance includes eliciting and attending to parents' concerns, obtaining a developmental history, making accurate and informed observations of the child, identifying the presence of risk and protective factors, and documenting the process and findings.
2. Administer a standardized developmental screening tool for children who appear to be at low risk of a developmental disorder at the 9-, 18-, and or 30-month* visits and for those whose surveillance yields concerns about delayed or disordered development.
3. Schedule early return visits for children whose surveillance raises concerns that are not confirmed by a developmental screening tool.
4. Refer children about whom developmental concerns are raised to early intervention and early-childhood programs.
5. Coordinate developmental and medical evaluations for children who have positive screening results for developmental disorders.
6. Initiate a program of chronic-condition management for any child identified with a developmental disorder.
7. Document all surveillance, screening, evaluation, and referral activities in the child's health chart.
8. Establish working relationships with state and local programs, services, and resources.
9. Use a quality-improvement model to integrate surveillance and screening into office procedures and to monitor their effectiveness and outcomes.

For Policy and Advocacy

10. Provide appropriate payment for developmental surveillance, screening, and evaluation.
11. Teach child health professionals, through training and continuing education programs, to conduct developmental surveillance and screening as an integral responsibility of the medical home.

For Research and Development

12. Develop information systems and data-gathering tools to automate the algorithm recommended by this policy statement for ease and consistency of use.
13. Expand the evidence base for the effectiveness of developmental surveillance activities.
14. Improve the effectiveness of developmental screening tools in the identification of children with developmental disorders in the medical home.
15. Expand the evidence base for the use and effectiveness of the proposed algorithm, including the optimal timing of the recommended developmental screening.

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There were errors in the American Academy of Pediatrics policy statement "Identifying Infants and Young Children With Developmental Disorders in the Medical Home: An Algorithm for Developmental Surveillance and Screening" published in the July 2006 issue of *Pediatrics* (doi:10.1542/peds.2006-1231). In Table 2, third row, CPT code 99210 should have been 99211. Also, in the fourth row, the notes should have corresponded with CPT codes as follows:

For follow-up visits with the patient and parents to complete the consultation or to discuss the results of the initial consultation	99211–99215[c]
For rendering opinions and addressing questions, not assuming care; once care is assumed, established office visit coding is utilized (see above[c])	99241–99245

Finally, a new footnote (c) accompanies the changes above as follows:

[c] The office or other outpatient consultation codes (99241–99245) are reported only when requested by another physician or other appropriate source. If more than one visit is necessary to complete a consultation, each subsequent visit beyond the first is reported with an established patient office or other outpatient service code (99211–99215). Only if an additional request for an opinion or advice regarding the same or a new problem is received and documented in the medical record may the consultation codes be reported again.

The revised table follows.

TABLE 2 **CPT Codes for Developmental Screening**

Services/Step in Algorithm	Notes	CPT Code	Comments
Pediatric preventive care visit	All preventive care visits should include developmental surveillance; screening is performed as needed or at periodic intervals	99381–99394 (EPSDT[a])	
Developmental screening	The expectation is that the screening tool will be completed by a parent or nonphysician staff member and reviewed by the physician	96110	Limited developmental testing, with interpretation and report
Developmental/ medical evaluation	If performed by the physician as an outpatient office visit	99211–99215[b] or 96110; or 96111 if objective developmental testing is performed	99214 is used for evaluations performed by the physician that are detailed and moderately complex or take at least 25 min (with over half spent counseling); 99215 is used for evaluations that are comprehensive and highly complex or take >40 min (with over half spent counseling); 99244 is used for "moderate activities" of up to 60 min; 99245 is utilized for "high" activity of up to 80 min
	Outpatient consultation; typically performed by a tertiary, local out-of-office referral source or another physician with the requisite skills in the same practice as the referring physician; the request for consultation must be recorded in the patient's chart; services/procedures and consulting physician's impressions must be recorded; time spent counseling and coordinating care should be specifically documented; these codes include "reporting" of the consulting physician, if completed by letter or office notes	99241–99245	

(continued)

TABLE 2 **CPT Codes for Developmental Screening *(Continued)***

Services/Step in Algorithm	Notes	CPT Code	Comments
	If a more extensive report is developed, this code is used; these costs may not be reimbursable	99080	
Developmental disorder identified	For follow-up visits with the patient and parents to complete the consultation or to discuss the results of the initial consultation	99211–99215[c]	
	For rendering opinions and addressing questions, not assuming care; once care is assumed, established office visit coding is utilized (see above[c])	99241–99245	
Identify as a child with special health care needs, initiate chronic condition management	Children with special health care needs are likely to require expanded time and a higher level of medical decision making found in these "higher-level" outpatient codes; these codes are appropriate for services in the office and for outpatient facility services for established patients; these codes may be reported using time alone as the factor if more than half of the reported time is spent in counseling	99211–99215	99213; 99214; 99215 (see above)
Prolonged services	At any point during the algorithm when outpatient office or consultation codes are used, prolonged physician service codes may be reported in addition when visits require considerably more time than typical for the base code alone; both face-to-face and non–face-to-face codes are available in CPT	99354 99355 99358 99359	99354 for first 30–74 min of outpatient face-to-face prolonged services 99355 for each additional 30 min 99358 for first 30–74 min of non–face-to-face prolonged services 99359 for each additional 30 min
Extended developmental testing/evaluation	Used for extended developmental testing typically provided by the medical provider (often up to 1 h) including the evaluation interpretation and report	96111	Reported in addition to evaluation and management (E/M) services provided on the same date

[a] EPSDT (Early and Periodic Screening, Diagnosis, and Treatment) is the federal Medicaid program for preventive services. States may require physicians to use different codes to report these services. In general, for non-Medicaid commercial insurers, the evaluation and management CPT codes for preventive medicine services (99381–99394) are used for the basic service (history, physical examination, and counseling/anticipatory guidance), with separate CPT codes reported additionally for the additional screening of hearing, vision, development, laboratory services, and immunization administration.

[b] CPT evaluation and management code levels are selected on the basis of the amount of physician work (history, physical examination, and medical decision-making) and/or time used in the encounter.

[c] The office or other outpatient consultation codes (99241–99245) are reported *only* when requested by another physician or other appropriate source. If more than 1 visit is necessary to complete a consultation, each subsequent visit beyond the first is reported with an established patient office or other outpatient service code (99211–99215). Only if an *additional request* for an opinion or advice regarding the same or a new problem is received and documented in the medical record may the consultation codes be reported again.

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IDENTIFYING AND RESPONDING TO DOMESTIC VIOLENCE

CONSENSUS RECOMMENDATIONS FOR CHILD AND ADOLESCENT HEALTH

Produced by
Family Violence Prevention Fund

In partnership with
AMERICAN ACADEMY OF FAMILY PHYSICIANS
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AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS
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US DEPARTMENT OF HEALTH AND HUMAN SERVICES, ADMINISTRATION FOR CHILDREN AND FAMILIES AND THE CONRAD N. HILTON FOUNDATION

Family Violence Prevention Fund

For more than two decades, the **Family Violence Prevention Fund (FVPF)** has worked to end violence against women and children around the world. Instrumental in developing the landmark Violence Against Women Act passed by Congress in 1994, the FVPF has continued to break new ground by reaching new audiences including men and youth, promoting leadership within communities to ensure that violence prevention efforts become self-sustaining, and transforming the way health care providers, police, judges, employers and others address violence.

The FVPF is a national non-profit organization committed to mobilizing concerned individuals, allied professionals, women's rights, civil rights, other social justice organizations and children's groups through public education/prevention campaigns, public policy reform, model training, advocacy programs and organizing.

American Academy of Family Physicians

Founded 1947, the **American Academy of Family Physicians** represents more than 93,500 physicians and medical students nationwide. It is the only medical specialty organization devoted solely to primary care. Family physicians, like other medical specialists, complete an extensive three-year residency program in the specialty after graduating from medical school. As part of their residency, family physicians receive training in six major medical areas: pediatrics, obstetrics and gynecology, internal medicine, psychiatry and neurology, surgery and community medicine. They also receive instruction in many areas including geriatrics, emergency medicine, ophthalmology, radiology, orthopedics, otolaryngology and urology. As a result, family physicians are the only specialists qualified to treat most ailments, and to provide comprehensive health care for people of all ages.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

The American Academy of Pediatrics (AAP) is an organization of 57,000 primary care pediatricians, pediatric medical sub-specialists and pediatric surgical specialists dedicated to the health, safety and well-being of infants, children, adolescents and young adults. The AAP's major activities include furthering the professional education of its members through continuing education courses, annual scientific meetings, seminars and publications. Our organization is committed to ensuring that children's health needs are taken into consideration as legislation and public policy are developed and implemented.

With over 43,000 members, the **American College of Obstetricians and Gynecologists (ACOG)** is the nation's leading group of professionals providing health care for women. ACOG is dedicated to the advancement of women's health through education, advocacy, practice, and research. It is a private, nonprofit organization. ACOG works in four primary areas: 1) serving as a strong advocate for quality health care for women; 2) maintaining high standards of clinical practice and continuing education for its members 3) Promoting patient education and stimulating patient understanding of, and involvement in, medical care; and 4) Increasing awareness among its members and the public of the changing issues facing women's health care. In fulfilling its purpose, ACOG develops and sponsors continuing medical education programs, creates guidelines to evaluate and improve medical practice, promotes access to the latest research through its publications and clinical gatherings, and supports programs for improved graduate medical education in obstetrics and gynecology.

CENTER BOSTON MEDICAL

The Child Witness to Violence Project, a program of the Department of Pediatrics at Boston Medical Center was established in 1992 to provide mental health and advocacy services to young children and their families who are affected by violence in the home or community. The project provides clinical services to children and conducts training and technical assistance to a wide range of professionals working with young children and families. The Project has been nationally recognized as an innovative and effective initiative for families affected by domestic violence.

National Association of Pediatric Nurse Practitioners (NAPNAP) was founded in 1973 as a non-profit specialty nursing organization devoted to improving the quality of infant and child health care. The pediatric nurse practitioner provides an advanced level of care to children and their families, including: counseling on normal development and behavioral problems, the prevention of illness and preventable injuries, and care of children with acute or chronic conditions. NAPNAP promotes high standards of child health care through education, research, and legislative action involving over 6,650 members in 50 chapters across the country.

Office for Victims of Crime
OVC

The Office for Victims of Crime (OVC) is a federal agency located within the Office of Justice Programs of the U.S. Department of Justice (DOJ) that Congress formally established in 1988 through an amendment to the 1984 Victims of Crime Act (VOCA). OVC provides leadership and federal funds to support victim compensation and assistance programs around the country and promotes victim services worldwide. OVC administers formula and discretionary grants designed to benefit victims, provides training for diverse professionals who work with victims, develops projects to enhance victims' rights and services, and undertakes public education and awareness activities on behalf of crime victims. The Office for Victims of Crime is a component of the Office of Justice Programs, which also includes the Bureau of Justice Assistance, the Bureau of Justice Statistics, the National Institute of Justice, and the Office of Juvenile Justice and Delinquency Prevention.

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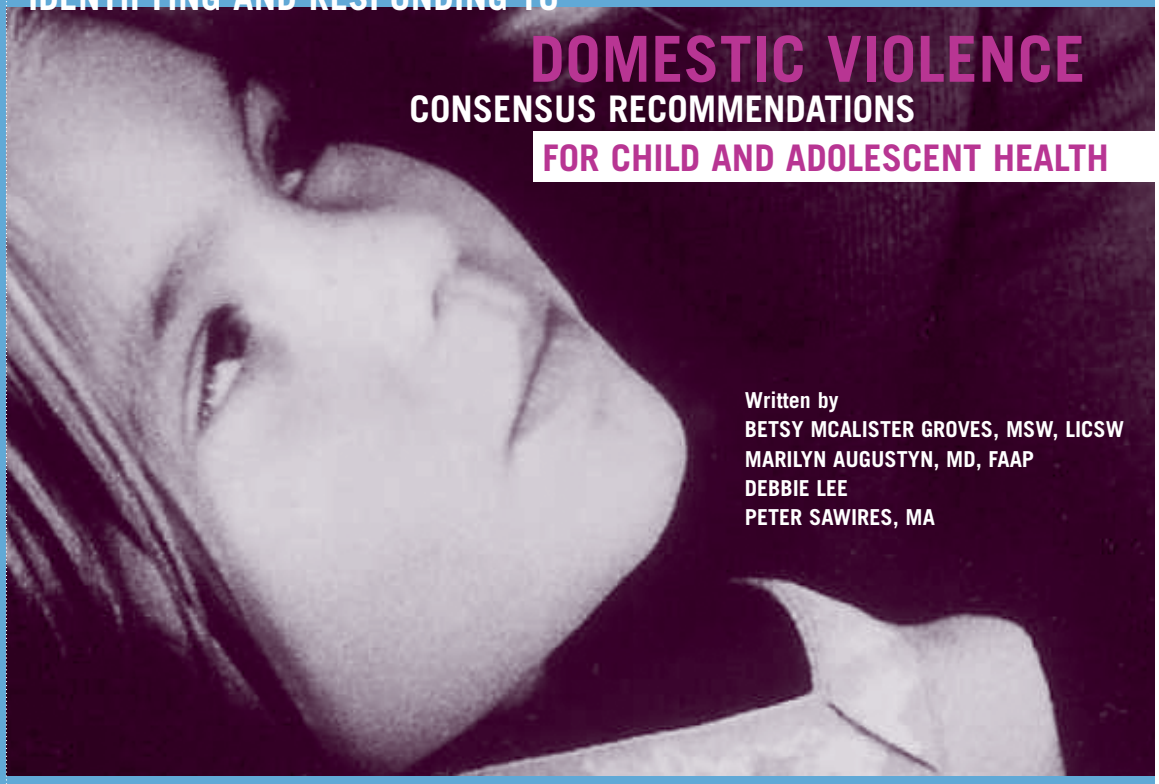
IDENTIFYING AND RESPONDING TO DOMESTIC VIOLENCE

CONSENSUS RECOMMENDATIONS FOR CHILD AND ADOLESCENT HEALTH



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CONTENTS

PART I

OVERVIEW

OVERVIEW

OVERVIEW

PART 1 | OVERVIEW

Over the past 15 years, there has been a growing recognition among health care professionals that domestic violence is a major health problem with devastating effects on individuals, families and communities. Health care professional associations have issued position statements or guidelines for their members that describe the impact of domestic violence on patients and suggest strategies for inquiring about domestic violence *(See the **Appendix I** for position statements from several professional associations).* Studies show that regular screening for domestic violence in medical settings has been effective in identifying women who are victims[1,2,3] and that victims are not offended when asked about domestic violence.[4,5,6,7,8]

In 1998, the American Academy of Pediatrics (AAP) issued a position statement declaring, "The abuse of women is a pediatric issue."[9] The statement made a strong case for recognizing domestic violence in child health care settings, but did not offer specific guidelines for inquiry and response or discuss the policy and practice dilemmas that arise when child health providers implement inquiry and response protocols.

The guidelines offered here provide specific recommendations for assessing and responding to domestic violence in child health settings, which provide a unique and important opportunity to inquire about for domestic violence and to educate parents about the impact of such violence on children. Virtually every child is seen at some point by a health provider. Thus, it is possible to assess every family that uses the health care system.

These guidelines also speak to the need for child health providers to engage in, model, and take leadership in delivering effective primary prevention of domestic violence, as well as other types of family and community violence, by highlighting violence prevention during well child and other routine visits, as a component of routine anticipatory guidance.

Part One of the guidelines presents an overview of the impact of domestic violence on children and adolescents, and the rationale for regular and universal assessment for domestic violence in child health settings. Part Two addresses dilemmas that providers may encounter in discussing domestic violence with parents of their patients and adolescents. Part Three contains the specific guidelines for inquiry and response. Part Four recommends elements to create a clinical environment that effectively responds to domestic violence. Several useful resources have been included in the Appendices.

DEFINITIONS

The term **"family violence"** and sometimes **"domestic violence"** has been used to describe acts of violence between family members, including adult partners, a parent against a child, caretakers or partners against elders and between siblings. While all forms of family violence can be devastating, this monograph focuses only on domestic violence or "intimate partner violence." In this monograph, "intimate partner violence" will be used to more specifically define a range of behaviors between intimate or dating partners:

> *Intimate partner violence is a pattern of purposeful coercive behaviors that may include inflicted physical injury, psychological abuse, sexual assault, progressive social isolation, stalking, deprivation, intimidation and threats. These behaviors are perpetrated by someone who is, was or wishes to be involved in an intimate or dating relationship with an adult or adolescent victim and are aimed at establishing control of one partner over the other.*[10]

Legal definitions of domestic violence or intimate partner violence are generally more restrictive and refer specifically to threats or acts of physical or sexual violence including forced rape, stalking, harassment, certain types of psychological abuse and other crimes where civil or criminal justice remedies apply. Laws vary from state to state. Since evidence exists that non-physical intimate partner violence has many devastating physical, psychological, behavioral and developmental effects, the definition used in these Guidelines is better suited for the identification and treatment of intimate partner violence in the health care setting.

> *"Child exposure to domestic violence or intimate partner violence" is a term encompassing a wide range of experiences for children whose caregivers are being abused physically, sexually, or emotionally by an intimate partner. This term includes the child who actually observes his/her parents being harmed, threatened or murdered, who overhears this behavior from another part of the home or who is exposed to the short- or long-term physical or emotional aftermath of caregiver's abuse without hearing or seeing a specific aggressive act. Children exposed to intimate partner violence may see their parents' bruises or other visible injuries, or bear witness to the emotional consequences of violence such as fear or intimidation without having directly witnessed violent acts.*[11]

Studies consistently show that the vast majority of victims of intimate partner violence are women. In fact, the latest United States Bureau of Justice Statistics report on intimate violence report found that 85 percent of victims are women.[12] The language in this monograph reflects this trend. However, it is important to note that some victims of intimate partner violence are men, and that violence exists in same sex relationships as well. All victims should be responded to appropriately.

DEFINITIONS

Prevalence of Intimate Partner Violence

Intimate partner violence is a health problem of enormous proportions. It is estimated that 20 percent to 30 percent of all women and 7.5 percent of men in the United States have been physically and/or sexually abused by an intimate partner at some point in their adult lives.[13,14,15] *Heterosexual women are five to eight times more likely than heterosexual men to be victimized by an intimate partner.*[16] *From 1993 to 1998, victimization by an intimate accounted for 22 percent of the violence experienced by females and three percent of the violent crime sustained by males.*[17] *Females are also approximately ten times more likely to be killed by an intimate partner than males.*

For adolescents, rates of experiencing some form of dating violence vary from 20 to 60 percent.[19,20,21] Women age 16 to 24 experience the highest per capita rate of intimate partner violence with 15.6 victimizations per 1,000 females age 16 to 24, as opposed to 5.8 per 1,000 females in general.[22] Teens are also at higher risk for abuse during pregnancy: 21.7 percent of pregnant teens experience abuse as opposed to 15.9 percent of pregnant adults.[23] While studies indicate that boys and girls may accept physical and sexual aggression as normal in dating and intimate partner relationships, female teens are more likely to receive more significant physical injuries and to be sexually victimized by their partners.[24] Finally, adolescent girls who have been sexually and physically hurt by dating partners are six to nine times more likely to attempt suicide or have suicidal ideation than those who reported no abuse.[25]

Far less data exist on lesbian, gay, transgender, and bisexual (or LGTB) victimization, however available literature suggests similarly high rates for LGTB adolescents and adults.[26,27] Intimate partner violence occurs in every community—urban, suburban or rural; in all social classes; and in all ethnic groups. Consequently, all health care settings and professionals are affected by intimate partner violence.

The estimates of numbers of children who are exposed to intimate partner violence vary from 3.3 million to ten million children per year, depending on the specific definitions of witnessing violence, the source of interview and the age of child included in the survey.[28]

Children who are five and under are disproportionately represented in households in which there is intimate partner violence and a sizable number of these children are involved because they calling for help, are identified as the cause of the dispute that led to violence, are caught in the cross fire, or are directly physically abused by the perpetrator.[29] In a study conducted in an urban outpatient pediatric clinic, 40 percent of a sample of 160 mothers had filed a restraining order against a boyfriend or husband.[30] In another study conducted in an office-based pediatric practice, 2.5 percent of mothers reported current intimate partner abuse and 14.7 percent reported abuse in past relationships.[31] In the Adverse Childhood Experiences (ACE) Study, conducted on a large sample of members

(30,000 adults) of the Kaiser Health Plan in California, 12.5 percent of respondents indicated childhood exposure to intimate partner violence and 10.8 percent indicated a history of child abuse, including physical, sexual and emotional abuse.[32] Together these studies indicate that children who witness intimate partner violence are seen with both frequency and regularity in virtually all health settings and that young children are disproportionately represented in the population of children who live with intimate partner violence.

Health Effects of Intimate Partner Violence on Adult and Teen Victims

In addition to injuries sustained by women during violent episodes, physical and psychological abuse are linked to a number of adverse physical health effects including arthritis, chronic neck or back pain, migraine and other frequent headaches, stammering, sexually transmitted infections, chronic pelvic pain, peptic ulcers, spastic colon, and frequent indigestion, diarrhea or constipation.[33] Additionally, optimal management of other chronic illnesses such as asthma, HIV/AIDS, seizure, diabetes and hypertension may be problematic in women who are being abused. Emerging research shows that women who are abused are less likely to engage in important preventive health care behaviors such as regular mammography.[34] Intimate partner violence is also linked with significant short- and long-term mental health consequences for victims.[35,36,37,38,39]

Female adolescents who reported being sexually or physically abused are more than twice as likely to report smoking, drinking and using illegal drugs as non-abused teens.[40] In addition, 32 percent of teen victims report bingeing and purging, compared to 12 percent of non-abused teens. Adolescent women who are battered are also less likely to attend school and less likely to receive good grades if they are in school.[41]

Adolescents' experiences with sex are also associated with their history of dating violence. A study of adolescents found that those who experienced dating violence were more likely than their non-abused peers to have sexual intercourse before age 15 and to have had three or more sex partners in the past three months.[42] Among young mothers on public assistance, half (51 percent) report birth control sabotage by a dating partner.[43] Additionally, high school girls reporting violence from dating partners are approximately four to six times more likely than their non-abused peers to have ever been pregnant.[44] The experience of interpersonal violence is correlated with rapid repeat pregnancy and higher incidences of miscarriage among low-income adolescents.[45] Finally, abused teens are more likely to enter prenatal care later in their pregnancy: 24 percent of teens identified as abused enter prenatal care in the third trimester compared to only nine percent of non-abused teens.[46]

Health Effects of Intimate Partner Violence on Children

More than 100 studies have explored the effects of intimate partner violence on children. These studies enumerate both short and long term effects of intimate partner violence on children.[47] The most obvious and potentially dangerous risk for children who live in homes in which there is intimate partner violence is that they become direct victims of abuse. In 30 to 60 percent of families affected by intimate partner violence, children are also directly abused.[48] Young children and adolescents are more vulnerable to the abuse. Very young children cannot get out of harm's way, and adolescents more frequently intervene to stop the violence, thereby putting themselves at greater risk for injury.[49]

Children who are exposed to intimate partner violence, particularly chronic episodes of violence, often show symptoms associated with posttraumatic stress disorder. One study found that exposure to intimate partner violence (without being directly victimized) was sufficiently traumatic to precipitate moderate to severe symptoms of posttraumatic stress in 85 percent of the children.[50]

Children who are exposed to intimate partner violence are more likely to exhibit behavioral and physical health problems including chronic somatic complaints, depression, anxiety and violence towards peers.[51] They are also more likely to attempt suicide, abuse drugs and alcohol, run away from home, engage in teenage prostitution and commit sexual assault crimes.[52] Children who are exposed to intimate partner violence have increased difficulties with learning and school functioning.[53] Symptoms of trauma including sleep difficulties, hyper-vigilance, poor concentration and distractibility which interfere with a child's ability to focus and to complete academic tasks in a school setting.

Intimate partner violence also affects parenting. The emotional consequences of being injured, harassed or terrified may be significant for the parent who is victimized. That parent may be less attuned to children's needs or less emotionally available to the children. However this does not mean that victims of intimate partner violence are inherently abusive or neglectful of their children. Parents who batter are generally less involved with child rearing, more likely to use physical punishment and less able to distinguish or recognize the child's needs as separate from the parent's needs.

Children who grow up with violence in the home learn early and powerful lessons about the use of violence in interpersonal relationships. They learn that violence is an acceptable way to assert one's views, get one's way or to discharge stress. These children also learn that violence may be an inherent part of loving relationships. Exposure to violence thus provides justification for children to use violence in their own relationships. This may be particularly true for adolescents.[54]

Studies demonstrate that children are not equally affected by exposure to intimate partner violence.[55,56,57] Children react in different ways to trauma, and they have a range of strengths and vulnerabilities to cope with this stress. Some children appear to be more resilient; others may be deeply affected. Variables such as age, gender, proximity to the violence and the frequency and severity of the violence affect children's responses. In addition, the response of the caregiver and other characteristics of the family and community affect children's responses.

Working Cross Culturally

Intimate partner violence affects people regardless of race, ethnicity, class, sexual and gender identity, religious affiliation, age, immigration status and ability. The term culture is used in this context to refer to those axes of identification and other shared experiences. Because of the sensitive nature of abuse, providing culturally relevant care is critical when working with victims of abuse. In order to provide care that is accessible and tailored to each patient and their family, providers must consider the multiple issues that victims may deal with simultaneously (including language barriers, limited resources, homophobia, acculturation, accessibility issues and racism) and recognize that each victim of intimate partner violence will experience both the abuse and the health system in culturally specific ways.

Disparities in access to and quality of health care also have an impact on ability of providers to help victims of intimate partner violence. For example, women who are members of racial and ethnic minority groups are more likely than white women to experience difficulty communicating with their doctors, and often feel they are treated disrespectfully in the health care setting.[58] English-speaking Latinos, Asians and Blacks report not fully understanding their doctors and feeling like their doctors were not listening to them.[59] People with disabilities that affect cognitive or communication may be dependent on an abusive intimate partner and thus at especially high risk. In addition, some patients may experience abuse from the health care system itself and this may affect their approach to and utilization of the health care system.[60]

Providers also enter health care encounters with their own cultural experiences and perspectives that may differ from those of the victim. In a successful health care interaction within a diverse client population, the provider communicates effectively with the patient, is aware of personal assumptions, asks questions in a culturally sensitive way and provides relevant interventions. Eliciting specific information about the patient's beliefs and experience with abuse, sharing general information about intimate partner violence relevant to that experience and providing culturally accessible resources in the community, improves the quality of care for victims of violence. In addition, having skilled interpreters who are trained to understand intimate partner violence (and not family members, caregivers or children) is crucial when helping non-English speaking patients [61] and their families. Culturally sensitive inquiry questions for all caretakers and adolescent patients can facilitate discussion and help providers offer appropriate and effective interventions.

Recent Trends

These guidelines reflect an important shift in terminology. "Assessment" or "inquiry" has replaced the work "screening" throughout this document. The concept of screening in the medical model usually involved the use of a standardized clinical test to detect disease in asymptomatic patients. Psychosocial health issues like IPV do not fit well into a disease-based approach, particularly when identification of the health concern relies primarily on the patient's response to a question. The U.S. Preventive Services Task Force (USPSTF) uses the term "assessment" in their recommendations for many psychosocial issues such as tobacco use and alcohol consumption. The USPSTF and other prominent medical organizations have identified the problems with fitting IPV into a traditional screening paradigm. The FVPF believes that using the term "assessment" will lead to a more appropriate evaluation of the importance of routine inquiry for IPV in the health care setting.

With growing recognition of the connection between IPV and other risk factors, there is a trend to integrate routine inquiry for IPV into assessment tools addressing a wide range of psychosocial issues associated with current or past victimization such as tobacco use, weight control, and access to preventive health care. This has led to innovative strategies for more comprehensive assessment and integrated service delivery. The Maternal and Child Health Bureau has funded several perinatal demonstration projects to develop as assessment tool for IPV, depression, and substance abuse. Another exciting initiative through the Substance Abuse and Mental Health Services Administration (SAMHSA) promotes coordinated services for women who experience violence, mental health problems, and have substance abuse issues.

Identifying and Responding to Abuse Can Make a Difference

The health care system plays an important role in identifying and preventing public health problems. Models developed to identify other chronic health problems may effectively be applied to intimate partner violence. **A primary starting point to improve the medical practice approach to intimate partner violence is routine assessment, with a focus on early identification of all families and victims of intimate partner violence whether or not symptoms are immediately apparent.**

Since nearly all young children and teens are seen at some point in a health care setting, these settings present a compelling opportunity to identify teens, mothers and children who may be living with intimate partner violence. A 2001 study in North Carolina found that only 23 percent of women injured by a partner shortly after pregnancy received treatment for their injuries. However, almost all of these women used health care services for their infants, indicating that child health settings are potentially important for identifying intimate partner violence.[62]

Universal and regular face-to-face screening of women in adult health settings by skilled health care providers markedly increases the identification of victims of intimate partner violence, as well as those who are at risk for verbal, physical and sexual partner abuse.[63,64] Expert opinion suggests that such interventions in adult health settings may lead to reduced morbidity and mortality.[65] Inquiry for IPV can assist clinicians in their diagnosis and assure more appropriate care for a victim's health symptoms by treating the underlying problems. Inquiry also gives victims a valuable opportunity to tell their providers about their experiences with abuse.[66] Battered women report that one of the most important parts of their interactions with their physicians is being listened to about the abuse. *(See* ***Appendix III****: Abstracts of selected studies on Provider and Patient Attitudes: Forward Screening for IPV in the Child Health Setting.)*

Although there is no research as yet that proves the efficacy of assessment in child health settings, it is reasonable to assume that such inquiry would increase opportunities for identification and intervention within families, thereby enabling pediatric, family practice and primary care providers to assist both victims and their children. When child witnesses of intimate partner violence, victims or those at risk for intimate partner violence are identified early, providers may be able to intervene to help patients understand their options, live more safely within the relationship or safely leave the relationship. The child health care provider's direct discussion about safety at home tells the family that this is an important topic and one that belongs in the realm of pediatric and family practice care. Even if a woman denies that she is being abused, the provider can often lay the groundwork for the possibility of future disclosure or discussion of the issue.

PART II

DILEMMAS FACED BY PROVIDERS

DILEMMAS

DILEMMAS

Family Violence Prevention Fund

PART II | DILEMMAS FACED BY PROVIDERS

A policy of universal and regular inquiry for intimate partner violence in child health settings presents dilemmas to the providers who assess that may not exist when assessing patients in an adult health setting. Perhaps the fundamental difference lies in the fact that adults are not the primary patients during pediatric visits. This section reviews several major dilemmas and provides specific recommendations for responding. Because these dilemmas present challenging practice and ethical questions for the provider, this panel strongly recommends that child health practices have access to legal consultation, as well as consultation from battered women's service providers, child protection and child mental health. These resources can be helpful in making decisions about how to intervene in ways that do not increase risk for the family or unnecessarily alienate the non-offending parent.

When Does Child Exposure to Intimate Partner Violence Become Child Maltreatment?

Because of the high rate of co-occurrence of intimate partner violence and child abuse, child health providers need to be concerned about the possibility of child abuse whenever intimate partner violence is disclosed. Whenever a child is abused, either intentionally or unintentionally, as a result of intimate partner violence, state law requires health care providers to report this abuse to child protection services. Mandated reporters would also report any high-risk situation of intimate partner violence in which children are at risk.

However, state laws are less clear about whether exposure to domestic violence in the absence of injury or serious risk of injury to the child would require a report to children's protective services.

- In some states, stringent rules/laws require mandated reporters to notify child protection services whenever a child is in the home and has been exposed to a parent's abuse, whether or not the child has been directly abused. Proponents of this definition point to the ample documentation of the overlap between adult intimate partner violence and child abuse and the adverse psychological effects on children who witness intimate partner violence. Opponents of this policy believe it penalizes women for abuse that they have no control over and may discourage women from seeking help.

- In other states, a child's exposure to intimate partner violence does not automatically require a mandatory child protection report. The provider has wider discretion to assess whether a child has been directly involved and what other factors may exist to put the child at risk. In these states, a provider would take into account the existence of direct injury to a child, the potential danger of the situation, and the capacity of the mother to keep her children safe in deciding whether to notify Child Protective Services (CPS).

Many victim advocates recommend having the victim place a phone call themselves to CPS from the practitioner's office, thus protecting her from charges of "failure to protect" while simultaneously protecting the child and meeting statutory child abuse reporting laws.

Unless a child health care provider is legally required to report all incidences of intimate partner violence to CPS, it is preferable to make this decision based on the specifics of the case and the provider's clinical judgment. In some instances, the children are not in danger; the victim has planned for their safety and is responding adequately to the child's needs or emotional reactions. In these cases, a provider should offer voluntary services and support instead of simply submitting a report to CPS, especially if not mandated.

A policy that automatically defines child exposure to intimate partner violence as neglect or maltreatment assumes that victims are neglectful parents solely because their children witnessed the abuse, implying that somehow the victim could have stopped the abuse. This approach implies that not only are these parents victims of abuse, but that they also bear the responsibility for child neglect. This may be inaccurate and unfair. This policy also makes the assumption that all children are adversely affected by exposure to violence, no matter the circumstances. It ignores the fact that some children are more adversely affected than others and that some families and communities are more able to support children than others. Finally, opponents of this policy allege that mandatory reports also would increase the demands on protective services—a system that is already overburdened and under funded in most states.[67] In addition, the practice of routinely reporting intimate partner violence incidents that involve children to protective services discourages victims from seeking help with intimate partner violence. If a victim believes that children may be removed from her care, she will be less likely to seek help from medical professionals. A mandatory reporting policy also may discourage child health care providers from assessing for intimate partner violence because they do not want to involve protective services in their patient's life.

RECOMMENDATIONS:

Know your state's child abuse reporting laws *(see **Appendix XI**)* and its specific policies on defining child exposure to intimate partner violence as child maltreatment *(see **Appendix X**)*. In a state that requires mandated reporting in all cases of intimate partner violence, the provider should inform the non-offending parent of the obligation to file a report to CPS, assess the safety needs of the victim, and inform CPS about the specifics of the perpetrator, his anticipated response and the potential for danger. In states where more discretion is left to the provider, the provider should assess the specifics of each situation as a means of making a decision about whether it is necessary to make a report. The assessment should include inquiries about injury or abuse to children, the current safety of the home, and whether the perpetrator has made threats to the children. Depending on the answers to these questions, the provider can make a decision about the imminent risk of harm to

the child and victim. If the situation is not currently dangerous, the provider can refer the victim to voluntary services: battered women's services, counseling (preferably with a provider who has worked with victims of intimate partner violence), or child-focused services. If the situation is currently dangerous to the child, a report needs to be filed. Consider involving the mother in filing the report and follow the recommendations above to maximize the protection afforded to the mother during the CPS investigation.

BOX 1

In States with Mandatory Reporting Requirements for Child Exposure to Intimate Partner Violence

PROVIDERS SHOULD:

- Inform the non-offending parent of obligation to report to CPS
- Assess the safety needs of the victim
- Give CPS specific information about the perpetrator, the intimate partner violence, and the potential for danger
- Have resources available for the non-offending parent

In States with Less Specific Reporting Requirements for Child Exposure to Intimate Partner Violence

PROVIDERS SHOULD DECIDE WHETHER TO FILE A REPORT WITH CPS BASED ON:

- An inquiry about direct injury to child
- An assessment of potential for danger (threats, weapons, substance abuse)
- An assessment of mother's ability to plan for children's safety
- An assessment of support and connections to community

If provider decides not to report to CPS, he/she should offer referrals to voluntary services and provide follow-up care.

IF PROVIDER DOES DECIDE TO REPORT:

- Consider asking the mother to file a report herself to avoid charges of "failure to protect"
- Follow all the steps outlined above for reports in mandated states

Intimate Partner Violence Victimization Reporting Requirements for Health Care Providers

While all states mandate reporting of child abuse or neglect, most states have also enacted general mandatory reporting laws which require the reporting of specified injuries and wounds, suspected abuse or intimate partner violence for individuals being treated by a health care professional. These mandatory reporting laws are distinct from child abuse, elder abuse or vulnerable adult abuse reporting laws, in that the individuals to be protected are not limited to a specific class. These laws pertain to all individuals to whom the health care professional provides treatment or medical care, or who come before the health care facility.

The laws vary from state to state, but generally fall into four categories: 1) states that require reporting of injuries caused by weapons; 2) states that mandate reporting for injuries caused in violation of criminal laws, as a result of violence, or through non-accidental means; 3) states that specifically address reporting in intimate partner violence cases; and 4) states that have no general mandatory reporting laws. *(See **Appendix IX** for state codes on Intimate Partner Violence Victimization Reporting Requirements for Health Care Providers).*

In the majority of states, neither statutory nor case law specifies if a health care provider must report a parent's injuries if they are observed or discovered during a health care visit with that parent's child. Therefore, under a strict reading of most laws, if a child's health care provider is not providing treatment or medical care to the abused parent during the child's visit, the health care provider would not be required to make a report. In family practice situations where the child and parent are the provider's patients, and the current visit appointment is for the child, the same reasoning could be applied, although it is less clear-cut. That is, the health care provider would not be required to report since he or she is not treating the parent for the specified injuries during the appointment. This issue merits further discussion among health care providers, advocates, licensing authorities, and other professionals, as it is uncharted territory. There has been much debate about the benefit of mandatory reporting of intimate partner violence by health care providers. A more extensive discussion of these laws, their risks and benefits, and their application to pediatric and family practice providers can be found in ***Appendix VIII***.

RECOMMENDATIONS:

Providers should know their state's intimate partner violence reporting law, including who is required to report and under what conditions. *(**Appendix IX** contains a chart listing state codes)*. In order to maximize patient input regarding law enforcement action, providers should also familiarize themselves with how their local law enforcement agency responds to such reports. Becoming familiar with such procedures will allow the

provider to better assist the patient in safety planning, and in knowing what to expect. Intimate partner violence reporting responsibilities should be carefully discussed with teens prior to assessing for dating violence or intimate partner violence in their homes. Additionally, recent federal privacy regulations require providers to inform patients of health information use and disclosure practices in general, and whenever a specific report has been made. Health care facilities should ensure that their intimate partner violence protocols and training materials address their state reporting laws and federal regulations.

Asking about Intimate Partner Violence with a Child in the Room

Providers differ in their practice of asking sensitive questions to the mother when the child is present. Generally, if the child is under age three, most providers assume that asking a mother about safety or other sensitive issues is appropriate. However, there is not consensus about whether to require that an older child not be present in the room when screening the mother for intimate partner violence. Some providers are concerned about asking questions when older children are present. They assert that having the child in the room will be a barrier to disclosure because parents will avoid discussing it in front of their children. Some say that it would be upsetting for children to hear such conversation or that children may reveal the conversation to the batterer which may endanger the mother and child. Other providers believe that the assessment questions about intimate partner violence should be asked regardless of the age of the child. They assert that children generally are aware of the intimate partner violence and that mothers will indicate if they are uncomfortable with the subject, thus giving the provider the opportunity to schedule a more private conversation with the parent.

RECOMMENDATIONS:

It is best to conduct assessment without children in the room and should occur regardless of the age of the child. In some practices it is possible to have the child wait in a supervised waiting area or under the supervision of another staff member. In other practice settings, it is not possible to have children leave the exam room. In these situations, providers can ask general questions and should always be sensitive to the comfort level of the parent. If the parent seems uncomfortable, the provider can offer other options for talking more privately, either by telephone or in a follow-up visit. Providers should be aware of the impact of a disclosure on a child, and should ask follow-up questions about the child and family's safety.

BOX 2

Asking about Intimate Partner Violence with a Child in the Room

Child in the Room

PRACTICAL POINTS:

1. Ask general questions first.
2. Be sensitive to comfort level of parent.
3. If parent is uncomfortable, schedule a time to talk without the child present.

Child not in the Room

PRACTICAL POINTS:

1. Ask during routine parts of visit when child is not in the room: vision screening, immunizations, laboratory work.
2. Have the child wait briefly in a supervised waiting area if possible.

Documentation

There is no consensus over the procedure for documenting the presence of intimate partner violence in a family in a child's chart. If the batterer is the biological or custodial parent, he may have access to the chart and the information about the victim would thus not be confidential. Therefore, putting information about intimate partner violence disclosures in the child's chart may not be advisable. On the other hand, the information is important and other providers who work with the family should know about this risk factor if they read the child's chart. Charting can also be helpful to the victim should custody disputes arise.

RECOMMENDATIONS:

A review of the literature and current practice reveals that recommendations for documentation are contradictory and inconsistent. One recommendation is for the provider to document all screenings for intimate partner violence in the child's chart. The suggested notation, perhaps in the section on anticipatory guidance, is: "The parent was routinely asked about verbal abuse, threats, physical violence in the home and community. If so, the parent was offered information about community resources for safety planning and counseling." This type of routine documentation is recommended for tracking and quality assurance. If possible, the documentation for the outcome of the inquiry (if positive for abuse) should be placed in the woman's health chart or in social work notes where there is more protection of confidentiality. Some practices use non-specific terms or a code word to indicate the presence of intimate partner violence in a child's chart: for example, "family problems," "difficult home situation" or "+ wtv." Some practices maintain a section of the child's chart that is confidential and is not released when there is a request for medical records. A brief notation of intimate partner violence in this section is appropriate. Intimate partner violence should not be listed as a discharge diagnosis or billing information that is sent home or can be viewed by the perpetrator.

If the provider is unsure about documentation and its confidentiality from the battering parent, he/she should consult with medical records experts, billing personnel, risk management professionals or attorneys.

BOX 3

Options for Documentation

- Document that inquiry has occurred.
- Document results of inquiry by using non-specific terms or code works: "family problems," "difficult home situation," or "wtv."
- Maintain a section of the child's chart that is confidential (not released with a request for medical records). Document finding of intimate partner violence in this section.
- If possible, document the existence of intimate partner violence in the woman's health chart or in social work notes where there is more confidentiality.

Responding to a Child's Disclosure of Intimate Partner Violence in the Home

Direct disclosures of intimate partner violence occur more frequently with older children or teenagers who see child health providers without their parents. If the parents are unaware of the disclosure, the provider must decide how to inform the parents in a way that protects the child and does not create an unsafe situation in the home. The provider may feel uncomfortable about how to handle this disclosure. Should the provider notify child protective services? What are the consequences for the child of telling someone outside the family about the violence? What are the issues and laws related to confidentiality?

RECOMMENDATIONS:

Find out as much specific information as possible about the abuse and the extent of risk for the child and the adult victim. If the situation is dangerous, notify protective services. Inform the child of your concern about his/her safety and tell the child that you would like to speak to the non-offending parent about the situation. Inform the non-offending parent of the child's concerns, taking care to stress that you are concerned and that you want to be helpful and supportive. Ask if the parent is safe and what types of supports would be helpful. If possible, make a referral to an intimate partner violence support agency or to counseling/social services/mental health. Schedule a follow-up appointment for the next week.

BOX 4

Responding to Child Disclosure of Intimate Partner Violence

PRACTICAL POINTS:

- Inform the child of your concern about her/his safety and that you intend to speak to the non-offending parent about the situation.
- Inform the non-offending parent of the child's concerns.
- Ask if the parent is safe and what types of supports would be helpful.
- If possible make a referral to an intimate partner violence support agency or to counseling/social services/mental health for the adult or adolescent victim and their children.
- Schedule a follow-up appointment for the next week.
- Notify protective services if there are safety concerns about the child.

PART III

CONSENSUS RECOMMENDATIONS

CONSENSUS RECOMMENDATIONS

PART III | CONSENSUS RECOMMENDATIONS

ASSESSING FOR INTIMATE PARTNER VIOLENCE WHEN YOUR PATIENT IS A CHILD OR ADOLESCENT

All health care providers seeing children and adolescents should provide intimate partner violence assessment as part of routine patient care in public health, private practice and managed care settings.

Who and How Often to Assess:

- Assess female caregivers/parents who accompany their children during new patient visits; at least once per year at well child visits; and, thereafter, whenever they disclose a new intimate relationship.
- Assess female and male caregivers/parents known to be in same-sex relationships who accompany their children during new patient visits; at least once per year at well-child visits; and, thereafter; whenever they disclose a new intimate relationship.
- Assess adolescents during new patient visits; at health maintenance visits once per year; or whenever they disclose a new intimate relationship.
- Ask pregnant teens at first pre-natal visit; at least once per trimester; and at the postpartum visit.[i]
- Also ask whenever signs and symptoms raise concerns:[ii]
  - Specifically, assess when the child or adolescent has:
    - Obvious physical signs of physical or sexual abuse;
    - Behavioral or emotional problems, such as increased aggression, increased fear or anxiety, difficulty sleeping or eating, or other signs of emotional distress; or
    - Chronic somatic complaints.
  - When adults present with obvious physical injuries or a history of intimate partner violence.

*(See **Appendix IV**: Dilemmas When Assessing All Patients for Victimization.)*

[i] Recommended by the American College of Obstetricians and Gynecologists

[ii] See Appendix V: Indicators of Abuse.

BOX 5

Who and How Often to Assess:

TYPE OF VISIT	WHO TO ASSESS	WHEN TO ASSESS
New Born	Caregiver	At postpartum visit
New Patient	Caregiver & Adolescent	At first visit
Well Child:		
Child	Caregiver	At 2, 6 and 12 months, then yearly
Adolescent	Adolescent	Yearly
Prenatal	Adolescent Mother	Once per trimester
Mental Health	Caregiver & Adolescent	At initial visit
Emergency	Caregiver & Adolescent	At every visit
Other Visits	Caregiver or Adolescent	Whenever there are physical or behavioral indicators or chronic somatic complaints

How to Assess:

- Direct questions should be asked, whether or not signs or symptoms are present and whether or not the provider suspects abuse has occurred.
- Inform patient about the limits of practitioner/patient confidentiality related to intimate partner violence prior to assessing.
- Use language that is direct, specific and easy to understand.
- Conduct assessment in a private room.
- For a parent, it should take place without the intimate partner or other adult family members present.
- For adolescents, it should take place without the parent (or partner) in the room.
- Can be included as part of a written health questionnaire or health history, but this should not replace face-to-face assessment.
- Should be conducted in a patient's primary language.
- If an interpreter is used, it should not be an acquaintance or relative of the family. Children should never be used as interpreters.

What to Ask:[iii]

Intimate partner violence questions can be framed within discussion of other safety issues such as car and bicycle helmet safety, and assessing for guns at home or community violence.

[iii] There are no controlled studies of the efficacy of screening questions in pediatric or family practice settings. The questions we propose are drawn from three sources: Family Violence Prevention Fund, Preventing Domestic Violence: Clinical Guidelines on Routine Screening. San Francisco, October, 1999. Groves, B. (1994). Children who Witness Violence, in Developmental and Behavioral Pediatrics: A Handbook for Primary Care. Parker, S. and Zuckerman, B., eds. Boston, Little Brown & Co. 334-336. McNamara M. (2001). "Clinical guidelines for screening and responding to child and youth exposure to domestic violence for healthcare providers". LINC (Living in a Nonviolent Community), UCSF Department of Pediatrics, November 2001.

For adults who accompany their children:

INTRODUCTORY STATEMENTS OR QUESTIONS:

- "I have begun to ask all of the women/parents/caregivers in my practice about their family life as it affects their health and safety, and that of their children. May I ask you a few questions?"
- "Violence is an issue that unfortunately effects everyone today and thus I have begun to ask all families in my practice about exposure to violence. May I ask you a few questions?"

INDIRECT QUESTIONS:

- "What happens when there is a disagreement with your partner/husband/boyfriend or other adults in your home?"
- "Do you feel safe in your home and in your relationship?"

DIRECT QUESTIONS:

- "Have you ever been hurt or threatened by your partner/husband or boyfriend?"
- "Do you ever feel afraid of (or controlled or isolated by) your partner/husband/boyfriend?"[iv]
- "Has your child witnessed a violent or frightening event in your neighborhood or home?"

For adolescents:

INTRODUCTORY STATEMENTS OR QUESTIONS:

- "Many teens your age experience threats, name calling, uninvited touching, sex or violence, so I ask all my teen patients about it. May I ask you a few questions?"
- " I don't know if this is a concern for you, but many teens I see are dealing with violence or bullying issues, so I've started asking questions about violence routinely."
- "Sometimes when I see an injury like yours, it's because somebody got hit. How did you get this injury/bruise?"
- " Now I am going to ask you confidential questions. The answers are confidential, unless your health is in immediate danger."
- "How are disagreements handled in your family?"

INDIRECT QUESTIONS:

- "Are you in a relationship or seeing anyone?" or "Do you have a boyfriend or girlfriend? What happens when you disagree with them?"
- "How are your parents getting along?"

[iv] In case of same sex relationships we recommend using "partner" or mirroring the language of the adult being screened. For example, if a parent refers to her same sex partner as "roommate," use "roommate." If the sexual orientation is unknown, we recommend "partner."

- "How often do you have yelling or screaming fights? Do any of them involve pushing or slapping?"

DIRECT QUESTIONS:

- "Sometimes if someone is being hurt in her/his own relationship, they may have seen it happen in their own family. Have you seen anyone get hurt in your home?"
- "Teens see a lot of violence these days. Seeing parents or other adults fight can feel as bad as being hit yourself. Has this happened to you?"
- "We all have disagreements sometimes with family members or friends. Have you ever been hurt or threatened by anyone?"
- "Have you ever been hurt – hit, kicked, slapped, shoved, pushed by a friend or person you know?"
- "Have you ever been forced to do something sexual that you didn't want to do?" —as part of sexual history.
- "Do you ever feel afraid of or controlled by someone you're dating or a friend?"
- "Has anyone hit you at home in the last year?"

QUESTIONS BASED ON INDICATORS:

- "I noticed that you have an injury. Sometimes injuries like that come from someone hurting you. What happened to you?"

Asking about Intimate Partner Violence with a Child in the Room

There are different opinions about whether inquiry about sensitive issues such as intimate partner violence should take place with the child in the room or whether the questions should be asked without the child's presence. For further discussion of this issue, see page 10.

- If it is possible to see the parent without the child, (e.g. the child is old enough to wait alone; the child is in a supervised waiting area; the child is having laboratory work or vision /hearing screening done), questions can be asked in the manner mentioned in the section "What to Ask" above.

- For children under age three, asking the mother questions about safety and relationships in the presence of the child is generally not an issue.

IF THE CHILD IS IN THE ROOM:

- Begin inquiry with an indirect question (see section "What to Ask" above).
- If parent appears uncomfortable or upset and it is not possible to see the parent alone in this visit, ask if there is another time to speak by telephone or to follow-up.
- If parent appears comfortable with the questions, proceed to ask more specific questions about intimate partner violence.

Who Should Assess:

QUESTIONS CAN BE ASKED BY ANY HEALTH CARE PROVIDER WHO IS:

- Educated about the dynamics of intimate partner violence, how children are affected and how to assess safety of children and/or know what resources are available for further assessment and counseling services;
- Trained on how to ask about abuse, how to assess the safety needs of an abuse victim, and how to assist the victim, and who recognizes her autonomy and right to make her own decision or is trained to refer the patient to someone who can assess safety needs and further assist her;
- Sensitive to issues of culture and class in interactions with patients; and
- Knowledgeable about community resources.

RESPONDING TO INTIMATE PARTNER VIOLENCE WHEN YOUR PATIENT IS A CHILD OR ADOLESCENT

If the patient or his/her mother tells you that s/he has been abused, you become an important part of her/his support system. Living with intimate partner violence or making the decision to leave a relationship are ongoing issues for both patient and family that affect their health care. Providers need to respect the integrity and authority of victims of intimate partner violence to make decisions about their own relationships, even if the provider does not agree with those decisions. The health care provider can play an important role in the victim's decision making process by asking the right questions, providing information about the nature of intimate partner violence, giving messages of support, and letting her know about resources available to her. At times it will be appropriate for the health care provider to make recommendations about what to do, but only after understanding the reality of the victim's situation and only with the understanding that, ultimately, the victim must and will make her own choices, not withstanding child abuse laws.

Support the Victim:

- Express concern for the patient's or parent's safety.
- If the victim is comfortable, encourage her/him to talk about what has happened.
- Listen without making judgments.
- Tell victims that they are not alone and that you and other people can help them.
- Tell her/him that the violence is not their fault, s/he does not deserve to be abused and that only her/his abuser can stop the abuse, and that there is no excuse for intimate partner violence.
- Make sure s/he knows that there is help available and that there are people s/he can turn to for support.
- Remind the victim that you are a resource, should s/he need further assistance.

- Inform the attending parent or adolescent of any reporting laws and requirements.

Provide Information on Intimate Partner Violence:

- Intimate partner violence is common (among all social strata, educational levels and ethnic groups).
- Most violence continues for a long time and often gets more frequent and more severe.
- Violence happens in all kinds of relationships – including teen relationships and lesbian and gay relationships.
- Violence in the home can harm all family members including children, both physically and emotionally
- There are resources for families, and this clinic/practice/provider can help find them.
- Intimate partner violence affects victim health and the health of the family.

What to Say to the Child Who has Witnessed Intimate Partner Violence:

If a parent discloses intimate partner violence, the provider with the parent's permission can specifically acknowledge the disclosure with the child by saying:

- "What are your worries about the fighting at home?"
- "I am concerned about the safety of people in your home and I am glad your mother told me about this."
- "What is going on in your house is not your fault."
- "You are not responsible for solving these problems. I am going to work with your mother (father, caretaker, etc.) to try to make things better."

The way in which the provider discusses these issues with children will vary by their age and level of cognitive development. For a four-year-old, it is probably sufficient to provide simple acknowledgment and reassurance about safety. For an eight-year-old, it may be appropriate to add more specific reassurances about what steps the parent is taking to handle the situation. For an older child or an adolescent, it may be important to offer the opportunity to talk about their perspectives of the situation at home.

For Adolescents Who are Victims of Violence:

- Address the health issues by obtaining a complete history.
- If possible, conduct a complete, unclothed, physical exam. Look for – and document – evidence of current or previous injuries and of sexual abuse.
- Ask about medical and psychological effects resulting from abuse, such as chronic pain, worsening of existing medical conditions, psychological distress, anxiety, sleeping and eating disorders, miscarriages or substance abuse.
- Schedule a follow-up appointment, encourage your patient to return and make other

appropriate referrals.
- Encourage the patient to talk to his/her parents or trusted adult about dating violence.
- For severe violence, inform adolescents that you must inform their parents or guardian to keep them safe. In this case, you may need to inform state protective service if the caretaker will not protect the child.

Assess and Address Safety Issues:

Before your adolescent patient or a parent leaves, talk with her/him about immediate and future safety. These questions can also be asked over time and during subsequent visits.

- Ask her/him about her/his immediate plans. Is s/he going home to the person who hurt her/him? Does s/he have a friend or relative s/he can talk to? If s/he is going to leave, where is s/he going to go?
- Depending on the amount of time the clinician has, the following issues can be pursued to assess current danger:
    - What happened during the latest incident? Is the abuse increasing in frequency or severity?
    - Were weapons involved?
    - Have there been prior incidents?
    - Have you sought any kind of assistance for previous battering? Have you ever left before?
    - Has the abuser ever threatened or physically injured the children?
- Assess for suicidal ideation and risk of homicide:
    - Have you ever considered, threatened or attempted suicide?
    - What injuries did you sustain during the worst incident of violence?
    - Has the violence increased in frequency and/or severity?
    - Has the abuser ever threatened to kill you? Do you believe s/he is capable of killing you? Has the abuser used a weapon or threatened you with a weapon before?
    - Are you planning to leave/divorce him in the near future?
    - Are there firearms or other weapons in the house?
- Help parents think about safety issues for their children. For example:
    - Do the kids usually get involved when a violent incident occurs?
    - What do they do when violence erupts?
    - Do you talk with them about it? What do you say?
    - Children should be taught that their job in a violent situation is to stay safe, not to protect their parents or stop the fighting. They should be taught now to call 911(where age appropriate).
    - Help the victim think about options and their implications.
- Inquire about the possibility of referring a victim to appropriate services from a battered women's shelter or support network and/or other culturally relevant agency such as a

community center, church or other organization serving the victim's community. *(See **Appendix VII** for a Safety Plan and Instructions).*

Referrals for Adult Parents and Adolescents:

Help your patient find culturally appropriate support from a hospital or community-based social worker or advocate who can help the victim with:

- Emergency shelter or permanent housing
- Emergency financial assistance or transportation
- Counseling and/or support groups for victims and their children
- Child care, visitation centers
- Legal assistance
- Mental health and substance abuse treatment
- Social services
- Batterer intervention programs
- Independent living centers

Note: Couples treatment and mediation are not usually recommended[v]

When possible, refer patients to organizations that reflect their cultural background or address their special needs such as organizations with multiple language capacity and those who specialize in working with teen, disabled or LGBT (lesbian, gay, bisexual, or transgender) clients.

Allow her/him to use your phone to make calls. If you don't have information about intimate partner violence programs in your area, call the National Domestic Violence Hotline at 800-799-SAFE (800-799-7233 or TDD: 800-787-3224).

[v] Mediation and couples counseling imply that both parties are responsible for the perpetrator's violent behavior, a message that blames victims and fails to hold offenders accountable for their crimes. Mediation also presumes that both parties have equal power and can negotiate a mutually agreeable settlement. Where there is domestic violence, sexual assault, or stalking behavior, however, one party has controlled the other through sexual, physical, emotional and/or economic abuse. Even the most skilled mediator or therapist cannot shift the balance of power when one party has abused or assaulted the other, making mediation and joint counseling dangerous and ineffective in such cases.

Referrals For Children:

Children react to witnessing intimate partner violence in many different ways. The family's capacity to support these children also varies, as do their beliefs or ways of seeking help. If the parent is concerned about her child, options for help should be discussed, including a counseling referral, mental health assessment or other support services (such as Big Brother/Big Sister). A referral would be strongly recommended in the following circumstances:

- If the child has witnessed severe violence resulting in injury or hospitalization of either the child, sibling or the parent.
- If the child's symptoms have persisted for more than three months.
- If there has been a change in behavior or an increase in aggression or depression.
- If the caretaker is unable to be emotionally attuned to the child's needs.
- If the violence has resulted in the death of a parent.

Reporting Requirements for Child Abuse and Intimate Partner Violence:

Know your state's child abuse and intimate partner violence reporting laws. *(Discussion of the complexity of these issues can be found in **Appendices VIII, IX & X**).* Contact your local prosecutor or state attorney general, and local law enforcement to interpret the law.

- Before asking about intimate partner violence, you may want to disclose any limits of confidentiality. Since many adolescents who are victimized by an intimate partner do not want their family to know about an intimate relationship, it is important that you understand and explain the limits of confidentiality of both their medical record and reporting before screening.[vi]
- If the child has been injured, or if your state requires mandated reporting in all cases of a child's exposure to intimate partner violence, you must:
- Follow the state guidelines for completing a report.
- Encourage the victim to place a call to CPS themselves from the practitioners office, thus protecting her from charges of "failure to protect" while simultaneously protecting the child and meeting statutory child abuse reporting laws.
- If possible, when making the report yourself, tell the attending parent what you will say in the report and/or allow her to read/hear what you will say.
- When making the report to CPS, inform the screener or intake worker about the specifics of the domestic abuse and give as much information as possible about the risks for safety of the mother and child, the perpetrator, his current location, the anticipated response and the potential for subsequent violence.

[vi] Federal health privacy regulations allow parents of teens to access health information unless the teen is emancipated or legally seeking care without parental consent such as services offered in Title XX, family planning clinics or STD clinics.

How to Document Intimate Partner Violence:

Documentation provides information on the effects of intimate partner violence over time and improves continuity of care. Make sure you are following your institution, state and federal privacy policies.

- Documentation is recommended. However, use caution in documenting intimate partner violence in a child's chart if the abuser is the biological or custodial parent. It may be advantageous to document on a separate form.
- For adolescents, documentation should be handled consistently with documentation of other sensitive issues, such as sexual activity, alcohol or drug use.[vi]
- When documenting, use direct quotes like " Mother/Patient states...". Avoid judgmental terms such as "patient alleges" or "patient claims."
- With permission, photograph or draw picture of any injuries.

What to Do if a Patient Says "No" or Will Not Discuss Abuse:

Many victims of intimate partner violence will talk about their experiences if asked to do so in a sensitive and empathetic way. However, some victims may be reluctant to talk about their experiences regardless, because they are embarrassed or ashamed, or afraid that if they tell anyone they may face more severe abuse. There may be financial issues and or immigration concerns. Patients need to decide for themselves about whether they wish to disclose. If you suspect intimate partner violence and the victim remains reluctant to discuss or disclose, let her/him know that should s/he need your assistance in the future, you are available. The goal is not to get the victim to admit to the problem, but to let her/him know that you are a resource should intimate partner violence ever be an issue for them.

PART IV

PREPARING YOUR CHILD HEALTH PRACTICE

PREPARING YOUR PRACTICE

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Family Violence Prevention Fund

PART IV | PREPARING YOUR CHILD HEALTH PRACTICE

It is important that the practice or clinic setting be set up to support the staff in responding effectively and efficiently to disclosures of intimate partner violence. In preparing your practice to begin routine inquiry for and response to intimate partner violence, it is advisable to obtain support from the leadership and administration, as well as to solicit staff input.

Physical environment should:

- Allow for confidential interviewing
- Have posters on intimate partner violence that are multicultural and multilingual; that present available resources; and that include information about victims, perpetrators, and/or other family and community members affected by family violence
- Have brochures/pocket cards for victims and perpetrators and resources that describe the impact of intimate partners violence on children.
- Have brochures placed in exam rooms and private places such as bathrooms
- Patient materials should include: brochures, discharge instructions, safety planning handouts and referral information on services for on-site or off-site advocacy, counseling, and legal and other community-based services for child witnesses, victims, perpetrators and others affected by intimate partner violence

*(See **Appendix XII** for resources or www@endabuse.org/health for materials.)*

Training for staff should include:

- Short- and long-term developmental and behavioral effects of childhood exposure to domestic violence and child abuse
- Survivors' perspectives
- Cultural competency
- Dynamics of victimization and perpetration
- Skills building—how to assess, intervene supportively and document appropriately
- Interactive role playing and modeling of inquiry and response techniques
- Information on where employees in abusive relationships can access help

Training should be part of staff orientation; ongoing, repeated and institutionalized; and mandatory for all employees. Providers who will be assessing and documenting in the medical record should receive training on dynamics and clinical response. Other staff —including allied health professionals, receptionists and security, who can play an essential role in identifying and protecting victims and their children — should receive general awareness training on intimate partner violence. Interpreters in particular should be trained in advance about the dynamics of intimate partner violence, childhood exposure to violence, the importance of confidentiality and non-judgmental interpretation, and appropriate word choices for translation of routine assessment.

Protocols should include:

- Definitions, guiding principles, routine assessment, intervention and documentation strategies, reporting policies and confidentiality rules
- Roles and responsibilities of staff

All staff should receive an orientation on the protocol. It should also be updated regularly and informed by new knowledge, laws and policies regarding intimate partner violence. It should be accessible to all staff.

Continuous Quality Improvement (CQI) Program:

- Scheduled audits of medical records to review compliance with the protocol
- Patient satisfaction surveys
- Regular discussions during staff meetings regarding functioning of intimate partner violence program
- Links to other quality improvement efforts
- Links to medical information system developments
- CQI goals publicized

Provider resources should include:

- Chart prompts in the medical record
- Documentation and assessment forms
- Posters and practitioner pocket cards
- Materials that are easily accessible to providers and regularly updated
- Consultation with on-site or off-site domestic violence advocates, legal and forensic experts, counselors with expertise in trauma treatment, and community experts from diverse communities (LGBT, disability, elder, teen, and ethnic-specific, immigrant, and others)
- Feedback mechanisms for providers

Employee assistance or human resources programs (for large facilities) should:

- Address intimate partner violence victimization and perpetration
- Be confidential (within legal limits), easily accessible and well publicized
- Be incorporated into managerial training
- Include intimate partners violence information in employee publications and alerts

APPENDICES

APPENDICES

APPENDICES

APPENDIX I

POSITION STATEMENTS FROM HEALTH PROFESSIONAL ASSOCIATIONS —EXCERPTS—

AMERICAN ACADEMY OF PEDIATRICS
COMMITTEE ON CHILD ABUSE AND NEGLECT

The Role of the Pediatrician in Recognizing and Intervening on Behalf of Abused Women (RE9748)

ABSTRACT. Pediatricians are in a position to recognize abused women in pediatric settings. Intervening on behalf of battered women is an active form of child abuse prevention. Knowledge of local resources and state laws for reporting abuse are emphasized.

The abuse of women is a pediatric issue. The American Academy of Pediatrics (AAP) and its membership recognize the importance of improving the physician's ability to recognize partner violence as well as child abuse and other forms of family violence.[1] Intervention is crucial because children whose mothers are being assaulted are also likely to be victims. Identifying and intervening on behalf of battered women may be one of the most effective means of preventing child abuse. [7]

Abuse of spouses and intimate partners is a pediatric issue even when children are not being physically assaulted. Pediatricians should be aware of the profound effects family violence has on children who witness it or even overhear it. Witnessing violence in the home can be as traumatic for children as being the victim of physical or sexual abuse. Children whose mothers are abused may experience serious emotional distress and manifest severe behavioral problems as a result.[6,8] Adolescents who observe abusive relationships at home may repeat that dynamic in dating or other relationships. (Men and older persons of both genders also can be victims of partner and intimate violence, but they are less likely to be seen in pediatric settings.)

Abused women are unlikely to seek care for their injuries from pediatricians. However, mothers of children seen by pediatricians may show signs of injury such as facial bruising. They may have other less obvious signs of abuse such as depression, anxiety, failure to keep medical appointments, reluctance to answer questions about discipline in the home, or frequent office visits for complaints not borne out by the medical evaluation of their child. Women may reveal the abuse to the pediatrician if they are questioned in a sympathetic and sensitive manner, in a confidential setting, away from the abuser, and provided some assurance of safety.

Questions about family violence should become part of anticipatory guidance. Pediatricians must understand the dynamics of abusive relationships. Excellent guidelines for managing situations of abuse have been published,[9-13] and pediatricians need to become familiar with them. There also are increasing numbers of continuing education opportunities available to learn intervention techniques.

Pediatricians should have a protocol or action plan that has been reviewed with local authorities on domestic violence. Because of time constraints in a busy office practice or emergency room setting, an interdisciplinary approach to family violence may be most appropriate. Pediatricians can call on nurses, social workers or advocacy groups with expertise in assisting and counseling victims. The AMA's 1996 Diagnostic and Treatment Guidelines on Domestic Violence state that optimal care for the woman in an abusive relationship depends on the physician's working knowledge of community resources that can provide safety, advocacy, and support. The AMA and many state medical associations provide directories of agencies that provide services or information about all forms of family violence.

Pediatricians can provide education to agencies that deal with battered women about the risk of primary and secondary abuse to children whose mothers are abused. Every effort should be made to secure counseling for children who have been exposed to family violence. Such treatment may be provided in groups or individually, but the focus should be on understanding violence and how to avoid it. There is increasing evidence that children who grow up with violence are prone to violent behavior themselves, and pediatricians are in a position to break the cycle.

THE AAP RECOGNIZES THAT FAMILY AND INTIMATE PARTNER VIOLENCE IS HARMFUL TO CHILDREN. THE AAP RECOMMENDS THAT:

1. Residency training programs and continuing medical education (CME) program leaders incorporate education on family and intimate partner violence and its implications for child health into the curricula of pediatricians and pediatric emergency department physicians;
2. Pediatricians should attempt to recognize evidence of family or intimate partner violence in the office setting;
3. Pediatricians should intervene in a sensitive and skillful manner that maximizes the safety of women and children victims; and
4. Pediatricians should support local and national multidisciplinary efforts to recognize, treat and prevent family and intimate partner violence.

American Academy of Child and Adolescent Psychiatry
This statement has been approved by the Council on Child and Adolescent Health.
The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

AMERICAN ACADEMY OF FAMILY PHYSICIANS-Violence (Position Paper)

Family violence permeates our society. It affects us as individuals, family physicians, parents, spouses, educators and citizens. The breadth of the problem is staggering. Public health officials identify family violence as a public health issue of epidemic proportions.

THE FAMILY PHYSICIAN'S ROLE

Family violence will affect at least one third of the patients cared for by family physicians, and the impact of family violence may become evident in the one-on-one relationship of the family physician and the patient. It is imperative that physicians be aware of the prevalence of violence in all sectors of society and be alert for its effects in their encounters with virtually every patient.

Violence against women will be the form of family violence most frequently seen in family practice. Physicians need to recognize that women who are victims of domestic violence will be patients in every family practice in this country because one in every four women has been a victim of domestic violence at some point in her life, and one in seven women has been victimized in the past year. Pregnancy confers no protection. In fact, abuse often begins or escalates during pregnancy. One in six pregnant women is abused during pregnancy and 17 percent of physical or sexual abuse of women occurs during pregnancy. One study reported abuse in 37 percent of obstetric patients and showed that class, race and educational level made no difference.

THE ROLE OF THE FAMILY PHYSICIAN IN THE IDENTIFICATION AND TREATMENT OF FAMILY VIOLENCE

Despite barriers to the diagnosis and treatment of victims of family violence, family physicians are in an ideal position to take on this challenge and are compelled to do so by the sheer magnitude of the problem. Family physicians are better able to identify those at risk because they are trained to care for the whole family and for the individual as a part of the larger community. Because of the continuity of care family physicians provide, they can gain patient confidence over time and can serve as sympathetic listeners and patient advocates. Family physicians can provide early intervention to break the cycle of violence through routine screening and the identification of abuse. They can help by teaching parenting skills and counseling patients on the stress of caring for children or elderly parents. Physicians can talk with women and men about their experiences of previous abuse and can be a central referral source for other resources in the community.

AAFP INITIATIVES TO DECREASE FAMILY VIOLENCE

Among activities for the American Academy of Family Physicians (AAFP) to consider are the following:

1. Developing or adapting teaching modules for members to present to medical students, residents, hospital staff and community groups;
2. Creating an ongoing education program for members on screening, recognition and treatment of violence, including distribution of the American Medical Association's guidelines for history-taking around issues of violence and abuse;
3. Supporting or developing university-, hospital- or office-based protocols and policies about family violence;
4. Publicizing to members the hot-line numbers for organizations that help physicians and

patients deal with abuse;
5. Offering continuing medical education for members to increase their skills in screening for, identifying and treating cases of domestic violence;
6. Participating in public policy initiatives and legislative reform to protect victims and rehabilitate batterers and partnering with other organizations committed to decreasing family violence;
7. Promoting reasonable and responsible control of firearms and other weapons.

AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS

Division of Women's Health Issues, ACOG Educational Bulletin, No. 257, December 1999
Domestic Violence –

SCREENING AND IDENTIFICATION

Specific measures can be taken to improve identification and facilitate disclosure of domestic violence. A prefacing statement followed by a few simple, direct questions will identify most women with a history of abuse or assault. The introduction or preface should establish that screening is universal. The screening assessment should follow with direct questioning.

Children in violent homes should be evaluated by a professional who can assess the child's behavioral patterns and help the child address the emotional impact of the violence. Referrals to such resources are essential, because the victim may not be willing or able to do so on her own, especially if she fears removal of the child more than the violence.

Physicians or other health care workers who provide acute or chronic medical care to the older adult may see the older adult on a regular basis and have unique opportunities for screening and assessment. Additionally, an opportunity for screening and recognition exists during all health-related encounters of older individuals, such as routine gynecologic examinations.

SUMMARY

Many physicians, especially in the current managed care environment, are concerned that abuse screening and disclosure will require inordinate amounts of time, but with an established protocol and referral system this important problem can be managed. Screening all patients is the key to identifying abuse. With disclosure of ongoing domestic violence, the physician's responsibility should incude acknowledgement of abuse, making a safety assessment, assisting with a safety plan, providing appropriate referrals, documentation, and continued support. For disclosure of past violence, the responsibilities are similar but generally do not require immediate intervention. Women with a history of past victimization need to have that history identified and acknowledged and may need referral to other professionals to assist with the resolution of their trauma-related issues. Regardless of the types of victimization a woman has experienced, providing a safe setting in which she can discuss the problem and receive support is an important part of her recovery. Through these measures, the health care team can help abused women take the first steps toward ending the violence and achieving a healthy recovery.

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APPENDIX III | ABSTRACTS OF SELECTED STUDIES ON PROVIDER AND PATIENT ATTITUDES

Knocking Down Walls: Barrier Myths to Screening for Violence in Primary Care

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BACKGROUND: In 1998 the AAP in a policy statement recommended that "questions about domestic violence(DV) should become part of anticipatory guidance". Since that time, studies have shown that providers are hesitant to follow the recommendation. Barriers have been sited from child presence in the room to fear of offending parents.

OBJECTIVE: This study explored how frequently providers in an urban practice screened for DV, whether children's age and/presence in the room, length of time providers knew the family and how providers perceived parents response influenced screening.

DESIGN/METHODS: At baseline, 24 providers in an urban pediatric practice completed an interview about their current practices of screening for a child's exposure to violence. Over the following 4 weeks, they completed a form at the conclusion of well child care visits(children birth to 12 years) which covered several areas including whether they screened for DV and a Likert scale rating provider perceptions of parents' response to being asked these questions.

RESULTS: The providers were 16 residents, 6 attending pediatricians, 1 Nurse practicioner and 1 fellow. 84% reported they asked screening questions with the child in the room. During the 4 week period of the study, 60% of the providers reported that they screened for DV with 60% also reporting screening for community violence (CV). 93% of the time, providers asked these questions with the child in the room. Of these encounters, 78% were first visits with the family. Of the 22% that were repeat visits, 80% had known the family more than 6 months. 70% of the providers rated parent response as an 8 or higher on a 10 point scale (10 being most receptive). Controlling for child age and how long the provider knew the family, providers were more likely to screen when the child was older whether or not they had known the family previously.

CONCLUSIONS: Over 3 years after the statement was issued recommending universal screening for DV, providers continue to struggle with several barriers. In this pilot data of an urban practice, only 60% of visits were screened and these primarily were visits among older children. Interestingly, child presence in the room did not appear to be a barrier nor did parent response to the questions. Since the greatest risk for DV is often when children are less than 5 years of age, providers perhaps need to consider alternative methods to screen more effectively.

Maternal Screening for Domestic Violence during Pediatric Visits: Physicians' Practices and Perspectives

Linda Chamberlain, Ph.D. MPH

OBJECTIVES: Very little is known about how physicians respond to domestic violence in the pediatric setting. Our objectives were to examine physicians' maternal screening and intervention practices for domestic violence and to investigate perceived barriers to screening during child health care visits.

METHODS/DESIGN: A 17-question survey about current screening and intervention practices, training and perspectives on perceived screening barriers was conducted by mail.

SAMPLE STUDIED: All physicians practicing in Alaska who provided health care to children, age 18 or younger.

PRELIMINARY RESULTS: Surveys were completed by 393 (73%) of the 540 eligible physicians, including 208 family practitioners and general practitioners; 70 pediatricians and 48 emergency medicine physicians. Forty-nine percent of physicians had specific training on the effects of domestic violence on children. More than one-quarter (29%) estimated that 1 in 10 children in their practices had lived in a household with domestic violence. The majority of physicians screened often or always for domestic violence when the mother had signs of injury (88%) or when they suspected child abuse (95%). Routine screening was less common at initial pediatric visits (16%), well-child visits (11%), urgent care visits (31%), and when providing counseling/anticipatory guidance to mothers of newborn infants (16%). Commonly reported intervention strategies included providing information on victim services (87%), talking to the mother about safety concerns (81%), and talking to the child alone when appropriate (51%). The majority of physicians did not consider commonly perceived barriers such as inadequate training and concerns about child witness reporting requirements as major barriers to screening. Nearly all (98%) respondents agreed that witnessing domestic violence in an important health issue for children. Eighty-five percent of physicians agreed that they have a responsibility as part of their practice to screen mothers for domestic violence when providing health care to children. There was nearly total agreement (99.5%) among respondents that helping a mother who is being battered can make a difference in the lives of her children.

CONCLUSION: While physicians frequently screen mothers for domestic violence when there is evidence of maternal injury or suspected child abuse, opportunities to screen at other child health care visits are being missed. Most physicians agreed that domestic violence is an important children's health care issue that should be addressed in the pediatric setting. Many commonly perceived barriers to screening may not be predictive of physicians'maternal screening practices

Mothers' and health care providers' perspectives on screening for intimate partner violence in a pediatric emergency department

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OBJECTIVE: To determine the attitudes, feelings and beliefs of mothers and pediatric emergency department health care providers toward routine intimate partner violence screening.

METHODS: This qualitative project employed focus groups of mothers who brought their children to a children's hospital emergency department for care and physicians and nurses who staffed the same department. We held six ethnically homogeneous mother groups: two Caucasian, two African-American, two Latina and four provider groups: two predominately female nurse groups and two physician groups: one male and one female. Professional moderators conducted the sessions using a semi-structured discussion guide. All groups were audio- and videotaped and tapes were reviewed for reoccurring themes.

RESULTS: A total of 59 mothers, 21 nurses and 17 physicians participated. Mothers identified intimate partner violence as a common problem in their communities and most remarked that routine screening for adult intimate partner violence is an appropriate activity for a pediatric emergency department. However, many expressed concern that willingness to disclose might be affected by a fear of being reported to child protective services. They stressed the importance of addressing the child's health problem first, that screening be done in an empathetic way and that immediate assistance be available if needed. Themes identified in the provider groups included concerns about time constraints, fear of offending and concerns that unless immediate intervention was available the victim could be placed in jeopardy. Many said they would feel obligated to notify child protective services upon disclosure of intimate partner violence.

CONCLUSIONS: Intimate partner violence screening protocols in the pediatric emergency department should take into consideration the beliefs and attitudes of both those doing the screening and those being screened. Those developing screening protocols for a pediatric emergency department should consider:1) Those assigned to screen must demonstrate empathy, warmth and a helping attitude. 2) The importance of addressing the child's medical needs first and a screening process that is minimally disruptive to the emergency department. 3) A defined, organized approach to assessing danger to the child and how and when it is appropriate to notify CPS when a caregiver screens positive. 4) Resources must be available immediately to a victim who requests them.

Pediatrician's views on the treatment and preventions of violent injuries to children

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(PERIODIC SURVEY OF FELLOWS, American Academy of Pediatrics, Division of Health Policy Research from PEDIATRIC ACADEMIC SOCIETIES , May 2001)

OBJECTIVE: To assess the portion of pediatricians treating violent injuries and their perceived capacity to address violence in the office setting.

DESIGN: National random sample, mailed survey.

PARTICIPANTS: 574 U.S. members of the American Academy of Pediatrics who provide direct patient care.

RESULTS: Many pediatricians report they treated (in the past 12 months) injuries due to child abuse (61%), domestic violence (43%) or community violence (45%). Substantial numbers of respondents believe that pediatricians should address, in the community and in practice, violence against children. However, while pediatricians generally feel confident about their skills in treating child abuse, they are less likely to feel adequately prepared to treat children at risk for domestic violence.

	Proportion of Pediatricians Indicating Agreement (%)		
	CHILD ABUSE	DOMESTIC VIOL.	COMMUNITY VIOL.
Are confident in ability to identify children at risk for.....	63.7	35.1	32.6
Are confident in ability to manage cases of.....	62.6	43.1	46.4
Have received adequate training in the area of.....	48.5	19.7	15.8

CONCLUSION: Injury from violence is a problem confronting large numbers of pediatric practices. The identified gaps can help shape new training programs and interventions to help practitioners address this critical risk to children.

Should Children Be in the Room When the Mother Is Screened for Partner Violence?

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BACKGROUND: The goal of our study was to understand the important issues to consider when screening women for intimate partner violence in front of their children.

METHODS: Interviews and focus groups were conducted with experienced family physicians and pediatricians and family violence experts (child psychologists, social workers, and domestic violence agency directors). Session transcripts were coded and categorized.

RESULTS: Experts disagreed on the appropriateness of general screening for intimate partner violence in front of children older than 2 to 3 years. The majority thought that general questions were appropriate, if the in-depth questioning of the abused parent was done in private. Screening for child abuse when domestic violence is identified (and for domestic violence when child abuse is discovered) was recommended. Documentation about intimate partner violence in the child's medical chart raises questions about confidentiality, since the person committing the abuse may have access, if he or she is a legal guardian. Physicians need more education on the symptoms of children who are exposed to violence between adults.

CONCLUSIONS: More research is needed to understand appropriate questions and methods of screening for intimate partner violence in front of children. The tension is between practical recommendations for routine screening and preserving the safety of the parent and the children. Intimate partner violence screening by physicians is important. Interrupting the cycle of violence may give a child a better chance at maturing into a healthy adult.

APPENDIX IV | DILEMMAS WHEN ASSESSING ALL PATIENTS FOR VICTIMIZATION

Routinely assessing all parents and caretakers (both female and male) for IPV victimization raises additional policy and practice issues for providers and there is debate in the field about appropriate responses. Those opposed to these policies assert that the risks of alerting perpetrators to protocols identifying and assessing IPV outweigh the benefits. The concerns are that perpetrators may limit their partners' access to health care, may threaten victims who disclose, or may learn about safety planning materials which could ultimately undermine victim safety. Proponents of policies to assess men and women assert that, because men in same sex relationships experience DV at equal rates as women in heterosexual relationships, and some men in heterosexual couples experience abuse, it is critical to identify and assist as many victims as possible. Proponents also argue that determined perpetrators can already access safety planning materials and that assessing all patients offers unparalleled opportunities for abuse prevention. Still others maintain that because the majority of IPV victims are women, providers should begin by assessing all female patients and integrate inquiries for men as a second step, after gaining more experience in screening for victimization and developing policies to address some of the difficult practical concerns that are raised when assessing all parents and caretakers. Providers and health facilities should consider the dilemmas and recommendations listed below as they develop their unique protocols.

DILEMMAS:

It may be difficult to assess who the victim is. The accounts of one or both parties may lead to significant confusion about the incident.

- Male perpetrators often claim victimization to avoid consequences or as a tactic to further control victims.[69] Because of the majority of IPV perpetrators are male, assessing men increases the likelihood of assessing perpetrators who may claim they are victims. There is not sufficient experience with female perpetrators of violence to know if this is also true in with female batterers.
- Victims may take the blame for the abuse because they have been told repeatedly by their partners that the problems in the relationship are their fault or because they used violence or other tactics in self-defense.
- Both parties may use physical force in an incident.

Whether the patient is viewed as a victim or perpetrator will influence the health care providers' response and may lead to inappropriate treatment.

- A victim who takes the blame for the abuse might prevent providers from offering them support and information about IPV
- Perpetrators who falsely claim they are victims might lead providers to sharing safety-planning strategies with perpetrators, inadvertently colluding with them and

undermining victims' safety planning efforts.
- What is recorded in the medical record by the health care provider can have legal ramifications for the victim particularly in divorce, custody or other legal cases.

While it is not the role of the health care provider to determine if the patient is telling the truth, the provider should take care in evaluating the patient's information and in identifying whether or not she/he is a victim of IPV, just as they take care in evaluating other patient's reports of health concerns. Understanding the definition of IPV and being skilled in behavioral inquiry assists providers in making accurate identification of victimization.

RECOMMENDATIONS FOR POLICY IMPLEMENTATION:

The Family Violence Prevention Fund recommends that providers implement policies to assess all male and female parents for victimization only after taking precautions to protect victims whose perpetrators claim to be abused. Training providers on perpetrator dynamics and responses to gay, lesbian and straight victims is critical for all IPV programs, including those that target women only. When implementing a policy to assess all patients, first:

- Contact local DV programs (and batterer's intervention programs that they recommend) and explain that you are considering a plan to assess all patients for victimization. This will prepare them for referrals and will give them an opportunity to inform the development of your protocol.
- Inform all patients that you assess men and women for victimization and make safety planning materials available to both, so that victims who are concerned about perpetrators sabotaging their safety plan efforts can plan accordingly. Make information available about advocates on-site or in the community that can help the victim with these plans, regardless of whether the victim discloses abuse.
- Understand and conduct training on the IPV prevalence studies. Emerging research demonstrates that IPV occurs at similar rates in LGTB adolescent and adult populations[70] with higher rates in male same sex relationships than female.[71] Most studies indicate that about 5-10%[72] of all victims are men (an unknown percentage of whom are gay). Because of this, you should expect to see a fairly small percentage of heterosexual male victims in your practice – but should be prepared to respond to all victims.
- Understand and conduct training on the dynamics of IPV: IPV serves the purpose of establishing power and control through various tactics. This establishment of an abusive imbalance of power and control is fundamentally what distinguishes IPV perpetrators from victims. There are multiple indicators of abusive behavior (denying access to friends/family, intimidation, etc) not just physical abuse, and victims' lives generally become more limited and controlled.

Recommendations for Clinical Practice:

- Do not blame patients or force them to prove their "victimhood."
- Assessments should be handled sensitively and without bias.
- Even if you are unsure if your patient is a victim, document that you inquired, the patients' response, and note the details of the abuse and health consequences. Offer the patient educational materials about IPV and referrals.

HEALTH CARE PROVIDER RESPONSE TO GAY, LESBIAN AND HETEROSEXUAL MALE VICTIMS

Lesbian, Gay Bisexual and Transgendered victims of abuse:

Emerging research demonstrates that IPV occurs at similar rates in LGTB adolescent and adult populations as in heterosexual populations[vii] with higher rates in male same sex relationships than female[viii]. However, it is important to realize that the statistics may be low because those in a same sex relationships may not be comfortable stating their sexual preference. A policy to assess all patients should include specific recommendations for responding to lesbian, gay bisexual, and transgendered (LGBT) victims. Specialized services may be limited in your area so, when unavailable, refer patients to national organizations or the National Domestic Violence Hotline.

PRIOR TO IMPLEMENTING A PROGRAM TO ASSESS ALL PATIENTS, IT IS IMPORTANT TO:

- Beware of your own bias and/or homophobia
- Call your local IPV program and determine what resources are available for lesbian, gay, bisexual and transgendered clients
- Call any local programs for LGBT communities and determine what resources they offer for victims of IPV
- In addition (or if no programs exist in your area), provide LGBT victims with the national DV hotline number for more information or materials.
- Have educational and safety materials available that are appropriate for LGBT victims (for materials, go to the FVPF website www.endabuse.org/health)
- Refer gay male victims of IPV to Community United Against Violence (San Francisco), Gay Men's Domestic Violence Project (Boston) or other organizations for information and support *(See **Appendix XII**).*

[vii] Bureau of Justice Statistics Special Report, Intimate Partner Violence and Age of Victim, 1993-99, United States Department of Justice, October 2001.

[viii] Morrow, Jeanie (April 1994). Identifying and treating battered lesbians. San Francisco MedicineLetellier, Patrick (April 1994). Identifying and treating battered gay men in a medical setting. San Francisco Medicine. Goodenow, Carol. (1998). 1997 Massachusetts Youth Risk Behavior Survey. Malden, MA: Massachusetts Department of Education. Renzetti, C. Violent Betrayal: Partner Abuse in Lesbian Relationships. Sage Publications. 1992, 18.

- Refer lesbian victims to the Network for Battered Lesbians and Bisexual Women (Boston), Anti-Violence Project and/or other local organizations for information and support *(See **Appendix XII**).*

Heterosexual Male Victims

There is limited research on male victims of IPV in heterosexual relationships. Most major studies on male victimization do not clarify if male victims are in gay or heterosexual relationships. However, a policy to assess all patients should include specific recommendations for responding to heterosexual male victims. Services for male victims may be very limited in your area, so be prepared to refer patients to national or international programs and the National Domestic Violence Hotline. Prior to implementing a program it is important to:

- Be aware of your own bias regarding heterosexual male victims of abuse.
- Call your local DV program and learn about their policy on heterosexual male victims
- Refer patients to any local programs available, the National Domestic Violence Hotline or other resources including:www.vix.com/menmag/batamen.htm.
- Have gender neutral educational materials available about abuse or refer patients to the websites listed in Appendix VIII for more educational materials for battered men.

APPENDIX V | INDICATORS OF ABUSE

Many victims of IPV will talk about their experiences if asked to do so in a sensitive and empathetic way. However, other victims may be reluctant to disclose. They may be embarrassed, ashamed, or afraid that if they tell anyone they may be at risk for more severe abuse. There may be financial issues and/or concerns about immigration status, or they may lack trust in people because trust was violated in their intimate relationship. Below are some of the reasons one might suspect IPV and might ask follow-up questions.

For Adults

- Failure to keep medical appointments, or comply with medical protocols
- Secrecy or obvious discomfort when interviewed about relationship
- The presence of a partner who comes into the examining room with the patient and controls or dominates the interview, is overly solicitous and will not leave the patient alone with her/his provider
- The patient returns repeatedly with vague complaints
- A patient who presents with health problems associated with abuse
- Unexplained injuries or injuries inconsistent with the history given
- Somatic complaints
- Delay between an injury and seeking medical treatment
- Injury to the head, neck, chest, breasts, abdomen, or genitals
- Bilateral or multiple injuries, especially if in different stages of healing
- Physical injury during pregnancy, especially on the breasts and abdomen
- Chronic pain without apparent etiology
- An unusually high number of visits to health care providers
- High number of STI's, pregnancies, miscarriages, and abortions repeat vaginal and urinary tract infections.

*(See **Appendix VI** for others)*

For Children and Adolescents

All of the applicable health problems listed above as well as:

- Age inappropriate injuries, burns, injuries to the genital areas
- Developmental & behavioral problems
- Psychological distress such as depression, suicidal ideation or attempts, attachment problems, anxiety, sleeping and/or eating disorders, panic attacks, symptoms of PTSD, and substance use/abuse problems

If you see any of these indicators, or if you suspect abuse, yet the patient remains reluctant to discuss or disclose, provide the patient with a hotline number and other resources in case they need them in the future. Let the patient know that should s/he ever need it, you are available as a resource. Bring the issue up during the next visit. The goal is not to force the victim to admit to a problem, but to try and anticipate his/her concerns about disclosure and to let her/him know that you can be a resource should this ever be a problem. Encourage her/him to return and schedule a follow-up visit within a short time.

APPENDIX VI | EXPANDED ASSESSMENT FOR VICTIMS OF DOMESTIC VIOLENCE

Assessment time will vary with the severity of the abuse, the readiness of the domestic violence victims to discuss it and time available with the provider. Unless the patient is in crisis, the assessment can be conducted over time. Expanded health assessments can include assessment of associated health problems and/or expanded assessment of the abuse. Provide the victim an opportunity to talk with someone else from the community who is trained on IPV if they are uncomfortable speaking with the provider. These assessments can occur in primary care, ob/gyn, mental health settings or in any setting where a trained health care provider, social worker, or advocate can conduct the assessment in private.

Expanded Assessment of Related Health Problems

A positive identification for lifetime or current exposure to IPV should trigger expanded health assessment (either by the provider who identified the patient or a specialist to whom the patient is referred). Consider and address the following areas:

- Health issues related to IPV: injuries, chronic pain (neck, back, pelvic migraines) peptic ulcers, irritable bowel syndrome, STI's (including HIV/AIDS), insomnia, vaginal and urinary tract infections, multiple pregnancies, miscarriages and abortions
- Substance abuse by the patient: (such as tobacco, alcohol, or others)
- Ability to manage other illnesses (such as hypertension, diabetes, asthma, HIV/AIDS)
- Mental health problems: depression, PTSD, anxiety, stress, suicide risk
- If pregnant: pregnancy complications such as miscarriages, low weight gain, anemia, infections, first and second trimester bleeding, and low birth weight babies
- If forced sex occured: assess for gynecological problems including STI's, anal/vaginal tearing, sexual dysfunction, and ask about safe sex practices and family planning
- If choking/head injury and the patient was unconscious: conduct a neurological exam
- Particularly for teens: Assessment of exposure to dating violence or forced use of drugs such as Rohypnol (RH) "rophies", GHB (Gama Hydroxybutyric acid) etc.
- Preventive health behaviors: encourage and help facilitate preventive health behaviors: such as regular mammography, pap smears, early pre-natal care, etc.

Expanded assessment of the history and extent of the abuse

- Discussion of childhood history of abuse in family of origin
- Discussion about whether abuser is limiting access to friends, family or co-workers
- Assessment of supports in place including friends, family, community, church, etc.
- Discussion of separation, divorce, or seeking shelter
- Assessment of the victim's community's response to abuse, marriage, divorce, health and healing, and find out how the victim responds to cultural expectations
- Assessment of how the abuse has affected the children (physically, emotionally, etc.)
- Assessment of how abuse affected her/his life, work, school, and relationships
- Assessment of whether threats have been made, or violence has been carried out against the family pet(s).

EXPANDED ASSESSMENT FOR VICTIMS OF DOMESTIC VIOLENCE

Questions about the batterer

- Does the batterer use illicit drugs and/or alcohol? How much? How often?
- Does batterer increase his/her violent behavior when under the influence?
- Does the batterer have any mental health problems?
- Is the batterer taking medications, if so what?
- Does the batterer have a criminal record?

Suicide and Homicide Assessment Questions

To assess the risk for victim's homicidal and suicidal ideation follow:

RISK OF SUICIDE BY THE VICTIM

- Have you ever felt so bad that you didn't want to go on living?
- Have you ever attempted or thought about suicide in the past?
- Are you thinking about killing yourself? Do you have a plan?
- Do you feel this way now?

RISK OF HOMICIDAL THOUGHT BY THE VICTIM

- How do you perceive your options for safety?
- Have you ever attempted or thought about homicide in the past?
- Have you thought about how you would do it? Do you have a homicide plan?
- Assess if the patient is expressing anger or a genuine intent to kill.

If there is significant risk of suicide or homicidal ideation the patient should be kept safe until emergency psychiatric evaluation can be obtained.

APPENDIX VII | SAFETY PLAN AND INSTRUCTIONS

SAFETY PLAN FOR ADULT VICTIMS LIVING WITH THEIR ABUSERS

STEP 1: Safety during a violent incident. I can use some or all of the following strategies:

A. If I have/decide to leave my home, I will go _____

B. I can tell _____ (neighbors) about the violence and request they call the police if they hear suspicious noises coming from my house.

C. I can teach my children how to use the telephone to contact the police.

D. I will use _____ as my code word so someone can call for help.

E. I can keep my purse/car keys ready at (place) _____ , in order to leave quickly.

F. I will use my judgment and intuition. If the situation is very serious, I can give my partner what he/she wants to calm him/her down. I have to protect myself until I/we are out of danger.

STEP 2: Safety when preparing to leave. I can use some or all of the following safety strategies:

A. I will keep copies important documents, keys, clothes and money at _____.

B. I will open a savings account by _____ , to increase my independence.

C. Other things I can do to increase my independence include: _____ .

D. I can keep change for my phone calls on me at all times. I understand that if I use my telephone credit card, the telephone bill will show my partner those numbers that I called after I left.

E. I will check with _____ to see who would be able to let me stay with them or lend me some money.

F. If I plan to leave, I won't tell my abuser in advance face-to-face, but I will call or leave a note from a safe place.

STEP 3: Safety in my own residence. Safety measures I can use include:

A. I can change the locks on my doors and windows as soon as possible.

B. I can replace wooden doors with steel/metal doors.

C. I can install additional locks, window bars, poles to wedge against doors, and electronic systems etc.

D. I can install motion lights outside.

E. I will teach my children how to make a collect call to _____ if my partner takes the children.

F. I will tell people who take care of my children that my partner is not permitted to pick up my children.

G. I can inform _____ (neighbor) that my partner no longer resides with me and they should call the police if he is observed near my residence.

STEP 4. Safety with a protection order. The following are steps that help the enforcement of my protection order.

A. Always carry a certified copy with me and keep a photocopy.

B. I will give my protection order to police departments in the community where I work and live.

C. I can get my protection order to specify and describe all guns may partner may own and authorize a search for removal.

SAFETY INSTRUCTIONS

If you are currently being abused...

Are you here as a result of someone hitting or threatening you—a spouse, boyfriend, lover, relative or someone you know? Have you been sexually abused by someone you know? As you read this, you may be feeling confused, frightened, sad, angry or ashamed. **You are not alone!** Unfortunately, what happened to you is very common. Domestic violence does not go away on its own. It tends to get worse and more frequent with time. There are people who can help you. If you want to begin talking about the problem, need a safe place to stay or want legal advice—call one of the agencies listed on the back of this instruction sheet today.

While still at the clinic...

- Think about whether it is safe to return home. If not, call one of the resources listed on the back of this instruction sheet or stay with a friend or relative.
- You have received instructions on caring for your injuries and taking medications prescribed. Remember, if you have received tranquilizers they may help you rest but they won't solve the problem of battering.
- Battering is a crime and you have the right to legal intervention. You should consider calling the police for assistance (see information on back of this sheet). You may also obtain a court order prohibiting your partner from contacting you in any way (including in person or by phone). Contact a local DV program or an attorney for more information.
- Ask the doctor or nurse to take photos of your injuries to become part of your medical record.

When you get home...

- Develop an "exit plan" in advance for you and your children. Know exactly where you could go even in the middle of the night—and how to get there.
- Pack an "overnight bag" in case you have to leave home in a hurry. Either hide it yourself or give it to a friend to keep for you.
- Pack toilet articles, medications, an extra set of keys to the house and car, an extra set of clothing for you and your children, and a toy for each child.
- Have extra cash, loose change for phone calls, checkbook, or savings account book hidden or with a friend.
- Pack important papers and financial records (the originals or copies), such as social security cards, birth certificates, green cards, passports, work authorization and any other immigration documents, voter registration cards, medical cards and records, drivers license, rent receipts, title to the car and proof of insurance, etc.
- Notify your neighbors if you think it is safe

APPENDIX VIII

INTIMATE PARTNER VIOLENCE VICTIMIZATION REPORTING REQUIREMENTS: HOW IT AFFECTS CHILD HEALTH SETTINGS

Most states have enacted mandatory reporting laws, which require the reporting of specified injuries and wounds, suspected abuse or domestic violence for individuals being treated by a health care professional, or who come before the health care facility.[ix] Mandatory reporting laws are distinct from elder abuse or vulnerable adult abuse reporting laws,[x] in that the individuals to be protected are not limited to a specific class, but pertain to all individuals[xi] whom the health care professional provides treatment or medical care to, or who come before the health care facility.

The elements that trigger these reports vary, from specific injuries such as gunshot and stab wounds to more broadly described "wounds indicating violence." With few exceptions, these reporting laws were not passed with domestic violence in mind. However, as the health care community became more aware of domestic violence, many asked how mandatory reporting laws should be applied in cases of domestic violence.

THE LAWS VARY FROM STATE TO STATE, BUT GENERALLY FALL INTO FOUR CATEGORIES:

1. States that require reporting of injuries caused by weapons;
2. States that mandate reporting for injuries caused in violation of criminal laws, as a result of violence, or through non-accidental means;
3. States that specifically address reporting in domestic violence cases;
4. States that have no general mandatory reporting laws.

In a majority of states, existing laws would most likely not apply in those cases when a child health provider is treating a child and screening the child's parent for domestic violence. In the pediatric visit where the parent is not the patient and not seeking treatment, the clinician is generally under no legal obligation to report because the parent does not fall within the purview of the reporting law. However, for family physician visits, the case may be more complicated. The parent may be a patient of the provider, even though she is not seeking treatment during the particular visit. Additionally, if the child is also presenting with injuries, child abuse reporting laws may require the physician to report.

(See page 13: When does child exposure to intimate partner violence become child abuse?)

[ix] Different states have different reporting requirements of various health care professionals, and various health care facilities. Because the differences vary widely, we do not include them in this paper. Please be sure to consult your state law and/or local expert for further information on reporting requirements in your state. A list of the specific codes can be found in Appendix VII.

[x] Elder abuse or vulnerable adult abuse reporting laws seek to protect a specific class of individuals being treated, i.e. the elderly, or mentally or physically incapacitated individuals.

[xi] Please note that all states with general mandatory reporting laws except for California, Georgia, Kentucky, and Wisconsin use the term "person(s)" in the text of the law. Georgia, California, and Wisconsin use the term "patient." Kentucky's general mandatory reporting law is an exception, as it uses the term "adult," rather than "person(s)" or "patient."

Appendix VIII

INTIMATE PARTNER VIOLENCE VICTIMIZATION REPORTING REQUIREMENTS

There has been much debate about the benefit of mandatory reporting of domestic violence by health care providers. Most advocates and providers support state laws that require reports to law enforcement only in the case of gunshot or other potentially life-threatening assault. However, several laws require reports of any domestic violence assault, regardless of severity or victim preference. The intended goals of these laws include assisting officers in solving crimes, enhancing patient safety, holding batterers accountable, and improving domestic violence data collection and documentation. Opponents argue that there are serious risks created by these laws, including unintentionally endangering victims, deterring victims who do not want or need police involvement from seeking medical care, and reducing victim autonomy, control, and ability to plan for safety for herself and her children.

Providers should know their state's domestic violence reporting law, including who is required to report, and under what conditions. (***Appendix IX*** contains a chart listing state codes). In order to maximize patient input regarding law enforcement action, providers should also familiarize themselves with how their local law enforcement agency responds to such reports. Becoming familiar with such procedures will also allow the provider to better assist the patient in safety planning, and in knowing what to expect. Additionally, recent federal privacy regulations require providers to inform patients of health information use and disclosure practices in general, and whenever a specific report has been made. Health care facilities should also ensure that their domestic violence protocols and training materials address their state reporting laws and federal regulations.

How do mandatory reporting laws apply to the pediatric and family practice setting?

In the vast majority of states, neither statutory nor case law specifies when or if a health care provider must report a parent's injuries if they are observed or discovered during a health care visit with that parent's child. Therefore, under a strict reading of most laws, if a child's health care provider is not providing treatment or medical care to the abused parent during the child's visit, the health care provider would not be required to make a report. In family practice situations where the child and parent are the provider's patients, and the current visit appointment is for the child, the same reasoning could be applied, although it is less clear-cut. That is, the health care provider would not be required to report since he or she is not treating the parent for the specified injuries during the appointment. This issue merits further discussion among health care providers, advocates, licensing authorities, and other professionals, as it is uncharted territory.

INTIMATE PARTNER VIOLENCE VICTIMIZATION REPORTING REQUIREMENTS

Georgia, Kentucky, and Ohio[xii] require reports when a provider believes that an individual has suffered certain injuries, or observes such injuries, but is not necessarily providing treatment or medical care. Since these laws do not specifically require that the individual must be seeking treatment or medical care in order to trigger the reporting requirement, a parent with visible injuries accompanying a child to a child health appointment may fall within the class of individuals the statutes apply to, and reporting would be required.

There are also two states that do not fit either category of laws: Michigan and Pennsylvania. In both of these states, the laws do not mention whether the physician must be providing treatment or medical care in order to trigger the reporting requirement. Additionally, the laws do not contain any language regarding a physician's belief or observance of the specified injuries. Thus, practitioners in these states should consult a local expert regarding further interpretation of these laws.

[xii] The Family Violence Prevention Fund opposes laws that specifically mandate health care providers to report all injuries, including those that may not be serious, to law enforcement or to any other authorities. See the paper entitled Mandatory Reporting of Domestic Violence by Health Care Providers: A Policy Papef (November, 1997), prepared by Ariella Hyman for the Family Violence Prevention Fund (FVPF), published by the FVPF: (415) 252-8900.

APPENDIX IX

STATE CODES ON INTIMATE PARTNER VIOLENCE VICTIMIZATION REPORTING REQUIREMENTS FOR HEALTH CARE PROVIDERS[xiii]

Current through March 8, 2002

			IF ANY OF THE FOLLOWING TYPES OF INJURIES ARE PRESENT, PRACTITIONERS IN THE STATE MUST MAKE A REPORT:								
	Code Number	States with General Mandatory Reporting Laws	Injuries Resulting from Domestic Violence or Abuse	Injuries Resulting from Criminal Activity	Injuries Resulting from General Violence	Intentionally Inflicted Injuries	Injuries Inflicted by Gun or Firearm	Injuries Inflicted by Knife or Other Sharp Object	Burn Injuries	Injuries Likely to Cause Death	Treatment of Specified Injuries Requires Practitioners to Report[xiv]
AL											
AK	Alaska Stat. §08.64.369	•				•	•	•	•	•	•
AZ	A.R.S. §13-3806	•		•			•	•			•
AR	A.C.A. §12-12-602	•				•	•	•			•
CA	Cal. Pen. Code §11160	•	•	•			•				•
CO	C.R.S. §12-36-135	•	•	•		•	•	•			•
CT	Conn. Gen. Stat §19a-490f	•					•				•
DC	D.C. Code §7-2601	•		•			•				•
DE	24 Del. C. §1762	•				•	•	•			•
FL	Fla. Stat. §790.24	•			•		•			•	•
GA	O.C.G.A. §31-7-9	•				•					
HA	HRS §453-14	•			•		•	•		•	•
ID	Idaho Code §39-1390	•		•			•				•
IL	20 ILCS 2630/3.2	•		•			•				•
IN	Ind. Code Ann. §35-47-7-1	•					•	•		•	•
IA	Iowa Code §147.111	•		•			•	•			•
KS	K.S.A. §21 – 4213	•					•	•		•	•
KY	KRS §209.030	•	•								
LA	La. R.S. §14:403.4 to 3.5	•					•		•	•	•
ME	17-A M.R.S. §512	•					•				•
MD	Md. Ann. Code art. 27, §336A	•					•				•
MA	Ma. Ann. Laws ch. 112, §12A	•		•			•	•	•		•
MI	MCLS §750.411	•			•		•	•			•
MN	Minn. Stat. §626.52	•		•			•		•	•	•
MS	Miss. Code Ann. §45-9-31	•					•	•			•
MO	§578.350 R.S.Mo.	•					•				•
MT	Mont. Code Anno. §37-2-302	•					•	•			•

[xiii] This document is intended to provide a cursory overview of mandatory reporting laws. Please be sure to consult the complete set of mandatory reporting laws in your state for further information. If you note any changes or errors on this document, please contact the FVPF at 415-252-8900.

[xiv] Under a strict reading of these laws, practitioners must be providing treatment or medical care to the person with specified injuries in order to trigger the reporting requirement. Therefore, in a pediatric or family practice setting, if an attending parent with injuries is bringing her child in for a health care appointment, the attending parent is not actually receiving treatment or medical care from the practitioner, and thus the practitioner in the state would not be required to report. Further discussion is merited, given the lack of statutory or case law that have been developed around this area.

[xv] The law provides an exception to reporting if the patient is over the age of 18, did not suffer a gunshot wound, and does not consent to reporting.

[xvi] Report is made for medical data collection purposes only, and does not contain identification information.

Prepared by Josephine Yeh, J.D., for the Family Violence Prevention Fund

APPENDIX IX

STATE CODES ON INTIMATE PARTNER VIOLENCE VICTIMIZATION REPORTING REQUIREMENTS FOR HEALTH CARE PROVIDERS[xiii] *Current through March 8, 2002*

			IF ANY OF THE FOLLOWING TYPES OF INJURIES ARE PRESENT, PRACTITIONERS IN THE STATE MUST MAKE A REPORT:								
	Code Number	States with General Mandatory Reporting Laws	Injuries Resulting from Domestic Violence or Abuse	Injuries Resulting from Criminal Activity	Injuries Resulting from General Violence	Intentionally Inflicted Injuries	Injuries Inflicted by Gun or Firearm	Injuries Inflicted by Knife or Other Sharp Object	Burn Injuries	Injuries Likely to Cause Death.	Treatment of Specified Injuries Requires Practitioners to Report[xiv]
NE	R.R.S. Neb. §28-902	•		•	•						•
NV	Nev. Rev. Stat. Ann.										
	§629.041, §629.045	•				•	•	•	•	•	•
NH	RSA §631:6	•	•[xv]	•			•				•
NJ	N.J. Stat. §2C:58-8	•					•		•		•
NM											
NY	NY CLS Penal										
	§265.25 to .26	•	•				•	•	•	•	•
NC	N.C. Gen. Stat. §90-21.20	•		•	•		•	•			•
ND	N.D. Cent. Code, §43-17-41	•		•			•	•			•
OH	ORC Ann. 2921.22	•		•	•		•	•	•		
OK	10 Okl. St. §7104	•		•							•
OR	ORS §146.750	•				•	•	•			•
PA	18 P.A.C.S. §5106	•		•			•				•
RI	R.I. Gen. Laws §11-47-48,										
	§12-29-9	•	•[xvi]				•				•
SC	S.C. Code Ann. §16-3-1072	•					•				•
SD	S.D. Codified Laws										
	§23-13-10	•					•				•
TN	Tenn. Code Ann. §38-1-101	•			•		•	•			•
TX	Texas Health & Safety Code										
	§161.041	•					•				•
UT	Utah Code Ann. §26-23a-2	•		•			•	•			•
VT	13 V.S.A. §4012	•					•				•
VA	Va. Code Ann. §54.1-2967	•					•	•			•
WA											
WV	W. Va. Code §61-2-27	•		•			•	•			•
WI	Wis. Stat. §146.995	•		•			•		•		•
WY											

[xiii] This document is intended to provide a cursory overview of mandatory reporting laws. Please be sure to consult the complete set of mandatory reporting laws in your state for further information. If you note any changes or errors on this document, please contact the FVPF at 415-252-8900.

[xiv] Under a strict reading of these laws, practitioners must be providing treatment or medical care to the person with specified injuries in order to trigger the reporting requirement. Therefore, in a pediatric or family practice setting, if an attending parent with injuries is bringing her child in for a health care appointment, the attending parent is not actually receiving treatment or medical care from the practitioner, and thus the practitioner in the state would not be required to report. Further discussion is merited, given the lack of statutory or case law that have been developed around this area.

[xv] The law provides an exception to reporting if the patient is over the age of 18, did not suffer a gunshot wound, and does not consent to reporting.

[xvi] Report is made for medical data collection purposes only, and does not contain identification information.

Prepared by Josephine Yeh, J.D., for the Family Violence Prevention Fund

APPENDIX X

LEGISLATION REGARDING CHILD WITNESSES TO DOMESTIC VIOLENCE

The following introduction was taken in part from Child Abuse and Neglect State Statutes Series Compendium of Laws:

CHILD WITNESS TO DOMESTIC VIOLENCE, 2002

Approximately 20 States and Puerto Rico have enacted legislation that specifically includes children who witness acts of domestic violence as a class of persons in need of legal protection. The majority of these States provide enhanced criminal penalties for the commission of domestic violence offenses in the presence of a child. Other States mandate counseling for child witnesses, allow courts to find a child witness in need of aide, require supervised visitation for such behavior, presume that a child witness many have sustained physical injury for purposes of restitution and consider such conduct an aggravating factor for courts to consider in sentencing. Although there is great variation across States as to the particular requirements imposed by this legislation, these statutes share common elements. The Statutes generally define which particular children are protected under the legislation, the meaning of "in the presence of a child," those actions that constitute domestic violence and whether one witnessing incident is sufficient or exposure to repeated incidents is required.

STATE BY STATE CIVIL AND CRIMINAL LEGISLATIVE REFERENCES

The following list was compiled and updated May, 2004 by the National Clearinghouse on Child Abuse and Neglect Information 330 C Street, SW, Washington, DC 20447
Website: http://nccanch.acf.hhs.gov/general/legal/statutes/index.cfm

Alabama	Not addressed in statutes reviewed
Alaska	Alaska Stat. § 47.10.011 (Lexis, WESTLAW through 2000 3rd Spec. Sess.) Alaska Stat. § 12.55.155 (LexisNexis through 2003 Sess.)
Arizona	Ariz. Rev. Stat. Ann. § 13-702 (LexisNexis through Ariz. 2004 Legis. Serv., Ch. 174)
Arkansas	Ark. Code Ann. § 5-4-701(2) (WESTLAW through 2001 Reg. Sess.) Ark. Code Ann. § 5-4-702 (WESTLAW through 2001 Reg. Sess.)
California	Cal. Penal Code § 1170.76 (West, WESTLAW through 1999-2000 Reg. Sess. & 1st Ex. Sess. & 11/7/00)
Colorado	Not addressed in statutes reviewed

LEGISLATION REGARDING CHILD WITNESSES TO DOMESTIC VIOLENCE

Connecticut	Not addressed in statutes reviewed
Delaware	Del. Code Ann. tit. 11, § 1102 (WESTLAW through 2001 Reg. Sess.)
District of Columbia	Not addressed in statutes reviewed
Florida	Fla. Stat. Ann. § 921.0024 (LexisNexis through 2003 Sess.)
Georgia	Ga. Code Ann. § 16-5-70 (LexisNexis through Ga. 2004 Legis. Serv., Act 439)
Hawaii	Haw. Rev. Stat. Ann. § 706-606.4 (LexisNexis through 2003 Reg. & Spec. Sess.)
Idaho	Idaho Code § 18-918 (LexisNexis through Idaho 2004 Legis. Serv., Ch. 118)
Illinois	720 Ill. Comp. Stat. Ann. 5/12-3.2 (LexisNexis through 3/20/04)
Indiana	Ind. Code Ann. § 31-14-14-5 (LexisNexis through 2004 Spec. Sess.)
Iowa	Not addressed in statutes reviewed
Kansas	Not addressed in statutes reviewed
Kentucky	Not addressed in statutes reviewed
Louisiana	Not addressed in statutes reviewed
Maine	Not addressed in statutes reviewed
Maryland	Not addressed in statutes reviewed
Massachusetts	Not addressed in statutes reviewed
Michigan	Not addressed in statutes reviewed
Minnesota	Minn. Stat. Ann. § 626.5552 (West, WESTLAW through 2000 Reg. Sess.)

LEGISLATION REGARDING CHILD WITNESSES TO DOMESTIC VIOLENCE

Mississippi	Miss. Code Ann. § 97-3-7(3)-(4) (LexisNexis through Miss. 2004 Legis. Serv., H.B. 816)
Missouri	Not addressed in statutes reviewed
Montana	Mont. Code Ann. § 45-5-206(1), (2), (3)(a) (LexisNexis through 2003 Reg. Sess.)
Nebraska	Not addressed in statutes reviewed
Nevada	Nev. Rev. Stat. Ann. § 200.485 (LexisNexis through End of 2003 Sess.)
New Hampshire	Not addressed in statutes reviewed
New Jersey	Not addressed in statutes reviewed
New Mexico	Not addressed in statutes reviewed
New York	Not addressed in statutes reviewed
North Carolina	N.C. Gen. Stat. § 14-33 (LexisNexis through 2003 Reg. & 2nd Ex. Sess.)
North Dakota	Not addressed in statutes reviewed
Ohio	Ohio Rev. Code Ann. § 2929.01(MM), (NN) (LexisNexis through 3/29/04) Ohio Rev. Code Ann. § 2929.12 (LexisNexis through 3/29/04) Ohio Rev. Code Ann. § 2929.17 (LexisNexis through 3/29/04)
Oklahoma	Okla. Stat. Ann. tit. 21, § 644 (West, WESTLAW through 2000 1st Ex. Sess.)
Oregon	Or. Rev. Stat. § 163.160 (WESTLAW through 1999 Reg. Sess.)
Pennsylvania	Not addressed in statutes reviewed
Rhode Island	Not addressed in statutes reviewed
South Carolina	Not addressed in statutes reviewed
South Dakota	Not addressed in statutes reviewed
Tennessee	Not addressed in statutes reviewed

LEGISLATION REGARDING CHILD WITNESSES TO DOMESTIC VIOLENCE

Texas	Not addressed in statutes reviewed
Utah	Utah Code § 76-5-109.1(1), (2) (LexisNexis through 2003 Sp. Sess.)
Vermont	Not addressed in statutes reviewed
Virginia	Not addressed in statutes reviewed
Washington	Wash. Rev. Code Ann. § 9.94A.535 (LexisNexis through 3/18/04)
West Virginia	Not addressed in statutes reviewed
Wisconsin	Not addressed in statutes reviewed
Wyoming	Not addressed in statutes reviewed

Please be advised that this list contains dated information and is intended for educational and research purposes only. It is the responsibility of each party receiving this information to verify the laws for accuracy and currency of legislation.

APPENDIX XI | CHILD ABUSE AND NEGLECT REPORTING LAWS

WHO MUST REPORT	Dentist	Mental Doctor	Health	Social Nurse	Worker	Standard for Reporting?	Report What?	Report to Whom?	Report How?
Alabama Ala. Code § 26-14-3 (2000)	Y	Y	Y	Y	Y	Knowledge or suspicion	Child Abuse or Neglect	Law enforcement Department of Human resources	Oral and written
Alaska Alaska Stat. § 47.17.020 (Michie 2000)	Y	Y	Y	Y	Y	Reasonable cause to suspect	Harm as a result of child abuse or neglect	Department of Health and Social Services	Not Specified
Arizona Ariz. Rev. Stat. § 13-3620 (2000)	Y	Y	Y	Y	Y	Resonable grounds to believe	Injury, commercial sexual expoitation of a minor, sexual exploitation of a minor, incest, child prostitution, death, abuse, or nonaccidental physical neglect	Law enforcement or Child Protective Services	Oral and written
Arkansas Ark. Code Ann. § 12-12-507 (Michie 1999)	Y	Y	Y	Y	Y	Reasonable cause to suspect	Child maltreatment or conditions that will reasonavle result in child maltreatment	Child abuse hotline	Oral
California Cal. [Penal] Code § 11166 (West 2000)	Y	Y	Y	Y	Y	Knowledge or reasonable suspicion	Child abuse	Child protective agency	Oral and written
Colorado Colo. Rev. Stat. § 19-3-304 (1999)	Y	Y	Y	Y	Y	Reasonable cause to know or suspect	Child abuse or neglect	County Department of Human Services or law emforcement	Not Specified
Connecticut Conn. Gen. Stat. §§ 17a-101 to - 101b (1999)	Y	Y	Y	Y	Y	Reasonable cause to suspect or believe	Abuse, nonaccidental physical injury, or neglect	Commissioner of Children and families or law enforcement agency	Oral

APPENDIX XI

CHILD ABUSE AND NEGLECT REPORTING LAWS

WHO MUST REPORT	Dentist	Mental Doctor	Health	Social Nurse	Standard for Worker	Reporting?	Report What?	Report to Whom?	Report How?
Delaware Del. Code Ann. Tit.16, §§ 903-904 (1999)	Y	Y	Y	Y	Y	Knowledge or good faith suspicion	Child abuse or neglect	Division of Child Protective Services of Department of Services for Children Youth, and Their Families	Oral and written (if requested)
District of Columbia D.C. Code Ann. § 2-1352 (1999)	Y	Y	Y	Y	Y	Knowledge or reasonable cause to suspect	Immediate danger of physical or mental avuse or neglect	Law enforcement or Child Protective Services	Not Specified
Florida Fla. Stat. ch. 39.201 (1999)	Y	Y	Y	Y	Y	Knowledge or reasonable cause to suspect	Abuse, abandonment, or neglect	Department of Children and Family Services	Oral
Georgia Ga. Code Ann. § 19-7-5 (1999)	Y	Y	Y	Y	Y	Reasonable cause	Abuse	Child welfare agency designated by the Department of Human Resources or law enforcement Commissioner of Children and families or law enforcement agency	Oral and written (if requested)
Hawaii Haw. Rev. Stat. § 350-1.1 (1999)	Y	Y	Y	Y	Y	Reason to believe	Child abuse or neglect or substantial risk of above in reasonably foreseeable future	Department of Human Services and law enforcement	Oral and written
Idaho Idaho Code § 16-1619 (1999)	Y	Y	Y	Y	Y	Reason to believe	Abuse, abandonment, or neglect or conditions that would reasonably result in any of above	Law enforcement or Department of Health and Welfare	Not specfied

APPENDIX XI | CHILD ABUSE AND NEGLECT REPORTING LAWS

WHO MUST REPORT	Dentist	Mental Doctor	Health Nurse	Social Worker	Standard for Reporting?	Report What?	Report to Whom?	Report How?
Illinois 325 Ill. Comp. Stat. 5/4 (West 2000)	Y	Y	Y	Y	Reasonable cause to believe	Abuse or neglect	Department of Children and Famiily Services	Not specified
Indiana Ind. Code §§ 31-33-5-1 to -2, -4 (1999)	Y	Y	Y	Y	Reason to believe	Abuse or neglect	Child protective services or law enforcement	Oral
Iowa Iowa Code § 232.69 (1999)	Y	Y	Y	Y	Reasonable belief	Child abuse	Department of Human Services	Oral and written
Kansas Kan. Stat. Ann. § 38-1522 (1999)	Y	Y	Y	Y	Reason to suspect	Injury resulting from physical, mental, or emotional, neglect, or sexual abuse	Department of Social and Rehabilitation Services	Oral and written (if requested)
Kentucky Ky. Rev. Stat. Ann. § 620.030 (Michie 1998)	Y	Y	Y	Y	Knows or has reasonable cause to believe	Dependency, neglect or abuse	Law enforcement, Cabinet for Families and Children, or county attorney	Oral or written
Louisiana La. Civ. Stat. Ann. Art. 603, 609-610 (West 2000)	Y	Y	Y	Y	Cause to believe	Endangerment of child's physical or mental health or welfare due to neglect or abuse	Child Pretection Unit of Department of Social Services	Written
Maine Me. Rev. Stat. Ann. Tit. 22 § 4011 (West 1999)	Y	Y	Y	Y	Knowledge or reasonable cause to suspect	Child likely to be or has been abused or neglected	Department of Human Services	Not Specified
Maryland Md. Code. Ann., [Fam. Law] § 5-704 (1999)	Y	Y	Y	Y	Reason to believe	Abuse or neglect	Department of Social Services or law enforcement	Oral and written

APPENDIX XI

CHILD ABUSE AND NEGLECT REPORTING LAWS

WHO MUST REPORT	Dentist	Doctor	Mental Health	Nurse	Social Worker	Standard for Reporting?	Report What?	Report to Whom?	Report How?
Massachusetts Mass. Gen. Laws ch. 119, § 51A (2000)	Y	Y	Y	Y	Y	Reasonable cause to believe	Physical or emotional injury resulting from abuse which causes harm or substantial risk of harm to child's health or welfare;	Juvenile Court	Oral and written
Michigan Mich. Comp. Laws § 722.623 (1999)	Y	Y	Y	Y	Y	Reasonable cause to suspect	Abuse or neglect	Department of Social Services	Oral and written
Minnesota Minn. Stat. § 626.556 (1999)	Y	Y	Y	Y	Y	Knows or has reason to believe	Neglect, or physical or sexual abuse, currently or within past three years	Welfare agency or law enforcement	Not specified
Mississppi Miss. Code Ann. § 43-21-353 (2000)	Y	Y	Y	Y	Y	Reasonable cause to suspect	Neglect or abuse	Department of Human Services	Oral and written
Missouri Mo. Rev. Stat. § 210.115 (1999)	Y	Y	Y	Y	Y	Reasonable cause to suspect	Child has been or may be subjected to abuse or neglect or is being subjected to conditions that would reasonably result in abuse or neglect	Division of Family Services	Not specified
Montana Mont. Code Ann. § 41-3-201 (1999)	Y	Y	Y	Y	Y	Knows or has reasonable cause to suspect	Abuse or neglect	Department of public Health and Human Services	Not specified
Nebraska Neb. Rev. Stat. § 28-711 (2000)	Y	Y	Y	Y	Y	Reasonable cause to believe	Abuse or neglect or conditions that reasonably would result in abuse or neglect	Law enforcement or Department of Health and Human Services	Oral and written

APPENDIX XI | CHILD ABUSE AND NEGLECT REPORTING LAWS

WHO MUST REPORT	Dentist	Mental Doctor Health	Social Nurse	Standard for Worker	Reporting?	Report What?	Report to Whom?	Report How?
Nevada Nev. Rev. Stat. § 432B.220 (2000)	Y	Y	Y	Y	Y	Knowledge or reasonable cause to believe	Abuse or neglect	Law enforcement or protective services	Not specified
New Hampshire N.H. Rev. Stat. Ann. §§ 169-C:29 to -C:30 (1999)	Y	Y	Y	Y	Y	Reason to suspect	Abuse or neglect	Department of Health and Human Services	Oral and written (if requested)
New Jersey N.J. Stat. Ann. § 9:6-8.10 (west 2000)	Y	Y	Y	Y	Y	Reasonable cause to believe	Abuse	Division of Youth and Family Services	Oral or written
New Mexico N.M. Stat. Ann. § 32A-4-3 (Michie)	Y	Y	Y	Y	Y	Knowledge or reasonable suspicion	Abuse or Neglect	Law enforcement or Department of Children, Youth, and Families or tribal law enforcement (if child resides in Indian country)	Not specified
New York N.Y. [Soc. Serv.] Law § 413 (McKinney 1999)	Y	Y	Y	Y	Y	Reasonable cause to suspect	Abuse or maltreatment	Central register of child abuse and maltreatment	Oral and written
North Carolina N.C. Gen. Stat. § 7B-301 (1999)	Y	Y	Y	Y	Y	Cause to suspect	Abuse, neglect, dependency, or death resulting from maltreatment	Department of Social Services	Oral or written
North Dakota N.D. Cent. Code § 50-25.1-03 (2000)	Y	Y	Y	Y	Y	Knowledge or reasonable cause to suspect	Abuse, neglect, or death resulting from abuse or neglect	Department of Human Services	Not specified

APPENDIX XI

CHILD ABUSE AND NEGLECT REPORTING LAWS

WHO MUST REPORT	Dentist	Doctor	Mental Health	Nurse	Social Worker	Standard for Reporting?	Report What?	Report to Whom?	Report How?
Ohio Ohio Rev. Code. Ann. § 2151.421 (Anderson 1999)	Y	Y	Y	Y	Y	Knowledge or suspicion	Suffers or faces threat of suffering abuse, neglect, physical or mental wound, injury or diability that reasonably indicates abuse or neglect	Public Children Services Agency or law enforcement	Oral and written (if requested)
Oklahoma Okla. Stat. Tit. 10, § 7103 (1999)	Y	Y	Y	Y	Y	Reason to believe	Abuse or neglect	Department of Human Services	Oral or written
Oregon Or. Rev. Stat. §§ 419B.005, .010-.015 (1997)	Y	Y	Y	Y	Y	Reasonable cause to believe	Abuse	Office for Services to Children and Families or law enforcement	Oral
Pennsylvania 23 Pa. Cons. Stat. § 6311 (1999)	Y	Y	Y	Y	Y	Reasonable cause to suspect	Abuse	Department or appropriate county agency	Oral and written
Rhode Island R.I. Gen. Laws § 40-11-3 (2000)	Y	Y	Y	Y	Y	Reasonable cause to know or suspect	Abuse, neglect, or sexual abuse perpetrated by another child	Department for Children and Their Families	Oral
South Carolina S.C. Code Ann. § 20-7-510 (Law. Co-op. 1999)	Y	Y	Y	Y	Y	Reason to believe	Physical or mental health or welfare has been or may be adversely affected by abuse or neglect	Department of Social Services or law enforcement	Oral
South Dakota S.D. Codified Laws §§ 26-8A-3, -6	Y	Y	Y	Y	Y	Reasonable cause to suspect	Abuse or neglect	State's attorney, Department of Social Services. or law enforcement	Oral

APPENDIX XI | CHILD ABUSE AND NEGLECT REPORTING LAWS

WHO MUST REPORT	Dentist	Mental Doctor	Health	Social Nurse	Worker	Standard for Reporting?	Report What?	Report to Whom?	Report How?
Tennessee Tenn. Code Ann. § 37-1-403 (1999)	Y	Y	Y	Y	Y	Knowledge or reasonable indication or reasonable appearance	Wound, injury, diability, physical or mental condition caused by brutality, abuse, or neglect	Juvenile court judge,Department of Children's Services, or law enforcement	Oral or written
Texas Tex. [Fam.] Code Ann. §§ 261.101-.103 (West 2000)	Y	Y	Y	Y	Y	Cause to believe	Physical or mental health or welfare adversely affected by abuse or neglect	Law enforcement or Department of Protective and Regulartory Services	Not specified
Utah Utah Code Ann. § 62A-4a-403 (1999)	Y	Y	Y	Y	Y	Observation or has reason to believe	Incest, molestation, sexual exploitation, sexual abuse, physical abuse, neglect, or circumstances reasonably resulting in any of above	Law enforcement or Division of Child andFamily Services	Not specified
Vermont Vt. Stat. Ann. Tit. 33, §§ 4913-4914 (2000)	Y	Y	Y	Y	Y	Resonable cause to believe	Abuse or neglect	Commissioner of Social And Rehabilitaiton Services	Oral and written
Virginia Va. Code Ann. § 63.1-248.3 (Michie 1999)	Y	Y	Y	Y	Y	Reason to suspect	Abuse or neglect	Department of Social Services	Oral
Washington Wash. Rev. Code § 26.44.030 (2000)	Y	Y	Y	Y	Y	Observation or reasonable cause to believe	Abuse or neglect orconditions likely toresult in neglect or abuse	Law enforcement or Department of Social and Health Services	Not specified
West Virgina W. Va. Code § 49-6A-2 (2000)	Y	Y	Y	Y	Y	Reasonable cause to suspect	Neglect or abuse, or conditions likely to result in neglect or abuse	State Department of Human Services and Division of Public Safety and law enforcement (if serious)	Not specified

APPENDIX XI

CHILD ABUSE AND NEGLECT REPORTING LAWS

WHO MUST REPORT	Dentist	Doctor	Mental Health	Nurse	Social Worker	Standard for Reporting?	Report What?	Report to Whom?	Report How?
Wisconsin Wis. Stat. § 48.981 (1999)	Y	Y	Y	Y	Y	Reasonable cause to suspect or reason to believe	Abuse or neglect, or threat of abuse or neglect	Department of Health and Family Services	Oral and written (if requested)
Wyoming Wyo. Stat. Ann. § 14-3 205 (Michie 1999)	Y	Y	Y	Y	Y	Knowledge or reasonable cause to believe or suspect	Abuse or neglect or subjection to conditions that would reasonably result in abuse or neglect	Child protective agency or law enforcement	Not specified

NOTE: Because the term allied health professional is defined variably among different states, this Chart cannot accurately summarize the duties of all persons who might be included in this broad category

APPENDIX XII | RESOURCES AND REFERRALS

HOTLINES FOR VICTIMS OF IPV/DOMESTIC VIOLENCE

NATIONAL DOMESTIC VIOLENCE HOTLINE, 24 hours, 1-800-799-SAFE (7233), 1-800-787-3224 (TTY) Links individuals to help in their area using a nationwide database that includes detailed information on DV shelters, other emergency shelters, legal advocacy and assistance programs, and social service programs. website: *www.ndvh.org*

RAPE ABUSE & INCEST NATIONAL NETWORK (RAINN), 24 hours, 1-800-656-HOPE Will automatically transfer the caller to the nearest rape crisis center, anywhere in the nation. It can be used as a last resort if people cannot find a DV shelter. 635-B Pennsylvania Ave SE, Washington, DC 20003 Phone: 1.800.656.HOPE (4673) ext. 3 Fax: (202) 544-3556 e-mail: *rainnmail@aol.com* website: *www.rainn.org*

LOCAL DV PROGRAMS (numbers are listed in the front of your telephone book). Or go to the list of State Domestic Violence or Sexual Assault Coalitions website: *www.ojp.usdoj.gov/vawo/state.htm*

DOMESTIC VIOLENCE (IPV) ORGANIZATIONS

FAMILY VIOLENCE PREVENTION FUND (FVPF) is a national non-profit organization that focuses on domestic violence education, prevention and public policy reform; and provides health care specific materials and information. 383 Rhode Island St., Suite 304, San Francisco, CA 94103-5133 phone: (415) 252-8900 fax: (415) 252-8991 e-mail: *fund@endabuse.org* website: *www.endabuse.org*

PENNSYLVANIA COALITION AGAINST DOMESTIC VIOLENCE (PCADV) AND NATIONAL RESOURCE CENTER ON DOMESTIC VIOLENCE is a private, nonprofit membership organization and is dedicated to ending domestic violence and helping battered women and their children re-establish physical, social, and economic dignity; PCADV has established health care advocacy programs throughout the state. 6400 Flank Drive, Suite 1300, Harrisburg, PA 17112 phone: (800) 932-4632 fax: (717) 671-8149 website: *www.pcadv.org*

NATIONAL COALITION AGAINST DOMESTIC VIOLENCE (NCADV) is dedicated to the empowerment of battered women and their children and is committed to the elimination of personal and societal violence in the lives of battered women and their children. PO Box 18749, Denver, CO 80218 phone: (303) 839-1852 fax: (303) 831-9251 website: *www.ncadv.org*

NATIONAL COUNCIL OF JUVENILE AND FAMILY COURT JUDGES, FAMILY VIOLENCE DEPARTMENT provides technical assistance to those working in the field of domestic violence and child protection and custody. The Resource Center identifies and develops model policies, protocols, and programs that are sensitive to the legal, cultural and

psychological dynamics of child protection and custody cases involving family violence. P.O. Box 8970, Reno, Nevada 89507 phone: (800)527-3223 email: www.ncjfcj.org/dept/fvd

NATIONAL NETWORK TO END DOMESTIC VIOLENCE THE NATIONAL NETWORK TO END DOMESTIC VIOLENCE is a membership and advocacy organization of state domestic violence coalitions, allied organizations and supportive individuals and is a leading voice among domestic violence advocates in public policy. website: *www.nnedv.org*

SACRED CIRCLE: THE NATIONAL RESOURCE CENTER TO END VIOLENCE AGAINST NATIVE WOMEN. Dedicated to the Actions that promote the Sovereignty and Safety of Women. 722 St. Joseph St. Rapid City, SD 57701 (605) 341-2050. 1 (877) RED-ROAD (733-7623)

ASIAN & PACIFIC ISLAND INSTITUTE ON DOMESTIC VIOLENCE: Strives to eliminate domestic violence in Asian and Pacific Islander communities by increasing awareness about the extent and depth of the problem making culturally specific issues visible; strengthening community models of prevention and intervention; identifying and expanding resources; informing and promoting research and policy and deepening understanding and analysis of the issues surrounding violence against women. 942 Market Street, Suite 200, San Francisco, CA 94102 (415) 954-9964 (p) (415) 954-9999 (f) website: *www.apiahf.org*

INSTITUTE ON DOMESTIC VIOLENCE IN THE AFRICAN AMERICAN COMMUNITY: Provides an interdisciplinary vehicle and forum by which scholars, practitioners, and observers of family violence within the African American community will have the continual opportunity to articulate their perspectives on family violence through research findings, the examination of service delivery and intervention mechanisms, and the identification of appropriate and effective responses to prevent/reduce family violence in the African American community. 290 Peters Hall 1404 Gortner Avenue St. Paul, MN 55108-6142 (p) (877) NID-VAAC (643-8222) Fax (612) 624-9201 website: *www.dvinstitute.org*

NATIONAL LATINO ALLIANCE FOR THE ELIMINATION OF DOMESTIC VIOLENCE A network of nationally recognized Latina and Latino advocates, community activists, practitioners, researchers, and survivors of domestic violence working together to promote understand, sustain dialogue, and generate solutions to move toward the elimination of domestic violence in Latino communities, with an understanding of the sacredness of all relations and communities. P.O. Box 322086 Fort Washington New York, NY 10032 Tel (800) 342-9903 Fax (800) 216-2404. website: *www.dvalianza.org*

CLINICAL MATERIALS FOR THE HEALTH CARE SETTING

THE NATIONAL HEALTH RESOURCE CENTER ON DOMESTIC VIOLENCE a project of the FVPF, provides support to thousands of health care professionals, policy makers and domestic violence advocates through its four main program areas: model training strategies,

practical tools, technical assistance, and public policy. phone: (888) Rx-ABUSE fax: (415) 252-8991 e-mail: *health@endabuse.org* website: *www.endabuse.org/health*

THE CHILD WITNESS TO VIOLENCE PROJECT AT BOSTON MEDICAL CENTER provides mental health services to young children exposed to violence. Staff also provide training and technical assistance to a wide range of professionals working with young children and families affected by violence and have published a training curriculum for mental health professionals and victim advocates: "Shelter from the Storm: Clinical Intervention with Young Children Affected by Domestic Violence". For more information, call (617) 414-4244. The project website is *www.bostonchildhealth.org/special/CWTV/overview.html*

ALASKA FAMILY VIOLENCE PREVENTION PROJECT specializes in training for health care and service providers, have articles, curricula in PowerPoint that can be downloaded, run a clearinghouse of education materials. website: http://*www.hss.state.ak.us/dph/chems*

HOWARD S. KING, MD, MPH AND MELINDA STRAUSS, ACSW, LISCW authors of Routine Screen for Domestic Violence in Pediatric Practice written to help pediatricians and family practitioners become aware of the problem of domestic violence and to consider screening for it during the routine office visit. View or download this publication at *www.drkingsoffice.com*

THE INSTITUTE FOR SAFE FAMILIES' (ISF) mission is to prevent family violence and to offer an alternative vision for wholeness, healing, family health, and personalempowerment. ISF is conducting a Philadelphia area initiative to address domestic violence within the pediatric setting and has developed a pocket card on what to do, with a variety of materials in development. ISF, 3502 Scotts Lane, Philadelphia, PA 19129, (215) 843-2046, website: *ISF2002@aol.com*

Websites of Interest for Adolescents

THE EMPOWER PROGRAM works with youth to end the culture of violence. 1312 8th Street, Washington, DC 20001 phone: (202) 882-2800 fax: (202) 234-1901 e-mail: *empower@empowered.org* website: *www.empowered.org*

GIRLS INCORPORATED NATIONAL RESOURCE CENTER is a national youth organization dedicated to inspiring all girls to be strong, smart and bold. 441 West Michigan Street, Indianapolis, IN 46202 phone: (317) 634-7546 fax: (317) 634-3024 e-mail: *girlsinc@girls-inc.org* website: *www.girlsinc.org*

LIZ CLAIBORNE INC. produces "A Teen's Handbook" and web pages to help teens learn about dating violence by providing facts, guidance and resources. To order a free handbook, phone: (800) 449-STOP (7867) website: *www.lizclaiborne.com/lizinc/lizworks/women/handbook.asp#teen*

LESBIAN, GAY, BISEXUAL, TRANSGENDERED, QUEER (LGBTQ)

COMMUNITY UNITED AGAINST VIOLENCE (CUAV) is a 20-year old multicultural organization working to end violence against and within lesbian, gay, bisexual, transgender and queer/questioning (LGBTQ) communities. 973 Market St., #500, San Francisco, CA 94103 phone: (415)777-5500 Fax: (415)777-5565 24 Hr. Support Line: (415) 333-HELP (4357) e-mail: *cuav@aol.com* website: *www.cuav.org*

PARENTS, FAMILIES, AND FRIENDS OF LESBIANS AND GAYS (PFLAG) is a national organization that promotes the health and well-being of gay, lesbian, bisexual and transgendered persons, their families and friends. Their Web site provides users with information on local chapters, advocacy and support information and other resources that support the family and friends of gays and lesbians. 1726 M Street, NW, Suite 400, Washington, DC 20036 phone: (202) 467-8180 fax: (202) 467-8194 e-mail: *info@pflag.org* website: *www.pflag.org*

GAY MEN'S DOMESTIC VIOLENCE PROJECT is a grassroots, non-profit organization in Boston providing community education and direct services for clients. GMDVP offers shelter, guidance, and resources to allow gay, bisexual, and transgender men in crisis to remove themselves from violent situations and relationships GMDVP, PMB 131, 955 Mass Ave. Cambridge, MA 02139 Fax: 617 354 6072, Bus: (617) 354-6056 Crisis: (800) 832-1901 website: *www.gmdvp.org* 1-800-832-1901.

NETWORK FOR BATTERED LESBIANS AND BISEXUAL WOMEN. The Network/La Red was formed to address battering in lesbian, bisexual women's, and transgender communities. Through a) the formation of a community-based multi-cultural organization in which battered/formerly battered lesbians, bisexual women, and transgender folks hold leadership roles; b) community organizing, education, and the provision of support services, we seek to create a culture in which domination, coercion, and control are no longer accepted and operative social norms. The Network POB 6011 Boston, MA 02114. Office (v/tty) (617) 695-0877. Hotline (v/tty)(617) 423-7233. website: *www.thenetworklared.org*

TEEN PREGNANCY

AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS (ACOG) has a membership of 40,000 physicians and is the nation's leading group of professionals providing health care for women. ACOG's website provides adolescent sexual assault screening tools as well as other teen pregnancy materials. To request free copies of their educational bulletins, call: (202) 638-5577 or e-mail: *violence@acog.org*. ACOG, 409 12th Street, SW, PO Box 96920 Washington, DC 20024. phone: (202) 863-2487 fax: (202) 484-3917 e-mail: *adolhlth@acog.org* website: *www.acog.org*

SEXUAL ASSAULT

CENTER FOR THE PREVENTION OF SEXUAL AND DOMESTIC VIOLENCE is an interreligious educational resource addressing issues of sexual and domestic violence whose goal is to engage religious leaders in the task of ending abuse, and to serve as a bridge between religious and secular communities. 936 North 34th St., Suite 200, Seattle, WA 98103 phone: (206) 634-1903 fax: (206) 634-0115
e-mail: *cpsdv@cpsdv.org* website: *www.cpsdv.org*

RAPE ABUSE & INCEST NATIONAL NETWORK (RAINN) *(see **"Hotlines"** for further info)*

SEXUAL ASSAULT RESOURCE SERVICE (SARS) is designed for nursing professionals involved in providing evaluations of sexually abused victims. SARS' website provides information and technical assistance to individuals and institutions interested in developing new SANE-SART programs or improving existing ones. website: *www.sane-sart.com*

ANIMAL CRUELTY AND FAMILY VIOLENCE

THE HUMANE SOCIETY OF THE UNITED STATES, through its First Strike campaign, is dedicated to raising public and professional awareness about the connection between animal cruelty and family violence. 2100 L Street, NW, Washington, DC 20037 phone: (301) 258-3076; toll-free (888) 213-0956 fax: (301) 258-3074 e-mail: *firststrike@hsus.org* website: *www.hsus.org/firststrike*

OTHER WEBSITES OF INTEREST WITH DOMESTIC VIOLENCE-SPECIFIC HEALTH CARE RESOURCES

AMERICAN ACADEMY OF PEDIATRICS: *www.aap.org*

AMERICAN COLLEGE OF EMERGENCY PHYSICIANS: *www.acep.org*

AMERICAN COLLEGE OF NURSE MIDWIVES: *www.acnm.org*

AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS: *www.acog.org*

AMERICAN MEDICAL ASSOCIATION: *www.ama-assn.org*

AMERICAN MEDICAL WOMEN'S ASSOCIATION: *www.amwa-doc.org*

AMERICAN PSYCHOLOGICAL ASSOCIATION: *www.apa.org*

ASSOCIATION OF TRAUMATIC STRESS SPECIALISTS: *www.atss-hq.com*

BATTERED WOMEN AND THEIR CHILDREN: *http://hosting.uaa.alaska.edu/afrhm1/wacan/*

CHILD WITNESS TO VIOLENCE PROJECT AT BOSTON MEDICAL CENTER: *www.childwitnesstoviolence.org*

FAMILY VIOLENCE AND SEXUAL ASSAULT INSTITUTE: *www.fvsai.org*

INTERNATIONAL ASSOCIATION OF FORENSIC NURSES: *www.forensicnurse.org*

RESOURCES AND REFERRALS

JOHNS HOPKINS UNIVERSITY SCHOOL OF NURSING: *www.son.jhmi.edu*

MASSACHUSETTS MEDICAL SOCIETY: *www.massmed.org*

MEN STOPPING VIOLENCE: *www.menstoppingviolence.org*

NURSING NETWORK TO END VIOLENCE AGAINST WOMEN INTERNATIONAL: *www.nnvawi.org*

NATIONAL SEXUAL VIOLENCE RESOURCE CENTER: *www.nsvrc.org*

SOCIETY OF ACADEMIC EMERGENCY MEDICINE: *www.saem.org*

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POLICY STATEMENT

Immunization Information Systems

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Practice and Ambulatory Medicine

ABSTRACT

The American Academy of Pediatrics continues to support the development and implementation of immunization information systems, previously referred to as immunization registries, and other systems for the benefit of children, pediatricians, and their communities. Pediatricians and others must be aware of the value that immunization information systems have for society, the potential fiscal influences on their practice, the costs and benefits, and areas for future improvement.

BACKGROUND

IMMUNIZATION INFORMATION SYSTEMS (IISs), previously known as immunization registries, have rapidly developed over recent years.[1] Appropriate functioning standards for IISs[2] that also address privacy and confidentiality have been adopted by the National Immunization Program,[3] and the American Immunization Registry Association has developed registry standards of excellence that provide a standardized self-assessment tool.[4,5] The American Academy of Pediatrics (AAP) continues to welcome and support the development of this technology and other systems for the benefit of children, pediatricians, and their communities. It is important for pediatricians to be aware of the value that IISs have for society, the potential fiscal influences on their practices, and areas for future efforts.

IISs AND SOCIETY

Since 1993, the United States Public Health Service (through the Immunization Grant Program, also called the "317 program"), the Robert Wood Johnson Foundation, and the National Immunization Program of the Centers for Disease Control and Prevention have provided funding for the development of IIS projects in virtually every state.[2] The projected annual cost of a nationwide network of IISs is $78 million for children 0 to 5 years of age ($100 million for children 0–6 years of age).[6] Annual cost offsets are estimated at $280 million.[6,7] These savings would result from improved efficiencies in the following areas:

- $168 million in immunization-assessment activities for entry in school, child care, and Head Start programs;
- $58 million in manual pulling of records for all children entering kindergarten;
- $16.2 million in manual pulling of records for changing health care professionals;
- $26.5 million in duplicated immunizations;
- $2 million in Health Plan Employer Data and Information Set (HEDIS) reports; and

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Key Words
immunization registries, immunization information systems, pediatricians, fiscal influences, costs, reimbursement, practice

Abbreviations
IIS—immunization information system
AAP—American Academy of Pediatrics

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- $11.1 million in the National Immunization Survey.

IISs would be helpful in identifying and improving immunization rates in vulnerable populations. They would also be a valuable tool for public health efforts in infection control and prevention during outbreaks. Also, recent catastrophic events suggest a need for seriously examining the role of IISs in disaster preparations.

IISs AND PATIENTS

Pediatric patients and their families would benefit from having a regional or national immunization record instead of a paper one. There would be a decrease in duplication of immunizations. Interstate agreements are being developed that would enable physicians to access IISs from an adjacent state.

Reports vary about whether IISs improve immunization rates. In Oregon, immunization rates improved from 32% to 36% as a result of having accurate immunization data from the registry.[8] Another study reported improved accuracy of immunization data, but the "up-to-date" rate did not change after 3 years of IIS use.[9] A report from Minneapolis stated improved rates in one practice environment but not in another.[2]

IISs provide an automated reminder recall system. One study with an inner-city population reported a 2% improvement (38%–40%) in immunization rates by 2 years of age using an automated telephone recall system[10]; another study showed no improvement in immunization rates and identified the rate-limiting step as reaching the families, not generating a reminder.[11]

IISs AND PEDIATRIC PRACTICE

Although recently there has been more published research about IISs in the private sector, there continues to be a paucity of information on the fiscal effect on private practices. The savings from not having to manually pull a chart for immunization records are estimated at $14.70 per chart.[12] The fiscal effect on a practice depends on whether immunization data can be directly downloaded into the IIS from billing information, which in most cases requires the practice to purchase appropriate software. This downloaded information would provide the date and type of vaccine to the IIS but not the other required fields, such as lot numbers, site, administering personnel, etc. One study reported that manually entered data would cost $3.24 per shot, compared with $0.24 if the entry were automated.[13]

A study in 2004 reported an increase in cost of $0.56 per shot after implementation of an IIS in the private sector, with nurses spending 3.4 minutes per shot on registry activities.[14] There are no reports on the cost to practices to enter historical immunization data on patients to populate the database of the IIS.

It is important that both the public and private sectors continue to study the financial implications of these systems, not only on the practice, but on the system of care itself. A recent task force of America's Health Insurance Plans (AHIP), an organization representing the nation's major health plans, has been charged with exploring collaborative opportunities or promoting provider participation with IISs and to share health insurance plans' experiences and initiatives.[15]

RECOMMENDATIONS

1. The AAP supports continued improvement in IISs.
2. The AAP supports the continued evaluation of IISs to determine their cost-effectiveness in increasing immunization rates.
3. The AAP supports further needed research into the cost and benefits of IISs for the practicing pediatrician.
4. Physicians should be reimbursed for entering historical immunization data into the database of the IIS.
5. Data in IISs should be used as tools to improve quality of immunization services and not to penalize physicians whose immunization coverage is below average.
6. IISs must be integrated with electronic medical chart systems.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

TECHNICAL REPORT

Immunizing Parents and Other Close Family Contacts in the Pediatric Office Setting

Herschel R. Lessin, MD, Kathryn M. Edwards, MD, and the COMMITTEE ON PRACTICE AND AMBULATORY MEDICINE AND THE COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS
parental immunization, adults, vaccines, Tdap, cocooning

ABBREVIATIONS
CDC—Centers for Disease Control and Prevention
Tdap—tetanus toxoid, reduced diphtheria toxoid, and reduced-content acellular pertussis vaccine

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abstract

FREE

Additional strategies are needed to protect children from vaccine-preventable diseases. In particular, very young infants, as well as children who are immunocompromised, are at especially high risk for developing the serious consequences of vaccine-preventable diseases and cannot be immunized completely. There is some evidence that children who become infected with these diseases are exposed to pathogens through household contacts, particularly from parents or other close family contacts. Such infections likely are attributable to adults who are not fully protected from these diseases, either because their immunity to vaccine-preventable diseases has waned over time or because they have not received a vaccine. There are many challenges that have added to low adult immunization rates in the United States. One option to increase immunization coverage for parents and close family contacts of infants and vulnerable children is to provide alternative locations for these adults to be immunized, such as the pediatric office setting. Ideally, adults should receive immunizations in their medical homes; however, to provide greater protection to these adults and reduce the exposure of children to pathogens, immunizing parents or other adult family contacts in the pediatric office setting could increase immunization coverage for this population to protect themselves as well as children to whom they provide care. *Pediatrics* 2012;129:e247–e253

INTRODUCTION

Prevention of infectious diseases through administration of vaccines according to recommended childhood and adolescent immunization schedules is an effective strategy to improve child health. Childhood immunizations are one of the greatest advances in modern medicine, markedly reducing morbidity and mortality. Data from the Centers for Disease Control and Prevention (CDC)'s 2009 National Immunization Survey of more than 17 000 households revealed that immunization rates against most vaccine-preventable diseases in children 19 to 35 months of age were >90%; <1% of children received no vaccines.[1]

Despite widespread adherence to childhood immunization schedules, some children remain unprotected.[2] This includes infants who are too young to be vaccinated, children who do not receive all scheduled immunizations at appropriate times, young infants who have not received a full primary series and are not yet fully immune, and vaccine recipients who experience vaccine failure or waning immunity in

adolescence or adulthood.[3] Children who receive immunosuppressive agents as a result of cancer, organ transplantation, autoimmune diseases, and other primary and secondary immune deficiencies may be incapable of mounting an adequate immune response to any vaccine, and certain live-attenuated vaccines (eg, measles-mumps-rubella and varicella vaccines) may be contraindicated for medical reasons.

Thus, additional strategies are needed to protect children from vaccine-preventable diseases, such as immunizing household contacts of children to reduce their exposure to vaccine-preventable pathogens. This can be facilitated by immunizing parents and other close family contacts in the pediatric office setting. With this in mind, the goals of this technical report are as follows:

1. review the literature to determine how immunization of close family contacts could be used to protect vulnerable children;
2. explore potential issues surrounding implementation of this practice in the pediatric office setting; and
3. develop objectives and a research plan to advance this concept.

BACKGROUND

The objective of providing immunizations for parents and other close family contacts of children in pediatric practice is to decrease infections in the family member, with subsequent reduction in exposure to the children. This strategy is referred to as "cocooning."[4–6] Exposure to infected parents or family members is a risk factor for many infections. For example, infants with pertussis are often infected in their home by family members or other close contacts.[7–10] Bisgard et al[9] examined 774 cases of infant pertussis from 4 states and determined the source of contagion in these infants through family interviews. An infectious source was identified in 43% of the case infants; of these, mothers were the source in 32% of cases, and another family member was the source in 43% of cases. The specific ages of the infectious source persons were described in 36% of reports; of these, 38 (17%) were 0 to 4 years of age, 16 (7%) were 5 to 9 years of age, 43 (20%) were 10 to 19 years of age, 45 (21%) were 20 to 29 years of age, and 77 (35%) were 30 years of age or older. Thus, more than half of the infectious sources were adults. Similarly, a prospective study conducted between 2006 and 2008 concluded that if parental immunity to pertussis was maintained, 35% to 55% of infant pertussis cases could have been prevented.[10]

Several studies have documented that vaccination of pregnant women against influenza reduces the incidence of influenza in their offspring.[11,12] Although research has documented a benefit of influenza vaccination of pregnant women for their babies, no studies have been conducted to determine whether postpartum vaccination or vaccination of other close family contacts with influenza vaccine reduces the incidence of influenza in their children. A 2010 report by Rekhtman et al[13] found that 69% of infants younger than 2 months of age hospitalized with influenza A had a history of exposure to a family member with upper respiratory tract infection symptoms. The ages and immunization status of the contacts, however, were not reported.

Several parental immunization programs have been conducted to reduce the burden of disease in their children. Healy et al[14] provided tetanus toxoid, reduced diphtheria toxoid, and reduced-content acellular pertussis vaccine (Tdap) to medically underserved, uninsured women postpartum in Houston through a standing order protocol. Nearly all (96%) of the women without self-reported contraindications to vaccination received Tdap before hospital discharge. Shah and colleagues[15,16] conducted several immunization campaigns of parents whose infants were hospitalized in NICUs. During one influenza season, all parents of infants admitted to the NICU were offered trivalent inactivated influenza vaccine at their infant's bedside. Of the 158 infants admitted to the NICU, 95% of the parents were immunized. Remarkably, 23% of the parent population had never received trivalent inactivated influenza vaccine previously, despite having indications for personal influenza immunization.[15] The same group offered Tdap to all parents of infants admitted to the NICU. During the 4-month study period, 352 children were admitted to the NICU, and 87% of their parents received Tdap. However, 11% of parents refused vaccination, citing that pertussis was not a significant health threat or that they did not believe that vaccinations were protective.[16] Overall, these programs highlight the observation that most parents are likely to agree to immunizations for the purpose of protecting their infants.

In addition to the hospital setting, the practice of offering Tdap to all parents of infants during the first month of life was evaluated in a pediatric office setting. Two hundred parents were approached for immunization. Of eligible parents, more than 50% (82/160) received the vaccine. Interestingly, 60% of these parents opting for immunization received the vaccine the first time they were approached, and 40% received the vaccine at a subsequent office visit during the baby's first month of life.[4]

In summary, there is considerable evidence that children are exposed to infections in their home environment from parents and other family members

and that parents are willing to be immunized to protect their infants from vaccine-preventable diseases.

BARRIERS TO IMMUNIZATION OF ADULTS

Data from the CDC in 2010 reported that Tdap coverage among adults who have contact with an infant was only 5%.[17] Another study conducted in 2004–2005 reported that 74% of insured adults did not receive influenza vaccine.[18] With evidence to support the benefits of immunization of parents and other close family contacts for the protection of children, several barriers to adult immunization remain. First, there are patient factors, such as a reluctance of healthy adults to seek preventive health care. Many adults see little need for a visit to a health care provider in the absence of an acute or chronic illness. Even among insured adults, influenza vaccination represented the least frequently received preventative health service among routine recommended services (26%) during a 2-year study period.[18] Second, lack of insurance coverage for vaccine-eligible adults and potential loss of income (because of the need to take time from work for preventive care) add to the challenges. Third, many healthy adults are unaware of the continuing need for immunization and the risks to themselves or others when their immunizations are not current.[19,20] Therefore, many adults do not receive recommended adult immunizations.

Physician and health care system factors contribute to low immunization rates in adults. Physicians may not have enough time during health maintenance visits to address immunizations, given the multiple chronic conditions or acute illnesses they are frequently managing[21,22]; thus, patients may not become aware of the importance of immunization for their own health or the health of their children. Physicians also face financial barriers in providing immunizations to adults. Pediatricians, for whom immunization is part of their core mission and business, report that economic concerns are a problem. Freed et al[23] reported in 2009 that 49% of pediatricians had delayed purchasing immunizations because of financial concerns. This study also reported that 5% of pediatricians and 21% of family practitioners were considering discontinuing immunization services. Presumably, practices in these disciplines have far more experience and expertise in the vaccine-purchasing realm than do practices that focus solely on adult patient populations. A survey of internists and family physicians published in 2011[24] found that although 96% of such practices stocked at least 1 adult immunization, only 27% stocked all recommended adult immunizations. Nearly three-quarters of respondents listed payment and coverage issues as a barrier. In addition, many adults seek specialty care and do not have a medical home where a primary care provider who routinely reviews the immunization status of patients. The adult health care system is often more focused on either treating disease or the secondary and tertiary levels of health prevention than on primary prevention associated with immunizations.[19,20]

IMMUNIZATION VENUES FOR ADULTS

In addition to the traditional medical home, there are a number of venues for immunizing adults.[25] At the start of the influenza season each year, "flu clinics" in pharmacies, supermarkets, department stores, workplace settings, and even airports are common. Many local and state health departments provide annual seasonal influenza vaccine clinics. Hospitals have been implementing standing orders for pneumococcal and influenza immunization before patient discharge for many years. Additionally, greater numbers of women have been immunized in obstetric offices, given the increased appreciation of the burden of influenza in this population. Recent immunization coverage rates among pregnant women during the 2009–2010 influenza season, according to the CDC, were 51% for seasonal influenza and 47% for 2009 H1N1. In addition, women for whom vaccination was recommended by their health care provider were three- to 10-fold more likely to receive vaccine than were women whose health care provider did not encourage vaccination. A 50% coverage rate is encouraging, but because it is recommended that all pregnant women receive influenza vaccine, much work remains to ensure that the Healthy People 2020 goal of 80% influenza vaccine coverage is achieved.[26,27]

The American College of Obstetricians and Gynecologists, American Academy of Pediatrics, American Academy of Family Physicians, and CDC recommend that when possible, postpartum women should receive Tdap before being discharged from the hospital to protect them and their infants from pertussis and that immunization should be confirmed during the 6-week follow-up visit.[28,29] Additionally, in June 2011, the Advisory Council on Immunization Practices voted to recommend Tdap immunization to pregnant women in the late second or third trimester.[30] A recent provider survey of members of the American College of Obstetricians and Gynecologists, however, found that only 78.7% routinely stock and administer vaccines.[31] Among that group, 91% stocked human papillomavirus vaccine, 66.8% stocked influenza vaccine, and 30% stocked Tdap. The overwhelming majority reported financial issues as the major barrier to providing immunization services. Of

respondents who provide primary care, 61% reported that they administer influenza vaccine, and only 30% reported that they administer Tdap. Respondent obstetrician-gynecologists also reported that immunization training during medical school and residency was not adequate (40% and 35%, respectively). Because obstetrician-gynecologists are the primary care providers for many women of childbearing age, the lack of immunization opportunities in that setting is concerning.[31]

POTENTIAL BENEFITS AND CONCERNS OF IMMUNIZING PARENTS IN THE PEDIATRIC OFFICE SETTING

There are many potential benefits of adding the pediatric office as another venue for adult immunization. Probably the most compelling is convenience for parents who must balance parenting responsibilities with work demands. Limited access to immunizations has been identified as one of the primary barriers to adult immunization.[32] One study reported that alternative locations for immunization, such as the workplace, can successfully address the issue of inconvenience in the vaccination decision.[33] Parents visit the pediatric office frequently with their infants and young children, where most vaccines needed for immunization of both children and adults are available. These visits represent an opportunity to immunize parents or other adult caregivers with minimal disruption for both the adults and the practice. Immunizations represent a major focus for pediatric care, and many educational opportunities exist for the pediatrician to explain the benefits of immunization for the child and for close family contacts. Thus, convenience, physician vaccine knowledge and encouragement, and vaccine availability are strong factors for immunizing parents and close family contacts in the pediatric office.

However, there are a numbers of concerns. First, most parents and close family contacts would be older than the usual patients seen by pediatricians. Pediatricians may be comfortable immunizing this population but are not likely to deliver other types of preventive health care. It is possible that adults who receive immunizations in the pediatric office may defer other preventive services usually delivered by family physicians, internists, and obstetrician-gynecologists.[34] Effort should be made to avoid compromising the adult medical home, and attempts should be made to ensure this does not happen. Parents and close family contacts should be encouraged to receive other primary care services in their medical homes.

Pediatricians may have concerns about safety, including whether they can obtain complete medical information to evaluate for contraindications and whether they have adequate facilities for dealing with adverse events in adults in a pediatric practice setting. Pediatricians may be concerned about liability if an adverse event occurs during adult immunization.[34] However, physicians are protected by the National Childhood Vaccine Injury Act of 1986 (Public Law No. 99-660), which limits the liability for vaccine manufacturers and established the Vaccine Injury Compensation Program. The act both protects and requires physicians to report suspected adverse events, and the Vaccine Injury Compensation Program covers all vaccines recommended for routine use in children, regardless of the age of the person being vaccinated. Claims arising from covered vaccines must be adjudicated through the program before civil litigation can be pursued.[35] Therefore, because both Tdap and influenza vaccines are recommended for children, this act would protect pediatricians when administering these vaccines to adults.[35] In addition, pediatricians would need to provide the adult being immunized the required Vaccine Information Statement[32,36] prior to vaccination.

There also are a number of medical record issues. Vaccination of parents and close family contacts of pediatric patients, including any required consent for treatment, would need to be documented by the pediatric office. Thus, close family contacts would likely need their own brief medical record documenting the vaccines administered and any required consent. The vaccinated close family contacts could be provided with a vaccine card listing the names and dates of vaccines received. The type of communication between pediatric offices and adult primary care offices or state immunization registries regarding the immunization status of the adults would need to be determined.

Logistical and financial issues will need to be addressed. Obtaining adequate supplies of vaccine for both children and close family contacts will be critical. Although supplies of influenza vaccine have been plentiful in the past few years, there have been years of shortages and occasional rationing of various vaccines. Because nearly all privately supplied influenza vaccine is preordered months in advance, there is a risk of using the ordered supply too quickly when immunizing both close family contacts and children. This is less likely, given that increasing numbers of manufacturers are producing influenza vaccine annually. Alternatively, too much vaccine might be ordered if the pediatrician were planning on immunizing both adults and children. Influenza vaccine may not be returnable to the manufacturer, leaving practices at economic risk of unused doses. This is a significant concern, given the narrow financial margins for immunizations.[34,37]

Immunizing parents and close family contacts must be financially viable for

pediatric practices, and the practices must determine whether they are able or willing to submit vaccine charges to adult insurers or simply require payment at the time of service. Many practices that currently provide this service as a convenience for the close family contacts require payment at the time of service or before administration of vaccines. Issues of source of supply must also be considered. In universal purchase states, practices may be legally enjoined from charging parents for doses supplied by the state, although administration fees might be charged. Pediatricians in such states may not be able to provide immunizations for adults and should check with their state vaccine purchase programs regarding use of these vaccines for this purpose. In most states, vaccines supplied to pediatricians by the Vaccines for Children Program may not be used for adults and certainly cannot be billed. If a practice chooses to involve itself in the insurance coverage of parents and close family contacts, it will produce a significantly increased burden that may make the provision of such services nonviable. If parents wish to submit to insurance, they should be informed that receiving vaccines at a location outside of their primary provider's practice may not be reimbursed and, therefore, it may be financially beneficial for them to obtain the vaccine through their primary health care provider. Ultimately, financial arrangements will be up to the individual practice and the individual adult involved. Payment details must be carefully evaluated before the provision of this service and communicated clearly to the family contacts seeking immunization.

Additional logistic concerns exist. For example, pediatric offices may need additional staff to immunize parents and close family contacts. However, it would seem logical that the same nurse providing care for the child could also administer vaccine to the adult. In addition, pediatricians must decide whether to vaccinate only parents or also immunize grandparents, child care providers, and other household contacts, because the reasons for immunizing parents also apply to other care providers.[6] Finally, the spectrum of vaccinations available for close family contacts in the practice must be determined.

Despite the challenges, pediatricians already are immunizing parents and other adults. One recent study quantified influenza vaccination of parents and guardians in pediatric offices and found that over the course of 2 influenza seasons, 43 (51%) of the 84 offices surveyed administered 2033 seasonal influenza vaccinations to parents or guardians.[38] The authors concluded that many pediatricians offered influenza vaccine to parents and other care providers, but that the actual number of doses administered was small. In addition, a 2006 survey of nonretired fellows of the American Academy of Pediatrics reported that 30% of respondent pediatricians usually offer influenza vaccination to parents of at-risk children.[39] No similar studies have evaluated the administration of Tdap by pediatric practices.

RESEARCH NEEDS

Further studies are needed to investigate the extent of this practice; the level of family contact satisfaction with the practice; how practices handle the logistic, liability, legal, and financial barriers that limit or complicate this service; and most importantly, how this practice will affect disease rates in children and adults.

SUMMARY

Although additional data are needed to assess the effects of pediatricians providing immunizations for parents and close family contacts on the burden of infectious diseases in children, the following reasonable statements can be made at this time for pediatricians considering vaccinating parents and other adult care providers.

1. Pediatric offices may choose to serve as an alternate venue for adult care provider vaccination if the practice is acceptable to both pediatricians and the adults who are to be vaccinated. However, the practice's decision of whether to offer vaccinations to adult care providers is not a deviation from the pediatric standard of care.
2. Pediatric practices choosing to offer immunizations to parents and close family contacts may avoid compromising the adult medical home by inquiring about the availability and likelihood of the family contact obtaining vaccines in that setting and notifying their medical homes if vaccines are administered. Offering immunizations in the pediatric practice setting would not be intended to undermine the adult medical home model but could serve as an additional venue for adult care providers to receive vaccinations. Pediatricians may actively encourage all parents and close family contacts to have their own medical home for their health care needs.
3. As part of their anticipatory guidance, pediatricians can actively support educating adults about the value of immunizations and emphasize that such medical care is not just for children.
4. If choosing to vaccinate parents and close family contacts, appropriate indications, contraindications, and precautions to vaccination of adults would need to be assessed and documented in a medical record. A Vaccine Information Statement would need to be provided,

and necessary consent to treatment would need to be documented.

5. Parents and close family contacts immunized in the pediatric office would need to receive a record of administered immunizations. In addition, if adults are included in vaccine registries, the immunizations provided in the pediatric practice would need to be recorded in the registry.
6. At the present time, if a practice chooses to provide such services, the focus of parent and close family contact immunization in the pediatric practice would be centered on influenza (either inactivated or live-attenuated vaccine) and Tdap. Decisions about other vaccines can be made on an individual basis.
7. Liability issues surrounding parent and close family contact immunizations in the pediatric office may be discussed with the malpractice insurance carriers for the pediatric practice, with the knowledge that policies may vary on a state-by-state basis. Pediatricians providing the aforementioned vaccinations would be protected by the Vaccine Injury Compensation Program.
8. Pediatricians may investigate insurance regulations within their states. Expectations for method of payment for parents and close family contact immunizations would need to be clearly outlined with the adult seeking vaccination. Pediatricians also may need to be aware of any state funds available to provide vaccines to adults at no cost.
9. Further research is needed to address the clinical implications of immunizing parents and close family contacts in the pediatric office, patient satisfaction, public health benefit, effects on adult medical homes, and cost-effectiveness.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Impact of Music, Music Lyrics, and Music Videos on Children and Youth

abstract

Music plays an important role in the socialization of children and adolescents. Popular music is present almost everywhere, and it is easily available through the radio, various recordings, the Internet, and new technologies, allowing adolescents to hear it in diverse settings and situations, alone or shared with friends. Parents often are unaware of the lyrics to which their children are listening because of the increasing use of downloaded music and headphones. Research on popular music has explored its effects on schoolwork, social interactions, mood and affect, and particularly behavior. The effect that popular music has on children's and adolescents' behavior and emotions is of paramount concern. Lyrics have become more explicit in their references to drugs, sex, and violence over the years, particularly in certain genres. A teenager's preference for certain types of music could be correlated or associated with certain behaviors. As with popular music, the perception and the effect of music-video messages are important, because research has reported that exposure to violence, sexual messages, sexual stereotypes, and use of substances of abuse in music videos might produce significant changes in behaviors and attitudes of young viewers. Pediatricians and parents should be aware of this information. Furthermore, with the evidence portrayed in these studies, it is essential for pediatricians and parents to take a stand regarding music lyrics. *Pediatrics* 2009;124:1488–1494

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KEY WORDS

music, lyrics, music videos, adolescents, violence

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INTRODUCTION

Music plays an important role in the socialization of children and adolescents.[1–3] Listening to popular music is considered by society to be a part of growing up.[2] Music provides entertainment and distraction from problems and serves as a way to relieve tension and boredom. Some studies have reported that adolescents use popular music to deal with loneliness and to take control of their emotional status or mood.[2,4] Music also can provide a background for romance and serve as the basis for establishing relationships in diverse settings.[2] Adolescents use music in their process of identity formation,[4–11] and their music preference provides them a means to achieve group identity and integration into the youth culture.[5,7–9,12,13] Some authors have suggested that popular music provides adolescents with the means to resolve unconscious conflicts related to their particular developmental stage[2,7,12,14] and that their music preference might reflect the level of turmoil of this stage.[14–17]

Adolescents' choice of music and their reactions to and interpretations of it vary with age, culture, and ethnicity.[2,13,14,18–25] Research has shown that

there also is a difference in these variables between the genders.[25] Female adolescents are more likely than male adolescents to use music to reflect their emotional state, in particular when feeling lonely or "down."[2,26,27] Male adolescents, on the other hand, are more likely to use music as a stimulant, as a way to "boost" their energy level, or to create a more positive image of themselves.[2,4,26]

To understand the importance of music in the life of adolescents, a survey performed in the early 1990s of 2760 American adolescents aged 14 through 16 years revealed that they listened to music an average of 40 hours per week.[28] In another study in 2000, North et al[4] found that a sample of 2465 adolescents in England reported listening to music for an average of 2.45 hours per day. On a study performed in 2005 to assess media use of 8- to 18-year-olds in the United States, Roberts et al[25] reported that on a given day, 85% of 8- to 18-year-olds listen to music. Although time devoted to listening to music varies with age group, American youth listen to music from 1.5 to 2.5 hours per day. Still, a study performed with a small sample of at-risk youth revealed an average of up to 6.8 hours of music-listening per day.[29] Furthermore, Roberts et al found that 33% of those listening to music did so while performing other tasks or activities. These data support the idea that the prevalence of music-listening in adolescents may be even higher than that of television viewing. The reason for this is that popular music is present almost everywhere, from the supermarket to the mall, often as background music. It also is easily available through the radio, various recordings, the Internet, and new technologies,[11,25] allowing adolescents to hear it in diverse settings and situations, alone or shared with friends.

Adolescents are not the only young consumers of popular music. A study with 100 fourth- through sixth-graders revealed that 98% of these children listened to popular music, 72% of them on "most days" or every day.[30] Furthermore, it has been reported that children 8 to 10 years of age listen to music an average of 1 hour per day.[25] With many children and adolescents listening on iPods or other devices using headphones, parents may have little knowledge of what their children are listening to.

Research on popular music has explored several areas such as its effects on schoolwork,[31] social interactions, mood and affect,[20,26,27,32,33] and particularly behavior.[10,11,34–36] Several theories have been developed to explain the relationship between music and behavior,[15,37,38] and a number of studies have demonstrated that there is a relationship between music and emotions, regardless of age.[20,23,27,39–41] Although the emotional response to music depends on the way it is presented, it is also true that it is closely related to the age of the listener and the experiences or preconceived ideas they bring to the music.[2,14,39] The effect that popular music has on children's and adolescents' behavior and emotions is of paramount concern.[40] There is particular concern related to the lyrics of some genres of music and their effect on children and adolescents.[3,10,11,42–45]

Lyrics have become more explicit in their references to drugs, sex, and violence over the years.[11] A content analysis of the top 10 CDs performed by the National Institute on Media in 1999 revealed that each of these CDs included at least 1 song with sexual content. Forty-two percent of the songs on these CDs contained very explicit sexual content.[46] Lyrics of some music genres, such as rock, heavy metal, rap, and new emerging genres such as reggaeton, have been found to revolve around topics such as sexual promiscuity, death, homicide, suicide, and substance abuse.[9,13,17,43,45,46–53] Most recently, some rap music has been characterized by the presence of explicit sexual language in its lyrics as well as messages of violence, racism, homophobia, and hatred toward women.[9,10,42,54] Drug, tobacco, and alcohol use also tend to be glorified in these songs.

In refuting concerns about the effect of lyrics, some have argued that children and adolescents use music only for entertainment, that little or no attention is paid to the words, and if any attention is given, understanding tends to be limited and related to the experiences lived by the listener.[32,55] However, other studies have demonstrated the contrary.[56] Approximately 17% of male adolescents and 25% of female adolescents expressed that they liked their favorite songs specifically because the lyrics were a reflection of their feelings.[2] Also, it has been found that the more importance adolescents give to a certain type of music, the more attention they will pay to the lyrics.[2,55,57,58] Furthermore, Knobloch-Westerwick et al have stated that although young listeners might not understand all the details in lyrics, they recognize enough to obtain a general idea of the message they bring.[11]

Regarding the effects of popular music on behavior, several studies have demonstrated that preference for certain types of music could be correlated or associated with certain behaviors,* such as the association of drug and alcohol use with "rave" music or electronic music dance events.[13,50,51,62] Roberts et al[39] performed a study in 1997 at an adolescent clinic, and their results suggested that probably the best predictor of risk in adolescents related to music is their self-report of negative feelings or emotions when listening to any type of music. The au-

*Refs 2, 10, 17, 29, 37, 39, 42, and 59–65.

thors of that study described an association between negative emotional response to music and risk-taking behaviors and even suggested that what triggers risky behavior in some adolescents is the negative emotional response rather than the type of music. Scheel and Westefeld[61] supported this suggestion in 1999. Heavy metal and some rock music have been associated in some studies with an increased risk of suicide.[17,61,63,66,67] Fans of heavy metal music have been reported in the literature to have more problems with school authorities and teachers than students who are not fans of that type of music.[2] Heavy metal music-listening has also been associated with increased depression, delinquency risk behavior,[63–65] smoking, and conduct problems.[60] Fans of heavy metal and rap music showed a greater tendency to engage in reckless behavior than their peers who were not fans of those types of music.[2,14,37,68] A study performed to explore the possible effect of heavy metal music containing either sexually violent or nonviolent lyrics on males' attitudes toward women revealed that those exposed to heavy metal music, with either sexually violent or nonviolent lyrics, showed significantly more negative stereotyped attitudes toward women than those in a group instead exposed to classical music.[2,69] Likewise, in a study performed by Fischer and Greitemeyer,[42] men who listened to misogynistic lyrics showed increased aggressive responses toward women as well as a more negative perception of them.

In a study in which adolescents who preferred heavy metal and rap music were compared with those who preferred other types of music, results indicated that the former consistently showed below-average current and elementary school grades, with a history of counseling in elementary school for academic problems.[14] A study performed in 1999 with a sample of 345 mothers from public schools revealed that 47% of the mothers believed that violent messages in rap music contribute to school violence[70]; yet, according to a 2007 report from the Kaiser Family Foundation on parents, children, and the media,[44] only 9% of parents revealed being concerned about inappropriate content in music.

The preference for heavy metal music, rap, and associated genres among adolescents must alert us to an increased vulnerability and tendency toward risky behaviors. Adolescents at risk and with a feeling of alienation because of previous failures or problems tend to prefer these types of music, which might reflect their pessimistic view of life and the world.[2,9,14,17,19,37,71] Correlational studies, however, have inherent limitations and cannot identify cause-and-effect relationships, but the associations reflect the status of the current research.

Research related to music and its effects on children and adolescents has been expanded into another expression of popular music: the music video. Music videos are appealing to children and adolescents. Considering that music videos mix 2 media that are attractive to youth (television and popular music), it is important to study their effects on a young audience and to be concerned about the messages these music videos promote.[30,72] Music videos have been widely studied.[29,30,55,72–93] They are mainly classified as either performance or concept videos. For a performance video, an artist or a group is filmed during a performance, usually a concert. Concept videos, on the other hand, tell the viewer a story that may or may not evolve from the song. This story may sometimes add content to the lyrics and provide a particular interpretation that is reinforced every time the viewer hears the song.[72,73,75] As with popular music, the perception and the effect of music-video messages on children and adolescents is related to the age and developmental and emotional stage of the viewer, as well as the level of exposure.

The prevalence of music-video–watching has been studied in both the United States and Europe.[30,79,90,92,94] A study of 100 fourth- to sixth-graders revealed that 75% of them watched music videos, with 60% of them self-describing their frequency of viewing videos as either "pretty much" or "a lot." Of these children, 62% watched music videos either "most days" or "every day," and 7% watched them even before going to school.[30] In 2003, a report of the Kaiser Family Foundation[90] revealed that 3 of 4 of those in the 16- to 24-year-old group watch MTV, 58% watch it at least once a week, and 20% watch it for an hour or more every day. More recently, a study revealed that a sample of 12- to 15-year-olds watched music videos on an average of 4.3 days per week.[92]

Research on music videos has been focused mainly on content analyses. A study published in 1997 by DuRant et al[76,82] described an analysis of 518 music videos on 4 television networks (MTV, VH1, CMT, and BET). This study revealed that the percentage of violence in music videos ranged from 11.5% to 22.4%, with the most violent videos having been presented on MTV. When analyzed according to type of music, rap videos had the highest portrayal of violence (20.4%), closely followed by rock videos (19.8%). Using the same sample, another study revealed that although the percentage of videos that portrayed alcohol use showed no significant differences among networks, the percentage portrayed was still significant, ranging from 18.7% to 26.9%. Of the networks, MTV had the highest percentage of alcohol representation and also the

highest percentage of videos that portrayed smoking behaviors (25.7%). Of these videos, rap music videos showed a higher content of alcohol or tobacco use than did other types of videos.[75] In 1998, Rich et al[82] reported on the findings of content analyses that looked for gender or race differences in aggressors or victims of acts of violence portrayed in the same sample of 518 music videos. The analyses showed that black individuals were overrepresented as aggressors (25%) and as victims (41%), compared with the percentage of black individuals in the general population (12%). Studies performed by Smith and Boyson in 2002[93] and Gruber et al in 2005[91] validated these findings.

Analysis of the content in music videos is important, because research has reported that exposure to violence, sexual messages, sexual stereotypes, and use of substances of abuse in music videos might produce significant changes in behaviors and attitudes of young viewers.† Frequent watching of music videos has been related to an increased risk of developing beliefs in false stereotypes and an increased perceived importance of appearance and weight in adolescent girls.[83] In studies performed to assess the reactions of young males exposed to violent rap music videos or sexist videos, participants reported an increased probability that they would engage in violence, a greater acceptance of the use of violence, and a greater acceptance of the use of violence against women than did participants who were not exposed to these videos.[29,35,77,78,92]

In 1999 Kalof[84] reported that college students who were exposed to videos with stereotyped sexual images showed more acceptance of adversarial relationships than those who were not exposed. Kaestle et al[92] reported in 2007 that in a group of seventh- and eighth-grade boys, watching music videos and professional wrestling was associated with an increased acceptance of date rape. A survey performed among 214 adolescents revealed that there was an association between music-video–watching and permissive sexual behaviors.[76] It has also been reported that after watching MTV, adolescents' attitudes were more accepting of premarital sex.[52,53,80] A survey performed among 2760 American adolescents demonstrated that listening to music and watching television and music videos more frequently was associated with increased risky behaviors[68] and alcohol use[85,86]; these results were validated by van den Bulck and Beullens,[94] who demonstrated a longitudinal relationship between adolescents' exposure to music videos and alcohol use while going out to a bar, party, disco, etc. In 2003, Wingwood et al[89] reported on a study in which 522 black female adolescents with a median exposure to rap music videos of 14 hours per week were followed for 12 months. After controlling for all the covariates, greater exposure to rap music videos was independently associated with a wide variety of risky behaviors such as increased promiscuity and use of drugs and alcohol, among others. Of importance, a study performed by Austin et al[98] in 2000 revealed that the potential risks of exposure to music videos can be moderated by parental reinforcement and counterreinforcement of conducts observed.

RECOMMENDATIONS

The American Academy of Pediatrics understands that, given the findings presented and our knowledge of child and adolescent development, pediatricians and parents should be aware of this information. Furthermore, with the evidence portrayed in these studies, it is essential for pediatricians and parents to take a stand regarding this issue. Therefore, the following recommendations are made.

1. Pediatricians should become familiar with the role of music in the lives of children and adolescents and identify music preferences of their patients as clues to emotional conflict or problems.[99]
2. Pediatricians should become familiar with the literature available on the effects of music and music videos on children and adolescents.[36,38,100–103]
3. Pediatricians should explore with patients and their parents what types of music they listen to and music videos they watch and under which circumstances they consume these media.
4. Pediatricians should encourage parents to take an active role in monitoring the type of music to which their children and adolescents are exposed and to be aware of the music they purchase.[104–106] Parents can find lyrics by typing "music lyrics" into an Internet search engine and accessing 1 or more of the Web sites that appear. Pediatricians also should counsel parents and caregivers to monitor and regulate television-viewing according to the age and maturity of their children and adolescents.
5. Pediatricians should encourage parents and caregivers to become media literate.
6. Pediatricians should sponsor and participate in local and national coalitions to discuss the effects of music on children and adolescents to make the public and parents aware of sexually explicit, drug-oriented, or violent lyrics on CDs and cassettes, in music videos, on the Internet, and in emerging technologies.
7. The public, and parents in particular, should be aware of and use

†Refs 29, 35, 52, 53, 68, 72, 76–78, 80, 85, 89, 92 and 94–97.

the music industry's parental advisory warning of explicit content. The advisory label is a black-and-white logo and should be located on the front of the CD, cassette, album, videocassette, or DVD. It may help protect children from certain offensive materials.

8. Performers should serve as positive role models for children and teenagers.
9. The music-video industry should produce videos with more positive themes about relationships, racial harmony, drug avoidance, nonviolent conflict resolution, sexual abstinence, pregnancy prevention, and avoidance of promiscuity.
10. Further research on the effects of popular music, lyrics, and music videos on children and adolescents is important and should be conducted.[107]

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—The Impact of Social Media on Children, Adolescents, and Families

abstract

FREE

Using social media Web sites is among the most common activity of today's children and adolescents. Any Web site that allows social interaction is considered a social media site, including social networking sites such as Facebook, MySpace, and Twitter; gaming sites and virtual worlds such as Club Penguin, Second Life, and the Sims; video sites such as YouTube; and blogs. Such sites offer today's youth a portal for entertainment and communication and have grown exponentially in recent years. For this reason, it is important that parents become aware of the nature of social media sites, given that not all of them are healthy environments for children and adolescents. Pediatricians are in a unique position to help families understand these sites and to encourage healthy use and urge parents to monitor for potential problems with cyberbullying, "Facebook depression," sexting, and exposure to inappropriate content. *Pediatrics* 2011;127:800–804

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KEY WORDS

Internet, cyberbullying, online harassment, Facebook depression, sexting, social media, digital footprint, COPPA, advertising, social networking, bullying, adolescents, children

ABBREVIATION

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SOCIAL MEDIA USE BY TWEENS AND TEENS

Engaging in various forms of social media is a routine activity that research has shown to benefit children and adolescents by enhancing communication, social connection, and even technical skills.[1] Social media sites such as Facebook and MySpace offer multiple daily opportunities for connecting with friends, classmates, and people with shared interests. During the last 5 years, the number of preadolescents and adolescents using such sites has increased dramatically. According to a recent poll, 22% of teenagers log on to their favorite social media site more than 10 times a day, and more than half of adolescents log on to a social media site more than once a day.[2] Seventy-five percent of teenagers now own cell phones, and 25% use them for social media, 54% use them for texting, and 24% use them for instant messaging.[3] Thus, a large part of this generation's social and emotional development is occurring while on the Internet and on cell phones.

Because of their limited capacity for self-regulation and susceptibility to peer pressure, children and adolescents are at some risk as they navigate and experiment with social media. Recent research indicates that there are frequent online expressions of offline behaviors, such as bullying, clique-forming, and sexual experimentation,[4] that have introduced problems such as cyberbullying,[5] privacy issues, and "sexting."[6] Other problems that merit awareness include Internet addiction and concurrent sleep deprivation.[7]

Many parents today use technology incredibly well and feel comfortable and capable with the programs and online venues that their chil-

dren and adolescents are using. Nevertheless, some parents may find it difficult to relate to their digitally savvy youngsters online for several reasons. Such parents may lack a basic understanding of these new forms of socialization, which are integral to their children's lives.[8] They frequently do not have the technical abilities or time needed to keep pace with their children in the ever-changing Internet landscape.[8] In addition, these parents often lack a basic understanding that kids' online lives are an extension of their offline lives. The end result is often a knowledge and technical skill gap between parents and youth, which creates a disconnect in how these parents and youth participate in the online world together.[9]

BENEFITS OF CHILDREN AND ADOLESCENTS USING SOCIAL MEDIA

Socialization and Communication

Social media sites allow teens to accomplish online many of the tasks that are important to them offline: staying connected with friends and family, making new friends, sharing pictures, and exchanging ideas. Social media participation also can offer adolescents deeper benefits that extend into their view of self, community, and the world, including[1,10]:

1. opportunities for community engagement through raising money for charity and volunteering for local events, including political and philanthropic events;
2. enhancement of individual and collective creativity through development and sharing of artistic and musical endeavors;
3. growth of ideas from the creation of blogs, podcasts, videos, and gaming sites;
4. expansion of one's online connections through shared interests to include others from more diverse backgrounds (such communication is an important step for all adolescents and affords the opportunity for respect, tolerance, and increased discourse about personal and global issues); and
5. fostering of one's individual identity and unique social skills.[11]

Enhanced Learning Opportunities

Middle and high school students are using social media to connect with one another on homework and group projects.[11] For example, Facebook and similar social media programs allow students to gather outside of class to collaborate and exchange ideas about assignments. Some schools successfully use blogs as teaching tools,[12] which has the benefit of reinforcing skills in English, written expression, and creativity.

Accessing Health Information

Adolescents are finding that they can access online information about their health concerns easily and anonymously. Excellent health resources are increasingly available to youth on a variety of topics of interest to this population, such as sexually transmitted infections, stress reduction, and signs of depression. Adolescents with chronic illnesses can access Web sites through which they can develop supportive networks of people with similar conditions.[13] The mobile technologies that teens use daily, namely cell phones, instant messaging, and text messaging, have already produced multiple improvements in their health care, such as increased medication adherence, better disease understanding, and fewer missed appointments.[14] Given that the new social media venues all have mobile applications, teenagers will have enhanced opportunities to learn about their health issues and communicate with their doctors. However, because of their young age, adolescents can encounter inaccuracies during these searches and require parental involvement to be sure they are using reliable online resources, interpreting the information correctly, and not becoming overwhelmed by the information they are reading. Encouraging parents to ask about their children's and adolescents' online searches can help facilitate not only discovery of this information but discussion on these topics.

RISKS OF YOUTH USING SOCIAL MEDIA

Using social media becomes a risk to adolescents more often than most adults realize. Most risks fall into the following categories: peer-to-peer; inappropriate content; lack of understanding of online privacy issues; and outside influences of third-party advertising groups.

Cyberbullying and Online Harassment

Cyberbullying is deliberately using digital media to communicate false, embarrassing, or hostile information about another person. It is the most common online risk for all teens and is a peer-to-peer risk.

Although "online harassment" is often used interchangeably with the term "cyberbullying," it is actually a different entity. Current data suggest that online harassment is not as common as offline harassment,[15] and participation in social networking sites does not put most children at risk of online harassment.[16] On the other hand, cyberbullying is quite common, can occur to any young person online, and can cause profound psychosocial outcomes including depression, anxiety, severe isolation, and, tragically, suicide.[17]

Sexting

Sexting can be defined as "sending, receiving, or forwarding sexually explicit messages, photographs, or images via cell phone, computer, or other digital devices."[18] Many of these images become distributed rapidly via cell phones or the Internet. This phenomenon does occur among the teen population; a recent survey revealed that 20% of teens have sent or posted nude or seminude photographs or videos of themselves.[19] Some teens who have engaged in sexting have been threatened or charged with felony child pornography charges, although some states have started characterizing such behaviors as juvenile-law misdemeanors.[20,21] Additional consequences include school suspension for perpetrators and emotional distress with accompanying mental health conditions for victims. In many circumstances, however, the sexting incident is not shared beyond a small peer group or a couple and is not found to be distressing at all.[4]

Facebook Depression

Researchers have proposed a new phenomenon called "Facebook depression," defined as depression that develops when preteens and teens spend a great deal of time on social media sites, such as Facebook, and then begin to exhibit classic symptoms of depression.[22–27] Acceptance by and contact with peers is an important element of adolescent life. The intensity of the online world is thought to be a factor that may trigger depression in some adolescents. As with offline depression, preadolescents and adolescents who suffer from Facebook depression are at risk for social isolation and sometimes turn to risky Internet sites and blogs for "help" that may promote substance abuse, unsafe sexual practices, or aggressive or self-destructive behaviors.

PRIVACY CONCERNS AND THE DIGITAL FOOTPRINT

The main risk to preadolescents and adolescents online today are risks from each other, risks of improper use of technology, lack of privacy, sharing too much information, or posting false information about themselves or others.[28] These types of behavior put their privacy at risk.

When Internet users visit various Web sites, they can leave behind evidence of which sites they have visited. This collective, ongoing record of one's Web activity is called the "digital footprint." One of the biggest threats to young people on social media sites is to their digital footprint and future reputations. Preadolescents and adolescents who lack an awareness of privacy issues often post inappropriate messages, pictures, and videos without understanding that "what goes online stays online."[8] As a result, future jobs and college acceptance may be put into jeopardy by inexperienced and rash clicks of the mouse. Indiscriminate Internet activity also can make children and teenagers easier for marketers and fraudsters to target.

INFLUENCE OF ADVERTISEMENTS ON BUYING

Many social media sites display multiple advertisements such as banner ads, behavior ads (ads that target people on the basis of their Web-browsing behavior), and demographic-based ads (ads that target people on the basis of a specific factor such as age, gender, education, marital status, etc) that influence not only the buying tendencies of preadolescents and adolescents but also their views of what is normal. It is particularly important for parents to be aware of the behavioral ads, because they are common on social media sites and operate by gathering information on the person using a site and then targeting that person's profile to influence purchasing decisions. Such powerful influences start as soon as children begin to go online and post.[29] Many online venues are now prohibiting ads on sites where children and adolescents are participating. It is important to educate parents, children, and adolescents about this practice so that children can develop into media-literate consumers and understand how advertisements can easily manipulate them.

ON TOO YOUNG: MIXED MESSAGES FROM PARENTS AND THE LAW

Many parents are aware that 13 years is the minimum age for most social media sites but do not understand why. There are 2 major reasons. First, 13 years is the age set by Congress in the Children's Online Privacy Protection Act (COPPA), which prohibits Web sites from collecting information on children younger than 13 years without parental permission. Second, the official terms of service for many popular sites now mirror the COPPA regulations and state that 13 years is the minimum age to sign up and have a profile. This is the minimum age to sign on to sites such as Facebook and MySpace. There are many sites for preadolescents and younger children that do not have such an age restriction, such as Disney sites, Club Penguin, and others.

It is important that parents evaluate the sites on which their child wishes to participate to be sure that the site is appropriate for that child's age. For sites without age stipulations, however, there is room for negotiation, and parents should evaluate the situation via active conversation with their preadolescents and adolescents.

In general, if a Web site specifies a minimum age for use in its terms of service, the American Academy of Pediatrics (AAP) encourages that age to be respected. Falsifying age has become

common practice by some preadolescents and some parents. Parents must be thoughtful about this practice to be sure that they are not sending mixed messages about lying and that online safety is always the main message being emphasized.

THE ROLE OF PEDIATRICIANS

Pediatricians are in a unique position to educate families about both the complexities of the digital world and the challenging social and health issues that online youth experience by encouraging families to face the core issues of bullying, popularity and status, depression and social anxiety, risk-taking, and sexual development. Pediatricians can help parents understand that what is happening online is an extension of these underlying issues and that parents can be most helpful if they understand the core issues and have strategies for dealing with them whether they take place online, offline, or, increasingly, both.

Some specific ways in which pediatricians can assist parents include:

1. Advise parents to talk to their children and adolescents about their online use and the specific issues that today's online kids face.
2. Advise parents to work on their own participation gap in their homes by becoming better educated about the many technologies their youngsters are using.
3. Discuss with families the need for a family online-use plan that involves regular family meetings to discuss online topics and checks of privacy settings and online profiles for inappropriate posts. The emphasis should be on citizenship and healthy behavior and not punitive action, unless truly warranted.
4. Discuss with parents the importance of supervising online activities via active participation and communication, as opposed to remote monitoring with a "net-nanny" program (software used to monitor the Internet in the absence of parents).

In addition, the AAP encourages all pediatricians to increase their knowledge of digital technology so that they can have a more educated frame of reference for the tools their patients and families are using, which will aid in providing timely anticipatory media guidance as well as diagnosing media-related issues should they arise.

To assist families in discussing the more challenging issues that kids face online, pediatricians can provide families with reputable online resources, including "Social Media and Sexting Tips" from the AAP (www.aap.org/advocacy/releases/june09socialmedia.htm),[30] the AAP Internet safety site (http://safetynet.aap.org),[31] and the AAP public education site, Healthy Children.org (www.healthychildren.org/english/search/pages/results.aspx?Type=Keyword&Keyword=Internet+safety),[32] and encourage parents to discuss these resources with their children. Pediatricians with Web sites or blogs may wish to create a section with resources for parents and children about these issues and may suggest a list of or links to social media sites that are appropriate for the different age groups. In this way, pediatricians can support the efforts of parents to engage and educate youth to be responsible, sensible, and respectful digital citizens.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Child Health Financing

Implementation Principles and Strategies for the State Children's Health Insurance Program

ABSTRACT. This policy statement presents principles and implementation and evaluation strategies recommended for the State Children's Health Insurance Program (SCHIP). The statement summarizes the current status of SCHIP, the needs of uninsured children, and the potential benefits of SCHIP programs. Principles and recommended strategies include expanding eligibility, maximizing funding, providing comprehensive benefits, including pediatricians in program design and evaluation, providing adequate reimbursement and access to pediatricians, ensuring choices for families and pediatricians, and establishing simple administrative procedures.

ABBREVIATIONS. SCHIP, State Children's Health Insurance Program; FPL, federal poverty level; AAP, American Academy of Pediatrics; HCFA, Health Care Financing Administration; EPSDT, Early and Periodic Screening, Diagnosis, and Treatment Program.

THE CURRENT STATUS OF THE STATE CHILDREN'S HEALTH INSURANCE PROGRAM (SCHIP)

The Balanced Budget Act of 1997[1] established SCHIP as Title XXI of the Social Security Act.[2] This program is a historic milestone in the financing of health care for children. Not since the enactment of Medicaid has there been a greater investment in children's health care. Although SCHIP did not create universal coverage for all children, it did offer an unprecedented opportunity to expand insurance coverage to a large portion of uninsured children. Title XXI of the Social Security Act provides more than $40 billion in federal grants to states over a 10-year period to provide health insurance coverage to children through 18 years of age who are uninsured and ineligible for Medicaid. States must, however, contribute a defined share of funds to obtain federal matching funds. The legislation gives flexibility to states in designing and implementing their programs.

Under SCHIP, states selected from among 3 approaches to providing health insurance coverage to children. These approaches include: 1) expanding Medicaid; 2) creating or expanding a non-Medicaid children's health insurance program; or 3) combining both options. Most states have created a non-Medicaid SCHIP program for at least some of their SCHIP-eligible children. Sixteen states created a non-Medicaid SCHIP program only, and 17 created a state program in combination with a Medicaid expansion. The remaining 17 states, the District of Columbia, Puerto Rico, Guam, and the Virgin Islands used SCHIP funds to expand Medicaid only.[3] Whichever approach a state chose, they receive an enhanced federal matching rate above their Medicaid rate. In addition, states can request to provide coverage through direct service support. In certain circumstances, states can also subsidize the purchase of family coverage.

States have used SCHIP funds to significantly expand eligibility. By January 2001, 38 states and the District of Columbia had established eligibility levels at or above the congressional target family income of 200% of the federal poverty level (FPL).[4] By October 2000, 3.3 million children were enrolled in SCHIP programs.[5] Many states are moving forward to expand coverage for children and their parents. For example, New Jersey covers children in families with incomes up to 350% of the FPL and approved expansion of coverage for parents with a household income up to 200% of the FPL. Vermont provides insurance for children in families with incomes up to 300% of the FPL. Many more states are using their tobacco funds and taking advantage of prosperous economies to expand health care coverage for children.

This statement presents a set of principles and implementation and evaluation strategies that the American Academy of Pediatrics (AAP) recommends the federal government and states adopt as they amend their SCHIP programs. These principles address issues related to financing, eligibility, outreach, enrollment, benefits, cost sharing, reimbursement, managed care, and accountability. SCHIP offers an opportunity for every state to develop an effective program to reduce the number of uninsured children, but this will require a strong partnership of SCHIP lead agencies, public health programs, health plans and managed care organizations, pediatricians and other physicians, business and advocacy groups, consumers, and other coalitions interested in the welfare of children.

THE NEEDS OF UNINSURED CHILDREN AND THE POTENTIAL BENEFITS OF SCHIP

Despite the eligibility expansions of SCHIP, the number and proportion of American children lacking health insurance remains high. In 1999, 10.8 million children younger than 19 years were uninsured.[6]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Between 1998 and 1999, the percentage of children who were uninsured dropped from 15.5% to 14.1%, the first significant decrease since 1993. Among children younger than 19 years with family incomes near the poverty level (between 100% and 125% of the FPL), the decline was even more dramatic, falling from 27.2% to 19.7%, according to analysis of US Census Bureau survey results (American Academy of Pediatrics, Division of Health Policy Research, unpublished data, 2000). Adolescents and young adults continue to be most likely to be uninsured, although they also experienced a drop in the rate of uninsured; 29.0% of those 18 through 24 years of age did not have insurance in 1999, down from 29.7% in 1998.[7] Factors contributing to the decrease in the number of uninsured children include the establishment of SCHIP, a philosophic shift toward increasing enrollment, the simplification of the Medicaid application process in many states, the unprecedented outreach and enrollment efforts, and the improving economy, in which increasing numbers of employers are offering health insurance.[8]

Children who are eligible for SCHIP (Medicaid expansions and non-Medicaid state programs) are more likely to have parents who are self-employed or employed in industries and occupations in which health insurance coverage is less available or less affordable. Compared with children who are privately insured, SCHIP-eligible children are twice as likely to be in poor health and 3 times as likely to be Hispanic.[9]

Health insurance is a critically important determinant of access to and use of health care services among children. The uninsured are 3 times as likely as the privately insured to go without needed medical care.[10] Uninsured low income children are 4 times as likely to rely on an emergency department or have no regular source of care.[11]

Although complete evaluations of the first year of SCHIP implementation are not yet available, preliminary results from New York State's Child Health Plus[12,13] and Pennsylvania's BlueCHIP and Caring programs,[14] prototype models for the SCHIP program, demonstrate the positive impact of health insurance programs and the potential impact of SCHIP. After enrollment in New York's Child Health Plus between 1991 and 1993, participants' access to and use of primary care increased, continuity of care improved, and many quality-of-care measures improved. Use of specialty, emergency, and inpatient care did not change. Many parents reported improved health status for their children as a result of enrollment in the insurance program. Similarly, after extending health insurance to uninsured children in western Pennsylvania in 1995, health insurance resulted in better access to health care, more appropriate use, and reduced family stress.[14] It is not clear how generalizable results from these 2 states are to all programs.

FACTORS AFFECTING ENROLLMENT OF ELIGIBLE CHILDREN AND USE OF SERVICES

Children are often uninsured because parents do not know they qualify for public coverage, according to a study funded by The Robert Wood Johnson Foundation. Six of 10 parents of uninsured children think that because they work and are not on welfare, their children do not qualify for federal health programs. Four of 5 parents said they would enroll their children in federal health programs if they knew they were eligible.[15]

Expanding coverage to parents may increase the number of children enrolled. Although most children without health insurance have an employed parent, their parents are likely not offered health benefits for children by their employers or they cannot afford to pay the premium contributions. A study of 3 states that implemented Medicaid expansions that included parents had greater Medicaid participation rates among low-income children than states that did not expand coverage to parents.[16]

Cost sharing may decrease participation in SCHIP and use of health services needed by children. Higher premium charges were associated with lower participation rates, according to a study of 4 states with sliding-scale premium health insurance programs.[17] Direct and indirect effects of cost sharing negatively affect the receipt of preventive counseling in health maintenance organizations and preferred provider organizations.[18]

Adequate physician participation is critical to ensuring that enrolled children have access to services. Pediatrician participation in Medicaid and non-Medicaid SCHIP programs varies substantially among states. The reasons cited by pediatricians to be most important for limiting participation in Medicaid and SCHIP are low payment, paperwork concerns, and unpredictable payment. States with the lowest pediatrician participation in Medicaid and SCHIP have the lowest rates of reimbursement and the highest rates of complaints about paperwork.[19]

Involuntary disenrollment of children from health plans plagues Medicaid and SCHIP. The dropping of individuals from plans may occur because of plan requirements for frequent reenrollment, excess paper work, or other vestiges of the philosophy to limit Medicaid enrollment. Changes in enrollment affect the integrity of the state's insurance programs, continuity of care, and the financial stability of safety net hospitals and community health centers.[20] It has been demonstrated that intermittent coverage compromises continuity of care.[21] This process also adds costs for outreach and reenrollment efforts.

PRINCIPLES AND RECOMMENDED IMPLEMENTATION AND EVALUATION STRATEGIES

As states continue to refine their SCHIP programs, the Academy suggests that the following principles and implementation and evaluation strategies be incorporated in their efforts:

1. **Expand Comprehensive Coverage**. SCHIP programs should provide comprehensive, quality health care coverage to the largest number of uninsured children possible.
   A. Congress should expand SCHIP to allow states to include children through 21 years of age.

States should adopt the highest income eligibility allowable and should discontinue asset testing to determine eligibility. To reach even more children, more flexible income limits should be considered.

B. States should allow adolescent emancipated minors to be evaluated for SCHIP eligibility based on their own income.[22]
C. States should consider offering a SCHIP buy-in option for children whose family incomes are above their state's SCHIP eligibility level but who do not have access to or cannot afford comprehensive private insurance.
D. States should consider applying for Section 1115 Research and Demonstration waivers from the Health Care Financing Administration (HCFA) to expand coverage for pregnant women or other parents if they have already maximized comprehensive coverage and full enrollment of children.
E. Although they will not be able to receive federal matching funds, states should consider using the SCHIP delivery system to provide health care to immigrant children who are not eligible for SCHIP.
F. States should offer 12-month continuous eligibility for Medicaid- and SCHIP-enrolled children. Continuous eligibility saves on outreach and enrollment so administrative costs for certifying income eligibility on a monthly basis are not incurred.
G. States should also implement presumptive eligibility for all children, allowing health care providers and other designated agencies, including schools and child care centers, to grant eligibility for up to 60 days while a child goes through the enrollment process.[23] Although the Academy understands that there must be some safeguards to ensure appropriate use of this option, this process should be administratively simple. Pediatricians' offices should be included as enrollment sites, when feasible. By doing so, children will receive health services and insurance coverage as rapidly as possible. If the child is determined ineligible, pediatricians and other caregivers should still be reimbursed for services rendered. Failure to pay for these services is a disincentive for physician participation. Presumptive eligibility offers qualified entities an added incentive to engage in outreach to their patients and clients.
H. States should adopt program eligibility rules that promote coordination between SCHIP and Medicaid and ease enrollment. Ending age-based income eligibility would enable all children from the same family to become enrolled in the same program. Currently, in many states the income eligibility for Medicaid varies by age.
I. Public and private, statewide, and community-based outreach programs to families and their employers should be designed to enroll all families with eligible children in SCHIP programs. Although the start-up of such efforts has been successful, sustaining the efforts may be another challenge. Creative approaches should be encouraged and supported. For example, using electronic application processes targeted to minority children served in child care centers, linking children receiving school lunch subsidies with health care coverage, and conducting door-to-door outreach to families in farming communities have been tried. State Medicaid and SCHIP agencies should coordinate outreach efforts and use consistent income assessment and documentation methods and enrollment procedures for the best long-term results. Outreach efforts should develop a seamless system to process applications for Medicaid and non-Medicaid programs. States should use community-based agencies for outreach, including offices where parents apply for government-subsidized programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); child care centers; schools; and other resource and referral agencies that provide services to families with young children. Community health programs and personnel and outreach workers for the Early and Periodic Screening, Diagnosis, and Treatment Program (EPSDT) can be used to enroll potential applicants. For example, the Agricultural Risk Protection Act of 2000[24] allows states to share information between SCHIP and school lunch programs. AAP chapter leaders and community pediatricians should be actively involved in developing outreach plans including education of peers and other physicians about program activities.
J. Simplified, joint application forms and expedited eligibility determination processes for SCHIP should be offered and coordinated with the state's Medicaid program and other public assistance programs offered for children in the state. From the family's perspective, a simplified process eases enrollment paperwork. States with a short application form, no asset testing, and similar documentation requirements for Medicaid and SCHIP have been most efficient.
K. States should implement proactive enrollment processes. Children who are found to be ineligible for Medicaid should be enrolled in SCHIP, if eligible, (or vice versa) through the use of automatic enrollment in the appropriate program without requiring families to submit additional application forms.[25] Reasonable fees or incentive payments with safeguards to prevent abuse may be provided to nonprofit agencies, community-based organizations, and safety net hospitals to enroll children in SCHIP or Medicaid. Use of 1 program name, 1 agency to determine eligibility, a SCHIP/Medicaid simplified joint application, and the same point of entry promotes coordination. Opera-

tional enhancements occur when simplified verification requirements are the same for both programs, easy transitions between programs occur when eligibility is redetermined, and a common service delivery system is used.[26] Pediatricians should be involved in the design and implementation of these administrative strategies. Frequent communication among agency staff is critical; single-agency governance may be more efficient.

L. Meaningful implementation of SCHIP must include an effort to maintain continuous health care coverage. Expanding health insurance programs and increasing enrollment in existing programs is not sufficient to reap maximum benefits for children. States should strive for full enforcement of existing state guaranteed eligibility laws, integration of plans into the recertification process, a streamlined recertification process, and where possible, multiple-year eligibility reviews. States should also link government-subsidized health care programs so that low-income children can move automatically from 1 program to another while maintaining continuity of care relationships with the same physicians and health plan, whenever possible.[20] States concerned about families or employers dropping private insurance coverage in favor of SCHIP, referred to as "crowding out," should monitor their policies so they do not penalize families who do not have access to coverage or only have access to individually purchased health insurance plans. If a state requires applicants to be uninsured for a period of time before becoming eligible, that time period should be short and allow for exceptions, for example, for children with special health care needs or acute catastrophic health events.

2. **Maximize Funding and Flexibility.** States should optimize their ability to draw down their full federal match for SCHIP. HCFA and Congress should allow greater flexibility for funding outreach and maximize appropriations for expanded coverage of uninsured children. SCHIP funds must be preserved for the primary purpose of increasing coverage of uninsured children.
3. **Provide Comprehensive Benefits.** All SCHIP plans should include a comprehensive scope of benefits. Because non-Medicaid programs often offer limited coverage for many special or chronic care services for children, states with such programs should consider expanding their benefit packages. This could be accomplished by emphasizing the use of the EPSDT provision in Medicaid to pay for services considered medically necessary or by creating wraparound programs for children meeting specific chronic or serious condition criteria.

A. Each benefit package should cover the services defined in the AAP policy statement "Scope of Health Care Benefits for Newborns, Infants, Children, Adolescents, and Young Adults Through Age 21 Years," including dental services and the full range of mental health services including substance abuse treatment.[27] Preventive care, immunization standards, and periodicity schedules should be consistent with current AAP requirements. Limited benefits packages limit the long-term cost-effectiveness for children.

B. Congress should ensure that all children enrolled in non-Medicaid SCHIP programs are eligible for the Vaccines for Children program.

C. To determine medical necessity and approval of services, states should use guidelines of recognized national professional organizations such as the Academy or recommendations of professional peer-review panels if evidence-based guidelines do not exist. Services should be reimbursed if they meet 1 or more of the following criteria: 1) the service is appropriate for the age and health status of the individual; 2) the service will prevent or ameliorate the effects of a condition, illness, injury, or disorder; 3) the service will aid the overall physical and mental growth and development of the individual; or 4) the service will assist in achieving or maintaining functional capacity.[28]

D. States should carefully assess the impact of premium cost sharing on participation and service use. States that impose cost sharing should eliminate differences in copayments and coinsurance for physical and mental health services. Tracking mechanisms for determining when families reach the 5% cost-sharing maximum should be handled at the plan level. Requiring families to track out-of-pocket expenditures should be discouraged.

Cost-sharing policies should be carefully designed so they do not simply shift cost to pediatricians, hospitals, and other providers. They should not deter the use of medically necessary services and should ensure that children with needs above and beyond the usual have access to necessary health care. Point-of-service cost sharing holds the greatest risks for children failing to seek or receive needed care and preventive services.

The Academy is not opposed to premium sharing with families, as long as the cost to families is moderate and based on a sliding income scale. For families with 1 child, individual premiums should be charged. For families with 2 or more children, a single premium rate should be charged to cover all children. Copayments for all SCHIP beneficiaries should be limited to the nominal level legislated for children in families with incomes up to 150% of the FPL. The Academy opposes the use of deductibles and coinsurance for any SCHIP-eligible children.

Consistent with SCHIP legislation and AAP policy, all preventive services should be exempt from copayments. The Academy believes that eliminating patient cost sharing for selected preventive services is a relatively easy

and effective means of improving the rates of delivery for recommended clinical preventive care.[29]

4. **Include Pediatricians in Program Design and Outcome-based Evaluation**. States should ensure that pediatricians, pediatric medical subspecialists including pediatric mental health professionals, and pediatric surgical specialists are involved in developing and reviewing the SCHIP program, annual reports, and evaluations that are required through the SCHIP legislation. States should have an ongoing SCHIP monitoring and advisory panel that includes pediatricians. State SCHIP evaluations, ideas, and forms can be found on the HCFA and AAP Web sites (http://www.hcfa.gov/init/chpa-map.htm and http://www.aap.org/advocacy/evaluation.htm, respectively).
   A. Primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists are critical stakeholders in developing SCHIP performance measurements. States are encouraged to use the AAP SCHIP Evaluation Tool, which includes Health Employer Data Information System measures. Process indicators should include age-appropriate immunization and comprehensive well child visit rates. Outcome indicators should include rates of hospitalization for ambulatory sensitive conditions and injuries, percent of SCHIP-enrolled children reporting missed school because of health problems as well as unmet medical, dental and vision needs, percent of SCHIP-enrolled adolescents reporting risky health behaviors and attempted suicide, and percent of family income used for health care.[30] States should develop uniform quality performance measurements for children insured by Medicaid and SCHIP and encourage use of these standards for employer-based plans.
   B. Performance goals should include short-term and long-term health care outcomes. Important features of SCHIP evaluation include monitoring eligibility thresholds and projected enrollment volume, program retention, transitions in coverage, access to medical care, assessments of process and outcomes of pediatric care, and family and provider satisfaction.[31]
   C. Congress should adopt proposals to authorize more funding for SCHIP evaluations and allow greater access to state data for research.
   D. States, local communities, and managed care organizations should publish pediatric-specific quality data that allow consumers and purchasers to evaluate and compare quality performance, including pediatric provider network composition among competing SCHIP plans.
5. **Provide Adequate Payment and Access to Pediatricians.** SCHIP plans should provide reimbursement for pediatric services comparable to rates offered in private insurance plans.
   A. In states with low provider payment rates for Medicaid services, SCHIP plans should engage in concurrent efforts to raise Medicaid rates to levels that are at least 90% of the usual, customary, or reasonable rates or equivalent to Medicare rates, whichever is higher. States with better levels of physician participation should serve as benchmarks for other states. Historically, states with low Medicaid reimbursement rates have lower participation rates. Efforts should be made by states to base payment rates for Medicaid and SCHIP on current market rates, although in some cases they may be inadequate.
   B. States should ensure that physicians receive adequate payment when new vaccines are recommended, particularly when physicians receive payment under a capitated arrangement. State should ensure that provisions are made to reimburse physicians for the cost of the new vaccines until new contracts are negotiated. In addition, physicians should receive payment for the expenses associated with the administration of each vaccine.
   C. In states using managed care models as a health delivery system for SCHIP, different strategies should be evaluated, such as pediatric risk-adjusted capitation rates and risk pools. The goal of such strategies is to reduce the negative financial consequences for health plans that enroll and pediatricians who serve high-risk children and the positive financial consequences for plans that enroll and pediatricians who serve low-risk children. Risk adjustment is a corrective tool designed to reorient the current incentive structure of the insurance market. Health plans should develop risk adjusted capitation at the primary care level. Enhanced payments for providing case management and care coordination for children with special health care needs should also be considered. Reimbursement levels must ensure reasonable clinician compensation in relation to the increased time required to coordinate and provide care for children, particularly those with special health care needs.[32]
   D. All health plans should provide access to pediatric primary care and pediatric medical subspecialty and pediatric surgical specialty services, as described in the AAP policy statement "Guiding Principles for Managed Care Arrangements for the Health Care of Newborns, Infants, Children, Adolescents, and Young Adults."[28]
   E. HCFA and states must monitor network capacity and pediatrician participation when developing plans. Failure to do so results in less adequate access to care providers for children.
6. **Ensure Choices for Families and Pediatricians**. SCHIP plans should allow choices to be made by patients and pediatricians.
   A. Parents should have the ability, with proactive outreach and information from the state, to

choose their child's pediatrician and managed care plan. Securing a medical home and continuity of care should be encouraged when families choose or are assigned to managed care plans. Families should be allowed to disenroll with cause at any time. However, to support the medical home optimally, families should be required to adhere to their choices or assignments for 1 year unless there is due cause to change.

B. Pediatricians, pediatric medical subspecialists, and pediatric surgical specialists are discouraged from accepting exclusive contracts with a single managed care plan. They should consider contracting with several plans to ensure that parents and children have a choice and to ensure that access to primary and specialty pediatric services is not lost if a single plan fails.

7. **Establish Simple Administrative Procedures**. SCHIP plans should establish simplified and efficient administrative systems.
   A. States should streamline and simplify their eligibility determination and enrollment process, cost-sharing policies, and copayment collection procedures.
   B. Health plans should simplify or eliminate procedures for preauthorization, obtaining second opinions, utilization review and quality assurance administration, claims processing, specialty referrals, and physician payment.[33]
   C. States should provide training for pediatricians, other physicians, and their office staff about how to participate in SCHIP. State Medicaid agencies can provide grants to optimize physician use of Medicaid and SCHIP. States should provide education and training to physicians about how to refer patients for SCHIP enrollment.

CONCLUSION

SCHIP has the potential to dramatically increase and maintain the number of children in the United States with health insurance coverage. To maximize the benefits of this legislation, states have an obligation to implement programs created in such a way that the most children receive the most comprehensive health care services available. To do this, states must ensure that all children who are eligible for coverage are enrolled and have access to high-quality care. The success of these programs will depend on the number of previously uninsured children who are now insured, the resulting increase in their access to health care services, and the ultimate improvement in their health and well-being. Although SCHIP does not create universal coverage for all children, it is an important step toward the goal of ensuring that all children in the United States have health insurance and, ultimately, access to high-quality health care.

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CLINICAL REPORT

The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds

Guidance for the Clinician in Rendering Pediatric Care

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ABSTRACT

Play is essential to development because it contributes to the cognitive, physical, social, and emotional well-being of children and youth. Play also offers an ideal opportunity for parents to engage fully with their children. Despite the benefits derived from play for both children and parents, time for free play has been markedly reduced for some children. This report addresses a variety of factors that have reduced play, including a hurried lifestyle, changes in family structure, and increased attention to academics and enrichment activities at the expense of recess or free child-centered play. This report offers guidelines on how pediatricians can advocate for children by helping families, school systems, and communities consider how best to ensure that play is protected as they seek the balance in children's lives to create the optimal developmental milieu.

INTRODUCTION

Play is so important to optimal child development that it has been recognized by the United Nations High Commission for Human Rights as a right of every child.[1] This birthright is challenged by forces including child labor and exploitation practices, war and neighborhood violence, and the limited resources available to children living in poverty. However, even those children who are fortunate enough to have abundant available resources and who live in relative peace may not be receiving the full benefits of play. Many of these children are being raised in an increasingly hurried and pressured style that may limit the protective benefits they would gain from child-driven play. Because every child deserves the opportunity to develop to their unique potential, child advocates must consider all factors that interfere with optimal development and press for circumstances that allow each child to fully reap the advantages associated with play.

No single set of guidelines could do justice to the many factors that impact on children's play, even if it was to focus only on children living in the United States. These guidelines will focus on how American children with adequate resources may be limited from enjoying the full developmental assets associated with play because of a family's hurried lifestyle as well as an increased focus on the fundamentals of academic preparation in lieu of a broader view of education. Those forces that prevent children in poverty and the working class from benefiting fully from play deserve full, even urgent, attention, and will be addressed in a future

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document. Those issues that impact on play for children with limited resources will be mentioned briefly here to reinforce that play contributes to optimal child development for all children and that we must advocate for the changes specific to the need of each child's social and environmental context that would enhance the opportunities for play.

These guidelines were written in response to the multiple forces that challenge play. The overriding premise is that play (or some available free time in the case of older children and adolescents) is essential to the cognitive, physical, social, and emotional well-being of children and youth. Although the guidelines were written in defense of play, they should not be interpreted as being against other forces that compete for children's time. Academic enrichment opportunities are vital for some children's ability to progress academically, and participation in organized activities is known to promote healthy youth development.[2,3] It is essential that a wide variety of programming remain available to meet the needs of both children and families. Rather, these guidelines call for an inclusion of play as we seek the balance in children's lives that will create the optimal developmental milieu to prepare our children to be academically, socially, and emotionally equipped to lead us into the future.

THE BENEFITS OF PLAY

Play allows children to use their creativity while developing their imagination, dexterity, and physical, cognitive, and emotional strength. Play is important to healthy brain development.[4–6] It is through play that children at a very early age engage and interact in the world around them. Play allows children to create and explore a world they can master, conquering their fears while practicing adult roles, sometimes in conjunction with other children or adult caregivers.[7–14] As they master their world, play helps children develop new competencies that lead to enhanced confidence and the resiliency they will need to face future challenges.[7,10,15] Undirected play allows children to learn how to work in groups, to share, to negotiate, to resolve conflicts, and to learn self-advocacy skills.[7,10,11,16] When play is allowed to be child driven, children practice decision-making skills, move at their own pace, discover their own areas of interest, and ultimately engage fully in the passions they wish to pursue.[7,10,11] Ideally, much of play involves adults, but when play is controlled by adults, children acquiesce to adult rules and concerns and lose some of the benefits play offers them, particularly in developing creativity, leadership, and group skills.[17] In contrast to passive entertainment, play builds active, healthy bodies. In fact, it has been suggested that encouraging unstructured play may be an exceptional way to increase physical activity levels in children, which is one important strategy in the resolution of the obesity epidemic.[18,19] Perhaps above all, play is a simple joy that is a cherished part of childhood.

Children's developmental trajectory is critically mediated by appropriate, affective relationships with loving and consistent caregivers as they relate to children through play.[4] When parents observe their children in play or join with them in child-driven play, they are given a unique opportunity to see the world from their child's vantage point as the child navigates a world perfectly created just to fit his or her needs. (The word "parent" is used in this report to represent the wide range of adult caregivers who raise children.) The interactions that occur through play tell children that parents are fully paying attention to them and help to build enduring relationships.[6,13,14,20,21] Parents who have the opportunity to glimpse into their children's world learn to communicate more effectively with their children and are given another setting to offer gentle, nurturing guidance. Less verbal children may be able to express their views, experiences, and even frustrations through play, allowing their parents an opportunity to gain a fuller understanding of their perspective. Quite simply, play offers parents a wonderful opportunity to engage fully with their children.

Play is integral to the academic environment. It ensures that the school setting attends to the social and emotional development of children as well as their cognitive development. It has been shown to help children adjust to the school setting and even to enhance children's learning readiness, learning behaviors, and problem-solving skills.[22–32] Social-emotional learning is best integrated with academic learning; it is concerning if some of the forces that enhance children's ability to learn are elevated at the expense of others. Play and unscheduled time that allow for peer interactions are important components of social-emotional learning.[33,34]

REDUCED CHILD-DRIVEN PLAY AND THE POTENTIAL REPERCUSSIONS

Despite the numerous benefits derived from play for both children and parents, time for free play has been markedly reduced for some children. This trend has even affected kindergarten children, who have had free play reduced in their schedules to make room for more academics. A 1989 survey taken by the National Association of Elementary School Principals found that 96% of surveyed school systems had at least 1 recess period. Another survey a decade later found that only 70% of even kindergarten classrooms had a recess period.[35,36]

Currently, many schoolchildren are given less free time and fewer physical outlets at school; many school districts responded to the No Child Left Behind Act of 2001[37] by reducing time committed to recess, the creative arts, and even physical education in an effort to focus on reading and mathematics.[38,39] This change may have implications on children's ability to store new in-

formation, because children's cognitive capacity is enhanced by a clear-cut and significant change in activity.[35,40] A change in academic instruction or class topic does not offer this clear-cut change in cognitive effort and certainly does not offer a physical release. Even a formal structured physical education class may not offer the same benefit as free-play recess.[35,41] Reduced time for physical activity may be contributing to the discordant academic abilities between boys and girls, because schools that promote sedentary styles of learning become a more difficult environment for boys to navigate successfully.[42,43]

Some children are given less time for free exploratory play as they are hurried to adapt into adult roles and prepare for their future at earlier ages.[44–46] Parents are receiving carefully marketed messages that good parents expose their children to every opportunity to excel, buy a plethora of enrichment tools, and ensure their children participate in a wide variety of activities.[45,47] Children are exposed to enrichment videos and computer programs from early infancy as well as specialized books and toys designed to ensure that they are well-rounded and adequately stimulated for excelled development. Specialized gyms and enrichment programs designed for children exist in many communities, and there is an abundance of after-school enrichment activities. These tools and programs are heavily marketed, and many parents have grown to believe that they are a requirement of good parenting and a necessity for appropriate development. As a result, much of parent-child time is spent arranging special activities or transporting children between those activities. In addition to time, considerable family financial resources are being invested to ensure that the children have what are marketed as the "very best" opportunities.[33,34,47–49]

It is clear that organized activities have a developmental benefit for children, especially in contrast to completely unsupervised time.[2] Some research substantiates that for most children, benefits increase with higher levels of participation.[2] In addition, it has been suggested that because this lifestyle is associated with middle-class families, it may have a benefit in maintaining social class or in creating upward mobility.[50] It is less clear, however, at what point a young person may be "overscheduled" to their developmental detriment or emotional distress. Free child-driven play known to benefit children is decreased, and the downtime that allows parents and children some of the most productive time for interaction is at a premium when schedules become highly packed with adult-supervised or adult-driven activities.[45–47,51,52]

It is left to parents to judge appropriate levels of involvement, but many parents seem to feel as though they are running on a treadmill to keep up yet dare not slow their pace for fear their children will fall behind. In addition, some worry they will not be acting as proper parents if they do not participate in this hurried lifestyle.[45–47,51,52]

Although most highly scheduled children are thriving,[2] some are reacting to the associated pressures with anxiety and other signs of increased stress.[45,46,53] In this regard, highly scheduled children have less time for free, child-driven, creative play,[45,46,47,54] which offers benefits that may be protective against the effects of pressure and stress.[45,54] There is evidence that childhood and adolescent depression is on the rise through the college years.[55–60] Although there are certainly many factors involved, and a direct link between the early pressure-filled intense preparation for a high-achieving adulthood and these mental health concerns cannot be made on the basis of current research, it is important that we consider the possibility of this linkage. We can be certain that in some families, the protective influences of both play and high-quality family time are negatively affected by the current trends toward highly scheduling children.

As trusted child advocates, pediatric health professionals are ideally suited to help parents consider the appropriate balance between preparing for the future and living fully in the present through play, child-centered organized activities, and rich parent-child interaction. It is likely that the balance that needs to be achieved will be different for every child on the basis of the child's academic needs, temperament, environment, and the family's needs. Because there are so many forces that influence the trend toward focusing on future preparation, it is important that parents have a medical home that can reinforce the importance of some of the basic, tried-and-true aspects of child rearing.

FACTORS THAT HAVE CHANGED THE ROUTINE OF CHILDHOOD

There may be as many explanations for the current trends as there are families, but several key factors that have led to decreased free play should be considered.

1. There are more families with a single head of household or 2 working parents and fewer multigenerational households in which grandparents and extended family members can watch the children. Therefore, fewer families have available adult supervision in the home during the workday, which makes it necessary for children to be in child care or other settings in which they can be monitored by adults throughout the day.[61] Organized after-school activities and academic enrichment opportunities offer valuable alternatives to children who might otherwise be left with minimal or no adult supervision.
2. Many parents have learned how to become increasingly efficient in balancing work and home schedules. They wish to make the most effective use of limited time with their children and believe that facilitating their children to have every opportunity

is the best use of that time. Some may use some of the standards of efficiency and productivity they have mastered at work to judge their own effectiveness as parents; this is sometimes referred to as the professionalization of parenthood.[51] This phenomenon may create guilt in parents who find it difficult to balance competing demands after a taxing workday. Parents who understand that high-interaction, at-home activities (eg, reading or playing with children) present opportunities for highly effective parenting may feel less stress than those who feel compelled to arrange out-of-home opportunities.

3. Parents receive messages from a variety of sources stating that good parents actively build every skill and aptitude their child might need from the earliest ages. They are deluged in parenting magazines and in the media with a wide range of enrichment tools and activities that tout their ability to produce superachieving children. They read about parents who go to extreme efforts, at great personal sacrifice, to make sure their children participate in a variety of athletic and artistic opportunities. They hear other parents in the neighborhood talk about their overburdened schedules and recognize it is the culture and even expectation of parents.[51,52]
4. The college-admissions process has become much more rigorous in recent years, largely because of a baby boom hitting the college years. Parents receive the message that if their children are not well prepared, well balanced, and high-achieving, they will not get a desired spot in higher education. Even parents who wish to take a lower-key approach to child rearing fear slowing down when they perceive everyone else is on the fast track.[62,63] Children are encouraged to build a college resume through both academic excellence and a wide variety of activities and volunteer efforts starting at younger ages. In some cases, parents feel pressured to help their child build a strong resume.
5. In response to the increasingly rigorous college-admissions process, many secondary schools are judged by the rates in which their students are accepted by the most prestigious centers of higher learning. Partly in response to this, many students have been encouraged to carry increasingly rigorous academic schedules, including multiple advanced-placement courses. In addition, many students are taking preparation courses for standardized entrance examinations. These students are left with less free time because of the home preparatory time needed for their classes.
6. The pressure for admission to select schools begins for some families long before college. Selection for private preschool programs can even be competitive, and parents may need to consider how best to "package" their preschoolers.
7. There is a national trend to focus on the academic fundamentals of reading and arithmetic. This trend, spearheaded by the No Child Left Behind Act of 2001, is a reaction to the unacceptable educational performance of America's children in some educational settings. One of the practical effects of the trend is decreased time left during the school day for other academic subjects, as well as recess, creative arts, and physical education.[38,39] This trend may have implications for the social and emotional development of children and adolescents.[33] In addition, many after-school child care programs prioritize an extension of academics and homework completion over organized play, free play, and physical activity.[64]
8. The decrease in free play can also be explained by children being passively entertained through television or computer/video games. In sharp contrast to the health benefits of active, creative play and the known developmental benefits of an appropriate level of organized activities, there is ample evidence that this passive entertainment is not protective and, in fact, has some harmful effects.[65–68]
9. In many communities, children cannot play safely outside of the home unless they are under close adult supervision and protection. This is particularly true in areas that are unsafe because of increased violence or other environmental dangers.

WHY IS IT A PROBLEM?

It would be wrong to assume that the current trends are a problem for all children; some excel with a highly driven schedule. Because we need skilled young people to be well prepared to be tomorrow's leaders, we must recognize the advantages to the increased exposures and enriched academics some of our children are receiving. In fact, many of our children, particularly those in poverty, should receive more enrichment activities. But even children who are benefiting from this enrichment still need some free unscheduled time for creative growth, self-reflection, and decompression and would profit from the unique developmental benefits of child-driven play.

However, for some children, this hurried lifestyle is a source of stress and anxiety and may even contribute to depression.[45,46] Increased pressure to achieve is likely to manifest in school avoidance and somatic symptoms.[69–72] The challenge for society, schools, and parents is to strike the balance that allows all children to reach their potential without pushing them beyond their personal comfort limits and while allowing them personal free playtime.

It appears that the increased pressures of adolescence

have left some young people less equipped to manage the transition toward the college years. Many student health services and counseling centers on college campuses have not been able to keep pace with the increased need for mental health services, and surveys have substantiated this need by reporting an increase in depression and anxiety among college students.[57–59] A survey by the American College Health Association reported that 61% of college students had feelings of hopelessness during the previous academic year, 45% felt so depressed they had trouble functioning, and 9% suffered suicidal ideation.[57] Several studies have linked feelings of anxiety and depression with that of perfectionism and an overly critical self-evaluation.[72–77] Other studies have linked this perfectionism with highly critical parents who instill pressures to excel.[78–82] Perfectionism is challenging to the individual and has a broader effect on society because it may stifle creativity and unencumbered thinking.[83] There are no longitudinal studies that directly link intense preparation for adulthood during childhood to this rise in mental health needs, and there certainly are other causes, but some experts believe today's pressured lifestyle is an important contributor.[46,84]

Children may also have received an unintended message from this hurried, intense preparation for adulthood. They may have learned that the end-point goal—the best school or the best job—must be reached at all costs. High schools, colleges, and universities throughout the country are reporting that more students may be cheating to achieve the desired end result of a superior grade.[85,86] Despite grade inflation over the last decades, many teachers report increased stress in students when they achieve less-than-perfect scores.[87–89] This competitive era may be producing a minority of young people so intensely worried about the appearance of high achievement that they will forsake core values such as fairness and honesty for the sake of acquiring good grades.

FAMILY CONSIDERATIONS

Some families whose children are highly scheduled may also suffer. Adults who may already be burdened by work responsibilities and maintaining a household find themselves sacrificing their downtime because they need to arrange activities and transport children between appointments.[45–47] In addition, because of the pressures they feel to meet every one of the needs they perceive (or are told) their child requires to excel, they may feel inadequate and ultimately have less personal satisfaction in parenting.[51,52] Most importantly, parents lose the opportunity for perhaps the highest-quality time with their children. Some of the best interactions occur during downtime—just talking, preparing meals together, and working on a hobby or art project, playing sports together, or being fully immersed in child-centered play.

As parents prepare their children for the future, they cannot know precisely which skills each will need for the workforce. With added anxiety over their inability to adequately predict the future, they become susceptible to the promises of success and full preparation offered by all of the special enrichment programs and vulnerable to the belief that if their children are at least exposed to everything, they will have the best chance to be prepared. Although no one can be sure what skills will be needed, certain character traits will produce children capable of navigating an increasingly complex world as they grow older. These traits include confidence, competence or the ability to master the environment, and a deep-seated connectedness to and caring about others that create the love, safety, and security that children need to thrive. In addition, to be resilient—to remain optimistic and be able to rebound from adversity—young people need the essential character traits of honesty, generosity, decency, tenacity, and compassion. Children are most likely to gain all of these essential traits of resiliency within a home in which parents and children have time to be together and to look to each other for positive support and unconditional love.[90–95] Many families are successfully navigating a wide variety of commitments without sacrificing high-quality parent-child time,[2] but some families' ability to maintain essential parent-child time may be compromised by this hurried lifestyle. In these families, overscheduling may lead to less emotionally competent, well-buffered children.

WHAT ARE THE SOLUTIONS?

Because there are at least several causes for the decreased amount of child-directed play, there is no single position that child advocates should take. For example, in the case of a child who is economically disadvantaged and does not reside in a safe neighborhood, it may be unwise to simply propose more child-centered play. Although parents can be encouraged to optimize conditions for this kind of play in the home, there must be broad societal responses that address poverty, social inequities, and violence before we can advise parents to allow unsupervised play. In addition, for children in poverty, enhanced child care services, early community-based education (eg, Head Start), increased academic programming, more enrichment activities, and greater opportunities for community-based adult-supervised activities are warranted. Some of the needed solutions for this group of disadvantaged children remain beyond the scope of this article and are raised here to emphasize that the suggestions offered here need to be individualized; one size does not fit all.

For all children, however, advocates need to promote the implementation of those strategies known to promote healthy youth development and resiliency. Some of those strategies are community based, and others are school based, but many reside within the family. They are rooted in the deep connection that develops when

parents engage with their children.[92,93,95] Play remains an ideal venue for parents to engage fully, and child professionals must reinforce the value of this play. Some play must remain entirely child driven, with parents either not present or as passive observers, because play builds some of the individual assets children need to develop and remain resilient.

Parents need to feel supported to not passively accept the media and advertising messages that suggest there are more valuable means of promoting success and happiness in children than the tried, trusted, and traditional methods of play and family togetherness. Purveyors of these special programs should be encouraged to produce long-term evidence that define how their products/strategies produce more successful children. In parallel, we would encourage independent researchers to evaluate both the benefits and problems associated with these enrichment tools. Researchers should also continue to explore the type and quantity of activities that are likely to be enriching for children with different needs.

Colleges are seeing a generation of students who appear to be manifesting increased signs of depression, anxiety, perfectionism, and stress. They should clarify their messages about the type of students they seek in the face of widespread folklore that they seek only super-achieving students. Colleges certainly seek a physically and emotionally healthy student body with the character traits that support learning. Colleges could reduce the stress levels of young people and their parents if they offered clear, more realistic expectations about the type of students they seek and helped families to understand that there is a match for each reasonably prepared student. In addition, colleges should address the myth that desirable students are those who excel in every area. In the adult world, people rarely excel in more than 1 or 2 areas, while well-balanced individuals enjoy several others. Colleges should recognize the possibility that when children believe that they must excel in all areas to gain admission, they might respond to those perceived and unrealistic expectations with stress and anxiety.[62,63]

ADVICE FOR PEDIATRICIANS*

In the midst of so many conflicting messages about what parents should do to prepare their child for what is perceived to be an increasingly complicated, competitive world, pediatricians have a natural role to serve as caring, objective child professionals with whom parents can discuss their approach to child rearing and reflect on their own desires for their children. Because pediatricians have a unique and important role in promoting the physical, emotional, and social well-being of children and adolescents, it is important that they promote strategies that will support children to be resilient and to reduce excessive stressors in their lives.

- Pediatricians can promote free play as a healthy, essential part of childhood. They should recommend that all children are afforded ample, unscheduled, independent, nonscreen time to be creative, to reflect, and to decompress. They should emphasize that although parents can certainly monitor play for safety, a large proportion of play should be child driven rather than adult directed.
- Pediatricians should emphasize the advantages of active play and discourage parents from the overuse of passive entertainment (eg, television and computer games).
- Pediatricians should emphasize that active child-centered play is a time-tested way of producing healthy, fit young bodies.
- Pediatricians should emphasize the benefits of "true toys" such as blocks and dolls, with which children use their imagination fully, over passive toys that require limited imagination.
- Pediatricians can educate families regarding the protective assets and increased resiliency developed through free play and some unscheduled time.
- Pediatricians can reinforce that parents who share unscheduled spontaneous time with their children and who play with their children are being wonderfully supportive, nurturing, and productive.
- Pediatricians can discuss that, although very well intentioned, arranging the finest opportunities for their children may not be parents' best opportunity for influence and that shuttling their children between numerous activities may not be the best quality time. Children will be poised for success, basking in the knowledge that their parents absolutely and unconditionally love them. This love and attention is best demonstrated when parents serve as role models and family members make time to cherish one another: time to be together, to listen, and to talk, nothing more and nothing less. Pediatricians can remind parents that the most valuable and useful character traits that will prepare their children for success arise not from extracurricular or academic commitments but from a firm grounding in parental love, role modeling, and guidance.
- Pediatricians should be a stable force, reminding parents that the cornerstones of parenting—listening, caring, and guiding through effective and developmentally appropriate discipline—and sharing pleasurable time together are the true predictors of childhood, and they serve as a springboard toward a happy, successful adulthood.

* This guidance is offered by the American Academy of Pediatrics and, therefore, is targeted to pediatricians. Other health professionals who serve children and adolescents, including other physicians, pediatric and family nurse practitioners, and physician assistants, are welcome to consider incorporating these guidelines into practice.

- Pediatricians should help parents evaluate the claims made by marketers and advertisers about the products or interventions designed to produce super-children.
- Pediatricians should emphasize the proven benefits of reading to their children, even at very early ages.
- Pediatricians can be available to parents as sounding boards to help parents evaluate the specific needs of their child in terms of promoting resiliency, developing confidence and competence, and ultimately enhancing that child's trajectory toward a successful future.
- Pediatricians can support parents to organize playgroups beginning at an early preschool age of approximately 2.5 to 3 years, when many children move from parallel play to cooperative play in the process of socialization.
- Pediatricians can advocate for developing "safe spaces" in underresourced neighborhoods, perhaps by opening school, library, or community facilities to be used by children and their parents after school hours and on weekends.
- Pediatricians can educate themselves about appropriate resources in their own community that foster play and healthy child development and have this information available to share with parents.
- Pediatricians should support children having an academic schedule that is appropriately challenging and extracurricular exposures that offer appropriate balance. What is appropriate has to be determined individually for each child on the basis of their unique needs, skills, and temperament, not on the basis of what may be overly pressurized or competitive community standards or a perceived need to gain college admissions.
- Pediatricians should encourage parents to allow children to explore a variety of interests in a balanced way without feeling pressured to excel in each area. Pediatricians should encourage parents to avoid conveying the unrealistic expectation that each young person needs to excel in multiple areas to be considered successful or prepared to compete in the world. In parallel, they should promote balance in those youth who are strongly encouraged to become expert in only 1 area (eg, a particular sport or musical instrument) to the detriment of having the opportunity to explore other areas of interest.
- As parents choose child care and early education programs for their children, pediatricians can reinforce the importance of choosing settings that offer more than "academic preparedness." They should be guided to also pay attention to whether the settings attend to the social and emotional developmental needs of the children.
- Pediatricians can join with other child professionals and parents to advocate for educational settings that promote optimal academic, cognitive, physical, social, and emotional development for children and youth.
- Pediatricians should assess their patients for the manifestations of stress, anxiety, and depression in family-centered interviews for children and privately conducted interviews with adolescents.
- Because stress often manifests with physical sensations, pediatricians should be highly sensitized to stress as an underlying cause of somatic illness.
- Pediatricians should refer to appropriate mental health professionals when children or their parents show signs of excessive stress, anxiety, or depression.

CONCLUSIONS

Play is a cherished part of childhood that offers children important developmental benefits and parents the opportunity to fully engage with their children. However, multiple forces are interacting to effectively reduce many children's ability to reap the benefits of play. As we strive to create the optimal developmental milieu for children, it remains imperative that play be included along with academic and social-enrichment opportunities and that safe environments be made available to all children. Additional research is needed to explore the appropriate balance of play, academic enrichment, and organized activities for children with different temperaments and social, emotional, intellectual, and environmental needs.

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NEW YORK PLANS TO MAKE GENDER PERSONAL CHOICE

"Separating anatomy from what it means to be a man or a woman, New York City is moving forward with a plan to let people alter the sex on their birth certificate even if they have not had sex-change surgery. Under the rule being considered by the city's Board of Health, which is likely to be adopted soon, people born in the city would be able to change the documented sex on their birth certificates by providing affidavits from a doctor and a mental health professional laying out why their patients should be considered members of the opposite sex, and asserting that their proposed change would be permanent. Applicants would have to have changed their name and shown that they had lived in their adopted gender for at least two years, but there would be no explicit medical requirements."

Cave D. *New York Times*. November 7, 2006
Noted by JFL, MD

American Academy of Pediatrics
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CLINICAL REPORT

The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bond: Focus on Children in Poverty

Regina M. Milteer, MD, Kenneth R. Ginsburg, MD, MSEd, and the COUNCIL ON COMMUNICATIONS AND MEDIA and COMMITTEE ON PSYCHOSOCIAL ASPECTS OF CHILD AND FAMILY HEALTH

abstract

FREE

Play is essential to the social, emotional, cognitive, and physical well-being of children beginning in early childhood. It is a natural tool for children to develop resiliency as they learn to cooperate, overcome challenges, and negotiate with others. Play also allows children to be creative. It provides time for parents to be fully engaged with their children, to bond with their children, and to see the world from the perspective of their child. However, children who live in poverty often face socioeconomic obstacles that impede their rights to have playtime, thus affecting their healthy social-emotional development. For children who are underresourced to reach their highest potential, it is essential that parents, educators, and pediatricians recognize the importance of lifelong benefits that children gain from play. *Pediatrics* 2012;129:e204–e213

KEY WORDS

children, development, parents, pediatrician, play, poverty

ABBREVIATIONS

AAP—American Academy of Pediatrics

More than 15 million children in the United States younger than 18 years live in poverty.[1] These children experience disparities in education, health care, and socioeconomic resources.[2–6] Children living in poverty may also be deprived of the benefits of safe and creative playtime and access to age-appropriate extracurricular activities. The implications of play deprivation may be substantial, because play is essential to the social, emotional, cognitive, and physical well-being of children beginning in early childhood.[7] In addition, play offers an opportunity for parents to view the world from their child's perspective as they engage fully with their children during playtime; all families deserve ready access to this bonding opportunity. Even before the United Nations High Commission for Human Rights cited play as a right of every child, philosophers and psychologists, such as Plato, Piaget, and Friedrich Froebel, recognized the importance of play in healthy child development.[8–10]

This report addresses issues that may deprive children who live in poverty from gaining the maximum benefit from play. Because it follows an earlier report that focused on factors reducing free playtime for children whose families have resources, this report addresses issues specific to children from lower-income families.[7] Although some of the factors covered in the previous report may also apply to children from lower-income and poor families, 3 issues disproportionately affect these children and merit special attention. First, access to recess and other in-school creative and physical

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outlets (eg, physical education, art, music), as well as after-school youth development programs are reduced. Second, out-of-school opportunities for play may be compromised by a lack of safe play areas, because parks and playgrounds are less abundant in lower-income areas and, in some cases, may be unsafe because of drug dealing, violence, and vandalism.[11,12] Finally, because lower-income parents have to deal with additional social, emotional, and economic stressors of daily living, they may have less time, energy, and resources available to provide active and creative playtime at the park, playground, or even in the home.

All children deserve the opportunity to reach their highest potential. The optimal developmental milieu for children includes academic enrichment, as well as opportunities for physical, cognitive, social, and emotional growth offered in school, home, and community settings. There are different forms of play—free unstructured play, which uses unlimited creativity, and semistructured play, which is guided play with joint attention by parent and child. It is beyond the scope of this report to define and divide, but poverty may prevent challenges to both unstructured and guided play.

Free unstructured play, as well as creative and physical outlets, contribute to social and emotional growth. This report offers guidance on how pediatricians can advocate for children by helping families, school systems, and communities consider how best to ensure play is protected and promoted as the optimal developmental milieu for positive child and youth development is explored.

THE BENEFITS OF PLAY

It could be argued that active play is so central to child development that it should be included in the very definition of childhood. Play offers more than cherished memories of growing up, it allows children to develop creativity and imagination while developing physical, cognitive, and emotional strengths. A previous manuscript described the benefits of play in fuller detail.[7]

Play enhances physical health by building active, healthy bodies. Physical activity beginning in early childhood prevents obesity.[13] In fact, play may be an exceptional way to increase physical activity levels in children and, therefore, may be included as an important strategy in addressing the obesity epidemic.[14,15]

Play contributes to healthy brain development.[16–18] Children engage and interact with the world around them through play from a very early age. Even in the academic environment, play helps children adjust to the school setting, thereby fostering school engagement, and enhances children's learning readiness, learning behaviors, and problem-solving skills.[19–31] In addition, play and recess may increase children's capacity to store new information, as their cognitive capacity is enhanced when they are offered a drastic change in activity.[19,20]

Play is essential to developing social and emotional ties. First, play helps to build bonds within the family. Children's healthy development is mediated by appropriate nurturing relationships with consistent caregivers.[16] Play allows for a different quality of interaction between parent* and child, one that allows parents to "listen" in a very different, but productive, way. When parents observe their children playing or join them in child-driven play, they can view the world through their child's eyes and, therefore, may learn to communicate or offer guidance more effectively. Less-verbal children may be able to express themselves, including their frustrations, through play, allowing their parents an opportunity to better understand their needs. Above all, the intensive engagement and relaxed interactions that occur while playing tell children that their parents are fully paying attention to them and, thereby, contribute to a strong connection.[17,32,33] Play also helps forge connections between children. It allows them to learn how to share, to negotiate and resolve conflicts, and to learn self-advocacy skills when necessary.[34,35] It teaches them leadership as well as group skills that may be useful in adult life.

Play should be an integral component of school engagement. School engagement is best realized when the educational setting attends to the social and emotional development of children as well as their cognitive development. The challenge is to make each child feel competent in a school setting, because the experience of success forms positive associations with school attendance.[9] Although we hope for each child to demonstrate academic strengths, opportunities to exhibit social, physical, and creative strengths optimizes the chances that children will realize their areas of strength. Play, recess time, and classes that foster creative aptitude and physical fitness allow for peer interactions that contribute both to school engagement and social-emotional learning. Social-emotional learning should not be thought of as distinct from academic learning, because it can creatively be integrated with academic learning and has been shown to enhance children's ability to learn.[36–38]

Play is a natural tool that children can and should use to build their resilience. At its core, the development of resilience is about learning to overcome challenges and adversity. As mentioned, children learn to deal with

*The word "parent" is used in this report to represent the wide range of adult caregivers who raise children.

social challenges and navigate peer relationships on the playground. In addition, even small children use imaginative play and fantasy to take on their fears and create or explore a world they can master. Play allows them to create fantasy heroes that conquer their deepest fears. It allows them to practice adult roles, sometimes while playing with other children and sometimes while play-acting with adults.[34,39–41] Sensitive adults can observe this play and recognize the fears and fantasies that need to be addressed; however, in many cases, play itself helps children meet their own needs. As they experience mastery of the world they create, children develop new competencies that lead to enhanced confidence and the resilience they need to address future challenges.[34,42]

FACTORS THAT REDUCE PLAY FOR CHILDREN IN POVERTY AND THE POTENTIAL IMPLICATIONS

Reduced Access to Play in Schools

There has been a national trend over the past decade of reducing playtime as an integral part of the school day. This trend is most easily observed in the reduction and, in some cases, elimination of recess; however, there are more subtle changes throughout the school day that reduce children's opportunity to play. First, the approach to early education that naturally incorporated play into the school day is shifting toward a more academically oriented instructional approach as new standards for reading readiness have changed for even kindergarten students.[9] Second, in many districts, there is less school time allocated to the creative arts and physical education.[9,43,44] These subjects contribute to a well-rounded education for a variety of reasons but share some of the benefits of play. They allow for a break from the standard academic subjects, foster creative and physical expression, and teach relaxation and stress-reduction skills that will last a lifetime.[9,13] Finally, even after-school activities have shifted away from play and physical activity and toward being an extension of academics and a space for homework completion.[43] This report focuses on reduced recess for illustrative purposes.

Many of these trends are disproportionately affecting underresourced school districts because of targeted efforts to reduce significant academic disparities. It is a national imperative that all children are given the opportunity to reach their academic potential, and efforts to reduce disparities between children with varying levels of resources are urgently needed. It remains important, however, that what is known about child development, including social and emotional learning, remains at the forefront of consideration as policies to raise academic standards and performance for children are created and implemented. Play, in all its forms, needs to be considered as the ideal educational and developmental milieu for children is created. Because poorer children are most dramatically affected by these policies, stakeholders must remain vigilant in ensuring that children do not inadvertently suffer from the diminution of play in their lives while exploring potential solutions to benefit them academically.

A report by the National Center for Education Statistics revealed that children who attend schools with high minority and high poverty rates in urban settings are more likely to have reduced recess time as compared with their peers in more affluent suburban areas.[44–46] Twenty-eight percent of schools with students who have the highest poverty rates had no recess at all.

The No Child Left Behind Act of 2001, designed to decrease the achievement gap of disadvantaged students, allocated additional educational resources and enrichment programs while decreasing recess time to allow more formal educational encounters.[47] At its inception, child development experts, including educators and pediatricians, voiced caution about the demise of playtime for young children with the proposed increased curriculum time of the program.[9] The experts supported the Alliance for Childhood recommendations that children from low-income families be afforded time to learn how to play and time to play.[9] Perhaps in recognition of the importance of the social and emotional development, as well as academic success of children who live at or below the poverty line, the US Department of Education in 2009 announced the Race to the Top Program, an education initiative that financially rewards school districts that support improving social, cognitive, physical, and emotional school readiness of disadvantaged students. In bids to receive the rewards, school districts must demonstrate focused programs that prepare students in the core academic subjects and other subjects that contribute to the development of well-rounded students, such as physical education and the arts.[48] Thus, children who might otherwise not be afforded opportunities for physical activity and enrichment programs outside of the school day have designated time to enhance their total development.

The disparity between access to recess between middle-income and lower-income districts may be explained by factors other than recess time being transferred to reading and math instruction. It has been suggested that reduced recess in poorer areas is reflective of adult concerns that it is not safe for poorer children to have

unstructured time; yet, it has not been proven that recess is unsafe. A time to play is different from the environment in which play occurs. When children have toys and equipment with which to play and attention is paid to helping the children transition back to class, the benefits of recess in terms of expressivity, exercise, and socialization suggest its vital role in the child's school day and overall well-being. Some experts believe the real danger is that the misunderstanding has led to the removal of playtime.[49] The reduction of recess and other in-school opportunities to play affect all children but may have a particularly detrimental effect on poorer children, because they are likely to have fewer opportunities to play outside of school.[11,12] In addition, because school is often the first true socialization environment for vulnerable children, the opportunity for social and emotional learning must not be compromised.

Poor children enter the educational system at a lower level of readiness, averaging 2 years behind their middle- and upper-class peers.[50] This may be explained in part by their increased exposure to social stressors (higher rates of single mothers who lack social supports and financial resources, absent fathers, limited access to early childhood education, unsafe neighborhoods, lack of preventive health care). They mainly enter schools in poor communities that lack financial resources to enhance the educational process.[51] Schools, under pressure to increase academic performance and to decrease the achievement gap of students, have increased direct educational time, including after-school enrichment and tutorial programs. Although it is important to decrease academic disparities, enhanced nonacademic interactions are also essential to prepare children for future success. If the overall goal is to decrease school failure, which could ultimately lead to depression, entry into the juvenile justice system, and continued economic deprivation, a response to the problem has to include efforts to promote school engagement.[49] As previously discussed, opportunities for play and social and emotional learning enhance school engagement. Quite simply, school engagement occurs when children succeed academically, have other nonacademic opportunities for success (creative arts, physical education), and consider school a place in which they feel safe and enjoy spending time.

Play in the school day offers benefits to academic as well as social and emotional learning. A recent report by Barros and others stated that a break during the school day of $\geq$15 minutes was associated with better teachers' ratings of classroom behavior scores.[19] Good behavior in the classroom is associated with a more productive learning environment secondary to increased attentiveness.[19,20] In addition, children's ability to store new information is increased, because their cognitive capacity is enhanced by a drastic change in activity.[51–53] A change in academic subject and even physical education class may not offer the same benefit as free-play recess.[49] A reduction of time for physical activity may have even greater implications for boys. Schools that use only sedentary styles of learning may be a more difficult environment for boys to navigate successfully and contribute to the discordant academic abilities between boys and girls.[54,55] These findings suggest that decreasing and eliminating recess for students at risk for school failure may be counterproductive.

Finally, it is recognized among educators that recess represents the most powerful strategy to get the most children to participate in physical activity.[56] In its "Physical Activity Guidelines for Americans," the US Department of Health and Human Services recommends 1 hour or more of physical activity per day, with a major part of the hour dedicated to moderate to vigorous physical activity at least 3 times per week for children and adolescents.[57] Physical education curricula should enhance attitudes, habits, and behavioral skills that result in continued physical activity throughout life.[14] Overall, recess offers the most available opportunity for children to play and to engage in physical activity, followed by physical education classes and after-school activities.[58]

Reduced Out-of-School Opportunities for Play

Children cannot play safely outside of the home in many poor communities —urban, suburban, and rural—unless they are under close adult supervision and protection. This is particularly true in areas that are unsafe because of increased violence or where other environmental dangers exist.[11,12] In the past, when neighbors knew each other and often supervised each other's children, there was an extra layer of protection for neighborhood children when they played outside. In today's society, it is not unusual for neighbors not to know one another. Therefore, parents are alone in protecting and supervising their children, which can severely limit outside playtime.

Children who are not engaged in play and physical activity outside of school hours spend time engaged in sedentary activities, such as viewing hours of television, playing video games, or listening to music. This time is often spent in isolation without social interaction and without adult supervision. In sharp contrast to the benefits of

active, creative play, there is substantial evidence that excessive screen time has adverse effects.[59–64] The AAP policy statement on media education presented research that associates media exposure with negative physical and behavioral health problems in children, including obesity, violent and aggressive behavior, depression, anxiety, earlier sexual behaviors, poor academic performance and self-image, nightmares, and tobacco and substance abuse.[63,64]

The sedentary lifestyle is associated with obesity, for which children from low income and minority families are already disproportionally at risk.[65] The AAP and others have reported that children who are obese in early childhood are more likely to be obese adults and to be at risk for the comorbidities associated with obesity, including type 2 diabetes mellitus, hypertension, coronary artery disease, hypercholesterolemia, hyperlipidemia, asthma, and sleep apnea.[14,66,67] In addition to the long-term health effects, obesity may be associated with immediate social and emotional consequences, including low self-esteem, negative body image, depression, teasing and bullying, social marginalization, and discrimination.[63,64,66,67] Obesity can have socioemotional effects on academic achievement and opportunities and can, therefore, thwart educational trajectories associated with long-term success.[66,67]

Family Considerations

Although lower-income parents have the same desires for their children to succeed and reach their full potential as do parents with greater economic and social assets, they must focus primarily on the family's day-to-day survival. When food and shelter are at risk, ensuring time for the children to have free and creative playtime may not be a priority. Economic hardship is a major obstacle for these families, in which the parents are more likely to have a lower educational level or be single heads of households. Minority households (black and Hispanic) and immigrant parents are at increased risk of having children who live in poverty.[1,68] There is more likely to be a history of substance abuse in poorer families. The neighborhoods in which they live lack community resources, such as community centers, parks, and fully equipped supervised playgrounds that offer safe places for children to play and to gather. Children have fewer opportunities to participate in organized sports. Because of fear of violence, families do not venture outside with their children for fun physical activities, such as walking, bike riding, swinging, swimming, playing tennis, or jogging.[11,12,69] In a safe environment with community resources, these activities would not be an additional financial burden to already challenged families.

Poor families may also be at a disadvantage in a material-driven culture in which marketing messages, often claims without proof, abound about what children need to prosper. They may absorb the messages that the best toys are those that are the most expensive or that children are only academically prepared for preschool if exposed to a variety of enrichment tools and activities that claim to produce high-achieving children. Parents who cannot afford these market-driven materials may feel disempowered to actively play with and enrich their children using the most effective known tools—themselves. Children's creativity is enhanced with the most basic (and least expensive) toys, blocks, dolls, and art supplies. Children's academic preparedness may be most developed with low-cost time spent reading with parents. They will learn to love books when they associate quality time with their parents with reading.[70]

Lower-income parents may have fewer resources, including time, to invest in playing with their children. Because play holds so many benefits, including fostering connection between parents and children, less play may be an added, although rarely mentioned, risk of poverty. No one is certain what skills will be needed for our children to be best prepared to lead us into the future, but we do have insight into which character traits will produce children capable of navigating an increasingly complex world. These include confidence, the ability to master the environment, and a connection to others. In addition, to be resilient—to retain hope and to be able to overcome adversity—young people need the added character traits of honesty, generosity, decency, tenacity, and compassion.[71] Children gain these essential traits within a home, when parents and children interact in a supportive manner and share unconditional love.[71–76] Play is a time-tested way for families to have these types of interactions.

WHAT ARE THE SOLUTIONS?

Because there are many causes for the decreased amount of play in the lives of lower-income and poor children, there is no single solution. In addition, simplistic proposed solutions might not take into consideration the complex interplay of factors that have led to decreased play, including the need for safety. For example, if a child does not reside in a safe neighborhood, it may be unwise to simply propose more outdoor child-centered play. Similarly, it may be naïve to insist on more recess without simultaneously coming up with solutions that address the very substantive issue of educational disparities. It is critical, however, that as strategies are developed that

address educational needs and safety, the recognition of children's need to play be strongly advocated, because play is known to promote healthy development and resilience.[46,52,55,58] To effectively preserve play in the lives of economically disadvantaged children, its presence in schools, communities, and homes must be supported.

In schools, the need to support social and emotional learning and healthy child development must be held alongside the need to increase academic scores. Otherwise, school engagement might suffer and efforts at creating a better-prepared generation might fail. The bottom line to school engagement is that schools should be the kind of places that children and adolescents want to be. This means that educators and policy makers must make opportunities for lower-income children to gain the benefits offered from physical education, recess, and the arts so they can reach their highest potential for cognitive, social, and physical development and so children and adolescents will like school. Advocates can also promote programs such as Head Start, the purpose of which is the promotion of school readiness for low-income children. Head Start provides an environment that enhances students' emotional, social, and cognitive development and has demonstrated effectiveness.[77] One of the keys to the success of Head Start has been the involvement of parents in social interaction with their children in playing, reading, and reading-related activities.[78]

Policy makers and community leaders must work together to prioritize the need for safe spaces for families to gather and for children to play. Supervised after-school programs can be critical to children who live in communities where outside playing might be dangerous or unsupervised. Community-based programs that offer a wide variety of services, ranging from homework assistance to athletic programs and from character development to the creative arts can contribute heavily to the positive development of youth. Keeping school facilities open for use by community families in the evenings and on weekends when they are usually closed may increase engagement in these activities. Communities can also offer strategies to link families at or below the poverty level to early education, health care, family support, and parenting education.

Parents of all income levels should use time together at home to engage in both free and structured play with their children. Playtime is bonding time for families. A first step may be education about the value of play that simultaneously refutes false notions that for play to be effective, it must involve expensive toys. Parents from across the economic spectrum need to understand that it is their presence and their attention that enrich their children and that one-on-one play is a time-tested, effective way of being fully present. In parallel, we must be sensitive to the fact that time itself is a commodity when struggling for economic survival. The most comprehensive solutions, therefore, must address broader economic disparities and other factors that create stresses for economically disadvantaged parents.

Certainly, these solutions are broad and societal, going beyond the purview of the pediatrician's office. But as child health professionals committed to the attainment of optimal physical, mental, and social health and well-being for all infants and children, pediatricians have a role in advocating for broad-based solutions that will preserve child play.

ADVICE FOR PEDIATRICIANS

As caring, objective child health professionals, pediatricians have a natural role to advocate for the conditions that allow for the optimal physical, emotional, and social development of children and adolescents. Because play contributes substantially to the healthy development and well-being of children, it is important that pediatricians promote the inclusion of play in homes, schools, and communities.†

- Pediatricians can educate parents about the importance of free, unstructured play in the normal development of children.
- Parents may be influenced by marketing messages that suggest the best toys are those that are financially out of reach. They should be educated that simple, inexpensive toys, such as dolls, jump ropes, blocks, balls, and buckets, are more effective in allowing children to be creative and imaginative than more expensive toys, which can make play a more passive and less physically involved experience.
- Pediatricians can educate parents about the benefits of using play as an opportunity to engage fully with their children. Playtime offers opportunities for parent-child bonding. Playtime offers parents the opportunity to promote healthy social-emotional development in their children through active engagement and shared imagination.
- Pediatricians can encourage parents to use love and understanding to encourage children to try again even when at first they fail. Parents can be informed that

†The guidance in this report is offered by the AAP and, therefore, is targeted to pediatricians. Other health professionals who serve children and adolescents, including other physicians, pediatric and family nurse practitioners, and physician assistants are welcome to consider incorporating this guidance into practice.

positive reinforcement goes further than negative responses as children engage in play alone and with others.

- Pediatricians can use well-child encounters to educate parents about the benefits of play to enhance physical activity that can help prevent childhood obesity. Parents should be educated about the potential for lifelong obesity in obese children, the lifelong health morbidities associated with obesity, and the long-term psychosocial impact of obesity.
- Parents should be encouraged to participate in physical activities with their children that will not have a financial impact on the family.
- Pediatricians can provide parents with information about resources that can provide financial, educational, and mental health assistance to families that have been marginalized by poverty. This may address the underlying stressors that interfere with parents' ability to engage fully in play activities.
- Pediatricians can educate parents about the negative impact of media exposure on children and encourage them to limit screen time and substitute other activities, including playtime and outdoor activities, for screen time. This is an opportunity to educate parents about the AAP recommendations regarding no media time for children younger than 2 years and fewer than 2 hours per day for older children.
- Pediatricians can provide parents and families with information about community resources that provide physical activities for children, such as team sports and camps. They should provide information about organizations that provide "scholarships" or grants that pay for activities that have associated costs.
- Pediatricians can educate parents about the importance of children's play outdoors in nature. Spending unstructured time in nature, surrounded by dirt, trees, grass, rocks, flowers, and insects inspires children's play and offers physical and emotional benefits.
- Pediatricians can advocate for safe play spaces for children who live in communities and attend schools with a high proportion of low-income and poor children by emphasizing that the lifelong success of children is based on their ability to be creative and to apply the lessons learned from playing.
- Pediatricians may consider offering presentations to help educators, community leaders, faith-based groups, and politicians understand the developmental benefits of play to children.
- Pediatricians may advocate for policies that reduce educational disparities while supporting the inclusion of recess, physical outlets, and the creative arts as means to enhance social and emotional learning and school engagement.

CONCLUSIONS

Children who live at or below poverty level in the United States experience educational and health disparities from early childhood. These children deserve additional resources to achieve academically, foster school engagement, and develop their social and emotional competencies. Many children reside in families that face stresses related to daily survival, including whether they will have food or safe shelter, leaving less energy to focus on enrichment opportunities, including play. Some live in neighborhoods where violence may be the norm and children playing on neighborhood playgrounds the exception. School systems are focused on overcoming their academic deficiencies in a safe environment often at the expense of time for arts, recess, physical education classes, and after-school activities that include playing, despite evidence that supports that what happens in play contributes substantially to social and emotional learning, even in the classroom.

Regardless of their socioeconomic status, all children have the right to safe places to play regularly, during which they develop cognitive, communication, problem-solving, negotiation, and leadership skills. They have the right to engage in safe and regular physical activity that will decrease the incidence of lifelong health disparities. The physically and emotionally healthy children of today will become the productive citizens who will contribute positively to society in the future.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Child Health Financing and Committee on Substance Abuse

Improving Substance Abuse Prevention, Assessment, and Treatment Financing for Children and Adolescents

ABSTRACT. The numbers of children, adolescents, and families affected by substance abuse have sharply increased since the early 1990s. The American Academy of Pediatrics recognizes the scope and urgency of this problem and has developed this policy statement for consideration by Congress, federal and state agencies, employers, national organizations, health care professionals, health insurers, managed care organizations, advocacy groups, and families.

ABBREVIATIONS. SCHIP, State Children's Health Insurance Program; LSD, lysergic acid diethylamide; PCP, phencyclidine hydrochloride; ADHD, attention-deficit/hyperactivity disorder.

INTRODUCTION

Leading the list of Americans' concerns for children is drug abuse, according to a 1997 Harvard study.[1] The numbers of children, adolescents, and families affected by substance abuse have sharply increased since the early 1990s.[2] Unfortunately, the availability of and financing for substance abuse prevention, assessment, and treatment have not kept pace with the needs of young people. Access to substance abuse services has decreased during the past decade because of inadequate insurance coverage, managed care controls, and low reimbursement rates. Although there are no national estimates of unmet need for substance abuse services for children, the surgeon general estimated that as many as 75% to 80% of children who are in need of mental health treatment fail to receive it.[3] The consequences of failing to intervene early and not providing age-appropriate substance abuse and mental health treatment are substantial and long-term.

This policy statement includes a summary of the prevalence of substance abuse among children and adolescents along with a review of financing problems experienced by those who are insured through private health insurance, Medicaid, and the State Children's Health Insurance Program (SCHIP), and those who are uninsured. The statement concludes with specific recommendations for financing substance abuse prevention, assessment, and treatment for children and adolescents. By necessity, these recommendations incorporate mental health problems and interventions because of the high prevalence of comorbid psychiatric disorders among children with substance abuse problems.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PREVALENCE AND IMPACT OF SUBSTANCE ABUSE AMONG CHILDREN AND ADOLESCENTS

Substance abuse by young people has increased in the past decade, and it is occurring at younger ages. According to results from the *Monitoring the Future Study* conducted in 1999 at the University of Michigan Institute for Social Research, 33% of 12th graders and 9% of eighth graders reported being drunk 1 or more times during the last 30 days.[2] As many as 23% of high school seniors and 10% of eighth graders reported using marijuana in the last 30 days, up from 14% and 3%, respectively, in 1991. The percentage of adolescents who reported using hallucinogens, lysergic acid diethylamide (LSD), phencyclidine hydrochloride (PCP), cocaine and crack cocaine, heroin, amphetamines, methamphetamines, barbiturates, and tranquilizers also increased between 1991 and 1999. In addition, cigarette use among adolescents, which is a risk factor for use of marijuana and other illicit drugs, also markedly increased during this decade. In 1999, 35% of 12th graders reported smoking cigarettes during the last 30 days, up from 28% in 1991. Among eighth graders, the reported 30-day cigarette use rate increased from 14% to 18%.

Epidemiologic data revealed that 9% of adolescent females and 20% of adolescent males meet adult diagnostic criteria for an alcohol use disorder.[4] Among adolescents and young adults with a substance abuse disorder, 41% to 65% also have a mental health disorder.[3] The most common of these are depression, conduct disorder, and attention-deficit/hyperactivity disorder (ADHD) in combination with conduct disorder. ADHD and learning disorders in combination with depression and anxiety disorders also carry a high risk of substance abuse. If the significant number of drug-exposed infants and the 1 in 6 children exposed to substance abuse within their families are added to these estimates, the size of the population affected by substance abuse and, therefore, potentially needing assistance dramatically increases.[5]

Obtaining accurate estimates of the prevalence of substance abuse among children and adolescents is very difficult. Most national studies survey only students, but many high-risk youth do not regularly attend school and, thus, are not included in these estimates. Other difficulties in obtaining reliable estimates are the results of coverage and reimbursement problems. Rather than using a substance abuse

diagnosis, health care professionals may be using procedure codes for treating associated symptoms of substance abuse, such as fatigue, irritability, weight loss, headache, abdominal pain, or depression. The lack of use of substance abuse codes may also reflect health care professionals' attempt to avoid stigmatizing a child. Consequently, existing prevalence data likely underestimate the scope of the problem.

Data specific to adolescents are limited, but there is growing evidence that successful early intervention and treatment carries significant benefit for the individual and society.[6] The most appropriate assessment of costs and benefits of treatment are based on broader outcome measures rather than abstinence alone. Despite the fact that there is no single treatment approach that works for all patients, standard treatments have been shown to produce significant decreases in drug use and in drug-related problems of crime, family violence, unemployment, welfare dependence, underachievement, and other antisocial behaviors.[7]

EXTENT OF FINANCING PROBLEMS FOR SUBSTANCE ABUSE SERVICES

Although most families whose children require substance abuse services experience financial difficulties related to high out-of-pocket expenses, those who are uninsured are at the greatest disadvantage. An estimated 14 million or 15.9% of children younger than 22 years had no health insurance coverage in 1999.[8] These families must rely exclusively on publicly funded services through their state's substance abuse and mental health agencies or must pay for care themselves. Often, uninsured youth receive uncompensated hospital and emergency care for acute symptoms only, which is seldom coordinated with primary care and behavioral health services. Unfortunately, publicly supported substance abuse and mental health services are underfunded and are typically available only for youth with serious emotional disturbances whose families meet a certain income threshold. Many young people, particularly those who are just beginning to abuse alcohol and other drugs, do not have serious emotional disturbances and, therefore, do not qualify for state-funded services. Moreover, children who are privately insured but without adequate substance abuse and mental health benefits are seldom eligible for state-funded services.

Most children under age 22 (65.4% or 57.7 million) are privately insured by plans purchased by their families individually or through their employers.[8] Often, these families rapidly exhaust their annual and even lifetime allotment of substance abuse benefits and must pay for needed services themselves or rely exclusively on self-help organizations, such as Alcoholics Anonymous and Narcotics Anonymous. Most private health insurance plans impose benefit limitations and cost-sharing requirements on substance abuse and mental health services that are greater than those imposed on general medical services.[9,10] For example, coverage of outpatient substance abuse services, when available, is typically short in duration and is often capped at an inadequate number of visits. Family therapy is often excluded. Inpatient substance abuse services are sometimes excluded altogether or covered only for acute detoxification purposes. Coverage of prevention, assessment, early intervention, relapse prevention, crisis intervention, partial hospitalization or day treatment, and residential care is seldom covered by private plans. Mental health benefits, however, are often provided somewhat more generously than are substance abuse benefits.[2,11]

In addition to benefit limitations, many private insurance plans require higher copayments or coinsurance in addition to separate deductibles for substance abuse benefits.[11] The Mental Health Parity Act of 1996 prohibits plans from imposing higher annual and lifetime out-of-pocket maximums for mental health services than for general medical services.[12] Although many states have passed mental health parity legislation, substance abuse parity is often not included. Thus, many of the gains that have been made in achieving parity only apply to mental health. This may perpetuate the pattern of physicians using procedure codes for treating associated symptoms of substance abuse rather than codes for a substance abuse diagnosis, which further distorts prevalence statistics. Also, the lack of specific data furthers the misconception that substance abuse is a consequence of mental illness rather than a primary disease, a comorbidity, or a significant precipitant of mental health problems.

Medicaid, the source of insurance for 16.4 million or 18.7% of all children younger than 22 years, has historically covered fewer adolescents than younger children.[8] Not until the enactment of SCHIP have many states taken the option to expand Medicaid to cover all adolescents from families with incomes at 100% of the federal poverty level. Unlike private coverage, Medicaid's benefits for children and adolescents are comprehensive and cover a continuum of inpatient and outpatient substance abuse and mental health services. Although Medicaid benefits are expansive, reimbursement rates have been very low and, as a result, serve as a disincentive to provide qualified pediatric and substance abuse services.

Regardless of the source of health insurance coverage, most substance abuse and mental health services are delivered by managed behavioral plans, distinct from general managed care plans and primary pediatric medical care. Although the literature shows that managed behavioral health plans have provided greater overall access to mental health services and a greater continuum of care, it also shows that as a result of tight utilization management, rates of ambulatory visits and hospitalizations have decreased.[3] Pediatricians and other referring health care providers report persistent problems in obtaining authorization for substance abuse treatment for children and adolescents. Often, utilization review criteria address the needs of adults, and children's conditions must be severe or associated with comorbidities to warrant extended counseling or hospital stays. For example, criteria such as chronicity, loss of work, and adult comorbidities—which are inappro-

priate for young people—are often used to determine whether substance abuse treatment is medically necessary. Moreover, many behavioral health plans have closed panels of mental health professionals with limited pediatric substance abuse training or experience. Seldom does coordination between primary care and behavioral health care take place effectively. Problems have also been reported in sharing medical information between behavioral health plans and primary care providers.

Compounding these difficulties is the overall shortage of ambulatory and inpatient substance abuse and mental health services for children and adolescents. Many inpatient facilities have closed during recent years. These shortages have resulted from many factors, including historically low rates of reimbursement provided to substance abuse and mental health professionals. To serve this population effectively is very labor intensive, and insurance dollars and public funds consistently fail to provide adequate reimbursement. Also contributing to payment and service gaps is the fact few insurers recognize the new *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition: Primary Care Version*, which was developed jointly by the pediatric and mental health communities to encourage earlier identification and primary behavioral interventions.[13] In addition, pediatricians are seldom able to receive reimbursement for providing counseling and education services to children at high risk of developing substance abuse problems.

Serious problems exist in the availability and organization of behavioral health services for the treatment of substance abuse problems among youth. Although there are substantial problems with low payment and persistent obstacles in gaining access to needed interventions, pediatricians are in a unique role to identify and intervene with children and adolescents who have or are at risk of substance abuse problems.[14] In addition, a cadre of physicians needs to be trained in the field of pediatric addiction medicine. However, the recruitment and retention of pediatricians and other health care providers in the field of addiction medicine has been very difficult, which seriously compromises the provision of high-quality substance abuse care.[14]

FINANCING RECOMMENDATIONS

Many changes need to be made to the financing and delivery of substance abuse care to improve the availability of services for all children and adolescents. Change in this area, however, is not likely to occur without the participation of a coalition of national and state legislators, public purchasers, employers, health professionals, families, and health services researchers. The American Academy of Pediatrics, together with other participating behavioral health organizations and consumer groups, released a consensus statement on insurance coverage for mental health and substance abuse services for children and adolescents, which highlights the deterioration of mental health and substance abuse services and recommends access, coordination, and monitoring strategies for achieving service improvements.[15] That article and this policy statement on financing should serve as blueprints for Congress, federal and state policy-makers, and employers.

The American Academy of Pediatrics recommends that Congress authorize the Substance Abuse and Mental Health Services Administration to conduct a comprehensive national study of the supply, distribution, financing, and quality of substance abuse prevention, assessment, and treatment services for children and adolescents.

Additional recommendations address the needs of all children, regardless of insurance status. In addition, there are specific recommendations that apply to those with private insurance, those with Medicaid or SCHIP coverage, and those who are uninsured.

For All Children and Adolescents, Regardless of Insurance Status

1. Ensure that substance abuse and mental health benefits are sufficient in amount, duration, and scope to reasonably achieve their purpose.
2. Allow pediatricians and safety net providers trained or experienced in substance abuse prevention, assessment, evaluation, and management services to be included in panels of professionals that provide these services.
3. Create an integrated system of referral and treatment for substance abuse that is consistent with the referral and treatment process of other chronic diseases.
4. Simplify and coordinate processes for families attempting to access substance abuse and mental health services for their children across public and private insurers plans, and public programs.
5. Improve preauthorization and utilization review criteria to be consistent with national standards on the treatment of substance abuse among youth developed by the American Academy of Pediatrics,[16] the Substance Abuse and Mental Health Services Administration,[17] the National Institute on Alcohol Abuse and Alcoholism,[18] and the American Society of Addiction Medicine.[19]
6. Provide reasonable compensation and allow reimbursement of counseling, coordination, and consultation procedure codes to enable pediatricians and other primary care providers to provide primary substance abuse and mental health services.
7. Adjust capitation rates to take into account substance abuse service needs and recommended clinical guidelines for length of care for children and adolescents rather than relying on historic utilization rates to establish capitation amounts.[19]
8. Encourage payers to reimburse for individual and group counseling and risk factor reduction interventions for children at risk of substance abuse problems.
9. Establish financing mechanism for smoking cessation programs for children.
10. Create financial incentives for comanagement of substance abuse treatment between primary care and behavioral health care (eg, transferring some behavioral health dollars into primary care).

11. Create mechanisms for sharing risk among public and private payors to allow for coverage of a comprehensive set of interventions to better manage children with complex cases.
12. Establish clear delineation of responsibilities with regard to children involved with multiple state agencies and required court-ordered treatment.
13. Ensure that health plans and health care providers adopt medical record and billing procedures to protect the confidentiality of children and adolescents.

For Privately Insured Children and Adolescents

1. Extend benefits to include a broader array of substance abuse prevention, assessment, and treatment services.
2. Establish parity between medical services and substance abuse and mental health services so that coverage of the management of substance abuse and mental health disorders is the same as coverage of other chronic conditions.
3. Reduce limitations on substance abuse and mental health services and allow for substitution of mental health and substance abuse benefits and use of alternative sites of care, including schools and homes.
4. Eliminate exclusions for specific diagnostic categories, chronic disorders, and preexisting conditions.
5. Reduce cost-sharing requirements for substance abuse services to encourage their use.

For Medicaid and SCHIP Insured Children and Adolescents

1. Target outreach efforts to ensure that Medicaid- and SCHIP-eligible adolescents are covered.
2. Ensure that a continuum of substance abuse and mental health services for children and adolescents are specified in state Medicaid plans and contracts, using a variety of benefit categories, including Early and Periodic Screening, Diagnosis, and Treatment expanded services.
3. In non-Medicaid SCHIP programs, offer supplemental or wraparound benefits to allow expanded behavioral health coverage for those who meet certain risk criteria.

For Uninsured Children and Adolescents

1. Expand SCHIP income eligibility levels to the maximum possible.
2. Expand the eligibility criteria of states' substance abuse and mental health service programs to include children with all levels of substance abuse and mental health risk.
3. Increase funding of state substance abuse and mental health programs for children and adolescents on the basis of comprehensive needs assessments and behavioral risk profiles of local communities.
4. Earmark a reasonable share of state block grants for prevention, assessment, and treatment services for children and adolescents.
5. Identify new revenue sources to increase availability of substance abuse services, including tobacco settlement funds and new taxes on alcohol.

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ERRATUM

An error occurred in the policy statement "Transfer of Drugs and Other Chemicals Into Human Milk" (Pediatrics 2001;108:776–789). In the first paragraph under "Breastfeeding and Smoking," line 14, the word "acotinine" should be "cotinine."

American Academy of Pediatrics

Policy Statement

Pediatrics Volume 95, Number 3 March, 1995, p. 437-438

The Inappropriate Use of School "Readiness" Tests (RE9512)

AMERICAN ACADEMY OF PEDIATRICS

Committee on School Health and Committee on Early Childhood, Adoption and Dependent Care

All children who reach the legal age of required school attendance are entitled to an appropriate education in the least restrictive environment.[1,2] Most communities offer some form of "school readiness testing" to screen for children with special educational needs, and most schools do this appropriately. However, readiness testing can vary greatly in its sophistication, and can easily be incorrectly applied and interpreted. When instruments and procedures designed for screening are used for diagnostic purposes,[3] or when tests are administered by individuals who have a limited perspective on the variations of normal development, or when staff with little formal training in test administration perform the screening, children can be wrongly identified and their education jeopardized. For these reasons, the use of readiness testing that is designed for screening should not be used to make placement decisions. No child should be excluded from school, placed in a special education setting, or provided with special educational services on the basis of such testing.

The decision that a child will require special educational services for developmental problems should be based upon the analysis of data obtained from individually administered, standardized developmental tests completed by qualified professionals with experience working with children of this age.[4] Such professionals include child psychologists, speech and language pathologists, special education diagnosticians, and pediatricians who have expertise in early childhood development. Special educational placement or services for developmental problems in the preschool and kindergarten years should be recommended only when appropriately administered developmental assessments clearly document significant developmental delays or serious emotional or behavioral problems.[5]

Because normal development is highly variable during the kindergarten and 1st grade years, school programs should be flexible and adaptable to each child's individual characteristics.[6-9]

The following principles are important:

1. All children are entitled to education in an environment where the great variability in early childhood development is understood and supported.
2. "Readiness" testing that relies on screening instruments and procedures should not be the sole basis for special education placement or services, nor should it be used to keep a child from access to formal education if the child is of legal age to attend school in that state or community.
3. If readiness screening suggests that the child has significant developmental delays or signs of emotional or behavioral problems, well-standardized tests that evaluate all relevant aspects of development need to be administered to the child in an individual setting by qualified professionals, experienced with children of this age, to determine if special class placement or special services are needed.

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The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Incorporating Recognition and Management of Perinatal and Postpartum Depression Into Pediatric Practice

abstract

FREE

Every year, more than 400 000 infants are born to mothers who are depressed, which makes perinatal depression the most underdiagnosed obstetric complication in America. Postpartum depression leads to increased costs of medical care, inappropriate medical care, child abuse and neglect, discontinuation of breastfeeding, and family dysfunction and adversely affects early brain development. Pediatric practices, as medical homes, can establish a system to implement postpartum depression screening and to identify and use community resources for the treatment and referral of the depressed mother and support for the mother-child (dyad) relationship. This system would have a positive effect on the health and well-being of the infant and family. State chapters of the American Academy of Pediatrics, working with state Early Periodic Screening, Diagnosis, and Treatment (EPSDT) and maternal and child health programs, can increase awareness of the need for perinatal depression screening in the obstetric and pediatric periodicity of care schedules and ensure payment. Pediatricians must advocate for workforce development for professionals who care for very young children and for promotion of evidence-based interventions focused on healthy attachment and parent-child relationships. *Pediatrics* 2010;126:1032–1039

BACKGROUND

Maternal and paternal depression affect the whole family.[1] This report will specifically focus on the impact of maternal depression on the young infant and the role of the primary care clinician in recognizing perinatal depression. Perinatal depression is a major/minor depressive disorder with an episode occurring during pregnancy or within the first year after birth of a child. A family history of depression, alcohol abuse, and a personal history of depression increase the risk of perinatal depression.[2]

The incidence of perinatal depression varies with the population surveyed, but estimated rates for depression among pregnant and postpartum women have ranged from 5% to 25%. Studies of low-income mothers and pregnant and parenting teenagers have reported rates of depressive symptoms at 40% to 60%. In general, as many as 12% of all pregnant or postpartum women experience depression in a given year, and for low-income women, the prevalence is doubled.[1] The rate of major and minor depression varies during pregnancy from 8.5% to 11.0%, and in the first year after birth of a child, the rate ranges from

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KEY WORDS

postpartum depression, perinatal depression, Edinburgh Postpartum Depression Scale, medical home, dyad relationship, paternal depression

ABBREVIATIONS

AAP—American Academy of Pediatrics
PCP—primary care provider

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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6.5% to 12.9%; the rate of major depression during pregnancy ranges from 3.1% to 4.9%, and in the first year after birth of a child, the rate ranges from 1.0% to 6.8%. The timing shows a peak of 6 weeks after birth of a child for major depression and 2 to 3 months for minor depression.[2] There is another peak of depression 6 months after birth of a child.

The spectrum of depressive symptoms in the postpartum period ranges from "maternity blues" to postpartum depression and postpartum psychosis. Maternity blues affects 50% to 80% of new mothers and occurs during the first few days after delivery. Symptoms include crying, worrying, sadness, anxiety, and mood swings. Symptoms are usually gone after a few days or within 1 to 2 weeks. It does not impair function and can be treated with reassurance and emotional support. Postpartum depression occurs in 13% to 20% of women after birth. It meets the criteria of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) for depression and is distinct from maternity blues.[3]

Postpartum psychosis affects approximately 1 to 3 mothers of 1000 deliveries and most often occurs in the first 4 weeks after delivery. Mothers with postpartum psychosis are severely impaired and may have paranoia, mood shifts, hallucinations, delusions, and suicidal and homicidal thoughts. This is a serious condition that requires immediate medical attention and usually hospitalization. Preexisting bipolar disorder is a risk factor for developing postpartum psychosis.

Depression: A Family Issue

Fathers

Paternal depression is estimated at 6%.[4] Eighteen percent of fathers of children in Early Head Start had symptoms of depression. In an 18-city study, depressed fathers had higher rates of substance abuse.[5] The rate of paternal depression is higher when the mother has postpartum depression, which compounds the effect on children.[5,6] A nondepressed father has a protective effect on children of depressed mothers and is a factor in resilience.[7–9]

Family

Perinatal depression may be comorbid with marital discord, divorce, family violence (verbal and/or physical), substance use and abuse, child abuse and neglect, failure to implement the injury-prevention components from anticipatory guidance (eg, car safety seats and electrical plug covers),[10] failure to implement preventive health practices for the child (eg, Back to Sleep),[10–13] and difficulty managing chronic health conditions such as asthma or disabilities in the young child.[11,14] Families with a depressed parent (ie, any parental depression) overutilize health care and emergency facilities.[14] Studies of families of a person with major depression that began before 30 years of age demonstrate that the parent, siblings, and children are 3 to 5 times more likely to have major depression themselves. It is likely that some types of depression have genetic determinants.

THE IMPACT OF MATERNAL DEPRESSION ON THE INFANT

Maternal postpartum depression threatens the mother-child (dyad) relationship (attachment and bonding) and, as such, creates an environment for the infant that adversely affects the infant's development. The processes for early brain development—neuronal migration, synapse formation, and pruning—are responsive to and directed by environment as well as genetics. For example, it is known that an infant living in a neglectful environment, which is common with depressed mothers, can have adverse changes visible on MRI of the brain.[15,16] Infants who live in a setting of depression are likely to show impaired social interaction and delays in development. If the maternal depression persists untreated and there is not intervention for the mother and the dyadic relationship, the developmental issues (particularly attachment) for the infant also persist and are likely to be less responsive to intervention over time.[17] Addressing maternal depression in a timely and proactive fashion is essential to ensure healthy early brain and child development and readiness to succeed.[18]

In their evidence report, "Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries,"[19] the Agency for Healthcare Research and Quality reviewed 6 prospective cohort studies regarding postpartum depression and breastfeeding. It revealed an association between not breastfeeding, or early cessation of breastfeeding, and postpartum depression. The report noted that "it is plausible that postpartum depression led to early cessation of breastfeeding as opposed to breastfeeding altering the risk of depression." It also noted that both effects might occur and that further investigation is needed to assess the nature of this association.

The consequences of maternal depression include negative effects on cognitive development, social-emotional development, and behavior of the child. Language acquisition depends on the number of words used by the family, playing, and having fun and cuddling with the infant and child,[20] which are likely to occur less frequently in the family of a depressed mother. As early as 2 months of age, the infant looks at the depressed mother less often, shows less engagement with objects, has a lower activity level, and has poor state regulation. Infants are at risk for failure to thrive, attachment disorder (deprivation/maltreatment disorder

of infancy as defined the *Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood: DC0-3R*[21]), and developmental delay on the Bayley Scales of Infant Development at 1 year of age. Such infants are at risk for insecure attachment, which is associated with later conduct disorders and behavior problems. Maternal depression impairs parenting skills and can affect attention to and judgment regarding child supervision for safety and health management. The presence of other risks to healthy parenting, such as poverty, substance abuse, domestic violence, and previous trauma, in addition to depression, creates an increased cumulative risk. The infant's temperament is another factor, which may increase parental stress (difficult temperament) or impart resilience for the infant (easy temperament). Maternal depression in infancy predicts a child's likelihood of increased cortisol levels at preschool age, which in turn has been linked with internalizing problems such as anxiety, social wariness, and withdrawal.[22] Behavior problems, attachment disorders, depression, and other mood disorders in childhood and adolescence can occur more frequently in children of mothers with major depression.

Treating a mother's depression is associated with improvement of depression and other disorders in her child.[24] The STAR*D–Child (Sequenced Treatment Alternatives to Relieve Depression–Child) project is a study that began in December 2001 and followed 151 mother-child pairs in 8 primary care and 11 psychiatric outpatient clinics across 7 regional centers in the United States. The children were assessed every 3 months. The researchers concluded that "continued efforts to treat maternal depression until remission is achieved are associated with decreased psychiatric symptoms and improved functioning in the offspring."[24,25]

THE ROLE OF THE PRIMARY CARE PROVIDER

Many experts see a role for primary care practices in screening for depression, in general, and specifically for postpartum depression. The 1999 report of the Surgeon General on mental health,[26] the 2000 report of the Surgeon General's Conference on Children's Mental Health,[27] and *Bright Futures* guidelines[28] call for early identification and treatment of mental health problems and disorders. In a recent policy statement, "The Future of Pediatrics: Mental Health Competencies for Pediatric Primary Care," the American Academy of Pediatrics (AAP) also recognized the unique advantage of the primary care clinician for surveillance, screening, and working with families to improve mental health outcomes.[29] The AAP Medical Home Initiative[30] and the AAP policy statement on the family[31] addressed family-centered pediatric care. The President's New Freedom Act of 2004 states that early screening, assessment, and treatment of mental health problems must become a national goal.[32] Using data from the National Evaluation of Healthy Steps for Young Children (in the Healthy Steps practices, mothers were assessed for depression), the effect of maternal depressive symptoms on the children's receipt of well-child care was assessed. Minkovitz et al concluded that "Increased provider training for recognizing maternal depressive symptoms in office settings, more effective systems of referral, and development of partnerships between adult and pediatric providers could contribute to enhanced receipt of care among young children."[33]

A recent study from the University of Pittsburgh followed 731 families to examine the effect of intervention for maternal depression on behavior outcomes for children at the ages of 3 and 4 years. The researchers concluded that "reductions in maternal depression mediated improvements in both child externalizing and internalizing problem behavior."[23]

The majority of pediatricians agree that screening for perinatal depression is in the scope of pediatric practice.[34] In a survey by Olson et al,[35] few of the pediatricians felt that they were responsible for diagnosis and management, but the majority reported that they had provided brief interventions. Most of the pediatricians indicated that they had insufficient training to diagnose and treat maternal depression. The Parental Well-being Project of Dartmouth Medical School, which included 6 community pediatric practices in New Hampshire and Vermont, showed that pediatricians, using a simple 2-question screen, could effectively screen for perinatal depression. In the 6 months of the pilot, screening was performed at 67% of well-child visits.

As with other screening (developmental and behavioral, psychosocial) initiatives in practice, there have been perceived barriers to implementation, including lack of time, incomplete training to diagnose/counsel, lack of adequate mental health referral sources, fear that screening means ownership of the problem, and lack of reimbursement.[36] However, since 2000, there have been many successful models of screening in primary care practices, including developmental and behavioral screening, maternal depression screening, and psychosocial screening. In these projects, strategies have been implemented to integrate screening into office flow, to improve reimbursement, and to assist practices with identifying and collaborating with community resources, including mental health resources.[37] The

ABCD (Assuring Better Child Health and Development) Project, funded by the Commonwealth Fund and administered by the National Academy for State Health Policy, now involves 28 states and their AAP chapters. The Medicaid agency in Illinois, one of the ABCD states, pays pediatricians who use the Edinburgh Postpartum Depression Scale. Details of the various state initiatives and practice and parent materials are available at www.abcdresources.org and www.nashp.org. Heneghan et al,[38] in their discussion of factors associated with management of maternal depression by pediatricians, reported that in their sample, 511 of 662 pediatricians reported identifying maternal depression and addressing it in practice. They discussed the practice characteristics and attitudes related to this and the need for changes in attitude and practice to improve identification and management. In their article about the legal and ethical considerations of postpartum depression screening at well-child visits, Chaudron et al concluded: "We believe that from the perspective of feasibility, and now from the legal and ethical standpoints, the benefits of screening outweigh the risks."[39]

The primary care provider (PCP) has a particularly important role in the early identification of maternal depression and facilitation of intervention to prevent adverse outcomes for the infant, the mother, and the family. The PCP may be the first clinician to see the infant and mother after the infant is born; therefore, the PCP has very early access. In addition, it is the PCP who has continuity with the infant and family, and by the nature of this relationship, the PCP practices with a family perspective.

Screening for postpartum depression does not require that the PCP treat the mother. The infant is the PCP's patient. However, the PCP has a role in supporting the mother and facilitating her access to resources to optimize the child's healthy development and the healthy functioning of the family. For the mother, the infant's PCP provides information for family support, therapy resources, and/or emergency services as indicated. The PCP does provide guidance, support, referrals, and follow-up for the infant and the dyad relationship.

IMPLEMENTATION

Over the course of routine well-child care, the PCP and the family are developing a longitudinal relationship. Communication at each visit is tailored to the developmental process for the child and for the family. Anticipatory guidance addresses this dynamic developmental process. A crucial part of this communication is eliciting parent/family/child strengths and risks. Both parental and provider concerns determine the anticipatory guidance discussion.

Screening and surveillance for risk and protective factors are an integral part of routine care and the relationship with the child and family. This communication includes discussion of family support systems and other psychosocial factors such as poverty, parental mental health, and substance use. It begins as early as the prenatal visit. According to a recent AAP statement, a prenatal visit allows for getting to know the parent(s) and is an opportunity to identify any high-risk conditions to anticipate special care needs.[40] In this statement, the AAP also recommended that pediatricians communicate with obstetricians in their community to inform them of their prenatal visit policies so that obstetricians might refer patients for the prenatal visit. This would also provide an opportunity for the pediatrician to become aware of depression during the pregnancy and to plan for support and follow-up of the mother-infant relationship. Perinatal/postpartum depression is an early risk to the infant, to the mother-infant bond, and to the family unit. Surveillance and screening for perinatal/postpartum depression is part of family-centered well-child care. Including postpartum depression screening in the practice's preventive services prompting system can help ensure a reliable process for addressing risk.

The new *Bright Futures* guidelines include surveillance regarding parental social-emotional well-being. The US Preventive Services Task Force has endorsed the Edinburgh Postnatal Depression Scale as well as the general 2-question screen for depression.[2,41] Given the peak times for postpartum depression specifically, the Edinburgh scale would be appropriately integrated at the 1-, 2-, 4-, and 6-month visits. The *Current Procedural Terminology* (CPT) code 99420 is recommended for this screening, recognizing the Edinburgh scale as a measure for risk in the infant's environment, to be appropriately billed at the infant's visit.

The Edinburgh Postpartum Depression Scale is a simple, 10-question screen that is completed by the mother. A score of $\geq$10 indicates risk that depression is present. An affirmative response on question 10 (suicidality indicator) also constitutes a positive screen result. The screen is in the public domain and is freely downloadable. It is available in English and Spanish.

The 2-question screen for depression[41] is:

Over the past 2 weeks:

1. Have you ever felt down, depressed, or hopeless?
2. Have you felt little interest or pleasure in doing things?

One yes answer is a positive screening result. This screen is suitable to indicate risk of depression for adults in

general and is not specific to postpartum depression. Beyond the postpartum period, incorporating surveillance for parental mental health is warranted as well and might be accomplished by use of this 2-question screen.

Responses to a positive postpartum depression screening result range from reassurance (maternity blues) to supportive strategies (maternity blues, minor depression) and referral for specific interventions (minor and major depression). In the situation of milder symptoms, demystification and parent education may be effective in addressing concerns. Demystification lets the mother know that (1) she is not alone (postpartum depression happens to many women to varying degrees), (2) she is not to blame (hormonal changes play a big role), and (3) she will get better. Provision of extra return visits for support may be all the family needs and can build a strong foundation for the ongoing relationship between physician and family. Given the association with cessation of breastfeeding, particular promotion and encouragement of breastfeeding is indicated. When concerns are significant enough to warrant referral, there are several options and considerations. For the mother, particularly if the depression is more than mild, referral for therapy and/or medication may be needed. In some models, mothers have been referred to their obstetricians for follow-up; in others, mothers have been referred to mental health providers or their PCPs. It is important for pediatricians to communicate with the mothers' obstetricians and/or PCPs when these situations arise, because the obstetricians/PCPs will want to know about the mother's depression and may have a better understanding of the mental health system for adults.

When the mother needs specific follow-up for herself, there are often access issues because of uninsured or underinsured status. Community mental health programs may also provide limited services for these mothers. Care for the mother is an advocacy issue for all who serve children and their families, and it is an issue for state AAP chapters to address in states where access for mothers is limited because of state policy and service and payment structure.

If suicidality or psychosis is a concern, or the score on the Edinburgh scale is greater than 20, accessing crisis intervention services for the mother is necessary. In this instance and for other mental health emergencies, the practice should know and use the referral process for local public mental health crisis/emergency services.

Treatment must address the mother-child dyad relationship. For the child and mother together, there are generally more referral options. If the child is in an environment of maternal depression, he or she is at risk for attachment issues, failure to thrive, abuse/neglect, and, ultimately, developmental delay. At the very least, close follow-up of the child in the medical home is warranted. Specific screening for social-emotional development, as well as for general development and behavior, should be included. Pilowsky et al, in the STAR*D–Child (Sequenced Treatment Alternatives to Relieve Depression–Child) study described above, recommended that children of depressed mothers be followed and assessed.[42,43] The infant (with the mother) can be referred to a mental health clinician (with expertise for treatment of very young children) to address the dyad relationship. (Note that, depending on the family situation, this referral might be for the father or both parents.) For women with mild symptoms who need support, it may be enough to refer them to a parent support organization.

There are research-based programs for treatment of the dyad to promote healthy attachment and relationship. These programs include the Circle of Security, parent-child interactive therapy, and child-parent psychotherapy.[44,45] The Circle of Security is a parent education and psychotherapy program. It is an individualized video-based intervention based on attachment theory to strengthen the parents' ability to observe and improve their caregiving capacity. Child-parent psychotherapy is a therapeutic treatment for mothers and young children to increase attachment security.[45]

Referral to early intervention (Part C of the Individuals With Disabilities Education Act) services can provide general developmental intervention (education), which, if performed in the home, also provides mentoring for healthy interaction. If the infant exhibits specific delays, specific therapies can also be provided. (To identify lead agencies and contacts according to state, see www.nectac.org and www.nichcy.org.)

For many families, referral to Early Head Start, Mother's Morning Out programs, or child care is an effective option as well. Mothers may receive services through Healthy Families America, a Nurse-Family Partnership (if the referral occurs prenatally), other evidence-based home-visiting programs, or local volunteer organizations. (To locate Head Start programs, see http://eclkc.ohs.acf.hhs.gov/hslc/HeadStartOffices.)

Whatever the treatment and referral options implemented, follow-up of the infant and mother by the PCP (to monitor progress and to support the family) is necessary.

The AAP Task Force on Mental Health and the Committee on the Psychosocial Aspects of Child and Family Health have promoted collaborative, colocated, and integrated models for mental health services within primary care medical homes. In such settings, social work staff or mental health providers, who are colocated in the practice as part of the care team, can provide immediate triage for positive screening results, support and follow-up for mothers, and linkage and referral for more specialized services. Colocated and integrated mental health providers can perform secondary screenings and collaborate with the PCP for ongoing care.

Concurrent with the implementation of screening, the practice needs to identify support and intervention resources, both within the practice and in the community. Although it is often the case that PCPs do not perceive that there are resources in the community, many public and private resources may be discovered in the process of engaging community partners. Networking with community providers may be a new activity for a primary care practice. It can be accomplished by invitation to a lunch meeting at the practice to discuss the planned screening and referral activities, or a larger meeting called by a group of practices may be possible. Sending out a brief inquiry or survey to local mental health providers or family support groups may yield additional contacts. Partnering with parents in finding community resources is the essence of the medical home.

MODELS AND RESOURCES

- Virginia Bright Futures has a training Web site and has developed a new parent kit that includes information on perinatal depression and is given to 70% of new parents. Virginia Bright Futures partnered with the Virginia chapter of the AAP, the state Early Periodic Screening, Diagnosis, and Treatment (EPSDT), Resource Mothers, and Healthy Families Virginia[47] and recommends adopting perinatal depression screening guidelines in the state budget.
- *Parental Depression Screening for Pediatric Clinicians: An Implementation Manual*, by Ardis Olson, MD (available on the Commonwealth Fund Web site at (www.cmwf.org): In her studies, Olson has found that a 2-question paper-based screen, followed by a brief discussion with the mother and the pediatrician, was both feasible and effective in identifying women who needed follow-ups or referrals. One of the studies examined the difference between a verbal interview and a paper form; the paper screen was found to be far more effective.[35,47,48]
- *Depression During and After Pregnancy: A Resource for Women, Their Families, and Friends* (www.mchb.hrsa.gov/pregnancyandbeyond/depression): This Web site has information for the woman and/or her family about the definition and symptoms of postpartum depression and when to seek treatment.
- National Center for Children in Poverty, Project Thrive (www.nccp.org): The Public Policy Analysis and Education Center for Infants and Young Children at the National Center for Children in Poverty has as its core mission increasing knowledge and providing policy analysis that will help states build and strengthen comprehensive early childhood systems and link policies to ensure access to high-quality health care, early care and learning, and family support. The National Center for Children in Poverty has a document entitled "Reducing Maternal Depression and Its Impact on Young Children" (January 2008) that is an excellent source for pediatricians and AAP state chapters.
- Bright Futures (http://brightfutures.aap.org).
- The American College of Obstetricians and Gynecologists recommends psychosocial screening of pregnant women at least once per trimester (or 3 times during prenatal care) by using a simple 2-question screen and further screening if the preliminary screen result indicates possible depression.[49]
- The National Women's Health Information Center (www.4women.gov) is a federal government source for women's health information.

SUMMARY AND CONCLUSIONS

The primary care pediatrician, by virtue of having a longitudinal relationship with families, has a unique opportunity to identify maternal depression and help prevent untoward developmental and mental health outcomes for the infant and family. Screening can be integrated, as recommended by *Bright Futures* and the AAP Mental Health Task Force, into the well-child care schedule and included in the prenatal visit. This screening has proven successful in practice in several initiatives and locations and is a best practice for PCPs caring for infants and their families. Intervention and referral are optimized by collaborative relationships with community resources and/or by colocated/integrated primary care and mental health practices.

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POLICY STATEMENT

Increasing Antiretroviral Drug Access for Children With HIV Infection

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric AIDS, Section on International Child Health

ABSTRACT

Although there have been great gains in the prevention of pediatric HIV infection and provision of antiretroviral therapy for children with HIV infection in resource-rich countries, many barriers remain to scaling up HIV prevention and treatment for children in resource-limited areas of the world. Appropriate testing technologies need to be made more widely available to identify HIV infection in infants. Training of practitioners in the skills required to care for children with HIV infection is required to increase the number of children receiving antiretroviral therapy. Lack of availability of appropriate antiretroviral drug formulations that are easily usable and inexpensive is a major impediment to optimal care for children with HIV. The time and energy spent trying to develop liquid antiretroviral formulations might be better used in the manufacture of smaller pill sizes or crushable tablets, which are easier to dispense, transport, store, and administer to children.

INTRODUCTION

Background

It is estimated that 540 000 (420 000–670 000) children younger than 15 years were infected with HIV in 2006, mostly through mother-to-child transmission during pregnancy, delivery, or breastfeeding. Effective prevention services, including prenatal HIV testing, perinatal antiretroviral (ARV) prophylaxis, and safe alternatives to breastfeeding, are offered to fewer than 10% of pregnant women worldwide. Because of this global failure in prevention of HIV in children, by the end of 2005 an estimated 2.3 million (1.7–3.5 million) children were living with HIV infection globally; of these children, 2.0 million reside in sub-Saharan Africa.[1]

In the absence of treatment, most infants and children younger than 5 years with perinatally acquired HIV infection experience rapid progression to severe symptomatic disease and death, particularly in resource-limited countries. In a study of almost 3500 children enrolled in 7 perinatal trials in Africa, 35% of infected children had died by 1 year of age, and 53% had died by 2 years of age.[2] In older African children with perinatally acquired HIV infection, most already suffer severe symptoms at the time of diagnosis, including profound growth retardation, and few live to reach adulthood.[3]

In sharp contrast, most children with perinatally acquired HIV infection in resource-rich countries are treated early with highly active ARV therapy (ART).[4,5] Such ART, consisting of a combination of 3 or more potent ARV drugs, has been shown to dramatically modify the course of HIV infection in children, reducing

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Key Words
HIV, children, antiretroviral therapy, drug formulations

Abbreviations
ARV—antiretroviral
ART—antiretroviral therapy
PEPFAR—President's Emergency Plan for AIDS Relief
WHO—World Health Organization
FDA—Food and Drug Administration
FDC—fixed-dose combination

mortality by fivefold or more and resulting in high survival rates (>90%) into adulthood.[6–8]

There are now intensive efforts by governments as well as multilateral and nongovernmental organizations to increase the number of people being treated with ART in resource-limited parts of the world (eg, the Global Fund, the US government–sponsored President's Emergency Plan for AIDS Relief [PEPFAR], the World Health Organization [WHO]– and United Nations–led "3 by 5 Initiative" and Universal Access, the Clinton Foundation). It is estimated that children accounted for approximately 15% of the 5 million new HIV infections that occurred globally in 2005. The rapid progression to death disproportionately decreases the number of children living with HIV to approximately 6% of the total infected population. In 2005, it was estimated that at least 660 000 children were in need of ART.[1] Of those, 90% live in sub-Saharan Africa. However, fewer than 5% of those who receive ART through the WHO 3 by 5 Initiative are children,[1] and through March 2005 only an estimated 9500 children living in PEPFAR "focus countries" were treated under PEPFAR funding.

Initial WHO guidelines on ART in 2002 (updated in 2003) included only one chapter on ARV management for HIV-infected children.[9] These guidelines have been updated as a pediatric-dedicated guideline document,[10] driven by the recognition that children have lagged severely behind adults in receiving ART and that there are numerous barriers to delivery of ART to children in resource-limited settings.[1,11]

Providing all pregnant women with the most effective prevention services possible within local settings, including prenatal care, HIV diagnosis, ARV prophylaxis, and appropriate feeding options, is important for minimizing the risk of HIV infection for their child. For children infected with HIV, overcoming barriers that limit access to ART is critical, and the enormous scale of the problem makes this an issue of worldwide concern. These issues have been addressed by organizations that are actively involved in prevention of mother-to-child transmission of HIV, deliver ART to children worldwide, and train practitioners in the appropriate use of ART. These organizations include the WHO, the Baylor International Pediatric AIDS Initiative,[12] the Elizabeth Glaser Pediatric AIDS Foundation (see "What About Us" at www.pedaids.org/News/Publications/Other/Children_s%20Battle%20to%20Access%20AI.aspx), Medecins Sans Frontieres, the Children's HIV Association of UK and Ireland, the Forum for Collaborative HIV Research (www.hivforum.org/projects/Pediatric%20Formulations.htm), and the Clinton Foundation.

This statement lists these barriers and potential ways to overcome them and provides strong support for the critical and urgent need for provision of ART to HIV-infected children globally. Multiple pediatric organizations throughout the world have endorsed this statement (see "Organizations That Endorsed This Statement").

Barrier 1: HIV Diagnostic Testing

Barriers to testing infants and children for HIV infection lead to a delay in diagnosis, and many infants and young children die before HIV is diagnosed or therapy can be given. Most pediatric HIV infections worldwide are attributable to mother-to-child transmission, with transmission occurring during pregnancy, around the time of birth, or through breastfeeding. Special tests are needed to diagnose HIV infection in infants and young children.

For adults and children older than 18 months, diagnosis of HIV infection is made by identification of antibodies to HIV in serum. However, because of the passive transplacental transfer of maternal HIV antibodies to the infant, newborn infants and children younger than 18 months will often test positive for the presence of anti-HIV antibodies even in the absence of true infection. Therefore, definitive diagnosis of HIV infection among infants and children younger than 18 months often requires the use of HIV-specific RNA or DNA nucleic acid tests to detect the virus itself,[13] instead of the inexpensive and readily available serologic assays that can be used in adults and children older than 18 months. These HIV-specific RNA or DNA assays are more expensive and more complex to perform and are not available in many areas of the world in which the risk of HIV infection in infancy is highest. In such settings, HIV antibody testing may be used to exclude HIV infection in nonbreastfed infants older than 9 to 12 months, because loss of passively transmitted maternal HIV antibody (seroreversion) occurs by 12 months of age in 95% of HIV-exposed but uninfected infants.[14]

Appropriate use of these nucleic acid tests requires that exposure of the infant or young child to HIV be identified by determination of maternal HIV-infection status. Ideally, this would occur before or during pregnancy. However, communication of maternal HIV-infection status from the mother's health care professional to the child's health care professional often does not occur. The linking of infant exposure to maternal infection will require system changes to optimize infant testing. The lack of appropriate testing in the youngest age group with the highest risk of HIV-related death prevents ART from being used in the very infants and young children who could potentially benefit the most from treatment with ARV drugs. To allow for early identification of HIV-infected infants and young children younger than 18 months, appropriate virologic testing technologies must be made available in resource-limited settings.

Psychological barriers to testing infants also may lead to a delay in diagnosis. The social stigma of the diagnosis for mother and child[15] and lack of treatment availability[16] may keep women from testing themselves to learn their

own HIV status and testing their children for HIV. Community-wide fear of discussing HIV infection in children may compound the effect of this barrier.

Barrier 2: Clinicians to Provide Care for Children With HIV

Even where appropriate HIV diagnostic testing is available and drugs for treatment of HIV infection and prophylaxis for HIV-associated infections are accessible, lack of personnel trained in treatment of children with HIV severely limits access to treatment for large numbers of children. In many areas of the world, medical care is provided by physicians, nurses, and other clinicians with training and experience in the management of adult, but not pediatric, patients. Even the best programs for training health care professionals in the principles of HIV care for children offer little practical exposure to treating pediatric patients, which is time- and resource-intensive. Some programs send health care professionals from resource-rich areas of the world to resource-limited areas to train local practitioners (eg, Medecins Sans Frontieres, the Baylor Pediatric AIDS Corps, the Clinton Foundation, the Children's HIV Association of UK and Ireland, UK/Kwazulu-Natal, the South Africa Collaboration). Additional efforts are needed to expand the availability of clinicians who are skilled in pediatric HIV care in resource-limited areas of the world,[17] including integrating pediatric HIV care into existing comprehensive child health programs, expanding local networks of experienced health care professionals, and linking local clinicians with local, regional, and international experts.

Barrier 3: ARV-Drug Formulations

Assuming that appropriate HIV diagnostic testing is available and the necessary clinical personnel are available to provide care and treatment to HIV-infected children, appropriate formulations of ARV agents for children are also necessary. Lack of availability of appropriate ARV formulations that are inexpensive and easily usable is a major impediment to access to economical health care for children with HIV. As of September 2005, 21 ARV agents were approved by the US Food and Drug Administration (FDA) for use in HIV-infected adults and adolescents older than 16 to 18 years in the United States, but only 13 were approved for children and adolescents younger than 16 to 18 years, and only 11 have pediatric formulations available[4] (see www.aidsinfo.nih.gov/other/cbrochure/english/13_en.pdf for a complete listing of HIV medications available in oral [liquid, capsule, and tablet] and intravenous formulations).

Because of the lack of appropriate pediatric formulations for certain drugs, caregivers of pediatric HIV patients may break or crush tablets meant for an adult patient in an attempt to produce child-size doses. With tablets that are asymmetric or not scored, this may lead to administration of erratic and inappropriate doses. Even with symmetrical tablets scored in the middle, the large quantity of medication in pills meant for adult use could mean that accurately breaking a scored tablet in half might not allow administration of a dosage small enough for an infant or young child, nor will it allow the incremental increases in doses required as the child grows. This problem can be addressed by developing products that contain smaller drug amounts per tablet or tablets that are scored to allow division accurately into halves or quarters. For regulatory purposes, bioequivalence studies may need to be performed by using the divided pills. Drug companies that are currently developing such drug formulations are to be commended.

Even when liquid formulations are available, special requirements and characteristics of such formulations may preclude their widespread use. For example, liquid drug formulations often require special storage such as refrigeration. The large volume of liquid formulations dispensed to allow ART to continue uninterrupted between clinic visits may make use of such drugs difficult in settings where transportation and storage are a challenge. For example, a 10-kg child who is being treated with standard doses of stavudine, lamivudine, and nevirapine, for whom a 3-month supply of drugs is dispensed at a clinic visit, would require 18 bottles of liquid that weigh almost half as much as the child (4.3 kg). For a rural family who may have walked a long distance to reach the clinical center, this is a significant issue. One commonly used ARV agent (zidovudine) requires high volumes of liquid and storage in brown glass bottles, which adds difficulty to treatment efforts.

Another problem with liquid formulations is the taste. When liquid formulations are developed, the taste is often so unpleasant that they may be practically unusable. Bad-tasting drugs are a well-recognized factor in treatment failures in children and lead practitioners to try many approaches to improve palatability of ARV drugs for children. When these attempts fail, some practitioners in resource-rich countries sometimes resort to insertion of gastrostomy tubes for medication administration.[18–20]

Finally, liquid formulations may contain excipients (additives to maintain the drug in solution) that could be harmful to children. For example, the oral solution of amprenavir has a high content of propylene glycol and vitamin E and should not be used in children younger than 4 years; other liquid formulations may contain high amounts of alcohol. Liquid formulations may contain high concentrations of sugar, which can be detrimental to dental health—a particular problem for children with HIV, many of whom have severely decayed teeth.

Although pharmaceutical companies may spend time and resources attempting to formulate different ARV medications into liquid formulations, this approach may not enable widespread, global access to ART for children. Such time and resources might be better used in the development of formulations that are more acceptable to

children and families than some of the liquid formulations that are currently available. Specifically, in addition to production of appropriate liquid formulations, development of the following should be strongly considered: (1) smaller tablets; (2) tablets in which active drug is uniformly distributed and in shapes that can be easily and accurately divided into halves or quarters to administer smaller doses; (3) capsule sprinkle formulations that can be opened and mixed with food; or (4) tablets that can be crushed, dissolved in water, or chewed.

Barrier 4: Appropriate Dosing of ARV Drugs in Children

Even when appropriate formulations of ARV agents are available for children, pharmacokinetic data may be insufficient to appropriately guide drug dosing, especially in the youngest children, who metabolize these drugs differently,[21] but also in adolescents, who may need higher than the "maximum adult dose" for adequate drug exposure.[22] For many available drugs, dosage recommendations made by European or US guideline-writing groups on the basis of pharmacokinetic and clinical studies in children may differ from doses approved by the FDA and European Medicines Agency.[4,5] The variability of drug exposure achieved by administration of "standard doses" of ARV drugs to children results in wide differences in plasma concentrations for many drugs, and some suggest the need for monitoring drug plasma concentrations in children to improve therapeutic outcomes[23]; this is clearly not practical in resource-limited settings.

Completion of the appropriate studies of new ARV agents for use in children younger than 13 years lags behind those in adults. Although it may be appropriate to perform initial phase 1 or 2 studies in adults for initial determination of drug safety, pharmacokinetic studies in children need to follow along quickly to ensure that when the drugs are approved and available for use in adults, information is already available to define appropriate use in children. When new formulations are developed to allow once-daily dosing in adults, these formulations need to be appropriately tested in children, and regulatory approval needs to be gained through the FDA or European Medicines Agency to ensure that the advantages of once-daily dosing become more widely available to children and younger adolescents 13 to 18 years of age. This is particularly critical for life-threatening diseases such as HIV. Government regulations need to be tightened to enforce this approach to pediatric drug development and approval. International cooperation is crucial for successful completion of pharmacokinetic studies of ARV medications in children.

Earlier evaluation of ARV-drug safety and pharmacokinetics in children is needed so that when new ARV formulations are approved for use in adults, there are also preparations available for children; enough information about drug pharmacokinetics in children is available to allow rational dosing recommendations.

Appropriate dosing of drugs in pediatric patients requires measurement of weight and height and the complex calculation of body surface area. The requirement for different doses according to age, weight, and body surface area may put accurate prescribing and safe dispensing of ART and other drugs to pediatric patients beyond the reach of many of the front-line health care professionals who manage children with HIV. Dosing by weight band (recommending a specific dose for an all-inclusive range of weights, so that complex dosing calculations are not needed) has been recommended (see http://bayloraids.org/resources/DosingGuide.pdf), and studies of this approach have shown safety and efficacy for patients as well as acceptability to practitioners.[24,25] Additional work on this approach is needed, including educating practitioners in its safety and effectiveness. Simplified dosing guides have been developed by the WHO and are readily available to clinicians who care for children and adolescents with HIV infection in resource-limited settings (see www.who.int/hiv/paediatric/en/index.html). These guides will increase the accuracy of dosing and dispensing ARV medications to these patients.

Barrier 5: Other Issues Related to ARV Drugs for Infants, Children, and Adolescents With HIV Infection

Many drugs are now being coformulated into tablets that contain 2 or 3 different ARV agents. These fixed-dose combinations (FDCs)[26–28] are easier to prescribe and dispense, which minimizes errors. A lower pill burden may enhance patient adherence to therapy. Many FDCs have been developed as generic drugs and are offered in resource-constrained settings at reduced prices, thus improving availability of ARV medications for adults in many areas of the world.

FDCs for adults cannot just be cut or directly scaled down for children without appropriate pharmacokinetic studies,[29] because the component medications may be required in different proportions for children than adults. Moreover, if the tablets are not formulated in equal layers, breaking the tablet may result in unequal doses being administered. FDCs are not currently available for children. Developing FDCs that are appropriately formulated for children should be a high priority for pharmaceutical companies.[11] In addition, development of pediatric FDCs as generic drugs, which are more affordable, will enhance availability of FDCs for use in children as it has in adults. However, with generic formulations being manufactured in many countries, formulations need to be standardized to minimize prescribing errors that might occur if pills are supplied in nonstandard sizes.

Drug administration to children is more complex than it is to adults. Finding the best way to get liquids out of a bottle and measured appropriately while avoiding spillage and fully using all of the medication in a bottle is not necessarily straightforward. Syringes enhance dos-

ing accuracy, but without the use of special bottle tops, there may be wastage of liquid left in the bottom of a bottle or spillage when trying to get to the liquid at the bottom. Dividing or crushing tablets takes time and may diminish adherence if it is too difficult. These issues of ease and accuracy of drug administration need to be considered in the effort to increase access to ART for children.

SUMMARY AND RECOMMENDATIONS

To increase the availability and appropriateness of the use of ARV medications for children, the following are suggested ways of overcoming the aforementioned barriers.

Barrier 1: HIV Diagnostic Testing

- Enhance early identification of infants with HIV infection by making appropriate virologic testing technologies available throughout the world.
- Support political, religious, and other community leaders in their endorsement of the value of HIV testing linked to treatment and prevention. Cultural leaders need to demonstrate acceptance and community support of HIV-infected individuals.

Barrier 2: Clinicians to Provide Care for Children With HIV Infection

- Work to expand education of practitioners in the care of children with HIV and expand the number of such practitioners in resource-limited areas of the world.
- Integrate pediatric HIV care into comprehensive child health programs.
- Facilitate collaboration among experts to build capacity and expand expertise in areas of need.

Barrier 3: ARV-Drug Formulations

- Produce pill formulations in smaller milligram amounts and smaller pill sizes.
- Configure tablets so they can be divided easily. This requires that thought be given to production of scored tablets of symmetrical shape with uniform dispersal of active drugs within the tablet, which can be divided accurately and then easily crushed or dissolved.
- In addition to production of liquid formulations, consider production of other formulations for pediatric use, including tablets for dispersal, chewable tablets, or sprinkle formulations.
- Consider best-possible attributes of liquid formulations, including taste, color, consistency, and the highest concentration possible, but recognize that the extra time and expense needed to develop a liquid formulation may be at too high of a cost if it delays availability of medications that are appropriately formulated for infants and children.
- Expedite the availability of new drugs for use in children by requiring that pediatric formulations (liquids and/or appropriate tablet dosage forms and sizes) be available at the time of country approval of the use of the drug in adults unless there is a biological imperative not to develop the drug for use in children.
- Develop formulations and perform necessary studies to allow once-daily dosing in children at the same time as planned for adults.

Barrier 4: Appropriate Dosing of ARV Drugs in Children

- Require studies of drug pharmacokinetics in infants, children, and adolescents at the time that phase 2 and 3 studies are being conducted in adults so that when drugs are approved for use in adults, there is adequate information to allow their appropriate dosing in each of those specific age groups.
- Provide dosing tables for pediatric formulations, preferably weight-band–based tables, to increase the accuracy of dosing and dispensing ART to children.

Barrier 5: Other Issues Related to ARV Agents for HIV-Infected Infants, Children, and Adolescents

- Increase the availability of FDCs for pediatric use.
- Make pediatric formulations affordable in the manner that adult formulations have been made more affordable in many countries.
- Provide drug-administration devices and tools with medications (eg, syringes, bottle tops for use with syringes, medicine spoons, tablet cutters, tablet crushers) and devices to aid adherence, including pill boxes that can accommodate a month's worth of pills or calendars with medications attached.

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Baylor International Pediatric AIDS Initiative
British HIV Pharmacy Association (HIVPA)
British Pediatric Allergy, Immunity and Infection Group (United Kingdom)
Canadian Paediatric Society
Children's HIV Association of the UK and Ireland (CHIVA)
Elizabeth Glaser Pediatric AIDS Foundation
Pediatric European Network for Treatment of AIDS (PENTA)
Pediatric Infectious Diseases Society
Indian Academy of Pediatrics
International Pediatric Association
Latin American Pediatric Association (ALAPE)
Pediatric Association of Jamaica
Pediatric Society of Thailand
Royal College of Pediatrics and Child Health (United Kingdom)
South African Pediatric Association (SAPA)
Southern African HIV Clinicians Society
Union of National African Pediatric Societies and Associations (UNAPSA)
World Health Organization (WHO)

APPENDIX 1: INTERNET ADDRESSES OF ORGANIZATIONS REFERRED TO IN THIS POLICY STATEMENT

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www.anecca.org
Baylor International Pediatric AIDS Initiative
http://bayloraids.org
Children's HIV Association of the UK and Ireland (CHIVA)
www.bhiva.org/chiva
Clinton Foundation
www.clintonfoundation.org/cf-pgm-hs-ai-home.htm
Elizabeth Glaser Pediatric AIDS Foundation
www.pedaids.org
Forum for Collaborative HIV Research
www.hivforum.org
Global Fund to Fight AIDS, Tuberculosis and Malaria
www.theglobalfund.org/en
Medecins Sans Frontieres (MSF)
www.msf.org
Pediatric European Network for Treatment of AIDS
www.pentatrials.org
President's Emergency Plan for AIDS Relief (PEPFAR)
www.usaid.gov/our_work/global_health/aids/pepfarfact.html
United Nations: Joint United Nations Program on HIV/AIDS (UNAIDS)
www.unaids.org/en
http://data.unaids.org/pub/GlobalReport/2006
World Health Organization (WHO)
www.who.int/en

APPENDIX 2: INTERNATIONAL COLLABORATORS

The following people were instrumental in arranging to have their respective organizations sign on in support of this document. The American Academy of Pediatrics appreciates their help with this endeavor and especially appreciates their ongoing efforts in care of children with HIV.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Increasing Immunization Coverage

COMMITTEE ON PRACTICE AND AMBULATORY MEDICINE AND COUNCIL ON COMMUNITY PEDIATRICS

KEY WORDS

immunization, vaccines, immunization coverage, increasing immunization coverage, vaccine financing, vaccine supply, vaccine safety, immunization information system, reminder-recall, missed opportunities, risk communication, refusal to vaccinate

ABBREVIATIONS

AAP—American Academy of Pediatrics
VFC—Vaccines for Children
VIS—vaccine information statement
DTaP—diphtheria and tetanus toxoids and acellular pertussis
Hib—*Haemophilus influenzae* type b
HBV—hepatitis B virus
MMR—measles-mumps-rubella
IPV—inactivated poliovirus
VZV—varicella-zoster virus
Td—tetanus toxoids and diphtheria booster
TdaP—tetanus-diphtheria-acellular pertussis booster
HPV—human papillomavirus
CDC—Centers for Disease Control and Prevention
ISO—Immunization Safety Office
NVAC—National Vaccine Advisory Committee
WIC—Special Supplemental Nutrition Program for Women, Infants, and Children
IIS—immunization information system

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abstract

FREE

In 1977, the American Academy of Pediatrics issued a statement calling for universal immunization of all children for whom vaccines are not contraindicated. In 1995, the policy statement "Implementation of the Immunization Policy" was published by the American Academy of Pediatrics, followed in 2003 with publication of the first version of this statement, "Increasing Immunization Coverage." Since 2003, there have continued to be improvements in immunization coverage, with progress toward meeting the goals set forth in *Healthy People 2010*. Data from the 2007 National Immunization Survey showed that 90% of children 19 to 35 months of age have received recommended doses of each of the following vaccines: inactivated poliovirus (IPV), measles-mumps-rubella (MMR), varicella-zoster virus (VZB), hepatitis B virus (HBV), and *Haemophilus influenzae* type b (Hib). For diphtheria and tetanus and acellular pertussis (DTaP) vaccine, 84.5% have received the recommended 4 doses by 35 months of age. Nevertheless, the *Healthy People 2010* goal of at least 80% coverage for the full series (at least 4 doses of DTaP, 3 doses of IPV, 1 dose of MMR, 3 doses of Hib, 3 doses of HBV, and 1 dose of varicella-zoster virus vaccine) has not yet been met, and immunization coverage of adolescents continues to lag behind the goals set forth in *Healthy People 2010*. Despite these encouraging data, a vast number of new challenges that threaten continued success toward the goal of universal immunization coverage have emerged. These challenges include an increase in new vaccines and new vaccine combinations as well as a significant number of vaccines currently under development; a dramatic increase in the acquisition cost of vaccines, coupled with a lack of adequate payment to practitioners to buy and administer vaccines; unanticipated manufacturing and delivery problems that have caused significant shortages of various vaccine products; and the rise of a public antivaccination movement that uses the Internet as well as standard media outlets to advance a position, wholly unsupported by any scientific evidence, linking vaccines with various childhood conditions, particularly autism. Much remains to be accomplished by physician organizations; vaccine manufacturers; third-party payers; the media; and local, state, and federal governments to ensure dependable vaccine supply and payments that are sufficient to continue to provide immunizations in public and private settings and to promote effective strategies to combat unjustified misstatements by the antivaccination movement.

Pediatricians should work individually and collectively at the local, state, and national levels to ensure that all children without a valid contraindication receive all childhood immunizations on time. Pediatricians and pediatric organizations, in conjunction with government agencies such as the Centers for Disease Control and Prevention, must communicate effectively with parents to maximize their understanding of the overall safety and efficacy of vaccines. Most parents and children have not experienced many of the vaccine-preventable diseases, and the general public is not well informed about the risks and sequelae of these conditions. A number of recommendations are included for pediatricians, individually and collectively, to support further progress toward the goal of universal immunization coverage of all children for whom vaccines are not contraindicated. *Pediatrics* 2010;125:1295–1304

BACKGROUND INFORMATION

In 1977, the American Academy of Pediatrics (AAP) issued a statement calling for universal immunization of all children for whom vaccines are not contraindicated.[1] Most immunizations in the United States are provided by private health care providers. Data from the 2004 National Immunization Survey show that 60.4% of children were vaccinated solely by a private health care provider, and an additional 24.2% received at least some of their vaccinations from a private provider.[2] Immunizations protect the individual child being vaccinated, but for most vaccine-preventable diseases, achieving high levels of immunization in the community offers indirect protection to others, because they are not exposed to infectious organisms. Children with contraindications to some vaccines, such as children with immunodeficiencies, who cannot receive measles vaccine, are indirectly protected when there is high coverage with measles-containing vaccines around that child. The 1995 AAP policy statement "Implementation of the Immunization Policy"[3] supported specific guidelines for improving the vaccine-delivery system and increase immunization rates. Many of the 1995 recommendations have been achieved, including the expansion of immunization financing through the Vaccines for Children (VFC) program,[4] production of parent-friendly vaccine information statements (VISs), promotion of the standards for child and adolescent immunization practices,[5] and development of safer and combination vaccines. Additional recommendations in the initial policy statement included (1) sending parent reminders for upcoming visits and implementation of client reminder/recall systems, (2) using prompts during all office visits to remind parents and staff about immunizations needed at that visit, (3) repeatedly measuring practice-wide immunization rates over time as part of a quality-improvement effort, and (4) having in place standing orders for nurses, physician assistants, and medical assistants to identify opportunities to administer immunizations, unless such standing orders are prohibited by statute or other regulation.[6]

Childhood immunization rates are one of the leading health indicators used to assess the health of the nation as part of the US Department of Health and Human Services' *Healthy People 2010* initiative.[7] *Healthy People 2010* set targets for immunization coverage rates for children and adolescents, for individual vaccines, and for the aggregate series of vaccines. For children 19 through 35 months of age, *Healthy People 2010* set a target of 90% coverage for each of the following: 4 doses of diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine, 3 doses of *Haemophilus influenzae* type b (Hib) vaccine, 3 doses of hepatitis B virus (HBV) vaccine, 1 dose of measles-mumps-rubella (MMR) vaccine, 3 doses of inactivated poliovirus (IPV) vaccine, and 1 dose of varicella-zoster virus (VZV) vaccine.[8] For children who attend licensed child care and children in kindergarten through first grade, an additional target of 95% coverage was set for the DTaP, MMR, and IPV vaccines.[9] An aggregate target for children in the 19- to 35-month age group was set for a minimum of 80% coverage for the full set of vaccines, referred to as 4:3:1:3:3:1 (at least 4 doses of DTaP vaccine, 3 doses of IPV vaccine, 1 dose of MMR vaccine, 3 doses of Hib vaccine, 3 doses of HBV vaccine, and 1 dose of VZV vaccine).[10] For teenagers 13 to 15 years of age, *Healthy People 2010* sets a target of 90% coverage for each of the following: at least 3 doses of HBV vaccine, 2 doses of MMR vaccine, 1 or more doses of a tetanus-diphtheria booster (tetanus toxoids and diphtheria booster [Td] or tetanus-diphtheria-acellular pertussis booster [TdaP] vaccine), and 1 or more doses of VZV vaccine (excluding those who have had varicella disease).[11]

CHALLENGES

With the implementation of many of the recommendations from the 1995 AAP policy statement[3] as well as the revised version published in 2003,[6] much progress has been made toward achieving universal immunization, which was announced as a goal of the AAP in 1977. According to data from the 2007 National Immunization Survey, although only 77.4% of US toddlers 19 to 35 months of age had completed the combined immunization series (4:3:1:3:3:1) described previously,[7] individual coverage for each of these vaccines, with the exception of the 4-dose series of DTaP vaccine, exceeded 90% for the first time. In 2007, 95.5% of children 19 to 35 months of age had received at least 3 doses of DTaP vaccine, and 84.5% had received 4 doses of DTaP vaccine.[12] Although the Institute of Medicine, in its 2000 report on vaccine financing, cited differences in vaccination rates on the basis of race/ethnicity, poverty, and location in inner-city or rural areas versus suburban areas,[13] data from the 2007 National Immunization Survey showed similar vaccination rates for the 4:3:1:3:3:1 series for all ethnic/racial groups after controlling for poverty status and a difference in immunization rate of only 3.2% when comparing children at or above the poverty level with children living below the poverty level.[12] Also encouraging are recent data that showed rates of immunization coverage for American Indian/Alaska Native children to be comparable to those of white children.[12] There have been, and will continue to be, challenges to the vaccine-delivery system in terms of the science, economics, and social impact

of immunization, and these challenges have only increased as new vaccines and new vaccine combinations have been developed. Although new vaccines have the potential to improve the health of America's children, they have increased the burden on an already strained vaccine-delivery system.[14] Today's vaccine-delivery system is actually a poorly integrated set of separate systems that include vaccine production, distribution, and financing. Immunization coverage of adolescents is a special challenge, and rates for adolescent immunization remain below targets set by *Healthy People 2010*. For example, data from the National Immunization Survey showed that for teenagers 13 to 17 years of age, only 30.4% had received TdaP vaccine, and only 72% had received at least 1 dose of either Td or TdaP vaccine after 10 years of age.[15] Only 32.4% of adolescents had received meningococcal conjugate vaccine, and only 25.1% of female adolescents had initiated the 3-dose human papillomavirus (HPV) series. Coverage rates for some vaccines were higher but still below the *Healthy People 2010* targets for adolescents 13 through 15 years of age; only 89% of these adolescents had received at least 3 doses of HBV vaccine, 69% had received at least 2 doses of MMR vaccine, and 80% of those without a history of varicella disease had received at least 1 dose of VZV vaccine.[15]

Disruptions of Vaccine Supply

Shortages of specific vaccines during 2001–2002 brought to light the fragile nature of the US childhood vaccine supply and resulted in significant disruptions to childhood immunizations. Subsequent to the last publication of this statement in 2003, there have been increasingly disruptive shortages in vital vaccines. Over the past 10 years, shortages of heptavalent pneumococcal conjugate, Hib, HBV, influenza, hepatitis A virus, VZV, and meningococcal conjugate vaccines have led to missed opportunities to immunize and have placed a large administrative burden on the delivery system. Some of these disruptions have lasted for an extended period of time; for example, the recent shortage of Hib vaccine has left a cohort of children not fully immunized with their final dose of Hib vaccine. Shortages of vaccines may lead to parental anxiety and increased demands on the practice setting. Children who fall behind in their coverage because of these systemic delivery disruptions should be tracked and then encouraged to return for these missed vaccine doses by using a reminder/recall system, which will be more easily accomplished with the adoption of electronic health records.

High Vaccine-Acquisition Costs and Inadequate Payment

With the introduction of VZV and heptavalent pneumococcal conjugate vaccines, a new era of higher-cost vaccines began. The introduction of other new vaccines, such as rotavirus and HPV, and combination vaccines such as Pediarix (GlaxoSmithKline Biologicals, Rixensart, Belgium) (HBV, IPV, DTaP) and Pentacel (Aventis Pasteur, Toronto, Ontario, Canada) (Hib, IPV, DTaP), as well as new indications for additional doses of existing vaccines, further increased the acquisition cost and complexity of delivering childhood immunizations. The introduction of HPV vaccine, with its single-dose acquisition cost of more than $120, brought this issue into acute focus. Estimates from the Centers for Disease Control and Prevention (CDC) for the cost of fully immunizing an otherwise healthy child through the age of 18 years, based on the VFC federal acquisition-cost data chart, indicate that the total acquisition cost has increased to more than $900 for boys and more than $1200 for girls, which represents more than a sixfold increase since 1995.[16] These increased acquisition costs are primarily the result of the addition of new vaccines or substitution of newer vaccines for older products by vaccine manufacturers (eg, IPV replacing oral poliovirus vaccine), as well as regular increases in the acquisition cost of older products, which often go unrecognized and unpaid by third-party payers.

Although payment for nearly all vaccines is available through either public or private sources, the high cost of buying, storing, and administering these products has increased to the point that the financial viability of many clinics and private practices is threatened unless realistic payments are provided. For some physicians, the strong desire to provide complete and timely immunizations to their patients is no longer sufficient to overcome these financial barriers. Even with universal purchase of vaccines, the administrative payment level varies tremendously and is often inadequate to justify the actual cost of administering the recommended immunizations, particularly by the Medicaid program, but also by other third-party payers. Third-party payers do not consistently pay at a level adequate to cover the cost of acquisition, storage, and administration of recommended vaccines to their intended recipients. Private payers often delay their coverage of new vaccines and fail to maintain adequate payment as acquisition costs increase, thereby resulting in payments that are insufficient to cover the costs of procuring and delivering vaccines. In a recent survey, half of the pediatricians and family physicians responded that they had delayed purchase of specific new vaccines because of financial reasons, and 5% of pediatricians and 20% of family physicians reported that they were seriously considering discontinuing the vaccination of privately insured patients because of vaccine-

acquisition cost, administration, and payment issues.[17] This will be a larger problem for rural children and children who live in sparsely populated areas with shortages of pediatricians, where family practitioners are called on to provide the bulk of pediatric care. Should the financial situation worsen, the potential remains for more physicians, including pediatricians, to discontinue providing immunization services.

The public sector now purchases more than half of all vaccines administered in the United States through 3 sources of public funding: the federal VFC program, Section 317 federal discretionary grants, and state funds. Children who are eligible for the VFC program include uninsured children and recipients of government-funded health coverage such as Medicaid and the Children's Health Insurance Program in some states, children identified as Alaska Native/American Indian, and underinsured children if they receive vaccine at federally qualified health centers or rural health clinics. States also use Section 317 discretionary funds and their own funds to provide vaccines to children who are not covered by the VFC program or private third-party insurance.

The availability of vaccines through the VFC program and other government sources can be confusing. The VFC program is governed by a set of federal rules that define eligibility. Although VFC eligibility rules do not vary according to state, rules that govern Medicaid eligibility do vary according to state, thereby leading to variation in eligibility for VFC vaccines. These different Medicaid eligibility rules lead to disparities in access, with some states allowing VFC use for children from families with income up to 400% of the federal poverty level, whereas other states may limit VFC use to families with income only 100% of the poverty level. The burden of record-keeping in the practice setting and inconsistencies in vaccine supply for vaccines funded through Section 317 and other funds places a large administrative burden on practices that elect to participate in these programs. Although the VFC program includes coverage for all CDC-recommended vaccines, variations in supply of vaccines covered by other vaccine sources as well as privately sourced vaccines introduce further complexity for practices that participate in these programs. In some states, such as Georgia, state funds are used to expand the supply of publicly available vaccines by adding these additional vaccine types to their VFC inventory of vaccines, which leads to yet more confusion for providers. Many states prohibit the interchange of VFC-sourced vaccines with private-sourced vaccines, which leads to the uncomfortable situation of having different vaccines available in the office for different groups of patients. In practices that care for both publicly and privately insured patients, these differences in vaccine availability, acquisition cost, and delivery lead to administrative confusion, vaccine-administration errors, and financial uncertainty. In many states, payments for the administration of VFC vaccines are less than the actual costs of administration, further eroding physician participation in the VFC program. Also, although Medicaid may attempt to cover administration costs for its beneficiaries, providers who care for other children enrolled in the VFC program, such as those who are uninsured, are not entitled to payment for their administrative costs of vaccination. Clearly the current "public-private partnership" for purchase, distribution, and administration of immunizations must be redesigned to maintain a consistent supply of vaccines at an acquisition cost that is predictable. This partnership also needs to provide funding to compensate providers for storage, administration, and overhead that is sufficient to motivate practitioners to continue to participate in immunization services. Given the fact that the vast majority of immunizations are now administered by private-sector providers, it is unlikely that the public sector has the infrastructure to immunize the numbers of children who would be referred to it if private providers stopped administering vaccines. Current levels of payment to pediatricians for administration of vaccines by Medicaid and many private payers are far less than Medicare payments for administration of vaccines to adults, although administering vaccines to consenting adult patients takes significantly less work than administering vaccines to children, who are frequently nonverbal and less cooperative. Furthermore, payment for the administration of combination vaccines should be increased above that of single-component vaccines, or calculated on a per-component basis, in recognition of the fact that the additional components require additional effort on the part of the provider to explain the risks and benefits of each, and the payment should not be lower than that for the individual-component vaccines. The National Vaccine Advisory Committee recently issued a report listing 24 recommendations to ensure adequate supply, distribution, and administration of vaccines in the United States, including the elimination of the financial barriers described previously.[18]

Safety Concerns and Media Distortion

Another significant challenge to immunization delivery is the increasing concern within a segment of the general public about the safety and potential adverse effects of childhood immunizations. New and existing organizations and Web sites that portray

themselves as official resources for credible information on vaccines continue to appear on the Internet. These sites provide flawed or biased information that serves to fuel public concern regarding the safety of childhood immunizations, which leads to increased rates of immunization refusal or delays in on-time immunization.[19] Celebrity opponents to vaccination, who are given national coverage by broadcast and cable networks because of their celebrity status, argue their case without scientific support or expert rebuttal. Adding further confusion to the public debate, well-known physicians have also published books that make recommendations, without any scientific or evidentiary basis, for altered vaccine schedules that contradict AAP and CDC recommendations. As a result, pediatricians are seeing an increasing number of parents who are demanding alternate schedules or completely refusing immunizations.[20] Pediatricians find themselves spending large amounts of time convincing frightened parents to follow published evidence-based recommendations for vaccine administration, thereby reducing time available for other important components of anticipatory guidance. To counter these antivaccination advocates, the CDC, AAP, and other professional agencies and organizations are also making use of the Internet and other media to promote greater acceptance of universal vaccination by providing evidence-based information and culturally sensitive and language-appropriate educational materials concerning the benefits of immunizations and their risks (eg, www.vaccinateyourbaby.org). Social marketing techniques should also be explored as a promising strategy for promoting acceptance of immunizations among members of the general public who remain hesitant or resistant to vaccinate their children.[21]

In response to the need for greater transparency and accountability regarding vaccine safety and the need to maintain constant surveillance of adverse events after vaccination, the CDC has established the Immunization Safety Office (ISO). Along with the Vaccine Adverse Event Reporting System, a cooperative program between the Food and Drug Administration and CDC, the ISO provides an infrastructure for high-quality vaccine-safety research, surveillance, and effective clinical translation of important vaccine-research findings, with an emphasis on enhanced follow-up of potential adverse events by using innovative research methods. A new and growing area of interest in the field of vaccine safety is the use of genomic research techniques to identify potential gene-based individual differences in vaccine recipients who experience adverse but not causally related events, such as Guillain-Barré syndrome or wheezing episodes after influenza vaccination and rheumatoid arthritis after HBV vaccination. In 2009, the ISO issued a statement on the CDC Web site categorically denying any scientific evidence for the highly publicized alleged linkage between vaccines and autism.[22]

OPPORTUNITIES FOR IMPROVEMENT IN IMMUNIZATION COVERAGE

Despite the many challenges described, opportunities exist to improve immunization coverage in the future. With widespread implementation of the VFC program and continued availability of federal Section 317 discretionary funds and state funds, fewer children remain unimmunized in the United States because of purely financial obstacles. It is unfortunate that the level of funding for Section 317 funds is at the discretion of the federal budget and has not always kept pace with the growing cost of vaccine delivery. Continued efforts at the local, state, and federal levels are needed to further reduce the financial barriers to physicians and families associated with the complex system of vaccine financing described previously.

As reported in the previous version of this policy statement,[6] the Task Force on Community Preventive Services, convened by the US Department of Health and Human Services with support from the CDC, reviewed evidence from published reports of interventions designed to improve the timely immunization of children and adults.[23] On the basis of the strength of this evidence as applied to the pediatric age group, the task force recommended a number of strategies for increasing immunization coverage for children.[24] They grouped these recommendations into 3 overall strategies: increase in community demand for vaccinations; enhancement of access to vaccination services; and provider-based interventions (see Table 1). The task force did not evaluate the extent to which financial constraints on those that provide immunizations (clinics, private offices) also affect the availability of immunizations to their clients.

In 2003, the National Vaccine Advisory Committee (NVAC) published a report titled "Standards for Child and Adolescent Immunization Practices."[5] This report highlighted 17 immunization practices that were recommended to enhance immunization practices in the United States, including standards for vaccine availability; assessment of vaccination status at every health care encounter; improved communication with parents and patients about vaccine benefits and risks; proper storage, handling, administration, and documentation of immunizations; and a number of specific strategies for increasing coverage, such as reminder systems, office- and clinic-based patient record reviews, and community-

TABLE 1 Quality of Evidence Available to Support Potential Strategies for Increasing Immunization Coverage[24]

Evidence Sufficient to Strongly Recommend or to Recommend	Insufficient Evidence to Evaluate or to Recommend
Client reminder/recall systems	Community education
Requirements for child care, school, and college enrollment	Patient incentives
Multicomponent patient education	Patient-held medical records
Reducing out-of-pocket costs	Using schools and child care centers as vaccination sites
Increasing vaccination settings closer to patients' homes	Provider education
Expanding clinic hours	Using standing orders
Using emergency departments and subspecialty clinics	
Using WIC sites	
Offering drop-in vaccination services	
Home-visiting services	
Use of electronic records	
Office-based quality-improvement activities	

based approaches. This extensive list of recommended immunization practices overlaps with those recommended by the CDC task force, as described previously, but does not specifically include the task force's recommended strategies involving Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) offices, home-visitation programs, or requirements for entry into child care, school, and college.

In September 2008, the NVAC endorsed a set of principles and recommendations for increasing provider and patient participation in immunization information systems (IISs), formerly known as immunization registries, as another strategy for increasing immunization coverage. The AAP, in its own policy statement in 2006, also endorsed the continued development and implementation of IISs.[25] To be most effective, IISs must provide bidirectional flow of vaccination information, allowing providers to enter vaccination data and retrieve patient-specific vaccination histories. It is unfortunate that many current IISs are incompatible with existing electronic medical records and, thus, present an added cost to those practices that are required or wish to participate in these systems. The time and cost of entering vaccination information into an IIS can be considerable; therefore, payments by government and private insurers to support the entry of patient immunization data into IISs will be necessary for clinical practices that currently use paper-based records to participate in these new systems. Although the deployment of IISs will make it easier to identify patients who are behind on their immunizations, the provision of vaccinations during sick visits or emergency department visits may not be desirable in all situations because of the possible impact on patient compliance with recommendations for well-child care.[26]

RECOMMENDATIONS

Recommendations below are based on evidence reviewed by the CDC Task Force on Community Preventive Services[24] and in the NVAC "Standards for Child and Adolescent Immunization Practices" report[5] and are updated to include newer recommendations for the use of IISs and to emphasize the importance of the pediatric medical home as the optimal location for the delivery of pediatric immunization services. Additional recommendations beyond those addressed directly in either of these previous publications acknowledge the extensive financial and administrative barriers that private pediatricians and pediatric clinics face in purchasing and delivering an adequate supply of vaccines to their patients and the current use of various media to influence parental decision-making by those who oppose a policy of universal childhood immunizations. In its most recent report, the NVAC included a set of 24 recommendations that address financial barriers that continue to undermine efforts to reach the goal of universal immunization coverage for children in whom vaccinations are not contraindicated.[18] Where appropriate, those recommendations have been incorporated into this policy statement.

1. Collectively, pediatricians and child health care professionals should join with the AAP and its chapters in the following activities.
   - Advocate for all children to receive comprehensive health care, including childhood immunizations, in a medical home[27] and improve access for children who are most likely to experience barriers to comprehensive care in a medical home, including members of racial and ethnic minorities, poor or uninsured children, children who live in inner-city or rural areas, and children with chronic medical conditions. Pediatricians can further assist by collaborating with local public and private child health services to identify children without access to a medical home and providing assistance in referring them to an appropriate medical home. The medical home should maintain the children's health records, including immunization records; furthermore, the pediatric medical home requires a level of payment at least as great as that for the adult medical home.
   - Assist in the identification of other venues in which vaccina-

tions can be delivered if a significant number of children in a community do not have convenient access to a medical home or if existing medical homes are not able to meet the demand. If sufficient pediatric medical homes are not available, additional venues could include public health department clinics, WIC program offices, child care centers, school-based health clinics, and, in those states that allow it, pharmacies. Elimination of the financial barriers to immunization delivery, as described in this statement, would reduce the need to consider such alternative venues.

- Advocate for reform in the distribution and payment systems that apply to the procurement, storage, and administration of immunizations and that often act as a barrier to physicians who wish to provide immunizations in their private offices and in their clinics. It is important that private- and public-sector payers provide payments to practitioners and clinics for immunization services sufficient not only to cover the direct and indirect costs of these services but also to provide a financial incentive for ongoing participation in this vital service to the community. Using "The Business Case for Vaccine Pricing" (available from Practice Management Online [PMO] at http://practice.aap.org/content.aspx?aid=1808), physicians and other child health providers can better understand and advocate for adequate payment for immunization services, including the direct costs of vaccine procurement, storage, and administration as well as the cost of related materials and the professional time involved in providing counseling to concerned parents. These payments must also be sufficient to cover the added indirect opportunity costs of stocking and purchasing expensive vaccines, as well as the predictable costs of wastage, refrigeration, and space. A vaccine-cost calculator is now available on the PMO Web site (http://practice.aap.org/vaccinecalculator.aspx). Private physicians should also be encouraged to participate in vaccine-purchasing pools.
- Advocate for a public-private partnership in the manufacture and distribution of vaccines so that purchasers of vaccines (eg, physicians, the VFC program) know what their acquisition costs will be and what to expect in payment for these services before exposing themselves to potential financial losses because of changes in pricing and third-party payment. These efforts would also include advocating for immediate recognition of and payment for newly recommended vaccines, adjustments in payments when prices increase on existing vaccines, and payment of administrative fees per component, not per injection, so as not to discourage the use of combination vaccines. When new vaccines are introduced or when price increases are announced, manufacturers should offer reasonable terms for payment to facilitate their introduction, thereby allowing physicians to purchase and receive payment for vaccines without experiencing excessive financial burden.
- Advocate for the removal of economic and administrative barriers for physicians who wish to participate in the VFC program and other state vaccination programs. Public health department clinics and private physician offices should be included as venues for underinsured VFC-eligible children to receive immunizations, rather than limiting access for these children to federally qualified health centers and rural health clinics.
- Advocate for the removal of economic barriers to immunizations for parents by minimizing their out-of-pocket expenses for immunizations. Public and private payers should provide first-dollar coverage for all recommended vaccines (ie, without copays or deductibles). Use of a uniform acquisition-price standard as the basis for acquisition cost for all vaccine products should be advocated. Such a basis could be the CDC Private Sector Price List, as posted on its Web site (www.cdc.gov/vaccines/programs/vfc/cdc-vac-price-list.htm). Funding is also encouraged to support studies that periodically estimate the actual financial burdens, both direct and indirect, of administering vaccines, and that third-party payers should be expected to honor and pay for these costs.
- Advocate with vaccine manufacturers and state and federal governments to maintain an adequate supply of all childhood vaccines at all times and to provide adequate notice, quick planning, and equitable distribution to all entities that administer immunizations to deal with shortages as they arise.
- Advocate for studies that ensure that the safest and most effective vaccines and combination products are available to children.
- Work with other physician organizations and their representa-

tives to advocate with state and federal governments, private payers, and employers who purchase health care to ensure that timely access to all immunizations recommended by the CDC, the AAP, and the American Academy of Family Physicians for all children remains a high public policy priority.

- Advocate for interoperability of IISs and electronic health records that accommodate bidirectional flow of information to facilitate pediatrician participation in these systems. IISs should also provide support for automated identification of vaccine products (eg, bar codes or radiofrequency tags) and include integrated, up-to-date VISs.
- Advocate for payment by commercial and government payers for the entry of patient immunization information into county and state IISs or for the interfaces necessary to allow transfer of these data from electronic health records to these IISs to support pediatric care provider participation in these systems. Likewise, schools must have adequate funding to cover the costs that arise from their mandate to verify immunization coverage for their students.
- Support ongoing education and quality-improvement programs for pediatricians and other child health care professionals about important vaccine-related issues, including the dissemination of peer-reviewed evidence for more effective immunization delivery. Educational programs should be offered to help physicians incorporate optimal business practices in their office or clinic setting to maximize their opportunities to offer immunizations to all children for whom vaccines are not contraindicated.
- Vigorously mount a public relations campaign to better inform the public and counter the influence of misinformation spread by celebrities and others who participate in the antivaccination movement to minimize the negative impact of this false information on the health of children. The public must be educated with regard to the risks associated with vaccine-preventable diseases and the impact of immunizations on their prevalence by using culturally effective materials in English and other languages.

2. Individually, pediatricians and other child health professionals are encouraged to do the following to increase the immunization coverage of those under their care.
   - Expand opportunities to immunize in the setting of a medical home by extending office hours when possible, making vaccinations available during visits for minor illnesses (if appropriate), and maintaining accurate and up-to-date records of immunizations received by each patient. Participation in IISs, including those that cross political boundaries, is also recommended.
   - Implement reminder/recall systems based on office charts or electronic information systems and minimize out-of-pocket costs to patients being immunized.
   - Undertake office- and clinic-based assessment and improvement activities necessary to maximize their practices' effectiveness in immunizing children. Offices and clinics should maintain up-to-date protocols that are accessible wherever immunizations are delivered and ensure that medically accepted contraindications to immunizations are accurately identified. This goal can be supported by using an IIS that is easily updated with new vaccine information and changes in protocols for existing vaccines.
   - Ensure that all those who administer immunizations are fully immunized (unless contraindicated), are knowledgeable about immunizations, and participate in continuing education activities regarding immunizations, including their proper administration, storage, and handling.
   - Always provide and document the most current VIS to educate parents about vaccine risks and benefits of immunizations, in accordance with the Vaccine Injury Compensation Program and CDC recommendations (available on the AAP Web site at www.aap.org). Physicians are encouraged to discuss the benefits and risks of immunizations with parents who refuse or delay age-appropriate vaccinations and to document ongoing discussion and refusal by using a form such as the AAP "Refusal to Vaccinate" template (http://practice.aap.org/popup.aspx?aID=2685&language). Although the AAP strongly discourages pediatricians from discharging patients from their practices solely as a result of vaccine refusal, pediatricians may encourage a family to find another physician or practice if there is a substantial level of distrust, differences in philosophy of care, or persistent poor quality of communication.[28]
   - Provide their patients with the addresses (URLs) of reliable and

accurate immunization and vaccine-information Web sites that discuss immunization issues (eg, www.aap.org/healthtopics/immunizations.cfm, www.immunize.org, www.cdc.gov/vaccines, www.vaccinateyourbaby.org).

- Report all adverse events related to vaccines by using the Vaccine Adverse Event Reporting System (see http://vaers.hhs.gov/index for forms and instructions), as directed by the National Childhood Vaccine Injury Act.[29]
- Support and implement the standards for child and adolescent immunization practices as endorsed by the AAP and the NVAC.[5]

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Indications for Management and Referral of Patients Involved in Substance Abuse (RE9947)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Substance Abuse

ABSTRACT. This statement addresses the challenge of evaluating and managing the various stages of substance use by children and adolescents in the context of pediatric practice. Approaches are suggested that would assist the pediatrician in differentiating highly prevalent experimental and occasional use from more severe use with adverse consequences that affect emotional, behavioral, educational, or physical health. Comorbid psychiatric conditions are common and should be evaluated and treated simultaneously by child and adolescent mental health specialists. Guidelines for referral based on severity of involvement using established patient treatment-matching criteria are outlined. Pediatricians need to become familiar with treatment professionals and facilities in their communities and to ensure that treatment for adolescent patients is appropriate based on their developmental, psychosocial, medical, and mental health needs. The family should be encouraged to participate actively in the treatment process.

ABBREVIATIONS. *DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; DSM-PC, Diagnostic and Statistical Manual for Primary Care Child and Adolescent Version.*

The stages of substance use leading to abuse and dependency were defined more than a decade ago (Table 1).[1] Since then, the American Academy of Pediatrics has published a number of related policy statements and has defined the role of the pediatrician in the management of substance abuse by children and adolescents.[2] One challenge that remains for the practitioner, however, is to determine the severity of the young person's drug involvement and then make a decision about continued office follow-up or referral for evaluation and possible treatment. If specialized treatment is needed, the practitioner should determine the most appropriate referral for that patient.

The early stages of substance abuse are often the most difficult to evaluate. Although experimentation with mood-altering chemicals, including nicotine, is common, it is important that the experimentation not be condoned or trivialized by adults. The first and only use of even the so-called gateway drugs (alcohol, marijuana, and inhalants) may result in tragic consequences as a result of unintentional injuries or even death. Often the early user is naive about the effects of a substance, is uninitiated in its use, and has no tolerance for the effects of the drug.

For the young person who is experimenting with drugs (stage 2), the pediatrician can have an important role in the educational process for the patient and the family. If there have been no adverse consequences, brief counseling and in-office follow-up may be all that are needed. For the young person who has begun to experience adverse consequences of substance abuse, such as injuries associated with acute intoxication, trouble with the law, truancy, decline in school performance, or deterioration in physical or mental health, intervention is indicated.

Although confidentiality is the cornerstone of establishing a relationship with older children and adolescents, sometimes the behaviors of a young person are dangerous enough to justify and require a discussion with the parents. Depending on the circumstances, maintenance of confidentiality with the adolescent and the family may not be possible. A level of substance abuse associated with injuries, legal entanglements, failure in school, or deterioration of physical or mental health requires that family members be made aware of the dangers so that they can become involved in the therapeutic process.

At follow-up office visits, the pediatrician has the opportunity to assess continued use or abuse. Families should be advised to set firm rules about their children's involvement with tobacco, alcohol, and other drugs, and the consequences for use should be defined so that all persons understand the expectations. Behavior by parents, teachers, other adults, and health care professionals that enables tobacco, alcohol, and other drug use (such as tolerating an adolescent's erratic behavior, decline in school performance, or association with known substance users) must be recognized and avoided. The pediatrician can become part of the chain of adults emphasizing the non-use message by providing clear and consistent information to parents and their children while maintaining a trusting and caring relationship. A nonjudgmental approach that emphasizes health risk is paramount.

Some adolescents are able to discontinue the use of alcohol and other drugs by making a personal commitment with little formal treatment and with the aid of self-help groups or family support only. Developmentally, most teenagers will stop abusing alcohol or other drugs by early adulthood. The goal should be not only to recommend treatment, but also to identify the consequences of a lifestyle of alcohol and other drug abuse and motivate the patient to seek the help needed to initiate and maintain recovery. This can be most difficult with the adolescent patient, and literature is emerging on the role of motivational interviewing to encourage change in the patient who is dependent on nicotine or other psychoactive drugs.[3,4] Physicians can enhance the motivational process in their patients by expressing their concerns and encouraging an evaluation or formal assessment. Successful recovery usually begins when the patient stops denying that substance abuse is the cause of the life consequences experienced. Active participation by the pediatrician can assist in breaking down the denial and facilitate entry into the recovery process.

The decision to refer more heavily involved children and adolescents (stages 3-5) is straightforward if their symptoms and signs are recognized as being caused by substance abuse or dependence. Deciding where to refer the identified adolescent in need of treatment often is more complicated. For admission, most treatment programs require a diagnosis of abuse or dependence based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*[5]

(*DSM-IV*), (Tables 2 and 3). Some treatment programs or communities have education and prevention services available for those identified early. Although most primary care practitioners do not have a working knowledge of *DSM-IV* diagnoses, an understanding of "substance abuse" and "substance dependence" criteria can help decide who needs referral and where the person should be referred.[5] The *Diagnostic and Statistical Manual for Primary Care* (*DSM-PC*) *Child and Adolescent Version*, published by the American Academy of Pediatrics in 1996, also classifies substance use/abuse by adolescents.[6] Any adolescent meeting the *DSM-IV* criteria for abuse or dependence should be assessed by a professional experienced in adolescent chemical dependency. If the patient or family is unwilling to pursue evaluation in this phase of the drug use continuum, it may be a challenge to avoid an adversarial relationship as the pediatrician makes referral recommendations that clearly are indicated but not accepted by the patient or family. Although resistance and denial are intrinsic to the disease and are expected at this stage, it is important to make the best recommendation for the teenager and family while remaining available and supportive.

DUAL DIAGNOSIS

Adolescents who manifest psychiatric diagnoses in addition to substance abuse raise additional diagnostic concerns. [7-10] Other psychiatric disorders, especially major depressive disorders and conduct disorder, have been demonstrated in adolescents who use tobacco, alcohol, and other drugs.[11] Although a high prevalence of comorbidity has been reported in adolescent substance abusers receiving inpatient treatment,[12-16] the number of adolescents who exhibit psychiatric symptoms because of the substance abuse disorder and the number who have a primary or coexisting psychiatric diagnosis is unclear. Miller and Fine[17] believe that methodological considerations, including the length of abstinence required before the diagnosis is made, the population sampled, and the perspective of the examiner, affect prevalence rates for psychiatric disorders in substance abusers and account for the variability. They see the prevalence rates for psychiatric disorders as being artificially elevated by the tendency to establish a diagnosis before some of the psychiatric symptomatology secondary to the substance use abates. Ideally, the patient in a stable condition should be observed for a minimum of 1 month after discontinuing drug use and before diagnosing a comorbid disorder or initiating treatment with a psychopharmacologic agent. In this era of very brief (or no) hospitalization, it may make sense to diagnose and prescribe medication sooner, especially if the disorder predates the substance use or if there is a family history of psychiatric disorder.

Awareness of the prevalence and manifestations of psychiatric diagnoses is essential for the quality treatment of adolescent substance abusers, and the clinician needs to know what kind of comorbid conditions are commonly seen. Large-scale population studies have not been conducted on children and adolescents, but the National Institute of Mental Health's Epidemiologic Catchment Area Study[18] attempted to estimate the true prevalence rates of alcohol abuse, other drug abuse disorders, and mental disorders in a community and institutional sample of more than 20 000 adults standardized to the US census. Of persons with alcohol disorders, 37% had another mental disorder, with the highest prevalence for affective, anxiety, and antisocial personality disorders. More than 50% of those with drug disorders other than alcohol use disorders had a comorbid mental disorder: 28% had anxiety disorders, 26% had affective disorders, 18% had antisocial personality disorder, and 7% had schizophrenia. The study[18] verified the widely held impression that comorbidity rates are much higher for patients in treatment and institutional settings than in the general population.

The diagnostic categories most likely to be encountered in the pediatrician's office are affective, anxiety, and disruptive behavior disorders. Pediatricians will best serve these patients if they:

1. Conduct a complete evaluation of each patient that includes a comprehensive psychosocial history and physical examination, as well as a mental status examination and an inquiry into other psychiatric symptomatology by using information obtained from collateral sources, such as parents or teachers;
2. Have a high index of suspicion for psychiatric comorbidity in adolescents whose conditions do not respond to treatment or who are presenting problems in treatment;
3. Individualize treatment to accommodate other psychiatric diagnoses; and
4. Have a working relationship with and know when to consult a mental health specialist. The close integration of mental health care and primary care are important; managed care arrangements that separate mental health and addiction services from primary care make this coordination more difficult.

WHERE TO REFER PATIENTS

In addiction medicine, the concept of "patient-treatment matching" has become increasingly important in determining the appropriate level of care for the patient with a diagnosis of substance abuse or dependence.[19] Matching is based on a comprehensive biopsychosocial assessment of the patient and considers the history of current and past drug use, previous treatment, health consequences, comorbid psychiatric conditions, family and social issues, vocational-educational effects, experience with the justice system, motivation for treatment, and support systems available.

Managed care dictates treatment options in chemical dependency and mental health as rigorously as for medical and surgical treatments, and the primary care physician is routinely required to approve referrals for substance abuse and mental health treatment. Firm guidelines are being established that determine the level of care and length of treatment, and inpatient treatment is no longer the norm for the initial referral. More commonly, the patient must be unsuccessful at outpatient treatment before being recommended for inpatient treatment. The presence of a comorbid psychiatric condition may necessitate an earlier inpatient admission.

The American Society of Addiction Medicine has published *Patient Placement Criteria* that define levels of adult and adolescent treatment.[20] Adolescent levels include early intervention, outpatient treatment, and medically monitored or managed inpatient care. Placement is based on 6 dimensions that include acute intoxication/withdrawal potential, previous medical conditions and complications, emotional/behavioral conditions and complications, treatment acceptance/resistance, relapse/continued use potential, and recovery environment (Table 4). The publication also includes parameters for continued stay and discharge from the various levels of treatment.

A more comprehensive and detailed description of the continuum of adolescent treatment options based on multiple client assessment criteria has been published by the Center for Substance Abuse Treatment.[21] The treatment levels include more intensive outpatient options, as well as long-term residential psychosocial care (therapeutic communities), half-way houses, and group home living arrangements for seriously involved adolescents.

Successful addiction treatment usually involves more than one level of care during a long recovery process. The treatment may involve outpatient or inpatient care in the beginning with continued care at a level appropriate for the patientôs recovery process. Most chemically dependent patients in treatment consider themselves "recovering" rather than "recovered" and are involved in sequential treatment levels that usually include a formal structured program, attendance at 12-step self-help groups (eg, Alcoholics Anonymous, Narcotics Anonymous), and continued self-recovery work. Relapse is an

expected part of recovery and can be viewed as a learning opportunity that is important to the process rather than a failure. If relapse occurs, pediatricians once again can have an important supportive role or initiate further referral if additional formal treatment is required. By collaborating with a counselor or addiction specialist, as well as the insurance company, the school, and the family, the pediatrician can make a meaningful contribution to the recovery process.

CRITERIA FOR THE SELECTION OF A SUBSTANCE ABUSE TREATMENT PROGRAM

Appropriate substance abuse treatment facilities for children and adolescents must have staff with adequate experience in dealing with these age groups. The following criteria may be useful in evaluating an inpatient or outpatient adolescent substance abuse treatment program.

1. The program views drug and alcohol abuse as a primary disease rather than a symptom.
2. The program includes a comprehensive evaluation of the patient and appropriately manages or refers for treatment any associated medical, emotional, or behavioral problems identified in the initial assessment.
3. The program adheres to an abstinence philosophy. Any use is abuse. Drug use is a chronic disease, and a drug-free environment is essential. Tobacco use ideally should be prohibited, or nicotine cessation treatment should at least be part of the overall treatment plan.
4. There is a low ratio of patients to staff. Treatment professionals should be knowledgeable in the treatment of chemical dependency and adolescent behavior and development.
5. Professionally led support groups and self-help groups are integral parts of the program.
6. Adolescent groups are separate from the adult groups if both are treated at the same facility.
7. The entire family is involved in treatment. The program relates to parents and patients with compassion and concern with the goal of reunification of the family whenever possible.
8. Follow-up and continuing care are integral parts of the program.
9. As progress is made in the program, patients have an opportunity to continue academic and vocational education and are assisted in restructuring family, school, and social life.
10. The program administration discusses costs and financial arrangements for inpatient and outpatient care and facilitates communication with managed care organizations.
11. The program is as close to home as possible to facilitate family involvement, even though separation of the adolescent from the family may be indicated initially.

RECOMMENDATIONS FOR PEDIATRICIANS

1. Pediatricians need to become familiar with the patterns of adolescent nicotine, alcohol, and drug use and the stages of substance abuse. Knowledge of the *DSM-IV* and *DSM-PC* criteria for diagnosis is useful for differentiating experimental use from problem use.
2. A thorough psychosocial and medical assessment of the patient is essential before making a referral for evaluation or treatment. Familiarity with the levels of treatment available and the multidimensional assessment criteria used to determine the intensity of services required can assist the pediatrician to make an appropriate referral.
3. Substance abuse is a potentially fatal disease. Use to the point at which school, activities, home, or work is affected represents symptomatic substance abuse and usually warrants parental involvement and a comprehensive interview and assessment.
4. Awareness of the high prevalence of psychiatric disorders among adolescents who abuse or are dependent on psychoactive substances will affect the decision as to where to refer the adolescent. If the pediatrician suspects a comorbid psychiatric diagnosis and needs assistance in determining appropriate treatment, psychiatric consultation should be obtained.
5. As advocates for adolescents and families requiring substance abuse treatment, pediatricians have the opportunity and obligation to become familiar with professionals and programs in their communities that provide education, prevention, and treatment services, including smoking cessation. A close working relationship facilitates referrals and communication.
6. Pediatricians also can advocate with local managed care organizations to provide quality mental health and substance abuse services that are appropriate for specific ages and developmental stages and that are integrated with primary care. Knowledge of the criteria for selecting an adolescent treatment program and the American Society of Addiction Medicine *Patient Placement Criteria* form the basis for these advocacy efforts.
7. Pediatricians must be familiar with state and federal regulations governing confidential exchange of information about substance abuse treatment. These are available from the state alcohol and substance abuse treatment regulatory agencies.

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TABLE 1
Stages of Adolescent Substance Abuse*

Stage	Description
1	Potential for abuse
	Decreased impulse control
	Need for immediate gratification
	Availability of tobacco, drugs, alcohol, inhalants
	Need for peer acceptance
2	Experimentation: learning the euphoria
	Use of inhalants, tobacco, marijuana, and alcohol with friends
	Few, if any, consequences
	May increase to regular weekend use

	Little change in behavior
3	Regular use: seeking the euphoria
	Use of other drugs, eg, stimulants, lysergic acid diethylamide (LSD), sedatives
	Behavioral changes and some consequences
	Increased frequency of use; use alone
	Buying or stealing drugs
4	Regular use: preoccupation with the "high"
	Daily use of drugs
	Loss of control
	Multiple consequences and risk-taking
	Estrangement from family and "straight" friends
5	Burnout: use of drugs to feel normal
	Use of multiple substances; cross-addiction
	Guilt, withdrawal, shame, remorse, depression
	Physical and mental deterioration
	Increased risk-taking, self-destructive behavior, or suicidal behavior

* Adapted from Comerci.[1(pp58-59)]

TABLE 2
*DSM-IV** Criteria for Substance Abuse[5]

1. A maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by 1 (or more) of the following, occurring within a 12-month period:
a. recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or home (eg, repeated absences or poor work performance related to substance use; substance-related absences, suspensions, or expulsions from school; neglect of children or household)
b. recurrent substance use in situations in which it is physically hazardous (eg, driving an automobile or operating a machine when impaired by substance use)
c. recurrent substance-related legal problems (eg, arrests for substance-related disorderly conduct)
d. continued substance use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance (eg, arguments with spouse about consequences of intoxication, physical fights)
2. The symptoms have never met the criteria for substance dependence for this class of substance.

* *DSM-IV* indicates *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.*[5(pp182-183)]

TABLE 3
*DSM-IV** Criteria for Substance Dependence[5(p181)]

A maladaptive pattern of substance use, leading to clinically significant impairment or distress, as manifested by 3 (or more) of the following, occurring at any time in the same 12-month period:
1. tolerance, as defined by either of the following:
a. a need for markedly increased amounts of the substance to achieve intoxication or desired effect
b. markedly diminished effect with continued use of the same amount of the substance
2. withdrawal, as manifested by either of the following:
a. the characteristic withdrawal syndrome for the substance
b. the same (or a closely related) substance is taken to relieve or avoid withdrawal symptoms
3. the substance is often taken in larger amounts or over a longer period than was intended
4. there is a persistent desire or unsuccessful efforts to cut down or control substance use
5. a great deal of time is spent in activities necessary to obtain the substance (eg, visiting multiple doctors or driving long distances), use the substance (eg, chain-smoking), or recover from its effects
6. important social, occupational, or recreational activities are given up or reduced because of substance use
7. the substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance (eg, current cocaine use despite recognition of cocaine-induced depression or continued drinking despite recognition that an ulcer was made worse by alcohol consumption)

* *DSM-IV* indicates *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.*[5(p181)]

TABLE 4
Adolescent Criteria: Crosswalk of Levels 0.5 Through IV*

Criteria Dimensions			Levels of Service		
	Level 0.5 Early Intervention	Level I Outpatient Treatment	Level II Intensive Outpatient Treatment	Level III Medically Monitored Intensive Inpatient Treatment	Level IV Medically Managed Intensive Inpatient Treatment
Dimension I: acute intoxication and/or withdrawal potential	No withdrawal risk	No withdrawal risk	Manifests no overt symptoms of withdrawal risk	Risk of withdrawal syndrome is present but manageable in Level III	Severe withdrawal risk
Dimension 2: biomedical conditions and complications	None or very stable	None or very stable	None or, if present, does not distract from addiction treatment; manageable at Level II	Require Medical monitoring but not intensive treatment	Requires 24-hour medical and nursing care
Dimension 3: emotional/behavioral	None or very stable	None or manageable in an outpatient structured environment	Mild severity, with the potential to distract from recovery efforts	Moderate severity; requires a 24-hour structured setting	Severe problems require 24-hour psychiatric care, with concomitant addiction treatment
Dimension 4: treatment acceptance/resistance	Willing to understand how current use may affect personal goals	Willing to cooperate but needs motivating and monitoring strategies	Resistance high enough to require structured program but not so high as to render outpatient treatment ineffective	Resistance high despite negative consequences; needs intensive motivating strategies in a 24-hour structured setting	Problems in this dimension do not qualify patient for level IV treatment
Dimension 5: relapse/continued use potential	Needs understanding of, or skills to change, current use patterns	Able to maintain abstinence and recovery goals with minimal support	Intensification of addiction symptoms; high likelihood of relapse without close monitoring and support	Unable to control use despite active participation in less intensive care; needs 24-hour structure	Problems in this dimension do not qualify patient for level IV treatment
Dimension 6: recovery environment	Social support system or significant others increase risk of personal conflict about alcohol/other drug use	Supportive recovery environment and/or patient has skills to cope	Environment unsupportive but, with structure or support, patient can cope	Environment dangerous for recovery, necessitating removal from the environment; logistical impediments to outpatient treatment	Problems in this dimension do not qualify patient for level IV treatment

* This overview of the adolescent admission criteria is an approximate summary to illustrate the principal concepts and structure of the criteria.
From the American Society of Addiction Medicine.[20(p131)]

AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Frank R. Greer, MD; Michael Shannon, MD; the Committee on Nutrition; and the Committee on Environmental Health

Infant Methemoglobinemia: The Role of Dietary Nitrate in Food and Water

ABSTRACT. Infants for whom formula may be prepared with well water remain a high-risk group for nitrate poisoning. This clinical report reinforces the need for testing of well water for nitrate content. There seems to be little or no risk of nitrate poisoning from commercially prepared infant foods in the United States. However, reports of nitrate poisoning from home-prepared vegetable foods for infants continue to occur. Breastfeeding infants are not at risk of methemoglobinemia even when mothers ingest water with very high concentrations of nitrate nitrogen (100 ppm). *Pediatrics* 2005;116: 784–786; *methemoglobinemia.*

INTRODUCTION

Nitrate poisoning resulting in methemoglobinemia continues to be a problem in infants in the United States. Most reported cases have been ascribed to the use of contaminated well water for preparation of infant formula.[1–3] Fifteen million families in the United States obtain their drinking water from unregulated wells.[4] In a survey of 5500 private water supplies from 9 Midwestern states, 13% of the wells were found to have nitrate concentrations >10 mg/L or 10 ppm nitrate nitrogen,[5] the federal maximum contaminant level.[6] It is estimated that 2 million families drink water from private wells that fail to meet the federal drinking-water standard for nitrate, and 40 000 infants younger than 6 months live in homes that have nitrate-contaminated water supplies.[4] In urban areas, municipal wastewater-treatment discharges (a source of nutrients) on surrounding farmland aggravate the problem.[7]

There have been occasional cases of nitrate poisoning in infants from ingestion of plant nitrates,[8–13] only one of which was reported from the United States.[9] Nitrates are natural constituents of plant material, and the effect of commercial nitrate-containing fertilizers on the nitrate content of vegetables is inconsistent.[14] Because the intake of naturally occurring nitrates from foods such as green beans, carrots, squash, spinach, and beets can be as high as or higher than that from well water, these foods should be avoided before 3 months of age, although there is no nutritional indication to add complementary foods to the diet of the healthy term infant before 4 to 6 months of age.[14,15] Some commercially prepared infant food vegetables are voluntarily monitored for nitrate content by private industry, including spinach, squash, and carrots. A target concentration of nitrate nitrogen for food of <100 ppm is desirable for infants. Because this concentration is frequently exceeded in spinach, this product is often labeled not to be used in infants younger than 3 months.

For breastfed infants, there is no evidence of an increased risk of methemoglobinemia from maternal ingestion of water with nitrate nitrogen concentrations as high as 100 ppm, because these mothers do not produce milk with high nitrate concentrations.[16] Furthermore, the predominant organism in the gastrointestinal tract (*Lactobacillus* species) of the breastfed infant does not reduce nitrate to nitrite (see following section).[14]

PATHOPHYSIOLOGY

The potential hazard of nitrate in either food or water is from its conversion to methemoglobin-producing nitrites before and/or after ingestion. The nitrite ion oxidizes ferrous iron in hemoglobin to the ferric state. The resulting compound, methemoglobin, is incapable of binding molecular oxygen and produces a leftward shift in the oxygen-dissociation curve, which results in hypoxemia. Absorbed nitrate that has not been converted to nitrite can be readily excreted in the urine without adverse effects.[14]

There are many factors that influence the incidence of methemoglobinemia in infancy.[14,17] The gastric pH of infants is higher than that in older children and adults, with resultant proliferation of intestinal flora that can reduce the ingested nitrate to nitrite. Fetal hemoglobin, the predominant form in infants up to 3 months of age, is oxidized more readily to methemoglobin by nitrite than is adult hemoglobin. Red blood cells contain methemoglobin reductases that convert methemoglobin back to hemoglobin. Ninety-nine percent of this reduction activity is accounted for by cytochrome-b_5 methemoglobin reductase; the activity of this enzyme is reduced by half in

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infants compared with adults.[18] Although these factors explain the higher incidence of methemoglobinemia in infants, there are not enough data to identify a specific level of nitrate intake that is safe for all infants.

CLINICAL MANIFESTATION

Methemoglobinemia generally manifests with few clinical signs other than cyanosis. Methemoglobin represents only 1% of the total hemoglobin of the healthy adult, although it can be slightly higher in preterm and term newborn infants.[19] Obvious cyanosis can occur with methemoglobin concentrations as low as 3% in infants with low hemoglobin concentrations. Symptoms are usually minimal until methemoglobin concentrations exceed 20%.[20] The mucous membranes of infants with methemoglobinemia tend to have brown (rather than blue) discoloration. This discoloration increases with the concentration of methemoglobin, as do the manifestations of irritability, tachypnea, and altered mental status.[20] In the absence of respiratory symptoms, history of cardiovascular disease, abnormal pulse, or abnormal pulse oximetry, a diagnosis of methemoglobinemia should be considered in a child who becomes acutely cyanotic and fails to respond to oxygen administration. When significant concentrations of methemoglobin (>30%) are present, a pulse oximeter is very misleading and will detect only mild to moderate oxygen desaturations in the 82% to 86% range.[20]

TREATMENT AND PREVENTION

Health care professionals who suspect that an infant has methemoglobinemia are advised to consult with the local poison control center or a toxicologist to help guide management. An asymptomatic infant with cyanosis who has a methemoglobin concentration of <20% usually requires no treatment other than identifying and eliminating the source of exposure (assuming a normal hematocrit). Anemic children will display toxicity at lower methemoglobin concentrations. More detailed information on diagnosis and treatment has been reviewed elsewhere.[20]

Clinical diagnosis and treatment for methemoglobinemia is not sufficient. Preventive strategies are needed to identify and eliminate the sources of exposure.[21] Assessment of potential nitrate exposure includes questions about the family residence, parental occupations, drinking water, foods ingested, topical medications, and folk remedies. Prenatal and newborn care for patients with private wells should include recommendation for testing well water for nitrate contamination. Water with high nitrate concentrations should not be ingested by the infant or used for preparation of infant formulas or infant foods. Use of alternative sources of water should be advised, including deeper wells, public water supplies, or bottled water free of nitrate. Boiling water with nitrate nitrogen concentrations of <10 ppm for 1 minute generally is sufficient to kill microorganisms without over concentrating nitrate.[21]

Effective in-home systems for nitrate removal include ion-exchange resins and reverse osmosis; however, these systems can be expensive. Ordinary water softeners used in the home do not remove nitrates.[22] Water testing for nitrate can be obtained from any reference or public health laboratory using laboratory methods approved by the US Environmental Protection Agency. Most state health departments have listings of these certified laboratories.

There is limited information on the nitrate content of commercial infant foods, although the highest concentrations (>100 ppm of nitrate nitrogen) are found in beets, carrots, spinach, squash, and green beans.[14,15] Preventive strategy would be not to introduce home preparations of these vegetables to infants before 3 months of age, although there is no nutritional indication to add complementary foods to the diet of the healthy term infant before 4 to 6 months of age.[23] Infants fed commercially prepared infant foods after 3 months of age generally are not at risk of nitrate poisoning, although the containers should be refrigerated after first use and discarded within 24 hours of opening.

SUMMARY

1. The greatest risk of nitrate poisoning (methemoglobinemia) occurs in infants fed well water contaminated with nitrates. All prenatal and well-infant visits should include questions about the home water supply. If the source is a private well, the water should be tested for nitrate. The nitrate nitrogen concentration of the water should be <10 ppm.
2. Infants fed commercially prepared infant foods generally are not at risk of nitrate poisoning. However, home-prepared infant foods from vegetables (eg, spinach, beets, green beans, squash, carrots) should be avoided until infants are 3 months or older, although there is no nutritional indication to add complementary foods to the diet of the healthy term infant before 4 to 6 months of age.
3. Breastfed infants are not at risk of nitrate poisoning from mothers who ingest water with high nitrate content (up to 100 ppm nitrate nitrogen), because nitrate concentration does not increase significantly in the milk.

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POLICY STATEMENT

Infection Prevention and Control in Pediatric Ambulatory Settings

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Infectious Diseases

ABSTRACT

Since the American Academy of Pediatrics published a statement titled "Infection Control in Physicians' Offices" (*Pediatrics*. 2000;105[6]:1361–1369), there have been significant changes that prompted this updated statement. Infection prevention and control is an integral part of pediatric practice in ambulatory medical settings as well as in hospitals. Infection prevention and control practices should begin at the time the ambulatory visit is scheduled. All health care personnel should be educated regarding the routes of transmission and techniques used to prevent transmission of infectious agents. Policies for infection prevention and control should be written, readily available, updated annually, and enforced. The standard precautions for hospitalized patients from the Centers for Disease Control and Prevention, with a modification from the American Academy of Pediatrics exempting the use of gloves for routine diaper changes and wiping a well child's nose or tears, are appropriate for most patient encounters. As employers, pediatricians are required by the Occupational Safety and Health Administration to take precautions to identify and protect employees who are likely to be exposed to blood or other potentially infectious materials while on the job. Key principles of standard precautions include hand hygiene (ie, use of alcohol-based hand rub or hand-washing with soap [plain or antimicrobial] and water) before and after every patient contact; implementation of respiratory hygiene and cough-etiquette strategies for patients with suspected influenza or infection with another respiratory tract pathogen to the extent feasible; separation of infected, contagious children from uninfected children when feasible; safe handling and disposal of needles and other sharp medical devices and evaluation and implementation of needle-safety devices; appropriate use of personal protective equipment such as gloves, gowns, masks, and eye protection; and appropriate sterilization, disinfection, and antisepsis.

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Key Words
infection control, infection prevention, respiratory hygiene/cough etiquette, isolation precautions, staff immunization

Abbreviations
AAP—American Academy of Pediatrics
SARS—severe acute respiratory syndrome
CDC—Centers for Disease Control and Prevention
OSHA—Occupational Safety and Health Administration
TST—tuberculin skin test
Tdap—adolescent-adult tetanus, diphtheria, and acellular pertussis
EPA—Environmental Protection Agency

INTRODUCTION

Infection-prevention and -control practices have long been recognized as an important means of preventing transmission of infectious agents. In the ambulatory setting, the goal is to prevent transmission of infectious agents to patients and visitors, health care personnel, and other employees. Infection prevention and control should start at the time an ambulatory visit is scheduled and is important in every patient encounter. In general, the standards for infection prevention and control are the same in all health care delivery settings, whether inpatient or outpatient, hospital or freestanding ambulatory facility. Recommendations for infection-prevention and -control practices in hospitals are well documented and

updated on a regular basis.[1–5] Because most patient encounters are with outpatients, the prevention of transmission of infection in ambulatory settings is critical.[2,6,7] In addition to the risk of health care–associated infection during medical evaluation and treatment, the reception and waiting areas of ambulatory facilities present opportunities for transmission of infectious agents among patients and accompanying persons.[8] Outbreaks of measles,[9,10] tuberculosis,[11] hepatitis B and C,[12] airborne infections,[9–11] and other infectious diseases have been traced to ambulatory visits.[6,13] Most disease outbreaks reported in ambulatory facilities were associated with nonadherence to recommended infection-prevention and -control procedures.[13]

This statement provides practical information that updates the 2000 American Academy of Pediatrics (AAP) policy statement[14] regarding infection-prevention and -control procedures as applied to ambulatory medical settings. Major changes include the endorsement of routine use of alcohol-based hand rub for hand hygiene and, where feasible, the addition of respiratory hygiene/cough etiquette to standard precautions to decrease transmission of influenza and other respiratory tract pathogens; evaluation and implementation of safer medical devices designed to reduce the risk of needle sticks; use of 2% chlorhexidine gluconate/70% isopropyl alcohol-based solutions for skin antisepsis under certain circumstances; and immunization of health care personnel with appropriate vaccines, including influenza vaccine and a vaccine to protect adults against pertussis. Additional prevention and control recommendations not covered in this statement may be necessary for other ambulatory settings such as dialysis centers, chemotherapy centers, procedure suites (eg, for endoscopy), emergency centers, and outpatient surgery suites.[6]

MODES OF TRANSMISSION OF INFECTIOUS AGENTS

To understand infection-prevention and -control issues, modes of transmission of infectious agents should be considered.[2,6,7,15] Transmission can result via direct contact (direct "contact transmission," contact with body substances including blood, urine, stool, and respiratory tract secretions), when the infectious agent is transferred directly from an infected person to a susceptible person, or, more commonly, via indirect contact transmission, when the infectious agent is transferred through a contaminated intermediate object such as a stethoscope, a countertop, a door handle, or a person's contaminated hands. Examples of pathogens transmitted via the contact route include gastrointestinal tract pathogens such as rotavirus and respiratory tract pathogens such as respiratory syncytial virus. Fomites such as toys and ambulatory facility equipment have been implicated in the transmission of some pathogens. Bloodborne pathogens can be spread via contaminated needles and other sharp instruments if recommended procedures to prevent exposure to blood or blood-containing body fluids are not implemented and followed. Pathogens in respiratory tract secretions can be transmitted a few feet through the air via droplets ("droplet transmission"; eg, influenza virus, *Bordetella pertussis*, adenovirus, and severe acute respiratory syndrome [SARS]–related coronavirus) or become airborne in small-particle aerosols ("airborne transmission"; eg, rubeola [measles virus], varicella virus, and *Mycobacterium tuberculosis*) and be transmitted over longer distances and remain suspended in the air for a long period of time. Overall, contaminated hands are the predominant mode of transmission of infectious agents, which underscores the importance of appropriate hand hygiene (ie, use of alcohol-based hand rub or hand-washing with soap and water) before and after contact with each patient or his or her immediate environment.

GUIDELINES FOR PREVENTION OF TRANSMISSION OF INFECTIOUS AGENTS

As with hospitalized patients, health care personnel should observe standard precautions[1] with every patient encounter in the ambulatory setting. "Standard precautions" refers to a single set of precautions that should be followed for all patients regardless of their diagnosis or presumed infection status and is predicated on the principle that every patient may harbor an unrecognized infectious agent that can be transmitted by blood or body fluids or via their skin or mucous membranes (Table 1). Standard precautions are supplemented with transmission-based precautions[2] when additional measures are needed to reduce the risk of contact, droplet, or airborne transmission and may include the use of a mask (a procedure mask or surgical mask), a respirator (a special mask that requires individual-fit testing and education for safe and effective usage), gowns, gloves, and/or protective eyewear such as a face shield or goggles.

Hand Hygiene

Hand hygiene (ie, using an alcohol-based hand rub or washing with soap and water) is the single most important method of preventing transmission of infectious agents (Table 1).[1,2,4,16–18] Use of an alcohol-based hand rub product in gel, rinse, or foam form is the preferred method of hand hygiene in most situations, because this method is convenient, acts rapidly, and is highly effective in inactivating microbes. Hands are decontaminated by using an alcohol-based hand rub and applying the product (using an amount recommended by the manufacturer) to the palm of one hand and rubbing the hands together, covering all surfaces of the hands and fingers, until the hands are dry.[4] Alcohol-based hand rub should be used (or hands should be washed with soap and water) before and after each contact with patients; between dirty and clean procedures on the same patient; after removing gloves; and before and after performing

TABLE 1 Standard Precautions, as Recommended by the CDC for Hospitalized Patients and Modified by the AAP for Children, Should Be Used With All Patients

Hand hygiene
- Hands should be disinfected with an alcohol-based hand rub (or washed with plain or antimicrobial soap and water) before and after each patient encounter or an encounter with the patient's immediate environment.
- Hands and other body surfaces should be washed with soap (antimicrobial preferred, but plain is acceptable) and water if visibly soiled or contaminated with blood or other body fluids or if exposure to spores (eg, *C difficile*) is likely to have occurred.
- Hands should be disinfected with an alcohol-based hand rub or washed with soap and water after removal of gloves.
- Barrier precautions to prevent skin and mucous membrane exposure
- Gloves should be worn for contact with blood, all body fluids, secretions and excretions, mucous membranes, nonintact skin, and items or surfaces contaminated with body fluids. Gloves need not be used for routine care of well children, including changing diapers and wiping the nose or eyes of children, except when required as part of contact precautions.[14,19]
- Gloves should be worn when performing venipuncture and other vascular-access procedures.
- Gloves are not routinely required when administering injections, including immunizations, unless the person administering the injection is likely to come into contact with body substances or has open lesions on his or her hands.
- Appropriate masks and protective eyewear or face shields should be used during procedures that are likely to generate droplets of blood or body fluids.
- Fluid-impermeable gowns or aprons should be worn during procedures that are likely to generate splashes of blood or other body fluids.

Respiratory hygiene/cough etiquette: see Table 2 and text[2,22]

Handling of sharp instruments to minimize risk of injury: see "Prevention of Exposure to Bloodborne Pathogens by Needles and Other Sharp Instruments"

Resuscitation equipment
- Equipment should be available for use in areas in which the need for resuscitation is predictable.
- Mouth-to-mouth resuscitation should be avoided.

Source: Garner JS; Hospital Infection Control Practices Advisory Committee. *Infect Control Hosp Epidemiol.* 1996;17:53–80.

invasive procedures. Repetitive use of alcohol-based hand rubs can be less drying to skin than repetitive use of soap and water. Hands should be washed with soap and water instead of alcohol-based hand rub whenever they are visibly soiled or contaminated with blood or other body fluids, if exposure to spores (eg, *Clostridium difficile*) is likely to have occurred, before eating, and after using the toilet. For hand-washing, antimicrobial soap may be preferable to plain soap, because plain soap may fail to remove pathogens from the hands, and use of an antimicrobial soap results in a significantly lower bacterial count on the skin.[4] Routine hand-washing should consist of the following steps: (1) wet hands with warm (not hot) water; (2) apply soap (plain or antimicrobial) to hands; (3) vigorously rub the hands together for at least 15 seconds, covering all surfaces of the hands and fingers; (4) rinse hands with warm water; (5) dry hands with a disposable towel; and (6) use the towel to turn off the faucet.[4] Disposable towels are preferred for hand-drying and always should be available and within easy reach by health care personnel. If used, hand lotions should be available in containers that are replaced frequently to avoid extrinsic contamination.[16] Hand lotions should not be petroleum based, because petroleum can cause deterioration of latex material and thereby reduce the effectiveness of latex gloves.

Hand hygiene before performing invasive procedures should consist of prewashing with soap and water and thorough drying followed by use of an alcohol-based surgical scrub with persistent activity or washing with an antimicrobial soap, such as chlorhexidine or povidone iodine, for the length of time specified by the manufacturer (usually 2 to 6 minutes).[4] In addition, fingernails need to be cleaned with disposable manicure sticks. Employees who perform direct patient care activities in practices that include immunocompromised patients at high risk of infection should keep their fingernails short and avoid wearing artificial fingernails and extenders, because these have been shown to harbor microorganisms that are not easily removed by hand hygiene.

Standard Precautions

Standard precautions include performing hand hygiene before and after every patient contact (Table 1).[1] Standard precautions require that gloves be available for use by all health care personnel and should be worn when contact with blood, body fluids, secretions, excretions, and items contaminated with these fluids is reasonably anticipated. However, the AAP modified standard precautions for well-child care by indicating that although hand hygiene should be performed, gloves do not need to be worn for routine procedures such as changing a diaper or wiping the nose or eyes of a well child except when required as part of contact precautions.[14,19,20] Gloves are not required when administering vaccines unless the health care professional has open hand lesions or will come into contact with potentially infectious body fluids.[21,22] When gloves are used, hand hygiene should be performed after gloves are removed, because contamination can occur during removal or from microscopic breaks in the glove.[23] A surgical-grade mask and face shield or protective eyewear, such as goggles, should be worn if splashing of body fluids is anticipated. Skin surfaces contaminated with blood or other body fluids should be washed immediately and thoroughly with soap and water.

The Centers for Disease Control and Prevention (CDC) added "respiratory hygiene/cough etiquette" to standard precautions to prevent transmission of influenza and potentially other pathogens that cause respiratory infection in reception areas, common waiting areas, and examination rooms in ambulatory facilities (Table 2).[2,24] Full implementation of this strategy requires education of patients and accompanying persons, including visual alerts on covering the nose and mouth when coughing or sneezing and coughing and sneezing into

TABLE 2 **Respiratory Hygiene/Cough Etiquette to Minimize Transmission of Influenza and Other Respiratory Tract Pathogens[2,24]**

1. Visual alerts for patients at the entrance to ambulatory facilities instructing patients and accompanying persons to inform staff of symptoms of a respiratory tract infection when they first register for care and to practice respiratory hygiene/cough etiquette
2. Components of respiratory hygiene/cough etiquette for patients and accompanying individuals with suspected respiratory virus infection
   - Cover the nose/mouth when coughing or sneezing; cough or sneeze into elbow rather than hand
   - Use tissues to contain respiratory tract secretions and dispose of them in the nearest waste receptacle after use
   - Perform hand hygiene (ie, use of alcohol-based hand rub, hand-washing with soap and water, or use of an antiseptic handwash) after having contact with respiratory tract secretions and contaminated objects/materials
   - If tolerated and feasible, consider providing a size-appropriate mask for the patient to wear to prevent respiratory droplet dispersal while in common reception and waiting areas[a]
3. Components of respiratory hygiene/cough etiquette for staff
   - Educate patients and accompanying persons on the need for and components of respiratory hygiene/cough etiquette
   - In reception area, have tissues and no-touch receptacles for used tissue disposal available
   - If feasible, provide conveniently located, but out of reach of young children, dispensers of alcohol-based hand rub with instructions for use (or have a sink available with consistently available soap and disposable towels)
   - When space and chair availability permit, cluster chairs for a coughing patient and accompanying persons at least 3 feet away from other patients
   - Consider having masks available for distribution to symptomatic patients by staff
   - In addition to hand hygiene before and after patient contact, health care personnel should consider wearing a mask when examining an ambulatory patient with suspected influenza[a]

In reception and common waiting areas of ambulatory facilities, implementation of some or all components of respiratory hygiene/cough etiquette should be considered for patients with suspected influenza or other respiratory tract pathogens. Influenza or another respiratory tract pathogen is suspected in patients with a new onset of cough or increased respiratory tract secretions, especially in the presence of fever.
[a] The use of masks and eyewear protection is strongly recommended if human cases of avian influenza or SARS have been diagnosed in the community.

the elbow rather than hand, maintaining a separation of at least 3 feet between symptomatic patients and others in common waiting areas, availability of materials and facilities for performing hand hygiene, and the use of masks by patients with symptoms of influenza or other respiratory tract infection before being placed in an examination room. Health care personnel who examine such patients should observe droplet precautions that include the use of masks. The effectiveness of these strategies for reducing transmission of influenza or other respiratory pathogens in the ambulatory setting has not been evaluated, but both covering a cough or sneeze and wearing a mask have been shown to prevent dispersion of respiratory droplets into the air[25] and decrease transmission of *Streptococcus pyogenes*.[26] The use of these measures evolved from the experience during SARS outbreaks in which individuals in emergency departments who were not suspected of having SARS were the source of continued transmission. Although respiratory hygiene/cough etiquette was designed primarily to reduce transmission of influenza including pandemic influenza strains, it may also reduce transmission of other agents that cause respiratory infection. Some features of respiratory hygiene/cough etiquette may be difficult to implement. For example, in many ambulatory settings, supplying masks for patients with suspected respiratory tract infection may not be feasible, and ensuring effective use of these masks in young children may not be possible. However, implementation of some of the features of respiratory hygiene/cough etiquette is likely to be more effective than no implementation. The individual ambulatory practice can determine whether to implement respiratory hygiene/cough-etiquette practices only during periods of increased prevalence of respiratory infections in the community or year-round.

Prevention of Exposure to Bloodborne Pathogens by Needles and Other Sharp Instruments

The following measures should be implemented to minimize risk of injuries by needles and other sharp instruments and of transmission of bloodborne pathogens to health care personnel or other patients:

1. Prepare a written policy for prevention of needlestick injuries.
2. Educate personnel.
3. Implement a practice not to recap, bend, or break needles or remove needles from a syringe by hand.
4. Evaluate safer medical devices designed to reduce the risk of needle sticks with the input of staff members who use needles, and implement use of devices that are likely to improve safety. Evaluation (with input from staff members) and implementation of needle safety devices is a requirement of the Occupational Safety and Health Administration (OSHA) of the US Department of Labor[27] and a number of states.[28]

5. Dispose needles into impermeable and puncture-proof needle-disposal containers that are available in areas where needles or other disposable sharps are used. Such containers should not be overfilled and should be out of reach of young children.
6. Prepare and follow policies consistent with state and local regulations for removal and incineration or sterilization.
7. Place reusable sharp instruments in puncture-resistant containers for transport to reprocessing areas.
8. Use a sterile, single-use, disposable needle and syringe for each injection given.
9. Preferentially use single-dose medication vials when medications are administered to more than 1 patient.
10. Develop a bloodborne pathogens exposure-control plan for management of contaminated–sharp-object injuries that includes written policies, is readily available to all staff, and is reviewed regularly. A workbook is available through the CDC[29] for designing, implementing, and evaluating a sharps injury-prevention program.

Transmission-Based Precautions

A mask is indicated and is adequate for protection of personnel from respiratory tract pathogens that are transmitted by respiratory droplets, such as influenza virus or *Bordetella pertussis*. However, OSHA guidelines require use of special particulate respirators (eg, National Institute for Occupational Safety and Health–approved N-95 or higher respirators) when caring for patients with infections such as pulmonary tuberculosis, which is transmitted via the airborne route in small-particle aerosols[30]; use of these respirators requires medical screening, individual-fit testing, and education to ensure proper use. It is important not to confuse the use of a surgical or procedure mask with the use of a particulate respirator that may have a similar appearance to some masks. A need for use of such respirators in pediatric ambulatory facilities is uncommon, because almost all children with tuberculosis who are younger than 12 years are not contagious, although an adult with contagious tuberculosis may be in their household and may be accompanying them for their health care visit.[31] Ideally, anyone suspected of having contagious tuberculosis should not be permitted in the ambulatory facility, because they pose a hazard to patients and staff. However, if an adult or adolescent suspected of having pulmonary tuberculosis is present in an ambulatory facility, a mask should be provided to and worn by that individual, and a referral should be made to a facility that is capable of appropriately isolating, evaluating, and treating tuberculosis.

General Health Considerations of Staff

As employers, pediatricians are required by the OSHA to institute procedures to protect staff from blood and other potentially infectious materials, including procedures to minimize the risk of sharp-instrument–related injuries and infections and to minimize exposure to tuberculosis while on the job. The OSHA has published bloodborne pathogen standards for protection of health care personnel from bloodborne agents.[32,33] Guidance on compliance with OSHA regulations, including education of personnel, writing a bloodborne pathogen exposure-control plan, sharp injuries and prevention, tuberculosis exposure, emergency procedures, emergency preparedness, hazardous chemical safety, and general facility safety, can be found in the *OSHA Safety Program Manual* from the Medical Group Management Association[34] and a technical manual from the OSHA.[35]

Management of Injuries by Needles and Other Sharp Instruments and Blood and Body-Fluid Contact

A written bloodborne pathogens exposure-control plan that includes written policies for management of contaminated–sharp-object injuries should be developed, readily available to all staff, and reviewed regularly. Policies for management of needle-stick injuries as described in Table 3 should address potential exposures to hepatitis B, hepatitis C, and HIV[36,37] and should be understood by employees. OSHA requirements for management of sharps injuries and education of employees on the management of sharp-instrument–related injuries should be followed. Skin surfaces that are contaminated with blood or other body fluids should be washed immediately and thoroughly with soap and water. Health care personnel with direct contact with patients should receive hepatitis B immunization if they have not been immunized previously.

Personnel Illness

Health care personnel may pose a risk to patients and other personnel if they develop a communicable disease. Written policies, therefore, should exist regarding exclusion of staff members with contagious illnesses.[38] Recommended work restrictions for health care personnel with selected infections are listed in Table 4. Respiratory tract infections may not be a reason to exclude personnel, but precautions should be taken with an emphasis on hand hygiene before every patient contact, and use of a mask should be considered when having direct patient contact. The inability to contain secretions and control coughing and sneezing is an indication to exclude personnel from patient contact. In addition, symptomatic health care personnel should avoid contact with immunosuppressed patients.

TABLE 3 Management of Potential Occupational Exposure to Bloodborne Pathogens

A written policy should be developed, available, and followed.

Definition of exposure that might place health care personnel at risk of hepatitis B, hepatitis C, or HIV infection: A percutaneous injury (eg, needle stick or cut with a sharp object) or contact of mucous membrane or nonintact skin (eg, exposed skin that is chapped, abraded, or afflicted with dermatitis) with blood, tissue, or other body fluids that are potentially infectious. Body fluids that are potentially infectious include those contaminated with visible blood, semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid. Feces, nasal secretions, saliva, sputum, sweat, tears, urine, and vomitus are not considered potentially infectious for these pathogens unless they contain blood; the risk of transmission of these pathogens from these fluids and materials is extremely low.[34,35]

The exposed employee should immediately follow these steps:

- Wash needle-stick site or cut with soap and water.
- If splashes to the nose, mouth, or skin occur, flush involved area with water.
- If splashes to the eye occur, irrigate eyes with clean water, saline, or sterile irrigants.
- Report the incident to your supervisor and immediately seek medical treatment.
- Document the type of injury including the involvement of blood, the source of the blood, and the extent of the injury (eg, deep injection, blood spill onto intact skin).

In all cases, the physician should:

1. Document the type of injury, including the involvement of blood.
2. Identify the source patient, if possible, and make a judgment of the likelihood that the source patient may have HIV, hepatitis B, or hepatitis C infection.
3. Have an established policy for management of an exposure such as that described below or an arrangement for immediate referral to a person or location with expertise in management of such exposures such as the emergency department of a specific hospital or the occupational health department of a large health care organization.
4. Ensure follow-up for the potentially exposed employee.
5. Ensure that all employees know how to access this policy.

Management includes the following steps:

Step 1: Determine the status of the source patient. If this is not possible, base actions on the likelihood of exposure considering source of needle and type of exposure. If the source is known, obtain permission consistent with local statutes and determine the serologic status of the source for hepatitis B virus, hepatitis C virus, and HIV. FDA-approved methods for rapid testing for HIV antibody are available.

Step 2: Determine the immunity of the employee. Was hepatitis B vaccine received? Was the employee tested for HBsAg? If response to immunization is unknown, obtain blood to test for anti-HBsAg. Test for antibody to hepatitis C. Obtain consent and test for antibody to HIV.

Step 3: Hepatitis B—follow the steps outlined below for hepatitis B prophylaxis after percutaneous or permucosal exposure:

A. If exposed person is unimmunized against hepatitis
   - Source HBsAg-positive: administer HBIG (0.06 mL/kg; maximum dose: 5 mL) intramuscularly and begin hepatitis B vaccine series.
   - Source HBsAg-negative: begin hepatitis B vaccine series.
   - Source not tested or unknown: begin hepatitis B vaccine series.

B. If exposed person was immunized and responded:
   - No treatment is necessary.

C. If exposed person was immunized and did not respond:
   - Source HBsAg-positive: HBIG immediately and in 1 mo or HBIG and initiate reimmunization.
   - Source HBsAg-negative: no treatment.
   - Source not tested or unknown: if high-risk source, consider HBIG or HBIG and HBV reimmunization as for HBsAg-positive source.

D. If exposed person was immunized and not tested for a response or response is unknown:
   - Source HBsAg-positive: test exposed for anti-HBs; if positive, no treatment; if negative, 1 dose of HBIG and 1 dose of vaccine, retest exposed for anti-HBs 4 to 6 mo later.

Step 4: Consider prophylaxis against HIV.[34,35] Antimicrobial prophylaxis should be initiated as soon as possible but within 24 h of exposure. Thus, clinicians in ambulatory settings should be prepared to prescribe and manage anti-HIV medications or arrange for urgent consultation with a specialist in the management of HIV infection who will also provide follow-up care of the employee. There are 2 postexposure HIV-prophylaxis regimens: the "basic regimen," a 4-wk course of 1 of several regimens containing 2 anti-HIV drugs, and an "expanded regimen" containing 3 anti-HIV drugs for exposures with an increased risk of transmission.[34,35] Updated information can be found at AIDSinfo (http://aidsinfo.nih.gov) or the National HIV/AIDS Clinician's Post Exposure Hotline (PEPline) at 1-888-448-4911. The PEPline provides consultation 24 h per day, 7 days per week for questions about managing occupational exposures to HIV, hepatitis B and C, and other bloodborne pathogens.

Step 5: Use this opportunity to educate the exposed person regarding risks of exposure, safe handling of sharps, immunization, standard precautions, and safe work habits.

Step 6: Repeat serologic testing for hepatitis C and HIV at 6 mo after potential exposure. Repeat serologic testing for hepatitis B (HBsAg and anti-HBs) at 6 mo if the exposed person was not previously documented to be anti-HBs-positive.

HBsAg indicates anti– hepatitis B surface antigen; HBIG, hepatitis B immunoglobulin.

Sources: Medical Group Management Association. *OSHA Safety Program Manual*. Englewood, CO: Medical Group Management Association; 2002; and Occupational Safety and Health Administration. Bloodborne Pathogens and needlestick prevention. Available at: www.osha.gov/SLTC/bloodbornepathogens/index.html.

Tuberculosis

In adults, screening for tuberculosis using a tuberculin skin test (TST) or a blood assay for *M tuberculosis* (eg, QuantiFERON-TB Gold test [Cellestis Limited, Carnegie, Victoria, Australia], which measures γ-interferon release by T cells after incubation of whole blood with 2 *M tuberculosis*–specific antigens[39,40]) should be performed before employment to ensure that persons with tuberculous infection are detected early and are treated. Employees with active pulmonary or laryngeal tuberculosis should be excluded from work until they are no longer contagious.[13,41] A TST result is considered positive in a

TABLE 4 **Work-Restriction Policies for Employees**

Infection	Restriction	Length of Restriction
Conjunctivitis	Restrict from direct patient care	Until discharge resolves
Gastroenteritis	Restrict from direct patient care and food preparation	Until symptoms resolve or person is deemed noncontagious
Hepatitis A	Restrict from direct patient care	Until 1 wk after onset of jaundice
Hepatitis B	None[a]	
Hepatitis C	None[a]	
Herpes simplex		
Orofacial	None (cover lesion if feasible)	
Whitlow	Restrict from direct care of newborn infants	Until lesions are crusted
HIV	None[a]	
Measles	Exclude from ambulatory facility	Until 7 d after onset of rash
Mumps	Exclude from ambulatory facility	Until 5 d after onset of parotitis
Pertussis	Exclude from ambulatory facility	Until treated for 5 d with appropriate antimicrobial therapy
Rubella	Exclude from ambulatory facility	Until 5 d after onset of rash
Staphylococcal skin infection	Restrict from direct patient care	Until treated for 24 h with an agent active against the isolate
Streptococcal group A pharyngitis	Restrict from direct patient care	Until treated for 24 h
Tuberculosis, active	Exclude from ambulatory facility	Until proven noninfectious
Varicella	Exclude from ambulatory facility	Until lesions crusted (usually 6 d after the onset of rash)
Zoster	If lesions are covered, may have contact with patients (other than immunocompromised patients and newborns); if lesions cannot be covered, restrict from patient care	Until lesions crusted

[a] Health care personnel with these infections should avoid performing procedures that are considered to be at risk for transmission of blood from health care personnel to a patient.

health care staff member who is otherwise healthy if the transverse diameter of the area of induration is at least 10 mm. For new employees with a negative TST and who have not had a TST within the past year, a 2-step TST (ie, use of a second TST 1–3 weeks after the initial skin test) is recommended, because it will boost the size of the induration in an individual with remote latent tuberculosis infection whose initial reading was less than 10 mm.[42] For employees with an immunocompromising condition, such as HIV infection, or close contact with a person with active tuberculosis, induration of 5 mm is considered a positive result.[42] If the TST result is positive, the employee is referred for evaluation and appropriate management. A blood assay for *M tuberculosis* is an acceptable alternative to a TST in adults, including health care personnel.[39,40] In contrast to a TST, there is no need for a second test if the initial result is negative. For ambulatory settings classified as having low risk of tuberculosis transmission, additional screening of employees is not necessary unless an exposure to *M tuberculosis* occurs.[40]

Staff Immunization

Policies should be established regarding immunization of employees, volunteers, students, and resident physicians against vaccine-preventable infections (Table 5).[22,43] Immunization records should be maintained for all employees. Immunization with hepatitis B vaccine at no cost to the employee is mandated by the OSHA and must be offered to all persons whose job category, specified in the bloodborne pathogen exposure-control plan for the facility, indicates likely exposure to bloodborne pathogens.[32,33] In 2005, a trivalent vaccine for protection against tetanus, diphtheria, and pertussis designed for adolescents and adults (Tdap; Adacel, Sanofi Pasteur, Swiftwater, PA) was licensed for persons 11 to 65 years of age.[44] (A second Tdap vaccine, Boostrix [GlaxoSmithKline Biologicals, Rixensart, Belgium] has been licensed for use in persons 10–18 years of age.[44]) Tdap is given instead of the tetanus-diphtheria booster to protect health care personnel and their patients from pertussis and provide protection against tetanus and diphtheria (Table 5). In 2006, the CDC recommended administering a single dose of Tdap to health care personnel with direct patient contact. This vaccine should be provided by the health care facility at no cost to the employee. Employees should be immunized against measles, mumps, rubella, and varicella unless immunity is documented by serologic testing or previous immunization or infection (Table 5). For the protection of health care personnel and their patients, the CDC also recommended that health care facilities provide influenza vaccine annually to all health care personnel at no cost to the employees.[45]

Staff Education

At the time of orientation, all employees should receive and review information regarding infection-prevention and -control policies and procedures, including precautions for minimizing the risk of transmission of bloodborne pathogens. Annual education regarding the OSHA bloodborne pathogens standard is required.[33] Furthermore, regularly scheduled educational sessions for all staff members are important to ensure that the levels of hand hygiene and infection-prevention and -control

TABLE 5 **Suggested Immunizations for Staff**

All staff members should receive the following immunizations:

- MMR vaccine
  - → All health care personnel born after 1956 should have received 2 doses of MMR vaccine. Ambulatory facility health care personnel often have contact with pregnant women; thus, it is optimal to ensure that all personnel are immune to rubella. Because birth before 1957 is only presumptive evidence of immunity to measles, mumps, and rubella, ambulatory facilities should consider recommending 1 dose of MMR vaccine for unimmunized workers born before 1957 who do not have a history of physician-diagnosed measles, mumps, and rubella or laboratory evidence of immunity to these viruses. Some experts recommend serologic screening for all employees to ensure immunity to measles, mumps, and rubella.
- Hepatitis B vaccine
  - → Hepatitis B vaccine should be strongly recommended for any employee who may come in contact with blood. The OSHA requires that hepatitis B vaccine must be offered to all employees who may be at risk of bloodborne exposures on the basis of job categories determined by the organization's bloodborne pathogen exposure-control plan. If the employee refuses immunization, this should be documented in the employee's file; the OSHA declination form is useful for this purpose.
- Varicella vaccine
  - → All employees should be questioned about a history of varicella. Employees with a negative or unknown history of disease who have not previously received 2 doses of varicella vaccine should be offered vaccine. Alternatively, employees with no history of disease or immunization can have a varicella antibody test performed, and vaccine can be offered to those who lack detectable varicella antibody. Adults require 2 doses of varicella vaccine separated by a minimum of 4 wk. If the employee has a medical contraindication to varicella vaccine or refuses immunization, this information should be placed in the employee's file.
- Influenza vaccine
  - → Vaccine use should be strongly promoted and offered free of charge yearly to all employees. Employee education and the use of a declination form should be considered to enhance immunization rates.
- Adolescent-adult Tdap vaccine
  - → This vaccine is recommended by the CDC for all health care personnel with direct patient contact. There should be a minimum of a 2-y interval between administration of Tdap and the most recent dose of Td vaccine.[43]

MMR indicates measles-mumps-rubella; Td, tetanus-diphtheria.

Source: Centers for Disease Control and Prevention. *MMWR Recomm Rep.* 2004;43(RR-13):1–132.

awareness remain high.[46,47] Policies for infection prevention and control should be written, available, read by staff, and enforced. All staff members should be aware of and motivated to follow these policies.[48]

Communication With Local and State Health Authorities

State and local health authorities determine which diseases should be reported. Physicians and staff in ambulatory facilities must be aware of the rules and regulations in their municipalities. Policies and procedures for communication with local and state health authorities regarding reportable diseases and suspected outbreaks should be established while adhering to current regulations of the Health Insurance Portability and Accountability Act (HIPAA).[49]

Minimize the Likelihood of Liability to Third Parties

A number of third-party liability cases involve infectious diseases (ie, cases alleging that a physician is liable for injury to others as a result of exposure to a contagious patient seen by the physician). A third party might include a family member or another close contact of a patient. Although some courts have concluded that there can be no liability without a physician-patient relationship, other courts have held that the physician has a duty to third parties if contact with the infected patient is "reasonably foreseeable." Third-party liability can occur not only from failing to warn the third party but also from failing to diagnose the disease in the patient or negligently advising the third party that there was no danger of infection. Therefore, physicians should be aware of their potential responsibility to third parties and should enact and document appropriate measures to minimize such risks. These measures include (1) informing the patient about the contagious nature of the disease, including treatments, potential risk to third parties, and advice about preventing the spread of the infection, (2) learning the relevant communicable diseases–reporting statutes and complying with them (although reporting may not be sufficient to satisfy the physician's duty to protect the third party), and (3) informing the patient of any action the physician intends to take to protect third parties at risk of contact with the patient.[50]

Ambulatory Facility Design, Procedures, and Patient Flow: Waiting and Reception Areas

Measures to prevent transmission of contagious infectious agents in ambulatory facilities that begin at the time the visit is scheduled should be developed and implemented. For example, during a telephone call request for an urgent visit for an ill child, the staff person should inquire whether the child has a skin rash. Parents of a child suspected of being contagious should register with the receptionist immediately on arrival; in some

cases, the child may be asked to use a separate entrance to avoid the waiting area and may be escorted directly into an examination room. Year-round (or during the winter season) and on the basis of recommendations from local public health departments and the CDC, travel- or symptom-based questions should be asked of patients/parents on arrival.[51] Staff should question patients and parents to determine if the patient has a rash or symptoms of a respiratory infection or has been exposed to individuals with specific infections (eg, tuberculosis, pertussis, measles). On the basis of current recommendations from local public health departments and the CDC, patients should be questioned about recent travel (eg, to countries with avian influenza infection or SARS-related coronavirus infection)[51] that might signify that the patient or an accompanying person has a contagious infection (Table 2). Signs should be displayed prominently at the entrance and reception areas with (1) instructions to patients and parents to notify staff immediately if the patient has a rash or symptoms of a respiratory infection or has been exposed to individuals with specific infections (eg, tuberculosis, pertussis, measles, varicella) and (2) instructions on implementing respiratory hygiene/cough etiquette (such as those prepared by the CDC[52,53]).

Waiting rooms and reception areas offer the opportunity for child-to-child interaction with concomitant child-to-child transmission of infectious agents. Waiting rooms are comparable with child care settings, where contamination of the environment and transmission of infectious agents occur at an increased rate compared with the home setting. Efforts should be made to limit transmission of infectious agents by designing waiting areas as multiple smaller rooms if possible, avoiding crowding, shortening waiting times, and minimizing the sharing of toys. To the extent feasible, respiratory hygiene/cough-etiquette guidelines (Table 2), including the use of tissues and hand-hygiene products (which should be supplied by the ambulatory facility), should be followed by children and adults with respiratory tract symptoms. Infected children who are symptomatic should be segregated from well children as quickly as possible. However, no studies document the need for, or benefit of, separate waiting areas for well and ill children.[8] Sick adults should be discouraged from spending time in waiting areas. Pathogenic bacteria have been recovered from toys in ambulatory waiting areas,[54] and contaminated bath toys have been implicated in an outbreak of *Pseudomonas aeruginosa* infection in a hospital.[55] A suggestion can be made to parents to bring along their child's personal book and toys for the office visit to minimize sharing of toys. Toys in ambulatory facility reception and waiting areas should be disposable or washable and of appropriate sizes and shapes to avoid aspiration or other injuries. Furry toys are less desirable because of the inability to clean them.[54] The value of antibacterial agents incorporated within toys is unproven. Ideally, toys should be cleaned between uses to avoid transfer of infectious agents.[56] Toys contaminated with body fluids should be removed until cleaned. Toys should be cleaned by washing with soap and water and then disinfecting (using a freshly prepared 1:100 dilution of household bleach or a product that meets the standards of the Environmental Protection Agency [EPA] for "hospital-grade" germicide that is nontoxic for children), rinsing, and air drying or by cleaning in a dishwasher that is designed for sanitizing dishes. Although smooth surfaces that are able to be scrubbed have not been demonstrated to have an infection-control advantage over carpeting and cloth upholstery, it may be prudent to use such materials in waiting areas because of their ease of cleaning and maintenance.

Sterilization, Disinfection, and Antisepsis

Sterilization completely eliminates or destroys all forms of microbial life, including spores. Disinfection reduces, but does not eliminate, the microbial burden. The extent of disinfection depends on the type of disinfectant and its concentration, the resistance of the microbes, contact time, and amount of organic material. Cleaning with detergent to remove organic material from medical instruments and other devices is a prerequisite to sterilization and disinfection. Antisepsis refers to the process used to decontaminate the skin of a patient or health care professional.

All patient care equipment should be cleaned at least daily while in use or when visibly contaminated and should be stored where it will not become contaminated. Reusable equipment having contact with mucous membranes requires high-level disinfection, whereas instruments that penetrate skin or sterile body cavities must be sterile (Table 6).[57–59]

Sterilization

Sterilization is accomplished by exposure to high-temperature steam, dry heat, or chemical sterilizing agents.[57,59] Items must be cleaned manually with soap and water to remove organic debris before autoclaving. Steam autoclaving uses distilled water that must reach a temperature of 121 to 132°C. The time for exposure of items and temperature depend on the type of sterilizer and what is being sterilized. Dry-heat sterilization in an oven is used only for items that cannot be sterilized by autoclaving. The oven temperature should be 170°C for an exposure time of 1 hour. For sterilizing specific instruments, the manufacturer's instructions must be followed. Unwrapped instruments should be used immediately or aseptically transferred to a sterile container.

A chemical indicator should be included with the equipment to be sterilized to ensure that sterilization has occurred. Instrument indicators ensure that a machine reaches the correct temperature and pressure. Chemical

TABLE 6 **Sterilization, Disinfection, and Antisepsis**

Instrument	Level of Disinfection	Methods (Examples)
Critical instrument or device: any instrument that enters tissue (eg, needles, surgical instruments, urinary catheters, some semicritical items)	Sterilization	Steam, low-temperature gas plasma, immersion in liquid chemical sterilants, ethylene oxide gas
Semicritical instrument or device: any instrument that contacts mucous membranes but does not enter tissue (eg, laryngoscope)	High-level disinfection	Wet pasteurization at 70°C for 30 min, chemical sterilants, liquid-chemical high-level disinfectants (eg, >2% glutaraldehyde, 0.55% ortho-phthalaldehyde [OPA], 7.5% hydrogen peroxide alone or in combination with peracetic acid)
Noncritical instruments or devices: instruments that touch only intact skin (eg, stethoscopes, blood pressure cuffs), including those with visible blood	Intermediate-level disinfection	1:50 dilution of sodium hypochlorite (1000 ppm of chlorine), 70%–90% isopropyl and ethyl alcohol, phenolic germicidal detergent solution, iodophor germicidal detergent solution
Environmental surfaces: knobs, handles, carts, or tabletops (with no visible blood)	Soap and water or low-level disinfection	EPA-approved disinfectants labeled for use against hepatitis B virus and/or tuberculocidal activity (eg, quaternary ammonium compounds), 1:500 dilution of sodium hypochlorite (100 ppm of chlorine)

Sources: Merriman E, Corwin R, Ikram R. *Br J Gen Pract*. 2002;52:138–140; Buttery JP, Alabaster SJ, Heine RG, et al. *Pediatr Infect Dis J*. 1998;17:509–513; and Geyer SA. *J Healthc Mater Manage*. 1986;4:52–53.

indicators are useful in showing that the wrapped package has been through the sterilization process. Biological indicators are necessary to ensure sterility. The procedure recommended by the manufacturer to document that sterility has been achieved should be performed at least weekly, and results should be recorded.

Packs that have been sterilized should be appropriately identified and stored in clean, dry areas to minimize recontamination. As long as the integrity of the sterile packaging is clean and intact, studies have shown that sterility of the product has no expiration date. Written policies and procedures for sterilization should be prepared, distributed to staff, and reviewed at regular intervals to be sure that policies are followed.

Disinfection

For this statement, the terms for disinfection are taken from the standards for sterilization, disinfection, and antisepsis used in hospitals.[57,59] High-level disinfection is used for instruments that have had contact with mucous membranes or nonintact skin. High-level disinfection is most often achieved by using liquid chemicals. Chemical disinfection is accomplished with several chemicals or combination of chemicals, including glutaraldehyde, 0.55% ortho-phthalaldehyde, or stabilized hydrogen peroxide (a combination of hydrogen peroxide and peracetic acid). The solution should be prepared according to manufacturer instructions and applied for the specified contact time, which varies with the chemical and the concentration. Activated glutaraldehyde solutions are used most commonly; however, these products have potential toxicity if proper ventilation is not ensured. After disinfection, instruments are rinsed with sterile water, dried, and stored in a clean, dry place to avoid extrinsic contamination.

Intermediate-level disinfection is accomplished with 70% ethyl or isopropyl alcohol, iodine and iodophors, or a 1:50 dilution of sodium hypochlorite.

Low-level disinfection is appropriate for equipment that does not touch mucous membranes; examples include bedpans, blood pressure cuffs, crutches, stethoscopes, and tabletops. Low-level disinfectants include phenolic compounds, quaternary ammonium compounds, and a 1:500 dilution of sodium hypochlorite.

Written policies and procedures for disinfection should be prepared, distributed to staff, and reviewed at regular intervals to be sure that policies are being followed.

Antisepsis

Antiseptics are chemical agents intended for use on skin or tissue. Skin-preparation agents include isopropyl alcohol, chlorhexidine gluconate, iodine, and iodophors. The preferred skin-preparation agent for immunization and venipuncture for routine blood collection (except obtaining blood for culture) is 70% isopropyl alcohol. Most skin-preparation agents must be allowed to dry before surface bacteria are killed. For children 2 months and older, a preparation that contains 2% chlorhexidine gluconate/70% isopropyl alcohol is the preferred skin-preparation agent for invasive procedures, including placement of central venous catheters. Tincture of iodine and povidone iodine are acceptable alternatives, may be used for infants younger than 2 months, and are routinely used for obtaining blood for culture. Contamination of antiseptics has been associated with outbreaks of infections and pseudoepidemics attributable to false-positive blood cultures.[60] To prevent contamination, bottles of antiseptics should be dated, should not be refilled, and should be inspected and discarded if not used within 28 days after opening. Alcohol pads, chlorhexidine gluconate, and iodine products prepared in single-use pack-

aging are available and eliminate the need for multiple-use bottles of these antiseptics.

General Housekeeping

All areas in ambulatory facilities should be cleaned on a regular basis and kept visibly clean. Examination rooms and frequently used equipment should be cleaned daily. Surfaces in examination rooms and patient waiting areas should be cleaned with a detergent and low-level disinfectant such as a disinfectant-grade quaternary ammonium compound "registered" by the EPA (ie, EPA approved). Linoleum and sealed wood floors are optimal floor surfaces, because they can be cleaned without difficulty. Furniture made of nonporous materials offers a similar advantage compared with furniture with cloth upholstery.

Spills and Environmental Contamination

Contaminated environmental surfaces should be cleaned with a detergent and then treated with a freshly prepared (ie, within the past 24 hours) 1:100 dilution of household bleach with contact time of at least 1 minute or a proprietary germicidal product on the EPA's list E (registered antimicrobial products effective against *M tuberculosis*, human HIV-1, and hepatitis B virus; see www.epa.gov/oppad001/chemregindex.htm). For spills with blood or body fluids contaminated by blood, visible organic matter should be removed with absorbable material (eg, paper towels) and discarded into a leak-proof, properly labeled container before cleaning and decontaminating. Chlorine, the active agent in household bleach, can be inactivated by blood and other organic material, and full-strength solution or a 1:10 dilution is required if the surface is not cleaned before disinfection. Gloves should be worn during cleaning.[3]

Examination Rooms

Each examination room in a pediatric ambulatory care setting should have a sink and alcohol-based hand rub. Properly functioning sinks, ideally with faucets that operate in a "hands-free" manner, with adjacent soap dispensers (with plain or antimicrobial soap) and disposable towels or dispensers with alcohol-based hand rub, should be located conveniently in all patient care areas. Installation of solid-surface sinks with continuous countertops and backsplashes may offer fewer opportunities for water trapping in seams. Soap should generally be in liquid form in pump dispensers that are designed to minimize the risk of extrinsic contamination. Bar soaps are less desirable, because bars frequently are wet and easily contaminated with potential pathogens; if used, small bars of soap and soap racks that facilitate drainage and drying of the soap should be used. Faucet aerators should be avoided, because they often become contaminated by *Pseudomonas* species and other waterborne organisms.

Equipment that makes physical contact with the patient should be cleaned after each use. Although furniture in the room generally is not a major concern for transfer of infectious agents, contamination of the examining table can be a problem. Covering the table with disposable paper or linen, which is changed between patients, decreases the risk of transmission of microbes. More-thorough cleaning should be performed if contamination, such as soiling from a diaper change, is visible. In such cases, a detergent should be used to remove visible soil followed by application of a freshly diluted solution of household bleach (1:100) applied for 1 minute to disinfect the surface, rinsing with water, and allowing to dry or using an EPA-approved low-level disinfectant disposable wipe indicated to inactivate *M tuberculosis* and/or hepatitis B virus. If reusable patient linens/gowns are used, they should be handled in a manner that minimizes contamination of the environment. Soiled linens should be contained or placed in a soiled linen bag at the point of use.[3] Provision should be made for the laundering of soiled linen.

Rest Rooms

Rest rooms for use by staff and patients should be cleaned daily and whenever visibly soiled. A diaper-changing area with disposable paper and a closed receptacle for soiled diapers and paper should be provided in at least 1 rest room.

Air Flow

Certain infections, including varicella, measles, and tuberculosis, are transmitted by the airborne route. Unfortunately, the number of air exchanges in buildings that house ambulatory facilities often is low, and the air is recirculated frequently.

Physicians should be aware of air-flow patterns to limit transmission of airborne pathogens. Special arrangements are recommended for patients who are considered to be contagious with an airborne pathogen, including (1) making efforts to see these patients at the end of the day, (2) placing a mask on the patient and quickly triaging these patients out of common waiting areas, and (3) closing the door of the examination room and limiting access to the patient by visitors and staff members who are not immune to the suspected disease. In some practices, it may be feasible for the clinician to perform a "car visit" by evaluating the patient in the family car in the parking area of the ambulatory facility. The duration of time that airborne pathogens remain in a room depends on air-exchange rates. For example, in hospitals where air-exchange rates are 6 to 8 per hour, several air exchanges occur within 30 minutes. Recommended air-exchange rates depend on the stated use of a room. Recommendations and guidelines for design and construction of hospitals and health care facilities are made by the American Institute of Architects and the

Facility Guidelines Institutes with guidance from the US Department of Health and Human Services.[61] These guidelines have been adopted in whole or in part as regulations in nearly all states and enforced by the Joint Commission (formerly called the Joint Commission on Accreditation of Healthcare Organizations). Another nonregulatory resource is the American Society of Heating, Refrigerating and Air-Conditioning Engineers. The current recommended air-exchange rate for a medical examination room is 6 air changes per hour, with 2 outside air exchanges per hour.

Diagnostic and Personal Equipment

The role of stethoscopes and other examining devices in transmitting infectious agents is unclear; however, studies have shown that stethoscopes can be contaminated with viral and bacterial agents, including bacteria that are resistant to multiple antimicrobial agents. A reasonable means of decreasing contamination is to wipe the bell and diaphragm of the stethoscope as well as the handle and body of otoscopes or ophthalmoscopes regularly, and whenever they become soiled, by using an EPA-approved disinfectant wipe labeled to be effective against hepatitis B or a 70% isopropyl alcohol wipe. Ear curettes, if not disposable, should be cleaned with 70% isopropyl alcohol after each use and, if grossly contaminated by blood/body substances, should be cleaned and then disinfected by using a sodium hypochlorite solution.

In most cases, blood pressure cuffs are placed on intact skin; therefore, the risk of transmission of infectious agents with their use is minimal. These reusable cloth cuffs should not be placed in direct contact with damaged or nonintact skin.

Whenever economically and medically feasible, disposable supplies should be used. Electronic thermometers have single-use shields, but care must be taken to avoid contaminating the housing of the thermometer. The "box" and the probe handle should be wiped with a low-level EPA-approved disinfectant whenever soiled. Care should be taken to avoid contamination of pulse-oximetry and tympanometry equipment with any body secretions, and equipment should be cleaned according to manufacturer recommendations after each use. Other equipment, such as electrocardiography machines and Denver Developmental Testing kits (Denver Developmental Materials Incorporated, Denver, CO), should be cleaned and disinfected with an intermediate-level disinfectant whenever they become soiled or contaminated by patient secretions.

Ballpoint pens, patient charts, computer mice and keyboards, and personal digital assistant devices can be contaminated with infectious agents that can be transmitted by hands to other environmental sources. Because these items are not cleaned after each use, hand hygiene before and after contact with the patient or immediate environment is necessary to minimize the potential transfer of bacteria and viruses from equipment to patients. A daily cleaning schedule that includes use of an EPA-approved low-level disinfectant is recommended for such items as computer mice and keyboards, blood pressure cuffs, and other commonly touched items in the patient's environment.

Disposal of Medical Wastes

The federal OSHA standards, as well as local and state regulations, dictate the proper disposal of medical wastes including dressings, needles, sharps, and body-fluid samples.[3,62] All physicians should be aware of the policies in their state and municipality and ensure that regulated wastes are disposed of appropriately. Basic principles include defining which items constitute infectious waste and which do not; appropriately separating, labeling, storing, and transporting items in these 2 categories; instructing staff on how to handle infectious waste; and developing plans for managing spills and inadvertent exposures.

Judicious Use of Antimicrobial Agents and Antimicrobial-Resistant Bacteria

Another aspect of infection prevention and control is diagnosis of infection and institution of antimicrobial therapy when indicated. Inappropriate use of antimicrobial agents in hospitals and ambulatory settings has contributed to the emergence of antimicrobial-resistant microorganisms. The CDC and the AAP have provided guidelines for the judicious use of antimicrobial agents.[63–69]

Guidelines have been published for isolation and precautions for hospitalized children and adults who acquire resistant flora.[70–72] Patients may continue to harbor antimicrobial-resistant bacteria as part of their skin, respiratory tract, or gastrointestinal tract flora. These organisms include methicillin-resistant *Staphylococcus aureus*, vancomycin–intermediately susceptible *S aureus* (glycopeptide–intermediately susceptible *S aureus*), vancomycin-resistant *Enterococcus* species, and extended-spectrum β-lactamase–producing and other multiply resistant Gram-negative bacteria. Many patients harboring these bacteria will not be identified, because the bacteria may not cause symptoms. Hand hygiene before and after contact with colonized children with or without the use of gloves is appropriate; no guidelines for management of these patients in ambulatory settings have been published. However, these resistant bacteria could contaminate the environment; thus, if a patient is known to have been infected or colonized with multidrug-resistant bacteria and has a draining wound or is in diapers, contact precautions may be beneficial, hand hygiene should be performed with an alcohol-based hand rub or washing with antimicrobial soap and water, and surfaces

in the examination room with which the patient had contact should be disinfected.

SUMMARY OF INFECTION-PREVENTION AND -CONTROL POLICIES (SEE APPENDIX FOR DESCRIPTION OF EVIDENCE CATEGORIES)

1. Written policies and procedures concerning infection prevention and control should be developed, incorporated into the ambulatory practice safety program, available at all times to office staff, and reviewed at least every 2 years (categories IB and IC).
2. Educational programs for staff concerning infection prevention and control should be implemented, reinforced, and evaluated on a regular basis (category IB).
3. Staff should receive influenza immunization annually and be immunized against or show documentation of immunity to other vaccine-preventable infections, including pertussis, measles, mumps, rubella, varicella, and hepatitis B, that can be transmitted in an ambulatory setting (categories IB and IC).
4. All health care personnel should perform hand hygiene by using an alcohol-based hand rub or handwashing with soap (plain or antimicrobial) and water before and after patient contact or contact with the patient's immediate environment (category IA).
5. Standard precautions (Table 1) should be used in every interaction with a patient (categories IB and IC).
6. In waiting rooms of ambulatory facilities, use of some or all components of respiratory hygiene/cough etiquette should be considered for patients and accompanying persons with suspected respiratory infection (category II).
7. Patients with potentially contagious diseases and immunocompromised children should be promptly triaged. Contact between contagious children and uninfected children should be minimized. Policies to deal with children who present with highly contagious infections, such as varicella, measles, pertussis, influenza, and mumps, should be devised and implemented (category IB).
8. Alcohol is preferred for skin antisepsis before immunization and routine venipuncture. Skin preparation for incision, suture, and collection of blood for culture requires either 2% chlorhexidine gluconate/70% isopropyl alcohol-based solutions (for children older than 2 months) or iodine (1% or 2% tincture of iodine, 2% povidone iodine) (category IB).
9. Physicians should be aware of requirements of government agencies, such as the OSHA, as they relate to the operation of ambulatory facilities (category IC).
10. Needles and sharps should be handled with great care. Needle-disposal units that are impermeable and puncture-proof should be available next to the areas used for injection or venipuncture. The containers should not be overfilled and should be kept out of reach of young children. Procedures should be established for removal and incineration or sterilization of contents. Needle devices with safety features should be evaluated periodically with input from staff members who use needles, and use of devices that are likely to improve safety should be implemented (categories IA and IC).
11. A written bloodborne pathogens exposure-control plan that includes written policies for management of contaminated–sharp-object injuries should be developed, readily available to all staff, and reviewed annually (category IC).
12. Standard guidelines for sterilization, disinfection, and antisepsis should be followed (category IC).
13. Policies and procedures should be developed for communication with local and state health authorities regarding reportable diseases and suspected outbreaks (category IC).
14. Antimicrobial agents should be used appropriately, and standard precautions (Table 1) should be observed to limit the emergence and spread of antimicrobial-resistant bacteria (category IB).

APPENDIX: EVIDENCE-BASED GUIDELINES CATEGORIES

CDC Healthcare Infection Control Practices Advisory Committee (HICPAC) guidelines[2,4] were used for categorizing the evidence base for each recommendation. Each recommendation is categorized on the basis of existing scientific data, theoretical rationale, applicability, and economic impact. The CDC/HICPAC system for categorizing recommendations is as follows:

Category IA. Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

Category IB. Strongly recommended for implementation and supported by certain experimental, clinical, or epidemiologic studies and a strong theoretical rationale.

Category IC. Required for implementation, as mandated by federal or state regulation or standard.

Category II. Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

No recommendation. Unresolved issue; practices for

which insufficient evidence or no consensus regarding efficacy exist.

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American Academy of Pediatrics

Policy Statement

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Informed Consent, Parental Permission, and Assent in Pediatric Practice (RE9510)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Bioethics

The statement on informed consent, parental permission, and patient assent has a long and extraordinary history. The first draft of this document, prepared by William G. Bartholome, MD, was presented to the original American Academy of Pediatrics (AAP) Committee on Bioethics in 1985. Bill put his soul into the manuscript and has watched over it carefully ever since. Now, a decade later, those who have worked on its continued development and urged its adoption as Academy policy applaud its publication. No one is more gratified than its primary author and champion. Those who have had the privilege to know Dr Bartholome share his sense of accomplishment, but cannot help but experience a cruel sense of irony. Just as the work Bill considers his most important contribution has become available for public appreciation, Dr Bartholome suffers from a serious illness that threatens his life
Bill always wanted "the experience, perspective, and power of children" to be taken most seriously. Through the years of the statement's revisions and re-presentation within the Academy, Bill "had faith in the power of the text and the ideas it contained, ... that its time would come." The statement embodies Bill Bartholome's dedication to children. Throughout his career, he worked to make medicine and medical research safer and more friendly for children. The AAP and its Committee on Bioethics, on behalf of all our colleagues, extend heartful thanks to Dr William G. Bartholome for helping us more fully appreciate that children are in the process of becoming, in his words, "intelligent, observant, capable, and responsible persons" who deserve our utmost respect.

AN OVERVIEW

Since the 1976 publication of an AAP policy statement on the legal concept of informed consent in pediatric practice, the concept has evolved and become more formal.[1] A better understanding now exists as to how physicians should collaborate with patients and parents in making these decisions. Patients should participate in decision-making commensurate with their development; they should provide assent to care whenever reasonable. Parents and physicians should not exclude children and adolescents from decision-making without persuasive reasons. Indeed, some patients have specific legal entitlements to either consent or to refuse medical intervention. Although physicians should seek parental permission in most situations, they must focus on the goal of providing appropriate care and be prepared to seek legal intervention when parental refusal places the patient at clear and substantial risk.[2] In cases of serious conflict, physicians and families should seek consultative assistance and only in rare circumstances look to judicial determinations.

We now realize that the doctrine of "informed consent" has only limited *direct* application in pediatrics. Only **patients** who have appropriate decisional capacity and legal empowerment can give their **informed consent** to medical care. In all other situations, parents or other surrogates provide **informed permission** for diagnosis and treatment of children with the **assent** of the child whenever appropriate.

In this statement, the AAP provides an updated analysis of 1) the concept of informed consent; 2) the ethics of informed consent and the concept of the right to refuse treatment; 3) the concept of "proxy consent"; 4) the concepts of parental permission and child assent; and 5) informed consent of adolescents.

CHANGES IN MEDICAL DECISION-MAKING

The authority to make medical decisions used to lie squarely in the hands of physicians. However, complex social changes have resulted in acceptance of the idea that patients have a right to know about their health, to know about available diagnostic and treatment options and their risks and probable benefits, and to choose among the alternatives.[3] Many now regard traditional practices based on the theory that "doctor knows best" as unacceptably paternalistic.[4] Society recognizes that patients or their surrogates have a right to decide, in consultation with their

physicians, which proposed medical interventions they will or will not accept. Decision-making power or authority is increasingly seen as something to be shared by equal partners in the physician-patient or physician-surrogate relationship. For many patients and family members, personal values affect health care decisions, and physicians have a duty to respect the autonomy, rights, and preferences of their patients and their surrogates.[5]

ETHICS AND INFORMED CONSENT

The doctrine of informed consent reminds us to respect persons by fully and accurately providing information relevant to exercising their decision-making rights. Experts on informed consent include at least the following elements in their discussions of the concept:[6]

1. Provision of information: patients should have explanations, in understandable language, of the nature of the ailment or condition; the nature of proposed diagnostic steps and/or treatment(s) and the probability of their success; the existence and nature of the risks involved; and the existence, potential benefits, and risks of recommended alternative treatments (including the choice of no treatment).
2. Assessment of the patient's understanding of the above information.
3. Assessment, if only tacit, of the capacity of the patient or surrogate to make the necessary decision(s).
4. Assurance, insofar as is possible, that the patient has the freedom to choose among the medical alternatives without coercion or manipulation.

The goals of this consent process include the development of the patient's comprehensive understanding of the clinical situation, and the timely exercise, by the patient, of active choices regarding the circumstances.[7,8]

INFORMED CONSENT AND THE RIGHT TO REFUSE TREATMENT

Health care providers should engage in the process of informed consent with patients before undertaking any medical intervention. Patients generally have a moral and legal right to refuse proposed medical intervention, except when the patient has diminished decision-making capacity or must undergo legally authorized "involuntary" treatment. Respect for competent patients' autonomy ordinarily extends even to the refusal or discontinuation of their own life-sustaining treatment.[9]

PROBLEMS WITH THE CONCEPT OF "CONSENT" BY PROXY

In attempting to adapt the concept of informed consent to pediatrics, many believe that the child's parents or guardians have the authority or "right" to give consent by proxy. Most parents seek to safeguard the welfare and best interests of their children with regard to health care, and as a result proxy consent has seemed to work reasonably well.

However, the concept encompasses many ambiguities. Consent embodies judgments about proposed interventions and, more importantly, consent (literally "to feel or sense with") expresses something for one's self: a person who consents responds based on unique personal beliefs, values, and goals.

Thus "proxy consent" poses serious problems for pediatric health care providers. Such providers have legal and ethical duties to their child patients to render competent medical care based on what the patient needs, not what someone else expresses. Although impasses regarding the interests of minors and the expressed wishes of their parents or guardians are rare, the pediatrician's responsibilities to his or her patient exist independent of parental desires or proxy consent.[10]

PARENTAL PERMISSION AND SHARED RESPONSIBILITY

Decision-making involving the health care of young patients should flow from responsibility shared by physicians and parents. Practitioners should seek the informed permission of parents before medical interventions (except in emergencies when parents cannot be contacted). The informed permission of parents includes all of the elements of standard informed consent, as outlined previously.

Usually, parental permission articulates what most agree represents the "best interests of the child." However, the Academy acknowledges that this standard of decision-making does not always prove easy to define. In a pluralistic society, one can find many religious, social, cultural, and philosophic positions on what constitutes acceptable child rearing and child welfare. The law generally provides parents with wide discretionary authority in raising their children.[11] Nonetheless, the need for child abuse and neglect laws and procedures makes it clear that parents sometimes breach their obligations toward their children. Providers of care and services to children have to carefully justify the invasion of privacy and psychologic disruption that come with taking legal steps to override parental prerogatives.

THE DEVELOPMENT OF THE CHILD AS PERSON AND THE CONCEPT OF ASSENT

Decision-making involving the health care of older children and adolescents should include, to the greatest extent feasible, the **assent of the patient** as well as the participation of the parents and the physician. Pediatricians should not necessarily treat children as rational, autonomous decision makers, but they should give serious consideration to each patient's developing capacities for participating in decision-making, including rationality and autonomy. If physicians recognize the importance of **assent,** they empower children to the extent of their capacity.[12] Even in situations in which one should not and does not solicit the agreement or opinion of patients, involving them in

discussions about their health care may foster trust and a better physician-patient relationship, and perhaps improve long-term health outcomes.

Assent should include at least the following elements:

1. Helping the patient achieve a developmentally appropriate awareness of the nature of his or her condition.
2. Telling the patient what he or she can expect with tests and treatment(s).
3. Making a clinical assessment of the patient's understanding of the situation and the factors influencing how he or she is responding (including whether there is inappropriate pressure to accept testing or therapy).
4. Soliciting an expression of the patient's willingness to accept the proposed care. Regarding this final point, we note that no one should solicit a patient's views without intending to weigh them seriously. In situations in which the patient will have to receive medical care despite his or her objection, the patient should be told that fact and should not be deceived.

As children develop, they should gradually become the primary guardians of personal health and the primary partners in medical decision-making, assuming responsibility from their parents.

Just as is the case with informed consent, the emphasis on obtaining assent should be on the interactive process in which information and values are shared and joint decisions are made. The Academy does not in any way recommend the development of new bureaucratic mechanisms, such as "assent forms," which could never substitute for the relational aspects of consent or assent.

THE PATIENT'S REFUSAL TO ASSENT (DISSENT)

There are clinical situations in which a persistent refusal to assent (ie, dissent) may be ethically binding.[13] This seems most obvious in the context of research (particularly that which has no potential to directly benefit the patient).[14] A patient's reluctance or refusal to assent should also carry considerable weight when the proposed intervention is not essential to his or her welfare and/or can be deferred without substantial risk.

Medical personnel should respect the wishes of patients who withhold or temporarily refuse assent in order to gain a better understanding of their situation or to come to terms with fears or other concerns regarding proposed care. Coercion in diagnosis or treatment is a last resort.[15]

ETHICAL CONFLICT AND ITS RESOLUTION

Social forces tend to concentrate authority for health care decisions in the hands of physicians and parents and this tendency diminishes the moral status of children.[12] Thus, those who care for children need to provide for measures to solicit assent and to attend to possible abuses of "raw" power over children when ethical conflicts occur. This is particularly important regarding the initiation, withholding, or withdrawing of life-sustaining treatment.[16,17] Examples of mechanisms to resolve ethical conflicts include additional medical consultation(s); short-term counseling or psychiatric consultation for patient and/or family; "case management" or similar multidisciplinary conference(s); and/or consultation with individuals trained in clinical ethics or a hospital-based ethics committee. In rare cases of refractory disagreement, formal legal adjudication may be necessary.

LEGAL EMANCIPATION AND INFORMED CONSENT

The traditional notion of informed consent clearly applies to patients who have reached the legal age of majority, except when the patient has been determined to be incompetent. In addition, laws designate two settings in which minors have sole authority to make health care decisions.[11] First, certain minors are deemed "emancipated" and treated as adults for all purposes. Definitions of the emancipated minor include those who are: 1) self-supporting and/or not living at home; 2) married; 3) pregnant or a parent; 4) in the military; or 5) declared to be emancipated by a court. Second, many states give decision-making authority (without the need for parental involvement) to some minors who are otherwise unemancipated but who have decision-making capacity ("mature minors") or who are seeking treatment for certain medical conditions, such as sexually transmitted diseases, pregnancy, and drug or alcohol abuse.[18] The situations in which minors are deemed to be totally or partially emancipated are defined by statute and case law and may vary from state to state.[19] Legal emancipation recognizes a special status (eg, independent living) or serious public and/or individual health problems that might not otherwise receive appropriate attention (eg, sexually transmitted disease).

PRACTICAL APPLICATIONS

The following illustrations may help practitioners when applying the concepts developed above. These examples are intended to provide a focus for discussion and clarification and do not suggest new legal standards for pediatric practice.

In cases involving the following kinds of medical care for infants and young children, the Academy encourages physicians to seek the **informed permission of the parents** before: 1) providing immunizations; 2) performing invasive diagnostic testing for a congenital cardiac defect; 3) beginning long-term anticonvulsant therapy to control a seizure disorder; 4) initiating serial casting to correct congenital "clubfoot"; or 5) undertaking surgical removal of a "suspicious" neck mass.

Even in pressing situations, informed permission should be sought for actions such as performing a lumbar puncture to evaluate the possibility of meningitis. (In this situation, if parents deny permission for the procedure, one should obtain permission from the parents to initiate treatment based on reasonable clinical judgment, rather than delaying care or risking liability for performing the lumbar puncture

without appropriate authorization).

In cases involving the following kinds of medical care for older school-age children, the Academy encourages physicians to seek the **assent of the patient** as well as the **informed permission of the parents:** 1) venipuncture for a diagnostic study in a nine-year-old; 2) diagnostic testing for recurrent abdominal pain in a 10-year-old; 3) psychotropic medication to control an attention-deficit disorder in a third grader; 4) an orthopedic device to manage scoliosis in an 11-year-old; 5) an "alarm" system to treat nocturnal enuresis in an eight-year-old; or 6) surgical repair of a malformed ear in a 12-year-old. In some cases, treatment may proceed over the objection of the patient. However, physicians and parents should realize that overruling the child may undermine their relationship(s) with the child.

In situations such as the following that involve adolescents and young adults, the Academy encourages physicians to obtain the **informed consent** of the patient, in most instances: 1) performance of a pelvic examination in a 16-year-old; 2) diagnostic evaluation of recurrent headache in an 18-year-old; 3) a request for oral contraceptives for fertility control in a 17-year-old; 4) proposed long-term oral antibiotics administration for severe acne in a 15-year-old; or 5) surgical intervention for a bone tumor in a 19-year-old. Such patients frequently have decision-making capacity and the legal authority to accept or reject interventions, and, in that event, no additional requirement to obtain **parental permission** exists. However, the Academy encourages parental involvement in such cases, as appropriate.

Review of the limited relevant empirical data suggests that adolescents, especially those age 14 and older, may have as well developed decisional skills as adults for making informed health care decisions.[20-22] Ethical and legal factors, (ie, confidentiality and/or privacy), suggest that the physician involve parents after appropriate discussion with the adolescent elicits his or her permission to do so. In some cases in which the patient has no legal entitlement to authorize treatment, the physician may have a legal obligation in some jurisdictions to obtain **parental permission** or to notify parents in addition to obtaining the patient's consent. An adolescent's refusal of consent in cases such as these may well be legally (and ethically) binding. If "conflict resolution" fails, formal legal adjudication may be needed.

CONCLUSION

A re-analysis of informed consent leads to the identification of important limitations and problems in its application to pediatric practice. Two additional concepts are needed: **parental permission** and **patient assent.** The American Academy of Pediatrics believes that in most cases, physicians have an ethical (and legal) obligation to obtain **parental permission** to undertaken recommended medical interventions. In many circumstances, physicians should also solicit a **patient assent** when developmentally appropriate. In cases involving emancipated or mature minors with adequate decision-making capacity, or when otherwise permitted by law, physicians should seek **informed consent** directly from patients.

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This statement has been approved by the Council on Child and Adolescent Health.
The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

CLINICAL REPORT

Inhalant Abuse

Guidance for the Clinician in Rendering Pediatric Care

Janet F. Williams, MD, Michael Storck, MD, and the Committee on Substance Abuse and Committee on Native American Child Health

ABSTRACT

Inhalant abuse is the intentional inhalation of a volatile substance for the purpose of achieving an altered mental state. As an important, yet-underrecognized form of substance abuse, inhalant abuse crosses all demographic, ethnic, and socioeconomic boundaries, causing significant morbidity and mortality in school-aged and older children. This clinical report reviews key aspects of inhalant abuse, emphasizes the need for greater awareness, and offers advice regarding the pediatrician's role in the prevention and management of this substance abuse problem.

TYPES OF CHEMICALS AND PRODUCTS ABUSED

The term "inhalant" encompasses a wide range of pharmacologically diverse substances that readily vaporize. Most other substances of abuse are classified by grouping together substances that share a specific central nervous system action or perceived psychoactive effect, but inhalant substances that are abused are grouped by having a common route of drug use. Inhalant abuse, sometimes referred to as solvent or volatile substance abuse, can be better understood when the expansive list of inhalants is classified into 3 groups on the basis of what is currently known pharmacologically: group I includes volatile solvents, fuels, and anesthetics; group II includes nitrous oxide; and group III includes volatile alkyl nitrites (Table 1). This classification is also consistent with reported differences in user populations, patterns of abuse, and associated problems seen clinically.[1–3] Drugs that do not readily vaporize at room temperature, such as cocaine, heroin, nicotine, or alcohol, can also be abused through inhalation, but characteristic pharmacologic properties distinguish these substances from inhalants.

Inhalant abusers use volatile products that are capable of producing a quick and generally pleasurable sensory experience, or "high," with rapid dissipation and minimal "hangover" symptoms. Inhaled substances are widely available, convenient, inexpensive, easily concealed, and legal for specific intended uses but are intentionally misused by abusers. Many of these qualities are important factors that promote use in a young age group, because children have less sophisticated resources for acquiring alternative substances of abuse. The most commonly abused inhalants are the group I aliphatic, aromatic, or halogenated hydrocarbons found in thousands of commonly used and readily available consumer products. Virtually any hydrocarbon can have mind-altering effects when inhaled in large doses. Nitrous oxide or "laughing gas" is diverted from medical or dental anesthesia use and sold in balloons for inhalation or is simply inhaled from whipped cream aerosol cans. Alkyl nitrites or "poppers" are also abused; prototypically, amyl nitrite ampules intended to treat angina are "popped" open and inhaled.

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Key Words
substance abuse, inhalant abuse, inhalants, solvent abuse, inhaled nitrites, drug abuse

Abbreviations
NSDUH—National Survey on Drug Use and Health
MTF—Monitoring the Future
TESS—Toxic Exposure Surveillance System

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TABLE 1 **Pharmacologic Classification of Inhalants: Selected Common Street Names and Chemical Content of Product Examples**

I. Volatile solvents, fuels, and anesthetics (air blast, discorama, hippie crack, medusa, moon gas, oz, poor man's pot)
Solvents: toluene, acetone, methylene chloride, ethyl acetate, TCE in paint thinner, paint and polish removers, correction fluid, and felt-tip marker fluid; TCE and tetrachloroethylene in degreasers, spot removers, and dry-cleaning fluids; toluene, hexane, TCE, ethyl acetate, and methyl chloride in glues and rubber cement; propellants and solvents such as butane, propane, chlorofluorocarbons, hydrocarbons in aerosol spray paint, computer/electronics-cleaning spray, spray deodorant, hair spray, vegetable-oil cooking spray, air-freshener spray, fabric-guard spray, and analgesic sprays
Fuels: butane or propane lighters or pressurized fuel tanks, gasoline, racing car octane boosters, refrigerants
Anesthetics: ether, halothane, enflurane, ethyl chloride
II. Nitrous oxide (laughing gas, buzz bomb, shoot the breeze): diverted medical anesthetic, whipped-cream dispenser charger (whippets), whipping-cream aerosol
III. Volatile alkyl nitrites (poppers, snappers, boppers, pearls, amys [isoamyl nitrite diverted from medical use], quicksilver, and brand/slang terms Rush, Bolt, Thrust, Climax, Locker Room): videocassette-recorder head cleaner, liquid aroma/liquid incense air fresheners or room odorizers (mostly cyclohexyl nitrite), isobutyl nitrite or butyl nitrite, isopropyl nitrite

TCE indicates 1,1,1-trichloroethane.

EPIDEMIOLOGY

Inhalant abuse occurs throughout the world, in industrialized nations as well as developing countries. Several studies have helped define the epidemiology of volatile substance abuse in the United States.[3–11] The peak age of inhalant abuse is 14 to 15 years, with onset in children as young as 5 or 6 years of age. Use typically declines by 17 to 19 years of age but can continue into adulthood. Use by adults may predominate under particular circumstances, such as when certain occupations make abusable solvents, propellants, or anesthetics readily available. Inhaled nitrites have a long history of being abused in certain social settings, particularly when men have sex with men.[3] The type, frequency, and method of volatile substance abuse vary widely in relation to age of the abuser, geographic region, and ease of availability.

The National Survey on Drug Use and Health (NSDUH), an annual survey of drug use in the general US noninstitutionalized civilian population 12 years and older, has documented inhalant abuse initiation by both adolescents and adults.[10] In 2005 and similar to previous years, 72.3% of the 877 000 new volatile substance abusers aged 12 to 49 years were younger than 18 years, with a mean age of 16.1 years. Since 2002, no significant change has occurred in the number of inhalant initiates, the average age of first use, or the rates of inhalant abuse by either youth or adults. This survey again showed no significant male-female difference in lifetime prevalence of inhalant abuse in the 12- to 17-year age group but confirmed a greater prevalence of inhalant abuse by men in the 18- to 25-year age group, suggesting that sustained use of inhalants is more common in males. Comparison of 2004 NSDUH findings with the Canadian Addiction Survey, a telephone survey in early 2004 of Canadian household residents 15 years and older, showed that US residents were 7 times more likely (9.5%) than Canadians (1.3%) to have ever used inhalants.[12]

According to the National Institute on Drug Abuse and the University of Michigan's annual Monitoring the Future (MTF) survey results[11]:

- Prevalence of lifetime inhalant use ("ever used") among 12th-graders has ranged between 10.3% in 1976 (when first included in the survey) and 18.0%, the 1990 peak. The 2006 rate of 11.1% has been stable since 2002.
- Since 1979, prevalence has additionally been reported after adjustment for the underreporting of amyl and butyl nitrite use. Adjusted lifetime prevalence figures remained at or above 17.0% until 1997 before steadily declining and stabilizing near the 2004 low of 11.4%. Adjusted lifetime and annual-use ("at least once in the past year") rates for 12th-graders (11.5% and 4.7%, respectively, in 2006) are among the lowest levels in survey history.
- Roughly similar declines in prevalence of inhalant use have been documented in the 8th- and 10th-grade age groups, which the MTF survey has included since 1991 but does not adjust for possible nitrite use.
- Recent data on perceived harmfulness may be portentous. Since 2001, the percentages of 8th- and 10th-graders who indicated that they "think people risk harming themselves (physically or in other ways) if they try inhalants once or twice" or "try inhalants regularly" have decreased. Past research has shown that decreasing perceived risk of using a drug often precedes an upswing in use of that drug.

MTF survey results have consistently shown that the reported prevalence of inhalant use by 8th-graders has been, on average, approximately 2% to 3% greater than that of 10th-graders, which runs approximately 2% greater than that of 12th-graders. This pattern, which is opposite that of nearly all other abused substances, may simply reflect that early experimentation with this easily acquired drug class is greater in younger age groups, that older students may fail to report inhalant use that occurred in earlier grades, or that many 8th-grade inhalant abusers subsequently drop out of school and are, therefore, no longer included in the survey population.[6,13,14] Research has shown that inhalant use often occurs in conjunction with other risk behaviors and that higher rates of inhalant abuse occur among children who have poor grades or have dropped out of school compared with classmates who remain in good standing at school.[6,13–15]

Although inhalant abuse is more prevalent among

geographically isolated and socioeconomically disadvantaged populations, it crosses all demographic boundaries and occurs in rural as well as urban settings and among all ethnic groups in the United States.[4,6–11] Important universal factors that promote initial experimentation with inhalants and their continued use include peer use and low perceived harm from use.[8,11,16] Inhalant use is often associated with impoverished living conditions, delinquency, criminal behavior, incarceration, depression, suicidal behavior, greater antisocial attitudes, family disorganization and conflict, or a history of abuse, violence, or other substance abuse, including injection drug use.[4,13,15–21]

MTF surveys have documented lower rates of past-year inhalant use among Hispanic compared with white individuals, with the lowest rates consistently among black individuals.[11] Similarly, most other studies have found rates of inhalant use by Hispanic youth to be the same as or lower than use by non-Hispanic white youth.[4–8,10,11] NSDUH data consistently show that rates of inhalant abuse by Asian American youth are among the lowest.[4,10] Inhalant use has been seen as a particularly serious problem among American Indian/Alaska Native youth for many years.[6,10,22] Research to discern factors contributing to inhalant abuse suggests that adverse socioeconomic conditions, including isolation and lower educational levels rather than racial or cultural factors per se, account for the reported higher rates among these minority populations. Eskimo children 10 to 19 years of age living in 14 isolated Bering Strait villages reported a lifetime prevalence of inhalant use of 48%.[23] American Indian youth living on reservations have been shown to have higher rates of inhalant abuse than do either American Indian youth living off reservations or non-Hispanic white youth.[22] Paralleling the decreasing inhalant abuse shown by the MTF studies until 2004, a promising downward trend has also been demonstrated since 1995 by the annual survey of American Indian students living on reservations.[8] Because use of other drugs during much of this time period also decreased, substitution of other drug use for solvent use was not felt to explain the trend. Despite these epidemiologic data, inhalants remain among the least studied groups of abused substances. Much research is needed to understand all aspects of inhalant use, including the neuropharmacologic effects and psychosocial correlates.

MECHANISM OF ABUSE AND IMMEDIATE EFFECTS OF INHALANTS

Inhalants are abused through a variety of methods, and many "street" terms for this activity have been generated, such as (glue) sniffing, snorting, huffing, glading, and dusting. Product fumes are usually inhaled through the mouth (huffing) or nose (sniffing or snorting) from the original container. Abusers may also inhale vapors from a chemical-saturated rag held to the face or stuffed in the mouth, which is also called huffing. Some aerosols are sprayed directly into the mouth or nose, and volatile solvents can be applied onto the nasal mucosa or a nearby surface such as fingernails or a shirt collar or cuff and then inhaled. "Glading" refers to the inhalation of air-freshener aerosols, whereas a recently coined term, "dusting," refers to the abuse of aerosol computer and personal electronics cleaning products by placing the canister straw into the mouth or nose. Familiar and innocuous containers are often used to help conceal inhalant abuse (eg, inhaling spray paint fumes out of a soft drink can or nitrous oxide–filled balloons). A paper or plastic bag containing the inhalant can be held to the mouth and nose or over the head ("bagging").

Unusual fads in inhalant abuse products or methods have been reported, such as heating volatile substances and inhaling the released vapors, as has been done with certain fertilizers or "snotballs" of rubber cement.[24] Mothballs have been abused by bagging or chewing.[25] Products combining inhalants with nonrespirable toxic ingredients, such as antiperspirants containing the toxic compound aluminum chlorohydrate, can be bubbled through water.[26] Combined alcohol and inhalant abuse by drinking "ocean" has been a periodic problem on and near some southwest American Indian reservations. Mixing water or mouthwash with the contents of a hairspray can, usually AquaNet, containing ethanol, methanol, and a propellant, produces foamy "ocean water" and combined toxicities.[27]

Inhalants are readily absorbed through the lungs, with immediate and brief effects, and then relatively rapidly metabolized predominately through the cytochrome P450 system of the liver. Inhalants, except nitrites, are depressants that act directly on the central nervous system through a wide range of mechanisms yet to be completely elucidated.[1,28] As a group, inhalants most resemble alcohol, whereby different cellular mechanisms are responsible for myriad pharmacologic and toxicologic effects. Opiate receptor involvement likely plays a role in the analgesic effects of nitrous oxide, but there is evidence for γ-aminobutyric acid (GABA)–mediated behavioral effects.[1] Volatile hydrocarbons also have GABAergic effects and a possible role in the inhibition of glutamatergic neurotransmission involving *N*-methyl-D-aspartate (NMDA) receptors.

The immediate effects of inhaling volatile solvents, fuels, anesthetics, or nitrous oxide are similar to the early stages of anesthesia. The user feels an initial stimulating "rush," then is light-headed, disinhibited, excitable, and prone to impulsive behavior. Intoxication lasts only a few minutes but can be extended for several hours by breathing inhalants repeatedly. Slurred speech, dizziness, diplopia, ataxic gait, and disorientation occur as the inhalant dose increases. Euphoria is followed by drowsiness, a lingering headache, and sleep, particularly after repeated cycles of inhalation. Visual hallucinations

are possible with prolonged use. Coma is unusual, because as the user becomes drowsy, exposure to the inhalant is usually terminated before a large enough dose is absorbed to cause severe neurologic and respiratory depression. Mucous membrane irritation may manifest as rhinorrhea, epistaxis, sneezing, coughing, excess salivation, and conjunctival injection. Some patients experience nausea, vomiting, diarrhea, abdominal cramps, dyspnea, or wheezing.[28,29]

Nitrites significantly differ pharmacologically from other inhalants, because instead of direct central nervous system effects, they primarily cause vasodilation and smooth muscle relaxation. The sensations of floating and increased skin tactility as well as warmth and throbbing occur within 10 seconds of inhalation but diminish within 5 minutes. Nitrite abuse may result in tachycardia, flushing, blurred vision, headache, lightheadedness, significant hypotension, syncope, and sufficient methemoglobinemia to cause cyanosis and lethargy.[1,3,29] Other inhalants are used to alter mood, but nitrites are inhaled to enhance sexual feelings, penile engorgement, and anal sphincter relaxation to intensify sexual experience.[3,29]

MORBIDITY AND MORTALITY

Patterns of inhalant abuse are similar to those of other substance abuse, and users can generally be described as experimenters, intermittent users, or chronic inhalant abusers. Similarly, morbidity and mortality increase as frequency of use increases, with the important exception that "sudden sniffing death syndrome" is a risk during any use, even during initial experimentation. In 1 study, 22% of inhalant abusers whose deaths were attributed to sudden sniffing death syndrome had no history of previous inhalant abuse.[30] Sudden sniffing death syndrome is the leading cause of fatality related to inhalant abuse.

Bass[31] originally described sudden sniffing death and elucidated its pathophysiology. Hydrocarbons and other inhalants "sensitize" the myocardium to epinephrine, and when this hormone is produced in response to any of a number of stimuli, most commonly sudden stress or fright, a fatal cardiac arrhythmia can result. Instead of truly sensitizing the cells, volatile substances stabilize myocardial cell membranes to depolarization. Because of variable individual myocardial cell response and the complex way that myocardial electrical impulses are propagated, greater cell stability actually blocks electrical impulse conduction and increases arrhythmia risk. During inhalant use, arrhythmias can occur even with normal epinephrine concentrations, but an adrenaline surge, such as when hallucinating or when discovered by or running from an authority figure, increases the risk.[32] Sudden sniffing death can occur during inhalation or in the subsequent few hours, because a volatile substance dissolved in lipid-rich cell membranes dissipates relatively slowly.[32] This unpredictable and unpreventable type of death leaves no specific macroscopic or microscopic postmortem features, so no cause can be identified at autopsy.

Death caused by inhalant abuse can also occur through a variety of other mechanisms but is usually attributable to an acute and related event, most likely suffocation, aspiration, or accidental injury (Table 2). From 1981 to 1985 in Britain, suffocation, aspiration, and accidental injury each accounted for approximately 15% of deaths attributable to inhalant abuse, and the remaining 56% of deaths were attributed to sudden sniffing death syndrome.[30] Suffocation occurs when the mode of use involves inhalation through the nose and mouth from a plastic bag, which may occlude the airway if the user loses consciousness. The risk of death caused by aspiration, usually of vomitus, is similar to that for alcohol or other depressants and is related to the combination of a decreased level of consciousness and the loss of protective airway reflexes. While under the influence of inhalants, users become less inhibited as well as less alert and oriented, which can promote their engaging in risk behaviors and lead to accidental injury and death, such as from a motor vehicle crash, drowning, fire, a jump or fall from heights, or hypothermia from exposure to the elements.

The United Kingdom, with a population approximately one fifth that of the United States, has been the only major part of the Western world to track in a systematic way deaths associated with volatile substance abuse. Since 1999 legislation banned the sale of butane cigarette lighter refills to youth younger than 18 years, there has been a significant drop in inhalant use deaths in both this age group and older individuals. The 2003 volatile substance abuse–related death total of 51 was the lowest number recorded for the United Kingdom since 1983. Of the 9 individuals younger than 18 years who died, 6 did so in relation to inhalation of butane lighter refills, compared with 15 of the 24 deaths in this age group in 2002.[33]

Three reports shed light on the US inhalant abuse mortality rate. The Toxic Exposure Surveillance System (TESS) database of the American Association of Poison Control Systems showed 63 deaths in 11 670 cases of

TABLE 2 Causes of Death From Inhalant Abuse

Acute
Direct causes: immediate or "postponed" sudden sniffing death syndrome; methemoglobinemia
Indirect causes: suffocation, aspiration, trauma, drowning, fire, other
Delayed
Cardiomyopathy
Central nervous system toxicity: toluene dementia and brainstem dysfunction
Hematologic: aplastic anemia, leukemia
Hepatocellular carcinoma
Renal toxicity: nephritis, nephrosis, tubular necrosis

intentional inhalant abuse reported from 1996 to 2001 to poison-control centers nationwide.[9] Actual mortality rates are likely greater, as evidenced by extrapolation from 2 studies that examined state death records that mentioned inhalants as a contributing cause of death at any age.[34,35] These studies found 39 deaths in Virginia from 1987 to 1996 and 144 deaths in Texas from 1988 to 1998. In Virginia, 70% of those who died were 22 years and younger, and in Texas, 28.7% of victims were 8 to 17 years of age. Of the inhalant abuse cases reported to the TESS, 54% were in youth 13 to 19 years of age, 15% were in children 6 to 12 years of age, and 0.4% were in children 5 years and younger. The 63 fatalities occurred almost exclusively in adolescents and young adults. Three types of inhalants were associated with the majority of deaths reported to the TESS: gasoline (45%), air fresheners (26%), and propane/butane (11%). These same group I inhalants (Table 1) were associated with the majority of deaths in both Virginia and Texas, particularly fuels including refrigerants and various solvents.

There is as diverse a list of possible sequelae of chronic inhalant abuse as there is diversity in the types of volatile solvents, fuels, and anesthetics used and the dose and frequency of exposure. If chronic solvent abuse is terminated, there is remarkable reversibility of many of the pathologic effects, but compared with other organ systems, the nervous system has less regenerative capacity. Of all biological membranes, myelin has the highest fat content at 75%, and neuronal membranes may contain up to 45% lipid. The primary consequence of frequent and longer-term inhalant use over months to years is chronic nervous system absorption of these highly lipophilic substances and significant nervous system damage, resulting in muscle weakness, tremor, peripheral neuropathy, cerebellar dysfunction, chronic encephalopathy, and dementia, including mood changes[28,29,36–39] (Table 3). Loss of coordination, gait disturbance, and spasticity, particularly in the legs, have also been noted.[37–39] Computed tomography has demonstrated a loss of brain mass, and magnetic resonance imaging has shown white-matter degeneration and subcortical abnormalities, particularly in the thalamus, basal ganglia, pons, and cerebellum.[40] Cognitive impairment has been reported with deficits found in memory, attention, auditory discrimination, problem-solving abilities, visual learning, and visual-motor function.[29,38] A limitation of the few studies that have investigated cognitive and neuropsychiatric functioning of inhalant abusers is that most of them have not adequately demonstrated that the impairments were not premorbid deficits. Most of the acute neurologic, neuropsychiatric, and cognitive sequelae of volatile solvent abuse seem to be reversible, but the resolution of chronic symptoms is much slower and less complete.[29,38]

TABLE 3 **Major Neurotoxic Consequences of Inhalant Abuse**

Cerebellar ataxia
Cranial neuropathy: usually cranial nerves V and VII
Encephalopathy: acute or chronic
Multifocal: both cortical and subcortical central nervous system damage, both central nervous system and peripheral nerve effects
Optic neuropathy: visual loss
Parkinsonism
Peripheral neuropathy

Other causes of morbidity and mortality are related to the specific volatile chemical(s) used, associated health risk behaviors, drug-drug interactions, or additional material(s) found in the various inhaled products. Toxic effects attributed to specific chemicals include an ichthyosis-like dermatitis on the extremities,[25] decreased visual acuity,[41,42] sensorineural hearing loss,[42] cardiomyopathy,[43] toxic hepatitis,[44] distal renal tubular acidosis,[45] metabolic acidosis,[46] leukemia,[47] and aplastic anemia.[48] There is evidence that tolerance, dependence, and withdrawal symptoms can occur, and reported morbidities also include toluene embryopathy and neonatal withdrawal.[49–52] Lung damage from paint pigments, lead poisoning from leaded gasoline, and other such toxicities have been reported when an inhalant contains another potential toxin.[53] Inhalant abuse is associated with the abuse of other substances, including pharmaceuticals, alcohol, tobacco, and illicit drugs, which can obscure the diagnosis of inhalant abuse and increase potential morbidity.[21,54,55] Combining other drugs with inhalants expands the potential for risk behaviors, altered drug metabolism, and drug-drug interactions, including potentiation of drug effects, particularly depressant effects. High flammability and accidental combustion of volatile agents have led to burns and other fire-related injuries.[3,24]

Chronic nitrous oxide abuse causes short-term memory loss and peripheral neuropathy, which subside with discontinuation of the abuse.[29] Peripheral neuropathy results from nitrous oxide inactivating vitamin B_{12} and mediating a pernicious anemia-type syndrome, which includes anemia, leukopenia, sensorimotor neuropathy, and posterior/lateral column spinal cord disease.[29] Nitrite inhalation has been associated with hemolytic anemia in patients with glucose-6-phosphate dehydrogenase deficiency.[56] Because nitrites are abused mainly for their sensory and sexual effects, use may promote higher-risk sexual practices, facilitate transmission of sexually transmitted infections, and result in drug interactions, such as with sildenafil.[3] Chronic abuse of volatile alkyl nitrites has documented hematologic and immune system effects without associated cognitive deficits.[1,29,56]

DETECTION OF INHALANT ABUSE

Inhalant abuse may not readily come to the attention of others, including pediatricians, because signs and symptoms of use are often subtle. Abuse of inhalants should

be suspected when a cache of a potential inhalant is discovered or when products with abuse potential are found stored in unusual locations, such as cans of gasoline or spray paint under a youth's bed. Changes in an adolescent's behavior, including apathy, malaise, poor appetite, a significant shift in choice of friends or activities, or an unexplained drop in school grades, can also be signs of inhalant abuse. Those who are chronic and heavy inhalant abusers may be identifiable because of their combination of poor hygiene and grooming, weight loss from decreased caloric intake, and chronic complaints of, for example, fatigue, rhinitis, conjunctivitis, recurrent epistaxis, and oral or nasal ulcerations. Chronic neuropsychiatric changes, such as confusion, poor concentration, depression, irritability, hostility, or paranoia,[28,29,57] may predominate. Symptoms of other organ system toxicities from long-standing inhalant use may also bring the abuser to medical attention.

Inhalant abusers may present with obvious intoxication and evidence of use, such as a conspicuous odor of the inhalant. This chemical odor is most often present because the abuser excretes a significant proportion of the absorbed dose when exhaling, and the odor can persist on the breath for many hours.[57] If the abused product spilled onto clothing during use or was intentionally put on clothing, the odor may also persist, and clothing stains or paint may be found. Paint or glitter may also be seen on the abuser's face or hands, or there may be a "huffer's rash," classically a perioral or perinasal dermatitis with pyoderma.[24,58] Contact with inhalants dries the skin and leads to small cracks, which allow bacteria to enter. The dermatitis may look like a nonspecific contact hypersensitivity reaction or perioral eczema or, with nitrite use, may have a yellow crust attributed to nitric acid, which can promote a xanthoprotein reaction.[58] Refrigerants and chlorofluorohydrocarbon propellants, such as those found in computer-cleaning aerosols, have been reported to cause frostbite on the face or in the nose or oral cavity that can lead to airway compromise.[59]

Similar to the approach to other substance abuse, providing appropriate medical care for any child or adolescent using inhalants results from a keen diagnostic awareness leading to detection, intervention, and treatment. Regular office screening for inhalant abuse as well as other substance abuse and health risk behaviors must be part of standard pediatric care. Inhalants are not detected by using routine urine drug screening, so detection relies on knowledgeable medical personnel who consistently include screening questions as part of conducting a thorough history and physical examination.[26] When considered in certain clinical contexts, abnormal nontoxicologic laboratory results, such as elevated liver enzymes, may arouse or confirm a suspicion of inhalant abuse. Blood and other tissues, usually brain or liver, can be tested by specific gas chromatography technique when inhalant detection is necessary, such as in a fatality.[26] Specific urine drug testing is sometimes useful as part of the treatment-compliance plan when benzene, toluene, or a similar agent has been chronically abused, because major urinary metabolites (phenol and hippuric acid, respectively) are detectable when there has been a high level of use.[26]

INHALANT ABUSE PREVENTION AND MANAGEMENT CONSIDERATIONS

As with other types of substance abuse, the most effective way to curtail use is through broad prevention efforts, particularly primary prevention through education paired with skills-building. Developmentally and culturally sensitive educational strategies should be implemented, such as those implemented in many American Indian communities through a prevention initiative in conjunction with the American Indian Institute at the University of Oklahoma.[8]

Limiting the availability of volatile substances is impractical, because they constitute products that are universally available and legal and have legitimate uses. Restricting the availability of some of these products, such as the United Kingdom ban on the sale of butane lighter refills to youth, can be successful but may also promote the use of other more-available products or create a black market for the restricted products. Adding a noxious chemical to the product to prevent misuse was tried with plastic glue and found to be ineffective, because multiple products would require such adulterants, abusers switch products, and legitimate consumers and product efficacy might be adversely affected.[60] Reformulating the product by replacing the hydrocarbon with other chemicals has occurred when economically feasible and when product efficacy could be maintained. Product warning labels can alert the public to inhalant dangers but may also promote easy identification of abusable substances.[61] Most states have laws making the use of inhalants or sale to minors illegal, and although difficult to enforce and of yet-unproven efficacy, such laws serve as a reminder that society condemns inhalant abuse.

Most acutely intoxicated inhalant abusers do not seek medical attention, and only when intoxication is life-threatening or has led to serious injury will an abuser present to the emergency department. Acute medical management of inhalant abuse starts with applying the "ABCs" of life support to assess and stabilize the patient and address any specific acute injury or toxicity, such as combating methemoglobinemia by administering intravenous methylene blue. Hydration and cardiorespiratory status should be monitored closely. Myocardial sensitization by inhalants necessitates a calm and supportive environment in which the use of pressor medications and bronchodilators are relatively contraindicated. No medications reverse acute inhalant intoxication or have

been found to be helpful with dependence or withdrawal symptoms. Decontamination of the patient's clothing and skin may be indicated. Laboratory testing can help monitor oxygenation and hematologic status and detect other substances being abused. Testing for organ-system damage should be considered only when there is a history of regular and long-term inhalant use. After acute stabilization, comprehensive medical care includes documenting a detailed history and physical examination and specifically evaluating the patient's mental health, substance abuse history, and psychosocial needs so that appropriate inpatient or outpatient interventions can be initiated.[28,29,57]

Little research exists concerning treatment needs and successful treatment modalities specific to inhalant users, so clinicians rely on applying methods that are used to treat other addictive disorders, such as cognitive-behavioral therapy, multisystem and family therapy, 12-step facilitation, and motivational enhancement techniques,.[62] Inhalant abusers seem to respond best to a treatment program that includes an extended detoxification or "treatment readiness" period of 4 or more weeks, during which basic supportive care and general orientation are emphasized. If sufficient time is not allowed, individuals seem incapable of engaging in the treatment program.[63] Some treatment facilities have used a peer-advocate system for patients, which seems to offer a nonthreatening and supportive treatment approach.[64] Neuroleptics and other forms of pharmacotherapy are usually not useful in the treatment of inhalant abusers except to address comorbid conditions. Increasing personal and ethnic self-identity through role-modeling has been suggested as helpful in treating some groups of inhalant abusers, and positive cultural identification has been shown to be important in American Indian/Alaska Native populations.[65] Treatment challenges are posed by the diversity of abused inhalants and user populations, comorbid psychopathology, psychosocial problems, polydrug use, and the physiologic and neurologic effects of inhalant abuse.[62,63] Treatment of longer-term inhalant users is hindered by the fact that there are few programs designed specifically for inhalant abuse treatment, access to care may be limited, providers generally have a pessimistic view about users' neurologic damage and chance for recovery, and providers often lack sufficient knowledge and training about inhalant abuse, inhalant users, and their treatment needs.[64] Although the principles of effective substance abuse treatment in general apply to inhalant abuse treatment, any treatment regimen must address the many clinical, emotional, social, academic, pharmacologic, neurocognitive, cultural, and demographic factors that make this type of substance abuse unique. Treatment strategies are still under development, and additional research is needed to identify effective strategies for the treatment of children and adolescents who use inhalants.

CONCLUSIONS AND ADVICE

The American Academy of Pediatrics has established recommendations[66] regarding the pediatrician's role in the prevention, identification, and management of substance abuse and advises the following to promote that role with regard to inhalant use by youth.

1. Pediatricians are encouraged to:
   - be aware that inhalant abuse occurs in all patient populations, including their own;
   - be knowledgeable about the epidemiology of inhalant abuse, particularly about local and regional trends, as well as resources, such as the telephone number 1-800-222-1222 to contact the nearest poison-control center;
   - be knowledgeable about health consequences of inhalant abuse and, in particular, about unique clinical features such as central nervous system damage and sudden sniffing death syndrome;
   - assist in educating children, adolescents, parents, teachers, media representatives, and vendors of volatile substances regarding inhalant abuse prevention and the health risks of inhalant use; and
   - serve as a community resource regarding inhalant use awareness, prevention, detection, and management using national and local community resources such as the National Inhalant Prevention Coalition (1-800-269-4237 or www.inhalants.com), an information and referral clearinghouse.
2. Inhalant abuse education can be included in all substance abuse prevention curricula in the primary and secondary grades, using approaches that effectively warn against the dangers of inhalant use yet do not inadvertently introduce youth to available substances with abuse potential.
3. Widespread accessibility and use of research-based resources such as National Institute on Drug Abuse publications (available at www.drugabuse.gov/DrugPages/Inhalants.html) are encouraged.
4. Increased research efforts to evaluate prevention and treatment approaches specific to inhalant abuse and to identify those with efficacy are needed.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Injuries Associated With Infant Walkers

ABSTRACT. In 1999, an estimated 8800 children younger than 15 months were treated in hospital emergency departments in the United States for injuries associated with infant walkers. Thirty-four infant walker-related deaths were reported from 1973 through 1998. The vast majority of injuries occur from falls down stairs, and head injuries are common. Walkers do not help a child learn to walk; indeed, they can delay normal motor and mental development. The use of warning labels, public education, adult supervision during walker use, and stair gates have all been demonstrated to be insufficient strategies to prevent injuries associated with infant walkers. To comply with the revised voluntary standard (ASTM F977-96), walkers manufactured after June 30, 1997, must be wider than a 36-in doorway or must have a braking mechanism designed to stop the walker if 1 or more wheels drop off the riding surface, such as at the top of a stairway. Because data indicate a considerable risk of major and minor injury and even death from the use of infant walkers, and because there is no clear benefit from their use, the American Academy of Pediatrics recommends a ban on the manufacture and sale of mobile infant walkers. If a parent insists on using a mobile infant walker, it is vital that they choose a walker that meets the performance standards of ASTM F977-96 to prevent falls down stairs. Stationary activity centers should be promoted as a safer alternative to mobile infant walkers.

ABBREVIATIONS. NEISS, National Electronic Injury Surveillance System; CPSC, Consumer Product Safety Commission; JPMA, Juvenile Products Manufacturers Association.

OVERVIEW

An infant walker, or baby walker, consists of a wheeled base supporting a rigid frame that holds a fabric seat with leg openings and usually a plastic tray. The device is designed to support a preambulatory infant, with feet on the floor, and to allow mobility while the infant is learning to walk. Some walkers are equipped with bouncing mechanisms, activity toys, or locking devices that keep them from moving, and some fold flat for storage.

Estimated annual sales of walkers are more than 3 million.[1] Older studies have found that 55% to 92% of infants between 5 and 15 months of age use walkers.[2–6] Parents give various reasons for using walkers—to keep the infant quiet and happy, to encourage mobility and promote walking, to provide exercise, and to hold the infant during feeding.[4,5,7] One third of parents in one study used walkers because they believed that walkers would keep their infants safe.[5]

DATA

According to the National Electronic Injury Surveillance System (NEISS) of the US Consumer Product Safety Commission (CPSC), an estimated 8800 children younger than 15 months were treated in hospital emergency departments in the United States in 1999 for injuries associated with the use of infant walkers.[8] This represents a 56% decrease in these injuries since 1995, when 20 100 injuries were reported.[8] Thirty-four deaths associated with the use of infant walkers were reported to the CPSC during the years 1973 through 1998 (D. Tinsworth, personal communication, November 2000). Population surveys suggest that there may be as many as 10 times more injuries that are sufficiently minor that they are treated in physicians' offices or do not require medical attention.[5] Parents report that walker-related injuries occur at some time in 12% to 40% of infants who use walkers.[6,9] A study of 65 Virginia children injured in walkers estimated the annual incidence of walker injuries resulting in emergency department visits to be 8.9 per 1000 children younger than 1 year. Severe injuries occurred at a rate of 1.7 per 1000.[10] Approximately one fourth of infant walker-associated injuries reported to the NEISS are described as "more severe," and these are nearly all fractures and closed head injuries. Skull fractures accounted for almost 10% of all walker-related injuries in one large series of patients.[11]

Reported injuries are overwhelmingly caused by falls, either from the walker or with the infant remaining in the walker. Stairs are implicated in 75% to 96% of cases and in almost all of the severe injuries.[11] A small number of pinch injuries to fingers and toes occur.[1,12] Burns account for 2% to 5% of walker-related injuries.[7,8,10] Walkers also have been commonly associated with poisonings of infants under 1 year of age.[13] These burns and poisonings are attributable to the increased access to these hazards afforded by an infant's increased mobility in a walker. Although submersion is not a commonly reported mechanism of nonfatal injury, 4 of the 11 deaths reported between 1989 and 1993 were from drowning (in a pool or toilet), 4 were from suffocation (compression of the neck against the feeding tray), and 3 were from falls.[12]

Little effort has been made to compare the rates and severity of various injuries in children of the

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

same age who do or do not use walkers. A report from Toronto's Hospital for Sick Children, however, states that during 1984, 123 infants who had fallen down stairs in walkers were evaluated; only 1 infant in the same age group who had fallen down stairs was not in a walker.[7] Although walkers do not consistently account for the majority of infant injuries associated with falls down stairs, in another study,[14] walkers accounted for 45% of falls down stairways causing head injury in children younger than 24 months, and these walker-related stairway falls caused more severe injury. The study authors[14] believe that the walker predisposes infants to more serious injury by increased kinetic energy resulting from the larger mass and higher initial speed (speeds of more than 3 ft/sec have been recorded[15]) and because the infant tends to remain in the walker while falling, resulting in unprotected head exposure.[14]

Parents who use infant walkers often express their perception that the walker keeps their child safe (a form of baby-sitting), or that it helps the infant learn to walk. Data supporting such benefits do not exist. One study that evaluated children between 6 and 15 months of age demonstrated that walker-experienced infants sat, crawled, and walked later than no-walker controls, and they scored lower on Bayley scales of mental and motor development.[16] At first, the unassisted gait of infants who use walkers may be slightly abnormal.[2] There is no evidence, however, that such effects are lasting in typical children or that they have any impact on the child's ultimate motor development or intelligence.[2,17] Anecdotal reports suggest that children with cerebral palsy who use walkers experience exaggerated abnormal motor reactions and delay in development of normal balance and protective responses; however, the duration of these signs and the consequences of these observations have not been addressed systematically.[18–20] Beyond parental impressions that infants seem happier in walkers, it does not appear that any real benefits of using a walker can be found to balance the considerable risk of injury.

PREVENTION

Strategies to prevent infant walker-related injuries include 1) warning labels and public education, 2) adult supervision during walker use, 3) barriers such as stair gates, 4) infant walker design changes to prevent falls down stairs, and 5) a proposed ban on mobile infant walkers.

Until the 1996 revision of the voluntary standard for infant walkers (ASTM F977-96),[21] injuries attributable to falls were addressed only through warning labels, which was an ineffective strategy in reducing these injuries.[1] Several studies have shown that even the occurrence of a walker-related injury does not deter parents from the continued use of walkers for the injured child or subsequent siblings. In one study, 32% of parents reported that they used the walker again after the injury, and 59% acknowledged that they were aware of the potential dangers of walkers before the injury episode.[11] Thus, more labeling and educational efforts are not likely to lead to an additional decrease in walker-related injuries.[4,5,7,11]

Adult supervision also cannot be relied on to prevent infant walker-related injuries. Moving at more than 3 ft/sec, an infant can be across the room before an adult has time to react. In one study, 78% of children were being supervised at the time of the injury, including supervision by an adult in 69% of cases.[11] Other studies have also shown that many of these events occur with 1 or both parents in the room.[7,12,22] Stair gates are not uniformly effective even when present; more than one third of falls down stairs in one study occurred with stair gates in place, but the gates were either left open or improperly attached.[7]

Both mandatory and voluntary standards exist for infant walkers. The mandatory standard that has been in effect since 1971 (16 CFR 1500.86 [a]4) primarily addresses injuries to digits caused by pinching or shearing in the frame of the walker and by collapse of the walker. Judging from CPSC statistics, these types of injuries are infrequent, suggesting that these standards are effective.[1] The voluntary standard (ASTM F977) addresses the more difficult problems of falls and tip-overs. The standard's performance requirements to prevent walker tip-overs and structural failures appear to have been effective, because these types of incidents are now uncommon.

In 1996, the voluntary standard was revised to include performance standards for infant walkers to prevent falls down stairs. To comply, walkers manufactured after June 30, 1997, must be wider than a 36-in doorway or must have a braking mechanism designed to stop the walker if 1 or more wheels drop off the riding surface, such as at the top of a stairway. A similar voluntary standard was adopted in Canada in June 1989 requiring the width of walkers to be at least 900 mm (35.4 in).[23] In the United States, CPSC data confirm that basement stairs are involved in approximately half of walker injuries and that about 80% of the doorways to these stairs are 36 in wide or less.[12] Although walkers meeting the new standard began appearing in retail stores at the end of 1997, overall industry compliance remains to be evaluated. Because compliance is voluntary, the incentive for manufacturers to meet the new safety standards is a product certification by the Juvenile Products Manufacturers Association (JPMA). The manufacturers most likely to comply with the revised voluntary standard are members of the JPMA; however, nearly 40% of the new baby walkers sold in the United States are manufactured by firms that do not belong to the JPMA. Because the rule-making proceeding that the CPSC began in 1994 is still open, the CPSC could pursue the development of a mandatory standard to prevent infant walker stairway falls if the industry's compliance with the voluntary standard were judged to be inadequate.

Baby walker-like devices that do not roll across the floor on wheels are also available to consumers. These stationary activity centers allow children to bounce, swivel, and tip, and they provide parents an alternative to the use of mobile infant walkers. Injury data for these devices are not yet available. Their

stationary design eliminates the risk of stair-related falls, however, and therefore they should be safer than mobile walkers. The recent decrease in the number of baby walker-associated injuries is likely to be attributable in part to the availability of walker alternatives, such as stationary activity centers, and a decrease in the use of baby walkers manufactured before July 1997.

RECOMMENDATIONS

1. Because data indicate a considerable risk of major and minor injury and even death from the use of walkers, and because there is no clear benefit from their use, the American Academy of Pediatrics recommends a ban on the manufacture and sale of mobile infant walkers.
2. If a parent insists on using a mobile walker, it is vital that they choose a walker that meets the performance standards of ASTM F977-96 to prevent falls down stairs.
3. Efforts should be made, through media campaigns and during anticipatory guidance, to educate parents about the hazards and lack of benefits of walkers. The particular risk of walkers in households with stairs should be emphasized.
4. Even if walkers are banned, the life span of existing devices is considerable, and community programs should be developed to encourage proper disposal of walkers so that they can be destroyed and the materials recycled.
5. Agencies responsible for licensing child care facilities should not permit the use of walkers in approved child care centers and homes. Hospitals should not permit the use of walkers in their facilities.
6. Because the safest baby walker is one without wheels, stationary activity centers should be promoted as a safer alternative to mobile walkers.
7. The CPSC should closely monitor the compliance of infant walker manufacturers with the voluntary standard ASTM F977-96 to ensure that noncomplying walkers do not continue to be manufactured and sold.
8. The CPSC should collect surveillance data on children injured while using walkers that are in compliance with ASTM F977-96.

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Injuries in Youth Soccer

abstract

Injury rates in youth soccer, known as football outside the United States, are higher than in many other contact/collision sports and have greater relative numbers in younger, preadolescent players. With regard to musculoskeletal injuries, young females tend to suffer more knee injuries, and young males suffer more ankle injuries. Concussions are fairly prevalent in soccer as a result of contact/collision rather than purposeful attempts at heading the ball. Appropriate rule enforcement and emphasis on safe play can reduce the risk of soccer-related injuries. This report serves as a basis for encouraging safe participation in soccer for children and adolescents. *Pediatrics* 2010; 125:410–414

INTRODUCTION

Soccer (known as football outside the United States) is one of the most popular team sports in the world and continues to provide healthy exercise for many young people. Participation in soccer is an effective way for children to increase their level of physical activity and fitness, because it requires intensive physical effort over an extended period of time through practice and games.[1] In the United States, an estimated 15.5 million[2] people participate in soccer. Two national youth organizations have registered 650 000[3] and 3.2 million[4] participants younger than 19 years, with a 7% increase in female adolescent players from 2001 to 2007.[2] More than 700 000 girls and boys played soccer in US high schools in 2008–2009,[5] placing soccer among the top sports for increased participation.[5] With this growing participation comes a greater number of injuries, leading to an increasing prevalence of soccer-related cases presenting to the pediatrician.

INJURY RISK

Soccer has a higher injury rate than many contact/collision sports such as field hockey, rugby, basketball, and football, although in 1 community study of 7- to 13 year-old players, football did have a higher percentage of serious injuries and higher frequency of injury per team per season.[6,7] The US Consumer Product Safety Commission (CPSC), through its National Electronic Injury Surveillance System, estimated that there were 186 544 soccer-related injuries in 2006.[8] Approximately 80% of these injuries affected participants younger than 24 years, and approximately 44% occurred in participants younger than 15 years. It is unfortunate that there is a wide variation in the reported incidence of soccer injuries as a result of study differences in factors such as level of competition, intensity of exposure, definition, classifications, and reporting of injuries. Because of difficulties with interstudy com-

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KEY WORDS
soccer, concussion, knee injury, anterior cruciate ligament tear

ABBREVIATIONS
CPSC—Consumer Product Safety Commission
ACL—anterior cruciate ligament
AAP—American Academy of Pediatrics

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of care. Variations, taking into account individual circumstances, may be appropriate.

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parisons, standard definitions and methodology have been proposed to ensure consistent and comparable results in the future.[9]

With respect to age, participants younger than 15 years tend to have a higher relative injury risk and greater prevalence of injuries compared with older players.[6,10–14] According to the National Electronic Injury Surveillance System, soccer injuries among young athletes in the United States occur at a peak of 2 injuries per 1000 participants.[10] For soccer players older than 12 years, rates of 4 to 7.6 injuries per 1000 player-hours have been reported.[11,13,14] Over an entire soccer season, girls' and boys' teams may expect 4.0 and 3.5 injuries per season, respectively.[15] It is notable that the risk of injury is greater during competition than during practice sessions.[6,11,13–17]

Although suffering a previous injury within the past year confers a 1.74 relative risk of a new injury,[11] there have been no consistent findings to support a higher risk to any position on the field. Some have reported overall injury rates to be similar between boys and girls,[18] but others have found higher prevalence of injuries in female players, with girls having an increased risk of anterior cruciate ligament (ACL) tears and concussions and being more likely than boys to be injured in training situations. In contrast, boys have a greater relative risk of injury during competition.[12,17]

Indoor and outdoor soccer environments have a similar relative risk of injury, including contact injury across age groups; however, knee injuries are more prevalent in outdoor soccer.[11] Field surface and shoe characteristics can affect injury risk, especially in outdoor soccer. Appropriate monitoring of field conditions, specifically holes or other irregularities, can reduce lower-extremity injuries. More specifically, uneven playing surfaces can result in excessive loading of ligaments and muscles and may contribute to improper landing after jumping. Inappropriate footwear can lead to either too little or too much frictional force, which can increase the risk of lower-extremity injury.[6] A common overuse injury in skeletally immature players, especially during peak growth velocity, is calcaneal apophysitis (Sever disease), attributable in part to play on hard fields with cleats that have insufficient heel/arch support.[19]

TYPES OF INJURIES

Soccer is classified as a high- to moderate-intensity contact/collision sport,[19] with most injuries overall occurring from either player-to-player or player-to-ground/ball/goalpost contact rather than overuse.[14–16] Contact injuries occur primarily when the player is tackling the ball, being tackled, or heading the ball as 1 or more defenders are impeding the play.[6] The mechanisms of noncontact injury include running, twisting/turning, shooting, and landing. Most injuries are classified as minor and require nothing more than basic first aid or a maximum of 1 week's absence from soccer participation.[6,14,18]

Injuries to the lower extremities are most common, with the majority of injuries resulting from nonbody contact.[6,10,11,12,16,18] Ankle injuries account for 16% to 29%[15,16] of these injuries and are more frequent in male players.[6,14] Knee injuries occur in 7% to 36% of injured players[16,17] and are seen more frequently in females.[6,14] The lower leg (5%–6%),[14,16] upper leg (9%–22%),[15,16] and groin/torso (5%)[16] are less commonly affected. Contusions and sprains/strains of the lower extremities are the most common injury types[6]; more sprains and strains are seen in the emergency department setting than either contusions/abrasions or fractures.[10] Fractures account for less than 10% of injuries.

One serious lower-extremity injury that presents frequently to physician offices or the emergency department is a rupture of the ACL. This injury is more common in female players than in male players. Arendt et al[20] reported that female collegiate soccer players have a 2.8 times greater risk of ACL rupture than do male players, and other studies have indicated a 4 to 6 times greater risk in female players than in age-matched male counterparts in the same activity.[18,21] Most injuries in female participants are the result of valgus hyperextension of the knee during landing, cutting, or turning.[21] Many contributing factors for this gender-based imbalance have been postulated, including hormonal influences, anatomic differences in lower-extremity alignment, ligament size and laxity, and dissimilar neuromuscular activation patterns.[21] Functional knee braces have proven unsuccessful at preventing ACL injuries.[20,22]

Prophylactic neuromuscular and proprioceptive exercise programs have been designed to train girls how to adopt particular muscle-recruitment strategies that decrease joint movement and protect the ACL from high-impact loading during high-risk athletic maneuvers.[21,23] Statistically significant reductions in ACL ruptures have been demonstrated in adolescent and college-aged females participating in such programs.[23,24] Results of a meta-analysis demonstrated that neuromuscular training decreases the potential biomechanical risk factors for ACL injuries and ACL tears in older adolescent and adult players as a result.[25] Studies indicating knee-injury risk along with potential risks and benefits of prophylactic exercise programs in preadolescent players are lacking. At the time of this writing, 2

TABLE 1 Components of a Knee-Injury Risk-Reduction Program[23,47,48]

1. Warm-up
   a. Jogging, skipping, backward running, and carioca
2. Stretching
   a. Calf, hamstring, quadriceps, inner thigh, and hip flexor
3. Strengthening
   a. Lunges, squats, hamstring-strengthening exercises, and toe raises
4. Plyometrics
   a. Variety of hopping, jumping, and bounding drills
5. Agility exercises
   a. Shuttle and diagonal running

Qualified instructors can reduce injury risk by helping to ensure proper technique (especially with plyometric loading and progression).

knee-injury risk-reduction programs have been studied (Table 1).

Upper-extremity injuries represent 3% to 12%[16,17] of total injuries, with the shoulder (1.1%–1.8% of total injuries) and the wrist/hand/elbow (3%–5% of total injuries) being uncommonly affected.[14]

Direct impact to the abdomen can result in intraabdominal organ damage, and although most cases are relatively minor in severity, life-threatening and even fatal cases of abdominal trauma have been reported.[10,26]

Fatalities Resulting From Goalpost Contact

Fatalities from soccer-related injuries are associated almost exclusively with traumatic contact with goalposts.[10] Since 1979, 28 fatalities have been reported from incidents associated with falling soccer goalposts.[8] These findings have prompted specific recommendations from equipment manufacturers and the CPSC[27] to ensure that soccer goalposts are adequately secured during play and when not in use. Padding of goalposts has also been recommended, but evidence of efficacy of pads in preventing injury is lacking.

Concussion

The concussion rate among soccer players is similar for both elite and recreational athletes to that of American football and ice hockey players.[28] Although some studies have indicated that head/facial injuries, including concussions, account for only 3% of total injuries, there may be significant underreporting.[14] Female high school soccer players have a slightly higher risk of concussion than do their male counterparts.[29] The most frequent cause of concussion in elite college soccer players was found to be contact with another player's head, elbow, or foot (47%), and contact with the ball (24%), ground/goalpost (17%), and combinations of objects (10%) were less frequent causes of concussions.[30] General sport-related concussion management and return-to-play guidelines have been published[31,32]; however, there are currently no postconcussion return-to-play guidelines specific to soccer.

Collision, rather than purposeful heading, was found to be the most likely cause for acute head injuries in soccer players treated in emergency departments.[33] The contribution of purposeful "heading" of the soccer ball to both acute and potential long-term concussive effects, such as cognitive dysfunction, seems less controversial today than previously.[28,33] A critical review of the literature does not support the contention that purposeful heading contacts are likely to lead to either acute[34,35] or cumulative brain damage,[36–39] and additional study is necessary to provide confirmatory evidence of neuropsychological consequences of subconcussive soccer-related head contacts.[40]

Efforts to reduce potential injury from heading the soccer ball are warranted. Proper heading techniques, the appropriate age at which to initiate teaching of purposeful heading, and characteristics of the soccer ball have been studied as a means to reduce head injury. The best technique is to contract the neck muscles to hold the head rigidly fixed to the trunk, allowing the ball to contact the hairline of forehead.[39] One large US-based soccer organization does not teach purposeful heading to players younger than 10 years,[3] but other soccer authorities or organizations do not adhere to this rule uniformly. Although proper technique is foremost in reducing the risk of concussion from heading the ball, it is also imperative that soccer balls be water resistant, sized appropriately for age, and not hyperinflated.[3,27,41]

Data currently are insufficient to state that soft helmets prevent head injury, and this absence of prospective data, combined with a lack of uniform safety standards and regulations, makes universal support of soft helmets premature at this time.[39] The authors of 1 retrospective cross-sectional study found that use of soft helmets was associated with a reduction in concussions and soft tissue injuries compared with no helmet, without increasing risk of injury to areas not covered by the head gear.[42]

Eye and Other Facial Injuries in Soccer

Soccer is classified as a sport with low-to-moderate risk of eye injury. The American Academy of Pediatrics (AAP) and American Academy of Ophthalmology strongly recommend protective eyewear for all participants in soccer, whereas on the basis of 1 study on ocular injury in collegiate sports, use of eye protection based on the athlete's past ocular history was recommended.[43,44] Protective eyewear should be mandatory for athletes with only 1 functional eye and for those who have had major eye surgery or trauma.[45] Proper protective eyewear includes

polycarbonate lenses that meet the American Society for Testing and Materials (ASTM) F803 standards.[43] Soccer is also associated with orofacial and dental injuries. Use of protective mouth guards has been advocated to reduce the number of these injuries.

FAIR PLAY

If there is low adherence to fair-play policy, injury risk can be greater. It is notable that foul play has been associated with a significant number of contact-related injuries.[12,18] One study of competitors in 9 different sports in 100 US high schools identified 98 066 injuries over a 2-year period that occurred as a direct result of an illegal activity as ruled by a referee or disciplinary committee. Girls' basketball (14%) and girls' (11.9%) and boys' (11.4%) soccer had the highest rates of such injuries, most of which were concussions or other head/facial injuries.[46] There is consensus that proper rule enforcement and limitation of violent contact can reduce the risk of injury. Officials controlling the physicality of the game and emphasis on safe play with respect for one's opponents[27,37] can both play significant roles in reducing contact injuries in soccer.

CONCLUSIONS AND GUIDANCE FOR CLINICIANS

1. Children, adolescents, and young adults can be encouraged to participate regularly in all forms of physical activity, including youth soccer. Soccer can provide a valuable component of fitness and physical activity strategies for young people.
2. Knee-injury risk-reduction programs seem promising, particularly for adolescent and collegiate female players. Research-validated programs are easily accessible at no cost on referenced Web sites. Pediatricians are encouraged to familiarize themselves with these programs and inform their patients on the availability and potential benefits. Additional research is needed to better define knee-injury risk in younger players (younger than 14 years) and to study potential risks (eg, plyometric leaping and impact on open growth plates) to starting prevention exercises in preadolescent players.
3. To reduce soccer-related fatalities, goalposts should be secured in a manner consistent with guidelines developed by the manufacturers and the CPSC.
4. Violent behavior and aggressive infractions of the rules tend to increase the risk of injury and should be strongly discouraged. Pediatricians are encouraged to advocate for the enforcement of all rules and guidelines while strongly promoting sportsmanship and fair play to ensure maximum safety and enjoyment for the athletes.
5. Data have been insufficient to link repetitive heading with permanent cognitive impairment. However, the AAP encourages heading of the ball to only be taught when the child is willing to learn proper technique and has developed coordinated use of his or her head, neck, and trunk to properly contract the neck muscles and contact the ball with the forehead. This guidance is based on consensus of opinion among members of the AAP Council on Sports Medicine and Fitness Executive Committee, because there is currently no valid evidence to support this conclusion.
6. Physicians are encouraged to be aware of and adhere to guidelines regarding the management of concussion and to help educate coaches and athletic trainers using available resources.
7. Protective eyewear is recommended for all participants in soccer, because there is a risk of eye injury, and should be mandatory for athletes with only 1 functional eye or those with a past history of major eye surgery or trauma.

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AMERICAN ACADEMY OF PEDIATRICS

TECHNICAL REPORT

Danielle Laraque, MD, and the Committee on Injury, Violence, and Poison Prevention

Injury Risk of Nonpowder Guns

ABSTRACT. Nonpowder guns (ball-bearing [BB] guns, pellet guns, air rifles, paintball guns) continue to cause serious injuries to children and adolescents. The muzzle velocity of these guns can range from approximately 150 ft/second to 1200 ft/second (the muzzle velocities of traditional firearm pistols are 750 ft/second to 1450 ft/second). Both low- and high-velocity nonpowder guns are associated with serious injuries, and fatalities can result from high-velocity guns. A persisting problem is the lack of medical recognition of the severity of injuries that can result from these guns, including penetration of the eye, skin, internal organs, and bone. Nationally, in 2000, there were an estimated 21840 (coefficient of variation: 0.0821) injuries related to nonpowder guns, with approximately 4% resulting in hospitalization. Between 1990 and 2000, the US Consumer Product Safety Commission reported 39 nonpowder gun–related deaths, of which 32 were children younger than 15 years. The introduction of high-powered air rifles in the 1970s has been associated with approximately 4 deaths per year. The advent of war games and the use of paintball guns have resulted in a number of reports of injuries, especially to the eye. Injuries associated with nonpowder guns should receive prompt medical management similar to the management of firearm-related injuries, and nonpowder guns should never be characterized as toys. *Pediatrics* 2004;114:1357–1361; *nonpowder guns, BB guns, pellet guns, air rifles, paintball guns.*

ABBREVIATIONS. BB, ball bearing; CPSC, US Consumer Product Safety Commission; NEISS, National Electronic Injury Surveillance System; EPD, eye-protective device; ASTM, American Society for Testing and Materials.

BACKGROUND

A traditional firearm gun is one that launches a projectile (ie, a bullet) by using the energy generated by burning of gunpowder. Nonpowder guns utilize the power of compressed air to launch a projectile. Nonpowder guns can be classified by the type of projectile they fire, the propulsion mechanism, or the type of barrel.[1–4] The type of projectile can be lead, brass, steel, copper, or, most recently, a paintball. Paintballs are small gelatin projectiles that are 17 mm in diameter, filled with nontoxic, water-soluble paint, and intended to explode on contact with an object.[5,6] This type of projectile is used in war games designed to mark the player with paint when he or she is hit. Air guns have been used since the 16th century[7,8] in warfare and to kill game as large as deer.

The caliber of a projectile refers to its diameter and is measured in hundredths of an inch or millimeters. The caliber affects how much energy the projectile acquires before leaving the muzzle, or the end of the barrel. Tight-fitting missiles, those with little discrepancy between the diameter of the projectile and that of the muzzle, lead to higher velocities. In older nonpowder guns, the projectile was smaller than the barrel size, leading to dissipating of compressed air and an inefficient, low-velocity gun. Technical modifications of these guns have resulted in higher-velocity weapons.[9] Standard pellet guns fire a pellet or spherical ball bearing (BB) with a diameter of less than 0.18 in (4.57 mm). Pellets have several designs, such as wad cutter, sharp pointed, round nosed, and hollow point. Each is suited for a different purpose. Hollow points are used for hunting, and the pellet's diameter increases on impact to cause maximum damage. Ballistic studies have shown that a larger caliber pellet will penetrate the body (eg, skin, bone) at lower velocities because of its increased mass. Skin penetration can be achieved, for example, at a velocity of approximately 331 ft/second with a 0.177-caliber pellet but at 245 ft/second with a 0.22-caliber pellet. Ocular penetration can occur at velocities as low as 130 ft/second.[7,10] Polishing steel pellets with a plastic skirt increases velocity, accuracy, and range and is designed to increase penetration. Typically, high-velocity guns are classified as those with muzzle velocities higher than 350 ft/second (D. Tinsworth, MS, US Consumer Product Safety Commission [CPSC], written communication, November 26, 2001).[7,9,11–13]

Projectiles can be fired by 3 propulsion mechanisms. The spring-piston type is a powerful spring that is cocked manually and released, driving the piston that shoots a stream of air. Use of the spring-piston can result in muzzle velocities between 250 and 350 ft/second. The carbon dioxide–powered gun uses a gas cartridge to generate a propulsive force that can produce muzzle velocities of 350 to 450 ft/second. Muzzle velocities ranging, on average, from 300 to 950 ft/second can be generated depending on the number of times the weapon is pumped, although velocities in excess of 1200 ft/second have been reported in the literature. This range of velocity

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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overlaps velocities reached by traditional firearm pistols that have muzzle velocities from 750 ft/second to 1450 ft/second.[1,3,9]

The longer the gun barrel is, the higher the velocity. Gun barrels can be smooth or rifled. Rifled weapons produce a spin in the projectile, giving it more stability in flight. Dieseling of the barrel is achieved when oil placed in the barrel is combusted by the heat generated from friction, leading to an explosion. This is used to increase the speed of the projectile. Piggybacking entails simultaneously loading 2 pellets into the firing chamber, increasing the momentum and energy of the missile.[9] A "zip gun" is a modified gun using homemade powder ammunition.[8] These modifications of nonpowder guns can result in increased ability of these guns to cause serious injury, not unlike traditional powder guns.

EXPOSURE AND INJURY PROFILE

The CPSC estimates that there are approximately 3.2 million nonpowder guns sold yearly.[12–14] Nonpowder guns are sold in many department stores, including toy stores.[9] Eighty percent have muzzle velocities over 350 ft/second, and 50% have muzzle velocities between 500 and 930 ft/second. In 2000, the National Electronic Injury Surveillance System (NEISS), operated by the CPSC, collected information from a nationally representative sample of 100 US hospital emergency departments that included information on nonpowder gun injuries.

According to data from the Centers for Disease Control and Prevention (http://webapp.cdc.gov/sasweb/ncipc/nfirates.html and www.cdc.gov/ncipc/wisqars/nonfatal/datasources.htm) and the CPSC,[12] in 2000 the overall nonfatal age-adjusted rate of injury from BB or pellet guns was 7.71 per 100000 population. In 2000, there were an estimated 21840 (coefficient of variation: 0.0821) nonpowder gun–related injuries treated in emergency departments (D. Tinsworth, MS, CPSC, written communication, November 26, 2001). Of these, 2% occurred in children 0 to 4 years of age; 49% occurred in children 5 to 14 years of age; 33% occurred in those 15 to 24 years of age; and the balance occurred in adults 25 years and older. Approximately 12% of injuries were to the eye; 24% were to the head and neck, excluding the eye; 63% were to extremities; and 1% were to other body areas. With the exception of the age group of 0 to 4 years, most victims were males. Sixty-six percent of injuries were diagnosed as either foreign-body lodgments or puncture wounds. There were no clear seasonal variations in the injury incidence. Nguyen et al[15] provided a review of trends in BB or pellet gun injuries in children and adolescents in the United States from 1985 to 1999 derived from a special study using the NEISS, which focused specifically on injuries associated with penetrating gunshot wounds. On the basis of data from this study, in 1999 an estimated 14313 (95% confidence interval: 12025-16601) children and adolescents had BB or pellet gun–related injuries.

Many articles have been written detailing the clinical manifestations of children injured by nonpowder guns.[3–10,16–31] Some striking observations have been made. Lawrence[3] reported on a series of 10 fatalities, 1 of which was a shot through the medial canthus of the eye in a 6-year-old. The weapon was a carbon dioxide–powered BB pistol. Bond et al[10] described 16 children, 57% of whom required intraoperative treatment, and 19% of whom required other invasive procedures such as arteriogram or ventriculostomy. Thoracic injuries were associated with high morbidity and mortality when penetration of the chest wall occurred. Abdominal wounds were frequently associated with visceral injury and multiple perforations, usually of the small bowel. Peritoneal penetration was associated with a more than 80% chance of visceral injury. Transtracheal and brain injuries were also reported. These authors warn that the wound itself may seem trivial, but if not appreciated for their potential for tissue disruption, nonpowder gun injuries to the head, chest, and abdomen may have catastrophic results. They also note that the pellets from air guns have a propensity to embolize if the missile enters a blood vessel or the heart. The light weight of air gun pellets allows the missile to be swept by the blood flow more readily than heavier, higher-energy projectiles. Friedman et al[7] report that the potential seriousness of pneumatic weapon injury is frequently underestimated. These authors concluded that injuries from air guns should be treated in a manner similar to those from low-velocity powder firearms. Bratton et al[4] reviewed the clinical course of 101 children injured by nonpowder guns between 1988 and 1996 from Cincinnati, Ohio; Kansas City, Missouri; and Seattle, Washington. The case fatality rate for intracranial injuries was 30%, and 56% of patients required at least 1 surgical procedure. Amirjamshidi et al[16] noted that air-gun pellet injuries are rare but catastrophic, with entrance usually through the orbit or the neck and the entry wound being so small that it may be disregarded on physical examination in the emergency department. They concluded that early recognition and correct management of possible complications is important to improve outcomes. Bhattacharyya et al[17] reported on 42 children admitted to a level I pediatric trauma center for air-gun injuries over a 7-year period (1988-1995). They had a mean hospital stay of 7 days (range: 1-136 days) and a mean injury severity score of 8.3. Half of the children underwent operative procedures, and 38% had serious long-term disability. They concluded that these guns are not toys but are weapons, and injuries related to their use should be evaluated and managed in a similar fashion to powder-weapon injuries. These findings were similar to those of Walsh et al.[18] In 1 study, the predominant risk factors for ocular injury from an air gun were lack of adult supervision, use of the gun for a purpose other than target practice, and being at a friend's home or yard.[20] Hearing loss has been reported from nonpowder gun use,[23] and suicides from the use of air guns have been documented.[8,28] Concurrent use of alcohol has been noted also and probably contributes to misuse.

Paintballs used in war games are a relatively new phenomenon.[5,6,21,25] Semiautomatic and fully automatic paintball pistols are available for purchase. The

sport typically involves a team, designated fields, and referees used to ensure fair and "safe" play. Players should be 18 years and older, but younger adolescents are allowed to play with the consent of their parent(s). Private games also occur. The players often wear camouflage, and start-up costs for the weapon, goggles, and paintballs total $100 to $150. The paintballs consist of spherical shells filled with sorbitol, glycol, and food dye. The propulsion mechanism is usually a carbon dioxide canister, and muzzle velocities between 60 and 250 ft/second can be achieved. Given the size of the projectile, the resulting injuries are nonpenetrating. Locally manufactured paintballs are harder than the more expensive imported varieties and may be responsible for the severity of injuries reported in the United States. Importantly, the increasing popularity of war games has been associated with a number of reports in the literature of ocular injuries. These injuries have included but are not limited to hyphemas, commotio retinae, glaucoma, cataracts, choroidal rupture, corneal abrasion, conjunctival laceration, dislocation of the crystalline lens, macular hole, and retinal detachments.[5,6,25,32,33] The visual outcome for many of these injuries is poor. Injuries have occurred even with eye-protective devices (EPDs), but no case of a player injured while properly wearing an EPD meeting the current American Society for Testing and Materials (ASTM) standards has been reported.[6] Some players have sustained injuries to the eye when they have removed their goggles because of fogging. Current antifog inserts with a polycarbonate lens with a urethane-based hydroscopic coating can help prevent fogging. The current ASTM specifications do not involve testing EPDs for their ability to resist fogging but do require manufacturers to attach a warning to EPDs without antifog treatment noting that fogging may occur and recommending the use of an antifog solution. There have been no reported deaths directly related to paintballs, but the CPSC issued a warning on March 24, 2004, because of its investigation of 2 deaths caused by carbon dioxide canisters flying off paintball guns (www.cpsc.gov/CPSCPUB/PREREL/prhtml04/04105.html).

Before 1972, only 2 nonpowder gun–related fatalities were reported in the literature. However, between 1972 and 1982, the decade after the introduction of high-powered air rifles, 10 more fatalities were recorded by the CPSC.[10] The number of deaths per year has increased since then. From 1990 to 2000, the CPSC reported 39 nonpowder gun–related deaths, of which 32 were children younger than 15 years, with an average of 4 deaths per year.[11] The highest number of deaths occurred in 1989, 1990, and 1991.[15] The trends in nonpowder gun fatalities and nonfatal injuries parallel the epidemic of firearm-related injuries and deaths of the past 2 decades.[34]

SAFETY STANDARDS

An ASTM voluntary safety standard was originally published in 1978. The current edition was published in December 1992 (ASTM F589, Standard Consumer Safety Specification for Non-Powder Guns).[35] This standard contains performance requirements to ensure the proper functioning of these products as well as provisions to address instructions, labeling, and marketing. The guns are general-purpose guns not classified as precision, adult, or training guns. For higher-power guns, the minimum labeled age is 16 years, and the potential for serious injury or death is indicated. For lower-power guns, the minimum labeled age is 10 years, and the risk of serious injury, particularly to the eye, is indicated, but not the risk of death. In the pediatric literature as early as 1984, Christoffel et al[36,37] pointed to the dangers of nonpowder guns, noting that they were loosely regulated and could be legally purchased by young adolescents in most jurisdictions. They also emphasized the inadequacy of voluntary standards and proposed stricter regulations.

From June 1 through July 31, 1994, the CPSC conducted a limited study using follow-up telephone investigation of the circumstances of 55 cases of nonpowder gun–related injuries reported to the NEISS. Percentages provided in the analysis were based on national estimates projected from the 55 cases for the 2 months of the survey. Additionally, information on deaths was obtained from the CPSC Death Certificate, In-Depth Investigation, and Injury or Potential Injury Incident files for the period of January 1, 1985, through September 1, 1994. Information on 37 deaths was included (D. Tinsworth, MS, CPSC, written communication, November 26, 2001). Respondents were victims or parents or guardians of victims. The injury epidemiology mirrored that described for the 2000 data, with most injuries occurring in males younger than 16 years. Individuals who fired the guns ranged in age from 8 to 32 years, with most reported to be younger than 16 years. When the gun operator was younger than 16 years, there was no one 18 years or older present at the time of the incident in more than two thirds of the cases. The gun was most often reported to be a rifle and received as a gift, and two thirds were high-powered guns. As reported by the respondents, 51% of the hazard patterns were unintentional shootings, with victims coming into the line of fire during practice, discharges during loading of the gun, or incidents in which the gun "accidentally fired." Fourteen percent were of unknown intent, 7% were intentional shootings, and 28% involved a gun thought to be unloaded, guns that discharged unexpectedly, ammunition that ricocheted, or fingers that became pinched in gun components. Ninety percent of those who died were younger than 16 years. Most fatalities resulted from wounds to the head or chest.

The CPSC report concluded that the effectiveness of age-specific warnings on packaging and instructions needed additional study and that adult supervision was often lacking. It was unclear from the data whether product modification to reduce hazards would be effective.

LEGISLATIVE EFFORTS

Almost 30 states have regulations, ordinances, or laws covering nonpowder guns.[9,38] Two of the strongest are in New York City and New York State. In New York City, air rifles and BB guns are prohibited, and licenses are not available. In New York State, no

purchase or unsupervised use by someone younger than 16 years is permitted, and adult supervision is required at a shooting range or when hunting for someone of this age. Florida also has a strong law similar to the New York State law. In Florida, it is a second-degree misdemeanor for a minor younger than 16 years to use a BB gun, air gun, or gas-operated gun unless an adult is supervising the possession and the minor's parent has consented to such possession.

However, much variability exists, with some states regarding nonpowder guns as firearms and others not.[15] Some state laws do not address nonpowder guns at all. Many authors have called for restrictions in sales and use of nonpowder guns, especially in light of the technologic advances that have resulted in much more powerful and dangerous weapons that are capable of killing and maiming.[9,19,31,39]

SUMMARY/CONCLUSIONS

This technical report is focused mainly on the potential for injury and death associated with the use of nonpowder guns. Although some comments have been made on risk factors for injury, this report is not meant to be an exhaustive review of the behavioral risk factors for injury, nor does the report summarize the literature regarding the psychological implications or effects of the use of these weapons. The data presented do allow the following conclusions:

- Nonpowder guns pose a serious risk of injury, permanent disability, and even death.
- Since the 1980s, the use of high-powered air rifles has been associated with approximately 4 deaths per year.
- The range of muzzle velocities for nonpowder guns overlaps velocities reached by traditional firearms.
- Data suggest that lack of supervision and unstructured use may be risk factors contributing to the incidence of injury from nonpowder guns.
- EPDs can be useful in decreasing, but not fully eliminating, the incidence of ocular injuries associated with paintball use.
- Injuries associated with nonpowder guns should receive prompt medical management similar to the management of firearm-related injuries.
- Nonpowder guns (BB guns, pellet guns, air rifles, paintball guns) are weapons and should never be characterized as toys.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention and Committee on Sports Medicine and Fitness

In-line Skating Injuries in Children and Adolescents

ABSTRACT. In-line skating has become one of the fastest-growing recreational sports in the United States. Recent studies emphasize the value of protective gear in reducing the incidence of injuries. Recommendations are provided for parents and pediatricians, with special emphasis on the novice or inexperienced skater.

Since its introduction in 1980, in-line skating has become one of the fastest growing recreational sports for children and teenagers in the United States. An estimated 17.7 million people younger than 18 years participated in this sport in 1996, a 24% increase over the previous year.[1] The sport offers the benefits of aerobic fitness,[2] independent transportation for younger children, the opportunity to play roller hockey or cross-train for other sports, and venues for competition in artistic, speed skating, and endurance events. Entry-level skates now cost less than $20 per pair, a 10-fold decrease in the past decade. The low cost and multiple benefits of participation have allowed the sport to thrive beyond the limits of a "fad," as evidenced by the existence of a professional roller hockey league, in-line speed skating competition at the Pan American Games, trick-skating competition at the Entertainment and Sports Programming Network (ESPN) Extreme Games, several periodicals for enthusiasts, an international skaters association, a formal training program for instructors,[3] and summer training camps.

As the sport has grown, so has the number of participants injured. In 1996, an estimated 76 000 children and teenagers younger than 21 years were injured sufficiently while in-line skating to require emergency department care, compared with about 415 000 bicyclists. The most common reasons cited for injuries during in-line skating were losing one's balance because of a road defect or debris, being unable to stop, out-of-control speeding, or doing a trick.[4] In one study, novice skaters incurred 14% of all injuries requiring treatment.[4] The wrist is the most common site of injury (37% of all injuries), and two thirds of wrist injuries are fractures. Few skaters die. Of a total of 36 who died since 1992, the US Consumer Product Safety Commission Clearinghouse reported that 31 had collided with a motor vehicle.

Wearing proper gear is essential for safe skating. This includes a helmet, wrist guards, knee pads, and elbow pads. Wrist guards are designed to prevent wrist injuries by preventing sudden extreme hyperextension, absorbing some shock of impact, dissipating kinetic forces by forward sliding on their hard volar plates, and preventing local gravel burns. A helmet, elbow pads, and knee pads are recommended for shock absorption.[5–9] Recent research[4] has evaluated the effectiveness of such gear and indicates that wearing wrist guards could reduce the number of wrist injuries by 87%, wearing elbow pads could reduce the number of elbow injuries by 82%, and wearing knee pads could reduce the number of knee injuries by 32%. Although in this study the number of in-line skaters who sustained a head injury was not sufficient to determine the degree of protection afforded by helmets, others[10] have reported that a bicycle helmet or similar approved sports helmet[11] is strongly protective against the occurrence of a head injury to bicyclists in the same physical environment to which a skater is exposed. Helmet use by child and adolescent skaters is required by law in New York and Oregon. Skaters who participate in roller hockey or perform tricks should wear heavy-duty protective gear, including well-constructed wrist guards, knee pads, elbow pads, and a full-head helmet that covers the ears.

"Truck-surfing" or "skitching" refers to skating behind or alongside a vehicle while the skater holds on to the vehicle. This enables a skater to travel at the same velocity as the vehicle. However, it can be very dangerous because the skater cannot slow down fast enough to prevent colliding with the vehicle or being thrown into oncoming traffic or the roadbed if the vehicle suddenly slows, stops, or turns. If the skater falls, his or her enhanced momentum will likely result in a greater force of impact, and consequently, a more severe injury. Several deaths have been caused by skitching.

The design of the skates should match the ability of the skater. Three- or four-wheeled skates are suitable for novice- or intermediate-level skaters, depending on the child's foot size. Five-wheeled skates are high-performance, extremely low-friction skates that should be used only by competitive or long-distance skaters. Skates should fit snugly to allow good, responsive control. Skates, whether rented or owned, should be well maintained: the brake pads should not be worn down, the wheels should be worn symmetrically and turn freely. Skates with expandable shells or interchangeable liners are now available to accommodate the child's growing foot.

Skating skill is not acquired easily or quickly. Good balance and speed control are essential skills to learn. In the past, children acquired skating skills on

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

traditional "quad" skates, rather than in-line skates, but that pattern appears to be changing. The age at which children are ready to use in-line skates safely is not known with certainty because a combination of factors are involved: physical factors (foot size and body strength); skill factors (general athletic ability and large-muscle coordination); and behavioral factors (vigilance in watching the surface for debris and defects, sufficient attention to traffic, judgment). Although most 7- and 8-year-olds can acquire the skills needed to in-line skate, some children may acquire these skills earlier or later. Judgment and ability to avoid obstacles, including bicyclists, pedestrians, and other skaters, are needed. Training may help the novice learn the sport; more than 2000 certified instructors now teach in the United States.

With either type of skate, the novice should preferably learn indoors at a skating rink, where surface conditions, speed, and lighting are controlled without the presence of motor vehicle traffic or other obstacles. Novices particularly need a flat, smooth surface free of debris.

Once a skater can control speed and direction on an indoor rink, he or she is ready to skate on a path or open lot. Hills (even small ones) should be avoided at first. The path selected should be isolated from motor vehicle, bicycle, and pedestrian traffic to the greatest extent possible until the skater is competent enough to avoid such obstacles. Separate trails are advisable where possible. Trail designs have been published, including recommendations for design speed, surface composition, drainage, trail width, and sight distances.[8] Trails should be kept free of sand, dirt, leaves, and twigs, which can become trapped between the wheels and cause a sudden change in velocity with loss of balance. Good drainage is needed so that puddles do not form—water changes the coefficient of friction and results in a sudden change in velocity. Trails should also flatten for at least 30 ft before intersections.[8]

RECOMMENDATIONS

The American Academy of Pediatrics recommends that pediatricians provide the following advice to patients and families concerned with this activity:

1. Parents need to understand both the benefits and risks of in-line skating. Children and their parents should appreciate that injuries are particularly common in novice skaters, roller hockey players, and those performing tricks.
2. Full protective gear needs to be used at all times, including a helmet, wrist guards, knee pads, and elbow pads. The helmet should be certified by the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), the Snell Memorial Foundation, or the Consumer Product Safety Commission. Skaters performing tricks need special heavy-duty protective gear.
3. If skating takes place on the streets, pediatricians should strongly encourage parents, children, and adolescents to use streets that are blocked off or closed to through traffic (eg, dead-end streets or cul-de-sacs).
4. Special attention should be paid to the needs of novice skaters to avoid injuries. They should skate on an indoor or outdoor rink, rather than on a path or street. Inexperienced children should not attempt to do tricks.
5. "Truck-surfing" or "skitching" should be prohibited for all skaters under any circumstance.
6. The type and fit of the skates should be carefully considered when they are purchased or rented and should be appropriate for the child's size, ability, and purpose.
7. Skaters should vigilantly watch for road debris and defects, which may precipitate a loss of balance. They should be trained to react appropriately to these and other rapidly occurring and unpredictable circumstances by learning to stop quickly and fall safely and by avoiding traffic. Instruction in skating by a teacher certified by the International In-Line Skating Association is recommended.
8. Children with large-muscle motor skill or balance problems and those with any uncorrected hearing or vision deficit should skate only in a protected environment. Appropriate areas include a skating rink or outdoor area where the skater is either alone or where no motor vehicle or bicycle traffic occurs and where all other skaters and pedestrians travel in same direction.
9. State legislation that requires helmet use while skating should be encouraged.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Bioethics

Institutional Ethics Committees

ABSTRACT. In hospitals throughout the United States, institutional ethics committees (IECs) have become a standard vehicle for the education of health professionals about biomedical ethics, for the drafting and review of hospital policy, and for clinical ethics case consultation. In addition, there is increasing interest in a role for the IEC in organizational ethics. Recommendations are made about the membership and structure of an IEC, and guidelines are provided for those serving on an ethics committee.

ABBREVIATIONS. IEC, institutional ethics committee; JCAHO, Joint Commission on Accreditation of Healthcare Organizations.

Institutional ethics committees (IECs) initially were proposed to review decisions to limit or withdraw life-sustaining treatment for neurologically devastated or dying adult patients[1,2] and were viewed as a reasonable approach to the complex issues raised by decisions not to treat seriously ill or disabled newborns.[3] IECs have evolved considerably since the 1984 American Academy of Pediatrics statement concerning infant bioethics committees.[4] Rather than being simply a mechanism for implementing federal regulations about treatment of disabled infants and children,[5] IECs help resolve conflicts about treatment decisions through case consultation, provide a forum for discussion of policies relating to institutional ethics, and educate their health care communities about ethical concepts. The Academy supports the availability of an IEC as an important mechanism for the discussion and resolution of ethical issues raised in the individual and institutional provision of patient care.

IECs traditionally have been involved in clinical ethics and have an emerging role in organizational ethics. Recognizing that the development of an IEC is a process, this statement discusses 3 typical roles for an IEC: 1) case consultation; 2) the drafting and review of institutional policy; and 3) the education of health care professionals, patients, and other health care employees. The statement also describes the membership and structure of an IEC. Finally, the statement advises physicians and other health care professionals about their participation as IEC members or as members of an ethics consultation team.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

THE ROLES OF AN IEC IN CLINICAL ETHICS

Case Consultation

For the majority of physician-patient encounters in pediatrics, the necessary scope, value, and desirability of the anticipated medical intervention is shared among physician, patient, and family. Problems tend to arise when no one intervention is clearly preferable, when there are conflicts about the value of an intervention, or when communication breaks down. As a result, parents, children, physicians, and others may experience uncertainty or conflict over how to respond to the situation. An IEC may be asked to help when uncertainty or conflict exists, when questions of moral, legal, or economic justification are raised, when problems of communication seem to be impeding patient care, or when it is simply unclear whom to ask for advice. In this role, the IEC or a subset of members constituting a "consultation team" may be requested to review the clinical situation and offer suggestions for resolution of the problem.[6–8]

The potential importance of the IEC's consultative role has been recognized in numerous ways, including the following: 1) case law suggesting that IEC deliberations may serve as evidence in court[9–11]; 2) state proposals to establish an IEC as an alternative to judicial review[12,13]; and 3) the requirement of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) that every health care organization have an established mechanism to address conflicts—a requirement most often met by establishing an IEC.[14]

The Academy recognizes that there are a range of acceptable approaches to the many issues that need to be considered in providing an ethics consultation service. An IEC that is engaged in providing ethics consultations should have a policy and procedure statement that includes the following: who can request a consultation, how the IEC is contacted, who responds to the request, how the consultation is conducted, who is to be included in the consultation, proper notification of affected persons, protection of patient confidentiality, how the consultation is documented, whether in some circumstances an ethics consultation is required, and the advisory nature of the consultant's recommendations. Information about the availability and process of ethics consultation should be widely distributed to patients, parents, family members, physicians, nurses, and other individuals who may have reason to call on the consultative services of the IEC.

The 2 characteristic features of an ethics consultation that distinguish it from an informal request for

advice or a case-based educational session are the involvement of a patient, family, or both and the documentation in a patient's medical record. If an ethics consultation is deemed inappropriate in favor of a case-based educational session, it may be appropriate for the patient, family, or both to be informed of the session and invited to participate. If hospital staff who are not involved in the patient's care will attend the session, the prior consent of the patient, family, or both for the disclosure of confidential information should be obtained, or the case should be presented while maintaining confidentiality. Acceptable approaches may vary among institutions and even from case to case. However, the following guidelines should apply to providing ethics consultation to ensure fairness and accountability:

1) Any patient, parent or guardian, or family member should be able to initiate an ethics consultation.
2) The patient and parent or guardian should be able to refuse to participate in an ethics consultation.
3) The refusal of a patient or parent or guardian to permit an ethics consultation should not obstruct the ability of an ethics committee to provide consultation services to physicians, nurses, and other concerned staff.
4) Any physician, nurse, or other health care provider who is involved in the care of the patient should be able to request an ethics consultation without fear of reprisal.
5) The process of consultation should be open to all persons involved in the patient's care, yet conducted in a manner that respects patient and family confidentiality.
6) Anonymous requests for consultation should not be accepted in the absence of an identified person who is willing to speak to the issue being raised.
7) The primary care pediatrician should be invited to participate in the consultation to support existing physician-family relationships.

Three models of prospective case consultation generally have been used: 1) an individual consultant who reports on a periodic basis to the entire committee; 2) a small team of committee members; or 3) a meeting of the entire committee. Each model has advantages and disadvantages. In some circumstances, consultation provided by a single person from the IEC may suffice. Although an individual consultant may respond in a timely and flexible manner, such an approach risks losing the diversity and range of perspectives offered by a group. In most situations, small consultation teams made up of individuals of varying personal and professional backgrounds are recommended to balance a timely and flexible response with the value of diverse points of view. The skills and knowledge necessary to participate as a member or leader of such a consultation team varies with one's role in the process.

IECs and their members should attend to the following concerns in developing a reasonable policy and procedure for ethics consultation. First, IECs must concern themselves with questions of procedural fairness and confidentiality. They must have a mechanism for involving or advising patients and others who are the subjects of consultation, and they must respect the privacy and confidentiality of all persons affected by all aspects of IEC consultation. Second, IECs must have means of keeping current with relevant basic bioethics and health law, including information relevant to infants, children, and adolescents, to avoid giving incorrect advice or supporting questionable actions; they must know when to seek further consultation or review (from "authorities" in ethics, medicine, or law) and when judicial involvement should be sought. Finally, a consultation service should report to the IEC, and there should be an IEC mechanism for quality review and improvement of ethics consultations. Failure to develop and then follow reasonable polices and procedures for ethics consultation violates JCAHO standards. Furthermore, these policies and procedures must be communicated to all patients, parents or guardians, and hospital personnel.

The quality of an ethics consultation rests on the IEC's ability to provide a forum for open discussion of the medical, moral, and legal issues surrounding a difficult situation. On occasion, a request for an ethics consultation is motivated by a desire to bring the perceived authority of an IEC to bear on a difference of opinion or conflict, usually with the hope that the IEC will support the position of the person requesting the consultation. The authority, whether institutional, moral, or legal, of an ethics consultant and an IEC is limited.[15] The Academy supports the view that the recommendations from an ethics consultation are advisory only, with all parties to a disagreement taking full responsibility for their own actions. Although the interpretation and application of case law and state regulations may be part of an ethics consultation, the mere fact that an IEC was involved in a case is of uncertain value in providing legal protection to the participants. Improved communication, clarification of differences and available options, and careful documentation of the decisional process may well reduce the potential for future legal action.[16–18] Finally, all ethics consultations should be documented in the committee records, and, in most cases, a summary of the consultation should be briefly, yet completely, included in the patient's medical record. The form and extent of chart documentation of ethics consultations may vary depending on local hospital regulations and requirements.

Policy Development

In addition to involvement in case consultation and educating patients, families, and staff members about ethical issues, the functions of an IEC generally include the drafting and review of institutional policy and procedures. Policies for the limitation or withdrawal of various treatments, such as cardiopulmonary resuscitation or fluid and nutrition, often have been drafted with IEC involvement. The IEC also may be involved in drafting other policies with ethical import, such as the ability of hospital employees to object to taking care of certain patients, the resolution of conflict, and the statement on institu-

tional business ethics now required by JCAHO.[19] The IEC may not only respond to administrative requests, but may also proactively identify issues with ethical ramifications that warrant an institutional policy and procedure.

Ethics Education

An IEC should have a major role in educating all health care professionals, employees, and administrative staff in the ethical foundations of patient care and institutional relationships. Such education can occur as traditional didactic presentations, as ad hoc discussions about common clinical situations, or as one aspect of clinical case consultation. Whenever possible, students and house officers should be included in these educational opportunities. Most important, an IEC should engage in continuing education and ongoing training to ensure the highest quality clinical ethics consultations.

THE ROLE OF AN IEC IN ORGANIZATIONAL ETHICS

Recent trends in the financing and provision of health care have raised concerns about the impact of institutional commitments such as managed-care contracts, integrated systems, and performance incentives on the care of patients. IECs are being looked to in some institutions as a venue within which these concerns might be addressed. Including organizational ethics in the purview of the IEC raises specific questions about its structure, function, and member qualifications.[20,21] The IEC should establish standards of membership, process, and self-improvement specific to organizational ethics issues and to the organizational structure of its home institution. In addition, the IEC should establish procedures for the evaluation and quality improvement of committee functions, process, and success in meeting institutional expectations. One approach is to establish an organizational ethics subcommittee of the IEC that includes additional representatives from administration and finance, along with persons committed to developing the requisite knowledge and skills in business ethics. Processes that organizational ethics teams commonly use to carry out their mission mirror those of clinical ethics: education, policy development, and case consultation.

MEMBERSHIP AND STRUCTURE OF AN IEC

The membership of an IEC should be multidisciplinary with sufficient knowledge and experience to address the range of ethical issues brought to the committee. The ability of a larger committee to encompass a diverse range of perspectives and expertise argues in favor of an IEC retaining overall responsibility for functions such as ethics consultation that are delegated to an individual or a smaller team. Also, the required knowledge and experience depend on the task at hand; that is, there are likely to be differences in the skills needed to draft a policy on organizational ethics, to develop a policy addressing the withdrawal of life-sustaining treatment, or to perform a clinical ethics consultation.

Diversity of IEC membership benefits from community representation, while recognizing the impossibility of including all points of view and the potential for inappropriate generalization in considering any individual "representative" of his or her class, race, gender, or professional group. As medical technology and information become more complex and ethical issues expand to encompass resource allocation and business practices, an IEC may need to seek and incorporate the advice of consultants. The IEC size necessary to include a sufficient diversity of personal, community, and professional views may hinder the IEC's efficiency. It thus may be appropriate for the larger IEC to delegate certain tasks to smaller subgroups (such as providing ethics consultation or drafting specific policies) while retaining the authority for coordination, oversight, and approval of activities of the subcommittees.

Two important issues concerning IEC structure are: 1) the participation of the hospital attorney or risk manager in the IEC; and 2) whether there are 1 or more IECs within a single institution. First, the hospital attorney or risk manager may experience a conflict of interest between a duty to protect the institution and a duty to protect the patient's interest. Such conflicts should be recognized prospectively, and, in some circumstances, the consultation team may choose to restrict the hospital attorney, risk manager, or other administrators to function as ex officio advisors on specific legal or administrative matters. Many IECs have found that the inclusion of nonhospital attorneys familiar with ethical issues is beneficial. In addressing organizational ethics issues, their membership may be essential.

Second, a single multidisciplinary IEC should have authority over all IEC subcommittees addressing consultative, educational, nursing, pediatric, or administrative concerns. The existence of special interest ethics committees, such as an infant care review committee or nursing ethics committee, undermines the diverse multidisciplinary context that is the strength of an IEC. The establishment of multiple IECs may indicate that the process and deliberations of one IEC are not inclusive. Although an institutional review board functions independently to ensure the protection of human subjects in research, it is advisable for an IEC and an institutional review board to establish a mechanism of communication. An IEC may fulfill its functions whether it reports to the medical staff, hospital administration, or board of directors; however, as some ethical issues may involve conflicts between the clinical, administrative, and financial commitments of an institution, reporting to the institutional board of directors may be advantageous in these cases.

At institutions with academic affiliations, the IEC may exist with an academic bioethics program engaged in teaching, research, and ethics consultation. Nevertheless, the IEC should retain oversight within an institution for ethics consultation, policy review, and education when these functions have been delegated to such programs.

SERVING ON AN IEC

Ideally, the members of an IEC encompass a wide range of clinical experiences, personal backgrounds, and professional perspectives, combined with personal integrity and a willingness to discuss and debate the ethical issues raised in the provision of health care. Integrity, diversity, and shared interest, however, do not guarantee that the members of an IEC collectively will have sufficient knowledge and experience in such areas as clinical ethics, health policy, law, communication, and group process. Accordingly, IEC membership requires a commitment to acquire, and then maintain, the knowledge sufficient to address the complex issues faced by an IEC. Each IEC should establish a continuing education program designed to assist IEC members in fulfilling the stated mission of the IEC, especially as new issues emerge.[22,23] When asked to be a member of an IEC, a pediatrician, pediatric subspecialist, or pediatric surgeon should assess his or her commitment to acquiring and then maintaining a sufficient level of knowledge in bioethics appropriate to the tasks of the IEC. A prospective IEC member should be comfortable with the committee's general mission statement, policies, and operation and the required responsibilities with respect to these functions.

If a pediatrician, pediatric subspecialist, or pediatric surgeon is involved in ethics consultation, clinical experience alone is insufficient to engage competently in clinical ethics consultation. An experienced clinician may possess the necessary medical and technical knowledge that often needs clarification during a consultation. An experienced clinician may also possess considerable skill in talking with patients and families about the difficult practical and moral problems faced in complex and, at times, uncertain situations. In addition, however, clinical experience must be supplemented with a basic knowledge of ethical theory, health policy, law, and clinical ethics literature. Performing an ethics consultation requires advanced knowledge of the aforementioned issues along with additional knowledge and skill in communication, group leadership, individual and group dynamics, techniques of mediation, and self-awareness.[24–27] An IEC should permit different levels of member involvement, ranging from simply attending general committee meetings, discussing and drafting institutional policy, or participating in ethics consultation, to leading an ethics consultation team, depending on the skills and experience of each member.

If engaged in clinical ethics consultation, it is reasonable to ask what one's legal liability might be in offering this service. An IEC should clarify the extent to which IEC proceedings are discoverable and whether its members are covered by liability insurance. The question of legal liability is difficult to answer except in general terms. Responsibility increases with authority, so it is generally "riskier" for IECs to act on their own or to mandate or require actions by others than to give advice and make recommendations. However, even IECs whose function is strictly advisory or educational can wield great apparent authority within an institution. IECs unquestionably have a responsibility to persons affected by their deliberations. Furthermore, the actual policies of an IEC are less important than the manner in which those policies are executed and the IEC's success in educating the hospital community, including patients and their families, about the availability and process for clinical ethics consultation. The likelihood that IEC members will be held legally liable for the actions arising from a consultation is, practically speaking, remote. Nevertheless, IECs and their members have an important opportunity to help set the standards for their own work by careful attention to continuing education, preparation, policy, procedure, and documentation.[28]

RECOMMENDATIONS

1. Membership on an IEC should be diverse and reflect different perspectives within the hospital and general community.
2. An IEC should have responsibility within an institution for clinical ethics consultation, review of policies, and education of professional, administrative, and support staff about ethical issues, regardless of whether these functions are delegated to other subcommittees or programs.
3. An IEC that is engaged in clinical ethics consultations should have policies and procedures that conform to ethical principles of fairness and confidentiality.
4. An IEC should establish continuing education and training programs that assure that IEC members are qualified to perform their specific duties within the IEC.
5. Independent ethics committees, such as an infant care review committee, should be dissolved or restructured to report to the larger IEC.
6. IECs within a general hospital setting should ensure an adequate degree of multidisciplinary expertise for addressing ethical issues specific to pediatrics.

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AMERICAN ACADEMY OF PEDIATRICS

Insurance Coverage of Mental Health and Substance Abuse Services for Children and Adolescents: A Consensus Statement

ABBREVIATIONS. SCHIP, State Children's Health Insurance Program; CPT, Current Procedural Terminology.

Mental health needs of children and adolescents are increasing while access to behavioral health, mental health, and substance abuse services is decreasing. Such services include preventive interventions, early identification, assessment and diagnosis, case management, outpatient treatment, hospitalization, home-based treatment, comprehensive drug and alcohol treatment, and residential and hospital psychiatric treatment. In the past 20 years, the rate of psychosocial problems identified in children in primary care has increased from 7% to 18%.[1] It is currently estimated that at least 13 million children are in need of mental health or substance abuse services,[2] yet attempts to restrain health costs have resulted in decreased availability of mental health and substance abuse services for children and adolescents. This decrease is attributable to benefits packages that provide limited mental health services or carve out plans, in which behavioral health care may be carved out (not included) or contracted for separately, making mental health services more difficult to obtain. This decrease is occurring despite increasing evidence of the effectiveness of specific mental health and substance abuse services.[3] In the general health care sector, primary care clinicians are being pressured to see more patients in less time and, therefore, have less time to address psychosocial issues.

Concern regarding the deterioration of clinical mental and behavioral health and substance abuse services for children and adolescents resulted in an unprecedented meeting of representatives from professional organizations who care for the mental health needs of children. These organizations reached consensus on the issues outlined in this statement.

To rectify the present shortage of mental health services, a commitment must be made to increase resources in both the private and public sectors. Without this increase, current and future needs will not be met. Although specific long-term economic benefits are difficult to calculate, children and adolescents who receive early intervention and care may avoid needing costly treatment in the future. In economic terms, immediate improvements in the mental health of children and adolescents are reflected in increased parent work productivity, less parent absenteeism, and less use of general medical services. More importantly, in the long-term, preventive efforts and early treatment of behavioral problems and mental disorders in childhood result not only in changes in behavior but also in changes in the brain. The potential impact of early intervention on instances of violence and the number of incarcerated juveniles and young adults is great. Even a modest reduction in negative outcomes of youth will more than compensate for the increased health care costs at this time.[4] Certainly, for children and families, the avoidance of problems and associated misery is a worthwhile goal in a humane society.

To improve mental health services, it is important to address 3 issues: access, coordination, and monitoring. These issues should be considered from the standpoint of needs for preventive interventions, direct mental health and substance abuse services, and coordinated multiservice care.

ACCESS

Traditional mental health care systems, which were limited at best, have recently been further disrupted by the change to a managed care system. In the past, primary care clinicians could refer patients with mental disorders to appropriate mental health clinicians. Parents and school personnel, when needed, could also obtain direct access to mental health clinicians. This arrangement increased the chances of the family obtaining the services needed and increased the likelihood of communication among professionals.

Many current behavioral health carve out programs make mental health services much more difficult for families to obtain. In many cases, clinicians and families must depend on external screening processes in which decisions for approval are based almost exclusively on preset guidelines for adults, not children. There is no direct contact between the referring physician and the professional provider during the referral process. It is difficult for families to obtain services because of obstacles, such as an absence of criteria for approving services that meet the needs of children, copayments that are higher for behavioral health services than those for other medical services, more limited yearly and lifetime caps, and limited panels of qualified mental health care professionals experienced in treating children.

Limiting the ability of primary care clinicians to provide preventive services further worsens the situation. Primary care clinicians do not receive ade-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

quate reimbursement for preventive efforts, such as addressing psychosocial problems, and they are pressured to see more patients in less time. As a result, they have less time to develop strong, ongoing relationships with families and are less likely to identify mental health and substance abuse problems.

The low number of qualified child mental health and substance abuse clinicians contracting with behavioral health management further limits access.[5] Clinicians experience difficulties in establishing credentials on multiple professional panels. There are obstacles in obtaining approval for adequate levels and quantity of services to care appropriately for their patients. In addition, payment for services to children, adolescents, and their families is inadequate, and administrative practices are burdensome. These factors result in a decrease in available facilities and a disincentive for professionals and those in training to enter or remain in the field.

To address the issues, the following recommendations are proposed:

- Parity should be established between medical health services and mental and behavioral health and substance abuse services.
- The State Children's Health Insurance Program (SCHIP), which has provided additional resources for children's health care and has allowed for flexibility in the distribution of resources, should be supported and expanded to include coverage for mental and behavioral health and substance abuse services.
- The number of qualified child mental health and substance abuse clinicians should be increased through support for training programs, better recruitment into these programs, and job incentives.
- Managed care and behavioral health organizations should be required to provide adequate panels of culturally competent clinicians who are qualified to address child and adolescent mental and behavioral health and substance abuse needs.
- Competent, licensed providers with training and expertise in providing services to children should be equally included on panels, without limitations to specific disciplines.
- Professionals need to be accessible and available to families within a reasonable distance and time frame.
- Services provided by clinicians in alternative sites, such as schools, homes, and centers, must be reimbursed.
- Families and purchasers of health care plans need to be clearly informed about the adequacy of the health care coverage they are considering. The health plan should specifically identify mental health services provided to children, including child and adolescent psychopharmacology, child and adolescent psychological and neuropsychological assessments, child and adolescent psychotherapy, behavioral medicine (eg, pain management, chronic illness management, eating disorders), and substance abuse programs.
- The processes required for children and adolescents to receive mental and behavioral health and substance abuse services should be simplified, shortened, and unified. For clinicians, this should include a universal credential verification process and a universal treatment authorization form. For families, it should include a simplified authorization and appeals process.
- There should be no exclusions for diagnostic categories, chronic disorders, and preexisting conditions (chronic illness and developmental disabilities).
- Reimbursements need to compensate clinicians adequately for the services provided.
- Administrative practices need to be revised to reduce the practitioner's administrative burden.

COORDINATION

Although coordination of care is critical in all types of health care treatment, it is particularly important for mental heath services. Many sectors of a community, including schools, social services, and the justice system, are involved with children and adolescents with mental health and substance abuse problems. For services to be effective and efficient and meet family needs, service professionals must communicate and coordinate with each other. At a time when all sectors are attempting to cut costs, there is a tendency to try to shift responsibilities from one sector to another. As a result, divisions of responsibilities are not always clear. Often, families are caught in the middle and receive no information or conflicting information as to who can best address the child's needs. This lack of organization often results in agencies working inefficiently and sometimes with different purposes. Nowhere is this more evident than with children who have severe and multiple conditions that require coordinated, multiple services.

To address the issues, the following recommendations are proposed:

- Families must be centrally involved in the coordination of care for their children and adolescents. Services provided that address family issues should be reimbursed adequately.[6]
- A seamless system of care must be established within and across sectors that includes mechanisms to promote communications and referrals among professionals such that children and families receive appropriate services regardless of how and where they seek help and irrespective of the nature of their problems.[7]
- Clinicians must be compensated for case management and coordination efforts (ie, compensation of counseling Current Procedural Terminology [CPT] codes and consultation CPT codes). Contracts should include compensation for interpretive and indirect services, such as staff conferences, consultation between clinicians, and contacts with professionals in other sectors, such as schools and law enforcement.
- Mechanisms for apportionment of costs and reimbursements must be established for complex cases that involve multiple agencies.

MONITORING

For economic competition to work to improve health services, families and purchasers of health care plans need to be informed about the quality of the services provided. This issue has always been complex, because quality includes the availability of a spectrum of qualified services, the quality and appropriateness of care provided, and the responsiveness of services to concerns raised by professionals or families. As direct recipients of services, families need information about the services provided and guidelines by which to evaluate this information. Families need mechanisms to communicate their comments and experiences to those who purchase health care plans, most commonly their employers. The purchasers also need uniform and accurate information about plans that provide health care services. As programs have multiplied and diversified, it has become difficult for all to determine the quality of services offered and for appropriate regulatory agencies to hold them accountable.

To address the issues, the following recommendations are proposed:

- Clinician professional organizations and provider plans should be encouraged to better define and use evidence-based care in mental and behavioral health and substance abuse services for children, adolescents, and families. Empirically supported assessments and treatments should include level of care criteria, best practices, and monitoring of incremental expectations for progress. Research on quality of care and outcomes effectiveness should also be enhanced by these groups.
- Public and private sectors should develop mechanisms for system accountability in the cost-effectiveness of service calculations, including consideration of administrative costs.
- Mechanisms to provide user-friendly information to families and purchasers regarding the availability, adequacy, and quality of mental and behavioral health and substance abuse services must be developed.
- Simplified and timely internal and independent external appeals processes should be developed by health plans and mental health care management programs. Families should be included on such panels.

The decreasing availability of health care services to meet the mental health needs of children and adolescents is a serious and worsening problem. Action must be taken to curb this decrease. Issues that negatively impact the access, coordination, and monitoring of such services must be addressed. Improvements in these services will have a positive impact not only on the health and well-being of children and adolescents but on society as well.

Participating Organizations

Academy for Eating Disorders
American Academy of Child and Adolescent Psychiatry
American Academy of Pediatrics
American Psychiatric Association
American Psychological Association
Family Voices
International Society of Psychiatric-Mental Health Nurses
Society for Developmental and Behavioral Pediatrics

Endorsing Organizations

Academy for Eating Disorders
American Academy of Child and Adolescent Psychiatry
American Academy of Pediatrics
American Psychiatric Association
American Psychological Association
American Society of Addiction Medicine
Family Voices
International Society of Psychiatric-Mental Health Nurses
National Association of Pediatric Nurse Associates and Practitioners
National Association of Psychiatric Health Systems
National Association of School Psychologists
National Mental Health Association
Society for Developmental and Behavioral Pediatrics

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness

Intensive Training and Sports Specialization in Young Athletes

ABSTRACT. Children involved in sports should be encouraged to participate in a variety of different activities and develop a wide range of skills. Young athletes who specialize in just one sport may be denied the benefits of varied activity while facing additional physical, physiologic, and psychologic demands from intense training and competition.

This statement reviews the potential risks of high-intensity training and sports specialization in young athletes. Pediatricians who recognize these risks can have a key role in monitoring the health of these young athletes and helping reduce risks associated with high-level sports participation.

There appear to be increasing numbers of children who specialize in a sport at an early age, train year-round for a sport, and/or compete on an "elite" level. Media coverage of national and international competition in sports such as gymnastics, figure skating, swimming, diving, and tennis has focused attention on a number of very talented but very young competitors. The successes of young athletes can serve as a powerful inducement for others to follow. Most Olympic sports have selection processes that attempt to identify future champions and initiate specialized training—often before the prospect finishes elementary school. The lure of a college scholarship or a professional career can also motivate athletes (and their parents) to commit to specialized training regimens at an early age. The low probability of reaching these lofty goals does not appear to discourage many aspirants.

To be competitive at a high level requires training regimens for children that could be considered extreme even for adults. The ever-increasing requirements for success creates a constant pressure for athletes to train longer, harder, more intelligently, and, in some cases, at an earlier age. The unending efforts to outdo predecessors and outperform contemporaries are the nature of competitive sports. The necessary commitment and intensity of training raises concerns about the sensibility and safety of high-level athletics for any young person.

Adverse consequences from intense training and competition have been reported in the lay and medical literature.[1,2] Many pediatricians can cite examples of undesirable outcomes from sports participation involving patients in their own practices. Unfortunately, anecdotal reports and case studies are insufficient grounds for drawing conclusions about the safety of intense training or high-level competition.

The short-term and long-term health consequences of such training in young athletes need to be further investigated. Physical, physiologic, and psychologic tolerances to stress in children have been studied in laboratory settings and can be defined by observing the threshold for injury in clinical settings. Unfortunately, this information is difficult to directly apply to the specific clinical scenarios of concern to the pediatrician. Studying the risks of "specialized," "intensely trained," or "elite" athletes is hampered by the lack of clear definitions of these at-risk populations. Even if a study group could be defined, the level of variation between sports, individuals, and training regimens creates further methodologic challenges for investigators.

Despite recognized inadequacies of current information, pediatricians can still help safeguard their young athletic patients by being aware of potential problems associated with intense training. Because pediatricians serve as the primary medical contact for most young athletes, they may have the best opportunity to recognize, treat, and monitor injuries or illnesses resulting from strenuous training. To respond to parental concerns and to more effectively monitor the child athlete engaged in intensive training, increased awareness of the following issues is suggested.

CARDIAC

Child athletes have superior cardiac functional capacity compared with nonathletes. Nonetheless, there is some cause for caution. Data obtained from studies using animals and humans indicate that myocardial function can be depressed, at least transiently, after intense exercise. Echocardiographic studies have indicated a transient decrease in left ventricular contractility after extremes of athletic competition (ie, 24-hour ultramarathon runs).[3]

A limited number of studies have failed to identify an adverse effect of intense endurance training on the heart of the child athlete. In these investigations, no differences in resting echocardiograms or electrocardiograms have been observed between trained prepubertal runners and nonathletes.[4,5] Rost studied a group of young swimmers longitudinally with echocardiograms over a 10-year period. Cardiac volume and chamber size exceeded those of nonathletic children.[6] The effects of sustained submaximal exercise on cardiac function are similar in children and adults.[7] Evaluation of cardiac function before and immediately after a 4-km road race by echocardio-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

grams in run-trained boys ages 9 to 14 years showed no evidence of change in left ventricular contractility.[8]

Based on these limited data, currently there is no indication that intense athletic training of the child athlete results in injury to the heart. However, closer study of the cardiac characteristics of children training at elite levels is necessary before this conclusion can be verified. Careful assessment of cardiovascular status (heart murmurs, abnormal rhythms) remains important in ongoing medical care of the child athlete.

MUSCULOSKELETAL INJURY AND GROWTH

With low or absent physical activity, muscle tissue becomes atrophic, and bone mineral content decreases. An increase in physical activity stimulates musculoskeletal growth and repetitive stress can stimulate positive adaptive responses in musculoskeletal structures. However, excessive stress or overload can lead to tissue breakdown and injury. To realize maximum gains, athletes must correctly identify and train just below the threshold for injury.

Overuse injuries (tendinitis, apophysitis, stress fractures) can be consequences of excessive sports training in child and adult athletes. Certain aspects of the growing athlete may predispose the child and adolescent to repetitive stress injuries such as traction apophysitis (Osgood-Schlatter disease, Sever disease, medial epicondylitis [Little League elbow]), injuries to developing joint surfaces (osteochondritis dissecans), and/or injuries to the immature spine (spondylolysis, spondylolisthesis, vertebral apophysitis).[9]

Because of the potential for long-term growth disturbances, injuries to epiphyseal growth centers are a particular concern for young athletes. Because the physeal plate may be weaker than surrounding ligamentous structures, external stress may disrupt a growth plate rather than damaging a ligament or related soft-tissue structure. Physeal fractures can result in growth arrest or deformity of long bones. Fortunately, there is no evidence that epiphyseal fractures or growth complications caused by epiphyseal injuries are seen disproportionately in children who participate in organized sports or higher levels of competition.

The long-term effects of repetitive microtrauma to the epiphysis is still under investigation. Damage to the distal radial epiphysis with subsequent alterations in radial-ulnar growth has been described in highly competitive gymnasts.[10] Epiphyseal injuries to the long bones of prepubertal children involved in distance running and other weight-bearing sports (that might potentially affect development of stature) have not been described. Similarly, cross-sectional and longitudinal studies describing growth in child athletes indicate that size and rate of growth of athletes are not negatively influenced by intensive training and competition.[11] Short stature in gymnasts has been considered most likely a consequence of genetic and physique preselection rather than a result of training, although some have concluded that training starting before and maintained throughout puberty can alter growth rates.[12]

NUTRITION

Proper nutrition is critical for both good health and optimal sports performance. For child athletes, an adequate diet is critical because nutritional needs are increased by both training and the growth process. Young athletes and their parents are frequently unaware of the appropriate components of a training diet. The following 4 areas are of particular concern.

Total Caloric Intake

Athletic training creates a need for increased caloric intake, and requirements relative to body size are higher in growing children and adolescents than at any other time in life. In child athletes, the energy intake must be increased beyond the needs of training to maintain adequate growth. Children who engage in sports in which slenderness is considered important for optimizing performance (ie, gymnastics, ballet dancing) may be at risk for compromising their growth. A risk for pathologic eating behaviors also may be increased in children participating in sports where leanness is rewarded.

Balanced Diet

Balance, moderation, and a variety of food choices should be promoted. The Food Guide Pyramid can be used to plan a diet that is balanced and provides sufficient nutrients and calories for both growth and training needs. Athletes who focus on particular dietary constituents (such as carbohydrates) at the expense of a well-rounded diet may potentially compromise their performance as well as their health.

Iron

The body's requirement for iron is greater during the growing years than at any other time in life. Adequate iron stores are important to the athlete to provide adequate oxygen transport (hemoglobin), muscle aerobic metabolism (Krebs' cycle enzymes), and cognitive function. However, athletes often avoid eating red meat and other iron-containing foods. Moreover, sports training itself may increase body iron losses.

Calcium

Inadequate calcium intake is common in athletes, presumably because of their concern about the fat content in dairy foods. Normal bone growth, and possibly, prevention and healing of stress fractures, are contingent on sufficient dietary calcium.

SEXUAL MATURATION

Athletic girls tends to experience menarche at a later age than nonathletic girls, leading to concern that intensive sports training might delay sexual maturation. The average age of menarche in healthy North American girls is 12.3 to 12.8 years, while that of athletes in a wide variety of sports is typically 1 to 2 years later. Undernutrition, training stress, and low levels of body fat have been hypothesized to account for this delay. Alternatively, it is possible that the

later age of menarche in athletes simply reflects a preselection phenomenon.[13] Girls who have narrow hips, slender physiques, long legs, and low levels of body fat—advantageous characteristics in many girls' sports—are more likely to experience later menarche regardless of sports participation.

Secondary amenorrhea, or cessation of menstrual cycles after menarche, can occur as a result of intense athletic training. Prolonged amenorrhea may cause diminished bone mass from the associated decrease in estrogen secretion, augmenting the risk for stress fractures and the potential for osteoporosis in adulthood. Efforts to improve nutrition or diminish training volume in these girls may permit resumption of menses and diminish these risks.

Studies of males have indicated no evidence of an adverse effect on sexual maturation related to sports training. Progression of Tanner stages of pubertal development has not been observed to be retarded in athletic compared with nonathletic adolescents.[11]

PSYCHOSOCIAL DEVELOPMENT

Considerable research has addressed anxiety and stress that affect children who engage in competitive sports but little data exist about the effects of more intense or sustained training on young athletes. Anecdotal reports suggest risks of "burnout" from physical and emotional stress, missed social and educational opportunities, and disruptions of family life. Unrealistic parental expectations and/or exploitation of young athletes for extrinsic gain can contribute to negative psychological consequences for elite young athletes. Survey studies suggest, however, that while such adverse effects occur, they are experienced by only a small minority of intensely training athletes.[13] Most athletes find elite-level competition to be a positive experience.

Research supports the recommendation that child athletes avoid early sports specialization. Those who participate in a variety of sports and specialize only after reaching the age of puberty tend to be more consistent performers, have fewer injuries, and adhere to sports play longer than those who specialize early.[15]

HEAT STRESS

Child athletes differ from adults in their thermoregulatory responses to exercise in the heat.[16] They sweat less, create more heat per body mass, and acclimatize slower to warm environments. As a result, child athletes may be more at risk for heat-related injuries in hot, humid conditions. It is particularly critical that coaches, parents, and young athletes are aware of signs of heat injury. They also should be aware that limiting sports play and training in hot, humid conditions and ensuring adequate fluid intake can prevent heat injury.

RECOMMENDATIONS

Although many concerns surround intense sports competition in children, little scientific information is available to support or refute these risks. Nonetheless, it is important to make efforts to assist young athletes in avoiding potential risks from early excessive training and competition. The following guidelines are suggested keeping in mind 1) the importance of assuring safe and healthy sports play for children, 2) the need to provide practical and realistic guidelines, and 3) the limited research basis for making such recommendations.

1. Children are encouraged to participate in sports at a level consistent with their abilities and interests. Pushing children beyond these limits is discouraged as is specialization in a single sport before adolescence.
2. Pediatricians should work with parents to ensure that the child athlete is being coached by persons who are knowledgeable about proper training techniques, equipment, and the unique physical, physiologic, and emotional characteristics of young competitors.
3. In the absence of prospective markers of excessive physical stress, physicians and coaches should strive for early recognition and prevention and treatment of overuse injuries (tendinitis, apophysitis, stress fractures, "shin splints"). Child athletes should never be encouraged to "work through" such injuries. Treatment recommendations for overuse injuries that include only "rest" or cessation of the sport are unlikely to be followed by the committed child athlete and are unlikely to adequately address the risk of further injury.
4. The conditions of child athletes involved in intense training should be monitored regularly by a pediatrician. Attention should be focused on serial measurements of body composition, weight, and stature; cardiovascular findings; sexual maturation; and evidence of emotional stress. The pediatrician should be alert for signs and symptoms of overtraining, including decline in performance, weight loss, anorexia, and sleep disturbances.
5. The intensely trained, specialized child athlete needs ongoing assessment of nutritional intake, with particular attention to total calories, a balanced diet, and intake of iron and calcium. Serial measurements of body weight are particularly important in ensuring the adequacy of caloric intake and early identification of pathologic eating behaviors.
6. The child athlete, family, and coach should be educated by the pediatrician about the risks of heat injury and strategies for prevention.

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American Academy of Pediatrics
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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Intimate Partner Violence: The Role of the Pediatrician

abstract

The American Academy of Pediatrics and its members recognize the importance of improving the physician's ability to recognize intimate partner violence (IPV) and understand its effects on child health and development and its role in the continuum of family violence. Pediatricians are in a unique position to identify abused caregivers in pediatric settings and to evaluate and treat children raised in homes in which IPV may occur. Children exposed to IPV are at increased risk of being abused and neglected and are more likely to develop adverse health, behavioral, psychological, and social disorders later in life. Identifying IPV, therefore, may be one of the most effective means of preventing child abuse and identifying caregivers and children who may be in need of treatment and/or therapy. Pediatricians should be aware of the profound effects of exposure to IPV on children. *Pediatrics* 2010;125:1094–1100

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KEY WORDS
domestic violence, intimate partner violence, family violence, child abuse, screening

ABBREVIATIONS
IPV—intimate partner violence
AAP—American Academy of Pediatrics

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INTIMATE PARTNER VIOLENCE: DEFINITION AND EPIDEMIOLOGY

The Centers for Disease Control and Prevention defines intimate partner violence (IPV) as a pattern of coercive behaviors that may include repeated battering and injury, psychological abuse, sexual assault, progressive social isolation, deprivation, and intimidation.[1] These behaviors are perpetrated by someone who is or was involved in an intimate relationship with the victim. Traditionally, research has focused on the subset of IPV that is partner violence against women. It has long been recognized, however, that partner violence against men is a substantial concern as well.[2] IPV occurs in heterosexual relationships and although the research is limited, it is also known to occur in lesbian, gay, bisexual, and transgender relationships.[3]

Patterns of dating violence behavior often start early. Adolescents have a particularly high risk of IPV. Approximately 1 in 5 female high school students report being physically and/or sexually abused by a dating partner.[4] A study of college students revealed that nearly half of them had been the victim of emotional, sexual, and/or physical violence by a partner.[5] Females 16 to 24 years of age are more vulnerable to IPV than any other age group.[3] Given the complexities and unique dynamics in the teenaged population, further discussion of IPV in adolescent relationships is beyond the scope of this report. Information on adolescent dating violence is available from the Centers for Disease Control and Prevention.[6]

It is estimated that approximately 1.5 million women and 830 000 men are physically or sexually assaulted by an intimate partner annually in

the United States.[7] Many of these victims are victimized more than once, which raises estimates of event incidence to approximately 4.8 million women and 2.9 million men assaulted annually in the United States. When considering additional and more common forms of IPV, such as emotional and psychological abuse, it is believed that 1 in 3 women worldwide will be abused in her lifetime.[8] In 2004, IPV resulted in 1544 deaths in the United States; 75% of the victims were women.[9]

IPV AND THE CHILD

As children develop and grow in a home in which they are exposed to IPV, they face not only the risk of becoming involved in an abusive act but also the risk of significant psychosocial trauma from exposure to abusive events. Each of these risks will be considered separately.

The Child as a Victim of Abuse

Children can become the victims of IPV-related abuse even before birth. Pregnancy may increase a woman's risk of being abused, and it is estimated that 3% to 19% of pregnant women are the victims of IPV.[10] Abuse during pregnancy has been associated with several poor health outcomes for the infant, including preterm labor,[11] low birth weight,[11] intracranial injury,[12] and neonatal death.[13] Rivara et al[14] reported increased health care utilization and costs for children whose mothers have experienced IPV, even when the violence stops before the infant's birth.

The co-occurrence of child abuse and IPV is well documented, and study results have indicated that in 30% to 60% of families in which either child maltreatment or IPV is occurring, the other form of violence also is being perpetrated.[15] One study revealed that if IPV was occurring in the home during the first 6 months of child-rearing, physical child abuse was 3.4 times more likely, and child psychological abuse or child neglect was twice as likely up to the child's fifth year.[16] In many of the studies that examined the co-occurrence of child abuse and IPV, child maltreatment was preceded by IPV. IPV has been called the leading precursor of child maltreatment. Identifying and intervening on behalf of a caregiver who is experiencing IPV, therefore, may be an effective means of preventing child abuse and neglect.[14]

It is also important to remember that children may become the collateral victims of IPV. A child may become the victim of abuse by simply being held in a caregiver's arms while he or she is battered. Older children may be harmed while mediating a crisis or defending the abused caregiver.[17]

The Child Exposed to Abuse

Exposure in the home to IPV as a child is associated with a multitude of behavioral and mental health consequences. It is estimated that millions of children are exposed to IPV each year,[18] and pediatricians should be aware of the profound effects on children who are exposed to such violence.[19,20] A clinical report from the American Academy of Pediatrics (AAP) provides guidance to the clinician on understanding the behavioral and emotional consequences of child maltreatment, including exposure to IPV.[21]

Perhaps the most compelling data to detail the impairment associated with exposure to IPV has come from the Adverse Childhood Experiences study. The original study assessed the effects of abuse and household dysfunction during childhood on long-term health and quality-of-life outcomes.[22] A subanalysis of these data by Dube et al[23] demonstrated that adults who were exposed to IPV as children were 6 times more likely to be emotionally abused, 4.8 times more likely to be physically abused, and 2.6 times more likely to be sexually abused than children who were not exposed to IPV. The behavioral effects of exposure to IPV can be long-reaching, and the medical effects can be profound. Exposure to IPV, along with other adverse childhood experiences, has been shown to be associated significantly with many risk factors for the leading causes of death in adulthood, including smoking, severe obesity, physical inactivity, depression, and suicide attempts.[24]

Children of abused caregivers demonstrate significantly more internalizing behaviors, including anxiety, depression, withdrawal, and somatic complaints, as well as externalizing behaviors, including attention problems, aggressive behavior, and rule-breaking actions, than do children of nonabused caregivers.[24,25] These children frequently have social functioning difficulties and trouble establishing and maintaining relationships with their peers. They may be more likely to be aggressive with peers and demonstrate cruelty, bullying, and meanness to others.[26] Academic performance may be poor. As adolescents, they may adopt the same dynamic of violence in their own dating or peer relationships. Stress and anxiety can persist long after the trauma of IPV exposure, and many children exhibit symptoms consistent with posttraumatic stress disorder. Ultimately, some of these children become abusers themselves.[27]

Given the significant overlap between IPV and child maltreatment, practitioners may wonder when a report to child protective services is appropriate. Individual states have differing requirements for reporting concerns of children exposed to IPV on the basis of age of the child, relationship of the child to the perpetrator of the violence, and physical proximity of the child to

the violent act. When a report is mandated, the practitioner should inform the caregiver of the practitioner's responsibility to report. In many situations, it is helpful for the caregiver to file a report as well; doing so may lessen later accusations of "failure to protect." When making this decision, as every decision relevant to IPV situations, the safety needs of both the caregiver and the child should be taken into consideration. The Family Violence Prevention Fund offers recommendations for pediatricians in states without specific reporting requirements for children exposed to IPV.[28] These requirements include an inquiry about direct injury to the child, an assessment of potential for danger (threats, weapons, substance abuse), an assessment of the caregiver's ability to plan for the child's safety, and an assessment of support and connections to community resources.

ASSESSMENT FOR IPV

It is clear that IPV is a pediatric issue. Plans for identification and resources to incorporate into a response are important considerations for the pediatrician.

Whom to Ask?

Assessment for IPV may be approached in a universal or "case-finding" manner. There is insufficient evidence at this time to support one approach over another. Some experts advocate a case-finding approach to IPV detection. Using this approach, only caregivers with specific signs, symptoms, or risk indicators for abuse are asked about exposure to IPV. Pediatricians need to be aware that most abused caregivers will seek care for their children but not for themselves, which makes the pediatric setting an ideal place to be alert to the presence of IPV.[29] Although a caregiver may present with overt signs of injury, such as facial bruising, it is much more likely that the signs of abuse will be subtle—depression, anxiety, failure to keep medical appointments, reluctance to answer questions about discipline in the home, or frequent office visits for complaints not borne out by the medical evaluation of the child. In fact, most of the time, indicators of abuse are absent altogether.

Because of this situation, some experts advocate "universal screening"—asking all caregivers about IPV regardless of clinical indicators. Assessing for IPV at every patient encounter in the pediatric setting has been demonstrated to significantly increase the number of victims who are identified.[30,31] It remains unknown whether there are potential benefits and risks of conducting assessments on a universal basis. The US Preventive Services Task Force found that, although screening increases identification of abuse, there is insufficient evidence to recommend for or against universal IPV assessments because no evidence exists that universal IPV assessments reduce morbidity or mortality of the abused caregiver.[32] Future research is necessary to explore effective interventions for IPV and to determine potential harms and benefits of universal IPV assessments. While these studies are being performed, it seems reasonable to incorporate early and repeated questioning regarding IPV as part of anticipatory guidance while remaining mindful of clinical presentations that suggest risk.

How to Ask?

Approaching the subject of IPV may be uncomfortable for both the pediatrician and the caregiver. Many studies have examined the barriers that pediatricians and caregivers face during an assessment for IPV. Common barriers that pediatricians experience include limited time, lack of education/experience with IPV, absence of resources to assist caregivers who have experienced IPV, and a fear of offending or angering the caregiver.[33] Caregivers may have attitudes and beliefs that make them reluctant to disclose IPV, including shame, fear that disclosure will escalate the abuse, or a desire to protect the abuser.[34] Other barriers that inhibit disclosure include the fear that a disclosure will result in a report to child protective services, a perceived lack of provider empathy, or the concern that a child's health care needs are the priority over those of the caregiver.[35] Intrinsic characteristics of the provider/caregiver dynamic, including race and gender, may negatively influence a caregiver's comfort level when being assessed for IPV.[36] Pediatricians should be aware of these barriers and how they may influence the process of conducting IPV assessments.

Two primary approaches to conducting assessments for IPV have been identified: verbally administered assessments and self-administered assessments, including written, computerized, and tape-recorded surveys.[37] Most literature suggests that verbally administered assessments (face-to-face interviews) are associated not only with lower detection rates[38–40] but also, as some have reported, less patient comfort.[41] Studies that directly compared verbal and self-administered assessments revealed that women significantly preferred self-administered assessments.[42,43] Not only are self-administered assessments preferred, but they may overcome many of the barriers described previously. It is imperative that verbal follow-up is provided if a patient discloses abuse on a self-administered assessment. It is likely that there is not a "1-size-fits-all" screening method. The type of assessment used will depend on many factors, such as type of clinical environment, resources avail-

able, and acceptability to practitioners and parents/caregivers. Several simple screening tools exist, many of which have been well validated and can be incorporated easily into a pediatric setting.[44–46]

If IPV is detected, or if the pediatrician has concerns that IPV may be occurring in the home, further questioning is warranted. The pediatrician should explore the topic with the caregiver in a sympathetic and sensitive manner. The interview should be conducted in a private setting away from all children, family, friends, and the suspected abuser. It is important to remember that even very young children may be affected by the discussion of IPV. The pediatrician should gently introduce the topic in a way that assures the caregiver that the conversation is confidential (if allowed by law), the problem is acknowledged, other resources for help are accessible, and his or her wishes about further disclosure or referral will be respected. These introductory statements can be developed and reviewed in advance for appropriateness with local violence advocacy groups. The Appendix provides nonjudgmental introductory statements that may be helpful in focusing the topic and setting the caregiver at ease.

It is appropriate to document all IPV assessments, although health care professionals must be aware that an abuser may have access to the child's and/or caregiver's health records. A generic statement indicating that an IPV assessment has taken place and resources have been offered per practice protocol provides documentation that inquiry has occurred but does not specify whether a caregiver has disclosed abuse or not.

REFERRALS/SAFETY PLANS

The Family Violence Prevention Fund has published a pediatric guideline for managing situations of IPV.[28] A free training video is available on its Web site (http://fvpfstore.stores.yahoo.net/screentoenda.html). Ideally, a protocol or action plan that has been developed with the input of local shelters, rape crisis centers, and victim advocacy groups should exist. Because of time constraints in a busy office practice or acute care setting, an interdisciplinary approach to IPV is most appropriate. The American Medical Association recognizes that optimal care for the caregiver in an abusive relationship depends on the physician's working knowledge of community resources that can provide safety, advocacy, and support.[47] Pediatricians are encouraged to partner with obstetricians, prenatal clinic nurses and social workers, hospital nurses and social workers, public health administrators, and early childhood education programs to coordinate a community response to the issue of IPV. The American Medical Association and many state medical associations provide directories of agencies that provide services or information about all forms of family violence. A national toll-free hotline (800-799-SAFE) is available to anyone who needs information about local resources on IPV. Additional resources may be accessed at the Family Violence Prevention Fund's Web site (www.endabuse.org/health). The AAP also provides resources to pediatricians on dating violence through the Connected Kids program (www.aap.org/connectedkids).

Pediatricians must understand the dynamics of abusive relationships. Zink et al[48] have suggested that physicians understand the transtheoretical model, known as "stages of change," to help patients with behavior changes and more effectively address the issue of IPV. It has been suggested that the risk of injury and/or death increases at the time a caregiver discloses abuse and attempts to leave his or her abusive partner. Thus, the process of disclosure is naturally very frightening and may not occur unless the caregiver feels that he or she is not in significant jeopardy. Unlike the situation with child maltreatment, there are no mandated state agencies that step in and act to ensure a caregiver's safety during this process. Few states have passed laws that mandate reporting of suspected IPV for individuals being treated by the health care professional, and few states have laws requiring health care professionals to report IPV if it is suspected or discovered during an evaluation of the child. Knowledge of existing state laws for reporting partner violence is essential.* A compilation of these laws is available for public access.[32] In addition, pediatricians should be aware of their state laws regarding the reporting of children exposed to IPV and how it may influence their practice of inquiry for IPV. An updated database of these laws is available through the Child Welfare Information Gateway.[49]

It is important to use discretion when providing printed information about partner violence to patients or their caregivers. If the information is discovered by the abuser, the victim may be at increased risk of violence. If the caregiver feels safe, information about legal and crisis counseling and shelters can be provided in written form. Written plans may be completed by the caregiver to facilitate ongoing safety, and many templates are available for use.[50,51] Because of the strong association between homicide in the home and the presence of both guns and partner violence, it could be life-saving to help an abused caregiver to recognize the value in removing firearms from the home, if it can be accom-

*For additional information and assistance with state laws and related advocacy issues, please contact the AAP Division of State Government Affairs.

plished safely. The possible role of substance abuse contributing to IPV should be considered. Pediatricians also need to be sensitive to ethnic and cultural attitudes about violence specifically toward women, not because such attitudes are acceptable but because they may have a profound influence on the willingness of women to discuss this problem.

Pediatricians can provide education to agencies that deal with IPV about the risk of maltreatment to children whose caregivers are abused. Every reasonable effort should be made to assess risk of harm and lethality in the home and to protect children from a potentially dangerous environment. Counseling should be secured for children who have been exposed to IPV. Such treatment may be provided in groups or individually, but the focus should be on understanding violence and how to avoid it.

CONCLUSIONS

The evidence is overwhelming that children who are exposed to IPV are at risk of child maltreatment and both short-term and long-term medical, behavioral, and mental health problems. The Institute of Medicine recommends several core competencies on family violence for health care professionals.[52] These core competencies include training on the identification, assessment, and documentation of abuse; knowledge of interventions to ensure victim safety; recognition of culture and values as factors that affect IPV; understanding of applicable legal responsibilities; and violence prevention. Pediatricians who possess knowledge and skills in these areas will be in a position to intervene when IPV is present and provide more effective health care to children and their families.

GUIDANCE FOR THE CLINICIAN

1. Residency training programs and continuing medical education program leaders are encouraged to incorporate education on IPV and its implications for child health into the curricula of pediatricians and pediatric subspecialists.
2. Pediatricians should remain alert to the signs and symptoms of exposure to IPV in caregivers and children and should consider attempts to identify evidence of IPV either by targeted screening of high-risk families or universal screening.
3. When caregivers are asked about IPV, it is ideal to have a plan in place to respond to affirmative screens.
4. Pediatricians are encouraged to intervene in a sensitive and skillful manner and attempt to maximize the safety of caretakers and child victims.
5. Pediatricians should be cognizant of applicable IPV laws in their state, particularly as they relate to reporting abuse or concerns of children exposed to IPV.
6. Pediatricians are encouraged to support local and national multidisciplinary efforts to recognize, treat, and prevent IPV.

APPENDIX: SUGGESTED STATEMENTS TO INTRODUCE THE TOPIC OF IPV

"We all have disagreements at home. What happens when you and your partner disagree?"

"Is there shouting, pushing, or shoving? Does anyone get hurt?"

"Has your partner ever threatened to hurt you or your children?"

"Do you ever feel afraid of your partner?"

"Has anyone forced you to have sex in the last few years?"

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AMERICAN ACADEMY OF PEDIATRICS

Thomas J. Martin, MD, and the Committee on Sports Medicine and Fitness

Technical Report: Knee Brace Use in the Young Athlete

ABSTRACT. This statement is a revision of a previous statement on prophylactic knee bracing and provides information for pediatricians regarding the use of various types of knee braces, indications for the use of knee braces, and the background knowledge necessary to prescribe the use of knee braces for children.

BACKGROUND

Pediatricians are appropriately becoming more involved in the care of young athletes. The knee is one of the most commonly injured joints in athletes. The correct care of knee injuries is an important part of any sports medicine or general pediatrics practice and may include the use of braces. Therefore, the pediatrician should be knowledgeable about knee bracing. This statement is an update of a previous statement on prophylactic knee bracing[1] and includes information for pediatricians regarding the use of various types of knee braces, indications for the use of knee braces, and the background knowledge necessary to prescribe the use of knee braces for children.

Acute and overuse injuries to the knee are seen as a result of participation in virtually all athletic activities. Injuries to the ligamentous structures of the knee in the young athlete are becoming more common. The medial collateral and anterior cruciate ligaments are prime stabilizers of the knee and can be injured when direct or indirect forces are applied to the knee. In a growing child, the distal femoral physis is subject to these same forces and may also be injured. In the skeletally immature child, acute trauma to the knee is most likely to cause injury to these 2 ligaments and/or to the distal femoral physis. Patella subluxation, dislocation, or tracking abnormalities can occur as a result of mechanical predisposition as well as direct or indirect stress to the knee. Cumulative microtrauma or overuse can lead to patellofemoral disorders or apophysitis of the tibial tuberosity (Osgood-Schlatter disease), which are common in adolescents.

TYPES OF KNEE BRACES

Various types of braces have been designed to provide symptomatic relief and diminish the effects of injury to the knee. The 4 categories of knee braces are knee sleeves, prophylactic knee braces, functional knee braces, and postoperative or rehabilitative knee braces (Table 1).[2,3] Although patients often report benefits from wearing braces,[4,5] these benefits have not been verified by scientific investigation.[2,4]

The ideal knee brace in any of the 4 categories would produce a synergism with the inherent knee stabilizers, both muscular and ligamentous, throughout the normal range of motion. It would increase resistance to injury from valgus, varus, rotational, or anterior-posterior translation forces. The ideal brace would not interfere with normal knee function or increase the risk of injury to other parts of the lower extremity or to other players.

Knee Sleeves

Knee sleeves are expandable, slip-on devices usually made of neoprene with a nylon cover. They increase warmth, provide even compression, and may enhance proprioception.[6] Knee sleeves may provide a feeling of support to the knee. Plain knee sleeves may be used to treat postoperative knee effusions[6] and patellofemoral syndrome.[6] Used in this capacity, the purpose of a knee sleeve is to decrease knee pain.[7,8] When a knee pad is added, it provides protective cushioning to the patella and anterior knee.

The knee sleeve may be modified to include an opening for the patella, 1 or more movable straps, or a buttress. The buttress may be circular, C-shaped, J-shaped, or H-shaped. With these modifications, the knee sleeve is often referred to as an extensor mechanism counterforce brace and is used to treat patellofemoral joint disorders, including patella subluxation, patella dislocation, and patellofemoral syndrome, all of which are very common in athletes.[9] The pathophysiology of patellofemoral syndrome is unclear,[10] but it has been postulated to occur as a result of abnormal tracking of the patella on the femoral trochlear groove.[2,6] The knee sleeve helps compress the tissue and limits patella movement.[6] The extensor mechanism braces are designed to apply a medially directed force to the lateral patella, thereby improving patellofemoral tracking and decreasing the likelihood of lateral patella subluxation or dislocation. Used in this capacity, they may be of benefit in the athlete with an unstable patella.[11] These braces may also contain a lateral hinge that incorporates an extension stop.[2,5,7]

When a strap is placed inferior to the patella, it may be used to treat Osgood-Schlatter disease and patellar tendonitis.[6] This infrapatellar band is used to decrease the traction forces at the tibia tuberosity for patients with Osgood-Schlatter disease and on the patellar tendon for patients with patellar tendonitis.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Table 1. Knee Braces and Indications for Use in the Young Athlete*

Brace Category	Indication	Comments
Knee Sleeves†		
 Plain sleeve	Postoperative knee effusions; patellofemoral syndrome	Insufficient for treatment of an unstable knee. Should only be worn during sports activities if swelling occurs. Simple to fit and inexpensive.
 Sleeve with knee pad	Protection and padding of the anterior knee	
 Sleeve with buttress	Patella subluxation, patella dislocation; patellofemoral syndrome	Improves patellofemoral tracking.
 Sleeve with strap	Osgood-Schlatter disease; patella tendonitis	Decreases traction forces on the tibia tuberosity and patella tendon.
Knee Braces		
 Prophylactic brace	Protect medial collateral ligament and anterior cruciate ligament, especially in contact sports	Insufficient evidence to use in the young athlete.
 Functional brace†	Tears of anterior cruciate, posterior cruciate, medial collateral, and lateral collateral ligaments	Intended to prevent reinjury. Not to be used prophylactically.
 Postoperative or rehabilitative brace†	Nonsurgical injury to and after surgical repair of anterior cruciate, posterior cruciate, medial collateral, lateral collateral ligaments, medial and lateral meniscus; or nondisplaced epiphyseal fracture	Can be adjusted for swelling, removed for examinations or icing, and adjusted to allow movement in a controlled range.

*Knee brace images reprinted with permission from djOrthopedics, LLC.
†The use of knee sleeves and functional and postoperative or rehabilitative braces has been accepted clinically on the basis of subjective experience and has not been supported by scientific evidence.

It is important to remember that knee sleeves do not provide ligamentous support and, therefore, are insufficient for the treatment of an unstable knee.[11] Knee sleeves can cause swelling by retaining heat around the knee or by obstructing venous and lymphatic return below the sleeve. They should only be worn during sports activities if these complications occur.[11] The use of these sleeves should be combined with quadriceps and hamstring flexibility, stretching, and strengthening exercises as well as correction of biomechanical dysfunction of the hip, ankle, or foot and improved sports technique.[6,7,9] Scientific evidence of benefits of the knee sleeve is lacking[3,10,12–14]; however, patients report benefits that exceed objective effects noticed by researchers.[2–4] Knee sleeves are relatively simple to fit and inexpensive.[6]

Prophylactic Knee Braces

Prophylactic knee braces[15–17] are braces with unilateral or bilateral bars, hinges, and adhesive straps. The deformable metal of these braces can absorb some of the impact and decrease the force applied to the medial collateral ligament by 10% to 30%.

Prophylactic knee braces are intended to protect (prevent or reduce the severity of injury to) the medial collateral ligament from valgus stress applied to the lateral aspects of the extended weight-bearing leg during contact sports. Some studies indicate they may also protect the anterior cruciate ligament from rotational stress in the same situation. In football, offensive linemen, defensive linemen, linebackers, and tight ends most commonly wear lateral knee stabilizers. Despite anecdotal reports of success, scientific studies have not universally shown that prophylactic knee braces significantly reduce knee injuries.[15–18] Thus, there is insufficient evidence to recommend prophylactic knee bracing in the young athlete.[1–3,7,15–18]

Functional Braces

Functional braces are generally made from a metallic plastic composite with medial and lateral vertical hinges and a variable stop to limit hyperextension. There are 2 types of functional braces: the hinge-postshell and hinge-poststrap models. The rigid shell or straps and hinges provide resistance to deformation. Hinges may be polyaxial to mimic the changing center of motion of the flexing knee. The hinge-postshell model theoretically provides improved tibial displacement control, greater rigidity, enhanced durability, and better soft tissue contact.[7] The upright of a functional brace should be the maximum length comfortable to the athlete.[7,19]

A functional brace is designed to enhance the stability of an unstable knee (usually after an anterior cruciate ligament injury with or without other injuries to the menisci, collateral ligaments, or bone contusion) when rotational and anteroposterior forces are applied. They may be used for 6 to 12 months after anterior cruciate ligament reconstruction[19] to reduce the strain on an anterior cruciate ligament graft.[7,20,21] They are intended to reduce the risk of future injuries without significantly impairing function.

Functional braces are most commonly used by the skeletally immature athlete with an anterior cruciate-deficient knee (awaiting skeletal maturation), the anterior cruciate-deficient athlete who is awaiting surgical reconstruction, and the anterior cruciate-deficient athlete who is not a surgical candidate. This type of brace may also be used during the healing phase of a medial or lateral collateral ligament injury or as a supplement to surgery[21] and rehabilitation to prevent reinjury. Functional anterior cruciate ligament braces may prevent hyperextension; however, their control of rotational forces is less efficient,[2,11,21] so the unstable knee is still at risk of subluxation or shifting, which may lead to meniscal or chondral injury.

There is a lack of scientific evidence that these braces are helpful at the level required for athletic participation.[2,7,19,22–25] However, patients report a positive subjective response, claiming an increase in knee stability, pain attenuation, performance enhancement, and confidence during athletics with brace use.[2,7,22–24] There is probably no difference in effectiveness between off-the-shelf models and custom-made braces.[9,18,23,26] Brace wearers have higher energy expenditures than do nonwearers.[22] Current experimental evidence suggests that functional knee braces do not significantly affect performance.[27]

Lower extremity muscle strengthening, flexibility, and ultimately, improvement and refinement of athletic techniques are more important than functional bracing in treating ligamentous knee injuries.[7,20] Functional braces will never substitute for proper rehabilitation and surgical procedures when necessary.[9]

Postoperative or Rehabilitative Braces

The postoperative or rehabilitative knee brace consists of foam liners that surround the calf, thigh, and knee; full-length medial and lateral rigid bars with hinges at the knee that can be adjusted to allow a controlled range of motion; and 6 to 8 nonelastic straps that hold the brace in place. These braces are prefabricated (off-the-shelf) and adjustable in size.

The postoperative or rehabilitative brace can be used to protect injured ligaments and control knee flexion and extension angles during the initial healing period[2] as part of the treatment program for an injured anterior cruciate ligament, posterior cruciate ligament, medial collateral ligament, lateral collateral ligament, or medial or lateral meniscus. These are most often used during crutch-assisted ambulation immediately after meniscal and/or cruciate ligament injury or surgery. They are used for a short period of time (2–8 weeks) after the acute injury or surgery. The value of a rehabilitative brace as opposed to a cast or splint includes the ability to adjust the brace for swelling, the ability to remove the brace for serial examinations or icing, and the ability to allow for movement in a controlled range of motion.

Pediatricians may order a postoperative brace for the treatment of nonsurgical ligamentous injuries or nondisplaced epiphyseal fractures. There are very little data on the clinical performance of rehabilita-

tive braces.[2,20,28–30] They are accepted clinically on the basis of their subjective performance.

PRESCRIBING KNEE BRACES

Prescribing any knee brace requires an accurate diagnosis of the injury, an appreciation and knowledge of the benefits and limitations of a brace, and an understanding of the physical demands and risks of the given sport. Knee sleeves with or without straps and buttresses can be prescribed for problems with patellar instability, patellofemoral pain, patellar tendonitis, or Osgood-Schlatter disease. Because prophylactic knee braces have not been proven to be cost-effective, pediatricians should not prescribe them. Functional braces may help prevent further injuries to a previously injured knee and may help protect a surgically repaired knee. Functional braces are not recommended for prophylaxis. Postoperative or rehabilitative braces are generally used for acute knee ligament or growth plate injuries or after surgical repair of an anterior cruciate ligament or meniscus.

Even when use of a knee brace is indicated, the brace alone is not sufficient to treat or protect the injured knee. The brace is only 1 component of injury rehabilitation, along with therapeutic exercises, such as flexibility, joint mobilization, strengthening, and proprioceptive retraining.

Brace designs will continue to evolve with lighter and stronger materials, more physiologic and durable hinges, and attachment systems that do not excessively compress the musculature or irritate the skin. Better ability to test the effectiveness of these braces will be rewarding.

SUMMARY

When prescribing the use of knee braces, pediatricians should establish an accurate diagnosis of the injury, consider the spectrum of treatment options, and understand the classifications, benefits, limitations, indications, and cost of any brace prescribed.

There is insufficient scientific evidence to recommend the use of prophylactic knee braces for the pediatric athlete, and available studies do not support the prescribing of most knee braces. However, the use of knee sleeves, functional braces, and postoperative braces has been accepted clinically on the basis of subjective performance. If used, knee braces should complement, rather than replace, rehabilitative therapy and required surgery.

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ERRATUM

In "Counseling Families Who Choose Complementary and Alternative Medicine for Their Child With Chronic Illness or Disability" by the AAP Committee on Children With Disabilities, Virginia Randall, MD, was omitted from the list of consultants due to an oversight. The statement was published in the March 2001 issue of *Pediatrics*. (*Pediatrics.* 2001;107(3):598–601.)

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CLINICAL REPORT

Lactose Intolerance in Infants, Children, and Adolescents

Guidance for the Clinician in Rendering Pediatric Care

Melvin B. Heyman, MD, MPH, for the Committee on Nutrition

ABSTRACT

The American Academy of Pediatrics Committee on Nutrition presents an updated review of lactose intolerance in infants, children, and adolescents. Differences between primary, secondary, congenital, and developmental lactase deficiency that may result in lactose intolerance are discussed. Children with suspected lactose intolerance can be assessed clinically by dietary lactose elimination or by tests including noninvasive hydrogen breath testing or invasive intestinal biopsy determination of lactase (and other disaccharidase) concentrations. Treatment consists of use of lactase-treated dairy products or oral lactase supplementation, limitation of lactose-containing foods, or dairy elimination. The American Academy of Pediatrics supports use of dairy foods as an important source of calcium for bone mineral health and of other nutrients that facilitate growth in children and adolescents. If dairy products are eliminated, other dietary sources of calcium or calcium supplements need to be provided.

INTRODUCTION

SIGNIFICANT CHANGES IN our knowledge and approach toward lactose intolerance have occurred over the past quarter century, since the first statement on lactose intolerance was published by the American Academy of Pediatrics Committee on Nutrition.[1] Lactose ingestion in certain susceptible individuals can cause abdominal symptoms that are variable and can be treated with dietary restriction or enzyme replacement, depending on the amount of lactose consumed and the degree of lactase deficiency. Pediatricians and other pediatric care providers should maintain awareness of the benefits and controversies related to the consumption of dietary milk products and milk-based infant formula. The lactose content of milk often influences, correctly or not, the ultimate decision about the use or continuation of milk in the diet. Milk and dairy-product avoidance has a negative effect on calcium and vitamin D intake in infants, children, and adolescents. Other nutrients such as protein make dairy products an important source of nutrition for growing children. This revised statement will update the initial statement of 1978 while incorporating changes from the 1990 supplement[2] and current state-of-the-art relating to lactose intolerance. Recommendations regarding dietary calcium have been updated recently.[3]

Lactose, a disaccharide that comprises the monosaccharides glucose and galactose, is the primary carbohydrate found exclusively in mammalian milk. Absorption of lactose requires lactase activity in the small intestinal brush border to split the bond linking the 2 monosaccharides. A β-galactosidase termed "lactase-phlorizin hydrolase" (lactase) accounts for most of the lactase activity in the intestinal

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abdominal pain, breath tests, calcium, dietary, dairy products, diarrhea, flatulence, lactase, malabsorption, pediatric

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mucosa.[4] Lactase is found in the small intestine and localized to the tips of the villi, a factor of clinical importance when considering the effect of diarrheal illness on the ability to tolerate milk.

Milk intolerance may be attributed to either the lactose or the protein content. Lactose intolerance can occur among infants and young children with acute diarrheal disease, although the clinical significance of this is limited except in more severely affected children. Symptoms of lactose intolerance are relatively common among older children and adolescents; however, associated intestinal injury is infrequently seen. Lactose intolerance is a distinct entity from cow milk–protein sensitivity, which involves the immune system and causes varying degrees of injury to the intestinal mucosal surface. Cow milk–protein intolerance is reported in 2% to 5% of infants within the first 1 to 3 months of life, typically resolves by 1 year of age, and is not the subject of this statement.[5,6]

DEFINITIONS

Following are definitions of terms used in the remainder of this statement:

- Lactose intolerance is a clinical syndrome of 1 or more of the following: abdominal pain, diarrhea, nausea, flatulence, and/or bloating after the ingestion of lactose or lactose-containing food substances. The amount of lactose that will cause symptoms varies from individual to individual, depending on the amount of lactose consumed, the degree of lactase deficiency, and the form of food substance in which the lactose is ingested.
- Lactose malabsorption is the physiologic problem that manifests as lactose intolerance and is attributable to an imbalance between the amount of ingested lactose and the capacity for lactase to hydrolyze the disaccharide.
- Primary lactase deficiency is attributable to relative or absolute absence of lactase that develops in childhood at various ages in different racial groups and is the most common cause of lactose malabsorption and lactose intolerance. Primary lactase deficiency is also referred to as adult-type hypolactasia, lactase nonpersistence, or hereditary lactase deficiency.
- Secondary lactase deficiency is lactase deficiency that results from small bowel injury, such as acute gastroenteritis, persistent diarrhea, small bowel overgrowth, cancer chemotherapy, or other causes of injury to the small intestinal mucosa, and can present at any age but is more common in infancy.
- Congenital lactase deficiency is extremely rare; teleologically, infants with congenital lactase deficiency would not be expected to survive before the 20th century, when no readily accessible and nutritionally adequate lactose-free human milk substitute was available.
- Developmental lactase deficiency is now defined as the relative lactase deficiency observed among preterm infants of less than 34 weeks' gestation.

Primary Lactase Deficiency

Approximately 70% of the world's population has primary lactase deficiency.[7,8] The percentage varies according to ethnicity and is related to the use of dairy products in the diet, resulting in genetic selection of individuals with the ability to digest lactose (Table 1). In populations with a predominance of dairy foods in the diet, particularly northern European people, as few as 2% of the population has primary lactase deficiency. In contrast, the prevalence of primary lactase deficiency is 50% to 80% in Hispanic people, 60% to 80% in black and Ashkenazi Jewish people, and almost 100% in Asian and American Indian people.[9–11] The age of onset and its prevalence differ among various populations. Approximately 20% of Hispanic, Asian, and black children younger than 5 years of age have evidence of lactase deficiency and lactose malabsorption,[12] whereas white children typically do not develop symptoms of lactose intolerance until after 4 or 5 years of age. Recent molecular studies of lactase-phlorizin hydrolase (lactase) have correlated the genetic polymorphism of messenger RNA expression with persistence of lactase activity, demonstrating early loss (at 1–2 years of age) of messenger RNA expression and enzyme activity in Thai children and late (10–20 years of age) loss of activity in Finnish children.[11,13] The clinical relevance of these observations is that children with clinical signs of lactose intolerance at an earlier age than is typical for a specific ethnic group may warrant an evaluation for an underlying cause, because primary lactase deficiency would otherwise be unusual at such a young age. Although primary lactase deficiency may present with a relatively acute onset of milk intolerance, its onset typically is subtle and progressive over many years. Most lactase-

TABLE 1 **Prevalence of Acquired Primary Lactase Deficiency[69]**

Examples of groups among whom lactase deficiency predominates (60%–100% lactase deficient)
Near East and Mediterranean: Arabs, Ashkenazi Jews, Greek Cypriots, Southern Italians
Asia: Thais, Indonesians, Chinese, Koreans
Africa: South Nigerians, Hausa, Bantu
North and South America: black Americans, Latinas, Eskimos, Canadian and American Indians, Chami Indians
Examples of groups among whom lactase persistence predominates (2%–30% lactase deficient)
Northern Europeans
Africa: Hima, Tussi, Nomadic Fulani
India: individuals from Punjab and New Delhi

deficient individuals experience onset of symptoms in late adolescence and adulthood.

Reports that focus on clinical symptoms of lactase deficiency are prone to subjectivity, confounding clinical diagnosis. For instance, when lactase-deficient adults were given 2 glasses of milk or 2 glasses of lactose-hydrolyzed milk per day in a double-blind, crossover study, no statistical differences in symptoms of lactose intolerance were found regardless of whether the individual described himself or herself as lactose intolerant.[14] Even lactose-intolerant adults may find that 1 glass of milk or a scoop of ice cream is tolerated, whereas an additional glass of milk or other milk product may produce symptoms. Because of the variation of dairy intake in each individual's diet and in the amount of lactose contained in different products, symptoms may vary and be modified by diet and by milk-containing foods (see "Management"). For these reasons, dietary history is an unreliable means to confirm or exclude the diagnosis of lactose intolerance.

Secondary Lactase Deficiency

Secondary lactase deficiency implies that an underlying pathophysiologic condition is responsible for the lactase deficiency and subsequent lactose malabsorption. Etiologies include acute infection (eg, rotavirus) causing small intestinal injury with loss of the lactase-containing epithelial cells from the tips of the villi. The immature epithelial cells that replace these are often lactase deficient, leading to secondary lactose deficiency and lactose malabsorption, although several reports indicate that lactose malabsorption in most children with acute gastroenteritis is not clinically important.[15] Several recent studies and a meta-analysis found that children with rotaviral (and other infectious) diarrheal illnesses who have no or only mild dehydration can safely continue human milk or standard (lactose-containing) formula without any significant effect on outcome, including hydration status, nutritional status, duration of illness, or success of therapy.[16–18] However, in the at-risk infant (eg, younger than 3 months or malnourished) who develops infectious diarrhea, lactose intolerance may be a significant factor that will influence the evolution of the illness. Giardiasis, cryptosporidiosis, and other parasites that infect the proximal small intestine often lead to lactose malabsorption from direct injury to the epithelial cells by the parasite. Secondary lactase deficiency with clinical signs of lactose intolerance can be seen in celiac disease, Crohn disease, and immune-related and other enteropathies and should be considered in these children. Diagnostic evaluation should be directed toward these entities when secondary lactase deficiency is suspected and an infectious etiology is not found.

Young infants with severe malnutrition develop small intestinal atrophy that also leads to secondary lactase deficiency.[19] Although uncommon in the United States, malnutrition is associated with lactose malabsorption and carbohydrate intolerance in developing countries.[20] Lactose malabsorption has also been associated with poor growth in these countries.[21] Most infants and children with malabsorption attributable to malnutrition are able to continue to tolerate dietary carbohydrates, including lactose.[22] However, the World Health Organization recommends avoidance of lactose-containing milks in children with persistent postinfectious diarrhea (diarrhea lasting more than 14 days) when they fail a dietary trial of milk or yogurt.[23]

Treatment of secondary lactase deficiency and lactose malabsorption attributable to an underlying condition generally does not require elimination of lactose from the diet but, rather, treatment of the underlying condition. Once the primary problem is resolved, lactose-containing products can often be consumed normally, and these excellent sources of calcium and other nutrients need not be unnecessarily excluded from the diet.

Developmental (Neonatal) Lactase Deficiency

In the immature gastrointestinal tract, lactase and other disaccharidases are deficient until at least 34 weeks' gestation.[24] One study in preterm infants reported benefit from use of lactase-supplemented feedings or lactose-reduced formulas,[25] and the use of lactose-containing formulas and human milk does not seem to have any short- or long-term deleterious effects in preterm infants.[26] Up to 20% of the dietary lactose may reach the colon in neonates and young infants. Bacterial metabolism of colonic lactose lowers the fecal pH (5.0–5.5 is normal), which has a beneficial effect, favoring certain organisms (eg, *Bifidobacterium* and *Lactobacillus* species) in lieu of potential pathogens (*Proteus* species, *Escherichia coli*, and *Klebsiella* species) in young infants. Antimicrobial agents may also affect this colonization.

Congenital Lactase Deficiency

Congenital lactase deficiency is a rare disorder that has been reported in only a few infants.[27,28] Affected newborn infants present with intractable diarrhea as soon as human milk or lactose-containing formula is introduced. Small intestinal biopsies reveal normal histologic characteristics but low or completely absent lactase concentrations.[29,30] Unless this is recognized and treated quickly, the condition is life-threatening because of dehydration and electrolyte losses. Treatment is simply removal and substitution of lactose from the diet with a commercial lactose-free formula.

DIAGNOSIS

Symptoms of lactose intolerance, including abdominal distention, flatulence, abdominal cramping, and (ultimately) diarrhea, are independent of the cause of lactose malabsorption and are directly related to the quantity of ingested lactose. These symptoms are not necessarily

correlated with the degree of intestinal lactase deficiency. Malabsorbed lactose generates an osmotic load that draws fluid and electrolytes into the intestinal lumen, leading to loose stool. The onset of diarrhea and other symptoms is related to the amount of lactose that is not absorbed. As little as 12 g of lactose (the amount of lactose in an 8-oz glass of milk) may be sufficient to cause symptoms in children with chronic abdominal pain.[31] In addition, unabsorbed lactose is a substrate for intestinal bacteria, especially in the colon. Bacteria metabolize lactose, producing volatile fatty acids and gases (methane, carbon dioxide, and hydrogen), leading to flatulence. The fatty acids lower the fecal pH, making the fecal pH test a nonspecific but sometimes helpful marker for lactose (or other carbohydrate) malabsorption. When sufficient intestinal gas is produced by the bacterial metabolic processes to cause stimulation of the intestinal nervous system by intestinal distention, visceral (abdominal) cramping results.

Initial studies using lactose hydrogen breath tests documented lactose malabsorption in up to 40% of children and adolescents presenting with abdominal pain.[32] However, recent studies suggest that the prevalence of abdominal symptoms related to lactose intolerance documented by hydrogen breath tests is variable and ranges from 2% in Finnish children to 24% in southern US children.[33,34]

A good clinical history often reveals a relationship between lactose ingestion and symptoms. When lactose intolerance is suspected, a lactose-free diet can be tried (Tables 2 and 3).[35] During a diagnostic lactose-free diet, it is important that all sources of lactose be eliminated, requiring the reading of food labels to identify "hidden" sources of lactose. Generally, a 2-week trial of a strict lactose-free diet with resolution of symptoms and subsequent reintroduction of dairy foods with recurrence of symptoms can be diagnostic. In more-subtle cases, the hydrogen breath test is the least invasive and most helpful test to diagnose lactose malabsorption. The test has been shown to be more reliable than history, because some patients think they are lactose intolerant when they prove not to be, and others prove to be lactose intolerant (lactose malabsorbers) when they think they are not.[36,37] The test is performed by administration of a standardized amount of lactose (2 g/kg, up to a maximum of 25 g, equivalent to the amount of lactose in 2 8-oz glasses of milk) after fasting overnight and then measuring the amount of hydrogen in expired air over a 2- to 3-hour period. An increase (>20 ppm) in the hydrogen expired after approximately 60 minutes is consistent with lactose malabsorption. Factors that may produce false-negative or false-positive results include conditions affecting the intestinal flora (eg, recent use of antimicrobial agents), lack of hydrogen-producing bacteria (10%–15% of the population), ingestion of high-fiber diets before the test, small intestinal bacterial overgrowth, or intestinal motility disorders. A pediatric gastroenterologist should be consulted to interpret the results of this test.

TABLE 2 **Lactose and Calcium Content of Common Foods[70,71]**

Dairy Products	Calcium Content, mg	Lactose Content, g
Yogurt, plain, low fat, 1 cup	448	8.4
Milk, whole (3.25% fat), 1 cup	276	12.8
Milk, reduced fat, 1 cup	285	12.2
Ice cream, vanilla, 1/2 cup	92	4.9
Cheddar cheese, 1 oz	204	0.07
Swiss cheese, 1 oz	224	0.02
Cottage cheese, creamed (small curd), 1 cup	135	1.4

TABLE 3 **Hidden Sources of Lactose[72]**

Bread and other baked goods
Processed breakfast cereals
Mixes for pancakes, biscuits, and cookies
Instant potatoes, soups, and breakfast drinks
Margarine
Nonkosher lunchmeats
Salad dressings
Candies and other snacks

The older lactose-tolerance test was previously relied on as the primary test of lactose malabsorption before the breath hydrogen test became available. Lactose intolerance was diagnosed by onset of symptoms and/or positive test results after ingestion of a standard lactose dose (2 g/kg of body weight or 50 g/m^2 of body surface area; maximum 50 g in a 20% water solution). If the maximum increase in blood glucose concentration was less than 26 mg/dL after a lactose-tolerance test dose, lactose malabsorption was diagnosed. The lactose-tolerance test is not sensitive enough to determine if a subject is malabsorbing some lactose. It is also often falsely positive because of lack of an increase of blood glucose concentration attributable to normal insulin response to the carbohydrate load. Given the high rate of false-negative and false-positive results, this test should not be used and has been replaced by the hydrogen breath test.

Other tests are available in consultation with a pediatric gastroenterologist to diagnose lactose intolerance. If an underlying cause for secondary lactose intolerance is suspected, testing for intestinal etiologies includes stool examination, particularly for parasites affecting the upper gastrointestinal tract such as *Giardia lamblia* and *Cryptosporidia* species, and blood tests for celiac disease (ie, total immunoglobulin A concentration and antitissue transglutaminase antibody[38,39]) or immunodeficiency (quantitative immunoglobulins). Intestinal biopsy may be needed to uncover an underlying gastrointestinal mucosal problem that is causing the lactose malabsorption. Biopsies can yield direct measurement of disaccharidase concentrations to document lactase deficiency directly and assess the status of the other

brush-border disaccharidases (sucrase, maltase, isomaltase), which may also be deficient under various circumstances. However, intestinal lactase concentrations do not seem to correlate well with symptoms of lactose intolerance.[40]

Newer tests may eventually yield additional detailed information pertaining to the prevalence and significance of lactose intolerance.[41] For example, the [^{13}C]lactose breath test is being considered as a test to augment the accuracy of the breath hydrogen test but is still primarily an investigational tool.[42,43]

In infants with diarrhea in whom lactose (or other carbohydrate) intolerance is suspected, stool can be screened for malabsorbed carbohydrate by testing fecal pH, which decreases with carbohydrate malabsorption as a result of the formation of volatile fatty acids. It should be remembered that fecal pH will normally be lower (5.0–5.5) in infants compared with older children and adolescents because of the physiologic overload of lactose in their diets, which in turn helps to favor growth of *Lactobacillus* species in the colon. Fecal reducing substances can also be measured and become positive by excretion of a reducing sugar in the stools. Reducing sugars include lactose, glucose, fructose, and galactose but not sucrose. Because some patients may only malabsorb enough carbohydrates, such as lactose, to lower the fecal pH but not increase excretion of carbohydrate in the stool, the pH test is a more sensitive test for carbohydrate malabsorption.

MANAGEMENT

When children are diagnosed with lactose intolerance, avoidance of milk and other dairy products will relieve symptoms. However, those with primary lactose intolerance have varying degrees of lactase deficiency and, correspondingly, often tolerate varying amounts of dietary lactose. Lactose-intolerant children (and their parents) should realize that ingestion of dairy products resulting in symptoms generally leads to transient symptoms without causing harm to the gastrointestinal tract (as compared with celiac disease or allergic reactions, including milk-protein intolerance, that can lead to ongoing inflammation and mucosal damage). Although lactose malabsorption does not predispose to calcium malabsorption,[44] avoidance of milk products to control symptoms may be problematic for optimal bone mineralization. Children who avoid milk have been documented to ingest less-than-recommended amounts of calcium needed for normal bone calcium accretion and bone mineralization.[45,46]

Lactose-free and lactose-reduced milks (and lactose-free whole milk for children younger than 2 years) are widely available in supermarkets and can be obtained with WIC (Special Supplemental Nutrition Program for Women, Infants, and Children) vouchers. Although lactose-free milk is more expensive than regular milk, some major chain stores sell less-expensive lactose-free milk under their own brand names.

Beyond infancy, substitutes for cow milk based on rice, soy, or other proteins are readily available and are generally free of lactose, although the nutrient content of most of these milks is not equivalent to cow milk. Other mammalian milks, including goat milk, are not free of lactose. Tolerance to milk products may be partial, so that dietary maneuvers alone may help avoid symptoms in some individuals. Small amounts of lactose in portions of 4 to 8 oz spaced throughout the day and consumed with other foods may be tolerated with no symptoms.[47–51] Some children are able to drink 1 to 2 glasses of milk each day without difficulty but cannot tolerate more without developing symptoms.[14] Many lactose-intolerant individuals who are intolerant of milk can tolerate milk chocolate[52] and/or yogurt (plain better than flavored), because the bacteria in the yogurt partially digest the lactose into glucose and galactose before consumption.[53,54] In addition, yogurt's semisolid state slows gastric emptying and gastrointestinal transit, resulting in fewer symptoms of lactose intolerance.[55] Furthermore, ingestion of other solid foods delays gastric emptying, providing additional time for endogenous lactase to digest dietary lactose. Aged cheeses tend to have lower lactose content than other cheeses and, thus, may also be better tolerated. Finally, oral lactase-replacement capsules or predigested milk or dairy products with lactase are readily available and will often permit a lactose-intolerant individual to be able to take some or all milk products freely.[56] Because the vitamin D content in milk-substitute products varies, labels must be checked to verify the vitamin D content of individual brands.

Even among population groups with significant lactose intolerance, the importance of dietary dairy products has been stressed. For example, the National Medical Association recently recommended that black people consume 3 to 4 servings per day of low-fat milk, cheese, and/or yogurt and that lactose-free milk be used as an alternative for those who are intolerant of these other products to help reduce the risk of nutrient-related chronic diseases such as hypertension and diabetes.[57]

Milk and dairy products are often well tolerated by many children with underlying inflammatory conditions of the intestines, including Crohn disease and ulcerative colitis, in whom the prevalence of lactose intolerance does not seem to be any greater than in the general population.[58–61]

Lactose-Free Formulas

In developed countries, even in the case of acute gastroenteritis, enough lactose digestion and absorption are preserved so that low-lactose and lactose-free formulas have no clinical advantages compared with standard lactose-containing formulas except in severely undernourished children, in whom lactose-containing formu-

las may worsen the diarrhea and lactose-free formulas may be advantageous.[62] Breastfed infants should be continued on human milk in all cases.[57] This has also been reviewed recently in the American Academy of Pediatrics' practice guideline for acute gastroenteritis.[63] The use of lactase in formulas for preterm infants has been noted above. Although lactose-free cow milk–protein-based formulas are readily available and popular, no studies have documented that these formulas have any clinical impact on infant outcome measures including colic, growth, or development.[64]

Lactose, Calcium Absorption, and Bone Mineral Content

Recent evidence indicates that dietary lactose enhances calcium absorption and, conversely, that lactose-free diets result in lower calcium absorption.[65] Thus, lactose intolerance (and lactose-free diets) theoretically may predispose to inadequate bone mineralization, a problem now recognized in many other disorders affecting pediatric patients.[45,46] The effects of lactose-free diets in childhood on long-term bone mineral content and risk of fractures and osteoporosis with aging remains to be clarified. Calcium homeostasis is also affected by protein intake, vitamin D status, salt intake, and genetic and other factors, making long-term studies essential to determine the risks of each or all of these to bone health. Recent studies suggest that in the future, genetic testing may be useful for identifying individuals at increased risk of lactase deficiency and consequent diminished bone mineral density,[66] potentially allowing early intervention with dietary manipulation or nutrient supplementation. Recent research has even suggested that gene-replacement therapies might someday be available for susceptible individuals.[67]

SUMMARY

Lactose intolerance has been recognized for many years as a common problem in many children and most adults throughout the world. Although rarely life-threatening, the symptoms of lactose intolerance can lead to significant discomfort, disrupted quality of life, and loss of school attendance, leisure and sports activities, and work time, all at a cost to individuals, families, and society. Treatment is relatively simple and aimed at reducing or eliminating the inciting substance, lactose, by eliminating it from the diet or by "predigesting" it with supplemental lactase-enzyme replacement. Calcium must be provided by alternate nondairy dietary sources or as a dietary supplement to individuals who avoid milk intake.

CONCLUSIONS

1. Lactose intolerance is a common cause of abdominal pain in older children and teenagers.
2. Lactose intolerance attributable to primary lactase deficiency is uncommon before 2 to 3 years of age in all populations; when lactose malabsorption becomes apparent before 2 to 3 years of age, other etiologies must be sought.
3. Evaluation for lactose intolerance can be achieved relatively easily by dietary elimination and challenge. More-formal testing is usually noninvasive, typically with fecal pH in the presence of watery diarrhea and hydrogen breath testing.
4. If lactose-free diets are used for treatment of lactose intolerance, the diets should include a good source of calcium and/or calcium supplementation to meet daily recommended intake levels.
5. Treatment of lactose intolerance by elimination of milk and other dairy products is not usually necessary given newer approaches to lactose intolerance, including the use of partially digested products (such as yogurts, cheeses, products containing *Lactobacillus acidophilus*, and pretreated milks[56,68]). Evidence that avoidance of dairy products may lead to inadequate calcium intake and consequent suboptimal bone mineralization makes these important as alternatives to milk. Dairy products remain principle sources of protein and other nutrients that are essential for growth in children.

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CLINICAL REPORT

"Late-Preterm" Infants: A Population at Risk

Guidance for the Clinician in Rendering Pediatric Care

William A. Engle, MD, Kay M. Tomashek, MD, Carol Wallman, MSN, and the Committee on Fetus and Newborn

ABSTRACT

Late-preterm infants, defined by birth at 34⁰⁄₇ through 36⁶⁄₇ weeks' gestation, are less physiologically and metabolically mature than term infants. Thus, they are at higher risk of morbidity and mortality than term infants. The purpose of this report is to define "late preterm," recommend a change in terminology from "near term" to "late preterm," present the characteristics of late-preterm infants that predispose them to a higher risk of morbidity and mortality than term infants, and propose guidelines for the evaluation and management of these infants after birth.

INTRODUCTION

Infants born at 34⁰⁄₇ through 36⁶⁄₇ weeks' gestation, or "late-preterm" infants, are often the size and weight of some term infants (born at 37⁰⁄₇–41⁶⁄₇ weeks' gestation). Because of this fact, late-preterm infants may be treated by parents, caregivers, and health care professionals as though they are developmentally mature and at low risk of morbidity. They are often managed in newborn level 1 (basic) nurseries or remain with their mother after birth.[1]

Late-preterm infants are physiologically and metabolically immature.[2–8] As a consequence, late-preterm infants are at higher risk than are term infants of developing medical complications that result in higher rates of mortality and morbidity during the birth hospitalization.[6–8] In addition, late-preterm infants have higher rates of hospital readmission during the neonatal period than do term infants.[2,4,7–9] During the last 15 years, the proportion of all US births that were late preterm increased from 7.3% in 1990 to 9.1% in 2005.[10] In 2005, late-preterm births accounted for more than 70% of all preterm births (<37 weeks' gestation), or approximately 377 000 infants.[10–12] In fact, much of the increase in the preterm birth rate in recent years can be attributed to increases in late-preterm births.[12,13]

The reason for the increase in late-preterm births during the last decade is not well understood. One hypothesis is that it may be attributable, in part, to increased use of reproductive technologies and, as a result, an increase in multifetal pregnancies.[11,14–16] Another hypothesis is that advances in obstetric practice have led to an increase in surveillance and medical interventions during pregnancy.[11,14–17] As a result, fetuses considered to be at risk of stillbirth, including those with intrauterine growth restriction, fetal anomalies, and intrapartum asphyxia, may be identified earlier, which results in more deliveries at 34 to 36 weeks' gestation. For example, between 1989 and 2003, the use of electronic fetal monitoring and prenatal ultrasonography increased substantially from 68.1% to 85.4% and 47.6% to 67%, respectively.[10] Rates of labor induction and cesarean delivery also in-

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Key Words
late preterm, near-term, moderate preterm, morbidity, mortality, readmission

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TABLE 1 **Statistical and Conventional Definitions of Weeks of Gestation, Completed Weeks of Gestation, Late Preterm Gestation, and Term Gestation**

	Gestation, wk	Gestation, Completed Weeks[a]							
Fraction of week[b]		0/7	1/7	2/7	3/7	4/7	5/7	6/7	
Statistical day[c]	0	0	1	2	3	4	5	6	1
Medical Convention day[d]		1	2	3	4	5	6	7	
	1	7	8	9	10	11	12	13	2
		8	9	10	11	12	13	14	
	33	231	232	233	234	235	236	237	34
		232	233	234	235	236	237	238	
	34	238	239	240	241	242	243	244	35
		239	240	241	241	243	244	245	
	35	245	246	247	248	249	250	251	36
		246	247	248	249	250	251	252	
	36	252	253	254	255	256	257	258	37
		253	254	255	256	257	258	259	
	37	259	260	261	262	263	264	265	38
		260	261	262	263	264	265	266	
	38	266	267	268	269	270	271	272	39
		267	268	269	270	271	272	273	
	39	273	274	275	276	277	278	279	40
		274	275	276	277	278	279	280	
	40	280	281	282	283	284	285	286	41
		281	282	283	284	285	286	287	
	41	287	288	289	290	291	292	293	42
		288	289	290	291	292	293	294	
	42	294	295	296	297	298	299	300	43
		295	296	297	298	299	300	301	

Late-preterm gestation is defined by medical convention as 34⁰⁄₇ weeks (239 days) through and including 36⁶⁄₇ weeks (259 days) after the beginning of the mother's last normal menstrual period. This is indicated in days with a red background. For comparison, term gestation spans from 37⁰⁄₇ weeks (260 days) through and including 41⁶⁄₇ weeks (294 days) after the beginning of the mother's last normal menstrual period, which is indicated in days with an aqua background.

[a] Completed week of gestation indicates the number of 7-day intervals that have passed since the beginning of the mother's last normal menstrual period. For example, the first completed week occurs after 1 seven-day interval (0⁶⁄₇th week or 7 days) has passed. The 37th completed week occurs after 37 seven-day intervals (36⁶⁄₇ weeks or 259 days) have passed.

[b] Fraction of a week indicates the days of each gestational week as a fraction. For example, the first day of gestation is the first day of the mother's 36⁰⁄₇th week of gestation and ends on the 36⁶⁄₇th week of gestation.

[c] Statistical day indicates that the first day of the mother's last menstrual period begins as day 0 and is not complete until the beginning of day 1.

[d] This statistical view of gestational age differs by 1 day from the conventional medical count of days, which indicates that the first day of the mother's last menstrual period begins as day 1. This important difference is indicated by the statistically defined days that have a gray background and conventionally defined days having no background or a red or aqua background.

creased during the last decade.[10,11] It is important to note, however, that the increased intensity of care provided to pregnant women has been accompanied by significant reductions in stillbirths, perinatal mortality, and births beyond 40 weeks' gestation.[11,14]

It is important to understand why these infants are being born early as well as the unique problems that this growing population of infants may experience. A clearer understanding of the underlying risk factors, associated etiologies, and their relative effects on delivery at 34⁰⁄₇

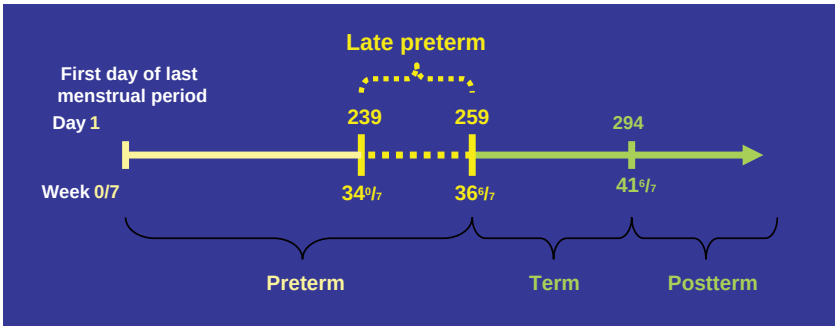

FIGURE 1
Late-preterm definition.

through 36⁶⁄₇ weeks' gestation on the mother and fetus is needed to develop interventions to prevent unnecessary late-preterm births and to improve the management of infants who are born late preterm. Thus, additional research is needed to determine the gestational age at delivery that optimally balances the risk of fetal morbidity or death against risks associated with late-preterm birth for both the mother and the fetus.

The purpose of this report is to define "late preterm," recommend a change in terminology to "late preterm" from the previously used "near term," describe the medical complications and health risks commonly encountered by late-preterm infants, suggest guidelines to identify and manage these complications and risks during the birth hospitalization and after discharge, and identify gaps in knowledge concerning the medical and developmental outcomes of these infants.

DEFINITION OF LATE PRETERM

The gestational age attributed to a newborn infant can be confusing, because the first day of a mother's last normal menstrual period is counted as either day 0 or day 1 depending on whether a statistical or conventional medical definition, respectively, is used. This difference in definition of gestational age accounts for a 1-day variation among data systems when determining the chronologic age of a newborn infant on the first day after birth (Table 1). The day of birth is counted as day 1 when using the conventional medical definition and day 0 when using the statistical definition. The use of conventional medical terminology is illustrated in the definitions of gestational age recommended by the American Academy of Pediatrics, the American College of Obstetricians and Gynecologists, and the World Health Organization.[18–20] For example, "preterm" is defined as birth that occurs on or before the end of the last day of the 37th completed week (ie, 36⁶⁄₇ weeks' gestation) after the onset of the mother's last menstrual period, which equates to 259 days in common medical terminology. The statistical definition for the last day of the 37th completed week of gestation is 258 days. Understanding these definitions is complicated further by financial systems that define the first day of age as delivery before 12:00 AM (midnight) and the subsequent day beginning immediately after 12:00 AM.

The use of the term "completed week" is also confusing. Completed weeks of gestation are defined by the number of 7-day intervals after the first day of the last menstrual period (Table 1).[5,20] For example, the end of the 37th completed week of gestation is 36⁶⁄₇ weeks' gestation, because 37 seven-day intervals (259 days) have transpired. To further clarify, the end of the 37th completed week is not 37⁶⁄₇ weeks' gestation; the beginning of the 38th week of gestation is designated as 37⁰⁄₇ weeks' gestation (260 days).[5,20]

A variety of terms have been used to describe preterm infants born at a number of different intervals between 32 and 37 weeks' gestation ("late preterm," "near term," "marginally preterm," "moderately preterm," "minimally preterm," and "mildly preterm").[2,6,12,21] In contrast, preterm, term, and postterm are mutually exclusive categories that have each been defined precisely according to week and day of gestation (counting the first day as day 1) by the American Academy of Pediatrics, the American College of Obstetricians and Gynecologists, and the World Health Organization (Fig 1).[18,19] As previously described, "preterm" is defined as a birth that occurs on or before the end of the last day of the 37th week (259th day) after the onset of the mother's last menstrual period. "Term" is defined as a birth that occurs on the first day (260th day) of the 38th week through the end of the last day of the 42nd week (294th day) after the onset of the last menstrual period (Table 1). "Postterm" describes the birth of an infant that occurs on or after the first day (295th day) of the 43rd week after the onset of the last menstrual period.

The 2005 workshop "Optimizing Care and Outcome of the Near-Term Pregnancy and the Near-Term Newborn Infant" sponsored by the National Institutes of Health recommended that infants born at 34⁰⁄₇ through 36⁶⁄₇ weeks' gestation after the onset of the mother's last menstrual period be referred to as late preterm to emphasize that these infants are preterm and, as such, are at risk of immaturity-related medical complications (Tables 2 and 3).[5] Furthermore, use of the term "near term," which connotes that the infant is almost term and,

TABLE 2 **Late-Preterm Infants and the Most Frequent Complications of Prematurity During the Birth Hospitalization**

Outcome During Initial Birth Hospitalization	Late-Preterm Morbidity		Term Morbidity		OR (95% CI)	*P*
	No.	%	No.	%		
Feeding difficulties						
Wang et al[2] (35–36⁶⁄₇ wk)	29	32.2	7	7.4	—	—
Hypoglycemia						
Wang et al[2] (35–36⁶⁄₇ wk)	14	15.6	5	5.3	3.30 (1.1–12.2)	.028
Jaundice						
Wang et al[2] (35–36⁶⁄₇ wk)	49	54.4	36	37.9	1.95 (1.04–3.67)	.027
Temperature instability						
Wang et al[2] (35–36⁶⁄₇ wk)	9	10.0	0	0.0	Infinite	.0012
Apnea						
Henderson-Smart[38] (34–35⁶⁄₇ wk)	—	7.0	—	<0.1	—	—
Merchant et al[42] (35–36⁶⁄₇ wk)	6	12.0	0	0.0	12.0 (4.5–24.3)	.0267
Wang et al[2] (35–36⁶⁄₇ wk)	4	4.0	0	0.0	—	.054
Respiratory distress						
Escobar et al[24] (34–36⁶⁄₇ wk)	345	10.7	975	2.7	—	—
Gilbert et al[70] (34–36⁶⁄₇ wk)	1167	3.6	843	0.8	—	—
Rubaltelli et al[33] (34–36⁶⁄₇ wk)	314	9.6	359	0.6	—	—
Wang et al[2] (35–36⁶⁄₇ wk)	26	28.9	4	4.2	9.14 (2.9–37.8)	.00001
Received intravenous infusion						
Wang et al[2] (35–36⁶⁄₇ wk)	24	26.7	5	5.3	6.48 (2.3–22.9)	.0007
Underwent sepsis evaluation						
Wang et al[2] (35–36⁶⁄₇ wk)	33	36.7	12	12.6	3.97 (1.8–9.2)	.00015
Received mechanical ventilation						
Gilbert et al[70] (34–36⁶⁄₇ wk)	1103	3.4	950	0.9	—	—

OR indicates odds ratio; CI, confidence interval; —, data not reported.

therefore, almost fully mature, should be discouraged, because it might lead health care professionals to underestimate the inherent risks to these infants.[5,20]

Workshop members acknowledged that the definition of "late preterm" was arbitrary.[5] The day after the end of the 34th completed week of gestation (ie, 239th day or 34⁰⁄₇ weeks' gestation after the onset of the mother's last menstrual period) was recommended as the lower limit, because it is frequently used as a cutoff point for obstetric decision-making, as a criterion for admission to a level 2 or 3 NICU, and for epidemiologic and clinical research. The upper limit of gestational age for prematurity was previously established as 36⁶⁄₇ weeks' gestation (259th day after the onset of the mother's last menstrual period). Thus, it was recommended that this same upper limit be applied to the late-preterm category of infants.

DEVELOPMENTAL AND PHYSIOLOGIC IMMATURITY OF LATE-PRETERM INFANTS

Late-preterm infants have not been studied frequently, and understanding of the developmental biology and mechanisms of disease experienced by these infants is largely incomplete.[2,5,7,8,22–30] Management strategies, therefore, are based on general principles, clinical experience, and extrapolation from knowledge of very preterm and term infants. Recently, descriptive studies that detailed the epidemiology, medical problems, and risk of mortality experienced by late-preterm infants have stimulated interest in exploring the comparative biology and basic mechanisms of disease in these infants.[2–8] Several important factors that may predispose late-preterm infants to medical conditions associated with immaturity, such as respiratory distress, apnea, temperature instability, hypoglycemia, hyperbilirubinemia, and poor feeding, are reviewed briefly in this report. However, a comprehensive review of the physiologic and functional deficits that predispose late-preterm infants to these conditions is beyond the scope of this report.[5]

After birth, infants with fetal lung structure and immature functional capacity are at greatest risk of respiratory distress, need for oxygen and positive-pressure ventilation, and admission for intensive care.[2,31–33] From 34⁰⁄₇ through 36⁶⁄₇ weeks' gestation, terminal respiratory units of the lung evolve from alveolar saccules lined with both cuboidal type II and flat type I epithelial cells (terminal sac period) to mature alveoli lined primarily with extremely thin type I epithelial cells (alveolar period).[34,35] During the alveolar period, pulmonary capillaries also begin to bulge into the space of each terminal sac, and adult pool sizes of surfactant are attained.[36] Functionally, this immature lung structure may be associated with delayed intrapulmonary fluid absorption, surfactant insufficiency, and inefficient gas exchange.[24,25]

Apnea occurs more frequently among late-preterm infants than term infants. The incidence of apnea in

TABLE 3 **Late-Preterm Infants and Rates of Readmission to the Hospital After the Birth Hospitalization**

Description of Comparison Groups by Study	Readmitted to Hospital[a]		Required Hospital Care[b]		Adjusted OR (95% CI)
	No.	%	No.	%	
All NICU survivors from 6 Kaiser Permanente hospitals, $N = 6054$ (Escobar et al[66])					
<33 wk, all LOS	20	3.4	—	—	1.88 (1.10–3.21)
33–36 wk, LOS < 96 h	31	5.7	—	—	2.94 (1.87–4.62)
33–36 wk, LOS ≥ 96 h	26	2.2	—	—	1.13 (0.69–1.84)
Term, LOS ≥ 96 h	32	2.8	—	—	1.31 (0.83–2.05)
Term, LOS < 96 h	56	2.2	—	—	Reference
One half of all births >34 wk born in UK northern region, $N = 11406$ (Oddie et al[4])					
35–37 wk	37	6.3	—	—	1.72 (1.15–2.57)
>40 wk	57	2.4	—	—	0.70 (0.51–0.95)
38–40 wk	178	3.4	—	—	Reference
All newborns surviving to discharge at 7 Kaiser Permanente hospitals, $N = 33\,276$ (Escobar et al[3])					
<34 wk (100% in NICU)	26	3.0	—	—	0.96 (0.57–1.62)
34–36 wk, in NICU ≥ 24 h					0.89 (0.54–1.46)
34–36 wk, in NICU < 24 h					1.31 (0.41–4.21)
34–36 wk, never in NICU					3.10 (2.38–4.02)
All 34- to 36-wk infants	94	4.4	—	—	
≥37 wk, in NICU ≥ 24 h					0.79 (0.52–1.21)
≥37 wk, in NICU < 24 h					1.43 (0.73–2.81)
≥37 wk, never in NICU					Reference
All ≥37-wk infants	618	2.0	—	—	
All Massachusetts newborns discharged early after vaginal delivery, $N = 25\,324$ (Tomashek et al[8])					
34–36 wk	35	3.5	—	—	1.8 (1.3, 2.5)[c]
37–41 wk	489	2.0	—	—	Reference
34–36 wk	—	—	43	4.3	1.5 (1.1, 2.0)[c]
37–41 wk	—	—	648	2.7	Reference

OR, odds ratio; CI, confidence interval; LOS, length of stay; UK, United Kingdom; —, data not reported.

[a] Readmitted to hospital within 2 weeks after birth hospitalization discharge (Escobar et al[3,66]) and within first 28 days of life (Oddie et al[4] and Tomashek et al[8]).

[b] Required hospital care includes hospital inpatient readmission and observational stay visit during neonatal period.

[c] Shown are relative risks with confidence limits.

late-preterm infants is reported to be between 4% and 7%,[28,31,37,38] compared with less than 1% to 2% at term.[38,39] It is notable that the frequency of apneic events at term was determined by using data from cardiopulmonary monitoring of healthy infants in their homes. Apneic events were inapparent to caregivers and resolved spontaneously. The predisposition to apnea in late-preterm infants is associated with several underlying factors including increased susceptibility to hypoxic respiratory depression, decreased central chemosensitivity to carbon dioxide, immature pulmonary irritant receptors, increased respiratory inhibition sensitivity to laryngeal stimulation, and decreased upper airway dilator muscle tone.[31,38,40–42] It is also suspected that late-preterm infants may be at higher risk of centrally mediated apnea, because their central nervous systems are developmentally immature (ie, fewer sulci and gyri, less myelin) and their brains are approximately two thirds the size of a term infant's brain.[30]

Little is known about cardiovascular physiology and pathobiology in late-preterm infants; it is generally believed that structural and functional immaturity restricts the amount of cardiovascular reserve that is available during times of stress.[43,44] Immature cardiovascular function also may complicate recovery of the late-preterm infant with respiratory distress because of delayed ductus arteriosus closure and persistent pulmonary hypertension.[45]

An infant's response to cold exposure after birth is related to gestational age and is affected by the physical size, the amount of mature brown and white adipose tissue, and maturity of the hypothalamus.[46–48] Brown-fat accumulation and maturation and concentrations of hormones responsible for brown-fat metabolism (eg, prolactin, leptin, norepinephrine, triiodothyronine, cortisol) peak at term.[49,50] Thus, late-preterm infants have less white adipose tissue for insulation, and they cannot generate heat from brown adipose tissue as effectively as infants born at term. In addition, late-preterm infants are likely to lose heat more readily than term infants,

because they have a larger ratio of surface area to weight and are smaller in size.

Hypoglycemia may affect fasting newborn infants of all gestational ages because of insufficient metabolic responses to the abrupt loss of the maternal glucose supply after birth.[51–55] The incidence of hypoglycemia is inversely proportional to gestational age. Within the first 12 to 24 hours after birth, concentrations of enzymes that are essential for hepatic gluconeogenesis and hepatic ketogenesis rapidly increase. Thereafter, hypoglycemia typically resolves. Preterm infants are at increased risk of developing hypoglycemia after birth, because they have immature hepatic glycogenolysis and adipose tissue lipolysis, hormonal dysregulation, and deficient hepatic gluconeogenesis and ketogenesis. Blood glucose concentrations among preterm infants typically decrease to a nadir 1 to 2 hours after birth and remain low until metabolic pathways can compensate or exogenous sources of glucose are provided.[51,54] Carbohydrate metabolism among late-preterm infants is not well understood. However, immature glucose regulation likely occurs in late-preterm infants, because hypoglycemia that requires glucose infusion during the initial birth hospitalization occurs more frequently than in term infants.[2]

Jaundice and hyperbilirubinemia occur more commonly and are more prolonged among late-preterm infants than term infants, because late-preterm infants have delayed maturation and a lower concentration of uridine diphosphoglucuronate glucuronosyltransferase.[21,56] Late-preterm infants are 2 times more likely than term infants to have significantly elevated bilirubin concentrations and higher concentrations 5 and 7 days after birth.[21]

Late-preterm infants also have immature gastrointestinal function[57,58] and feeding difficulties that predispose them to an increase in enterohepatic circulation, decreased stool frequency, dehydration, and hyperbilirubinemia.[59–68] Feeding during the birth hospitalization may be transiently successful but not sustained after discharge. Feeding difficulties in late-preterm infants that are associated with relatively low oromotor tone, function, and neural maturation also predispose these infants to dehydration and hyperbilirubinemia.[30,67–69]

MORBIDITY AND MORTALITY AMONG LATE-PRETERM INFANTS

Late-preterm infants are at increased risk of neonatal morbidity compared with term infants. During the initial birth hospitalization, late-preterm infants are 4 times more likely than term infants to have at least 1 medical condition diagnosed and 3.5 times more likely to have 2 or more conditions diagnosed.[2] Late-preterm infants are more likely than term infants to be diagnosed during the birth hospitalization with temperature instability,[2] hypoglycemia,[2] respiratory distress,[2,24,33,70,71] apnea,[38,42] jaundice,[2] and feeding difficulties[2] (Table 2). During the first month after birth, late-preterm infants are also more likely than term infants to develop hyperbilirubinemia[21,60,72,73] and to be readmitted for hyperbilirubinemia[3,59,64] and non–jaundice-related diagnoses such as feeding difficulties and "rule-out sepsis."[3]

Some of the reported increase in morbidity among late-preterm infants may be attributable to observation and detection bias, because a clinician's threshold to monitor late-preterm infants for medical complications may be lower than their threshold for term infants. For example, a hospital-based study found that late-preterm infants were evaluated for possible sepsis 3 times as often as term infants, and the majority of evaluated late-preterm infants received antibiotic treatment, whereas term infants did not.[2] However, studies have also found that late-preterm infants are at increased risk of developing more severe illness than term infants.[2,24,70] One study of all California singleton live births who survived to 1 year of age found that infants born at 34 to 36 weeks' gestation were 3 to 9 times more likely to require mechanical ventilation than infants born at 38 weeks' gestation.[70] Late-preterm infants are also more likely than term infants to have longer initial hospital stays and to be admitted to the NICU.[2,3,33,70] One large cohort study found that 88% of infants born at 34 weeks' gestation, 54% of infants born at 35 weeks' gestation, 25% of infants born at 36 weeks' gestation, 12% of infants born at 37 weeks' gestation, and 2.6% of infants born at 38 through 40 weeks' gestation were admitted to a NICU.[3]

Severity of illness is also reflected in the increased risk of mortality among late-preterm infants compared with term infants in the United States.[6,10] In 2002, the neonatal mortality rate (deaths among infants 0–27 days' chronologic age) for late-preterm infants was 4.6 times higher than the rate for term infants (4.1 vs 0.9 per 1000 live births, respectively). This difference in neonatal mortality has widened slightly since 1995, when there was a fourfold difference in rates between late-preterm and term infants (4.8 vs 1.2 per 1000 live births, respectively). The infant mortality rate was also higher among late-preterm infants than term infants in 2002 (7.7 vs 2.5 per 1000 live births, respectively). This threefold difference has remained relatively constant since 1995, at which time the infant mortality rate was 9.3 per 1000 live births among late-preterm infants and 3.1 per 1000 live births among term infants.

Several case-control studies designed to evaluate risk factors for neonatal hospital readmission after the birth hospitalization have identified late-preterm birth as a significant risk factor.[62,63,65,68,74] Studies that compared neonatal hospital readmission rates among late-preterm infants and other groups of infants, including term infants, have found that late-preterm infants are more likely to be readmitted than are term infants (Table 3).[3,4,8,24,59] A large study in the United Kingdom found that infants born at 35 through 37 weeks' gestation were

1.7 times more likely to be readmitted during the neonatal period than were infants born at 38 through 40 weeks' gestation (adjusted odds ratio: 1.7; 95% confidence interval: 1.2–2.6).[4] A retrospective cohort study of all newborn infants who survived to discharge at 7 hospitals within a large managed care organization found that 4.4% of all late-preterm infants were readmitted within 2 weeks after the birth hospitalization, compared with 3.0% of infants less than 34 weeks' gestation and 2.0% of infants born at or after 37 weeks' gestation.[3] Late-preterm infants who were never admitted to the NICU were at the highest risk of rehospitalization. This study also found that having a home visit or a scheduled outpatient visit within 72 hours after discharge was associated with a decreased risk of rehospitalization. In addition, a population-based study found that late-preterm infants who were not admitted to the NICU after birth were 2 to 3 times more likely than term infants to be rehospitalized for hyperbilirubinemia.[59]

Late-preterm infants with short NICU stays may be at increased risk of hospital readmission after the birth hospitalization compared with all other NICU survivors. A study that assessed outcomes among all newborn infants discharged alive from 6 NICUs within a large managed care organization found that preterm infants of 33 to 36 weeks' gestation with a hospital stay of less than 4 days had higher hospital readmission rates than all other groups, including the most preterm group.[66] The reason for readmission for the majority of these late-preterm infants was jaundice (71%), followed by suspected sepsis (20%) and feeding difficulties (16%).

Late-preterm infants who are discharged early (<2-night hospital stay) from the hospital after a vaginal delivery may be at increased risk of neonatal morbidity compared with term infants who are discharged early.[8] A population-based study that compared rates of postdischarge neonatal morbidity between singleton late-preterm and term infants who were discharged early found that 4.3% and 2.7% of infants, respectively, were either readmitted or had an observational stay; 3.5% and 2.0%, respectively, were readmitted. Jaundice and infection accounted for 77.1% of readmissions among late-preterm infants and 60.3% of readmissions among term infants. In this study, breastfed late-preterm infants were 1.8 times more likely to require hospital-related care and 2.2 times more likely to be readmitted than breastfed term infants. In contrast, there was no difference in need for subsequent hospital-related care or readmission between nonbreastfed late-preterm and term infants.

Several factors have been identified to be associated with an increased risk of hospital readmission, an observational hospital stay, or severe morbidity among late-preterm infants. A population-based cohort study of healthy, singleton late-preterm infants delivered vaginally in Massachusetts hospitals between 1998 and 2002 found that 6.1% received hospital care after the birth hospitalization or died during the neonatal period.[7] Risk factors for requiring hospital care or experiencing morbidity included being the first born, being breastfed at discharge, having a mother who had labor and delivery complications, being a recipient of public insurance at delivery, or being of Asian/Pacific Island descent.[7,9]

Although it is known that late-preterm infants are at increased risk compared with term infants for infant mortality, morbidity during the initial birth hospitalization, and neonatal morbidity that requires hospital readmission, the long-term health consequences of being born late preterm are not yet known.[75] Small clinical reports that compared late-preterm infants with term infants suggested a higher risk of cerebral palsy,[76] speech disorders,[77,78] neurodevelopmental handicaps,[78] behavioral abnormalities,[79] and competence (behavioral, scholastic, social, and global).[75,79–81] Given that late-preterm infants are born before their nervous systems have fully developed, large population studies that evaluate long-term neurodevelopmental and behavioral outcomes of these children are needed.[75]

The emotional, personal, and financial costs to individuals, family, and society associated with late-preterm births have not been sufficiently described.[82] A conservative estimate for the long-term medical, educational, and productivity costs associated with the birth of all infants before 37 weeks' gestation is approximately $51 600 for each infant or a total cost of $26.2 billion in 2005 dollars. Individual late-preterm infants, on average, require fewer financial and other resources than infants who are born more preterm. However, the total resources and costs associated with late-preterm birth are likely to be a relatively substantial part of the total cost of all preterm births, because the population of late-preterm infants is significantly larger than the population of infants who are born before 34 weeks' gestation.

Collaborative counseling by neonatal and obstetric clinicians about fetal, neonatal, and maternal outcomes is warranted when maternal or fetal conditions indicate the necessity for late-preterm birth. The obstetric clinician can discuss the indications for the delivery and the risks inherent in delaying delivery. The neonatal clinician can provide the family with gestational age-specific outcome information and help prepare the family for the newborn infant's anticipated course in the nursery. Collaborative counseling allows the family to be fully informed and to participate in decision-making. Under emergent conditions, the time to provide such counseling may not exist.

SUMMARY

1. Late-preterm infants are immature.
    a. Infants born at 34 0/7 through 36 6/7 weeks' gestation (239–259 days since the first day of the last

menstrual period) should be referred to as "late preterm."

   b. Late-preterm infants are physiologically immature and have limited compensatory responses to the extrauterine environment compared with term infants.

2. Late-preterm infants are at a greater risk of morbidity and mortality than are term infants.

   a. During the birth hospitalization, late-preterm infants are more likely than are term infants to be diagnosed with temperature instability, hypoglycemia, respiratory distress, apnea, jaundice, or feeding difficulties.

   b. During the first month after birth, late-preterm infants are more likely than term infants to be rehospitalized for jaundice, feeding difficulties, dehydration, and suspected sepsis.

3. Risk factors that have been identified for rehospitalization or neonatal morbidity among late-preterm infants include being the first born, being breastfed at discharge, having a mother who had labor and delivery complications, being a recipient of public insurance at delivery, and being of Asian/Pacific Island descent.

4. Collaborative counseling by both obstetric and neonatal clinicians about the outcomes of late-preterm births is warranted unless precluded by emergent conditions.

Gaps in Knowledge, Clinical Implications, and Research Implications for Late-Preterm Births

The following are areas in which knowledge and research need to be expanded:

1. causes for delivery and short-term fetal, neonatal, and maternal outcomes;
2. developmental immaturity and mechanisms of disease in late-preterm infants;
3. identification tools, educational programs, and screening strategies to identify risk factors and prevent potential medical complications of late-preterm births;
4. recommendations for discharge, early follow-up evaluation, and treatment for jaundice, poor feeding, dehydration, and other complications in late-preterm infants; and
5. long-term medical, neurologic, and developmental outcomes for late-preterm infants.

Recommended Minimum Criteria for Discharge of Late-Preterm Infants

Discharge criteria for late-preterm infants have similarities to criteria developed for both high-risk infants and healthy term infants.[82] Because late-preterm infants are at greater risk of neonatal morbidity and mortality than are term infants, parents of late-preterm infants may need special instruction and guidance before hospital discharge and closer follow-up after discharge. Late-preterm infants who have risk factors for morbidity that requires hospital care (ie, hospital readmission), such as those who are breastfed or are first born, are most vulnerable. It is especially important to educate first-time mothers of late-preterm infants how to evaluate feeding success and what signs to look for to detect dehydration and hyperbilirubinemia. In some circumstances, this education may require a longer birth hospitalization.

Recommended criteria for discharge of late-preterm infants are intended to reflect evidence of physiologic maturity; feeding competency; thermoregulation; maternal education; assessment and planned interventions for medical, family, environmental, and social risk factors; and follow-up arrangements.

Minimum discharge criteria for late-preterm infants are as follows:

1. Accurate gestational age has been determined.[83,84]
2. Timing of discharge is individualized and based on feeding competency, thermoregulation, and absence of medical illness and social risk factors (see below). Late-preterm infants usually are not expected to meet the necessary competencies for discharge before 48 hours of birth.[85]
3. A physician-directed source for continued medical care (ie, medical home) has been identified, with a follow-up visit arranged for 24 to 48 hours after hospital discharge. Additional visits may be indicated until an established and maintained pattern of weight gain has been demonstrated.[86,87]
4. Vital signs should be documented as being within reference ranges and stable for the 12 hours preceding discharge, including a respiratory rate of less than 60 breaths per minute, a heart rate of 100 to 160 beats per minute, and axillary temperature of 36.5 to 37.4°C (97.7–99.3°F) measured in an open crib with appropriate clothing.[85]
5. At least 1 stool has been passed spontaneously.[85]
6. Twenty-four hours of successful feeding, either at the breast or with a bottle, and the ability to coordinate sucking, swallowing, and breathing while feeding has been demonstrated. Any infant with a weight loss of more than 2% to 3% of birth weight per day or a maximum of 7% of birth weight during the birth hospitalization should be assessed for evidence of dehydration before discharge.[85,88–90]
7. A formal evaluation of breastfeeding, including observation of position, latch, and milk transfer, has been undertaken and documented in the chart by trained caregivers at least twice daily after birth.[90,91]

8. A feeding plan has been developed and is understood by the family.[86]
9. A risk assessment for the development of severe hyperbilirubinemia has been performed and appropriate follow-up has been arranged.[88]
10. Physical examinations of the infant reveal no abnormalities that require continued hospitalization.[85]
11. There is no evidence of active bleeding at the circumcision site for at least 2 hours.[85]
12. Maternal and infant test results are available and have been reviewed, including blood test results for maternal syphilis and hepatitis B surface-antigen status; cord or infant blood type and direct Coombs test results, as clinically indicated; and results of screenings performed in accordance with state regulations, including screening for HIV infection.[85,92]
13. Initial hepatitis B vaccine has been administered or an appointment has been scheduled for its administration, and the importance of immunizations has been stressed.[85]
14. Metabolic and genetic screenings have been performed in accordance with state requirements. If a newborn screening is performed before 24 hours of milk feeding, a system for repeating the screening must be in place in accordance with state policy.[93]
15. A car safety seat study completed by a trained professional to observe for apnea, bradycardia, or oxygen desaturation has been passed.[94]
16. Hearing assessment has been performed and the results have been documented in the medical chart. Results have been discussed with family or caregivers. If follow-up is needed, follow-up plans have been outlined.[95]
17. Family, environmental, and social risk factors have been assessed. When risk factors are identified, the discharge should be delayed until they are resolved or a plan to safeguard the infant is in place. Such risk factors may include but are not limited to:
    a. untreated parental substance use or positive toxicology test results in the mother or newborn infant;
    b. history of child abuse or neglect;
    c. mental illness in a parent in the home;
    d. lack of social support, particularly for single, first-time mothers;
    e. homelessness, particularly during this pregnancy;
    f. ongoing or established risk of domestic violence; or
    g. adolescent mother, particularly if other risk factors are present.[85]
18. The mother and caregivers have received information or training or have demonstrated competency in the following:
    a. infant's hospital course and current condition;
    b. expected pattern of urine and stool frequency for the breastfeeding or formula-fed neonate (verbal and written instruction is recommended);
    c. umbilical cord, skin, and newborn genital care;
    d. hand hygiene, especially as a means to reduce the risk of infection;
    e. use of a thermometer to assess an infant's axillary temperature;
    f. assessment and provision of appropriate layers of clothing;
    g. identification of common signs and symptoms of illness, such as hyperbilirubinemia, sepsis, and dehydration;
    h. assessment for jaundice;
    i. provision of a safe sleep environment, including positioning the infant on his or her back during sleep[96];
    j. newborn safety issues including car safety seat use, need for smoke/fire alarms, and hazards of secondhand tobacco smoke and environmental pollutants;
    k. appropriate responses to a complication or an emergency; and
    l. sibling interactions and appropriate inclusion in care responsibilities.

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ERRATA

Engle WA, Tomashek KM, Wallman C, and the Committee on Fetus and Newborn. "Late-Preterm" Infants: A Population at Risk. PEDIATRICS 2007;120(6): 1390–1401.

An error occurred in the American Academy of Pediatrics clinical report "'Late Preterm' Infants: A Population at Risk" (doi:10.1542/peds.2007-2952). The affiliation of committee liaison Gary D.V. Hankins, MD, should be American College of Obstetricians and Gynecologists rather than American College of Obstetrics and Gynecology.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Lawn Mower-Related Injuries to Children

ABSTRACT. Lawn mower-related injuries to children are relatively common and can result in severe injury or death. Many amputations during childhood are caused by power mowers. Pediatricians have an important role as advocates and educators to promote the prevention of these injuries.

ABBREVIATION. ANSI/OPEI, American National Standards Institute and Outdoor Power Equipment Institute.

BACKGROUND

Each year in the United States, approximately 9400 children younger than 18 years receive emergency care for lawn mower-related injuries. Although most of these injuries occur to older children and adolescents, about one fourth are to children younger than 5 years. Males account for approximately three fourths of these injuries. Ride-on mowers and other power mowers account for 21% and 23% of pediatric mower-related injuries, respectively.[1] More than 7% of pediatric mower-related injuries require hospitalization, which is approximately twice the hospitalization rate for consumer product-related injuries overall. Amputations and avulsions account for 7% of pediatric mower-related injuries.[1] Power lawn mowers caused 22% of the amputation injuries among children admitted to one regional level 1 trauma center.[2] Additional details regarding pediatric lawn mower-related injuries are available in the technical report available online.[3]

PREVENTION OF INJURY

Prevention of lawn mower-related injuries can be achieved by 1) design changes of lawn mowers to enhance safety, 2) appropriate age and maturity guidelines for mower operation, and 3) education of parents, other child caregivers, and children regarding the hazards associated with lawn mowers. Details are included in the technical report available online.[3]

Age and Maturity Guidelines for Lawn Mower Operation

No age-specific criteria for use of lawn mowers have been established by the industry or government. However, children should not operate lawn mowers until they have displayed appropriate levels of judgment, strength, coordination, and maturity necessary for their safe operation. They should also receive a period of operational training, safety instruction, and supervision by an adult before they are allowed to operate a mower by themselves. Because of the complexities involved in safe operation, a prudent guideline for the minimum age for operation of lawn mowers by children is at least 16 years for ride-on mowers and at least 12 years for walk-behind power mowers and hand mowers.

A patient safety sheet for distribution to families is available online.

RECOMMENDATIONS

1. Young children must not be allowed to play in or be adjacent to areas where lawn mowers are being used. Children younger than 6 years should be kept indoors during mowing.
2. Children must not be allowed to ride as passengers on mowers or to be towed behind mowers in carts or trailers. They should not be permitted to play on or around the mower when it is in use or in storage.
3. Children should not operate lawn mowers until they have displayed the necessary levels of judgment, strength, coordination, and maturity. They should also be educated in mower operation and safety and be supervised by an adult before they are allowed to operate a mower by themselves. Most children will not be ready to operate a walk-behind power mower or hand mower until at least 12 years of age or a ride-on mower until at least 16 years of age.
4. Additional research regarding the circumstances and contributing factors of lawn mower-related injuries is needed, especially injuries involving mower instability or situations in which a person has been run over or backed over.
5. Strengthening of the voluntary standard of the American National Standards Institute and Outdoor Power Equipment Institute (ANSI/OPEI B71.1) is needed, for example, by requiring manufacturers to design ride-on lawn mowers that will not mow in reverse, with a manual override option. If adequate levels of safety cannot be achieved voluntarily, a mandatory federal safety standard may be necessary.
6. Designs for mower controls should continue to be improved for ease of operation and to minimize inadvertent control contact and unintended operation.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

P² Online version of this article contains a PDF of "Parent Pages," which can be used as a handout for patient education.

PEDIATRICS (ISSN 0031 4005).

7. Evaluation is needed of the effectiveness of education programs and curricula for lawn mower operators, as well as the effectiveness of public awareness and education initiatives regarding lawn mower safety.

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AMERICAN ACADEMY OF PEDIATRICS

Gary A. Smith, MD, DrPH, and the Committee on Injury and Poison Prevention

Technical Report: Lawn Mower-Related Injuries to Children

ABSTRACT. In the United States, approximately 9400 children younger than 18 years receive emergency treatment annually for lawn mower-related injuries. More than 7% of these children require hospitalization, and power mowers cause a large proportion of the amputations during childhood. Prevention of lawn mower-related injuries can be achieved by design changes of lawn mowers, guidelines for mower operation, and education of parents, child caregivers, and children. Pediatricians have an important role as advocates and educators to promote the prevention of these injuries. *Pediatrics* **2001; 107(6). URL: http://www.pediatrics.org/cgi/content/full/107/6/e106; *lawn mower-related injuries, children.***

ABBREVIATIONS. CPSC, US Consumer Product Safety Commission; ANSI/OPEI, American National Standards Institute and Outdoor Power Equipment Institute.

BACKGROUND

In the United States, an estimated 68 000 injuries related to lawn mowers (including hand mowers, walk-behind power mowers, and ride-on power mowers, but excluding garden tractors) were treated annually in hospital emergency departments from 1990 through 1999. Approximately 14% of these injuries occur to children younger than 18 years, accounting for an estimated 9400 injuries annually.[1] Ride-on mowers and other power mowers account for 21% and 23% of pediatric mower-related injuries, respectively. The type of lawn mower is not specified in 54% of cases, and hand mowers account for 2% of mower-related injuries to children.[1] Twenty-four percent of pediatric mower-related injuries occur in children younger than 5 years; 36% occur in 5- to 12-year-olds; and 40% occur in 13- to 17-year-olds. The age distribution of these injuries is bimodal, with peaks around 2 and 15 years. Males account for approximately three fourths of these injuries.[1] More than 7% of pediatric mower-related injuries require hospitalization,[1] which is approximately twice the hospitalization rate for consumer product-related injuries overall. Lacerations account for 41% of pediatric mower-related injuries, followed by soft-tissue injuries such as sprains, strains, contusions, and abrasions (20%); burns (14%), fractures, and dislocations (11%); amputations and avulsions (7%); and foreign bodies (3%). Body parts that may be injured include the hands and fingers (31%), legs (19%), feet and toes (18%), head (18%), and arms (7%).[1] Power lawn mowers caused 22% of the amputation injuries among children admitted to one regional level 1 trauma center.[2]

INJURIES RELATED TO RIDE-ON MOWERS

In the United States, ride-on mowers (including riding mowers, lawn tractors, and garden tractors) are commonly used for mowing lawns and fields. An estimated 10.3 million of these mowers were in operation in 1992.[3] They are larger, more powerful, and more mechanically complex to operate than walk-behind lawn mowers. As a consequence, the risk of injury and possible death to children from these vehicles is high compared with that from walk-behind mowers.

In the United States between 1991 and 1993, an estimated 26 800 injuries related to ride-on mowers were treated annually in hospital emergency departments, representing an annual injury rate of 2.6 injuries per 1000 ride-on mowers.[3] This injury rate is more than 3 times greater than that for walk-behind power mowers. In contrast to the decline in the annual injury rate for walk-behind power mowers, the injury rate for ride-on mowers showed no significant change during the 11-year period from 1983–1993.[4] Twenty percent of injuries related to ride-on mowers occur in children 15 years or younger, and approximately 12% of these children require hospitalization.[5] The hospitalization rate is 9% for all ages. Two thirds of the injuries occur when mowers are in use (during mowing, driving, or operating attachments); the remainder of injuries occur when mowers are being maintained or repaired, loaded or unloaded, or played on when not in use. More than half of all injuries related to ride-on mowers occur to operators, and 9% of the injured operators are 14 years or younger. The rate of injury for 5- to 14-year-old operators is more than twice that for 15- to 64-year-olds.[5] Approximately 8% of deaths related to ride-on mowers involve passengers or bystanders, whose average ages are 6 and 4 years, respectively.[5] Infants and children younger than 6 years and children and adolescents 6 to 15 years of age each accounted for 6% of all deaths related to ride-on mowers from 1987 through 1990.[6] The 1993 US Consumer Product Safety Commission (CPSC) report[5] on ride-on mower hazards identified 4 key injury mechanisms: loss of mower stability, blade contact, layout and function of the mower controls (ie, location on mower), and running over or backing over young children.

Approximately 13% of injuries that occur during ride-on mower use are associated with loss of mower stability, accounting for an estimated 2200 injuries annually. Approximately 20% of these injuries require hospitalization.[5] Since July 1987, the lawn

mower voluntary standard of the American National Standards Institute and Outdoor Power Equipment Institute (ANSI/OPEI B71.1)[7] has addressed ride-on mowers tipping over as a result of sudden traction after quick release of the clutch. This standard states that the wheels of the mower cannot lift more than 10° off of level ground when there is a quick release of the clutch. Turning stability is also addressed in the current standard,[8] stating that wheel lift-off will not exceed 5° when the mower performs a maximum turn maneuver while traveling at maximum governed speed on level ground. In 1994, the CPSC abandoned efforts to develop a dynamic stability test on a slope for ride-on mowers.[9]

Approximately 12% of injuries that occur during ride-on mower use are associated with blade contact, accounting for an estimated 2000 injuries per year. Approximately 10% of these injuries require hospitalization.[5] Since July 1987, the lawn mower voluntary standard[7] has required an operator-presence control device on ride-on mowers that automatically stops the blades if the operator leaves the operating position. This type of safety device, often called a "dead man control," is also required on rotary walk-behind power mowers.[10]

Approximately 7% of injuries that occur during ride-on mower use are associated with problems in the layout and function of mower controls that can, for example, result in inadvertent control contact and unintended operation. These problems account for an estimated 1200 injuries per year, and about 14% of these injuries require hospitalization.[5]

Approximately 5% of injuries that occur during ride-on mower use (an estimated 850 injuries annually) and 7% of deaths related to ride-on mowers occur when a person is run over or backed over. Approximately 85% of these injuries occur in children between 15 months and 10 years of age while they are playing in the area being mowed (76% of cases) or after they fall from or jump off of a mower (24%). One third of injured individuals require hospitalization for treatment of serious injuries from blade contact.[5] Injuries from back overs occur approximately twice as often as injuries from run overs.[9] Ride-on mowers can be designed to disengage the blades when the mower is backing up, preventing the machine from mowing in reverse. This feature could help reduce the number of injuries from back overs involving blade contact. A manual switch can be provided to override this feature, but the default setting would be reactivated when the mower is shifted out of reverse.

INJURIES RELATED TO WALK-BEHIND MOWERS

In 1992, there were an estimated 44.2 million walk-behind mowers in use. The annual injury rate was 0.7 per 1000 mowers in use during the years 1983 through 1993, and there was a significant decline in this rate during this time period that resulted in a decrease of 3100 injuries per year.[4] The mean age of children with injuries from walk-behind power mowers is 9 years, and 74% are male. Almost 5% of children who experience injuries from walk-behind power mowers require hospitalization.[1] Among children, a statistically significant association exists between injury to the hands and fingers or feet and toes and walk-behind power mowers when compared with other types of mowers. There is also an association between walk-behind power mowers and amputation or avulsion injuries, and a strong association between these mowers and burns.[1]

PREVENTION OF INJURY

Lawn mower-related injuries to children are relatively common and can result in severe injury and death. Prevention of these injuries can be achieved by 1) design changes of lawn mowers to enhance safety, 2) appropriate age and maturity guidelines for mower operation, and 3) education of parents, other child caregivers, and children regarding the hazards associated with lawn mowers.

Lawn Mower Safety Design

The science of injury prevention recognizes that the most effective prevention strategies are those that do not require frequent human action and vigilance.[11] Therefore, automatic protection provided by safe product design offers the best solution for prevention of lawn mower-related injuries. Changes to the voluntary standard ANSI/OPEI B71.1 and improvements in ride-on mower design led to significant decreases in injury rates related to blade contact and control layout during the period from 1983 through 1993. However, similar declines did not occur in injury rates related to mower instability and incidents that involved running over or backing over a person.[4] These findings indicate a need for additional evaluation of the circumstances of injury for those cases and development and implementation of design changes to ride-on lawn mowers to prevent those injuries. A mandatory standard for rotary walk-behind power lawn mowers[10] went into effect in July 1982, and a significant decline in the annual injury rate related to these machines subsequently occurred.[4]

Age and Maturity Guidelines for Lawn Mower Operation

No age-specific criteria for use of lawn mowers have been established by the industry or government. However, children should not operate lawn mowers until they have displayed appropriate levels of judgment, strength, coordination, and maturity necessary for their safe operation. They should also receive a period of operational training, safety instruction, and supervision by an adult before they are allowed to operate a mower by themselves. Because of the complexities involved in safe operation, a prudent guideline for the minimum age for operation of lawn mowers by children is at least 16 years for ride-on mowers and at least 12 years for walk-behind power mowers and hand mowers.

Education

In 1985, a curriculum[12] was developed by the American Red Cross to provide children 12 years and older with the knowledge and skills for safe operation of power lawn mowers, but no evaluation

of the effectiveness of this curriculum has been done to determine if mower-related injuries decreased as a result. Lawn mower operators, parents, and other child caregivers also should be educated about the hazards that lawn mowers present to children and how to prevent these injuries.

OPPORTUNITIES FOR PREVENTION

The following are important opportunities for prevention of lawn mower-related injuries available to pediatricians, researchers, the public health community, manufacturers, and others:

1. Additional research regarding the circumstances and contributing factors of lawn mower-related injuries is needed, especially injuries involving mower instability or situations in which a person has been run over or backed over.
2. Strengthening of the voluntary standard (ANSI/OPEI B71.1) is needed, for example, by requiring manufacturers to design ride-on lawn mowers that will not mow in reverse, with a manual override option. If adequate levels of safety cannot be achieved voluntarily, a mandatory federal safety standard may be necessary.
3. Designs for mower controls should continue to be improved for ease of operation and to minimize inadvertent control contact and unintended operation.
4. Young children must not be allowed to play in or be adjacent to areas where lawn mowers are being used. Children younger than 6 years should be kept indoors during mowing.
5. Children must not be allowed to ride as passengers on mowers or to be towed behind mowers in carts or trailers. They should not be permitted to play on or around the mower when it is in use or in storage.
6. Children should not operate lawn mowers until they have displayed the necessary levels of judgment, strength, coordination, and maturity. They should also be educated in mower operation and safety and be supervised by an adult before they are allowed to operate a mower by themselves. Most children will not be ready to operate a walk-behind power mower or hand mower until at least 12 years of age or a ride-on mower until at least 16 years of age.
7. Evaluation is needed of the effectiveness of education programs and curricula for lawn mower operators, as well as the effectiveness of public awareness and education initiatives regarding lawn mower safety.

Advice pediatricians may provide to parents is specified in the accompanying policy statement,[13] along with a patient education sheet for duplication and distribution.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Joint Statement—Learning Disabilities, Dyslexia, and Vision

AMERICAN ACADEMY OF PEDIATRICS, SECTION ON OPHTHALMOLOGY, COUNCIL ON CHILDREN WITH DISABILITIES
AMERICAN ACADEMY OF OPHTHALMOLOGY
AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS
AMERICAN ASSOCIATION OF CERTIFIED ORTHOPTISTS

KEY WORDS
learning disabilities, vision, dyslexia, ophthalmology, eye examination

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abstract

Learning disabilities, including reading disabilities, are commonly diagnosed in children. Their etiologies are multifactorial, reflecting genetic influences and dysfunction of brain systems. Learning disabilities are complex problems that require complex solutions. Early recognition and referral to qualified educational professionals for evidence-based evaluations and treatments seem necessary to achieve the best possible outcome. Most experts believe that dyslexia is a language-based disorder. Vision problems can interfere with the process of learning; however, vision problems are not the cause of primary dyslexia or learning disabilities. Scientific evidence does not support the efficacy of eye exercises, behavioral vision therapy, or special tinted filters or lenses for improving the long-term educational performance in these complex pediatric neurocognitive conditions. Diagnostic and treatment approaches that lack scientific evidence of efficacy, including eye exercises, behavioral vision therapy, or special tinted filters or lenses, are not endorsed and should not be recommended. *Pediatrics* 2009;124:837–844

BACKGROUND

Reading is the process of extracting meaning from written symbolic characters. In elementary school, a large amount of time and effort is devoted to the complicated task of learning to read. Because of the difficulties that some children experience with learning to read, Congress mandated that the Eunice Kennedy Shriver National Institute of Child Health and Human Development assemble a national panel of educators and scientists to review the literature to research the optimal methods of teaching children to read. The 2000 report of the National Reading Panel titled "Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction"[1] linked research findings with recommendations for specific approaches to teaching reading to all children.

Learning disabilities remain a concern for the children and families involved and for the public. The inability to read and comprehend is a major obstacle to learning, which may have long-term educational, social, and economic consequences. Depending on the definition chosen, 5% to 17.5% of people in the United States have a learning disability, with an estimated 2.6 million children aged 6 to 11 years affected.[2] Learning disabilities often prevent children from reaching their full potential. They may cause children to have difficulty learning to listen,

speak, read, spell, write, reason, concentrate, solve mathematical problems, and organize information. These children may also have difficulty mastering social skills or motor coordination. Learning difficulties are frequently associated with and complicated by attention-deficit/hyperactivity disorder.[2] Left untreated, learning difficulties may lead to frustration, low self-confidence, and poor self-esteem and substantially increase the risk of developing psychological and emotional problems.[3]

Approximately 80% of people with learning disabilities have dyslexia.[2,4–7] The terms "reading disability" and "dyslexia" are often used interchangeably in the literature.[8] Dyslexia is a primary reading disorder and results from a written word processing abnormality in the brain.[2,4] It is characterized by difficulties with accurate and/or fluent sight word recognition and by poor spelling and decoding abilities. These difficulties are unexpected in relation to the child's other cognitive skills. Dyslexia has been identified as having a strong genetic basis.[2,8,9] Recent genetic-linkage studies have identified many loci at which dyslexia-related genes are encoded. Approximately 40% of siblings, children, or parents of an affected individual will have dyslexia. Although dyslexia is often inherited, it may exist in the absence of a family history. Dyslexia can be mild or severe, occurs throughout the world, seems to affect boys more than girls,[10] involves children with all levels of intelligence, and can persist for a lifetime.[2,4,5,8,11,12] Dyslexia is identified in some people early in their lives but in others is not diagnosed until much later, when more complex reading and writing skills are required. People with dyslexia can be very bright and may be gifted in math, science, the arts, or even in unexpected areas such as writing.[12] Dyslexia should be separated from other secondary forms of reading difficulties caused by visual or hearing disorders, mental retardation, and experiential or instructional deficits.[2,8] Early reading difficulties may be caused by experiential and instructional deficits.[8] It is important to identify and address such causes of secondary reading difficulties.[5,8]

Oral language development has been found to play a critical role in learning to read.[1] Unlike speaking, reading and writing do not develop naturally and require active learning. Reading is more difficult than speaking, because children must be aware of the sound structure in spoken language and then break the alphabetic code to acquire the sound/symbol connection.

English is a phonemically complex language in which the 26 letters of the alphabet create 44 sounds, or phonemes, in approximately 70 letter combinations.[6,7,13] The phonemic complexity of an alphabet-based language corresponds to the prevalence of dyslexia, pointing to the linguistic origin of dyslexia.[8,14] Reading involves the integration of multiple factors related to a person's experience, ability, and neurologic functioning. Most people with dyslexia have a neurobiological deficit in the processing of the sound structure of language, called a phonemic deficit,[1,2,4–8,11,13,15] which exists despite relatively intact overall language abilities.[2,4–7] Children with more severe forms of dyslexia may have a second deficit in naming letters, numbers, and pictures, creating a double deficit,[8,16] or they may have problems with their attention or working memory.[8] Other children may have trouble orienting, recognizing, and remembering letter combinations.[8,17] This difficulty may be a neuromaturational delay that improves with development. Importantly, the definition of dyslexia does not include reversal of letters or words or mirror reading or writing, which are commonly held misconceptions.[8,12,14]

Research has shown that most children and adults with reading disabilities experience a variety of problems with language[1,2,4–8,11,13] that stem from altered brain function.[2,4,8,18–29] There is solid scientific evidence that supports the neurologic basis for the phonological coding deficit theory of reading disabilities.[2,4–8,18–29] Scientific research using functional MRI studies and positron emission tomography scans has shown that reading takes place predominantly in left-hemisphere sites including the inferior frontal, superior temporal, parietotemporal, and middle temporal-middle occipital gyri in typical readers. Children with dyslexia, on the other hand, use different areas of the brain when reading.[2,4,18–29] People with dyslexia demonstrate a dysfunction in the left-hemisphere posterior reading systems and show compensatory use of the inferior frontal gyri of both hemispheres and the right occipitotemporal area.[2,4,18–29] People with dyslexia have an abnormality in the word-analysis pathways that interferes with their ability to convert written words into spoken words. These dyslexia-specific brain abnormalities have been shown to improve after successful phonologically based intervention.[19,28,29]

THE ROLE OF THE VISUAL SYSTEM AND THE EYES

Visual processing is a higher cortical function.[8,30] Decoding and interpretation of retinal images occur in the brain after visual signals are transmitted from the eyes. Reading print involves adequate vision and the neurologic ability to identify what is seen. Although vision is fundamental for reading, the brain must interpret the incoming visual images. Historically, many theories have implicated defects in the visual system as a cause of dys-

lexia. We now know these theories to be untrue. Improved understanding began with a series of related studies that systematically demonstrated that deficits in visual processes, such as visualization, visual sequencing, visual memory, visual perception, and perceptual-motor abilities, were not basic causes of reading difficulties.[8] Difficulties in maintaining proper directionality have been demonstrated to be a symptom, not a cause, of reading disorders.[8,30,31] Word reversals and skipping words, which are seen in readers with dyslexia, have been shown to result from linguistic deficiencies rather than visual or perceptual disorders.[8]

Specific reading disability in a small subset of patients with dyslexia has been attributed by some researchers to a deficit in the magnocellular visual system.[32–35] The visual system comprises 2 parallel systems: the magnocellular system and the parvocellular system.[32] The magnocellular system responds to high temporal frequency and object movement, and the parvocellular system is sensitive to low-frequency and fine spatial details.[32] It has been proposed that a magnocellular system deficit produces a visual trace of abnormal longevity that creates a masking effect and causes visual acuity blurring when reading connected text in some children with dyslexia.[35] There are study results that support this theory[32–35] and others that refute it.[36–44] Many researchers have concluded that magnocellular system deficits and associated visual trace persistence are not a significant cause of specific reading disability.[8,36–43] At the present, there is insufficient evidence to base any treatment on this possible deficit.

Short-duration, high-velocity, small jumping eye movements called saccades are used for reading. Readers with dyslexia characteristically have saccadic eye movements and fixations similar to the beginning reader but show normal saccadic eye movements when content is corrected for ability.[30,31] The saccadic patterns seen in readers with dyslexia seem to be the result, not the cause, of their reading disability.[30,31,45,46] Decoding and comprehension failure, rather than a primary abnormality of the oculomotor control systems, is responsible for slow reading, increased duration of fixations, and increased backward saccades.[46] Children with dyslexia often lose their place while reading because they struggle to decode a letter or word combination and/or because of lack of comprehension, not because of a "tracking abnormality." Improving reading has been shown to change saccadic patterns, but there has been no evidence to suggest that saccadic training results in better reading. Finally, children with saccadic disorders do not show an increased likelihood of dyslexia.[47] As indicated above, dyslexia is not correlated with eye or eye-movement abnormalities.[8,30,31,45–59]

Other conditions may affect reading. Convergence insufficiency and poor accommodation, both of which are uncommon in children, can interfere with the physical act of reading but not with decoding.[14] Thus, treatment of these disorders can make reading more comfortable and may allow reading for longer periods of time but does not directly improve decoding or comprehension.[14]

Numerous studies have shown that children with dyslexia or related learning disabilities have the same visual function and ocular health as children without such conditions.[8,30,31,45,46,48–59] Specifically, subtle eye or visual problems, including visual perceptual disorders, refractive error, abnormal focusing, jerky eye movements, binocular dysfunction, and misaligned or crossed eyes, do not cause dyslexia.[8,30,31,45,46,48–59] In summary, research has shown that most reading disabilities are not caused by altered visual function.[8,30,31,45,46,48–59]

Many children with reading disabilities enjoy playing video games, including handheld games, for prolonged periods. Playing video games requires concentration, visual perception, visual processing, eye movements, and eye-hand coordination. Convergence and accommodation are also required for handheld games. Thus, if visual deficits were a major cause of reading disabilities, children with such disabilities would reject this vision-intensive activity.

EARLY DETECTION

A family history of learning disabilities should keep parents, teachers, and physicians alert to this possibility. A history of delay or difficulty in developing speech and language, learning rhymes, or recognizing letters and sound/symbol connections may be an early indication of dyslexia.[2,4,5,8] Parents or teachers may detect early signs of learning difficulties in preschool-aged children; however, in most cases, learning disabilities are not discovered until children experience academic difficulties in elementary school.[2,4] The child may have difficulty with reading, spelling, handwriting, remembering words, or performing mathematical computation. Because remediation is more effective during the early years, prompt diagnosis is important.[1,2,4–8,13,15,60] The effect that dyslexia has may be different for each person and depends on the severity of the condition and the effectiveness and timeliness of instruction or remediation.

THE ROLE OF EDUCATION

The educational system has the triple responsibility of early detection, evaluation, and treatment of chil-

dren with learning disabilities. Elementary school teachers are often the first to detect learning difficulties. Assessments for difficulties with alphabet recognition in kindergarten and difficulties with phonemic awareness and rapid naming in kindergarten and first grade can predict many of those who will have difficulty learning to read.[1,2,5–8,13,15] Because early reading difficulties may be caused primarily by experiential and instructional deficits, there are 2 approaches that can be used in the young underachieving child.[8] In the traditional approach, the child would need to show significant underachievement before referral, assessment, and remediation. In the response-to-intervention method, the child will be placed directly in an educational intervention program when he or she first experiences academic difficulties. Only the children who do not show significant improvement with both the group-intervention first-tier program and second-tier targeted intensive individual intervention will undergo a full educational assessment.[8,61,62] Ideally, the response-to intervention approach will allow earlier identification of learning disabilities than the "wait-to-fail" situation that occurs when an ability achievement discrepancy formula is used to determine if a student qualifies for an evaluation of a learning disability.[62]

Because dyslexia is a language-based disorder, treatment should be directed at this etiology.[1,2,4–8,13,15,60] Most students with dyslexia require highly structured, intensive, individualized instruction by a teacher or educational therapist who was specially trained explicitly in teaching the application of phonics.[1,2,4–8,13,15] Longitudinal data indicate that systematic phonics instruction results in more favorable outcomes for readers with disabilities than does a context-emphasis (whole-language) approach.[1,4,8,13,15,60] The critical elements of effective intervention include individualization, feedback and guidance, ongoing assessment, and regular ongoing practice.[4]

Remediation programs should include specific instruction in decoding, fluency training, vocabulary, and comprehension.[1,4–8,13,15] The approach to learning decoding skills begins with explicit instruction in recognizing spoken sounds (phonemic awareness), becoming aware of rhyme, learning the alphabetic code, memorizing sight words, and studying phonics and spelling.[6–8] A child must first accurately decode a word before it can be read fluently.[4,6–8] The home is the ideal setting for practice and reinforcement. Just as an athlete must practice to optimize his or her skills, the child should read aloud to a parent or tutor each day to practice decoding, memorize new sight words, and develop greater fluency by rereading of previously decoded and memorized words.[4] Fluency forms the bridge between decoding and comprehension.[4,6–8] Comprehension is gained through fluency training, vocabulary instruction, and active reading comprehension.[4] Techniques that enhance active reading comprehension include prediction, summarization, visualization, clarification, critical thinking, making inferences, and drawing conclusions.[2,4,6–8,13] Because people with dyslexia have a persistent problem and continue to have slower reading throughout their lives, accommodations and modifications may be necessary in addition to remediation.[2,4] Examples of accommodations include extra time, shortened assignments, a separate quiet room for taking tests, testing alternatives, computers, spell checkers, tape recorders, lecture notes, recorded books, and tutors.[2,4,11]

A MULTIDISCIPLINARY APPROACH

The diagnosis and treatment of learning disabilities depend on the collaboration of a team that may include educators; educational remediation specialists; audiologists; speech, physical, and occupational therapists; teachers for the visually impaired; psychologists; and physicians. Children with learning disabilities should undergo assessments of their health, development, hearing, and vision and, when appropriate, medical and psychological interventions for associated and related treatable conditions.[63]

A formal evidence-based evaluation is needed to discover whether a child has a learning disability. Educational psychologists and neuropsychologists diagnose learning disabilities by performing appropriate testing as part of an educational assessment of the child's abilities and disabilities. A formal assessment for learning disabilities should include evaluation of cognition, memory functions, attention, intellectual ability, information processing, psycholinguistic processing, expressive and receptive language function, academic skills, social-emotional development, and adaptive behavioral functioning. These results are used to develop an individualized education plan (IEP), which includes evidence-based educational remediations, accommodations, and modifications.[2,4,7,13] Educational therapists or educators with specialized training in learning disabilities play a key role by designing and implementing remedial programs and monitoring the student's progress.

Audiologists can identify hearing problems. Speech therapists can evaluate and treat underlying oral language difficulties often associated with dyslexia and help students learn phonological awareness. Physical and occupational therapists do not treat dyslexia but do treat fine and gross motor difficulties or sensory problems that may be associated with learning disabilities. Children with low vision and learning disabilities may benefit from having a

teacher of the visually impaired. Psychiatrists, psychologists, neurologists, and specialty-trained pediatricians can diagnose associated comorbid conditions. Psychiatrists, clinical psychologists, licensed clinical social workers, or licensed mental health counselors can provide strategies to help children adapt to their disabilities and provide therapy to address concurrent psychological disorders. Psychiatrists, neurologists, or specialty-trained pediatricians may prescribe medications. The role of other physicians will be elaborated in a later section of this statement.

THE ROLE OF PARENTS

Parental participation in a child's education is of utmost importance. Families with a history of dyslexia should observe their children for early language difficulties. Reading to their preschool-aged child and having their child read to them as soon as he or she is able allows parents to detect early signs of learning difficulties. Parents should collaborate with early elementary school teachers to monitor their child for academic struggles. Parents need to serve as the child's advocate, speaking with the child's teacher, pediatrician, and other professionals; requesting an educational evaluation; and coordinating remediation and other treatment. By educating themselves in the areas of learning disabilities, available services, and state education rules and regulations, parents will increase their effectiveness as the child's advocate. After a child has been diagnosed with a learning disability, an individualized educational plan or a Section 504 plan may be created. Parents should work with educators to ensure that the school provides the proper remediation and accommodations. Children with dyslexia should read aloud to their parents frequently. Parents should help with practice and reinforcement at home in a supportive and nurturing environment with adequate opportunity for their child to participate in activities in which he or she excels. As the child gets older, parents should help their child use recommended alternative learning strategies such as books on tape or computers. Parents should continue to monitor their child's progress and advocate for their child when necessary.

Because of the complex nature of learning disabilities, including dyslexia, there are no simple remedies. Teaching children with dyslexia and learning disabilities can be a challenge for educators and parents. With proper remediation, accommodations, and support, children with dyslexia and learning disabilities can succeed.

THE ROLE OF THE PHYSICIAN

Physicians, including pediatricians, family physicians, otolaryngologists, neurologists, ophthalmologists, mental health professionals, and other relevant medical specialists, may participate in the comprehensive care of children with learning disabilities including dyslexia. Pediatricians should not diagnose learning disabilities[63] but should inquire about the child's educational progress and be vigilant in looking for early signs of evolving learning disabilities.[63] When a child has suspected learning difficulties, the pediatrician or family physician should first assess the child for medical problems that could affect the child's ability to learn and refer him or her for further evaluation if deemed appropriate.[63,64]

Pediatricians and family physicians have an extremely important function in acting as a medical home by helping parents decide whether further evaluations are needed and in coordinating care for the child after a diagnosis has been made.[63,64] Primary care physicians who have a strong role in assisting school districts should only recommend evidence-based treatments and accommodations. Pediatricians and family physicians should provide information and support to parents on learning disabilities and their treatment and should dispel the myths surrounding these disorders.[30] This should include discussion regarding the lack of efficacy of vision therapy and other "alternative treatments" with the parents.[30] Parents need to be informed that dyslexia is a complex disorder and that there are no quick cures. The American Academy of Pediatrics has information for families on what parents need to know about learning disabilities.[65] The primary care physician should compile and provide a resource list of local specialists from whom the child can obtain proper help and from whom the family members can learn to become advocates for the child.[63]

The Individuals With Disabilities Education Act, Section 504 of the Rehabilitation Act, and the Americans With Disabilities Act define the rights of students with dyslexia and other specific learning disabilities.[66,67] These acts allow parents to request a formal educational evaluation by the school district to determine eligibility for special education and related services. Information for pediatricians on this legislation and its associated rights and procedures is available from the American Academy of Pediatrics.[63,64] Physicians can refer parents of children with learning disabilities to their state's parent training and information center. These parent-directed centers provide information and technical assistance to parents and professionals regarding family and student rights and responsibilities in special education.

For all children, primary care physicians should perform hearing and vision screenings according to national standards[68] so that hearing, ocular, and visual disorders are identified as early as possible. Periodic eye and vi-

sion screenings can identify children who have reduced visual acuity or other visual disorders. Vision screening with nonletter symbols may be necessary for testing children with dyslexia or other learning disabilities.

Children who do not pass vision screening should be referred to an ophthalmologist with experience in the care of children.[68] In addition, the recommended routine pediatric vision screenings are unlikely to disclose near-vision problems such as convergence insufficiency, accommodative insufficiency, and significant hyperopia. Children with suspected learning disabilities in whom a vision problem is suspected by the child, parents, physicians, or educators should be seen by an ophthalmologist with experience in the assessment and treatment of children, because some of these children may also have a treatable visual problem that accompanies or contributes to their primary reading or learning dysfunction.[30,45,58] Treatable ocular conditions can include strabismus, amblyopia, convergence and/or focusing deficiencies, and refractive errors. Missing these problems could cause long-term consequences from assigning these patients to incorrect treatment categories.

The ophthalmologist should identify and treat any significant visual defect according to standard principles of treatment.[69,70] Strabismus, amblyopia, and refractive errors may require glasses, eye patching, eye drops, or eye-muscle surgery. Symptomatic convergence insufficiency can be treated with near-point exercises, prism-convergence exercises, or computer-based convergence exercises. Most of these exercises can be performed at home, and extensive in-office vision therapy is usually not required.[71–73] Alternatively, for other patients, reading glasses with base-in prism[73] or minus-lenses can be used as treatment. Treating convergence insufficiency can make reading more comfortable but does not improve the decoding or understanding of reading.[14] If no ocular or visual disorder is found, the child needs no further vision assessment or management. The ophthalmologist should not diagnose learning disabilities but should provide information on learning disabilities and reinforce the need for additional medical, psychological, educational, or other appropriate evaluation or services. In addition, the ophthalmologist should discuss the lack of efficacy of vision therapy and other "alternative treatments" with the parents. The American Academy of Ophthalmology has a patient-education brochure for families titled "Learning Disabilities."[74] The ophthalmologist, when necessary, should compile and provide a resource list of local specialists who can help obtain proper help for the child.[69]

CONTROVERSIES

Because they are difficult for the public to understand and for educators to treat, learning disabilities have spawned a wide variety of controversial and scientifically unsupported alternative treatments, including vision therapy.* Scientific evidence of effectiveness should be the basis for treatment recommendations.[4,45,60] Treatments that have inadequate scientific proof of efficacy should be discouraged. Ineffective, controversial methods of treatment such as vision therapy may give parents and teachers a false sense of security that a child's learning difficulties are being addressed, may waste family and/or school resources, and may delay proper instruction or remediation.[45]

Currently, there is inadequate scientific evidence to support the view that subtle eye or visual problems, including abnormal focusing, jerky eye movements, misaligned or crossed eyes, binocular dysfunction, visual-motor dysfunction, visual perceptual difficulties, or hypothetical difficulties with laterality or "trouble crossing the midline" of the visual field, cause learning disabilities.[8,30,31,45,46,48–59] Statistically, children with dyslexia or related learning disabilities have the same visual function and ocular health as children without such conditions.[8,30,31,45,46,48–59] Because visual problems do not underlie dyslexia, approaches designed to improve visual function by training are misdirected.[31,47,56,57,69,78] Other than convergence-insufficiency treatment,[70–73,79,81,95,96] scientific evidence does not support the assumption that vision therapy is capable of correcting subtle visual defects,† nor does it prove eye exercises or behavioral vision therapy to be effective direct or indirect treatments for learning disabilities.‡ Detailed review of the literature supporting vision therapy reveals that most of the information is poorly validated, because it relies on anecdotes, poorly designed studies, and poorly controlled or uncontrolled studies.§ Their reported benefits can often be explained by the placebo effect or by the traditional educational remedial techniques with which they are usually combined.[30,45,46,55,57,58,78,79] There is currently no evidence that children who participate in vision therapy are more responsive to educational instruction than are children who do not participate.‖ Thus, current evidence is of poor scientific quality and does not provide adequate scientific evidence that vision training is a necessary primary or adjunctive therapy.¶

*Refs 2, 8, 30, 31, 45, 46, 55–58, 69, 70, and 75–94.

†Refs 14, 30, 31, 45, 46, 55, 57, 58, 69, 70, 77, and 79–81.

‡Refs 2, 4, 8, 14, 30, 31, 45, 46, 55–58, 69, 70, and 76–82.

§Refs 30, 31, 45, 46, 55–58, 69, 70, and 76–81.

‖Refs 2, 4, 8, 14, 30, 31, 45, 46, 55–58, 69, 70, and 76–82.

¶Refs 2, 4, 8, 14, 30, 31, 45, 46, 55–58, 69, 70, and 76–82.

Tinted lenses and filters have been suggested to treat visual perceptual dysfunctions that lead to visual distortion caused by sensitivities to particular wavelengths of light but not to treat language-based dyslexia.[97] Scrutiny of published study results that advocated the use of these therapies to treat dyslexia have shown serious flaws in their methods and have not been sufficiently well controlled to support this assertion.[30,70,84,85,88] There have also been many inconsistencies in the results,[89,98,99] with some studies showing some partial positive results[100–106] and others showing negative results.[84,86,90–94] The method used to select the lens or filter color has been highly variable,[89,104,106] the color selection has also shown considerable variability,[104] and the test-retest consistency has been poor.[107] Many of the studies that have been cited as proof of Irlen-lens efficiency have actually been inconclusive after deeper analysis. The evidence does not support the effectiveness of tinted lenses and tinted filters in these patients because of the weaknesses in methodology and statistics, variability in techniques in the trials, and the largely negative results.[8,30,45,70,76,83–94,107]

RECOMMENDATIONS

1. Children who exhibit signs of learning disabilities should be referred as early in the process as possible for educational, psychological, neuropsychological, and/or medical diagnostic assessments.
2. Children with learning disabilities should receive appropriate support and individualized evidence-based educational interventions combined with psychological and medical treatments as needed.
3. Families of children with suspected learning disabilities should receive information about state and local parent support programs.
4. Pediatricians and family physicians should perform periodic eye and vision screening for all children according to national standards and refer those who do not pass screening to ophthalmologists who are experienced in the care of children.
5. Children with a suspected or diagnosed learning disability in which vision is felt to play a role by parents, the child, educators, or physicians should be referred to an ophthalmologist with experience in the care of children, because routine pediatric vision screening is not designed to detect near-vision problems.
6. Ophthalmologists should identify and treat any significant ocular or visual disorder found to be present.
7. Primary care physicians should only recommend evidence-based treatments and accommodations to school districts.
8. Diagnostic and treatment approaches for dyslexia that lack scientific evidence of efficacy such as behavioral vision therapy, eye-muscle exercises, or colored filters and lenses are not endorsed or recommended.

SUMMARY

Dyslexia and learning disabilities are complex problems that have no simple solutions. The most widely accepted view is that dyslexia is a language-based disorder. The American Academy of Pediatrics, the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus, and the American Association of Certified Orthoptists strongly support the need for early diagnosis and educational intervention.

Recommendations for multidisciplinary evaluation and management must be based on evidence of proven effectiveness that is demonstrated by objective scientific methodology.[4,45,60] It is important that any therapy for learning disabilities be scientifically established to be valid before it can be recommended for treatment.[60]

Currently, there is no adequate scientific evidence to support the view that subtle eye or visual problems cause learning disabilities.[8,30,31,45,46,48–59] Furthermore, the evidence does not support the concept that vision therapy or tinted lenses or filters are effective, directly or indirectly, in the treatment of learning disabilities.# Thus, the claim that vision therapy improves visual efficiency cannot be substantiated. Diagnostic and treatment approaches that lack scientific evidence of efficacy are not endorsed or recommended.

With early recognition and individualized, interdisciplinary management strategies, children with learning disabilities can enjoy successful academic experiences.

#Refs 2, 4, 8, 14, 30, 31, 45, 46, 55–58, 69, 70, 76–88, and 90–94.

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OTHER RESOURCES

International Dyslexia Association: www.interdys.org

National Center for Learning Disabilities: www.ncld.org

Learning Disabilities OnLine: www.ldonline.org

Interdisciplinary Council on Developmental and Learning Disorders: www.icdl.com

Great Schools Inc/Schwab Learning: www.schwablearning.org

All Kinds of Minds: www.allkindsofminds.org

Children and Adults With Attention Deficit/Hyperactivity Disorder: www.chadd.org

National Center for the Study of Adult Learning and Literacy: www.ncsall.net

Parent Advocacy Coalition for Educational Rights Center: www.pacer.org

Parental Information and Resource Centers: www.ed.gov/programs/pirc/index.html

Family Voices: www.familyvoices.org

American Academy of Pediatrics
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Joint Technical Report—Learning Disabilities, Dyslexia, and Vision

abstract

FREE

Learning disabilities constitute a diverse group of disorders in which children who generally possess at least average intelligence have problems processing information or generating output. Their etiologies are multifactorial and reflect genetic influences and dysfunction of brain systems. Reading disability, or dyslexia, is the most common learning disability. It is a receptive language-based learning disability that is characterized by difficulties with decoding, fluent word recognition, rapid automatic naming, and/or reading-comprehension skills. These difficulties typically result from a deficit in the phonologic component of language that makes it difficult to use the alphabetic code to decode the written word. Early recognition and referral to qualified professionals for evidence-based evaluations and treatments are necessary to achieve the best possible outcome. Because dyslexia is a language-based disorder, treatment should be directed at this etiology. Remedial programs should include specific instruction in decoding, fluency training, vocabulary, and comprehension. Most programs include daily intensive individualized instruction that explicitly teaches phonemic awareness and the application of phonics. Vision problems can interfere with the process of reading, but children with dyslexia or related learning disabilities have the same visual function and ocular health as children without such conditions. Currently, there is inadequate scientific evidence to support the view that subtle eye or visual problems cause or increase the severity of learning disabilities. Because they are difficult for the public to understand and for educators to treat, learning disabilities have spawned a wide variety of scientifically unsupported vision-based diagnostic and treatment procedures. Scientific evidence does not support the claims that visual training, muscle exercises, ocular pursuit-and-tracking exercises, behavioral/perceptual vision therapy, "training" glasses, prisms, and colored lenses and filters are effective direct or indirect treatments for learning disabilities. There is no valid evidence that children who participate in vision therapy are more responsive to educational instruction than children who do not participate. *Pediatrics* 2011;127:e818–e856

Sheryl M. Handler, MD, Walter M. Fierson, MD, and the SECTION ON OPHTHALMOLOGY AND COUNCIL ON CHILDREN WITH DISABILITIES, AMERICAN ACADEMY OF OPHTHALMOLOGY, AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS, AND AMERICAN ASSOCIATION OF CERTIFIED ORTHOPTISTS

KEY WORDS

learning disabilities, vision, dyslexia, ophthalmology, eye examination, vision therapy

ABBREVIATIONS

ADHD—attention-deficit/hyperactivity disorder
IDEA—Individuals With Disabilities Education Act
ADA—Americans With Disabilities Act
IEP—individualized education plan
EBM—evidence-based medicine
SSS—scotopic sensitivity syndrome

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

This technical report supports the joint policy statement from the American Academy of Pediatrics, American Academy of Ophthalmology, American Academy of Pediatric Ophthalmology and Strabismus, and American Association of Certified Orthoptists titled "Learning Disabilities, Dyslexia, and Vision," which is available at www.aap.org (direct link: www.aappolicy.org/cgi/reprint/pediatrics;124/2/837.pdf) and www.aao.org(direct link: www.aao.org/about/policy/upload/Learning-Disabilities-Dyslexia-Vision-2009.pdf).

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INTRODUCTION

Reading is the complex process of extracting meaning from abstract written symbols. In modern societies, reading is the most important way to access information, and in today's Western society, literacy is a prerequisite for success. In elementary school, a large amount of time and effort is devoted to the complicated process of learning to read. Because of the difficulties encountered in teaching some children to read, Congress mandated that the Eunice Kennedy Shriver National

Institute of Child Health and Human Development assemble a national panel of educators and scientists to research the optimal methods of teaching children to read. The 2000 report of the National Reading Panel, titled *Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction*,[1] linked research findings with recommendations for specific approaches to teaching reading to all children. The panel concluded that existing evidence supported early explicit instruction in phonemic awareness, phonics-based reading programs, and guided oral reading to improve fluency.

Learning disabilities may interfere with children reaching their full potential. The inability to read and comprehend is a major obstacle to learning that may have long-term educational, social, and economic implications. Teaching children with reading difficulties is a challenge for the student, parents, and educators. Therefore, the causes and treatment of reading disorders have been the subject of considerable thought and study.

This report discusses how we learn to read, the phonologic model, the recognition and treatment of reading difficulties, visual function and reading, the magnocellular deficit theory, colored lenses and overlays, vision therapy, and the roles of the pediatrician and ophthalmologist.

BACKGROUND

History

In 1877, Kussmal[2,3] first described a case of acquired word blindness in an adult alexic patient with a parietal lobe lesion. Hinshelwood,[2,4] an ophthalmologist from Scotland, studied and described an adult with word blindness in 1895. In 1903, an autopsy of this patient revealed abnormalities in the left angular gyrus immediately posterior to Wernicke's area.[4] Morgan,[2,5] a general practitioner from England, published the first case of a child with congenital word blindness in 1896. Subsequently, Hinshelwood turned his attention to both congenital and acquired word blindness. He credited the term "dyslexia" to Berlin.[6] In 1917, he highlighted the potentially inherited aspect of reading disability. Hinshelwood estimated that 1 in 1000 students in elementary schools might have word blindness and postulated that the primary disability was in visual memory for words and letters. He strongly advocated intensive, individualized personal instruction.[2,4]

Beginning in the 1920s, Orton,[2,7,8] a neuropsychiatrist, demonstrated a hereditary component for reading disabilities in children. His studies led to an expanded definition of reading disabilities that was much broader than Hinshelwood's and included a graded series of all degrees of severity of disability. This more liberal definition increased the presumed prevalence to more than 10% of schoolchildren. IQ testing revealed that these children scored near or above average. In 1925, Orton attributed dyslexia to a problem in the visual system, which suggests that an apparent dysfunction from "mixed cerebral dominance" caused problems in visual perception and visual memory, characterized by perception of letters and words in reverse.

The theory that visual dysfunction caused dyslexia led to a proliferation of training programs developed for visual-perceptual and/or visual-motor disabilities. In the 1960s, those prominent in developing and promoting these programs included Kephart, Frostig, Getman, Barsch, Dorman, and Delacato. Research into the programs revealed that, although these programs were sometimes effective in improving perceptual and/or perceptual-motor development, they were ineffective in improving academic performance.[9–12] Although the use of perceptual and perceptual-motor training by educators persisted for a time, by the mid-1980s its use had waned considerably.

Attempts at improved understanding of dyslexia led to the rejection of the visual theories. This process began with a series of related studies that systematically evaluated traditional and widely accepted etiologic conceptualizations, such as Orton's optical reversibility theory,[7] Hermann's spatial confusion theory,[13] and other theories that implicated deficits in visual processes, such as visualization, visual sequencing, and visual memory, as basic causes of reading difficulties.[14,15]

Although Orton attributed dyslexia to visual dysfunction, he was the first to advocate intensive phonics instruction, sound-blending, and multisensory training.[2,8] Orton's work served as the stimulus for Gillingham and Stillman,[16] who also emphasized multisensory training. Subsequently, the Orton-Gillingham phonics techniques have served as the basis for many remediation programs. The International Dyslexia Society, formerly the Orton Dyslexia Society, provides information and resources to professionals and parents regarding reading disabilities.

Learning Disabilities

Learning disabilities constitute a diverse group of disorders in which children who generally possess at least average intelligence have problems processing information or generating output. Learning disabilities can affect neurocognitive processes and may manifest as an imperfect ability to listen, speak, read, spell, write, reason, concentrate, solve mathematical problems, or organize information. Some children may have associated difficul-

ties with motor coordination. Learning difficulties can be associated with and complicated by attention-deficit/hyperactivity disorder (ADHD),[17,18] oppositional defiant disorder, obsessive compulsive disorder, anxiety, or depression.[19] Problems in self-regulatory behaviors, social perception, and social interaction may exist with learning disabilities but do not, by themselves, constitute a learning disability. Although learning disabilities may occur concomitantly with other disabilities (eg, sensory impairment, intellectual disability, serious emotional disturbance) or with extrinsic influences (eg, cultural differences, insufficient or inappropriate instruction), they are not the result of those conditions or influences.[20] Results of recent studies suggest that approximately 20% of the population has some degree of a learning disability.[21] In 2007, 2.7 million public school students (5.5% of all students in public schools) were identified as having learning disabilities and were eligible to receive educational assistance under the Individuals With Disabilities Education Act (IDEA).[22]

Specific learning disabilities include dyslexia (reading disability), dysgraphia (writing disability), and dyscalculia (mathematics disability). Although not included in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*[23] as a specific learning disability, nonverbal learning disability comprises difficulties with social interactions, interpersonal skills, nonverbal problem-solving, visuospatial skills, motor skills, reading comprehension, and mathematics and often coexists with strengths in verbal skills and with fluent and accurate reading.[23] Autism spectrum disorder, although not a specific learning disability, certainly affects learning, because people with autism have difficulties with verbal and nonverbal communication, social interactions, and motor function and may show inappropriate response to sensory information.[23]

Dyslexia

Difficulties in reading are found in a diverse group of conditions that include dyslexia and secondary forms of reading difficulties caused by visual or hearing disorders, intellectual disability, experiential and/or instructional deficits, and other problems.[14,24–26] Dyslexia is defined as a primary reading disorder that is separate from secondary forms.[14,24–26] The terms "specific reading disability," "reading disability," "reading disorder," and "dyslexia" are often used interchangeably in the literature.[14] The term "dyslexia" is derived from Greek and means "difficulty with reading words." Dyslexia is often unexpected in relation to the child's other cognitive abilities. It is a receptive language-based learning disability that is characterized by difficulties with decoding, fluent word recognition, and/or reading-comprehension skills. These difficulties typically result from a deficit in the phonologic component of language that makes it difficult to use the alphabetic code to decode the written word. Secondary consequences may include reduced reading experience that can impede growth of vocabulary, written expression, and background knowledge.[27] A common misconception is that dyslexia is a problem of letter or word reversals. Reversals of letters or words and mirror writing occur normally in early readers and writers. Children with dyslexia are not unusually prone to reversals. Although they do occur, reversal of letters or words, or mirror writing, is not included in the definition of dyslexia.[14,28,29] People with dyslexia may be very creative and bright. In many cases, their high-level thinking is unaffected, and they may be gifted in mathematics, science, the arts, or even in unexpected areas such as writing.[28] People with dyslexia read slowly, but not all people who read slowly have dyslexia.

Approximately 80% of people with learning disabilities have dyslexia, which makes it the most common learning disability.[24,25,30–35] Depending on the definition chosen, the prevalence of reading disability is approximately 5% to 20% of school-aged children in the United States.[21,24,31,34] Reading disabilities seem to affect males slightly more than females,[36–38] although schools identify boys with them twice as often as girls.[22,31] Both environmental and genetic influences affect the expression of dyslexia.[39] Dyslexia has been identified as having a strong genetic basis.[14,24–26,30,31,40,41] Approximately 40% of siblings, children, or parents of an affected person will have dyslexia. Although dyslexia may be inherited, it may also exist in the absence of a family history. Results of family and twin studies have suggested that 50% of the problems in performance can be accounted for by heritable factors; environmental influences are greater in children with lower IQ scores.[42]

Reading ability and reading disability occur along a continuum; reading disability is represented within the lower tail of a normal bell-shaped distribution of reading ability.[21] The lower tail is actually composed of reading difficulties from both primary dyslexia and secondary causes. Dyslexia is a lifelong condition that varies in degrees of severity. Most children with reading disabilities have relatively mild reading disabilities, and a smaller number of them have more severe reading disabilities.[21,30] Because reading skills occur on a continuum with no clear distinction between typical readers and readers with dyslexia, some experts assert that the term "dyslexia" should be reserved for the 2% to 5% with the most severe reading deficits.[43]

Dyslexia occurs at all levels of intelligence and is a persistent problem that does not represent a transient developmental lag.* Children with poor oral language skills in kindergarten often become poor readers. Over time, good readers and poor readers without intervention tend to maintain their relative positions along the spectrum of reading ability. Children who get off to a poor start in reading rarely catch up on their own. A poor reader in 1st grade will almost invariably stay a poor reader; more than 88% of these children display similar difficulties at the end of 4th grade.[35,44,50] Seventy-four percent of those children identified in 3rd grade as reading disabled will remain so in the 10th grade.[30,34,43,51] Readers with dyslexia must expend more attention, concentration, and energy on the task, which makes reading unpleasant, tiring, and difficult.[39] Students who cannot read well read less. Lost practice opportunities make it difficult to acquire even average levels of reading fluency. Both inaccurate reading and diminished reading practice cause slow growth of fluent word-identification skills and vocabulary growth. The vocabularies and concept knowledge of children who read less will plateau as their reading peers improve.[52] The consequences of a slow start in reading become monumental as they accumulate exponentially over time.[35] In the later grades, when children switch from learning to read to reading to learn, reading-impaired children are prevented from fully exploring science, history, literature, mathematics, and the wealth of information that is presented in print. With interventions, people with dyslexia may learn to read accurately, but they have a persistent problem with fluency and continue to read slowly and not automatically throughout their lives.[39] The fluency deficit is problematic for older children, who are expected to read increasingly sophisticated texts.[53]

Many children with reading disability are observed to grow ashamed as they struggle with skills that their classmates master easily. This shame may cause a loss of motivation to learn to read that can further compound the situation. Untreated or poorly treated dyslexia may lead to frustration, low self-confidence, and poor self-esteem, which substantially increases the risk of developing psychological and emotional problems.[19,30]

Approximately 15% of students with reading disability also have ADHD, whereas approximately 35% of students with disorders of attention also have reading disability.[19,24,30,54] However, the 2 disorders are distinct and separable.

Dysgraphia is a learning disability that affects writing abilities. Disorders of written expression can manifest themselves as difficulty with spelling and problems putting thoughts on paper. The spelling deficits in dysgraphia may be oral and/or written. Dysgraphia can also manifest itself as difficulty with writing motor coordination or poor handwriting. Dysgraphia is the learning disability that most frequently co-occurs with dyslexia because of their directly related phonemic base. Decoding breaks the code receptively and encoding (spelling) puts it back together expressively.

Phonologic Model

Currently, the most accepted model for the acquisition of the ability to read is the phonologic model. Phonologic awareness is the sensitivity to the sound structure of oral speech and phonemic awareness is the understanding that speech can be segmented or broken into individual sounds that signal differences in meaning, whereas phonics is the understanding that segmented units of speech can be represented by printed forms.[55] Phonologic awareness is the basis for scaffolding written language onto oral language.[55]

Phonemes are the speech sounds that enable us to tell 1 word from another. For example, "pet" and "bet" are distinguished by the sounds of their initial consonant; thus, changing the "p" to "b" changes the meaning of the word.[56] Coarticulation is the merging and overlapping of sounds into a sound "bundle," which makes oral communication much more efficient.[55] To make normal conversation possible, 8 to 10 phonemes per second are strung together and blended so thoroughly that it is often impossible to separate them. A written word like "cat" has 3 letter-sound units, although the ear hears only 1 sound, not 3, when the word "cat" is spoken aloud.

Oral language development has been found to play a critical role in learning to read.[1,35,57–59] Oral language acquisition is preprogrammed into human development; a drive for expression through organized vocalization seems innate to infant development, although specific languages need to be acquired. On the other hand, writing, an artificially designed use of abstract symbols to represent language, is an acquired skill.[34] English uses an alphabetic system in which each letter is a symbol that is an abstract building block of that language's phonemes (sounds). English is a phonemically complex language in which the 26 letters of the alphabet create 44 sounds or phonemes in approximately 70 letter combinations.[32,33,60] The phonemic complexity of a language corresponds to the prevalence of dyslexia, which points to the linguistic origin of dyslexia.[14,29] Manifestations of dyslexia are often worse in English because of the greater number of inconsistencies and exceptions within the English lan-

*Refs 14, 20, 24–26, 28–31, 34, 35, and 44–49.

guage, but dyslexia is confined neither to the United States nor to English speakers.[14]

Learning to read and write is a complex process that requires active learning. Reading is more difficult than speaking, because children must be aware of the sound structure in spoken language and then break the alphabetic code to acquire the sound/symbol connection. Developing this awareness is not automatic, because phonemes are not separated in speech. To decode a written word, the sounds must be broken apart. Unless the child can convert the printed characters into the phonetic code, these letters remain a mystery of lines and circles that are devoid of linguistic meaning.[34] According to Moats[61] and the American Federation of Teachers, teaching reading is rocket science!

Reading comprises decoding, fluency, and comprehension and requires adequate memory and sustained attention. The foundation for reading is decoding. Decoding, or word attack, is the ability to sound out words. Poor decoding is the core characteristic of poor reading. Most people with dyslexia have a neurobiological deficit in the processing of the sound structure of language, called a phonemic deficit, which impairs decoding and prevents word identification.† The ability to learn to decode print is determined primarily by phonologic skills such as phonologic awareness, facility in alphabetic mapping, name encoding and retrieval, and verbal memory.[14] The reader with dyslexia experiences difficulty in decoding and identifying words because of a specific impairment in the neural representation, storage, retrieval, and coding of phonemes.‡ Children with dyslexia often experience even more difficulty with spelling (dysgraphia) because of imperfectly stored representations of words, although not all children with poor spelling skills have dyslexia.

Children with more severe forms of dyslexia may have a second deficit in rapid automatic naming that causes slow naming of letters, numbers, and pictures, which creates a double deficit.[14,31,66–69] Other children with severe forms of dyslexia may have problems with their short-term working memory or attention or an additional comprehension deficit.[70] Some children with reading difficulties also experience a deficit in orthographic skills, which are defined as difficulties with letter/number orientation recognition and memory, although these skills may improve with development.[14,71]

A child must first accurately decode a word before it can be read fluently. Fluency is the ability to read connected text with expression rapidly, smoothly, effortlessly, and automatically with little conscious attention to decoding. An inexperienced reader will use the phonetic method to sound out most words and consequently will read slowly. No fluent reader uses phonics routinely. Poor decoders are stuck on the task of trying to sound out words to make sense of the text.[52] The next task for the beginning reader is to move from the early phases of "sounding out" words to the more skilled phase in which word recognition occurs almost instantly. Word recognition is the ability to read words without sounding them out.[52] Experienced readers use the whole-word method and will quickly recognize most words as individual units. Average readers require 4 to 14 exposures to a word before it becomes a sight word,[32,33] whereas students with learning disabilities may need up to 40 exposures.[33,72] Fluent reading requires automatic phonemic decoding and word recognition.[1,24,25,31–34,64] Although the ability to read words accurately is a necessary skill, reading speed and fluency become critical factors in ensuring that children gain comprehension. Fluency forms the bridge between decoding and comprehension.[34]

Comprehension is impaired without efficient automatic word-recognition skills.[55] If reading is slow and labored because of decoding difficulties and requires a large portion of their available conscious attention, children do not have enough attentional capacity and cognitive energy to remember what they have read, much less relate the ideas to their own background knowledge.[32–34,64] Current theory maintains that the deficit in lower-order phonologic linguistic decoding function blocks access to the usually intact higher-order cognitive and linguistic functions.[15,24,25,30–35] Thus, it is difficult to apply general intelligence and reasoning, vocabulary, and syntax to the reading endeavor to obtain comprehension.[24,25,34] In some cases, however, other children can show comprehension difficulties in the absence of word-recognition problems. Vocabulary acquisition in a child with dyslexia often may not keep pace with that of a child's peers, because the less a child reads, the fewer the new words to which the child is exposed. In addition to decoding deficiencies, inadequate vocabulary, verbal reasoning, attention, memory, and limitations in background knowledge also can cause reading-comprehension difficulties. Thus, any or all of these problems can interfere with the ultimate purpose of reading, which is comprehension.[34]

Neurobiology

Dyslexia is currently believed to be neurobiological in origin, which means that the problem is located physically in the brain. There is strong scientific evidence that supports the neurobiological basis for the phonologic-coding–

†Refs 1, 14, 15, 20, 24–26, 30–35, 43, 46–49, 55, 60, and 62–65.

‡Refs 1, 24, 25, 31–34, 39, 46–49, and 64.

deficit theory of dyslexia.§ Both anatomical and brain-imagery studies have revealed differences in the way the brain of a person with dyslexia develops and functions. Neuroanatomical changes, microarchitectural distortion, and MRI findings in language-related areas have been observed in the brains of patients with dyslexia, including the absence of the normal asymmetry in the language areas of the brain and similar volume in the left and right planum temporale; normally, the left planum temporale is larger.[86–88] Functional MRI and positron emission tomography (PET) scans measure changes in metabolic activity and blood flow during cognitive tasks in specific brain regions. In typical readers, functional MRI and PET-scan studies have shown that reading takes place predominantly in left-hemisphere sites including the inferior frontal (Broca) area, which is associated with articulation, naming, and silent reading; 2 areas in the posterior brain regions—the parietal temporal region, which serves word analysis, and the left occipitotemporal area, which is involved in word-form and fluent reading; and the posterior inferior temporal cortex, which is associated with lexical retrieval. Children with dyslexia, on the other hand, use different areas of the brain when reading.‖ People with dyslexia have demonstrated a dysfunction in the left-hemisphere posterior reading systems and have shown compensatory use of the inferior frontal gyri of both hemispheres and the right occipitotemporal word-form area.¶ These studies have demonstrated that dyslexia is an abnormality in the word-analysis pathways of the brain that interferes with its ability to convert written words into spoken words. It is postulated that this abnormality is causal, not a result of poor reading experience. Functional MRI studies have also shown brain plasticity in that the dyslexia-specific brain-activation profile improves after successful evidence-based phonologic remedial intervention.[48,80,85]

White-matter abnormalities have also been detected in association with dyslexia. In people with dyslexia, white-matter organization seems to be weaker in the left posterior brain region and seems to project too weakly within the primary reading pathways of the linguistic left hemisphere and too strongly between hemispheres.[53] White-matter pathways of the brain may be characterized by diffusion tensor imaging that provides a quantitative index of the organization of large myelinated axons that constitute the long-range connections of brain networks. Young children are able to undergo diffusion tensor imaging.

Recent genetic-linkage studies have identified many loci at which dyslexia-related genes are encoded. Four candidate genes have been implicated in neural migration, axonal growth, and brain development.[89] These brain changes seem to cause phonologic and auditory processing abnormalities.[89]

RECOGNITION AND TREATMENT

Dyslexia is a disorder that affects people of all ages, but its symptom profile changes over time.[81,90] Because dyslexia is both familial and heritable, affected younger siblings can often be identified earlier. A child should be observed for early indications of dyslexia if he or she has a family history of learning disabilities or has a history of other factors that may be predictive of learning disabilities including hearing, language, or speech problems; preterm birth; low birth weight; fetal exposure to drugs or alcohol; infections of the central nervous system; severe head injuries; cognitive difficulties; or developmental delay.[28] An early history of language difficulties such as delay or difficulty in developing speech and language, learning rhymes, or recognizing letters and sound/symbol connections, may be an early indication of dyslexia.[14,24,34,35,58,62,81] Parents or teachers may detect early warning signs of learning difficulties in preschool-aged children, and early evaluation and intervention should be considered. It is not in the child's best interest to "wait and see" or hope that the child will "grow out of" his or her problems.[91]

However, in many cases, learning disabilities are not discovered until children experience academic difficulties in elementary school.[24,25,34,81] Many parents who had noticed that their child was exhibiting learning difficulties waited a year or more before acknowledging that their child might have a problem and seeking assistance. In elementary school, a child with reading disabilities may show difficulty with remembering words, reading, spelling, handwriting, or writing speed. Teachers are in a position to identify reading problems before they progress significantly. Early identification of children in early grades who are showing delays or difficulties should be a high priority for elementary school teachers. Teachers need to have a strong understanding of the result of research in reading theory and practice to become well versed in reading development and assessment.[33] At all grade levels, teachers must understand the course and the role of instruction in optimizing literacy development. After initial school interventions have been unsuccessful, evaluation for learning disabilities should be considered for all children who present with school diffi-

§Refs 14, 24, 25, 30–35, 39, 40, 43, 46, 48, 49, 66, and 73–85.

‖Refs 14, 24, 25, 30, 31, 34, 39, 40, 46, 48, 49, 66, and 73–85.

¶Refs 24, 25, 30, 31, 34, 40, 46, 48, 49, 66, and 73–85.

culties, even if reading difficulty is not the chief complaint.[34]

Parents should read aloud to their children to help develop language skills beginning as early as 6 months of age.[92] Educational experts indicate that reading aloud to children is the single most important activity for parents and caregivers to do to prepare children to learn to read.[33,35] Comprehensive beginning reading instruction is the best educational prevention for reading problems.

The best current approach to the problem of reading failure is to allocate resources for prevention and early identification. The beneficial effects of early identification and intervention are apparent in many studies.[35] In the elementary grades, reading screening should be performed yearly and early in the school year. Assessments for difficulties with alphabet recognition, phonemic awareness and rapid naming in kindergarten,[57,93] adding word identification fluency in 1st grade, and adding oral reading fluency in 2nd grade can predict many of those who will have difficulty learning to read.# Prevention and early phonologic awareness intervention programs in kindergarten through 2nd grade can increase reading skills in many poor readers to average reading levels. Torgesen reviewed many studies on early intervention and found that when intervention began in the 1st grade, the expected incidence of reading disability of 12% to 18% was reduced substantially to 1.6% to 6%.[94] If reading-impaired children receive effective phonologic training in kindergarten and 1st grade, they will have significantly fewer problems in learning to read on grade level than do children who are not identified or helped until 3rd grade.** Children identified as reading disabled after 2nd grade rarely catch up to their peers.[43] Waiting for failure decreases the chances of interventional success. Results of longitudinal studies have shown that when intervention is delayed until 3rd grade or 9 years of age (the average age at which these children receive services), then approximately 74% of these children will continue to have difficulties learning to read through high school.[30,34,43,51] Gains are maintained for at least 1 or 2 years by approximately 50% of children after they return to the school's standard curriculum. These children who retain their benefits improve from year to year, but they do not further catch up to typical readers.[53]

Dyslexia is most often identified in the primary grades, but it is not diagnosed in some students until later during middle or high school, when more complex reading and writing skills are required. In early elementary school, some children compensate by using other strengths until the educational demands increase and make the reading disability more evident. Reading problems diagnosed in the 4th grade or beyond may be secondary to poor word recognition, a combination of poor word recognition and poor comprehension skills, or solely attributable to poor comprehension skills. Late emerging reading disabilities often go undetected in schools. Approximately 10% of children with dyslexia have good word-reading skills but have poor listening and reading-comprehension skills. Poor comprehension skills are often attributable to working-memory, semantic, and syntactic difficulties. Deficits in phonologic coding continue to characterize readers with dyslexia even in adolescence and adulthood.[34] Older children and adults may learn to read words accurately, but they will not be as fluent or automatic, which results in a slower reading rate.†† Although older children and adults can be taught to read, the time and expense of doing so is enormous.[34] Poor comprehension skills also persist and will impair the ability to learn in general.

Difficulties in early reading may be caused by experiential and instructional deficits in addition to primary dyslexia. Some children enter school with experiential deficits in oral language skills and general knowledge as well as delayed phonologic skills.[35] Experiential risk factors include being raised in a high-poverty environment or in a home in which English is the second language or having limited exposure to oral or written language. It is important to recognize these children, differentiate them from children with true dyslexia, and provide proper remediation for them.

The IDEA, Section 504 of the Rehabilitation Act, and the Americans With Disabilities Act (ADA) define the rights of students with dyslexia and other specific learning disabilities.[95–98] The IDEA defines a child with a disability as someone who has any of 13 disabling conditions, including learning disabilities, and who need special education and related services because of the disability. The IDEA guarantees each child a free, appropriate public education tailored to his or her individual needs and allows parents to request a formal educational evaluation by the school district to determine if a child has a disability and qualifies for special education and related services. It allows parental access to all meetings and paperwork, transition planning, and related services. The IDEA also provides funding for special education services.[96] People with a physical or mental impairment that substantially restricts 1 or more major life activities are eligible for services under Section

#Refs 1, 14, 20, 24, 30, 32–35, 43, 55, 58, 60, 64, 65, and 93.

**Refs 1, 14, 19, 32, 33, 35, 41, 43, 47, 54, 60, 64, 65, 88, 90, and 95.

††Refs 14, 24, 25, 34, 35, 39, 54, 60, and 65.

504 of the Rehabilitation Act of 1973.[97] This act protects the civil rights of students with disabilities and attempts to remove barriers to allow them to participate freely. Students who do not have 1 of the 13 included disabilities or meet the severity criteria but still require some assistance to be able to participate fully in school may be a candidate for a Section 504 plan. Some schools use Section 504 to support learning-disabled students who need only accommodations. Children with ADHD who do not need more comprehensive special education support also are frequently served under this law. The ADA protects people who have a physical or mental impairment that restricts 1 or more major life activities from discrimination. Because learning is considered such an activity under the ADA, students served under the IDEA also are covered by this law.[99] Congress recently passed the ADA Amendments Act of 2008, which became effective in 2009. It expanded the list of major life activities to include reading, thinking, and concentrating.[99] As a result, more people with learning disabilities are now able to satisfy the definition of disability, gain access to reasonable accommodations, and be protected from discrimination.

The latest revision of the IDEA, the federal law that governs special education, offers 2 approaches that can be used in the young underachieving child.[14] The first method is called the response-to-intervention (RTI) method and is designed primarily for the elementary school grades. RTI is a multitiered approach to the early identification and support of students with learning and behavior needs. The RTI process begins with high-quality instruction and screening of all children in kindergarten to identify any child who exhibits the early signs of potential reading difficulties. In the RTI method, the child will be placed directly in an educational intervention program when he or she first experiences academic difficulties. Struggling learners are provided with interventions at increasing levels of intensity to accelerate their rate of learning. The individual student's progress is closely monitored to assess both the learning rate and level of performance. Educational decisions about the intensity and duration of interventions are based on the individual student's response to instruction. Only the children who do not show significant improvement with the first-tier group intervention program and the second-tier targeted intense individual intervention program will undergo a full diagnostic educational assessment.[14,100,101] The majority of these students undergoing educational assessment will likely be identified as reading disabled and qualify for special education services. Ideally, this approach will allow earlier and more effective identification and treatment than the traditional method in which the child must show persistent poor academic achievement for a few years before referral, assessment, and remediation. A "wait-to-fail" situation can occur when an ability-achievement discrepancy formula is used to determine if a student qualifies for a formal diagnostic assessment for a learning disability.[35,43,65,100,101] Thus, the student has suffered the academic and emotional strains of failure for 2 to 3 years before potentially effective instruction can begin.

At all ages, dyslexia is a clinical diagnosis.[81] A formal evaluation is needed to discover whether a person has a learning disability. The assessment techniques should be evidence based.[102,103] Although many schools still use a discrepancy formula to qualify students for special education, there is an emerging consensus among researchers and clinicians that the dependence on a discrepancy between IQ and reading achievement for a diagnosis of dyslexia has outlived its usefulness except in limited circumstances.[34,44,104] There is no single standardized test used to make the diagnosis of dyslexia. Because the hallmark of dyslexia is the presence of a phonologic deficit in the context of relatively intact overall language abilities, the diagnosis of dyslexia can be far more specific.[34] Indicators of phonologic difficulties can be detected by a child's history, by observation, and/or by specific tests. Furthermore, dyslexia is not diagnosed with testing in the areas of vision, sensory-motor skill, or auditory processing, and it is not determined solely by medical screening or psychological/IQ testing alone.[105]

A comprehensive evaluation is necessary to determine the appropriate diagnosis for children who present with reading weaknesses. Comprehensive evaluation in all areas of the suspect disability should be conducted. Such evaluation is multifaceted and generally involves interviews with the child and family; questionnaires and rating scales completed by parents, teachers, and the student; social, developmental, medical, and educational histories; observation of the child in the classroom; and evaluation of test data.[26] The testing can be conducted by trained school or outside specialists. The composition of testing by a school psychologist varies according to state and school district. An evaluation by a developmental/behavioral pediatrician, school psychologist, educational psychologist, clinical psychologist with special training in learning assessments, or neuropsychologist consists of a battery of tests that will provide information on a child's overall abilities, particularly learning style, information-processing abilities, academic skills, and describing areas of strength and weakness. The assess-

ment may include information provided by parents; health and developmental history; knowledge of any previous medical conditions; behavioral rating scales completed by parents, teachers, and, if appropriate, the student; school observations; review of school records; evaluation of intellect, memory, attention, and concentration; perceptual and sensory skills; executive skills; language; academic achievement; motor skills; social-emotional and behavioral components; and adaptive levels. Such an evaluation traditionally has included critical underlying language skills that are closely linked to dyslexia, including receptive-listening skills; expressive-language skills; phonologic skills, including phonemic awareness and rapid naming of letters and names; vocabulary; reading accuracy; fluency; and comprehension. A student's ability to read lists of words in isolation, as well as words in context, should also be assessed. School assessments are usually performed to determine if a child qualifies for special education programs or therapies. These assessments focus on achievement and the skills needed for academic success.

If the focus of the studies is on educational issues as well as on a broader assessment of brain function, the assessment is called a "neuropsychological" evaluation. Neuropsychologists with a special competency in the area of pediatrics can perform extensive evaluations that can lead to a comprehensive understanding of the child's cognitive and emotional processes and provide the gold standard for a learning-disability evaluation. Neuropsychologists can diagnose learning or behavior disorders caused by altered brain function or development. In addition to test data, the assessment also involves a review of the relevant medical, psychiatric, educational, speech-language, occupational therapy, and school-related records (ie, Section 504 plans and individualized education plans [IEPs]). Parents, teachers, and treating professionals are interviewed for their presenting concerns. Neuropsychologists assess intellect, memory, attention and concentration, perceptual and sensory skills, executive skills, language, academic achievement, motor skills, social-emotional and behavioral components, regulatory capacities, adaptive levels, and other neuropsychological phenomena to illuminate the neurocognitive underpinnings of specific learning disabilities as well as their subtypes. This information is critical in identifying the specific deficits relative to the reading weaknesses as well as other comorbid variables that are also involved. These variables can include coexisting attention and concentration disorders, executive-functioning weaknesses, and social-emotional factors (ie, anxiety, depression, and oppositional features). Such information helps to identify whether attentional and/or emotional issues might be contributing to or resulting from learning difficulties.[19] Because neuropsychological evaluation is driven by an understanding of the brain systems involved in different academic functions, it can illuminate learning disorders, allow predictions to be made about future difficulties a child may encounter so that preemptive interventions can be initiated, and bring to light comorbid conditions that may not yet have become apparent. The determination of the underlying causes of the disorder and comorbid conditions will clarify the types of interventions from which the child is most likely to benefit and will provide a road map on which evidence-based interventions and accommodations are based across home and school environments. Referring professionals and parents are provided with a detailed written report of test findings, the diagnosis, treatment recommendations, accommodations, and referral suggestions.

After a comprehensive school evaluation, a learning disability will be diagnosed formally in some students. Under the IDEA, a "child with a disability" is one who is eligible for special education and related services. Eligibility for special education is determined by the IEP team. The evaluation is necessary for developing a proper treatment plan and should also identify the different instructional methods that are most beneficial at various stages of reading development for each child.[55,59,104] To outline the educational goals and services that the student needs to be successful, an IEP contract is developed. The IEP will describe goals and objectives; outline what services will be needed, including specific remedial interventions, accommodations, modifications, and which type of program would be best; and set guidelines to measure future educational progress. After there is agreement by the school professionals and parents, the services that the school system will provide are listed in the IEP. The IEP contract must be signed by the school professionals and parents before it can be implemented. The IEP is reviewed on an annual basis and, if necessary, revised for the next school year. Addendum IEPs can be held if issues in the initial IEP need to be changed or modified during the school year. Every 3 years, the child will undergo comprehensive reevaluation. Alternatively, parents may obtain an independent educational evaluation. If parents obtain an independent educational evaluation on their own and it meets the school's criteria, those results and recommendations must be considered by the IEP team. The IEP team would still need to determine if the disability and its severity qualify to obtain special education and related services in school. Children with less

severe disabilities who do not qualify for school services may still benefit from remediation and other therapies outside of school at the parents' expense.

Many struggling students will not show severe enough difficulties on evaluation to receive a diagnosis of a learning disability and will not be eligible for special education and related services. These students still may need targeted reading assistance to be able to participate fully in school and may be a candidate for a Section 504 plan. The evaluation information may be used to decide what educational accommodations may be needed in a regular education program. In that case, a Section 504 plan will be written that describes the areas of difficulty and lists the accommodations that will be provided in the regular classroom.

The diagnosis and treatment of a child who has learning disabilities depend on the ongoing, coordinated collaboration of a multidisciplinary team that may consist of educators, educational remediation specialists, special services, psychologists, and physicians. Speech therapists can evaluate and treat underlying oral language difficulties often associated with dyslexia or help students learn phonemic awareness. Physical and occupational therapists do not treat dyslexia but do treat fine motor, gross motor, balance, proprioceptive, and sensory-processing disorders that may coexist in some children with learning disabilities.[19] A vision specialist for the visually impaired may benefit children with dyslexia who have low vision. Physicians, including general pediatricians, developmental/behavioral pediatricians, family physicians, neurologists, ophthalmologists, otolaryngologists, mental health professionals, and other appropriate medical specialists may assist in diagnosing and treating any associated health problems if they are present in these patients. Clinical psychologists or other mental health providers, including developmental/behavioral and neurodevelopmental pediatricians, can provide strategies to help children better cope with social challenges that may be associated with learning disabilities. Psychiatrists, developmental/behavioral pediatricians, neurodevelopmental pediatricians, or general pediatricians with special expertise may prescribe medications or conduct therapy to improve comorbid psychological disorders.

Treatment for dyslexia consists of using educational tools to enhance the ability to read. Educational therapists or educators who have been specially trained in learning disabilities develop and implement intervention plans for children with learning disabilities and dyslexia. An appropriate treatment plan will focus on strengthening the student's weaknesses while using the strengths. Because many students with learning disabilities receive most of their instruction in general education class, teachers need to be trained on the instructional strategies essential to success for these students.[22] Many children with dyslexia do well in small group instruction of matched students, whereas others need one-on-one help so that they can move forward at their own pace. The instruction must be intensive enough and continue long enough to have a positive effect that will endure.[105] If a student with dyslexia has an outside academic therapist, the therapist should work closely with the child's classroom teachers.

The critical elements for effective intervention include individualization, feedback and guidance, ongoing assessment, and regular ongoing practice.[34] Remediation, educational accommodation, and modification are used as techniques for overcoming dyslexia and the educational deficits that it causes.[24,30,33,34,55,60,63,81] The management of dyslexia demands a lifespan perspective; early on, the focus is on remediation.[34] Remedial interventions should be aimed at the specific needs of the child and viewed as a dynamic process. Because dyslexia is a language-based disorder, treatment should be directed at this etiology.‡‡ Reading instruction should be explicitly taught, which means that children are not expected to infer key skills or knowledge.[34] Students who are easily confused are more likely to be successful when teachers demonstrate and clearly explain what they need to learn.[58] Most children with dyslexia need help from a teacher, tutor, or therapist who has been specially trained in using a multisensory, structured language approach. It is important for these children to be taught by a sequenced systematic and explicit method that involves several senses (hearing, seeing, touching) at the same time.[107] Highly structured daily intensive individualized instruction by an educational therapist or skilled teacher specially trained in explicitly teaching phonemic awareness and the application of phonics is the foundation for remedial programs.§§ In addition, students with dyslexia often need a great deal of structured practice and immediate, corrective feedback to develop automatic word-recognition skills. Remedial programs should include specific instruction in decoding, fluency training, vocabulary, and comprehension.|||| The approach to learning decoding begins with detailed instruction in phonemic awareness and then progresses to sound-symbol association (alphabetic principle), phonics, awareness of rhyme, and word segmentation. Phonics is the system of instruction used to teach children

‡‡Refs 1, 14, 24, 25, 30–35, 43, 55, 60, 63–65, 81, and 106.

§§Refs 1, 14, 24, 25, 30–35, 55, 60, and 63–65.

||||Refs 1, 14, 32–35, 43, 55, 60, 63–65, and 81.

the connection between letters and sounds. Longitudinal data indicate that systematic phonics instruction results in more favorable outcomes for readers with disabilities than does a context-emphasis (whole-language) approach.¶¶ Later, syllable instruction, morphology, memorization of sight words, spelling, syntax, and semantics are taught.[55] A child must first accurately decode a word before it can be read fluently, but accuracy does not spontaneously evolve into fluency. Sight words need to be memorized, and speeded word-repetition drills should be performed. Daily fluency practice involves repeated guided oral reading of a large amount of text at the child's independent reading level. Practicing reading aloud makes feedback possible. Fluency forms the bridge between decoding and comprehension.[34] Comprehension is gained through fluency training, vocabulary instruction, and active reading comprehension.[34,35] Techniques that enhance active reading comprehension include prediction, summarization, visualization, clarification, critical thinking, making inferences, and drawing conclusions.[14,24,25,33–35,60,63,65] To further gain comprehension, these activities should be combined with other activities to improve language development.[24,25,32–34,55,60,63,64] The brain learns best by practice, and practice is the key to learning to read.

Schools can implement academic accommodations and modifications to help students with dyslexia succeed. Because people with dyslexia have a persistent problem and continue to read slowly throughout their life, it often becomes necessary to adapt the learning environment.[24,25,34,81] Accommodations allow access to higher-level thinking and reasoning strengths. Examples can include preferential seating, extra time for assignments and tests, shortened or modified assignments, help taking notes, lecture notes, computers for writing, a separate quiet room for taking tests, extra assistance using computers, spell checkers, a line guide, or tutors. Reading can be bypassed by using tape recorders, recorded books, text-reading computer programs, lecture tapes, taped tests, or other testing alternatives.[24,25,34,47,81]

Many good software programs currently exist and are affordable. Text-reading software programs provide an excellent opportunity for students with dyslexia to keep up with reading assignments. They are also helpful with written examinations and handouts provided by the teacher. A portable scanner can easily scan written material in the classroom and at home and be used with these programs. The text-reading rate can be adjusted to assist with comprehension, and spaces can be created to write notes in the text. Text-reading software is also designed to be used with writing software to allow a student's writing to be read aloud. The software includes phonetic spelling assistance and intelligent word-prediction features that can address the dysgraphia that often co-occurs with dyslexia. These programs should be a key component of an educational plan, especially for older students. They provide relief, promote self-esteem, and are fun to use. Ongoing appropriate reading remediation should continue along with these compensatory techniques.

Parental participation in a child's education is of utmost importance but may be more difficult if the parents are functionally illiterate. The home is an ideal setting for practice and reinforcement.[34] Children should read aloud to their parents using fun, easy-to-read books. Reading aloud will alert parents if a problem exists. Children who avoid reading are most in need of practice. Parents should help with practice and reinforcement at home with opportunities to check fluency and comprehension via interactive reading experiences. Reading practice at home should be conducted in a supportive and nurturing environment with adequate opportunity for the child to participate in other activities in which he or she excels. As the child gets older, parents should help the child use recommended alternative learning strategies such as books on tape or computers.

Parents should provide ongoing feedback to remediating specialists and should be given the opportunity to ask questions to maximize educational outcomes. Parents need to serve as the child's advocate by speaking with the child's teacher, pediatrician, and other professionals; requesting an educational evaluation; and coordinating remediation and other treatment. By educating themselves in the areas of learning disabilities, available services, and state education rules and regulations, parents will increase their effectiveness as the child's advocate. Parents should work with educators to ensure that the school provides the proper remediation and accommodations and should continue to monitor their child's progress and advocate for their child when necessary.

The teaching of children with dyslexia and learning disabilities is a challenge for educators and parents; however, with proper remediations, educational accommodations, and support, children with dyslexia and learning disabilities can overcome obstacles to improve their reading and writing. Children with extreme deficits in basic reading skills or those with the double deficit of phonologic and rapid automatic naming difficulties are much more difficult to remediate than children with mild or moderate deficits.[30]

¶¶Refs 1, 14, 30, 34, 60, 63, 65, 81, and 106.

The prognosis depends on the severity of the disability; specific patterns of strengths and weaknesses of the individual child; and the appropriateness, amount, intensity, and timing of the intervention.[34] The instruction must be intensive enough and continue long enough to have a positive effect that will endure.[105] Early identification and treatment are the keys to helping children with dyslexia, because children 8 years and younger are more likely to show improvement.

A potential goal in the treatment of dyslexia will be its prevention. Brain measures, such as studies of longitudinal event-related potentials, have shown impressive relations between brain responses at infancy and later language and reading success or failure. In the future, a combination of behavioral and brain measures, perhaps together with genetic and familial information, may enhance the certainty with which dyslexia can be predicted and promote the possibility of preventive intervention that would allow many more children to succeed at learning to read.[53]

ROLE OF THE PEDIATRICIAN AND PRIMARY CARE PHYSICIAN

Pediatricians and primary care physicians can serve a number of important functions for children with dyslexia and their family members. Developmental screening as early as 30 to 48 months may identify language or learning concerns. During well-child visits, physicians should inquire about the child's educational progress and be vigilant in looking for early signs of evolving learning disabilities. General pediatricians should not diagnose learning disabilities but may discuss the possibility with parents.[108] When a child has suspected learning difficulties, the pediatrician or family physician should first assess the child for medical problems that could affect the child's ability to learn and refer him or her for further evaluation if deemed appropriate.[98,108] The physician should take a complete medical history, including determination of maternal drug or alcohol use, neonatal/birth problems, genetic syndromes, and congenital anomalies. Additional medical history should include detection of medical problems (such as chronic or persistent otitis media, asthma, thyroid problems, or any chronic disease that may have caused school absences); neurologic problems (such as seizure disorder, head trauma, history of central nervous system infection, or lead poisoning); developmental, behavioral, emotional, or psychiatric problems (anxiety, depression, obsessive compulsive disorder, or oppositional defiant disorder); ADHD; or autism spectrum disorder. Specific questions on language acquisition and learning should include history of speech delay, speech difficulties, or articulation problems; difficulties in learning letters or phonics; lack of reading readiness; poor instruction; overall academic achievement; and visual difficulties. A family history of speech and language problems, learning disabilities, or functional illiteracy should also be noted. A social history should be taken, and alcohol use, drug use, cultural differences, or poverty for the child or the family should be noted. A complete physical examination to evaluate the child's overall medical and neurologic condition and a psychological, emotional, and behavioral evaluation should be performed. An assessment of the child's activity level, attention span, alertness, cooperation, and ability to communicate should be noted.

Primary sensory impairments should be ruled out by hearing and vision screenings. For all children, primary care physicians should perform hearing and vision screenings according to national standards so that hearing, ocular, and visual disorders are identified as early as possible.[109] Periodic eye and vision screenings can identify most children who have reduced visual acuity or other visual disorders. Vision screening with nonletter symbols may be necessary for testing children with dyslexia or other learning disabilities.[110]

Children who do not pass vision screening should be referred to an ophthalmologist who has experience with the care of children.[109,110] In addition, the recommended routine pediatric vision screenings are unlikely to disclose near-vision problems such as convergence insufficiency, accommodative insufficiency, and significant hyperopia. Children with suspected learning disabilities in whom a vision problem is suspected by the child, parents, physicians, or educators should be seen by an ophthalmologist who has experience with the assessment and treatment of children, because some of these children may also have a treatable visual problem that accompanies or contributes to their primary reading or learning dysfunction.[110–113] Treatable ocular conditions can include strabismus, amblyopia, convergence and/or focusing deficiencies, and refractive errors. Missing these problems could cause long-term consequences from assigning these patients to incorrect treatment categories.

Pediatricians and primary care physicians play an extremely important function in acting as a medical home by helping parents decide whether further evaluations are needed and in coordinating care for the child after a diagnosis has been made.[98,108] A child should receive medical and psychological interventions as appropriate for diagnosed conditions.[108] If the pediatrician believes that the child has not received a proper assessment at school, then the pediatrician should refer the

child for an outside independent educational evaluation by an educational psychologist, clinical psychologist with special training in learning assessments, neuropsychologist, developmental/behavioral pediatrician, neurodevelopmental pediatrician, or neurologist with appropriate expertise. Referral to an educational psychologist for psychoeducational assessment for the purpose of identifying special needs should be considered if the primary issue is the child's educational performance or learning problems. For patients with complex or long-standing educational problems that have been difficult to remediate, referral to a neuropsychologist, developmental/behavioral pediatrician, neurodevelopmental pediatrician, or neurologist with appropriate expertise should be considered for a more in-depth evaluation of brain function to asses overall cognitive, emotional, and behavioral functioning. A child should be referred to a neuropsychologist for problems such as learning, attention, behavior, socialization, or emotional control; a disease or developmental problem that affects the brain; or a brain injury from an accident or birth trauma. Pediatricians and primary care physicians should compile and provide a resource list of local specialists from whom the child can obtain proper help and from whom the family members can learn to become advocates for the child.[108] Pediatricians and primary care physicians should provide information and support to parents on learning disabilities and their treatment and should dispel the myths surrounding these disorders.[111] When parents inquire about a new technique or treatment concept, physicians should be ready to discuss the treatment and the current knowledge about its efficacy.[26] This discussion should include providing the parents with information regarding the lack of proven efficacy of vision therapy and other "alternative treatments."[111] Parents need to be informed that dyslexia is a complex disorder and that there are currently no quick cures. The American Academy of Pediatrics has information for families on what parents need to know about learning disabilities.[114]

Pediatricians and primary care physicians should be familiar with the IDEA, Section 504 of the Rehabilitation Act, and the ADA, because these acts define the rights of students with dyslexia and other specific learning disabilities.[95–97] The IDEA allows parents to request a formal educational evaluation by the school district to determine eligibility for special education.[96] Information for pediatricians on this legislation and its associated rights and procedures is available from the American Academy of Pediatrics.[98,108] Physicians can refer parents of children with learning disabilities to their state's parent training and information center. These parent-directed centers provide information and technical assistance to parents and professionals about family and student rights and responsibilities in special education.

Physicians who have a strong role in assisting school districts should recommend only evidence-based treatments and accommodations. They should also discourage school districts and parents from pursuing treatments that are not evidence based, because they are likely to waste time and resources.

THE EYES AND VISION

Visual Acuity and Refraction

Books for beginning readers usually have very large print of approximately 20/200 to 20/100 size. Good visual clarity and resolution are necessary to discern small print. There is no evidence that children with moderate myopia, moderate hyperopia, or moderate astigmatism have any greater difficulty in learning to read than do other children. Small amounts of hyperopia are normal in young children and are usually of no pathologic significance. The average refraction of white children in the United States is nearly 2.00 diopters (D) of hyperopia in the first 5 years of life and then gradually decreases into adolescence.[115] (A diopter is the unit of measurement of the refractive power of lenses equal to the reciprocal of the focal length measured in meters.) Nonmyopic significant refractive errors are present in 10% of children younger than 12 years. Children with uncorrected myopia will have reduced distance visual acuity and, thus, have difficulties with reading the board at school but no difficulty with near vision. Despite the condition, children with myopia have been found to be average to above-average students. Early optometric studies that have indicated increased hyperopia in children with reading difficulties are of limited significance, because the studies did not have control groups and were generally unreliable because they were performed without cycloplegia.[116] Before diagnosis and treatment, children with uncorrected high hyperopia may be uninterested in books and near tasks and secondarily experience difficulty starting to read, but they do not have an increased likelihood of true dyslexia.[115] There is no correlation between reading performance and any specific type of refractive error, including hyperopia or a need for glasses.[111]

Amblyopia causes reduced visual acuity and susceptibility to the crowding phenomenon, a difficulty with distinguishing letters in close proximity to one another, but only in the amblyopic eye/visual system. In children with amblyopia, fixation is usually performed with the fellow, nonamblyopic eye/visual system. In 1 study, microstrabismic amblyopia was associated with slower reading rates but not with dyslexia.[117] Nystagmus, bilateral cataracts, and retinal or optic nerve prob-

lems can interfere with visual acuity. Children with severe visual impairment are able to learn to read with assistance from spectacle correction for refractive errors and low-vision appliances. In general, ocular disease does not affect the ability of children to learn to read. Furthermore, children who are blind are able to learn to read using Braille. Vision impairment, in itself, has not been shown to be a predictor of reading disability.[58]

Saccades and Fixations

The eye movements used in reading are not similar to a typewriter typing. Smooth pursuit or tracking eye movements are not used in reading.[136] Reading uses saccades that are short-duration, high-velocity, small jumping eye movements. Reading uses both forward (rightward in English) saccades (85% of saccades) and backward or regression (leftward in English) saccades (15% of saccades).[118,119] Scanning a line of text in English involves a sequence of rightward and leftward saccades. The saccade length depends on the ability to recognize letters, the difficulty of the text, and the length of the word before the saccade. Experienced readers use longer saccades of approximately 2 degrees or 8 letters of average-sized print text.[120] Backward saccades are used for verification and comprehension, increase with the difficulty of the text, and are also used to jump to the next line. Early readers use more backward saccades. Visual perception is suppressed during saccades. Visual information is perceived during foveal fixations, which constitute 90% of our reading time.[111,118] Fixations may last 45 to 450 milliseconds and average 180 milliseconds. The duration of a fixation varies with the difficulty of the text being read.[118] When fixated, the eye rests on a content word and takes in a span of approximately 7 to 9 letters to the right of fixation and 3 to 4 letters to the left before it jumps over to the next fixation point. More letters are processed to the right of fixation if the eye is scanning from left to right, as in English, and the opposite would be true for reading a language than is scanned from right to left.

Early anecdotal publications in the optometric literature in the 1950s reported a possible oculomotor deficit that disrupted the normal saccadic reading pattern. In contrast, many studies subsequently have demonstrated that ocular coordination and motility are normal in children with dyslexia.[121–129] No difference was found between adults with dyslexia and controls on measures of saccadic accuracy and saccadic latency.[130] Readers with dyslexia have shown saccadic eye movements and fixations similar to those of the beginning reader and have shown normal saccadic eye movements when content is corrected for ability.[111,122] Improving reading has been shown to change saccadic patterns, but there is no evidence to suggest that saccadic training results in better reading. Readers with dyslexia have shown normal sequential saccadic tracking in tasks other than reading and oculomotor functioning.[125] Simulated saccadic "abnormalities" can be created by giving normal readers overly complex material or material in a new language.[122] Results of 3 studies by Rayner et al[131–133] were consistent with visual/linguistic-control models of eye-movement control and inconsistent with visual/oculomotor-control models. The saccadic patterns seen in readers with dyslexia appear not as a cause but as a result of their reading disability.## Decoding and comprehension difficulties, rather than a primary abnormality of the oculomotor control systems, are responsible for slow reading, increased duration of fixations, and increased backward saccades.[136] Children with dyslexia often lose their place while reading because they struggle to decode a letter or word combination and/or lack attention or comprehension, not because of a "tracking abnormality." Children with saccadic disorders, Duane syndrome, Moebius syndrome, and abnormal eye movements such as those with congenital motor nystagmus have shown the ability to learn to read fluently.[137] Dyslexia is no more frequent in these children with significant eye-movement disorders than in the general population.[137] Problems such as nystagmus interfere with foveal fixation time, yet affected children have not shown an increased likelihood of dyslexia. Thus, dyslexia is not the result of oculomotor deficits but, rather, the result of more central processing problems.[125]

Accommodation

Accommodation is the ability to focus accurately at near and is necessary for reading at near. Accommodative amplitudes are maximal in childhood and decrease naturally with age. The average amplitude of accommodation in children younger than 10 years is 14 D, which corresponds with a near point of accommodation of 2 to 3 in. Fifty percent, or 7 D, is available for sustained near activity; thus, young children can read comfortably at 6 in for a prolonged time. In the pediatric population, the incidence of accommodative insufficiency is low.[138,139] If it is present, symptoms can include discomfort or blurry or moving vision. Findings of accommodative insufficiency may include decreased visual acuity at near, a remote monocular near point, accommodative lag, and either esophoria or exophoria. Decreased accommodation has been associated with uncorrected high hyperopia, nonspecific viral illness, local ocular trauma, many medications, and functional problems.[138] There is no proof that

##Refs 14, 111, 112, 116, 118–128, and 134–136.

there is a difference in accommodative ability between normal and abnormal readers.[111] Difficulties in accommodation do not interfere with decoding but can interfere with the child's ability to concentrate on print for a prolonged period of time.[29]

The vergence system works to maintain fusion so that the eyes remain aligned on a visual target. Convergence is the inward turning of the eyes and is used for near reading. Various authors define convergence insufficiency differently. The diagnosis of convergence insufficiency is based on a remote near point of convergence or difficulty in sustaining convergence combined with asthenopic symptoms (sensations of visual or ocular discomfort) at near. The presence of 500 seconds of arc of stereopsis is required. These findings should be accompanied by a low convergence fusional amplitude, and/or a large exophoria or intermittent exotropia at near with a smaller exophoria, orthophoria, or esophoria at the distance. These latter findings alone do not constitute the diagnoses of convergence insufficiency, because they may be present with good convergence.[140,141] Of these findings, the most important are the ability to obtain and maintain convergence. The diagnosis of convergence insufficiency is relevant only if there are multiple findings accompanied by significant symptoms. Lack of sleep, illness, and anxiety are known to aggravate the problem. Older children, teenagers, and adults may become symptomatic because of large amounts of demanding near work and reading while fatigued. Patients typically present as teenagers or young adults with gradually increasing complaints of discomfort, eyestrain, headache, blurred vision, or diplopia during extended periods of studying.

The prevalence of convergence insufficiency has been reported to be in approximately 3% to 5% of the population. However, because of the differences in diagnostic criteria, some studies report the prevalence as being as low as 0.3% to 0.8%,[142,143] whereas a retrospective study of 8- to 12-year-olds in which findings alone were used classified 51% of the children with possible convergence insufficiency.[144] This classification system is obviously not valid, because it leads to classifying many normal children as abnormal. The disorder is much less common in children younger than 10 years. The incidence of ADHD was reported in 1 study to be increased in children with convergence insufficiency,[145] but additional analysis has revealed that the reported incidence was actually average when compared with large studies in which the prevalence of ADHD was evaluated.[17,18] Convergence amplitudes have not been correlated with reading comprehension.[146] A study of 735 children found no significant difference in school achievement for children who showed convergence insufficiency and those who did not.[147] Convergence insufficiency can interfere with a child's ability to concentrate on print for a prolonged period of time but does not interfere with decoding.[29]

Binocular Vision

True orthophoria—perfectly straight eyes—occurs rarely; most people demonstrate a small asymptomatic phoria, a latent deviation usually esophoria or exophoria, that should be considered a normal variant. A study of more than 3000 unselected students revealed a near phoria in most children. Several studies have investigated the connection between reading ability and the binocular and accommodative status of unselected children. No causal relationship was found between normal variants and reading/writing difficulties.[113] Manifest strabismus, known as tropias (eg, esotropia and exotropia), also has not been associated with dyslexia.[116,148]

Visual Processing

Processing of visual input is a higher cortical function.[14,15,111] Decoding and interpretation of retinal images occur in the brain after visual signals are transmitted from the eyes. Although vision is necessary for reading, it is the brain that must perform the complex function of interpreting the incoming visual images. Historically, many theories have implicated the visual system in the causation of dyslexia. The demise of these theories began in the 1980s with a series of related studies that systematically evaluated deficits in visual processes such as visualization, visual sequencing, and visual memory as basic causes of reading difficulties.[14,15] Visual theories of reading disability have become less and less popular, because only a few children who are poor readers actually suffer from perceptual malfunctions. Robinson and Schwartz[149] found no correlation between visual-perceptual abilities and reading ability. Larsen et al[150] found no differences in visual perception between normal and learning-disabled children. Larsen and Hammill[151] found no predictive relationship between standardized tests of visual perception and reading ability in their review of 60 studies. Morrison et al[152] found no perceptual deficits in children with reading disabilities. In short, visual skills do not reliably distinguish children who differ in reading ability.*** In their review in 2004, Vellutino et al[14] found no statistically significant differences in the studies between poor and normal readers on measures evaluating visual recognition and visual recall of letters and words. Visual deficits of the types from the early literature were found to be no more prevalent in poor readers than they

***Refs 2, 9–12, 14, 15, 116, 119–128, 134, 135, 137, and 149–151.

were in normal readers. In many studies that compared poor and normal readers, few significant differences were found on measures of visual processing ability when the influence of verbal coding was controlled.[14] Difficulties in maintaining proper directionality have been demonstrated to be a symptom, not a cause, of reading disorders.[14,15,111,122] Word reversals and skipping words and lines were attributable to linguistic deficiencies and not visual or perceptual disorders.[14,15,59]

In summary, vision problems can interfere with the process of reading; however, vision problems are not the cause of dyslexia. Significant refractive errors can make reading more difficult. Convergence insufficiency and poor accommodation, both of which are uncommon in children, can interfere with the physical act of reading but not with decoding and word recognition.[29] Thus, treatment of these disorders can make reading more comfortable and may allow reading for longer periods of time but does not directly improve decoding or comprehension.[29] If reading impairment is attributable solely to a visual problem, improvement in school performance should be observed once the problem is corrected.[153] Other than the need for long-term optical correction, these problems generally do not require extended treatment programs.

Many children with reading disabilities enjoy playing video games, including handheld games, for prolonged periods. Playing video games requires concentration, visual perception, visual processing, eye movements, and eye-hand coordination. Convergence and accommodation are also required for handheld games. Thus, if visual deficits were a major cause of reading disabilities, these children would reject this vision-intensive play activity.

ROLE OF THE OPHTHALMOLOGIST

Because routine pediatric vision screening is not designed to detect problems with near vision, children with suspected or diagnosed learning disabilities should undergo a comprehensive pediatric medical eye examination by an ophthalmologist who has experience with the assessment and treatment of children, because some children may also have a treatable visual problem along with their primary reading or learning dysfunction.[110–113,154] The medical history should include detection of any medical condition that could interfere with the child's ability to learn or a chronic medical illness that could cause school absences or difficulties concentrating or learning. The ocular history should include any eye or vision complaints that may make it difficult for the child to concentrate on reading for extended periods of time. It is important for the ophthalmologist to recognize that healthy children often have visual complaints from normal visual phenomena such as physiologic diplopia and relaxation of accommodation.[112,155] Also, most children (82%) who complain of eyestrain and headaches have a normal eye examination, whereas children with refractive error (78%), amblyopia (68%), or strabismus (58%) are free of eyestrain, which makes these complaints a poor marker of eye conditions in young children.[156]

The ophthalmologist should perform a complete dilated eye examination, including cycloplegic refraction. Cycloplegia with either 1% or 2% cyclopentolate is necessary for accurate refraction in young children. The strength should be based on the child's weight, iris coloration, and dilation history. In eyes with heavily pigmented irides, adjunctive agents such as tropicamide and/or phenylephrine hydrochloride may be necessary to achieve maximal cycloplegia and pupillary dilation. Vision testing with nonletter symbols may be necessary and may be especially important for testing children with dyslexia or other learning disabilities. The eye examination should place special importance on the detection of undiagnosed vision impairment by assessing visual acuity at the distance and near, significant refractive errors, amblyopia, or strabismus.

Strabismus, amblyopia, and refractive errors may require glasses, eye patching, eye drops, convergence training, prisms, or eye muscle surgery in accordance with standard principles of treatment.[110,157,158] In school-aged children without strabismus or amblyopia, correction of myopia should be considered approximately at −0.75 D or greater, astigmatism at 1.00 D to 1.50 D or greater, hyperopia at +4.00 D to +4.50 D or greater, anisometropic myopia at 2.00 D or greater, anisometropic hyperopia at 1.50 D or greater, and anisometropic astigmatism at 1.50 D to 2.00 D or greater.[110,159] Myopia and astigmatism are fully corrected, whereas high hyperopia is often undercorrected by up to 50% but no more than 3.00 D, depending on the clinical situation.[110] These guidelines should be adjusted on the basis of the patient's visual needs and symptoms, such as asthenopia and reduced visual acuity or lack of symptoms. Children with developmental delay or Down syndrome often hypoaccommodate and may benefit from spectacle correction at lower thresholds.[159]

A careful external ocular examination should be performed to determine if the child has problems such as dry eyes, blepharitis, or ocular allergies that could cause eye irritation that can secondarily interfere with his or her ability to concentrate and learn. Finally, a dilated retinal evaluation should be performed. Retinal or optic nerve problems can lead to strabis-

mus, amblyopia, reduced visual acuity, and, rarely, photophobia.

Emphasis should be placed on the evaluation of ocular alignment, binocular function, stereopsis, accommodation, and convergence. Ocular alignment is assessed by using the corneal light reflection, the binocular red-reflex (Bruckner) test, cover/uncover, and alternate-cover tests in primary gaze with accommodative targets at distance and near when feasible; cover testing is most important. If an ocular misalignment is detected, multiple measurements of the ocular deviation using prisms in 1 or more fields of gaze at distance and/or at near is necessary. Ocular versions and ductions should be evaluated. Stereoacuity can be evaluated with the random dot E, Lang, or stereo fly test, whereas fusion can be tested with the Worth 4-dot test or Bagolini lenses. These tests can be performed at both near and distance when necessary.

Near visual acuity should be assessed in the evaluation of accommodation. The monocular near point of accommodation can be measured by conventional push-up technique using a ruler, Clark stick, or Costenbader accommodometer.[160] Before cycloplegia, dynamic retinoscopy can provide a rapid assessment of accommodative function and may be helpful in evaluating a child with high hyperopia, accommodative lag, or possible accommodative insufficiency. The accommodative facility can be assessed by alternately applying −2.00 and +2.00 lenses while the child reads monocularly. Symptomatic accommodative infacility may cause difficulty in shifting from far to near and near to far. The accommodative amplitude can be assessed by using increasing minus lenses while the child reads monocularly. Symptomatic accommodative insufficiency can cause blurry vision and discomfort, which can contribute to difficulties in concentrating on print for prolonged periods of time. Symptomatic accommodative insufficiency with a near point of accommodation well outside established norms can be treated with reading glasses or bifocals; it must be emphasized, however, that this condition is rare; hence, bifocals are rarely needed by children. Treatment of accommodation difficulties can make reading more comfortable but does not improve decoding or comprehension.[29]

The near point of convergence should be tested by using an accommodative target and measured with a ruler. Distance- and near-convergence amplitudes can be measured by using a base-out horizontal prism bar or rotary prism while the child is reading. Symptomatic convergence insufficiency can cause discomfort, eyestrain, blurry vision, diplopia, and headache, which can contribute to limited fluency by interfering with the child's ability to concentrate on print for a prolonged period of time. Symptomatic convergence insufficiency is a treatable condition. To improve reading comfort, it can be treated with near-point exercises, prism convergence exercises, or computer-based convergence exercises. Home computer-based convergence exercises are a newer method of treatment, and many children enjoy using the computer program. Over the years, orthoptic therapy has been adapted into simple visual tasks that can be taught in the office and conducted by the patient at home. Near-point convergence exercises generally consists of push-up exercises using an accommodative target of letters, numbers, or pictures; push-up exercises with additional base-out prisms; jump-to-near-convergence exercises; stereogram convergence exercises; recession from a target; and maintaining convergence for 30 to 40 seconds.[140,161,162] Generally, children are reevaluated in the office on a monthly basis.[140,161] Intensive in-office vision therapy is effective but not required.[161,163–165] Alternatively, for other patients, reading glasses with base-in prism or occlusion during reading can be used to treat the symptoms of diplopia but not the underlying convergence insufficiency.[140] The treatment of convergence insufficiency can help reading become more comfortable and may allow reading for longer periods of time, but this approach does not directly improve decoding or comprehension.[29]

In summary, the ophthalmologist should identify and treat any significant visual defect according to standard principles of treatment.[110,153,158,166] If no ocular or visual disorder is found, the child needs no further vision treatment. The ophthalmologist should not diagnose learning disabilities but should provide information on learning disabilities and reinforce the need for additional medical, psychological, educational, or other appropriate evaluation or services.[153,167] The ophthalmologist, when necessary, should compile and provide a resource list of local specialists to assist in obtaining proper help for the child.[167] In addition, the ophthalmologist should dispel myths surrounding these disorders and discuss the lack of proven efficacy of vision therapy and other alternative treatments with the parents. The American Academy of Ophthalmology and American Academy of Pediatrics have patient-education brochures for families on learning disabilities.[114,168]

SCIENTIFIC RESEARCH AND DISSEMINATION TO THE PUBLIC

Science advances by a process of modification. A continuous process of research and testing needs to take place to show that a treatment has demonstrable effect and benefits and to compare effectiveness between treat-

ments. Over the last 50 years, progress in medicine has been based on controlled studies. Evidence-based medicine (EBM) categorizes different types of clinical evidence and ranks them according to the strength of their freedom from various biases. The "evidence pyramid" ranks testimonials, anecdotes, case reports, and case studies as poor sources of scientific information. Alternative medicine makes most of its claims by unsubstantiated testimonials.

EBM is the use of the most reliable current evidence to make treatment decisions. The practice of EBM integrates individual clinical expertise with the best available external clinical evidence from systematic research.[169] EBM is open to new evidence and revised conclusions. To use EBM, the physician should investigate the medical literature efficiently, read the methodology section to evaluate the quality of the evidence to determine the validity of the study, and, lastly, evaluate the results. The issue of validity speaks to the "truthfulness" of the information. Properly performed scientific studies offer the possibility of validity. Critical appraisal is a systematic process used to identify the strengths and weaknesses of a research article to assess the usefulness and validity of its findings. If the study is not valid, the data are not useful.[170] The physician must not take the conclusion seriously until the appropriateness of the study design, methodology, and statistical analysis have been critically evaluated. Thus, a physician cannot read the study abstract alone and be confident of the conclusion. Serious scientific, methodologic, and statistical flaws noted in some study reports that invalidated their conclusions are discussed in "Controversial Theories and Therapies."

Many types of statistical bias or other problems can be present in published scientific study reports. A positive ascertainment bias leads us to remember only positive results and positive studies. Positive studies are more likely to be published than are negative studies because of publication bias. Nonrandom sampling leads to difficulties generalizing the data. Selection bias includes self-selection, subject prescreening, and attrition. Manipulation of the data by rejection of "bad data" or "outliers" leads to biased data. Preliminary positive results in smaller studies often are not repeatable in larger randomized, placebo-controlled, double-blinded studies. A study with more preliminary supporting evidence is more plausible than one with weak or no previous supporting evidence. False-positive results are more likely in clinical trials that examine highly improbable hypotheses compared with hypotheses with a stronger basis in science.[171,172]

The Hawthorne effect may occur and bias the research when the experimental subjects change their behavior as a result of being observed, not in response to any particular experimental manipulation. The multiplicity problem may occur when the more often a hypothesis is tested, the more likely a positive result will be obtained. Similarly, when a lot of data are collected without a specific hypothesis in advance, some pattern will likely be found. An advanced hypothesis and appropriate statistical methodologies to control the probability of false-positive findings are essential for demonstrating credible scientific findings.

In poor research, the results or the conclusions may be skewed or biased to seem to be consistent with hypotheses proposed. Confirmation bias occurs when experiments are designed to seek confirmatory evidence instead of trying to disprove the hypothesis. Conclusions may be misleading or artificially inflated when data-derived, posthoc subgroup analysis is performed; new statistically significant outcomes are introduced for publication; nonsignificant primary outcomes are omitted from reports; or statistically significant secondary outcomes are upgraded to primary end points.[173]

Poorly conducted research may produce false-positive or false-negative results. Studies that do not control for the placebo effect may produce false-positive results. Studies with controls and "no-treatment groups" are necessary to evaluate the size of the placebo effect. The placebo effect may be a large portion of the positive responders.

The public is largely uninformed about the hallmarks of good research. The finding of an association is not a finding of cause and effect. There should be documented objectivity associated with research, and, when possible, there should be replication. Good research is rigorous and objective and requires peer review. Research findings should be tested and scrutinized from many angles by multiple, unrelated researchers. Ideally, a study of efficacy compares a treatment with a placebo or another treatment by using a double-masked controlled trial and well-defined protocol. Reports should describe enrollment procedures, eligibility criteria, clinical characteristics of the patients, methods for diagnosis, randomization method, definition of treatment, control conditions, and length of treatment. Standardized outcomes and appropriate statistical analyses should be used. Age-matched control groups are important in learning-disability studies.[112] Good baseline similarities of the population and the medical condition is necessary to compare like with like. All associated conditions or treatments should be controlled. The comparison groups must be the same except for the factor that is being studied. Large-scale stud-

ies provide more reliable conclusions by reducing the margin of error. The strongest evidence for therapeutic interventions is provided by carefully designed large-scale, randomized, double-blinded, placebo-controlled trials that involve good baseline similarities of patient population and medical condition with an adequate follow-up time and low study participant attrition rate.[170]

From a scientific perspective, "healthy skepticism" should be adopted by the research community[174] and the public. Scientists hesitate to accept research results unless they can demonstrate a statistical probability of more than 95% that the observations are not attributable to chance. The research community is willing to embrace a theory only when there is substantial convergent evidence from multiple sources. It often takes years to convince the research community that a theory has merit, but it frequently takes no time at all to convince the public.

The media now play a major role in providing information or misinformation on new scientific developments to the public. They may report claims by a tiny minority and place them on equal footing with the majority opinion or report claims before any research. Some scientists report their claims directly to the media, which circumvents the normal process of scientific review and debate. Public health messages are inadequate or distorted when journalists ignore complexities or fail to provide context.[175] The result is that a large share of the science seen by the public is flawed because of minimal or distorted scientific facts. This public information can influence the behavior of clinicians and patients. Media hype of the overstated findings of poorly designed research may change behavior and harm public welfare.[176]

In 1984, Levine[128] stated that pediatricians (and ophthalmologists) must serve as scientific consumer advocates and help parents, teachers, and the community at large to evaluate claims and insist on hard evidence regarding diagnostic and therapeutic modalities. Although it is prudent to be skeptical, especially with regard to prematurely disseminated therapies, it is important to also remain open-minded. Aggressive marketing, dramatic presentations, loosely reviewed journal articles, and fervent anecdotal reports of cure may convince school personnel and parents that visual training is the answer. Levine warned that in such cases, the pediatrician may be bypassed and considerable family and community resources may be diverted toward unsubstantiated interventions.

Helveston[177] stated that it has become traditional in medicine for new and unproven treatments to be evaluated under a protocol by qualified investigators on patients who give informed consent after the risks and benefits have been explained. The work is often performed at no charge, and results are reported for peer review. Only when the aforementioned criteria are met and it is shown that treatment is effective is treatment customarily offered on an unrestricted basis. According to Helveston, the use of tinted lenses or filters and vision therapy for learning disabilities does not follow these standards.

Silver[178,179] has written many articles on controversial therapies including vision therapy. He stated that a treatment approach can be considered suspect if the approach is proposed to the public before any research results are available or preliminary research has not been replicated; the proposed approach goes beyond what research data support; the approach is used in an isolated way when a multimodal assessment and treatment approach is needed; the treatment approach is being commercially promoted before the research shows any support for the proposed treatment; or there is clear research evidence showing that the approach does not work, yet the approach is still advertised commercially.

Kennedy et al[180] stated that unvalidated treatments often claim to be effective against a range of disorders with different symptoms and etiologies. Worrall[181] recommended that the public be suspicious of any therapy that claims to treat a large number of illnesses. He stated that the chronic nature of learning disabilities offers the ideal environment for fraud and quackery. He noted that parents often abandon common sense in their quest to help their struggling children and become easy prey for therapists who promise a cure.[181,182] Thus, the public must learn to carefully evaluate the information received in the face of aggressive promotion.

CONTROVERSIAL THEORIES AND THERAPIES

Magnocellular Deficit Theory

There is continuing interest in low-level impairments of the visual system as an etiologic factor in dyslexia. The visual system is composed of 2 parallel systems: the magnocellular (large-celled) (transient) system and the parvocellular (small-celled) (sustained) system.[183] The magnocellular system responds to high temporal frequency and object movement, and the parvocellular system is sensitive to low-frequency and fine spatial details.[183] The magnocellular component of the visual system is important for timing visual events and controlling eye movements when reading.[183,184] It is postulated that the magnocellular system suppresses the parvocellular system at the time of each saccade. This suppression terminates the activity in the parvocellular system to prevent ac-

tivity elicited during a fixation from lingering into that from the next fixation. The magnocellular deficit theory of dyslexia proposes that without this suppression, the parvocellular activity from different fixations would be confused, which would result in a failure to keep separate neural activity elicited during different fixations. Specific reading disability in a small subset of patients with dyslexia has been attributed to a deficit in the magnocellular visual system.[183–187]

In 1983, Breitmeyer[183] proposed that reading disability is an expression of the disruptive effects of a temporal processing deficit in the magnocellular system. Stein and Walsh[184,187] suggested that this deficit in the inhibitory function of the magnocellular system produces a visual trace of abnormal longevity that creates masking effects along with visual acuity problems when reading connected text. This visual trace could be responsible for complaints of visual distortion and moving print in some people with dyslexia. Selective disruption of the magnocellular pathway via the posterior parietal cortex in certain people with dyslexia could lead to deficiencies in visual processing, visuospatial attention, and abnormal binocular control. Reading errors have been attributed to instabilities in binocular vision that result from destabilization of binocular eye position. However, eye-movement recordings have shown that poor readers and age-matched normal readers have comparable stabilities in binocular fixation. In another article, Stein and Walsh[187] concluded that people with dyslexia may be unable to process fast incoming sensory information adequately in the phonological, visual, and motor systems.

In 1991, Livingstone et al[186] found that disabled readers had abnormally long visual evoked-potential latencies in conditions of low contrast or with rapid changes of the stimulus. It was concluded that the temporal deficits were attributable to a defective magnocellular visual pathway, because this pathway preferentially responds at higher temporal rates and lower contrasts. This finding was not reproduced in a larger study by Victor et al,[188] who concluded that it was unlikely that a simple loss of magnocellular function readily manifest in the visual evoked potential is causally and specifically related to dyslexia. Also in opposition to Livingstone et al, May et al[189] found that the latency periods were shortened under low spatial frequency conditions. In 1993, Lehmkuhle et al[185] noted the lack of change in the latency of the visual evoked potential in reading-disabled children compared with the increased latency noted in children without a reading disability by using low spatial frequency target and high-frequency flicker fields. Their conclusion was that it is possible that a defect in the magnocellular pathway creates a timing disorder that precludes rapid and smooth integration of detailed visual information necessary for efficient reading. A letter to the editor from Victor[190] interpreted the findings of Lehmkuhle et al as showing that the equalization of the responses of normal readers and reading-disabled subjects with the addition of the flickering background reflects not only an increase in response latency in subjects with no reading disability but also a statistically insignificant shortening of response latency in reading-disabled subjects. Victor further stated that this finding defies a simple interpretation in terms of a loss of the magnocellular input.

Most of the evidence supporting the magnocellular theory comes from contrast-sensitivity and functional MRI studies on visual movement processing.[183–187] The studies supporting this theory are outnumbered by studies that have found no loss of contrast-sensitivity and other studies that have found contrast-sensitivity reductions or other findings inconsistent with a magnocellular deficit.[188–201] Thus, the evidence in support of the magnocellular theory is equivocal at best. Amitay et al[191] found that although some (6 of 30) subject with dyslexia showed impaired magnocellular function, they consistently showed impaired performance in auditory and nonmagnocellular visual tasks. Amitay et al hypothesized that the magnocellular pathway deficit is part of a more generalized deficit in fast temporal processing of visual, auditory, and perceptual information. Hutzler et al[129] suggested that pathologic abnormality in the magnocellular system may coexist with dyslexia but that it is not causal. Skoyles and Skottun[202] calculated that more people without dyslexia have magnocellular deficits than those with dyslexia, which challenges the view that dyslexia is the result of a magnocellular deficit. Many researchers have concluded that magnocellular system deficits and associated visual trace persistence are not significant causes of specific reading disability.[14,188–190,192–203]

Some study results involving tinted lenses, tinted filters, or occlusion seem to support the magnocellular theory,[183–187,204] and others refute it.[188–201,205] Iovino et al[204] evaluated 60 children with reading disability and comorbid conditions involving mathematics and ADHD in 1998. Reading accuracy, word-decoding rate, and reading comprehension were assessed by using red, blue, and no overlay. Colored overlays did not differentially affect the reading performance of subjects with and without reading disabilities. However, blue transparencies significantly improved reading comprehension in all groups but reduced the reading rate. The authors noted that these find-

ings indicated that the magnocellular deficit theory may need to be reexamined. This result is important, because Breitmeyer, an author of the Iovino et al report, was also one of the authors who originally proposed the magnocellular deficit theory of dyslexia. Their alternative hypothesis involved the facilitation of attention. At the present time, there is insufficient evidence to base any treatment on this possible deficit.[203]

Colored Lenses and Overlays

At a national meeting in 1983, Irlen[206] proposed treatment with tinted lenses for a specific group of adults with reading problems, which she originally called the "scotopic sensitivity syndrome" (SSS) (now also called the Irlen syndrome or the Meares-Irlen syndrome). Before any supporting research, SSS was featured twice on the television program *60 Minutes*. On the program, it was stated that specially prescribed tinted lenses may be an effective method for the treatment of a variety of reading disorders, including dyslexia.[177] This national exposure led to great interest in the treatment. The initial claims of Irlen were based on observations, students' anecdotal accounts, and no formal experimentation. Supporters of the Irlen syndrome contend that the syndrome affects, to some degree, 12% to 15% of the general population and 45% of those with learning problems. People with this syndrome are thought to suffer from perceptual dysfunctions that cause visual distortion, light sensitivity, visual stress, and visual fragmentation from sensitivities to particular wavelengths of light not attributable to ocular conditions. This syndrome is postulated to interfere with overall attention, performance, fluency, and comprehension and create symptoms similar to learning disabilities. Proposed reading problems can include slow reading rate, poor comprehension, misreading words, skipping words and lines, reading in dim light, shortened reading times, and avoidance of reading. Writing problems can include slanted writing, unequal spacing, misaligning numbers, and errors while copying. General symptoms can include headaches, nausea, fatigue, burning eyes, and tearing. The *Irlen International Newsletter*[207] has reported that the Irlen syndrome should often be expected within the following clinical composites: bipolar spectrum disorder, sensory integration disorder, ADHD, anxiety disorders, school phobia, cranial cerebral trauma, visual dyslexia, tic disorders, reactive attachment disorders, migraines, mood disorder spectrum, recurrent automobile accidents, excessive daytime fatigue, and irritable bowel syndrome.

The Irlen method uses colored lenses and filters to reduce the offending wavelengths and correct these perceptual dysfunctions but does not treat children or adults with language deficiencies, dyslexia, specific learning disabilities, or attention deficit (Helen Irlen, MA., LMFT, personal communication, July 17, 2007). In addition to helping people read better, tinted lenses have been credited by multiple Irlen International newsletters with helping those who suffer from light sensitivity, discomfort, and distortions associated with a wide variety of different problems, including head injuries, concussions, whiplash, perceptual problems, neurologic impairment, memory loss, language deficits, headaches (including migraine), autoimmune disease, fibromyalgia, macular degeneration, cataracts, retinitis pigmentosa, complications from laser-assisted in situ keratomileusis (LASIK) and radial keratotomy, depression, seasonal depression, chronic anxiety, schizophrenia, multiple sclerosis, Asperger syndrome, and others.[207]

A multitude of different models have been used to explain the apparent "visual stress" and perceptual distortions that seem to occur in people with SSS. Currently, the magnocellular dysfunction theory and cortical excitability are being considered. Although the basis of SSS is unknown and the syndrome may not exist, interest in colored filters or overlays as a treatment for dyslexia persists and promotion continues.

Although Irlen and proponents of her method routinely refer to SSS as though it were an accepted medical syndrome, many experts question its validity.[177,208,209] It is interesting that the January 2006 *Irlen International Newsletter* stated that 1 reason that the problem of SSS escapes ophthalmologists is that ophthalmologists typically test under dim-light conditions.[207] In 1990, Helveston[177] stated that there is no evidence that SSS exists and also that there is no basis to use the word "scotopic," because the photopic system is used for reading. He also noted that reports of successful treatment of reading disorders using tinted lenses are based on anecdotal information and testimonials.[177] For many, the problem goes far beyond that of semantics. Hoyt[209] and others have maintained that SSS is not a recognized medical syndrome and consists merely of a group of vague and nonspecific symptoms derived from anecdotal accounts. To this day, there are no clearly established criteria for SSS. The only defining characteristic is a reported benefit of colored filters while reading.[208]

In 1990, the *Journal of Learning Disabilities* published 3 articles in a special series on use of the Irlen technique. A preface was written by Wiederholt,[210] the editor in chief, who noted that the Irlen techniques had received extensive media coverage without having data-based, experimentally controlled studies to validate either the syndrome or the treatment ap-

proach. He stated that the consulting editors who reviewed the studies for publication noted significant scientific and methodologic flaws that created a significant controversy as to whether the studies should be published in the journal. He further stated that on the basis of these 3 studies and the literature before 1990, the validity of the Irlen technique still had not been established.

These 3 studies were then reviewed in the journal by Parker,[176] Solan,[211] and Hoyt.[209] In their reviews of these 3 Irlen-filter studies, Parker, Solan, and Hoyt noted serious methodologic flaws. Parker concluded that the findings could not be considered statistically or scientifically valid. Because firm conclusions could not be drawn, Hoyt recommended a long-term (over 1-year) prospective multicenter trial with carefully constructed control groups of children with learning disabilities who have an ophthalmic or optometric examination at the study's onset and at least yearly thereafter.

The first article in the series was by Robinson and Conway,[212] who studied poor readers with symptoms of scotopic sensitivity. For the first 3 months, the study subjects used an "intermediate" set of lenses based on the student's first preference, then followed by use of "optimum" lenses for the next 9 months. Optimum color lenses were identified after a 2-hour diagnostic procedure that involved up to 130 colors. The use of the intermediate colors was expected to act as a "semiplacebo." The authors concluded that comprehension and accuracy but not reading rate improved using the optimum color lenses.[212] In his review of the study, Parker stated that the use of age scores was a major flaw, the improvement in all reading measures seemed developmental, and the treatment with the optimum lenses seemed to have no greater effect than the semiplacebo. He also noted that the study only had a 50/50 chance of obtaining a statistically significant finding because of the small study size (which was actually the best of the 3 studies).[176] Furthermore, no control group was used,[176,209] and 12 of the 44 subjects reported changes in remedial coaching, degree of assistance, or an alteration in the learning/supportive environment. Hoyt[209] and Solan[211] noted that the study authors stated that the participants had undergone optometric or ophthalmic examination within the year but did not provide the results. Because of the many weaknesses in this study, the conclusion is not valid.

The second study was by O'Connor et al[213] of 105 students from grades 2 to 6 who were reading below grade level. Students who displayed definite scotopic symptoms using the Irlen Differential Perceptual Schedule and displayed marked improvement in reading performance with a particular colored overlay were classified as scotopic. Students who did not show scotopic signs were classified as nonscotopic. Thirteen subjects were dropped from the study, because although they had scotopic complaints, they did not show any preference for color and showed no symptomatic or reading improvement with the colored overlays. Ninety-two children continued in the 1-week study.[213] The article's conclusion stated that reading rate, accuracy, and comprehension were significantly improved when the scotopic children read with the preferred colored overlay. In his review, Parker noted that the study was very short, and the subjects were divided into small groups, randomly and in an idiosyncratic manner.[176] The small group size diminished the study's statistical significance.[176] Reading measures varied between improvement, no change, and regression in 4 of 5 groups. The improvement in some of the subjects in the placebo-filter groups may have been attributable to the placebo effect.[209] The finding of regression may have been attributable to the unreliability or variability of the reading assessments. Solan noted that the improvement in reading was equivocal[211] and that the use of grade-equivalent scores was misleading.[176,211] Solan also noted that there was no optometric pretesting.[211] Most importantly, this study was highly flawed, because the children underwent biased selection.[209,211] Dropping the 13 subjects in the study led Parker to explain that using the same or similar measures to define the treatment group and to assess the effects of treatment is "criterion contamination."[176] On the basis of examination of the methodology of this study, the conclusion is not valid.

The third study, by Blaskey et al,[214] included 40 participants from the ages of 9 to 51 years who were self-referred for a study on Irlen treatment. Thirty-eight of these participants were found to have optometric problems. The study then included only subjects who tested positive for both SSS symptoms and vision problems. Thirty of the 38 originally chose to participate, but only 22 completed the study. The subjects were assigned to an Irlen-treatment, vision-therapy, or control group. The subjects underwent pretreatment and posttreatment optometric and reading tests. The Irlen-treatment group used Irlen lenses for 2 weeks and placebo lenses for 2 weeks, in random order. Three of 11 in the Irlen-treatment group preferred the placebo filter. Subjects in the Irlen-filter group noted a reduction in SSS symptoms, but no reading improvement or change in optometric testing results was noted. Three of 11 in the vision-therapy group dropped out. The remaining subjects in the vision-therapy group showed a

reduction in SSS symptoms and improvement in optometric testing but improvement on only 1 of 4 reading subtests. Five of the 8 control subjects dropped out. The remaining control group was too small to be of any significance, but it was stated that they showed no change in vision status or symptoms or on any of the reading measures. Authors of past studies have remarked that the symptoms of SSS seem similar to convergence insufficiency.[209,211,213] This group with Irlen symptoms showed a high percentage of convergence and accommodative dysfunction, which challenges the claim that the symptoms of SSS are not attributable to vision abnormalities.[211,213] This finding highlighted the need for a formal definition of SSS. The main flaws in this study were that multiple treatments were given to the Irlen-treatment group and the unacceptably large loss of subjects. Parker[176] challenged the statistics in the study and stated that the probability of finding a statistically significant result when none existed was unacceptably high, which invalided the study.

Serious methodologic flaws have continued to be noted in subsequent SSS studies. In 1991, Evans and Drasdo[215] criticized the literature for having no sound theoretical basis for SSS and for the unscientific testing of precision tints. Robinson[216] reviewed the literature concerning tinted lenses and filters up to 1993. He reported that authors of some studies that used anecdotal comments and questionnaires reported improvements in symptoms of visual distortion. Although those survey studies have produced a high rate of positive anecdotal comments, they have not been supported by significant gains of reading achievement in controlled studies. The few noncontrolled studies that he reviewed showed evidence of inconsistent improvement in variable subskill areas of reading. One study showed initial positive gains in reading that were not sustained at retesting. Another study claimed that the positive effects may have been confounded with other remedial interventions given at the same time. In many studies with positive results, the effect of heightened expectations cannot be eliminated because of the lack of a control group. Robinson also noted that some studies with positive results were unable to be duplicated. Many studies found no significant improvement in reading when using colored filters. Robinson concluded in his review that improved print clarity may make the learning of word-attack skills more effective but will not teach such skills and must be accompanied by reading instruction when needed.[208,216]

Menacker et al[217] performed a cohort study (the results of which were published in 1993) using 6 different colored lenses, 1 neutral-density lens, and an empty spectacle frame and showed no reading-performance change or preferred tint among disabled readers.

In 1994, Wilkins et al[218] conducted the first double-masked placebo-controlled study to test the effect of colored filters on symptoms of SSS and reading performance.[218] Subjects who experienced headaches or eye strain in addition to reading difficulties were chosen. Both the precision-tint and placebo-control groups showed a reduction in symptoms of SSS, but a larger effect occurred in the group that used prescribed colored filters. Although the contribution of placebo effects was not entirely ruled out, this study's results suggested that some of the effects of colored lenses may not be entirely attributable to placebo. Although symptoms were reduced in this study, reading rate, accuracy, and comprehension were not affected by either the prescribed or placebo filters.

The study by Robinson and Foreman[219] in 1999 also highlighted the need for proper control procedures. This study measured the effect of Irlen filters on reading performance as well as students' perception of their academic ability. The study included a control group (no SSS and no filter) and 3 experimental groups (placebo, blue, and precision filters). All 4 groups showed increased accuracy and reading comprehension, and the 3 experimental groups, including the placebo group, demonstrated significantly more improvement than the controls. Subjects also perceived an improvement in their SSS symptoms regardless of whether they were wearing placebo tints, blue tints, or prescribed tints.[219] This study revealed a likely placebo effect not only on subjective symptoms but on actual reading performance.[208,219]

In 2002, Bouldoukian et al[220] reported on subjects who experienced SSS symptoms while reading and concluded that colored overlays improved reading speed. However, the results also revealed that greater than one-third of the subjects preferred the control filter and, overall, the subjects were not significantly more likely to prefer their colored overlay than the control filter.

Spafford et al[221] found that contrast reduction, but not lens color, permitted poor readers to be diagnostically differentiated from proficient readers. Lightstone et al[222] stated that the choice of color must be child-specific and requires trial and error. Multiple different methods have been used to select the lens or filter color.[218,223–225] Color selection has shown considerable variability[224] and poor test-retest consistency.[226] Also, the tint selected needed to be changed in up to 25% of subjects within 1 year in a study by

Stone.[227] In a study by Croyle, the blue background provided improvement in the reading rate in low-contrast conditions, whereas the blue background had a slight deteriorative effect under high-contrast conditions.[228] Solan et al[229] found that comprehension of poor readers was improved by using blue filters, whereas Christenson et al[230] found no significant difference in reading comprehension or reading rate when using blue filters. Iovino et al[205] found that blue transparencies significantly improved reading comprehension but reduced reading rate. In a study of yellow filters by Ray et al,[231] the conclusion stated that there was improvement in accommodation, convergence, and reading rates, but deeper analysis of the statistics revealed a question of significance.

Among the numerous criticisms of Irlen's treatment is the argument that precision tints are highly susceptible to placebo effects. By relying on anecdotal accounts or experiments that lack adequate placebo controls, interpretations of findings are speculative at best. Controlling for placebo effects requires, among other things, the inclusion of placebo filters of similar color to precision tints but outside the effective range of chromaticity. Such filters have been successfully produced but have rarely been implemented in Irlen-lens research. Many studies include control groups, but they are typically composed of children who use no filters during testing and who report no symptoms of SSS. Although this is a form of control, it does not adequately control for the possibility of placebo effects.[208] Results are inconclusive when placebo filters are not implemented.[208]

More recent published studies advocating the use of these therapies to treat reading difficulties have continued to have serious flaws in their methods, including biased sample selection, small sample size, biased interpretation, heightened expectations, combination with traditional remediation techniques, and insufficient control for the placebo effect to support the assertion.††† Some studies have claimed to detect some improvement in a few patients in 1 reading subskill but not in other areas. However, improvements in reading subskills do not necessarily translate into improvements in reading. Overall, study results have been inconsistent[208,216,223,232]; many studies have shown that colored overlays and filters are ineffective,[205,214,217,233–235] but a few studies have reported partial positive results.[212,213,218,222,224,231] Many unreported studies have shown no effect of colored filters on measures of either reading performance or SSS symptoms. Also, many of the studies cited as proof of Irlen-lens efficiency actually have been found to be inconclusive after deeper analysis. Not only are some findings less meaningful than they first appear, the large variability in the methodology, techniques, and largely negative results does not support the effectiveness of tinted lenses and tinted filters in these patients.‡‡‡

Contrary to the broad claims of many Irlen-treatment proponents that the syndrome is highly prevalent in the reading-disabled population, the efficacy, if any, of this approach seems to be limited to a small subgroup of children with reading problems. The positive evidence for the effects of colored overlays and filters on reading performance is limited. Worrall et al[182] noted that the studies indicated that fewer than 5% of readers who experience discomfort benefit from a change in contrast, brightness, or color on the page beyond what would be expected from a placebo treatment alone. Thus, colored filters and lenses may be ineffective, except that they act as a placebo. In 1999, Evans[237] explained that treating visual problems or perceptual symptoms will likely alleviate only the "visual component" of reading problems and will not impact the phonologic deficits underlying most cases of reading disabilities. Thus, even proponents of precision tints have maintained that although an improvement in print clarity may facilitate the process of learning to read, it is not enough to lead to spontaneous improvements in word-recognition skills and other complex elements of reading; therefore, remediation for underlying reading problems will still be required.[208] Rooney[238] advised the education community not to embrace SSS and its treatment for learning disabilities and dyslexia.

With nothing but a small amount of anecdotal evidence, CBS reported Irlen's claims to the public and circumvented the normal process of scientific review and debate. Despite the continued lack of definitive evidence of its effectiveness, colored lenses and filters continue to be promoted. Since 1990, the medical community has recommended that Irlen promoters design and perform rigorous prospective, masked, controlled scientific studies to document the effectiveness of their method. Scientifically, the burden of proof is on the developers and promoters of the Irlen method to provide strong evidence to show that their diagnosis is valid and their treatments are beneficial. Contrary to usual scientific practice, 1 Irlen center director stated that it is equally the responsibility of others to carry out this validation research.[177]

Behavioral Optometry

Skeffington was the director of education of the Optometric Extension Program from 1928 to 1976.[239] The Skeffin-

†††Refs 111, 166, 176, 208, 209, and 215.

‡‡‡Refs 14, 111, 112, 177, 178, 205, 208, 209, 211, 214, 215, 217, 223, and 233–236.

gton near-point stress model is the basis for much of behavioral optometry.[240] His theories were derived exclusively from his and his collaborators' (Harmon and Renshaw) clinical experience and never independently refereed or formally debated outside the Optometric Extension Program.[239] Skeffington's model states that binocular anomalies and refractive errors are not primary conditions but products of underlying near-point stress. The model states that near-work stress causes underaccommodation and overconvergence. Esophoria usually develops, but sometimes exophoria or myopia develops from the stress. The model further states that this esophoria is best treated preventively. Harmon's theories concern reading posture.

Skeffington recommends an examination using 21 procedures for every patient in a standard sequence.[241] The results of each test are then noted to be higher or lower than an "expected" value.[242] The "expected value" is an "ideal value," not a norm.[242] The Optometric Extension Program "expected value" for ocular alignment at near for children is 6 prism diopters of exophoria. Most people free from ocular symptoms have small amounts of latent strabismus (esophorias or exophorias) that should be considered physiologic. Ophthalmologic and optometric clinical studies have shown that the average near ocular alignment is approximately 1 prism diopter of exophoria.[243–246] Using diagnostic criteria that are not valid such as the developmental optometric "expected values" will lead to misdiagnosis of many conditions. Many children with typical latent strabismus have been labeled by developmental optometrists as abnormal and diagnosed with near-point stress and a "relative esophoria" if they show physiologic lower values of exophoria than their "expected value."

A recent model of vision, considerably different than the traditional optometric model, proposed by Scheiman[247] divides evaluation and treatment into 3 categories: (1) visual acuity, refraction, and eye health disorders; (2) visual efficiency skills of accommodation, binocularity, and ocular motility; and (3) visual information-processing skills of visual discrimination, visual closure, visual memory, visualization, visual-motor integration, and figure-ground perception.

The optometric literature has implicated accommodative spasm, accommodative insufficiency, ill-sustained accommodation, accommodative inertia, and binocular dysfunction as being linked with reading disorders.[111,113,116,247–250] The authors of most of these studies claim that patients experience visual symptoms that lead to degradation in reading performance.[249–252] Accommodative disorders are implicated in causing print blurring, daydreaming, decreased attention span, increased heart and respiratory rate, and poor posture.[253–256] Grisham et al[257] reported an increased incidence of various symptoms in slower readers but could not show a significant difference in reading ability between readers with normal and abnormal binocular function. There is no proof of cause and effect between decreased binocular function and symptoms or between symptoms and poor reading. Other studies have been unable to find an increase in the incidence of binocular disorders in children with reading difficulties or an association between motility disorders and reading ability.[124,126,127]

Training Glasses

"Training" or "developmental" lenses are low-plus power glasses to be used for reading to relieve stress. They are frequently used in conjunction with vision training. Behavioral optometrists believe that training lenses help the visual system develop and mature normally. Skeffington[240] stated that they are best prescribed preventively before a visual problem is identified. Hendrickson stated that every child would benefit from the use of "learning glasses" in the classroom.[258] It has been argued that treatment of accommodative dysfunctions with low-power reading lenses will eliminate secondary problems and their associated symptoms and thereby improve reading efficacy.[259,260] Although they do not provide best-distance visual acuity, they are used to teach the eyes to relearn distance-vision skills that have atrophied. They generally have a power of +0.50 to +1.00 D, and some incorporate bifocals or prisms. Practitioners have followed several highly variable methods to establish the dioptric value of the near correction.[261,262]

Greenspan[253] showed improvement in pencil-and-paper visual tasks and reading posture with the low-plus lenses. Keller and Amos[263] critically reviewed Greenspan's data and found the effect of the developmental lenses to be insignificant. Keller and Amos also noted that if there is an effect, it would imply some unique property of the +0.50 D lens regardless of the patients' refractive error. A study by Barry and Cochran[264] compared plano (no power) and +0.50 D lenses near prescriptions in young adults and found no significant difference in visual performance. Wildsoet and Foo[265] compared 13 children who wore plano lenses and low-power (+0.50 to +1.00 D) training lenses for 6 to 15 months and found no significant difference in reading comprehension. Beauchamp[266] discussed the issue of overprescription of spectacles in his review of vision training in 1986. The justification and benefit for routine in-

tegration of costly spectacles into the program is unsupported and often not discussed. Beauchamp stated that spectacles are provided to the vast majority of children undergoing optometric vision training despite the demonstrably low incidence of ocular motility or refractive deficits.[124,126,127,266,267] Blika[124] found that one third of children in his study had unnecessary glasses, and many had improper prescriptions.

Olitsky and Nelson[111] stated that there is no proof that there is a difference in accommodative ability between normal and abnormal readers and that there was no correlation between reading performance and any specific type of refractive error, including hyperopia or a need for glasses. Olitsky and Nelson noted that the very low power of the reading glasses or bifocals that are often prescribed throws further doubt on their usefulness in a child who often shows large amplitudes of accommodative ability.[111] In a critical review of the behavioral optometric literature before 2000 for the UK College of Optometrists, Jennings[239] declared that the literature revealed no convincing experimental evidence of any benefits from a low-plus prescription.

Vision Therapy

Vision therapy is an attempt to correct or improve ocular, visual processing, and visual-perceptual disorders. A task force representing the College of Optometrists in Vision Development, the American Optometric Association, and the American Academy of Optometry formulated the following policy statement: "Optometric intervention for people with learning related vision problems consists of lenses, prisms, and vision therapy. Vision therapy does not directly treat learning disabilities or dyslexia. Vision therapy is a treatment to improve visual efficiency and visual processing, thereby allowing the person to be more responsive to educational instruction."[268] A vision-therapy program consists of in-office and at-home exercises performed over weeks to months and may include training glasses.

Developmental optometrists divide vision therapy into 2 broad categories: classic orthoptic techniques and behavioral or perceptual vision therapy. Orthoptic techniques are used to correct accommodative and convergence dysfunctions as well as heterophorias and refractive errors that might be responsible for asthenopic symptoms (eye fatigue and discomfort often aggravated by close work). In behavioral vision therapy, eye-movement and eye-hand coordination training techniques are used to improve learning efficiency by improving visual processing skills. These visual processing skills include visual-spatial orientation skills, visual discrimination, visual closure, visual memory, and visual-motor integration. Behavioral vision therapists claim to improve the efficiency of eye movements to improve scanning and locating. Behavioral vision therapy is based on the premise that differences in children's visual-perceptual-motor abilities exist and that these perceptual-motor abilities influence cognitive and adaptive skills such as reading, writing, and motor activities used in activities of daily living. It has been recommended to improve visual skills and processing in the belief that they will improve learning disabilities, including speech and language disorders, and nonverbal learning disorders.[112]

Vision-Therapy Literature Review

Two major reviews of the vision-training literature were undertaken by Keogh, a professor of special education, in 1974 and again in 1985 with Pelland[267,269] to answer the questions of what optometric vision training is and for whom vision training is appropriate and effective. In 1974, Keogh[269] stated that the research on vision theory was sparse, fragmented, and, for the most part, methodologically flawed, and that the professional literature was characterized more by opinion than evidence. The 1974 review concluded with the observation that there was a lack of substantive and comprehensive evidence on which to make decisions about program effects and called for research to specify child and program characteristics that contribute to intervention outcomes.

Keogh stated that, in the 10 years after her first review, behavioral optometrists continued to offer and expand vision training to learning- and reading-disabled pupils, which led to her second review. She noted in her 1985 review that the necessary and sufficient components of vision training are unspecified and, thus, untested. Keogh and Pelland[267] stated that after detailed review of more than 35 program descriptions, there was not a single prototypic program model, which led to the comment that there were almost as many training programs as there were vision trainers. They noted that the variation in vision-training programs was so great that it was extraordinarily difficult to draw inferences about the effectiveness of the procedures. Furthermore, it seemed paradoxical that vision training was being recommended and used for a broad range of problems including preventive treatment.

Keogh and Pelland also noted that the nature of the relationship between vision, reading, and learning problems continues to be a troublesome theoretical question that has not been well answered by optometrists involved in vision training. Although much of the research basis for behavioral optometrists' interpretation was completed before 1975, in general, optometrists accept a link between poor reading

and convergence inefficiencies, farsightedness, and near and distance phorias. Thus, many optometrists argue in favor of vision therapy for problems of convergence, accommodation, ocular motility, and binocular fusion. Keogh and Pelland reported that most of the reviewed studies did not meet rigorous research standards. In most of the reported studies the data were ambiguous with equivocal findings so that the importance of visual efficacy was undeterminable. They declared that to focus on a single aspect of learning problems and to interpret an association or relationship as if it has causal implications goes beyond the evidence.[267]

Keogh and Pelland stated that if visual processing problems are not the cause of many reading problems, vision training to improve visual efficiency is not the treatment of choice. They found little definitive evidence for the effectiveness of vision therapy even when the results were aggregated across studies and concluded that using this treatment would lead to wasteful and ineffective intervention efforts. They concluded that it is imperative that vision-training research receive systematic and rigorous testing and that the research be reported for review in a broader scientific arena.[267]

In 1984, Metzger and Werner[116] reviewed the ophthalmologic, optometric, and psychological literature on the use of visual training for reading disabilities. They found that refractive abnormalities, ocular motor abnormalities, and perceptual capabilities did not differ between reading-disabled children and those with no reading disability. In their review, they noted significant flaws in experimental methodology that supports the visually based hypotheses. They also found that visual-motor-perceptual training programs produced no further improvement in reading ability for affected children when compared with those in control groups.[116] Levine,[128] in his commentary on their article, remarked on the poor methodology in the reviewed studies, researchers having a vested interest, narrow interpretation of the findings, and an initial preconception that a factor in isolation causes reading disability. He recommended properly designing research on the use of vision training for learning disabilities.

In 1987, Beauchamp and Kosmorsky[122] extensively reviewed the interdisciplinary literature for the history of dyslexia and its relationship to neuropathology and eye movements. They concluded that eye movements are not the controlling factor in dyslexia or learning disabilities but are secondary to the comprehension difficulties. In addition, they concluded that approaches designed to improve visual perception by training are misdirected, because visual-perceptual problems do not underlie dyslexia. Their literature review revealed that visual-perceptual training seems to be ineffective and that controlled evidence for treatment efficacy has been found to be conceptually flawed, scant, and contradictory.

Complementary Therapy Assessment: Vision Therapy for Learning Disabilities was published in 2001 by the American Academy of Ophthalmology.[112] This report reviewed the literature on vision therapy for reading disabilities and concluded that there seems to be no consistent scientific evidence that supports behavioral vision therapy, orthoptic vision therapy, or colored overlays and lenses as effective treatments for learning disabilities. No well-performed randomized controlled trials (level I evidence) were found in the literature. The vision-therapy studies have shown an absence of a standard definition of the techniques that constitute vision therapy. Children included in the studies had been diagnosed with learning disabilities by using different criteria and may have been misdiagnosed or may have had additional conditions that confounded the findings. Furthermore, during a course of vision therapy, children were simultaneously receiving continued and even enhanced instruction in a standard or remedial educational setting and undergoing natural maturational changes. The results of subsequent studies have been inconsistent and have failed to reproduce many of these findings. The American Academy of Ophthalmology recommended that appropriately designed and methodologically rigorous scientific studies with a team approach using multidisciplinary educational specialists be conducted to assess the effectiveness of vision therapy.[112]

The Institute for Clinical Systems Improvement technology assessment report on vision therapy was published in 2003.[270] The Institute for Clinical Systems Improvement reports are designed to assist clinicians by providing a scientific assessment, thorough search, review, and analysis of medical literature of the safety and efficacy of medical technologies. The reports classify and grade references by their level of evidence. Two ophthalmologists and 2 optometrists were included on the panel on the topic of vision therapy. Their conclusions were that the studies of vision therapy are predominantly poor-quality case series that provided inadequate scientific evidence to enable a conclusion to be reached about the efficacy of vision therapy for patients with learning disabilities, amblyopia, strabismus, convergence insufficiency, or accommodative disorders. The committee encouraged masked, randomized, controlled trials of vision therapy for these potential uses. They recommended that these trials include clearly defined patient populations, control

groups, clearly defined treatment programs, relevant outcome measures, and adequate patient follow-up to determine if any observed benefits are maintained.[270]

Rawstron et al[271] published a literature review of eye exercises in 2005. The review concluded that the results of small controlled trials and many case reports support the use of eye exercises in the treatment of convergence insufficiency but that there is no clear scientific evidence published in the literature to support the use of eye exercises in the remainder of the areas reviewed, including learning disabilities and dyslexia.

A 2005 Association for Research in Vision and Ophthalmology abstract by optometrists Sampson et al[272] discussed a randomized, masked, and controlled study of 96 suboptimally achieving children who showed visual information-processing delay and normal auditory/verbal language development. The experimental group underwent a visual training program designed to be typical of programs used in pediatric optometric practice. The control group received a placebo program that provided similar amounts of individual time with the children. Diagnostic educational testing took place before the study, at the conclusion, and 6 months after the completion of the programs. Both groups made significantly greater postintervention progress on most variables compared with that expected had no intervention occurred. Results for the entire group showed no significant between-group differences for all educational tests. Thus, results for the entire group did not provide evidence to support efficacy of the visual training program under investigation, which suggests that a placebo effect was responsible for much of the demonstrated improvement.

In 2005, the Convergence Insufficiency Treatment Group published data from a small, masked, placebo-controlled, multicenter, randomized clinical trial that showed that patients treated with office-based vision therapy improved more than those treated with minimally intensive home-based pencil push-up exercises or placebo.[165] The study used both findings and a symptom score. Eight of the 15 patients, or 53% of the patients treated with office-based vision therapy, were considered symptomatically "cured."[165] Kushner,[161] in his accompanying editorial, surveyed 20 pediatric ophthalmologists and 15 orthoptists who treat convergence insufficiency. His survey revealed that most pediatric ophthalmologists and orthoptists do not use unmonitored home treatment with pencil push-ups. Generally, orthoptic therapy prescribed by pediatric ophthalmologists and orthoptists consists of push-up exercises using an accommodative target of letters, numbers, or pictures; push-up exercises with additional base-out prisms; jump-to-near-convergence exercises; stereogram convergence exercises; and recession from a target. The exercises are performed at home, and the children are reevaluated in the office on a monthly basis. Kushner retrospectively reviewed his last 20 patients with convergence insufficiency treated with these orthoptic techniques. Sixteen of his 20 patients (80%) reported complete resolution of symptoms and were objectively "cured" using the same criteria as in the study.[160] The Convergence Insufficiency Treatment Group study showed that convergence insufficiency can be improved with in-office vision therapy, but the accompanying editorial revealed that properly prescribed and monitored home treatment is also very effective.[161,165]

The Convergence Insufficiency Treatment Group[163] published a larger second study in 2008, which was a randomized clinical trial comparing home-based pencil push-up exercises, home computer vergence therapy, office-based orthoptic vision therapy with home reinforcement, and office-based placebo therapy with home reinforcement in 221 children in a 12-week study. Symptomatic improvement was noted in 43% of the home-based pencil push-up exercises group, 33% of the home computer vergence therapy group, 75% of the office-based vision therapy with home reinforcement group, and 35% of the office-based placebo therapy with home reinforcement group. The Convergence Insufficiency Treatment Group study showed better improvement with intensive office-based vergence/accommodative and home reinforcement therapy compared with less intensive home treatments or placebo. Wallace,[164] in his accompanying editorial, noted that neither home-based treatment group used in this study was an ideal comparison group, because fewer actual hours of treatment were received, and the home therapy was less intensive. Granet,[273] a site principle investigator for the study, wrote a letter to the editor concerning the methodology of the study. He stated that the difference between treatment groups could have easily been affected if the time in true treatment had been equalized.

Another major criticism of the 2 studies is the definition of convergence insufficiency. The criteria for study inclusion was a near exophoria at least 4 prism diopters greater than at far, a receded near point of convergence, insufficient positive fusional vergence at near or minimum positive fusional vergence, and a minimum symptom score. Using these diagnostic criteria may overestimate convergence insufficiency. Although the convergence-insufficiency symptom survey has undergone validation,[274] many of the symptoms in their symptom-scoring system are too vague and repetitive. Two examples are: (1) Do your eyes

hurt when reading or doing close work? and (2) Do your eyes ever feel sore when reading or doing close work? Also, many of the symptoms used in the symptom score are nonspecific. Two examples are: (1) Do you read slowly? and (2) Do you have trouble remembering what you have read? Using this symptom survey, many people without convergence insufficiency may have a symptom score that qualifies them for the study. Finally, the use of symptoms in children may be unreliable. In a separate study, complaints such as eyestrain and headaches have been found to be poor markers of eye conditions in young children.[156]

The apparent superiority of office-based orthoptic vision therapy over home-based exercises in these 2 studies is not as strong as it first seemed. This problem was noted in the editorials[161,164] that accompanied both the 2005 and 2008 convergence-insufficiency treatment studies and also in a letter to the editor by Granet.[273] The major weakness of these studies was that the study groups were not appropriately chosen to provide a proper comparison. Treatment with minimally intensive pencil push-ups is not representative of the standard of care and, thus, does not provide the appropriate comparison. The comparison group should consist of the home exercise methods that are frequently prescribed by pediatric ophthalmologists or orthoptists and should be for the same number of hours and intensity as the in-office vision therapy. Sethi,[275] in his letter to the editor, noted that sustained convergence should have been stressed in performing the home pencil push-up exercises. Methodologically, the 2008 study is weakened, because it included 2 different variables and compared different treatments and 2 different intensities of treatment.

Jennings[239] reviewed behavioral vision-therapy studies for the UK College of Optometrists. His report on the evaluation of the theory and practice of behavioral optometry was published in 2000. In his review he noted that many studies showed methodologic and statistical weaknesses. He commented that careful study design is essential, because with training and practice, perceptual judgments improve. This improvement would be greatest if the patient is encouraged and reinforced. He also questioned whether improvement on the training task would transfer to routine activities. He concluded that the merits of vision therapy are extremely difficult to assess and that there is a lack of controlled studies to support behavioral management strategies. Jennings' conclusion was that behavioral optometric therapies do not satisfy evidence-based scrutiny.

On behalf of the UK College of Optometrists, Barrett[276] in 2009 reviewed studies of vision therapy published since the Jennings report in 2000. Barrett remarked that the theory and practice of behavioral optometry remain controversial, especially when considered from the perspective of the traditional optometrist. This is because many of the patients that behavioral optometrists are treating would not exhibit any abnormality under clinical assessment using traditional optometric approaches. Barrett reviewed evidence in 10 categories: accommodative/vergence disorders; underachieving child; prisms for near binocular disorders and for producing postural change; near-point stress and low-plus prescriptions; low-plus lenses at near-to-slow myopia progression; therapy to reduce myopia; therapy of amblyopia and strabismus; training central and peripheral awareness and syntonics; sports vision therapy; and neurologic disorders and neurorehabilitation after trauma/stroke. Barrett found that vision therapy for convergence insufficiency seemed to have some benefits but that further large-scale controlled trials that used proper controls were needed. He reported that vision therapy cannot currently be considered as an evidence-based treatment for reading or learning disorders. He declared that the large majority of behavioral management techniques were to be considered unproven until more rigorous trials were undertaken. His report concluded that the continued absence of rigorous scientific evidence from well-designed trials to support behavioral management approaches, and the paucity of controlled trials in particular, represented a major challenge to the credibility of the theory and practice of behavioral optometry. Barrett's final conclusion was that these approaches were not evidence-based and could not be advocated.[276]

A 2009 article in *Optician Online* commented on Barrett's study. The clinical editor of *Optician Online* stated that although some practitioners may be convinced from their own experience of the effectiveness of behavioral optometry, the lack of sound evidence-based research supporting this stance will always leave it open to the criticism that all it does is pay attention to a perceived problem and thereby influence its expression. The editor contended that it seemed less than ethical to charge for such interventions under a cloak of clinical practice until good evidence for the techniques exists.[277]

Summary on Vision Therapy

Some optometrists attribute reading disabilities or a portion of them to 1 or more subtle ocular or visual abnormalities. The basic tenet of their hypothesis is that children with reading disorders have an increased incidence of vision abnormalities. The College of Optometrists in Vision Development estimates that more than 60% of prob-

lem learners have undiagnosed vision problems that contribute to their difficulties. This claim has not been scientifically established. Many children without vision problems have been labeled as abnormal, because typical physiologic latent strabismus is not taken into account. Optometrists also claim that visual dysfunction in children impairs their ability to respond to the specific instruction intended to remedy the disability. However, the association of binocular and other vision anomalies with learning disabilities, as well as the significance of any association, has not been scientifically demonstrated. Thus, the nature of the relationship between vision problems and reading and learning problems continues to be a troublesome theoretical question that has not been answered adequately by optometrists involved in vision training.[267] Currently, there is inadequate scientific evidence to support the view that subtle eye or visual problems, including abnormal focusing, jerky eye movements, misaligned or crossed eyes, visual-motor dysfunction, binocular dysfunction, perceptual dysfunctions, or hypothetical difficulties with laterality or "trouble crossing the midline" of the visual field, cause or increase the severity of learning disabilities.§§§ Statistically, children with dyslexia or related learning disabilities have the same visual function and ocular health as children without such conditions.|||||| Visual problems may coexist with dyslexia but seem to be present with the same incidence as in the population in general; furthermore, no consistent relationship between visual function and academic performance and reading ability has been shown.¶¶¶ Although it is important to have adequate eyesight and ocular motility to read with the greatest efficiency, subtle or severe eye defects do not cause decoding or comprehension difficulties.

Because visual problems do not underlie dyslexia, approaches designed to improve visual function by training are misdirected.[122,128,137,153,266,267] Optometric vision training is based on the premise that reading is primarily a visual task. Many authors in the optometric literature proclaim the usefulness of vision therapy for reading and learning disabilities. Proponents of vision therapy claim that treatment of these visual abnormalities will help children with learning disabilities be more responsive to educational instruction, but this hypothesis has not been proven scientifically. Also, many of the abnormalities that are said to cause problems with reading are undefined and unspecified, which makes evaluation of the claims of successful treatment difficult to analyze. It is even more difficult to determine any possible benefit of vision therapy when used "preventively."

Over the last 35 years, many reviews of the literature that optometry uses to support vision therapy have been performed. Reviews of the vision-therapy literature revealing a lack of scientific support have been performed by researchers in reading and education, pediatricians, and ophthalmologists. Many of the detailed reviews that scientifically questioned the credibility of the theory and practice of vision therapy have been performed recently by optometrists.[181,182,239,270,276] Detailed review of the vision-therapy literature has revealed significant weaknesses, because most of the information has been of poor statistical and scientific quality. Many claims supporting vision therapy are old or found in newsletters, flyers, books without research, or nonedited or loosely reviewed publications. Many of the references used to support the claims in these articles do not relate directly to the topic. Often, a variety of criteria have been used in diagnosing subjects included in the study, and a variety of treatment programs have been used within a study. In addition, the investigator often has a vested interest in the outcome of the study. Many of the studies that support vision therapy use small numbers, and they typically rely on case studies, self-reports, anecdotal information, and testimonials. Studies have been poorly designed, failed to "mask" the investigator, and used inadequate or poor controls so that bias and placebo effects may have confounded the results.### In general, these research methods and references show poor scientific validation.[62,112,270,271]

Scientific evidence does not support the claims that visual training, muscle exercises, ocular pursuit-and-tracking exercises, behavioral/perceptual vision therapy, training glasses, prisms, and colored lenses and filters are effective direct or indirect treatments for learning disabilities.**** There is no valid evidence that children who participate in vision therapy are more responsive to educational instruction than children who do not participate.†††† The reported benefits of vision therapy, including nonspecific gains in reading ability, can often be explained by the placebo effect, increased time and attention given to students who are poor readers, maturation changes, or the traditional educational remedial techniques with which they are usually combined.‡‡‡‡

§§§Refs 14, 26, 111–113, 116, 119–128, 134–138, 154, and 266.

||||||Refs 2, 9–12, 14, 15, 111–113, 116, 119–128, 134–137, 149–151, 153, 166, 178, 239, 266, 267, 270, and 276.

¶¶¶Refs 118–121, 123, 124, 126, 127, 134, 135, and 149–151.

###Refs 111–113, 116, 122, 128, 136, 153, 166, 178, 239, 266, 267, 270, 271, and 276.

****Refs 14, 24–26, 29, 31, 34, 39, 44, 82, 111–113, 116, 122, 128, 136, 152, 153, 166, 178, 205, 208, 214, 233–235, 239, 266, 267, 270–272, and 276.

††††Refs 14, 24, 29, 34, 111–113, 116, 122, 128, 136, 152, 153, 166, 178, 239, 266, 267, 270–272, 276, and 278.

‡‡‡‡Refs 111–113, 116, 136, 239, 266, 267, 270, and 278.

Other than convergence-insufficiency treatment, the optometric claims that vision therapy improves visual efficiency cannot be substantiated. Treatment of convergence insufficiency helps the reader maintain visual effort for prolonged reading, but treatment of convergence insufficiency by any method is not a treatment for dyslexia. These ineffective, controversial methods of treatment may give parents and teachers a false sense of security that a child's reading difficulties are being addressed, may waste family and/or school time and resources, and may delay proper instruction or remediation.

Because they are difficult for the public to understand and for educators to treat, learning disabilities have spawned a wide variety of scientifically unsupported vision-based diagnostic and treatment procedures.§§§§ Despite the continued lack of definitive evidence of its effectiveness, vision training for improving visual efficiency and visual processing has been widely used, at great cost, over the last half-century in many thousands of children with learning disabilities and also as a "preventive treatment." During these years, the medical and educational communities have recommended designing and performing rigorous prospective, masked, controlled scientific studies to document the effectiveness of vision therapy. The burden of proof is on the promoters of vision therapy to provide strong evidence to show that their testing methods are valid, that an association exists between visual dysfunction and learning disabilities, and that their treatments are beneficial. Outcome studies documenting effective results using EBM are necessary before vision therapy can be recommended. Continuing critical literature review will ensure that the best evidence is disseminated and poor-quality studies are subject to proper scrutiny.

§§§§Refs 12, 14, 24, 111–113, 116, 122, 128, 136, 152, 166, 177, 178, 205, 208, 209, 211, 214, 215, 217, 223, 233–236, 239, 266, 267, 270–272, 276, and 278.

MANAGEMENT SUMMARY

Parents should read aloud to their children to help develop language skills. If early warning signs of learning difficulties are detected in preschool-aged children by parents or teachers or during developmental surveillance or screening, the primary care provider should refer the child for early evaluation and intervention. Cost-effective prevention, early identification, and early phonologic awareness intervention programs in kindergarten through 2nd grade should be encouraged. Early identification of children who show delays or difficulties should be a high priority for elementary school teachers. Evaluation for learning disabilities should be considered for all children who present with school difficulties, even if reading difficulty is not the chief complaint.[34] A child with suspected learning disabilities should be placed into remediation and be referred as early as possible for educational evaluation.

A multidisciplinary team consisting of educators, educational remediation specialists, special service professionals, psychologists, and pediatric specialists in neurodevelopmental disabilities or developmental and behavioral pediatrics should be called on to diagnose and treat suspected learning disabilities in children. Making the correct diagnosis of the specific type of learning disability along with any comorbid conditions is of paramount importance before any therapeutic regimen can be prescribed.[167] To outline the educational goals and services that the student needs to be successful, an IEP contract should be developed. The IEP should describe what services will be needed, including specific remedial interventions and accommodations, and which type of program would be best and should set guidelines for measuring future educational progress.

The remedial program should be individualized. Remedial programs should include specific instruction in decoding, fluency training, vocabulary, and comprehension.¶¶¶¶ Most programs include daily intensive individualized instruction to explicitly teach phonemic awareness and the application of phonics.#### Later, syllable instruction, morphology, memorization of sight words, spelling, syntax, and semantics are taught.[55] Comprehension is gained through fluency training, vocabulary instruction, and active reading comprehension.[34,35] Practice-reading aloud at home is essential. Because people with dyslexia have a persistent problem and continue to read slowly throughout their life, it often becomes necessary to adapt the learning environment.[24,25,34,81] Schools can implement academic accommodations and modifications to help students with dyslexia succeed.

Children with learning disabilities and possible visual problems suspected by their parents, teachers, or physician should be seen by an ophthalmologist who has experience with the assessment and treatment of children, because some of these children may also have a treatable visual problem along with their primary reading or learning dysfunction.[110–113,154] Treatable ocular conditions include strabismus, amblyopia, convergence and/or focusing deficiencies, and refractive errors. The ophthalmologist should identify and treat any significant visual defect according to standard principles of treatment.[110,113,153,166] The primary care pediatrician and ophthalmologist should not diagnose learning disabilities but should provide information on learning disabili-

¶¶¶¶Refs 1, 14, 32–35, 43, 55, 60, 63–65, and 81.
####Refs 1, 14, 24, 25, 30–35, 55, 60, and 63–65.

ties and reinforce the need for additional medical, psychological, educational, or other appropriate evaluation or services.[167] In addition, the primary care pediatrician and ophthalmologist should discuss the lack of proven efficacy of vision therapy and other alternative treatments with the parents. Finally, the public must learn to carefully evaluate the information that they receive in the face of aggressive promotion.

CONCLUSIONS

Underachievement is not synonymous with specific learning disability.[279] Learning disabilities arise from neurologic differences in brain structure and function that affect the brain's ability to store, process, or communicate information. The consensus of educators, psychologists, and medical specialists is that children who exhibit signs of learning disabilities should be referred as early as possible for educational, psychological, neuropsychological, and/or medical diagnostic assessments, because the beneficial effects of early identification and intervention are apparent in many studies. Children diagnosed with learning disabilities should receive appropriate support and individualized evidence-based educational interventions combined with psychological, medical, and visual treatments as needed.

Reading difficulties constitute a diverse group of problems that include dyslexia and secondary forms of reading difficulties caused by visual or hearing disorders, intellectual disability, experiential and/or instructional deficits, and other problems.[14,24–26] Missing these problems could cause long-term consequences from assigning these patients to incorrect treatment categories. Dyslexia is a primary receptive language-based reading disorder secondary to a neurobiological deficit in the processing of the sound structure of language called a phonemic deficit that makes it difficult to use the alphabetic code. Because of our rudimentary knowledge of learning disabilities, including dyslexia, there currently are no simple remedies. Because dyslexia is a language-based disorder, treatment should be directed at this etiology.***** The prognosis depends on the severity of the disability, the specific patterns of strengths and weaknesses, and the appropriateness, amount, intensity, and timing of the intervention. Early recognition and individualized, interdisciplinary management strategies are the keys to helping children with dyslexia. Early intervention with intense, explicit instruction is critical for helping students ameliorate the lifelong consequences of poor reading.

Visual problems do not cause dyslexia. Scientific evidence does not support the efficacy of eye exercises, behavioral/perceptual vision therapy, training glasses, or special tinted filters or lenses in improving the long-term educational performance in these complex pediatric neurocognitive conditions. Recommendations for multidisciplinary evaluation and management must be based on evidence of proven effectiveness demonstrated by objective scientific methodology.[106,112,239,270,276] It is important that any therapy for learning disabilities be scientifically established to be valid before it can be recommended for treatment.[106] Because vision therapy is not evidence based, it cannot be advocated.

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*****Refs 1, 14, 24, 25, 30–35, 55, 60, 63–65, 81, and 106.

OTHER RESOURCES

International Dyslexia Association: www.interdys.org

National Center for Learning Disabilities: www.ncld.org

Learning Disabilities Online: www.ldonline.org

Interdisciplinary Council on Developmental and Learning Disorders: www.icdl.com

Great Schools Inc/Schwab Learning: www.schwablearning.org

All Kinds of Minds: www.allkindsofminds.org

Children and Adults With Attention Deficit/Hyperactivity Disorder: www.chadd.org

National Center for the Study of Adult Learning and Literacy: www.ncsall.net

PACER Center: www.pacer.org

Parental Information and Resource Centers: www.ed.gov/programs/pirc/index.html

Family Voices: www.familyvoices.org

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Substance Abuse and Committee on Adolescence

Legalization of Marijuana: Potential Impact on Youth

ABSTRACT. As experts in the health care of children and adolescents, pediatricians may be called on to advise legislators concerning the potential impact of changes in the legal status of marijuana on adolescents. Parents, too, may look to pediatricians for advice as they consider whether to support state-level initiatives that propose to legalize the use of marijuana for medical purposes or to decriminalize possession of small amounts of marijuana. This policy statement provides the position of the American Academy of Pediatrics on the issue of marijuana legalization, and the accompanying technical report (available online) reviews what is currently known about the relationship between adolescents' use of marijuana and its legal status to better understand how change might influence the degree of marijuana use by adolescents in the future. ***Pediatrics*** **2004;113:1825–1826;** ***marijuana, legalization, substance abuse, decriminalization.***

INTRODUCTION

Substance abuse by adolescents is an ongoing concern of pediatricians. Marijuana is the illicit substance most commonly abused by adolescents.[1] Any change in the legal status of marijuana, even if limited to adults, could affect the prevalence of use among adolescents.[2] For example, tobacco and alcohol products, both legal for adults 18 and 21 years of age, respectively, are the psychoactive substances most widely abused by adolescents.

Marijuana currently is classified by the US Drug Enforcement Agency as a schedule I drug, which means that it has a high potential for abuse, has no currently accepted medical use in the United States, and lacks accepted safety for use under supervision by a physician. Rigorous scientific research to determine whether marijuana, especially cannabinoids, has any potential therapeutic effect is just beginning. In contrast, the significant neuropharmacologic, cognitive, behavioral, and somatic consequences of acute and long-term marijuana use are well known and include negative effects on short-term memory, concentration, attention span, motivation, and problem solving, which clearly interfere with learning; adverse effects on coordination, judgment, reaction time, and tracking ability, which contribute substantially to unintentional deaths and injuries among adolescents (especially those associated with motor vehicles); and negative health effects with repeated use similar to effects seen with smoking tobacco.[3]

More information, including historical perspectives on the legal status of marijuana as well as concerns surrounding medicinal use of marijuana, is available in the accompanying technical report (available online).[2]

RECOMMENDATIONS

1. The American Academy of Pediatrics opposes the legalization of marijuana.
2. The American Academy of Pediatrics supports rigorous scientific research regarding the use of cannabinoids for the relief of symptoms not currently ameliorated by existing legal drug formulations.

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

AMERICAN ACADEMY OF PEDIATRICS

TECHNICAL REPORT

Alain Joffe, MD, MPH, and W. Samuel Yancy, MD, the Committee on Substance Abuse and Committee on Adolescence

Legalization of Marijuana: Potential Impact on Youth

ABSTRACT. This technical report provides historical perspectives and comparisons of various approaches to the legal status of marijuana to aid in forming public policy. Information on the impact that decriminalization and legalization of marijuana could have on adolescents, in addition to concerns surrounding medicinal use of marijuana, are also addressed in this report. Recommendations are included in the accompanying policy statement. *Pediatrics* 2004;113:e632–e638. URL: http://www.pediatrics.org/cgi/content/full/113/6/e632; *marijuana, legalization, substance abuse, decriminalization.*

ABBREVIATIONS. AAP, American Academy of Pediatrics; IOM, Institute of Medicine.

BACKGROUND

Over the last 40 years, the legal status of marijuana has been debated vigorously. Proponents of policies that would permit individual possession of small amounts of marijuana argue that it is a safe drug and that criminal sanctions against personal use and possession represent at worst excessively harsh and at best unnecessary penalties. Echoing these sentiments, editors of *The Lancet* have concluded that "cannabis per se is not a hazard to society but driving it further underground may well be."[1] Advocates for legalization also point out that the morbidity, mortality, and economic costs to society associated with alcohol and tobacco use in the United States dwarf those associated with marijuana use.

Those opposing liberalization of current laws counter that marijuana is not a benign drug, especially in light of new psychopharmacologic information demonstrating that marijuana shares many features with other illicit drugs. They also contend that legalization or decriminalization of personal use of marijuana likely would trigger a substantial increase in use, with foreseeable increases in the social, economic, and health costs.

Most recently, the debate has focused on the medical use of marijuana (that is, the use of smoked marijuana to treat a variety of medical conditions). Eight states (Alaska, Arizona, California, Colorado, Maine, Nevada, Oregon, and Washington) have passed ballot initiatives that provide for medical use of marijuana under certain circumstances; one other state (Hawaii) has enacted state legislation permitting medical marijuana use.[2] The federal government has opposed vigorously any efforts to permit physicians to prescribe marijuana for medical purposes, an approach characterized by the former editor of the *New England Journal of Medicine* as "misguided, heavy-handed, and inhumane."[3]

Controversy regarding marijuana is not limited to the United States. Australia has decriminalized the use of marijuana in some territories, and Canada[4] as well as Switzerland and other European countries[5] are reconsidering their approach to marijuana. However, the most widely publicized approach to regulation of marijuana is that of The Netherlands. Under a complex system of "law-on-the-books" and "law-in-action," Dutch law permits personal use of marijuana but outlaws possession.[6]

Pediatricians, too, are not of one mind in their views regarding the legal status of marijuana. In a periodic survey of fellows of the American Academy of Pediatrics (AAP) conducted in 1995,[7] only a minority (18%) favored legalization, and 26% believed that possession or sale should be a felony; 31% felt that marijuana should be available by prescription for medical purposes to a certain class of patients, and 24% believed that marijuana should remain illegal but penalties for personal possession should be reduced or eliminated.

Since the periodic survey was conducted, much more has been learned about the psychopharmacologic properties of marijuana. Scientists have demonstrated that the emotional stress caused by withdrawal from marijuana is linked to corticotropin-releasing factor, the same brain chemical that has been linked to anxiety and stress during opiate, alcohol, and cocaine withdrawal.[8] Others report that tetrahydrocannabinol, the active ingredient in marijuana, stimulates release of dopamine in the mesolimbic area of the brain, the same neurochemical process that reinforces dependence on other addictive drugs.[9] Current scientific information about marijuana has been summarized in the AAP policy statement "Marijuana: A Continuing Concern for Pediatricians."[10] Some of the significant neuropharmacologic, cognitive, behavioral, and somatic consequences of acute and long-term marijuana use are well known and include negative effects on short-

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

term memory, concentration, attention span, motivation, and problem solving, which clearly interfere with learning; adverse effects on coordination, judgment, reaction time, and tracking ability, which contribute substantially to unintentional deaths and injuries among adolescents (especially those associated with motor vehicles); and negative health effects with repeated use similar to effects seen with smoking tobacco. Three recent studies[11–13] demonstrate an association between marijuana use and the subsequent development of mental health problems; however, a small study of 56 monozygotic cotwins discordant for marijuana use did not find any such associations.[14]

DEFINITION OF TERMS

There are 3 general policy perspectives concerning the status of marijuana in the United States: prohibition, decriminalization, and legalization. Prohibition describes current federal policy toward marijuana use, which seeks to minimize or prevent use of marijuana with strong legal sanctions and aggressive interdiction of supply routes. Decriminalization and depenalization (used interchangeably in this report) refer to the elimination, reduction, and/or nonenforcement of penalties for the sale, purchase, or possession of marijuana although such activities remain illegal. Under decriminalization, penalties for use or distribution are at least possible theoretically, and advertising would be banned. Legalization, one step beyond decriminalization, would fundamentally change the status of marijuana in society. It is an acknowledgment that the government has no fundamental interest in an individual's use of a drug, although it may still seek to regulate its sale, distribution, use, and advertisement to safeguard the public's health. Such is the case with alcohol and tobacco. Of the 3 approaches, only the prohibitionist approach has reducing or limiting drug use as its explicit goal.

HISTORICAL PERSPECTIVES ON DRUG POLICIES IN THE UNITED STATES

Important perspectives on how changing the status of marijuana could affect use by adolescents can be gleaned from an examination of this country's experience with drugs over the last 200 years. During the 19th century, opiate drugs were legal and widely available. Opium use was common, especially among middle-class white women.[15] Use of morphine also was extensive, and heroin was marketed as a "sedative for coughs." Cocaine, which routinely was added to patent medicines and beverages, also was legal; it was prized for its local anesthetic effect and its ability to counteract the effects of morphine. The national opiate addiction rate increased from 0.72 per 1000 in 1840 to 4.59 per 1000 in the 1890s, thereafter beginning a sustained decline.[16(p28)]

Another wave of drug use began in the mid-1960s as enforcement of marijuana laws by police became lax and adolescent and layperson perceptions of the risk of regular use declined. Officials from the US Drug Enforcement Agency expressed the view that the fight against marijuana detracted from the more important work of combating heroin use.[16(p174)] Drug incarcerations per 1000 arrests began to drop in 1960 and remained low through 1979. The Carter administration (1977–1981) proposed removing criminal sanctions for possessing small amounts of marijuana.[16(p175)] In 1975, 6% of high school seniors reported using marijuana daily during the previous 30 days. By 1978, the same year during which perceived risk of regular use of marijuana reached its lowest point ever, 10.7% of high school seniors reported using the drug daily.[17]

Drug use in America tends to follow cycles, often with one generation having to relearn the experiences of previous ones. Ninety years after the first cocaine epidemic, cocaine use began to increase in the 1970s and escalated substantially from 1980 to 1995. Because it had been so long since the previous epidemic, cocaine was perceived to be a safe drug. In a chapter on cocaine in the 1980 edition of a prominent textbook of psychiatry, the authors wrote: "If it is used no more than two or three times a week, cocaine creates no serious problems."[18] In 1977, 10% of 18- to 25-year-olds had used cocaine; that proportion doubled to 20% in 1979. By 1985, one third of 18- to 25-year-olds had used cocaine, as had 17.3% of 12th graders.[15] Only with subsequent widespread publicity about the health risks and addictive properties of cocaine and the epidemic of crack cocaine did cocaine use among young people begin to wane.

US AND INTERNATIONAL EXPERIENCES WITH MARIJUANA LEGALIZATION AND DEPENALIZATION

Because to our knowledge no country has completely legalized the sale, possession, and advertising of marijuana, there are no studies that examine the effect of legalization on marijuana use by young people. Hence, we examine data on adolescents' use of marijuana in states and countries that have, to a greater or lesser extent, decriminalized use and possession of this drug.

Analyzing data from the annual Monitoring the Future survey, Johnston et al[19] concluded that decriminalization of marijuana in a number of states from 1975 to 1980 apparently had no effect on high school students' beliefs and attitudes about marijuana or on their use of the drug during those years. In contrast, Chaloupka et al,[20] analyzing data from the 1992–1994 Monitoring the Future surveys, found that "youths living in decriminalized states are significantly more likely to report currently using marijuana and may consume more frequently."

There are several possible explanations for these disparate findings. Although the study by Johnston et al did not find any effect of decriminalization, baseline marijuana use was higher in states that changed their laws compared with states that did not, although the subsequent rate of increase in all states was the same. It is possible that the higher baseline rates of use in the states that decriminalized marijuana use may have reflected a more lax or tolerant approach to marijuana use before decriminalization. Hence, decriminalization would not have resulted in any significant lessening of enforcement,

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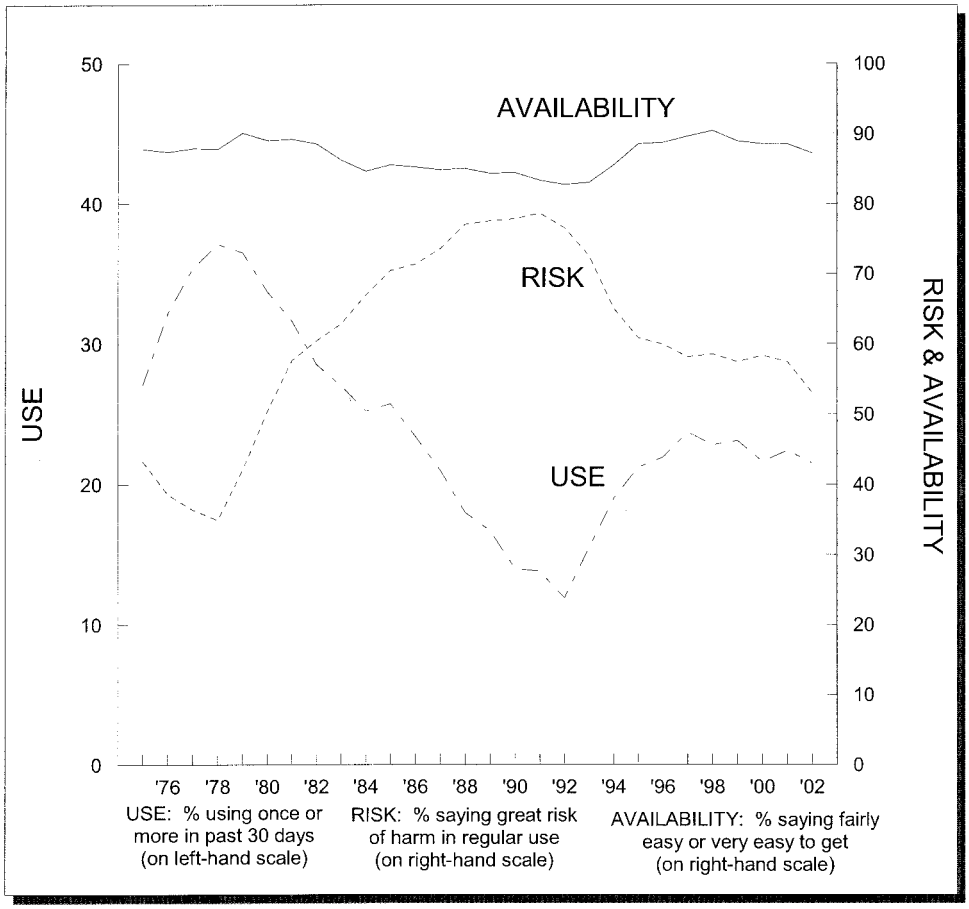
rettes (defined as those smoked by >5% of 8th, 10th, and 12th graders in 1998) in youth-oriented magazines increased from 1995 to 2000, as did expenditures for adult brands in youth-oriented magazines.[33] The Supreme Court recently struck down several Massachusetts regulations aimed at protecting schoolchildren from tobacco advertising (including bans on tobacco ads within 1000 feet of a school or playground). "The state's interest in preventing underage tobacco use is substantial and even compelling, but it is no less true that the sale and use of tobacco by adults is a legal activity," wrote Justice Sandra Day O'Connor for the majority. She continued, ". . . tobacco retailers and manufacturers have an interest in conveying truthful information about their products to adults, and adults have a corresponding interest in receiving truthful information about tobacco products."[34] Presumably, these same interests in regard to advertising for marijuana products also would be protected.

DiFranza[35] has demonstrated that both the states and the federal government are poorly enforcing the Synar Amendment, which requires states to control the sale of tobacco products to those younger than 18 years. Legalization of marijuana for adults but not adolescents would necessitate additional law enforcement burdens on a system that currently is not meeting its regulatory obligations.

Similarly, the alcoholic-beverage industry continues to portray drinking in terms that clearly appeal to young people. Drinking is associated with being sexy, popular, and fun and as an ideal means to "break the ice" in social settings.[36] These portrayals are extremely enticing to adolescents, who are in the process of developing their own identities as well as refining their social skills. One can speculate that distributors of marijuana quickly would recognize the profitability of portraying marijuana in a similar manner (thereby maximizing sales), all the while protesting that their marketing attempts seek only to induce adults to change brands.

How adolescents would perceive a change in the legal status of marijuana, even if only for adults, also is difficult to determine. However, recent studies have shown that prevalence of adolescent marijuana use is inversely proportional to the perceived risk associated with use (Fig 1).[37] The proportion of 12th graders who reported using marijuana in the past 30 days peaked in 1978 and again in 1997, exactly the years in which the perceived risk of regular use was at its lowest.

Some research suggests that legal sanctions may



Source: Johnston LD, O'Malley PM, Bachman JG. Monitoring the Future: National Survey Results on Drug Use, 1975-2002. Vol I: Secondary School Students. Bethesda, MD: National Institute on Drug Abuse; 2003

Fig 1. Marijuana: trends in perceived availability, perceived risk of regular use, and prevalence of use in past 30 days for 12th graders

influence the initial decision to use drugs and that this influence diminishes as drug use by individuals progresses.[38] If so, it is the youngest adolescents (those who have not yet tried marijuana or are in the experimentation phase) who would be affected most by changes in marijuana laws. Age at first use is, in turn, a risk factor for problem use in the future.[39]

Moral development in children and adolescents assumes a developmental trajectory. Early adolescents have a concrete approach to morality: laws are obeyed to avoid punishment. As such, young adolescents would be most susceptible to the deterrent effects of drug laws. This deterrent effect could disappear or lessen with legalization of marijuana. Once adolescents gain the ability to think abstractly, challenges to the apparent hypocrisy of "do as I say, not as I do" can be anticipated.

Parental drug use is an important influence on adolescents' drug use.[40] Recent data indicate that easy household access to illicit substances is associated with greater risk of marijuana use among both younger and older adolescents.[41] Some adults may choose not to use marijuana (however they may feel about the law), because the potential risk of criminal sanctions outweighs any perceived benefit from using the drug. With the demise of legal sanctions against use, some parents may choose to begin using marijuana, acting as an important new source of exposure for their adolescents. Parental use of marijuana in the last year is associated with their adolescent's use during the same period.[42]

Availability of marijuana, which might increase if the drug were legalized, clearly has been shown to affect adolescents' use. Adolescents who have been offered marijuana are 7 times more likely to use it than are those who have not been offered marijuana. Similarly, those who report that marijuana is easy to get are approximately 2.5 times more likely to use it than those who consider it hard to get.[43]

Marijuana is cheap and easy to produce; if it were legalized, its price likely would decrease below current levels. Work by Pacula et al[44] in the United States and Williams[45] in Australia demonstrates clearly that a decrease in the price of marijuana is associated with a significant increase in the prevalence of use among adolescents.

Some advocates for the legalization of marijuana argue that it is safer than alcohol. They suggest that increased use of marijuana by young people might have a positive effect if some adolescents switched from alcohol to marijuana (a substitution effect). This theory cannot be supported by recent studies on adolescent marijuana and alcohol use that incorporated the price of marijuana into the analysis. These studies conclude that an increase in use of marijuana by adolescents would result in an increased use of alcohol (ie, that the 2 drugs are economic complements).[46]

From a public health perspective, even a small increase in use, whether attributable to increased availability or decreased perception of risk, would have significant ramifications. For example, if only an additional 1% of 15- to 19-year-olds in the United States began using marijuana, there would be approximately 190 000 new users.[47]

COMPARISONS BETWEEN MARIJUANA, ALCOHOL, AND TOBACCO

Proponents of legalization of marijuana argue that in terms of costs to society, both financial and health-related, alcohol and tobacco cause far more harm than does marijuana. They argue that classifying a relatively benign drug (marijuana) as schedule I and vigorously prosecuting its sale and possession while permitting the legal use of substances that cause far more damage are inconsistent and illogical practices or policies. That alcohol and tobacco cause far more harm in our society than marijuana is undeniable, but it does not follow logically that yet a third addictive psychoactive drug (marijuana) should be legalized. Many of the harms associated with alcohol and tobacco use stem from the widespread acceptability, availability, and use of these substances. Still other harms result from lax enforcement of current laws regulating their use or sale, especially to underage youth. Rather than legalizing marijuana, an equally compelling approach would be vigorously enforcing current regulations regarding sale and use of alcohol and tobacco products to minimize health-related problems attributable to their consumption. Recent examples include lowering the blood alcohol concentration that defines whether an individual is driving while intoxicated to 0.08 mg/dL (0.02 mg/dL for youth), limiting or banning smoking in public places, and banning cigarette advertisements targeted toward young people.

SUMMARY

Several recent studies concerning American adolescents, the Dutch experience with decriminalization (from 1984 to 1992), and the relationship between cheaper marijuana and use by adolescents suggest that decriminalization increases marijuana use by adolescents. Because no country has legalized use of marijuana outright, there are no studies available to evaluate the potential effect of legalization in the United States. Legalization of marijuana could decrease adolescents' perceptions of the risk of use and increase their exposure to this drug. Furthermore, data concerning adolescents' use of the 2 drugs that are legal for adults (alcohol and tobacco) suggest strongly that legalization of marijuana would have a negative effect on youth. Alcohol and tobacco are the drugs most widely abused by adolescents, although their sale to adolescents (younger than 18 years for tobacco and younger than 21 years for alcohol) is illegal. Research demonstrates that manufacturers of alcohol and tobacco market their products to young people, and the recent Supreme Court decision and experience with the Synar Amendment suggest that, if marijuana were legalized, restrictions on the sale and advertising of the substance to young people would prove daunting. Finally, two in-depth reviews of medical marijuana conclude that future research should focus on the medical use of cannabinoids, not smoked marijuana.

Recommendations from the AAP are included in the accompanying policy statement.[48]

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TECHNICAL REPORT

The Lifelong Effects of Early Childhood Adversity and Toxic Stress

abstract

FREE

Advances in fields of inquiry as diverse as neuroscience, molecular biology, genomics, developmental psychology, epidemiology, sociology, and economics are catalyzing an important paradigm shift in our understanding of health and disease across the lifespan. This converging, multidisciplinary science of human development has profound implications for our ability to enhance the life prospects of children and to strengthen the social and economic fabric of society. Drawing on these multiple streams of investigation, this report presents an ecobiodevelopmental framework that illustrates how early experiences and environmental influences can leave a lasting signature on the genetic predispositions that affect emerging brain architecture and long-term health. The report also examines extensive evidence of the disruptive impacts of toxic stress, offering intriguing insights into causal mechanisms that link early adversity to later impairments in learning, behavior, and both physical and mental well-being. The implications of this framework for the practice of medicine, in general, and pediatrics, specifically, are potentially transformational. They suggest that many adult diseases should be viewed as developmental disorders that begin early in life and that persistent health disparities associated with poverty, discrimination, or maltreatment could be reduced by the alleviation of toxic stress in childhood. An ecobiodevelopmental framework also underscores the need for new thinking about the focus and boundaries of pediatric practice. It calls for pediatricians to serve as both front-line guardians of healthy child development and strategically positioned, community leaders to inform new science-based strategies that build strong foundations for educational achievement, economic productivity, responsible citizenship, and lifelong health. *Pediatrics* 2012;129:e232–e246

INTRODUCTION

Of a good beginning cometh a good end.

John Heywood, *Proverbs* (1546)

The United States, like all nations of the world, is facing a number of social and economic challenges that must be met to secure a promising future. Central to this task is the need to produce a well-educated and healthy adult population that is sufficiently skilled to participate effectively in a global economy and to become responsible stakeholders in a productive society. As concerns continue to grow about the quality of public education and its capacity to prepare the nation's future workforce, increasing investments are being made in

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KEY WORDS

ecobiodevelopmental framework, new morbidity, toxic stress, social inequalities, health disparities, health promotion, disease prevention, advocacy, brain development, human capital development, pediatric basic science

ABBREVIATIONS

ACE—adverse childhood experiences
CRH—corticotropin-releasing hormone
EBD—ecobiodevelopmental
PFC—prefrontal cortex

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the preschool years to promote the foundations of learning. Although debates about early childhood policy focus almost entirely on educational objectives, science indicates that sound investments in interventions that reduce adversity are also likely to strengthen the foundations of physical and mental health, which would generate even larger returns to all of society.[1,2] This growing scientific understanding about the common roots of health, learning, and behavior in the early years of life presents a potentially transformational opportunity for the future of pediatrics.

Identifying the origins of adult disease and addressing them early in life are critical steps toward changing our current health care system from a "sick-care" to a "well-care" model.[3–5] Although new discoveries in basic science, clinical subspecialties, and high-technology medical interventions continue to advance our capacity to treat patients who are ill, there is growing appreciation that a successful well-care system must expand its scope beyond the traditional realm of individualized, clinical practice to address the complex social, economic, cultural, environmental, and developmental influences that lead to population-based health disparities and unsustainable medical care expenditures.[2,6,7] The science of early childhood development has much to offer in the realization of this vision, and the well-being of young children and their families is emerging as a promising focus for creative investment.

The history of pediatrics conveys a rich narrative of empirical investigation and pragmatic problem solving. Its emergence as a specialized domain of clinical medicine in the late 19th century was dominated by concerns about nutrition, infectious disease, and premature death. In the middle of the 20th century, as effective vaccines, antibiotics, hygiene, and other public health measures confronted the infectious etiologies of childhood illness, a variety of developmental, behavioral, and family difficulties became known as the "new morbidities."[8] By the end of the century, mood disorders, parental substance abuse, and exposure to violence, among other conditions, began to receive increasing attention in the pediatric clinical setting and became known as the "newer morbidities."[9] Most recently, increasingly complex mental health concerns; the adverse effects of television viewing; the influence of new technologies; epidemic increases in obesity; and persistent economic, racial, and ethnic disparities in health status have been called the "millennial morbidities."[10]

Advances in the biological, developmental, and social sciences now offer tools to write the next important chapter. The overlapping and synergistic characteristics of the most prevalent conditions and threats to child well-being—combined with the remarkable pace of new discoveries in developmental neuroscience, genomics, and the behavioral and social sciences—present an opportunity to confront a number of important questions with fresh information and a new perspective. What are the biological mechanisms that explain the well-documented association between childhood adversity and adult health impairment? As these causal mechanisms are better elucidated, what can the medical field, specifically, and society, more generally, do to reduce or mitigate the effects of disruptive early-life influences on the origins of lifelong disease? When is the optimal time for those interventions to be implemented?

This technical report addresses these important questions in 3 ways. First, it presents a scientifically grounded, ecobiodevelopmental (EBD) framework to stimulate fresh thinking about the promotion of health and prevention of disease across the lifespan. Second, it applies this EBD framework to better understand the complex relationships among adverse childhood circumstances, toxic stress, brain architecture, and poor physical and mental health well into adulthood. Third, it proposes a new role for pediatricians to promote the development and implementation of science-based strategies to reduce toxic stress in early childhood as a means of preventing or reducing many of society's most complex and enduring problems, which are frequently associated with disparities in learning, behavior, and health. The magnitude of this latter challenge cannot be overstated. A recent technical report from the American Academy of Pediatrics reviewed 58 years of published studies and characterized racial and ethnic disparities in children's health to be extensive, pervasive, persistent, and, in some cases, worsening.[11] Moreover, the report found only 2 studies that evaluated interventions designed to reduce disparities in children's health status and health care that also compared the minority group to a white group, and none used a randomized controlled trial design.

The causal sequences of risk that contribute to demographic differences in educational achievement and physical well-being threaten our country's democratic ideals by undermining the national credo of equal opportunity. Unhealthy communities with too many fast food franchises and liquor stores, yet far too few fresh food outlets and opportunities for physical activity, contribute to an unhealthy population. Unemployment and forced mobility disrupt the social networks that stabilize communities and families and, thereby, lead to higher rates of violence

and school dropout. The purpose of this technical report is to leverage new knowledge from the biological and social sciences to help achieve the positive life outcomes that could be accrued to all of society if more effective strategies were developed to reduce the exposure of young children to significant adversity.

A NEW FRAMEWORK FOR PROMOTING HEALTHY DEVELOPMENT

Advances in our understanding of the factors that either promote or undermine early human development have set the stage for a significant paradigm shift.[12] In simple terms, the process of development is now understood as a function of "nature dancing with nurture over time," in contrast to the longstanding but now outdated debate about the influence of "nature versus nurture."[13] That is to say, beginning prenatally, continuing through infancy, and extending into childhood and beyond, development is driven by an ongoing, inextricable interaction between biology (as defined by genetic predispositions) and ecology (as defined by the social and physical environment)[12,14,15] (see Fig 1).

Building on an ecological model that explains multiple levels of influence on psychological development,[16] and a recently proposed biodevelopmental framework that offers an integrated, science-based approach to coordinated, early childhood policy making and practice across sectors,[17] this technical report presents an EBD framework that draws on a recent report from the Center on the Developing Child at Harvard University to help physicians and policy makers think about how early childhood adversity can lead to lifelong impairments in learning, behavior, and both physical and mental health.[1,6]

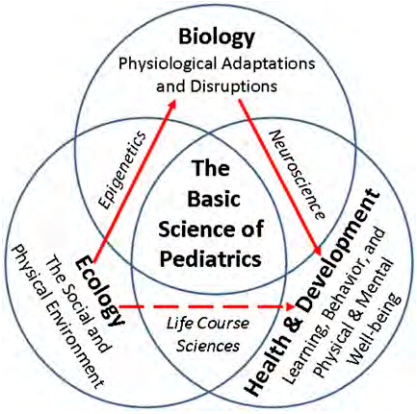

FIGURE 1

The basic science of pediatrics. An emerging, multidisciplinary science of development supports an EBD framework for understanding the evolution of human health and disease across the life span. In recent decades, epidemiology, developmental psychology, and longitudinal studies of early childhood interventions have demonstrated significant associations (hashed red arrow) between the ecology of childhood and a wide range of developmental outcomes and life course trajectories. Concurrently, advances in the biological sciences, particularly in developmental neuroscience and epigenetics, have made parallel progress in beginning to elucidate the biological mechanisms (solid arrows) underlying these important associations. The convergence of these diverse disciplines defines a promising new basic science of pediatrics.

Some of the most compelling new evidence for this proposed framework comes from the rapidly moving field of epigenetics, which investigates the molecular biological mechanisms (such as DNA methylation and histone acetylation) that affect gene expression without altering DNA sequence. For example, studies of maternal care in rats indicate that differences in the quality of nurturing affect neural function in pups and negatively affect cognition and the expression of psychopathology later in life. Moreover, rats whose mothers showed increased levels of licking and grooming during their first week of life also showed less exaggerated stress responses as adults compared with rats who were reared by mothers with a low level of licking and grooming, and the expression of mother-pup interactions in the pups has been demonstrated to be passed on to the next generation.[18–22] This burgeoning area of research is challenging us to look beyond genetic predispositions to examine how environmental influences and early experiences affect when, how, and to what degree different genes are actually activated, thereby elucidating the mechanistic linkages through which gene-environment interaction can affect lifelong behavior, development, and health (see Fig 1).

Additional evidence for the proposed framework comes from insights accrued during the "Decade of the Brain" in the 1990s, when the National Institutes of Health invested significant resources into understanding both normal and pathologic neuronal development and function. Subsequent advances in developmental neuroscience have begun to describe further, in some cases at the molecular and cellular levels, how an integrated, functioning network with billions of neurons and trillions of connections is assembled. Because this network serves as the biological platform for a child's emerging social-emotional, linguistic, and cognitive skills, developmental neuroscience is also beginning to clarify the underlying causal mechanisms that explain the normative process of child development. In a parallel fashion, longitudinal studies that document the long-term consequences of childhood adversity indicate that alterations in a child's ecology can have measurable effects on his or her developmental trajectory, with lifelong consequences for educational achievement, economic productivity, health status, and longevity.[23–27]

The EBD framework described in this article presents a new way to think about the underlying biological mechanisms that explain this robust link between early life adversities (ie, the

new morbidities of childhood) and important adult outcomes. The innovation of this approach lies in its mobilization of dramatic scientific advances in the service of rethinking basic notions of health promotion and disease prevention within a fully integrated, life span perspective from conception to old age.[6] In this context, significant stress in the lives of young children is viewed as a risk factor for the genesis of health-threatening behaviors as well as a catalyst for physiologic responses that can lay the groundwork for chronic, stress-related diseases later in life.

Understanding the Biology of Stress

Although genetic variability clearly plays a role in stress reactivity, early experiences and environmental influences can have considerable impact. Beginning as early as the prenatal period, both animal[28–30] and human[31,32] studies suggest that fetal exposure to maternal stress can influence later stress responsiveness. In animals, this effect has been demonstrated not only in the offspring of the studied pregnancy but also in subsequent generations. The precise biological mechanisms that explain these findings remain to be elucidated, but epigenetic modifications of DNA appear likely to play a role.[31,33,34] Early postnatal experiences with adversity are also thought to affect future reactivity to stress, perhaps by altering the developing neural circuits controlling these neuroendocrine responses.[34,35] Although much research remains to be performed in this area, there is a strong scientific consensus that the ecological context modulates the expression of one's genotype. It is as if experiences confer a "signature" on the genome to authorize certain characteristics and behaviors and to prohibit others. This concept underscores the need for greater understanding of how stress "gets under the skin," as well as the importance of determining what external and internal factors can be mobilized to prevent that embedding process or protect against the consequences of its activation.

Physiologic responses to stress are well defined.[36–38] The most extensively studied involve activation of the hypothalamic-pituitary-adrenocortical axis and the sympathetic-adrenomedullary system, which results in increased levels of stress hormones, such as corticotropin-releasing hormone (CRH), cortisol, norepinephrine, and adrenaline. These changes co-occur with a network of other mediators that include elevated inflammatory cytokines and the response of the parasympathetic nervous system, which counterbalances both sympathetic activation and inflammatory responses. Whereas transient increases in these stress hormones are protective and even essential for survival, excessively high levels or prolonged exposures can be quite harmful or frankly toxic,[39–41] and the dysregulation of this network of physiologic mediators (eg, too much or too little cortisol; too much or too little inflammatory response) can lead to a chronic "wear and tear" effect on multiple organ systems, including the brain.[39–41] This cumulative, stress-induced burden on overall body functioning and the aggregated costs, both physiologic and psychological, required for coping and returning to homeostatic balance, have been referred to as "allostatic load."[38,42–44] The dynamics of these stress-mediating systems are such that their overactivation in the context of repeated or chronic adversity leads to alterations in their regulation.

The National Scientific Council on the Developing Child has proposed a conceptual taxonomy comprising 3 distinct types of stress responses (in contrast to the actual stressors themselves) in young children—positive, tolerable, and toxic—on the basis of postulated differences in their potential to cause enduring physiologic disruptions as a result of the intensity and duration of the response.[17,45] A positive stress response refers to a physiologic state that is brief and mild to moderate in magnitude. Central to the notion of positive stress is the availability of a caring and responsive adult who helps the child cope with the stressor, thereby providing a protective effect that facilitates the return of the stress response systems back to baseline status. Examples of precipitants of a positive stress response in young children include dealing with frustration, getting an immunization, and the anxiety associated with the first day at a child care center. When buffered by an environment of stable and supportive relationships, positive stress responses are a growth-promoting element of normal development. As such, they provide important opportunities to observe, learn, and practice healthy, adaptive responses to adverse experiences.

A tolerable stress response, in contrast to positive stress, is associated with exposure to nonnormative experiences that present a greater magnitude of adversity or threat. Precipitants may include the death of a family member, a serious illness or injury, a contentious divorce, a natural disaster, or an act of terrorism. When experienced in the context of buffering protection provided by supportive adults, the risk that such circumstances will produce excessive activation of the stress response systems that leads to physiologic harm and long-term consequences for health and learning is greatly

reduced. Thus, the essential characteristic that makes this form of stress response tolerable is the extent to which protective adult relationships facilitate the child's adaptive coping and a sense of control, thereby reducing the physiologic stress response and promoting a return to baseline status.

The third and most dangerous form of stress response, toxic stress, can result from strong, frequent, or prolonged activation of the body's stress response systems in the absence of the buffering protection of a supportive, adult relationship. The risk factors studied in the Adverse Childhood Experiences Study[23] include examples of multiple stressors (eg, child abuse or neglect, parental substance abuse, and maternal depression) that are capable of inducing a toxic stress response. The essential characteristic of this phenomenon is the postulated disruption of brain circuitry and other organ and metabolic systems during sensitive developmental periods. Such disruption may result in anatomic changes and/or physiologic dysregulations that are the precursors of later impairments in learning and behavior as well as the roots of chronic, stress-related physical and mental illness. The potential role of toxic stress and early life adversity in the pathogenesis of health disparities underscores the importance of effective surveillance for significant risk factors in the primary health care setting. More important, however, is the need for clinical pediatrics to move beyond the level of risk factor identification and to leverage advances in the biology of adversity to contribute to the critical task of developing, testing, and refining new and more effective strategies for reducing toxic stress and mitigating its effects as early as possible, before irrevocable damage is done. Stated simply, the next chapter of innovation in pediatrics remains to be written, but the outline and plot are clear.

Toxic Stress and the Developing Brain

In addition to short-term changes in observable behavior, toxic stress in young children can lead to less outwardly visible yet permanent changes in brain structure and function.[39,46] The plasticity of the fetal, infant, and early childhood brain makes it particularly sensitive to chemical influences, and there is growing evidence from both animal and human studies that persistently elevated levels of stress hormones can disrupt its developing architecture.[45] For example, abundant glucocorticoid receptors are found in the amygdala, hippocampus, and prefrontal cortex (PFC), and exposure to stressful experiences has been shown to alter the size and neuronal architecture of these areas as well as lead to functional differences in learning, memory, and aspects of executive functioning. More specifically, chronic stress is associated with hypertrophy and overactivity in the amygdala and orbitofrontal cortex, whereas comparable levels of adversity can lead to loss of neurons and neural connections in the hippocampus and medial PFC. The functional consequences of these structural changes include more anxiety related to both hyperactivation of the amygdala and less top-down control as a result of PFC atrophy as well as impaired memory and mood control as a consequence of hippocampal reduction.[47] Thus, the developing architecture of the brain can be impaired in numerous ways that create a weak foundation for later learning, behavior, and health.

Along with its role in mediating fear and anxiety, the amygdala is also an activator of the physiologic stress response. Its stimulation activates sympathetic activity and causes neurons in the hypothalamus to release CRH. CRH, in turn, signals the pituitary to release adrenocorticotropic hormone, which then stimulates the adrenal glands to increase serum cortisol concentrations. The amygdala contains large numbers of both CRH and glucocorticoid receptors, beginning early in life, which facilitate the establishment of a positive feedback loop. Significant stress in early childhood can trigger amygdala hypertrophy and result in a hyperresponsive or chronically activated physiologic stress response, along with increased potential for fear and anxiety.[48,49] It is in this way that a child's environment and early experiences get under the skin.

Although the hippocampus can turn off elevated cortisol, chronic stress diminishes its capacity to do so and can lead to impairments in memory and mood-related functions that are located in this brain region. Exposure to chronic stress and high levels of cortisol also inhibit neurogenesis in the hippocampus, which is believed to play an important role in the encoding of memory and other functions. Furthermore, toxic stress limits the ability of the hippocampus to promote contextual learning, making it more difficult to discriminate conditions for which there may be danger versus safety, as is common in posttraumatic stress disorder. Hence, altered brain architecture in response to toxic stress in early childhood could explain, at least in part, the strong association between early adverse experiences and subsequent problems in the development of linguistic, cognitive, and social-emotional skills, all of which are inextricably intertwined in the wiring of the developing brain.[45]

The PFC also participates in turning off the cortisol response and has an important role in the top-down

regulation of autonomic balance (ie, sympathetic versus parasympathetic effects), as well as in the development of executive functions, such as decision-making, working memory, behavioral self-regulation, and mood and impulse control. The PFC is also known to suppress amygdala activity, allowing for more adaptive responses to potentially threatening or stressful experiences; however, exposure to stress and elevated cortisol results in dramatic changes in the connectivity within the PFC, which may limit its ability to inhibit amygdala activity and, thereby, impair adaptive responses to stress. Because the hippocampus and PFC both play a significant role in modulating the amygdala's initiation of the stress response, toxic stress–induced changes in architecture and connectivity within and between these important areas might account for the variability seen in stress-responsiveness.[50] This can then result in some children appearing to be both more reactive to even mildly adverse experiences and less capable of effectively coping with future stress.[36,37,45,51]

Toxic Stress and the Early Childhood Roots of Lifelong Impairments in Physical and Mental Health

As described in the previous section, stress-induced changes in the architecture of different regions of the developing brain (eg, amygdala, hippocampus, and PFC) can have potentially permanent effects on a range of important functions, such as regulating stress physiology, learning new skills, and developing the capacity to make healthy adaptations to future adversity.[52,53] As the scientific evidence for these associations has become better known and has been disseminated more widely, its implications for early childhood policy and programs have become increasingly appreciated by decision makers across the political spectrum. Notwithstanding this growing awareness, however, discussions about early brain development in policy-making circles have focused almost entirely on issues concerned with school readiness as a prerequisite for later academic achievement and the development of a skilled adult workforce. Within this same context, the health dimension of early childhood policy has focused largely on the traditional components of primary pediatric care, such as immunizations, early identification of sensory impairments and developmental delays, and the prompt diagnosis and treatment of medical problems. That said, as advances in the biomedical sciences have generated growing evidence linking biological disruptions associated with adverse childhood experiences (ACE) to greater risk for a variety of chronic diseases well into the adult years, the need to reconceptualize the health dimension of early childhood policy has become increasingly clear.[1,6] Stated simply, the time has come to expand the public's understanding of brain development and shine a bright light on its relation to the early childhood roots of adult disease and to examine the compelling implications of this growing knowledge base for the future of pediatric practice.

The potential consequences of toxic stress in early childhood for the pathogenesis of adult disease are considerable. At the behavioral level, there is extensive evidence of a strong link between early adversity and a wide range of health-threatening behaviors. At the biological level, there is growing documentation of the extent to which both the cumulative burden of stress over time (eg, from chronic maltreatment) and the timing of specific environmental insults during sensitive developmental periods (eg, from first trimester rubella or prenatal alcohol exposure) can create structural and functional disruptions that lead to a wide range of physical and mental illnesses later in adult life.[1,6] A selective overview of this extensive scientific literature is provided below.

The association between ACE and unhealthy adult lifestyles has been well documented. Adolescents with a history of multiple risk factors are more likely to initiate drinking alcohol at a younger age and are more likely to use alcohol as a means of coping with stress than for social reasons.[54] The adoption of unhealthy lifestyles as a coping mechanism might also explain why higher ACE exposures are associated with tobacco use, illicit drug abuse, obesity, and promiscuity,[55,56] as well as why the risk of pathologic gambling is increased in adults who were maltreated as children.[57] Adolescents and adults who manifest higher rates of risk-taking behaviors are also more likely to have trouble maintaining supportive social networks and are at higher risk of school failure, gang membership, unemployment, poverty, homelessness, violent crime, incarceration, and becoming single parents. Furthermore, adults in this high-risk group who become parents themselves are less likely to be able to provide the kind of stable and supportive relationships that are needed to protect their children from the damages of toxic stress. This intergenerational cycle of significant adversity, with its predictable repetition of limited educational achievement and poor health, is mediated, at least in part, by the social inequalities and disrupted social networks that contribute to fragile families and parenting difficulties.[7,58,59]

The adoption of unhealthy lifestyles and associated exacerbation of socioeconomic inequalities are potent

risk factors for poor health. Up to 40% of early deaths have been estimated to be the result of behavioral or lifestyle patterns,[3] and 1 interpretation of the ACE study data is that toxic stress in childhood is associated with the adoption of unhealthy lifestyles as a coping mechanism.[60] An additional 25% to 30% of early deaths are thought to be attributable to either inadequacies in medical care[3] or socioeconomic circumstances, many of which are known to contribute to health care–related disparities.[61–67]

Beyond its strong association with later risk-taking and generally unhealthy lifestyles, it is critically important to underscore the extent to which toxic stress in early childhood has also been shown to cause physiologic disruptions that persist into adulthood and lead to frank disease, even in the absence of later health-threatening behaviors. For example, the biological manifestations of toxic stress can include alterations in immune function[68] and measurable increases in inflammatory markers,[69–72] which are known to be associated with poor health outcomes as diverse as cardiovascular disease,[69,70,73] viral hepatitis,[74] liver cancer,[75] asthma,[76] chronic obstructive pulmonary disease,[77] autoimmune diseases,[78] poor dental health,[72] and depression.[79–81] Thus, toxic stress in early childhood not only is a risk factor for later risky behavior but also can be a direct source of biological injury or disruption that may have lifelong consequences independent of whatever circumstances might follow later in life. In such cases, toxic stress can be viewed as the precipitant of a physiologic memory or biological signature that confers lifelong risk well beyond its time of origin.[38,42–44]

Over and above its toll on individuals, it is also important to address the enormous social and economic costs of toxic stress and its consequences for all of society. The multiple dimensions of these costs extend from differential levels of civic participation and their impacts on the quality of community life to the health and skills of the nation's workforce and its ability to participate successfully in a global economy. In the realm of learning and behavior, economists argue for early and sustained investments in early care and education programs, particularly for children whose parents have limited education and low income, on the basis of persuasive evidence from cost-benefit analyses that reveal the costs of incarceration and diminished economic productivity associated with educational failure.[82–86] In view of the relatively scarce attention to health outcomes in these long-term follow-up studies, the full return on investments that reduce toxic stress in early childhood is likely to be much higher. Health care expenditures that are paying for the consequences of unhealthy lifestyles (eg, obesity, tobacco, alcohol, and substance abuse) are enormous, and the costs of chronic diseases that may have their origins early in life include many conditions that consume a substantial percentage of current state and federal budgets. The potential savings in health care costs from even small, marginal reductions in the prevalence of cardiovascular disease, hypertension, diabetes, and depression are, therefore, likely to dwarf the considerable economic productivity and criminal justice benefits that have been well documented for effective early childhood interventions.

In summary, the EBD approach to childhood adversity discussed in this report has 2 compelling implications for a full, life span perspective on health promotion and disease prevention. First, it postulates that toxic stress in early childhood plays an important causal role in the intergenerational transmission of disparities in educational achievement and health outcomes. Second, it underscores the need for the entire medical community to focus more attention on the roots of adult diseases that originate during the prenatal and early childhood periods and to rethink the concept of preventive health care within a system that currently perpetuates a scientifically untenable wall between pediatrics and internal medicine.

THE NEED FOR A NEW PEDIATRIC PARADIGM TO PROMOTE HEALTH AND PREVENT DISEASE

In his 1966 Aldrich Award address, Dr Julius Richmond identified child development as the basic science of pediatrics.[87] It is now time to expand the boundaries of that science by incorporating more than 4 decades of transformational research in neuroscience, molecular biology, and genomics, along with parallel advances in the behavioral and social sciences (see Fig 1). This newly augmented, interdisciplinary, basic science of pediatrics offers a promising framework for a deeper understanding of the biology and ecology of the developmental process. More importantly, it presents a compelling opportunity to leverage these rapidly advancing frontiers of knowledge to formulate more effective strategies to enhance lifelong outcomes in learning, behavior, and health.

The time has come for a coordinated effort among basic scientists, pediatric subspecialists, and primary care clinicians to develop more effective strategies for addressing the origins of social class, racial, and ethnic disparities in health and development. To this end, a unified, science-based approach to early childhood policy and practice across multiple sectors (including primary health care, early

care and education, and child welfare, among many others) could provide a compelling framework for a new era in community-based investment in which coordinated efforts are driven by a shared knowledge base rather than distracted by a diversity of traditions, approaches, and funding streams.

Recognizing both the critical value and clear limitations of what can be accomplished within the constraints of an office visit, 21st century pediatrics is well positioned to serve as the primary engine for a broader approach to health promotion and disease prevention that is guided by cutting-edge science and expanded in scope beyond individualized health care.[88,89] The pediatric medical home of the future could offer more than the early identification of concerns and timely referral to available programs, as enhanced collaboration between pediatricians and community-based agencies could be viewed as a vehicle for testing promising new intervention strategies rather than simply improving coordination among existing services. With this goal in mind, science tells us that interventions that strengthen the capacities of families and communities to protect young children from the disruptive effects of toxic stress are likely to promote healthier brain development and enhanced physical and mental well-being. The EBD approach proposed in this article is adapted from a science-based framework created by the Center on the Developing Child at Harvard University to advance early childhood policies and programs that support this vision (see Fig 2).[1] Its rationale, essential elements, and implications for pediatric practice are summarized below.

Broadening the Framework for Early Childhood Policy and Practice

Advances across the biological, behavioral, and social sciences support 2 clear and powerful messages for leaders who are searching for more effective ways to improve the health of the nation.[6] First, current health promotion and disease prevention policies focused largely on adults would be more effective if evidence-based investments were also made to strengthen the foundations of health in the prenatal and early childhood periods. Second, significant reductions in chronic disease could be achieved across the life course by decreasing the number and severity of adverse experiences that threaten the well-being of young children and by strengthening the protective relationships that help mitigate the harmful effects of toxic stress. The multiple domains that affect the biology of health and development—including the foundations of healthy development, caregiver and community capacities, and public and private sector policies and programs—provide a rich array of targeted opportunities for the introduction of innovative interventions, beginning in the earliest years of life.[1]

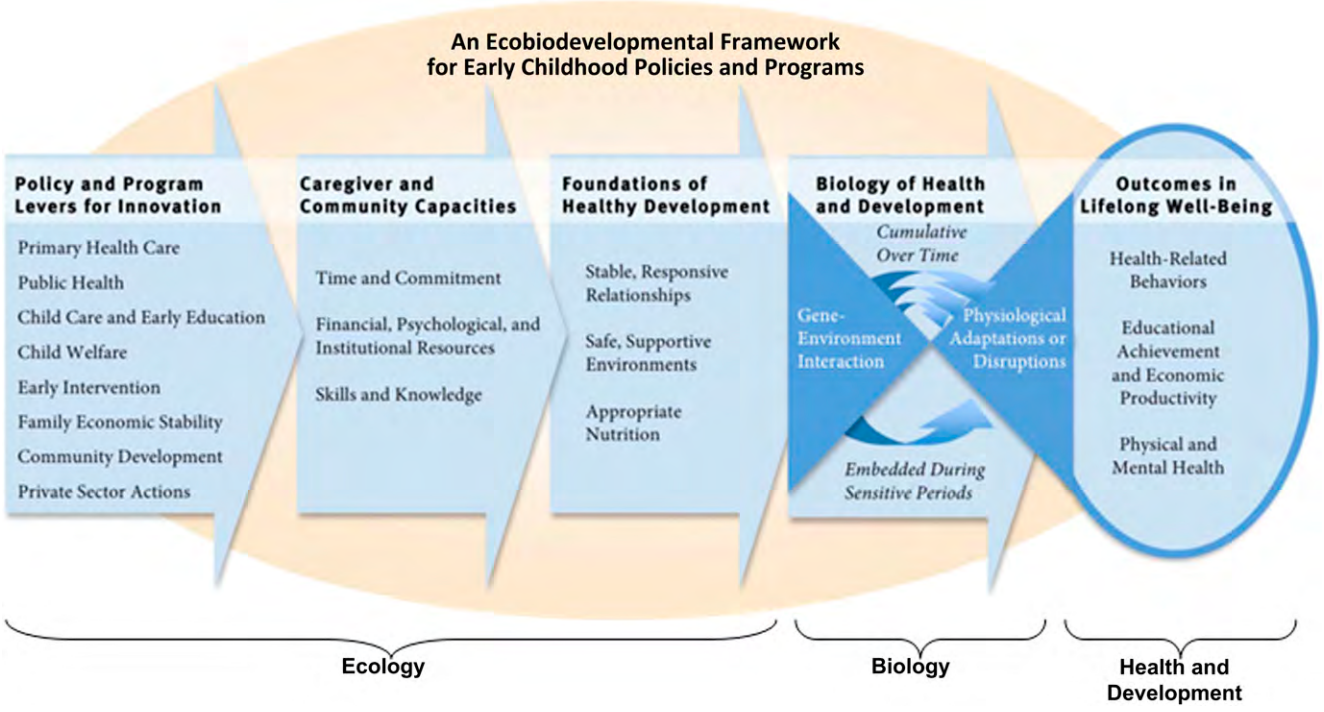

FIGURE 2
An ecobiodevelopmental framework for early childhood policies and programs. This was adapted from ref 1. See text for details.

The biology of health and development explains how experiences and environmental influences get under the skin and interact with genetic predispositions, which then result in various combinations of physiologic adaptation and disruption that affect lifelong outcomes in learning, behavior, and both physical and mental well-being. These findings call for us to augment adult-focused approaches to health promotion and disease prevention by addressing the early childhood origins of lifelong illness and disability.

The foundations of healthy development refers to 3 domains that establish a context within which the early roots of physical and mental well-being are nourished. These include (1) a stable and responsive environment of relationships, which provides young children with consistent, nurturing, and protective interactions with adults to enhance their learning and help them develop adaptive capacities that promote well-regulated stress-response systems; (2) safe and supportive physical, chemical, and built environments, which provide physical and emotional spaces that are free from toxins and fear, allow active exploration without significant risk of harm, and offer support for families raising young children; and (3) sound and appropriate nutrition, which includes health-promoting food intake and eating habits, beginning with the future mother's preconception nutritional status.

Caregiver and community capacities to promote health and prevent disease and disability refers to the ability of family members, early childhood program staff, and the social capital provided through neighborhoods, voluntary associations, and the parents' workplaces to play a major supportive role in strengthening the foundations of child health. These capacities can be grouped into 3 categories: (1) time and commitment; (2) financial, psychological, social, and institutional resources; and (3) skills and knowledge.

Public and private sector policies and programs can strengthen the foundations of health through their ability to enhance the capacities of caregivers and communities in the multiple settings in which children grow up. Relevant policies include both legislative and administrative actions that affect systems responsible for primary health care, public health, child care and early education, child welfare, early intervention, family economic stability (including employment support for parents and cash assistance), community development (including zoning regulations that influence the availability of open spaces and sources of nutritious food), housing, and environmental protection, among others. It is also important to underscore the role that the private sector can play in strengthening the capacities of families to raise healthy and competent children, particularly through supportive workplace policies (such as paid parental leave, support for breastfeeding, and flexible work hours to attend school activities and medical visits).

Defining a Distinctive Niche for Pediatrics Among Multiple Early Childhood Disciplines and Services

Notwithstanding the important goal of ensuring a medical home for all children, extensive evidence on the social determinants of health indicates that the reduction of disparities in physical and mental well-being will depend on more than access to high-quality medical care alone. Moreover, as noted previously, experience tells us that continuing calls for enhanced coordination of effort across service systems are unlikely to be sufficient if the systems are guided by different values and bodies of knowledge and the effects of their services are modest. With these caveats in mind, pediatricians are strategically situated to mobilize the science of early childhood development and its underlying neurobiology to stimulate fresh thinking about both the scope of primary health care and its relation to other programs serving young children and their families. Indeed, every system that touches the lives of children—as well as mothers before and during pregnancy—offers an opportunity to leverage this rapidly growing knowledge base to strengthen the foundations and capacities that make lifelong healthy development possible. Toward this end, explicit investments in the early reduction of significant adversity are particularly likely to generate positive returns.

The possibilities and limitations of well-child care within a multidimensional health system have been the focus of a spirited and enduring discussion within the pediatric community.[88,90,91] Over more than half a century, this dialogue has focused on the need for family-centered, community-based, culturally competent care for children with developmental disabilities, behavior problems, and chronic health impairments, as well as the need for a broader contextual approach to the challenges of providing more effective interventions for children living under conditions of poverty, with or without the additional complications of parental mental illness, substance abuse, and exposure to violence.[10] As the debate has continued, the gap between the call for comprehensive services and the realities of day-to-day practice has remained exceedingly difficult to reduce. Basic recommendations for routine developmental screening and referrals to appropriate community-based services have been particularly difficult

to implement.[92] The obstacles to progress in this area have been formidable at both ends of the process—beginning with the logistical and financial challenges of conducting routine developmental screening in a busy office setting and extending to significant limitations in access to evidence-based services for children and families who are identified as having problems that require intervention.

Despite long-standing calls for an explicit, community-focused approach to primary care, a recent national study of pediatric practices identified persistent difficulties in achieving effective linkages with community-based resources as a major challenge.[92] A parallel survey of parents also noted the limited communication that exists between pediatric practices and community-based services, such as Supplemental Nutrition Program for Women, Infants, and Children; child care providers; and schools.[93] Perhaps most important, both groups agreed that pediatricians cannot be expected to meet all of a child's needs. This challenge is further complicated by the marked variability in quality among community-based services that are available—ranging from evidence-based interventions that clearly improve child outcomes to programs that appear to have only marginal effects or no measurable impacts. Thus, although chronic difficulty in securing access to indicated services is an important problem facing most practicing pediatricians, the limited evidence of effectiveness for many of the options that are available (particularly in rural areas and many states in which public investment in such services is more limited) presents a serious problem that must be acknowledged and afforded greater attention.

At this point in time, the design and successful implementation of more effective models of health promotion and disease prevention for children experiencing significant adversity will require more than advocacy for increased funding. It will require a deep investment in the development, testing, continuous improvement, and broad replication of innovative models of cross-disciplinary policy and programmatic interventions that are guided by scientific knowledge and led by practitioners in the medical, educational, and social services worlds who are truly ready to work together (and to train the next generation of practitioners) in new ways.[88,89] The sheer number and complexity of underaddressed threats to child health that are associated with toxic stress demands bold, creative leadership and the selection of strategic priorities for focused attention. To this end, science suggests that 2 areas are particularly ripe for fresh thinking: the child welfare system and the treatment of maternal depression.

For more than a century, child welfare services have focused on physical safety, reduction of repeated injury, and child custody. Within this context, the role of the pediatrician is focused largely on the identification of suspected maltreatment and the documentation and treatment of physical injuries. Advances in our understanding of the impact of toxic stress on lifelong health now underscore the need for a broader pediatric approach to meet the needs of children who have been abused or neglected. In some cases, this could be provided within a medical home by skilled clinicians with expertise in early childhood mental health. In reality, however, the magnitude of needs in this area generally exceeds the capacity of most primary care practice settings. A report from the Institute of Medicine and National Research Council[15] stated that these needs could be addressed through regularized referrals from the child welfare system to the early intervention system for children with developmental delays or disabilities; subsequent federal reauthorizations of the Keeping Children and Families Safe Act and the Individuals with Disabilities Education Act (Part C) both included requirements for establishing such linkages. The implementation of these federal requirements, however, has moved slowly.

The growing availability of evidence-based interventions that have been shown to improve outcomes for children in the child welfare system[94] underscores the compelling need to transform "child protection" from its traditional concern with physical safety and custody to a broader focus on the emotional, social, and cognitive costs of maltreatment. The Centers for Disease Control and Prevention has taken an important step forward by promoting the prevention of child maltreatment as a public health concern.[95,96] The pediatric community could play a powerful role in leading the call for implementation of the new requirement for linking child welfare to early intervention programs, as well as bringing a strong, science-based perspective to the collaborative development and implementation of more effective intervention models.

The widespread absence of attention to the mother-child relationship in the treatment of depression in women with young children is another striking example of the gap between science and practice that could be reduced by targeted pediatric advocacy.[97] Extensive research has demonstrated the extent to which maternal depression compromises the contingent reciprocity between a mother and her young child that is essential for healthy cognitive, linguistic, social, and emotional development.[98] Despite that well-documented observation, the treatment of depression in women with

young children is typically viewed as an adult mental health service and rarely includes an explicit focus on the mother-child relationship. This serious omission illustrates a lack of understanding of the consequences for the developing brain of a young child when the required "serve and return" reciprocity of the mother-child relationship is disrupted or inconsistent. Consequently, and not surprisingly, abundant clinical research indicates that the successful treatment of a mother's depression does not generally translate into comparable recovery in her young child unless there is an explicit therapeutic focus on their dyadic relationship.[98] Pediatricians are the natural authorities to shed light on this current deficiency in mental health service delivery. Advocating for payment mechanisms that require (or provide incentives for) the coordination of child and parent medical services (eg, through automatic coverage for the parent-child dyad linked to reimbursement for the treatment of maternal depression) offers 1 promising strategy that American Academy of Pediatrics state chapters could pursue. As noted previously, although some medical homes may have the expertise to provide this kind of integrative treatment, most pediatricians rely on the availability of other professionals with specialized skills who are often difficult to find. Whether such services are provided within or connected to the medical home, it is clear that standard pediatric practice must move beyond screening for maternal depression and invest greater energy in securing the provision of appropriate and effective treatment that meets the needs of both mothers and their young children.

The targeted messages conveyed in these 2 examples are illustrative of the kinds of specific actions that offer promising new directions for the pediatric community beyond general calls for comprehensive, family-centered, community-based services. Although the practical constraints of office-based practice make it unlikely that many primary care clinicians will ever play a lead role in the treatment of children affected by maltreatment or maternal depression, pediatricians are still the best positioned among all the professionals who care for young children to provide the public voice and scientific leadership needed to catalyze the development and implementation of more effective strategies to reduce adversities that can lead to lifelong disparities in learning, behavior, and health.

A great deal has been said about how the universality of pediatric primary care makes it an ideal platform for coordinating the services needed by vulnerable, young children and their families. In this respect, the medical home is strategically positioned to play 2 important roles. The first is to ensure that needs are identified, state-of-the-art management is provided as indicated, and credible evaluation is conducted to assess the effects of the services that are being delivered. The second and, ultimately, more transformational role is to mobilize the entire pediatric community (including both clinical specialists and basic scientists) to drive the design and testing of much-needed, new, science-based interventions to reduce the sources and consequences of significant adversity in the lives of young children.[99] To this end, a powerful new role awaits a new breed of pediatricians who are prepared to build on the best of existing community-based services and to work closely with creative leaders from a range of disciplines and sectors to inform innovative approaches to health promotion and disease prevention that generate greater effects than existing efforts.

No other profession brings a comparable level of scientific expertise, professional stature, and public trust—and nothing short of transformational thinking beyond the hospital and office settings is likely to create the magnitude of breakthroughs in health promotion that are needed to match the dramatic advances that are currently emerging in the treatment of disease. This new direction must be part of the new frontier in pediatrics —a frontier that brings cutting-edge scientific thinking to the multidimensional world of early childhood policy and practice for children who face significant adversity. Moving that frontier forward will benefit considerably from pediatric leadership that provides an intellectual and operational bridge connecting the basic sciences of neurobiology, molecular genetics, and developmental psychology to the broad and diverse landscape of health, education, and human services.

SUMMARY

A vital and productive society with a prosperous and sustainable future is built on a foundation of healthy child development. Health in the earliest years—beginning with the future mother's well-being before she becomes pregnant—lays the groundwork for a lifetime of the physical and mental vitality that is necessary for a strong workforce and responsible participation in community life. When developing biological systems are strengthened by positive early experiences, children are more likely to thrive and grow up to be healthy, contributing adults. Sound health in early childhood provides a foundation for the construction of sturdy brain architecture and the achievement of a broad range of skills and learning capacities. Together these constitute the building blocks for a vital and sustainable society that invests in its

human capital and values the lives of its children.

Advances in neuroscience, molecular biology, and genomics have converged on 3 compelling conclusions: (1) early experiences are built into our bodies; (2) significant adversity can produce physiologic disruptions or biological memories that undermine the development of the body's stress response systems and affect the developing brain, cardiovascular system, immune system, and metabolic regulatory controls; and (3) these physiologic disruptions can persist far into adulthood and lead to lifelong impairments in both physical and mental health. This technical report presents a framework for integrating recent advances in our understanding of human development with a rich and growing body of evidence regarding the disruptive effects of childhood adversity and toxic stress. The EBD framework that guides this report suggests that many adult diseases are, in fact, developmental disorders that begin early in life. This framework indicates that the future of pediatrics lies in its unique leadership position as a credible and respected voice on behalf of children, which provides a powerful platform for translating scientific advances into more effective strategies and creative interventions to reduce the early childhood adversities that lead to lifelong impairments in learning, behavior, and health.

CONCLUSIONS

1. Advances in a broad range of interdisciplinary fields, including developmental neuroscience, molecular biology, genomics, epigenetics, developmental psychology, epidemiology, and economics, are converging on an integrated, basic science of pediatrics (see Fig 1).
2. Rooted in a deepening understanding of how brain architecture is shaped by the interactive effects of both genetic predisposition and environmental influence, and how its developing circuitry affects a lifetime of learning, behavior, and health, advances in the biological sciences underscore the foundational importance of the early years and support an EBD framework for understanding the evolution of human health and disease across the life span.
3. The biology of early childhood adversity reveals the important role of toxic stress in disrupting developing brain architecture and adversely affecting the concurrent development of other organ systems and regulatory functions.
4. Toxic stress can lead to potentially permanent changes in learning (linguistic, cognitive, and social-emotional skills), behavior (adaptive versus maladaptive responses to future adversity), and physiology (a hyperresponsive or chronically activated stress response) and can cause physiologic disruptions that result in higher levels of stress-related chronic diseases and increase the prevalence of unhealthy lifestyles that lead to widening health disparities.
5. The lifelong costs of childhood toxic stress are enormous, as manifested in adverse impacts on learning, behavior, and health, and effective early childhood interventions provide critical opportunities to prevent these undesirable outcomes and generate large economic returns for all of society.
6. The consequences of significant adversity early in life prompt an urgent call for innovative strategies to reduce toxic stress within the context of a coordinated system of policies and services guided by an integrated science of early childhood and early brain development.
7. An EBD framework, grounded in an integrated basic science, provides a clear theory of change to help leaders in policy and practice craft new solutions to the challenges of societal disparities in health, learning, and behavior (see Fig 2).
8. Pediatrics provides a powerful yet underused platform for translating scientific advances into innovative early childhood policies, and practicing pediatricians are ideally positioned to participate "on the ground" in the design, testing, and refinement of new models of disease prevention, health promotion, and developmental enhancement beginning in the earliest years of life.

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National Athletic Trainers' Association Position Statement: Lightning Safety for Athletics and Recreation

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Objective: To educate athletic trainers and others about the dangers of lightning, provide lightning-safety guidelines, define safe structures and locations, and advocate prehospital care for lightning-strike victims.

Background: Lightning may be the most frequently encountered severe-storm hazard endangering physically active people each year. Millions of lightning flashes strike the ground annually in the United States, causing nearly 100 deaths and 400 injuries. Three quarters of all lightning casualties occur between May and September, and nearly four fifths occur between 10:00 AM and 7:00 PM, which coincides with the hours for most athletic or recreational activities. Additionally, lightning casualties from sports and recreational activities have risen alarmingly in recent decades.

Recommendations: The National Athletic Trainers' Association recommends a proactive approach to lightning safety, including the implementation of a lightning-safety policy that identifies safe locations for shelter from the lightning hazard. Further components of this policy are monitoring local weather forecasts, designating a weather watcher, and establishing a chain of command. Additionally, a flash-to-bang count of 30 seconds or more should be used as a minimal determinant of when to suspend activities. Waiting 30 minutes or longer after the last flash of lightning or sound of thunder is recommended before athletic or recreational activities are resumed. Lightning-safety strategies include avoiding shelter under trees, avoiding open fields and spaces, and suspending the use of land-line telephones during thunderstorms. Also outlined in this document are the prehospital care guidelines for triaging and treating lightning-strike victims. It is important to evaluate victims quickly for apnea, asystole, hypothermia, shock, fractures, and burns. Cardiopulmonary resuscitation is effective in resuscitating pulseless victims of lightning strike. Maintenance of cardiopulmonary resuscitation and first-aid certification should be required of all persons involved in sports and recreational activities.

Key Words: lightning, policies and procedures, lightning casualties, severe-storm hazards, environmental hazards, emergency action plan, thunderstorms, lightning-safety policy, athletics, recreation

Over the past century, lightning has consistently been 1 of the top 3 causes of weather-related deaths in this country.[1,2] It kills approximately 100 people and injures hundreds more each year.[2ï 5] Lightning is an enormous and widespread danger to the physically active population, due in part to the prevalence of thunderstorms in the afternoon to early evening during the late spring to early fall and a societal trend toward outdoor physical activities.[2,3,6] Certain areas of the United States have higher propensities for thunderstorm activity, and thus, higher casualty rates: the Atlantic seaboard, southwest, southern Rocky Mountains, and southern plains states.[2,7]

Worldwide, approximately 2000 thunderstorms and 50 to 100 lightning flashes occur every second.[8] In 1997, the National Lightning Detection Network recorded nearly 27 000 000 cloud-to-ground lightning strikes in the United States (Christoph Zimmerman, Global Atmospherics, Inc, Tucson, AZ, unpublished data). Many of these strikes caused fires, power outages, property damage, loss of life, and disabling injuries. Property damage from lightning is estimated to cost $5 000 000 000 to $6 000 000 000 annually in this country.[9] While print and television news reports of lightning-strike incidents to recreational athletes are frequent during the thunderstorm season, many people are unsure about what to do and where to go to improve their safety during thunderstorms. It is incumbent on all individuals, particularly those who are leaders in athletics and recreation, to appreciate the lightning hazard, learn the published lightning-safety guidelines, and act prudently, wisely, and in a spirit that will encourage safe behavior in others.

The guidelines presented in this article govern all outdoor activities, as well as indoor swimming-pool activities. The purpose of this position statement is to recommend lightning-safety policy guidelines and strategies and to educate athletic trainers and others involved with athletic or recreation activities about the hazards of lightning.

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RECOMMENDATIONS

1. Formalize and implement a comprehensive, proactive lightning-safety policy or emergency action plan specific to lightning safety.[1,7,10–14] The components of this policy should include the following:
   A. An established chain of command that identifies who is to make the call to remove individuals from the field or an activity.
   B. A designated weather watcher (ie, a person who actively looks for the signs of threatening weather and notifies the chain of command if severe weather becomes dangerous).
   C. A means of monitoring local weather forecasts and warnings.
   D. A listing of specific safe locations (for each field or site) from the lightning hazard.
   E. The use of specific criteria for suspension and resumption of activities (refer to recommendations 4, 5, and 6).
   F. The use of the recommended lightning-safety strategies (refer to recommendations 7, 8, and 9).
2. The primary choice for a safe location from the lightning hazard is any substantial, frequently inhabited building. The electric and telephone wiring and plumbing pathways aid in grounding a building, which is why buildings are safer than remaining outdoors during thunderstorms. It is important not to be connected to these pathways while inside the structure during ongoing thunderstorms.
3. The secondary choice for a safer location from the lightning hazard is a fully enclosed vehicle with a metal roof and the windows closed.[1,7,10,11,13,14] Convertible cars and golf carts do not provide protection from lightning danger. It is important not to touch any part of the metal framework of the vehicle while inside it during ongoing thunderstorms.
4. Seeking a safe structure or location at the first sign of lightning or thunder activity is highly recommended. By the time the flash-to-bang count approaches 30 seconds (or is less than 30 seconds), all individuals should already be inside or should immediately seek a safe structure or location.[1,13–15] To use the flash-to-bang method, the observer begins counting when a lightning flash is sighted. Counting is stopped when the associated bang (thunder) is heard. Divide this count by 5 to determine the distance to the lightning flash (in miles). For example, a flash-to-bang count of 30 seconds equates to a distance of 6 miles (9.66 km).
5. Postpone or suspend activity if a thunderstorm appears imminent before or during an activity or contest (regardless of whether lightning is seen or thunder heard) until the hazard has passed. Signs of imminent thunderstorm activity are darkening clouds, high winds, and thunder or lightning activity.
6. Once activities have been suspended, wait at least 30 minutes after the last sound of thunder or lightning flash before resuming an activity or returning outdoors.[1,13–15] A message should be read over the public address system and lightning-safety tips should be placed in game programs alerting spectators and competitors about what to do and where to go to find a safer location during thunderstorm activity.[13,15]
7. Extremely large athletic events are of particular concern with regard to lightning safety. Consider using a multidisciplinary approach to lessen lightning danger, such as integrating weather forecasts, real-time thunderstorm data, a weather watcher, and the flash-to-bang count to aid in decision making.
8. Avoid being in contact with, or in proximity to, the highest point of an open field or on the open water. Do not take shelter under or near trees, flag poles, or light poles.[1,8,10,13–15]
9. Avoid taking showers and using plumbing facilities (including indoor and outdoor pools) and land-line telephones during thunderstorm activity.[1,8,10,13–15] Cordless or cellular telephones are safer to use when emergency help is needed.
10. Individuals who feel their hair stand on end or skin tingle or hear crackling noises should assume the lightning-safe position (ie, crouched on the ground, weight on the balls of the feet, feet together, head lowered, and ears covered). Do not lie flat on the ground.[1,8,10,13–15]
11. Observe the following basic first-aid procedures, in order, to manage victims of lightning strike[16]:
    A. Survey the scene for safety. Ongoing thunderstorms may still pose a threat to emergency personnel responding to the situation.
    B. Activate the local emergency management system.
    C. Move the victim carefully to a safer location, if needed.
    D. Evaluate and treat for apnea and asystole.
    E. Evaluate and treat for hypothermia and shock.
    F. Evaluate and treat for fractures.
    G. Evaluate and treat for burns.
12. All persons should maintain current cardiopulmonary resuscitation (CPR) and first-aid certification.
13. All individuals should have the right to leave an athletic site or activity, without fear of repercussion or penalty, in order to seek a safe structure or location if they feel they are in danger from impending lightning activity.[13,15]

BACKGROUND

Lightning-Flash Development

Within a developing thunderstorm cloud, updrafts promote the collision of rising and descending ice and water particles, and the positive and negative charges are separated into distinct layers. Positive charges are taken via updrafts to the top of the cloud, while negative charges accumulate in the bottom of the cloud, creating the equivalent of a giant atmospheric battery.[8]

A cloud-to-ground lightning flash is the product of the buildup and discharge of static electric energy between the charged regions of the cloud and the earth. The negatively charged lower region of the cloud induces a positive charge on the ground below. The tremendous electric forces between these 2 opposite charges initiate the lightning flash, which begins as a barely visible step leader moving in a series of steps downward from the cloud. Various objects on the ground (trees, chimneys, people, etc) can produce positively charged, upward streamers. The connection of the step leader with an upward streamer determines the connection point on the ground. After contact, a bright return stroke propagates upward from the ground, while electrons move downward toward the earth.[8] This entire phenomenon happens in less than a fraction of a second,[8] but a large amount of charge is transferred to the earth from the cloud.

Most lightning flashes have several return strokes, separated by only 0.004 to 0.005 seconds.[8] The human eye can barely

resolve the intervals between the strokes that cause the lightning flash to appear to flicker. A lightning flash is essentially a brief spark, similar to that received from touching a doorknob after walking across a carpeted room. The lightning channel is approximately 2.54 cm (1 inch) in diameter and averages 4.83 to 8.05 km (3 to 5 miles) in vertical height but can be 9.66 km (6 miles) or higher.[8] Cloud-to-ground lightning flashes typically have peak currents ranging from 10 000 to 200 000 ¡ , and the electric potential between the cloud and ground can be 10 000 000 to 100 000 000 V.[8]

Thunder is created when lightning quickly heats the air around it, sometimes to temperatures greater than approximately 27 800ÁC (50 000ÁF), which is about 5 times hotter than the surface of the sun.[8] The rapidly heated air around a lightning channel explodes, which in turn creates the sound we hear as a clap of thunder.[8] The audible range of thunder is about 16.09 km (10 miles) but can be more or less depending on local conditions.[1] Heat lightning is intracloud or intercloud lightning that is too distant for the accompanying thunder to be heard.[8] Although it is possible to have lightning without thunder, thunder never occurs in the absence of lightning.

Lightning Casualty Demographics

On average, lightning kills approximately 100 people each year in this country, while many hundreds more are injured.[2ï5] The death toll from lightning for 1940 to 1973 was greater than that from tornadoes and hurricanes combined.[17] Ninety-two percent of lightning casualties occur between May and September, while July has the greatest number of casualties.[2,3,7,18] Furthermore, 45% of the deaths and 80% of the casualties occurred in these months between 10:00 AM and 7:00 PM,[2,3,7,8] which coincides with the most likely time period for athletic or recreational events. For these reasons, it is accurate to say that lightning is the most dangerous and frequently encountered severe-storm hazard that most people experience each year.[10,11]

The statistics on lightning casualty demographics compiled from the National Oceanographic and Atmospheric Administration publication *Storm Data* for the state of Colorado over the last few decades demonstrate an increase in the number of lightning casualties in persons involved in sports and outdoor recreation.[7,10,18,19] Fifty-two percent of lightning casualties were people involved in outdoor recreation.[7,18] In addition, these authors noted that the highest number of casualties from lightning was recorded in recreational and sports activities for each year of the study.[18] During the 1960s, more than 30% of lightning casualties occurred during outdoor recreation activities; during the 1970s, that figure rose to 47%.[17] Furthermore, the rate of increase of lightning casualties during sports was higher than the general United States population rate of increase during the same time period.[7,18]

Lightning casualty statistics from Colorado demonstrate that the most common sites for fatalities were open fields (27%), near trees (16%), and close to water (13%).[7,8,18] Statistics from the country as a whole mimic the numbers from Colorado. Open fields, ballparks, and playgrounds accounted for nearly 27% of casualties, and under trees (14%), water-related (8%), and golf-related (5%) deaths associated with lightning followed.[19] All these fatalities had 1 common denominator: being near the highest object or being the tallest object in the immediate area. This single factor accounted for 56% of all fatalities from Colorado. Thus, it is imperative to avoid high ridges and high points on the terrain, and conversely, it is important to seek low-lying points on the terrain.[1,3,8,13ï15]

The height above ground has been demonstrated to play a prominent role in determining the strike probability. Therefore, it is important to understand why minimizing vertical height is critical in decreasing the chances of becoming a victim of lightning. Warning signs of a high electromagnetic field and imminent lightning strike include hair standing on end and sounds similar to bacon sizzling or cloth tearing.[8] If these conditions occur, a cloud-to-ground lightning flash could strike in the immediate area. Therefore, one should immediately crouch in the lightning-safe position: feet together, weight on the balls of the feet, head lowered, and ears covered.[1] This position is intended to minimize the probability of a direct strike by both lowering the personôs height and minimizing the area in contact with the surface of the ground. Taller objects are more likely to be struck (but not always) because their upward streamer occurs first, so that it is closer in proximity to the step leader coming downward from the cloud.

The ultimate message is that individuals in dangerous lightning situations should never wait to seek a safe location and pursue safety measures. It is important to be proactive by having all individuals inside a safe structure or location long before the lightning is close enough to be threatening.

Mechanisms of Lightning Injury

Injury from lightning can occur via 5 mechanisms.[16] A direct strike most commonly occurs to the head, and lightning current enters the orifices. This mechanism explains why eye and ear injuries in lightning-strike victims are abundantly reported in the literature.[16] The shock wave created by the lightning channel can also produce injuries, such as rupture of the tympanic membrane, a common clinical presentation in the lightning-strike victim.[16,23,24] Recommending that individuals cover their ears while in the lightning-safe position may help to mitigate this type of injury.

The second mechanism, contact injury, occurs when the lightning victim is touching an object that is in the pathway of a lightning current.[16] Side flash, the third mechanism, occurs when lightning strikes an object near the victim and then jumps from that object to the victim. This is the main danger to a person who is sheltered under an isolated, tall tree.[6] An upward streamer is triggered by the tree but when this connects with the step leader, the resulting stroke jumps to the victim, who represents an additional pathway to ground.

The fourth mechanism, a step voltage or ground current, occurs when the lightning current flowing in the ground radiates outward in waves from the strike point. If 1 of the individualôs feet is closer to the strike than the other, a step voltage is created.[6,16] Humans are primarily salt minerals in an aqueous solution, and a lightning current preferentially travels up from the earth through this solution (that is, the person) rather than through the ground. The greater the differential step voltage (ie, the greater the distance between the 2 feet), the greater the likelihood of injury. Placing oneôs feet close together while in the crouched position and not lying flat on the ground are crucial in reducing the likelihood of injury from a step voltage or ground current.

Blunt injury is the fifth mechanism for lightning-strike injuries. Lightning current can cause violent muscular contractions that throw its victims many meters from the strike point.

Explosive and implosive forces created by the rapid heating and cooling by the lightning current are also enough to produce traumatic injuries.[16]

Common Effects of Lightning Injury

While lightning kills nearly 100 people annually in this country, the protracted suffering of the survivors should not be underestimated. Although the only acute cause of death from lightning injury is cardiac arrest,[20] the anoxic brain damage that can occur if the person is not rapidly resuscitated can be devastating. In addition, even for the survivor who did not sustain a cardiac arrest, permanent sequelae can include common brain-injury symptoms such as deficits in short-term memory and processing of new information, as well as severe and ongoing headaches, hyperirritability, sleep disturbances, and distractibility.[21,22] Others may develop chronic pain syndromes or absence-type seizures. Frequently, survivors are unable to return to their previous level of function. They may not be able to continue in their jobs or in their educational pursuits and may be permanently disabled.

Components of a Lightning-Safety Policy

The purpose of formalizing a policy on lightning safety is to provide written guidelines for safety during lightning storms. Ninety-two percent of National Collegiate Athletic Association Division I athletics departments responding to a survey did not have a formal, written lightning-safety policy.[12] The best means of reducing the lightning hazard to people is to be proactive. Athletic and recreational personnel should formalize and implement an emergency action plan specific to lightning safety before the thunderstorm season.[1,11,13ï 15] Dissemination of the plan is paramount, so that all persons will know what to do and where to go to improve their own safety during thunderstorms. The 6 components of a lightning-safety policy or emergency action plan for lightning are discussed in the following paragraphs.

The first component in an emergency action plan or policy for lightning safety is the establishment of a specific chain of command that identifies the person who has the authority to remove participants from athletic venues or activities. The second is to appoint a weather watcher who actively looks for signs of developing local thunderstorms, such as high winds, darkening clouds, and any lightning or thunder.

The third element of a lightning-safety policy is the stipulation for monitoring local weather forecasts. One method is to use weather radios that broadcast information on daily forecasts and approaching storm systems. Weather radios are an excellent informational tool for general storm movement and strength. While this information is extremely important in decision making, the National Weather Service does not broadcast information on specific storm cells or lightning. Therefore, in addition to monitoring weather radios, it is essential that the weather watcher be on constant lookout for conditions in the immediate vicinity of the athletic event and compare these conditions with the weather radio information.

When a local area is placed under a severe-storm watch or warning by the National Weather Service, weather radios can be programmed to give audible alert tones. A watch indicates conditions are favorable for severe weather; a warning means severe weather has been detected in the locale, and all persons should take the necessary precautions to preserve their own safety. If severe storms are in the vicinity, all individuals should more intently monitor thunderstorm activity, such as severity and direction of movement of the storm. It may also mean that steps should be taken to remove athletes from the field or perhaps to postpone or suspend athletic or recreational activities during the event or before the storm begins.

Safe Locations

The fourth aspect of a lightning-safety policy, defining and listing safe structures or locations to evacuate to in the event of lightning, is of utmost importance. While there are reports of people being injured by lightning inside buildings,[8] evacuating to a substantial building can considerably lower the risks of lightning injury compared with those of remaining outside during the thunderstorm. The lightning-safety policy should identify the safe structure or location specific to each venue. This information will enable individuals to know where to go in advance of any thunderstorm situation and appreciate how long it takes to get to the specific safe location from each field or event site.

The primary choice for a safe structure is any fully enclosed, substantial building.[1,3,8,13ï 15] Ideally, the building should have plumbing, electric wiring, and telephone service. The lightning current is more likely to follow these pathways to ground, which aids in electrically grounding the structure.[8] If a substantial building is not available, a fully enclosed vehicle with a metal roof and the windows completely closed is a reasonable alternative.[1,3,13ï 15] It is not the rubber tires that make the vehicle safe but the metal enclosure that guides the lightning current around the passengers, rather than through them. Do not touch any part of the metal framework while inside the vehicle.[8] Convertible vehicles and golf carts do not provide a high level of protection and cannot be considered safe from lightning.

Unsafe Locations

Unfortunately, those properties that serve to define a safe structure and improve the safety of its inhabitants also present a potential risk. Lightning current can enter a building via the electric or telephone wiring. It can also enter via a ground current through the incoming plumbing pipelines. This condition makes locker-room shower areas, swimming pools (indoor and outdoor), telephones, and electric appliances unsafe during thunderstorms because of the possible contact with current-carrying conduction. While such reports are rare, people have been killed or injured by lightning in their homes while talking on the telephone, taking a shower, or standing near household appliances such as dishwashers, stoves, or refrigerators.[1,3,8,13ï 15]

From 1959 through 1965, lightning killed 4 people and injured 36 others while they were talking on the telephone. These numbers comprised 0.42% (n = 960) of deaths and 2.1% (n = 1736) of injuries for the period.[5] Studying reports from *Storm Data*, researchers found that between 1959 and 1994, 2.4% of lightning casualties were telephone related.[2] Because they are not connected directly to a land-line phone, cellular and cordless telephones are reasonably safe alternatives for summoning help during a thunderstorm. It should be noted that injury from acoustic damage can occur via explosive static from the earpiece caused by a nearby lightning strike.

Even though a swimming pool may be indoors and apparently safe, it can be a dangerous location during thunderstorms.[25] The current can be propagated through plumbing and electric connections via the underwater lights and drains of most swimming pools. Lightning current can also enter the building, either into the electric wiring inside the building or through underground plumbing pipelines that enter the building.[8] If lightning strikes the building or ground nearby, the current will most likely follow these pathways to the swimmers through the water. Thus, indoor-pool activities are potentially dangerous and should be avoided during thunderstorms.[25]

Small structures, such as rain or picnic shelters or athletic storage sheds, are generally not properly protected and should be avoided during thunderstorms. These locations may actually increase the risk of lightning strike via a side flash and cause injury to the occupants.

Criteria for Postponement and Resumption of Activities

The fifth component of any lightning-safety policy is to clearly describe criteria for both the suspension and resumption of athletic or recreational activities. Various technologies currently on the market propose to assist in determining when lightning is in the immediate area. Within the developing area of this lightning technology, data-based research is insufficient to either support or dispute companiesô claims regarding establishing when one is in danger of a lightning strike. Therefore the National Athletic Trainersô Association promotes the flash-to-bang standard to warn people of imminent lightning danger. The flash-to-bang method is the easiest and most convenient means for determining the distance to a lightning flash and can also be used to determine when to suspend or postpone activities. The flash-to-bang method is based on the fact that light travels faster than sound, which travels at a speed of approximately 1.61 km (1 mile) every 5 seconds.[1,8,13,14] To use the flash-to-bang method, begin counting on the lightning flash, and stop counting when the associated clap of thunder is heard. When storms have a high flash rate, it is important to correlate a specific flash with the thunder it produced. Divide the time to thunder (in seconds) by 5 to determine the distance (in miles) to the lightning flash.[1,8,13,14] For example, an observer obtains a count of 30 seconds from the time he or she spots the flash to when the thunder is heard. Thirty divided by 5 equals 6; therefore, that lightning flash was 6 miles (9.66 km) from the observer.

The 30-second rule is not an arbitrary guideline. Lõpez and Holle[26] studied storms in Oklahoma, Colorado, and Florida and found that in larger thunderstorms, the distance between successive flashes can be up to 6 miles (9.66 km) (ie, a flash-to-bang count of 30 seconds) in approximately 80% of the flash pairs. The authors also found the distance between successive flashes may be as great as 9 miles (14.48 km) or more, depending on local geography and atmospheric conditions. If a flash-to-bang count of 30 seconds is observed, the next flash could conceivably be at the observerôs location.

Another important factor to consider when using the flash-to-bang method is that, although a relatively rare occurrence, lightning has been reported to strike 16.09 km (10 miles) or more from where it is raining.[1] Therefore, a flash-to-bang count of at least 30 seconds is strongly recommended as a determinant of when to suspend or postpone athletic or recreational activities.[13ï15] As the flash-to-bang count approaches 30 seconds, all persons should be seeking, or already inside, a safe structure or location. This is the minimal guideline when using the flash-to-bang method to halt athletic or recreational activities. Seeking a safe location at the first sign of thunder or lightning activity is also highly recommended.

Another facet of the lightning-safety policy is embodied in the ñ30ï 30 ruleò (Table 1), which relies on the flash-to-bang method. If a game, practice, or other activity is suspended or postponed due to lightning activity, it is important to establish strict criteria in the lightning-safety policy for resumption of activities. Waiting at least 30 minutes after the last lightning flash or sound of thunder is recommended.[13ï15] When storm reports and flash data at the time of death or injury were compared, researchers found that the end of the storm, when the flash-rate frequency began to decline, was as deadly as the middle of the storm, when the lightning flash rate was at its peak. The authors postulated that once the flash rate begins to decline, people do not perceive the thunderstorm as dangerous and are struck by lightning when they return outdoors prematurely.[1] An important adage for athletic trainers, coaches, and officials to remember is, ñif you see it (lightning) flee it, if you hear it (thunder), clear it.ò

The 30-minute rule can also be explained in another way. A typical thunderstorm moves at a rate of approximately 40.23 km (25 miles) per hour. Experts believe that 30 minutes allow the thunderstorm to be about 16.09 to 19.31 km (10 to 12 miles) from the area, minimizing the probability of a nearby, and therefore dangerous, lightning strike.[15] Blue sky in the local area or a lack of rainfall are not adequate reasons to breach the 30-minute return-to-play rule. Lightning can strike far from where it is raining, even when the clouds begin to clear and show evidence of blue sky.[1] This situation is often referred to as a ñbolt out of the blue.ò Each time lightning is observed or thunder is heard, the 30-minute clock should be reset.

Obligation to Warn

The recommendation for reading lightning-safety messages over public address systems and placing placards conspicuously around each venue resulted from a fatal lightning strike in Washington, DC, in May 1991.[27] During a high school lacrosse game, a dangerous thunderstorm swept into the local area, and the game was suspended. Lightning killed 1 young person and injured 10 others who sought refuge under a tree. Many people stated that they did not know what to do or where to go to protect themselves from the dangers of lightning.

According to the basic principles of tort law, an individual has a duty to warn others of dangers that may not be obvious to a guest or subordinate of that person.[28] Black et al[29] defined the legal principle of ñforeseeabilityò as ñthe ability to see or

Table 1. The 30-30 Rule[15]

Criteria for suspension of activities	By the time the flash-to-bang count approaches 30 seconds, all individuals should already be inside a safe shelter.
Criteria for resumption of activities	Wait at least 30 minutes after the last sound (thunder) or observation of lightning before leaving the safe shelter to resume activities.

know in advance, eg, reasonable anticipation, that harm or injury is a likely result from certain acts or omissions.ò With regard to dangerous lightning situations, it could be argued that an institution (or athletic department) has the duty to warn spectators, invited guests, and participants if conditions are such that lightning activity may be an imminent danger in the immediate area. Whereas lightning is understood by all to be a dangerous phenomenon, the importance of seeking safe shelter and the specific time that one should vacate to safety are generally not known. Based on research presented in this article regarding the number of lightning casualties resulting from the erroneous tendency of people to seek shelter under trees, it would be wise for an organization to promote lightning safety to its clientele and participants, including a list of specific safe locations or structures.

Warnings should be commensurate with the age and understanding of those involved. Announcements should be repeated over the public address system and colorful notices and safety instructions both placed in the event programs and posted in visible, high-traffic areas. Safety instructions should include the location of the nearest safe shelter, similar to airline pocket diagrams of nearest emergency exits. Being proactive with regard to the lightning threat demands not putting individuals at risk if a hazardous situation could have been prevented. If thunderstorm activity looks menacing before or during an event, consider canceling or postponing the event until the complete weather situation can be ascertained and determined to no longer be a threat. The first lightning flash from the thunderstorm cloud and storms that produce only a few flashes still pose a potential threat and should be treated as such. Every cloud-to-ground lightning flash is dangerous and potentially deadly and should not be taken lightly or viewed complacently. Therefore, it is the recommendation of the National Athletic Trainersô Association to postpone or suspend athletic and recreational activities before their onset, if thunderstorm activity appears imminent.

Prehospital Care of Victims

If a lightning-strike victim presents in asystole or respiratory arrest, it is critical to initiate CPR as soon as safely possible.[23] Because lightning-strike victims do not remain connected to a power source, they do not carry an electric charge and are safe to assess.[30] However, during an ongoing thunderstorm, lightning activity in the local area still poses a deadly hazard for the medical team responding to the incident. The athletic trainer or other medical personnel should consider his or her own personal safety before venturing into a dangerous situation to render care.

If medical personnel assume the risk of entering a dangerous lightning situation to render care, the first priority should be to move the victim to a safe location. In this way, a hazardous situation can be neutralized for the athletic trainer, as well as the victim. It is unlikely that moving a victim to an area of greater safety for resuscitation will cause any serious injury to the victim.[16] The primary and secondary survey of the victimôs condition can then be conducted once safety is reached.

It is not uncommon to find a lightning-strike victim unconscious, with fixed and dilated pupils and cold extremities and in cardiopulmonary arrest. Case studies of individuals with prolonged apnea and asystole after a lightning strike have demonstrated successful resuscitations using CPR.[23,24,31] Once stopped, the heart will most likely spontaneously restart, but breathing centers in the brain may be damaged. Respiratory arrest lasts longer than cardiac arrest, leading to secondary asystole from hypoxia.[16] Therefore, the basic principle of triage, ñtreat the living first,ò should be reversed in cases involving casualties from a lightning strike. It is imperative to treat those persons who are ñapparently deadò first by promptly initiating CPR. See Table 2 for quick-reference guidelines in evaluating and treating victims of lightning strike.

Table 2. Recommended Prehospital Care for Treating Lightning-Strike Victims[16]

Perform the following steps in order:

1. Survey the scene for safety.
2. Activate the local emergency management system.
3. Carefully move the victim to a safe area, if needed.
4. Evaluate and treat for apnea and asystole.
5. Evaluate and treat for hypothermia and shock.
6. Evaluate and treat for fractures.
7. Evaluate and treat for burns.

CONCLUSIONS

Due to its pervasiveness during the times that most athletic events occur, lightning is a significant hazard to the physically active population. Lightning-casualty statistics show an alarming rise in the number of lightning casualties in recreational and sports settings in recent decades.[2,3,9] Each person must take responsibility for his or her own personal safety during thunderstorms.[10] However, because people are often under the direction of others, whether they are children or adults participating in organized athletics, athletic trainers, coaches, teachers, and game officials must receive education about the hazards of lightning and become familiar with proved lightning-safety strategies. A policy is only as good as its compliance and unwavering, broad-based enforcement.

It is important to be much more wary of the lightning threat than the rain. Lightning can strike in the absence of rain, as well as from apparently clear blue skies overhead, even though a thunderstorm may be nearby. The presence of lightning or thunder should be the determining factor in postponing or suspending games and activities, not the amount of rainfall on the playing field. Lightning should be the only critical factor in decision making for athletic trainers, umpires, officials, referees, and coaches.

Athletic trainers, umpires, officials, referees, coaches, teachers, and parents can make a difference in reducing the number of lightning casualties if they (1) formalize and implement a lightning-safety policy or emergency action plan specific to lightning safety; (2) understand the qualifications of safe structures or locations, in addition to knowing where they are in relation to each athletic field or activity site; (3) understand the 30ï 30 rule as a minimal determinant of when to suspend activities and follow it; being conservative and suspending activities at the first sign of lightning or thunder activity is also prudent and wise; (4) practice and follow the published lightning-safety guidelines and strategies; (5) and maintain CPR and standard first-aid certification.

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CLINICAL REPORT

Long-term Follow-up Care for Pediatric Cancer Survivors

Guidance for the Clinician in Rendering Pediatric Care

AMERICAN ACADEMY OF PEDIATRICS
Section on Hematology/Oncology
CHILDREN'S ONCOLOGY GROUP

ABSTRACT

Progress in therapy has made survival into adulthood a reality for most children, adolescents, and young adults diagnosed with cancer today. Notably, this growing population remains vulnerable to a variety of long-term therapy-related sequelae. Systematic ongoing follow-up of these patients, therefore, is important for providing for early detection of and intervention for potentially serious late-onset complications. In addition, health counseling and promotion of healthy lifestyles are important aspects of long-term follow-up care to promote risk reduction for health problems that commonly present during adulthood. Both general and subspecialty pediatric health care providers are playing an increasingly important role in the ongoing care of childhood cancer survivors, beyond the routine preventive care, health supervision, and anticipatory guidance provided to all patients. This report is based on the guidelines that have been developed by the Children's Oncology Group to facilitate comprehensive long-term follow-up of childhood cancer survivors (www.survivorshipguidelines.org). *Pediatrics* 2009;123:906–915

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Key Words
childhood cancer, treatment, survival, late effects, guidelines, long-term follow-up

Abbreviations
COG—Children's Oncology Group
COG LTFU guidelines—Children's Oncology Group's *Long-term Follow-up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers*

INTRODUCTION

Cancer is diagnosed in approximately 12 400 children and adolescents younger than 20 years each year in the United States.[1] Before 1970, almost all children with cancer died as a result of their primary disease. However, rapid improvements in multimodal treatment regimens (chemotherapy, radiation therapy, and surgery), coupled with aggressive supportive-care regimens, have resulted in survival rates that continue to increase at a fast pace. The current overall survival rate for childhood malignancies is estimated at 79%.[2] This translates into approximately 300 000 childhood cancer survivors now in the United States, many of whom may seek ongoing care from pediatricians and other pediatric subspecialty providers.[3] As the number of childhood cancer survivors continues to grow, there is a concomitant increase in the number of survivors being cared for in the primary care setting. The Childhood Cancer Survivor Study (CCSS), the largest and most extensively characterized cohort of 5-year childhood cancer survivors in North America, reported that survivors receive most of their care from primary care providers.[4] Furthermore, the proportion of survivors reporting a cancer-related visit decreases with increasing time from cancer diagnosis. Thus, the general pediatrician is likely to have an increasingly vital role in caring for this rapidly growing population.

Cancer and its treatment may result in a variety of physical and psychosocial effects that predispose childhood cancer survivors to excess morbidity and early mortality when compared with the general population.[5–12] Virtually every organ system can be affected by the chemotherapy, radiation, and/or surgery required to achieve cure of pediatric malignancies. Late complications of treatment may include problems with organ function, growth and development, neurocognitive function and academic achievement, and the potential for additional cancers. Cancer and its treatment also have psychosocial consequences that may adversely affect family/peer relationships, vocational and employment opportunities, and insurance and health care access. A child's life is forever changed when touched by the cancer experience, and it is critical to assist the child and his or her family with rehabilitation into a society that places high value on good health and proper performance. Moreover, late effects after childhood cancer are common. Two of every 3 childhood cancer survivors will develop at least 1 late-onset therapy-related complication;

in 1 of every 4 cases, the complication will be severe or life-threatening.[13] Childhood cancer survivors, therefore, require ongoing comprehensive long-term follow-up care to optimize long-term outcomes by successfully monitoring for and treating the late effects that may occur as a result of previous cancer therapies.

Because health risks associated with cancer are unique to the age at treatment and specific therapeutic modality, follow-up evaluations and health screening should be individualized on the basis of treatment history. To facilitate comprehensive and systematic follow-up of childhood cancer survivors, the Children's Oncology Group (COG) organized exposure-based health screening guidelines. This clinical report presents the pediatrician with guidance in providing high-quality long-term follow-up care and health supervision for survivors of pediatric malignancies by incorporating long-term follow-up guidelines developed by the COG into their practice[14] and by maintaining ongoing interaction with pediatric oncology subspecialists to facilitate communication regarding any changes in follow-up recommendations specific to the childhood cancer survivors under their care.

METHODS: DEVELOPMENT OF LONG-TERM FOLLOW-UP GUIDELINES

The COG is a cooperative clinical trials group supported by the National Cancer Institute with more than 200 member institutions. In January 2002, at the request of the Institute of Medicine, a multidisciplinary panel within the COG initiated the process of developing comprehensive risk-based, exposure-related recommendations for screening and management of late treatment-related complications potentially resulting from therapy for childhood cancers. The resulting comprehensive resource, the COG's *Long-term Follow-up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers* (COG LTFU guidelines),[14] is designed to raise awareness of the risk of late treatment-related sequelae to facilitate early identification and intervention for these complications, standardize follow-up care, improve quality of life, and provide guidance to health care professionals, including pediatricians, who supervise the ongoing care of childhood cancer survivors.

The methodology used in developing these guidelines has been described elsewhere.[15] Briefly, evidence for development of the COG LTFU guidelines was collected by conducting a complete search of the medical literature for the previous 20 years via Medline. After the screening recommendations were developed, a multidisciplinary panel (including experts from pediatric oncology and other pediatric subspecialties, nursing, radiation oncology, behavioral medicine, and patient advocacy) reviewed and revised the guidelines. A panel of experts in the late effects of childhood and adolescent cancer treatment then reviewed and scored the guidelines by using a modified version of the National Comprehensive Cancer Network "Categories of Consensus" system.[16] Each score reflects the strength of data from the literature linking specific late complications with therapeutic exposures, coupled with an assessment of the appropriateness of screening recommendations on the basis of collective clinical experience of the expert panel. The COG LTFU guidelines, therefore, are a hybrid of evidence-based and consensus-driven approaches to guideline development. Task forces within the COG monitor the literature on an ongoing basis and provide recommendations for guideline revision as new information becomes available. These task forces include general pediatricians and other primary care providers to incorporate a primary care perspective and facilitate effective dissemination of these guidelines into the "real-world" setting. Table 1 provides a summary of selected treatment exposures and associated late effects according to organ system as outlined in the COG LTFU guidelines. Fig 1 provides an example of an exposure-based recommendation from the COG LTFU guidelines.

The COG LTFU guidelines are designed for use in asymptomatic survivors presenting for routine health maintenance at least 2 years after completion of therapy.[15] They are not designed for disease-related surveillance, which generally continues under the guidance of the treating oncologist throughout the period when the patient remains at risk of relapse from his or her primary disease. This period of risk varies depending on diagnosis and is generally highest in the first few years, with the risk decreasing significantly as time from diagnosis lengthens.

CLINICAL APPLICATION OF THE COG LTFU GUIDELINES

Malignancies that present in the pediatric age range encompass a spectrum of diverse histologic subtypes that have been managed with heterogeneous and evolving treatment approaches. Over the last 20 years, treatment protocols for localized and biologically favorable presentations of pediatric cancers have been modified substantially to reduce the risk of therapy-related complications. Conversely, therapy has been intensified for many advanced and biologically unfavorable pediatric cancers to optimize disease control and long-term survival. Thus, not all childhood cancer survivors have similar risks of late treatment effects, including those with the same diagnosis. The diversity and potential interplay of factors contributing to cancer-related morbidity are illustrated in the case presentations summarized in Table 2. In general, the risk of late effects is directly proportional to the intensity of therapy required to achieve and maintain disease control. Longer treatment with higher cumulative doses of chemotherapy and radiation, multimodal therapy, and relapse therapy increases the risk of late treatment effects. Specifically, the risk of late effects is related to the type and intensity of cancer therapy (eg, surgery, radiation therapy, chemotherapy, hematopoietic stem cell transplantation) and the patient's age at the time of treatment. Chemotherapy most often results in acute effects, some of which may persist and cause problems as the survivor ages. Many radiation-related effects on growth and development, organ function, and carcinogenesis may not manifest until many years after cancer treatment. The young child is especially at risk of delayed treatment toxicity affecting linear growth, skeletal maturation, intellectual function, sexual develop-

TABLE 1 Potential Late Effects of Selected Therapeutic Interventions for Childhood Cancer According to Organ System

Organ System	Therapeutic Exposures			Potential Late Effect
	Chemotherapy	Radiation Therapy Field	Surgery	
Skin	—	All fields	—	Dysplastic nevi; skin cancer
Ocular	Busulfan; corticosteroids	Cranial; orbital/eye; TBI	Neurosurgery	Cataracts; retinopathy (XRT doses ≥ 30 Gy only); ocular nerve palsy (neurosurgery only)
Auditory	Cisplatin; carboplatin (in myeloablative doses only)	≥30 Gy to: cranial, ear/infratemporal, nasopharyngeal	—	Sensorineural hearing loss; conductive hearing loss (XRT only); Eustachian tube dysfunction (XRT only)
Dental	Any chemotherapy before development of secondary dentition	Head and neck fields that include the oral cavity or salivary glands (eg, cranial, oropharyngeal, mantle, TBI)	—	Dental maldevelopment (tooth/root agenesis, microdontia, enamel dysplasia); periodontal disease; dental caries; osteoradionecrosis (XRT doses ≥ 40 Gy)
Cardiovascular	Anthracycline agents (eg, doxorubicin, daunorubicin)	Chest (eg, mantle, mediastinal); upper abdominal	—	Cardiomyopathy; congestive heart failure; arrhythmia; subclinical left ventricular dysfunction; XRT only: valvular disease, atherosclerotic heart disease, myocardial infarction, and pericarditis, pericardial fibrosis
Pulmonary	Bleomycin; busulfan; carmustine; lomustine	Chest (mantle, mediastinal, whole lung); TBI	Pulmonary resection; lobectomy	Pulmonary fibrosis; interstitial pneumonitis; restrictive/obstructive lung disease; pulmonary dysfunction
Breast	—	Chest (mantle, mediastinal, axillary, whole lung, TBI)	—	Breast tissue hypoplasia; breast cancer (XRT doses ≥ 20 Gy)
Gastrointestinal	—	Abdominal, pelvic (doses ≥ 30 Gy)	Laparotomy; pelvic/spinal surgery	Chronic enterocolitis; gastrointestinal tract strictures; adhesions/obstruction; fecal incontinence; colon cancer (XRT only; doses ≥ 30 Gy)
Liver	Antimetabolites (mercaptopurine, thioguanine, methotrexate)	Abdominal (doses ≥ 30 Gy)	—	Hepatic dysfunction; veno-occlusive disease (VOD); hepatic fibrosis, cirrhosis; cholelithiasis
Renal	Cisplatin; carboplatin; ifosfamide; methotrexate	Abdominal (including kidney)	Nephrectomy	Glomerular toxicity; tubular dysfunction; renal insufficiency; hypertension
Bladder	Cyclophosphamide; ifosfamide	Pelvic (including bladder); lumbar-sacral spine	Spinal surgery; cystectomy	Hemorrhagic cystitis; bladder fibrosis; dysfunctional voiding; neurogenic bladder; bladder malignancy (cyclophosphamide, XRT)
Sexual/reproductive				
Males	Alkylating agents (eg, busulfan, carmustine, lomustine, cyclophosphamide, mechlorethamine, melphalan, procarbazine)	Hypothalamic-pituitary; testicular; pelvic; TBI	Pelvic/spinal surgery; orchiectomy	Delayed/arrested puberty; hypogonadism; infertility; erectile/ejaculatory dysfunction
Females	Alkylating agents (eg, busulfan, carmustine, lomustine, cyclophosphamide, mechlorethamine, melphalan, procarbazine)	Hypothalamic-pituitary; pelvic; ovarian; lumbar-sacral spine; TBI	Oophorectomy	Delayed/arrested puberty; premature menopause; infertility; uterine vascular insufficiency (XRT only); vaginal fibrosis/stenosis (XRT only)

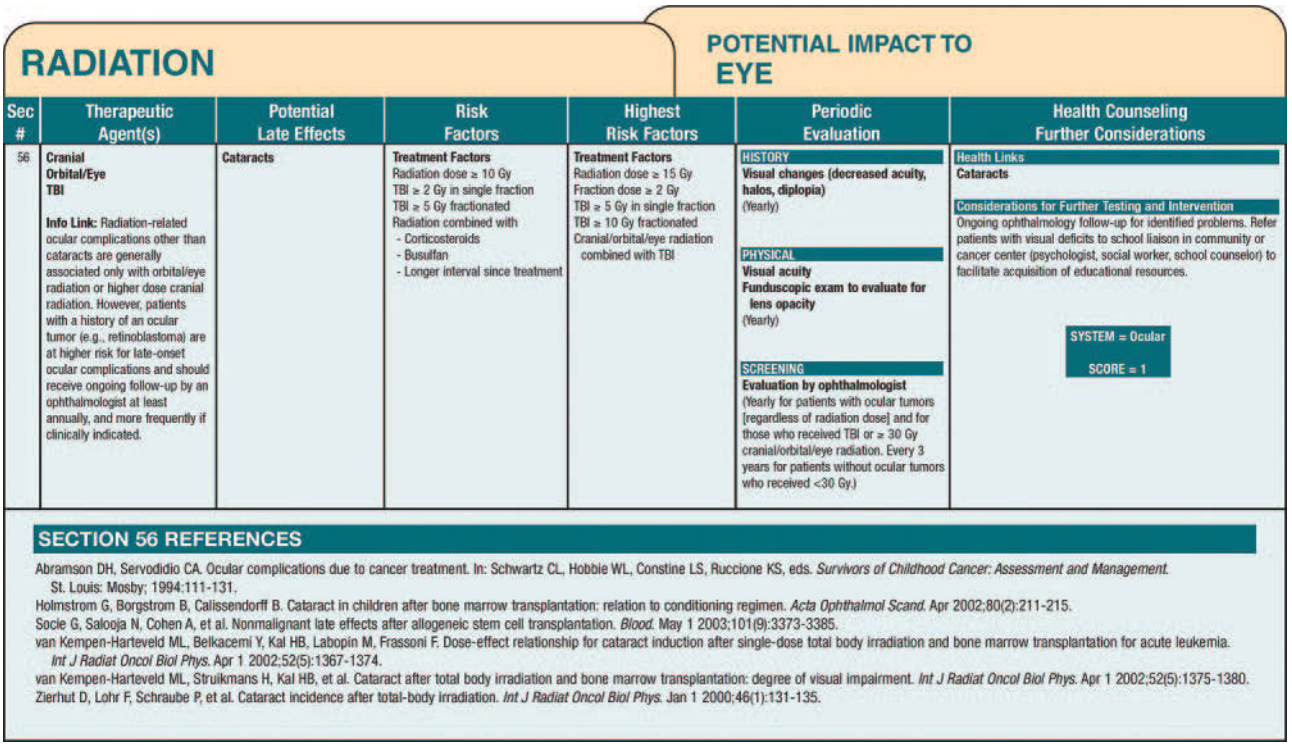
TABLE 1 Continued

Organ System	Therapeutic Exposures			Potential Late Effect
	Chemotherapy	Radiation Therapy Field	Surgery	
Endocrine/metabolic	—	Hypothalamic-pituitary; neck (thyroid)	Thyroidectomy	Growth hormone deficiency; precocious puberty; hypothyroidism; thyroid nodules/cancer; XRT doses ≥ 40 Gy: hyperprolactinemia, central adrenal insufficiency, gonadotropin deficiency, and hyperthyroidism
Musculoskeletal	Corticosteroids; methotrexate	—	—	Osteopenia/osteoporosis; osteonecrosis
	—	All fields	—	Reduced/uneven growth; reduced function/mobility; hypoplasia, fibrosis; radiation-induced fracture (doses ≥ 40 Gy); scoliosis/kyphosis (trunk fields only); secondary benign or malignant neoplasm
	—	—	Amputation; limb sparing	Reduced/uneven growth; reduced function/mobility
Neurocognitive	Methotrexate (intrathecal administration or IV doses ≥ 1000 mg/m^2); cytarabine (IV doses ≥ 1000 mg/m^2)	Cranial; ear/infratemporal; total body irradiation	Neurosurgery	Neurocognitive deficits (executive function, attention, memory, processing speed, visual motor integration); learning deficits; diminished IQ
Central nervous system	Methotrexate, cytarabine (intrathecal administration or IV doses ≥ 1000 mg/m^2)	Doses ≥ 18 Gy to: cranial, orbital/eye, ear/infratemporal, nasopharyngeal	Neurosurgery	Leukoencephalopathy (spasticity, ataxia, dysarthria, dysphagia, hemiparesis, seizures [chemotherapy and XRT]); motor and sensory deficits; cerebrovascular complications (stroke, Moya Moya, occlusive cerebral; vasculopathy [XRT and surgery]) Brain tumor (any XRT dose)
Peripheral nervous system	Plant alkaloids (vincristine, vinblastine); cisplatin, carboplatin	—	Spinal surgery	Peripheral sensory or motor neuropathy
Immunologic		Abdomen, left upper quadrant, spleen (doses ≥ 40 Gy)	Splenectomy	Life-threatening infection related to functional or anatomic asplenia (note: functional asplenia can also occur as a consequence of active chronic graft-vs-host disease after hematopoietic stem cell transplant)
Psychosocial	Any	Any	Any	Social withdrawal; educational problems; depression; anxiety; posttraumatic stress

This table briefly summarizes potential late effects for selected therapeutic exposures only; the complete set of long-term follow-up guidelines from the Children's Oncology Group, including screening recommendations, is available at www.survivorshipguidelines.org. XRT indicates radiation therapy; TBI, total body irradiation; IV, intravenous.

ment, and organ function. Because pediatricians provide care across a continuum of developmental periods, they must also recognize that childhood cancer survivors face unique vulnerabilities related to their age at diagnosis and treatment.

Risk-based care involving a systematic plan for lifelong screening, surveillance, and prevention that incorporates risks on the basis of previous cancer, cancer therapy, genetic predispositions, lifestyle behaviors, and comorbid health conditions is recommended for all survivors.[10,17] Information critical to the coordination of risk-based care includes the date of cancer diagnosis, cancer histology, organs/tissues affected by cancer, and specific treatment modalities such as surgical procedures, chemotherapeutic agents and radiation treatment fields and doses, and history of bone marrow or stem cell transplant and blood-product transfusion. Knowledge of cumulative chemotherapy dosages (eg, for anthracycline agents), or dose intensity of administration (eg, for methotrexate), also is important in estimating risk and screening frequency. This pertinent clinical information can be organized into a treatment summary that interfaces with the COG LTFU guidelines to



RADIATION

POTENTIAL IMPACT TO EYE

Sec #	Therapeutic Agent(s)	Potential Late Effects	Risk Factors	Highest Risk Factors	Periodic Evaluation	Health Counseling Further Considerations
56	**Cranial** **Orbital/Eye** **TBI** **Info Link:** Radiation-related ocular complications other than cataracts are generally associated only with orbital/eye radiation or higher dose cranial radiation. However, patients with a history of an ocular tumor (e.g., retinoblastoma) are at higher risk for late-onset ocular complications and should receive ongoing follow-up by an ophthalmologist at least annually, and more frequently if clinically indicated.	**Cataracts**	**Treatment Factors** Radiation dose ≥ 10 Gy TBI ≥ 2 Gy in single fraction TBI ≥ 5 Gy fractionated Radiation combined with - Corticosteroids - Busulfan - Longer interval since treatment	**Treatment Factors** Radiation dose ≥ 15 Gy Fraction dose ≥ 2 Gy TBI ≥ 5 Gy in single fraction TBI ≥ 10 Gy fractionated Cranial/orbital/eye radiation combined with TBI	**HISTORY** **Visual changes (decreased acuity, halos, diplopia)** (Yearly) **PHYSICAL** **Visual acuity** **Funduscopic exam to evaluate for lens opacity** (Yearly) **SCREENING** **Evaluation by ophthalmologist** (Yearly for patients with ocular tumors [regardless of radiation dose] and for those who received TBI or ≥ 30 Gy cranial/orbital/eye radiation. Every 3 years for patients without ocular tumors who received <30 Gy.)	**Health Links** **Cataracts** **Considerations for Further Testing and Intervention** Ongoing ophthalmology follow-up for identified problems. Refer patients with visual deficits to school liaison in community or cancer center (psychologist, social worker, school counselor) to facilitate acquisition of educational resources. SYSTEM = Ocular SCORE = 1

SECTION 56 REFERENCES

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FIGURE 1

Example of an exposure-based recommendation from the COG LTFU guidelines. (Reproduced with permission from the Children's Oncology Group. *Long-term Follow-up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers*. Version 3.0. Arcadia, CA: Children's Oncology Group; 2008:73.)

facilitate identification of potential late complications and recommended follow-up care (Fig 2). Because of the diversity and complexity of pediatric cancer therapies, the treating pediatric oncology center represents the optimal resource for this treatment information. Furthermore, the need for ongoing, open lines of communication between the pediatric cancer center and the primary care provider is critical.

TABLE 2 Examples of 2 Survivors: Factors Contributing to Cancer-Related Morbidity

Factor	Example 1: Leukemia	Example 2: Solid Tumor
Host	3-y-old white male	16-y-old black female
Tumor	Acute lymphoblastic leukemia, B lineage, average risk, without CNS involvement	Embryonal rhabdomyosarcoma of the chest wall, stage II
Treatment	Vincristine; corticosteroids; antimetabolites (PO, IV, intrathecal); asparaginase; cyclophosphamide (moderate dose); doxorubicin (low dose)	Vincristine; dactinomycin; chest radiation (36 Gy)
Potential late effects	Peripheral neuropathy; osteopenia/osteoporosis; osteonecrosis; cataracts; hepatic dysfunction; renal insufficiency; neurocognitive deficits; leukoencephalopathy; hemorrhagic cystitis, bladder malignancy; secondary myelodysplasia or myeloid leukemia; gonadal dysfunction; cardiomyopathy, congestive heart failure, arrhythmia; dental maldevelopment, periodontal disease, excessive dental caries	Peripheral neuropathy; cardiac complications (cardiomyopathy, congestive heart failure, arrhythmia, subclinical left ventricular dysfunction, valvular disease, atherosclerotic heart disease, myocardial infarction, pericarditis, pericardial fibrosis); pulmonary complications (fibrosis, interstitial pneumonitis, restrictive/obstructive lung disease); esophageal stricture; breast tissue hypoplasia; breast cancer; scoliosis/kyphosis; shortened trunk height; secondary benign or malignant neoplasms in radiation field
Genetics/familial	Diabetes mellitus, type 2	Hypertension; early coronary artery disease
Comorbid conditions	Obesity	Hypertension
Health behaviors	Sedentary lifestyle	Smoker
Aging	Bone mineral density (osteoporosis)	Cardiomyopathy

CNS indicates central nervous system; PO, oral; IV, intravenous.

SUMMARY OF CANCER TREATMENT
(Abbreviated)

DEMOGRAPHICS		
Name:	Sex:	Date of Birth:

CANCER DIAGNOSIS		
Diagnosis:	Date of Diagnosis:	Date Therapy Completed:

CHEMOTHERAPY: ☐ Yes ☐ No *If yes, complete chart below*

Drug Name	Additional Information†

† Anthracyclines: Include cumulative dose in mg/m^2 and age at first dose (see section 28 of Guidelines for isotoxic dose conversion);
Carboplatin: Indicate if dose was myeloablative; Methotrexate and Cytarabine: Indicate route of administration (i.e., IV, IM, SQ, PO, IT, IO);
IV Methotrexate and Cytarabine: Indicate if "high dose" (any single dose ≥1000 mg/m^2) or "standard dose" (all single doses <1000 mg/m^2)
Note: Cumulative doses, if known, should be recorded for all agents, particularly for alkylators and bleomycin.

RADIATION ☐ Yes ☐ No *If yes, complete chart below*

Site/Field*	Total Dose** (Gy)***

* For chest, thoracic spine, and upper abdominal radiation, include age at first dose ** Total dose to each field should include boost dose, if given
*** Note: To convert cGy or rads to Gy, divide dose by 100 (example: 2400 cGy = 2400 rads = 24 Gy)

HEMATOPOIETIC CELL TRANSPLANT ☐ Yes ☐ No *If yes, answer question below*

Was this patient ever diagnosed with **chronic** graft-versus-host disease (cGVHD)? ☐ Yes ☐ No

SURGERY ☐ Yes ☐ No *If yes, complete chart below*

Procedure	Site (if applicable)	Laterality (if applicable)

OTHER THERAPEUTIC MODALITIES ☐ Yes ☐ No *If yes, answer questions below*

Did this patient receive radioiodine therapy (I-131 thyroid ablation)?	☐ Yes ☐ No
Did this patient receive systemic MIBG (in therapeutic doses)?	☐ Yes ☐ No
Did this patient receive bioimmunotherapy?	☐ Yes ☐ No

Summary prepared by:	Date prepared:

CureSearch
Children's Oncology Group

Summary Form - Abbreviated

FIGURE 2
Sample template for cancer treatment summary containing essential data elements necessary for generating long-term follow-up guidelines. (Reproduced with permission from the Children's Oncology Group. *Long-term Follow-up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers*. Version 3.0. Arcadia, CA: Children's Oncology Group; 2008:Appendix 1.)

Coordination of risk-based care for childhood cancer survivors requires a working knowledge about cancer-related health risks and appropriate screening evaluations or access to a resource that contains this information. Individualized recommendations for long-term follow-up care of childhood cancer survivors can be customized from the COG LTFU guidelines on the basis of each patient's treatment history, age, and gender into a "survivorship care plan" that is ideally developed by, or in coordination with, the pediatric oncology subspecialist. In addition, the COG LTFU guidelines provide information to assist with risk stratification, allowing the health care provider to address specific treatment-related health risks that may be magnified in individual patients because of familial or genetic predisposition, sociodemographic factors, or maladaptive health behaviors. The patient education materials (known as "health links") that accompany the COG LTFU guidelines are specifically tailored to enhance health supervision and promotion in this population by providing simplified explanations of guideline-specific topics in lay language.[18] The COG LTFU guidelines, associated patient education materials, and supplemental resources to enhance guideline application, including clinical summary templates, can be downloaded from www.survivorshipguidelines.org. A Web-based platform that will allow online generation of therapeutic summaries with simultaneous output of patient-specific guidelines on the basis of exposure history, age, and gender is currently under development.[19]

DISCUSSION/RECOMMENDATIONS

Pediatricians are uniquely qualified to deliver ongoing health care to childhood cancer survivors, because they are already familiar with health maintenance and supervision for healthy children and adolescents and also provide care for patients with complex chronic medical conditions. The concept of the "medical home" has been endorsed by the American Academy of Pediatrics as an effective model for coordinating the complex health care requirements of children with special needs, such as childhood cancer survivors, to provide care and preventive services that are accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective.[20,21] Within this framework, the pediatrician is able to view the cancer survivor in the context of the family and to assist not only the survivor but also the parents and siblings in adapting to the "new normal" of cancer survivorship. The focus of care for the childhood cancer survivor seen in the general pediatric practice is not the cancer from which the patient has now recovered but, rather, the actual and potential sequelae of cancer and its therapy. Childhood cancer survivors are at a substantially increased risk of morbidity and mortality when compared with the general population.[5–12] Their follow-up evaluations should be individualized on the basis of their treatment history and may include screening for such potential complications as thyroid or cardiac dysfunction, second malignant neoplasms, neurocognitive difficulties, and many others.[13] The COG LTFU guidelines should be used to guide development of individualized follow-up plans for each patient on the basis of his or her particular risk of late complications, which should be developed through a shared partnership that includes the general pediatric and pediatric oncology subspecialty providers, the child, and the family. The COG LTFU guidelines can assist the clinician in maintaining a balance between overscreening (which could potentially cause undue fear of unlikely but remotely plausible complications as well as higher medical costs resulting from unnecessary screening) and underscreening (which could miss potentially life-threatening complications, thus resulting in lost opportunities for early intervention that could minimize morbidity). Ultimately, as with all clinical practice guidelines, decisions regarding specific screening and ongoing clinical management for individual patients should be tailored to take all relevant factors (such as therapeutic exposures, medical and psychosocial history, and comorbidities) into consideration.

The pediatrician must also be aware that the childhood cancer experience is unique in that some survivors, given their young age at diagnosis, may not remember their cancer diagnosis or the treatment that they received. For others, parents may not have told the child about his or her cancer history. Therefore, it is not surprising that when childhood cancer survivors have been questioned regarding knowledge of their diagnosis and treatment, important deficits have been identified.[22] The pediatrician may need to request a cancer treatment summary and "survivorship care plan" from the pediatric oncology center if one is not provided at the time that the child transitions back to the primary care setting. Many pediatric oncology centers offer ongoing multidisciplinary follow-up care for childhood cancer survivors on an annual, 1-time, or as-needed basis. Some follow-up clinics are comprehensive and offer ongoing care and risk-based screening for childhood cancer survivors, and other follow-up clinics are consultative in nature and develop risk-based recommendations for ongoing follow-up (included in survivorship care plans) that can be conducted in the primary care setting. In any case, the components of a survivorship care plan should include recommendations for late-effects screening generated from the COG LTFU guidelines on the basis of therapeutic exposures, identification of the provider(s) who will be coordinating the indicated screening evaluations, and identification of the provider(s) responsible for communicating and explaining the results to the patient and/or caregivers.

In addition to screening for late effects on the basis of previous therapeutic exposures, health counseling and promotion of healthy lifestyles are important aspects of long-term follow-up care in this population. Oeffinger and colleagues[13] have shown that survivors of childhood cancer have a high rate of chronic health conditions when followed long-term. For this reason, it is essential for the pediatrician to provide anticipatory guidance regarding health promotion and disease prevention aimed at minimizing the risk of future morbidity and mortality. For example, survivors who are at risk of obesity, cardiovascular disease, and osteoporosis should be counseled re-

garding the importance of eating a well-balanced diet (high in calcium, low in fat) and participating in regular exercise. The COG LTFU guidelines can be used to facilitate targeted education regarding health promotion. In addition to the verbal counseling completed in the office setting, survivors should also receive written and/or Web-based educational material that can be used to further reinforce their knowledge about their risks for specific late effects. These written and Web-based health education materials are called health links and are available with the COG LTFU guidelines at www.survivorshipguidelines.org. They can be printed for distribution in the primary care office setting and are available for viewing by patients and their caregivers on the Internet.[18]

Again, it must be emphasized that the pediatrician is not alone in caring for the childhood cancer survivor. There are numerous multidisciplinary long-term follow-up programs for childhood cancer survivors, and most of these programs will work collaboratively with pediatricians to assist with the development of individualized survivorship care plans. Depending on geographic location, insurance coverage, and other considerations, some patients may return to the primary oncology center for annual or periodic visits, and their long-term follow-up care may be partially or entirely accomplished through these specialized centers, with the pediatrician providing the primary pediatric health care for those patients. However, for many survivors, long distances or other barriers may make specialized long-term follow-up impractical, and the pediatrician is often called on to provide both long-term follow-up and primary care for childhood cancer survivors in the community setting. Telephone consultation with the primary oncology team or associated long-term follow-up center is generally available to facilitate this ongoing care. For survivors who are identified as having chronic health problems as a result of their previous cancer therapy, the pediatrician can also work with the primary oncology center to obtain assistance with referrals to subspecialists knowledgeable in issues related to childhood cancer survivorship. In addition, a listing of COG-affiliated subspecialty survivorship clinics is available (www.childrensoncologygroup.org). These clinics are also excellent venues for pediatric residents to learn about the unique health care needs of childhood cancer survivors and of the long-term therapy-related risks that they continue to face across their life span; however, there are currently no formal mechanisms for including cancer survivorship in the training of medical students or pediatric residents.

Ensuring a smooth transition from pediatric to adult-oriented health care services poses additional challenges in the care of childhood cancer survivors as they age out of the pediatric health care system. Pretransition planning is a critical element in the successful transition from pediatric to adult-oriented health care for all adolescents and young adults with special health care needs, including childhood cancer survivors, and the medical home model provides a strong foundation for this planning.[23,24] The pretransition plan should outline the roles of patient, family, subspecialty and community health care providers in the ongoing care of the survivor to ensure a successful transition. Adolescent and young adult survivors should be well versed regarding their own health maintenance needs, their potential health risks, necessary ongoing screening related to their cancer therapy, and health-related behaviors that can reduce their risk of potential adverse sequelae. They need to be aware of the importance of maintaining continuous health insurance coverage to ensure access to screening for their late effects. This can be challenging, because many adolescent and young adult survivors are still defining career goals and, therefore, have not yet attained employer-based health insurance coverage. The adolescent or young adult cancer survivor may be grappling with unique treatment-related health issues, such as infertility, at a time when their sexual maturity and personal relationships are developing. Some may also be at risk of early death because of primary disease recurrence or second malignant neoplasms,[25] which in turn may require frank discussions regarding advanced directives. Therefore, adolescent and young adult survivors should leave the pediatric health care environment equipped with a comprehensive survivorship care plan, along with the knowledge and skills required to keep abreast of new information relating to their potential health risks as that information emerges.

Although late treatment effects can be anticipated in many cases on the basis of therapeutic exposures, the risk to an individual patient is modified by multiple factors. The patient with cancer may present with premorbid health conditions that influence tolerance to therapy and increase the risk of treatment-related toxicity. Cancer-related factors, including histology, tumor site, and tumor genetics, often dictate treatment modality and intensity. Host-related factors such as age at diagnosis, race, and gender may affect the risk of several treatment-related complications. Sociodemographic factors such as household income, educational attainment, and socioeconomic status often influence access to health insurance, remedial services, and appropriate risk-based health care. Organ senescence in aging survivors may accelerate presentation of age-related health conditions in survivors with subclinical organ injury or dysfunction resulting from cancer treatment. Genetic or familial characteristics may also enhance susceptibility to treatment-related complications. Problems experienced during and after treatment may further increase morbidity. Health behaviors, including tobacco and alcohol use, sun exposure, and dietary and exercise habits, may increase the risk of specific therapy-related complications. Although much is known about factors predisposing to cancer-related morbidity and mortality in this growing population, there is still much to learn to inform the development of interventions that will optimize survival rates for pediatric malignancies while limiting or eliminating therapy-related toxicities. This fact underscores the importance of long-term follow-up for childhood cancer survivors to accurately define health outcomes, characterize groups at high risk, and implement risk-reducing interventions.

SUMMARY

Given the high incidence of late effects experienced by childhood cancer survivors, it is essential that individuals who were treated for cancer during childhood receive long-term follow-up care from knowledgeable providers so

that their care is appropriately tailored to their specific treatment-related risk factors. This is an exciting time for providing care to childhood cancer survivors. Discussion regarding the best models for providing survivorship care are emerging concomitantly with the availability of the COG LTFU guidelines. A recent review by Oeffinger and McCabe[26] proposed a "shared-care model" that includes roles for both the primary care provider and the cancer subspecialist in the care of cancer survivors. In this model, the generalist is responsible for routine health maintenance, management of comorbid diseases, and ongoing management of the physical and emotional needs of the survivor. The oncology subspecialist provides the generalist with the survivorship care plan and is available for ongoing consultation with the generalist regarding any areas of uncertainty. Most importantly, the emphasis is on providing ongoing 2-way communication between the generalist and specialist to optimize the follow-up care for childhood cancer survivors.

Ultimately, the goal of this clinical report from the American Academy of Pediatrics is to increase the awareness of general pediatricians to the readily available resource of the COG LTFU guidelines. These guidelines can, in turn, be used to develop a comprehensive yet individualized survivorship care plan for each childhood cancer survivor. The pediatrician works collaboratively with the pediatric oncology subspecialist, who develops the cancer treatment summary and survivorship care plan. The survivorship care plan can be used by general pediatricians as a "road map" for providing risk-based, long-term follow-up care in the community setting. Ultimately, ongoing communication between the pediatric cancer center and the primary care pediatrician is the cornerstone for providing high-quality care to this vulnerable patient population.

CHILDREN'S ONCOLOGY GROUP

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Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

Male Adolescent Sexual and Reproductive Health Care

abstract

FREE

Male adolescents' sexual and reproductive health needs often go unmet in the primary care setting. This report discusses specific issues related to male adolescents' sexual and reproductive health care in the context of primary care, including pubertal and sexual development, sexual behavior, consequences of sexual behavior, and methods of preventing sexually transmitted infections (including HIV) and pregnancy. Pediatricians are encouraged to address male adolescent sexual and reproductive health on a regular basis, including taking a sexual history, performing an appropriate examination, providing patient-centered and age-appropriate anticipatory guidance, and delivering appropriate vaccinations. Pediatricians should provide these services to male adolescent patients in a confidential and culturally appropriate manner, promote healthy sexual relationships and responsibility, and involve parents in age-appropriate discussions about sexual health with their sons. *Pediatrics* 2011;128:e1658–e1676

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KEY WORDS

male sexual health, male reproductive health, male adolescents, male puberty

ABBREVIATIONS

STI—sexually transmitted infection
SMR—sexual maturity rating
AAP—American Academy of Pediatrics
NSFG—National Survey of Family Growth
CI—confidence interval
HPV—human papillomavirus
CDC—Centers for Disease Control and Prevention
USPSTF—US Preventive Services Task Force

INTRODUCTION

During adolescence, a number of changes occur for boys, including the physical, psychological, and social changes associated with puberty, and the majority of male adolescents report the initiation of sexual behavior.[1] Many of these events, including sexual initiation, are associated with preventable consequences that can lead to significant morbidity and mortality.[2] During this same time period, the number of health visits typically declines, particularly among older male adolescents, and there is a shift from routine to more time-limited acute visits.[3]

For health care providers, including primary care providers and pediatricians, who care for male adolescents, issues of puberty and sexuality are areas that should be commonly addressed with the male patient and his family.[4] Even after the release of the American Medical Association's *Guidelines for Adolescent Preventive Services* (GAPS)[5] and *Bright Futures*,[6] which recommend preventive health services for adolescents, few improvements have been observed in the counseling of male teenagers regarding the prevention of sexually transmitted infections (STIs) or HIV infection.[7,8] Furthermore, data from outpatient ambulatory medical records show that primary care providers are 3 times more likely to take sexual health histories from female than male patients and twice as likely to counsel female patients on the use of condoms.[9,10] Thus, it is important for primary care providers to have an understanding of what sexual/reproductive health care means for the male adolescent.

Addressing male teenagers' sexual/reproductive health includes but is not limited to preventing STIs and HIV. The 1994 Cairo United Nations

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International Conference on Population and Development and the World Health Organization defined sexual/reproductive health as "a state of physical, mental and social well-being and not merely the absence of disease, dysfunction or infirmity, in all matters relating to the reproductive system, its functions and its processes."[11,12] Sexual health also requires a positive and respectful approach to sexuality and sexual relationships. People should be able to have pleasurable and safe sexual experiences free of coercion, discrimination, or violence. Men, along with women, have the right to be informed and have access to safe, effective, affordable, and acceptable methods of family planning of their choice and the right of access to appropriate health care services.

For health care providers, goals for male adolescents' sexual/reproductive health beyond the prevention of STIs, HIV infection, unwanted pregnancy, and reproductive health-related cancers should include promoting sexual health and adolescent development, healthy intimate relationships and responsible behavior, and responsible fatherhood as well as reducing problems related to sexual dysfunction and infertility.[13] Health care providers require the knowledge, skills, and confidence to screen and examine male adolescents and discuss with them and provide appropriate education about the scope of sexual/reproductive health care for male adolescents.

The goals of this report are to:

1. describe key components of male adolescents' sexual/reproductive health;
2. explain how interactions with male adolescents and their families regarding sexual/reproductive health requires an individualized patient-centered approach; and
3. offer health care providers specific advice on how to deliver sexual/reproductive health care to male adolescents using each encounter with a young man as an opportunity.

I. CORE MALE ADOLESCENT SEXUAL/REPRODUCTIVE HEALTH KNOWLEDGE AREAS

A. Puberty

With pubertal changes and the development of reproductive capacity come questions and concerns. Puberty for male adolescents follows a predictable sequence, but clinicians need to be aware that its timing is variable because of a variety of factors, including heredity and race/ethnicity. For boys, the first visible sign of puberty and the hallmark of the second sexual maturity rating (SMR) stage (SMR2) is testicular enlargement, followed by penile growth (the hallmark of SMR3). During SMR4, a male's testicular volume has reached approximately 9 to 10 cm^3 and his peak height growth typically occurs.

Results from a recent national survey suggest that the median age of boys' pubertal initiation is trending earlier in the United States, especially among non-Hispanic white boys.[14,15] One study used estimates from a sample of non-Hispanic white, non-Hispanic black, and Mexican American males 8 to 19 years of age. Two independent analyses of the same data indicate that the median age of SMR2 for genital development was 10.0 years for non-Hispanic white boys, 9.2 to 9.5 years for non-Hispanic black boys, and 10.3 to 10.4 years for Mexican American boys, whereas the median age of SMR2 for pubic hair development was 12.0, 11.2, and 12.3 years, respectively.[16,17] These data suggest that a significant portion of boys are entering puberty earlier than 9.5 years, which was the previous lowest age of normal entry into puberty for boys. Future studies with comparable measures are needed to confirm these secular trends.

B. Alterations in Growth Associated With Puberty

Health conditions related to male growth and development are not uncommon, can be quite distressing, and might not be identified until adolescence. The frequencies of more common disorders are 1 in 500 to 700 for Klinefelter syndrome; 1 in 1000 to 4000 for fragile X syndrome; 1 in 5000 to 10 000 for Marfan syndrome; and 1 in 8000 to 10 000 for Kallman syndrome.[18–21] Other non–STI-related male genital issues that occur during adolescence include gynecomastia (40%–65% of male teenagers), testicular torsion (8.6 per 100 000 males 10–19 years of age), varicocele (10% of males), and testicular cancer (3.1 in 100 000 males 15–19 years of age).[22–27]

Early and delayed pubertal timing, including short stature, can result in negative consequences for the developing male. Consequences can include higher mean levels of aggression and delinquency. Earlier-maturing boys might have more frequent involvement in risk-taking behaviors, and later-maturing boys might have lower levels of confidence and self-efficacy and increased experiences of teasing, bullying, mental health issues, and substance abuse.[28–30] Even a common issue such as acne, which affects 95% of male adolescents,[31] can be related to self-reported embarrassment, lower self-esteem, depression, and anxiety.[32]

Given the frequency of these growth and developmental concerns, the typical practicing health care provider will certainly see male patients with 1 or more of these disorders.

C. Sexuality

Sexuality, as defined by the World Health Organization in 2002, is a cen-

tral aspect of the human life course and encompasses sex, gender identities and roles, sexual orientation, intimacy, and reproduction.[12] Although sexuality can be experienced and expressed in thoughts, fantasies, desires, beliefs, values, behaviors, roles, and relationships, not all sexuality dimensions are experienced or expressed. One's sexuality is also influenced by a variety of factors including biological, psychological, familial, societal, political, cultural, and religious factors. Before adolescence even begins, boys might be curious and ask questions about sex, body parts, differences between boys and girls, and where babies come from. However, not all parents talk about sex with their children. In the United States, many more mothers than fathers talk about sex with their sons, but mothers are less comfortable talking about sex with their sons than with their daughters.[33,34] Fathers have also been shown to have more difficulty communicating about sexuality-related topics with their adolescents.[35]

A recent study of California teenagers and their parents found that adolescents who reported that their parents had more frequent sexual-related communication also reported feeling closer to their parents, being more comfortable talking with their parents in general, and having more open conversations about sex with their parents.[36] Health care providers are in a position to advise male patients and their parents about the value and importance of repeatedly talking about sex and related topics.[37] Involving parents and sons in sexual health discussions can help reinforce family values and create opportunities for sons to ask clarifying questions instead of relying on misinformation provided by their peers.

Male adolescents should be encouraged to talk with their health care provider about general health and, in particular, sex, relationships, and prevention of STIs/HIV and pregnancy.[38,39] Male adolescents cite their mothers, doctors, and nurses as their principle resources for general health care concerns[39] and cite doctors and other health care providers as 1 of their top 4 sources of sexual health information inclusive of parents, health classes, and television.[38] Schools, media, and the Internet can also play important roles in the provision of sexual health information. For example, male teenagers who received instruction on AIDS prevention and sex education at school were more likely to have fewer sexual partners, engage in fewer sex acts, and use condoms more consistently than those who did not receive such information.[40] However, adolescents should understand the potential negative influence of media and the Internet, because negative sexual health messages from these sources can lead to risky sexual behaviors.[41,42]

D. Sexual Development

During adolescence, teenagers begin the process of developing a sexual self-concept, which involves the combination of physical sexual maturation, age-appropriate sexual behaviors, and formation of a positive sexual identity and sense of well-being. In early adolescence, boys might become preoccupied with body changes, become interested in sexual anatomy and sex, compare changes in their body with others, and explore touching and mutual masturbation. Along with the experience of spontaneous erections, ejaculation related to masturbation, and the onset of nocturnal ejaculatory events during sleep (ie, "wet dreams"), there are many reasons why preadolescent and older boys might have questions and anxieties about their emerging sexuality. Later, male adolescents begin to test their ability to attract others through dating and sexual behavior. It is not uncommon for a male to have anxieties and questions about genital size and function, especially when comparing himself to others and after initiating sexual behavior.[43]

Some male adolescents might be exploring their sexual attraction to others, and others might already recognize that they are heterosexual, homosexual, bisexual, or transgendered. Studies have found that gay male youth who have a supportive environment during the disclosure process can have a more positive psychological adjustment.[44,45] As discussed in the American Academy of Pediatrics (AAP) statement on sexual orientation and adolescents,[46] boys who are questioning and gay and do not have supportive environments are at increased risk of social isolation, school failure, family conflict, substance abuse, depression, suicide, and stigmatization.[47–50] Most sexual-minority youth are quite resilient and work through adolescent development issues. Being gay or bisexual or questioning their orientation is not in itself a problem but is a risk factor for exploring other associated risks.[51] Questioning, bisexual, and gay male youth who fear being "found out" may choose not to openly discuss their concerns with potentially helpful adults such as their health care provider. Because sexual identities might be "fluid" or subject to change during adolescence, providers may find it more beneficial to inquire about sexual attractions and actual behaviors of their adolescent patients rather than asking about sexual identity (ie, how a person identifies his or her own sexuality). The health care provider might ask a series of questions such as, "A question or even a concern that a teen might have is, am I attracted to both guys and girls, just guys, or just girls. . . has that been a question for you? If so, have you been

able to answer that yet?" "Have you ever had sex with women, men, or both?" "Have you ever engaged in vaginal, oral, or anal sex?"

E. Masturbation and Spermarche

On average, the age of first male masturbation occurs between 12 and 14 years of age; most boys learn about masturbation through self-discovery. Masturbation among males is common and ranges from 36% reporting masturbating 3 to 4 times per month to 10% reporting masturbating every other day or daily.[52] There is no evidence that masturbation is harmful in general or to one's sexual development or later adult sexual adjustment.[53,54] However, myths related to negative consequences of masturbation persist and can result in inappropriate anxiety and/or guilt.

Before puberty, boys might masturbate to orgasm; however, no ejaculation will occur until pubertal changes commence.[55] Sperm in the ejaculate, or spermarche, typically appears during SMR3, approximately 12 to 18 months after the testes begin to enlarge. Although mature sperm production begins after the first ejaculate, a young man should be considered fertile from the time of his first ejaculation.

Health care providers can reassure male adolescents that self-masturbation is a normal behavior and can be a positive expression of sexuality and a way to delay having sex and its associated risks. Health care providers can also assist male adolescents with information and resources about normal sexual physiology and function that might not otherwise be available at home or school.

F. Sexual Behavior and Its Consequences

Sexual behavior is a normal part of development. According to the Youth Risk Behavior Surveillance, more than half (59.6%) of school-aged male teenagers report that they have had sex by the 12th grade.[2] Data from the 2002 National Survey of Family Growth (NSFG) indicate that among 15- to 19-year-old male adolescents who reported never having had vaginal sex, nearly one-quarter reported engaging in oral sex or mutual masturbation behaviors.[1,56] More recent data from the NSFG indicate that approximately one-eighth of 15- to 19-year-old males report having oral sex or other sexual contact but not vaginal sex.[57] Oral sex, in particular, is part of the repertoire of sexual behaviors and might predict involvement in other sexual behaviors.[58–60] Thus, at a minimum, three-quarters of US male youth are reporting involvement in varying types of sexual behavior. Male adolescents also report an earlier age of sexual debut[2] and more sexual partners than female adolescents,[1,2,61] which are factors known to be associated with STI-acquisition risk.[62,63] Sexual experience increases as teenagers get older; 59.6% of 12th-grade boys have report having had sexual intercourse, compared with 33.6% of 9th-grade boys.[2]

A substantial number of young men also report engaging in higher-risk sexual behaviors. Data from the 2009 Youth Risk Behavior Surveillance indicate that among male high school students, 25.9% reported using alcohol or drugs before last sex, 16.2% reported 4 or more lifetime partners, and 8.4% reported initiating sex at 13 years or younger.[2] Data from the 2002 NSFG also showed that among 15- to 19-year-old males, 28.6% reported no condom use at last vaginal sex, 11.1% reported engaging in anal sex with a female partner, and 5.6% reported having sex with a prostitute or an HIV-infected person or often/always being high during sex.[7]

Patterns of male adolescent sexual behaviors also vary according to race/ethnicity.[2] Higher proportions of non-Hispanic black high school boys (72.1%) report being sexually experienced compared with Hispanic (52.8%) or non-Hispanic white (39.6%) high school boys. Higher proportions of non-Hispanic black boys (24.9%) initiate sex at 13 years of age or younger compared with Hispanic (9.8%) and non-Hispanic white (4.4%) boys.

National US data on same-sex sexual attraction and behavior is limited. From the 1995 National Longitudinal Survey on Adolescent Health, the mean report of same-sex attraction or relationship among male adolescents was 8.4% (95% confidence interval [CI]: 7.5–9.3).[49] In the 2006–2008 NSFG, 1.8% of 18- to 19-year-olds and 2.3% of 20- to 24-year-olds reported equally to both or mostly/only same-sex attraction.[57] In the 2002 NSFG, 4.5% of male teenagers 15 to 19 years of age and 5.5% of young adult men 20 to 24 years of age reported a same-sex partner.[61] In the 2006–2008 NSFG, 2.5% of male teenagers 15 to 19 years of age and 5.6% of young adult men 20 to 24 years of age reported a same-sex partner.[57] Discordance between sexual attraction/orientation and behavior is also possible, because one's sexual attraction and identity do not always predict sexual behavior.[57,64,65]

G. Unwanted Sex

Although males are more likely than females to agree with the statement, "sex is something that just happens,"[66] the majority (82%) of males 12 to 19 years of age reported feeling pressured by friends to have sex.[67] Among sexually experienced males 15 to 19 years of age, more than half (55%) wished that they had waited longer before having sex for the first time,[68] and more than one-third (38%) of men 18 to 24 years of age reported that they really did not want sex to happen the first time that it did or had mixed feelings about it.[56] Approximately 1 in 12

men (7.6%), particularly those whose first sexual intercourse was at younger than 15 years and non-Hispanic black men, reported that they had actually been coerced to have sex by a female (5.8%) or male (2%).[56] Long-term consequences of sexual abuse of males include HIV risk behaviors, psychiatric disorders, substance abuse, and thoughts of suicide.[69–72]

Many male adolescents and young adults are unaware of state laws on statutory rape and resultant consequences. Although these punitive measures attempt to force people to change their sexual/reproductive health behavior, there are few data to support that such laws are effective deterrents to, for example, adolescent pregnancy.[73] A recently prepared report by the Lewin Group contains a guide to state laws on statutory rape and reporting requirements.[74] It is recommended that health care providers be aware of local statutory rape laws and be able to counsel teenagers about potential legal consequences of early sexuality, especially if a patient's sexual partner(s) is younger than the patient. As discussed in the AAP statement on media education,[75] pediatricians also need to become educated about the public health risks of media such as "sexting." Resources for patients and families that explain more generally the laws about statutory rape, age of consent, sexting, etc (www.sexlaws.org) are also available.

H. Dating Violence

Violence in adolescent relationships can include bullying, threatening, sexual harassment, dating violence, and/or coercion. Within the context of intimate relationships among romantic and sexual partners, such violence can be verbal, emotional, physical, or sexual. Male adolescents can be perpetrators, victims, or both. For example, 9.9% of high school students nationwide reported having been hit, slapped, or physically hurt intentionally by their boyfriend or girlfriend in the past year.[76] Overall, the prevalence of experiencing dating violence was higher among male (11.0%) than female (8.8%) 9th- and 12th-grade students. Despite the high prevalence, many adolescents who are victims or perpetrators of violence do not seek help.[77] Health care providers have an opportunity to promote healthy relationships, improve communication, and improve the detection of unhealthy relationships through screening for intimate partner violence (1 example of a mnemonic screening tool for violent behavior is FISTS [fighting, injuries, sex, threats, and self-defense]) and subsequent referral when appropriate.[78–81]

I. Sexual Function and Dysfunction

Healthy sexual function has an important role in adolescents' and young adults' well-being and development. Few studies, however, have examined sexual health and/or problems with sexual dysfunction among adolescents. Common causes of sexual dysfunction among young adult men include anxiety about performance, premature ejaculation, worries about attractiveness during sex, decreased pleasure associated with condom use, and organic performance-related issues attributable to comorbid medical conditions (eg, diabetes, cardiac disease, neurologic deficits) or adverse effects from medication (eg, selective serotonin-reuptake inhibitors or alcohol).[82,83] Health care providers have an opportunity to screen for problems with sexual performance (eg, "Some men may be worried because they ejaculate too soon or late or have difficulty getting or losing an erection. Have you ever experienced any of these problems?") and offer reassurance or appropriately assess for an underlying medical condition.

J. STIs/HIV, Pregnancy, and Adolescent Fatherhood

Involvement in sexual behaviors places young men and their partners at risk of negative sexual/reproductive health outcomes that are preventable, such as STIs, HIV infection, unintended pregnancy, and reproductive health-related cancers such as anal cancer attributable to human papillomavirus (HPV).

Although adolescents and young adults 15 to 24 years of age represent only one-quarter of the sexually active US population, this population is estimated to account for half of the 18.9 million new STI cases[84] and approximately 30% of all new HIV infections[85] that occur each year. Among STIs, chlamydia, HPV infection, and trichomoniasis account for 88% of all infections.[84] Among all populations, rates of chlamydia and gonorrhea are highest among people 15 to 24 years of age.[86,87] The chlamydia prevalence rate for males 14 to 19 years of age reported from the recent National Health and Nutrition Examination Survey (1999–2002) was found to be 2.3% (95% CI: 1.5–3.5).[88] This rate is not too dissimilar from the chlamydia rate of 3.67% (95% CI: 2.93–4.58) reported among young adult men 18 to 26 years of age in the National Longitudinal Study on Adolescent Health. The Add Health study also reported prevalence rates among 18- to 26-year-olds for gonorrhea (0.44% [95% CI: 0.26–0.77]) and trichomoniasis (1.7% [95% CI: 1.3–2.2%]).[87,89] It is common for males with chlamydia and gonorrhea infections to be asymptomatic. Males who are not circumcised are also more likely to have gonorrhea (adjusted odds ratio: 4.0 [95% CI: 1.9–8.4]) and syphilis (adjusted odds ratio: 1.6 [95% CI: 1.2–2.2]) infections than circumcised males.[90] Racial disparities have been observed for STIs other than HIV. Non-Hispanic black male adolescents have higher

rates of chlamydia, gonorrhea, and trichomoniasis compared with those of other race/ethnicity groups.[85,89,91]

In 2006, an estimated one-quarter of the 1.1 million people living with HIV infection in the United States were not aware of their HIV status. Young people 13 to 24 years of age represent an estimated 10% of undiagnosed cases each year.[92] HIV prevalence among young men who have sex with men is estimated at 7.2% (5.6% for those 15–19 years of age, 8.6% for those 20–22 years of age). Rates are higher for non-Hispanic black, mixed/other race, and Hispanic young men.[93] Young men at higher risk of HIV infection include men who have sex with men; have unprotected sex (especially with multiple partners); are past or present injection-drug users; exchange sex for money or drugs; are past or present sex partners of HIV-infected or bisexual persons or injection-drug users; are being treated for an STI; have a history of blood transfusion between 1978 and 1985; and request an HIV test, because nondisclosure might be indicative of high-risk behavior.[94] Male circumcision among mostly African samples has been associated with a lower risk of HIV acquisition to the male himself and possible benefits to the female by decreasing transmission.[95–98] The Centers for Disease Control and Prevention (CDC) is currently considering guidelines for the role of male circumcision in the prevention of HIV transmission in the United States.[99]

After a reduction in teen births and pregnancies from 1991 to 2005, more recent trends in behavioral risks for pregnancy (eg, declines in contraceptive use) have stalled or are reversing among certain groups, particularly non-Hispanic black and Hispanic teenagers.[100] National data indicate that approximately 750 000 pregnancies occur each year among women younger than 20 years[101]; the majority of teen pregnancies (82%) are unplanned or mistimed.[102] These data translate to approximately 1 in 20 female teenagers becoming pregnant each year.[103] Most of these pregnancies end in a live birth (57%), 27% end in induced abortion, and 16% end in fetal loss.[104] The majority of teen pregnancies are fathered by males who are within 2 years of age or older of their partners.[105–108] Among sexually experienced male adolescents, 1 in 8 (13%) reported that they have impregnated a partner, and 4% are fathers.[109] Because of lacking or inaccurate documentation of paternal age on birth certificates, especially among younger and unmarried mothers,[110] the rates of fatherhood among male adolescents might be even higher.

The consequences of teen pregnancy and STIs, including HIV infection/AIDS, are many and costly. Males diagnosed with an STI can have complications such as epididymitis and infertility[111,112] and, if left untreated, can place female partners at risk for morbidity and mortality, such as acute and recurrent pelvic inflammatory disease and resultant tubal scarring, infertility,[113–115] ectopic pregnancy,[116] and HIV infection/AIDS. Although it can be challenging to disentangle the link between teen pregnancy and poverty, personal costs of teen pregnancy often include truncated schooling, increased unemployment, welfare dependency, lower lifetime earnings, single parenthood, depression, and poor infant outcomes.[117,118] Each year, costs related to adolescent pregnancy and its complications are estimated to be $9 billion,[119,120] and costs related to STIs/HIV infection and their complications are estimated to be $17 billion.[86]

K. Preventing STIs/HIV Infection and Pregnancy

The male adolescent and his partner, family, school, and health care provider all have important roles in preventing the negative consequences of sexual behavior.

Table 1 summarizes the effectiveness of available male contraceptive options.[121] Condoms are the most commonly used contraception method[122] and are highly effective if used consistently and correctly. Over the past 3 decades, the report of condom use by male adolescents at first and most recent sex has increased, particularly among Hispanic and non-Hispanic black males.[1] Seven in 10 male adolescents (71%) report condom use the first and most recent time they had sex.[1] The majority of young men also report using condoms to prevent both pregnancy and STIs/HIV infection.[56] However, during the past 3 decades, there has been little change in male

TABLE 1 Contraceptive Effectiveness: Rates of Unintended Pregnancies per 100 Women

	First-Year Pregnancy Rate, %[a]		Key
	Consistent and Correct Use	As Commonly Used	
Male methods			
Vasectomy	0.10	0.15	0.0%–0.9%: very effective
Male condom	2	15	1%–9%: effective
Withdrawal	4	27	10%–25%: moderately effective
No method	85	85	26%–32%: less effective
Common female hormonal methods			
Progestin-only injectable	0.3	3	—
Combined oral pills, patch, ring	0.3	8	—

[a] Rates are largely from the United States.

Modified from: Trussell J. Contraceptive efficacy. In: Hatcher RA, Trussell J, Nelson AL, et al, eds. *Contraceptive Technology.* 19th Rev ed. New York, NY: Ardent Media; 2007:747–826.

adolescents' consistency of condom use (ie, use with every sexual encounter in the past year); less than half (48%) of sexually active males report consistent use.[1] Barriers to condom use include being embarrassed when buying them, reduced physical sensation, incorrect use and lack of availability, planning, discussion, or negotiation with one's partner.[1,123–128] Reduced likelihood of condom use at most recent sex and inconsistency in condom use have been observed among young men who did not receive formal sex education at school or the community.[129] Low condom use during adolescence, combined with the report of multiple partners, has also been shown to be associated with elevated STI rates when subjects become young adult men.[130]

Approximately 10% of male adolescents report using withdrawal as their contraception method of choice.[1] Although withdrawal does not protect against STIs/HIV infection and, thus, is not an appropriate form of STI/HIV prevention, effectiveness data (Table 1) show that it can substantially reduce the risk of pregnancy for people who report difficulties using contraception (eg, people with latex allergy or during unplanned sex acts).[131] Withdrawal is better than doing nothing, but it must be emphasized that withdrawal is not equivalent to using other barrier methods (eg, condoms), hormonal methods, or dual contraception. Polyurethane condoms are also available for people who are allergic to latex.

Only one-quarter (24%) of male adolescents report the use of dual contraception methods (eg, combined condom use with a hormonal method).[1] This may be explained by a lack of awareness of the partner's contraception methods or familiarity with how female hormonal methods work, including emergency contraception.[132–134] For example, situations in which a male was less likely to use a condom included if the male's partner used a method of contraception, if the male was older at most recent sex, if the male's partner was older at first sexual encounter, and during a casual first sexual encounter.[129] Increased odds of ever or always using any contraceptive method is observed among teenagers who wait longer between the start of a relationship and first sex, discuss contraception before first sex, or use dual contraception methods.[135] Two groups of teenagers, males and non-Hispanic white teenagers, are less likely to regularly talk about contraception and STIs with their partners before first sex than are females and teenagers from other racial groups.[136] Health care providers have an opportunity to talk with males about all types of contraception and provide consistent messages about counseling for risk reduction (Table 2). Some teenagers might choose to take virginity pledges and abstain from sex until marriage. However, such pledges have not been found to have long-term effectiveness in preventing STIs and other adverse outcomes and might actually place pledge-takers at greater risk of STIs and unintended pregnancy. One prospective study found that adolescents who signed abstinence pledges experienced similar STI rates as did adolescents who did not sign pledges.[137] Although pledge-takers delayed initiation of sex for a longer period of time, when pledge-takers initiated sex, they were less likely to use condoms and seek reproductive health care compared with their peers who did not sign pledges.

L. Male Adolescents' Sexual/Reproductive Health Care Use

Male adolescents' use of sexual/reproductive health care services remains low for a variety of reasons. For many, the onset of sexual behavior during adolescence serves as a rite of passage into manhood but does not trigger thinking about preventive behaviors related to the consequences of sexual behavior. Young men might also hold more traditional masculine beliefs that preclude them from seeking care despite having symptoms.[138,139] In addition, the components of young men's sexual/reproductive health care have been poorly defined and have historically received little attention. Unlike females, who have historically received bundled sexual/reproductive health care as part of gynecologic examinations, birth control visits, and prenatal care,[140] this is not typically true for young men. Barriers to care can also play a role in male adolescents' care-seeking in general and sexual/reproductive health care in particular. These barriers include fear; stigma; shame; denial; lack of social support; lack of confidential services; lack of health insurance options especially as they get older; and not knowing where to go for care.[141–146] Given the asymptomatic nature of many STIs, including HIV infection, strategies are needed to raise young men's awareness about sexual/reproductive health services, STI and HIV testing options, and related resources. Promoting sexual/reproductive health for young men can lead to sexual responsibility, healthy intimate relationships, and responsible fatherhood. Health care providers, and pediatricians in particular, are in the best position to deliver high-quality sexual/reproductive health care services to male adolescents and should view even follow-up, acute care, and immunization visits as opportunities to address these health issues. Health care providers can also use "clinical hooks," such as sports physicals or acne follow-up, to keep male adolescents engaged in care and to deliver sexual/reproductive health care services.

TABLE 2 Anticipatory Guidance Topics

Anticipatory Guidance Topics and Questions	Example Message	Resources
Counseling on sexual risk reduction including barriers to condom use		
2 separate sessions, 1 wk apart	Avoiding sex is the safest way to prevent pregnancy and STIs/HIV. If you choose to have sex, take responsibility and use a condom *every* time. If you do not have a condom, choose not to have sex.	www.ahwg.net (see sexual health toolkit—provider, pages C13–C15)
Session 1: assess for personal risk, barriers to risk reduction, and identification of a small risk-reduction step within 1 wk (eg, consistent condom use)	Choosing not to have sex at any point will not diminish one's status or manhood.	www.sexetc.org/topic/guys_health
Session 2: review previous week's behavioral-change successes and barriers, provide support for changes made, identify barriers and facilitators to change, and develop a long-term plan for risk reduction		www.goaskalice.columbia.edu/Cat7.html
Help me understand why condoms are difficult for you to use. Do you vary your condom use depending on who your partner is? How can you reintroduce condom use in a relationship without creating issues about trust?		www.iwannaknow.org
What would you do if your partner does not want you to use a condom?	"I really like you but am not comfortable having sex without using a condom."	
Do you know how to make condom use more pleasurable?	Place a drop of lubrication in the inside tip of the condom. Also, condoms come in various shapes and sizes, and 1 condom type may not fit all.	www.ahwg.net (see sexual health toolkit—provider, pages C36–C37; youth page C50)
What would you do if a condom breaks or slips off?	"Do you know about emergency contraception (eg, Plan B)? This is something we can get and have you take within the next 3 to 5 days to help prevent you from getting pregnant if you are not on birth control."	www.not-2-late.com; 1-888-NOT-2LATE; http://bedsider.org/where_to_get_it
What do you know about the consequences of sexual behavior?	You can have an STI and not even know it. Not all STIs have symptoms, and not all STIs are curable. Getting pregnant as a teenager comes with many legal and economic responsibilities. Having sex can have legal implications depending on who you have sex with and how old you and your partner are.	www.youngmenshealthsite.org/std-general.html www.babycenter.com/babyCostCalculator.htm www.sexlaws.org
Demonstrate or provide resources (eg, videos, handouts) for correct condom use; distribute condoms		
Have you ever been taught, using a condom model, how to correctly put on a condom?	Using a condom can help reduce your risk of getting an STI and/or getting someone pregnant.	www.cdc.gov/condomeffectiveness/brief.html; www.stdcentral.org/SitC/about
How comfortable are you with putting on a condom?	Check that the condom has not expired and has been properly stored. When opening the package, be careful not to rip the condom. Once open, place the correct side of the condom over an erect penis. Hold onto the reservoir tip at the top, remove any excess air and slowly roll the condom all the way down over the erect penis to the penis base. After ejaculation, hold onto the condom rim at the base of the penis, making sure the condom does not slip off or leak. After removing the condom, dispose of it in the trash.	
Communication with partner about sex		
Do you talk with your partner about sex, preventing STIs/HIV, getting tested for STIs/HIV before having sex for the first time, getting tested together, preventing pregnancy, whether she is on birth control?	I encourage you to talk with your partner about contraception and getting tested together before you start engaging in a new sexual relationship.	www.ahwg.net (see sexual health toolkit—provider pages C45–C65)
Do you know about the different types of female birth control methods?		www.youngwomenshealth.org/contra_types.html

TABLE 2 Continued

Anticipatory Guidance Topics and Questions	Example Message	Resources
Help teenaged fathers understand their role in parenting Help me understand your relationship with your child(ren) (eg, emotional, physical, and financial support and barriers/facilitators to involvement)? Assess for experience of stress Identify local community resources to promote parenting role (parenting classes, educational support, job training, etc)	We know that fathers who are involved in their children's lives can improve the health of their children and the health of the fathers themselves.	www.fatherhood.org

II. ROLE OF THE HEALTH CARE PROVIDER

A. Provide Individualized Sexual/Reproductive Health Care to Male Adolescents

The provision of sexual/reproductive health care to young men in the clinical setting should be individualized on the basis of the patient's developmental and psychosocial needs by using patient-centered approaches.[147] Health care providers need to be comfortable taking a young man's sexual/reproductive history to elicit the type of information needed to determine the appropriate anticipatory guidance, counseling, and treatment. Trust and relationship-building are also critical elements of the male adolescent's visit that help him to feel comfortable regardless of a physician's gender and/or background. Interviewing the young man one-on-one, separate from accompanying parents or guardians, will also improve the quality of information received and ensure confidentiality of the information shared. As with young women, health care providers need to be cognizant of minor consent laws in the states in which they practice and educate patients about specific state laws as appropriate.[148,149]

Myths about adolescent male sexuality still pervade American society. Health care providers should avoid making assumptions or allowing stereotypes about male adolescent sexuality influence interactions with their young male patients. Health care providers need to understand the specific needs of gay, bisexual, or questioning male adolescents and provide support and/or referral resources as appropriate. Sexual initiation during adolescence should be viewed as part of sexual development. Contrary to the image of male promiscuity, the majority of male adolescents have no more than 1 sex partner during a 1-year period. Most male adolescents also believe that they should be responsible for pregnancy prevention and report condom use as a means of preventing both STIs and pregnancy. Rather than holding young men responsible for the negative sexual/reproductive health outcomes seen among young women (pregnancy, STIs/HIV, and relationship violence), health care providers can address the other half of the partner equation that has historically been left out. Health care providers should share clear and consistent messages with all male adolescents, their parents, and schools about sexual health, comprehensive sex education, and regular care-seeking.

B. Deliver High-Quality Sexual/Reproductive Health Care to Male Adolescents

A number of national organizations make recommendations about clinical services that health care providers should deliver, including the AAP's *Bright Futures*,[4] the CDC,[150–152] and the US Preventive Services Task Force (USPSTF).[153] Sexual/reproductive health services that have been shown to be most effective for health care providers to provide include taking sexual health histories, assessing sexual risk, and providing behavioral counseling regarding STIs.[4,150,153] Regarding laboratory screening for HIV infection, the USPSTF recommends HIV testing on the basis of risk factors for the individual and/or clinic setting.[150,154] The CDC and *Bright Futures* recommend HIV testing for all persons 13 years of age and older and subsequent testing for all persons at high risk at least annually.[4,150,154] Regarding laboratory screening for STIs, although the USPSTF has stated that there is insufficient evidence to screen sexually active young men for chlamydia and gonorrhea,[155,156] the CDC recommends chlamydia screening among sexually active young men in high-prevalence settings (eg, STI, Job Corps, or jail clinics) and rescreening of persons infected with chlamydia 3 months later,[151,152] and *Bright Futures* recommends screening sexually active adolescents for chlamydia and gonorrhea.[4] The USPSTF[157] and *Bright Futures*[4] also recommend testing for syphilis on the basis of individual risk factors. *Bright Futures* also recommends an annual genital examination for SMR and observations for signs of STIs (ie, warts, vesicles) and testicles for hydrocele, hernias, varicocele, or masses. Refer to the AAP's recommended childhood and adolescent immunization schedule.[158] The CDC Advi-

sory Committee on Immunization Practices' recent update recommends routine vaccination of male adolescents against HPV starting at age 11 through 12 years, states that the series can be started beginning at age 9 years, and recommends catch-up vaccination among males ages 13 through 21 years who have not been vaccinated previously or have not completed the 3-dose series through age 21 years. Such vaccination is also recommended in AAP immunization schedule (for updates, see: www.aap.org/immunization/izschedule.html).[158,159] Males age 22 through 26 years may be vaccinated (permissive recommendation for this age group). Routine vaccination is recommended among at-risk males including males who have sex with males and immunocompromised males through age 26 years.

The delivery of sexual/reproductive health services is one of the few effective clinical preventive services that can positively affect male adolescents' and young adults' health.[160] However, health care providers miss many opportunities to assess young men's sexual health and deliver STI/HIV services; on average, fewer than one-quarter of male adolescents and young adult men report receiving sexual/reproductive health services compared with more than half of similarly aged female adolescents.[9,10,161,162]

Health care providers can use each encounter in the office setting as an opportunity to address the core recommended components of male adolescents' sexual/reproductive health with all male adolescent patients, including the provision of appropriate resources to patients and parents. Health care providers should consider scheduling an annual sexual/reproductive health visit for the sexually active young man. The health care provider should know how to:

- take a complete sexual history;
- perform a complete sexual/reproductive health examination that includes examination of the skin, breasts, genitals, hair, and, if relevant, the perianal area and documentation of the SMR;
- perform and interpret STI/HIV tests and know how to treat STIs;
- administer vaccinations, as recommended by the AAP,[158] to protect against infections that are transmitted sexually, such hepatitis B and A vaccines and HPV vaccine[159];
- provide anticipatory guidance/counseling on sexual/reproductive health matters (Table 2), including the use of messages about dual methods (eg, "not having sex is the best way to avoid pregnancy and STIs/HIV, but if you choose to have sex, use condoms consistently and use a reliable contraceptive method for the partner"); and
- use resources (Table 3) in varying formats (ie, clinic handouts, books, Web-based resources, community resources) to share and/or refer patients and parents as needed.

C. Take a Sexual History

A comprehensive and confidential sexual assessment is a standard part of the past medical, family, and social history and should begin during early adolescence and be updated at least annually. This can be accomplished face-to-face or through the use of confidential previsit questionnaires (Table 3).[163–165] Components of a comprehensive sexual health assessment should include asking about attractions to females, males, or both; sexual initiation and age of onset; engagement in vaginal, oral, or anal sex; gender of partner(s); number of partners; current STI symptoms or concerns; history and results of STI/HIV testing; use of condoms; partners' use of methods to protect against STIs and/or pregnancy; and experience of sexual abuse. Assess for comfort with changes in one's body, masturbation, knowledge about how to use a condom correctly, hormonal contraception methods, and emergency contraception. Among sexually experienced males, assess pressure to have sex, access to condoms, use of alcohol or other substances when having sex, experience of pregnancy or fatherhood, experience of being a perpetrator or victim of verbal/physical abuse or force to have sex in a relationship, whether sex is pleasurable, and/or problems with sexual performance. Among patients who state a high number of partners or are hesitant to share their number of partners, consider and ask about whether they are exchanging sex for money or drugs. Among non–sexually active young men, assess for dating, pressure or plans to initiate sex, and knowledge about ways of preventing STIs/HIV and pregnancy. During childhood, encourage and provide resources to parents and families to have developmentally appropriate conversations with their sons that continue through adolescence about sexuality, sex, and other sensitive topics.[37]

A number of verbal and written tools are available that can assist health care providers to take a sexual health assessment and other components of the adolescent's psychosocial history,[166] including the HEEADSSS (home, education and employment, eating, activities, drugs, sexuality, suicide and depression, and safety) assessment and *Bright Futures* toolkits (http://brightfutures.aap.org/tool_and_resource_kit.html).[4,167,168]

D. Perform a Physical Examination

Despite the lack of evidence-based guidelines supporting routine testicular screening and teaching of testicular self-examination for detection of testicular cancer, a genital

TABLE 3 Male Teen Resources for Patients, Parents, and Health Care Providers

Male patient resources	
Brochures to order	
ETR Publishing	http://pub.etr.org
Office of Population Affairs Clearinghouse	www.hhs.gov/opa/pubs/download_pubs/download_pubs.html
Planned Parenthood	www.plannedparenthood.org/teen-talk
Downloadable brochures and male-friendly Web sites	
American Social Health Association	www.iwannaknow.org
Children's Hospital Boston	www.youngmenshealthsite.org
Gay and Lesbian Medical Association: Online Health Care Referrals	www.glma.org
Go Ask Alice! (Columbia University)	www.goaskalice.columbia.edu/Cat7.html
Family Acceptance Project (Marian Wright Education Institute: resource for lesbian, gay, bisexual, transgendered youth and families)	http://familyproject.sfsu.edu
Palo Alto Medical Foundation (a Sutter Health affiliate)	www.pamf.org/teen/health/malehealth
Sex Etc (Rutgers University)	www.sexetc.org/topic/guys_health
TeensHealth (Nemours Foundation)	www.kidshealth.org/kid/grow www.kidshealth.org/teen/sexual_health
The Trevor Project	www.thetrevorproject.org/lifelinechat
Youth Resource (advocates for youth)	www.amplifyyourvoice.org/youthresource
Parent resources	
American Academy of Child and Adolescent Psychiatry (handouts on talking to your kids about sex; gay, lesbian, and bisexual adolescents)	www.aacap.org/cs/root/facts_for_families/facts_for_families
AAP Section on Adolescent Health	www.aap.org/moc/AdolHandouts_AAPMbrs/Resources.htm
Madaras L, Madaras A. *My Body, My Self: For Boys*. New York, NY: Newmarket Press; 2007	
McCoy K, Wibbelsman C. *The Teenage Body Book*. New York, NY: Perigee; 2008	
The National Campaign to Prevent Teen Pregnancy	www.thenationalcampaign.org/parents/default.aspx
Parents, Families and Friends of Lesbians and Gays	www.pflag.org
Provider resources	
AAP Section on Adolescent Health	www.aap.org/moc/AdolHandouts_AAPMbrs/ProviderHandouts.htm
Adolescent Health Working Group: an adolescent provider toolkit series on sexual health, behavioral health, body basics, and adolescent health care 101	www.ahwg.net (see toolkit provider resource page)
American Medical Association Guidelines for Adolescent Preventive Services (AMA GAPS): previsit questionnaires	www.ama-assn.org/ama/pub/physician-resources/public-health/promoting-healthy-lifestyles/adolescent-health.shtml
Bright Futures: toolkit	http://brightfutures.aap.org/tool_and_resource_kit.html
CDC: expedited partner therapy and places for referral to local public health facilities for STI/HIV testing	www.cdc.gov/std/ept; www.hivtest.org
Physicians for Responsible Choice and Health	www.prch.org
Society for Adolescent Health and Medicine: previsit questionnaires	www.adolescenthealth.org/Clinical_Care_Resources/2173.htm

examination, including examination of the testicles, represents an important part of a male adolescent's complete physical examination during annual preventive health visits and, specifically, as part of a visit related to a genital complaint.[4] The content of the pediatric/adolescent physical examination required to report preventive health care codes (*Current Procedural Terminology* [CPT] codes 99382–99384; 99392–99394) depends on age and developmental level and would be expected to include a male genital examination. There are many reasons to perform a genital examination, including SMR for hair and genital progress in pubertal development; screening for visual signs of STIs such as herpes, warts, and asymptomatic urethral discharge; identification of signs for genetic diseases such as firm testes (Klinefelter syndrome) or ambiguous genitalia (congenital adrenal hyperplasia); evidence of structural anomalies including varicocele, which can affect fertility, or uncorrected hypospadias, which can result in significant embarrassment, problems with sexual function, and/or abnormal urine flow. Other issues might be related to an uncircumcised penis (eg, phimosis and hygiene); hair or skin findings for treatable conditions (eg, folliculitis and tinea cruris); previously unrecognized absent testes attributable to cryptorchidism; evidence of testicular atrophy secondary to central or exog-

enous causes (eg, steroids or marijuana use); and normal findings that might require reassurance (eg, pearly penile papules).[111,168,169]

Ultimately, one of the goals of the genital examination is to help the young man gain a better understanding of his own body and reproductive parts. For example, young men might not be aware of their genital anatomy, the importance of using genital protection as part of sports participation, or general issues related to their hygiene. Guidance can be given by briefly reviewing the main components of the physical examination and, as the examination progresses, by commenting on normal anatomy, what to expect next, and pertinent findings. Examination in gowns will help prevent missing important physical examination findings, such as gynecomastia or truncal acne. Avoiding lengthy discussions while the patient is undressed also allows for greater patient comfort.

Despite the lack of recommendations that support testicular cancer screening, the USPSTF has noted that "clinicians should be aware that patients who present with symptoms of testicular cancer are frequently diagnosed as having epididymitis, testicular trauma, hydrocele or other benign disorders."[170,171] The American Cancer Society has stated that it "does not have a recommendation on regular testicular self-examinations for all men."[172] Risk factors for testicular cancer among men include being white; being between 13 and 39 years of age; having a history of cryptorchidism, testicular atrophy/dysgenesis, testicular trauma, HIV infection, and Klinefelter syndrome; or having a family history of testicular cancer. An external anal inspection, a digital rectal examination, and screening for hernia as part of the male adolescent physical examination should be performed on the basis of specific concerns or complaints such as a bulging mass or pain (hernia examination), hemorrhoid or rectal bleeding (digital rectal examination), or risk factors that would warrant an external anal inspection for HPV lesions in a young man who engages in receptive anal intercourse.

Health care providers might be confronted with male adolescents who refuse a genital examination because of concerns about homophobia, lack of experience with such examinations, fear of getting an erection, or even because of previous abuse. Understanding the specific concern can help the health care provider educate the patient about the importance of this examination, determine the priority of such an examination for a particular patient, and negotiate how and when to complete the required components of the examination. Routinely examining the genitals from childhood through adolescence can help the male patient understand the routine nature of this examination component. The use of a chaperone might also be relevant and should be considered during all genital examinations for patient and/or provider comfort regardless of whether the provider and patient are the same gender.[173]

E. Perform Laboratory Screening

Sexually active male adolescents 13 years of age and older should be offered an HIV test. HIV testing should occur at least once by 16 to 18 years of age or sooner once an adolescent is known to be sexually active or otherwise at risk. Youth at high risk should be tested annually for HIV infection. Adolescents tested for other STIs should be tested for HIV at the same visit. Youth seen in urgent care facilities and emergency departments should be routinely tested for HIV. In addition, routine HIV screening of young persons in high-risk or high-prevalence settings, such as juvenile detention centers and jails, STI clinics, and teen clinics, has been shown to increase the yield for HIV screening. HIV testing options include serologic tests that provide results within 1 to 2 weeks and newer noninvasive oral rapid tests that provide results within 20 minutes.

Sexually active male adolescents are considered to be among the high-risk groups for STIs and, in general, should be screened even if they are asymptomatic for chlamydia using noninvasive urine tests. Other screenings available as urine tests include those for gonorrhea and trichomonas.[89] Routine screening of asymptomatic males should be based on the prevalence rates within the communities. Among sexually active male adolescents with painful urination (dysuria) and/or urethral discharge, urethritis attributable to an STI will be the most common cause of infection, as opposed to urinary tract infection, which affects less than 0.01% of male adolescents with normal urogenital anatomy.[174] Noninvasive tests are the preferred method (eg, urine-based nucleic acid amplification tests [NAATs] to screen for chlamydia and gonorrhea). These tests have high sensitivities and specificities (>90%) as well as high patient acceptability. Refer to the current CDC's sexually transmitted diseases treatment guidelines for best testing strategies if NAATs are unavailable.[152]

For male patients who report sexual behavior with another man, the CDC's sexually transmitted diseases treatment guidelines recommend HIV serologic testing, if HIV-negative or not tested in the previous year; syphilis serologic testing; a test for urethral infection with chlamydia and gonorrhea among men who have had insertive sex during the preceding year; a test for rectal infection with chlamydia and gonorrhea among men who have had receptive anal sex during the preceding year; and a test for pharyngeal in-

fection for gonorrhea among men who have had receptive oral sex during the preceding year.[152] No current guidelines detail screening recommendations for chlamydia of the pharynx or for anal screening of the rectum using anal Papanicolaou tests or HPV typing.[175–177] Anal Papanicolaou tests and/or HPV typing are currently under review as possible screening tools for anal carcinoma. Nucleic acid amplification tests are not currently approved by the Food and Drug Administration for pharyngeal or rectal specimens but might be available for use in some laboratories. Both chlamydia and gonorrhea can infect the rectum, and gonorrhea can also infect the pharynx. However, there is little evidence that chlamydia can cause pharyngeal infection.

Health care providers should be able to diagnose STIs that occur most commonly in male adolescents and young adults, including chlamydia, gonorrhea, HPV, trichomoniasis, herpes, ascending infections (ie, epididymitis), and syphilis. The CDC's sexually transmitted diseases treatment guidelines (www.cdc.gov/std/treatment) and the AAP's *Red Book* (http://aapredbook.aappublications.org) are updated on a regular basis and provide the most up-to-date screening, testing, and treatment recommendations.[152,178] Health care providers should also encourage STI treatment of their partners through provision of expedited partner therapy, if allowed by state law[179] (www.cdc.gov/std/ept); bringing the partner in for testing and treatment; or referral to local public health facilities (www.hivtest.org).

Health care providers are encouraged to communicate to their patients and families that the delivery of sexual/reproductive health services, including STI/HIV testing, is a standard and routine part of adolescent clinical services. State mandates that require an explanation of benefits to be sent to parents of adolescent patients might conflict with patients' rights to confidential care and minor consent. Adolescents who are seeking confidential testing for STIs might require referral to settings that provide confidential STI testing, such as local public health clinics or Planned Parenthood centers. Informed and proactive health care providers can ensure that their patient's confidentiality is maintained.

F. Provide Anticipatory Guidance and Counseling

Health care providers should tailor anticipatory guidance and counseling on the basis of specific risk factors and/or information obtained during an individual male patient's visit and his developmental stage. Health care providers should continue to be up-to-date on coding and local reimbursement practices that allow for the time it takes to counsel on preventive health care matters to be included within a problem-focused visit. Table 2 lists suggested sexual/reproductive health anticipatory guidance topics and messages for male adolescent patients.

The USPSTF recommends moderate- to high-intensity behavioral counseling in the clinic setting to prevent STIs for all sexually active adolescents.[153] One example of such a counseling approach would be 2 separate 20-minute clinical sessions 1 week apart.[180] During the first clinical session, patients are assessed for personal risk, barriers to risk reduction, and identifying a small risk-reduction step within the next week. During the second clinical session, the previous week's behavioral-change successes and barriers are reviewed, support for changes made is provided, barriers and facilitators to change are identified, and a long-term plan for risk reduction is developed. A study of this method found that participants in intervention clinics who were receiving structured behavioral counseling reported significantly higher condom-use rates and fewer new STIs than participants at control sites. Males and females benefited equally from counseling interventions, and brief interventions were more effective among adolescents than older participants.

G. Administer Vaccinations

Reproductive health-related vaccines, including hepatitis A and B and HPV vaccines, should be administered to male adolescents as recommended by the AAP and the CDC's Advisory Committee on Immunization Practices along with other routine immunizations for male adolescents.

III. GUIDANCE FOR HEALTH CARE PROVIDERS

1. Know the core sexual/reproductive health knowledge areas for male adolescents and understand the affect that sexual health has on the male adolescent's quality of life.
2. Encourage parents to talk about pubertal development and have age-appropriate discussions about sexual health with their sons on repeated occasions.
3. Guide male adolescents to build healthy, responsible relationships.
4. Recognize that some male adolescents might be dealing with issues of sexuality that can affect their psychosocial and physical health, provide appropriate support for families,[181] and identify local resources for referral when appropriate.
5. Regardless of reason for the visit and clinical setting, routinely provide quality male sexual/reproductive health services to all male adolescents.
6. Deliver core sexual/reproductive health services to male adoles-

cents: take a sexual history, perform an appropriate examination, screen for STIs/HIV, provide patient-centered and age-appropriate anticipatory guidance, and deliver appropriate vaccinations.

7. Provide sexual/reproductive health services in a confidential and culturally appropriate manner.
8. Use "clinical hooks," such as sports physicals and acne follow-up visits, to keep young men enrolled in general and especially sexual/reproductive health care. Consider promoting an annual sexual/reproductive health visit for male adolescents to address their core sexual/reproductive health issues.
9. Include in clinic settings everything from handouts to posters to make male adolescents feel welcome and comfortable. Educational materials such as handouts, pamphlets, references, and videos should also be made available to reinforce office-based educational efforts.
10. Continue to be up-to-date on coding and local reimbursement practices that allow for preventive health care counseling to be included within problem-focused visits.

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CLINICAL REPORT

Maltreatment of Children With Disabilities

Guidance for the Clinician in Rendering Pediatric Care

Roberta A. Hibbard, MD, Larry W. Desch, MD, and the Committee on Child Abuse and Neglect and Council on Children With Disabilities

ABSTRACT

Widespread efforts are being made to increase awareness and provide education to pediatricians regarding risk factors of child abuse and neglect. The purpose of this clinical report is to ensure that children with disabilities are recognized as a population that is also at risk of maltreatment. Some conditions related to a disability can be confused with maltreatment. The need for early recognition and intervention of child abuse and neglect in this population, as well as the ways that a medical home can facilitate the prevention and early detection of child maltreatment, are the subject of this report.

INTRODUCTION

The maltreatment of children, including those with disabilities, is a critical public health issue. For purposes of this report, the terms "disability" and "special health care needs" include the full spectrum of physical, mental, and emotional impairment. Current data on incidence and prevalence of maltreatment in children with disabilities are limited by varying definitions of disability and lack of uniform methods of classifying maltreatment. Nonetheless, children with disabilities and special health care needs are at increased risk of child maltreatment. This report is an update to the previous policy statement, "Assessment of Maltreatment of Children With Disabilities."[1]

The Children's Bureau reported that an estimated 872 000 children were determined to be victims of abuse or neglect in 2004.[2] More than 60% of child victims experienced neglect, almost 20% were physically abused, and 10% were sexually abused. Of the 36 states that reported on disabilities, child victims who were reported with a disability accounted for 7.3% of all victims. Children with the following conditions were considered as having a disability: mental retardation, emotional disturbance, visual impairment, learning disability, physical disability, behavioral problems, or another medical problem. It was believed that these conditions were underrecognized and underreported, because not every child received a clinical diagnostic assessment when child maltreatment was suspected.

Child maltreatment may result in the development of disabilities, which in turn can precipitate further abuse.[3] Studies have been unable to accurately document the extent or rate of abuse among children with disabilities or determine if disabilities were present before the abuse or were the direct result of maltreatment.[4] It should be emphasized also that several case reports and epidemiologic data remind us that the natural history of some medical conditions can include conditions that mimic child maltreatment.[5,6]

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Key Words
child neglect, child maltreatment, developmental disabilities, child abuse, physical abuse, child sexual abuse

Abbreviations
CPS—child protective services
AAP—American Academy of Pediatrics

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The numbers of children who survive disabling medical conditions as a result of technologic advances and children who are recognized and identified as having disabilities are increasing.[7] The rates of child maltreatment have been found to be high in the child population in general and in children with blindness, deafness, chronic illness, developmental delays, behavioral or emotional disorders, and multiple disabilities.[8] Minimal research on child abuse has focused specifically on children with disabilities; further study is indicated and has been encouraged.[9,10]

The Child Abuse and Prevention, Adoption, and Family Services Act of 1988 (Pub L No. 100–294) included a mandate to study the incidence of child maltreatment among children with disabilities. This research was funded by the National Center on Child Abuse and Neglect and conducted by the Center for Abused Children With Disabilities at the Boys Town National Research Center.[8] A study by Westat, Inc, determined the incidence of abuse among children with disabilities and the relationship between child abuse and disabilities.[9] Data were collected from 35 child protective services (CPS) agencies across the country, and results indicated that 14.1% of children whose maltreatment was substantiated by CPS workers had 1 or more disabilities. A Nebraska study that used an electronic merger of hospital, central registry, foster care review board, and law enforcement records found disabilities to be twice as prevalent among maltreated children in hospitals as among hospital controls, which is consistent with the hypothesis that disabilities increase the risk of maltreatment. The data are also consistent with the hypothesis that maltreatment contributes to disabilities.[11]

According to research performed by the Boys Town National Research Hospital, children with disabilities were found to be at greater risk of becoming victims of abuse and neglect than were children without disabilities. The study showed that children with disabilities are 1.8 times more likely to be neglected, 1.6 times more likely to be physically abused, and 2.2 times more likely to be sexually abused than are children without disabilities.[8] Another study found the overall incidence of child maltreatment to be 39% in 150 children with multiple disabilities admitted to a psychiatric hospital. Of those children, 60% had been physically abused, 45% had been neglected, and 36% had been sexually abused.[12] In a 2000 study of more than 4500 maltreated children, Sullivan and Knutson[13] observed children with disabilities to be 3.76 times more likely to be neglected, 3.79 times more likely to be physically abused, and 3.14 times more likely to be sexually abused when compared with children without disabilities.[13] Children with behavioral disorders were found to be at the highest risk of all types of maltreatment, and neglect was the most common form of maltreatment across all disability types. A relative-risk matrix for all types of maltreatment among children with specific disabilities was developed. In 1 recent study, caregivers reported that 18.5% of children with autism had been physically abused and 16.6% had been sexually abused.[14] Spencer et al[15] concluded that children with disabling conditions are at increased risk of child abuse and neglect, although the type of maltreatment varies with the specific disabling condition.

LIMITATIONS OF CURRENT RESEARCH

The prevalence of maltreatment of children with disabilities is difficult to calculate, because states do not use comparable definitions of child abuse and neglect. Another major problem with the published literature is the variable definition of "disabilities."[4] The Centers for Disease Control and Prevention describes developmental disabilities as a diverse group of severe chronic conditions that are attributable to mental and/or physical impairments and result in problems with major life activities such as language, mobility, learning, self-help, and independent living. The Americans With Disabilities Act[16] defines "disability" as a physical or mental impairment that substantially limits 1 or more of the major life activities of an individual. This definition includes all types of disabilities, including physical disabilities, cognitive or learning disabilities, motor and sensory dysfunctions, mental illness, or any other kind of physical, mental, or emotional impairment.[17] Perrin[18] reported that most childhood chronic health conditions do not cause disability. The Maternal and Child Health Bureau has defined children with special health care needs as "those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally."[19] The term "children with special health care needs" is less limiting than some other terms.[20]

Legal definitions do not always match clinical data. Child development evaluations do not always allow an immediate and precise diagnosis of extent or type of disability, and some studies rely on evaluations by untrained observers. Therefore, evaluation of research efforts is hindered by different definitions of terms (eg, disabilities and maltreatment), noncomparable methods, various study sample sizes, and lack of uniform data collection. Furthermore, changes in reporting laws and societal attitudes can occur during a study period.[21]

Another problem that has been cited in the literature is the lack of recognition and documentation of disabilities by CPS workers and their lack of training on evaluating children with disabilities.[4] In the study by Westat,[9] analyses were based on CPS workers' opinions rather than data empirically derived from physicians or other professionals trained to diagnose disabilities. Bonner et al[4] demonstrated that since 1982, correct and consistent use of a CPS-created system of collecting information regarding disabilities in maltreated children

had decreased, suggesting that disabilities were unlikely to be identified as children enter the CPS system. A survey of 51 state CPS agencies found that in 86% of states, CPS workers used a standardized form to record child-maltreatment cases, but in only 59% of those states did the workers record information regarding preexisting disabilities on the form.[22]

The Westat study was limited to intrafamilial cases.[9] Because it is well known that individuals other than family members can commit harm to children, statistics limited to intrafamilial cases would be likely to underestimate the overall incidence of maltreatment among children with disabilities.

Along with the lack of well-designed research on maltreatment is the lack of research on how to respond to children with disabilities who have been maltreated. A needs assessment of parents, educators, and CPS investigators in 2000 revealed that knowledge and experience in child maltreatment were lacking.[23] Most respondents were interested in training, with recognition of maltreatment in the child with a disability as a top priority. In this same report, a collaborative team-approach response was recommended.

CAUSAL FACTORS

In general, the causes of abuse and neglect of children with disabilities are the same as those for all children; however, several elements may increase the risk of abuse for children with disabilities. Children with chronic illnesses or disabilities often place higher emotional, physical, economic, and social demands on their families.[21] For example, a physical disability that causes difficulty in ambulation can place a child at risk of accidental falls. Therefore, much closer supervision will be needed, which itself can be stressful. Parents with limited social and community support may be at especially high risk of maltreating children with disabilities, because they may feel more overwhelmed and unable to cope with the care and supervision responsibilities that are required.[17] Lack of respite or breaks in child care responsibilities can contribute to an increased risk of abuse and neglect. Finally, the added requirements of special health care and educational needs can result in failure of the child to receive needed medications, adequate medical care, and appropriate educational placements, resulting in child neglect.[17]

Numerous problems have been cited with the provision of care for foster children with disabilities. Foster parents sometimes are not told about a child's medical and emotional problems and are, therefore, not sufficiently educated or prepared to deal with the specific condition. Other problems for foster children with disabilities include lack of permanent placement, lack of a medical home, lack of financial support, and inappropriately prepared foster parents.[3]

Parents or caregivers may feel increased stress because children with disabilities may not respond to traditional means of reinforcement, and sometimes these children's behavioral characteristics (eg, aggressiveness, noncompliance, and communication problems) may become quite frustrating.[8] Behavioral challenges in children who have disabilities may further increase the likelihood of physical abuse.[17]

Parents of children with communication problems may resort to physical discipline because of frustration over what they perceive as intentional failure to respond to verbal guidance. It has been noted paradoxically, however, that families who report higher stress levels may actually have greater insight into problems associated with caring for a disabled child, whereas parents with a history of neglect of a child may not experience the level of stress that a more involved parent may experience.[24]

Although the use of aversive procedures and restraints for children who have disabilities has been fortunately diminishing, in part because of legislative changes (eg, modifications of the Individuals With Disabilities Education Act [Pub L No. 108–446 (2004)]), these practices are still used sometimes in homes, schools, programs, and institutions.[25] Aversive techniques are procedures that use painful or unpleasant stimuli to modify a behavior that has been found to be unacceptable or inappropriate. Restraints are physical measures (such as tie-downs or prolonged seclusion) used to prevent something physical from happening or for "punishment." This includes "therapeutic holding," which has been repudiated as being harmful.[26] During the past 20 years, much research has demonstrated the effectiveness of alternative measures, commonly called "positive behavioral supports," to change behavior.[25] Pediatricians and others who could use additional information about the problems that occur from the use of aversive procedures or restraints can easily get this guidance from the Web sites of organizations such as the Association for the Severely Handicapped (www.tash.org/IRR/resolutions/res02aversive.htm) and the Autism National Committee (www.Autcom.org/restraints.html). Information about positive behavioral support guidelines is available from a US Department of Education–funded program, the Technical Assistance Center on Positive Behavioral Interventions & Supports (www.Pbis.org), and other national and international programs. The American Academy of Child and Adolescent Psychiatry also provides guidance on this subject (www.aacap.org/page.ww?section=Policy+Statements&name=Coercive+Interventions+for+Reactive+Attachment+Disorder).

The presence of multiple caregivers may heighten or reduce the risk of abuse of the child. Infrequent contact of a child with disabilities with other children and adults may make them uniquely vulnerable to molestation because there is decreased opportunity for the child to

develop a trusting relationship with an individual to whom he or she may disclose the abuse[17] and decreased opportunity to learn to resist molestation. On the other hand, children with disabilities who require multiple caregivers or providers may have contact with numerous individuals, thereby increasing the opportunity for abuse, including sexual abuse. However, advantages to having a large number of caregivers are that there are more individuals who may detect the injuries or signs of abuse, and the additional assistance may actually lessen the amount of stress placed on the primary caregivers. Risk may be minimized by careful screening and selection of caregivers, sporadic and unscheduled monitoring of care, and an open mind to recognition that any child may become a victim.

Children with disabilities often have limited access to critical information pertaining to personal safety and sexual abuse prevention. Children who have increased dependency on caregivers for their physical needs may be accustomed to having their bodies touched by adults on a regular basis. Parents may object to their child being provided with education on human sexuality, because they may feel that their children will never be in sexually risky situations because of their special needs. However, children with disabilities may be unintentionally conditioned to comply with authority, which could result in them failing to recognize abusive behaviors as maltreatment.[8] Children with disabilities are often perceived as easy targets, because their intellectual limitations may prevent them from being able to discern the experience as abuse and impaired communication abilities may prevent them from disclosing abuse. Because some forms of therapy may be painful (eg, injections or manipulation as part of physical therapy), the child may not be able to differentiate "appropriate" pain from "inappropriate" pain.

PEDIATRICIAN'S ROLE

Pediatricians should be aware that the presence of disabilities in a child is a risk factor for victimization and that disabilities can also be the result of child maltreatment. The pediatrician should work with families, other health care professionals, and other community resources to ensure the safety of all children, including those with disabilities. The following should be considered.

Identification and Reporting

Pediatricians always need be alert to signs or symptoms that are suggestive of abuse, no less in children with disabilities than in others. However, recognizing the signs and symptoms of maltreatment among children with disabilities may be difficult, because many children may not be able to verbalize that they were abused or they may not understand that what took place was wrong.[17] Because it is common for the physical examination to be normal, especially in sexual abuse and emotional maltreatment, a high index of suspicion in selected cases is warranted.

Familiarity with the natural history of disorders that may mimic child abuse can prevent the misdiagnosis of child maltreatment.[27–29] Children with motor and balance disabilities may experience increased injuries from accidents. Children with neurosensory disabilities may be predisposed to fractures, and in the absence of pain, there may be a delay in seeking medical attention. For example, children with spina bifida have a high risk of fracturing a paralyzed, desensitized limb.[5] Children with severe nutritional deficiency and immobility or chronic steroid use may develop demineralized bones that fracture easily. Children with blood dyscrasias may have bruises of varying ages in unusual places. There are also reports of a variety of disabling conditions that mimic child maltreatment, including methylmalonic aciduria and glutaric aciduria, which can manifest as chronic subdural effusions and mild retinal hemorrhages, with other telltale findings including neurodevelopmental problems.[6,30]

Awareness of injury patterns from inflicted versus noninflicted trauma is important for pediatricians and other professionals who work with children. Signs and symptoms of maltreatment in children with disabilities are commonly ignored, misinterpreted, or misunderstood. Furthermore, many schools, programs, and institutions may have a disincentive to recognize or report child maltreatment because of fear of negative publicity or loss of funding or licensure. Pediatricians may want to act proactively with these entities so that concerns and referrals are more forthcoming if questions or problems arise.

If abuse or neglect is suspected after a careful assessment, a report must be made to the appropriate CPS agency. Every child suspected of being abused or neglected needs a thorough evaluation by an experienced professional.[31] The evaluation process should consist of a structured interview with the child, if possible, and a comprehensive physical examination including appropriate laboratory and radiologic studies as indicated. In many situations, a consultation with a developmental pediatrician, pediatric neurologist, child abuse pediatrician, or other expert in children with disabilities is also indicated.

Treatment

Appropriate medical treatment for injuries, infections, or other conditions should be provided. Each case of abuse or neglect that is clinically confirmed or strongly suspected needs a multidisciplinary treatment plan, which includes a mental health assessment and treatment component that is appropriate for the child's cognitive and developmental level and counseling for the family. This child and family treatment plan should be integrated

with other intervention plans that may already have been developed for the child. Federal legislation requires that each child identified as having a disability should have a written plan of service (an individualized family service plan for children from birth to 3 years of age or an individualized education plan for children 3 through 21 years of age).[32,33] The pediatrician should also make appropriate medical recommendations and provide treatments that are preventive or prescriptive. The pediatrician may help the family explore available child care and respite services. A discussion of injury-prevention guidelines for children with disabilities is also helpful.[34] Although pediatricians can have input into the process, removal of the child from the home or therapeutic foster care placement is at the discretion of the CPS agency only after a thorough investigation.

Education

In-service training for CPS workers, law enforcement professionals, health care professionals, child care providers, early childhood educators, teachers, and judges is crucial, and protocols are necessary for the identification, reporting, and referral of all cases of suspected child maltreatment in all schools, programs, and institutional settings. Experts in child maltreatment and childhood disabilities would be the main group to assist with this educational endeavor. However, general pediatricians can have important roles, for example, with local school districts. In addition, education on risk factors for maltreatment of children with disabilities should be emphasized.

Pediatricians can also be important role models to parents, trainees, and others. In their own offices, clinics, or hospital settings, pediatricians and others who provide care for children with disabilities should not rush to use physical restraints during procedures for these children. Often, taking the time to explain procedures in terms appropriate to developmental level or in other ways to prepare such a child can make restraints unnecessary except in situations when children are dangerous to themselves or others. Even when some types of restraints are needed, such as to prevent a child from scratching at newly repaired lacerations, such restraints should be as comfortable and as minimal as possible and used for the shortest time feasible.

Pediatricians may also have roles to assist in the education about child abuse to their peers, residents, medical students, and other health care students. All health care professionals need adequate training to monitor children with disabilities for signs of abuse and neglect and to screen suspected victims of child maltreatment for disabilities.[35]

Prevention

Support and assistance with parenting skills are often needed by families, especially families who have children with special health care needs. Medical and nonmedical needs of the child and family should be addressed at each health supervision visit. Child and family strengths should be recognized and fostered at each encounter. Family stressors should be identified and addressed, and referrals for appropriate support services should be made. Disability-specific injury-prevention guidelines can be presented to help the family minimize injury.[34] The availability of parent support groups, respite care, and home health services may be explored, and referrals may be made when appropriate. Pediatricians can help educate parents of children with disabilities about the various respite and medical waiver subsidies and programs specific to each state and how to qualify for such funds. Pediatricians can explain the need for getting placed on the inevitable waiting lists for these programs as early as possible. The American Academy of Pediatrics (AAP)–sponsored medical home Web site (www.medicalhomeinfo.org) is an important resource for the pediatrician to find out more information on these programs, including state-by-state resources.

All children with or without disabilities need a medical home that consists of a health care professional who is readily accessible to the family to answer questions, help coordinate care, and discuss concerns.[36] Medical home is an approach to providing comprehensive primary care that is accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective. Families should be encouraged and assisted by these health care professionals to work with a variety of agencies and disciplines and pursue resources and services that they need. Child abuse prevention, including indicators of abuse, should be discussed with parents and caregivers.[23,24] Neurodevelopmental and developmental-behavioral pediatricians and child neurologists who are trained and experienced in the diagnosis and evaluation of children with disabilities can also serve as excellent resources to both the general pediatricians and the families.

Advocacy

The pediatrician, in providing the medical home and acting as his or her patient's and family's advocate, may review care that is provided by the various agencies and resources. Much of this advocacy effort can be performed by coordinating efforts and ensuring that recommendations are made and followed.[36] By providing this careful follow-up, if child maltreatment is suspected, the need for appropriate referrals can be identified immediately.

Pediatricians play an important advocacy role in their relationships with various governmental and nongovernmental agencies. State AAP chapters also have an important role in these arenas. State, educational, social, foster care, financial, and health care systems often function in isolation from each other, with very little coordination or communication.[8] Community involvement

can also encourage the development of needed resources, including child care and respite services for families with a child with a special health care need. Foster children with disabilities and their foster parents often suffer from lack of adequate support systems.[4] Communication with schools and other systems with which families interact is another avenue for heightening the awareness of the needs of children who have disabilities and/or special health care needs.

As child advocates, pediatricians are in an ideal position to influence public policy by sharing information and giving educational presentations on child maltreatment and the needs of children with disabilities. They should advocate for state practices or policies that mandate CPS agencies to gather disability information on child-maltreatment cases. Pediatricians should emphasize the devastating costs of child maltreatment to legislators, policy-makers, and the public.[4] Pediatricians should also advocate for screening procedures for potential employees in educational, recreational, and residential settings to help ensure the safety of all children in their care.[37]

One resource that is useful to the pediatrician is the report *A Call to Action: Ending Crimes of Violence Against Children and Adults With Disabilities*.[38] This is a report that includes recommendations on policy, surveillance systems and data collection, violence prevention, intervention, and research needs.[38] The Oregon Institute on Disability & Development has developed prevention resources that may be useful to the pediatrician (www.ohsu.edu/research/oidd/oakspublication.cfm).

GUIDANCE FOR THE PEDIATRICIAN

1. Be capable of recognizing signs and symptoms of child maltreatment in all children and adolescents, including those with disabilities.
2. Be familiar with disabling conditions that can mimic abuse or pose an increased risk of accidental injury that can be confused with abuse.
3. Because children with disabilities are at increased risk of maltreatment, remain vigilant not only in assessment for indications of abuse but also in offerings of emotional support and provision of equipment and resources to meet the needs of children and families.
4. Ensure that any child in whom maltreatment has been identified is evaluated thoroughly for disabilities.
5. Advocate for all children, especially those who have disabilities or special health care needs, to have a medical home.[36] If a child is hospitalized and does not have a medical home, the inpatient attending physician can help the family secure one before discharge, preferably as early as possible in the hospital course.[39]
6. Be actively involved with treatment plans developed for children with disabilities and participate in collaborative team approaches.
7. Use health supervision visits as a time to assess a family's strengths and need for resources to counterbalance family stressors and parenting demands.
8. Advocate for changes in state and local policies in which system failures seem to occur regarding the identification, treatment, and prevention of maltreatment of children with disabilities.
9. Advocate for the implementation of positive behavioral supports and elimination of aversive techniques and unnecessary physical restraints in homes, schools, and other educational and therapeutic programs (both public and private), institutions, and settings for children who have disabilities.
10. Advocate for better health care coverage by both private insurers and governmental funding.

CONCLUSIONS

The AAP supports the belief that pediatricians play a significant role in the prevention, identification, and treatment of child abuse and neglect, especially in children with disabilities, who are at increased risk of maltreatment. Children suspected of being maltreated should be evaluated for developmental, physical, and mental health disabilities. In addition, CPS workers and others involved in the investigation of child maltreatment should work closely with pediatricians to identify disabilities in children.[16] Every effort should be made to ensure the safety of children through collaboration with families, other health care professionals, schools, CPS agencies, and other appropriate resources.

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THE RISE OF IN-STORE CLINICS: THREAT OR OPPORTUNITY?

"The recent acquisition by the pharmacy chain CVS of MinuteClinic, a chain of in-store clinics founded in Minnesota, has put this model of primary care delivery back in the spotlight. Although still not widespread, the model is increasing in prevalence . . . and appeals to several stakeholders: payers note that primary care is less expensive when delivered at in-store clinics than when provided in a doctor's office or emergency room, patients value the convenience and low price, entrepreneurs see a profitable business model, and proponents of consumer-driven health care see services that can be paid for out of health savings accounts. Physicians, however, express concern about the quality of care and the potential impact on their businesses. The typical in-store clinic is a kiosk—a small, thin-walled structure located inside a store—staffed by a nurse practitioner. The clinics differ from the old 'doc-in-the-box' model in that they are neither routinely staffed by a physician nor intended to provide all primary care services. Indeed, the range of services—posted as a 'menu' on the company's Web site or on the kiosk—is strikingly small, including common adult vaccinations, screening tests, and treatment for simple conditions. . . . But for these circumscribed services, the clinics provide a compelling value proposition. Care is intended to be quick, inexpensive, and convenient; visits and waiting times are short, the charge is usually less than $50, and extended hours are offered along with ample parking. It's not surprising, then, that patients and investors have taken notice. . . . Some wonder whether this model is a 'disruptive innovation'—that is, a service or technology that enters a market at the low end, initially not performing as well as higher-end incumbents, then improves until it captures the whole market."

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Noted by JFL, MD

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Management of Food Allergy in the School Setting

abstract

FREE

Food allergy is estimated to affect approximately 1 in 25 school-aged children and is the most common trigger of anaphylaxis in this age group. School food-allergy management requires strategies to reduce the risk of ingestion of the allergen as well as procedures to recognize and treat allergic reactions and anaphylaxis. The role of the pediatrician or pediatric health care provider may include diagnosing and documenting a potentially life-threatening food allergy, prescribing self-injectable epinephrine, helping the child learn how to store and use the medication in a responsible manner, educating the parents of their responsibility to implement prevention strategies within and outside the home environment, and working with families, schools, and students in developing written plans to reduce the risk of anaphylaxis and to implement emergency treatment in the event of a reaction. This clinical report highlights the role of the pediatrician and pediatric health care provider in managing students with food allergies. *Pediatrics* 2010;126:1232–1239

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KEY WORDS
food allergy, school, anaphylaxis

ABBREVIATION
IHCP—individualized health care plan

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INTRODUCTION

Anaphylaxis is a severe, potentially fatal, systemic allergic reaction that occurs suddenly after contact with an allergy-causing substance.[1] Food allergy is a common cause of anaphylaxis.[2] The Centers for Disease Control and Prevention recently reported an 18% increase in food allergy among school-aged children from 1997 to 2007; 1 in 25 children are now affected.[3] Results of studies of children with food allergy indicate that 16% to 18% have experienced a reaction in school.[4,5] Allergic reactions or treatment for anaphylaxis also occur in children whose allergy was previously undiagnosed (~25% of cases of anaphylaxis).[5,6] Fatalities were noted to be overrepresented by children with peanut, tree nut, or milk allergy and among teenagers and those with underlying asthma. Preschool-aged children may experience food-induced anaphylaxis more often than older children, but the majority of food-allergic reactions in preschool- and school-aged children are not anaphylaxis,[7,8] and deaths are rare.[9]

In case series of fatalities from food allergy among preschool- and school-aged children in the United States, 9 of 32 fatalities occurred in school and were associated primarily with significant delays in administering epinephrine.[10–12]

The purpose of this clinical report is to highlight the pediatrician's role in management of food allergy in the school setting and emphasize prevention and treatment of food-induced anaphylaxis.[13] Management of infants, toddlers, and preschool-aged children who are cared for in myriad settings poses additional challenges (eg, infants may suck on

shared toys, grab another infant's bottle, etc) that are beyond the scope of this document.

DOCUMENTING FOOD ALLERGY (DIAGNOSIS) AND ASSESSING RISKS

Before developing a management plan, it is important to ascertain, as best as possible, whether a child has a potentially life-threatening food allergy. It is beyond the scope of this report to present all of the factors that might be considered in rendering a diagnosis, although comprehensive reviews are available,[14] as are national guidelines (www.niaid.nih.gov/topics/foodAllergy/clinical/Pages/default.aspx). The pediatrician may wish to work with a pediatric allergist but should be aware of several key observations:

- Any food may elicit a reaction; however, most significant reactions in children are attributable to peanut, tree nuts (eg, walnut, cashew, etc), milk, fish, shellfish, egg, soy, and wheat. Sesame and other seeds have been reported as potent allergens as well.[15] Fatalities in school-aged children in the United States have primarily been attributed to peanuts, tree nuts, milk, and seafood,[10–12] but as stated previously, anaphylaxis and death are rare in school-aged children.
- Confirmation of a clinical history (eg, urticaria, wheezing shortly after ingestion) by laboratory tests (eg, allergy skin-prick tests or food-specific serum immunoglobulin E [IgE] testing) is a typical modality for securing a diagnosis. However, although increasingly large skin tests and increasing levels of food-specific IgE antibodies correlate with increasing risk of a true allergy, these tests do not, in isolation, diagnose an allergy, nor do they accurately reflect severity of an allergy or the dose of food that might trigger a reaction. A child also may test strongly positive to a food without a previous known ingestion; in this situation, the child may still be at risk of anaphylaxis. Physician-supervised oral food-challenge testing, typically undertaken by an allergist, may be required to confirm or refute a diagnosis when the history and testing is not sufficient to diagnose the food allergy. Caution must be exercised in making a diagnosis of a life-threatening food allergy, because treatment and food-allergen avoidance require significant efforts for everyone involved.
- Although subsequent reactions are not necessarily more severe than initial reactions, they may be. For example, initial mild reactions to peanut may be followed by more severe reactions on subsequent exposures.[16,17]
- Clinical factors such as a history of asthma, previous reactions to trace exposures, and allergies to foods mentioned previously are potential risk factors for fatal anaphylaxis.[10–12,18]

NOTIFICATION OF THE SCHOOL, PRESCRIPTION OF EPINEPHRINE, AND DEVELOPMENT OF A PERSONALIZED EMERGENCY ACTION PLAN

The family must notify the school about the child's potentially life-threatening food allergy. The family may notify the school by providing a written "emergency action plan" or "food-allergy action plan" (see Appendix for a list of resources). It is recognized that multiple forms of plans are in use and that development of a more universal plan would streamline care. The physician/family may also need to provide the school with a list of foods to be avoided and possible substitutions. Physician-recommended substitutions may be required for school food programs.

The following considerations may be helpful in developing emergency plans:

- The written treatment plan could include the child's name, identifying information (child's picture, if provided), specifics about the food allergies, symptoms and treatments, instructions to activate emergency services, and contact information (see Appendix).
- The parent should be given a prescription for self-injectable epinephrine devices to be used at school in addition to ones for use at home. It may be useful to prescribe additional autoinjectors for school: (1) one to be carried by the child in a dedicated pack that is either on his or her person (if it is judged reasonable for the specific child and is in accord with local regulations) or in possession of the supervising adult and (2) other(s) to be kept in the health office, should the self-carried pack be misplaced or an additional dose be needed. The second-dose feature of some types of self-injectors requires handling of a used needle; although access to the second dose is appropriate in some settings by licensed personnel, these types of injectors should be disposed of after the first dose to reduce the risk of needle-stick injury in the school setting (if a second dose is needed, another unit should be used).
- Before creating an action plan, the pediatrician may determine if there is a licensed health care professional who will be assisting the child. When there is not, and only a nonlicensed assistive person is available, the action plan should be as simple as possible. For example, whereas a licensed health professional may be able to administer an antihistamine and observe for progression of symptoms before administering epinephrine, a nonli-

censed professional should not be expected to make a medical or nursing assessment. Instead, the advice may be to give the epinephrine via autoinjector and call for activation of emergency medical services immediately.

- There is no diagnostic test for anaphylaxis, and specific symptoms may vary. A recent report suggested that anaphylaxis is likely to be occurring if any of the following 3 situations are observed[1]:

1. acute onset (minutes to several hours from exposure) of symptoms with involvement of the skin and/or mucosal tissue (eg, generalized hives, pruritus or flushing, swollen lips/tongue/uvula) and signs or symptoms of either respiratory compromise (eg, dyspnea, wheeze/bronchospasm, stridor, reduced peak expiratory flow, hypoxemia) and/or reduced blood pressure or associated symptoms of end-organ dysfunction (eg, hypotonia [collapse], syncope, incontinence); or
2. 2 or more of the following that occur rapidly after exposure to a likely allergen for that patient: involvement of the skin/mucosal tissue; respiratory compromise; reduced blood pressure or associated symptoms; or persistent gastrointestinal tract symptoms (eg, crampy abdominal pain, vomiting); or
3. reduced blood pressure after exposure to a known allergen for that patient (minutes to several hours).

- In the context of a possible allergen ingestion, a simple means to impart instructions regarding when epinephrine should be administered is to suggest that it be injected for significant respiratory (eg, tightness of the throat, hacking cough, hoarseness, shortness of breath, wheezing, etc) or cardiovascular symptoms (eg, paleness, blue skin tone, decreased consciousness/confusion, poor pulses, etc) or if there is progression of symptoms or involvement of more than 1 organ system (eg, more than a few hives). The treatment plans (see Appendix) list key additional symptoms not stated in this report.
- Anaphylaxis may occur without urticaria.[10]
- Dosing of self-injectable epinephrine (either 0.15 or 0.3 mg) has been reviewed in a previous clinical report.[19] Briefly, the manufacturer recommends switching to the 0.3-mg dose at 66 lb, but because that results in underdosing as children approach this weight, consideration should be given to prescribing the 0.3-mg dose at approximately 55 lb.
- Symptoms of anaphylaxis may initially respond to treatment but recur (biphasic response) with possibly more severe manifestations.[10] Therefore, emergency plans should include activation of emergency medical services and transport to a facility at which additional observation and care can be administered in the ensuing hours whenever a significant allergic reaction is believed to have occurred. A second dose of epinephrine is recommended[20–22] in 5 to 20 minutes if significant symptoms progress or are not responding to the first dose.
- Because 25% of anaphylaxis in schools occurs without a previous diagnosis,[6] a prescription for unassigned epinephrine for general use, consistent with district regulations and state laws, should be considered, especially in schools with nurses. A standard anaphylaxis-management protocol should be developed by the school health services staff and the consulting school physician. In districts without a school physician, a standard anaphylaxis-management protocol could be developed in consultation with local public health professionals, community health center staff, or school-of-medicine faculty.

Additional information about administration of medications in schools is addressed in a policy statement from the American Academy of Pediatrics titled "Guidance for the Administration of Medication in School."[23] The diagnosis, treatment plan, and prescriptions should be reviewed periodically and updated at least yearly. Pediatricians should remind parents to be cognizant of expiration dates on epinephrine autoinjectors and to be alerted to proper temperature storage requirements.

- It may be advisable to inject epinephrine at the time of first symptoms if an allergen was ingested that previously caused anaphylaxis.[24]
- It may be advisable to inject epinephrine before symptoms if an allergen was ingested that previously caused anaphylaxis with cardiovascular collapse.[24]
- Emergency action plans can be individualized according to the child's history as well as the abilities of the responsible adult.
- Physicians are encouraged to educate parents/school caregivers that:
  - antihistamines are adjunctive therapies to treat an allergic reaction but cannot be depended on to treat anaphylaxis;
  - inhaled bronchodilators may be given for respiratory reactions but must not be depended on to treat anaphylaxis;
  - medication should not be exposed to extremes in temperature, and expired units should be replaced; and

- epinephrine is generally safe (ie, when in doubt, inject), and parents/school caregivers should be advised about common adverse effects of epinephrine (eg, tremor, tachycardia, flushing/paleness).

- In some adults experiencing anaphylaxis who were raised from the supine to the upright position during transport to a hospital, death occurred suddenly, presumably from "empty-ventricle syndrome" caused by blood pooling in the legs during anaphylactic shock.[25] The implications of this observation for children, who more typically succumb to respiratory insufficiency during anaphylaxis and who may vomit during anaphylaxis, are not known. Nevertheless, caregivers should be advised that individuals with severe anaphylaxis who may benefit from being in a supine position with legs raised should remain in that position and be transported that way by emergency personnel until advanced care can be accessed (eg, additional medications and intravenous fluids).
- Physicians are encouraged to educate families and the student, as appropriate for age (or arrange for education):
  - about how to administer self-injectable epinephrine and educate others, because mistakes are common[26];
  - to consider obtaining medical identification jewelry;
  - about the importance of avoidance strategies (eg, no food-sharing), to notify an adult of any symptoms or if they may have eaten an unsafe food, and when to use self-injectable epinephrine; and
  - to determine if carrying/self-administration of self-injectable epinephrine is appropriate (assuming local and state agencies allow it) (to make these decisions, student, parent/guardian, and school and community factors may be assessed [see: www.nhlbi.nih.gov/health/prof/lung/asthma/emer_med.htm]; however, designated adults [eg, licensed provider or a lay designee] should be additionally responsible for treatment. because the student may not be depended on for or be capable of self-administration).
- Pediatricians can encourage parents to request to meet with key school staff members who have responsibility for the care of their child and to work cooperatively with schools to ensure their child's safety. Key staff members may include the directors of transportation and food service, the building administrator, school nurse, classroom teacher, and director of health services. Pediatricians can provide resources for parents to give to school officials to help them develop food-allergy management protocols at the school board of directors' level. Pediatricians can also serve as a resource to school wellness committees or councils and to boards of education to help them in developing safe policies, regulations, and procedures for children with food allergies.
- Pediatricians (and allergists) are encouraged to counsel parents about the level of exposure that might be dangerous for a specific child, such as ingestion versus inhalation versus touching food residues, so that parents are appropriately vigilant without becoming needlessly hypervigilant about avoidance strategies, particularly because they might affect schools or neighbors.

AVOIDANCE STRATEGIES

Avoidance strategies must be practical and focus on policies to avoid ingestion of the allergen, the primary route that can result in anaphylaxis. There have been no controlled studies to evaluate the effectiveness of potential avoidance strategies. Knowledge about risks primarily come from observational studies and self-report. Avoidance strategies appropriate for a specific child may vary on the basis of the nature of the allergy, circumstances unique to the particular institution, age of the child, and the child's developmental stage and disposition.

BEST-PRACTICE STRATEGIES

The following points may be helpful in instructing families and schools about avoidance strategies.

- Studies of skin contact and inhalation of peanut-butter vapors by children with peanut allergy failed to induce any systemic reactions.[27,28] Lack of a reaction from these casual exposures is not unexpected, because penetration to the systemic circulation by skin contact is unlikely, and peanut-butter vapors do not contain protein. Although these findings suggest that such exposures are of low risk, concern remains for young children transferring skin contact to their mouths.
- Case reports and controlled studies in which foods are vaporized through heating have shown that reactions, primarily respiratory, can be elicited.[29] These observations support limiting exposure to allergens being cooked (eg, in science/craft projects).
- Reports that focused on reactions to peanut in schools from noningestion exposures primarily identified craft projects with peanut butter as a cause of mostly mild reactions.[5] This observation supports not using

food allergens in craft or cooking projects.

- A study showed that peanut can be cleaned from the hands of adults by using running water and soap or commercial wipes but not antibacterial gels alone.[30] In addition, peanut was cleaned easily from surfaces by using soap, wet wipes, and commercial wipes but not dishwashing liquid alone. Results of threshold studies indicated a wide range of doses of peanut that elicit objective symptoms, but the lower range seems to be 10 to 100 mg, on average. More typical eliciting doses are one-half to one whole peanut kernel.[31] These observations indicate that standard cleaning and lack of visible contamination should suffice for most children with peanut allergies.
- On the basis of the aforementioned studies, allergen avoidance might vary depending on the age of the children, and more supervision, cleaning, and containment of the allergen are needed for younger children. Care must be taken not to ostracize or physically separate the child with food allergies. For example, an "allergen-aware" table should include the child's friends who are eating safe meals. Experts have not espoused blanket "bans" on foods,[32] particularly because peanut butter, milk, egg, and other common allergens may be a protein staple of another child's diet. In rare instances, individual schools or classrooms might pursue these options. For example, removal of highly allergenic foods from the vicinity of kindergarten-aged children or children with significant developmental disabilities might be warranted when transfer of the allergen among the children is likely. Schools may wish to ban children from bringing food from home to share with classmates for celebratory functions and offer acceptable alternative options for purchase through school food services.
- Several professional organizations (see Appendix) have advocated procedures to reduce the risk of accidental allergen ingestion that are responsive to previously published observations regarding circumstances leading to allergic reactions.[4,5] These procedures include strict "no food-sharing" policies; use of commercially prepared and labeled, individually wrapped food items; education of those providing foods regarding safe and unsafe foods and label-reading; education of cafeteria/food service staff; a ready supply of safe alternative snacks; and policies of no eating on the school bus and having a means of communication on the bus. Avoidance strategies and emergency management must also be communicated to personnel who may not have primary responsibilities for the student, such as coaches, specialty teachers (art, music, etc), substitute teachers, field trip personnel, etc. These individuals also require training in the use of epinephrine autoinjectors, familiarity with the food-allergy action plan, and indicators for activating the emergency medical response system.
- School food services leadership should be involved in district policy development and assist in the education of cafeteria/food service staff at the individual school level.

SCHOOL TREATMENT GUIDANCE/ DEVELOPMENT OF THE INDIVIDUALIZED HEALTH CARE PLAN

The pediatrician may submit a written emergency action plan, emergency care plan, or food-allergy action plan or emergency medical order so that the school nurse can develop an individualized health care plan (IHCP). The emergency action or care plan is a document created by the pediatrician or school nurse on the basis of medical orders from the pediatrician that is written in simple lay terms for the nonlicensed staff members who may have a supervisory role for a child at any time before, during, or after the school day. The IHCP is a nursing document created by a school nurse with input from the pediatrician's orders that contains a complete school management plan with preventive procedures for day-to-day management in the school. The following information should be considered:

- The student's IHCP is typically developed by the school nurse in collaboration with the family, physician, and other school personnel. General recommendations for materials to be included in the IHCP are included in various state guidelines (see Appendix). The IHCP should be revised according to the child's needs on the basis of age and developmental stages.
- Schools may establish a core team responsible for food-allergy management and actions, to ensure that reasonable and nondiscriminatory avoidance plans are in place, that a food-allergy treatment plan is reviewed and practiced periodically, that people are designated and trained to recognize and treat anaphylaxis, etc (also see Appendix). The pediatrician should be familiar with these responsibilities and may wish to provide education on these procedures, particularly when the plans are part of the student's IHCP. The pediatrician/family may also determine if a full-time registered nurse is present in the student's school during all school hours and advocate for delegation of nursing

services in that school when the school nurse is not present. If there is a before- and/or after-school program, the parent should be aware of the process for ensuring access to epinephrine and allergen reduction during this out-of-school time.

- Results of several studies support the notion that epinephrine may be needed in locations outside of the school cafeteria, that significant delays in administration are associated with fatalities (eg, >20 minutes after symptoms), and prompt administration is advantageous.[6,8,10–12] To ensure access to epinephrine within several minutes, school plans should consider allowing the student to self-carry, if allowed and age appropriate, and/or storing epinephrine in secure and readily accessible locations. Prompt access to a reliable source of autoinjectable epinephrine is critical. To ensure medication security and safety and provide for timely treatment, procedures should be established that specify where the medication will be stored, who is responsible for the medication, who regularly monitors and replaces outdated medication, and who will carry the medication for field trips.
- The adolescent age group seems to be at the highest risk of fatal food-induced anaphylaxis.[10–12] Special attention for this group should include education of the adolescent and his or her peers to reduce risk-taking and to encourage carrying and using medications when needed.[33] Education should be provided to staff, including coaches, trainers, and after-school advisors. Affected students should be permitted to wear/carry clothing/bags/purses that facilitate carrying medications (eg, large pockets, larger purses, book bags, etc).
- Harassment or bullying of students because of their food allergy must be taken seriously. Students should be encouraged to report such behaviors, and the school should address the situation with quick and decisive antibullying policies.
- The legal rights of children with life-threatening food allergies are protected under several laws. If a student qualifies for special education services under the Individuals With Disabilities Education Act and also has food allergies, the food allergy should be addressed in the student's individualized education plan. Section 504 of the Rehabilitation Act of 1973 may also be used to document specific management plans and provides legal recourse for students and their families if they and the school are unable to come to terms on health care plans through normal channels. In some schools, Section 504 plans may not be necessary if the written emergency action plan and/or IHCP provide the necessary procedures for safety. The Americans With Disabilities Act also protects children with life-threatening food allergies who attend schools that do not receive federal funding.
- After a reaction has occurred, it is important to review policies and procedures among the school staff, the child's health care provider, parents, and the child.

SUMMARY

The pediatrician plays an important role in contributing to the management of school-aged children with food allergies. Consultation with a board-certified allergist-immunologist to secure a diagnosis and provide directed treatments and advice is recommended.[34] It is important that there be close communication between the pediatrician and allergist for diagnosis and management. Partnerships with students, families, school nurses, school physicians, and school staff are important for individualizing effective and practical care plans.

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Comments on this clinical report were solicited from committees, sections, and councils of the AAP; 5 responded. Additional comments were sought from the Centers for Disease Control and Prevention, National Association of State School Nurse Consultants, National Association of School Nurses, and Food Allergy & Anaphylaxis Network. For recommendations for which high levels of evidence are absent, the expert opinions and suggestions of the members of the Section on Allergy and Immunology and other groups and authorities consulted were taken into consideration in developing this clinical report.

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APPENDIX RESOURCES

Example of an emergency treatment plan
- www.foodallergy.org/downloads/FAAP.pdf

Overview of school guidelines endorsed by professional organizations
- www.foodallergy.org/school/schoolguidelines.pdf

Examples of state school programs
- Arizona
  - www.azdhs.gov/phs/oeh/fses/pdf/allergies1007.pdf
- Connecticut
  - www.sde.ct.gov/sde/lib/sde/PDF/deps/student/health/Food_Allergies.pdf
- Maryland
  - www.marylandpublicschools.org/nr/rdonlyres/6561b955-9b4a-4924-90ae-f95662804d90/21182/anaphylaxisstateguidelines_final082809.pdf
- Massachusetts
  - www.doe.mass.edu/cnp/allergy.pdf
- Mississippi
  - www.healthyschoolsms.org/health_services/documents/GuidelinesforManagingFoodAllergies.pdf
- New Jersey
  - www.nj.gov/education/students/safety/health/services/allergies.pdf
- New York
  - www.schoolhealthservices.org/uploads/Anaphylaxis%20Final%206-25-08.pdf
- Tennessee
  - http://health.state.tn.us/Downloads/HealthySchoolsGuidelines.pdf
- Vermont
  - http://education.vermont.gov/new/pdfdoc/pgm_health_services/food_allergies_manual_0608.pdf
- Washington
  - www.k12.wa.us/HealthServices/publications/09-0009.aspx
- West Virginia
  - http://wvde.state.wv.us/osshp/main/documents/GuidelinesforAllergiesintheSchoolSetting-Final2.doc

Centers for Disease Control and Prevention information for school food allergy
- www.cdc.gov/Healthyyouth/foodallergies/index.htm

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CLINICAL REPORT

Management of Children With Autism Spectrum Disorders

Guidance for the Clinician in Rendering Pediatric Care

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ABSTRACT

Pediatricians have an important role not only in early recognition and evaluation of autism spectrum disorders but also in chronic management of these disorders. The primary goals of treatment are to maximize the child's ultimate functional independence and quality of life by minimizing the core autism spectrum disorder features, facilitating development and learning, promoting socialization, reducing maladaptive behaviors, and educating and supporting families. To assist pediatricians in educating families and guiding them toward empirically supported interventions for their children, this report reviews the educational strategies and associated therapies that are the primary treatments for children with autism spectrum disorders. Optimization of health care is likely to have a positive effect on habilitative progress, functional outcome, and quality of life; therefore, important issues, such as management of associated medical problems, pharmacologic and nonpharmacologic intervention for challenging behaviors or coexisting mental health conditions, and use of complementary and alternative medical treatments, are also addressed.

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Key Words
autism, autism spectrum disorders, Asperger syndrome, pervasive developmental disorders, complementary and alternative medicine, early intervention

Abbreviations
ASD—autism spectrum disorder
TEACCH—Treatment and Education of Autistic and Related Communication Handicapped Children
ABA—applied behavior analysis
DTT—discrete trial training
DIR—developmental, individual-difference, relationship-based
RDI—relationship-development intervention
RT—responsive teaching
SI—sensory integration
EEG—electroencephalography
SSRI—selective serotonin-reuptake inhibitor
CAM—complementary and alternative medicine

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INTRODUCTION

The term autism spectrum disorders (ASDs) has been used to include the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)*[1] diagnostic categories autistic disorder, Asperger disorder, and pervasive developmental disorder–not otherwise specified.[2] Recent estimates of the prevalence of ASDs are in the range of 6.5 to 6.6 per 1000, and pediatricians, therefore, are likely to care for children and adolescents with these diagnoses.[3–5] In the companion document to this clinical report,[2] the American Academy of Pediatrics has summarized pertinent background information on ASDs and emphasized the importance of surveillance and screening as well as other potential physician roles in the diagnostic process. However, the role of the primary health care professional extends beyond recognizing signs of ASDs, referring for diagnostic evaluation, conducting an etiologic investigation, providing genetic counseling, and educating caregivers about ASDs and includes ongoing care and management.

ASDs, similar to other neurodevelopmental disabilities, are generally not "curable," and chronic management is required. Although outcomes are variable and specific behavioral characteristics change over time, most children with ASDs remain within the spectrum as adults and, regardless of their intellectual functioning, continue to experience problems with independent living, employment, social relationships, and mental health.[6–8] The primary goals of treatment are to minimize the core features and associated deficits, maximize functional indepen-

dence and quality of life, and alleviate family distress. Facilitating development and learning, promoting socialization, reducing maladaptive behaviors, and educating and supporting families can help accomplish these goals. Ideally, interventions should help mitigate the core features of ASDs, which include impairment in social reciprocity, deficits in communication, and restricted, repetitive behavioral repertoire.

Educational interventions, including behavioral strategies and habilitative therapies, are the cornerstones of management of ASDs. These interventions address communication, social skills, daily-living skills, play and leisure skills, academic achievement, and maladaptive behaviors.

Optimization of medical care is also likely to have a positive impact on habilitative progress and quality of life. In addition to routine preventive care and treatment of acute illnesses, management of sleep dysfunction, coexisting challenging behaviors or psychiatric conditions, and associated medical problems, such as seizures, may be particularly important. Medications have not been proven to correct the core deficits of ASDs and are not the primary treatment. However, associated maladaptive behaviors or psychiatric comorbidities may interfere with educational progress, socialization, health or safety, and quality of life. These behaviors may be amenable to psychopharmacologic intervention or, in some cases, treatment of underlying medical conditions that are causing or exacerbating the behaviors. Effective medical management may allow a child with an ASD to benefit more optimally from educational interventions.

EDUCATIONAL INTERVENTIONS

Education has been defined as the fostering of acquisition of skills and knowledge to assist a child to develop independence and personal responsibility; it encompasses not only academic learning but also socialization, adaptive skills, communication, amelioration of interfering behaviors, and generalization of abilities across multiple environments.[9] Physicians and other clinicians are often in a position to guide families to empirically supported practices and help them evaluate the appropriateness of the educational services that are being offered.

Comprehensive Programs for Young Children

In the last 2 decades, research and program development in the area of educational intervention have focused largely on very young children with ASDs because of earlier identification and evidence that early intensive intervention may result in substantially better outcomes.[9,10] Model early childhood educational programs for children with ASDs have been described in thorough reviews.[9,11,12] These model programs are often categorized as behavior analytic, developmental, or structured teaching on the basis of the primary philosophical orientation. Although the approaches have important differences, they also overlap. For example, contemporary comprehensive behavioral curricula borrow from developmental or cognitive approaches (such as addressing joint attention, reciprocal imitation, symbolic play, and theory of mind and using indirect language stimulation and contingent imitation techniques), and some developmental models (eg, the Denver model) and the structured teaching approach of the Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH) program use behavioral techniques to fulfill their curriculum goals.[10,13]

Although programs may differ in philosophy and relative emphasis on particular strategies, they share many common goals, and there is a growing consensus that important principles and components of effective early childhood intervention for children with ASDs include the following[9,10,14–16]:

- entry into intervention as soon as an ASD diagnosis is seriously considered rather than deferring until a definitive diagnosis is made;
- provision of intensive intervention, with active engagement of the child at least 25 hours per week, 12 months per year, in systematically planned, developmentally appropriate educational activities designed to address identified objectives;
- low student-to-teacher ratio to allow sufficient amounts of 1-on-1 time and small-group instruction to meet specific individualized goals;
- inclusion of a family component (including parent training as indicated);
- promotion of opportunities for interaction with typically developing peers to the extent that these opportunities are helpful in addressing specified educational goals;
- ongoing measurement and documentation of the individual child's progress toward educational objectives, resulting in adjustments in programming when indicated;
- incorporation of a high degree of structure through elements such as predictable routine, visual activity schedules, and clear physical boundaries to minimize distractions;
- implementation of strategies to apply learned skills to new environments and situations (generalization) and to maintain functional use of these skills; and
- use of assessment-based curricula that address:
  - functional, spontaneous communication;
  - social skills, including joint attention, imitation, reciprocal interaction, initiation, and self-management;

- functional adaptive skills that prepare the child for increased responsibility and independence;
- reduction of disruptive or maladaptive behavior by using empirically supported strategies, including functional assessment;
- cognitive skills, such as symbolic play and perspective taking; and
- traditional readiness skills and academic skills as developmentally indicated.

Specific Strategies

A variety of specific methodologies are used in educational programs for children with ASDs. Detailed reviews of intervention strategies to enhance communication,[9,17–20] teach social skills,[21–24] and reduce interfering maladaptive behaviors[21,25,26] have been published in recent years. Brief descriptions of selected methodologies are provided below.

Applied Behavior Analysis

Applied behavior analysis (ABA) is the process of applying interventions that are based on the principles of learning derived from experimental psychology research to systematically change behavior and to demonstrate that the interventions used are responsible for the observable improvement in behavior. ABA methods are used to increase and maintain desirable adaptive behaviors, reduce interfering maladaptive behaviors or narrow the conditions under which they occur, teach new skills, and generalize behaviors to new environments or situations. ABA focuses on the reliable measurement and objective evaluation of observable behavior within relevant settings including the home, school, and community. The effectiveness of ABA-based intervention in ASDs has been well documented through 5 decades of research by using single-subject methodology[21,25,27,28] and in controlled studies of comprehensive early intensive behavioral intervention programs in university and community settings.[29–40] Children who receive early intensive behavioral treatment have been shown to make substantial, sustained gains in IQ, language, academic performance, and adaptive behavior as well as some measures of social behavior, and their outcomes have been significantly better than those of children in control groups.[31–40]

Highly structured comprehensive early intervention programs for children with ASDs, such as the Young Autism Project developed by Lovaas[35,41] at the University of California Los Angeles, rely heavily on discrete trial training (DTT) methodology, but this is only one of many techniques used within the realm of ABA. DTT methods are useful in establishing learning readiness by teaching foundation skills such as attention, compliance, imitation, and discrimination learning, as well as a variety of other skills. However, DTT has been criticized because of problems with generalization of learned behaviors to spontaneous use in natural environments and because the highly structured teaching environment is not representative of natural adult-child interactions. Traditional ABA techniques have been modified to address these issues. Naturalistic behavioral interventions, such as incidental teaching and natural language paradigm/pivotal response training, may enhance generalization of skills.[13]

Functional behavior analysis, or functional assessment, is an important aspect of behaviorally based treatment of unwanted behaviors. Most problem behaviors serve an adaptive function of some type and are reinforced by their consequences, such as attainment of (1) adult attention, (2) a desired object, activity, or sensation, or (3) escape from an undesired situation or demand. Functional assessment is a rigorous, empirically based method of gathering information that can be used to maximize the effectiveness and efficiency of behavioral support interventions.[42] It includes formulating a clear description of the problem behavior (including frequency and intensity); identifying the antecedents, consequences, and other environmental factors that maintain the behavior; developing hypotheses that specify the motivating function of the behavior; and collecting direct observational data to test the hypothesis. Functional analysis also is useful in identifying antecedents and consequences that are associated with increased frequency of desirable behaviors so that they can be used to evoke new adaptive behaviors.

Structured Teaching

The TEACCH method, developed by Schopler and colleagues,[43] emphasizes structure and has come to be called "structured teaching." Important elements of structured teaching include organization of the physical environment, predictable sequence of activities, visual schedules, routines with flexibility, structured work/activity systems, and visually structured activities.[43] There is an emphasis on both improving skills of individuals with ASDs and modifying the environment to accommodate their deficits. Several reports have documented progress in children who have received TEACCH services as well as parent satisfaction and improvement in parent teaching skills, but these reports were not from controlled studies of treatment outcomes.[44–49] In a controlled trial, Ozonoff and Cathcart[50] found that children treated with a TEACCH-based home program for 4 months in addition to their local day treatment programs improved significantly more than children in the control group who received local day treatment services only.

Developmental Models

Developmental models are based on use of developmental theory to organize hypotheses regarding the fundamental nature of ASDs and design approaches to address

the deficits. The Denver model, for example, is based largely on remediating key deficits in imitation, emotion sharing, theory of mind, and social perception by using play, interpersonal relationships, and activities to foster symbolic thought and teach the power of communication.[12] This program has shifted from a center-based treatment unit to service delivery in homes and inclusive school environments. Several studies have demonstrated improvements in cognitive, motor, play, and social skills beyond what would be expected on the basis of initial developmental rates in children who are treated according to the Denver model, but controlled trials are lacking.[51–54]

Relationship-focused early intervention models include Greenspan and Wieder's developmental, individual-difference, relationship-based (DIR) model,[55] Gutstein and Sheely's relationship-development intervention (RDI),[56] and the responsive-teaching (RT) curriculum developed by Mahoney et al.[57,58] The DIR approach focuses on (1) "floor-time" play sessions and other strategies that are purported to enhance relationships and emotional and social interactions to facilitate emotional and cognitive growth and development and (2) therapies to remediate "biologically based processing capacities," such as auditory processing and language, motor planning and sequencing, sensory modulation, and visual-spatial processing. Published evidence of the efficacy of the DIR model is limited to an unblinded review of case records (with significant methodologic flaws, including inadequate documentation of the intervention, comparison to a suboptimal control group, and lack of documentation of treatment integrity and how outcomes were assessed by informal procedures[55]) and a descriptive follow-up study of a small subset (8%) of the original group of patients.[59] RDI focuses on activities that elicit interactive behaviors with the goal of engaging the child in a social relationship so that he or she discovers the value of positive interpersonal activity and becomes more motivated to learn the skills necessary to sustain these relationships.[56] Some reviewers have praised the face validity of this model, which targets the core impairment in social reciprocity. However, the evidence of efficacy of RDI is anecdotal; published empirical scientific research is lacking at this time. One study reported beneficial effects of RT on young children with ASDs or other developmental disabilities.[58] Parents were taught to use RT strategies to encourage their children to acquire and use pivotal developmental behaviors (attention, persistence, interest, initiation, cooperation, joint attention, and affect). Children in both groups improved significantly on nonstandardized play-based measures of cognition and communication and standardized parent ratings of socioemotional functioning. Although a control group was lacking and the potential role of concurrent educational services was unclear, the improvements were beyond what the authors expected from maturational factors alone.[58]

Speech and Language Therapy

A variety of approaches have been reported to be effective in producing gains in communication skills in children with ASDs.[9,17,20] Didactic and naturalistic behavioral methodologies (eg, DTT, verbal behavior, natural language paradigm, pivotal response training, milieu teaching) have been studied most thoroughly, but there is also some empirical support for developmental-pragmatic approaches (eg, Social Communication Emotional Regulation Transactional Support, Denver model, RDI, Hanen model).

People with ASDs have deficits in social communication, and treatment by a speech-language pathologist usually is appropriate. Most children with ASDs can develop useful speech, and chronologic age, lack of typical prerequisite skills, failure to benefit from previous language intervention, and lack of discrepancy between language and IQ scores should not exclude a child from receiving speech-language services.[60] However, traditional, low-intensity pull-out service delivery models often are ineffective, and speech-language pathologists are likely to be most effective when they train and work in close collaboration with teachers, support personnel, families, and the child's peers to promote functional communication in natural settings throughout the day.[60]

The use of augmentative and alternative communication modalities, including gestures, sign language, and picture communication programs, often is effective in enhancing communication.[17,20,61] The Picture Exchange Communication System (PECS)[62,63] is used widely. The PECS method incorporates ABA and developmental-pragmatic principles, and the child is taught to initiate a picture request and persist with the communication until the partner responds. Some nonverbal people with ASDs may benefit from the use of voice-output communication aids, but published evidence for these aids is scant.[20,64] Introduction of augmentative and alternative communication systems to nonverbal children with ASDs does not keep them from learning to talk, and there is some evidence that they may be more stimulated to learn speech if they already understand something about symbolic communication.[61,62,65]

Social Skills Instruction

There is some objective evidence to support traditional and newer naturalistic behavioral strategies and other approaches to teaching social skills.[22–24,66–68] Joint attention training may be especially beneficial in young, preverbal children with ASDs, because joint attention behaviors precede and predict social language development.[69,70] A recent randomized, controlled trial demonstrated that joint attention and symbolic play skills can be taught and that these skills generalize to different

settings and people.[71] Families can facilitate joint attention and other reciprocal social interaction experiences throughout the day in the child's regular activities. Examples of these techniques are described in the American Academy of Pediatrics parent booklet "*Understanding Autism Spectrum Disorders*."[72]

A social skills curriculum should target responding to the social overtures of other children and adults, initiating social behavior, minimizing stereotyped perseverative behavior while using a flexible and varied repertoire of responses, and self-managing new and established skills.[10] Social skills groups, social stories, visual cueing, social games, video modeling, scripts, peer-mediated techniques, and play and leisure curricula are supported primarily by descriptive and anecdotal literature, but the quantity and quality of research is increasing.[10,15,73] A number of social skills curricula and guidelines are available for use in school programs and at home.[10,66,74,75]

Occupational Therapy and Sensory Integration Therapy

Traditional occupational therapy often is provided to promote development of self-care skills (eg, dressing, manipulating fasteners, using utensils, personal hygiene) and academic skills (eg, cutting with scissors, writing). Occupational therapists also may assist in promoting development of play skills, modifying classroom materials and routines to improve attention and organization, and providing prevocational training. However, research regarding the efficacy of occupational therapy in ASDs is lacking. Sensory integration (SI) therapy often is used alone or as part of a broader program of occupational therapy for children with ASDs. The goal of SI therapy is not to teach specific skills or behaviors but to remediate deficits in neurologic processing and integration of sensory information to allow the child to interact with the environment in a more adaptive fashion. Unusual sensory responses are common in children with ASDs, but there is not good evidence that these symptoms differentiate ASDs from other developmental disorders, and the efficacy of SI therapy has not been demonstrated objectively.[76–78] Available studies are plagued by methodologic limitations, but proponents of SI note that higher-quality SI research is forthcoming.[79] "Sensory" activities may be helpful as part of an overall program that uses desired sensory experiences to calm the child, reinforce a desired behavior, or help with transitions between activities.

Comparative Efficacy of Educational Interventions for Young Children

All treatments, including educational interventions, should be based on sound theoretical constructs, rigorous methodologies, and empirical studies of efficacy.[15] Proponents of behavior analytic approaches have been the most active in using scientific methods to evaluate their work, and most studies of comprehensive treatment programs that meet minimal scientific standards involve treatment of preschoolers using behavioral approaches.[16,38] However, there is still a need for additional research, including large controlled studies with randomization and assessment of treatment fidelity. Empirical scientific support for developmental models and other interventions is more limited, and well-controlled systematic studies of efficacy are needed.

Most educational programs available to young children with ASDs are based in their communities, and often, an "eclectic" treatment approach is used, which draws on a combination of methods including applied behavior analytic methods such as DTT; structured teaching procedures; speech-language therapy, with or without picture communication or related augmentative or alternative communication strategies; SI therapy; and typical preschool activities. Three studies that compared intensive ABA programs (25–40 hours/week) to equally intensive eclectic approaches have suggested that ABA programs were significantly more effective.[31,32,34] Another study that involved children with ASDs and global developmental delay/mental retardation retrospectively compared a less intensive ABA program (mean: 12 hours) to a comparably intensive eclectic approach and found statistically significant but clinically modest outcomes that favored those in the ABA group.[33] Although the groups of children were similar on key dependent measures before treatment began, these studies were limited because of parent-determined rather than random assignment to treatment group. Additional studies to evaluate and compare educational treatment approaches are warranted.

Programs for Older Children and Adolescents

Some model programs provide programming throughout childhood and into adulthood.[11] More commonly, the focus of specialized programs is on early childhood, and published research evaluating comprehensive educational programs for older children and adolescents with ASDs is lacking. However, there is empirical support for the use of certain educational strategies, particularly those that are based on ABA, across all age groups to increase and maintain desirable adaptive behaviors, reduce interfering maladaptive behaviors or narrow the conditions under which they occur, teach new skills, and generalize behaviors to new environments or situations.[13,21,28]

When children with ASDs move beyond preschool and early elementary programs, educational intervention continues to involve assessment of existing skills, formulation of individualized goals and objectives, selection and implementation of appropriate intervention strategies and supports, assessment of progress, and adaptation of teaching strategies as necessary to enable students to acquire target skills. The focus on achieving social communication competence, emotional and be-

havioral regulation, and functional adaptive skills necessary for independence continues. Educational programs should be individualized to address the specific impairments and needed supports while capitalizing on the child's assets rather than being based on a particular diagnostic label.

Specific goals and objectives and the supports that are required to achieve them are listed in a child's individualized education plan and should be the driving force behind decisions regarding the most appropriate, least restrictive classroom placement. Appropriate settings may range from self-contained special education classrooms to full inclusion in regular classrooms. Often, a mix of specialized and inclusive experience is appropriate. Even highly functioning students with ASDs often require accommodations and other supports such as provision of explicit directions, modification of classroom and homework assignments, organizational supports, access to a computer and word-processing software for writing tasks, and social communication skills training. When a paraprofessional aide is assigned, it is important that there be an infrastructure of expertise and support for the child beyond the immediate presence of the aide.[80] The specific duties of the aide should be outlined, the strategies to be used should be defined, and the aide should receive adequate training.

In adolescence, the term "transition" is used to describe the movement from child-centered activities to adult-oriented activities. The major transitions are from the school environment to the workplace and from home to community living. In schools, transition-planning activities may begin at as early as 14 years of age, and by 16 years of age, the individualized education plan should include an individualized transition plan. The emphasis may shift from academic to vocational services and from remediating deficits to fostering abilities. A vocational assessment is often conducted to evaluate the adolescent's interests and strengths and to determine the services and supports needed to promote independence in the workplace and in the community. Comprehensive transition planning involves the student, parents, teachers, the medical home, and representatives from all concerned community agencies. Depending on the individual's cognitive level, social skills, health condition, work habits, and behavioral challenges, preparation for competitive, supported, or sheltered employment is targeted. Regardless of the type of employment, attention to skill development should never stop. Skills necessary for independent living should be taught to the degree possible given the abilities of the person. Sexuality education instruction should be included, and there is a growing body of literature that has addressed the topic.[81–83]

MEDICAL MANAGEMENT

Children with ASDs have the same basic health care needs as children without disabilities and benefit from the same health-promotion and disease-prevention activities, including immunizations. In addition, they may have unique health care needs that relate to underlying etiologic conditions, such as fragile X syndrome or tuberous sclerosis, or to other conditions, such as epilepsy, that often are associated with ASDs. Those with pica or persistent mouthing of fingers or objects should be monitored for elevated blood lead concentrations, particularly if the history suggests potential for environmental exposure.[84] These health care needs are most appropriately met within the context of a medical home.[85,86]

To deliver appropriate and effective medical care, the history, approach to the patient, physical evaluation, and treatment options must be considered in the context of the patient's ASD.[87,88] Familiarizing the patient with the office setting and staff, allowing ample time while talking before touching the patient, allowing the child to manipulate instruments and materials, keeping instructions simple, using visual cues and supports, slowing down the pace, exaggerating social cues, and having family and/or familiar staff available may be helpful in reducing the obstacles to health care provision presented by patients' difficulties with social interaction, communication, and accepting novelty.[88] Often, more time is required for outpatient appointments. In a nationally representative sample, it was found that children with ASDs spent twice as much time with the physician per outpatient visit compared with children in control groups.[89]

Associated Morbidity and Mortality

Health care utilization and costs are substantially higher for children and adolescents with ASDs compared with children without ASDs,[89–91] and available data suggest that mortality is increased as well (standardized mortality ratio: 2.4–2.6).[92,93] The increased mortality in ASDs is thought to be largely, but not completely, accounted for by the increased mortality associated with mental retardation and epilepsy. Cases of suicide in higher-functioning individuals have been reported.[6]

Seizures

The reported prevalence of epilepsy among people with ASDs ranges from 11% to 39%.[94] Comorbid severe global developmental delay/mental retardation and motor deficits are associated with a high prevalence of seizures (42%),[95] whereas the prevalence of seizures is only 6% to 8% in children with ASDs without severe mental retardation, a motor deficit, an associated etiologic medical disorder, or a positive family history of epilepsy.[95,96] The prevalence of epilepsy also was higher in studies that included adolescents and young adults, because the onset of epilepsy in ASDs has 2 peaks: 1 before 5 years of age and another in adolescence.[97] Anticonvulsant treatment in children with ASDs is based on the same criteria that are used for other children with

epilepsy, including accurate diagnosis of the particular seizure type.[98]

Epileptiform abnormalities on electroencephalography (EEG) are common in children with ASDs, with reported frequencies ranging from 10% to 72%.[99] Some studies have suggested that epileptiform abnormalities on EEG[100] and/or epilepsy[101] are more common in the subgroup of children with ASDs who have a history of regression, whereas other studies have not demonstrated this association.[102,103] Autistic regression with epileptiform abnormalities on EEG has been compared by analogy with Landau-Kleffner syndrome and electrical status epilepticus in sleep, but there are important differences between these conditions, and the treatment implications are unclear.[94,104] Whether subclinical seizures have adverse effects on language, cognition, and behavior is debated, and there is no evidence-based recommendation for the treatment of children with ASDs and epileptiform abnormalities on EEG, with or without regression.[104] Universal screening of patients with ASDs by EEG in the absence of a clinical indication is not currently supported.[2,99] However, because of the increased prevalence of seizures in this population, a high index of clinical suspicion should be maintained, and EEG should be considered when there are clinical spells that might represent seizures.

Gastrointestinal Problems

The relationship between gastrointestinal problems and ASDs is unclear, because most studies have not examined representative groups of children with ASDs compared with appropriate controls.[105,106] Surveys published in the gastroenterology literature have stated that gastrointestinal problems, such as chronic constipation or diarrhea, occur in 46% to 85% of children with ASDs.[107–109] Lower rates in the range of 17% to 24% have been reported in other population-based studies,[110–112] and a nested case-control study in the United Kingdom found that only 9% of children with ASDs and the same percentage of controls had a history of gastrointestinal complaints.[113] However, in a recent cross-sectional study that used structured interviews and matched control groups, a lifetime history of gastrointestinal symptoms (including abnormal stool pattern, frequent constipation, frequent vomiting, and frequent abdominal pain) was elicited in 70% of the children with ASDs, compared with 42% of the children with other developmental disabilities ($P = .03$) and 28% of the children without developmental disabilities ($P < .001$).[114]

In children with ASDs undergoing endoscopy, who may or may not be representative of the general population of children with ASDs, high rates of lymphoid nodular hyperplasia and, often, histologically subtle esophagitis, gastritis, duodenitis, and colitis have been described, and preliminary evidence suggests that some immunohistochemical features may be unique to inflammation associated with ASDs.[105,115,116] The existing literature does not support routine specialized gastroenterological testing for asymptomatic children with ASDs.[105] However, if a child with an ASD presents with symptoms such as chronic or recurrent abdominal pain, vomiting, diarrhea, or constipation, it is reasonable to evaluate the gastrointestinal tract. Occult gastrointestinal discomfort also should be considered in a child who presents with a change in behavior, such as outbursts of aggression or self-injury. Radiographic evidence of constipation has been found to be more common in children with ASDs than in controls with abdominal pain (36% vs 10%),[117] and effective management may provide global benefit.

Sleep Disturbance

Sleep problems are common in children and adolescents with ASDs at all levels of cognitive functioning.[118–122] Sleep problems correlate with family distress and may have significant effects on daytime functioning and quality of life of children with ASDs.[123–125] In some cases, there may be an identifiable etiology such as obstructive sleep apnea or gastroesophageal reflux; assessment and treatment are guided by history and physical examination. When there is not an identifiable medical cause, behavioral interventions including sleep-hygiene measures, restriction of daytime sleep, positive bedtime routines, and extinction procedures often are effective.[118,126–129]

Relatively little empirical information is available regarding pharmacologic management of sleep problems in children with ASDs or other developmental disabilities. Recommendations typically are based on case reports and open-label trials, extrapolation from the adult literature, and expert consensus (Table 1).[128] There is some evidence of abnormality of melatonin regulation in children with ASDs,[125,130] and melatonin may be effective for improving sleep onset in children with ASDs as well as children with other developmental disabilities[131–134] and otherwise healthy children with sleep/wake disorders.[135] A recent open-label study suggested that controlled-release melatonin improved sleep in a group of 25 children with ASDs and that treatment gains were maintained at 1- and 2-year follow-up,[136] but randomized, double-blind, placebo-controlled studies are needed. Recently, a child and a young adult with ASDs with significant insomnia were reported to have responded well, with no apparent adverse effects, to open-label treatment with the high-affinity melatonin receptor agonist ramelteon.[137] Antihistamines, α_2-agonists, benzodiazepines, chloral hydrate, trazodone, and newer nonbenzodiazepine hypnotic agents, such as zolpidem and zaleplon, sometimes are used to treat pediatric insomnia.[128] In some cases, other conditions or symptoms, such as epilepsy, depression, anxiety, or aggressive outbursts, warrant pharmacologic treatment, and an agent that also may assist with sleep can be chosen.[118]

TABLE 1 **Selected Potential Medication Options for Common Target Symptoms or Coexisting Diagnoses in Children With ASDs**

Target Symptom Cluster	Potential Coexisting Diagnoses	Selected Medication Considerations	Selected References
Repetitive behavior, behavioral rigidity, obsessive-compulsive symptoms	Obsessive-compulsive disorder, stereotypic movement disorder	SSRIs (fluoxetine,[a] fluvoxamine,[a] citalopram, escitalopram, paroxetine, sertraline)	McDougle et al,[158,b] Buchsbaum et al,[180,b] Sugie et al,[159,b] Hollander et al,[157,b] Moore et al,[160,c] Namerow et al,[181,d] Owley et al[182,d]
		Atypical antipsychotic agents (risperidone,[a] aripiprazole, olanzapine, quetiapine, ziprasidone)	McDougle et al[164,b]
		Valproic acid[a]	Hollander et al[183,b]
Hyperactivity, impulsivity, inattention	Attention-deficit/hyperactivity disorder	Stimulants (methylphenidate,[a] dextroamphetamine, mixed amphetamine salts)	Quintana et al,[168,b] Handen et al,[169,b] RUPP Autism Network[170,b]
		α_2-agonists (clonidine,[a] guanfacine)	Fankhauser et al,[172,b] Jaselskis et al,[173,b] Posey et al,[175,d] Scahill et al (RUPP Autism Network)[174,d]
		Atomoxetine[a]	Arnold et al,[178,b] Jou et al,[176,d] Posey et al[177,d]
		Atypical antipsychotic agents (risperidone,[a] aripiprazole, olanzapine,[a] quetiapine, ziprasidone)	McCracken et al,[162,b] Arnold et al,[163,b] Shea et al,[165,b] RUPP Autism Network,[166,b] Troost et al[167,d]
Aggression, explosive outbursts, self-injury	Intermittent explosive disorder	Atypical antipsychotic agents (risperidone,[a] aripiprazole, olanzapine, quetiapine, ziprasidone)	McCracken et al,[162,b] Arnold et al,[163,b] Shea et al,[165,b] RUPP Autism Network,[166,b] Troost et al[167,d]
		α_2-agonists (clonidine,[a] guanfacine)	Fankhauser et al,[172,b] Jaselskis et al,[173,b] Posey et al[175,d]
		Anticonvulsant mood stabilizers (levetiracetam, topiramate, valproic acid)	Hollander et al[184,d], Rugino and Samsock[185,d], Hardan et al[186,d], Myers[148,c], Myers and Challman[149,c]
		SSRIs (fluoxetine,[a] fluvoxamine,[a] citalopram, escitalopram, paroxetine, sertraline)	McDougle et al,[158,b] Moore et al,[160,c] Namerow et al,[181,d] Owley et al[182,d]
		β-blockers (propranolol, nadolol, metoprolol, pindolol)	Connor et al,[187,d] Ratey et al,[188,d] Myers and Challman[149,c]
Sleep dysfunction	Circadian rhythm sleep disorder, dyssomnia–not otherwise specified	Melatonin	Giannotti et al,[136,d] Jan and Freeman,[131,c] Phillips and Appleton,[133,c] Turk,[134,c] Owens et al[128,c]
		Ramelteon	Stigler et al[137,e]
		Antihistamines (diphenhydramine, hydroxyzine)	Reed and Findling,[189,c] Owens et al[128,c]
		α_2-agonists (clonidine, guanfacine)	Mehta et al,[190,d] Ingrassia and Turk,[191,d] Posey et al,[175,d] Owens et al[128,c]
		Mirtazapine	Posey et al[192,d]
Anxiety	Generalized anxiety disorder, anxiety disorder–not otherwise specified	SSRIs (fluoxetine,[a] fluvoxamine,[a] citalopram, escitalopram, paroxetine, sertraline)	McDougle et al,[158,b] Buchsbaum et al,[180,b] Sugie et al,[159,b] Hollander et al,[157,b] Moore et al,[160,c] Namerow et al,[181,d] Owley et al[182,d]
		Buspirone	Buitelaar et al[193,d]
		Mirtazapine	Posey et al[192,d]
Depressive phenotype (marked change from baseline including symptoms such as social withdrawal, irritability, sadness or crying spells, decreased energy, anorexia, weight loss, sleep dysfunction)	Major depressive disorder, depressive disorder–not otherwise specified	SSRIs (fluoxetine,[a] fluvoxamine,[a] citalopram, escitalopram, paroxetine, sertraline)	McDougle et al,[158,b] Moore et al,[160,c] Namerow et al,[181,d] Owley et al[182,d]
		Mirtazapine	Posey et al[192,d]

Evaluation of Challenging Behaviors

Problematic emotional reactions and behaviors such as aggression and self-injury are common in children and adolescents with ASDs. In some cases, medical factors may cause or exacerbate maladaptive behaviors, and recognition and treatment of medical conditions may eliminate the need for psychopharmacologic agents. For example, in the case of an acute onset or exacerbation of aggressive or self-injurious behavior, a source of pain or discomfort may be identified and treated.[138] Sources of discomfort may include otitis media, otitis externa, pharyngitis, sinusitis, dental abscess, constipation, urinary

TABLE 1 **Continued**

Target Symptom Cluster	Potential Coexisting Diagnoses	Selected Medication Considerations	Selected References
Bipolar phenotype (behavioral cycling with rages and euphoria, decreased need for sleep, manic-like hyperactivity, irritability, aggression, self-injury, sexual behaviors)	Bipolar I disorder, bipolar disorder–not otherwise specified	Anticonvulsant mood stabilizers (carbamazepine, gabapentin, lamotrigine, oxcarbazepine, topiramate, valproic acid)	Kowatch and DelBello,[194,c] Myers and Challman[149,c]
		Atypical antipsychotic agents (risperidone, aripiprazole, olanzapine, quetiapine, ziprasidone)	Cheng-Shannon et al,[195,c] Kowatch and DelBello,[194,c] Myers,[148,c] Myers and Challman[149,c]
		Lithium	DeLong,[196,e] Kerbeshian et al,[197,e] Steingard and Biederman,[198,e] Myers,[148,c] Myers and Challman[149,c]

RUPP indicates Research Units on Pediatric Psychopharmacology.

[a] At least 1 published double-blind, placebo-controlled trial supports use in patients with an ASD.

[b] Double-blind, placebo-controlled trial.

[c] Review article.

[d] Open-label trial or retrospective chart study.

[e] Case report.

tract infection, fracture, headache, esophagitis, gastritis, colitis, allergic rhinitis, and others. When behavioral deterioration is temporally related to menstrual cycles in an adolescent female,[139] use of an analgesic or oral or injectable contraceptive may be helpful. Obstructive sleep apnea may contribute to behavioral deterioration and may be amenable to weight reduction, tonsillectomy and adenoidectomy, or continuous positive airway pressure.[140] Extreme food selectivity has the potential to lead to protein-calorie malnutrition or specific vitamin or mineral deficiencies; however, most studies that evaluated nutritional status in children with ASDs have suggested that despite dietary selectivity, malnutrition is uncommon.[105,141] Although the prevalence in children with ASDs is unknown, pica related to iron or zinc deficiency may respond to supplementation with the appropriate mineral. It should be noted that it is not clear how frequently medical factors cause or exacerbate serious maladaptive behaviors in children with ASDs, and the efficacy of these interventions is based on anecdotes, case reports, and conventional clinical practice rather than empirical support from clinical trials.

It is also important to consider environmental factors that may precipitate challenging behaviors. Parents, teachers, or other caregivers may inadvertently reinforce maladaptive behaviors, and in such cases, the most appropriate and effective interventions are behavioral. In some instances, a mismatch between educational or behavioral expectations and cognitive ability of the child is responsible for disruptive behavior (eg, when the diagnosis of mental retardation has not been recognized), and adjustment of expectations is the most appropriate intervention. In both situations, a functional analysis of behavior, completed by a behavior specialist in the settings in which the problems occur, will identify factors in the environment that exacerbate or maintain the problematic behavior. A strategy for intervention through behavioral techniques and environmental manipulations can then be formulated and tested.

Psychopharmacology

Pharmacologic interventions may be considered for maladaptive behaviors such as aggression, self-injurious behavior, repetitive behaviors (eg, perseveration, obsessions, compulsions, and stereotypic movements), sleep disturbance, mood lability, irritability, anxiety, hyperactivity, inattention, destructive behavior, or other disruptive behaviors. After treatable medical causes and modifiable environmental factors have been ruled out, a therapeutic trial of medication may be considered if the behavioral symptoms cause significant impairment in functioning and are suboptimally responsive to behavioral interventions. In some cases, the diagnosis of a comorbid disorder, such as major depression, bipolar disorder, or an anxiety disorder, can be made reasonably and the patient can be treated with medications that are useful for treating these conditions in otherwise typically developing children and adolescents. Modifications of diagnostic criteria may be necessary to account for clinical presentations of psychiatric conditions in individuals with developmental disabilities,[142,143] and tools such as behavior checklists[144] and structured interviews[145] may be helpful. In other cases, clinicians opt to target specific interfering maladaptive behaviors or symptom clusters in the absence of a clear comorbid psychiatric diagnosis (a target-symptom approach).[146–151]

Recent surveys indicate that approximately 45% of children and adolescents[152–154] and up to 75% of adults[8,155] with ASDs are treated with psychotropic medication. Greater age, lower adaptive skills and social competence, and higher levels of challenging behavior are associated with the likelihood of medication use.[154] The evidence regarding the efficacy of psychopharmacologic interventions in patients with ASDs has been de-

tailed in recent reviews.[148,150,151,156] Although most psychotropic medications have been used in children with ASDs, there is currently insufficient literature to establish consensus regarding an evidence-based approach to pharmacologic management. However, in recent years, there has been an increase in publication of randomized, double-blind, placebo-controlled clinical trials to guide clinical practice.

Surveys performed in the United States suggest that selective serotonin-reuptake inhibitors (SSRIs), atypical antipsychotic agents, stimulants, and α_2-adrenergic agonist antihypertensive agents are the most commonly prescribed classes of psychotropic medications for children with ASDs.[152,153] Double-blind, placebo-controlled trials have demonstrated efficacy of the SSRIs fluoxetine[157] and fluvoxamine[158,159] in the treatment of repetitive and other maladaptive behaviors in patients with ASDs, and open-label trials of these and other SSRIs have shown improvements in target symptoms, including repetitive behaviors, irritability, depressive symptoms, tantrums, anxiety, aggression, difficulty with transitions, and aspects of social interaction and language.[157–161] Potential adverse effects of SSRIs include but are not limited to nausea, drowsiness, sexual dysfunction, constipation, abdominal discomfort, fatigue, headache, dizziness, dry mouth, agitation, behavioral activation, hypomania or mania, apathy, suicidal ideation, and alteration of sleep.

Risperidone has become the first medication with US Food and Drug Administration–approved labeling for the symptomatic treatment of irritability (including aggressive behavior, deliberate self-injury, and temper tantrums) in children and adolescents with ASDs. Two large, multisite, randomized, controlled trials have confirmed the short-term efficacy of risperidone for these severe disruptive behaviors in youth with ASDs,[162–165] and 2 open-label studies, each with a double-blind discontinuation component, have suggested long-term benefits and tolerance.[166,167] Potential adverse effects include but are not limited to excessive appetite and weight gain, insulin resistance, dyslipidemia, hyperprolactinemia, extrapyramidal symptoms, tardive dyskinesia, neuroleptic malignant syndrome, QTc prolongation, dry mouth, urinary retention, constipation, seizures, hematologic abnormalities, and sedation.

Although early studies of the effects of stimulants yielded negative results, recent double-blind, placebo-controlled trials of methylphenidate have demonstrated improvement in hyperactivity, impulsivity, and inattention in children with ASDs.[168–170] Methylphenidate is effective in some children with ASDs, but the response rate is lower than that in children with isolated attention-deficit/hyperactivity disorder, adverse effects are more frequent, and it is unclear whether the results can be generalized to other stimulants.[170,171] Potential adverse effects of stimulant medications include but are not limited to appetite reduction, inhibition of growth, delayed sleep onset, jitteriness, exacerbation of tics, abdominal discomfort, increased blood pressure, increased heart rate, irritability, increased anxiety, and repetitive behaviors.

Two small double-blind, placebo-controlled trials have documented modest benefits of clonidine in reducing hyperarousal symptoms including hyperactivity, irritability and outbursts, impulsivity, and repetitive behaviors in children with ASDs.[172,173] A prospective open-label trial[174] and a retrospective record review[175] have suggested that guanfacine was similarly effective in some patients. Potential adverse effects of these centrally acting α_2-agonists include but are not limited to drowsiness, sedation, dry mouth, decreased blood pressure, dizziness, constipation, and irritability, and these drugs can be dangerous in overdose. Recently, a retrospective study,[176] an open-label trial,[177] and a small double-blind, placebo-controlled crossover trial[178] suggested that atomoxetine may be effective for attention-deficit/hyperactivity disorder–like symptoms in children and adolescents with ASDs, and additional research is warranted. Appetite suppression, nausea, fatigue, mood swings, suicidal ideation, dizziness, and liver injury are among the potential adverse effects of atomoxetine.

A summary of selected target symptoms, potential psychiatric diagnoses, and medication options is provided in Table 1. Pediatricians and other practitioners should only prescribe medications with which they have sufficient expertise, including knowledge of indications and contraindications, dosing, potential adverse effects, drug-drug interactions, and monitoring requirements. It will be important for future research to address the need for more rigorous evaluation of safety and efficacy of psychotropic agents in children with ASDs; the value of combining behavioral and medical interventions; the practice of polypharmacy; delineation of clinical and biological subgroups of patients who may be responsive to particular treatments; the role of drugs in treating deficits in language and nonlanguage cognition, social interaction, and behavioral rigidity; and the potential to alter the neural substrate during early critical periods to affect brain development and future function. Several multisite trials are underway, and others undoubtedly will be forthcoming.[179]

Principles to guide the approach to psychopharmacologic management of ASDs in clinical practice have been proposed by several authors in recent years, and an approach is outlined in Table 2.[148–151] When medications are used, potential benefits and adverse effects should be explained, informed consent should be obtained, baseline data regarding behaviors and somatic complaints should be collected, and potential strategies for dealing with treatment failure or partial response should be reviewed. It is important to have some quantifiable means of assessing the efficacy of the medication and to

TABLE 2 **Clinical Approach to Psychopharmacologic Management**

- Identify and assess target behaviors
  - Parent/caregiver interview
    - Intensity
    - Duration
    - Exacerbating factors/triggers (time, setting/location, demand situations, denials, transitions, etc)
    - Ameliorating factors and response to behavioral interventions
    - Time trends (increasing, decreasing, stable)
    - Degree of interference with functioning
  - Consider baseline behavior-rating scales and/or baseline performance measures/direct observational data
  - Include input from school staff and other caregivers
- Assess existing and available supports
  - Behavioral services and supports
  - Educational program, habilitative therapies
  - Respite care, family psychosocial supports
- Search for medical factors that may be causing or exacerbating target behavior(s)
  - Consider sources of pain or discomfort (infectious, gastrointestinal, dental, allergic, etc)
  - Consider other medical causes or contributors (sleep disorders, seizures, menstrual cycle, etc)
- Complete any medical tests that may have a bearing on treatment choice
- Consider psychotropic medication on the basis of the presence of
  - Evidence that the target symptoms are interfering substantially with learning/academic progress, socialization, health/safety (of the patient and/or others around him or her), or quality of life
  - Suboptimal response to available behavioral interventions and environmental modifications
  - Research evidence that the target behavioral symptoms or coexisting psychiatric diagnoses are amenable to pharmacologic intervention
- Choose a medication on the basis of
  - Likely efficacy for the specific target symptoms
  - Potential adverse effects
  - Practical considerations such as formulations available, dosing schedule, cost, and requirement for laboratory or electrocardiographic monitoring
  - Informed consent (verbal or written) from parent/guardian and, when possible, assent from the patient
- Establish plan for monitoring of effects
  - Identify outcome measures
  - Discuss time course of expected effects
  - Arrange follow-up telephone contact, completion of rating scales, reassessment of behavioral data, and visits accordingly
  - Outline a plan regarding what might be tried next if there is a negative or suboptimal response or to address additional target symptoms
    - Change to a different medication
    - Add another medication to augment a partial or suboptimal therapeutic response to the initial medication (same target symptoms)
    - Add a different medication to address additional target symptoms that remain problematic
  - Obtain baseline laboratory data if necessary for the drug being prescribed and plan appropriate follow-up monitoring
- Explore the reasonable dose range for a single medication for an adequate length of time before changing to or adding a different medication
- Monitor for adverse effects systematically
- Consider careful withdrawal of the medication after 6–12 mo of therapy to determine whether it is still needed

Adapted from Myers SM. The status of pharmacotherapy for autism spectrum disorders. *Expert Opin Pharmacother*. 2007;8:1579–1603; and Myers SM, Challman TD. Psychopharmacology: an approach to management in autism and intellectual disabilities. In: Accardo PJ, ed. *Capute & Accardo's Neurodevelopmental Disabilities in Infancy and Childhood*. 3rd ed. Baltimore, MD: Paul H. Brookes; 2007: In press.

obtain input from a variety of sources, such as parents, teachers, therapists, and aides. Consistent use of validated, treatment-sensitive rating scales and medication adverse-effect scales is desirable. A wide variety of outcome measures have been used in research trials and in clinical practice to measure maladaptive behavior treatment effects.[199] Among the most common are the Clinical Global Impression Scale, Aberrant Behavior Checklist, and Nisonger Child Behavior Rating Form.

Complementary and Alternative Medicine

Complementary and alternative medicine (CAM) is defined by the National Center for Complementary and Alternative Medicine as "a group of diverse medical and health care systems, practices, and products that are not presently considered to be part of conventional medicine."[200] The definition of CAM adopted by the Cochrane Collaboration is "a broad domain of healing resources that encompasses all health systems, modalities, and practices and their accompanying theories and beliefs, other than those intrinsic to the politically dominant health systems of a particular society or culture in a given historical period."[201] Detailed reviews of CAM as related to developmental disabilities and ASD-specific CAM have been published recently.[202–204]

Use of CAM is common in children with ASDs.[152,205–207] Levy et al[206] reported that by the time their clinical population received a formal diagnostic evaluation for a suspected ASD, almost one third of the children already had received a complementary or alternative therapy, and a survey conducted in a predominantly white, middle-to-upper socioeconomic-status private-practice population found that 92% of parents who responded had used CAM therapies for their children with ASDs.[205]

Another recent parent survey found that 52% of the children with an ASD had been treated with at least 1 CAM therapy, compared with 28% of a group of control children without disabilities.[207] Surveys indicate that only 36% to 62% of caregivers who used CAM therapies for their children with ASDs had informed the child's primary care physician,[207,208] although more information on CAM is something that families indicate that they want from their child's primary health care professionals.[209]

It is important that health care professionals understand how to evaluate the evidence used to support all treatments, including CAM, psychopharmacologic, and other interventions. Ideally, the evidence supporting or refuting a treatment should include peer-reviewed studies with appropriately diagnosed, well-defined homogeneous study populations; a randomized, double-blind, placebo-controlled design; an adequate sample size to support the statistical analysis presented; control for confounding factors; and use of appropriate, validated outcome measures. When evaluating the efficacy of studies, it is particularly important to keep in mind confounding factors, such as the placebo effect, and the natural history of the disorder. Participation in a study may alter the way a parent interacts with a child and confound the perceived outcome,[210] and improvements are expected with maturation and educational interventions. Only appropriately controlled studies are helpful in proving that an effect is attributable to the intervention being studied.

The practitioner should encourage families to seek additional information when they encounter the following claims or situations[211]:

- treatments that are based on overly simplified scientific theories;
- therapies that are claimed to be effective for multiple different, unrelated conditions or symptoms;
- claims that children will respond dramatically and some will be cured;
- use of case reports or anecdotal data rather than carefully designed studies to support claims for treatment;
- lack of peer-reviewed references or denial of the need for controlled studies; or
- treatments that are said to have no potential or reported adverse effects.

To help to describe their proposed rationales and mechanisms, CAM therapies used to treat ASDs have been categorized as "nonbiological" or "biological."[204] Examples of nonbiological interventions include treatments such as auditory integration training, behavioral optometry, craniosacral manipulation, dolphin-assisted therapy, music therapy, and facilitated communication. Examples of biological therapies include immunoregulatory interventions (eg, dietary restriction of food allergens or administration of immunoglobulin or antiviral agents), detoxification therapies (eg, chelation), gastrointestinal treatments (eg, digestive enzymes, antifungal agents, probiotics, "yeast-free diet," gluten/casein-free diet, and vancomycin), and dietary supplement regimens that are purported to act by modulating neurotransmission or through immune factors or epigenetic mechanisms (eg, vitamin A, vitamin C, vitamin B_6 and magnesium, folic acid, folinic acid, vitamin B_{12}, dimethylglycine and trimethylglycine, carnosine, omega-3 fatty acids, inositol, various minerals, and others).[203,204]

For most of the aforementioned CAM interventions, there is not enough scientific evidence yet to support or refute their use as treatment for ASDs. However, evaluation of treatments is possible, and a few CAM treatments have been appropriately studied. For example, more than a dozen randomized, double-blind, placebo-controlled trials involving more than 700 patients have demonstrated that secretin (a biological treatment) is not an effective treatment for ASDs.[212,213] Evaluation of nonbiological treatments also is feasible. This has been demonstrated in the case of facilitated communication, a technique that uses a trained facilitator to provide physical support to a nonverbal person's hand or arm while that person uses a computer keyboard or other device to spell. Evidence suggests that the communications produced actually originate from the facilitator[214,215] and that facilitated communication is not a valid treatment for ASDs.[216–218]

Because of methodologic flaws, insufficient numbers of patients, or lack of replication, many CAM therapies have been inadequately evaluated; therefore, evidence-based recommendations for their use are not possible. The most recent and most appropriately designed trials have demonstrated no significant benefit of dimethylglycine,[219,220] vitamin B_6 and magnesium,[221,222] or auditory integration training.[223–225] Both positive[226] and negative[227,228] results have been described for small, methodologically flawed studies of intravenous immunoglobulin. A recent double-blind, placebo-controlled trial revealed no statistically significant differences on Aberrant Behavior Checklist subscale scores between small groups of children with ASDs who were given omega-3 fatty acids and those who were given placebo.[229] However, the investigators noted a trend toward superiority of omega-3 fatty acids over placebo for hyperactivity, which suggests that further investigation may be warranted.[229] The gluten/casein-free diet is based on a hypothesis of abnormal gut permeability and exogenous opiate excess. Although use of the gluten/casein-free diet for children with ASDs is popular, there is little evidence to support or refute this intervention, and reviewers have determined that meaningful conclusions cannot be drawn from the existing literature.[230,231] Subsequent to these reviews, a randomized, double-blind

pilot study demonstrated no significant benefit.[232] Double-blind, placebo-controlled elimination and challenge studies are in progress, and it is anticipated that these studies will provide substantially more useful information regarding the efficacy of the gluten/casein-free diet.[204,230] Measurement of urinary peptides has not been proven to be clinically useful as a marker for ASDs or as a tool to determine if dietary restriction is warranted or would be effective.

Many popular interventions, such as chelation of heavy metals, antifungal agents to decrease presumed yeast overgrowth, and antiviral agents to modulate the immune system, have not yet been studied in people with ASDs; their popularity is based on unproven theories and anecdotes or case reports. None of these interventions can be endorsed as treatment for ASDs outside of well-designed and appropriately monitored clinical trials. Some treatments, such as intravenous chelation, may be particularly dangerous and should be discouraged. One child with autism died as a result of chelation with edetate disodium (Na_2EDTA) despite the facts that a causal association between mercury and ASDs has not been demonstrated, there is no scientific evidence that chelation is an effective treatment for ASDs, and the effectiveness of chelation therapy to improve nervous system symptoms of chronic mercury toxicity has not been established.[233] Unless there is clear evidence of current heavy metal toxicity, chelation by any method is not indicated outside of monitored clinical trials.

In some cases, interesting findings await replication or further investigation. For example, in a double-blind, placebo-controlled trial of vitamin C, improvement was found in total and sensory motor scores on the Ritvo-Freeman Real Life Rating Scale,[234] and several small studies have suggested that music therapy had some short-term benefit on communication skills but not on behavior problems of children with ASDs.[235] Recently, a group of 20 children with ASDs were compared with children without ASDs and found to have an imbalance of methionine and homocysteine metabolism, which was interpreted to represent impaired capacity for methylation and increased oxidative stress.[236] Treatment with trimethylglycine, folinic acid, and methylcobalamin resulted in normalization of laboratory findings. The study did not measure clinical response to the intervention, but anecdotal improvements were noted. Interpretation of these preliminary findings awaits further investigation.

Health care practitioners who diagnose and treat children with ASDs should recognize that many of their patients will use nonstandard therapies. The importance of becoming knowledgeable about CAM therapies, inquiring about current and past CAM use, providing balanced information and advice about treatment options, identifying risks or potential harmful effects, avoiding becoming defensive or dismissing CAM in ways that convey a lack of sensitivity or concern, maintaining open communication, and continuing to work with families even if there is disagreement about treatment choices has been emphasized.[237] It also is essential to critically evaluate the scientific merits of specific therapies and share this information with families, educate families about how to evaluate information and recognize pseudoscience, and insist that studies that examine CAM be held to the same scientific and ethical standards as all clinical research.[202,238]

Parents of children with ASDs will understandably pursue interventions that they believe may present some hope of helping their child, particularly if the therapies are viewed as being unlikely to have any adverse effects. Unfortunately, families are often exposed to unsubstantiated, pseudoscientific theories and related clinical practices that are, at best, ineffective and, at worst, compete with validated treatments or lead to physical, emotional, or financial harm. Time, effort, and financial resources expended on ineffective therapies can create an additional burden on families. Health care professionals can help parents and other caregivers to distinguish empirically validated treatment approaches from treatments that have been proven to be ineffective and those that are unproven and potentially ineffective and/or harmful.

FAMILY SUPPORT

Management should focus not only on the child but also on the family. Although parents once were viewed erroneously as the cause of a child's ASD, it is now recognized that parents play a key role in effective treatment.[9] Having a child with an ASD has a substantial effect on a family. Parents and siblings of children with ASDs experience more stress and depression than those of children who are typically developing or even those who have other disabilities.[239–243] Supporting the family and ensuring its emotional and physical health is an extremely important aspect of overall management of ASDs.

Physicians and other health care professionals can provide support to parents by educating them about ASDs; providing anticipatory guidance; training and involving them as cotherapists; assisting them in obtaining access to resources; providing emotional support through traditional strategies such as empathetic listening and talking through problems; and assisting them in advocating for their child's or sibling's needs.[244] In some cases, referral of parents for counseling or other appropriate mental health services may be required. The need for support is longitudinal, although the specific needs may vary throughout the family life cycle.

One of the chief strategies for helping families raise children with ASDs is helping to provide them with access to needed ongoing supports and additional services during critical periods and/or crises. Natural supports include spouses, extended family members, neigh-

bors, religious institutions, and friends who can help with caregiving and who can provide psychological and emotional support. Informal supports include social networks of other families of children with ASDs and community agencies that provide training, respite, social events, and recreational activities. Formal supports include publicly funded, state-administrated programs such as early intervention, special education, vocational and residential/living services, respite services, Medicaid, in-home and community-based waiver services, Supplemental Security Income benefits, and other financial subsidies. The breadth and depth of services vary, even within the same state or region. Few services exist in many rural areas, and public programs may have long waiting lists.

Sibling support groups offer the opportunity to learn important information and skills while sharing experiences and connecting with other siblings of children with ASDs.[244] Although the research on support groups for siblings of children with disabilities is difficult to interpret because of study-design problems and inconsistent outcome effects on sibling adjustment, these groups generally have been evaluated positively by participating siblings and parents,[244] and there is some evidence of beneficial effects for siblings of children with ASDs.[245]

Because each state has organized its services and access mechanisms differently, physicians and families must learn their own state's unique rules to access supports by contacting the state or county offices of the states' Department of Health and Human Services or Mental Health and Mental Retardation or the state developmental disabilities organization. In addition, local parent advocacy organizations, national autism and related developmental disability organizations, early intervention administrators, and school district special education coordinators often are knowledgeable about various programs and their respective eligibility requirements.

CONCLUSIONS

ASDs are chronic conditions that affect nearly 1 of every 150 children and require ongoing medical and nonmedical intervention. There is a growing body of evidence that supports the efficacy of certain interventions in ameliorating symptoms and enhancing functioning, but much remains to be learned. In addition to their important roles in identifying ASDs through screening and surveillance, establishing the diagnosis, conducting an etiologic evaluation, and providing genetic counseling after a diagnosis is made,[2] pediatricians and other primary health care professionals are in a position to provide important longitudinal medical care and to support and educate families and guide them to empirically supported interventions for their children.

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RESOURCE FOR FAMILIES

American Academy of Pediatrics. *Autism: Caring for Children With Autism Spectrum Disorders: A Resource Toolkit for Clinicians*. Elk Grove Village, IL: American Academy of Pediatrics; 2007

American Academy of Pediatrics
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POLICY STATEMENT

Management of Pediatric Trauma

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

AMERICAN ACADEMY OF PEDIATRICS

Section on Orthopaedics, Committee on Pediatric Emergency Medicine, Section on Critical Care, Section on Surgery, Section on Transport Medicine, Committee on Pediatric Emergency Medicine

PEDIATRIC ORTHOPAEDIC SOCIETY OF NORTH AMERICA

ABSTRACT

Injury is the number 1 killer of children in the United States. In 2004, injury accounted for 59.5% of all deaths in children younger than 18 years. The financial burden to society of children who survive childhood injury with disability continues to be enormous. The entire process of managing childhood injury is complex and varies by region. Only the comprehensive cooperation of a broadly diverse group of people will have a significant effect on improving the care and outcome of injured children.

This statement has been endorsed by the American Association of Critical-Care Nurses, American College of Emergency Physicians, American College of Surgeons, American Pediatric Surgical Association, National Association of Children's Hospitals and Related Institutions, National Association of State EMS Officials, and Society of Critical Care Medicine.

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Key Words

pediatric, trauma, injury, children

Abbreviations

EMS—emergency medical services
EMSC—Emergency Medical Services for Children (Add words as needed)
PICU—pediatric intensive care unit

INTRODUCTION

Injury results in more deaths in children and adolescents than all other causes combined.[1] Deaths caused by injuries, intentional or unintentional, account for more years of potential life lost under the age of 18 years than do deaths attributable to sudden infant death syndrome, cancer, and infectious diseases combined. It is estimated that 1 in 4 children sustain an unintentional injury that requires medical care each year.[2] The cost of childhood injury in 1996 serves as an illustration for today.[3] In that year, unintentional childhood injuries resulted in an estimated $14 billion in lifetime medical spending, $1 billion in other resource costs, and $66 billion in present and future work losses. Survivors of childhood trauma may suffer lifelong disability and require long-term skilled care. Improving outcomes for the injured child requires an approach that recognizes childhood injury as a significant public health problem. Efforts should be made to improve injury-prevention programs, emergency medical care, and trauma systems for pediatric patients. Additional topics related to the injured child that can complement and enhance our understanding of pediatric trauma management are addressed in other publications from the American Academy of Pediatrics.[4–10] This policy statement provides an overview of the desired components of trauma care systems in meeting the unique needs of injured children.

This statement has been endorsed by the American Association of Critical-Care Nurses, American College of Emergency Physicians, American College of Surgeons, American Pediatric Surgical Association, National Association of Children's Hospitals and Related Institutions, National Association of State EMS Officials, and Society of Critical Care Medicine.

TRAUMA SYSTEMS

The pediatric trauma system functions best as part of the inclusive emergency medical services (EMS), trauma, and disaster response system for the region or state. The inclusive trauma system is defined as 1 in which all hospitals participate in the care of injured patients. The regional adult trauma center or centers and the regional pediatric trauma center or centers are the central components of a trauma system. As was noted in a 2006 Institute of Medicine report, within any given EMS or trauma system, it is likely that not all hospitals will be completely equipped with appropriate pediatric resuscitation equipment or medications.[11,12] The Institute of Medicine report used the word "uneven" to describe the status of pediatric emergency and trauma care in the United States. There may also be significant variability in pediatric training and experience among physicians and nurses who staff hospital emergency

departments.[13] When the trauma system extends over a large geographic area, the outlying hospitals of the system must be able to undertake the stabilization and initial management of injured children who present to the hospital. Optimally, each trauma system will also define for itself the age range of the pediatric patient on the basis of specific hospital and physician resources available.

Even in regions of the country with well-developed trauma systems, most children are treated in facilities with no trauma center designation.[14,15] When a regional pediatric referral center is available within the trauma system, the smallest, most severely injured children often are eventually transported to that facility.[14] Trauma system administrators should recognize that all hospitals with emergency departments may be required to evaluate and resuscitate injured children.[4,6,8] Ideally, physician and nursing coordinators for pediatric emergency medicine should be identified in each facility, with pediatric-specific policies, procedures, and guidelines for care established.[8,11] An example of such guidelines are the Emergency Medical Services for Children (EMSC) performance measures that have been developed to assess a state's operational capacity to provide pediatric emergency care.[16] These guidelines can assist policy makers and care providers in prehospital-based and hospital-based settings in delivering optimal pediatric care.

Protocols for triage, treatment, and transfer of victims of pediatric trauma are an important part of any trauma system. Standard transfer protocols are available from many states and regional systems. The quality of care that is provided within the system should be continuously evaluated by the trauma system administration through performance-improvement processes. Outcomes for pediatric trauma patients should be compared with available benchmarks, and information should be shared with specific providers so that an optimal environment for quality improvement in pediatric trauma care is promoted.

PREHOSPITAL PEDIATRIC TRAUMA CARE

Prehospital emergency care providers are often not as familiar with pediatric emergency management issues as they are with adult care[17] because of infrequent exposure of most EMS personnel to critically ill or injured children. This lack of experience is typically addressed by continuing education efforts for EMS personnel through established courses such as Pediatric Education for Prehospital Professionals,[18] Basic Trauma Life Support,[19] Prehospital Trauma Life Support,[20] or practical experience that is gained in children's hospitals. Pediatric readiness may also be facilitated by the presence of a pediatric emergency coordinator and advocate within each EMS system.[17] No matter how education is accomplished, mechanisms for knowledge and skill retention and continuous evaluation of performance are crucial for prehospital personnel. The method for maintaining skills may include continuous evaluation of performance. Direct feedback to the provider in the field is required in any trauma system to improve outcomes for injured children. There is a relative lack of data supporting the best practices for pediatric resuscitation in the field, including fluid administration, cervical spine stabilization, and airway management of children. Comprehensive support for research in pediatric trauma needs to come from regional, state, and national organizations. Examples of such support include the federally funded EMSC program, the American Pediatric Surgical Association Outcomes and Clinical Trials Center, and the Pediatric Emergency Care Applied Research Network.[21,22]

TRAUMA CENTERS

It has been shown that younger and more seriously injured children have better outcomes at a trauma center within a children's hospital or at a trauma center that integrates pediatric and adult trauma services.[14,23–26] The ability to provide a broad range of pediatric services, including the presence of physicians trained in pediatric emergency medicine, pediatric surgical specialists, pediatric anesthesiologists, and pediatric medical subspecialists, is important. Yet, the nationwide ability to provide around-the-clock trauma care may be in peril because of physician workforce shortages.[27] In particular, trauma care is increasingly unpopular because of lifestyle demands and inadequate reimbursement.[28]

Pediatric protocols for imaging and diagnostic testing[29] and a child-centered and family-centered environment for care[30] should be duplicated in trauma centers that are not part of children's hospitals whenever possible. Hospitals caring for pediatric trauma patients should have specific pain-management and sedation protocols and the ability to provide a full range of pediatric pain strategies for children, including systemic analgesics, regional and local pain control, anxiolysis, and distraction techniques. Pain management is critically important in managing trauma patients and transitioning them to rehabilitation.[9] Continuing education on trauma for hospital providers is important and is best accomplished by current verification in the American College of Surgeons Advanced Trauma Life Support course.[31]

Trauma centers may not have the resources to care for all of the injured children within their referral region at any given time. Thus, the most seriously injured children may need to be stabilized and transported to facilities with these resources. Hospitals that seek regional or state designation or verification through the American College of Surgeons verification process as a Pediatric Trauma Center are examples of facilities that have made an extraordinary effort to provide resources to care for injured children.

A well-equipped and staffed pediatric intensive care unit (PICU) is an essential component of a pediatric trauma center. Data demonstrate that the availability of PICU beds within a region may improve survival in pediatric trauma.[26] Pediatric critical care physicians, surgeons, and anesthesiologists who work together

and are trained in the care of the injured child are needed for optimal care of severely injured and unstable patients in the ICU. In addition to critically injured children, stable patients with the potential for deterioration may also require the specialized services of a PICU. Pediatric trauma care specialists, especially those with critical care training, are in short supply; thus, the nationwide delivery of pediatric trauma care is endangered.[32] PICUs offer a setting with the necessary monitoring devices, equipment, medications, and technology to support physiologic function and are staffed with professionals with the expertise to apply them to the pediatric patient. The presence of experienced PICU nursing and allied health care personnel support the environment necessary for frequent monitoring and assessment of injured children. Trauma care may continue on the inpatient unit once the child is stable and the probability of rapid deterioration is less likely.

Rehabilitation is another vital component of pediatric trauma care. Returning the child to full, age-appropriate function with the ability to reach his or her maximum adult potential is the ultimate goal after critical injury. Early rehabilitation is especially crucial for children who have sustained neurologic injuries. Physical, occupational, cognitive, speech, and play therapy, and psychological support are all essential elements of a comprehensive rehabilitation effort for the injured child and his or her family.

Trauma centers caring for children ideally will have active quality and performance improvement processes as an important component of the trauma service. In many trauma centers, quality improvement activities also include a focus on patient safety. Periodic review of trauma care by the providers of that care is the process that is most likely to improve patient outcomes in any hospital. Trauma care review is facilitated by a comprehensive trauma registry that has ties with national databases so that outcomes can be benchmarked for improved quality of care.

Pediatric trauma center personnel should be aware of reporting requirements for child abuse and neglect within their jurisdiction. Cooperation and collaboration with hospital-based child protection teams are essential for the management of cases of suspected abuse and neglect. The National Association of Children's Hospitals and Related Institutions has recently published guidelines for the establishment and management of hospital-based child protection teams.[33]

INJURY PREVENTION

Injury prevention is the cornerstone of any discussion concerning pediatric trauma. Injury prevention initiatives work.[34,35] However, these initiatives are not promoted equally across the board, often because of limited resources. There are methods to identify and refine the approach to injury prevention initiatives that are specific for the region.[36] Every provider can contribute to injury prevention by documenting not only the nature of the injury but also the circumstances and antecedents as well. EMS systems, emergency departments, hospitals, and trauma centers should support and participate in data collection that promotes an understanding of the causes of injury (such as the use of external cause-of-injury codes or, if selected, participation in the National Electronic Injury Surveillance System [NEISS]) and should incorporate injury-prevention activities into staff and patient education and community-based intervention programs.

RECOMMENDATIONS

- The unique needs of injured children need to be integrated specifically into trauma systems and emergency and disaster planning in every state and region.
- Pediatric surgical specialists and pediatric medical subspecialists should participate at all levels of planning for trauma, emergency, and disaster care.
- Every state should identify appropriate facilities with the resources to care for injured children and establish continuous monitoring processes for care delivered to injured children. Ensuring that the appropriate resources are available is especially important for the youngest and most severely injured children.
- All potential providers of pediatric emergency and trauma care should be familiar with their regional trauma system and be able to evaluate, stabilize, and transfer acutely injured children.
- Although qualified pediatric critical care transport teams should be used when available in the interfacility transport of critically injured children, evaluation and management should begin with the care providers at the first point of entry into the trauma system.
- Every pediatric and emergency care-related health professional credentialing and certification body should define pediatric emergency and trauma care competencies and require practitioners to receive the appropriate level of initial and continuing education to achieve and maintain those competencies.
- Efforts to define and maintain pediatric care competencies should target both out-of-hospital and hospital-based care providers.
- Evidence-based protocols for management of the injured child should be developed for every aspect of care, from prehospital to postdischarge.
- Research, including data collection for best practices in isolated trauma and mass-casualty events, should be supported.
- Pediatric injury management should include an integrated public health approach, from prevention through prehospital care, to emergency and acute hospital care, to rehabilitation and long-term follow-up.
- National organizations with a special interest in pediatric trauma should collaborate to advocate for a

higher and more consistent quality of care within the nation.

- National organizations with a special interest in pediatric trauma should collaborate to advocate for injury-prevention research and application of known prevention strategies into practice.
- State and federal financial support for trauma system development and maintenance must be provided.
- Steps should be taken to increase the number of trainees in specialties that care for injured children to address key subspecialty service shortages in pediatric trauma care. Strategies should include increased funding for graduate medical education and appropriate reimbursement for trauma specialists.

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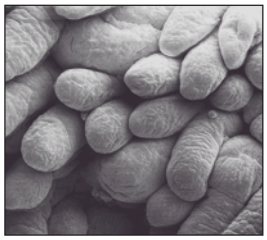
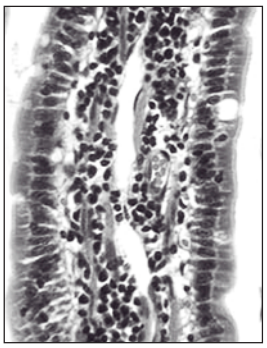
Oral Rehydration, Maintenance, and Nutritional Therapy





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On the Cover: Clockwise from left, 1) scanning electronic micrograph of intestinal villi; 2) an Egyptian child receives oral rehydration (photograph courtesy of Norbert Hirschhorn, M.D., Yale School of Medicine); 3) package of oral rehydration salts; and 4) photomicrograph of intestinal villus (photograph courtesy of Alberti Lamberti, Ph.D., Temple University).

CONTENTS

Managing Acute Gastroenteritis Among Children

Oral Rehydration, Maintenance, and Nutritional Therapy

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Summary

*Acute gastroenteritis remains a common illness among infants and children throughout the world. Among children in the United States, acute diarrhea accounts for >1.5 million outpatient visits, 200,000 hospitalizations, and approximately 300 deaths/year. In developing countries, diarrhea is a common cause of mortality among children aged <5 years, with an estimated 2 million deaths annually. Oral rehydration therapy (ORT) includes rehydration and maintenance fluids with oral rehydration solutions (ORS), combined with continued age-appropriate nutrition. Although ORT has been instrumental in improving health outcomes among children in developing countries, its use has lagged behind in the United States. This report provides a review of the historical background and physiologic basis for using ORT and provides recommendations for assessing and managing children with acute diarrhea, including those who have become dehydrated. Recent developments in the science of gastroenteritis management have substantially altered case management. Physicians now recognize that zinc supplementation can reduce the incidence and severity of diarrheal disease, and an ORS of reduced osmolarity (i.e., proportionally reduced concentrations of sodium and glucose) has been developed for global use. The combination of oral rehydration and early nutritional support has proven effective throughout the world in treating acute diarrhea. In 1992, CDC prepared the first national guidelines for managing childhood diarrhea (*CDC. The management of acute diarrhea in children: oral rehydration, maintenance, and nutritional therapy. MMWR 1992;41[No. RR-16]*), and this report updates those recommendations. This report reviews the historical background and scientific basis of ORT and provides a framework for assessing and treating infants and children who have acute diarrhea. The discussion focuses on common clinical scenarios and traditional practices, especially regarding continued feeding. Limitations of ORT, ongoing research in the areas of micronutrient supplements, and functional foods are reviewed as well. These updated recommendations were developed by specialists in managing gastroenteritis, in consultation with CDC and external consultants. Relevant literature was identified through an extensive MEDLINE search by using related terms. Articles were then reviewed for their relevance to pediatric practice, with emphasis on U.S. populations. Unpublished references were sought from the external consultants and other researchers. In the United States, adoption of these updated recommendations could substantially reduce medical costs and childhood hospitalizations and deaths caused by diarrhea.*

Introduction

Among children in the United States, acute gastroenteritis remains a major cause of morbidity and hospitalization, accounting for >1.5 million outpatient visits, 200,000 hospitalizations, and approximately 300 deaths/year. Direct medical costs for rotavirus diarrhea, which represents approximately one third of all hospitalizations for diarrhea among U.S. children aged <5 years, have been estimated to be $250 million/year, with an estimated $1 billion/year in total costs to society (*1*). Worldwide, diarrheal diseases are a leading cause of pediatric morbidity and mortality, with 1.5 billion episodes and 1.5–2.5 million deaths estimated to occur annually among children aged <5 years (*2–4*). Although the total number of deaths from diarrhea is still unacceptably high, these numbers have been reduced substantially in the 1980s and 1990s. For example, in 1982, an estimated 5 million deaths/year occurred (*5*), and in 1992, the estimated annual deaths declined to 3 million/year (*6*). A substantial portion of the decrease in mortality is attributable to worldwide campaigns to treat acute diarrhea with oral rehydration therapy (ORT). The

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development of ORT represents a successful collaboration between basic and applied biomedical research (*7*). The application of ORT also represents a case of reverse technology transfer (*8*), because protocols originally implemented to benefit patients in developing countries have changed the standard of care in industrialized countries as well.

ORT encompasses two phases of treatment: 1) a rehydration phase, in which water and electrolytes are administered as oral rehydration solution (ORS) to replace existing losses, and 2) a maintenance phase, which includes both replacement of ongoing fluid and electrolyte losses and adequate dietary intake. Although ORT implies rehydration alone, the definition used in this report has been broadened to include maintenance fluid therapy and appropriate nutrition.

The full benefits of ORT for acute gastroenteritis have not been realized, especially in countries with developed market economies that have lagged behind less-developed countries in their use of ORT. One reason for this low usage of ORT might be the ingrained use of intravenous (IV) therapy or the reduced appeal of a technologically simple solution (*9,10*). This is especially true in the United States, where children with all forms of dehydration are treated with IV fluids rather than ORT (*11–16*). Approximately 30% of practicing pediatricians withhold ORT for children with vomiting or moderate dehydration (*17*). In addition, the practice of continued feeding during diarrheal episodes has been difficult to establish as accepted standard of care. Although substantial in vitro and in vivo data support the role of continued nutrition in improving gastrointestinal function and anthropometric, biochemical, and clinical outcomes (*18,19*), early appropriate feeding is often withheld.

In 1992, CDC prepared the first national guidelines for managing childhood diarrhea (*20*). Since the last recommendations were published in *MMWR*, data have emerged regarding diarrhea treatment, including the importance of zinc supplementation and the value of more effective oral solutions of lower osmolarity (i.e., proportionally reduced concentrations of sodium and glucose). These recommendations update the previous report, review the historical background and scientific basis of ORT, and provide a framework for assessing and treating infants and children who have acute diarrhea. The discussion focuses on common clinical scenarios and traditional practices, especially with regard to continued feeding. Limitations of ORT, ongoing research in the areas of micronutrient supplements, and functional foods are reviewed.

These updated recommendations were developed by specialists in managing gastroenteritis, in consultation with CDC and external consultants. Relevant literature was identified through an extensive MEDLINE search by using related terms. Articles were then reviewed for their relevance to pediatric practice, with emphasis on U.S. populations. Unpublished references were sought from the external consultants and other researchers.

Background

Early attempts at treating dehydration resulting from diarrhea were described in the 1830s during epidemics of *Vibrio cholerae* infections (*21,22*). Use of IV fluid did not become widespread until >100 years later. In the 1940s, oral solutions were developed (*23*), and the effect of potassium replacement in reducing mortality was recognized, which led to substantial decreases in case fatality rates. By the 1950s, patients with cholera were being successfully treated with IV fluids (24).

Studies documenting the effectiveness of IV rehydration fluids among economically disadvantaged populations provided an impetus to develop less expensive but equally effective oral solutions. Studies published in 1968 from Dhaka and Calcutta demonstrated the effectiveness of ORS for cholera patients, including those with high stool output (*25,26*). In 1971, oral electrolyte solutions were tested through the large-scale treatment of refugees from Bangladesh (*12,27*). The resulting success of oral solutions hastened development of the first World Health Organization (WHO) guidelines for ORT and the production of standard packets of oral rehydration salts. Now, ORT is accepted as the standard of care for the clinically efficacious and cost-effective management of acute gastroenteritis (*9,20*).

Physiologic Basis for Using Oral Rehydration Solutions

Human survival depends on the secretion and reabsorption of fluid and electrolytes in the intestinal tract. The adult intestinal epithelium must handle 6,500 mL of fluids/day, consisting of a combination of oral intake, salivary, gastric, pancreatic, biliary, and upper intestinal secretions. This volume is typically reduced to 1,500 mL by the distal ileum and is further reduced in the colon to a stool output of <250 mL/day in adults (*28*). During diarrheal disease, the volume of intestinal fluid output is substantially increased, overwhelming the reabsorptive capacity of the gastrointestinal tract.

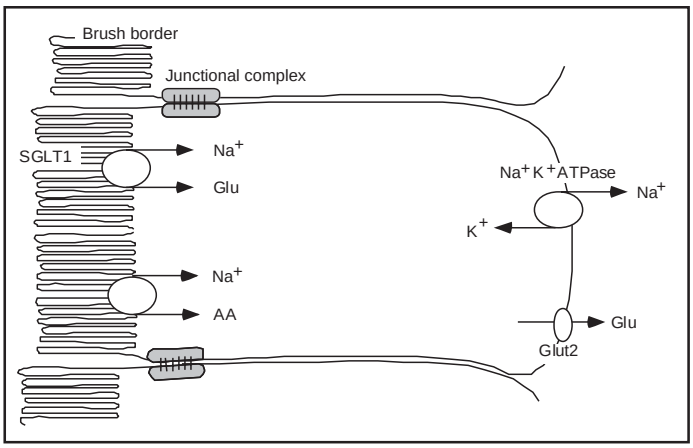
Applied clinical research, first implemented among patients with cholera (*25,29*), demonstrated that although the secretory nature of diarrhea in cholera results in substantial stool losses of water and electrolytes, intact Na-coupled solute co-transport mechanism allows efficient reabsorption of salt and water (*30*). In addition to *V. cholerae* 01 and 139, certain strains of *Escherichia coli*, shigella, salmonella, and other

pathogenic bacteria produce toxins that bind to enterocyte receptors, causing chloride-mediated secretion stimulated by second messengers (e.g., cAMP, cGMP, and calcium) (*31,32*). Even those infectious agents typically classified as causing osmotic diarrhea (i.e., fluid and electrolyte loss caused by malabsorbed intestinal contents) can increase enterocyte secretion. Rotavirus damages the villous brush border, causing osmotic diarrhea, and also produces an enterotoxin that causes a Ca^{++}-mediated secretory diarrhea (*33*).

Studies of intestinal solute transport mechanisms were also crucial in outlining the processes by which solute absorption is maintained. Water passively follows the osmotic gradient generated by the transcellular transport of electrolytes and nutrients. Although three principle mechanisms of sodium absorption have been described (*28*), the mechanism essential to the efficacy of ORS is the coupled transport of sodium and glucose molecules at the intestinal brush border (*34*) (Figure). Co-transport across the luminal membrane is facilitated by the protein sodium glucose co-transporter 1 (SGLT1). Once in the enterocyte, the transport of glucose into the blood is facilitated by GLUT2 (glucose transporter type 2) in the basolateral membrane. The Na^+ K^+ ATPase provides the gradient that drives the process. This mechanism remains intact, even in patients with severe diarrhea (*25*).

ORS in which additional co-transporters of Na (e.g., amino acids or cereals) were added has demonstrated promising results, but larger trials have not confirmed their efficacy (*35,36*). Solutions with a high concentration of co-transporters increase the risk from hypertonic solutions that decrease rather than improve sodium and water transport into the bloodstream. However, solutions of lower osmolarity, but that maintain the 1:1 glucose to sodium ratio, perform optimally as oral solutions for diarrhea management (see Choice of ORS).

FIGURE. Solute-coupled sodium absorption



Home Management of Acute Diarrhea

Treatment with ORS is simple and enables management of uncomplicated cases of diarrhea at home, regardless of etiologic agent. As long as caregivers are instructed properly regarding signs of dehydration or are able to determine when children appear markedly ill or appear not to be responding to treatment, therapy should begin at home. Early intervention can reduce such complications as dehydration and malnutrition. Early administration of ORS leads to fewer office, clinic, and emergency department (ED) visits (*37*) and to potentially fewer hospitalizations and deaths.

Initiation of Therapy

In all cultures, treatment of diarrhea usually begins at home (*38*). All families should be encouraged to have a supply of ORS in the home at all times and to start therapy with a commercially available ORS product as soon as diarrhea begins. Although producing a homemade solution with appropriate concentrations of glucose and sodium is possible, serious errors can occur (*39*); thus, standard commercial oral rehydration preparations should be recommended where they are readily available and attainable. The most crucial aspect underlying home management of diarrhea is the need to replace fluid losses and to maintain adequate nutrient intake. Regardless of the fluid used, an age-appropriate diet should also be given (*18,19*). Infants should be offered more frequent breast or bottle feedings, and older children should be given more fluids.

Severity Assessment

Caregivers should be trained to recognize signs of illness or treatment failure that necessitate medical intervention. Infants with acute diarrhea are more prone to becoming dehydrated than are older children, because they have a higher body surface-to-volume ratio, a higher metabolic rate, relatively smaller fluid reserves, and they are dependent on others for fluid. For this reason, parents of infants with diarrhea should promptly seek medical evaluation as soon as the child appears to be in distress (Box 1). No guidelines have established a specific age under which evaluation is mandated, but usually, the smaller the child, the lower the threshold for health-care provider assessment. When fever is present, infants and children should be evaluated to rule out other serious illnesses (e.g., sepsis and meningitis). Underlying conditions, including premature birth, metabolic and renal disorders, immune compromise, or recent recovery from surgery, might prompt early evaluation, as might concurrent illness, including a

BOX 1. Indications for medical evaluation of children with acute diarrhea

- Young age (e.g., aged <6 months or weight <8 kg)
- History of premature birth, chronic medical conditions, or concurrent illness
- Fever ≥38°C for infants aged <3 months or ≥39°C for children aged 3–36 months
- Visible blood in stool
- High output, including frequent and substantial volumes of diarrhea
- Persistent vomiting
- Caregiver's report of signs consistent with dehydration (e.g., sunken eyes or decreased tears, dry mucous membranes, or decreased urine output)
- Change in mental status (e.g., irritability, apathy, or lethargy)
- Suboptimal response to oral rehydration therapy already administered or inability of the caregiver to administer oral rehydration therapy

concurrent respiratory tract infection. Children with dysentery (blood or mucus in stool) or prolonged diarrhea (lasting >14 days) should be evaluated because stool cultures and antimicrobial therapy might be indicated.

Reports from parents or other caregivers of dehydration can indicate the need for immediate health-care provider evaluation. Reports of changing mental status are of particular concern. When the child's condition is in doubt, immediate evaluation by a health-care professional should be recommended. Clinical examination of the child provides an opportunity for physical assessment, including vital signs, degree of dehydration, and a more detailed history, and for providing better instructions to the caregivers.

Referral for Evaluation

In developed countries, the decision whether to bring a child to an office or ED setting for evaluation is usually made after consultation with a physician or other health-care provider by telephone. Questions should focus on those factors putting a child at risk for dehydration. Whenever possible, quantification is helpful. The clinician should determine how many hours or days the child has been ill, the number of episodes of diarrhea or vomiting, and the apparent volume of fluid output. The child's mental status should be determined. Parents and other caregivers might not mention underlying conditions without prompting; therefore, questions from the health-care provider regarding past medical history are essential.

Clinical Assessment

Diarrhea is characterized by the passage of loose or watery stools; a common case definition of acute diarrhea is ≥3 loose or watery stools/day. The volume of fluid lost through stools can vary from 5 mL/kg body weight/day (approximately normal) to ≥200 mL/kg body weight/day (*40*). Dehydration and electrolyte losses associated with untreated diarrhea cause the primary morbidity of acute gastroenteritis. Diarrhea can be among the initial signs of nongastrointestinal tract illnesses, including meningitis, bacterial sepsis, pneumonia, otitis media, and urinary tract infection. Vomiting alone can be the first symptom of metabolic disorders, congestive heart failure, toxic agent ingestion, or trauma. To rule out other serious illnesses, a detailed history and physical examination should be performed as part of the evaluation of all children with acute gastroenteritis.

History

The clinical history should assess the onset, frequency, quantity, and character (i.e., the presence of bile, blood, or mucus) of vomiting and diarrhea. Recent oral intake, including breast milk and other fluids and food; urine output; weight before illness; and associated symptoms, including fever or changes in mental status, should be noted. The past medical history should identify underlying medical problems, history of other recent infections, medications, and human immunodeficiency virus (HIV) status. A relevant social history can include the number and nature of caregivers, which can affect instructions regarding follow-up care.

Physical Examination

As part of the physical examination, an accurate body weight must be obtained, along with temperature, heart rate, respiratory rate, and blood pressure. When recent premorbid weight is unknown but a previous growth curve is available, an estimate of fluid loss can be obtained by subtracting current weight from expected weight as determined on the basis of the previous weight-for-age percentile. The quality of this estimate will vary, depending on the number and variability of prior data points, differences among scales, and other factors. The general condition of the patient should be assessed, with special concern given to infants and children who appear listless, apathetic, or less reactive. The appearance of the eyes should be noted, including the degree to which they are sunken and the presence or absence of tears. The condition of the lips, mouth, and tongue will yield critical clues regarding the degree of dehydration, even if the patient has taken fluid recently. Deep respirations can be indicative of metabolic acidosis. Faint or

absent bowel sounds can indicate hypokalemia. Examination of the extremities should be included because general perfusion and capillary refill can help in assessment of dehydration. An especially valid sign is the presence of prolonged skin tenting (*41*). Visual examination of stool can confirm abnormal consistency and determine the presence of blood or mucus.

Dehydration Assessment

Certain clinical signs and symptoms can quantify the extent of a patient's dehydration (Table 1). Assessment of the anterior fontanel might be helpful in selected instances, but it can be unreliable or misleading (*41,42*). Among infants and children, a decrease in blood pressure is a late sign of dehydration that heralds shock and can correspond to fluid deficits >10%. Increases in heart rate and reduced peripheral perfusion can be more sensitive indicators of moderate dehydration, although both can be difficult to interpret because they can vary with the degree of fever. Decreased urine output is a sensitive but nonspecific sign. Urine output might be difficult to measure for infants with diarrhea; however, if urinalysis is indicated, a finding of increased urine specific gravity can indicate dehydration.

Prior guidelines, including CDC's 1992 recommendations (*20*) and the American Academy of Pediatrics (AAP) 1996 guidelines (*9*), divide patients into subgroups for mild (3%–5% fluid deficit), moderate (6%–9% fluid deficit), or severe (≥10% fluid deficit, shock, or near shock) dehydration. Other classification schemes, including the 1995 WHO (*40*) and 2001 European Society of Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) guidelines (*43*), divide patients into those indicating no signs of dehydration (<3%–5%), some signs of dehydration (5%–10%), and severe dehydration (>10%). Studies that have evaluated the correlation of clinical signs of dehydration with posttreatment weight gain indicate that the first signs of dehydration might not be evident until 3%–4% dehydration, with more numerous clinical signs evident at 5% dehydration and signs indicating severe dehydration not evident until fluid loss reaches 9%–10% (*40,41*). Because of this threshold effect, distinguishing between mild and moderate dehydration on the basis of clinical signs alone might be difficult. Therefore, these updated recommendations group together patients with mild to moderate dehydration and specify that the signs of dehydration might be apparent over a relatively wide range of fluid loss (i.e., from 3%–9%) (Table 1). The goal of assessment is to provide a starting point for treatment and to conservatively determine which patients can safely be sent home for therapy, which ones should remain for observation during therapy, and which ones should immediately receive more intensive therapy.

Utility of Laboratory Evaluation

Supplementary laboratory studies, including serum electrolytes, to assess patients with acute diarrhea usually are unnecessary (*44,45*). Stool cultures are indicated in cases of dysentery but are not usually indicated in acute, watery diarrhea for the immunocompetent patient. However, certain laboratory studies might be important when the underlying diagnosis is unclear or diagnoses other than acute gastroenteritis are possible. For example, complete blood counts and urine and blood cultures might be indicated when sepsis or urinary tract infection is a concern.

TABLE 1. Symptoms associated with dehydration

Symptom	Minimal or no dehydration (<3% loss of body weight)	Mild to moderate dehydration (3%ï 9% loss of body weight)	Severe dehydration (>9% loss of body weight)
Mental status	Well; alert	Normal, fatigued or restless, irritable	Apathetic, lethargic, unconscious
Thirst	Drinks normally; might refuse liquids	Thirsty; eager to drink	Drinks poorly; unable to drink
Heart rate	Normal	Normal to increased	Tachycardia, with bradycardia in most severe cases
Quality of pulses	Normal	Normal to decreased	Weak, thready, or impalpable
Breathing	Normal	Normal; fast	Deep
Eyes	Normal	Slightly sunken	Deeply sunken
Tears	Present	Decreased	Absent
Mouth and tongue	Moist	Dry	Parched
Skin fold	Instant recoil	Recoil in <2 seconds	Recoil in >2 seconds
Capillary refill	Normal	Prolonged	Prolonged; minimal
Extremities	Warm	Cool	Cold; mottled; cyanotic
Urine output	Normal to decreased	Decreased	Minimal

Sources: Adapted from Duggan C, Santosham M, Glass RI. The management of acute diarrhea in children: oral rehydration, maintenance, and nutritional therapy. MMWR 1992;41(No. RR-16):1ï 20; and World Health Organization. The treatment of diarrhoea: a manual for physicians and other senior health workers. Geneva, Switzerland: World Health Organization, 1995. Available at http://www.who.int/child-adolescent-health/New_Publications/CHILD_HEALTH/WHO.CDR.95.3.htm.

Acute Gastroenteritis Therapy Based on Degree of Dehydration

Seven basic principles guide optimal treatment of acute gastroenteritis (Box 2) (*43*); more specific recommendations for treating different degrees of dehydration have been recommended by CDC, WHO, and AAP (Table 2) (*9,20,40*). Although the first principle, use of ORS, seems self-evident, one national survey of physicians in emergency care facilities indicated that many would treat mild dehydration with IV therapy, and half would always or routinely use IV therapy for a moderately dehydrated child aged <2 years (*14*).

Treatment should include two phases: rehydration and maintenance. In the rehydration phase, the fluid deficit is replaced quickly (i.e., during 3–4 hours) and clinical hydration is attained. In the maintenance phase, maintenance calories and fluids are administered. Rapid realimentation should follow rapid rehydration, with a goal of quickly returning the patient to an age-appropriate unrestricted diet, including solids. Gut rest is not indicated. Breastfeeding should be continued at all times, even during the initial rehydration phases. The diet should be increased as soon as tolerated to compensate for lost caloric intake during the acute illness. Lactose restriction is usually not necessary (although it might be helpful in cases of diarrhea among malnourished children or among children with a severe enteropathy), and changes in formula usually are unnecessary. Full-strength formula usually is tolerated and allows for a more rapid return to full energy intake. During both phases, fluid losses from vomiting and diarrhea are replaced in an ongoing manner. Antidiarrheal medications are not recommended for infants and children, and laboratory studies should be limited to those needed to guide clinical management.

BOX 2. Seven principles of appropriate treatment for children with diarrhea and dehydration

1. Oral rehydration solutions (ORS) should be used for rehydration.
2. Oral rehydration should be performed rapidly (i.e., within 3–4 hours).
3. For rapid realimentation, an age-appropriate, unrestricted diet is recommended as soon as dehydration is corrected.
4. For breastfed infants, nursing should be continued.
5. If formula-fed, diluted formula is not recommended, and special formula usually is not necessary.
6. Additional ORS should be administered for ongoing losses through diarrhea.
7. No unnecessary laboratory tests or medications should be administered.

Source: Adapted from Sandhu BK. Practical guidelines for the management of gastroenteritis in children. J Pediatr Gastroenterol Nutr 2001;33(Suppl 2):S36–9.

Minimal Dehydration

For patients with minimal or no dehydration, treatment is aimed at providing adequate fluids and continuing an age-appropriate diet. Patients with diarrhea must have increased fluid intake to compensate for losses and cover maintenance

TABLE 2: Summary of treatment based on degree of dehydration

Degree of dehydration	Rehydration therapy	Replacement of losses	Nutrition
Minimal or no dehydration	Not applicable	<10 kg body weight: 60ï 120 mL oral rehydration solution (ORS) for each diarrheal stool or vomiting episode >10 kg body weight: 120ï 240 mL ORS for each diarrheal stool or vomiting episode	Continue breastfeeding, or resume age-appropriate normal diet after initial hydration, including adequate caloric intake for maintenance*
Mild to moderate dehydration	ORS, 50ï 100 mL/kg body weight over 3ï 4 hours	Same	Same
Severe dehydration	Lactated Ringerôs solution or normal saline in 20 mL/kg body weight intravenous amounts until perfusion and mental status improve; then administer 100 mL/kg body weight ORS over 4 hours or 5% dextrose İ normal saline intravenously at twice maintenance fluid rates	Same; if unable to drink, administer through nasogastric tube or administer 5% dextrose ı normal saline with 20 mEq/L potassium chloride intravenously	Same

* Overly restricted diets should be avoided during acute diarrheal episodes. Breastfed infants should continue to nurse ad libitum even during acute rehydration. Infants too weak to eat can be given breast milk or formula through a nasogastric tube. Lactose-containing formulas are usually well-tolerated. If lactose malabsorption appears clinically substantial, lactose-free formulas can be used. Complex carbohydrates, fresh fruits, lean meats, yogurt, and vegetables are all recommended. Carbonated drinks or commercial juices with a high concentration of simple carbohydrates should be avoided.

needs; use of ORS should be encouraged. In principle, 1 mL of fluid should be administered for each gram of output. In hospital settings, soiled diapers can be weighed (without urine), and the estimated dry weight of the diaper can be subtracted. When losses are not easily measured, 10 mL of additional fluid can be administered per kilogram body weight for each watery stool or 2 mL/kg body weight for each episode of emesis. As an alternative, children weighing <10 kg should be administered 60–120 mL (2–4 ounces) ORS for each episode of vomiting or diarrheal stool, and those weighing >10 kg should be administered 120–240 mL (4–8 ounces). Nutrition should not be restricted (see Dietary Therapy).

Mild to Moderate Dehydration

Children with mild to moderate dehydration should have their estimated fluid deficit rapidly replaced. These updated recommendations include administering 50–100 mL of ORS/kg body weight during 2–4 hours to replace the estimated fluid deficit, with additional ORS administered to replace ongoing losses. Using a teaspoon, syringe, or medicine dropper, limited volumes of fluid (e.g., 5 mL or 1 teaspoon) should be offered at first, with the amount gradually increased as tolerated. If a child appears to want more than the estimated amount of ORS, more can be offered. Although administering ORS rapidly is safe, vomiting might be increased with larger amounts. Nasogastric (NG) feeding allows continuous administration of ORS at a slow, steady rate for patients with persistent vomiting or oral ulcers. Clinical trials support using NG feedings, even for vomiting patients (*45*). Rehydration through an NG tube can be particularly useful in ED settings, where rapid correction of hydration might prevent hospitalization. Although rapid IV hydration can also prevent hospital admission, rapid NG rehydration can be well-tolerated, more cost-effective, and associated with fewer complications (*45*). In addition, a randomized trial of ORS versus IV rehydration for dehydrated children demonstrated shorter stays in EDs and improved parental satisfaction with oral rehydration (*46*).

Certain children with mild to moderate dehydration will not improve with ORT; therefore, they should be observed until signs of dehydration subside. Similarly, children who do not demonstrate clinical signs of dehydration but who demonstrate unusually high output should be held for observation. Hydration status should be reassessed on a regular basis, and might be performed in an ED, office, or other outpatient setting. After dehydration is corrected, further management can be implemented at home, provided that the child's caregivers demonstrate comprehension of home rehydration techniques (including continued feeding), understand indications for returning for further evaluation, and have the means to do so. Even among children whose illness appears uncomplicated on initial assessment, a limited percentage might not respond adequately to ORT; therefore, a plan for reassessment should be agreed upon. Caregivers should be encouraged to return for medical attention if they have any concerns, if they are not sure that rehydration is proceeding well, or if new or worsening symptoms develop.

Severe Dehydration

Severe dehydration constitutes a medical emergency requiring immediate IV rehydration. Lactated Ringer's (LR) solution, normal saline, or a similar solution should be administered (20 mL/kg body weight) until pulse, perfusion, and mental status return to normal. This might require two IV lines or even alternative access sites (e.g., intraosseous infusion). The patient should be observed closely during this period, and vital signs should be monitored on a regular basis. Serum electrolytes, bicarbonate, blood urea nitrogen, creatinine, and serum glucose levels should be obtained, although commencing rehydration therapy without these results is safe. Normal saline or LR infusion is the appropriate first step in the treatment of hyponatremic and hypernatremic dehydration. Hypotonic solutions should not be used for acute parenteral rehydration (*47*).

Severely dehydrated patients might require multiple administrations of fluid in short succession. Overly rapid rehydration is unlikely to occur as long as weight-based amounts are administered with close observation. Errors occur most commonly in settings where adult dosing is administered to infants (e.g., "500 mL NS [normal saline] IV bolus x 2" would provide 200 mL/kg body weight for an average infant aged 2–3 months). Edema of the eyelids and extremities can indicate overhydration. Diuretics should not be administered. After the edema has subsided, the patient should be reassessed for continued therapy. With frail or malnourished infants, smaller amounts (10 mL/kg body weight) are recommended because of the reduced ability of these infants to increase cardiac output and because distinguishing dehydration from sepsis might be difficult among these patients. Smaller amounts also will facilitate closer evaluation. Hydration status should be reassessed frequently to determine the adequacy of replacement therapy. A lack of response to fluid administration should raise the suspicion of alternative or concurrent diagnoses, including septic shock and metabolic, cardiac, or neurologic disorders.

As soon as the severely dehydrated patient's level of consciousness returns to normal, therapy usually can be changed to the oral route, with the patient taking by mouth the

remaining estimated deficit. An NG tube can be helpful for patients with normal mental status but who are too weak to drink adequately. Although no studies have specifically documented increased aspiration risk with NG tube use in obtunded patients, IV therapy is typically favored for such patients. Although leaving IV access in place for these patients is reasonable in case it is needed again, early reintroduction of ORS is safer. Using IV catheters is associated with frequent minor complications, including extravasation of IV fluid, and with rare substantial complications, including the inadvertent administration of inappropriate fluid (e.g., solutions containing excessive potassium). In addition, early ORS will probably encourage earlier resumption of feeding, and data indicate that resolution of acidosis might be more rapid with ORS than with IV fluid (*45*).

Clinical Management in the Hospital

Inpatient care is indicated for children if

- caregivers cannot provide adequate care at home;
- substantial difficulties exist in administrating ORT, including intractable vomiting, ORS refusal, or inadequate ORS intake;
- concern exists for other possible illnesses complicating the clinical course;
- ORS treatment fails, including worsening diarrhea or dehydration despite adequate volumes;
- severe dehydration (>9% of body weight) exists;
- social or logistical concerns exist that might prevent return evaluation, if necessary, or
- such factors as young age, unusual irritability or drowsiness, progressive course of symptoms, or uncertainty of diagnosis exist that might indicate a need for close observation.

In addition, studies of mortality caused by acute diarrhea in the United States have identified prematurity, young maternal age, black race, and rural residence as risk factors for suboptimal outcome (*48*); thus, these factors should also be considered when deciding if hospital care is required.

Limitations of ORT

Although ORT is recommended for all age groups and for diarrhea of any etiology, certain restrictions apply to its use. Among children in hemodynamic shock, administration of oral solutions might be contraindicated because airway protective reflexes might be impaired. Likewise, patients with abdominal ileus should not be administered oral fluids until bowel sounds are audible. Intestinal intussusception can be present with diarrhea, including bloody diarrhea. Radiographic and surgical evaluation are warranted when the diagnosis of bowel obstruction is in question.

Stool output in excess of 10 mL/kg body weight/hour has been associated with a lower rate of success of oral rehydration (*49*); however, children should not be denied ORT simply because of a high purging rate, because the majority of children will respond well if administered adequate replacement fluid.

A limited percentage of infants (<1%) with acute diarrhea experience carbohydrate malabsorption. This is characterized by a dramatic increase in stool output after intake of fluids containing simple sugars (e.g., glucose), including ORS. Patients with true glucose malabsorption also will have an immediate reduction in stool output when IV therapy is used instead of ORS. However, the presence of stool-reducing substances alone is not sufficient to make this diagnosis, because this is a common finding among patients with diarrhea and does not in itself predict failure of oral therapy.

Certain patients with acute diarrhea have concomitant vomiting. However, the majority can be rehydrated successfully with oral fluids if limited volumes of ORS (5 mL) are administered every 5 minutes, with a gradual increase in the amount consumed. Administration with a spoon or syringe under close supervision helps guarantee a gradual progression in the amount taken. Often, correction of acidosis and dehydration lessens the frequency of vomiting. Continuous slow NG infusion of ORS through a feeding tube might be helpful. Even if a limited amount of emesis occurs after NG administration of fluid, treatment might not be affected adversely (*45*). The physician might meet resistance in implementing NG rehydration in a vomiting child, but NG rehydration might help the initial rehydration and speed up tolerance to refeeding (*50*), leading to improved patient disposition and quicker discharge.

Hypernatremic Dehydration

Patients with hypernatremic dehydration (i.e., serum sodium concentration >145 mEq/L) respond well to ORT. Those with severe dehydration should first receive IV hydration as previously discussed. Subsequent hydration should be achieved with ORS (*51*). As with isonatremic dehydration, ORS should be administered to replace the calculated deficit and ongoing losses. ORS might be safer than IV therapy because it is less likely to lead to a precipitous increase in intracellular water associated with seizures and elevated intracranial pressure (*43*). For more detailed recommendations regarding therapy of hypernatremic dehydration, other sources should be consulted (*52*).

Dietary Therapy

Recommendations for maintenance dietary therapy depend on the age and diet history of the patient. Breastfed infants should continue nursing on demand. Formula-fed infants should continue their usual formula immediately upon rehydration in amounts sufficient to satisfy energy and nutrient requirements. Lactose-free or lactose-reduced formulas usually are unnecessary. A meta-analysis of clinical trials indicates no advantage of lactose-free formulas over lactose-containing formulas for the majority of infants, although certain infants with malnutrition or severe dehydration recover more quickly when given lactose-free formula (*53*). Patients with true lactose intolerance will have exacerbation of diarrhea when a lactose-containing formula is introduced. The presence of low pH (<6.0) or reducing substances (>0.5%) in the stool is not diagnostic of lactose intolerance in the absence of clinical symptoms. Although medical practice has often favored beginning feedings with diluted (e.g., half- or quarter-strength) formula, controlled clinical trials have demonstrated that this practice is unnecessary and is associated with prolonged symptoms (*54*) and delayed nutritional recovery (*55*).

Formulas containing soy fiber have been marketed to physicians and consumers in the United States, and added soy fiber has been reported to reduce liquid stools without changing overall stool output (*56*). This cosmetic effect might have certain benefits with regard to diminishing diaper rash and encouraging early resumption of normal diet but is probably not sufficient to merit its use as a standard of care. A reduction in the duration of antibiotic-associated diarrhea has been demonstrated among older infants and toddlers fed formula with added soy fiber (*57*).

Children receiving semisolid or solid foods should continue to receive their usual diet during episodes of diarrhea. Foods high in simple sugars should be avoided because the osmotic load might worsen diarrhea; therefore, substantial amounts of carbonated soft drinks, juice, gelatin desserts, and other highly sugared liquids should be avoided. Certain guidelines have recommended avoiding fatty foods, but maintaining adequate calories without fat is difficult, and fat might have a beneficial effect of reducing intestinal motility. The practice of withholding food for ≥24 hours is inappropriate. Early feeding decreases changes in intestinal permeability caused by infection (*58*), reduces illness duration, and improves nutritional outcomes (*18,19*). Highly specific diets (e.g., the BRAT [bananas, rice, applesauce, and toast] diet) have been commonly recommended. Although certain benefits might exist from green bananas and pectin in persistent diarrhea (*59*), the BRAT diet is unnecessarily restrictive and, similar to juice-centered diets, can provide suboptimal nutrition for the patient's nourishment and recovering gut. Severe malnutrition can occur after gastroenteritis if prolonged gut rest or clear fluids are prescribed (*60*).

Children in underdeveloped countries often have multiple episodes of diarrhea in a single season, making diarrhea a contributing factor to suboptimal nutrition, which can increase the frequency and severity of subsequent episodes (*61*). For this reason, increased nutrient intake should be administered after an episode of diarrhea. Recommended foods include age-appropriate unrestricted diets, including complex carbohydrates, meats, yogurt, fruits, and vegetables. Children should as best as possible maintain caloric intake during acute episodes, and subsequently should receive additional nutrition to compensate for any shortfalls arising during the illness.

Pharmacologic Therapy

Antimicrobial Agents

Because viruses (e.g., rotavirus, astrovirus, enteric adenovirus, norovirus, and sapovirus) are the predominant cause of acute diarrhea in developed countries (62), the routine use of antimicrobial agents for treating diarrhea wastes resources and might lead to increased antimicrobial resistance. Even when a bacterial cause is suspected in an outpatient setting, antimicrobial therapy is not usually indicated among children because the majority of cases of acute diarrhea are self-limited and not shortened by antimicrobial agents. Exceptions to these rules involve special needs of individual children (e.g., immune-compromised hosts, premature infants, or children with underlying disorders). Information regarding appropriate antimicrobial therapy of bacterial and parasitic causes of acute infectious diarrhea is available (*63–66*).

Nonantimicrobial Drug Therapies

Nonspecific antidiarrheal agents (e.g., adsorbents such as kaolin-pectin), antimotility agents (e.g., loperamide), antisecretory drugs, and toxin binders (e.g., cholestyramine), are commonly used among older children and adults, but data are limited regarding their efficacy. Side effects of these drugs are well-known, in particular among the antimotility agents, including opiate-induced ileus, drowsiness, and nausea caused by the atropine effects and binding of nutrients and other drugs. In Pakistan, 18 cases of severe abdominal distention associated with using loperamide included 6 deaths (*67*). Bismuth subsalicylate has limited efficacy in treating traveler's diarrhea (*68*) and other causes of acute gastroenteritis among children (*69*). Although the side effects are fewer than those from antimotility agents, certain theoretical concerns regard-

ing the potential toxicity from salicylate absorption remain (*70*), and trials supporting its use have employed frequent doses (e.g., every 4 hours for 5 days) (*71*).

None of these drugs address the underlying causes of diarrhea, specifically increased secretion by intestinal crypt cells. Racecadotril, an enkephalinase inhibitor, preserves the antisecretory activity of enkephalins and does not slow intestinal transit or promote bacterial overgrowth (*72*). Its use has demonstrated promise in two controlled clinical trials among children, among whom it significantly reduced stool output when compared with placebo (*73,74*). Although the majority of cases of acute diarrhea require no adjunctive therapy, racecadotril might prove to be a useful adjunct. More studies are needed.

Antiemetics are usually unnecessary in acute diarrhea management. Using phenothiazines might interfere with oral rehydration by causing sleepiness. Ondansetron, a serotonin antagonist, either by the oral (*75*) or IV (*76*) route, can be effective in decreasing vomiting and limiting hospital admission. However, reliance on pharmacologic agents shifts the therapeutic focus away from appropriate fluid, electrolyte, and nutritional therapy, can result in adverse events, and can add unnecessarily to the economic cost of illness. Because acute diarrhea is a common illness, cost-effective analyses should be undertaken before routine pharmacologic therapy is recommended.

Supplemental Zinc Therapy

Multiple reports have linked diarrhea and abnormal zinc status (*77*), including increased stool zinc loss, negative zinc balance (78), and reduced tissue levels of zinc (*79*). Although severe zinc deficiency (e.g., acrodermatitis enteropathica) is associated with diarrhea, milder deficiencies of zinc might play a role in childhood diarrhea, and zinc supplementation might be of benefit either for improved outcomes in acute or chronic diarrhea or as prophylaxis against diarrheal disease. Reduced duration of acute diarrhea after zinc supplementation among patients with low zinc concentrations in rectal biopsies has been demonstrated (*79*). In Bangladesh, zinc supplements also improved markers of intestinal permeability among children with diarrhea (*80*). In India, zinc supplementation was associated with a decrease in both the mean number of watery stools per day and the number of days with watery diarrhea (*81*). Prophylactic zinc supplementation in India has been associated with a substantially reduced incidence of severe and prolonged diarrhea, two key determinants of malnutrition and diarrhea-related mortality (*82*). In Nepal, this effect was independent of concomitant vitamin A administration, with limited side effects apart from a slight increase in emesis (*83*). In Peru, zinc administration was associated with a reduction in duration of persistent diarrhea (*84*). In two different pooled analyses of randomized controlled trials in developing countries (*85,86*), zinc supplementation was beneficial for treating children with acute and persistent diarrhea and as a prophylactic supplement for decreasing the incidence of diarrheal disease and pneumonia. Among infants and young children who received supplemental zinc for 5 or 7 days/week for 12–54 weeks, the pooled odds ratio (OR) for diarrhea incidence was 0.82 (95% confidence interval [CIs] = 0.72–0.93), and the OR for pneumonia incidence was 0.59 (95% CI = 0.41–0.83). The efficacy and safety of a zinc-fortified (40 mg/L) ORS among 1,219 children with acute diarrhea was evaluated (*87*). Compared with zinc syrup administered at a dose of 15–30 mg/day, zinc-fortified ORS did not increase the plasma zinc concentration. However, clinical outcomes among the zinc-fortified ORS group were modestly improved, compared with those for the control group, who received standard ORS only. In that study, the total number of stools was lower among the zinc-ORS group (relative risk: 0.83; 95% CI = 0.71–0.96), compared with the total number for the control group. No substantial effect on duration of diarrhea or risk for prolonged diarrhea was noted.

Thus, a number of trials have supported zinc supplementation as an effective agent in treating and preventing diarrheal disease. Further research is needed to identify the mechanism of action of zinc and to determine its optimal delivery to the neediest populations. The role of zinc supplements in developed countries needs further evaluation.

Functional Foods

Functional foods can be defined as foods that have an effect on physiologic processes separate from their established nutritional function (*88*). Probiotics have been defined as live microorganisms in fermented foods that promote optimal health by establishing an improved balance in intestinal microflora (*89*). Reviews have evaluated studies of their use in preventing or reducing the severity or duration of diarrheal illnesses among children (*90*), including diarrhea caused by rotavirus (*91*) or associated with antibiotic use (*92*). These products have included various species of lactobacilli or bifidobacteria or the nonpathogenic yeast *Saccharomyces boulardii*. The mechanism of action might include competition with pathogenic bacteria for receptor sites or intraluminal nutrients, production of antibiotic substances, and enhancement of host immune defenses (*93,94*). One meta-analysis concludes that *Lactobacillus* species are both safe and effective as treatment for children with infectious diarrhea (*95*).

A positive recommendation also emerges from a meta-analysis of probiotic use in antibiotic-associated diarrhea (*92*).

Certain trials included in these reviews were of limited sample size, and negative studies might not have been published. Because dietary supplements (e.g., probiotics) are usually not regulated by the federal government, potential exists for great variability among them, providing a challenge to the prescribing physician to make an informed recommendation regarding their use.

Prebiotics differ from probiotics in that they are complex carbohydrates rather than organisms used to preferentially stimulate the growth of health-promoting intestinal flora (*96*). The oligosaccharides contained in human milk have been called the prototypic prebiotic because they foster growth of lactobacilli and bifidobacteria in the colon of breastfed neonates (*97*). Data have linked higher intakes of breast milk oligosaccharides with a lowered incidence of acute diarrhea (*98*). Two randomized trials of prebiotic supplemented infant cereal did not demonstrate a reduced incidence of diarrheal disease among infants and children living in an urban economically depressed area (*99*). Specific recommendations regarding their use should await further well-controlled human trials.

Specific Clinical Scenarios

Oral rehydration therapy is critical in managing specific types of diarrheal diseases.

Acute Bloody Diarrhea (Dysentery)

Dysentery is defined as acute bloody diarrhea caused by invasive microbial infection. This does not include occult blood (detected by guaiac card only) or streaks of blood on the surface of formed stool. The treatment of dehydration in dysentery follows the same principles as treatment of acute watery diarrhea. The child with bloody diarrhea is at higher risk for complications, including sepsis and other systemic diseases; therefore, the threshold for admission of such children to the hospital for close observation is lower. Stool cultures are indicated in the setting of acute bloody diarrhea and are helpful for guiding therapy. Food should not be withheld for children with dysentery any more than in other cases of diarrhea. More frequent, smaller meals might be better tolerated, and higher protein intakes have proven beneficial among children recovering from dysentery (*100,101*).

In the majority of cases, empiric antimicrobial agents should not be administered while awaiting culture results, because antimicrobial therapy might not be indicated even when culture results are positive. Amoebiasis is an unusual cause of bloody diarrhea in young children, even in less-developed countries (*102*). Treatment for amoebiasis should be reserved for those cases in which trophozoites are detected on microscopic examination of the stools (*65*). Recommendations for therapy of specific enteric pathogens associated with bloody diarrhea are available elsewhere (*63–66*).

Persistent Diarrhea and Diarrhea with Severe Malnutrition

These clinical entities are critical, especially among children of developing countries. Therapy should include oral rehydration when indicated, although the specifics of the evaluation, and fluid, electrolyte, and nutritional management differ and are beyond the scope of this review. The reader is referred to other sources for information regarding these conditions (*103,104*).

Choice of ORS

In 1975, WHO and the United Nations Children's Fund (UNICEF) agreed to promote a single ORS (WHO-ORS) containing (in mmol/L) sodium 90, potassium 20, chloride 80, base 30, and glucose 111 (2%) for use among diverse populations. This composition was selected to allow for a single solution to be used for treatment of diarrhea caused by different infectious agents and associated with varying degrees of electrolyte loss. For example, rotavirus diarrhea is associated with stool sodium losses of approximately 30–40 mEq/L; enterotoxigenic *E. coli* infection with losses of 50–60 mEq/L; and cholera infection with losses of ≥90–120 mEq/L (*105*). WHO-ORS has been demonstrated during >25 years of use to be safe and effective at rehydration and maintenance for children and adults with all types of infectious diarrhea.

However, subsequent clinical research, documented in multiple controlled trials and summarized in a meta-analysis (*106*), has supported adoption of a lower osmolarity ORS (i.e., proportionally reduced concentrations of sodium and glucose). A reduced osmolarity ORS has been associated with less vomiting, less stool output, and a reduced need for unscheduled intravenous infusions when compared with standard ORS among infants and children with noncholera diarrhea. In cholera infection, no clinical difference existed between subjects treated with the lower osmolarity solution and those treated with the standard solution, apart from certain increased incidence of asymptomatic hyponatremia (*107*). On the basis of those and other findings, UNICEF and WHO organized a consultation on oral rehydration that recommended a reduced osmolarity solution for global use (*108*). In May 2002, WHO announced a new ORS formulation consistent with these

recommendations, with 75 mEq/L sodium, 75 mmol/L glucose, and total osmolarity of 245 mOsm/L (*109*) (Table 3). The newer hypotonic WHO-ORS is also recommended for use in treating adults and children with cholera, although postmarketing surveillance is under way to confirm the safety of this indication. The composition of commonly available oral rehydration solutions is distinct from other beverages frequently used inappropriately for rehydration (Table 3).

New Solutions

Recipes to improve ORS have included adding substrates for sodium co-transport (e.g., the amino acids glycine, alanine, and glutamine) (*35*) or substituting complex carbohydrates for the glucose (rice and other cereal-based ORS) (*36*). The amino acid preparations have not been demonstrated to be more effective than traditional ORS, and they are more costly. Rice-based ORS can be recommended where training is adequate and home preparation is preferable, and it can be particularly effective in treating dehydration caused by cholera (*36*). Nevertheless, given the simplicity and safety of ORS packets in developing countries and of commercially available ORS in developed countries, these remain the first choice for the majority of clinicians.

Other potential additives to ORS include substances capable of liberating short-chain fatty acids (e.g., amylase-resistant starch derived from corn) (*110*) and partially hydrolyzed guar gum (*111*). The presumed mechanism of action is the enlistment of increased colonic sodium uptake coupled to short-chain fatty acid transport. Other possible future ORS composition changes include addition of probiotics (*91*), prebiotics, zinc (*87*), or protein polymers.

Barriers to ORT

Among patients, barriers to using ORS and continued nutrition during diarrheal disease include cultural practices (*38*), lack of parental knowledge (*11*), lack of training of medical professionals, and cost of commercially available ORS (*112*). Among physicians, preference for IV hydration, even where evidence indicates improved results from oral rehydration (*13,14*), remains a major barrier. Patients, even at times under physician supervision, frequently attempt rehydration with solutions bearing no resemblance to physiologically based ORS. The electrolyte content of different fluids commonly used in treating diarrhea do not contain physiologically sound concentrations of carbohydrates and electrolytes, compared with commonly available ORS (Table 3). An informal survey of hospital Internet sites revealed outdated recommendations

TABLE 3. Composition of commercial oral rehydration solutions (ORS) and commonly consumed beverages

Solution	Carbohydrate (gm/L)	Sodium (mmol/L)	Potassium (mmol/L)	Chloride (mmol/L)	Base* (mmol/L)	Osmolarity (mOsm/L)
ORS						
World Health Organization (WHO) (2002)	13.5	75	20	65	30	245
WHO (1975)	20	90	20	80	30	311
European Society of Paediatric Gastroenterology, Hepatology and Nutrition	16	60	20	60	30	240
Enfalyte[È À]	30	50	25	45	34	200
Pedialyte[È Ä]	25	45	20	35	30	250
Rehydralyte[È Æ]	25	75	20	65	30	305
CeraLyte[È**]	40	50ï 90	20	NA[ÀÀ]	30	220
Commonly used beverages (not appropriate for diarrhea treatment)						
Apple juice[ÀÄ]	120	0.4	44	45	N/A	730
Coca-Cola[È Æ Æ]Classic	112	1.6	N/A	N/A	13.4	650

* Actual or potential bicarbonate (e.g., lactate, citrate, or acetate).
[À] Mead-Johnson Laboratories, Princeton, New Jersey. Additional information is available at http://www.meadjohnson.com/products/cons-infant/enfalyte.html.
[Ä] Ross Laboratories (Abbott Laboratories), Columbus, Ohio. Data regarding Flavored and Freezer Pop Pedialyte are identical. Additional information is available at http://www.pedialyte.com.
[Æ] Ross Laboratories (Abbott Laboratories), Columbus, Ohio. Additional information is available at http://rpdcon40.ross.com/pn/PediatricProducts.NSF/web_Ross.com_XML_PediatricNutrition/96A5745B1183947385256A80007546E5?OpenDocument.
** Cera Products, L.L.C., Jessup, Maryland. Additional information is available at http://www.ceralyte.com/index.htm.
[ÀÀ] Not applicable.
[ÄÄ] Meeting U.S. Department of Agriculture minimum requirements.
[Æ Æ] Coca-Cola Corporation, Atlanta, Georgia. Figures do not include electrolytes that might be present in local water used for bottling. Base = phosphate.

for treating diarrhea that include nonstandard fluids (unpublished data, Caleb K. King, M.D., University of North Carolina, Chapel Hill, North Carolina). A case report of one child whose care was compromised by following advice obtained from a prominent hospital's Internet site highlights the continued gap between knowledge and practice and the ongoing need to disseminate accurate information regarding oral rehydration (*113*).

Conclusion

Treatment of acute diarrhea has relied upon simple and effective therapy of oral rehydration. The critical co-principle in case management of early resumption of feeding of children immediately upon rehydration has also gained wide acceptance. More recent advances in the science of diarrhea treatment include recognition for the role of zinc supplementation in reducing disease severity and occurrence, and development of an oral rehydration solution of lower osmolarity for global use. The combination of oral rehydration and early nutritional support promises to safely and effectively assist a patient through an episode of diarrhea. If the principles of therapy outlined in this report are accepted by all levels of the medical community and if education of parents includes teaching them to begin ORT at home, numerous deaths and unnecessary clinic visits and hospitalizations can be avoided. ORT is suitable for use among children throughout the world (*114*).

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Management of Acute Gastroenteritis Among Children

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Marijuana: A Continuing Concern for Pediatricians

ABSTRACT. Marijuana, the common name for products derived from the plant *Cannabis sativa*, is the most common illicit drug used by children and adolescents in the United States.[1] Despite growing concerns by the medical profession about the physical and psychological effects of its active ingredient, Δ-9-tetrahydrocannabinol, survey data continue to show that increasing numbers of young people are using the drug as they become less concerned about its dangers.[1]

ABBREVIATION. THC, tetrahydrocannabinol.

Because the decision of whether to use marijuana is usually made by the time a young person reaches the age of 19 years,[2,3] pediatricians must continue to be cognizant of the implications of marijuana use. Widespread debate exists about marijuana and the possibility of legalizing its use or at least decriminalizing its possession.[4–7] Furthermore, marijuana is being promoted for medical purposes, such as the treatment of glaucoma and the management of nausea and anorexia related to cancer chemotherapy.[4,8,9] Although these topics are beyond the scope of this statement, evidence suggests that pediatricians should continue their vigilant efforts to prevent the use of this drug by young people.

The abuse of marijuana by adolescents is a major health problem with social, academic, developmental, and legal ramifications.[10] Marijuana is an addictive, mind-altering drug capable of inducing dependency.[11] Pediatricians are obligated to develop a reasoned approach to dealing with its use by children and adolescents so they can provide appropriate care and counsel.[12]

EPIDEMIOLOGY

Between 1991 and 1997, the use of marijuana by young people increased dramatically.[1] In 1997, 23% of eighth graders reported having used the drug at some time in their lives, an increase in use from 10% in 1991. Among 10th graders, the number nearly doubled from 23% in 1991 to 42% in 1997. In 1997, 50% of high school seniors reported having used marijuana compared with 37% 6 years earlier. The abuse of marijuana among teenagers has increased as the "perceived harmfulness" of regular use has decreased and the perception of "peer acceptance" has increased.[1,2]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

POTENCY

The potency of marijuana is defined as the percentage of Δ-9-tetrahydrocannabinol (Δ-9-THC) in the dry weight of the sample. Increased sophistication in the selective breeding of marijuana plants has led to a substantial increase in the potency of street samples during the past 2 decades. In 1975, the average potency of THC in confiscated samples was 0.71%; by 1997, the average concentration was 3.71%—a fivefold increase. There is wide variation in the potency of smoked marijuana. Sensimilla (considered by many to be the finest product, produced from the flowering tops of the female hemp plant) had an average potency of 6.6% in 1997. Marijuana sold as loose plant material (leaves, stems, and seeds) had an average potency of 3.2%.[13] In addition, the method of consumption (smoking as a rolled cigarette or in a pipe or packed into a hollowed-out cigar), as well as the presence of adulterating substances, affect the potency.

Because of the documented change in potency, pediatricians must be able to address with their patients what seems to be "casual use" of marijuana. Trends suggest that the low-dose, self-experimentation type of use typical of the 1960s may be giving way to the high-potency–high-reward pattern of compulsive marijuana use prevalent during the late 1990s.[14]

SOMATIC CONSEQUENCES

Marijuana should not be considered an innocuous drug. Regular use has been associated with cardiovascular, pulmonary, reproductive, and immunologic consequences. The physiologic effects of marijuana use include an accelerated heart rate and a minimal rise in blood pressure.[15,16] These effects, which seem to be secondary to Δ-adrenergic vascular mechanisms, are transient and usually not deleterious to the otherwise healthy adolescent. The immediate pulmonary effect of smoking marijuana is bronchodilation, although with long-term use the smoked particles act as an irritant, causing bronchoconstriction and eventual airway obstruction.[17–19] The chronic effects are similar to those of smoking tobacco, and there seems to be a relationship between smoking marijuana and neoplastic changes in the lungs.[20]

Heavy marijuana use may be especially dangerous for adolescents during puberty. Such use has been associated with diminished sperm motility, decreased sperm counts, decreased circulating testosterone levels,[21,22] irregular ovulation, and decreased pituitary gonadotropin levels.[23,24] The metabolites of

marijuana cross the human placenta and are also found in human milk. Although the consequences of the presence of such metabolites in human milk have yet to be identified,[25–27] infants born to mothers who smoke marijuana during pregnancy are shorter, weigh less, and have smaller head circumferences at birth.[27,28] Marijuana and some of its components influence the immune system and affect the body's antitumor activities. Marijuana receptors have been identified on macrophages and T and B lymphocytes, suggesting a molecular basis for immunosuppression by THC.[29–31]

NEUROPHARMACOLOGY

The psychoactive effects of Δ-9-THC are receptor-mediated. The cannabinoid receptor sites in the brain are particularly dense in the outflow nuclei of the basal ganglia, the hippocampus, and the molecular layers of the cerebellum, implicating roles for cannabinoids in the disruption of cognition and coordination. Sparse densities in the lower brainstem areas controlling cardiovascular and respiratory functions may explain why high doses of Δ-9-THC are not lethal.[32]

Anandamide, a derivative of arachidonic acid, is an endogenous chemical in the brain that binds with cannabinoid receptors.[33] Like Δ-9-THC, it has been shown to affect muscle coordination, produce analgesic and tranquilizing effects, and inhibit secretion of follicle-stimulating hormone, prolactin, and growth hormone.[34] The use of anandamide as a marijuana antagonist has substantial effects on rats conditioned to self-treatment with THC[33,34] and has helped elucidate the mechanism by which cannabinoids exert their biological and psychologic effects.

The most pervasive common pathway among drugs of abuse, including cocaine, heroin, opiates, and marijuana, is the stimulation of release of the neurotransmitter, dopamine.[35–38] This endogenous catecholamine stimulates certain dopaminergic projections of the medial forebrain bundle—the brain's so-called reward circuitry.[39] Psychoactive drugs, including marijuana, derive substantial abuse liability from enhancing these circuits; and it is the psychoactive ingredient of marijuana, Δ-9-THC, that stimulates the release of dopamine, mediated through the cannabinoid receptors.[40,41]

In both animal and human experiments, subjects self-administer marijuana. They predictably select high-potency marijuana over low-potency marijuana,[42] supporting the hypothesis that the reinforcing effect and abuse liability of marijuana are positively related to the Δ-9-THC content.

Marijuana is lipophilic and is stored in the brain and other fat-rich areas of the body, forming what has been described as a "depot."[43] The slow release of marijuana and its metabolites from lipid stores may explain the carry-over effects of marijuana on driving and other cognitive and behavioral changes,[44] as well as the absence of acute signs of withdrawal after abrupt discontinuation of use.[45]

BEHAVIORAL AND COGNITIVE CONSEQUENCES

Marijuana affects the brain, resulting in behavioral and cognitive effects. Acutely, marijuana produces euphoria, relaxation, and disinhibition. Persons under the influence of the drug show impaired problem-solving skills and difficulty in organizing thoughts and conversing. Other adverse consequences of marijuana use include interference with coordination; the ability to judge elapsed time, speed, and distance; the ability to track a moving object; and reaction time.[46–49] There is little doubt that marijuana intoxication contributes substantially to accidental deaths and injuries among adolescents, especially those associated with motor vehicle crashes, and is frequently involved in incidents related to driving while intoxicated.[50,51]

Regular use of marijuana also exerts a negative effect on short-term memory, learning, and attention span. Three methodologically strong studies presented compelling evidence that these functions were impaired in frequent users of marijuana (defined as using 20 to 30 days per month), even up to 6 weeks after discontinuation of use,[52] and noticeable impairment in attention and memory was evident even after 24 hours of abstinence.[53,54] Clearly, young people who are frequent users of marijuana experience residual neuropsychologic effects with an impaired ability to learn.[53]

An "amotivational syndrome" has been described in chronic heavy marijuana users. This syndrome is characterized by the inability to sustain attention on environmental stimuli and to maintain goal-directed thinking and behavior.[55] An additional source of concern is the occasional occurrence of dysphoric reactions that may range from mild fear to depersonalization to frank paranoia.[56,57]

Finally, marijuana use often precedes the use of other more dangerous drugs. Although marijuana use does not necessarily predict progression to the use of "harder" drugs, adolescents who use marijuana are 104 times as likely to use cocaine compared with peers who never smoked marijuana.[4,58] Therefore, the use of marijuana as a risk behavior and its role as a "gateway drug" for some teenagers must be considered.

SUMMARY

The seriousness of the behavioral consequences of marijuana use is sufficient to cause great concern and should prompt the pediatrician to counsel young people against any use of the drug. Such counsel should be based on health concerns, including the relationship of marijuana use to trauma associated with intoxication and the effect on memory and learning during this important period of development. Additional reasons for concern and counsel include anxieties and uncertainties about the potential harm that marijuana use may cause to adolescents during a period of rapid change in hormonal secretion, possible teratogenicity, and the known consequences of long-term use.

A discussion of drug use, including the use of marijuana, should be a routine part of primary health

care clinical preventive services for every child and adolescent. An assessment of potential drug use gives the pediatrician the opportunity to offer anticipatory guidance before the onset of drug use, to intervene and minimize consequences if drug use has begun, and to detect and address issues of long-term or heavy use.

Although all users should be counseled about the dangers of the drug and the illicit nature of its use, marijuana is an addictive drug and is capable of producing dependency. Marijuana-dependent teenagers should be offered treatment options, rather than simply punishment, for their illness.

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Clinical Report—Maternal-Fetal Intervention and Fetal Care Centers

AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS, COMMITTEE ON ETHICS; AMERICAN ACADEMY OF PEDIATRICS, COMMITTEE ON BIOETHICS

ABBREVIATION

IRB—institutional review board

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

FREE

The past 2 decades have yielded profound advances in the fields of prenatal diagnosis and fetal intervention. Although fetal interventions are driven by a beneficence-based motivation to improve fetal and neonatal outcomes, advancement in fetal therapies raises ethical issues surrounding maternal autonomy and decision-making, concepts of innovation versus research, and organizational aspects within institutions in the development of fetal care centers. To safeguard the interests of both the pregnant woman and the fetus, the American College of Obstetricians and Gynecologists and the American Academy of Pediatrics make recommendations regarding informed consent, the role of research subject advocates and other independent advocates, the availability of support services, the multidisciplinary nature of fetal intervention teams, the oversight of centers, and the need to accumulate maternal and fetal outcome data. *Pediatrics* 2011;128:e473–e478

The past 2 decades have yielded profound advances in the fields of prenatal diagnosis and fetal intervention. Ultrasonography and magnetic resonance imaging have led to the diagnosis of fetal anomalies that can affect many organ systems. Concomitantly, improvements in minimally invasive techniques and in the understanding of fetal physiology have allowed for more successful and less invasive or risky interventions for fetal diseases in utero. Intervention has been offered for a variety of fetal diseases, including structural abnormalities, cardiac arrhythmias, fetal metabolic diseases, and abnormalities of the placental vessels or membranes. Many of these diseases would be lethal without treatment; some (eg, spina bifida or hypoplastic left heart syndrome) are not necessarily lethal postnatally, but efforts to treat them in utero have been offered with the goal of improving long-term outcomes for the child. Many interventions are offered within the construct of a research protocol. Although fetal interventions are driven by a beneficence-based motivation (ie, a desire to do good, to improve fetal and neonatal outcomes, to ameliorate suffering), advancement in fetal therapies raises ethical issues surrounding maternal autonomy and decision-making, concepts of innovation versus research, and organizational aspects within institutions in the development of fetal care centers.

THE DECISION-MAKING PROCESS

The overarching goal of fetal interventions is clear: to improve the health of children by intervening before birth to correct or treat prenatally diagnosed abnormalities. This stems from a beneficence-based obligation to the fetus. Any fetal intervention, however, has implications for the pregnant woman's health and necessarily her bodily integrity and, therefore, *cannot be performed without her explicit informed consent*.[1] It is impossible to treat the fetus without going through the pregnant woman either physically (in the case of surgical treatments) or pharmacologically (as in the case of medications given to the woman that then cross the placenta to treat the fetus). Because the pregnant woman who chooses to undergo these procedures and treatments must assume some of the risk, respect for her autonomy requires a thorough discussion and evaluation of the maternal risks and harms of any of these therapies as well as her valid consent.[2] A pregnant woman's right to informed refusal must be respected fully.[3]

For many women, as well as the physicians caring for them, decision-making considerations relevant to fetal treatment may seem to parallel the parental decision-making process in determining treatment of childhood ailments. Women weigh the risks and benefits of the intervention for the fetus against the possible outcomes without intervention. For those few treatments that have been shown to be effective and be of low risk or minimal invasiveness, most women will agree to the treatment out of a beneficence-based obligation to their fetuses. Nonetheless, consent still must be based on the pregnant woman's assessment of her *own* interests. And, although a parental decision may, in certain circumstances, be overridden for a child after birth, even the strongest evidence for fetal benefit would not be sufficient ethically to ever override a pregnant woman's decision to forgo fetal treatment.[4,5]

A pregnant woman will often assume quite significant risks for her fetus, and some women might find it difficult to forgo these interventions because of pressures from within themselves, from their families, from their communities, or even from their care providers.[6] A pregnant woman's decision may be affected by factors such as her family's or society's expectations regarding her responsibility as a prospective mother, maternal feelings of guilt and her desire to try and make things "right," or even the psychosocial "therapeutic misconception," that is, the presumption that an intervention with no proven efficacy will actually work merely because it is *offered* by a center, is under a study protocol, or has been covered by the news media.[7,8] The informed consent process should, therefore, contain reasonable safeguards against limits to voluntariness, ranging from undue influence to coercion.

Safeguards should be in place to protect women considering fetal research. One possible safeguard would be to have a research subject advocate who does not have direct ties to the experimental protocol so that this individual can act as an independent advocate for the pregnant woman, especially when the proposed intervention poses significant risks to the pregnant woman.[9] This advocate should be nondirective in his or her support of the woman's decision and focus on meeting the woman's decision-making needs. Involving someone who has an understanding of the culture of research and yet maintains "separateness" from the research team can provide an ethical safeguard to support the pregnant woman.[10] But even outside a research protocol, a pregnant woman receiving treatment that is not experimental may also benefit from an independent advocate who might be her obstetric provider, a perinatal nurse, or a specially trained advocate.

Other family members involved in these decisions also need consideration. Pregnant women have a variety of support persons, including spouses and partners of either sex. The interests of others involved vary depending on their relationship to the woman and fetus. Because families come in differing forms, the woman herself should define these relationships and determine who should assist in any decision-making. In this Committee Opinion, the American College of Obstetricians and Gynecologists (the College) and the American Academy of Pediatrics (the Academy) write about the interests of the father but recognize that the father of the fetus may be absent or uninvolved and that the involved partner may be a man or a woman biologically unrelated to the fetus.

In most cases, the father has a moral interest in the health of the fetus and the pregnant woman, just as he would have interests in the health of the mother and child after delivery. It is appropriate for women to involve fathers in these decisions for good reasons: they will usually be raising this future child together, they will make joint decisions about health issues, and their relationship may be one of mutual support in family decision-making. It may be problematic for a woman to proceed with these interventions without consulting the father. It must be recognized that postnatally, pediatric care commonly involves shared decision-making between a child's mother *and* father, making the recommendation not to grant any authority to the father in the prenatal period uncomfortable for many pediatricians. However, for the reasons stated earlier, the pregnant woman's interests and final decisions regarding fetal interventions assume priority in the

prenatal period. Although it may be appropriate and helpful for the father to be involved in these decisions and have complete access to information (with proper authorization from the pregnant woman), to assign him any authority to assent or dissent would unjustifiably erode the autonomous decision-making capacity of the pregnant woman. The College addressed paternal consent for research in a previous Committee Opinion.[3,11] The College concluded that paternal consent for research on fetuses should not be required but recognizes that federal regulations continue to require this consent in some circumstances.

PREGNANT WOMEN REQUIRE INFORMATION ON RISKS, BENEFITS, OUTCOMES, AND ALTERNATIVES FOR BOTH THE FETUS AND THEMSELVES

One of the challenges surrounding fetal interventions is the difficulty in delivering information to prospective parents that is both thorough and unbiased. Not only do prospective parents need to be informed of the goals of treatment, but they also need to know about the sometimes conflicting data, or more commonly the paucity of data, that support offering or performing interventions. The risks and possible benefits to the fetus undergoing an intervention need to be weighed against the risks and benefits of obstetric and neonatal care without the intervention (which is often the standard of care). Moreover, the range of outcomes of all options must be presented, because prospective parents may erroneously believe that there are only 2 possible results: 1) success (fetal cure) or 2) failure (fetal death).

In addition to information regarding the risks and benefits to the fetus or neonate, women require a frank discussion of the maternal risks of any fetal intervention. The morbidity and mortality associated with some interventions may be quite small (an amniocentesis needle and use of many maternal medications) or quite significant (the performance of a laparotomy and hysterotomy). Maternal hysterotomy may increase the risk of uterine rupture to rates as high as those after a classical cesarean delivery (4%–9%)[12]; these ruptures are associated with significant maternal and neonatal morbidities and mortalities. Moreover, these risks will persist in subsequent pregnancies as well. A thorough disclosure of these risks is always necessary.

INNOVATIVE AND EXPERIMENTAL CARE

One vital, though sometimes difficult, distinction that should be made to prospective parents concerns which fetal interventions are standard or evidence-based therapy and which are innovative or experimental. Certainly any intervention that is being studied as part of a research protocol requires formal institutional review board (IRB) oversight and an approved informed consent process. Federal guidelines indicate that novel interventions that deviate substantially from standard practice do not need to be performed within a research protocol but should eventually be developed into a protocol subject to IRB oversight[13]:

> "When a clinician departs in a significant way from standard or accepted practice, the innovation does not, in and of itself, constitute research. The fact that a procedure is 'experimental,' in the sense of new, untested or different, does not automatically place it in the category of research. Radically new procedures of this description should, however, be made the object of formal research at an early stage to determine whether they are safe and effective. Thus, it is the responsibility of medical practice committees, for example, to insist that a major innovation be incorporated into a formal research project."

An attempt should be made to make clear to patients the distinction between the goals of therapeutic medicine (eg, cure, treatment, or palliation) versus the goals of research (eg, answering a scientific question that contributes to generalizable knowledge). In addition, there is often a blurring of boundaries between research and innovative practice associated with the rapidly developing technologies used in fetal interventions that raises concerns about the protection of pregnant women and their fetuses from the risks of unproven therapies. Although the first few uses of a new intervention may be motivated by a desire to help particular fetuses, once feasibility and potential benefit have been identified, innovations should be subjected to systematic formal research as soon as feasible.[14] This benefits science, because evaluation of new procedures might be hindered if new procedures continue to be considered "innovative therapy" rather than part of careful research. Pregnant women and their fetuses who undergo these interventions must have at least the same protections afforded to other research participants, and studies should be designed to assess the full impact of risks and benefits of these interventions on both the woman and the fetus, for both short- and long-term outcomes.

ALTERNATIVES TO INTERVENTION

The case of prospective parents electing to forgo fetal intervention also needs further exploration. Given the maternal morbidities and experimental nature of many fetal interventions, some women may understandably elect to carry the pregnancy to term but *not* to undergo fetal intervention. It is critical, therefore, for those centers offering fetal interventions to provide care, support, and appropriate referral services for these women and their families. For the fetus with anomalies such as spina bifida, this will involve postnatal neurosurgical treatment, which is currently standard care. For the fetus with lethal abnormalities,

this may take the form of access to palliative care or perinatal hospice programs. In the situation in which the fetal intervention is being offered in an attempt to avoid fetal death, these services could be offered alongside the intervention in case it is unsuccessful.

Finally, the clinical reality of serving women during pregnancy is that some women will elect pregnancy termination when facing the diagnosis of significant fetal anomalies. Centers offering fetal intervention should evaluate pregnant women in a timely fashion, counsel them adequately and nondirectively about all options, and, for women who might opt for pregnancy termination, have in place appropriate mechanisms, including the ability and resources for referral, to support these women through a difficult decision. An integrated palliative care, hospice, or bereavement service can help support women who elect to terminate their pregnancies as well.

Thus, the ethical provision of fetal intervention requires that women are not only well informed but also have, to the greatest extent possible, meaningful access to alternatives to intervention. Practitioners participating in fetal care centers may face significant difficulties in presenting in as nonbiased a fashion as possible these 4 distinct options: 1) fetal intervention, 2) postnatal therapy, 3)palliative care, or 4) pregnancy termination. Certainly each pediatrician, surgeon, and obstetrician involved in these decisions may have his or her own distinct views about the best course of action for any given disease entity, and thus, the counseling of the pregnant woman becomes complicated. Coordination of care and good communication between providers can help to minimize the conflicting information and opinions that may be given to patients.

OTHER NECESSARY SUPPORT SERVICES

The complex emotional stressors that pregnant women and their families may experience when considering fetal intervention may necessitate access to a variety of support services. These may include social services, palliative care and perinatal hospice services, genetic counseling, and ethics consultation, when appropriate.

FETAL CARE CENTERS

Diagnostic and therapeutic efforts are frequently being combined frequently and marketed in the form of fetal care or treatment centers. Fetal care centers can exist in many forms, having developed through a variety of multidisciplinary collaborative relationships among pediatric subspecialists, maternal–fetal medicine specialists, and radiologists. Often, they are freestanding centers, but they also can exist within established pediatric or obstetric departments. Regardless of their origin or site, they typically offer a wide variety of fetal diagnostic services as well as proven therapies and experimental practices of unproven benefit. These centers are driven by a beneficence-based motivation to improve fetal and neonatal outcomes and have frequently been the site of innovation and research that has furthered this end.[15,16] It should be noted that most maternal–fetal medicine divisions already provide such fetal care along with care of pregnant women; these divisions routinely call on pediatric surgeons and other subspecialists to consult with pregnant women without having any direct affiliation with a formal "fetal care" center. The dilemmas that may arise in the context of fetal care are, thus, not unique to fetal care centers; many of these dilemmas are faced by anyone caring for pregnant women. However, in marketing these centers around the fetus and its care, these centers require heightened scrutiny so that the needs and the interests of pregnant women are being adequately addressed.[17]

Conflicts of interest may arise in providing fetal intervention services, because these services may be financially lucrative for the institutions and may benefit the careers of the centers' practitioners. Furthermore, institutional use of resources by a fetal care center for the few women and fetuses who may benefit from an intervention may not be the most just or fair distribution of resources. Even if centers do not perform an intervention in the majority of cases they see, this may simply mean that prenatal counseling is a major component of most "fetal care" and is, in fact, a good justification for the use of resources in this fashion.

Cooperation between fetal care centers should be encouraged to establish collaborative research networks (especially for rare diseases and procedures) and to support multicenter trials to accumulate more robust short- and long-term maternal and fetal outcome data on all categories of fetal intervention. In addition, the establishment of centers of excellence for those procedures that are particularly challenging and rare may help to optimize fetal and maternal outcomes.[18] As with many rare specialty-specific endeavors, the balance of offering geographical access while having the quantity of cases necessary to develop clinical expertise and quality outcomes is difficult to achieve. Limiting interventions to a few centers of excellence for the sake of quality of care will create both geographical and financial barriers to access. Furthermore, those centers not participating in multicenter trials must consider whether to refer patients to centers that are participating to facilitate these research studies and find answers that cannot be discovered by offering interventions "off-study."

OVERSIGHT AND GOVERNANCE

To protect the panoply of interests involved (fetal, maternal, professional, and institutional), centers performing fetal interventions should have organizational structures or groups to provide oversight of both clinical and nonclinical activities. Multidisciplinary teams should be assembled to oversee the care being offered and to ensure that appropriate informed consent is obtained. To protect the interests of the pregnant woman, such teams should include a maternal–fetal medicine specialist. Indeed, because of their particular training, maternal–fetal medicine specialists are best suited to direct the care of the pregnant woman undergoing fetal interventions. Neonatologists also should be involved, because they will typically be the primary physicians managing the care of the neonate and dealing with the medical consequences of the antenatal intervention. Including a variety of other professionals on the team, such as nurses, pediatric and surgical subspecialists, genetic counselors, chaplains, ethicists, and other members of institutional ethics committees, is vital. Ideally, this group would include members, both professionals and nonprofessionals, without direct ties to the center involved. This group can help explore conflicts of interest, distinguish between innovation and research, and ensure that pregnant women are not being unduly influenced, coerced, or taken advantage of in what may be a time of crisis.

There also may be clinical management conflicts that arise between the obstetric and pediatric staff caring for these women, because the focus of care of the 2 groups can differ. Organizational structures within fetal care centers that foster consensus building are crucial to resolving these conflicts. The obstetrician, however, must remain in charge of the pregnant woman's overall care. Moreover, these centers must be able to provide the high-risk and obstetric critical care that these women often need; this may be a challenge when centers are housed in pediatric hospitals but it is necessary to optimize the well-being of the pregnant woman.

Finally, to protect against institutional conflicts of interest, an external advisory group may be necessary to monitor the center's nonclinical activities including marketing, outreach, and community relations. A memorandum of understanding should be developed that delineates the oversight group's authority to veto or halt activities that do not provide adequate benefits or pose inordinate risks.

RECOMMENDATIONS

To safeguard the interests of both the pregnant woman and the fetus, the College and the Academy make the following recommendations:

- Because it is impossible to treat the fetus without going through the pregnant woman either physically or pharmacologically, any fetal intervention has implications for the pregnant woman's health and necessarily her bodily integrity and, therefore, cannot be performed without her explicit informed consent.
- Distinctions should be made to prospective parents between which protocols are standard or evidence-based therapies and which are innovative or experimental interventions. Ordinarily, innovations should be subjected to systematic formal research as soon as feasible. Research must always be offered under proper oversight by an IRB.
- The informed consent process should involve thorough discussion of the risks and benefits for both the fetus and the pregnant woman. The full range of options, including fetal intervention, postnatal therapy, palliative care, or pregnancy termination, should be discussed. The informed consent process should contain reasonable safeguards against limits to voluntariness, ranging from undue influence to coercion.
- Safeguards should be in place to protect women considering fetal research. One possible safeguard would be to have a research subject advocate who does not have direct ties to the experimental protocol so that this individual can act as an independent advocate for the pregnant woman, especially when the proposed intervention poses significant risks to the pregnant woman. Similarly, a woman receiving treatment that is not experimental may also benefit from an independent advocate who might be her obstetric provider, a perinatal nurse, or a specially trained advocate.
- The complex emotional stressors that pregnant women and their families may experience when considering fetal interventions may necessitate access to a variety of support services. These may include social services, palliative care and perinatal hospice services, genetic counseling, and ethics consultation, when appropriate.
- The organization and governance of centers providing fetal interventions should involve a diverse group of professionals. Maternal–fetal medicine specialists and neonatologists should be included in this group. Including a variety of other professionals on the team, such as nurses, pediatric and surgical subspecialists, genetic counselors, chaplains, ethicists, and other members of institutional ethics committees, is vital. Ideally, this group would include members, both professionals and nonprofession-

als, without direct ties to the center involved.

- Cooperation between fetal care centers should be encouraged to establish collaborative research networks (especially for rare diseases and procedures) and to support multicenter trials to accumulate more robust short- and long-term maternal and fetal outcome data on all categories of fetal intervention. In addition, the establishment of centers of excellence for those procedures that are particularly challenging and rare may help to optimize fetal and maternal outcomes.

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American Academy of Pediatrics
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POLICY STATEMENT

Maternal Phenylketonuria

Organizational Principles to Guide and Define the Child Health System and/or Improve the Health of All Children

Committee on Genetics

ABSTRACT

Elevated maternal phenylalanine concentrations during pregnancy are teratogenic and may result in growth retardation, microcephaly, significant developmental delays, and birth defects in the offspring of women with poorly controlled phenylketonuria during pregnancy. Women of childbearing age with all forms of phenylketonuria, including mild variants such as mild hyperphenylalaninemia, should receive counseling concerning their risks for adverse fetal effects, optimally before conceiving. The best outcomes occur when strict control of maternal phenylalanine concentration is achieved before conception and continued throughout pregnancy. Included are brief descriptions of novel treatments for phenylketonuria. *Pediatrics* 2008;122:445–449

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Key Words
phenylketonuria, maternal phenylketonuria, pregnancy, birth defect prevention

Abbreviations
PKU—phenylketonuria
Phe—phenylalanine
PAH—phenylalanine hydroxylase
BH_4—tetrahydrobiopterin
PAL—phenylalanine ammonia lyase

BACKGROUND

Phenylketonuria (PKU) is an autosomal recessive disorder of phenylalanine (Phe) metabolism associated with deficient activity of Phe hydroxylase (PAH) and elevated concentrations of Phe and Phe metabolites. Untreated PKU is characterized by severe to profound intellectual disability, seizures, autistic-like behaviors, microcephaly, rashes, hypopigmentation, and a musty body odor (phenylacetic acid). Hyperphenylalaninemia may be defined as having a blood Phe concentration above the reference range (31–110 μmol/L [0.51–1.8 mg/dL], depending on age). Different schemes exist for classifying subtypes of PKU on the basis of the severity of the clinical or biochemical and/or molecular phenotype.[1–4] Patients have been classified as having mild hyperphenylalaninemia if their blood Phe concentration without dietary therapy is elevated but less than 600 μmol/L (10 mg/dL).[2] Classic PKU is characterized by a Phe concentration higher than 1200 μmol/L (20 mg/dL) while receiving a normal dietary intake of protein.[3] "Variant" or "atypical" forms of PKU (600–1200 μmol/L [10–20 mg/dL] that do not fit the mild or classic descriptions also exist, although there is not yet a universally accepted definition of these variant forms. In rare cases, an elevated blood Phe concentration may be caused by inherited disorders of the biosynthesis or recycling of tetrahydrobiopterin (BH_4), a cofactor in the PAH reaction.

Since the 1960s, newborn screening for PKU has allowed early detection and treatment of the disorder, preventing untoward consequences. Standard current treatment consists of selectively restricting intake of Phe and supplementing tyrosine (the product of normal PAH activity) by using special medical foods that are devoid of or low in Phe while providing enough additional protein, vitamins, and minerals to support normal growth. With good control of Phe concentrations during early childhood, most affected children have normal development measured at 5 years of age. Recommendations for dietary therapy have evolved as experience with different regimens and durations of therapy have accumulated. In earlier therapeutic protocols, treatment was only continued through the first few years of life, theoretically corresponding to the age at which brain myelination is complete. As developmental data accumulated, it became evident that treatment throughout childhood and adolescence was the best course for preserving intelligence. In more recent studies, it has been shown that brain MRI abnormalities and electrophysiologic testing abnormalities referable to the central nervous system are observed in adults who are on unrestricted Phe intake. Accordingly, it is reasonable to continue treatment into adulthood, and most centers recommend lifelong treatment. Strict adherence to the PKU diet is especially important for women during their reproductive years because of the risks to the fetus.

Adults with classic PKU who had good control as children typically have normal intelligence or mild degrees of intellectual deficit. Careful psychometric testing of well-treated individuals has detected instances and degrees of impairment in visual motor skills, abstract reasoning, problem solving, specific aspects of executive control, attention, verbal memory, expressive naming, and verbal fluency,[5] although overall IQ may still be within the reference range. One possible explanation for these neuropsychologic impairments invokes mid-dorsolateral prefrontal cortex dys-

function caused by abnormal catecholamine concentrations.[6] Another theory suggests that abnormal brain myelination and deficiency of brain large neutral amino acids may play a role in impaired cognition.[7–9]

In addition, emotional disorders (depression, anxiety, phobias), as well as hyperactive behaviors, are encountered more frequently in individuals treated for classic PKU than in the general population.[10] However, people with untreated mild hyperphenylalaninemia do not seem to be at risk of developing neuropsychologic impairment.[11]

Poor dietary adherence leads to blood Phe concentrations above the current recommended therapeutic range.[4] High blood Phe concentrations in people who have discontinued their special diets often results in a decrease in IQ, learning disabilities, behavioral problems, and even neurologic complications. White matter abnormalities may develop in people with PKU who have poor dietary control. MRI of the brain may detect dysmyelination, especially T2 enhancement in the periventricular white matter in individuals with PKU who are under poor dietary control. Abnormal areas of white matter may also demonstrate restricted diffusion of water, possibly indicative of increased myelin turnover.[12] These findings are potentially reversible once proper dietary therapy is reinstituted.[13]

During pregnancy, Phe crosses the placenta by active transport, resulting in 70% to 80% increased fetal concentration of Phe compared with maternal concentration.[14] An elevated Phe concentration is toxic and teratogenic to a developing fetus.[15] Abnormalities in the children of women with uncontrolled PKU during pregnancy were first reported by Dent[16] in 1957 and Mabry et al[17] in 1963. The international survey of women with PKU, the results of which were published in 1980, documented an increased risk of spontaneous miscarriage (24%), intrauterine growth retardation (40%), microcephaly (73%), global developmental delays (92%), and congenital heart defects (12%) in their offspring.[18] Postnatal growth retardation, abnormal neurologic findings, and mild craniofacial dysmorphic features also have been reported.[18] The frequency of abnormalities seems to be directly correlated with maternal Phe concentration during pregnancy.[19] Poor fetal growth, microcephaly, and structural heart defects also are more likely to occur if there was "lack of control" of maternal Phe concentrations during critical periods of embryogenesis early in pregnancy.[19]

The Maternal Phenylketonuria Collaborative Study, sponsored by the National Institute of Child Health and Human Development, began in the United States in 1984 to determine fetal outcomes with improved control of maternal Phe concentrations during pregnancy.[19,20] This study became an international effort with participating clinics in Canada and Germany since 1985 and 1991, respectively. The National Institutes of Health consensus conference on PKU in 2000 emphasized the importance of dietary control before conception. This international effort was completed in 2002 and culminated with the International Conference on Maternal Phenylketonuria in April 2002, which provided clear guidelines for the management of pregnancy in women with PKU. The study has provided essential information regarding the effective treatment of women with PKU. This information is now available for clinicians to impart to their patients with PKU to ensure that women with PKU know their risk and how they may be able to have healthy children with timely and appropriate intervention.[18]

The effects of uncontrolled maternal PKU occur regardless of whether the fetus has PKU. The best observed outcomes occur when strict control of maternal blood Phe concentration is instituted before pregnancy or by 8 weeks of gestation at the latest.[19,21,22] Women with PKU who have their blood Phe concentration in good control before conception have an excellent chance for normal pregnancies and neonatal outcome. The achievement of preconceptional and periconceptional dietary control with a Phe-restricted diet significantly decreases the risk of microcephaly, intrauterine growth retardation, congenital heart disease, and developmental delays in the offspring of women with hyperphenylalaninemia.[19] Normal pregnancy and neonatal outcome have been achieved in women with PKU who have blood Phe concentrations between 120 and 360 μmol/L before conception or by 8 weeks of gestation at the latest.[22]

Before conception, counseling and early entrance into a prenatal care program are essential for achieving optimal fetal outcome for women with PKU, variant PKU, and mild hyperphenylalaninemia. It is acknowledged that reinstitution of a Phe-restricted diet and supplements is difficult.[23] Because many pregnancies are unintended, dietary control throughout the childbearing years is essential for preventing an adverse effect on the fetus.[24] The currently recommended Phe concentrations during pregnancy (120–360 μmol/L [2–6 mg/dL] in the United States)[3] are consistent with those currently recommended for PKU treatment during early childhood. Achieving this degree of control requires a major commitment by the woman and support by her treating professionals. The recommendations for maternal control are based on maternal Phe concentration, as opposed to the genotype or severity of the mother's metabolic condition. In 1 study, the IQs of offspring exposed to high concentrations of maternal Phe during pregnancy (>750 μmol/L) were low (mean IQ: 56) and similar whether the mother had PKU or hyperphenylalaninemia and regardless of the genotype, whereas offspring had normal cognitive development (mean IQ: 105) when their average exposure to Phe concentration during pregnancy was less than 360 μmol/L.[25]

Dietary control for adults with PKU is challenging. Although low-Phe flour, pastas, cookies, and nutrition bars have increased dietary options for patients, the PKU diet remains bland, so poor dietary adherence continues to be a major problem. In addition to considerations about the palatability of the PKU diet, economic and health care system issues may contribute to barriers to dietary control. In 1 study that examined impediments to successful dietary control, women with private insurance identified infrequent assistance with the cost of medical food and beverages and low-protein foods as a

barrier, despite the existence of US public law defining the formula as medical foods.[26] Public assistance programs provided more coverage for the cost of the medical foods, clinic visits, and low-protein foods.[26] However, these women were less likely to achieve metabolic control before 10 weeks' gestation. Brown et al[26] believed this may reflect that many women enrolled in public assistance programs were younger and less educated, which are factors associated with late control. Adolescent girls with PKU who become pregnant are at particular risk of not having dietary control until late in their pregnancy, given their young age and the higher risk of unplanned pregnancy.

The National Institutes of Health consensus guidelines recommend that pregnant women with PKU have their Phe concentrations monitored twice weekly.[3] Frequent visits to clinicians who specialize in treating PKU are also recommended for pregnant women with PKU. However, given the limited number of specialist centers, especially centers skilled at caring for adults, there may be a need to travel relatively long distances to obtain appropriate management. Such barriers to access challenge patients to comply with the frequency recommendations for PKU monitoring. In addition, psychosocial, emotional, and social factors contribute to the barriers for successful control of PKU during pregnancy.[26]

All offspring of mothers with PKU will inherit at least 1 abnormal allele at the *PAH* locus from the affected mother. Affected mothers have 2 *PAH* mutations, either in a homozygous (2 identical mutations) or compound heterozygous (2 different mutations) state. Depending on the PKU carrier status of the father, approximately 1 in 120 offspring will also inherit an abnormal *PAH* gene from the father and will have PKU.

A number of novel therapies are being developed for treatment of PKU, including large neutral amino acid supplementation, BH_4 administration, and enzyme therapy using Phe ammonia lyase (PAL). Large neutral amino acids compete with Phe for transport across the blood-brain barrier by the L-type amino acid carrier and consequently decrease the concentration of Phe in the central nervous system.[27] Decreased brain Phe concentration, as measured by proton magnetic resonance spectroscopy, and increased blood concentrations of tyrosine and tryptophan (the respective precursors for dopamine and serotonin) were noted in 1 clinical trial using large neutral amino acid supplements.[28] Oral BH_4, the naturally occurring cofactor to the PAH reaction, has been shown to decrease serum Phe concentrations, especially in patients with mild hyperphenylalaninemia.[29,30] Response to BH_4 has also been documented in patients with classic or variant PKU.[30,31] Another novel therapeutic approach uses the nonmammalian enzyme PAL. PAL converts Phe to transcinnamic acid, a harmless compound, and has been shown to reduce hyperphenylalaninemia in animal models of PKU.[32] PAL therapy has the theoretic potential to increase dietary Phe tolerance, but significant practical hurdles need to be overcome (PAL is destroyed by gastric acidic pH and intestinal proteolysis). Although these are exciting developments, they are not currently approved for use during pregnancy, so the role that such therapies may play in reducing the risk of maternal PKU syndrome is still to be determined.

RECOMMENDATIONS

The recommendations of the American Academy of Pediatrics reflect the guidelines of the Maternal Phenylketonuria Collaborative Study of the National Institutes of Health.[3,19] These recommendations are to be applied to individual patients and their particular care plan with the guidance of their primary care physician in coordination with the patient's metabolic expert physician.

1. All girls and women of childbearing age with elevated Phe concentrations, including those with PKU and milder forms of hyperphenylalaninemia, should be counseled concerning their risks of having an adverse fetal outcome if they have uncontrolled blood Phe concentrations during pregnancy. Education regarding the risks of maternal PKU should begin when an infant is diagnosed with PKU in the newborn period. We recommend that the pediatrician include this information again in anticipatory guidance counseling during preadolescence and adolescence for girls with PKU. All individuals, particularly women and girls of childbearing age, should be referred to an experienced PKU treatment center for genetic and nutritional evaluation and counseling throughout their lifetime.
2. Women with hyperphenylalaninemia who are unable or unwilling to maintain blood Phe concentrations in the range for optimum pregnancy outcome should be counseled before conception regarding the risk of microcephaly, mental retardation, and fetal anomalies in their offspring. Emphasis should also be placed on the education that structural defects, such as congenital heart disease, are associated with poor control early in pregnancy. Dietary therapy should be in place before conception to ensure optimal outcome for the fetus. It is important that these women receive assistance to obtain adequate means for access to reproductive services.
3. Genetic counseling should be offered for all women with PKU before and after conception. Pregnant women with hyperphenylalaninemia should be counseled concerning the risks to the fetus and offered detailed ultrasonographic examinations and fetal echocardiography to detect fetal abnormalities (eg, growth retardation, congenital heart defects). Consideration should be given to maternal Phe concentrations during critical time periods of organogenesis. It is equally important that these women obtain assistance in locating centers with skilled clinicians who are able to provide medical care for pregnant women with PKU.
4. Mothers who give birth to children with features suggestive of maternal PKU, such as congenital heart disease, microcephaly, and suggestive facial dysmorphic features without a known cause, should undergo blood testing for hyperphenylalaninemia. The Phe level of a newborn of a mother with PKU is usually

normal. Consideration should also be given to other teratogenic causes, such as maternal diabetes mellitus, alcohol abuse, or use of isotretinoin. In addition, mothers should be considered for PKU testing if their infants have an initial elevation of Phe concentration on newborn screening that resolves.

5. Pediatricians should work with the families of people with PKU to ensure access to social services, medical foods, and routine reliable visits to a center with expertise in caring for people with metabolic disorders.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Media Education

abstract

FREE

The American Academy of Pediatrics recognizes that exposure to mass media (eg, television, movies, video and computer games, the Internet, music lyrics and videos, newspapers, magazines, books, advertising) presents health risks for children and adolescents but can provide benefits as well. Media education has the potential to reduce the harmful effects of media and accentuate the positive effects. By understanding and supporting media education, pediatricians can play an important role in reducing harmful effects of media on children and adolescents. *Pediatrics* 2010;126:1012–1017

COUNCIL ON COMMUNICATIONS AND MEDIA

KEY WORD
media

ABBREVIATION
AAP—American Academy of Pediatrics

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THE AMOUNT OF TIME SPENT WITH MEDIA

Children and teenagers spend more time engaged in various media than they do in any other activity except for sleeping. A 2010 Kaiser Family Foundation survey of more than 2000 8- to 18-year-olds revealed that children and teenagers in the United States spend an average of more than 7 hours/day with a variety of different media.[1] By the time today's young people reach 70 years of age, they will have spent the equivalent of 7 to 10 years of their lives watching television.[2] There are more homes in America that have a TV than those that have indoor plumbing, and today's child lives in an environment with an average of 4 TVs, nearly 3 DVD players or VCRs, 1 DVR, 2 CD players, 2 radios, 2 video game consoles, and 2 computers.[1] Preadolescents and adolescents can download racy videos, send sexual text messages or explicit photographs to their friends, buy cigarettes and beer on the Internet, and post enticing profiles on Facebook. Yet, across all ages, TV remains the predominant medium. TV-viewing is also beginning at increasingly younger ages. The latest national report revealed that on a typical day, nearly two-thirds of children and infants younger than 2 years are watching TV for an hour and a half.[3] More than 70% of American teenagers have a TV in their own bedrooms, half have a VCR or DVD player, half have a video game console, and one-third have a computer and Internet access.[1] Time spent with media often displaces involvement in creative, active, or social activities.

THE EFFECTS OF MEDIA VIOLENCE ON AGGRESSIVE BEHAVIOR

Results of more than 2000 scientific studies and reviews have shown that significant exposure to media violence increases the risk of aggressive behavior in certain children and adolescents, desensitizes them to violence, and makes them believe that the world is a "meaner and scarier" place than it is.[4–9] Violence appears in various forms of media entertainment such as movies, video games, and TV news. For example, nearly 90% of the top-grossing PG-13–rated films of 1999–2000 contained violence.[10] Research has shown that

news reports of bombings, natural disasters, murders, and other violent crimes have the potential to traumatize young children.[5,11]

SEXUAL CONTENT IN THE MEDIA

American media—both programming and advertising—are highly sexualized in their content. On prime-time TV, more than 75% of shows contain sexual content, yet for only 14% of sexual incidents is any mention made of risks or responsibilities of sexual activity.[12,13] In the first 10 months of 2004, the makers of erectile-dysfunction drugs spent nearly $350 million on advertising, which makes sex seem like a harmless recreational activity.[14] Major networks remain extremely reluctant to advertise birth control pills, condoms, or emergency contraceptives, which could avert thousands of unwanted adolescent pregnancies and elective abortions by adolescents each year.[15–17] Research is beginning to show that all of this sexual content may contribute to early sexual intercourse among teenagers.[18–20]

TOBACCO, ALCOHOL, AND ILLICIT DRUGS

Increasingly, media messages and images normalize and glamorize the use of tobacco, alcohol, and illicit drugs. Tobacco manufacturers spend more than $12 billion per year and alcohol manufacturers spend nearly $6 billion per year to entice youngsters into "just saying yes."[21,22] Smoking and drinking are frequently glamorized and are portrayed as normative behavior on TV and in movies. A new study of top-grossing movies from 1991 to 2009 showed that smoking scenes in movies peaked in 2005 but have decreased significantly since then. However, in 2009, more than half of PG-13 movies still contained smoking scenes.[23] A meta-analysis of 4 studies estimated that 44% of all smoking initiation among children and young teenagers could be attributed to viewing smoking in movies.[24] Alcohol remains the number 1 drug portrayed on American TV, with 1 drinking scene every 22 minutes.[25] More than one-third of drinking scenes are humorous, and negative consequences are shown in only 23% of them.[26] Through popular music, the average teenager is exposed to nearly 85 explicit drug references each day.[27] Again, the behavioral effects are increasingly clear in the research: children and teenagers exposed to more movie images of smoking are at greater risk of smoking,[24,28] and alcohol advertising, in particular, is adept at convincing teenagers to begin drinking.[29–34]

EFFECTS OF MEDIA ON OBESITY AND SCHOOL PERFORMANCE

Increased TV use is documented to be a significant factor leading to obesity[35–39] and may lead to decreased school achievement as well.[40–42] New research is also investigating whether there might be a relationship between overstimulation from high levels of media use and attention-deficit/hyperactivity disorder,[43,44] sleep disorders,[45] and eating disorders.[37]

NEW TECHNOLOGY

The Internet and cellular phones have become important new sources of sexual information, pornography, "sexting" (sending sexual text messages and/or explicit images), and social networking. In a recent study, nearly one-quarter of MySpace profiles referenced sexual behaviors.[46] In another study, 20% of teenagers reported having sent or posted nude pictures or videos of themselves (sexting).[47] Parents, schools, and law enforcement officials are sometimes in a quandary about how to deal with the new social networking sites and with sexting.[48,49] Web sites that promote anorexia nervosa are also putting teenagers at risk of eating disorders.[50]

VALUE OF MEDIA EDUCATION

Media education has the potential to reduce harmful media effects.[51,52] In the past 2 centuries, to be "literate" meant that a person could read and write. In the new millennium, to be "literate" means that a person can successfully understand and decode a variety of different media.[53] Given the volume of information transmitted through mass media as opposed to the written word, it is now as important to teach media literacy as it is to teach print literacy. The prime tenets of media education are as follows[52]:

- All media messages are constructed.
- Media messages shape our understanding of the world.
- Individuals interpret media messages uniquely.
- Mass media have powerful implications.

A media-educated person will be able to limit his or her use of media; make positive media choices; select creative alternatives to media consumption; develop critical thinking and viewing skills; and understand the political, social, economic, and emotional implications of all forms of media.[52] Results of recent research suggest that media education may make young people less vulnerable to negative aspects of media exposure.[52] Media education programs have resulted in less aggressive attitudes[54] and behaviors,[54–58] increased sophistication about advertising,[59] fewer requests for commercial products,[60,61] less alcohol and tobacco use or intentions to use,[62–66] better nutritional habits[67,68] and less obesity,[69,70] better body self-image,[71–73] fewer sexual disclosures on social networking sites,[74] and less overall TV-viewing.[69,70,75] Many countries, including Canada, Great Britain, Australia, and some Latin American countries, mandate media education in their school curricula. However, media edu-

cation should not be used as a substitute for careful scrutiny of the media industry's responsibility for its programming. In addition, simply reducing children's and adolescents' screen media use has been shown conclusively to have beneficial health effects.[69,70,75]

RECOMMENDATIONS

The American Academy of Pediatrics (AAP) recommends the following:

1. Pediatricians need to become educated about the public health risks of media. Given the impact that media have on the health of children and adolescents, AAP chapters and districts, as well as medical schools and residency training programs, should ensure that ongoing education in this area is a high priority.[76]
2. Pediatricians should ask at least 2 media-related questions at each well-child visit:
   - How much entertainment media per day is the child or adolescent watching? The AAP recommends that children have less than 2 hours of screen time per day.
   - Is there a TV set or Internet access in the child's or adolescent's bedroom?[77]

   Children or teenagers who are showing aggressive behavior, have academic difficulties, or are overweight or obese should have additional history taken. A recent study revealed that office-based counseling regarding media is effective and could result in the parents of nearly 1 million additional children learning about the AAP recommendation to limit media time to 2 hours/day.[78] Advice to parents should include the following:
   - Encourage a careful selection of programs to view.
   - Co-view and discuss content with children and adolescents.
   - Teach critical viewing skills.
   - Limit and focus time spent with media. In particular, parents of young children and preteens should avoid exposing them to PG-13– and R-rated movies.[19,23,24,79–81]
   - Be good media role models; children often develop their media habits on the basis of their parents' media behavior.
   - Emphasize alternative activities.
   - Create an "electronic media-free" environment in children's rooms.
   - Avoid use of media as an electronic baby-sitter.
3. Pediatricians should continue to urge parents to avoid TV- and video-viewing for children younger than 2 years. Increasing amounts of research have shown that infants and toddlers have a critical need for direct interactions with parents and other regular caregivers for healthy brain growth.[82–84] In addition, the results of 7 studies have shown that infants younger than 18 months who are exposed to TV may suffer from a delay in language development, and 1 study revealed that infant videos may delay language development.[85–91] No studies have documented a benefit of early viewing.[92]
4. Pediatricians should serve as role models for appropriate media use by limiting TV and video use in waiting rooms and patients' rooms, using educational materials to promote reading, and having visits by volunteer readers in waiting rooms. Pediatricians should also offer in-office reading programs, such as Reach Out and Read, and promote active play.[93]
5. Schools need to begin implementing media education in their curricula. The simplest way to do this would be to incorporate principles of media education into existing programs on drug prevention and sex education.
6. Congress should consider mandating and funding universal media education in American schools.
7. The federal government and private foundations should dramatically increase their funding of media research, particularly in the areas of media education, violence prevention, sex and sexuality, drugs, obesity, and early brain development.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Media Use by Children Younger Than 2 Years

abstract

FREE

In 1999, the American Academy of Pediatrics (AAP) issued a policy statement addressing media use in children. The purpose of that statement was to educate parents about the effects that media—both the amount and the content—may have on children. In one part of that statement, the AAP recommended that "pediatricians should urge parents to avoid television viewing for children under the age of two years." The wording of the policy specifically *discouraged* media use in this age group, although it is frequently misquoted by media outlets as *no* media exposure in this age group. The AAP believed that there were significantly more potential negative effects of media than positive ones for this age group and, thus, advised families to thoughtfully consider media use for infants. This policy statement reaffirms the 1999 statement with respect to media use in infants and children younger than 2 years and provides updated research findings to support it. This statement addresses (1) the lack of evidence supporting educational or developmental benefits for media use by children younger than 2 years, (2) the potential adverse health and developmental effects of media use by children younger than 2 years, and (3) adverse effects of parental media use (background media) on children younger than 2 years. *Pediatrics* 2011;128:1040–1045

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KEY WORDS

media, development, infants, young children, television, screen time

ABBREVIATION

AAP—American Academy of Pediatrics

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INTRODUCTION

From built-in DVD players in minivans to smart cell phone technology, today's children have more access to electronic media than those of any previous generation. As predicted in the 1999 American Academy of Pediatrics (AAP) policy statement,[1] industry has also targeted those in the 0- to 2-year age group (and their parents) as key consumers of electronic media. Educational DVDs/videos, television programs, and even entire cable networks are geared toward this age group.

Currently, 90% of parents report that their children younger than 2 years watch some form of electronic media.[2] By 3 years, almost one-third of children have a television in their bedroom.[3] Parents report that they view television as a peacekeeper and a safe activity for their children while they are preparing dinner, getting ready for work, or doing household chores.[3] Many parents report feeling better knowing that the programming their children watch has been described as educational. Parents who believe that educational television is "very important for healthy development" are twice as likely to have the television on all or most of the time.[4]

Some children are watching television programs or recorded programs (DVDs/videos) intended for their viewing, termed "foreground

media." Others are exposed to programs intended for adults, termed "background media," because the television is on while they are present in the room. Some children are exposed to 4 hours or more of televised programs per day. Other children may be watching a 30-minute DVD while a parent is just taking a shower or preparing dinner. Some children are watching shows with parents or siblings, and some are watching alone. On average, children younger than 2 years watch televised programs 1 to 2 hours/day.[2] Fourteen percent of children aged 6 to 23 months watch 2 or more hours/day of media.[3]

Some media industry executives claim that educational media programs are meant to be watched by both the parent and the child to facilitate social interactions and the learning process.[5] However, it is not clear whether this happens in the real world. In fact, it seems that audible television is associated with decreased parent-child interactions.[6] Although a leading survey of family media use has reported that 40% of parents watch with their child all the time and 28% watch with their child most of the time, parents also report that they avoid co-viewing because their child's media time provides an opportunity for them to do other things.[3]

Although there is equal access to media among children of different socioeconomic groups, the amount of media consumption is unequal. Children who live in homes with lower socioeconomic status and children with single mothers or mothers with less than a high school education are spending more time in front of a screen on a daily basis.[3,7] Another study found no association between family income and early childhood media use but did find a relationship between lower parental education and higher levels of media use in early childhood.[8]

This revised policy statement addresses the past 10 years of research on the effect of media on young children, clarifies the rationale for the position of the AAP on media use by children younger than 2 years, and provides updated recommendations for families, clinicians, and researchers. For the purposes of this policy statement, the term "media" refers to television programs, prerecorded videos, Web-based programming, and DVDs viewed on either traditional or new screen technologies.

LOST IN TRANSLATION: CAN CHILDREN LEARN FROM MEDIA?

Research has found that certain high-quality programs have educational benefits for children older than 2 years. Children who watch these programs have improved social skills, language skills, and even school readiness.[9] However, the educational merit of media for children younger than 2 years remains unproven despite the fact that three-quarters of the top-selling infant videos make explicit or implicit educational claims.[5] To be beneficial, children need to understand the content of programs and pay attention to it. Children older than 2 years and those younger than 2 years are at different levels of cognitive development and process information differently.[10] In fact, 2 studies have found that watching a program such as "Sesame Street" has a negative effect on language for children younger than 2 years,[11,12] and 2 studies have found no evidence of benefit.[13,14] There is a paucity of research on this topic, but the existing literature suggests that media use does not promote language skills in this age group.

Young children have difficulty discriminating between events on a video and the same information presented by a live person, which is referred to as "video deficit."[15–17] Children 12 to 18 months of age are more likely to learn from a live presentation than from a televised one and are also more likely to remember the information from a live presentation afterward.[18] These studies have only been performed on noncommercial videos. Some studies have found that children 1 to 2 years of age can remember an event on video if the screen demonstration repeats several times.[19] Two studies have shown that infants as young as 12 months learn emotional responses after media viewing.[20,21] One longitudinal study performed has thus far found that children younger than 2 years who watch television have no statistical improvement in their cognitive development compared with their nonviewing peers by 3 years of age.[22]

Children aged 12 months and younger do not follow sequential screen shots or a program's dialogue.[23,24] Other research has found that children younger than 18 months do not pay much attention to televised programs.[25] However, there are significant individual differences in attention to and interest in television in this age group that depend on content, setting, and whether a parent is watching with the child.[26] A developmental shift in attention to televised programs occurs between 1.5 and 2.5 years of age.[24,25]

Children progress through developmental milestones on a continuum. Where each individual child is on that continuum determines what that child is capable of learning from a televised program. Some 18- to 24-month-olds might be capable of learning from media, but others might not. Other variables that influence a child's ability to learn are the content of the program, the amount of television watched, and whether a parent is watching with the child.[13,27]

Despite the explicit or implicit marketing claims of educational programs for infants, whether they are actually

learning something from these programs is questionable. More research is needed to determine if early television exposure has any long-term effects on learning.

SECONDHAND TELEVISION: FOREGROUND VERSUS BACKGROUND MEDIA

Many families have reported that they have a television on at least 6 hours/day or that a television is "always on" as background noise.[28] Thirty-nine percent of families with infants and young children have a television on constantly.[29] When a parent has an adult television program on, children are often in the room; 61% are there at least some of the time, including 29% who are there all or most of the time.[3]

Young children may not be paying close attention to a televised program that they cannot understand, but their parents are watching. It might be background media to the child, but it is foreground media to the parent. It distracts the parent and decreases parent-child interaction.[30,31] Infant vocabulary growth is directly related to the amount of "talk time" or the amount of time parents spend speaking to them.[32] Heavy television use in a household can interfere with a child's language development simply because parents likely spend less time talking to the child.[33]

Even if the program is not intended for the child to watch, research has found that children play and interact less with adults when a television is on, perhaps because the adult's attention is focused on the television program. A study that examined 12-, 24-, and 36-month-olds found that background television not only reduced the length of time that a child played but also that it reduced the child's focused attention during play.[34] Children stop to look at a televised program, halt their ongoing play, and move on to a different activity after the interruption.[34] Although most research has been performed on adolescents, study results suggest that background media might interfere with cognitive processing, memory, and reading comprehension.[4,34–36] Only 1 research study, conducted in 1996, resulted in evidence to the contrary. In that study, 10-month-old infants tuned out surrounding noise and concentrated more during play.[37]

Background television has the direct effect of distracting a child and the indirect effect of taking a parent's attention away from the child. In addition, parents' media diet influences the media habits of their children.[3]

A GOOD USE OF TIME?

Children younger than 5 years who watch television spend less time in creative play and less time interacting with parents or siblings.[38] For every hour of television that a child younger than 2 years watches alone, he or she spends an additional 52 minutes less time per day interacting with a parent or sibling. For every hour of television, there is 9% less time on weekdays and 11% less time on weekends spent in creative play for a child younger than 2 years.

Does television displace more developmentally valuable playtime? No research exists at this point to know whether a child would find better things to do with his or her time if all screens were turned off, although evidence suggests that the child would hear more adult speech and talk more.[6] Heavy media use is defined as the television being on always or most of the time. Heavy media use may be a sign of parenting style, so one cannot assume that parents will spend developmentally nurturing time with their child with the television off.[38]

Heavy media use in a household does not seem to affect the amount of time a child of any age plays outside.[4] However, children who live in households with heavy media use spend between 25% (for 3- to 4-year-olds) and 38% (for 5- to 6-year-olds) less time being read to or reading.[3,4] These children have a lower likelihood of being able to read compared with their peers from households with low media use.[4] What is known is that unstructured playtime is critical to learning problem-solving skills and fostering creativity.[39]

HEALTH CONSEQUENCES

Media use has been associated with obesity, sleep issues, aggressive behaviors, and attention issues in preschool- and school-aged children.[1,40] Studies are lacking on the health effects in children younger than 2 years. One area of concern, however, is media's effect on sleep. Television is part of the bedtime routine for many children. In 1 survey, 19% of parents of children younger than 1 year reported that their children have a television in their bedrooms. Twenty-nine percent of children 2 to 3 years of age have a television in their bedroom, and 30% of parents have reported that watching a television program enabled their children to fall asleep.[3] Although parents perceive a televised program to be a calming sleep aid, some programs actually increase bedtime resistance, delay the onset of sleep, cause anxiety about falling asleep, and shorten sleep duration.[41] Specifically, in children younger than 3 years, television viewing is associated with irregular sleep schedules.[42] Poor sleep habits have adverse effects on mood, behavior, and learning. Although the effects of media on infants' cognitive and emotional development are still being explored, there are ample reasons to be concerned.

DEVELOPMENTAL CONSEQUENCES

Since 1999, 3 studies have evaluated the effects of heavy television use on language development in children 8 to

16 months of age. In the short-term, children younger than 2 years who watch more television or videos have expressive language delays,[12,43,44] and children younger than 1 year with heavy television viewing who are watching alone have a significantly higher chance of having a language delay.[44] Although the long-term effects on language skills remain unknown, the evidence of short-term effects is concerning.

Two studies have examined infant media use and subsequent attention problems in school-aged children.[45,46] One of these studies found that the effects of television watching on infants' attention span varied with the content of the programming.

Research findings to date might suggest a correlation between television viewing and developmental problems, but they cannot show causality. Are infants with poor language skills placed in front of the television more? Are infants with shorter attention spans more attracted to screens? Does media exposure contribute to a delay in social or communication skills and diminished attentional capacity? Because these questions remain unanswered, more research is needed.

CONCLUSIONS AND RECOMMENDATIONS

This updated policy statement provides further evidence that media—both foreground and background—have potentially negative effects and no known positive effects for children younger than 2 years. Thus, the AAP reaffirms its recommendation to discourage media use in this age group. This statement also discourages the use of background television intended for adults when a young child is in the room. Although infant/toddler programming might be entertaining, it should not be marketed as or presumed by parents to be educational.

No longitudinal study has determined the long-term effects of media use on infants and children younger than 2 years. The AAP supports research to understand the consequences of early electronic media exposure.

Recommendations for Pediatricians

1. The AAP discourages media use by children younger than 2 years. Pediatricians should discuss these recommendations with parents.
2. The concept of setting "media limits" before 2 years of age should be discussed at health maintenance/well-child visits, because many parents are not aware of the AAP recommendations. It is important to set limits and create balance at an early age. Only 15% of parents report that their pediatrician discusses media use with them.[3] Families should be encouraged to provide supervised independent play for infants and young children during times at which a parent cannot sit down and engage in play with the child. Simply having a young child play with nesting cups on the kitchen floor while a parent prepares dinner is useful playtime.
3. Pediatricians should explain to parents the importance of unstructured, unplugged play in allowing a child's mind to grow, problem-solve, think innovatively, and develop reasoning skills. Unstructured play occurs both independently and cooperatively with a parent or caregiver. The importance of parents sitting down to play with their children cannot be overstated.
4. Families should be strongly encouraged to sit down and read to their child to foster their child's cognitive and language development.

Recommendations for Parents

1. The AAP discourages media use by children younger than 2 years.
2. The AAP realizes that media exposure is a reality for many families in today's society. If parents choose to engage their young children with electronic media, they should have concrete strategies to manage it. Ideally, parents should review the content of what their child is watching and watch the program with their child.
3. Parents are discouraged from placing a television set in their child's bedroom.
4. Parents need to realize that their own media use can have a negative effect on their children. Television that is intended for adults and is on with a young child in the room is distracting for both the parent and the child.
5. Unstructured playtime is more valuable for the developing brain than any electronic media exposure. If a parent is not able to actively play with a child, that child should have solo playtime with an adult nearby. Even for infants as young as 4 months of age, solo play allows a child to think creatively, problem-solve, and accomplish tasks with minimal parent interaction. The parent can also learn something in the process of giving the child an opportunity to entertain himself or herself while remaining nearby.

Recommendations for Industry

1. Independent research should be performed to assess the educational claims made in advertising for infant media products.
2. The Federal Trade Commission should improve its standards for scientifically valid educational claims in product advertising.

Recommendations for Research

1. Researchers should conduct prospective, longitudinal studies to determine the long-term effects of early media exposure on children's future physical, mental, and social health.
2. The AAP supports the National Children's Study by the Eunice Kennedy Shriver National Institute of Child Health and Human Development to examine the effects of environmental influences on children.
3. The mission of the AAP is to attain optimal physical, mental, and social health and well-being for all infants, children, adolescents, and young adults. To this end, the AAP supports continued research to examine the influence of media in children's lives and will offer evidence-based guidance to its members and the public.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Media Violence

COUNCIL ON COMMUNICATIONS AND MEDIA

KEY WORD
media violence

ABBREVIATION
AAP—American Academy of Pediatrics

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abstract

Exposure to violence in media, including television, movies, music, and video games, represents a significant risk to the health of children and adolescents. Extensive research evidence indicates that media violence can contribute to aggressive behavior, desensitization to violence, nightmares, and fear of being harmed. Pediatricians should assess their patients' level of media exposure and intervene on media-related health risks. Pediatricians and other child health care providers can advocate for a safer media environment for children by encouraging media literacy, more thoughtful and proactive use of media by children and their parents, more responsible portrayal of violence by media producers, and more useful and effective media ratings. Office counseling has been shown to be effective. *Pediatrics* 2009;124:1495–1503

INTRODUCTION

Although shootings in schools around the world periodically prompt politicians and the general public to focus their attention on the influence of media violence, the medical community has been concerned with this issue since the 1950s.[1–3] The evidence is now clear and convincing: media violence is 1 of the causal factors of real-life violence and aggression. Therefore, pediatricians and parents need to take action.[4]

In 1972, the US Surgeon General issued a special report on the public health effects of media violence that was based on a growing and nearly unanimous body of evidence.[5] Ten years later, the National Institute of Mental Health issued a comprehensive review of the research on media violence and its effects, which outlined concerns about children's psychological health.[6] At a Congressional public health summit in July 2000, the American Academy of Pediatrics (AAP) was joined by the American Medical Association, the American Academy of Child and Adolescent Psychiatry, and the American Psychological Association in issuing an unprecedented joint statement on the impact of entertainment violence on children.[7] Also in 2000, the Federal Bureau of Investigation released a report on shootings in schools that stated that media violence is a risk factor.[8] In 2003, a panel of media-violence experts convened by the National Institute of Mental Health, at the request of the US Surgeon General, published its comprehensive report on the effects of media violence on youth, which revealed media violence to be a significant causal factor in aggression and violence.[9] Most recently, in 2007, the Federal Communications Commission (FCC) released its report on violent television programming and its effects on children and agreed with the Surgeon General that there is "strong evidence" that exposure to media violence can increase aggressive behavior in

children.[10] The weight of scientific evidence has been convincing to pediatricians, with more than 98% of pediatricians in 1 study expressing the personal belief that media violence affects children's aggression.[11] Yet, the entertainment industry, the American public, politicians, and parents all have been reluctant to accept these findings and to take action.[4] The debate should be over.[9,12]

EXPOSURE

American children between 8 and 18 years of age spend an average of 6 hours and 21 minutes each day using entertainment media (television, commercial or self-recorded video, movies, video games, print, radio, recorded music, computers, and the Internet).[13] Children between 0 and 6 years of age spend an average of almost 2 hours each day using screen media (television, movies, computers).[14,15] Televisions are also commonly present in bedrooms, with 19% of infants, 29% of 2- to 3-year-olds, 43% of 4- to 6-year-olds, and 68% of children 8 years and older having a television in their bedrooms.[13,15,16] The effects of having a television in a child's bedroom are only beginning to be studied, but the early indications are alarming. Children with a television in their bedroom increase their television-viewing time by approximately 1 hour per day.[13,17] Their risk of obesity increases 31%,[17] and their risk of smoking doubles.[18] In addition, if children have a television in their bedroom, parents are less able to monitor what is seen; parents are less able to have consistent rules for children's media use; children participate in fewer alternative activities such as reading, hobbies, and games; and children perform more poorly in school.[19,20]

A large proportion of children's media exposure includes acts of violence that are witnessed or "virtually perpetrated" (in the form of video games) by young people. By 18 years of age, the average young person will have viewed an estimated 200 000 acts of violence on television alone.[21] The National Television Violence study evaluated almost 10 000 hours of broadcast programming from 1995 through 1997 and revealed that 61% of the programming portrayed interpersonal violence, much of it in an entertaining or glamorized manner.[22] The highest proportion of violence was found in children's shows. Of all animated feature films produced in the United States between 1937 and 1999, 100% portrayed violence, and the amount of violence with intent to injure has increased through the years.[23] In a study of the top-rated PG-13 films of 1999–2000, 90% contained violence, half of it of lethal magnitude.[24] An estimated 12% of 22 million 10- to 14-year-olds saw 40 of the most violent movies in 2003.[25] More than 80% of the violence portrayed in contemporary music videos is perpetrated by attractive protagonists against a disproportionate number of women and blacks.[26] Similarly, teenagers' music has become more violent, especially rap music.[3,27,28] And, as teenagers increasingly use the Internet, they are exposed to violence there as well; a survey of more than 1500 10- to 15-year-olds revealed that 38% had been exposed to violent scenes on the Internet.[29] Video games also are filled with violence. A recent analysis of the Entertainment Software Ratings Board (ESRB) ratings of video games revealed that more than half of all games are rated as containing violence, including more than 90% of games rated as appropriate for children 10 years or older (E10+ and T ratings).[30]

Prolonged exposure to such media portrayals results in increased acceptance of violence as an appropriate means of solving problems and achieving one's goals.[2,3,9] American media, in particular, tend to portray heroes using violence as a justified means of resolving conflict and prevailing over others.[24,31] Television, movies, and music videos normalize carrying and using weapons and glamorize them as a source of personal power.[22,32] Children in grades 4 through 8 preferentially choose video games that award points for violence against others, and 7 of 10 children in grades 4 through 12 report playing M-rated (mature) games, with 78% of boys reporting owning M-rated games.[33,34] Of 33 popular games, 21% feature violence against women.[35] Because children have high levels of exposure, media have greater access and time to shape young people's attitudes and actions than do parents or teachers, replacing them as educators, role models, and the primary sources of information about the world and how one behaves in it.[36]

After the tragic shootings at Columbine High School in 1999, the Federal Trade Commission (FTC) investigated whether the motion picture, music, and video-game industries specifically advertised and marketed violent material to children and adolescents. Working with industry-provided documents, the FTC determined that, despite the fact that their own rating systems found the material appropriate only for adults, these industries practiced "pervasive and aggressive marketing of violent movies, music, and electronic games to children," such as promoting R-rated movies to Campfire girls.[37]

Studies have revealed that children and adolescents can and do easily access violent media that are deemed inappropriate for them by the various rating systems and parents.[13,38,39] In a study of PG-, PG-13-, and R-rated films, the rating did not even predict the frequency of violence in the various films.[39] Many parents find the entertainment industry's media-rating sys-

tems difficult to use.[40] The movie ratings are used by approximately three quarters of parents, but only about half of parents say they have ever used the video-game ratings, the television ratings, or the music advisories to guide their choices.[41] Many parents find the ratings unreliably low, with an objective parental evaluation revealing as many as 50% of television shows rated TV-14 to be inappropriate for their teenagers.[42] At the same time, most parents do not even know that their television is equipped with a V-chip ("V" for "viewer" control), and only 20% of parents actually use it.[40] Video games with higher ratings may actually attract more young children (the "forbidden-fruit" hypothesis).[43] The various media ratings are determined by industry-sponsored ratings boards or the artists and producers themselves. They are age based, which assumes that all parents agree with the raters about what is appropriate content for children of specific ages. Furthermore, different rating systems for each medium (television, movies, music, and video games) make the ratings confusing, because they have little similarity or relationship to one another. The AAP offers an informational brochure that pediatricians can offer to parents and children to help them use the various rating systems to guide better media choices.[44]

IMPACT

Research has associated exposure to media violence with a variety of physical and mental health problems for children and adolescents, including aggressive and violent behavior, bullying, desensitization to violence, fear, depression, nightmares, and sleep disturbances. Consistent and significant associations between media exposure and increases in aggression and violence have been found in American and cross-cultural studies; in field experiments, laboratory experiments, cross-sectional studies, and longitudinal studies; and with children, adolescents, and young adults.[9,45–47] The new Center on Media and Child Health at Harvard lists more than 2000 research reports.[48] The strength of the association between media violence and aggressive behavior found in meta-analyses[9,49] is greater than the association between calcium intake and bone mass, lead ingestion and lower IQ, and condom nonuse and sexually acquired HIV infection, and is nearly as strong as the association between cigarette smoking and lung cancer[50]—associations that clinicians accept and on which preventive medicine is based without question.

Children are influenced by media—they learn by observing, imitating, and adopting behaviors.[51] Several different psychological and physiologic processes underlie media-violence effects on aggressive attitudes, beliefs, behaviors, and emotions, and these processes are well understood.[2,3,9] Furthermore, because children younger than 8 years cannot discriminate between fantasy and reality, they may be especially vulnerable to some of these learning processes and may, thereby, be more influenced by media violence.[52,53] However, even older adolescents and young adults are adversely affected by consumption of media violence, demonstrating that the ability to discriminate between fantasy and reality does not inoculate one from the effects of media violence.[54,55]

Some research has indicated that the context in which media violence is portrayed and consumed can make the difference between learning about violence and learning to be violent.[3] Plays such as *Macbeth* and films such as *Saving Private Ryan* treat violence as what it is—a human behavior that causes suffering, loss, and sadness to victims and perpetrators. In this context, with helpful adult guidance on the real costs and consequences of violence, appropriately mature adolescent viewers can learn the danger and harm of violence by vicariously experiencing its outcomes. Unfortunately, most entertainment violence is used for immediate visceral thrills without portraying any human cost and is consumed by adolescents or children without adult guidance or discussion. Furthermore, even if realistic portrayals of harmful consequences of violence reduce the typical immediate short-term aggression-enhancement effect, there still exists the potential long-term harm of emotional desensitization to violent images.[9,47,54] Other studies have shown that the more realistically violence is portrayed, the greater the likelihood that it will be tolerated and learned.[3,56] Titillating violence in sexual contexts and comic violence are particularly dangerous, because they associate positive feelings with hurting others.[57,58] One study of nearly 32 000 teenagers in 8 different countries, for example, revealed that heavy television-viewing was associated with bullying.[59]

In addition to modeling violent behavior, entertainment media inflate the prevalence of violence in the world, cultivating in viewers the "mean-world" syndrome, a perception of the world as a dangerous place.[60–62] Fear of being the victim of violence is a strong motivation for some young people to carry a weapon, to be more aggressive, and to "get them before they get me."[61] For some children, exposure to media violence can lead to anxiety, depression, posttraumatic stress disorder,[56,63] sleep disturbances and nightmares,[56,64] and/or social isolation.[65] Some have defended media violence as an outlet for vicariously releasing hostility in the safety of virtual reality. However, research that has tested this "catharsis hypothesis" revealed that after experiencing media

violence, children and young adults behave more aggressively, not less.[66–68] Numerous studies have shown that an insidious and potent effect of media violence is to desensitize all of us to real-life violence.[69–72]

Interactive media, such as video games and the Internet, are relatively new media forms with even greater potential for positive and negative effects on children's physical and mental health. Exposure online to violent scenes has been associated with increased aggressive behavior.[29] Studies of these rapidly growing and ever-more-sophisticated types of media have indicated that the effects of child-initiated virtual violence may be even more profound than those of passive media such as television. In many games, the child or teenager is "embedded" in the game and uses a "joystick" (handheld controller) that enhances both the experience and the aggressive feelings. Three recent studies directly compared the effects of interactive (video games) and passive (television and movies) media violence on aggression and violence; in all 3 cases, the new interactive-media-violence effect was larger.[54] Correlational and experimental studies have revealed that violent video games lead to increases in aggressive behavior and aggressive thinking and decreases in prosocial behavior.[62,73–76] Recent longitudinal studies designed to isolate long-term violent video-game effects on American and Japanese school-aged children and adolescents have revealed that in as little as 3 months, high exposure to violent video games increased physical aggression.[54,77] Other recent longitudinal studies in Germany and Finland have revealed similar effects across 2 years.[78,79] On the other hand, there is also good evidence that prosocial video games can increase prosocial attitudes and behavior.[80]

Children learn best by observing a behavior and then trying it. The consequences of their behavioral attempts influence whether they repeat the behavior. All violent media can teach specific violent behaviors, the circumstances when such behaviors seem appropriate and useful, and attitudes and beliefs about such behavior. In this way, behavioral scripts are learned and stored in memory.[47] Video games provide an ideal environment in which to learn violence and use many of the strategies that are most effective for learning.[81] They place the player in the role of the aggressor and reward him or her for successful violent behavior. Rather than merely observing only part of a violent interaction (such as occurs in television violence), video games allow the player to rehearse an entire behavioral script, from provocation, to choosing to respond violently, to resolution of the conflict.[54,62,82] Children and adolescents want to play them repeatedly and for long periods of time to improve their scores and advance to higher levels. Repetition increases their effect. In addition, some youth demonstrate pathologic patterns of video-game play, similar to addictions, in which game play disrupts healthy functioning.[81,83] Advances in the measurement of brain function have been applied to the study of media violence. Several studies have linked media-violence exposure to decreases in prefrontal cortex activity associated with executive control over impulsive behavior.[84]

AAP ACTION

Interpersonal violence, for victims and perpetrators, is now a more prevalent health risk than infectious disease, cancer, or congenital disorders for children, adolescents, and young adults. Homicide, suicide, and trauma are leading causes of mortality in the pediatric population. In 2004, unintentional injuries claimed 17 741 lives, homicides claimed 5195 lives, and suicide claimed 4506 lives among 5- to 24-year-olds.[85] Of all deaths by homicide or suicide, fully half were gun related, making gun violence a leading killer of children and adolescents.[86] For young black males, homicide is the leading cause of death, accounting for nearly 45% of all deaths. The homicide rate for black males is 2.7 to 15.8 times higher than for other racial/ethnic groups at the same age.[87] Although violent crime rates have decreased by more than 50% between 1994 and 2004 for young people 12 to 24 years of age, they remain higher at this age than at any other age.[87] Furthermore, the proportion of youth admitting to having committed various violent acts within the previous 12 months has remained steady or even increased somewhat in recent years.[88] In the 2007 National Youth Risk Behavior Survey, 18% of students in the 9th through 12th grades reported carrying a weapon to school in the month preceding the survey, and more than one third had been in a physical fight in the year before the survey.[85] An estimated 30% of 6th- through 10th-graders report either bullying other students or being targets of bullies.[89] A recent large study of New York City students found that nearly 10% of girls and more than 5% of boys reported a lifetime history of being sexually assaulted, and 10% of both boys and girls reported experiencing dating violence in the previous year.[90] Although exposure to media violence is not the sole factor contributing to aggression, antisocial attitudes, and violence among children and adolescents, it is an important health risk factor on which we, as pediatricians and members of a compassionate society, can intervene. Some research has suggested that interventions of the types discussed below can reduce media-violence consumption and its effects on children and adolescents.[2,3,54,91,92]

RECOMMENDATIONS

1. Pediatricians must become cognizant of the pervasive influence that the wide and expanding variety of entertainment media have on the physical and mental health of children and adolescents.[4,93] Residency training conferences, grand rounds, and continuing medical education courses are all important venues that should be used for teaching pediatricians about the effects of media on children and adolescents.
2. Pediatricians should ask at least 2 media-related questions at each well-child visit: (1) How much entertainment media per day is the child or teenager watching? (2) Is there a television set or Internet connection in the child's or teenager's bedroom?[4,93] For all children, healthy alternatives such as sports, interactive play, and reading should be suggested.[94] When heavy media use by a child is identified, pediatricians should evaluate the child for aggressive behaviors, fears, or sleep disturbances and intervene appropriately.[95,96]
3. Pediatricians should encourage parents to adhere to the AAP media recommendations[11,95]:
   - Remove televisions, Internet connections, and video games from children's bedrooms.
   - Make thoughtful media choices and coview them with children. Coviewing should include discussing the inappropriateness of the violent solutions offered in the specific television show, movie, or video game and helping the child to generate nonviolent alternatives. Parents tend to limit sexual content more than violent content,[38] yet research has indicated that the latter is potentially more unhealthy.[2,3]
   - Limit screen time (including television, videos, computer and video games) to 1 to 2 hours per day, using the V-chip, and avoiding violent video games (defined as games that include intentional harm to other game characters, including cartoonish or unrealistic violence as well as realistic or gory violence). Counseling about limiting screen time has been shown to be effective in office settings.[97] For example, just a minute or two of office counseling about media violence and guns could lead to less violence exposure for more than 800 000 children per year.[97] Parents also need to be reminded that they are important role models in terms of their own media use.
   - Avoid screen media for infants or toddlers younger than 2 years.[98] There have been no studies to indicate that screen time contributes positively to infant development,[99,100] and there are now 7 studies that have documented possible language delays among children younger than 2 years who are exposed to television or videos.[100–108]
4. Pediatricians and other child health professionals should ensure that only nonviolent media choices be provided to patients in outpatient waiting rooms and inpatient settings.
5. On a local level, pediatricians should encourage parents, schools, and communities to educate children to be media literate as a means of protecting them against deleterious health effects of media exposure.[93,109,110] Research has demonstrated that media education and thoughtful media use can reduce violent behavior in children.[9,92,111]
6. On state and national levels, pediatricians should work with the AAP and their AAP chapters and districts to collaborate with other health care organizations, educators, government, and research-funding sources to keep media violence on the public health agenda. Media violence is often characterized in the public domain as a values issue rather than what it truly is: a public health issue and an environmental issue. A recent revealed found that two thirds of parents actually favor increased governmental oversight of the media when children and teenagers are concerned.[40]
7. Pediatricians should advocate for more child-positive media. Pediatricians should support and collaborate with media producers, applying our expertise in child health and development toward creating child-friendly and truthful media. The AAP makes the following recommendations to the entertainment industry:
   - Avoid the glamorization of weapon-carrying and the normalization of violence as an acceptable means of resolving conflict.
   - Eliminate the use of violence in a comic or sexual context or in any other situation in which the violence is amusing, titillating, or trivialized.
   - Eliminate gratuitous portrayals of interpersonal violence and hateful, racist, misogynistic, or homophobic language or situations unless explicitly portraying how destructive such words and actions can be. Even so, violence does not belong in media developed for very young children.
   - If violence is used, it should be used thoughtfully as serious drama, always showing the pain and loss suffered by victims and perpetrators.
   - Music lyrics should be made easily available to parents so they can be

read before deciding whether to purchase the recording.

- Video games should not use human or other living targets or award points for killing, because this teaches children to associate pleasure and success with their ability to cause pain and suffering to others.
- Play of violent video games should be restricted to age-limited areas of gaming arcades; the distribution of videos and video games and the exhibition of movies should be limited to appropriate age groups.

8. Pediatricians should advocate for a simplified, universal, content-based media-rating system to help parents guide their children to make healthy media choices. Content should be rated on the basis of research about what types of media depictions are likely to be harmful to children, rather than simply on what adults find offensive. Just as it is important that parents know the ingredients in food they may feed to their children, they should be fully informed about the content of the media their children may use.[4,30,112,113]

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness

Medical Concerns in the Female Athlete

ABSTRACT. Female children and adolescents who participate regularly in sports may develop certain medical conditions, including disordered eating, menstrual dysfunction, and decreased bone mineral density. The pediatrician can play an important role in monitoring the health of young female athletes. This revised policy statement provides updated and expanded information for pediatricians on these health concerns as well as recommendations for evaluation, treatment, and ongoing assessments of female athletes.

ABBREVIATIONS. BMD, bone mineral density; LH, luteinizing hormone.

Exercise is good for female children and adolescents. Special medical concerns should be considered, however, when caring for young female athletes. Athletes can develop abnormal eating patterns (termed disordered eating), which can be associated with menstrual dysfunction (amenorrhea or oligomenorrhea) and subsequent decreased bone mineral density (BMD), or osteoporosis. These 3 conditions—disordered eating, amenorrhea, and osteoporosis—often occur together and have been termed the female athlete triad.[1] Although these conditions may also be seen in the nonathlete, this statement will concentrate on the physically active and athletic female.

DISORDERED EATING

Some physically active females, particularly adolescents, may develop an energy deficit when the energy (calories) they expend exceeds their energy (calorie) intake.[2] This deficit may be unintentional, resulting from inadequate replenishment of the caloric (energy) demands of training, or may be intentional—a conscious attempt to lose weight or body fat in the interest of improved appearance or athletic performance. These athletes often restrict food intake but may develop other disordered eating behaviors, such as binge eating and/or purging by vomiting or use of laxatives, diuretics, and diet pills. Compulsive exercise, defined as excessive exercise in addition to a normal training regimen, is another form of "purging," or energy expenditure often overlooked in athletes. The spectrum of disordered eating behaviors ranges from mild—slight restriction of food intake or occasional binge eating and purging—to severe—significant restriction of food intake, as in anorexia nervosa, or regular binge eating and purging, as in bulimia nervosa.[3] Disordered eating may result in adverse health consequences, with the risk of morbidity and mortality increasing as the severity of the behavior increases.

Disordered eating behavior has been reported in young female athletes and dancers.[4–6] One study of young elite swimmers revealed that 60.5% of average-weight girls and 17.9% of underweight girls were trying to lose weight. Most of the girls were trying to lose weight by decreasing their food intake[7]; however, 12.7% were vomiting, 2.5% were using laxatives, and 1.5% were using diuretics.[7] Disordered eating can be seen in athletes participating in all sports. Sports that may place athletes at higher risk for the development of these behaviors include those in which leanness is emphasized (eg, gymnastics, ballet dancing, diving, and figure skating) or perceived to optimize performance (eg, long-distance running and cross-country skiing) and those that use weight classification (eg, martial arts and rowing).[3] A variety of factors may contribute to the development of disordered eating patterns in the young athlete, including pressure to optimize performance or meet inappropriate weight or body fat goals, social factors (eg, idealization of thinness in Western cultures), psychological factors (eg, poor coping skills, unhealthy family dynamics, and low self-esteem), and personality traits (eg, perfectionism, compulsiveness, and high achievement expectations).[3]

Disordered eating behaviors may impair athletic performance and increase risk of injury. Decreased energy (caloric) intake and fluid and electrolyte imbalance can result in decreased endurance, strength, reaction time, speed, and ability to concentrate. Because the body initially adapts to these changes, a decrease in performance may not be seen for some time, and athletes may falsely believe disordered eating practices are harmless. To the contrary, food restriction and purging can result not only in menstrual dysfunction and potentially irreversible bone loss but also in psychological and other medical complications, including depression, fluid and electrolyte imbalance, and changes in the cardiovascular, endocrine, gastrointestinal, and thermoregulatory systems.[8,9] Some of these complications are potentially fatal.

MENSTRUAL DYSFUNCTION

Menstrual dysfunction in athletes may include primary amenorrhea, secondary amenorrhea, oligomenorrhea, and luteal phase deficiency.[10–12]

An adolescent is considered to have delayed pu-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

berty when breast development has not begun by 13.3 years of age.[13] Because sports involvement or poor nutrition may be associated with a delay in development, evaluation might be postponed until 14 years of age, as determined by clinical judgment. Primary amenorrhea is defined as the absence of menses by age 16 years. If menses have not occurred within 4.5 years after the onset of breast development, evaluation should be considered. Secondary amenorrhea is typically defined as the absence of at least 3 to 6 consecutive menstrual cycles in a female who has begun menstruating. Oligomenorrhea refers to menstrual periods that occur at intervals longer than every 35 days.[11,12,14] Although adolescents may have irregular periods or amenorrhea for 3 to 6 months in the first several years after menarche, the cessation of menses for longer than 3 months after regular cycles have begun or persistent oligomenorrhea is considered abnormal.[15]

Menstrual dysfunction is more common in athletes than in the general population. Athletes and dancers who begin training before menarche occurs may experience a later menarche and have an increased incidence of menstrual dysfunction when compared with girls who begin training after menarche occurs.[16–19] The prevalence of secondary amenorrhea in adult athletes ranges from 3.4% to 66% (depending on the sport studied and the criteria used to define amenorrhea),[10–12] compared with 2% to 5% of women in the general population.[12] The prevalence of secondary amenorrhea in the young athlete is unknown.

Luteinizing hormone (LH) pulsatility and, therefore, normal menstrual function are dependent on energy availability (dietary energy intake minus energy expenditure from exercise).[20] Low energy availability causes a hypometabolic state characterized by a variety of substrate and hormonal alterations, including hypoglycemia, hypoinsulinemia, hypothyroidemia, hypercortisolemia, and the suppression of the 24-hour mean and amplitude of the diurnal rhythm of leptin.[2,20–23] Amenorrheic and regularly menstruating athletes display reduced LH pulse frequencies[24] and similarly low 24-hour mean leptin levels.[25] However, amenorrheic athletes are distinctive in having a more extreme suppression and disorganization of LH pulsatility[24] and a complete suppression of the amplitude of the diurnal rhythm of leptin.[25] It is not known whether a particular threshold of energy availability is required to maintain normal reproductive function or whether the macronutrient composition of the diet is important.

Menstrual dysfunction may lead to decreased BMD. Other long-term consequences of a chronically estrogen-depleted state in young women are unknown at this time.

DECREASED BONE MINERAL DENSITY

Hypoestrogenism associated with amenorrhea may predispose to osteoporosis.[26,27] Osteoporosis is defined as premature bone loss and/or inadequate bone formation resulting in low bone mass and microarchitectural deterioration.[1] Adequate levels of estrogen slow bone resorption and improve or maintain bone mass.[28,29] The prevalence of osteoporosis in adult and adolescent women is unknown.[1] Studies of adult female athletes have shown that premature osteoporosis may occur as a result of amenorrhea and oligomenorrhea and may be partially irreversible despite resumption of menses, estrogen replacement, or calcium supplementation.[27,30,31] Amenorrheic adolescents, both athletes and nonathletes, have been found to have lower BMD than eumenorrheic adolescents.[28,32–34] This may be attributable to decreased bone accretion as well as increased bone loss.[35] An overall increase in BMD is demonstrated throughout adolescence. However, the amenorrheic teenager remains osteopenic in comparison with regularly menstruating teenagers.[28,32–35]

High-intensity exercise in some sports for many years may actually increase BMD in specific skeletal sites despite amenorrhea. Elite adolescent ice skaters and gymnasts have been found to have increased BMD in the lower skeleton, compared with controls, despite menstrual dysfunction.[29,36,37]

Girls who begin menarche at a later age and have a lower weight during adolescence have been found to have the lowest BMD when compared with their peers.[34,35] An increased incidence of stress fracture in dancers has been associated with older age at menarche.[38] Weight gain and the resumption of menses result in increased BMD.[33,35] Estrogen replacement therapy may decrease bone loss and potentially increase BMD in the adolescent with secondary amenorrhea.[28,35,39]

CLINICAL EVALUATION

The physical examination that precedes participation in sports is an ideal opportunity to screen for problems of disordered eating, menstrual dysfunction, and decreased BMD.[40] Signs of disordered eating may be recognized by parents, coaches, athletic trainers, teammates, or school nurses and brought to the physician's attention. If an athlete shows signs of disordered eating behavior, further evaluation by the physician, a nutritionist, and a mental health professional may be necessary.[3]

The diagnosis of primary amenorrhea or secondary amenorrhea in an athlete first requires a full evaluation to rule out pregnancy and underlying pathologic conditions. Pathologic conditions that may cause menstrual dysfunction include pituitary tumors (especially prolactinomas), thyroid dysfunction, polycystic ovary disease, premature ovarian failure, and other chronic illnesses.[10]

Evaluation of amenorrhea includes a complete physical examination and pelvic examination when indicated. A pregnancy test is usually indicated. Laboratory studies may include measurement of thyroid-stimulating hormone, prolactin, and follicle-stimulating hormone (FSH). If the athlete shows signs of androgen excess (eg, hirsutism, acne) or if the pelvic examination reveals polycystic ovaries, a determination of levels of LH, testosterone, dehydroepiandrosterone sulfate (DHEA-S), and 17-hydroxyprogesterone may need to be done. A progesterone challenge may help determine if the patient is hy-

poestrogenemic.[10,15] The possible use of anabolic steroids should also be considered.

In the athlete who has been amenorrheic, a study to evaluate BMD may be helpful.[29]

TREATMENT

The female athlete who has restrictive eating patterns because she is unaware of her energy needs may require only nutritional counseling. The female athlete who purposefully engages in disordered eating behaviors is often best treated using a multidisciplinary team approach: with a physician who monitors her medical status and ability to participate safely in sports, a nutritionist who provides appropriate nutritional guidance, and a mental health professional who addresses any psychological issues.[3]

Increased dietary energy intake or decreased energy expenditure (exercise) usually results in the development or resumption of menses and ovulation in adolescent girls and women with exercise-associated amenorrhea.[29,31] Daily requirements for calories, carbohydrates, and protein are greater in athletes than in more sedentary women and girls,[41] and diet should be changed accordingly. The recommended daily dietary allowance of calcium for adolescents is 1200 mg. Amenorrheic athletes should be encouraged to increase their calcium intake to at least 1500 mg daily. If intake of dietary sources of calcium is inadequate, calcium supplements may be recommended. If estrogen levels are deficient, the efficacy of calcium supplementation in improving bone mass may be impaired.[10,29,42]

In adolescents and young women with hypothalamic amenorrhea, estrogen-progesterone supplementation may help maintain bone density, protect the endometrium, and promote regular menses at predictable times.[10,28,35] The criteria for initiating estrogen replacement therapy and the optimal dosing schedule have not been determined. The minimum daily estrogen dose that has been shown to prevent bone loss in postmenopausal women is 0.625 mg of conjugated estrogens[43]; this dose, however, has not been shown to increase BMD in young women with hypothalamic amenorrhea.[28] Supplementation with a low-dose oral contraceptive (<50 μg of estrogen per day) is a readily available source of estrogen and may be associated with an increase in total body BMD.[39]

RECOMMENDATIONS

1. Exercise and sports participation should be promoted in girls and adolescents for health benefits and enjoyment.
2. Dietary practices; exercise intensity, duration, and frequency; and menstrual history need to be reviewed during evaluations that precede participation in sports or other medical encounters in which related problems may present.
3. Amenorrhea should not be considered a normal response to exercise. Exercise-associated amenorrhea or amenorrhea attributable to decreased energy availability should be considered a diagnosis of exclusion. A complete medical evaluation is required for any adolescent with primary or secondary amenorrhea or persistent oligomenorrhea.
4. Disordered eating should be considered in adolescents with amenorrhea. Treatment often requires a team of health care professionals, including a physician, nutritionist, and mental health professional, all experienced in the treatment of eating disorders, in addition to cooperation by coaches, parents, and teammates.
5. Education and counseling should be provided to athletes, parents, and coaches regarding disordered eating, menstrual dysfunction, decreased bone mineralization, and adequate energy (calorie) and nutrient intake to meet energy expenditure and maintain normal growth and development.
6. When athletes and coaches want to know what weight and amount of body fat are best for a given athlete, it is preferable to establish a range of values rather than specific values. It is difficult and potentially dangerous to define an ideal level of weight and/or body fat for each sport or individual participant. Weight is not an accurate estimate of fitness or fatness, and when weight is lost, muscle and fat are lost.
7. An adolescent with menstrual dysfunction attributed to exercise should be encouraged to increase her energy (caloric) intake and modify excessive exercise activity. If an athlete's weight is low, she may be required to gain weight before resuming athletic activity.
8. Estrogen-progesterone supplementation may be considered in the mature amenorrheic athlete.
9. Measurement of BMD may be considered as a tool when making treatment decisions for the amenorrheic athlete.

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CLINICAL REPORT

Medical Conditions Affecting Sports Participation

Guidance for the Clinician in Rendering Pediatric Care

Stephen G. Rice, MD, PhD, MPH, and the Council on Sports Medicine and Fitness

ABSTRACT

Children and adolescents with medical conditions present special issues with respect to participation in athletic activities. The pediatrician can play an important role in determining whether a child with a health condition should participate in certain sports by assessing the child's health status, suggesting appropriate equipment or modifications of sports to decrease the risk of injury, and educating the athlete, parent(s) or guardian, and coach regarding the risks of injury as they relate to the child's condition. This report updates a previous policy statement and provides information for pediatricians on sports participation for children and adolescents with medical conditions.

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Key Words
youth, athletes, risk of injury, contact and collision sports, prevention management, strenuousness, safety

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In 2001, the American Academy of Pediatrics published an analysis of medical conditions affecting sports participation.[1] This updated report replaces the 2001 policy statement and provides additions and changes to increase the accuracy and completeness of the information.

Health care professionals must determine whether a child with a health condition should participate in a particular sport. One way of determining this is by estimating the relative risk of an acute injury to the athlete by categorizing sports as contact, limited-contact, or noncontact sports (Table 1). This categorization may subdivide contact sports into collision and contact sports; although there may be no clear dividing line between the 2, collision implies greater injury risk. In collision sports (eg, boxing, ice hockey, football, lacrosse, and rodeo), athletes purposely hit or collide with each other or with inanimate objects (including the ground) with great force. In contact sports (eg, basketball and soccer), athletes routinely make contact with each other or with inanimate objects but usually with less force than in collision sports. In limited-contact sports (eg, softball and squash), contact with other athletes or with inanimate objects is infrequent or inadvertent. However, some limited-contact sports (eg, skateboarding) can be as dangerous as collision or contact sports. Even in noncontact sports (eg, power lifting), in which contact is rare and unexpected, serious injuries can occur.

Overuse injuries are related not to contact or collision but to repetitive microtrauma; furthermore, overuse injuries generally are not acute. For these reasons, the categorization of sports in Table 1 insufficiently reflects the relative risks of injury. However, the categorization indicates the comparative likelihood that participation in different sports will result in acute traumatic injuries from blows to the body.

For most chronic health conditions, current evidence supports and encourages the participation of children and adolescents in most athletic activities. However, the medical conditions listed in Table 2 have been assessed to determine whether participation would create an increased risk of injury or affect the child's medical condition adversely. These guidelines can be valuable when a physician examines an athlete who has one of the listed problems. Decisions about sports participation are often complex, and the usefulness of Table 2 is limited by the frequency with which it recommends individual assessment when a "qualified yes" or a "qualified no" appears.

The physician's clinical judgment is essential in the application of these recommendations to a specific patient. This judgment is enhanced by consideration of the available published information on the risks of participation, the risk of acquiring a disease as a result of participation in the sport, and the severity of that disease. Other variables to consider include (1) the advice of knowledgeable experts, (2) the current health status of the athlete, (3) the sport in which the athlete participates, (4) the position played, (5) the level of competition, (6) the maturity of the competitor, (7) the relative size of the athlete (for collision/contact sports), (8) the availability of effective protective equipment that is acceptable to the athlete and/or sport governing body, (9) the availability and efficacy of treatment, (10) whether treatment (eg, rehabilitation of an injury) has been completed, (11) whether the sport can be modified to allow safer participation, and (12) the ability of the athlete's parent(s) or guardian and coach to understand and

TABLE 1 **Classification of Sports According to Contact**

Contact	Limited-Contact	Noncontact
Basketball	Adventure racing[a]	Badminton
Boxing[b]	Baseball	Bodybuilding[c]
Cheerleading	Bicycling	Bowling
Diving	Canoeing or kayaking (white water)	Canoeing or kayaking (flat water)
Extreme sports[d]	Fencing	Crew or rowing
Field hockey	Field events	Curling
Football, tackle	High jump	Dance
Gymnastics	Pole vault	Field events
Ice hockey[e]	Floor hockey	Discus
Lacrosse	Football, flag or touch	Javelin
Martial arts[f]	Handball	Shot-put
Rodeo	Horseback riding	Golf
Rugby	Martial arts[f]	Orienteering[g]
Skiing, downhill	Racquetball	Power lifting[c]
Ski jumping	Skating	Race walking
Snowboarding	Ice	Riflery
Soccer	In-line	Rope jumping
Team handball	Roller	Running
Ultimate Frisbee	Skiing	Sailing
Water polo	Cross-country	Scuba diving
Wrestling	Water	Swimming
	Skateboarding	Table tennis
	Softball	Tennis
	Squash	Track
	Volleyball	
	Weight lifting	
	Windsurfing or surfing	

[a] Adventure racing has been added since the previous statement was published and is defined as a combination of 2 or more disciplines, including orienteering and navigation, cross-country running, mountain biking, paddling, and climbing and rope skills.[1]

[b] The American Academy of Pediatrics opposes participation in boxing for children, adolescents, and young adults.[2]

[c] The American Academy of Pediatrics recommends limiting bodybuilding and power lifting until the adolescent achieves sexual maturity rating 5 (Tanner stage V).

[d] Extreme sports has been added since the previous statement was published.

[e] The American Academy of Pediatrics recommends limiting the amount of body checking allowed for hockey players 15 years and younger, to reduce injuries.

[f] Martial arts can be subclassified as judo, jujitsu, karate, kung fu, and tae kwon do; some forms are contact sports and others are limited-contact sports.

[g] Orienteering is a race (contest) in which competitors use a map and a compass to find their way through unfamiliar territory.

to accept the risks involved in participation. Potential dangers of associated training activities that lead to repetitive and/or excessive overload also should be considered.

Unfortunately, adequate data on the risks of a particular sport for athletes with medical problems often are limited or lacking, and an estimate of risk becomes a necessary part of the decision-making process. If primary care physicians are uncertain or uncomfortable with the evaluation and/or the decision-making process, they should seek the counsel of a sports medicine specialist or a specialist in the specific area of medical concern. If the physician thinks that restriction from a sport is necessary for a particular patient, then he or she should counsel the athlete and family about safe alternative activities.

Physicians making decisions about sports participation for athletes with cardiovascular disease (Table 2) are strongly encouraged to consider consulting a cardiologist and to review carefully recommendations from the 36th Bethesda Conference.[12] The complexities and nuances of cardiovascular disease make it difficult to provide important detailed information in a single table.

An athlete's underlying cardiac pathologic condition and the stress that a sport places on that condition are the 2 primary factors determining the risk of participating in that sport. A strenuous sport can place dynamic (volume) and static (pressure) demands on the cardiovascular system. These demands vary not only with activities of the sport but also with factors such as the associated training activities and the environment, as well as the level of emotional arousal and fitness of the competitors. Figure 1 lists sports according to their dynamic and static demands, as classified by cardiopulmonary experts of the 36th Bethesda Conference.[12]

New recommendations on sports participation for athletes with hypertension (Table 2) are available.[10,12] The latest blood pressure tables provide the 50th, 90th, 95th, and 99th percentiles based on age, gender, and height.[10] The blood pressure reading must be at least 5 mm Hg above the 99th percentile before any exclusion from sports is indicated.[10] Periodic monitoring of resting (preexercise) blood pressure levels is preferred for readings above the 90th percentile. A more-complete evaluation is performed for sustained blood pressure readings above the 95th percentile.[10,12]

In earlier legal decisions, athletes have been permitted to participate in sports despite known medical risks and against medical advice, usually in cases involving missing or nonfunctioning paired organs. In recent years, however, courts have been reluctant to permit athletes to participate in competitive athletics contrary to the team physician's medical recommendation. When an athlete's family seeks to disregard such medical advice against participation, the physician should ask all parents or guardians to sign a written informed consent statement indicating that they have been advised of the potential dangers of participation and that they understand these dangers. The physician should document, with the athlete's signature, that the child or adolescent athlete also understands the risks of participation. To ensure that parents or guardians truly understand the risks and dangers of participation against medical advice, it is recommended that these adults write the statement in their own words and handwriting.[59–62]

Additional information on the effects of medical problems on the risk of injury during sports participation is available in *Care of the Young Athlete* by the American Academy of Orthopaedic Surgeons and the American Academy of Pediatrics[63] and *Preparticipation Physical Evaluation, Third Edition,* by the American Academy of Family Physicians, American Academy of Pediatrics, American College of Sports Medicine, American Medical Society for Sports Medicine, American Orthopaedic Society for Sports Medicine, and American Osteopathic Academy of Sports Medicine.[7] In addition, other American Academy of Pediatrics policy statements include relevant material.[64–67]

TABLE 2 **Medical Conditions and Sports Participation**

Condition	May Participate
Atlantoaxial instability (instability of the joint between cervical vertebrae 1 and 2)	Qualified yes
Explanation: Athlete (particularly if he or she has Down syndrome or juvenile rheumatoid arthritis with cervical involvement) needs evaluation to assess the risk of spinal cord injury during sports participation, especially when using a trampoline.[4–7]	
Bleeding disorder	Qualified yes
Explanation: Athlete needs evaluation.[8,9]	
Cardiovascular disease	
Carditis (inflammation of the heart)	No
Explanation: Carditis may result in sudden death with exertion.	
Hypertension (high blood pressure)	Qualified yes
Explanation: Those with hypertension >5 mm Hg above the 99th percentile for age, gender, and height should avoid heavy weightlifting and power lifting, bodybuilding, and high-static component sports (Fig 1). Those with sustained hypertension (>95th percentile for age, gender, and height) need evaluation.[10–12] The National High Blood Pressure Education Program Working Group report defined prehypertension and stage 1 and stage 2 hypertension in children and adolescents younger than 18 years of age.[10]	
Congenital heart disease (structural heart defects present at birth)	Qualified yes
Explanation: Consultation with a cardiologist is recommended. Those who have mild forms may participate fully in most cases; those who have moderate or severe forms or who have undergone surgery need evaluation. The 36th Bethesda Conference[12] defined mild, moderate, and severe disease for common cardiac lesions.	
Dysrhythmia (irregular heart rhythm)	Qualified yes
Long-QT syndrome	
Malignant ventricular arrhythmias	
Symptomatic Wolff-Parkinson-White syndrome	
Advanced heart block	
Family history of sudden death or previous sudden cardiac event	
Implantation of a cardioverter-defibrillator	
Explanation: Consultation with a cardiologist is advised. Those with symptoms (chest pain, syncope, near-syncope, dizziness, shortness of breath, or other symptoms of possible dysrhythmia) or evidence of mitral regurgitation on physical examination need evaluation. All others may participate fully.[13–15]	
Heart murmur	Qualified yes
Explanation: If the murmur is innocent (does not indicate heart disease), full participation is permitted. Otherwise, athlete needs evaluation (see structural heart disease, especially hypertrophic cardiomyopathy and mitral valve prolapse).	
Structural/acquired heart disease	
Hypertrophic cardiomyopathy	Qualified no
Coronary artery anomalies	Qualified no
Arrhythmogenic right ventricular cardiomyopathy	Qualified no
Acute rheumatic fever with carditis	Qualified no
Ehlers-Danlos syndrome, vascular form	Qualified no
Marfan syndrome	Qualified yes
Mitral valve prolapse	Qualified yes
Anthracycline use	Qualified yes
Explanation: Consultation with a cardiologist is recommended. The 36th Bethesda Conference provided detailed recommendations.[12,13,15–18] Most of these conditions carry a significant risk of sudden cardiac death associated with intense physical exercise. Hypertrophic cardiomyopathy requires thorough and repeated evaluations, because disease may change manifestations during later adolescence.[12,13,17] Marfan syndrome with an aortic aneurysm also can cause sudden death during intense physical exercise.[18] Athlete who has ever received chemotherapy with anthracyclines may be at increased risk of cardiac problems because of the cardiotoxic effects of the medications, and resistance training in this population should be approached with caution; strength training that avoids isometric contractions may be permitted.[19,20] Athlete needs evaluation.	
Vasculitis/vascular disease	Qualified yes
Kawasaki disease (coronary artery vasculitis)	
Pulmonary hypertension	
Explanation: Consultation with a cardiologist is recommended. Athlete needs individual evaluation to assess risk on the basis of disease activity, pathologic changes, and medical regimen.[21]	
Cerebral palsy	Qualified yes
Explanation: Athlete needs evaluation to assess functional capacity to perform sports-specific activity.	
Diabetes mellitus	Yes
Explanation: All sports can be played with proper attention and appropriate adjustments to diet (particularly carbohydrate intake), blood glucose concentrations, hydration, and insulin therapy. Blood glucose concentrations should be monitored before exercise, every 30 min during continuous exercise, 15 min after completion of exercise, and at bedtime.	
Diarrhea, infectious	Qualified no
Explanation: Unless symptoms are mild and athlete is fully hydrated, no participation is permitted, because diarrhea may increase risk of dehydration and heat illness (see fever).	
Eating disorders	Qualified yes
Explanation: Athlete with an eating disorder needs medical and psychiatric assessment before participation.	
Eyes	Qualified yes
Functionally 1-eyed athlete	
Loss of an eye	
Detached retina or family history of retinal detachment at young age	
High myopia	
Connective tissue disorder, such as Marfan or Stickler syndrome	
Previous intraocular eye surgery or serious eye injury	

TABLE 2 **Continued**

Condition	May Participate
Explanation: A functionally 1-eyed athlete is defined as having best-corrected visual acuity worse than 20/40 in the poorer-seeing eye. Such an athlete would suffer significant disability if the better eye were seriously injured, as would an athlete with loss of an eye. Specifically, boxing and full-contact martial arts are not recommended for functionally 1-eyed athletes, because eye protection is impractical and/or not permitted. Some athletes who previously underwent intraocular eye surgery or had a serious eye injury may have increased risk of injury because of weakened eye tissue. Availability of eye guards approved by the American Society for Testing and Materials and other protective equipment may allow participation in most sports, but this must be judged on an individual basis.[22,23]	
Conjunctivitis, infectious	Qualified no
Explanation: Athlete with active infectious conjunctivitis should be excluded from swimming.	
Fever	No
Explanation: Elevated core temperature may be indicative of a pathologic medical condition (infection or disease) that is often manifest by increased resting metabolism and heart rate. Accordingly, during athlete's usual exercise regimen, the presence of fever can result in greater heat storage, decreased heat tolerance, increased risk of heat illness, increased cardiopulmonary effort, reduced maximal exercise capacity, and increased risk of hypotension because of altered vascular tone and dehydration. On rare occasions, fever may accompany myocarditis or other conditions that may make usual exercise dangerous.	
Gastrointestinal	Qualified yes
Malabsorption syndromes (celiac disease or cystic fibrosis)	
Explanation: Athlete needs individual assessment for general malnutrition or specific deficits resulting in coagulation or other defects; with appropriate treatment, these deficits can be treated adequately to permit normal activities.	
Short-bowel syndrome or other disorders requiring specialized nutritional support, including parenteral or enteral nutrition	
Explanation: Athlete needs individual assessment for collision, contact, or limited-contact sports. Presence of central or peripheral, indwelling, venous catheter may require special considerations for activities and emergency preparedness for unexpected trauma to the device(s).	
Heat illness, history of	Qualified yes
Explanation: Because of the likelihood of recurrence, athlete needs individual assessment to determine the presence of predisposing conditions and behaviors and to develop a prevention strategy that includes sufficient acclimatization (to the environment and to exercise intensity and duration), conditioning, hydration, and salt intake, as well as other effective measures to improve heat tolerance and to reduce heat injury risk (such as protective equipment and uniform configurations).[24,25]	
Hepatitis, infectious (primarily hepatitis C)	Yes
Explanation: All athletes should receive hepatitis B vaccination before participation. Because of the apparent minimal risk to others, all sports may be played as athlete's state of health allows. For all athletes, skin lesions should be covered properly, and athletic personnel should use universal precautions when handling blood or body fluids with visible blood.[26]	
HIV infection	Yes
Explanation: Because of the apparent minimal risk to others, all sports may be played as athlete's state of health allows (especially if viral load is undetectable or very low). For all athletes, skin lesions should be covered properly, and athletic personnel should use universal precautions when handling blood or body fluids with visible blood.[26] However, certain sports (such as wrestling and boxing) may create a situation that favors viral transmission (likely bleeding plus skin breaks). If viral load is detectable, then athletes should be advised to avoid such high-contact sports.	
Kidney, absence of one	Qualified yes
Explanation: Athlete needs individual assessment for contact, collision, and limited-contact sports. Protective equipment may reduce risk of injury to the remaining kidney sufficiently to allow participation in most sports, providing such equipment remains in place during activity.[22]	
Liver, enlarged	Qualified yes
Explanation: If the liver is acutely enlarged, then participation should be avoided because of risk of rupture. If the liver is chronically enlarged, then individual assessment is needed before collision, contact, or limited-contact sports are played. Patients with chronic liver disease may have changes in liver function that affect stamina, mental status, coagulation, or nutritional status.	
Malignant neoplasm	Qualified yes
Explanation: Athlete needs individual assessment.[27]	
Musculoskeletal disorders	Qualified yes
Explanation: Athlete needs individual assessment.	
Neurologic disorders	
History of serious head or spine trauma or abnormality, including craniotomy, epidural bleeding, subdural hematoma, intracerebral hemorrhage, second-impact syndrome, vascular malformation, and neck fracture.[4,5,28–30]	Qualified yes
Explanation: Athlete needs individual assessment for collision, contact, or limited-contact sports.	
History of simple concussion (mild traumatic brain injury), multiple simple concussions, and/or complex concussion	Qualified yes
Explanation: Athlete needs individual assessment. Research supports a conservative approach to concussion management, including no athletic participation while symptomatic or when deficits in judgment or cognition are detected, followed by graduated return to full activity.[28–32]	
Myopathies	Qualified yes
Explanation: Athlete needs individual assessment.	
Recurrent headaches	Yes
Explanation: Athlete needs individual assessment.[33]	
Recurrent plexopathy (burner or stinger) and cervical cord neuropraxia with persistent defects	Qualified yes
Explanation: Athlete needs individual assessment for collision, contact, or limited-contact sports; regaining normal strength is important benchmark for return to play.[34,35]	
Seizure disorder, well controlled	Yes
Explanation: Risk of seizure during participation is minimal.[36]	
Seizure disorder, poorly controlled	Qualified yes
Explanation: Athlete needs individual assessment for collision, contact, or limited-contact sports. The following noncontact sports should be avoided: archery, riflery, swimming, weightlifting, power lifting, strength training, and sports involving heights. In these sports, occurrence of a seizure during activity may pose a risk to self or others.[36]	

TABLE 2 **Continued**

Condition	May Participate
Obesity	Yes
Explanation: Because of the increased risk of heat illness and cardiovascular strain, obese athlete particularly needs careful acclimatization (to the environment and to exercise intensity and duration), sufficient hydration, and potential activity and recovery modifications during competition and training.[37]	
Organ transplant recipient (and those taking immunosuppressive medications)	Qualified yes
Explanation: Athlete needs individual assessment for contact, collision, and limited-contact sports. In addition to potential risk of infections, some medications (eg, prednisone) may increase tendency for bruising.	
Ovary, absence of one	Yes
Explanation: Risk of severe injury to remaining ovary is minimal.	
Pregnancy/postpartum	Qualified yes
Explanation: Athlete needs individual assessment. As pregnancy progresses, modifications to usual exercise routines will become necessary. Activities with high risk of falling or abdominal trauma should be avoided. Scuba diving and activities posing risk of altitude sickness should also be avoided during pregnancy. After the birth, physiological and morphologic changes of pregnancy take 4 to 6 weeks to return to baseline.[38,39]	
Respiratory conditions	
Pulmonary compromise, including cystic fibrosis	Qualified yes
Explanation: Athlete needs individual assessment but, generally, all sports may be played if oxygenation remains satisfactory during graded exercise test. Athletes with cystic fibrosis need acclimatization and good hydration to reduce risk of heat illness.	
Asthma	Yes
Explanation: With proper medication and education, only athletes with severe asthma need to modify their participation. For those using inhalers, recommend having a written action plan and using a peak flowmeter daily.[40–43] Athletes with asthma may encounter risks when scuba diving.	
Acute upper respiratory infection	Qualified yes
Explanation: Upper respiratory obstruction may affect pulmonary function. Athlete needs individual assessment for all except mild disease (see fever).	
Rheumatologic diseases	Qualified yes
Juvenile rheumatoid arthritis	
Explanation: Athletes with systemic or polyarticular juvenile rheumatoid arthritis and history of cervical spine involvement need radiographs of vertebrae C1 and C2 to assess risk of spinal cord injury. Athletes with systemic or HLA-B27-associated arthritis require cardiovascular assessment for possible cardiac complications during exercise. For those with micrognathia (open bite and exposed teeth), mouth guards are helpful. If uveitis is present, risk of eye damage from trauma is increased; ophthalmologic assessment is recommended. If visually impaired, guidelines for functionally 1-eyed athletes should be followed.[44]	
Juvenile dermatomyositis, idiopathic myositis	
Systemic lupus erythematosis	
Raynaud phenomenon	
Explanation: Athlete with juvenile dermatomyositis or systemic lupus erythematosis with cardiac involvement requires cardiology assessment before participation. Athletes receiving systemic corticosteroid therapy are at higher risk of osteoporotic fractures and avascular necrosis, which should be assessed before clearance; those receiving immunosuppressive medications are at higher risk of serious infection. Sports activities should be avoided when myositis is active. Rhabdomyolysis during intensive exercise may cause renal injury in athletes with idiopathic myositis and other myopathies. Because of photosensitivity with juvenile dermatomyositis and systemic lupus erythematosis, sun protection is necessary during outdoor activities. With Raynaud phenomenon, exposure to the cold presents risk to hands and feet.[45–48]	
Sickle cell disease	Qualified yes
Explanation: Athlete needs individual assessment. In general, if illness status permits, all sports may be played; however, any sport or activity that entails overexertion, overheating, dehydration, or chilling should be avoided. Participation at high altitude, especially when not acclimatized, also poses risk of sickle cell crisis.	
Sickle cell trait	Yes
Explanation: Athletes with sickle cell trait generally do not have increased risk of sudden death or other medical problems during athletic participation under normal environmental conditions. However, when high exertional activity is performed under extreme conditions of heat and humidity or increased altitude, such catastrophic complications have occurred rarely.[8,49–52] Athletes with sickle cell trait, like all athletes, should be progressively acclimatized to the environment and to the intensity and duration of activities and should be sufficiently hydrated to reduce the risk of exertional heat illness and/or rhabdomyolysis.[25] According to National Institutes of Health management guidelines, sickle cell trait is not a contraindication to participation in competitive athletics, and there is no requirement for screening before participation.[53] More research is needed to assess fully potential risks and benefits of screening athletes for sickle cell trait.	
Skin infections, including herpes simplex, molluscum contagiosum, verrucae (warts), staphylococcal and streptococcal infections (furuncles [boils], carbuncles, impetigo, methicillin-resistant *Staphylococcus aureus* [cellulitis and/or abscesses]), scabies, and tinea	Qualified yes
Explanation: During contagious periods, participation in gymnastics or cheerleading with mats, martial arts, wrestling, or other collision, contact, or limited-contact sports is not allowed.[54–57]	
Spleen, enlarged	Qualified yes
Explanation: If the spleen is acutely enlarged, then participation should be avoided because of risk of rupture. If the spleen is chronically enlarged, then individual assessment is needed before collision, contact, or limited-contact sports are played.	
Testicle, undescended or absence of one	Yes
Explanation: Certain sports may require a protective cup.[22]	

This table is designed for use by medical and nonmedical personnel. "Needs evaluation" means that a physician with appropriate knowledge and experience should assess the safety of a given sport for an athlete with the listed medical condition. Unless otherwise noted, this need for special consideration is because of variability in the severity of the disease, the risk of injury for the specific sports listed in Table 1, or both.

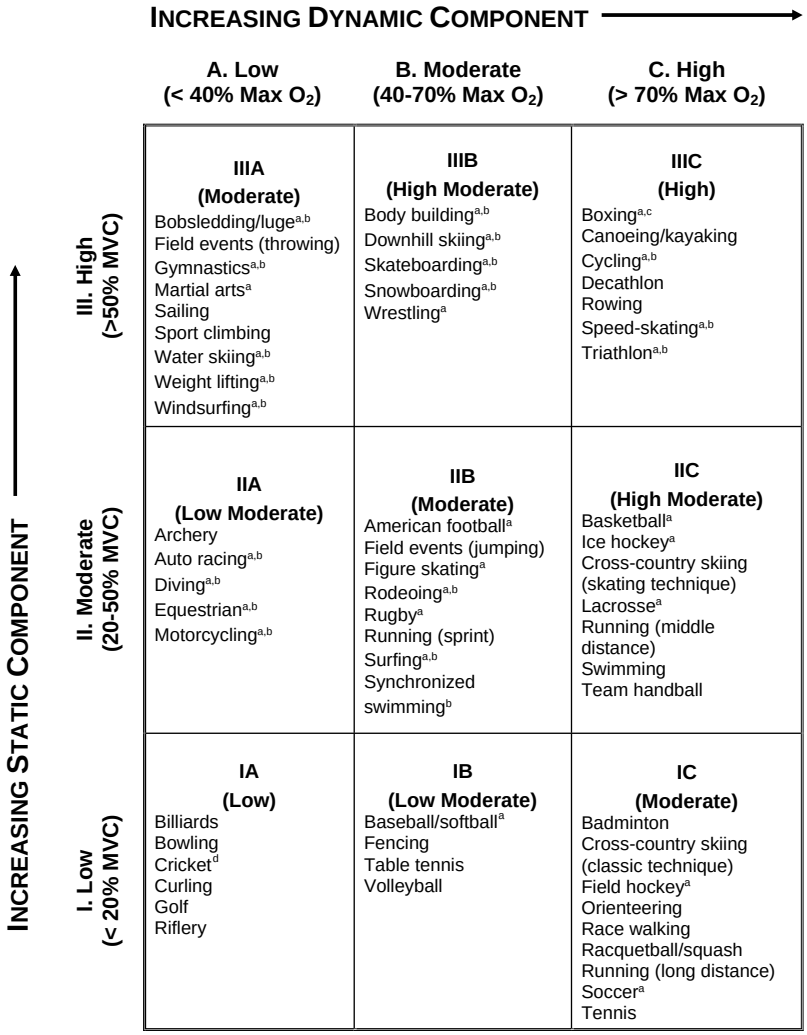

FIGURE 1
Classification of sports according to cardiovascular demands (based on combined static and dynamic components).[1,2] This classification is based on peak static and dynamic components achieved during competition. It should be noted, however, that the higher values may be reached during training. The increasing dynamic component is defined in terms of the estimated percentage of maximal oxygen uptake (Max O_2) achieved and results in increasing cardiac output. The increasing static component is related to the estimated percentage of maximal voluntary contraction (MVC) reached and results in increasing blood pressure load. Activities with the lowest total cardiovascular demands (cardiac output and blood pressure) are shown in box IA, and those with the highest demands are shown in box IIIC. Boxes IIA and IB depict activities with low/moderate total cardiovascular demands, boxes IIIA, IIB, and IC depict activities with moderate total cardiovascular demands, and boxes IIIB and IIC depict high/moderate total cardiovascular demands. These categories progress diagonally across the graph from lower left to upper right. [a] Danger of bodily collision. [b] Increased risk if syncope occurs. [c] Participation is not recommended by the American Academy of Pediatrics.[2] [d] The American Academy of Pediatrics classifies cricket in the IB box (low static component and moderate dynamic component).[58] (Reproduced with permission from Mitchell JH, Haskell W, Snell P, Van Camp SP. 36th Bethesda Conference. Task force 8: classification of sports. *J Am Coll Cardiol.* 2005;45(8):1364–1367.)

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ADDITIONAL RESOURCE

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Medical Emergencies Occurring at School

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on School Health

ABSTRACT

Children and adults might experience medical emergency situations because of injuries, complications of chronic health conditions, or unexpected major illnesses that occur in schools. In February 2001, the American Academy of Pediatrics issued a policy statement titled "Guidelines for Emergency Medical Care in Schools" (available at: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;107/2/435). Since the release of that statement, the spectrum of potential individual student emergencies has changed significantly. The increase in the number of children with special health care needs and chronic medical conditions attending schools and the challenges associated with ensuring that schools have access to on-site licensed health care professionals on an ongoing basis have added to increasing the risks of medical emergencies in schools. The goal of this statement is to increase pediatricians' awareness of schools' roles in preparing for individual student emergencies and to provide recommendations for primary care and school physicians on how to assist and support school personnel. *Pediatrics* 2008;122:887–894

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Key Words
school, medical emergency, emergency care plan

Abbreviations
AAP—American Academy of Pediatrics
EMS—emergency medical services
CPR—cardiopulmonary resuscitation
AED—automated external defibrillator
EMT—emergency medical technician
IHP—individualized health plan
IEP—individualized education plan
ECP—emergency care plan

RATIONALE

Many schools lack a licensed health care professional on site to respond to individual student medical emergencies. Injuries are the leading cause of death and disability in the United States, especially among children, with 70% of injury deaths occurring in school-aged youth (5–19 years of age).[1] It is estimated that 10% to 25% of injuries to children occur while they are in school.[2] In addition to injury-related emergencies, status asthmaticus, diabetic crises, status epilepticus, sudden cardiac death, and other medical emergencies can occur in students and staff at school. The prevalence of children with special health care needs attending schools means that there now exists a pool of students with a broad range of medical conditions that may require special equipment, preparation and training of personnel, medications and supplies, and/or transport decisions and arrangements.[3] This statement highlights the role of school personnel, the school health and safety team (school nurse, social worker, school resource officer), school physician, and primary care clinician in each step in the process of managing individual student emergencies occurring at school. It is important to note that there is a fundamental link between emergency readiness and disaster preparedness. Schools that are prepared for an emergency in an individual are more likely to be prepared for complex events such as community disasters. Disaster planning in schools is covered in a separate policy statement from the American Academy of Pediatrics (AAP), "Disaster Planning for Schools."[4] It is helpful to view these 2 policies together to appreciate the full spectrum of school emergency planning.

BACKGROUND

The average school-aged child spends 28% of the day and 14% of his or her total annual hours in school.[2] There are 72.3 million children younger than 18 years living in the United States (according to the 2000 US Census). The Maternal and Child Health Bureau of the US Department of Health and Human Services estimates that of this group, 18 million children and adolescents have special health care needs or a chronic illness. Children with special health care needs or chronic illness account for 25% of the pediatric patients seen in hospital emergency departments each year.[3] Despite its critical importance, school emergency preparedness is frequently inadequate because of barriers such as geographic and physical facility conditions, staffing, staff education and training, and financial resources.

Schools across the nation vary tremendously in their degree of preparedness to deal with emergencies. A survey of schools in rural New Mexico found that schools, particularly in larger communities, were ill prepared to deal with emergencies in students or staff as assessed by evaluating equipment and emergency training (communities with

populations of <200 000 were more likely to have equipment available).[2] Oxygen was available in only 20% of the surveyed schools, epinephrine was available in only 16%, artificial airways were available in only 30%, cervical collars were available in only 22%, and splints were available in only 69%. Annually, 67% of schools activate emergency medical services (EMS) systems for an emergency involving a student, and 37% activate EMS for an emergency involving an adult. EMS response time was less than 10 minutes for 84% of the schools.[2]

A national survey of 573 school nurses conducted by Olympia et al[5] revealed that 68% of the school nurses managed a life-threatening emergency requiring EMS activation in the school year before the survey. Although 86% of the surveyed schools reported having a medical emergency-response plan, 35% of the schools had not tested it during a drill.

Regional statistics demonstrate that injuries are the chief complaint listed for two thirds of EMS dispatches to schools. Medical emergencies, such as breathing difficulties and seizures, account for one quarter of school calls to the EMS system.[3] Compared with non-school–based EMS incidents, school-based EMS incidents are more often attributable to injury, are frequently related to a sporting activity, and are more likely to result in transport to a medical facility.[6] Even in the case of children with special health care needs, approximately half of EMS responses are unrelated to the child's special needs and include traditional causes of EMS calls, such as an acute injury.[1]

Another critical factor in the preparedness of schools for emergencies is medical, nonmedical, and students' training. School medical emergencies can involve students, adults, staff members, or attendees of special events. Because injuries are the most common life-threatening emergencies encountered by children and adolescents inside or outside schools, teachers, school nurses, physicians, athletic trainers, coaches, and students should know general principles of first aid and cardiopulmonary resuscitation (CPR). In a survey of all high schools in Washington State, 80% of teachers thought that CPR training was important, yet 35% of the schools provided no CPR training for students.

The goal of this statement is to increase the pediatric clinician's awareness of the role that schools play in preparing for and responding to the individual student emergency. Recommendations and resources will be provided to assist primary care clinicians and school physicians in supporting schools in this role. The management of individual emergencies is linked to the preparation for large-scale community emergencies.[4] Resources, linkages with EMS, and staff training are all vital to emergency preparedness. It is really the scale and terminology that distinguish the response to an individual emergency from the response to a disaster. The terminology of mitigation and prevention, preparedness, response, and recovery[7] is generally not used for individual emergencies but reserved for large-scale disasters. However, in individual emergencies, the emphasis is less on prevention and more on preparedness and response. The following reflects the role that schools play in these aspects of individual emergency response.

DESCRIPTION OF THE SCHOOL'S ROLE

Readiness for Response

Any child can have a medical emergency in school. Children with special health care needs carry additional risks of emergencies related to their diagnoses. From injury to anaphylaxis to status epilepticus, schools are expected to anticipate and prepare to respond to a wide variety of emergencies.[8,9]

General Preparation

Ideally, schools develop emergency policies with input from the medical community—both EMS and community clinicians. These policies need to be flexible enough to accommodate different students' developmental levels. Integration of EMS into school emergency planning familiarizes them with the location and type of medical resources available at the school. This collaboration leads to the creation of policies and regulations that appropriately delegate authority, assign roles, distribute shared resources, and establish parameters for health care providers. The range of possible policies can vary from general emergency management to use of CPR and automated external defibrillators (AEDs) to life-threatening allergy management; these are discussed briefly below.

- Policies, regulations, and protocols are created to cover all aspects of school jurisdiction, from classroom to playground, school-based health centers (if one is available), before- and after-school programs, field trips, transportation, and athletic events. These are to be clearly stated and communicated to all school staff and parents. Table 1 provides some resources for the creation of such policies.
- Emergency data are to be collected on all children and include parental contact, health care provider contact, medical conditions, medications, allergies, and insurance. Information technology could facilitate the collection, storing, and transfer of these data.
- Protocols should include algorithms for determining levels of emergencies. Minor illnesses or injuries are to be distinguished from emergencies that require EMS activation.
- It is important that the EMS-activation process is clear to all staff. This process ensures accessible and appropriate transportation and care during transport to a hospital or other appropriate medical facility.[10] Although EMS traditionally is thought of as emergency medical technicians (EMTs) and ambulances, it really encompasses prehospital through emergency department management. Therefore, in the event of a medical emergency within school jurisdiction, EMS include school nurses and school staff. Ongoing communication, review, and practice of procedures ensure achievement of this level of integration.

TABLE 1 **Selected Emergency-Preparedness Resources and Links**

General resources	
AAP Council on School Health	www.schoolhealth.org
American Heart Association: School emergency-response plan	"Response to Cardiac Arrest and Selected Life-Threatening Medical Emergencies: The Medical Emergency Response Plan for Schools," www.americanheart.org/presenter.jhtml?identifier=3017969
National Association of School Nurses	www.nasn.org
American Heart Association	www.americanheart.org
Emergency Medical Services for Children National Resource Center	www.childrensnational.org/emsc
Food Allergy & Anaphylaxis Network	www.foodallergy.org
National Asthma Education and Prevention Program, American Diabetes Association, American School Health Association, Epilepsy Foundation, Food Allergy & Anaphylaxis Network, and National School Boards Association	"Students With Chronic Illnesses: Guidance for Families, Schools and Students," www.nhlbi.nih.gov/health/public/lung/asthma/guidfam.htm
Asthma: general information	Lung diseases information, www.nhlbi.nih.gov/health/public/lung/index.htm "Is the Asthma Action Plan Working? A Tool for School Nurse Assessment," www.nhlbi.nih.gov/health/prof/lung/asthma/asth_act_plan_frm.htm Managing Asthma in the School Environment, www.epa.gov/iaq/schools Schooled in Asthma, www.schoolhealth.org/asthma_materials.cfm "Suggested Emergency Protocol for Students With Asthma Symptoms," http://rover.nhlbi.nih.gov/health/prof/lung/asthma/sch-emer-protocol.htm "When Should Students With Asthma or Allergies Carry and Self-administer Emergency Medications at School?" http://rover.nhlbi.nih.gov/health/prof/lung/asthma/emer_medi.htm
Disease-specific action plans	
Asthma action plans	Schooled in Asthma, www.schoolhealth.org/content/Asthma%20Action%20Plan.pdf Agency for Healthcare Research and Quality: quality tools, www.qualitytools.ahrq.gov/summary/summary.aspx?doc_id=6123 Asthma patient action plan, http://schoolasthmaallergy.com/html/toolkit/library/AsthmaActionPlan.pdf
Diabetes action plans	"My Diabetes Action Plan," www.diabetes.com/pdfs/action_plan.pdf Emergency action plan: diabetes health care, www.dhss.mo.gov/diabetes/DMEmergencyAction.pdf Diabetes health care emergency action plan, www.childrenwithdiabetes.com/d_0q_5l0.htm
Seizures emergency action plan	Epilepsy Foundation: school nurse training program, www.epilepsyfoundation.org/programs/schoolnurse/schoolnurse.cfm
Allergy action plan	Food allergy action plan, www.foodallergy.org/actionplan.pdf
Children with special health care needs emergency information form	Emergency preparedness for children with special health care needs, www.pediatrics.org/cgi/content/full/104/4/e53
National Association of School Nurses	"Emergency Care Plans for Students With Special Health Care Needs," www.nasn.org/Default.aspx?tabid=220 "Preparing for School Emergencies," www.nasn.org/Default.aspx?tabid=238
Pediatric first aid for caregivers and teachers	PedFACTS Online, www.pedfactsonline.com; also available through the AAP Bookstore, www.aap.org/bst/showdetl.cfm?&DID=15&Product_ID=4107
Managing Infectious Diseases in Child Care and Schools: A Quick Reference Guide	www.aap.org/bst/showdetl.cfm?&DID=15&Product_ID=3934

- Participation of physical facilities administrators in the planning ensures that the most efficient access routes to the school, as well as floor plans, are available to EMS.
- Clarity of school staff roles in an emergency is essential for smooth response. Ideally, the school nurse in each building should be the key person to develop and implement the emergency plan, because the nurse is the staff member who is most skilled and familiar with individual students' health issues and community resources. In the absence of a school nurse, members of the school health and safety team (social worker, school resource officer) are designated, trained, and empowered to make decisions concerning health emergencies. Names, telephone numbers, and locations of these designated and trained school personnel are to be provided to all staff members.
- The development of campus-wide communication strategies (2-way radios, pagers, cell phones) is key so that staff members are accurately informed and rumors are minimized, which is especially important in the event of an incident involving violence.
- Schools can determine if using trained students in an emergent situation is feasible within the constraints of confidentiality. These students may maximize limited resources by being used as runners, for mobilizing equipment, helping in evacuation, or providing escorts to response agencies not familiar with school grounds. It is important to define their role ahead of

time, guarantee adequate training, include them in the plan, and practice executing the plan.

- Periodic drills with local EMS and hospital emergency departments are essential components of preparedness. This process allows schools to better understand their barriers to good EMS care, and in turn, EMS professionals get a preemergency look at school operations and physical structure, which allows problem solving to begin before any emergency or crisis.[3]
- The availability of sufficient supplies to address an individual emergency is of utmost importance. A complete emergency medical kit that is secure, carefully organized, and monitored by protocol should be accessible for use by authorized and trained school staff members who have volunteered to serve in an emergency.[10] In 2003, a national consensus group that included the AAP was convened by the Emergency Medical Services for Children National Resource Center and the National Association of School Nurses and published a report titled "Recommended Minimal Emergency Equipment and Resources For Schools: National Consensus Group Report."[11] This report is a valuable reference for putting together an emergency medical kit.[1]
- All equipment should be maintained and inspected at appropriate intervals. If an AED is available on site, an AED maintenance, testing, and repair program is to be incorporated into the AED emergency-response protocol.[1]
- Staff development and training is essential for responding to a medical emergency. Human resources policies and regulations may determine to what extent and capacity staff may respond to an emergency. However, there are certain basics in which all staff members can participate.
- It is important that universal precautions be discussed with the entire staff at the beginning of each year.
- Basic response to emergent situations is to be discussed with the entire staff. This discussion should include responses to large-scale emergencies and minor problems. Because parents have the right to limit medical information given to schools, it is prudent to give general response guidelines for seizures, fainting, bleeding, anaphylaxis, choking, and head trauma so that staff members can become more comfortable with initiating an emergent response even if they are not aware that the child has a medical concern.
- Some staff members may opt for more in-depth training, and it is recommended that at least 1 staff member, in addition to the school nurse, have CPR and first aid training.[1]
- Schools determine if a school staff member accompanies the student to the hospital. If a staff member is to accompany the student, the school must develop policy to clarify when the staff member assumes "in loco parentis" (in-the-absence-of-parents status).
- It is preferable that multiple back-up numbers for emergency contacts be available for each student's family.

Preparation for Children With Special Health Care Needs

- Students and staff members with chronic medical conditions or other special health care needs are more susceptible to medical emergencies and require schools to have a heightened sense of readiness. Students should have an updated individualized health plan (IHP) prepared by the school nurse with input from the family and the primary care clinician. The IHP contains information on medications, activity levels, dietary needs, equipment, transportation, and other accommodations. Using this information, the school can then plan for accommodations for daily classroom activity, field trips, and emergency needs of the student. The IHP can assist school teams in developing individualized education plans (IEPs) or 504 plans.
- Individual emergency care plans (ECPs), developed from information in the IHP, are to be copied and made available for transport with the child if he or she requires hospital treatment and/or management in the event of a community-wide disaster. The emergency information form, developed by the AAP and the American College of Emergency Physicians, is useful in developing both an IHP and an ECP.[12] Unlike IHPs and ECPs, both a 504 plan and an IEP are formal, legal documents, which means that the school is legally bound to implement the elements of the plans. A 504 plan is an agreement between a student's legal guardian and a school district that the student will have full access to all school activities and will have his or her medical needs met.
- Any equipment or medication required for emergency management of a student or staff member (eg, evacuation chair or epinephrine autoinjector) is to be easily accessible.
- Staff who care for students with special needs should have an awareness of the illnesses and be trained to respond to emergencies (eg, seizures, asthma, diabetic ketoacidosis, hypoglycemia, sickle crisis) until a health care professional arrives. This capacity is especially important in the event of a community disaster in which the EMS, prehospital emergency-response system may not be readily available.
- As stated previously, some parents may opt not to disclose a child's disability to teachers out of concern about stigmatization. In these cases, basic awareness training to all staff at the beginning of the year is a prudent approach.

Policies and Procedures for Specific Emergencies

- Life-threatening allergic reactions, particularly related to food triggers, are increasing in schools.[9,13] It is very important that schools have policies, procedures, and protocols for addressing the response to such inci-

dents. School procedures must comply with state and local regulations for administration of epinephrine autoinjectors by nonlicensed personnel.

- Use of CPR and AEDs is a valuable addition to school emergency response.[14,15] An AED program is to be covered by a school policy,[16] and staff members who are trained for such use are to be able to respond effectively to first aid and cardiopulmonary emergencies. Sudden cardiac arrest has an estimated annual incidence of 0.7 to 1.0 per 1000 population[17–20] and is responsible for >50% of all deaths attributable to cardiovascular disease in the United States. If no CPR is provided, each minute that defibrillation is delayed decreases the chances of survival for victims of sudden cardiac arrest attributable to ventricular fibrillation by 8% to 10%.[21,22] High school athlete sudden death is rare. When sudden death of an athlete does occur, it is more likely to affect collegiate than high school athletes. However, sudden cardiac deaths in adult spectators have been reported, and schools need to prepare for them. Professional and collegiate sporting venues typically use emergency medical response teams for spectator care coverage.[23,24] High school event coverage is less organized and typically falls under the responsibility of the athletic director or school administrators.[17–20] Many national agencies that provide certified training programs exist. The American Heart Association's medical emergency-response plan for schools describes the core elements of such a program (Table 2).[1,25,26]
- Communicable-disease emergencies involve exposures for which there needs to be contact tracking and management. Protocols for varicella, pertussis, measles, methicillin-resistant *Staphylococcus aureus*, and meningococcal meningitis exposures are developed in conjunction with local health departments.
- Protocols for responding to specific emergencies (eg, head trauma, choking, lacerations) are helpful to school nurses or designated staff. The Illinois Emergency Medical Services for Children program has an online manual that provides algorithms for managing specific school emergencies.[27]

TABLE 2 **American Heart Association Medical Emergency-Response Plan for Schools[2,23,24]: 5 Core Elements of the American Heart Association Plan**

Effective and efficient communication throughout the school campus
Coordinated and practiced response plan
Risk reduction
Training and equipment for first aid and CPR
Implementation of a lay-rescuer AED program in school with an established need; the program will have 5 elements:
Medical/health care professional oversight
Training of anticipated rescuers in CPR and use of an AED
Coordination with the EMS system
Appropriate device maintenance
Ongoing quality improvement program

Response

Once policies and procedures are in place, the response follows the plan in an organized and efficient manner.

- A staff member, ideally the school nurse, is to assess the situation and activate the appropriate protocol(s) and determine whether EMS needs to be activated.
- When EMS is activated, communication of school entry points to EMTs and a designated greeter to direct them to the emergency are of utmost importance.
- When possible, other students and staff members are removed from the scene.
- All emergency-response interventions should be promptly and accurately recorded and passed on to the EMTs.
- For children with special health care needs, the ECP is activated and information is to be prepared for EMTs.
- Any student who receives emergency epinephrine must be transported to the emergency department as recommended by the American Academy of Asthma Allergy & Immunology.[9,13]
- Parents, legal guardians, or designated emergency contact persons are informed ideally as quickly as possible about the child's injury or sudden illness at school after an emergency response and about actions taken to care for him or her.[10] In addition, notification systems must be in place through a designated spokesperson to inform the school staff, students, the media, and the community at large of the outcome of an individual student's emergency situation in an appropriate manner that respects the student's confidentiality and dispels false rumors.
- The description and disposition of significant illnesses or injuries (including the illnesses or injuries for which a student, staff member, or visitor is released from school to visit a physician or hospital) are to be recorded on an illness and injury form. This information is also used to (1) identify patterns of injury, (2) prevent another such injury or illness, (3) inform parents of the nature and management of the injury, (4) share information with the child's primary care clinician (ie, medical home), local and state child fatality review teams charged with investigating death and near-death events, and/or EMS personnel, and (5) provide information for liability and insurance purposes.[10]

After the Event

- Ideally, the records developed are studied and used to provide feedback to staff, identify areas in need of improvement, and design education programs.
- After an emergency intervention, the ECP is to be reviewed and adjusted as needed.
- Mental health interventions, as appropriate, are preferably planned for all affected students.
- Necessary equipment and medications should be restocked.

CONCLUSIONS

School preparedness for an individual student medical emergency intervention heavily depends on a team effort that involves the school administration and its physician (if applicable), the individual school health and safety team and its nurse, the local community (EMS, local hospital/emergency department), and the student's medical home/primary care clinician. Continued and timely communication between the student's medical home and the school is the key to ensuring that updated IHPs, ECPs, 504 plans, and IEPs are established, when applicable. Some of the documents referenced in this statement can be used as communication tools. The primary care clinician should advise parents and caregivers, particularly for a child with a chronic illness, to be familiar with and support the school emergency-preparedness plan. In addition, medical home clinicians and school physicians can be the best advocates to help a school obtain needed life-saving emergency services for a student with a particular condition. The medical home clinician can play a key role in supporting the school's efforts in ensuring students' safety in school, particularly those with special health care needs.

FACTORS THAT AFFECT SCHOOL EMERGENCY PREPARATION

School administration preparedness for individual student medical emergencies must recognize and address:

1. system factors such as school district size, student/school nurse ratio, students' ages/grade levels, the complexity of student medical needs, prehospital level of training of school personnel, local emergency department capability, local readily available medical treatment facilities, and human and financial resources; and
2. process factors such as protocols and procedures, continuous training and evaluation, and collaboration among the medical and educational homes and community services such as EMS, clinical and mental health support, and follow-up services.

Emergencies that occur in school can be either anticipated risks related to an individual student's medical condition or unanticipated events that occur in an otherwise healthy student or a staff member. The following recommendations are meant to assist primary care clinicians and school physicians in providing support to schools in their efforts to prepare for the individual student medical emergency.

RECOMMENDATIONS FOR PRIMARY CARE CLINICIANS

The medical home plays a key role in helping schools prepare for the individual student emergency. The following are key recommendations for primary care clinicians:

- Communication: Maintain a strong, open, and ongoing line of communication with the school nurse and/or the school physician (when available) regarding the individual student's medical condition and current management in coordination with the parent/caregiver. This linkage informs the school nurse of any changes or updates to the student's IHP, ECP, 504 plan, or IEP when applicable. The emergency information form[13] (developed by the American College of Emergency Physicians and the AAP) is 1 such tool that can be completed by the primary care clinician and may be used to communicate with the school nurse.[13] Table 2 provides selected resources for general and disease-specific emergency care, action, and health plans that can be used by the primary care clinician in communication with the school nurse after obtaining parental permission. The school nurse plays an important role in developing and implementing health plans, activating physicians' orders, and interpreting physicians' instructions for staff, students, and families.
- Familiarity: Be familiar with the individual emergency plan and the disaster plan of the patient's school, the school resources, and staffing and provide advice on issues that might affect the student's disease management and outcome.
- Parent engagement: Advise parents to become familiar with the school's emergency plan and help them evaluate how the plan meets the needs of their children.
- Advocacy: Get involved with the school district's School Health Advisory Council and provide input on health-related policies that will affect individual patient care, including school wellness policies and emergency plans.
- Drafting health plans: Participate in the drafting of IEPs and 504 plans as needed. If a student with a particular special health care need or chronic disease has special education needs, an IEP may be developed by using the IHP as a foundation for details on the student's disease-management routine. To qualify for an IEP, a child must have an impairment that substantially affects his or her academic performance.[24]
- Orders: Provide a clearly written problem list, daily care instructions, accommodations, and orders for the use of emergency medications (eg, epinephrine autoinjector, albuterol) and the necessary current prescriptions to keep these medications and devices available in school for use in a particular student's emergency. This information is used by the school nurse to create the student's IHP and ECP.
- Be available to assess the individual student after an emergency and assist in a prompt and safe return to school and provide support to parents whose child sustained a medical emergency in school.
- Review the documentation and details of the student's school emergency, provide feedback, and provide instructions that amend the individual ECP as necessary.
- Communicate directly with the school physician (where available) as needed.

RECOMMENDATIONS FOR THE SCHOOL PHYSICIAN

The school physician, if one is available, is uniquely positioned to interact with schools in each of the previ-

ously mentioned steps and provide global and system-based recommendations related to individual students' medical emergency readiness as follows:

- Assist administration and collaborate with the school nurse in the planning, development, training, implementation, review, evaluation, update, and approval of the school emergency plan and protocols for individual student emergencies,[9] including medical emergencies and injuries that occur in school, after school, in transport, and on the playground.
- Ensure that the individual emergency preparation seamlessly links with the preparations for disaster planning.
- Be familiar with the spectrum of medical diagnoses of individual students in each of the schools in the district to effectively assist the school nurse in obtaining, interpreting, and implementing the IHP, ECP, IEP, and 504 plans for those students and to anticipate the schools' needs and resources to deal with anticipated emergencies.
- Assist in the development and periodic assessment of programs for emergency education, training, and retraining of school staff and designated volunteers in emergency procedures, including basic life support, first aid, AED use, and emergency medication administration.[1]
- Act as a liaison between the medical home and the school staff to ensure continued communication regarding a student's IHP, ECP, IEP, or 504 plan.
- Provide guidelines and recommendations on the contents of the emergency kit and ensure that the kit medications are safe, accessible, and in adequate supply[9] (see the AAP policy statement "Guidelines for Emergency Medical Care in School"[10] for a guideline for kit contents).
- Oversee school emergency drills in collaboration with the local EMS, hospitals, and community agencies.
- Establish a program for regular AED maintenance, testing, and repair when an AED is available in the school[25] (see Table 2 for highlights of the elements of an AED plan).
- Oversee and manage the medical emergency-response actions on behalf of an affected student (if present in school during an emergency).
- After a student emergency occurs, review the records of the school's management of the medical emergency, its response and adherence to the emergency protocol, the adequacy of services provided, and the accuracy and completeness of data recorded to evaluate access to and quality of emergency services and materials, and make necessary recommendations for changes in the school's protocols, supplies, and individual student ECPs.
- Act as a liaison between the medical home and the local school of the student who sustained the emergency to ensure adequate communication, perform any needed changes/modifications to the student health plan, and assist the primary care clinician in ensuring the student's safe return to class after an emergency.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Medical Home Initiatives for Children With Special Needs Project Advisory Committee

The Medical Home

ABSTRACT. The American Academy of Pediatrics proposed a definition of the medical home in a 1992 policy statement. Efforts to establish medical homes for all children have encountered many challenges, including the existence of multiple interpretations of the "medical home" concept and the lack of adequate reimbursement for services provided by physicians caring for children in a medical home. This new policy statement contains an expanded and more comprehensive interpretation of the concept and an operational definition of the medical home.

ABBREVIATION. AAP, American Academy of Pediatrics.

The American Academy of Pediatrics (AAP) believes that the medical care of infants, children, and adolescents ideally should be accessible, continuous, comprehensive, family centered, coordinated,[1] compassionate, and culturally effective.[2] It should be delivered or directed by well-trained physicians who provide primary care[3] and help to manage and facilitate essentially all aspects of pediatric care. The physician should be known to the child and family and should be able to develop a partnership of mutual responsibility and trust with them. These characteristics define the "medical home." In contrast to care provided in a medical home, care provided through emergency departments, walk-in clinics, and other urgent-care facilities, though sometimes necessary, is more costly and often less effective. Although inadequate reimbursement for services offered in the medical home remains a very significant barrier to full implementation of this concept,[4,5] reimbursement is not the subject of this statement. It deserves coverage in other AAP forums.

Physicians should seek to improve the effectiveness and efficiency of health care for all children and strive to attain a medical home for every child in their community.[6] Although barriers such as geography, personnel constraints, practice patterns, and economic and social forces create challenges, the AAP believes that comprehensive health care for infants, children, and adolescents should encompass the following services:

1. Provision of family-centered care through developing a trusting partnership with families, respecting their diversity, and recognizing that they are the constant in a child's life.
2. Sharing clear and unbiased information with the family about the child's medical care and management and about the specialty and community services and organizations they can access.
3. Provision of primary care, including but not restricted to acute and chronic care and preventive services, including breastfeeding promotion and management,[7] immunizations, growth and developmental assessments, appropriate screenings, health care supervision, and patient and parent counseling about health, nutrition, safety, parenting, and psychosocial issues.
4. Assurance that ambulatory and inpatient care for acute illnesses will be continuously available (24 hours a day, 7 days a week, 52 weeks a year).
5. Provision of care over an extended period of time to ensure continuity. Transitions, including those to other pediatric providers or into the adult health care system, should be planned and organized with the child and family.
6. Identification of the need for consultation and appropriate referral to pediatric medical subspecialists and surgical specialists. (In instances in which the child enters the medical system through a specialty clinic, identification of the need for primary pediatric consultation and referral is appropriate.) Primary, pediatric medical subspecialty, and surgical specialty care providers should collaborate to establish shared management plans in partnership with the child and family and to formulate a clear articulation of each other's role.
7. Interaction with early intervention programs, schools, early childhood education and child care programs, and other public and private community agencies to be certain that the special needs of the child and family are addressed.
8. Provision of care coordination services in which the family, the physician, and other service providers work to implement a specific care plan as an organized team.
9. Maintenance of an accessible, comprehensive, central record that contains all pertinent information about the child, preserving confidentiality.

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TABLE 1. Desirable Characteristics of a Medical Home

Accessible
Care is provided in the child's or youth's community.
All insurance, including Medicaid, is accepted.
Changes in insurance are accommodated.
Practice is accessible by public transportation, where available.
Families or youth are able to speak directly to the physician when needed.
The practice is physically accessible and meets Americans With Disabilities Act[10] requirements.
Family centered
The medical home physician is known to the child or youth and family.
Mutual responsibility and trust exists between the patient and family and the medical home physician.
The family is recognized as the principal caregiver and center of strength and support for child.
Clear, unbiased, and complete information and options are shared on an ongoing basis with the family.
Families and youth are supported to play a central role in care coordination.
Families, youth, and physicians share responsibility in decision making.
The family is recognized as the expert in their child's care, and youth are recognized as the experts in their own care.
Continuous
The same primary pediatric health care professionals are available from infancy through adolescence and young adulthood.
Assistance with transitions, in the form of developmentally appropriate health assessments and counseling, is available to the child or youth and family.
The medical home physician participates to the fullest extent allowed in care and discharge planning when the child is hospitalized or care is provided at another facility or by another provider.
Comprehensive
Care is delivered or directed by a well-trained physician who is able to manage and facilitate essentially all aspects of care.
Ambulatory and inpatient care for ongoing and acute illnesses is ensured, 24 hours a day, 7 days a week, 52 weeks a year.
Preventive care is provided that includes immunizations, growth and development assessments, appropriate screenings, health care supervision, and patient and parent counseling about health, safety, nutrition, parenting, and psychosocial issues.
Preventive, primary, and tertiary care needs are addressed.
The physician advocates for the child, youth, and family in obtaining comprehensive care and shares responsibility for the care that is provided.
The child's or youth's and family's medical, educational, developmental, psychosocial, and other service needs are identified and addressed.
Information is made available about private insurance and public resources, including Supplemental Security Income, Medicaid, the State Children's Health Insurance Program, waivers, early intervention programs, and Title V State Programs for Children With Special Health Care Needs.
Extra time for an office visit is scheduled for children with special health care needs, when indicated.
Coordinated
A plan of care is developed by the physician, child or youth, and family and is shared with other providers, agencies, and organizations involved with the care of the patient.
Care among multiple providers is coordinated through the medical home.
A central record or database containing all pertinent medical information, including hospitalizations and specialty care, is maintained at the practice. The record is accessible, but confidentiality is preserved.
The medical home physician shares information among the child or youth, family, and consultant and provides specific reason for referral to appropriate pediatric medical subspecialists, surgical specialists, and mental health/developmental professionals.
Families are linked to family support groups, parent-to-parent groups, and other family resources.
When a child or youth is referred for a consultation or additional care, the medical home physician assists the child, youth, and family in communicating clinical issues.
The medical home physician evaluates and interprets the consultant's recommendations for the child or youth and family and, in consultation with them and subspecialists, implements recommendations that are indicated and appropriate.
The plan of care is coordinated with educational and other community organizations to ensure that special health needs of the individual child are addressed.
Compassionate
Concern for the well-being of the child or youth and family is expressed and demonstrated in verbal and nonverbal interactions.
Efforts are made to understand and empathize with the feelings and perspectives of the family as well as the child or youth.
Culturally effective
The child's or youth's and family's cultural background, including beliefs, rituals, and customs, are recognized, valued, respected, and incorporated into the care plan.
All efforts are made to ensure that the child or youth and family understand the results of the medical encounter and the care plan, including the provision of (para)professional translators or interpreters, as needed.
Written materials are provided in the family's primary language.

Physicians should strive to provide these services and incorporate these values into the way they deliver care to all children. (Note: pediatricians, pediatric medical subspecialists, pediatric surgical specialists, and family practitioners are included in the definition of "physician.")

10. Provision of developmentally appropriate and culturally competent health assessments and counseling to ensure successful transition to adult-oriented health care, work, and independence in a deliberate, coordinated way.

Medical care may be provided in various locations, such as physicians' offices, hospital outpatient clinics, school-based and school-linked clinics, community health centers, and health department clinics. Regardless of the venue in which the medical care is provided, to meet the definition of medical home, a designated physician must ensure that the aforementioned services are provided (see Table 1 for more details).

The need for an ongoing source of health care—ideally a medical home—for all children has been identified as a priority for child health policy reform at the national and local level. The US Department of

Health and Human Services' *Healthy People 2010* goals and objectives state that "all children with special health care needs will receive regular ongoing comprehensive care within a medical home"[8] and multiple federal programs require that all children have access to an ongoing source of health care. In addition, the Future of Pediatric Education II goals and objectives state: "Pediatric medical education at all levels must be based on the health needs of children in the context of the family and community" and "all children should receive primary care services through a consistent 'medical home.'"[9] Over the next decade, with the collaboration of families, insurers, employers, government, medical educators, and other components of the health care system, the quality of life can be improved for all children through the care provided in a medical home.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Meningococcal Conjugate Vaccines Policy Update: Booster Dose Recommendations

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS
adolescents, meningitis, meningococcal vaccine, immunization, vaccination

ABBREVIATIONS
MCV4—quadrivalent meningococcal conjugate vaccine
CI—confidence interval

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abstract

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The Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention and the American Academy of Pediatrics approved updated recommendations for the use of quadravalent (serogroups A, C, W-135, and Y) meningococcal conjugate vaccines (Menactra [Sanofi Pasteur, Swiftwater, PA] and Menveo [Novartis, Basel, Switzerland]) in adolescents and in people at persistent high risk of meningococcal disease. The recommendations supplement previous Advisory Committee on Immunization Practices and American Academy of Pediatrics recommendations for meningococcal vaccinations. Data were reviewed pertaining to immunogenicity in high-risk groups, bactericidal antibody persistence after immunization, current epidemiology of meningococcal disease, meningococcal conjugate vaccine effectiveness, and cost-effectiveness of different strategies for vaccination of adolescents. This review prompted the following recommendations: (1) adolescents should be routinely immunized at 11 through 12 years of age and given a booster dose at 16 years of age; (2) adolescents who received their first dose at age 13 through 15 years should receive a booster at age 16 through 18 years or up to 5 years after their first dose; (3) adolescents who receive their first dose of meningococcal conjugate vaccine at or after 16 years of age do not need a booster dose; (4) a 2-dose primary series should be administered 2 months apart for those who are at increased risk of invasive meningococcal disease because of persistent complement component (eg, C5–C9, properdin, factor H, or factor D) deficiency (9 months through 54 years of age) or functional or anatomic asplenia (2–54 years of age) and for adolescents with HIV infection; and (5) a booster dose should be given 3 years after the primary series if the primary 2-dose series was given from 2 through 6 years of age and every 5 years for persons whose 2-dose primary series or booster dose was given at 7 years of age or older who are at risk of invasive meningococcal disease because of persistent component (eg, C5–C9, properdin, factor H, or factor D) deficiency or functional or anatomic asplenia. *Pediatrics* 2011;128:1213–1218

INTRODUCTION

Neisseria meningitidis is an important cause of invasive bacterial disease in infants, children, adolescents, and young adults. The highest rates occur in children younger than 1 year. Unlike infants in whom serogroup B meningococcus causes the majority of invasive disease, the majority of cases in adolescents and young adults in the United States are caused by serogroups that are included in available vac-

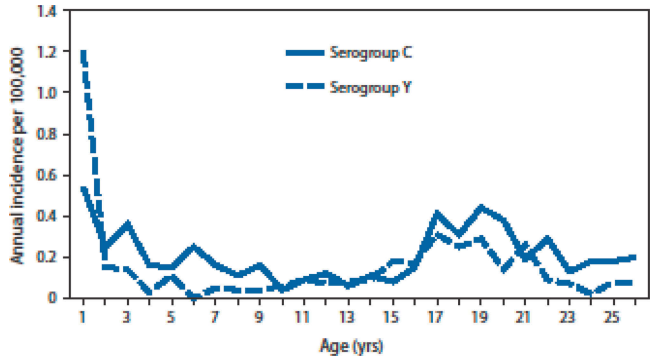

FIGURE 1
Annual incidence of meningococcal disease (serogroup C and serogroup Y), by age—Active Bacterial Core Surveillance (ABCs), United States 1999–2008. (Reproduced with permission from Centers for Disease Control and Prevention. *MMWR Morb Mortal Wkly Rep.* 2011;60[3]:73.)

cines. Adolescents and young adults experience rates of meningococcal disease that exceed those of the general population.[1] Increased risk begins at 14 years of age and persists through the age of 22 years (Fig 1).[1]

BACKGROUND AND RATIONALE

In 2005, the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention and the American Academy of Pediatrics developed recommendations for the use of the quadrivalent meningococcal conjugate vaccine (MCV4) with the objective of protecting adolescents as well as young adults aged 16 through 21 years, the time at which meningococcal disease rates peak.[2–6] Recent information on persistence of antibodies and the occurrence of breakthrough cases indicates that this recommendation for administration of MCV4 at 11 through 12 years of age may not provide protection for more than 5 years or throughout the full period of highest risk.

Certain immunocompromising conditions predispose to invasive meningococcal infection, including persistent complement component (such as C5–C9, properdin, factor H, or factor D) deficiency, functional or anatomic asplenia, and HIV infection. These immunocompromising conditions may reduce immune response to the meningococcal conjugate vaccine or may require higher titers of antibody to provide protection. Thus, people with these conditions are likely to benefit from a 2-dose primary series.

RATIONALE FOR ADDING A BOOSTER DOSE TO THE ADOLESCENT MENINGOCOCCAL IMMUNIZATION SCHEDULE

In 2005, when the recommendation was made for routine administration of meningococcal vaccine to 11- through 12-year-olds,[2,4] with catch-up immunization through 18 years of age, protective antibody concentrations were expected to persist for 10 years, through the period of increased vulnerability. Recent studies that evaluated antibody persistence after administration of MCV4 demonstrated that approximately 50% of persons vaccinated 5 years earlier will not have protective bactericidal antibody concentrations for serogroups C and Y (Table 1).[7–12] These serologic data demonstrated waning immunity 5 years after MCV4 administration, and serum antibody concentrations returned to levels similar to those detected in vaccine-naive individuals (Sanofi Pasteur [5-year follow-up of 11- to 18-year-olds at first dose], personal communication, sanfi provided slides with the data to the ACIP Meningococcal Working Group. Written communication/unpublished data.).

Additional data suggest that waning antibody concentrations result in increased susceptibility to meningococcal disease in older adolescents and young adults.[13] Comparisons of the numbers of estimated annual cases of serogroup C and Y disease in the period before the vaccine recommendation (2000–2004) with those from post–vaccine-recommendation years

TABLE 1 Summary of Serogroup C Bactericidal Antibody Persistence as Determined by Serum Bactericidal Activity (SBA) 2–5 Years After Vaccination With Menveo and/or Menactra

Age Group (yrs) at Vaccination	Years Postvaccination	Serogroup C SBA	Vaccine	No. of Vaccine Recipients in Study	% of Recipients With Protective Antibody Levels
11 through 18*	2	% hSBA "" 1:8	Menveo	273	62
			Menactra	185	58
11 through 18†	3	% hSBA "" 1:4	Menactra	52	35
			MPSV4	48	35
11 through 18§	3	% brSBA "" 1:128	Menactra	71	75
			MPSV4	72	60
2 through 10§	5	% brSBA "" 1:128	Menactra	108	55
			MPSV4	207	42
11 through 18§	5	% brSBA "" 1:128	Menactra	16	56
			MPSV4	10	60

Abbreviations: hSBA-SBA using human complement; brSBA-SBA using baby rabbit complement; MPSV4-quadrivalent meningococcal polysaccharide vaccine.

* Source: Gill C, Baxter R, Anemona A, Cavarro G, Dull P. Persistence of immune responses after a single dose of Novartis meningococcal serogroup A, C, W-135 and Y CRM-197 conjugate vaccine (Menveo) or Menactra among healthy adolescents. *Human Vaccines*; 2010, 6:881–7.

† Source: Vu DM, Welsch JA, Zuno-Mitchell P, Dela Cruz N, Granoff DM. Antibody persistence 3 years after immunization of adolescents with quadrivalent meningococcal conjugate vaccine. *J Infect Dis* 2006;193:821–8.

§ Source: Proceedings of the Advisory Committee on Immunization Practices (ACIP) meeting, June 2009.

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(2005–2009) revealed a greater reduction in the number of cases among adolescents aged 11 through 14 years (74% reduction) when compared with older adolescents of aged 15 through 18 years (27% reduction).

A case-control study that evaluated vaccine effectiveness of the first licensed MCV4 (Menactra [Sanofi Pasteur, Swiftwater, PA]) noted a decrease in vaccine effectiveness with time since immunization.[14] The overall vaccine effectiveness for adolescents immunized 0 to 5 years previously was 78.0% (95% confidence interval [CI]: 29%–93%). The effectiveness of the vaccine for persons vaccinated less than 1 year earlier, 1 year earlier, and 2 through 5 years earlier was 95% (95% CI: 10%–100%), 91% (95% CI: 10%–101%), and 58% (95% CI: 72%–89%), respectively. Although the 95% CIs around the point estimate were wide, the trend supports waning immunity. Data for vaccine effectiveness beyond 5 years since immunization are not available.

Between July 1, 2006, and October 31, 2010, the Centers for Disease Control and Prevention received 30 reports of serogroup C or Y invasive meningococcal disease in persons aged 15 through 22 years who had previously received a meningococcal conjugate vaccine; 12 of the 30 cases of meningococcal disease occurred in 2010. The mean age of people in these cases from 2010 was 18.2 years (range: 16–22 years). The mean time since they had received their meningococcal conjugate vaccine and the development of meningococcal disease was 3.25 years (range: 1.5–4.6 years). Five of these 12 people with breakthrough meningococcal disease had an underlying condition that might have affected their risk of meningococcal disease (Centers for Disease Control and Prevention, personal communication from Amanda Cohn MD, 2010).[1]

Cases of breakthrough meningococcal disease in MCV4 recipients seem to have clinical manifestations similar to disease occurring in vaccine-naive persons.[14,15] The lack of modification of illness suggests that an anamnestic immune response was not sufficient to modify disease severity. Recent data suggest that the memory response after meningococcal C conjugate vaccine is not rapid enough to protect against disease.[15] The incubation period for invasive meningococcal disease is usually less than 3 days. After initial priming with monovalent meningococcal C (MenC) conjugate vaccine, a memory response after a booster dose is not measurable until 5 to 7 days after the booster.[9]

Herd immunity seems to be important for long-term protection after widespread use of monovalent meningococcal C conjugate vaccine in the United Kingdom. Immunization coverage with MCV4 has been slow in the United States. In the 2009 National Immunization Survey-Teen, 53.6% of adolescents aged 13 through 17 years had received a dose of meningococcal vaccine.[16] To date, there is no evidence that this level of uptake of a single dose of MCV4 provides herd immunity in the United States.

Two studies have assessed the serologic response after a booster dose of MCV4 (Menactra).[7,14] When a booster dose was administered either 3 or 5 years after the first dose, the geometric mean titer elicited after the booster dose was substantially higher than that after the primary dose. This finding is consistent with expectations that the first dose of MCV4 primes the immune system and results in a strong response to the booster dose. Local and systemic reactions to the booster dose were comparable to reactions noted in persons who received a first dose. The duration of protective concentrations of antibody after a booster dose is not known. A booster dose administered at 16 through 18 years of age is expected to result in protective antibody concentrations through the age of 21 years.

The cost of a second dose of MCV4 in adolescents was considered in deliberations that led to the new recommendation. When using the cost-effectiveness measure of quality-adjusted life-years (QALYs), the 2-dose schedule had a lower cost per QALY than did the recommendation for a single dose given at 11 through 12 years of age, because the 2-dose series results in a greater reduction in the number of cases, morbidities, and mortalities attributable to invasive meningococcal disease.[17] Another option was a single dose of MCV4 at 15 years of age. This had the lowest cost per QALY of the 3 options considered (no change in recommendation; single dose at 15 years of age; and 2 doses: at 11–12 years of age and a booster at 16 years of age).[17] However, the cost per QALY for the single dose at 15 years of age and the 2-dose series at 11 and 16 years of age was not significantly different, and the 2-dose series resulted in fewer cases of invasive meningococcal disease and fewer deaths.[17]

RATIONALE FOR A 2-DOSE PRIMARY SERIES FOR PERSONS WITH PERSISTENT COMPLEMENT COMPONENT DEFICIENCY, FUNCTIONAL OR ANATOMIC ASPLENIA, OR HIV

People with persistent complement component deficiency or properdin deficiency respond similarly to healthy children when immunized with the quadrivalent meningococcal polysaccharide vaccine (MPSV4). However, their antibodies wane more quickly than do those of healthy children. Antibody data from this population after administration of MCV4 are lacking. Maintaining high antibody concentrations is important for people with complement component deficiency, because higher antibody con-

centrations are needed for other clearance mechanisms, such as opsonophagocytosis, to kill meningococci.[18,19]

Asplenic people achieve significantly lower geometric mean serum bactericidal activity than do healthy people immunized with monovalent meningococcal C conjugate vaccine. In 1 study, a protective antibody concentration was not achieved in 20% of asplenic people after vaccination.[20] However, the percentage of those in whom protective antibody concentrations did not develop decreased to 7% when a booster dose was given 2 months later, which suggests that a booster dose can increase the proportion of asplenic people who have protective antibody concentrations and might be able to achieve higher circulating antibody concentrations and improve immunologic memory.

Although HIV-infected children may have an increased risk of meningococcal disease, the magnitude of the increased risk has not been established. MCV4 is not routinely recommended for HIV-infected children younger than 11 years. Response rates to MCV4 among HIV-infected adolescents are lower than those in healthy adolescents. In 1 study, seroconversion rates were significantly lower in adolescents with $CD4^+$ T-lymphocyte percentages less than 15% or viral loads greater than 10 000 copies per mL.[21]

A 2-dose primary series has not been studied in older children or adolescents. However, immunogenicity and safety of a 2-dose primary series of MCV4 with either Menactra or Menveo (Novartis, Basel, Switzerland) have been evaluated in infants and young children. Infants who received a 2-dose primary series of Menactra at 9 months and 12 through 15 months of age developed high antibody titers after the second dose. Data provided by Sanofi Pasteur has noted decreases in antibody concentrations for some pneumococcal serotypes when Menactra is administered at the same time as Prevnar 7 (Wyeth Pharmaceuticals, Philadelphia, PA) at 9 months and 12 to 15 months of age. The clinical significance of these decreased antibody concentrations is not clear. Because pneumococcal infections are a more common problem in children with asplenia (functional or anatomic), it would be prudent to provide age-appropriate pneumococcal conjugate vaccines to asplenic children and provide MCV4 after completion of the pneumococcal conjugate vaccine series. Adverse events after 2 doses of Menveo given 2 months apart to children 2 through 5 years of age had similar rates as after a single dose.[22]

UPDATED MENINGOCOCCAL CONJUGATE VACCINE RECOMMENDATIONS

Routine Vaccination of Adolescents 11 Through 18 Years of Age

Routine immunization of adolescents with MCV4 is recommended at age 11 through 12 years along with a 1-time booster dose at 16 years of age (Table 2). For adolescents who receive their first dose of MCV4 at age 13 through 15 years, a 1-time booster should be administered, preferably at age 16 through 18 years, to provide additional protection during the period of increased risk. Adolescents who receive their first dose of MCV4 at or after 16 years of age do not need a booster

TABLE 2 Recommended Vaccination Schedule and Intervals

	Subgroup	Primary Vaccination	Booster Dose
9–23 mo, with high-risk conditions	Children with complement deficiencies	2 doses of MCV4, 3 mo apart	**If the first dose is received at 9 mo to 6 y of age and child remains at increased risk for meningococcal disease**, child should receive an additional dose of MCV4 3 y after primary vaccination; boosters should be repeated every 5 y thereafter
	Children with HIV, if another indication for vaccination exists	2 doses of MCV4, 3 mo apart	
	All others in this age group recommended for vaccination (travelers to the "meningitis belt," etc)	2 doses of MCV4, 3 mo apart (infants receiving the vaccine before travel can receive the doses as early as 2 mo apart)	
2–18 y, with high risk conditions[a]	Children with complement deficiencies or functional or anatomic asplenia	2 doses of MCV4, 2 mo apart	**If the first dose is received at 7 y of age or older and child remains at increased risk for meningococcal disease**, child should receive an additional dose of MCV4 5 y after primary vaccination; boosters should be repeated every 5 y thereafter
	Children with HIV, if another indication for vaccination exists	2 doses of MCV4, 2 mo apart	
	All others in this age group recommended for vaccination (travelers to the Meningitis Belt, etc)	1 dose of MCV4	
All other children aged 11–18 y	—	Routine vaccination with MCV4 at ages 11–12 y	**If vaccinated at age 11–12 y**, should receive a 1-time booster dose at the age of 16 y **If vaccinated at age 13–15 y**, should receive a 1-time booster dose at the age of 16–18 y

Currently, there are currently 2 licensed MCV4 products. One product, Menactra, is manufactured by Sanofi Pasteur and is licensed for use in persons aged 9 months through 55 years of age. The second product, Menveo, is manufactured by Novartis Vaccines and Diagnostics, Inc and is licensed for use in persons aged 2 through 55 years of age. A meningococcal polysaccharide vaccine is also available. This product is licensed for use in persons 2 years of age and older and may be used when meningococcal conjugate vaccine is unavailable or contraindicated.

[a] Includes children who have complement (eg, C5–C9, properdin, factor H, or factor) deficiencies or anatomic or functional asplenia and children with HIV infection; travelers to or residents of countries in which meningococcal disease is hyperendemic or epidemic; and children who are part of a community outbreak of a vaccine-preventable serogroup.

dose. Immunization with the MCV4 vaccine is not recommended after 21 years of age in healthy people because of diminished risk of meningococcal disease after that age.

People at Persistent Increased Risk of Meningococcal Disease

People with persistent complement deficiencies, functional or anatomic asplenia, or HIV infection should receive a 2-dose primary series given 2 months apart. Children aged 9 months or older with persistent complement deficiencies or functional or anatomic asplenia should receive the 2-dose primary series of MCV4. Children aged 2 years or older with functional or anatomic asplenia should receive the 2-dose primary series of MCV4. HIV-infected adolescents (>11 years) should receive a 2-dose primary series of MCV4 if they have not received any doses of MCV4 previously. HIV-infected children aged 2 through 10 years are likely to be at increased risk of meningococcal disease, but the risk is not as great as for invasive *Streptococcus pneumoniae*. MCV4 is not routinely recommended for HIV-infected children younger than 11 years. Providers may elect to give HIV-infected children aged 2 through 10 years a 2-dose primary series of MCV4. People with a history of complement component deficiency, asplenia, or HIV infection who have previously received a single dose of meningococcal conjugate vaccine as their primary dose should receive a second dose at least 2 months later. Booster doses should be given 3 years after the primary series if the primary 2-dose series was given from 2 through 6 years of age and 5 years after the primary series if the primary 2-dose series was given at 7 years of age or older. Boosters should then be given every 5 years. People who are at increased risk of meningococcal disease other than those with immunocompromising conditions (microbiologists who work routinely with *N meningitidis* or travelers to or residents of countries in which meningococcal disease is hyperendemic) should receive a single-dose primary series. If they remain at increased risk, a booster dose should be given 3 years later if the primary dose was given from 2 through 6 years of age and 5 years after the last dose if the previous dose was given at 7 years of age or older. If they continue to remain at risk, additional boosters should be given every 5 years.

IMPLEMENTATION ISSUES

Whenever feasible, the same brand of vaccine should be used for all doses of the vaccination series. Data are limited on the interchangeability of meningococcal vaccine products from different manufacturers. A small study revealed similar antibody responses when either Menactra or Menveo was given after a first dose of Menactra. If vaccination providers do not know or do not have available the brand of vaccine product previously administered, any product should be used to continue or complete the series. People who received quadrivalent meningococcal polysaccharide vaccine 5 or more years previously and remain at risk of meningococcal disease should be revaccinated with MCV4. There are no data to provide guidance as to how to address future needs for MCV4 vaccine in children who may have received vaccine products overseas that differ from products available in the United States. If these children remain at risk of meningococcal disease (healthy adolescent aged 11 years or older, complement deficiency, asplenia, etc), it would be prudent to provide MCV4 according to the recommendations for their risk group.

MCV4 is safe and immunogenic among nonpregnant women aged 11 through 55 years. No data are available on the safety of MCV4 during pregnancy. MCV4 should only be given to a pregnant woman if the benefit of providing vaccine during pregnancy outweighs the potential for risk. There is no contraindication to administering any dose of MCV4 to a woman who is breastfeeding.

Some states, secondary schools, colleges, or universities have policies that require immunization against meningococcal disease as a condition of enrollment. A single dose of MCV4 5 or fewer years before matriculation should be considered acceptable. A booster dose should be administered before matriculation if the adolescent was immunized more than 5 years previously.

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CLINICAL REPORT

Menstruation in Girls and Adolescents: Using the Menstrual Cycle as a Vital Sign

Guidance for the Clinician in Rendering Pediatric Care

AMERICAN ACADEMY OF PEDIATRICS
Committee on Adolescence

AMERICAN COLLEGE OF OBSTETRICIANS AND GYNECOLOGISTS
Committee on Adolescent Health Care

ABSTRACT

Young patients and their parents often are unsure about what represents normal menstrual patterns, and clinicians also may be unsure about normal ranges for menstrual cycle length and amount and duration of flow through adolescence. It is important to be able to educate young patients and their parents regarding what to expect of a first period and about the range for normal cycle length of subsequent menses. It is equally important for clinicians to have an understanding of bleeding patterns in girls and adolescents, the ability to differentiate between normal and abnormal menstruation, and the skill to know how to evaluate young patients' conditions appropriately. Using the menstrual cycle as an additional vital sign adds a powerful tool to the assessment of normal development and the exclusion of pathological conditions.

INTRODUCTION

Young patients and their parents frequently have difficulty assessing what constitutes normal menstrual cycles or patterns of bleeding. Girls may be unfamiliar with what is normal and may not inform their parents about menstrual irregularities or missed menses. Additionally, girls often are reluctant to discuss this very private topic with a parent, although they may confide in another trusted adult. Some girls will seek medical attention for cycle variations that actually fall within the normal range. Others are unaware that their bleeding patterns are abnormal and may be attributable to significant underlying medical issues with the potential for long-term health consequences.

Clinicians also may be unsure about normal ranges for menstrual cycle length and for amount and duration of flow through adolescence. Clinicians who are confident in their understanding of early menstrual bleeding patterns may convey information to their patients more frequently and with less prompting; girls who have been educated about menarche and early menstrual patterns will experience less anxiety when they occur.[1] By including an evaluation of the menstrual cycle as an additional vital sign, clinicians reinforce its importance in assessing overall health status for both patients and parents. Just as abnormal blood pressure, heart rate, or respiratory rate may be key to the diagnosis of potentially serious health conditions, identification of abnormal menstrual patterns through adolescence may permit early identification of potential health concerns for adulthood.

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Key Words
menarche, menstruation, adolescent

Abbreviation
PCOS—polycystic ovary syndrome

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NORMAL MENSTRUAL CYCLES

Menarche

From the early 1800s to the mid-1950s, menarche occured at increasingly younger ages in the United States, but there has been no further decline in the last 40 to 50 years. This finding also has been seen in international studies of other developed urban populations.[2] The US National Health and Nutrition Examination Surveys have found no significant change in the median age at menarche over the past 30 years except among the non-Hispanic black population, which has a 5.5-month earlier age at menarche than it did 30 years ago.[3] Age at menarche varies internationally and especially in less developed countries; in Haiti, for example, the mean age at menarche is 15.37 years.[4,5] This knowledge may be especially pertinent for practitioners with a large number of immigrant families in their patient population. Although onset of puberty and menarche typically occur at a later age in females from less well-developed nations, 2 large studies have confirmed that a higher gain in body mass index (BMI) during childhood is related to an earlier onset of puberty.[6,7] This earlier onset of puberty may result from attainment of a minimal requisite body mass at a younger age. Other possible explanations for the perceived trend in timing and progression of puberty are environmental factors, including socioeconomic conditions, nutrition, and access to preventive health care.[8]

Despite variations worldwide and within the US population, median age at menarche has remained relatively stable, between 12 and 13 years, across well-nourished populations in developed countries. The median age of females when they have their first period or menarche is 12.43 years (see Table 1).[3] Only 10% of females are menstruating at 11.11 years of age; 90% are menstruating by 13.75 years of age. The median age at which black female adolescents begin to menstruate is earlier (12.06 years of age) than the median age for Hispanic (12.25 years of age) and non-Hispanic white (12.55 years of age) females.[3] Although black girls start to mature earlier than non-Hispanic white and Hispanic girls, US females complete secondary sexual development at approximately the same ages.[9]

Menarche typically occurs within 2 to 3 years after thelarche (breast budding), at Tanner stage IV breast development, and is rare before Tanner stage III development.[10] Menarche correlates with age at onset of puberty and breast development. In girls with early onset of breast development, the interval to menarche is longer (3 years or more) than in girls with later onset.[11–13] By 15 years of age, 98% of females will have had menarche.[3,14]

Traditionally, primary amenorrhea has been defined as no menarche by 16 years of age; however, many diagnosable and treatable disorders can and should be detected earlier, using the statistically derived guideline of 14 to 15 years of age.[3,14] Thus, an evaluation for primary amenorrhea should be considered for any adolescent who has not reached menarche by 15 years of age or has not done so within 3 years of thelarche. Accordingly, lack of breast development by 13 years of age also should be evaluated.[15]

TABLE 1 **Normal Menstrual Cycles in Young Females**

Menarche (median age): 12.43 years
Mean cycle interval: 32.2 days in first gynecologic year
Menstrual cycle interval: typically 21–45 days
Menstrual flow length: ≤7 days
Menstrual product use: 3–6 pads/tampons per day

Cycle Length and Ovulation

Menstrual cycles are often irregular through adolescence, particularly the interval from the first to the second cycle. According to the World Health Organization's international and multicenter study of 3073 girls, the median length of the first cycle after menarche was 34 days, with 38% of cycle lengths exceeding 40 days. Variability was wide: 10% of females had more than 60 days between their first and second menses, and 7% had a first cycle length of 20 days.[16] Most females bleed for 2 to 7 days during their first menses.[17–19]

Early menstrual life is characterized by anovulatory cycles,[20,21] but the frequency of ovulation is related to both time since menarche and age at menarche.[21–23] Early menarche is associated with early onset of ovulatory cycles. When the age at menarche is younger than 12 years, 50% of cycles are ovulatory in the first gynecologic year (year after menarche).

By contrast, it may take 8 to 12 years after menarche until females with later-onset menarche are fully ovulatory.[23] Despite variability, most normal cycles range from 21 to 45 days, even in the first gynecologic year,[16–18] although short cycles of fewer than 20 days and long cycles of more than 45 days may occur. Because long cycles most often occur in the first 3 years postmenarche, the overall trend is toward shorter and more regular cycles with increasing age. By the third year after menarche, 60% to 80% of menstrual cycles are 21 to 34 days long, as is typical of adults.[16,18,24] An individual's normal cycle length is established around the sixth gynecologic year, at a chronologic age of approximately 19 or 20 years.[16,18]

Two large studies, one cataloging 275 947 cycles in 2702 females and another reporting on 31 645 cycles in 656 females, support the observation that menstrual cycles in girls and adolescents typically range from 21 to approximately 45 days, even in the first gynecologic year.[25,26] In the first gynecologic year, the fifth percentile for cycle length is 23 days and the 95th percentile is 90 days. By the fourth gynecologic year, fewer females are having cycles that exceed 45 days, but anovulation is still

significant for some, with the 95th percentile for cycle length at 50 days. By the seventh gynecologic year, cycles are shorter and less variable, with the fifth percentile for cycle length at 27 days and the 95th percentile at only 38 days. Thus, during the early years after menarche, cycles may be somewhat long because of anovulation, but 90% of cycles will be within the range of 21 to 45 days.[16]

ABNORMAL MENSTRUAL CYCLES

Prolonged Interval

A number of medical conditions can cause irregular or missed menses in adolescents. Although secondary amenorrhea has been defined as the absence of menses for 6 months, it is statistically uncommon for girls and adolescents to remain amenorrheic for more than 3 months or 90 days—the 95th percentile for cycle length. Thus, it is valuable to begin evaluation of secondary amenorrhea after the absence of menses for 90 days. Therefore, girls and adolescents with chaotically irregular cycles with more than 3 months between periods should be evaluated, not reassured that it is "normal" to have irregular periods in the first gynecologic years.

Irregular menses may be associated with many conditions, including pregnancy, endocrine disorders, and acquired medical conditions, because all of these conditions are associated with derangement of hypothalamic-pituitary endocrine function (see Table 2). Commonly, polycystic ovary syndrome (PCOS) causes prolonged intervals between menstrual periods, especially in patients with signs of androgen excess. The pathogenesis of PCOS is unclear; many experts believe that PCOS results from primary functional intraovarian overproduction of androgen. Others believe that excessive luteinizing hormone secretion from the pituitary gland, which stimulates a secondary ovarian androgen excess, has a role in causing the disorder. Still others hypothesize that PCOS may be related to hyperinsulinism. Whatever its origins, PCOS accounts for 90% of hyperandrogenism among females and, by definition, is characterized by amenorrhea and oligomenorrhea. Before the diagnosis is confirmed, hyperprolactinemia, adrenal and ovarian tumors, and drug effects (such as those caused by danazol and several psychotropic medications) must be ruled out. Additionally, although uncommon in the general population, congenital adrenal hyperplasia should be ruled out by a negative 17-α-hydroxyprogesterone test result (serum concentrations less than 1000 ng/dL).[27] Treatment of PCOS should target menstrual irregularities, hirsutism if present, obesity, or insulin resistance.

Menstrual irregularities can be caused by disturbance of the central gonadotropin-releasing hormone pulse generator as well as by significant weight loss, strenuous exercise, substantial changes in sleeping or eating habits, and severe stressors. Menstrual disturbances also occur with chronic diseases, such as poorly controlled diabetes mellitus; with genetic and congenital conditions, such as Turner syndrome; and with other forms of gonadal dysgenesis. The diagnosis of pregnancy always should be excluded, even if the history suggests the patient has not been sexually active.

TABLE 2 **Causes of Menstrual Irregularity**

Pregnancy
Endocrine causes
Poorly controlled diabetes mellitus
Polycystic ovary syndrome (PCOS)
Cushing disease
Thyroid dysfunction
Premature ovarian failure
Late-onset congenital adrenal hyperplasia
Acquired conditions
Stress-related hypothalamic dysfunction
Medications
Exercise-induced amenorrhea
Eating disorders (both anorexia and bulimia)
Tumors
Ovarian tumors
Adrenal tumors
Prolactinomas

Excessive Menstrual Flow

A female's first period usually is reported to be of medium flow, and the need for menstrual hygiene products is not typically excessive. Although experts typically report that the mean blood loss per menstrual period is 30 mL per cycle and that chronic loss of more than 80 mL is associated with anemia, this has limited clinical utility because most females are unable to measure their blood loss. However, a recent study in adult women confirms that the perception of heavy menstrual flow is correlated with a higher objective volume of blood loss.[28]

Attempts to measure menstrual blood loss on the basis of number of pads or tampons used per day or frequency of pad changes are subject to variables such as the individual's fastidiousness, her familiarity or comfort with menstrual hygiene products, and even variation among types and brands of pads or tampons.[29] Most report changing a pad approximately 3 to 6 times a day, although external constraints such as school rules and limited time between classes may make menstrual hygiene more problematic for adolescents than adults. Menstrual flow requiring changes of menstrual products every 1 to 2 hours is considered excessive, particularly when associated with flow that lasts more than 7 days at a time. This type of acute menorrhagia, although most often associated with anovulation, also has been associated with the diagnosis of hematologic problems, including von Willebrand disease and other bleeding disorders, or other serious problems, including hepatic failure and malignancy.[30–33]

The prevalence of von Willebrand disease is 1% in the general population. Von Willebrand disease is the most

common medical disorder associated with menorrhagia at menarche.[34] As many as 1 in 6 girls presenting to an emergency department with acute menorrhagia may have von Willebrand disease.[30] Therefore, hematologic disorders should be considered in patients presenting with menorrhagia—especially those presenting acutely at menarche. Hormonal treatment, in the form of estrogen therapy, may affect hematologic factors and mask the diagnosis. Blood collection to screen for hematologic disorders should be obtained before initiating treatment. Evaluating the patient may include referral to a hematologist or a specialized hemophilia treatment center for appropriate screening.

ANTICIPATORY GUIDANCE

Because development of secondary sex characteristics begins at ages as young as 8 years, primary care clinicians should include pubertal development in their anticipatory guidance to children and parents from this age on. Clinicians should take an ongoing history and perform a complete annual examination, including the inspection of the external genitalia. It is important to educate children and parents about the usual progression of puberty. This includes the likelihood that a child's initial breast growth may initially be unilateral and slightly tender. Breast development will likely then become bilateral, but some asymmetry is normal. Young females and their parents should understand that the progression of puberty also includes the development of pubic hair, which will increase in amount over time and become thicker and curlier. Additionally, clinicians should convey that females will likely begin to menstruate approximately 2 to 2.5 years after breast development begins, keeping in mind that recent studies have suggested that the onset of both breast development and menarche may occur slightly earlier for black girls than for white girls.[35] Young females should understand that menstruation is a normal part of development and should be instructed on use of feminine products and on what is considered normal menstrual flow. Ideally, both parents and clinicians can participate in this educational process.

EVALUATION

Once young females begin menstruating, evaluation of the menstrual cycle should be included with an assessment of other vital signs. By including this information with the other vital signs, clinicians emphasize the important role of menstrual patterns in reflecting overall health status. Clinicians should ask at every visit for the first date of the patient's last menstrual period. Clinicians should convey that the menstrual cycle is from the first day of a period to the first day of the next period and may vary in length.

Both the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists recommend preventive health visits during adolescence to begin a dialogue and establish an environment where a patient can feel good about taking responsibility for her own reproductive health and feel confident that her concerns will be addressed in a confidential setting.[36,37] These visits are also an opportunity to provide guidance to young females and their parents on adolescent physical development based on data that define normal pubertal development, menarche, and menstrual cyclicity.[38] Even during visits with adult patients who interact with adolescents or have children, education about appropriate expectations and normal patterns for the adolescent menstrual cycle may be helpful guidance in the decision to consider evaluation.

Asking the patient to begin to chart her menses may be beneficial, especially if the bleeding history is too vague or considered to be inaccurate. Although uncommon, abnormalities do occur. Confirming normal internal and external genital anatomy with a pelvic examination or ultrasonography can rule out significant abnormalities. Therefore, one might consider the menstrual cycle as a type of vital sign and an indicator of other possible medical problems. Using menarche or the menstrual cycle as a sensitive vital sign adds a powerful tool to the assessment of normal hormonal development and the exclusion of serious abnormalities, such as anorexia nervosa, inflammatory bowel disease, and many other chronic illnesses. Menstrual conditions that suggest the need for further evaluation are listed in Table 3.

Because menarche is such an important milestone in physical development, it is important to be able to educate young females and their parents regarding what to expect of a first period and about the range for normal cycle length of subsequent menses. Girls who have been educated about early menstrual patterns will experience less anxiety as development progresses.[1] It is equally important for clinicians to have an understanding of bleeding patterns of young females, the ability to differentiate between normal and abnormal menstruation,

TABLE 3 Menstrual Conditions That May Require Evaluation

Menstrual periods that:

- Have not started within 3 years of thelarche
- Have not started by 13 years of age with no signs of pubertal development
- Have not started by 14 years of age with signs of hirsutism
- Have not started by 14 years of age with a history or examination suggestive of excessive exercise or eating disorder
- Have not started by 14 years of age with concerns about genital outflow tract obstruction or anomaly
- Have not started by 15 years of age
- Are regular, occurring monthly, and then become markedly irregular
- Occur more frequently than every 21 days or less frequently than every 45 days
- Occur 90 days apart even for one cycle
- Last >7 days
- Require frequent pad/tampon changes (soaking more than 1 every 1–2 hours)

and the skill to know how to evaluate the young female patient appropriately.

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POLICY STATEMENT

AACAP/CWLA POLICY STATEMENT ON MENTAL HEALTH AND SUBSTANCE USE SCREENING AND ASSESSMENT OF CHILDREN IN FOSTER CARE

I. INTRODUCTION

Children who are removed from their primary caregivers because of suspected child abuse, neglect, or caregiver impairment have compelling and urgent mental health and are at risk for substance abuse disorders. The American Academy of Child and Adolescent Psychiatry (AACAP) and the Child Welfare League of America (CWLA) urge that these children receive immediate mental health and substance use screening followed by a comprehensive mental health and substance use assessment and periodic reassessments. This screening and assessment is to assure that these children receive prompt and appropriate mental health and substance use care. In order to achieve this, the screening and assessment should be:

II. COMPLETED IN A TIMELY WAY BY TRAINED AND QUALIFIED PROFESSIONALS

An initial mental health and substance use screening should be conducted within 24 hours of a child's placement in the care of the child welfare agency. The mental health and substance use screening is intended to identify children in urgent need of emergency mental health and substance use services, including youth whose behavior may pose a danger to themselves or others. Appropriate training should be provided on the screening protocol, and the individual administering the screening should have on-site or readily accessible mental health and substance use consultation. Ideally, the mental health and substance use screening will take place as part of a child's health examination upon entry into care and be conducted by a health professional with expertise in the developmental and mental health and substance use needs of children in foster care. [3]

Children who are removed from their family may require an intervention to address their separation issues immediately. The screening process should assess the internalized and externalized levels of distress the child is in regarding the separation and identify and support the child's strengths and successful coping strategies. Based on the outcome of the individualized screen the child minimally should be provided a triage intervention to address the child's feelings regarding the separation, the needs of the new placement, and to provide support for the child around the separation. It is recommended that the process be monitored to

ensure all children receive the mental health and substance use screen and appropriate intervention based on their individualized needs.

Children entering foster care and their families should receive a comprehensive mental health and substance use assessment within 60 days of placement, or sooner based on the severity of the child's needs as identified in the screening process. Assessments should be conducted by qualified mental health and substance use providers and include the active involvement of a child and adolescent psychiatrist. The comprehensive assessment should incorporate use of developmentally appropriate techniques and tools, be conducted in a comfortable and accessible setting, and address the child and family's strengths as well as needs. Informed consent should be obtained from the party or parties legally responsible for the child. Where indicated, the child or adolescent ought to be directly involved with procedures such as informed assent and be made partner to all assessments and treatment.

III. CHILD-FOCUSED

This process should include support for the child that acknowledges and addresses that removal from primary caregivers usually constitutes a psychological and social crisis for the child and family. The initial screening should be developmentally sensitive and seek to understand the child's internal experience of the placement and the nature of the child's attachments.

Placement often suddenly separates a child from everything familiar, including places (home, neighborhood, school) and people (primary caregivers, birth family, other family members, friends). This sudden and complete loss may result in unrecognized experiences of trauma and bereavement, which in turn can interfere with making new attachments and with the success of placement. New caregivers may need immediate advice on how to help the child make a positive adjustment. Children may need mental health and substance use services to cope with the trauma of placement, even in the absence of symptoms that constitute a psychiatric diagnosis. Children with internalizing problems, such as depression and anxiety, should receive the same consideration for mental health and substance use care as those with externalizing problems such as disruptive behavior. A child's wishes about placement and visitation should be ascertained and given as much weight as possible.

Children and adolescents should be assessed individually, and adequate time and preparation must be devoted to the assessment so that every child and adolescent has the opportunity to freely express his or her concerns.

IV. FAMILY-CENTERED

Approximately 80% of children placed outside of the home are returned to their family of origin. In order to achieve successful reunification, whenever possible,

we must consider the family of origin including siblings in assessments and services/supports for children placed in out-of-home care. Assessment and services/supports should be both child-focused and family-centered. The definition of family includes biological, foster and adoptive parents, grandparent and their partners, as well as kinship caregivers and others who have primary responsibility for providing love, guidance, food, shelter, clothing, supervision, and protection for children and adolescents (National Peer Technical Assistance Network, 1997). Finally, other persons may be considered members of the family for purposes of assessment and services/supports depending on the family of origin, their culture, ethnicity, language and the culture of their community.

Professionals are expected to work in partnership with the family to:

- assess the individual strengths and needs of the children;
- assess the parents/families strengths and needs to effectively deal with their children's emotional/mental health and substance use needs;
- identify ways to effectively provide the appropriate mental health and substance use services/supports to children and their family; to determine the level of involvement required with the foster family to successfully return the child home; and
- determine the level/type of relationship which is needed between the foster parents and the birth parents to ensure the emotional/mental health and substance use needs of the child are met.

Some specific decisions need to be made early because they have a strong impact on a child's experience while in foster care. These include the following:

- if a child and his birth family can be in immediate and continuing contact (face-to-face visitation and/or by telephone) to decrease the trauma of separation; and
- if the birth parents and foster parents can be expected to communicate with each other to maximize continuity and mutuality in accomplishing therapeutic goals.

Initial assessments and follow up assessments should address these questions as well.

Family members, as defined above, should be considered essential partners for successful treatment unless there is evidence to the contrary. Unless mandated otherwise by the courts, there should always be family involvement in the assessment and reassessment process, the development of the individualized treatment plan and the treatment/support process. All treatment plans should be individualized for the child and family and include family treatment services and supports as part of the plan unless the courts have restricted access/contact due to safety issues or there is evidence to the contrary. The treatment plan should also be in keeping with the permanency plan for the child as well as the family service

plan. When parents are mandated to not have contact and/or are not available to have contact with the child, the initial assessment and reassessments must address the impact of this loss upon the child and recommend effective interventions.

Placing a child in out-of-home care automatically expands the definition of their family, at least temporarily, to include the foster parents. This means including the foster parents' input in the ongoing assessment and treatment/support process. With family-centered practice, when indicated, families are supported and empowered to be an advocate for the needs of their child and for the services which will facilitate the family being successful in dealing with the emotional/mental health and substance use needs of their child. Other key components of family-centered practice include:

- μ# focusing on the whole family as the unit of attention;
- μ# organizing assistance in accord with the family's strengths while acknowledging but not emphasizing deficits;
- μ# except where a child's safety is at risk, service planning and delivery should take family priorities into consideration;
- μ# structuring treatment/support service delivery to ensure accessibility, minimal disruption of family integrity and routine; and
- μ# sharing results of assessments/reassessments with the birth family when a child is returning home (should this not have been done for some reason during out-of-home care) or the adoptive families when a child is being adopted.

V. CULTURALLY SENSITIVE AND ADMINISTERED IN A CULTURALLY COMPETENT MANNER

The assessment and reassessment of children and their families must take into account the influence of each family's heritage. This includes culture, ethnicity and religion and consists of-but is not limited to race, religion, gender, socioeconomic status, language, sexual orientation, geographic origin and location and their immigration status.

Clinicians and/or staff who perform assessments should develop specialized knowledge and understanding about the history, tradition, values, family systems, perceptions, communication styles and artistic expressions of major client groups that they serve (NASW, 2001). Acquiring this knowledge should be accompanied by a regular assessment of their own personal values, beliefs, and biases in an effort to inform their practice and increase the quality of relationships they have with the children and families they serve (NASW, 2001).

This cross-cultural knowledge and personal awareness should be considered and applied to all approaches, skills, and techniques when working with children and

families (NASW, 2001). This kind of approach is necessary to understand the stigma and shame that many cultures associate with mental health and substance use issues. This insight will help clinicians and/or staff to better understand the kind of help people seek, the types of coping and communication styles, social supports needed and the level of resistance to treatment that can be expected from the children and families they serve (DHHS, 2001).

In all circumstances, special consideration should be given to ensure that there are adequate numbers of clinicians and staff who speak the language(s) of the client groups served and when not available that there are procedures in place for obtaining translation and/or interpreter services.

In addition, it is necessary to ensure that all screening tools, protocols, instruments and approaches used in the mental health and substance use screening, assessment, reassessment and treatment process are tailored for the population being served.

This commitment to cultural competence is essential to adequately assess and treat the mental health and substance use needs of children and families in the foster care system. It is recommended that there be a monitoring process to ensure this takes place (DHHS, 2001).

VI. PERIODICALLLY REPEATED WITH STANDARDIZED COLLECTION OF HEALTH INFORMATION

Since all foster children are at serious risk for mental health and/or substance use problems, they need individualized reassessment. The appropriate intervals depend on the severity of the child's disturbance and the family's needs and must be determined on a case-by-case basis that is consistent with requirements for case planning.

Children who are found at initial screening to have mental health and/or substance use problems need to be treated and reassessed at regular intervals as recommended by guidelines from AACAP, the American Academy of Pediatrics and/or CWLA. Reassessments should collect standardized information needed to ensure continuity of care.

Children who need psychotropic medications, including psychostimulants, should be reassessed following the AACAP Policy Statement, "Prescribing Psychoactive Medications for Children and Adolescents." During the initial stabilization period, children should be reassessed frequently and have immediate access to a psychiatrist if they experience any difficulty adjusting to their medication. Once the child is stabilized on a standard dose of medication, he or she should be reassessed in a face-to-face interview no less than every three months. When children are moved to a new placement, all medications should be turned over to the caregiver at the next placement to ensure continuity of care. Once a child has

settled into his or her new placement, all medications should be reassessed to determine if any adjustments are needed. It is crucial that this assessment and reassessment process include clear and regular communication between the clinical service provider and the caregiver(s) where the child is living.

Children and families who are adjusting well to foster care and are in no apparent need of mental health and substance use intervention should also be reassessed in face-to-face interviews at regular intervals-no less than every 12 months or as requested by the child or family. Given the level of vulnerability of children and the potential to be re-victimized/traumatized, professionals must assess and reassess to ensure the ongoing safety and well-being of children in out-of-home care.

Children about to leave the system whether moving to self-sufficiency or returning home should be reassessed. Recognition should be given that children moving into self-sufficiency may still require assistance in dealing with issues related to their family and their individual mental health and substance use needs. Those who need, or desire further mental health and substance use services should have adequate referral and follow-up plans in place to assure proper continuity of care. All parties involved in the child's care should be notified of any follow-up appointments. The clinician should follow the standard procedures (locale specific) that are in place to document summary reports and to assure that the child's health data is conveyed to the next provider or caregiver.

VII. CONCLUSION

These most vulnerable and traumatized of children need and deserve appropriate screening, comprehensive assessment and reassessments, effective mental health and substance use treatment services/supports provided by appropriately trained individuals, including the active involvement, when indicated, of a child and adolescent psychiatrist. We urge local, state and federal authorities to work together with the mental health, substance use and child welfare professions and other relevant child and family serving systems to assure that these children's mental health and substance use needs are met and that the children have the skills, capacities, and support necessary to thrive.

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CLINICAL REPORT

Minors as Living Solid-Organ Donors

Guidance for the Clinician in Rendering Pediatric Care

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ABSTRACT

In the past half-century, solid-organ transplantation has become standard treatment for a variety of diseases in children and adults. The major limitation for all transplantation is the availability of donors, and the gap between demand and supply continues to grow despite the increase in living donors. Although rare, children do serve as living donors, and these donations raise serious ethical issues. This clinical report includes a discussion of the ethical considerations regarding minors serving as living donors, using the traditional benefit/burden calculus from the perspectives of both the donor and the recipient. The report also includes an examination of the circumstances under which a minor may morally participate as a living donor, how to minimize risks, and what the informed-consent process should entail. The American Academy of Pediatrics holds that minors can morally serve as living organ donors but only in exceptional circumstances when specific criteria are fulfilled. *Pediatrics* 2008;122:454–461

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Key Words
living donors, organ transplantation, psychosocial risks, child, adolescent, siblings

Abbreviations
AAP—American Academy of Pediatrics
UNOS—United Network for Organ Sharing

INTRODUCTION

In the past half-century, solid-organ transplantation has become standard treatment for a variety of diseases in children and adults. The major limitation for all transplantation is the availability of donors. The gap between demand and supply is attributable to a multitude of factors including failure to procure consent for many potential deceased donors, the growing number of indications for transplantation, and the realization that transplantation can benefit an increasing number of individuals with end-stage organ failure, including those with significant comorbidities. Despite numerous policy attempts to increase the number of deceased donor organs[1] and the acceptance of "expanded-criteria donors,"[2,3] the deceased donor supply is inadequate to meet the growing demand. Instead, living donors constitute an ever-growing proportion of organ donors. Initially restricted to first-degree genetic relatives, living donation then expanded to include more distant genetically related relatives (eg, cousins), emotionally related relatives (eg, spouses), and friends (those with whom the recipient had a strong personal bond) and more recently has expanded to include altruistic strangers.[4] Liberalization of medical criteria and upper age criteria also has permitted more people to qualify as living donors. In 2001, for the first time, more kidney donors were living than deceased, and the trend persists.[5] Living donors have also provided segments of livers and, less frequently, lungs, pancreases, intestines, and skin for transplantation.

Although minors are more likely to be organ recipients than living donors, minors have served as living donors. The American Academy of Pediatrics (AAP) believes that minors may ethically serve as living donors but only in specific, limited circumstances. A minor will most likely be considered to serve as a living organ donor for a minor sibling, although there may be rare cases in which it is morally appropriate for a donation to be considered from a minor donor to an adult family member.

Participation of minors as living organ donors raises serious ethical issues. This report includes a discussion of the ethical considerations regarding minors serving as living donors, using the traditional benefit/burden calculus from the perspectives of both the donor and the recipient. The report also includes an examination of the circumstances under which a minor may morally participate as a living donor, how to minimize risks, and what the informed-consent process should entail.

HISTORY

The first successful kidney transplant between identical twins occurred in 1954.[6] Three years later, judicial rulings permitted renal transplants between 3 sets of identical-twin minors (aged 14, 14, and 19 years, because at that time, the age of majority was 21 years).[7–9] Although live children continue to be a rare source of solid organs in the United States, data from the United Network for Organ Sharing (UNOS) reveal that at least 60 children younger than 18 years served as living kidney donors between 1987 and 2000, during which time approximately 40 000 live kidney

donations occurred.[10] At least 4 minors in the United States have served as living liver donors since 1989.[10] There is a case report from Switzerland of a 13-year-old donating a portion of small bowel to an identical twin.[11] Although children younger than 10 years rarely serve as living organ donors, there is a case report in the literature of a 7-year-old identical twin serving as a kidney donor[12] and a second documented kidney donation by a child younger than 10 years on the Organ Procurement and Transplantation Network data report.[13]

RISK/BENEFIT RATIO

To determine if a living organ donation is ethically permissible, one must examine the risks and benefits to the donor and the recipient. Although ethically the risk/benefit calculation focuses mainly on the risks and benefits to the donor, it also considers the risks and benefits to the recipient and his or her family. The focus on the donor is to ensure that the donation promotes the donor's interests and respects the donor as an end in himself or herself and not merely as a utilitarian organ source. Consider, for example, a donation by someone with cognitive disabilities. There have been several court cases that have prohibited such donations on the grounds that the potential psychological and emotional benefit may be minimal or nonexistent if the individual does not currently understand why he or she is being asked to undergo the donor operation, particularly if that individual is not expected ever to understand the purpose.[14,15]

Risks and Benefits to the Donor

Although serving as an organ donor is not in the donor's medical best interest, it may be in the donor's best interest, all things considered. For example, there are potential psychological and emotional benefits that a minor donor may experience. The child may develop greater self-esteem and be seen as a hero by his or her family, friends, classmates, and larger community. There are also the potential benefits that a child accrues when his or her family is relieved of the burden of caring for a seriously ill family member.[16] For example, the donor may now receive more parental time and energy and more intrafamilial companionship and may benefit from improved financial resources. The psychological benefits may even accrue if the transplant fails, because the donor and his or her family can take solace in the fact that everything possible was done.

However, there are also psychological risks of serving as a living donor, although the data in children are limited.[17] Although some adults experience greater self-esteem after donating, others feel lower self-esteem, a sense of neglect, and lack of appreciation after the donation as the attention refocuses on the recipient.[17] Psychological risks may be greater in younger children, who may not understand the meaning of the lost body part or the reason for any scars.[18]

The donor may experience guilt and blame if the transplant fails and/or the recipient dies.[19] Several cases of adult donor suicides after failed transplants have been reported in the literature.[20] Still, the vast majority of donors understand this risk and do not regret their decision.[21–23]

Another risk is the potential coercive nature of the request: how can children refuse when their parents are asking them to donate?[16,17] And, if a child does refuse, additional guilt may result.[16,23] On the other hand, there are potential psychological and emotional risks from not being allowed to serve as a donor and the possibility of blame, by self or others, for the death of the family member if the child does not donate. These and other psychological risks and benefits need to be studied longitudinally.

There are some significant medical risks to the organ donor. First, there are the risks of surgery and anesthesia themselves. The calculated risk of mortality from kidney donation is approximately 2 in 10 000[24] and is up to 10-fold greater for a left lateral segment living liver donation (with the right-lobe having a greater risk than left-lobe).[25] There are also risks of significant morbidity, including postoperative bleeding and infections. All donors experience acute pain, and some develop chronic pain. The risks of serious or significant morbidity to kidney donors are often quoted at less than 5% regardless of the surgical method of procurement (eg, laparoscopic versus open),[26] although there is minimal experience with laparoscopic kidney procurement in children. The risks of serious or significant morbidity to liver donors cited in the literature are quite variable. One review described the range of serious morbidity for living liver donors between 0% and 69%, acknowledging that the discrepancies were attributable, in part, to individual center definition and recognition of morbidity as well as which liver lobe was being donated and the experience of the center.[27] Other reviews have described the risk of morbidity as ranging from 0% to 100%.[25,28] The true rate of morbidity and mortality for other solid-organ donations is difficult to establish (eg, lung, pancreas, and small bowel) because of the small numbers of reported cases in the literature and the lack of living-donor registries.[29]

Long-term risks for the potential child donor need to be considered as well, especially because there have been no long-term data on the safety of pediatric donation. One study followed 111 minors younger than 16 years who underwent unilateral nephrectomy for unilateral renal disease.[30] The study participants were reevaluated 7.1 to 51.9 years after surgery (average: 26.0 years). The researchers found that renal function was maintained at approximately 75% of the reported normal 2-kidney value.[30] Although adult data suggest that kidney donors are not at increased risk of chronic renal disease,[26,31,32] it was reported recently that 56 previous adult living donors were later placed on waiting lists for deceased kidney transplantation.[33] The contribution of the nephrectomy to the subsequent cause and timing of renal failure in these donors is unknown. Long-term follow-up is necessary to determine the risks to pediatric donors, because children, by the nature of their young age, will have a longer at-risk period of decreased renal reserve than will their adult counterparts. If the need for

the transplant is related to a genetic condition in the recipient, there is a risk that a genetically related donor may develop the same health problem and need a transplant at some time in the future; this may be particularly true of identical twins.

Although the worldwide experience of living pediatric liver donors is too small and too recent to allow statements about the actual long-term risks, these donors theoretically should suffer no long-term risks of liver failure, because the liver is a regenerative organ.

An additional risk to the donor is the restrictions in activities because of the donation. Frequently, organ donors are counseled to refrain from certain activities, especially those perceived as physically hazardous, despite the fact that guidelines have become less restrictive. The AAP now gives a "qualified yes" to participation in contact sports for children with only 1 kidney.[34] The US military will not enlist a person with 1 kidney,[35,36] although they may not necessarily discharge a serviceman who loses a kidney. No recommendations exist for donors of organs other than kidneys, although there should be no long-term restriction of activity for donors of partial organs, such as liver, intestine, and lung.

Benefits and Risks to the Child Recipient and the Family

The main benefit to the recipient is a healthy living graft. For kidney transplantation, if the donor and recipient are siblings, there is a 25% chance that they are HLA identical, which increases mean graft survival on a statistical basis. Ten-year graft survival for HLA-identical siblings is 75% (vs 56% for unrelated HLA-mismatched living donors and 44% for cadaveric donors).[37] If they are identical twins, the graft can survive even without the need for immunosuppression. The recipient's improved medical well-being benefits the recipient as well as the family and the donor. For other transplanted organs, there is no demonstrated benefit of HLA matching except that no organ transplants between identical twins require immunosuppression.

Risks to the child recipient are the medical risks of the transplantation procedure and the psychological and emotional risk of feeling indebted. There is also the potential risk of guilt should the donor sibling develop a significant chronic morbidity or die. Unless the children are identical twins, there are also the risks and adverse effects of immunosuppression, which include increased risk of infection and malignancies.

CONDITIONS UNDER WHICH A MINOR MAY PARTICIPATE AS A LIVING ORGAN DONOR

UNOS data regarding the participation of minors as donors[10] suggest a lack of stringent criteria. In response, the Amsterdam Consensus Panel, an international panel of experts in transplantation, accepted a proposal that minors younger than 18 years should never be allowed to donate.[24] The US Live Organ Donor Consensus Group, a national panel of experts in transplantation, however, argued that minors younger than 18 years could ethically serve but only in rare and exceptional circumstances.[38] The AAP concurs that it may be permissible for a minor to participate as a living organ donor provided that stringent criteria are met. The US consensus group offered 4 conditions, all of which must be satisfied for a minor to ethically serve as an organ donor. The following is a review and modification of these 4 criteria with a fifth criterion added to ensure that minors only serve in very rare and exceptional circumstances.

Condition 1

The first condition requires both the potential donor and recipient to be highly likely to benefit.[38] Condition 1 will most likely occur if donations by minors are restricted to donations within an intimate family setting in cases in which the psychological benefit to the potential donor is likely to be significant.[39] Moreover, minors should never be considered as potential donors for strangers[40] or people they only know through the Internet.

Condition 1 also implies that minors should not be asked to serve as living donors in cases in which the likelihood of success is low. The justification for this restriction is to reduce the psychological burden that the child donor may experience if the donation fails. Although all living donors may experience psychological distress (from either a successful or failed donation), competent adult donors should be allowed to accept lower benefit-to-risk opportunities, because they can give their own informed consent (see "Informed Consent").

Condition 2

The second condition is a requirement that "the surgical risk for the donor [be] extremely low."[38] Although this is not quantified, the risks of certain solid-organ donations such as that of a kidney are known to be smaller than others, such as that of the liver. This would suggest that minors should be restricted to serve as living kidney donors. One could envision the rare situation in which the older adolescent might be permitted to donate a left lateral segment of the liver on the basis of his or her ability to make an informed decision,[41] but the data to support the long-term safety of donation of lung, small bowel, and right liver lobes are currently insufficient to permit individuals younger than 18 years to donate these organs. Again, competent adults should have the right to take greater risks, although the transplant team, as moral agents, can decide that the risks are too great for any living donor.[42]

Condition 3

The third condition mandates that "all other opportunities for transplantation have been exhausted, no potential adult living donor is available, and timely and/or effective transplantation from a cadaver donor is unlikely."[38] To ensure that the child is truly a donor of last resort, children should not undergo donor evaluation until other potential living donors have been evaluated and found to be unable to donate. Children should also not be considered as living donors if deceased donors are likely to become available for their intended recipients.

The current kidney allocation system of the UNOS gives children special priority to receive a deceased donor kidney quickly,[43,44] so unless there are extenuating circumstances (eg, the recipient is highly sensitized), the need to donate to a sibling should be rare. The practice of splitting livers from deceased donors increases availability of deceased donor livers for young children.[45] These practices should eliminate the need for children to donate to their siblings in all but the rarest circumstances.

Condition 3 merits further clarification. For a child to serve as a donor of last resort, the recipient should be likely not to survive the wait to receive a deceased donor organ, despite being an excellent candidate for transplantation. Examples of such situations include cases in which the potential kidney recipient has exhausted sites for dialysis access or is highly sensitized to most potential donors but not the identified child donor.

Some have argued to bypass condition 3 when the donor and recipient are identical twins because of the additional benefit provided to the potential recipient, who will not require immunosuppression.[10,46] Although such a transplant provides great benefit to the recipient and, by extension, to the family, the benefit does not significantly alter the risks to the donor. If it is ethically impermissible for a minor to serve as living donor to a sibling because of the risks or because the child cannot make a voluntary and informed decision, the same standards should hold if the potential child donor is an identical twin.

Condition 4

The fourth condition requires "the minor [to] freely [agree] to donate without coercion (established by the independent donor advocate)."[38] The Advisory Committee on Organ Transplantation of the US Department of Health and Human Services recommends that all living donors have a donor advocate.[47] The donor advocate's primary obligation is to help donors understand the process and procedures and to protect and promote the interests and well-being of the donor. If the donor is a minor, the donor advocate should have (1) training and education in child development and child psychology, (2) skills in communicating with children and understanding children's verbal and nonverbal communication, and (3) working knowledge of transplantation and organ donation. Thus, donor advocacy will usually require partnering of professional colleagues to provide all these skills (an "advocacy team"). Even with an advocacy team, one must realize that the parental request for a child to serve as a donor for a family member may be perceived by the child as a request that cannot be refused. Minors who are evaluated to be donors must be evaluated for maturity and cognitive ability. Before they are allowed to give assent; they must be educated about living donation and counseled at various junctures that it is permissible to say no or to withdraw at any time before the procedure.

No minor should begin the consent process without the support of his or her parents and/or guardians. This decision is too momentous to be left to minors alone but should reflect a shared decision between minor and parent(s). That said, it is important to acknowledge that parents who give permission for their minor to donate have a potential conflict of interest by the nature of their relationship with both the donor and recipient, and because of the recipient's illness, the parents may be prone to focus more heavily on the effect of their decision on the health of the recipient. Parents must have some insight into their own conflicts of interest, and the donor advocacy team should help them analyze their own decision-making processes.

In addition, minors should only be allowed to donate within intimate families and only as a last resort. The child advocacy team should ensure that the degree of emotional intimacy can justify the risks from the perspective of the minor donor, that there are no alternative donors who are adults, and that dialysis is not a realistic possibility for the recipient as a bridge to deceased donor transplantation. Although the US Living Organ Donor Consensus Group did not provide a lower age limit, younger children clearly are less able to make an informed and voluntary decision. Using a Piagetian conception of development,[48] a firm lower age limit of 11 years can be set on the basis of the developmental stage of achieving abstract thought. Institutions that are uncomfortable with donation by preadolescents could alternatively choose a higher age cutoff (eg, 14 years). Nonetheless, recognizing that the cognitive and mental abilities of preadolescents and adolescents can vary greatly, an individual review of each prospective pediatric donor should be undertaken by the advocacy team to establish a child's maturity and understanding irrespective of his or her chronological age.

Condition 5

In addition to the 4 criteria enumerated by the US Live Organ Donor Consensus Group, the AAP would add a fifth criterion. Condition 5 would require the emotional and psychological risks to child donors to be minimized. Data in the bone marrow transplantation literature suggest that the risks can be minimized by preparing future donors through medical role-playing, allowing them to ask questions, and including them in the decision-making process.[49,50] Families need to be educated about the psychological risks that the donor may feel, particularly if most of the family's resources remain focused on the ill recipient. Families must also be educated about the importance of affirming the donor's role and the discomfort that some of the procedures may cause. These 5 criteria are summarized in Table 1.

TABLE 1 When Children May Ethically Serve as Solid-Organ Donors

Children may serve as solid-organ donors if:
Donor and recipient are both highly likely to benefit;
Surgical risk for the donor is extremely low;
All other deceased and living donor options have been exhausted;
The minor freely assents to donate without coercion (established by an independent advocacy team); and
Emotional and psychological risks to the donor are minimized

The first 4 criteria were adopted from the Live Organ Donor Consensus Group's consensus statement on the live organ donor[38] and modified.

DOMINO DONORS

In rare cases, an organ recipient may serve as a living donor in what is known as a "domino" donation.[51] For example, if an individual with cystic fibrosis undergoes a heart-lung transplant because of end-stage pulmonary disease, the removed heart may be "healthy" enough to be used for a solitary heart transplant. In that case, the recipient may simultaneously serve as a donor. This opportunity, although rare, may occur for both pediatric and adult patients, including pediatric patients who cannot understand what is occurring. In such cases, the procurement of the organ poses no additional medical risk to the donor and the use of organs ought to be permissible on the basis of normal standards of parental consent. The potential psychological risks and benefits to minors whose organs are used as domino donations have not been studied, but parents and physicians should consider the potential impact when deciding how much to explain to such minors.

INFORMED CONSENT

Legally, in pediatrics, parental permission is all that is required for consent to clinical treatment (with a few exceptions), whereas parental permission and the child's assent is necessary for research purposes. Ethically, there are guidelines that promote obtaining both parental permission and the child's assent for both clinical and research purposes.[41] The term "assent" is used to signal that the child's decision itself is not sufficient. It is understood to be an active agreement to participate and not a mere failure to object. Because serving as a solid-organ donor is not in a child's medical best interest, although for some children it may be in their overall best interest, the AAP believes that serving as a solid-organ donor should require, at minimum, both parental permission and the child's assent. This would disqualify all younger children and cognitively disabled children who are not able to give meaningful assent.[41]

In seeking parental permission, it is important for the transplant team to acknowledge the tension that parents experience when 1 of their children is ill and the conflict of interest created if they ask 1 of their healthy children to serve as a potential donor. The transplant team must emphasize that minors should only serve as donors of last resort, and the team should help the family consider whether there are other potential healthy adults and/or whether the ill child can wait for a deceased donor organ. When a minor is a potential donor, the transplant team must help the parents weigh the risks and benefits for the healthy child to serve as an organ donor for an ill family member and not just weigh the risks and benefits from the perspective of the family as a unit.

Discussions between the transplant team and the minor must be developmentally appropriate. The psychological and medical aspects of the donation should be explored in language that is understandable to the potential donor. The donor must be informed that the donation may have some acute and long-term health risks.[26] Although there have been few studies that explored the minor's psychological response to serving as an organ donor, the adult literature shows that individuals may have unexpected reactions to donation.[52–54] The minor needs to understand that the donated organ may fail or may be rejected by the recipient or that the original cause of the organ failure may recur and that the outcome is beyond his or her control.[19,21,53] The literature shows that many donors feel neglected after donation as the focus returns to the ill recipient.[52,55] Family members should be reminded that they need to be attentive to the needs of both the donor and the recipient.

Given the potential serious risks of living organ donation without concomitant medical benefit to the donor, minors should not be allowed to serve as solid-organ donors unless they can show some understanding of the risks and benefits of the donation and the procedures to be performed and affirm that their assent is voluntary.

Although what is required for a minor's assent to be adequate is not specified in any clinical or research guidelines,[41,56,57] the ability to understand the risks and benefits of donation and to make an informed decision improves with the developmental maturity of the minor.[41,48] There exist some data to suggest, at least in hypothetical cases, that older adolescents make decisions as well as their adult counterparts,[58–60] but there is not a specific age at which these capacities uniformly exist. Case-by-case review by the transplant team and an independent donor advocacy team is necessary. Additional consultations by a psychiatrist and/or an ethics committee are recommended for younger minors. If there are doubts that the minor can provide voluntary assent or if there is concern about the minor's comprehension of the risks, benefits, or procedures involved, the presumption should be to recommend against the child serving as an organ donor.

Although all children are vulnerable, children with disabilities are even more vulnerable than are healthy children. In the early court cases regarding kidney donation by incompetent individuals, some courts expressed concern about individuals with cognitive disabilities serving as organ donors, because the potential psychological and emotional benefit may be minimal or nonexistent if that individual does not understand why he or she is being asked to undergo the procurement.[14,15] There is also concern that families may be more willing to expose these individuals to risks than they would be with other family members.[61] To alleviate this concern, additional consultations by a psychiatrist and an ethics committee are recommended when a minor with cognitive disabilities is being considered as a potential living donor.

FOLLOW-UP

All children who serve as living solid-organ donors need long-term follow-up. Ideally, national donor registries should be established to collect short-term and long-term medical and psychological data that would allow for more accurate assessment of the risks, benefits, and outcomes of solid-organ donations. All minor donors and their guardians should be asked to authorize the long-term collection and storage of their health data. Parents should be responsible for authorizing the child's registration, but the child should be asked to re-consent

when he or she reaches the age of majority. Costs associated with maintaining living-donor registries should be estimated and included on a prorated basis in the reimbursement for the living-donor procedure. Currently, no such registries exist. Until national registries exist, the burden of collecting long-term follow-up data on pediatric donors must be assumed by transplant programs that perform such transplants.

ROLE OF THE COURTS

In the early years of transplantation (1950s to 1970s), judicial review was often sought when children were considered for organ donation.[39] These cases raised the issue of whether parents can authorize an invasive medical procedure on a healthy child that does not promote the child's medical well-being. The courts affirmed parental authority to authorize such procedures but required that the family demonstrate that the donation was in the donor's best interest, which frequently entailed the family demonstrating that the donor would experience psychological benefit from helping his or her sibling and psychological harm if not allowed to help. Numerous cases affirmed the guardian or parent's authority to authorize a donation from an incompetent adult (defined as a person who has reached the age of majority but lacks decision-making capacity) or child.[7–9,12,62,63] The courts prohibited some donations by minors and other incompetent individuals, particularly when (1) the donor had severe cognitive disabilities and would not benefit from the recipient's survival and (2) the donor was institutionalized and not an intimate member of the family.[14,15] The AAP holds that parental authority is necessary but not sufficient and that the minor's assent also is necessary.

Given that legal precedent for living organ donations by incompetent adults and children is firmly established, the AAP does not believe that every donation by a minor should require court approval. The real value of the judicial review process was historical in that it provided an independent advocate for the potential incompetent donor, a role that should now be fulfilled by donor advocacy teams.[47] A donor advocacy team with special pediatric expertise should be appointed for all individuals younger than 18 years who are being considered as living solid-organ donors. The donor advocacy team should ensure that (1) the minor understands the risks and benefits of the procedure, (2) the minor has the developmental maturity to understand that participation is voluntary, and (3) the minor's decision is voluntary. At least some of the conversations between the potential minor donor and the independent advocacy team should be held in the absence of other family members. If the minor is unwilling to serve or is emotionally or cognitively unable to appreciate, at some level, the risks and benefits or the procedures involved, the donor advocacy team should recommend against the donation. The donor advocacy team should also assess whether the recipient to whom the minor is being asked to donate is an appropriate candidate (eg, a child sibling with a high likelihood of doing well with the graft), that no adult living donors are available, and that waiting for a deceased donor transplant is not clinically appropriate. The donor advocacy team should help ensure that the parents are assessing the risks and benefits of a sibling donation from the independent perspectives of the recipient and of the donor. The donor advocacy team should affirm in writing that it has determined that the minor is operationally capable of understanding the donation procedures and that the minor actively assents to his or her participation. This process, then, should obviate the need for routine court review. Additional consultations (eg, with a psychiatrist and an ethics committee) are recommended for more complex cases such as those involving younger minors (eg, minors between 11 and 14 years old) or minors with cognitive disabilities, with court review as a last resort (eg, if a hospital lacks an ethics committee with sufficient expertise).[16]

CONCLUSIONS

The AAP believes that it is morally permissible for minors to serve as living donors in exceptional circumstances only when the aforementioned 5 criteria are met (see Table 1). A donor advocacy team with training in child development and child psychology, with experience in communication and role-playing with children and with understanding of transplantation and organ donation, should be required for all transplants that involve living minor donors. Hospital ethics committee and psychiatric consultations should be considered for more complex cases, such as when (1) the minor donor has cognitive disabilities or (2) there are procedural questions given the child's age (eg, when younger minors are being considered as kidney donors or when adolescents are being considered for donating a left lateral segment of the liver). Court review of pediatric donations should be rare (eg, if there is a question about whether the 5 criteria in Table 1 are met and the hospital lacks an ethics committee with sufficient expertise).

Parental permission is sufficient for domino donations by children. All other donations by minors should require both parental permission and the child's assent. Although identical twins offer an immunologic benefit as living donors, the best interest of the donor child still requires that they serve as donors of last resort and only if all 5 criteria listed in Table 1 are met.

Finally, long-term follow-up data should be collected to help determine the actual benefits and risks of donation, both medically and psychologically, for children. These data should then be used to modify future recommendations for the permissibility of minors to serve as living solid-organ donors.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Child Health Financing

Model Contractual Language for Medical Necessity for Children

ABSTRACT. The term "medical necessity" is used by Medicare and Medicaid and in insurance contracts to refer to medical services that are generally recognized as appropriate for the diagnosis, prevention, or treatment of disease and injury. There is no consensus on how to define and apply the term and the accompanying rules and regulations, and as a result there has been substantial variation in medical-necessity definitions and interpretations. With this policy statement, the American Academy of Pediatrics hopes to encourage insurers to adopt more consistent medical-necessity definitions that take into account the needs of children. ***Pediatrics*** **2005; 116:261–262;** ***medical necessity, medically necessary, managed care, contract.***

INTRODUCTION

The definition of "medical necessity" in this statement articulates model language that takes into account the unique needs of infants, children, adolescents, and young adults through 21 years of age. To the extent possible, this definition draws on model language developed by Stanford University.[1] For contractual purposes, an intervention will be covered if it is an otherwise covered category of service, not specifically excluded, and medically necessary.

DEFINITION

Health insurers should define medical necessity as health interventions for children that take into account all of the following criteria.

Scope of Health Problems

Medically necessary health interventions are intended to promote normal growth and development and prevent, diagnose, detect, treat, ameliorate, or palliate the effects of a physical, mental, behavioral, genetic, or congenital condition, injury, or disability. They should:

- assist in achieving, maintaining, or restoring health and functional capabilities without discrimination to the nature of a congenital/developmental anomaly;
- be appropriate for the age and developmental status of the child;
- take into account the setting that is appropriate to the specific needs of the child and family; and
- reflect current bioethical standards.

Evidence of Effectiveness

Medically necessary interventions must be reasonably expected to produce the intended results for children and to have expected benefits that outweigh potential harmful effects.

- For new interventions, for which clinical trials have not been conducted, effectiveness should be determined on the basis of clinical judgment after assessing the professional standards of care for children or consensus pediatric expert medical opinion.
- For existing interventions, effectiveness for children should be determined first on the basis of scientific evidence.* If insufficient scientific evidence for children is available, professional standards of care for children must be considered. If professional standards of care for children do not exist or are outdated or contradictory, decisions about existing interventions must be made on the basis of consensus pediatric expert opinion. Giving priority to scientific evidence does not mean that coverage of existing interventions should be denied in the absence of conclusive scientific evidence.

Value

- Medically necessary interventions must consider value for children on the basis of effectiveness. Cost-effective does not necessarily mean lowest price.

Process for Determining Medical Necessity

The American Academy of Pediatrics recommends that health plans describe the processes by which physicians and other health care professionals pro-

* Scientific evidence consists primarily of randomized, controlled clinical trials that either directly or indirectly demonstrate the effect of the intervention on health outcomes. If randomized, controlled clinical trials are not available, observational studies that demonstrate a causal relationship between the intervention and health outcomes can be used. Partially controlled observational studies and uncontrolled clinical series may be suggestive but do not by themselves demonstrate a causal relationship unless the magnitude of the effect observed exceeds anything that could be explained by either natural history of the medical condition or potential experimental biases.

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vide justification for the medical necessity of health interventions that they prescribe or order. Descriptions of these processes should include:

- how to provide clinical evidence supporting coverage of interventions that meet the needs of the individual child;
- how to incorporate appropriate pediatric medical or surgical subspecialty or expert opinion or testimony supporting coverage of interventions;
- how to assist families or physicians who wish to appeal medical-necessity denials; and
- how and when coverage decisions will be made.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Genetics

Molecular Genetic Testing in Pediatric Practice: A Subject Review

ABSTRACT. Although many types of diagnostic and carrier testing for genetic disorders have been available for decades, the use of molecular methods is a relatively recent phenomenon. Such testing has expanded the range of disorders that can be diagnosed and has enhanced the ability of clinicians to provide accurate prognostic information and institute appropriate health supervision measures. However, the proper application of these tests may be difficult because of their scientific complexity and the potential for negative, sometimes unexpected, consequences for many patients. The purposes of this subject review are to provide background information on molecular genetic tests, to describe specific testing modalities, and to discuss some of the benefits and risks specific to the pediatric population. It is likely that pediatricians will use these testing methods increasingly for their patients and will need to evaluate critically their diagnostic and prognostic implications.

ABBREVIATION. FISH, fluorescence in situ hybridization.

Recent developments in genetic research have accelerated the discovery of individual genes and enhanced our understanding of how genes work and how gene abnormalities lead to disease. There is a growing list of molecular diagnostic tests, with estimates that 10 to 12 new tests become available each year. Such tests in an individual can provide the following: 1) diagnostic confirmation in a symptomatic patient, including genotype-phenotype correlation in some disorders; 2) carrier testing; and 3) presymptomatic testing for late-onset disorders. They also can be used for population-based screening to predict future genetic disease or assess the risk for complex conditions such as cancer, cardiovascular diseases, and neurodegenerative disorders in otherwise healthy people. Although this subject review focuses on molecular genetic testing that can be used to diagnose many genetic disorders, it should be remembered that this type of technology may not be appropriate for diagnosis of all, or even most, genetic conditions. For example, molecular genetic testing is available for diseases such as cystic fibrosis, sickle cell anemia, and Tay-Sachs disease, but the initial diagnosis of these disorders usually is established by other methods.

The molecular genetic technology underlying genetic testing is complex, as are the issues of pretest counseling about the indications, benefits, and limits of testing. Expert interpretation and explanation of results to individuals and families is essential. Furthermore, predictive genetic testing in children and adolescents leads to complicated medical, psychological, ethical, and legal issues.[1,2] Media publicity combined with entrepreneurial marketing of molecular genetic tests to physicians accentuates the need for the practicing pediatrician to be informed and aware of the technologies and issues related to testing. This subject review will familiarize pediatricians with diagnostic molecular genetic testing and the clinical and ethical issues to be considered in the diagnosis of children and adolescents. A number of other reviews are available regarding the laboratory techniques of this testing and can serve as excellent background resources for understanding the methods by which molecular genetic diagnostic testing is accomplished.[3–5]

BACKGROUND INFORMATION

It is estimated that anywhere from 50 000 to 100 000 genes are contained in the 46 chromosomes present in each human cell. A genetic locus is the place on homologous chromosome pairs where genes are located. Each gene is composed of 2 alternative copies known as alleles, one originating from the maternally derived chromosome and the other originating from the paternally derived chromosome of each chromosome pair. Genes are composed of DNA, and the products of genes are most often proteins that may be used for a variety of purposes, including structural development, regulation of cellular function, enzyme activity, and control of metabolic pathways.

Although most changes in the DNA base-pair composition of genes do not result in disease and are known as *polymorphisms,* some gene changes alter gene function to such a degree that clinical disease is manifested, and these are known as *mutations.* Most genetic disease is caused by single base-pair deletions, additions, or substitutions. However, some disorders are caused by large-scale gene abnormalities, such as deletions of the entire gene, that can be detected by newer methods of diagnosis, such as molecular cytogenetic analysis.

As in all diagnostic testing, it is most important that the clinician have a reasonable index of suspicion based on clinical signs and symptoms that suggest a specific diagnosis. For proper interpretation of molecular genetic test results, it is also important that clinicians understand the probabilistic nature of

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

these tests and the full implication of positive and negative results.

TYPES OF MOLECULAR TESTING

Indirect Analysis

Indirect analysis, often referred to as *linkage analysis,* is used when the location of a gene is known, although the gene itself and its function are not, or when the gene is known but the mutations are too heterogeneous to make direct analysis practical. In addition to its critical importance as a research tool, linkage analysis sometimes may be used to identify heterozygotes (carriers) and in prenatal diagnosis. This diagnostic strategy often requires more than one affected individual in more than one generation. Under such circumstances, it is possible to use markers within or around the gene to track its inheritance within a family.

Markers for DNA sequences in or near genes include restriction fragment length polymorphisms, variable number of tandem repeats, or microsatellite repeats. Any marker known to be linked to a disease gene can be used to track the transmission of the mutant allele within the family studied.

Direct Mutation Analysis

Direct mutation analysis is the approach used when the gene responsible for the condition has been identified and specific mutations within the gene have been characterized. The techniques used to detect these mutations are diverse, including allele-specific oligonucleotide hybridization analysis, heteroduplex analysis, Southern blot analysis, multiplex polymerase chain reaction analysis, and direct sequencing. A detailed description of these techniques is beyond the scope of this subject review but is available elsewhere.[6,7]

Direct mutation analysis is preferred over indirect analysis, as it is mutation-specific and does not require testing of parents or family members. As with all molecular genetic testing, however, it is also subject to limitations that must be recognized when ordering such testing. One of the major limitations of direct mutation analysis is that some diseases are caused by many mutations, not all of which are detected by a particular molecular test. A characteristic example of this complexity is in the molecular diagnosis of cystic fibrosis. In Caucasians of northern European background, about 70% of all cystic fibrosis mutations are accounted for by deletion of 3 base pairs that results in loss of a phenylalanine at position 508 of the cystic fibrosis transmembrane regulator protein. The other 30% of mutations number in the hundreds, making it impractical to screen a single person for all disease-causing alleles.[8] In other populations, such as those of African and Asian descent, there is an even smaller percentage of affected persons who can be detected from a single test or even a panel of the most common mutations, further complicating the use of molecular technology for clinical diagnosis and determination of carrier status. This huge diversity of mutations at a single genetic locus is known as *allelic heterogeneity.* Another limitation of mutation analysis is the result of another type of genetic heterogeneity, known as *locus heterogeneity,* in which mutations at 2 or more genetic loci can produce the same phenotype, as has been demonstrated for congenital sensorineural deafness, for which more than a dozen loci have been identified.[9]

It is important to recognize that mutation analysis, like most other forms of molecular diagnosis, can confirm a diagnosis when the test result is positive. However, a negative test result may not determine conclusively that the patient is unaffected. Table 1 provides a list of some of the genetic disorders for which direct mutation analysis is available. There are many other disorders that may be diagnosed by molecular genetic techniques. Geneticists and other subspecialists usually will have specialized information about testing for disorders within their area of spe-

TABLE 1. Selected Disorders Diagnosable by Direct Mutation Analysis

Disorder	Associated Features	Gene Symbol (Locus)
Achondroplasia	Macrocephaly, short-limbed dwarfism	FGFR3 (4p16)
Apert's disease	Acrocephaly, craniosynostosis, extensive syndactyly of fingers and toes	FGFR2 (10q26)
Charcot-Marie-Tooth disease, type 1A	Progressive sensory and motor neuropathy	PMP22 (17p11)
Crouzon's disease	Bicoronal synostosis, proptosis, hypertelorism	FGFR2 (10q26)
Cystic fibrosis	Recurrent pulmonary infections, exocrine pancreatic insufficiency	CFTR (7q31)
Familial adenomatous polyposis	Adenomatous polyps of the colon, high risk for colorectal cancer in early adulthood	APC (5q21)
Fragile X syndrome	Mental retardation, long-appearing face, large ears, macro-orchidism	FMR1 (Xq27)
Friedreich ataxia	Progressive ataxia, insulin resistance, concentric cardiomyopathy	FRA1 (9q13)
Hemophilia A	Deficient thrombostasis, hemarthrosis	F8C (Xq28)
Huntington's disease	Progressive loss of motor and cognitive function, usually beginning in adulthood	HD (4p16)
Muscular dystrophy (Duchenne's and Becker's)	Progressive muscle weakness	DMD (Xp21)
Myotonic dystrophy	Frontal balding, cataracts, progressive myotonia, infertility, cardiac conduction defects	DMPK (19q13)
Neurofibromatosis, type 1	Café au lait spots, neurofibromas, Lisch nodules, optic gliomas	NF1 (17q11)
Neurofibromatosis, type 2	Vestibular schwannomas and other intracranial and spinal tumors	NF2 (22q12)
Saethre-Chotzen syndrome	Craniosynostosis, ptosis, variable digital anomalies	TWIST (7p22)

cialty practice and are appropriate resources for evaluation, test selection and interpretation, and counseling of patients with suspected genetic disease.

Molecular Cytogenetic Analysis

Standard cytogenetic analysis is used to detect abnormalities in chromosome number or microscopically visible duplications or deletions of chromosomal material. With the advent of molecular cytogenetic techniques, such as fluorescence in situ hybridization (FISH), it is now possible to detect chromosomal rearrangements that are beyond the resolution of light microscopy used for standard cytogenetic analysis.

The use of FISH analysis for genetic diagnosis is made possible when a unique sequence of a gene or group of genes is known and when the disease in question is the result of a deletion of this critical region. This unique sequence, known as a *critical region,* is synthesized in the laboratory and labeled with a fluorescent marker. A sample from a patient is cultured as in standard cytogenetic analysis, and the fluorescent-labeled probe is added to the sample. If the unique sequence is present, the fluorescent probe will hybridize with it and be visible when viewed under a fluorescent microscope. A characteristic example of this type of genetic diagnosis is in a patient suspected to have Williams syndrome, which is known to be associated with a deletion of the elastin gene. When a sample is taken from an affected person and combined with the elastin probe, only 1 fluorescent signal will be visible, whereas 2 signals will be visible in the unaffected person, indicating that both copies of the elastin gene critical region are present. Table 2 provides a partial list of disorders that can be diagnosed by FISH analysis. In addition to detecting large-scale deletions of chromosome material, FISH also can be used to detect abnormalities of chromosome number or large-scale rearrangements that may not be detectable by standard cytogenetic techniques.

BENEFITS AND RISKS OF MOLECULAR DIAGNOSIS

Persons who are at increased risk for a genetic disorder live with uncertainty about their health and that of their children and extended family members. The use of molecular testing may eliminate this uncertainty. When one's health status is known, an appropriate treatment plan can be developed, including timely health supervision, anticipatory guidance, and institution of preventive measures.

Molecular genetic testing seldom poses significant physical risks. However, presymptomatic testing or carrier screening, particularly for diseases with serious health implications, can have profound effects and should not be performed without pretest counseling. The decision to have a test and its results can reverberate throughout the family. As a part of pretest counseling, it should be recognized that genetic testing may reveal information about the extended family, as well as the person being tested, and that a genetic test inadvertently may disclose family secrets involving paternity or adoption. Emotions elicited by test results can shift family dynamics. Family members identified as carrying the gene may feel anger, while one who is identified as a noncarrier may feel guilt for avoiding a disease that affects a close relative. It is also important to recognize that positive test results may be used to discriminate against the patient and family member in the areas of insurability, job hiring and promotion, and adoption of children.[10] Many states have adopted, or are in the process of adopting, laws that protect the privacy of genetic information.

SPECIAL CONCERNS FOR CHILDREN AND ADOLESCENTS

Special considerations must be given to genetic testing of children and adolescents. Because minors may be incapable of giving informed consent, they generally should not be tested except under the following specific circumstances that have been outlined in publications from a number of national organizations, including the American Academy of Pediatrics[2,11–13]: 1) testing should be offered when there are immediate medical benefits, such as institution of measures that can prevent the disease, delay its onset, limit its severity, or prevent secondary disabilities; and 2) testing also may be offered when there is a benefit to another family member and no anticipated harm to the minor. When the results of

TABLE 2. Microdeletion Syndromes Diagnosable by FISH

Syndrome	Site	Comments
Prader-Willi	(del)15q11 (pat)	Hypotonia, obesity, hypogonadism, mental retardation, small fingers
Angelman's	(del)15q11 (mat)	Hypertonia, global developmental delay, ataxia, episodes of inappropriate laughter, seizures, microcephaly, movement disorder
22q deletion syndromes: DiGeorge Velocardiofacial	(del)22q11	Hypoparathyroidism, absent thymus—T-cell defect, velopharyngeal incompetence or cleft; typical facies, conotruncal heart defect
Williams	(del)7q11	Prominent lips, wide mouth, developmental delay, supravalvar aortic stenosis, growth delay, infantile hypercalcemia
Miller-Dieker	(del)17p13	Lissencephaly, microcephaly, decorticate and decerebrate postures, associated cardiac, kidney, and genital anomalies
Smith-Magenis	(del)17p11	Brachycephaly, broad face and nasal bridge, flat midface, mental retardation, hyperactivity, self-destructive behavior, insomnia
Langer-Giedion	(del)8q24	Characteristic facial features, exostosis, cone-shaped epiphysis, polydactyly, microcephaly, mental retardation
Alagille (arteriohepatic dysplasia)	(del)20p12	Neonatal and infantile cholestasis, peripheral artery stenosis and cardiovascular anomalies, typical facies

genetic testing will be used solely for future reproductive decisions or when parents request it and there are no benefits to the child, in most circumstances it should be deferred until the child can request such testing as an autonomous individual who is able to appreciate the emotional and social consequences, as well as the genetic facts, of the results.

Central to all types of genetic testing is the process of genetic counseling to ensure that the patient has adequate information to give truly informed consent, that he or she is psychologically prepared to cope with the results, and that patients and sometimes other family members receive assistance in understanding the medical, psychological, social, and legal implications of these findings.

SUMMARY

Molecular genetic testing is increasingly available in pediatric practice because of recent developments in genetic research and their rapid translation into clinical practice. The technology behind molecular genetic testing is complex, and such testing has its own limits. Furthermore, testing brings with it complex ethical, legal, and social issues, particularly for children and adolescents. Pediatricians must understand these issues and, through proper consultation with experts and specialists, aim to prepare families adequately before ordering molecular genetic testing.

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AMERICAN ACADEMY OF NEUROLOGY

Special Article

CME

Practice parameter: Neuroimaging of the neonate

Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society

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Article abstract—*Objective:* The authors reviewed available evidence on neonatal neuroimaging strategies for evaluating both very low birth weight preterm infants and encephalopathic term neonates. *Imaging for the preterm neonate:* Routine screening cranial ultrasonography (US) should be performed on all infants of <30 weeks' gestation once between 7 and 14 days of age and should be optimally repeated between 36 and 40 weeks' postmenstrual age. This strategy detects lesions such as intraventricular hemorrhage, which influences clinical care, and those such as periventricular leukomalacia and low-pressure ventriculomegaly, which provide information about long-term neurodevelopmental outcome. There is insufficient evidence for routine MRI of all very low birth weight preterm infants with abnormal results of cranial US. *Imaging for the term infant:* Noncontrast CT should be performed to detect hemorrhagic lesions in the encephalopathic term infant with a history of birth trauma, low hematocrit, or coagulopathy. If CT findings are inconclusive, MRI should be performed between days 2 and 8 to assess the location and extent of injury. The pattern of injury identified with conventional MRI may provide diagnostic and prognostic information for term infants with evidence of encephalopathy. In particular, basal ganglia and thalamic lesions detected by conventional MRI are associated with poor neurodevelopmental outcome. Diffusion-weighted imaging may allow earlier detection of these cerebral injuries. *Recommendations*: US plays an established role in the management of preterm neonates of <30 weeks' gestation. US also provides valuable prognostic information when the infant reaches 40 weeks' postmenstrual age. For encephalopathic term infants, early CT should be used to exclude hemorrhage; MRI should be performed later in the first postnatal week to establish the pattern of injury and predict neurologic outcome.

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Despite the development of sophisticated care techniques, the incidence of neurodevelopmental disability among the survivors of newborn intensive care remains high.[1-4] As newborn special care enters its fifth decade, survival rates for both severely compromised term infants and very low birth weight (VLBW) preterm (PT) infants have increased.[5,6] However, the incidence of cerebral palsy (CP) has not changed during the past 10 years, the number of children with school-based problems is on the rise, and the population of infants at risk for disability is increasing.[7-13] Because the clinical evaluation of these infants may not provide either adequate diagnostic or prognostic information, neuroimaging is frequently used.[14-16]

Additional material related to this article can be found on the *Neurology* Web site. Go to www.neurology.org and scroll down the Table of Contents for the June 25 issue to find the title link for this article.

This statement has been endorsed by the American Academy of Pediatrics, the American Society of Pediatric Neuroradiology, and the Society for Pediatric Radiology.

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Neuroimaging plays two important roles: 1) diagnosis of brain injury in the newborn at risk so that appropriate medical management can be provided and 2) detection of those lesions associated with long-term neurodevelopmental disability. Currently, cranial ultrasonography (US), CT, and MRI are the most available means for these tasks.

Goals. The Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society seek to develop scientifically sound, clinically relevant practice parameters for physicians for diagnostic procedures, treatment modalities, and clinical disorders. Practice parameters are strategies for patient management that might include diagnosis, symptom, treatment, or procedure evaluation. They make specific recommendations based on the analysis of evidence in the published literature.

This practice parameter provides recommendations in response to questions regarding brain imaging of PT and term infants. For PT infants: which PT infants should undergo routine screening US? When should these studies be performed? Do abnormalities shown by neonatal US require follow-up MRI? What is the ability of US to accurately predict long-term neurodevelopmental outcome for this patient population? For term infants: which imaging strategies are able to provide clinically important information for infants with neonatal encephalopathy? Can MRI provide prognostic information for these infants?

Description of the process. The committee consisted of neonatologists, pediatric neurologists, perinatal epidemiologists, and neonatal radiologists selected by five professional organizations (see the electronic version of this article for appendix 1 at www.neurology.org); we evaluated the quality of the evidence from the published literature. Evidence reviewed for this parameter was identified through literature searches using MEDLINE and EMBASE for the years 1990 to 2000 and CURRENT CONTENTS for 2000. This literature search was updated in June 2001. Relevant articles were chosen from the English-language literature using the following search terms: neonate, infant, brain, cerebral, MRI, MRS, diffusion-weighted imaging (DWI), diffusion tensor imaging, US, echoencephalography, Doppler ultrasonography, cranial axial tomography, near-infrared spectroscopy, SPECT, germinal matrix hemorrhage, intraventricular hemorrhage (IVH), periventricular leukomalacia (PVL), stroke, ischemia, ventriculomegaly, and echodensity. Because neonatal practices and imaging strategies have changed over the past decade,[12,17-21] we reviewed only those references from 1990 onward.

This search produced >1,320 citations, from which 90 met the predefined inclusion criteria: original clinical articles published since 1990, review articles, and reports of meta-analyses.

Each of the selected articles was reviewed, abstracted, and classified (appendix 2) by at least two reviewers. Abstracted data included patient number, mean birth weight (BW), mean gestational age (GA), age at the time of the neuroimaging study, primary neuroimaging measure, primary and secondary outcome measures, and timing of subject selection (prospective, retrospective, case-control, or case series study). We also noted both inclusion and exclusion criteria for patient selection and description of the neuroimaging strategy in addition to the results of the given study.

The strength of the evidence for each relevant article was ranked using the defined criteria shown in appendix 2. Recommendations were derived based on the strength of the evidence and stratified (level A, B, C, or U) as shown in appendix 3.

For the purposes of this practice parameter, a screening neuroimaging study was defined as one that is routinely applied to identify infants at sufficient risk of a specific disorder who would benefit from further investigation or direct action but who have no specific neurologic signs or symptoms requiring medical attention (e.g., infants born before 28 weeks of gestation).

Neuroimaging strategies. Although neuroimaging has proven to be extremely helpful for the assessment of injury to the PT brain and may provide useful information for evaluating the infant with neonatal encephalopathy, there are significant problems associated with imaging of the critically ill infant.[14,22,23] These include the choice of imaging technique, the timing of the imaging study, and regional variations in maturation of the developing brain. Further, transporting acutely ill neonates, many of whom require ventilatory assistance, multiple indwelling catheters, infusions, vasopressor support, and warming lights, represents a major challenge.

Currently, US, CT, and MRI represent the major imaging modalities most widely available for evaluating critically ill infants.

VLBW PT infants. Birth weight (BW) remains one of the most important predictors of infant mortality and morbidity. VLBW infants (BW <1,500 grams) now represent 1.45% of all live births in the United States.[5,6,24] In addition, the survival rates for this population are steadily increasing. In contrast, the handicap rates for surviving infants—particularly those with the lowest BW—are high. At 8 years of age, >50% of children with BW of <1,000 grams are educated in special education classrooms or resource rooms, 20% have repeated a grade in school, and 10% to 15% have spastic motor handicaps.[1,9,13]

Hemorrhage, hypoxia, and ischemia are the major causes of injury to the PT brain, and multiple studies over the past decade have used neuroimaging techniques to assess these injuries.[24-28]

US screening of the VLBW PT infant. Although cranial US of VLBW PT infants is routinely performed

Table 1 *Classification of cranial ultrasound findings for the preterm infant*

Classification		Findings
Intraventricular hemorrhage*	Grade 1	Germinal matrix hemorrhage
	Grade 2	Blood within the ventricular system but not distending it
	Grade 3	Intraventricular hemorrhage with ventricular dilatation
	Grade 4	Parenchymal involvement
Preterm white matter injury†	Cystic lesions	Periventricular
Ventriculomegaly‡	Mild	0.5–1.0 cm§
	Moderate	1.0–1.5 cm§
	Severe	>1.5 cm§

*Reference 30.
†References 29, 31–35.
‡References 36, 37.
§ Measurements at the midbody of the lateral ventricle on sagittal scan.

in newborn intensive care units, the target populations, number of examinations, and timing of these studies vary widely. Further, different institutions use different systems of nomenclature to describe IVH, white matter injury, and ventriculomegaly, the three major findings for the PT infant. For this parameter, the grading system for IVH of Papile et al.[29] will be used (table 1). In addition, because there is controversy surrounding the meaning of the periventricular echodensities routinely reported in US studies of PT infants,[28,30-32] injury to the PT white matter will include only periventricular cystic lesions.[114,115] There is a consensus in the field that the degree of ventriculomegaly (see table 1) predicts long-term neurodevelopmental outcome for PT infants studied at or near term.[33,34]

Correlation of US findings with neuropathologic data. Before reviewing data pertinent to the practice parameter questions, the committee reviewed the evidence correlating clinical US findings with neuropathologic data. In four class II studies[35-38] reporting results of a total of 87 autopsies performed on PT infants, US was 76% to 100% accurate in detecting grade 1 lesions of >5 mm and grade 3 and grade 4 hemorrhages (see the electronic version of this article for table 4 at www.neurology.org). Detection of grade 2 hemorrhages was much less accurate.

Correlation of US findings of cystic PVL with neuropathologic data was evaluated in three class II studies.[38-40] Each study found 100% correlation between US findings and neuropathologic data.

Which PT infants should undergo routine screening cranial US? Evidence. Seven class II studies evaluated the need for screening cranial US in low BW PT infants.[25,27,28,41-44] Review of these studies (table 2; see the electronic version of this article for table 5 at www.neurology.org) suggests that although cranial US of 12% to 51% of infants with BW of <1,500 grams or GA of <33 weeks shows some abnormalities in the first 2 weeks of life, major US abnormalities such as grades 3 and 4 IVH or bilateral cystic PVL occur in ≤20% of infants. Furthermore, more severe abnormalities occur in those infants with the lowest BW.

Because infants with grades 3 and 4 IVH are at considerable risk for metabolic abnormalities, posthemorrhagic hydrocephalus, and its sequelae (e.g., apnea and obtundation), such a, US finding would in all likelihood alter the infant's care and thus was considered clinically significant.[16] In addition, cystic PVL and ventriculomegaly are risk factors for CP. These US findings might not only provide critical prognostic information but also influence long-term care strategies. Therefore, it is important to determine which infants are at high risk for grades 3 and 4 IVH, cystic PVL, and/or ventriculomegaly.

In only four studies, the data were presented by specific GA and/or BW groups.[25,28,41,43] In these studies, grades 3 and 4 IVH was noted in 11% of infants with BW of <1,000 grams and in 5% of infants with BW of 1,000 to 1,250 grams; when infants were compared by GA groups, 16% of those with GA of ≤25 weeks and 1% to 2% of infants with GA of >25 weeks had grades 3 and 4 IVH (see the electronic version of this article for table 5 at www.neurology.org). Likewise, cystic PVL was noted in 5% to 26% of infants weighing <1,000 grams, compared with 1% to 5% of infants with BW of >1,000 grams. Ventriculomegaly was described in 5% to 7% of infants weighing <1,000 grams.Conclusions. Twelve percent to 51% of infants with BW of <1,500 grams and/or GA of 33 weeks have cranial US abnormalities (class II evidence). However, major abnormalities such as grades 3 and 4 IVH, cystic PVL, and ventriculomegaly, which might alter treatment or provide prognostic information, are considerably more common (20%–25%) in infants with GA of <30 weeks.

Recommendations (level B). Close to 25% of infants with GA of <30 weeks have significant cranial US abnormalities that trigger important changes in acute and long-term care. Therefore, routine screening cranial US should be performed on all infants with GA of <30 weeks.

When should screening cranial US be performed? Evidence. Multiple class II studies performed before 1990 suggested that >90% of all IVH cases in VLBW PT infants were detected during postnatal days 4 to 5.[45-48]

Data from recent class II studies are shown in table 2 (see the electronic version of this article for table 6 at www.neurology.org). In one study,[28] 248 infants with BW of <1,500 grams underwent regular US at predefined times (1–5 days, 10–14 days, 28 days, and term). Approximately 65% of IVH cases were detected within the first week. The other cases

Table 2 *Incidence and timing of ultrasound abnormalities in preterm infants*

Reference no.	Class	Inclusion criteria	US abnormalities, incidence (%)	Major abnormalities, incidence (%)	No. (%) of major abnormalities	Incidence of major abnormalities by GA or BW	Timing of major abnormalities, incidence (%)
41	II	BW, <1,500 g; GA, <34 wk	IVH, 50/250 (20)	Grades 3 and 4 IVH, 13/250 (5)	13 (5)	GA of <25 wk, 9/57 (16); GA of >25 wk, 4/193 (2)	
42	II	BW, <1,500 g; <33 wk	IVH and/or PVL, 245/338 (43)	Grades 3 and 4 IVH and/or cystic PVL, 75/338 (22)	75 (22)		d 1–3, 27/75 (36); d 4–7, 36/75 (48); d 8–14, 12/75 (16)
43	II	BW, <1500 g	PVL, 14/115 (12)			BW of <1000 g, 12/46 (26)	wk 1, 6/14 (43); wk 3–15, 8/14 (57)
25	II	GA, <32 wk; BW, <1,500 g; or GA, <37 wk with ventilator	IVH, 106/800 (13)	Grades 2–4 IVH, 51/800 (6)	51 (6)	GA of <30 wk, 46/364 (13); GA of >30 wk, 5/436 (1)	
27	II	GA, <33 wk	PVL, 26/172 (15)				wk 1, 19/26 (73); wk 2–7, 7/26 (27)
44	II	GA, <36 wk	PVL, 11/53 (21)				wk 1, 10/11 (91); wk 2, 1/11 (9)
28	II	BW, <1,500 g	IVH, PVL and/or VM, 161/317 (51)	Grades 3 and 4 IVH, PVL and/or VM, 40/317 (13)	40 (12.6)	BW of <1,000 g; 13/114 (11.4); BW of >1,000 g; 4/203 (2)	BW of <1,000 g; wk 1 (52) wk 2 (12); wk 4 (16); term (20)

BW = birth weight; GA = gestational age; wk = week; IVH = intraventricular hemorrhage; PVL = periventricular leukomalacia; VM = ventriculomegaly; d = day.

occurred in the second and third postnatal weeks, and one infant developed severe IVH after postnatal day 28. When BW was <1,000 grams, severe IVH was detected in 10 (77%) of 13 infants on days 1 to 5; 13 (100%) of 13 cases of severe IVH were detected on day 28.

In a study designed to assess changes in US findings across time,[42] 144 infants with BW of <1,500 grams or GA of <33 weeks underwent US between days 1 and 7 and then between days 10 and 14. Fifteen infants (10%) had significant changes in US findings from the first to the second scan. Thirteen infants whose first US showed normal results or grades 1 and 2 IVH were found to have major abnormalities (i.e., grades 3 and 4 IVH and/or PVL) at the time of the second scan. For two infants, US findings changed from a major abnormality during the first US (i.e., PVL) to either normal results or a minor abnormality (i.e., grade 2 IVH) during the second US.

Cystic PVL has been detected in infants without previous US abnormalities as late as postnatal day 104.[27,43,44] In one report,[28] cystic PVL and ventriculomegaly were found in 8 (3%) of 256 neonates after previously normal US findings. For infants weighing <1,000 grams, 3 (50%) of 6 cases of PVL were noted at 36 to 40 weeks' postmenstrual age.

Conclusions. The timing at which US can detect injury in the developing brain may be changing. Grades 3 and 4 IVH, which may alter medical management and prognostic information, may be detected as late as the third postnatal week. Cystic PVL and ventriculomegaly, which may alter prognosis and treatment programs, may be first seen by US at term. Furthermore, these lesions may be detected in many infants after previously normal US findings.

Recommendation (level B). Screening cranial US should be performed on all infants with GA of <30 weeks at 7 to 14 days of age and should be optimally repeated at 36 to 40 weeks' postmenstrual age. This recommendation is designed to detect both clinically unsuspected IVH, which may require additional clinical and/or radiologic monitoring and changes in management plans, and evidence for PVL and/or ventriculomegaly, which are useful for prognosis and best seen when the infants are examined at term.

Do abnormalities of screening cranial US for the PT infant require follow-up MRI either to obtain information for patient management or to provide long-term prognostic data? Evidence. Three recent class II studies (see the electronic version of this article for table 7 at www.neurology.org) compared results of cranial US and MRI performed during the newborn period for PT infants.[26,49,50] Maalouf et al.[26] performed paired MRI and US studies on the same day for 32 infants with GA of <30 weeks. US accurately detected the presence of germinal matrix, IVH, and parenchymal hemorrhage confirmed by MRI (positive predictive values of 0.8, 0.85, and 0.96, respectively). However, in this study and others,[49,50] white matter injury detected by MRI was less well predicted by US (sensitivity of 0.56–0.89). Additional information provided by MRI included depiction of hemorrhagic lesions in 64% of infants and more numerous or extensive cysts in infants with

PVL diagnosed by US.[50] To date, there has not been correlation with neurodevelopmental follow-up.

Conclusions. Compared with US performed on the same day, MRI of PT neonates detects more white matter abnormalities in the first week of life, more hemorrhagic lesions, and more numerous or extensive cysts. There are insufficient data from follow-up studies to indicate whether these additional findings provide more information about the neurodevelopmental prognosis.

Recommendation (level C). Currently, available data from class II studies do not provide sufficient evidence that routine MRI should be performed on all VLBW PT infants for whom results of screening cranial US are abnormal.

What is the ability of neonatal cranial US to predict long-term neurodevelopmental outcome for VLBW PT infants? Evidence. VLBW PT infants are at high risk for neurodevelopmental handicap. Depending on the GA of the cohort and the year of birth, the previously reported incidence of mental retardation and/or CP among PT infants ranged from 7% to almost 50%.[1,4,51,52] Further, the timing of cranial US used to predict outcome in the reported literature varied from the first 2 weeks of life through term. For this reason, the lesions reported and the predictive values for these lesions were difficult to compare. Finally, in several studies, children deemed excessively impaired were omitted from the follow-up assessments, and in many, the outcome measures were reported in broad categories. Therefore, it was difficult to assess the nature of CP or mental retardation across cohorts.

Only reports containing the following data were included: GA and/or BW of the study population, postmenstrual age of the "predictor" US when recorded, neurodevelopmental follow-up rate, age at assessment, and outcome variables.

The six class II studies[34,53-57] (see the electronic version of this article for table 8 at www.neurology.org) compared US findings with the incidence of CP for almost 2,250 VLBW PT children at ages 2 to 9 years. Significant associations between grade 4 IVH, PVL, and/or ventriculomegaly and CP were noted in all six studies. In the largest of these studies,[58] both grade 4 IVH and PVL were associated with CP (odds ratio [OR], 15.4; 95% CI, 7.6–31.1); any grade IVH alone was also associated with CP (OR, 3.14; 95% CI, 1.5–6.5). Similar data were available from one class III study and three class IV studies (see the electronic version of this article for table 8 at www.neurology.org).[59-62]

When the same groups from class II and class III studies[53-55,57-59,63,64] assessed the correlation of neonatal US findings with the developmental quotient, grade 4 IVH and moderate to severe ventriculomegaly were strongly associated with the risk of mental retardation at 2 to 9 years of age (see the electronic version of this article for table 8 at www.neurology.org). In these prospective studies, OR ranged from 9.97 to 19.0. In addition, Whitaker et al.[65] demonstrated that for infants with BW of 500 to 2,000 grams who had grade 4 IVH and/or moderate to severe ventriculomegaly, the OR for the development of any neuropsychiatric disorder at the age 6 years was 4.4.

Conclusions. Grades 3 and 4 IVH, cystic PVL, and moderate to severe ventriculomegaly determined by US have all been shown to be significantly associated with CP at 2 to 9 years of age in VLBW PT infants (class II evidence). In addition, class II evidence, grade 4 IVH, and ventriculomegaly have been significantly associated with mental retardation and neuropsychiatric disorders at the same time points. The OR, which vary depending on the population under study, the lesion, and the outcome measure, all indicate at least a 10-fold elevation in the risk of adverse outcome for VLBW PT infants with US evidence of grades 3 and 4 IVH, cystic PVL, and moderate to severe ventriculomegaly.

Recommendation (level A). For VLBW PT infants, US should be used to predict long-term neurodevelopmental outcome. The findings of grades 3 and 4 IVH, periventricular cystic lesions, and moderate to severe ventriculomegaly are all associated with adverse outcome.

Term infants with neonatal encephalopathy. Clinical examination of the term infant with signs and symptoms of neonatal encephalopathy is often unable to determine the severity or extent of cerebral damage and frequently provides little information regarding the etiology of the insult. Although numerous reports suggest that hypoxic–ischemic encephalopathy (HIE) is a common cause of neonatal encephalopathy, the differential diagnosis of this condition is extensive, including a spectrum of abnormalities ranging from infectious to metabolic abnormalities and congenital malformations.[66,67] Even in those infants with documented HIE, the clinical presentation may vary widely.[68] Of those neonates with moderate to severe HIE, almost one-quarter have mental retardation, seizures, and CP, and promising intervention strategies are now becoming available.[69-71] Therefore, for diagnostic and prognostic reasons, early assessment and diagnosis of infants with neonatal encephalopathy is important.

For the definition of neonatal encephalopathy, the committee used the criteria set forth by the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists in *Guidelines for Prenatal Care*.[72] For results of a study to be rated as class I evidence, infants described therein must meet all of the following conditions:

1. Profound metabolic or mixed acidemia (pH $<$ 7.00 [umbilical cord artery blood sample if obtained]).
2. Apgar score of 0 to 3 for $>$5 minutes.
3. Neonatal neurologic manifestations (e.g., seizures, coma, or hypotonia).
4. Multisystem organ dysfunction (e.g., cardiovascu-

lar, gastrointestinal, hematologic, pulmonary, or renal system).

Although these criteria were originally developed for those infants thought to have HIE, they also describe any infant who requires immediate neonatal evaluation—both to determine the underlying cause of encephalopathy and to provide therapeutic interventions, when available.[67,73,74] Studies in which the entry criteria of the infants evaluated were less rigorously defined received lower classification levels than did those in which infants met these conditions.

Which neonatal neuroimaging strategies can detect cerebral abnormalities that may affect the immediate and long-term management of the infant with neonatal encephalopathy? Evidence. One study discussed gray-scale US of the infant with neonatal encephalopathy.[75] A second study compared findings of gray-scale US and Doppler US with outcome,[76] and a third study compared results of gray-scale US and Doppler US with somatosensory evoked potentials, visual evoked potentials, and results of the cerebral function monitoring.[77] A fourth study compared findings of gray-scale US, Doppler US, and CT.[78] Three other studies compared results of gray-scale US and MRI for infants with neonatal encephalopathy.[79-81] Four studies reported CT findings for these infants.[82-85]

Gray-scale US, Doppler US, and studies comparing US with CT and/or MRI. In one class III study[75] (see the electronic version of this article for table 9 at www.neurology.org), US was performed on 104 encephalopathic term neonates and 70 control term neonates on the first postnatal day. A diffuse increase in echogenicity of the cerebral parenchyma and slit-like ventricles were significantly more common in infants with encephalopathy than in controls (39% versus 1% [$p < 0.001$] and 44% versus 9% [$p <$ 0.00l], respectively), but the investigators found no correlation between US findings on the first postnatal day and neurodevelopmental status at 1 year of age. Similar results were noted in a class II study evaluating term infants with neonatal encephalopathy on the first postnatal day.[76]

In the same class II study,[76] analysis of simultaneous Doppler US demonstrated resistive indices (resistive index = peak systolic velocity minus end diastolic velocity divided by peak systolic velocity) of <0.60 for all children with adverse neurodevelopmental outcome. In another class II study,[78] gray-scale US, Doppler US, and CT were performed on infants with neonatal encephalopathy (see the electronic version of this article for table 9 at www.neurology.org). Gray-scale US was not predictive of outcome, but a resistive index of ≤ 0.5 in the middle cerebral artery was associated with adverse neurodevelopmental outcome at 1 to 2 years (sensitivity, 82%; specificity, 89%). In addition, CT demonstrating generalized decreased density had 91% sensitivity and 100% specificity for adverse outcomes.

Three studies compared early US and MRI studies for infants with neonatal encephalopathy (see the electronic version of this article for table 9 at www.neurology.org).[79-81] An abnormal MRI signal in the basal ganglia in association with an abnormal US result for the basal ganglia was most frequently associated with an adverse neurodevelopmental outcome including CP, seizures, and developmental delay at 1 year of age, while normal findings of US and CT or US and MRI had low negative predictive values.

Conclusions. Seven studies (classes II and III) assessed the role of gray-scale US in the diagnosis of term infants with neonatal encephalopathy. Although gray-scale US can be easily performed at the bedside, there are little data to support the use of this modality in imaging of the encephalopathic term neonate. However, two class II studies of Doppler US suggested that resistive indices of $<0.5–0.6$ are consistent with the diagnosis of HIE.

CT studies. CT can be performed rapidly and without sedation of the neonate. Four studies used CT to evaluate term infants with neonatal encephalopathy. One study[84] reported basal ganglia changes; a second study[82] reported both basal ganglia and thalamic changes. Two studies[83,85] used CT to detect intracranial hemorrhages in infants with signs and symptoms of neonatal encephalopathy who also had low hematocrit or evidence of coagulopathy; in both studies, detection of intracranial hemorrhages altered clinical care.

Conclusions. One class II study and three class IV studies assessed the value of CT for encephalopathic term neonates. Two studies suggested that low attenuation in the basal ganglia and/or thalami indicates severe injury consistent with HIE. The other two studies demonstrated that CT plays a role in the detection of hemorrhagic lesions.

MRI studies. Two studies (see the electronic version of this article for table 9 at www.neurology.org) compared MRI findings with neuropathologic data for infants with neonatal encephalopathy believed attributable to HIE.[86,87] In the larger study,[87] imaging data were compared with results of neuropathologic analyses of the posterior limb of the internal capsule, thalamus, parietal cortex, hippocampus, and medulla. The posterior limb of the internal capsule was the most reliable region analyzed, and agreement of MRI findings was similar to that achieved by two pathologists reviewing the histologic sections ($\kappa = 0.66$). In this study, the MRI abnormality was predictive of the pathologic abnormality with a sensitivity of 0.70 and a positive predictive value of 1.0. The predictive value of a single MRI abnormality was 0.79 (95% CI, 0.61–0.96).

In eight class II studies (see the electronic version of this article for table 9 at www.neurology.org),[2,88-94] conventional T1- and T2-weighted MRI studies were performed for a total of 272 term neonates, most of whom were clinically suspected of having neonatal encephalopathy secondary to hypoxic–ischemic injury. Scans were obtained at ages ranging from 1 to 30 postnatal days, and the mean age range was 2 to

8 days. Three patterns of injury were detected by MRI: 1) injury to the thalami and/or posterior–lateral putamen with involvement of the subcortical white matter in the most severe injuries; 2) injury to the parasagittal gray matter and subcortical white matter, posteriorly typically more than anteriorly; and 3) focal or multifocal injury. Thalamic and basal ganglia damage was the most common abnormality reported. This pattern of injury was detected in almost 40% of infants and represented over one-half of all abnormalities (see the electronic version of this article for table 10 at www.neurology.org). In one class III study,[95] abnormal T1-weighted images showing hyperintensities in a characteristic distribution were demonstrated as early as 3 days after the injury; abnormal T2-weighted images showing hypointensities were demonstrated by 6 to 7 days.

Conclusions. Results of class II studies indicate that characteristic MR patterns of cerebral injury can be detected using conventional T1- and T2-weighted imaging sequences performed at mean ages of 2 to 8 days for encephalopathic term infants.

Diffusion weighted imaging. Studies of adult arterial infarcts have shown that DWI signal changes occur within minutes of symptom onset and hours before changes become apparent on T1- or T2-weighted images.[96] In one class II study[86] and four class III studies[97-100] that investigated the use of DWI in the evaluation of term neonates (see the electronic version of this article for table 11 at www.neurology.org), entrance criteria were not stated in enough detail to determine which infants met strict criteria for acute neonatal encephalopathy, and neonates with focal seizures were also included. MR studies were performed a mean of 2 to 4 days after birth, and DWI findings were compared with those of standard MRI sequences. Abnormal DWI results were reported for two-thirds of infants. For 7% to 58% of infants with abnormal DWI findings, T2- and/or T1-weighted images were also abnormal. Abnormal DWI results and normal T1- and/or T2- weighted images typically occurred when imaging was performed earlier than day 2 of life or when there was diffuse white matter involvement. Robertson et al.[99] described one patient for whom all imaging sequences including DWI and T1- and T2-weighted imaging sequences were normal when performed at 13 hours despite development of DWI and T1- and T2-weighted imaging abnormalities by 5 days. Robertson et al. also described one other patient for whom DWI results were normal at 8 days when T1- and T2-weighted images were abnormal; this decreased sensitivity of DWI in the subacute to chronic phase has also been noted for the adult population, suggesting that the maximum sensitivity of DWI is between 2 and 8 days.

Conclusions. Findings of one class II study and four class III studies suggest that DWI can provide evidence of cerebral injury before conventional MRI techniques for term infants with neonatal encephalopathy. However, DWI results may be negative if it is performed earlier than 24 hours of life or later than 8 days of life.

Proton MRS. A number of investigators have explored the utility of ^{1}H-MRS and 31P-MRS at field strengths of $\geq$1.5 T, but the recommendations for this parameter will be limited to ^{1}H-MRS at 1.5 T because this is the equipment most commonly available for neonatal imaging. All of the studies that evaluated ^{1}H-MRS at 1.5 T used single-voxel point resolved spectroscopy (PRESS) or stimulate echo acquisition mode (STEAM) MRS; although mutivoxel chemical shift imaging (CSI) allows high resolution evaluation of larger regions of tissue, there are no data at this time that assess the role of this modality in perinatal brain injury.

In a number of class II studies (see the electronic version of this article for table 12 at www.neurology.org), echo times of $\approx$136 msec and 272 msec were preferred over the shorter echo times of $\approx$36 msec because of the higher SD of metabolite concentrations measured at these shorter echo times.[20,93] An echo time of 136 msec has the additional advantage of an inverted lactate peak, making distinction from lipids (which can resonate in the same region) more accurate.

One class II study[101] used MRS at 1.5 T within the first 18 hours in 31 cases of suspected HIE and in 7 matched controls. Lactate/creatine ratios ranged from 0 to 0.6 (median, 0.05) for the seven controls. In contrast, the investigators demonstrated lactate/creatine ratios of $>$1.0 for 10 (32%) of the 31 infants with suspected HIE. In three additional class II studies,[93,102,103] proton MRS of the basal ganglia was performed within the first 2 weeks of life on 77 infants with neonatal encephalopathy. Elevated lactate/*N*-acetylaspartate ratios were the most consistent findings, although elevated lactate/creatine and lactate/choline ratios were also reported for infants with suspected neonatal encephalopathy.

Conclusions. Data from class II studies suggest that MRS can play an important role in the assessment of encephalopathic term infants. Lactate/creatine ratios of $>$1 in the first 18 hours are more common in those infants with later neurologic findings consistent with HIE. Elevated lactate/NAA, lactate/creatine, and lactate/choline ratios in the first 2 postnatal weeks are more common in infants with suspected neonatal encephalopathy than in age-matched controls.

Recommendations for diagnostic assessment.

1. For infants with a history of neonatal encephalopathy, significant birth trauma, and evidence for low hematocrit or coagulopathy:

a. Noncontrast CT should be performed to look for hemorrhage (level B).

b. If the CT findings cannot explain the clinical status of the neonate, MRI should be performed (level A).

2. For other neonates with acute encephalopathy:

a. MRI should be performed between days 2 and 8 of life (level A).

b. If single-voxel MRS is available, MRI should include MRS (level B).

c. At the time of MRI, DWI should also be performed if this modality is available (level C).

d. CT should be performed only if MRI is not available or if the neonate is too unstable for MRI (level A).

Can MRI provide prognostic data for term infants with neonatal encephalopathy? Evidence. Eight class II studies (table 3; see the electronic version of this article for table 9 at www.neurology.org) assessed the ability of conventional MRI performed between 2 and 8 days of age to predict neurodevelopmental handicap at postnatal ages of 12 to 24 months.[2,88-94] Although results of several studies suggested that abnormalities of the cerebral white matter are associated with adverse outcome in term infants with neonatal encephalopathy, 50% to 94% of infants with changes in the basal ganglia developed CP, mental retardation, and seizures at 1 to 2 years of age.[2,88,91,94] Barkovich et al.[89] correlated cognitive and motor outcome with timing of conventional MRI. Proton density MRI scans correlated best during the first 3 postnatal days, proton density and T1-weighted images correlated best during the first 7 postnatal days, and T2-weighted images correlated best after 7 to 8 postnatal days. Overall, proton density images during the first 7 postnatal days were the best predictor of outcome in this study.

Similarly, three studies using DWI (table 3; see the electronic version of this article for table 11 at www.neurology.org) performed at a mean age of 2 days in neonatal encephalopathy demonstrated a significantly elevated risk of adverse neurologic outcome, although the small sample sizes make predictions unreliable.[97-99]

Finally, review of the class II studies using proton MRS (table 3; see the electronic version of this article for table 12 at www.neurology.org) within the first 11 days of life demonstrated that lactate/creatine ratios of >1.0 and elevated lactate/NAA or lactate/choline ratios were highly predictive of adverse neurodevelopmental outcome at 1 to 2 years of age.[93,101-103] Infants with lactate/creatine ratios of >1.0 were found to have adverse neurodevelopmental outcome at 1 year of age (OR, 13.2; sensitivity, 66%; specificity, 95%; positive predictive value, 86%; negative predictive value, 88%).[101] Similarly, ele-

Table 3 *MRI studies of term neonatal encephalopathy*

Reference no.	Class	Number	Follow-up	Predictor study	Time study	Outcome measures	Age	Data
88	II	15	15/15	MRI	newborn	CP	1 yr	only BG predict CP (3/3)
102	II	31	31/31	MRS	newborn	CP, MR	1 yr	BG lac/CHO & lac/NAA associated with MR and/or CP $p < 0.003$ for all
90	II	25	25/25	MRI	>7 days	DQ	1 yr	6/6 N MRI—Normal 12 abn BG—12/12 MR/CP
117	III	16	16/16	MRS	d 18	exam	1 yr	no significant differences
101	II	31 HIE & 7N	31/31	MRS	newborn	CP, MR	1 yr	if Lac/creat >1.0, OR 13.2; sens 66%, spec 95%
97	II	26	26	DWI	newborn	exam	6 mo	abn DWI: 10/12 abn examN DWI: 12/14 N exam
98	II	4	4 of 4	DWI	d 2	exam	3–21 mo	abn DWI: 4/4 abn exam
91	II	43	43/43	MRI	d 6	MR, CP		abn BG predict CP or MR $p < 0.01$
2	II	52	52/52	MRI	d 8–30	head growth	1 yr	N MRI: 11/12 N outcome abn WM: 5/5 abn outcomeabn BG: 5/7 abn outcome
93	II	21	18/18 survivors 3 deaths	MRI/MRS	d 8	outcome	2 yrs	N MRI: 8/9 N; abn MRI: 5/11 abn; abn BG/MRI: 4/7 abn; Lac/NAA assoc with outcome $p < 0.05$
99	II	43	43/43	MRS	<1 mo	outcome	1 yr	lac/creat predict outcome $p = 0.001$
94	II	75	73/75	MRI	d 1–17	DQ	1 yr	abn BG: sens 90%; spec 100%
104	II	18 HIE & 3 N	14/14 survivors 4 deaths	MRI	d 6	outcome	1–2 yrs	Lac/NAA predict outcome $p = 0.05$

vated lactate/NAA and lactate/choline or lactate/creatine ratios in the region of the basal ganglia were significantly associated with CP and mental retardation ($p < 0.001$ for all studies).[102,103] In another report, abnormalities of NAA/creatine, NAA/choline, and choline/creatine ratios in the occipital gray/parietal white matter regions were predictive of adverse outcome at a mean age of 15 months in infants with HIE.[104] Positive predictive values for abnormal neurodevelopmental outcome based on these metabolites were 0.64, 0.68, and 0.75 for values >2 SD from those of controls.

Conclusions. Class II MRI studies demonstrated that the incidence of neurodevelopmental handicap among those infants with abnormalities of the thalami and basal ganglia at mean postnatal ages of 2 to 8 days is significant at 1 to 2 years of age. Limited and predominantly class III DWI evidence demonstrates abnormalities in infants with neonatal encephalopathy at a time when results of conventional MRI are normal. Class II studies of proton MRS performed within the first 8 postnatal days also suggest good to excellent predictive values for this measure for neurodevelopmental outcome at 1 to 2 years of age.

Recommendation. MRI should be performed within the first 2 to 8 days of life to provide predictive data for neurodevelopmental outcome in encephalopathic term infants (level A). DWI (level C) and MRS (level B), when available, should also be performed within the first 2 to 8 days to provide additional prognostic data concerning neurodevelopmental outcome.

Future directions. As the number of infants cared for in neonatal intensive care units grows and survival statistics steadily increase, neuroimaging has become critical technology. Imaging of the developing brain is no longer a research goal; it has become clinically relevant. Neuroimaging can provide diagnostic information but also data used for clinical decision making as well as information on treatment efficacy and prognosis. This becomes particularly important in the anticipation of potential preventive, protective, and rehabilitative strategies for the management of critically ill newborn infants.

Several ongoing clinical trials are assessing the impact of neuroprotective strategies on long-term neurodevelopmental outcome.[105] For these studies, neuroimaging is critical—not only to provide diagnostic entry criteria but also to assess the effect of the intervention and to provide prognostic neurologic information.

Two sets of difficulties must be overcome to more fully incorporate neuroimaging into the newborn intensive care unit. MRI holds great promise; however, this imaging modality and others that may be soon developed must become more infant friendly, and imaging strategies should be developed to provide maximum information in minimum time. This would include the following: improved magnet technology that would allow easy placement of affordable MRI devices in newborn intensive care units, software and hardware advances that would minimize imaging time and allow DWI and/or MRS sequences to be easily performed on critically ill neonates, and MRI-compatible devices that improve our ability to monitor and maintain critically ill neonates. Further, it is important that results of these imaging studies, including processed DWI and MRI data, be available immediately for viewing by all involved specialties.

To provide more accurate information, these MR techniques must be optimized and standardized in terms of types of sequence, parameters for each imaging sequence, regions of brain evaluated, and timing of evaluations. Prospective imaging studies with centralized, blinded readers and well-defined cohorts of infants and matched controls should be performed to determine accurate diagnostic criteria. Similarly, prognostic data can be determined only from blinded standardized follow-up assessments of all infants imaged by the modality under study.

Although there is some recent control data on DWI for neonates,[106,107] the numbers of patients studied are small. There is also a strong need for MRS control data for neonates. For both of these modalities, serial studies are generally lacking, and the impact of timing of the study and regional variation on its result remains unknown. For example, although elevated lactate/NAA, lactate/creatine, and lactate/choline ratios are reported to be more common for infants with suspected HIE, more studies are required to determine the upper limits of these ratios for the normal population at various postnatal ages and to determine the sensitivity, specificity, and predictive values of these ratios. Studies are also needed to determine not only the optimal timing of DWI and MRS evaluation for term infants with neonatal encephalopathy but also the optimal region for investigation for MRS. Long-term follow-up data on the disability rate are of critical importance. Control data, timing studies, neuropathologic correlations, and ultimately outcome assessments are also needed before MRI becomes the standard of care for the VLBW PT neonate. MRS and DWI for this age group have the potential to provide much needed information concerning the timing of white matter injury in the developing brain and may lead to injury-specific interventions.[108]

Preliminary studies suggest that the more aggressive and timely use of advanced structural and functional prenatal imaging techniques to detect and characterize abnormalities may allow intervention to prevent postnatal neurologic morbidity and mortality.[109,110] Prenatal imaging may provide information for consideration of corrective prenatal surgical or medical interventions where appropriate and can assist with the planning of surgical or medical interventions in the intrapartum and postpartum periods. Therefore, studies that correlate prenatal US and MRI findings with results of postnatal neuroimaging and outcome are needed.

Near infrared spectroscopy, nuclear medicine (SPECT and PET), and fMRI are other major imaging technologies not discussed in this parameter because of lack of data; these technologies are under evaluation for use in the assessment of the developing brain.[111-115] The challenge is to develop and implement effective applications of these advanced neuroimaging techniques and to perform studies evaluating their diagnostic and predictive ability. As evidence becomes available,[116] it must be reviewed on a regular basis, and the practice parameter must be modified accordingly.

Disclaimer. This statement is provided as an educational service of the American Academy of Neurology and the Child Neurology Society. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The American Academy of Neurology and the Child Neurology Society recognize that specific patient care decisions are the prerogative of the family and the physician caring for the patient.

Appendix 1

Professional Organizations Represented: American Academy of Pediatrics, American Academy of Neurology, American Society of Pediatric Neuroradiology, Child Neurology Society, Society for Pediatric Radiology.

AAN Quality Standards Subcommittee Members: Gary Franklin, MD, MPH (Co-Chair); Catherine Zahn, MD (Co-Chair); Milton Alter, MD, PhD (ex-officio); Stephen Ashwal, MD; Rose M. Dotson, MD; Richard M. Dubinsky, MD; Jacqueline French, MD; Gary H. Friday, MD; Michael Glantz, MD; Gary Gronseth, MD; Deborah Hirtz, MD (facilitator); Robert G. Miller, MD; David J. Thurman, MD, MPH; and William Weiner, MD.

CNS Practice Committee Members: Carmela Tardo, MD (Chair); Bruce Cohen, MD (Vice-Chair); Elias Chalhub, MD; Roy Elterman, MD; Murray Engel, MD; Bhuwan P. Garg, MD; Brian Grabert, MD; Annette Grefe, MD; Michael Goldstein, MD; David Griesemer, MD; Betty Koo, MD; Edward Kovnar, MD; Leslie Anne Morrison, MD; Colette Parker, MD; Ben Renfroe, MD; Anthony Riela, MD; Michael Shevell, MD; Shlomo Shinnar, MD; Gerald Silverboard, MD; Russell Snyder, MD; Dean Timmns, MD; Greg Yim, MD; Mary Anne Whelan, MD.

Appendix 2

Definitions for classification of diagnostic evidence

Class I: Evidence provided by a prospective study in a broad spectrum of persons with the suspected condition, using a "gold standard" for case definition, where test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy.

Class II: Evidence provided by a prospective study of a narrow spectrum of persons with the suspected condition, or a well designed retrospective study of a broad spectrum of persons with an established condition (by "gold standard") compared to a broad spectrum of controls, where test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy.

Class III: Evidence provided by a retrospective study where either persons with the established condition or controls are of a narrow spectrum, and where test is applied in a blinded evaluation.

Class IV: Any design where test is not applied in blinded evaluation OR evidence provided by expert opinion alone or in descriptive case series (without controls).

Definitions for classification of prognostic evidence

Class I: Evidence provided by a prospective study of a broad spectrum of persons who may be at risk for developing the outcome (e.g., target disease, work status). The study measures the predictive ability using an independent gold standard for case definition. The predictor is measured in an evaluation that is masked to clinical presentation and the outcome is measured in an evaluation that is masked to the presence of the predictor.

Class II: Evidence provided by a prospective study of a narrow spectrum of persons who may be at risk for developing the outcome, or by a retrospective study of a broad spectrum of persons with the outcome compared to a broad spectrum of controls. The study measures the predictive ability using an acceptable independent gold standard for case definition. The risk factor is measured in an evaluation that is masked to the outcome.

Class III: Evidence provided by a retrospective study where either the persons with the condition or the controls are of a narrow spectrum. The study measures the predictive ability using an acceptable independent gold standard for case definition. The risk factor is measured in an evaluation that is masked to the outcome.

Class IV: Any design where the predictor is not applied in a masked evaluation OR evidence provided by expert opinion or case series without controls.

Appendix 3

Definitions for strength of recommendations

Level A: Established as useful/predictive or not useful/predictive for the given condition in the specified population (requires at least one convincing class I study or at least two consistent, convincing class II studies).

Level B: Probably useful/predictive or not useful/predictive for the given condition in the specified population (requires at least one convincing class II study or at least three consistent class III studies).

Level C: Possibly useful/predictive or not useful/predictive for the given condition in the specified population (requires at least two convincing and consistent class III studies).

Level U: Data inadequate or conflicting. Given current knowledge, test/predictor is unproven.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Psychosocial Aspects of Child and Family Health

The New Morbidity Revisited: A Renewed Commitment to the Psychosocial Aspects of Pediatric Care

ABSTRACT. In 1993, the American Academy of Pediatrics adopted the policy statement "The Pediatrician and the 'New Morbidity.'" Since then, social difficulties, behavioral problems, and developmental difficulties have become a main part of the scope of pediatric practice, and recognition of the importance of these areas has increased. This statement reaffirms the Academy's commitment to prevention, early detection, and management of behavioral, developmental, and social problems as a focus in pediatric practice.

ABBREVIATIONS. AAP, American Academy of Pediatrics; *DSM-PC, Diagnostic and Statistical Manual for Primary Care.*

ONCE A NEW MORBIDITY

In 1991, the American Academy of Pediatrics (AAP) Task Force on the Future Role of the Pediatrician in the Delivery of Health Care made reference to the 1800s, when pediatrics developed as a medical specialty. "A focus on growth and development was established rapidly, and it was recognized that the child's health was influenced greatly by family attitudes, environment, and socioeconomic class."[1] Thus, the concept of morbidity associated with environmental and psychosocial issues in child health care is not new. Social and behavioral issues were recognized by the early leaders in pediatrics, and the style in which they are addressed constitutes the art of pediatric practice. Carl C. Fischer spoke in 1969 about the role of the AAP in child health care: "The founding fathers, in their wisdom, established the major objective of the Academy, which is to foster and stimulate interest in pediatrics and correlate all aspects of the work for the welfare of children which properly comes within the scope of pediatrics."[2]

Public health initiatives, such as immunizations and improved public hygiene, and specific treatments with new technologies for disease, equip pediatricians at the beginning of this century with the ability to offer prevention, cure, and resolution of ailments and injuries, now a standard expectation of pediatric practice. These advances have led to an emphasis on specialization as an essential component of training for the care of patients. Pediatricians are now challenged to place more attention on activities related to the quality of outcomes, chronic disease management, and the psychosocial consequences of chronic conditions as the behavioral needs of our patients are now recognized as core elements of pediatric care.

THE CURRENT ENVIRONMENT

Although dealing with social, developmental, and behavioral issues may once have been considered an art, advances in the social sciences have established a knowledge base of specific skills and interventions effective in dealing with many psychosocial issues.[3,4] For example, there is a better understanding of long-term consequences of divorce,[5] child sexual abuse,[6] and the ongoing effects of attention-deficit/hyperactivity disorder into adulthood.[7,8] The field of pediatric psychopharmacology has been rapidly evolving over the past decade with the introduction of new medications such as selective serotonin reuptake inhibitors and atypical antipsychotics.[9,10] The practicing pediatrician must have a broader knowledge base to identify these problems and intervene and has a responsibility to become knowledgeable about approaches that work.

When this topic was last reviewed,[11] the new morbidities in pediatric practice demanded competence in the following areas of knowledge:

- physical and environmental factors affecting behavior, including risk factors, and their impact, prevention, and management;
- normal variations of behavior and emotional development and how to help parents deal with them;
- behaviors affecting physical health, including risk factors (eg, medical adherence, smoking), and their impact, prevention, and management;
- mild and moderate behavioral problems, including detection, evaluation, and management; and
- severe behavioral deviations, including recognition, preliminary evaluation, and appropriate referral.

These morbidities remain important foci in the care of children and families. The purpose of this statement is to reaffirm the commitment of the AAP to prevention, early detection, and management of behavioral, developmental, and social problems as a focus in pediatric practice.

NEWER MORBIDITIES

Now an increasingly complex environment brings newer morbidities to the attention of pediatric practitioners, such as:

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

- school problems, including learning disabilities and attention difficulties;
- child and adolescent mood and anxiety disorders;
- the alarming increase in adolescent suicide and homicide;
- firearms in the home;
- school violence;
- drug and alcohol abuse;
- human immunodeficiency virus and acquired immunodeficiency syndrome; and
- the effects of media on violence, obesity, and sexual activity.

These are the morbidities that place our patients at risk. The mortality of meningococcemia is appreciated by all pediatricians, but the morbidity of depression and the mortality of adolescent suicide are more appreciable.[12–14] In other words, after infancy, children in the United States are more likely to die from injuries or violence and suicide than from infectious disease.

In addition, pediatricians are challenged in their practices by aspects that relate to quality of life, social justice, equality in health care access, population and public health, and personal and institutional values, including but not limited to:

- poverty;
- homelessness;
- single-parent families;
- the effects of parental divorce on children;
- the struggles of working parents; and
- issues of child care policy and quality.

Pediatricians' creativity, flexibility, patience, and commitment are being challenged in ways that test the very original motivations for choosing pediatrics as a profession and vocation.

THE BARRIERS

If we embrace the importance of these morbidities, how will we meet these challenges? Why has a good idea not taken hold? Why do disciplines struggle over the conceptualization of these problems and implementation of effective treatments? To practice effectively in this arena, pediatricians must overcome existing educational, economic, and time management obstacles.

THE PATH TOWARD CHANGE

The pediatrician's professional competence and job satisfaction in managing behavioral issues can be enhanced by several changes.

Training and Continuing Medical Education

Pediatric residency training is largely focused on major physical illness in tertiary care hospitals and, to a limited degree, on behavioral issues. Limited training opportunities are provided to integrate psychosocial issues into primary care.

Training in ambulatory settings must expand the emphasis on behavioral, developmental, and psychologic issues. More extensive developmental, behavioral, and adolescent training during residency will better equip pediatricians to address these practice challenges. The experience must be supervised by faculty with training and/or experience in the behavioral/developmental aspects of pediatrics.[15]

Continuing medical education training in the areas of developmental and behavioral pediatrics are now provided by the AAP and other sources.

Improving Diagnostic Skills

The *Diagnostic and Statistical Manual for Primary Care* (*DSM-PC*) *Child and Adolescent Version*[16] describes the full range of psychosocial and behavioral problems encountered by pediatricians, from normal variant behavior through problem behaviors, to syndromic or diagnosable levels. The *DSM-PC* classification of coding of mental conditions in children allows for early identification and enhances the understanding and management of a broader range of psychosocial issues in pediatrics. The *DSM-PC* describes problems intrinsic to the child and situational diagnoses that complicate a child's function. The *DSM-PC* is an essential part of the primary care pediatrician's library, providing accurate and appropriate diagnoses and allowing the documentation of services provided and claims submissions for appropriate reimbursement.

Improving Interviewing Skills

Interviewing skills are essential to all aspects of medicine. There is a need to better learn how to elicit information, including using a narrative interview approach, allowing the child, adolescent, and parents to tell their stories, even when it means giving up control of the interview. There is a need to effectively communicate empathy. Pediatricians also need to recognize their own experience, culture, and values and the impact of their personal issues on the therapeutic relationship. As a skill to be learned, interviewing needs to include supervised practice and feedback as well as mentoring. Formalized and tested screening tools are available to cast a wider net to screening. Many practices develop their own questionnaires to assist in screening and in the interviewing process. Internet-based screening tools are also available to facilitate referral to community mental health services and to improve access.[17]

Improving Pediatric Counseling Skills

Counseling is a skill that is underused in the management of behavioral problems. With a combined knowledge of psychosocial issues, interviewing skills, and diagnostic understanding, pediatricians can effectively counsel patients and families and improve many of the behavioral problems they encounter at early stages of their presentation.

Establishing a Comprehensive Mental Health Model

A collaborative model that integrates physical and mental issues, considers positive and negative aspects of child and family adjustment, and encourages the clinician to make behavioral diagnostic judgments is also important. Strong consideration should be given to an interdisciplinary approach in the ambulatory clinical setting with mental health professionals and physicians working side by side.[18] Col-

laborative approaches can also be created for smaller practices where on-site mental health professionals are not available.

Allocating Time Realistically

Child health supervision visits are effective for detecting abnormalities and preventing illness. When psychosocial issues are detected during such a visit, there may be insufficient time to address the problems adequately. Although developmental issues reflecting normal variations may be managed within the context of health supervision visits, more complex issues, such as divorce, bereavement, school failure, domestic violence, or homosexuality, require additional visits with ample time to discuss the problem. The individual skill level of the pediatrician will determine the complexity of psychosocial issues that he or she can manage effectively.

Ensuring Adequate Reimbursement

Pediatricians must advocate for themselves in their individual practices and for the practice of pediatrics at large by negotiating managed care and fee-for-service contracts with third party payers that ensure reimbursement for excess services provided and by advocating for the mandatory inclusion of benefits for these services in families' insurance contracts, both public and private.

CONCLUSION

The "new morbidity" represents a shift in the understanding of what impacts the health of children and families. Pediatricians witness complex psychosocial family issues and care for the patients impacted by them; understanding and addressing these issues will make the pediatrician more effective in serving children and families. The cooperation of pediatric residency directors, educators, practicing pediatricians, and developmental and behavioral pediatricians will be required for training residents and experienced pediatricians. To effectively address these new morbidities, pediatricians will need a model that encompasses expanded areas of competence in child behavior, development, and family function.

RECOMMENDATIONS

1. Residency training programs should reflect in their curricula psychosocial issues that affect children and their families.
2. Practicing pediatricians are encouraged to increase their knowledge of developmental and behavioral aspects of child health care.
3. Pediatricians should develop an increased understanding of positive and negative factors that influence child psychosocial development.
4. Pediatricians should enhance their interviewing, counseling, and referral skills to better address psychosocial aspects of child and family health care.
5. Pediatricians are strongly encouraged to establish side-by-side practice with mental health professionals to address more complex psychosocial issues encountered in clinical practice.
6. Pediatricians are strongly encouraged to use *DSM-PC* coding to convey to insurance companies and health financing institutions the importance and value of pediatricians spending time addressing psychosocial issues.
7. The pediatrician should become familiar with mental health referral processes and community resources in the mental health field to ensure access and continuity of services.
8. Pediatricians should advocate for children's mental health needs within their professional communities and the education system, as well as among legislators.
9. Pediatricians should enhance their understanding of the newer psychotropic medications and establish collaborative working relationships with child and adolescent psychiatrists.

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CLINICAL REPORT

Newborn Screening Expands: Recommendations for Pediatricians and Medical Homes—Implications for the System

Guidance for the Clinician in Rendering Pediatric Care

Newborn Screening Authoring Committee

ABSTRACT

Advances in newborn screening technology, coupled with recent advances in the diagnosis and treatment of rare but serious congenital conditions that affect newborn infants, provide increased opportunities for positively affecting the lives of children and their families. These advantages also pose new challenges to primary care pediatricians, both educationally and in response to the management of affected infants. Primary care pediatricians require immediate access to clinical and diagnostic information and guidance and have a proactive role to play in supporting the performance of the newborn screening system. Primary care pediatricians must develop office policies and procedures to ensure that newborn screening is conducted and that results are transmitted to them in a timely fashion; they must also develop strategies to use should these systems fail. In addition, collaboration with local, state, and national partners is essential for promoting actions and policies that will optimize the function of the newborn screening systems and ensure that families receive the full benefit of them.

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Key Words
newborn screening, genetic disorders, children with special health care needs, medical home

Abbreviations
AAP—American Academy of Pediatrics
ACMG—American College of Medical Genetics
ACHDGDNC—Advisory Committee on Heritable Disorders and Genetic Diseases in Newborns and Children
MCHB—Maternal Child Health Bureau
HRSA—Health Resources and Services Administration
PCP—primary care pediatrician
CPT—*Current Procedural Terminology*
ACOG—American College of Obstetricians and Gynecologists
SNSAC—state newborn screening advisory committee

INTRODUCTION

> It's another busy day in pediatric practice, even before you receive the telephone call from the state newborn screening program. One of your newborn patients has an out-of-range result* on the screen for a rare but serious congenital condition. "Now what?" you wonder, as you begin to take down the notes. What additional testing is needed? What is the treatment regimen, and when does it begin? What do you tell the parents? And, what do you do about the rest of your schedule?

In the past decade, new technologies have led to a rapid expansion in the number of congenital conditions that are targeted in state newborn screening programs. As newborn screening programs expand, the likelihood increases that individual pediatricians will one day receive an out-of-range screening result for an unfamiliar congenital condition for one of their patients.

In 2005, the American Academy of Pediatrics (AAP) endorsed a report from the American College of Medical Genetics (ACMG), which recommended that all states screen newborn infants for a core panel of 29 treatable congenital conditions and an additional 25 conditions that may be detected by screening (Appendix 1).[1] The Secretary of Health and Human Services' Advisory Committee on Heritable Disorders and Genetic Diseases in Newborns and Children (ACHDGDNC)† also adopted that report. Some states are now screening for more than 50 congenital conditions, many of which are rare and unfamiliar to pediatricians and other

*A note about language: although physicians often think of screening results as being "normal/abnormal" or "negative/positive," laboratories use the more specific language of "in range" and "out of range" to report results. We felt that it was appropriate to use and promote this language for the sake of clarity and consistency. For ease of reading, we use "parent" as a generic term to connote the adult who is responsible for a child's health care; we recognize that adults other than the biological parent may serve in this role. Where implications of congenital disorders are discussed, these obviously affect only those persons who are related biologically. In some circumstances, a primary care physician may suggest that the biological parent be contacted regarding congenital conditions, even if that parent is not the current primary caregiver for the child.

†A federal advisory committee to the Secretary of Health and Human Services, the ACHDGDNC advises and guides the Secretary regarding the most appropriate application of universal newborn screening tests, technologies, policies, guidelines, and programs for effectively reducing morbidity and mortality in newborns and children having or being at risk for heritable disorders.

primary health care professionals. In the foreseeable future, screening programs will likely adopt screening technologies that will further expand the number of conditions screened and tests offered.

The ACMG, with the support of the Health Resources and Services Administration (HRSA) Maternal and Child Health Bureau (MCHB), has developed and maintains Web-based resources it calls action (ACT) sheets to guide pediatricians through preliminary responses to out-of-range newborn screening results. These brief reference resources provide a focused, single-page summary of differential diagnoses, descriptions of the condition, actions to be taken by the pediatrician, diagnostic evaluation, clinical considerations, reporting requirements, and links to additional resources. ACT sheets are designed to be supplemented by state-specific information regarding referral resources. Many state-program Web sites have additional program-specific educational information; links to these program Web sites are readily accessible through an interactive map maintained by the National Newborn Screening and Genetics Resource Center (http://genes-r-us.uthscsa.edu/resources/consumer/statemap.htm).

Advances in newborn screening technologies and the availability of resources such as ACT sheets are aimed at improving health outcomes for affected children. To optimize this potential, primary care pediatricians (PCPs) must effectively engage the newborn screening program in their state. PCPs who treat patients who routinely cross state borders for care will likely engage multiple newborn screening programs.

The primary goals of this statement are to:

- delineate the responsibilities of PCPs and pediatric medical subspecialists within the newborn screening program;
- introduce 2 algorithms that, together, outline a clear and efficient pathway through the process of fulfilling those responsibilities; and
- outline resources that will support PCPs in addressing these responsibilities.

In addition to these primary goals, this statement addresses the steps that individual PCPs and practices must take to prepare for these responsibilities. We also recognize the significant roles other health care professionals and agencies have on the newborn screening system and identify ways these other entities can support PCPs and improve newborn screening and, therefore, advance improved health outcomes for newborns across the nation.

Limitations of This Statement

State newborn screening systems vary in their specific structure, procedures, and practices; this statement is focused on the core elements that are common to most state newborn screening systems. Newborn screening is increasingly being offered by commercial laboratories that market directly to parents and pediatric health care professionals. These programs introduce another layer of variation, which is beyond the scope of this statement.

Adequate funding of all aspects of newborn screening systems is necessary to ensure optimal performance of the system. This statement includes some general recommendations to promote such funding, and the AAP supports efforts to address financing for the nation's newborn screening systems and their constituent parts. Detailed recommendations for addressing the myriad challenges of system financing lie beyond the purview of this document.‡

Limitations of Newborn Screening

It is important to emphasize that newborn screening panels do not include all possible congenital conditions, and results for conditions on the panel should not be considered diagnostic. Thus, an in-range newborn screening result does not eliminate the possibility that a clinically symptomatic child has a congenital condition. Congenital conditions must be considered whenever an infant has signs or symptoms that are suggestive of (or consistent with) one of the disorders that can be detected by newborn screening.

An important goal of newborn screening is to identify infants with treatable congenital conditions before they become symptomatic. However, clinicians who care for children must be aware that some screened conditions may present with clinical deterioration before notification of newborn screening results. Pediatricians and emergency care physicians are often among the first health care professionals to encounter symptomatic infants, so they should be knowledgeable about the newborn screening program, ACT sheets for suspected conditions, and local or regional pediatric medical subspecialists to whom infants can be referred. The state newborn screening program usually can provide information about suspected conditions and expedite the newborn's follow-up confirmatory testing and care.

THE ALGORITHMS

The PCP plays several significant roles in the newborn screening system. In addition to responding to out-of-range newborn screening results, the PCP serves as a central source of education for parents regarding multiple aspects of the newborn screening system; the PCP also has responsibility for ensuring that newborn screening has been conducted, which can include providing education and encouragement to parents who decline screening. Finally, the PCP must ensure coordinated and comprehensive care for children affected by congenital conditions that are identified through newborn screening. The medical home provides a model for such care; the algorithms presented here address the specific roles of a medical home provider within the newborn screening system (Figs 1 and 2).

3- to 5-Day-Old Visit

The AAP[2] and *Bright Futures*[3] recommend neonatal follow-up visits in a child's medical home shortly after

‡For guidance on the *Current Procedural Terminology* (CPT) codes appropriate for use in the care of children who are identified as having congenital disorders, PCPs should refer to Rappo MA, Rappo PD. A special issue: coding for children with special health care needs. *AAP Pediatric Coding Newsletter*. January 2007. Available at: http://coding.aap.org/newsletterarchive.aspx.

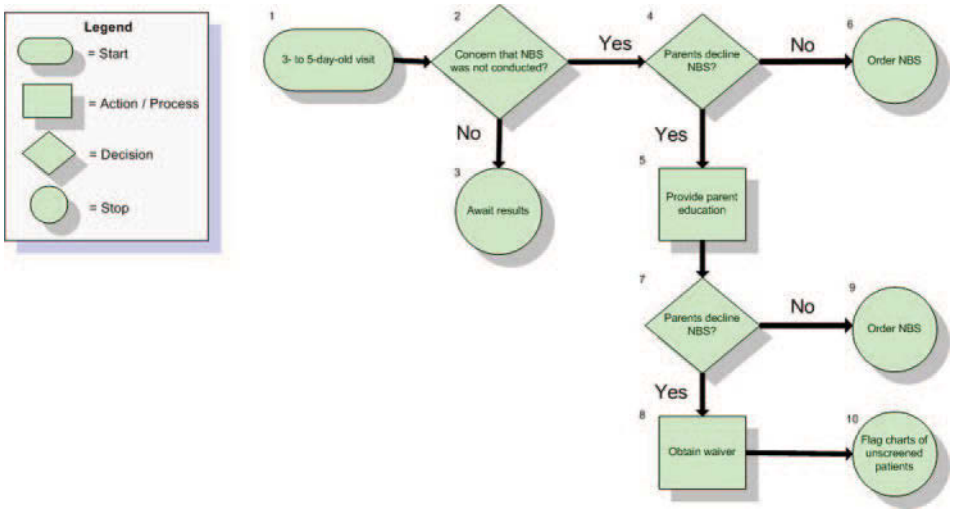


FIGURE 1
Algorithm 1. NBS indicates newborn screening program (see Appendix 2).

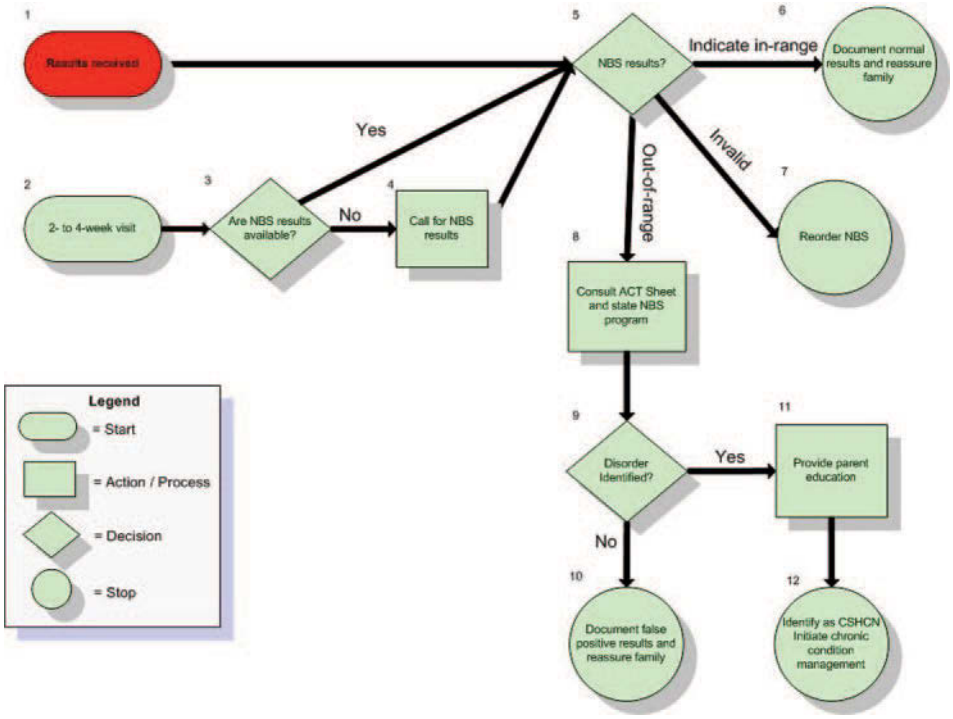
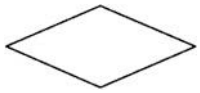


FIGURE 2
Algorithm 2. NBS indicates newborn screening program; CSHCN, child with special health care needs (see Appendix 3).

hospital discharge (3 to 5 days of life) and again by 1 month of age to ensure adequate weight gain, resolve neonatal concerns such as hyperbilirubinemia, and address parental questions. At the 3- to 5-day-old visit, the PCP should check for circumstances suggesting that newborn screening might not have been conducted.



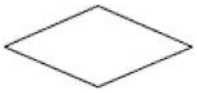
Concern That Newborn Screening Was Not Conducted?

In most cases, newborn screening will occur as a result of standing orders at a hospital or birthing facility. In these cases, the PCP can address other aspects of the visit.

There are circumstances, however, under which the PCP might have cause for concern that the newborn screening was not performed. These circumstances include, but are not limited to, home births, emergency births, hospital transfers, and international adoption. In

addition, although most states mandate newborn screening, most jurisdictions provide parents with the right of refusal (see "Parents Decline Newborn Screening?").

If available discharge papers do not indicate that the newborn screening has been performed, the PCP should make arrangements for specimen acquisition.



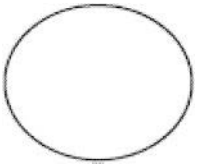
Parents Decline Newborn Screening?

If parental refusal is the reason that newborn screening has not been conducted, or if parents refuse newborn screening suggested by the PCP, the PCP should discuss the possible implications of nontesting and supply the parents with printed materials on newborn screening. Educational materials for parents and PCPs can be accessed through the AAP Web site (www.medicalhomeinfo.org/screening/newborn.html).

Provide Parent Education

Parent concerns and questions should be addressed fully, and a discussion of the general benefits and limited risks of newborn screening is recommended. More familiar conditions, such as congenital hearing loss, phenylketonuria, and sickle cell disease, may be used as examples.

If parental permission is obtained, arrangements for specimen acquisition should be made immediately, and newborn screening should be ordered.

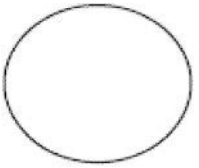


Order Newborn Screening

Newborn screening is conducted through the state newborn screening program, and protocols for ordering the screening vary by state. Contact information for each state's newborn screening program is available (see Appendix 4 and http://genes-r-us.uthscsa.edu/resources/consumer/statemap.htm).

Obtain Waiver

If parental permission is not obtained, parents or guardians should be asked to sign a waiver that documents their decision to decline newborn screening. In many cases, parents already will have signed a waiver at the hospital. PCPs should document the additional conversation and the parents' decision in the patient's chart and may wish to include a waiver signed in the PCP's office. A sample waiver form is included as Appendix 5; appropriate waiver forms should also be available through the state health department.



Flag the Charts of Unscreened Patients

In addition to documenting the discussion of newborn screening and the parents' refusal to consent to the screening, PCPs should flag the chart of any patients who are not screened so that the lack of screening will be taken into account should any subsequent concerns emerge regarding the child's growth or development. Vomiting, poor growth, seizures, developmental delay, lethargy, recurrent pneumonia, or poor feeding should prompt an evaluation that includes consideration of heritable conditions.

The chart note should also prompt the pediatrician to return to the question of newborn screening on subsequent visits to determine if the parents have changed their minds. The usefulness of screening after the neonatal period varies by condition, and use of state newborn screening systems for older infants varies by program.

Special Circumstances

For cases in which newborn screening is delayed because of previous parental refusal, because the infant was receiving total parenteral nutrition, or because of circumstances such as international adoption or an older infant entering care, the PCP should consult with the state newborn screening program regarding the availability and usefulness of the newborn screening protocol.

Newborn screening may not be ordered or may require an additional specimen in the case of preterm births, transfusion before screening, and other circumstances.[4] In these cases, the PCP should consult with a neonatal specialist.

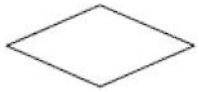
In every circumstance, until and unless newborn screening is conducted, the patient's chart should be flagged to ensure that the lack of newborn screening is considered during ongoing care.

Results Received

In the case of an invalid or out-of-range screening result, the pediatrician identified on the newborn screening card should be called by the state newborn screening program in accordance with the urgency of the need for clinical intervention. In-range results are often transmitted by mail and should arrive before the 2- to 4-week visit.

2- to 4-Week Visit

The PCP cannot assume a "no news is good news" approach with regard to newborn screening. Delays or procedural failures at hospitals, state laboratories, other facilities, or within the newborn screening program may result in late or lost results. An infant's medical follow-up may not occur as planned, or newborn screening results may go directly to the child's birth facility instead of the infant's medical home.



Are Newborn Screening Results Available?

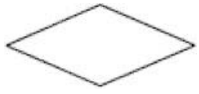
Office staff should check routinely for newborn screening results before the 2- to 4-week visit and pursue missing results before the visit. Using electronic-chart prompts or paper-chart templates for newborn visits will remind office staff to seek out newborn screening results.

Call for Newborn Screening Results

If newborn screening results are not available before the 2- to 4-week visit, the PCP should contact the state newborn screening program or the birthing facility for the results. An increasing number of state newborn screening programs have automated interactive telephone- or Internet-based systems through which pediatric offices can check for newborn screening results at any time.

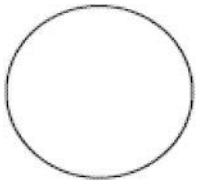
Special Circumstances

Occasionally, newborn screening results may be sent to the nonprimary physician; a physician who provides hospital or perinatal care for the infant may be noted on the newborn screening card even if he or she is not the infant's medical home physician. Clerical or other errors also may result in a physician who is unconnected to the child receiving the newborn screening results. However, the name on the card implies responsibility for the results, and physicians who receive results for patients who are no longer in their care should collaborate with the state newborn screening program and, in some instances, the hospital or birthing facility to locate the infant's family and/or current provider and to proceed with appropriate follow-up until the responsibility for subsequent care is clearly established. Physicians who receive results for patients with whom they or their colleagues have had no interaction should also notify the state newborn screening program immediately.



Screening Results?

The state newborn screening program will report results to the child's physician of record as being in range, invalid, or out of range. Appropriate responses to each of these results are discussed in the next sections.

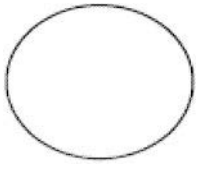


Document In-Range Screening Results and Reassure Family

In-range newborn screening results should be noted in the infant's chart and shared with the parents or guardians. In reassuring the family, the PCP should keep in mind that newborn screening does not rule out congenital conditions that are not included in the panel and does not absolutely guarantee the absence of the conditions that are screened. The PCP might note, however, that false in-range results are quite rare and the family can be reassured that their child is unlikely to be affected by conditions for which screening was performed.

Special Circumstances

Nine states (Arizona, Colorado, Delaware, Nevada, New Mexico, Oregon, Texas, Utah, and Wyoming) mandate an additional screening when the infant is 1 to 2 weeks old on the basis of the belief that a second screening is necessary to identify the maximum number of children with genetic disorders. A second screening is recommended for all infants in several other states, and approximately 25% of all US newborn infants currently receive 2 screenings. The relevance of second screenings for endocrinopathies is the subject of a study currently being designed by the MCHB. PCPs should familiarize themselves with their state's policies and procedures. If a second screening is ordered, it can be introduced and explained to parents within the context of state policies and the current limitations to newborn screening technologies discussed previously.



Reorder Newborn Screening

If the specimen is invalid (eg, collected too early, inadequate specimen, poor drying or application technique, inadequate or illegible patient information), the infant's newborn screening must be reordered and blood redrawn. This screen should be completed promptly to optimize the availability of results. PCPs must be familiar with local protocols for rescreening and should contact parents immediately to direct them to the site at which the second blood specimen will be obtained.

Consult ACT Sheets and State Newborn Screening Program

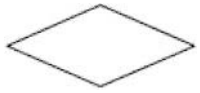
An out-of-range result on the newborn screening panel is not a diagnosis. However, some congenital conditions can be rapidly fatal in infants who appeared entirely healthy a few days earlier; thus, out-of-range screening results should always lead to prompt action by the PCP.

If the state newborn screening program does not provide the ACT sheet specific to the condition for which an out-of-range result was obtained, the PCP should download it (www.acmg.net/resources/policies/ACT/condition-analyte-links.htm).

The ACT sheet should be reviewed and followed in its entirety, but the most important actions are highlighted. These actions include:

- when to contact the family;
- whom to consult and whether an appointment is needed immediately;
- when the patient must be seen by the PCP;
- whether additional confirmatory testing is needed and what tests should be conducted;
- whether treatment is necessary and what treatment to initiate;
- how to educate parents about the condition; and
- when findings need to be reported back to the newborn screening program.

In addition to following ACT sheet recommendations, the PCP should consult with the state newborn screening program regarding out-of-range results. The state program should be familiar with local or regional experts for the conditions on their screening panels. In some states, the programs fund subspecialty clinics to conduct diagnostic evaluations and provide short-term and/or long-term subspecialty care to infants with out-of-range screening results.



Condition Identified?

After an out-of-range screening result is obtained, confirmatory testing and/or definitive consultation with subspecialists are required before a final diagnosis can be made.

To increase the sensitivity of a population screening test for rare conditions (and hopefully minimize the number of false in-range results missed), false out-of-range results are expected to occur, and false out-of-range results are significantly more frequent than true out-of-range results for most newborn screening tests. However, given the seriousness of the congenital conditions included in the newborn screening panel, the PCP must avoid complacency in the face of out-of-range results. Until confirmatory testing and/or definitive consultation with subspecialists can be accomplished, all out-of-range results must be taken very seriously.

Special Circumstances

In addition to true or false out-of-range results, confirmatory tests may identify the child as a carrier of the condition or may lead to an indeterminate result.

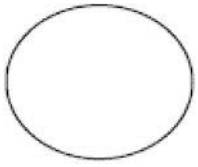
Carriers are individuals who are heterozygous for an autosomal-recessive condition and are usually not at risk of health problems themselves, although this may vary with the condition. Many state programs notify the PCP that the infant has been identified as a carrier, and it may be the responsibility of the PCP to disclose and discuss these results with the parents.

Knowledge of carrier status has 2 implications. First, because most of the conditions tested for on newborn screening are autosomal-recessive in inheritance, it is highly probable that at least 1 of the parents is a carrier also, and both parents might be carriers. If both parents are carriers, they have a 1-in-4 chance with each pregnancy of having an affected child. Alerting parents to the carrier status of their child serves to alert them that they may be at increased risk of having an affected infant with their next pregnancy. (When newborn screening results lead to genetic testing of the parents, pediatricians should be aware that misattributed paternity could be identified. Discussion with a geneticist or genetic counselor about how to manage these sensitive results may be helpful.)

The second implication of identifying a newborn as a carrier is that the infant will be at an increased risk of bearing an affected child when he or she achieves reproductive age if his or her future partner also is a carrier for the same condition. The risk is largely determined by the prevalence of the condition within the population, and additional genetic counseling may be warranted.

Occasionally, confirmatory diagnostic test results will not result in a definitive diagnosis. Uncertain results can be distressing to parents and PCPs, so thorough consultation with a subspecialist is essential. Unfortunately, indeterminate results may not be possible to resolve without more knowledge about some of these conditions and longer-term follow-up of these children.

At this point, it is incumbent on the PCP and the subspecialist to maintain an ongoing collaboration and continue to monitor the infant for signs and symptoms of a suspected condition. Children with uncertain results should have their chart identified for close monitoring. Good communication between the PCP and the consulting subspecialist is essential at this point to ensure that a unified message is conveyed to parents.



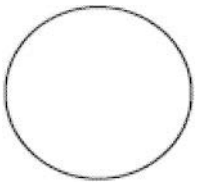
Document False Out-of-Range Results and Reassure Parents

In the event that the initial out-of-range result proves to be a false out-of-range result, the PCP can provide reas-

surance to parents. However, research that evaluated parents of infants with false out-of-range results has suggested that 5% to 20% of these parents will persist in their concerns about the health of their children for months or years after screening.[5–9] Therefore, PCPs should not take the event of a false out-of-range result too lightly and may wish to discuss this issue with parents on subsequent visits to provide additional reassurance and eliminate any misconceptions.

Provide Parent Education

To lay the foundation for comprehensive and collaborative care, it is critical during this time of uncertainty that the parents and family of the neonate be provided with condition-specific information and support as they await final clarification of the child's diagnosis and begin to plan for treatment and management. Parents are usually intensely anxious about the health of their child while the diagnosis is being pursued, and increasingly, parents are adept at tapping into resources on the Internet about specific conditions. Frequent, specific, and supportive communication from the PCP will help to avoid confusion and build trust. Appropriate materials for distribution to parents have been produced by the AAP (www.aap.org), the American College of Obstetricians and Gynecologists (ACOG [www.acog.org]), and MCHB/HRSA (www.mchb.hrsa.gov/screening). State newborn screening programs may also make educational materials available to health care professionals.



Identify the Child as a Child With Special Health Care Needs and Initiate Chronic Care Management

Any child who is given a diagnosis of a significant medical condition should be identified by the medical home physician as a child with special health care needs. Such a child should be entered into the practice's children with special health care needs registry, and chronic condition management should be initiated. Chronic care management provides proactive care for children with special health care needs, including condition-related office visits, written care plans, explicit comanagement with subspecialists, appropriate patient education, and effective information systems for monitoring and tracking the child's condition.[10]

IMPLEMENTING THE ALGORITHM

Role of the Medical Home

Regardless of diagnosis, every child needs a medical home to ensure coordinated and comprehensive care such that all of the medical, psychosocial, and educational needs of the child and family are met successfully within the local community. The PCP is responsible for providing a medical home.

Some conditions identified by newborn screening are relatively mild and or/transitory, and others have a wide spectrum of severity from asymptomatic to life-threatening crises. Plans for continuing care should be made in consultation with the family and appropriate subspecialists in light of the condition affecting the child and the severity of its manifestation. In some cases, the PCP may provide all or most of the ongoing care.

In other cases, the family may view their subspecialist as their primary care physician. Although a subspecialist may provide substantial ongoing care for a child who has been diagnosed with a severe and complex condition, the PCP retains the responsibility for providing a central source of "family centered, accessible, continuous, coordinated, comprehensive, compassionate, and culturally effective" care for the family.[11] The parents and family should be encouraged to maintain their relationship with their PCP. This relationship is critical, especially for cases in which the subspecialist is located at some distance from the family. In a crisis, the PCP may be the only available provider with knowledge of the child; he or she must have up-to-date information regarding the child's treatment.

The complex nature of many conditions identified by newborn screening may require care by a team of medical subspecialists, therapists, nutritionists, and educators.[12] The PCP and other professionals involved in the child's care must collaborate in the provision of acute care for illness or injury; surveillance of growth and development; anticipatory guidance to the family; immunizations; communications with schools, social services, and camps; transitions in care; and communication with other care professionals. In any case, clearly defined roles may help to reduce redundancies of services and prevent fragmentation of care.

The medical home should actively engage public and private resources to aid in the management of chronic conditions. Public health nursing provided through some state public health departments' maternal and child health programs often has a role in assisting PCPs, subspecialists, and families of children with conditions that are diagnosed through newborn screening. The level of public health nursing may vary from simply providing information and referrals to assisting with chronic condition management for a family.

If there is not a local health department or nursing service, PCPs may contact their state maternal and child health department (Title V) and the directors of programs for children with special health care needs through the state department of public health to obtain information on the availability of local family services; the state department of education for contacts with school nurses; and the early intervention agency (Individuals With Disabilities Education Act Part C) for contact information for the local early childhood connections program. Although the state resources for public health vary greatly from state to state, almost all communities have one or all of these resources available for

families. The national organization Family Voices (www.familyvoices.org) can provide information on local organizations and agencies that can offer resources to families with children with special health care needs and can assist families in accessing community services.

For additional information regarding care coordination, see the AAP policy statement "Care Coordination in the Medical Home: Integrating Health and Related Systems of Care for Children With Special Health Care Needs."[13]

Role of the Subspecialist

For most of the conditions that may be detected through newborn screening, the subspecialist will confirm the diagnosis, develop the treatment plan, educate the family about the treatment, monitor treatment, identify complications related to the disease process that may require additional referral, and work with other consultants in coordination of care. When acute illness exacerbates the condition, the PCP should work with the subspecialist to diagnose the acute illness and manage it appropriately to reduce morbidity.

Some children with conditions identified through newborn screening will have long-term sequelae that will require ongoing subspecialty management despite appropriate early intervention. Many of these children will have mild neurodevelopmental disabilities that may present as learning difficulties, attention-deficit/hyperactivity disorder, or other behavioral problems. However, in some instances, more significant cognitive and motor deficits and/or problems that adversely affect the child's feeding skills and respiratory status may be present. It is essential that the PCP provide ongoing screening and surveillance for these developmental disabilities.

Even with appropriate treatment, patients with certain conditions identified through newborn screening can undergo metabolic decompensation during an acute febrile illness. PCPs need to be aware of the initial clinical signs and laboratory abnormalities that may be found when metabolic decompensation occurs and be able to provide immediate intervention to stabilize the child until more specific advice can be obtained from the appropriate treating subspecialist. Effective communication among subspecialists as well as between each subspecialist and the PCP is essential for optimal long-term management of these children.[14] Long-term responsibilities of the subspecialist, in collaboration with the PCP, include:

- Providing genetic counseling and evaluation: Because the majority of conditions diagnosed through newborn screening are hereditary, genetic evaluation and counseling will be necessary for the parents. Older siblings may be affected with the condition but not yet symptomatic; diagnostic studies may be indicated for the siblings, and other relatives may wish to undergo carrier testing. The PCP, the state newborn screening program, and subspecialists are jointly responsible for ensuring that referral for genetic services occurs.
- Providing ongoing parent education and links to available resources: Resources for managing the condition should be made available to the patients and their families. Subspecialists, the PCP, and the state newborn screening program should collaborate in making appropriate referrals to programs for children with special health care needs, childhood early intervention programs, community-based support services, and additional subspecialists who are needed to evaluate and manage associated disabilities. Information from disease-specific advocacy organizations, along with parent brochures and guidance for child health care professionals, may be available through the subspecialist. The Genetic Alliance, a coalition of advocacy groups, serves as another national resource for parents (www.geneticalliance.org). The National Library of Medicine also has material on every condition in the expanded ACMG-recommended panel (http://ghr.nlm.nih.gov).
- Assisting in the transition to adult care: When transition to adult care is appropriate, the subspecialist will work with the PCP to identify a new team of physicians to care for the young adult. As adolescence proceeds, additional genetic counseling and preparation for family planning are appropriate.

RECOMMENDATIONS

Preparing the Practice

Before receiving notice of an out-of-range newborn screening result from their state newborn screening system, PCPs can take several steps to enhance their ability to successfully address their roles and responsibilities within the newborn screening program.

1. PCPs should familiarize themselves with their state newborn screening program via available (online) resources or, if necessary, by contacting the state program. PCPs should develop some familiarity with the conditions being screened and basic operations of their state newborn screening program, including protocols for retesting invalid screening results and conducting second screenings. PCPs should identify the person(s) with whom they should consult in the case of an out-of-range screening result and ensure that contact information is readily available.
2. State-specific contact information for regional pediatric medical subspecialists should be collected and kept on file in the PCP's office.
3. Procedures to address several steps of the algorithm should be developed in advance. These procedures include:
   a. updating contact information for the state newborn screening program and regional pediatric medical subspecialists;
   b. identifying children who are most likely not to have had newborn screening;
   c. confirming receipt of newborn screening results on all patients;

d. obtaining newborn screening results when they are not received from the state program;

e. documenting parental refusal of newborn screening; and

f. obtaining newborn screening specimens in the case of lost, delayed, or invalid results (the CPT code for retesting is 84030, and the diagnosis code is 270.10; PCPs should check with insurers to assess reimbursement).

4. PCPs should establish registries to identify, follow, and provide chronic condition management for children with special health care needs.

5. Educational materials regarding newborn screening should be on hand to distribute to expectant parents, parents who may decline newborn screening, and parents whose child's screening returns an out-of-range or inconclusive result. These materials should be available in languages and at literacy levels appropriate to all patients served. Appropriate materials for distribution to parents have been produced by the AAP (www.medicalhomeinfo.org/screening/newborn.html), ACOG (www.acog.org), and MCHB/HRSA (www.mchb.hrsa.gov/screening). State newborn screening programs may also make educational materials available to health care professionals.

Care coordination plays an essential role in ongoing efforts to integrate health and related systems of care for children and youth with special health care needs.[15] Becoming aware of available resources, being involved in the care coordination process, and developing unique care coordination approaches within one's own practice and community and in relationship with existing tertiary care centers are essential for providing optimal care for children with special health care needs. Families, PCPs, and other professionals can collaborate meaningfully to provide effective coordinated care.[13,15]

PCPs are also encouraged to participate in state, regional, or national registries; quality assurance programs; and/or research projects designed to enhance the care of children with the rare and complex conditions included in the newborn screening panel. They are also encouraged to seek opportunities for additional training and learning about state newborn screening programs and the conditions for which infants are screened and to work with their local AAP chapter and state newborn screening advisory committee (SNSAC) to advance the quality and effectiveness of the newborn screening system at the state and federal levels.

Collaboration With Other Health Care Professionals

The goals of ensuring the successful operation of the newborn screening system and advancing optimal care for infants and their families cannot be accomplished by PCPs alone. Effective collaboration and communication among PCPs and other clinicians and among the systems of care that engage the newborn screening system will ensure the best outcomes for infants and families. In light of this necessary collaboration, recommendations have been developed for prenatal health care professionals, hospitals and other birthing facilities, pediatric medical subspecialists, states and SNSACs, and federal agencies.

Prenatal Health Care Professionals

The prenatal period provides an ideal opportunity to begin to educate a family regarding the importance of newborn screening and the risks and benefits of early identification of the conditions identified through screening. The ACOG Committee on Genetics has asserted that "[o]bstetricians need to be aware of the status of newborn screening in their states and should be prepared to address questions or refer their patients to appropriate sources for additional information."[16] The following specific steps can help bring the awareness and knowledge of the obstetrician to bear in preparing a family for newborn screening and promoting the function of the newborn screening system.

1. Prenatal health care professionals are ideally positioned to educate expectant parents about the newborn screening program in conjunction with the prenatal screening program. The obstetrician is encouraged to begin the education early enough to allow patients the opportunity to ask questions that will assist them in understanding the purpose of newborn screening, its implementation, and the importance of test results and follow-up. Concise, clear, and comprehensive educational materials and/or video presentations already in existence should be made available to expectant parents during the prenatal period. Appropriate materials are available from the AAP (www.medicalhomeinfo.org/screening/newborn.html) and the National Library of Medicine (ghr.nlm.nih.gov/nbs).

2. Prenatal health care professionals should strongly encourage prospective parents to identify a medical home for their infant early in pregnancy. When the mother presents for postpartum care, the prenatal health care professional can further support the medical home by inquiring about the infant's well-being and follow-up care.

3. If an infant is lost to follow-up to the newborn screening program, prenatal health care professionals should assist in locating the family.

Hospitals and Other Birthing Facilities

In most cases, it is the facility at which the infant is delivered that is initially responsible for processing the newborn screening specimen. It is essential that these facilities have policies and procedures in place to ensure high-quality specimen processing and prompt delivery to the designated screening laboratory.

1. Particular attention should be brought to the development of protocols for:

   a. Repeat screening of invalid specimens.

   b. Documenting parental refusal to consent to newborn screening: Parents should be asked to sign a waiver form that documents not only their refusal to consent to newborn screening but also their

understanding of the program and its purpose and the risks associated with their refusal.

c. Adequate training of clinical and laboratory staff and quality assurance programs focused on high-quality specimen processing: Appropriate and complete information regarding the infant, contact information, and medical follow-up must be gathered and submitted with specimens.

d. Assisting public health authorities in locating infants who are lost to follow-up: If the infant's medical home is not clearly identified, the facility at which the child was born should assume responsibility for notifying the family of an out-of-range screening result and referring for additional diagnostic testing and subspecialty care.

2. Identification of the medical home or site of medical follow-up should be established as a condition for discharge.
3. Discharge materials should clearly indicate whether newborn screening was conducted and should identify the PCP and the in-hospital managing physician for later contact, if needed.
4. Hospitals and other birthing facilities should ensure the availability of printed and/or video educational materials, presented in concise and understandable language, to all families, including those whose primary language is not English. These materials should address the purpose of newborn screening, the risks and benefits associated with newborn screening, and the consequences of delaying or refusing newborn screening.
5. Opportunities for further discussion or questions should be made available with either the family's chosen PCP or staff members who are knowledgeable about the screening process and the conditions for which screening is conducted.

Pediatric Medical Subspecialists

Pediatric medical subspecialists play several roles in the care of children who have out-of-range results from newborn screening: they conduct confirmatory testing, care for the primary condition of infants who are affected by congenital diseases, and collaborate in the care of children with disabilities associated with some of the diseases identified through newborn screening. In fulfillment of these roles:

1. Pediatric medical subspecialists should assist the state newborn screening program in the development of educational materials for the public, families, PCPs, the state newborn screening program, and policy makers on specific conditions identified by newborn screening.
2. Pediatric medical subspecialists should serve on their SNSAC.
3. Pediatric medical subspecialists should respond promptly to requests for diagnostic and management services to infants with out-of-range screening results and children with conditions identified by newborn screening. Findings from clinic visits, laboratory studies, imaging studies, and diet and medication changes should be communicated promptly to the PCP, state newborn screening programs, other pediatric medical subspecialists, and the family (as appropriate).
4. Pediatric medical subspecialists should underscore the importance of maintaining a medical home relationship with the PCP for the infant identified with a condition through newborn screening.
5. Pediatric medical subspecialists should assist in the identification of associated disabilities and appropriate referral to other subspecialists for management.
6. Pediatric medical subspecialists should assist in the development of condition-specific protocols for the treatment of acute illness or injury and in the development of the child's care plan for school, activity restrictions, and special feeding/diet programs. Pediatric medical subspecialists should also work with the PCP, the family, and other subspecialists to delineate each person's role in managing acute illnesses, establishing relationships with schools and therapists, providing immunizations, working with social services and camps, and maintaining contact with insurers.
7. Pediatric medical subspecialists should provide ongoing education to the family and PCP about new developments and treatments for the condition and associated disabilities.
8. Pediatric medical subspecialists should work with the PCP and other subspecialists in identifying appropriate adult health care professionals for the transition to adult care.

State Systems

The state's role in newborn screening is to design, coordinate, and manage an effective newborn screening system. It has traditionally been the state's responsibility to oversee key aspects of the newborn screening system, including initial screening, confirmation of diagnosis, and coordination of short-term follow-up for infants with out-of-range screening results as well as longer-term care for children with special health care needs. Ultimately, the state must maintain an adequate public health infrastructure to ensure that every newborn infant receives appropriate care.

The AAP Newborn Screening Task Force set forth a broad agenda for state newborn screening systems in its statement published in 2000.[17] In addition to addressing the recommendations that follow, states are urged to consult that AAP statement for guidance in developing and supporting an effective and comprehensive newborn screening system.

To ensure the appropriate and effective function of newborn screening systems, the following recommendations must be addressed immediately:

1. States must monitor specimen collection and transmission of information between screening hospitals, the testing laboratory, and individual practitioners.

2. Identification of the follow-up medical home must be required on all newborn screening specimens.[16,18]
3. Laboratory collection and handling procedures must be clearly delineated at every site at which newborn screens are obtained or processed. State newborn screening laboratories are expected to maintain up-to-date technology and procedures and be prepared to implement recommended changes in the newborn screening process.[11]
4. Practical mechanisms should be established for retesting infants whose newborn screening results are indeterminate/invalid regardless of the cause.
5. Procedures should be adopted to ensure that the medical home is notified of out-of-range screening results by telephone on a schedule consistent with the urgency of the need for intervention. In the case of urgent out-of-range results, a designated medical subspecialist may be notified in addition to the medical home; the newborn screening program may need to contact the family if efforts to contact physicians are not successful.
6. Procedures should be adopted to ensure that in-range and invalid screening results are available to the medical home within 2 weeks of an infant's birth.
7. When out-of-range screen results are reported, the appropriate updated ACT sheet (or equivalent) and state-specific referral information should be forwarded immediately to the PCP.
8. States must have policies and procedures in place to locate children who have not established a medical home and to ensure that all newborn infants with out-of-range screening results receive appropriate diagnostic follow-up and subspecialty care.
9. States must provide clinicians with contact information for their newborn screening program coordinator and ensure that clinicians are updated promptly should any changes occur.
10. Public health agencies and maternal and child health programs should assist with care coordination for patients with special health care needs and their families.

Because states play a significant educational role in the newborn screening system, the following are recommended:

11. With direction from the SNSAC, states should develop and facilitate distribution of clear and concise educational materials for families at prenatal visits and in the hospital at the time of delivery. Condition-specific materials must be developed for families whose infants have out-of-range screening results; these materials include an explanation of test results, appropriate educational materials on the tested condition, referral for additional diagnostic testing, and referral for subspecialty care. Educational materials developed by the AAP, ACOG, and HRSA/MCHB may be used and/or supplemented with materials developed by the state. These materials can be accessed at www.medicalhomeinfo.org/screening/newborn.html or mchb.hrsa.gov/screening.
12. The state must develop educational information for medical professionals that outlines their responsibilities in the newborn screening process.

Finally, there are a number of steps that can be taken to improve the operation of the newborn screening system, including the following:

13. To prevent delays in processing when screening occurs on the weekend, the newborn screening laboratory responsible for state screening should operate at least 6 days a week, with coverage for holidays. Rapid turnaround time for results is essential for prompt diagnosis and treatment of metabolic conditions.
14. Information systems through which clinicians could directly download newborn screening results should be developed. Policies and regulations must be developed concurrently to protect privacy and confidentiality rights.
15. States should develop and implement information systems that facilitate the tracking of infants across state lines through communication and integration of data across newborn screening systems.
16. States must develop and implement policies that allow for interstate licensure and practice of medicine (including the use of telemedicine) to facilitate consultation and communication to underserved areas and ensure the free flow of information across state lines. There is a shortage of pediatric medical subspecialists across the country and a complete absence from more sparsely populated regions. This challenge must be addressed cooperatively by the states.
17. States should ensure the availability of ongoing care for infants with out-of-range screening results who lack health insurance and for those whose insurance does not provide coverage for necessary services and treatments. Medically required diets and vitamins are among the treatments often excluded from coverage provided by third-party payers.[19]
18. To promote greater understanding of the effects and benefits of the newborn screening system, states should develop information systems that are capable of tracking the multitude of performance measures for the newborn screening system and long-term outcomes of children with special health care needs identified through newborn screening. Performance measures include diagnosis for and treatment of infants with out-of-range screening results, cases missed by newborn screening, false out-of-range result rates, time to diagnosis, parental involvement and satisfaction, the social and psychological effects on families of infants with out-of-range and false out-of-range results, and family access to appropri-

ate and necessary services. Data to support the analysis of cost-effectiveness and cost benefit should also be collected.

19. To provide national data for newborn screening system quality assurance and program comparison, state programs should contribute timely case findings and laboratory data to the national newborn screening data-collection system operated by the National Newborn Screening and Genetics Resource Center (www2.uthscsa.edu/nnsis).
20. SNSACs should be authorized in each state to help implement and ensure the establishment of principles of universal access, clinician and community education, remedial surveillance for accountability, and quality of services for all infants. SNSACs should be chartered with appropriate authority and provided adequate support to effectively fulfill the roles outlined as follows.

State Newborn Screening Advisory Committees

1. SNSACs should comprise a balanced, representative, and diverse membership. Representation by diverse families and societal leaders should be balanced by members of the health care community, including clinicians in practice, representatives of hospitals and professional organizations, and public health experts, including the laboratories and the state. A diverse clinician representation would include pediatricians, obstetricians, family physicians, and nurse and midwife practitioners. In addition, the panel must have access to expert medical subspecialists, health care researchers, and biostatisticians.
2. SNSACs should cooperate with the US Department of Health and Human Services ACHDGDNC and other federal agencies to promote consistency in newborn screening throughout the nation.
3. SNSACs must work to advance state support and development of the newborn screening system, with particular attention to:
   a. efforts to use health information technology to advance clinician and family access to information about newborn screening as well as screening and follow-up services;
   b. optimization and accurate interpretation of privacy laws;
   c. implementation of a systems approach based on the Institute of Medicine principles for patient-centered safety, effectiveness, efficiency, timeliness, and equity[20];
   d. efforts to provide unfettered access, through both print and electronic media, to understandable education materials for families with diverse reading and language abilities; and
   e. development and distribution of resources for PCPs.
4. SNSACs must address identified challenges of fragmented service delivery as well as geographic, cultural, social, and financing barriers across county and state lines.
5. SNSACs should promote a statewide report on newborn health status for identifiable conditions and a national newborn health report that provides data on incidence, outcome, and community participation.
6. SNSACs must develop a mechanism for receiving feedback from parents, medical home practitioners, and subspecialists on the appropriateness of including particular conditions in the newborn screening program. This feedback should then be transmitted to the ACHDGDNC.
7. Each SNSAC is encouraged to develop its own charter and seek statutory establishment and state support.

National Partnerships

Although states remain responsible for newborn screening systems, federal agencies and national organizations play a significant role in the newborn screening system and in supporting families of children with genetic conditions. Strengthening national partnerships between federal agencies and professional, nonprofit, and family organizations provides the opportunity for a coordinated effort to increase the services offered to children with genetic and congenital conditions in all stages of diagnosis, treatment, and follow-up. There are 4 critical points of partnership for these groups: collaboration, funding, oversight, and follow-up.

Collaboration

1. Health care professionals, nonprofit agencies, state and federal public health programs, and families should seek to build relationships with other groups that focus on the newborn screening system. Relationships can be fostered through partnering on national initiatives, inviting other perspectives to serve on project advisory committees, and establishing a systematic method of receiving feedback from families.
2. Research should be performed on all aspects of newborn screening systems, including parent and provider education, results management, laboratory quality, residual specimen storage and use, and, most importantly, efficacy of newborn screening for each proposed condition. A national research agenda for newborn screening should be outlined. Input from federal agencies, professional associations, nonprofit organizations, and family support organizations should be coordinated. Multistate or national collaborations are often necessary to recruit a sufficient number of affected infants to understand the clinical spectrum of the disease and to compare treatment strategies. Collaboration will be key in conducting this research.
3. National partnerships should be developed and coordinated to support state newborn screening sys-

tems and encourage coordination, effective collaboration, and decrease duplication.

Funding

4. Adequate third-party reimbursement, grant applications, nonprofit fundraising efforts, and other sources of funding for newborn screening programs should be pursued by those who seek to improve the newborn screening system. Funding for the components of the newborn screening system and long-term care of children with genetic conditions comes from a variety of sources including screening fees, federal programs, state programs, nonprofit fundraising, insurance companies, and others, and such funding is critical at all levels.
5. Because ongoing research in the areas of education, results management, laboratory quality, and identifying and treating genetic diseases is important as the world of newborn screening continues to expand, funding for the implementation of these research projects should be provided.
6. Because establishing and funding a 24-hour hotline for access to online state-specific newborn screening program contact information can be useful in supporting state newborn screening programs, physicians, and families, a dedicated newborn screening hotline should be considered as part of preparing for national emergencies, natural disasters, or other circumstances.
7. Funding should be provided for demonstration projects directed toward strengthening the communication process between pediatricians and the newborn screening program. These efforts can include the development of telemedicine, effective health information exchanges, and linked information systems to facilitate the communication process.
8. Because the increased level of services required to comanage and coordinate care for patients with special needs identified through newborn screening can pose a significant financial burden for the PCP and the subspecialist, appropriate CPT coding that is aimed at enhanced reimbursement for chronic condition management should be developed.

Oversight

9. ACHDGDNC policies and activities should promote and facilitate uniformity across newborn screening programs, promote coordination between state newborn screening programs, support public health infrastructure for these programs, monitor the quality of these programs, and coordinate and promote research efforts related to newborn screening.
10. The ACHDGDNC should promote federal interagency collaboration and federal agency collaboration with state public health newborn screening programs to encourage coordination and effective collaboration between federal and state agencies.
11. Family involvement in all levels of newborn screening and follow-up care is important and should be encouraged. Families can give feedback on services provided, make suggestions on improving systems of care, advocate for needed services, and support other families that are going through similar situations.

Follow-up

12. Appropriate treatment and chronic condition management for children with congenital conditions should be ensured. Federal agencies, state newborn screening programs, and others can collaborate to create a national definition for follow-up to newborn screening systems.
13. Because enrolling children onto long-term research studies can provide the opportunity to test new treatments and better understand the natural history of chronic conditions, federal agencies and national organizations should promote opportunities for such research and create materials to educate parents about research in general and specific opportunities to participate in research.

National Medical Specialty Organizations, Including the AAP

National medical specialty organizations and their state chapters can play specific roles in the continued development of the collaboration necessary to ensure optimal performance of the newborn screening system throughout the country.

1. They should maintain communication with and participation on the ACHDGDNC to provide information to their constituencies and communicate any concerns to the ACHDGDNC.
2. They should foster education regarding newborn screening and promote pediatric medical subspecialties that focus on metabolic diseases among medical students and residents.
3. They should promote the development and implementation of a Health Plan Employer Data and Information Set (HEDIS) measure on newborn screening.
4. They should comment on the appropriateness of adding new tests to the core screening panel, ensuring that any newborn screening provides clear benefit to all children screened and to their families. These comments should be presented to the ACHDGDNC for consideration and adoption.

CONCLUSIONS

Advances in newborn screening technology, coupled with recent advances in the diagnosis and treatment of rare but serious congenital conditions that affect newborn infants, provide increased opportunities for positively affecting the lives of children and their families. These advantages, however, also pose new challenges to PCPs, both educationally and in response to the management of affected infants.

To respond appropriately, PCPs require immediate

access to clinical and diagnostic information and guidance; ACT sheets from the ACMG are a valuable source of such guidance. PCPs, however, have a proactive role to play in supporting the performance of the newborn screening system and ensuring the successful completion of their responsibilities to the program. PCPs must develop office policies and procedures to ensure that newborn screening is conducted and that results are transmitted to them in a timely fashion. PCPs must also develop strategies to use should these systems fail.

The newborn screening system extends well beyond the PCP's office, and many other stakeholders are essential for ensuring that the system functions well and supporting PCPs in their role within the system. The system is challenged by error, lack of education or information on the part of families and health care professionals, and systemic challenges such as the national shortage of pediatric medical subspecialists and barriers inherent in state licensing requirements. Lack of universal health care coverage and limited funding for newborn screening programs present additional significant challenges.

State and federal entities, hospitals, prehospital health care professionals, pediatricians, and pediatric medical subspecialists should act collaboratively to address these challenges or reduce their effects on the newborn screening system. AAP chapters and individual pediatricians should work together with the AAP and SNSACs to promote actions and policies that will optimize the function of newborn screening systems and ensure that children and families receive the full benefit of them.

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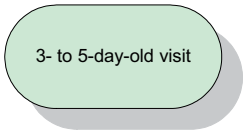
APPENDIX 1 2005 ACMG Recommended Screening Panel

OA	FAO	AA	Hemoglobinopathies	Other
Core panel				
Isovaleric acidemia	Medium-chain acyl-CoA dehydrogenase deficiency	Phenylketonuria	Sickle cell anemia (Hb SS disease) Hb	Congenital hypothyroidism
Glutaric acidemia type I	Very long-chain acyl-CoA dehydrogenase deficiency	Maple syrup disease	Hb S/β-thalassemia	Biotinidase deficiency
3-Hydroxy-3-methylglutaryl-CoA lyase deficiency	Long-chain L-3-hydroxy acyl-CoA dehydrogenase deficiency	Homocystinuria (caused by cystathionine β-synthase)	Hb S/C disease	Congenital adrenal hyperplasia (21-hydroxylase deficiency)
Multiple carboxylase deficiency	Trifunctional protein deficiency	Citrullinemia		Classical galactosemia
Methylmalonic acidemia (mutase deficiency)	Carnitine-uptake defect	Argininosuccinic acidemia		Hearing loss
3-Methylcrotonyl-CoA carboxylase deficiency		Tyrosinemia type I		Cystic fibrosis
Methylmalonic acidemia (Cbl A,B)				
Propionic acidemia				
β-ketothiolase deficiency				
Secondary targets				
Methylmalonic acidemia (Cbl C,D)	Short-chain acyl-CoA dehydrogenase deficiency	Benign hyperphenylalaninemia	Variant hemoglobinopathies (including Hb E)	Galactokinase deficiency
Malonic acidemia	Glutaric acidemia type II	Tyrosinemia type II		Galactose epimerase deficiency
Isobutyryl-CoA dehydrogenase deficiency	Medium/short-chain L-3-hydroxy acyl-CoA dehydrogenase deficiency	Defects of biopterin cofactor biosynthesis		
2-Methyl 3-hydroxy butyric aciduria	Medium-chain ketoacyl-CoA thiolase deficiency	Argininemia		
2-Methylbutyryl-CoA dehydrogenase deficiency	Carnitine palmitoyltransferase II deficiency	Tyrosinemia type III		
3-Methylglutaconic aciduria	Carnitine: acylcarnitine translocase deficiency	Defects of biopterin cofactor regeneration		
	Carnitine palmitoyltransferase I deficiency (liver)	Hypermethioninemia		
	Dienoyl-CoA reductase deficiency	Citrullinemia type II		

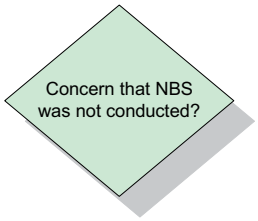
OA indicates disorders of organic acid metabolism; FAO, disorders of fatty acid metabolism; AA, disorders of amino acid metabolism; CoA, coenzyme A.

APPENDIX 2.

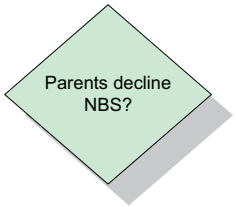
Algorithm 1



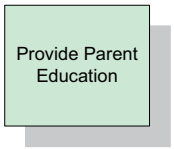
At the 3- to 5-day-old visit, the PCP should check for circumstances suggesting newborn screening might *not* have been conducted. Concerning situations include home or emergency births or international adoption.



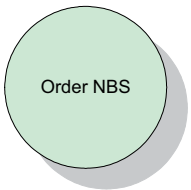
If the PCP has cause for concern that the newborn screening was not ordered and available discharge papers do not indicate the newborn screening has been ordered, the PCP should make arrangements for sample acquisition.



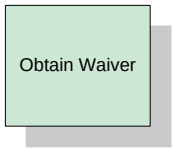
If newborn screening has not been conducted because of parental refusal or if parents refuse newborn screening suggested by the PCP, the PCP should discuss the general benefits and limited risks of newborn screening as well as possible implications of not testing.



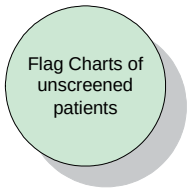
Educational materials for parents and PCPs can be accessed through the AAP Web site (www.medicalhomeinfo.org/screening/newborn.html). Parent concerns and questions should be addressed fully, and a discussion of the general benefits and limited risks of newborn screening is recommended. Very treatable conditions, such as phenylketonuria (PKU) and congenital hypothyroidism (CH), may be used as examples. If parental permission is obtained, arrangements for sample acquisition should be made immediately, and newborn screening should be ordered, as noted previously.



Newborn screening is conducted through the state newborn screening program, and protocols for ordering the screen vary by state. Contact information for each state's newborn screening program is available (http://genes-r-us.uthscsa.edu/resources/consumer/statemap.htm; Appendix 4).



If parental permission is not obtained, parents or guardians should be asked to sign a waiver documenting their choice to decline newborn screening. A sample waiver form is included as Appendix 5; appropriate waiver forms should also be available through the state health department.



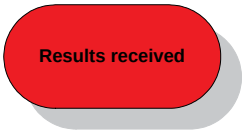
PCPs should flag the charts of any patients who have not been screened so that the lack of screening will be taken into account should any subsequent concerns emerge regarding the child's growth or development. The chart note should also prompt the pediatrician to return to the question of newborn screening with subsequent visits to determine whether parents have changed their minds.

Special Circumstances

- In cases in which newborn screening is delayed, the PCP should consult with the state newborn screening program regarding the availability and usefulness of the newborn screening protocol.
- In the case of preterm births, neonatal transfusion, and other circumstances in which screening is not ordered or a second specimen is required, the PCP should consult with a neonatal specialist.

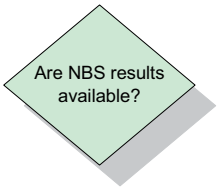
APPENDIX 3.

Algorithm 2

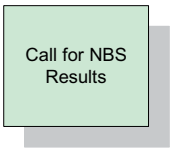


In the case of an out-of-range screening result, the pediatrician identified on the newborn screening card should be called by the state newborn screening program within the first week after birth. Normal results are often transmitted by mail; these may arrive before to the 2- to 4-week visit.

Delays or procedural failures at hospitals, state laboratories, or other facilities or within the newborn screening program may result in late or lost results. The PCP cannot assume a "no news is good news" approach with regard to newborn screening.



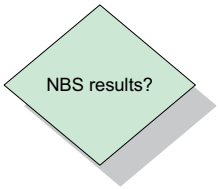
Office staff should check routinely for newborn screening results before the 2- to 4-week visit and pursue missing results in advance of that visit.



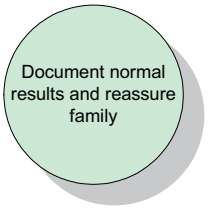
If newborn screening results are not available before the 2- to 4-week visit, the PCP should contact the state newborn screening program for the results at that time.

Special Circumstances

Newborn screening results may occasionally be sent to the wrong pediatrician. Physicians who receive results for patients no longer in their care should immediately contact the state newborn screening program and/or hospital to alert them that the PCP may not have received these results.



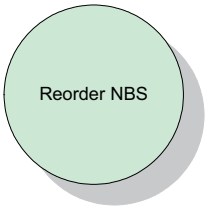
The state newborn screening program will report results as normal, unsatisfactory, or abnormal.



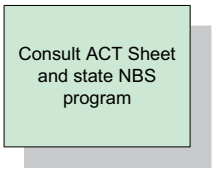
Normal newborn screening results should be noted in the infantôs chart and shared with the parents or guardians. Keep in mind that newborn screening does not rule out congenital disorders that are not included in the panel and does not absolutely guarantee the absence of the disorders that are screened.

Special Circumstances

Currently, 9 states mandate a second screening, and 12 states allow it. If necessary, the PCP should order another newborn screening.



In instances where the specimen is unacceptable for testing, the infantôs newborn screen must be reordered and a specimen must be obtained promptly.



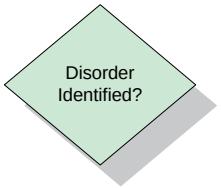
If abnormal results are received, the PCP should access the ACT sheet specific to the disorder. The ACT sheet may be provided by the state newborn screening program or can be accessed at: www.acmg.net/resources/policies/ACT/condition-analyte-links.htm.

The most important actions to take are highlighted on the ACT sheets and include:

- When to contact the family;
- Whom to consult and whether an appointment is needed immediately;
- When the patient must be seen by the PCP;
- Whether further confirmatory testing is needed and what tests should be conducted;
- Whether treatment is necessary and what treatment to initiate;

- How to educate parents about the disorder;
- When findings need to be reported back to the newborn screening program.

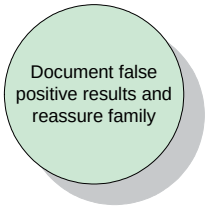
In addition to following ACT sheet recommendations, the PCP should consult with the state newborn screening program.



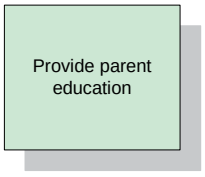
After an abnormal screening result is obtained, confirmatory testing and/or definitive consultation with subspecialists are required before a final diagnosis can be made.

Special Circumstances

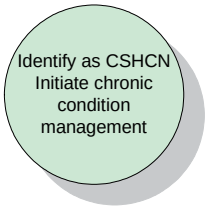
In addition to true or false positive results, confirmatory tests may identify the child as a carrier of the disorder or may be of indeterminate result.



In the event that the initial positive result proves to be a false positive result, the PCP can provide reassurance to parents. Up to 20% of these parents will persist in their concerns about the health of their children for months or years after screening.



To lay the foundation for comprehensive and collaborative care, it is critical during this time of uncertainty that the parents and family of the neonate be provided with disorder-specific information and support as they await final clarification of the childôs diagnosis and begin to plan for treatment and management. Frequent, specific, and supportive communication from the PCP will help to avoid confusion and build trust.



The parents and family of the neonate should be provided with disorder-specific information and support as they await final clarification of the childôs diagnosis and begin to plan for treatment and management.

Any child in whom a significant medical disorder is diagnosed should be entered into the practice's registry for children with special health care needs, and chronic care management should be initiated. Chronic care management provides proactive care for children with special health care needs, including condition-related office visits, written care plans, explicit comanagement with specialists, appropriate patient education, and effective information systems for monitoring and tracking the child's disorder.

A subspecialist may provide substantial ongoing care for a child with a severe and complex disorder. However, the PCP retains the responsibility to provide a medical home, which is the central source of "family-centered, accessible, continuous, coordinated, comprehensive, compassionate, and culturally effective" care for the family, and the family should be encouraged to maintain their relationship with their PCP.

The complex nature of many disorders identified by newborn screening may require care by a team of medical subspecialists, therapists, nutritionists, and educators. Clearly defined roles may help to reduce redundancies of services and prevent fragmentation of care.

APPENDIX 4 CONTACT INFORMATION FOR STATE NEWBORN SCREENING PROGRAMS

State	Contact	Web Site	Telephone	E-mail
Alabama	Melissa Tucker, AuD, CCC-A, Director of Newborn Screening Program	www.adph.org/newbornscreening	(334) 206–2944	melissatucker@adph.state.al.us
Alaska	Stephanie Birch, RNC, BSN, MPH, MCH Title V and CSHCN Director	www.hss.state.ak.us/dph/wcfh/screening_testing.htm	(907) 334–2424	stephanie_birch@health.state.ak.us
Arizona	Jan Kerrigan, RN, Program Manager	www.aznewborn.com/index.htm	(602) 364–1409	kerrigj@azdhs.gov
Arkansas	Dianne Pettit, Newborn Screening Coordinator	www.healthyarkansas.com/services/services_ph2.html#Newborn	(501) 280–4145	dpettit@arkansas.gov
California	John E. Sherwin, PhD, NBS Director	www.dhs.ca.gov/pcfh/gdb/html/nbs/	(510) 231–1728	jsherwin@dhs.ca.gov
Colorado	Vickie Thomson, MA, Director for the Newborn Screening Program	www.cdphe.state.co.us/ps/hcp/nbms/index.html	(303) 692–2458	vickie.thomson@colorado.edu
Connecticut	Vine Samuels, Newborn Screening Supervisor	www.dph.state.ct.us/BCH/NBS/NBS.htm	(860) 509–8081	vine.samuels@po.state.ct.us
Delaware	Betsy Voss, Newborn Screening Program Director	www.dhss.delaware.gov/dhss/dph/chca/dphnsp1.html	(302) 741–2987	betsy.voss@state.de.us
District of Columbia	Michelle Sermon, Genetics Program Specialist	http://doh.dc.gov/doh/cwp/view,a,3,q,573233, dohNav_GID,1802,dohNav,%7C33200%7C33245%7C.asp	(202) 442–9162	michelle.sermon@dc.gov
Florida	Lois Taylor, Director, Florida Newborn Screening Program	www.cms-kids.com/InfantScrning.htm	(850) 245–4670	lois_taylor@doh.state.fl.us
Georgia	Mary Ann Henson, MSN, Genetics Program Manager	http://health.state.ga.us/programs/nsmscd/index.asp	(404) 657–6359	mahenson@dhr.state.ga.us
Hawaii	Christine Matsumoto, Newborn Metabolic Screening Program Coordinator	www.state.hi.us/health/family-child-health/genetics/ genetics/nbshome.html	(808) 733–9069	chris.matsumoto@fhsd.health.state.hi.us
Idaho	Paige Fincher, Acting Manager	www.healthandwelfare.idaho.gov	(208) 334–4935	fincherp@idhw.state.id.us
Illinois	Claude-Alix Jacob, Deputy Director	www.idph.state.il.us/HealthWellness/genetics.htm	(217) 785–4093	claude.jacob@illinois.gov
Indiana	Iris Stone, Chief Nurse Consultant	www.in.gov/isdh/programs/nbs/NewbornScrSitemap.htm	(317) 233–1379	istone@isdh.in.gov
Iowa	Kimberly Noble Piper, State Genetics Coordinator	www.idph.state.ia.us/genetics/neonatal_parent_page.asp	(515) 281–6466	kpiper@idph.state.ia.us
Kansas	Melanie Warren, Follow-up Coordinator	www.kdheks.gov/newborn_screening	(785) 291–3363	mwarren@kdhe.state.ks.us
Kentucky	Sandy Fawbush, Nurse Administrator	http://chfs.ky.gov/dph/ach/ecd/newbornscreening.htm	(502) 564–3756, ext 3563	sandy.fawbush.ky.gov
Louisiana	Charles Myers, GSW, Program Administrator	www.dhh.louisiana.gov/offices/page.asp? ID = 263&Detail = 6302	(504) 219–4411	charlie@dhh.la.gov
Maine	John (Jack) A. Krueger, MSChE, Chief, Health and Environmental Testing Laboratory	www.maine.gov/dhhs/etl/newborn.htm	(207) 287–2727	john.a.krueger@maine.gov
Maryland	Susan Panning, NBS Director	www.fha.state.md.us/genetics/html/nbs_ndx.cfm	(410) 767–6730	panny.s.dhmh.state.md.us
Massachusetts	Roger Eaton, Director	www.umassmed.edu/nbs/index.aspx	(617) 983–6300	roger.eaton@umassmed.edu
Michigan	William Young, Newborn Screening Program Director	www.michigan.gov/mdch/0,1607,7–132–2942_4911_4916-64851—,00.html	(517) 335–8938	youngw@michigan.gov
Minnesota	Mark McCann, Supervisor, Newborn Screening Public Health Laboratory	www.health.state.mn.us/divs/fh/mcshn/nbshome.htm	(651) 201–5450; (651) 201–5471 (fax)	mark.mccann@state.mn.us
Mississippi	Beryl W. Polk, Director of Genetic Services	www.msdh.state.ms.us/msdhsite/index.cfm/41,0101,html	(601) 576–7619	bpolk@msdh.state.ms.us
Missouri	Sharmini V. Rogers, MD, BBS, MPH, Bureau Chief of Genetics and Healthy Childhood	www.dhss.mo.gov/NewbornScreening	(573) 751–6214	sharmini.rogers@dhss.mo.gov
Montana	Sib Clack, Newborn Screening Manager	www.dphhs.mt.gov/PHSD/family-health/newborn/newborn-screening.shtml	(406) 444–1216	sclack@mt.gov

APPENDIX 4 **Continued**

State	Contact	Web Site	Telephone	E-mail
Nebraska	Julie Miller, Program Manager	www.hhs.state.ne.us/nsp	(402) 471–6733	julie.miller@hhss.ne.gov
Nevada	[Vacant]	http://health.nv.gov/index.php		
New Hampshire	Marcia LaVochkin, Newborn Screening Program Coordinator	www.dhhs.state.nh.us/DHHS/MCH/default.htm	(603) 271–4225	mlavochkin@dhhs.state.nh.us
New Jersey	Mary Mickles, Program Manager of Newborn Screening and Genetics Services	www.state.nj.us/health/fhs/nbs/index.shtml	(609) 292–1582	mary.mickles@doh.state.nj.us
New Mexico	[Vacant]	http://sld.state.nm.us/nms	(505) 841–2581	
New York	Michele Caggana, MD, SCD FACNG Chief of Laboratory of Genetic Services	www.wadsworth.org/newborn	(518) 473–3854	mxc08@health.state.ny.us
North Carolina	Shu Chiang, Unit Supervisor Newborn Screening/Clinical Commissioner	http://slph.state.nc.us/Newborn/default.asp	(919) 733–3937	chu.chiang@ncmail.net
North Dakota	Barb Schweitzer, RN, Director of Newborn Screening	www.ndmch.com/metabolic-screening/default.asp	(701) 328–4538	bschweit@nd.gov
Ohio	William Becker, MD, Medical Director of Laboratory	www.odh.ohio.gov/odhPrograms/phl/newbrn/nbrn1.aspx	(888) 634–5227	william.becker@odh.ohio.gov
Oklahoma	Pam King, MPA, RN, Director of Genetics and State Genetics Coordinator	www.health.state.ok.us/program/gp/index.html	(405) 271–9444 ext 56737	pamk@health.ok.gov
Oregon	Cheryl Hermerath, Newborn Screening Program Manager	http://oregon.gov/DHS/ph/nbs/index.shtml	(503) 229–5882	cheryl.a.hermerath@state.or.us
Pennsylvania	M. Jeffery Shoemaker, PhD, Director	www.dsf.health.state.pa.us/health/cwp/view.asp?a=167&q=202513	(610) 280–3464	mshoemaker@state.pa.us
Puerto Rico	P. J.Santiago Borrero, Director of Hereditary Disease Program		(787) 754–3623	pjsantiago@centennial.net
Rhode Island	Ellen Amore, MS, Newborn Screening Program Manager	www.health.ri.gov/genetics/newborn.php	(401) 222–4601	ellena@doh.state.ri.us
South Carolina	Kathy Tomashitis, Pediatric Screening Follow-up Program, SC DHEC, Women and Children's Services	www.scdhec.net/health/lab/analyt/newborn.htm	(803) 898–0619	tomashk@dhec.sc.gov
South Dakota	Lucy Fossen, Newborn Screening Coordinator	www.state.sd.us/doh/NewbornScreening	(605) 773–2944	lucy.fossen@state.sd.us
Tennessee	Mitzi Lamberth, Newborn Screening Follow-up Program Director	http://health.state.tn.us/womenshealth/NBS/index.htm	(615) 262–6304	mitzi.lamberth@state.tn.us
Texas	David Martinez, Program Director	www.dshs.state.tx.us/newborn/default.shtm	(512) 458–7111, ext 2216	davidr.martinez@dshs.state.tx.us
Utah	Fay Keune, RN, Program Manager	http://health.utah.gov/newbornscreening	(801) 584–8256	fkeune@utah.gov
Vermont	Cynthia Ingham, Newborn Screening Program Chief	http://healthvermont.gov/regs/newborn_screening_reg.aspx	(802) 951–5180	cingham@vdh.state.vt.us
Virginia	Sharon K. Williams, RN, MS, Genetics Program Manager	www.vahealth.org/PSGS/	(804) 864–7712	sharonk.williams@vdh.virginia.gov
Washington	Mike Glass, Director	www.doh.wa.gov/ehsphl/phl/newborn/default.htm	(206) 418–5470	mike.glass@doh.wa.gov
West Virginia	Cathy Cummons, Newborn Screening Research Director	www.wvdhhr.org/mcfh/icah/unlinked/newborn_screening.htm	(304) 558–5388	cathycummons@wvdhhr.org
Wisconsin	Gary Hoffman, Newborn Screening Laboratory Manager	www.slh.wisc.edu/newborn	(608) 262–4692	hoffman@mail.slh.wis.edu
Wyoming	Shelly Gonzalez Sherry Long, Metabolic Records Analyst Nurse Consultant	http://wdh.state.wy.us/csh/index.asp	(307) 777–7943; (307) 777–7948	sgonza@state.wy.us; slong@state.wy.us

MCH indicates Maternal Child Health; CSHCN, children with special health care needs; NBS, newborn screening; SC DHEC, South Carolina Department of Health and Environmental Control.

THE AMERICAN ACADEMY OF PEDIATRICS STRONGLY RECOMMENDS NEWBORN SCREENING FOR ALL INFANTS

Refusal for Newborn Screening

Child's Name: _____ Child's Date of Birth: _____

Parent's/Legal Guardian's Name: _____

My child's doctor/nurse _____has advised me that my child (named above) should participate in the newborn screening program.

☐ As the parent or legal guardian of my child (named above), I choose to decline participation in my state's newborn screening program.

I have been provided information about newborn screening in my state and the importance of early identification of the diseases. I have had the opportunity to discuss these with my child's doctor or nurse, who has answered my questions regarding the recommended screening. I understand the following:

- The purpose of and the need for newborn screening.
- The risks and benefits of newborn screening.
- **If my child does not participate in newborn screening, the consequences of a late diagnosis of certain conditions can include mental retardation or death.**
- My child's doctor or nurse and the American Academy of Pediatrics strongly recommend that all newborn infants be screened for certain disorders.
- If my child has one of my state's screened conditions, failure to participate in newborn screening may endanger the health or life of my child.

Nevertheless, I have decided at this time to decline participation in the newborn screening program for my child, as indicated by checking the box above.

I acknowledge that I have read this document or it has been read to me in its entirety and I fully understand it.

Parent's/Legal Guardian's Signature _____ Date _____

Witness _____ Date _____

I have had the opportunity to re-discuss my decision not to participate in my state's newborn screening program and still decline the recommended participation.

Parent's initials _____ Date _____ Parent's initials _____ Date _____

Parent's initials _____ Date _____ Parent's initials _____ Date _____

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

APPENDIX 5: DOCUMENTING REFUSAL TO HAVE INFANTS UNDERGO NEWBORN SCREENING

Despite the best efforts of health care professionals to educate parents and guardians about the need to have their infants undergo newborn screening and the importance of newborn screening in the early identification of certain diseases, some parents and guardians will decline to have their infants undergo newborn screening.

All parents and guardians should be informed about the purpose of and need for newborn screening, the risks and benefits of newborn screening, and the consequences of late diagnosis of certain conditions that would have been identified earlier through newborn screening. The use of this or a similar form that demonstrates the importance you place on newborn screening and focuses attention on the unnecessary risk for which a parent or guardian is accepting responsibility may, in some instances, induce a wavering parent or guardian to accept your recommendation.

Disclaimer. This form may be used as a template for such documentation, but it should not be used without obtaining legal advice from a qualified health care attorney about the use of the form in your practice. Moreover, completion of a form, in and of itself, never substitutes for good risk communication, nor would it provide absolute immunity from liability. For instances in which parents or guardians refuse newborn screening, health care professionals should take advantage of their ongoing relationship with the family and revisit the discussion on subsequent visits. Documentation in the medical chart of such follow-up discussions is strongly recommended, and the template, therefore, makes provision for this documentation.

This form may be duplicated or changed to suit your needs and your patients' needs and should be reviewed with your health care attorney before use. It will be available on the AAP Web[7] site (www.aap.org/bookstore).

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

TECHNICAL REPORT

Introduction to the Newborn Screening Fact Sheets

Celia I. Kaye, MD, PhD, and the Committee on Genetics

ABSTRACT

Newborn screening fact sheets were last revised in 1996 by the Committee on Genetics of the American Academy of Pediatrics. These fact sheets have been revised again because of advances in the field, including technologic innovations such as tandem mass spectrometry, as well as greater appreciation of ethical issues such as informed consent. The fact sheets provide information to assist pediatricians and other professionals who care for children in performing their essential role within the newborn screening public health system. The newborn screening system consists of 5 parts: (1) newborn testing; (2) follow-up of abnormal screening results to facilitate timely diagnostic testing and management; (3) diagnostic testing; (4) disease management, which requires coordination with the medical home and genetic counseling; and (5) continuous evaluation and improvement of the newborn screening system. The following disorders are reviewed in the newborn screening fact sheets (which are available at www.pediatrics.org/cgi/content/full/118/3/e934): biotinidase deficiency, congenital adrenal hyperplasia, congenital hearing loss, congenital hypothyroidism, cystic fibrosis, galactosemia, homocystinuria, maple syrup urine disease, medium-chain acyl-coenzyme A dehydrogenase deficiency, phenylketonuria, sickle cell disease and other hemoglobinopathies, and tyrosinemia.

NEWBORN screening fact sheets were last revised in 1996 by the Committee on Genetics of the American Academy of Pediatrics (AAP). Publication of these revised newborn screening fact sheets was prompted by advances in the field, including technologic innovations, as well as greater appreciation of ethical issues such as those surrounding informed consent.

NEWBORN SCREENING AS A PUBLIC HEALTH SYSTEM

Every infant born in the United States is screened shortly after birth using heelstick blood spots to detect a variety of congenital conditions. Many infants are also screened for congenital hearing loss. Newborn screening programs have been developed and managed within states, the District of Columbia, Puerto Rico, the US Virgin Islands, and Guam (Table 1). As public health programs, they require a coordinated system of follow-up, diagnosis, and treatment. Periodic program evaluation is also necessary. Thus, newborn screening is not simply a test to identify whether a metabolite is found in unusually high or low concentration in a particular blood spot. Newborn screening is also more than a state-run program that ensures that each abnormal screening result is linked to a particular infant who subsequently receives a diagnostic test and, if indicated, referral for appro-

www.pediatrics.org/cgi/doi/10.1542/peds.2006-1782

doi:10.1542/peds.2006-1782

Key Words

newborn screening, screening, genetic disorder, biotinidase deficiency, congenital adrenal hyperplasia, congenital hearing loss, congenital hypothyroidism, cystic fibrosis, galactosemia, hemoglobinopathies, homocystinuria, maple syrup urine disease, medium-chain acyl-coenzyme A dehydrogenase deficiency, phenylketonuria, sickle cell disease, tyrosinemia, tandem mass spectrometry

Abbreviations

AAP—American Academy of Pediatrics
MS/MS—tandem mass spectrometry
PKU—phenylketonuria
MCAD—medium-chain acyl-coenzyme A dehydrogenase
FAO—fatty acid oxidation

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

TABLE 1 **Status of Newborn Screening in the United States**

State	Core Conditions[a]									Additional Conditions Included in Screening Panel (Universally Required Unless Otherwise Indicated)
	Hearing	Endocrine		Hemoglobin			Other			
	HEAR	CH	CAH	Hb S/S	Hb S/A	Hb S/C	BIO	GALT	CF	
Alabama	A	●	●	●	●	●	●	●		
Alaska	A	●	●	●	●	●	●	●		
Arizona	A	●	●	●	●	●	●	●		
Arkansas	●	●		●	●	●		●		
California	B	●	●	●	●	●		●		5-OXO; HHH; PRO
Colorado	●	●	●	●	●	●	●	●	●	
Connecticut	●	●	●	●	●	●	●	●	B	5-OXO; HHH; HIV[b]; NKH
District of Columbia	●	●	●	●	●	●	●	●	●	G6PD
Delaware	A	●	●	●	●	●		●		
Florida	●	●	●	●	●	●	●	●	C	
Georgia	A	●	●	●	●	●	●	●		
Hawaii	●	●	●	●	●	●	●	●		
Idaho	A	●	●	●	●	●	●	●		
Illinois	●	●	●	●	●	●	●	●		5-OXO
Indiana	●	●	●	●	●	●	●	●		
Iowa	●	●	●	●	●	●	●	●	●	HHH; NKH
Kansas	●	●		●	●	●		●		
Kentucky	A	●	C	●	●	●	C	●	C	
Louisiana	●	●		●	●	●	●	●		
Maine	A	●	●	●	●	●	●	●		HHH (A); CPS (D)
Maryland	●	●	●	●	●	●	●	●	C	
Massachusetts	●	●	●	●	●	●	●	●	A	TOXO; HHH (A); CPS (D)
Michigan	A	●	●	●	●	●	●	●		
Minnesota	A	●	●	●	●	●	●	●	●	
Mississippi	●	●	●	●	●	●	●	●	●	5-OXO; CPS; HHH
Missouri	●	●	●	●	●	●	C	●	C	
Montana	●	●	B	●	●	●	B	●	B	
Nebraska	A	●	●	●	●	●	●	●	●	5-OXO; HHH; NKH (A)
Nevada	A	●	●	●	●	●	●	●		
New Hampshire	A	●	C	C	C	C	C	●	C	TOXO
New Jersey	●	●	●	●	●	●	●	●	●	
New Mexico	●	●	●	●	●	●	●	●	C	
New York	●	●	●	●	●	●	●	●	●	HIV
North Carolina	●	●	●	●	●	●	●	●		
North Dakota	A	●	●	●	●	●	●	●	●	
Ohio	●	●	●	●	●	●	●	●		
Oklahoma	●	●	●	●	●	●		●	●	
Oregon	A	●	●	●	●	●	●	●		
Pennsylvania	●	●	●	●	●	●	B	●	B	5-OXO; CPS; G6PD; HHH; NKH (B)
Rhode Island	●	●	●	●	●	●	●	●		
South Carolina	A	●	●	●	●	●	●	●	●	
South Dakota	A	●	●	●	●	●	●	●	B	5-OXO; EMA; HHH; NKH
Tennessee	A	●	●	●	●	●	●	●		5-OXO; HHH; NKH
Texas	A	●	●	●	●	●		●		
Utah	●	●		●	●	●		●		
Vermont	A	●	●	●	●	●	●	●		CPS
Virginia	●	●	●	●	●	●	●	●	●	
Washington	A	●	●	●	●	●	●	●		
West Virginia	●	●		●	●	●		●		
Wisconsin	A	●	●	●	●	●	●	●	●	
Wyoming	●	●	●	●	●	●	●	●	●	

A dot (●) indicates that screening for the condition is universally required by law or rule; A, universally offered but not yet required; B, offered to select populations or by request; C, testing required but not yet implemented; D, likely to be detected (and reported) as a byproduct of multiple reaction monitoring screening (MS/MS) targeted by law or rule. BIO indicates biotinidase; CAH, congenital adrenal hyperplasia; CF, cystic fibrosis; CH, congenital hypothyroidism; GALT, transferase-deficient galactosemia (classical); HBS/S, sickle cell disease; HB S/C, sickle C disease; HB S/A, S-β-thalassemia; HEAR, hearing screening; 5-OXO, 5-oxoprolinuria (pyroglutamic aciduria); CPS, carbamoylphosphate synthetase; EMA, ethylmalonic encephalopathy; G6PD, glucose 6 phosphate dehydrogenase; HHH, hyperammonemia/ornithinemia/citrullinemia (ornithine transporter defect); NKH, nonketotic hyperglycinemia; PRO, prolinemia; TOXO, toxoplasmosis.

[a] Terminology is consistent with that of the American College of Medical Genetics. *Newborn Screening: Toward a Uniform Screening Panel and System*. Rockville, MD: Health Resources and Services Administration; 2005:63.

[b] Newborn screened for HIV only if mother was not screened during pregnancy.

priate treatment. Newborn screening is a 5-part system[1] in which the pediatrician plays a vital role.

Part 1: Testing of Newborn Infants

Along with the obstetrician, the pediatrician is involved in the education of parents regarding the availability of newborn screening tests, the benefits of early detection of disorders for which screening is performed, the risks that exist for newborn infants who do not receive screening, the process of screening and follow-up, and government requirements that may exist.[2] The pediatrician is also involved in obtaining informed consent in states where this is applicable. Although the timing of specimen collection is straightforward in term, healthy newborn infants, the pediatrician should be aware of factors that may influence the results of a particular screening test, including gestational and postnatal age, early discharge, diet, transfusions, and total parenteral nutrition (Table 2). Results must be documented for all patients in a timely fashion, which may be a challenge in geographic regions with large numbers of neonates, understaffed nurseries and physician offices, and poor technologic support.

Part 2: Follow-up

Proper follow-up of a "not-normal" screening result is crucial if mortality, morbidity, and disabilities are to be avoided. The primary function of the follow-up program is to locate infants with abnormal screening results and facilitate timely diagnostic testing and management. The time frame for follow-up will vary by disorder and by the degree of abnormality of the screening result. Maple syrup urine disease, congenital adrenal hyperplasia, and galactosemia are 3 disorders that can be fatal rapidly unless treatment is instituted very quickly. The pediatrician may be the provider of first contact for screen-positive infants; hence, he or she must be familiar with initial management, including referral management and subsequent diagnostic testing of such infants. The pediatrician also must be prepared to explain to the family the meaning of a positive screening result, the possibility of a false-positive test result, and the steps that must be taken next.

Part 3: Diagnostic Testing

Many of the disorders identified by newborn screening programs are heterogeneous. This variability requires specialized laboratory testing, interpretation, and treatment. The pediatrician works with specialized laboratories and providers in obtaining appropriate specimens, initiating treatment, diagnosis when appropriate, and coordinating care once the diagnosis is confirmed.

Part 4: Disease Management

Infants affected with disorders detected by newborn screening usually require lifelong management. Every

TABLE 2 Effect of Sample Timing, Preterm Birth, Diet, Transfusion, and Total Parenteral Nutrition on Newborn Screening Results

Disorder	Sample Timing	Diet	Preterm Birth	Transfusion	Total Parenteral Nutrition
Biotinidase deficiency	—	—	—	>90 d after transfusion	—
Congenital adrenal hyperplasia	↑ in false-positives first 24 h	—	↑ in false-positives secondary to normal ↑ in 17-hydroxyprogesterone	A few hours (estimated) after transfusion	—
Congenital hearing loss	—	—	—	—	—
Congenital hypothyroidism					
Thyrotropin method	↑ in false-positives before 48 h	—	—	—	—
Thyroxine method	—	—	↑ in false-positives and false-negatives	—	—
Cystic fibrosis	↑ in false-positives in first 24 h	Not known	Not known	Interferes with mutation analysis for 3–6 wk	—
Galactosemia					
Galactose method	—	Galactose-containing formula	—	—	False-negative
GALT method	—	—	—	>90 d after transfusion	—
Homocystinuria	>24 h; second test at 2–4 wk advisable	Adequate protein intake	—	—	False-positive
Maple syrup urine disease	—	—	—	—	False-positive
MCAD deficiency	Before 8 d	—	—	—	—
PKU	—	Adequate protein intake	—	—	False-positive
Sickle cell diseases and other hemoglobinopathies	—	—	↑ in false-negatives with extreme preterm birth	>90 d after transfusion	—
Tyrosinemia	—	Adequate protein intake	Increased likelihood of neonatal tyrosinemia	—	False-positive

— indicates no impact; ↑, increase.

child should have a medical home to coordinate care; that care should be accessible, family centered, continuous, comprehensive, coordinated, compassionate, and culturally competent.[3] The pediatrician plays a central role in the development of the medical home, which includes experts who understand the etiology, pathophysiology, clinical heterogeneity, and psychosocial issues associated with the disorder. Genetic counseling, including discussion of carrier testing of family members and prenatal diagnosis of future pregnancies, may be indicated.

Part 5: Evaluation

The newborn screening system can function optimally only when its components are coordinated, which means that there must be regular and timely communication between nurseries, screening laboratories, state health departments, pediatricians, and subspecialists. To ensure that this is happening, the effectiveness of each component of the system must be assessed continuously through the collection and analysis of data, including outcomes data. Although an adequate evaluation program has not been developed for most newborn screening systems, the pediatrician will be central to the implementation of such a program, particularly through the provision of outcomes data.

NEWBORN SCREENING TASK FORCE REPORT

Several factors have contributed to the need for review of the newborn screening system, including enhanced public interest in newborn screening as a universal genetic screening program; the introduction of new technologies such as tandem mass spectrometry (MS/MS) and DNA-based tests; and changing demographics, which emphasize the importance of human variation and cultural competence. In response to this need, the AAP, with support from the Health Resources and Services Administration and the National Institutes of Health, convened a task force to review the role and operation of newborn screening as a public health system.[4] The Newborn Screening Task Force outlined a national agenda to strengthen state newborn screening systems through the development of model regulations for disease and test selection; minimum standards for sample collection and other activities; model guidelines for follow-up, diagnosis, and treatment; strategies to inform families and the public more effectively; and demonstration projects to evaluate technology, quality assurance, and health outcomes. The task force report emphasized the need for a sixth component of the 5-part newborn screening system: education of professionals and the public.

INFORMED CONSENT

With the introduction of DNA-based testing as a component of newborn screening panels, consumers, health care professionals, and policy makers have become increasingly aware of issues of informed consent for both the performance of the screening tests and retention and use of residual test samples. Although all states require newborn screening, most newborn screening laws or regulations provide exemptions in some situations.[5] Expert panels have not reached consensus, but in general, they have recognized the benefit of informed consent before testing as a tool for educating parents.[6] When the validity and utility of the test have been established, experts have usually concluded that informed consent for newborn screening could be waived.[7] The Newborn Screening Task Force emphasized the need for education and concluded that, "Before newborn screening, parents (on behalf of their children) have a right to be informed about screening, and have the right to refuse screening. They also have a right to confidentiality and privacy protection for information contained in all newborn screening results."[4] The consent process in each state is governed by state law.

Among the benefits, newborn screening may:

- detect a serious, treatable disorder before symptoms are present;
- lead to treatment that can prevent serious problems including mental retardation and death; or
- detect carriers of certain genetic disorders.

Among the risks, newborn screening may:

- fail to identify some children who actually have the condition;require repeat testing;
- cause parental anxiety after false-positive results;
- reveal (through genetic tests) misattributed paternity; or
- detect disorders for which treatment is not effective.

There is agreement that policy guidelines for residual sample retention and use are needed, but to date, there has been no consensus on the content of such guidelines.

MS/MS

Population screening for phenylketonuria (PKU) began in the 1960s using a relatively simple analytic method. New disorders were added as methods to use blood spots were developed and were applicable to large populations at low cost. By the 1990s, scientific advances and technologic innovations led to the possibility of adding numerous new metabolic disorders to the screening panel using MS/MS (Table 3). Consumers throughout the nation acted quickly through their state legislatures to mandate the addition of medium-chain acyl-coenzyme A dehydrogenase (MCAD) deficiency and other disorders of fatty acid oxidation (FAO) to the list of disorders for which newborn screening is mandated. Several states

TABLE 3 **Additional Disorders Detected by MS/MS Screening**

	Description
Amino acid disorders	
Argininosuccinic aciduria	A disorder of the urea cycle. Episodes of hyperammonemia produce acute intoxication. The major symptoms include mental retardation, failure to thrive, liver dysfunction, unusual hair (trichorrhexis nodosa), and seizures.
Citrullinemia	A disorder of the urea cycle. Episodes of hyperammonemia produce coma and seizures. The major symptoms include changes in sensorium (irritability, lethargy), seizures, ataxia, and mental retardation.
Hypermethioninemia	Can be seen in a variety of conditions. It is found in conjunction with homocystinuria and tyrosinemia. Neonatal hypermethioninemia can occur in preterm infants or be attributable to neonatal hepatitis or a combination of factors.
FAO disorders	
Carnitine/acylcarnitine translocase deficiency	Major symptoms are fasting hypoglycemia with seizures and coma, cardiomyopathy, arrhythmias, muscle weakness, and hepatomegaly/abnormal liver function.
3-Hydroxy long-chain acyl-coenzyme A dehydrogenase (LCHAD) deficiency	Results in an inability of the body to break down fatty acids into a usable energy source. LCHAD deficiency can present as hypoglycemia, lethargy, SIDS, hypotonia, and cardiomyopathy.
MCAD deficiency	Can cause recurrent episodes of hypoglycemia, failure to thrive, persistent vomiting, hepatomegaly, and rhabdomyolysis. Acute episodes are usually associated with concurrent illness or fasting and occur in infancy or early childhood.
Multiple acyl-coenzyme A dehydrogenase deficiency (also known as glutaric acidemia-type II)	Often associated with unexplained death in neonates. Other features include respiratory distress, hypotonia, unusual odor (described as "sweaty feet") and liver dysfunction.
Neonatal carnitine palmitoyl transferase deficiency-type II	Symptoms include hypoketotic hypoglycemia with seizures and coma, cardiac arrhythmia, cardiomyopathy, and hepatopathy.
Short-chain acyl-coenzyme A dehydrogenase (SCAD) deficiency	Patients with SCAD deficiency have failure to thrive, developmental delays/hypotonia, metabolic acidosis, recurrent emesis, and a lipid-storage myopathy.
Short-chain hydroxy acyl-coenzyme A dehydrogenase deficiency	The major symptom is hypoketotic hypoglycemia.
Trifunctional protein deficiency	Can present as skeletal myopathy, cardiomyopathy, or SIDS.
Very long-chain acyl-coenzyme A dehydrogenase deficiency	Symptoms are similar to other FAO defects.
Organic acid disorders	
3-Hydroxy-3-methylglutaryl-coenzyme A lyase deficiency	This enzyme catalyzes the final step of leucine catabolism and plays a key role in ketone body formation. The major clinical features are metabolic acidosis and hypoglycemia. Unexplained fevers can occur. Encephalopathy (somnolence, coma, and malaise) and hepatopathy are common. SIDS may occur.
Glutaric acidemia type I	Results from an inherited defect in the degradation of lysine and tryptophan. Macrocephaly with an increase in the size of the extra cerebral fluid spaces occurs before the onset of any neurologic symptoms. Neurologic disease usually presents later in infancy with tonal abnormalities and choreoathetosis secondary to basal ganglia injury.
Isovaleric acidemia	This is a disorder of branched-chain amino acid metabolism that results in recurrent episodes of emesis, dehydration, and severe metabolic acidosis. Other symptoms include anorexia, listlessness, lethargy, neuromuscular irritability, and hypothermia. Acute episodes are associated with concurrent illnesses or high dietary protein intake.
Methylmalonic acidemia	An increase in methylmalonic acid can be seen with a variety of conditions. Transient increases in methylmalonic acid can be detected in otherwise healthy infants. Symptoms can include failure to thrive, episodic dehydration, and hypotonia. A variety of central nervous system changes (dystonia, dysphagia, and dysarthria) can occur. Infants with methylmalonic acidemia have been noted to have distinct facial dysmorphism.
Propionic acidemia	Symptoms are usually episodic emesis, dehydration, and metabolic acidosis. Hematologic abnormalities such as neutropenia, thrombocytopenia, and hypogammaglobulinemia are common. Mental retardation is a consistent feature, and most patients exhibit intolerance to dietary protein.
Multiple-coenzyme A carboxylase deficiency	This is a deficiency of the enzyme that attaches biotin to enzyme proteins that then results in multiple secondary enzyme deficiencies. Symptoms can be linked to deficiencies of the individual enzymes. Recurrent episodes of emesis, metabolic acidosis, and seizures can occur.
Other organic acidemias detected by MS/MS screening	2-Methylbutyryl-coenzyme A dehydrogenase deficiency, 3-methylcrotonyl-coenzyme A carboxylase deficiency, 3-methylglutaconyl-coenzyme A hydratase deficiency, mitochondrial acetoacetyl-coenzyme A thiolase deficiency (3-ketothiolase deficiency)
Other abnormal profiles	Abnormal results may be found on MS/MS screening secondary to hyperalimentation, liver disease, or contamination of the specimen. Also, treatment with medium-chain triglyceride oil, benzoate, valproate, or pyvalic acid can produce abnormal results.

SIDS indicates sudden infant death syndrome.

TABLE 4 **Status of Newborn Screening in the United States: Core Conditions Detected by MS/MS**

State	Core Conditions: Metabolic[a]																				
	Fatty Acid Disorders					Organic Acid Disorders									Amino Acid Disorders						
	CUD	LCHAD	MCAD	TFP	VLCAD	GA-I	HMG	IVA	3-MCC	Cbl-A,B	BKT	MUT	PROP	MCD	ASA	CIT	HCY	MSUD	PKU	TYR-I
Alabama	●		●							●		●	●			●	●	●	●	●
Alaska	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Arizona																	●	●	●	
Arkansas																			●	
California	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Colorado	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	●	C
Connecticut	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
District of Columbia	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Delaware		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Florida	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Georgia			●														●	●	●	●
Hawaii	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Idaho	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Illinois		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Indiana	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Iowa	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Kansas																			●	
Kentucky	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Louisiana			A												A	A	A	A	●	
Maine	D	●	●	D	●	●	●	●	●	●	●	●	●	D	●	●	●	●	●	●
Maryland		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Massachusetts	D	A	●	D	A	A	A	A	A	A	A	A	A	D	A	A	●	●	●	A
Michigan	A	A	●	A	A	A	A	A	A	A	A	A	A	A	●	●	●	●	●	A
Minnesota	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Mississippi	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Missouri		●	●	●	●	●	●	●	●	●			●		●	●	●	●	●	
Montana	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	●	B
Nebraska		A	●	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	●	A
Nevada	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
New Hampshire			C														●	●	●	
New Jersey		A	●	A	●	●	●	●	●	●	A	●	●		●	●	A	●	●	A
New Mexico	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	●	C
New York	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
North Carolina		●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	
North Dakota		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Ohio		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Oklahoma			C																●	
Oregon	A	●	●	A	●	●	●	●	●	A	A	●	●	A	●	●	●	●	●	●
Pennsylvania	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	●	●	B
Rhode Island	D		●														●	●	●	
South Carolina	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
South Dakota	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Tennessee		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Texas																			●	
Utah	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Vermont	D	●	●	D	●	●	●	●	●	●	●	●	●	D	●	●	●	●	●	●
Virginia	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Washington			●														●	●	●	
West Virginia																			●	
Wisconsin	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Wyoming																			●	

A dot (●) indicates that screening for the condition is universally required by law or rule; A, universally offered but not yet required; B, offered to select populations or by request; C, testing is required but not yet implemented; D, likely to be detected (and reported) as a byproduct of multiple reaction monitoring screening (MS/MS) targeted by law or rule. 3-MCC indicates 3-methylcrotonyl-coenzyme A carboxylase; ASA, argininosuccinate acidemia; BKT, β ketothiolase (mitochondrial acetoacetyl-coenzyme A thiolase; short-chain ketoacyl thiolase; T2); CBL A,B, methylmalonic acidemia (vitamin B_{12} disorders); CIT I, citrullinemia type I (Argininosuccinate synthetase); CUD, carnitine uptake defect (carnitine transport defect); GA-1, glutaric acidemia type 1; HCY, homocystinuria (cystathionine β synthase); HMG, 3-hydroxy 3-methylglutaric aciduria (3-hydroxy 3-methylglutaryl-coenzyme A lyase); IVA, isovaleric acidemia (isovaleryl-coenzyme A dehydrogenase); LCHAD, long-chain L-3- hydroxyacyl-coenzyme A dehydrogenase; MCD, multiple carboxylase (holocarboxylase synthetase); MSUD, maple syrup urine disease (branched-chain ketoacid dehydrogenase); MUT, methylmalonic acidemia (methylmalonyl-coenzyme A mutase); PROP, propionic acidemia (propionyl-coenzyme A carboxylase); TFP, trifunctional protein deficiency; TYR-1, tyrosinemia type 1; VLCAD, very long-chain acyl-coenzyme A dehydrogenase.

[a] Terminology is consistent with report from the American College of Medical Genetics. *Newborn Screening: Toward a Uniform Screening Panel and System*. Rockville, MD: Health Resources and Services Administration; 2005:63.

Nomenclature source: National Newborn Screening and Genetic Resource Center (http://genes-r-us.uthscsa.edu).

now require screening for MCAD deficiency and other disorders of FAO[8] (Table 4), and a cost/benefit analysis of MS/MS has been published.[9] MS/MS technology can also be used to screen for PKU and some other amino acid disorders and has a rate of false-positive results that is lower than other screening methods. Therefore, states that adopt MS/MS technology to screen for FAO disorders may also revise their panels of amino acid disorders for which they screen (Table 5). In addition, certain screening methods for particular disorders permit the diagnosis of other conditions that were not originally designated on the list of disorders for newborn screening. These have been called "secondary-target conditions" (Table 6). Pediatricians, who are central to the newborn screening system as discussed earlier, will need to be familiar with these new disorders as they are added to screening panels or are diagnosed because the technology for newborn screening identifies them (secondary-target conditions).

ROLE OF DNA ANALYSIS IN NEWBORN SCREENING

Analysis of DNA for mutations is not a primary screening method for any of the disorders for which newborn screening is performed today. However, secondary DNA analysis may be used in conjunction with other tests to decrease the rate of false-positive results. It may also be used as a diagnostic test for certain disorders.

CONCERNS AND CONTROVERSIES

Because the initial test in the newborn screening process is a screening test, there is a significant risk of false-positive (abnormal test, normal infant) and false-negative (normal test, affected infant) results. False-positive results lead to additional testing and parental anxiety, and long-term consequences such as the vulnerable-child syndrome may occur. False-negative results may lead to a delay in diagnosis, because the health care professional may be falsely reassured by a normal newborn screening result. These possibilities raise clinical and ethical issues, which should be discussed with parents before testing.

There is a lack of uniformity between states regarding the diseases screened and the technology used. Such lack of uniformity results in the place of birth determining the likelihood of early diagnosis of these serious but treatable conditions. Newborn screening rules and statutes require that a newborn infant be screened using the panel in the state in which he or she was born, not necessarily the state in which the mother is a resident. There is also controversy regarding whether newborn screening should incorporate conditions for which highly effective interventions that reduce morbidity for the child are unavailable. Numerous state and national organizations have convened groups to discuss these issues and propose policies, but no national consensus has been developed.[10] Finally, it must be emphasized that "normal" results of newborn screenings do not rule out the presence of these disorders, because some variants of these conditions may have onset later in life, and false-negative results may occur. The clinical judgment of the pediatrician remains the most important tool in the diagnosis of all of these conditions.

INDEX OF NEWBORN SCREENING FACT SHEETS

The following newborn screening fact sheets are available at www.pediatrics.org/cgi/content/full/118/3/e934:

- Biotinidase deficiency
- Congenital adrenal hyperplasia
- Congenital hearing loss
- Congenital hypothyroidism
- Cystic fibrosis
- Galactosemia
- Homocystinuria
- Maple syrup urine disease (branched-chain ketoaciduria)
- MCAD deficiency
- PKU
- Sickle cell disease and other hemoglobinopathies
- Tyrosinemia

TABLE 5 **Use of MS/MS for Newborn Screening**

By MS/MS Only	By MS/MS or Other Technique[a]	Not By MS/MS
Argininemia	Congenital adrenal hyperplasia	Biotinidase
Argininosuccinic acidemia	Galactosemia	Cystic fibrosis
Citrullinemia	Hemoglobinopathies	Hearing loss
Hypermethioninemia	Homocystinuria	Hypothyroidism
Hyperornithinemia-hyperammonemia-homocitrullinuria	Maple syrup urine disease	
FAO disorders (such as MCAD deficiency)	PKU	
Organic acidemias	Tyrosinemia	

This is not a comprehensive list of disorders for which newborn screening is possible.

[a] Most states use a method other than MS/MS to screen for these disorders.

TABLE 6 Status of Newborn Screening in the United States: Disorders Detected Secondary to Testing for Another Condition

State	Secondary-Target Conditions[a]																								
	Fatty Acid Disorders								Organic Acid Disorders						Amino Acid Disorders								Other Metabolic Disorders		HbG, Variant Hemoglobins
	CACT	CPT-Ia	CPT- II	DE-RED	GA-II	MCKAT	M/SCHAD	SC AD	2M3HBA	2MBG	3MGA	CbI-C,D	IBG	MAL	ARG	BIOPT-BS	BIOPT-RG	CIT-II	H-PHE	MET	TYR- II	TYR- III	GALE	GALK	
Alabama												●						●	●		●	●			A
Alaska	●	●	●		●			●	●	●	●	●	●	●	●	B	B	●	●	●	●		B	B	●
Arizona																			●						A
Arkansas																			●				●	●	A
California	●	●	●		●			●	●	●	●	●	●	●	●	A	A	●	●	●	●	●			●
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Connecticut	●	●	●	●	●			●				●		●	●				●	●			●	●	A
District of Columbia	●	●	●	●	●	A	●	●	A	●	●	●	●	●	●	A	A	●	●	●	●	A	●	●	A
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Florida	●	●	●		●			●				●						●	●	●	●				A
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Hawaii	●	●	●		●			●	●	●	●	●	●	●	●	B	B	●	●	●	●		B	B	A
Idaho	●	●	●		●			●	●	●	●	●	●	●	●	B	B	●	●	●	●		B	B	●
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Massachusetts	D	D	A		A			A		D	D	A	D		A			A	●	D	A	D	●	●	●
Michigan	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A			●	●						A
Minnesota	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
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Montana	B		B	B	B	B	B	B		B	B	B	B	B		B	B	B	●	B	B	B			●
Nebraska	A		A		A			A		A		A	A	A	A			A	●	A	A		●	●	A
Nevada	●	●	●		●			●	●	●	●	●	●	●	●	B	B	●	●	●	●		B	B	A
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North Dakota	●	●	●		●	●	●	●	●	●	●	●	●	●	●			●	●		●				A
Ohio	●	●	●		●			●		●		●	●		●			●	●	●					A
Oklahoma																			●						A
Oregon	●	A	●		●			●	A	A	●	●	A	A	A	B	B	●	●	●	●		B	B	●
Pennsylvania	B	B	B	B	B		B	B		B	B	B	B	B	B	B	B	B	●	B	B	B	●	●	A
Rhode Island		D																	●				●	●	●
South Carolina	●		●		●	●		●	●	●	●	●	●			●	●	●	●	●			●	●	A
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Virginia																			●						A
Washington																			●						A
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Wisconsin	●		●	●	●	●	●	●			●	●	●	●		●	●	●	●	●	●	●			●
Wyoming																			●						●

A dot (●) indicates that screening for the condition is universally required by law or rule; A, universally offered but not yet required; B, offered to select populations or by request; C, testing is required but not yet implemented; D, likely to be detected (and reported) as a byproduct of multiple reaction monitoring screening (MS/MS) targeted by law or rule. 2M3HBA indicates 2-methyl-3-hydroxy butyric aciduria; 2MBG, 2-methylbutyryl-coenzyme A dehydrogenase; 3MGA, 3-methylglutaconic aciduria; ARG, argininemia (arginase deficiency); BIOPT-BS, defects of biopterin cofactor biosynthesis; BIOPT-REG, defects of biopterin cofactor regeneration; CACT, carnitine acylcarnitine translocase; CBL-C,D, methylmalonic acidemia (Cbl C,D); CIT-II, citrullinemia type II; CPT-Ia, carnitine palmitoyltransferase I; CPT-II, carnitine palmitoyltransferase II; De-Red, dienoyl-coenzyme A reductase; GA-II, glutaric academia type II; GALE, galactose epimerase; GALK, galactokinase; H-PHE, benign hyperphenylalaninemia; IBG, isobutyryl-coenzyme A dehydrogenase; M/SCHAD, medium/short-chain L-3-hydroxy acyl-coenzyme A dehydrogenase; MAL, malonic academia (malonyl-coenzyme A decarboxylase); MCKAT, medium-chain ketoacyl-coenzyme A thiolase; MET, hypermethioninemia; SCAD, short-chain acyl-coenzyme A dehydrogenase; TYR-II, tyrosinemia type II; TYR-III, tyrosinemia type III.

[a] Terminology is consistent with the American College of Medical Genetics. *Newborn Screening: Toward a Uniform Screening Panel and System*. Rockville, MD: Health Resources and Services Administration; 2005:63.

Nomenclature source: National Newborn Screening and Genetic Resource Center (http://genes-r-us.uthscsa.edu).

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American Academy of Pediatrics
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TECHNICAL REPORT

Newborn Screening Fact Sheets

Celia I. Kaye, MD, PhD, and the Committee on Genetics

Abbreviations: OMIM, Online Mendelian Inheritance in Man; MS/MS, tandem mass spectrometry; CoA, coenzyme A; *BTD*, biotinidase gene; CAH, congenital adrenal hyperplasia; 21-OH, 21-hydroxylase; SW, salt wasting; SV, simple virilizing; AG, ambiguous genitalia; ACTH, adrenocorticotropic hormone; 17-OHP, 17-OH-progesterone; AABR, automated auditory brainstem response; OAE, otoacoustic emission; CH, congenital hypothyroidism; T_4, thyroxine; HPT, hypothalamic-pituitary-thyroid; CF, cystic fibrosis; CFTR, cystic fibrosis transmembrane conductance regulator; IRT, immunoreactive trypsinogen; GALT, galactose 1-phosphate uridyltransferase; GALK, galactokinase; GALE, galactose-4′-epimerase; CBS, cystathionine β-synthase; BIA, bacterial inhibition assay; MSUD, maple syrup urine disease; BCKD, branched-chain α-keto acid dehydrogenase; BCAA, branched-chain amino acid; BCKA, branched-chain α-keto acid; E3, dihydrolipoyl dehydrogenase; E1, thiamine pyrophosphate– dependent decarboxylase; E2, transacylase; MCAD, medium-chain acyl-coenzyme A dehydrogenase; FAO, fatty acid oxidation; SIDS, sudden infant death syndrome; ADHD, attention-deficit/hyperactivity disorder; PKU, phenylketonuria; PAH, phenylalanine hydroxylase; BH4, tetrahydrobiopterin; SCD, sickle cell disease; HPLC, high-performance liquid chromatography; Hb, hemoglobin; HbF, fetal hemoglobin; HbA, normal adult hemoglobin; FA, fetal and adult hemoglobin; MCV, mean corpuscular volume; FAH, fumarylacetoacetate hydrolase; TAT, tyrosine aminotransferase; NTBC, 2-(2-nitro-4-trifluoromethylbenzyl)-1,3-cyclohexanedione

ABSTRACT

Newborn screening fact sheets were last revised in 1996 by the American Academy of Pediatrics Committee on Genetics. This revision was prompted by advances in the field since 1996, including technologic innovations, as well as greater appreciation of ethical issues such as those surrounding informed consent. The following disorders are discussed in this revision of the newborn screening fact sheets: biotinidase deficiency, congenital adrenal hyperplasia, congenital hearing loss, congenital hypothyroidism, cystic fibrosis, galactosemia, homocystinuria, maple syrup urine disease, medium-chain acyl-coenzyme A dehydrogenase deficiency, phenylketonuria, sickle cell disease and other hemoglobinopathies, and tyrosinemia. A series of topics related to newborn screening is discussed in a companion publication to this electronic publication of the fact sheets (available at: www.pediatrics.org/cgi/content/full/118/3/1304). These topics are newborn screening as a public health system; factors contributing to the need for review of the newborn screening system; informed consent; tandem mass spectrometry; DNA analysis in newborn screening; status of newborn screening in the United States; and the effect of sample timing, preterm birth, diet, transfusion, and total parenteral nutrition on newborn screening results.

Newborn screening fact sheets were last revised in 1996 by the American Academy of Pediatrics Committee on Genetics. This revision was prompted by advances in the field since 1996, including technologic innovations, as well as greater appreciation of ethical issues such as those surrounding informed consent. The following disorders are discussed in this revision of the newborn screening fact sheets: biotinidase deficiency, congenital adrenal hyperplasia (CAH), congenital hearing loss, congenital hypothyroidism (CH), cystic fibrosis (CF), galactosemia, homocystinuria, maple syrup urine disease (MSUD), medium-chain acyl-coen-

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Key Words
newborn screening, screening, genetic disorder, biotinidase deficiency, congenital adrenal hyperplasia, congenital hearing loss, congenital hypothyroidism, cystic fibrosis, galactosemia, hemoglobinopathies, homocystinuria, maple syrup urine disease, medium-chain acyl-CoA dehydrogenase deficiency, phenylketonuria, sickle cell disease, tyrosinemia, tandem mass spectrometry

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zyme A dehydrogenase (MCAD) deficiency, phenylketonuria (PKU), sickle cell disease (SCD) and other hemoglobinopathies, and tyrosinemia. A series of topics related to newborn screening is discussed in a companion publication to this electronic publication of the fact sheets (available at: www.pediatrics.org/cgi/content/full/118/3/1304). These topics are newborn screening as a public health system; factors contributing to the need for review of the newborn screening system; informed consent; tandem mass spectrometry (MS/MS); DNA analysis in newborn screening; status of newborn screening in the United States; effect of sample timing, preterm birth, diet, transfusion, and total parenteral nutrition on newborn screening results.

BIOTINIDASE DEFICIENCY

Biotinidase deficiency (Online Mendelian Inheritance in Man [OMIM] database No. 253260)[1] is a disorder of biotin recycling. Biotin is a water-soluble vitamin of the B complex that acts as a coenzyme in each of 4 carboxylases in humans (pyruvate carboxylase, propionyl-coenzyme A [CoA] carboxylase, β-methylcrotonyl CoA carboxylase, and acetyl-CoA carboxylase).[2] Missing a diagnosis of biotinidase deficiency, a condition that is easily treated with vitamin supplementation, can have severe consequences, including seizures, developmental delay, and sensorineural deafness.

Incidence

Neonatal screening for biotinidase deficiency has been instituted in many states (25 at the time of this publication) as well as many countries (approximately 25) since the biochemical basis was elucidated by Wolf et al[3] in 1983. Of slightly more than 8.5 million newborn infants screened worldwide up to 1990, 142 affected infants have been identified, with 76 having profound (<10% activity) deficiency (approximate incidence 1 in 112 000) and 66 having partial (10%–30% activity) deficiency (approximate incidence 1 in 129 000).[4] Most affected individuals who have been identified are of European descent; however, individuals of Turkish, Saudi Arabian, and Japanese descent have been described.[5]

Clinical Manifestations

Biotinidase deficiency can present with clinical symptoms as early as the first week of life up to 10 years of age. Most infants first exhibit clinical symptoms between 3 and 6 months of age.[2] The most commonly affected systems are the central nervous system and skin. Affected children usually have myoclonic seizures, hypotonia, seborrheic or atopic dermatitis, partial or complete alopecia, and conjunctivitis.[2] Other features may include developmental delay, sensorineural hearing loss, lethargy, ataxia, breathing problems, hepatosplenomegaly, and coma.[6,7] Laboratory findings vary and can include ketolactic acidosis, organic aciduria, and mild hyperammonemia.[2]

Individuals with partial biotinidase deficiency can present with skin manifestations and no neurologic symptoms.[8] Several children with profound deficiency have presented later in childhood or during adolescence with hemiparesis and eye findings (scotoma).[9,10] With therapy, the eye problems resolved quickly, but the neurologic findings remained for a longer period of time.[11] There are even reports of adults with profound biotinidase deficiency who have never had symptoms but were diagnosed because their children had positive results of newborn screening.[2]

Pathophysiology

Each of the 4 carboxylases in humans requires biotin as a cofactor. The carboxylases are first synthesized as inactive apoenzymes. After synthesis, biotin is added to the inactive proteins through 2 partial reactions, each of which is catalyzed by the enzyme holocarboxylase synthetase. Ultimately, each of these active, biotin-containing enzymes is degraded. The biotin-containing products of degradation are acted on by biotinidase to liberate biotin, which is recycled and enters the free-biotin pool. Biotinidase deficiency results in inability to recycle endogenous biotin and to release dietary protein-bound biotin. Thus, the brain may be unable to recycle biotin adequately. This may lead to dependence on the biotin that crosses the blood-brain barrier, resulting in decreased pyruvate carboxylase activity in the brain and accumulation of lactate. The neurologic symptoms may be secondary to accumulation of lactic acid in the brain.[2]

Inheritance

Biotinidase deficiency is inherited as an autosomal recessive trait. The biotinidase (*BTD*) gene has been mapped (chromosome 3p25), cloned, and characterized.[12–14] Sixty-two mutations of the *BTD* gene have been described to date.[14] Interestingly, when testing a US population, mutations occur at different frequencies in children with symptoms than in children who were only identified through newborn screening. Two mutations accounted for 52% of the mutations found in symptomatic patients, and 3 other mutations accounted for 52% of mutations in children identified through newborn screening. Partial *BTD* deficiency is predominantly caused by the 1330G→C mutation on one allele in combination with one of the mutations causing profound deficiency on the other allele.[14]

Benefits of Newborn Screening

Biotinidase deficiency has been identified as an appropriate disorder for newborn screening by numerous countries and states because of its prevalence, the potentially tragic outcome if not diagnosed, and availability of effective, low-cost treatment. Unfortunately, once

symptoms have occurred, some of the findings are not reversible with therapy. This is particularly true in the case of the neurologic findings. For example, sensorineural hearing loss is common (detected in approximately 75% of symptomatic children with profound deficiency) and is usually irreversible.[6]

Screening

The best method of screening is a semiquantitative colorimetric assessment of biotinidase activity that can be performed on whole blood spotted on filter paper.[2,15,16] Although the majority (>80%) of patients with biotinidase deficiency demonstrate organic aciduria when symptomatic, a significant percentage (20% in one study) may not; therefore, tandem mass spectrometry (MS/MS) testing should not be used for newborn screening of biotinidase deficiency.[2]

Follow-up and Diagnostic Testing

A positive screening result for biotinidase deficiency should be followed up with definitive testing for diagnosis. Quantitative measurement of enzyme activity should be performed on a fresh serum sample. Residual enzyme activity determines whether the patient has profound (<10% activity) or partial (10%–30% activity) biotinidase deficiency. Most patients with profound deficiency present early in life, whereas those with partial deficiency can present later or with a cutaneous phenotype and no neurologic findings.

Brief Overview of Disease Management

Children with profound biotinidase deficiency have been treated successfully with biotin. Pharmacologic doses of biotin (5–20 mg/day) were determined empirically.[8,17] One patient required a dose of 30 mg/day to resolve dermatitis.[18] For most patients, the currently prescribed dose is probably much more than is needed to overcome the deficiency. It should be stressed that the biotin must be in the free, not bound, form to be effective. There are no known adverse effects of the currently recommended dosage of 5 to 20 mg/day.[19]

Once therapy is instituted, cutaneous symptoms resolve quickly, as do seizures and ataxia. Some of the symptoms (as mentioned previously) are less reversible, including hearing loss and optic atrophy. Children who have developmental delay have been noted in some cases to achieve new milestones and regain lost milestones after beginning therapy.[19] There are individuals reported who have profound biotinidase deficiency, have never been treated, and have never had any associated symptoms.[11]

Partial biotinidase deficiency can probably be treated with lower doses of biotin (1–5 mg/day) and/or only during times of metabolic stress.[19] There are children with partial deficiency who have never had any related illness. In others with partial deficiency, it has been noted that mild intercurrent illnesses such as gastroenteritis can lead to development of typical clinical symptoms that resolve with biotin therapy.[19]

Current Controversies

As noted above, it is difficult to determine if individuals with partial biotinidase deficiency need daily therapy. When such individuals are identified in newborn screening programs, follow-up happens routinely and care is instituted. The negative psychological aspects of learning through newborn screening that an infant potentially has a genetic disorder and the parental anxiety generated should be weighed against the positive aspects, including that the treatment is simple and inexpensive and some individuals with partial deficiency would (at some point) have symptoms. Although this is mildly controversial, it is truly not of enough significance to negate the value of newborn screening for the disorder.

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CONGENITAL ADRENAL HYPERPLASIA

Congenital adrenal hyperplasia (CAH) is a family of inherited disorders of the adrenal cortex that impair steroidogenic enzyme activity essential for cortisol biosynthesis.[20,21] Newborn screening focuses exclusively on the most common 21-hydroxylase (21-OH) deficiency CAH (>90% of all CAH cases [OMIM database No. 201910]),[22] which impairs production of cortisol and often aldosterone.[20,21] Prompt diagnosis and treatment of CAH is essential to prevent potential mortality as well as physical and emotional morbidity.[20–23]

Incidence

Health organizations in 13 countries (including 36 US states) screen or will screen for CAH in their newborn screening programs. On the basis of newborn screening data, the incidence of CAH ranges from a low of 1 in 21 270 (New Zealand) to a high of 1 in 5000 (Saudi Arabia) live births.[24] The incidence is 1 in 15 981 live births (Hispanic > American Indian > white > black > Asian) in North America, 1 in 14 970 live births in Europe, and 1 in 19 111 live births in Japan.[25] An exceedingly high CAH incidence (1 in 282 live births) exists among Yupik Eskimos in western Alaska.[26]

Clinical Manifestation and Variability

The spectrum of disease in CAH ranges from the "classic, severe" salt-wasting (SW) form, to "classic, less severe" simple-virilizing (SV), to "mild, nonclassic" forms.[20,21]

Symptomatic Presentation and Morbidity

Neonates with the SW form exhibit adrenal crisis during the first through fourth weeks of life, peaking at approximately 3 weeks of age. This manifests as poor feeding, vomiting, loose stools or diarrhea, weak cry, failure to thrive, dehydration, and lethargy. These symptoms may not be evident until serum sodium concentrations are below 125 mEq/L. If untreated, circulatory collapse, shock, and death are inevitable. Permanent brain injury attributable to shock, lower cognitive scores, and learning disabilities are observed in some with the SW form.[20] Affected females have ambiguous genitalia (AG) (but normal internal reproductive anatomy), prompting a clinical diagnosis in many. Affected males have no obvious physical signs of CAH. Therefore, without newborn screening and in the absence of a positive family history, all male and a minority of female neonates are undiagnosed until adrenal crisis. The SW form affects approximately 70% of patients with CAH that is diagnosed through newborn screening programs.[25,26] If inadequately treated, postnatal virilization (girls), pseudo- or true-precocious puberty (boys), and premature growth acceleration (boys and girls) occur, leading to early growth cessation.[20–23] Patients with the SV form do not manifest adrenal-insufficiency symptoms unless subjected to severe stress but exhibit virilization as in patients with SW.[20,21] Males and some females with the SV form are not diagnosed until much later when symptoms of virilization, precocious pseudopuberty, or growth acceleration occur.[20–23] The markedly advanced skeletal age of patients with the SV form diagnosed late contributes to their short adult stature. Late discovery of incorrect male sex assignment in females with the SW and SV forms causes extreme distress to the family and matured patients. Mild 21-OH deficiency produces no symptoms at birth and manifests as premature sexual hair, acne, and mild growth acceleration in childhood and hirsutism, excessive acne, menstrual disorder, and infertility later in life.[20,21] This milder disorder may be missed by newborn screening programs.

Mortality

The mortality rate for infants with the SW form not detected through newborn screening was 11.9%, which was fivefold higher than that of the general population (2.29%).[23]

Pathophysiology

21-OH deficiency results in cortisol deficiency with or without aldosterone deficiency. Cortisol deficiency from early fetal life leads to increased adrenocorticotropic hormone (ACTH) secretion,[20,21] which then stimulates excess secretion of the precursor steroids including 17-OH-progesterone (17-OHP) and causes hyperplastic changes of the adrenal cortex.[20,21] The precursor steroids can only be metabolized by way of the androgen biosynthetic pathway, resulting in excess androgen production that virilizes the genitalia.[20,21] Aldosterone deficiency contributes to SW. The increased circulating 17-OHP concentration is diagnostic for 21-OH deficiency.

Inheritance and Genotype

21-OH deficiency is an autosomal recessive disorder caused by a mutation of the *CYP21* gene.[20,21] There is an active *CYP21* gene and an inactive pseudo-*CYP21P* gene in normal individuals. Both genes are in the HLA complex on chromosome 6p21.3.[20,21] Most mutations in the *CYP21* gene are the pseudogene sequences, suggesting

that the mutations in *CYP21* were caused by a gene conversion or recombination between *CYP21* and *CYP21P*. The genotypes from 5 different populations of individuals with CAH correlated well with the phenotype in approximately 90% of affected subjects but did not correlate well in the remaining patients.[21]

Rationale for and Benefits of Newborn Screening

The goals of newborn screening are to (1) prevent life-threatening adrenal crisis, thereby averting shock, brain damage, and death, (2) prevent male sex assignment for life in virilized female newborns, and (3) prevent progressive effects of excess adrenal androgens, which cause short stature and psychosexual disturbances in boys and girls. Kovacs et al[23] found the average serum sodium concentration at diagnosis of the SW form of CAH to be 135 mEq/L in individuals detected through newborn screening programs and 125 mEq/L in those detected after development of clinical symptoms. Thus, prevention of severe SW CAH by newborn screening was demonstrated. Worldwide newborn screening data showed that screening prompted early diagnosis of CAH before clinical suspicion in 67% of newborn infants with CAH, including many females with AG.[26] The mortality rate of individuals with CAH identified through newborn screening has not been established yet. Other newborn screening benefits include (1) improved case detection evidenced by twofold higher incidence versus that of case-survey reports (North America and Japan), (2) improved detection of patients with SW CAH (70% with newborn screening vs 43%–60% in patients with clinical symptoms), and (3) improved detection of males, as evidenced by a 1:1 sex ratio in subjects identified through newborn screening versus a male/female ratio of 0.6:1 in patients with clinical symptoms leading to diagnosis.

Screening

Screening for 21-OH deficiency is accomplished by measurement of 17-OHP concentration in the dried blood spot. Newborn screening for CAH requires a rapid process to prompt the diagnosis before the onset of SW symptoms. Sampling at less than 1 day is associated with a high rate of false-positive results, and sampling beyond 5 to 7 days of age reduces the benefit of screening. Normal preterm infants have higher concentrations of 17-OHP than do term infants; therefore, it is important to have 17-OHP reference concentrations in blood spots of preterm and term unaffected infants according to birth weight or gestational age.[27,28] 17-OHP is not influenced if drawn several hours after transfusion.

Dissociation-enhanced lanthanide fluorescence immunoassay, radioimmunoassay, and enzyme-linked immunosorbent assay with a commercial kit are used to measure 17-OHP concentrations in blood spots.[25,26] The screening 17-OHP assays are nonspecific, and the result on a screening study is not equivalent to the diagnostic serum concentrations.[21,26,29] Affected neonates had screening 17-OHP concentrations of 35 to 900 ng/mL of blood, with preterm infants having higher concentrations.[27,29]

MS/MS may have the advantage of rapid 17-OHP detection and may eliminate the variable 17-OHP cutoff concentrations influenced by different reagents/assays. However, comparative studies of immunoassays versus MS/MS are necessary, and because of the complexity of the MS/MS assay for 17-OHP detection, MS/MS may be used as a complementary test. *CYP21* genotyping is not currently used in newborn screening, but it may be helpful in uncertain cases and for genetic counseling.

Almost all neonates with SW CAH have been identified with the first sample test.[26] Newborn screening for CAH is not intended to detect mild cases, although some are detected. In a study performed in Texas, testing again at 1 to 2 weeks increased detection of SV CAH and the mild form.[29] Despite the birth weight- or age-adjusted 17-OHP cutoff concentrations, preterm birth or low birth weight and samples taken at less than 1 day of age are major factors for false-positive results.[24–30] In an international study, 7% of neonates later determined to have CAH (mostly the SV form) were not detected in newborn screening for a variety of reasons (human error, prenatal dexamethasone therapy, or high 17-OHP cutoff concentrations).[25]

Follow-up and Diagnostic Testing

In most newborn screening programs, 2-tiered 17-OHP cutoff concentrations are established to guide evaluation in term and preterm newborn infants. Exceptionally high (urgent) and moderately high (suspected) 17-OHP concentrations are reported. Pediatricians need to be familiar with these concentrations as reported by their local newborn screening program. Most newborn screening programs that screen for CAH report the presumed positive results with instructions. Immediate evaluation (serum electrolytes, 17-OHP) is necessary in newborn infants with AG, in sick or asymptomatic male newborn infants with urgent or suspected 17-OHP concentrations, and in sick female infants with urgent 17-OHP concentrations. The evaluation is necessary in asymptomatic normal female infants with urgent 17-OHP concentrations and in sick female infants with normal genitalia and suspected 17-OHP concentrations, but these newborns are at low risk of having SW CAH. Normal females with suspected 17-OHP concentrations are not at risk of SW CAH but need at least a second screening to be sure that a mild deficiency is not missed.

Diagnosis

Quantitative serum 17-OHP concentration is used for the diagnosis of CAH. Concentrations are generally higher in individuals with the SW form.[29] Care must be

taken to use the appropriate term or preterm normal values for comparison.[26] With age, serum 17-OHP concentrations decrease in unaffected neonates but increase in those with CAH.[30] Concentrations in neonates with SW and SV CAH are higher than the concentrations in infants with the mild form.[21,29] In neonates with mildly elevated 17-OHP concentrations (4–10 ng/mL), the ACTH-stimulation test helps to rule out nonclassic CAH.[20,21] In asymptomatic infants, serial evaluation of electrolytes throughout the neonatal period is necessary if serum electrolyte concentrations remain normal.

Brief Overview of Disease Management

Treatment for CAH involves replacement of cortisol, which suppresses increased ACTH, 17-OHP, and androgen secretion. Replacement of aldosterone with an analog of mineralocorticoid (Florinef) is required for patients with SW CAH. Adequate medical therapy restores normal energy, glucose and electrolyte concentrations, and fluid balance and prevents excess adrenal androgen effects. Special medical care is needed in case of stress. The rate of mortality is 4.3% for treated patients.[23] In virilized female infants, surgical correction is generally performed before 1 year of age and, if necessary, again before menarche. With standard glucocorticoid therapy, adults with classic CAH do not always reach their genetic potential for height, and obesity is common. Inadequate medical therapy causes infertility. Experimental antiandrogenic/antiestrogenic drug therapy to improve height outcome is ongoing in children with CAH. Adrenalectomy is recommended when medical therapy is ineffective.

Carrier testing for CAH is performed most accurately using *CYP21* genotyping.

Pregnant women known to be at risk of having a fetus with CAH can receive prenatal dexamethasone therapy. First-trimester prenatal diagnosis is indicated for these women. An elevated 17-OHP concentration in amniotic fluid by a specific assay (>6–18 ng/mL) is also diagnostic, but normal concentrations do not exclude SV or nonclassic forms of CAH, and concentrations may be normal in mothers who are on dexamethasone therapy. Prenatal treatment is only indicated for female fetuses with classic virilizing CAH. Maternal dexamethasone therapy at 20 μg/kg per day beginning at 5 to 8 weeks' fetal age prevents or reduces AG in most affected females.[31] Controversy regarding prenatal therapy is related to the fact that (1) this treatment must begin before fetal sex can be determined or CAH diagnosis can be made, and 7 of 8 fetuses are thus unnecessarily subjected to this therapy, and (2) long-term safety of early exposure to dexamethasone in utero is unproven to date.[31] Maternal adverse effects include cushingoid features of excessive weight gain, intense striae, edema, discomfort, and emotional instability. In a consensus meeting concerning prenatal CAH therapy, representatives from the US Lawson Wilkins Pediatric Endocrine Society and European Pediatric Endocrine Society recommended that designated teams undertake this specialized therapy using a national protocol approved by institutional review boards. Treatment is preceded by informed consent about the risks and benefits of the therapy, and prospective follow-up and evaluation are needed.[31]

Current Controversy

The major controversy regarding newborn screening for CAH is the cost and impact of evaluating those whose test results are false-positive.[32] A second issue is the use of prenatal dexamethasone therapy for CAH. A large national multicenter study on long-term cognitive and psychological development and other health-related outcomes is required to resolve this issue.

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CONGENITAL HEARING LOSS

Congenital hearing loss, for the purposes of this fact sheet, is defined as permanent and is bilateral or unilateral, is sensory or conductive, and averages 30 dB or more in the frequency region important for speech recognition. Congenital hearing loss has many etiologies, with at least half associated with genetic risk factors. Congenital nonsyndromic hearing loss is usually categorized by mode of inheritance—autosomal recessive, autosomal dominant, X-linked, or mitochondrial.[33–35]

Newborn hearing screening programs became possible after the development of hearing screening technologies. Although most states have begun screening for congenital hearing loss, the integration of these programs with ongoing screening and early intervention programs remains a challenge.[36]

Prevalence

Estimates of the prevalence of moderate-to-profound bilateral hearing loss vary, depending on the criteria used to define the different degrees of hearing loss and the characteristics of the studied population.[37] The prevalence of congenital hearing loss also depends on race, birth weight, and other risk factors.[38] Profound and permanent congenital hearing loss is estimated to occur in approximately 1 in 1000 births.[39,40]

Clinical Manifestations

The spectrum of congenital hearing loss ranges from mild to profound hearing loss. In syndromic hearing loss, the auditory pathology may be conductive and/or sensorineural, unilateral or bilateral, symmetrical or asymmetrical, and progressive or stable. The auditory pathology of nonsyndromic hearing impairment is usually sensorineural.[41,42]

Pathophysiology

Approximately half of the cases of congenital hearing loss are thought to be attributable to environmental factors (acoustic trauma, ototoxic drug exposure [aminoglycosides], bacterial or viral infections such as rubella or cytomegalovirus).[39,41,42] The remaining cases are attributable to genetic mutations. Although these cases may seem to be part of a recognizable syndrome, approximately 70% are nonsyndromic (the deafness is not associated with other clinical findings that define a recognized syndrome) and, therefore, clinically undetectable at birth. In the remaining 30%, 1 of more than 400 forms of syndromic deafness can be diagnosed because of associated clinical findings.[39,42]

Inheritance

Approximately 77% of congenital nonsyndromic hearing impairment is autosomal recessive, 22% is autosomal dominant, and 1% is X-linked. As a general rule, individuals with autosomal recessive congenital nonsyndromic hearing impairment have profound prelingual deafness, and dominant mutations lead to a more variable phenotype. More than 90% of children with congenital profound autosomal recessive congenital nonsyndromic hearing impairment are born to parents with normal hearing, and the remaining 10% or less are born to deaf parents.[41]

There has been significant progress in identifying and sequencing autosomal dominant, autosomal recessive, and sex-linked genes for deafness.[41,43] However, it is clear that more genes and mutations await discovery. This knowledge may lead to mutation-specific therapies that can delay or prevent certain forms of genetic deafness, such as the avoidance of aminoglycoside therapy in those with specific mitochondrial mutations.

Benefits of Newborn Screening

The goals of newborn screening are to identify those infants with hearing loss early for prompt intervention to diminish the morbidity associated with congenital hearing loss. Left undetected and untreated, hearing impairment can affect speech and many other cognitive abilities. For children without risk factors, hearing loss frequently escapes detection until the age when hearing children normally begin to talk (9 months or older).[44–48] Current theory views auditory stimulation during the first 6 months of life as critical to development of speech and language skills. Children who are identified early as having hearing loss and receive intensive early intervention perform better on school-related measures (reading, arithmetic, vocabulary, articulation, percent of the child's communication understood by non–family members, social adjustment, and behavior) than children who do not receive such intervention.[49] Early intervention resulted in improvements in receptive language[50] and prevented developmental delays.[51] However, the efficacy of universal newborn hearing screening to improve long-term language outcomes remains uncertain.[52–54]

Screening

Newborn hearing screening is accomplished through the use of a variety of computerized equipment that uses automated auditory brainstem response (AABR), distortion product otoacoustic emissions (OAEs), or transient evoked OAEs. Screening is performed before discharge from the nursery.[55] Screening for congenital hearing loss is a simple process and in some cases may be performed by specially trained volunteers under the supervision of nurses or audiologists. Screening with AABR is accomplished by placement of soft earphones through which a series of soft clicks are introduced, usually at the 30- to 40-dB level. An auditory brainstem response detected through electrodes attached to the infant's forehead and

neck indicates that there is no significant sensorineural hearing loss. If OAE technology is selected as the screening test, a tiny microphone that detects sounds generated by the outer hair cells of the cochlea is introduced into the infant's auditory canal. Presence of those sounds indicates a functioning inner, middle, and outer ear. Each of these tests has advantages and disadvantages that should be considered carefully when selecting equipment. AABR tends to be somewhat more expensive and must be used in a quiet setting. OAE screening may result in higher false-positive rates if the infant's ear canal is blocked by fluid or debris.[56,57] Some hospitals use a combination of screening tests or repeat the OAE screening to reduce the false-positive rate and thereby minimize the need for follow-up after hospital discharge, which may reduce costs overall.[58]

Follow-up and Diagnostic Testing

Infants who do not "pass" the screening are either rescreened before discharge or given an appointment for rescreening as outpatients. Results of the screening are generally transmitted to the primary care physician of record, to the parents, and to the state health department. Failure to pass the screening results in a recommendation for referral to a qualified audiologist for confirmatory testing for congenital hearing loss.

In areas where universal newborn hearing screening is occurring, appropriate and timely diagnosis and intervention continue to be a major challenge. Attrition rates as high as 50% between initial referral and diagnostic confirmation still are not unusual.[36] Linkages between hospital-based screening programs and early intervention programs may not be well established, and data management and tracking of infants through the screening and diagnostic process also may be in the developmental stage.[49] As state programs assume more responsibility for the tracking and follow-up, these linkages will be more firmly established.[36]

Brief Overview of Disease Management

Appropriate management of all persons identified with congenital hearing loss requires a comprehensive pediatric and genetic evaluation.[33] Core personnel include individuals with expertise in the genetics of hearing loss, dysmorphology, audiology, otolaryngology, and genetic counseling. Qualified interpreting services may be needed when the parents are deaf. On the basis of the outcome of the evaluation, other types of professional expertise also may be needed, including professionals with experience with syndromal hearing loss (eg, ophthalmology, cardiology, nephrology, neurology).

After a family history, patient history, and physical examination, it may be possible to ascribe an etiology to the hearing loss. However, in approximately 30% of patients, there will be no obvious etiology.[33] An important goal of the genetic evaluation is to attempt to distinguish isolated or simplex cases, in which the risk of deafness in subsequent offspring may be 25%, from sporadic cases, which have a low risk of recurrence.[33]

After diagnosis of hearing loss, continuity of care for the affected infant is important to reduce morbidity. The pediatrician should ensure referral to the state early intervention program and/or the state program for children with special health care needs as appropriate. Referral to these programs at hospital discharge helps to minimize loss to follow-up.

Current Controversy

The US Preventive Services Task Force did not find evidence for the benefit of (nor evidence against the benefit of) universal newborn hearing screening.[53] They argued that, among low-risk infants, the prevalence of hearing impairment was very low, and substantial numbers of infants would be misclassified. They found that evidence for the efficacy of early intervention for patients diagnosed by screening was incomplete.

Additional controversy centers on the generally inadequate integration of these programs with ongoing newborn screening and early intervention programs.[36] The Newborn Screening Task Force suggested that child health–related programs such as newborn genetic and hearing screening programs would avoid unnecessary duplication of effort if they were more closely aligned with each other.[59]

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CONGENITAL HYPOTHYROIDISM

Thyroid hormone deficiency at birth is one of the most common treatable causes of mental retardation. There are multiple etiologies of this disorder, both heritable and sporadic, varying in severity. There is an inverse relationship between age at diagnosis and neurodevelopmental outcome; the later treatment is started, the lower the IQ will be. Most infants seem to be protected for the first few weeks of life by the fraction of maternal thyroid hormone that crosses to the fetus. Because of the urgency in detection and initiating treatment to prevent mental retardation, screening newborns for this disorder was added to existing programs in the mid-1970s.

Incidence

Congenital hypothyroidism (CH) occurs in 1 in 4000 to 1 in 3000 newborns. Programs reporting a higher incidence may include some transient cases. CH seems to occur more commonly in Hispanic and American Indian/Alaska Native people (1 in 2000 to 1 in 700 newborns) and less commonly in black people (1 in 3200 to 1 in 17 000 newborns). Programs report a consistent 2:1 female/male ratio, which is unexplained but speculated to be related to an autoimmune risk factor. Newborn infants with Down syndrome are at increased risk of having CH (approximately 1 in 140 newborns).

Clinical Manifestations

Most affected infants appear normal at birth, without obvious manifestations of CH. This is likely the result of transplacental passage of some maternal thyroid hormone; cord thyroxine (T_4) concentrations are approximately one third of maternal concentrations. In addition, many infants have some functioning thyroid tissue. Gestational age is 42 weeks or greater in approximately one third of these infants. Their birth weight and length fall into the normal range, and their head circumference may be at a slightly higher percentile because of brain myxedema. Approximately 5% of these infants, generally those who are more severely affected, have recognizable features at birth, including large fontanels and wide suturae, macroglossia, distended abdomen with umbilical hernia, and skin mottling. As maternal thyroid hormone is excreted and disappears in the first few weeks, clinical features gradually become apparent. These infants are slow to feed, constipated, lethargic, and sleep more ("sleep through the night" early), often needing to be awakened to feed. They may have a hoarse cry, may feel cool to touch, may be hypotonic with slow reflexes, and may have prolonged jaundice because of immaturity of hepatic glucuronyl transferase. A goiter is seen in 5% to 10% of these infants, most commonly in those with an inborn error of T_4 synthesis. If hypothyroidism goes undiagnosed beyond 2 to 3 months of age, infants will begin to manifest slow linear growth. If this disorder is untreated, studies show a loss of IQ proportionate to the age at which treatment is started: if treatment is started at 0 to 3 months of age, mean IQ is 89 (range: 64–107); if treatment is started at 3 to 6 months of age, mean IQ is 71 (range: 35–96); if treatment is started at older than 6 months, mean IQ is 54 (range: 25–80). Other long-term neurologic sequelae include ataxia, gross and fine motor incoordination, hypotonia and spasticity, speech disorders, problems with attention span, and strabismus. Approximately 10% of these infants will have an associated sensorineural deafness, and approximately 10% will have other congenital anomalies, most commonly cardiac defects.[60] Some newborn screening programs also detect secondary or hypopituitary hypothyroidism in infants. These infants may have

associated midline defects, such as the syndrome of septooptic dysplasia or midline cleft lip and palate. Other pituitary hormones, such as growth hormone, may also be missing.

Pathophysiology

The most common cause is some form of thyroid dysgenesis: aplasia, hypoplasia, or an ectopic gland; thyroid ectopy accounts for two thirds of thyroid dysgenesis. The cause of thyroid dysgenesis is unknown; rare cases result from mutations in the genes that control thyroid gland development, including thyroid transcription factor (TTF-2) and paired box-8 protein (PAX-8). Inborn errors of T_4 synthesis, secretion, or utilization account for two thirds of heritable cases. Errors in iodide trapping, organification of iodide to iodine by thyroid peroxidase (most common inborn error), coupling of monoiodothyronine and diiodothyronine, deiodinase, and an abnormal thyroglobulin molecule all have been described. In mothers with autoimmune thyroiditis, transplacental passage of a thyrotropin-receptor–blocking antibody is associated with transient hypothyroidism. Infants born to mothers with Graves' disease treated with antithyroid drugs also may have transient hypothyroidism. Worldwide, iodine deficiency resulting in endemic cretinism is the most common cause of hypothyroidism at birth. Exposure of the neonate to excess iodine, as with topical antiseptics, can also cause hypothyroidism.

Inheritance

Approximately 85% of cases are sporadic, and 15% are hereditary. Each of the inborn errors of T_4 synthesis is autosomal recessive except thyroid hormone receptor defects, which are autosomal dominant. In the cases associated with transplacental passage of a maternal blocking antibody, future siblings are at risk of having the same problem.

Rationale for and Benefits of Newborn Screening

Most newborn screening programs report no difference in global IQ score compared with sibling or classmate controls, whereas some report a reduction in IQ ranging from 6 to 15 points. Even if there are no differences in global IQ, some show differences in subtest components, such as language or visual-spatial skills. These results are more likely in severely affected infants,[61] those started on too low an initial dose of levothyroxine sodium, or those who are not optimally managed or poorly compliant in the first 2 years of life. However, these differences in IQ nearly disappeared if higher starting doses of levothyroxine, averaging 11.6 μg/kg per day, were used.[62] Recent data suggest that a starting dose of 10 to 15 μg/kg per day normalized serum thyrotropin by 1 month and resulted in a higher IQ as compared with infants started on a lower treatment dose.[63]

Screening

Most screening programs in the United States measure T_4 initially, with a thyrotropin determination on infants whose T_4 level is less than the 10th percentile for that specific assay. Some US newborn screening programs and more in Canada now are screening with an initial thyrotropin measurement. Because there is a thyrotropin surge after birth that decreases over the next 5 days, infants with screening specimens obtained at less than 48 hours of age may have false-positive thyrotropin increases. Each screening program must establish its own T_4 and thyrotropin cutoff levels. Primary T_4 screening programs may identify infants with delayed thyrotropin increase (usually preterm infants) and secondary hypothyroidism. Primary thyrotropin screening programs identify infants with subclinical hypothyroidism (high thyrotropin, normal T_4). The false-positive rate is generally higher for primary T_4 programs compared with primary thyrotropin programs (0.30% vs 0.05%, respectively). Preterm infants have reduced T_4 concentrations and, thus, make up a disproportionate percentage of infants with false-positive results. Neither screening is affected by diet or transfusion, except total exchange transfusion.

Follow-up and Diagnostic Testing

Infants with abnormal screening results must have confirmatory serum T_4 testing and some measure of thyroid-binding proteins (eg, triiodothyronine [T_3] resin uptake), or a free T_4 level, and thyrotropin determination. Once a diagnosis of hypothyroidism is confirmed, studies may be undertaken to determine the underlying etiology. Most useful are imaging studies, either thyroid ultrasound or thyroid uptake and scan, using either technetium 99m pertechnetate or iodine 123. In general, information gained from these studies does not alter management, so they are considered optional; they should never delay onset of treatment. If there is evidence of maternal autoimmune thyroid disease, measurement of thyrotropin-binding inhibitor immunoglobulin in the mother and infant can identify those with likely transient hypothyroidism. If iodine exposure or deficiency is suspected, measurement of urinary iodine can confirm this etiology.

Brief Overview of Disease Management

Levothyroxine is the treatment of choice; only tablets should be used, because liquid preparations are not stable. The recommended starting dose is 10 to 15 μg/kg per day[62,63]; it is important that the initial dose correct hypothyroxinemia as rapidly as possible.[64–66] Treatment can be started after confirmatory studies are obtained, pending results. Treatment goals are to keep the serum T_4 or free T_4 in the upper half of the reference range (10–16 μg/dL [130–204 nmol/L] or 1.2–2.3 ng/dL [18–30 pmol/L], respectively) and the thyrotropin in the

reference range (<6 mU/L). Laboratory evaluation should be conducted (1) at 2 and 4 weeks after initiation of T_4 treatment, (2) every 1 to 2 months during the first year of life, (3) every 3 to 4 months between 1 and 3 years of age, and (4) 2 to 4 weeks after any change in dosage.[67] Prolonged overtreatment can lead to disorders of temperament and craniosynostosis and should be avoided. Close monitoring is essential in the first 2 to 3 years of life, a time at which the brain still has a critical dependence on thyroid hormone. If permanent hypothyroidism has not been established by 3 years of age, levothyroxine treatment can be discontinued for 1 month and endogenous thyroid function can be reevaluated.

Current Controversies

Preterm infants with hypothyroidism can have a delayed thyrotropin increase,[68] most likely because of immaturity of the hypothalamic-pituitary-thyroid (HPT) axis. Such infants may be missed by either the primary T_4 or thyrotropin screening approach. Some programs, therefore, have undertaken or are considering a routine second screening between 2 and 6 weeks of age in preterm infants. Programs that undertake a routine second screening report an additional 10% of cases. In addition, some studies suggest that infants less than 28 weeks' gestational age who lose the maternal contribution of thyroid hormone may benefit from treatment until the HPT axis matures.[69] Additional studies are needed before this can be considered standard of care. Last, some infants seem to have altered feedback of the HPT axis, manifested as persistently high serum thyrotropin concentrations despite apparent adequate treatment.

Special Issues/Concerns

Managing CH presents challenges with stakes that are far greater than management of acquired hypothyroidism. Laboratory evaluation occurs much more frequently, and target T_4 or free T_4 ranges are different for infants. Infants with an altered HPT axis and persistently high thyrotropin concentrations are difficult treatment challenges. With a goal of ensuring optimal treatment and, therefore, optimal neurodevelopmental outcome, these cases should be managed by pediatricians in consultation with pediatric endocrinologists.

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CYSTIC FIBROSIS

Cystic fibrosis (CF) (OMIM database No. 219700)[70] is a hereditary disease that has primary effects on the lungs, pancreas, intestine, liver, sweat glands, and male reproductive tract as well as important secondary effects on growth and nutrition.[71] The clinical course is variable, but most patients succumb to lung disease in early adulthood.

Incidence

The incidence of CF is approximately 1 in 3500 in white newborn infants. The incidence in black and Hispanic newborn infants (approximately 1 in 15 000 and approximately 1 in 7000, respectively) is higher than previously suspected. There is a low incidence in Asian infants.

Clinical Manifestations

CF usually presents in infancy. Meconium ileus, a neonatal intestinal obstruction, occurs in approximately 17% of infants with CF. Beyond the perinatal period, CF presents as failure to thrive secondary to exocrine pancreatic insufficiency, chronic respiratory symptoms, or both. Nutritional deficits can be severe at presentation and may lead to edema and hypoproteinemia from protein-calorie malnutrition. Infants may present with hypoelectrolytemia from sweat salt loss. The most common chronic respiratory symptoms are cough and wheeze. If infants are not diagnosed in the newborn period, they often undergo months of illness with concomitant stress

on the parents. Patients are prone to chronic endobronchial infections with *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and other characteristic bacteria throughout childhood. Many of these patients suffer from recurrent intestinal blockages, and a small percentage of patients have severe liver disease. Diabetes is increasingly common during adolescence and young adulthood. Fifteen percent of these patients have mutations that do not lead to exocrine pancreatic insufficiency. They are at risk of recurrent pancreatitis, however. The median predicted age of survival is 33 years.[72]

Pathophysiology

CF results from abnormalities in the CF transmembrane conductance regulator (*CFTR*) protein, a membrane glycoprotein that regulates ion flux at epithelial surfaces. Abnormalities in *CFTR* cause thick secretions that obstruct pancreatic ductules, leading to exocrine pancreatic destruction. In the airway, dehydration of airway surface liquid leads to chronic infection and neutrophil-dominated inflammation. Bronchiectasis and progressive obstructive lung disease then follow.

Inheritance

CF is autosomal recessive. More than 1000 mutations in the *CFTR* gene have been described, but one mutation, ΔF508, accounts for more than 70% of affected chromosomes in individuals of European ancestry. Several-dozen mutations have been characterized as pancreatic sufficient or insufficient on clinical grounds. The American College of Medical Genetics has developed standards and guidelines for population-based CF-carrier screening that include a panel of 25 mutations.[73]

Rationale for and Benefits of Newborn Screening

The principal benefit of newborn screening and early diagnosis is improved height and weight at least through adolescence, demonstrated in a well-controlled clinical trial.[74] Improvement in height and weight likely occurs from early institution of pancreatic enzyme, fat-soluble vitamin and salt supplementation, as well as the general nutritional follow-up that is part of care at a CF center. In addition, it is likely that early diagnosis and attention to nutrition can help patients avoid severe nutritional complications of infancy, although this has not been shown in a controlled trial. Severe nutritional complications of CF in infancy include anemia from vitamin E deficiency, zinc deficiency, linoleic acid deficiency, hypoelectrolytemia, and protein-calorie malnutrition. In addition, vitamin E deficiency at symptomatic diagnosis of CF is associated with cognitive deficits. Thus, early diagnosis through newborn screening is likely to improve developmental outcome. Observational studies support improved pulmonary outcome after newborn screening. In addition, height in CF is correlated with improved pulmonary outcome. Thus, the increase in height in patients identified through screening also may be beneficial. Another benefit of screening is that parents of children identified through screening have been shown to have greater trust in the medical establishment than parents whose children are identified only after symptoms appear.[75]

Screening

Methodology

Determination of immunoreactive trypsinogen (IRT) concentrations from dried blood spots serves as the basis for the first tier in all newborn-screening programs for CF. IRT concentration is high in the blood of infants with CF, presumably from leakage of the protein into the circulation after exocrine pancreatic injury. Two approaches can be taken if the IRT concentration is high. The more common approach is to perform mutation analysis from the dried blood spot for a set of CF mutations. Another approach is based on persistent elevation of IRT concentration, which requires a second dried blood spot taken 2 to 3 weeks after birth.

The value at which the initial IRT concentration is considered abnormal varies from program to program. If mutation analysis is performed from the first dried blood spot, a second specimen is not required. Thus, the IRT cutoff can be set to include a substantial fraction of the newborn population. In some programs, the top 5% of all IRT concentrations are considered abnormal and mutation analysis is performed. In other programs, the cutoff is set at the top 1%.

Programs that are based on persistent elevation of IRT concentration require a second dried blood spot taken at 2 to 3 weeks of age in infants with a high concentration on the first specimen. These programs set the cutoff value for IRT at a higher concentration (0.5% of newborn infants) than programs that perform mutation analysis. Diagnosis through persistent elevation of IRT concentration can identify infants with CF who do not carry mutations included in most mutation-analysis panels.

Timing

Because IRT concentration is frequently high immediately after birth, specificity is improved if the test is performed after the first day of life.

Sensitivity and Specificity

The sensitivity of most CF screening programs, whether based on genotyping or persistent elevation of IRT concentration, is approximately 95%. The specificity of programs that rely on persistent elevation of IRT concentration without genotyping is approximately 99.5% after the first measurement of IRT concentration. The specificity of programs that perform genotyping after the initial elevation of IRT may be as high as 99.9%.

Follow-up and Diagnostic Testing (Short-term)

Timeline

For programs that perform mutation analysis, the diagnosis of CF can be made if 2 mutations are identified from the dried blood spot. If only one mutation is identified from the dried blood spot, then sweat testing, the definitive diagnostic test, should be performed as soon as possible. In programs that do not perform mutation analysis, sweat testing should be performed within a few days of the repeat IRT test. There is some urgency to making the diagnosis. Many patients are pancreatic insufficient in the first weeks of life and are at risk of severe nutritional complications. Pancreatic enzyme-replacement therapy, fat-soluble vitamin supplementation, and salt supplementation should be initiated very soon after diagnosis in pancreatic-insufficient infants.

Test and Procedures

Sweat testing should be performed at more than 1 week of age. Almost all term infants will have adequate sweat amounts by that time.[76] Sweat collection amounts may be inadequate in preterm infants; in such a case, mutation analysis can be performed.[77] Currently, a sweat chloride value of more than 40 mmol/L is required for the diagnosis of CF in the newborn period; infants with values more than 30 mmol/L, however, require follow-up.[78] In programs that perform mutation analysis, confirmatory sweat testing should be obtained even in infants who test positive for 2 mutations.

Brief Overview of Disease Management

Nutrition is an important focus of management beginning in infancy. A recently developed test for fecal elastase may allow convenient determination of need for pancreatic enzyme supplementation. Pancreatic enzyme, fat-soluble vitamin, and salt supplementation will be started in most infants at diagnosis. Outpatient regimens become increasingly complex with age and often include several inhaled medications, nutritional supplements, attention to secretion clearance, and a number of ongoing oral medications to be taken daily. Patients with pulmonary exacerbation require hospitalization to receive intravenous antibiotic therapy and intensive secretion clearance. Every effort should be made to have the infant and family cared for at centers accredited by the Cystic Fibrosis Foundation.

Current Controversies

Three controversies have surrounded newborn screening for CF. One issue has been whether the growth and nutritional benefits of early diagnosis are sufficient to justify screening. Very recently, however, the Centers for Disease Control and Prevention has determined that newborn screening for CF is of benefit.[79] Follow-up studies of pulmonary and cognitive outcomes may further address this issue. A second issue is carrier detection, which occurs in all programs that use mutation analysis as part of the screening. It is not known for sure whether identification of otherwise well infants as carriers of CF may do harm, but studies suggest that this is not the case. A third issue is that approximately 5% of newborn infants identified will have borderline sweat tests (sweat chloride levels of 30–40 mmol/L) and "mild" mutations. It is not clear yet how many of these infants will have important medical problems. Follow-up studies are underway.

Counseling

Parents will require education on all aspects of CF. The care team consists of the primary pediatrician and the CF center staff. Genetic counseling should be arranged for all families.[80]

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GALACTOSEMIA

Lactose, or milk sugar, is broken down into its constituent simple sugars, glucose and galactose, before absorption in the intestine. Galactosemia, which is an increased concentration of galactose in the blood, has many causes. The genetic disorders that cause galactosemia vary in severity from a benign condition to a life-threatening disorder of early infancy. Early diagnosis and treatment of the latter condition can be life saving; hence, newborn screening for this disease has been instituted in many states.

Incidence

Three distinct enzyme deficiencies may lead to galactosemia. The most common of these, galactose 1-phosphate uridyltransferase (GALT) deficiency (OMIM database No. 606999),[81] occurs in approximately 1 in 47 000 newborn infants.[82] This disorder is often referred to as "classic galactosemia." Galactokinase (GALK) deficiency (OMIM database No. 230200)[81] seems to be very rare, although there have been no large population studies to assess its incidence. One study found that 1% of North American people were carriers, suggesting a disease frequency of 1 in 40 000.[83] However, a newborn screening study conducted in Massachusetts detected no cases among 177 000 newborn infants.[84] The third disorder, galactose-4′-epimerase (GALE) deficiency (OMIM database No. 230350), occurs in 2 forms; one form is confined to red blood cells and has no symptoms, and the second form, which is exceedingly rare, is generalized, with only a few patients reported nationally.[85,86]

Clinical Manifestations

Infants with classic galactosemia, or GALT deficiency, generally present within the first weeks after birth with a life-threatening illness. Feeding intolerance, vomiting and diarrhea, jaundice, hepatomegaly, lethargy, hypotonia, and excessive bleeding after venipuncture are characteristic findings. Laboratory studies indicate liver and renal tubular disease. Septicemia, particularly with *Escherichia coli*, is not uncommon. Cataracts are generally seen at presentation, but they may be mild in the first few weeks of life and only detectable with slit-lamp examination. Less frequently, patients with classic galactosemia may have a more chronic presentation, with failure to thrive, poor feeding, and developmental delay. Black individuals with classic galactosemia, in particular, frequently have a mild presentation.

Infants with GALK deficiency generally present with bilateral cataracts, which have been observed as early as 4 weeks of age. The cataracts are identical to those seen in classic galactosemia.[87] The great majority of infants with GALE deficiency have an enzyme deficiency that is confined to the red blood cells and causes no symptoms. Five individuals with generalized GALE deficiency had developmental delay, hypotonia, and poor growth; 3 had sensorineural hearing loss.[88]

Pathophysiology

The main metabolic pathway for the conversion of galactose to glucose uses 3 enzymes: GALK, GALT, and GALE. Individuals who lack GALK cannot convert galactose to galactose 1-phosphate. As a result, galactose is converted to galactitol by an alternative pathway. The accumulation of galactitol in the lens results in the development of cataracts. Individuals with classic galactosemia, or GALT deficiency, cannot convert galactose 1-phosphate to uridine diphosphate galactose. Galactose, galactitol, galactose 1-phosphate, and other metabolites accumulate. Although it seems clear that increased galactitol is responsible for the development of cataracts in all forms of galactosemia, it is not known which metabolites are responsible for the other clinical findings in classic galactosemia.[89]

Inheritance

All forms of galactosemia are autosomal recessive in inheritance. More than 150 different mutations have been identified in GALT, the enzyme that is deficient in classic galactosemia. The most common GALT mutation in Europe and North America is Q188R, which is associated with the severe presentation of classic galactosemia. A mutation found in black and some Hispanic individuals is S135L.[90] This mutation is associated with a milder presentation of the disorder.

Benefits of Newborn Screening

Exclusion of galactose from the diet results in marked improvement of the life-threatening complications of classic galactosemia. However, this treatment has only limited efficacy in the prevention of long-term complications. These include impaired cognitive development, with mean IQ in the range of 70 to 90; verbal dyspraxia, a speech disorder attributable to a sensorimotor disturbance of articulation; growth delay, with ultimate height in the normal range; neurologic findings, including tremor and ataxia beginning in midchildhood to middle age; and ovarian failure, manifesting as delayed puberty, primary amenorrhea, secondary amenorrhea, or oligomenorrhea.[91] Prepubertal children with GALT deficiency are also at increased risk of having decreased bone mineral density despite normal calcium intake.[92]

Screening

Newborn screening for galactosemia may test for galactose, galactose 1-phosphate plus galactose, or GALT enzyme deficiency. Some laboratories test for all of these substances. Because GALT is deficient only in classic galactosemia, this newborn screening test alone will not detect the other 2 forms of galactosemia. The GALT enzyme test has the advantage of being independent of

the infant's diet. Therefore, the timing of the newborn screening sample collection will have no effect on the reliability of this test. However, because GALT analysis is performed using red blood cells, there may be a false-negative result for up to 3 months if the infant has received a blood transfusion. Tests for galactose and galactose 1-phosphate depend on the infant's diet; therefore, it is important to be sure that the infant is receiving galactose-containing formula or breast milk before testing. MS/MS can be used as a technology in screening for galactosemia.[93]

Follow-up and Diagnostic Testing

All newborn infants with positive screening results should be evaluated rapidly by an experienced physician for feeding difficulty, signs of sepsis, jaundice, and hepatomegaly. Untreated classic galactosemia may progress very rapidly to hepatic toxicity, with death resulting from sepsis or bleeding. Immediate restriction of dietary galactose is critical and should not await diagnostic testing. Galactose restriction should be instituted immediately even in the asymptomatic child and should be continued until the extent of enzyme deficiency, if any, is known.

Diagnostic studies for classic galactosemia include quantitative analysis of GALT and red blood cell galactose 1-phosphate. In states where the screening test measures GALT activity, these studies will establish or rule out classic galactosemia. When the screening results, including estimates of galactose and galactose 1-phosphate and quantitative GALT activity, are normal, quantitative analysis of GALK and GALE are required to identify these forms of galactosemia. It is likely that another pathway exists that can be responsible for galactose disposal, but this pathway has not been characterized.[94]

Brief Overview of Disease Management

Infants suspected of having galactosemia should be fed with a galactose-free formula until diagnostic testing confirms a specific diagnosis. Children who are seriously ill at the time of diagnosis of classic galactosemia require supportive care, which may include vitamin K supplementation and fresh-frozen plasma transfusions, antibiotics for presumed Gram-negative sepsis, and phototherapy for hyperbilirubinemia. After dietary galactose has been eliminated, most infants improve rapidly. Milk and milk products are excluded from the diet indefinitely, because significant ingestion of galactose at any age can be toxic.[92] Because medications may contain galactose, the pediatrician should instruct parents to ask the pharmacist if a medication is galactose free before administering it to the child. Regular nutritional evaluation is necessary to ensure adequate calcium intake. Regular developmental evaluation and early speech assessment are also required. Girls should be monitored frequently in late childhood and adolescence for pubertal development. Regular measurement of galactose 1-phosphate in red cells is the most common method used to assess dietary compliance.[85]

Lifelong galactose restriction is also indicated for individuals with GALK and generalized GALE deficiencies. No treatment seems to be necessary for red blood cell GALE deficiency.

Current Controversies

In addition to milk products, certain fruits contain significant quantities of galactose.[93] There is no consensus about whether these fruits should be eliminated from the diet, because endogenous synthesis of galactose also occurs.[94] Some authors have suggested that an elemental formula (galactose free) may be preferable to soy formula in the treatment of galactosemia.[95]

Special Issues

Galactose is a reducing substance, and the presence of reducing substances in the urine is sometimes suggested as a test for galactosemia. However, this test is neither sensitive nor specific, and it should not be used as a screening or diagnostic test for galactosemia.

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HOMOCYSTINURIA

The term "homocystinuria" designates a biochemical abnormality, not a specific disease entity. There are many causes of homocystinuria. All affect one of the transsulfation pathways that convert the sulfur atom of methionine into the sulfur atom of cysteine. This pathway is the chief route of disposal of methionine. The most common defect, cystathionine β-synthase (CBS) deficiency (OMIM database No. 236200),[96] results in high concentrations of serum methionine. One form of CBS deficiency is responsive to vitamin B_6.[97] Other metabolic variants of homocystinuria include defects of vitamin B_{12} uptake or activation and tetrahydrofolate reductase deficiency (OMIM database No. 236250).

Incidence

Although homocystinuria is a rare disorder, carriers of the condition represent a much larger population. If one assumes a worldwide incidence of 1 in 300 000 individuals, the expected carrier frequency is 1 in 135. Because carriers are more prone to thromboembolic events, ascertainment of these individuals via identification of an affected person needs to be emphasized to primary health care professionals.[98]

Clinical Manifestations

Clinical problems include multiple, recurrent thromboemboli.[99] Arterial or venous thromboses may involve the cerebral, pulmonary, renal, and myocardial circulation.[100] Patients may also exhibit ectopia lentis, glaucoma, cataracts, developmental delays/mental retardation, seizures, psychiatric disturbances, osteoporosis with bone deformities, scoliosis, high palatal arch, muscle weakness with a shuffling gait, and a marfanoid habitus. Death has been reported within the first year of life. Approximately 50% of untreated individuals die by 25 years of age; death is frequently a result of thromboembolic events. Developmental delay is reported in 65% to 80% of untreated individuals.[101]

Pathophysiology

Two mechanisms probably explain most of the clinical symptoms seen: (1) abnormal (hyper) coagulation because of "sticky" platelets; and (2) direct toxicity of homocystine and its metabolites, causing endothelial cell damage.

Inheritance

The specific enzymatic defect should be ascertained. However, all heritable forms of homocystinuria exhibit autosomal recessive inheritance. Prenatal diagnosis is available for CBS deficiency using cultured chorionic villus cells or amniotic fluid cells to measure the activity of this enzyme. The chromosome map location is 21q22. The incidence in Ireland, Australia, Great Britain, and New England is 1 in 50 000, the incidence in Japan is 1 in 1 million, and the worldwide incidence is 1 in 250 000.

More than 90 different disease-associated mutations of the *CBS* gene have been identified. The vast majority of these mutations are "private" mutations that occur in only a single or a very small number of families. The most prevalent mutations are the G307S and I278T mutations.[102] Affected patients vary widely in the extent to which they manifest clinical abnormalities, suggesting considerable genetic heterogeneity. Some of the variability is accounted for by the relative reduction of enzymatic activity. Absent to relatively low residual activity (up to 10%) of CBS has been noted among different families. However, there are reports of individuals with the identical genotype resulting in a different phenotype within the same family.

Rationale for and Benefits of Newborn Screening

The potential for early clinical diagnosis is limited. Ocular abnormalities, because of their distinctive lens displacement, may lead to the diagnosis. The diagnosis should be considered in any child or young adult with thromboembolism affecting both the large and small arteries as well as the veins, particularly in association with developmental disabilities, mental retardation, or skeletal findings. Most patients, however, have nonspecific features so that definitive testing involving the measurement of serum or urine amino acids is not accomplished before the expression of more severe clinical symptoms. Treatment seems to reduce the risk of thromboembolic episodes. Because this is the major cause of mortality and morbidity in these patients, the survival rate may improve with early, effective treatment. The incidence of mental retardation may be prevented or reduced.[103] For patients with classic (homozygous) homocystinuria, early treatment with good biochemical control (lifetime plasma-free homocystine < 11 μmol/L) seems to prevent mental retardation,[104] ectopia lentis seems to be delayed, and the incidence of seizures is reduced.

Screening

The bacterial inhibition assay (BIA) test may be used to detect increased concentrations of blood methionine.[105]

Normal values for serum methionine concentration are noted to be less than 2 mg/dL. Newer methods include direct methionine assay by MS/MS.[106] The false-negative rate seems to correlate with the time that the specimen was obtained and the level of residual CBS activity present (ie, the B_6-responsive form). The false-negative rate increases with earlier newborn discharges. Approximately 1 in 5000 infants is found to have blood methionine concentrations more than 2 mg/dL. The use of a reduced cutoff level (1 mg/dL) increases the false-positive rate from 0.006% to 0.03%.[107] However, use of this cutoff should identify affected infants who have only slightly increased concentrations of methionine and reduce the frequency of false-negative results. It has been suggested that the increased false-positive rate does not represent an undue burden in terms of requests for repeat analysis.

Follow-up and Diagnostic Testing

Quantitative serum or plasma amino acid determination is used for diagnosis of homocystinuria. Plasma amino acids show increased methionine and homocystine concentrations with reduced concentrations of cystine and absent cystathionine. A urine organic acid profile with gas chromatography and MS/MS may be used to determine the presence or absence of methylmalonic acid.

Brief Overview of Disease Management

Treatment depends on the underlying cause of homocystinuria. As a first step, pyridoxine (vitamin B_6) responsiveness should be ascertained, because approximately 50% of patients respond to large doses of this vitamin. Nonresponsive patients with CBS deficiency should be treated with a methionine-restricted, cystine-supplemented diet. Folic acid and betaine therapy may also be helpful with all patients. In the disorders of cobalamin metabolism and transport in which methylmalonic acid and homocystine appear in the urine, hydroxycobalamin treatment (vitamin B_{12}, not cyanocobalamin) may be beneficial. Aspirin and dipyridamole have also been used to decrease the occurrence of thromboembolic phenomena. Clinical variability remains despite therapy. Not all affected individuals have increased methionine concentrations. The relationship between variability and the underlying metabolic processes or compliance has not yet been completely ascertained. One described mutation, G307S, is typically a pyridoxine-nonresponsive mutation, and individuals homozygous for the I278T mutation are usually responsive to pyridoxine therapy. The presence of some activity of the enzyme seems necessary for a clinical response to pyridoxine (vitamin B_6) administration. Individuals who are clinically responsive to pyridoxine generally have milder or more slowly progressive disease.

Current Controversies

Increased concentrations of methionine may be minimal during the first 3 days of life until there is adequate protein intake (milk feedings). This is especially true in patients who are responsive to vitamin B_6, who usually have some residual enzyme activity. This minimal increase probably accounts for the difference in screening frequencies between the United States and United Kingdom, where screening specimens are obtained at 5 to 7 days. It may be preferable to screen for this disorder at 2 to 4 weeks of age. Early discharge at 24 or even 18 hours results in many missed cases and decreases screening effectiveness.

Programs continue to evaluate the efficacy of screening and early treatment. Improvement in screening to decrease the numbers of missed cases is important. Recent evidence has shown that carriers (heterozygotes) for homocystinuria have an increased risk of thromboembolic events. Therefore, genetic counseling and screening should be offered to relatives of persons with homocystinuria.

Special Issues/Concerns

Specialized care is required that includes the ability to monitor amino acids and provide nutritional assessment and planning. Doses of pyridoxine higher than 900 mg have been associated with neuropathy; however, these higher doses are usually not required for adequate treatment. Thromboembolic phenomena are more prone to occur during anesthesia, surgical procedures, and prolonged immobilization.

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MAPLE SYRUP URINE DISEASE (BRANCHED-CHAIN KETOACIDURIA)

Maple syrup urine disease (MSUD) (OMIM database No. 248600),[108] also known as branched-chain ketoaciduria, is caused by a deficiency in activity of the branched-chain α-keto acid dehydrogenase (BCKD) complex. Deficiency of the BCKD complex results in accumulation of the branched-chain amino acids (BCAAs) leucine, isoleucine, and valine and the corresponding branched-chain α-keto acids (BCKAs).[109] A pathognomonic finding in individuals with MSUD is the presence of alloisoleucine, a compound that is not present in other individuals. There are 5 phenotypes observed in patients with MSUD: classic, intermediate, intermittent, thiamine-responsive, and dihydrolipoyl dehydrogenase (E3)-deficient. Although enzyme activities overlap to some degree in these phenotypes, in general, lower enzyme activity is associated with a more severe disorder.

Incidence

The worldwide frequency of MSUD (including classic and some variant forms), which is based on routine screening data from 26.8 million newborn infants, is approximately 1 in 185 000.[109,110] Newborn screening of 756 163 newborn infants over an 8-year period in Georgia revealed a much higher frequency of 1 in 84 000.[111] In the population of Mennonites living in Lancaster and Lebanon counties in Pennsylvania, the incidence is 1 in 176 newborn infants, most likely attributable to a founder effect.[112,113]

Clinical Manifestations

Classic MSUD (residual enzyme activity $\leq$2%) is the most severe and most common form. Affected infants are normal at birth, with symptoms usually developing between 4 and 7 days of age; however, lower intake of protein, as in breastfeeding, can delay the onset of symptoms until the second week of life. Initial symptoms are lethargy and poor sucking with little interest in feeding. Weight loss follows with abnormal neurologic signs (alternating hypertonia and hypotonia; dystonic posturing of the arms) becoming more and more apparent. The characteristic odor of the urine, described as smelling like maple syrup, burnt sugar, or curry, is then noted. Finally, seizures and coma, leading to death (in untreated cases), occurs.[109] Laboratory findings include increased concentrations of BCAAs, ketosis, acidosis, and occasionally hypoglycemia.[114] Patients with intermittent MSUD (enzyme activity 5%–20%) exhibit normal growth and intelligence. These children do not go into metabolic crisis unless the body is in a stressful situation, such as an infection (ie, otitis media) or after surgery.[115] Although patients with intermittent MSUD generally present between 5 months and 2 years of age secondary to a minor infection, some individuals have not shown symptoms until the fifth decade. Concentrations of BCAAs are normal between episodes.

In contrast, patients with intermediate MSUD (enzyme activity 3%–30%) do not present with catastrophic illness during the neonatal period but have gradual neurologic problems, eventually resulting in mental retardation. In one study, most were diagnosed between 5 months and 7 years of age while undergoing evaluation for developmental delay or seizures.[116,117] Several patients have had episodes of ketoacidosis, but acute encephalopathy is rare.[118] Increased concentrations of BCAAs and BCKAs in serum and urine are present. Patients with thiamine-responsive MSUD (enzyme activity 2%–40%) have a clinical course similar to those with intermediate MSUD. These patients have decreased concentrations of BCKAs and/or BCAAs with thiamine therapy in varying dosages ranging from 10 to 1000 mg/day.[119,120] In some instances, the patient does not show the full response to thiamine until therapy has commenced for 3 weeks.[121] In all documented cases, patients required dietary intervention in conjunction with thiamine to achieve metabolic control.[109]

E3-deficient MSUD (E3 deficiency) is rare, with fewer than 20 patients having been described.[109,122,123] Clinically, newborn infants with E3 deficiency are similar to patients with intermediate MSUD, but severe lactic acidosis is also present. The infants develop a persistent lactic acidosis between 8 weeks and 6 months of age followed by progressive neurologic deterioration with hypotonia, developmental delay, and movement disorder. Laboratory findings include mild to moderately increased concentrations of BCAAs and increased lactate, pyruvate, α-ketoglutarate, α-hydroxyisovalerate, and α-hydroxyglutarate concentrations. The patients have a combined deficiency of BCKD, pyruvate, and α-ketoglutarate dehydrogenase complexes, leading to the more complex phenotype. Various combinations of dietary therapy, vitamin therapy (thiamine and biotin), and lipoic acid have been tried without success.[122]

Pathophysiology

The BCKD complex is a macromolecule composed of 3 catalytic components: a thiamine pyrophosphate–dependent decarboxylase (E1) with α and β subunits, a transacylase (E2), and a dehydrogenase (E3). In addition, the BCKD complex contains 2 regulatory enzymes, a kinase and a phosphatase, that control activity of the complex.[109] The genes encoding E1α, E1β, E2, E3, and the specific kinase are cloned. Mutations with genotype/phenotype correlations have been described (see "Inheritance" below).

Inheritance

MSUD is an autosomal recessively inherited condition.[109] Mutations in the E1α subunit result in the molecular phenotype referred to as MSUD type IA (OMIM database No. 248600). The type IA mutations almost always result in the severe classic form of MSUD. The most prevalent mutation is Y393N, the mutation in the Mennonite community in Pennsylvania. DNA testing has been developed for the Y393N mutation because of its prevalence.[124] Only a few mutations have been described in the E1β subunit (type IB mutations; OMIM database No. 248611), all resulting in the classic neonatal MSUD phenotype. Mutations affecting the E2 core of the BCKD complex (type II MSUD mutations; OMIM database No. 248610) characteristically lead to a milder phenotype than types IA or IB. Most patients have the intermediate or intermittent phenotype, and several have been reported to respond to thiamine therapy. All type III mutations (defects in the E3 subunit; OMIM database No. 238331) lead to a distinct severe combined phenotype (MSUD plus primary lactic acidosis).

Benefits of Newborn Screening

Prognosis is poor for the patient with classic MSUD that goes undiagnosed and untreated, with death versus survival with severe neurologic damage as potential outcomes. Patients with classic MSUD who are not treated by 14 days of age generally have a less desirable outcome. In one study, the outcome with treatment was reported in more than 150 patients with classic MSUD and more than 25 patients with the variant forms.[109,125] Most of these cases were detected by newborn screening or because of clinical presentation. In the patients with classic MSUD, one third had IQ scores higher than 90, and one third had scores between 70 and 90. Rapid recognition and treatment (as with newborn screening) is important. When both performance and verbal scores are available, verbal scores are consistently higher than performance scores.[126] The discrepancy between the 2 scores is not surprising, because cerebellar dysfunction is often an early sign of acute metabolic decompensation. Even with newborn screening leading to timely treatment, outcome is not perfect. Short attention span and minor learning disabilities were observed even in patients with normal intellect who were treated soon after birth.[126]

Screening

State-of-the-art screening for MSUD is by MS/MS. The sum of the 3 isomers (leucine, isoleucine, and alloisoleucine) leads to a distinct diagnostic peak.[109] Classic MSUD, the intermediate form, and E3 deficiency can usually be detected by screening in the newborn period. Intermittent MSUD would not be detected, because the patients' concentrations are normal when they are not in crisis. Thiamine-responsive MSUD has been missed by newborn screening.[110]

Follow-up and Diagnostic Testing

A blood leucine concentration greater than 4 mg/dL, or a concentration of 3 to 4 mg/dL (305 mmol) in the first 24 hours of life, requires immediate medical follow-up.[109] Plasma amino acid analysis reveals findings diagnostic for MSUD: increased concentrations of BCAAs, low alanine concentrations, and the presence of alloisoleucine.

Brief Overview of Disease Management

Treatment consists of a carefully regulated diet that provides sufficient BCAAs for normal growth and development without exceeding the patient's degradative enzyme capacity.[109] Because natural protein must be limited, a medical food product (BCAA-free) supplement is necessary. A metabolic team, including not only a physician metabolic specialist but also a metabolic nutritionist, is crucial. A trial of thiamine supplementation (50–300 mg/day for at least 3 weeks) is recommended, because it is therapeutic for some patients and has no adverse effects. There are 2 aspects of treatment: long-term management and treatment during acute metabolic crisis. The goal of long-term dietary management is normalization of blood BCAA concentrations while providing nutrition adequate to sustain growth and development in children. Dietary therapy should be continued for life.[127] Patients with intermediate MSUD may only require protein restriction without supplementation of synthetic formula. Individuals with intermittent MSUD do not require a special diet except during episodes that may lead to metabolic crisis. Treatment during acute illnesses should be aggressive, because the metabolic decompensation can be life-threatening.[109] Toxic metabolites must be removed at the same time that catabolism is minimized and anabolism is promoted. Dialysis (first peritoneal and, more recently, continuous venovenous hemofiltration) has proven useful in BCAA/BCKA clearance.[128] Dietary treatment to break the cycle of catabolism and promote anabolism sometimes requires parenteral nutrition[129] or insulin combined with a large glucose infusion.[130]

Current Controversies

MSUD has been treated since the early 1960s,[131] and consequently, some neurologically intact MSUD-affected women have reached childbearing age and reproduced. As has been reported for other enzyme deficiencies, postpartum metabolic decompensation can be a problem.[132]

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MEDIUM-CHAIN ACYL-CoA DEHYDROGENASE

Medium-chain acyl-CoA dehydrogenase (MCAD; OMIM database No. 201450)[133] deficiency is a disorder of fatty acid oxidation (FAO) first described in 1982–1983.[134] All together, 10 disorders affecting mitochondrial FAO and ketogenesis have been identified. Among these, MCAD deficiency seems to be the most important because it is the most common and it has been implicated in some cases of sudden infant death syndrome (SIDS) and Reye syndrome.[135]

Incidence

MCAD deficiency has been diagnosed almost exclusively among individuals of northwestern European origin, with frequencies ranging from 1 in 46 000 to 1 in 6400.[136,137] The heterozygote frequency is 1% to 2%. A few cases have been identified in other populations, including one Pakistani patient, one black patient, and isolated cases in individuals of Southern European and Northern African origin.[138,139] Newborn screening in Japan did not identify any carriers.[138]

Clinical Manifestations

The classic presentation is an episode of vomiting and lethargy after a period of fasting in a child between 3 and 15 months of age. The child may have had a previous viral infection (gastrointestinal or upper respiratory) resulting in decreased oral intake that would have little consequence in an unaffected child.[139] The episode may

result in coma, and the child may remain obtunded even after hours of treatment with intravenous glucose. Undiagnosed disease has a mortality rate of 20% to 25%, many times with death occurring during the initial episode.[140] In a clinical review of 94 families with MCAD deficiency, 19 families (20%) had one or more unexplained child deaths. The diagnosis of MCAD deficiency was made postmortem in all cases.[141]

There are few reports of first symptoms after 4 years of age and fewer recurrent episodes after 4 years of age. Symptoms that require hospitalization during the second decade are unusual. The earliest onset of symptoms and sudden death is in the neonatal period, although this is rare, and the latest documented onset of the first episode was at 14 years of age. Most deaths would be preventable if dietary therapy and measures to prevent fasting were begun before the onset of symptoms. Cases in which children have died have, in some instances, resembled cases of SIDS or Reye syndrome. There is marked clinical variability even within the same family. There are families reported with several affected children with one child in the family dying on the first episode before 2 years of age and other children as old as 10 years never having had an episode.[139]

Although death is certainly the most important potential outcome of not screening for MCAD deficiency, there are findings in survivors that are very concerning regarding morbidity. A follow-up survey of 78 MCAD-deficiency survivors (all older than 2 years) revealed a number of unexpected problems, including developmental disabilities, speech and language delay, behavioral problems, attention-deficit/hyperactivity disorder (ADHD), proximal muscle weakness, chronic seizure disorder, cerebral palsy, and failure to thrive. The finding of ADHD was seen in 9 patients (12%), 8 of whom were female, in contrast to the usual male preponderance of ADHD in the general population. The development of muscle weakness was strongly correlated with length of time between symptomatic presentation and the institution of appropriate measures to prevent additional episodes of illness.[141,142]

Pathophysiology

MCAD deficiency is one defect in the pathway of mitochondrial β-oxidation. It is primarily a disease of hepatic FAO, with the most frequent presentation being episodic hypoketotic hypoglycemia provoked by fasting. FAO disorders do not present under nonfasting conditions and, therefore, have escaped attention for many years. The plasma and urinary metabolites of MCAD deficiency are of 2 types: general indicators of impaired function of the β-oxidation pathway (eg, dicarboxylic acids) and specific metabolites (eg, octanoylcarnitine). The inability to break down fats to ketone bodies for an energy source while fasting eventually leads to hypoglycemia. In addition, medium-chain (C8–C12) acyl-CoA intermediates accumulate in mitochondria, with the end result being inhibition of mitochondrial β-oxidation. Fatty acid is incorporated into triglycerides, resulting in accumulation of fat in the liver during acute episodes. The clinical presentation and many of the routine laboratory observations in MCAD deficiency are indistinguishable from those in Reye syndrome.[143] Encephalopathy and cerebral edema are secondary to accumulation of fatty acids within the central nervous system. Coma results from a combination of hypoglycemia and toxic effects of fatty acids or their metabolites.[134]

Inheritance

MCAD deficiency is inherited as an autosomal recessive trait. The causative gene is known, and multiple mutations have been identified. In studies of clinically affected patients with MCAD deficiency, 90% of mutant alleles identified have a single missense mutation (A985G); other mutations identified seem to individually account for less than 1% of the mutant alleles.[144] Virtually all of the A985G alleles arose on a background with the same haplotype, which suggests a founder effect, with the mutation beginning in northwestern Europe and then spreading throughout the rest of the world.[145] Recent molecular studies performed as follow-up to newborn screening by MS/MS technology have found a lower percentage of individuals with the common A985G mutation.[136,146] A second common mutation (T199C) has been observed in US populations identified initially by MS/MS screening. The T199C mutation is a mild mutation that produces a biochemical phenotype but has never been observed in clinically affected patients.[146]

Benefits of Newborn Screening

The benefits of and rationale for using newborn screening for diagnosis of MCAD deficiency are obvious. As noted above, many individuals affected with MCAD deficiency will die during the presenting episode, sometimes having been misdiagnosed with SIDS or Reye syndrome. Not only is this a tragic outcome for the loss of the child, but the family also has a 25% recurrence risk for the condition or may already have affected children who have not yet had clinical symptoms. The condition is relatively common, with a frequency of 1 in 15 001 in prospective newborn screening of 930 078 blood spots from different areas of the United States.[146]

Screening

The most efficient and sensitive method of screening for MCAD deficiency is MS/MS, measuring octanoylcarnitine (a compound normally not present) on the filter-paper blood spot. The optimal time for testing is the newborn period, because levels of octanoylcarnitine are significantly higher in the first 3 days of life than later (8 days to 7 years).[147] Individuals who are homozygous for

the common mutation (A985G) who are most likely to present clinically will have octanoylcarnitine concentrations higher than 2.3 μmol/L, and individuals with one copy of 985 and one copy of a milder mutation (eg, T199C) will have octanoylcarnitine present but most likely at a lower concentration (≥1.0 μmol/L). The latter group is more challenging to determine the best course of follow-up.

Follow-up and Diagnostic Testing

Any child with an octanoylcarnitine concentration of 1.0 μmol/L or greater will require definitive diagnostic testing. Follow-up testing will consist of plasma acylcarnitine analysis, urinary organic acid analysis, and molecular testing. The plasma acylcarnitine analysis and urinary organic acid analysis will confirm the diagnosis. The molecular analysis should provide guidance regarding prognosis.

Brief Overview of Disease Management

Treatment for MCAD deficiency consists of avoidance of fasting and mildly decreased intake of dietary fat coupled with L-carnitine supplementation. MCAD deficiency results in a secondary deficiency of carnitine, because carnitine couples with toxic intermediates, resulting in their excretion while depleting carnitine stores. Although it remains questionable how helpful supplemental carnitine is during periods when the patient with MCAD deficiency is healthy, there is no doubt that exogenous carnitine is recommended during times of illness.[139] Another important point is that patients should be treated aggressively even during minor illnesses (eg, otitis media) to avoid a severe episode. There should be no hesitation to institute therapy with intravenous glucose and carnitine.

Current Controversies

Genotype/phenotype correlation is not straightforward, and the treatment of individuals with milder mutations remains controversial.[148,149] There are questions yet to be answered, such as whether some (or all) individuals with the less deleterious mutations (either in combination with the common 985 mutation or in combinations with one another) who have a biochemical phenotype would ever have medical problems. In addition, would some such individuals have serious episodes and others would not because of unknown modifying factors? Until we know the answer to these and other questions, we would be remiss in not treating everyone identified, perhaps overtreating some individuals. Newborn screening for MCAD deficiency will be key in answering some of these questions.

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PHENYLKETONURIA

Hyperphenylalaninemia (OMIM database No. 261600),[150] an abnormal increase in the concentration of the amino acid phenylalanine (Phe) in the blood, may be a benign condition with little clinical significance. When the concentration of Phe is very high (>20 mg/dL or 1210 μmol/L) and there is accumulation of phenylketones, the condition is called classic phenylketonuria (PKU).

Incidence

Despite the fact that newborn screening has been underway for more than 40 years in the United States, data only allow estimates of the incidence and prevalence of this disorder. This is partly because of the fact that states vary in their definitions of hyperphenylalaninemia and PKU. For PKU, the reported incidence ranges from 1 in 19 000 to 1 in 13 500 newborn infants. For non-PKU hyperphenylalaninemia, the estimated incidence is 1 in 48 000 newborn infants. There are large variations in the incidence of PKU by ethnic and cultural groups, with individuals of Northern European ancestry and American Indian/Alaska Native individuals having a higher incidence than black, Hispanic, and Asian individuals.[151]

Clinical Manifestations

PKU is rarely diagnosed before 6 months of age without newborn screening, because the most common manifestation without treatment is developmental delay followed by mental retardation. Untreated individuals may also develop microcephaly, delayed or absent speech, seizures, eczema, and behavioral abnormalities.

Pathophysiology

PKU results from a deficiency of activity of a liver enzyme, phenylalanine hydroxylase (PAH), leading to increased concentrations of Phe in the blood and other tissues. Certain mutations of the *PAH* gene usually result in non-PKU hyperphenylalaninemia, and others result in classic PKU. Because siblings with the same mutation at the *PAH* locus may have different clinical findings, it is likely that other genetic and environmental factors influence the severity of the disorder.[152] In fact, a few individuals with PKU have no evidence of mental retardation, even without dietary treatment.[151] However, there is evidence that certain genotypes are associated with higher increases of Phe concentration.[153] It is likely that Phe itself leads to the mental retardation and other findings of PKU. In excess, Phe disturbs transport of other amino acids across the blood-brain barrier and impairs synthesis of neurotransmitters.[151] For the enzyme PAH to be active, the cofactor tetrahydrobiopterin (BH4) is required. Impaired synthesis or recycling of BH4 results in increased concentrations of Phe and certain other amino acids. This condition does not respond to routine dietary management of PKU, and hence, states have instituted additional screening programs to identify infants with these rare disorders so that appropriate treatment can be initiated.

Inheritance

PKU is an autosomal recessive disorder, with the *PAH* locus on chromosome 12q24.1. More than 400 different mutations have been described, including deletions, insertions, missense mutations, splicing defects, and nonsense mutations. Most individuals with PKU are compound heterozygotes, meaning that a single individual will have different mutations of each copy of the *PAH* gene.[151] The numerous possible combinations of gene mutations undoubtedly contributes to the variable clinical findings in PKU.

Benefits of Newborn Screening

Children with PKU who are treated appropriately after positive newborn screening results have average intelligence as measured by IQ tests, although their scores are somewhat lower than expected when compared with parent and sibling IQs. There is an inverse relationship between the age at which treatment is begun and the IQ level, even in PKU that is treated early.[154] Tremor of unknown origin has been reported in 10% to 30% of early-treated individuals with PKU.[155] Adolescents and young adults who are treated early and continuously seem to have no increased incidence of psychiatric, emotional, or functional disorders, and there is no increase in problems of self-concept.[156,157] Although children with PKU are not at increased risk of developing dental caries, children with PKU may exhibit increased signs of tooth wear because of the erosive potential of the amino acid supplements in the diet.[158] Therefore, it is important for children and adolescents with PKU to have regular dental care.

Screening

There are 3 main methods used for screening newborns for PKU in the United States: the Guthrie BIA, fluorometric analysis, and MS/MS. The Guthrie BIA is inexpensive and reliable. Fluorometric analysis and MS/MS are quantitative and can be automated; both of these methods also produce fewer false-positive results than BIA.[151] Preliminary data indicate that MS/MS produces fewer false-positive results than the fluorometric method in samples obtained in the first 24 hours of life.[159] Newborn screening laboratories in the United States use cutoff values from 2 mg/dL (125 μmol/L) to 6 mg/dL (375 μmol/L). A positive screening result should lead to rapid evaluation of the newborn for clinical status, age, and diet at the time of sample collection. Severe

deficiency of PAH will usually result in an increased concentration of blood Phe within the first 24 hours of life; however, infants with a less severe deficiency may take longer to develop an abnormal Phe concentration. It is for this reason that a repeat test for all infants initially screened in the first 24 hours of life has been recommended by some authorities.[160] Few states, however, currently require a second screen.

Follow-up and Diagnostic Testing

Early treatment of PKU is associated with improved intellectual outcome. Therefore, an infant with a positive newborn screening result should receive the benefit of rapid diagnostic testing. Diagnostic testing includes quantitative determination of plasma Phe and tyrosine concentrations. If the Phe concentration is increased, additional studies are indicated to determine if the infant has an abnormality in synthesis or recycling of BH4.

Brief Overview of Disease Management

Once the diagnosis of hyperphenylalaninemia is confirmed, metabolic control should be achieved as rapidly as possible. This is achieved through the use of medical foods, including medical protein sources that are low in Phe; small amounts of Phe must also be provided, which is achieved through the use of small amounts of natural protein. The infant with PKU can be given breast milk along with Phe-free formula under the direction of a metabolic dietitian. The response to dietary treatment is monitored through periodic measurement of blood Phe concentrations, assessment of growth parameters, and review of nutritional intake. There is no consensus concerning the optimal blood Phe concentration or the duration of strict dietary management. The most commonly reported blood Phe concentration recommendations for US centers are 2 to 6 mg/dL for individuals 12 years or younger and 2 to 10 mg/dL for persons older than 12 years.[151] Most US centers recommend lifelong dietary treatment. This is particularly important for women, because fetuses exposed to increased concentrations of Phe are at significant risk of microcephaly, congenital heart disease, and reduced IQ.[151] It is recommended that a woman with PKU achieve Phe concentrations of less than 6 mg/dL at least 3 months before conception and that concentrations be maintained between 2 and 6 mg/dL throughout pregnancy.[151] The importance of management throughout the reproductive years illustrates the critical role of long-term follow-up in this disorder.

Current Controversies

As noted previously, there is no national or international consensus regarding the optimal concentration of Phe across the life span. Similarly, there is no consensus regarding discontinuation of dietary therapy. Although appropriately treated young adults with PKU lead normal and productive lives, there are no meaningful data regarding the incidence of long-term sequelae in individuals who remain on dietary therapy into middle and old age. Recent evidence suggests that some individuals with hyperphenylalaninemia and classic PKU may benefit from BH4 treatment in addition to dietary Phe restriction.[161]

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SICKLE CELL DISEASE AND OTHER HEMOGLOBINOPATHIES

The term sickle cell disease (SCD) (OMIM database No. 603903)[162] encompasses a group of genetic disorders characterized by chronic hemolysis and intermittent episodes of vascular occlusion that cause recurrent episodes of severe pain and a wide variety of other disease manifestations. Specialized comprehensive medical care markedly reduces mortality in infancy and early child-

hood by preventing some disease-related complications and limiting the severity and sequelae of others.

Newborn screening for SCD also identifies infants with nonsickle hemoglobinopathies, hemoglobinopathy carriers, and, in some states, infants with α-thalassemia.[163,164] Newborn screening results and clinical manifestations for some of these conditions are outlined in Table 1. Guidance for follow-up and diagnostic evaluation of infants with these screening results has been published[163,164] and is often provided by state newborn screening programs or their designated hemoglobinopathy consultants.

Incidence

Overall, SCD occurs in 1 of 2500 to 1 of 2000 US newborns.[165,166] Its incidence is highest in persons of African, Mediterranean, Middle Eastern, Indian, Caribbean, and Central and South American ancestry. The disease occurs less commonly in other ethnic groups, including individuals of Northern European descent. Accurate incidence data for many groups are unavailable. SCD is estimated to occur in 1 of 346 black infants and in 1 of 1114 Hispanic infants in the eastern United States.[167]

Clinical Manifestations

Most infants with SCD are healthy at birth and become symptomatic later during infancy or childhood. The most common clinical manifestation is musculoskeletal or abdominal pain, which occurs unpredictably and is often excruciating. Acute manifestations that may rapidly become life-threatening include bacterial sepsis or meningitis, splenic sequestration, acute chest syndrome, and stroke. Other acute complications include aplastic crises, priapism, and renal papillary necrosis. Chronic manifestations include anemia, jaundice, splenomegaly, hyposthenuria, hematuria, proteinuria, cholelithiasis, and delayed growth and sexual maturation. Avascular necrosis of the hip and shoulder, restrictive lung disease, and leg ulcers may cause chronic disability. Pulmonary hypertension is a risk factor for early death. It is important to note that the severity of SCD varies widely, even among individuals with the same genotype.

Pathophysiology

Sickle hemoglobin is caused by a point mutation in the β-globin gene, which leads to an amino acid change that causes hemoglobin to polymerize when deoxygenated. Sickle red blood cells are dehydrated and show oxidative damage and increased adhesion to endothelial cells. The cumulative effects of these cellular abnormalities are shortened red cell survival and intermittent episodes of vascular occlusion, which cause tissue ischemia and organ damage.

Inheritance

SCD is an autosomal recessive disorder. Heterozygous individuals have a generally benign, asymptomatic genetic carrier state, sometimes referred to as a sickle cell

TABLE 1 Newborn Screening for Conditions Other Than SCD

Screening Results	Possible Conditions	Clinical Manifestations
Nonsickle hemoglobinopathies		
F only	Preterm infant	Repeat screening necessary
	Homozygous β^0-thalassemia	Severe thalassemia
FE	EE	Microcytosis with mild or no anemia
	E β^0-thalassemia	Mild to severe anemia
FC	CC	Mild microcytic hemolytic anemia
	C β^0-thalassemia	Mild microcytic hemolytic anemia
FCA	C β^+-thalassemia	Mild microcytic hemolytic anemia
α-Thalassemia syndromes		
FA + Bart's[a]	α-Thalassemia silent carrier	Normal complete blood cell count
	α-Thalassemia minor	Microcytosis with mild or no anemia
	HbH disease	Mild to moderately severe microcytic hemolytic anemia
	HbH Constant Spring	Moderately severe hemolytic anemia
FAS + Bart's	α-Thalassemia with structural Hb variant	Clinical manifestations, if any, depend on the structural variant (eg, HbE) and severity of α-thalassemia
FAC + Bart's		
FAE + Bart's		
FE + Bart's		
Hemoglobinopathy carriers		
FAS	Sickle cell trait	Normal complete blood cell count; generally asymptomatic
FAC	HbC carrier	No anemia; asymptomatic
FAE	HbE carrier	Normal or slightly decreased MCV without anemia; asymptomatic
FA Other	Other Hb variant carrier	Depends on variant; most without clinical or hematologic manifestations

[a] Hemoglobin Bart's, a tetramer of γ-globulin, is present in infants with α-thalassemia.

Modified from: National Heart, Lung, and Blood Institute. Neonatal screening. In: *The Management of Sickle Cell Disease*. Washington, DC: National Institutes of Health; 2002:7–14. NIH publication No. 02-2117.

trait. Homozygous and compound heterozygous individuals have symptomatic disease. Four SCD genotypes (sickle cell anemia, sickle-hemoglobin C disease, and 2 types of sickle β-thalassemia [sickle β^+-thalassemia and sickle β^0-thalassemia]) account for most SCD cases in the United States.[163,164,168] Less-common forms of SCD are caused by coinheritance of hemoglobin S with other hemoglobin variants such as hemoglobin D-Punjab and hemoglobin O-Arab.

Benefits of Newborn Screening

The primary rationale for newborn screening and presymptomatic diagnosis is prevention of mortality from pneumococcal sepsis and splenic sequestration during infancy and childhood.[167,169–172] Prophylactic penicillin has been shown to reduce the incidence of pneumococcal sepsis by 84%[170] and is used in conjunction with pneumococcal conjugate and polysaccharide vaccines and urgent evaluation and treatment of febrile illness with parenteral antibiotics. Family education about signs and symptoms of splenic sequestration results in earlier detection and reduced mortality from that complication.[169] Data from a number of statewide newborn screening programs confirm that mortality from SCD during the first 3 to 4 years of life, historically as high as 20%, is virtually eliminated by universal screening and appropriate follow-up and treatment.[173]

Screening

Most newborn screening programs use isoelectric focusing to separate hemoglobins eluted from dried blood spots. A few programs use high-performance liquid chromatography (HPLC) or cellulose acetate electrophoresis as the initial screening method. Most programs retest screening specimens with abnormal results using a second complimentary electrophoretic technique, HPLC, immunologic tests, or DNA-based assays. The sensitivity and specificity of isoelectric focusing and HPLC are excellent,[167] but results and interpretation can be confounded by extreme preterm birth or previous blood transfusion.[163,174]

Hemoglobins identified by these screening methods are reported in order of quantity. Because more fetal hemoglobin (HbF) than normal adult hemoglobin (HbA) is present at birth, most normal infants show FA results. Infants with SCD also show a predominance of F at birth; FS, FSC, or FSA are the most common results in children with SCD.

Follow-up and Diagnostic Testing

Infants with screening results indicative of possible SCD (FS, FSC, FSA) should have confirmatory testing of a second blood sample accomplished before 2 months of age. Confirmatory testing is performed by isoelectric focusing, HPLC, hemoglobin electrophoresis (cellulose acetate and citrate agar), and/or DNA-based methods.[164] Most infants with screening results that show HbFS have sickle cell anemia, but other possibilities include sickle β^0-thalassemia, sickle δβ-thalassemia, and hereditary persistence of fetal hemoglobin, a benign condition. For this reason, testing of parents or DNA analysis may help clarify the diagnosis in selected cases. For infants with probable sickle cell disease, the selection of diagnostic tests and the interpretation of results ideally should be supervised by an expert in the diagnosis of hemoglobin disorders in childhood.

Family testing to identify carriers, for the purpose of defining an infant's diagnosis and/or providing genetic education and counseling, requires a complete blood cell count and hemoglobin separation by electrophoresis, isoelectric focusing, and/or HPLC.[164,168] Individuals with hemoglobin variants such as S, C, and E are identified readily. Most individuals with heterozygous β-thalassemia show a decreased mean corpuscular volume (MCV) and increased levels of hemoglobin A_2 and/or hemoglobin F. Thus, accurate quantitation of hemoglobin F and hemoglobin A_2 is needed if the MCV is decreased or borderline decreased. Solubility testing is inadequate and should never be used for carrier testing, in part because it will not identify individuals with the hemoglobin C trait and β-thalassemia.

Brief Overview of Disease Management

SCD is a complex disorder with multisystem manifestations that require specialized comprehensive care to achieve an optimal outcome.[168] Family and patient education about the genetics, clinical manifestations, and treatment of SCD and its complications are important, particularly because prompt recognition of potentially life-threatening complications reduces morbidity and mortality. Important health maintenance issues include prophylactic medications, particularly prophylactic penicillin (should be started no later than 2 months of age), and timely immunizations, especially with the pneumococcal conjugate and polysaccharide vaccines. Periodic comprehensive medical evaluations facilitate documentation of important baseline physical findings and laboratory values, detection of signs of chronic organ damage, and development of individualized patient care plans. Timely and appropriate treatment of acute illness is critical, because life-threatening complications can develop rapidly. Some patients, including those who have suffered a stroke or who are identified as being at high risk of stroke by transcranial Doppler ultrasonography screening, receive chronic blood transfusions to prevent stroke and other complications. Selected patients with frequent or severe disease manifestations may benefit from hydroxyurea therapy and/or may be considered for stem cell transplantation, particularly if there is an HLA-matched sibling donor. Guidelines for the management of SCD were published recently.[168,175]

Current Controversies

Because SCD is more prevalent in some racial and ethnic groups than others, some programs initially implemented selected or targeted screening rather than testing all newborn infants. However, experience with targeted screening showed a rate of missed cases as high as 30%, in part because of difficulties identifying infants' race or ethnicity. In addition, targeted compared with universal screening incurs additional costs and exposes screening programs, nurseries, and physicians to increased litigation risk for the preventable morbidity and mortality that results from delayed diagnosis. For these and other reasons, universal screening is strongly recommended and has been implemented in all 50 states, the District of Columbia, and the US Virgin Islands.

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TYROSINEMIA

There are 2 clinically recognized types of tyrosinemia. Type I (hepatorenal) tyrosinemia (OMIM database No. 276700)[176] is characterized by liver toxicity from increased concentrations of tyrosine and other metabolites with hepatocellular damage. Acutely, this produces jaundice and increased transaminase concentrations. Chronically, there is a high risk of hepatic cancer. Other features include the renal Fanconi syndrome and peripheral neuropathy.[177] Type I tyrosinemia is caused by deficiency of the enzyme fumarylacetoacetate hydrolase (FAH). Type II (oculocutaneous tyrosinemia, also known as Richner-Hanhart syndrome; OMIM database No. 276600) exhibits corneal lesions and hyperkeratosis of the palms and soles. It is caused by deficiency of the enzyme tyrosine aminotransferase (TAT). A third entity, neonatal tyrosinemia, should be mentioned. It is more common in preterm infants and, in fact, is the most common cause of abnormal initial newborn screening results for tyrosinemia and PKU.[178] All show increased concentrations of serum tyrosine that can be detected on newborn screening.

Incidence

Type I tyrosinemia has an incidence of 1 in 12 000 to 1 in 100 000 in those of northern European descent. The incidence of type II and neonatal tyrosinemia has not been established.

Clinical Manifestations

Type I

Type I tyrosinemia in the acute form is characterized by failure to thrive, vomiting, diarrhea, a cabbage-like odor, hepatomegaly, fever, jaundice, edema, melena, and progressive liver disease. If untreated, death from liver failure may occur in the first year of life. The chronic form is similar but with milder features characterized by hypophosphatemic rickets. Other features have included hypertrophic obstructive cardiomyopathy, abdominal crises, polyneuropathy, hypertension, and hepatoma (a late complication in one third of patients). Death occurs during the first decade of life. There are increased concentrations of tyrosine in blood and urine. Urinary tests for succinylacetone and tissue analysis (liver or fibroblasts) for FAH activity establish the diagnosis.

Type II

Type II tyrosinemia is a distinctive oculocutaneous syndrome. Eye findings may be limited to lacrimation, pho-

tophobia, and redness. Signs may include mild corneal herpetiform erosions, dendritic ulcers, and, rarely, corneal and conjunctival plaques. Neovascularization may be prominent. Long-term effects include corneal scarring, nystagmus, and glaucoma. The skin lesions usually begin with or after the eye lesions. Skin findings may begin as painful, nonpruritic blisters or erosions that crust and become hyperkeratotic. They are usually limited to the palms and soles, especially the tips of the digits, and to the thenar and hypothenar eminences. They may be linear or subungual. A skin biopsy is not diagnostic and may show nonspecific hyperkeratosis, acanthosis, and parakeratosis. Skin lesions may be difficult to distinguish from any of the more common forms of keratosis. Mental retardation is an inconstant feature; mild-to-moderate retardation, self-mutilating behavior, disturbances of fine motor coordination, and language deficits have been reported. Tyrosinemia is the diagnostic feature of this disorder. Tyrosine is the only amino acid that is found in increased concentrations in the urine in this disorder.

Neonatal

Clinical findings in neonatal tyrosinemia are nonspecific. Infants with persistent neonatal tyrosinemia may be somewhat lethargic and have difficulty swallowing, impaired motor activity, prolonged jaundice, and increased levels of galactose, phenylalanine, histidine, and cholesterol. Mild acidosis may be present in approximately half of the infants. Mild retardation and decreased psycholinguistic abilities have been noted in some studies.[179]

Pathophysiology

Type I

This disorder, although not a primary disorder of tyrosine metabolism, is accompanied by increased concentrations of tyrosine and its metabolites, which inhibit many transport functions and enzymatic activities. It has been proposed that the degree of residual FAH activity determines whether the disease will be acute or chronic in the affected patient.

Type II

This disorder is associated with a deficiency of hepatic TAT, the rate-limiting enzyme of tyrosine catabolism. Tyrosinemia, tyrosinuria, and increases in urinary phenolic acids, *N*-acetyltyrosine, and tyramine persist for life. The metabolism of other amino acids and renal and hepatic function are otherwise normal.

Neonatal

It is generally assumed that this disorder is caused by a relative deficiency of *p*-hydroxyphenylpyruvate oxidase stressed by high-protein diets, with resulting high tyrosine and phenylalanine concentrations. Others have suggested a mild decrease in TAT activity.

Inheritance

Type I and II tyrosinemias are autosomal recessive, with a 25% risk of recurrence in siblings. The heterozygotes for type I have approximately half-normal levels of FAH activity in fibroblasts and lymphocytes. Prenatal diagnosis is complex, requiring at least 3 different procedures using amniotic fluid and cultured amniocytes or chorionic villus cells. These procedures involve the direct measurement of succinylacetone by combined gas chromatography and mass spectrometry in amniotic fluid, FAH enzymatic activity, and the measurement of the ability of succinylacetone to inhibit aminolevulinic dehydrase activity in cultured amniotic fluid or chorionic villus cells.[180]

The carrier state for type II tyrosinemia has not been detected biochemically, and prenatal diagnosis is not currently available. The inheritance of neonatal tyrosinemia is unclear.

The chromosome map location for type I (FAH) is 15q23-25, the location for type II (TAT) is 16q22.1–22.3, and the location for neonatal (*p*-hydroxyphenylpyruvate) oxidase is 12q24-qter. Type I tyrosinemia is most prevalent in French Canadians, with an overall incidence of as high as 1 in 700 in certain regions of Quebec.[181] Type II tyrosinemia cases have been described in several countries including the United States, Canada, Japan, Europe, and the Middle East. Neonatal tyrosinemia is most prevalent in Canadian Inuits.

Rationale for and Benefits of Newborn Screening

Death from complicating liver failure occurs in untreated patients with type I tyrosinemia during the first year of life in the acute form and during the first decade of life in the chronic form. Hepatocellular carcinoma may also be a cause of death. The introduction of 2-(2-nitro-4-trifluoromethylbenzyl)-1,3-cyclohexanedione (NTBC) has changed the outcome of this disorder dramatically.[182] More than 90% of patients respond clinically to treatment with NTBC. The current indications for liver transplantation in type I tyrosinemia are nonresponsiveness to NTBC, risk of malignancy, and decreased quality of life related to dietary restriction and frequency of blood sampling. Successful liver transplantation can further reduce the mortality rate in nonresponders to 5%.[183] There is a strong decrease in the risk of early development of hepatocellular carcinoma in patients with effective, early therapy.

Screening

The BIA can be used to screen for tyrosinemia using dried blood spots. Abnormal concentrations of tyrosine are reported as more than 6 mg/dL. Newer methods include direct measurement of tyrosine by MS/MS. The

test is performed in the neonatal period, but the optimal time for study is unclear. Presumably, it is best if measurements are obtained 48 to 72 hours after milk feeding. The stability of tyrosine in specimens has not been determined specifically but should be similar to that of phenylalanine. The rate of false-negative results has not been determined. Data from the 1999 National Newborn Screening Report[184] showed an initial positive screening result in 136 of 407 118 newborn infants tested (1 in 3000), with 2 positive confirmed cases. Available data on second screenings performed between 1 and 4 weeks of age showed 2 positive results in 60 474 infants (1 in 30 000); no cases of tyrosinemia were confirmed among this group.

Follow-up and Diagnostic Testing

An increased tyrosine concentration on newborn screening requires confirmation and additional testing, because it may be caused by other metabolic disorders (eg, fructose and galactose enzyme deficiencies), giant cell hepatitis, neonatal hemochromatosis, and neonatal infections. The optimal approach is complex and requires determination of the concentrations of tyrosine and other amino acids and metabolites in the blood and urine. Type I tyrosinemia involves increased concentrations of urine succinylacetone and nonspecific aminoaciduria and requires tissue analysis (fibroblasts, erythrocytes, lymphocytes, or liver) for FAH activity. Type II tyrosinemia involves increased tyrosine concentrations only in blood and urine. Confirmation of neonatal tyrosinemia depends on the presence of increased concentrations of tyrosine and phenylalanine.

Brief Overview of Disease Management

Type 1

Treatment options for tyrosinemia include dietary therapy, liver transplantation, and use of the pharmacologic agent NTBC. Clinical signs and symptoms improve with NBTC therapy and diet.[182] Signs of improvement include a decrease in concentrations of metabolites, correction of the secondary abnormality in porphyrin synthesis, improved liver and renotubular function, and regression of hepatic abnormalities by computed tomography. Correction of porphyrin synthesis reduces the risk of porphyric crises.

Type II

Therapy with a diet low in tyrosine and phenylalanine is curative in type II tyrosinemia. Early diagnosis can help avoid the risk of mental retardation in these patients.

Neonatal

Most cases of neonatal tyrosinemia, especially those seen in small preterm infants, may be transient and controlled by reducing the protein intake to 2 to 3 g/kg per day or by breastfeeding. Some patients respond to ascorbic acid supplementation.

Current Controversies

The incidence and pathogenetic mechanisms of specific disorders associated with increased concentrations of tyrosine require clarification. The consequences of early diagnosis and treatment for type I tyrosinemia (the most formidable disorder in this group) should be beneficial. NBTC therapy seems to be very effective. No marked adverse effects have been noted. Follow-up for long-term outcome is needed.

Special Issues/Concerns

Confirmation of the exact cause of increased concentrations of tyrosine requires referral and evaluation by an expert in the field. Outcome with treatment remains variable.

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DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Nondiscrimination in Pediatric Health Care

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Workforce

ABSTRACT

This policy statement is a revision of a 2001 statement and articulates the positions of the American Academy of Pediatrics on nondiscrimination in pediatric health care. It addresses both pediatricians who provide health care and the infants, children, adolescents, and young adults whom they serve.

THE MISSION OF the American Academy of Pediatrics (AAP) is "to attain optimal physical, mental, and social health and well-being for all infants, children, adolescents and young adults."[1] In support of this mission, therefore, the AAP is opposed to discrimination in the care of any patient on the basis of race, ethnicity, ancestry, national origin, religion, gender, marital status, sexual orientation, gender identity or expression, age, veteran status, immigration status, or disability of the patient or patient's parent(s) or guardian(s). In addition, the AAP supports the right of pediatricians, pediatric medical subspecialists, pediatric surgical specialists, and other specialist physicians who care for pediatric patients in both educational and practice settings to participate in the delivery of health care without discrimination on the basis of race, ethnicity, ancestry, national origin, religion, gender, marital status, sexual orientation, gender identity or expression, age, veteran status, immigration status, or disability. Physicians with disabilities who maintain the ability to perform the essential functions of their jobs with or without "reasonable accommodation," as defined by the Americans With Disabilities Act (ADA),[2] should not be hindered from participating in such activities.

Regardless of the size of the practice, all pediatricians, whether employers or employees, are encouraged to have nondiscrimination policies and to review all their personnel policies and procedures to monitor how they are implemented to ensure that they do not have an adverse effect on any individual or group.[3] If one wishes to air a grievance concerning discrimination on the basis of any of the above-listed factors, they must be able to do so in an environment that is free of prejudice and discrimination so that the matter may be addressed and resolved expediently.

The AAP recognizes the value of diversity among patients and pediatricians and the importance of proactively establishing and adhering to nondiscrimination policies for both pediatricians (as employers and employees) and the patients in their care. The AAP recommends that both public and private insurers provide nondiscriminatory and continuous coverage of pediatric services. Finally, the AAP encourages its members to support these nondiscrimination principles consistently in their interactions with colleagues, patients, and the patient's parent(s) or guardian(s).

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AHA Scientific Statement

Noninherited Risk Factors and Congenital Cardiovascular Defects: Current Knowledge

A Scientific Statement From the American Heart Association Council on Cardiovascular Disease in the Young

Endorsed by the American Academy of Pediatrics

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Abstractð Prevention of congenital cardiovascular defects has been hampered by a lack of information about modifiable risk factors for abnormalities in cardiac development. Over the past decade, there have been major breakthroughs in the understanding of inherited causes of congenital heart disease, including the identification of specific genetic abnormalities for some types of malformations. Although relatively less information has been available on noninherited modifiable factors that may have an adverse effect on the fetal heart, there is a growing body of epidemiological literature on this topic. This statement summarizes the currently available literature on potential fetal exposures that might alter risk for cardiovascular defects. Information is summarized for periconceptional multivitamin or folic acid intake, which may reduce the risk of cardiac disease in the fetus, and for additional types of potential exposures that may increase the risk, including maternal illnesses, maternal therapeutic and nontherapeutic drug exposures, environmental exposures, and paternal exposures. Information is highlighted regarding definitive risk factors such as maternal rubella; phenylketonuria; pregestational diabetes; exposure to thalidomide, vitamin A cogeners, or retinoids; and indomethacin tocolysis. Caveats regarding interpretation of possible exposure-outcome relationships from case-control studies are given because this type of study has provided most of the available information. Guidelines for prospective parents that could reduce the likelihood that their child will have a major cardiac malformation are given. Issues related to pregnancy monitoring are discussed. Knowledge gaps and future sources of new information on risk factors are described. **(*Circulation*. 2007;115:2995-3014.)**

Key Words: AHA Scientific Statements ■ heart defects, congenital ■ heart disease ■ risk factors

Congenital cardiovascular defects (CCVDs) represent some of the more prevalent malformations among live births[1] and remain the leading cause of death from congenital malformations.[2] Disease prevention has been hampered by a lack of information about modifiable risk factors for abnormalities in cardiac development. Over the past decade, there have been major breakthroughs in the understanding of inherited causes of CCVDs, including the identification of specific genetic abnormalities for some types of malformations.[3] Although relatively less information has been available on noninherited modifiable factors that may have an adverse effect on the fetal heart, there is a growing body of epidemiological literature on this topic. The proportion of cases of CCVDs that are potentially preventable through changes in the fetal environment is currently unknown. One study suggests that the fraction of cases attributable to identifiable and potentially modifiable factors may be as high as 30% for some types of defects.[4] The lack of reliable information on modifiable risk factors has made it difficult to create population-based strategies to reduce the burden of

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illness from CCVDs and for couples to make lifestyle choices to reduce the likelihood of having a child with a major cardiac malformation.

The purpose of this article is to review the current state of knowledge regarding noninherited risk factors for structural cardiac anomalies, to provide guidance to potential parents that could reduce the likelihood that their child will have a major cardiovascular malformation, and to provide guidance for pregnancy monitoring after known exposures. The current state of knowledge of inheritable causes of CCVDs is reviewed separately and is not included.[3] Similarly, because this statement focuses on factors that influence cardiac development during weeks 2 to 7 of gestation,[5] this review is limited to parental exposures during the first trimester of pregnancy and the 3 months before pregnancy (ie, periconceptional period) that could result in structural abnormalities; exposures that may cause other types of cardiac injury (eg, congenital heart block, myocardial damage) are not considered.

Methods

This statement summarizes the currently available literature, as of May 2006, on prenatal parental conditions and exposures and risk for CCVDs in offspring. English-language publications in scientific journals reporting data on risks of CCVDs in offspring after maternal or paternal diseases, conditions, or exposures were identified through Medline searches, bibliographies of individual articles, and reviews of scientific journals. The information about maternal drug exposure also includes information from the Teratogen Information System (http://depts.washington.edu/terisweb/teris/) and the online version of *Shepardôs Catalog of Teratogenic Agents*. Publications were assessed to determine the quality of information available (eg, consistency of findings and study design, including the ability to estimate magnitude of risk and exclude chance and bias as possible explanations) regarding a specific type of parental condition or exposure during pregnancy and the risk of having an infant with a major CCVD. Conditions or exposures for which only limited information was available such as a single published epidemiological study were included but generally considered insufficient for discussion. Exceptions were maternal conditions about which there has been some concern (ie, systemic lupus erythematosus and HIV-1 infection). Case reports and case series were not considered to be sufficiently reliable for discussion, unless confirmed by epidemiological studies. From the review of published epidemiological studies, parental conditions and exposures were classified into one of the following categories: factors possibly associated with a decreased risk of CCVDs, factors associated with an increased risk of CCVDs, factors not associated with risk of CCVDs, and factors that have been studied but for which the information about risk of CCVDs is inconclusive. Although some exposures may be risk factors for specific types of CCVDs and not others, quantified measures of overall relative risk such as relative risk (RR) or odds ratios (ORs) are given, if known, to attempt to quantify the increased risk of having a child with any CCVDs, as well as with a specific CCVD, after a specific exposure. Presentation of results for specific types of malformations is, of course, often limited by the different methods used to identify and group malformations in different reports. Confidence limits for the RR or ORs are given if available; confidence limits that contain the value 1.0 indicate that the RR or OR estimate does not differ statistically from the null value (ie, 1.0).

To date, there are no published reports of large prospective cohort studies examining environmental or other exposures associated with CCVDs. The best available information comes from large population-based case-control studies specifically designed to investigate possible risk factors for CCVDs. Two such studies deserve specific mention. The Baltimore-Washington Infant Study (BWIS) was prospectively conducted in the Baltimore, Washington, and northern Virginia area between 1981 and 1989 with a random sample of infants without CCVDs ascertained from the same birth cohort.[6] The National Public Health Institute in Helsinki retrospectively conducted a study in Finland of cases and controls born during 1982 to 1984.[7] In both of these case-control studies, information on potential exposures early in pregnancy was obtained by interview of the parents after the child was born. There were no available reliability or validation studies of the parental reports.

Results

The findings from this review are summarized in the tables. Table 1 summarizes the literature regarding 1 factor that may be associated with a decreased risk of CCVDs, specifically supplementation with a multivitamin containing folic acid. Table 2 summarizes the literature on factors that may increase the risk of a pregnancy resulting in an infant with any CCVDs and with a specific CCVD. Table 3 shows the same information, organized by CCVD phenotype rather than type of exposure. Table 4 shows factors that have been studied but for which no associations have been found thus far. Table 5 shows factors that have been studied but for which too little information is available to make a determination about risk.

Multivitamins and Folic Acid

One of the most important recent discoveries is the possibility that periconceptional intake of multivitamin supplements containing folic acid may reduce the risk of CCVDs in offspring, similar to the known risk reduction for neural tube defects seen with folic acid. This finding was first identified

TABLE 1. Maternal Multivitamin/Folic Acid Supplements and Decreased Risk of Offspring With Congenital Cardiovascular Defects

Vitamin/Supplement	Defect	OR	Reference(s)
Multivitamin supplements (including folic acid)	Any	0.5–0.8	8–10
	VSD	0.2–1.2	9, 10, 12
	Conotruncal defects	0.5–1.0	10–12
Multivitamin supplements (including folic acid) in women with febrile illness	Any	*	15
Folate antagonist only	Any	2.1	13, 14

*OR not applicable.

after analysis of data from a Hungarian randomized trial on birth defects[8,9] (Table 1). Findings from subsequent case-control studies have been generally supportive but not conclusive.[8,10–12]

Two of the studies examined a broad range of heart defects rather than any specific type.[9,10] Use of multivitamins containing folic acid was associated with an ≈60% overall reduction in risk for congenital heart defects in the Hungarian randomized trial (RR, 0.42; 95% confidence interval [CI], 0.19 to 0.98)[8,9] and an ≈25% reduction in risk in a population-based case-control study done in Atlanta (OR, 0.76; 95% CI, 0.60 to 0.97).[10] These and other studies also examined specific types of CCVDs. Multivitamin use was associated with a reduced risk for conotruncal defects in 2 population-based case-control studies (54% and 30%, respectively).[10,11] The Hungarian trial also provides suggestive data (no case of conotruncal defects in the supplemented group, 2 cases in the nonsupplemented), but the trial was too small to provide definitive results. A third study showed possible risk reduction for 1 but not all types of conotruncal heart defects.[6] A fourth, a hospital-based case-control study,[12] showed no evidence of reduction.

For ventricular septal defects (VSDs), 2 studies, a population-based case-control study and the Hungarian randomized trial, were consistent with a reduction in risk (40% and 85% reduction, respectively).[9,10] The hospital-based case-control study again found no risk reduction.[12]

In addition to these studies directly testing the association between multivitamin use and risk for heart defects, other studies among high-risk groups present ancillary evidence supporting a protective effect of folic acid–containing multivitamin supplements. For example, 2 studies have shown that women who used medications that are folic acid antagonists had an increased risk of having babies with heart defects but that this risk was reduced for women who also took multivitamin supplements containing folic acid.[13,14]

In a third study,[15] an increased risk for heart defects associated with maternal febrile illness (see below) appeared to be reduced among women using multivitamin supplements around the time of conception and during early pregnancy. Similar findings have been reported for other birth defects.[16]

The findings of a possible protective effect for CCVDs from folic acid–containing multivitamin supplements are encouraging but inconclusive given the limited number of studies and mixed results. Additional studies are warranted to determine whether the association of specific phenotypes with multivitamins can be corroborated in large population-based studies in which multivitamin intake can be validated, potential confounders such as maternal age and diabetes can be taken into account, and the components of the multivitamin supplements responsible for the association can be identified.

Maternal Illnesses and Conditions

Phenylketonuria

Untreated maternal phenylketonuria is associated with a >6-fold-increased risk of heart defects.[17–20] The most frequent defects are tetralogy of Fallot, VSDs, patent ductus arteriosus (PDA), and single ventricle. Fortunately, with strict diet control before conception and during pregnancy, this excess risk can be reduced.[18–22]

Maternal Diabetes

CCVDs have been associated with maternal pregestational and, less consistently, with gestational diabetes.[6,23–34] The associations with gestational diabetes are hypothesized to be due to inclusion of a group of women with previously undetected type 2 diabetes among women classified as having gestational diabetes.[27–29] Specific types of cardiovascular malformations associated with maternal pregestational diabetes include laterality and looping defects,[6] transposition of the great vessels,[6,33] nonchromosomal atrioventricular septal defects,[6] VSDs,[6,33,35] hypoplastic left heart syndrome,[6] conotruncal defects,[36] outflow tract defects,[33,35] cardiomyopathy,[6] and PDA.[33] Diabetes appears to induce malformation before the seventh week of gestation.[37]

Studies have shown a clear link between glycemic control during organogenesis and fetal malformations.[38,39] Although strict glycemic control before conception and during pregnancy has been shown to reduce risk levels comparable to those of the general population,[40] achieving and maintaining euglycemia early in pregnancy remains a challenge because many women with diabetes neither plan their pregnancies nor achieve adequate glycemic control before conception.[39,41] Given the increasing prevalence of risk factors for diabetes,[42–44] it is important to gain a better understanding of the current impact of both preexisting and gestational diabetes on CCVDs.

Although congenital anomalies associated with maternal diabetes are presumed to be related to abnormalities in maternal metabolic fuels essential for embryogenesis,[45] precise pathogenic mechanisms remain unclear. One hypothesis is that abnormal glucose levels characteristic of diabetes mellitus disrupt expression of a regulatory gene in the embryo, leading to embryotoxic apoptotic cellular changes.[46] The prevention of diabetic embryopathy by antioxidants in animal studies suggests that oxidative stress resulting from metabolic abnormalities and generation of free radicals is another possible mechanism.[47–52] The increasing prevalence of type 2 diabetes among women of childbearing age in recent decades[42–44,53,54] makes identifying and implementing effective prevention strategies a high priority.

Rubella, Febrile Illnesses, and Influenza

The potential association between maternal infections and birth defects was first suggested by the observation of the relation between maternal rubella infection early in gestation and the congenital rubella syndrome in offspring.[55–57] It is now well known that maternal rubella infection during pregnancy can result in offspring with PDA, pulmonary valve abnormalities, peripheral pulmonary stenosis, and VSDs[58–60] and that the risk of rubella embryopathy can be virtually eliminated by ensuring that women of childbearing age are immunized against rubella.[61] More recent studies suggest that other maternal febrile illnesses during the first trimester of pregnancy also may be associated with an increased risk for certain heart defects.[6,15,62,63] Mothers reporting any febrile illnesses during the first trimester of pregnancy have a 2-fold-higher risk of offspring with any heart defect in these

TABLE 2. Exposures Associated With Definite or Possible Risk of Offspring With CCVD*

	Defect	RR	Reference(s)
Maternal illness			
PKU	Any defects	>6	17–20
Pregestational diabetes	Any defects	3.1–18	6, 23, 33, 34
	Conotruncal defects	5.55	36
	Laterality and looping	8.3	6
	d-TGA	3.8–27.2	6, 33
	AVSD	10.6	6
	Septal defects	2.9–20.2	6, 33, 35
	HLHS	3.9	6
	Outflow tract defects	3.7–17.9	33, 35
	PDA (BTW >2500 g only)	56.9	33
Febrile illness	Any defects	1.8–2.9	6, 16, 62, 63
	Conotruncal defects	1.55	36
	Any right-sided obstructive defects	2.2–2.9	6, 15
	Tricuspid atresia	5.1–5.2	6, 15
	All left-sided obstructive defects	2.7	15
	Aortic coarctation	2.7	15
	VSD	1.8	15
Influenza	Any defects	2.1	10, 63
	Conotruncal defects	1.74	36
	d-TGA	2.1	10
	All right-sided obstructive defects	2.5	10
	All left-sided obstructive defects	2.9	10
	Aortic coarctation	3.8	10
	VSD	2.0	10
	d-TGA with intact ventricular septum	2.2	6
	Tricuspid atresia	4.3	6
Maternal rubella	Any defects	†	55–57
	VSD	†	58, 59, 196
	PDA	†	58, 59, 196
	Pulmonary valve abnormalities	†	58, 59, 196
	Peripheral pulmonic stenosis	†	58, 59, 196
Epilepsy	Any defects	†	82
Maternal nontherapeutic drug exposure			
Maternal vitamin A	Outflow tract defects	0.0–9.2	169, 170
	Cranial neural crest defects (cardiac and noncardiac)	0.7–4.8	168, 171, 172
	Pulmonic stenosis and other noncardiac defects	0.5	173
Maternal therapeutic drug exposure			
Anticonvulsants	Any defects	4.2	105–107
Indomethacin tocolysis	PDA	†	123, 124
NSAIDs			
Ibuprofen	Any defects	1.86	122
	d-TGA	2.5	4
	AVSD (Down syndrome)	2.4	4
	VSD	1.9	4
	Bicuspid aortic valve	4.1	4
Sulfasalazine‡	Any defects	3.4	13
Thalidomide	Any defects	†	84
Trimethoprim-sulfonamide‡	Any defects	2.1–4.8	13, 14

TABLE 2. Continued

	Defect	RR	Reference(s)
Vitamin A congeners/retinoids	Any defects	†	85, 86
Maternal nontherapeutic drug exposure			
Marijuana	VSD	1.9	160
	Ebstein's	2.4	6
Environmental (maternal)			
Organic solvents	Conotruncal defects	2.3–3.9	150, 175
	HLHS	3.4	6
	Aortic coarctation	3.2	6, 176
	Pulmonic stenosis	5.0	6
	d-TGA with intact ventricular septum	3.4	6
	Tetralogy of Fallot	2.7	6
	TAPVR	2.0	6, 214
	AVSD, nonchromosomal	5.6	6
	Ebstein's anomaly	3.6	6, 215
	VSD		119

PKU indicates phenylketonuria; d-TGA, dextro-looped transposition of the great arteries; AVSD, atrioventricular septal defect; HLHS, hypoplastic left heart syndrome; PDA, patent ductus arteriosus; BTW, birth weight; NSAIDs, nonsteroidal antiinflammatory drugs; and TAPVR, total anomalous pulmonary venous return.

*Consider fetal echocardiogram or neonatal echocardiogram if any of these exposures are present based on the level and type of exposure and the timing of the exposure in gestation.

†OR not available.

‡Risk reduced if mother took folic acid simultaneously.

§If both parents smoked.

studies.[6,15] Specific groups of defects that have been shown to be associated with maternal febrile illness include pulmonic stenosis,[6] all right-sided obstructive defects,[15] tricuspid atresia,[6,15] coarctation of the aorta,[15] all left-sided obstructive defects,[15] conotruncal defects, and VSDs.[15] A case-control study in California found an association of maternal fever with conotruncal defects among offspring born to mothers who did not use multivitamins.[64] In some of these studies, the febrile illness often was characterized as flu-associated fever or influenza; thus flu-associated fever also was a risk factor for any cardiac defect and for some specific malformations.[10,63] The mechanism by which maternal febrile illnesses may result in malformations is unclear. One possibility is altered apoptosis. Apoptosis is known to be involved in cardiac morphogenesis, for example, in the development of the cardiac outflow tract,[65] and can be altered by both fever and infection.[66–69] Another possibility is a direct effect of the underlying infection, as with maternal rubella infection. Most studies to date have been unable to distinguish between independent and joint effects associated with maternal fever, maternal infection, and use of certain medications to control the fever or infection.

Obesity

A number of studies have examined the association between maternal prepregnancy obesity and CCVDs, although findings have been inconsistent. A study by Waller et al[70] reported an association between maternal obesity, defined as a body mass index of >26 kg/m^2, and a grouped category of defects of the great vessels. Two additional studies found no statistically significant increased risks for any heart defect[6,71] or conotruncal heart defects in relation to maternal obesity.[72] A recent study reported a 6.5-fold risk elevation for aggregate cardiac defects among obese black women,[73] and Watkins et al[71] reported a 2-fold increase in risk of aggregate cardiac defects in relation to maternal obesity. Obesity is a complex condition that has to be studied carefully to minimize underreporting of body weight, especially in case-control studies, and the possibility of confounding by other factors associated with nutrition, such as the intake of micronutrients or use of multivitamin supplements, or with obesity, such as type 2 diabetes.

HIV Infection

Maternal infection with HIV can transmit the infection vertically to offspring. Children infected with HIV-1 in utero have an increased risk of dilated cardiomyopathy and inappropriate left ventricular hypertrophy.[74–76] Such children also are more likely to have low left ventricular fractional shortening.[76] Maternal HIV has not been associated with an increased risk of structural congenital cardiovascular malformations thus far.

Systemic Lupus Erythematosus

Although a high proportion of infants with congenital complete heart block are born to women with systemic lupus erythematosus,[77–79] no published reports show an association between maternal connective tissue disease and an increased risk of structural congenital cardiovascular malformations.

Epilepsy

Offspring of women with epilepsy are at an increased risk for congenital malformations,[80,81] including congenital heart de-

TABLE 3. Exposures With Reported Risk for Specific CCVDs

Lesion	Exposures That May Increase Risk
All left-sided obstructive defects	Febrile illness
	Influenza
All right-sided obstructive defects	Febrile illness
	Influenza
	Organic solvents
Aortic coarctation	Febrile illness
	Influenza
	Organic solvents
	Pregestational diabetes
AVSD	Pregestational diabetes
AVSD (Down syndrome)	Ibuprofen
AVSD (nonchromosomal)	Organic solvents
Bicuspid aortic valve	Ibuprofen
	Vitamin A cogeners/retinoids
Conotruncal defects	Organic solvents
Cranial neural crest defects (cardiac and noncardiac)	Maternal vitamin A
d-TGA	Pregestational diabetes
	Influenza
	Ibuprofen
d-TGA with intact ventricular septum	Influenza
	Organic solvents
Ebstein's anomaly	Organic solvents
	Marijuana
HLHS	Organic solvents
	Pregestational diabetes
Laterality and looping	Pregestational diabetes
Membranous VSD	Vitamin A cogeners/retinoids
Outflow tract defects	Pregestational diabetes
	Maternal vitamin A
PDA (BTW >2500 g only)	Pregestational diabetes
	Maternal rubella
	Indomethacin tocolysis
Peripheral pulmonic stenosis	Maternal rubella
Pulmonic stenosis	Organic solvents
	Maternal vitamin A
Pulmonary valve abnormalities	Maternal rubella
Septal defects	Pregestational diabetes
	Febrile illness
	Influenza
	Marijuana
	Organic solvents
	Ibuprofen
	Rubella
TAPVR	Organic solvents
Tetralogy of Fallot	Organic solvents
Transposition of the great arteries	Pregestational diabetes
	Influenza
	Organic solvents
Tricuspid atresia	Febrile illness
	Influenza
VSD	Febrile illness
	Influenza
	Maternal rubella
	Marijuana
	Ibuprofen
	Organic solvents

Abbreviations and references as in Table 2.

fects.[82] Because several therapy-related factors could account for this increased risk, including direct teratogenic effects of anticonvulsant drug therapy and an indirect effect of the drugs by interfering with folate metabolism, it has been difficult to determine whether maternal seizures are independently associated with an increased risk of heart defects.

Maternal Therapeutic Drug Exposure

The US Food and Drug Administration (FDA) has classified a number of medications according to risk for birth defects if ingested during pregnancy. Although this classification relates to birth defects in general and not specifically to congenital cardiac defects, when available, the FDA description of risk as defined in Table 6 is included in each of the therapeutic drug discussions that follow.[83]

Thalidomide

Thalidomide is known to be a cardiac teratogen and therefore contraindicated during pregnancy and among women planning a pregnancy. Thalidomide embryopathy includes cardiovascular malformations ranging from ventricular and atrial septal defects (ASDs) to complex conotruncal defects.[84] No safe dose of thalidomide treatment during the critical period of gestation has been established, and cases of thalidomide embryopathy have been described after maternal ingestion of as little as one 50-mg capsule during this time (FDA category X).

Vitamin A Cogeners/Retinoids

Maternal intake of isotretinoin has been shown to cause congenital cardiac defects in addition to other malformations. Characteristic features of isotretinoin embryopathy include central nervous system malformations, micrognathia, cleft palate, thymic and eye anomalies, and cardiac and great vessel defects. The frequency of congenital anomalies does not appear to be increased among children of women who discontinue therapy before conception.[85] These medications are contraindicated during pregnancy and among women planning a pregnancy (FDA category X).

Etretinate persists in the body for an extremely long time after administration, and the length of time that teratogenic effects may occur is currently not known. In case reports, congenital abnormalities possibly related to prior etretinate therapy have been seen as long as 45 months after therapy was stopped.[86] No large studies examining the association of acitretin have been performed. Because acitretin can be

TABLE 4. Reported Exposures With No Evidence of an Association With Risk for CCVDs

Maternal Illnesses/Conditions	Reference(s)
HIV	74–76
Maternal therapeutic drug exposure	
Ampicillin	87–90
Corticosteroids	120, 121
Diazepam	87–89, 91, 118, 119
Oral contraceptives	138
Penicillin	91–95
Vaginal metronidazole	96–98
Maternal nontherapeutic drug exposure	
Caffeine	6, 91, 147–150

converted to etretinate in the body, the length of time that acitretin may cause teratogenic effects may be longer than its half-life (50 to 60 hours).

Topical therapy with tretinoin in usual doses during pregnancy is unlikely to pose a substantial teratogenic risk, but data are insufficient to state that there is no risk.

Antibiotics

Rothman et al[87] observed an association with maternal ampicillin (FDA category B) treatment ñabout the time pregnancy beganò in a case-control study of 390 infants with congenital heart disease, specifically transposition of the great arteries. Their follow-up study of similar design did not confirm these findings.[88] Additionally, a separate case-control study failed to show an association between ampicillin use and congenital heart disease.[89] Finally, in a large population-based (Hungarian) case-control study of maternal ampicillin use in the second or third month of pregnancy, no association was found among 4468 cases with cardiovascular malformations.[90]

Multiple large studies have shown no association between the use of penicillin (FDA category B) and an increased risk of congenital anomalies in general.[91ï94] One Danish population-based record linkage study that examined the frequency of congenital heart defects in mothers given penicillin during the first trimester showed it to be no higher than expected.[95]

The epidemiological data regarding maternal vaginal metronidazole (FDA category B) use early in pregnancy were summarized in 2 meta-analyses.[96,97] In both instances, the risk of congenital anomalies in offspring was not increased. One of the studies included in these analyses specifically examined a large group (984) of infants with cardiovascular defects.[98] In the BWIS, maternal use of metronidazole during pregnancy was found to be associated with an increased risk of outflow tract anomalies with normally related great arteries (OR, 6.0; 95% CI, 1.8 to 20.7) and an increased risk of membranous VSDs (OR, 12.2; 95% CI, 3.0 to 50.2).[6]

An association was found with maternal trimethoprim-sulfonamide (FDA category C) treatment during the second or third month of gestation in a case-control study among 3870 infants with cardiovascular defects (OR, 4.8; 95% CI, 1.5 to 16.1).[13] Similar findings were reported from the Hungarian case-control surveillance of congenital abnormalities (OR, 2.1; 95% CI, 1.4 to 3.3).[14] The risks were reduced if the mother also took folic acid supplementation.

Antiviral/Antiretroviral Agents

An association was observed between major congenital anomalies, including congenital cardiovascular malformations, and a maternal prescription for zidovudine (FDA category C) during pregnancy in a Medicaid record linkage study.[99] When the exposures were broken down by trimester of pregnancy, the significant association was seen among women who received the prescription in the third trimester, not in the first or second, a finding inconsistent with a teratogenic mechanism. The Antiretroviral Pregnancy Registry has been established and to date has not shown an increase in congenital defects in women receiving therapy in the second or third trimester.

Antifungal Therapies

In a UK cohort study and a Danish record linkage study, the frequency of congenital anomalies was not increased in infants of women who received prescriptions for a single oral dose of fluconazole (FDA category C) in the first trimester of pregnancy.[100,101] Similarly, in a prospective study, the frequency of congenital anomalies was not increased in women receiving fluconazole with median doses of 200 mg. It should be noted that 4 children have been described with a similar and unusual pattern of congenital anomalies (including congenital heart disease) in offspring whose mothers were treated during most or all of the first trimester with a high dose (400 to 800 mg/d) of fluconazole for coccidioidomycosis meningitis.[102ï104] These observations suggest the need for further study of fluconazole treatment with consideration of possible threshold effects.

Anticonvulsants

Although many large epidemiological studies of the offspring of epileptic women have been published, currently available data are incapable of resolving the controversy as to whether the malformations are due to the epilepsy or the anticonvulsant therapy. Additionally, the studies examining congenital malformations in infants of women who took anticonvulsant therapies are difficult to interpret because accurate assessment of the effects of the anticonvulsant treatment may be confounded by multiple other factors.[105ï107] Specifically, many women with seizures are treated with multiple therapies either serially or simultaneously, and most women with seizures are treated with an anticonvulsant drug (leaving no control group). There are characteristic anomalies associated with some of the anticonvulsants (eg, fetal hydantoin syndrome), which may involve cardiac abnormalities (phenytoin, FDA category D; valproic acid, FDA category D).

Lithium

An association has been observed between maternal treatment with lithium carbonate during pregnancy and the occurrence of Ebsteinôs anomaly.[108ï113] In a voluntary reporting registry, serious congenital cardiovascular anomalies were observed in 8% of 225 infants born to mothers who had taken lithium during the first trimester of pregnancy.[114] One third of these infants had Ebsteinôs anomaly. Contradicting these

TABLE 5. Exposures Studied but Insufficient Data to Determine Risk for CCVDs

Exposure	Reference(s)
Maternal illnesses/conditions	
Gestational diabetes	6, 23–34
Obesity	6, 44, 70–73, 118
Systemic lupus erythematosus	77–79
Nausea	146
Life event stress	36, 197
Maternal therapeutic drug exposure	
Angiotensin-converting enzyme inhibitors	144
Amobarbital	6
Antihistamines	6
Antihypertensives	6
Aspirin	216
Barbiturates (except amobarbital)	6
Bendectin	88, 145
Clomiphene	5, 36
Dactinomycin	143
Deoxyrubicin	143
Fluconazole	100–104
Ibuprofen	6
Lithium	108–117
Metronidazole	6
Oral contraceptives	6
Narcotics	6
Parasympatholytics	6
Phenothiazines	6
Phenylephrine	87, 88, 91
Topical tretinoin	85, 86
Xanthenes	6
Ziduvudin	99
Maternal nontherapeutic drug exposure	
Alcohol	6, 36, 119, 151–154
Cigarette smoking	6, 64, 217
Cocaine	6, 155–159
Maternal environmental factors	
Air quality	178, 179
Herbicides/pesticides/rodenticides	175, 177, 214, 218
Proximity to hazardous waste site	187–189
Trichloroethylene in groundwater	180
Water chlorination byproducts	182–186
Maternal sociodemographic characteristics	
Age	6, 191
Race/ethnicity	36, 192–196, 211
Socioeconomic status	192
Paternal factors/exposure	
Age	198, 202–204
Cigarette smoking	6, 217
Cocaine	6, 204
Alcohol exposure (father)	
Frequency	6
Greatest number of drinks on any occasion	6
Housing characteristics	
Type of home (individual, townhouse, apartment)	6
Gas heating	6
Electric heating	6
Oil heater	6
Gas stove	6
Electric stove	6
Cooking with kerosene, coal, or wood	6
Medical exposures	
Maternal dental x-rays	6
Maternal chest x-rays	6
Maternal skeletal x-rays	6
Maternal abdominal x-rays	6
Paternal dental x-rays	6
Paternal chest x-rays	6
Paternal skeletal x-rays	6
Paternal abdominal x-rays	6
Maternal home and occupational exposures	
Anesthetic gas (occupational)	6
Arsenic	6
Art dyes	6
Arts and crafts painting	6
Cadmium	6
Carpentry	6
Cold, extreme (occupational)	6
Drug manufacturing	6
Dry-cleaning solvents	6
Heavy metals	6
Home tap water	181
Housekeeping cleaners	175
Jewelry making	6
Laboratory chemicals	6
Laboratory viruses	6
Lead score	6
Mercury	6
Pesticides, insecticides, rodenticides	175, 177
Plastics manufacturing	175
Propellants	6
Pyrolysis/combustion products	175
Stained glass crafts	6
Textile dyes	6
Welding	6
Paternal home and occupational exposures	
Anesthetic gas (occupational)	6
Arsenic	6
Art dyes	6
Arts and crafts painting	6
Auto body repair work	6

TABLE 5. Continued

Exposure	Reference(s)
Cadmium	6
Carpentry	6
Drug manufacturing	6
Dry-cleaning solvents	6
Extreme cold (occupational)	6
Hair dyes	6
Hypothermia	6
Ionizing radiation	6
Laboratory chemicals	6
Lead score	6
Marijuana	6
Mercury	6
Pesticides	6
Plastics manufacturing	6
Solvents	6
Stained glass crafts	6
Textile dyes	6
Varnishes	6

reports, no association was seen in a case-control study of 10 698 children with congenital anomalies, but the number of exposures in the case and control groups was small.[115] More recent retrospective, prospective, and meta-analysis studies suggest that lithium appears not to be a cardiac teratogen (FDA category D).[116,117]

Benzodiazepines/Barbiturates (Sedatives/Hypnotics)/Tranquilizers

An association with the maternal use of diazepam (FDA category D) or related drugs during the first trimester of pregnancy was observed in 2 case-control studies of almost 400 children each.[87,118] Bracken[89] reanalyzed these data and failed to find a significant association, and Zierler and Rothman[88] found no association in a follow up-study. No association with maternal use of diazepam during the first trimester of pregnancy was seen in case-control studies of 150 children with VSDs.[91,119]

The frequencies of congenital anomalies were not significantly increased among infants of women occasionally treated with amobarbital (FDA category D) as a hypnotic. However, the frequency of cardiac malformations was increased (RR, 2.6; 95% CI, 1.0 to 5.2).[91] The risk for chronic or high-dose maternal use is unknown.

Sympathomimetics

A case-control study by Rothman et al[87] observed a slightly higher rate of exposure to phenylephrine (FDA category C) early in pregnancy in mothers of infants with congenital heart disease than in controls. This observation was not confirmed in a later and more rigorous study by the same authors.[88] No association was seen between the first-trimester use of phenylephrine and congenital heart disease in a large cohort study.[91]

Corticosteroids

A possible association between maternal corticosteroid use and congenital cardiac malformations was identified in the BWIS by univariate analysis (OR, 1.71; 95% CI, 1.01 to 2.88). This finding was no longer significant after other variables were taken into account.[120] Using data derived from a population based case-control study that included 207 cases of conotruncal heart defects, Carmichael and Shaw[121] showed no association between maternal corticosteroid use and congenital cardiovascular malformations.

Folate Antagonists

Associations with maternal treatment with sulfasalazine (FDA category B) or another dihydrofolate reductase inhibitor during the second or third month of pregnancy were observed in a case-control study of 3870 infants with cardiovascular defects (OR, 3.4; 95% CI, 1.1 to 6.1). These associations were not seen among the subset of mothers who took supplemental folic acid. As mentioned, maternal use of trimethoprim-sulfonamide also has resulted in congenital heart defects in offspring,[13,14] with risk reduction if mothers also took folic acid supplementation (see the Antibiotics section).

Nonsteroidal Antiinflammatory Drugs

Ericson and Kallen[122] examined use of nonsteroidal antiinflammatory drugs in early pregnancy in a large registry study (n=2557) and found that the adjusted OR for any congenital malformation was 1.04 (95% CI, 0.84 to 1.29), but for cardiac defects, the OR was 1.86 (95% CI, 1.32 to 2.62). There was no drug specificity for cardiac defects.

Associations with maternal use of ibuprofen (FDA category B) during pregnancy have been reported in evaluations of infants with dextro-looped transposition of the great arteries (OR, 2.5; 95% CI, 1.2 to 4.9), membranous VSDs (OR, 1.9; 95% CI, 1.0 to 3.5), atrioventricular septal defects, Down syndrome (OR, 2.4; 95% CI, 1.1 to 4.2), and bicuspid aortic valve (OR, 4.1; 95% CI, 1.8 to 9.3).[4] No association

TABLE 6. FDA Categories of Risk for Birth Defects

Category	Description of Risk
A	No fetal risk shown in controlled human studies.
B	No human data available. Animal studies show no fetal risk or animal studies show a risk but not a fetal risk.
C	No controlled studies on fetal risk available for human beings or animals, or fetal risk shown in controlled animal studies but no human data available (benefit of drug use must clearly justify potential fetal risk in this category).
D	Studies show fetal risk in human beings (use of drug may be acceptable even with risks, such as in life-threatening illnesses or where safer drugs are ineffective).
X	Risk to fetus clearly outweighs any benefit from these drugs.

was seen in infants with atrioventricular septal defect without Down syndrome.

Two studies by Souter et al[123] and Hammerman et al[124] document the association between indomethacin tocolysis and persistent PDA. The magnitude of these effects appears to be greatest when indomethacin is administered within 48 hours of delivery. Additionally, there have been case reports of persistent pulmonary hypertension and premature closure of the ductus arteriosus in infants whose mothers took other forms of nonsteroidal antiinflammatory drugs, including naproxen,[125,126] diclofenac,[127,128] ketoprofen,[129,130] indomethacin,[131ï 134] and sulindac.[133,135,136]

Female Hormones

A potential risk for congenital cardiac defects in offspring from maternal use of oral contraceptives was identified in 2 case-control studies.[137,138] Wiseman and Dodds-Smith[139] evaluated the case histories included in Heinonen et al[138] study and found that only half were exposed during the critical period of cardiogenesis. Oral contraceptive use was no longer significantly associated with congenital heart disease in an analysis restricted to early exposure. Ferencz et al[140] studied mothers of 110 children with heart disease and found no association with maternal hormone therapy. Additionally, a recent meta-analysis failed to document any associations between oral contraceptive use and CCVD[141]; in general, the data are now thought to support their safety.

An association with maternal use of clomiphene was observed in a case-control study of 126 children with coarctation of the aorta (OR, 4.5; 99% CI, 1.0 to 19.9).[6] No association with maternal use of clomiphene was seen in a case-control study involving 83 infants with conotruncal cardiac defects.[36] In the BWIS, maternal use of clomiphene was found to be associated with an increased risk of tetralogy of Fallot (OR, 3.2; 95% CI, 1.6 to 6.3).[6]

Narcotics

Two case-control studies,[87,88] each involving 300 to 400 children with congenital heart disease, reported an association with maternal codeine (FDA category C) use during the first trimester of pregnancy, but methodological limitations raise doubt as to their validity. No association was observed in 2 other studies.[142]

Chemotherapy

There have been no published studies examining the effect of chemotherapy treatment during pregnancy. The literature has been limited to studies of patients who have been treated with chemotherapeutic agents before becoming pregnant. A large case-control study investigating congenital anomalies in children of patients who received chemotherapy for cancer in childhood and adolescence identified structural congenital cardiac defects in 10.0% (2 of 20) of the offspring of women who had been treated in the past with dactinomycin compared with 0.6% (24 of 144) among the children in a multicenter survey of fetal anomalies ($P=0.01$).[143] Of note, studies examining the use of doxorubicin showed no fetal effects in human or animal experiments[143] (antineoplastics, FDA category D).

Angiotensin-Converting Enzyme Inhibitors

A recent cohort of 29 507 infants from a large database of Tennessee Medicaid patients was linked with vital records and hospitalization claims during the first year of life to study the risk of congenital malformations after maternal exposure to angiotensin-converting enzyme used to treat maternal hypertension.[144] This study identified a prevalence of use of angiotensin-converting enzyme inhibitors in the first trimester of 0.7% and a higher risk of major congenital malformations, including malformations of the heart (OR, 3.72; 95% CI, 1.89 to 7.30), in offspring of mothers exposed to angiotensin-converting enzyme inhibitors in the first trimester of pregnancy. The prevalence of major malformations identified in the reference group (2.6%) was lower than expected in the general population (3.0% to 3.5%), raising questions about possible differences in ascertainment and classification of major malformations by exposure group. There is a need for further studies of this issue using standard methods of case ascertainment and classification and accounting for potential risk factors.

Composite Drugs

Bendectin, a combination of doxylamine and pyridoxine, is no longer available in the United States. Extensive studies provide no evidence that maternal use alters the risk of congenital anomalies in offspring. Specifically, case-control studies provide no consistent indication that maternal use of Bendectin during the first trimester of pregnancy increases the risk of congenital heart disease.[36,80,145,146]

Maternal Nontherapeutic Drug Exposure

Caffeine

Caffeine is known to cross the placenta, and concern that caffeine may cause birth defects prompted the FDA to caution pregnant women to limit their caffeine intake. As illustrated below, there is no clear association between caffeine ingestion during human pregnancy and congenital heart disease.

A case-control study of 2030 malformed infants, including 277 with cardiac defects, evaluated risk associated with caffeine ingestion, including consumption of tea, coffee, and cola. No risk was identified for consumption of any of the 3 beverage types. Risk also was assessed in relation to amount of total daily caffeine ingestion in the categories of any ingestion per day, >200 mg/d, and >400 mg/d. Again, no risk was identified in doses equivalent to 4 cups of coffee per day. Too few mothers consumed as much as 1000 mg/d caffeine to assess the risk of very high consumption.[147]

In a population-based cohort study of 850 mothers who drank ≥8 cups of coffee per day, the frequency of all congenital malformations, including heart disease, was not increased from expected.[148] In another well-controlled cohort study, 595 women who drank ≥4 cups of coffee daily also did not produce offspring with congenital anomalies any more frequently than expected.[149] In addition, in a study of 12 696 women who took caffeine-containing medications in the first 4 months of pregnancy, the frequency of congenital anomalies, including heart disease, was no greater than expected.[91] Caffeine also was evaluated as a potential risk

factor in the BWIS.[6] Again, no association was observed between cardiac defects and caffeine consumption or caffeine dose. Other studies also have failed to identify an association.[150]

Alcohol

Ever since the first description of the fetal alcohol syndrome by Jones and Smith in 1973, several studies have documented a wide range of teratogenic effects of alcohol consumption during pregnancy, including cardiac defects.[151] It has been suggested that ethanol may produce fetal tissue edema and affect the turgor of the primitive cardiac loop. Studies of this topic are especially difficult because of the notorious problem of obtaining reliable estimates of alcohol consumption during pregnancy in addition to other forms of recall bias. In a prospective study that collected information on maternal alcohol consumption during the first trimester of pregnancy, investigators noted no increased risk of major malformations among offspring of women who consumed 1 to 2 drinks per day compared with offspring of nondrinkers.[152] In a case-control study of 90 patients with conotruncal abnormalities and 150 with VSDs born in Finland between 1982 and 1983, the effect of maternal alcohol use was compared with 756 controls.[119] Although more mothers of infants with conotruncal malformations consumed any alcohol, consumed alcohol regularly every week, and consumed >1 drink per occasion, these results did not reach statistical significance. Maternal alcohol consumption during the first trimester of pregnancy was more common among the mothers of infants with VSDs (47%) than among those of controls (38%; $P<0.05$).[119] A case-control study of conotruncal defects in Atlanta showed no association with maternal reports of alcohol consumption (OR, 0.72; 95% CI, 0.49 to 1.06) or ñbingeò drinking (OR, 0.44; 95% CI, 0.13 to 1.46).[36] A more recent case-control study that examined the risk of congenital anomalies with different sporadic and daily doses of alcohol consumption in Spain reported an increased risk of congenital heart defects as a group only with the highest level of maternal consumption of alcohol per day (ie, >92 g/d).[153]

In the BWIS, the only association between alcohol and cardiovascular malformations was limited to increased risk for small muscular VSDs with heavy consumption (5 drinks on a single occasion) during the period defined by the last menstrual period ±3 months. There was no evidence of a trend in the risk of any cardiac defect with increased exposure.[6] A similar study from Finland also reported that maternal alcohol consumption during the first trimester appeared to double the risk of ASDs (OR 1.9; 95% CI, 1.0 to 3.4) but that the dose-response trends in risk were inconsistent with causal association.[154]

Cocaine and Marijuana

A case report by Shepard et al[155] suggested that single ventricle may result from maternal cocaine ingestion by inducing coronary occlusion in the developing fetal heart. Martin and Khoury[156] used data from a case-control study, the Atlanta Birth Defects Case-Control Study, to investigate the role of maternal cocaine ingestion in the induction of single ventricles. None of the 27 case infants were reportedly exposed to cocaine during early pregnancy, and only 7 of the control infants (0.43%) were exposed during early pregnancy. These data suggest that in this population the use of cocaine was rare or underreported.

An increased frequency of cardiovascular malformations was observed among 214 infants with neonatal toxicology screens showing the prevalence of cocaine in 1 study, with peripheral pulmonic stenosis as the leading diagnosis and in far greater numbers than in the general population.[157] A meta-analysis of 6 other epidemiological studies revealed no significant association between maternal cocaine use in pregnancy and fetal cardiovascular malformations.[158] Subsequent case-control studies have reported an association of maternal reports of cocaine use with an increased risk of any cardiac defects (adjusted OR, 11.6; 95% CI, 0.89 to 151.5),[159] heterotaxy (OR, 3.7; 95% CI, 1.3 to 10.7),[160] and membranous VSDs (adjusted OR, 2.4; 95% CI, 1.3 to 4.4).[6] The imprecise results in 2 of these studies are due to small numbers of cases with maternal reports and could reflect rare exposures, underreporting, or sampling variability.

In the Atlanta Birth Defects Case-Control Study, a 2-fold increase in risk of isolated simple VSDs was identified for maternal self- and paternal proxy-reported marijuana use. Risk of isolated simple VSDs increased with regular (≥3 d/wk) marijuana use for both maternal self- and paternal proxy report, although the association was significant only for maternal self-report.[161] Maternal use of marijuana was evaluated in the BWIS and was found to be associated with a slight increase in risk for Ebsteinôs anomaly.[6] Adams et al[36] used a case-control design with sufficient power to identify a 2-fold increase in risk for conotruncal defects and did not find an association (FDA category C).

Cigarette Smoking

A number of studies have investigated maternal cigarette smoking and congenital heart disease. A meta-analysis of studies published between 1971 and 1999 (12 analyses of all heart defects combined and 7 analyses of heart defect groups or specific phenotypes separately) found no association for all heart defects combined (OR, 1.07; 95% CI, 0.98 to 1.17) and mixed results for analyses of specific groups or phenotypes.[162] The latter probably reflects differences in methods, including case ascertainment, classification, control of confounding, and case group sample size, between the different studies. Some recent studies have reported associations of maternal smoking with heart defects combined (OR, 2.1; 95% CI, 1.2 to 3.5 in the Torf and Christianson[163] study; OR, 1.56; 95% CI, 1.12 to 1.82 in the Woods and Raju[164] study), but others such as the BWIS[6] and a Swedish study[165] have not. Some studies have reported associations between maternal smoking and heart defect groups, including ASDs (OR, 2.2; 95% CI, 1.1 to 4.3), atrioventricular septal defects (OR, 2.3; 95% CI, 1.2 to 4.5), and tetralogy of Fallot (OR, 4.6; 95% CI, 1.2 to 17.0).[163] However, these associations were not corroborated by larger studies such as the BWIS[6] and a study conducted in Sweden.[162] Recent exploratory analyses of small case groups based on the BWIS data have identified associations of maternal smoking with single ventricle and L-transposition of the great arteries.[160,166] Further research is needed to determine whether there is a relationship between

maternal smoking and risk of heart defects based on large population-based studies using more standardized case ascertainment and classification methods.

Vitamin A

A number of studies have examined the association between high vitamin A in the diet and/or supplements and neural crest cell defects (ie, cardiac and noncardiac defects) or outflow tract defects. Some studies suggest that a high intake of vitamin A is associated with an increased risk of CCVDs,[167–169] whereas others suggest no increased risk.[170–173] One possible reason for the inconsistency of the findings may relate to the differences in methods of assessing high exposure to vitamin A intake. Worth noting are 2 studies reporting an increased risk of CCVDs with an intake of >10 000 IU retinol in the form of supplements[168,169] and animal studies reporting the occurrence of defects of the cardiac outflow tract and other neural crest–derived structures[174] (FDA category X at dosages >18 000 to 25 000 IU/d).

Maternal Environmental Exposures

Organic Solvents

Studies of this topic can be difficult because organic solvents often comprise a mixture of chemicals, because the composition varies between different commercial preparations, and because of limitations in the way that exposure was defined in retrospective case-control studies. A few have reported associations of cardiac defects with reported maternal exposure to solvents and paints. Reports of exposure to degreasing or other solvents have been associated with an increased risk of hypoplastic left heart syndrome, coarctation of the aorta, pulmonic stenosis, transposition of the great arteries with intact ventricular septum, tetralogy of Fallot, total anomalous pulmonary venous return, nonchromosomal atrioventricular septal defects, and Ebsteinôs anomaly.[6] Maternal reports of occupational exposure to organic solvents have been associated with an increased risk of VSDs[119,175]; dyes, lacquers, and paints with conotruncal malformations[150]; and mineral oil products with coarctation of the aorta.[176]

Herbicides, Pesticides, and Rodenticides

A study suggesting an association of maternal employment in the agricultural industry with an increased risk of conotruncal defects[36] suggested a possible association with chemicals used in agriculture. In the BWIS, maternal reports of potential exposure to herbicides and rodenticides were associated with an increased risk of transposition of the great arteries and of potential exposure to pesticides with total anomalous pulmonary venous return and membranous VSDs.[6] A case-control study of various potential sources and numerous measures of maternal exposure to pesticides and congenital anomalies found mixed results for conotruncal defects.[177] A more recent case-control study of various end-product uses reported an increased risk of conotruncal defects with maternal reports of exposure to insecticides.[175]

Air Quality

Two recent studies have examined possible associations of ambient air pollutants with CCVDs. One study conducted in southern California reported possible increased risks of any heart defects and of VSDs with increased ambient levels of carbon monoxide, of aortic artery and valve anomalies with increased levels of ambient air levels of ozone during the second month of pregnancy,[178] and possible decreased risks of these defects with increased air levels of these pollutants during the third month of pregnancy. Another study conducted in 7 Texas counties evaluating potential exposures during weeks 3 to 8 of pregnancy reported possible increased risks of tetralogy of Fallot with carbon monoxide, isolated ASDs with particulate matter $<10\ \mu$m in aerodynamic diameter, and isolated VSDs with similar dioxide, as well as a possible risk of isolated ASD with carbon monoxide and isolated VSD with ozone.[179] These findings underscore the need for further studies using standard heart defect classification systems to elucidate whether the associations are real or are due to chance or bias.

Groundwater Contamination

The risk of congenital cardiac defects was reported to be greater among children of parents who had contact with areas that had groundwater contaminated with trichloroethylene than among children of parents who had no such contact.[180] This study did not evaluate the relation between maternal water consumption and risk of cardiac defects. Another study that did evaluate maternal consumption of home tap water during the first trimester of pregnancy found an increased risk of cardiac anomalies.[181]

Water Chlorination Byproducts

A possible association between maternal exposure to chlorination byproducts that result from the interaction of residual chlorine and organic matter in tap water and cardiac defects in offspring has been the subject of several investigations.[182–186] These studies evaluated information on the type of chlorination treatment at the water plant or on levels of trihalomethanes measured at sampling points in the water distribution but not on actual levels of contaminants in water consumed or used for showering. These studies found no associations with cardiac defects.

Other Environmental Concerns

Evaluations of possible associations of heart defects with maternal exposure to ionizing radiation have been limited. The BWIS examined possible associations of heart defects with maternal reports of exposure to ionizing radiation in occupational settings or as part of medical or dental evaluations and found few reports of such exposures and no evidence of any associations.[6] Concerns have been raised about the risk of birth defects in communities situated near hazardous waste sites or other sources of environmental pollution. Large population-based studies have evaluated this issue with mixed results. One study found an increased risk of all heart defects as a group,[187] but the results were imprecise because of the small number of exposed cases (n=3). Two studies found no associations with cardiac defects.[188,189] Surveillance data from population-based congenital anomaly registers in 16 regions of Europe (mainly Western Europe) were analyzed to evaluate the impact of the Chernobyl accident on the prevalence of selected congenital anomalies.[190] Chernobyl had no detectable impact on the prevalence of congenital anomalies in Western Europe.

Maternal Sociodemographic Characteristics

Age

In the BWIS, maternal age was not associated with nongenetic CCVDs as a group.[6] Analysis by specific defects found that maternal age of ≥30 years was associated with an increased risk of transposition of the great arteries (OR, 1.7; 95% CI, 1.1 to 2.7) and Ebsteinôs anomaly (OR, 2.6; 95% CI, 1.4 to 4.8), that more advanced maternal age (>34 years) was associated with an increased risk of bicuspid aortic valve (OR, 2.5; 95% CI, 1.3 to 4.8) and ASDs (OR, 1.6; 95% CI, 1.0 to 2.5), and that young maternal age (<20 years) was associated with an increased risk of tricuspid atresia (OR, 2.8; 95% CI, 1.3 to 6.4).[6] An analysis of nonchromosomal birth defects of the Metropolitan Atlanta Congenital Defects Program from 1968 to 2000 found associations of advanced maternal age (35 to 40 years) with an increased risk of all heart defects (OR, 1.12; 95% CI, 1.03 to 1.22), tricuspid atresia (OR, 1.24; 95% CI, 1.02 to 1.50), and right ventricular outflow tract defects (OR, 1.28; 95% CI, 1.10 to 1.49).[191]

Race/Ethnicity

Racial/ethnic variations in risk of a specific CCVD have been noted by a number of reports. Compared with black infants, white infants have been found to have an increased prevalence of Ebsteinôs anomaly, aortic stenosis, atrioventricular septal defects, ASDs,[192] coarctation of the aorta,[36,192,193] truncus arteriosus, transposition of the great arteries, tetralogy of Fallot,[36,192] PDA,[192,194] pulmonary stenosis,[192,194] hypoplastic left heart syndrome,[194,195] and a decreased prevalence of pulmonary stenosis.[194] In a population-based study of variations in prevalence of birth defects in offspring of Hispanic and black women in California between 1987 and 1997, no variations in prevalence were noted compared with the prevalence in offspring of non-Hispanic white women.[196]

Reproductive History

A history of reproductive problems has been associated with an increased risk of tetralogy of Fallot (previous miscarriage: OR, 1.5; 95% CI, 1.0 to 2.2), nonchromosomal atrioventricular septal defects (previous stillbirth: OR, 5.61; 95% CI, 1.94 to 16.21), ASDs (previous preterm birth: OR, 2.1; 95% CI, 1.24 to 3.4), and Ebsteinôs anomaly (previous miscarriage: OR, 3.2; 95% CI, 1.7 to 5.9).[6] Whether a history of reproductive problems represents a proxy for teratogenic exposures (eg, diabetes) or for an inherent increased susceptibility for CCVDs is unclear.

Maternal Stress

Maternal stress as measured by maternal reports of job loss, divorce, separation, or death of a close relative or friend was found to be associated with an increased risk of conotruncal heart defects (OR, 2.4; 95% CI, 1.42 to 4.2) in a case-control study in Atlanta.[36] A more recent case-control study in California obtained a similar result (OR, 1.4; 95% CI, 1.0 to 2.1) with a stronger effect among offspring of mothers who had not completed high school (OR, 2.4; 95% CI, 1.3 to 4.8).[197]

Paternal Exposures

There is growing concern that paternal factors may play a role in the origin of congenital defects in general and of CCVDs in particular. New dominant mutations are more common in older fathers,[198] and paternal age has been shown to be associated with birth defects such as achondroplasia and Alpert syndrome[199] and in genetic conditions known to affect the cardiovascular system such as Marfan syndrome[200]; the average age of fathers of children with sporadic or new mutation forms of Marfan syndrome was greater (37 years versus 30) than the general population. Paternal factors also have been shown to be important in diseases thought to have a combined genetic and environmental origin such as diabetes mellitus; children of a type 1 diabetic father have a greater likelihood of developing type 1 diabetes mellitus[201] than children of a mother with diabetes. This section examines the evidence for various paternal factors.

Paternal Age

Several studies have focused on paternal age as a risk factor for congenital cardiac defects in offspring. Olshan et al[202] evaluated the effect of paternal age on the risk of congenital heart defects in 4110 cases of congenital heart defects from the British Columbia Health Surveillance registry; matched controls were obtained from the birth files of British Columbia. The association of paternal age with 8 cardiac defects was examined after controlling for maternal age and other risk factors. A general pattern of increasing risk with increasing paternal age was found for ASDs, VSDs, and PDA. Offspring of men <20 years of age were also at higher risk for VSDs (OR, 2.0; 95% CI, 1.1 to 3.6) and possibly ASDs (OR, 1.9; 95% CI, 0.9 to 4.3). A separate study by Lian et al,[198] using data from the Metropolitan Atlanta Congenital Defects Program, also found an increased risk for ASDs and VSDs with increasing paternal age after adjustment for maternal age and race. In contrast, a Chinese study found no relationship between advancing paternal age and congenital heart defects.[203] In fact, risk was higher for men <25 years of age compared with men ≥25 years of age at the time of the childôs birth (OR, 2.27; 95% CI, 1.85 to 2.79).

Risk for men ≥25 years of age also was increased for VSDs, PDA, and tetralogy of Fallot. Similarly, an analysis of data from the BWIS[204] that focused on isolated membranous VSDs found no association with paternal age.

Other Paternal Exposures

Some studies have been conducted to evaluate the role of paternal exposures in the origin of congenital heart disease, but the number of studies is limited, and the results are inconclusive. The BWIS reported an association of paternal cocaine use with an increased risk of any CCVD in general and with VSDs and tricuspid atresia in particular.[6]

An analysis of data from the BWIS performed by Ewing et al[204] found that reports of paternal marijuana use (OR, 1.36; 95% CI, 1.30 to 11.86) and use of cocaine among older fathers (OR, 3.92; 95% CI, 1.30 to 11.86) were associated with the occurrence of an isolated membranous VSD in offspring. Other authors suggested that 5% of cases of isolated membranous VSDs may be attributed to older fathers who used cocaine.[205] The potential for recall bias associated with illicit drug use makes it difficult to interpret the conclusiveness of these findings.

Savitz et al[206] evaluated the influence of paternal factors on congenital cardiac anomalies using data from 1959 to 1966 Kaiser Health Plan members who participated in the Child Health and Development Study. The authors could not demonstrate any statistically significant relationships, although trends were identified for paternal cigarette smoking, alcohol intake, and older age.

Discussion

This statement provides a summary of well-known prenatal maternal conditions or exposures associated with an increased risk for cardiac defects (ie, definite risk factors) such as maternal rubella infection, phenylketonuria, diabetes, thalidomide, vitamin A congeners/retinoids, and indomethacin tocolysis. In addition, this article summarizes available information on several prenatal maternal and paternal factors that also may alter the risk for cardiac defects in the offspring (ie, possible risk factors). Particularly noteworthy is the suggestion that maternal use of multivitamin supplements containing folic acid during the periconceptional period may be associated with a reduced risk for some cardiac defects. This association and others reported in the literature warrant further evaluation because findings thus far are based on limited studies and/or tend to be mixed. This article also summarizes available information on a wide range of factors for which no associations have been noted or the evidence has been found to be insufficient to assess the risk for CCVDs.

Caveats

In interpreting findings on possible associations between nongenetic factors and CCVDs, we must remember that such associations from observational studies may be due to the exposures or factors of interest, but they may also be a result of chance, bias, or confounding. An observational study can yield an association as a result of sampling variation of the controls or multiple comparisons in an exploratory study. Recall bias is a potential concern because assessment of exposure to many factors (eg, first-trimester fever, medication use, consumption of vitamin supplements, solvents) often is based on parental recall after the birth of the child. Confounding is also of concern in that an apparent association between reported analgesic use and a heart defect might be due to confounding by the condition for which the analgesic was taken (eg, influenza or a febrile illness), and the apparent protective effect of multivitamin supplement use might be due not to the use itself but to the behavior of the user. Because some maternal illnesses can result in treatment with medications, uncertainty remains in some areas regarding independent effects of the disease or its treatment on fetal risk. A lack of an association between exposure and disease risk may be real, but it also may reflect effect dilution resulting from grouping of phenotypes with different inherent susceptibilities or errors in exposure assessment. In this review, most of the findings on risk factors come from case-control studies, and the best available information comes from 2 large population-based case-control studies specifically designed to investigate risk factors for congenital heart disease in an exploratory manner: the BWIS conducted in the Baltimore-Washington area between 1981 and 1989[6] and the study conducted in Finland by the National Public Heath Institute in Helsinki of cases and controls born during 1982 to 1984.[7] Although these larger, population-based studies used standardized methods for ascertaining and classifying cardiac defects, control selection, and methods to minimize potential biases and confounding, the above methodological issues may still be present. Therefore, the consistency of the findings from among multiple well-designed studies is particularly important.

TABLE 7. Recommendations to Prospective Parents Based on Evidence and the Precautionary Principle*

Mothers who wish to become pregnant should:
Take a multivitamin with folic acid daily
Obtain preconception and prenatal care with specific attention to detection and effective management of phenylketonuria and diabetes and vaccination for rubella
Discuss any medicine use with your doctor, even over-the-counter medications
Avoid contact with people with flu or other febrile illnesses
Avoid exposures to organic solvents

*These are recommendations based on evidence available in the medical literature to reduce risk of offspring with a congenital heart defect only. Prospective parents should discuss other important health behaviors with their healthcare provider and/or obstetrician.

Implications for Prevention

With these caveats in mind, the information presented here and the precautionary principle[207i 209] yield some guidelines that could be useful to prospective parents who wish to minimize their chances of having a baby with a CCVD. These guidelines are listed in Table 7. It is important to note that these guidelines are aimed at minimizing potential prenatal exposure to risk factors for congenital heart defects only, not other adverse health outcomes. Prospective parents should discuss important health behaviors that may affect a pregnancy such as nutrition, physical activity, lifestyle, and occupation with their primary care provider or obstetrician. Women of childbearing age should take multivitamins containing folic acid on a daily basis in the periconceptional period and should avoid certain types of behaviors such as exposure to organic solvents. Women of childbearing age also should obtain prenatal care, including testing for diabetes and past rubella exposure; should discuss any medication use with their obstetrician; and should avoid contact with ill people, especially those with rubella or influenzalike illnesses.

Recommendations also are possible for screening for possible cardiac defects using fetal echocardiography during pregnancy when warranted by reports of prenatal maternal illnesses or exposures. The need for screening any individual should be made on an individual basis from the type, likelihood, and level of potential exposure, as well as the time of gestation during which it occurred. This decision typically will be made as a result of the obstetrical history.

Ultimately, the aim of epidemiological studies is to provide information necessary for development of prevention policies and interventions. Because congenital heart defects represent

some of the more prevalent birth defects, result in significant lifelong morbidity, and are an important cause of mortality attributed to birth defects, the development of effective prevention interventions is paramount from a public health perspective. However, the evidence base to support the development and implementation of effective prevention policies and interventions specifically directed at reducing the public health impact of congenital heart defects is somewhat limited.

Nevertheless, some strategies may be considered that may help to ameliorate risk for congenital heart defects on a population basis. In part, these must be based on concern regarding a broader set of risks for pregnancy outcomes other than heart defects alone. Preconception care and appropriate dietary management for women with phenylketonuria should be an important strategy. Detection and appropriate management of diabetes before and during pregnancy should be an important priority, given the increasing prevalence of type 2 diabetes and glucose intolerance in the general population. Guidelines for managing diabetes before and during pregnancy have been published by the American Diabetes Association.[210,211] Ensuring that women of childbearing age are immunized against rubella is also an important and practical strategy. Medications that are suspected of causing congenital defects, including congenital heart disease, should have warnings about that risk to allow mothers and physicians to make informed decisions about the risks and benefits of use of the medication during pregnancy. One strategy that has already been implemented is the recommendation for use of prenatal vitamins. Continuing to emphasize the importance of using prenatal vitamins containing folic acid is practical and important.

Implications for Further Research

Information available regarding several potential noninheritable risk factors for congenital heart defects is limited because of few studies, few exposures of mothers or fathers to yield highly reliable findings, or possible methodological issues. A recent example of this problem of limited available information involves the drug paroxetine. The FDA has recently changed the pregnancy category of this drug from C to D because of concerns related to possible increased risk of congenital cardiac malformations in the fetus raised by preliminary results from epidemiological studies. A warning has been placed in the prescribing information for the drug and on the FDA Web site (http://www.fda.gov/medwatch/safety/2005/safety05.htm#Paxil3). No evidence-based studies have been published in the scientific literature to date. Clearly, further research on many of the potential risk factors discussed in this statement is needed to expand the evidence base needed for the development of prevention strategies. The potential for expansion of the evidence base may be realized within the next few years, with the recent implementation of 2 large population-based studies in which standard methods for classification and grouping will be used. One of these is the National Birth Defect Prevention Study (NBDPS), a multicenter population-based case-control study of birth defects, which has been ascertaining and collecting clinical information on children with birth defects, including congenital heart defects, on an ongoing basis since 1997.[212] This is the largest case-control study of birth defects conducted in the United States and will include one of the largest collections of cases of heart defects from several regions of the country. The NBDPS will facilitate evaluation of a wide array of known and suspected risk factors for subgroups of the population and will enable investigators to evaluate the relation between various types of heart defects and candidate genes, environmental factors, and gene-environment interactions. A number of data analyses have already been initiated, and some results should become available within the next few years. Another potential future source of information is the National Children's Study (NCS).[213] This study will explore a broad range of environmental factors that influence health and well-being of children. Because this study plans to examine ≈100 000 children across the United States and follow them during prenatal development, through birth, in childhood, and into adulthood, it will provide opportunities to evaluate prospectively the impact of prenatal exposures on some of the more common heart defects, as well as the developmental outcomes, other comorbidities, transition to adulthood issues, and the survival experience of children with heart defects.

Conclusions

In conclusion, this statement summarizes the current state of knowledge of noninherited risk factors for both mothers and fathers that may increase or, in some cases, decrease the likelihood that a congenital cardiac defect may occur in offspring. Much of the recent evidence is preliminary and may not ultimately prove to be causal. Nevertheless, some reasonable recommendations are offered to prospective parents and healthcare professionals that may reduce the risk of having a child with a congenital cardiac defect based on the current state of knowledge for the prevention of other birth defects and the precautionary principle. Similarly, pregnancies with some types of maternal exposures may warrant prenatal screening with fetal echocardiography. To date, no public policies or interventions are specifically directed at reducing the public health impact of congenital heart disease. However, new studies such as the NBDPS or the NCS may yield evidence needed to support the development of such policies or interventions in the future.[214–218]

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POLICY STATEMENT

Noninitiation or Withdrawal of Intensive Care for High-Risk Newborns

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Fetus and Newborn

ABSTRACT

Advances in medical technology have led to dilemmas in initiation and withdrawal of intensive care of newborn infants with a very poor prognosis. Physicians and parents together must make difficult decisions guided by their understanding of the child's best interest. The foundation for these decisions consists of several key elements: (1) direct and open communication between the health care team and the parents of the child with regard to the medical status, prognosis, and treatment options; (2) inclusion of the parents as active participants in the decision process; (3) continuation of comfort care even when intensive care is not being provided; and (4) treatment decisions that are guided primarily by the best interest of the child.

INTRODUCTION

As medical technology has advanced, outcomes for high-risk newborn infants have greatly improved. With advanced technology, such as assisted ventilation, it is now possible to keep some terminally or severely ill or extremely preterm infants alive for long periods of time. The result of such treatment is that dying may be prolonged or the infant may survive with profound neurologic or other debilitating problems.[1–3] The treatment of infants should be based on what is perceived to be in their best interest. Parents and health care professionals often confront difficult treatment decisions when faced with the care of a severely ill, extremely preterm, or terminally ill infant, in part because the effects of treatment decisions on the infant's outcome are not always predictable. In these circumstances, there is no ethical distinction between noninitiation and withdrawal of life-sustaining treatment.

THE TREATMENT DILEMMA

If intensive treatment uniformly resulted in survival with an acceptable quality of life for infants at risk, it would be the obvious choice for all severely ill infants. This outcome, of course, does not always occur. If intensive treatment is not provided to very ill infants, most of them will die, but some may survive with significant neurodevelopmental disability, perhaps in part because specific treatments were withheld. The following dilemma, therefore, exists: intensive treatment of all severely ill infants may result in prolongation of dying accompanied by significant discomfort for the infant or in survival with unacceptable quality of life; on the other hand, nonintensive treatment may result in increased mortality and morbidity. Either approach risks undesired and unpredictable results.

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Key Words
treatment, resuscitation, withdrawal, newborn, neonate

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STRATEGY FOR CARE

For infants with poor prognosis, decisions about treatment should be made jointly by the health care team and the infant's family on the basis of the infant's physiologic maturity; the infant's medical condition, including any serious birth defects or medical complications; and the probabilities of death and severe disability based on the best available data.[4]

The types of decisions can be divided into 3 categories on the basis of prognosis[5]:

1. When early death is very likely and survival would be accompanied by high risk of unacceptably severe morbidity, intensive care is not indicated.
2. When survival is likely and risk of unacceptably severe morbidity is low, intensive care is indicated.
3. There may be cases that fall within these first 2 categories in which the prognosis is uncertain but likely to be very poor and survival may be associated with a diminished quality of life for the child; in these cases, parental desires should determine the treatment approach.

Whenever possible, discussion between the physician and parents should begin before the birth of a child with anticipated poor prognosis.[6] The obstetric care provider and the health care professional who will care for the infant after birth should collaborate in communicating with the expecting parents before the birth of the child. Such dialogue helps to ensure that appropriate care is provided for the individual infant on the basis of the infant's condition and prognosis at the time of birth. Sometimes, as when the woman is in active labor, it may seem that there is inadequate time for such a discussion. Nevertheless, it is essential that the meeting be conducted promptly and with great empathy. Follow-up meetings can take place if the situation changes over subsequent hours and days. Despite efforts to the contrary, an infant with a poor prognosis is sometimes born quickly, before the physicians can converse with the parents about the plan for treatment of the infant after birth. In such cases, the physician must use his or her judgment on behalf of the infant in deciding whether to initiate resuscitation of the infant until the parents can be involved in the decision. In making these decisions, the physician should err on the side of resuscitating the infant if the appropriate course is uncertain.

Once intensive care is initiated, the infant is continuously reevaluated, and the prognosis is reassessed on the basis of the best available information in conjunction with the physician's best medical judgment. This approach places significant responsibility on the physician and health care team to evaluate the benefits to and burdens on the infant with continuing intensive care. The family of the infant must be kept fully informed of the infant's evolving status and prognosis. The physician and family must be involved together in major decisions that ultimately could alter the infant's outcome.[7] Unless circumstances dictate otherwise, one physician should be designated as the spokesperson for the health care team and should discuss treatment options with the family and communicate decisions to the full health care team. When there is more than one valid approach to treatment, the physician should present these options to the family for their consideration and opinion. When the health care team is unable to agree on a treatment strategy, the physician, serving as the team leader, should attempt to resolve existing differences by using an independent medical consultant or consulting with the hospital bioethics committee.

The physician spokesperson must recognize that the parents' view of their child's status and the treatment choices is influenced by how the information is presented by the physician.[8] This recognition imposes a special obligation on the physician to present prognostic information in a frank and balanced way without coercion. The physician spokesperson must be sensitive to the parents' concerns and desires, which are often based on a complex combination of values and influences derived from their cultural, religious, educational, social, and ethnic backgrounds. The physician's role is to present the treatment options to the parents and provide guidance as needed. The parents' role is to participate actively in the decision-making process. Decisions to continue, limit, or stop intensive care must be based only on the best interest of the infant and not on the financial status of the parents or the financial interests of the physicians, the hospital, or any third-party payer.

The important role of the parents in decision-making must be respected. However, the physician's first responsibility is to the patient. The physician is not obligated to provide inappropriate treatment or to withhold beneficial treatment at the request of the parents. Treatment that is harmful, of no benefit, or futile and merely prolonging dying should be considered inappropriate. The physician must ensure that the chosen treatment, in his or her best medical judgment, is consistent with the best interest of the infant.

When there is conflict or disagreement between the recommendations of the physician and the desires of the infant's parents, continued discussion will often lead to agreement. If the disagreement continues, one option is to consult with the hospital bioethics committee. Another option is for the physician and family to seek another physician who is willing to provide care for the infant in the manner desired by the family. This disagreement between the physician and the family may result in the involvement of the court system. If this occurs, the physician should continue to serve as an advocate for the infant. Involvement of the court system is adversarial by nature and should be considered the last possible choice in resolution, to be used only in the case

of irreconcilable differences of opinion, and it should be avoidable in nearly all cases.

RECOMMENDATIONS

1. Decisions about noninitiation or withdrawal of intensive care should be made by the health care team and the parents of a high-risk infant working together. This approach requires honest and open communication. Ongoing evaluation of the condition and prognosis of the high-risk infant is essential, and the physician, as the spokesperson for the health care team, must convey this information accurately and openly to the parents of the infant.
2. Parents should be active participants in the decision-making process concerning the treatment of severely ill infants.
3. Compassionate basic care to ensure comfort must be provided to all infants, including those for whom intensive care is not being provided.
4. The decision to initiate or continue intensive care should be based only on the judgment that the infant will benefit from the intensive care. It is inappropriate for life-prolonging treatment to be continued when the condition is incompatible with life or when the treatment is judged to be harmful, of no benefit, or futile.

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AMERICAN ACADEMY OF PEDIATRICS

TECHNICAL REPORT

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Nontherapeutic Use of Antimicrobial Agents in Animal Agriculture: Implications for Pediatrics

ABSTRACT. Antimicrobial resistance is widespread. Overuse or misuse of antimicrobial agents in veterinary and human medicine is responsible for increasing the crisis of resistance to antimicrobial agents. The American Academy of Pediatrics, in conjunction with the US Public Health Service, has begun to address this problem by disseminating policies on the judicious use of antimicrobial agents in humans. Between 40% and 80% of the antimicrobial agents used in the United States each year are used in food animals; many are identical or very similar to drugs used in humans. Most of this use involves the addition of low doses of antimicrobial agents to the feed of healthy animals over prolonged periods to promote growth and increase feed efficiency or at a range of doses to prevent disease. These nontherapeutic uses contribute to resistance and create health dangers for humans. This report will describe how antimicrobial agents are used in animal agriculture and review the mechanisms by which such uses contribute to resistance in human pathogens. Although therapeutic use of antimicrobial agents in agriculture clearly contributes to the development of resistance, this report will concentrate on nontherapeutic uses in healthy animals. ***Pediatrics*** **2004; 114:862–868;** ***antibiotic, antimicrobial, resistance, child, infant, agriculture, foodborne, epidemiology.***

ABBREVIATIONS. NARMS, National Antimicrobial Resistance Monitoring System; VRE, vancomycin-resistant enterococci; Q-D, quinupristin-dalfopristin.

ANTIMICROBIAL USE IN ANIMAL FEEDS

Rationale for Use

In livestock and poultry production, antimicrobial agents are used therapeutically, prophylactically, and to promote growth and improve feed efficiency.[1] Therapeutic use in clinically ill animals involves using curative doses of antimicrobial agents for a relatively short period of time. However, antimicrobial agents used for acute illness may be delivered not just to sick individuals but to the entire group of animals to which the sick individuals belong. Many therapeutic antimicrobial agents are administered in water to animals raised in large numbers under industrial conditions, which may result in individual animals or birds receiving inadequate doses. The nature of swine and poultry production makes it difficult to treat individual animals; if a few birds show signs of clinical illness, the entire house (10 000–30 000 birds) is treated. Of the wide variety of agents approved for therapeutic use in animals, many are identical or similar to drugs used in human medicine[2] (Table 1). Only some require a veterinarian's prescription. Although the therapeutic uses of antimicrobial agents in agriculture have significant impact on the development of resistant organisms, they are not the focus of this report.

Antimicrobial agents are also used in animal production to promote growth, primarily by enhancing feed efficiency; the mechanism of action is not known. When used for this purpose, low doses of antimicrobial agents are added to the feed of healthy animals for much of their life span. In addition, prophylactic antimicrobial agents are used to control the dissemination of clinically diagnosed infectious diseases identified within a group of animals or to prevent an infectious disease that has not yet been clinically diagnosed.[1] Prophylactic antimicrobial agents may be used at either low doses or therapeutic doses. These uses generate selection pressure on microbial populations that is similar to growth-promotion use and will be discussed under the common term "nontherapeutic use" to denote their use in healthy animals. Prophylactic antimicrobial agents are used to prevent diseases common to animals grown under industrial conditions.[1] Feed efficiency refers to the ability to grow animals faster with less food. This results in shorter time to slaughter at less expense to the producer, improving profits and decreasing consumer costs.[3] Addition of subtherapeutic doses of antimicrobial agents to feed also results in bigger animals, an effect known as growth promotion.

Scope of Use

Manufacturers and users of antimicrobial agents are not required to report data on production or use for human or food-animal applications. Annual production estimates range from 35 million[4] to 50 million[5] pounds per year. The major nonhuman use of antimicrobial agents is in food-animal production. The Institute of Medicine estimates that 40% of an-

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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TABLE 1. Major Antimicrobial Agent Classes Approved for Nontherapeutic Use in Animals

Antimicrobial Class	Species	Prophylaxis	Growth Promotion
Aminoglycoside	Beef cattle, goats, poultry, sheep, swine	Yes	No
β-Lactam (penicillin)	Beef cattle, dairy cows, fowl, poultry, sheep, swine	Yes	Yes
β-Lactam (cephalosporin)	Beef cattle, dairy cows, poultry, sheep, swine	Yes	No
Ionophore	Beef cattle, fowl, goats, poultry, rabbits, sheep	Yes	Yes
Lincosamide	Poultry, swine	Yes	Yes
Macrolide	Beef cattle, poultry, swine	Yes	Yes
Polypeptide	Fowl, poultry, swine	Yes	Yes
Streptogramin	Beef cattle, poultry, swine	Yes	Yes
Sulfonamide	Beef cattle, poultry, swine	Yes	Yes
Tetracycline	Beef cattle, dairy cows, fowl, honey bees, poultry, sheep, swine	Yes	Yes
Other			
Bambermycins	Beef cattle, poultry, swine	Yes	Yes
Carbadox	Swine	Yes	Yes
Novobiocin	Fowl, poultry	Yes	No
Spectinomycin	Poultry, swine	Yes	No

Source: US General Accounting Office. *The Agricultural Use of Antibiotics and Its Implications for Human Health*. Washington, DC: General Accounting Office; 1999. Publication no. GAO-RCED 99–74

nual antimicrobial use in the United States is veterinary, and approximately three fourths of this use is categorized as nontherapeutic "supplements" in food animals.[5] Other estimates of nontherapeutic use in livestock are as high as 78%[4] of the total annual use of antimicrobial agents in the United States.

EVIDENCE OF SELECTION FOR ANTIMICROBIAL RESISTANCE ATTRIBUTABLE TO AGRICULTURAL USES OF ANTIMICROBIAL AGENTS

One of the most efficient ways to select for resistance genes in bacteria is to expose bacteria chronically to low doses of broad-spectrum antimicrobial agents. Levy et al[6] examined the effect of low-dose tetracycline in feed on the intestinal flora of chickens. Chickens were divided into experimental and control groups; the experimental group received feed containing oxytetracycline at concentrations similar to those used for therapy or prophylaxis; the control group received feed without oxytetracycline. The baseline resistance to tetracycline was generally less than 10%, with many samples exhibiting less than 0.1% resistance. Within 36 hours, resistance began to increase, and after 2 weeks, 90% of the chickens in the experimental group were excreting bacteria that were 100% resistant to tetracycline. Chickens in the control group did not exhibit an increase in resistant organisms during this same time period. Although the chickens were exposed only to tetracycline, multidrug resistance developed (to tetracycline, sulfonamides, streptomycin, ampicillin, and carbenicillin) through plasmid transfer. By 12 weeks, almost two thirds of the chickens in the experimental group excreted organisms resistant to tetracycline and at least 1 additional antimicrobial agent, and more than one quarter were resistant to 4 antimicrobial agents (tetracycline, ampicillin, streptomycin, and carbenicillin). Over time, chickens in the control group, despite isolation in different pens, also developed resistance, although at lower levels. One third of chickens in the control group were excreting more than 50% resistant organisms after 4 months. Transfer of resistance to humans also occurred, although more slowly and at lower levels than in the control-group chickens. Within 6 months, more than 30% of fecal samples from farm dwellers contained more than 80% tetracycline-resistant bacteria versus 6.8% from control neighbors ($P < .001$). A 4-drug resistance pattern was found in farm families corresponding to that of the experimental-group chickens but was not found in neighborhood controls. Six months after the removal of all tetracycline feed from the farm, no tetracycline-resistant organisms were isolated from stool samples in 8 of 10 farm dwellers tested. This experiment demonstrated that resistance can develop quickly in the presence of antimicrobial pressure, that single-drug resistance becomes multidrug resistance, that resistance spreads beyond individuals exposed to the antimicrobial agent to other members of their species within the environment and to humans living and working on the farm, and that stopping feed supplementation with oxytetracycline leads to decreased incidence of resistance.

MECHANISMS OF SPREAD OF RESISTANT BACTERIA TO HUMANS

When animals become colonized with resistant organisms, these organisms can eventually reach humans through the food chain, direct contact, or contamination of water or crops from animal excreta.[7] Increasingly, food animals are raised in large numbers under close confinement, transported in large groups to slaughter, and processed very rapidly.[8] These stressful conditions cause increased bacterial shedding and inevitable contamination of hide, carcass,[9] and meat[10] with fecal bacteria. Dissemination of resistant pathogens via the food chain is facilitated further by centralized food processing and packaging, particularly of ground meat products, and broad distribution through food wholesalers and retail chains.[11] Farmers, farm workers, and farm families[6] as well as casual visitors[12] are at risk of infection with resistant organisms.

Environmental reservoirs may also contribute to the movement of resistance genes. Active antimicrobial agents have been detected in water near animal

waste lagoons,[13] surface waters, and river sediments,[14] giving rise to concerns that environmental contamination with antimicrobial agents from agricultural and human use could present microbial populations with selective pressure, stimulate horizontal gene transfer, and amplify the number and variety of organisms that are resistant to antimicrobial agents. Supporting this concern, investigators recently found resistance genes identical to those found in swine waste lagoons in groundwater and soil microbes hundreds of meters downstream.[15]

Finally, there may also be direct human exposure to antimicrobial agents. Because many antimicrobial agents used in food-animal production can be obtained without a veterinarian's prescription, they are available for direct purchase and are often manually added to feed or water at farm level. This may be another pathway leading to development of resistance in occupationally exposed individuals, their families, and neighbors.[6]

EFFECT ON TREATMENT OF INFECTIONS IN CHILDREN

This section of the report reviews evidence that links agricultural use of antimicrobial agents to disease in infants and children for 2 major foodborne pathogens, *Campylobacter* species and *Salmonella* species, and for the opportunistic pathogen *Enterococcus* species.

Campylobacter Species

Campylobacter organisms cause approximately 2.5 million cases of foodborne illness annually in the United States and are the leading cause of bacterial foodborne illness.[16] The incidence of *Campylobacter* infections in infants younger than 1 year is twice that in the general population (54.1 vs 21.7 per 100 000 population).[17] Almost 20% of all reported cases of *Campylobacte*r infections occur in children younger than 10 years.[18]

Erythromycin or another macrolide is the drug of choice for *Campylobacter* infections in infants and children; fluoroquinolones and tetracyclines are used frequently in adults. Antimicrobial resistance in *Campylobacter* species is an increasing problem.[19] Currently, macrolide resistance in human isolates of *Campylobacter jejuni*, the species causing 90% of human infections, is stable and usually less than 5%.[19] *Campylobacter coli*, which causes approximately 10% of human infections, has a much higher resistance rate, reaching 70%.[20] The major reservoirs are poultry for *C jejuni* and turkeys and swine for *C coli*.[21] Differences in resistance rates may reflect differences in the use of antimicrobial agents.[20] Erythromycin and tetracyclines are approved for use in food-producing animals for therapeutic and growth-promotion purposes.

Fluoroquinolone resistance in *Campylobacter* species demonstrates the links among agricultural use of antimicrobial agents, selection of resistance, and dissemination of resistant infections through the food chain. Fluoroquinolones were approved for use by prescription in diseased poultry flocks in the United States in 1995.[22] In Minnesota between 1996 and 1998, infections in humans caused by fluoroquinolone-resistant organisms increased, parallel with the prevalence of retail domestic chicken products contaminated with fluoroquinolone-resistant organisms. Data from the National Antimicrobial Resistance Monitoring System (NARMS) demonstrate that fluoroquinolone resistance among *Campylobacter* isolates from humans began to increase nationwide in the late 1990s, from 13% in 1997 to 20.5% in 1999.[23] A 1999 survey of grocery store chicken found that 44% of samples were contaminated with *Campylobacter* species; 24% of the isolates were resistant to ciprofloxacin, and 32% were resistant to nalidixic acid.[24] Increasing resistance is even more worrisome, because data suggest that strains of resistant *Campylobacter* species may be more virulent than sensitive strains. In a case-control telephone study, investigators found that untreated patients with fluoroquinolone-resistant *Campylobacter* infection had an average of 12 days of diarrhea versus 6 days in patients with sensitive strains ($P = .02$).[25] For patients who were treated with fluoroquinolones, the duration of diarrhea was significantly longer in those infected with resistant versus sensitive strains (8 vs 6 days [$P = .02$]).

Salmonella Species

Nontyphoidal *Salmonella* organisms cause 1.4 million illnesses annually, 95% of which are thought to be foodborne.[16] It is estimated that 600 deaths occur annually from *Salmonella* infections, primarily among the elderly and very young.[16] More than one third of all cases occur in children younger than 10 years,[18] and the incidence in children younger than 1 year is 10 times higher than in the general population (128.9 vs 12.4 per 100 000).[17] Ten percent of blood and central nervous system infections caused by *Salmonella* species as reported to the Centers for Disease Control and Prevention occur in children younger than 1 year.[26] Children of all ages with chronic conditions such as sickle cell anemia are at high risk of serious complications from infections with *Salmonella* species.[27]

The dissemination of resistant *Salmonella* infections through the food chain is well documented. A 6-state outbreak of plasmid-mediated, multidrug-resistant *Salmonella newport* infection attributed to consumption of contaminated beef was traced back to a feedlot that used nontherapeutic doses of chlortetracycline as a growth promoter in feed.[28] Investigators found the outbreak organism in isolates from both animals and humans on an adjacent dairy farm. An increased risk of illness caused by a resistant strain was observed in patients who were taking antimicrobial agents for other infections (odds ratio, 51.3; $P = .001$), suggesting that asymptomatic carriage was converted to symptomatic infection by the use of antimicrobial agents. Of 3 children younger than 10 years, 2 had received antimicrobial agents before onset of their illness.

Neonatal infections caused by *Salmonella* species also have been attributed to indirect exposure to foodborne sources. Bezanson et al[29] described a plasmid-mediated, 6-drug–resistant strain of *Salmonella*

serotype Typhimurium acquired asymptomatically by a pregnant woman from raw milk and passed to her infant at birth. The infant became ill within 24 hours with septicemia and meningitis. Three to 4 days later, several other infants in the newborn nursery developed diarrhea with the same resistant organism. In another newborn nursery outbreak, *Salmonella heidelberg* resistant to chloramphenicol, sulfamethoxazole, and tetracycline caused bloody diarrhea in 3 infants.[30] The index case was a term infant born by cesarean delivery after 18 hours of ruptured membranes. The mother was a farmer's daughter who, until shortly before delivery, had been working with new calves from a herd containing several sick calves.

The treatment of *Salmonella* infections, especially in young children, has become increasingly difficult because of antimicrobial resistance. In the early 1980s, the prevalence of multidrug-resistant *Salmonella* species began to increase and by 1995 had reached 19% in the United States.[31] Some strains, particularly *Salmonella* serotype Typhimurium DT104, cause invasive disease that frequently requires treatment but may be resistant to 5 or more classes of antimicrobial agents.[32,33] Currently, extended-spectrum cephalosporins have become the preferred drugs for empiric treatment in pediatrics, and fluoroquinolones are preferred in adults. The efficacy of these drugs may now be threatened. In 1999, Molbak et al[34] described an outbreak in Denmark of *Salmonella* serotype Typhimurium DT104 resistant to ampicillin, chloramphenicol, streptomycin, sulfonamides, tetracycline, and quinolones, linked by molecular fingerprinting (the process of identifying unique clones by DNA typing) to 2 swine herds. Two patients died in this outbreak, and therapeutic failure was considered related to antimicrobial resistance. Of 4 children, 1 was an infant who was hospitalized and treated with cefotaxime. Fey et al[35] reported on a child from Nebraska who became infected with *Salmonella* serotype Typhimurium DT104 resistant to ampicillin, chloramphenicol, tetracycline, sulfisoxazole, kanamycin, streptomycin, several classes of cephalosporins, aztreonam, cefoxitin, gentamicin, and tobramycin. An analysis of recent NARMS data revealed that 77% of patients with culture-proven ceftriaxone-resistant *Salmonella* infection between 1997 and 1998 were younger than 18 years and that the prevalence of ceftriaxone-resistant human isolates increased fivefold from 0.1% in 1996 to 0.5% in 1999.[36] Human isolates of *Salmonella* species resistant to 8 or more agents increased almost sevenfold from 0.3% in 1996% to 2% in 1999. Decreased susceptibility to fluoroquinolones may also be emerging. According to NARMS data, the prevalence of resistance to ciprofloxacin among *Salmonella* isolates increased from 0.4% in 1996 to 1% in 1999.

Major reservoirs for *Salmonella* infection are food animals, including poultry, cattle, and swine. Nontherapeutic antimicrobial agents are routinely used, particularly in swine. One survey of 825 retail samples of raw chicken, turkey, pork, and beef revealed an overall rate of 3% contamination with *Salmonella* species.[37] White et al[38] recently reported that 20% of retail ground meat samples were contaminated with *Salmonella* species; 80% of these samples were resistant to at least 1 antimicrobial agent, 53% were resistant to at least 3 antimicrobial agents, and 16% were resistant to ceftriaxone.

Enterococci

Enterococci are normal flora in food animals, domesticated animals, wild animals, and humans. In the 1990s, vancomycin-resistant enterococci (VRE) became common bacterial pathogens responsible for an increasing number of nosocomial infection in the United States, including in children.[39] Hospitalized and seriously ill children are increasingly affected.[40,41] Patterns in the prevalence of VRE infection have developed differently in the United States and Europe, helping to elucidate the links between use of antimicrobial agents in animals and resistance in humans. Whereas the epidemic of VRE infection in the United States seems related to the large increase in vancomycin use in human medicine,[42] the increased incidence of VRE infection in Europe seems to be attributable to the use of antimicrobial agents in animals. Vancomycin has not been used widely in Europe in human medicine, but avoparcin, a related glycopeptide, has been used as a growth promoter for decades.[43] Avoparcin selects for cross resistance to vancomycin when used in farm animals.[44,45] In the United States, VRE is rarely cultured from healthy individuals in the community,[46] but it is often isolated from healthy community members in Europe.[47] In Europe, VRE can also be cultured from healthy poultry, pigs,[48] ponies, and dogs[49]; uncooked chicken meat[50] and minced pork; and raw sewage from urban and rural locations.[51] Molecular fingerprinting of these isolates shows much higher heterogeneity in European isolates compared with US isolates, suggesting that the prevalence of VRE in Europe is a response of multiple enterococcal populations to the presence of avoparcin in a variety of host species and locations.

Recent reports from the United States, however, suggest a strong and emerging link between VRE and agricultural use of antimicrobial agents. In response to the epidemic of VRE infection, quinupristin-dalfopristin (Q-D) was licensed for use in 1999 by the US Food and Drug Administration as treatment for highly resistant strains. Q-D is a streptogramin, a class of antimicrobials not used previously in humans because of unacceptable toxicity.[52] Virginiamycin is a related streptogramin that has been used in the United States as a growth promoter for poultry, swine, and cattle since 1974.[53] In a recent study, 58% of 407 retail chicken samples and 1% of human stool samples were found to harbor Q-D-resistant enterococci 1 year before its release for human use, and humans were also found to carry resistant organisms without previous exposure to Q-D.[54] This suggests that ingestion of resistant enterococci in retail meats resulted in colonization of the human gut by these foodborne pathogens; such colonization of the gut of humans has been documented for up to 14 days after ingestion.[55] It also demonstrates the potential risks of using antimicrobial agents thought not to be impor-

tant to human medicine as growth promoters. As antimicrobial resistance increases, it is likely that more veterinary agents may be modified for human use. If resistance has already developed in animal populations, however, the period of their efficacy in human disease may be quite limited.

EUROPEAN EXPERIENCE

Sweden led Europe in banning antimicrobial growth promoters in 1986.[56] The ban in Sweden has resulted in decreased use of antimicrobial agents in food animals and, accompanied by improved animal husbandry practices, sustained productivity and profitability of the industry.[57] Denmark, which has a more industrialized animal production system similar to that in the United States, instituted a voluntary ban on antimicrobial growth promoters in 1998. Denmark has had a similar decrease in antimicrobial use and decreased prevalence of resistant organisms in food animals without loss of productivity or profitability.[58]

CONCLUSIONS

Resistance to antimicrobial agents is an increasing and serious problem. Judicious use of antimicrobial agents in humans will address only approximately 50% of use and will be insufficient to curb the accelerating upward trend in resistance. The largest nonhuman use of antimicrobial agents is in food-animal production, and most of this is in healthy animals to increase growth or prevent diseases. Evidence now exists that these uses of antimicrobial agents in food-producing animals have a direct negative impact on human health and multiple impacts on the selection and dissemination of resistance genes in animals and the environment. Children are at increased risk of acquiring many of these infections with resistant bacteria and are at great risk of severe complications if they become infected. Improved surveillance and continued documentation will elucidate the magnitude of the impact that these uses have on public health in general and children's health in particular.

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CLINICAL REPORT

Office-Based Counseling for Unintentional Injury Prevention

Guidance for the Clinician in Rendering Pediatric Care

H. Garry Gardner, MD, and the Committee on Injury, Violence, and Poison Prevention

ABSTRACT

Unintentional injuries are the leading cause of death for children older than 1 year. Pediatricians should include unintentional injury prevention as a major component of anticipatory guidance for infants, children, and adolescents. The content of injury-prevention counseling varies for infants, preschool-aged children, school-aged children, and adolescents. This report provides guidance on the content of unintentional injury-prevention counseling for each of those age groups.

INTRODUCTION

Unintentional injuries continue to be the leading cause of death in children older than 1 year. In 2003, unintentional injuries caused 34.6% of all deaths in 1- to 4-year-olds, 37.8% of all deaths in 5- to 9-year-olds, 37.5% of all deaths in 10- to 14-year-olds, and 49.7% of all deaths in 15- to 19-year-olds. Among all children from 1 to 19 years of age, 64.7% of unintentional injury deaths involved motor vehicles.[1]

Pediatricians play a key role in educating parents about the risks of unintentional injuries and specific measures to minimize those risks, including environmental modification or the use of safety equipment. Anticipatory guidance is a major component of well-child care and injury visits, and parents value the advice and counseling they receive from their pediatricians. Anticipatory guidance for injury prevention should be an integral part of the medical care provided for all infants, children, and adolescents.

Counseling for the prevention of unintentional injuries needs to be appropriate for the child's age and locale. Initially, it is necessary for the counseling to be provided to the parent or caregiver as both the role model for the child's behavior and the person who is most capable of modifying the child's environment. As children mature, counseling should be directed increasingly toward children or adolescents as they become responsible for their own behavior. Physicians are encouraged to document injury-prevention counseling in the medical chart.

In 1983, the American Academy of Pediatrics introduced The Injury Prevention Program (TIPP). TIPP includes a safety-counseling schedule, age-appropriate safety surveys, and age-appropriate safety sheets for families to take home.[2] Physicians may use different parts of TIPP to supplement their anticipatory guidance.[2] The interventions outlined here and in TIPP have been shown to be effective in improving parental safety practices.[3–9] A review of the literature on childhood injury-prevention counseling in primary care settings demonstrated that 18 of 20 studies have shown positive outcomes in increasing knowledge and behavior and in decreasing injury rates in children.[10] A systematic review of 22 randomized,

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
injuries, prevention, anticipatory guidance, infants, children, adolescents

Abbreviations
TIPP—The Injury Prevention Program
ATV—all-terrain vehicle

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controlled trials of counseling and other interventions in a clinical setting demonstrated improvement in certain safety practices, specifically motor vehicle restraint use, smoke alarm ownership, and maintenance of safe hot-water temperature.[11]

INFANTS

Advise parents about the following issues:

1. Traffic safety: The correct use of currently approved child safety restraints needs to be discussed. The infant car safety seat should be rear-facing in the back seat, never in the front seat if there is a passenger-side air bag. Infants should never be left unattended in an automobile. Parents need to be reminded of the importance of using their own seat belts.[12]
2. Burn prevention: Smoke alarms in the home should be installed and maintained.[13,14] Hot-water temperature should be set at a maximum of 120°F to avoid scald burns. Parents should be advised not to carry their infant and hot liquids or foods at the same time. Milk and formula should not be heated in the microwave because it can heat unevenly, causing pockets of liquid hot enough to scald the infant's mouth. Electrical outlets should be covered with devices that will not pose a choking hazard.
3. Fall prevention: Window and stairway guards/gates are necessary to prevent falls from heights.[15] Infant walkers should not be used.[16] Infants should never be left alone on any furniture such as changing tables, beds, or sofas.
4. Choking prevention: Small parts or objects can pose a choking hazard to young children. Round or cylindrical and compressible objects and foods can pose life-threatening risks of airway obstruction. Balloons pose a similar risk for young children. To avoid risk of strangulation, parents should be advised to avoid clothes and toys with long strings and cords and to cut looped blind and drapery cords. Suffocation may occur from entrapment in unsafe crib environments and access to waterbeds or plastic bags. Parents should be aware of hazards in any home where an infant spends time.
5. Drowning prevention: Because very young infants drown most commonly in bathtubs and buckets while unsupervised, advise parents never to leave infants or young children in the bathtub or around other bodies of water without constant adult supervision, and advise them to empty and properly store buckets immediately after use.[17–19] Parents should be reminded that infant bath seats or supporting rings are not a substitute for adult supervision.
6. Safe sleep environment: Infants should be placed for sleep in a supine position in a crib that conforms to current safety standards. Infants should not be put to sleep on soft surfaces such as waterbeds or sofas. Avoid soft materials in the infant's sleep environment. If bumper pads are used, they should be removed when the infant begins to stand. Never leave the crib sides down when the infant is in the crib.[20]
7. Cardiopulmonary resuscitation: It is important that parents become trained in infant and child cardiopulmonary resuscitation and learn how to access their local emergency medical services (eg, 911).

PRESCHOOL-AGED CHILDREN

Toddlers and young children are more able to explore their environment but do so with little regard to risk or consequences. Parents of preschool-aged children need to be counseled to take a proactive role in protecting their children.

1. Traffic safety: Toddlers may be placed in a forward-facing car safety seat when they reach 1 year and 20 pounds, but it is best for them to remain rear-facing until they reach the highest weight or height allowed in that position by the car safety seat. Preschool-aged children should always ride in the back seat. Parents need to be reminded again of the importance of using their own seat belts.[12] Young children should never be left unsupervised in or around cars. Driveways and streets are particularly dangerous places for children to play. Supervised pedestrian safety begins at this age. Preschool-aged children are not ready to cross the street alone. Children must be watched closely when near driveways and streets.[21] Use of an approved bicycle helmet begins with riding a tricycle or bicycle with training wheels.
2. Burn prevention: Smoke alarm batteries should be checked regularly.[22] Children should be kept away from hot oven doors, irons, wall heaters, and grills. Advise parents to keep hot food and coffee out of the reach of young children.[14] Electrical outlets should be covered.
3. Fall prevention: Toddlers learning to walk and climb need to be protected from stairways, open windows, and heavy furniture that could topple over.[15]
4. Poison prevention: Medicines and household products should be kept out of the sight and reach of children and locked up whenever possible. These items should be purchased and kept in original child-proof containers or blister packs. Ipecac is no longer recommended and, if present in the home, should be discarded. Keep the poison control telephone number (1-800-222-1222) handy.[23]
5. Drowning prevention: Backyard swimming pools or spas need to be completely fenced on 4 sides to separate them from the house and yard; the fence should

have a self-closing, self-latching gate.[24] The gate should open away from the pool and should be checked often to ensure that it is in good working order. Children younger than 5 years should swim only with close adult "touch" supervision.[17–19]

6. Firearm safety: Because of the dangers that in-home firearms, particularly handguns, pose to young children, parents should be advised to keep handguns out of places where children live and play. If parents choose to keep a firearm in the home, the unloaded gun and ammunition must be kept in separate locked cabinets.[25]

SCHOOL-AGED CHILDREN

Advice to parents of elementary school–aged children begins to be more focused on the child's behavior. Children begin to learn home safety rules by 3 to 4 years of age.[26] The child should then be included in this learning process, and the parents should be reminded again of their need to model safe behaviors.

1. Traffic safety: When children reach the top weight or height allowed for their car safety seat, they need to ride in booster seats. A booster seat should be used until the child properly fits in the adult seat belt with the shoulder belt lying across the chest, the lap belt low and snug across the upper thighs, and the legs bent at the knees when sitting against the vehicle seat back (usually around 4 feet 9 inches in height and between 8 and 12 years of age).[12] Remind children and parents that no one should ride in the bed of a pickup truck.[27] All-terrain vehicles (ATVs) should not be used by children younger than 16 years.[28,29] Review safe pedestrian practices.[21] Approved bicycle helmets should be worn on every bike ride.[30,31]
2. Water safety: Children 5 years and older should be taught to swim and should be taught appropriate rules for water play. Children must never be allowed to swim alone. Coast Guard–approved personal flotation devices should be worn by all children engaged in any boating activity.[17]
3. Sports safety: Adults who supervise children participating in organized sports programs and recreational activities need to emphasize the importance of safety equipment for the particular sport as well as appropriate physical conditioning for that sport.[32–35] The use of protective equipment for in-line skating and skateboarding needs emphasis.[36,37]
4. Firearm safety: In addition to removing firearms from the home environment where children explore and play, it is important for parents to ask whether there is a gun in any home that their child visits. If parents choose to keep a firearm in the home, the unloaded gun and ammunition must be kept in separate locked cabinets.[25]

ADOLESCENTS

Injury-prevention advice to adolescents ideally is included in a broader discussion of healthy lifestyle choices, especially the avoidance of alcohol, tobacco, or other drug use. It is important for pediatricians, parents, and schools to remain united in their efforts to promote community choices that, by modifying the adolescent environment, make adolescent risk-taking less likely to occur, thus decreasing the risk of significant injury. Specific areas of injury-prevention guidance include the following:

1. Traffic safety: Encourage seat belt use and discuss the role of alcohol and drugs in teenage motor vehicle crashes. Discuss specific ways to minimize distracted driving, including eating, drinking, and especially using a cellular phone or electronic device while driving. Alert parents and adolescents to the dangers of high-risk situations, including speeding and reckless driving. Encourage compliance with graduated driver-licensing laws. Parents should enact strict rules to limit nighttime driving and the number of passengers in the car.[38] A helmet should be worn whenever riding a bicycle, motorcycle, or ATV.[28,30] ATVs should not be used by children younger than 16 years.[28]
2. Water safety: Discuss the risks of swimming in remote locations and at sites that are not designated as swim areas as well as the dangers of alcohol and other drug consumption during aquatic recreation activities (eg, swimming, diving, boating). The first entry into any body of water should be feet first, and it is important to know the water's depth and the location of any underwater hazards before jumping or diving. Discuss the need to use an approved personal flotation device whenever the child is riding on a boat or other watercraft or fishing.[17]
3. Sports safety: Adolescents participating in organized sports programs and recreational activities need to be reminded of the importance of safety equipment, including protective eyewear, for their particular sport as well as appropriate physical conditioning for that sport.[32–35] The importance of using protective equipment for in-line skating and skateboarding needs emphasis.[36,37]
4. Firearm safety: In-home firearms are particularly dangerous during adolescence because of the potential for impulsive, unplanned use by teens resulting in suicide, homicide, or serious unintentional injuries. Firearms, and especially handguns, should be kept out of the home. If parents choose to keep a firearm in the home, the unloaded gun and ammunition must be kept in separate locked cabinets. Parents should ask whether there is a gun in any home that teenagers visit.[25]

CONCLUSIONS

Injury-prevention counseling should be integrated into every well-child visit. Because of time constraints, specific topics could be addressed at different visits and tailored to be appropriate for the season, the child's activities, and concerns and questions raised by the parent. The topics addressed should be documented in the medical record. TIPP information sheets could be attached to vaccine information sheets on each visit. Telephone numbers (eg, poison control center) and Web sites could be posted in the waiting room along with brochures and posters. Parents and children are often receptive to injury-prevention counseling during a sick visit, especially if it is related to an injury, a recent emergency department visit, or injury to a sibling.[39] Finally, pediatricians can be more effective advocates for injury prevention by working with community resources that have a major influence on children,[11] such as the school system, park district, Head Start, child care centers, organizations such as the YMCA, and local media.

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CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Ophthalmologic Examinations in Children With Juvenile Rheumatoid Arthritis

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ABSTRACT

Unlike the joints, ocular involvement with juvenile rheumatoid arthritis is most often asymptomatic; yet, the inflammation can cause serious morbidity with loss of vision. Scheduled slit-lamp examinations by an ophthalmologist at specific intervals can detect ocular disease early, and prompt treatment can prevent vision loss.

INTRODUCTION

Chronic uveitis is an important and sometimes devastating complication of juvenile rheumatoid arthritis (JRA).[1–3] The intraocular inflammation primarily affects the iris and ciliary body (iridocyclitis), but the choroid may also be involved.[4] Overall, the frequency varies from 2% to 34% in children with JRA.[5–8] Diagnosis of early involvement is not possible by direct ophthalmoscopy, but slit-lamp examination will reveal the presence or absence of inflammatory cells and increased protein within the anterior chamber of the eye.

Morbidity includes cataracts, glaucoma, band keratopathy, phthisis bulbi, and loss of vision.[7,9] Visual outcome has improved in the past 20 years; most children have a relatively good prognosis if the disorder is detected and treated early.[9,10] However, uveitis in children with JRA remains a leading cause of loss of vision and blindness in the United States.

RISK FACTORS FOR CHRONIC UVEITIS

Articular Features

The classification of JRA describes a heterogeneous group of disorders of predominantly peripheral arthritis with onset of disease before 16 years of age. The 3 major onset types defined by clinical manifestations in the first 6 months of the disease are oligoarticular (pauciarticular), polyarticular, and systemic.[11] The onset type is determined by the systemic features of the illness and the number of joints with arthritis at diagnosis. Oligoarticular JRA is defined by involvement of 4 or fewer joints; polyarticular JRA is defined by involvement of >4 joints (usually 10–20); and systemic-onset JRA is defined by quotidian fevers during the first 6 weeks of the illness, almost always associated with a characteristic rash. Less than 1% of children with systemic-onset JRA develop chronic uveitis.[5,7] Most children with uveitis have an oligoarticular onset.[1,2,7]

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Key Words
juvenile rheumatoid arthritis, ophthalmologic examination

Abbreviation
JRA—juvenile rheumatoid arthritis

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TABLE 1 **Frequency of Ophthalmologic Examination in Patients With JRA**

Type	ANA	Age at Onset, y	Duration of Disease, y	Risk Category	Eye Examination Frequency, mo
Oligoarthritis or polyarthritis	+	≤6	≤4	High	3
	+	≤6	>4	Moderate	6
	+	≤6	>7	Low	12
	+	>6	≤4	Moderate	6
	+	>6	>4	Low	12
	−	≤6	≤4	Moderate	6
	−	≤6	>4	Low	12
	−	>6	NA	Low	12
Systemic disease (fever, rash)	NA	NA	NA	Low	12

ANA indicates antinuclear antibodies; NA, not applicable.
Recommendations for follow-up continue through childhood and adolescence.

Chronic uveitis may be detected at the time of initial diagnosis of arthritis; however, if not present at onset, it most often presents during the next 4 to 7 years.[7,12] The period of highest risk is within 4 years of onset of arthritis, although the risk is never entirely absent.[7,12] Eye involvement precedes involvement of the joints in approximately 5% of cases.

Children with JRA remain at risk of developing uveitis into adulthood. There are reports of uveitis diagnosed initially more than 20 years after onset of arthritis.[13] The activity of the uveal inflammation does not parallel that of the joint disease.[14,15]

Age

Children at greatest risk of developing uveitis are those with oligoarticular-onset JRA.[1,2,13] The peak age of onset of arthritis in oligoarthritis is 1 to 5 years.[12]

Immunogenetic and Serologic Markers

The serologic marker most strongly associated with chronic uveitis is the presence of antinuclear antibodies.[1,2,16] Antinuclear antibodies are present in 65% to 90% of children with chronic uveitis and are a major risk factor for its development.[7,17] They are usually detected in low to moderate titers on HEp-2 cells and are of unknown antigenic specificity. Rheumatoid factor is not usually present in children with JRA, including those with uveitis. Immunogenetic factors may predispose to the development of chronic uveitis. The associated alleles are located predominantly in the major histocompatibility complex (MHC) region on chromosome 6 and involve specificities in the HLA-DR, DP, and DQ regions.[18]

Clinical Characteristics

The onset of ocular inflammation is insidious and asymptomatic in most young children.[1,2,17] Because of the lack of symptoms or the cognitive recognition by the child, the exact time of onset of ocular involvement is frequently difficult to determine. This observation emphasizes the requirement for slit-lamp examination by an ophthalmologist at diagnosis of JRA and periodically thereafter.

Signs or symptoms in older children, rare as they are, may include a red eye, decreased vision, unequal pupils, ocular pain, and headaches and should prompt an urgent eye examination. Most cases of uveitis are bilateral (70% to 80%); unilateral disease may progress to bilateral involvement.

Data compiled before widespread therapy with methotrexate and tumor necrosis factor blockers indicated that the prognosis was good in 25% of cases, and 25% of children responded poorly to treatment and/or might require surgery for cataracts or glaucoma.[3] Approximately 50% of patients required prolonged treatment for moderate to severe chronic inflammation; the visual prognosis in these patients remained guarded. Early and aggressive treatment of intraocular inflammation has helped to reduce the morbidity of the ocular disease.[19]

FREQUENCY OF OPHTHALMOLOGIC EXAMINATIONS IN CHILDREN WITH JRA

The suggested frequency of ophthalmologic visits for children with JRA without known uveitis at diagnosis and during follow-up is presented in Table 1. Once uveitis is diagnosed, the pediatric ophthalmologist will determine the frequency of examinations on the basis of response to therapy and complications. Because a substantial number of patients may have the eye disease before or shortly after their arthritis is diagnosed, they should have their initial eye examination within 1 month of the diagnosis of arthritis rather than waiting for the first available appointment.

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AMERICAN ACADEMY OF PEDIATRICS
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CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Nancy Kellogg, MD; and the Committee on Child Abuse and Neglect

Oral and Dental Aspects of Child Abuse and Neglect

ABSTRACT. In all 50 states, physicians and dentists are required to report suspected cases of abuse and neglect to social service or law enforcement agencies. The purpose of this report is to review the oral and dental aspects of physical and sexual abuse and dental neglect and the role of physicians and dentists in evaluating such conditions. This report addresses the evaluation of bite marks as well as perioral and intraoral injuries, infections, and diseases that may cause suspicion for child abuse or neglect. Physicians receive minimal training in oral health and dental injury and disease and, thus, may not detect dental aspects of abuse or neglect as readily as they do child abuse and neglect involving other areas of the body. Therefore, physicians and dentists are encouraged to collaborate to increase the prevention, detection, and treatment of these conditions. ***Pediatrics*** **2005;116: 1565–1568;** ***bite marks, sexual abuse, physical abuse, dental neglect.***

ABBREVIATION. ABFO, American Board of Forensic Odontology.

PHYSICAL ABUSE

Craniofacial, head, face, and neck injuries occur in more than half of the cases of child abuse.[1–10] A careful and thorough intraoral and perioral examination is necessary in all cases of suspected abuse and neglect. In addition, all suspected victims of abuse or neglect, including children in state custody or foster care, should be examined carefully not only for signs of oral trauma but also for caries, gingivitis, and other oral health problems. Some authorities believe that the oral cavity may be a central focus for physical abuse because of its significance in communication and nutrition.[11] Oral injuries may be inflicted with instruments such as eating utensils or a bottle during forced feedings; hands; fingers; or scalding liquids or caustic substances. The abuse may result in contusions, burns, or lacerations of the tongue, lips, buccal mucosa, palate (soft and hard), gingiva alveolar mucosa, or frenum; fractured, displaced, or avulsed teeth; or facial bone and jaw fractures. In 1 study,[12] the lips were the most common site for inflicted oral injuries (54%), followed by the oral mucosa, teeth, gingiva, and tongue. Discolored teeth, indicating pulpal necrosis, may result from previous trauma.[13,14] Gags applied to the mouth may result in bruises, lichenification, or scarring at the corners of the mouth.[15] Some serious injuries of the oral cavity, including posterior pharyngeal injuries and retropharyngeal abscesses, may be inflicted by caregivers with factitious disorder by proxy[16] to simulate hemoptysis or other symptoms requiring medical care; regardless of caregiver motive, all inflicted injuries should be reported for investigation. Unintentional or accidental injuries to the mouth are common and must be distinguished from abuse by judging whether the history, including the timing and mechanism of injury, is consistent with the characteristics of the injury and the child's developmental capabilities. Multiple injuries, injuries in different stages of healing, or a discrepant history should arouse a suspicion of abuse. Consultation with or referral to a knowledgeable dentist may be helpful.

SEXUAL ABUSE

Although the oral cavity is a frequent site of sexual abuse in children,[17] visible oral injuries or infections are rare. When oral-genital contact is suspected, referral to specialized clinical settings equipped to conduct comprehensive examinations is recommended. The American Academy of Pediatrics statement "Guidelines in the Evaluation of Sexual Abuse of Children"[18] provides information regarding these examinations.

Oral and perioral gonorrhea in prepubertal children, diagnosed with appropriate culture techniques and confirmatory testing, is pathognomonic of sexual abuse[19] but rare among prepubertal girls who are evaluated for sexual abuse.[20] Pharyngeal gonorrhea is frequently asymptomatic.[21] When oral-genital contact is confirmed by history or examination findings, universal testing for sexually transmitted diseases within the oral cavity is controversial; the clinician should consider risk factors (eg, chronic abuse, perpetrator with a known sexually transmitted disease) and the child's clinical presentation in deciding whether to conduct such testing. Although human papillomavirus infection may result in oral or perioral warts, the mode of transmission remains uncertain and debatable. Human papillomavirus infections may be transmitted sexually through oral-genital contact, vertically from mother to infant during birth, or horizontally through nonsexual con-

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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tact from a child or caregiver's hand to the genitals or mouth.[22] Unexplained injury or petechiae of the palate, particularly at the junction of the hard and soft palate, may be evidence of forced oral sex.[23] As with all suspected child abuse or neglect, when sexual abuse is suspected or diagnosed in a child, the case must be reported to child protective services and/or law enforcement agencies for investigation.[24–27] A multidisciplinary child abuse evaluation for the child and family should be initiated.

Children who present acutely with a recent history of sexual abuse may require specialized forensic testing for semen and other foreign materials resulting from assault. If a victim provides a history for oral-penile contact, the buccal mucosa and tongue can be swabbed with a sterile cotton-tipped applicator, then the swab can be air dried and packaged appropriately for laboratory analysis. However, specialized hospitals and clinics equipped with protocols and experienced personnel are best suited for collecting such material and maintaining a chain of evidence necessary for investigations.

BITE MARKS

Acute or healed bite marks may indicate abuse. Dentists trained as forensic odontologists can assist physicians in the detection and evaluation of bite marks related to physical and sexual abuse.[28] Bite marks should be suspected when ecchymoses, abrasions, or lacerations are found in an elliptical or ovoid pattern. Bite marks may have a central area of ecchymoses (contusions) caused by 2 possible phenomena: (1) positive pressure from the closing of the teeth with disruption of small vessels or (2) negative pressure caused by suction and tongue thrusting. Bites produced by dogs and other carnivorous animals tend to tear flesh, whereas human bites compress flesh and can cause abrasions, contusions, and lacerations but rarely avulsions of tissue. An intercanine distance (ie, the linear distance between the central point of the cuspid tips) measuring more than 3.0 cm is suspicious for an adult human bite. [29]

The pattern, size, contour, and color of the bite mark should be evaluated by a forensic odontologist or a forensic pathologist if an odontologist is not available. If neither specialist is available, a physician or dentist experienced in the patterns of child abuse injuries should observe and document the bite-mark characteristics photographically with an identification tag and scale marker (eg, ruler) in the photograph. The photograph should be taken such that the angle of the camera lens is directly over the bite and perpendicular to the plane of the bite to avoid distortion. A special photographic scale was developed by the American Board of Forensic Odontology (ABFO) for this purpose as well as for documenting other patterned injuries and can be obtained from the vendor (ABFO No. 2 reference scale, available from Lightening Powder Co, Inc, 1230 Hoyt St SE, Salem, OR 97302-2121). Names and contact information for ABFO-certified odontologists can be obtained from the ABFO Web site (www.abfo.org). In addition to photographic evidence, every bite mark that shows indentations should have a polyvinyl siloxane impression made immediately after swabbing the bite mark for secretions containing DNA. This impression will help provide a three-dimensional model of the bite mark. Written observations and photographs should be repeated daily for at least 3 days to document the evolution of the bite. Because each person has a characteristic bite pattern, a forensic odontologist may be able to match dental models (casts) of a suspected abuser's teeth with impressions or photographs of the bite.

Blood-group substances can be secreted in saliva. DNA is present in epithelial cells from the mouth and may be deposited in bites. Even if saliva and cells have dried, they should be collected by using the double-swab technique. First, a sterile cotton swab moistened with distilled water is used to wipe the area in question, dried, and placed in a specimen tube. A second sterile, dry cotton swab cleans the same area and then is dried and placed in a specimen tube. A third control sample should be obtained from an uninvolved area of the child's skin. All samples should be sent to a certified forensic laboratory for prompt analysis.[30] The chain of custody must be maintained on all samples submitted for forensic analysis. Questions regarding evidentiary procedure should be directed to a law enforcement agency.

DENTAL NEGLECT

Dental neglect, as defined by the American Academy of Pediatric Dentistry, is the "willful failure of parent or guardian to seek and follow through with treatment necessary to ensure a level of oral health essential for adequate function and freedom from pain and infection."[31] Dental caries, periodontal diseases, and other oral conditions, if left untreated, can lead to pain, infection, and loss of function. These undesirable outcomes can adversely affect learning, communication, nutrition, and other activities necessary for normal growth and development.[32] Some children who first present for dental care have severe early childhood caries (formerly termed "infant bottle" or "nursing" caries); caregivers with adequate knowledge and willful failure to seek care must be differentiated from caregivers without knowledge or awareness of their child's need for dental care in determining the need to report such cases to child protective services.

Failure to seek or obtain proper dental care may result from factors such as family isolation, lack of finances, parental ignorance, or lack of perceived value of oral health.[33] The point at which to consider a parent negligent and to begin intervention occurs after the parent has been properly alerted by a health care professional about the nature and extent of the child's condition, the specific treatment needed, and the mechanism of accessing that treatment.[33] Because many families face challenges in their attempts to access dental care or insurance for their children, the clinician should determine if dental services are readily available and accessible to the child when considering whether negligence has occurred.

The physician or dentist should be certain that the caregivers understand the explanation of the disease and its implications and, when barriers to the needed

care exist, attempt to assist the families in finding financial aid, transportation, or public facilities for needed services. Parents should be reassured that appropriate analgesic and anesthetic procedures will be used to ensure the child's comfort during dental procedures. If, despite these efforts, the parents fail to obtain therapy, the case should be reported to the appropriate child protective services agency.[31,33]

CONCLUSIONS

Pediatricians should be aware that physical or sexual abuse may result in oral or dental injuries or conditions that sometimes can be confirmed by laboratory findings. Furthermore, injuries inflicted by one's mouth or teeth may leave clues regarding the timing and nature of the injury as well as the identity of the perpetrator. Pediatricians are encouraged to be knowledgeable about such findings and their significance and to meticulously observe and document them. When questions arise or when consultation is needed, a pediatric dentist or a dentist with formal training in forensic odontology can ensure appropriate testing, diagnosis, and treatment.

Pediatric dentists and oral and maxillofacial surgeons, whose advanced education programs include a mandated child abuse curriculum, can provide valuable information and assistance to physicians about oral and dental aspects of child abuse and neglect. The Prevent Abuse and Neglect Through Dental Awareness (also known as PANDA; telephone: 501-661-2595; e-mail: lmouden@healthyarkansas.com) coalition, which has trained thousands of physicians, nurses, teachers, child care providers, dentists, and dental auxiliaries, is another resource for physicians seeking information on this issue. Physician members of multidisciplinary child abuse and neglect teams are encouraged to identify such dentists in their communities to serve as consultants for these teams. In addition, physicians with experience or expertise in child abuse and neglect can make themselves available to dentists and dental organizations as consultants and educators. Such efforts will strengthen our ability to prevent and detect child abuse and neglect and enhance our ability to care for and protect children.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Section on Pediatric Dentistry

Oral Health Risk Assessment Timing and Establishment of the Dental Home

ABSTRACT. Early childhood dental caries has been reported by the Centers for Disease Control and Prevention to be perhaps the most prevalent infectious disease of our nation's children. Early childhood dental caries occurs in all racial and socioeconomic groups; however, it tends to be more prevalent in low-income children, in whom it occurs in epidemic proportions. Dental caries results from an overgrowth of specific organisms that are a part of normally occurring human flora. Human dental flora is site specific, and an infant is not colonized until the eruption of the primary dentition at approximately 6 to 30 months of age. The most likely source of inoculation of an infant's dental flora is the mother or another intimate care provider, through shared utensils, etc. Decreasing the level of cariogenic organisms in the mother's dental flora at the time of colonization can significantly impact the child's predisposition to caries. To prevent caries in children, high-risk individuals must be identified at an early age (preferably high-risk mothers during prenatal care), and aggressive strategies should be adopted, including anticipatory guidance, behavior modifications (oral hygiene and feeding practices), and establishment of a dental home by 1 year of age for children deemed at risk.

INTRODUCTION

The Centers for Disease Control and Prevention reports that dental caries is perhaps the most prevalent of infectious diseases in our nation's children. Dental caries is 5 times more common than asthma and 7 times more common than hay fever in children.[1] More than 40% of children have tooth decay by the time they reach kindergarten.[2] Infants who are of low socioeconomic status, whose mothers have a low education level, and who consume sugary foods are 32 times more likely to have caries at the age of 3 years than children in whom those risk factors are not present.[3] Decay of primary teeth can affect children's growth, lead to malocclusion, and result in significant pain and potentially life-threatening swelling. Because pediatricians and other pediatric health care professionals are far more likely to encounter new mothers and infants than are dentists, it is essential that they be aware of the infectious pathophysiology and associated risk factors of early childhood dental caries to make appropriate decisions regarding timely and effective intervention. Dental decay can be well advanced by 3 years of age.

BACKGROUND

Dental caries results from an overgrowth of specific organisms that are part of normally occurring human dental flora.[4] *Streptococcus mutans* and *Lactobacillus* species are considered to be principal indicator organisms of those of aciduric bacteria responsible for caries. Human dental flora is site specific, and an infant is not colonized with normal dental flora until the eruption of the primary dentition at approximately 6 to 30 months of age.[5,6] The vertical colonization of *S mutans* from mother to infant is well documented.[7,8] In fact, genotypes of *S mutans* in infants appear identical to those present in mothers in approximately 71% of mother-infant pairs.[9] Furthermore, evidence suggests that specific organisms exhibit discrete windows of inoculation; the acquisition of *S mutans* occurs at an average age of approximately 2 years.[10]

The significance of this information becomes focused when considering 3 points. First, high caries rates run in families[11] and are passed from mother to child from generation to generation. The children of mothers with high caries rates are at a higher risk of decay.[12] Second, approximately 70% of all dental caries are found in 20% of our nation's children.[13] Third, the modification of the mother's dental flora at the time of the infant's colonization can significantly impact the child's caries rate.[14–16] Therefore, an oral health risk assessment before 1 year of age affords the opportunity to identify high-risk patients and to provide timely referral and intervention for the child and allows an invaluable opportunity to decrease the level of cariogenic organisms in the mother with a significant caries risk before and during colonization of the infant.

BASIC PREVENTIVE STRATEGIES

Historically, the approach to preventing the development of dental caries has been to establish and maintain good oral hygiene, optimize systemic and topical fluoride exposure, and eliminate prolonged exposure to simple sugars in the diet. The success of this age-old approach is also the foundation for the ideal standard of establishment of the dental home

by 1 year of age, as endorsed by the American Dental Association, the American Academy of Pediatric Dentistry, supporting organizations of Bright Futures, and numerous other children's health organizations.

Dental caries typically results from diet-mediated shifts in dental bacterial populations that favor acidogenic-aciduric (cariogenic) organisms.[17] The judicious optimization of diet, fluoride intake, and hygiene reverses the aciduric shift, resulting in fewer cariogenic flora and decreased rates of caries. Clinical observations suggest that aciduric shifts are often associated with pregnancy, with return to prepregnancy cariogenic-benign flora ratio occurring on the same timeline as the colonization of the infant with dental flora (6 to 30 months of age). The overall strategy is to lower the numbers of cariogenic bacteria in the mother's mouth and delay colonization as long as possible (avoid sharing of spoons, orally cleansing pacifiers, etc).

Tooth decay is a disease that is, by and large, preventable. Because of how it is caused and when it begins, however, steps to prevent it ideally should begin prenatally with pregnant women and continue with the mother and young child, beginning when the infant is approximately 6 months of age. The primary thrust of early risk assessment is to screen for parent-infant groups who are at risk of early childhood dental caries and would benefit from early aggressive intervention. The ultimate goal of early assessment is the timely delivery of educational information to populations at high risk of caries to avoid the need for later surgical intervention.

ORAL HEALTH RISK ASSESSMENT

Every child should begin to receive oral health risk assessments by 6 months of age by a qualified pediatrician or a qualified pediatric health care professional. The Caries Risk Assessment Tool (provided and continually updated by the American Academy of Pediatric Dentistry and available at http://www.aapd.org/members/referencemanual/pdfs/02-03/Caries%20Risk%20Assess.pdf) can be used to determine the relative risk of caries of the patient. In the case of the very young patient, a risk assessment to identify parents (usually mothers) and infants with a high predisposition to caries can easily be performed by taking a simple dental history from a new mother. Questions directed at dietary practices, fluoride exposure, oral hygiene, utilization of dental services, and the number and location of the mother's dental fillings can give a relative indication of the mother's baseline decay potential. Frequent sugar intake, low fluoride exposure, poor oral hygiene practices, infrequent utilization of dental services and/or active decay and/or multiple dental fillings in multiple quadrants of the mouth indicates a high caries risk in the mother. Because the dental history of the mother has a direct correlation to that of her infant, it is justifiable and appropriate for the pediatrician to garner permission to examine the mother's dentition and gingival tissues. Additionally, clinical observations suggest that second and third infants tend to be colonized earlier, when the mother's cariogenic flora is at a higher level. Therefore, the later-order offspring of a mother with mildly to moderately high caries rate may be at higher risk of caries than are offspring born earlier. Unfortunately, the lack of accessible longitudinal dental databases has not yet allowed these observations to be epidemiologically confirmed.

RISK GROUPS FOR DENTAL CARIES

The caries risk potential of an infant can be determined by the use of the Caries Risk Assessment Tool. However, even the most judiciously designed and implemented caries risk assessment tool can fail to identify all infants at risk of early childhood dental caries. If an infant is assessed to be within 1 of the following risk groups, the care requirements would be significant and surgically invasive; therefore, these infants should be referred to a dentist as early as 6 months of age and no later than 6 months after the first tooth erupts or 12 months of age (whichever comes first) for establishment of a dental home:

- Children with special health care needs
- Children of mothers with a high caries rate
- Children with demonstrable caries, plaque, demineralization, and/or staining
- Children who sleep with a bottle or breastfeed throughout the night
- Later-order offspring
- Children in families of low socioeconomic status

Despite all efforts to predict children at high risk of caries, patients can and do fall outside statistical expectations. In these cases, the mother may not be the colonization source of the child's dental flora, the dietary intake of simple carbohydrates may be extremely high, or other uncontrollable factors may combine to place the patient at risk of caries. Therefore, screening for risk of caries in the parent and patient coupled with oral health counseling, although a feasible and equitable approach to early childhood caries control, is not a substitute for early establishment of the dental home. Whenever possible, the ideal approach to early childhood caries prevention and management is the early establishment of a dental home.

ESTABLISHING THE DENTAL HOME

The concept of the "dental home" is derived from the American Academy of Pediatrics concept of the "medical home." The American Academy of Pediatrics states, "the medical care of infants, children, and adolescents ideally should be accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective. It should be delivered or directed by well-trained physicians who provide primary care and help to manage and facilitate essentially all aspects of pediatric care."[18] Pediatric primary dental care needs to be delivered in a similar manner. The dental home is a specialized primary dental care provider within the philosophical complex of the medical home. Referring a child for an oral health examination by a dentist who provides care for infants and young children

6 months after the first tooth erupts or by 12 months of age establishes the child's dental home and provides an opportunity to implement preventive dental health habits that meet each child's unique needs and keep the child free from dental or oral disease. The dental home should be expected to provide:

- An accurate risk assessment for dental diseases and conditions
- An individualized preventive dental health program based on the risk assessment
- Anticipatory guidance about growth and development issues (ie, teething, digit or pacifier habits, and feeding practices)
- A plan for emergency dental trauma
- Information about proper care of the child's teeth and gingival tissues
- Information regarding proper nutrition and dietary practices
- Comprehensive dental care in accordance with accepted guidelines and periodicity schedules for pediatric dental health
- Referrals to other dental specialists, such as endodontists, oral surgeons, orthodontists, and periodontists, when care cannot be provided directly within the dental home

ANTICIPATORY GUIDANCE AND PARENT AND PATIENT EDUCATION

General anticipatory guidance for the mother (or other intimate caregiver) before and during the colonization process should include the following:

- Oral hygiene—the parent should be instructed to brush thoroughly twice daily (morning and evening) and to floss at least once every day.
- Diet—the parent should be instructed to consume fruit juices only at meals and to avoid all carbonated beverages during the first 30 months of the infant's life.
- Fluoride—the parent should be instructed to use a fluoride toothpaste approved by the American Dental Association and rinse every night with an alcohol-free over-the-counter mouth rinse with 0.05% sodium fluoride.
- Caries removal—parents should be referred to a dentist for an examination and restoration of all active decay as soon as feasible.
- Delay of colonization—mothers should be educated to prevent early colonization of dental flora in their infants by avoiding sharing of utensils (ie, shared spoons, cleaning a dropped pacifier with their saliva, etc).
- Xylitol chewing gums—recent evidence suggests that the use of xylitol chewing gum (4 pieces per day by mother) had a significant impact on decreasing the child's caries rates.[16]

General anticipatory guidance for the young patient (0 to 3 years of age) should include the following:

- Oral hygiene—the parent should begin to brush the child's teeth as soon as they erupt (twice daily, morning and evening) and floss between the child's teeth once every day as soon as teeth contact one another.
- Diet—after the eruption of the first teeth, the parent should provide fruit juices (not to exceed 1 cup per day) during meals only. Carbonated beverages should be excluded from the child's diet. Infants should not be placed in bed with a bottle containing anything other than water. Ideally, infants should have their mouths cleansed with a damp cloth after feedings.
- Fluoride—all children should have optimal exposure to topical and systemic fluoride. Caution should be exercised in the administration of all fluoride-containing products. The specific considerations of the judicious administration of fluoride should be reviewed and tailored to the unique needs of each patient. Review articles with applicable fluoride recommendations and supplementation algorithms are available.[19–22]

RECOMMENDATIONS

1. Early childhood caries is an infectious and preventable disease that is vertically transmitted from mothers or other intimate caregivers to infants. All health care professionals who serve mothers and infants should integrate parent and caregiver education into their practices that instruct effective methods of prevention of early childhood caries.
2. The infectious and transmissible nature of bacteria that cause early childhood caries and methods of oral health risk assessment, anticipatory guidance, and early intervention should be included in the curriculum of all pediatric medical residency programs and postgraduate continuing medical education curricula at an appropriate time.
3. Every child should begin to receive oral health risk assessments by 6 months of age from a pediatrician or a qualified pediatric health care professional.
4. Pediatricians, family practitioners, and pediatric nurse practitioners and physician assistants should be trained to perform an oral health risk assessment on all children beginning by 6 months of age to identify known risk factors for early childhood dental caries.
5. Infants identified as having significant risk of caries or assessed to be within 1 of the risk groups listed in this statement should be entered into an aggressive anticipatory guidance and intervention program provided by a dentist between 6 and 12 months of age.
6. Pediatricians should support the concept of the identification of a dental home as an ideal for all children in the early toddler years.

SUMMARY

Early childhood dental caries emerges within all cultural and economic pediatric populations; however, it approaches near epidemic proportions in populations with low socioeconomic status. Dental caries is an infectious disease usually passed from mother to child from generation to generation. Judicious optimization of diet, fluoride intake, and hy-

giene can decrease bacterial levels of specific organisms responsible for dental caries residing within normal dental flora. Decreasing the levels of cariogenic flora in the mother before and during the colonization process coupled with counseling directed toward optimal practices of diet, oral hygiene, and fluoride exposure can significantly and positively impact the child's predisposition to early childhood caries.

Pediatricians and pediatric health care professionals should develop the knowledge base to perform oral health risk assessments on all patients beginning at 6 months of age. Patients who have been determined to be at risk of development of dental caries or who fall into recognized risk groups should be directed to establish a dental home 6 months after the first tooth erupts or by 1 year of age (whichever comes first).

The ideal deterrence to early childhood caries is the establishment of the dental home when indicated by the unique needs of the child. Although not always feasible because of manpower and participation issues, best practice dictates that whenever feasible, all patients should have a comprehensive dental examination by a dentist in the early toddler years.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness and Committee on School Health

Organized Sports for Children and Preadolescents

ABSTRACT. Participation in organized sports provides an opportunity for young people to increase their physical activity and develop physical and social skills. However, when the demands and expectations of organized sports exceed the maturation and readiness of the participant, the positive aspects of participation can be negated. The nature of parental or adult involvement can also influence the degree to which participation in organized sports is a positive experience for preadolescents. This updates a previous policy statement on athletics for preadolescents and incorporates guidelines for sports participation for preschool children. Recommendations are offered on how pediatricians can help determine a child's readiness to participate, how risks can be minimized, and how child-oriented goals can be maximized.

INTRODUCTION

Participation in organized sports can have physical and social benefits for children. However, the younger the participant, the greater the concern about safety and benefits. The involvement of preadolescents in organized sports is a relatively recent phenomenon. In the early 20th century, physical activity was a more regular part of life for the average child. Sports and games provided an additional outlet for physical activity and were characterized by play that was generally spontaneous, unstructured, and without adult involvement. Participation in such sports and games allowed for development of motor skills, social interaction, creativity, and enjoyment for participants.

During the latter part of the 20th century, "free play" or unstructured games primarily gave way to organized sports. The starting age for organized sports programs has also evolved to the point that infant and preschool training programs are now available for many sports. Organization of sports has potential benefits of coaching, supervision, safety rules, and proper equipment but can also create demands and expectations that exceed the readiness and capabilities of young participants. Organization can also shift the focus to goals that are not necessarily child oriented. Clearly, the nature of the organization can determine if it has a positive or negative influence.

This statement is an update to a previous policy statement on athletics for preadolescents[1] and incorporates guidelines for sports participation for preschool children.[2] Recommendations are made on how pediatricians can help determine a child's readiness to participate in organized sports, how risks can be minimized, and how child-oriented goals can be maximized.

ORGANIZED SPORTS PROGRAMS: LIMITATIONS AND RISKS

The effects of organized sports participation on growth and maturation have come under question, as have the effects of growth and maturation on the ability to participate in sports. Because children are beginning to train and compete at earlier ages, there is increasing concern about potential negative effects on growth and maturation. Reports of gymnasts and divers with short stature or ballet dancers with lean body types or late menarche have contributed to such concerns. Despite such reports, it is unclear if these characteristics were a result of intensive training or other factors, such as dietary practices, psychological and emotional stress, or selection bias for the sport.[3]

The effects of immaturity on sports participation are more obvious. When the demands of a sport exceed a child's cognitive and physical development, the child may develop feelings of failure and frustration. Even with coaches available to teach rules and skills of a sport, children may not be ready to learn or understand what is being taught. Furthermore, many coaches are not equipped to deal with the needs or abilities of children. Basic motor skills, such as throwing, catching, kicking, and hitting a ball, do not develop sooner simply as a result of introducing them to children at an earlier age.[4] Teaching or expecting these skills to develop before children are developmentally ready is more likely to cause frustration than long-term success in the sport.[5] Because most youth sports coaches are volunteers with little or no formal training in child development, they cannot be expected to correctly match demands of a sport with a child's readiness to participate. Educational programs are available for youth sports coaches, but most coaches do not participate. Nonetheless, coaches may still try to teach what often cannot be learned and blame resulting failures on shortcomings of athletes or themselves.

Parental or adult supervision of children's activity is usually considered to be desirable. However, in organized sports, inappropriate or overzealous parental or adult influences can have negative effects. Adults' involvement in children's sports activities may bring goals or outcome measures that are not oriented toward young participants. Tournaments, all-star teams, most valuable player awards, tro-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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phies, and awards banquets are by-products of adult influences. Despite good intentions, increased involvement of adults does not necessarily enhance the child athlete's enjoyment. The familiar image of a parent imploring their 5-year-old to "catch the ball," "kick the ball," or "run faster" is a reminder of how adult encouragement can have discouraging effects.

ORGANIZED SPORTS PROGRAMS: BENEFITS

In contrast to unstructured or free play, participation in organized sports provides a greater opportunity to develop rules specifically designed for health and safety. Organization can allow for the establishment of developmentally sound criteria for determining readiness to play. Organization can also allow for a fair process in choosing teams,[6] matching competitors,[7] and enforcing rules. Rules specifically targeted at younger athletes can reduce injuries. Recommendations have been made to limit dangerous practices, such as headfirst sliding in baseball[8] and body checking in hockey.[9] Safety accommodations associated with organized youth sports can also include smaller playing fields, shorter contest times, pitch counts for Little League pitchers, softer baseballs, matching opponents by weight in youth football, and adjusting play for extreme climatic conditions.[10] The availability of qualified coaches in organized sports can be a key factor in providing safety and a positive experience.

In this regard, the effects of organization provide positive environments for young participants. Unfortunately, not all youth sports participants have access to all known safety measures. Furthermore, a great deal remains to be learned about safety in youth sports. Additional resources are needed to study injury prevention and ensure that all participants will benefit from existing safety measures. The prospects for additional development and implementation of safety measures are far greater for organized sports than for unstructured free play.

Despite many potential benefits of organization, there is no consensus as to the overall value of organized sports for preadolescents. A return to the days of free play has been suggested as one means to eliminate negative aspects of organized sports. Unfortunately, the days when children had the time, opportunity, or inclination to play in neighborhoods or local parks have passed. Today, there are more demands on a young person's time, more options for free time, diminished requirements for regular physical activity, and fewer opportunities for free play. School-based physical education programs have also been reduced throughout the years and can no longer be relied on to provide adequate levels of healthy activity.[11]

Regular physical activity can help reduce the risk of many adult health problems, including diabetes, obesity, and heart disease.[12] However, with less time dedicated to free play and school physical education programs, the result may be lower activity levels and lower levels of fitness for children. There is a greater need to protect opportunities for structured and unstructured physical activity for children. Organized sports may not provide all physical activity needs but can be a viable means to increase activity levels in children and, hopefully, lead to the adoption of active lifestyles as adults.

Organized Sports Programs: Optimizing the Benefit-to-Risk Ratio

If organized sports are going to be safe, healthy, and beneficial for children and preadolescents, there must be reasonable goals for participation and appropriate strategies to attain these goals. Reasonable goals for children and preadolescents participating in organized sports include acquisition of basic motor skills, increasing physical activity levels, learning social skills necessary to work as a team, learning good sportsmanship, and having fun.[13]

Organized sports sessions should be tailored to match the developmental level of participants. Most preschool children have short attention spans and are easily distracted; therefore, exercise sessions should be short and emphasize playfulness, experimentation, and exploration of a wide variety of movement experiences. A reasonable format would consist of no longer than 15 to 20 minutes of structured activity combined with 30 minutes of free play. Concentration will be maximized if instructional sessions take place in a setting with minimal distraction. Instructing younger children using a show-and-tell format with physical demonstration may be more effective than with verbal instruction.

For children and preadolescents, factors such as fun, success, variety, freedom, family participation, peer support, and enthusiastic leadership encourage and maintain participation, whereas others such as failure, embarrassment, competition, boredom, regimentation, and injuries discourage subsequent participation.[14]

Pediatricians, as experts in child development, can help parents and coaches determine readiness of a child to participate in organized sports. Readiness is often defined relative to the demands of the sport. Because different sports and even the same sport may vary widely with respect to demands and expectations, pediatricians must understand these demands to help determine if they are appropriate for the physical and cognitive maturation of participants. Preparticipation examinations are typically not mandated until junior high and high school. However, annual examinations for younger children afford an opportunity to promote physical activity and address issues of readiness as they apply to organized sports.

Pediatricians can further advocate safe sports participation by promoting better education and training of youth sports coaches. Standards for coaching competency are available, and certification for youth sports coaches should address these competencies.[15] In addition, pediatricians can work with sports administrators and coaches within their community to share relevant information on child development, injury assessment, first aid, and injury prevention. Pediatricians can also take an active role in developing safety programs while ensuring that existing safety measures are observed. A pediatrician may be

one of the few adults who can objectively determine when pressures and expectations of organized sports become excessive for any individual or group. Finally, pediatricians can serve as role models for appropriate sideline behavior and can help parents and other adults remember the reasons children want to participate.

SUMMARY AND RECOMMENDATIONS

Organized sports for children and preadolescents provide an opportunity for increased physical activity and an opportunity to learn sports and team skills in an environment where risks of participation can potentially be controlled. Unfortunately, when demands and expectations of the sport exceed the maturation or readiness of the participant, benefits of participation are offset. The shift from child-oriented goals to adult-oriented goals can further negate positive aspects of organized sports.

To optimize the safety and benefits of organized sports for children and preadolescents and to preserve this valuable opportunity for young people to increase their physical activity levels, the American Academy of Pediatrics recommends the following:

1. Organized sports programs for preadolescents should complement, not replace, the regular physical activity that is a part of free play, child-organized games, recreational sports, and physical education programs in the schools. Regular physical activity should be encouraged for all children whether they participate in organized sports or not.
2. Pediatricians are encouraged to help assess developmental readiness and medical suitability for children and preadolescents to participate in organized sports and assist in matching a child's physical, social, and cognitive maturity with appropriate sports activities.
3. Pediatricians can take an active role in youth sports organizations by educating coaches about developmental and safety issues, monitoring the health and safety of children involved in organized sports, and advising committees on rules and safety.
4. Pediatricians are encouraged to take an active role in identifying and preserving goals of sports that best serve young athletes.
5. Additional research and resources are needed to:
   a. determine the optimal time for children to begin participating in organized sports;
   b. identify safe and effective training strategies for growing and developing athletes;
   c. educate youth sports coaches about unique needs and characteristics of young athletes; and
   d. develop effective injury prevention strategies.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine

Overcrowding Crisis in Our Nation's Emergency Departments: Is Our Safety Net Unraveling?

ABSTRACT. Emergency departments (EDs) are a vital component in our health care safety net, available 24 hours a day, 7 days a week, for all who require care. There has been a steady increase in the volume and acuity of patient visits to EDs, now with well over 100 million Americans (30 million children) receiving emergency care annually. This rise in ED utilization has effectively saturated the capacity of EDs and emergency medical services in many communities. The resulting phenomenon, commonly referred to as ED overcrowding, now threatens access to emergency services for those who need them the most. As managers of the pediatric medical home and advocates for children and optimal pediatric health care, there is a very important role for pediatricians and the American Academy of Pediatrics in guiding health policy decision-makers toward effective solutions that promote the medical home and timely access to emergency care. ***Pediatrics*** **2004;114:878–888;** ***access to emergency care, ambulance diversion, emergency medical services for children, EMTALA, emergency department overcrowding.***

ABBREVIATIONS. ED, emergency department; EMS, emergency medical services; ACEP, American College of Emergency Physicians; AHA, American Hospital Association; GAO, US General Accounting Office; EMTALA, Emergency Medical Treatment and Active Labor Act; MSE, medical screening examination; SCHIP, State Children's Health Insurance Program; IOM, Institute of Medicine.

INTRODUCTION

Much has been written about the use of emergency services. A prophetic 1958 study examining a significant increase in emergency department (ED) utilization suggested that physicians and hospitals should plan for the future by increasing the number of emergency facilities.[1] Since that time, the number of ED visits in the United States has increased more than 600%, with an estimated 108 million ED visits in 2000.[2] Thirty million of those ED visits were for children 0 to 18 years of age.[2]

Over the past 2 decades, there has been increasing concern about this dramatic growth in ED visits. During the mid-1980s and early 1990s, many health care policy analysts viewed these increases as evidence of overutilization of EDs, specifically for nonemergent problems.[3,4] Armed with data suggesting that care provided in the ED was more expensive and perhaps less effective, policy-makers and managed care organizations worked to limit patients' access to emergency care. This perception was perhaps best summarized in 1993 by President Clinton, who in a nationally televised speech to Congress and the nation referred to EDs as "the most expensive place of all" to get care.[5]

In the past decade, physicians and administrators responsible for the management of municipal emergency medical services (EMS) systems and hospital EDs have been voicing their concern regarding the capacity of their services. Their concern has been driven by an increasingly familiar phenomenon, overcrowding of EDs, which has worsened to the point of crisis in certain communities.[6–13] Surprisingly, this saturation of emergency services is not primarily a result of excessive, inappropriate use of the ED by those with nonemergent problems. It is a byproduct of increasing numbers of patients with serious illnesses or injuries requiring hospital and/or intensive care unit admission.[14,15] Evidence of the severity of the problem may be found in numerous articles in the lay press and in publications from the American College of Emergency Physicians (ACEP),[16–19] the Emergency Nurses Association,[20,21] and the American Hospital Association (AHA)[22–24] and in peer-reviewed journals such as *Academic Emergency Medicine*, which recently devoted an entire issue to this crisis and its related problems.[25] The US Senate has commissioned a study of ED overcrowding, as reported by the US General Accounting Office (GAO) in March 2003.[26] This problem has also garnered the attention of the Joint Commission on Accreditation of Healthcare Organizations, which developed a standard regarding overcrowding for publication in the *2004 Hospital Accreditation Manual*.[27]

So, how did this happen, what are the implications, and what can pediatric health care professionals do to help? ED overcrowding has evolved from a complex series of problems. An understanding of the key legislative, social, and health care economic factors that have led us to where we are today is warranted before considering potential solutions.

THE EMERGENCY MEDICAL TREATMENT AND ACTIVE LABOR ACT: THE UNDERFUNDED FEDERAL MANDATE FOR UNIVERSAL HEALTH CARE

The Emergency Medical Treatment and Active Labor Act (EMTALA) was enacted in 1985 as part of the

Consolidated Omnibus Budget Reconciliation Act. Its purpose was to protect the rights of indigent patients seeking emergency care.[28] The law was a response to the practice of patient "dumping," the refusal of a hospital (and/or hospital-based physicians) to provide emergency care for patients who could not pay for their care. This regulation requires all Medicare-participating hospitals to provide a medical screening examination (MSE) for all patients who present for care to the ED regardless of their ability to pay.[29–31]

Subsequent revisions, reinterpretation, and increased enforcement of this law over the past decade have expanded the reach of EMTALA, delineating the responsibility of hospitals, EDs, and their physicians to provide services to all patients who request them in a nondiscriminatory and consistent manner. The law specifies that the scope of the MSE should include all ancillary services routinely available to the ED, such as physician consultation and inpatient care, if required.[32] In the absence of a national universal health benefits program, hospital EDs are essentially the only place in our current health care system at which all patients are guaranteed medical care.[3,4,29,33]

Although clearly intended to promote the public good, EMTALA poses a profound economic challenge for hospitals and emergency care professionals, because this mandate for care does not carry with it a mandate for reimbursement for services rendered. Nationwide, EMTALA requirements are estimated to cost emergency care professionals more than $425 million annually.[17] Mitchell and Remmel[34] projected the financial impact of uncompensated emergency care in the state of Florida to reach an annual cost of $100 000 per emergency physician. This "free care" was estimated to be 5 times the amount provided by primary care physicians in that state. National data from 1998 suggest that the total direct expense for emergency physician services provided to uninsured patients approximated $1 billion.[17,35] Hospital facility costs for this same group of patients exceeded another $2 billion.[29,35] This incredible economic burden is exacerbated by insufficient Medicare reimbursement, which frequently fails to cover the direct costs of either the hospital facility or the emergency physician. In most states, services provided under Medicaid are reimbursed at 30% to 50% less than the same services provided under Medicare, creating an even greater funding gap for those providing care to our nation's 44.3 million Medicaid recipients.[36,37] It is little wonder that these financial stresses have resulted in the closure of nearly 500 hospitals and more than 1000 EDs over the past decade.[38]

More recently, the Centers for Medicare and Medicaid Services published a set of rule changes[39] that seem to be an effort at moving the law back toward its original intent as well as giving the courts clearer guidance for enforcement. The new rules clarify that a hospital must maintain an on-call physician list "that best meets the needs of the hospital's patients."[39] Physicians no longer have to be available all the time, but the hospital must have a written policy on how to deal with times when the on-call specialist is unavailable. Although this seems to be good news for rural and smaller hospitals and their medical staff members who have struggled to provide 24-hour coverage, this relaxation ultimately could contribute to a greater reliance on hospitals that suffer the most from overcrowding: large urban tertiary care centers, trauma centers, and academic medical centers.

Although EMTALA interpretation and enforcement has become increasingly punitive,[40,41] EMTALA is arguably more important today than when it was first enacted. With growing numbers of uninsured Americans, more physicians opting not to provide services to Medicaid and Medicare beneficiaries, and a failing public health and social welfare network, the ED has become one of the few reliable points of health care access in an unraveling safety net.[3,4,25,42–45]

THE EXPANDING ROLE OF THE ED IN A SHRINKING PUBLIC HEALTH SAFETY NET

Hospital EDs hold a very strategic position in the continuum of care in our society. Accessible and always open, the ED remains one of the few institutions available to aid all persons. Services are provided regardless of economic or social status and without an appointment. As previously noted, this societal responsibility has been both affirmed and mandated through federal legislation.

The importance of the ED's role has increased over the past decade as other public health and social care programs have eroded. Many people in need do not qualify for public support or are unable to take advantage of services to which they are entitled, including several million uninsured and underinsured children who could qualify for Medicaid or State Children's Health Insurance Program (SCHIP) benefits.[46,47] Disadvantaged Americans may pass through the entrance of an ED more than any other public institution. Some have suggested that this represents a remarkable opportunity for EDs to serve the needs of the disadvantaged by developing their full potential as social welfare institutions.[48–51]

In 2000, the Institute of Medicine (IOM) published a report titled *America's Health Care Safety Net: Intact but Endangered*.[52] The goal of the IOM was to "examine the impact of Medicaid managed care and other changes in health care coverage on the future viability of safety net providers operating primarily in ambulatory and primary care settings."[52] In its report, the IOM panel expressed grave concern for the current and future state of our nation's unraveling health care safety net and the vulnerable populations it serves. The report described several trends that seem to threaten the viability of safety net providers. These trends included inadequate monitoring of safety net viability and function, poor integration of services, financial instability of core safety net providers, and rapid shifts to Medicaid managed care.[44] Although this report did not specifically focus on the role played by EDs, it is clear that EDs meet the 2 defining characteristics of core safety net providers: 1) maintenance of an open-door policy, offering ser-

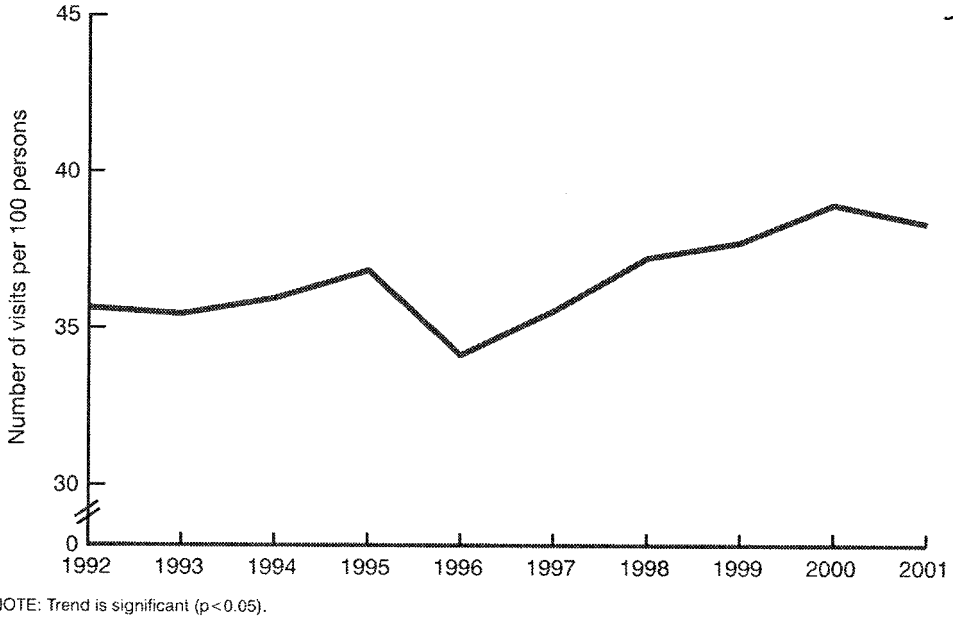

Fig. 1. Trend in ED visit rates: United States, 1992–2001. Source: McCaig LF, Burt CW. *National Hospital Ambulatory Medical Care Survey: 2001 Emergency Department Summary.* Hyattsville, MD: National Center for Health Statistics; 2003.

vices to patients regardless of their ability to pay; and 2) caring for a patient mix with a substantial share of Medicaid, uninsured, and other vulnerable populations.[52]

The number of uninsured Americans has grown steadily every year, even during the economic boom of the 1990s. In our nation of amazing wealth, there is also great poverty. There were approximately 43.6 million uninsured Americans in 2002, including 12.5 million children through 21 years of age. In fact, the proportion of the nonelderly American population (younger than 65 years) with health insurance coverage decreased in 2002 to a post-1987 low of 82.7%.[53] Although difficult to assess, there are between 4 and 13 million homeless persons in America.[54] More than 30% of children younger than 21 years (24.2 million) receive their health care benefits through the Medicaid program.[37] Although there are data showing that the Medicaid program has significantly improved the primary care access of impoverished children,[46,47,55,56] the program has fallen far short of creating equity between Medicaid beneficiaries and children living above the poverty line.[46,47,55–57]

An analysis of data from the 1988 National Health Interview Survey provides additional insight into the problem. Indigent children with Medicaid insurance were more likely to have a regular source of health care than those without Medicaid coverage. However, in comparison with children living above the poverty line, poor children with Medicaid were less likely to receive routine care in a physician's office, were more likely to lack continuity between their usual sources for sick and well care, and were more likely to identify hospital EDs as their preferred source for sick care.[46] In all, the survey determined that 6 million children lacked a usual source for primary care, and 12 million had not made a timely visit for preventive health care.[46] Although studies a decade later indicated significant improvement in access to care for Medicaid beneficiaries, these children are still less likely to have a consistent source of health care and are 3 times more likely to have unmet health needs than are nonpoor children with private insurance.[57,58] Recent studies by the GAO indicate that less than half of Medicaid and SCHIP recipients have received early and periodic screening, diagnosis, and treatment services and that most states are doing little to monitor the use of primary or preventive health care services in this vulnerable population.[59,60]

Complaint urgency aside, inadequate or inaccessible sources of primary care are frequently cited as the most common reason for use of emergency services.[61–66] Studies examining the use of EDs by children for routine sick care have found several key demographic risk factors for "excessive" ED use, including black versus white race, single versus 2-parent family, parent with less than high school education versus education at the high school level or greater, poor versus nonpoor, and urban versus suburban location.[67] Children who receive their usual care in a neighborhood health clinic seem to be twice as likely as private-office practice patients to seek care in the ED. Furthermore, the absence of readily available primary care physicians is significantly associated (twofold increase) with ED use.[67]

What remains unclear is the role that health insurance plays in the use of emergency services. Data for 1998 from the National Center for Health Statistics indicate different utilization rates for commercially insured (19.9 visits per 100 individuals), Medicaid (64.2 visits per 100 individuals), and uninsured (34.2 visits per 100 individuals) patient groups.[29,68] Viewed as a proportion of total ambulatory care utilization, data from the 2001 National Ambulatory Medical Care Survey indicate that ED visits represented 25% of all outpatient use by the uninsured versus 17.5% by Medicaid recipients and nearly 8% by those with private insurance.[69] Although it would

seem that Medicaid and uninsured patients are more likely to use the ED for acute episodic care, when one controls for confounding variables, this does not hold true.[70] Several studies have found that the lack of an established primary care relationship or the lack of accessible primary care services (not the lack of health insurance) are the primary risk factors for nonurgent ED visits.[61,67,71,72] In fact, it was the steady growth in the utilization of emergency services by privately insured patients that represented the largest segment of increased ED visits between 1996 and 2001 (Fig 1).[73]

A primary influence for the great attention and concern regarding ED utilization by these populations is the well-held perception of a relatively high cost for those services. Various studies have suggested cost differentials between ED care and the same care in a doctor's office to be between 50% and 100%.[3] Although charges are a poor reflection of true cost, the relative cost of ED care may be best understood through an analysis of marginal cost, or the cost of seeing 1 additional patient. In a study of 6 EDs in Michigan, Williams[35] found the marginal cost (the direct cost incurred from providing care for 1 additional patient) of an urgent ED visit to be $148, whereas for nonurgent visits, that cost was only $24, an amount likely less than the marginal cost associated with keeping a doctor's office open after regular office hours for nonurgent patient visits. In other words, EDs may be a cost-effective solution for certain components of after-hours ambulatory care.

DEFINING ED OVERCROWDING

Although the subjective assessment that a particular ED (or any public facility) is overcrowded may be inherently obvious to the average observer, objective and generalizable indicators of ED capacity and precise patient volume or acuity thresholds consistent with saturation of ED resources have proven to be difficult to define scientifically.[14] ED overcrowding is defined by the ACEP as a situation in which the identified need for emergency services outstrips available resources in the ED[16] (the Appendix contains a list of terms and metrics typically used in describing ED overcrowding and their definitions). In fact, part of the problem faced by those who manage emergency care systems is that there is not a universally held gold-standard definition for ED overcrowding.[43] Some have described overcrowding on the basis of excessive waiting times to see an ED physician or by treatment time delays in the ED. Others have based the definition on delays in the movement of admitted ED patients to inpatient beds. For some, the definition is based on the number of patients versus the number of available ED treatment stations (beds) or the forced use of nontreatment areas (eg, the ED hallway) to care for or hold ED patients. Others have attempted to define overcrowding on the basis of an assessment of patient acuity in the ED in relation to staffing resources. Finally, some link ED overcrowding to the need to divert incoming ambulance transports.[43]

Surveys of ED medical directors have identified a number of commonly held definitions for overcrowding, including patients placed in hallways, all ED beds occupied for more than 6 hours per day, a full ED waiting room for 6 hours or more per day, physicians feeling rushed for 6 hours or more per day, and acutely ill patients who wait more than 60 minutes to see a physician.[7,74] To better understand increasing demand for emergency services, pursue multicenter or regional research on overcrowding, and plan for future ED resource needs, some have proposed the use of standard formulas to assess ED capacity (Table 1).[75]

STUDIES ON ED UTILIZATION AND OVERCROWDING

ED overcrowding is an obvious, almost predictable symptom of steadily growing demand that has exceeded available resources. ED visits have increased nearly 20% over the past decade. In 1988, 5200 US hospitals had 86 million ED visits. A decade later, emergency care was provided for 103 million encounters, but by this time only 4700 hospital EDs provided emergency care.[17] Many EDs are experiencing significant increases in their patient volumes because of regional population growth, an increasing number of visits from uninsured and underinsured patients, and decreased access to primary care services. In general, the pace and extent of facility and personnel resource expansion in the remaining EDs has not kept up with patient volume and acuity increases.

As the prevalence and severity of the phenomenon has grown, so have the number of descriptive reports and studies attempting to assess overcrowding. A decade ago, only a small percentage (less than 10%) of ED directors, mostly those from urban public hospitals, reported concerns about overcrowding.[19] More recent studies find nearly all ED medical directors reporting at least periodic ED saturation, with a steadily increasing number of directors reporting it as a frequent problem.[7,8,10,12,16,22,26,74,76,77]

Derlet et al[7] conducted a national random survey of 575 ED directors in 1998–1999 regarding the definition and extent of ED overcrowding and factors associated with it. Ninety-one percent of the responding medical directors reported ED overcrowding, with 53% reporting overcrowding occurring several times a week and 39% stating that it was a daily

TABLE 1. Calculations to Assess ED Overcrowding[66]

Bed ratio (BR): the relationship between the number of ED patients and the number of treatment stations (beds) in the ED at any given time.
BR = (number of patients in ED + predicted arrivals − predicted departures)/ED beds
Acuity ratio (AR): a measure of total patient acuity in the ED at a given point in time
AR = sum of patient triage category/number of patients or sum of all triage scores/number of patients
Provider ratio (PR): the relationship between patient arrivals and ED physician staff, specifically the number of patients per hour (PPH) that each provider can manage
PR = arrivals per hour/the sum of PPH for each physician
Demand value (DV): an overall measure of ED demand, including bed capacity, total patient acuity, and provider resources
DV = (BR + PR) × AR

problem. Overcrowding problems were similar (more than 90%) in academic and private hospitals, although hospitals serving populations of greater than 250 000 had higher rates of overcrowding than did hospitals serving smaller populations (96% vs 87%). One third of the directors reported that patients had experienced poor outcomes as a result of overcrowding. Most frequently cited causes for overcrowding were high ED patient acuity, hospital bed shortage, high ED patient volume, ancillary service delays, and insufficient ED space.[7]

The AHA surveyed member hospitals regarding ED capacity and overcrowding in November 2001.[22] A total of 1500 hospitals responded. ED visit volume had grown by 5% over the previous year. Overall, 62% of respondents reported that they were either at or above the operating capacity of their ED, with 80% of teaching hospitals and urban hospitals and 90% of level I trauma centers experiencing this problem. One third of all hospitals experienced "ED diversion," with more than half of the urban hospitals reporting some time on diversion. One third of urban hospitals reported being on ambulance diversion at least 10% of the time, with 1 of 8 reporting time on diversion at 20% or greater. Lack of available, staffed critical care beds was the number one reason cited by hospitals for ED diversion.[22]

Lambe et al[76] conducted an analysis of the changes in California's hospital ED capacity between 1990 and 1999. Over the decade, the number of EDs in California decreased by 12%. The total number of ED treatment stations (ED beds) increased by 16%, but there was a 27% increase in visits per ED, with disproportionately greater volume increases in public versus private hospitals. In regard to patient acuity, critical care visits per ED increased by 59%, and nonurgent visits decreased by 8%.[76] The combination of volume and acuity increases was hypothesized to be the source of ED overcrowding. A 1999 survey of California ED medical directors found that 96% reported overcrowding as a problem, and 28% reported daily overcrowding.[74] The most frequently cited causes for overcrowding were increasing patient acuity and volume, hospital bed shortage, laboratory delays, and nursing shortage.

A 2001 survey of ED medical directors in the state of Washington revealed that 100% of large hospitals and 91% of small hospitals reporting overcrowding problems.[16] Frequent overcrowding (more than 3 times per week) was reported by 59% of large hospitals. On average, hospitals were on ambulance diversion 18 times per month, with an average time on diversion of 7.5 hours. The 3 most common reasons cited for overcrowding were volume overload, full hospital capacity, and nonphysician staff shortages.[16]

ED medical directors in Massachusetts were surveyed in 2000 regarding the causes of ambulance diversion.[77] Diversion was attributed most often to a lack of inpatient bed capacity and increased numbers of high-acuity patients in the ED. Nearly 90% reported facing a nursing shortage, which contributed to the problem. Seventy-two percent of the medical directors believed that patient care was compromised in some manner by overcrowding, and 21% reported adverse patient outcomes directly attributable to overcrowding.[77]

In response to numerous anecdotal reports in the news media, the Committee on Government Reform of the US House of Representatives commissioned a study on ambulance diversion in 2000. In their report, *National Preparedness: Ambulance Diversions Impede Access to Emergency Rooms*,[13] the committee found ambulance diversion impeding timely access to metropolitan emergency services in 22 states, affecting nearly 75 million Americans residing in those areas.[13]

The GAO, commissioned by the US Senate Committee on Finance to study ED overcrowding, conducted a national survey of more than 2000 hospital EDs in 2001.[26] Two of every 3 EDs reported diversion at some point during that year. ED overcrowding and diversion was reported to be more common by hospitals located in areas with larger populations or those with high rates of population growth and by hospitals in areas with higher-than-average proportions of people without health insurance. Overcrowding was also more prevalent at trauma centers and teaching hospitals. Although no single factor stood out as the primary reason for ED overcrowding, the factor most commonly associated with crowding was the inability to transfer existing ED patients to hospital inpatient beds. Ninety percent of the surveyed hospitals reported "boarding" of admitted patients in their ED, with nearly 50% indicating an average boarding time of 2 hours or longer. Inpatient beds in greatest demand were intensive care unit and other monitored beds.[26]

KEY FACTORS CONTRIBUTING TO ED OVERCROWDING

Although increasing demand and fewer EDs are part of the problem, as indicated in the GAO report, many experts feel that the primary source of ED overcrowding is the increasing difficulty that most EDs face in moving acutely ill "admitted" patients from ED beds to inpatient beds. Intense economic pressures over the past 2 decades have forced most hospitals to decrease inpatient care capacity, leaving many with an inadequate number of inpatient beds or insufficient qualified nursing staff to handle fluctuating levels of demand. According to the AHA, there were 1.36 million inpatient beds in 6933 hospitals in 1981, 927 000 staffed beds in 5370 hospitals in 1991, and 829 000 beds in 4956 hospitals in 1999.[78]

With nearly all hospitals running at a higher census, it has become more difficult to admit patients. This seems especially true for patients (including children) who require admission on an unscheduled or emergency basis and compete for a limited number of beds with scheduled inpatient procedures and semielective admissions.[26] Tertiary and critical care beds are particularly in short supply. With no other place to move seriously ill or injured patients in need of admission, EDs must hold these patients for increasingly greater periods of time until an inpatient bed is available. These admitted patients, commonly referred to as "ED boarders," require ongoing care, consuming already taxed ED resources. Boarders es-

sentially shrink the capacity of the ED and compromise its ability to provide timely care for incoming ambulance cases as well as acute patients who are still waiting to be seen. Although not conclusive, risk-management studies suggest that overcrowding and boarded inpatients pose considerable risk for medical errors.[43] ED overcrowding also has a deleterious effect on the teaching missions of academic medical centers, with more than 90% of teaching hospitals reporting overcrowding.[79]

Adding to the mismatch between a steadily growing patient demand and relatively fixed ED capacity is a shortage of qualified ED staff. Real shortages exist in the supply of residency-trained emergency physicians[80] and subspecialty-trained pediatric emergency physicians. The effects of new residency training rules and the reduction of trainee work hours on both hospital and ED capacity at teaching hospitals are yet to be appreciated. Among all the supply shortages in health care professional groups, the greatest deficiency is found within the ranks of registered nurses. Experienced ED nurses are truly the backbone of emergency care. Nationwide, there is a well-recognized deficiency of nurses, with vacancy rates in some states as high as 18%.[81] Annual turnover rates in high-stress practice settings such as EDs can be 30% or higher. Added to the dilemma of a small workforce is the fact that this workforce is aging steadily. The latest studies indicate an average age of 46 years for the nursing workforce, with only 9% of nurses now younger than 30 years of age, a 40% decrease from 1983 to 1998. One study projects a deficit of nearly 300 000 registered nurses by 2020.[82]

Another notable problem that threatens the viability of our emergency care system and the well-being of the patients it serves is a decreasing number of medical and surgical subspecialists who are willing or available to provide consultative backup to the ED.[83,84] A growing number of hospitals no longer have a "full panel" of on-call specialists who, because of the EMTALA mandate, are expected to provide consultative support to the ED. This problem has grown beyond small rural hospitals to affect large urban hospitals, including trauma centers. This problem will likely spread further in the wake of the November 2003 revisions to EMTALA that relax on-call physician requirements.

Global shortages in key medical subspecialties and surgical specialties and variations in geographic availability are both long-standing contributors to ED overcrowding, particularly for rural hospitals. More recently, 2 pressing issues are driving this growing deficiency. The first is a recent and alarming increase in professional liability insurance premiums. A recent American Medical Association study identified 44 of 50 states as having a current or impending liability crisis, with premiums for some subspecialists increasing as much as 25% to 50% annually.[85] Physicians who provide ED or trauma on-call services typically pay higher liability insurance premiums than those who do not. Many subspecialists have concluded that they can no longer afford to provide ED on-call services. The second issue is the increasing percentage of uninsured or underinsured ED patients and managed care barriers, all of which contribute to poor reimbursement for the mandated emergency services provided by these on-call specialists.

Numerous other factors have contributed to the overcrowding crisis (Table 2). Although some problems are internal to the ED, most are not. Insufficient access to primary and subspecialty care services and barriers to follow-up care each contribute significantly to the problem. The ED has been characterized by some as the proverbial "canary in the coal mine," with ED overcrowding representing a warning sign of growing distress within hospital and primary care delivery systems and a fraying health care safety net.

DELETERIOUS EFFECTS OF ED OVERCROWDING

Overcrowding of EDs produces a series of negative effects. First and foremost is that overcrowding places all involved parties, both patients and health care professionals, at risk. Excessive clinical demands on an already saturated ED often lead to medical errors and poor outcomes.[43] Overcrowding has promoted the expansion of ED facility capacity through increased utilization of hallways and other suboptimal, poorly equipped locations as patient treatment areas, challenging patient comfort, care satisfaction, and confidentiality and adding additional risk for error.[26] The only way busy clinicians faced with too many patients can care for all is to spend less time with each patient. The fine line between a highly efficient assessment and an incomplete assessment is easily crossed, generally at the expense of the patient. In teaching-hospital EDs, effective clinical teaching is an early casualty of excessive patient volumes.[79] The high-stress practice environment of a crowded ED is one that also contributes mightily to staff burnout, higher turnover rates, and worsening deficiencies in clinical staffing.

Lengthy waiting times also promote patient dissatisfaction. More importantly, for patients with acute injuries and other painful conditions, it means prolonged pain and needless suffering. For others, inappropriately long waiting times pose an even greater risk if the acuity of their condition was underassessed during triage or if there has been signif-

TABLE 2. Causes of ED Overcrowding

Increased ED patient volumes
Increased ED patient acuity
Increased complexity of diseases and associated evaluations
Lack of inpatient hospital beds and related resources
Nursing shortage
Physician shortage
On-call physician/consultant availability
Insufficient physical plant space for the ED
Ancillary service (eg, lab, radiology) delays
Reduced access to primary care services
Reduced access to subspecialty care services
Difficulty in arranging follow-up care
Language and cultural barriers
Increased medical record documentation requirements
Medical liability issues
Managed care issues
Uninsured and underinsured patients
Inadequate funding for emergency services

icant progression of illness during a lengthy stint in the waiting room.

ED patient safety concerns aside, perhaps the most prominent deleterious effect of overcrowding is ambulance diversion. As suggested by survey data, ambulance diversion has become an increasingly common solution pursued by overcrowded EDs. Diversion had previously been confined to large urban teaching hospitals, timed with peak winter influenza outbreaks. Ambulance diversion now has become a year-long phenomenon, affecting more than two thirds of US hospitals in urban, suburban, and rural settings.[16,26,86] It is now fairly common for numerous hospitals within the same city or state EMS region to be on ambulance diversion at the same time. Many EMS systems have reacted to this by eliminating diversion as an option for overcrowded EDs during periods of peak patient volumes or when more than a certain number of institutions are saturated.[16–18,26]

When most or all major hospitals in an area are "on diversion," an entire municipality's EMS system can be paralyzed. This represents failure of the health care safety net at a rudimentary level, one that affects all economic and social strata. With saturated EDs on bypass, ambulance patients with true emergencies are forced to travel to more distant and perhaps less appropriate facilities. For an adult with a myocardial infarction or a stroke or a child with respiratory failure, the additional time to definitive care necessitated by ambulance diversion is a very meaningful factor. For children with special health care needs, this may limit their access to specialized EDs or tertiary care professionals who are familiar with their condition. Once an acutely ill patient is in the back of an ambulance, neither socioeconomic status nor special health care needs may have any bearing on disposition when diversion is in place.

SOLUTIONS TO ED OVERCROWDING: WHAT CAN PEDIATRICIANS DO TO HELP?

The ED overcrowding crisis did not mysteriously appear and, in reality, has been lurking in the shadows for some time. It is attributable, in part, to the absence of a coherent national health policy to create a comprehensive health care and social services delivery system for all Americans. For many adults and children, the ED has become and still remains the access point to health care by default. Intense economic pressure over the past decade has forced a reduction in the capacity of all aspects (primary care through tertiary care) of the American health care system. The result in certain communities is a dangerously overburdened and underfunded EMS system, with our nation's EDs sustaining the brunt of the problem.

The definitive solutions to ED overcrowding are complex, resource intensive, and expensive. Hospitals must improve their inpatient capacity, particularly the number of staffed critical care beds. Hospitals must also become better prepared to manage seasonal variations in acute illness and coordinate elective and nonelective admissions. Existing inpatient beds must be managed in a manner that promotes efficient utilization. Effective use of observation units may help to maximize availability of limited inpatient beds. If the hospital capacity problem can be remedied, one of the root causes of ED overcrowding will have been addressed.

Hospital EDs must also adapt to meet growing patient demand. In the face of steadily growing utilization, there must be a corresponding expansion in the number of ED treatment stations and in the levels of physician and nurse staffing. Of course, this may be easier said than done considering current workforce shortages. Hospital EDs must also strive to improve the efficiency of the care provided to all patient acuity levels, both emergent/urgent and nonurgent groups. Improving ancillary service support will also help to make the ED more effective.

RECOMMENDATIONS

Pediatricians must serve as powerful advocates for improved health care for all children. The problem of ED overcrowding cannot be solved without solutions in our current health care systems that will provide an accessible and comprehensive medical home.[87] There are some specific actions that both primary care pediatricians and pediatric subspecialists can pursue to address this growing problem.

1. Include the management of acute illness or injury and the utilization of emergency services in anticipatory guidance. The best time to educate families about the appropriate use of an ED, calling 911, or calling the regional poison control center is before the emergency occurs. Although parents will continue to view and respond to acute medical problems as laypersons, they may make better-informed decisions if they are prepared.
2. Work with emergency care professionals to make every ED experience an educational opportunity for the patient and family. Components of this education should include: (*a*) clear instructions for the illness or injury of immediate concern; (*b*) instructions regarding the management or maintenance of chronic conditions and special health care needs; (*c*) preventive health education; and (*d*) guidance about EMS and ED utilization and available sources of primary and specialty care.
3. Connect patients to a fully functional medical home, thereby improving access to office-based acute care and coordinating utilization of after-hours clinical services. Although it would be unreasonable to expect a physician's office to be available 24 hours a day, pediatricians should take a critical look at the accessibility of their practice to patients with acute (nonscheduled) complaints. Hours of operation, same-day appointments, walk-in visits, the function of the practice's answering service, and the application of telephone triage systems should be scrutinized carefully. It might be especially helpful to interview families who have sought emergency care during office hours or those who have visited the ED without first calling the doctor's office to determine if communication or access was an issue in choosing to use the ED. An effective

primary care delivery system may prevent ED visits for low-acuity complaints and may enable timely interventions that prevent low-acuity illnesses from becoming high-acuity illnesses.

4. Coordinate effective follow-up care for ED visits. Even with optimal access to primary care and the medical home, patients will still require access to emergency services. Pediatricians should work closely with local institutions and providers of emergency services to ensure coordination of effective primary and subspecialty follow-up care. This communication and coordination of care is especially important for children with special health care needs.
5. Advocate for improved Medicaid reimbursement. On average, Medicaid reimbursed pediatricians for only 68% of the amount that would be paid under Medicare.[88] Many pediatricians are already doing more than their fair share, devoting a significant amount of their practice to the care of underserved and underfunded populations. In fact, pediatricians' average Medicaid caseload increased from 24.3% in 1983 to 30.0% in 2000, according to American Academy of Pediatrics survey data.[89] Health services research data suggest that we need more pediatricians and other pediatric care professionals to follow suit. We must strongly advocate for fair Medicaid reimbursement rates so that more pediatricians will have the financial incentive to care for these patients. Until then, many Medicaid and uninsured patients will continue to use EDs in the absence of a functional and accessible medical home.
6. Encourage SCHIP enrollment. There is a growing number of children from low-income families who are uninsured or underinsured who would qualify for SCHIP or Medicaid benefits. Because many of these patients have no medical home, pediatricians should partner with their community EDs to identify opportunities to enroll eligible children and families who pass through the ED. Facilitating the enrollment of these children into SCHIP will not be successful in improving their access to a medical home if the SCHIP or Medicaid reimbursement is not sufficient to encourage the participation of pediatric care professionals.
7. Become familiar with local hospital ED and EMS services and their constraints. Pediatricians can play an important role as "consumers" in advocating for expansion of hospital services. Pediatric centers are not immune to overcrowding and now experience many of the same problems as larger adult facilities. This may be an even greater problem for acutely ill or injured children, because many communities are served by a single pediatric tertiary care center. Pediatricians should play a direct role in addressing pediatric inpatient bed (particularly critical care beds) and ED capacity concerns at both their local community hospital and at regional pediatric tertiary care centers.
8. Support advocacy efforts directed toward medical professional liability and tort reform. In states in which tort reform has not occurred, the economic effect is on all health care professionals including pediatricians. Hospital-based specialists and high-risk service providers are affected disproportionately by this burden, which has diminished the availability of key medical subspecialists and surgical specialists for patients when they might need them most. Pediatricians should partner with their state medical society and other professional organizations in this important effort.
9. Conduct and/or advocate for health services research directed toward ED overcrowding. The numerous medical, economic, cultural, and social factors that have led to emergency service saturation are admittedly complex. In sharp contrast to the enormity of this problem is the relative paucity of health services research in this area, particularly regarding pediatric populations. A better understanding of these complex factors might promote a clearer perspective for policy-makers and provide a foundation for effective problem solving. This research agenda also should focus on the unique issues faced by children, including the effect of ED overcrowding and ambulance diversion on the outcome of pediatric emergency care.
10. Advocate for effective reforms in current health care delivery systems. As managers of the pediatric medical home and advocates for children and optimal pediatric health care, there is a very important role for pediatricians in educating citizens, elected officials, and health policy decision-makers about ED overcrowding and effective solutions. This advocacy must be directed toward both optimization of primary care access and improvement of hospital and emergency service capacity. The goal should be for every child to have a fully functional medical home. To maximize the effectiveness of their advocacy, pediatricians should partner with other key stakeholder groups including emergency physicians, emergency nurses, EMS professionals, hospital administrators, legislators, and others in efforts to repair the fraying health care safety net and overburdened emergency services. Organizations such as the ACEP, American Academy of Emergency Medicine, Society for Academic Emergency Medicine, National Association of EMS Physicians, American College of Physicians, Emergency Nurses Association, and others have each engaged in active advocacy programs to address this concern.

APPENDIX: ED Overcrowding Metrics and Definitions (adapted with permission from the American College of Emergency Physicians, Crowding Resources Task Force. *Responding to Emergency Department Crowding: A Guidebook for Chapters*. Dallas, TX: American College of Emergency Physicians; 2002)

ED overcrowding: a situation in which the identified need for emergency services exceeds the available resources in the ED. Evidence of ED overcrowd-

ing is typically found when the number of ED patients receiving care exceeds the number of staffed ED beds, which may lead to the use of hallways and other nontreatment areas to assess or monitor patients and is usually associated with lengthy waiting times for treatment.

ED saturation: a situation in which patient needs, including timely evaluation and treatment, as defined by patient acuity or triage level, cannot be met for existing or new patients because of fully committed ED resources.

ED treatment station (ED bed): a gurney or bed in a space designed to be a treatment area in the ED. Beds in such areas as the hallway, waiting room, conference rooms, etc, are not ED beds.

ED boarder: a patient who remains in the ED beyond the time of disposition after the decision has been made for either inpatient admission or transfer to another facility.

ED boarding time: the time interval between the acceptance of an admission or transfer request for an ED patient and the time the patient actually leaves the ED.

Boarding burden: the proportion of the ED functional treatment spaces or beds occupied by boarding patients.

Hospital ED or ambulance diversion: a situation in which a hospital has determined that it does not or will not have the required capacity or capability to accept additional patients from prehospital or EMS ambulance transports. Diversion can be for a specified category of patients (eg, trauma, critical care) or all prehospital or interhospital ambulance transfers.

Left prior to triage: a patient who has been logged as having arrived in the ED requesting medical care yet leaves prior to the triage assessment.

Left without being seen: a patient who has been triaged but leaves the ED prior to receiving an MSE by the ED physician or other qualified personnel.

Refusal of MSE or treatment: a patient presenting to the ED requesting medical evaluation who subsequently declines additional evaluation or treatment prior to the completion of care (also known as leaving against medical advice).

Waiting room time: the time interval between the completion of the triage assessment and placement of that patient in a waiting area and the time at which the patient is placed in a treatment bed.

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CLINICAL REPORT

Overuse Injuries, Overtraining, and Burnout in Child and Adolescent Athletes

Guidance for the Clinician in Rendering Pediatric Care

Joel S. Brenner, MD, MPH, and the Council on Sports Medicine and Fitness

ABSTRACT

Overuse is one of the most common etiologic factors that lead to injuries in the pediatric and adolescent athlete. As more children are becoming involved in organized and recreational athletics, the incidence of overuse injuries is increasing. Many children are participating in sports year-round and sometimes on multiple teams simultaneously. This overtraining can lead to burnout, which may have a detrimental effect on the child participating in sports as a lifelong healthy activity. One contributing factor to overtraining may be parental pressure to compete and succeed. The purpose of this clinical report is to assist pediatricians in identifying and counseling at-risk children and their families. This report supports the American Academy of Pediatrics policy statement on intensive training and sport specialization.

INTRODUCTION

Overuse injuries, overtraining, and burnout among child and adolescent athletes are a growing problem in the United States. Although inactivity and obesity are on the rise, the number of children and adolescents who participate in organized or recreational athletics has grown considerably over the past 2 decades. It is estimated that 30 to 45 million youth 6 to 18 years of age participate in some form of athletics. Sports participation is more accessible to all youth, from recreational play and school activities, to highly organized and competitive traveling teams, to pre-Olympic training opportunities. The variety of available, organized sporting activities has also grown from the typical American favorites, such as football, baseball, and soccer, to include lacrosse, field hockey, rugby, cheerleading, and dance, each with its own list of sports medicine concerns. This report will assist the clinician managing young athletes by first defining the medical, psychological, and developmental concerns of intensive, focused athletic participation. In addition, it will highlight specific overtraining issues such as participation in endurance events, weekend athletic tournaments, year-round training on multiple teams, and the multisport athlete. This clinical report should be used in conjunction with the American Academy of Pediatrics policy statement on intensive training and sports specialization in young athletes.[1] There is currently a very small body of scientific evidence pertaining to these issues. Therefore, some of the recommendations are based on committee opinion and/or expertise.

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Overuse Injuries

An overuse injury is microtraumatic damage to a bone, muscle, or tendon that has been subjected to repetitive stress without sufficient time to heal or undergo the natural reparative process. Overuse injuries can be classified into 4 stages: (1) pain in the affected area after physical activity; (2) pain during the activity, without restricting performance; (3) pain during the activity that restricts performance; and (4) chronic, unremitting pain even at rest.[2] The incidence of overuse injuries in the young athlete has paralleled the growth of youth participation in sports. Up to 50% of all injuries seen in pediatric sports medicine are related to overuse.[3]

The risks of overuse are more serious in the pediatric/adolescent athlete for several reasons. The growing bones of the young athlete cannot handle as much stress as the mature bones of adults.[4,5] For example, a young baseball pitcher who has not yet learned proper throwing mechanics (ie, recruiting the entire kinetic chain—from foot to hand—instead of just the arm) is at risk of traction apophysitis of the medial elbow. A young gymnast who performs repetitive hyperextension activities may develop spondylolysis (ie, a stress fracture of the spine), which is an injury particular to the pediatric age group. In addition, young swimmers may not recognize signs of rotator cuff tendonitis, because they may be unable to cognitively connect vague symptoms, such as fatigue or poor performance, as a sign of injury. Identifying youth at risk of overuse injuries is the first step to prevention. Guidelines for parents, coaches, and athletes need to be developed to provide opportunities for education, injury reduction, and early recognition of overuse injuries.

Overtraining

A question often asked of the practitioner who cares for young athletes is, "How much athletic training is too much?" There are no scientifically determined guidelines to help define how much exercise is healthy and beneficial to the young athlete compared with what might be harmful and represent overtraining. However, injuries tend to be more common during peak growth velocity, and some are more likely to occur if underlying biomechanical problems are present.

A sound training regimen is essential, recognizing that although repetition is important, it may induce harm. Sport-specific drills that use a variety of modalities, such as water running for the track athlete on alternate days, may provide similar fitness benefits with less stress to the body. The American Academy of Pediatrics Council on Sports Medicine and Fitness recommends limiting 1 sporting activity to a maximum of 5 days per week with at least 1 day off from any organized physical activity. In addition, athletes should have at least 2 to 3 months off per year from their particular sport during which they can let injuries heal, refresh the mind, and work on strength, conditioning, and proprioception in hopes of reducing injury risk. In addition to overuse injuries, if the body is not given sufficient time to regenerate and refresh, the youth may be at risk of "burnout."

"Burnout" or Overtraining Syndrome

Burnout, or overtraining syndrome, has been well described in the literature for adult athletes, but little is found regarding its applicability in youth. The overtraining syndrome can be defined as a "series of psychological, physiologic, and hormonal changes that result in decreased sports performance."[6] Common manifestations may include chronic muscle or joint pain, personality changes, elevated resting heart rate, and decreased sports performance.[6,7] The pediatric athlete may also have fatigue, lack of enthusiasm about practice or competition, or difficulty with successfully completing usual routines. Burnout should be recognized as a serious sequela of overtraining syndrome. Prevention of burnout should be addressed by encouraging the athlete to become well rounded and well versed in a variety of activities rather than 1 particular sport. The following guidelines are suggested to prevent overtraining/burnout:

1. Keep workouts interesting, with age-appropriate games and training, to keep practice fun.
2. Take time off from organized or structured sports participation 1 to 2 days per week to allow the body to rest or participate in other activities.
3. Permit longer scheduled breaks from training and competition every 2 to 3 months while focusing on other activities and cross-training to prevent loss of skill or level of conditioning.
4. Focus on wellness and teaching athletes to be in tune with their bodies for cues to slow down or alter their training methods.[6]

Endurance Events

Endurance athletic events (triathlons, marathons, and half-marathons) are becoming more popular in the United States, and legitimate concerns have been raised for the safety of youth participating in these events. The American Academy of Pediatrics has stated that triathlons for children and adolescents are reasonably safe as long as the events are modified to be age appropriate.[8] Specifically, such events should be of shorter duration/length, and careful attention should be given to safety and environmental conditions.[8,9] Children and adolescents must be properly trained to avoid hypothermia or hyperthermia, overtraining, overuse injuries, and burnout.

Recent concerns regarding the participation of children in marathon running has led to different opinions being expressed in the literature.[10–12] There is, at present, no scientific evidence that supports or refutes the safety of children who participate in marathons. There are no recorded data on injuries sustained by children who run marathons. Marathon training requires a gradual increase in total weekly mileage, which may be less than or equal to the total weekly distance that is generally logged by high school cross-country teams (35–40 miles). Regardless, a clearly devised weekly plan, ensuring that safe running conditions are in place, and the provision of proper education on endurance activities (including environmental conditions and appropriate hydration) should all be part of the training process. A critical environmental safety concern is the ambient temperature and relative humidity, because a child is less able than an adult to handle heat stress.[13] Weather-related guidelines have been set for all marathons, and these guidelines should be strictly enforced by the medical director for all youth endurance events.[14] Ultimately, there is no reason to disallow participation of a young athlete in a properly run marathon as long as the athlete enjoys the activity and is asymptomatic.[15]

Weekend Athletic Tournaments

Weekend-long sports tournaments for soccer, baseball, or tennis are common across the country. Often, these athletes are actively participating at least 6 hours each day in their sport and are exposed to the associated weather elements for an additional 2 to 3 hours. The risks associated with these events include heat-related illness, nutritional deficiencies, overuse injuries (eg, pitching in multiple games over a 48-hour span), and burnout from having a lack of "free time." Research examining the possibility of fatigue contributing to an increased injury risk in the tournament situation does not exist, but the general overtraining-prevention guidelines outlined earlier should also apply.

Year-Round Training on Multiple Teams

Single-sport, year-round training and competition is becoming more common for children and adolescents. A focus on participating in 1 sport, or single-sport specialization, to improve, advance, and compete at the highest level may drive youth to participate for long hours daily on 1 or more teams at a time. This is common in soccer, baseball, and gymnastics. The motivation behind this overinvolvement may be induced by the child or parent. As more young athletes are becoming professionals at a younger age, there is more pressure to grab a piece of the "professional pie," to obtain a college scholarship, or to make the Olympic team. Most young athletes and their parents fail to realize that, depending on the sport, only 0.2% to 0.5% of high school athletes ever make it to the professional level.[16] Yet, youth continue to specialize in 1 sport while participating on multiple teams and risk overuse and/or burnout if there is no break from athletics during the year. Young athletes who participate in a variety of sports have fewer injuries and play sports longer than those who specialize before puberty.[1]

Multisport Athlete

Well-rounded, multisport athletes have the highest potential to achieve the goal of lifelong fitness and enjoyment of physical activity while avoiding some of the pitfalls of overuse, overtraining, and burnout provided that they participate in moderation and are in tune with their bodies for signs of overuse or fatigue. Many youth will play multiple sports throughout the year either simultaneously or during different seasons. They may do this because they enjoy multiple sports or because their coach or parent pushes them to participate in other sports to condition them for their primary sport or in hopes of being noticed by college or professional scouts. There may be additional pressures from other coaches who wish to better their team by calling on well-rounded athletes from other sports. Multisport athletes are at risk of overuse injuries if they do not get sufficient rest between daily activities or if they do not get a break between seasons. Multisport athletes who participate in 2 or more sports for which the major emphasis is the same body part (eg, swimmers and baseball pitchers) are at higher risk of overuse injuries than are those who participate in sports that have a different emphasis (eg, track and golf).

What Is the Goal of the Athlete?

The ultimate goal of youth participation in sports should be to promote lifelong physical activity, recreation, and skills of healthy competition that can be used in all facets of future endeavors. As providers of care for youth, it is important to obtain a physical activity history (type of activity, frequency, duration) and take the opportunity to promote healthy participation and preventive care measures. Education of parents, athletes, and coaches must be part of the plan to promote fun, skill development, and success for each individual athlete. Skilled young athletes must be mentored carefully to prevent overparticipation, which may affect them physically as well as psychologically. The parent or pediatrician may wonder how hard a child should be pushed to train and compete. Ultimately, it is important for the practitioner to discuss the underlying motivation for sport participation with the athlete, the parent, and, possibly, the coach. Unfortunately, too often the goal is skewed toward adult (parent/coach) goals either implicitly or explicitly. The parent often hopes the child will get a scholarship, become a professional athlete, or fulfill the parents' unfulfilled childhood dreams. It is best to identify and focus on the child's motivation and goals to provide guidance.

GUIDANCE FOR THE CLINICIAN

1. Encourage athletes to strive to have at least 1 to 2 days off per week from competitive athletics, sport-specific training, and competitive practice (scrimmage) to allow them to recover both physically and psychologically.
2. Advise athletes that the weekly training time, number of repetitions, or total distance should not increase by more than 10% each week (eg, increase total running mileage by 2 miles if currently running a total of 20 miles per week).
3. Encourage the athlete to take at least 2 to 3 months away from a specific sport during the year.
4. Emphasize that the focus of sports participation should be on fun, skill acquisition, safety, and sportsmanship.
5. Encourage the athlete to participate on only 1 team during a season. If the athlete is also a member of a traveling or select team, then that participation time should be incorporated into the aforementioned guidelines.
6. If the athlete complains of nonspecific muscle or joint problems, fatigue, or poor academic performance, be alert for possible burnout. Questions pertaining to sport motivation may be appropriate.
7. Advocate for the development of a medical advisory board for weekend athletic tournaments to educate athletes about heat or cold illness, overparticipation, associated overuse injuries, and/or burnout.
8. Encourage the development of educational opportunities for athletes, parents, and coaches to provide information about appropriate nutrition and fluids, sport safety, and the avoidance of overtraining to achieve optimal performance and good health.
9. Convey a special caution to parents with younger athletes who participate in multigame tournaments in short periods of time.

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Committee on Bioethics and Committee on Hospital Care

Palliative Care for Children

ABSTRACT. This statement presents an integrated model for providing palliative care for children living with a life-threatening or terminal condition. Advice on the development of a palliative care plan and on working with parents and children is also provided. Barriers to the provision of effective pediatric palliative care and potential solutions are identified. The American Academy of Pediatrics recommends the development and broad availability of pediatric palliative care services based on child-specific guidelines and standards. Such services will require widely distributed and effective palliative care education of pediatric health care professionals. The Academy offers guidance on responding to requests for hastening death, but does not support the practice of physician-assisted suicide or euthanasia for children.

ABBREVIATION. AAP, American Academy of Pediatrics.

In modern society, we expect children to outlive their parents. However, 53 000 children in the United States die every year from trauma, lethal congenital conditions, extreme prematurity, heritable disorders, or acquired illness.[1] The causes of death in children are substantially different from the causes of death in adults; thus, palliative care guidelines that are appropriate for adults are often inappropriate for children. For children living with life-threatening or terminal conditions, medical professionals are obligated to ensure that medical technology is used only when the benefits for the child outweigh the burdens. An infant or child will benefit from palliative care when no treatment has been shown to alter substantially the expected progression toward death.

Palliative care seeks to enhance quality of life in the face of an ultimately terminal condition. Palliative treatments focus on the relief of symptoms (eg, pain, dyspnea) and conditions (eg, loneliness) that cause distress and detract from the child's enjoyment of life. It also seeks to ensure that bereaved families are able to remain functional and intact. Hospice care refers to a package of palliative care services (including, for example, durable medical equipment, and both diagnostic and therapeutic interventions), generally provided at a limited per diem rate by a multidisciplinary group of physicians, nurses, and other personnel, such as chaplains, health aides, and bereavement counselors.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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Palliative care includes the control of pain and other symptoms and addresses the psychological, social, or spiritual problems of children (and their families) living with life-threatening or terminal conditions.[2,3] The goal of palliative care is the achievement of the best quality of life for patients and their families, consistent with their values, regardless of the location of the patient.[4] The American Academy of Pediatrics (AAP) has previously addressed the limitation or withdrawal of life-sustaining medical treatment.[5–7] Specific strategies for palliative management of pain, dyspnea, agitation, nausea, vomiting, seizures, depression, anxiety, grief, and other symptoms can be found in other sources.[8–11]

PRINCIPLES FOR PALLIATIVE CARE

The AAP calls for the development of clinical policies and minimum standards that promote the welfare of infants and children living with life-threatening or terminal conditions and their families, with the goal of providing equitable and effective support for curative, life-prolonging, and palliative care.[12] The following principles serve as the foundation for an integrated model of palliative care.

Respect for the Dignity of Patients and Families

The provision of palliative care for children includes sensitivity to and respect for the child's and family's wishes. In consultation with the child's parent or guardian, the plan of care incorporates respect for the terminally ill child's preferences concerning testing, monitoring, and treatment. Consistent with this principle of respect, information about palliative care should be readily available and parents may choose to initiate a referral to a pediatric palliative care program. The needs of families must be attended to both during the illness and after the child's death to improve their ability to survive the ordeal intact.

Access to Competent and Compassionate Palliative Care

In addition to alleviating pain and other physical symptoms, physicians must provide access to therapies that are likely to improve the child's quality of life.[13] Such therapies may include education, grief and family counseling, peer support, music therapy, child life intervention or spiritual support for both the patient and siblings, and appropriate respite care. Respite care, the provision of care to an ill child (in his or her usual state of health) by qualified caregivers other than family members, allows the family

time to rest and renew, whether for hours or days, on a schedule, or intermittently as needed. Families may benefit from the provision of respite care throughout a child's illness, not only near the end. Appropriate pediatric respite care is often lacking, but is considered by many families to be essential for their continued integrity and ability to care for the ill child, siblings, and themselves. Ideally, the patient's pediatrician, family physician, pediatric subspecialist, or surgeon will offer to continue to care for the child, while making a timely referral to palliative and hospice care. Palliative care programs should assist the child's usual medical caregivers in maintaining an ongoing role in the child's care.

Support for the Caregivers

Health care professionals must be supported by the palliative care team, their colleagues, and institutions in dealing with the child's dying process and death. Institutional support may include paid funeral leave, routine counseling with a trained peer or psychologist, and regularly scheduled remembrance ceremonies or other interventions such as inviting bereaved families to return and celebrate with staff the deceased child's life.

Improved Professional and Social Support for Pediatric Palliative Care

Regulatory, financial, and educational barriers often bar families from access to pediatric palliative care services. Professional and public education may foster awareness of the need for, and value of, pediatric palliative care and lead to efforts to remove bureaucratic and economic obstacles to its availability.

Continued Improvement of Pediatric Palliative Care Through Research and Education

Clinical research concerning the effectiveness and benefits of pediatric palliative care interventions and models of service provision should be promoted. In addition, information about pediatric palliative care that is already available must be effectively disseminated and incorporated into education and practice.

AN INTEGRATED MODEL OF PALLIATIVE AND CURATIVE TREATMENT

The AAP supports an integrated model of palliative care "in which the components of palliative care are offered at diagnosis and continued throughout the course of illness, whether the outcome ends in cure or death."[8] It is difficult to determine which children may benefit from palliative care. If palliative care is reserved for children who are dying or have a terminal condition, other patients who may benefit from these services may not receive them. Time of death is often difficult to predict. If the nearness of death is used to determine if children receive palliative care, some children may die without the benefits of individualized family-centered palliative care. With a broader definition that includes children living with a life-threatening condition, all children who need palliative care may benefit. In addition, aspects of an integrated palliative care approach, including symptom management and counseling, may prove beneficial when provided early in the course of a child's illness.[11]

Curative treatments seek to reverse the disease process, whereas palliative treatments focus on relieving symptoms, regardless of their impact on the underlying disease process. Rigid distinctions between curative, life-prolonging, and palliative interventions may hinder the appropriate provision of palliative care to children living with a terminal condition. Physicians and family members may exhaust all curative options before they consider palliative care, which delays the timely introduction of palliative care or referral to palliative care specialists. Finally, it may be difficult to define individual therapies as either curative or palliative. For example, mechanical ventilation often is viewed as a life-prolonging or curative therapy that should be forgone with palliative care. However, such support, especially noninvasive forms of positive pressure ventilation, may provide symptomatic relief from dyspnea and significantly improve a child's quality of life.

Moreover, the assumption that there is no place for palliative care until all curative options have been exhausted may interfere with an early discussion of palliative issues, including limitations of unduly burdensome interventions at the end of life. Parents and children may infer that a discussion of issues such as do not resuscitate orders or comfort care is equivalent to "giving up." Such inferences may inhibit family members from voicing fears and concerns about the burdens of life-prolonging interventions and the dying process. Communication with patients and families about these concerns must be done with respect and empathy. An explanation of the usefulness of specific therapies, such as cardiopulmonary resuscitation, and a discussion of the value of advance directives to ensure that treatments that have become burdensome are not used, can be comforting to families. The ability of health care professionals to communicate difficult messages well can be learned through directed education and practice.

DEVELOPING A PALLIATIVE CARE PLAN

As no one person can provide all the necessary support for the child and family, palliative care is best provided using an integrated interdisciplinary approach. The provision of palliative care for children involves a partnership between the child, family, parents' employer(s), teachers, school staff, and health care professionals, including nurses, chaplains, bereavement counselors, social workers, primary care physicians, subspecialty physicians, and consultants. Physical, emotional, psychosocial, and spiritual/existential domains of distress must be addressed. The child should participate to the fullest extent possible, given his or her illness experience, developmental capacities, and level of consciousness. Regardless of the prognosis, respect for the child requires that he or she be given a developmentally appropriate description of the condition along

with the expected burdens and benefits of available management options, while soliciting and listening to the child's preferences.[14] For example, burdens may include time away from home and friends; benefits may include participation in research studies based on an altruistic motive.[15] The discussion should focus on what interventions, from the child's and family's perspective, will be of the most benefit.

Each available diagnostic or therapeutic intervention needs to be considered within the context of the goals and expectations of the child and family. The decision to forgo certain treatments means that only those selected interventions are withheld or withdrawn. As the goals of therapy change with the progression of the child's condition or disease, the desirability of some interventions may change. Early interdisciplinary discussion and planning facilitates the smooth integration of these changes. The relief of pain and anxiety is an essential aspect of palliative care, and should be addressed throughout the course of illness. In some instances, pain relief may free a child to participate more fully in his or her final days, weeks, or months of life. Openness to the day-to-day experience of the child and flexibility in considering all options that may palliate distressing symptoms and conditions are essential when developing a treatment plan. *The goal is to add life to the child's years, not simply years to the child's life.*

WORKING WITH PARENTS OF DYING CHILDREN

While acknowledging uncertainty, a pediatrician needs to provide a realistic appraisal of prognosis and the range of time in which death is likely to occur. Pediatricians should support parental expression of the disappointment, anger, grief, and suffering associated with the child's illness. Acknowledging grief is often the first step toward facing the reality of the child's illness. Such acceptance may help parents focus on the quality of the child's remaining life.[16] Most importantly, the pediatrician needs to reassure the parents and child of the continued involvement and support of caring, skilled clinicians throughout the child's life, as well as after death. Fear of abandonment and isolation, especially during a child's long illness, is a major concern to chronically ill or dying children and their families.[17]

The place where death occurs, whether in an intensive care unit, another area of the hospital, another institution, or at home, may depend on such factors as the wishes of the child and family, the physical layout and visitation policies of the alternative sites, the desire and ability of staff to remain involved, and the availability of other caregivers such as bereavement counselors and clinicians with palliative care expertise. Whether death is anticipated or unexpected, pediatricians are expected to help support parental grief and guilt as parents struggle to cope with their fundamentally incomprehensible loss. The family must have the opportunity to carry out important family, religious, and/or cultural rituals and to hold the child before and after death.[18] Members of the extended family, friends, primary care physicians, and religious advisors are to be included, if the family chooses. These individuals can support the family and each other during this time of crisis and in bereavement. A handwritten note of sympathy from the pediatrician or attendance at the funeral can be healing for the family and the physician. In addition, an opportunity for either organ and/or tissue donation when feasible, and an explanatory meeting with the pediatrician to share the results of a limited or full autopsy, may provide some comfort for a grieving family.

The death of a child who has been chronically ill presents added challenges. Parents grieve the loss of the expected normal child from the time of diagnosis of a condition likely to result in disability and childhood death. Often, these parents may find it difficult to accept the reality of impending death, perhaps because previous predictions proved inaccurate. For some parents, continued hope for cure, no matter how unlikely, may be an important coping mechanism or may conform with deeply held religious or cultural beliefs.

WORKING WITH CHILDREN

As many children with chronic, life-shortening illnesses are now living into adolescence and young adulthood, the pediatrician needs to acknowledge the child's own recognition of the likelihood of premature death, to help the child communicate his or her wishes, and to plan for the child's death.[19]

The pediatrician should assist parents in understanding and supporting the siblings of the ill child, all of whom are affected by the child's condition and eventual death. Parents are to be supported in attending to the needs of the ill child and siblings while acknowledging the sadness that results from life-threatening illness. The child should be reassured that he or she has done nothing wrong and is not responsible for his or her own illness or that of a sibling. Children should be encouraged to talk about feelings of anger, sadness, fear, isolation, and guilt, or to express themselves through art or music therapy.[13,20,21] Pediatricians should provide families with developmentally appropriate guidance about these difficult communications, encourage parents of older children and adolescents to talk together as a family about their feelings, and encourage the sharing of memories to facilitate bereavement and healing.[22,23] Families may benefit from the pediatrician or another member of the palliative care team participating in such family discussions. In these tragic situations, it is also helpful for the primary care pediatrician to work with the schools and other youth organizations to assist other children affected by the death of the child.

The pediatrician and the child's parents may consider the following factors when discussing death with a child: the disease experience and developmental level of the child; the child's understanding of and prior experience with death; the family's religious and cultural beliefs about death; the child's usual patterns of coping with pain and sadness; and the expected circumstances of death. The appropri-

ate time to start a conversation about a child's impending death is difficult to determine, as cultural beliefs must be respected and denial by family members may provide some relief from the overwhelming sense of loss and pain. However, avoiding this conversation ignores the fact that ill children and their siblings are usually aware of their condition. Children may maintain silence out of a desire to protect their parents, while feeling painfully isolated from those they need most.[20,24] Hints that a child wants to talk about death may be subtle. Open and honest communication is usually most effective in relieving the child's distress, allowing for mutual support and personal growth during the final phases of the child's life.

HASTENING DEATH

The decision to forgo life-sustaining medical treatment does not necessarily imply an intent or choice to hasten the death of a child.[25] Although a child's life may be shortened by forgoing burdensome interventions or providing adequate sedation in the face of otherwise unrelieved symptoms, the goal of palliative care is to optimize the quality of the child's experience rather than hasten death. On occasion, the relief of severe, progressive symptoms such as pain or dyspnea may require a rapid escalation in the doses of administered analgesics and sedatives. If the child becomes obtunded and less responsive, parents and staff may feel that the medication is to blame, rather than the disease process—a misunderstanding that is reinforced by referring to the procedure as "terminal sedation."[26–28] The child's progressive deterioration and death may be attributable to the disease process, and not the medication.[7,29] Rarely, the relief of progressive symptoms may require deep sedation. Dying with dignity and without pain or distress is the primary goal.

If a child or adolescent requests euthanasia, the health care team is to respond compassionately, with a renewed focus on determining and alleviating the sources of distress, including perceptions of abandonment, depression, loneliness, physical symptoms, and communication problems. Patients and families are never to be prevented from forgoing burdensome life-sustaining medical treatment under appropriate circumstances—regardless of worry that others may view such a decision as euthanasia or suicide. With the provision of competent and compassionate palliative care, including the use of adequate analgesia and sedation for the treatment of rapidly progressive symptoms, requests to hasten death are generally abandoned. The informed decision of an adolescent or young adult patient nearing death to refuse further life-sustaining medical treatment ought to be respected; such respect does not imply the right of a patient to obtain assistance to commit suicide.[30]

The AAP is concerned about reports of involuntary euthanasia of infants and young children and of physician-assisted suicide of adolescents.[30–32] The AAP does not support the practice of physician-assisted suicide or euthanasia for children.

BARRIERS TO THE PROVISION OF PEDIATRIC PALLIATIVE CARE

Primary care pediatricians may be unfamiliar or uncomfortable with counseling or managing a child and family in palliative care, given the infrequency of death in most practices.[33] Thus, early consultation with pediatric hospice or palliative care professionals may be useful. Nevertheless, pediatricians who have established relationships with a child and family may assist in evaluating proposed interventions, help monitor the health and well-being of the siblings and family, and attend to the sometimes subtle and prolonged effects of grief on the family after the palliative care or hospice program is no longer involved.

Unfortunately, the majority of children who die have not had the benefit of palliative care services.[34,35] A major factor impeding pediatric palliative care is that the federal Medicare model was used to create most state Medicaid hospice benefits.[36] The Medicare model of hospice care was designed for adult patients with cancer, restricting admission to patients with a life expectancy of 6 months or less. This stipulation restricts the availability of hospice services to children, given the difficulty in predicting length of survival for many of the childhood diseases that result in premature death. Some hospice programs may require that patients and families agree to forgo life-prolonging or curative treatments and perhaps authorize a do not resuscitate order as a requirement for admission. Such requirements ignore the fact that many families accept the concept of hospice care only after a counseling process that is available within a hospice or palliative care program.[34] In addition, children living with a life-threatening or terminal condition may be receiving therapies that improve their quality of life, but are not adequately reimbursed through Medicaid hospice benefits. Treatment that generally is not reimbursed, for example, includes the use of newer, more expensive antibiotics for children with cystic fibrosis, long-term ventilator therapy for children with neuromuscular disorders, or surgical interventions that may palliate the child's symptoms. Reimbursement and regulatory policies may also preclude appropriate hospitalizations for children with life-threatening conditions. Moreover, families qualifying for Medicaid hospice benefits may lose other state-provided benefits, including dietary supplements and, more importantly, skilled home nursing care. Finally, health benefits from private insurance companies often mimic those from Medicare, and most do not have specific provisions in place for children.

Although hospice personnel are better equipped than most health care professionals to address issues surrounding terminal conditions, many hospice programs lack pediatric expertise and thus deprive chil-

dren and their families of the benefits of palliative care. Limited access to pediatric-specific palliative care and hospice services deprives children of knowledgeable health care personnel for home-based pain and symptom management. Many families may have to choose between life-prolonging or palliative care, and between pediatric or nonpediatric health care professionals, rather than have the opportunity to develop an individualized treatment plan that accounts for the specific needs of the child and family. As a result, the child living with a life-threatening or terminal condition may suffer an unnecessarily poor quality of life, leaving surviving family members with an excessively difficult bereavement.

MINIMUM STANDARDS FOR PEDIATRIC PALLIATIVE CARE

Excellence in pediatric palliative care is essential for hospitals and other facilities caring for children. Program development in pediatric palliative care, along with community outreach and public education, must be a priority of tertiary care centers serving children.

Minimum standards of pediatric palliative care must include a mechanism to ensure a seamless transition between settings, including at least 1 consistent caregiver, the availability of expert pediatric palliative care assistance 24 hours a day, 365 days a year, and the availability of an interdisciplinary care team with sufficient expertise to address the physical, psychosocial, emotional, and spiritual needs of the child and family. At the minimum, this team will include a physician, nurse, social worker, spiritual advisor, and child life therapist.

Although palliative care services may not be necessary for all families, the full range of clinical and educational resources must be made available. In addition, comprehensive palliative care cannot be accomplished without a designated care coordinator who can maintain continuity and ensure the care provided is consistent with the child's and family's goals despite the intermittent care and high staff turnover associated with tertiary care centers. The coordinator can ensure that the plan of care is coordinated with community care professionals to ensure a realistically achievable plan. Tertiary centers must provide community caregivers with explicit instruction in the care of the child, and appropriate pediatric palliative care consultation must be available 24 hours a day. Creative ways of coordinating care between the tertiary center and the community may involve individualized video conferencing or other forms of electronic communication. Respite for family caregivers and home nursing care are essential to maintain the integrity of families and the safety and well-being of the ill child. Finally, bereavement support must be available to the family, caregivers, and others affected by the death of a child, for as long as necessary. These essential services must be reimbursed equitably. The early inclusion of insurance case managers on the palliative care team may assist in accomplishing some of these goals.

Nursing, medical, pastoral care, and social work curricula must include the interdisciplinary management of childhood life-threatening conditions. Practical exercises involving interdisciplinary education, including hospice visits, may best achieve this goal. In addition, attending to the needs of children who experience the death of a significant adult must be addressed. The requirement to achieve competency in these areas must be reinforced by adding questions on palliative care to professional certification examinations. The needs of the medical caregivers who provide pediatric palliative care must be recognized and actively addressed to allow them to continue to provide this rewarding but emotionally draining care.

RECOMMENDATIONS

1. Palliative care and respite programs need to be developed and widely available to provide intensive symptom management and promote the welfare of children living with life-threatening or terminal conditions.
2. At diagnosis of a life-threatening or terminal condition, it is important to offer an integrated model of palliative care that continues throughout the course of illness, regardless of the outcome.
3. Changes in the regulation and reimbursement of palliative care and hospice services are necessary to improve access for children and families in need of these services. Modifications in current regulations should include 1) broader eligibility criteria concerning the length of expected survival; 2) the allowance of concurrent life-prolonging and palliative care; and 3) the provision of respite care and other therapies beyond those allowed by a narrow definition of "medically indicated." Adequate reimbursement should accompany these regulatory changes.
4. All general and subspecialty pediatricians, family physicians, pain specialists, and pediatric surgeons need to become familiar and comfortable with the provision of palliative care to children. Residency, fellowship training, and continuing education programs should include topics such as palliative medicine, communication skills, grief and loss, managing prognostic uncertainty, and decisions to forgo life-sustaining medical treatment, spiritual dimensions of life and illness, and alternative medicine.[33,37,38] Pediatric board and subboard certifying examinations should include questions on palliative care.
5. An increase in support for research into effective pediatric palliative care programming, regulation and reimbursement, pain and symptom management, and grief and bereavement counseling is necessary. The pharmaceutical industry must provide labeling information about symptom-relieving medications in the pediatric population and provide suitable formulations for use by children.
6. The practice of physician-assisted suicide or euthanasia for children should not be supported.

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TECHNICAL REPORT

Patient- and Family-Centered Care of Children in the Emergency Department

Patricia J. O'Malley, MD, Kathleen Brown, MD, Steven E. Krug, MD, and the Committee on Pediatric Emergency Medicine

ABSTRACT

Patient- and family-centered care is an innovative approach to the planning, delivery, and evaluation of health care that is grounded in a mutually beneficial partnership among patients, families, and health care professionals. Providing patient- and family-centered care to children in the emergency department setting presents many opportunities and challenges. This technical report draws on previously published policy statements and reports, reviews the current literature, and describes the present state of practice and research regarding patient- and family-centered care for children in the emergency department setting as well as some of the complexities of providing such care. This technical report has been endorsed by the Academic Pediatric Association (formerly the Ambulatory Pediatric Association), the American College of Osteopathic Emergency Physicians, the National Association of Emergency Medical Technicians, the Institute for Family-Centered Care, and the American College of Emergency Physicians. This report is also supported by the Emergency Nurses Association. *Pediatrics* 2008;122:e511–e521

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Key Words
patient- and family-centered care, family-centered care, family-member presence, cultural sensitivity, pediatric patient's medical home

Abbreviations
PFCC—patient- and family-centered care
ED— emergency department
AAP—American Academy of Pediatrics
IOM—Institute of Medicine
EMTALA—Emergency Medical Treatment and Active Labor Act of 1986

INTRODUCTION

Patient- and family-centered care (PFCC) is an innovative approach to the planning, delivery, and evaluation of health care that is grounded in a mutually beneficial partnership among patients, families, and health care professionals. PFCC applies to patients of all ages, and it may be practiced in any health care setting.[1] Providing PFCC to children in the emergency department (ED) setting presents many opportunities and challenges. This technical report is intended to supplement the joint policy statement of the American Academy of Pediatrics (AAP) and American College of Emergency Physicians published in 2006.[2] It draws on previously published AAP policy statements and reports[3–16] and reviews current literature. The present state of practice and research regarding PFCC for children in the ED setting is described, as are some of the complexities of providing such care. Best practices from a number of acute care and nonemergency settings with implications for the care of children and families in the ED are also described. The 3 appendixes include several resources for PFCC, including potential solutions for common challenges to providing PFCC faced in the ED, a draft protocol for family-member presence during invasive procedures, and resources for promoting institutional change. This technical report has been endorsed by the Academic Pediatric Association (formerly the Ambulatory Pediatric Association), the American College of Osteopathic Emergency Physicians, the National Association of Emergency Medical Technicians, the Institute for Family-Centered Care, and the American College of Emergency Physicians. This report is also supported by the Emergency Nurses Association.

BACKGROUND

PFCC ensures the health and well-being of children and their families through a respectful patient/family-professional partnership. It honors the strengths, cultures, traditions, and expertise that all members of this partnership bring to the relationship.[2] PFCC embraces the following concepts: (1) we are providing care for a person, not a condition; (2) the patient is best understood in the context of his or her family, culture, values, and goals; and (3) honoring that context will result in better health care, safety, and patient satisfaction. ED health care professionals, the family, and the child team up to optimize the child's care.

The development of PFCC is well described elsewhere.[1–3,17] The essence of PFCC is an understanding of the relationship between the patient/family and health care professionals as a partnership. In the past, the fiduciary duties of a physician toward a patient were interpreted to give the physician an implied authority and ability to

determine unilaterally what is in the patient's best interests. In recent years, an understanding of the relationship as one between professional and consumer gave greater authority to the voice of the "client" (ie, patient).[14] PFCC represents further evolution in understanding the physician-patient relationship, one that will undoubtedly continue to evolve. The Institute of Medicine (IOM) has identified PFCC as 1 of the 6 attributes of high-quality health care in its 2001 report *Crossing the Quality Chasm: A New Health System for the 21st Century*.[18] Furthermore, the Joint Commission has incorporated a patient bill of rights and standards for patient comfort in its accreditation evaluation, as well as an acknowledgment that a patient's active involvement in his or her own care is a potent strategy for ensuring patient safety.[19] In its 2006 report *Emergency Care for Children: Growing Pains*,[20] the IOM concluded that failure to incorporate PFCC and culturally effective care into emergency care practice "can result in multiple adverse consequences, including difficulties with informed consent, miscommunication, inadequate understanding of diagnoses and treatment by families, dissatisfaction with care, preventable morbidity and mortality, unnecessary child abuse evaluations, lower quality care, clinician bias, and ethnic disparities in prescriptions, analgesia, test ordering, and diagnostic evaluation."

PFCC relies on a model of partnership with common goals and mutual respect for the contributions of each partner. This alliance is most successful when information is shared in an unbiased and nonjudgmental manner and when the patient and family are supported in their use of that information to make their own health care decisions. The clinician can be viewed as the knowledgeable navigator who is able to describe and recommend the available options with all their benefits and shortcomings; nonetheless, it is the patient and family who must fly the plane. ED health care professionals must understand that patients and families may not always know what questions to ask or may feel an inherent inequality in the partnership because of the vulnerability brought about by their medical circumstances; this may be particularly true of emergency circumstances. In addition, the possibility exists that the patient and family may value potential risks or benefits differently from how the treating physician does. Thus, the physician's ability to share information openly is vital to good patient care. Recognizing the role of the patient and family as team members in shared decision-making and validating their concerns while providing information about potential risks and benefits are critical for the entire team to feel comfortable with the plan and to ensure good patient care.

PFCC FOR THE CHILD IN THE ED

There are significant challenges to providing PFCC for children in the ED. Overcrowding and acuity in the ED may cause delay or disruption of care, which challenges the ability of health care professionals to provide respectful and sensitive care. The lack of a previous relationship between the patient/family and ED health care professionals, as well as the acute nature of many events prompting an ED visit, can limit the ability to create an effective partnership, and the many cultural and societal variations constituting families compound the difficulty in identifying with certainty who, in fact, is a child's legal guardian. Situations particular to the ED (such as arrival of a child by ambulance without family; the unaccompanied minor seeking care without the knowledge of his or her family; visits related to abuse or violence; time-sensitive invasive procedures, including attempted resuscitation; unanticipated critical illness, injury, or death of a child) require our most thoughtful advanced planning. Finally, reluctance on the part of health care professionals to allow family-member presence during invasive procedures or attempted resuscitation has limited family access that may be beneficial to the patient, family, and health care professional alike.

Despite these challenges, achieving excellence in provision of PFCC is possible in the ED (see Appendix 1). Communication between health care professionals in the ED and in the child's medical home[4,5] will enhance support of PFCC in the ED. Because PFCC is, by its nature, interdisciplinary, embracing the philosophy of PFCC across disciplines often available in an ED but possibly less accessible in other practice locations (such as nursing, interpreter services, child life and social services, chaplaincy, or mental health services), it can promote patient safety, comfort, and satisfaction despite the challenges of the environment.

All aspects of emergency care can reflect the practice of PFCC, including clinical operations and patient flow, policies and practice, physical plant, and education, training, and research of staff. Although the following examples may apply in other patient care settings, they are presented here in the context of the ED.

1. Patient Flow

Patient flow that exemplifies PFCC does not limit the child's access to family members or vice versa unless the demands of evolving patient independence, need for private interview or examination, or safety of the patient, family, or staff dictate otherwise. For example, an operational patient flow that requires the parent to leave the child for registration while the child is receiving care can be made more patient and family centered with a bedside registration system. Assistance can also be provided for the single parent who arrives with an ill child in the ED driveway so that he or she can remain with the child.

2. Security and Identification of Family

For security reasons, many EDs have a policy of identifying family members with a "visitor" badge. Changing that label to read "family" is a small step that may help to reinforce the commitment to moving beyond thinking of family as visitors and truly welcoming them as partners in care of the child.

3. Family Presence

A practice that requires parents to leave a child during certain procedures, such as fracture reduction or others, because the ED health care professional judges that it would be too disturbing for parents to watch is another opportunity for change. The ED can be made more pa-

tient and family centered by allowing the patient and family members to choose for themselves whether to be present after receiving complete and unbiased information about what will happen and by supporting their decision about whether to be present. Guidelines for establishing a program of family-member presence in the ED have been published.[21–23] A sample family-member presence policy is presented as Appendix 2.

4. Interpretation Services and Communication

Because communication is a cornerstone of PFCC, timely access to professional interpreter services is essential for providing PFCC when a language or communication barrier exists. A 1996 study suggested that nearly half of patients who need interpreter services do not receive them.[24] Moreover, children of families with language barriers are more likely to be admitted to the hospital, have more tests ordered, and have more severe disease and are less likely to get good follow-up care[25]; thus, evidence shows that language and communication barriers do indeed lead to lower quality of ED care. A commitment to hiring and funding professional interpreter services is a high mark of an institution's dedication to principles of PFCC. The common practice of using family members or accompanying friends as translators, particularly in the setting of unfamiliar medical terms or sensitive information, runs the risk of allowing faulty communication and may compromise patient privacy and safety as well. In addition, this practice disregards the National Standards on Culturally and Linguistically Appropriate Services. These standards elaborate on Title VI of the Civil Rights Act of 1968 (42 USC §2000), which requires that all health organizations receiving federal financial assistance ensure timely and effective interpreter services for patients.[26]

5. Comfort Care

The routine measurement of patient pain, anxiety, and comfort as part of initial and continuing patient assessment is central to PFCC, as is the commitment to respond to identified needs for comfort with interventions such as pharmacologic and nonpharmacologic treatment, child life services,[8] and psychosocial and spiritual support. Moreover, institution-wide commitment to these practices is urged by the IOM report on quality of care[18] and sought by the Joint Commission.

6. Coordination With the Medical Home

In the emergency setting, the patient's usual health care professionals can be considered an extension of that patient's family. Not only will health care professionals from the patient's medical home be able to provide valuable information at the time of the initial evaluation, but their input is necessary to shape an appropriate disposition as well. It is likely also that the patient and family will feel more comfortable with ED care when they know that their medical home health care professionals are involved and that the ED has access to essential parts of the child's medical history. This ED/medical home communication can be supported further through electronic health records and automated health-information exchange.[27]

7. Discharge Planning and Instructions

Standard discharge instructions can be a vehicle for PFCC when they can be customized to reflect solicited family preferences that are incorporated into the family's assumption of care at discharge and include appropriate input from and follow-up with the patient's medical home health care professional.

8. The ED Physical Plant

A physical plant that embodies PFCC will accommodate family members, including well siblings, and provide restrooms, diaper-changing space, safe and dedicated pediatric waiting areas, and simple refreshments. It should also provide children protection from the sights, sounds, and smells of emergency care of other ED patients and ensure adequate privacy on-site for sensitive interviews and for families who are experiencing grief or loss.

9. Patient and Family Input in Policies and Procedures

When new policies, practices, or physical plant changes are considered, they are more likely to reflect a PFCC philosophy if family representatives are included in the planning stages. For example, patients or family representatives have provided their input on drafts of printed materials and participated in the design of new ED facilities. They may be members of a family or teen advisory board or participate as part of an interdisciplinary team to develop and implement a policy to support families and staff when family members choose to be present during resuscitation.[1]

10. Modeling PFCC in the ED

For EDs in an academic center, providing supervision and teaching to trainees at the bedside, with the active participation of the patient and family, is an opportunity to model PFCC. Curricula that include precepts of PFCC[28,29] or use families and patients as teachers[30] reflect another enhancement. EDs that engage in research to examine the relationship of specific PFCC practices and short-term and long-term outcomes for both patients and health care professionals can ensure that progress made toward the goals of PFCC will continue.

CHANGING THE CULTURE OF THE ED

In many institutions, changing long-standing health care professional–centered practice to be congruent with PFCC requires an interdisciplinary paradigm shift. If there is an institutional will to change, there are ample tools available to assist in the process.[31] An Emergency Nurses Association assessment tool[32] provides guidelines for implementing change and focuses on 8 domains: (1) PFCC approach in the stated mission of the department; (2) evidence of family participation in care; (3) resources for family support; (4) practice regarding information sharing and decision-making; (5) coordination of services and continuity of care; (6) personnel practices; (7) evaluation practices; and (8) community partnerships. The assessment tool has been piloted in 9 EDs.[33]

A first step in promoting change is the assessment of current practice by using the self-assessment tool and soliciting information through satisfaction surveys, follow-up telephone calls, focus groups, and/or a family advisory group. Incorporating PFCC principles into the departmental mission statement can encourage influential individuals to strive for consensus and to provide leadership for change. Evaluating existing policies and procedures in light of a PFCC model can provide the impetus to change those policies. Hospital community forums through which staff can voice their concerns and share personal experiences as patients can be effective in recruiting staff commitment to PFCC.

Increasing PFCC awareness and understanding of patient/family perspectives and needs through staff education is important in the transition to PFCC. Engaging family members to assist with this task can be a powerful strategy. Staff involvement in measuring outcomes (such as satisfaction with care) and family-member presence can help overcome reluctance to support those activities. Reinforcement of PFCC values by incorporating them into job descriptions, competency assessments, and performance evaluations can help to achieve a change in culture. Finally, working to provide a physical environment that supports and reflects PFCC provides visible confirmation of PFCC. Some tool kits and additional resources for change are provided in Appendix 3.

BENEFITS TO HEALTH CARE PROFESSIONALS

PFCC has benefited health care professionals through greater job satisfaction and less burnout on the job.[34] Collaboration with the patient and family can lead to a more comprehensive medical record, a better sense of the patient as a person, and a better understanding of how the patient will function at home. When parents are present for the care of their child, they can help the staff provide support to the patient, understand the patient's attempts to communicate, position the patient, reduce a need for sedatives or restraints, and provide essential medical information. This may be especially important for children with special health care needs.[35,36]

Timely and convenient interpreter services will improve both family and ED health care professional satisfaction, improve the quality and efficiency of care, and limit otherwise unnecessary use of testing and resources.[37] In adult patient care settings, implementing a PFCC approach has led to improvements in patient safety, fewer medical errors, and lower cost of care.[38] In pediatric EDs, a PFCC design of in-process rooms with a playroom-like environment can allow for better neurologic and extremity evaluation by promoting a normal repertoire of behaviors in a more normal setting.

FUTURE DIRECTIONS

Well-designed research that establishes the effects of a PFCC approach to care of the child in the ED is limited.[39] The IOM report on emergency care for children[20] highlights the importance of PFCC and recommends that emergency medical services agencies and hospitals integrate principles of PFCC into emergency care practice. The IOM report gathers many voices (including the Institute for Family-Centered Care, the Emergency Nurses Association, and others) calling for increased evaluation and research regarding PFCC in emergency practice. Among the issues to be examined are the following:

- Regarding PFCC:
  - long-term and short-term outcomes associated with implementing PFCC, including patient satisfaction, safety and quality of care, cost of patient care, and staff satisfaction and retention
- Regarding family-member presence:
  - long-term effects of family-member presence on patient outcomes, families, and staff
  - best methods for educating health care professionals regarding family-member presence
  - potential legal ramifications of implementing or not implementing policy on family-member presence
  - relationship of family-member presence to tissue donation or autopsy
  - relationship of family-member presence to pain management (ie, is it improved by family-member presence or, conversely, does improved pain management allow for greater staff willingness to support family-member presence?)

CONCLUSIONS

Commitment to PFCC ensures that patients'/families' experiences and perspectives guide the practice of culturally sensitive care that promotes patient dignity, comfort, and autonomy. In the ED setting, particular issues deserve specific attention. The patient and family are key decision-makers regarding the patient's medical care. The option of family-member presence should be encouraged for all aspects of ED care. Information and support should be provided to the family during interventions regardless of the family's decision to be present or not. Because communication is a cornerstone of PFCC, timely and culturally effective professional interpreter services should be available to the ED. The interdependence of child and parent, patient and family wishes for privacy, and the evolving independence of the pediatric patient should be respected. PFCC encourages collaboration along the continuum of care (prehospital, ED, hospital, and rehabilitation) and commitment to the importance of the patient's medical home. With the collaboration of patients and families, institutional policies can be developed for the provision of PFCC through environmental design, practice, and staffing. Education of ED health care professionals should include the teaching of principles of PFCC to ensure active participation by patients and families in formal medical education and so that the ED setting can provide the venue for continued evaluation and research into the benefits of PFCC.

APPENDIX 1: CHALLENGING SITUATIONS COMMON TO THE CARE OF CHILDREN IN THE ED

1. Identifying "Family"

The Institute for Family-Centered Care defines family as:

> "two or more persons who are related in any way—biologically, legally, or emotionally. Patients and families define their families. In PFCC, the definition of family, as well as the degree of the family's involvement in health care, is determined by the patient, provided that he or she is developmentally mature and competent to do so. In pediatrics, particularly with infants and young children, family members are defined by the patient's parents or guardians."[40]

In the acute care setting of the ED, it is necessary to identify both a legal guardian and the primary family members who can offer support to a child and the child's parent or guardian, recognizing that those entities may not be one and the same, particularly in situations of child protective services custody, parental custody disputes, domestic violence, sexual assault, families with nontraditional composition, or families of different language or culture. However, in the case of emancipated or mature minors or for patients with selected conditions (such as sexually transmitted infections, physical or sexual assault, or potential pregnancy), the "legal guardian" may properly be construed as the patient himself or herself. Honoring the patient's implicit or explicit identification of primary family members who can provide support is essential, even recognizing that they may be different from legal guardians. When compounded by lack of a preexisting relationship, these factors make the ED practice of PFCC complex. To be able to develop policies and implement procedures for identifying family members and legal guardians that reflect a PFCC philosophy, ED health care professionals may need access to resources such as social services, interpreters, chaplaincy, security personnel, and legal counsel. Nevertheless, in providing PFCC, we are still bound by the legal obligation to share decision-making around the care of minors with a parent or legal guardian unless specific exemptions exist, such as those mentioned previously.

2. Arrival of a Child Who Is Unattended by Family

The unaccompanied child may arrive by ambulance or in the company of a teacher, child care provider, home nurse, or bystander. Providing a surrogate such as a volunteer, child advocate, or a child life specialist to the child without family, engaging ED and outside resources to locate family members, and enabling timely reunification of family and child are important for the safety and comfort of the pediatric patient of any age. As was demonstrated during Hurricane Katrina, the issue of timely reunification is an important consideration in disaster planning.

Under the Emergency Medical Treatment and Active Labor Act of 1986 (EMTALA [42 USC §1395dd]), ED providers are required to provide a medical screening examination for any unaccompanied minor who requests examination or treatment. It also requires that the same screening be provided when requested on behalf of the patient in a circumstance under which a "prudent layperson" would perceive a need for care. In fact, if the medical screening examination process identifies an emergency condition, a minor can be examined, treated, stabilized, and even transferred to another hospital without consent ever being obtained from a parent or legal guardian.[41] The implications and application of this regulation have been summarized previously.[10,15,42] A PFCC philosophy does not alter the ED health care professional's obligation to follow guidelines for a medical screening examination required by the EMTALA.

3. Care of the Adolescent Patient

Providing PFCC to the adolescent patient requires a careful balance to respect the patient's privacy and evolving independence and to communicate with the parent or guardian. Adolescents must routinely be given an opportunity to speak privately with the health care professional without other family members or partners being

present.[15] Requesting a private interview with the teenaged patient should be framed as the need to protect the young person's dignity and privacy while ensuring that information that may be critical to his or her health will not be withheld because of concern that it may worry, anger, or alienate the parent. The health care professional should be able to assure the patient that any information so obtained will be confidential to the extent that state law permits,[43,44] unless doing so poses a direct threat to the patient's or others' safety. Clinicians must recognize that the services that are protected and accessible for confidential access vary from state to state.

Many states allow for treatment without parental knowledge if the condition may reasonably involve transmission of sexually transmitted infection, mental illness, substance abuse, or reproductive concerns.[45] Although the EMTALA specifically states that ability to pay for care must not affect care delivered, ED health care professionals should be aware that billing notification of an ED visit may constitute a breach of the adolescent's privacy and, therefore, should make provisions to safeguard patient confidentiality, including identifying with the adolescent patient the financially responsible party to be billed. ED health care professionals should be familiar with the limitations to and obligations of providing care to the unaccompanied older pediatric patient who is seeking care without the knowledge of his or her family[10,11,46] and should make those limits and obligations clear to the patient. It is prudent to identify a means of communicating follow-up information by mail or telephone that will be secure and confidential if that is desired by the patient. One potential means of resolving conflicting obligations to the adolescent patient and guardian is for the health care professional to facilitate communication between the adolescent patient and parent.[47] This role may include exploring with the patient the potential consequences of nondisclosure to the parent, offering to disclose information to the parent without the patient present, or mediating a conversation between the patient and parent.

4. Family-Member Presence

In the procedure-intense acute care setting of the ED, PFCC is often most tested in the area of family-member presence. In the 1980s, studies demonstrated that parents were an asset in the setting of venipuncture and other simple procedures[48–50] if they had been prepared for what would happen and if they were given a role other than passive witness. This finding has been extended successfully to other more-invasive procedures, and parents have been demonstrated to be successful partners in providing sucrose to soothe an infant undergoing lumbar puncture or in calming the child who is receiving procedural sedation for laceration repair or fracture reduction with a familiar voice, story, poem, or song.[50]

Although some parents would not choose to be present during resuscitation, nearly all parents surveyed by Boie et al in 1999 reported that they would want the option to choose to be present or not. Other surveys have shown similar findings.[52,53] However, surveys of pediatricians, ED staff, and trauma care providers have noted a reluctance to allow family members to be present during resuscitation.[54–56] Providers often cite fears that it will be traumatic for the family members, that families will be disruptive, or that it may result in increased litigation. EDs that have reported their experience with family-member presence for resuscitation have noted rare instances of disruption by family members and increased acceptance by staff members once they had experience with family-member presence.[52,57–59] Staff members at these institutions noted that the family members were often helpful to the staff, providing support to the patient, essential medical information, enhanced communication, and assistance with positioning of the patient.[53,57,60,61] They have also reported perceived benefits to the family, including a positive effect on the grieving process when a resuscitation attempt results in death.[62] A recently published study designed to evaluate the outcomes of a structured program of family presence during pediatric trauma team activations demonstrated no instances of family interference with medical care in 197 instances of family-member presence. The time taken for completion of key components of the trauma evaluation was not different for trauma team activations with the family present versus those without family presence. In this study, most health care professionals reported that family presence either had no effect on or improved medical decision-making (97%), institution of patient care (94%), communication among health care professionals (92%), and communication with family members (98%).[63] Although no studies have directly addressed the effect of family-member presence on malpractice litigation, there is reason to believe that family-member presence may actually decrease litigation by improving patient and family satisfaction.[64,65]

Although there have been few rigorous studies to date and patient numbers in those studies have been small, there is more clinical evidence to support the benefits of family-member presence to patient, family, and health care professionals than there is for the competing concerns that family-member presence might be disruptive during procedures, might be traumatic to bereaved family members, or might result in increased litigation.[66] The Emergency Nurses Association, the American Association of Critical-Care Nurses, the National Association of Emergency Medical Technicians, and the AAP have all issued policy statements in support of offering family-member presence in emergency care.[2,67–69] Since 2000, the American Heart Association has recommended offering the option of family-member presence during resuscitation attempts (although the 2005 Pediatric Advanced Life Support teaching materials still use an example of parents who are excluded from the resuscitation room as the model for breaking news of the death of a child).[70] Guidelines for family-member presence have also been integrated into the Advanced Pediatric Life Support, the Pediatric Emergency Medicine Resource, the Emergency Nurses Association's Trauma Nursing Core Course, and the Emergency Nursing Pediatric Course. A national consensus panel that

convened in 2005 conducted an in-depth literature review of studies examining family-member presence and recommended that family-member presence be encouraged for all aspects of ED care.[71] The consensus report described criteria for support staff and for possible exclusion from family-member presence (such as threat of violence to self, staff, or patient). Benefits to patient, family, and health care professionals were detailed and included the potential to optimize medical information gathering, improve the assessment of how the patient might function at home, and enhance the understanding of the patient as a person rather than a condition. This report also noted that although many institutions' practices support family-member presence, fewer than 5% of surveyed institutions reported having a written protocol. Appendix 2 presents a draft protocol for family-member presence.

5. When the Child and Parents Disagree Regarding Treatment

Disagreements between the patient and the family present a difficult challenge to providing PFCC. When the child and parents disagree regarding a proposed treatment, the ED provider must weigh the child's ability to give or withhold assent within the context of that child's ability to understand and make reasonable decisions. A toddler cannot be deemed capable of either consent or assent and will not commonly cooperate with a laceration repair. On the other hand, a 14-year-old brought by a parent with the request for drug screening can withhold assent in such a way that it might constitute assault for the ED provider to attempt to obtain a blood sample. Such a patient may well be capable of understanding the decision to refuse. Similarly, a 10-year-old who has experienced repeated relapses of cancer may be able to understand the consequences of a refusal of further invasive treatments such as a ventriculoperitoneal shunt or central venous catheter placement. That child's withholding of assent merits serious consideration by ED staff and consultation not only with parents and the child's subspecialty care team but also potentially with the primary care physician, palliative care team, chaplaincy, hospital ethics team, or child protective services. The legal aspects of when and under what circumstances minors can refuse and consent to medical treatment remain largely unresolved and complex,[72,73] and ED health care professionals may not be able to resolve them in any particular case without the assistance of resources outside the ED.

6. When the Family Refuses a Proposed Treatment

It is not uncommon in the acute care setting for parent and health care professional to have different opinions about the value of a particular treatment or outcome. When that happens, the child's well-being should remain the primary focus, recognizing that parents and ED health care professionals may not always agree on what constitutes the child's best interest. Remembering the parents' and child's role as team members, ED health care professionals should explore the parents' reasoning and concerns in a manner that is sensitive to that reality, particularly regarding concerns about the risk of a procedure, the pain involved, the cost, the possible infringement of religious rules, or previous negative experiences in similar settings. Because there is rarely a preexisting relationship between the family and the ED health care professional, it can be helpful to enlist the health care professional of the patient's medical home in these discussions if time permits.

Parents are generally considered free to make choices regarding medical care unless those choices place their child at substantial risk of serious complications. For instance, a parent of a febrile neonate may not allow a lumbar puncture or a bladder tap. Alternatives to the standard practice of a full sepsis workup and empiric antibiotics do exist. It is possible to consider a plan to admit and observe the well-appearing febrile infant without empiric treatment or to presumptively treat an infant with risk factors or ill appearance with the hope for an opportunity to perform a diagnostic lumbar puncture later in the course of care if the family reconsiders after consulting with others.

One of the roles of the ED health care professional is to provide parents with the risk and benefit information that will allow the family to make an informed decision, ensuring that the family understands the diagnostic burden of obtaining a sterilized cerebrospinal fluid sample or the potential risks associated with a delay in initiating antibiotics. On both sides of this negotiation, there may be resources that will support a respectful and full discussion. ED health care professionals may want to avail themselves of the resource of the medical home or a subspecialty opinion; they will also want to ensure that the family members have access to the supports on which they rely to assist them with difficult decisions, such as a family elder or faith advisor. The ED health care professional should "listen carefully and respectfully to the parents' concerns, recognizing that some parents may not use the same decision criteria as the physician and may weigh medical evidence very differently."[12] Very few medical interventions are completely without any risk, although the ED health care professional can help the family to weigh any risks in the context of the untreated conditions for which they sought care. Physician liability in these circumstances is best addressed by good documentation of discussions with the family and of the steps taken to negotiate a medically safe course. In a situation in which the ED health care professional feels that a parent's decision places the child in jeopardy, then the appropriate child protective services agency should be engaged.

If a family decides to leave the ED rather than pursue the treatment choices outlined by the ED health care professional, the ED health care professional must consider the potential consequences to the child. Some institutions specifically forbid the option of allowing the family and child to leave, even after signing a form that states that they are aware that they are leaving against medical advice when the patient is a minor. In other institutions, a form and policy on leaving against medical advice exist but are rarely invoked; instead, the practice is to negotiate an alternative that is acceptable to all and to document the attempts and reasoning used to arrive

at that negotiated agreement. If a family leaves before or without such a discussion (a category often labeled "left without being seen" or "left without completing treatment"), further communication with the family should be informed by the potential for adverse outcome to the child and may range from a simple follow-up call to the family and primary health care professional to involvement of police and child protective services (personal communication, Pediatric Emergency Medicine Database discussion list [http://listserv.brown.edu/archives/cgi-bin/wa?A0=PED-EM-L], 2007).

The time frame of an ED visit does not commonly allow for the judicial process to provide a solution, although in less time-sensitive situations, many courts have shown reluctance to require medical treatment over the objection of parents "except where immediate action is necessary or where the potential for harm is rather serious."[74] The urgency of certain interventions, therefore, requires proactive planning for such events and a well-defined process for resolving a refusal of care, including, if needed, emergency custody.

7. Visits Related to Abuse or Violence

In situations in which the patient presentation prompts consideration of possible inflicted injury, ED health care professionals need to keep all involved parties (patient, family members, and staff) safe. Precepts of PFCC in no way reduce the obligation to report suspected abuse or neglect. However, it is important to remember that the intent of such reporting is to protect the child, a goal that most families, even abusive ones, will acknowledge. Understanding that a report of suspected abuse or neglect is filed on behalf of a child rather than against a suspected perpetrator ensures that the process is patient and family centered. ED health care professionals have no obligation and no expertise to be judge or prosecutor in such situations. However, although it is not the physician's place to indict a parent or caregiver, it is clearly the ED health care professional's responsibility to ensure an appropriate safety plan, which may involve hospitalization or otherwise removing the child from parental care until the child's safety can be ensured.

8. Unanticipated Critical Event or Death

Caring for the child with unanticipated critical injury, illness, or death in the ED is one of the most difficult tasks for any ED health care professional, one that requires careful planning, training, and previous identification of resources within and outside the ED. Several important resources exist to guide planning and preparation for such an event.[4,75,76] Having protocols and procedures in place is critical for anticipating the needs of family members, who often arrive separate from their child and in emotional disarray. Under such circumstances, immediate response from designated, trained staff who are not required for the medical management of the child but whose role is to support the family is vital. Protocols should address how the ED team is to relate to media, police, private physicians, the medical examiner, child protective services, and organ- and tissue-procurement teams. Protocols should address a plan for safe and compassionate family-member presence and identify additional resources available to the ED, such as social service, chaplaincy, acute psychiatric services, and child life services. Space should be designated for family privacy, with adequate seating, local and long-distance telephone capability, an accessible restroom, tissues, water, and writing materials.

If family members are not able to be present with the child in the ED, conveying the information of the child's death can be a very difficult task for an ED health care professional. Recommended bereavement guidelines[74] include: informing the family in a private location; using the child's name; informing the family of all medical procedures performed; noting any family efforts to help or comfort the child (such as seeking medical care, giving a good medical history, providing comfort by touching the child); offering information about autopsy and tissue donation; contacting important family supports such as members of the family's faith community; offering private or accompanied time with the child's body; allowing for time to make meaningful mementos consonant with religious or cultural precepts; and providing a follow-up contact. For most parents, the image of their child's body lying unattended in a hospital morgue inflicts additional pain after loss. If a medical examiner's evaluation is not required, many EDs have found a way to keep an attendant with the child's body until a designated funeral home can come, in that way reassuring and comforting surviving family members. The death of a child is the beginning of a lifelong condition of bereavement for parents and siblings, one on which ED health care professionals can have a profound effect.[76]

APPENDIX 2: SAMPLE PROTOCOL FOR FAMILY PRESENCE IN THE ED (ADAPTED FROM MASSACHUSETTS GENERAL HOSPITAL ED POLICY)

Practice Statement

Family-member presence should be considered as an option in all phases of ED care, including invasive procedures and resuscitation efforts, unless the patient's own wishes, demands of evolving patient independence, need for private interview or examination, or safety of the patient, family, or staff dictate otherwise. The health care team will be responsible for assessing patient and family needs and supporting the family and patient during their time in the ED, whether at the bedside or not.

Definitions

Family member: a relative or person (significant other) with an established relationship with the patient.

Invasive procedure: a procedure that involves penetration or manipulation of the body.

Resuscitation: life-sustaining or life-saving measures.

Family support facilitator: a staff member (nurse, clinical nurse specialist, physician, chaplain, paramedic, or other suitable staff member) assigned to support the psychosocial needs of the family; this person should not be needed for the immediate re-

suscitation or direct assistance with the invasive procedure.

Procedure

- Designate family support facilitator
- Assess/screen family members:
  - Determine the preference of the patient, if possible. Assess the family's perception and understanding of the clinical situation and scope of crisis, need to be with the patient, coping abilities, comfort level with medical environment, and ability to ask for help or leave the area. Consider cultural preferences.
  - Exclusion criteria may include combativeness, agitation, extreme emotional instability, altered mental status, and intoxication. Families who do not wish to participate should be supported in that decision and should be supported while they are separated from the patient. If the family is not offered the option of family-member presence, the reason should be documented (eg, risk of combative or threatening behavior, extreme emotional lability, behaviors consistent with intoxication or altered mental status, disagreement among family members).
- Consult with health care team: As early as possible, inform the health care team of the family's presence. Discuss with the team the family's wish to be with the patient. Both the team and the facilitator should be in agreement and determine the appropriate time for the family to be at the patient's bedside. Departmental situations or constraints should be considered.
- Prepare family member(s): The facilitator will present the clinical situation, explaining what the family member may expect to observe during the patient's treatment. The facilitator will explain to the family that patient care is the top priority and alert them to any potential limitations on time or numbers of family members who may be present, where they may sit or stand to optimize patient contact without impeding care, and any situations in which they would be escorted out of the room and will reassure them that they may leave at any time. Family members agree to the structure of their time at the bedside.
- Escort family member(s) to the bedside: The facilitator will remain with the family at all times during the visit and explain procedures and answer questions. The family will be allowed to see, touch, and speak with the patient when possible. If the time at the bedside must be limited, the facilitator will escort family to a private room and provide clinical updates on the patient's condition. A facilitator, primary nurse, or psychiatric clinical nurse specialist will follow-up with the family.

Note that this policy should undergo institutional legal review and, when verified as part of hospital policy, be part of staff education and orientation.

APPENDIX 3: RESOURCES FOR PFCC IN EMERGENCY CARE

Emergency Medical Services for Children National Resource Center Web site (available at: http://bolivia.hrsa.gov/emsc)

Emergency Nurses Association. *Position Statement: Pediatric Patient Care in the Emergency Setting*. Des Plaines, IL: Emergency Nurses Association; 2007 (available at: www.ena.org/about/position/pdfs/4592d5a3e6c04a579c09be5c3fdedadf.pdf).

Institute for Family Centered Care Web. Useful links (available at: www.familycenteredcare.org/index.html.)

Rundle AK, Carvalho M, Robinson M. *Cultural Competence in Health Care: A Practice Guide*. San Francisco, CA: Jossey-Bass; 1999

Society of Pediatric Nurses. *Family-Centered Care: Putting It Into Action—The SPN/ANA Guide to Family-Centered Care*. Pensacola, FL: Society of Pediatric Nurses; 2003 (available at: www.pedsnurses.org/component/option.com_docman/Itemid,117/task,doc_view/gid,104/)

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Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

Parent-Provider-Community Partnerships: Optimizing Outcomes for Children With Disabilities

Nancy A. Murphy, MD, Paul S. Carbone, MD, and the COUNCIL ON CHILDREN WITH DISABILITIES

KEY WORDS
disabilities, children with special health care needs, community, medical home

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abstract

FREE

Children with disabilities and their families have multifaceted medical, developmental, educational, and habilitative needs that are best addressed through strong partnerships among parents, providers, and communities. However, traditional health care systems are designed to address acute rather than chronic conditions. Children with disabilities require high-quality medical homes that provide care coordination and transitional care, and their families require social and financial supports. Integrated community systems of care that promote participation of all children are needed. The purpose of this clinical report is to explore the challenges of developing effective community-based systems of care and to offer suggestions to pediatricians and policy-makers regarding the development of partnerships among children with disabilities, their families, and health care and other providers to maximize health and well-being of these children and their families. *Pediatrics* 2011;128:795–802

INTRODUCTION

Children with special health care needs are a group of 10 million US children with a wide variety of conditions, medical needs, and caregiving requirements.[1] However, children with disabilities, a subset of children with special health care needs, tend to have more complex conditions and functional impairments, often with technology dependencies and recurrent hospitalizations. In fact, 6.3% of US children between 5 and 15 years of age have 1 or more disabilities, and approximately 1%, or nearly one-half million children, are unable to care for themselves.[2] Over the past 50 years, the number of children living with disabilities has tripled, largely as the result of health care advances that have allowed the survival of children with conditions that were historically incompatible with life.[3] Children and adolescents have had the highest growth rate of disability of any age group during the past decade.[3] Despite these changing demographics, the current system of health care continues to use an outdated system that emphasizes acute illness and well-child care at the expense of long-term management of chronic conditions and disabilities.

Historically, hospital-based or institutional care was the only option for most children with complex medical conditions, technology dependence, and significant behavioral and emotional needs. More recently, social policy has promoted community-based programs that provide care for children with disabilities in their homes and communities.[4] For

example, Healthy People 2010 set a goal of reducing to zero the number of children and youth living in congregate care settings. These well-intentioned efforts to care for all children with disabilities in their homes and communities rather than congregate care centers have benefitted many children and families. However, community-based care has also brought new and unanticipated challenges for some children with disabilities, their families, communities, and health care systems. The purpose of this clinical report is to explore the challenges of developing effective community-based systems of care and to offer suggestions to pediatricians and policymakers regarding the development of partnerships among children with disabilities, their families, and health care and other providers to maximize the health and well-being of these children and their families.

ADDRESSING THE NEEDS OF CHILDREN WITH DISABILITIES

Children With Disabilities Require Medical Homes

It is a national health care objective to ensure that all children with special health care needs have access to comprehensive health care consistent with the standard of a medical home.[5,6] A core component of community-based systems of care, the medical home ideally comprises providers who are knowledgeable in the area of chronic condition management and actively screen all children for developmental disability.[4] Children with disabilities cared for in medical homes that provide care coordination benefit from increased access to subspecialty care, fewer missed days of school, and decreased family financial burden.[7] Moreover, having a medical home is a predictor for less inpatient and emergency department utilization[8] and fewer unmet medical and support-service needs.[9] The longitudinal relationship between medical home providers, children with disabilities, and their families provides a comfortable and trusted framework for shared decision-making and, in some instances, end-of-life discussions. Despite these benefits, only half of all children with special health care needs currently receive care consistent with an ideal medical home, a proportion that is significantly lower than that of their typically developing peers.[7] Living in poverty or certain geographic locations and having a more severe disability or certain conditions, such as autism, further limit a child's access to a medical home.[9–11]

Beyond access, care coordination within the medical home matters. Care coordination facilitates strong partnerships between families and physicians and supports shared medical decision-making. Providers beyond the medical home are frequently involved in the care of children with disabilities in emergency departments, subspecialty clinics, and hospitals. Even if they do not participate directly in care delivery, medical homes can collaborate with providers and families to foster trust, provide information, and assist in treatment planning.[12] Without such collaborations, children with disabilities are at increased risk of experiencing adverse events related to delayed or incomplete information transfer between providers.[13] However, nearly half of all children with special health care needs do not receive adequate care coordination, at least in part because of inadequate payment to providers.[14,15] Eliminating barriers to effective care coordination within the medical home is essential if pediatric systems of care are to effectively address the needs of children with chronic conditions and disabilities.

Pediatricians have a vital role in linking medical homes with other community-based services for children with disabilities and their families. With universal approaches to developmental surveillance and screening, providers can make timely referrals for at-risk children to educational services, such as early intervention and special education programs. Familiarity with the Individuals With Disabilities Education Act and Section 504 of the Rehabilitation Act can help pediatricians effectively advocate for children with disabilities and their families in the development and implementation of individualized educational plans that are family centered and goal directed.[16,17] Likewise, the medical home should be a clearinghouse of information for potential sources of support for families and assist in providing medical information to agencies to facilitate the eligibility process.[18] For example, the Supplemental Security Income (SSI) program can provide financial assistance and establish eligibility for other vital services that may not otherwise be accessed.[19]

Although financing the critical aspects of the medical home has been a barrier for implementation, recent national policy changes have improved the outlook on providing these services for children with disabilities. The Children's Health Insurance Program Reauthorization Act of 2009 contains several provisions that support state initiatives to strengthen medical homes for children with disabilities. For example, Idaho and Utah are using electronic health records and other health information technology and placing medical home coordinators in primary and subspecialty practices to improve care coordination.[20] In addition, section 2702 of the Affordable Care Act (Health Home for Enrollees With Chronic Conditions) provides states the option to receive an enhanced federal match if they amend

state plans to fund medical home services for children with disabilities.[21]

Youth With Disabilities Require Transitional Care

Every year, more than one-half million youth with disabilities transition to adulthood.[22] This process may include participation in postsecondary education, vocational training, employment, independent or supported living arrangements, and adult health care systems. However, for children with complex chronic conditions and lifelong functional limitations, the transition process can be complex and fraught with barriers, particularly for those who are uninsured, poor, or lacking medical homes or who have more severe disabilities.[23] Not all youth with disabilities transition fully into independent or supported living arrangements; for example, more than half of young adults with autism continue to live with their parents.[24] Uninterrupted comprehensive health care; coordinated transfers of medical information; and accessible, affordable, and continuous health insurance coverage are core elements of successful health care transitions.[25] Lack of adult provider expertise and experience in the care of youth with child-onset disabilities creates additional access barriers, even for those young adults with insurance coverage. Changes in insurance rules and training for the medical workforce would improve transition processes.[26] Several pilot programs that provide clinical services during the late adolescent/young adult years or deliberate transition-specific care coordination offer promising approaches to health care transitions for youth with disabilities.[26]

Pediatricians can assist in the transition of youth with disabilities into adult health care systems by preparing families well in advance, assisting in the identification of adult providers, and communicating relevant patient information with adult providers via written medical summaries and current care plans. Provisions in the Individuals With Disabilities Education Act mandate the development of an individualized transition plan (ITP) to prepare youth with disabilities to enter the adult community. Pediatricians can assist youth with disabilities by encouraging pursuit of identified vocational goals and advocating for implementation of an appropriate individualized transition plan.[27]

ADDRESSING THE NEEDS OF FAMILIES OF CHILDREN WITH DISABILITIES

Parents of Children With Disabilities Need Opportunities to Promote Their Own Health and Well-being

Parents of children with disabilities often experience unrecognized and, therefore, unaddressed negative consequences of long-term caregiving. They are in poorer physical and emotional health than are parents of typically developing children.[28,29] When compared with others, parents of children with cerebral palsy report greater chronic distress and higher rates of back problems, migraine headaches, stomach/intestinal ulcers, and chronic pain.[30] Parents of children with technology dependencies report limited time for sleep and for participation in social and community activities.[31] Behavioral problems in children with autism spectrum disorders are strongly associated with parental stress.[32,33]

When parents of children with disabilities experience poor health, they may be less able to care for their children, which sets up a vicious cycle of negative outcomes for all family members.[30,34] In fact, the physical health of parents is directly associated with the physical health of their children with cerebral palsy, and their mental health is significantly associated with the psychosocial function and total quality of life of their children.[35] Strategies that promote the health and well-being of parents might benefit the entire family through these complex, reciprocal interactions. For example, resilient families of children with autism find a positive meaning in the disability, mobilize resources, and gain spiritual strength, which culminates in greater family cohesion and appreciation of life.[36] Linking parents of children with disabilities to appropriate family organizations and peer support has been shown to positively affect both parents and children.[37–40]

Siblings of Children With Disabilities Need Support

Living with a child with a disability changes the childhood experience for siblings. Many siblings report that family routines are focused and planned around the sibling with a disability. Older siblings report that they have provided nursing and respite care, which limits their own time for social activities outside the home. Nearly half of all siblings report that their attendance and performance at school is negatively affected by the home care regimen of a sibling dependent on technology.[31] The caregiving responsibilities and frustration about perceived competition for parental attention render siblings of children with disabilities at heightened risk of negative psychological effects such as anxiety and depression.[40] Despite these challenges, nearly 40% of parents of children with developmental disabilities report positive outcomes for siblings.[41] Family-based interventions that enrich sibling experiences while minimizing negative consequences are needed.

Parents of Children With Disabilities Need Financial Support

Forty percent of families with children with special health care needs experience financial burden related to their child's condition.[42] Although most families of children with special health care needs have medical insurance, underinsurance resulting in financial stress preferentially affects families of children with disabilities.[43] Reports of financial hardship are more frequent in families with children with more severe disabilities, those with lower incomes,[44] and those with certain conditions such as autism spectrum disorders.[45,46] Hopeful investment in unproven interventions can further deplete family finances.

At the same time that families of children with disabilities experience greater financial demands, nearly 30% of them also contend with loss of income secondary to the need to reduce or eliminate employment.[47] Although some innovative employers offer benefits that might support employees of children with disabilities,[48] having a child with a disability is still associated with reduced parental employment. Single parents of children with technology dependencies are 15 times more likely to quit employment secondary to care responsibilities at home than those in 2-parent families.[49] Lower financial stress is associated with receipt of coordinated care in a medical home, having adequate insurance, and access to organized and accessible community-based service systems.[42] Beyond reducing financial stress, employment builds resilience in parents by offering challenges and rewards that are distinct from the complex responsibilities of caregiving.[49]

The recently enacted Affordable Care Act contains several provisions within private insurance reform that benefit families of children with disabilities: (1) elimination of lifetime and annual caps on benefits; (2) guaranteed coverage through elimination of preexisting condition denials; and (3) expansion of dependent coverage up to the age of 26 years. Once exchanges are established by 2014, benefits for health plans must include chronic disease management, behavioral health treatment, habilitation and rehabilitation services and devices, and oral and vision care. The scope of each of these benefits is yet to be defined.[21]

Families of children with disabilities rely on a variety of public and private programs such as private insurance, Title V programs, special education services, Supplemental Security Income (SSI), and Medicaid. SSI can be an important source of financial support for low-income families of children with disabilities.[19] Since 1993, the Family Medical Leave Act (FMLA) has afforded parents of children with disabilities the option of taking up to 12 weeks of excused absence from their work per year to better balance work and family obligations.[50] The mix of support varies depending on geographic location, parental income, and eligibility factors, and pediatricians can guide parents as they navigate these complex systems of funding.[3] Family coordinators in medical homes can identify community resources and offer supports for both families and providers of children with disabilities.[51]

Families Require Options for High-Quality Care Outside the Home

With proper support, most children with disabilities thrive at home.[52] Although home is the ideal place for most children, it may not be the best place for every child. In 1997, approximately 1 per 1000 (nearly 25 000) children and youth were cared for in congregate care settings, including group homes and residential centers.[53] Healthy People 2010 established an objective to reduce this number to zero. Five years later, the percentage of children and youth cared for in congregate care settings was nearly unchanged,[53] which may relate to the unpredictable and often unavoidable circumstances that necessitate that children with disabilities receive intervals of care outside of their homes. The long-term demands of addressing the physical, emotional, and behavioral needs of some children with disabilities may periodically exceed that which their parents and families can manage, particularly when financial and social supports are limited.[28] In such instances, the stress of caregiving can lead to disrupted parenting and poor child outcomes.[54] For example, children with disabilities are 3 to 4 times more likely to be neglected or abused than are typically developing children.[55] Community-based congregate care options can offer safe harbor for children with disabilities when families find themselves in need of respite or when facing crisis situations. By maintaining strong partnerships, pediatricians can recognize families in crisis and assist them with finding appropriate resources.

ADDRESSING NATIONAL GOALS

Communities Must Promote the Participation of All People, Including Children With Disabilities

The World Health Organization's International Classification of Function characterizes people with disabilities according to their ability to participate in meaningful community activities rather than diagnostic groupings. It emphasizes what children do rather than how they do it and note that the presence of a disability does not suggest an absence of health.[56] The participation of each child is influenced by contextual elements such as interactions between the child, family, and community. Although all children, including those with disabilities, can

benefit from participation in sports, recreation, and physical activities, personal and societal barriers need to addressed.[57] In general, children with disabilities are less involved in leisure activities than their peers and engage in activities that are more passive, home based, and less varied.[58] Parents and children with physical disabilities describe architectural barriers, restrictive policies, limited personal assistance, cultural biases, and inadequate social support as major barriers to community participation.[59] Age, gender, activity limitations, family preferences, and coping, motivation, and environmental resources are other determinants of participation.[58]

Coordinated Systems of Care for Children With Disabilities Need Universal Implementation

A well-functioning system of family-centered, coordinated health care for children with disabilities would comprise a full range of health care, education, and social services.[50] The overarching goal would be to address each child's mental, physical, emotional, and social needs to optimize function and participation according to the International Classification of Function model of disability. Regardless of the point of entry, children and their families would be linked to other necessary services, because the system would be accessible, flexible, and responsive. Family partnerships would lie at the hub of this system, consistent with the fact that families know their children best and make decisions on behalf of their children.[50] This community-based system of service would be universally accessible, equitable, and organized to promote the cost-effective provision of evidence-based care.[60]

A comprehensive community-based system has been conceptualized but not implemented. Despite the evidence that a sense of partnership between families and providers is associated with fewer unmet needs and better outcomes overall, of US families of children with special health care needs, 1 million (14%) report a lack of such partnerships.[61] Poverty, minority status, lack of insurance, and greater severity of functional limitations are associated with greater risk of lacking a sense of partnership.[61] The barriers to implementation include lack of integration, coordination, and communication between various service providers and agencies; lack of adequate funding to develop system infrastructure; lack of funding sources to meet children's needs; and balancing privacy concerns with service providers' need for information.[50] Although our society expects that parents will unconditionally and indefinitely care for their children with disabilities, our health care system offers, at best, a fragmented and 1-size-fits-all response to their individualized and often changing needs.[62] The Affordable Care Act addresses several of these shortcomings with provisions that strengthen community-based options for long-term services and supports for children with disabilities: (1) the Community First Choice Option; (2) new options for home- and community-based services in Medicaid; and (3) extension of "money follows the person" demonstration grants.[63]

Analogous to Russian nesting dolls, children with disabilities do not live in isolation but are embraced by their parents, who function within family units, which are, in turn, nested in communities and, ultimately, in local and national health care systems.[64] This social ecological framework of human development illustrates the critical importance of community-based systems response to the multifaceted and dynamic interdependencies among children with disabilities and their parents, families, communities, and health care systems.[65] Because the characteristics of each child and family, their shared history, and the social, economic, and cultural contexts within which they find themselves combine to create an infinite variety of circumstances,[66] care must be individualized and based on the tenets of mutual trust, respect, and family-centered decision-making.

SUGGESTIONS FOR PEDIATRICIANS

1. Provide a medical home for children with disabilities that emphasizes the family as a valued partner in decision-making, coordinates care with subspecialists, and links families with community-based services.
2. Ensure coordinated, deliberate, and community-based transitions for all youth with disabilities by advocating for access to appropriate educational and related community-based transition services and coordinating with adult medical providers.
3. Recognize the unique needs of parents and siblings of children with disabilities, and offer strategies for them to promote their own physical and emotional health and well-being, including links to family support groups and mental health services.
4. Understand and promote access to financial supports for families of children with disabilities, including Medicaid, Supplemental Security Income, and Family Medical Leave Act programs.
5. Recognize caregiver stress and ensure that all parents are aware of self-care strategies and options for high-quality care for their children with disabilities, both inside and outside the home.
6. Encourage participation of children with disabilities and their families in educational, recreational, and social activities by actively linking

them to community-based agencies and organizations.

7. Adopt a family-centered approach to the care of children with disabilities by involving families in all aspects of medical decision-making.

SUGGESTIONS FOR POLICY-MAKERS

1. Ensure enforcement of health insurance reforms that benefit children with disabilities under the Affordable Care Act, including the elimination of lifetime and annual caps on benefits, guaranteed coverage through elimination of preexisting-condition denials, and the expansion of dependent coverage up to the age of 26 years.
2. Adopt models that support essential functions of medical homes for children with disabilities, including care coordination and telephone management.[67]
3. Advocate for the continuous provision of vital public health services that support families of children with disabilities, including state Title V programs and Family-to-Family Health Information Centers.
4. Maintain and extend public coverage options (Medicaid and Children's Health Insurance Program) for children with disabilities through Affordable Care Act initiatives, such as simplifying eligibility requirements and amending state Medicaid plans to fund medical home activities.

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POLICY STATEMENT

Patient- and Family-Centered Care and the Role of the Emergency Physician Providing Care to a Child in the Emergency Department

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

AMERICAN ACADEMY OF PEDIATRICS
Committee on Pediatric Emergency Medicine

AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
Pediatric Emergency Medicine Committee

ABSTRACT

Patient- and family-centered care is an approach to health care that recognizes the role of the family in providing medical care; encourages collaboration between the patient, family, and health care professionals; and honors individual and family strengths, cultures, traditions, and expertise. Although there are many opportunities for providing patient- and family-centered care in the emergency department, there are also challenges to doing so. The American Academy of Pediatrics and the American College of Emergency Physicians support promoting patient dignity, comfort, and autonomy; recognizing the patient and family as key decision-makers in the patient's medical care; recognizing the patient's experience and perspective in a culturally sensitive manner; acknowledging the interdependence of child and parent as well as the pediatric patient's evolving independence; encouraging family-member presence; providing information to the family during interventions; encouraging collaboration with other health care professionals; acknowledging the importance of the patient's medical home; and encouraging institutional policies for patient- and family-centered care.

INTRODUCTION

Patient- and family-centered care (PFCC) is an approach to health care that recognizes the integral role of the family and encourages mutually beneficial collaboration among the patient, family, and health care professionals. PFCC ensures the health and well-being of children and their families through a respectful family-professional partnership. It honors the strengths, cultures, traditions, and expertise that all members of this partnership bring to the relationship. PFCC is the standard of practice that results in high-quality services.[1] PFCC embraces the concepts that (1) we are providing care for a person, not a condition, (2) the patient is best understood in the context of his or her family, culture, values, and goals, and (3) honoring that context will result in better health care, safety, and patient satisfaction.

Although there are many opportunities for providing PFCC in the emergency department (ED), there are significant challenges to doing so.[2] Overcrowding and

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Key Words
patient- and family-centered care, family-centered care, family-member presence, cultural sensitivity, pediatric patient's medical home

Abbreviations
PFCC—patient- and family-centered care
ED— emergency department
AAP—American Academy of Pediatrics

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acuity in the ED may result in delay or disruption of care, challenging the ability of ED staff to provide respectful and sensitive care. The lack of a previous relationship between patient/family and health care professionals and the acute nature prompting an ED visit can make it difficult to create an effective partnership. The many cultural and societal variations among families can increase the difficulty in identifying who is a child's legal guardian. Situations unique to the ED, such as the arrival of a child by ambulance without family, the unaccompanied minor seeking care without the knowledge of family, visits related to abuse or violence, time-sensitive invasive procedures including resuscitation efforts, and the unanticipated death of a child, require the most thoughtful advanced planning.[3–5]

The option of family-member presence during invasive procedures including resuscitation efforts has been recommended in a statement by the Ambulatory Pediatric Association[2] that was endorsed by the American Academy of Pediatrics (AAP) in November 2004. PFCC includes respect for the privacy of the patient and acknowledgment of the pediatric patient's evolving independence, especially with regard to reproductive issues. Communication between health care professionals in the ED and the child's medical home primary care physician who is accessible and community-based and offers coordinated, comprehensive, continuous, culturally effective care[6] will enhance support of PFCC in the ED.

The AAP and American College of Emergency Physicians have a long tradition of supporting PFCC and have issued independent and joint policy statements in the past.[7,8] This policy statement addresses the particular challenges in, and opportunities for, providing PFCC in the ED setting and is in concert with and as an adjunct to earlier statements.

RECOMMENDATIONS

The AAP and American College of Emergency Physicians support the following:

1. Knowledge of the patient's experience and perspective is essential to practice culturally effective care that promotes patient dignity, comfort, and autonomy.
2. The patient and family are key decision-makers regarding the patient's medical care.
3. The interdependence of child and parent, patient and family wishes for privacy, and the evolving independence of the pediatric patient should be respected.
4. The option of family-member presence should be encouraged for all aspects of ED care.
5. Information should be provided to the family during interventions regardless of the family's decision to be present or not.
6. PFCC encourages collaboration with other health care professionals along the continuum of care and acknowledgment of the importance of the patient's medical home to the patient's continued well-being.
7. Institutional policies should be developed for provision of PFCC through environmental design, practice, and staffing in collaboration with patients and their families.

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POLICY STATEMENT

Patient Safety in the Pediatric Emergency Care Setting

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine

ABSTRACT

Patient safety is a priority for all health care professionals, including those who work in emergency care. Unique aspects of pediatric care may increase the risk of medical error and harm to patients, especially in the emergency care setting. Although errors can happen despite the best human efforts, given the right set of circumstances, health care professionals must work proactively to improve safety in the pediatric emergency care system. Specific recommendations to improve pediatric patient safety in the emergency department are provided in this policy statement.

BACKGROUND

Since the release of 2 landmark reports by the Institute of Medicine (IOM) Committee on Quality of Health Care in America in 1999 and 2001,[1,2] patient safety has become a priority issue and area of focus for health care professionals and researchers, hospital administrators, policy makers, accrediting agencies, health care purchasers, and patients and families. The US Department of Health and Human Services, through the Agency for Healthcare Research and Quality, launched a $50 million initiative in 2001 to increase and improve research in patient safety.

Despite an increased focus on patient safety at a national level, leaders in patient safety and quality improvement have reported little progress in reduction of harm since the release of the IOM reports.[3] Professional societies, national health care agencies, individual health care systems, and hospitals have demonstrated some successes such as a reduction in serious infections or fewer patients dying from accidental injections of concentrated potassium chloride. Overall, however, there is still much room for improvement in delivering safe, high-quality health care in America.

Health care can be risky and highly complex. Thousands of patients still die or suffer harm from medical errors while receiving health care services despite the dedication and hard work of well-trained health care professionals who seek to provide good care. Leape, in a seminal article published in 1994,[4] sought to explain the epidemic of medical errors by comparing the American health care system to other highly complex, high-risk industries such as nuclear power and aviation. Researchers in these industries found that mishaps and accidents were often caused by poorly designed systems rather than by mistakes of irresponsible or ill-prepared individuals. Leape further noted that skilled people predictably make some mistakes, especially when distracted or fatigued, so the complex systems in which they function must be designed in a way to defend against human error.

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

Key Words
patient safety, pediatric patient safety, clinical quality, quality improvement, performance improvement, culture of safety, medication safety, pediatric emergency care, emergency medical services for children, teamwork training, family-centered care, safety event reporting system

Abbreviations
IOM—Institute of Medicine
EMS—emergency medical services
ED—emergency department
AAP—American Academy of Pediatrics
HRO—high-reliability organization
ATLS—Advanced Trauma Life Support
CPOE—computerized physician order entry
CRM—crew resource management

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Reason, a noted psychologist and expert in human performance, described numerous human factors that predictably lead to errors when humans work in complex systems.[5] For example, memory, vigilance, and attention to detail often decrease when people are fatigued or stressed. Errors occur more readily when people are required to perform multiple complex cognitive tasks simultaneously, such as calculating a dose of medicine for a child while performing clinical tasks such as airway maneuvers or establishing intravascular access, as might be the case in the out-of-hospital emergency medical services (EMS) or emergency department (ED) setting.

A limited number of studies have been published describing problems related to pediatric patient safety; however, the body of literature is growing.[6–9] Unique aspects of pediatric care that may increase the risk of medical error include lack of standardized dosing because of size variation in the pediatric age range; inability of young children to provide a medical history or clearly communicate complaints; and the unique physical and developmental characteristics of children that may affect treatment strategies and medication regimens. The American Academy of Pediatrics (AAP) has published 2 policy statements on patient safety that describe these risks in more detail and provide useful recommendations for all pediatric health care professionals.[10,11]

Studies have suggested that medication dosing in children is a particularly high-risk activity, because it requires manual dosing.[12] Standardized unit doses are rarely used in children; rather, each dose of medicine is calculated by using a dosing equation based on the child's weight. The act of calculating dosing equations has been identified as a high-error activity, and several factors compound the risk of error when medications are given emergently.[13] For example, the child's weight is often not known and, therefore, must be approximated. There are limited opportunities for prescription monitoring or double checking, and in some cases, the inherent stress of managing a life-or-death situation can lead to errors. Indeed, a study that reviewed medical errors in academic medical centers found the pediatric service to be the most error-prone setting and the ED to be a close second.[14]

Three reports from the IOM Committee on the Future of Emergency Care in the United States Health System in 2006 identified patient safety as a significant concern.[15–17] The report dedicated to pediatric care, *Emergency Care for Children: Growing Pains*, noted that the state of pediatric emergency care in 2006 was best described as "uneven." This assessment of the current performance of our nation's EMS system for ill and injured children offered specific observations and recommendations relating to pediatric patient safety, including that "hospitals and EMS systems should implement evidence-based approaches to reduce errors in emergency and trauma care for children."[15]

STATEMENT OF THE PROBLEM

Caring for children in the emergency setting is especially prone to error because of a number of environmental and human factors. The ED environment is often hectic and chaotic, with frequent workflow interruptions. The out-of-hospital emergency care setting can be similarly chaotic. Wide fluctuations in patient volume, especially including large numbers of children who are not seriously ill or injured, require increased resources and attention from physicians and nurses, who then become distracted from caring for more critically ill or injured children.[18] Shift work, especially overnight shifts—although necessary for fulfilling the 24/7 mission of EDs—can lead to provider fatigue and increased risk for errors.[19]

There are many opportunities for communication errors in the ED because of numerous hand-offs of care, decision-making by multiple health care professionals and consultants, and frequent verbal orders during emergency events, which preclude the opportunity for redundancy and "double checks."[20] In addition, a growing number of children and families who present to an ED do not speak English. Studies have shown that these patients may represent a group that is at high risk for medical errors.[21]

Most children in this country are cared for in EDs that are located in general hospitals rather than in hospitals dedicated to the care of children. Because a minority of patients in general hospitals are in the pediatric age group, many ED staff may lack familiarity with pediatric emergencies and sufficient opportunities to regularly practice the cognitive and technical skills necessary for providing emergent pediatric care.

Finally, there is great opportunity for improvement during the process of ordering and administering medications to children in the emergency setting. Observational studies of simulated pediatric emergency events have identified problems with dosing of medications[22] and conversion of medication doses ordered in units by weight (eg, milligrams) to the appropriate number of units by volume (eg, milliliters), depending on the formulation of the drug.[23] These studies have also described a prolonged period of time required to calculate doses and administer certain critical medications.[22,23]

STRATEGIES FOR IMPROVEMENT

High-Reliability Organizations

A key concept in the development of a safer environment in the ED is that of a high-reliability organization (HRO). HROs are those that operate in a high-risk environment but maintain very low rates of injury or

harm.[24] In these organizations, there is a general acknowledgment among all members that a mishap can happen at any time, given the right set of circumstances, and that only through a constant mindfulness that no person or organization is perfect can the risk of mishap be minimized. It is this desire to achieve perfection, while at the same time recognizing that mishaps can occur, that allows HROs to achieve such impressive safety records.

Systems-Based Approach to Patient Safety

A preoccupation with the potential for harm manifests itself in a systems-based approach to patient safety, an approach that acknowledges that human beings and their limitations must be accounted for in the design of the system.[24] By proactively designing a system that takes into account the strengths and limitations of individual health care professionals, the ED team can improve the safety of patients and minimize the risk of harm.

Examples of the systems-based approach include the standardization of processes or procedures as guided by evidence rather than by individual preference. A specific example provided by Pronovost et al[25] demonstrated how use of a standard approach to the insertion of central venous catheters could reduce the number of associated bloodstream infections.

A number of national organizations are beginning to identify evidence-based safe practices that can lead to improved patient safety. The National Quality Forum recently published its recommendations for 30 safe practices for better health care,[26] and the AAP Safer Health Care for Kids project, funded by a Physician's Foundation for Health Systems Excellence grant, is assembling various safe practices as part of a suite of Web offerings, including Web seminars and an unprecedented pediatric patient safety Web site, to improve the care of children.[27]

Hand-washing is a simple example of a safe practice for all clinicians, including pediatric emergency care professionals. Ample evidence suggests that handwashing is an important component of infection-control practices,[28] and patients and families should be taught that the most important thing they can do to prevent the spread of infectious diseases is to wash their hands at home. Health care professionals have a great opportunity to provide an example and model behavior that will lead to improved patient safety by washing their hands before and after examining each patient in the ED.

Best Practice in Emergency Stabilization and Resuscitation

Emergency care is most complex and risky in the setting of resuscitation, when assessment, information transfer, and treatment must occur simultaneously at the hands of a multidisciplinary team.[15] Many members of the ED team maintain training in resuscitation techniques through life support courses such as Pediatric Advanced Life Support,[29] Advanced Pediatric Life Support,[30] and Advanced Trauma Life Support (ATLS).[31] These courses offer a well-structured "ABC" approach as a standard that should be used to direct patient assessment and potentially life-saving interventions. After addressing concerns related to airway, breathing, and circulation, the team must continue through the resuscitation protocol to identify signs of critical illness or injury that require prompt treatment. However, observational studies have demonstrated that health care professionals do not always adhere to ATLS guidelines.[32] A recent study described marked variation in the clinical performance of ED professionals in a simulated pediatric trauma event.[32] Resuscitation tasks associated with both the primary survey (a quick examination to identify life- or limb-threatening injuries) and the secondary survey (a complete head-to-toe examination to identify all signs of injury) were often skipped or performed incompletely by the ED team.

Evidence-Based Clinical Guidelines and Decision Support

Researchers in many other areas of health care have described clinical practice variability, even in areas for which best practice has been defined on the basis of strong scientific evidence and a high degree of expert consensus.[33] In the past few years, there have been many efforts to increase the use of evidence-based care guidelines and therapies by health care professionals through regulatory mechanisms (such as the pay-for-performance initiative of the Centers for Medicare and Medicaid Services and the use of quality measures by the Joint Commission on Accreditation of Healthcare Organizations), provider organizations (AAP, American College of Emergency Physicians, American College of Surgeons), and individual health care institutions. A number of quality improvement initiatives have been implemented to improve compliance with clinical guidelines and evidence-based therapies. A recent review of 59 published evaluations of clinical guidelines showed that the most effective implementation strategies were those that provided patient-specific advice at the time of decision-making,[34] such as at the time of entering orders.

Information Technology

Computerized physician order entry (CPOE, or clinical provider order entry) systems can provide a useful platform for integrating evidence-based guidelines into clinicians' workflow by providing "just-in-time" treatment advice or decision support tailored to the needs of the individual patient.[35] It is important to note, however, that unanticipated problems may result from implementation of a CPOE system that is not customized for children.[36] Although CPOE is not yet available in many EDs,

ED providers should advocate for pediatric-specific information technology tools and systems such as this, which can help improve the quality and safety of care provided to patients.

Safety WalkRounds

In HROs, the clear goal of every team member is to improve safety. This requires open lines of communication, such that any individual who has a critical piece of information is expected to communicate it to whomever needs to know, regardless of hierarchy, seniority, title, gender, pay grade, or ethnic background. ED leaders can initiate activities that will help create a culture in which every team member is comfortable to speak up about safety concerns. One such activity is Safety WalkRounds,[37] which was developed to help executives and leaders learn from front-line staff how to improve care and reduce the risk of error in clinical care areas. Hospital executives or clinical and operational leaders and managers walk around care units and talk directly with staff to identify "what will hurt the next patient here." This experience helps to close the gap between leadership and front-line staff perspectives on safety. It allows physicians, nurses, and other staff members to express their safety concerns directly to hospital leaders and executives, and it allows executives an opportunity to model safety as a priority and provide appropriate resources to improve care.[38]

Safety Event Reporting Systems

Another opportunity for staff to share concerns is through the use of a voluntary reporting system. Many institutions and states have implemented reporting systems in response to the recommendation of the IOM to expand reporting of serious adverse events and medical errors.

The primary purpose of reporting is to learn from experience, especially when near-misses are included in the reports. Ideally, when an adverse or near-miss event occurs, an analysis is completed and changes are made to prevent a recurrence of the event. When aggregate voluntary reporting-system data are reported to an external body, the lessons learned can be shared more broadly, which then can lead to improved safety throughout the organization through the identification of trends or recurrent hazards and development of best practices to reduce risk.[10]

A number of computerized reporting systems have been developed, but many hospitals and health care agencies still use hand-written reports. Whatever reporting method or system is used, it should be nonpunitive, readily accessible, and easy for staff to use. Feedback to the reporter is important for addressing the concerns raised, offering possible solutions, and encouraging future reporting. As the AAP recommended in "Principles of Patient Safety in Pediatrics,"[10] reporting systems should require that information reported to internal and external review groups should not be discoverable in civil or legal actions.

Teamwork Training

The ED environment is similar in many ways to other high-risk workplaces, such as in aviation settings, where behavioral principles known as crew resource management (CRM) were developed to improve safety.[39] Crew training led to reductions in aviation mishaps, beyond those eliminated by improvements in equipment and technology, by focusing on behaviors of the people (team members) who use the technology. The basic principle of CRM is that team communication and coordination behaviors are identifiable and teachable. Indeed, specific teamwork behaviors have been observed in high-reliability teams performing in very demanding, high-risk, time-stressed environments such as combat aviation.[40]

The IOM recommended in its 1999 report that organizations "establish interdisciplinary team training programs that incorporate proven methods for team management, such as CRM."[1] A number of institutions are now providing teamwork training for physicians and staff members who work in high-acuity areas such as emergency medicine, critical care, perinatology, and surgery.

When the physician, as team leader, sets a tone of mutual respect and "psychological safety" by calling team members by name and inviting their input, staff satisfaction improves, staff turnover decreases, and team members report a safer environment for patients.[41,42] Too often, procedure-related errors occur when a member of the care team is aware of the error but is unable to communicate it to the physician. Staff can be taught communication skills, such as critical language skills, that will help avoid this type of situation. A consistent phrase can be used by all team members to signal an impending adverse event without disrupting the care environment. When such a phrase is used (such as "I need clarity"), the message communicated to the team leader is that he or she must stop and listen to the team member who has a concern about the patient's safety. Additional communication techniques, such as SBAR (situation, background, assessment, recommendation),[42] provide staff with a tool for facilitating the exchange of pertinent and important clinical information by using a standard format. Communication techniques such as this are critically important at times of hand-off in care, such as at change-of-shift when patients are transferred from one care team to another.

Patient- and Family-Centered Care

Patient- and family-centered care is an approach to health care that recognizes the integral role of the family and encourages mutually beneficial collaboration and partnership among the patient, family, and health care professionals.[43] Although there are many opportunities for providing patient- and family-centered care in the ED, there are also significant challenges to doing so. The lack of a previous relationship between patient/family and health care professionals, as well as the acute nature of many events prompting an ED visit, can limit efforts to create such a partnership and, likewise, may limit effective communication with the family. Situations particular to the ED, such as the arrival of a child by ambulance without his or her family, the unaccompanied minor who is seeking care without the knowledge of his or her family, or the day-to-day phenomena of overcrowding and high patient acuity in the ED, also pose significant challenges to patient- and family-centered care.

Family members and the medical home are both vital sources of information regarding the patient. The emergency care team should invite the family to be present during all phases of care, and the resources necessary to promote effective communication should be available. Timely identification of, and appropriate communication with, the child's medical home should also be considered in designing care processes. As mentioned previously, language and cultural barriers can present another challenge to successful communication and may increase the likelihood of medical errors when caring for non–English-speaking children and their families. This risk can be lessened by providing linguistically competent care through professional interpreters.[21]

Shift Work and Fatigue

In HROs, systems are designed to take into account the limitations of human beings, yet limitations related to fatigue are often not acknowledged. Cognitive and psychomotor skills cannot be consistently maintained by individuals who are fatigued, and prolonged wakefulness of 18 hours has been shown to have a negative effect on human performance approximately equivalent to a blood alcohol concentration of 0.1%.[44] Fatigue can negatively affect a variety of abilities that are critical in the emergency setting, including reaction time, hand-eye coordination, clerical accuracy, memory, and reasoning.[45] Sleep-deprived surgeons have been reported to make 20% more errors and take 14% longer to complete a laparoscopic surgical procedure in virtual-reality exercises.[45] Studies linking fatigue with medical errors have been reported for anesthesiologists,[46] residents,[47] and nurses[48]; residents attribute their medical errors to fatigue in 41% of cases.[47]

Joffe[19] and others have described strategies that can be used to reduce fatigue of health care professionals in the ED, and many of these strategies are related to shift work. The length of shifts should be carefully considered by those making the ED schedule. Although many workers prefer 12-hour shifts, a study that compared 8- and 12-hour shifts among nurses demonstrated increased fatigue and some safety concerns associated with the longer shift.[49] Another important consideration is shift sequence and rotation because of circadian rhythms. As human beings, we have an intrinsic biological clock, which cycles with an approximate period of 1 day. This cycle is not the result of cultural conditioning; rather, it is a property of neurons in the suprachiasmatic nucleus.[50] No amount of determination or professional commitment can fully override this fundamental biological function.[19]

Circadian rhythms can be altered over time, but this process transpires slowly. Generally, it takes at least 1 week to accomplish an 8-hour circadian phase change. Thus, ED providers who work a few consecutive overnight shifts usually are not able to accommodate to the schedule, and they are often significantly sleep deprived. If an ED group is large enough, it may be best to schedule single overnight shifts.[50]

Strategic napping is another fatigue countermeasure that might be considered by leaders of emergency medicine programs. After completion of an overnight shift, physicians can be encouraged to consider napping in a call room before driving home.[19] Strategies such as this can help ED providers meet the demands of the profession without compromising performance and without compromising their own health and safety or that of their patients.

Pediatric-Specific Clinical Tools

When performing resuscitation tasks in children, opportunities for error are magnified by several unique aspects of pediatric emergency care. Medication dosing, choice of equipment size, and determination of fluid volume for resuscitation all depend on the size of the child; thus, each must be determined or calculated in a high-risk environment by using high-level cognitive skills. Studies have shown that simple tools, such as a length-based tape that provides precalculated medication doses in color-coded zones,[51] can reduce deviation from the recommended dose range (dosing error) by 25% in simulated resuscitation scenarios, compared with other traditional dosing references.[22] By providing a precalculated dose for a specific length or weight zone, the tool helps to simplify and standardize the complex task of pediatric resuscitation.

Although helpful, the Broselow length-based tape is not ideal. Medication doses are listed on the tape in milligrams, yet nurses must draw up medications by volume. Although this tape provides precalculated medication doses for physicians to order, it does not provide the nurse with a precalculated volume (mil-

liliters) of medication to administer. There is currently no clinical tool universally available to ED nurses that provides them with this critical information, and a recent study of a simulated pediatric emergency event suggests that errors may occur at this point in the process of emergent medication administration.[23]

Many hospitals and health care systems are developing and/or implementing CPOE systems. Currently, few systems are available that provide precalculated doses of medications based on a weight that is entered into the system. Even fewer systems provide a precalculated dose in both milligrams and milliliters; without this capability, nurses and pharmacists will still be left to perform conversion calculations. Pediatric emergency health care professionals should advocate for a computerized dosing system to help reduce one of the greatest risks in pediatric care: that of medication dosing within the ED and hospital and at the time of discharge.

TRANSPARENCY AND DISCLOSURE: WORKING WITH PATIENTS AND FAMILIES

Physicians historically have been trained to be autonomous and ultimately responsible for the care of patients, including any errors that may occur. In the traditional "blame and shame" culture of medicine, errors were attributed to incompetent, lazy, or irresponsible people, so physicians and other health care professionals are often devastated when errors occur. Physicians feel guilty, frustrated, and often fearful of legal consequences. Most want to talk to patients and families about what happened, but few have been trained how to disclose unanticipated outcomes or medical errors appropriately. Worse yet, some health care professionals continue to be trained to avoid talking about adverse events.

Studies have clearly shown that patients and families want to know what happened at the time of an adverse event or unexpected outcome.[52,53] Sorrel King, as the mother of a young child who died after a medical error, has become a spokesperson for disclosure and patient safety and relates very clearly what she believes parents and families want: an honest explanation about what happened, a sincere apology, and to know what will be done to prevent a recurrence of the error in the future so that no one else will be hurt.[53] Consumer- and parent-driven groups have emerged that are aggressively demanding a change in culture on how health care organizations report errors to guarantee patient safety. One such organization worked with the Joint Commission on Accreditation of Healthcare Organizations to include kernicterus as a sentinel event alert for all hospitals, and the Agency for Healthcare Research and Quality has sponsored consumer-led workshops to advance patient safety.

Many institutions have implemented educational programs to teach physicians and other health care professionals how to appropriately disclose information to patients and families at the time of a medical error or unexpected outcome. Risk managers and hospital attorneys are most often supportive of such efforts, and many are willing to participate in educational sessions. In addition, instruction in disclosure and transparency is now being introduced in medical schools and nursing schools, and some institutions have implemented an educational experience on disclosure into the core competencies of residency training.

SUMMARY AND RECOMMENDATIONS

The ED is a stressful, risky, highly complex environment in which dedicated, hard-working professionals strive to provide safe, high-quality care to children and families. Over the past decade, a great deal has been learned about medical errors and patient harm, and there is a much better understanding of the environmental and human factors that can lead to adverse events. Health care professionals need first to acknowledge that mishaps can happen any time, given the right set of circumstances, and then must understand how critically important it is to proactively integrate safety into the pediatric emergency care system. Through collective efforts, a system can be designed that takes into account the strengths and limitations of health care professionals, and a culture can be established in which every team member understands how important it is to speak up and actively participate in initiatives to improve patient safety.

The following are recommendations to improve pediatric patient safety in the ED:

1. Raise awareness of safety as everyone's highest priority.
   a. Provide education on core patient safety concepts and topics at orientation for all ED staff and trainees and provide ongoing, regularly scheduled, multidisciplinary patient safety conferences and grand rounds.
   b. Include a discussion of patient safety issues and concerns as the first agenda item at health care organization governance (board of directors) meetings, medical and nursing department leadership meetings, performance improvement meetings, and operational meetings.
   c. Provide performance metrics and incentives related to patient safety for all clinical and administrative leaders.
2. Participate in, and model, important safety practices, including:
   a. hand-washing;
   b. time-outs before procedures;
   c. structured communication during hand-offs (ie,

times when patient care is transferred from one provider to another);

d. teamwork training; and

e. mock codes or simulated patient scenarios to rehearse the use of clinical guidelines (eg, ATLS, Advanced Pediatric Life Support, Pediatric Advanced Life Support).

3. Implement Safety WalkRounds.
   a. Encourage active and regular participation by hospital and department leaders and managers.
   b. Keep a log of risks and concerns that are identified and addressed, and document feedback to clinicians.
   c. Include front-line staff in the process.
4. Encourage nonpunitive voluntary reporting of medical errors and near-misses, and provide a convenient, user-friendly mechanism for filing the report.
   a. Promote use of a voluntary reporting system.
   b. Advocate that reported information not be discoverable, and design a system that allows individuals to maintain anonymity.
   c. Develop a clearly stated and timely process for addressing reports and tracking trends.
   d. Provide feedback to event reporters regarding resolution of the reported concern.
5. Provide training in teamwork and communication to include information on:
   a. CRM and psychological safety;
   b. the SBAR (situation, background, assessment, recommendation) technique;
   c. critical language; and
   d. briefing and debriefing.
6. Recognize fatigue as an important safety risk, and implement strategies for reducing fatigue in health care professionals.
   a. Consider the impact of length of shift on staff performance.
   b. Recognize effects of shift sequence and rotation on provider fatigue.
   c. Consider strategic napping to decrease fatigue.
7. Develop, implement, evaluate, and update multidisciplinary evidence-based clinical practice guidelines for pediatric emergency care.
8. Encourage the use of clinical tools to aid medication dosing and administration.
   a. Educate ED staff on the correct use of length-based tape.
   b. Promote development of CPOE systems with dosing parameters or other clinical tools.
9. Establish a link between efforts to improve care quality and safety within the ED to those in other units or departments that care for children.
10. Build a partnership between ED- or hospital-based safety improvement and efforts to improve the quality and safety of care provided by prehospital and intrahospital care providers.
    a. Work with EMS professionals to develop evidence-based prehospital care protocols for the treatment, triage, and transport of children.
11. Define pediatric emergency care competencies for all disciplines (physicians, nurses, paramedics, emergency medical technicians), and require health care professionals to receive the appropriate level of initial and continuing education necessary to achieve and maintain those competencies.
    a. Require regular training for key cognitive and technical skills and updates on resuscitation guidelines.
12. Integrate patient- and family-centered care into all aspects of pediatric care and in all settings.
    a. Provide timely access for emergency care providers to qualified language-translation support.
    b. Institute a system for timely identification of, and appropriate communication with, the child's medical home.
13. Advocate for formal training in transparency and disclosure of medical errors.
    a. Engage parents and families in training to convey the patient/family perspective to staff.
    b. Invite risk management and legal staff to participate.
    c. Include medical students, residents, and fellows in training.
    d. Revise morbidity and mortality conferences to include a discussion of system-based problems and error-reduction strategies.
14. Support the IOM recommendation that federal agencies and private industry should fund research on pediatric-specific technologies, equipment, and medications used by emergency care providers to improve patient safety.
    a. Implement CPOE and decision-support systems to aid in pediatric dosing.
    b. Use standard dosing guidelines and formulations for pediatric medications.
    c. Include focus on the prescribing of discharge medications.

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POLICY STATEMENT

Payment for Telephone Care

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Section on Telephone Care and Committee on Child Health Financing

ABSTRACT

Telephone care in pediatrics requires medical judgment, is associated with practice expense and medical liability risk, and can often substitute for more costly face-to-face care. Despite this, physicians are infrequently paid by patients or third-party payors for medical services provided by telephone. As the costs of maintaining a practice continue to increase, pediatricians are increasingly seeking payment for the time and work involved in telephone care. This statement reviews the role of telephone care in pediatric practice, the current state of payment for telephone care, and the practical issues associated with charging for telephone care services, a service traditionally provided gratis to patients and families. Specific recommendations are presented for appropriate documenting, reporting, and billing for telephone care services.

BACKGROUND

Telephone care is an increasing component of pediatric practice. Pediatricians are forced to provide more care to children and their families by telephone because of changing consumer and health plan expectations for enhanced access to care, 2-parent employment, the use of cellular phones by a "connected" society, a new focus on chronic disease management, and continued pressure by employers and health plans to reduce the costs of medical services. To address these concerns, pediatricians are required to develop new practice styles and provide more "non–face-to-face" medical services outside the traditional office or hospital setting.

Expansion of telephone care has great potential to further decrease health care costs, in part by providing a convenient and safe alternative to more costly in-person services. As a cost-containment strategy, telephone triage and advice, combined with indicated prescriptive therapy, often serves as a substitute for a patient visit to the office, urgent care center, or emergency department (ED). Tools to improve triage, provide advice for acute illnesses, and improve clinical and functional outcomes for the chronically ill patient include guidelines, disease and case management, and patient education. Many of these interventions depend heavily on the telephone.

Despite the fact that telephone care involves challenging medical decision-making, medicolegal risk, and practice expense and provides convenience and cost benefits to patients and health plans, physicians are rarely paid for providing telephone care. Arguments against payment have included the difficulty in determining appropriate payment without a more exact assessment of physician work than that contained in the *Current Procedural Terminology* (CPT) telephone codes, the absence of time-based codes as a proxy for work, and the absence of Centers for Medicare and Medicaid Services–published resource-based relative value units (RVUs) for these services. Additional barriers to payment for telephone

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Key Words
telephone care, payment, telephone triage, after-hours call centers, non–face-to-face services

Abbreviations
ED— emergency department
CPT—*Current Procedural Terminology*
RVU—relative value unit
AAP—American Academy of Pediatrics
E/M— evaluation and management
AHC—after-hours call center

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care include educational gaps in telephone management, perceived ethical concerns in billing families for services traditionally provided free of charge, and practical concerns for documentation and billing for services.

Recognizing the growing importance of telephone care in today's physician practices and acknowledging the significant barrier posed by the lack of a consistent and rational system for payment of these services, the American Academy of Pediatrics (AAP) has developed this policy statement, which will review the role of telephone care in pediatric practice, summarize the evidence for clinical effectiveness of telephone care, review the current state of telephone care payment, and discuss practical considerations for pediatricians seeking payment for telephone care. Finally, this statement presents recommendations for determining which telephone care services delivered by physicians should be considered separate and distinct from the preservice or postservice work of evaluation and management (E/M) services. For physicians who elect to charge for telephone care, suggestions for practical implementation are provided. These suggestions include office procedures, communication with families, and documentation and reporting of telephone codes.

TELEPHONE CARE IN PEDIATRIC PRACTICE

The first recorded use of the telephone in pediatric practice was reported in *The Lancet* in 1879, describing the evaluation of an infant with croup using the newly developed telephone. By 1968, a practice survey reported that pediatricians spent up to 30% of their work day on the telephone,[1] and in 1981, practice surveys reported that pediatricians spent more time on telephone care than did physicians in other specialties.[2] The increasing burden of telephone care in pediatric practice was reflected in a 1987 survey in which pediatricians reported that telephone care was the least satisfying part of their practice. In 1993, the first pediatric after-hours call center (AHC) opened in Denver.[3] By 1999, more than 35 children's hospitals had opened call centers,[4] and some estimates indicate that 25% of all after-hours calls to pediatric offices are handled by call centers.

Practice surveys have reported that telephone care by physicians and nurses accounts for at least 20% of all clinical care in a general pediatric practice and as much as 80% of after-hours pediatric care.[1,5–7] A study of Colorado- and Utah-based office pediatric practices showed that an average of 2500 calls were managed during office hours and an additional 1000 calls were managed after hours per pediatrician per year.[8,9] Twenty-seven percent of all decisions by pediatricians to have a patient seen by a specialist are made during a telephone encounter rather than a face-to-face encounter.[10] Telephone care, including standardized protocols, has become a key tool in the management of children with special needs and those with chronic diseases such as diabetes.[11,12] Many pediatric medical subspecialists caring for children with chronic and special needs, such as asthma or attention-deficit/hyperactivity disorder, provide significant amounts of telephone-based disease management. It has been suggested that in a busy pediatric neurology practice, more care is provided during telephone encounters than during face-to-face encounters.[13]

Although the practice expenses associated with pediatric telephone care have not been widely studied, a 1999 study showed that the average cost per call at children's hospital–sponsored telephone triage programs was $12.50.[4] One study of Colorado office practices estimated the cost of in-office telephone triage to be $6750 per physician per year.[9]

Telephone care not only is costly but also exposes the physician to increased medical liability risks.[14] This is especially true for after-hours telephone calls, during which the patient's medical history may not be available, a physical examination cannot be performed, nonverbal communication is challenged by the lack of face-to-face contact, and documentation of the telephone calls is often less than optimal. Telephone care is especially risky for pediatricians compared with other specialists. In an analysis of closed malpractice claims from 1985 to 2004, the AAP Committee on Medical Liability found that pediatricians were more likely to have paid claims for telephone care compared with other specialists, and the average payment per claim was also higher for telephone claims than for other claims ($281 300 [pediatric telephone claims] vs $254 100 [all pediatric claims]).[15,16]

CLINICAL EFFECTIVENESS OF TELEPHONE CARE

Telephone care in pediatric practice currently includes triage and advice, disease and case management, medication adjustments, acute illness care, test result interpretation, counseling, and education. Telephone care has been used for follow-up after ED visits[17] and was shown to decrease missed appointments, increase compliance with instruction, and ensure appropriateness of follow-up care.[18,19] In the area of chronic illness, telephone care has been shown to reduce medical costs, hospitalization, and ED visits for children with diabetes.[11,20] In a randomized trial of a self-directed parent training program for those with oppositional preschoolers that included weekly telephone encounters as part of a parenting program, investigators found reduced behavior problems in the children, and parents reported lower levels of anxiety, depression, and stress compared with parents in a control group.[21]

Perhaps the best evidence available describing the outcomes of telephone care is in the area of AHCs using standardized algorithms and nurses to deliver telephone care. Studies of telephone care provided in this setting have shown a high rate of parental satisfaction with AHC care[3,22] and compliance with urgent and home care dis-

position.[23] Disposition decisions made through AHCs using standard telephone triage protocols are also relatively accurate, with reported rates of hospitalization within 24 hours for calls with nonurgent disposition of approximately 1.5 per 1000 calls.[24] Although referral rates for urgent care using telephone triage protocols is approximately 20%,[24,25] this referral rate can be decreased by 50% with the use of second-level physician triage, a process whereby a physician is consulted to review triage dispositions made by call center nurses that include referring a patient for urgent or emergency care.[26]

PAYMENT FOR TELEPHONE CARE

The American Medical Association's CPT manual, the standard reference for coding medical encounters with patients, categorizes telephone calls under case management services.[27] Telephone calls by physicians for case management, including counseling, medical management, and coordination of care, are categorized by complexity of medical decision-making. Case management telephone calls involving simple, intermediate, or complex decision-making are described by CPT codes 99371, 99372, and 99373, respectively. Telephone calls are also included within care plan oversight services codes, which reflect physician work in the complex and often multidisciplinary management of patients being cared for by a home health agency, hospice, or nursing facility. Recent changes in these codes will make them applicable for children managed at home without home health care agencies (ie, by parents or relatives). These services, which can be reported using CPT codes 99374, 99375, and 99377 through 99380, are cumulative over a 30-day period and are reported according to total physician time spent with these activities. Although telephone time is included in these codes, the services provided are much broader. Reporting these charges requires that a physician document the encounter and the complexity (telephone codes) or time (care plan oversight) and submit the charge on a CMS-1500 form. Physicians must be prepared to collect a patient's copay if required by the insurance carrier. Furthermore, if the insurance carrier allows the charge but deems it an uncovered service, the physician must then bill the patient directly for the service.

Physician experience with payment for telephone care is limited, because government payors and most private health plans do not pay physicians for these services even when available CPT codes are used.[28] Certain Medicare plans pay for telephone calls during which care plans are organized or reviewed. Although most Medicaid programs do not reimburse providers for telephone care, some Medicaid managed care plans include telephone triage as one of their covered services under capitation. A study of payment for telephone codes (99371–99373) at a clinic in Texas for care provided by physicians or nurses for children with diabetes showed that Texas Medicaid did not reimburse for telephone management of complex problems, but 14 of 18 insurance companies reimbursed at 26% of charges, and parents paid copays at 54%.[12] In that study, the authors reported that the collection rate for telephone care for patients with diabetes in a largely insured population was 33%.

Practice surveys indicate that payment for telephone care is supported by most pediatricians.[29] Pediatricians convincingly argue that the physician work component of telephone care shares all the characteristics of in-office care except for the hands-on physical examination. They also cite the increased liability risks and practice expenses[30] of telephone care as a justification for payment and note that the increased documentation required for telephone care compensation would actually decrease the liability of telephone calls and increase patient continuity of care. Additional arguments for payment of specific telephone encounters include benefits to patients, physicians, and third-party payors, because telephone care is cost-effective compared with traditional face-to-face encounters in the office or ED.[31]

Among pediatricians, there is evidence of increasing advocacy for payment for telephone care. In its statement titled "Principles of Child Health Financing,"[32] the AAP defined a set of principles of child health care financing and concluded that such financing should encourage the delivery of services in the most timely, medically appropriate, and cost-effective setting, including appropriate payment for medical care provided via telephone. In addition, the AAP statement acknowledged that all chronically ill children have special needs that require appropriate health care financing for E/M, care coordination and case management, team meetings and conferences, and delivery of medical and surgical subspecialty care. The AAP also recently developed a white paper titled "Reimbursing Physicians for Non-Face-to-Face Care," which supported payment for non–face-to-face care in preparation for the development of a new set of CPT codes and corresponding RVUs for telephone care and Internet medical services.[33]

Support for payment for telephone care is not limited to pediatricians. In a recent policy statement, the American College of Physicians[34] also endorsed payment for telephone care, stating that it supports "payment by Medicare and other payors for health-related communications, consultations, and other appropriate services by telephone."

PRACTICAL CONCERNS WITH SEEKING TELEPHONE CARE PAYMENT

Although support for payment for telephone care is widespread, some physicians, reluctant to charge for telephone care, have raised ethical concerns that billing

for telephone care may create a barrier to health care access and deter poor families from calling with serious problems. Of course, this concern was also true with patient copayments, a practice that no longer generates either ethical or access concerns in most offices. The issue of access to telephone care reflects the broader societal nature of the problems of access to care and the inequities that exist within our current health care system.[35] In a market-driven health care system such as that found in the United States, it is difficult to make the case that physicians should provide clinical care without payment, and as such, the AAP believes that there are no ethical conflicts in charging for telephone-care services rendered. The problem of access to care by telephone should not be laid before physicians but put before citizens and policy makers, and the AAP believes it is appropriate for pediatricians to advocate for more comprehensive coverage.

Another concern that has been raised regarding payment for telephone care is that this practice will increase the overall financial burden placed on the nation's health care industry. In response, others argue that an even greater risk is that, without compensation for telephone encounters, medical practices already facing increasing financial and productivity pressures may be unable to provide telephone care and instead may require patients to come in for face-to-face visits to either the office or the ED to address medical concerns that could be managed readily over the telephone. This will result in patient access limitations, unwarranted ED use, decreased chronic care and disease management, increased expenses to patients and third-party payors, and an overall increased burden on the health care industry.

Given that the current payment system encourages the provision of care in an office setting, it is expected that increases in costs for telephone care will be more than offset by the savings incurred when physicians begin to provide more efficient telephone care for certain illnesses and chronic diseases rather than requiring patients to be seen in a more expensive face-to-face encounter. From the perspectives of both the patient facing copayments or an increasing portion of out-of-pocket expenses and the insurance companies paying for costly emergency and office visits, telephone care makes economic sense. As consumer-driven health plans become more commonplace, demand for telephone care will likely grow as consumers seek more cost-effective and convenient care choices.

Other concerns with charging for telephone care include the risk that this practice might create a negative physician image or allow for overuse or fraudulent billing for these services. With trends among consumers of increased expectations for services on demand at the time and place of the customer's choosing, it can be argued that the responsiveness of physicians will increase, rather than decrease, consumer satisfaction and improve physician image. Physicians often fear that the introduction of fees for selected medical services, such as telephone care, or office services, such as form completion, will alienate patients and cause them to leave their practice. Yet, anecdotal reports suggest that many of these fees have become commonplace in offices across the country without patient exodus. Regarding concerns that physicians charging for telephone care may be tempted to overuse and/or abuse charges, no evidence has been uncovered that the ability to charge for telephone care, especially if codes with clear reporting criteria were used, would create any new or unique opportunities for physician fraud or abuse.

RECOMMENDATIONS

1. The AAP supports reimbursement by payors, including state Medicaid agencies, for telephone care services provided by physicians to established patients, including the following categories of medical services:
   - calls for physician management of a new problem, including counseling, medical management, and coordination of care not resulting in an office visit within 24 hours;
   - calls for physician management about an existing problem for which the patient was not seen in a face-to-face encounter in the previous 7 days; and
   - calls related to care plan oversight for patients with special needs in residential settings and/or those with a chronic disease who require physician supervision over a period of time during a calendar month.
2. The AAP believes that pediatricians should make efforts to negotiate fee schedules and/or capitated rates for telephone care payment with all payors including state Medicaid agencies. When necessary and appropriate, physicians are encouraged to track utilization of telephone care codes and to appeal insurance denials.
3. Within the terms of existing payor contracts, the AAP supports pediatricians charging families for telephone care. The AAP also supports the exploration by pediatricians of different charge structures for telephone care, such as "per-call" rates or prepaid monthly telephone "access fees" that may help families anticipate telephone care expenses. Pediatricians choosing to charge patients and families for telephone care should ensure that they do the following:

- Develop office policies and procedures to ensure consistent processes for reporting telephone care charges to third-party payors and collecting payment for uncovered but allowable telephone care services while maintaining compliance with the Health Insurance Portability and Accountability Act (HIPAA) (Pub L No. 104-191 [1996]).
- Develop a clear communication plan for patients before initiating a fee for telephone care. Patients should be informed about the types of calls that will be billed and should be instructed that a copay (or possibly the entire charge) may be their responsibility if their insurance company does not cover telephone care service. Patients should be instructed that if they choose not to use care provided by telephone, standard office-based care will remain available, and they will always have the choice to have a face-to-face encounter if they so choose.

4. The AAP believes that physicians should document telephone care in a consistent manner.
   - Documentation should fulfill the need for continuity of care, demonstrate the complexity of the call, and meet the requirements of the typical E/M visit. Suggested items to document include the date and time of the call, patient's name and date of birth, name of caller, reason for the call, total encounter time, relevant patient history and evaluation, assessment of the issue at hand, plan, and disposition of the call.
   - It is suggested that the physician document the type of telephone encounter (eg, new problem, review of chronic problem with change in management, interpretation of test results, coordination of care, etc) to demonstrate the expertise required and the complexity of the decision-making process. Documentation for all telephone encounters for which a patient is charged should be placed in the medical record.
5. The AAP supports the development of mechanisms for payment for telephone care services provided by pediatric providers, including triage and advice, care coordination, patient education, and chronic disease management, and will provide support, along with other professional societies, for efforts to develop a new set of CPT codes with assigned RVU values for non–face-to-face medical services including telephone care.
6. The AAP believes that additional research should be undertaken to evaluate and report the clinical and economic effects of seeking payment for telephone care on patient access to care, quality of care and outcomes, total health care expenditures, and patient and physician satisfaction.

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Policy Statement—Pedestrian Safety

abstract

Each year, approximately 900 pediatric pedestrians younger than 19 years are killed. In addition, 51 000 children are injured as pedestrians, and 5300 of them are hospitalized because of their injuries. Parents should be warned that young children often do not have the cognitive, perceptual, and behavioral abilities to negotiate traffic independently. Parents should also be informed about the danger of vehicle back-over injuries to toddlers playing in driveways. Because posttraumatic stress syndrome commonly follows even minor pedestrian injury, pediatricians should screen and refer for this condition as necessary. The American Academy of Pediatrics supports community- and school-based strategies that minimize a child's exposure to traffic, especially to high-speed, high-volume traffic. Furthermore, the American Academy of Pediatrics supports governmental and industry action that would lead to improvements in vehicle design, driver manuals, driver education, and data collection for the purpose of reducing pediatric pedestrian injury. *Pediatrics* 2009;124:802–812

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INTRODUCTION

Morbidity and Mortality Statistics

According to the Web-Based Injury Statistics Query and Reporting System (WISQARS) of the Centers for Disease Control and Prevention,[1] approximately 6000 pedestrian deaths occurred in the United States in 2005. Of this total, 876 (14%) of the victims were 19 years or younger. In 2007, estimates from the National Electronic Injury Surveillance System (NEISS), which uses a sampling of hospital emergency department data, indicate that approximately 51 000 individuals 19 years or younger were injured as pedestrians, and 5300 of them were hospitalized for their injuries.[1] Although pedestrian fatality rates are actually higher in adults, children in the 10- to 15-year-old and 15- to 19-year-old groups have had the highest rates of nonfatal injuries in recent years (see Table 1).

According to the National Highway Traffic Safety Administration (NHTSA), in the 10-year period from 1997 to 2007, the number of pedestrian fatalities decreased by 49% in children 14 years and younger, with the greatest percent drop (57%) in the 4- to 7-year age group.[2] It is most likely that much of this decrease is attributable to less walking and lower exposure to traffic. The contribution from educational programs, increased law enforcement, and/or environmental modifications is not clear.

One of the goals of *Healthy People 2010* is to substantially increase the proportion of trips less than 1 mile being made by walking. In 1969, 42%

TABLE 1 2005 Pedestrian Death and 2007 Injury Rates per 100 000 Population

Age, y	Deaths, *n*	Rate	Injured, *n*	Rate
0–4	284	1.40	5274	25.45
5–9	130	0.66	8595	43.30
10–14	152	0.73	13716	67.52
15–19	310	1.47	23518	109.52
20–55	3307	2.19	91850	61.79
≥56	1884	2.97	28924	40.97

The number of pedestrian fatalities and injuries that are published by the NHTSA are somewhat lower than those found in the WISQARS database. Rather than using emergency room data, NHTSA information comes primarily from police traffic reports and, therefore, may not include driveway and parking lot crashes that frequently injure and kill toddlers. The NHTSA data do, however, contain more information about the cause and nature of the crash event.[67]

Data are from Centers for Disease Control and Prevention WISQARS.

of all schoolchildren and 87% of those living within 1 mile of school walked or bicycled to and from school.[3] More recently, only approximately 16% of children walk or bike to school, and even 37% of those who live within 1 mile are driven to school.[4,5] This situation is especially problematic considering the nation's major health challenge with pediatric obesity and the need for increased physical activity.[6]

Demographics

In addition to age, several factors increase the risk of child pedestrian injury. As with adults, approximately 60% to 70% of children killed and injured as pedestrians are male. Black and American Indian/Alaska Native children have higher rates of pedestrian death and injury,[1] in great part because of the environments in which poor children live.[7] The worst time of day for child (16 years and younger) pedestrian injury is between 3 and 7 PM, during which time 36% of fatalities occur.[8] A disproportionately high number of deaths (40%) occur on the weekend, but this was not found with nonfatal injuries.[9] As would be expected, pedestrian injury is more common when children are outside playing in the spring and summer.[10] The vast majority of pedestrian crashes actually occur under optimal driving conditions in full daylight, when the road is dry, and in the absence of precipitation.[11]

Nature of Injuries Sustained

Although most pediatric pedestrian injuries are minor, approximately 20% of the injuries score in the "serious-severe" category and roughly 10% are rated "critical-unsurvivable" on the Abbreviated Injury Scale or the Injury Severity Score.[12–14] In cases in which the child sustains an injury that is at least "moderate" in severity, the head and face are most frequently involved. Except for the youngest children, when there is at least 1 "serious" injury, the lower extremity is most often hurt.[12,15] A questionnaire study designed to study long-term outcomes of pediatric pedestrian crashes found impairment of cerebral function in 1.8% and disability related to the lower extremity in 2.8% of the children.[16]

In addition to physical injuries, childhood victims of pedestrian-automobile crashes and their parents very often have psychological sequelae. Both acute stress disorder and/or posttraumatic stress disorder are seen commonly (approximately 30%) in pediatric pedestrian injury cases.[17–19] Children may develop reexperiencing, avoidance, hyperarousal, and/or dissociation (emotional numbing).[19] Unfortunately, most parents do not seek professional help for their child's psychological symptoms.[19] At 6-month follow-up, in addition to stress disorders, many children who had serious physical injuries were found to have continuing difficulties with problem solving, memory, and social interaction.[20]

THE CHILD

Development

Young children have the motor skills to access roadways, yet they do not have the cognitive, perceptual, and behavioral abilities to negotiate traffic. Children move quickly and impulsively, which places them at high risk of pedestrian injury.[7,21,22] Furthermore, children have been shown to have difficulty seeing cars in their peripheral vision, localizing sounds, comprehending traffic, and understanding the meaning of road signs.[23] Children have difficulty scanning for traffic, judging vehicle distance and speed, anticipating driver behavior, and determining whether there is adequate time to cross the street safely.[21] Observations of children walking to school showed that they often neglect to look for traffic or stop at the curb before entering the street.[24] Normal developmental characteristics, such as magical thinking, egocentricity, distractibility, and impulsivity, increase pedestrian risk for children.[21,25] A high percentage of pediatric pedestrian crashes result from the child not paying attention to the traffic and road environment.[26]

In a study designed to compare pedestrian skills of children aged 4 to 5, 7 to 8, and 10 to 11 years, there were clear improvements with increasing age.[27] Compared with the 7- to 8-year-olds, the children in the 10- to 11-year-old group were significantly better at (1) identifying safe places to cross the road, (2) detecting traffic and road dangers, and (3) coordinating information from multiple parts of the traffic environment. Development of pedestrian skills was highly variable such that a few of the 5-year-olds did better than some 11-year-olds on the overall pedestrian skills score. Subjects who scored better seemed to use more effective visual search strategies (where, how often, and how fast they checked the road before crossing). Although some of the mature search strategies were occurring by 7 to 8 years of age, "there were continuing levels of sophistication unattained by

many of the oldest children (10–11 years of age) but present among the adult sample." In a study of attentional skills of 4- to 10-year-old children, older age was associated with better ability to appropriately switch focus to important pedestrian tasks.[28] This ability, which correlated with more awareness of traffic and better observed pedestrian behavior, continued to improve through the entire 5- to 9-year age range.

Unfortunately, many parents are not aware of these developmental limitations and overestimate their child's abilities to handle the traffic environment as a pedestrian.[29,30] In 1 study, one third of parents allowed kindergarten-aged children to cross residential streets alone and first-grade children to walk to school unsupervised.[31]

Child and Family Education

No randomized clinical trial has demonstrated that an educational intervention can decrease pediatric pedestrian injury rates. Systematic reviews of traffic skills-training programs have demonstrated improvements in attitudes, knowledge, and observed street-crossing behaviors.[32–34] A variety of educational programs aimed at school-aged children, including classroom sessions and individual instruction, use of audiovisual materials, training and practice in real and model traffic situations, behavior-modification techniques, and virtual reality computer simulations, have been shown to provide modest benefit. In a study in which an educational program was a component of a broad community campaign that included parent education, legislative changes, construction of separate pedestrian pathways, lowering of speed limits, and rigorous police enforcement measures, the rate of child pedestrian injuries dropped significantly.[35] There is evidence that involving parents as trainers or role models may add to the success of an educational program for child pedestrians.[36]

Because educational programs alone rarely result in safe pedestrian behaviors, supervision by parents or other adults is critically important. Unfortunately, in addition to overestimating childhood street-crossing abilities, parents often lack basic knowledge about pedestrian injury and do not adequately teach children about road safety.[37] Although it is reasonable for pediatricians to counsel parents regarding the risk of pedestrian injury in the context of child development and the need for supervision, no published randomized clinical trial has evaluated an office-based educational intervention.[38]

THE VEHICLE

Vehicle Speed

Vehicle speed is a strong risk factor for pedestrian injuries and is associated with greater injury severity.[13] Pedestrians who are hit by a car traveling 40 mph have a 15% chance of survival, but 85% survive when hit by a car moving at 20 mph. Because a faster-moving vehicle has a longer braking distance, impact with a pedestrian is more likely. Although several factors, such as driver reaction time, vehicle weight, brake quality, and road-surface conditions, play a role, the stopping distance for a vehicle traveling at 30 mph is considerably greater than that of a car traveling at 20 mph (197 vs 112 ft, respectively).[39] In residential neighborhoods, an average vehicle speed of 30 mph, compared with 20 mph, was associated with more than a sevenfold greater risk of children being hospitalized for pedestrian injuries.[40]

Vehicle Characteristics

Overall, the risk of pedestrian fatality is 18% to 29% higher with elevated-body vehicles (sport utility vehicles, pickup trucks, vans) than with passenger cars. Sport utility vehicles are especially dangerous for children. When children in the 4- to 7- and 8- to 15-year age groups were struck by an SUV, the relative risk of death was 87% and 46% higher respectively, than if the vehicle had been a passenger car.[41] Sport utility vehicles and pickup trucks are also more likely to cause severe injuries to children than are passenger cars.[42] When hit by an elevated vehicle, children are often thrown forward or knocked to the ground and run over instead of rolling up onto the vehicle's hood as an adult would do. This may explain why, compared with adults, children are at greater risk of death when hit by an elevated vehicle.[41,43]

Vehicle Modifications

The movements of a victim struck by a motor vehicle depend on the pedestrian's size and weight and the shape and structure of the car's front end. When a car hits a 6-year-old child, initial impact is usually with the upper leg, pelvis, and torso, followed by contact of the head with the front portion of the hood.[44] Injury severity generally is more related to these initial impacts than from contacts with the ground.[45] Modifications to automobiles, such as bumpers that are lower and more compliant, hoods that are more energy absorbent, and external windshield airbags can add to pedestrian protection.[45,46] How beneficial automobile structural modifications will be to children (who have different crash biomechanics than adults do) still requires study. Since 2005, new cars with structural modifications sold in Europe are required to pass various pedestrian safety crash tests, but no such testing is currently required in the United States.

Some automobile modifications have been developed to deal specifically with the blind spot behind the car and the problem of nontraffic back-over

pedestrian injuries. One study showed that young children do not respond consistently to back-up warning devices.[47] Back-up sensor alarms to warn drivers of objects behind the car are now available, but their shallow, narrow detection zones make prevention of pedestrian back-overs unlikely, because drivers cannot react fast enough at the speeds involved in such collisions.[48] Similarly, rear-window wide-angle lenses and auxiliary mirrors do not provide adequate visualization of the entire blind spot.[49] The combination of a video camera and a sensor alarm provides the best blind-spot coverage, but the high cost of such a system may be problematic.[49]

THE DRIVER

Driver Characteristics

Driver characteristics also contribute to child pedestrian injuries. Male drivers, drivers younger than 40 years, and those with a record of multiple driving infractions and suspended or revoked licenses are more likely to be involved in a collision with a child pedestrian.[50,51] Two studies performed by the National Safe Kids campaign show that large numbers of drivers speed and fail to stop at stop signs in school zones.[52,53] Information from the Pedestrian and Bicycle Crash Analysis Tool database from North Carolina showed that approximately 2% of the pediatric (15 years and younger) pedestrian crashes that occurred from 2000 to 2004 involved a driver who had been drinking alcohol.[54] One 1970s study of drivers involved in fatal collisions with pedestrians showed that even the experience of hitting and killing a pedestrian did not change the frequency of speeding convictions.[55] Because children are smaller than adults, drivers often falsely perceive that children are further away than they actually are. The result is that drivers misjudge time-to-impact and make inadequate speed adjustments in the presence of children.[56,57]

Driver Education and Enforcement

Although pedestrian advocates recommend driver-education programs to remedy dangerous driving, there is little research regarding interventions aimed at improving driver knowledge, attitudes, or skills to avoid pedestrian crashes. Furthermore, a study that looked at state driver's license manuals showed that most of these publications had no information about common locations for pedestrian-vehicle conflicts, automobile movements that are most hazardous for pedestrians, safest ways to conduct turns, or requirements for yielding to pedestrians at stop signs and intersections.[58] One 4-year program that combined a media campaign with strong police enforcement of crosswalk laws did not result in drivers becoming more willing to stop for pedestrians.[59]

ENVIRONMENT

Neighborhood

Children who come from low-income families tend to live in dense, low-income, urban residential neighborhoods where they are at much higher risk of sustaining a pedestrian injury.[40,60–65] Commonly, there are inadequate play areas in these neighborhoods, with children playing in and around streets in the afternoon and evening hours. The increased traffic, faster average speed, and number of parked cars along the curb add to the risk of pedestrian injury in these neighborhoods.[60,64,66] Parked cars along a residential street obscure visibility for both drivers and pedestrians, especially children.[40,66] In contrast to the crowded inner city, studies of American Indian/Alaska Native populations living in rural areas have identified the lack of traffic-control devices, poor lighting, and alcohol (driver and pedestrian) as important risk factors in pedestrian injury.[67]

Location of Event: Street Traffic

Children are most likely to be struck by a motor vehicle in an urban area on a residential street close to their home.[68] The most common type of pediatric crash is the pedestrian "dart-out" or "dash" in which a child walks or runs into the road, either at midblock or at an intersection, often from a position out of view of the motorist. This type of crash accounts for 43% of crashes that involve 5- to 9-year-olds, 30% of crashes that involve 10- to 15-year-olds, and 26% of crashes that involve children younger than 5 years.[69] In 2005, 82% of the pediatric pedestrian deaths occurred at nonintersection locations.[2] A study of 139 urban children who were struck by automobiles found that 29% were playing in or near the street at the time of the crash, and 71% were walking to a specific destination.[70]

Nontraffic Injuries (Back-Overs)

Although only 2% of all pedestrian fatalities are attributable to impact with the rear of a backing vehicle,[71] 14% of toddler pedestrian deaths in 2002 resulted from such non–traffic-related back-overs.[9] One study found that 57% of pedestrian injuries to children 2 years and younger resulted from a vehicle in reverse.[72] The typical event involves a vehicle backing out of a driveway driven by a family member who is unaware of an unsupervised child playing behind the car. The child's short height makes it difficult for the driver to see him or her, especially from an elevated vehicle (van, sport utility vehicle, or pickup truck). Toddlers do not perceive the hazard, and frequently the car rolls over (rather than strikes) the child, resulting in severe or fatal injury. It is estimated that each year, these back-over events injure approximately 2500 children younger than 14 years and that 48% of these children are 1 to 4 years old.[73] In addition to driveways, many

rear-impact crashes that involve pediatric pedestrians occur in parking lots.[69,72,74]

The Safe Kids Worldwide "Spot the Tot" program[75] advises parents to (1) hold children's hands in driveways, parking lots, and on sidewalks, (2) when driving, look for children at all times, and (3) walk all the way around the parked vehicle to check for kids, toys, and pets before entering the car and starting the motor. As previously mentioned, automobile modifications to prevent back-overs are available, but their efficacy has not yet been tested adequately.

Traffic Calming

Child pedestrian injury has been shown to be much less common in neighborhoods with a large number of streets with low speed limits.[76] In addition to lower speed limits, other speed-reduction street modifications include speed bumps, curved and narrow traffic lanes, traffic circles (instead of intersections), intersection curb extensions, and trees planted along curbs (to increase the driver's sense of speed). Methods designed to separate pedestrians from cars by either time or space include wide sidewalks, fences and barriers to prevent mid-block pedestrian crossing, raised medians/refuge islands (allow 2-step crossing of wide street), overpasses and underpasses, traffic signals exclusively for pedestrians (all traffic stopped simultaneously), and restrictions to keep traffic low in residential areas. These environmental changes that result in slower traffic and lower volumes of traffic (known as "traffic calming") can be effective.[77–82] A meta-analysis of 33 studies showed that injury-causing crashes decreased by approximately 15% (25% on residential streets, 10% on main roads) with the institution of various urban traffic-calming methods.[83]

Playgrounds

Keeping children off streets and away from traffic can be an effective method of reducing pediatric pedestrian injury. This was demonstrated by construction and renovation of playgrounds in Harlem, New York, where the number of pediatric pedestrian injuries decreased by 45% over a 7-year period.[84]

Walkability Checklists

The Partnership for a Walkable America (Centers for Disease Control and Prevention, National Highway Traffic Safety Administration, Federal Highway Administration, Institute of Transportation Engineers, Pedestrian and Bicycle Information Center, and the Robert Wood Johnson Foundation) advises the use of a "walkability checklist," available on the Internet,[85] to score the walkability of a community and identify the safest pedestrian routes for children. For each type of pedestrian problem, the checklist outlines specific strategies to help individuals and community groups who want to create safe walking routes for children. Formal evaluation of the ability of such checklists to decrease pediatric pedestrian injury is lacking.

School Trip Safety

It seems that the number of children struck while walking to or from school may actually be quite small (8%–15% of crashes that involve children).[70,86] Between 1994 and 2004, incidents that involved school buses were responsible for the deaths of approximately 11 school-aged pedestrians annually.[87] Surveys of parents have found that the major barriers that prevent children from walking to school are distance (62%), traffic dangers (30%), weather (19%), and crime (12%).[73]

The use of qualified, well-trained adult crossing guards is an effective method to help children cross streets safely.[88] According to Federal Highway Administration regulations, these individuals should wear high-visibility reflective apparel and should use a standard-sized, octagonal shaped "stop" paddle to control traffic.[89] Flashing speed limit signs, fluorescent school-zone signs, specially marked crosswalks, and strict police enforcement of speed limits and stop signs also are helpful.[90] It is recommended that drop-off and pick-up zones for parents driving their children to school be clearly marked and placed far from child pedestrians and school bus drop-off areas (www.walkinginfo.org).

The "Walking School Bus," a program supported by the Partnership for a Walkable America, fosters groups of children walking to school together with 1 or more adults. The "bus" may have meeting points, a timetable, and a regular rotation of trained volunteers or be as simple as 2 families taking turns walking their children to school.[91]

Many organizations and programs, such as Safe Routes to School, Kids Walk, and Walk to School Day have information available to help parents identify safe walking routes and teach their children pedestrian skills.[92] Significant federal funding has recently been allocated to Safe Routes to School to help states develop programs and infrastructure to encourage children to walk to school in a safe environment. Some concern has been voiced that low-income communities, where pedestrian rates are highest, do not always have the resources to compete for this funding.[93]

Low-Light Conditions

Although crashes that involve adult pedestrians often occur in low-light conditions, darkness is less often a factor for pediatric pedestrians who do not walk alone at night often. Reflective clothing has the ability to make pedestrians visible to drivers at considerably greater

distances; however, there are inadequate data to show that such clothing actually decreases collisions and injuries.[94] Enhanced illumination of crosswalks[90] and extending daylight savings time throughout the year[95,96] may have some significant benefit, but pediatric-specific data are not available.

RECOMMENDATIONS

To create safe pedestrian environments for children to enable greater amounts of walking and physical activity, the American Academy of Pediatrics recommends the following:

1. Through the use of counseling and/or with anticipatory guidance handouts, pediatricians should advise parents and caregivers that:
   - Young children have developmental limitations that prevent them from being safe pedestrians. In deciding when a child can cross streets independently, parents must consider the child's age and maturity, the distance to be traveled, the amount of on-street parking, and the volume and speed of traffic. On the basis of developmental considerations and currently available research data, the American Academy of Pediatrics recommends that children should not be unsupervised pedestrians before 10 years of age, except in limited situations.
   - Parents should be good pedestrian role models, supervise children carefully around traffic, and teach children how to be safe pedestrians.
   - To avoid injuries from vehicle back-overs, driveways, alleyways, and the adjacent unfenced front yard should not be used as a play area. Parents should be reminded of the large blind spot behind the car (especially in larger, elevated vehicles) and the need to walk completely around the car before getting in and starting the engine.
   - Reflective clothing and other visibility aids should be used in low-light conditions.
2. Parents, schools, community agencies, and policy makers should work with chapters of the American Academy of Pediatrics to increase the number of children who can safely walk regularly for the purpose of exercise and weight control. Residential neighborhoods should have sidewalks and be designed to foster low traffic volume and speed.
3. Although some pedestrian education programs for children have been shown to modestly improve road-crossing behaviors, their efficacy in reducing injury rates is not clear. Close adult supervision and environmental modification are more effective strategies for preventing motor vehicle-pedestrian collisions.
4. Community groups, municipal governments, and school systems should collaborate to design safe routes for children to use to walk to school. Methods to meet this goal could include sidewalks, traffic calming, on-street parking limits, hiring adequate numbers of well-trained adult crossing guards, locating schools close to residential areas, and helping parents develop special escort programs for young children. Highly visible, strict police enforcement of traffic regulations in school zones is extremely important.
5. Federal funding of Safe Routes to School and other programs to encourage walking and make it safe to do so should continue to be supported nationally. Priority for funding and grant application technical assistance should be given to low-income communities where the risk of child pedestrian injury is highest.
6. Communities should create play areas to keep children away from traffic as much as possible.
7. State driver's manuals should include a section that informs drivers about avoiding pedestrian collisions. Drivers should be warned not to have unrealistic expectations of a child's pedestrian abilities and reminded about the need to slow down and be alert for dart-outs when children are nearby. This pedestrian section should include information, photographs, and diagrams about pedestrian-vehicle conflicts at intersections, safest ways to conduct turns to avoid pedestrian injury, and requirements for yielding to pedestrians at stop signs and when making right turns after stopping at red lights.
8. Automobile manufacturers should develop design modifications that will decrease injury from automobile-child pedestrian collisions.
9. Pediatricians should be aware of the high incidence of acute and posttraumatic stress disorder after a pedestrian injury. Pedestrian crash victims and their close family members should be carefully screened for these conditions. Patients should be given emotional support, reassured that acute and posttraumatic stress disorders are common problems, and referred for counseling as needed.
10. Governmental agencies should expand pedestrian injury surveillance systems so that detailed information regarding the pedestrian, the vehicle, the specific

location (to allow geographic information systems mapping), the nature of the crash, the speed and volume of traffic, and the features of the road and sidewalks can be collected and analyzed. Furthermore, parameters for describing children's exposure to traffic should be defined and measured. Such information will be needed to determine the effectiveness of interventions designed to decrease pediatric pedestrian injury.

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RESOURCES FOR PEDIATRICIANS

National Highway Traffic Safety Administration (www.nhtsa.gov/portal/site/nhtsa/menuitem.dfedd570f698cabbbf30811060008a0c): contains excellent data summaries ("Traffic Safety Facts: Children" and "Traffic Safety Facts: Pedestrians"), tip sheets for parents and teachers, resource guides, major research reports, information regarding pedestrian laws, and links to programs designed to encourage safe walking. The entire NHTSA site can be "searched" for information about child pedestrians. The Fatality Analysis Reporting System (FARS) (www-fars.nhtsa.dot.gov) can be used to obtain detailed information about fatal crashes. In addition to reviewing detailed tables, users can generate custom reports through an interactive query system. NHTSA staff also accept data requests at this site.

Centers for Disease Control and Prevention (www.cdc.gov/nccdphp/dnpa/kidswalk/resources.htm and www.cdc.gov/injury/wisqars/index.html): contains extensive information about the Kids Walk-to-School program, including brochures, slide shows, fact sheets, and a sample press release. The site also has links to various Centers for Disease Control and Prevention reports about pedestrian safety. The Web-Based Injury Statistics Query and Reporting System (WISQARS) can be used to obtain data about fatal and nonfatal pedestrian injuries, categorized according to age (or age group), race, gender, state, and year.

Insurance Institute for Highway Safety (www.iihs.org/research/topics/peds.html): contains detailed statistics ("Fatality Facts: Pedestrians"), a Q&A, status reports, and a selected research bibliography.

Federal Highway Administration (www.tfhrc.gov/safety/pedbike/index.htm and http://safety.fhwa.dot.gov/local_program/pedcampaign): the Turner-Fairbank Highway Research Center site contains pedestrian-related articles, facts, issue briefs, publications, research, resources, and links. The Federal Highway Administration Pedestrian Safety Campaign site has a tool kit with videos, slide shows, brochures, posters, and other materials for individuals, organizations, or communities interested in implementing a pedestrian safety campaign.

Pedestrian and Bicycle Information Center (http://pedbikeinfo.org and www.walkinginfo.org): contains a Walkability checklist, an extensive research review ("Review of Pedestrian Research in US and Abroad"), crash facts and crash type definitions (with diagrams), and the Pedestrian and Bicycle Crash Analysis Tool, which allows access to a database of extensive pedestrian crash information.

Walking School Bus program (www.walkingschoolbus.org): contains a handout describing how a "walking school bus" works as well as guides for people who want to start a program and descriptions and evaluations of existing programs.

National Center for Safe Routes to School (www.saferoutesinfo.org): contains pedestrian safety tip handouts, applications and information about obtaining funding, state contact personnel, and an online library of materials, documents, and reports used by Safe Routes to School program administrators.

Safe Kids USA (www.usa.safekids.org; search "pedestrian"): contains facts and safety tips for parents, a checklist on how to teach children pedestrian safety, research reports, and a report to the nation that describes the pedestrian problem and offers solutions.

Harborview Injury Prevention Center (http://depts.washington.edu/hiprc/practices/topic/pedestrians/index.html): the "best practices" section on "child pedestrians" contains detailed research reviews on skills training, daylight savings time, reflective clothing, road environment changes, community campaigns, and vehicle modifications.

Kids and Cars (http://kidsandcars.org): contains statistics regarding nontraffic injuries and deaths from back-overs, hyperthermia, and power-window strangulation. The site also has fact sheets and public service announcement videos on these topics.

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Technical Report—Pediatric and Adolescent Mental Health Emergencies in the Emergency Medical Services System

abstract

FREE

Emergency department (ED) health care professionals often care for patients with previously diagnosed psychiatric illnesses who are ill, injured, or having a behavioral crisis. In addition, ED personnel encounter children with psychiatric illnesses who may not present to the ED with overt mental health symptoms. Staff education and training regarding identification and management of pediatric mental health illness can help EDs overcome the perceived limitations of the setting that influence timely and comprehensive evaluation. In addition, ED physicians can inform and advocate for policy changes at local, state, and national levels that are needed to ensure comprehensive care of children with mental health illnesses. This report addresses the roles that the ED and ED health care professionals play in emergency mental health care of children and adolescents in the United States, which includes the stabilization and management of patients in mental health crisis, the discovery of mental illnesses and suicidal ideation in ED patients, and approaches to advocating for improved recognition and treatment of mental illnesses in children. The report also addresses special issues related to mental illness in the ED, such as minority populations, children with special health care needs, and children's mental health during and after disasters and trauma. *Pediatrics* 2011; 127:e1356–e1366

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KEY WORDS

emergency department, emergency medical services, mental health care, psychiatric illness, trauma, posttraumatic stress disorder

ABBREVIATIONS

ED—emergency department
PTSD—posttraumatic stress disorder
AAP—American Academy of Pediatrics
ACEP—American College of Emergency Physicians
EMS—emergency medical services

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

BACKGROUND

Emergency department (ED) health care professionals often care for patients with previously diagnosed psychiatric illnesses who are ill, injured, or having a behavioral crisis. ED health care professionals also need to identify and manage patients with previously undiagnosed and/or undetected conditions such as suicidal ideation, depression, anxiety, psychosis, substance use and abuse, and posttraumatic stress disorder (PTSD). This report will address the roles that the ED and ED health care professionals play in emergency mental health care of children and adolescents in the United States. This technical report supports the 2006 joint statement from the American Academy of Pediatrics (AAP) and American College of Emergency Physicians (ACEP) titled "Pediatric Mental Health Emergencies in the Emergency Medical Services System."[1,2] Previous policy statements, clinical reports, and technical reports by the AAP that have addressed specific pediatric emergency mental health issues and formulated guidelines for model programs include, but are not limited to, "Adolescent Assault Victim

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Needs: A Review of Issues and a Model Protocol" (1996),[3] "Access to Pediatric Emergency Medical Care" (2000),[4] "Child Life Services" (2006),[5] "Care of the Adolescent Sexual Assault Victim" (2008),[6] "Achieving Quality Health Services for Adolescents" (2008),[7] "Suicide and Suicide Attempts in Adolescents" (2007),[8]"Underinsurance of Adolescents" (2008),[9] "Death of a Child in the Emergency Department" (joint statement from the AAP and ACEP in 2002[10] and a supporting technical report by the same title (2005),[11] "Patient- and Family-Centered Care and the Role of the Emergency Physician Providing Care to a Child in the Emergency Department" (2006),[12] and "Family-Centered Care and the Pediatrician's Role" (2003).[13]

PSYCHIATRIC ILLNESS AND THE ED

The current and increasing concerns regarding pediatric mental health emergencies occur within the context of the overall crisis in pediatric ED care. First, there has been an increase in the prevalence of ED visits for psychiatric illness.[14–18] This situation is complicated by a shortage of inpatient and outpatient services available for patients who need mental health care and an unfunded mandate to care for these patients in an ED setting. The 1999 Surgeon General's report on mental health[19] indicated that 21% of US children 9 to 17 years of age have a diagnosable mental or addictive disorder. The National Institute of Mental Health has reported that 10% of children in the United States currently suffer from mental illness, and more than 13 million children require mental health or substance abuse services.[20,21] The World Health Organization has estimated that by the year 2020, neuropsychiatric disorders will become 1 of the 5 most common causes of morbidity, mortality, and disability for children.[22] A study at the University of Pittsburgh found that from 1979 to 1996, the rate of psychosocial problems identified in primary care visits of 4- to 15-year-olds increased from 7% to 18%.[23] Suicide in the United States currently ranks as the fourth leading cause of death for 10- to 14-year-olds and the third leading cause of death for 15- to 19-year-olds, accounting for 11.3% of all deaths in the latter age group in 2006. More than half of adolescents 13 to 19 years of age have suicidal thoughts, nearly 250 000 adolescents attempt suicide each year, and up to 10% of children attempt suicide sometime during their lives.[24–26] Of great concern is the fact that, despite its increasing prevalence, the risk of suicidal behavior in many children and adolescents is often undetected. One study found that 83% of adolescent patients who had attempted suicide were not recognized as suicidal by their primary care physicians.[27] Rotheram-Borus et al[28] reported that fewer than 50% of adolescents seen for suicidal behavior in the ED were ever referred for treatment, and, even when they were referred, compliance with treatment was low. Another study revealed that only one-fifth of these children receive necessary treatment.[21]

Patients who need mental health care can be disturbing to the routine and flow of the ED and require more resources than many medical or trauma patients. In a 2006 study, Santiago et al[29] reported that 210 patients with a median age of 14 years and requiring psychiatric evaluation spent a median of 5.7 hours in the ED. Hospital police monitored 51.9% of these patients, and 45 patients exhibited dangerous behaviors. Among children who frequently used mental health services in the ED, approximately 50% of them were seen again within 2 months of their initial visit, which suggests that patterns of recidivism are high for psychiatric patients. Repeat patients are more likely to threaten to harm others; to have a diagnosis of adjustment, conduct, or oppositional disorder; and to be under the care of a child welfare agency. Repeat users were also significantly more likely than one-time patients to be less compliant with outpatient follow-up, be admitted to the hospital, and require more social support. These youth also have increased risk of involvement with juvenile justice; a large proportion of them have related behavioral, emotional, and cognitive disabilities and have greater difficulty remaining in residential treatment. The total proportion of children admitted to general inpatient services from the ED for mental health problems is also increasing. In Washington State, psychiatric disorders were the leading cause of adolescent hospitalization and accounted for one-third of hospital days for 5- to 19-year-olds over a 10-year period from 1994 to 2003.[30]

According to a 2004 AAP policy statement, ED overcrowding threatens access to emergency services for those who need them the most and further complicates the ability of EDs to serve the needs of patients who need mental health care and their families.[31] A 2008 report from the Centers for Disease Control and Prevention noted that ED visits increased 32% from 1996 to 2006, whereas the number of EDs decreased by 5%. Approximately one-third of EDs reported having to divert incoming patients to another ED in the previous year.[32] Boarding of patients with mental illness in the ED has many deleterious effects on the health care of those patients and others.[33] The ED is often a high-stimulation environment that is not conducive to calming agitated patients. In addition, privacy is not as easy to arrange, which leads to distraction and disruption of care for these patients and their families as well as the other ED patients.

The pediatrics section of the 2007 Institute of Medicine report on emergency services described the burgeoning problem of pediatric mental health problems in the saturated emergency medical services (EMS) system.[34] The report cited studies that have demonstrated inadequate or nonexistent screening and evaluation for children with mental health complaints, inadequate training and comfort levels for ED physicians and nurses in caring for pediatric patients with mental health complaints, suboptimal ED environment for mental health patients in crisis, and extended ED wait times for patients who need mental health care and require admission because of lack of psychiatric inpatient resources. According to the Institute of Medicine report, not only is ED use increasing, but younger patients are being seen, and depression, bipolar disorder, and anxiety are now being identified in children of elementary school age. EDs are increasingly used as the safety net for diagnosing and managing psychiatric illness in these children. The pediatric ED at Yale noted an increase of 59% in psychiatric illness-related visits between 1995 and 1999; the most common complaints were behavioral changes, ingestions, suicide attempts, and violence.[35] The Cincinnati Children's Hospital ED reported an annual increase in visits by psychiatric patients from 800 in 1995 to more than 2000 in 2004.[36] In their 1999 study of pediatric EMS usage, Sapien et al[37] found that 15% of pediatric EMS responses were for suicide, assault, or alcohol and drug intoxication, which emphasizes the need for first responders to have an informed approach to these problems. The actual number of psychiatric emergencies may be underestimated, because many children and adolescents who present with trauma may have made a suicide attempt, and vague somatic complaints may actually represent depression, PTSD, suicidal ideation, or abuse.

BARRIERS TO MENTAL HEALTH SERVICES IN THE EMS SYSTEM

Hoyle and White[38] outlined the barriers to adequate pediatric mental health services in the EMS system. These barriers can be categorized as (1) a lack of information relating to pediatric psychiatric illness, (2) limitations of the ED setting that influence timely and comprehensive evaluation, (3) need for education and training of ED staff regarding identification and management of pediatric psychiatric illness, and (4) a lack of access to and effectiveness of inpatient and outpatient mental health services.

Lack of Information Relating to Pediatric Psychiatric Illness

In a 2002 report, Horwitz et al noted, "Federal agencies' planning documents devote considerable attention to the need to understand the identification and treatment of children's behavioral and emotional issues within primary medical settings. Nevertheless, a paucity of evidence exists to demonstrate that such attention has resulted in aggressive programs of research in this area."[39] They found that adults received 15 times more research attention than did children and adolescents. Some epidemiologic data regarding psychiatric problems are available from national database sources including the National Hospital Discharge Survey, the National Hospital Ambulatory Medical Care Survey, and the National Electronic Injury Surveillance System. However, because children's psychiatric issues were largely unrecognized during the development of these databases, information regarding children and adolescents is obtained most often by extrapolation or inference. The National Hospital Discharge Survey and National Hospital Ambulatory Medical Care Survey use broad age groupings (younger than 15 and 15 through 44 years) that obfuscate the data pertinent to children and do not always subcategorize psychiatric illness or ED visits. Olson et al[40] used National Electronic Injury Surveillance System data from 10 hospitals over a 3-month period in 2000 to categorize presentations to the ED and found that psychiatric or violence-related complaints represented a relatively high proportion of pediatric ED visits.

Limitations of the ED Setting That Influence Timely and Comprehensive Evaluation

ED health care professionals recognize the difficulties in providing care to all children with psychiatric emergencies and note a lack of psychiatric specialists and inpatient and outpatient facilities and an increase in referrals from schools, primary care physicians, and mental health therapists who cannot admit patients directly from their offices.[34] These limitations, coupled with a mandate to care for all patients who present to the ED, create a difficult obligation for ED practitioners to fulfill. The Emergency Medical Treatment and Active Labor Act (EMTALA), enacted in 1985 with the purpose of protecting the rights of indigent patients seeking emergency care, requires Medicare-participating hospitals to provide a medical screening examination for all patients who present for care to the ED, regardless of the patient's ability to pay.[41] Subsequent revisions have clarified the responsibility of hospitals, EDs, and their physicians to act on this medical screening examination if the patient is determined to have an acute medical or psychiatric condition, such as suicidal ideation, by providing all ancillary services routinely available to the ED, such as a physician consultation, inpatient care, and mental health services, in a nondiscriminatory and consistent manner. This revi-

sion guarantees that hospital EDs are essentially the only place in our current health care system in which all patients with acute psychiatric illness can be guaranteed thorough evaluation.[42–44] A comprehensive emergency psychiatric examination may take several hours, and often there is no private or quiet area within the ED to facilitate effective consultations. In addition, the ED is not the optimal setting for assessing and managing patient and family anxiety, because they are crowded, noisy, and full of distressing sights and sounds that may even exacerbate some patients' symptoms or behavior. Given the declining numbers of available consultants, the formal psychiatric evaluation often begins hours after initial medical stabilization. Regulatory agencies have recognized the importance of standardized approaches toward high-risk psychiatric patients in the ED. Since January 1, 2007, the Joint Commission has required accredited organizations to conduct suicide risk assessment for any patient with a primary diagnosis or primary complaint of an emotional or behavioral disorder.[42]

Need for Education and Training of ED Staff Regarding Identification and Management of Pediatric Psychiatric Illness

Education about the causes, signs and symptoms, and optimal management of pediatric mental illness is essential for pediatric, family practice, and emergency medicine practitioners, including residents and pediatric emergency medicine fellows as well as those who practice in community hospitals. This education includes the use of appropriate mental health screening tools, appropriate discharge instructions, and mental health follow-up for depressed patients and patients who have considered or attempted suicide. However, residency program education may be insufficient in many of these areas.[45,46]

Lack of Access to Inpatient and Outpatient Mental Health Services

Nationally, the number of adult and pediatric beds in state mental health facilities plummeted 32% between 1992 and 1998 and has since dropped significantly below 60 000, and fewer than half are allocated for acute care.[47] Media reports have highlighted the fact that these inpatient cost reductions have not been offset by outpatient expenditures, and as a consequence, the ED has more frequently become a location for nonurgent mental health complaints.[48–50] They cite the combination of fewer inpatient psychiatric beds and insufficient outpatient services, which leaves EDs to hold pediatric psychiatric patients or admit them to a medical unit with little hope of being reimbursed for that admission. This process can be resource-intensive, because these patients sometimes must be restrained and/or constantly monitored.

POTENTIAL SOLUTIONS TO THE CRISIS IN MENTAL HEALTH CARE

Solutions to the mental health care crisis are not easily found within other, nonmedical systems, which are equally unprepared to handle children with acute psychiatric illness. A nationwide survey of juvenile detention centers, the results of which were presented at a Senate hearing in July 2004, revealed that 15 000 children with psychiatric disorders were improperly incarcerated the previous year because no mental health services were available.[48] Many community health centers that traditionally provide mental health care have lost their state funding and often turn away patients or place them on long waiting lists. Schools, therefore, frequently function as the de facto mental health system for children and adolescents; 70% to 80% of schoolchildren who need mental health services receive that care in the school setting.[51–53] School counselors are primarily funded by state and local funds, but school districts also use funds from federal programs such as the Safe and Drug-Free Schools grants that are authorized by the Elementary and Secondary Education Act, otherwise known as the No Child Left Behind Act (Pub L No. 107-110 [2002]). However, it is important to remember that this program, like other legislative mandates, depends on the vagaries of federal funding and budget cuts. Primary care physician offices are another point of contact for children and youth at which there is high potential for identifying and managing mental illness, but even when children are seen in the general medical setting, identification and management of mental illness are still challenging.[54–57] To address these issues, the AAP Task Force on Mental Health has developed algorithms to help pediatricians identify, manage, and develop safety plans for children and adolescents and offers strategies for diverting patients from the ED and referring more directly to mental health resources when available.[51] However, primary care physicians cannot do this alone. For this approach to be successful there needs to be an increase in the flow of pediatric trainees into child psychiatry training programs and a concomitant increase in payments for child psychiatric services to these program graduates. Telepsychiatry, first piloted in Britain, also offers a potential solution to the lack of mental health care providers in rural and remote areas.[58,59]

Stabilization and Management of Patients in Psychiatric Crisis

Patients who arrive with a psychiatric emergency require a rapid, thoughtful response by the ED team to assess the degree of stress and safety of the patient, provide medical stabilization,

and use specific interventions to alleviate symptoms and increase safety for the patient and ED staff and other patients. During these evaluations, ED health care professionals maintain a delicate balance between maintaining patient confidentiality and engaging the external support systems that already exist for these patients. In many states, adolescents can seek and receive care for mental health issues and drug/alcohol use without parental involvement, and EDs must maintain confidentiality except if the child is at risk of harming himself or herself or others. However, the ED must also recognize the primary support role of the family and caregivers, as well as the child's primary care providers, in all phases of pediatric mental illness. In this light, ED health care professionals must encourage, but not coerce, the adolescent to allow family involvement whenever possible.

Of paramount importance is for EDs to have the capacity to provide such care within an overall system of mental health care. The most important element is establishing an effective relationship with a specialized mental health team. Team composition and availability may vary but should be predefined. When consultations are requested, the degree of urgency and the expected response time should be communicated clearly. Additional dialogue should take place after consultation to ensure that there is agreement with a treatment plan and to facilitate expeditious and appropriate disposition. Acute drug ingestions present a specific challenge in this regard and require ED health care professionals to blend the usual resuscitation protocols with psychosocial management by medical staff, social workers, psychiatrists, and security personnel. Preexisting relationships with psychiatric inpatient facilities promote efficient disposition. It is also helpful to have familiarity with child protection laws and to establish relationships with local law enforcement and child welfare and social service agencies. School nurses, often the liaisons among family, health care professionals, and school personnel, can also be included, with appropriate consent, to help inform as well as facilitate management plans after the ED visit.[60] Adequate and appropriate physical space should be available for children and families in crisis; a private room with monitoring equipment that is out of the patient's reach is considered optimal. Patients should be within the sight of ED staff; screening for suicide risk or potential self-harm should occur, and one-to-one supervision should be provided as needed. If a patient requires medical admission or must wait in the ED for transfer to another facility, guidelines should be available for staff and faculty members in handling inpatient psychiatric patients and their family members.

On occasion, children and adolescents with psychiatric illness will require physical or chemical restraint to protect them or others from harm. The AAP and ACEP offer guidelines or policies related to patient restraint and reaffirm the need for frequent safety checks, vital-sign monitoring, evaluation of limb neurovascular status, and assistance with nutritional and bathroom needs.[61,62] It is more common for EDs to use anxiolysis and mild sedation to avoid the need for physical restraint. The decision to use physical restraints should be made by an attending physician but may be initiated by nursing staff in extenuating circumstances. Even with proper restraint, mental or cardiopulmonary status may deteriorate unexpectedly; therefore, patients in restraints should be monitored continuously with time-limited orders. The Joint Commission carefully monitors the institutional policies around implementation and documentation of patient restraint and emphasizes that it must be used as a last resort and that the treatment is for the patient's benefit.[63,64]

The Role of the ED in Discovering Mental Illness in Children

As mentioned above, in 2007, the Joint Commission recommended a suicide risk assessment for any patient with a primary diagnosis or primary complaint of an emotional or behavioral disorder.[42] Some suicide-assessment instruments, such as the Suicidal Behavior Interview and the Suicide Intent Scale, are not options for EDs, because they are designed to be administered by trained mental health specialists or require complicated computations by clinicians.[65,66] Although there is no standard or optimal instrument that screens for suicidality, high sensitivity and rapid administration are 2 highly valued characteristics. One tool with such characteristics is the Suicidal Ideation Questionnaire (SIQ), a 30-item instrument originally designed for 10th- through 12th-grade students.[67] A 15-item instrument (SIQ-JR) is also available for students in grades 7 through 9 and has been standardized for older students as well.[68] These tools may take longer than desired in an ED setting but have strong psychometric validity and reliability. Shorter tools that are more appropriate for the ED setting have also been developed. Horowitz et al[69] demonstrated good content validity of the Risk of Suicide Questionnaire (RSQ), a brief screening tool for screening for suicidal ideation in the ED that assesses major facets for suicide risk, present and past suicidal ideation, previous self-destructive behavior, and current stressors. Folse et al[70] piloted a 2-question version of this screening tool in the pediatric emergency setting, and almost 30% of the adolescents screened positive for suicidal

ideation within the previous week. The authors recommended that clinicians ask the questions: "Are you here because you tried to hurt yourself," and "In the past week have you thought about killing yourself" as an initial assessment for adolescents coming to the ED for medical care, regardless of the presenting symptoms.

Patients may exhibit "externalizing" symptoms that initially have been identified by a caregiver, teacher, health care professional, or even criminal justice personnel. However, many children with psychiatric illness do not present to the ED with overt psychiatric symptoms. It is also clear that many patients with psychiatric disorders exhibit somatic symptoms, such as headache and abdominal pain; some chronic medical illnesses, such as asthma and diabetes, can be exacerbated by stress and anxiety.[71,72] Scott et al[73] found a 30% rate of moderate or severe depression in 13- to 19-year-olds in the pediatric ED. Similarly, Rutman et al[74] found that 37% of the adolescents in a pediatric ED research study were above the threshold for depression on the Center for Epidemiologic Studies Depression Scale.

The US Preventive Services Task Force recommends screening of adolescents 12 to 18 years of age for major depressive disorder when systems are in place to ensure accurate diagnosis, psychotherapy, and follow-up.[75] Because the ED may be the only point of contact for children with undiagnosed psychiatric illness, it is imperative to have adequate resources in this setting to link patients who "screen positive" with inpatient or outpatient services. In addition, it is necessary to have efficient, culturally sensitive, and developmentally appropriate screening tools that promote the accurate detection of suicidal ideation, depression, and other psychiatric illnesses. Some investigators have adapted full-length, adult scales for use with younger populations, but they require 20 to 40 minutes to administer.[76] Some EDs have developed their own mental health screening tools to help in the evaluation of child and adolescent patients. Adolescents at the Children's Hospital of Philadelphia use computers to complete the self-administered Behavioral Health Screen for Emergency Departments, which provides their physicians and nurses with information about their risk for depression, suicidal ideation, PTSD symptoms, and substance abuse.[77,78]

Similar developments have occurred in the real-time assessment of traumatic stress in pediatric ED patients. Just like adults, children's previous adverse experiences can influence their response to acute illness and their ED visit. When children experience sustained stress attributable to traumatic experiences, neurohormones, such as cortisol, are increased. These elevated neurohormones can lead to permanent changes in their developing brain structures, such as the amygdala and hypothalamus.[79] Unrecognized and untreated, acute stress symptoms can cause lifelong behavioral and mental health problems attributable to changes in neurodevelopment and function.[80–86] Children with a history of a traumatic experience, be it from unintentional injury, violence, or sexual or physical abuse, can be expected to have more acute stress symptoms in the immediate aftermath of a specific event.[87] Shemesh et al[88] identified PTSD in 29% of the patients in a small convenience sample of pediatric patients who presented to a pediatric ED. All patients but 6 identified at least 1 previous salient traumatic event; most of the events were not immediately related to the reason for the ED presentation. Knowledge of trauma symptoms significantly altered the ED clinical management in 16% of the cases.[88] Winston and colleagues[89] have developed brief screening tools for acutely injured children and their families and have achieved some success in providing these families with practical print and Web-based management tools. Although these data suggest that early identification and management of psychological trauma and its consequences are feasible in the pediatric ED, further efforts are required to incorporate these techniques into the routine systems and processes in the ED.[90] Parents and caregivers also need education from appropriate personnel on what to expect, how to parent a traumatized child, how to know when additional help is needed, and where to find it. Information such as this can be found at sites for the National Child Traumatic Stress Network (www.nctsnet.org) and the Center for Pediatric Traumatic Stress at the Children's Hospital of Philadelphia (www.healthcaretoolbox.org).

SPECIAL ISSUES RELATED TO MENTAL ILLNESS IN THE ED

Minority Populations

Children from minority populations have less access to mental health services and are less likely to receive needed care.[91] Likely because of the complexity and cultural interpretation of psychiatric illness, the lack of proper translation when needed, even by trained interpreters, may contribute to difficulty in receiving information and following through with mental health referrals.[92] According to Rand's 2001 *Mental Health Care for Youth*,[93] 31% of white children who needed mental health services received them, compared with 22% of black and 14% of Hispanic children. In addition, the same study found that people from minority populations in treatment often receive a poorer quality of mental health care and are underrepresented

in mental health research. After adjusting for other demographic factors and parent characteristics, Hispanic children with mental health problems had greater odds of having no care or unmet need compared with white children. This finding is particularly concerning given the increased suicidal ideation, depression, anxiety symptoms, and school dropout rates among Hispanic compared with white adolescents. Cultural factors, particularly around the stigma of mental illness, were noted to be important for Hispanic people. Financial factors also play a role in these disparities; although they differ according to state, these differences are more likely the result of varied state policies and health care market characteristics rather than differences in racial or ethnic makeup.[94]

Children With Special Health Care Needs

It is well known that children with special health care needs frequently have coexisting psychiatric morbidity.[95–97] For example, children with asthma and allergies are especially prone to having anxiety disorders.[98] Obesity is also associated with problems such as depression, especially in Hispanic and black children.[99] The Emergency Information Form (EIF), developed jointly by the AAP and ACEP (www.aap.org/advocacy/blankform.pdf), allows providers to include psychiatric and behavioral diagnoses for children with special health care needs and also includes information about their health care professionals, medications, and significant medical history.

Children's Mental Health During and After Disasters and Trauma

The ED is the initial source of physical care for child victims of disasters (natural or man-made) or trauma (unintentional or intentional). Many studies have demonstrated the development of depression and PTSD in child survivors of trauma and disaster.[100–104] Unrecognized and untreated, acute and posttraumatic stress symptoms can cause lifelong behavioral and mental health problems as a result of changes in brain neurodevelopment and function. These alterations in function create a lifetime risk of subsequent poor school performance, depression, suicidal ideation or attempts, aggression, and risk-taking behaviors. Current research is ongoing to identify these at-risk children as early as possible and to develop validated interventions to cope with the stress and avoid later psychiatric morbidity. An AAP-funded Agency for Healthcare Research and Quality resource, "Pediatric Terrorism and Disaster Preparedness: A Resource for Pediatricians," includes information on children's mental health in disasters (www.ahrq.gov/research/pedprep/resource.htm).

RESEARCH AND ADVOCACY AGENDA FOR MENTAL HEALTH EMERGENCIES IN THE ED

The President's New Freedom Commission on Mental Health was convened in 2002 to study the mental health service delivery system and make recommendations to enable adults and children with emotional disturbance "live, work, and learn and participate fully in their communities." The 2003 report of the commission addressed awareness, disparities, early screening, the use of technology, and the need for research in this area. Specifically, research that focuses on the identification and management of pediatric mental health emergencies is critical for establishing best practices for screening of undiagnosed psychiatric illness, formal psychiatric evaluation in the ED setting, and engagement into community care. The development of a mental health interest group in the Pediatric Emergency Care Applied Research Network provides an ideal vehicle through which to conduct much-needed large-scale studies that elucidate and evaluate identification, identification, engagement, and treatment methodologies for the emergency setting.[105] Support of funding for local and regional fatality-review teams can also promote surveillance and understanding of factors related to suicide in children and adolescents.[106] Pediatricians can also petition legislators and policy makers to increase reimbursement for mental health services for children and adolescents at all levels, including funding for Medicaid, school-based and community-center services, inpatient services, and mental health providers who provide Medicaid services. This petitioning includes encouraging private insurers to promote need-based coverage rather than fixed limits for mental health and to increase reimbursements to hospitals and consultants who provide pediatric mental health services. A recent joint statement from the American Academy of Pediatrics and the American Academy of Child and Adolescent Psychiatry outlined recommendations to insurers that could decrease the impediments to providing mental health care in the primary care setting.[107] In October 2008, Congress passed the Paul Wellstone and Pete Domenici Mental Health Parity and Addiction Equity Act of 2008 (Pub L No. 110-343).[108] The new law, which went into effect January 1, 2010, requires equity between mental health and substance abuse benefits and medical and surgical benefits in employer-sponsored group health insurance plans for companies with more than 50 employees. The law also requires equity in all financial requirements, including deductibles, copayments, coinsurance, out-of-pocket expenses, and all treatment limitations, including frequency of treatment, number of visits, days of coverage, or other similar limits. The federal legis-

lation will not override state laws that require additional coverage and subjects the definition of mental health conditions to state law.

SUMMARY

Pediatric psychiatric emergencies constitute a large and growing segment of pediatric emergency medical care, and EDs play a critical role in the evaluation and management of these child and adolescent patients. The ED has increasingly become the safety net for a fragmented mental health infrastructure in which the needs of children and adolescents, among the most vulnerable populations, have been insufficiently addressed. Inpatient bed shortages, private and public insurance changes, and shortages of pediatric-trained mental health specialists create particular challenges in this effort. Ideally, these challenges can be addressed through a reinvigorated outpatient infrastructure that supports pediatric mental health care, advance planning for crises on a local level using community resources, and the establishment of a stronger mental health support and education network for primary care physicians. Using a skilled, culturally sensitive, multidisciplinary approach, EDs can safely and effectively manage child and adolescent patients. In addition, EDs can play a significant role in identifying and referring patients with previously undiagnosed and undetected conditions such as suicidal ideation, depression, substance abuse, and PTSD.

The 3-pronged approach of education, research, and advocacy are crucial for improving the accurate and timely ED management of childhood psychiatric illness. Education of medical students, residents, fellows, faculty members, and nurses can focus on not only rapid diagnosis and medical management but also the internal social supports and available external resources for their local service area. Researchers need to develop easy and rapid pediatric screening tools and test strategies that enlist the family and primary care physicians as partners in the effort to provide basic psychiatric care and appropriately access the mental health system. Finally, because this issue permeates almost all aspects of pediatric medicine, it is clear that pediatricians need to advocate for fairness and parity with respect to the provision and reimbursement for mental health care for children.

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TECHNICAL REPORT

Pediatric Aspects of Inpatient Health Information Technology Systems

Council on Clinical Information Technology

ABSTRACT

US adoption of health information technology as a path to improved quality of patient care (effectiveness, safety, timeliness, patient-centeredness, efficiency, and equity) has been promoted by the medical community. Children and infants (especially those with special health care needs) are at higher risk than are adults for medical errors and their consequences (particularly in environments in which children are not the primary patient population). However, development and adoption of health information technology tools and practices that promote pediatric quality and patient safety are lagging. Two inpatient clinical processes—medication delivery and patient care transitions—are discussed in terms of health information technology applications that support them and functions that are important to pediatric quality and safety. Pediatricians and their partners (pediatric nurses, pharmacists, etc) must develop awareness of technical and adaptive issues in adopting these tools and collaborate with organizational leaders and developers as advocates for the best interests and safety of pediatric patients. Pediatric health information technology adoption cannot be considered in terms of applications (such as electronic health records or computerized physician order entry) alone but must be considered globally in terms of technical (health information technology applications), organizational (structures and workflows of care), and cultural (stakeholders) aspects of what is best. *Pediatrics* 2008;122:e1287–e1296

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Key Words
health information technology, electronic health record, quality improvement, quality of care, pediatrics

Abbreviations
HIT—health information technology
CPOE—computerized provider order entry
CDS—clinical decision support
EHR—electronic health record
AAP—American Academy of Pediatrics

INTRODUCTION

US adoption of health information technology (HIT) has been advocated by federal agencies, health care industry groups, and patient-advocacy organizations as a major approach to improve patient safety through reduction and prevention of medical errors.[1–5] Adoption of HIT tools such as electronic health records (EHRs), computerized provider order entry (CPOE), and clinical decision support (CDS) is increasing, and although current implementation of all these HIT tools is not yet widespread in US hospitals,[6,7] most hospitals that provide care for children and infants use some form of an electronic information system to manage personal health information and other data that affect children's health.[8]

Children and infants have vulnerabilities and needs that are distinct from adults with regard to the management of their clinical care and its associated information. The extended normal ranges of body weights, sizes, and physiologic responses require modifications of clinical, technical, and information workflows to provide pediatric-specific care that is safe. A systematic evidence base for design and implementation of effective HIT that improves care quality and safety is needed but lacking,[9] and recent observations and experience indicate that changes (such as the adoption of information technology) can introduce new and unanticipated errors.[10–12]

MOTIVATIONS

The primary reason for adopting HIT is to improve the quality and safety of care. Information technology can reduce variations that lead to task failures[13] and uncertainties that increase cognitive burdens that lead to incorrect decisions. An important component in safety is the consideration (and estimation) of risk:

$$\text{risk} = \text{likelihood of error} \times \text{severity of error (harm)}.$$

Children seem to be at higher risk than adults for medical errors, with estimates based on inpatient data suggesting that hospitalized children may be at higher (up to triple) risk of preventable adverse drug events. Contributors to these may include wider ranges of children's and infants' weights (neonates seem to be at the highest risk of adverse drug events), greater complexity of medication dosing (universal weight-based dosing is prone to calculation errors

and must include consideration for adult maximum-dose limits), and higher risk in special domains (continuous intravenous infusions and chemotherapy may have higher immediate and/or cumulative toxicities than other drug types).

Another contributor to children's risk of medical errors is the variety of institutional settings in which they receive medical, surgical, and psychiatric care. Environments range from academic centers that specialize in tertiary pediatric care to general community hospitals that care primarily for adults. Each type of inpatient setting (and each individual setting) has specific attributes that may contribute to error likelihood.

BARRIERS

The major technical barrier to adoption of pediatric HIT tools is a lack of pediatric-specific information technology standards. Among these needs for standards are pediatric data that are machine-readable, terminologies and dictionaries that fully describe pediatric clinical entities (such as pediatric drug-dose data), and electronic standards (Health Level 7 Child Health Functional Profile[14] is currently in development) that adequately describe pediatric clinical events.

To establish these technical standards, there must be recognized leadership and authority as well as legislative and financial support at national, regional, and institutional levels. Standards for HIT products and practices designed for pediatric care must be based on pediatric data, not extrapolated from adult data.[9] Recent efforts by the American Academy of Pediatrics (AAP) Council on Clinical Information Technology have promoted collaboration to define standard pediatric functionalities for EHRs, and the requirements for pediatrics are being addressed by the Certification Commission for Health Information Technology.[15]

STAKEHOLDERS IN PEDIATRIC INPATIENT CARE

The child and family caregivers are central to pediatric care. Health care structures and processes, including errors and their disclosure, must be transparent to patients and families. Inpatient HIT applications must support family-centered, developmentally appropriate care of children[16] and must preserve transparency and patient/family empowerment.

The primary care provider and the medical home are central in the longitudinal care of children, particularly those with special health care needs. Inpatient HIT applications and workflows must support facilitated communication and continuity among patients' primary care providers, families, and inpatient care teams as well as (real-time) interoperability between inpatient and medical home clinical data systems.

Hospitalists and nursing and affiliate staff (such as pharmacists) are central to the inpatient care process. The progressive compartmentalization of health care has separated clinical responsibilities for transitional and inpatient care: emergency physicians for emergent care, hospitalists for general inpatient and observation-unit services, neonatologists and intensivists for critical care services, specialists for specific problems and procedures, and nursing for inpatient unit management and patient care administration. Inpatient HIT tools must support the work of inpatient staff to organize patient care, facilitate communication, and make care transitions (including shift change, admission, transfer, and discharge) safe while reinforcing staff roles in patient care[17–23] (including issues of training and certification requirements[24–26] for pediatric care).

WORKFLOWS IN PEDIATRIC INPATIENT CARE

Medication delivery and patient care transitions are 2 inpatient processes that are vulnerable to errors and are the focus of current research and development of information technologies.

Medication Delivery

Medication delivery is a set of common inpatient processes consisting of a series of role-based functions and handoffs. Certain environments and processes have higher risk because of a higher likelihood and/or impact of errors, but at the core:

1. A prescriber determines a patient's need for a drug regimen; specifies a medication and its dosage, form, route, and frequency; and then generates a formal order for the regimen and transcribes it for transmission to the pharmacist.
2. The pharmacist receives and checks the order; consults patient data and the prescriber (when needed) for errors and clarifications; makes certain independent decisions on form, route, and dose adjustments; and prepares and dispenses drug doses and instructions.
3. Drug doses are delivered to the inpatient unit nurse, who accepts and stores the drug doses; retrieves, administers, and documents drug doses to the patient according to the original order/schedule and pharmacy instructions; and makes certain independent decisions within practice scope (such as with "as-needed" orders or optional administration routes [oral versus rectal]).

Inpatient Patient Transitions

During an inpatient stay, patients undergo numerous care transitions, including admission (from emergency departments, transport services, and physician offices), discharge (to home or other facilities), and/or transfer to different locations within the institution for tests (imaging), procedures (surgery), and special levels of care (postanesthesia recovery care). Patients in transit (away from the "home" inpatient unit) may have needs, including life (ventilator) and environmental (temperature regulation for preterm infants) support, maintenance of scheduled and continuous medical care, physical transport, patient-location tracking, and contingencies that must be anticipated and coordinated before transition. Information (in the form of notes, orders, and other documentation) accompanies personnel until the patient reaches his or her destination, where transition (handover) occurs.

The most common transition is the transfer of care responsibilities (handovers, handoffs, or sign-outs). Physicians, nurses, consultants, and ancillary staff members transfer responsibilities in parallel (physician to physician, nurse to nurse, etc) and, in most cases, asynchronously according to shift and call schedules. Higher rates of handovers of information, authorization, and responsibility are associated with higher risks of incomplete or incorrect information transfer but may be necessary because of residency hour requirements.[27] Currently identified transition problems include needs for medication reconciliation and structured and interactive information transfers during handovers.

GENERAL CONSIDERATIONS FOR INPATIENT HIT APPLICATIONS

The consideration of adopting HIT for clinical use involves assessments of both the clinical and institutional environment and of available products.

Assessment of the Clinical and Institutional Environment

Within any clinical environment or workflow, HIT adoption is high-risk change that must be managed carefully. In assessing HIT-adoption initiatives, stakeholders should consider HIT applications globally, in terms of the anticipated technical and adaptive changes that will be needed for adoption,[28] including the ways that information will be presented, communicated, and used; downtime and recovery procedures; anticipated benefits; and how these changes will be measured. These considerations (plus others, including the political climate for change) and the presence or lack of answers can focus and guide efforts in securing resources and expertise.

Assessment of Information Technology Products

Institutional awareness about specific HIT products gained through interchange with similar institutions can help reduce trial-and-error. Beyond sharing of knowledge about technology (hardware, software, interoperability with other systems, messaging), information assurance (data confidentiality, integrity, and availability), and accessibility/usability requirements (including the ability to override CDS) that a system must meet, institutional leaders involved with HIT decisions should communicate, not only with other institutions but with vendors and workers from all levels involved in using HIT applications. Site visits to external deployments can help decision-makers to gain familiarity with products, to assess a product's applicability to specific work environments, and to learn from the experience of their peers with products, vendors, and the adoption process. A "community-of-practice"[29] approach encourages information sharing and dissemination about HIT adoption among practitioners (as well as others) and provides firsthand experiences of current users that can impart information on challenges and shortcomings that new customers need to make informed decisions. Collective formal and informal knowledge forums[30] will be needed for specific applications if informed HIT adoption is to increase.

SPECIFIC HIT APPLICATIONS: CONTEXTS, PURPOSES, FUNCTIONS, AND PEDIATRIC FEATURES

Medication Delivery

Computerized Provider Order Entry

Context, Purpose, and Functions

CPOE[31] provides support for prescribers at the prescribing/ordering step of the medication-delivery process, with the purpose of standardizing and ensuring completeness in orders for drugs, tests, and procedures. CPOE interfaces promote standardization through default options[32] and guide prescribers in creating and formatting structured orders through an electronic interface. CPOE differs from stand-alone prescription writers by an electronic data connection (excluding fax) to a pharmacy information system. In most cases, inpatient CPOE is linked to CDS, which improves its ability to reduce errors.[33]

Pediatric-Specific Features

CPOE for pediatric inpatients should provide:

- universal weight/body surface area–based dosing (with standard and consistent units of measurement (eg, metric) to prevent conversion and calculation errors);
- drug dictionaries with pediatric-specific dose ranges and alerts that include single-dose, daily-dose, and cumulative-dose decision support, including lifetime cumulative dose for chemotherapies;
- drug-dosing decision support that is contextual for pediatric-specific health issues that can include neonatal, renal, oncology, and other illness or wellness states;
- automated calculations and automatic dose limits/caps for larger patients;
- medication-reconciliation tools;
- pediatric-specific order sets;
- ability to link vaccination ordering to current immunization schedules; and
- linkage to pediatric-appropriate nutrition, laboratory, radiology, and other ancillary service orders (eg, orders linked to pediatric-specific tests [smaller blood volumes]).

Clinical expertise by pediatricians, pediatric nurses, and pediatric pharmacists familiar with both HIT and pediatrics must guide pediatric CPOE implementation. Specific pediatric medication-delivery processes pose specific challenges in error reduction because of the potential for increased errors or increased impact of errors as follows:

- continuous intravenous infusions, because of the immediate and dynamic impact of administered drugs and complex calculations that change in critically ill patients, benefit from in-line calculators that deter-

mine dosing and appropriate standard concentration choices (per Joint Commission regulations[34]) of drugs[35,36];

- pediatric chemotherapy, because of the narrow therapeutic indices and acute and cumulative effects of drugs as well as complex schedules that are prone to interruption as a result of changes in patient condition, is an area of research and development of management and decision-support tools[37,38]; and
- total parenteral nutrition (a special case of continuous intravenous infusion), because of the complexity of rules and calculations and schedule-critical dependence on timed laboratory results and order, may benefit from in-line calculators with automated rules to avert incorrect dosing, interactions, precipitation of solutes, and other costly errors.[39]

CDS: Clinical Calculators

Context, Purpose, and Functions

Automated calculation (of drug doses, dates, etc) eliminates manual computation errors, especially in high-stress situations[40] such as cardiopulmonary resuscitation of a child. For cases in which parameters (such as weight and height) are known, precalculated charts may provide an alternative.[41–43] The primary failure point for calculators is manual numerical entry (decimal, unit errors), which must be considered in the design and evaluation of interfaces and user training.

Pediatric-Specific Features

Because possible pediatric weights may vary over orders of magnitude, the wide range of allowed values may facilitate decimal errors and evade detection. Incorporation of independent and redundant checks (automated and human) into workflow to mitigate this type of error is an important consideration of design.

CDS: Electronic Prescribing Systems

Context, Purpose, and Functions

Electronic prescribing systems are designed help clinicians to generate paper or electronic medication prescriptions. The use of CDS, default options, and improved legibility offer the potential for improved patient safety.[44] In the hospital environment, these applications are usually used in the discharge process.

Pediatric-Specific Features

Features and requirements are similar to the CPOE requirements discussed previously.

CDS: Management Systems

Context, Purpose, and Functions

Management systems can provide high-level decision support by applying clinical and business rules to information processes across different but related systems (such as laboratory, imaging, and hospital admission systems) to improve prevention, therapy, and efficiency. In conjunction with CDS at CPOE interfaces, these tools can provide users with situational awareness of patient and hospital status. Examples of management tools include electronic whiteboards (census displays),[45] antimicrobial restriction programs (decision support to reduce inappropriate antibiotic use),[46] and early notification systems for infection risks for patient cohorting.[47] The specification of rules requires close interaction of clinicians and developers to specify alerts of high impact and to avoid "alert fatigue."[48]

Pediatric-Specific Features

Systems have been devised to provide alerts for respiratory syncytial virus and rotavirus.[49] The extension and linkage of such systems beyond hospitals to public health information systems may have value as resistant organisms previously confined to inpatient settings migrate to the community.[50,51]

CDS: Reference (or Teaching) Materials

Context, Purpose, and Functions

Automatic or on-demand linkages of patient-specific data (from EHRs)[52] and general medical knowledge (from formularies or electronic textbooks and handbooks) can aid decisions and help physicians in training.

Pediatric-Specific Features

Application-specific pediatric reference data should be checked by pediatric domain experts for conflicts with accepted norms from trusted data sources. Institutions should decide on "final authority status" of specific resources to resolve discrepancies. Many standard texts and references are available in multiple electronic formats (online, CD-ROM, handheld devices), and availability of trusted pediatric-specific information resources should be coordinated with a pediatrician and a hospital medical librarian. In institutions where children receive care on a partial basis, a core library (which may be available as an online subscription package, either commercially or through organizations such as the AAP or the Centers for Disease Control and Prevention), should be established and maintained. The AAP publishes authoritative policies on most pediatric issues[53] and on infectious disease diagnosis and management in children (the *Red Book* online).[54] The Centers for Disease Control and Prevention publishes current immunization schedules as well as surveillance data for influenza, respiratory syncytial virus, and rotavirus in the *Morbidity and Mortality Weekly Report*.

Pharmacy Information Systems

Context, Purpose, and Functions

Pharmacy information systems[55] support the dispensing step of the medication-delivery process, with the purpose of providing inventory selection and management and decision support for pharmacists and a redundant check for dosing, drug-allergy, and drug-drug interaction errors and for other pharmacology problems (such as solute precipitation in intravenous solutions). Pharmacology information systems may be linked to or require prompts for data from laboratory information systems (or from previous drug orders) and may be

partially automated (such as in creation of standard-concentration intravenous solutions or parenteral alimentation solutions).[56]

Pediatric-Specific Features

Because most of the details of pharmacy preparation of drug doses are invisible to prescribers and nurses, the most valuable component of a pediatric pharmacy information system is a qualified and experienced pediatric pharmacist and pharmacy staff[57] who actively participate in clinical care of inpatients (such as daily work rounds).[58,59] This expertise provides an additional layer to error catching and safety in medication ordering; however, neither CPOE nor pharmacy information systems may be effective in directly preventing medication-administration errors.[57] Essential expertise also provided by pediatric pharmacists is knowledge that populates (weight/body surface area) drug-dose range tables and alerts for pediatrics.

Administration Tools: Radio Frequency Identification, Bar Coding, Smart Pumps, Patient-Controlled Anesthesia, and Medication-Administration Records

Context, Purpose, and Functions

The administration step is the last step before a prescribed/ordered medication dose is given to the patient. The substeps of administration (usually performed by a nurse within inpatient environments) include receipt of drug doses from the pharmacy, storage of medication doses before final delivery, scheduled dose retrieval and preparation, identification of patient/drug/dose/form/route ("5 rights"), and final dose delivery. Radio frequency identification[60–62] and bar-coding[63,64] systems are used to verify and record identification of patient and drug dose and to track inventory. "Smart" infusion pumps programmed for specific workflows with appropriate drug doses and alerts may be useful in pediatrics[65] but require caution in deployment because of poor compliance with alerts by human operators.[66,67] Electronic medication-administration records link administration tools such as radio frequency identification, bar coding, and smart pumps to documentation and tracking of drugs and are used by multiple members of the medical team,[68] and usability by nursing is an important factor in success.[69]

Pediatric-Specific Aspects

The 2006 Joint Commission mandate for universal use of standardized concentrations in continuous infusion medications[70] created a debate among pediatric intensivists, particularly neonatologists, about fluid overload in extremely low weight infants. Hierarchical task analysis of neonatal infusion ordering/administration concluded that use of standardized admixtures could be associated with a higher risk of errors than ad hoc ("rule of 6") admixtures in patients in critical condition who require frequent adjustments in infusion rates.[71] Because of the feedback from this debate, the Joint Commission extended a transition period (until 2008) for pediatric/neonatal acute care if certain safeguards, including the use of "smart" pumps, were in place.[72,73] A published description of the implementation process of standard concentrations for neonatal care includes allowances for nonstandard concentrations,[74] with key knowledge being the lowest infusion rate allowed by the pump.

Errors in expressed human milk administration (wrong mother, wrong infant, wrong milk, wrong expiration date) in the NICU have been described with suggested methodologies for reducing their incidence.[75,76] In addition to system design to prevent such errors, barcoding systems have been developed, explored, and advocated[77] as a means of tracking and ensuring correct administration of human milk.

Certain "high-alert" medications are associated with an increased risk of causing harm to patients[78] when involved in errors. Approaches to these medications include proactive monitoring and redundant checks to prevent errors[79] in addition to the use of technology. Pediatric patient-controlled analgesia and patient-controlled analgesia by proxy pose challenges to implementation, and inpatient protocols should be developed in consultation with specialists in pediatric pain control.[80]

Patient Care Transitions

Electronic Health Records

Context, Purpose, and Functions

EHRs are a central structure for patient-specific data documentation. Their multiple roles include facilitating communication among providers, standardizing medicolegal documentation of care, historical record archiving and retrieval, and coordination of care. They can facilitate centralized clinical communication and documentation among hospitalists, primary care providers in medical homes, consultants, and emergency care providers. They also will start to hold artifacts of historical significance over time, such as records of patients who will become persons of public importance as well as historical trends in disease and wellness. They form the basis for medication reconciliation and may support personal health records to inform and empower patients and families about their care. Important technical functions of EHRs include interoperability of data elements, connectivity to other electronic records, and information assurance (according to established standards). Essential in their implementation is effective user training to prevent misuse that may lead to errors.

Pediatric-Specific Features

Pediatric functions in an EHR have been articulated in an AAP policy statement[81] and include:

- immunization management (recording data, linking to immunization systems, decision support);
- growth tracking (graphing and percentile calculation);
- medication dosing (dosing by weight, dose-range checking, safe and convenient dose rounding, age-based decision support, dosing for the school day);
- patient identification (prenatal identifiers, newborn identifiers, name changes, ambiguous gender);

- norms for pediatric data (numeric; nonnumeric; complex normative, such as blood pressures; gestational age); and
- privacy (adolescent, foster/custodial care, consent by proxy, adoption, guardianship, emergency treatment).

Technical standards and certification criteria for inpatient systems are still in development.

Ancillary Information Systems: Laboratory and Radiology (Imaging) Information Systems

Context, Purpose, and Functions

Laboratory and radiology information systems may exist independently or may be integrated with other inpatient information systems. They allow the ordering, managing, processing, billing, and result reporting for laboratory or imaging services. Interoperability and connectivity with inpatient systems (CPOE, EHRs, electronic medication-administration records) is usually limited to single hospitals but may be a safety issue in related institutions that share clinical care of a patient[82] during a single inpatient stay.

Pediatric-Specific Features

Pediatric-specific features are similar to those outlined for the EHR. Pediatric/age-specific norms for parameters and result reporting for radiologic and laboratory tests are critical.

Ancillary Information Systems: Admission, Discharge, and Transfer Systems

Context, Purpose, and Functions

Admission, discharge, and transfer systems track and facilitate the patient flow throughout the hospital by providing correct and unique patient identifiers for other clinical information technology systems for clinical care and billing.

Pediatric-Specific Features

Pediatric-specific issues that may contribute to increased errors include identification of individual infants in multiple births, mother-infant link, the ability to register patients before arrival (especially for critical and emergency patients), and reconciliation of alerts across information systems.

Standardized Handoffs, Whiteboards, and Patient-Tracking Tools

Context, Purpose, and Functions

Standardized care transitions have been identified as a national patient safety goal.[83] Within inpatient settings, types of transitions include:

- admissions and discharges;
- transfers to other units within the same institution; and
- handoffs of care (shift change).[84]

Each transition involves an exchange of information, responsibility, and authority from a provider (or team of providers) to another and involves a complex interaction of communication and dialogue between the sender and receiver in the transition process. The level of interactivity depends on a variety of factors including the acuity and intensity of care, the uncertainty of the patient's status, the specialty, the level of care, and the experience of the provider (supervising attending, hospitalist, resident, intern). An important aspect of transition is the provision of an appropriate time and location for transition, protected from the interruptive nature of care environments.[85] Models for handoff transitions and for creating standard checklists and for handoffs have been published.[86–88] HIT applications that support the handovers or transfers include electronic patient records, electronic whiteboards, and personal information tools that allow organization, management, and transfer of patient-specific task information.

Pediatric-Specific Features

Drivers for this area of efficiency and patient safety are medication discrepancies at sign-out[89] and the restriction of resident work hours.[27,90] A general structured template for transitions developed at an academic pediatric program has been proposed and is based on the mnemonic "PEDIATRIC"[88]:

- Problem list
- Expected tasks to be done
- Diagnostic one-liner
- If/then contingency plans
- Administrative data/advance directive
- Therapeutics
- Results and other important facts
- Intravenous access/invasive devices/procedures
- Custody and consent issues

Other approaches may be preferred in specific specialties or units (such as a systems-based approach used in pediatric and neonatal intensive care).

PRAGMATIC ISSUES

Data Conversion, Accumulation, and Noise

A proposed advantage of electronic data in HIT systems is data reuse.[91] Advantages of electronic data in this regard include reduction of costs and effort of storage and retrieval; however, technical limitations to realizing the full advantage include:

- Current technical ability to convert legacy print information into an electronically usable form. Optical character-recognition technology is limited in its capability to convert handwriting into computer-usable text. Legacy paper documents are typically scanned as photographic images for inclusion into electronic records. Limitations of this format include difficulty searching documents by text matching (other than by reading them) unless documents are labeled. The assignment of scanned records to the correct patient is challenging, and bar-code technologies have been

used to aid in the process.[92] EHRs may contain many such scanned documents, which are electronically inaccessible and of little added value other than for (manual) searching.

- Default values on clinical forms (such as review of systems and physical examination) are intended to ensure completeness for quality assurance and billing. However, when the printed or retrieved versions of the contents of such forms are generated, very long notes with many negatives (pertinent and extraneous) result in low information "signal-to-noise" ratios and reduce clinical usefulness of form data. The value of notes generated from structured data has been improved with the addition of narrative text,[93] which may be richer (or different) than structured data entry.[94] In addition, "copy-and-paste" behaviors that allow providers to generate notes from previous entries may result in inflated notes and persistent propagation of errors.[95]

Effective solutions are difficult, and considerations should include which product options (such as optical character-recognition conversion) to use and how data-input forms should be designed.

Assurance and Certification

HIT purchasers and clinicians want assurances that the systems they purchase and use will provide needed technical functions and interoperate with other systems securely. To accomplish these goals, public-private processes are in development to define standards for HIT products and evaluate which systems meet them. Efforts aimed at certifying EHRs and their networks (including CPOE) have been implemented by the Certification Commission for Healthcare Information Technology and the Leapfrog Group.[15,96,97] The current list of certifications for pediatric HIT functions is small (limited to pediatric ambulatory EHRs) but growing.

Liability Risk Modification

The accessibility of data afforded by electronic information systems creates new types of medicolegal liabilities. Increased availability of personal health data from multiple locations creates the potential for information breaches and confidentiality violations. New federal rules extend discovery to electronic information beyond the patient record, including e-mails, electronic business records, archived data, and administrative metadata on the origins and times of records.[98] Electronic clinical records can facilitate discovery of practice deviations and record alterations,[99] and converted legacy records, although they may have limited clinical value, may be admissible, although their paper counterparts may have long been discarded.

Ethnic and Minority Populations and Special Health Information Needs

Language and literacy barriers may add to the complexities of care in non–English-speaking populations and may contribute to poor outcomes. Preformatted patient information sheets may not match the needs of patients,[100,101] which may be missed by providers. The special needs of these patients and families include cultural competence by providers (including knowledge of language and health literacy issues) and information tools (such as personal health records and information sheets) adjusted to patient needs (including forms and scripts that ensure true informed consent).

For children with special health care needs, special communication needs may include extended discussions to ensure access to timely and appropriate care. An indirect effect of inpatient HIT adoption for minority populations may ultimately be related to the financial barriers of access and where families seek care. Low HIT-implementation rates in institutions where these patients receive care may reflect health disparities that are only part of the complex issues of the effects of poverty on children and their care.[102]

CONCLUSIONS

The adoption, incorporation, and use of HIT in inpatient settings to ensure patient safety where children receive care goes beyond consideration of available technical products. Pediatricians and child health advocates interested in adopting HIT for inpatient care must be aware of the technical and adaptive considerations that go into its successful acquisition, implementation, and deployment.

HIT adoption involves a global consideration of local institutional issues including:

- existing safety problems and outcomes that are to be improved with HIT;
- organizational structure and clinical process changes that will be required, including the work of implementation and the costs of adoption, deployment, use, and maintenance; and
- cultural and political factors that facilitate and block the changes.

Pediatric-specific HIT adoption involves familiarity with collective experience and knowledge.

- Similar institutions with the same problems, experiences, and data can be key in providing input and experiences.
- Specific products, their functions, and pediatric-centered features must be evaluated.
- Shared information resources can be consulted to aid evaluation and decision-making.

HIT adoption involves expertise in clinical informatics among the following:

- pediatric clinicians (physicians, nurses, pharmacists) with information technology experience in analysis, implementation, and evaluation of systems;
- organizational change managers versed in information technology transitions in clinical settings; and
- pediatric and institutional leaders who understand the goals and values of health care improvement and clin-

ical information technology adoption with regard to the health needs of children, including those with special health care needs.

Introduction of HIT may significantly improve clinical performance, reduce costs, and reduce workloads; however, every HIT-system implementation will invariably introduce new and sometimes unforeseen errors and challenges.

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The Society for Academic Emergency Medicine Position on Pediatric Care in the Emergency Department

Roger J. Lewis, MD, PhD, on behalf of the SAEM Board of Directors

PREAMBLE

The Society for Academic Emergency Medicine (SAEM) Board of Directors recognizes the importance of providing quality emergency care to all pediatric patients in all emergency department settings, as well as our responsibility to teach medical students, residents, and fellows the skills and knowledge necessary to provide such care. Further, the SAEM Board of Directors is aware that the abilities of emergency physicians to provide quality emergency care to children occasionally has been questioned, most commonly in the lay media. While not in response to any particular event, the Board felt it important to assert certain principles regarding the qualifications of emergency physicians to provide emergency care to children. Thus, in collaboration with a variety of emergency medicine and pediatric organizations, the following position statement was developed and approved by the Board. This position statement has been approved by the following pediatric and emergency medicine organizations: The Ambulatory Pediatric Association (APA); the American Academy of Emergency Medicine (AAEM); the American Academy of Pediatrics (AAP); the American College of Emergency Physicians (ACEP); the Association of Academic Chairs in Emergency Medicine (AACEM); and the Council of Residency Directors in Emergency Medicine (CORD).

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POSITION STATEMENT

Physicians who are certified in emergency medicine by the American Board of Emergency Medicine (ABEM) or the American Osteopathic Board of Emergency Medicine (AOBEM), or those who are certified in pediatric emergency medicine by ABEM or the American Board of Pediatrics (ABP), possess the knowledge and skills required to provide quality emergency medical care to children. To provide quality care, the emergency physician must have all necessary and age-appropriate medical equipment readily available. The emergency physician must also have access via consultation, admission, or transfer, to appropriate specialty and subspecialty physicians, who will provide any needed patient care after emergency department treatment. Although physically separate care areas for children are ideal, they are not mandatory to provide high-quality care.

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT
Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine

Pediatric Care Recommendations for Freestanding Urgent Care Facilities

ABSTRACT. Freestanding urgent care centers are not emergency departments or medical homes, yet they are sometimes used as a source of pediatric care. The purpose of this policy statement is to provide updated and expanded recommendations for ensuring appropriate stabilization in pediatric emergency situations and timely and appropriate transfer to a hospital for definitive care when necessary. ***Pediatrics*** **2005;116:258–260;** ***urgent care, equipment standards, emergency preparedness, pediatric preparedness.***

Freestanding urgent care facilities remain a fixture in the provision of health services for children in some communities. Although the American Academy of Pediatrics does not encourage the routine use of urgent care facilities because it may undermine the provision of coordinated, comprehensive, family-centered care consistent with the medical home concept,[1] the use of these facilities as part of urgent and emergent care systems is not uncommon. The term "urgent care" may imply to the public that a facility is capable of managing critical or life-threatening emergencies. This was the case for the youngest victim of the sniper in the Washington, DC, area on October 7, 2002. After being shot in the abdomen, despite the advice of the 911 operator to stay and wait for help, this 13-year-old child was driven to a local freestanding urgent care center.[2] He survived because this freestanding urgent care center was properly equipped and staffed to handle this child's initial stabilization and transfer to a level I pediatric trauma center.

Freestanding urgent care centers are not emergency departments. However, they must have the capability to identify patients with emergency conditions, stabilize them, and coordinate timely access to definitive care. These facilities must have appropriate pediatric equipment and experienced staff trained to provide critical support for ill and injured children until transferred for definitive care. It is necessary for freestanding urgent care facilities to have prearranged access to comprehensive pediatric emergency services through transfer and transport agreements. Available modes of transport should be identified in advance and be appropriate for the acuity of illness of the child.

If freestanding urgent care facilities are to be used as a resource for pediatric urgent care, they should first solicit help from the pediatric professional community to define expectations and levels of plans for pediatric consultation. Pediatricians who are prepared to assist in the stabilization and management of critically ill and injured children should be accessible. Pediatricians should be certain that freestanding urgent care centers are prepared to stabilize and transfer critically ill and injured children before they are recommended to their patients and families for after-hours use.

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RECOMMENDATIONS

Freestanding Urgent Care Facility Emergency Preparedness

1. Administrators at freestanding urgent care facilities should ensure that their staff is capable of providing resuscitation, stabilization, timely triage, and appropriate transfer of all pediatric patients.
2. Although the minimum standards for drugs, equipment, and supplies are listed in Tables 1 and 2, freestanding urgent care facilities with emergency medical systems response times of >10 minutes and transport times of >20 minutes to an emergency department need to have all suggested equipment, resuscitation drugs, and supplies as detailed in "Care of Children in the Emergency Department: Guidelines for Preparedness," issued jointly by the American Academy of Pediatrics and American College of Emergency Physicians.[3]
3. Freestanding urgent care facilities that provide care for children must be staffed by physicians, nurses, and ancillary health care professionals with the certification, experience, and skills necessary for pediatric basic and advanced life support during all hours of operation.
4. Triage, transfer, and transport agreements should be prearranged with definitive care facilities that are capable of providing the appropriate level of care based on the acuity of illness or injury of the child.[4]
5. Mechanisms for notifying the primary care physician or another on-call health care professional about the treatment given to ensure appropriate follow-up with the child's medical home should be in place and should be compliant with the regulations of the Health Insurance Portability and Accountability Act (HIPAA) (Pub L No. 101-

TABLE 1. Office Emergency Equipment and Supplies

	Priority*
Airway management	
Oxygen-delivery system	E
Bag-valve-mask (450 and 1000 mL)	E
Clear oxygen masks, breather and nonrebreather, with reservoirs (infant, child, adult)	E
Suction device, tonsil tip, bulb syringe	E
Nebulizer (or metered-dose inhaler with spacer/mask)	E
Oropharyngeal airways (sizes 00–5)	E
Pulse oximeter	E
Nasopharyngeal airways (sizes 12–30F)	S
Magill forceps (pediatric, adult)	S
Suction catheters (sizes 5–16F) and Yankauer suction tip	S
Nasogastric tubes (sizes 6–14F)	S
Laryngoscope handle (pediatric, adult) with extra batteries, bulbs	S
Laryngoscope blades (straight 0–4; curved 2–3)	S
Endotracheal tubes (uncuffed 2.5–5.5; cuffed 6.0–8.0)	S
Stylets (pediatric, adult)	S
Esophageal intubation detector or end-tidal carbon dioxide detector	S
Vascular access and fluid management	
Butterfly needles (19–25 gauge)	S
Catheter-over-needle device (14–24 gauge)	S
Arm boards, tape, tourniquet	S
Intraosseous needles (16, 18 gauge)	S
Intravenous tubing, microdrip	S
Miscellaneous equipment and supplies	
Color-coded tape or preprinted drug doses	E
Cardiac arrest board/backboard	E
Sphygmomanometer (infant, child, adult, thigh cuffs)	E
Splints, sterile dressings	E
Automated external defibrillator with pediatric capabilities	E
Spot glucose test	S
Stiff neck collars (small/large)	S
Heating source (overhead warmer/infrared lamp)	S

* E indicates essential; S, strongly suggested (essential if emergency medical services response time is >10 minutes).
Adapted from: American Academy of Pediatrics, Committee on Pediatric Emergency Medicine. *Emergency Medical Services for Children: The Role of the Primary Care Provider*. Singer J, Ludwig S, eds. Elk Grove Village, IL: American Academy of Pediatrics; 1992.

TABLE 2. Office Emergency Drugs

	Priority*
Drugs	
Oxygen	E
Albuterol for inhalation†	E
Epinephrine (1:1000)	E
Activated charcoal	S
Antibiotics	S
Anticonvulsants (diazepam, lorazepam)	S
Corticosteroids (parenteral/oral)	S
Dextrose (25%)	S
Diphenhydramine (parenteral, 50 mg/mL)	S
Epinephrine (1:10 00)	S
Atropine sulfate (0.1 mg/mL)	S
Naloxone (0.4 mg/mL)	S
Sodium bicarbonate (4.2%)	S
Fluids	
Normal saline solution or lactated Ringer's solution (500-mL bags)	S
5% Dextrose, 0.45 normal saline (500-mL bags)	S

* E indicates essential; S, strongly suggested (essential if emergency medical services response time is >10 minutes).
† Metered-dose inhaler with spacer or mask may be substituted.
Adapted from: American Academy of Pediatrics, Committee on Pediatric Emergency Medicine. *Emergency Medical Services for Children: The Role of the Primary Care Provider*. Singer J, Ludwig S, eds. Elk Grove Village, IL: American Academy of Pediatrics; 1992.

191 [1996]). If a primary care physician is not identified, efforts should be made to refer the patient to a pediatrician able to promote a medical home environment.

6. Administrators at freestanding urgent care facilities must ensure that there is an organized and structured quality-improvement program to monitor and improve care for ill or injured children.
7. Freestanding urgent care facilities should have in place and should monitor compliance with policies, procedures, and protocols for emergency care of children consistent with those listed in "Care of Children in the Emergency Department: Guidelines for Preparedness."[3]
8. Freestanding urgent care facilities should have a policy for disaster preparedness and participate in their community disaster plan.[5]

Pediatrician's Role in Freestanding Urgent Care Facilities

1. Pediatricians should refer patients for after-hours care only to freestanding urgent care facilities that have the capability to identify patients with emergency conditions, stabilize them, and arrange transfer for definitive care.
2. When referring a patient, the pediatrician should provide to the freestanding urgent care facility necessary clinical information and be available to provide consultation.

If freestanding urgent care centers are staffed and equipped properly and have appropriate triage, transfer, and transport guidelines, the safety of children using these services for emergencies can be protected.[6]

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NEW BUREAUCRATIC JOBS WOULD PAY FOR 2,000 MORE DOCTORS AND 6,000 NURSES

"The NHS was accused . . . of wasting millions of pounds of taxpayers' cash on 'unnecessary' jobs and hospital bureaucracy. Figures released by the Conservative Party show that in the last nine months a staggering 3,300 non-clinical jobs have been advertised in one health magazine alone. The salaries for these jobs amount to more than £133 million, enough for 6,000 more nurses, 2,000 more doctors or 29,000 hip replacements."

Fletcher V. *Daily Express.* April 23, 2005

Noted by JFL, MD

FEDERATION OF PEDIATRIC ORGANIZATIONS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Pediatric Fellowship Training

In 1996, the Federation of Pediatric Organizations revised its 1990 statement on pediatric fellowship training. The following statement represents the current (2004) position of the federation regarding the purpose and objectives of fellowship training.

The goal of subspecialty fellowship training is to advance the health of children by preparing graduates who are competent in clinical care, education, and research. This goal is best achieved by fellowship training that fosters the development of future academic pediatricians, recognizing the diverse roles they now play. This goal requires that graduates of training programs have a keen curiosity about issues in their subspecialty field, a healthy skepticism of their own experience (and the published experience of others), and a working understanding of the analytic tools relevant to exercising critical judgment. Training is best provided in an environment in which there are faculty role models committed to scholarly activities.

Subspecialists may serve as expert clinicians providing direct and consultative care to patients based on their experience and critical evaluation of scientific evidence and research. They may serve as educators helping to guide and facilitate life-long learning of medical students, residents, fellows, and others who provide care for children. They also may be investigators adding to the body of knowledge in their subspecialty. The eventual careers of subspecialists may involve 1 or more of these roles to varying degrees. Therefore, training programs should provide all trainees with experiences that will allow them to develop competence for each of these roles, and applicants must be selected on the basis of their potential to achieve appropriate skills in each of these domains. The following are guidelines for fellowship programs and trainees.

1. Fellowship training must educate trainees to develop and maintain life-long learning skills for themselves, especially the ability to critically evaluate new knowledge to determine its appropriate use in caring for patients.
2. Fellowship training programs must provide the opportunity for trainees to acquire appropriate clinical skills and must incorporate into their curriculum mastery of each of the 6 general competencies identified by the Accreditation Council of Graduate Medical Education and the American Board of Medical Specialties (medical knowledge, patient care, communication, professionalism, practice-based learning and improvement, and systems-based practice.) Relevant benchmarks and thresholds must be developed to ensure that competency in each area can be verified as achieved by all subspecialty graduates by the conclusion of their training program.
3. To achieve and maintain the goal of subspecialty training, in addition to acquiring appropriate clinical skills and competencies during the period of training, subspecialty trainees must acquire skills that will enable them to provide quality care throughout their professional lifetimes. These skills include the ability to critically analyze and evaluate their own observations and the observations of others; assimilate new knowledge, concepts, and technology; formulate clear and testable questions (hypotheses) from a body of information; and communicate ideas verbally and in writing.

   Programs must provide opportunities for trainees to acquire these skills. These opportunities for scholarship may include a variety of activities, but they must result in the acquisition of the skills referred to in the preceding paragraph, and the trainee's participation must be guided by 1 or more mentors.

   Scholarly activities, including but not limited to basic, clinical, or translational biomedical research, must be undertaken and successfully completed by trainees. These activities must be integrated into the training experience along with the core curriculum for the subspecialty and any formal coursework that is part of the training experience. Obtaining a graduate degree is not a substitute, per se, for such scholarly activities.
4. Fellowship training must be structured to provide a scholarly experience for every trainee, because it is essential to a successful subspecialty career in clinical care, education, research, or a combination of these activities. The subspecialty training program must have an oversight committee (at least 3 individuals, one of whom should be outside the trainee's subspecialty) for each trainee with appropriate expertise in scholarly endeavors. This committee must assess and confirm the presence of an adequate scholarly experience for each fellowship trainee and evaluate the product of the individual's scholarly experience.
5. Fellowship programs must provide training and experience to ensure that graduates will be effec-

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tive teachers for all learners in need of understanding and collaboration in the subspecialist's area(s) of expertise. This training must include the ability to participate effectively in all aspects of the educational process including curriculum development, delivery of information, and assessment of educational outcomes. Graduates should be scholarly and effective in teaching both individuals and groups of learners in clinical settings, classrooms, lectures, and seminars and through electronic and print modalities.

6. Fellowship training programs must provide a career mentor(s) for each trainee who will assist the trainee in developing an individualized learning plan for the entire training period. This mentor must be responsible for providing the ongoing formative feedback that is essential to the trainee's attainment of competence in clinical care, teaching, and scholarship. The mentor may come from a division or department other than the one offering the fellowship.
7. Fellowship training programs must be periodically reviewed and evaluated to improve the quality of the trainee's experiences in clinical care, education, and investigation. Tracking trainee career outcomes must be part of this review. The reports of these evaluations must be used to judge whether a program has met predetermined standards for fellowship training and to identify areas in need of improvement. The reports must be made available to trainee applicants and trainees.

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Policy Statement—Pediatric Organ Donation and Transplantation

abstract

Pediatric organ donation and organ transplantation can have a significant life-extending benefit to the young recipients of these organs and a high emotional impact on donor and recipient families. Pediatricians, pediatric medical specialists, and pediatric transplant surgeons need to be better acquainted with evolving national strategies that involve organ procurement and organ transplantation to help acquaint families with the benefits and risks of organ donation and transplantation. Efforts of pediatric professionals are needed to shape public policies to provide a system in which procurement, distribution, and cost are fair and equitable to children and adults. Major issues of concern are availability of and access to donor organs; oversight and control of the process; pediatric medical and surgical consultation and continued care throughout the organ-donation and transplantation process; ethical, social, financial, and follow-up issues; insurance-coverage issues; and public awareness of the need for organ donors of all ages. *Pediatrics* 2010;125:822–828

COMMITTEE ON HOSPITAL CARE, SECTION ON SURGERY, AND SECTION ON CRITICAL CARE

KEY WORDS

organ donor, organ donation, organ transplantation, organ procurement, pediatrics, children, ethics

ABBREVIATIONS

OPO—organ-procurement organization
OPTN—Organ Procurement and Transplantation Network
DCD—donation after cardiac death
UNOS—United Network for Organ Sharing

BACKGROUND

In 1998, the Centers for Medicare and Medicaid Services changed the federal conditions of participation to require that hospitals participating in Medicare and Medicaid programs refer potential organ donors to their local organ-procurement organization (OPO) in a timely manner.[1] The Centers for Medicare and Medicaid Services mandates that all families of potential organ donors be made aware of their option to donate. Legislation further requires all hospitals to have trained "designated requestors" available to discuss organ donation with families of potential donors. Even with these mandates, organ availability remains inadequate. The number of individuals who are on the national transplant waiting list remains far in excess of the number of organs recovered and transplanted.[2] Children from birth to 17 years of age account for approximately 2% to 3% of the national waiting list. More than 70% of the children on the list are waiting for a liver or a kidney, and the small bowel is the organ with the greatest increase in need.[3,4] Ongoing debates attempt to identify the best ways to manage the existing supply of organs and how to improve organ procurement in general.[5]

The Organ Procurement and Transplantation Network (OPTN) is the nation's organ procurement, donation, and transplantation system. The United Network for Organ Sharing (UNOS) is the nonprofit organization that operates under the OPTN under a contract from the federal

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government. All organ procurement organizations (OPOs) and transplant programs are OPTN/UNOS members and follow OPTN policies. The OPTN is overseen by the US Department of Health and Human Services, Health Resources and Services Administration. The Children's Health Act,[6] which was passed in October 2000, called on the OPTN to develop specific criteria, policies, and procedures to address the unique needs of children and adults. To overcome the ethical dilemma of organ distribution based on time on the waiting list versus benefit to the patient, the OPTN developed new criteria for organ transplantation for children and adolescents. Included is a new lung-allocation score to maximize benefits and fairness for allocation of donor lungs to potential transplant recipients. This lung-allocation score for patients aged 12 years and older is based on multiple factors, not just the length of time on the transplant waiting list, and allows children to receive priority for pediatric donor lungs before they can be offered to adults. Liver allocation to children on the transplant waiting list is based on the pediatric end-stage liver disease (PELD) and model for end-stage liver disease (MELD) scores and not only on the length of time on the transplant waiting list.[7,8] Kidney-allocation policies are revised so that kidneys from donors younger than 35 years are offered preferentially to pediatric candidates. Children younger than 11 years on the kidney transplant waiting list are given additional priority because of the greater impact of kidney failure on development.[3] Pediatric heart transplantation candidates receive preference over adult candidates in the allocation of adolescent donor hearts depending on the urgency of each case.[3]

ORGAN DONATION

This discussion of organ donation and transplantation acknowledges that this is a most difficult time for 2 families: one with a loved one who has suffered an untimely death and another with a child with a terminal condition. Organ donation is a process that starts when the family begins receiving information about their critically ill child.

The American Academy of Pediatrics supports the role of OPOs by recommending that all potential donor families be approached in a systematic method by individuals trained in the psychological, social, and medical aspects of organ donation. OPOs exist throughout the country. They evaluate potential donors, discuss donation with family members, arrange for surgical removal of donated organs, and arrange for distribution of the organs according to national organ-sharing policies. The rate of families that consent to donation can be increased significantly by using hospital or OPO staff who are specifically trained in organ procurement and by separating or "decoupling" the death notification and organ-donation consent processes.[4,9–11] Timely referral and the use of staff trained in organ procurement are federal requirements for participation in the Medicare program. Timely referral is crucial to ensure that a rushed approach regarding donation is avoided with the family. This may start in the emergency department with the admission of a critically injured child, and staff may start the process at that time.[12] Timely referral provides active communication with the health care team and the OPO, which enhances the chances that the family will agree to organ donation. Deliberation with the OPO should occur before or when initial brain-death testing is occurring or "withdrawal-of-care" or "do-not-resuscitate" options are being discussed. Collaboration with physicians, the health care team, and the OPO is critical to ensure that every family is provided the opportunity to discuss organ donation during end-of-life discussions.[13] Accurate determination of death is essential before efforts to actively recover organs can proceed. One must ensure that death has occurred; if there is any question, additional testing or extending the observation period between neurologic examinations is warranted. Just as important is the timely declaration of neurologic death. Therefore, timely and definitive treatment of the donor is critical.[10] The timely declaration of neurologic death has important benefits. First, it allows the grieving process to begin for the family, which makes a point of closure more likely to be achieved by the family. Second, it improves the success associated with the acquisition of organs. Aggressive medical management of the potential donor to keep organs perfused can increase organ yield. Progression of organ failure secondary to hemodynamic instability after neurologic death results in the loss of up to 25% of potential donors. Third, it avoids continued life support for a person who has died and is no longer a potential donor. Care of the pediatric donor is a natural extension of care for a critically ill and injured child and the family. This continuum of care of the potential pediatric donor and the family is crucial in helping families understand what has transpired with their child. Likewise, support and advice of the child's primary caregiver provides further continuity of care.

Pediatric donors become eligible for organ procurement after the determination of neurologic death has been made. Although most pediatric donors will meet standard criteria for declaration of brain death, donation after cardiac death (DCD)—or non–heart-beating organ donation—has the potential to increase organ donation.[14] Contrary to the belief that DCD is a new way to recover organs, DCD is, in fact,

the foundation of modern transplantation. Organs were routinely recovered from deceased donors by this method before development of brain-death guidelines. For patients with severe brain injury for whom neurologic death is unlikely to occur, DCD enters the end-of-life continuum of care. Discussions regarding DCD can occur only after the family and the medical team have made the decision to withdraw support or terminate care. Comfort measures are provided for the patient as would normally be instituted anytime withdrawal of support occurs. Once life support is withdrawn and the donor develops circulatory arrest, apnea, and unresponsiveness, the patient is observed for a period of 2 to 5 minutes before certification of death. Organs can be recovered for transplantation if death occurs within a short period of time, usually 1 hour, after withdrawal of support. DCD is slowly gaining acceptance in the pediatric community, as evidenced by an increase in organs from pediatric non–heart-beating organ donors over the past few years.[3,4] DCD enables the ability to recover 2 of the most needed organs for children—kidney and liver. Concerns regarding prolonged ischemia time and graft dysfunction have been raised; however, several reports have indicated that renal and liver grafts from DCD donors have graft function and transplant recipient survival rates comparable to those with organs recovered from brain-dead donors.[15–19] In addition, lungs from DCD donors are now being recovered with good success.[9] The Institute of Medicine and the American College of Critical Care Medicine both endorse DCD as a means to recover organs for transplantation.[20,21]

TRANSPLANTATION

The process of organ transplantation begins when the child is referred to a transplant center. When it is determined that the child is a suitable candidate, he or she is added to that transplant center's waiting list through the United Network for Organ Sharing (UNOS) computer, and access information for organ-matching is listed. The UNOS is contracted with the Health Services and Resources Administration to maintain a centralized computer network linking OPOs with transplant centers. When a potential organ donor is identified, a transplant coordinator accesses the UNOS computer. The computer generates a ranked list of potential recipients for each organ that may be procured according to organ-allocation policies, which differ for each organ. These policies were developed by patients and transplant professionals to ensure fair and equitable distribution of organs. There are no criteria based on gender, religion, celebrity status, or financial status. The organ is offered to the transplant team of the first person on the list. The transplant surgeon then determines if that person is appropriate for that particular organ, and if so, the transplant takes place. If not, the organ is offered to the next person on the list.

OPOs are the link between organ donors and recipients. They are responsible for coordinating the recovery of organs, ensuring that there is informed consent, managing the clinical care of the donor once consent is obtained, ensuring the viability of the donated organs until transplant, and transporting the organ to the transplant team. They also provide follow-up information to the donor family and hospital staff. Pediatric transplant programs are smaller than adult programs, because fewer children require transplantation, and they must offer special expertise in children's health care (eg, critical care, dialysis, and interventional radiology). Pediatric transplantations should be performed in only the most experienced of institutions.

The family should be involved in every aspect of transplantation. There are unique consequences of transplantation in childhood that require ongoing evaluation and care besides the functioning of the transplanted organ. Special attention must be given to growth and developmental issues to ensure an optimal neurodevelopmental outcome.[22–24] Some considerations for the medical team caring for the pediatric organ recipient include support (emotional and spiritual) for the recipient, other siblings (eg, social aspects relating to their care), and parents or guardians (eg, maintaining employment status) and the availability of pediatric subspecialty support (critical care, dialysis, anesthesia, interventional radiology, etc).[25,26] Children are much harder to relocate to a transplant center for care, because their families must accompany them and siblings must be cared for at the same time. Involvement of the child's primary care physician and local subspecialist can be beneficial in providing follow-up visits and laboratory monitoring where these capabilities exist.[26] This decreases transportation costs and improves patient access to medical intervention. Keeping the family unit intact reduces stress on the family and improves the outcome for the child.

ETHICAL ISSUES

There are numerous ethical issues involved in the area of organ transplantation. Three general topics are deciding when human beings are dead, deciding when it is ethical to procure organs, and deciding how to allocate organs once they are procured.[27] Additional questions that are raised include: Who should pay for transplantation? Is it ever appropriate to pay for organs? Is transplantation worth the

tremendous cost? Are the benefits justified for all conditions? Is the distribution system as fair as it can be? Should we allow second transplants? It is not the purpose of this policy statement to answer those questions but to raise awareness of them. Donation and procurement of vital organs after cardiac death is ethical, provided informed consent is obtained ahead of time. Organ procurement must not cause death, and death must precede procurement of unpaired organs or both paired organs. Death must be certified by using standardized, objective, and auditable criteria, and death determination must follow state law. All decisions about children are made by parents or guardians on the basis of the best interests of minor children and not on the basis of preservation of patient autonomy per se. It is reasonable for any child for whom a do-not-resuscitate or withdrawal-of-care decision is made in the course of management, or any child who has a nonneurologic death, to be considered a DCD candidate. Unless parents or guardians initiate donation conversations first, discussions regarding donation should occur only after the decision to withdraw support or terminate care has been established. The medical and forensic investigation of the death of a child attributable to trauma (unintentional or resulting from abuse), sudden infant death syndrome, or poisonings presents unique issues related to organ procurement. Close cooperation between the forensic system, transplant team, treating physicians, and OPO facilitates evaluation, guidance, and successful organ procurement in most cases. Cooperation ensures that evidence will not be destroyed and that any injuries noted during organ recovery will be documented and reported. The surgeon also has the responsibility to testify to the condition of the organs at the time of recovery. Some medical examiners believe that individuals who died as a result of abuse should not be organ donors. However, if protocols are developed through which the historical data, surgical and autopsy findings, and laboratory studies are cooperatively examined, most individuals whose death requires investigation can be donors.[28–30] The National Association of Medical Examiners supports organ donation and is working to achieve zero medical examiner denials.[11]

FAMILY SUPPORT

The American Academy of Pediatrics supports the key role of OPO professionals to provide family support during the donation process and in long-term follow-up of the donor family. The success of these efforts is an integral part of increasing organ donation within the local community. In addition to OPOs, the broader medical community must also provide support to the donor family. This includes nurses, clergy, pediatricians and family physicians, child life specialists, and social workers. Involvement of the child's primary care physician and treating subspecialist during organ procurement and transplantation can be beneficial in bedside management, discussion of complex or unusual diseases, and addressing broader medical issues with the donor family. Education of the primary care pediatrician and other health care professionals about approaching the emotional and physical health of the donor's family can be provided by the OPOs. Sensitivity to the needs, beliefs, and desires of each individual family is an important aspect of organ donation, and these family issues must be considered in each circumstance. Each local medical community must evaluate its resources and have procedures in place to support the family during and after the death of a child. The primary care physician is an integral part of the care of the family and should be involved in support and follow-up of the donor family. In addition to family support, the staff at the local medical center should also receive training in dealing with the death of a child, including confidentiality and religious, cultural, and ethical issues. Hospital ethics committees are beneficial in the development of staff support and for discussion of difficult cases.[31,32]

FINANCIAL ISSUES

The cost of organ donation is borne entirely by the OPO. Transplant costs are the responsibility of the recipient. Organ transplantation is one of the most resource-intensive and expensive therapies available to children. The costs are higher for children because of a longer expected life span after transplantation and loss of work for parents or guardians.

Despite these increased costs, the significant benefits of organ and tissue transplantation should outweigh financial concerns.

Payment for organ transplantation and subsequent follow-up care may be covered by employer and individual insurance policies. However, the coverage of certain organ transplants, second transplants, and long-term care is variable, and most policies have a lifetime maximum amount or "cap."[33] Once this amount has been reached, the insurance company has no obligation to pay for additional benefits. The amount of the cap varies greatly and may apply to just 1 procedure or to all procedures and treatments combined. The ongoing cost of transplantation plus ongoing long-term care may exceed the cap. Improved long-term survival in younger transplant recipients places them at high risk of reaching this cap. Medicaid rules vary from state to state, but most transplant procedures are now included. Because

publicly funded programs such as Medicaid, the State Children's Health Insurance Program, TRICARE, and others are insurers of a large segment of the pediatric population, transplantation financial issues must be addressed by state and federally funded health care programs.

PUBLIC AWARENESS

Because the death of a child is often unforeseen, many families have not considered the possibility of organ donation. Pediatricians, children's advocacy groups, and institutions that care for children need to increase awareness of the need for organs with the same enthusiasm with which blood donations and immunization programs are promoted, through the use of posters in waiting rooms, handouts, and other public campaigns. Educational programs have begun with a classroom program titled "Decision: Donation," developed as a part of the US Department Health and Human Services Gift of Life Donation Initiative.[34] Options also exist for the promotion of living donation and bone marrow transplantation. An opportunity to discuss these options within the context of anticipatory guidance during adolescent visits might arise when reviewing the risks of driving.[35] This interaction would better prepare the adolescent for future decisions that he or she may have to make regarding family members and serve to educate the parents of their own organ-donation options. Organ donation is a decision made by families, not by physicians. Every family should be given the opportunity to allow their loved one to become an organ donor. Organ donation should be an option for any family with a loved one for whom end-of-life issues are being discussed.

RECOMMENDATIONS

1. Pediatricians at local, regional, and national levels should promote the awareness for increased organ donation and support regional transplant programs.
2. Organ donation is an integral part of end-of-life care that provides families with a final decision to make concerning a loved one. Every family should be given the opportunity for organ donation if it is medically appropriate, and it should be the expectation that the family will be approached in a professional, compassionate manner. The decision to donate is one made by the family, not by physicians.
3. Accurate and timely declaration of neurologic death is essential to ensure that viable organs are not lost because of a delay in declaration of death.
4. DCD is a reasonable way to increase the number of organs recovered for pediatric transplantation, especially much-needed livers and kidneys.
5. Timely referral to OPOs can increase organ-donation rates by providing active communication with the health care team and the OPO. Timely notification decreases the likeliness of a rushed approach to donation, which enhances the chances of the family agreeing to organ donation. Collaboration with physicians, the health care team, and the OPO is critical to ensure that every family is provided the opportunity to discuss organ donation during end-of-life discussions.
6. The consent procedure for organ donation should be handled by a trained professional, and the death notification and consent for organ-donation processes should be separated or "decoupled."
7. Education of staff should include medical, ethical, social, cultural, and religious issues related to the potential donor and recipient families.
8. Programs for support of donor families should be in place and coordinated with the child's primary care physician.
9. The treating physician should continue to be involved in cooperative medical decision-making and support of the family after the determination of brain death and cardiac death in the patient who has become an organ donor. Care of the pediatric donor is a natural extension of care for a critically ill or injured child and the child's family. Involvement of pediatric critical care specialists as early as possible can increase organ availability and improve the quality of organs recovered for transplantation.
10. Protocols should be developed that allow cooperative examination of evidence and injuries so that organ donation can successfully proceed in cases in which forensic investigation is required.
11. The US Department of Health and Human Services and the medical community must closely examine all transplant and organ-donation regulations and work to ensure that children are fairly served by their policies.
12. An organ-distribution system should recognize the following:
    - Health care for children who need transplantation is best provided in centers of excellence by a health care system that provides medical care delivered by pediatricians, pediatric medical subspecialists, and surgical specialists with expertise in pediatric organ transplantation.
    - Issues related to relocation of the child and family to a transplant center for care, transpor-

tation, and family support must be addressed at all centers that provide transplantations for children.

13. Adequate financial resources and payment for pediatric organ transplantation and lifetime follow-up care must be available.
14. Pediatricians should be informed of the possibility of transplantation for certain patients, be educated about the process of transplantation, be familiar with the transplant center in their region, and be advocates for their patients and their families in the transplant-listing process.

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Policy Statement

November, 1993
AAP
News

Pediatric Primary Health Care (RE9262)

AMERICAN ACADEMY OF PEDIATRICS

PRIMARY HEALTH CARE is described as accessible and affordable, first contact, continuous and comprehensive, and coordinated to meet the health needs of the individual and the family being served.

PEDIATRIC PRIMARY HEALTH CARE encompasses health supervision and anticipatory guidance; monitoring physical and psychosocial growth and development; ageappropriate screening; diagnosis and treatment of acute and chronic disorders; management of serious and life-threatening illness and, when appropriate, referral of more complex conditions; and provision of first contact care as well as coordinated management of health problems requiring multiple professional services. PEDIATRIC PRIMARY HEALTH CARE for children and adolescents is family oriented and incorporates community resources and strengths, needs and risk factors, and sociocultural sensitivities into strategies for care delivery and clinical practice. PEDIATRIC PRIMARY HEALTH CARE is best delivered within the context of a "medical home," where comprehensive, continuously accessible and affordable care is available and delivered or supervised by qualified child health specialists.

The PEDIATRICIAN, because of training (which includes four years of medical school education, plus an additional three or more years of intensive training devoted solely to all aspects of medical care for children and adolescents), coupled with the demonstrated interest in and total professional commitment to the health care of infants, children, adolescents and young adults, is the most appropriate provider of PEDIATRIC PRIMARY HEALTH CARE.

The Medical Home (RE9262)

The recommendations in this statement do not indicate an exclusive course of treatment or standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

AMERICAN ACADEMY OF PEDIATRICS

Committee on Psychosocial Aspects of Child and Family Health

The Pediatrician and Childhood Bereavement

ABSTRACT. Pediatricians should understand and evaluate children's reactions to the death of a person important to them by using age-appropriate and culturally sensitive guidance while being alert for normal and complicated grief responses. Pediatricians also should advise and assist families in responding to the child's needs. Sharing, family support, and communication have been associated with positive long-term bereavement adjustment.

The death of an important person in a child's life is among the most stressful events that a youngster can experience.[1–3] Adults in the midst of their own grief often are confused and uncertain about how to respond supportively to a child.[3,4] When the death involves a parent or a sibling, the potential for an adverse response by the child is compounded.[5] During such a crisis, the pediatrician can be an important source of education and support for a child and family.[1]

By already knowing something of the family interactions and individual coping skills, the pediatrician is in a position to help evaluate and understand a child's reactions and to advise and assist the family in responding to the child's needs.[1–3] Awareness of the child's temperament and typical responses to stress can help the pediatrician counsel the child and family.[2] Cultural and religious background are important considerations in dealing with the bereaved family.[2,6,7] Knowledge of previous significant losses and parent and child responses to them are helpful in understanding and predicting how a death may affect the child and family.[2] Circumstances (eg, prolonged illness, sudden unexpected death, or violent death) are important additional considerations.[6–8] In instances of disasters with multiple deaths, the pediatrician is likely to be called on as a resource by rescue teams, school personnel, and others. The pediatrician should describe to families and personnel the normal childhood emotional reactions to such an abnormal incident and offer support and counsel to the children and to the adults caring for them.[9]

The child should be told about a death honestly and in language that is developmentally appropriate. When advising an adult about informing the child of the death, the pediatrician needs to be aware that a child's concept of death varies with age (Table 1) and needs to be able to tailor the specific advice given to a parent.[3,5,10] The family can be reassured that their showing of feelings, such as shock, disbelief, guilt, sadness, and anger, is normal and helpful.[2] A bereaved parent or other close family member who shares these feelings and memories (eg, with pictures and stories) with a child reduces the child's sense of isolation.[5,11] Children need reassurance that they will be cared for and loved by a consistent adult who attends sensitively to their needs. In addition, they must be assured that they did not cause the death, could not have prevented it, and cannot bring back the deceased.[1,5,8] Parents should be encouraged to continue family routines and discipline.[2,8,12]

The funeral services can provide even a young child with an important way to grieve a loved one if such involvement is supportive, appropriately explained, and compatible with the family's values and approach.[2,8] Children need to be prepared if they are to participate in the funeral process.[12] The participation should be tailored according to the developmental level of the child. For instance, the younger child may have the process broken down into shorter, more manageable, intervals. A trusted person should be with a child to explain what is happening and to offer support.[3] Older children and adolescents may want to participate by speaking at the funeral or memorial service. Encouraging a child to commemorate loss through some form of participation, such as drawing pictures, planting a tree, or giving a favorite object, will promote inclusion in the process and provide a meaningful ritual.[5]

Grief for a child is a process that unfolds over time. The initial shock and denial of death may evolve into sadness and anger that can last for weeks to months and eventually end, in the best of circumstances, with acceptance and readjustment.[13] Some children may seem emotionally unmoved, thus causing concern to family members.[5,8] It is important for the pediatrician to be aware of the range of manifestations of childhood grief (Table 2) and to be alert to prolonged or severe behavior change that signals the need for more intensive intervention.[1,4,8] A number of age-appropriate books can be read by or to a child as support for understanding and dealing with the grieving process (Table 3). The pediatrician should remain alert to the resurfacing of the child's concerns at the anniversary of the death, at holidays, or at times of other losses as the child progresses through subsequent developmental stages.[5,11]

Recognition of one's own attitudes and reactions to death is essential for objectively and supportively counseling the family.[1] Pediatricians must realize that grief counseling is an emotionally demanding,

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

TABLE 1. Overview of Children's Concepts of Death

Age Range, Years	Concept
0 to 2	Death is perceived as separation or abandonment Protest and despair from disruption in care-taking No cognitive understanding of death
2 to 6	Death is reversible or temporary Death is personified and often seen as punishment Magical thinking that wishes can come true
6 to 11	Gradual awareness of irreversibility and finality Specific death of self or loved one difficult to understand Concrete reasoning with ability to see cause-and-effect relationships
Older than 11	Death is irreversible, universal, and inevitable All people and self must die, although latter is far off Abstract and philosophical reasoning

time-consuming, and potentially frustrating endeavor.[3] *The Classification of Child and Adolescent Mental Diagnoses in Primary Care: Diagnostic and Statistical Manual for Primary Care (DSM-PC) Child and Adolescent Version*[14] identifies diagnoses and conditions and may help the pediatrician evaluate the degree of severity of the child's behavior. Use of *DSM-PC* coding also may help the pediatrician deal with third-party payers. Referral to a mental health specialist or clergy (pastoral counselor) should be considered when the pediatrician believes that progress is not being made or would feel more comfortable having someone else work with the family.

RECOMMENDATIONS

1. The pediatrician should provide support and anticipatory guidance for children and families who face death. The pediatrician is in a position to encourage open discussion of reactions, thoughts, and feelings in the family, thereby increasing the sense of mutual support and cohesion.
2. The pediatrician must use age-appropriate and culturally sensitive guidance while being alert for

TABLE 3. Selected Books About Bereavement for Parents and Children*

Young Children and Parents Dealing With Death

The Dead Bird, by Margaret Wise-Brown. Addison-Wesley, Reading, MA, 1958 (3 to 5 y)

Lifetimes: The Beautiful Way to Explain Death to Children, by Bryan Mellonie and Robert Ingpen. Bantam Books, New York, NY, 1983 (3 to 6 y)

When Dinosaurs Die: A Guide to Understanding Death, by Laurene Krasny Brown and Marc Brown. Little Brown, Boston, MA, 1996 (4 to 8 y)

Accident, by Carol Carrick, Seabury Press, New York, NY, 1976 (6 to 8 y)

Older Children and Young Adolescents on Death of a Sibling or Close Friend

A Taste of Blackberries, by Doris B. Smith. Thomas Y. Crowell Co, New York, NY, 1973 (8 to 9 y)

The Magic Moth, by Virginia Lee, Seabury Press, New York, NY, 1972 (10 to 12 y)

Beat the Turtle Drum, by Constance C. Greene. The Viking Press, New York, NY, 1976 (10 to 14 y)

Bridge to Terabithia, by Katherine Paterson. Thomas Y. Crowell Co., New York, NY, 1977 (10–14 y)

Straight Talk About Death for Teenagers, by Earl A. Grollman. Beacon Press, Boston, MA, 1993 (13 to 19 y)

Guidelines for Parents and Other Caregivers

How Do We Tell the Children? Helping Children Understand and Cope With Separation and Loss, by Dan Schaefer and Christine Lyons. Newmarket Press, New York, NY, 1993

Talking About Death: A Dialogue Between Parent and Child, by Earl A. Grollman. Beacon Press, Boston, MA, 1990

Sudden Infant Death Syndrome: Who Can Help and How, edited by Charles A. Corr, Helen Fuller, Carol Ann Barnickol and Donna M. Corr. Springer Publishing Co, New York, NY, 1991

Questions and Answers About Suicide, by David Lester. The Charles Press, Philadelphia, PA, 1989

Young People and Death, edited by John Morgan. The Charles Press, Philadelphia, PA, 1991

* The book list in the table was adapted from the following book: *A Child Dies. A Portrait of Family Grief,* by Joan Hagan Arnold and Penelope Buschman Gemma. The Charles Press, Philadelphia, PA, 1994.

TABLE 2. Range of Common Grief Manifestations in Children and Adolescents

Normal or Variant Behavior	Sign of Problem or Disorder*
Shock or numbness	Long-term denial and avoidance of feelings
Crying	Repeated crying spells
Sadness	Disabling depression and suicidal ideation
Anger	Persistent anger
Feeling guilty	Believing guilty
Transient unhappiness	Persistent unhappiness
Keeping concerns inside	Social withdrawal
Increased clinging	Separation anxiety
Disobedience	Oppositional or conduct disorder
Lack of interest in school	Decline in school performance
Transient sleep disturbance	Persistent sleep problems
Physical complaints	Physical symptoms of deceased
Decreased appetite	Eating disorder
Temporary regression	Disabling or persistent regression
Being good or bad	Being much too good or bad
Believing deceased is still alive	Persistent belief that deceased is still alive
Adolescent relating better to friend than to family	Promiscuity or delinquent behavior
Behavior lasts days to weeks	Behavior lasts weeks to months

* Should prompt investigation by pediatrician; mental health referral is probable.

normal and complicated grief responses. The ability to share, reliance on family members, and good communication have been associated with positive long-term bereavement adjustment.

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POLICY STATEMENT

Pediatric Mental Health Emergencies in the Emergency Medical Services System

Organizational Principles to Guide and Define the Child Care Health System and/or Improve the Health of All Children

AMERICAN ACADEMY OF PEDIATRICS
Committee on Pediatric Emergency Medicine
AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
Pediatric Emergency Medicine Committee

Endorsed by the American Academy of Child and Adolescent Psychiatry and the American Academy of Family Physicians.

ABSTRACT

Emergency departments are vital in the management of pediatric patients with mental health emergencies. Pediatric mental health emergencies are an increasing part of emergency medical practice because emergency departments have become the safety net for a fragmented mental health infrastructure that is experiencing critical shortages in services in all sectors. Emergency departments must safely, humanely, and in a culturally and developmentally appropriate manner manage pediatric patients with undiagnosed and known mental illnesses, including those with mental retardation, autistic spectrum disorders, and attention-deficit/hyperactivity disorder and those experiencing a behavioral crisis. Emergency departments also manage patients with suicidal ideation, depression, escalating aggression, substance abuse, posttraumatic stress disorder, and maltreatment and those exposed to violence and unexpected deaths. Emergency departments must address not only the physical but also the mental health needs of patients during and after mass-casualty incidents and disasters. The American Academy of Pediatrics and the American College of Emergency Physicians support advocacy for increased mental health resources, including improved pediatric mental health tools for the emergency department, increased mental health insurance coverage, and adequate reimbursement at all levels; acknowledgment of the importance of the child's medical home; and promotion of education and research for mental health emergencies.

STATEMENT

PEDIATRIC mental health emergencies constitute a large and growing segment of pediatric emergency medical care. Emergency departments (EDs) play a critical role in the evaluation and management of child and adolescent patients with mental health emergencies. Community mental health resources have diminished and, in some regions, even disappeared through inpatient bed shortages, private and public health insurance changes, reorganization of state mental health programs, and shortages of pediatric-trained mental health specialists. These changes have resulted in critical shortages of inpatient and outpatient mental health services for children.[1] The ED has increasingly become the safety net for a fragmented mental health infrastructure in which the needs of children and adolescents, among the most vulnerable populations, have been insufficiently addressed.

ED staff must safely, humanely, and in a culturally sensitive manner manage patients with exacerbations of known diagnosed mental illnesses as well as those

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Key Words
emergency department, mental health emergencies, school and community mental health services, medical home

Abbreviation
ED— emergency department

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with mental retardation, autistic spectrum disorders, and attention-deficit/hyperactivity disorder or those who are having a behavioral crisis. They also must identify and manage patients with previously undiagnosed and/or undetected conditions such as suicidal ideation, depression, escalating aggression, substance abuse, and posttraumatic stress disorder.[2] ED personnel evaluate and treat trauma patients, physically and sexually maltreated children, and children exposed to community and domestic violence and also must deal with unexpected deaths of children in the ED. Violence-related situations may involve pediatric victims and/or pediatric-aged perpetrators of violence. In many states, adolescents can seek and receive care for mental health issues and drug/alcohol use without parental involvement, and confidentiality must be maintained unless the child is at risk of harming himself/herself or others. The ED staff must also recognize the primary support role of the family and caregivers in all phases of pediatric mental illness.

EDs play a critical role in mass-casualty occurrences and disasters, and staff must address the unique mental health needs of children during and after these events. A strong and growing body of evidence indicates that emotional and physical trauma to children can cause neurochemical and structural brain changes resulting in posttraumatic stress disorder and can affect some children into their adult lives.[1–12] Emotional trauma may be ameliorated by timely, culturally appropriate, pediatric-specific stress intervention that may be implemented in the initial hours after the trauma.[13,14]

The epidemiologic and outcome data on pediatric mental health emergencies are insufficient, but there is evidence that pediatric mental health concerns are commonly unaddressed.[15,16] Pediatric mental health emergencies are frequently not recognized as such, presenting initially as trauma or somatic complaints, and are, therefore, underrepresented in the existing data.[17–20] The challenges to an already overburdened ED "safety net" are to provide safe, humane, and culturally and developmentally sensitive triage, diagnosis, stabilization, initial management, and treatment and referral for a broad spectrum of mental health emergencies, working within a mental health infrastructure in crisis.

Pediatric mental health emergencies are best managed by a skilled, multidisciplinary team approach, including specialized screening tools, pediatric-trained mental health consultants, the availability of pediatric psychiatric facilities when hospitalization is necessary, and an outpatient infrastructure that supports pediatric mental health care, including communication back to the primary care physician and timely and appropriate ED referrals to mental health professionals.[21]

The American Academy of Pediatrics and American College of Emergency Physicians support the following actions:

1. Advocacy for adequate pediatric mental health resources in both inpatient and outpatient settings, including the availability of prompt psychiatric consultation for ED psychiatric patients and school and community mental health services, including adequate mental health screening.
2. Development of mechanisms for the ED to deal with unique pediatric mental health issues including violence in the community, physical trauma, domestic violence, child maltreatment, mass-casualty incidents and disasters, suicides and suicide attempts, and the death of a child in the ED.
3. Appropriate payment for both inpatient and outpatient pediatric mental health services.
4. Acknowledgment of the importance of the child's medical home* to his or her continued well-being, including prevention, screening, and treatment of mental health issues.[22]
5. Advocacy for comprehensive pediatric mental health insurance coverage to include provision of mental health services for the uninsured and expansion of coverage to include mental health services for those who are insured.
6. Advocacy for additional research funding dedicated to pediatric emergency mental health issues.
7. Promotion of education and research for mental health emergencies and specifically to

   - expand the data on epidemiology, best practices, treatment outcomes, and cost/benefit issues for pediatric mental health emergencies in the ED;
   - evaluate the adequacy of patient access to pediatric mental health services;
   - evaluate children with behavioral crisis to understand gaps in primary care and community resources;
   - develop mental health support networks that minimize reliance on acute crisis management;
   - develop and validate accurate pediatric mental health screening tools for use in various settings and best practices for follow-up programs for pediatric mental health patients; and
   - enhance the pediatric mental health curriculum for emergency medicine and pediatric residency training programs and pediatric emergency medicine fellowships.

* A medical home is defined as primary care that is accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective.

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POLICY STATEMENT

The Pediatrician and Disaster Preparedness

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine
Committee on Medical Liability
Task Force on Terrorism

ABSTRACT

Recent natural disasters and events of terrorism and war have heightened society's recognition of the need for emergency preparedness. In addition to the unique pediatric issues involved in general emergency preparedness, several additional issues related to terrorism preparedness must be considered, including the unique vulnerabilities of children to various agents as well as the limited availability of age- and weight-appropriate antidotes and treatments. Although children may respond more rapidly to therapeutic intervention, they are at the same time more susceptible to various agents and conditions and more likely to deteriorate if not monitored carefully.

The challenge of dealing with the threat of terrorism, natural disasters, and public health emergencies in the United States is daunting not only for disaster planners but also for our medical system and health professionals of all types, including pediatricians. As part of the network of health responders, pediatricians need to be able to answer concerns of patients and families, recognize signs of possible exposure to a weapon of terror, understand first-line response to such attacks, and sufficiently participate in disaster planning to ensure that the unique needs of children are addressed satisfactorily in the overall process. Pediatricians play a central role in disaster and terrorism preparedness with families, children, and their communities. This applies not only to the general pediatrician but also to the pediatric medical subspecialist and pediatric surgical specialist. Families view pediatricians as their expert resource, and most of them expect the pediatrician to be knowledgeable in areas of concern. Providing expert guidance entails educating families in anticipation of events and responding to questions during and after actual events. It is essential that pediatricians educate themselves regarding these issues of emergency preparedness.

For pediatricians, some information is currently available on virtually all of these issues in recently produced printed materials, at special conferences, in broadcasts of various types, and on the Internet. However, selecting appropriate, accurate sources of information and determining how much information is sufficient remain difficult challenges. Similarly, guidance is needed with respect to developing relevant curricula for medical students and postdoctoral clinical trainees.

See Technical Report on page e340.

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Key Words
emergency preparedness, disasters, terrorism, bioterrorism

Abbreviations
HRSA—Health Resources and Services Administration
CDC—Centers for Disease Control and Prevention

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INTRODUCTION

Recent natural disasters and events of terrorism and war have heightened society's recognition of the need for emergency preparedness. Moreover, the possibility of

additional terrorism on US soil has become increasingly likely, so much so that billions of dollars have been allocated to massive investments in homeland security and public health readiness. The challenge of dealing with the threat of terrorism, natural disasters, and public health emergencies in the United States is daunting not only for disaster planners but also for our medical system and health professionals of all types, especially pediatricians. Pediatricians need to be able to answer concerns of patients or families, know when to recognize signs of possible exposure to a weapon of terror, understand first-line response to such attacks, and sufficiently participate in disaster planning to ensure that the unique needs of children are addressed satisfactorily in the overall process.

THE ROLE OF THE PEDIATRICIAN

Managing Family Concerns About Disaster and Terrorism Preparedness

Pediatricians play a central role in disaster and terrorism preparedness with families, children, and their communities. This applies not only to the general pediatrician but also to the pediatric medical subspecialist and pediatric surgical specialist. Families view pediatricians as their expert resource, and most of them expect the pediatrician to be knowledgeable in areas of concern. Providing expert guidance entails educating families in anticipation of events and responding to questions during and after actual events. It is essential that pediatricians educate themselves regarding these issues of emergency preparedness. The American Academy of Pediatrics has an extensive set of emergency-preparedness resources for pediatricians. In addition, many other resources for pediatricians regarding emergency preparedness exist and can be found in "Suggested Resources for Additional Information."

As part of anticipatory guidance, pediatricians should discuss issues related to family emergency preparedness. They should provide families with information on creating a family emergency plan, discussing this plan with their children, and practicing the plan. There are several good resources for pediatricians to use in educating families regarding emergency preparedness. They can be found in "Suggested Resources for Additional Information."

Although adults can actively seek help, children cannot; they depend on the adults in their lives to get them the assistance that they need. With appropriate support and guidance, children can develop the skills and resiliency needed to deal with, overcome, and possibly even grow from these traumatic experiences. As part of anticipatory guidance, pediatricians should ask parents about their child's awareness of natural disasters and previous or potential future terrorist attacks, their degree of exposure (including television) to these issues, and their previous and current reactions. Such queries may provide an opportunity to advise parents about how best to discuss terrorist attacks with their child. Pediatricians should encourage parents to present information to children honestly, using language that is appropriate to the child's developmental level and cognitive abilities. Parents can be encouraged to talk with their children about a specific plan that includes things to do in case of a disaster, terrorist incident, or other emergency, such as to whom to go for help, safe places to seek, and other concrete steps that can be taken at home, at school, and in the community. The approach may be similar to that taken to prepare children for other potential threats such as fire or approach by a stranger. By using specific plans to ensure safety, the goal of these discussions should be to help the child to potentially feel in control of a threatening situation and also to convey that the parents are in control.

In addition to handling the needs of all their patients and discussing family emergency planning, pediatricians need to address the unique needs of children with special health care needs. Pediatricians should provide guidance to families of children with special health care needs regarding:

- notification of utility companies to provide emergency support during a disaster;
- maintenance of medications and equipment should supply be disrupted during a disaster;
- knowledge of how to obtain additional medications and equipment during times of disaster;
- training for family members to assume the role of in-home health care providers, who may not be available during a disaster; and
- keeping an up-to-date emergency information form (available from ref 1) to provide health care workers with the patient's medical information should the regular care provider be unavailable.

Office-Based Preparedness

After a disaster, offices or clinics may become sites for care if area hospitals are unable to provide services. If even local offices are unusable, alternative sites for primary care must be identified. If necessary, medical care may be provided in schools, public buildings, malls, and/or makeshift facilities, such as tents, using limited power and water sources. Pediatricians should prepare, regularly update, and practice an office disaster plan that addresses response and recovery issues. This office plan should be coordinated with local hospital and community emergency-response plans. Office training programs in emergency procedures, including first aid, cardiopulmonary resuscitation, evacuation, search and rescue (as appropriate), the use of fire extinguishers, and participation in community disaster drills, should be a routine part of the office's overall emergency preparedness.

Emergency preparations should include plans for storage of temperature-sensitive vaccines, medications, and supplies during extended periods of absent or limited power supply.

Community Preparedness

Pediatricians in the community can assist in both triage and treatment of patients. Important questions to ask include: (1) Where should the pediatrician go during the disaster? (2) How should pediatricians be notified that they are needed to respond to the disaster? (3) How should hospital physicians be identified and notified to go to the scene to attend to victims of the disaster? and (4) How should transfers of pediatric patients in the hospital and discharges be handled? In areas in which pediatricians cover several hospitals, pools should be initiated through the local medical or pediatric society to provide uniform pediatric coverage of area hospitals. Pediatricians can aid schools, child care centers, and other child congregate facilities in developing disaster plans. At the local level, the agency that will have the responsibility for the overall coordination during a disaster or terrorism event will be the office of emergency management (OEM). The specific role of coordination and preplanning for the health care needs of the community will be coordinated by the office of emergency management but assigned to the local department of public health.

Currently, the 2 major programs that provide departments of health in states and the 5 largest cities with direct funding to help fulfill this role of coordinating the health care system for terrorism preparedness are the Health Resources and Services Administration (HRSA) Bioterrorism Hospital Preparedness program and the Centers for Disease Control and Prevention (CDC) Public Health Preparedness and Response for Bioterrorism program. The CDC-funded initiative is primarily concerned with improving public health departments' ability to address bioterrorism, whereas the HRSA effort allows public health departments to provide training, guidance, and funding to hospitals to improve their preparedness. Both of these programs specifically mention pediatric considerations in their guidance, but unfortunately, the pediatric care activities in many states are minimal and often lack sufficient involvement by pediatricians. It is important for pediatricians to become familiar with the activities of these programs to ensure pediatric involvement. Information on these programs can be found on state public health department Web sites in addition to the HRSA and CDC Web sites (see "Suggested Resources for Additional Information").

The Office of the Surgeon General and USA Freedom Corps support local voluntary Medical Reserve Corps units in more than 200 American communities (www.medicalreservecorps.gov). These volunteer units provide a mechanism for health care professionals to volunteer their services during times of disaster as part of the organized response in a community. In addition, by joining a Medical Reserve Corps or other governmentally sponsored or recognized volunteer program, physicians will be provided with mechanisms for identification during times of emergencies. Because the Medical Reserve Corps program does not have pediatric capability as a requirement for their units, it is important for pediatricians to join these teams to ensure that pediatric considerations are met.

Some state health departments have begun to coordinate and link the activities of the Medical Reserve Corps units in their states. In addition, most state health departments and many large local health departments are establishing notification systems based on requirements of the HRSA and CDC grant programs. The purpose of these systems is to ensure that physicians and other health care professionals have timely access to needed information about the existence of an event (disaster, terrorism, or public health emergency), are provided with information on what their role should be, and know whom to contact with problems or for additional information. It is important that all physicians register for these notification systems so that in a time of emergency, they are notified and informed of their role.

Last, pediatricians should inquire about the emergency-preparedness plans at all the hospitals at which they work or admit patients. In times of emergency, there may be a need for transfers or discharges based on different criteria or altered admission policies. To assist hospitals with these functions and provide better care for their patients, pediatricians must understand how each hospital has planned to handle these events.

Surveillance

One of the key elements in emergency preparedness is early detection of any possible public health threat or bioterrorism event. The most likely scenario involves exposure in a community that may manifest with subtle signs and symptoms and/or unusual patient presentations. The role of the pediatrician is key. Pediatricians must be functioning constantly as part of a surveillance system to provide for early detection of any bioterrorism agent, which requires pediatricians to become familiar with the types of bioterrorism agents that may be involved. They also must become familiar with referral procedures and when to report cases to the local health department. Health department reporting is based on local requirements but should be considered for all unusual cases, any cases that are suspicious for a bioterrorist agent, or an unusual number of patients, either absolute or for the season, who present with similar symptoms.

Reporting a Disaster, Terrorism, or Public Health Emergency

It is important that health care professionals be knowledgeable about the mechanism and appropriate contacts to report an event, whether natural or man-made. In

case of any emergency, health care professionals should activate their local emergency system, which in most areas can be done by calling 911. Any suspicious or confirmed disaster situation should be reported immediately to the local 911 emergency-response number.

In addition, if a pediatrician believes that someone has been exposed deliberately to a biological, chemical, or radioactive agent or if a pediatrician believes an intentional terrorist threat will occur or is occurring, he or she should immediately involve the public health authorities. This can be done by contacting the local health department, the local police or other law enforcement agency, and the 24-hour CDC hotline at 770-488-7100.

Last, any incident related to terrorism or possible terrorist activity also requires telephone notification to local law enforcement and the National Response Center at 800-424-8802. This includes bombings, bomb threats, suspicious letters or packages, and incidents related to the intentional release of chemical, radiologic, and biological agents.

Pediatricians' Actions During a Disaster

During a disaster, pediatricians may need to serve in a variety of functions ranging from routine disaster actions for themselves and their families to providing medical care and answering questions from their patients and families and participating in the local disaster response to meet the needs of their community and the hospitals in their community. Medical responders likely will need to function unassisted until outside resources arrive, at least 6 to 8 hours after the onset. Hospitals and clinics will be flooded with affected patients and the "worried well."

To fulfill these roles during a disaster, all pediatricians need to:

- institute office and home disaster plans;
- participate in the community or hospital disaster plan, including drills and exercises;
- provide medical assistance via established disaster medical delivery systems;
- provide guidance to patients and their families;
- when volunteering to assist during or after a disaster, make every effort to work in concert with the lead organization coordinating disaster relief; and
- serve a key role in identifying sentinel cases of illness after a chemical, biological, or radiologic release.

In addition to important functions during the actual event, pediatricians' assistance will be needed after the event throughout the recovery period. The role of the pediatrician is to help patients who have been affected by the event to return to normal functioning and to assist with community efforts at return to normal activity. During the recovery period, all pediatricians need to:

- be prepared to deal with continued disruption of services (which may include medical services in the community; supplies for their patients, their office, and hospitals; limited availability of pharmacy services; and altered utilities such as telephone, electrical power, and water);
- continue providing care as part of their office emergency plan and as needed in community disaster medical programs;
- continue to provide surveillance for the effects of chemical, biological, or radiologic agent release but also during any disaster provide surveillance for unusual rates of infectious disease that may occur; and
- ensure that the mental health needs of children and their families are being addressed and, when needed, provide appropriate referral for mental health services.

Hospital Preparedness

It is important for hospitals to consider the needs of children in all aspects of emergency preparedness and all hazards plans. This will include, but is not limited to, appropriate types and numbers of pediatric-trained staff, equipment, medications, and decontamination equipment, including the ability to handle nonambulatory children. In addition, hospitals must be prepared to handle situations in which patients will be cared for as a family unit and children will not be able to be separated from adults, such as in a quarantine situation. This will require all hospitals to have the capability to handle children, and all children's hospitals must possess the ability to care for adult patients who will be staying with their children.

Pediatricians' Liability During Disasters

In the past, many pediatricians have provided care without affiliation with recognized government or volunteer agencies. When providing medical services during a disaster or terrorism event, it is important that health care professionals are part of an organized program. Lack of an oversight organization providing the service may result in services that are not in concert with the organized response and places health care professionals in a position without professional liability insurance coverage. Most malpractice coverage is limited to the health care professional's usual scope of practice and practice setting. In some states, individual malpractice insurance policies do not cover out-of-office care or the expanded scope of practice that may be required during a disaster. Good Samaritan statutes provide some liability protection when rendering medical care at the scene of an emergency to one who would not otherwise receive it. Good Samaritan statutes cover physicians at the scene of acute incidents but vary among states and may not provide liability protection during or after disasters or ter-

rorism events. These laws do not cover a physician if there is any payment for services or if there is an accusation of gross negligence. In many states, coverage for liability during a disaster requires health care professionals to practice under the umbrella of an official disaster agency such as the Federal Emergency Management Agency, the US Department of Health and Human Services, a state or local health department, a state or local office of emergency management, the local emergency medical services authority, or an other recognized government or volunteer agency.

Advocating for Children and Families in Disaster Planning

As all pediatricians know, children are often not considered in government and community activities for a multitude of reasons. Properly informed and motivated pediatricians are essential advocates for children. This role can take several forms. Grassroots advocacy can include efforts to ensure legislation and funding to support an emphasis on children in disaster planning at every level. Pediatricians can also serve as expert advisors to local, state, and federal agencies and committees. Most often, this can be done through involvement in professional organizations such as the American Academy of Pediatrics and its chapters, committees, sections, and task forces.

RECOMMENDATIONS

1. Pediatricians should advocate for the inclusion of the needs of children in all federal, state, and local disaster planning.
2. Pediatricians and pediatric trainees should become knowledgeable in issues related to pediatric disaster management, including chemical, biological, explosive, radiologic, and nuclear events and physician liability during disasters.
3. Pediatricians should participate in disaster planning by:
   - taking part in local community and hospital disaster planning, exercises, and drills through emergency medical services and public health systems;
   - preparing and regularly updating and practicing an office disaster plan;
   - working with schools and child care centers in developing disaster plans;
   - providing anticipatory guidance to families on home disaster preparedness, with consideration given to the unique problems faced by children with special health care needs;
   - participating in disease surveillance and reporting to local health departments; and
   - participating with and providing guidance to medical volunteer programs such as disaster medical assistance teams, Medical Reserve Corps, and other response teams to ensure that they are equipped and trained for the care of children.
4. Pediatricians need to educate themselves regarding liability issues during the acute and recovery phases of a disaster, including:
   - individual states' Good Samaritan statutes and protections afforded while providing emergency care during a disaster and any limitations to those protections;
   - individual liability insurance coverage protections and limitations outside of the usual scope of practice and practice settings when providing urgent and routine care; and
   - the importance of working under the auspices of an official government or disaster agency for volunteer liability protection to apply.

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Publications and Media

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American Academy of Pediatrics. AAP offers advice on communicating with children about disasters. Available at: www.aap.org/terrorism/topics/psychosocial_aspects.html

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American Academy of Pediatrics. Smallpox: frequently asked questions—parent handout. Available at: www.aap.org/advocacy/releases/smallpoxfaq.htm

American Academy of Pediatrics. Terrorism: a family disaster plan. Available at: www.aap.org/advocacy/releases/famdisplan.pdf

American Academy of Pediatrics. The youngest victims: disaster preparedness to meet children's needs. Available at: www.aap.org/terrorism/topics/PhysiciansSheet.pdf

American College of Emergency Physicians (www.acep.org)

American Hospital Association (www.aha.org)

American Red Cross (www.redcross.org)

Centers for Disease Control and Prevention

Emergency Preparedness and Response

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Children's Health Fund (www.childrenshealthfund.org)

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Emergency Medical Services for Children Natural Resource Center (www.ems-c.org)

Federal Emergency Management Agency (www.fema.gov)

Health Resources and Services Administration (www.hrsa.gov/bioterrorism)

Infectious Diseases Society of America (www.idsociety.org)

Medical Reserve Corps (www.medicalreservecorps.gov)

Program for Pediatric Preparedness, National Center for Disaster Preparedness (www.pediatricpreparedness.org)

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Pediatrician-Family-Patient Relationships: Managing the Boundaries

COMMITTEE ON BIOETHICS

KEY WORDS
pediatricians, relationships, boundaries

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abstract

All professionals are concerned about maintaining the appropriate limits in their relationships with those they serve. Pediatricians should be aware that, under normal circumstances, caring for one's own children presents significant ethical issues. Pediatricians also must strive to maintain appropriate professional boundaries in their relationships with the family members of their patients. Pediatricians should avoid behavior that patients and parents might misunderstand as having sexual or inappropriate social meaning. Romantic and sexual involvement between physicians and patients is unacceptable. The acceptance of gifts or nonmonetary compensation for medical services has the potential to affect the professional relationship adversely. *Pediatrics* 2009;124:1685–1688

INTRODUCTION

Physicians and the public recognize the need for high moral standards and accountability in medicine. Most commonly, the focus of concern involves physician competence and integrity, as demonstrated by such measures as board certification, hospital credentialing, peer review of practice, participation in impaired physician programs, and malpractice litigation. Physician behavior is guided by various practice guidelines, review articles, policy statements by professional organizations, and applicable laws and regulations. Codes of ethics for physicians have a role in addressing personal and other nontechnical aspects of physician conduct, as exemplified by the American Medical Association's periodically updated code[1] and a 2008 document from the American College of Obstetricians and Gynecologists.[2] The American Academy of Pediatrics also has issued policy statements titled "The Use of Chaperones During the Physical Examination of the Pediatric Patient"[3] and "Professionalism in Pediatrics: Statement of Principles."[4]

This statement delineates the appropriate professional boundaries[5] between pediatricians who provide medical care for children (including their own) and their patients and patients' family members. The American Academy of Pediatrics believes that pediatricians must exercise substantial care in nonprofessional relationships with patients and families to promote the highest possible degree of trust in the doctor-patient-family relationship.

PROVIDING MEDICAL CARE FOR ONE'S OWN CHILDREN

Pediatricians, because of their unique expertise, often find themselves in the position of providing medical advice and treatment for their own

children (and minor relatives as well as the children of close friends). Although such activities seem to be common,[6–9] the American Medical Association[10] considers the practice of treating immediate family members inappropriate. The normal feelings that pediatricians have for their patients can be distorted when the patients are their own children. Pediatricians, when providing medical care for their own children, are more likely to lack objectivity, function with incomplete information, and have difficulty setting physician-patient boundaries. Significant confidentiality issues could arise when caring for minor relatives and the children of close friends. By providing potentially less-than-optimal care for these children, pediatricians violate a fundamental professional obligation. Exceptions to the general prohibition are limited to minor treatments and decisions (often similar to those handled by nonphysician parents) or clear emergencies and disasters and for pediatricians who practice in underserved areas in which there are no other physicians capable of providing pediatric care. If at all possible, the treating pediatrician should notify the child's primary care physician of treatment plans and prescriptions to ensure continuity of care.

GIFTS OR OTHER EXPRESSIONS OF AFFECTION OR GRATITUDE

Patients or parents sometimes give pediatricians gifts, especially after providing help for a complex or troubling health-related problem. Under most circumstances, gifts have a far more symbolic than material value.[11] For most pediatricians, accepting modest gifts does not involve a serious conflict; in fact, refusal of a gift may constitute a social or cultural affront. As the monetary worth of the gift increases, however, so does the psychological and ethical difficulty in maintaining appropriate boundaries in the professional relationship. When the pediatrician feels uncomfortable with a gift that a family insists on delivering, he or she must voice the concern and suggest acceptable alternatives, such as a charitable donation in the pediatrician's name. Highly valued gifts may indicate that these boundaries have been crossed. The patient or loved one may have misinterpreted the pediatrician's earlier behavior or may be inviting the pediatrician to engage in a relationship that could compromise medical judgment and action.

ROMANTIC AND SEXUAL RELATIONSHIPS

It is difficult to find reliable data on the prevalence of sexual contact between physicians and their patients or their patients' family members. Authors of position papers about psychiatrists[12] and obstetricians[13] have commented on the lack of well-conducted, reliable studies on professional boundary violations by physicians. Attention to the subject, in the form of complaints against practitioners and publications in professional journals, has been more prominent among psychiatrists and obstetricians/gynecologists.[14–18] Interpersonal entanglements raise at least 2 serious questions. First, can a patient or family member make clear and free choices to accept or reject affections, especially sexual, in the context of the unavoidably unequal physician-patient-family relationship? Second, once such intimacy develops, can the parties maintain a proper and effective therapeutic relationship?

Because pediatricians provide counseling services for patients and families, these concerns closely parallel those faced by mental health professionals. Pediatricians who feel sexually attracted to their patients may put the patients at risk of sexual abuse or exploitation.[19] A more common circumstance, however, is that pediatricians may be misunderstood when they first discuss sexual maturation and sexuality with patients.[20] Similarly, examination of an adolescent's maturing genitals or breasts during an office visit may be distressing or misunderstood by the patient, especially if a parent or chaperone is not in the examining room.[3] Pediatricians should develop and follow clear and consistent office policies about the presence of a chaperone during parts of the physical examination, taking into account context, local customs, families' religious and cultural traditions, and the need for patient privacy. Pediatricians should include notations in the record if they do not adhere to the documented office policy requiring the presence of a chaperone.

Pediatricians also interact with the parents or guardians of their patients, although seldom in doctor-patient relationships. Pediatricians are responsible for maintaining appropriate professional boundaries with the families of their patients, although their obligations toward them may be somewhat different from those toward their patients.

There is an inherent risk of exploitation for patients or family members who depend on the knowledge and authority of the pediatrician, especially in cases that involve nonroutine health care. The success of the doctor-patient or doctor-family relationship depends on the ability of the patient or family member to trust the pediatrician completely. Patients and family members legitimately expect to feel physically and emotionally safe in professional relationships with pediatricians. They should not feel vulnerable to romantic or sexual advances while receiving medical care for themselves or their children. In addition, children should be free from concern that their treatment may be compromised by a nonprofessional relationship between a parent and their pediatrician. Children

should not have to worry about confidentiality or have anxiety over the potential for the pediatrician to have a conflict of loyalty because of the pediatrician's involvement with the parent.

Patients or family members, to some extent, identify with and feel gratitude toward pediatricians. At times, these feelings may result in efforts to initiate a nonprofessional relationship with the physician or may leave the patient or family member consciously or otherwise unwilling or unable to reject a pediatrician's romantic or sexual advances. Any confusion between complex professional bonds and extraprofessional personal relationships may leave the patient or family member unable to exercise the best judgment or choice about medical matters.

The clinical judgment of pediatricians who become intimately involved with a patient or family member may become clouded, and they may breach their professional responsibilities. Whether this possibility extends to close family members of patients is somewhat less clear. If the intimacy develops in the context of a patient's serious illness, concerns about exploitation of the family member's dependency on the pediatrician arise. Under these circumstances, the pediatrician is well advised to end the professional relationship after ensuring the transfer of the patient's medical care to another appropriate practitioner. Nevertheless, proscriptions on pediatricians pursuing relationships with parents or adult siblings of their patients may, in unusual circumstances, result in unnecessary and inappropriate restrictions on the pediatrician's personal life.

INADVERTENT SEXUALITY IN THE PEDIATRICIAN-PATIENT RELATIONSHIP

Pediatricians usually prefer warm, friendly relationships with their patients. The need to avoid untoward personal intimacy should not lead to a cold, indifferent manner in their interactions with patients or family members. Many cultures expect physical expressions of care and concern in times of personal crisis, including sickness. Pediatricians might well be seen as unsympathetic and excessively remote if they avoid handshakes or other socially approved touching during emotional encounters with families. In most social groups in the United States, interaction with children is likely to involve appropriate physical contact such as hugging.

Pediatricians should be aware of their patients' customs and personal and religious beliefs. In addition, it may be helpful to recognize that some kinds of touching may be confusing or offensive to children, depending on their stage of physical and emotional maturation. For example, certain children may have strong preferences about whether their physical examination is performed by a male or female pediatrician or whether someone else besides the pediatrician is present during the examination. Anticipatory discussion of these issues should reduce fears and misunderstandings and lead to enhanced pediatrician, patient, and family comfort.

Pediatricians also have an obligation to recognize that physical interaction is not the only means by which humans communicate sexually. Body language and verbal expressions also convey attitudes and emotions that may provoke strong feelings. Because socioeconomic or cultural groups may differ in what they consider acceptable or expected behavior, it is usually best to ask patients and parents their preferences about how they would like to be addressed.[17] For example, pediatricians should use neutral language or names in addressing patients rather than using terms of endearment such as "honey" or "dear." Words that could be seen as evaluative or provocative when referring to body parts, such as the breasts, should be avoided. Personal questions about family history and household functioning should be asked in a way that clearly indicates that their sole purpose is to assist in optimizing the child's development.

OTHER CONSIDERATIONS

Patients or family members may want to compensate pediatricians with an exchange of services or with barter. For example, an adolescent or the adolescent's parents may offer the patient's services as a baby-sitter or gardener in lieu of monetary payment for care. Such arrangements vary legitimately with local custom and the economic circumstances of patients and families. However, problems may arise about exactly what services constitute adequate compensation for professional care and the appropriateness of increased personal contact between the patient or family member and the pediatrician. Nonmonetary payments, as with gifts, may become precursors to boundary violations and should be approached with caution.

RECOMMENDATIONS

1. Pediatricians should know that caring for one's own children and caring for the minor children of relatives and close friends, particularly outside of the doctor-patient relationship, presents significant ethical issues, including issues of confidentiality, and may lead to less-than-optimal medical care. Exceptions exist for treatment of minor conditions or during emergencies and disasters and in underserved areas in which alternatives are unavailable.
2. It may be acceptable for pediatricians to accept modest gifts from patients and their families. When the pediatrician feels uncomfortable with a gift that a family insists on delivering, he or she should suggest acceptable alternatives such

as a charitable donation in the pediatrician's name. However, caution is urged when the material value of gifts or offered services could seem to influence the pediatrician's professional judgment. Furthermore, the pediatrician must be sensitive to the possibility that the intent of the gift is, in fact, to alter behavior.

3. Pediatricians caring for children and adolescents need to be aware of the potential for conflict between their professional roles and their personal relations with their patients and their patients' family members. Romantic and/or sexual relationships with patients are always inappropriate. Romantic or sexual relationships with adult family members of patients should be avoided, given the potential for adverse effects on professional judgment and family-member behavior concerning the patient's health.
4. In providing care for children and adolescents, pediatricians need to be aware that their words, body language, and other aspects of professional conduct may inadvertently offend or insult patients and family members depending on both the context of the event and local customs. Many expressions and actions during the physical examination may have an unintended sexual connotation for the patient or parent. Pediatricians are advised to use neutral language that is acceptable to the patient and to discuss thoroughly and in advance aspects of care that may seem sexually charged. Personal questions about family history and household functioning need to be asked in the context of optimizing the child's development.
5. Medical school, residency, and continuing medical education programs should routinely discuss the importance of personal boundaries between professionals, their patients, and their patients' family members.

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AMERICAN ACADEMY OF PEDIATRICS

TECHNICAL REPORT

David C. Goodman, MD, MS; and the Committee on Pediatric Workforce

The Pediatrician Workforce: Current Status and Future Prospects

ABSTRACT. The effective and efficient delivery of children's health care depends on the pediatrician workforce. The number, composition, and distribution of pediatricians necessary to deliver this care have been the subject of long-standing policy and professional debate. This technical report reviews current characteristics and recent trends in the pediatric workforce and couples the workforce to a conceptual model of improvement in children's health and well-being. Important recent changes in the workforce include (1) the growth in the number of pediatricians in relation to the child population, (2) increased numbers of female pediatricians and their attainment of majority gender status in the specialty, (3) the persistence of a large number of international medical graduates entering training programs, (4) a lack of ethnic and racial diversity in pediatricians compared with children, and (5) the persistence of marked regional variation in pediatrician supply. Supply models projecting the pediatric workforce are reviewed and generally indicate that the number of pediatricians per child will increase by 50% over the next 20 years. The differing methods of assessing workforce requirements are presented and critiqued. The report finds that the pediatric workforce is undergoing fundamental changes that will have important effects on the professional lives of pediatricians and children's health care delivery. *Pediatrics* **2005; 116:e156–e173. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2005-0874;** ***child health workforce, diversity, family medicine, female pediatricians, geographic distribution, health manpower, internal medicine-pediatrics, international medical graduates, nonphysician clinicians, physician workforce, pediatrics, pediatric medical subspecialists, pediatric surgical specialists.***

ABBREVIATIONS. AAP, American Academy of Pediatrics; FOPE II, Future of Pediatric Education II; ABP, American Board of Pediatrics; AMA, American Medical Association; GME, graduate medical education; IMG, international medical graduate; medpeds, internal medicine-pediatrics; FTE, full-time equivalent; HMO, health maintenance organization; GMENAC, Graduate Medical Education National Advisory Committee; GDP, gross domestic product.

INTRODUCTION

Our common mission to attain the optimal physical, mental, and social health and well-being for all infants, children, adolescents, and young adults (mission statement of the American Academy of Pediatrics [AAP]) depends on the pediatrician workforce. The improvement of children's health occurs through the efforts of these professionals who draw on their training and experience to deliver within a medical home the best possible pediatric care and to serve as child advocates. How, then, can we ensure that the right number of qualified clinicians are located where needed to provide pediatric care that is effective and efficient? Market forces alone are insufficient to meet these public and professional workforce goals given the inherent imperfections in the market for health care labor and health care services.[1–6] With a continuing need to influence the number and characteristics of child health professionals, this technical report seeks to inform pediatricians and child health policy makers of the status of the child health workforce and the public policies that will influence its future.

The last AAP policy statement on the pediatric workforce, prepared by the Committee on Pediatric Workforce and published in 1998,[7] combined a status report of the workforce with policy recommendations. In this current effort, the technical report provides the background to recommendations included in the separate but companion policy statement "Pediatrician Workforce Statement."[8] To accomplish this, the report draws mostly on published sources, many of them from the AAP or the Future of Pediatric Education II (FOPE II) Project, to identify salient trends, possible future challenges to the profession, and critical domains of underdeveloped information. When published sources of data were not available, unpublished data have been cited from the Center for the Evaluative Clinical Sciences at Dartmouth Medical School (data sources and methods are available on request). The focus of the report is on general and medical subspecialty board-certified (by the American Board of Pediatrics [ABP]) pediatricians and the 99 million patients younger than 21 years whom they serve. Surgical and non–ABP-boarded pediatricians also provide essential services to children, but a detailed discussion of their status is beyond the scope of this report.

HEALTH WORKFORCE TRENDS

A full understanding of recent trends and current challenges facing the pediatric health workforce requires an examination of 4 general workforce themes.[9] First, the number of physicians in the United States continues to grow in both absolute and per-capita numbers.[10,11] In 2001 (December 31), the number of total patient-care physicians (defined by the American Medical Association [AMA] Masterfile as >50%

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of professional time spent in clinical care) was 668 939, reflecting a 28% absolute and 18% per-capita increase during the decade. The number of residency or graduate medical education (GME) positions, the best predictor of entry into practice, was virtually unchanged at 93 674, with an 11% decrease in per-capita numbers. The per-capita decrease in the number of residency positions is slow enough that the physician workforce will continue its per-capita growth for another 20 years before decreasing. These figures do not include osteopathic physicians, who increased by 41% per capita during the decade and are a particularly important provider of primary care in many regions (Center for the Evaluative Clinical Sciences, unpublished data, 1998).

The second notable trend was the continued growth in the number of female medical students.[12] Although men continued to outnumber women in some specialties in both residency programs and practice,[13] most specialties have experienced a shift in their gender mix. Overall, the per-capita number of female physicians increased 53% during the decade, reflecting an increase from 100 024 to 173 254.[10,11]

Third, the physician workforce still fails to reflect the growing racial and ethnic diversity of the nation despite efforts to broaden medical school opportunities for individuals of traditionally underrepresented minority groups (black, Hispanic, and American Indian/Alaska Native). From information primarily collected by medical schools and residencies, in 2001 the AMA Masterfile listed 20 738 black (2.5%), 28 626 Hispanic (3.4%), 73 849 Asian, (8.8%) and 504 American Indian/Alaska Native (<1%) physicians of 836 156 physicians.[11] The system of racial/ethnic designation is presumably self-designation from a list of mutually exclusive categories, a type of categorization that has limitations.[14] It is notable that race/ethnicity was missing for 256 995 physicians (31%) in the Masterfile. More complete data are known for physicians in residency programs; in 2000, 6% of all residents in programs approved by the Accreditation Council for Graduate Medical Education were black, 5.5% were Hispanic, and 22% were Asian (see Appendix II in ref 15). The racial/ethnic makeup of physicians is in contrast to the US population, of which in 2000, 12.2% were black non-Hispanic, 11.8% were Hispanic, 3.8% were Asian, and 0.7% were American Indian/Alaska Native.[16]

Physicians trained in other countries represent a fourth trend. The number of international medical graduates (IMGs) increased by 38% during the past decade, from 118 531 to 164 097.[10,11] IMGs include US citizens who graduated from medical schools outside of the United States or Canada, citizens of other countries emigrating to the United States, and those planning on returning to their native country after completing residency. The most common country of citizenship of those issued Educational Commission for Foreign Medical Graduates certificates in 2001 was the United States (25.6%), followed by India (19.6%), Pakistan (6.2%), China (2.5%), Philippines (2.5%), and Iran (2.5%).[17] Despite their ethnic diversity, IMGs leave unaddressed the need for a physician workforce reflective of and culturally competent to care for growing US minority populations.

A final important characteristic of the medical workforce is its uneven geographic distribution. Regional variation in physicians per capita, whether measured by state, county, or health service areas,[18–20] exceeds threefold for all specialties. Although the term "geographic variation" is typically used to refer to maldistribution associated with physician shortage in rural and inner-city communities, most regional variation occurs in a range of supply above that considered adequate.[21,22] To date, studies that have examined the relationship between physician supply and population health needs have found a tenuous association.[19,20,23–25] Similarly, the limited research on the association between the per-capita numbers of physicians in regions and health outcomes has found diminishing returns of improved health with higher levels of physicians per capita.[24,26–35] It should be noted that this type of research is methodologically challenging.

A MODEL OF THE CHILD HEALTH WORKFORCE

There are many factors that can influence the size and composition of the child health workforce. The workforce is not, of course, an end in and of itself but exists to provide medical services to children. Parents, the public, and pediatricians, in turn, expect that pediatric services delivered within a medical home will lead to better health and well-being for children. To bring clarity and cohesiveness to workforce-related factors discussed in this report, we present a conceptual framework that is referenced throughout (Fig 1). As complex as the model may appear at first glance, it provides a simplified map of the elements that influence the number and characteristics of pediatricians and their relation to the production of improved children's health outcomes. The model presents a sequence of "steps" using common economic and health services concepts. The medical education system (sometimes referred to by others as "the pipeline") produces pediatricians who, in turn, produce pediatric services, leading to the production of improved child health outcomes. The model severely abbreviates some critical health influences that are beyond the scope of this report. For example, the many important genetic, environmental, and social factors that bear on health outcomes are summed by the component "relative need" in box 17 of the model.

COMPOSITION AND RECENT TRENDS IN THE CHILD HEALTH WORKFORCE

The per-capita growth rate in pediatricians during the past decade has exceeded that of the overall physician supply. The total number of active patient-care pediatricians (including medical subspecialists but excluding those in residency) increased from 33 691 to 51 675 (53%) over the past decade (January 1, 1992, through December 31, 2001), and the number of children younger than 18 years increased 11%; on a per-child basis, this represents a 38% increase. The numbers of general pediatricians increased at a slightly slower pace, from 29 931 to 42 214, a 41%

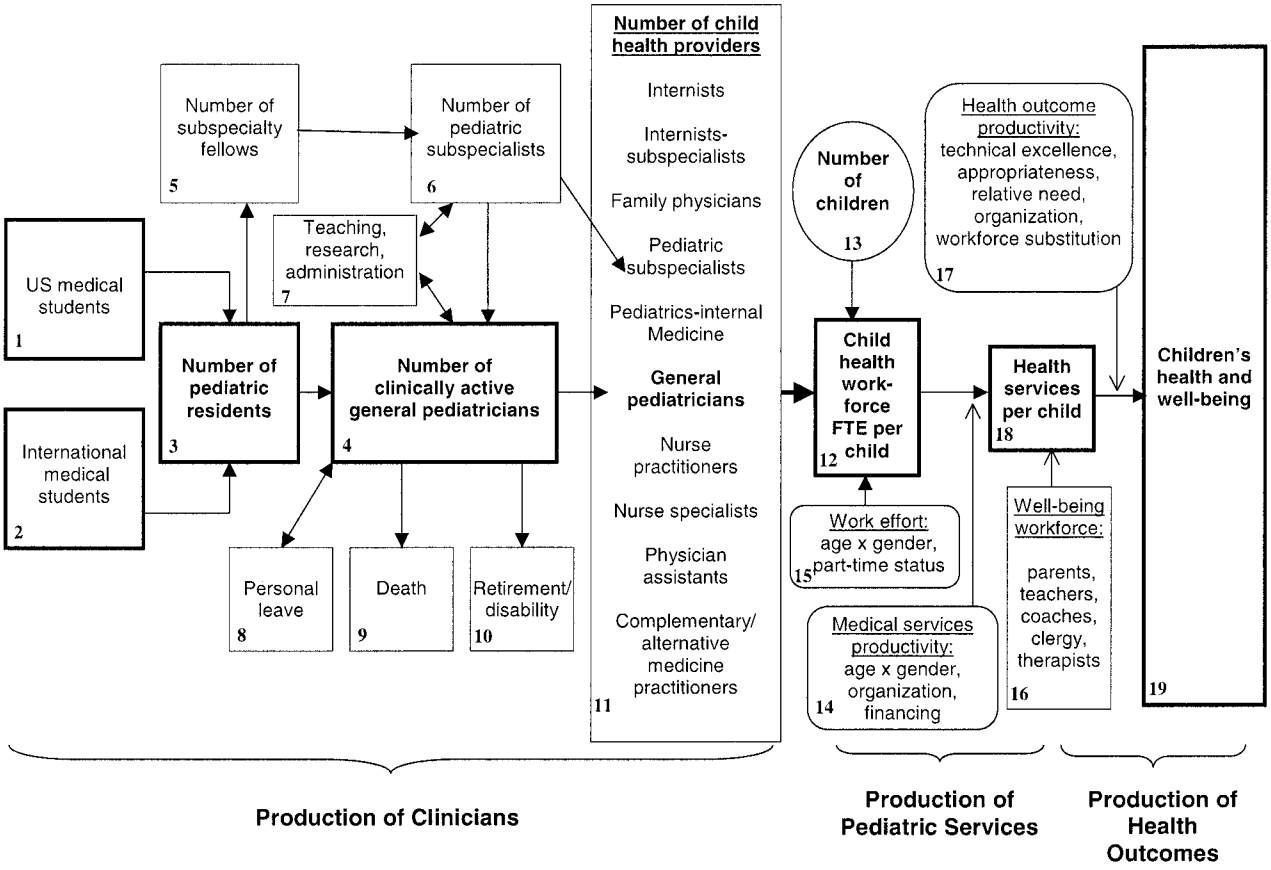

Fig 1. The child health workforce and the production of improved health outcomes.

increase or a 27% per-child increase. This increase in general pediatricians is higher than the per-capita (total population) growth in general internal medicine (20%) and family medicine (11%).[10,11] Although concerns remain that the current number of pediatric residency positions is insufficient to meet patient and research needs for certain subspecialties,[36] the overall per-capita number of pediatric medical subspecialists increased by 127% during the past decade.

Gender

The most notable change in the composition of the child health workforce has been the accelerating entry of women into pediatric residency programs. Women constituted 65.2% of the 7629 pediatric residents in 2000, a proportion exceeded only by few other specialties such as obstetrics and gynecology (69.6%).[15] In the past decade, the number of women in patient-care pediatrics increased from 17 219 to 31 276 (82% increase), and now women constitute 50% of all pediatricians.[10,11] By the time this report is published, women will represent the majority of pediatricians, a historic first for any specialty in the United States. Information specific to pediatrics is lacking, but generally a woman's choice to enter a primary care specialty is influenced by children and other family responsibilities, volunteer or clerkship experiences with the underserved, personal social values, and factors related to marriage and spouse. In contrast, men are more influenced by income potential, parental preferences, and role models before medical school.[37]

There are many implications of this gender shift for pediatric health care delivery. The pediatrician workforce has begun to approach the gender mix of pediatric patients, better meeting the preferences of female adolescents for a clinician of the same gender. If the current gender mix of residents continues, male pediatricians will eventually make up approximately one third of the workforce. This trend is unlikely to stimulate increased demand for male clinicians. Although 50% of girls prefer a female clinician, only 23% of boys prefer a male clinician.[38]

Another implication of more female pediatricians is that, all else held equal, additional physicians will be needed as more women choose to work part-time, particularly when their children are young.[39] The most useful source of information to assess these factors is the AAP Periodic Survey of Fellows, administered to 6400 active members annually. An excellent analysis of gender differences in 1993 was published by Brotherton and colleagues,[40] which this technical report will briefly summarize. First, the proportion of women practicing as general rather than subspecialty pediatricians was higher (61.4% female vs 55.4% male) and was particularly low for some subspecialties such as cardiology (0.9% of all pediatricians were female cardiologists vs 4.3% male); the proportion of female residents in 2000 remains less than 40% in pediatric cardiology and

gastroenterology.[15] Male physicians, compared with female physicians, work more hours per week (average: 57 vs 48 hours, respectively) and spend more time delivering direct patient care (average: 42 vs 35 hours, respectively); thus, female physicians work, on average, 17% fewer patient-care hours than do male physicians over the course of their work lives. These figures include overall hours of both part-time and full-time pediatricians and are similar to data from the most recent AAP Periodic Survey of Fellows as well as previous reports.[41]

Analysis of the AAP Periodic Survey of Fellows has shown that the gender differences in work hours is explained by more women working part-time. The work hours of full-time men and women were similar, but 26% of women worked part-time, compared with 4% of men (Table 1). Pediatricians in part-time employment worked, on average, 15 fewer hours per week than did full-time pediatricians.

These data contradict any notions that women are less productive than men (productivity defined as "medical services productivity" and discussed later in the report [Fig 1, box 14]). More pediatricians will be needed as the proportion of female pediatricians increases, because women choose to work part-time or not at all during certain periods of their life but not because they do not work as hard as men when they are working full-time. Differing retirement rates by gender could also affect the numbers of pediatricians required, but no published studies are available to date.

Other gender differences merit mention. Overall, male and female pediatricians both spend approximately 17 minutes with patients for preventive care visits from birth through 11 years of age. However, female pediatricians spend 22 minutes with patients 12 years and older, compared with male pediatricians, who spend 19 minutes with patients 12 years and older.[40] In a study of a university-based pediatric primary care practice, female pediatrician visits were 29% longer than those with male pediatricians.[42] These findings differ from those reported by McMurray et al[43] in data from the Physician Work Life Study. In this study, women and men allocated similar time for patient visits, but a discrepancy was reported between perceived and actual time needed by female physicians for complete physical examination/consultation.

Frank and Meacham[44] found that female pediatricians worked less and had lower incomes compared with other female physicians but also reported less stress and career dissatisfaction. Female physician income was also reported to be consistently lower for both generalists and subspecialists compared with men, a difference that persists even when controlling for employment status. McMurray et al[43] also found a similar disparity when studying the combined specialties of pediatrics, family medicine, and internal medicine. Female pediatricians also face significant barriers in achieving advancement in academic medicine.[45] These disparities are troubling and have not been explained to date, although it would not be surprising if the gender discrimination in income and advancement that is pervasive in other professions was also found in pediatrics.[46,47]

International Medical Graduates

Approximately one third of practicing pediatricians attended medical schools outside of the United States and Canada,[10,11] a proportion that has changed little during the past 10 years. US medical students generally fill residency positions first and constitute a higher proportion of pediatric residency positions than most other specialties. In 2003, 28.7% of offered first-year pediatric residency positions were filled by IMGs, a lower proportion than for internal medicine (44.8%) or family medicine (58%).[48] IMGs remain an important and relatively stable part of the pediatrician workforce.

IMG residents and practicing physicians are heterogeneous in their national origin and their intentions to remain in the United States. The majority (58%) of first-year pediatric IMG residents are either US citizens, native or naturalized, or are permanent US residents with the right to apply for citizenship.[15] The remaining IMGs hold a variety of visas that usually require a return to their country of origin after residency unless they accept employment in an underserved area of the United States. Their stay in the United States can be prolonged as long as they are in Accreditation Council for Graduate Medical Education–approved residency programs, including subspecialty education. This is a strong incentive to enter pediatric subspecialty residency programs, but when this training is completed, the final choices are still to practice primary care in an underserved area for several years or return to their country of origin. For example, an analysis of New York State IMGs by citizenship and visa status shows that IMGs with temporary visas were more likely to initially enter a primary care residency but that they planned to continue on to subspecialty education. Most planned to

TABLE 1. Mean Number of Hours and Part-time Status of Pediatricians According to Age and Gender: 2000

Age, y	Hours per Week (SD)		Percentage Working Full-time	
	Female	Male	Female	Male
≤35	42.6 (14.3)	46.9 (17.3)	77.1	91.1
36–45	38.8 (16.9)	46.0 (17.2)	66.9	99.0
46–55	36.2 (19.8)	47.3 (15.8)	70.9	97.9
≥56	45.5 (16.0)	43.1 (16.7)	93.3	92.2

Values represent the average work of post-GME clinical general pediatricians.
Source: AAP Periodic Survey of Fellows, unpublished data, 2000.

remain in the United States for additional education or by working with underserved populations.[49] In the end, a majority of IMGs remain in the United States.[50]

The social value of the continuing flow of IMGs into residency positions, and ultimately into practice, is one of the most contentious issues among health workforce policy leaders. The debate is largely centered on the services they provide for indigent patients while in residency and the care they provide in practice to patients who are medically disenfranchised for geographic, cultural, or financial reasons.[50–52] Some have argued that IMGs exacerbate an existing relative surplus of physicians, particularly specialists, and that in some instances they seem to add to regional disparities in the workforce. There are also concerns that international workforce migration of foreign-born physicians exacerbates health problems in developing countries by draining the supply of their physicians.[53,54] Mullan[55] makes a similar point and argues that IMGs deny opportunities to US citizens aspiring to a career in medicine. In truth, many of the US citizens denied medical school admission in this country do travel overseas and return as one tributary of the IMG river. A fair reading of the policy research in this area does not support any simple conclusions. Foreign-born IMGs preferentially locate in areas with established IMG physicians, and IMGs of Hispanic and Asian descent tend to settle in areas with a higher proportion of these populations.[56] IMGs also disproportionately locate in high-need and underserved counties, and community health centers depend on them; at the same time, the data also indicate that they tend to locate in states with large numbers of physicians.[57–60] In some instances, the presence of IMGs seems to exacerbate regional disparities in physician supply.[61]

IMGs receive their medical education in varied settings. The differences in education and training have raised concerns about the technical and cultural competencies of IMGs. Although data are incomplete about practicing IMGs, training-examination results provide some limited information. US IMGs and non–US IMGs have comparable pass rates in steps 1 and 2 of the US Medical Licensing Examination, but both fall short of US medical graduates. In the Clinical Skills Assessment Examination, overall pass rates of non–US IMGs are 79.7%, compared with 88.6% for US IMGs.[62] ABP scores of first-time takers reveal a bimodal distribution with more low and high scores compared with US medical graduates (G. McGuinness, MD, ABP, written communication, January 16, 2003). These differences in scores may have implications for patient care; a recent study from Canada found a strong association between certification scores of primary care physicians and subsequent practice performance.[63]

The number of foreign-trained physicians is a critical variable that affects growth in the physician workforce. Although the total number of residency positions, largely supported by funds from Medicare and the Health Resources and Services Administration, determines the GME maximum training capacity,[64] filling these positions depends on IMGs. The number of physicians entering practice, therefore, is not determined by a national workforce policy linked to the need for physicians but by the vagaries of visa regulations, federal GME funding, and the perceived needs of teaching hospitals. Together, these factors, which determine the size of the GME pipeline, remain the most salient example of an absent national workforce policy in the United States.

Racial/Ethnic Diversity

The more general issue of people of minority groups in medicine is explored extensively in the 12th report of the Council on Graduate Medical Education.[65] The Committee on Pediatric Workforce has also published 2 relevant policy statements, "Enhancing the Racial Diversity of the Pediatric Workforce"[66] and "Culturally Effective Pediatric Care: Education and Training Issues,"[67] that are essential reading for those concerned with child health workforce policy issues. Although this technical report is partly duplicative of these efforts, the pressing nature of this topic warrants, at the very least, a summary of the factual basis of the policy recommendations. Additional information can also be found in 2 recent papers.[68,69]

The overall racial/ethnic composition of pediatricians little resembles the populations they seek to serve. In 1996, for example, the number of black pediatricians per black children was less than one third that of white pediatricians per white children.[68] The proportion of third-year residents from underrepresented minority groups (black, Hispanic, or American Indian/Alaska Native) increased from 6% in 1997 to 12% in 2002.[70] Still, the disparity in race and ethnicity is anticipated to grow substantially by 2025,[68] reflecting the combination of high minority-population growth rates and an assumption of slow increases in enrollment rates of individuals of minority groups in medical education.

Given that physicians are never likely to be completely reflective of their patients, why should racial/ethnic diversity be a particular concern in planning the workforce for children? The disparities in health status and health services by race and ethnicity are well documented and incontrovertible.[71] These disparities can only be partly attributed to an associated income gradient.[72,73] Ronsaville and Hakim[74] found in a recent analysis of the 1991 National Maternal and Infant Survey that 35% of black infants and 37% of Hispanic infants obtained adequate well care, compared with 58% of white infants; these findings persisted after controlling for socioeconomic status.

Greater minority representation in the workforce seems to be one important way of improving health outcomes in children of minority groups. Physicians from underrepresented minority groups are known to preferentially provide care for patients from minority and underserved groups.[75–79] Furthermore, many individuals of minority groups prefer physicians of similar racial or ethnic background and are more likely to seek care when such a clinician is available.[80] Other necessary measures to improve the delivery of care include the development of greater

cultural competence in current and new physicians[81] and better identification of health system–specific disparities.[82] Neither of these measures addresses the reasons for low rates of minority entrance into medical education, which in and of itself is a fundamental issue of societal equity.[83]

Internal Medicine-Pediatrics

Although internists have assumed a relatively minor role in the care of children, the combined specialty of internal medicine-pediatrics (med-peds) has emerged in the past 30 years as an important alternative to family medicine for physicians interested in providing primary care to all age groups.[84] At present, there are 109 approved programs with a total of 1558 residents.[85] Growth in residency positions was rapid in the 1990s but has now slowed. In 1999, 432 positions were offered in the match and 88.4% were filled, 80.3% of them by US medical graduates. In 2003, 385 positions were offered and 82.3% were filled, 67% of them by US medical graduates.[48] After completing the 4-year program, approximately 90% achieve board certification in one discipline, and 80% achieve board certification in both. Fifty-four percent of med-peds physicians practice in community office settings, usually in primary care serving adults and children.[86] Med-peds is an important component of the pediatrician workforce, but its implications for projecting the workforce supply are less clear. Similar to family physicians, med-peds physicians can adjust their practices to the availability of patients without additional training. As the US population continues to age, med-peds physicians may accommodate a relative decrease in the local pediatric population by seeing more adults.

Nonpediatrician Providers of Pediatric Care

Pediatricians provide only a portion of the care received by pediatric patients. The extent of future pediatric primary care that is delivered by pediatricians will not be determined solely by the pediatrician's extensive education and training in children's health, the fact that they are the largest group of clinicians exclusively caring for children, or that their professional competency and availability may be preferred by families. Influential market forces that will shape the role of pediatricians include the (1) availability and rates of growth of other clinicians, particularly nurse practitioners and physician assistants, (2) salaries and productivity of all pediatric clinicians, (3) practice independence of nonphysician clinicians, and (4) hiring practices of health plans and existing pediatric practices, which hire nonphysician clinicians in increasing numbers.

The number of family physicians (post-GME clinically active) increased from 63 209 to 76 409 in the past decade (1992–2002), a per-child (younger than 18 years) increase of 9%.[10,11] These numbers overstate the growth of family physicians who, unlike pediatricians, care for a rapidly growing population: the elderly. The number of first-year residency positions in family medicine was unchanged in the later part of the decade, and the number filled by US medical graduates decreased.[13] Family physicians view themselves as the primary care providers for families, including children, and their important role in this regard is evidenced by their providing 17% of primary care office visits for children younger than 5 years, 28% for children 5 to 9 years of age, 43% for children 10 to 14 years of age, and 61% for adolescents 15 to 17 years of age (Table 2). The fact that family physicians provide the majority of primary care office visits for older adolescents may translate into new opportunities for pediatricians as the aging population creates additional demand on family physician services. Recent trends indicate that pediatricians are, in fact, providing an increasing proportion of children's primary care visits.[87]

Family physicians currently have a high interest in children's health care,[88] as demonstrated by a recent search of the Web site of the American Academy of Family Physicians. Twenty pediatric policy statements were identified, including clinical recommendations for breastfeeding and otitis media with effusion (see www.aafp.org/x6595.xml). Family physicians are vigorous advocates for the further expansion of their residency programs and are active in all aspects of workforce public policy.[88]

Nurse practitioners and physician assistants have emerged as a health workforce larger than many physician specialties, including pediatrics. Precise figures for the total number of nurse practitioners are not available, but estimates of those practicing in primary care vary from 52 000 to 71 000.[90–92] Approximately 90% of all nurse practitioners deliver primary care services,[90] and others such as neonatal nurse practitioners provide highly specialized tertiary care.[93] Approximately 46% of physician assistants (42 000), in contrast, work in primary care settings, including 14 734 in family practice and 1110 in general pediatrics.[90,94,95]

Nurse practitioners and physician assistants have a particularly important role in rural underserved communities, the setting least likely to attract or support a pediatrician. In 1977, the Rural Health Clinics Services Act (Pub L No. 95-210) established rural health clinics to improve primary care availability in rural underserved areas through favorable Medicare and Medicaid reimbursements. The 2 most salient criteria for rural health clinic designation are location within a health profession–shortage area or

TABLE 2. Number of Primary Care Office Visits According to Specialty of Physician

Age of Patient, y	Primary Care Specialty, No. of Visits (%)	
	General Pediatricians	Family Physicians
0–4	40 480 000 (83)	8 163 529 (17)
5–9	15 960 000 (72)	6 058 195 (28)
10–14	10 660 000 (57)	8 073 828 (43)
15–17	3 422 674 (39)	5 327 585 (61)
Total	71 860 000 (72)	27 620 000 (28)

Office visits by internists are excluded because of the small number of observations.
Source: National Ambulatory Medical Care Survey, unpublished data, 1999.

medically underserved area and the employment of a nurse practitioner or physician assistant. Although the clinic must be under the supervision of a physician, the physician needs to be on site only once every 2 weeks. It is not surprising that many physician assistants and nurse practitioners who practice underserved areas seem to serve as physician substitutes.[96–98] The proportion, however, of nonphysician clinicians located in underserved areas is small, and the overall location of nurse practitioners measured across states has been shown to be correlated closely with that of physicians.[99]

The growth in training programs for both physician assistants and nurse practitioners greatly exceeds primary care physician residency growth, and therefore the availability of nonphysician clinicians will also grow faster than that of pediatricians.[90–92] The growth in numbers has also been accompanied by an expansion of practice independence and prescription authority.[100–102] Both greater numbers and practice autonomy are likely to lead to much larger roles of nonphysician clinicians in pediatric medical care.

Geographic Variation in Child Health Clinician Supply

The study of geographic variation in health care resources and utilization, termed "small-area analysis," emerged in the late 1960s and remains one of the most active and provocative areas of health services research.[103,104] Whether measured at a state, county, or health-market area level, the per-capita numbers of physicians and the use of medical care vary substantially from place to place. There is now an extensive literature of small-area variation in health care resources, although few studies are concerned with children and their clinicians.[19,105]

The study of regional variation in child health clinicians, and pediatricians specifically, remains today an underdeveloped field of research. Almost without exception, pediatrician-workforce analysts have viewed the variation phenomenon as an aspect of underservice in rural and inner-city areas.[7,61,106–108] Some of these locales are underserved in terms of all primary care clinicians (ie, health profession shortage areas[109]), and others have an adequate number of primary care clinicians per capita but no pediatrician. For example, more than 7 million children live in 2935 primary care service areas (of a total of 6102) without a pediatrician. A small but important number of children (290 000) live in 313 primary care service areas without either a pediatrician or a family physician (Primary Care Service Area Project, Dartmouth Medical School, unpublished data, 1999).[110] A recent study by Cull and colleagues[70] found a decreasing number of third-year residents accepting positions in rural areas.

There are myriad public programs that seek to address low clinician availability,[109,111–113] including state and federal programs that run the gamut from subsidizing physicians to practice in designated areas (eg, National Health Service Corps), to providing incentives for nonphysician clinicians (eg, rural health clinics), to selectively recruiting medical students from rural areas.[113] By and large, these programs have increased the availability of primary care physicians, although less is known about the availability and quality of clinicians for children.

Recently, a few studies have examined the geographic variation in child health clinicians across the full distribution of supply, ranging from areas of underservice to areas of perceived high supply.[20,25,30,31,61] Although not without controversy, these studies challenge several long-held assumptions. All these studies demonstrate that the regional per-capita (ie, per-child or per-newborn) supply of general pediatricians or neonatologists varies more than fourfold. Chang and Halfon[20] examined pediatrician-to-child populations across the 50 US states between 1982 and 1992 and found a range of 18.5 (Idaho) to 84.3 (Maryland) clinical pediatricians per 100 000 population (children younger than 18 years). Pediatricians were the least well-distributed primary care specialty in relation to the child population and had the smallest reduction in regional variation between 1982 and 1992. LeBaron et al[30] found a similar degree of state variation in pediatrician supply for 1997. Politzer et al[61] used county aggregates as units of analysis and found a similarly high relative degree of geographic variation in pediatricians compared with other primary care physicians and no decrease in regional disparities between 1989 and 1994. A recent study examined the per-newborn supply of neonatologists across 246 market-based neonatal intensive care regions and also observed a greater than fourfold variation. These differences in neonatologists could not be explained by the substitution of nonphysician clinicians or the presence of academic medical centers.[114] Although capturing only a fraction of the total pediatrician workforce, the studies of neonatologists offer important methodologic advantages: geographic accuracy in physician enumeration and in the ascertainment of patient health care needs.

None of these studies provide evidence that areas with a higher supply of general pediatricians or neonatologists have populations with greater health needs. Across states, the supply of pediatricians, but not family physicians, is positively correlated with median household and per-capita income.[20,30] Higher supply is associated also with the presence of pediatric residency programs[20] and minority populations.[30] State-based analyses are limited methodologically, because important within-state variation of physician supply and population risk are obscured. No work has been published examining the relation of general pediatricians to child health needs in health-market–based areas. Analyses of neonatologists and newborn risk address a narrower population but with greater measurement accuracy. By using vital record data to measure newborn risk and neonatal intensive care regions to measure supply, virtually no relationship was observed between the regional supply of neonatologists and low birth weight rates or any other commonly used measure of perinatal risk.[25,31] Additional study is needed on the relation of supply and child-population needs, but these initial efforts do not suggest that current market forces and public policy lead to

an equitable distribution of child health physicians with respect to their health needs.

The final aspect of regional variation in pediatrician supply that has received some recent attention is the relation between the supply of pediatricians and the outcomes of infants and children. To date, no study has examined health outcomes of children in relation to the supply or availability of general pediatricians, and substantial methodologic challenges would confront any such research effort. These difficulties are evident in cross-sectional studies examining adult populations, which have shown a weak association between higher primary care physician supply and lower mortality. The analyses rely on large-area summations of population characteristics (ie, states, metropolitan statistical areas, or counties) and limited measures for controlling population health-risk differences (eg, income, race).[28,35] Causal direction is also ambiguous. Do more physicians lead to lower mortality, or do physicians tend to locate in areas with healthier and wealthier populations? A recent study showing an association between the supply of pediatricians, but not family physicians, and immunization rates using states as the units of analysis had similar limitations.[30]

A retrospective cohort study of the 1995 birth cohort found higher neonatal mortality in neonatal intensive care regions with a very low supply of neonatologists compared with those with a low supply but no difference in mortality between regions with low and very high supply. These findings suggest that there is indeed a threshold of supply beneath which poorer newborn outcomes are evident. On the other hand, the absence of any additional mortality decrease as supply increases suggests that many areas have more neonatologists than required for minimizing neonatal deaths. This study did not examine whether neonatologist supply was associated with decreased morbidity or better quality of care.[31]

Pediatric Subspecialists

Using the broadest criteria, there are 19 areas of pediatric medical subspecialization,[115] 16 of which offer certification through the ABP.[116] On the basis of physician report to AMA surveys on December 31, 2001, there were 9461 post-GME clinical (>50% of professional time spent directly caring for patients) pediatric subspecialists and an additional 740 researchers, 331 teachers, and 260 administrators (Table 3).[11] Many of these pediatricians, of course, have more than one professional role.

AMA data are also likely to undercount subspecialists, because physicians will retain their initial GME specialty in the database until updated by a response to a survey. The alternative to AMA data has its own weakness. The ABP reports granting 14 699 subspecialty diplomas since 1961,[116] but the current practice status of these pediatricians is not known.

Pediatric subspecialists are a heterogeneous group of pediatricians that eludes generalizations with respect to their type of practice, workforce size, and future opportunities. Some subspecialists such as neonatologists provide services not offered by other specialties, and others such as pediatric allergists provide care for conditions that are within the scope of practice of general pediatricians, pulmonologists, or internist-allergists. New specialties continue to develop and establish their role in caring for children before formal fellowships and board certification are established. Hospitalists are the most recent example. Certain subspecialists may have decreased the patient load of general pediatricians (neonatologists and hospitalists, for example) as they assume care for infants and children that were formerly central to the practice of many general pediatricians. Most important are the differences in the sizes of the subspecialties. At one extreme are neonatologists and pediatric cardiologists, who number 2847 (post-GME clinically active) and 1310, respectively, using AMA data, and at the other extreme are pediatric endocrinologists and rheumatologists, which, by the AMA system of enumeration, number less than 100 each in full-time clinical practice.[11] The number of board-certified subspecialists is higher.[117] The ABP has certified 828 infectious-disease subspecialists and 192 rheumatologist subspecialists,[116] but these figures do not identify those returning to general pediatrics and those with research, teaching, or administration as their primary focus. The proportion of professional time devoted to academic work also varies across these specialties, adding another factor to be considered in workforce planning.

The heterogeneity in pediatric subspecialists has 2 important implications. The first is that workforce statistics, forecasting models, and health services studies that report the general experience of pediatric subspecialists will be driven by the largest subspe-

TABLE 3. Professional Activities of Allopathic Pediatricians: December 31, 2001

	Total	Patient Care		Other Professional Activities			
		Post-GME Patient Care	Resident/ Fellows	Administration	Medical Teaching	Research	Other
Pediatricians	66 636	51 675	10 924	1270	1128	1435	204
Generalists	52 888	42 214	8006	1010	797	695	166
Subspecialists	13 748	9461	2918	260	331	740	38
Nonfederal	65 622	50 868	10 876	1207	1108	1370	193
Federal	1014	807	48	63	20	65	11
US medical graduates	48 522	35 917	8964	1075	930	1166	170
IMGs	18 414	15 758	1960	195	198	269	34

Source: AMA Masterfile.[11]

cialties. These generalizations may lead to policies that suit no particular group of children's health services needs. Pediatric subspecialists, as a whole, have already suffered this fate by being subject to the same policy brush as have adult subspecialists, an extremely large group of physicians who, unlike pediatricians, are largely nonacademically based and more highly remunerated. The second implication is that workforce analysts must recognize, from a measurement viewpoint, that many pediatric subspecialists qualify in epidemiologic terms as "rare events." Enumeration, workforce models, and measures of local availability have relatively low precision and, for the smallest subspecialties, great uncertainty. The geographic variation in subspecialists can lead to additional confusion about the overall adequacy of supply.

Pediatric subspecialists are more likely to be based academically than as general pediatricians or adult subspecialists,[118,119] although this differs by specialty. Most pediatric subspecialists, nevertheless, spend most of their professional time in patient care. Pediatric departments have difficulty recruiting subspecialists, at the same time that subspecialists interested in nonacademic practices have trouble finding positions, and those in practice may experience significant competition.[117,120] Failure to differentiate the academic and community labor markets for pediatric subspecialists perpetuates shortages of academic subspecialists who have unique roles in education and research. These shortages may be exacerbated in the future if there is a decrease in the number of IMGs and a greater number of female pediatricians, trends that are likely to lead to fewer pediatricians seeking subspecialty education.[121] Notwithstanding these possible future influences, the recent trend is toward a greater interest in subspecialty education by third-year residents.[70] It is the pediatrician-scientist supply that remains at highest risk, facing particularly long training periods and shrinking clinical revenues while competing with PhD-trained investigators for research funding.

For these reasons, subspecialty workforce policy and planning need to occur by specialty, with an eye to finding commonality when it is present and rejecting it when it is not. Although the recommendations of the recent FOPE II report are not universally accepted,[36] FOPE II has produced an important literature about pediatric medical subspecialists and surgical specialists through the review of primary literature and surveys of pediatricians.[117–120,122–126]

FORECASTING THE CHILD HEALTH WORKFORCE SUPPLY

The 2 fundamental questions in any consideration of the child health workforce are: How many will we have in the future, and will that number be enough or too many? As the previous discussion suggests, future child health workforce supply and requirements are related to many factors, each with their own uncertainties (Fig 1). Methods of projecting the number of pediatricians are on safest ground. Using simple actuarial models with assumptions about training (box 3), retirement (box 10), and death rates (box 9 [the last 2 are sometimes combined as a separation rate]), the models have finite solutions. The robustness of forecasting models using these 3 rates can be tested with simple sensitivity analysis.

Training rates depend on the number of pediatric GME positions (Fig 1, boxes 3 and 5). Changes in the size of US medical schools (Fig 1, box 1) alter the makeup of the workforce but not the number of pediatricians. Positions unfilled by US medical school graduates[48,127] are filled by physicians trained in other countries (Fig 1, box 2). Since 1997, the number of categorical pediatric residency positions offered in the match has increased by 11% and the number filled has increased by 6%.[48] ABP data indicate a 5% increase in the number of categorical first-year positions from 1997 to 2002.[116] Changes in GME funding could quickly alter the size of this pipeline, although none are on the immediate horizon.

We can expect that death rates will continue their downward drift for physicians, but these rates are already low in the preretirement years and a further decrease will not appreciably alter supply-projection models. There are many opinions about trends in retirement rates,[128] but there is no dominant a priori direction that can be asserted. Much has been made of physician frustration with managed care, greater administrative tasks, and increasingly litigious families. Without a doubt, these are less attractive sides of the medical profession. On the other hand, health care professionals are retiring later, not earlier, as they follow a general labor trend to a longer work life. Pediatricians and their employers are also faced with the same dramatic short-term challenges of decreasing financial markets that devalue pension funds and 401(k) accounts alike. This inevitably will lead to postponed retirement, at least in the short run. By the time this report is published, it is hoped that the country's economic health along with the rate of return of financial investments will have improved. Still, no credible economist predicts a return to the "irrational exuberance" of the 1990 equity markets, as attractive as that might be for retirement expectations.

In a model forecasting the number of clinically active pediatricians, 2 additional gender-related variables are of increasing importance: personal leave (Fig 1, box 8) and part-time employment (Fig 1, box 15), typically for child care responsibilities. The former affects the number of clinically active pediatricians employed at any given time, and the latter modifies the full-time equivalence of those physicians. The dominant influence on these event rates will be the number of women entering pediatric residencies. Current rates are known and can be added to actuarial models with assumptions about future changes in these rates.

Forecasting becomes increasingly complex as we incorporate additional parameters into the model. Many of the desired variables are difficult to measure, requiring the substitution of proxies. Other measures lack a theoretic or definitional consensus within the health policy and medical community. Even with perfect measurement, simply adding

more variables to the model introduces additional uncertainty to the results.

One domain that bedevils child health workforce-supply forecasting is workforce productivity, how it is defined and measured.[12,129–132] For the moment, we will restrict productivity to its common measures that are more aptly named medical services productivity (Fig 1, box 14). Examples include visits or hours of clinical activity per week per physician full-time equivalent (FTE). These measures are not equivalent. As previously discussed, the hours worked per week are not strongly related to pediatrician gender. Full-time female and male pediatricians work similar clinical hours.[39] Data are not available about gender differences in patient visits per week.

Organizational factors are increasingly important in medical productivity as pediatricians continue to shift from solo and partnership practice to employee-based work arrangements. Employee pediatricians work an average of 6.4 fewer hours per week compared with those practicing solo or in partnerships.[133] Financial incentives related to patient insurance types or the compensation plans by physician employers can also affect the number of medical services delivered per physician FTE.[134,135] For all of these factors, the consistent trend is for pediatricians to work fewer hours and provide fewer visits per week. In 1989, pediatricians (those working at least 20 hours per week in patient care) worked an average of 53 hours per week in patient-care activities; by 1999, they worked 50 hours. During the same period, the average number of office visits decreased from 102 visits per week to 95 (Table 4).[136,137] The numbers indicate a decrease in the medical services productivity of pediatricians but do not account for possible but still unmeasured changes in patient complexity. It is also not known if these trends stem from fewer patients, lifestyle choices of pediatricians, or both. How will medical services productivity change in the future? Answers offered to this question are highly speculative.

Medical services productivity ignores the very purpose of the profession. The difficulty becomes obvious when one is reminded that the unit of production (in an economic sense) in health care is improvement in health outcomes (Fig 1). Therefore, a strict measure of productivity would be the labor input required per unit of greater health outcomes. In this instance, "health outcomes" is defined broadly to include the maintenance of health, the care and cure of illness, and the restoration of a sense of well-being in children and families through education and counseling. Although operationalizing the theory of health outcomes productivity with actual measurements is difficult, it should at least be understood that the number of hours worked or patients seen per week is not always related to the health status, reduction of risk, or sense of well-being of a physician's patient population.

Many workforce-supply models have been developed,[138–140] but few have been for pediatrics and only one is recent. Shipman and colleagues[141] developed an interactive general pediatrician–supply model using software developed for modeling scientific and business systems. The actuarial model estimates future pediatrician FTEs by using parameters for GME output, gender mix, and retirement patterns. Other parameters incorporated into the model include rates of subspecialization, mortality, and the proportion of IMGs returning to their home countries. Although not intended to fully represent workforce requirements, the model also calculates pediatrician-to-child ratios by using low-, middle-, and high-census projections. The supply projections are compared with a user-selected benchmark or reference value, the default being the current supply of

TABLE 4. Characteristics of Allopathic Pediatricians (General Pediatrics, Pediatric Cardiology, and Pediatric Allergy Included): 1989 and 1999

Pediatrician Characteristic	1989	1999	Percent Change 1989–1999
Net income	$93 000	$126 000	35.5
Adjusted for inflation*	—	$93 750	0.8
Professional activities			
Weeks of practice per year	47.4	47.6	0.4
Hours of professional activities per week	58.0	54.5	−6.0
Hours of patient care per week	53.4	49.5	−7.3
Office hours per week	31.8	29.8	−6.3
Office visits per week	101.8	95.0	−6.7
Revenue sources			
Medicaid	—	20%	—
Private insurance	—	65%	—
Patients	—	10%	—
Time spent in primary care activities	—	95%	—
Wait for new patient appointment	—	2 days	—
Employment type	—		—
Self-employed solo	—	19.2%	—
Self-employed group	—	27.5%	—
Employee	—	50.5%	—
Independent contractor	—	2.1%	—

Physicians working <20 hours/week in patient care are excluded. Mean values are presented unless otherwise specified. — indicates that data were not available.

* Information was obtained from the US Department of Labor, Bureau of Labor Statistics (www.bls.gov/cpi).

Source: AMA Socioeconomic Monitoring System.[136,137]

49.0 per 100 000 population. The benchmark can also be adjusted for the different future demand as the age structure shifts (infants require more visits than do adolescents) as well as the greater need for pediatricians if family physicians see fewer children. The program has a simple-to-use interface, and the user can adjust the default values. The effects of varying model parameters can be tested quickly by comparing projection curves of the number of pediatrician FTEs. The model is available at www.dartmouthatlas.org/workforce_model.php, and AAP members are encouraged to test their own assumptions about the relative importance of the factors discussed in this report.

By using default assumptions, the model forecasts a 36% increase (from 38 457 to 52 169) in general pediatricians in 10 years and a 64% increase (62 952) in 20 years. Using middle-census estimates, the number of general pediatricians per 100 000 children will increase 31% in 10 years and 50% in 20 years. Adjusting the number of future pediatricians for age and gender productivity will require 4% more pediatricians in 20 years, in large part to compensate for part-time status. This assumes that the current gender mix of residents continues into the future. Sensitivity testing included retirement rates, ranging from a 20% decrease to a doubling of current rates within all age and gender strata, decreased productivity of at least 30% for pediatricians older than 50 years, GME downsizing to 110% of US medical graduates, increase in pediatric residency positions by 1% per year, and substituting low- or high-census child-population estimates. At 20 years, these resulted in differences from the default model pediatrician-to-child ratio of less than 16%. This model demonstrates that the growth in the pediatrician-to-child ratio is robust to varied alternative-forecasting scenarios.

PEDIATRICIAN-WORKFORCE REQUIREMENTS

Workforce analyses usually run aground when forecasting the physician requirements of populations. The most important parameter is simply the size of the population or its age definition, in this instance the number of children (Fig 1, box 13); from this, future FTEs per child (or per capita) are calculated. Population projections may seem straightforward, but there are uncertainties in both the number and composition of the future population, leading to contentious and seemingly arcane arguments among forecasters.[138,139,142]

Requirements for general pediatricians are also related to substitution within the broader child health workforce (Fig 1, box 11). As discussed in this report, the number of child health professionals includes a complex mix of physicians and nonphysician clinicians with differing training and education, skills, and knowledge that provide, at times, similar services. Two examples come to mind. Within pediatrics, subspecialists such as neonatologists and hospitalists provide care that once was part of nearly every pediatrician's daily professional life. For whatever factors that may increase the need for pediatric services in the future, rearrangement of clinical work within pediatrics decreases the need for general pediatricians. Similarly, the growth in numbers of nonphysician clinicians may spare the efforts of pediatricians within a practice while decreasing the need for pediatricians in aggregate.

More difficult to measure, and usually ignored, are the rich and complex factors that relate the number of health services delivered per child to children's health and well-being, termed health outcome productivity (Fig 1, box 17). A short list of factors includes the technical excellence and appropriateness of the service and the division of labor across the many possible clinicians (Fig 1, box 11) or even across the nonmedical workforce—parents, teachers, coaches, clergy, and therapists (Fig 1, box 16). Relative health needs are also of central importance (Fig 1, box 17). All else held equal, we would also expect a greater production of health (ie, improvement in health status or well-being) when care is delivered to a less healthy child. The organizational and community milieu can also modify the efforts of the child health workforce (Fig 1, box 14). When these factors are considered together, it becomes apparent that successful health outcomes might occur with a widely differing number of pediatricians. Workforce forecasters have accounted for these factors through 5 different models.[130,139,143,144] Each model requires particular theoretic assumptions and data, and none of these methods should be viewed as mutually exclusive of the others. The acceptance of a particular framework partly depends on the definition of "requirement" and the policy goal of the forecasting process. Another way of looking at the task of assessing requirements is that it is not a science in the traditional sense but is intertwined with the values expressed in the assumptions. Is the goal to optimize health or the perception of access to physicians or to maximize employment opportunities for physicians? Is reducing disparities in the access and use of medical services one goal? What level of public funding in education and payment of health services is assumed, and what is the rationale for public funding at all if it is thought that markets will drive the health care system to desirable outcomes? Although the values inherent in different requirement models may not be explicitly stated, the careful reader will find them implicit in the models' assumptions.

Employment Opportunities for Pediatricians

The most basic approach to assess the requirements for pediatricians is to determine their employment opportunities and competition for patients. Both measures are indicative of the pediatrician's short-term prospects, although no forecasting models have been constructed that formally incorporate these economic signals.

Studies from the mid- to late 1990s show that although there were wide employment opportunities for general pediatricians, there was also significant competition for jobs and patients. In 1996, 17% of residents finishing training had difficulty finding a position, 15% received only 1 job offer, 9% accepted positions that were not their first choice, 17% accepted a position in a location that was not their first choice, and 18% accepted a job with a salary that was less than expected. Although discouraging at first

glance, pediatricians had less difficulty finding a position than did physicians in 25 of the 32 specialties examined. The specialty with the most favorable employment prospects was family medicine; job prospects in general internal medicine were slightly less favorable than in general pediatrics. The specialties with the poorest job prospects were pathology, adult pulmonary disease/critical care medicine, and adult infectious disease.[145] Another study found that between 1990 and 1995, the number of employment ads for pediatricians decreased, and ads for pediatric subspecialists remained nearly constant. At the same time, the number of ads for family physicians grew close to 25%.[146] Perhaps the most pessimistic view of general pediatrics was reported to the Council on Graduate Medical Education by the Center for Workforce Studies in Albany, NY.[147] In exit surveys of residents completing training in New York State and Texas, 6 measures were used to assess relative demand by specialty; general pediatrics was second to last of the 28 specialties studied.

The most recent information comes from Cull et al,[70] who used survey data from third-year pediatric residents. Over a 5-year period ending in 2002, the proportion of residents with a general pediatrics goal without a position increased from 5% to 15%, and the proportion reporting that their position was their first choice decreased from 86% to 80%.

Our information about the competition experienced by practicing pediatricians is limited to subspecialists. Competition is highest for pediatric allergy/immunology, cardiology, pulmonary medicine, and critical care medicine; lower levels of competition were perceived by infectious disease, genetics, and adolescent medicine pediatricians. The strongest predictors of competition were working in solo, group, or medical school practices in contrast to staff- or group-model health maintenance organizations (HMOs) or community hospitals. Pediatricians working in the Midwest or southern regions also experienced the strongest competition. Less competition was felt by IMGs, those working in rural areas, and female physicians.[120]

Salary information also indicates a weak demand for pediatricians compared with other primary care specialties. In one nationally representative survey conducted between 1996 and 1998, general pediatricians reported an average income of $126 000 compared with $144 000 for general internists; pediatric subspecialists reported an average salary of $156 000, whereas the average salary of internal medicine subspecialists was $192 000.[148] When adjusted for inflation, the salary of pediatricians changed little between 1989 and 1999 (Table 4).[136,137] Starting salaries for graduating residents entering general pediatric practices decreased (in 2002 dollars) from $103 161 in 1997 to $99 123 in 2002.[70]

Data from the National Resident Matching Program indicated that pediatric residency positions are among the most highly sought by medical students. At its peak in 1998, 98.9% of pediatric positions offered through the match were filled, with 82.2% filled by US medical graduates; these match rates exceeded internal medicine and family medicine. By 2002, the overall pediatric match rate had fallen to 90.5%, with 70.7% filled by US medical graduates, and then increased slightly in 2003 to 93.8%, with 71.3% filled by US medical graduates. Other primary care specialties experienced similar decreases, particularly with respect to the proportion of US medical graduates matching: 55.2% for internal medicine and 42.0% for family medicine in 2003. For all first-year positions in 2003, 89.9% were match-filled, 63.9% by US medical graduates.[48,127,149,150]

Despite these marketplace signals, it is worth noting that once in practice, general pediatricians have higher satisfaction with their job, career, and specialty than do general internists. Satisfaction, job stress, and burnout for pediatric subspecialists were less favorable and similar to general and subspecialty internal medicine physicians. These findings show a lack of correlation with salary levels and attitudes about practice and also identify stress experienced by pediatric subspecialists.[148]

Needs-Based Models

One formal model for forecasting future physician requirements was that developed by the Graduate Medical Education National Advisory Committee (GMENAC).[151] GMENAC estimated physician requirements in the late 1970s through a complicated process of defining the need for efficient medical services to optimize health. For each specialty, clinicians and epidemiologists estimated the future disease burden, the necessary treatments, and the workforce required to provide those services. The GMENAC report predicted a physician surplus for both generalists and specialists, pediatricians included. From the standpoint of physician employment, this obviously did not occur, and in the absence of unemployed physicians, GMENAC predictions have generally been rejected.[9,152]

What went wrong with GMENAC? First, the data requirements of the models were unrealistic. Needs-based planning assumes that the disease burdens of populations are measurable and that it is known which medical interventions can most effectively and efficiently improve health today and in the future.[153] In actuality, the measurement of health status in populations is imperfect, and knowledge of medical care effectiveness is incomplete and likely to remain so as technologic developments outpace effectiveness studies.[154,155] Second, there was an assumption by the readers of GMENAC that as physician supply approached levels needed for populations to be healthy, demand would attenuate. In this instance, surplus would be evidenced in unemployment or, at the very least, pressure on physician salaries. Populations with higher health status, however, do not consume necessarily less health care, as might be expected, but continue to demand (in an economic sense) services to address an ever-elusive definition of "health." With most health care costs borne by third parties and the general sense that more medical care always leads to better health, physicians continue to be fully employed even as health status improves. This would be of little public policy interest except that societal resources for medical care

reimbursement are not without limits, and many populations remain with unmet health care needs, even as the healthy seek more care. The lesson learned from GMENAC is that in the complex market for medical care and physician labor, population needs are poorly related to demand for physicians.

Demand-Based Models

Demand-based forecasting uses current medical services utilization as an indication of medical need and projects future utilization to determine the required number of physicians under different conditions of productivity. In its most elegant form, utilization is measured for many different combinations of population characteristics such as age, gender, and race and for different medical care settings and financing. These include the mixture of fee-for-service or managed care penetration and patient insurance status. Once these are measured in the present, then populations for each of these characteristics are projected into the future, and the number of required pediatricians can be calculated.

Demand-based models are the most common type of forecasting.[138,139,156] Medical service utilization data are available for many populations and types of service delivery. The model assumes that current delivery patterns are rational and desirable and that similar populations in the future will require utilization rates close to those delivered today. The acceptance of current utilization patterns as normative measures also assumes that the current market for health care services maximizes the well-being of children.

The 2 merits of demand forecasting are the availability of data and the simple assumption that the medical marketplace reasonably delivers health care consistent with societal values and expectations. Among the many criticisms that can be leveled, the most obvious is that the supply of physicians, as seen with general pediatricians and neonatologists, is not located where child health needs are greater[20,114] and that medical utilization similarly varies widely across regions without detectable population differences. Current demand for health care cannot be used as a normative standard when the location of resources is idiosyncratic. The health services literature is replete with studies that show the irrationality of health care delivery.[18,157–160] Critics of demand-based planning ask: Why would we want to perpetuate these delivery patterns into the future?

Trend Analysis

Recently, a new method of projecting physician requirements was proposed: trend analysis.[144,152] The method uses a macroeconomic conceptual framework that asserts that growth in physician requirements is tightly linked with increases in the gross domestic product (GDP). In addition to long-term trends in GDP, 8 "macro" trends are emphasized in the model, some that can be reasonably measured and others that are highly speculative. The model attempts to separate trends that are "the natural evolution of the current fiscal and organizational characteristics of the health care system and the societal fabric in which it exists" (attrition, productivity, substitution, geographic distribution, technology, demographics, health systems, and economic dependency) from trends that are "value judgments" (technology controls, specialist controls, volume controls, and cost controls).[161] The developers of this model have used it to advance the idea of an "impending" physician shortage. Although the method forecasts physicians in aggregate, they have interpreted trends as indicating a future shortage in specialists and an "abundance of generalists."[162,163]

Trend analysis has been criticized for its view that the macroeconomic association of GDP and the workforce is causal, inevitable, and a self-evident expression of societal wants. Many other criticisms have also been vigorously advanced.[164–170]

When this model is applied to the pediatrician workforce, a contradiction emerges. Just as Cooper et al[162] have observed a correlation between the growth of GDP per capita and total physicians per capita, Freed et al[171] have presented a similar correlation with pediatricians per 100 000 children. Projecting this trend into the future, Freed et al[171] find, instead of Cooper et al's "abundance of generalists," that "the current net inflow of pediatricians will not be sufficient to meet future demand as expressed by the trend line." These conclusions need to be considered in the context of the estimate of Shipman et al[141] that the per-child number of pediatricians will grow more than 5 times faster than the per-capita number of internists or family physicians. One interpretation is that there is an impending shortage of primary care as well as specialist physicians. Another interpretation is that macroeconomic correlations are an overly simple estimator of workforce requirements. A potential weakness with these models is that the number of physicians per capita has increased over time and will correlate highly with any other upward trend. Bivariate time-series analyses are subject to the same limitations as any other observational study, with the added problems of a small number of observations (n = number of time periods) and difficulty in identifying and measuring time-dependent confounders. When the models are technically correct,[172] health care planners still must decide whether previous patterns of physician growth should be used as the primary guide of the child health workforce in the future.

Benchmarking

Benchmarking is a final method of determining workforce requirements. Benchmarking exploits natural experiments in workforce levels by using physician-to-population ratios found in regions of the United States or within health care systems as indications of real life and attainable physician levels.[19,139,143,173,174] Benchmarking seeks to find regions in which workforce deployment is efficient and effective in delivering health care. A slightly different approach is to use the staffing levels in efficient capitated health systems that deliver high-quality care as measured by medical care processes, family satisfaction, and health outcomes. Benchmarking rejects the notion that the current national physician

labor or health services markets have any particular normative value in terms of optimizing health outcomes and offers a variety of available reference points to help guide physicians' employment decisions. In the short term, benchmarks can caution a health plan about adding additional specialists to an area with a high per-capita number or point to areas with a low supply that may be an opportunity for expanded services. As the marginal effects of physician supply on patient satisfaction and outcomes are better understood, benchmarks may provide a means of improving systems of care for populations enrolled in health plans or residing within regions. To the degree we fall short of the need or desire to develop effective delivery systems with constrained resources, benchmarking will fail to predict physician employment opportunities.

Requirements for Pediatricians

In Table 5 we present published projections of pediatrician supply and requirements. It is evident from this list that relatively little work has been done in this area. The supply of general pediatricians forecasted by Shipman et al[141] for 2010 is similar to the earlier predictions of Kletke et al.[175]

The current supply (53 general pediatricians per 100 000 children younger than 18 years) exceeds the requirement suggested by GMENAC in 1980 (49 per 100 000) and by Abt Associates in 1991[176] (41 per 100 000). The only other estimates of requirements that are available are from the AAP Pediatric Research in Office Settings Network (71 per 100 000) and various group and HMO practices (49–89 per 100 000). These figures assume that children receive care only within pediatrician-dominated practices with staffing levels observed in practices serving largely employer-insured populations.[107,177] Even with these assumptions, Shipman et al[141] and Kletke et al[175] forecast a supply in 2010 (72 per 100 000) that exceeds staffing levels observed in most of these groups.

As discussed elsewhere in this report, a level of supply judged sufficient for the United States as a whole still leaves pockets of underservice or possible pediatrician excess. In addition, the effects of the growing supply of pediatricians on employment opportunities will depend on both the financing and organization of health care. General pediatrician unemployment would most likely occur if pediatric care were delivered entirely under the organizational systems that carefully manage panel size, the mix of physicians and nonphysician clinicians, and utilization, such as staff- or group-model HMOs. To the extent that pediatric care is less explicitly planned and financed, there are likely to be substantial regional differences in future opportunities for pediatricians.

TABLE 5. General Pediatrician Current Supply, Projected Supply, and Requirements

Supply	Date	Children per General Pediatrician*	General Pediatricians per 100 000 Children*	No. of General Pediatricians
Current				
Shipman et al[141]				
Population age <18 y	2000	1886	53	38 457
Population age <20 y	2000	2041	49	38 457
Kletke et al[175] (estimated)	2000	—	—	41 600
Projected				
Shipman et al[141]				
Population age < 18 y	2010	1390	72	52 169
Population age < 20 y	2010	1555	64	52 169
Population age < 18 y	2020	1293	77	62 900
Population age < 20 y	2020	1362	73	62 900
Kletke et al[175] (ratios assume age <18 y)	2010	1408	71	51 500
Estimated Requirements				
Population-based				
GMENAC[151]	1980	2034	49	NA
Abt Associates and the Bureau of Health Professions[176]	1991	2430	41	NA
Practice-based†				
AAP PROS Network[166]	1996	1400	71	NA
Managed care staffing				
Group Health Association of America[178] (age not stated)	1993	2222	45	NA
New England IPA (0–17 y)	—	1300	77	NA
33 HMOs (0–14 y)	1992	1157	86	NA
Group-model HMO 1 (age not stated)	—	1125	89	NA
Group-model HMO 2 (age not stated)	—	1750	57	NA
Group-model HMO 3 (age not stated)	—	1200	83	NA
FOPE II "ideal"[107]				
High	2000	1200	83	NA
Low	2000	1400	71	NA

PROS indicates Pediatric Research in Office Settings; IPA, independent practice association; NA, not applicable.

* Assumes middle-US estimates.

† These practice-based measures need to be viewed cautiously. They assume that all children are cared for exclusively by pediatric practices and that most have employer-based insurance.

Which Supply of Pediatricians Is "Right?"

This report does not recommend a particular supply of pediatricians but instead challenges the reader to consider the values worth promoting through workforce policy. Much of the disagreement about physician requirements is seen as a consequence of uncertainty in the data and analytic methods when, in fact, these debates are driven by fundamental, and often unstated, conflicts in values. The differences in values are embedded in both the means and ends of the pediatrician workforce.

With respect to the "means," there are significant disagreements among pediatricians, health care planners, and families about the appropriate and effective mix of market-based and publicly funded programs in the education and deployment of the workforce. Should public funding of medical education (eg, GME Medicare and Health Resources and Services Administration monies) be accompanied by an obligation to care for underserved populations? Who should decide on the size of the pediatrician pipeline? Should it continue to be residency programs or a quasi-public entity? How much of medical education should be funded publicly if markets are considered the best arbiter of workforce supply?

As far as the "ends" of workforce policy, should the workforce be equitably available to children? If not, how much disparity is acceptable, and who should pay the associated uneven costs? How much should workforce policy be influenced by the interest in tempering pediatric competition and thereby ensuring practice opportunities and stable incomes? If this is ignored, will we able to attract the best and the brightest of rising medical talent to pediatrics? These are only a few of the questions that need to be considered in developing workforce policy, including the target supply. The answers are linked to the values held as individuals and jointly as a profession.

If producing better health and well-being of children remains the goal of pediatricians and associated workforce policy, there are still areas in which sound policy is hindered by inadequate data. The 2 related and unanswered questions in pediatrician-workforce research are: How much of an improvement in child health outcomes is derived from a given increase in the number of pediatricians, and would an equal investment in an alternative input provide a greater benefit? Past investments in pediatricians have brought good value in children's health outcomes improvement. At the same time, there is a need to evaluate the effectiveness of additional growth in pediatrician supply.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—The Pediatrician's Role in Child Maltreatment Prevention

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KEY WORDS
child maltreatment, primary care, prevention

ABBREVIATION
AAP—American Academy of Pediatrics

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

FREE

It is the pediatrician's role to promote the child's well-being and to help parents raise healthy, well-adjusted children. Pediatricians, therefore, can play an important role in the prevention of child maltreatment. Previous clinical reports and policy statements from the American Academy of Pediatrics have focused on improving the identification and management of child maltreatment. This clinical report outlines how the pediatrician can help to strengthen families and promote safe, stable, nurturing relationships with the aim of preventing maltreatment. After describing some of the triggers and factors that place children at risk for maltreatment, the report describes how pediatricians can identify family strengths, recognize risk factors, provide helpful guidance, and refer families to programs and other resources with the goal of strengthening families, preventing child maltreatment, and enhancing child development. *Pediatrics* 2010;126:833–841

INTRODUCTION

Since Kempe et al[1] published their description of the battered-child syndrome in 1962, the medical profession has made great strides in recognizing and intervening in cases of child maltreatment. Child maltreatment is now recognized to be part of a continuum of family violence that includes child maltreatment, intimate partner violence, and the abuse of animals and the elderly. A great deal is known about the factors that contribute to the abuse of a child and about those that may prove protective. Despite the progress made, the problem remains widespread and serious in its costs, whether reckoned in dollars[2–4] or human potential.[5] Child maltreatment, however, is a preventable problem, and pediatricians have a role in its prevention.[6]

Pediatricians, because of their unique relationship with families, are in an excellent position to help families enhance their ability to protect children and to address factors that put them at increased risk of abuse. Because pediatricians have contact with families during challenging and stressful times (eg, when a child is ill), they can become familiar with a family's stressors and strengths. As a trusting relationship evolves, families and patients develop comfort discussing personal issues with their pediatrician.[7] Pediatricians are often connected to community resources that have the welfare of the child and family as a priority. Families tend to trust their pediatricians' guidance and referral to these resources. The literature shows that parents view pediatricians as respected advisors and counselors.[8]

Pediatricians accept this role as well. The majority of pediatricians (70%) who participated in the 2002–2003 American Academy of Pedi-

atrics (AAP) periodic survey agreed that they can help prevent child abuse by providing anticipatory guidance.[9] Almost all the respondents to this survey (91%) agreed that pediatricians should screen for parenting problems during health supervision visits.

Triggers

Pediatricians can play a role in preventing child maltreatment if they understand the situations that commonly trigger maltreatment and if they identify and address some of the factors that may make a child more vulnerable to maltreatment.

Certain elements of normal child development are often the triggers for child maltreatment. Schmitt[10] described what he called the "7 deadly sins" of childhood. He described normal developmental phases that may cause difficulty for some parents, specifically colic, awakening at night, separation anxiety, normal exploratory behavior, normal negativism, normal poor appetite, and toilet-training resistance. He suggested that pediatricians anticipate these normal developmental stages and provide guidance to families about how to best manage potentially difficult situations.

Crying is a common trigger for child abuse[11] and is the most common trigger of abusive head trauma.[12,13] In 1 study of infants who suffered abusive head trauma, almost all of the parents had sought help for their infant's crying previously from their primary care physician.[14] All infants cry; crying generally begins in the first month of life, and the duration of crying increases and peaks between 2 and 4 months of age. That the incidence of abusive head trauma parallels this normal developmental crying curve may serve as additional corroboration of the association between crying and abuse.[15,16]

The severity and frequency of caregivers' adverse responses to crying have largely been underappreciated. In 1 study, almost 6% of parents of 6-month-old infants admitted that they had smothered, slapped, or shaken their infant at least once because of his or her crying.[17]

Discipline can become abusive, as when punishment is used inappropriately in response to a child's developmentally normal behaviors. Unprepared parents may mistake separation anxiety, normal exploratory play, and normal negativism, for example, for abnormal behaviors or unacceptable behavior and resort to punitive measures to correct them. Apart from its possible effects on emotional development, corporal punishment may result in serious physical injuries for the child. When mothers in the Carolinas were interviewed, 4.3% of them admitted using harsh physical techniques when disciplining their children. These practices included beating, burning, kicking, or hitting a child with an object somewhere other than on the buttocks; 2.3% of the mothers said that they shook children younger than 2 years as a form of discipline.[18]

Toilet-training and toilet accidents are another common trigger for child abuse.[19] Immersion burns are frequently inflicted in response to soiling and enuresis by caregivers who believe that the children should be able to control these behaviors.[20,21] Genital bruising and immersion burns are common child abuse injuries associated with toilet-training. The average age of children who have been intentionally burned is 32 months, which is about the same age many children are being toilet trained and, thus, the same age at which some are accidentally soiling or wetting themselves.

TABLE 1 Factors and Characteristics That Place a Child at Risk for Child Maltreatment

Child	Parent	Environment (Community and Society)
Emotional/behavioral difficulties	Low self-esteem	Social isolation
Chronic illness	Poor impulse control	Poverty
Physical disabilities	Substance abuse/alcohol abuse	Unemployment
Developmental disabilities	Young maternal or paternal age	Low educational achievement
Preterm birth	Abused as a child	Single-parent home
Unwanted	Depression or other mental illness	Non–biologically related male living in the home
Unplanned	Poor knowledge of child development or unrealistic expectations for child	Family or intimate partner violence
	Negative perception of normal child behavior	

Factors That Place a Child at Risk for Child Maltreatment

Many disparate factors may combine to make a child more likely to be abused or neglected.[22] Using an ecologic model as a framework for considering risk,[23] certain characteristics of the child, the parent, and the environment may place a child at risk, as shown in Table 1. Often, multiple factors coexist and are interrelated, which increases the risk for the child.

Child characteristics that could predispose a child to maltreatment include anything that makes a child more difficult to care for or makes a child different from the parent's expectation. For example, a demanding infant or a child with special health care needs may test the parent's patience. As a result, children with physical, developmental, or emotional/behavioral disability are at an increased risk of being maltreated.[24,25]

Children with disabilities are approximately 3 times more likely to be maltreated than are children without disabilities.[26] A number of characteristics

may make children with disabilities more vulnerable to maltreatment.[27] The child's disability may place additional emotional or financial demands on the family. A child who is heavily dependent on others beyond infancy may engender resentment. Further complicating matters, the child with disabilities may be conditioned to obey caregivers without question and, thus, may lack the ability to disclose abuse. If children have been taught to accept painful touch as normal, they may not be able to distinguish when boundaries are crossed.

Children born prematurely may also be at increased risk of being maltreated.[28–30] Some preterm infants may be more at risk for abuse, because the infants are perceived as less attractive and more demanding by their parents.[28] Some experts have suggested that the early and sometimes prolonged separation of these infants from their parents may contribute to their vulnerability. Some preterm children may be more vulnerable because they have special needs or require special care, including additional physician visits or special therapy. All of this care may place an additional financial and/or emotional strain on the family.

Likewise, the child who is unplanned or unwanted is at risk for maltreatment.[31] An unplanned pregnancy may place an extra financial and/or emotional burden on the family.[30]

Parent factors also may make a child more vulnerable to being maltreated. Factors that may decrease a parent's ability to cope with the stresses of parenting include low self-esteem; poor impulse control, including a tendency to lash out in response to stress; substance use; and alcohol abuse.[30,32] Young maternal and paternal age are risk factors for maltreatment,[33,34] and young maternal age is strongly associated with infant homicide.[35] Parents who were abused or neglected themselves as children may parent in the only style they have learned.[30,31]

A parent's depression or other mental illnesses,[34,36] particularly postpartum depression, affect a child's growth and development and may place the child at risk for maltreatment. Depression is a significant problem for both fathers and mothers.[37]

Parents who have a negative view of themselves and their children and parents who devalue their children are at risk of maltreating their children. Oates et al[30] found that mothers who had maltreated their children tended to rate their children as below average, whereas control mothers viewed their infants as normal or above average.

Lack of knowledge about child-rearing can increase the caregiver's level of frustration with the child's behavior. Parents vary widely in their knowledge of child development and what they should reasonably expect from a child at a given age. Parents who maltreat their children are more likely to have developmentally inappropriate and unrealistic expectations for their child's behavior and to have a negative perception of normal behaviors.[28]

Oates et al[30] also found that parents who maltreated their children were more likely to have a punitive child-rearing style and were stricter. When the maltreated children behaved well, they were rarely praised, compared with the children in the control group, who were praised for good behavior.

Environmental factors can add to parents' stress. Parents who are isolated and who have low levels of social support are at increased risk of maltreating their child.[38] Poverty, unemployment, low maternal education, and single parenting are risk factors associated with physical child abuse.[36,39–42] Having a non–biologically related male living in a single-female–headed home is a risk factor for child maltreatment and for fatal child maltreatment.[43–45]

Adult intimate partner violence and child maltreatment are closely linked.[46] Children who live with an adult victim of intimate partner violence are at an increased risk of being physically abused. In addition, children who are exposed to violence in the home are affected emotionally, cognitively, and behaviorally.[47] Exposure to this toxic environment is often considered a form of child maltreatment.

These factors may interact and increase the child's vulnerability to maltreatment. Infants who are not nurtured properly in their first months may not learn to regulate their emotions, because development of this vital task is enhanced by early parental attention and support.[48] As the infants become more challenging to their parents, this complex interplay may increase their risk for abuse. Adults who are socially isolated may lack standards for comparison of their child's behaviors, or role models and resources for themselves. Food or employment insecurity, poor access to community services, or simply the lack of community feedback can exacerbate stress and anxiety. Even if no single factor would be sufficient to overwhelm the caregiver, the combination of stresses may precipitate an abusive crisis.[49,50]

Protective Factors

Besides assessing a child's risk for maltreatment, the pediatrician should identify and consider the child's and family's strengths. Maltreatment occurs when factors specifically pertinent to the child and factors relevant to the parent, the community, and to the environment interact, which creates a "perfect storm" for abuse and/or neglect.[51–53] In other words,

maltreatment occurs when risk factors are greater than protective factors and stressors exceed the supports.

Several factors seem to both protect a child from maltreatment and provide children with resilience to the effects of child maltreatment, as shown in Table 2.[54–56] Using the same ecologic framework, protective factors include attributes of the child and the family as well as support from outside the family. Although many studies have focused on how these behaviors may trigger a physical response or physical abuse, it is likely that these behaviors also trigger other forms of maltreatment, including sexual abuse. Prevention may require changing some cultural beliefs and social policy and improving education and economic opportunities.

PREVENTION AND INTERVENTION PROGRAMS

It is not the intent of this report to review and evaluate all of the available prevention and intervention programs. Instead, the report will discuss some of the programs as examples and, when available, cite any evidence for their effectiveness.

Hospital- and Office-Based Intervention Programs

Programs have been developed to help parents to better cope with a child's crying. Dias et al[57] implemented a program in nurseries in western New York designed to teach new parents about violent infant-shaking and alternatives to use when infants cried. They found that the incidence of abusive head injuries decreased by 47% during the first 5 years of the program. A similar program, the Period of PURPLE Crying, also uses a brief video and written material to educate new parents about normal crying and how to cope with an infant's crying. This program has been shown to improve mothers' knowledge about crying and to improve their behavioral response to it.[58,59] Although both of these programs represent promising models, neither program has yet demonstrated strong evidence that they are effective as a primary prevention of abusive head trauma.

One office-based prevention model, the Safe Environment for Every Child (SEEK) model, was tested in a resident continuity clinic over a 3-year period.[60] Residents were trained to recognize factors that placed a family at risk for maltreatment. Study families were screened for risk factors, and a team that consisted of a resident and a social worker addressed any identified risk factors. When the families were compared with a control group, the prevention program resulted in fewer reports of child maltreatment made to child protective services, fewer incidents of medical noncompliance and delayed immunizations, and less harsh punishment by parents. Although some of the differences between the control group and intervention group were of modest significance, participation in this program improved the residents' sense of competence and comfort when addressing risk behaviors.

The AAP developed Connected Kids: Safe, Strong, Secure, an office intervention originally known as the Violence Intervention and Prevention Program (VIPP). This program was modeled after The Injury Prevention Program (TIPP), also from the AAP.[61] The Connected Kids program uses a resilience-based approach to anticipatory guidance and is designed to help primary care physicians use their therapeutic relationship to support families as a means of violence prevention. The Connected Kids program includes a clinical guide, online training materials, and parent education materials and educates both pediatricians and parents about discipline, parenting, and other issues. Brochures on child development show parents that normal problematic child behaviors—from crying to climbing—arise from the child's normal growth and development and advocate that these behaviors be addressed with guidance rather than punishment. The Connected Kids program has not been

TABLE 2 Protective Factors

Dispositional/Temperamental Attributes of the Child	Warm and Secure Family Relationships	Availability of Extrafamilial Support
Above-average cognitive ability	Presence of a caring and supportive adult	Structured school environment
High ego control (high degree of impulse control and modulation)	Positive family changes (eg, family interventions, father no longer allowed on visitations)	Involvement with a religious community
Internal locus of control (belief in one's ability to control own destiny)		Involvement in extracurricular activities or hobbies
External attribution of blame (attribute cause to something outside oneself [eg, some external pressure])		Access to good health, educational, and social welfare services
Presence of spirituality		
Ego control and ego resilience (able to modify impulses and insulate themselves from environmental distracters)		
High self-esteem or sense of self-worth		

evaluated formally, but a study on implementation of Connected Kids was conducted in 2007 with 27 pediatricians over a 6-month period, with a focus on improving parental supervision and monitoring during middle childhood. Findings from the project indicate that the Connected Kids program is appealing to pediatricians, implementation is feasible, and use is sustainable over a period of 6 months. More information about the Connected Kids program is available at www.aap.org/connectedkids.

Practicing Safety, a program conducted by the AAP and funded by the Doris Duke Charitable Foundation, developed expanded anticipatory guidance modules for use in primary care offices. The 7 modules provide pediatricians with suggested assessment, guidance, and resources to help parents cope with crying, help them parent, ensure their children's safety when they are in the care of others, improve the family environment, provide effective discipline, assist with sleeping and eating, and help with toilet-training (www.aap.org/practicingsafety). The program was tested in 8 practices in New Jersey and Pennsylvania, and parent and staff reports showed a significant increase in maternal depression screening. Staff reports also showed an increase in discussion and use of resources on coping with crying, discipline, and toilet-training. The toolkit was revised and was implemented by 14 practices in the AAP Quality Improvement Innovation Network (QuIIN); the next steps are being developed.

Community Prevention Programs and Resources

Home-visitation programs, in which targeted families receive regular contact with trained personnel, are a prevention model that has been widely used and are supported by the AAP.[62] The Nurse-Family Partnership model developed by Olds et al has been rigorously tested.[63] The model, which uses trained nurses, has demonstrated improvements in maternal and child functioning and showed a trend toward reduced childhood mortality rates from preventable causes.[64] On the other hand, Healthy Families, a home-visitation program that uses trained paraprofessionals, has been tested in a number of states, but it has not been shown to reduce child abuse or child abuse risk factors.[65–67] Cincinnati's "Every Child Succeeds" program used both the Nurse-Family Partnership model and the Healthy Families model and provided home-visiting to mothers at high risk (adolescent, unmarried, low income, or suboptimal education) and first-time mothers. They found that intensive home-visiting reduced the risk of infant death during the first year of life.[68] The Task Force on Community Preventive Services found that, in the 21 programs for which records were available, home-visiting was associated with a median reduction in child abuse of more than 50%.[69–71]

Although pediatricians have long been familiar with therapeutic preschools and with parenting programs, study results have suggested that these interventions are more effective when multiple modalities are combined with those that target the entire family. Reynolds and Robertson[72] reported that participation in school-based child-parent centers, which provided extensive family education and support, reduced maltreatment by 50% in a population at high risk. Other study results have shown significant effects when community-based parent-child interventions are targeted at specific populations, combine peer and professional support, and provide some services directly to the children.[73]

Parent-training programs, such as the Triple P program, Sure Start, Family Connections, Healthy Families America, and Together for Kids, aim to improve parenting skills and parents' emotional adjustment. The quality of the programs, however, is variable. The Triple P program resulted in a positive reduction of maltreatment in 1 study,[74] but the program needs to be replicated and reassessed to determine its effectiveness.[63] A comparison of the effectiveness of parent-training programs is available through the *Cochrane Database of Systematic Reviews*.[75,76] More information about child abuse—prevention programs, local resources, and program evaluation can be found at www.childwelfare.gov/preventing/programs/types/homevisit.cfm.

The Role of Pediatricians

It is important for pediatricians to recognize and respond to ongoing maltreatment. Universal prevention of child maltreatment must begin with an approach that assesses the caregivers' strengths and deficits and connects the family with community resources that will protect the dependent children before abuse or neglect occurs. The schedule of routine health care visits recommended by the AAP provides ample opportunity for the clinician to observe and assess parenting practices at the very times when a child would be expected to initiate new and possibly challenging behaviors.[77]

The third edition of *Bright Futures* (http://brightfutures.aap.org/about.html) from the AAP provides pediatricians with guidelines for anticipatory guidance and prioritizes topics for discussion at each health supervision visit. This multimedia program includes the *Bright Futures* guidelines in a manual format, pocket guide, and personal digital assistant (PDA) version in addition to toolkits, PowerPoint presentations, and health-promotion information sheets.

A clinician may receive answers or observe behaviors that suggest the family's resilience is compromised in some significant way. Such compromise may derive from child factors, parental deficits, or environmental stressors. If the family's ability to nurture and protect the child is compromised, that child must be considered at risk for abuse, and action should be taken. Unless the child is felt to have been abused in some way, such action rarely entails referral to child protective services but frequently goes beyond the scope of a typical office visit. Efforts may be as straightforward as taking the time to elicit a more comprehensive history or counseling a frustrated parent. A more complicated case may involve referral to a community agency for evidence-based parent training or for intervention for intimate partner violence. If there is significant doubt about the child's safety, the caregivers' ability to protect, or maltreatment is suspected, the pediatrician should, of course, contact child protective services.

TABLE 3 Incorporating Primary Child Maltreatment Prevention Into the Health Supervision Visit

	Parent Coping Skills and Support System
Prenatal or first visit	Who lives in the home? History of mental health problems, substance abuse/alcohol abuse, or intimate partner violence?
	How were the parents parented and disciplined?
	What were the parents' experience(s) with trauma?
	Are there financial problems and/or poverty?
	Was the pregnancy planned?
	Who will care for the infant?
Newborn	Infant crying
	Expectations
	Identify 3 friends or family members who can help (safety line)
First months	Infant crying
	Normal development and expectations
	Maternal depression
	Identify 3 friends or family members who can help (safety line)
	Loving is not "spoiling"
Cruiser/toddler	Discipline = teaching
	Toilet-training
	Normal development and age-appropriate expectations
Preschool	Teach child names for genitalia
	Safe touch/unsafe touch
	Normal sexual behavior
	Normal development and age-appropriate expectations
	Discipline = teaching
	Model nonviolent anger management and conflict resolution
School	Discipline = teaching
	Model nonviolent anger management and conflict resolution
	Appropriate supervision
	Respect private parts of others and others to do the same
	Personal safety; peer pressure; Internet use
Adolescence	Discipline = teaching
	Dating violence
	Model nonviolent anger management and conflict resolution

Note that topics may be reintroduced at successive visits

GUIDANCE FOR THE PEDIATRICIAN

1. Obtain a thorough social history, initially and periodically, throughout a patient's childhood. The parent-screening tool included in the *Bright Futures* tool and resource kit (available at http://brightfutures.aap.org) can be used to help screen for risk factors and problems; identify and build on family strengths, resilience, and mediating factors; identify and address parents' concerns; and reinforce effective parenting.[78] Reinforcement builds strength and a sense of competence.
2. Acknowledge the frustration and anger that often accompany parenting. Provide anticipatory guidance about developmental stages that may be stressful or serve as a trigger for child maltreatment. A health visit framework can be helpful (see Table 3) or refer to the Connected Kids counseling schedule (http://aap.org/connectedkids).
3. Talk with parents about their infant's crying and how they are coping with it. Learn their perception of their infant's crying and which strategies they use to cope. The pediatrician should provide parents with insight into the infant's behavior and teach alternative responses.
4. When caring for children with disabilities, be cognizant of their increased vulnerability and watch for signs of maltreatment.[79,80] Provide families with information about the child's condition. Activities may include giving out handouts or having group instructional sessions with parents. Validate the parent's stresses and provide them with techniques to manage the stress. Provide the family with information about respite care, which allows someone else to care for the child so that the parents or other family members can take a break. Identify families at greater risk of abusing their child. Help educate older children about how to protect themselves against abuse and that they should share uncomfortable, abusive, or concerning experiences with a trusted adult.
5. Be alert to signs and symptoms of parental intimate partner violence[81] and postpartum depression. Instruments are available

that can be used by clinicians to identify depression in mothers and fathers.[37,82] Familiarize yourself with appropriate community resources, and know how to respond if a caregiver reports intimate partner violence or depression.

6. Guide parents in providing effective discipline.[83] Encourage parents to use alternatives to corporal punishment, such as time out techniques and positive reinforcement. Brochures such as those developed for the Connected Kids program (http://aap.org/connectedkids) and *Bright Futures* (http://brightfutures.aap.org) can be used to supplement this discussion.
7. Talk to parents about normal sexual development and counsel them about how to prevent sexual abuse. The AAP has developed an educational toolkit that helps health care professionals talk to parents and patients about sexual violence topics and provides them with educational materials and other resources (www.aap.org/pubserv/PSVpreview/start.html).
8. Encourage caregivers to use the pediatric office as a conduit to needed expertise. Become knowledgeable about resources in the community, and, when appropriate, refer families, especially stressed parents, to these resources.
9. Advocate for community programs and resources that will provide effective prevention, intervention, research, and treatment for child maltreatment and for programs that address the underlying problems that contribute to child maltreatment (eg, poverty, substance abuse, mental health issues, and poor parenting skills).
10. Advocate for positive behavioral interventions and supports in schools. Encourage schools to implement effective and supportive behavioral expectations and interventions. (More information about school-based positive behavioral interventions and support can be found at www.pbis.org.)
11. Recognize signs and symptoms of maltreatment and report suspected maltreatment to the appropriate authorities.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Community Health Services

The Pediatrician's Role in Community Pediatrics

ABSTRACT. This policy statement reaffirms the pediatrician's role in community pediatrics. It offers pediatricians a definition of community pediatrics and provides a set of specific recommendations that underscore the critical nature of this important dimension of the profession. ***Pediatrics*** **2005;115:1092–1094;** ***community, pediatrics, pediatrician, role of, definition of, profession.***

ABBREVIATION. AAP, American Academy of Pediatrics.

INTRODUCTION

Today's children and families live in a period of rapid social change. The economic organization of the health care and other human service systems in the United States is undergoing profound changes. Pediatric training programs are searching for the optimal blend of knowledge, skill, attitudes, and experience to prepare tomorrow's pediatricians for the new challenges and morbidities that they will face.[1–3] As clinicians and educators encounter new demands on their expertise and resources, it is important to reaffirm the vital and long-standing role of pediatricians in promoting the physical, mental, and social health and well-being of all children in the communities they serve.

DEFINITION OF COMMUNITY PEDIATRICS

The American Academy of Pediatrics (AAP) offers a definition of community pediatrics to remind all pediatricians, generalists and specialists alike, of the profound importance of the community dimension in pediatric practice. Community pediatrics is all of the following:

- A perspective that enlarges the pediatrician's focus from one child to all children in the community;
- A recognition that family, educational, social, cultural, spiritual, economic, environmental, and political forces act favorably or unfavorably, but always significantly, on the health and functioning of children;
- A synthesis of clinical practice and public health principles directed toward providing health care to a given child and promoting the health of all children within the context of the family, school, and community[4];
- A commitment to use a community's resources in collaboration with other professionals, agencies, and parents to achieve optimal accessibility, appropriateness, and quality of services[5] for all children and to advocate especially for those who lack access to care because of social, cultural, geographic, or economic conditions or special health care needs[6,7]; and
- An integral part of the professional role and duty of the pediatrician.

For many pediatricians, efforts to promote the health of children have been directed at attending to the needs of particular children in a practice setting, on an individual basis, and providing them with a medical home.[8] This approach, in combination with pediatricians' own personal community interests and commitments, has proven to be very successful. Increasingly, however, the major threats to the health of America's children, the new morbidities,[9] arise from problems that cannot be addressed adequately by the practice model alone.[10] These problems include high infant mortality rates, children with chronic health care needs, obesity, disproportionately high levels of intentional and unintentional injuries, exposure to lead and other environmental hazards, substance abuse, behavioral and developmental consequences of inappropriate care and experience, mental health conditions, poor school readiness,[11]family dysfunction, sexually transmitted diseases, unwanted pregnancies, and lack of access to medical homes.[12] An integral component of a community-pediatrics approach incorporates interdisciplinary practice. As former AAP president Robert Haggerty, MD, FAAP, reminded us in 1995, "we must become partners with others, or we will become increasingly irrelevant to the health of children."[13]

Communities should impart a sense of health, safety, and well-being and promote a supportive environment for families of all types. Just as children depend on the interaction of families in which they live, the communities that support them affect families. The health and welfare of children depend on the ability of families and the community support system to foster positive emotional and physical development.[14] Recently the AAP's Task Force on the Family examined the concept of family pediatrics and the discipline that must be practiced within the context[15] of the community.[16,17]

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Pediatricians remain instrumental in efforts to create, organize, and implement changes in communities' efforts that can substantially improve the health of children. As far back as Abraham Jacobi, MD (1830–1919), a leading child advocate of his time and a founder of the discipline of pediatrics, pediatricians recognized that children are best understood, and their needs attended to, within interlinking contexts of biology, family, and community.[18] More recently, Haggerty identified the unique contribution and focus of community pediatrics:

> Community pediatrics [has sought] to provide a far more realistic and complete clinical picture by taking responsibility for all children in a community, providing preventive and curative services, and understanding the determinants and consequences of child health and illness, as well as the effectiveness of services provided. Thus, the unique feature of community pediatrics is its concern for all of the population—those who remain well but need preventive services, those who have symptoms but do not receive effective care, and those who do seek medical care either in a physician's office or in a hospital.[19]

With the sweeping changes occurring in medicine and other human services, it is especially important now for pediatricians to reexamine and reaffirm their role as professionals in the community, as community pediatricians, and prepare themselves for it just as diligently as they prepare for traditional clinical roles.

RECOMMENDATIONS

1. Pediatricians should use community data (epidemiologic, demographic, and economic) to increase their understanding of the health and social risks on child outcomes and of the opportunities for successful collaboration with other child advocates.
2. Pediatricians should work collaboratively with public health departments and colleagues in related professions to identify and decrease barriers to the health and well-being of children in the communities they serve.[20,21]
3. Pediatricians should become comfortable with an interdisciplinary collaborative approach and advocacy effort to child health. Pediatricians can play an important role in coordinating and focusing new and existing services to realize maximum benefit for all children.[22,23]
4. Pediatricians and other members of the community should interact and advocate to improve all settings and organizations in which children spend time (eg, child care facilities, schools, youth programs). School and community resources should be considered as assets in developing strategies for the problems that children will face now and throughout their lives.
5. Pediatricians should nurture and advocate for neighborhood structures that support healthy families capable of promoting optimal health, safety, and development in their children.
6. Pediatricians should advocate improving the effectiveness and efficiency of health care for all children, striving to ensure that every child in the community has a medical home.
7. Pediatricians should educate themselves concerning the availability of community resources that affect the health and well-being of the children they serve.
8. Pediatricians are encouraged to become involved in the education of residents and medical students in community settings. Pediatricians have the unique opportunity to model roles outside the traditional clinical roles that students and residents encounter. Pediatric academicians should use resources from the AAP and the Ambulatory Pediatric Association to engage the community pediatrician as an educator, both in the care of individual patients in community-based practice and in roles related to promotion of the well-being of all children in the community. Community-based resources outside the bounds of the traditional hospital and outpatient office setting should be used to instruct residents in the effect of the community on child health status and the positive effect of interdependent collaboration of community agencies with health professionals on child health.[24]
9. Medical student, resident, and continuing medical education programs should consider and periodically review basic community pediatric competencies to be included in training and maintenance of certification efforts for pediatricians.[25]
10. AAP chapters and their members should provide leadership for furthering the understanding of community pediatrics and encourage participation in creative, community-based, integrated models such as those supported through the Community Access to Child Health program and the Healthy Tomorrows Partnership for Children.
11. AAP chapters should provide leadership, support, and recognition for pediatricians involved in advocacy efforts at the local, state, and national levels to ensure that children have access to care and to foster integration of these activities as an integral part of the professional role and duty of the pediatrician.

Caring, compassionate, and knowledgeable pediatricians should address the needs of their patients and all children in the context of the community.

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SUGGESTED READINGS

American Academy of Pediatrics, Committee on Children With Disabilities. Role of the pediatrician in family-centered early intervention services. *Pediatrics*. 2001;107:1155–1157

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Children With Disabilities

The Pediatrician's Role in Development and Implementation of an Individual Education Plan (IEP) and/or an Individual Family Service Plan (IFSP)

ABSTRACT. The Individual Education Plan and Individual Family Service Plan are legally mandated documents developed by a multidisciplinary team assessment that specifies goals and services for each child eligible for special educational services or early intervention services. Pediatricians need to be knowledgeable of federal, state, and local requirements; establish linkages with early intervention, educational professionals, and parent support groups; and collaborate with the team working with individual children.

ABBREVIATIONS. IDEA, Individuals With Disabilities Education Act; IEP, Individual Education Plan; IFSP, Individual Family Service Plan; OHI, Other Health Impaired.

Special education in each local school district is protected and regulated by strong legislative and judicial safeguards created by the federal Education for All Handicapped Children Act (PL 94–142). This act was reauthorized in the 1991 legislation PL 101–476 under the new title, Individuals With Disabilities Education Act (IDEA), which has four key components: 1) identification of children with learning-related problems; 2) evaluation of the health and developmental status of the child with special needs, determining current and future intervention requirements, and developing a plan to match services to needs; 3) provision of services that include educational and related services; and 4) guaranteed due process.[1] These federally legislated safeguards establish that children with disabilities and their parents share the same legal right to a free and appropriate education as children without disabilities.

Federal legislation requires that each child recognized as having a disability that interferes with learning has a written plan of service: an Individual Education Plan (IEP) for children aged 3 through 21 years, an Individual Family Service Plan (IFSP) for infants and toddlers birth through 3 years, and a Transitional Services Outcome Plan for young adults at 16 years of age. Federal legislation defines transition from school as a coordinated set of activities for a student designed to promote movement from school to postschool activities, including postsecondary education, vocational training, integrated employment, continuing and adult education, adult services, independent living, and community participation. This transition plan highlights and validates the lifelong needs of individuals with disabilities and is the beginning of an integrated program that enables adults with disabilities to live, work, and play in our towns and cities.[2] The pediatrician is in a key position to participate in planning services and to provide care for these children and young adults.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

BACKGROUND

The Individual Education Plan (IEP)

In 1975 Congress enacted PL 94–142, the Education for All Handicapped Children Act, as an educational bill of rights to assure children with disabilities a free and appropriate education in the least restrictive environment. In 1977 implementation of services was extended to children 3 to 21 years old, although services for children aged 3 to 5 years remained optional. States were also requested to identify children who had not previously received services.

PL 94–142 (currently Part B) allowed children with mental retardation, hearing deficiencies, speech and language impairments, specific learning disabilities, visual impairments, emotional disturbances, orthopedic impairments, and a variety of medical conditions that may interfere with education (categorized as Other Health Impaired [OHI]) to receive special education services. To meet the eligibility criteria, a child's disability must interfere with the educational process and normal school performance to the extent that special education assistance is needed.

Other portions of the law provide the following:

1. Every child must have a multidisciplinary evaluation by a team. This team, working in collaboration with the family, is responsible for designing an IEP that has specific education and therapeutic strategies and objectives. Each plan must be reviewed annually.
2. Every child must be educated in the least restrictive environment. This criterion supports the concept of integrating children with and without disabilities as much as possible and with extra supports and services when necessary to facilitate inclusion.
3. The evaluation team may recommend the following related services: transportation; developmental, corrective, and other supportive services (in-

cluding speech pathology, audiology, psychological services, and physical and occupational therapy); recreation (including therapeutic recreation); and social work services (including rehabilitative counseling) and medical services (for diagnostic and evaluative purposes only). These services may be required to assist a child to benefit from special education and include early identification and assessment of disabling conditions.[3] If the parents approve the IEP, they sign a document and the school is committed to providing these outlined services.

4. The rights of the parents and child to "due process" shall be protected. This ensures the parents' rights to be involved in developing the educational plan and for the meeting to be conducted in their native language or other mode of communication if it is not a written language understandable to the general public. The IEP/IFSP team leader is responsible for arranging and paying for an interpreter if English is not the native language of the home or if the parent has a hearing impairment. Furthermore, parents have the right to appeal when they view the team's decision as inappropriate or harmful.

The Individual Family Service Plan (IFSP)

In 1986 Congress enacted the Education of the Handicapped Act Amendments, PL 99–457.[4] It was reauthorized in PL 105–17 in 1997. Part C of this reauthorization legislation, formerly known as Part H, called for the creation of statewide, coordinated, multidisciplinary, interagency programs for the provision of early intervention services for all infants and toddlers with disabilities. Although the law did not mandate these services, partial reimbursement of costs was made readily available to states that wished to participate. All states have established programs for children birth to 3 years. These developmental services are designed to meet needs in the areas of physical, cognitive, communicative, and psychological development, and in self-help skills. The purpose of these services is to enhance the development of the infant and toddlers with disabilities; to minimize their potential for developmental delay; and to optimize the abilities of the families to meet the special needs of their children. It was also hoped that this would minimize the cost over time of special education services when youngsters attained school age, decrease the need for institutionalization, and enhance the potential for independent living.

The law requires each state to create its own definition of developmental delay as a basis for determining eligibility for services. Pediatricians played a significant role in determining this eligibility by advocating for a broad definition of developmental delay. Services are provided for children with developmental delay, as well as for those whose biological conditions have a high probability of having a delay. In addition, states have the option to provide services to those children who are at risk of manifesting developmental delays attributable to environmental factors.

A major difference between Part C of PL105–17 and Part B of PL94–142 is that Part C focuses on the involvement of the family and supports for the family. Under this law, the evaluation, assessment, and planning take place with family participation and approval. Early intervention services are all optional, subject to family approval, and are provided in natural settings such as the parents' home and child care settings as well as more formal child development programs. The current discussions about early brain development center around children from birth to 3 years. It is during this period that the growth and organization of the brain is most influenced by environmental factors that Part C strives to make optimal.

Children referred as potentially eligible receive a comprehensive multidisciplinary assessment. The assessment describes the abilities and needs of the child and family. Following assessment, an IFSP is created, to include the following:

- the child's present attainments,
- family strengths,
- how to enhance development of the child,
- major outcomes expected, including the outcome measures and criteria, and time lines to achieve specific goals,
- specific early intervention services that the child and family will receive,
- projected dates for initiating services and their duration,
- name of the service coordinator responsible for coordinating and helping the family implement the plan,
- steps to help the child and family with the transition to school services at an appropriate time.

The statute specifies a wide array of other services, but the only health services included are those that are "necessary for the infant or toddler to benefit from other early intervention services." Diagnostic and consultative medical services are also included, but the extent to which these services are funded by the early intervention program varies.

MEDICAL ROLE AND RECOMMENDATIONS

Several roles for the pediatrician exist under IDEA. All pediatricians should ensure that in their practices, every child with a disability has access to the following services:

1. A medical home.[5,6] A medical home provides care that is accessible, continuous, comprehensive, family-centered, coordinated, and compassionate. For children with special health care needs, many of whom have an IEP or an IFSP, the pediatrician's central role as the provider of primary care means that he or she would participate in the plan development. In addition, the pediatrician should collaborate with community resources in treatment planning and in promoting early intervention programs that work.
2. Screening, surveillance, and diagnosis.[7,8] The pediatrician should screen all children from the first encounter, checking for risk or existence of a disability or developmental delay. Pediatricians are

in key positions to identify at the earliest possible age those children who may benefit from services under IDEA. Pediatricians should provide screening and surveillance using a combination of methods best designed to take advantage of multiple sources of information.

3. Referral. The pediatrician should be knowledgeable about the referral process to early intervention programs in his or her community and knowledgeable about the parents' right for multidisciplinary team evaluation by the school- or state-designated agency if a disabling condition may be present. In addition, some of the best support of parents comes from other parents who are able to offer emotional and social support and practical advice. Many communities have programs in which parents support each other and help parents new to the system better navigate the system.[9] Family Voices, a nationwide grassroots network of families and friends speaking on behalf of children with special health care needs, is a creditable organization that can assist parents and pediatricians and is accessible by telephone and the Internet (1–888-835–5669; www.familyvoices.org).
4. Diagnosis and eligibility. For early intervention, the pediatrician has an important role in the identification of children with established delays and in the diagnosis of conditions with a high probability of developmental delay, which will qualify a child for this program. Each state has developed a definition of these conditions, which should be obtained from the state's lead agency for this infant and toddler program. In addition, some states include "at risk" conditions as defined by the state as eligible for services. Further information about these issues can be obtained from the single point of entry into Part C locally or the state's lead agency. A list of lead agencies for state early intervention services can be obtained from the National Childhood Technical Assistance System (919/962-2001; www.nectas.unc.edu/).
5. Participation in assessment. A child identified through screening or observation as meeting the definition for developmental delay should receive a comprehensive multidisciplinary assessment. The pediatrician has an important role as a referral source or, if more extensive participation is elected, as a member of the multidisciplinary team. Few pediatricians have the flexibility in their schedules to participate in person in lengthy team meetings. Usually, these meetings are scheduled with a short lead time and at the convenience of the educators arranging them. However, all pediatricians should offer to be available by written communication or participate by conference call or other means to offer input to and receive feedback from the assessment team. Ideally, the pediatrician should be a member of the team and attend the IEP/IFSP meeting.
6. Counsel and advice. During the assessment process, families will need a knowledgeable person for medical advice and counsel. Pediatricians can alert parents to the benefits of a pre-IFSP or pre-IEP conference; of their right to sign the IFSP or IEP only when they are comfortable with the recommendations; and their right to have a friend or other advocate at the IFSP and IEP conference. Although a parent may bring their personal attorney to the conference, most parents do not. If an attorney is going to attend on behalf of the family, the family should notify the school agency of that fact before the meeting to give the school an opportunity to have their legal counsel or top administrator scheduled for the conference. The appeal process begins at the district school board where the child resides. The president of the school board and superintendent of schools should receive the written appeal document. If appeal at the district level fails to satisfy the family's concerns, their next appeal is to the State Board of Education. Rarely does an appeal by either the school district or family go to state or federal supreme courts. Each district school board has a published document that advises parents of procedural safeguards, which can be obtained at no cost to the family. Most assessment teams nominate a member as service coordinator to work with the families. A strong link should be developed between the assessment team and the primary care pediatrician, as well as an open sharing of concerns between parents, the pediatrician, and the assessment team.
7. Creation of the IEP and IFSP. Pediatricians who participate in the assessment process should be consulted by the assessment team when these documents are created. Such consultation is vital to preparing an appropriate and effective plan. The pediatrician should review the plan developed, counsel the family, and comment on health-related issues as needed. The pediatrician should determine if the health-related services proposed are appropriate and sufficiently comprehensive and assist parents in performing their advocacy tasks when there is evidence of inappropriate planning. Ideally, when schools or educational agencies are developing the IEP or IFSP, a pediatrician should serve as a member of the assessment team.
8. Coordinated medical services. When medical services are part of the IEP or IFSP, they should be conducted by the primary care pediatrician or an appropriate pediatric subspecialist. Medical services and communication should be coordinated by the primary care pediatrician or his or her designee in those cases in which the children have complex medical needs involving several physicians or centers. Special education personnel should be made aware of the restrictions of health care insurance including limited referral options and the role of the primary physician as "the gatekeeper" in some programs.
9. Advocacy. Pediatricians have many local and state opportunities to serve as knowledgeable, thoughtful advocates for improved community and educational services for children with disabilities. Pediatricians who select this role need to be aware of the structure of services in the commu-

nity and the key persons who implement them. Examples of advocacy roles for pediatricians include participation in the local or state early intervention interagency council, consulting with the local school system or state department of education, or becoming a school board member.

CONCLUSION

Participation in interdisciplinary efforts for children with disabilities can help the pediatrician focus on the needs of the child with disabilities or developmental delay and improve the coordination of all forms of service and care for the child and the child's family.[10] The pediatrician's role in IEP and IFSP development and implementation includes knowledge of federal statutes and state and local mandates and regulations; establishing linkages with local early intervention and education professionals and parental support groups; and collaborating with the team serving the individual child. Collaboration among parents, pediatricians, and educators can lead to better quality of care and paves the way for a better quality of life for the child and young adult with a disability.

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POLICY STATEMENT

The Pediatrician's Role in Family Support and Family Support Programs

abstract

FREE

Children's social, emotional, and physical health; their developmental trajectory; and the neurocircuits that are being created and reinforced in their developing brains are all directly influenced by their relationships during early childhood. The stresses associated with contemporary American life can challenge families' abilities to promote successful developmental outcomes and emotional health for their children. Pediatricians are positioned to serve as partners with families and other community providers in supporting the well-being of children and their families. The structure and support of families involve forces that are often outside the agenda of the usual pediatric health supervision visits. Pediatricians must ensure that their medical home efforts promote a holistically healthy family environment for all children. This statement recommends opportunities for pediatricians to develop their expertise in assessing the strengths and stresses in families, in counseling families about strategies and resources, and in collaborating with others in their communities to support family relationships. *Pediatrics* 2011;128:e1680–e1684

COMMITTEE ON EARLY CHILDHOOD, ADOPTION, AND DEPENDENT CARE

KEY WORDS
family support, social emotional health, counseling, community resources

ABBREVIATION
AAP—American Academy of Pediatrics

INTRODUCTION

The health and welfare of children depend on the ability of their families, supported by systems in their communities, to foster positive emotional and physical development. Recent scientific research confirms that brain growth and neurophysiologic development during the first years of life respond directly to the environmental influences of early emotional relationships. The neurologic pathways produced then have profound effects on the behaviors of children and adolescents and affect their interactions within their families and extended society across the life course. The enormous effect the family has on this developmental process led the American Academy of Pediatrics (AAP) to make the "promotion of nurturing families for all children" a priority among AAP resolutions in 1993 and 1994 and, subsequently, to develop the AAP Task Force on the Family. The task force published a thorough and extensive report in 2003 that informs pediatricians and guides policy-makers regarding the effect that family has on children's functioning and the expectations for pediatricians to promote optimal family functioning for their patients.[1] Pediatricians play a unique role as family health advisors during the formative period of a child's development and during crucial developmental stages throughout childhood and adolescence. Pediatricians need expertise in working with families to identify strengths, stresses, and needs and to identify priorities and

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goals with families. They also need to develop expertise in counseling skills and knowledge regarding community-based resources to offer strategies and resources to families. The structure and support of families involve forces that are often outside the agenda of the usual pediatric health supervision visits. Pediatricians must ensure that their medical home efforts promote a holistically healthy family environment for all children.[2]

CHANGES IN FAMILIES

Stresses accompanying contemporary American life can challenge families' efforts to promote successful developmental and emotional outcomes for their children. The structure of families and patterns of family life in the United States have changed profoundly in the past quarter century. Five percent of all births in 1960 were to unmarried women; this figure increased to almost 37% by 2005.[3] Since 1960, the divorce rate has more than doubled[4]; 40% to 50% of all first-time marriages end in divorce.[5] Divorce rates seem to have leveled overall since the 1980s, but factors exist that increase the risk for some couples (eg, lower educational level or younger age at the time of marriage).[6] Although remarriage rates are high, more than one-third of remarried couples divorce again.[7] As a consequence, approximately 14% more children are now living in 1-parent households than approximately 40 years ago (25.8% in 2007 versus 11.8% in 1968).[8]

Another change in family life is that, by 2005, approximately 63% of all mothers with preschool-aged children were in the labor force, which reflects a twofold increase since 1970.[9] Three-fourths of the mothers of school-aged children work.[10] In 2-parent households, this means a marked increase in homes in which both parents work. Despite the majority of American mothers being in the workforce, half of female-led single-parent households lived below the poverty level in 2004.[9] A decline in the purchasing power of family income and the lack of comparable wages for women have added to the stress on families. Social disparities have also contributed to the growing percentage of children who live in poverty, and poverty is the strongest predictor of poorer health and well-being for children.[1,11] Residential mobility has separated many families from the natural support systems provided by their extended families, which may leave parents feeling socially isolated and prevents the intergenerational transmission of cultural and community-specific advice and support. Economic and social inequalities have led to increasingly impoverished neighborhoods, more working families living in or near poverty, and weakening of community ties. Longer hours away from their children, disconnection from close extended family support, and disintegration of traditional community interdependence all reduce the time, energy, and external supports available for rearing healthy children. The stress and speed of social change has weakened the support systems for many American families.[12]

RESILIENCE IN FAMILIES

Despite these enormous pressures working against families, intact and successful families do exist. Although it is evident that the risk of poorer outcomes for children is lowest among 2-parent households,[13] there is not a specific family constellation that makes poor outcomes inevitable. How a family influences children's outcomes is embedded within the interactions among its members. Table 1 lists characteristics that positively contribute to a family's success in raising children and, ultimately, to communities and society.[14]

TABLE 1 Characteristics of Successful Families[14]

Clear, open, and frequent communication
Encouragement of individual members
Expressing appreciation
Commitment to family
Religious or spiritual orientation
Social connectedness to external resources
Ability to adapt to stressors
Clear roles within the family
Time together that is of high quality and quantity

SUPPORT PROGRAMS: WHAT PEDIATRICIANS NEED TO KNOW

Social institutions have begun to offer various family support services to help parents carry out essential functions on behalf of their children. Many pediatricians have perinatal exposure to families who need community-based support for a variety of reasons, and all community pediatricians begin providing comprehensive health services for children as soon as they are discharged from the newborn nursery. Many pediatricians are already familiar with some types of family support programs. Examples of successful programs include prenatal and infant home visitor programs, comprehensive early childhood education programs (eg, Early Head Start, Head Start), early screening and referral programs, crisis care programs, parent support and/or education groups, early reading and parental literacy, and early intervention programs for children with special needs (eg, Individuals With Disabilities Education Act, Part C).[1,10,15–18] Because of significant variability regarding the effectiveness of available support programs, pediatricians should be aware of the evidence base for different types of programs and, specifically, the programs available in their communities. Home visitation programs, for example, can lead to improvements for families (eg, detecting postpartum depression, reducing the frequency of unintentional injury, improving parenting skills), but the relative effect depends on the qual-

ities of the program; for example, programs that use professionals (ie, nurses) rather than paraprofessionals[19] and programs targeted at specific populations (eg, infants born prematurely) have more measurable effects on child outcomes.[20]

Many comprehensive, community-based family support programs have been established around the country. These programs aim to support family relationships and promote parental competencies and behaviors that contribute to parental and infant/child/adolescent health and development. The best programs offer a spectrum of services that involve informal and structured groups. Topics may include information on child development, personal growth, family relationships, parenting education, peer support groups, parent-child activities, early developmental screening, community referral and follow-up, job skills training, and/or adult education, especially language and literacy education.[21,22] Services should be available to all families regardless of economic or ethnic background. The programs operate on the premise that no family is entirely self-sufficient and that most can benefit from some external support.[23] Pediatricians should search for, become familiar with, and refer families to high-quality family support services in their communities.

Some schools are providing after-school programs for children whose parents cannot be at home when classes end; others are providing school-based or associated health services to ensure that children receive timely health care and counseling. School curricula have expanded to include topics such as conflict resolution, sex education, and community service. Some employers offer family-oriented benefits such as flexible work hours, shared jobs, and child care. Religious congregations in some communities have developed a full array of social services and supports. The Family and Medical Leave Act of 1993 is an example of government acting in support of families, as are more established programs such as the Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Temporary Assistance for Needy Families (TANF).

PRINCIPLES OF FAMILY SUPPORT PROGRAMS

High-quality programs operate on the following principles[1,24,25]:

- The primary responsibility for the development and well-being of children lies within the family.
- Families are part of a community, and support should be provided in the context of community life and through collaborative links with community resources.
- The kinds of support provided should be determined by individual and community needs. Although participation should be voluntary, it should be encouraged for at-risk families such as those led by single and/or socially isolated parents and those living in poverty.
- Support offered by friends, neighbors, and community-based resources is as vital as access to professional support services. Families are resources for themselves, for other families, and for communities and programs.
- The support given should enhance the strengths found within the family unit and among family members and empower families to use those strengths. The aim of support is to strengthen the family unit and the community while preventing alienation and family dysfunction.
- Support is available for all families and provided with an awareness of and sensitivity toward the culture, race, and native language of families and communities.

Family support programs play an important and, in some instances, essential role in promoting the positive functioning of families and ensuring the well-being of children. Their effectiveness, at least with certain populations (eg, low-income families, young single mothers, low birth weight infants, children with behavioral problems, children with special health care needs) is well documented.[17,20,26] All families need knowledge, skills, and support to raise their children and to foster normal growth, development, and learning. The AAP encourages public policies, professional practices, and personal behavior that support the caregiving role of families, advocate comprehensive approaches to child health and encourage prevention and early intervention strategies oriented toward the family.

RECOMMENDATIONS

1. Pediatricians should be aware of the increasing number of families experiencing stress and should learn to recognize situations (eg, maternal depression) that interfere with successful child rearing. The AAP *Bright Futures* guidelines recommend using open-ended questions to screen for and assess family stress during health supervision visits, with sample questions provided to probe for stressors such as parental depression, domestic violence, separation/divorce, and substance abuse. In addition, *Bright Futures* has a chapter titled "Promoting Family Support," which outlines the importance of family development to a child's overall growth and development.[27]
2. As medical homes, pediatric practices should collaborate with patients and their caregivers and provide family-centered care with an

awareness of cultural diversity. By having open and ongoing relationships with parents, pediatricians can facilitate discussions; monitor and guide developmental progress; address parental concerns; and support parental care, capacities, and needs. Focus should be on fostering those characteristics (Table 1) known to be associated with successful family functioning.

3. Pediatricians should interview families with a real awareness of the significant influence that family factors (socioeconomic status, discipline style, cultural beliefs, parental health and mental health, etc) have on children's development and behavior.[28] Continuing medical education programs on pediatric family interviewing and psychosocial issues in pediatric practice can enhance the pediatrician's skills and opportunities for counseling families. As recommended by the Task Force on the Family, the AAP advocates for pediatricians to have "adequate time, resources, billing options, and reimbursement to provide family-oriented care."[1]
4. Pediatricians can provide family support by engaging in a relationship with parents based on collaboration and shared decision-making so that parents feel and become more competent. The AAP provides pediatricians with guidance for supporting families in the prevention of violence and injury and the enhancement of parent-child communication on the basis of individual families' needs in the Connected Kids program (www.aap.org/ConnectedKids/ClinicalGuide.pdf). This collaboration with parents might also be in the form of parent councils and other partnerships that allow parents to provide input to practices and programs.
5. Pediatrician counseling of parents should include considering the needs and resources of the family and helping them benefit from the support of members of extended family and the community.
6. Pediatricians should work to identify, develop, refer to, and participate in community-based family support programs to help parents secure the knowledge, skills, support and strategies they need to raise their children. Having information easily available for families within the pediatric office that includes information and schedules of parenting classes, volunteer and community organizations incorporating family participation, and child care resources is also extremely helpful. The Maternal and Child Health Library provides an online directory to assist families and health providers to locate services within their own communities (www.mchlibrary.info/KnowledgePaths/kp_community.html).
7. Pediatricians should actively participate in sustaining the social capacity of their communities through their personal participation in local recreational, social, educational, civic, or philanthropic activities and associations. By participating in community-based family support programs, pediatricians can provide technical advice on health and safety aspects of services, serve as a source of professional information for families, and learn from these programs how best to contribute to the healthy development of children, families, and communities.
8. Pediatricians need to work within their communities to develop plans for identifying and coordinating care for families in need of more extensive social support services. An opportunity the AAP provides that might support pediatricians in this endeavor is the Community Access to Child Health (CATCH) program. CATCH provides pediatricians funding, training, technical assistance, and networking opportunities to ensure that all children have access to needed health care services within their communities.[29]

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Barbara J. Howard, MD, Daniel D. Broughton, MD, and the Committee on Psychosocial Aspects of Child and Family Health

The Pediatrician's Role in the Prevention of Missing Children

ABSTRACT. In 2002, the *Second National Incidence Studies of Missing, Abducted, Runaway, and Thrownaway Children* report was released by the US Department of Justice, providing new data on a problem that our nation continues to face. This clinical report describes the categories of missing children, the prevalence of each, and prevention strategies that primary care pediatricians can share with parents to increase awareness and education about the safety of their children. *Pediatrics* 2004;114: 1100–1105; *missing children, runaway children, thrownaway children, family abduction, nonfamily abduction.*

ABBREVIATIONS. NISMART-2, Second National Incidence Studies of Missing, Abducted, Runaway, and Thrownaway Children, AMBER, American's Missing: Broadcast Emergency Response.

INTRODUCTION

Missing children are of considerable concern to parents, children, and the nation. In one study, nearly 75% of parents acknowledged worrying about their children being kidnapped, and 35% said they were very concerned.[1] The issue of missing children is complex and needs to be dealt with in the appropriate context. When considering how to counsel parents about this issue, it is important for pediatricians to have a good understanding of the problem.

Of the 837 055 missing persons reported in 2001,[2] it is estimated that 80% of them were children.[3] Fortunately, approximately 99% were found within hours or days by usual law-enforcement response. However, 7115 to 7534 children nationwide were missing for prolonged periods.

There are several categories of missing children. Most children reported missing are runaways and children taken by noncustodial parents, both of which are preventable events. A small but indeterminate number of children are abducted by nonfamily members. Most of these nonfamily abductions occur as a result of direct contact between the perpetrator and the child. However, with the increase in Internet use, an increasing number of children have been reported as missing through contact with people they have met only through this medium. Abduction of newborn infants has been nearly eliminated through additional security and educational measures implemented in hospitals.

Pediatricians have an important role in helping parents put the problem of missing children in perspective, recommending general safety measures to be discussed without frightening children or adults, advocating for services for dysfunctional families and for children after runaway events, and condemning the use of commercial techniques that exploit fears about missing children.

CATEGORIES OF MISSING CHILDREN

In 2002, the US Department of Justice released the *Second National Incidence Studies of Missing, Abducted, Runaway, and Thrownaway Children (NISMART-2)*.[4] Children who had been missing according to their families in 1999 were put into one of several categories: nonfamily abductions; family abductions; runaways or thrownaways (children forced to leave their homes by their parents); missing involuntary, lost, or missing; and missing benign explanation.

Nonfamily Abductions

According to the US Department of Justice, nonfamily abduction occurs when a nonfamily perpetrator takes a child by the use of physical force or threat of bodily harm or detains a child for at least 1 hour in an isolated place by the use of physical force or threat of bodily harm without lawful authority or parental permission or when a child who is younger than 15 years or is mentally incompetent, without lawful authority or parental permission, is taken or detained by or voluntarily accompanies a nonfamily perpetrator who conceals the child's whereabouts, demands ransom, or expresses the intention to keep the child permanently.[5] According to NISMART-2, more than 50 000 children and adolescents were taken in this manner in 1999.[6] Most victims of nonfamily abductions were girls (65%), and most were 12 years old or older (58%). Forty-six percent of the victims were sexually assaulted while missing. Most nonfamily abductions lasted less than 1 day (91%), with 29% lasting 2 hours or less. Less than 1% of children were not yet returned at the time of the study. Although much less common, classic nonfamily kidnappings pose the greatest risk of death or serious harm. According to law-enforcement statis-

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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tics, a few more than 100 children were kidnapped in this sense in 1999.[4] Although these numbers are small, the effects on the child, family, and community are enormous. All nonfamily abductions are part of a continuum. On one end are relatively brief episodes in which there is no physical harm to the victim. At the other extreme are the horrific cases of classic kidnappings that often grab the nation's attention.

The statistics on abductions are powerful reasons for teaching safety principles to older children, especially girls. As an example, the National Center for Missing and Exploited Children has developed a campaign to get kids to "know the rules"[7] when going out:

- Don't go out alone.
- Always tell an adult where you are going.
- Say "no" if you feel threatened.

These are good rules, because they lessen the risk for children and adolescents to develop serious problems from getting into situations in which they are most vulnerable to exploitation and harm, whether with unfamiliar people or as in "date rape."

We all can remember our parents and teachers giving admonitions such as "don't take candy from strangers," hoping to keep us safe. Unfortunately, we now know that most people who perpetrate these crimes on children are not strangers in the eye and mind of the child. A neighbor, a familiar face in a child's daily routine, or someone the child's parents know well enough to speak to or whose name the child knows is probably not viewed as a stranger by the child. The perpetrators usually understand and practice seduction techniques that make themselves appear nonthreatening to children. Such techniques include calling the child by name, becoming familiar with their family or friends to provide a sense of familiarity, and providing toys or sweets for enticement. Often, these perpetrators will ask the child for assistance in looking for something such as an address or a lost puppy, thus becoming a new "friend" or ally. In cases of long-term kidnappings in which the child was found alive, 85% of the victims did not consider the kidnapper to be a stranger. In at least 65% of the cases in which a child was found dead and the perpetrator was identified, it was clear that the child would not have considered the person a stranger.[8] These strategies make it ineffective to give simple instructions to children not to talk to or go with strangers, because these people do not seem to be strangers by the time the abduction occurs. Use of an "appropriate stranger" such as a police officer or a store clerk or manager may be of great assistance to a lost child. Careful supervision of children, screening of references of potential caregivers, and excellent communication between parent and child are the best defense. Children sense unease in inappropriate relationships and can report this as long as parents routinely take all of their concerns in life seriously rather than downplaying or shaming them. Children should also be taught from an early age that they need not kiss, hug, touch, or sit on the lap of anyone, relative or not, if they do not wish to. This respect for their comfort and wishes translates into self-respect and the ability to differentiate unwanted contacts without generating fear.

Runaways and Thrownaways

Most children reported as missing left of their own accord, often from adverse family or living situations. In fact, leaving home as an impulsive act of protest is very common, occurring in an estimated 1 of 7 children younger than 16 years in England, with 11% being younger than 11 years,[9] with girls leaving twice as often as boys.[10] Traditionally, most of these children were not reported as missing to national authorities, however, and were not included in national statistics from earlier surveys. In 1983, the Inspector General of the Department of Health and Human Services estimated that there were as many as 1 million and possibly more than 2 million runaways annually in the United States.[11] Children who run away commonly live in difficult situations such as poverty or reconstituted homes. Many of them were truant previously.

Runaway or thrownaway children missing for a prolonged time commonly were subject to physical abuse (up to 75%), sexual abuse (up to 20%),[12] or other harsh treatment from which they were seeking escape and felt they had no other way out. A variety of additional risk factors are more common among runaways than among other children and adolescents, including psychological problems, strained family relationships, school difficulties, and adverse peer-group pressure.[13] Up to 30% of runaway children ran away from foster care.[9] Runaways gone for a prolonged time are at risk of many medical and psychological problems including disease, crime (both as victims and perpetrators), injuries, alcohol use, illegal drug use (one third)[10] and selling, sexual contact, and death. They may pose for pornography or prostitute themselves to provide income to survive or be taken into prostitution as a form of "sheltering" relationship. As a result of this activity, they are at high risk of pregnancy and sexually transmitted diseases including human immunodeficiency virus infection. In urban areas, these children often join gangs or are involved in burglary or armed robbery and other crimes. The psychological effect of the coercive parenting they were receiving and their subsequent experiences can be severe. Many have learning disabilities and school failure and belong to deviant peer groups preceding the runaway event, which makes recovery more difficult.

NISMART-2 data about runaways show that 68% of runaways were 15 to 17 years of age, 28% were 12 to 14 years of age, and 4% were 7 to 11 years of age.[14] Runaway episodes are most likely to occur during summer (39%), with the runaway going more than 10 but no more than 50 miles from home (31%), and most were gone from 24 hours to 1 week (58%). Although many such episodes seem minor, 7% of runaways were missing from 1 to 6 months, 23% traveled more than 50 miles from home, and at least 9% traveled out of state. Many of the runaways are harmed during the episode, with 1% having been sexually assaulted or having had someone attempt to

do so and 4% having been physically assaulted or having had someone attempt to do so.

Preventing children from becoming runaways and thrownaways lies in detecting family situations that include behavior problems or coercive interactions, especially when discipline is inappropriately harsh. Early and ongoing intervention for these families can promote more positive understanding of their children and better strategies for coexisting. Often, these children are targeted for punishment for the act of running away or for the associated misdeeds of substance use, theft, or prostitution when what is really needed is medical and psychological treatment, family realignment, or foster placement. Pediatricians should support community shelter and hot-line programs for runaways (eg, the National Runaway Switchboard at l-800-621-4000) that provide comprehensive medical and psychological care. Quality follow-up care is also needed to monitor for psychological and family adjustment and long-term sequelae. Problems that warrant treatment include skin, respiratory, gastrointestinal, and genital infections; dental disease; accidental or inflicted trauma; lack of immunizations; poor nutrition; and pregnancy in addition to preexisting and subsequent learning and psychological disorders.[13] On reunion, if it is possible, the entire troubled family needs to be addressed. The pediatrician needs to work as part of a team with the goal of long-term recovery for these children.

Family Abductions

One of the most prevalent categories of missing children is abduction by a noncustodial parent or unauthorized extended visits with family members. NISMART-2 research found that 203 900 children each year were victims of family abduction.[15] Thirty-five percent of these children were 6 to 11 years of age, 23% were 3 to 5 years of age, 21% were younger than 2 years, and 17% were 12 to 14 years of age. Thirty-five percent of abductions occurred in the summer, 26% occurred in the fall, 24% occurred in the winter, and 15% occurred in the spring. Twenty-four percent of these abductions lasted 1 week to 1 month, and less than 1% of children were still absent at the time of the research. Police were contacted in 60% of the cases.

Pediatricians have an important but difficult role to play in preventing family abduction through monitoring for marital difficulties or substance abuse in the family. It is important to offer early advice on ways to protect the child from marital discord and prompt referral to counseling or mediation. In the case of parental separation, the pediatrician may need to give advice on how to manage affected children.[16]

Children abducted by family members may be at increased risk of physical and sexual abuse or neglect.[17] However, data from NISMART-1 indicate that sexual abuse of children may be relatively uncommon in parental kidnapping. Although children abducted by family members can be with familiar and loving caregivers, emotional trauma still occurs. The children are separated from other loved ones and exposed to uncertainty and secrecy, and care is provided by an adult who is usually experiencing his or her own pain or anger. The goal of the adult taking the child generally is revenge or manipulation toward the ex-partner rather than the benefit of the child. In one study[18] of children after family abduction, 16 of 18 had emotional effects including severe fright, mental indoctrination, grief or rage about parental abandonment, rejection of the offending parent, and exaggerated identification with one parent. The 2 children abducted by fathers without any apparent reaction were told the truth, maintained contact with the mother, and came from such lifestyle chaos that this event seemed insignificant.

Missing Benign Explanations

A very large number of children who have not been abducted nor run away end up missing with benign explanations. In fact, this is the second largest category of missing children. "A missing benign explanation episode occurs when a child's whereabouts are unknown to the child's caretaker and this causes the caretaker to 1) be alarmed, 2) try to locate the child, and 3) contact the police about the episode for any reason, as long as the child was not lost, injured, abducted, victimized, or classified as runaway/thrownaway."[5] NISMART-2 data show that 374 000 or 28% of missing children were in this category. NISMART-1 included a category called "otherwise missing" to include those who were missing but did not fit into any of the other categories. There were nearly 440 000 children in this category with one third of the episodes being concerning enough for the parents to have reported them to the police. Children who have wandered off or disappeared in this way are at significant risk even though they have not been abducted or run away. They are vulnerable to abuse and exploitation, may become disoriented, or may be injured unintentionally. One in five suffered some type of physical harm, and 1 in 7 was abused or assaulted while missing, which emphasizes the point that every case in which a child is missing must be taken seriously regardless of the reason or perceived reason the child is gone.

Neonatal Abductions

From 1983 to 2001, the number of neonatal abductions per year ranged from 0 to 12. The perpetrators of this crime were typically females of childbearing age who had had a miscarriage or had been unable to conceive and had carefully planned an abduction to replace the lost child or maintain a relationship with a lover. The infant was usually kept in the area within 25 miles of the hospital[19] and in 95% of cases was returned to the parents.[20] Prevention of infant abductions has been successful through a combination of increased security measures in hospitals, including video cameras and alarm devices, and education of staff and parents about precautions to take while in the hospital. It is critical not to allow anyone without identification to take an infant for any reason and to keep the infant within sight of the parent or nursery staff at all times. These measures should be largely invisible and create a sense of security rather than increasing parental fears about abduc-

tion. Apparently as a result of these measures, there were no reported infant abductions from hospitals in the United States in 1999.[21] Infant abductions did occur in 2000 and 2001, but at a lower rate than in previous years. The National Center for Missing and Exploited Children provides free security and training consultations (1-800-843-5678). Pediatricians should support appropriate safeguards in the hospitals they serve but should also reassure parents of the rarity of this crime in a sensitive way so as not to promote a sense of vulnerability at this especially sensitive time of family formation.

Internet Issues

Although still relatively uncommon, the practice of pedophiles and child molesters approaching children on the Internet is occurring more frequently. In some cases, pedophiles and/or child molesters have arranged meetings with children. Nineteen percent of children using the Internet had received unwanted online requests to engage in sexual activities or provide intimate sexual information. Almost half of these solicitations were from other children. However, at least one quarter of them were from adults.[22] The National Center for Missing and Exploited Children reports that approximately 840 cases of people (of unspecified ages) "traveling to or luring" children they had contacted on the Internet are "proven or under investigation." Parents need to be advised to supervise Internet use by their children, discuss Internet experiences with their children, and set clear rules about contacts with people met via the Internet. Any computer with access to the Internet should always be kept in an open place (eg, living room, family room) in any home with children and should not be in a room in which the door can be closed or locked. It is important to monitor where children and adolescents have been surfing on the Internet. Parents may find it desirable to use filtering or censoring devices on the computer or limit access to restricted passwords. Eighty-five percent of parents in a national survey indicated that they had warned their children about the dangers of chats on the Internet, but only one third had used any blocking devices. Children need realistic education about the potential of the Internet as part of their media education but without generating fears for their safety.

IN THE EVENT OF A MISSING CHILD

In the event of a missing child, parents should:

- immediately call local law enforcement.
- provide police and/or the Federal Bureau of Investigation with a detailed description of the child, including clothing or jewelry worn at the time of the disappearance, and medical and dental information.
- be sure that the child is entered into National Crime Information Center logs by their local police.
- report abductions or suspected abductions to the National Center for Missing and Exploited Children (1-800-THE-LOST or www.missingkids.com) by parents or law enforcement.
- report runaways to the hot line (1-800-621-4000) of the federal Runaway and Homeless Youth Program.

PREVENTION

The pediatrician's advice for preventing missing children, as for many other health issues, needs to be a balance of safeguarding children while avoiding generating fear. None of this information needs to be taught specifically as abduction safeguarding, with all its overtones of danger and threat. Instead, it should be taught as developmental achievements to be praised for their own value in the growing child. The appropriate message allows the child to go forward with skill and confidence rather than fear and avoidance.

Pediatricians can help safeguard children older than 5 years by encouraging parents to teach them to memorize their name, address, and phone number, including area code, so that they can be identified readily if separated from their families. Older children can learn numbers for contacting parents at home or at work. Because abductions are rarely conducted by strangers, even in nonfamily abductions, teaching children not to talk to strangers frightens them without any proven benefit. Passive methods of identifying children such as the placement of microchips in the teeth and fingerprinting are primarily techniques for identification of bodies. Their use has become common for fund raising and as a "service to the community" often without considering the potential effect in frightening children and inappropriately raising fears in adults without any perspective provided on the real nature or rareness of abduction.[23,24] On the other hand, keeping recent photographs of children and promptly reporting incidences to the police are extremely helpful measures. Law-enforcement officials consider photographs the number one tool in finding missing children. In addition, photograph campaigns such as direct mail cards and "rogues' galleries" in magazines have resulted in 1 in 6 children being located as a direct result of the photograph. Parents should be instructed to keep a high-quality photograph of each child, updated at least every 6 months. School photographs serve this purpose with only positive connotations.

The importance of a prompt response in missing-children cases is demonstrated in the AMBER (American's Missing: Broadcast Emergency Response) Plan. Patterned after the emergency weather warnings, the AMBER Plan is intended to flood a region with information regarding high-risk missing children when time is of the essence. Strict criteria are in place to initiate an AMBER Plan response. It was introduced in Dallas, Texas, in 1997 and became a national program in 2002. Since its inception, the AMBER Plan has been credited with successfully recovering more than 130 children. When combined with the success of the photograph-distribution campaigns (1 in 6 featured long-term missing children found as a direct result of these programs), we see the value of both a prompt response and persistence in searching in missing-child cases.

Learning about personal safety is an important part of a child's education. Schools should be encouraged to include such a program as part of their K-12 curriculum. Many such programs exist but vary greatly in quality and effectiveness. The National Center for Missing and Exploited Children, in cooperation with the American Academy of Pediatrics and other child-advocacy groups, has developed a tool to help school districts evaluate these programs and select one that best fits their individual needs (*Guidelines for Programs to Reduce Child Victimization: A Resource for Communities When Choosing a Program to Teach Personal Safety to Children*[25]).

ADVICE FOR PEDIATRICIANS

1. Help parents and children put the risk of becoming missing in perspective.
2. Encourage families to teach children self-identifying information without connecting it to a threat of becoming missing.
3. Encourage families to keep a high-quality and current photograph of each child.
4. Encourage families to teach children to accept only touches that are comfortable to them regardless of the toucher's relationship to them.
5. Encourage families to teach older children, especially girls, to "know the rules":
   - When going out, don't go out alone.
   - Always tell an adult where you are going.
   - Say "no" if you feel threatened.
6. Consider advocating for an appropriate personal-safety curriculum to be taught in schools and check its approach.
7. Continually screen for risk factors for missing children (ie, family discord, divorce, coercive parenting, substance abuse, school failure, deviant peer group, etc) and intervene early with appropriate work-up and referrals.
8. Assess whether adolescents consider themselves to have several sources of support, including the pediatrician, so that they need not resort to running away.
9. Be skeptical of new patients presenting with vague stories about absent parents or children who report mysterious parent deaths or separations without contact, because they may represent abductions.
10. Insist on prompt transfer of medical records as a routine practice.
11. Support programs that serve runaways.
12. Consider providing or coordinating comprehensive care to any families who have just had a missing child returned.
13. Expose programs spuriously generating fear of abduction.
14. Look at and encourage others to look at pictures of missing children.

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American Academy of Pediatrics

Policy Statement

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Personal Watercraft Use by Children and Adolescents (RE9925)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

ABSTRACT. The use of personal watercraft (PWC) has increased dramatically during the past decade as have the speed and mobility of the watercraft. A similar dramatic increase in PWC-related injury and death has occurred simultaneously. No one younger than 16 years should operate a PWC. The operator and all passengers must wear US Coast Guard-approved personal flotation devices. Other safety recommendations are suggested for parents and pediatricians.

ABBREVIATION. PWC, personal watercraft.

Personal watercraft (PWC) became commercially available during the 1970s when Kawasaki Motors Corporation introduced the Jet Ski. This craft allowed 1 person to maneuver a small (<4 m) boat while standing up. Newer sit-down models made by several manufacturers allow as many as 3 people on board, can pull a water skier, and may be able to reach speeds of 60 mph with engines ranging from 60 to 135 hp. The lure of speed and mobility at a relatively inexpensive price has proven irresistible to many recreational boaters.

The use of PWC has increased dramatically during the past decade. Between 1990 and 1995, the number of PWC in operation more than tripled from 240 000 to 760 000.[1] Annual sales of PWC rose from 29 000 in 1987 to 200 000 in 1995.[2] Current estimates suggest that more than 1 million PWC are now in use. Despite the increased popularity of PWC, many communities are limiting or banning their use because of environmental concerns and the risk of injury.[3]

Until recently only scattered case reports of injury associated with PWC use have been published.[4-6] However, several regional reports[7-10] and 2 national reports[1,2] suggest a fairly uniform and substantial increase in the number of injuries associated with the use of PWC. Data from the National Electronic Injury Surveillance System used in 1 study estimate that nearly 12 000 people were treated in hospital emergency departments during 1995. This represents a fourfold increase from 1990, when 2860 injuries were treated.[1] The Coast Guard reports an even greater increase in fatalities, from 5 during 1987 to 57 during 1996. Preliminary data from the National Association of State Boating Law Administrators show at least 83 fatalities for 1997.[2]

According to the National Electronic Injury Surveillance System data, 7% of injuries occurred to children 14 years and younger; 38% of those injured were 15 to 24 years old.[1] In the National Transportation Safety Board study, 9% of operators involved in PWC incidents were younger than 16 years, and 46% were 16 through 24 years old.[2] Finally, in the report by Hamman et al,[7] 27% of the injured were younger than 17 years, and 61% were 25 years of age or younger. In an even more telling set of statistics, in California, children younger than 18 years accounted for 14% of all boating incidents, 18% of all boating injuries, and 5% of boating fatalities, but 93% of these incidents involved PWC.[8] Conversely, PWC in California represented 16% of all registered vessels but accounted for 55% of all boating injuries.[2,8]

PWC are the only recreational boats for which the leading cause of death is not drowning; most fatalities result from blunt trauma. When the cause of death is drowning, most victims are not wearing personal flotation devices. The types of nonfatal injury are quite varied. Lacerations represent 30% to 57% of the injuries. There are 3 case reports of significant vaginal laceration while riding a PWC.[4-6] Fractures are the next most commonly recorded injury (12% to 26%). The lower extremity is injured more commonly than is the upper extremity. Branche et al[1] and Hamman et al[7] report a significant incidence of head injury (17% to 29%).

Most injuries seem to occur when PWC collideï either with other vessels including other PWC or with fixed objects such as docks or tree stumps. Behavioral factors cited in 3 studies include operator inexperience (most operators had <20 hours of experience in boat operation), operator inattention, and excess speed or reckless operation.[2,9,10] Operators who rent the watercraft seem to be at especially high risk. Operating characteristics of the PWC contribute to these problems. They are maneuverable only when the throttle is open. Contrary to experience in every other motor vehicle, an obstruction is not avoided by slowing and turning but by maintaining or increasing speed and turning to avoid the hazard. In addition, as with any other watercraft, there is no ability to brake. Stopping is achieved only by cutting the throttle and by coasting; while coasting, no steering is possible.[2]

No published studies exist dealing with the effectiveness of protective equipment to prevent injury sustained while riding PWC. Just as wearing a personal flotation device should be mandatory for any boat operator or passenger, personal flotation devices must be worn by anyone riding PWC. The Personal Watercraft Industry Association recommends wearing eye protection, a wet suit, footwear, and gloves. Helmets are worn by some professional PWC riders. Although it makes intuitive sense that a helmet would be protective, it is unclear which type of helmet would provide the best protection. No studies have been performed to assess the effectiveness of these equipment interventions, and industry standards are not available for this gear.

RECOMMENDATIONS

1. No one younger than 16 years should operate PWC.
2. The operator and every passenger must wear a US Coast Guard-approved personal flotation device.
3. Alcohol or other drug use should be avoided before and while operating PWC.

4. Participation in a safe boater course with specific information about PWC should be required before operating PWC.
5. Safe operating practices, such as no operation between sunset and sunrise, no wake jumping, and observing posted speed limits or no-wake zones, should be followed. (No-wake zone means the craft speed is slow enough that no wake is formed behind the craft as it crosses a specific area.)
6. PWC should not be operated where swimmers are in the water.
7. If a PWC is being used to tow another person on skis, knee boards, tubes, or other devices, a second person must face the rear to monitor the person being towed.
8. All persons who rent PWC should be required to comply with these recommendations.
9. Protective equipment such as wet suits, gloves, boots, eyewear, and helmets may be appropriate to wear.
10. Pediatricians should work within their communities to pass legislation that supports the previously mentioned recommendations.[11] Included in such legislation should be funding to support adequate enforcement of regulations such as alcohol consumption, speed limits, and the use of personal flotation devices.
11. Additional research into appropriate protective equipment and modification of PWC to improve safety should be supported by pediatricians.

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AMERICAN ACADEMY OF NEUROLOGY

Special Article

CME Practice Parameter: Pharmacological treatment of migraine headache in children and adolescents

Report of the American Academy of Neurology Quality Standards Subcommittee and the Practice Committee of the Child Neurology Society

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Abstract—*Objective:* To review evidence on the pharmacologic treatment of the child with migraine headache. *Methods:* The authors reviewed, abstracted, and classified relevant literature. Recommendations were based on a four-tiered scheme of evidence classification. Treatment options were separated into medications for acute headache and preventive medications. *Results:* The authors identified and reviewed 166 articles. For acute treatment, five agents were reviewed. Sumatriptan nasal spray and ibuprofen are effective and are well tolerated vs placebo. Acetaminophen is probably effective and is well tolerated vs placebo. Rizatriptan and zolmitriptan were safe and well tolerated but were not superior to placebo. For preventive therapy, 12 agents were evaluated. Flunarizine is probably effective. The data concerning cyproheptadine, amitriptyline, divalproex sodium, topiramate, and levetiracetam were insufficient. Conflicting data were found concerning propranolol and trazodone. Pizotifen, nimodipine, and clonidine did not show efficacy. *Conclusions:* For children (>age 6 years), ibuprofen is effective and acetaminophen is probably effective and either can be considered for the acute treatment of migraine. For adolescents (>12 years of age), sumatriptan nasal spray is effective and should be considered for the acute treatment of migraine. For preventive therapy, flunarizine is probably effective and can be considered, but is not available in the United States. There are conflicting or insufficient data to make any other recommendations for the preventive therapy of migraine in children and adolescents. For a clinical problem so prevalent in children and adolescents, there is a disappointing lack of evidence from controlled, randomized, and masked trials.

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Migraine headaches are common in children and occur with increasing frequency through adolescence.[1-6] The reported prevalence increases from 3% (age 3 to 7 years) to 4 to 11% (age 7 to 11) to 8 to 23% (age 11 to 15+) with the mean age at onset being 7.2 years for boys and 10.9 years for girls.[7,8]

The evaluation of a child with recurrent headaches begins with a thorough medical and family history followed by a complete physical examination with measurement of vital signs, particularly blood pressure, and complete neurologic examination including examination of the optic fundi. Recently, a

Endorsed by the American Academy of Pediatrics and the American Headache Society.

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Table 1 *2004 International Headache Society classification of headache disorders: Criteria for pediatric migraine without aura*[11]

A. ≥5 attacks fulfilling features B–D
B. Headache attack lasting 1 to 72 hours
C. Headache has at least 2 of the following 4 features:
1. Either bilateral or unilateral (frontal/temporal) location
2. Pulsating quality
3. Moderate to severe intensity
4. Aggravated by routine physical activities
D. At least 1 of the following accompanies headache:
1. Nausea and/or vomiting
2. Photophobia and phonophobia (may be inferred from their behavior)

practice parameter that outlined guidelines for the clinical and laboratory evaluation of children and adolescents with recurrent headaches was published.[9]

Diagnosis of primary headache disorders of children rests principally on clinical criteria as set forth by the International Headache Society (IHS, 1988).[10] In 2004, the IHS published a modified International Classification of Headache Disorders (ICHD) for primary (e.g., including migraine, with and without aura) and secondary headache disorders (table 1).[11] For young children, the 1988 IHS criteria were too restrictive, and the second edition ICHD criteria have incorporated more developmentally sensitive criteria.[12-16] Consensus-based criteria for pediatric migraine are essential for the conduct of future clinical treatment trials.

Appropriate treatment for children and adolescents with migraine requires an individually tailored strategy giving due consideration to both pharmacologic and nonpharmacologic measures in the context of the degree of disability produced by the headache. Not all children require pharmacologic intervention. Treatment of migraine headaches in children has remained difficult for both parents and physicians. In young children, accurate diagnosis, assessment of the severity of symptoms, and recognition of associated symptoms is complicated by the inability of children to articulate their complaints. In addition, other infectious, allergic, or gastrointestinal disorders of childhood may mimic symptoms of migraine. Therefore, medications directed specifically for the treatment of childhood migraine may be of limited value if there are other conditions present that mimic or even precipitate migraine. Of equal importance has been the difficulty in using medications either acutely or for preventive purposes in children and adolescents that have shown efficacy in adults, as the appropriate safety and efficacy studies have not been conducted.

This practice parameter reviews the evidence on the pharmacologic treatment of migraine in children and adolescents. Nonpharmacologic treatments and biobehavioral measures are not addressed.

Description of process. Three organizations participated in the development of this practice parameter, including the American Academy of Neurology (AAN), the Child Neurology Society, and the American Headache Society. The American Academy of Pediatrics reviewed the manuscript. Computer-assisted literature searches were conducted with the help of the AAN and the University of Minnesota Biomedical Information Services Research Librarian for relevant articles published from 1980 through December 2003. Databases searched included Medline and Current Contents using the following key words: headache, migraine, children and adolescents, and treatment. The age qualifier of 3 years to 18 years was selected, as this is the age group, based on previous literature, when most children are seen for pediatric or neurologic evaluation. Searches included titles from English and non-English language journals. Only those articles reporting studies with ≥10 patients were included. A bibliography of the 166 articles and abstracts identified and reviewed for preparation of this parameter is available at the AAN Web site (http://www.aan.com/). Relevant position papers from professional organizations were also reviewed.

Individual committee members reviewed titles and abstracts for content and relevance. Those articles dealing with aspects of treatment of pediatric headache were selected for further detailed review. Bibliographies of the articles cited were checked for additional pertinent references. Each of the selected articles was reviewed, abstracted, and classified by at least two committee members. Abstracted data included the number of patients, age, sex, nature of subject selection, case-finding methods (prospective, retrospective, or referral), inclusion and exclusion criteria, headache type and characteristics, and study design and statistical analysis employed.

A four-tiered classification scheme for therapeutic evidence approved by the Quality Standards Subcommittee was utilized (Appendix 1). Depending on the strength of this evidence it was decided whether specific recommendations could be made, and if so, the strength of these recommendations. Evidence pertinent to treatment with the committee's evidence-based recommendations is presented.

General principles of treatment. General principles of management of adults with migraine headaches have been established by the previously published AAN practice parameter (Appendix 2). Likewise, fundamental goals of long-term migraine treatment have been established that include 1) reduction of headache frequency, severity, duration, and disability; 2) reduction of reliance on poorly tolerated, ineffective, or unwanted acute pharmacotherapies; 3) improvement in quality of life; 4) avoidance of acute headache medication escalation; 5) education and enablement of patients to manage their disease to enhance personal control of their migraine; and 6) reduction of headache-related distress and

Table 2 *Evidence summary for treatment of acute attacks of migraine*

Drug, doses, ages	Class	n	Efficacy			Adverse effects	Ref.
			Active, %	Placebo, %	*p* Value		
NSAIDs and nonopiate analgesics							
Ibuprofen							
10 mg/kg (4–16 y)	I	88	68	37	<0.05*	Infrequent	18
7.5 mg/kg (6–12 y)	I	84	76	53	0.006	Infrequent	19
Acetaminophen 15 mg/kg (4–16 y)	I	88	54	37	<0.05*	Infrequent	18
Triptans							
Sumatriptan							
Nasal 20 mg (6–14 y)	I	14	85.7	42.8	0.03	Occasional to frequent	20
5, 10, 20 mg (12–17 y)	I	510	66†	53	0.05		21
10, 20 mg (8–17 y)	I	83	64	39	0.003		22
Oral (50, 100 mg (8–16 y)	I	23	30	22	NS	Occasional	25
Subcutaneous							
3, 6 mg (6–16 y)	IV	17	64	—	—	Occasional to frequent	23
0.06 mg/kg (6–18 y)	IV	50	78	—	—		24
Oral triptans							
Rizatriptan 5 mg (12–17 y)	I	296	66	56	NS	Occasional	26
Zolmitriptan 2.5, 5 mg (12–17 y)	IV	38	85 (2.5 mg)	—	—	Occasional	27
			70 (5 mg)		—		

* Exact *p* values not provided.
† 5 mg dose—66% ($p < 0.05$), 20 mg dose—63% ($p = 0.059$).
NSAIDs = non-steroidal anti-inflammatory drugs; NS = nonsignificant.

psychological symptoms.[17] These general principles of management and fundamental goals of treatment also apply to children and adolescents and once the diagnosis of migraine headache is established a comprehensive treatment program should be implemented. Treatment options include use of 1) acute or episodic medications; 2) prophylactic or preventive agents; and 3) nonpharmacologic or biobehavioral interventions.

Modalities selected must be individually tailored to a particular patient's pattern and must also be flexible enough to accommodate a changing headache frequency. Fundamental to this process is assessment of a patient's degree of disability or headache "burden," which reflects an individual patient's frequency, duration, intensity, functional disability, qualify of life, comorbidity, and pain tolerance. The extent of medical management should be determined by assessment of the headache burden.

Pharmacologic treatment. As in adults, treatment in children and adolescents can be employed on an acute basis as well as daily to prevent frequent recurring migraine attacks.

Acute treatment. Recommended general principles for treatment of acute migraine headache as established in the previously published AAN practice parameter include the following: 1) treat attacks rapidly and consistently without recurrence; 2) restore the patient's ability to function; 3) minimize the use of back-up and rescue medications; 4) optimize self-care and reduce subsequent use of resources; 5) be cost-effective for overall management; and 6) have minimal or no adverse events.[17]

Evidence-based recommendations for the acute treatment of migraine headaches. There is a paucity of controlled data regarding the treatment of primary headache disorders in children and adolescents. The data that exist focus on the most frequent of the primary headache disorders, migraine with and without aura. A summary of the evidence for treatment of acute attacks of migraine is presented in table 2. These data are reviewed according to the different medications used and directed at answering the following questions: 1) How safe and tolerable are acute migraine medications in children and adolescents? 2) What are the effects on acute headache pain of medications taken during the attack?

Nonsteroidal anti-inflammatory agents (NSAIDs) and acetaminophen. Ibuprofen has been the most rigorously studied medication. Two double-blind, placebo-controlled class I trials have shown that ibuprofen (7.5 to 10 mg/kg) in childhood migraine is safe and effective.[18,19]

The first study (n = 88) compared ibuprofen (10 mg/kg) to acetaminophen (15 mg/kg) and a placebo.[18] At the 1- and 2-hour endpoints, both ibuprofen and

acetaminophen were significantly more effective than placebo in providing pain relief as defined by a ≥2-point reduction of pain on a 5-point pain scale ($p < 0.05$). At the 2-hour intent to treat endpoint, ibuprofen provided alleviation of headache in 56% of treated patients compared to 53% for acetaminophen and 36% for the placebo group. Differences between ibuprofen compared to acetaminophen were not statistically significant at this end point. Complete resolution of headache was found in 60% of ibuprofen-treated children and 39% of the acetaminophen group vs 28% of those who received placebo. Reduction in moderate to severe headache by at least two grades after 2 hours was twice as likely with acetaminophen and three times as likely with ibuprofen as placebo. Acetaminophen was considered effective and well tolerated. Acetaminophen was observed to have a faster onset of action than ibuprofen.

The second class I study of ibuprofen (7.5 mg/kg) in 84 children ages 6 to 12 years found that there was a significant reduction in headache severity in 76% of those on active drug vs 53% in the placebo group at the primary 2-hour endpoint ($p = 0.006$). Reduction in pain score, absence of nausea, and reduced need for rescue medications all reached statistical significance. However, the primary endpoint effect seen in the study was accounted for by the results in boys only (84% ibuprofen vs 43% placebo) whereas results for girls were 65% reduction in severity with ibuprofen and 67% with placebo.

There were no statistically significant adverse effects of ibuprofen or acetaminophen reported in either study.

5-Hydroxytryptamine receptor agonists ("triptan agents"). Sumatriptan, available in nasal spray, subcutaneous injection, and tablet forms, has been subjected to several double-blind, placebo–controlled trials. Three controlled trials (class I) have demonstrated both efficacy and safety of sumatriptan nasal spray in adolescent migraineurs. The first study (class I; n = 14) found significant headache relief at 2 hours in 85.7% vs 42.9% in the placebo group ($p = 0.03$).[20] Headache-associated symptoms were also significantly improved in the sumatriptan group; nausea decreased by 36% and phonophobia by 57%.

The second study was multicentered, double-blind, and placebo-controlled (class I) and included 510 adolescents (ages 12 to 17 years) comparing 5 mg, 10 mg, and 20 mg sumatriptan nasal spray to placebo.[21] The 2-hour response rate (reduction in headache severity from severe or moderate to mild or no headache) was 66% for the 5 mg dose ($p < 0.05$), 63% for the 20 mg dose ($p = 0.059$), and 53% for placebo. Significant relief ($p < 0.05$) was noted at 1 hour in the 5 mg and 20 mg dosing arms. A pain-free state at 2 hours was achieved to a statistically significant degree with 20 mg nasal spray ($p < 0.05$). Both photophobia and phonophobia were reduced with the 20 mg dose ($p < 0.05$). The only adverse effect was taste disturbance (26%).

The third trial, a double-blind, placebo-controlled, two-way crossover design (class 1; n = 83), included children ages 8 to 17 years (median 12.4 years). Doses of 10 mg nasal spray were provided for children weighing 20 to 39 kg and 20 mg for children weighing >40 kg. The primary endpoint was headache relief as defined by a 2-point improvement in headache severity based upon a 5-point pain scale at 2 hours. At 2 hours, the primary endpoint was met in 64% of patients receiving sumatriptan and in 39% of those receiving matching placebo ($p = 0.003$). At 1 hour, headache relief was found in 51% of children receiving sumatriptan and in 29% receiving placebo ($p = 0.014$). Complete pain relief was experienced by 31% of those treated with sumatriptan and 19% receiving placebo ($p = 0.14$). Secondary endpoints including use of rescue medications and patient preference also favored sumatriptan (NS). Bad taste was again the most common side effect (29%).[22]

Subcutaneous sumatriptan has been studied in two open label trials (class IV). The first trial in children 6 to 16 years (n = 17) used the 6 mg dose in children weighing >30 kg and 3 mg in children <30 kg.[23] The injection was effective in 64% with side effects including chest pressure, neck pressure, or tingling, lasting 15 minutes, occurring in 15/17 patients.

A second subcutaneous trial in 50 patients, ages 6 to 18 years (class IV), using a dose of 0.06 mg/kg, found an efficacy of 78% with 26% responding within 30 minutes, 46% within 60 minutes, and 6% between 1 to 2 hours.[24] Headache recurrence rate was low at 6%. Ninety-one percent of boys responded, whereas 68% of girls responded. Eighty percent of patients experienced transient adverse effects including head, neck, or chest discomfort.

One class I clinical trial including children aged 8.3 to 16.4 years (n = 23) examining oral sumatriptan tablet (50 to 100 mg) failed to clearly demonstrate efficacy greater than matched placebo at the primary endpoint of pain relief at 2 hours (difference 9%, 95% CI for difference 21 to 38%, p = NS).[25]

Rizatriptan. Studies of rizatriptan in children are limited. A single class I report (n = 296) found no difference compared to placebo in pain relief in children ages 12 to 17 years at the 2-hour primary endpoint (rizatriptan 66%; placebo 56%; $p = 0.79$).[26] These results may have been influenced by the high placebo responder rate. Rizatriptan did demonstrate good tolerability and safety with adverse events (asthenia, dizziness, and dry mouth) being comparable to placebo (3 to 5%).

Zolmitriptan. A class IV open-labeled multicenter trial of oral zolmitriptan (2.5 to 5 mg) in 12- to 17-year-old adolescents (n = 38) who had 276 migraine attacks found that treatment was well tolerated. Overall improvement in headache symptoms at 2 hours was 88% with the 2.5 mg dose and 70% with the 5 mg dose.[27] A pain-free state was achieved in 66% of patients.

Conclusions. For the acute treatment of migraine headaches in children, both ibuprofen and acetaminophen have been shown to be safe and effec-

tive (class I). Sumatriptan is the only 5HT1 agonist that has proven effective for the treatment of children and adolescents with migraine with the 5 mg and 20 mg nasal spray having the most favorable profile (class I). There is only class IV evidence for effectiveness of subcutaneous sumatriptan. Oral triptan agents have not demonstrated efficacy in class I studies. There are currently no agents approved by the Food and Drug Administration for the acute treatment of migraine in children or adolescents.

Recommendations for the acute treatment of migraine in children and adolescents.

1. Ibuprofen is effective and should be considered for the acute treatment of migraine in children (Level A).
2. Acetaminophen is probably effective and should be considered for the acute treatment of migraine in children (Level B).
3. Sumatriptan nasal spray is effective and should be considered for the acute treatment of migraine in adolescents (Level A).
4. There are no data to support or refute use of any oral triptan preparations in children or adolescents (Level U).
5. There are inadequate data to make a judgment on the efficacy of subcutaneous sumatriptan (Level U).

Preventive treatments. General principles related to the goals of migraine preventive therapies are to 1) reduce attack frequency, severity, and duration; 2) improve responsiveness to treatment of acute attacks; and 3) improve function, reduce disability, and improve the patient's quality of life. Rationales for institution of preventive therapies and principles of care have been published in the AAN practice parameter on the treatment of headaches in adults. The following questions are addressed in the review of medications listed below: 1) What are the effects on the frequency and/or severity of migraine attacks of medications taken on a daily basis for prevention of migraine? 2) How safe and tolerable are preventive migraine medications in children and adolescents? 3) How do the efficacy and tolerability of preventive medications for migraine compare to those for placebo?

Cyproheptadine. One class IV retrospective study of the use of preventive agents for children and adolescents within one child neurology practice found that headache frequency was reduced from a mean baseline of 8.4 headaches/month to 3.7 headaches per month at a dose of 2 to 8 mg/day.[28] A positive response rate, defined as an overall favorable decrease in headache frequency and intensity plus acceptability of the agent, occurred in 83% of children receiving cyproheptadine (n = 30). Common side effects of cyproheptadine included sedation and increased appetite. No Class I to III studies were found in children regarding the use of cyproheptadine in children.

Antihypertensive agents. Beta-blockers. The nonselective beta-blocker propranolol has been evaluated in three class II trials with conflicting results. One double-blind, crossover trial in children ages 7 to 16 years (n = 28) using 60 to 120 mg per day found that 20 of 28 (71%) had complete remission from headaches and another 3 patients (10%) experienced a 66% reduction in headache frequency among the propranolol treated patients ($p < 0.001$). In the placebo group, 3/28 had complete remission and 1 of the 28 experienced a 66% improvement.[29] A second trial (n = 39) failed to demonstrate preventive efficacy at doses of 80 to 120 mg/day and, in fact, significantly increased the average duration of headache in the propranolol group.[30] A third trial compared propranolol at a dose of 3 mg/kg/day vs self-hypnosis and found no benefit from propranolol but significant improvement with hypnotherapy.[31]

Clonidine. The alpha-adrenergic agonist clonidine was assessed in two studies. The first study had two phases. The initial pilot phase (n = 50) had an open-label design and 40% of the children experienced extended relief from migraine attacks. The second phase, a follow-up, double blind, crossover design in 43 children, failed to demonstrate significant difference from placebo (class II).[32] Side effects of sedation and enuresis were more common in the placebo group. The second study compared clonidine to placebo in parallel-group trial (class II) at doses of 25 to 50 μg for 2 months (n = 57).[33] There was no statistical significance between the two groups with 9 of 28 patients in the clonidine group and 9 of 26 in the placebo group experiencing freedom from headache attacks.

Antidepressants. Antidepressants have become a mainstay of migraine prophylaxis, although limited controlled data exist in children to validate this convention.

Amitriptyline. In one open labeled class IV trial of 192 children with frequent headache, 70% had migraine and were treated with amitriptyline up to 1 mg/kg/day.[34] The average age was 12 years and the patients had more than three headaches per month. Over 80% of patients reported a significant reduction in headache frequency and severity but no change in headache duration. Side effects were "minimal," but not specified.

One class IV retrospective study of the use of preventive agents for children and adolescents within one child neurology practice found that amitriptyline produced a "positive response rate" of 89% (n = 73). Positive response rate was defined as an overall decrease in headache frequency and intensity plus acceptability of the agent. Headache frequency was reduced from a mean baseline of 11 to 4.1 headaches per month.[28] The principal side effect was mild sedation.

There are no comparative data for the tricyclic antidepressants nortriptyline and desipramine.

Trazodone. Trazodone hydrochloride, a triazolopyridine derivative antidepressant, was studied in

one class II, placebo-controlled, crossover study (n = 35) in patients ages 7 to 18 years.[35] The results were mixed between the two crossover phases. During the first crossover phase, both groups had a significant reduction in headache frequency and there was no significant difference between the placebo and the trazodone treated group. During the second phase, the trazodone treated group (1 mg/kg/day divided TID) experienced "further" reduction in headache frequency compared to the placebo group. No side effects were observed in either group.

The serotonin-blocking agent pizotifen, unavailable in the United States, was studied in a randomized, crossover class I trial (n = 47) with two 12-week treatment phases and no washout period between phases.[36] There was no significant difference in either headache frequency or headache duration between the placebo and pizotifen-treated groups. Side effects occurred in 17% of patients, but there was no significant difference between the two groups.

No studies have been performed in children or adolescents using the serotonin reuptake inhibitors.

Anticonvulsants. Considering current views concerning the pathophysiology of migraine involving a primary neuronal initiation and a cortical spreading depression, anticonvulsants have received increasing attention as an alternative therapeutic option.

Divalproex sodium. One class IV study in 42 children (ages 7 to 16 years) found that over 80% were able to discontinue their abortive medications when treated with divalproex sodium (15 to 45 mg/kg/day).[37] After 4 months of treatment, 75.8% of patients reported a 50% reduction in headache frequency; 14.2% had a 75% reduction and 14.2% achieved a headache-free status. Side effects included gastrointestinal upset, weight gain, somnolence dizziness, and tremor, similar to those seen for patients with epilepsy.

A second study using divalproex sodium included children ages 9 to 17 years (n = 10) who were treated in an open label fashion (class IV) with doses between 500 and 1,000 mg. Both headache severity and frequency were reduced. Mean severity at baseline using a visual analog scale was reduced from 6.8 to 0.7 at the end of treatment ($p = 0$). Mean headache attacks per month were reduced from 6/month to 0.7/month and mean duration of headache attacks was reduced from 5.5 hours to 1.1 hour following treatment. Side effects included dizziness, drowsiness, and increased appetite, but no serious side effects were noted in this small study.[38]

Caution must be exercised with the use of divalproex sodium in women of childbearing potential.

Topiramate. One retrospective study (class IV) assessing the efficacy of topiramate for pediatric headache included 75 patients of whom 41 were available at a second follow-up visit. Daily doses of 1.4 (±0.74) mg/kg/day were reached and headache frequency was reduced from 16.5 (±10) headaches/month to 11.6 (±10) headaches/month ($p < 0.001$). Mean headache severity, duration, and accompanying disability were also reduced. Side effects included cognitive changes (12.5%), weight loss (5.6%), and sensory symptoms (2.8%).[39] This study population was predominantly children with very frequent migraine headaches approaching the spectrum of chronic daily headache as defined by ≥15 headaches per month.

Levetiracetam. One retrospective study (class IV) assessed the efficacy and safety of levetiracetam for pediatric migraine at doses of 125 to 250 mg twice daily and included 19 patients (mean age 12 years) treated for a mean duration of 4.1 months. The mean frequency of headache attacks before treatment was 6.3/month and after treatment, fell to 1.7/month ($p < 0.0001$). Fifty-two percent of patients experienced elimination of migraine attacks during treatment. No side effects were reported in 82.4% but 10.5% discontinued treatment because of side effects including somnolence, dizziness, and irritability.[40]

Calcium channel blockers. Calcium channel blockers are thought to exert their effects through selective inhibition of vasoactive substances on cerebrovascular smooth muscle.

Nimodipine. One controlled, crossover trial including children ages 7 to 18 years (n = 37) found inconsistent effects with nimodipine (10 to 20 mg TID) compared to placebo between the two treatment phases (class I). During the first treatment period, there was no difference between active and placebo. Headache frequency per month fell from 3.3 to 2.8 in the active group and from 3.0 to 2.5 in the placebo group (NS). During the second treatment phase, there was a significant reduction in headache frequency in the nimodipine group, but no effect on headache duration. Side effects were limited to mild abdominal discomfort in 0.08%.[41]

Flunarizine. Unavailable in the United States, flunarizine is a calcium channel blocker that has been evaluated in several trials for the prevention of childhood migraine. A double blind, placebo-controlled, crossover trial (class I) using 5 mg/day doses of flunarizine (n = 63) demonstrated significant reduction in headache frequency ($p < 0.001$) and decreased average headache duration ($p < 0.01$) compared to the placebo group.[42] The main side effects were drowsiness (9.5%) and weight gain (22.2%).

An open label (class IV) study of 12 patients showed decreased headache frequency with 8/12 experiencing a 75 to 100% reduction in headache frequency during a 6-month follow-up.[43] Another randomized trial compared flunarizine, dimethothiazine, and placebo and showed clinical improvement in 80 to 93% of patients without statistical significance among the three groups.[44]

A class II trial compared flunarizine to propranolol. Headache frequency was decreased in both treatment groups, but no statistically significant difference was detected between the trial agents.[45]

Only two of the trials detailed side effects, which included sedation (9.5%) and weight gain (22.2%) but extrapyramidal side effects (e.g., tremor) have been reported in postmarketing trials.[42,43]

Table 3 *Preventive therapies for migraine*

Therapies	Class	n	Efficacy	Adverse effects	Ref.
Antiepileptic medications					
Divalproex sodium				Occasional to frequent	
15–45 mg/kg/d (7–16 y)	IV	42	76% had >50% reduction headache frequency		37
500–1,000 mg/d (9–17 y)	IV	10	$p = 0$		38
Topiramate 12.5–225 mg (8–15 y)	IV	75	$p < 0.001$	Occasional to frequent	39
Levetiracetam 250–500 mg (3–17 y)	IV	19	$p < 0.0001$	Occasional to frequent	40
Antidepressant medications					
Trazodone 1 mg/kg/d (7–18 y)	II	35	NS	Occasional to frequent	35
Pizotifen 1–1.5 mg (7–14 y)	I	47	NS	Occasional to frequent	36
Tricyclic antidepressants amitriptyline					
1 mg/kg (9–15 y)	IV	192	80%	Occasional to frequent	34
10 mg (3–12 y)	IV	73	89%		28
Antihistamines					
Cyproheptadine 4 mg (3–12 y)	IV	30	83%	Occasional to frequent	28
Calcium channel blockers					
Flunarizine 5 mg (5–11 y)	I	63	$p < 0.001$	Occasional	42
5 mg (10–13 y)	IV	12	75% had 75–100% reduction headache frequency		43
Nimodipine 10–20 mg (7–18 y)	I	37	NS	Occasional	41
Antihypertensive agents					
Propranolol					
80 mg (3–12 y)	II	39	81%	Occasional to frequent	30
6–120 mg (7–16 y)	II	28	NS		29
3 mg/kg/d (6–12 y)	II	28	NS		31
Clonidine					
0.07–0.1 mg (7–14 y)	II	43	NS	Occasional to frequent	32
0.025–0.05 mg (≤15 y)	II	57	32%: 34%—NS		33

Conclusions. The calcium channel blocker flunarizine was studied in one class I trial and is probably effective but is unavailable in the United States. The evidence is insufficient (class IV) to determine efficacy for the antihistamine cyproheptadine, the antidepressant amitriptyline, and the anticonvulsant agents valproic acid, topiramate, and levetiracetam for prevention of pediatric migraine. There is conflicting class II evidence regarding propranolol and trazodone. Clonidine (class II), pizotifen (class I), and nimodipine (class I) were not shown to be more effective than placebo (table 3).

A recent Cochrane Database review of the medical literature also concluded that the calcium channel blocker flunarizine is the only agent that has been studied in rigorous controlled trials and found to be effective.[46] The authors conclude with the statement that there is a "clear and urgent need" for methodologically sound randomized controlled trials for the use of prophylactic drugs in pediatric migraine.

Recommendations for preventive therapy of migraine in children and adolescents.

1. Flunarizine is probably effective for preventive therapy and can be considered for this purpose but is not available in the United States (Level B).
2. There is insufficient evidence to make any recommendations concerning the use of cyproheptadine, amitriptyline, divalproex sodium, topiramate, or levetiracetam (Level U).
3. Recommendations cannot be made concerning propranolol or trazodone for preventive therapy as the evidence is conflicting (Level U).
4. Pizotifen and nimodipine (Level B) and clonidine (Level B) did not show efficacy and are not recommended.

Future directions.

1. Standardized criteria for the diagnosis of migraine headaches in children and adolescents are

needed in order to facilitate proper diagnosis and for the purpose of providing a case definition that could be used as part of therapeutic clinical trials.
2. Standardized criteria of the response to treatment of migraine in children/adolescents need to be established that are related to the frequency, duration, severity, and disability of headaches.
3. The safety and efficacy of currently available medications used to treat migraine headaches in adults need to be established in children and adolescents, particularly the dose and age range in which these medications are deemed safe and effective to use. Failure of an agent for acute or preventive therapy to demonstrate efficacy to a statistically significant degree does not imply that these medications have no role in the pediatric population and their use must be based upon good clinical judgment.
4. It is essential that multicentered, placebo-controlled clinical trials be conducted to assess the safety, tolerability, and efficacy of medications used for the acute and preventive treatment of pediatric and adolescent migraine.
5. Efforts must be made to develop novel and innovative study designs that will address the critical issue of high placebo response rates encountered in clinical trials in children and adolescents, which has proven to be the major impediment to demonstration of efficacy.
6. There are no epidemiologic studies of the incidence or prevalence of status migraine (defined by the International Headache Society as a prolonged attack [≥72 hours] of unremitting headache) in children or adolescents. These epidemiologic studies are needed, as well as treatment studies directed at this clinical entity.
7. It will be important to understand the variations in effects of treatments by age and sex.

Mission statement. The Quality Standards Subcommittee (QSS) of the American Academy of Neurology is charged with developing practice parameters for physicians. This practice parameter summarizes the results from the two evidence-based reviews on the management of pediatric patients with migraine: specifically, acute and preventive treatments for pediatric and adolescent migraine.

Disclaimer. This statement is provided as an educational service of the American Academy of Neurology. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of

Appendix 1 *AAN evidence classification scheme for a therapeutic article and linkage to level of recommendation*

Rating of therapeutic article	Rating of recommendation	Translation of evidence to recommendations
Class I: Prospective, randomized, controlled clinical trial with masked outcome assessment, in a representative population. The following are required: a) primary outcome(s) is/are clearly defined b) exclusion/inclusion criteria are clearly defined c) adequate accounting for drop-outs and cross-overs with numbers sufficiently low to have minimal potential for bias d) relevant baseline characteristics are presented and substantially equivalent among treatment groups or there is appropriate statistical adjustment for differences.	Level A = Established as effective, ineffective or harmful (or established as useful/predictive or not useful/predictive) for the given condition in the specified population	Level A rating requires at least two consistent class I studies*
Class II: Prospective matched group cohort study in a representative population with masked outcome assessment that meets a–d above OR a RCT in a representative population that lacks one criteria a–d.	Level B = Probably effective, ineffective or harmful (or probably useful/predictive or not useful/predictive) for the given condition in the specified population	Level B rating requires at least one class I study or two consistent class II studies
Class III: All other controlled trials (including well-defined natural history controls or patients serving as own controls) in a representative population, where outcome is independently assessed, or independently derived by objective outcome measurement.†	Level C = Possibly effective, ineffective or harmful (or possibly useful/predictive or not useful/predictive) for the given condition in the specified population	Level C rating requires at least one class II study or two consistent class III studies
Class IV: Evidence from uncontrolled studies, case series, case reports, or expert opinion.	Level U = Data inadequate or conflicting. Given current knowledge, treatment (test, predictor) is unproven	Studies not meeting criteria for class I–class III

* In exceptional cases, one convincing class I study may suffice for an "A" recommendation if 1) all criteria met, 2) magnitude of effect ≥5, and 3) narrow confidence intervals (lower limit >2).

† Objective outcome measurement—an outcome measure that is unlikely to be affected by an observer's (patient, treating physician, investigator) expectation or bias (e.g., blood tests, administrative outcome data).

Appendix 2 *Consensus-based general principles of adult migraine management*[17]

- Establish a diagnosis.
- Assess the headache burden or disability:
  - Treatment choice depends on the frequency and severity of attacks,
  - the presence and degree of temporary disability,
  - impact on the patient's quality of life, and
  - associated symptoms such as nausea and vomiting.
- Educate migraine sufferers and their families about their condition and its treatment.
- Discuss the rationale for a particular treatment, how to use it, and what adverse events are likely.
- Encourage the patient to identify and avoid triggers.
- Establish realistic patient expectations by setting appropriate goals and discussing the expected benefits of therapy and how long it will take to achieve them.
- Empower the patients to be actively involved in their own management by encouraging patients to track their own progress through the use of:
  - diary cards, flow charts, headache calendars, and
  - methods for tracking days of disability or missed work, school, or family activities.
- Create a formal management plan and individualize management: consider the patient's response to, and tolerance for, specific medications.
- Consider co-morbidity/coexisting conditions that need to be ascertained as they may influence treatment choices.
  - Co-morbid conditions: depression, anxiety, obsessive-compulsive disorders
  - Co-existing conditions (such as reactive airway disease, hypertension).

To meet these goals:

- Use migraine-specific agents (e.g. triptans) in patients whose headaches respond poorly to nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen.

Failure to use an effective treatment promptly may increase pain, disability, and the impact of the headache. Aspirin containing compounds should not be used in children under the age of 15 due to the risk of Reye syndrome.

- Select a non-oral route of administration for patients with migraine associated with severe nausea or vomiting where the nausea and vomiting restrict the use of oral medications.

Antiemetics should not be restricted to patients who are vomiting or likely to vomit. Nausea itself is one of the most aversive and disabling symptoms of a migraine attack and should be treated appropriately.

- Consider a self-administered rescue medication for patients with severe migraine who do not respond to (or fail) other treatments.

A rescue medication is used when other treatments fail and permits the patient to achieve relief without the discomfort and expense of a visit to the physician's office or emergency department.

- Guard against medication-overuse headache ("rebound headache" or "drug-induced headache").

Frequent use of acute medications (including but not limited to opiates, triptans, simple analgesics, and mixed analgesics containing butalbital, caffeine, or isometheptene) is generally thought to cause medication-overuse headache. Many experts limit acute therapy to two headache days per week on a regular basis. Patients with medication overuse should use preventive therapy.

care for a particular neurologic problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved.

Appendix 3

Quality Standards Subcommittee Members: Gary Franklin, MD, MPH (co-chair); Gary Gronseth, MD (co-chair); Charles E. Argoff, MD; Steven A. Ashwal, MD (ex-officio); Christopher Bever, Jr., MD; Jody Corey-Bloom, MD, PhD; John D. England, MD; Jacqueline French, MD (ex-officio); Gary H. Friday, MD; Michael J. Glantz, MD; Deborah Hirtz, MD; Donald J. Iverson, MD; David J. Thurman, MD; Samuel Wiebe, MD; William J. Weiner, MD; and Catherine Zahn, MD (ex-officio).

Appendix 4

CNS Practice Committee Members: Carmela Tardo, MD (chair); Bruce Cohen, MD (vice-chair); Elias Chalhub, MD; Roy Elterman, MD; Murray Engel, MD; Bhuwan P. Garg, MD; Brian Grabert, MD; Annette Grefe, MD; Michael Goldstein, MD; David Griesemer, MD; Betty Koo, MD; Edward Kovnar, MD; Leslie Anne Morrison, MD; Colette Parker, MD; Ben Renfroe, MD; Anthony Riela, MD; Michael Shevell, MD; Shlomo Shinnar, MD; Herald Silverboard, MD; Russell Snyder, MD; Dean Timmons, MD; Greg Yim, MD; and Mary Anne Whelan, MD.

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American Academy of Pediatrics
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TECHNICAL REPORT

Phototherapy to Prevent Severe Neonatal Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

abstract

FREE

OBJECTIVE: To standardize the use of phototherapy consistent with the American Academy of Pediatrics clinical practice guideline for the management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation.

METHODS: Relevant literature was reviewed. Phototherapy devices currently marketed in the United States that incorporate fluorescent, halogen, fiber-optic, or blue light-emitting diode light sources were assessed in the laboratory.

RESULTS: The efficacy of phototherapy units varies widely because of differences in light source and configuration. The following characteristics of a device contribute to its effectiveness: (1) emission of light in the blue-to-green range that overlaps the in vivo plasma bilirubin absorption spectrum (~460–490 nm); (2) irradiance of at least 30 $\mu W \cdot cm^{-2} \cdot nm^{-1}$ (confirmed with an appropriate irradiance meter calibrated over the appropriate wavelength range); (3) illumination of maximal body surface; and (4) demonstration of a decrease in total bilirubin concentrations during the first 4 to 6 hours of exposure.

RECOMMENDATIONS (SEE APPENDIX FOR GRADING DEFINITION): The intensity and spectral output of phototherapy devices is useful in predicting potential effectiveness in treating hyperbilirubinemia (group B recommendation). Clinical effectiveness should be evaluated before and monitored during use (group B recommendation). Blocking the light source or reducing exposed body surface should be avoided (group B recommendation). Standardization of irradiance meters, improvements in device design, and lower-upper limits of light intensity for phototherapy units merit further study. Comparing the in vivo performance of devices is not practical, in general, and alternative procedures need to be explored. *Pediatrics* 2011;128:e1046–e1052

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KEY WORDS
phototherapy, newborn jaundice, hyperbilirubinemia, light treatment

ABBREVIATION
LED—light-emitting diode

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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INTRODUCTION

Clinical trials have validated the efficacy of phototherapy in reducing excessive unconjugated hyperbilirubinemia, and its implementation has drastically curtailed the use of exchange transfusions.[1] The initiation and duration of phototherapy is defined by a specific range of total bilirubin values based on an infant's postnatal age and the potential risk for bilirubin neurotoxicity.[1] Clinical response to phototherapy depends on the efficacy of the phototherapy device as well as the balance between an infant's rates of bilirubin production and elimination. The active agent in phototherapy is light delivered in measurable doses, which makes phototherapy conceptually similar to pharmacotherapy. This report standardizes the use of phototherapy consistent with the American Academy of Pediatrics clinical practice guideline for the management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation.

I. COMMERCIAL LIGHT SOURCES

A wide selection of commercial phototherapy devices is available in the United States. A complete discussion of devices is beyond the scope of this review; some are described in Tables 1 and 2. Phototherapy devices can be categorized according to their light source as follows: (1) fluorescent-tube devices that emit different colors (cool white daylight, blue [B], special blue [BB], turquoise, and green) and are straight (F20 T12, 60 cm, 20 W), U-shaped, or spiral-shaped; (2) metal halide bulbs, used in spotlights and incubator lights; (3) light-emitting diodes (LEDs) or metal halide bulbs, used with fiber-optic light guides in pads, blankets, or spotlights; and (4) high-intensity LEDs, used as over- and under-the-body devices.

TABLE 1 Phototherapy Devices Commonly Used in the United States and Their Performance Characteristics

Device	Manufacturer	Distance to Patient (cm)	Footprint Area (Length × Width, cm^2)	% Treatable BSA	Spectrum, Total (nm)	Bandwidth* (nm)	Peak (nm)	Footprint Irradiance ($\mu W/cm^2/nm$)		
								Min	Max	Mean ± SD
Light Emitting Diodes [LED]										
neoBLUE	Natus Medical, San Carlos, CA	30	1152 (48 × 24)	100	420–540	20	462	12	37	30 ± 7
PortaBed	Stanford University, Stanford, CA	≥5	1740 (30 × 58)	100	425–540	27	463	40	76	67 ± 8
Fluorescent										
BiliLite CW/BB	Olympic Medical, San Carlos, CA	45	2928 (48 × 61)	100	380–720	69	578	6	10	8 ± 1
BiliLite BB	Olympic Medical, San Carlos, CA	45	2928 (48 × 61)	100	400–550	35	445	11	22	17 ± 2
BiliLite TL52	Olympic Medical, San Carlos, CA	45	2928 (48 × 61)	100	400–626	69	437	13	23	19 ± 3
BiliBed	Medela, McHenry, IL	0	693 (21 × 33)	71	400–560	80	450	14	59	36 ± 2
Halogen										
MinBiliLite	Olympic Medical, San Carlos, CA	45	490 (25 diam)	54	350–800	190	580	<1	19	7 ± 5
Phototherapy Lite	Philips Inc, Andover, MA	45	490 (25 diam)	54	370–850	200	590	<1	17	5 ± 5
Halogen fiberoptic										
BiliBlanket	Ohmeda, Fairfield, CT	0	150 (10 × 15)	24	390–600	70	533	9	31	20 ± 6
Wallaby II Preterm	Philips, Inc, Andover, MA	0	117 (9 × 13)	19	400–560	45	513	8	30	16 ± 6
Wallaby II Term	Philips, Inc, Andover, MA	0	280 (8 × 35)	53	400–560	45	513	6	11	8 ± 1
SpotLight 1000	Philips, Inc, Andover, MA	45	490 (25 diam)	54	400–560	45	513	1	11	6 ± 3
PEP Model 2000	PEP, Fryeburg, ME	23	1530 (30 × 51)	100	400–717	63	445	12	49	28 ± 11
Bili Soft	GE Healthcare, Laurel, MD	0	825 (25 × 33)	71	400–670	40	453	1	52	25 ± 16

Data in Table 1 are expanded and updated from that previously reported by Vreman et al.[3] The definitions and standards for device assessment are explained below.

EMISSION SPECTRAL QUALITIES. Measured data of the light delivered by each of the light sources are presented as the minimum, maximum and range. Light source emission spectra within the range of 300–700 nm were recorded after the device had reached stable light emission, using a miniature fiberoptic radiometer (IRRAD2000, Ocean Optics, Inc, Dunedin, FL). For precision based device assessment, the spectral bandwidth (*), which is defined as the width of the emission spectrum in nm at 50% of peak light intensity, is the preferred method to distinguish and compare instead of the total range emission spectrum (data usually provided by manufacturers). Emission peak values are also used to characterize the quality of light emitted by a given light source.

IRRADIANCE: Measured data are presented as mean ± standard deviation (SD), representing the irradiance of blue light (including spectral bandwidth), for each device's light footprint at the manufacturer-recommended distance. To compare diverse devices, the spectral irradiance ($\mu W/cm2/nm$) measurements were made using calibrated BiliBlanket Meters I and II (Ohmeda, GE Healthcare, Fairfield, CT), which were found to yield identical results with stable output phototherapy devices. This type of meter was selected from the several devices with different photonic characteristics that are commercially available, because it has a wide sensitivity range (400–520 nm with peak sensitivity at 450 nm), which overlaps the bilirubin absorption spectrum and which renders it suitable for the evaluation of narrow and broad wavelength band light sources. The devices have been found exceptionally stable during several years of use and agree closely after each annual calibration.

FOOTPRINT: The minimum and maximum irradiance measured (at the intervals provided or defined) in the given irradiance footprint of the device (length × width). The footprint of a device is that area which is occupied by a patient to receive phototherapy. The irradiance footprint has greater dimensions than the emission surface, which is measured at the point where the light exits a phototherapy device. The minimum and maximum values are shown to indicate the range of irradiances encountered with a device and can be used as an indication of the uniformity of the emitted light. Most devices conform to an international standard to deliver a minimum/maximum footprint light ratio of no lower than 0.4.

BSA: BODY SURFACE AREA refers to percent (%) exposure of either the ventral or dorsal planar surface exposed to light and Irradiance measurements are accurate to ±0.5.

All of the reported devices are marketed in the United States except the PortaBed, which is a non-licensed Stanford-developed research device and the Dutch Crigler-Najjar Association (used by Crigler-Najjar patients).

TABLE 2 Maximum Spectral Irradiance of Phototherapy Devices (Using Commercial Light Meters at Manufacturer Recommended Distances) Compared to Clear-Sky Sunlight

Light Meter [Range, Peak]	Footprint Irradiance, (μW/cm^2/nm[a])							
	Halogen/Fiberoptic			Fluorescent		LED		Sunlight
	BiliBlanket	Wallaby (Neo)		PEP Bed	Martin/Philips BB	neoBLUE	PortaBed	@ Zenith on 8/31/05
		II	III					
	@ Contact	@ Contact		@ 10 cm	@ 25 cm	@ 30 cm	@ 10 cm	Level Ground
BiliBlanket Meter II [400–520, 450 nm]	34	28	34	40	69	34	76	144
Bili-Meter, Model 22 [425–475, 460 nm]	29	16	32	49	100	25	86	65**
Joey Dosimeter, JD-100 [420–550, 470 nm]	53	51	60	88	174	84	195	304**
PMA-2123 Bilirubin Detector[a] (400–520, 460 nm)	24	24	37	35	70	38	73	81
GoldiLux UVA Photometer, GRP-1[b] [315–400, 365 nm]	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	2489

Data in Table 2 were tested and compiled by Hendrik J. Vreman (June 2007 and reverified December 2010).

** Irradiance presented to this meter exceeded its range. Measurement was made through a stainless-steel screen that attenuated the measured irradiance to 57%, which was subsequently corrected by this factor.

[a] Solar Light Company, Inc., Glenside, PA 19038.

[b] Oriel Instruments, Stratford, CT 06615 and SmartMeter GRP-1 with UV-A probe. GRP-1 measures UV-A light as μW/cm^2. No artificial light source delivered significant (<0.04 μW/cm^2) UV-A radiation at the distances measured.

II. STANDARDS FOR PHOTOTHERAPY DEVICES

Methods for reporting and measuring phototherapy doses are not standardized. Comparisons of commercially available phototherapy devices that use in vitro photodegradation techniques may not accurately predict clinical efficacy.[2] A recent report explored an approach to standardizing and quantifying the magnitude of phototherapy delivered by various devices.[3] Table 1 lists technical data for some of the devices marketed in the United States.[3] Factors to consider in prescribing and implementing phototherapy are (1) emission range of the light source, (2) the light intensity (irradiance), (3) the exposed ("treatable") body surface area illuminated, and (4) the decrease in total bilirubin concentration. A measure of the effectiveness of phototherapy to rapidly configure the bilirubin molecule to less toxic photoisomers (measured in seconds) is not yet clinically available.

A. Light Wavelength

The visible white light spectrum ranges from approximately 350 to 800 nm. Bilirubin absorbs visible light most strongly in the blue region of the spectrum (~460 nm). Absorption of light transforms unconjugated bilirubin molecules bound to human serum albumin in solution into bilirubin photoproducts (predominantly isomers of bilirubin).[2,4,5] Because of the photophysical properties of skin, the most effective light in vivo is probably in the blue-to-green region (~460–490 nm).[2] The first prototype phototherapy device to result in a clinically significant rate of bilirubin decrease used a blue (B) fluorescent-tube light source with 420- to 480-nm emission.[6,7] More effective narrow-band special blue bulbs (F20T12/BB [General Electric, Westinghouse, Sylvania] or TL52/20W [Phillips]) were subsequently used.[8,9] Most recently, commercial compact fluorescent-tube light sources and devices that use LEDs of narrow spectral bandwidth have been used.[9–14] Unless specified otherwise, plastic covers or optical filters need to be used to remove potentially harmful ultraviolet light.

Clinical Context

Devices with maximum emission within the 460- to 490-nm (blue-green) region of the visible spectrum are probably the most effective for treating hyperbilirubinemia.[2,4] Lights with broader emission also will work, although not as effectively. Special blue (BB) fluorescent lights are effective but should not be confused with white lights painted blue or covered with blue plastic sheaths, which should not be used. Devices that contain high-intensity gallium nitride LEDs with emission within the 460- to 490-nm regions are also effective and have a longer lifetime (>20 000 hours), lower heat output, low infrared emission, and no ultraviolet emission.

B. Measuring Light Irradiance

Light intensity or energy output is defined by irradiance and refers to the number of photons (spectral energy) that are delivered per unit area (cm^2) of exposed skin.[1] The dose of phototherapy is a measure of the irradiance delivered for a specific duration and adjusted to the exposed body surface area. Determination of an in vivo dose-response relationship is confounded by the optical properties of skin and the rates of bilirubin production and elimination.[1] Irradiance is measured with a radiometer (W·cm^{-2}) or spectroradiometer (μW·cm^{-2}·nm^{-1}) over a given wavelength band. Table 2 compares the spectral irradiance of some of the devices in the US market, as measured with different brands of me-

ters. Often, radiometers measure wavelengths that do not penetrate skin well or that are far from optimal for phototherapy and, therefore, may be of little value for predicting the clinical efficacy of phototherapy units. A direct relationship between irradiance and the rate of in vivo total bilirubin concentration decrease was described in the report of a study of term "healthy" infants with nonhemolytic hyperbilirubinemia (peak values: 15–18 mg/dL) using fluorescent Philips daylight (TL20W/54, TL20W/52) and special blue (TLAK 40W/03) lamps.[15,16] The American Academy of Pediatrics has recommended that the irradiance for intensive phototherapy be at least 30 $\mu W \cdot cm^{-2} \cdot nm^{-1}$ over the waveband interval 460 to 490 nm.[1] Devices that emit lower irradiance may be supplemented with auxiliary devices. Much higher doses (>65 $\mu W \cdot cm^{-2} \cdot nm^{-1}$) might have (as-yet-unidentified) adverse effects. Currently, no single method is in general use for measuring phototherapy dosages. In addition, the calibration methods, wavelength responses, and geometries of instruments are not standardized. Consequently, different radiometers may show different values for the same light source.[2]

Clinical Context

For routine measurements, clinicians are limited by reliance on irradiance meters supplied or recommended by the manufacturer. Visual estimations of brightness and use of ordinary photometric or colorimetric light meters are inappropriate.[1,2] Maximal irradiance can be achieved by bringing the light source close to the infant[1]; however, this should not be done with halogen or tungsten lights, because the heat generated can cause a burn. Furthermore, with some fixtures, increasing the proximity may reduce the exposed body surface area. Irradiance distribution in the illuminated area (footprint) is rarely uniform; measurements at the center of the footprint may greatly exceed those at the periphery and are variable among phototherapy devices.[1] Thus, irradiance should be measured at several sites on the infant's body surface. The ideal distance and orientation of the light source should be maintained according to the manufacturer's recommendations. The irradiance of all lamps decreases with use; manufacturers may provide useful-lifetime estimates, which should not be exceeded.

C. Optimal Body Surface Area

An infant's total body surface area[17] can be influenced by the disproportionate head size, especially in the more preterm infant. Complete (100%) exposure of the total body surface to light is impractical and limited by use of eye masks and diapers. Circumferential illumination (total body surface exposure from multiple directions) achieves exposure of approximately 80% of the total body surface. In clinical practice, exposure is usually planar: ventral with overhead light sources and dorsal with lighted mattresses. Approximately 35% of the total body surface (ventral or dorsal) is exposed with either method. Changing the infant's posture every 2 to 3 hours may maximize the area exposed to light. Exposed body surface area treated rather than the number of devices (double, triple, etc) used is clinically more important. Maximal skin surface illumination allows for a more intensive exposure and may require combined use of more than 1 phototherapy device.[1]

Clinical Context

Physical obstruction of light by equipment, such as radiant warmers, head covers, large diapers, eye masks that enclose large areas of the scalp, tape, electrode patches, and insulating plastic covers, decrease the exposed skin surface area. Circumferential phototherapy maximizes the exposed area. Combining several devices, such as fluorescent tubes with fiber-optic pads or LED mattresses placed below the infant or bassinet, will increase the surface area exposed. If the infant is in an incubator, the light rays should be perpendicular to the surface of the incubator to minimize reflectance and loss of efficacy.[1,2]

D. Rate of Response Measured by Decrease in Serum Bilirubin Concentration

The clinical impact of phototherapy should be evident within 4 to 6 hours of initiation with an anticipated decrease of more than 2 mg/dL (34 μmol/L) in serum bilirubin concentration.[1] The clinical response depends on the rates of bilirubin production, enterohepatic circulation, and bilirubin elimination; the degree of tissue bilirubin deposition[15,16,18]; and the rates of the photochemical reactions of bilirubin. Aggressive implementation of phototherapy for excessive hyperbilirubinemia, sometimes referred to as the "crash-cart" approach,[19,20] has been reported to reduce the need for exchange transfusion and possibly reduce the severity of bilirubin neurotoxicity.

Clinical Context

Serial measurements of bilirubin concentration are used to monitor the effectiveness of phototherapy, but the value of these measurements can be confounded by changes in bilirubin production or elimination and by a sudden increase in bilirubin concentration (rebound) if phototherapy is stopped. Periodicity of serial measurements is based on clinical judgment.

III. EVIDENCE FOR EFFECTIVE PHOTOTHERAPY

Light-emission characteristics of phototherapy devices help in predicting

TABLE 3 Practice Considerations for Optimal Administration of Phototherapy

Checklist	Recommendation	Implementation
Light source (nm)	Wavelength spectrum in ~460- 490-nm blue-green light region	Know the spectral output of the light source
Light irradiance ($\mu W \cdot cm^{-2} \cdot nm^{-1}$)	Use optimal irradiance: >30 $\mu W \cdot cm^{-2} \cdot nm^{-1}$ within the 460- to 490-nm waveband	Ensure uniformity over the light footprint area
Body surface area (cm^2)	Expose maximal skin area	Reduce blocking of light
Timeliness of implementation	Urgent or "crash-cart" intervention for excessive hyperbilirubinemia	May conduct procedures while infant is on phototherapy
Continuity of therapy	Briefly interrupt for feeding, parental bonding, nursing care	After confirmation of adequate bilirubin concentration decrease
Efficacy of intervention	Periodically measure rate of response in bilirubin load reduction	Degree of total serum/plasma bilirubin concentration decrease
Duration of therapy	Discontinue at desired bilirubin threshold; be aware of possible rebound increase	Serial bilirubin measurements based on rate of decrease

their effectiveness (group B recommendation) (see Appendix). The clinical effectiveness of the device should be known before and monitored during clinical application (group B recommendation). Local guidelines (instructions) for routine clinical use should be available. Important factors that need to be considered are listed in Table 3. Obstructing the light source and reducing the exposed body surface area must be avoided (group B recommendation).

These recommendations are appropriate for clinical care in high-resource settings. In low-resource settings the use of improvised technologies and affordable phototherapy device choices need to meet minimum efficacy and safety standards.

IV. SAFETY AND PROTECTIVE MEASURES

A clinician skilled in newborn care should assess the neonate's clinical status during phototherapy to ensure adequate hydration, nutrition, and temperature control. Clinical improvement or progression of jaundice should also be assessed, including signs suggestive of early bilirubin encephalopathy such as changes in sleeping pattern, deteriorating feeding pattern, or inability to be consoled while crying.[1] Staff should be educated regarding the importance of safely minimizing the distance of the phototherapy device from the infant. They should be aware that the intensity of light decreases at the outer perimeter of the light footprint and recognize the effects of physical factors that could impede or obstruct light exposure. Staff should be aware that phototherapy does not use ultraviolet light and that exposure to the lights is mostly harmless. Four decades of neonatal phototherapy use has revealed no serious adverse clinical effects in newborn infants 35 or more weeks of gestation. For more preterm infants, who are usually treated with prophylactic rather than therapeutic phototherapy, this may not be true. Informed staff should educate parents regarding the care of their newborn infant undergoing phototherapy. Devices must comply with general safety standards listed by the International Electrotechnical Commission.[21] Other clinical considerations include:

a. Interruption of phototherapy: After a documented decrease in bilirubin concentration, continuous exposure to the light source may be interrupted and the eye mask removed to allow for feeding and maternal-infant bonding.[1]
b. Use of eye masks: Eye masks to prevent retinal damage are used routinely, although there is no evidence to support this recommendation. Retinal damage has been documented in the unpatched eyes of newborn monkeys exposed to phototherapy, but there are no similar data available from human newborns, because eye patches have always been used.[22–24] Purulent eye discharge and conjunctivitis in term infants have been reported with prolonged use of eye patches.[25,26]
c. Use of diapers: Concerns for the long-term effects of continuous phototherapy exposure of the reproductive system have been raised but not substantiated.[27–29] Diapers may be used for hygiene but are not essential.
d. Other protective considerations: Devices used in environments with high humidity and oxygen must meet electrical and fire hazard safety standards.[21] Phototherapy is contraindicated in infants with congenital porphyria or those treated with photosensitizing drugs.[1] Prolonged phototherapy has been associated with increased oxidant stress and lipid peroxidation[30] and riboflavin deficiency.[31] Recent clinical reports of other adverse outcomes (eg, malignant melanoma, DNA damage, and skin changes) have yet to be validated.[1,2,32,33] Phototherapy does not exacerbate hemolysis.[34]

V. RESEARCH NEEDS

Among the gaps in knowledge that remain regarding the use of phototherapy to prevent severe neonatal hyperbilirubinemia, the following are among the most important:

1. The ability to measure the actual wavelength and irradiance delivered by a phototherapy device is urgently needed to assess the efficiency of

phototherapy in reducing total serum bilirubin concentrations.

2. The safety and efficacy of home phototherapy remains a research priority.
3. Further delineation of the short- and long-term consequences of exposing infants with conjugated and unconjugated hyperbilirubinemia to phototherapy is needed.
4. Whether use of phototherapy reduces the risk of bilirubin neurotoxicity in a timely and effective manner needs further exploration.

SUMMARY

Clinicians and hospitals should ensure that the phototherapy devices they use fully illuminate the patient's body surface area, have an irradiance level of $\geq 30\ \mu W \cdot cm^{-2} \cdot nm^{-1}$ (confirmed with accuracy with an appropriate spectral radiometer) over the waveband of approximately 460 to 490 nm, and are implemented in a timely manner. Standard procedures should be documented for their safe deployment.

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APPENDIX Definition of Grades for Recommendation and Suggestion for Practice

Grade	Definition	Suggestion for Practice
A	This intervention is recommended. There is a high certainty that the net benefit is substantial	Offer and administer this intervention
B	This intervention is recommended. There is a moderate certainty that the net benefit is moderate to substantial	Offer and administer this intervention
C	This intervention is recommended. There may be considerations that support the use of this intervention in an individual patient. There is a moderate to high certainty that the net benefit is small	Offer and administer this intervention only if other considerations support this intervention in an individual patient
D	This intervention is not recommended. There is a moderate to high certainty that the intervention has no net benefit and that the harms outweigh the benefits	Discourage use of this intervention
I	The current evidence is insufficient to assess the balance of benefits against and harms of this intervention. There is a moderate to high certainty that the intervention has no net benefit and that the harms outweigh the benefits. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined	If this intervention is conducted, the patient should understand the uncertainty about the balance of benefits and harms

US Preventive Services Task Force Grade definitions, May, 2008 (available at www.uspreventiveservicestaskforce.org/3rduspstf/ratings.htm).

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Physician Refusal to Provide Information or Treatment on the Basis of Claims of Conscience

COMMITTEE ON BIOETHICS

KEY WORDS
conscience, conscientious objection, cooperation

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abstract

Health care professionals may have moral objections to particular medical interventions. They may refuse to provide or cooperate in the provision of these interventions. Such objections are referred to as conscientious objections. Although it may be difficult to characterize or validate claims of conscience, respecting the individual physician's moral integrity is important. Conflicts arise when claims of conscience impede a patient's access to medical information or care. A physician's conscientious objection to certain interventions or treatments may be constrained in some situations. Physicians have a duty to disclose to prospective patients treatments they refuse to perform. As part of informed consent, physicians also have a duty to inform their patients of all relevant and legally available treatment options, including options to which they object. They have a moral obligation to refer patients to other health care professionals who are willing to provide those services when failing to do so would cause harm to the patient, and they have a duty to treat patients in emergencies when referral would significantly increase the probability of mortality or serious morbidity. Conversely, the health care system should make reasonable accommodations for physicians with conscientious objections. *Pediatrics* 2009;124:1689–1693

INTRODUCTION

Health care professionals may morally object to particular treatments and refuse to provide them. This practice is referred to as "conscientious objection."[1–3] This statement will not address claims of conscience on behalf of institutions. Possible examples of conscientious objection in pediatric practice include refusals to prescribe contraception, specifically emergency contraception[4]; perform routine neonatal male circumcision[5]; or administer vaccines developed with virus strains or cell lines derived from voluntarily aborted human fetuses.[6] Such objections may limit patients' access to information or treatment. Given this ethical dilemma, the legitimacy of such objections has become an important issue. Legislation has been proposed both to protect health care providers' ability to conscientiously object and to ensure patients' access to health care.[7]

Conscience

There are morally important reasons to protect the individual's exercise of conscience even if one disagrees with the content of the consci-

entious belief. Conscience is closely related to integrity. Performing an action that violates one's conscience undermines one's sense of integrity and self-respect and produces guilt, remorse, or shame.[8,9] Integrity is valuable, and harms associated with the loss of self-respect should be avoided. This view of conscience provides a justification for respecting conscience independent of particular religious beliefs about conscience or morality. Claims of conscience are generally negative (the right to not perform an action) rather than positive (the right to perform an action).[10]

There are potential social benefits to protecting individuals' ability to act according to their consciences. These benefits include empowering individuals to think and act morally, encouraging the use of reason rather than force, exemplifying and encouraging tolerance, and encouraging moral action. For example, people are more likely to act morally if they are permitted to act on their own decisions.[11]

What constitutes a violation of conscience may be difficult to identify or validate. In some situations, claims of conscientious objection may hide self-serving motives.[12] For example, a potential military recruit may illegitimately assert conscientious objection not because of moral objections to killing but because of a concern for his or her personal safety. Personal affiliation with an organization that publicly proscribes certain actions makes it easier to identify true claims of conscience. Confirmation may also be difficult regarding actions that are not intrinsically immoral but only immoral under certain conditions. Whereas some traditions view war as intrinsically immoral, others view the use of lethal force as morally appropriate if certain criteria are fulfilled. Whether the criteria are fulfilled may depend on empirical claims about which there is controversy. Objectors have an obligation to explain and defend their position and may be required to demonstrate the sincerity and importance of their belief.[11]

There are, however, a number of difficulties in characterizing and validating claims of conscience. The boundary between legitimate conscientious objection and unjust discrimination is particularly problematic. For example, the medical profession would not tolerate a physician's refusal to treat patients of a particular racial group because the physician considered members of this group inferior. Discrimination is an affront to the dignity of the individual discriminated against and may impose significant practical burdens on the individual. Alternatively, clinicians might claim that an action is not intrinsically immoral but only immoral when performed by certain categories of persons. For example, a clinician might object to prescribing contraception to unmarried people because the clinician believes it facilitates immoral sexual activity. In such situations, clinicians should be careful not to violate patients' privacy by asking personal questions only to satisfy their own interests.[13] Legally, when claims of conscience conflict with claims of nondiscrimination in public accommodations, such as hotels and restaurants, nondiscrimination claims take precedence. Whether private physician practices should be considered public accommodations, and which groups of individuals should be protected against discrimination, are subjects of continuing societal debate.[14] The American Academy of Pediatrics opposes discrimination in the care of any patient or against any physician.[15]

Evaluating claims of conscience is also difficult, because some individuals object not only to performing an action themselves but also to assisting someone else to perform the action. Physicians who object to emergency contraception do not use it themselves and also refuse to prescribe it to others. They argue that assisting others to do something they themselves consider immoral makes them morally culpable. For example, a physician whose patient makes a credible threat against a third party would be morally culpable if he or she refused to warn the third party or to notify the police and the patient harmed the other individual.

Whether assisting someone else to perform an act that you consider immoral is wrong depends on a number of factors including intention. It would be wrong if you intend for the wrong to be committed and share the intention of the person you are helping. In other cases you might cooperate in the act but not share the other person's intention, and your assistance might be appropriate. Using a bank robbery as a nonmedical example, the getaway driver shares the robber's intention, but the bank manager who is forced to open the vault does not. The getaway driver's actions are wrong, whereas those of the manager may be excusable. The moral evaluation of assisting another without sharing his or her intention depends on a variety of practical considerations including the seriousness of the wrong, the causal relationship between the assistance and the act, the necessity of the assistance for completing the act, and the reason for providing the assistance. There is also the concern that cooperation may be misinterpreted as approval and might cause another to act wrongly.[16] Often, these relative determinations do not permit clear lines to be drawn between morally acceptable and immoral assistance. Questions regarding cooperation can become issues of conscience.

Conscientious Objection in Health Care

Claims regarding conscientious objection in medicine should be evaluated on the health care system rather than the individual level, because neither the clinicians' nor the patients' claims clearly trump the others' in all situations. Conflicts are often framed in terms of an individual provider and a single patient. Both of these individuals have morally significant interests.[17] Consider a pediatrician who refuses to prescribe emergency contraception for a patient whose partner's condom broke during intercourse. A health care professional might choose to leave medicine rather than violate his or her conscience. This decision could have secondary effects not only for the professional and his or her family but also for patients. It might limit their access to other services. Alternatively, the health care professional might violate his or her conscience and experience significant guilt and shame and their secondary effects. Constrained access to health care may also have significant effects for patients, such as an unintended but possibly preventable pregnancy. Benefits and harms to patients should be evaluated from the patients' points of view. The frequency of particular outcomes is difficult to predict, and the type and magnitude of these outcomes do not lend themselves to weighing and balancing. Therefore, it is not possible to state in the abstract that either the health care professional's claim to conscientious objection or the patient's claim to access should always prevail.

Some refusals constitute an imposition of the physician's moral beliefs on the patient. Refusing to transfer a patient's medical records, for example, unfairly constrains a patient's subsequent action and is morally unacceptable.[9] More egregious actions, such as berating or humiliating patients, violate the respect that objectors themselves are seeking and are clearly morally wrong. It is not clear, however, that refusing to cooperate is morally equivalent to imposing one's views. Physicians, except in emergencies, have significant latitude in selecting patients, and pharmacies may not stock dedicated emergency contraceptives for reasons unrelated to conscience. Those who refuse on the basis of conscience should not be held to higher standards than those who refuse treatment on the basis of other accepted grounds.

Constraints on claims of conscience can, nonetheless, be justified on the basis of health care professionals' role responsibilities and the power differential created by licensure. Health care professionals fulfill a particular societal role with associated expectations and responsibilities. For example, physicians' primary focus should be on their patients' rather than their own benefit. These role expectations are based in part on the power differential between physicians and patients, which is the result of physicians' knowledge and patients' conditions.

Role obligations are generally voluntarily accepted; therefore, health care professionals' claims of conscientious objection may justifiably be limited. It is unreasonable for an individual to enter a profession or specialty with primary activities that conflict with his or her central values.[18] Individuals, however, may change their moral points of view after having accepted a role, or the role may be redefined during the course of their professional practice. The debate over physician-assisted suicide, for example, has evolved during many practicing physicians' careers.[8] The boundaries of medical practice, both in terms of what constitutes disease and the scope of available treatments, may also evolve over time. Although individuals should not knowingly enter a specialty with core activities that they are unwilling to perform, changes in medical practice over time should also be acknowledged.

Some have argued that the exercise of conscience is integral to being a professional, but this claim confuses professional and nonprofessional commitments. Physicians generally can refuse to perform actions that they consider medically inappropriate. A pediatrician may, for example, refuse to prescribe antibiotics for a viral respiratory infection or perform a surgery that has an unacceptable mortality rate. In contrast, conscientious objections are typically based not on medical knowledge but on moral, religious, or political beliefs.[9,11] The ability to refuse to provide a service or treatment on these other bases is not part of being a physician.

One responsibility of the physician's role is providing medical information, including risks, benefits, and alternatives, during the informed-consent process. This role responsibility is supported by the value of autonomy and patients' need for information to make autonomous decisions.[12] Permitting physicians, on the basis of a claim of conscience, not to disclose a legally available treatment option of which the patient is unaware but might otherwise choose would significantly undermine the practice of medicine. For example, it would be unfair for a victim of sexual assault who was unfamiliar with emergency contraception not to be informed of its existence. Acknowledging that language is not value neutral, the information disclosed should be accurate, complete, easily understood, and focused on the patients' decision-making needs. Physicians should document the informed-consent process in the patient's medical record.

As previously mentioned, clinical information should be provided in a respectful manner.[19] Physicians can ex-

plain the reasons why they do not provide certain treatments or services while respecting patients' autonomy. The power differential between physicians and patients may, however, create unintended coercion. Patients should be able to refuse to listen to physicians' reasons.

Similar considerations require clinicians to provide prospective disclosure and referral. Physicians who, on the basis of conscience, refuse to provide particular treatments or services within the usual scope of practice for their specialty have an obligation to disclose this to potential patients. This knowledge may be important to patients in selecting physicians. In some situations, it may be feasible to transfer care. Although some clinicians object that referring makes them morally complicit,[8] patients may be harmed by the lack of referral. Patients, particularly adolescents, may not know how to identify a willing health care professional. Patients may also face a significant delay in obtaining a new-patient appointment. The power differential in the physician-patient relationship is based not only on physicians' greater medical knowledge but also on their greater knowledge about the health care system. In situations of potential harm to patients, physicians have a duty to refer in a timely manner. This duty may be fulfilled by informing patients about referral services such as those provided by hospitals or insurance companies. Physicians should provide other, ongoing care while transferring patient care responsibilities. For example, a physician who decides not to see unimmunized patients should continue to treat an established, unimmunized patient's asthma until a new primary care provider can be established.

Special obligations on the part of health care professionals also result from the system of licensure.[17,20] Licensure requirements constrain others from providing similar services and limit patients' access. Physicians' relative monopoly on health care services and their fiduciary obligations to patients create an obligation to treat, irrespective of conscientious objection, in emergencies. Health care providers have a duty to perform procedures within the scope of their training when the patient's health is at significant risk and an alternative health care professional is unavailable.[11,13]

Protection of physicians' conscience and provision of legal health care services are both goods that the health care system should protect. A variety of accommodations are feasible. For example, alternative modes of providing emergency contraception include advance prescription, pharmacist provision, and over-the-counter sales.[21] Employers have important legal obligations and can provide an essential coordinating function within the health care system. They should provide reasonable accommodations, such as job restructuring or modified work schedules.[18] Referral services may also be created to provide resources for patients seeking care.[21] Accommodation efforts should recognize a wide variety of potential barriers for patients, including education level, income, and geography. Local variation in circumstance makes broad policy recommendations difficult.[17]

Conversely, physicians have obligations to their patients. These obligations include disclosure, provision of informed consent, referral, and emergency treatment.[22] Physicians have a moral obligation to disclose their beliefs to employers and to accept reasonable accommodations from them.[18] Physicians should avoid placing undue burdens on their colleagues. Self-employed physicians should avoid creating situations that inordinately constrain patients' access to legal treatments. For example, a physician with a conscientious objection to a particular procedure should avoid intentionally displacing the only willing provider of that procedure for a large geographic area.

RECOMMENDATIONS

1. The American Academy of Pediatrics supports a balance between the individual physician's moral integrity and his or her fiduciary obligations to patients. A physician's duty to perform a procedure within the scope of his or her training increases as the availability of alternative providers decreases and the risk to the patient increases.
2. Physicians should work to ensure that health care–delivery systems enable physicians to act according to their consciences and patients to obtain desired health care.
3. Physicians have a duty to prospective patients to disclose standard treatments and procedures that they refuse to provide but are normally provided by other health care professionals.
4. Physicians have a moral obligation to inform their patients of relevant alternatives as part of the informed-consent process. Physicians should convey information relevant to the patient's decision-making in a timely manner, using widely accepted and easily understood medical terminology, and should document this process in the patient's medical record.
5. Physicians who consider certain treatments immoral have a duty to refer patients who desire these treatments in a timely manner when failing to do so would harm the patients. Such physicians must also provide appropriate ongoing care in the interim.

6. Physicians should work to ensure that employers make reasonable accommodations for employees' conscientiously held views and that responsibilities are equitably distributed among colleagues.
7. In emergencies, when referral would significantly increase the probability of mortality or serious morbidity, physicians have a moral obligation to provide treatment.

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Physicians' Roles in Coordinating Care of Hospitalized Children

Patricia S. Lye, MD and THE COMMITTEE ON HOSPITAL CARE AND SECTION ON HOSPITAL MEDICINE

KEY WORDS
care coordination, care transitions and family-centered care

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abstract

FREE

The care of hospitalized children and adolescents has become increasingly complex and often involves multiple physicians beyond the traditional primary care pediatrician. Hospitalists, medical subspecialists, surgical specialists, and hospital attending physicians may all participate in the care of hospitalized children and youth. This report summarizes the responsibilities of the pediatrician and other involved physicians in ensuring that children receive coordinated and comprehensive medical care delivered within the context of their medical homes as inpatients, and that care is appropriately continued on an outpatient basis. *Pediatrics* 2010;126:829–832

BACKGROUND

Although an infrequent occurrence for most children and their families, hospitalization is a significant event in the life of a child and his or her family. Most children are hospitalized for an acute illness or injury. Children with disabilities are more likely to be hospitalized and experience 8 times as many hospital days as other children.[1] Care coordination is an important aspect of caring for children with special health care needs and has been emphasized by the American Academy of Pediatrics as part of the medical home concept.[2] Care coordination is essential for safe care and includes developing and guiding diagnostic and therapeutic plans with integration of input from the medical team, patients, and families toward the goal of discharging a healthier child back to his or her medical home.[3]

Patient and family satisfaction with the hospital experience is an important element of quality of care. Parents in 1 review, on average, were very satisfied with the overall care of their child; however, information shared with the child and coordination of care had the highest problem scores. In addition, problems with information provided to the parents correlated most strongly with overall negative perception of care received.[4]

As the care that is delivered to children on an outpatient basis becomes more sophisticated, illnesses that warrant hospitalization are becoming more complex and severe and often require specialty consultation(s). Although the primary care pediatrician may be the attending physician directly responsible for clinical management of the hospitalized child, this is becoming much less common.[5,6] In community hospitals, pediatric hospitalists, medical subspecialists, and surgical specialists may be unavailable, and a physician whose primary practice is adult medicine may provide general, specialty, and/or surgical care and function as the attending physician for pediatric patients. Alternatively, a pediatric hospitalist, full-time teaching attending pediatrician, pediatric medical subspecialist, or

surgical specialist may be responsible for the supervision and care of the child. Coordination and oversight of care must be provided by the attending physician who is caring for the patient, regardless of whether that is the primary care pediatrician and/or other physicians as described above. The following functions are the essential components of this coordination and oversight role.

INITIAL ASSESSMENT

For any child who requires hospital admission, an initial assessment made before or at the time of hospitalization allows for the child to be admitted to the inpatient setting that is best suited to his or her specific problem(s). At times, authorization may be needed from the child's insurance carrier before admission. In addition, attention must be directed to the safest way for the child to travel to the hospital (family car, ambulance, or specialized pediatric transport). A safe transport plan is particularly important if the child's destination is distant. Referring and receiving physicians should work together to advocate and direct a timely, well-coordinated, and safe transfer.

A complete initial evaluation includes a history of the present illness; complete medical history; pain assessment; drug and food allergies; review of systems; review of immunizations; medication reconciliation; assessment of growth (including BMI), nutritional, developmental, educational, and emotional status; review of family and social history, including review of behavioral and environmental risk factors and cultural or ethnic issues; and a physical examination.[7] The effects of the child's condition on his or her family and the effects of the family on the child's condition need to be evaluated to initiate family-centered care. These assessments may be performed just before or concurrent with hospitalization and routinely involve collaboration with other health care professionals such as nursing staff, child life specialists, social workers, and others.

It is especially important that the child's medical history be obtained if the primary care pediatrician is not the attending physician. Hospitalists, medical subspecialists, and surgical specialists who care for hospitalized children must communicate with the child's primary care pediatrician for overall coordination of care. Pertinent previous health information must be available on admission for the inpatient health care team to review, including a list of prescribed medications and therapies. Access to this information prevents unnecessary duplication of previous diagnostic and therapeutic measures; reduces the risk of errors in medication dosing; allows primary care and hospital-based physicians to update the status of past conditions that may not be obvious on the current admission; provides an opportunity to address identified deficiencies while the child is hospitalized, such as catching up on immunizations; provides insight into psychosocial issues facing the patient and family; and facilitates monitoring of the child's growth and development. Inpatient and outpatient facilities must be able to provide and receive necessary medical records in a reliable, timely, safe, and confidential manner. An accessible electronic health record may provide more timely and accurate data. In some settings, equipment from home (eg, a home bilevel positive airway pressure [BIPAP] device, insulin pump, or specialized wheelchair) can be critical, even if only to bridge the gap in transition from home to hospital.

DURING THE HOSPITAL STAY

The attending physician integrates and coordinates the input of all physicians and other ancillary providers when multiple providers are involved in the patient's care. Duties include directing the overall care of the child, coordinating input from consultants, confirming that the child and the family understand the information from all consultants, considering the options when consultants disagree, planning for discharge from the hospital, and efficiently using inpatient resources.

Family-centered care is linked to improved health outcomes[8] and has been recommended by many key constituents for children's health care. Family-centered rounds is a system that emphasizes the essential role of the family in coordinating the care of hospitalized children.[9] Communication with the patient, family, bedside nurse, and other members of the inpatient care team can improve coordination of the daily plan, which leads to fewer misunderstandings and more timely completion of the daily plan. In a nonteaching hospital, family-centered rounds can be as simple as rounding together with the nurse, patient, and family and trying to coordinate this time with the visit of other involved subspecialists and/or surgeons.

Increasing emphasis is being placed on ways to reduce medication errors.[10] Children are more at risk for medication errors than adults, and the potential for harm is higher.[11,12] Errors are likely to occur during transitions of care, including admission, handoffs from 1 team to another, and discharge. In academic medical centers, resident work-hour restrictions have led to increasing numbers of sign-outs, another time at which errors may occur.[13] The process for handoffs and sign-outs should be standardized and include opportunities for verbal interchange and links to the hospital information system to ensure up-to-date and accurate information.

When the attending physician does not routinely care for pediatric patients, pediatric consultation can help with

the physiologic, pharmacologic, and psychosocial issues; discharge planning; and identifying and arranging for home care resources unique to younger and smaller patients. Hospitals are encouraged to set criteria for pediatric consultation, depending on local resources. Formal consultation is recommended for any hospitalized child with complex medical or psychosocial problems. Some hospitals have set age or weight criteria for mandatory consultation, such as age younger than 14 years or body weight less than 40 kg.

When physicians other than the primary care pediatrician participate in the care of the hospitalized child, the primary care pediatrician can help ensure continuity of care and help the family develop trust in providers who have no preexisting relationship with the family. As the hospitalization progresses, the primary care pediatrician can provide valuable insight into the patient's changing medical condition and the patient's and family's psychosocial status and response. For patients and families facing end-of-life issues, the involvement of the primary care pediatrician and community resources, such as pastoral care, is particularly valuable.

DISCHARGE PLANS AND COORDINATION

Preparation for discharge needs to begin at admission and engage the family at all stages. Discharge criteria are set at admission and reviewed at least daily by members of the team and the patient and family. When going home, an assessment of the child's needs should be made; plans should be formulated; medications should be reconciled, including clarifying that some medications may purposely be discontinued at the time of discharge; and appropriate training and education should be completed. Treatment plans must be made in accordance with the child's developmental, educational, and emotional level and available resources. The continued involvement of the primary care pediatrician ensures that discharge planning is proceeding effectively. It improves the primary care pediatrician's understanding of the patient's hospital course to facilitate optimal transitional and ongoing outpatient care.[14] Family members or guardians must be involved with formulation of the treatment plan, because they are ultimately responsible for decisions about the care their child receives.[15]

If treatment is not completed during hospitalization, appropriate outpatient management must be arranged. The attending physician, together with other members of the health care team and the family, is responsible for evaluating whether the outpatient treatment plan seems feasible for the child's family to undertake and modifying the plan if needed. At the time of discharge, a legible summary, including medications, appropriate follow-up, and assignment of care responsibilities, must be available to all personnel and institutions involved in the subsequent care of the child.[16] Timely electronic reports should be available to ensure that a complete and legible record of events is provided. Laboratory, imaging, and consultative reports that are pending at the time of discharge should be identified, and the physician responsible for checking these results should be clearly specified. Referrals must be provided for all needed outpatient services, including a source of primary care if the child does not have a medical home. In such instances or when the primary care pediatrician was not directly involved in the child's hospitalization, the provider responsible for ongoing care should be contacted directly by the inpatient team to ensure prompt initiation of outpatient care; ideally, this would occur at the time of discharge. All referrals for outpatient services should be arranged with providers who are familiar with the special needs of children.[17]

CONCLUSIONS

Most inpatient care represents an episodic incident of care and must be viewed and managed within the context of the child's medical home. To accomplish this requires ongoing communication between the primary care pediatrician and the hospital attending physician. Care coordination must include continual involvement of the family, timely legible communication between inpatient and outpatient physicians, meticulous handoffs at every transition, and clear delineation of the responsibilities of all involved physicians during the hospital stay and when the child returns home.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Poliovirus

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS
polio, poliovirus vaccine, immunization, polio eradication, IPV, OPV

ABBREVIATIONS
IPV—inactivated poliovirus vaccine
OPV—oral poliovirus vaccine
DTaP—diphtheria-tetanus-acellular pertussis
Hib—*Haemophilus influenzae* type b

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abstract

FREE

Despite marked progress in global polio eradication, the threat of polio importation into the United States remains; therefore, all children should be protected against the disease. The standard schedule for poliovirus immunization remains 4 doses of inactivated poliovirus vaccine at 2, 4, and 6 through 18 months and 4 through 6 years of age. The minimum interval between doses 1 and 2 and between doses 2 and 3 is 4 weeks, and the minimum interval between doses 3 and 4 is 6 months. The minimum age for dose 1 is 6 weeks. Minimal age and intervals should be used when there is imminent threat of exposure, such as travel to an area in which polio is endemic or epidemic. The final dose in the inactivated poliovirus vaccine series should be administered at 4 through 6 years of age, regardless of the previous number of doses administered before the fourth birthday, and at least 6 months since the last dose was received. *Pediatrics* 2011;128:805–808

INTRODUCTION

Despite marked progress in global efforts to eradicate polio, wild polioviruses still persist in a small number of Asian and African countries. Thus, it is essential to ensure high poliovirus immunity levels in US children to prevent outbreaks should poliovirus be imported into this country. In 2000, inactivated poliovirus vaccine (IPV) became the poliovirus vaccine of choice for routine immunization in the United States; it replaced oral poliovirus vaccine (OPV), which had been in use since the 1960s.[1] The rationale behind the change to IPV was to prevent the rare occurrence of vaccine-associated paralytic polio caused by OPV. Since 2000, 3 combination vaccines containing IPV have been licensed.[2] This brief policy statement provides guidance on the optimal use of such combinations. In addition, the appropriate intervals between doses, particularly for catch-up schedules, and the importance of the dose at 4 through 6 years of age for maintaining long-term immunity to polio are addressed.

BACKGROUND AND RATIONALE

Before the introduction of IPV in 1955, more than 15 000 cases of paralytic polio occurred annually in the United States. During the early 1960s, OPVs replaced IPV as the vaccine of choice because of their ease of use and because, at the time, it was believed that OPV would provide better community protection and produce long-lasting immunity. Use of OPV led to the elimination of indigenous polio in this country; the last reported outbreak was in 1979.[3] Although the use of OPV was highly effective, there were rare but serious cases of vaccine-associated paralytic polio (~8 cases per year) in both healthy and immunocompro-

mised recipients and contacts of recipients of OPV.[4] In addition, data accumulated to show that IPV-induced immunity was long-term and that IPV alone had interrupted poliovirus transmission in several industrialized countries.[5] Thus, in 2000, IPV replaced OPV for preventing vaccine-associated paralytic polio cases while maintaining high levels of individual and community protection against wild polioviruses. The current IPV immunization schedule was designed to induce immunity to polio early in life; it calls for 3 doses administered at 2, 4, and 6 through 18 months of age and a booster dose at 4 through 6 years of age.[1] The 3-dose primary series of IPV leads to more than 95% seroconversion to all 3 poliovirus serotypes.

In 1988, the World Health Assembly adopted a goal to eradicate polio. At the time, there were an estimated 350 000 cases worldwide, and polio was indigenous to 125 countries.[6] By 2009, the number of cases caused by wild polioviruses was reduced to 1604, and only 4 countries (Afghanistan, India, Nigeria, and Pakistan) had never interrupted indigenous virus transmission (www.polioeradication.org). However, these 4 countries exported virus to at least 19 other countries, which reported cases of polio in 2009, which indicates the potential for continuing spread outside the currently affected areas. Although the number of reported cases during 2010 was reduced compared with 2009 (1349 vs 1604), polio had been reported from 20 countries during 2010. As of August 23, 333 cases were reported from 14 countries, compared with 618 cases during the same period in 2010.

The need for increased investment in implementation of strategies for eradicating polio was recently well articulated, and both donor and affected countries should be encouraged to continue to make progress toward this goal.

OPV is the vaccine used in most of the world.[7] Rarely, circulation of oral vaccine viruses has been associated with acquisition of a wild virus phenotype (comparable neurovirulence and transmissibility to wild polioviruses) leading to outbreaks of polio.[6] The medical care costs of even 1 case of polio are substantial. A recent study estimated that such costs were on the order of $520 000 per case (range: $250 000–$1 500 000).[8] These costs are exclusive of the costs that would be incurred trying to contain an outbreak. Thus, the United States remains at risk of importation of pathogenic polioviruses, which indicates the need, into the foreseeable future, to maintain high levels of polio immunity in the population through widespread use of IPV. Individual protection is important, because even within the United States, there are pockets of underimmunized children who might sustain polio transmission if the virus is introduced.[9,10]

EVIDENCE TO SUPPORT POLICY/ RECOMMENDATION

Seroconversion rates and geometric mean titers (GMTs) after receipt of IPV are influenced by preexisting maternal antibody, the age at which doses are administered, and the intervals between doses. For example, a study from Puerto Rico reported seroconversion rates of 99.6%, 100%, and 99.1% against serotypes 1, 2, and 3, respectively, when administered at 2, 4, and 6 months of age, compared with 85.8%, 86.2%, and 96.9%, respectively, when administered at 6, 10, and 14 weeks of age.[11] In each schedule, children with higher maternal antibodies tended to have lower GMTs and lower seroconversion rates; maternal antibodies decrease with increasing age. For example, infants vaccinated during the first 6 months of life using 1-month intervals at 2, 3, and 4 months or 3, 4, and 5 months of age tend to produce lower antibody levels than do infants vaccinated using 2-month intervals.[7,11,12]

The duration of immunity after receipt of the IPV series is long-term, possibly lifelong. A study in Sweden revealed persistent levels of antibody for the 12-year duration of follow-up for children who received a 4-dose series beginning in the first year of life with a booster at 4 through 5 years of age.[13] A review of IPV schedules in 36 countries that used IPV in 2009 revealed that 34 countries included a booster dose at 4 or more years of age.[14] Thus, there is substantial experience showing that countries that provide such a booster dose at that age have been able to sustain polio elimination. On the other hand, the experience in countries that do not provide the booster has been limited.

Four preparations of IPV are available in the United States (Table 1),[2] including a stand-alone preparation and 3 combination vaccines: DTaP-HepB-IPV (diphtheria and tetanus toxoids and acellular pertussis adsorbed, hepatitis B [recombinant], and IPV combined [Pediarix (GlaxoSmithKline Biologicals, Rixensart, Belgium)]), licensed for the first 3 doses of the IPV series through 6 years of age; DTaP-IPV/Hib (diphtheria-tetanus-acellular pertussis [DTaP], IPV, and *Haemophilus influenzae* type b [Hib] conjugate [tetanus toxoid conjugate] vaccine [Pentacel (Sanofi Pasteur, Swiftwater, PA)]), licensed for 4 doses of the IPV series through 4 years of age; and DTaP-IPV (Kinrix [GlaxoSmithKline Biologicals]), licensed for the booster dose at 4 through 6 years of age.

RECOMMENDATIONS

1. The standard schedule for IPV should be 4 doses administered at 2 months, 4 months, 6 through 18 months, and 4 through 6 years of age.
2. If there is risk of imminent exposure to circulating polioviruses, such as travel to a country in which

TABLE 1 Currently Licensed Vaccines Containing Inactivated Poliovirus Vaccine (IPV)—United States, 2011*

Vaccine Composition	Trade Name	Manufacturer	Approved Use in ACIP Routine Schedule†	Comments
IPV	Ipol (Poliovax§)	Sanofi Pasteur	2, 4, 6–18 months, and 4–6 years	Approved for use in infants, children, and adults¶
DTaP-HepB-IPV**	Pediarix	GlaxoSmithKline	2, 4, and 6 months	Approved for first 3 doses of IPV through 6 years old††
DTaP-IPV/Hib§§	Pentacel	Sanofi Pasteur	2, 4, 6, and 15–18 months	Approved for 4 doses of IPV through 4 years old¶¶
DTaP-IPV***	Kinrix	GlaxoSmithKline	4–6 years	Approved for booster dose at age 4–6 years†††

* As of August 30, 2011.
† Advisory Committee on Immunization Practices. Full schedule available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5751a5.htm.
§ Not currently distributed in the United States.
¶ Package insert available at http://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM133479.pdf.
** Diphtheria and tetanus toxoids and acellular pertussis adsorbed, hepatitis B (recombinant), and inactivated poliovirus vaccine combined.
†† Package insert available at http://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM241874.pdf.
§§ Diphtheria and tetanus toxoids and acellular pertussis adsorbed, inactivated poliovirus, and *Haemophilus influenzae* type b conjugate (tetanus toxoid conjugate) vaccine.
¶¶ Package insert available at http://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM109810.pdf.
*** Diphtheria and tetanus toxoids and acellular pertussis adsorbed, and inactivated poliovirus vaccine.
††† Package insert available at http://www.fda.gov/downloads/BiologicsBloodVaccines/Vaccines/ApprovedProducts/UCM241453.pdf.
Reprinted with permission from Centers for Disease Control and Prevention. *MMWR Morb Mortal Wkly Rep.* 2009;58(30):829–830.

polio is endemic or there is an outbreak, then the minimum age and intervals for the first 3 doses of IPV should be followed. Maternal antibodies can interfere with seroconversion in the first 6 months of life. For this reason, the standard schedule in recommendation 1, which calls for vaccine administration during periods when maternal antibodies are likely to have waned substantially, should be implemented unless there is imminent exposure risk. Although not ideal, the great majority of infants vaccinated at the minimum age with minimal intervals are protected from polio, and with imminent risk of exposure, the benefits of using the abbreviated schedule far outweigh any risks of failure to induce a protective immune response.

- The minimum interval from doses 3 to 4 should be 6 months.
- The minimum interval from doses 1 to 2 and from doses 2 to 3 should be 4 weeks.
- The minimum age for dose 1 is 6 weeks.

3. The final dose of IPV should be administered at 4 through 6 years of age regardless of the number of doses administered before 4 years of age. The final dose should be given at least 6 months after the preceding dose.
4. When DTaP-IPV/Hib is used for the first 4 doses, a fifth dose of an IPV-containing preparation (IPV alone or DTaP-IPV) should be administered on or after the fourth birthday. The minimal interval between doses 4 and 5 of IPV in this case should be 6 months.
5. IPV should be administered to immunocompromised and immunodeficient children using the same schedule as that for children with normal immune systems. Because the vaccine is inactivated, it is safe in children with abnormal immune systems. IPV might not be as effective in such children, depending on the disorder and degree of immunocompromise, compared with protection rates in children with normal immune systems.
6. Adults who are at an increased risk of exposure to wild-type poliovirus and who previously completed primary immunization with OPV or IPV can receive a single dose of IPV.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Pediatric AIDS

Planning for Children Whose Parents Are Dying of HIV/AIDS

ABSTRACT. Although the character of acquired immunodeficiency syndrome is changing into a chronic illness, it is estimated that by the end of this century, 80 000 children and adolescents in the United States will be orphaned by parental death caused by human immunodeficiency virus infection. Plans for these children need to be made to ensure not only a stable, consistent environment that provides love and nurturing, but also the medical and social interventions necessary to cope with the tragic loss. Pediatricians should become aware of local laws and community resources and initiate discussion early in the course of parental illness to facilitate planning for the future care and custody of the children. States need to adopt laws and regulations that provide flexible approaches to guardianship and placement of children orphaned by acquired immunodeficiency syndrome.

ABBREVIATIONS. AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency virus.

THE PROBLEM

Health care professionals caring for children of parents who are chronically or terminally ill with acquired immunodeficiency syndrome (AIDS) should consider raising the issue of planning for the future of these children at an appropriate time in the course of the parents' illness. It is estimated that by the end of this century, parental death caused by human immunodeficiency virus (HIV) infection or AIDS will result in as many as 80 000 orphaned children and adolescents in the United States.[1,2] For parents who face worsening illness and impending death, one of the most painful realizations is the inability to care for their children, plan their futures, and see them grow to maturity. In the context of HIV infection, both parents are likely to be infected and possibly ill or dying, and the mother may be quite isolated and not have assistance from the father of the children, who may have died or is unavailable. Future planning for the children can create peace of mind for parents by assuring that the children will be cared for according to the parents' wishes concerning their future. Future planning is a difficult and complex process that requires considerable time and effort and should be initiated in a sensitive manner early in the course of illness. Parents often are reluctant to initiate such planning because of a sense of guilt, denial of the seriousness of the illness, or fear that others may learn about the diagnosis.

Planning for the future of a child or adolescent who will be orphaned includes creating a stable, nurturing environment providing love and stability. At the same time, the legal framework and social interventions necessary must be provided for the child to cope with the loss of their parents and to receive necessary medical, mental health, and educational services.

BACKGROUND

Children and adolescents who are orphaned by the HIV/AIDS epidemic are generally from families who have experienced the consequences of poverty, lack of access to services, discrimination, and family disruption. They are most often cared for solely by their mother, with or without the assistance of other family members such as a grandmother.[3] It is, therefore, not surprising that parent(s) may be somewhat reluctant to discuss the issue of their own death and the planning for their children.[4,5] Parents with HIV/AIDS may fear the potential stigmatization and isolation from family and community that is associated with revealing the diagnosis. In addition, they may fear losing custody or parental rights to direct their child's future when they reveal concern about their future loss of capacity.[6] They also may be concerned about the burden imposed on potential guardians such as a grandmother, sister, or aunt, and may be reluctant to raise the issue of planning for their children. Most poignantly, the parents may be reluctant to face their own potential death and be unwilling to discuss their child's future with the child or with anyone else.[7]

A legal guardian is appointed by a court and is empowered, in lieu of a parent, to make day-to-day decisions for a child, including issues involving health care, housing, and education. Once a guardian has been appointed, that person assumes legal authority for the child even if the chronically ill parent and guardian have agreed informally that the guardian will not assume responsibility until the parent is no longer able. A parent can ask the court to designate a guardian for a child, but the other parent, if alive, must agree to the appointment or be judged to be unknown, unavailable, or determined to have relinquished parental rights. A parent can designate a guardian in a will, but the authority comes into effect only after the completion of the approval of the guardianship petition by the court after the death of the parent.[8–10] Some states have created flexible laws and regulations that aid ill parents in planning for

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

their children's future. New York, New Jersey, Illinois, Florida, North Carolina, and California have instituted a stand-by guardianship law to authorize a guardian to be temporarily or permanently designated by a chronically ill parent to make decisions for the child at a specified time such as at the death of the parent or when the parent becomes physically debilitated or mentally incapacitated. This guardianship arrangement can allow the parent to resume custody if sufficient health returns.[9] This approach allows maximal involvement of the parent while alive, and immediate clarification of guardianship for the child after the death of the parent.

Foster care agencies generally have not developed flexible policies for placement of children during episodes of parental illness and rapid return of the children to the parent when sufficient health warrants resumption of custody. This is particularly important as HIV infection becomes a chronic disease with multiple acute episodes of serious illness. Agencies also should make efforts to keep siblings from being separated or losing regular contact with one another when making foster care arrangements.

Children and adolescents who have experienced the death or face the impending death of a parent require sensitive bereavement counseling services including information, long-term emotional support, and preventive services.[11–13] Pediatricians should be aware of community and financial resources to assist such children and families and should monitor the grief process and provide appropriate anticipatory guidance and referral when needed.[14]

CONCLUSION

Because an increasing number of children and adolescents are being orphaned because of the death of their parents from HIV/AIDS, health care professionals should assist chronically ill and dying parents to plan for the future of their children. Creating loving and nurturing environments for such children by providing the legal framework; the counseling and other necessary social and financial services; and the stability of a clear, consistent family structure enhances the outcome for children while assuring that chronically ill parents participate actively in the planning process.

RECOMMENDATIONS

1. Health care professionals caring for the children and adolescents of chronically and terminally ill parents with AIDS should assist families to create a plan for the future care and custody of their children. This discussion should be initiated in a sensitive manner early in the course of parental illness and take place over an appropriate period consistent with disease severity and the course of the parents' illness.
2. Pediatricians should refer families for assistance with planning for the future well-being of their children to social service agencies that provide these services. When pediatricians are not aware of such agencies, they should advise parents to contact the HIV Resource Center or the Pediatric AIDS Foundation.
3. Pediatricians should advocate for laws that include provisions to authorize flexible and stand-by guardianship and that provide specific funding to facilitate planning for children with parents with HIV/AIDS who will become ill and have limited life expectancy.
4. Pediatricians should ask state and local child welfare agencies to develop flexible policies that permit temporary placement of children during parental illness and return of the children if the parent regains sufficient health. Whenever possible, such policies should not separate siblings. For those children who are HIV-infected themselves, policies should address the special concerns about the continuity of health care during placement.
5. Pediatricians should advocate for and assist in the development of state-funded programs that provide economic and social support to family members who care for children orphaned by HIV infection. Permanent adoption should be encouraged through the provision of social services and by decreasing economic disincentives.
6. Pediatricians should advocate for state-funded model programs that provide comprehensive mental health care, social support, and legal services for chronically ill HIV infected parents, their children, and future caregivers and guardians to enhance the well-being of the children and their families. Additional research is necessary and should be promoted by pediatricians to learn more about program effectiveness and the long-term outcomes of the children and their foster and adoptive families.

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CLINICAL REPORT

Postdischarge Follow-up of Infants With Congenital Diaphragmatic Hernia

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Section on Surgery and the Committee on Fetus and Newborn

ABSTRACT

Infants with congenital diaphragmatic hernia often require intensive treatment after birth, have prolonged hospitalizations, and have other congenital anomalies. After discharge from the hospital, they may have long-term sequelae such as respiratory insufficiency, gastroesophageal reflux, poor growth, neurodevelopmental delay, behavior problems, hearing loss, hernia recurrence, and orthopedic deformities. Structured follow-up for these patients facilitates early recognition and treatment of these complications. In this report, follow-up of infants with congenital diaphragmatic hernia is outlined.

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Key Words
congenital diaphragmatic hernia, gastroesophageal reflux, pulmonary hypoplasia, follow-up

Abbreviations
CDH— congenital diaphragmatic hernia
ECMO— extracorporeal membrane oxygenation

INTRODUCTION

Survival rates for patients with congenital diaphragmatic hernia (CDH) have increased during the past decade with the implementation of more "gentle" ventilation and physiology-specific strategies, high-frequency ventilation, extracorporeal membrane oxygenation (ECMO), and improved supportive care.[1–3] Improvement in survival rates has occurred for infants with CDH complicated by severe pulmonary hypoplasia, pulmonary hypertension, and chronic lung disease.[4] However, other significant morbidities, such as neurocognitive delay, gastroesophageal reflux, hearing loss, chest wall deformity, poor growth, hernia recurrence, and complications attributable to associated congenital anomalies, continue to affect the lives of many infants with CDH beyond the neonatal period.[1,5,6]

Coordination of the complex medical and surgical needs of these infants is challenging. Comprehensive multispecialty clinics that aggregate specialty physicians and services are family-friendly and provide for collaborative evaluation and management planning. Same-site multidisciplinary service teams also improve coordination, communication, and support for the medical home pediatrician who is responsible for managing the general health care needs of the infant. Unfortunately, such multispecialty clinics are not available to all infants with CDH. The following information is intended to provide clinicians who care for infants with CDH with a template to organize a comprehensive plan for detection and management of associated morbidities.

PULMONARY MORBIDITY

Survivors with CDH may require treatment beyond the initial hospitalization for chronic lung disease, bronchospasm, pulmonary hypertension, aspiration, pneumonia, and pulmonary hypoplasia. Oxygen treatment beyond the initial hospitalization may be needed for many of these infants, especially those who are treated with ECMO and a prosthetic patch.[7–9] Many survivors not treated with ECMO also receive bronchodilators and inhaled steroids.[8] At least 4% of survivors require a long-term tracheostomy.[9,10] Nearly one fourth of infants with CDH who survive have obstructive airway disease at 5 years of age,[10,11] and some have pulmonary hypertension that persists for months or years. Pulmonary hypertension that persists for more than the first few weeks after birth is a risk factor for early death.[12] Persistent abnormalities in lung function also have been demonstrated on ventilation/perfusion scans.[8,12–15]

Pneumonia occurs in approximately 7% of infants with CDH during the first year after birth.[5,16,17] Aspiration-associated pneumonia and bronchospasm may be reduced in frequency by avoiding oral feeding if oromotor incoordination is significant and by early detection and treatment of gastroesophageal reflux. Pneumonia may be prevented in part by treatment for chronic lung disease, effective management of pulmonary secretions, and immunization with recommended childhood vaccines (such as pneumococcal, influenza, and other recommended vaccines). Palivizumab (respiratory syncytial virus monoclonal antibody; Synagis [MedImmune, Inc, Gaithersburg,

MD]) also is suggested for infants with CDH who have chronic lung disease, as described in the "Revised Indications for the Use of Palivizumab and Respiratory Syncytial Virus Immune Globulin Intravenous for the Prevention of Respiratory Syncytial Virus Infections" technical report and policy statement by the American Academy of Pediatrics.[18,19]

Although the incidence of chronic lung disease is 33% to 52% at discharge, most infants who survive CDH have clinical improvement over time.[6,16,17] Nevertheless, nearly 50% of adult survivors have impairment on pulmonary function testing.[16]

GASTROESOPHAGEAL REFLUX/FOREGUT DYSMOTILITY

Gastroesophageal reflux or some form of foregut dysmotility occurs in 45% to 90% of infants with CDH.[20–24] Abnormal hiatal anatomy at the gastroesophageal junction, lack of an angle of His in some patients, and herniation of the stomach into the chest with distortion are possible mechanisms to explain this high incidence of gastroesophageal reflux. Esophageal dilation or ectasia also has been described in some infants with CDH, and as many as 70% of such infants have severe gastroesophageal reflux.[21] The incidence of gastroesophageal reflux also correlates with defect size and need for patch repair.[20,25] Pulmonary morbidity may be worsened by aspiration associated with gastroesophageal reflux. Importantly, a high incidence of esophagitis in adult survivors with CDH suggests that long-term surveillance is needed.[26] For all patients with CDH, it is important to have a high index of suspicion for gastroesophageal reflux. Antireflux surgery may be an option for patients with failed medical therapy, although the long-term success rate of this procedure has yet to be proven.

GROWTH FAILURE

Many survivors with CDH fail to grow as well as healthy term infants do and require close nutritional surveillance and intervention.[6,9,20] Infants with CDH and chronic lung disease often have poor oral feeding skills. Gastroesophageal reflux is common, and oral aversion is frequent; both contribute to growth deficiency. In 1 clinical series, more than 50% of infants with CDH had weight below the 25th percentile.[20] Gastrostomy tube placement was performed in 33% of infants in this series. Van Meurs et al[6] showed that more than 40% of CDH survivors had weight below the 5th percentile at 2 years of age. Gastrostomy tube feeding is suggested by some experts who hypothesize that nasogastric or orogastric tube feeding impairs oral feeding. Others suggest use of nasogastric or orogastric tube feeding for a period of time, especially when success with oral feeding is anticipated within several months. Despite controversy about the most appropriate mode of feeding the infant with CDH at discharge, almost 33% do not orally feed enough fluid volume to support growth and receive feedings through nasogastric or gastrostomy tubes.[6,20] Early recognition and intervention is essential for optimizing both somatic and alveolar growth and long-term outcomes for infants with CDH.

NEUROCOGNITIVE DELAY AND BEHAVIORAL DISORDERS

Significant developmental delay and behavioral disorders have been reported for a large number of infants with CDH. The infant with a large diaphragmatic defect or need for ECMO is at greatest risk.[27–36] Nobuhara et al[27] reported developmental delay in more than 33% of their CDH survivors. McGahren et al[30] described neurologic abnormalities in 67% of infants with CDH who were treated with ECMO compared with 24% of infants with CDH who were not as ill and did not receive ECMO.

The critical illness and physiologic disruption of high-risk infants with CDH places them at risk of neurologic and developmental disabilities. Many infants who present with symptoms of CDH soon after birth are clinically unstable and hypoxemic and require high levels of extraordinary life support such as ECMO and other invasive therapies. Although severity of illness is most predictive of long-term outcome, complications associated with invasive therapies may contribute to morbidity in CDH survivors. In a study by Bernbaum et al[37] of survivors receiving ECMO, infants with CDH treated with ECMO had a higher risk of significant neurodevelopmental delays than did infants without CDH. The higher risk of disability in ECMO-treated survivors with CDH compared with ECMO-treated survivors without CDH suggests that at least 3 potential factors may contribute to neurodevelopmental disability in infants with CDH: (1) an intrinsic neurologic abnormality, (2) greater number and severity of morbidities that impair development in infants who require ECMO, (3) and a greater number of ECMO-associated complications.

HEARING LOSS

Sensorineural hearing loss has been described in a number of case series of CDH survivors[27,28,33,35] and seems to occur in infants regardless of whether they were treated with ECMO. The cause remains unknown, but it is speculated to be related to treatments for respiratory failure (such as hyperventilation, ototoxic medications, or neuromuscular blockade).[38] Severe hypoxemia, prolonged ventilation, and ECMO also are risk factors. Approximately half of infants with initially normal hearing assessments develop hearing loss later in infancy.[39–41]

HERNIA RECURRENCE

Recurrent diaphragmatic hernias have been reported in 8% to 50% of patients with CDH. The single-most important predictor of hernia recurrence is the presence of a large defect that requires a patch to repair.[2,6,42,43] Recurrences can present from months to years after the initial hospitalization, or the patient can remain asymptomatic. Detection of recurrences may be discovered incidentally on chest radiographs performed for surveillance or other reasons.[6,43] The lifetime risk of recurrence for a patient with a patch repair is unknown.

ORTHOPEDIC DEFORMITIES

Pectus deformities and progressive asymmetry of the chest wall have been described in CDH survivors.[27,28,44] The incidence of these orthopedic disorders ranges from

TABLE 1 **Recommended Schedule of Follow-up for Infants With CDH**

	Before Discharge	1–3 mo After Birth	4–6 mo After Birth	9–12 mo After Birth	15–18 mo After Birth	Annual Through 16 y
Weight, length, occipital-frontal circumference	X	X	X	X	X	X
Chest radiograph	X	If patched	If patched	If patched	If patched	If patched
Pulmonary function testing			If indicated		If indicated	If indicated
Childhood immunizations	As indicated throughout childhood	X	X	X	X	X
RSV prophylaxis	RSV season during first 2 years after birth (if evidence of chronic lung disease)	X	X	X	X	X
Echocardiogram and cardiology follow-up	X	If previously abnormal or if on supplemental oxygen	If previously abnormal or if on supplemental oxygen	If previously abnormal or if on supplemental oxygen	If previously abnormal or if on supplemental oxygen	If previously abnormal or if on supplemental oxygen
Head computed tomography or MRI	If (1) abnormal finding on head ultrasound; (2) seizures/abnormal neurologic findings[a]; or (3) ECMO or patch repair	As indicated	As indicated	As indicated	As indicated	As indicated
Hearing evaluation[44]	Auditory brainstem evoked response or otoacoustic emissions screen	X	X	X	X	Every 6 mo to age 3 y, then annually to age 5 y
Developmental screening evaluation	X	X	X	X		Annually to age 5 y
Neurodevelopmental evaluation	X			X		Annually to age 5 y
Assessment for oral feeding problems	X	X	If oral feeding problems	If oral feeding problems	If oral feeding problems	If oral feeding problems
Upper gastrointestinal study, pH probe, and/or gastric scintiscan	Consider for all patients	If symptoms	If symptoms	Consider for all patients	If symptoms	If symptoms
Esophagoscopy		If symptoms	If symptoms	If symptoms or if abnormal gastrointestinal evaluations	If symptoms	If symptoms
Scoliosis and chest wall deformity screening (physical examination, chest radiograph, and/or computed tomography of the chest)				X		X

The neurosensory tests performed and frequency of surveillance may differ among infants with CDH because of variability in neurologic, developmental, and physiologic impairments. Follow-up should be tailored to each infant. RSV indicates respiratory syncytial virus.

[a] Muscle weakness, hypotonia, hypertonia, or other abnormal neurologic sign or symptom.

21% to 48%. Many of them are mild and do not require surgical intervention. Scoliosis also has been found in these patients, with an incidence of 10% to 27%.[27,44] The incidence of both of these morbidities is higher in patients who have large defects and a patch repair. Periodic and regular follow-up is suggested to detect and prevent development of functionally significant deformities from developing.

OTHER CONGENITAL ABNORMALITIES

Additional congenital anomalies are present in approximately 40% of infants with CDH.[45–48] Congenital heart lesions account for nearly two thirds of these anomalies and have a major effect on risk of mortality.[45,48] Anomalies of the central nervous system, esophageal atresia, and omphalocele also are relatively prevalent compared with other organ systems. A number of syndromes and chromosomal anomalies (such as trisomies 21, 13, and 18; Fryns syndrome; Brachmann-de Lange syndrome; and Pallister-Killian syndrome) include CDH as one of the associated anomalies. Each of these anomalies and syndromes adds to the complexity and specialty care needs for affected infants. The care requirements for such infants necessitate individualized, multidisciplinary care plans.

SUMMARY

Survivors with CDH are at risk of a number of morbidities that may affect development and function. Infants with large defects, those who have received ECMO, or those with a patch repair are at highest risk. These unique patients, especially those at highest risk, require long-term periodic follow-up by a multidisciplinary team of medical, surgical, and developmental specialists to identify and treat morbidities before additional disability results. Preventive pediatric health care according to guidelines developed by the American Academy of Pediatrics is recommended for all children, including those with CDH.[49–52] To emphasize the importance of follow-up for specific morbidities associated with CDH, additional suggestions are provided (Table 1). These are most applicable to children with extraordinary medical and surgical complications associated with CDH and should be individualized depending on the specific needs of each infant.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Postnatal Corticosteroids to Prevent or Treat Bronchopulmonary Dysplasia

abstract

FREE

The purpose of this revised statement is to review current information on the use of postnatal glucocorticoids to prevent or treat bronchopulmonary dysplasia in the preterm infant and to make updated recommendations regarding their use. High-dose dexamethasone (0.5 mg/kg per day) does not seem to confer additional therapeutic benefit over lower doses and is not recommended. Evidence is insufficient to make a recommendation regarding other glucocorticoid doses and preparations. The clinician must use clinical judgment when attempting to balance the potential adverse effects of glucocorticoid treatment with those of bronchopulmonary dysplasia. *Pediatrics* 2010;126:800–808

INTRODUCTION

Chronic lung disease (CLD) after preterm birth, also known as bronchopulmonary dysplasia (BPD), a major morbidity of the very preterm infant, is remarkably resistant to therapeutic interventions and negatively affects neurodevelopmental outcomes.[1–4] In 2002, the American Academy of Pediatrics (AAP), in a policy statement regarding the use of postnatal corticosteroids for prevention or treatment of CLD in preterm infants, concluded that routine dexamethasone therapy for the prevention or treatment of CLD could not be recommended.[5] Instead, the AAP recommended that (1) use of dexamethasone for the prevention or treatment of CLD be limited to randomized, controlled trials (RCTs) with long-term follow-up, (2) alternative corticosteroids undergo further study, and (3) infants currently enrolled in RCTs of corticosteroids receive long-term neurodevelopmental follow-up. The statement added that outside the context of such trials, "the use of corticosteroids should be limited to exceptional clinical circumstances (eg, an infant on maximal ventilatory and oxygen support). In those circumstances, parents should be fully informed about the known short- and long-term risks and agree to treatment."[5]

Postnatal use of dexamethasone for BPD has decreased since the publication of the AAP statement; however, the incidence of BPD has not decreased.[6] Instead, several reports have suggested that the incidence or severity of BPD may have increased.[4,7,8] Moreover, results of additional clinical trials, meta-analyses, and follow-up studies have been published, warranting a review of the new information and revision of the statement. The objectives of this revised statement are to review data published since the 2002 AAP statement and to reexamine previous recommendations for the use of glucocorticoid therapy in view of new information.

COMMITTEE ON FETUS AND NEWBORN

KEY WORDS

bronchopulmonary dysplasia, preterm infant, glucocorticoid, dexamethasone, chronic lung disease

ABBREVIATIONS

CLD—chronic lung disease
BPD—bronchopulmonary dysplasia
AAP—American Academy of Pediatrics
RCT—randomized, controlled trial
CP—cerebral palsy

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LITERATURE REVIEW

Dexamethasone

Reviews and meta-analyses cited in the previous AAP statement indicated that dexamethasone may decrease mortality rates, facilitate extubation, and generally decrease the incidence of BPD but that it carries a significant risk for short- and long-term adverse effects, especially impairment of growth and neurodevelopment.[5,9–12] In recently updated systematic reviews, the Cochrane Collaboration continues to conclude that the benefits of dexamethasone therapy in the first week of life may not outweigh its many adverse effects.[13] In contrast, it concludes that treatment after the first postnatal week may reduce mortality rates without increasing adverse long-term neurodevelopmental outcomes, although long-term follow-up data remain limited.[14] Therefore, it has been suggested that "it appears prudent to reserve the use of late corticosteroids to infants who cannot be weaned from mechanical ventilation and to minimize the dose and duration of any course of treatment."[14]

Two other systematic reviews have added different perspectives on dexamethasone and BPD. In the first review, a risk-weighted meta-analysis, the authors emphasized the importance of the a priori risk of death or BPD in different study populations.[15] In this analysis, the incidence of death or cerebral palsy (CP) was increased among dexamethasone-treated infants compared with placebo-treated infants in studies that enrolled patients at low risk (<35%) of BPD. In contrast, dexamethasone treatment decreased the risk of death or CP when infants at high risk of BPD (≥65%) were studied.[15] Thus, for infants at the highest risk of BPD, the beneficial effect of dexamethasone in reducing lung disease seemed to outweigh its adverse effect of increasing the risk of CP. In the second meta-analysis, the authors compared outcomes for trials with different cumulative doses of dexamethasone and concluded that a higher cumulative dose improved rates of survival without BPD and did not increase adverse long-term effects.[16] However, 3 small individual RCTs that directly compared high versus low dexamethasone doses, variably defined, have revealed no differences in efficacy (Table 1).[17–19] These studies have generally been small and heterogeneous, which makes them difficult to compare.

The results of 3 RCTs that compared dexamethasone to placebo have been published since the previous AAP statement (Table 1); 1 was small and the other 2 were stopped early and are, therefore, underpowered.[20–22] One trial compared an early, short course

TABLE 1 RCTs of Dexamethasone to Prevent or Treat BPD Reported Since 2001

Study, No. of Centers	*n*	Eligibility Criteria (All on Mechanical Ventilation)	Dexamethasone Dosing Regimen	Outcome
McEvoy et al,[17] 1 center	62	500–1500 g BW; ≤32 wk gestation; 7–21 postnatal days	5 mg/kg per d tapered over 7 d vs 0.2 mg/kg tapered over 7 d	Rate of survival without BPD[a] 76% vs 73% (NS); no benefit to higher dose
Odd et al,[18] 1 center	33	≤1250 g BW; 1–3 wk of age	0.5 mg/kg per d tapered over 42 d vs "individualized" (same dose, shorter course)	Rate of survival without BPD: 24% vs 30% (NS); no difference in 18-mo outcomes
Malloy et al,[19] 1 center	16[b]	<1501 g BW; <34 wk gestation; <28 postnatal days	0.5 mg/kg per d tapered over 7 d vs 0.08 mg/kg per d for 7 d	Rate of survival without BPD: 11% vs 38% (NS); higher dose had more adverse effects, no apparent benefit
Walther et al,[20] 1 center	36	≥600 g BW; 24–32 wk gestation; 7–14 d postnatal age	0.2 mg/kg per d tapered over 14 d vs placebo	Rate of survival without BPD: 65% vs 47% (NS); extubation: 76% vs 42% ($P < .05$)
Anttila et al,[21] 6 centers	109[b]	500–999 g BW; ≤31 wk gestation; eligible at 4 h of age	0.25 mg/kg every 12 h × 4 doses vs placebo	Rate of survival without BPD: 58% vs 52% (NS)
Doyle et al,[22] 11 centers	70[b]	<1000 g BW; <28 wk gestation; >1 wk postnatal age	0.15 mg/kg per d tapered over 10 d vs placebo	Rate of survival without BPD: 14% vs 9% (NS); extubation: 60% vs 12% (odds ratio: 11.2 [95% confidence interval: 3.2–39.0])
Rozycki et al,[23] 1 center	61	650–2000 g BW; ≥ 14 d postnatal age	0.5 mg/kg per d tapered over 42 d vs inhaled beclomethasone at 3 different doses for 7 d followed by above-listed dexamethasone course, if still mechanically ventilated	Rate of survival without BPD: 53% vs 46% (NS); extubation by 7 d: 7 of 15 vs 6 of 46 ($P < .01$)

BW indicates birth weight; NS, not significant.

[a] BPD defined as receiving supplemental oxygen at 36 weeks postmenstrual age.

[b] Patient enrollment terminated early.

of dexamethasone to placebo and revealed no significant difference in mortality or BPD rates.[21] The other 2 trials evaluated the efficacy of a later, lower-dose course of dexamethasone for facilitating extubation, and the authors reported that significantly more dexamethasone-treated infants were successfully extubated during the treatment period.[20,22] Similar results were reported from an additional study that compared systemic dexamethasone to inhaled beclomethasone for extubation: significantly more dexamethasone-treated infants were successfully extubated within 7 days (Table 1).[23] These extubation trials were not powered to evaluate the effect of the treatment on rates of survival without BPD.

Many short-term adverse effects of dexamethasone therapy have been described; however, the main reason for the decline in its use is an adverse effect on neurodevelopment, particularly higher rates of CP. Since publication of the previous AAP statement, additional follow-up data on the adverse effects of dexamethasone have become available from RCTs (Table 2).[17,24–32] The heterogeneity of these reports makes it problematic to combine them meaningfully. Some studies revealed no adverse effects on neurodevelopmental outcomes at various ages, whereas others did. Most of the studies were small, which reduced their ability to either prove or disprove causation. Two RCTs that used low doses of dexamethasone revealed no significant increase in CP or other neurodevelopmental impairments when compared with placebo. Because only a total of 96 dexamethasone-treated infants were evaluated in these studies, the results must be interpreted with caution.[25,26]

Cohort studies of dexamethasone have revealed an association of its use with

TABLE 2 Neurodevelopmental Follow-up of Dexamethasone RCTs Reported After 2001

Study, Planned Age at Follow-up	Follow-up, % (No. of Infants Seen)	Treatment Start Time	Dexamethasone Dosing Regimen	Primary Neurodevelopmental Findings
McEvoy et al,[17] 1 y	66 (39)	At 7–21 d	High vs low dose: 7-d taper from 0.5 mg/kg per d vs 0.2 mg/kg per d	MDI < 70: 24% (high) vs 17% (low) (NS); CP: 10% vs 11% (NS)
Armstrong et al,[24] 18 mo chronological age	96 (64)	On day 7	42-d taper vs 3-d pulse	No difference in 18-mo outcomes No disability: 34% vs 31% (NS)
Doyle et al,[25] 2 y corrected age	98 (58)	After 7 d	0.15 mg/kg per d tapered over 10 d	Death or major disability: 46% vs 43% (NS); death or CP: 23% vs 37% (NS); CP: 14% vs 22% (NS); major disability 41% vs 31% (NS)
Stark et al,[26] 18–22 mo corrected age	74 (123)	On day 1	0.15 mg/kg per d tapered over 7 d	MDI < 70: 51% vs 43% (NS); PDI < 70: 30% vs 35% (NS); abnormal neurologic exam: 25% each group
Romagnoli et al,[27] 3 y	100 (30)	On day 4	0.5 mg/kg per d tapered over 1 wk	No differences in any parameter; CP: 9% vs 14% (NS)
Wilson et al,[28] 7 y	84 (127)	Before 3 d	4 groups: 0.5 mg/kg per d tapered over 12 d vs late (15 d) selective, vs inhaled early or late selective	No difference in cognitive, behavioral, CP, or combined outcomes
Yeh et al,[29] school age (mean: 8 y)	92 (146)	On day 1	0.5 mg/kg per d for 1 wk, then tapered for a total of 28 d	Treated children were shorter ($P = .03$), had smaller head circumference ($P = .04$), lower IQ scores ($P = .008$), and more significant disabilities (CP, IQ < 5th percentile, vision or hearing impairment): 39% vs 22% ($P = .04$)
O'Shea et al,[30] 4–11 y	89 (84)	On day 15–25	0.5 mg/kg per d tapered over 42 d vs placebo	Death or major NDI[a]: 47% vs 41% (NS); major NDI alone: 36% vs 14% ($P = .01$)
Gross et al,[31] 15 y	100 (22)	On day 14	0.5 mg/kg per d tapered over 42 d vs 18-d taper vs placebo	Intact survival (IQ > 70, normal neurologic exam, regular classroom): 69% vs 25% (18-d course) vs 18% (placebo) ($P < .05$)
Jones and the Collaborative Dexamethasone Trial Follow-up Group,[32] 13–17 y	95 (150)	At 2–12 wk	0.5 mg/kg per d for 7 d	No difference in moderate/severe disability (defined as IQ > 2 SDs < mean, CP, hearing or vision loss); CP: 24% vs 15% (relative risk: 1.58 [95% confidence interval: 0.81–3.07])

MDI indicates Bayley Mental Developmental Index; NS, not significant. PDI, Bayley Psychomotor Development Index; NDI, neurodevelopmental impairment.

[a] Major neurodevelopmental impairment included CP and/or an IQ score of <70.

impaired neurodevelopmental outcomes[3,4,33]; however, such an association cannot be construed as definitive evidence of harm. A clinician's decision to use a therapy incorporates numerous undocumented factors and varies from one clinician to the next, which may seriously confound the interpretation of such studies. Patients who receive dexamethasone for BPD are likely to be perceived as having more severe respiratory disease than infants who are not treated; such infants may have worse overall outcomes regardless of dexamethasone therapy. Authors of small series have also reported that infants treated with dexamethasone have more abnormalities on MRI than those not treated; again, causation cannot be attributed in the absence of an RCT.[34,35] Two previously reported RCTs revealed more cranial ultrasound abnormalities in dexamethasone-treated infants compared with those treated with placebo, but the patient numbers were quite small.[36,37]

In summary, high daily doses of dexamethasone have been linked frequently to adverse neurodevelopmental outcomes, and this therapy is discouraged. Because an increase in adverse neurodevelopmental outcomes in treatment studies that used low doses of dexamethasone has not been reported, further studies of low-dose dexamethasone to facilitate extubation are warranted.

Hydrocortisone

Results of 4 RCTs designed to evaluate the ability of early hydrocortisone therapy to improve rates of survival without BPD have been published (Table 3).[38–41] These studies were based on the premise that extremely preterm infants may have immature adrenal gland function, predisposing them to a relative adrenal insufficiency and inadequate anti-inflammatory capability during the first several weeks of life.[42–46] In contrast to the heterogeneous nature of previous dexamethasone trials, these studies were similar in design, time of initiation, duration, and dose. The direction of effect favored the hydrocortisone-treated infants in all 4 studies, and a significant increase in rate of survival without BPD in the hydrocortisone-treated infants was reported for 2 of the studies. The largest trial ($n = 360$) did not reveal a significant benefit of hydrocortisone treatment in the overall study group; however, for infants exposed to prenatal inflammation ($n = 149$), identified before the trial as a specific group for analysis, hydrocortisone treatment resulted in a significant decrease in mortality rate and an increase in rate of survival without BPD.[39]

Patient enrollment was halted early in 3 of these 4 studies because of a significant increase in spontaneous gastrointestinal perforation discovered in the largest trial,[39] a complication also observed with early dexamethasone.[47,48] The perforations may have resulted from an interaction between high endogenous cortisol concentrations and indomethacin therapy in the first 48 hours; however, because administration of indomethacin was not randomized, this hypothesis remains to be tested.

Neurodevelopmental outcomes at 18 to 22 months' corrected age have been published for 3 of these trials, and no adverse effects of hydrocortisone treatment were found.[49,50] In the largest multicenter trial, the incidence of death or major neurodevelopmental impairment (52% [hydrocortisone-treated] vs 56% [placebo]), major neurodevelopmental impairment alone (39% vs 44%), and CP (16% vs 18%) were similar.[49] The only significant findings favored the hydrocortisone-treated group and included a decreased incidence of a Bayley Scales of Infant Development (2nd ed) Mental Developmental Index (MDI) 2 SDs below the mean (MDI $<$ 70, 27% vs 37%;

TABLE 3 RCTs of Early Hydrocortisone to Prevent BPD

Study, No. of Centers	*n*	Population: Mechanically Ventilated Infants	Hydrocortisone Dosing Regimen	Rate of Survival Without BPD[a] HC vs Placebo, %
Watterberg et al,[38] 2 centers	40	500–999 g BW; <48 h postnatal age	0.5 mg/kg every 12 h for 9 d 0.25 mg/kg every 12 h for 3 d	60 vs 35 ($P = .04$)
Watterberg et al,[39] 9 centers	360[b]	500–999 g BW; <48 h postnatal age	0.5 mg/kg every 12 h for 12 d 0.25 mg/kg every 12 h for 3 d	35 vs 34 (aOR[c]: 1.20 [95% CI: 0.72–1.99])
Peltoniemi et al,[40] 3 centers	51[b]	501–1250 g BW; <36 h postnatal age	2.0 mg/kg per d tapered to 0.75 mg/kg per d over 10 d	64 vs 46 (OR: 1.48 [95% CI: 0.49–4.48])
Bonsante et al,[41] 2 centers	50[b]	500–1249 g BW; <48 h postnatal age	0.5 mg/kg every 12 h for 9 d; 0.25 mg/kg every 12 h for 3 d	64 vs 32 ($P < .05$)
Total	601	—	—	—

BW indicates birth weight; aOR, adjusted odds ratio; OR, odds ratio; CI, confidence interval.

[a] BPD was defined as receiving supplemental oxygen at 36 weeks' postmenstrual age.

[b] Study enrollment was terminated early because of concern for spontaneous gastrointestinal perforation.

[c] Adjusted for center, birth weight, risk factors (gender, "outborn" [infants who were born at an outlying institution and transported into the study center], white race, vaginal delivery, no prenatal steroids, hydrocortisone, and/or vasopressor support at study entry).

odds ratio: 0.47 [95% confidence interval: 0.25–0.87]) and a higher incidence of awareness of object permanence (an early test of working memory and prefrontal executive function) (89% vs 79%; odds ratio: 2.19 [95% confidence interval: 1.06–4.52]).

Two other RCTs have evaluated administration of hydrocortisone to preterm infants during the first week of life with the objective of reducing respiratory morbidity. The first, published in 1974, had the objective of decreasing the severity of respiratory distress syndrome.[51] The investigators used a much higher dose (25 mg/kg per day on the first day of postnatal life), which showed no effect on respiratory distress syndrome. The second, published in 2003, was based on the hypothesis that extremely preterm infants have immature sodium channels and, therefore, cannot clear their lung liquid after birth.[52] Triiodothyronine (T_3) was given together with hydrocortisone to stimulate maturation of the sodium channels. The medications were started within 5 hours of birth and given as a constant infusion for 7 days. The investigators enrolled 253 infants and found no difference in their primary outcome variables of death or ventilator dependence at 7 days and at 14 days. At 36 weeks' postmenstrual age, 47% of the treated survivors and 51% of the placebo group remained on oxygen.

Reports of hydrocortisone therapy given to facilitate extubation have been limited to cohort studies. In the first reported study, 25 infants treated with hydrocortisone at 1 hospital (5 mg/kg per day, tapered over 3 weeks) were compared with 25 untreated infants at the same hospital and additionally with a cohort of 23 infants treated with dexamethasone (0.5 mg/kg per day, tapered over 3 weeks) at a separate hospital.[53] The investigators found that hydrocortisone was as effective as dexamethasone in weaning infants from the ventilator and in decreasing supplemental oxygen therapy, with fewer short-term adverse effects. Follow-up of these children at school age revealed no differences in neurodevelopmental outcomes between hydrocortisone-treated infants and their comparison group, whereas dexamethasone-treated infants more often had an abnormal neurologic examination and less favorable school performance than their comparison cohort.[53,54] Subsequently, several large cohort studies from the same institution reported that, although hydrocortisone-treated children were younger, smaller, and sicker than their untreated comparison groups, there were no adverse effects of hydrocortisone treatment on IQ, visual motor integration, memory testing, CP, or findings on MRI.[55–57] Investigators from this institution have also reported that neonatal dexamethasone but not hydrocortisone therapy resulted in long-lasting changes in hypothalamic-pituitary-adrenal axis and T-cell function.[58]

Other Glucocorticoids (Systemic or Inhaled)

Since the previous AAP statement, no RCTs of other systemic glucocorticoids, such as prednisone or methylprednisolone, to treat or prevent BPD have been published. No additional evidence has been published to support the efficacy of inhaled glucocorticoids to prevent or decrease the severity of BPD.[59,60]

DISCUSSION: DIFFERENCES BETWEEN DEXAMETHASONE AND HYDROCORTISONE

As described previously, many RCTs have shown adverse neurodevelopmental outcomes after postnatal dexamethasone treatment for BPD, but neither multicenter RCTs nor cohort studies have revealed adverse effects on functional or structural neurologic outcomes after neonatal hydrocortisone therapy. One possible explanation for the observed differences between dexamethasone and hydrocortisone is the difference in effective glucocorticoid dose. Neonatal animal studies have consistently revealed adverse effects on brain growth after high doses of glucocorticoid,[61,62] and results of evaluation of 22 patients who received high-dose hydrocortisone in a study from the early 1970s were suggestive of harm.[63,64] High-dose dexamethasone (0.5 mg/kg per day) is equivalent to at least 15 to 20 mg/kg per day of hydrocortisone,[65] far higher than the doses of hydrocortisone given in the recent studies described previously. Low-dose dexamethasone (0.1–0.15 mg/kg per day) may be equivalent to 3 to 6 mg/kg per day of hydrocortisone; however, because of its much longer biological half-life, it could have a much higher relative potency.[66] Lowering the dose of dexamethasone may, therefore, decrease its adverse effects, as is suggested by the 2 studies of outcome after lower-dose dexamethasone therapy.[25,26]

Second, the observed differences in neurodevelopmental outcomes may result from the different effects of these agents on the hippocampus, an area of the brain critical to learning, memory, and spatial processing.[67,68] The hippocampus contains a high density of both mineralocorticoid and glucocorticoid receptors.[69,70] Hydrocortisone, which is identical to native cortisol, can bind to both classes of receptors. In contrast, dexamethasone binds only to glucocorticoid receptors, which, in animal models, has been shown to result in degeneration and necrosis of hippocampal neurons.[71,72] This effect of dexamethasone is blocked by simultaneous administration of corticosterone (the cortisol equivalent in the rat).[71] In humans,

neonatal treatment with dexamethasone, but not hydrocortisone, has been shown to alter hippocampal synaptic plasticity and associative memory formation in later life.[73] Dexamethasone exposure has also been linked to decreased hippocampal volume in 1 cohort study,[74] but cohort studies of infants treated with hydrocortisone have revealed no decrease in hippocampal volume,[55] no adverse effect on hippocampal metabolism, and no adverse effect on memory at school age[57] when compared with a larger, more mature group of nontreated infants.

Whatever the underlying explanation(s) for the observed differences in short- and long-term outcomes may be, further RCTs are needed to answer the many remaining questions, including whether lower doses of dexamethasone can avoid previously observed adverse effects, whether hydrocortisone is efficacious for extubation, whether specific groups of infants may derive particular benefit from hydrocortisone therapy, and whether the incidence of spontaneous gastrointestinal perforation during early glucocorticoid administration can be decreased by avoiding concomitant indomethacin or ibuprofen therapy and/or by monitoring cortisol concentrations.

SUMMARY AND RECOMMENDATIONS

- BPD remains a major morbidity of the extremely preterm infant and is consistently associated with adverse effects on long-term outcomes, including neurodevelopment. Additional RCTs of postnatal glucocorticoids are warranted to optimize therapy and improve outcomes for these infants. Those who design such trials in the future should attempt to minimize the use of open-label glucocorticoid, which has confounded analysis of most previous trials, and should include assessment of long-term pulmonary and neurodevelopmental outcomes.
- High daily doses of dexamethasone (approximately 0.5 mg/kg per day) have been shown to reduce the incidence of BPD but have been associated with numerous short- and long-term adverse outcomes, including neurodevelopmental impairment, and at present there is no basis for postulating that high daily doses confer additional therapeutic benefit over lower-dose therapy. **Recommendation: in the absence of randomized trial results showing improved short- and long-term outcomes, therapy with high-dose dexamethasone cannot be recommended.**
- Low-dose dexamethasone therapy (<0.2 mg/kg per day) may facilitate extubation and may decrease the incidence of short- and long-term adverse effects observed with higher doses of dexamethasone. Additional RCTs sufficiently powered to evaluate the effects of low-dose dexamethasone therapy on rates of survival without BPD, as well as on other short- and long-term outcomes, are warranted. **Recommendation: there is insufficient evidence to make a recommendation regarding treatment with low-dose dexamethasone.**
- Low-dose hydrocortisone therapy (1 mg/kg per day) given for the first 2 weeks of life may increase rates of survival without BPD, particularly for infants delivered in a setting of prenatal inflammation, without adversely affecting neurodevelopmental outcomes. Clinicians should be aware of a possible increased risk of isolated intestinal perforation associated with early concomitant treatment with inhibitors of prostaglandin synthesis. Further RCTs powered to detect effects on neurodevelopmental outcomes, aimed at targeting patients who may derive most benefit and developing treatment strategies to reduce the incidence of isolated intestinal perforation, are warranted. **Recommendation: early hydrocortisone treatment may be beneficial in a specific population of patients; however, there is insufficient evidence to recommend its use for all infants at risk of BPD.**
- Higher doses of hydrocortisone (3–6 mg/kg per day) instituted after the first week of postnatal age have not been shown to improve rates of survival without BPD in any RCT. RCTs powered to assess the effect of this therapy on short- and long-term outcomes are needed. **Recommendation: existing data are insufficient to make a recommendation regarding treatment with high-dose hydrocortisone.**

IMPLICATIONS FOR PRACTICE

Because available data are conflicting and inconclusive, clinicians must use their own clinical judgment to balance the adverse effects of BPD with the potential adverse effects of treatments for each individual patient. Very low birth weight infants who remain on mechanical ventilation after 1 to 2 weeks of age are at very high risk of developing BPD.[14] When considering corticosteroid therapy for such an infant, clinicians might conclude that the risks of a short course of glucocorticoid therapy to mitigate BPD is warranted.[15] This individualized decision should be made in conjunction with the infant's parents.

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COMMITTEE ON FETUS AND NEWBORN, 2009–2010
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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Peter L. Havens, MD, and the Committee on Pediatric AIDS

Postexposure Prophylaxis in Children and Adolescents for Nonoccupational Exposure to Human Immunodeficiency Virus

ABSTRACT. Exposure to human immunodeficiency virus (HIV) can occur in a number of situations unique to, or more common among, children and adolescents. Guidelines for postexposure prophylaxis (PEP) for occupational and nonoccupational (eg, sexual, needle-sharing) exposures to HIV have been published by the US Public Health Service, but they do not directly address nonoccupational HIV exposures unique to children (such as accidental exposure to human milk from a woman infected with HIV or a puncture wound from a discarded needle on a playground), and they do not provide antiretroviral drug information relevant to PEP in children.

This clinical report reviews issues of potential exposure of children and adolescents to HIV and gives recommendations for PEP in those situations. The risk of HIV transmission from nonoccupational, nonperinatal exposure is generally low. Transmission risk is modified by factors related to the source and extent of exposure. Determination of the HIV infection status of the exposure source may not be possible, and data on transmission risk by exposure type may not exist. Except in the setting of perinatal transmission, no studies have demonstrated the safety and efficacy of postexposure use of antiretroviral drugs for the prevention of HIV transmission in nonoccupational settings. Antiretroviral therapy used for PEP is associated with significant toxicity. The decision to initiate prophylaxis needs to be made in consultation with the patient, the family, and a clinician with experience in treatment of persons with HIV infection. If instituted, therapy should be started as soon as possible after an exposure—no later than 72 hours—and continued for 28 days. Many clinicians would use 3 drugs for PEP regimens, although 2 drugs may be considered in certain circumstances. Instruction for avoiding secondary transmission should be given. Careful follow-up is needed for psychologic support, encouragement of medication adherence, toxicity monitoring, and serial HIV antibody testing.

ABBREVIATIONS. HIV, human immunodeficiency virus; USPHS, US Public Health Service; PEP, postexposure prophylaxis; CDC, Centers for Disease Control and Prevention; CI, confidence interval; AIDS, acquired immunodeficiency syndrome; PI, protease inhibitor; NRTI, nucleoside analog reverse transcriptase inhibitor; PCR, polymerase chain reaction; ZDV, zidovudine.

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

INTRODUCTION

Exposure to human immunodeficiency virus (HIV) can occur in a number of situations unique to or more common among children and adolescents. Guidelines for prophylaxis after exposure to HIV in occupational and nonoccupational (eg, sexual, needle-sharing) settings have been published by the US Public Health Service (USPHS),[1–3] but they do not directly address nonoccupational HIV exposures unique to children (such as accidental exposure to human milk from a woman infected with HIV or a puncture wound from a discarded needle on a playground), and they do not provide antiretroviral drug information relevant to postexposure prophylaxis (PEP) in children.

This clinical report provides a review of the literature focused on issues of HIV exposure uniquely related to children and adolescents and gives recommendations for PEP in the following situations: injury from discarded needles, bite wounds, sexual exposure, and inadvertent exposure to human milk from an HIV-infected woman. In each setting, the risk of HIV transmission is directly related to the probability that the exposure source has HIV infection and that transmission of a sufficient amount of infectious virus occurred in a manner that could result in infection in the recipient. Because no studies have directly measured the effectiveness of PEP in decreasing the risk of HIV transmission in nonoccupational settings or after mucosal exposure, the potential benefit of PEP in modifying transmission risk is extrapolated from data regarding HIV pathogenesis in animals, from information about PEP for needlestick injuries in occupational settings, and from studies of vertical transmission of HIV.

Type of Source Material

Not all body fluids from persons with HIV infection are equally infectious (Table 1). Blood and fluids contaminated with blood from persons with HIV infection should be assumed to contain HIV and are associated with the highest risk of HIV transmission. Semen or vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, amniotic fluid, human milk, and unfixed tissue from persons with HIV infection also may contain HIV and should be considered infectious.

TABLE 1. Materials That May Contain HIV From Persons With HIV Infection[1]

Usually Infectious Materials*	Usually Infectious Materials†	Usually Noninfectious Materials
Concentrated HIV in a laboratory specimen	Semen	Saliva
Blood[1]	Vaginal secretions	Urine
Fluid contaminated with blood	Cerebrospinal fluid	Feces
	Synovial fluid	Tears
	Pleural fluid	Sweat
	Peritoneal fluid	Vomitus
	Pericardial fluid	Nasal secretions
	Amniotic fluid	Sputum
	Human milk	
	Unfixed body tissue	

* Most likely to be associated with a risk of HIV transmission.
† May contain HIV, but less likely to be associated with risk of HIV transmission.

However, exposure to these "other potentially infectious materials"[1] is associated with a lower risk of HIV transmission. Blood-free saliva, urine, feces (including diarrhea), and vomitus are highly unlikely to transmit HIV.

Volume of Source Material

Exposure to a large volume of infectious material carries a greater risk of HIV transmission than does exposure to a smaller volume. For example, in studies of health care professionals with percutaneous exposure to blood from persons with HIV infection (Table 2),[4] injuries with large-gauge, hollow-bore needles were 14 times as likely to result in HIV transmission as were injuries with smaller-gauge, hollow needles; solid suture needles; or solid objects (such as a scalpel; Table 2).[4] Risk is also greater after exposure to a needle on which blood is visible, compared with that after exposure to a needle on which blood is not visible.[4]

Concentration of Virus in Source Material

In addition to the volume of source material, the concentration of virus in the source material is an important factor in determining the risk of transmission after an exposure. The concentration of virus in blood is highest during early (primary) HIV infection, before the infected person has fully developed an immune response, and late in infection, when immunity wanes. Some persons with HIV infection have persistently high viral load. Percutaneous exposure to blood from a person with late-stage HIV infection increases transmission risk by more than fivefold (Table 2).[4] For persons 15 to 24 years of age, for each act of heterosexual intercourse, risk of HIV transmission varies from 0.01% at viral loads less than 1700 copies/mL to 0.3% at viral loads more than 38 500 copies/mL.[5] Risk of perinatal transmission is higher for mothers with late-stage HIV disease. Prenatal maternal HIV viral load is a critical factor in determining the risk of perinatal HIV transmission.[6,7] Treatment with antiretroviral drugs can decrease the concentration of virus in blood and body fluids, even in persons with primary or late-stage infection. Therefore, antiretroviral treatment of the HIV infected individual may be associated with decreased risk of sexual and perinatal HIV transmission. However, although antiretroviral therapy for an HIV-infected source patient may decrease viral load, transmission has occurred after exposure to blood or infectious body fluids from HIV-infected persons with plasma viral loads below the level of detection, perhaps from cell-associated virus. Although there is a correlation between plasma and genital viral load, HIV may be present in genital secretions even when undetectable in plasma.[8]

TABLE 2. Percutaneous Exposure to Blood Infected With HIV: Risk Factors for HIV Transmission[4]

Risk Factor	Adjusted Odds Ratio*	95% CI
Deep injury	15	6.0–41
Visible blood on device	6.2	2.2–21
Procedure involving needle in artery or vein	4.3	1.7–12
Terminal illness in source patient	5.6	2.0–16
Postexposure use of ZDV	0.19	0.06–0.52

* Based on logistic regression analysis of 33 case patients and 665 controls reported by national surveillance systems in France, Italy, the United Kingdom, and the United States.

Viability of Virus in Source Material

The viability of virus in the source material also is an important consideration when evaluating the significance of a potential exposure to HIV, especially in the setting of a puncture wound from a needle found in the community setting.[9] In most reports of HIV transmission by percutaneous injury, needlestick injury occurred shortly after needle withdrawal from the vein or artery of the source patient with HIV infection. HIV RNA was detected in only 3 (3.8%) of 80 discarded disposable syringes that had been used by health care professionals for intramuscular or subcutaneous injection of patients with HIV infection,[10] indicating that most syringes will not contain HIV even after being used to draw blood from a person with HIV infection. HIV is susceptible to drying, and when HIV is placed on a surface exposed to air, the 50% tissue culture infective dose decreases by ~6 logs in 72 hours (1 log every 9 hours).[11] The concentration of viable virus on a discarded needle will be related to the initial virus concentration and the time that contaminated material has been drying.[12] Such drying may not occur uniformly; if there are cells, tissue, or a blood clot inside the needle, drying and virus inactivation may be slower than for a thin uniform layer of fluid on the outside of a

needle, and in the laboratory setting, HIV has been shown to survive for up to 28 days in syringes containing as little as 20 μL of blood.[13] HIV survival may be less likely outside the laboratory, and HIV proviral DNA could not be found in 28 syringes discarded in public places and 10 syringes from a needle exchange program for injection drug users.[14] Two small studies have found no evidence of HIV transmission after injuries from needles of discarded syringes.[15,16] There have been no confirmed reports of HIV acquisition from percutaneous injury by a needle found in the community (M.G. Fowler, Epidemiology Branch, Division of HIV/AIDS, Centers for Disease Control and Prevention [CDC], personal communication, June 15, 2002).

Type of Contact

The type of contact between the infectious fluid and a susceptible person is an important determinant of the risk of HIV transmission (Table 3). Blood transfusion from an HIV-infected donor carries a 95% risk of HIV transmission.[17] The risk of perinatal HIV transmission is between 13% and 45% in the absence of prophylaxis with antiretroviral medications.[18,19]

The risk of HIV transmission from breastfeeding is associated with maternal stage of infection and duration of breastfeeding. For women who acquire HIV infection after giving birth, the transmission risk from breastfeeding is estimated to be 29% (95% confidence interval [CI], 16%–42%).[20] For women with chronic HIV infection, transmission risk from breastfeeding is estimated to be 10% to 16%.[20–23] The cumulative risk of transmission if breastfeeding for 5, 11, 17, and 23 months was 3.5%, 7.0%, 8.9%, and 10.3%.[21] Using these estimates of cumulative risk and assuming that a mother breastfeeds 6 to 10 times per day, the per-episode risk of HIV transmission from a single exposure to human milk is estimated at ~0.001% to 0.004% (Table 3). There are no reports of HIV transmission from a single episode of exposure to HIV-infected human milk in an individual handling human milk in a nursery or in an infant with a single enteral exposure to milk from a woman with HIV infection.[24]

Sharp percutaneous exposure (needlestick, scalpel) to blood infected with HIV is associated with a much lower risk of transmission than that for perinatal or blood transfusion exposure. Prospective evaluation of 6202 health care professionals after percutaneous exposure to HIV-infected blood identified seroconversion in 20 persons, with an overall risk estimate of 0.32% (95% CI, 0.20%–0.50%).[4,25,26] Needle sharing in the context of injection drug use is estimated to have a transmission probability of 0.67% per injection (Table 3).[27]

The risk of HIV transmission from sexual exposure is highest with unprotected receptive anal intercourse (0.5%–3.2%), intermediate with receptive vaginal intercourse (0.05%–0.15%), and lowest for insertive vaginal intercourse (0.03%–0.09%; Table 3).[28–33] The per-act risk of HIV transmission from oral sex is not known, although HIV rarely has been transmitted from orogenital sexual exposure.[34–39] The risk of sexual transmission of HIV is potentially modified by a variety of factors related to the type of sexual act and to biological variables in each partner (Table 4).[29,40] These factors may be important for younger children in the context of a single episode of sexual abuse and for adolescents who may have repeated sexual encounters that may put them at risk of HIV infection.

Transmission of HIV by human bites has been described,[41–44] although such transmission seems to be extremely rare, even when saliva is contaminated with the biter's blood,[24] on the basis of the following observations:[45]

- Saliva inhibits HIV infectivity.[46]
- HIV is rarely isolated from saliva.[47]
- Concentrations of HIV are low in the saliva of HIV-infected persons, even in the presence of periodontal disease.[48]
- None of the approximately 500 000 cases of acquired immunodeficiency syndrome (AIDS) reported to the CDC by 1997 have been attributed to exposure to saliva.
- Transmission of HIV has not been documented in studies of nonsexual household exposure,[49] although unconfirmed transmission has been reported.[50]

Risk of HIV transmission after mucous membrane exposure is low, probably near 0.1% or less.[51,52] Transmission has occurred after contact between

TABLE 3. Type of Exposure and Risk of HIV Transmission per Exposure Event When the Source is HIV Infected

Type of HIV Exposure	Risk of Transmission per Exposure Event
Blood transfusion[17]	0.95
Perinatal exposure[18,19]	0.13 to 0.45
Needle sharing (injection drug use)[27]	0.0067
Unprotected receptive anal intercourse†[5,29,31–33]	0.005 to 0.032
Needlestick (health care professional)[4,25,26]	0.0032
Unprotected receptive vaginal intercourse†[29,30]	0.0001 to 0.003
Unprotected insertive vaginal intercourse‡[29,30]	0.0003 to 0.0009
Ingestion of human milk[20–23]*	0.00001 to 0.00004

* See text for derivation of per-event risk calculation.
† Receptive anal intercourse and receptive vaginal intercourse refer to the risk of HIV acquisition for the person whose anus or vagina was entered by the penis of the exposure source.
‡ Insertive vaginal intercourse refers to the risk of HIV acquisition for the person whose penis was inserted into the vagina of the exposure source.

TABLE 4. Sexual Exposure to HIV: Factors Affecting Risk of Sexual Transmission of HIV.[40]

Biologic Factor	Effect on Risk of HIV Transmission*	Effect on Risk of HIV Acquisition†
Late stage of HIV infection	↑ ↑ ↑	Not applicable
Primary HIV infection	↑ ↑	Not applicable
Antiretroviral therapy	↓ ↓	↓ ↓
Local infection at exposure site	↑ ↑	↑ ↑
Presence of cervical ectopy	↑ ↑	↑ ↑
Presence of foreskin	↑ ↑	↑ ↑
Condoms	↓ ↓ ↓	↓ ↓ ↓
Intrauterine device contraception	↑	↑ ↑
Menstruation	↑ ↑	↑
Genital tract trauma	↑ ↑	↑ ↑

Arrows represent risk relative to baseline values in Table 3 (the more arrows pointing upward, the higher the risk; the more arrows pointing downward, the lower the risk).
* Risk of transmission: the likelihood that HIV will be passed (transmitted) from donor to recipient.
† Risk of acquisition: the likelihood that recipient, once exposed, will become infected with HIV.

blood and nonintact skin (eczema, abrasions, etc), but infectious blood in contact with intact skin has not been reported to result in HIV transmission and is not considered an exposure with risk of transmission.[1]

RATIONALE FOR PEP TO PREVENT TRANSMISSION

During acute HIV infection, the viral doubling time is approximately 10 hours, and approximately 19 newly infected cells will develop from each HIV-infected cell.[53] Therefore, within 48 hours of infection, there will be more than 1.3×10^6 HIV-infected cells. For HIV injected directly into blood, early administration of potent antiretroviral drugs may be particularly important for successful PEP.[54] For skin and mucosal exposures, dendritic cells of skin, mucosa, and submucosa may be the first sites of virus capture and containment.[55,56] Thus, rapid drug penetration to those tissues may be an important consideration in regimen efficacy. HIV is rapidly incorporated into the DNA of resting lymphocytes, where it exists in a nonduplicating state that will not be affected by antiretroviral treatment. Host genetic and immune factors may affect the susceptibility of the exposed patient to infection.

Animal Models of PEP

Animal models of PEP suggest that antiretroviral therapy initiated after virus inoculation can prevent or ameliorate infection when drugs of adequate potency are administered immediately[57] or within a few hours of exposure[58–60] and continued for a few days[61] to weeks.[62,63] PEP was most effective if begun immediately or within 24 hours[64] to 36 hours[65] and was less[65] or not[66] beneficial if begun after 72 hours. Animals developing HIV infection despite receiving PEP may have evidence of infection delayed for up to 16 weeks after virus inoculation.[65] However, even potent therapy may not be able to prevent transmission if the virus inoculum is high.[63,67,68]

In animal models of PEP, antiretroviral drugs are most efficacious when continued for 28 days, compared with shorter durations.[64] This suggests that "prophylactic" therapy is not always truly preventing transmission but rather may be modifying the course of primary infection,[69,70] allowing the host to eliminate HIV early in infection. The development of a cellular immune response in HIV-exposed but ultimately uninfected animals[71–73] and humans[74–76] lends further support to this concept. If these regimens for prophylaxis are truly acting to abort early mucosal, submucosal, or subcutaneous infection, then antiretroviral regimens chosen for prophylaxis should be similar to those that have been shown to be effective for treatment of established HIV infection.

Prevention of Perinatal HIV Transmission as a Model of PEP

Single-drug preexposure plus postexposure antiretroviral therapy can decrease perinatal HIV transmission. In a randomized, placebo-controlled trial in 477 nonbreastfeeding women in the United States and Europe, zidovudine (ZDV [formerly called azidothymidine or AZT]) was administered to women during pregnancy and labor and to their infants for 6 weeks after birth. The rate of perinatal transmission of HIV was decreased by 67%, from 25.5% in the placebo group to 8.3% in the treatment group.[77] In a placebo-controlled trial in 626 breastfeeding women in Uganda, a single dose of nevirapine given to pregnant women at labor onset followed by a single dose to the infant after birth was compared with a very short course of ZDV. At 14 to 16 weeks of age, HIV infection was present in 25.1% of the nevirapine group, compared with 13.1% of the ZDV group, a 47% decrease in the rate of perinatal HIV transmission.[78]

Prenatal use of combinations of antiretroviral agents may further decrease perinatal HIV transmission, compared with use of single-agent therapy. In a randomized, placebo-controlled trial in 1797 pregnant women with HIV infection in southern Africa, the rate of perinatal HIV transmission was decreased by 63%, from 15.3% in placebo-treated patients to 5.7% in women treated with the combination of ZDV plus lamivudine during pregnancy and labor and continued through 7 days after birth in women and their infants.[79] In an observational cohort study of 1542 pregnant women with HIV infection in the United States who delivered infants from 1990 to 2000, the rate of perinatal HIV transmission was 20.0% for women who received no antiretroviral therapy during pregnancy, 10.4% for those who received ZDV alone, 3.8% for women treated with 2-drug combination therapy, and 1.2% for women who received combination therapy that included protease inhibitors (PIs [highly active antiretroviral therapy]) during pregnancy.[80]

Treating infants of HIV-infected women with ZDV exclusively, starting within 12 to 24 hours after birth and continued for 6 weeks, was associated with a decrease in the rate of perinatal HIV transmission in an observational study in New York.[81,82] However, observational data from North Carolina did not confirm the effectiveness of only postexposure treatment

in preventing perinatal HIV transmission.[83,84] This suggests that combined pre- and postexposure therapy may more effectively prevent perinatal HIV transmission, at least when a single agent is used.

PEP: Potential for Failure

Although postexposure ZDV treatment of HIV-exposed health care professionals was associated with an 81% lower risk of HIV transmission in an analysis of observational data (Table 2),[4] failures have occurred.[85] Such failures may result from large inoculum size,[86] late institution of therapy or failure to take prescribed therapy,[87] transmission of ZDV-resistant virus,[88,89] or other as yet unidentified factors.[2]

Although the feasibility of prophylaxis after nonoccupational exposure to HIV has been demonstrated,[90] there are no data measuring the efficacy or effectiveness of PEP in the nonoccupational setting, although this therapy is being offered in various communities.[91] Failures of such prophylaxis have been reported,[92] as have apparent successes.[54] The theoretic concern that offering PEP to sexually active persons would increase risk-taking behavior has not been identified in practice.[93] However, the cost of prophylaxis after nonoccupational exposures is high,[94] and adverse effects are relatively common[95] and can rarely be fatal.[2,96]

General Considerations Regarding Recommendations for Prophylaxis

In evaluating the need for PEP, the following factors should be considered: the duration of time that has passed since the potential exposure, the likelihood of HIV infection in the exposure source, the risk of transmission given the source material and type of exposure, the effectiveness of therapy at modifying that risk, the toxicity of the therapy, and the burden of adherence to antiretroviral therapy.

Because PEP is only recommended for exposures to material from persons with HIV infection, efforts should be made to learn the infection status of the exposure source. If the HIV infection status of the exposure source is unknown, HIV testing should be requested of the person who is the source of the exposure, with consent as required by local laws or regulations. Although awaiting results of testing of the exposure source, PEP may be started for the potentially exposed person and stopped if the exposure source is found not to be infected with HIV.

According to USPHS recommendations for PEP in the nonoccupational setting,[3] PEP should not be used for persons with HIV exposures that have a low risk of HIV transmission (eg, potentially infected body fluid on intact skin) or for persons who seek care too late for the anticipated interruption of transmission (more than 72 hours after reported exposure). Clinicians considering use of PEP after a nonoccupational HIV exposure should recognize that benefits likely would be restricted to situations in which the risk of transmission is high, the intervention can be initiated promptly, and adherence to the regimen is likely. If PEP is used, physicians experienced in the management of children and adolescents with HIV infection should be consulted.[97] Because PEP needs to be started within 72 hours of exposure, often the most feasible approach is to start PEP with a 3-day supply of medications and refer the patient to be evaluated by a consultant within 72 hours.

Recommendations for PEP in children and adolescents vary and include: 1) no PEP; 2) consider PEP; and 3) recommend PEP. Because of the absence of data documenting safety and efficacy of PEP, clinicians may make different, reasonable decisions in similar clinical circumstances. In individual cases of potential exposure, the perceived risks of HIV acquisition may be great enough to justify the burden and potential toxicity of PEP. The final decision to undertake PEP in a specific patient depends on the clinician's recommendation and the exposed person's and/or parent's evaluation of the risk of transmission versus the toxicity of therapy.

If an exposure is serious enough to warrant PEP, 2-drug or 3-drug therapy can be chosen, balancing the theoretically improved efficacy of 3 drugs with the potentially lower toxicity of 2-drug regimens. The USPHS identifies the strength of their recommendations for PEP in the occupational setting by the number of drugs in the regimen.[1,97] The recommendations in this clinical report separate the decision to start PEP from the decision about the number of drugs to include in the regimen. CDC guidelines suggest that determining which agents and how many agents to use is largely empiric.[1] Complete recommendations from the CDC[97] are available online (www.hivpepregistry.org/pdf/pedipep.pdf). American Academy of Pediatrics recommendations follow.

Prophylaxis with ZDV alone or in combination with other drugs was associated with at least 1 adverse effect in 49% of 674 health care professionals treated after occupational exposure to HIV, and 20% stopped prophylaxis prematurely because of adverse effects.[98] Adverse effects can be severe, including potentially fatal lactic acidosis and hepatitis from mitochondrial toxicity of nucleoside analog reverse transcriptase inhibitors (NRTIs)[99] and fatal hypersensitivity reactions from nevirapine.[96] Concern about adverse effects may contribute to low initiation rates for PEP,[100] and difficulty in adhering to complex drug regimens may lead to premature cessation of PEP.[101]

HIV antibody testing of the exposed person is recommended at baseline and at 6 weeks, 12 weeks, and 6 months after exposure. Such diagnostic testing will identify most persons who develop HIV infection after an exposure, although a small fraction of infected persons may not develop detectable antibody until more than 6 months after exposure.[102,103] Delay in HIV seroconversion may be more common if hepatitis C virus transmission occurs at the same time as HIV transmission.

Recommendation for Prophylaxis After Nonoccupational Exposure to HIV in Children and Adolescents

The risk of HIV transmission after an exposure varies by the type and severity of exposure (Tables

1–4) and by the likelihood that the source is infected with HIV (Table 5). Evaluation of both factors allows for estimation of the risk of HIV transmission after a potential exposure (Table 6). For an exposure to a person known to be infected with HIV, the baseline risk of transmission will be modified by the viral load in the exposure fluid.[5] For an exposure to a person of unknown HIV infection status, the baseline risk of HIV transmission will be modified by the probability that the exposure source is infected with HIV (Table 5).

Once the risk of HIV transmission has been estimated, a decision whether to recommend PEP needs to be made. In the absence of specific data on efficacy of PEP outside of the health care setting, this decision is best made by experienced clinicians in collaboration with the exposed person and/or parents after a careful discussion of the risks of transmission and the burden and potential complications of antiretroviral therapy. The risk of transmission and potential benefits of PEP vary for different clinical situations, as outlined in Tables 6 through 8 and Fig 1.

Although PEP may be considered in many circumstances, it is only recommended for high-risk exposures to persons known to be infected with HIV (Table 8). No PEP is given if the exposure occurred more than72 hours previously, if the exposed person refuses PEP, or if the exposed person is unwilling or unable to commit to 28 days of therapy and appropriate follow-up (Table 7).

A careful discussion of the risks and benefits of therapy guides the decision-making regarding PEP and allows appropriate postexposure care (Table 9). If PEP is begun, it should be started as soon as possible after the exposure (within hours, and definitely within 72 hours), and therapy should be continued for 28 days. If consultation with a clinician experienced in the care of children and adolescents with HIV is not immediately possible, a supply of medications sufficient to last until consultation occurs could be dispensed to the patient.

Sexual Exposure

Sexual exposure can result in HIV infection (Tables 3 and 4), and sexual abuse has resulted in HIV transmission to children. Of 9136 children with HIV infection or AIDS reported to the CDC from 1981 through 1997, 26 were sexually abused, with confirmed HIV exposure in 17 and suspected HIV exposure in 9.[104] Of the 17 children with confirmed HIV exposure, 14 had no other risk of HIV infection, and 3 had multiple risk factors. Sexual abuse may be more likely to result in HIV transmission in girls than in women because of thin vaginal epithelium in children and cervical ectopy in adolescents and because children may be repeatedly abused by the same person over a long period.[24] In proven cases of sexual assault by a person known or suspected to have HIV infection, PEP may be considered up to 72 hours after the exposure but is likely to be most effective if given sooner, preferably within a few hours after exposure.[105–107] If the exposure source has genital ulcer disease or another sexually transmitted disease or if the exposure included tissue damage, the risk of HIV transmission is greater (Tables 3 and 4), increasing the potential benefit of PEP relative to the burden of therapy and risks of drug toxicity. Such modifying factors might strengthen the force of the recommendation in a given clinical setting.

For adolescents with a history of a single sexual exposure, PEP can be considered, and if given should be started as soon as possible after the exposure but certainly within 72 hours.[108,109] Such exposure might occur from sexual abuse or by accidental exposure in a consensual relationship (eg, a broken condom). For persons with ongoing consensual sexual exposure to HIV, PEP is not indicated, and behavioral interven-

TABLE 5. Characteristics of the Exposure Source and Risk of Human Immunodeficiency Virus (HIV) Transmission

HIV Infection Status of Exposure Source	Risk of HIV Transmission
Not HIV infected Known not to be infected with HIV*	No risk
HIV status unknown/unknown source HIV infection status unknown, HIV risk status unknown	Unquantified
HIV status unknown: low risk HIV infection status unknown, but known not to have risk factors†	Low
HIV status unknown: high risk HIV infection status unknown but known to have 1 or more risk factors†	Intermediate
HIV infected Known to be infected with HIV‡	High

* HIV infection is documented by presence of specific antibody to HIV in persons older than 18 months and by positive plasma HIV RNA polymerase chain reaction (PCR) assay results, positive cell-associated HIV DNA PCR assay results, or detection of plasma HIV p24 antigen in persons of any age.

† Risk factors for HIV infection include male homosexual activity, injection drug use, blood transfusion or blood product infusion before 1985, or sexual activity with a member of a high-risk group. Some persons who have sex with members of a high-risk group do not identify themselves as at risk, because they are unaware of the risk history of their sexual partner. Their risk of HIV infection is related to the prevalence of HIV infection in their immediate community.

‡ Absence of HIV infection is identified by laboratory documentation of negative HIV antibody or negative HIV DNA PCR assay results from a specimen collected close to the time of the exposure and in the absence of interval high-risk behavior or symptoms compatible with acute retroviral infection syndrome.

TABLE 6. Exposure Type and Exposure Risk Category for HIV

Exposure Type	Exposure Risk Category
Cutaneous exposure	
Fluid on intact skin	No risk identified
Bite without break in skin	
Skin with compromised integrity (eczema, chapped skin, dermatitis, abrasion, laceration, open wound)	Low to intermediate
Traumatic skin wound with bleeding in donor and recipient*	High
Mucous membrane exposure	
Kissing	No risk identified
Oral sex	Low
Human milk: single ingestion	
Splash to eye or mouth	
Receptive vaginal sex without trauma	Intermediate
Receptive anal intercourse	High
Traumatic sex with blood (sexual assault)	
Percutaneous exposure†	
Superficial scratch with sharp object, including a needle found in the community	No risk identified
Puncture wound with solid needle	Low
Puncture wound with hollow needle without visible blood	
Body piercing	
Bite with break in skin	
Puncture wound with hollow needle with visible blood	Intermediate
Puncture wound with large-bore hollow needle with visible blood on needle, or needle recently used in source patient artery or vein	High

* For example, in a fight, a blow to the mouth might break a tooth that bleeds and lacerate the first that also bleeds. If there was mixing of blood, both persons may be at risk.
† See text for considerations used in assigning the appropriate risk category for a percutaneous exposure.

TABLE 7. Suggested Approach to HIV (PEP) on the Basis of Characteristics of the Exposed Patient*

Characteristics of Exposed Patient	Suggested Approach
Exposure >72 h ago; or Exposed person refuses PEP; or Exposed person unwilling or unable to commit to 28 d of therapy and appropriate follow-up.	No PEP
Exposure ≤72 h ago; or Exposed person voluntarily accepts PEP; or Exposed person commits to 28 d of therapy and appropriate follow-up.	Consider PEP in appropriate exposure setting (Tables 6 and 8)

* Animal data suggest PEP started later than 72 hours after exposure is less effective in preventing infection.[64–66]

tions to decrease repeated exposure probably are more appropriate.[110,111]

Percutaneous Exposures

Risk of HIV transmission from a puncture wound from a needle found in the community is significantly lower than the 0.3% HIV transmission risk after needlestick injury in a health care professional from a person with HIV infection. Although it is unlikely that a true estimate of risk can be established, transmission will be related to:

- The probability that the person who used the needle has HIV infection (Table 5);
- The time interval since the needle was in contact with blood of the source;
- The initial concentration of HIV on the needle, presence of blood or tissue that might delay drying (and, therefore, killing of the virus), or the presence of fresh blood or material that might contain viable virus; and
- The severity of the injury (skin contact without skin breakage, abrasion without bleeding, deeper skin penetration) in the exposed individual.

In evaluating a puncture wound, the following factors are considered in assessing potential for HIV transmission (presented as lower risk category followed by higher risk category for each attribute): the depth of the wound (superficial scratch or deep puncture); the presence of blood on the needle (no visible blood or visible blood); the characteristics of the blood on the needle (dried or fresh); the type of needle (solid or hollow bore); and the location the needle was used in the source patient's body (not in artery or vein; or in artery or vein).

The risk of HIV transmission from a discarded needle in public places (often referred to as a "found" needle) seems to be low. Because data are not available on the efficacy of PEP in this circumstance for adults or children, the USPHS is unable to recommend for or against PEP in this circumstance.

TABLE 8. Suggested Approach* to PEP on the Basis of Exposure Risk Category and HIV Infection Status of the Source

Exposure Risk Category†	HIV Infection Status of Source‡	Suggested Approach
No risk identified	Any	No PEP
Any	Not HIV infected	No PEP
Low, intermediate, or high	Unknown	Consider PEP
Low or intermediate risk	HIV infected	Consider PEP
High risk	HIV infected	Recommend PEP

* PEP is not recommended if the exposure occurred >72 hours ago, the exposed person refuses PEP, or if the exposed person is unwilling or unable to commit to 28 days of therapy and appropriate follow-up (Table 7). When considering PEP, the approach is suggested on the basis of type and severity of exposure, fluid involved, and HIV infection status of the exposure source, as outlined in Tables 1 through 6. Characteristics of the exposed patient are also considered, as described here and in the text. Given the absence of compelling data on effectiveness of PEP, clinicians may make different, reasonable decisions in similar clinical circumstances.
† See Table 6.
‡ See Table 5.

Furthermore, PEP is not without risk and often is associated with significant adverse effects. Therefore, PEP is not routinely recommended in this situation. However, if the needle and/or syringe are found to have visible blood and the source is known to be HIV infected, some experts recommend that PEP be considered. Testing the syringe for HIV is not practical or reliable and is not recommended.

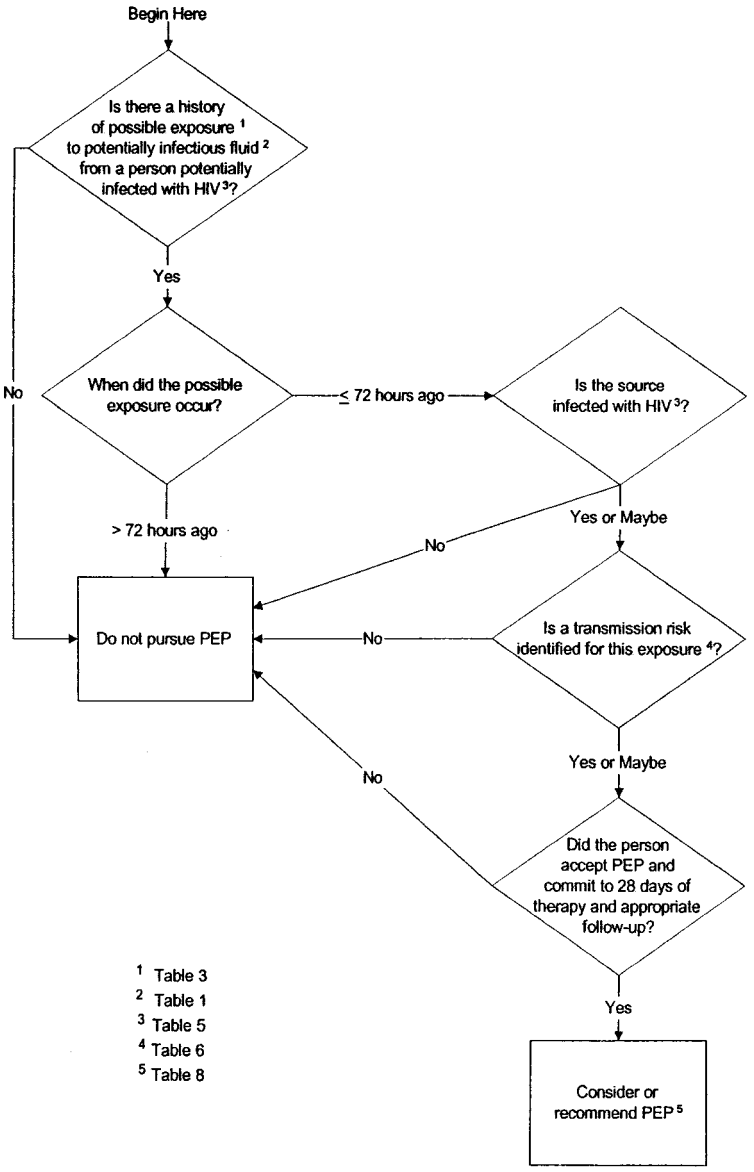

Fig 1. Possible exposure to HIV in children and adolescents: algorithm for decision-making for use of PEP.

TABLE 9. Management of Patients With Possible Exposure to HIV

Exposure Management Issue	Implementation Comment
Treat exposure site	—Wash wounds with soap and water; flush mucous membranes with water. Give tetanus booster if appropriate.
Evaluate exposure source if possible	—Determine the HIV infection status of the exposure source. If unknown, testing with appropriate consent should be offered if possible.
Evaluate exposed person	—Perform HIV serologic testing to identify current HIV infection and hepatitis B and hepatitis C serologic testing as appropriate[122] —Provide or refer for counseling to address stress and anxiety —Discuss prevention of potential secondary HIV transmission —Discuss prevention of repeat exposure, if appropriate —Report incident to legal or administrative authorities as appropriate to the setting of the exposure and the severity of the incident
Consider PEP	—Explain potential benefits and risks —Discuss issues of drug toxicity and medication compliance —Measure complete blood cell count, creatinine, and alanine transaminase concentration as baseline for possible drug toxicity —Begin prophylaxis as soon as possible after exposure, preferably within 1 to 4 h; prophylaxis begun more than 72 h after exposure is unlikely to be effective —Arrange for follow-up with HIV specialist and psychologist, if appropriate —Educate about prevention of secondary transmission (sexually active adolescent should avoid sex, or use condoms, until all follow-up test results are negative) —Report to PEP registry at CDC
Choose therapy	—Consider drug potency and toxicity, regimen complexity and effects on compliance, and possibility of drug resistance in the exposure source —Supply 3–5 d of medication immediately, instructing patients to obtain remainder of medication at follow-up visit
Follow-up	—Perform initial follow-up within 2–3 d to review drug regimen and adherence, evaluate for symptoms of drug toxicity, assess psychosocial status, and arrange appropriate referrals, if needed —Continue therapy for 28 d —Monitor for drug adverse effects at 4 wk with complete blood cell count and alanine transaminase concentration —Evaluate for psychologic stress and medication compliance with weekly office visits or telephone calls —Consider referral for counseling if needed —Repeat HIV serologic testing at 6 wk, 12 wk, and 6 mo after exposure

Bite wounds are another percutaneous body fluid exposure that may occur in children, but the risk of HIV transmission after exposure to saliva is very low. In the absence of blood in saliva and blood in the bite wound, PEP is not indicated. However, if there is blood exchange from a bite, both the person bitten and the person biting should be considered at risk of transmission of HIV and considered for PEP. Use in this setting would be extremely unusual and is potentially indicated only when there is significant exposure to deep, bloody wounds in persons with HIV infection.

Adolescents may be percutaneously exposed to potentially infectious fluids by needle sharing for injection drug use (including anabolic steroids) or for body piercing. The per-contact probabilities of HIV transmission in Table 3 apply in this setting, and for a single percutaneous exposure to blood of a person at risk for or known to have HIV infection, PEP can be considered. For adolescents with ongoing needle sharing and potential exposure to HIV, PEP is not routinely recommended, and behavioral interventions to decrease repeated exposures are more appropriate than is postexposure drug therapy after a single episode.[110,111]

Human Milk Exposures

Because HIV can be transmitted via human milk, even a single exposure to human milk should be considered to confer a potential (albeit very low) risk of HIV transmission (Table 3). Such exposure is possible in a hospital if stored, unpasteurized human milk is given to the wrong infant or if an infant is accidentally breastfed by a woman with HIV infection who is not the child's mother. Exposure also could occur if a mother developed HIV infection while breastfeeding or if a breastfeeding mother with established HIV infection was not tested for HIV in the prenatal period. However, in most areas of the United States, the prevalence of HIV infection in pregnant women is less than 2 per 1000.[112] Most breastfeeding women will have been tested for HIV during pregnancy,[113,114] and women known to be HIV infected will have been counseled not to breastfeed.[115] Therefore, the actual likelihood that exposure to HIV would occur by this route is extremely low.

For women with known HIV infection, the best approach to preventing transmission is to avoid breastfeeding. For a woman who continues to breastfeed, potent antiretroviral therapy for herself may decrease viral load and decrease risk of transmission, but prolonged therapy for the mother or the infant so exposed is of unknown benefit. For an infant with a single exposure to human milk from a woman with HIV infection, the magnitude of risk is estimated to be approximately 100 times lower than that for other mucous membrane exposures (Table 3), and PEP is likely not warranted (Tables 6–8).

TABLE 10. Dosage and Administration of Selected Antiretroviral Drugs That Might Be Used for Prophylaxis After Exposure to HIV in Children or Adolescents[121]

Drug Generic Name (Abbreviation), Trade Name	Recommended Dosage*	How Supplied
NRTIs		
ZDV, Retrovir	Preterm infants (investigational) 0–2 wk of age: 1.5 mg/kg/dose, twice daily, orally (1.0 mg/kg/dose, every 12 h, IV) >2 wk of age: 2.0 mg/kg/dose, 3 times/day, orally (1.5 mg/kg/dose, every 8 h, IV) Term infants 0–6 wk of age: 4 mg/kg/dose, twice daily, orally (3.0 mg/kg/dose, every 12 h, IV) 4 wk–12 y of age: 160 mg/m^2/dose, 3 times/day, orally, or 180–240 mg/m^2/dose, twice daily, orally (maximum 200 mg/dose, 3 times/day or 300 mg/dose, twice daily) ≥13 years of age: 200 mg/dose, 3 times/day, orally or 300 mg/dose, twice daily, orally	Syrup: 10 mg/mL Capsules: 100 mg Tablets: 300 mg Combination (Combivir): ZDV, 300 mg, plus lamivudine, 150 mg, in a single tablet Injection: 10 mg/mL in 20-mL vials
ddI, Videx	<3 mo of age: 50 mg/m^2/dose, twice daily, orally (investigational) 3 mo–12 y of age: 90–135 mg/m^2/dose, twice daily, orally or 240 mg/m^2/dose once daily, orally (investigational) ≥13 y of age: <60 kg in body weight: Tablets, 125 mg, twice daily, orally Powder, 167 mg, twice daily, orally ≥60 kg in body weight: Tablets, 200 mg, twice daily, orally, or 400 mg, once daily, orally Powder, 250 mg, twice daily, orally, or 500 mg, once daily, orally	Chewable tablets*: 25 mg, 50 mg, 100 mg, 150 mg (2 tablets/dose) Buffered powder packets: mix with water: 100 mg, 167 mg, 250 mg Coated tablets (Videx EC): 125 mg, 200 mg, 250 mg, 400 mg Pediatric powder for oral solution mixed to final concentration of 20 mg/mL or 10 mg/mL
d4T, Zerit	<30 kg in body weight: 1 mg/kg/dose, twice daily, orally 30–60 kg: 30 mg, twice daily, orally >60 kg: 40 mg, twice daily, orally	Solution: 1 mg/mL Capsules: 15, 20, 30, 40 mg. Mix with applesauce.
3TC, Epivir	<1 mo of age: 2 mg/kg/dose, twice daily, orally <37.5 kg in body weight: 4 mg/kg/dose, twice daily, orally ≥37.5 kg in body weight: 150 mg/dose, twice daily, orally	Oral solution: 10 mg/mL Tablets: 150 mg Combination (Combivir): ZDV, 300 mg, plus 3TC, 150 mg, in a single tablet.
PIs		
RTV, Norvir	3 mo–12 y of age: 400–450 mg/m^2/dose, twice daily, orally ≥13 y of age: 600 mg/dose, twice daily, orally	Oral solution: 80 mg/mL Gelcaps: 100 mg
IDV, Crixivan	3–12 y of age: 450 to 500 mg/m^2/dose, 3 times/day, orally ≥13 y of age: 800 mg, 3 times/day, orally	Capsules: 200 and 400 mg. Must be stored in original bottle.
NFV, Viracept	1 mo–12 y of age: 30–50 mg/kg/dose, 3 times/day, orally, or 55 mg/kg/dose, twice daily, orally (maximum 2000 mg/dose) ≥13 y of age: 750 to 1250 mg/dose, 3 times/day, orally, or 1250 mg/dose, twice daily, orally	Powder for oral suspension: 50 mg/"level scoop" Tablet: 250 mg
LPV/r, Kaletra	Children: LPV, 300 mg/m^2/dose, plus RTV, 75 mg/m^2/dose, twice daily, orally Adults: LPV, 400 mg/dose, plus RTV, 100 mg/dose, twice daily, orally, or LPV, 533 mg/dose, plus RTV, 133 mg/dose, twice daily, orally if given with nevirapine	Oral solution: 400 mg of LPV/100 mg of RTV per 5 mL (80 mg of LPV/20 mg of RTV per mL). Can store at room temperature for 2 mo. Capsules: 133.3 mg of LPV/33.3 mg of RTV per capsule.

IV indicates intravenous. ddI, didanosine; d4T, stavudine; 3TC, lamivudine; RTV, ritonavir; IDV, indinavir sulfate; NFV, nelfinavir mesylate; LPV/r, lopinavir/ritonavir.

* Although the doses listed for adults are usually the Food and Drug Administration-licensed doses, the doses listed for children may be higher than the Food and Drug Administration-licensed doses. Before prescribing, see package insert for complete prescribing information, including drug toxicities, potential drug interactions, and contraindications for use.

Choice of Antiretroviral Medications for PEP

No clinical studies are available to determine the best antiretroviral regimen for PEP. The most extensive data in terms of potential efficacy and safety are for ZDV monotherapy.[4,81] A clinician with experience in treatment of persons with HIV infection should be consulted before starting PEP.

Many clinicians would use the 3-drug combination of ZDV, lamivudine, and nelfinavir for PEP in children and adolescents (doses in Table 10).[116] If the efficacy of PEP is in aborting early mucosal, submucosal, subcutaneous, or lymphatic HIV infection, then potent suppressive therapies, such as 2 NRTIs plus a PI, should be chosen, because such regimens have been shown to be more likely to suppress HIV replication than have monotherapy or dual therapy.

Taking the multiple medications required for PEP is a daunting task, and problems with drug toxicity (Table 11), patient adherence, and other factors severely limit the proportion of patients who finish PEP once they have started it.[107,117–119] Completing 28 days of a 2-drug regimen is easier than completing

TABLE 11. Major Toxicities of Selected Antiretroviral Drugs for Use as Prophylaxis After Exposure to HIV in Children or Adolescents[121]

Drug Generic Name (Abbreviation), Trade Name	Major Adverse Effects
Zidovudine (ZDV), Retrovir	Anemia, neutropenia, nausea, headache, insomnia, muscle pain, weakness, lactic acidosis, hepatic steatosis
Didanosine (ddI), Videx	Pancreatitis, neuropathy, diarrhea, abdominal pain, nausea, lactic acidosis, hepatic steatosis
Stavudine (d4T), Zerit	Peripheral neuropathy, headache, diarrhea, nausea, insomnia, anorexia, pancreatitis, hepatitis, anemia, neutropenia, lactic acidosis, hepatic steatosis
Lamivudine (3TC), Epivir	Abdominal pain, nausea, diarrhea, rash, pancreatitis, lactic acidosis, hepatic steatosis
Ritonavir (RTV), Norvir	Abdominal pain, nausea, diarrhea, circumoral paresthesias, taste alteration, increased cholesterol and triglyceride concentrations
Indinavir sulfate (IDV), Crixivan	Nephrolithiasis, hyperbilirubinemia, nausea, abdominal pain, increased cholesterol and triglyceride concentrations
Nelfinavir mesylate (NFV), Viracept	Diarrhea, nausea, abdominal pain, weakness, rash, increased cholesterol and triglyceride concentrations
Lopinavir/ritonavir (LPV/r), Kaletra	Abdominal pain, nausea, diarrhea, circumoral paresthesias, taste alteration, increased cholesterol and triglyceride concentrations

a 3-drug regimen and may be associated with fewer medication adverse effects. Although the burden and toxicity of a 3-drug regimen may be warranted for treatment of persons with established HIV infection, the risk-benefit ratio for PEP may favor a 2-drug regimen for some patients. Therefore, some clinicians recommend 2-drug combinations of ZDV and lamivudine for PEP, hoping that the improved ease of use and potential decrease in toxicity will balance out the theoretic decrease in efficacy. It may be reasonable to consider a 2-drug regimen for treatment of some patients. The effectiveness of a drug regimen in practice will be related to the efficacy of the drugs and the probability of completion of the course of therapy.

ZDV and lamivudine are each available as syrups and are available together in a single tablet (Combivir [GlaxoSmithKline, London, United Kingdom]), enhancing ease of use for adolescents (doses in Table 10). If current and/or previous therapy used by the source patient is known and drug resistance is a concern, alternatives to the standard regimen might be considered in consultation with a specialist in HIV care in children and adolescents. Stavudine or didanosine are reasonable alternative NRTIs for use if resistance to ZDV or lamivudine is suspected. ZDV and stavudine should never be used in combination with one another because of intracellular antagonism. Because of the potential for a severe hypersensitivity reaction, the NRTI abacavir sulfate should be avoided in PEP regimens.

Nelfinavir is available as a powder for children who are unable to take pills, although some children prefer the crushed tablets to the powder. Indinavir is only available in capsule form, is associated with crystalluria and nephrolithiasis, and requires extra hydration and for these reasons is usually avoided for PEP in children and adolescents. Other PIs available in a liquid formulation appropriate for children include ritonavir, lopinavir/ritonavir (Kaletra [Abbott Laboratories, North Chicago, IL]), and amprenavir. However, gastrointestinal intolerance may be a problem with ritonavir and lopinavir/ritonavir. The liquid formulation of amprenavir has high levels of vitamin E, contains propylene glycol in a concentration that exceeds World Health Organization standards for use in infants, and should not be used in children under 4 years; therefore, it is not recommended for routine use in PEP regimens. PIs have multiple potential interactions with other drugs, and the package insert should always be consulted before prescribing any of these medications.

Nevirapine is a non-NRTI that has been shown to decrease mother-to-child transmission in a single-dose intrapartum and infant regimen.[78] The single-dose regimen has been shown to be safe for mothers and infants.[120] However, severe life-threatening cases of hepatotoxicity, including liver failure and death, have been reported in patients receiving nevirapine as part of a PEP regimen or as treatment of HIV infection. Therefore, nevirapine should not be used as part of a PEP regimen in children.[96,121]

All antiretroviral agents have potential adverse effects (Table 11). It is critical to review the drug regimen, assess adherence, and evaluate the child for any symptoms of drug toxicity at all follow-up visits.

Implementation and Follow-up

The HIV infection status of the exposure source should be sought. If the source person is known but HIV status unknown, then HIV testing with appropriate counseling and consent should be requested.

Wounds should be washed completely with soap and water. Mucous membranes should be flushed with water or saline solution. Tetanus booster and other wound care should be provided as needed (Table 9).

A discussion of risks and benefits of PEP with the family of an exposed toddler will differ from the discussion with a potentially exposed adolescent, whose family may be specifically excluded from knowledge of the whole event. Treating adolescents in this setting should follow state and local laws regarding confidentiality of medical care. Because of the need to begin prophylaxis as quickly as possible after an exposure, office or clinic staff should be instructed to act immediately on telephone calls concerning possible HIV exposure, and the clinician should not wait until the end of the clinic day to return a call. Such staff education might be incorpo-

rated into OSHA-mandated bloodborne pathogen training.

Emergency departments should have protocols concerning possible need for postexposure HIV prophylaxis, and a "starter kit" of 3 days of antiretroviral medicines should be available at all times to ensure immediate institution of PEP therapy. Careful follow-up is crucial to ensure that the rest of the medications can be obtained easily and that consultation with a specialist in pediatric and adolescent HIV care occurs, to monitor toxicity, and to provide support for medication adherence and psychologic stress.

Initial follow-up of the exposed child is recommended within 2 to 3 days to review drug regimen, assess adherence, evaluate for any symptoms of toxicity, assess psychosocial status of the child and family, and arrange appropriate referrals if needed. To support patient adherence to medications, visits to the clinician's office or clinic or patient-clinician telephone calls should occur at weekly intervals.

Laboratory testing for drug toxicity should be performed at baseline and 2 weeks (optional) and 4 weeks after starting therapy, and at a minimum should include complete blood cell count and alanine transaminase concentration. Persons treated with indinavir should be monitored for hematuria because of the risk of nephrolithiasis. Careful attention needs to be paid to complaints of abdominal pain, which might prompt evaluation for pancreatitis.

Monitoring for seroconversion to HIV includes testing for HIV by enzyme immunoassay, indicated at baseline and 6 weeks, 12 weeks, and 6 months after exposure. For patients coinfected with hepatitis C virus, HIV enzyme immunoassay should also be performed 12 months after the potential exposure. Testing for hepatitis B and hepatitis C should be performed as appropriate, following standard guidelines.[122]

In a significant exposure, the person at risk of HIV acquisition also becomes a potential source of HIV transmission to others. This needs to be discussed, and methods of preventing possible secondary transmission of HIV should be outlined, including abstinence or use of condoms for sexually active adolescents.

The potential for acquisition of HIV infection can lead to psychologic stress, which may require intensive counseling during the immediate postexposure period and until follow-up testing is negative 6 months after the exposure.

If local experts in the use of antiretroviral agents in children are unavailable for consultation, the University of California-San Francisco has a hot line (1–888-HIV-4911) that is supported by the CDC and the Health Resources and Services Administration and is staffed 24 hours a day to help clinicians through the decision pathways and to provide information on choice of therapy.

In selected instances of possible HIV exposure, legal or administrative issues may be raised, and careful documentation is important. For exposures in the hospital setting, hospital administrative policies should be consulted. For adolescents, support from family or friends might be encouraged, but the adolescent's right to privacy should be respected.

Reporting of Exposures and Therapy

Exposures that are considered for PEP should be reported to the nonoccupational HIV PEP registry, which is run by the John Snow Institute under the auspices of the CDC. The registry can be accessed online (www.hivpepregistry.org), by telephone (1–877-HIV-1PEP), or by fax (1–877-HIV-7PEP).

SUMMARY

The risk of HIV transmission from nonoccupational, nonperinatal exposure is generally low. Transmission risk is modified by factors related to the exposure source and extent. Determination of the HIV infection status of the exposure source may not be possible, and data on transmission risk by exposure type may not exist. Except in the setting of perinatal transmission, no studies have demonstrated the safety and efficacy of postexposure use of antiretroviral drugs for the prevention of HIV transmission in the nonoccupational setting. Antiretroviral therapy used for PEP is associated with significant toxicity. The decision to initiate prophylaxis needs to be made in consultation with the patient, family, and a clinician with experience in treatment of persons with HIV infection. If instituted, therapy should be started as soon as possible after an exposure—no later than 72 hours—and continued for 28 days. Many clinicians would use 3 drugs for prophylaxis regimens, although 2 drugs may be considered in certain circumstances. Instruction for avoiding secondary transmission should be given. Careful follow-up is needed for psychologic support, encouragement of medication adherence, toxicity monitoring, and serial HIV antibody testing.

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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Postnatal Glucose Homeostasis in Late-Preterm and Term Infants

David H. Adamkin, MD and COMMITTEE ON FETUS AND NEWBORN

KEY WORDS
newborn, glucose, neonatal hypoglycemia, late-preterm infant

ABBREVIATIONS
NH—neonatal hypoglycemia
$D_{10}W$—dextrose 10% in water

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

abstract

This report provides a practical guide and algorithm for the screening and subsequent management of neonatal hypoglycemia. Current evidence does not support a specific concentration of glucose that can discriminate normal from abnormal or can potentially result in acute or chronic irreversible neurologic damage. Early identification of the at-risk infant and institution of prophylactic measures to prevent neonatal hypoglycemia are recommended as a pragmatic approach despite the absence of a consistent definition of hypoglycemia in the literature. *Pediatrics* 2011;127:575–579

INTRODUCTION

This clinical report provides a practical guide for the screening and subsequent management of neonatal hypoglycemia (NH) in at-risk late-preterm (34–36⅙ weeks' gestational age) and term infants. An expert panel convened by the National Institutes of Health in 2008 concluded that there has been no substantial evidence-based progress in defining what constitutes clinically important NH, particularly regarding how it relates to brain injury, and that monitoring for, preventing, and treating NH remain largely empirical.[1] In addition, the simultaneous occurrence of other medical conditions that are associated with brain injury, such as hypoxia-ischemia or infection, could alone, or in concert with NH, adversely affect the brain.[2–5] For these reasons, this report does not identify any specific value or range of plasma glucose concentrations that potentially could result in brain injury. Instead, it is a pragmatic approach to a controversial issue for which evidence is lacking but guidance is needed.

BACKGROUND

Blood glucose concentrations as low as 30 mg/dL are common in healthy neonates by 1 to 2 hours after birth; these low concentrations, seen in all mammalian newborns, usually are transient, asymptomatic, and considered to be part of normal adaptation to postnatal life.[6–8] Most neonates compensate for "physiologic" hypoglycemia by producing alternative fuels including ketone bodies, which are released from fat.

Clinically significant NH reflects an imbalance between supply and use of glucose and alternative fuels and may result from a multitude of disturbed regulatory mechanisms. A rational definition of NH must account for the fact that acute symptoms and long-term neurologic sequelae occur within a continuum of low plasma glucose values of varied duration and severity.

The authors of several literature reviews have concluded that there is not a specific plasma glucose concentration or duration of hypoglycemia that can predict permanent neurologic injury in high-risk infants.[3,9,10] Data that have linked plasma glucose concentration with adverse long-term neurologic outcomes are confounded by variable definitions of hypoglycemia and its duration (seldom reported), the omission of control groups, the possible inclusion of infants with confounding conditions, and the small number of asymptomatic infants who were followed.[3,11,12] In addition, there is no single concentration or range of plasma glucose concentrations that is associated with clinical signs. Therefore, there is no consensus regarding when screening should be performed and which concentration of glucose requires therapeutic intervention in the asymptomatic infant. The generally adopted plasma glucose concentration that defines NH for all infants (<47 mg/dL) is without rigorous scientific justification.[1,3,4,9,12]

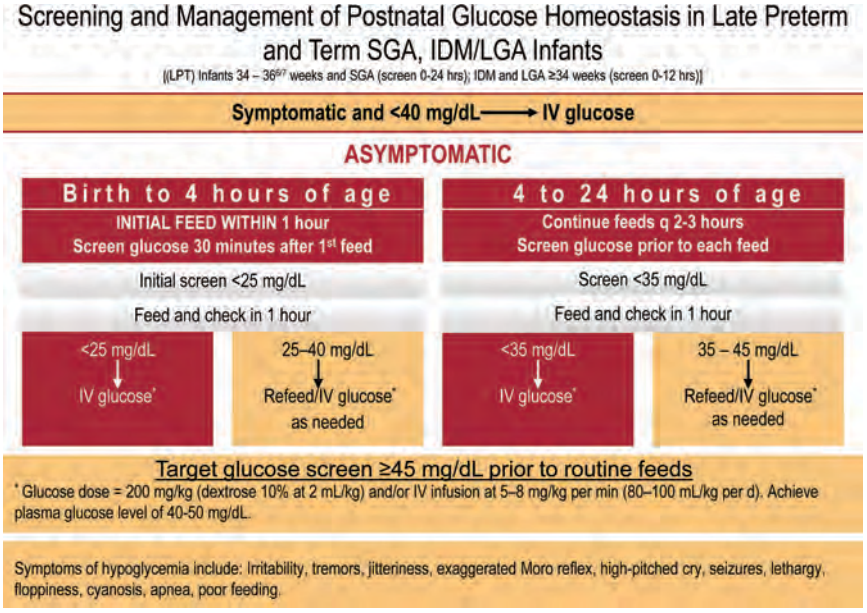

FIGURE 1
Screening for and management of postnatal glucose homeostasis in late-preterm (LPT 34–36⁶/₇ weeks) and term small-for-gestational age (SGA) infants and infants who were born to mothers with diabetes (IDM)/large-for-gestational age (LGA) infants. LPT and SGA (screen 0–24 hours), IDM and LGA ≥34 weeks (screen 0–12 hours). IV indicates intravenous.

WHICH INFANTS TO SCREEN

Because plasma glucose homeostasis requires glucogenesis and ketogenesis to maintain normal rates of fuel use,[13] NH most commonly occurs in infants with impaired glucogenesis and/or ketogenesis,[14,15] which may occur with excessive insulin production, altered counterregulatory hormone production, an inadequate substrate supply,[14–16] or a disorder of fatty acid oxidation.[15] NH occurs most commonly in infants who are small for gestational age, infants born to mothers who have diabetes, and late-preterm infants. It remains controversial whether otherwise normal infants who are large for gestational age are at risk of NH, largely because it is difficult to exclude maternal diabetes or maternal hyperglycemia (prediabetes) with standard glucose-tolerance tests.

A large number of additional maternal and fetal conditions may also place infants at risk of NH. Clinical signs are common with these conditions, and it is likely that patients with such a condition are already being monitored and that plasma glucose analyses are being performed.[13,17] Therefore, for practicality, "at risk" in the management approach outlined in Fig 1 includes only infants who are small for gestational age, infants who are large for gestational age, infants who were born to mothers who have diabetes, and late-preterm infants. Routine screening and monitoring of blood glucose concentration is not needed in healthy term newborn infants after an entirely normal pregnancy and delivery. Blood glucose concentration should only be measured in term infants who have clinical manifestations or who are known to be at risk. Plasma or blood glucose concentration should be measured as soon as possible (minutes, not hours) in any infant who manifests clinical signs (see "Clinical Signs") compatible with a low blood glucose concentration (ie, the symptomatic infant).

Breastfed term infants have lower concentrations of plasma glucose but higher concentrations of ketone bodies than do formula-fed infants.[13,17] It is postulated that breastfed infants tolerate lower plasma glucose concentrations without any clinical manifestations or sequelae of NH because of the increased ketone concentrations.[8,12–14]

WHEN TO SCREEN

Neonatal glucose concentrations decrease after birth, to as low as 30 mg/dL during the first 1 to 2 hours after birth, and then increase to higher and relatively more stable concentrations, generally above 45 mg/dL by 12 hours after birth.[6,7] Data on the optimal timing and intervals for glucose screening are limited. It is controversial whether to screen the asymptomatic at-risk infant for NH during this

normal physiologic nadir. No studies have demonstrated harm from a few hours of asymptomatic hypoglycemia during this normal postnatal period of establishing "physiologic glucose homeostasis."[9]

Infants born to mothers with diabetes may develop asymptomatic NH as early as 1 hour after birth[18] and usually by 12 hours of age.[18] In contrast, infants who are large for gestational age or small for gestational age may develop low plasma glucose concentrations at as early as 3 hours of age,[19] and these infants may be at risk of NH for up to 10 days after birth.[20] Therefore, at-risk infants should be screened for NH with a frequency and duration related to risk factors specific to the individual infant.[5] Screening the asymptomatic at-risk infant can be performed within the first hours of birth and continued through multiple feed-fast cycles. Late-preterm infants and infants who are small for gestational age should be fed every 2 to 3 hours and screened before each feeding for at least the first 24 hours. After 24 hours, repeated screening before feedings should be continued if plasma glucose concentrations remain lower than 45 mg/dL.

LABORATORY DATA

When NH is suspected, the plasma or blood glucose concentration must be determined immediately by using one of the laboratory enzymatic methods (eg, glucose oxidase, hexokinase, or dehydrogenase method). Plasma blood glucose values tend to be approximately 10% to 18% higher than whole-blood values because of the higher water content of plasma.[21,22]

Although a laboratory determination is the most accurate method of measuring the glucose concentration, the results may not be available quickly enough for rapid diagnosis of NH, which thereby delays the initiation of treatment.[23] Bedside reagent test-strip glucose analyzers can be used if the test is performed carefully and the clinician is aware of the limited accuracy of these devices. Rapid measurement methods available at the bedside include the handheld reflectance colorimeter and electrode methods. The blood sample is usually obtained from a warmed heel.

Test-strip results demonstrate a reasonable correlation with actual plasma glucose concentrations, but the variation from the actual level may be as much as 10 to 20 mg/dL.[24–27] Unfortunately, this variation is greatest at low glucose concentrations. There is no point-of-care method that is sufficiently reliable and accurate in the low range of blood glucose to allow it to be used as the sole method for screening for NH.

Because of limitations with "rapid" bedside methods, the blood or plasma glucose concentration must be confirmed by laboratory testing ordered stat. A long delay in processing the specimen can result in a falsely low concentration as erythrocytes in the sample metabolize the glucose in the plasma. This problem can be avoided by transporting the blood in tubes that contain a glycolytic inhibitor such as fluoride.

Screening of the at-risk infant for NH and institution of prophylactic measures to prevent prolonged or symptomatic NH is a reasonable goal. Treatment of suspected NH should not be postponed while waiting for laboratory confirmation. However, there is no evidence to show that such rapid treatment will mitigate neurologic sequelae.

CLINICAL SIGNS

The clinical signs of NH are not specific and include a wide range of local or generalized manifestations that are common in sick neonates.[12,13,17] These signs include jitteriness, cyanosis, seizures, apneic episodes, tachypnea, weak or high-pitched cry, floppiness or lethargy, poor feeding, and eye-rolling. It is important to screen for other possible underlying disorders (eg, infection) as well as hypoglycemia. Such signs usually subside quickly with normalization of glucose supply and plasma concentration.[9,13] Coma and seizures may occur with prolonged NH (plasma or blood glucose concentrations lower than 10 mg/dL range) and repetitive hypoglycemia. The more serious signs (eg, seizure activity) usually occur late in severe and protracted cases of hypoglycemia and are not easily or rapidly reversed with glucose replacement and normalization of plasma glucose concentrations.[28–30] Development of clinical signs may be ameliorated by the presence of alternative substrates.[31]

Because avoidance and treatment of cerebral energy deficiency is the principal concern, greatest attention should be paid to neurologic signs. To attribute signs and symptoms to NH, Cornblath et al[12] have suggested that the Whipple triad be fulfilled: (1) a low blood glucose concentration; (2) signs consistent with NH; and (3) resolution of signs and symptoms after restoring blood glucose concentrations to normal values.[12]

MANAGEMENT

Any approach to management needs to account for the overall metabolic and physiologic status of the infant and should not unnecessarily disrupt the mother-infant relationship and breastfeeding. The definition of a plasma glucose concentration at which intervention is indicated needs to be tailored to the clinical situation and the particular characteristics of a given infant. For example, further investigation and immediate intravenous glucose treatment might be instituted for an infant with clinical signs and a plasma glucose concentration of less than 40 mg/

dL, whereas an at-risk but asymptomatic term formula-fed infant may only require an increased frequency of feeding and would receive intravenous glucose only if the glucose values decreased to less than 25 mg/dL (birth to 4 hours of age) or 35 mg/dL (4–24 hours of age).[32] Follow-up glucose concentrations and clinical evaluation must always be obtained to ensure that postnatal glucose homeostasis is achieved and maintained.

Because severe, prolonged, symptomatic hypoglycemia may result in neuronal injury,[27,28,32] prompt intervention is necessary for infants who manifest clinical signs and symptoms. A reasonable (although arbitrary) cutoff for treating symptomatic infants is 40 mg/dL. This value is higher than the physiologic nadir and higher than concentrations usually associated with clinical signs. A plasma sample for a laboratory glucose determination needs to be obtained just before giving an intravenous "minibolus" of glucose (200 mg of glucose per kg, 2 mL/kg dextrose 10% in water [$D_{10}W$], intravenously) and/or starting a continuous infusion of glucose ($D_{10}W$ at 80–100 mL/kg per day). A reasonable goal is to maintain plasma glucose concentrations in symptomatic infants between 40 and 50 mg/dL.

Figure 1 is a guideline for the screening and management of NH in late-preterm infants and term infants who were born to mothers with diabetes, small for gestational age, or large for gestational age. In developing a pragmatic approach to the asymptomatic at-risk infant during the first 24 hours after birth, mode of feeding, risk factors, and hours of age were considered. This strategy is based on the following observations from Cornblath and Ichord[13]: (1) almost all infants with proven symptomatic NH during the first hours of life have plasma glucose concentrations lower than 20 to 25 mg/dL; (2) persistent or recurrent NH syndromes present with equally low plasma glucose concentrations; and (3) little or no evidence exists to indicate that asymptomatic NH at any concentration of plasma glucose in the first days of life results in any adverse sequelae in growth or neurologic development.[13]

Figure 1 is divided into 2 time periods (birth to 4 hours and 4–12 hours) and accounts for the changing values of glucose that occur over the first 12 hours after birth. The recommended values for intervention are intended to provide a margin of safety over concentrations of glucose associated with clinical signs. The intervention recommendations also provide a range of values over which the clinician can decide to refeed or provide intravenous glucose. The target glucose concentration is greater than 45 mg/dL before each feeding. At-risk infants should be fed by 1 hour of age and screened 30 minutes after the feeding. This recommendation is consistent with that of the World Health Organization. Gavage feeding may be considered in infants who are not nippling well. Glucose screening should continue until 12 hours of age for infants born to mothers with diabetes and those who are large for gestational age and maintain plasma glucose concentrations of greater than 40 mg/dL. Late-preterm infants and infants who are small for gestational age require glucose monitoring for at least 24 hours after birth, because they may be more vulnerable to low glucose concentrations, especially if regular feedings or intravenous fluids are not yet established.[20] If inadequate postnatal glucose homeostasis is documented, the clinician must be certain that the infant can maintain normal plasma glucose concentrations on a routine diet for a reasonably extended period (through at least 3 feed-fast periods) before discharge. It is recommended that the at-risk asymptomatic infant who has glucose concentrations of less than 25 mg/dL (birth to 4 hours of age) or less than 35 mg/dL (4–24 hours of age) be refed and that the glucose value be rechecked 1 hour after refeeding. Subsequent concentrations lower than 25 mg/dL, or lower than 35 mg/dL, respectively, after attempts to refeed, necessitate treatment with intravenous glucose. Persistent hypoglycemia can be treated with a minibolus (200 mg/kg [2 mL/kg] $D_{10}W$) and/or intravenous infusion of $D_{10}W$ at 5 to 8 mg/kg per minute, 80 to 100 mL/kg per day; the goal is to achieve a plasma glucose concentration of 40 to 50 mg/dL (higher concentrations will only stimulate further insulin secretion). If it is not possible to maintain blood glucose concentrations of greater than 45 mg/dL after 24 hours of using this rate of glucose infusion, consideration should be given to the possibility of hyperinsulinemic hypoglycemia, which is the most common cause of severe persistent hypoglycemia in the newborn period. A blood sample should be sent for measurement of insulin along with a glucose concentration at the time when a bedside blood glucose concentration is less than 40 mg/dL, and an endocrinologist should be consulted.

SUMMARY

Current evidence does not support a specific concentration of glucose that can discriminate euglycemia from hypoglycemia or can predict that acute or chronic irreversible neurologic damage will result. Therefore, similar to the Canadian Paediatric Society guidelines, a significantly low concentration of glucose in plasma should be reliably established and treated to restore glucose values to a normal physiologic range.[5] Recognizing infants at risk of disturbances in postnatal glucose homeostasis and providing a margin of safety by early measures to

prevent (feeding) and treat (feeding and intravenous glucose infusion) low concentrations are primary goals. Follow-up glucose measurements are always indicated to be sure an infant can maintain normal glucose concentrations over several feed-fast cycles. This will also permit recognition of infants with persistent hyperinsulinemic hypoglycemia and infants with fatty acid oxidation disorders.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Hospital Care

Precertification Process

ABSTRACT. Precertification is a process still used by health insurance companies to control health care costs. Although we believe precertification is unnecessary and not cost-effective, in those instances where precertification is still being utilized, we suggest that the following procedures be adopted. This statement suggests guidelines that should help achieve this goal while allowing optimal access to care for children.

The precertification process is a utilization management tool used to control hospital admissions, utilization of services, and medical facility expense. This "tool" must be used uniformly with care, concern, and compassion and with a clear objective that its use does not prevent care needed by pediatric patients.

Children respond to illness and injuries differently from adults. Critical symptoms may develop more rapidly, and children often cannot appropriately communicate the severity of their condition. For these reasons children frequently require early and expedient physician evaluation and in-hospital monitoring. Delay that compromises a child's care or clinical outcome is not acceptable as part of a cost-containment screening process. The timely and appropriate approval of pediatric referrals to hospitals and physicians must be of paramount consideration in any established approval process or procedure. The following guidelines are meant to help achieve the goals of utilization management and optimal care for children.

1. The precertification process must be available in writing for use by the attending physician.
2. The precertification process must be available and clearly presented in all insurance plans and health care contracts so that the parent or guardian is aware of the requirement.
3. Contact telephone approval numbers must be on the patient's insurance card and health care contract. The contracting agency's response personnel must be available 24 hours a day, 7 days a week, including holidays, and must be knowledgeable in pediatric care. Fax or electronic communication should also be available to be used in place of telephone contact as a way to save time.
4. When disagreements about recommended management occur between referring physicians and screening personnel for the health care plan, a system of immediate response by health care plan physicians knowledgeable in pediatric care needs to be in place to resolve the concerns of the referring physician, the parents, or both.
5. If the child's situation is related to an emergency, precertification should be waived as the primary consideration must be to protect the patient's life and health.
6. In the case of a nonacute precertification conflict, an immediate review process by physicians knowledgeable in pediatric care should be available to resolve the problem.
7. Unnecessary delays in treatment must be avoided—most importantly to prevent endangering the patient's life and health and also to reduce excessive nonclinical administrative time required of referring physicians. The health insurance company should compensate the physician's office for all costs involved in performing the work of precertification.

The American Academy of Pediatrics believes it is in the best interest of children for all pediatricians to assist in the monitoring and control of the rapidly rising costs of children's health care. If this includes the use of precertification mechanisms, then the precertification process should be efficient and not result in delays in the patient receiving any recommended treatment.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

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Clinical Report—Premedication for Nonemergency Endotracheal Intubation in the Neonate

abstract

Endotracheal intubation is a common procedure in newborn care. The purpose of this clinical report is to review currently available evidence on use of premedication for intubation, identify gaps in knowledge, and provide guidance for making decisions about the use of premedication. *Pediatrics* 2010;125:608–615

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KEY WORDS
neonate, endotracheal intubation, premedication

ABBREVIATION
LMA—laryngeal mask airway

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INTRODUCTION

Endotracheal intubation is a common procedure in NICUs and should be performed expeditiously in as controlled an environment as possible to reduce complications. Several studies that evaluated the success rate of neonatal endotracheal intubations have reported that successful intubations frequently require more than 1 attempt and are rarely accomplished within the currently recommended time frame.[1–3] Many failed attempts can be attributed to suboptimal intubating conditions. Excellent intubating conditions are characterized by good jaw relaxation, open and immobile vocal cords, and suppression of pharyngeal and laryngeal reflexes assessed by the absence of coughing or diaphragmatic movements in response to intubation.[4] Several trials have demonstrated that the use of premedication for intubation of the newborn significantly improves intubating conditions, decreases the time and number of attempts needed to complete the intubation procedure, and minimizes the potential for intubation-related airway trauma.[5–10]

The alleviation of pain in neonates should be the goal of all caregivers, because repeated painful experiences have the potential for deleterious consequences.[11] The experience of being intubated is unpleasant and painful and seriously disturbs physiologic homeostasis.[12,13] A consensus statement from the International Evidence-Based Group for Neonatal Pain concluded that "tracheal intubation without the use of analgesia or sedation should be performed only for resuscitation in the delivery room or for life-threatening situations associated with the unavailability of intravenous access."[14] Subsequently, in a recent policy statement the American Academy of Pediatrics also recommended that every health care facility caring for neonates implement an effective pain-prevention program and use pharmacologic and nonpharmacologic therapies for the prevention of pain associated with procedures.[11] Despite these recommendations, there remains wide variation in the frequency of use of premedication before intubation, and in the medications used for premedication.[15,16] Some of the reasons offered for not using premedications before intubation are concern for ad-

verse reactions and/or toxic effects of the medications, inadequate time for administration of medications in emergency situations, and the perception that risk/benefit ratios are worsened by using premedications.[13] This report will address some of these issues, including the choices of available medications, the circumstances for the use of medications, the risks of these medications, and the appropriate precautions to take while adopting these procedures.

PHYSIOLOGIC RESPONSES TO INTUBATION

The process of intubation may cause hypoxemia,[17] bradycardia,[18] intracranial hypertension,[19] systemic hypertension,[17] and pulmonary hypertension.[20] Hypoxemia seems to be related either to apnea at the time of intubation or possible airway obstruction associated with positioning.[17] Bradycardia is presumed to be vagal in origin, because the very rapid onset is suggestive of a reflexive etiology[17] and is not prevented by preoxygenation and the avoidance of hypoxemia.[18] The increase in intracranial pressure may be a result of coughing and struggling of the infant that can result in venous stasis with an increase in cerebral blood volume.[19,21] Systemic arterial hypertension has been investigated in adults and seems to be caused by an increase in systemic vascular resistance, which is probably caused by catecholamine release.[22] Pulmonary hypertension leading to right ventricular failure has been described in adults,[23] and although pulmonary artery pressures have not been measured in newborn infants undergoing intubation, endotracheal suctioning is known to cause an increase in pulmonary artery pressure postoperatively in infants with congenital heart disease[20] and is presumed to occur with intubation. In addition, improperly performed direct laryngoscopy can cause traumatic injuries to the face, eyes, tongue, and gums, and placement of the endotracheal tube can dislodge the arytenoids or damage other glottic structures. These injuries can be avoided by improved technique that can be enhanced by the use of premedication.[24]

CHARACTERISTICS OF AN IDEAL STRATEGY

An ideal strategy for premedication for intubation eliminates the pain, discomfort, and physiologic abnormalities of the procedure, helps to carry out intubation expeditiously, minimizes the chances for traumatic injury to the newborn, and has no adverse effects. An individual skilled in the use of bag-mask ventilation should be present to ensure adequate ventilation after the use of premedication and before the intubation. An ideal approach would be to administer supplemental oxygen, as needed, via a properly sized face mask, then a vagolytic agent, followed by analgesic and/or hypnotic medications before infusion of a muscle relaxant. The vagolytic drug prevents bradycardia, the analgesic and/or hypnotic drug can control pain and may render the infant unconscious and minimize adverse hemodynamic responses to laryngoscopy, and the muscle relaxant provides the best possible intubating conditions. Nonpharmacologic interventions, including swaddling and comfortable positioning, would contribute to the infant's comfort as well.

Analgesia

Premedication with an analgesic reduces the pain and discomfort of intubation. An ideal analgesic agent would have a rapid onset, be of short duration, have no adverse effects on respiratory mechanics, and possess predictable pharmacokinetic properties. None of the currently available agents fit this profile.

Opioids are the most commonly used medications for analgesia in the neonate. The mechanism of action of the individual opioids involves interaction at various receptor sites in both the central and peripheral nervous system to modify transmission of painful signals and diminish pain perception.[25] Morphine is the most frequently used opiate for pain control in the neonate. It has been used for acute postoperative pain control and as a continuous infusion for ventilated infants. The use of morphine for premedication for intubation was studied in a randomized, controlled trial of 34 premature infants in which infants were given either morphine alone or placebo 5 minutes before the intubation. There was no effect on the severity of physiologic disturbances during intubation including the duration of severe hypoxemia, incidence of bradycardia, and change in mean blood pressure.[26] This lack of effect is thought to be because of the delayed onset of action of morphine[27] related to the relative hydrophilic nature of the drug. Intravenous morphine has a mean onset of action at 5 minutes and peak effect at 15 minutes.[25] Another randomized, controlled trial of 20 preterm infants compared the use of morphine and midazolam versus remifentanil and midazolam for intubation.[8] No differences were noted between the groups with regard to pain control or hemodynamic variables, but the probability of having excellent intubation conditions was significantly higher with remifentanil than with morphine. All infants pretreated with remifentanil and midazolam were intubated at first attempt compared with only 60% of the infants in the morphine and midazolam group.[8] In another study, when morphine was used in combination with a vagolytic and a paralytic agent, the time needed to intubate was reduced and bradycardia was decreased.[24] However, these effects may be related to the vagolytic and paralytic agents used in the study, not to

morphine effects. Furthermore, the status of pain control was not assessed in that study. For these reasons, morphine alone would not be the most appropriate choice for premedication for intubations. Meperidine is rarely used in neonates because of its slow onset of action, variability in metabolism, and risk of toxic effects of its metabolites; as a result, it is not recommended.[27]

Fentanyl is the most frequently used synthetic opioid in the neonate. This drug may be preferable to morphine for pain control for intubation because of a more rapid onset of action related to its more lipophilic nature.[25] Fentanyl's impact on some of the physiologic disturbances during intubation has been studied. In older infants and children this drug blunts physiologic disturbances during endotracheal suctioning and, in patients after surgery, decreases pulmonary arterial pressure and systemic hypertension.[20,23] It is likely that such responses may occur during intubation too. Its impact on cerebral and systemic hemodynamics was studied with a short-term infusion in 15 preterm infants, and there were no significant changes in the systemic or cerebral perfusion or pressure.[28] Although fentanyl as a single agent in intubation has not been studied, a cohort study of 33 preterm and term infants intubated after a combination of atropine, fentanyl, and a paralytic agent showed that fentanyl had no significant adverse effects.[7] Remifentanil, another synthetic opiate, has a rapid onset of action and an ultrashort duration of action and has been shown to be a useful drug for neonatal intubation.[8,29] A primary concern with synthetic opioid use is the risk of chest wall rigidity, but this risk can be reduced by slow administration and can be treated with either naloxone or muscle relaxants.[30] However, it is important to remember that the use of naloxone, a competitive antagonist at all opioid receptors, will also reverse the analgesic effects of these drugs.

Sedation

Sedatives do not always reduce pain but can sedate or render individuals unconscious or amnestic depending on the dose and individual response. Benzodiazepines have been frequently used for sedation before elective intubations but may not be appropriate in many cases. Midazolam is the most commonly used medication in this category[31] in the United States, but it has not been shown to reduce any physiologic changes during intubation. In a randomized, double-blind trial (stopped after only 16 intubations because of adverse events and reported in a letter to the editor), preterm infants who received midazolam and atropine for intubation had more desaturations, and 29% required cardiopulmonary resuscitation compared with those in the groups that received either atropine alone or no premedication.[32] Midazolam can cause hypotension in both preterm and term infants,[33–36] decreased cardiac output in older children,[37] and decreased cerebral blood flow velocity in premature infants.[33,38] The studies that demonstrated these effects were not performed as part of premedication for intubation, and the results may not be applicable to the circumstances necessitating endotracheal intubation. However, kinetic studies in preterm and term infants have shown that the serum half-life of midazolam given as continuous infusion or by repetitive dosing can exceed 22 hours.[38,39] Further concern in the use of midazolam for preterm infants is the exposure to the preservative benzyl alcohol.[40,41] For these reasons, midazolam should not be used in preterm infants, but it can be considered for use in the term or older infant as part of the premedication sequence for elective intubation in the NICU.

Elective intubation of patients before surgery is often accomplished with a sedative-hypnotic agent such as a barbiturate and a muscle relaxant. Barbiturates have been used for induction of anesthesia for decades; however, barbiturates are poor analgesics.[42] Barbiturates such as thiopental and methohexital have a rapid onset and short duration of action. In a randomized, placebo-controlled trial in term infants, thiopental was shown to reduce changes in heart rate and blood pressure during intubation and to shorten the time to intubation.[43] In a small cohort study of term and preterm infants, methohexital facilitated intubation with rapid onset within 1 minute of sedation and recovery within 10 minutes.[44] However, more studies are necessary before methohexital can be recommended for use.

Propofol is a nonbarbiturate anesthetic that is frequently used for induction of anesthesia in older children and adults but has not been well evaluated in newborns. Propofol is lipophilic and rapidly equilibrates between plasma and brain with quick loss of consciousness and also has a short duration of action after a single-bolus dose.[25] In a randomized, controlled trial in 63 premature infants, propofol was shown to be a more effective induction agent than the morphine, atropine, and suxamethonium regimen to facilitate neonatal intubation.[9] Oxygenation during intubation was maintained better in the propofol group and was attributed to the maintenance of spontaneous respiration in infants who received propofol. Twenty-three percent of the infants in the morphine, atropine, and suxamethonium group and 6% of the infants in the propofol group sustained intubation-related trauma. No other adverse events were noted in the propofol group. Although the results of this study are encouraging, more research

confirming these initial findings is necessary before propofol can be recommended as a single premedication agent for neonatal intubation. Propofol can only be administered intravenously, and pain at the site of injection that may sometimes be moderately severe has been reported with intravenous injection of propofol in 10% to 20% of patients.[45]

Vagolytic Agents

Vagolytic agents prevent bradycardia during intubation and decrease bronchial and salivary secretions but are infrequently used for neonatal intubation.[46] One reason for their sparse use has been the concern that vagolytic agents mask hypoxia-induced bradycardia during intubation; however, most episodes of bradycardia during intubation are secondary to vagal stimulation, not hypoxia. Glycopyrrolate and atropine are both effective vagolytic agents, and although they have not been directly compared in neonates, they have been studied in infants and children. In a randomized, controlled trial in 90 older infants and children that compared the use of glycopyrrolate and atropine at anesthetic induction, none had bradycardia, but more subjects who received atropine developed sinus tachycardia than those who received glycopyrrolate.[47] Glycopyrrolate is widely used in pediatric intensive care and anesthesia; however, its pharmacokinetics in small preterm infants is not known.

Muscle Relaxants

The ideal muscle relaxant for intubation would have a rapid onset, short duration of action, and minimal or no deleterious effect on heart rate and blood pressure. None of the currently available agents meet all these criteria for neonates, but use of a muscle relaxant to facilitate intubation can eliminate or minimize the increase in intracranial pressure that occurs during awake intubation. This has been demonstrated with both succinylcholine in preterm infants[48] and pancuronium in preterm and term infants.[18]

Succinylcholine, the only depolarizing agent in clinical use, blocks neuromuscular transmission by binding to the acetylcholine receptors of the muscle membrane and depolarizing the membrane. It has both a rapid onset and a short duration of action. In a randomized, controlled trial in preterm infants, succinylcholine given with morphine and atropine was compared with awake intubation. This combination resulted in faster intubation with less bradycardia and less trauma as defined by less blood in the oral and nasal passages.[48]

The nondepolarizing muscle relaxants compete with acetylcholine for receptors on the motor endplate but do not result in depolarization of the membrane. Of these agents, pancuronium is widely used in newborns and has few adverse effects but is slower in onset of action and longer acting compared with the other available muscle relaxants. Pancuronium has a vagolytic effect that helps minimize the reflex bradycardia that often accompanies laryngoscopy. In a randomized, controlled trial, infants who received pancuronium and atropine showed less hypoxia during intubation and less increase in intracranial pressure compared with infants who received no premedication or atropine alone.[18]

Mivacurium, another nondepolarizing agent, is no longer commercially available because of its adverse effect of histamine release and associated bronchospasm. Cisatracurium has been introduced to replace mivacurium and seems to have similar physiologic effects but has not yet been tested in a neonatal population. Vecuronium and rocuronium, 2 other nondepolarizing muscle relaxants in wide use in pediatric anesthesia and PICUs, are characterized by their minimal effects on blood pressure or heart rate. Rocuronium is a metabolic derivative of vecuronium and has quicker onset to paralysis and shorter duration of action compared with vecuronium.

ADVERSE EFFECTS

Concern for adverse effects has been a barrier to implementing premedication for intubation,[49] but most reports and randomized, controlled trials have not demonstrated serious adverse effects. A large multicenter observational study showed no increase in the frequency of adverse effects when infants were premedicated.[31] When used alone, fentanyl and other synthetic opioids have been associated with acute chest wall rigidity in both preterm and term infants, which can significantly impair ventilation.[30] However, this adverse effect may be related to dose and rapid delivery and can be prevented by slow infusion of an appropriate dose and overcome with muscle relaxant[50] or reversed with naloxone.[30]

Succinylcholine has been reported to have rare serious adverse effects in children, including hyperkalemia, myoglobinemia, and cardiac arrhythmias. Atropine seems to protect against bradyarrhythmias induced by succinylcholine.[51] Hyperkalemia is also unlikely, because marked elevations have been reported only in clinical circumstances associated with significant tissue destruction.[51] Succinylcholine is a known trigger of malignant hyperthermia, a skeletal muscle disorder inherited as an autosomal dominant trait. The incidence of malignant hyperthermia is estimated to be 0.4 to 0.5 in 10 000 in the general population.[52] Diagnosis and management of malignant hyperthermia is beyond the scope of this report. Succinylcholine should not be used in the presence of hyperkalemia and/or a family history of malignant hyperthermia.[53]

CLINICAL CIRCUMSTANCES FOR INTUBATION WITHOUT PREMEDICATION

Intubation without premedication may be acceptable during resuscitation or after acute deterioration or critical illness at a later age. The risk/benefit ratio may also support intubation without premedication in infants with upper airway anomalies such as Pierre Robin sequence. Intubation of infants with severely abnormal airways can be difficult, and the infant's own respiratory effort may be essential for maintaining an open airway. If intubation attempts are unsuccessful in these infants, the use of laryngeal mask airway (LMA) or anticipatory transfer to a center with a team of personnel, including a neonatologist, pediatric otolaryngologist, and pediatric anesthesiologist, experienced in managing infants with structurally abnormal airways should be considered. It is important to note that LMA is a temporary airway device and should be used only as a last resort while preparations for a secure airway are in progress. One might also consider the use of a fiber-optic bronchoscope for intubation if personnel experienced in its use are available.[54]

GAPS IN KNOWLEDGE

Many unanswered questions remain regarding the practice of premedication for nonemergent intubation in the newborn.

- The optimal pharmaceutical agents have not been developed for use in newborns, and appropriate drug doses of currently available agents based on gestational age are currently unknown.
- The pharmacokinetic and pharmacodynamic characteristics of many drugs used in premedication have not been well studied in newborns.
- An ideal combination and/or sequence of premedications have not been established.
- Alternative routes of administration of premedications have not been systematically studied.
- Long-term benefits and adverse effects of premedications are unknown.

Further research must continue to answer these and other questions.

CLINICAL IMPLICATIONS

- Preparation should include having appropriate equipment such as an oxygen source, appropriately sized bags, face masks, endotracheal tubes, stylet, laryngoscope, and suction.
- All support staff assisting with the procedure should have clearly preassigned responsibilities during the procedure.
- Infants should have cardiorespiratory, oxygen saturation, and noninvasive blood pressure monitoring during nonemergent intubation, and an end-tidal carbon dioxide detector should be available. Intravenous access should preferably be established, and the stomach should be decompressed.
- All personnel who intubate neonates should acquire training with LMAs, because this device may prove to be an effective bridge to intubation in some cases in which bag-mask ventilation is suboptimal.[55,56] Appropriately sized LMAs should be available for all intubations, particularly when any difficulty is anticipated. LMAs have been used successfully in late-preterm and term newborns weighing more than 2500 g.
- Individuals who perform intubations should be experienced in the use of bag-mask ventilation and be knowledgeable about the effects of the procedure of laryngoscopy and intubation, as well as risks and benefits of premedications. Ascertainment of appropriate endotracheal tube position immediately after intubation should be done by auscultation and end-tidal carbon dioxide monitoring.
- Except for emergent intubation during resuscitation either in the delivery room or after acute deterioration or critical illness at a later age, premedication should be used for all endotracheal intubations in newborns. Medications with rapid onset and short duration of action are preferable (Table 1).
  - Analgesic agents or anesthetic dose of a hypnotic drug should be given.
  - Vagolytic agents and rapid-onset muscle relaxants should be considered.
  - Use of sedatives alone such as benzodiazepines without analgesic agents should be avoided.
  - A muscle relaxant without an analgesic agent should not be used.
- Each unit should develop protocols and lists of preferred medications to improve compliance and minimize medication errors and adverse effects.
- For circumstances in which intravenous access is not available, alternative routes such as intramuscular administration can be considered.

TABLE 1 Medications for Premedication for Nonemergency Intubation

Drug	Route/Dose	Onset of Action	Duration of Action	Common Adverse Effects	Comments[a]
Analgesic					
Fentanyl	IV or IM[b]/1–4 μg/kg	IV, almost immediate; IM, 7–15 min	IV, 30–60 min; IM, 1–2 h	Apnea, hypotension, CNS depression, chest wall rigidity	Preferred analgesic Effects reversible with naloxone Give slowly (preferably over 3–5 min, at least over 1–2 min) to avoid chest wall rigidity Chest wall rigidity can be treated with naloxone and muscle relaxants
Remifentanil	IV/1–3 μg/kg May repeat in 2–3 min if needed	IV, almost immediate	IV, 3–10 min	Apnea, hypotension, CNS depression, chest wall rigidity	Acceptable analgesic Short duration of action and limited experience in neonates Effects reversible with naloxone Give slowly over 1–2 min to avoid chest wall rigidity Chest wall rigidity can be treated with naloxone and muscle relaxants
Morphine	IV or IM/0.05–0.1 mg/kg	IV, 5–15 min; IM, 10–30 min	IV, 3–5 h; IM, 3–5 h	Apnea, hypotension, CNS depression	Acceptable analgesic agent Use only if other opioids are not available; if selected, must wait at least 5 min for onset of action Effects reversible with naloxone
Hypnotic/sedative					
Midazolam	IV or IM/0.05–0.1 mg/kg	IV, 1–5 min; IM, within 5–15 min	IV, 20–30 min; IM, 1–6 h	Apnea, hypotension, CNS depression	Acceptable sedative for use in term infants in combination with analgesic agents Hypotension more likely when used in combination with fentanyl Not recommended in premature infants Effects reversible with flumazenil
Thiopental	IV/3–4 mg/kg	IV, 30–60 s	IV, 5–30 min	Histamine release, apnea, hypotension, bronchospasm	Acceptable hypnotic agent Hypotension more likely when used in combination with fentanyl and/or midazolam
Propofol	IV/2.5 mg/kg	Within 30 s	3–10 min	Histamine release, apnea, hypotension, bronchospasm, bradycardia; often causes pain at injection site	Acceptable hypnotic agent Limited experience in newborns Neonatal dosing has not been well established
Muscle relaxant					
Pancuronium	IV/0.05–0.10 mg/kg	1–3 min	40–60 min	Mild histamine release, hypertension, tachycardia, bronchospasm, excessive salivation	Acceptable muscle relaxant Relatively longer duration of action Effects reversible with atropine and neostigmine
Vecuronium	IV/0.1 mg/kg	2–3 min	30–40 min	Mild histamine release, hypertension/hypotension, tachycardia, arrhythmias, bronchospasm	Preferred muscle relaxant Effects reversible with atropine and neostigmine
Rocuronium	IV/0.6–1.2 mg/kg	1–2 min	20–30 min	Mild histamine release, hypertension/hypotension, tachycardia, arrhythmias, bronchospasm	Preferred muscle relaxant Effects reversible with atropine and neostigmine
Succinylcholine	IV/1–2 mg/kg; IM[b]/2 mg/kg	IV, 30–60 s; IM, 2–3 min	IV, 4–6 min; IM, 10–30 min	Hypertension/hypotension, tachycardia, arrhythmias, bronchospasm, hyperkalemia, myoglobinemia, malignant hyperthermia	Acceptable muscle relaxant Contraindicated in presence of hyperkalemia and family history of malignant hyperthermia
Vagolytic					
Atropine	IV or IM/0.02 mg/kg	1–2 min	0.5–2 h	Tachycardia, dry hot skin	Preferred vagolytic agent
Glycopyrrolate	IV/4–10 μg/kg	1–10 min	~6 h	Tachycardia, arrhythmias, bronchospasm	Acceptable vagolytic agent Limited experience in newborns Contains benzyl alcohol as preservative

Most of these drugs have limited pharmacokinetics data from newborns and are not approved for use in the newborn, but they have been used in newborns. IV indicates intravenously; IM, intramuscularly; CNS, central nervous system.

[a] Preferred and acceptable designation of medications is based on consensus opinion after review of available evidence.

[b] Consider only if no intravenous access.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—The Prenatal Visit

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KEY WORDS
pregnancy, prenatal visit, pediatrician, expectant parents, medical home

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abstract

As advocates for children and their families, pediatricians can support and guide expectant parents in the prenatal period. Prenatal visits allow the pediatrician to gather basic information from expectant parents, offer them information and advice, and identify high-risk conditions that may require special care. In addition, a prenatal visit is the first step in establishing a relationship between the family and the pediatrician (the infant's medical home) and in helping the parents develop parenting skills and confidence. There are several possible formats for this first visit. The one used depends on the experience and preference of the parents, the style of the pediatrician's practice, and pragmatic issues of reimbursement. *Pediatrics* 2009;124:1227–1232

INTRODUCTION

Prenatal contact with a pediatrician generally begins with a telephone call from a prospective parent to the physician's office to ask whether the pediatrician is accepting new patients and to inquire about hours, fees, hospital affiliation, health insurance accepted, and emergency coverage. These questions may be answered by a member of the office staff or the physician and establishes an initial relationship between the pediatrician's office and the parent. During this conversation, the parent should be invited to schedule a prenatal visit with the pediatric clinician, which should include both parents if possible.

A prenatal visit with the pediatrician is recommended for all expectant families. It is especially valuable for first pregnancies; parents who are new to the practice; single parents; families with high-risk pregnancies, pregnancy complications, or multiple gestations; and for parents who previously have experienced a perinatal death. This visit can also be valuable to parents who are planning to adopt a child.

The most comprehensive prenatal visit is a full office visit, during which the expectant parent(s) can have time to air their needs, interests, and concerns and receive initial anticipatory guidance. Most pediatricians feel that the prenatal visit is helpful for them as well as for the prospective parents. Because they cannot initiate these visits, pediatricians should discuss the concept with referring obstetricians, who can, in turn, encourage their patients to contact pediatricians for a prenatal visit.

OBJECTIVES

1. Establishing a Positive Pediatrician-Family Relationship

The prenatal period is a good time to start building the health care alliance that should last throughout the child's pediatric care.[1] This is

a particularly good time to invite spouses/partners and other supportive adults, including grandparents,[2–4] to establish a relationship with the pediatrician or other health care provider for the infant and to encourage them to come to future visits and help them support the new mother. A prenatal visit can be used to introduce parents to the concept of a medical home for the child's future health and developmental needs. Parents' comfort level should increase as they become familiar with their pediatric health care provider before the birth of their infant, especially if a referral or transfer of care seems necessary because of unusual medical needs of the infant. Adolescent parents and older first-time parents also can benefit from having the opportunity to share their special concerns with a knowledgeable professional. If grandparents are available and interested in being involved, it is important that ground rules be established so that the parents can feel supported but not controlled by their parents and that all grandparents play by the same rules.

2. Information-Gathering From the Family

The most important information to collect during the prenatal visit concerns the general assets and needs of the parents and their hopes, expectations, and worries about the infant that they are expecting.[5–7] In addition to family and parent medical history, including possible problems with previous pregnancies, discreet inquiry should be made into the parents' relationship with each other and other family members, concerns regarding possible domestic violence, anxiety about the present pregnancy, fear of hereditary or congenital disorders (if this information is available), experience with infants, resources for child rearing, delivery plans, feeding choice, and concerns about changes in lifestyle. This is an appropriate time to identify cultural beliefs, values, and practices related to pregnancy and parenting[8,9] as well as attitudes toward tobacco, alcohol, and other drug use. Additional issues to consider are the nature and extent of support from family and friends, parents' work arrangements, and child care plans, especially if both parents work outside the home. If there are other children in the family, their feelings, worries, and expectations and sibling rivalry should be considered.

3. Anticipatory Guidance and Enhanced Parenting Skills

One of the pediatrician's most complex but gratifying tasks is to help mothers, fathers, and other supportive adults become more competent caregivers. This can begin with discussion of the parents' concerns and planned strategies. Advice can be offered about shared roles in parenting, such as diapering, bathing, nighttime care, and helping with feeding. Description of the routine in the hospital, including who will be in the delivery room and how new infants behave in the first hours and days, can be reassuring. This discussion might include the newborn's ability to seek and attach to the mother's breast right after delivery. The Appendix is an example of a handout that the pediatrician can offer the parents at the prenatal visit.

This is an appropriate teaching moment for describing to both parents the many advantages of exclusive breastfeeding and how it improves outcomes for both the mother and infant.[10,11] Special breastfeeding training of expectant fathers has been shown to increase their support of their wives and the duration of breastfeeding.[12] Breastfeeding should be strongly recommended if there are no contraindications, and support services should be discussed.[13–16] However, ultimately, decisions about feeding the infant are made by the parents. If bottle feeding is the parents' choice, they should be supported in their decision and given advice on formula type, preparation, and proper bottle use.

Discussion of circumcision, including benefits, risks, the surgical process, and analgesia, can be presented at this visit, with particular attention to the family's religious and cultural views.

Safety is an important topic to present to the parents, particularly advice such as "back to sleep" and proper bedding,[17,18] proper holding of the infant, bathing and water temperature, proper use of a pacifier, and handwashing and other sanitation matters. Encouraging good family diet, regular checkups with the family physician or obstetrician[19] and dentist,[20,21] and appropriate rest and exercise is important also.

During the visit, the parents' emotions and worries should be explored and information should be offered about "baby blues," postpartum depression and the usual parental frustrations and initial feelings of incompetence.[22–24] Fathers' or partners' feelings about lack of parenting skills and decreased marital intimacy can be addressed as well. Parents should be given ideas about soothing a fussy infant, such as holding, including cuddling and kangaroo care[25]; rocking; singing; talking quietly; and dimming lights and playing soft music. They should be assured that they can call the pediatrician for advice if they feel anxious or angry or are afraid that they might hurt the infant.

Although the volume of information and advice may seem overwhelming to expectant parents, they can be given appropriate handouts, CDs, or videotapes to supplement and reinforce visit information. They should also be offered the opportunity for a follow-up

visit or telephone call if they still have questions. A Web page can be a good source of information and can include parent questionnaires for subsequent visits.

4. Identification and Approaches to High-Risk Issues

Neonatal screening and immunization should be explained so that the parents understand the benefit of early diagnosis and therapy. Family history of congenital disease, if known, can be discussed and advance planning arranged if necessary. Adolescent parents often need more guidance than more experienced parents, and older-than-usual parents often feel stressed and insecure also. Single parents may not have family or other support systems and may need referral to social service agencies for help. Absence of the father, parental disagreement, chronic parental physical or mental issues, and preterm birth or birth defect in the infant may require additional medical visits and specialist involvement[26–28] and can present physical, emotional, and financial burdens for the parents.[29] During the pregnancy, maternal obesity and maternal drug use are risk factors for birth defects and/or developmental impairment.[30,31]

TYPES OF PRENATAL VISITS

1. The Full Prenatal Visit

The most comprehensive form of visit is a scheduled office visit with both parents and other significant family members present. During this visit, the 4 objectives listed previously are discussed in detail. Discussion should include office and telephone hours; fees; office staff; hospital affiliations; coverage for night, weekend, and emergency care; arrangements for delivery at a hospital where the pediatrician is not on the staff; and the pediatrician's expectations of the family. A handout containing this information should be given to the family. This type of visit is most important for a first pregnancy, for adolescent and other young parents, when pregnancy complications or newborn problems are anticipated, or when parents are unusually anxious for any reason. The establishment of a mutual commitment to a sound and rewarding family-physician relationship usually results from this visit.

As more women have high-risk pregnancies that require bed rest, there may be a need for home prenatal visits and/or telephone calls. These contacts should include the same content as the full prenatal visit and can be conducted by the pediatrician, the office nurse, or other trained office personnel. The outcome should be the same mutual commitment as from the full prenatal visit in the office.

2. The Brief Visit to Get Acquainted

An encounter at the office for 5 to 10 minutes between the physician and an expectant parent may include introduction to other members of the staff and a short tour of the office. Administrative issues may be discussed briefly and/or a handout with the information may be given to the parent. This type of visit is appropriate for parents who are still deciding on a pediatrician and not ready for a full visit. Although such a visit cannot cover all the desirable elements of a full visit, the pediatrician can offer to schedule a longer visit and include both parents and significant family members.

3. The Basic Contact or Telephone Call

The initial prenatal contact often is an expectant parent's call to the pediatrician's office. If the pediatrician is accepting new patients, the staff member can offer a brief description of the practice, as noted above. The parent can be asked for the same identifying information as in the longer visits, such as name, address, telephone number, source of referral, expected delivery date, and type of insurance and can be invited to make an appointment for a full prenatal visit. The office information handout may be mailed to the expectant parents.

4. No Prenatal Contact

If no prenatal contact has been made, the objectives and discussion of the prenatal visit can be presented to the parents in the newborn visit or first postnatal visit. Unfortunately, the new mother may be too tired or distracted to absorb much of what the pediatrician can offer at the hospital visit, so a handout containing pertinent information may be particularly useful for this type of visit. For the infant's first office visit, parents should be encouraged to have an additional family member on hand to care for the infant while the pediatrician confers with them.

5. The Group Prenatal Visit

The concept of the group well-child visit can be used for the prenatal visit as well. It encourages mutual support among the expectant parents in addition to providing the information and advice of the more traditional session with an individual family. It has the added advantage of saving the pediatrician time and expense. The pediatrician's participation in a prenatal class is another alternative. Families with children may find group visits an opportunity to discuss sibling rivalry.

REIMBURSEMENT

Reimbursement for a prenatal visit may be problematic. Payment by third-party payers for pediatric prenatal visits rarely, if ever, occurs. Networking—sharing information and ideas with community obstetricians and with health insurance medical directors—might be of benefit in establishing reimbursement methods. If the obstetrician makes a formal referral to the

pediatrician, who in turn sends a report back to the obstetrician about the prenatal discussion with the parents, the visit might be reimbursable. Even without insurance coverage, a modest fee may not dissuade the expectant parents from attending a prenatal visit.

ADVICE FOR PEDIATRICIANS

1. Pediatric practices are encouraged to establish a policy on prenatal visits. Services offered can be flexible and designed to meet the needs of expectant parents. In many cases, a full prenatal visit is ideal, but for some parents, a shorter encounter is sufficient.
2. Communication of the policy on charges for prenatal visits to third- party payers and to families is advised. State chapters of the American Academy of Pediatrics (as through pediatric councils) and pediatric practices can advocate to insurance companies, including Medicaid, the short-term and long-term benefits of prenatal visits for the health of infants and their parents.
3. Pediatricians should share their established policies on prenatal visits with local obstetricians and with expectant parents.
4. During their training, pediatric residents should learn about the content and importance of prenatal visits.
5. A comprehensive review of this topic with suggested questions and specific suggestions for expectant parents can be found in the third of edition of *Bright Futures*.[32]

APPENDIX: PARENT PAGE

Welcome to the world of parenthood. As you get closer to the time of your delivery, here is some information that can help you get ready to care for your new baby.

Hopefully, when the baby is born, you'll be able to hold him or her right away. Brand new infants like to be cuddled, and they are usually ready to nurse at the breast. Even if you don't want to breastfeed, holding the baby close to you can make you both feel good. It's good, too, if Daddy, grandparents, and siblings can be close by for the labor and delivery. They'll want to cuddle the baby also. They will be important players in the baby's life and can be a great help for the new mother. If breastfeeding is not the family's choice, your pediatrician will advise you about formula preparation and proper bottle feeding.

The first few weeks at home will be a lot different from the time before the baby was born. Both parents will be tired, sometimes not sure how to handle the infant's crying and other behaviors, and often a bit frustrated. When you don't quite know what to do next, or if you feel blue, edgy, or angry, that's a good time to contact your pediatrician for advice.

Your sleeping will be interrupted by the baby needing feedings and diaper changes; new infants may need to be fed every 2 to 4 hours in the first several weeks. Learn to take a nap when the baby does, and let the housework be done by family and friends during the first few weeks.

Your pediatrician can offer you advice or suggestions about supplies, furniture, and other baby needs, as well as safety tips. For example, it's much safer to put the baby to sleep on his or her back, not on the tummy, and the bassinet or crib should have a firm, smooth mattress. Both alcohol and tobacco use by the pregnant woman can be harmful for the developing fetus. Tobacco smoke anywhere near the baby may lead to breathing problems for the baby then or even months later.

It's amazing and exciting to see babies develop and change in the first few weeks. As you get to know your baby's routine and personality, you'll be more comfortable in handling him or her and making decisions in the baby's best interest.

Remember, there is no such thing as a stupid question. Whenever you need an answer about anything related to your baby, you should feel free to call your pediatrician.

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POLICY STATEMENT

Preparation for Emergencies in the Offices of Pediatricians and Pediatric Primary Care Providers

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine

ABSTRACT

High-quality pediatric emergency care can be provided only through the collaborative efforts of many health care professionals and child advocates working together throughout a continuum of care that extends from prevention and the medical home to prehospital care, to emergency department stabilization, to critical care and rehabilitation, and finally to a return to care in the medical home. At times, the office of the pediatric primary care provider will serve as the entry site into the emergency care system, which comprises out-of-hospital emergency medical services personnel, emergency department nurses and physicians, and other emergency and critical care providers. Recognizing the important role of pediatric primary care providers in the emergency care system for children and understanding the capabilities and limitations of that system are essential if pediatric primary care providers are to offer the best chance at intact survival for every child who is brought to the office with an emergency. Optimizing pediatric primary care provider office readiness for emergencies requires consideration of the unique aspects of each office practice, the types of patients and emergencies that might be seen, the resources on site, and the resources of the larger emergency care system of which the pediatric primary care provider's office is a part. Parent education regarding prevention, recognition, and response to emergencies, patient triage, early recognition and stabilization of pediatric emergencies in the office, and timely transfer to an appropriate facility for definitive care are important responsibilities of every pediatric primary care provider. In addition, pediatric primary care providers can collaborate with out-of-hospital and hospital-based providers and advocate for the best-quality emergency care for their patients.

INTRODUCTION

Pediatricians and pediatric primary care providers (PPCPs) are vitally important members of the emergency care system for children. Children with potentially life-threatening illnesses and injuries are sometimes taken to primary care offices, which often serve as the child's medical home, by parents or caregivers seeking help from health care professionals they know and trust. The office site then serves as an entry into the emergency care system, and it is there that vital, perhaps even life-saving, care is provided.

Studies have shown that emergencies are common in primary care practices that provide care to children. In 1 study, the authors surveyed 52 pediatric offices and found that these practices saw a median of 24 emergencies per year.[1] Most of the offices (82%) reported that they encountered, on average, at least 1 emer-

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Key Words
emergency readiness, office preparedness, emergency medical services for children, pediatric emergencies, emergency response plan

Abbreviations
PPCP—pediatric primary care provider
EMS—emergency medical services
APLS—advanced pediatric life support
BLS—basic life support
ALS—advanced life support
AAP—American Academy of Pediatrics
CPR—cardiopulmonary resuscitation
ED—emergency department
PALS—pediatric advanced life support
EMT—emergency medical technician

gency per month. In another study, 62% of pediatricians and family physicians in an urban setting who were asked about emergencies in their offices reported that they assessed more than 1 patient each week in their offices who required hospitalization or urgent stabilization.[2]

Despite these findings, which suggest that a significant number of children present to primary care offices with urgent or emergent problems, some health care professionals discount the need for preparation because "emergencies are not very common" or because they feel they can rely on rapid response from emergency medical services (EMS) or proximity to a hospital. Some PPCPs have interpreted risk-management guidelines to mean that having emergency equipment and medications on site will increase their liability in emergency situations; however, lack of preparation may be a true cause of increased liability. Other providers state that emergency equipment and medications are expensive, and they cannot afford to maintain these items. Indeed, studies have shown that a substantial number of practices are not prepared to manage pediatric emergencies and have documented deficiencies in equipment and training.[3,4] One study showed that physicians with training in advanced pediatric life support (APLS) were more likely to have resuscitation equipment and to have conducted a mock code in their office.[4] Other studies have supported training in basic life support (BLS) as well as advanced life support (ALS), as suggested by the American Academy of Pediatrics (AAP) policy statement published in December 2004.[5] The statement suggested that pediatricians will improve the chance of survival of children who experience cardiac arrest by advocating for cardiopulmonary resuscitation (CPR) training of parents and caregivers and participating in BLS training courses as participants and instructors.

STATEMENT OF THE PROBLEM

Although pediatric emergencies may not be common occurrences in all primary care settings, numerous studies have shown that children continue to be taken to primary care offices at the time of an emergency.[6–9] The most common types of emergencies include respiratory emergencies, seizures, infections in young infants, and dehydration.[10] Pediatricians and PPCPs may be required to provide urgent or emergent care in their offices for children with these conditions, at least until the arrival of EMS. The consequences of being unprepared are serious; therefore, appropriate stabilization of pediatric emergencies and timely transfer to an appropriate facility for definitive care are important responsibilities of every PPCP.[11]

OFFICE-BASED SELF-ASSESSMENT

Optimizing PPCP office readiness for emergencies begins with a consideration of the unique aspects of each office practice, the types of patients and emergencies that have been or might be seen, the resources on site, and the resources of the larger emergency care system of which the PPCP's office is part. Reviewing a standardized office-based self-assessment can provide PPCPs with a starting point for optimizing office readiness.[12] Sample questions include:

1. What emergencies have you experienced in the office setting? How often have office emergencies occurred in your practice?
2. What is your office setting (freestanding office, clinic based, health center based, hospital based, other)? Are there resources outside of your office that you could call on during an office emergency (eg, security, other medical or dental professionals in the same building, hospital code team)?
3. What are the high and low staffing points during the times when your office is open? (Include nights and weekends if applicable.) What is the emergency readiness training of the staff present during those times?
4. How far is your office from a site of definitive care, such as the nearest emergency department (ED) or the nearest pediatric center? How long does it take for EMS to respond to a 9-1-1 call from your office? What is the point of entry for your local 9-1-1 response team (ie, the facility to which they are required by protocol to bring a pediatric patient)?
5. Does your practice care for any children who are technology dependent or have special health care needs? Do you have need for any additional equipment or expertise should a technology-dependent child have an emergency in your office?
6. What is your risk-management company's policy regarding emergency preparedness of your office?

Answers to these and other questions (see Appendix 1) can help PPCPs examine their office practice within the context of the larger emergency care system and make informed choices to enhance the readiness of their office setting for anticipated emergencies.

PARENT AND PATIENT EDUCATION

Through effective parent and patient education and anticipatory guidance, some emergencies that present to the PPCP office could be prevented or directed more appropriately to an ED. PPCPs can improve the outcome of childhood emergencies by advocating CPR and first aid training of parents and caregivers and by educating them about how to prevent injuries, recognize an emergency, and respond appropriately in terms of first aid, CPR, accessing the private office or EMS, and choosing the appropriate facility: office, urgent care center, local ED, or pediatric specialty care center. Anticipatory guidance regarding emergencies should include when and

how to access EMS (9-1-1 or the local emergency access number), posting the national Poison Control Center number (800-222-1222), a means of obtaining after-hours advice, the need for consent for treatment of minors, any constraints to emergency care from health plan requirements for referral, and what facilities to access in a true emergency. Family teaching materials such as *The Injury Prevention Program*, the first aid chart, and EMS information card are available through the AAP.[13]

PPCPs should discuss advance directives and limitation of life-sustaining treatment with a family before any emergency develops.[14] Because some states do not allow EMS personnel to recognize and respect pediatric advance directives, it is critical that any out-of-hospital do-not-resuscitate or "accept-natural-death" orders be discussed at the time of their issue with local EMS medical directors to ensure that EMS personnel, when called and asked to perform comfort measures instead of aggressive resuscitative measures, are acting within preapproved medical direction and remain free from liability.

In addition, PPCPs who care for children with special health care needs can help improve emergency care for these children by providing a brief but comprehensive summary of important information for hospital and prehospital providers. Nationally recognized forms, such as the emergency information form,[15] and medical-alert jewelry can provide needed information during an emergency. Inquiring about the existence of a local Emergency Medical Services for Children–sponsored "child alert" program can further enhance the EMS response and care by strengthening the link with responding EMS personnel and decreasing the anxiety levels of parents, EMS personnel, and hospital staff. With the family's consent, mechanisms to identify children with special needs in an emergency can be established and shared with local EMS providers.[15]

PREPARING THE OFFICE AND OFFICE PERSONNEL

At the time of a pediatric emergency, good resuscitation knowledge and skills are essential to provide high-quality care and ensure the best chances for intact survival for the child, but the outcome does not depend solely on the pediatrician or primary care physician. Successful stabilization requires an effective team, and members of the office staff need to be prepared; they need adequate knowledge, training, and resources to respond to an emergency.[10] They also need an opportunity to practice; awareness of each member's role on the team and an opportunity to rehearse these roles will lead to a more highly functioning, effective emergency team.

The first person to assess patients who arrive in the office may be the least clinically experienced employee: the secretary or receptionist. These employees should be able to recognize emergencies and know how to summon help. They can be taught about signs and symptoms that may signal an emergency in a child, such as labored breathing, cyanosis, audible stridor or wheezing, grunting or flaring, seizures, depressed mental status, or uncontrolled bleeding.[16] Front-desk personnel or the office nurse might periodically check the waiting area, especially if the waiting time for an acute care visit is prolonged or the waiting area is not under direct visual supervision.

A clear response plan, including a plan for those times when the office is open but not fully staffed, is very helpful at the time of an emergency.[17] Each member of the office staff can have a specific role in the overall management plan, including designation of the individual who will access the emergency response system. Personnel who fulfill this role should receive training specific to accessing EMS, and they should be knowledgeable about the capabilities and level of response provided by the local EMS agency. Office staff will need to provide information to the EMS dispatcher, including office address and location of the office within the building; the child's age, condition, and vital signs; the transport destination; and need for an ALS unit if available.[11] Office staff cue cards can be posted by the telephone to assist in accessing emergency help and providing appropriate information[12] (Appendices 2A–2D).

The PPCP can preassign roles for the "resuscitation team," and the team can then practice these roles by participating in office mock codes or simulated exercises on a regular basis. The PPCP can "run the code" and provide medical direction, but a contingency plan should be developed to guide staff if no physician is in the office at the time of the emergency. Pediatric care protocols adapted from EMS providers might help provide a basis for the development of individualized office-based protocols and scenarios for the top 5 to 10 emergency conditions. Tasks of the office team during an emergency include assisting and performing resuscitative measures, such as chest compressions, and recording or documenting the events of the resuscitation process and drawing up and administering medications and fluids. It may be helpful for PPCPs to assess the skill level and knowledge of new employees and clinical care providers who will likely have different levels of experience in handling pediatric emergencies. All PPCPs in practice should have a minimum of BLS training, and a more advanced level of training is essential if the office does not have rapid access to an ALS response unit. When the office is open, there should be someone in the office who can recognize an emergency situation, provide BLS, and activate the emergency response system. PPCPs can facilitate training in BLS and ALS by providing time for employees to take training courses offered in the community or local hospital or by collaborating with local EMS personnel who can offer training courses on site at the office. By working together in nonemergency situations, EMS providers and office staff can create an opportunity to improve communication and develop teamwork skills that will

facilitate the transfer of care at the time of an emergency (see Appendix 3). EMS staff may be able to identify logistic problems, such as ease in locating the office or accessing the examination room with a gurney, and clarify treatment and destination protocols in their region. Some PPCPs have also found it very helpful to review actual cases and invite local EMS providers to participate in simulated drills and to supplement certification or training with teaching specific to the most common problems seen in their offices.

EMERGENCY EQUIPMENT AND MEDICATIONS

Trained personnel must have rapid access to appropriate equipment and medications to use at the time of an emergency. All office staff members need to know where resuscitation equipment is located so that no time is wasted in finding it during an emergency. For those who practice in an office located in or near a hospital, basic airway equipment may be all that is needed. However, for practices and offices that have prolonged emergency response times, stabilization efforts may need to be maintained for up to 30 minutes before EMS arrives with their equipment and stabilization skills. In these offices, more equipment might be required to maintain an airway and to initiate treatment of shock.

Resuscitation equipment can be kept in an examination room designated as the resuscitation room, which is prestocked in an organized way, or it can be stocked and organized in a box, to be taken to the site of the resuscitation. A list of recommended equipment for office emergencies is provided in Table 1, and a list of recommended medications is provided in Table 2. Equipment and medications should be checked on a regular basis to ensure that all essential items are present, operating properly, and not expired.

Health care professionals, patients, and families have developed an increased awareness of issues related to patient safety since the release of the Institute of Medicine report on medical errors in 1999.[18] Current safety literature suggests that pediatric patients are especially susceptible to medication error (dosing error) because of the need to calculate doses rather than using standardized dosing as in adult medicine.[19,20] Over the past few years, a number of clinical tools have been developed to help decrease medication errors. One of the most familiar is the Broselow pediatric resuscitation tape, which is now available in many EDs and offices across the country.[21] Studies have shown that the Broselow tape can help to reduce medication dosing (prescribing) error by providing precalculated doses.[22] It allows prescribers to avoid the step of mathematical calculation, a frequent source of error in the medication process.[23–25] However, some studies have described a potential increase in medical errors when using the Broselow tape because of its design and the fact that it is often used incorrectly.[26,27]

The Duke University Medical Center maintains a Web site (Duke Enhancing Pediatric Safety Web site; available at: www.dukehealth.org/deps) that was developed to provide education about the proper use of the Broselow tape. New resuscitation tools, which are currently being developed, will help pediatricians and pediatric care providers by providing suggested care protocols with recommended medications and precalculated doses.

Every office needs a system to ensure that all equipment, medications, and resuscitation fluids are restocked and readily available. Many offices have found it helpful to stock equipment in a way that facilitates retrieval according to the size of the child. Making sure that staff members are educated about the storage system used at the office and assessing its effectiveness in quickly guiding clinicians to the appropriate supplies is crucial to ensuring a working system.

TABLE 1 Recommended Equipment for Pediatric Office Emergencies

Office Emergency Equipment and Supplies	Priority[a]
Airway management	
Oxygen-delivery system	E
Bag-valve-mask (450 and 1000 mL)	E
Clear oxygen masks, breather and nonrebreather, with reservoirs (infant, child, adult)	E
Suction device, tonsil tip, bulb syringe	E
Nebulizer (or metered-dose inhaler with spacer/mask)	E
Oropharyngeal airways (sizes 00–5)	E
Pulse oximeter	E
Nasopharyngeal airways (sizes 12–30F)	S
Magill forceps (pediatric, adult)	S
Suction catheters (sizes 5–16F) and Yankauer suction tip	S
Nasogastric tubes (sizes 6–14F)	S
Laryngoscope handle (pediatric, adult) with extra batteries, bulbs	S
Laryngoscope blades (0–2 straight and 2–3 curved)	S
Endotracheal tubes (uncuffed 2.5–5.5; cuffed 6.0–8.0)	S
Stylets (pediatric, adult)	S
Esophageal intubation detector or end-tidal carbon dioxide detector	S
Vascular access and fluid management	
Butterfly needles (19–25 gauge)	S
Catheter-over-needle device (14–24 gauge)	S
Arm boards, tape, tourniquet	S
Intraosseous needles (16 and 18 gauge)	S
Intravenous tubing, microdrip	S
Miscellaneous equipment and supplies	
Color-coded tape or preprinted drug doses	E
Cardiac arrest board/backboard	E
Sphygmomanometer (infant, child, adult, thigh cuffs)	E
Splints, sterile dressings	E
Automated external defibrillator with pediatric capabilities	S
Spot glucose test	S
Stiff neck collars (small/large)	S
Heating source (overhead warmer/infrared lamp)	S

Note that some offices are located at a distance from EMS services. Providers in offices that are located more than 10 minutes away from the nearest EMS service need equipment that may not be required in the initial minutes of a resuscitation but will be required as the resuscitation effort extends past 10 minutes.

[a] E indicates essential; S, strongly suggested (essential if EMS response time is >10 minutes).

Adapted from: American Academy of Pediatrics, Committee on Pediatric Emergency Medicine. *Emergency Medical Services for Children: The Role of the Primary Care Provider*. Singer J, Ludwig S, eds. Elk Grove Village, IL: American Academy of Pediatrics; 1992.

TABLE 2 **Office Emergency Drugs**

	Priority[a]
Drugs	
Oxygen	E
Albuterol for inhalation[b]	E
Epinephrine (1:1000)	E
Activated charcoal	S
Antibiotics	S
Anticonvulsant agents (diazepam, lorazepam)	S
Corticosteroids (parenteral/oral)	S
Dextrose (25%)	S
Diphenhydramine (parenteral, 50 mg/mL)	S
Epinephrine (1:10 000)	S
Atropine sulfate (0.1 mg/mL)	S
Naloxone (0.4 mg/mL)	S
Sodium bicarbonate (4.2%)	S
Fluids	
Normal saline solution or lactated Ringer's solution (500-mL bags)	S
5% Dextrose, 0.45 normal saline (500-mL bags)	S

[a] E indicates essential; S strongly suggested (essential if EMS response time is more than 10 minutes).

[b] Metered-dose inhaler with spacer or mask may be substituted.

Adapted from: American Academy of Pediatrics, Committee on Pediatric Emergency Medicine. *Emergency Medical Services for Children: The Role of the Primary Care Provider*. Singer J, Ludwig S, eds. Elk Grove Village, IL: American Academy of Pediatrics; 1992.

HEALTH CARE PROFESSIONAL SKILLS

In the setting of a pediatric emergency, PPCPs must be able to provide basic airway management and initiate treatment of shock. The skills required to perform these tasks successfully are usually acquired in training, but many PPCPs do not use them frequently, because the incidence of office emergencies is not high. Nonetheless, when an emergency occurs, the best chance for intact survival of the child is determined by adequate airway management. Therefore, providers need to keep their resuscitation skills and knowledge up to date. Pediatric advanced life support (PALS)[28] and APLS[29] courses provide an excellent opportunity to renew knowledge and skills. The Emergency Nurse Pediatric Course, developed by the Emergency Nurses Association, provides training in basic assessment, triage skills, critical care, and pediatric emergent situations. The course includes small group sessions for skills training and evaluation.

Although maintaining knowledge and skills of clinicians is important, more is involved to ensure that the best care is provided to every child who is brought to the office with an emergency. The best way to ensure readiness for an emergency is to practice regularly in the office setting, with as many office staff members as possible participating. Simulated exercises, or mock codes, provide a good opportunity for staff members to practice the steps of an emergency.[16] A mannequin, doll, or even "volunteer child" can be used to make the practice session more realistic, and participants can be asked to "act out" each step of the resuscitation. For example, direct an individual to act as a parent and "present" to the reception area of the office, holding an "infant" (mannequin) and complaining that the infant will not wake up. The receptionist would then need to activate the emergency response system designed for the office. In some offices, this may mean calling aloud for help; in other offices, the receptionist may ring a bell or overhead-page someone for help. The nurse can be instructed to respond as he or she would in a real emergency, perhaps by taking the infant to a treatment room if one exists in the office or by calling for help and locating the emergency equipment box to bring to the examination room where the infant is taken. Clinical staff can then be asked to locate specific pieces of equipment they may need for the resuscitation. For example, they might be asked to locate the oxygen tank with appropriate tubing and demonstrate how to turn it on or locate the bag-valve-mask device (eg, Ambu bag) and demonstrate proper bagging technique. The physical act of locating and handling equipment such as the bag-valve-mask device is important for staff members to practice to be better prepared to perform these tasks when a true emergency occurs. Team members can then offer observations of their own and others' performances, and specific action plans for improvement and problem solving can be developed. Action plans might address such topics as additional training needs, skills practice, equipment needs, and organizational issues. A sample of a mock-code evaluation form is shown in Appendices 4A and 4B, and sample scenarios for use in a mock code are shown in Appendix 5.

When planning a mock code for office personnel, designate a recorder for each simulated exercise. After completing the exercise, critique not only the mock code itself but also the documentation of the event. In addition, keep records of mock codes held in the office with a note of "lessons learned" from each one. If there has been a recent change in office practice or equipment (ie, new forms used to document treatment), it may be helpful to include these as specific teaching points after the simulated exercise.

Another strategy used by some offices to improve "readiness" for an emergency is a scavenger hunt.[11] This may be especially helpful for new staff or employees as part of their orientation to the office setting. Staff members are given a list of items (such as emergency equipment, medications, supplies, posted protocols for accessing EMS) and asked to find them within a defined period of time.

DOCUMENTATION

The most effective tool for risk management of office emergencies is documentation of efforts taken to improve office readiness, such as purchase and maintenance of equipment and medications; training provided; and policy and practice for patient education, patient triage, and office flow. Working toward the common goal of improved outcomes for office emergencies, pedi-

atric practices can collaborate with their risk-management agent to find ways to reduce risk while improving readiness. Documentation should also be included in office training and mock codes and, most importantly, during true resuscitation attempts.

Emergency situations are the most difficult to document properly. Stress levels are high, there are often not enough trained assistants, and other patients in the waiting room cannot be ignored. However, complete and accurate information regarding resuscitative efforts is vital for ongoing care, especially at the time of transfer of care. Documentation should include the date and time of treatment, the estimated or actual weight of the child if known, medications given with dosages and response noted, fluid volumes given, information or explanations given to the family, and the condition of the child at the time of departure from the office. An example of a "resuscitation log" is shown in Appendix 6.

EMERGENCY MEDICAL SERVICES

When a child requires resuscitation in an office, the PPCP and office staff members need help from other members of the emergency care team to ensure the best possible outcome. EMS personnel can provide competent assistance to the office team.

EMS personnel who respond to pediatric emergencies may include first responders, BLS emergency medical technicians (EMTs), or ALS EMTs (eg, EMT-paramedics). First responders and BLS EMTs can offer essential BLS skills and transport. ALS EMTs, acting under medical control and advanced protocols, can perform advanced airway-management skills, including positive-pressure ventilation and placing airway adjuncts. They can also establish intravenous or intraosseous access, administer intravenous or nebulized medications, defibrillate, and perform other advanced skills, in accordance with local protocols.[16] Because only a small percentage (5%–10%) of EMS calls are for pediatric patients, many paramedics may have limited experience in working with children.[11] PPCPs can help EMS personnel gain experience with children by inviting them to observe well-child visits in the office and providing an opportunity to interact with children. In many communities, paramedics have assisted pediatricians by helping to teach PALS or CPR classes to office staff. Establishing good and close communication with local EMS providers can help inform your office of their unique skill sets and introduce them to the types of emergencies to which they might be called to respond from your office. Including the medical director of the EMS service in office-based emergency-preparedness activities can assist in helping the EMS personnel be prepared with proper training and protocols for pediatric patients.

EMS personnel are well trained in resuscitative skills and are important members of the health care team. However, they cannot assist in the care of children who are critically ill unless they are called. PPCPs should confirm the access number for EMS (usually 9-1-1, but in some areas it may still be a 7-digit number) and have the number posted for easy access by any office staff directed to call EMS when an emergency is recognized. The office staff and physician should not delay activating EMS because of a concern that they might not actually be needed. In the long run, it is much better to have a unit respond even if the call is canceled en route or the child is not transported if he or she stabilizes in the office.

ADVOCACY

PPCPs have a critical role as advocates for high-quality emergency care for their pediatric patients. In partnership with out-of-hospital and hospital-based staff, PPCPs can help ensure the readiness of all components of the emergency care system to care for children. For example, PPCPs can collaborate with local EMS to offer life-support training courses; provide office-based pediatric training for EMTs; participate in development of pediatric protocols with EMS; serve as advisors for out-of-hospital pediatric care review; and advocate for EMS to obtain appropriate pediatric training, equipment, and supplies. Finally, they can work to educate parents and lawmakers about the unique needs of children and the special and sometimes complex medical needs of children within the EMS system.

SUMMARY

Pediatricians and other PPCPs are critically important members of the pediatric emergency care team. They can be most successful when they understand their role within a larger emergency care system. Effective parent education can reduce emergencies and help ensure appropriate access to the emergency care system. Careful self-assessment of office practice and policies can optimize office readiness before an emergency. When the primary care office becomes the entry point into the EMS system for a child, that child's long-term outcome can be greatly influenced by care provided in the first minutes of the emergency. Skilled physicians who work with appropriate equipment and a well-trained team, in collaboration with the EMS system, can achieve timely resuscitation and transfer to definitive care and offer the best chance for intact survival for every child and family who seeks their care in an emergency.

RECOMMENDATIONS

1. Perform a self-assessment of office readiness for emergencies based on a review of experiences of common emergent, urgent, and acute conditions treated in the office, including events involving children with special health care needs.
2. Develop an organizational plan for emergency response in the office, which includes:
   a. recognition of an emergency;

b. staff communication, roles, and responsibilities at the time of an emergency during times of high and low staffing;

c. protocol to access EMS; and

d. maintaining readiness through practice (mock codes).

3. Maintain recommended emergency equipment.

   a. Organize emergency equipment in a way that facilitates access to appropriate type and size at the time of an emergency.

   b. Develop a system to check equipment on a regular basis to make sure that it is immediately available and functioning properly.

4. Maintain recommended emergency medications and use a resuscitation aid or tool that provides suggested protocols with precalculated medication doses.

   a. Develop a system to check medications on a regular basis to make sure that stock is always present and expired medications are disposed of properly.

5. Develop a plan to provide education and continuing medical education for all staff.

   a. Front-line staff: recognizing emergencies; activating the emergency response plan; and understanding EMS roles, capabilities, and access

   b. Clinical staff: maintaining knowledge and skills related to pediatric emergencies

   c. All staff: maintaining readiness; participating in mock codes; office checklist; office self-assessment

6. Practice mock codes in the office on a regular basis (quarterly or biannually).

   a. Involve as many staff members as possible.

   b. Include documentation as a defined role for a staff member.

   c. Critique the simulation and maintain a list of lessons learned.

   d. Include EMS when possible.

   e. Include disaster-preparedness scenarios in mock drills (see www.dukehealth.org/deps).

7. Educate families about what to do in an emergency.

   a. Encourage first aid and CPR training for parents and caregivers.

   b. Provide access number for after-hours advice, emergency response system, and poison information to families.

   c. Educate families about symptoms and situations for which they should access office advice, EMS, and poison information.

   d. Facilitate use and maintenance of emergency information forms for children with special health care needs.

8. Partner with EMS and hospital-based emergency providers to ensure optimal emergency care and emergency/disaster readiness for children.

APPENDIX 1: SELF-ASSESSMENT OF OFFICE PREPAREDNESS FOR PEDIATRIC EMERGENCIES

As you answer these questions, you may be better able to identify those areas in which your office preparedness can be enhanced.

1. What emergencies have you experienced in the office setting? How often have office emergencies occurred in your practice?

2. What is your office setting (freestanding office, clinic based, health center based, hospital based, other)? Are there resources outside your office on which you could call during an office emergency (eg, security, other medical or dental professionals in the same building, hospital code team)?

3. What are the high and low staffing points during the times when your office is open? (Include nights and weekends if applicable.)

4. What is the emergency readiness of the staff present during those times? (Include first aid, CPR, BLS, ALS, PALS, APLS, Emergency Nurse Pediatric Course, other continuing medical education, etc.)

5. Have nonclinical staff been trained to recognize a potential or actual emergency?

6. What anticipatory guidance and education do you provide parents regarding injury prevention, first aid and CPR training, recognizing and responding to emergencies, and accessing EMS?

7. Is your waiting room under direct observation or screened frequently by a clinical staff member? Is it childproofed?

8. Does your practice have a written protocol for response in an office emergency? Does that protocol cover times of low staffing?

9. Do all staff members know how to access the EMS system? Staff members should be able to give the location and directions to the office, level of clinical staff present, age and condition of child (including vital signs if appropriate), desired transport location, and the level of emergency response (ALS or BLS) required.

10. Do you have specific telephone triage protocols for nonclinical and clinical staff?

11. How far is your office from a site of definitive care, such as the nearest ED, or the nearest pediatric center?

12. How long does it take for EMS to respond to a 9-1-1 call from your office?
13. Has EMS ever been to visit your office for a nonemergency call or to receive experience in evaluating pediatric patients?
14. What level of provider comes when you call 9-1-1: first responder, BLS, or ALS? Does your local EMS have the necessary equipment and expertise to manage children?
15. What is the point of entry for your local 9-1-1 response team (ie, the facility to which they are required by field protocol to bring a pediatric patient)?
16. If EMS does not go directly to a pediatric center on a 9-1-1 call, how do you emergently transport a child to the desired pediatric center when necessary?
17. Does your office use oxygen? If so, how is it supplied? Do all clinical staff members know how to operate the oxygen canister and know where the key is kept?
18. What emergency dosage strategy do you use in the office (code card, length-based tape, dosage book, no strategy)?
19. What airway equipment do you stock? Do all staff members know how to locate, choose, and use the appropriate size of equipment for any given child?
20. What equipment and supplies do you have on site to provide you and your staff with universal precautions?
21. Does your practice care for any children who are technology dependent or have special health care needs? Do you have need for any additional equipment or expertise if a technology-dependent child should have an emergency in your office?
22. Do you have written office protocols for common office emergencies such as respiratory distress, anaphylaxis, sepsis, dehydration, and supraventricular tachycardia?
23. How do you document events during an office emergency (assigned role, tape recorder, retrospective, other)?
24. How do you and your staff maintain skills and readiness? (Examples include attending nursery deliveries, moonlighting in urgent care or pediatric ED, being a PALS or APLS instructor, holding regular mock office codes and scavenger hunts for infrequently used equipment, providing expert review of pediatric runs for your local EMS, or other.)
25. How do you document parent education, staff training, protocols, and stocking for emergencies?
26. What is your risk-management company's policy regarding emergency preparedness of your office?
27. Are there other aspects of your office practice that you think could be improved to achieve fewer office emergencies and better outcomes?

APPENDIX 2A: RECEPTION DESK EMERGENCY CARD

The following signs and symptoms may signal an emergency:

- Extremely labored breathing
- Blue or pale color (cyanosis)
- Noisy breathing (wheezing or stridor)
- Altered mental status
- Seizure
- Agitation (in the parent)
- Vomiting after a head injury
- Uncontrolled bleeding

If you feel a patient has symptoms that may signal an emergency, alert the following office staff: _____.

APPENDIX 2B: IMPORTANT TELEPHONE NUMBERS

- EMS provider (9-1-1 or your local emergency response number)
- Private ambulance service
- Specialized pediatric transport team(s)
- Office building security
- Police department
- Fire department
- Receiving hospital

Office address and directions _____

APPENDIX 2C: CALLING EMS FOR AN OFFICE EMERGENCY

Call 9-1-1 or your local EMS emergency response number: _____.

Be ready to give the emergency medical dispatcher the following information:

- Age and condition of child (with vital signs, if appropriate)
- Your office location (with directions and telephone number, if necessary)
- Level of clinical staff present
- Desired transport destination (pediatric center, local ED, other)
- Level of EMS provider required: ALS (advanced life support) or BLS (basic life support)
- If required, where security or other personnel will be meeting them to assist in guiding EMS to location of the child

APPENDIX 2D: IMPORTANT EMERGENCY TELEPHONE NUMBERS

(Fill in the blanks with your local emergency numbers)

EMS 9-1-1 or local EMS access number_____

Non-EMS Ambulance Transport Services

_____

_____

_____

Pediatric Transport Teams

_____

_____

_____

Referral Hospitals

_____

_____

_____

Poison Control Centers

_____

_____

_____

Helicopter Service

_____

_____

Police (non-9-1-1) _____

Security _____

Other _____

APPENDIX 3: BUILDING A PPCP-EMS PARTNERSHIP—ACTION POINTS

- Offer your office as a pediatric training and refresher site for EMTs.
- Invite local EMS to participate in regularly scheduled office mock codes.
- Sponsor a local EMT to take a PALS instructor course together with one of your staff members.
- Consult your local EMS to review office emergency procedures, access, and equipment in light of their response time, medications, equipment, and destination options.
- Offer to review pediatric run sheets as part of your local EMS agency quality assurance/quality improvement processes.

APPENDIX 4A: MOCK-CODE EVALUATION FORM

	Yes	No	Comments
Clinical primary survey			
Airway assessed initially			
Breathing then assessed			
Oxygen started for respiratory distress			
Circulation assessed			
Initial interventions			
Protocol or treatment guideline followed			
Patient reassessed frequently			
Secondary survey (head-to-toe examination)			
Organization			
All supplies requested were available			
Supplies were found quickly when requested			
"Code form" available and/or used			
Personnel knew how to use equipment properly (O_2 tanks, etc)			
Protocols available and/or used			
Communication			
Leader communicated effectively			
Events recorded accurately			
Roles were assigned			
Office staff reported to EMS			
EMS communicated needs/plans with office staff			
Other comments			

APPENDIX 4B: MOCK CODES IN THE OFFICE—OBSERVATIONS DURING A MOCK CODE

Clinical

- Were the ABCs assessed rapidly at the onset of the emergency then reassessed at frequent intervals during the resuscitation?
- If intravenous access was not established within 90 seconds, did the team move rapidly to intraosseous access?
- Once the ABCs were assessed, did the examiner complete a systematic evaluation of the patient?
- When interventions were unsuccessful, did the team move rapidly to another intervention?
- Was the patient stabilized before the transfer, or was the "scoop–and–run" principle utilized?
- Did office practitioners use services that EMS can provide, including equipment and skills?

Organizational

- Was the EMS system activated promptly?
- Was communication directed and clear between all members of the emergency team?
- Were roles clearly assigned by the team leader?
- Were all members of the emergency team free to make suggestions on the patient's behalf?
- Did anyone speak to the family during the emergency stabilization?
- Did someone record the events during the emergency stabilization?

APPENDIX 5: SCENARIO SAMPLES

Diabetic ketoacidosis: 10-year-old with new-onset diabetic ketoacidosis; polyuria and polydipsia for 1 week; today lethargic and confused; glucose >800.

Sepsis: 2-year-old with meningococcemia; well in past but found this morning with rash, moaning and minimally responsive; had upper respiratory infection yesterday and 2 episodes of vomiting; otherwise fine.

Asthma: 8-year-old with asthma; has been wheezing for 2 days with upper respiratory infection but worsened this afternoon; told mom before he was brought to the office that he had been giving himself puffs of his inhaler every half hour most of the day.

Head trauma: 6-year-old with concussion and possibly more; was playing soccer and collided with another child; she was "out" for 2 to 3 minutes, then woke up and was groggy but oriented; vomited once on the way to your office.

Seizures: 1-year-old with a complex febrile seizure; pulling at her ears and found to have a temperature of 104°F; mom gave her a bath to cool her off, and she began to have a generalized seizure several minutes later; her parents rushed her to the office while carrying her on their laps; the seizure has persisted for over 20 minutes.

Stridor: 2-year-old with possible epiglottitis; woke up early this morning with very loud breathing and a barking cough; feels very hot to touch; has been drooling for past 30 minutes; now appears anxious and tired.

Anaphylaxis: 5-year-old boy who was stung by a bee while playing outside; mom notes that his eyes and lips swelled within minutes; she brought him to the doctor when he subsequently developed wheezing.

Patient_____ Date_____Time_____
Physician_____Nurse_____Other_____
Nurse_____Nurse_____Other_____

Time	Intervention	Medication/Dose/Route	HR	RR	BP	Temp	Pox	O^2	CPR

Code start time	Transferred to
EMS Time Called	Physician referred to
EMS Time Arrived	Diagnosis
EMS Time Departed	
Paramedic Names	
IO Size/Location	
IV Size/Location	

APPENDIX 6
Code chart: consider for use at time of office emergency. HR indicates heart rate; RR, respiration rate; BP, blood pressure; Pox, pulse oximetry; IO, intraosseous needle; IV, intravenous catheter.

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CLINICAL REPORT

Preparing for Pediatric Emergencies: Drugs to Consider

Guidance for the Clinician in Rendering Pediatric Care

Mary A. Hegenbarth, MD, and the Committee on Drugs

ABSTRACT

This clinical report provides current recommendations regarding the selection and use of drugs in preparation for pediatric emergencies. It is not intended to be a comprehensive list of all medications that may be used in all emergencies. When possible, dosage recommendations are consistent with those used in current emergency references such as the *Advanced Pediatric Life Support* and *Pediatric Advanced Life Support* textbooks and the recently revised American Heart Association resuscitation guidelines.

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
pediatric emergency, drugs, resuscitation, emergency preparedness

Abbreviations
IV—intravenous
IO—intraosseous
ET—endotracheal
RSI—rapid-sequence intubation
VT—ventricular fibrillation
PE—phenytoin equivalent

INTRODUCTION

The purpose of this document is to assist health care professionals and facilities in their preparation for pediatric emergencies. This clinical report enables the practitioner to review current recommendations for the use of emergency medications in acutely ill children who require pharmacologic intervention. New agents and changing patterns of practice make it necessary to revise and update this clinical report.

This document is not intended to be an all-inclusive list of drugs used in pediatric emergencies, and it does not provide detailed drug information. Antimicrobial agents are not included in this document. Descriptions of medication indications and adverse effects are limited. Although not all-inclusive, the drug information listed in Table 1 should be helpful to practitioners and institutions when selecting which pharmacologic agents to have readily available for use in pediatric emergencies. The selection of which drugs to have available will depend on the setting; although emergency departments and hospitals will likely need the majority of the agents listed, a much more limited selection would likely be needed in a practitioner's office. This information should also be helpful for creating or editing preprinted drug-dosage charts. Table 2 contains a list of rescue, reversal, and antidote medications that may be useful in specific settings; it lists only the agents and indications and is not augmented with textual descriptions.

Dosages are generally given as milligrams per kilogram. The format for presented dosages is consistent with American Academy of Pediatrics recommendations for reducing medication errors.[1] For high-potency drugs such as prostaglandins, vasoactive amines, nitroprusside, and fentanyl, dosages are given as micrograms per kilograms. Historically, the weight-based "rule of 6" was recommended for preparation of vasoactive drip medications.[2] However, the Joint Commission and other organizations have recommended that standardized drip concentrations should replace rule-of-6 calculations to reduce the possibility of medication errors.[3] The selection of drugs for use in pediatric emergencies is only one part in a large system or program that needs to be designed effectively to manage pediatric patients in an emergency situation. It is the creation, monitoring, and evaluation of these systems that will result in an improved outcome for pediatric patients.[4]

Rates and routes of administration are drug specific, and proper infusion systems should be used. Both adverse events and therapeutic effectiveness are dose and rate dependent, especially when highly potent vasoactive medications are administered. In general, most drugs should be administered over several minutes to avoid transient excessive blood concentrations. However, exceptions exist. One example is adenosine, for which rapid infusion is needed for efficacy. Another example of the importance of administration rate is phenytoin/fosphenytoin, for which slow infusion is necessary to minimize adverse events. Please refer to the text below. Unless otherwise indicated, the intravenous (IV) route is preferred. In an emergency, intraosseous (IO) administration is an acceptable alternative when IV access cannot be promptly obtained. Although certain drugs (lidocaine, epinephrine, atropine, naloxone [memory aid: LEAN]) can be administered endotracheally if no

TABLE 1 Potentially Useful Drugs in Pediatric Emergencies

Adenosine	Diphenhydramine	Glucagon	Lorazepam	Phenytoin
Albuterol	Dobutamine	Glucose	Magnesium sulfate	Prednisone/Prednisolone
Alprostadil	Dopamine	Haloperidol	Mannitol	Procainamide
(see Prostaglandin E_1)	Epinephrine	Hydrocortisone	Methylprednisolone	Propranolol
Amiodarone	Epinephrine, racemic	Insulin	Midazolam	Prostaglandin E_1
Atropine	Etomidate	Ipratropium	Milrinone	Rocuronium
Bicarbonate, sodium	Fentanyl	Kayexalate™ (see sodium	Morphine	Sodium polystyrene
Calcium chloride	Flumazenil	polystyrene	Nalmefene	sulfonate
Charcoal, activated	Fosphenytoin	sulfonate)	Naloxone	Succinlycholine
Dexamethasone	Furosemide	Ketamine	Nitroprusside	Thiopental
Diazepam		Levalbuterol	Norepinephrine	Vecuronium
		(see albuterol)	Phenobarbital	
		Lidocaine		

Adenosine	
Indication	Supraventricular tachycardia
Dosage	Initial dose: 0.1 mg/kg IV (maximum: 6 mg for first dose) as rapidly as possible, followed by immediate rapid flush of the IV catheter with 5–10 mL of normal saline. A 2-syringe technique is preferred; a larger flush of up to 20 mL may be helpful in older children. The most proximal IV site possible should be used. Adenosine may be given intraosseously if IV access has not been achieved.
Subsequent doses	If no AV block occurs and there is no response within 30 s, give double the initial dose (0.2 mg/kg, up to 12 mg maximum for second/subsequent doses) followed by immediate rapid saline flush as described above.
Note	Continuous electrocardiographic monitoring should be employed during use. A defibrillator must be immediately available.
Warning	Contraindicated in patients who have had a heart transplant; contraindicated in second- and third-degree AV block or sick-sinus syndrome unless a pacemaker has been placed.
Albuterol	
Indication	Asthma exacerbation, bronchospasm
Dosage	Intermittent treatment with 0.5% nebulizer solution (5 mg/mL): minimum dose 2.5 mg (0.5 mL) every 20 min for 3 doses, then 0.15–0.30 mg/kg up to 10 mg every 1–4 h as needed. Dilute in a minimum of 2–3 mL of saline solution for adequate nebulization. Continuous/prolonged nebulization: 0.5 mg/kg per h up to 10–15 mg/h diluted in a larger amount of saline by prolonged nebulization (total amount of fluid is determined by particular type of nebulizer delivery device, usually 25–30 mL for 1 h of nebulization). Metered-dose inhaler: 4–8 puffs (90 μg per puff) every 15–20 min for 3 doses. Repeat every 1–4 h as needed. A spacer/holding chamber must be used when administering metered-dose inhaler treatments. Administration can be repeated and dose can be adjusted until desired clinical effect unless patient develops symptomatic tachycardia.
Notes	Oxygen is the preferred gas source for nebulization. Supplemental oxygen may be needed when compressed air–driven nebulizers are used or when the oxygen flow rate dictated by the nebulizer device is inadequate to maintain adequate oxygen saturation. Levalbuterol may also be used; the dose is half of the (racemic) albuterol dose listed above.
Alprostadil—see prostaglandin E_1	
Amiodarone	
Indication	Pulseless ventricular fibrillation (VT)
Dosage	IV/IO: 5 mg/kg rapid bolus (maximum: 300 mg); may be repeated up to a total daily dose of 15 mg/kg.
Indication	VT/supraventricular tachycardia with a pulse.
Dosage	IV/IO: 5 mg/kg (maximum: 300 mg) over 20–60 min. Adjust administration rate to urgency. May be followed by infusion of 5 μg/kg per min, increased to maximum of 10 μg/kg per min. Concentration of continuous infusion should not exceed 2 mg/mL and should be diluted with D5W.
Note	Amiodarone is only appropriate in pulseless ventricular arrhythmias after defibrillation and epinephrine have been initiated. Because of its long half-life and potential drug interactions, cardiologist consultation is recommended when considering amiodarone treatment outside of the cardiac arrest setting.
Warning	May cause hypotension, bradycardia, heart block, prolonged QT interval, and torsades de pointes VT. Should not be used in combination with procainamide or other drugs that cause QT prolongation without expert consultation. Contraindicated in severe sinus node dysfunction, marked sinus bradycardia, and second- and third-degree AV block. Do not confuse name with amrinone; potential fatal complications if drugs or dosages are interchanged.
Atropine	
Indication	Symptomatic vagally mediated bradycardia or AV block Symptomatic bradycardia unresponsive to oxygenation, ventilation, and epinephrine
Dosage	IV/IO: 0.02 mg/kg. Minimum single dose: 0.1 mg. Maximum single dose: 0.5 mg for a child, 1.0 mg for an adolescent. May repeat dose every 5 min to maximum total dose of 1 mg for a child and 2 mg for an adolescent or adult. IM: 0.02–0.04 mg/kg.

TABLE 1 **Continued**

	ET: Neonates: 0.01–0.03 mg/kg.
	Children and adolescents: 0.03–0.06 mg/kg.
	Follow with or dilute in saline flush (1–5 mL) based on patient size.
Note	Oxygenation and ventilation are essential first maneuvers in the treatment of symptomatic bradycardia. Epinephrine is the drug of choice if oxygen and adequate ventilation are not effective in the treatment of hypoxia-induced bradycardia.
Indication	Anticholinesterase poisoning
Dosage	IV: for children, 0.05 mg/kg (up to initial adult dose: 2–5 mg).
	Repeat/adjust dose as needed for clinical effect. If response to initial dose is inadequate, may double the dose and repeat every 10–20 min as needed to dry pulmonary secretions and achieve anticholinergic effect (atropinization). Anticholinesterase or nerve gas poisonings may require large doses of atropine and the addition of pralidoxime.
Indication	Prevention of bradycardia associated with RSI
Dosage	IV/IO: 0.01–0.02 mg/kg (minimum dose: 0.1 mg; maximum dose: 1 mg) before administration of sedative/anesthetic and paralytic agents.
Warning	Atropine sulfate comes in different concentrations; calculate dosage accordingly.
Bicarbonate, sodium	
Indication	Metabolic acidosis
	Hyperkalemia
	Sodium channel blocker (eg, tricyclic antidepressant) overdose
Dosage	IV/IO: 1–2 mEq/kg given slowly; do not give by ET route.
Notes	Only the 0.5 mEq/mL concentration should be used for newborn infants; dilution of available stock solutions may be necessary. Do not mix sodium bicarbonate with vasoactive amines or calcium.
	Routine initial use of sodium bicarbonate to treat cardiac arrest is not recommended. However, sodium bicarbonate may be used in patients with documented metabolic acidosis after effective ventilation has been established (effective ventilation is needed to allow elimination of excess CO_2 produced by bicarbonate).
	For sodium channel blocker overdose, titrate bicarbonate to maintain a serum pH of 7.45–7.55, followed by infusion of 150 mEq $NaHCO_3$/L solution to maintain alkalosis.
Calcium chloride	
Indications	Hypocalcemia
	Hyperkalemia
	Hypermagnesemia
	Calcium channel blocker toxicity
Dosage	IV/IO: 20 mg/kg (0.2 mL/kg for 10% $CaCl_2$). Give by slow push for cardiac arrest; infuse over 30–60 min for other indications. Monitor heart rate; repeat dose as necessary for desired clinical effect.
Notes	Calcium chloride administration results in a more rapid increase in ionized calcium concentration than calcium gluconate and is preferred for the critically ill child. Calcium gluconate (dose: 60 mg/kg) may be substituted if calcium chloride is not available.
	Recommended for cardiac resuscitation only in cases of documented hyperkalemia, hypocalcemia, hypermagnesemia, or calcium channel blocker toxicity.
Warning	Stop injection if symptomatic bradycardia occurs. Administration through a central venous catheter is preferred; extravasation through a peripheral IV line may cause severe skin and soft tissue injury.
Charcoal, activated	
Indication	Acute ingestion of selected toxic substances
Dosage	1–2 g/kg PO or nasogastrically; adolescent/adult dose: 50–100 g.
Note	Consultation with poison center/clinical toxicologist is strongly encouraged before use (national Poison Control Center telephone number: 800-222-1222). Iron, lithium, alcohols, ethylene glycol, alkalis, fluoride, mineral acids, and potassium are not bound by activated charcoal.
Warnings	If airway protective reflexes are impaired, the risk of administering activated charcoal may outweigh the benefits.
	Commercially available preparations of activated charcoal often contain sorbitol as a cathartic. Fatal hypernatremic dehydration has been reported after repeated doses of charcoal with sorbitol. Non–sorbitol-containing products should be used for children $<$1 y old and if repeated doses of charcoal are necessary.
Dexamethasone	
Indication	Emergency treatment of elevated ICP caused by brain tumor
Dosage	IV/IO: 1–2 mg/kg.
Indication	Laryngotracheobronchitis (croup)
	Asthma exacerbation
Dosage	IV, IM, or PO: 0.6 mg/kg (maximum: 16 mg).
Note	Further dosing and route of administration determined by clinical course.
Diazepam	
Indication	Status epilepticus
Dosage	IV: 0.1–0.3 mg/kg every 5–10 min (maximum: 10 mg per dose). Administer over ~2 min to avoid pain at IV site.
	Rectal: 0.5 mg/kg up to 20 mg (this route may be useful when IV access is unavailable, but absorption may be erratic).
Note	IM route is not recommended because of tissue necrosis (other benzodiazepines, such as lorazepam and midazolam, may be given IM). Diazepam should be followed immediately by a long-acting anticonvulsant, such as phenytoin/fosphenytoin, because it is rapidly redistributed and seizures often recur within 15–20 min. Lorazepam may be preferred, because it has a prolonged duration of anticonvulsant activity.

TABLE 1 **Continued**

Warning	There is an increased incidence of apnea when diazepam is given rapidly IV or when it is used in combination with other sedative agents. Monitor oxygen saturation and respiratory effort. Be prepared to support ventilation. Flumazenil may be administered to reverse life-threatening respiratory depression caused by diazepam or other benzodiazepines; however, it also counteracts the anticonvulsant effects and may precipitate seizures.
Diphenhydramine	
Indications	Acute hypersensitivity reactions Dystonic reactions
Dosage	IV/IM: 1–2 mg/kg (maximum initial dosage: 50 mg).
Note	May cause sedation and respiratory suppression, especially if using other sedative agents. May cause hypotension. Rapid IV administration may precipitate seizures. All doses may cause paradoxical excitement or agitation.
Dobutamine	
Indication	Cardiogenic shock, congestive heart failure
Dosage	IV infusion: 2–20 μg/kg per min, titrated to desired clinical effect.
Warning	May cause tachyarrhythmias/ectopic beats, hypotension, and hypertension. Extravascular administration can result in severe skin injury. Phentolamine (dose: 0.1–0.2 mg/kg up to 10 mg diluted in 10 mL of 0.9% sodium chloride) injected intradermally at extravasation site may be helpful for counteracting dermal vasoconstriction.
Dopamine	
Indication	Cardiogenic/distributive shock
Dosage	IV infusion: 2–20 μg/kg per min, titrated to desired clinical effect.
Note	Effects are dose dependent; low-dose (1–5 μg/kg per min) infusions usually stimulate dopaminergic and β-adrenergic receptors; α-adrenergic effects predominate at higher doses.
Warning	May cause arrhythmias and hypertension. Infusion rates of >20 μg/kg per min may cause peripheral, renal, and splanchnic vasoconstriction and ischemia. Extravascular administration can result in severe skin injury. Phentolamine (dose: 0.1–0.2 mg/kg up to 10 mg diluted in 10 mL of 0.9% sodium chloride) injected intradermally at extravasation site may be helpful for counteracting dermal vasoconstriction.
Epinephrine	
Dosage/formulation	Epinephrine is available in 2 concentrations: 1:1000 (1 mg/mL) and 1:10 000 (0.1 mg/mL). Use caution to ensure selection of the appropriate concentration for the route of administration and patient age/condition. To convert mg/kg dosage to mL/kg: 0.01 mg/kg = 0.1 mL/kg of 1:10 000 solution and 0.1 mg/kg = 0.1 mL/kg of 1:1000 solution.
Indication	Cardiopulmonary resuscitation
Dosage	
IV/IO	Newborn infants: 0.01–0.03 mg/kg of 1:10 000 solution. Older infants/children: 0.01 mg/kg of 1:10 000 solution (maximum: 1 mg), repeated every 3–5 min.
ET	Newborn infants: 0.03–0.10 mg/kg of 1:10 000 solution. Older infants/children: 0.1 mg/kg of 1:1000 solution (maximum: 10 mg). Follow ET administration with saline flush or dilute in isotonic saline (1–5 mL) based on patient size.
Note	IV high-dose epinephrine (0.1 mg/kg) is no longer recommended for routine use in resuscitation. It may be considered in exceptional circumstances such as β-blocker poisoning.
Indication	Anaphylaxis
Dosage	IM/SC: 0.01 mg/kg of 1:1000 solution (maximum: 0.3–0.5 mg), repeated every 5–20 min. The IM route is preferred for anaphylaxis. Severe reactions (eg, latex allergy) may require IV epinephrine (see above); a continuous infusion of epinephrine may be necessary.
Indication	Continued shock after volume resuscitation
Dosage	IV infusion: 0.1–1.0 μg/kg per min. Start at lowest dose and titrate to desired clinical effect. Doses as high as 5 μg/kg per min are sometimes necessary.
Warning	IV infiltration can result in severe skin injury. Phentolamine (dose: 0.1–0.2 mg/kg up to 10 mg diluted in 10 mL of 0.9% sodium chloride) injected intradermally at extravasation site may be helpful for counteracting dermal vasoconstriction.
Indication	Severe asthma exacerbation
Dosage	SC: 0.01 mg/kg of 1:1000 solution (maximum: 0.3–0.5 mg); may repeat every 20 min up to 3 doses. Begin simultaneous treatment with inhaled β-agonist (albuterol) and corticosteroids.
Indication	Laryngotracheobronchitis (croup)
Dosage	0.5 mL/kg of 1:1000 solution (maximum: 5 mL = 5 mg) administered by nebulizer.
Epinephrine, racemic	
Indication	Laryngotracheobronchitis (croup) Acute airway edema
Dosage	2.25% inhalation solution: 0.05 mL/kg (maximum: 0.5 mL) in 2 mL of normal saline administered by nebulizer.
Note	Many institutions use a standard 0.5-mL dose of racemic epinephrine for all patients. If racemic epinephrine is not available, single-isomer L-epinephrine (1:1000) can be substituted in a dosage of 0.5 mL/kg up to 5 mL.
Etomidate	
Indication	Sedation for RSI
Dosage	IV/IO: 0.2–0.4 mg/kg (maximum: 20 mg).
Etomidate	
Indication	Sedation for RSI
Dosage	IV/IO: 0.2–0.4 mg/kg (maximum: 20 mg).

TABLE 1 **Continued**

Notes	Will lower ICP and does not usually lower blood pressure. Desirable agent for patients with head injury, multisystem trauma, or hypotension. Rapid onset: duration ~ 10–15 min. This agent does not have analgesic properties.
	May cause brief myoclonic activity (hiccups, cough, twitching) and may exacerbate focal seizure disorders. Causes transient adrenal suppression that is not clinically significant.
Fentanyl	
Indications	Pain
	Adjunct to intubation
Dosage	IV: 1–2 μg/kg. Repeat dose as necessary to desired clinical effect.
Notes	Rapid administration of fentanyl has been associated with both glottic and chest wall rigidity, even with dosages as low as 1 μg/kg. Therefore, fentanyl should be titrated slowly over several minutes when used for treatment of pain. More rapid administration is allowable before intubation, particularly if a muscle relaxant is also being administered.
	Higher doses (1–5 μg/kg) are often recommended for intubation.
Warning	There is an increased incidence of apnea when combined with other sedative agents, particularly benzodiazepines. Be prepared to administer naloxone or nalmefene and provide respiratory support. May cause chest wall and glottic rigidity, which may be reversed with naloxone/nalmefene or a muscle relaxant. Be prepared for the loss of the desired clinical effect (analgesia) if a reversal agent is given.
Flumazenil	
Indications	Benzodiazepine overdose
	Required or desired reversal of therapeutic benzodiazepine effect
Dosage	IV: 0.01–0.02 mg/kg (maximum: 0.2 mg); repeat at 1-min intervals to a maximum cumulative dose of 0.05 mg/kg or 1 mg, whichever is lower. When IV access is unavailable, may be given IM.
Note	Most patients with oversedation attributable to benzodiazepines may be managed with supportive care alone. The duration of action of flumazenil is shorter than for most benzodiazepines; repeat dosage may be necessary. Patients should be observed continuously for at least 2 h after the last dose of flumazenil.
Warning	May precipitate acute withdrawal in benzodiazepine-dependent patients. Use with extreme caution in children with underlying seizure disorders who are being treated with benzodiazepines; flumazenil reverses the anticonvulsant effects and may precipitate seizures. Contraindicated in tricyclic antidepressant overdose; may induce seizures or arrhythmias.
Fosphenytoin	
Indication	Status epilepticus
Dosage	Given in phenytoin equivalents (PE).
	IV: 15–20 PE/kg, infused at a rate of 1–3 PE/kg per min (maximum rate: 150 PE per min).
	IM: 15–20 PE/kg.
Notes	When given IV, itching is common and controllable by reducing the flow rate.
	Lower risk of hypotension or cardiac effects than phenytoin.
Warning	Rate of infusion should not exceed 3 PE/kg per min. Monitor heart rate via ECG, and reduce the rate of infusion if heart rate decreases by 10 beats per min.
Furosemide	
Indications	Fluid overload
	Congestive heart failure/pulmonary edema
Dosage	IV/IM: 1–2 mg/kg (usual maximum dose: 20 mg for patients not chronically on loop diuretics).
Note	May cause significant hypokalemia.
Glucagon	
Indication	Hypoglycemia caused by insulin excess (as adjunct to glucose).
Dosage	IV/IM/SC: 0.03 mg/kg up to maximum of 1 mg; repeat every 15 min up to a total of 3 doses if needed for clinical effect.
Indication	β-adrenergic blocker or calcium channel blocker overdose.
Dosage	IV: 0.03–0.15 mg/kg, followed by an infusion of 0.07 mg/kg per h (maximum: 5 mg/h).
Adolescent dosage	5–10 mg over several min, followed by infusion of 1–5 mg/h. Reconstitute doses of >2 mg in sterile water rather than the diluent supplied by the manufacturer.
Note	May cause nausea/vomiting because of delayed gastric emptying.
Glucose	
Indications	Hypoglycemia
	Hyperkalemia
Initial Dose	
Children	IV/IO: 0.5–1.0 g/kg.
Neonates	IV: 200 mg/kg as D10W only.
Maintenance dose	Constant infusion of D10W-containing IV fluids with appropriate maintenance electrolytes at a rate of 100 mL/kg per 24 h (7 mg/kg per min). Older children may require a substantially lower dose. The rate should be titrated to achieve normoglycemia, because hyperglycemia has its own adverse central nervous system effects.
Notes	For D10W: 200 mg/kg = 2 mL/kg; 0.5–1.0 g/kg = 5–10 mL/kg.
	For D25W: 0.5–1.0 g/kg = 2–4 mL/kg.
	For D50W: 0.5–1.0 g/kg = 1–2 mL/kg.
	D50W is irritating to veins; dilution to 25% dextrose is desirable.
	Glucose, sodium, and potassium levels should be monitored carefully. Depending on etiology, hypoglycemia may recur.

TABLE 1 **Continued**

Haloperidol	
Indication	Psychosis with agitation
Dosage	IM/IV: 0.05–0.15 mg/kg; may repeat hourly as necessary. Maximum single dose: 5 mg.
Notes	Hypotension and dystonic reactions may occur. Repeated doses can prolong QT interval and precipitate torsades de pointes.
Hydrocortisone	
Indication	Adrenal insufficiency
Dosage	IV/IO: 2–3 mg/kg (maximum: 100 mg) over 3–5 min, followed by 1–5 mg/kg every 6 h for infants or 12.5 mg/m^2 every 6 h for older children.
Note	Do not underdose. Strongly consider concomitant fluid bolus of 20 mL/kg of D5NS or D10NS during the first hour of treatment.
Insulin, regular	
Indication	DKA
Dosage	IV infusion: 0.05–0.10 unit/kg per h. Neonatal IV: 0.05 unit/kg per h. SC: 0.25–0.50 unit/kg per dose.
Note	IV bolus insulin is not generally recommended for children with DKA. Monitor blood glucose and potassium concentrations hourly or more closely as needed, with the goal of gradually reducing the blood glucose level by 50–100 mg/dL per h. Appropriate fluid and electrolyte therapy is also essential when treating DKA.
Indication	Hyperkalemia (although glucose alone is effective).
Dosage	IV: 0.1 unit/kg with 400 mg/kg glucose. Ratio is 1 unit of insulin for every 4 g of glucose.
Ipratropium	
Indication	Adjunct to β-agonists for status asthmaticus/bronchospasm
Preparation	Nebulized solution (0.25 mg/mL).
Dosage	Children $<$12 y old: 0.25 mg nebulized every 20 min for up to 3 doses. Children $\geq$12 y old: 0.5 mg nebulized every 20 min for up to 3 doses.
Notes	May be mixed with albuterol for nebulization. Should not be used as first-line therapy.
Kayexalate (Sanofi-Aventis, Bridgewater, NJ)—see sodium polystyrene sulfonate	
Ketamine	
Indications	Sedation/analgesia Adjunct to intubation Infundibular spasm (hypercyanotic spell with tetralogy of Fallot)
Dosage	IV: 1–2 mg/kg, titrate repeat doses to desired effect. IM: 4–5 mg/kg (onset of action within $\sim$ 5 min); may repeat half the initial dose if patient is not fully dissociated.
Notes	Doses listed above are recommended to achieve dissociative sedation/anesthesia. Lower doses may be used to provide analgesia without full dissociation. Laryngospasm may occur, most often associated with rapid infusion or concomitant upper respiratory infection. It is usually reversible with oxygen administration, repositioning of the airway, and brief positive-pressure ventilation. Rarely, treatment with a muscle relaxant may be required. Atropine or glycopyrrolate may be used to prevent increased salivation.
Warning	Be prepared to provide respiratory support. Monitor oxygen saturation. Avoid use in patients with increased ICP or increased intraocular pressure.
Levalbuterol—see albuterol	
Lidocaine	
Indication	Ventricular arrhythmias, wide complex tachycardia
Dosage	IV/IO: 1 mg/kg (maximum: 100 mg), repeat every 5–10 min to desired effect or until maximum dose of 3 mg/kg is given. IV infusion: 20–50 μg/kg per min. ET: 2–3 mg/kg, followed by or diluted in isotonic saline (1–5 mL) based on patient size.
Note	Recent data suggest that lidocaine is less effective than amiodarone but may be used if amiodarone is not available.
Warning	High concentrations may cause myocardial depression, hypotension, and seizures. Contraindicated in complete heart block and wide complex tachycardia attributable to accessory conduction pathways.
Indication	ICP protection before ET intubation or airway manipulation.
Dosage	1–2 mg/kg IV as a single dose 30 s to 5 min before airway instrumentation.
Note	Considered optional adjunct for RSI in patients with head injury/increased ICP. When a neuroprotective agent that reduces ICP (eg, etomidate, thiopental) is used, lidocaine is less likely to provide additional benefit.
Lorazepam	
Indication	Status epilepticus
Dosage	IV/IM: 0.05–0.10 mg/kg (maximum: 4 mg per dose). May repeat dose every 10–15 min if needed for continued seizures.
Warning	There is an increased incidence of apnea when combined with other sedative agents. Monitor oxygen saturation and be prepared to provide respiratory support. Flumazenil may be administered to reverse life-threatening respiratory depression caused by lorazepam; however, it will also counteract the anticonvulsant effects and may precipitate recurrence of seizures.

TABLE 1 **Continued**

Magnesium sulfate	
Indications	Hypomagnesemia
	Torsades de pointes VT
	Refractory status asthmaticus
Dosage	IV/IO: 25–50 mg/kg (maximum: 2 g).
	Given by bolus for pulseless torsades, over 10–20 min for hypomagnesemia/torsades with pulses, and over 15–30 min for status asthmaticus.
Warning	Rapid infusion may cause hypotension and bradycardia. Have calcium chloride available if needed to reverse magnesium toxicity.
Mannitol	
Indication	Increased ICP
Dosage	IV: .25–1 g/kg given over 20–30 min.
Note	Larger doses (≥0.5 g/kg given over 15 min) may be appropriate in an acute intracranial hypertensive crisis. In conjunction with mannitol, other measures to control ICP such as hyperventilation, sedation/analgesia, head-of-bed elevation, cerebrospinal fluid drainage, barbiturates, and muscle relaxation (using a neuromuscular blocking agent) should be considered. A urine-collecting catheter should be placed when using mannitol. Monitor for hyperosmolality.
Note	Administer through a filter; do not use solutions that contain crystals.
Methylprednisolone	
Indications	Asthma/allergic reaction
	Laryngotracheobronchitis (croup)
Dosage	IV/IM: 1–2 mg/kg initial dose (must use acetate salt for IM route).
Indication	Spinal cord injury
Dosage	IV: 30 mg/kg over 15 min, followed in 45 min by a continuous infusion of 5.4 mg/kg per h for 23 h.
Note	Administration within 8 h of injury is optimal.
Midazolam	
Indication	Sedation/anxiolysis
Dosage	IV: 0.05–0.10 mg/kg given over 2–3 min (maximum single dose: 5 mg).
Note	Peak effect occurs at 3–5 min. Dose/observe and redose/observe every 3–5 min to avoid oversedation. Paradoxical agitation may occur, especially in younger children.
Dosage	PO: 0.25–0.50 mg/kg (maximum: 20 mg). Children <6 y old may require up to 1 mg/kg.
Indication	Adjunct for ET intubation
Dosage	IV: 0.2 mg/kg.
Note	Lower doses of midazolam are ineffective for RSI. After preoxygenation, allow sufficient time (2–3 min) for midazolam to take effect before administration of muscle relaxant.
Indication	Seizures
Dosage	IM: 0.2 mg/kg (maximum: 6 mg per dose); may repeat every 10–15 min.
Note	Other benzodiazepines (eg, lorazepam) are typically used for initial IV treatment of status epilepticus.
Indication	Refractory status epilepticus, not controlled by standard therapies.
Dosage	IV: Loading dose 0.15–0.20 mg/kg, followed by continuous infusion of 1 μg/kg per min, increasing by increments of 1 μg/kg per min (maximum: 5 μg/kg per min) every 15 min until seizures stop.
Warning	There is an increased incidence of apnea when combined with other sedative agents. Be prepared to provide respiratory support regardless of route of administration. Monitor oxygen saturation. Flumazenil may be administered to reverse life-threatening respiratory depression caused by benzodiazepines such as midazolam; however, it will also reverse the anticonvulsant effects and may precipitate seizures.
Milrinone	
Indication	Myocardial dysfunction and increased SVR/PVR (eg, after cardiac surgery, normotensive septic shock).
Dosage	IV/IO: loading dose of 50–75 μg/kg over 10–60 min.
	Infusion: 0.50–0.75 μg/kg per min.
Warning	May cause hypotension, ventricular arrhythmias, and angina. Monitor blood pressure and ECG continuously. Intravascular volume must be maintained. Longer infusion times reduce the risk of hypotension.
Morphine	
Indications	Pain
	Infundibular spasm (hypercyanotic spell with tetralogy of Fallot)
Dosage	IV (slowly)/IM: 0.1 mg/kg.
Notes	Repeat dose as necessary for clinical effect. Burn pain often requires larger or more frequent doses.
	Higher doses may be necessary if patient is tolerant. Histamine release with flushing, itching, and hives is common. Histamine release may also cause hypotension, particularly in unstable cardiac/trauma patients; fentanyl may be preferred in these situations.
Warning	There is an increased incidence of apnea when combined with other sedative agents, particularly benzodiazepines. Be prepared to administer naloxone/nalmefene. Monitor the patient's vital signs and oxygen saturation. Be prepared to provide respiratory support.
Nalmefene	
Indication	Apnea/respiratory depression caused by opioid overdose
Dosage	IV/IM: 0.25–0.50 μg/kg every 2 min.

TABLE 1 **Continued**

Notes	Duration of action is 4–8 h (vs <1 h for naloxone).
	For reversal of respiratory depression in sedation/analgesia or patients with pain, lower doses are indicated to avoid complete reversal of analgesia.
	Do not administer nalmefene to a newborn infant whose mother is suspected of long-term opioid use because of the risk of acute withdrawal.
Warning	May induce acute withdrawal in opioid-dependent patients. Patients should be observed continuously for recurrence of respiratory depression and other narcotic effects for at least 4 h after the last dose of nalmefene. Not recommended for empiric use in coma of unknown etiology.
Naloxone	
Indication	Apnea/respiratory depression caused by opioid overdose
Dosage	
Newborn infants	IV/IM: 0.1 mg/kg (ET route not recommended for newborn infants).
Older infants/children	IV/IO/IM/SC: <5 y old or <20 kg: 0.1 mg/kg; ≥5 y old or ≥20 kg: 2 mg.
Notes	Use lower doses (1–15 μg/kg) to reverse respiratory depression associated with therapeutic opioid use.
	Doses may be repeated as needed to maintain opiate reversal.
	Do not administer naloxone to a newborn infant whose mother is suspected of long-term opioid use because of the risk of seizures/acute withdrawal.
Warning	May induce acute withdrawal in opioid-dependent patients. Patients should be observed continuously for recurrence of respiratory depression and other narcotic effects for at least 2 h after the last dose of naloxone.
Nitroprusside	
Indications	Hypertensive crisis
	Cardiogenic shock (associated with high SVR)
Dosage	IV: starting dose 0.3–0.5 μg/kg per min (maximum dose: 10 μg/kg per min). Start at the lowest dosage and titrate for the desired clinical effect.
Note	Bottle, burette, or syringe pump should be covered with protective foil to avoid breakdown by light. IV tubing does not need protective foil.
Warning	Administration may result in profound hypotension. Blood pressure should be monitored continuously with an arterial line. Extreme caution should be used to avoid accidental flushing/bolus injection of the IV line. May cause cyanide/thiocyanate toxicity and metabolic acidosis, especially in patients with hepatic or renal insufficiency.
Norepinephrine	
Indication	Hypotensive (usually distributive) shock, with low SVR and unresponsive to fluid resuscitation (eg, hypotensive septic shock, neurogenic shock).
Dosage	IV/IO: 0.1–2.0 μg/kg per min, titrated to desired effect.
Warning	May cause tachycardia, bradycardia, arrhythmias, and hypertension. Extravascular administration can result in severe skin injury. Phentolamine (dose: 0.1–0.2 mg/kg up to 10 mg diluted in 10 mL of 0.9% sodium chloride) injected intradermally at extravasation site may be helpful for counteracting dermal vasoconstriction.
Phenobarbital	
Indication	Status epilepticus
Dosage	IV: 20 mg/kg (maximum dose: 1000 mg), infused over 10 min. Repeat dose once if necessary after 15 min (maximum total dose: 40 mg/kg).
Warning	There is an increased incidence of apnea when combined with other sedative agents. Be prepared to provide respiratory support. Monitor oxygen saturation.
Phenytoin	
Indication	Status epilepticus
Dosage	Neonates IV: 10 mg/kg.
	Children IV: 20 mg/kg.
Notes	Maximum initial dose: 1000 mg. Recommended infusion time is 10–20 min; drug-delivery rate not to exceed 1 mg/kg per min.
	Neonates have an increased risk of toxicity because of decreased protein binding; phenobarbital is preferred.
	Phenytoin should be diluted in normal saline to avoid precipitation. Incompatible with glucose-containing solutions.
Warning	May cause hypotension and arrhythmias, especially with rapid infusion. Heart rate should be monitored, and the rate of infusion should be reduced if the heart rate decreases by 10 beats per min. If available, fosphenytoin is preferred, because it has a lower risk of adverse cardiac effects.
Prednisone/prednisolone	
Indication	Asthma, acute exacerbation
Dosage	Initial dose: 1–2 mg/kg PO (maximum: 60 mg); subsequent dose: 1–2 mg/kg per d divided in 1–2 doses per d for 3–10 d (maximum: 60 mg per d).
Notes	No advantage of IV or IM preparations over the PO route if gastrointestinal absorption is not impaired.
	No need to taper steroid dose if used for <10 d.
Procainamide	
Indications	Wide complex tachycardia with a pulse, atrial flutter/fibrillation, supraventricular tachycardia resistant to other drugs
Dosage	IV/IO loading dose: 15 mg/kg over 30–60 min.
	Adult dose: 20 mg/min IV infusion up to total maximum dose of 17 mg/kg (maximum loading dose: 1.0–1.5 g).
Warning	May cause hypotension, negative inotropic effect, prolonged QT interval, torsades de pointes, heart block, and cardiac arrest. If ≥50% QRS widening or hypotension occurs during administration of the drug, the remainder of the dose should be held. Cardiologist consultation is strongly recommended when considering the use of this medication. Should not be used with amiodarone or other drugs that prolong QT interval without expert consultation.

TABLE 1 **Continued**

Propranolol	
Indication	Infundibular spasm (hypercyanotic spell with tetralogy of Fallot)
Dosage	IV: 0.15–0.25 mg/kg per dose infused over 10 min in D5W.
	Maximum initial dose: 1 mg. May repeat dose once.
Note	Oxygen should be administered first. Morphine is considered the first-line drug for the treatment of infundibular spasm. Use with caution in congestive heart failure.
Prostaglandin E_1 (alprostadil)	
Indication	Suspected or proven ductal-dependent cardiac malformation in the neonatal period
Dosage	IV/IO: 0.05–0.10 μg/kg per min infusion in D5W (maximum dose: 0.2 μg/kg per min).
Warning	Apnea, hyperthermia, and seizures may occur; however, none are reasons to stop infusion. Be prepared to provide respiratory support.
Rocuronium	
Indications	Paralysis to facilitate mechanical ventilation
	Emergency intubation
Dosage	IV: 1 mg/kg.
Notes	This drug does not provide sedation, analgesia, or amnesia.
	Satisfactory conditions for ET intubation (adequate relaxation) will generally occur in 60–90 s. Duration of action is ~30–45 min and is dose dependent.
Warning	Ventilatory support is necessary. Personnel with skills in airway management must be present and prepared to respond when this agent is administered. Age-appropriate equipment for suctioning, oxygenation, intubation, and ventilation should be immediately available.
Sodium polystyrene sulfonate (Kayexalate)	
Indication	Hyperkalemia
Dosage	PO: 1 g/kg up to 15 g (60 mL) every 6 h as needed.
	Rectal: 1 g/kg up to 50 g every 6 h as needed.
Warning	Avoid using the commercially available liquid preparation in neonates because of the hyperosmolar preservative (sorbitol) content. Hospital pharmacies can prepare sorbitol-free preparations. Extremely preterm neonates may develop intestinal hemorrhage (hematochezia) from rectal Kayexalate.
Succinylcholine	
Indications	Emergency intubation
	Laryngospasm
Dosage	IV: 1–2 mg/kg (2 mg/kg for infants <6 mo of age).
	IM: 4 mg/kg IM (5 mg/kg for infants <6 mo of age).
Notes	This drug does not provide sedation, analgesia, or amnesia.
	Atropine 0.02 mg/kg (minimum dose: 0.1 mg; maximum dose: 1 mg) is typically administered before succinylcholine to prevent bradycardia or asystole. If being used for patients with increased ICP, a defasciculation dose of a nondepolarizing agent (eg, 0.01 mg/kg of vecuronium) may be considered.
	Satisfactory conditions (adequate relaxation) for ET intubation generally occur 30–45 s after IV administration and 3–5 min after IM administration. Duration of action is ~5–10 min.
Warning	Causes increased serum potassium levels, which may be life-threatening in patients with a previous history of malignant hyperthermia, severe burns/crush injury, spinal cord injury, neuromuscular disease, or myopathy. When these contraindications exist, use a nondepolarizing muscle relaxant such as rocuronium. If cardiac arrest occurs immediately after administration of succinylcholine, suspect hyperkalemia (particularly in boys <9 y old).
Warning	Ventilatory support is necessary. Personnel with skills in airway management must be present and prepared to respond when this agent is administered. Age-appropriate equipment for suctioning, oxygenation, intubation, and ventilation should be immediately available.
Thiopental	
Indication	Sedation/anesthesia for RSI
Dosage	IV: 2–6 mg/kg.
Note	May need to use lower dose if other sedatives/narcotics have been administered. Flush with saline before administration of rocuronium or vecuronium to avoid precipitation and obstruction of IV tubing.
Warnings	IM administration leads to tissue necrosis.
	Be prepared to provide respiratory support. Monitor oxygen saturation. Causes vasodilation and decreased cardiac output; higher doses are associated with hypotension and apnea. If patient has cardiovascular dysfunction or volume depletion, consider etomidate as alternative.
Vecuronium	
Indications	Paralysis to facilitate mechanical ventilation
	Emergency intubation
Dosage	IV: 0.1 mg/kg for routine paralysis; 0.2 mg/kg for intubation.
Notes	This drug does not provide sedation, analgesia, or amnesia.
	Satisfactory conditions (adequate relaxation) for ET intubation generally do not occur until 2 min after administration. Duration of action is ~45–90 min (dose dependent). Rocuronium or succinylcholine is preferred for facilitating rapid intubation in emergency situations.
Warning	Ventilatory support is necessary. Personnel with skills in airway management must be present and prepared to respond when this agent is administered. Age-appropriate equipment for suctioning, oxygenation, intubation, and ventilation should be immediately available.

AV indicates atrioventricular; VT, ventricular tachycardia; D*n*W, *n*% dextrose in water; IM, intramuscular; PO, per os (oral); DKA, diabetic ketoacidosis; ICP, intracranial pressure; SC, subcutaneous; PE, phenytoin equivalents; ECG, electrocardiogram; D*n*NS, *n*% dextrose in normal saline; SVR, systemic vascular resistance; PVR, pulmonary vascular resistance.

TABLE 2 **Potentially Useful Rescue, Reversal, and/or Antidotal Agents**

Agent/Condition	Rescue, Reversal, and/or Antidote
Chemical intoxications	
Alcohol, toxic (eg, methanol)	Ethanol, thiamine, fomepizole (4 methyl-1H-pyrazole)
Iron	Deferoxamine
Carbon monoxide	Oxygen
Cyanide	Hydroxocobalamin (Cyanokit; Dey, LP, Napa, CA) is preferred antidote; cyanide kit (amyl nitrate, sodium nitrate, sodium thiosulfate) may be used if hydroxocobalamin unavailable
Lead	Dimercaprol (British anti-Lewisite [BAL]); edetate calcium disodium (Ca- EDTA); DMSA (succimer [Chemet])
Drug intoxications	
Acetaminophen	*N*-acetylcysteine
Benzodiazepines	Flumazenil
β-adrenergic blockers	Glucagon
Digoxin	Digoxin immune Fab (Digibind; GlaxoSmithKline, Research Triangle Park, NC)
Heparin	Protamine sulfate
Isoniazid	Pyridoxine
Opiates	Naloxone, nalmefene
Envenomations	
Snake bites	Snake-specific antivenoms (eg, CroFab [Protherics, Yorkshire, United Kingdom] for Crotalidae [rattlesnakes]; coral snake antivenom, etc)
Black widow spider bites	*Latrodectus* antivenom
Metabolic crises	
Methemoglobinemia	Methylene blue
Hyperkalemia	Bicarbonate, glucose and insulin, calcium, sodium polystyrene resin (Kayexalate)
Miscellaneous	
Nondepolarizing muscle relaxants	Neostigmine, pyridostigmine, edrophonium
Cholinergics (organophosphates, carbamates)	Atropine, pralidoxime
Radionuclides	
Iodine	Potassium iodide
Plutonium	Pentetate calcium disodium (Ca-DTPA) within 24 h followed by pentetate zinc trisodium (Zn-DTPA)
Americium	Zn-DTPA or Ca-DTPA
Uranium	Sodium bicarbonate and tubular diuretics
Cesium	Prussian blue
Tritium	Water
Phosphorus	Individualize treatment; consult Poison Control Center

Consultation with a toxicologist or the Poison Control Center (national telephone number: 800-222-1222) strongly advised if considering antidote administration.

vascular access has been obtained, any vascular access (IV or IO) is preferred, because tracheal drug administration results in lower, less predictable drug concentrations than intravascular administration.[5] If the endotracheal (ET) route is used, administer the drug with or diluted in 1 to 5 mL of isotonic saline solution followed by manual ventilations. ET administration of naloxone is no longer recommended for neonates.[6]

Most of the medications listed in this clinical report are used for airway management, resuscitation, sedation, analgesia, status epilepticus, or asthma. The Committee on Drugs recognizes that gaps exist in pediatric labeling and dosage information for many of these drugs. Despite these gaps, the package inserts, labels, and available medical literature should be consulted for additional information. The continued lack of clinical testing in pediatric populations before Food and Drug Administration approval of therapeutic agents makes it impossible to have the clinical data to support all pediatric dosing recommendations. Although local practice patterns and individual preferences exist for the use and dosage of many of these medications, the information provided in this document includes recommendations that are based on consensus opinion and literature review. References for individual drug indications and dosing are not provided in this report. Dosages should be individualized, taking into account the patient's age, weight, underlying illness, concurrently administered drugs, and known hypersensitivity. This committee recommends use of the current *Advanced Pediatric Life Support*[7] and *Pediatric Advanced Life Support*[8] textbooks, updated American Heart Association guidelines,[5] and additional references for more detailed information on pediatric resuscitation algorithms, rapid-sequence intubation (RSI), procedural sedation, and treatment of asthma.[9,10] For newborn infants, practitioners can consult the *Textbook of Neonatal Resuscitation*[11] and updated American Heart Association guidelines[6] for detailed information concerning management of neonatal emergencies and appropriate drugs, dosages, and routes of administration. In addition, pre-

printed medication cards and/or length-based resuscitation tapes (eg, Broselow tape) should be readily available at all sites that provide medical care for children.

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CLINICAL REPORT

Prescribing Assistive-Technology Systems: Focus on Children With Impaired Communication

Guidance for the Clinician in Rendering Pediatric Care

Larry W. Desch, MD, Deborah Gaebler-Spira, MD, and the Council on Children With Disabilities

ABSTRACT

This clinical report defines common terms of use and provides information on current practice, research, and limitations of assistive technology that can be used in systems for communication. The assessment process to determine the best devices for use with a particular child (ie, the best fit of a device) is also reviewed. The primary care pediatrician, as part of the medical home, plays an important role in the interdisciplinary effort to provide appropriate assistive technology and may be asked to make a referral for assessment or prescribe a particular device. This report provides resources to assist pediatricians in this role and reviews the interdisciplinary team functional evaluation using standardized assessments; the multiple funding opportunities available for obtaining devices and ways in which pediatricians can assist families with obtaining them; the training necessary to use these systems once the devices are procured; the follow-up evaluation to ensure that the systems are meeting their goals; and the leadership skills needed to advocate for this technology. The American Academy of Pediatrics acknowledges the need for key resources to be identified in the community and recognizes that these resources are a shared medical, educational, therapeutic, and family responsibility. Although this report primarily deals with assistive technology specific for communication impairments, many of the details in this report also can aid in the acquisition and use of other types of assistive technology. *Pediatrics* 2008;121:1271–1280

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Key Words
assistive technology, communication, children with disabilities, special health care needs, pediatrician, augmentative and alternative communication, communication impairments

Abbreviations
VOCA—voice-output communication aid
SGD—speech-generating device
AAC—augmentative/alternative communication
PECS—Picture Exchange Communication System
ICF—International Classification of Functioning, Disability and Health
AAP—American Academy of Pediatrics
IDEA—Individuals With Disabilities Education Act
EPSDT—Early and Periodic Screening, Diagnosis, and Treatment

BACKGROUND

Communication skills are ranked as the concern of highest priority for adults with physical disabilities and, therefore, should be of paramount importance for children with impaired communication and their families.[1] Nearly 5 million children in the United States (approximately 15%) have some type of disabling condition.[2] Among children with disabilities who are attending school, >20% have significant communication impairments that are not attributable to impaired hearing.[3] Conditions that can cause communication impairment include cerebral palsy, autism spectrum disorders, traumatic brain injury, and several genetic syndromes (eg, DiGeorge syndrome).

Many children and youth with special health care needs can improve day-to-day functioning with the aid of assistive technology, including alternative or augmentative technology. "Assistive technology," the more general term, describes systems and devices that help alleviate the effects of a disability and, thus, improve function. An example is the use of orthotics (braces) for a child who has L4 paraplegia attributable to spina bifida. "Alternative technology" substitutes for functional impairments related to a disability (eg, adapted power wheelchairs for children who have quadriplegia). Lastly, "augmentative devices" are those that augment a deficient area of functioning but for which residual abilities remain. An example of this would be an electronic voice-output communication aid (VOCA), sometimes called a speech-generating device (SGD), to be used for a child who has dysarthria attributable to cerebral palsy. In this situation, although natural speech may be somewhat understood by family members, it is augmented when communicating with people who are less familiar with the child.

The most common context for alternative and augmentative systems is in the field of speech-language pathology (eg, augmentative/alternative communication [AAC] systems). According to an analysis of data from the National Survey of Children With Special Health Care Needs, approximately 2.1% of children and youth with disabilities have a need for "communication aids or devices"—AAC systems.[4] The data also revealed that the needs for communication aids and devices were unmet for approximately 25% of these children.

TABLE 1 **Spectrum of Assistive Technology for Communication Impairments**

Type of AAC Technology	Characteristics	Examples	Advantages	Disadvantages
Low-tech	Uses paper, plastic or similar materials	Simple picture/word boards or cards; PECS; eye-gaze picture board; visual scheduler or planner; adapted pens/pencils	Usually low cost; portable; personal; training is quick; readily acceptable to listener; rugged; no need for power supply	Very limited speed; very limited vocabulary; unable to use for long-distance communication
Mid-tech	Uses batteries for voice, text, or light output	Lighted on/off devices; "wrist communicator" (eg, with 2–10 stored vocal outputs); keyboard with display or printer; scanning light board (eg, with pictures)	Low-to-moderate cost; usually portable; usually personally owned; training is moderate; usually acceptable to listener; occasionally can use for limited long-distance communication	Limited speed; limited vocabulary; limited distance communication; power supply needed
High-tech	Microcircuits and microcomputer technology	Adapted laptop computers; commercially available VOCAs (dynamic displays, touch pads, or keyboards); individualized devices that use special inputs (eg, eye blinks)	Ease of progressing in skill levels; able to carry out extensive and efficient conversations; usually portable; often can use for long-distance communication (eg, telephone); able to connect to other devices (eg, for access to computer or for environmental control)	Moderate to very high cost; sometimes is not personally owned; power supply needed; training often extensive; listeners may need to have training

See text for more details on some devices.

AAC is often erroneously thought to refer only to microcomputer-based and complex electronic devices. Although such electronic devices may be the best answer for a particular problem, they represent only the higher end of the spectrum of technology. Assistive technology, including AAC systems, can be thought of as low-tech, mid-tech, or high-tech.[5] The costs for assistive technology also vary widely depending on the level of complexity and other factors. Although many low- and mid-tech AAC solutions are available to assist children with communication disabilities, this report focuses primarily on high-tech VOCAs or SGDs, because pediatricians are often asked to prescribe or approve the use of these more expensive devices.

CURRENT PRACTICE

Many types of AAC systems are available for use by individuals who have speech and/or language impairment (Table 1). Low-tech strategies include the use of objects, line drawings, and actual photographs or pictures of objects or persons to replace or augment spoken words. This is especially helpful for the development of communication skills of children who are nonverbal, particularly those who are unable to read.

Low-tech AAC also includes systems such as lists of words, phrases, or symbols that can be understood easily by others in many environments. By pointing to a desired target, simple communication boards or "flip-books" can be quite effective for face-to-face communication. For children who have visual impairment, three-dimensional objects that can be felt may be substituted for pictures.

Simple communication boards can be accessed through both direct selection and assisted scanning. In direct selection, the child directly touches or points to the desired target (eg, word, symbol). In partner-assisted scanning, the communication partner scans through the available choices until he or she is stopped by a response from the child (such as an eye blink). For children with autism spectrum disorders, a systematic program called the Picture Exchange Communication System (PECS) has been developed and has gained increasing acceptance as a valuable tool for improving communication skills.[6] In this system, children are taught to "exchange" laminated picture cards of the items or activities they are requesting for the actual items or activities themselves.

Mid-tech devices are typically battery-operated portable voice-output storage devices or devices that produce printed text. Devices can store a few recorded or digitized messages, such as "I want to see a movie," or multiple levels of messages. These levels are typically changed by the communication partners on the basis of the activity. When the desired button is accessed, the recorded message plays. Most mid-tech devices are accessed only through direct selection. Some mid-tech devices have scanning capabilities, accessed with a single switch.

Low- and mid-tech communication systems have inherent limitations. Vocabulary is limited by what is presented, and lengthy, novel messages are not feasible. Communication is usually slow and often more scripted than spontaneous or independent, and mid-tech devices require programming of scripted messages before the activity.

High-tech electronic AAC devices often incorporate the use of pictures or symbols, which may substitute for sentences or other groups of words, and are becoming more commercially available. High-tech AAC aids primarily have digitized or synthesized voice output (ie, are VOCAs or SGDs), although the methods of producing this voice output vary. Many high-tech devices use synthesized speech, an electronic voice that simulates that of a human voice. The use of a synthesized vocabulary allows for the creation of novel messages. Most comput-

erized systems have the capability to add digitized speech to specific messages. Unlike mid-tech devices, high-tech devices usually feature a dynamic display that changes with the input so that many levels of symbols, words, or lengthy messages can be stored for quicker retrieval, which improves both the variety of potential vocabulary items and independence in communication.

High-tech devices typically have the capability to have multiple access (input) methods ranging from direct selection on a touch screen to various types of scanning, mouse/joystick controllers, or encoding systems. Some computer-based devices can be accessed via eye gaze. For children who have both communication and physical disabilities, these alternative access methods are often needed. Systems that allow direct selection (eg, with a finger) are used with children who have adequate control of movements.

Single-function AAC devices (SGDs or VOCAs) serve as communication-output devices only. Some of the newer AAC systems, including some VOCAs, can also perform functions such as controlling the environment, accessing a telephone, or serving as a computer-access method.

The advantage of high-tech VOCAs is their expandability and flexibility. For children whose communication skills are likely to improve over time, the vocabulary in the VOCA can be modified to accommodate the advancing development and changing needs of the child. Thus, the skills of the child and capability of the device increase in tandem and promote communicative proficiency into adulthood. As an example, for a young child who has an ASD but is limited in communication by using the PECS, a VOCA may be helpful, because at least 1 report has indicated that VOCAs can increase communication skills in preschool-aged children with autism spectrum disorders.[7]

People who have normal speech are so accustomed to a high rate of speed that patience and appropriate training are necessary to communicate with an individual using AAC systems. This is especially true if the child is using a low-tech communication aid such as a symbol, letter, or word board. Although these methods are extremely slow and/or inflexible, they should not be abandoned. Depending on the child, they often are just as effective, if not more so, than high-tech devices in simple face-to-face communications and with multiple caregivers.

Another important consideration is that electronic devices are sometimes limited by their need for a power source, which inhibits their usefulness in situations in which battery power gets depleted. A lower-tech solution, such as a word or picture board, should always be available as a backup for high-tech AAC system users.

CURRENT RESEARCH AND LIMITATIONS

Much research has been published to demonstrate the benefits of early intervention for speech and language disorders, including using alternative systems such as pictures or sign language. Furthermore, research has demonstrated that the use of AAC systems does not decrease the use of natural speech.[8] Currently, there is no consensus about the earliest age at which a child can successfully use a more complex AAC device (eg, a VOCA). Some recent reports, however, have demonstrated successful use of complex devices with children younger than 3 years.[9]

The use of electronic or computer-based AAC devices may promote natural language acquisition and cognitive development. For example, 1 study has shown that an AAC device will facilitate natural speech production in children who have some potential for speech.[10] In addition, the use of communication aids offers opportunities for research into the interaction of people who are nonverbal (because of a disability) with those who are able to speak. An interesting but limited study by Beukelman and Mirenda[11] demonstrated the need to study the process by which AAC devices are selected and used. Their research suggested that if a child who has a severe communication impairment is successfully using an AAC device by the time he or she reaches the first grade, that child will participate more actively in classroom settings. Children who were skilled and comfortable with their AAC devices communicated more frequently with their typically developing peers. Additional research on AAC systems and children is needed, especially to determine if earlier exposure to communication aids will promote more facility in their use or other gains.

ASSESSMENT ISSUES

The assessment of a child who has a communication disorder and the selection of any assistive device should be performed by a team of knowledgeable professionals. This team approach is needed to properly evaluate both the child and devices to ensure the best match and to ensure that the device can be used effectively across environments and communication partners. Depending on the AAC device to be prescribed and the disabilities of the child, this team might include speech and language pathologists, physical therapists, occupational therapists, rehabilitation engineers, primary care and developmental pediatricians, psychologists, neurologists, physiatrists, special educators and other school personnel, child care workers, computer specialists, and others in conjunction with the family. In all circumstances, however, the major evaluator and decision-maker will be the speech-language pathologist. The team should be interdisciplinary and function collaboratively with ongoing discussions among the team members. Decisions of the team should be made jointly. Team members should provide or receive training and monitor the ongoing use of the device.

The basics of the overall assessment process for assistive technology are shown in Fig 1. This cycle usually needs to be repeated periodically as the child develops and his or her needs change. The assessment process for AAC should include consideration of the entire spectrum of AAC. One possible approach is to consider the use of low-tech devices and, if needed, to progress to mid-tech devices and, finally, high-tech devices. If a low-tech solution solves a particular problem, then more sophisticated technology may not be needed currently (but may be in the future). For example, a child with an autism spectrum disorder or other severe language disorder may derive more benefit from the simple PECS

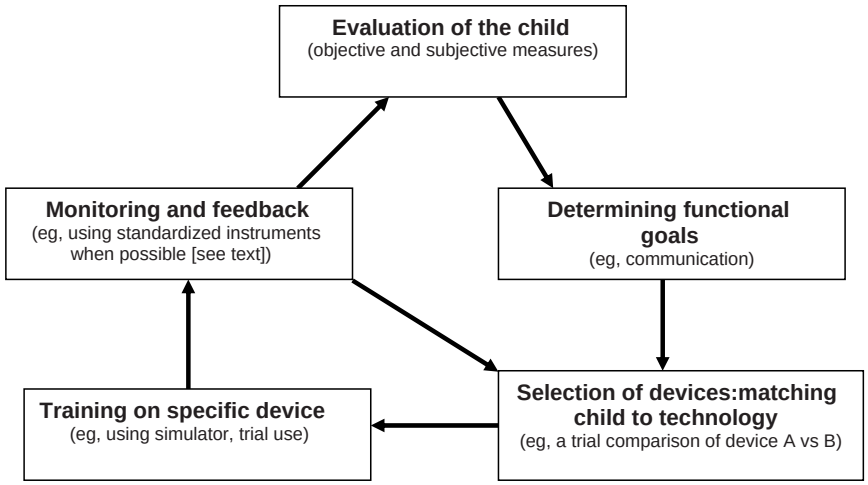

FIGURE 1
The assistive-device–assessment cycle. (Adapted from Batshaw ML, ed. *Children With Disabilities*. 6th ed. Baltimore, MD: Paul H Brookes; 2007:563.)

than a complex VOCA, but if that same child outgrows the PECS, a sophisticated VOCA may become the most appropriate means of AAC.

The ultimate goal for using any AAC device is to achieve the highest possible functional communication. The first step, therefore, is to determine the person's current functional abilities, environmental situations, and personal preferences (Fig 1). One system that may be useful in such an assessment is the International Classification of Functioning, Disability and Health (ICF), specifically that for children and youth developed by the World Health Organization.[12,13] Using this system, for example, one can classify and determine the extent of problems and strengths that a person has related to a communication disability that affects the ICF "activities and participation" domain and subcategories such as "communication" or "mobility." Using the ICF system may help to predict the effect that a specific device will have on a child in regard to each subcategory.

Standardized instruments for initial and follow-up assessments include the Functional Independence Measure, the children's version of the Functional Independence Measure (the Wee-FIM), and the Pediatric Disability Inventory.[14–16] Environmental modifications, such as the use of assistive devices, have been shown to significantly affect these types of measures.[17] Standardized language-assessment tests should also be used to determine progress in communication abilities.[18] Caution is advised when using standardized tools to evaluate children using AAC systems, because they were not developed with these devices in mind.[19] Accurate baseline measurements are crucial for evaluating functional changes over time after the introduction of any assistive technology, including AAC.[11]

Children who have moderate to severe physical and communicative limitations are in particular need of the combined knowledge and experience of an interdisciplinary team, because many barriers to the use of assistive devices exist.[20] Factors that need to be assessed include current and future language needs, motor abilities and deficits, cognitive levels of functioning, vision and hearing functioning, communication partners, and environment and mobility issues. A major task for the team is to determine which movements the child can make consistently and how these movements can be used to control some type of device. Next, the team should determine the most acceptable, useful, and feasible output method depending on the child's needs and his or her communication partners. For example, output information could be displayed on a monitor screen, output by a printer, or presented as synthesized speech. Most of the time, multiple output types are preferred. Last, the child should be observed using various devices.

Educated opinions based on the successful experiences of other children who have similar disabilities using AAC can be quite useful. Using the aforementioned steps, the skilled speech-language pathologist should be able to select the devices that are most likely to meet the child's individual needs on the basis of his or her abilities and communication environments. Ideally, the child should have a trial period with a rented or loaned unit of the intended device before it is ordered or purchased. A 1- to 2-month trial gives the child and his or her family and the educators/caregivers the opportunity to be trained and to assess the child's ability to use the device in different settings to identify both the strengths and weaknesses of the system. These steps may reduce purchases of inappropriate devices. Partnering with a reliable technology center (especially at a university or nonprofit organization) is often useful, but these centers may be quite distant or have long waiting lists.

Studies have demonstrated that assistive devices may be abandoned shortly after they are obtained in one third of cases and that up to 75% of devices are never used successfully.[21,22] Much of this can be attributed to lack of proper assessment and training. During the past 2 decades, however, methods have been developed to improve the successful matching of assistive devices to users (especially with adults [eg, "Matching Person and Technology"]).[23,24] Similar methods have been used with older children and adolescents.[25,26]

The physician or therapist who prescribes or recommends a VOCA or assistive devices in general must also accept responsibility for ensuring that the child and all

caregivers receive proper training and monitoring for the use of the device. Training is crucial for the successful use of any assistive device. Generally, the most appropriate approach to training and monitoring is to use the combined expertise of an interdisciplinary team of therapists and specialists.

A few tools and standardized measures are available to assist in the process of evaluating the efficacy and performance of assistive devices.[27,28] One promising method was reported recently by a group that developed a 10-step framework, which includes input from parents, to help professionals obtain assistive technology for young children.[29] These tools are promising but are still in their infancy and require additional work.

Despite minimal data from controlled studies, methods are available to promote evidence-based and appropriate uses of assistive devices. A useful approach for determining the effectiveness of interventions in individuals may be the implementation of what has been called a "single-subject research design."[30,31] This type of study involves the quantitative assessment of a child's baseline abilities, followed by repeat assessments after specific interventions.[32] In the best of such studies, the assessments are performed by evaluators who are unaware of the intervention ("masked"); however, this is not critical. In the single-subject research design, the individual serves as his or her own control.

Although multiple-baseline studies may be difficult to obtain with children who are in a therapeutic or school environment, 2 or more types of interventions could easily be studied across time to determine which treatment or device seems to be the most effective. Figure 1 includes a "detour" between the steps of monitoring the use of the device and selection of device to allow for multiple baselines.

ROLE OF THE PRIMARY CARE PEDIATRICIAN

Identification, Referral, and Care Coordination

As part of providing the medical home, the primary care pediatrician should recognize communication disorders in children and make appropriate referrals.[33] Knowing how to contact experienced professionals and other appropriate community resources for assistive technology (which may be primarily for adults) is crucial. Children who need AAC systems require services for evaluation, procurement, training, and monitoring for devices and therapy programs. These particular services also need to be coordinated with other therapies and programs (eg, educational) that the child is already receiving and with the family. However, this integrative process can be confusing and overwhelming for the family. The pediatrician who is providing the medical home should develop a care-coordination process that involves all available resources (internal and external) to help families through this often-complicated process.

Primary care aspects of care coordination in the context of communication disorders involves 4 components: cooperating/assisting with the diagnostic assessment process to ensure proper diagnostic and prognostic information; helping with short-term and long-term planning by appropriate professionals, especially speech-language pathologists; assisting with the implementation of any of the parts of the plan, including helping to find funding sources for the purchase of devices; and working closely with the family and a team of professionals, mainly educational and speech-language therapists, to evaluate the effectiveness of the efforts being made and to ensure appropriate follow-up.

Although the primary care pediatrician should be closely involved with all 4 of these components of care coordination, the last step is particularly important. The primary care pediatrician may be the professional who is best able to evaluate the child's progress in relationship to the family's satisfaction or dissatisfaction. For specifics about providing care coordination and care management, a recent policy statement from the American Academy of Pediatrics (AAP), "Care Coordination in the Medical Home: Integrating Health and Related Systems of Care for Children With Special Health Care Needs," provides additional information and resources.[34]

Funding Issues and Access Regulations

Funding for assistive technology for children can come from schools; third-party payers including Medicaid and private insurance companies; or philanthropic sources. Roadblocks to funding AAC still exist, and many families have found that it is much easier to obtain funding for an expensive power wheelchair than it is for a less-expensive communication device. However, it is best to assume that funding will be provided, because, in the context of communication impairments, AAC is often necessary to overcome the limitations in functional communication caused by the impairment (just as a wheelchair overcomes the limitation of not being able to walk).

Beginning in 1973, several laws were passed that affected access to assistive devices for children with disabilities. First, Section 504 of the Rehabilitation Act of 1973 (Pub L No. 93–112) prohibited discrimination of children with disabilities and mandated educational programs for children with disabilities. This law was followed by the Education for All Handicapped Children Act of 1975 (Pub L No. 94–142), which required public education systems to provide a "free and appropriate education and related services" to meet the unique needs of every child with a disability. This educational service was to be provided in the "least restrictive environment" possible, an environment in which a child with a disability may interact with nondisabled peers. Section 602 of the law provides for the "use of instructional materials, including telecommunications, sensory and other technical aids and devices," to aid the child with disabilities to function more easily in the school environment.

The Technology-Related Assistance for Individuals With Disabilities Act of 1988 (Pub L No. 100–407, later amended as Pub L No. 103–218 [1994]), although written mainly to affect adults, also has proven to be quite beneficial to children. Called the "Tech Act," this law defined assistive technology and, more importantly, provided financial assistance to states to develop projects to

improve each state's delivery of assistive-technology devices and services. By 1996, after several revisions to the law and increased funding, 56 assistive-technology centers (1 in each state and US territory) were functioning.[35]

The Education for All Handicapped Children Act was changed in 1990 to the Individuals With Disabilities Education Act (IDEA [Pub L No. 101–476]). The IDEA has increased services to children who have disabilities (birth to 21 years of age), including, by specific provisions in the law, appropriate assistive technology. This law was last reauthorized in 2004 (Pub L No. 108–446), and the sections related to assistive technology were essentially left intact.

The latest education law, the No Child Left Behind Act of 2001 (Pub L No. 107–110), does not specifically address technology but does include provisions that mandate "measurable educational improvement" for children who have disabilities.[36] In some instances, AAC technology may be needed to meet the measurable educational goals.

Recent Medicare regulations can be seen as a possible template for future mandates that may affect many more children. Medicare now authorizes that all people who receive Medicare benefits are entitled to receive "medically necessary" AAC devices, with 80% of the cost paid for by Medicare funds.[37] These new regulations, included in Part B of Medicare, cover only SGDs and provide for 4 levels of funding (up to nearly $6500 for a device). Any adapted computer, however, would not be covered, because computers are not considered "dedicated" SGDs. Since final rulings in 2001, essentially all Medicare beneficiaries are entitled to an SGD if there is any "functional need" (eg, after a stroke) and a medical necessity letter is submitted by a physician (who does not need to be a specialist). Medicare also requires an evaluation and report by a "certified speech and language pathologist," although there is, as yet, no credentialing specifically for AAC by the American Speech-Language-Hearing Association.

Approximately 3 years ago, these same Medicare regulations were used to develop rules that cover funding for VOCAs for adults and children who receive benefits from the US Department of Defense (ie, the TRICARE program).[38] However, neither of these sets of regulations (Medicare and TRICARE) contain a requirement that the communication impairment be permanent.

In contrast to these 2 sets of regulations, Medicaid payments for AAC systems, being dependent on state laws and rulings, are extremely variable, and some states with strict limits for Medicaid rarely pay for AAC systems for children, especially expensive devices such as VOCAs. Medicaid funding is further discussed later in this report.

Educational System Funding

Funding for assistive devices and software will remain challenging for many school districts unless funding inequities among schools are resolved. It is fortunate that, as noted before, there are provisions within the IDEA and subsequent laws (eg, the Tech Act) and various legal opinions about these laws that specifically indicate that funding should be made available for "technologic devices" (including software) to help children who have special education needs. Although these statements are in public law, difficulties in finding the funds to pay for assistive devices and for other "educationally related services" will continue, at least for the foreseeable future. Additional information about these issues can be found in a statement from the AAP.[39]

On occasion, schools have purchased VOCAs or other electronic communication aids for children with functional impairments. Unfortunately, these devices are sometimes kept at the school and are not allowed to be used at home. The Tech Act has tried to alleviate this problem partially by allowing Medicaid funding to be used by the school to purchase the assistive device. The Tech Act requires that such devices be allowed to be taken home with the child for "educationally related" purposes. In other words, for any device even partially funded by Medicaid, the school cannot prevent the child from using the device at home.

Debate continues whether AAC devices are "medically" or "educationally" necessary. If they could be shown to be medically necessary, it may be possible to obtain funding for these devices from health insurance companies or other third parties. In this regard, the use of AAC systems should lead to more efficient and accurate medical encounters (eg, improved describing of symptoms). If they are truly educationally necessary, perhaps school systems should be required to purchase the needed devices. Appropriate learning certainly depends on the exchange of information and efficient communication. This dichotomous debate is short sighted. Clearly, if one takes the view that health is about overall well-being and functioning, not just absence of disease, AAC is often medically necessary in many ways.

The complicated nature of education law terminology can sometimes cause knowledgeable parents to have unrealistic expectations that assistive devices, including AAC systems, must be immediately provided. Cooperative efforts between philanthropic agencies, school systems, and parents in some localities may be the best solution to finding appropriate funding. Parent groups and their allies may be able to lobby effectively for other sources of funding and convince schools of the need for appropriate assistive devices. The last resort, although laborious and slow, is to work with lawyers and the court systems if educational funding of AAC systems is not forthcoming for an identified educational need.

Third-Party Funding (Insurance and Medicaid)

As with wheelchairs, some AAC devices are increasingly being recognized as medically necessary forms of "durable medical equipment." For years, most private and governmental medical coverage programs have been willing to pay for the purchase of wheelchairs and gradually are beginning to fund other assistive devices, including AAC systems, primarily under their durable medical equipment benefit rules. In addition to requiring a doctor's prescription (and possibly a letter of medical necessity), most third-party payers also require a written evaluation report by a speech-language pathologist. It is unfortunate that some insurance companies

will not pay for any follow-up assessments or follow-up therapy critical to learning how to use the device (even when the school provides the funding for the device).

Although in all states Medicaid will pay for AAC devices, wide variation exists in state Medicaid requirements, which limit the ability to obtain funding. The Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) program, which is a required part of every state Medicaid plan, could be used for funding of AAC systems, because under EPSDT, children are entitled to an "expanded scope of benefits."[40] However, a number of recent reports have underscored continuing problems with implementation of EPSDT programs in most states.[41] Some states have put considerable restrictions on the types, severity, or permanency of disabilities for people who can receive Medicaid payment for AAC systems. For example, Medicaid regulations in 1 state indicate that AAC is not covered for any person who can "functionally communicate verbally or through use of gestures," and the person needs to have a "permanent" disorder.[42] As mentioned before, pointing and gestures are very limiting and are not efficient communication methods.

The parent or guardian of any child who receives Medicaid benefits always has the legal right to challenge any decision made by a state Medicaid program, including denial of payment for therapy services or cost of repairing an AAC device. The appeal process involves requesting an administrative hearing, a process that varies from state to state. If there is an unfavorable decision made from this hearing, an appeal can be made to state and federal courts; such appeals have been successful occasionally.

Most state Medicaid programs will not fund AAC unless it is medically necessary to treat a permanent inability to communicate through oral speech. In some children who have communication impairments (eg, posttraumatic head injury), there may not be any "proof" that they are permanently disabled. Another source of reticence from Medicaid and other funding sources can be the minimal evidence for demonstrable short-term benefits. Long-term benefits could be substantial but may also be difficult to measure and may be mainly the result of improved mental health, self-esteem, and independence.

Referrals and Prescriptions

Pediatricians are often called on to make referrals, sign prescriptions, and write letters of medical necessity to help obtain funding both for the devices and the assessments. A letter of medical necessity should be written only after conferring with members of the team who have evaluated the child (especially the speech-language pathologist). This letter should state that the physician received the evaluation reports, reviewed the recommendations, and concurs that the recommended devices are medically necessary for treatment of the child's communication impairment caused by the specific diagnosis. For some agencies, information about the child's current status and expected outcome after using the device must also be included (but this information is often part of the report from the speech-language pathologist). The funding agency needs more than just a report of the physical examination or diagnoses. Government agencies, private insurance companies, and charitable organizations all have limited funds, and requests that include the most complete and clear information are the most likely to be funded. Medicaid payers in many states and some insurance companies have set up specific requirements for a detailed evaluation report by a licensed speech-language therapist to accompany the prescription or medical-necessity letter that is signed by the physician.

Funding Overview

Obtaining funding requires perseverance. Sometimes, a request for an AAC device is denied because the funding agency has never had any experience with such a device. However, denials of funding by most agencies are subject to appeal. The appeal process in these situations should not be taken lightly. The denial letter may include reference to the specific statements made in the insurance policy. This can often be the starting point of an appeal letter by the family. Often, the speech-language pathologist, pediatrician, or other advocate can offer a supportive letter for this appeal. An appeal is most likely to be successful if it can be shown that a child can benefit significantly from using the particular device. Failure of an appeal can sometimes make funding for a particular device (or even any device) unlikely, if not impossible, for other children with similar disabilities. Therefore, a successful appeal can be used as an important precedent for future requests. AAC devices and their related professional services are relatively new and specialized, and they sometimes are not included on lists of approved products eligible for funding. Funding agencies may benefit from instruction about the potential of these devices to improve functioning and independence for children who have disabilities. Many companies that make AAC devices also have their own funding specialists on staff who can be helpful in dealing with insurance companies or other agencies.

Because funding for the purchase of devices and funding for training and monitoring in the use of AAC devices are difficult to obtain, the multidisciplinary team may need to develop insightful strategies to obtain funding for even the simplest low-tech devices. Literature is becoming available that focuses on the specifics of funding for devices and their long-term cost-effectiveness.[43–45]

Unfortunately, there is no final answer to the conundrum of who should pay, and funding often requires a good deal of patience and creativity. In some cases, the final possible source of funding, when other options have been exhausted, may be local philanthropic organizations (eg, United Cerebral Palsy, Easter Seals, various social organizations). It is possible that additional improvements in regulations or expansions of state Medicaid-based programs (such as enforcing EPSDT rules) will also lead to more availability of AAC devices for children who need them. In addition, particularly if grass-roots efforts succeed, Medicaid rules may also be expanded to more closely parallel the rules now being implemented within Medicare (because of the recent regulations made in Medicare mentioned previously). However, this might lead, once again, to the apparently common situation in which Medicaid rules may some-

times be more permissive in funding AAC and other devices for children and youth with special health care needs than are insurance programs, which sometimes contractually consider them "noncovered" benefits (eg, for children who have autism spectrum disorders).[40]

Advocacy Information

Technology advances quickly, and it is rare that a pediatrician can stay current with all new developments. Pediatricians, however, should serve as informed advocates. Families of children with disabilities may have very high expectations about AAC and other assistive technology. They may try to find answers to their concerns and questions with or without support from health care professionals. Pediatricians often have a critical role in this process, because caregivers, patients, or allied health professionals may request their opinion or prescriptions for some of these devices. To be able to provide realistic and appropriate answers, pediatricians should keep generally informed about what is being developed and marketed and, more importantly, what local resources are available to provide more information and access to a proper assessment.

Fortunately, there are readily accessible sources of information that can provide current information about assistive technology (see Appendix). An important resource for specific materials, such as examples of medical-necessity letters, is the AAP National Center for Medical Home Initiatives for Children With Special Needs. The National Assistive Technology Technical Assistance Partnership oversees the federally mandated but state-funded "Assistive Tech" projects. These state projects are excellent information hubs and can refer individuals to appropriate service providers. Various organizations that deal with children with disabilities, such as the Council for Exceptional Children and others, have also developed services that can be used to obtain references and abstracts about many facets of disability, especially with regard to school-related services. There are increasing numbers of Internet sites that offer resources for using assistive technology with children, although some of them are thinly veiled advertisements from companies or groups that may propose "alternative therapies." The Appendix contains a list of selected sources for information retrieval.

CONCLUSIONS

Children with disabilities can benefit considerably from assistive technology, perhaps sometimes more than adults with similar problems, because assistive technology can help to maximize children's developmental potential. Financial and societal barriers currently prevent the equitable distribution and application of this technology, especially for AAC systems. Many jobs are now becoming available for adults who have physical and communication disabilities. Jobs such as editing, writing, and computer applications do not depend on speed of output as much as good judgment and reasoning abilities. Children who have severe physical and communication impairments but good cognitive skills should be able to look forward to a degree of independence in adult life with the possibility of an occupation that is personally rewarding and provides financial security. Their ultimate success, however, depends on what tools they are given as children.

The future will bring many new and useful devices that can help a child who has a communication disability be more functional. Appropriate use of the entire spectrum of AAC systems and devices for children who have communication disabilities is needed, is supported by several federal and state laws, and is ethically proper.

GOALS AND GUIDANCE

1. As part of the medical home, pediatricians should identify all children who have communication problems and refer them for appropriate evaluations.
2. As a part of providing the medical home, primary care pediatricians should recognize their roles in advocacy and care coordination for children who have communication disabilities.
3. Pediatricians should ensure that all children with communication disabilities have access to appropriate AAC systems, including complete evaluations, training, and monitoring by professionals (eg, speech-language pathologists and occupational therapists) and acquisition of appropriate devices.
4. Pediatricians should advocate for the appropriate funding of AAC and related services for children with communication impairments at local, state, and federal levels. Barriers to funding must be addressed. There is a critical need for Medicaid funding of AAC and AAC evaluations to be based on a more uniform policy and funding stream, such as what has recently occurred with Medicare Part B, rather than extremely variable state-by-state decisions.
5. Care-coordination efforts by pediatricians and other health care professionals, a crucial part of the provision of a medical home, should be paid for by third-party payers.
6. All pediatricians, including subspecialists, who are vital to the child's medical home, university and tertiary care centers, state Title V agencies, school districts, state agencies, and insurers should work cooperatively and collaboratively to improve appropriate access to AAC devices and programs.
7. Pediatricians should provide guidance, information, and support for families of children with communication impairments to act as advocates and care coordinators for their children.
8. Pediatricians caring for children with communication disabilities should assist parents in discussions with school personnel and child care personnel to ensure that any communication system or device that is being used in educational settings can also be used in the home and other family-oriented settings.
9. Pediatricians should advocate for research to be directed toward new approaches to the assessment of children who have communication disabilities and evaluation of the effects of using AAC devices (especially VOCAs).

10. Pediatric residents should receive appropriate training in the assessment of children who have communication disabilities so that they are properly prepared to diagnose, manage, and coordinate care for children with communication disabilities and advocate for these children and their families.

APPENDIX: RESOURCES

National Organizations

American Speech-Language-Hearing Association, 10801 Rockville Pike, Rockville, MD 20852; www.asha.org; 301-897-5700

National Institute on Deafness and Other Communication Disorders, National Institutes of Health, 31 Center Drive, MSC 2320, Bethesda, MD 20892–2320; www.nidcd.nih.gov; 800-241-1044

Internet Resources

AAP Department of Practice, Division of Health Care Finance and Quality Improvement (a resource to assist pediatricians with helping families to obtain coverage for needed services including speech/language and other therapeutic services); http://aap.org/moc/reimburse/codingrbrvsresources.htm

AAP National Center of Medical Home Initiatives for Children With Special Needs (training programs and materials and other resources for pediatricians including materials to help with care coordination for children who need assistive devices); www.medicalhomeinfo.org/training/compindex.html

Assistive Technology Law Center, SGD Funding Solutions (provides information about resources and programs that provide funding for AAC, especially SGDs); www.aacfundinghelp.com

ATOMS (Assistive Technology Outcomes Measurement System) Project (an academic, research-based resource for measuring outcomes of the use of assistive technology); www.r2d2.uwm.edu/atoms

Council for Exceptional Children (a site with broad uses including references to laws and links to agencies [including CEC-Canada]); www.cec.sped.org/AM/Template.cfm?Section=Home

Hattie B. Munroe Barkley Memorial Augmentative and Alternative Communication Centers (resources and links for AAC, including specific Web sites for AAC uses with young children and early intervention [the YAACK program]); http://aac.unl.edu

National Assistive Technology Technical Assistance Partnership (NATTAP) (provides technical assistance to the 56 state and territory assistive technology programs as authorized under the Assistive Technology Act of 1998); www.resna.org/taproject

National Organization Caring for Kids (NOCK) (provides grants for AAC devices for children with severe communication impairment caused by a chronic illness [another part of NOCK provides wheelchairs]); www.nockonline.org; 253-851-6625

Net Connections for Communication Disorders and Sciences. An Internet Guide (by Judith Maginnis Kuster). This site includes valuable resources for professionals and students in communication disorders and sciences as well as for persons with communication disorders. www.mankato.msus.edu/dept/comdis/kuster2/welcome.html

United States Society for Augmentative and Alternative Communication (an "organization dedicated to supporting the needs of people who rely on AAC devices, as well as the professionals, [and others] . . . making up our community"); www.ussaac.org

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Linda J. Michaud, MD, and the Committee on Children With Disabilities

Prescribing Therapy Services for Children With Motor Disabilities

ABSTRACT. Pediatricians often are called on to prescribe physical, occupational, and speech-language therapy services for children with motor disabilities. This report defines the context in which rehabilitation therapies should be prescribed, emphasizing the evaluation and enhancement of the child's function and abilities and participation in age-appropriate life roles. The report encourages pediatricians to work with teams including the parents, child, teachers, therapists, and other physicians to ensure that their patients receive appropriate therapy services. ***Pediatrics*** **2004;113:1836–1838;** ***children with motor disabilities, physical therapy, occupational therapy, speech-language therapy.***

BACKGROUND

Pediatricians commonly are asked to evaluate children with motor disabilities and to write prescriptions for physical, occupational, and speech-language therapy services. Although many states require a physician's prescription for such services, many physicians have limited formal education about these therapeutic interventions.[1]

The spectrum of motor impairments affecting function in children and adolescents is wide and comprises many congenital and acquired conditions, primarily involving the neurologic and musculoskeletal systems, including but not limited to cerebral palsy, traumatic brain injury, myelomeningocele, spinal cord injury, neuromuscular disease, juvenile rheumatoid arthritis, arthrogryposis, and limb deficiencies. These conditions are associated with motor impairments including muscle weakness, abnormal muscle tone, decreased joint range of motion, and decreased balance and coordination. There are variations in severity within each of these conditions. Many children with impairments attributable to these conditions will have some degree of disability that may limit their participation in age-appropriate activities at home, in school, and in the community and should benefit from physical, occupational, and/or speech-language therapy services.

The pediatrician needs to understand the role of physical, occupational, and speech-language therapists in the overall treatment of children with motor disabilities and the therapeutic interventions that may improve function and participation.[2,3] If the child has motor problems severe enough to interfere with mobility, self-care, or communication, therapists may provide a program to help the child ameliorate, compensate for, or adapt to the impairment or disability. Physical, occupational, and speech-language therapists, working with the family, child, physician, and teacher, promote a positive functional adaptation to impairment or disability in the context of the child's developmental progress.

Physical therapists focus on gross motor skills and functional mobility, including positioning; sitting; transitional movement such as sitting to standing; walking with or without assistive devices (eg, walkers, crutches) and orthoses (braces) or prostheses (artificial limbs); wheelchair propulsion; transfers between the wheelchair and other surfaces such as a desk chair, toilet, or bath; negotiation of stairs, ramps, curbs, and elevators; and problem-solving skills for accessibility of public buildings. Physical therapists often have responsibilities for procuring adaptive equipment related to ambulation, positioning, and mobility.[4–6]

Occupational therapists focus on fine motor, visual-motor, and sensory processing skills needed for basic activities of daily living such as eating, dressing, grooming, toileting, bathing, and written communication (handwriting, keyboard skills).[7] Occupational therapy services may include training in school-related skills and strategies to help children compensate for specific deficits.[7]

Speech-language pathologists address speech, language, cognitive-communication, and swallowing skills in children with disabilities.[8] Speech therapy is the therapy most commonly prescribed by pediatricians.

The services that can be provided by physical and occupational therapists and speech-language pathologists overlap. For example, a physical or occupational therapist can address motor delay or dysfunction in the very young child. Depending on the community, occupational therapists or speech-language pathologists may address deficits in oral motor skills associated with feeding dysfunction related to motor disability. Occupational therapists and/or speech-language pathologists provide expert consultation related to adaptive equipment, environmental modifications, and assistive technology devices such as environmental control units, augmentative communication systems, adapted computers, and adaptive toys.[6]

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

EVALUATING THE EVIDENCE

The therapeutic methods, frequency and duration of service, setting in which the service is delivered, and service delivery system vary.[9] Evaluating the efficacy and effectiveness of therapy for motor disability is difficult, because treatment is not a standardized, readily quantifiable process that can be prescribed in discrete, consistent units. Individualized therapy programs vary in many parameters and incorporate subjective as well as objective elements. Clear documentation of efficacy related to the variable parameters of therapy continues to be elusive. This problem may in part reflect difficult methodologic issues including the measurement of treatment-related change on a background of developmental maturation, the establishment of appropriate outcome criteria, heterogeneity of the populations involved, and the complex nature of the interventions.[10,11]

A recent review of the evidence to support the effectiveness of neurodevelopmental treatment for children with cerebral palsy indicates that this popular method of intervention does not confer an advantage over the alternatives with which it has been compared in altering abnormal motor responses, slowing or preventing contractures, or facilitating more normal motor development or functional motor activities, nor does more intensive neurodevelopmental treatment result in greater benefit.[12] Physical therapy alone was found in 1 well-designed study to be less effective in improving motor development after 1 year than the therapy incorporating developmentally appropriate play and learning skills for children younger than 3 years with motor impairment.[13]

Improvement in motor function is more likely to occur when the goals of therapy are specific and measurable[14] and established in partnership with the child's parents and other caregivers. Intensive amounts of physical therapy may confer no advantage over routine amounts of therapy,[15] and long-term therapy may confer no advantage over short-term therapy. Provision of a home exercise program, with instruction of family members and caregivers in therapeutic exercises and age-appropriate activities to meet the child's goals, is generally indicated. This program can include recommendation of participation in sports to increase endurance, strength, and self-esteem in a natural setting with peers.[16] Aquatic therapy, hippotherapy (horseback-riding therapy), and participation in karate, gymnastics, and dance classes in integrated or special classes also can be considered to meet the child's therapeutic goals. Parent and caregiver education by all therapists is critical in effective partnerships with families for implementation of therapy programs.

Some programs such as patterning have little effect on functional skills and are inappropriate for children with motor disabilities.[17] Scientific legitimacy has also not been established for sensory integration intervention for children with motor disabilities.[18]

Prescribing therapy services for children with motor disabilities clearly cannot be based entirely on sound scientific evidence. As the knowledge base is expanded related to the effectiveness of therapy interventions, evidence-based practice described as using the best available evidence, along with clinical judgment, and taking into consideration the priorities and values of the individual patient and family in a shared decision-making process, as outlined by the Institute of Medicine, is advised.[19]

SERVICE DELIVERY

Therapies for a child with motor impairment are required to be provided by the school if the disability interferes with the educational process.[20] Recently, managed health care has made it more difficult for children with special needs to receive therapy services outside of school, with insurance companies denying services for children who attend school, maintaining that therapy is mandated at school and is partially funded with education and third-party monies.[9] Therapy services at school for students who are eligible for Medicaid and whose disabilities are medically based can be reimbursed by Medicaid if the disability has an adverse effect on the child's ability to benefit from the educational program.[9] Services also may be provided in environments other than the hospital or school, as appropriate for the child's individual circumstances; such other environments include child care, home, or job settings.

THE PEDIATRICIAN'S ROLE

The pediatrician's responsibility in writing a prescription for therapy includes providing an accurate diagnosis when possible. When the exact cause of the disability is not apparent, the physician must provide an accurate description of the medical condition and note whether the child has a transient, static, or progressive impairment. In addition to the primary motor disorder, all potential associated problems such as learning disabilities, mental retardation, sensory impairment, speech disorders, emotional difficulties, and seizure disorders must be identified, and a care plan must be recommended. There are some children with special needs whose medical conditions may be affected adversely by movement or other specific therapeutic activities; therapists and caregivers should be advised to take appropriate precautions with these children.

The physician's prescription for therapy should contain, in addition to the child's diagnosis: age; precautions; type, frequency, and duration of therapy; and designated goals. Goals for physical, occupational, and speech-language therapy do not depend solely on the diagnosis or age of the child, and they are most appropriate when they address the functional capabilities of the individual child and are relevant to the child's age-appropriate life roles (school, play, work).[9] The pediatrician should work with the family, child, therapists, school personnel, developmental diagnostic or rehabilitation team, and other physicians to establish realistic functional goals.[20] The pediatrician can assist families in identifying the short- and long-term goals of treatment, establishing realistic expectations of therapy out-

comes, and understanding that therapy will usually help the child adapt to the condition but not change the underlying neuromuscular problem. Pediatricians should be encouraged to seek and use expert consultation as in any other area of medicine. Helpful resources may include local and regional diagnostic and intervention teams, early intervention and developmental evaluation programs, developmental pediatricians, pediatric physiatrists, pediatric neurologists, pediatric orthopedists, and orthotists.

Regular communication among parents and other caregivers, therapists, educators, and prescribing physicians should be ongoing, with periodic reevaluations to assess the achievement of identified goals, to direct therapy toward new objectives, and to determine when therapy is no longer warranted.[21] Changes in the child's status (eg, surgical intervention, school-to-work transition warranting assistive technology intervention) may indicate resumption of specific short-term, goal-directed services.

SUMMARY

Successful therapy programs are individually tailored to meet the child's functional needs and should be comprehensive, coordinated, and integrated with educational and medical treatment plans, with consideration of the needs of parents and siblings. This can be facilitated by primary care pediatricians and tertiary care centers working cooperatively to provide care coordination in the context of a medical home.[22,23]

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TECHNICAL REPORT

Preservation of Fertility in Pediatric and Adolescent Patients With Cancer

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ABSTRACT

Many cancers that present in children and adolescents are curable with surgery, chemotherapy, and/or radiation therapy. Potential adverse consequences of treatment include sterility, infertility, or subfertility as a result of either gonad removal or damage to germ cells from adjuvant therapy. In recent years, treatment of solid tumors and hematologic malignancies has been modified in an attempt to reduce damage to the gonads. Simultaneously, advances in assisted reproductive techniques have led to new possibilities for the prevention and treatment of infertility. This technical report reviews the topic of fertility preservation in pediatric and adolescent patients with cancer, including ethical considerations.

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Key Words
fertility, infertility, cancer, cancer survivor, late effects, childhood

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INTRODUCTION

During the past 40 years, survival rates from many childhood cancers have increased dramatically.[1] Approximately half of childhood cancers are hematologic malignancies (leukemia and lymphoma), and the anticipated long-term survival for children with these disorders is now greater than 75%. Improvements in prognosis and survival have also been observed for many other childhood malignancies, including Wilms' tumor, malignant bone tumors, and rhabdomyosarcomas. The relative 5-year survival rate for all childhood cancers combined is 78%.[2] It has been estimated that approximately 200 000 people who reside in the United States are survivors of childhood cancer.[3]

Past and contemporary treatments for childhood cancer can affect future fertility. For purposes of this discussion, sterility is defined as the inability to conceive a pregnancy naturally in the absence of clinical interventions.[4] Clinical infertility is recognized as the inability to conceive after 1 year or more of unprotected intercourse during the fertile phase of the menstrual cycle.[5,6] The baseline incidence of sterility is estimated at 1% of the general population, and this percentage does not change with age during the window of reproductive potential. Fertility begins to decline when women reach their late 20s and when men reach their late 30s.[4] The prevalence of infertility is estimated at 8% for women aged 19 to 26 years and gradually increases to 18% for women aged 35 to 39 years. This compares with an increase from 18% if the male partner is 35 years old to 28% if the male partner is 40 years old. The risks of infertility after cancer treatment variably affect these numbers depending on the type of malignancy and its specific treatment.[7]

NORMAL PHYSIOLOGY AND POTENTIAL FOR FERTILITY

The differences in the male and female reproductive systems influence available options for fertility after cancer treatment.[2,8] Spermatogenesis begins in the prepubertal male, although spermatogenesis and steroidogenesis are functions of the adult male testes.[9] Meiosis is a relatively early event that is completed by the time of maturation to spermatids. Spermatogenesis depends on the capacity of the totipotential stem cells to undergo self-renewal and provide progeny that mature into viable spermatocytes. Postmeiotic spermatocytes occasionally may be seen in children as young as 4 years. Prepubertal boys have not yet developed gametes. Spermarche (the release of spermatozoa) is an early- to midpubertal event that precedes the ability to produce an ejaculate and is associated with age-appropriate gonadotropin production.[10,11] There is a large variation in the stage of maturity among 13- to 18-year-old boys with respect to seminal plasma. Once sperm are present, sperm quality does not seem to be affected by patient age. In at least 1 study, sperm concentration, motility, and morphology showed the same pattern in 12 pubertal boys with cancer who were 14 to 17 years of age as in 210 men with malignancies who were older than 20 years.[12,13] Spermaturia is present in 1% to 2% of boys at 11 years of age, 15% to 37% at 12 to 13 years of age, and 24% to 69% at 14 years of age.[14]

It is generally accepted that in females, oocyte production ceases during fetal development, with a finite number of oocytes present at birth.[15] A few oocytes will be released during reproductive life as a consequence of ovulation, and most will be lost as a result of atresia.[16] Although recent animal studies have suggested that primordial germ cells in vitro are capable of forming oogonia and follicle-like structures[17] and that ovarian regeneration may occur from stem cells or arise from stem cells in the bone marrow,[18] these studies are problematic. They have been performed in rodents (interspecies differences can be profound), and evidence that fertility can be modified through these techniques is limited or lacking (even in rodents).[19]

RISK OF INFERTILITY AFTER TREATMENT

Most children treated for cancer now can be expected to be cured and remain fertile,[20] although many contemporary treatment modalities for childhood cancer can affect fertility. Several large studies have evaluated the fertility outcome of childhood cancer survivors. During the 1970s, a multicenter study of 5-year survivors of solid tumor cancers and Hodgkin's disease who were diagnosed before they were 20 years of age demonstrated a 15% incidence of impaired fertility, with problems more prevalent in boys than in girls.[21] Subsequent follow-up studies of childhood, adolescent, and young adult cancer and bone marrow transplant survivors have further defined variables associated with decreased fertility after cancer treatment.[22] These variables include (1) older age and/or developmental maturity of the patient at the time of therapy,[23] (2) the type of therapy,[24] (3) the site of therapy, and (4) gender. For example, the administration of alkylating agents seems to involve more of a risk of infertility in boys compared with the same therapy administered to girls,[21] although the alkylating agents destroy the primordial ovarian follicles in a dose-dependent manner.[25]

The dose of chemotherapy that will render a patient sterile will vary with his or her age and developmental maturity at the time of therapy.[26–28] Older children are more likely to be left infertile. In addition, gonadal toxic effects of chemotherapy during therapy will vary with the type of chemotherapeutic agent, dose, and schedule of administration.[1] Agents that are more likely to pose a risk to gametes include alkylating agents, cytarabine, vinblastine, cisplatin, and procarbazine, among others. Participation in therapeutic clinical trials allows concurrent assessment of efficacy and risk, with the ultimate goal of reconsidering and adjusting regimens so that efficacy is preserved and risks are reduced.

Follow-up studies of sperm production and gonadal function performed on adolescent and young adult male survivors of Hodgkin's disease have shown that both the chemotherapeutic regimen and dose intensity are important variables that affect reproductive potential. Adolescent boys and young men treated for Hodgkin's disease with 6 cycles of chemotherapy, including nitrogen mustard, vincristine, prednisone, and procarbazine, had a greater than 90% risk of infertility, primarily attributable to azoospermia.[29,30] In contrast, azoospermia occurred in only 50% of patients receiving 3 cycles or fewer[29] and in 33% of patients treated with an alternative regimen of adriamycin, bleomycin, vinblastine, and dacarbazine.[1]

The effect of chemotherapy on ovarian function and subsequent recovery is often unknown. In addition to infertility, female survivors of childhood cancer may be at risk of premature ovarian failure or early menopause.[31] Risk factors include institution of therapy after the onset of puberty, administration of alkylating agents such as procarbazine and cyclophosphamide, and the delivery of radiation therapy at doses of 1000 cGy and higher to the region of the ovaries.[25,32] The relative risk of early menopause is also significantly greater for women who have received a combination of alkylating therapy and radiation therapy below the diaphragm, compared with either modality alone.[23,31]

For radiation therapy, variables for infertility risk also include the (1) age and developmental maturity of the patient, (2) dose and fractionation of therapy, and (3) site of radiation therapy. The oocyte median lethal dose for radiation therapy is less than 2 Gy,[33] and sperm production is susceptible to damage at doses of more than 1.2 Gy.[28,34] Testicular Leydig cell function seems to be present at radiation doses up to 20 Gy.[2]

Recognizing the risks associated with both radiation and chemotherapy, the American Society of Clinical Oncology[35] has recommended that oncologists address the possibility of infertility with patients treated during their reproductive years and be prepared to discuss fertility-preservation options or refer patients to reproductive specialists as indicated. However, there is not consensus or direction on when the age of reproductive potential actually occurs or at what age patients should be referred, making it unclear how these recommendations should apply to patients with cancer who are younger than 18 years.

The issues related to considering preservation of fertility in patients younger than 18 years include whether the gonads or gametes have achieved reproductive potential and limitations of the patient and/or partner to understand or consent to necessary procedures. Before considering the unique circumstances of pediatric patients with respect to these issues, it is important to understand what options for fertility preservation are available.

PRESERVATION OF NATIVE GONADAL TISSUE DURING TREATMENT

Males

Before puberty, the only theoretical methods available for gonadal and gamete preservation involve hormonal and other manipulations to protect the testes from injury during cancer treatment. Primordial sperm cells are susceptible to toxicity at all stages of life. Gonad shielding can be used during radiation therapy but is only possible with selected radiation fields and anatomy.[35] The gonad(s) can also be temporarily relocated outside of the radiation field to either the thigh or the anterior abdominal wall.[36,37] In all studies to date, no effective interven-

tion has been identified. Gonadal protection through hormone manipulation has been evaluated only in small studies of patients with cancer and is uniformly ineffective in either preserving fertility or speeding recovery of spermatogenesis.[35] Animal studies suggest that testicular cryopreservation, autotransplantation, xenotransplantation, and in vitro maturation may be successful methods of fertility preservation, but most of these methods have yet to be tested in humans.[2] Human spermatocytes have been matured in vitro to mature spermatids, resulting in at least 1 pregnancy.[38] Testicular-tissue cryopreservation has been reported in 2 boys, with only spermatogonia (ie, cells that are the progenitors of spermatocytes) detected in 1 specimen.[39] The options for this specimen in the future include in vitro maturation or germ-cell transplantation.

Females

Gonad shielding during radiation therapy and oophoropexy to divert the ovaries from the radiation field are potential strategies for preserving ovarian function during treatment.[25,40] Although ovarian transposition is relatively effective at preserving the endocrine function of the ovary (in approximately 60% of cases), only approximately 15% of patients who wish to become pregnant ever achieve this goal.[25] There are also potential means of preserving ovarian function in selected cases of reproductive tract malignancy, including more conservative surgery for certain early-stage tumors and choosing chemotherapeutic agents that have less gonadal toxicity.[41] Germinal and stromal tumors of the ovary are more common in young women and children. Stage Ia dysgerminoma may be managed with unilateral adnexectomy and preservation of the uterus and contralateral adnexa. Early-stage epithelial ovarian cancer (stage Ia), which is less common in children and adolescents, may be managed with unilateral ovariectomy,[25,42] which preserves the chance of natural pregnancy. The overall prognosis for stage I borderline tumors of the ovary is good, and most authors have concluded that conservative treatment increases the risk of recurrence but does not increase the mortality rate.[41,42]

Uterine choriocarcinoma is seen in young people. Tumors with a good prognosis are managed with single-agent chemotherapy by using agents such as actinomycin D or methotrexate, and subsequent fertility rates are reported to be good.[25]

Recently, there has been speculation that concomitant treatment with gonadotropin-releasing hormone analogs may be a promising approach for preventing ovarian failure induced by cancer therapy. The gonadotropin-releasing hormone analog may protect against chemotherapy-induced follicular depletion, thus preserving primordial follicles. Although some studies have been performed in adult patients with cancer, these studies have not yet been extended to children.[43] However, a recent review on this topic in adults concluded that the effectiveness of the intervention is controversial.[44]

FERTILITY PRESERVATION BEFORE TREATMENT

The options for fertility preservation before treatment are different depending on gender. Boys have more available options that are less invasive, less expensive, and more effective and do not require their choosing a partner at the time that they avail themselves of fertility preservation.

Males

Sperm cryopreservation after masturbation is the most established and effective method of fertility preservation in males.[35,45] Sperm should be collected before initiation of cancer therapy because of the risk that sperm DNA integrity or sample quality will be compromised. Underlying sperm quality may be poor for patients with certain cancer types, including testicular cancer, leukemia, and Hodgkin's disease.[46] Nevertheless, recent progress in andrology laboratories and with assisted reproductive techniques allows successful freezing and future use of a very limited amount of sperm, even in cases such as these.[47] Collection of semen through masturbation in adolescents may be compromised by embarrassment and issues of informed consent.[48] Alternative methods of obtaining sperm besides masturbation include testicular aspiration or extraction, electroejaculation under sedation or anesthesia,[49] or from a postmasturbation urine sample.[48] Testicular aspirates do not freeze well and cannot be used as a method of preserving sperm. Published success in creating a viable embryo that results in a living child with any of these methods is limited to case reports.

Females

The collection of mature oocytes requires ovarian stimulation, has been used only in adult patients to date, and may be contraindicated if a cancer is estrogen sensitive.[45,50,51] Because of their large size, water content, and chromosomal architecture, mature female oocytes are extremely fragile. The spindle apparatus of the chromosome is easily damaged by intracellular ice formation during the freezing or thawing process.[52] Therefore, the number of pregnancies resulting in successful deliveries after using cryopreserved oocytes has been small. In addition, because the number of infants born from frozen oocytes is small, information on the health outcomes of children born as a result of this technique versus other techniques of advanced reproductive technologies is lacking.

Ovarian-tissue cryopreservation is a process in which normal, functioning ovarian tissue is excised from the ovary and stored cryogenically.[53–57] Currently, this technique is available only in certain parts of the United States as an experimental protocol until more can be learned about its safety and efficacy.[45] Within this context, it is the only method that can be offered to prepubertal girls.[50] There are a large number of immature oocytes in the ovarian cortex at this age, when the primordial follicles contain prophase I oocytes. This technique has been accomplished in children as young as 2.7 years of age, and the chance of later restoring fertility should be higher, theoretically, because the ovarian cor-

tex contains an increased number of primordial and primary follicles in younger children.[50] Ideally, the stored ovarian tissue is thawed and autotransplanted into the donor once treatment has been completed.[58] However, although the efficiency of ovarian-tissue autografting and/or in vitro maturation has been demonstrated in animals, studies in humans are still in their infancy.[59,60] Recently, successful pregnancies have occurred in cancer survivors after autotransplantation of cryopreserved ovarian tissue.[61,62]

Embryo cryopreservation is an established technique with acceptable pregnancy rates, but its use is limited to females who are either involved in a stable relationship or willing to identify a known or anonymous donor because of the need for sperm.[54] The need for ovarian stimulation theoretically precludes this option for women with estrogen-sensitive tumors, although the use of aromatase inhibitors during stimulation has been proposed as a way of mitigating this concern.[57]

EXPERIMENTAL ANIMAL STUDIES WITH ONCOFERTILITY POTENTIAL

Investigators have developed in vitro three-dimensional follicle-culture systems that mimic the stromal microenvironment of the ovary to produce meiotically competent oocytes that are capable of being fertilized and resulting in live birth of viable murine offspring.[63] Other investigators have shown that bone-marrow transplantation restores oocyte production in wild-type mice sterilized by chemotherapy,[18] although these studies have yet to be duplicated. Daley[64] recently reviewed the prospects of gametogenesis from embryonic stem cells and noted that clinical use of embryonic stem cell–derived gametes seems temporally remote. However, this technology would theoretically eliminate the need to worry about gamete or gonadal preservation before therapy. Although experimental, these techniques have potential in oncofertility.

COSTS OF FERTILITY PRESERVATION

The costs of fertility preservation are unlikely to be covered by insurance,[65] although the psychological distress and effects of infertility are well documented.[66,67] Therefore, patients and their families become responsible for all of the costs. Although some techniques are considered experimental and are, therefore, of unproven benefit, sperm preservation is a technique that has been used for many years and has associated benefits and a record of success that would allow for a change in coverage for this option.

The cost of sperm cryopreservation after masturbation was estimated in 2006 at approximately $1500 for 3 samples stored for 3 years, with additional costs incurred if alternative methods were needed to obtain sperm or for prolonged storage.[35]

The costs of ovarian-tissue preservation can be separated into 3 parts: (1) the procedure to retrieve the tissue, generally laparoscopy and attendant anesthesia[68]; (2) ovarian-tissue pathologic evaluation and freezing; and (3) the annual cost of ovarian-tissue storage. This cost estimate does not include the initial screening and evaluation costs performed before in vitro fertilization or the costs of estradiol testing during therapy (typically 5 blood tests at approximately $200 per sample). Egg retrieval, anesthesia, egg cryopreservation, and the first year of frozen-egg storage costs can be estimated at $5538 (Thomas Toth, MD [Vincent Reproductive Endocrinology Service, Massachusetts General Hospital, Boston, MA] written communication, March 17, 2006). Laparoscopic procedures, even in children, often can be performed on an outpatient basis, precluding any inpatient hospitalization cost.[58] The cost of ovarian-tissue freezing alone might be similar to that of freezing of testicular sperm after testicular dissection (see previous discussion), and the annual cost of ovarian-tissue storage is similar to that of embryo cryopreservation,[50] which costs approximately $350 to $500 per year.[35] Assuming recovery of the patient after treatment, the costs will then include tissue thawing and the procedure for autotransplantation, subsequent medications/hormones, and laboratory testing. The cost of subsequent thawing, culture, fertilization, and embryo transfer followed by 1 pregnancy blood test can be estimated at $3162. Separate costs would include the medication costs necessary for cycling at $2000 to $4000 per cycle, and $330 per ultrasonographic examination. The need for more sophisticated assisted reproduction techniques, such as intracytoplasmic sperm injection, would add additional costs. Use of ovarian suppression with gonadotropin-releasing hormone analogs or antagonists to ovarian tissue during chemotherapy or radiation therapy costs approximately $500 per month.[35]

ETHICAL ISSUES

Fertility preservation raises several ethical issues, including disclosure of the reproductive consequences of therapy, evidence regarding the options for fertility preservation in the setting of available techniques, cultural issues, the consent process,[20,69] and the dilemma of counseling someone who has not yet reached adulthood to make decisions concerning his or her reproductive health while facing the treatment of a life-altering disease.[70] Recognizing that fertility preservation may create both burdens and opportunities for patients with cancer, discussions regarding reproductive potential should take place in the context of maximizing the child's future options and well-being.

Recent surveys of adult male and female cancer survivors of reproductive age and studies evaluating oncology practice patterns for discussing infertility suggest that a conversation with patients with cancer on the infertility consequences of their treatment is lacking in more than half of cases.[35] Some physicians do not recognize the importance of this issue, assume that patients cannot afford fertility-preservation procedures, feel emotionally uncomfortable discussing the topic, or choose not to refer the patient because of the poor prognosis of the tumor.[50]

Most men who completed a survey given by Schover et al[71] felt that having experienced cancer increased the value they placed on family closeness and would make

them better parents. For men who desire children in the future, lack of timely information is the most common reason for not banking sperm. Making an appointment with the andrology laboratory usually is the responsibility of the patient and family. Chemotherapy induction may need to proceed expeditiously and may not allow the luxury of time for needed consultations and decision-making or may preclude the ability of the patient to provide more than 1 or 2 samples.[46] Facilitating the andrology laboratory visit and delaying the induction of chemotherapy, if possible, are 2 approaches that might be used in appropriate cases to increase the fertility options of cancer survivors. Some situations, however, are true medical emergencies (eg, respiratory compromise from a mediastinal lymphoma) or are significantly urgent to preclude even the short delay required for an andrology laboratory visit.

At the present time, ovarian-tissue preservation is limited to centers that perform research by using this technology, and it is considered experimental.[45,72] Offering the technique might provide some degree of comfort in light of a life-threatening diagnosis, because it offers an optimistic perspective for the future that may conform to a patient-centered philosophy of care. An alternative view is that the technique is not essential to the health and well-being of the child, provides unrealistic expectations because of the hope of survival and subsequent procreation, is ethically problematic, and may pose a significant financial or moral burden on the family. In addition, even offering the option to a vulnerable patient may create an additional burden, especially because refusal might be difficult in light of perceived expectations of the physician or family member. Another concern is that children might not be ready to use stored tissue for several years, and deterioration of the germ cells may occur over time.

With the exception of a heritable cancer syndrome, a history of cancer does not seem to increase the rate of congenital abnormalities or cancer in a man's offspring,[73] although some types of cancer pose a greater relative risk of ovarian or testicular metastasis, including leukemia and lymphoma. The safety of sperm preservation in boys with either of the latter disorders (ie, future risk to any offspring) has not been specifically studied. It has been suggested that patients with leukemia may have decreased sperm motility/function related to their illness.[47] Small studies have suggested a transiently higher rate of aneuploidy after chemotherapy and radiation therapy. The sperm of men before treatment may have poor DNA integrity, although in 1 reported cohort of pediatric cancer survivors, DNA integrity of sperm seemed similar to age-matched controls.[74] Ovarian metastatic involvement has been seen in childhood tumors, such as neuroblastoma, Wilms' tumor, lymphoma, osteosarcoma, Ewing sarcoma, and extragenital rhabdomyosarcoma,[75] and in adult women with breast cancer. In a child or adolescent with 1 of these tumors, there is not a specific contraindication to ovarian-tissue cryopreservation if it is available, but the potential risk of development of a metastatic tumor in the reproductive tract must be considered and fully disclosed to the patient and family before proceeding.[76]

Other issues that should be considered include the special circumstances that might be posed by specific religious beliefs or cultural values that preclude either discussing or allowing assisted reproductive techniques or that condemn masturbation.[65] The parent or guardian will most likely be transferring their beliefs to the clinical situation, and these beliefs may or may not represent the child's current or future interests. Individuals who will later be a partner in a marriage (whether arranged or not) may be adversely affected by decisions that are made for them by the patient's parents or guardians. In some cultures, a person's status in the afterlife may be culturally dependent on their ability to reproduce, which makes discussion of future reproductive options much more important. The condition of shyness may be perceived inappropriately as reticence and, thus, a full discussion of the options may be avoided. One study suggested that adolescent boys may be more successful at masturbation if a parent does not accompany them to the sperm bank.[48] Gay adolescents may decline to be involved because of reluctance to disclose their sexual preferences, although the desire to have children is not limited to heterosexual people.

There are fundamental differences between storing a gamete or ovarian tissue and storing an embryo. Embryo cryopreservation is a technique currently offered only to adults. The use of embryo cryopreservation is much different from ovarian preservation in terms of the product that it creates and the issues that it presents. Its use in children would not only be morally problematic from a procedural viewpoint (ie, is it morally acceptable under any circumstances to subject a minor to oocyte retrieval and in vitro fertilization?), but it also would introduce the ethical dilemma of divergent views about the moral status of a preimplantation embryo. Although not technically precluded, exercising this option would force the adolescent to make a mature decision not only about creating an embryo and choosing a partner or anonymous donor but also about future disposition, including the options of disposal, donation for research, or implantation of the embryo in a surrogate mother in the event of death. These are difficult and deeply unstable decisions for healthy adults with infertility and are likely to pose more difficulties for children with cancer. Other ethical issues include the future role of the partner in the decision-making process about the embryo(s) created in this process and what (if any) role the parent(s) or surrogate of the patient should have, both at the time of consent and for the future of the embryo(s). For the parent of the child, the act of preserving a child's life must take precedence over preservation of the possibility of that child's ability to have children, although the goals of each are intertwined.

Finally, consideration must be given to disposition of the sperm, oocytes, or ovarian tissue (in applicable cases) regardless of whether the child lives or dies.[51,65,77] Any procedure performed should be for the benefit of the child's reproductive future, and this must be addressed in the consent process. If the child lives, a decision must

be made relative to when he or she will have the necessary maturity and moral development to make a personal decision about what to do with the cryopreserved biological material. If the child dies, the parents should not have discretion over the biological material, and it should be destroyed.[78] The role that the child plays in this decision should be clearly defined, and questions must be posed and answered before acquisition of any biological specimen. These issues are not unique, have precedent in case law, and need to be addressed by any person who agrees to the preservation of tissue or gametes.[51]

ROLE OF THE PHYSICIAN

A physician's encouragement is a strong predictor of whether an optional intervention will be considered or conducted by a patient. The gesture of fertility preservation may be of great comfort for patients and their families and may assist them in managing the emotional trauma of the cancer diagnosis,[25] although the offer may also raise expectations.[69] Most younger patients with cancer have historically been left with significant anxieties and insufficient information about reproductive issues.[79] Oncologists have a responsibility to inform parents and age-appropriate patients about the likelihood that cancer treatment will permanently affect their fertility.[35] Ideally, the decision about candidacy for fertility preservation will be guided by an institutional policy and shaped by a medical team, including a pediatric oncologist, fertility specialist, ethicist, and mental health professional. Parents of minors and age-appropriate children should be informed of their prognosis in realistic terms. The option of adoption should be discussed. The success rates, costs, and experimental nature of specific assisted reproduction techniques and the acceptability of the option to decline the intervention should also be discussed.[69,80] The fertility specialist should lead an open and detailed discussion about ownership of reproductive tissue and/or a biological specimen in the event of the patient's death or incapacity.

There is no evidence that fertility-preservation options used today directly compromise the success of cancer therapy or adversely affect a survivor's health.[35] Other than hereditary genetic syndromes, large registry studies have also failed to demonstrate an increased risk of genetic abnormalities, birth defects, or cancers in the children of cancer survivors.[73,81] Disclosing this information to patients and families will provide reassurance of the potential value of fertility preservation. For families with hereditary conditions that are risk factors for developing malignancies, the development of preimplantation genetic diagnosis of embryos and prenatal diagnostic techniques may offer a way of minimizing the risk of transmitting cancer genes to offspring. The technique of preimplantation genetic diagnosis is controversial insofar as inherited disorders may be early or late in onset and, thus, may be ethically distinct. Although the onset of disease may be later in life, the American Society of Reproductive Medicine Ethics Committee has stated that it is ethical for couples to choose to screen embryos to avoid having children with high-risk cancers.[82]

GUIDANCE FOR COUNSELING OF PARENTS AND PATIENTS ABOUT PRESERVATION OF FERTILITY OPTIONS IN CHILDREN AND ADOLESCENTS WITH CANCER

Evaluation of candidacy for fertility preservation should involve a team of specialists, including a pediatric oncologist and/or radiation oncologist, a fertility specialist, an ethicist, and a mental health professional.

1. Cryopreservation of sperm should be offered whenever possible to male patients or families of male adolescents.
2. Current fertility-preservation options for female children and adolescents should be considered experimental and are offered only in selected institutions in the setting of a research protocol.
3. In considering actions to preserve a child's fertility, parents should consider a child's assent, the details of the procedure involved, and whether such procedures are of proven utility or experimental in nature. In some cases, after such consideration, acting to preserve a child's fertility may be appropriate.
4. Instructions concerning disposition of stored gametes, embryos, or gonadal tissue in the event of the patient's death, unavailability, or other contingency should be legally outlined and understood by all parties, including the patient if possible.
5. Concerns about the welfare of a resultant offspring with respect to future cancer risk should not be a cause for denying reproductive assistance to a patient.

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CLINICAL REPORT

Preventing and Treating Homesickness

Guidance for the Clinician in Rendering Pediatric Care

Christopher A. Thurber, PhD, Edward Walton, MD, and the Council on School Health

ABSTRACT

Homesickness is the distress and functional impairment caused by an actual or anticipated separation from home and attachment objects such as parents. It is characterized by acute longing and preoccupying thoughts of home. Almost all children, adolescents, and adults experience some degree of homesickness when they are apart from familiar people and environments. Pediatricians and other health care professionals are in a unique position to assist families in understanding the etiology, prevention, and treatment of homesickness. In the case of planned separations, such as summer camp, techniques are provided that may aid in prevention. In the case of unanticipated or traumatic separations, such as hospitalization, effective treatment strategies are available.

INTRODUCTION

Leaving home is a universal developmental milestone. The homesickness associated with this event is usually mild, but the distress and level of impairment among some homesick persons can become extreme. It is an ancient phenomenon, mentioned in both the Old Testament book of Exodus and Homer's *Odyssey*. The Greek physician Hippocrates (circa 460–377 bc) believed that homesickness was caused by a surfeit of black bile in the blood.[1] Seventeenth-century Swiss physician Johannes Hofer (1688) held that homesickness resulted from exposure to foreign environments. This exposure caused "vital spirits [to] constantly surge back and forth through the nerve fibers in which the impressions of the native land are stored."[2]

Today, there is a clearer sense of what causes homesickness and how it can be prevented and treated. Comprehensive historical[1,3,4] and contemporary[5,6] reviews of the literature are available.

DEFINITIONS, EPIDEMIOLOGY, AND DIAGNOSIS

Homesickness is defined as distress and functional impairment caused by an actual or anticipated separation from home and attachment objects such as parents. According to the taxonomy of the American Psychiatric Association, severe homesickness may be best classified as adjustment disorder with mixed anxiety and depressed mood (diagnostic code 309.28).[7,8] The defining feature of homesickness is recurrent cognitions that are focused on home (eg, house, loved ones, homeland, home cooking, returning home), and the precipitating stressor is always an anticipated or actual separation from home. Therefore, it is possible to distinguish homesickness from all other kinds of anxiety disorders, mood disorders, or adjustment disorders as well as from separation distress that young people may feel

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when caregivers leave home (eg, for work, military service, divorce, incarceration).[9,10] Homesickness may also be comorbid with other behavioral, emotional, cognitive, and physical problems that warrant clinical attention.

As noted, homesickness occurs to some degree in nearly everyone leaving familiar surroundings and entering a new environment. Recent research has confirmed that homesickness is a significant source of distress and impairment for young people at summer camps, boarding-school students, and hospitalized children.[6,11,12] Other populations frequently affected include immigrants, foreign students, foreign employees, displaced persons, refugees, and military personnel.[13–20]

Prevalence estimates of homesickness vary widely depending on how homesickness is defined, the population under study, the circumstances of the separation, and the type of measurement. For example, prevalence of homesickness among adolescent boarding-school students is estimated to range from 16% to 91%.[12] Because nearly all homesickness researchers have relied on retrospective self-reports, these wide-ranging prevalence estimates also reflect variation in people's recollection of bouts of homesickness. In studies in which researchers measured homesickness at the time the individual was in the new environment, a prevalence of 83% to 95% has been reported.[21,22] Prevalence rates measured while the subject was in the new environment were similar for children at summer camp[5] and hospitalized children,[11] with younger children being at greater risk. There seem to be no gender differences in the prevalence or intensity of homesickness,[9,22] nor are there cultural differences in the way individuals and researchers define the term "homesickness."[21,23]

Another way to examine the severity of homesickness is to look at the percentage of children who rate the average intensity of their homesickness at or above the midpoint of the research rating scale used. This measurement technique consistently categorizes approximately 20% of boys and girls away from home as moderately to severely homesick.[5,9,21,22] A much smaller percentage of children—between 6% and 9%—report intense homesickness that is associated with severe symptoms of depression and/or anxiety.[9,11,21,22]

Longitudinal changes in intensity of homesickness in children and adolescents also have been studied.[9,11,21,22] In summer camps as well as in hospitals, young people seem to fall into 1 of 2 groups. For the least homesick 80% of children, they begin their stay away from home with a low level of homesickness and maintain that low level throughout their time away. For the most homesick 20% of children, they begin their stay with an elevated level of homesickness, and the intensity increases over the course of several weeks, decreasing a bit just before reuniting with their caregivers. With preventive interventions, this trajectory can be altered significantly.[11] The longitudinal course of homesickness intensity for young people in other environments, such as refugee camps and foster homes, is unknown.

Children with homesickness usually present as being tearful and withdrawn. Other children might present atypically with externalizing behaviors such as fighting, swearing, or destroying property.[9,21,22] Therefore, the best diagnostic tool at anyone's disposal is the simple question, "How homesick have you been feeling?" Contrary to some conventional wisdom, research has shown that asking this question as part of a broader assessment of positive and negative moods, even on a daily basis, does not worsen symptoms of homesickness.[9] Quite the opposite: it puts adult caregivers in a better, more educated position to help. Also contrary to conventional wisdom, severe homesickness does not remit spontaneously after a few days. Although this may be true for mild cases of homesickness, severe homesickness typically worsens over time if left undiagnosed and untreated.[9,21,22]

Although some homesick children have somatic complaints, it is more likely for them to have withdrawn or depressed behaviors.[9,21,24] Of the children who somaticize their distress, only a small percentage are evaluated by a health care professional. In a study of 1412 consecutive visits to a summer camp health center by boys and girls 6 to 15 years of age, only 1.6% of visits were classified as "psychiatric."[25] Although somatization is possible in homesick children, the careful clinician will work to diagnose any contemporaneous but distinct physical ailments such as menstrual pain, viral illness, or otitis media. It should be noted that genuine physical injuries or illnesses that occur during a separation may exacerbate or even induce a bout of homesickness. The converse may also be true, at least in adults; poor self-reported physical health has been linked to homesickness.[26]

Severe homesickness in children is associated with social problems, behavior problems, significant symptoms of depression and anxiety, coping deficits, and feelings of helplessness.[9,22,27–29] In academic settings, homesickness among adolescents and young adults can be associated with nontraumatic ailments,[30–32] academic difficulties,[33–35] absentmindedness,[30,31,33,34] low self-esteem,[34,36] and/or obsessive thoughts and behaviors.[30,31]

Unfortunately, data do not exist on the incidence and severity of homesickness in children with cognitive or developmental delay. However, it can be inferred that these children would respond to these situations in a manner consistent with their developmental age, separation attitudes, attachment style, and previous experiences away from home.

Some data do exist for hospitalized children that suggest homesickness is more severe and less predictable than in comparable samples of children in less stressful environments. Across a variety of presenting problems,

approximately 50% of hospitalized children 8 to 18 years of age reported moderate-to-severe levels of homesickness.[11] The best predictors of homesickness were negative hospitalization attitudes and previous separations from home, such as foster placements. Contrary to the experience of children in other settings, homesickness for hospitalized children was not predicted by insecure attachment or low perceived control.[11]

RISK FACTORS

The risk factors for homesickness fall into 4 categories: experience, personality, family, and attitude. More is known about some of these factors in adults—especially personality factors—because more homesickness research has been performed with older populations.[23] However, a growing body of research is elucidating the etiology of homesickness in younger populations.

Experience Factors

In studies of children at summer camps and boarding schools, the experience factors most predictive of homesickness are little previous experience away from home, little or no previous experience at the camp or school, and young age.[5,37] Age, of course, is often a proxy for experience, which is the more powerful predictor. For example, an 8-year-old with lots of experience away from home has less chance of becoming homesick at summer camp than a 12-year-old with very little experience away from home. Experience is probably most valuable when it refines coping strategies.

Not surprisingly, previous experience away from home did not function as a protective factor in a study of hospitalized children.[21] This finding suggests that the types of previous separation experiences shape expectations of future separations.[38] If early separations are negative experiences, as may be the case with foster placements and traumatic hospitalizations, then expectations of future separations may be negative. This, in turn, causes homesickness, as discussed in the next paragraph.

Attitude Factors

The belief that homesickness will be strong, coupled with negative first impressions and low expectations for a new environment, is a powerful predictor of homesickness.[5] In some ways, expectations of intense homesickness and negative experiences become self-fulfilling prophecies. In a study of college freshmen, perceived absence of social support was a strong predictor of homesickness.[39] As noted above, a child's history of time spent away from home largely shapes his or her attitudes. In a study of boys 8 to 16 years of age spending 2 weeks at camp, a combination of little previous experience away from home, low perceived control, negative attitudes about the separation, and high expectations of homesickness accounted for nearly 70% of the variance in the actual intensity of the boys' homesickness.[5]

Personality Factors

An insecure attachment relationship with primary caregivers is the most common risk factor associated with homesickness.[5] In particular, children and adolescents with an "anxious-ambivalent" attachment style are likely to experience significant distress on separation from home. These young people are unsure about how reliably or positively primary caregivers will respond to their displays of distress and may have mixed feelings about how worthy they are of other people's love and attention. This uncertainty can engender great distress in new social settings with surrogate caregivers. Secure attachment, on the other hand, is associated with independence, a proclivity to explore, and solid social skills, all of which help young people adjust to a novel environment.

Two other personality factors that increase the risk of homesickness are low perceived control (over life in general or the separation itself) and anxious or depressed feelings in the months before a separation.[5] In adults, low self-directedness, high harm avoidance, rigidity, and a wishful-thinking coping style all predict homesickness,[20,23] although it is unclear whether these traits can be extrapolated downward to children and adolescents.

Family Factors

The family factor most predictive of homesickness is low "decision control."[5] In other words, when parents force a young person to spend time away, that child or adolescent feels very little decision control. Consequently, he or she is more likely to feel homesick on separation. Other family factors that are weaker predictors of homesickness include caregivers who express anxiety or ambivalence about the separation (eg, "Have a great time at camp. I don't know what I'll do without you.") and the presence of an unresolved negative life event.[5] Although conventional wisdom once held that a recent move, divorce, or similarly disruptive event might predispose a child to homesickness, research has not supported that assumption.[21] It is plausible that if children have had a chance to process the thoughts and emotions associated with a recent negative life event, they are not at increased risk of homesickness.

PREVENTION

Prevention programs for homesickness involve a combination of environmental information, psychoeducation, social support, explicit coping instruction, caregiver education, practice time away from home, and surrogate caregiver training. The result of these interventions is less severe homesickness, fewer feelings of depression and anxiety, and greater satisfaction with the new environment.[11,40,41] In advance of planned separations, such as camp, boarding school, or college, parents should be advised to:

- Involve children (to the extent possible) in the decision to spend time away from home. This is easier for a stay at summer camp than it is for a hospitalization, but even the latter can include children in the planning stages. Taking part in even the smallest decisions will increase perceptions of control.[28,42,43] By contrast, feeling forced to leave home without input into the decision often increases homesickness intensity.[5]
- Educate children. Young people should be told, "Almost everyone misses something about home when they are away. Homesickness is normal. It means there are lots of things about home you love. And the good news is that there are lots of things you can think and do to help make things better if homesickness bothers you."
- Provide explicit coping instruction (see the next section for details). Using some of these strategies during a practice time away from home will boost a child's confidence about the separation.
- Arrange for practice time away from home, such as a weekend at a friend's or relative's house. Ideally, these 2 or 3 days do not include telephone calls but do include opportunities for writing a letter or postcard home. After the practice time away, parents can discuss how things went and which coping strategies worked best.
- Practice basic correspondence. Ensuring that children know how to write letters increases the likelihood that they will maintain some contact with home. Better yet, parents can provide children with prestamped, preaddressed envelopes and notebook paper.
- Work together with children to learn about the new environment, be it a hospital, school, new neighborhood, or summer camp. Web sites, orientation booklets, and current students, alumni, or staff members are excellent resources. They increase familiarity and, thereby, reduce anxiety.[40]
- Get to know people in the new environment. Having at least 1 familiar face—be it an adult or a peer—in a new place can diminish feelings of homesickness by augmenting social support and connections.[39]
- Encourage children to make new friends and seek the support of trusted adults. Both kinds of connections ease the adjustment to a novel environment. Research suggests that college students who are socially anxious are less likely to seek social support and more likely to feel homesick.[39]
- Refrain from expressing anxious or ambivalent feelings about time away from home. Well-intentioned parents have often exacerbated homesickness with comments such as, "I sure hope the food there is decent," "I hope you'll be okay," or "Have a wonderful time. I hope I remember to feed your dog." Giving children something to worry about will increase the likelihood of their having preoccupying thoughts of home. Ideally, parents should express enthusiasm and optimism about the separation and the novel environment. They should be counseled to share their own separation anxiety with other parents, not with their children.
- Maintain predictability and perspective about the time away. Use a wall calendar to show children the time between today and the day of the separation. Highlight which days or weeks the child will be away, so he or she can see that it is a discrete period, not an eternity. During the separation, calendars are also useful tools for helping children keep a perspective on duration.

Surrogate caregivers (eg, camp counselors, nurses, teachers, child life specialists, resident advisors) should be educated about the symptoms of homesickness and the most effective treatments. Staff at an increasing number of camps, schools, and hospitals receive training on how to coach homesick children. If such training is not provided, parents or health care professionals who believe a child is at risk of severe homesickness should inform the caregivers in the new environment and provide them with the following list of treatment techniques.

TREATMENT

Treating homesickness involves normalizing homesickness, coaching young people on effective ways to cope, working on building new social connections, helping them keep some perspective on the duration of the separation, and involving them with the new environment in meaningful ways that enhance their commitment to it.[11,40]

Research with boys and girls 8 to 16 years of age who spent 2 weeks at overnight summer camp suggested that the following strategies are the most effective for coping with homesickness.[27] Some are "doing" strategies (ie, observable, behavioral ways of coping); others are "thinking" strategies (ie, unobservable, cognitive ways of coping). It is worth noting that boys and girls report using these strategies with nearly equal frequency, except for social support, which girls report doing more often than boys.[27] Boys, on the other hand, engage in a bit more aggressive and delinquent behavior than girls, but the baseline frequency of this response to homesickness is quite low.[27,28]

- Do something fun, such as play with friends, to forget about homesick feelings (distraction and social connection).
- Do something (write a letter, look at a family picture) to feel closer to home (contact with home).

- Go see someone who can talk with you to help you feel better (social support).
- Think about the good side of things (activities, friends) to feel better (optimism).
- Think that time away is actually pretty short to make time go by faster (perspective).
- Try not to think about home and loved ones to forget about homesickness (cognitive avoidance).
- Think about loved ones to figure out what they would say to help (vicarious social support).

Research also suggests that the following strategies do not help.[27,28,44] Few children respond to the stressor of separation from home with these approaches, but some may try. They deserve mention so that caregivers can steer children away from these strategies and toward something helpful.

- Doing nothing because of a belief that nothing would help make things better (relinquished control).
- Wishful thinking, such as wishing that camp or school would end tomorrow (fantasy).
- Doing something angry or mean to get sent home (aggressive or delinquent behavior).
- Trying to get home (escape).

On the subject of telephone calls and e-mail, professional opinions are mixed and research is scant. Ultimately, the kind and frequency of child-caregiver contact should be dictated by the goals of the separation.

At summer camps, for example, anecdotal evidence suggests that telephone calls, and to a lesser extent instant messaging, exacerbate homesickness during relatively short stays away from home (eg, 4 weeks or less). Such real-time correspondence also erodes the burgeoning independence that camps and trips are designed to nurture.[45] Therefore, parents should be strongly discouraged from insisting they talk with their homesick child during a short stay away. Chances are great that such contact will only increase the distress for both parties. Old-fashioned letters may be the best way to maintain contact with home. They lack the emotionally evocative quality of a telephone call, and they require narrative reflection, which promotes understanding of one's experience.[46] Such reflection may even serve a therapeutic function, as does keeping a journal.

During longer separations (eg, camp stays greater than 4 weeks, boarding school, college), scheduled telephone calls and 1-way e-mails (from parent to child) seem not to interfere with boys' and girls' enjoyment of the experience, although they still may be evocative.[14] For college students, such contact is actually associated with less homesickness.[40] Although no studies have been conducted on the topic, it is reasonable to assume that the same conclusion applies to adolescents in boarding school.

Research examining the association between contact with home and adjustment in hospitalized children is scarce. A review of these studies suggested that the quality, rather than the quantity, of child-caregiver contact is associated with adjustment.[47] Because the goal of hospitalization is good heath, rather than increased self-reliance, a different approach to child-caregiver contact is warranted. Whereas minimal contact is encouraged during a stay at camp, maximal contact—both in person and electronic—is appropriate for medically hospitalized children. For psychiatric hospitalizations, health care professionals can advise parents on the appropriate quality and quantity of child-caregiver contact. Indeed, this contact may be an integral part of treatment.

NO DEAL

Under no circumstances of planned, recreational separations from home should parents ever make a "pick-up deal" with their son or daughter.[48] Promising that "if you don't like it, I'll come pick you up" reduces the child's likelihood of success for several reasons. First, the subtext of such deals is "I have so little confidence in your ability to cope with this normal response to separation that I believe the only solution is for me to rescue you." Such expressions of anxiety and doubt contradict the recommended expressions of optimism and confidence outlined above. Second, such deals plant the seeds of homesickness by giving young people the expectation that they will not like the new place. Negative separation attitudes are powerful predictors of homesickness.[5] Third, such deals prevent the development of effective coping by pointing young people toward an escape route. Fourth, such deals paralyze surrogate caregivers who, after enthusiastic support and coaching, may be faced with a child who says, "My parents said that if I didn't like it here, they would come to get me." Parents are then faced with 2 equally unsatisfactory choices: (1) fulfill their promise, pick the child up, and deprive him or her of a wonderful opportunity to grow and develop; or (2) renege on their promise and suffer an erosion of trust in their relationship with the child.

If a conversation with a parent or child suggests great anxiety about a planned separation, invite the family to reconsider the timing of the separation. Postponing a trip, a session at camp, or a year at boarding school until parents and children are more comfortable with the separation may be indicated. Knowing when the time is right for a planned separation is the cornerstone of homesickness prevention.[49]

THE PEDIATRICIAN'S ROLE

Pediatricians have a unique role to play in the prevention and treatment of homesickness. Whether the patient is coming to the office for a camp or boarding-

school physical, establishing care because of a recent move or refugee status, or being evaluated before a hospitalization, education about homesickness should be included as a part of the anticipatory guidance associated with these encounters.

For prospective boarding-school students or overnight campers, help families assess their child's readiness to spend time away from home. Ask about previous separations, encourage practice time away from home, and assess the child's coping skills. Strongly dissuade parents from making pick-up deals (see previous section). Encourage families to activate all of the homesickness-prevention strategies listed above. Help families select a school or camp that is well matched to their child's interests, abilities, and developmental needs.[50] Be sure they have a plan for keeping in touch and that they understand the school's or camp's policies regarding telephone calls, e-mails, and visits. For children with special mental, physical, or emotional needs, be sure the school or camp has the appropriate resources in place to support and care for the child. For all children, normalize feelings of missing home and frame the separation as a positive developmental experience.

Elective interruptions in long-term medication regimens for behavioral or psychiatric diagnoses ("drug holidays") should be avoided when there are plans for a child to enter a new environment.[50] If the medications are helpful in one setting, they are likely to be helpful at school or camp. Only after 1 month or more of positive adjustment in a novel environment should changes to helpful medications be considered.

For displaced families, take time to understand the circumstances of the recent move. Was the family, or part of the family, forced to relocate? How traumatic was that for the family members? Homesickness, as noted above, is idiosyncratic, so ask, "What do you miss most about where you used to live?" In addition to the treatment strategies listed above, homesickness in displaced families is also ameliorated by settling into and connecting with the new community.[14] Parents and children alike benefit from social support, a sense of purpose (eg, work, school, or sports), and feelings of security.[29,51] As knowledgeable, native authority figures, pediatricians can be instrumental in assisting newly displaced families connect with the social, educational, and vocational opportunities in the community. Connecting a newly displaced family with an established family of the same ethnicity or country of origin can be particularly helpful.

For hospitalized children, the pediatrician's approach will depend on timing. For unplanned hospitalizations, the best approach may be to educate parents about the normalcy of adjustment difficulties encountered during hospitalizations, including homesickness.[47] Then, coach the parents and hospital staff on some of the best ways to bolster children's coping skills. Frequent, predictable contact between children and their primary caregivers is of paramount importance. For planned hospitalizations, the best anticipatory guidance will focus on creating positive attitudes about the hospitalization. Because negative separation attitudes are such strong predictors of homesickness,[5] it is essential that parents and pediatricians partner to convey positive expectations about the helpful outcomes of the hospitalization. Anecdotal evidence also suggests that orienting children to the hospital unit, to various medical procedures, and to the staff members who will be caring for them reduces anxiety and minimizes homesickness.

With children in all these circumstances, pediatricians can debunk certain myths[21,52] about homesickness:

- Homesickness is not just something that young children get. It is normal for all people to experience some degree of distress or impairment when they are away from home.
- Severe homesickness does not remit spontaneously but does get better with positive coping efforts. Therefore, encourage children to seek support from surrogate caregivers in the new environment.
- Talking about homesickness does not cause homesickness. Instead, it provides a way to educate and encourage a homesick person.
- Young people are not all homesick for their parents. Some children most miss home cooking or the family pet. Instead of assuming, always ask, "What do you (will you) miss most about home?"
- Homesickness does not always feel like sadness or nervousness. Sometimes, homesick persons feel angry, irritable, or disoriented. Therefore, homesick children are sometimes hard to identify.

APPENDIX 1: HOMESICKNESS-PREVENTION STRATEGIES FOR HOSPITAL STAFF MEMBERS WORKING WITH CHILDREN

1. Coach parents before admission to not deceive their child about the purpose and timing of hospitalization. Although the honest truth may be upsetting or startling to some children, coping with the reality of their situation now prevents uncomfortable surprises later. Children who feel "tricked" into hospitalization lose confidence in the reliability of their caregivers and therapists, and this both increases homesickness and lessens trust.
2. Orientation to the unit is one key to good adjustment. When children feel as if they have some control over the novel hospital environment, they may be less fearful and homesick. Depending on the child's condition, a tour of the unit, labeled photographs of staff members, big calendars, daily schedules, and introductions to the other kids on the unit can all help children feel comfortable and oriented in their new environment.

3. When possible, staff members should convey a consistent message about length of stay. Conflicting messages from adults in charge reduces children's global confidence in caregivers. Unpredictability leads to anxiety. If one staff member says "you'll be here about 2 weeks" and another says "you'll be here about 3 weeks," children are likely to feel distressed and homesick.
4. When hospitalization follows a traumatic event in which multiple family members were involved, family members may be in different parts of the hospital or even different hospitals. This can induce homesickness and separation anxiety. When possible, staff members should help children make contact, by telephone or in person, with dispersed family members.
5. A child's mental status during hospitalization can change dramatically, even in the course of a day. Often, these changes involve a distorted sense of time and a fluctuating awareness of the caregivers' presence. These factors can cause homesickness. Continue efforts to orient the child. Pictures of the family, large clocks and calendars, lights on in rooms during the day, and frequent reminders often help reorient homesick children.
6. Changes and uncertainties in caregiver visitations can cause homesickness. Caregivers should be apprised of the importance of frequent, reliable contact with their children. Staff members should encourage caregivers to call and give ample warning if they are unable to make a scheduled visit.
7. Sometimes hospitalized children feel left alone, and this can cause homesickness. Especially early in a hospital stay, before the child knows the staff and routine, even 5 minutes alone can be frightening. Try to keep children apprised of the day's schedule, and give ample warning if there are going to be times when the child is left alone, however briefly.
8. To ease parental separation anxiety, staff members should forewarn parents when their child will be moved to a different room. Parents are unsettled to come to visiting hours and enter their child's room, only to find it empty or occupied by a stranger. For the same reasons that children need to feel prepared for upcoming events, so do parents.
9. When possible, minimize discharge uncertainty. Children have an easier time coping with homesickness when they have a fixed-length hospital stay to manage. By the same token, avoid changing a child's discharge date if at all possible. Once staff members state an exact date out loud, children (and parents) have a tendency to fixate on that date. Changing the promised date can provoke homesickness. It may be best to tell children and families that discharge dates are hard to predict and give them a range of plausible dates.

APPENDIX 2: HOMESICKNESS-PREVENTION STRATEGIES FOR PARENTS OF HOSPITALIZED CHILDREN

1. Homesickness is normal. Almost all children feel a bit sad and nervous when they are separated from home and loved ones. No matter how turbulent your child's life has been lately, he or she is likely to miss many things about home during this hospitalization. One way that parents can help children deal with this distress is to reassure them that missing home is normal.
2. Talk with your child honestly about when and why he or she is being hospitalized. Although the honest truth may be upsetting or surprising to some children, coping with the reality of their situation now prevents uncomfortable surprises later. Children who feel "tricked" into hospitalization lose confidence in the reliability of their caregivers and therapists, which increases homesickness.
3. To help your child feel "at home" in the hospital, the staff may give your child a tour of the unit. Staff members can explain the daily routine on the unit and answer any questions that you or your child might have. This orientation, along with photographs, calendars, schedules, and introductions to other children, will help your child feel more comfortable.
4. Although you may have some mixed feelings about your child's hospitalization, try not to convey those feelings to your child. If you talk about your mixed feelings, you may increase your child's own doubts about the value of hospitalization. Instead, give your child a consistent, positive message about why he or she is here. Help your child understand the value of this hospital stay.
5. Often, it is impossible for staff to predict your child's exact discharge date. This date depends on many factors, some of which are constantly changing. Although this uncertainty is hard for families, it is even harder when an exact date does not work out as planned. The disappointment of a postponed discharge date can make children quite homesick. Therefore, instead of focusing on a particular date, ask the staff to estimate a range of dates, and be honest with your child that no one knows the exact discharge date yet.
6. Sometimes, children in the hospital get confused about time. Your child might even forget when you visited the last time or when you said you would come back for a visit. This confusion can make homesickness worse. To help your child keep track of your

visits, draw or buy a simple calendar and write your plans down. Try your best to be on time for the visits and telephone calls that you plan.

7. Frequent visits and telephone calls help ease children's homesickness. Of course, you have other commitments, but try to visit as often as possible. Avoid canceling visits at the last moment, which is particularly upsetting to children. If you cannot visit, be sure to call and talk with your child on the telephone.
8. Despite all of your efforts and all of the staff's efforts to make children feel comfortable, many of them still feel homesick in the hospital. Fortunately, many children can help themselves feel better by doing one of the things below. You and the hospital staff should share these techniques with your child:
   a. Do a fun activity to forget about missing home. Play a game with a friend, watch television, listen to music, or read a book.
   b. Do something to feel closer to home. Write a letter, talk on the telephone, or look at a family picture.
   c. Think about the good side of being in the hospital. There are kids to play with and staff to help you. Being in the hospital will help you get better.
   d. Keep a positive attitude. Staff members can answer your questions and teach you a lot about dealing with your problems.
   e. Remind yourself that you will be home soon. Hospitalizations do not last forever.
   f. Talk with someone who can make you feel better, such as your doctor or one of the other staff members.

APPENDIX 3: HOMESICKNESS-PREVENTION STRATEGIES FOR PARENTS TO USE WITH CHILDREN AROUND PLANNED SEPARATIONS

1. Discuss the upcoming separation with your child. Young people should be told, "Almost everyone misses something about home when they are away. Homesickness is normal. And the good news is that there are lots of things you can think and do to help make things better if homesickness bothers you."
2. Involve your child in the decision to spend time away from home. Prepare and pack as a family. Taking part in even the smallest decisions will increase perceptions of control. By contrast, feeling forced to leave home often increases the severity of homesickness.
3. Discuss coping strategies with your child. Using some of these strategies during practice time away from home will boost your child's confidence about the separation.
   a. Do something fun, like play with friends, to forget about homesick feelings.
   b. Do something (write a letter, look at a family picture) to feel closer to home.
   c. Go see someone who can talk with you to help you feel better.
   d. Think about the good side of things (activities, friends) to feel better.
   e. Think that time away is actually pretty short to make time go by faster.
   f. Try not to think about home and loved ones to forget about homesickness.
   g. Think about loved ones to figure out what they would say to help.
4. Arrange for practice time away from home, such as a weekend at a friend's or relative's house. Ideally, these 2 or 3 days do not include telephone calls but do include opportunities for writing a letter or postcard home. After the practice time away, discuss with your child how things went and which coping strategies worked best.
5. Practice correspondence. Ensuring that children know how to write traditional letters increases the likelihood that they will maintain some contact with home. Give children prestamped, preaddressed envelopes and notebook paper.
6. Work together with your child to learn about their new environment, be it a hospital, school, new neighborhood, or summer camp. The more young people know about the new place to which they are going, the more at home they will feel when they arrive. Web sites, orientation booklets, and current participants, alumni, or staff members are excellent resources.
7. Help your child get to know some of the people in the new environment. Having at least 1 familiar face—be it an adult or a peer—in a new place can diminish feelings of homesickness by increasing feelings of social support and connection.
8. Encourage your child to make new friends and seek the support of trusted adults. Both kinds of connections ease the transition to a new environment.
9. Avoid expressing anxious or ambivalent feelings about time away from home to your child. Instead, express enthusiasm and optimism about the fun your child is going to have in the new environment.
10. Use a wall calendar to show your child the time between today and the day of the separation. Highlight which days or weeks they will be away so that

he or she can see that it is a discrete period, not an eternity. During the separation, a calendar might be a way for your child to keep perspective on the separation.

11. Do not make a "pick-up deal" with your son or daughter. Promising that "if you don't like it, I'll come pick you up" decreases your child's likelihood of success in the new environment; this will give the impression to your child that you have so little confidence in his or her ability to cope with the separation that the only solution is to be rescued. Also, such deals create difficulties for staff members, who after enthusiastic support and coaching may be faced with a child who says, "My parents said that if I didn't like it here, they would come to get me." It also puts you in the position of either (1) fulfilling your promise to pick up your child, robbing him or her of a wonderful opportunity to grow and develop, or (2) reneging on your promise, causing an erosion of trust in your relationship with your child. Respond to the query, "What if I feel homesick?" with a statement such as, "You probably will feel a little homesick, but your practice time away has taught you what to think or do in case any homesickness bothers you. Plus, staff members will be there to talk with you and help you make it through. You'll have a great time."

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RESOURCES FOR FAMILIES

American Camp Association Web site. Available at: www.acacamps.org

CampParents.org: an American Camp Association online resource for families. Available at: www.campparents.org

Find A Camp: the American Camp Association's camp locator with data from more than 2400 accredited camps. Available at: www.campparents.org

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention and Committee on Community Health Services

Prevention of Agricultural Injuries Among Children and Adolescents

ABSTRACT. Although the annual number of farm deaths to children and adolescents has decreased since publication of the 1988 American Academy of Pediatrics statement, "Rural Injuries," the rate of nonfatal farm injuries has increased. Approximately 100 unintentional injury deaths occur annually to children and adolescents on US farms, and an additional 22 000 injuries to children younger than 20 years occur on farms. Relatively few adolescents are employed on farms compared with other types of industry, yet the proportion of fatalities in agriculture is higher than that for any other type of adolescent employment. The high mortality and severe morbidity associated with farm injuries require continuing and improved injury-control strategies. This statement provides recommendations for pediatricians regarding patient and community education as well as public advocacy related to agricultural injury prevention in childhood and adolescence.

ABBREVIATIONS. ED, emergency department; AAP, American Academy of Pediatrics; ATV, all-terrain vehicle; ROPS, rollover protective structures; NIOSH, National Institute for Occupational Safety and Health.

INTRODUCTION

Although "agriculture," "farm," and "rural" are not interchangeable terms, many of the risk factors are similar for injuries in each of these settings. Present data collection systems do not always allow clear distinctions among these injury categories; therefore, for purposes of this statement, only unintentional agricultural injuries will be considered. Migrant farmworker children are also not well represented in available data. Although this statement includes much that is generally applicable to any farm child, it emphasizes family farms and does not deal in full with patterns of exposure and injury specific to migrant farmworker children. Not all rural people live on farms, but most farms are in rural areas. In 1991, 923 000 children younger than 15 years and 346 000 adolescents 15 through 19 years of age resided on US farms and ranches.[1] There are no good estimates of the population of migrant farmworker children, but it is known that at least 600 000 school-aged children are enrolled in migrant education programs.[2] Thus, it is estimated that almost 2 million children live on, work on, or visit farms annually.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

FARM FATALITIES

From 1991 to 1993, an annual average of 104 deaths of children younger than 20 years occurred on US farms and ranches.[3] Based on the estimated 1 298 000 children and adolescents younger than 20 years living on farms in 1991, the overall annual farm death rate was 8.0 per 100 000 child and adolescent farm residents. This is a 39% reduction compared with the 1979 to 1981 rate in the same data set.[4] However, the actual number of farm-related deaths is probably underestimated, because these data do not include deaths on public roadways, even if a farm vehicle was involved (motor vehicle crashes are the leading cause of death for farm children younger than 18 years, as they are for all other children younger than 18 years).[5] Also, surveillance using only death certificates at the state level has been found to miss 18% of actual agricultural fatalities.[6] The lack of a national agricultural injury surveillance system does not permit better estimates than these.

Death rates from unintentional agricultural injuries increase with age,[7] with a slight dip in the 5- to 9-year age group.[3] Death rates for boys and girls have declined equally since the 1979 to 1981 study[4]; however, fatality rates among males were 5.6 times higher when compared with those for females overall and nearly 10 times higher than rates for females among those 15 to 19 years of age. Head injuries occurred in 64% of the fatalities.[3,4]

Each year, farming ranks among the most dangerous occupations in the country for adult and adolescent workers.[8] When using estimates of actual hours worked, the rate of adolescent injury exceeds the rate for adult workers.[9] A study of 670 occupationally related deaths from 1980 to 1989 among 16- and 17-year-olds found that one third of the 354 victims with known industry of employment worked in agriculture (for the other 316 victims, industry was unknown).[9] Machinery accounted for 105 of the 670 deaths, and 68% of deaths caused by machinery were related to agriculture. Tractor-related injuries, often rollovers, account for 30% to 50% of fatal injuries.[10–13]

In a study of pediatric farm fatalities, almost 72% of victims died before ever reaching a hospital[4]; however, more recent data show a decrease to 52%.[3] This decrease may be related to expanded emergency medical services in rural areas and to increased pediatric training of prehospital providers through the Emergency Medical Services for Children program.

NONFATAL FARM INJURIES

On average, an additional 22 288 children younger than 20 years who live on farms and ranches are

injured severely enough to be seen in an emergency department (ED) each year.[3] The total childhood farm injury toll has been estimated at greater than 100 000 annually (Fig 1).[14]

Although fatality rates and the number of farm injuries have decreased since publication of the previous American Academy of Pediatrics (AAP) statement,[15] in light of a shrinking farm population, the rate of nonfatal farm injuries has risen 10.7%.[3,4] Significant long-term disability occurred in 41% of 88 people with farm-related injuries who were brought to a Minnesota ED, and 13% required reconstructive surgical procedures.[16] In New York State, permanent disability rates exceeded temporary disability (1.17:1) in agriculture, to a greater degree than in any other industry.[17]

Many studies have examined the most common causes of agricultural injury.[3,4,6,7,9–11,16–26] Tractor-related injuries and other farm machinery are a major source of morbidity.[3,4,6,7,10–13,17–23,26] Livestock, other farm machinery (including power take-offs), falls from structures, chemical burns and poisonings, and wound infections accounted for most of the remaining morbidity.[3,4,6,7,11–13,16,18,20,24–26] High school students with active involvement in farm work have been found to have audiometric evidence of early noise-induced hearing loss. As in adults, this loss was most marked in the ear turned closest to the tractor engine while driving.[27] A 4-year intervention program designed to protect hearing by promoting use of hearing protection devices was found to be successful.[28] Other environmental or health hazards experienced by adult workers, such as exposure to pesticides, fuel, toxic gases, infections, and stress, also affect children.

Among 1- to 16-year-old children brought to the ED for a farm injury, 84% were boys and 16% were girls.[16] Several studies suggest a bimodal age distribution for agricultural injuries, the first peak occurring at 3 to 4 years of age and the second at 13 to 14 years of age.[16,18] The first age peak is attributable to increased mobility, exploration, and the need for both supervision and separation of play areas from the rest of the farm. Poisonings from pesticides and alkali agents in the toddler age group can result from storage in containers that are not childproof and those that resemble drink containers.[24,25]

The second age peak at 13 to 14 years of age appears to be attributable to involvement of adolescents in farm work. Multiple factors may contribute to this peak, including the hazardous nature of the work and use of large machinery, coupled with inexperience and, in some cases, risk-taking behaviors. Among adolescents working on farms, nearly three fourths reported being injured during work.[19] In a review of workers' compensation awards to New York State youth from 1980 to 1987, only 3% of employed youth worked in agriculture, yet agriculture was the second most hazardous industry employing youth overall, and with the highest injury rates, was the most hazardous for 16- and 17-year-old workers.[17] Most of these injured adolescents were employed as farm workers (64%), gardeners and groundskeepers (14%), and animal caretakers (5%). Seasonal variation in pediatric agricultural injury has been observed, with several studies noting increases during the summer in addition to peaks occurring at planting and harvest time.[11,16,18]

Fig 1. Estimated annual childhood farm injury toll.[12]

RECOMMENDATIONS

The lethality of farm injuries, the implications for long-term disability of those injured, and the impact on families warrant continuing injury-control efforts on the part of pediatricians. The entire injury-control spectrum, including prevention, timely acute medical care delivered by professionals trained in the care of children, and age-appropriate rehabilitation, should be addressed by pediatricians with the support of the AAP. Several articles and publications have stressed the need for injury prevention education to farm families as well as the very important role of physicians in both prevention and treatment.[29–33] In 1996, the National Committee for Childhood Agriculture Injury Prevention, a multidisciplinary consensus group, recommended action steps to reduce unintentional agricultural injuries to children younger than 18 years.[29] The AAP supports these recommendations and makes the following recommendations to pediatricians who care for children living on or visiting farms:

1. Parents and patients should be asked about farm residence, farm work involving children, and visits to relatives on farms and should be informed about the risks of agricultural injury and effective preventive measures. Strategies for prevention might include the following:
   - Separating young children from farm hazards by fencing in a play area
   - Providing child care to assist farm families and farm workers or pooling family child care, especially at planting and harvesting times
   - Prohibiting extra riders on tractors, mowers, and all-terrain vehicles (ATVs)[34]
   - Ensuring that there are rollover protective structures (ROPS) and seat belts on tractors and other farm equipment and that these are used at all times
   - Limiting young children's access to large animals
   - Properly storing farm chemicals and cleaning agents
   - Providing children who work on farms with

personal hearing-protection equipment and training them on how to use it properly.

2. Parents should be educated about normal growth and development in adolescence and should be encouraged to consider the physical and emotional readiness of the child for work. Parents need to recognize that small adolescents on adult-sized machinery and large adolescents with immature cognitive and judgment skills are at high risk for farm injury. Consensus guidelines have been developed by the North American Guidelines for Children's Agricultural Tasks project.[35] These guidelines discuss skill sets for discrete tasks and skill acquisition necessary before advancing to a new task. They are available on the Internet[35] to physicians, parents, and youth and may be helpful for counseling about developmentally and age-appropriate agricultural work for children 7 to 16 years old.
3. For any farm machinery work, parental supervision, task-specific education, and initial experiences in good weather on level terrain with visual contact by parents or other adults should be supported. Children should be taught to get help from adults if any difficulties are encountered. These behaviors should be supported not only for individual families but also in the schools and as community norms.
4. Pediatric training programs should increase teaching about the importance of childhood and adolescent agricultural health and safety issues, including regional epidemiology and effective prevention strategies. Pediatricians should then ensure that this information is shared with the community and schools. Community farm safety organizations such as 4-H, National FFA, and Farm Safety 4 Just Kids, as well as county extension agents taking leadership roles in agricultural health and safety, should be supported. Also, community-based pediatric injury prevention organizations, such as SAFE KIDS coalitions and Safe Communities, should be encouraged to include education about prevention of agricultural injury in their rural-related activities. Especially where none of these efforts exist, rural pediatricians should themselves consider leading farm injury prevention efforts with local support and resources.
5. The emergency medical services system should be improved to provide the best possible emergency care, medical assessment, and access to tertiary care for children and adolescents residing in rural areas.
6. A national data system for childhood agricultural injury epidemiology and prevention should be maintained. The National Institute for Occupational Safety and Health (NIOSH) has been designated the lead agency in this effort. The purpose of this national system is to collect and analyze data, establish policy, promote and evaluate research, and link agencies with related purposes. Mandatory coding to identify external cause-of-injury for nonfatal agricultural injuries would greatly assist in providing an epidemiologic profile of these injuries as the first step in prevention.[36]
7. Voluntary or legislated safety standards should be promoted, including the following:
   - Improved safety standards for farm equipment. All tractors should be equipped with seat belts and ROPS, and individuals younger than 18 years should be restricted from operating any tractor not so equipped.
   - Children younger than 16 years should not operate any farm vehicles, including ATVs.[34] Individuals between 16 and 18 years of age should have a valid motor vehicle license and should also be a certified graduate of a state-approved tractor and farm vehicle safety training program, if available, to operate a farm vehicle on a public road. Such courses need to be developed, standardized, and evaluated.
   - Children and adolescents should be restricted from riding on or in areas of machinery or motorized vehicles not approved for passengers (including the racks of ATVs, fenders of tractors, and cargo areas of pickup trucks[37]).
   - Safety and environmental guidelines to protect bystander children from agricultural hazards should be established.
   - Child labor laws, including hazard orders, should be amended to apply uniformly to machinery and exposures in other settings and on farms to provide equal protection for all children.[38]
8. Manufacturers of farm equipment and farm chemicals should be encouraged to apply existing technologies and invest research funds in the development of new technologies to decrease the number of agricultural injuries and poisonings.

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American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Prevention of Choking Among Children

COMMITTEE ON INJURY, VIOLENCE, AND POISON PREVENTION

KEY WORDS
choking, food, toys

ABBREVIATIONS
NEISS-AIP—National Electronic Injury Surveillance System–All Injury Program
CPSC—Consumer Product Safety Commission
FHSA—Federal Hazardous Substance Act
CSPA—Child Safety Protection Act
SPTF—small-parts test fixture
AAP—American Academy of Pediatrics
FDA—Food and Drug Administration
USDA—US Department of Agriculture

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abstract

Choking is a leading cause of morbidity and mortality among children, especially those aged 3 years or younger. Food, coins, and toys are the primary causes of choking-related injury and death. Certain characteristics, including shape, size, and consistency, of certain toys and foods increase their potential to cause choking among children. Childhood choking hazards should be addressed through comprehensive and coordinated prevention activities. The US Consumer Product Safety Commission (CPSC) should increase efforts to ensure that toys that are sold in retail store bins, vending machines, or on the Internet have appropriate choking-hazard warnings; work with manufacturers to improve the effectiveness of recalls of products that pose a choking risk to children; and increase efforts to prevent the resale of these recalled products via online auction sites. Current gaps in choking-prevention standards for children's toys should be reevaluated and addressed, as appropriate, via revisions to the standards established under the Child Safety Protection Act, the Consumer Product Safety Improvement Act, or regulation by the CPSC. Prevention of food-related choking among children in the United States has been inadequately addressed at the federal level. The US Food and Drug Administration should establish a systematic, institutionalized process for examining and addressing the hazards of food-related choking. This process should include the establishment of the necessary surveillance, hazard evaluation, enforcement, and public education activities to prevent food-related choking among children. While maintaining its highly cooperative arrangements with the CPSC and the US Department of Agriculture, the Food and Drug Administration should have the authority to address choking-related risks of all food products, including meat products that fall under the jurisdiction of the US Department of Agriculture. The existing National Electronic Injury Surveillance System–All Injury Program of the CPSC should be modified to conduct more-detailed surveillance of choking on food among children. Food manufacturers should design new foods and redesign existing foods to avoid shapes, sizes, textures, and other characteristics that increase choking risk to children, to the extent possible. Pediatricians, dentists, and other infant and child health care providers should provide choking-prevention counseling to parents as an integral part of anticipatory guidance activities. *Pediatrics* 2010;125:601–607

INTRODUCTION

Choking is the blockage or hindrance of respiration by a foreign-body obstruction in the internal airway, including the pharynx, hypopharynx, and trachea. Airway obstruction can be fatal if it leads to serious impair-

ment of oxygenation and ventilation. Choking is a leading cause of morbidity and mortality among children, especially those who are 3 years of age or younger. This is largely because of the developmental vulnerabilities of a young child's airway and the underdeveloped ability to chew and swallow food. Young children also commonly put objects in their mouths as they explore their environments.[1] The most common objects on which children choke are food, coins, balloons, and other toys.

FACTORS ASSOCIATED WITH THE ANATOMY AND FUNCTION OF THE AIRWAY

An infant is developmentally able to suck and swallow and is equipped with involuntary reflexes (gag, cough, and glottic closure) that help to protect against aspiration during swallowing. Dentition initially develops at approximately 6 months with eruption of the incisors. Molars are required for chewing and grinding food and do not erupt until approximately 1.5 years of age. However, mature mastication abilities take longer to develop and remain relatively incomplete throughout early childhood.[2,3] Young children and children with developmental and neurologic impairment also do not have the overall cognitive skills, behavioral control, or experience to chew well and eat slowly.

Despite a strong gag reflex, a young child's airway is more vulnerable to obstruction than that of an adult in several ways. The smaller diameter is more likely to experience significant blockage by small foreign bodies. Resistance to air flow is inversely related to the radius of the airway to the fourth power, so even small changes in the cross-section of the airway of a young child can lead to dramatic changes in airway resistance and air flow. Mucus and secretions around a foreign body in the airway will reduce the radius of the airway even further and may also form a seal around the foreign body, making it more difficult to dislodge by forced air, such as with a cough or Heimlich maneuver. The force of air generated by a cough in an infant or young child is less than that in an adult; therefore, a cough may be less effective in dislodging a complete or partial airway obstruction during early childhood.[4]

EPIDEMIOLOGY

Nonfatal Choking Episodes

A complete description of nonfatal choking events among children is limited, because many of these events are transient, do not result in aspiration, and consequently do not result in visits to health professionals. Many episodes, therefore, are not reported. Choking events that result in emergency medical treatment or bronchoscopy are the most serious of episodes and have been well described.[5–8] Data are lacking regarding the long-term consequences of brain hypoxia caused by nonfatal choking; however, the morbidity in these cases can be severe.

The Centers for Disease Control and Prevention conducted an analysis of nonfatal choking episodes among children aged 14 years or younger treated in US hospital emergency departments during 2001 on the basis of data reported through the National Electronic Injury Surveillance System–All Injury Program (NEISS-AIP).[9] Of an estimated 17 537 children aged 14 years or younger who were treated for nonfatal choking, more than half (59.5%) were treated for food-related choking, approximately one third (31.4%) were treated for choking on nonfood items, and the cause of choking for the remaining 9.1% was unknown. Almost 13% of all these choking episodes were associated with coins, and 19% were caused by candy or gum. These findings are similar to those reported in a comparative retrospective analysis of foreign-body–related injuries to children from 1920–1932 and 1988–2000, confirming that food and coins are the most common foreign bodies.[10] Coin-related choking episodes among children are usually transient, with the coin typically being swallowed. The coin usually passes through the gastrointestinal tract without problems but may lodge in the esophagus.

A Centers for Disease Control and Prevention report[9] indicated that choking rates were highest among infants (140.4 per 100 000 population) and decreased consistently with increasing age, with an overall rate of 29.9 per 100 000 population among children aged 14 years and younger. Almost one third (30.5%) of choking episodes occurred among infants, and more than three fourths (77.1%) occurred among children aged 3 years or younger. Male and female children were treated for choking at similar rates: 32.1 and 27.3 per 100 000 population, respectively. An estimated 10.5% of children receiving emergency medical treatment were admitted to the hospital or transferred to a facility with advanced care available.[9]

Fatal Choking Episodes

From 1972 to 1992, 449 deaths from aspirated nonfood foreign bodies among children aged 14 years or younger were recorded by the US Consumer Product Safety Commission (CPSC). Nearly two thirds (65%) of these fatalities were among children younger than 3 years. Latex balloons were associated with 29% of deaths overall.[11] Choking on food causes the death of approximately 1 child every 5 days in the United States. Hot dogs accounted for 17% of food-related asphyxiations among children younger than 10 years of age in a 41-state study by Harris et al.[12]

NONFOOD-RELATED CHOKING

Coins and toys account for most nonfood-related choking events among children. Purchasing toys for children

with younger siblings poses a challenge to parents. They may find it difficult to meet the developmental play needs of the older child while addressing the safety needs of a younger sibling. Toys that are acceptable for older children sometimes have small or removable parts that can pose a choking risk to the younger brother or sister.

High-Risk Shapes, Sizes, and Consistencies

Of all children's products, latex balloons are the leading cause of choking death, and most of these fatalities are among children younger than 6 years.[13,14] At least 68 children died from choking on latex balloons from 1990 through 2004 in the United States.[15] Uninflated and pieces of broken latex balloons pose a particular hazard because of their ability to conform to the child's airway and form an airtight seal.

In addition to conforming objects, round, ovoid, or cylindrical objects such as balls, marbles, and spherical toys or toy parts pose the greatest risk of choking death.[11,15] When these objects are approximately the same diameter as a child's upper airway, they can completely occlude the airway with a snug fit and are difficult to dislodge with rescue maneuvers.

Monitoring and Enforcement by the CPSC

The Federal Hazardous Substance Act (FHSA) (Pub L No. 86–613 [1960]) was amended in 1994 by the Child Safety Protection Act (CSPA) (Pub L No. 109–248). The CSPA requires choking-hazard warning labels on packaging for small balls, balloons, marbles, and certain toys and games that contain small parts when these items are intended for use by children in defined age groups. This act also bans any toy intended for use by children younger than 3 years that may pose a choking, aspiration, or ingestion hazard. The CPSC created a CSPA fact sheet[16] (www.cpsc.gov/cpscpub/pubs/282.html) that lists the required warning statement for each item when intended for use by defined age groups. Section 1501 of the FHSA defines a test of object size using the small-parts test fixture (SPTF). The SPTF is a truncated cylinder with a diameter of 3.17 cm (1.25 in), simulating the mouth, and a depth between 2.54 and 5.71 cm (1.00 and 2.25 in), simulating the pharynx (Fig 1). An object is considered a small part if it fits completely within the SPTF. The SPTF was developed, in part, on the basis of data regarding the dimensions of airway foreign bodies recovered by bronchoscopy by Chevalier Jackson in the early 1900s.[8] Because of their high-risk shape, small balls are held to a stricter criterion to prevent choking. The CSPA requires that balls be at least 1.75 inches in diameter if they are intended for use by children younger than 3 years. The CSPA defines a ball as a spheroid, ovoid, or elliptical object that is designed or intended to be thrown, hit, kicked, rolled, bounced, or dropped.

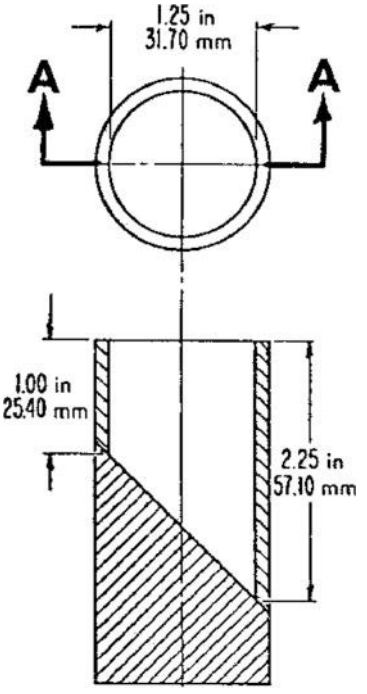

FIGURE 1
The SPTF.

In addition, the Consumer Product Safety Improvement Act of 2008 (Pub L No. 110–314) amended the FHSA to require choking-hazard warnings to be displayed on or adjacent to product advertisements on Web sites or in catalogs or other printed materials that provide a direct means for purchase or order of a product for which a warning is required under the FHSA.

High-Risk Settings and Circumstances

In a study that predated the CSPA, Rimell et al[11] examined 101 foreign bodies that had caused a choking death and found that 14 passed requirements for use by children younger than 3 years. In another study on airway foreign bodies, Reilly et al concluded that greater child protection would be achieved if the diameter of the SPTF was increased from 1.25 to 1.75 in.[10] Milkovich et al[17] examined approximately 7000 foreign-body injuries from 15 countries and recommended the use of a 1.50-in-diameter test device for nonspherical objects and a 1.75-in-diameter test device for spherical objects. The ball test fixture defined in the CSPA has a 1.75-in diameter; however, there are spheroid, ovoid, or elliptical toys or toy parts that do not meet the definition of a ball but present the same cross-sectional profile to a child's airway. Although these spheroid, ovoid, or elliptical nonball objects present an increased risk of fatal choking to young children, similar to the increased risk of fatal choking associated with balls, they currently are not held to the stricter choking-prevention standard applied to balls. Therefore, these gaps in choking-prevention standards for children's toys should be reevaluated and addressed, as appropriate, via revi-

sions to the CSPA or regulation by the CPSC.

Because the CPSC does not conduct premarket testing of toys, consumers need to be aware that just because a toy is on the market does not guarantee its safety. Consumers should be proactive in evaluating toy features that may pose a danger to a child before the toy is purchased and given to a child. Toys sold in retail store bins, vending machines, and on the Internet may not be consistently marked with appropriate warning labels and, thus, present a challenge to consumers who wish to make informed safe purchases. Toys resold in yard sales, at secondhand stores, and via online auction Web sites commonly lack appropriate cautionary labeling and information.[18] Choking risk to children younger than 3 years is the most common reason for the CPSC to issue a recall notice for a children's product; however, the effectiveness of children's product recalls is very low. For example, consumers generally return only 10% to 30% of sold infant products after they have been recalled.[19] Recalled children's products are commonly resold on online auction Web sites.[18]

FOOD-RELATED CHOKING

Choking on food poses an important and relatively underaddressed problem for US children. Approximately 66 to 77 children younger than 10 years of age die from choking on food each year in the United States,[12] and >10 000 emergency department visits annually can be attributed to choking on food among children aged 14 years and younger.[9]

High-Risk Foods and Food Characteristics

Hot dogs are the food most commonly associated with fatal choking among children.[12] A hot dog shares the physical characteristics described above for high-risk toys. It is cylindrical, airway sized, and compressible, which allows it to wedge tightly into a child's hypopharynx and completely occlude the airway. Other high-risk foods include hard candy, peanuts/nuts, seeds, whole grapes, raw carrots, apples, popcorn, chunks of peanut butter, marshmallows, chewing gum, and sausages.[12] Many of these foods, such as round candy, grapes, marshmallows, and meat sticks/sausages, share the same high-risk physical characteristics that create effective plugs for the pediatric airway. Similar to latex balloons, peanut butter can conform to the airway and form a tenacious seal that is difficult to dislodge or extract. It is noteworthy that many foods with high-risk characteristics associated with choking are man-made. The characteristics of these foods are engineered and, therefore, amenable to change, unlike naturally occurring food products such as certain fruits and vegetables. Manufacturers of foods that are frequently consumed by children should, to the extent possible, design these products to minimize choking risk to those in that age group.

Child Risk Factors

The American Academy of Pediatrics (AAP) Section on Breastfeeding and many other health organizations recommend exclusive breastfeeding for the first 6 months of life.[20] The AAP Committee on Nutrition recommends that complementary foods be introduced between 4 and 6 months of age.[21] Children younger than 4 years and children with chewing and swallowing disorders are at greater risk of food-related choking. Before the molars erupt, children are able to bite off a piece of food with their incisors but are unable to grind it adequately in preparation for swallowing. Children 3 to 4 years old have molars but are still learning to chew effectively.[2,3] Children at this age also may be easily distracted when they need to pay full attention to the task of eating. Children with swallowing disorders are at increased risk of choking. Neuromuscular disorders, developmental delay, traumatic brain injury, and other primary and secondary medical conditions may adversely affect the complex neuromuscular coordination involved in the swallowing process.[22] Therefore, caregivers should pay special attention to choking prevention among children with such neurologic impairments regardless of the age of the child.

Behavioral factors may also affect a child's risk for choking. High activity levels while eating, such as walking or running, talking, laughing, and eating quickly, may increase a child's risk of choking.[12] Child games that involve throwing food in the air and catching it in the mouth or stuffing large numbers of marshmallows or other food in the mouth also may increase the risk of choking.

Prevention of Food-Related Choking

Increased federal action to prevent choking on food by young children should include surveillance, cautionary food labeling, recalls when necessary, and public education. These actions will encourage food manufacturers to give greater attention to child safety and modify their products to prevent choking-related injury. Current systems for conducting injury surveillance (such as the NEISS-AIP) and strategies for prevention of choking associated with toys have direct application to the problem of food-related choking in the same high-risk group of young children.

Need for Increased Federal Regulation of Choking Hazards

Although the CPSC has well-established surveillance systems and an array of

legislation and regulations to protect children against choking and injury on toys and other consumer products, there are currently no counterpart surveillance systems, laws, regulations, or dedicated resources to protect children against choking on food, yet food is more likely to go into a child's mouth than a toy. A mandatory system is needed to label foods with appropriate warnings according to their choking risk, to conduct detailed surveillance and investigate food-related choking incidents, and to warn the public about emerging food-related choking hazards. As has been proposed through federal legislation, the US Food and Drug Administration (FDA) should be responsible for these measures and should work closely with the CPSC to integrate food-related hazards into product recalls and public notices. This collaborative effort would build on the support currently being provided by the CPSC to the FDA to identify food-related choking hazards. The NEISS-AIP currently collects information on food-related choking requiring an emergency department visit; however, more detail about the types of food and the choking events needs to be incorporated into the surveillance system. Enabling federal legislation with appropriate additional funding for implementing these changes should be enacted as needed.

Although some food manufacturers voluntarily label foods with choking warnings, all companies should provide appropriate warning labels, either voluntarily or through mandatory measures. Other countries are ahead of the United States in this regard. For example, Sweden has had age labeling on foods for infants and young children since 1979 and warning labels on prepackaged shelled peanuts since 1981 to prevent choking among young children.[12,23,24] The FDA should collaborate with the US Department of Agriculture (USDA), which has jurisdiction over the safety of meat products such as hot dogs. There is a precedent for such collaboration; the FDA and USDA worked together on a National Task Force on Foods and Choking in Children convened by the AAP in 1983.

An example of the involvement of the FDA in ensuring children's safety from food-related choking is its response to the hazard of gel candy. During a relatively short period, there were at least 6 choking deaths and a series of aspirations and near-deaths among children associated with gel candies containing the ingredient konjac.[25] The dimensions (which approximated the diameter of a child's upper airway), rounded shape, consistency, and slipperiness of the product contributed to a serious choking risk. Indeed, these characteristics are very similar to those of the rounded end of a hot dog, a known high-risk food for young children. These candies were packaged in rounded cups as individual mouth-size servings designed to be sucked out of the cups by the consumer. Unlike most gel products, these candies did not dissolve when in the mouth. The consumption method also contributed to the choking risk, because the candy was intended to be sucked out of its packaging.

In 2002, the FDA seized the candies at 1 manufacturer's facility in California and issued general warnings against consuming products containing konjac. The FDA also issued an import alert to prevent this product from entering the country and declared the candy as "unfit for food" under the Federal Food Drug and Cosmetic Act.[26] The action of the FDA likely prevented additional choking episodes; however, other children might have been saved had a coordinated surveillance system and mechanism for determining choking hazards associated with food already been in place. In addition, the similar characteristics of the gel candy and a hot dog (and also small balls and other high-risk toys) should have alerted public health officials to the inherent choking risk for children posed by this gel candy product.

Legislation to Prevent Food-Related Choking

Legislation focused on reducing the risk of choking on food by children was introduced, but never enacted, in each session of Congress from 2002 through 2006. The Food Choking Prevention Act went through 3 iterations and proposed various measures on food-choking prevention and education.[27–29] In different drafts of the bill, the proposals ranged from simple educational efforts and research to the establishment of an FDA Office of Choking Hazard Evaluation. State legislation addressing food-choking hazards to children has been enacted, including a law passed in 2007 in New York[30] that gave authority to the New York State Department of Health to establish age-differentiated criteria for defining foods that pose a significant and unacceptable choking hazard, produce and distribute educational materials, conduct a public education program, and establish a statewide database of food-choking incidents.

CONCLUSIONS

Choking is an important public health problem for young children. Choking hazards are primarily associated with food, coins, and toys. A comprehensive choking-prevention effort will rely on education of parents, teachers, child care workers, and other child caregivers to supervise and create safer environments for children; enactment and enforcement of safety legislation that will lead to surveillance and reduction of the availability of hazardous products on the market; and product-design changes that will reduce the inherent choking risk of consumer products, especially food and toys.

RECOMMENDATIONS

1. The FDA should establish a systematic, institutionalized process for examining and addressing the hazards of food-related choking, which should include the establishment of the necessary surveillance, hazard-evaluation, enforcement, and public-education activities to prevent food-related choking among children. Specifically, the authority and activities of the FDA should be enhanced to permit the agency to:
   - Evaluate foods and require warning labels on foods that pose a high choking risk to children. The FDA should collaborate with the USDA to ensure that meat products also undergo similar evaluation and labeling.
   - Recall food products that pose a significant and unacceptable choking hazard to the public. The FDA should collaborate with the USDA to ensure that a similar recall process exists for meat products.
   - Establish a national food-related choking-incident surveillance and reporting system to warn the public of existing and emerging hazards. The NEISS-AIP of the CPSC should be modified to provide the surveillance function of this system.
   - Conduct, in consultation with the USDA, CPSC, AAP, and other organizations, a widely publicized food-related choking-prevention campaign that is focused on children.
   - Focus resources and prevention program efforts on high-risk groups, circumstances, and products that are identified through the surveillance system.
   - Maintain highly cooperative arrangements with the CPSC and USDA, and information should be openly shared among these agencies.
2. Pediatricians, dentists, and other infant and child health care professionals should intensify choking-prevention counseling as an integral part of anticipatory guidance activities.
3. Pediatricians should continue to provide parents and caregivers guidance on appropriate food and toy selection with respect to choking prevention as outlined by the AAP.[31–35]
4. Food manufacturers should design new foods and redesign existing foods, including meat products, to avoid shapes, sizes, textures, and other characteristics that increase choking risk to children, to the extent possible.[12]
5. The CPSC should increase efforts to ensure that toys that are sold in retail store bins, in vending machines, or online have appropriate choking-hazard warnings; work with manufacturers to improve the effectiveness of recalls of products that pose a choking risk to children; and increase efforts to prevent the resale of these recalled products on online auction sites. Current gaps in choking-prevention standards for children's toys should be reevaluated and addressed via revisions to the standards established under the CSPA or the Consumer Product Safety Improvement Act or via regulation by the CPSC.
6. Because it is impossible to prevent all choking episodes among children, cardiopulmonary resuscitation and choking first aid for children should be taught to parents, teachers, child care providers, and others who care for children, particularly children at high risk of choking.

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Policy Statement—Prevention of Drowning

abstract

Drowning is a leading cause of injury-related death in children. In 2006, fatal drowning claimed the lives of approximately 1100 US children younger than 20 years. A number of strategies are available to prevent these tragedies. As educators and advocates, pediatricians can play an important role in the prevention of drowning. *Pediatrics* 2010;126:178–185

COMMITTEE ON INJURY, VIOLENCE, AND POISON PREVENTION

KEY WORDS
drowning prevention, pools, swimming lessons

ABBREVIATIONS
CPR—cardiopulmonary resuscitation
AAP—American Academy of Pediatrics
CPSC—Consumer Product Safety Commission
SVRS—safety vacuum-release system
PFD—personal flotation device
CDC—Centers for Disease Control and Prevention

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INTRODUCTION

Background

From 2000 to 2006, drowning was the second leading cause of unintentional injury death among US children between 1 and 19 years of age.[1] In 2006, drowning claimed the lives of approximately 1100 US children. Fortunately, childhood unintentional drowning fatality rates have decreased steadily from 2.68 per 100 000 in 1985 to 1.32 per 100 000 in 2006. Rates of drowning death vary with age, gender, and race. Age groups at greatest risk are toddlers and male adolescents. After 1 year of age, male children are at greater risk than are female children. Black and American Indian/Alaska Native children have higher drowning fatality rates than do white and Asian American children. From 2000 to 2006, the highest death rates were seen in white boys 0 to 4 years of age (3.53 per 100 000) and black male adolescents 15 to 19 years of age (4.46 per 100 000).[1] In 2008, approximately 3800 children younger than 20 years visited a hospital emergency department for a nonfatal drowning event, and more than 60% of those children were hospitalized.[1] Most victims of nonfatal drowning do well, but severe long-term neurologic deficits are seen with extended submersion times, prolonged resuscitation efforts, and lack of early bystander-initiated cardiopulmonary resuscitation (CPR).[2–4]

The American Academy of Pediatrics (AAP) has decided to revise this policy statement because of new information and research regarding (1) the World Health Organization's classification of drowning, (2) drain-entrapment and hair-entanglement injuries, (3) dangers of inflatable and portable pools, and (4) the possible benefit of swimming lessons for young children.

Classification of Drowning

The World Congress on Drowning and the World Health Organization have revised the definition of drowning to be "the process of experiencing respiratory impairment from submersion/immersion in liquid." Drowning outcomes are now to be classified as "death," "no morbidity," or "morbidity" (further categorized as "moderately disabled," "severely disabled," "vegetative state/coma," and "brain death"). The new definition and classification are more consistent with other medical

conditions and injuries and should help in drowning surveillance and collection of more reliable and comprehensive epidemiologic information.[5]

Drain Entrapment and Hair Entanglement

From 1990 to 2004, 74 cases (13 deaths) of body entrapment in a pool or spa drain were reported to the Consumer Product Safety Commission (CPSC).[6] In a separate report, 24 additional cases (2 deaths) were reported in the 3 years from 2005 to 2007.[7] The situation often involves a child playing with an open drain, inserting a hand or foot into the pipe, and then becoming trapped by increasing suction that causes tissue swelling. In the same time period (1990–2004), 43 incidents (12 deaths) of hair entanglement were reported.[6] These incidents typically involve females who are underwater with their long hair near a suction outlet. The water flow into the drain sweeps the hair into and around the drain cover, where it becomes tangled in the holes and protrusions of the cover. Entrapment and entanglement can be prevented by the use of special drain covers, safety vacuum-release systems (SVRSs), filter pumps with multiple drains, and a variety of other pressure-venting filter-construction techniques.[6] In 2007, Congress passed the Virginia Graeme Baker Pool and Spa Safety Act (effective December 2008), which requires special drain covers, unblockable drains, and SVRSs for all public pools and spas in the United States.[8]

Inflatable, Portable Pools

Recently there was an increase in sales of large, inexpensive, inflatable or portable above-ground pools, which come in various sizes, shapes, and water depths. The pools are 18 to 48 in deep and can hold less than 200 to more than 5000 gallons of water. Some models even require filtration equipment. Prices range from $50 to $750.[9] From 2004 to 2006, the CPSC reported 47 deaths of children related to inflatable pools.[10] Unfortunately, many parents do not consider fencing for an inflatable or portable pool, and such pools often fall outside of local building codes that require pool barriers. Because they contain such large amounts of water, these pools are often left filled for weeks at a time, which presents a continuous danger. The soft sides of some models allow children to lean over them and easily fall into the pool headfirst.

Swimming Lessons for Young Children

The position of the AAP has been that children are not developmentally ready for swimming lessons until after their fourth birthday.[11] This position was based on (1) lack of data needed to determine if infant and toddler aquatic programs increase or decrease the likelihood of drowning, (2) concerns that such programs would cause parents to develop a false sense of security and lead them to provide inadequate supervision around water, and (3) evidence that starting swimming lessons at a very young age does not result in earlier development of proficient swimming skills.[12,13] In addition, there was concern that swimming programs might reduce a child's fear of water and unwittingly encourage the child to enter the water without supervision.

A recently published case-control study report from the Eunice Kennedy Shriver National Institute of Child Health and Human Development concluded that swimming lessons do not increase the risk of drowning in 1- to 4-year-olds and may actually provide a reduction in drowning risk in this age group. Drowning victims were less likely than matched controls (3% vs 26%, respectively) to have had formal swimming instruction.[14] A Chinese study of swim instruction revealed similar drowning-protection statistics.[15] In light of this new research, it is reasonable for the AAP to relax its policy regarding the age at which children should start learning water-survival skills (see recommendation 6). The evidence no longer supports an advisory against early aquatic experience and swimming lessons for children of any specific age. However, the current evidence is insufficient to support a recommendation that all 1- to 4-year-old children receive swimming lessons. It must be stressed that even advanced swimming skills will not always prevent drowning and that swimming lessons must be considered only within the context of multilayered protection with effective pool barriers and constant, capable supervision. In addition, the possible benefit of early swimming instruction must be weighed against the potential risks (eg, hypothermia, hyponatremia, infectious illness, and lung damage from pool chemicals).[16–19]

In recent years, water-survival skills programs designed for infants younger than 12 months have become popular both in the United States and internationally. Many movies of tiny infants who have been taught to swim underwater, float fully clothed on their backs, and even cry out for help have emerged on the Internet. Although there are anecdotal reports of infants who have "saved themselves," no scientific study has clearly demonstrated the safety and efficacy of training programs for such young infants.

Additional details regarding childhood drowning are available in the accompanying technical report, available online.[20]

PREVENTION OF DROWNING

Supervision of young children around any water is an essential preventive

strategy, but inevitable lapses make supervision alone insufficient.[21] Installation of 4-sided fencing that completely isolates the pool from the house and yard is effective in preventing more than 50% of swimming-pool drownings of young children.[21,22] Some new, but limited, data suggest that swimming and water-survival skills training may lower drowning rates in 1- to 4-year-old children.[23] Lifeguards, personal flotation devices (PFDs), and CPR training seem to be effective[2,24–26]; however, data regarding the value of other potential preventive strategies, such as pool covers and pool alarms, are lacking. Interventions to prevent drowning are discussed in detail in the accompanying technical report, available online.[20]

As part of routine anticipatory guidance, pediatricians may use direct counseling, handouts, Web sites, and other educational methods to alert parents to the dangers that water presents at different ages and in different situations (see Appendix 1 for a list of resources). In addition to providing generic water-safety advice, pediatricians can provide specific targeted messages to children identified as having special risks of drowning.

1. Parents and caregivers need to be advised that they should never—even for a moment—leave small children alone or in the care of another young child while in bathtubs, pools, spas, or wading pools or near irrigation ditches or other open standing water. Because infant bath seats can tip over and children can slip out of them, bath seats cannot be a substitute for adult supervision.[27] Water should be emptied from containers, such as large pails and 5-gallon buckets, immediately after use. To prevent drowning in toilets, young children should not be left alone in the bathroom, and unsupervised access to the bathroom should be prevented.
2. Whenever infants and toddlers (or weak swimmers) are in or around water, be it in a pool or an open body of water, a supervising adult with swimming skills should be in the water, within an arm's length, providing "touch supervision." With older children and better swimmers, the eyes and attention of the supervising adult should be constantly focused on the child, and the adult should not be engaged in other distracting activities that can compromise this attention, such as talking on the telephone, socializing, tending chores, or drinking alcohol. Supervision needs to be close, constant, and capable. In case of an emergency, the supervising adult must know how to swim, perform a rescue, initiate CPR, and call for help. If children are in out-of-home child care, parents should inquire about exposure to water and water-related activities at the provider's site or during off-site visits. Recommendations for child-to-staff ratios while children are wading or swimming are available and vary according to the age of the child and according to jurisdiction. Some states include staffing ratios for water activities in their child care and school licensing requirements.[28] Parents should be aware of the ratios at their child's site of care. National recommendations are available from the AAP.[28]
3. Pediatricians are encouraged to identify families who have residential (home and apartment complex) swimming pools and include periodic drowning-prevention counseling during routine health visits (see Appendix 2 for an office-based quiz that can be used to initiate a discussion about pool safety). It is important to ask specifically about portable and inflatable above-ground pools, because so many of these types of pools do not have adequate protective fences and barriers.[9] Families (and extended families and others visited by children) should be advised to install an isolation fence (also referred to as a 4-sided fence) that prevents direct access to the pool from the house. The fence should be at least 4 ft high (or higher if required by local ordinance). The fence should also be climb resistant. For example, chain-link fences can be scaled easily by young children, whereas ornamental iron-bar fences are more difficult to climb.[29] The distance between the bottom of the fence and the ground should be less than 4 in (some building codes suggest a 2-in limit). To prevent small children from squeezing through, the distance between vertical members of the fence should be less than 4 in. The gate is the single most important component of the fence. It should be self-latching and self-closing, with the latch placed at least 54 in above the bottom of the gate. The gate should open away from the pool, and should be checked often to ensure that it is in good working order. Detailed guidelines for safety barriers for home pools are available online from the CPSC.[30]
4. Although data are lacking, families can also be advised to consider supplemental pool alarms and rigid pool covers as additional layers of protection; however, neither alarms nor pool covers are a substitute for adequate fencing. It is important to note that some types of pool covers, such as thin plastic solar covers, should not be

used as a means of protection, because children may try to walk on the cover, fall into the pool, and be hidden from view.

5. Body entrapment and hair entanglement in pool and spa drains were recently recognized as potential dangers to children.[31] Entrapment and entanglement injuries can be prevented by the use of special drain covers, SVRSs, filter pumps with multiple drains, and a variety of other pressure-venting filter-construction techniques.[6] Managers of public pools and owners of private pools and spas must be made aware of entrapment/entanglement risks and encouraged to install the drain covers and filter-pump equipment needed to prevent these injuries.
6. Children need to learn to swim. The AAP continues to support swimming lessons for most children 4 years old and older. Because children develop at different rates, not all children will be ready to learn to swim at exactly the same age. For example, children with motor or cognitive disabilities may not be ready for swimming lessons until a later age. The evidence no longer supports an advisory against early aquatic experience and swimming lessons for children of any specific age. However, the current evidence is insufficient to support a recommendation that all 1- to 4-year-old children receive swimming lessons. A parent's decision about starting swimming lessons or water-survival skills training at an early age must be individualized on the basis of the child's frequency of exposure to water, emotional maturity, physical limitations, and health concerns related to swimming pools (ie, hypothermia, hyponatremia, infectious illness, and lung damage from pool chemicals). Parents should be reminded that swimming lessons will not provide "drown-proofing" for children of any age. It is important that swim instructors stress this message as well as the need for constant supervision around water. Swimming skills are just one potential prevention strategy that must be considered in the context of a multifaceted approach that includes effective barriers, appropriate adult supervision, and training in CPR. Knowing how to swim well in a swimming pool does not necessarily make a child safe in natural water environments. Children need to be taught never to swim alone and not to swim without adult supervision.
7. Parents, caregivers, and pool owners should learn CPR and keep a telephone and equipment approved by the US Coast Guard (eg, life buoys, life jackets, and a reach tool such as a shepherd's crook) at poolside. Older children and adolescents should learn CPR, and pediatricians should support the inclusion of CPR training in high school health classes.
8. Parents should be cautioned not to use air-filled swimming aids (such as inflatable arm bands) in place of PFDs (life jackets). These aids can deflate and are not designed to keep swimmers safe.
9. All children should be required to wear an approved PFD whenever they are riding in watercraft. Small children and nonswimmers should use PFDs when they are at water's edge, such as along a river bank or on a dock or pier. Pediatricians should encourage all family members to wear PFDs to model safe behavior. Information about PFDs is available from the US Coast Guard Web site.[32]
10. Parents and children need to understand that jumping or diving into water can result in injury. Parents should know the depth of the water and the location of underwater hazards before permitting children to jump or dive. The first entry into any body of water should be feetfirst.
11. When selecting an open body of water in which their children will swim, parents should select sites with lifeguards. Even for the strongest of swimmers, it is important to consider weather, tides, waves, and water currents in selecting a safe location for recreational swimming. Swimmers should know what to do in case of rip currents (swim parallel to the shore until out of the current, then swim back toward the shore).
12. Parents and children need to recognize drowning risks in cold seasons. Children should refrain from walking, skating, or riding on weak or thawing ice on any body of water.
13. When swimming or taking a bath, children of any age with seizure disorders should be supervised closely by an adult at all times.[33] Showers are preferable to baths for situations in which the child cannot be supervised directly because of privacy issues.
14. Counseling parents and adolescents about water safety provides an opportunity to stress the problems related to illegal alcohol and drug use during any activity. Specifically, the discussion should include a warning about the increased drowning rates that result from impairment of a swimmer or watercraft occupant when alcohol or illicit drugs are used.

Because male adolescents are at much higher risk of water-based injuries than are female adolescents, they warrant extra counseling.

COMMUNITY INTERVENTIONS

1. Pediatricians are encouraged to work in their communities to pass legislation to mandate 4-sided isolation pool fencing for all new and existing residential pools. Pediatricians should encourage local governmental inspection of pool fencing with strict enforcement programs, because they have been shown to be effective in reducing drowning.[34]
2. Pediatricians should support efforts to ensure that community pools and other pools accessible to the public (such as pools at apartments, hotels, and motels) have certified lifeguards with current CPR certification. (Currently, most states do not require hotel pools to have lifeguards.)
3. Pediatricians are encouraged to support efforts in their states and communities to pass legislation and adopt regulations to establish basic safety requirements for natural swimming areas and public and private recreational facilities (eg, mandating the presence of certified lifeguards in designated swimming areas).
4. Pediatricians should support state and community efforts to enforce laws that prohibit alcohol and other drug consumption by boat occupants, not just operators.
5. Pediatricians should work with state and local emergency medical services personnel to encourage systematic reporting of information on the circumstances of immersion events. Consistent review of these data is critical for the development of drowning-prevention strategies appropriate for the geographic area.
6. Pediatricians should work in their communities to ensure adequate emergency medical services for childhood drowning victims. The Emergency Medical Services for Children (EMSC) program should be reauthorized and funded at levels recommended by the Institutes of Medicine.
7. Supportive counseling services should be available to relatives and friends of drowning victims.

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APPENDIX 1: RESOURCES FOR PEDIATRICIANS

1. American Academy of Pediatrics (www.aap.org)—Contains educational materials for parents from The Injury Prevention Program (TIPP) about home water hazards for young children, life jackets, pool safety, and water safety for school-aged children; also has links to water-safety information from the CPSC, Centers for Disease Control and Prevention (CDC), and SafeKids.
2. Safe Kids USA (www.usa.safekids.org/water)—Contains information about pools and hot tubs, drain covers and SVRSs to prevent entrapment, and safety checklists (English and Spanish) about pools, spas, open-water swimming and boating, and home water safety; also has links to national research study about pool and spa safety; has some nice materials for children including boating safety coloring pages; has a color "Water Watcher" badge available for download.
3. Centers for Disease Control and Prevention (CDC) (www.cdc.gov)—Contains a water-related injuries fact sheet, CDC research and information on water safety and water-related illnesses and injuries, and a link to the Web-based Injury Statistics Query and Report System (WISQARS); the CDC Childhood Injury Report contains state-specific information about drowning and other injuries (available at: www.cdc.gov/safechild/images/CDC-childhoodinjury.pdf).
4. Consumer Product Safety Commission (CPSC) (www.cpsc.gov)—Contains information about the Virginia Graeme Baker Pool and Spa Safety Act and a list of manufacturers of approved drain covers and SVRSs; the publications section contains safety-barrier guidelines for home pools and a family education brochure about preventing childhood drowning.
5. US Coast Guard (www.uscgboating.org)—Contains detailed information and tip sheets about inflatable and foam-filled PFDs, vessel safety checks, approved on-line boating safety courses, and beach safety; also has links to sites with informa-

tion about safety and boating regulations, as well as statistics, research, and surveys about boating and boating crashes and injury.

APPENDIX 2: DROWNING-PREVENTION QUESTIONNAIRE (FOR OFFICE WATER-SAFETY COUNSELING)

Quiz

1. Which of the pictures in Figure 1 looks the most like your backyard pool area?
2. In Figure 2, can you find 3 things that are dangerous?
3. How would you supervise a 3-year-old child around water?
   A. Always be close enough to *see* the child.
   B. Always be close enough to *hear* the child.
   C. Always be close enough to *touch* the child.
4. At what age can you leave a child alone in the bathtub?
   A. As young as 2 years old, if you have a special bath seat or ring.
   B. 3 years old.
   C. Approximately 6 years old.
5. How many children and teenagers died from drowning in the United States in the past 3 years?
   A. 500
   B. 1000
   C. More than 3000

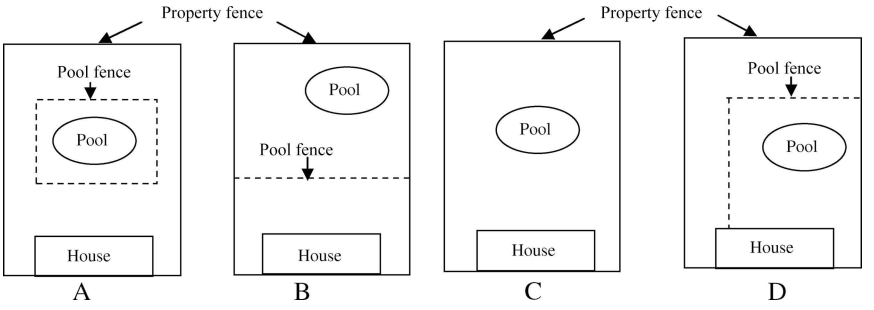

FIGURE 1

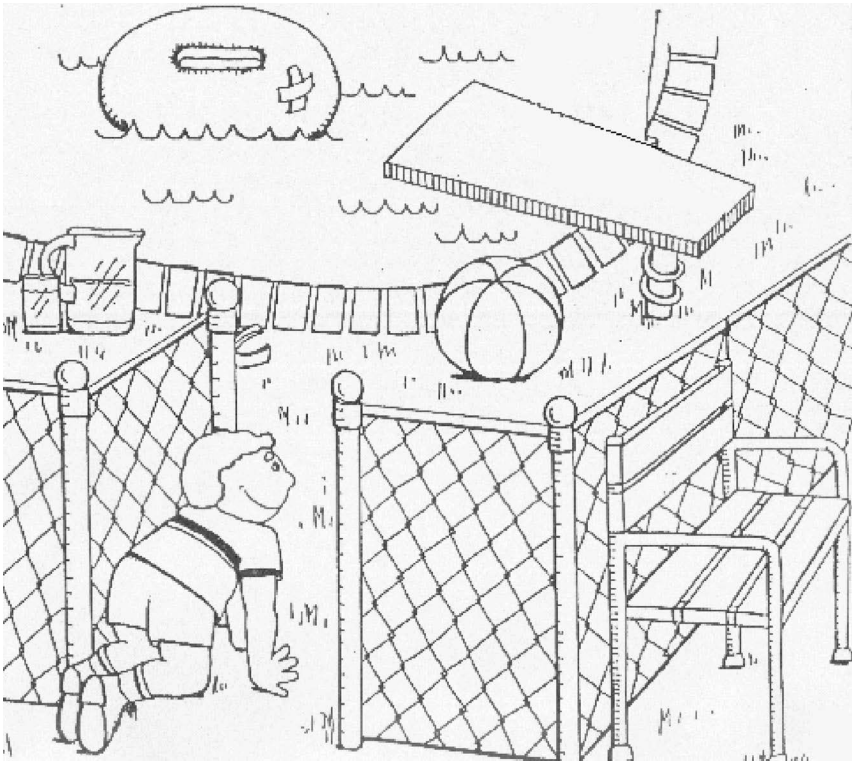

FIGURE 2

Quiz Answers

Question 1

A. *TERRIFIC!* A fence that surrounds the pool on all 4 sides is the safest. But remember, even with a good fence, children can drown if not supervised very carefully around water. The fence, gate, and latch have to be well maintained to make sure children cannot enter the pool area.

B. *GOOD!* This arrangement is good, because it will keep kids from getting out of the house and into the pool. It is important that kids playing in the pool area be well supervised—that means you can't be reading, talking on the phone, or involved in distracting conversations.

C. *DANGER!* This arrangement is not safe. Children playing in the back yard can easily get to the pool. A child could also sneak out the back door, back windows, or even through a pet door!

D. *DANGER!* Although there is a fence around the pool area, a child could enter the pool area from a door or window at the back or side of the house!

Question 2

A. The gate is open. You should never prop the gate open! Make sure that the automatic self-closing and self-locking mechanisms are working at all times.

B. The ball and pool toys will attract the child into the pool area.

C. Children can climb up on furniture to get over the fence and into the pool area. It would be better to keep the pool furniture inside the fence.

D. No glass or breakables should be in the pool area.

E. The fence design (chain-link) would allow a child to climb over it.

Question 3

C is the correct answer. You should always be close enough to *touch* your child when near the swimming pool. Pools can be as dangerous as a street, and you'd always hold your child's hand when crossing the street. It is hard, almost impossible, to watch your child all the time. It is easy to get distracted and look away. Remember that it only takes a few seconds for a child to fall into the pool. Drowning is a quick and quiet death, most kids don't thrash around and yell when they fall into the pool; they just sink to the bottom without splashing or crying out!

Question 4

C is the correct answer. Every year in the United States, several children drown in the bathtub. Bathtub seats and rings can topple over and are not safe. Some infants have died when an older brother or sister was supposed to be watching them in the tub. Only an adult or teenager should supervise bath time. And, be careful with toilets and buckets—kids have drowned in these too! We suggest that all kids under the age of 6 be watched carefully while in the bathtub.

Question 5

C is the correct answer. There have been more than 3000 children and teenagers who have died from drowning in the United States in the past 3 years. Several hundred survivors are victims of severe, permanent brain damage. These kids are from all cultural and economic backgrounds.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Technical Report—Prevention of Drowning

Jeffrey Weiss, MD, THE COMMITTEE ON INJURY, VIOLENCE, AND POISON PREVENTION

KEY WORDS
drowning prevention, pools, swimming lessons

ABBREVIATIONS
CPR—cardiopulmonary resuscitation
CPSC—Consumer Product Safety Commission
SVRS—safety vacuum-release system
OR—odds ratio
CI—confidence interval
PFD—personal flotation device

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

Drowning is a leading cause of injury-related death in children. In 2006, approximately 1100 US children younger than 20 years died from drowning. A number of strategies are available to prevent these tragedies. As educators and advocates, pediatricians can play an important role in the prevention of drowning. *Pediatrics* 2010;126:e253–e262

INTRODUCTION

Background

From 2000 to 2006, drowning was the second leading cause of unintentional injury death among US children between 1 and 19 years of age.[1] In 2006, unintentional drowning claimed the lives of 1077 US children and adolescents, a fatality rate of 1.32 per 100 000 population. Fortunately, drowning deaths of children and adolescents have decreased dramatically since 1985 (2.68 per 100 000) and 1995 (1.96 per 100 000). In 2008, approximately 3800 children younger than 20 years visited a hospital emergency department for a nonfatal drowning event; more than 60% of those children were hospitalized.[1] Most victims of nonfatal drowning do well, but severe long-term neurologic deficits are seen with extended submersion times, prolonged resuscitation efforts, and lack of early bystander-initiated cardiopulmonary resuscitation (CPR).[2–4] Overall, 5% to 10% of drowning incidents result in severe neurologic damage,[2,4–6] but such poor outcomes are even more common when the drowning occurs in open-water settings.[3]

In 2002, the World Congress on Drowning and the World Health Organization revised the definition of drowning to be "the process of experiencing respiratory impairment from submersion/immersion in liquid."[7,8] Drowning outcomes are now to be classified as "death," "no morbidity," or "morbidity" (further categorized as "moderately disabled," "severely disabled," "vegetative state/coma," and "brain death"). The terms "wet," "dry," "active," "passive," "silent," and "secondary drowning," as well as the term "near-drowning," are no longer to be used. The new definition and classifications are more consistent with other medical conditions and injuries and should help both in drowning surveillance and collection of more reliable and comprehensive epidemiologic information.[7,8]

Sociodemographic Factors

Rates of drowning vary with age, gender, and race. The highest rate of drowning is in the 0- to 4-year age group (2.5 per 100 000), and children 12 to 36 months of age are at the highest risk (almost 4 deaths per 100 000). There is a second peak incidence in adolescence, attributable entirely to a high number of male drowning deaths.[1] After 1 year of age,

males are at greater risk of drowning than are females at all ages. Up to 12 years of age, drowning death is roughly twice as common in boys as in girls, but in adolescents, the rate is approximately 10 times higher for boys (see Table 1).[1] The higher drowning rate for males has been explained by greater exposure to aquatic environments, overestimation of swimming ability, higher risk-taking, and greater alcohol use.[9]

In the period from 2000 to 2006, 3 times more white children and adolescents died from drowning than did black children of the same age; however, the drowning-death rate was actually higher in black children than in white children (1.95 vs 1.29 per 100 000, respectively). Drowning-death rates for Native American children (1.79 per 100 000) were almost as high as those for black children, whereas rates for Asian children and adolescents (1.23 per 100 000) were similar to those for white children. Overall, the highest death rates were seen in black boys 15 to 19 years of age (4.46 per 100 000) and white boys 0 to 4 years of age (3.53 per 100 000).[1] An analysis that focused specifically on swimming-pool drowning deaths in the 5- to 24-year age group revealed that black males had higher drowning rates than either white or Hispanic males even when adjustments were made for low income. Although the majority of white children drowned in residential pools, black children were more likely to die in a public pool, often at a motel or hotel.[10] The reasons that black children and teenagers are more likely to drown are not clear, but poor parental swimming skills, lack of early training, poor swimming ability, and lack of lifeguards at motel/hotel pools may be important factors.[10,11]

TABLE 1 Unintentional Drowning Deaths: United States, 2006

Age Group, y	No. of Deaths (Rate per 100 000)		
	Male	Female	Total
<1	27 (1.26)	24 (1.18)	51 (2.64)
1–2	183 (4.36)	127 (3.17)	310 (3.78)
3–4	106 (2.57)	42 (1.07)	148 (1.83)
0–4	316 (3.02)	193 (1.93)	509 (2.49)
5–9	104 (1.03)	38 (0.40)	142 (0.72)
10–14	89 (0.85)	25 (0.25)	114 (0.55)
15–19	282 (2.59)	30 (0.29)	312 (1.47)
0–19	791 (1.89)	286 (0.72)	1077 (1.32)

The role of socioeconomic status and income on drowning rates, independent of race, is not well known. Worldwide, drowning rates are much higher in low-income, underdeveloped countries.[12] In contrast, a study of pool drownings conducted in California revealed that among children younger than 10 years, drowning rates were actually associated with higher family income and parental education. This association was attributed to increased exposure to residential swimming pools in more affluent communities.[13]

Temporal and Geographic Variation

Among all causes of unintentional injury death in the United States, drowning shows the greatest seasonal variation.[14] Among drowning victims younger than 15 years, two-thirds of deaths occur from May through August. Drowning also occurs disproportionately on Saturdays and Sundays. In a 17-year study (1990–2006) from Maricopa County, Arizona, 43% of the 865 life-threatening pool-related incidents among children 0 to 4 years of age occurred on the weekend. The peak time of day was 5:00 to 6:00 PM, and 75% of all incidents occurred between 12:00 and 8:00 PM.[15]

For the period 2000–2006, the 3 states with the highest number of drowning deaths in the 0- to 19-year age group were California (898), Texas (800), and Florida (798). For the same age group, the rates of drowning deaths per 100 000 population were highest in Alaska (3.61), Mississippi (2.77), and Florida (2.69). The lowest drowning-death rates were seen in some of the New England and Mid-Atlantic states.[1]

Location

In a large national study of 1420 drowning deaths in individuals younger than 20 years, 47% occurred in fresh bodies of water (rivers, creeks, lakes, ponds, canals, quarries), 32% occurred in artificial pools, 9% occurred in the home (bathtubs, buckets), and 4% occurred in salt water.[16] Age is an important determinant of drowning location.

Most (78%) of the approximately 60 infant drowning deaths that occur each year are in bathtubs and large buckets.[1,16] Almost all parents, even those who admitted to other risky behaviors, believe that a child should be at least 6 years old before being allowed to bathe alone.[17] Unfortunately, many caregivers confess that they do leave young children unsupervised in the bath for some period of time.[18,19] The association of unsupervised bathtub drowning deaths with the use of bathtub seats and rings was recognized more than a decade ago.[20] Three hazard scenarios have been noted: (1) seat tipping over from suction cup failure; (2) child becoming entrapped in leg openings that are too big; and (3) child climbing out of the seat.[21] In response to reports of at least 27 deaths and 29 nonfatal incidents with bath seats from 2003 to 2005, the Consumer Product Safety Commission (CPSC) has released warnings about these products but has not banned them from the market.[22]

In a national study, more than half (51%) of the drowning deaths of children 0 to 4 years of age occurred in swimming pools, but a sizable proportion (25%) occurred in ponds, rivers, and lakes.[16] Older children in the 5- to 14-year age range are slightly more

apt to drown in a natural body of water than in a swimming pool, but a high proportion (69%) of adolescents 15 to 19 years of age drowned in fresh bodies of water.[16] In a study from Washington state, open-water drowning occurred in 35% of those in the 0- to 4-year age group, 69% of those in the 5- to 14-year age group, and 95% of adolescents.[23] Regarding nonfatal drowning in children and adults, 66% occurred in pools, 22% occurred in natural water, and 12% were unspecified.[24]

Above-Ground Inflatable and Portable Pools

Recently there was an increase in sales of large, inexpensive, inflatable or portable above-ground pools that come in various sizes, shapes, and water depths. The pools are 18 to 48 in deep and can hold less than 200 to more than 5000 gallons of water. Some models even require filtration equipment. Prices range from $50 to $750.[25] From 2004 to 2006, the CPSC reported 47 deaths of children related to inflatable pools.[26] Unfortunately, many parents do not consider fencing for an inflatable or portable pool, and such pools often fall outside of local building codes that require pool barriers. Because they contain such large amounts of water, these pools are often left filled for weeks at a time, which presents a continuous danger. The soft sides of some models allow children to lean over and easily fall into the pool headfirst. In a study of above-ground pools, children between 42 and 54 months of age were shown to be able to climb into a pool with a 48-in wall, even if the ladder was removed.[27] The American Society for Testing and Materials (ASTM) has published a standard (F 2666-07) for above-ground pools for residential use that addresses structural integrity, sanitation, electrical safety, and safety-message labeling.[28]

Drain Entrapment

From 1990 to 2004, 74 cases (13 deaths) of body entrapment in a pool or spa drain were reported to the CPSC.[29] In a separate report, 24 additional cases (2 deaths) were reported in just the 3 years from 2005 to 2007.[30] The situation often involves a child playing with an open drain, inserting a hand or foot into the pipe, and then becoming trapped by increasing suction and resulting tissue swelling. The deaths were from drowning. The majority (77%) of the victims were younger than 15 years. In the same time period (1990–2004), 43 incidents (12 deaths) of hair entanglement were reported.[29] These incidents typically involve females with long hair who are underwater near a suction outlet. The water flow into the drain sweeps the hair into and around the drain cover, where it becomes tangled in the holes and protrusions of the cover. Almost all (92%) of these cases were also in children younger than 15 years. In addition, there have been 2 incidents of evisceration and disembowelment that have occurred when a young child sat on and was sucked into a drain with a missing cover.[29]

Entrapment and entanglement can be prevented by the use of special drain covers, safety vacuum-release systems (SVRSs), filter pumps with multiple drains, and a variety of other pressure-venting filter-construction techniques.[29] Unfortunately, many parents and pool and spa owners are not aware of entrapment/entanglement risk, and only 15% have installed antivortex drain covers, only 14% have multiple drain systems, and only 12% have an SVRS on their pool or spa.[31] In 2007, Congress passed the Virginia Graeme Baker Pool and Spa Safety Act, which requires drain covers, unblockable drains, and SVRSs for all public pools and spas in the United States.[32] Although the sct does not apply to private pools, all pool owners should implement the recommendations reflected in the act.

Lapses in Adult Supervision

Drowning is not generally associated with a complete lack of adult supervision but, rather, with a momentary lapse in supervision. In fact, in a study of 496 drowning deaths in children younger than 14 years that were reviewed by state child-death review teams, only 10% were completely unsupervised at the time of the drowning. Most of the children (68%) were expected to be in or near the water just before the drowning incident.[33] In a questionnaire portion of the same study, parents of children younger than 14 years admitted that they talk to others (38%), read (18%), eat (17%), and talk on the telephone (11%) while supervising their child near water. Attempts to attribute cause to 538 swimming-pool submersion incidents of children younger than 5 years in Maricopa County revealed seasonal differences (warm versus cold months) and differences related to outcome (fatal versus nonfatal). In winter months, both with fatal and nonfatal cases, lack of a barrier and broken fences and gates were responsible for most (76%) cases, and poor supervision was blamed in only 16% of the cases. During warm months, lapses in supervision were responsible for 62% of nonfatal cases; however, lack of a barrier and broken fences and gates were responsible for most (70%) of the deaths.[15] Fencing is clearly important all year round. Overall, nonfunctioning gates were the cause of 17% of all pool drowning incidents in this study.

Alcohol

A recent meta-analysis revealed that 30% to 70% of swimming and boating fatal drowning victims had a measurable blood alcohol concentration (BAC)

and that 10% to 30% of those deaths could be attributed specifically to alcohol use.[34] In boating, there is evidence that the relative risk of drowning death is directly related to BAC, with a 16-fold greater risk when the victim's BAC was more than 0.10 (100 mg/dL).[35] Alcohol intake may increase the risk of drowning not only by impairing judgment and performance but also through physiologic effects (ie, impaired orientation, hypothermia) that affect survival once submersion occurs.[35] Little information is available regarding the association of drug use and drowning. One 10-year retrospective study from Ohio revealed that only 3% of 141 accidental drowning deaths were associated with illicit drugs.[36]

Swimming Ability

Few studies have examined the relationship between swimming ability and the risk of drowning, and there is no clear evidence that drowning rates are higher in poor swimmers. Increased swimming proficiency might lead to an increase in drowning rates through an increased exposure to water and dangerous aquatic situations.[37,38] A CPSC study of 140 swimming-pool child-drowning deaths revealed that better swimming ability, as reported by the parents, was associated with lower drowning risk.[39] An 8- to 12-week training course for preschool-aged (24–42 months) children revealed that the subjects were able to develop the water-safety skills necessary to survive a fall into a home swimming pool.[40] With training, the young children could stand and recover when dropped into 2 ft of water, kick propulsively, and get to the side of the pool after jumping in or being released in the pool by an adult.

Two recent case-control studies revealed that swimming lessons may reduce drowning risk in small children. A study from rural China that examined drowning deaths in children 1 to 4 years of age revealed that drowning "case" children were less likely to have had swimming lessons than were controls (6.8% vs 12%, respectively).[41] Research on 61 drowning deaths in children 1 to 4 years of age (mean age: 2.62 years) from the Eunice Kennedy Shriver National Institute of Child Health and Human Development revealed that the drowning victims were reportedly less likely (3% vs 26%) to have participated in formal swimming lessons (odds ratio [OR]: 0.05 [95% confidence interval (CI): 0.01–0.34]; $P = .002$) and were less likely (5% vs 18%) to be able to float on their back for 10 seconds ($P = .01$). When adjusted for education, race, and risk-taking, formal swimming lessons remained a significant predictor of drowning risk (OR: 0.12 [95% CI: 0.01–0.97]). The authors indicated that "this can be interpreted as an 88% reduction in risk of drowning among those with swimming lessons, with 95% confidence that a protective effect between 3% and 99% includes the true value."[42] The study reports did not describe the details of the swim instruction or water-survival skills training.

Although swimming ability may or may not decrease drowning risk, it does not result in "drown-proofing." A study from the Canadian Red Cross revealed that 16% of those who fatally drowned while swimming had "strong" or "average" swimming skills.[43] In a study of children younger than 5 years from New Zealand, 6 of 36 (17%) of the drowning victims had received swimming instruction.[44]

In recent years, water-survival skills programs designed for infants younger than 12 months have become popular both in the United States and internationally. Many movies of tiny infants who have been taught to swim underwater, float fully clothed on their backs, and even cry out for help have emerged on the Internet. Although there are anecdotal reports of infants who have "saved themselves," no scientific study has clearly demonstrated the safety and efficacy of training programs for such young infants.

Underlying Medical Conditions

Seizure disorder is a known risk factor in drowning. Children with epilepsy are at greater risk of drowning in bathtubs as well as in swimming pools.[45] The relative risk of submersion events and drowning deaths in patients with epilepsy varies greatly from study to study and depends on such factors as age, severity of illness, degree of exposure to water, and level of supervision.[45–47] There is some evidence from studies with small numbers of patients that children with autism spectrum disorders are at higher risk of drowning than those in the general population.[48,49] The risk in children with autism seems to be higher with greater degrees of mental retardation.[48] For children without autism, no study has specifically studied developmental disabilities or attention-deficit/hyperactivity disorder as drowning risk factors. In individuals with long QT syndrome, exertion from swimming may trigger an arrhythmia.[50] Although such cases represent a small percentage of drownings, this syndrome should be considered as a possible cause for unexplained submersion injuries among proficient swimmers in low-risk settings.

Boating

In 2008, the US Coast Guard reported 71 boating deaths of individuals 19 years and younger, with 53 (75%) attributed to drowning. Eighty-five of the 669 injuries in this age group occurred while riding in an open motorboat or personal watercraft. Analysis of all fatal boating incidents has revealed that 79% of the operators had no boating

training, and 22% of the incidents involved alcohol.[51]

The vast majority of boating drowning deaths (90%) occur in individuals not wearing a personal flotation device (PFD).[51] For children younger than 14 years, it is reported that nearly 45% of those who died in a boating-related incident were not wearing a life jacket.[33] Federal law requires life-jacket use for children younger than 13 years on recreational boats in the United States. One observational study revealed that 90% of children younger than 5 years wore life jackets, but only 13% of those 14 years or older used a life jacket.[52]

Reasons commonly cited for not wearing a life jacket include beliefs that there is a low risk of drowning, that life jackets restrict movement, that life jackets are uncomfortable, that life jackets are unattractive, and that wearing a life jacket is a sign of fear.[53] Parents of children who do not always wear life jackets report reasons including (1) the parent is in close proximity to the child, (2) a PFD for the child is on board in case of emergency, and/or (3) the child has good swimming skills.[33]

INTERVENTIONS

In the Haddon matrix of injury prevention, safety interventions are aimed at changing the environment, the individual at risk, or the agent of injury (in this case, water). For drowning prevention, the environment and the individual are the prime targets. Experts generally recommend that multiple "layers of protection" be used to prevent drowning, because no single strategy is likely to prevent all submersion deaths and injuries. Such layers might include environmental changes such as adult supervision, pool fencing, pool covers, water-entry alarms, lifeguards, and CPR training. Additional prevention layers focused on the individual would include strategies such as swimming and survival skills training and use of PFDs.

Studies from the late 1990s revealed that pediatricians report that they were not adequately taught about drowning prevention during their residency training and that few of them counseled parents about this topic.[54,55] There have been no recent publications regarding the current status of drowning-prevention counseling by physicians and no research about whether such an intervention is effective in decreasing drowning rates.

Adult Supervision

Close supervision of young children around any body of water is an essential preventive strategy, but inevitable lapses make supervision alone insufficient.[15,33] Because young children who fall into water often make no noise and are hard to see below the water surface, proper care of a young nonswimmer requires the supervising adult to be within an arm's length and provide "touch supervision." To stress the importance of supervision, some communities have distributed "designated water watcher" badges as part of their drowning-prevention campaigns. While wearing the badge, the adult "water watcher" is responsible for pool safety and is expected not to engage in any distracting activities. The efficacy of such programs still needs evaluation.

Pool Fencing

Pool fencing is an important prevention strategy for decreasing the risk of drowning in swimming pools when children are not supposed to have access to the water. Compared with no fencing, installation of 4-sided fencing that isolates the pool from the house and yard has been shown to decrease the number of pool-immersion injuries among young children by more than 50%.[56–58] One Cochrane collaboration meta-analysis of available studies revealed the OR for drowning in a fenced versus an unfenced pool to be 0.27 (95% CI: 0.16–0.47). In this analysis, pool isolation fencing was revealed to be superior to property-perimeter fencing (OR: 0.17 [95% CI: 0.07–0.44]).[58] A study from Australia revealed that the risk of a child drowning in a pool with perimeter fencing was almost twice that seen in pools with an isolation fence (incidence rate ratio: 1.78 [95% CI: 1.40–1.79]).[59]

Unfortunately, laws and ordinances regarding pool fencing may have dangerous loopholes. Perimeter fencing with self-locking or alarming doors between the house and pool area are often considered acceptable, and in some locales, pool covers can substitute for a fence. Often, the fence law pertains only to new pool construction or to homes in which a young child is actually living at the time of the pool installation. Furthermore, in the United States, pool fences are rarely inspected, and ordinances are often not enforced. A recent study from Australia revealed that government inspections raised the rate of compliance with pool-fencing laws from approximately 50% to 97%.[60]

Children's ability to climb fences varies with the type of fence. In 1 study, chain-link fences were easily scaled by children, whereas ornamental iron-bar fences proved more difficult to climb.[61] Fences should be at least 4 ft high, and no opening under the fence should be more than 4 in (some building codes require a 5-ft fence and a maximum fence-to-ground distance of only 2 in). Vertical members of the fence should be less than 4 in apart to keep a child from squeezing through them, and there should be no footholds or handholds that could help a young child climb the fence. The fence should not prevent a clear view of the pool. Gates should be self-closing and self-

latching, and the latch should be placed at least 54 in above the bottom of the gate. The gate should open away from the pool and should be checked often to ensure that it is in good working order. Pool gate alarms may provide additional protection, but no research exists on their efficacy. Detailed guidelines for safety barriers for home pools are available online from the CPSC,[62] but homeowners must also be aware of local laws and building codes regarding pool-fence construction.

Pool Covers

Retractable pool covers and pool nets capable of holding the weight of a child have been advertised as effective barriers for drowning prevention. Because these covers must be removed and replaced each time the pool is used, they are not likely to be used appropriately and consistently. Because there has been no scientific study regarding the efficacy of pool covers, they cannot be recommended as a substitute for isolation fencing.

Some types of pool covers actually present a hazard for children. In 1980, the CPSC issued a warning about solar pool covers that are designed to keep the water warm and minimize pool chemical and water evaporation. When children try to walk on these thin sheets of plastic, they can fall into the water and drown while entangled in the cover or hidden from view.[63]

Pool Alarms

The CPSC has evaluated the performance of surface, subsurface, and wristband pool alarms.[64] Several of these alarms functioned properly and were thought to provide some protection against drowning; however, the report concluded that alarms "should not be relied on as a substitute for supervision or a barrier completely surrounding the pool." No study results have demonstrated whether pool alarms prevent drowning.

Lifeguards

Although no formal scientific study has quantified the value of lifeguards, anecdotal reports indicate that drowning rates are lower when lifeguards are present.[65] The US Lifesaving Association has reported that only 20 of the 109 beach drowning deaths occurred on guarded beaches in 2007.[66] In addition to rescue efforts, lifeguards serve to make beaches safer by monitoring the aquatic environment, enforcing rules and regulations, and educating beachgoers about safety and injury prevention. Those who choose to swim in natural bodies of water or other sites accessible to the public should swim in designated swim areas with lifeguards present.

CPR Training

Immediate resuscitation at the site of a submersion incident, even before the arrival of emergency medical services personnel, is an important means of secondary prevention and is associated with a significantly better outcome for children with submersion injury.[2,3] For this reason, all parents and caregivers should be trained in infant/child CPR. Initial resuscitative efforts for a drowning victim should include rescue breathing as well as chest compressions when signs of circulation are absent. "Hands-only" CPR is not appropriate for drowning victims. The Heimlich maneuver is not recommended to expel water from the lungs, because positive pressure ventilation by mouth or mask will accomplish adequate oxygenation.[67] Additional CPR information and courses for parents and caregivers is available through the American Heart Association and the American Red Cross. Education for health care professionals on resuscitation of pediatric patients is available through American Academy of Pediatrics programs Pediatric Advanced Life Support (PALS) and Pediatric Education for Prehospital Professionals (PEPP).

Swimming Instruction and Water-Survival Training

All children should eventually learn to swim. In the past, the position of the American Academy of Pediatrics has been that children are not "developmentally ready" for formal swimming lessons until after their fourth birthday.[68] This policy was based on (1) the lack of data needed to determine if infant and toddler aquatic programs increase or decrease the likelihood of drowning, (2) concerns that such programs would cause parents to develop a false sense of security and lead them to provide inadequate supervision around water, and (3) evidence that starting swimming lessons at a very young age does not result in earlier development of proficient swimming skills.[69,70] In addition, there was concern that swimming programs might reduce a child's fear of water and unwittingly encourage him or her to enter the water without supervision.

Concern about parents developing a false sense of security is well founded. Compared with controls, parents of small children who were enrolled in swimming lessons were more likely to endorse the statements "swimming lessons are the best way to prevent drowning," "toddlers can learn to save themselves if they fall into water," and "it is better to develop swimming ability rather than rely on adult supervision."[71] In a follow-up study, when they were given a targeted educational program to reverse misconceptions about toddler water safety, parents of children in a toddler swim program were more likely to agree that their child required more, not less, supervision. These parents were also more likely to disagree that swimming lessons were

the best way to prevent drowning.[72] The authors suggested that "swim schools can provide a valuable opportunity to address parental misconceptions about toddler water safety."

By 4 years of age, most children can learn basic aquatic locomotion, and by 5 or 6 years of age, most of them can master the front crawl.[69,70] The more important question for this report relates to when a child can learn water skills needed to prevent a drowning. Results of research from Asher et al,[40] Yang et al,[41] and Brenner et al[42] have indicated that some drowning-prevention skills can be learned between 1 and 4 years of age. It should be stressed, however, that these were relatively small studies that had outcomes with wide CIs. Although there is anecdotal evidence that even some small infants can successfully learn water-survival skills, there are currently no published scientific studies to indicate that such training results in the "drown-proofing" claimed by some advocates.

The American Red Cross Advisory Council on First Aid, Aquatics, Safety and Preparedness recently published an extensive scientific review regarding minimum age for swimming lessons. They concluded that the "limited empirical research evidence does not support prohibiting early aquatic experiences at any specific age." In their report, the council stated that "children between the ages of 2 and 4 years can optionally start swim lessons for the purpose of building aquatic readiness and water acclimation on an individual basis."[73] Although the council recognized that there may be some drowning-prevention benefit to swim lessons before 4 years of age, they indicated that "there is absolutely no published evidence to support anecdotal claims" that "rolling over and floating are sufficient to prevent drowning."

Although early instruction may be beneficial, there are some concerns about aquatic programs in this young age group. These concerns include the risk of gastrointestinal tract infections, dermatitis, and acute respiratory illness that can result from exposure to infectious agents and pool chemicals. Hyponatremia from drinking pool water and hypothermia have also been reported. Generally, medical problems from swimming are rare, treatable, and preventable events.[74,75] The World Aquatic Infants and Children Network has published guidelines for the operation of aquatic programs for children younger than 3 years. The guidelines address (1) required parental involvement, (2) a fun atmosphere with 1-on-1 teaching, (3) qualified teachers, (4) warm water to prevent hypothermia, (5) maintenance of water purity, and (6) a limited number of submersions to prevent water ingestion and hyponatremia.[76]

Recent articles have been published and suggest a link between infant exposure to chlorination byproducts in swimming pools and damage to respiratory epithelium, resulting in a predisposition to asthma and bronchitis.[77–79] In 1 of these studies, asthma was more likely in infants of atopic mothers.[79] In another study, atopic adolescents exposed to chlorinated pools were more likely to have hay fever, asthma, cough, and shortness of breath than were atopic adolescents who swam in pools disinfected by a copper-silver method.[80]

The AAP continues to support swimming lessons for children 4 years old and older without physical or developmental disabilities. In light of new research that has revealed that swim instruction for children 1 to 4 years of age may decrease drowning,[41,42] it is reasonable for the AAP to relax its policy regarding the age at which children should start learning water-survival skills. The evidence no longer supports an advisory against early aquatic experience and swim lessons for children of any specific age. However, the current evidence is insufficient to support a recommendation that all 1- to 4-year-old children receive swim lessons. Clearly, more research is needed to determine which types of swim instruction and water-survival skills training are most effective in preventing drowning in young children of various ages.

A parent's decision about the age at which to teach water-survival skills or initiate swimming lessons must be individualized on the basis of a variety of factors such as frequency of exposure to water, health concerns, emotional maturity, and physical limitations. Some parents may feel that the benefits of infant or toddler water programs outweigh any possible dangers. Once again, it must be stressed that even advanced swimming skills will not always prevent drowning and that swimming lessons must be considered only within the context of multilayered protection with effective pool barriers and constant, capable supervision.

PFDs

The use of an approved PFD, although not well evaluated, seems likely to decrease drowning morbidity and mortality.[81,82] US Coast Guard boating statistics from 2008 indicate that only 9% of 510 drowning-death victims (all ages) were wearing a PFD.[51] Successful educational and life-jacket–loaner programs designed to increase PFD use have been reported,[83,84] and in the past 10 years, the Coast Guard reported a slight improvement in PFD use in children younger than 18 years from 56% to 65% nationally.[85] It is important to recognize that air-filled swimming aids (such as inflatable arm bands) are toys that can deflate and should not be used in place of PFDs.

Information about infant and child PFDs for a variety of aquatic situations is available online from the US Coast Guard.[86]

Policy Statement

Advice pediatricians may provide to parents and recommendations for advocacy at the community level is specified in the accompanying policy statement.[87]

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Prevention of Infective Endocarditis

Guidelines From the American Heart Association

A Guideline From the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group

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The Council on Scientific Affairs of the American Dental Association has approved the guideline as it relates to dentistry. In addition, this guideline has been endorsed by the Infectious Diseases Society of America and by the Pediatric Infectious Diseases Society.

Backgroundð The purpose of this statement is to update the recommendations by the American Heart Association (AHA) for the prevention of infective endocarditis that were last published in 1997.

Methods and Resultsð A writing group was appointed by the AHA for their expertise in prevention and treatment of infective endocarditis, with liaison members representing the American Dental Association, the Infectious Diseases Society of America, and the American Academy of Pediatrics. The writing group reviewed input from national and international experts on infective endocarditis. The recommendations in this document reflect analyses of relevant literature regarding procedure-related bacteremia and infective endocarditis, in vitro susceptibility data of the most common microorganisms that cause infective endocarditis, results of prophylactic studies in animal models of experimental endocarditis, and retrospective and prospective studies of prevention of infective endocarditis. MEDLINE database searches from 1950 to 2006 were done for English-language papers using the following search terms: endocarditis, infective endocarditis, prophylaxis, prevention, antibiotic, antimicrobial, pathogens, organisms, dental, gastrointestinal, genitourinary, streptococcus, enterococcus, staphylococcus, respiratory, dental surgery, pathogenesis, vaccine, immunization, and bacteremia. The reference lists of the identified papers were also searched. We also searched the AHA online library. The American College of Cardiology/AHA classification of recommendations and levels of evidence for practice guidelines were used. The paper was subsequently reviewed by outside experts not affiliated with the writing group and by the AHA Science Advisory and Coordinating Committee.

Conclusionsð The major changes in the updated recommendations include the following: (1) The Committee concluded that only an extremely small number of cases of infective endocarditis might be prevented by antibiotic prophylaxis for

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This guideline was approved by the American Heart Association Science Advisory and Coordinating Committee on March 7, 2007. A single reprint is available by calling 800-242-8721 (US only) or by writing the American Heart Association, Public Information, 7272 Greenville Ave, Dallas, TX 75231-4596. Ask for reprint No. 71-0407. To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com. To make photocopies for personal or educational use, call the Copyright Clearance Center, 978-750-8400.

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dental procedures even if such prophylactic therapy were 100% effective. (2) Infective endocarditis prophylaxis for dental procedures should be recommended only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from infective endocarditis. (3) For patients with these underlying cardiac conditions, prophylaxis is recommended for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa. (4) Prophylaxis is not recommended based solely on an increased lifetime risk of acquisition of infective endocarditis. (5) Administration of antibiotics solely to prevent endocarditis is not recommended for patients who undergo a genitourinary or gastrointestinal tract procedure. These changes are intended to define more clearly when infective endocarditis prophylaxis is or is not recommended and to provide more uniform and consistent global recommendations. **(*Circulation*. 2007;115:&NA;-.)**

Key Words: AHA Scientific Statements ■ cardiovascular diseases ■ endocarditis ■ prevention ■ antibiotic prophylaxis

Infective endocarditis (IE) is an uncommon but life-threatening infection. Despite advances in diagnosis, antimicrobial therapy, surgical techniques, and management of complications, patients with IE still have high morbidity and mortality rates related to this condition. Since the last American Heart Association (AHA) publication on prevention of IE in 1997,[1] many authorities and societies, as well as the conclusions of published studies, have questioned the efficacy of antimicrobial prophylaxis to prevent IE in patients who undergo a dental, gastrointestinal (GI), or genitourinary (GU) tract procedure and have suggested that the AHA guidelines should be revised.[2–5] Members of the Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee of the AHA Council on Cardiovascular Disease in the Young (ñthe Committeeò) and a national and international group of experts on IE extensively reviewed data published on the prevention of IE. The Committee is especially grateful to a group of international experts on IE who provided content review and input on this document (see Acknowledgments). The revised guidelines for IE prophylaxis are the subject of this report.

The writing group was charged with the task of performing an assessment of the evidence and giving a classification of recommendations and a level of evidence (LOE) to each recommendation. The American College of Cardiology (ACC)/AHA classification system was used as follows.

Classification of Recommendations:

Class I: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is beneficial, useful, and effective.

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful/effective and in some cases may be harmful.

Level of Evidence:

Level of Evidence A: Data derived from multiple randomized clinical trials or meta-analyses.

Level of Evidence B: Data derived from a single randomized trial or nonrandomized studies.

Level of Evidence C: Only consensus opinion of experts, case studies, or standard of care.

History of AHA Statements on Prevention of IE

The AHA has made recommendations for the prevention of IE for more than 50 years. In 1955, the first AHA document on this subject was published in *Circulation*.[6] Table 1 shows a summary of the documents published from 1955 to 1997.[1,6–13] The 1960 document called attention to the possible emergence of penicillin-resistant oral microflora as a result of prolonged therapy for prevention of IE, and pediatric patients were included for the first time.[8] Chloramphenicol was recommended for patients who were allergic to penicillin. In 1965, the Committee published for the first time a document devoted solely to the prophylaxis of IE and recognized the importance of enterococci after GI or GU tract procedures.[9] The revised recommendations published in 1972 were endorsed for the first time by the American Dental Association (ADA) and emphasized the importance of maintenance of good oral hygiene.[10] This version introduced a recommendation for ampicillin in patients undergoing a GI or GU tract procedure. The 1977 revisions categorized both patients and procedures into high- and low-risk groups.[11] This resulted in complex tables with many footnotes. The 1984 recommendations attempted to simplify prophylactic regimens by providing clear lists of procedures for which prophylaxis was and was not recommended and reduced postprocedure prophylaxis for dental, GI, and GU tract procedures to only 1 oral or parenteral dose.[12] In 1990, a more complete list of cardiac conditions and dental or surgical procedures for which prophylaxis was and was not recommended was provided.[13] These previous recommendations recognized the potential medical-legal risks associated with IE prophylaxis and suggested that the recommendations were intended to serve as a guideline, not as established standard of care. The most recent AHA document on IE prophylaxis was published in 1997.[1] The 1997 document stratified cardiac conditions into high-, moderate-, and low-risk (negligible risk) categories, with prophylaxis not recommended for the low-risk group.[1] An even more detailed list of dental, respiratory, GI, and GU tract procedures for which prophylaxis was and was not recommended was provided. The 1997 document was notable for its acknowledgment that most cases of IE are not attributable to an invasive procedure but

TABLE 1. Summary of 9 Iterations of AHA-Recommended Antibiotic Regimens From 1955 to 1997 for Dental/Respiratory Tract Procedures*

Year (Reference)	Primary Regimens for Dental Procedures
1955 (6)	Aqueous penicillin 600 000 U and procaine penicillin 600 000 U in oil containing 2% aluminum monostearate administered IM 30 minutes before the operative procedure
1957 (7)	For 2 days before surgery, penicillin 200 000 to 250 000 U by mouth 4 times per day. On day of surgery, penicillin 200 000 to 250 000 U by mouth 4 times per day and aqueous penicillin 600 000 U with procaine penicillin 600 000 U IM 30 to 60 minutes before surgery. For 2 days after, 200 000 to 250 000 U by mouth 4 times per day.
1960 (8)	Step I: prophylaxis 2 days before surgery with procaine penicillin 600 000 U IM on each day
	Step II: day of surgery: procaine penicillin 600 000 U IM supplemented by crystalline penicillin 600 000 U IM 1 hour before surgical procedure
	Step III: for 2 days after surgery: procaine penicillin 600 000 U IM each day
1965 (9)	Day of procedure: procaine penicillin 600 000 U, supplemented by crystalline penicillin 600 000 U IM 1 to 2 hours before the procedure
	For 2 days after procedure: procaine penicillin 600 000 U IM each day
1972 (10)	Procaine penicillin G 600 000 U mixed with crystalline penicillin G 200 000 U IM 1 hour before procedure and once daily for the 2 days after the procedure
1977 (11)	Aqueous crystalline penicillin G (1 000 000 U IM) mixed with procaine penicillin G (600 000 U IM) 30 minutes to 1 hour before procedure and then penicillin V 500 mg orally every 6 hours for 8 doses.
1984 (12)	Penicillin V 2 g orally 1 hour before, then 1 g 6 hours after initial dose
1990 (13)	Amoxicillin 3 g orally 1 hour before procedure, then 1.5 g 6 hours after initial dose
1997 (1)	Amoxicillin 2 g orally 1 hour before procedure

IM indicates intramuscularly.

*These regimens were for adults and represented the initial regimen listed in each version of the recommendations. In some versions, >1 regimen was included.

rather are the result of randomly occurring bacteremias from routine daily activities and for its acknowledgment of possible IE prophylaxis failures.

Rationale for Revising the 1997 Document

It is clear from the above chronology that the AHA guidelines for IE prophylaxis have been in a process of evolution more than 50 years. The rationale for prophylaxis was based largely on expert opinion and what seemed to be a rational and prudent attempt to prevent a life-threatening infection. On the basis of the ACC and AHA Task Force on Practice Guidelinesô evidence-based grading system for ranking recommendations, the recommendations in the AHA documents published during the past 50 years would be Class IIb, LOE C. Accordingly, the basis for recommendations for IE prophylaxis was not well established, and the quality of evidence was limited to a few case-control studies or was based on expert opinion, clinical experience, and descriptive studies that utilized surrogate measures of risk.

Over the years, other international societies have published recommendations and guidelines for the prevention of IE.[14,15] Recently, the British Society for Antimicrobial Chemotherapy issued new IE prophylaxis recommendations.[15] This group now recommends prophylaxis before dental procedures only for patients who have a history of previous IE or who have had cardiac valve replacement or surgically constructed pulmonary shunts or conduits.

The fundamental underlying principles that drove the formulation of the AHA guidelines and the 9 previous AHA documents were that (1) IE is an uncommon but life-threatening disease, and prevention is preferable to treatment of established infection; (2) certain underlying cardiac conditions predispose to IE; (3) bacteremia with organisms known to cause IE occurs commonly in association with invasive dental, GI, or GU tract procedures; (4) antimicrobial prophylaxis was proven to be effective for prevention of experimental IE in animals; and (5) antimicrobial prophylaxis was thought to be effective in humans for prevention of IE associated with dental, GI, or GU tract procedures. The Committee believes that of these 5 underlying principles, the first 4 are valid and have not changed during the past 30 years. Numerous publications have questioned the validity of the fifth principle and suggested revision of the guidelines, primarily for reasons as shown in Table 2.

Another reason that led the Committee to revise the 1997 document was that over the past 50 years, the AHA guidelines on prevention of IE became overly complicated, making it difficult for patients and healthcare providers to interpret or remember specific details, and they contained ambiguities and some inconsistencies in the recommendations. The decision to substantially revise the 1997 document was not taken lightly. The present revised document was not based on the results of a single study but rather on the collective body of

TABLE 2. Primary Reasons for Revision of the IE Prophylaxis Guidelines

IE is much more likely to result from frequent exposure to random bacteremias associated with daily activities than from bacteremia caused by a dental, GI tract, or GU tract procedure.
Prophylaxis may prevent an exceedingly small number of cases of IE, if any, in individuals who undergo a dental, GI tract, or GU tract procedure.
The risk of antibiotic-associated adverse events exceeds the benefit, if any, from prophylactic antibiotic therapy.
Maintenance of optimal oral health and hygiene may reduce the incidence of bacteremia from daily activities and is more important than prophylactic antibiotics for a dental procedure to reduce the risk of IE.

evidence published in numerous studies over the past 2 decades. The Committee sought to construct the present recommendations such that they would be in the best interest of patients and providers, would be reasonable and prudent, and would represent the conclusions of published studies and the collective wisdom of many experts on IE and relevant national and international societies.

Potential Consequences of Substantive Changes in Recommendations

Substantive changes in recommendations could (1) violate long-standing expectations and practice patterns; (2) make fewer patients eligible for IE prophylaxis; (3) reduce malpractice claims related to IE prophylaxis; and (4) stimulate prospective studies on IE prophylaxis. The Committee and others[16] recognize that substantive changes in IE prophylaxis guidelines may violate long-standing expectations and practice patterns by patients and healthcare providers. The Committee recognizes that these new recommendations may cause concern among patients who have previously received antibiotic prophylaxis to prevent IE before dental or other procedures and are now advised that such prophylaxis is unnecessary. Table 2 includes the main talking points that may be helpful for clinicians in reeducating their patients about these changes. To recommend such changes demands due diligence and critical analysis. For 50 years, since the publication of the first AHA guidelines on the prevention of IE,[6] patients and healthcare providers assumed that antibiotics administered in association with a bacteremia-producing procedure effectively prevented IE in patients with underlying cardiac risk factors. Patients were educated about bacteremia-producing procedures and risk factors for IE, and they expected to receive antibiotic prophylaxis; healthcare providers, especially dentists, were expected to administer them. Patients with underlying cardiac conditions that carry a lifetime risk of acquisition of IE, such as mitral valve prolapse (MVP), had a sense of reassurance and comfort that antibiotics administered in association with a dental procedure were effective and usually safe to prevent IE. Healthcare providers, especially dentists, felt a sense of obligation and professional and legal responsibility to protect their patients from IE that might result from a procedure. On the basis of recommendations in this revised document, substantially fewer patients will be recommended for IE prophylaxis.

Cases of IE either temporally or remotely associated with an invasive procedure, especially a dental procedure, have frequently been the basis for malpractice claims against healthcare providers. Unlike many other infections for which there is conclusive evidence for the efficacy of preventive therapy, the prevention of IE is not a precise science. Because previously published AHA guidelines for the prevention of IE contained ambiguities and inconsistencies and were often based on minimal published data or expert opinion, they were subject to conflicting interpretations among patients, healthcare providers, and the legal system about patient eligibility for prophylaxis and whether there was strict adherence by healthcare providers to AHA recommendations for prophylaxis. This document is intended to identify which, if any, patients may possibly benefit from IE prophylaxis and to define, to the extent possible, which dental procedures should have prophylaxis in this select group of patients. Accordingly, the Committee hopes that this document will result in greater clarity for patients, healthcare providers, and consulting professionals.

The Committee believes that recommendations for IE prophylaxis must be evidence based. A placebo-controlled, multicenter, randomized, double-blinded study to evaluate the efficacy of IE prophylaxis in patients who undergo a dental, GI, or GU tract procedure has not been done. Such a study would require a large number of patients per treatment group and standardization of the specific invasive procedures and the patient populations. This type of study would be necessary to definitively answer long-standing unresolved questions regarding the efficacy of IE prophylaxis. The Committee hopes that this revised document will stimulate additional studies on the prevention of IE. Future published data will be reviewed carefully by the AHA, the Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease, and other societies, and further revisions to the present document will be based on relevant studies.

Pathogenesis of IE

The development of IE is the net result of the complex interaction between the bloodstream pathogen with matrix molecules and platelets at sites of endocardial cell damage. In addition, many of the clinical manifestations of IE emanate from the hostôs immune response to the infecting microorganism. The following sequence of events is thought to result in IE: formation of nonbacterial thrombotic endocarditis (NBTE) on the surface of a cardiac valve or elsewhere that endothelial damage occurs, bacteremia, adherence of the bacteria in the bloodstream to NBTE, and proliferation of bacteria within a vegetation.

Formation of NBTE

Turbulent blood flow produced by certain types of congenital or acquired heart disease, such as flow from a high- to a low-pressure chamber or across a narrowed orifice, traumatizes the endothelium. This creates a predisposition for deposition of platelets and fibrin on the surface of the endothelium, which results in NBTE. Invasion of the bloodstream with a microbial species that has the pathogenic potential to colonize this site can then result in IE.

Transient Bacteremia

Mucosal surfaces are populated by a dense endogenous microflora. Trauma to a mucosal surface, particularly the gingival crevice around teeth, oropharynx, GI tract, urethra, and vagina, releases many different microbial species transiently into the bloodstream. Transient bacteremia caused by viridans group streptococci and other oral microflora occurs commonly in association with dental extractions or other dental procedures or with routine daily activities. Although controversial, the frequency and intensity of the resulting bacteremias are believed to be related to the nature and magnitude of the tissue trauma, the density of the microbial flora, and the degree of inflammation or infection at the site of trauma. The microbial species entering the circulation

depends on the unique endogenous microflora that colonizes the particular traumatized site.

Bacterial Adherence

The ability of various microbial species to adhere to specific sites determines the anatomic localization of infection caused by these microorganisms. Mediators of bacterial adherence serve as virulence factors in the pathogenesis of IE. Numerous bacterial surface components present in streptococci, staphylococci, and enterococci have been shown in animal models of experimental endocarditis to function as critical adhesins. Some viridans group streptococci contain a FimA protein that is a lipoprotein receptor antigen I (LraI) that serves as a major adhesin to the fibrin platelet matrix of NBTE.[17] Staphylococcal adhesins function in at least 2 ways. In one, microbial surface components recognizing adhesive matrix molecules facilitate the attachment of staphylococci to human extracellular matrix proteins and to medical devices that become coated with matrix proteins after implantation. In the other, bacterial extracellular structures contribute to the formation of biofilm that forms on the surface of implanted medical devices. In both cases, staphylococcal adhesins are important virulence factors.

Both FimA and staphylococcal adhesins are immunogenic in experimental infections. Vaccines prepared against FimA and staphylococcal adhesins provide some protective effect in experimental endocarditis caused by viridans group streptococci and staphylococci.[18,19] The results of these experimental studies are highly intriguing, because the development of an effective vaccine for use in humans to prevent viridans group streptococcal or staphylococcal IE would be of major importance.

Proliferation of Bacteria Within a Vegetation

Microorganisms adherent to the vegetation stimulate further deposition of fibrin and platelets on their surface. Within this secluded focus, the buried microorganisms multiply as rapidly as bacteria in broth cultures to reach maximal microbial densities of 10^8 to 10^{11} colony-forming units per gram of vegetation within a short time on the left side of the heart, apparently uninhibited by host defenses in left-sided lesions. Right-sided vegetations have lower bacterial densities, which may be the consequence of host defense mechanisms active at this site, such as polymorphonuclear activity or platelet-derived antibacterial proteins. More than 90% of the microorganisms in mature left- or right-sided valvular vegetations are metabolically inactive rather than in an active growth phase and are therefore less responsive to the bactericidal effects of antibiotics.[20]

Rationale for or Against Prophylaxis of IE

Historical Background

Viridans group streptococci are part of the normal skin, oral, respiratory, and GI tract flora, and they cause at least 50% of cases of community-acquired native valve IE not associated with intravenous drug use.[21] More than a century ago, the oral cavity was recognized as a potential source of the bacteremia that caused viridans group streptococcal IE. In 1885, Osler[22] noted an association between bacteremia from surgery and IE. Okell and Elliott[23] in 1935 reported that 11% of patients with poor oral hygiene had positive blood cultures with viridans group streptococci and that 61% of patients had viridans group streptococcal bacteremia with dental extraction.

As a result of these early studies and subsequent studies, during the past 50 years, the AHA guidelines recommended antimicrobial prophylaxis to prevent IE in patients with underlying cardiac conditions who underwent bacteremia-producing procedures on the basis of the following factors: (1) bacteremia causes endocarditis; (2) viridans group streptococci are part of the normal oral flora, and enterococci are part of the normal GI and GU tract flora; (3) these microorganisms were usually susceptible to antibiotics recommended for prophylaxis; (4) antibiotic prophylaxis prevents viridans group streptococcal or enterococcal experimental endocarditis in animals; (5) a large number of poorly documented case reports implicated a dental procedure as a cause of IE; (6) in some cases, there was a temporal relationship between a dental procedure and the onset of symptoms of IE; (7) an awareness of bacteremia caused by viridans group streptococci associated with a dental procedure exists; (8) the risk of significant adverse reactions to an antibiotic is low in an individual patient; and (9) morbidity and mortality from IE are high. Most of these factors remain valid, but collectively, they do not compensate for the lack of published data that demonstrate a benefit from prophylaxis.

Bacteremia-Producing Dental Procedures

The large majority of published studies have focused on dental procedures as a cause of IE and the use of prophylactic antibiotics to prevent IE in patients at risk. Few data exist on the risk of or prevention of IE associated with a GI or GU tract procedure. Accordingly, the Committee undertook a critical analysis of published data in the context of the historical rationale for recommending antibiotic prophylaxis for IE before a dental procedure. The following factors were considered: (1) frequency, nature, magnitude, and duration of bacteremia associated with dental procedures; (2) impact of dental disease, oral hygiene, and type of dental procedure on bacteremia; (3) impact of antibiotic prophylaxis on bacteremia from a dental procedure; and (4) the exposure over time of frequently occurring bacteremia from routine daily activities compared with bacteremia from various dental procedures.

Frequency, Nature, Magnitude, and Duration of Bacteremia Associated With a Dental Procedure

Transient bacteremia is common with manipulation of the teeth and periodontal tissues, and there is a wide variation in reported frequencies of bacteremia in patients resulting from dental procedures: tooth extraction (10% to 100%), periodontal surgery (36% to 88%), scaling and root planing (8% to 80%), teeth cleaning (up to 40%), rubber dam matrix/wedge placement (9% to 32%), and endodontic procedures (up to 20%).[24–30] Transient bacteremia also occurs frequently during routine daily activities unrelated to a dental procedure, such as tooth brushing and flossing (20% to 68%), use of wooden toothpicks (20% to 40%), use of water irrigation devices (7%

to 50%), and chewing food (7% to 51%).[26–29,31–36] Considering that the average person living in the United States has fewer than 2 dental visits per year, the frequency of bacteremia from routine daily activities is far greater.

There has been a disproportionate focus on the frequency of bacteremia associated with dental procedures rather than on the species of bacteria recovered from blood cultures. Studies suggest that more than 700 species of bacteria, including aerobic and anaerobic Gram-positive and Gram-negative microorganisms, may be identified in the human mouth, particularly on the teeth and in the gingival crevices.[24,37–40] Approximately 30% of the flora of the gingival crevice is streptococci, predominantly of the viridans group. Of the more than 100 oral bacterial species recovered from blood cultures after dental procedures, the most prevalent are viridans group streptococci, the most common microbiological cause of community-acquired native valve IE in nonintravenous drug users.[21] In healthy mouths, a thin surface of mucosal epithelium prevents potentially pathogenic bacteria from entering the bloodstream and lymphatic system. Anaerobic microorganisms are commonly responsible for periodontal disease and frequently enter the bloodstream but rarely cause IE, with fewer than 120 cases reported.[41] Viridans group streptococci are antagonistic to periodontal pathogens and predominate in a clean, healthy mouth.[42]

Few published studies exist on the magnitude of bacteremia after a dental procedure or from routine daily activities, and most of the published data used older, often unreliable microbiological methodology. There are no published data that demonstrate that a greater magnitude of bacteremia, compared with a lower magnitude, is more likely to cause IE in humans. The magnitude of bacteremia resulting from a dental procedure is relatively low ($<10^4$ colony-forming units of bacteria per milliliter), similar to that resulting from routine daily activities, and is less than that used to cause experimental IE in animals (10^6 to 10^8 colony-forming units of bacteria per milliliter).[20,43,44] Although the infective dose required to cause IE in humans is unknown, the number of microorganisms present in blood after a dental procedure or associated with daily activities is low. Cases of IE caused by oral bacteria probably result from the exposures to low inocula of bacteria in the bloodstream that result from routine daily activities and not from a dental procedure. Additionally, the vast majority of patients with IE have not had a dental procedure within 2 weeks before the onset of symptoms of IE.[2–4]

The role of duration of bacteremia on the risk of acquisition of IE is uncertain.[45,46] Early studies reported that sequential blood cultures were positive for up to 10 minutes after tooth extraction and that the number of positive blood cultures dropped sharply after 10 to 30 minutes.[24,45–51] More recent studies support these data but report a small percentage of positive blood cultures from 30 to 60 minutes after tooth extraction.[43,52,53] Intuitively, it seems logical to assume that the longer the duration of bacteremia, the greater the risk of IE, but no published studies support this assumption. Given the preponderance of published data, there may not be a clinically significant difference in the frequency, nature, magnitude, and duration of bacteremia associated with a dental procedure compared with that resulting from routine daily activities. Accordingly, it is inconsistent to recommend prophylaxis of IE for dental procedures but not for these same patients during routine daily activities. Such a recommendation for prophylaxis for routine daily activities would be impractical and unwarranted.

Impact of Dental Disease, Oral Hygiene, and Type of Dental Procedure on Bacteremia

It is assumed that a relationship exists between poor oral hygiene, the extent of dental and periodontal disease, the type of dental procedure, and the frequency, nature, magnitude, and duration of bacteremia, but the presumed relationship is controversial.[23,29,30,38,45,54–61] Nevertheless, available evidence supports an emphasis on maintaining good oral hygiene and eradicating dental disease to decrease the frequency of bacteremia from routine daily activities.[45,56–58,62,63] In patients with poor oral hygiene, the frequency of positive blood cultures just before dental extraction may be similar to that after extraction.[62,63]

More than 80 years ago, it was suggested that poor oral hygiene and dental disease were more important as a cause of IE than were dental procedures.[64] Most studies since that time have focused instead on the risks of bacteremia associated with dental procedures. For example, tooth extraction is thought to be the dental procedure most likely to cause bacteremia, with an incidence ranging from 10% to 100%.* However, numerous other dental procedures have been reported to be associated with risks of bacteremia that are similar to that resulting from tooth extraction.À A precise determination of the relative risk of bacteremia that results from a specific dental procedure in patients with or without dental disease is probably not possible.[27,72,73]

Bleeding often occurs during a dental procedure in patients with or without periodontal disease. Previous AHA guidelines recommended antibiotic prophylaxis for dental procedures in which bleeding was anticipated but not for procedures for which bleeding was not anticipated.[1] However, no data show that visible bleeding during a dental procedure is a reliable predictor of bacteremia.[62] These ambiguities in the previous AHA guidelines led to further uncertainties among healthcare providers about which dental procedures should be covered by prophylaxis.

These factors complicated recommendations in previous AHA guidelines on prevention of IE that suggested antibiotic prophylaxis for some dental procedures but not for others. The collective published data suggest that the vast majority of dental office visits result in some degree of bacteremia; however, there is no evidence-based method to decide which procedures should require prophylaxis, because no data show that the incidence, magnitude, or duration of bacteremia from any dental procedure increase the risk of IE. Accordingly, it is not clear which dental procedures are more or less likely to cause a transient bacteremia or result in a greater magnitude of bacteremia than that which results from routine daily activities such as chewing food, tooth brushing, or flossing.

*References 23, 24, 27, 29, 45, 48, 52, 54, 57, and 65–67.
ÀReferences 27, 28, 47, 51, 54, 56, 58, and 68–71.

In patients with underlying cardiac conditions, lifelong antibiotic therapy is not recommended to prevent IE that might result from bacteremias associated with routine daily activities.[5] In patients with dental disease, the focus on the frequency of bacteremia associated with a specific dental procedure and the AHA guidelines for prevention of IE have resulted in an overemphasis on antibiotic prophylaxis and an underemphasis on maintenance of good oral hygiene and access to routine dental care, which are likely more important in reducing the lifetime risk of IE than the administration of antibiotic prophylaxis for a dental procedure. However, no observational or controlled studies support this contention.

Impact of Antibiotic Therapy on Bacteremia From a Dental Procedure

The ability of antibiotic therapy to prevent or reduce the frequency, magnitude, or duration of bacteremia associated with a dental procedure is controversial.[24,74] Some studies reported that antibiotics administered before a dental procedure reduced the frequency, nature, and/or duration of bacteremia,[53,75,76] whereas others did not.[24,66,77,78] Recent studies suggest that amoxicillin therapy has a statistically significant impact on reducing the incidence, nature, and duration of bacteremia from dental procedures, but it does not eliminate bacteremia.[52,53,76] However, no data show that such a reduction as a result of amoxicillin therapy reduces the risk of or prevents IE. Hall et al[78] reported that neither penicillin V nor amoxicillin therapy was effective in reducing the frequency of bacteremia compared with untreated control subjects. In patients who underwent a dental extraction, penicillin or ampicillin therapy compared with placebo diminished the percentage of viridans group streptococci and anaerobes in culture, but there was no significant difference in the percentage of patients with positive cultures 10 minutes after tooth extraction.[24,66] In a separate study, Hall et al[77] reported that cefaclor-treated patients did not have a reduction of postprocedure bacteremia compared with untreated control subjects. Contradictory published results from 2 studies showed reduction of postprocedure bacteremia by erythromycin in one[75] but lack of efficacy for erythromycin or clindamycin in another.[78] Finally, results are contradictory with regard to the efficacy of the use of topical antiseptics in reducing the frequency of bacteremia associated with dental procedures, but the preponderance of evidence suggests that there is no clear benefit. One study reported that chlorhexidine and povidone iodine mouth rinse were effective,[79] whereas others showed no statistically significant benefit.[52,80] Topical antiseptic rinses do not penetrate beyond 3 mm into the periodontal pocket and therefore do not reach areas of ulcerated tissue where bacteria most often gain entrance to the circulation. On the basis of these data, it is unlikely that topical antiseptics are effective to significantly reduce the frequency, magnitude, and duration of bacteremia associated with a dental procedure.

Cumulative Risk Over Time of Bacteremias From Routine Daily Activities Compared With the Bacteremia From a Dental Procedure

Guntheroth[81] estimated a cumulative exposure of 5370 minutes of bacteremia over a 1-month period in dentulous patients resulting from random bacteremia from chewing food and from oral hygiene measures, such as tooth brushing and flossing, and compared that with a duration of bacteremia lasting 6 to 30 minutes associated with a single tooth extraction. Roberts[62] estimated that tooth brushing 2 times daily for 1 year had a 154 000 times greater risk of exposure to bacteremia than that resulting from a single tooth extraction. The cumulative exposure during 1 year to bacteremia from routine daily activities may be as high as 5.6 million times greater than that resulting from a single tooth extraction, the dental procedure reported to be most likely to cause a bacteremia.[62]

Data exist for the duration of bacteremia from a single tooth extraction, and it is possible to estimate the annual cumulative exposure from dental procedures for the average individual. However, calculations for the incidence, nature, and duration of bacteremia from routine daily activities are at best rough estimates, and it is therefore not possible to compare precisely the cumulative monthly or annual duration of exposure for bacteremia from dental procedures compared with routine daily activities. Nevertheless, even if the estimates of bacteremia from routine daily activities are off by a factor of 1000, it is likely that the frequency and cumulative duration of exposure to bacteremia from routine daily events over 1 year are much higher than those that result from dental procedures.

Results of Clinical Studies of IE Prophylaxis for Dental Procedures

No prospective, randomized, placebo-controlled studies exist on the efficacy of antibiotic prophylaxis to prevent IE in patients who undergo a dental procedure. Data from published retrospective or prospective case-control studies are limited by the following factors: (1) the low incidence of IE, which requires a large number of patients per cohort for statistical significance; (2) the wide variation in the types and severity of underlying cardiac conditions, which would require a large number of patients with specific matched control subjects for each cardiac condition; and (3) the large variety of invasive dental procedures and dental disease states, which would be difficult to standardize for control groups. These and other limitations complicate the interpretation of the results of published studies of the efficacy of IE prophylaxis in patients who undergo dental procedures.

Although some retrospective studies suggested that there was a benefit from prophylaxis, these studies were small in size and reported insufficient clinical data. Furthermore, in a number of cases, the incubation period between the dental procedure and the onset of symptoms of IE was prolonged.[80,82–84]

van der Meer and colleagues[85] published a study of dental procedures in the Netherlands and the efficacy of antibiotic prophylaxis to prevent IE in patients with native or prosthetic cardiac valves. They concluded that dental or other procedures probably caused only a small fraction of cases of IE and that prophylaxis would prevent only a small number of cases even if it were 100% effective. These same authors[86] performed a 2-year case-control study. Among patients for whom prophylaxis was recommended, 5 of 20 cases of IE

occurred despite receiving antibiotic prophylaxis. The authors concluded that prophylaxis was not effective. In a separate study,[87] these authors reported poor awareness of recommendations for prophylaxis among both patients and healthcare providers.

Strom and colleagues[2] evaluated dental prophylaxis and cardiac risk factors in a multicenter case-control study. These authors reported that MVP, congenital heart disease (CHD), rheumatic heart disease (RHD), and previous cardiac valve surgery were risk factors for the development of IE. In that study, control subjects without IE were more likely to have undergone a dental procedure than were those with cases of IE ($P=0.03$). The authors concluded that dental treatment was not a risk factor for IE even in patients with valvular heart disease and that few cases of IE could be prevented with prophylaxis even if it were 100% effective.

These studies are in agreement with a recently published French study of the estimated risk of IE in adults with predisposing cardiac conditions who underwent dental procedures with or without antibiotic prophylaxis.[88] These authors concluded that a ñhuge number of prophylaxis doses would be necessary to prevent a very low number of IE cases.ò

Absolute Risk of IE Resulting From a Dental Procedure

No published data accurately determine the absolute risk of IE that results from a dental procedure. One study reported that 10% to 20% of patients with IE caused by oral flora underwent a preceding dental procedure (within 30 or 180 days of onset).[85] The evidence linking bacteremia associated with a dental procedure with IE is largely circumstantial, and the number of cases related to a dental procedure is overestimated for a number of reasons. For 60 years, noted opinion leaders in medicine suggested a link between bacteremia-causing dental procedures and IE,[23] and for 50 years, the AHA published regularly updated guidelines that emphasized the association between dental procedures and IE and recommended antibiotic prophylaxis.[1] Additionally, bacteremia-producing dental procedures are common; it is estimated that at least 50% of the population in the United States visits a dentist at least once a year. Furthermore, there are numerous poorly documented case reports that implicate dental procedures associated with the development of IE, but these reports did not prove a direct causal relationship. Even in the event of a close temporal relationship between a dental procedure and IE, it is not possible to determine with certainty whether the bacteremia that caused IE originated from a dental procedure or from a randomly occurring bacteremia as a result of routine daily activities during the same time period. Many case reports and reviews have included cases with a remote preceding dental procedure, often 3 to 6 months before the diagnosis of IE. Studies suggest that the time frame between bacteremia and the onset of symptoms of IE is usually 7 to 14 days for viridans group streptococci or enterococci. Reportedly, 78% of such cases of IE occur within 7 days of bacteremia and 85% within 14 days.[89] Although the upper time limit is not known, it is likely that many cases of IE with incubation periods longer than 2 weeks after a dental procedure were incorrectly attributed to the procedure. These and other factors have led to a heightened awareness among patients and healthcare providers of the possible association between dental procedures and IE, which likely has led to substantial overreporting of cases attributable to dental procedures.

Although the absolute risk for IE from a dental procedure is impossible to measure precisely, the best available estimates are as follows: If dental treatment causes 1% of all cases of viridans group streptococcal IE annually in the United States, the overall risk in the general population is estimated to be as low as 1 case of IE per 14 million dental procedures.[41,90,91] The estimated absolute risk rates for IE from a dental procedure in patients with underlying cardiac conditions are as follows: MVP, 1 per 1.1 million procedures; CHD, 1 per 475 000; RHD, 1 per 142 000; presence of a prosthetic cardiac valve, 1 per 114 000; and previous IE, 1 per 95 000 dental procedures.[41,91] Although these calculations of risk are estimates, it is likely that the number of cases of IE that result from a dental procedure is exceedingly small. Therefore, the number of cases that could be prevented by antibiotic prophylaxis, even if 100% effective, is similarly small. One would not expect antibiotic prophylaxis to be near 100% effective, however, because of the nature of the organisms and choice of antibiotics.

Risk of Adverse Reactions and Cost-Effectiveness of Prophylactic Therapy

Nonfatal adverse reactions, such as rash, diarrhea, and GI upset, occur commonly with the use of antimicrobials; however, only single-dose therapy is recommended for dental prophylaxis, and these common adverse reactions are usually not severe and are self-limited. Fatal anaphylactic reactions were estimated to occur in 15 to 25 individuals per 1 million patients who receive a dose of penicillin.[92,93] Among patients with a prior penicillin use, 36% of fatalities from anaphylaxis occurred in those with a known allergy to penicillin compared with 64% of fatalities among those with no history of penicillin allergy.[94] These calculations are at best rough estimates and may overestimate the true risk of death caused by fatal anaphylaxis from administration of a penicillin. They are based on retrospective reviews or surveys of patients or on healthcare providersô recall of events. A prospective study is necessary to accurately determine the risk of fatal anaphylaxis resulting from administration of a penicillin.

For 50 years, the AHA has recommended a penicillin as the preferred choice for dental prophylaxis for IE. During these 50 years, the Committee is unaware of any cases reported to the AHA of fatal anaphylaxis resulting from the administration of a penicillin recommended in the AHA guidelines for IE prophylaxis. The Committee believes that a single dose of amoxicillin or ampicillin is safe and is the preferred prophylactic agent for individuals who do not have a history of type I hypersensitivity reaction to a penicillin, such as anaphylaxis, urticaria, or angioedema. Fatal anaphylaxis from a cephalosporin is estimated to be less common than from penicillin, at approximately 1 case per 1 million patients.[95] Fatal reactions to a single dose of a macrolide or clindamycin are extremely rare.[96,97] There has been only 1 case report of

documented *Clostridium difficile* colitis after a single dose of prophylactic clindamycin.[98]

Summary

Although it has long been assumed that dental procedures may cause IE in patients with underlying cardiac risk factors and that antibiotic prophylaxis is effective, scientific proof is lacking to support these assumptions. The collective published evidence suggests that of the total number of cases of IE that occur annually, it is likely that an exceedingly small number are caused by bacteremia-producing dental procedures. Accordingly, only an extremely small number of cases of IE might be prevented by antibiotic prophylaxis even if it were 100% effective. The vast majority of cases of IE caused by oral microflora most likely result from random bacteremias caused by routine daily activities, such as chewing food, tooth brushing, flossing, use of toothpicks, use of water irrigation devices, and other activities. The presence of dental disease may increase the risk of bacteremia associated with these routine activities. There should be a shift in emphasis away from a focus on a dental procedure and antibiotic prophylaxis toward a greater emphasis on improved access to dental care and oral health in patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE and those conditions that predispose to the acquisition of IE.

Cardiac Conditions and Endocarditis

Previous AHA guidelines categorized underlying cardiac conditions associated with the risk of IE as those with high risk, moderate risk, and negligible risk and recommended prophylaxis for patients in the high- and moderate-risk categories.[1] For the present guidelines on prevention of IE, the Committee considered 3 distinct issues: (1) What underlying cardiac conditions over a lifetime have the highest predisposition to the acquisition of endocarditis? (2) What underlying cardiac conditions are associated with the highest risk of adverse outcome from endocarditis? (3) Should recommendations for IE prophylaxis be based on either or both of these 2 conditions?

Underlying Conditions Over a Lifetime That Have the Highest Predisposition to the Acquisition of Endocarditis

In Olmsted County, Minnesota, the incidence of IE in adults ranged from 5 to 7 cases per 100 000 person-years.[99] This incidence has remained stable during the past 4 decades and is similar to that reported in other studies.[100–103] Previously, RHD was the most common underlying condition predisposing to endocarditis, and RHD is still common in developing countries.[99] In developed countries, the frequency of RHD has declined, and MVP is now the most common underlying condition in patients with endocarditis.[104]

Few published data quantitate the lifetime risk of acquisition of IE associated with a specific underlying cardiac condition. Steckelberg and Wilson[90] reported the lifetime risk of acquisition of IE, which ranged from 5 per 100 000 patient-years in the general population with no known cardiac conditions to 2160 per 100 000 patient-years in patients who underwent replacement of an infected prosthetic cardiac valve. In that study,[90] the risk of IE per 100 000 patient-years was 4.6 in patients with MVP without an audible cardiac murmur and 52 in patients with MVP with an audible murmur of mitral regurgitation. Per 100 000 patient-years, the lifetime risk (380 to 440) for RHD was similar to that (308 to 383) for patients with a mechanical or bioprosthetic cardiac valve. The highest lifetime risks per 100 000 patient-years were as follows: cardiac valve replacement surgery for native valve IE, 630; previous IE, 740; and prosthetic valve replacement done in patients with prosthetic valve endocarditis, 2160. In a separate study, the risk of IE per 100 000 patient-years was 271 in patients with congenital aortic stenosis and 145 in patients with ventricular septal defect.[105] In that same study, the risk of IE before closure of a ventricular septal defect was more than twice that after closure. Although these data provide useful ranges of risk in large populations, it is difficult to utilize them to define accurately the lifetime risk of acquisition of IE in an individual patient with a specific underlying cardiac risk factor. This difficulty is based in part on the fact that each individual cardiac condition, such as RHD or MVP, represents a broad spectrum of pathology from minimal to severe, and the risk of IE would likely be influenced by the severity of valvular disease.

CHD is another underlying condition with multiple different cardiac abnormalities that range from relatively minor to severe, complex cyanotic heart disease. During the past 25 years, there has been an increasing use of various intracardiac valvular prostheses and intravascular shunts, grafts, and other devices for repair of valvular heart disease and CHD. The diversity and nature of these prostheses and procedures likely present different levels of risk for acquisition of IE. These factors complicate an accurate assessment of the true lifetime risk of acquisition of IE in patients with a specific underlying cardiac condition.

On the basis of the data from Steckelberg and Wilson[91] and others,[2] it is clear that the underlying conditions discussed above represent a lifetime increased risk of acquisition of IE compared with individuals with no known underlying cardiac condition. Accordingly, when utilizing previous AHA guidelines in the decision to recommend IE prophylaxis for a patient scheduled to undergo a dental, GI tract, or GU tract procedure, healthcare providers were required to base their decision on population-based studies of risk of acquisition of IE that may or may not be relevant to their specific patient. Furthermore, practitioners had to weigh the potential efficacy of IE prophylaxis in a patient who may neither need nor benefit from such therapy against the risk of adverse reaction to the antibiotic prescribed. Finally, healthcare providers had to consider the potential medicolegal risk of not prescribing IE prophylaxis. For dental procedures, there is a growing body of evidence that suggests that IE prophylaxis may prevent only an exceedingly small number of cases of IE, as discussed in detail above.

Cardiac Conditions Associated With the Highest Risk of Adverse Outcome From Endocarditis

Endocarditis, irrespective of the underlying cardiac condition, is a serious, life-threatening disease that was always fatal in

TABLE 3. Cardiac Conditions Associated With the Highest Risk of Adverse Outcome From Endocarditis for Which Prophylaxis With Dental Procedures Is Recommended

Prosthetic cardiac valve
Previous IE
Congenital heart disease (CHD)*
Unrepaired cyanotic CHD, including palliative shunts and conduits
Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first 6 months after the procedure†
Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
Cardiac transplantation recipients who develop cardiac valvulopathy

*Except for the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of CHD.

†Prophylaxis is recommended because endothelialization of prosthetic material occurs within 6 months after the procedure.

the preantibiotic era. Advances in antimicrobial therapy, early recognition and management of complications of IE, and improved surgical technology have reduced the morbidity and mortality of IE. Numerous comorbid factors, such as older age, diabetes mellitus, immunosuppressive conditions or therapy, and dialysis, may complicate IE. Each of these comorbid conditions independently increases the risk of adverse outcome from IE, and they often occur in combination, which further increases morbidity and mortality rates. Additionally, there may be long-term consequences of IE. Over time, the cardiac valve damaged by IE may undergo progressive functional deterioration that may result in the need for cardiac valve replacement.

In native valve viridans group streptococcal or enterococcal IE, the spectrum of disease may range from a relatively benign infection to severe valvular dysfunction, dehiscence, congestive heart failure, multiple embolic events, and death; however, the underlying conditions shown in Table 3 virtually always have an increased risk of adverse outcome. For example, patients with viridans group streptococcal prosthetic valve endocarditis have a mortality rate of ≈20% or greater,[106–109] whereas the mortality from patients with viridans group streptococcal native valve IE is 5% or less.[108,110–116] Similarly, the mortality of enterococcal prosthetic valve endocarditis is higher than that of native valve enterococcal IE.[107,108,114,117] Moreover, patients with prosthetic valve endocarditis are more likely than those with native valve endocarditis to develop heart failure, the need for cardiac valve replacement surgery, perivalvular extension of infection, and other complications.

Patients with relapsing or recurrent IE are at greater risk of congestive heart failure and increased need for cardiac valve replacement surgery, and they have a higher mortality rate than patients with a first episode of native valve IE.[118–124] Additionally, patients with multiple episodes of native or prosthetic valve IE are at greater risk of additional episodes of endocarditis, each of which is associated with the risk of more serious complications.[90]

Published series regarding endocarditis in patients with CHD are underpowered to determine the extent to which a specific form of CHD is an independent risk factor for morbidity and mortality. Nevertheless, most retrospective case series suggest that patients with complex cyanotic heart disease and those who have postoperative palliative shunts, conduits, or other prostheses have a high lifetime risk of acquiring IE, and these same groups appear at highest risk for morbidity and mortality among all patients with CHD.[125–129] In addition, multiple series and reviews reported that the presence of prosthetic material[130,131] and complex cyanotic heart disease in patients of very young age (newborns and infants <2 years of age)[132,133] are 2 factors associated with the worst prognoses from IE. Some types of CHD may be repaired completely without residual cardiac defects. As shown in Table 3, the Committee recommends prophylaxis for dental procedures for these patients during the first 6 months after the procedure. In these patients, endothelialization of prosthetic material or devices occurs within 6 months after the procedure.[134] The Committee does not recommend prophylaxis for dental procedures more than 6 months after the procedure provided that there is no residual defect from the repair. In most instances, treatment of patients who have infected prosthetic materials requires surgical removal in addition to medical therapy with associated high morbidity and mortality rates.

Should IE Prophylaxis Be Recommended for Patients With the Highest Risk of Acquisition of IE or for Patients With the Highest Risk of Adverse Outcome From IE?

In a major departure from previous AHA guidelines, the Committee no longer recommends IE prophylaxis based solely on an increased lifetime risk of acquisition of IE. It is noteworthy that patients with the conditions listed in Table 3 with a prosthetic cardiac valve, those with a previous episode of IE, and some patients with CHD are also among those patients with the highest lifetime risk of acquisition of endocarditis. No published data demonstrate convincingly that the administration of prophylactic antibiotics prevents IE associated with bacteremia from an invasive procedure. We cannot exclude the possibility that there may be an exceedingly small number of cases of IE that could be prevented by prophylactic antibiotics in patients who undergo an invasive procedure. However, if prophylaxis is effective, such therapy should be restricted to those patients with the highest risk of adverse outcome from IE who would derive the greatest benefit from prevention of IE. In patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE (Table 3), IE prophylaxis for dental procedures may be reasonable, even though we acknowledge that its effectiveness is unknown **(*Class IIb, LOE B*)**.

Compared with previous AHA guidelines, under these revised guidelines, many fewer patients would be candidates to receive IE prophylaxis. We believe that these revised guidelines are in the best interest of patients and healthcare providers and are based on the best available published data and expert opinion. Additionally, the change in emphasis to recommend prophylaxis for only those patients with the highest risk of adverse outcome should reduce the uncertainties among patients and providers about who should receive

prophylaxis. MVP is the most common underlying condition that predisposes to acquisition of IE in the Western world; however, the absolute incidence of endocarditis is extremely low for the entire population with MVP, and it is not usually associated with the grave outcome associated with the conditions identified in Table 3. Thus, IE prophylaxis is no longer recommended for this group of individuals.

Finally, the administration of prophylactic antibiotics is not risk free, as discussed above. Additionally, the widespread use of antibiotic therapy promotes the emergence of resistant microorganisms most likely to cause endocarditis, such as viridans group streptococci and enterococci. The frequency of multidrug-resistant viridans group streptococci and enterococci has increased dramatically during the past 2 decades. This increased resistance has reduced the efficacy and number of antibiotics available for the treatment of IE.

Regimens Recommended

General Principles

An antibiotic for prophylaxis should be administered in a single dose before the procedure. If the dosage of antibiotic is *inadvertently* not administered before the procedure, the dosage may be administered up to 2 hours after the procedure. However, administration of the dosage after the procedure should be considered only when the patient did not receive the pre-procedure dose. Some patients who are scheduled for an invasive procedure may have a coincidental endocarditis. The presence of fever or other manifestations of systemic infection should alert the provider to the possibility of IE. In these circumstances, it is important to obtain blood cultures and other relevant tests before administration of antibiotics intended to prevent IE. Failure to do so may result in delay in diagnosis or treatment of a concomitant case of IE.

Regimens for Dental Procedures

Previous AHA guidelines on prophylaxis listed a substantial number of dental procedures and events for which antibiotic prophylaxis was recommended and those procedures for which prophylaxis was not recommended. On the basis of a critical review of the published data, it is clear that transient viridans group streptococcal bacteremia may result from any dental procedure that involves manipulation of the gingival or periapical region of teeth or perforation of the oral mucosa. It cannot be assumed that manipulation of a healthy-appearing mouth or a minimally invasive dental procedure reduces the likelihood of a bacteremia. Therefore, antibiotic prophylaxis is recommended for patients with the conditions listed in Table 3 who undergo any dental procedure that involves the gingival tissues or periapical region of a tooth and for those procedures that perforate the oral mucosa (Table 4). Although IE prophylaxis may be reasonable for these patients, its effectiveness is unknown **(*Class IIb, LOE C*)**. This includes procedures such as biopsies, suture removal, and placement of orthodontic bands, but it does not include routine anesthetic injections through noninfected tissue, the taking of dental radiographs, placement of removable prosthodontic or orthodontic appliances, placement of orthodontic brackets, or adjustment of orthodontic appliances. Finally, there are other events that are not dental procedures and for which prophylaxis is not recommended, such as shedding of deciduous teeth and trauma to the lips and oral mucosa.

TABLE 4. Dental Procedures for Which Endocarditis Prophylaxis Is Recommended for Patients in Table 3

All dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa*

*The following procedures and events do not need prophylaxis: routine anesthetic injections through noninfected tissue, taking dental radiographs, placement of removable prosthodontic or orthodontic appliances, adjustment of orthodontic appliances, placement of orthodontic brackets, shedding of deciduous teeth, and bleeding from trauma to the lips or oral mucosa.

In this limited patient population, prophylactic antimicrobial therapy should be directed against viridans group streptococci. During the past 2 decades, there has been a significant increase in the percentage of strains of viridans group streptococci resistant to antibiotics recommended in previous AHA guidelines for the prevention of IE. Prabhu et al[135] studied susceptibility patterns of viridans group streptococci recovered from patients with IE diagnosed during a period from 1971 to 1986 and compared these susceptibilities with those of viridans group streptococci from patients with IE diagnosed from 1994 to 2002. In that study, none of the strains of viridans group streptococci were penicillin resistant in the early time period compared with 13% of strains that were intermediately or fully penicillin resistant during the later time period. In that study, macrolide resistance increased from 11% to 26% and clindamycin resistance from 0% to 4%.

Among 352 blood culture isolates of viridans group streptococci, resistance rates were 13% for penicillin, 15% for amoxicillin, 17% for ceftriaxone, 38% for erythromycin, and 96% for cephalexin.[136] The rank order of decreasing level of activity of cephalosporins in that study was cefpodoxime equal to ceftriaxone, greater than cefprozil, and equal to cefuroxime, and cephalexin was the least active. In other studies, resistance of viridans group streptococci to penicillin ranged from 17% to 50%[137i,142] and resistance to ceftriaxone ranged from 22% to 42%.[131,140] Ceftriaxone was 2 to 4 times more active in vitro than cefazolin.[131,140] Similarly high rates of resistance were reported for macrolides, ranging from 22% to 58%[137,141,143,144]; resistance to clindamycin ranged from 13% to 27%.[128,129,131,137,138,140]

Most of the strains of viridans group streptococci in the above-cited studies were recovered from patients with serious underlying illnesses, including malignancies and febrile neutropenia. These patients are at increased risk of infection and colonization by multiple-drugï resistant microorganisms, including viridans group streptococci. Accordingly, these strains may not be representative of susceptibility patterns of viridans group streptococci recovered from presumably normal individuals who undergo a dental procedure. Diekema et al[137] reported that 32% of strains of viridans group streptococci were resistant to penicillin in patients without cancer. King et al[144] reported erythromycin resistance in 41% of streptococci recovered from throat cultures in otherwise healthy individuals who presented with mild respiratory tract infections. In that study, after treatment with either azithromycin or clindamycin, the percentage of resistant streptococci increased to 82% and 71%, respectively. Accordingly, the

TABLE 5. Regimens for a Dental Procedure

Situation	Agent	Regimen: Single Dose 30 to 60 min Before Procedure	
		Adults	Children
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicillin	2 g IM or IV	50 mg/kg IM or IV
	OR		
	Cefazolin or ceftriaxone	1 g IM or IV	50 mg/kg IM or IV
Allergic to penicillins or ampicillin—oral	Cephalexin*†	2 g	50 mg/kg
	OR		
	Clindamycin	600 mg	20 mg/kg
	OR		
	Azithromycin or clarithromycin	500 mg	15 mg/kg
Allergic to penicillins or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone†	1 g IM or IV	50 mg/kg IM or IV
	OR		
	Clindamycin	600 mg IM or IV	20 mg/kg IM or IV

IM indicates intramuscular; IV, intravenous.

*Or other first- or second-generation oral cephalosporin in equivalent adult or pediatric dosage.

†Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillins or ampicillin.

resistance rates of viridans group streptococci are similarly high in otherwise healthy individuals and in patients with serious underlying diseases.

The impact of viridans group streptococcal resistance on antibiotic prevention of IE is unknown. If resistance in vitro is predictive of lack of clinical efficacy, the high resistance rates of viridans group streptococci provide additional support for the assertion that prophylactic therapy for a dental procedure is of little, if any, value. It is impractical to recommend prophylaxis with only those antibiotics, such as vancomycin or a fluoroquinolone, that are highly active in vitro against viridans group streptococci. There is no evidence that such therapy is effective for prophylaxis of IE, and their use might result in the development of resistance of viridans group streptococci and other microorganisms to these and other antibiotics.

In Table 5, amoxicillin is the preferred choice for oral therapy because it is well absorbed in the GI tract and provides high and sustained serum concentrations. For individuals who are allergic to penicillins or amoxicillin, the use of cephalexin or another first-generation oral cephalosporin, clindamycin, azithromycin, or clarithromycin is recommended. Even though cephalexin was less active against viridans group streptococci than other first-generation oral cephalosporins in 1 study,[136] cephalexin is included in Table 5. No data show superiority of 1 oral cephalosporin over another for prevention of IE, and generic cephalexin is widely available and relatively inexpensive. Because of possible cross-reactions, a cephalosporin should not be administered to patients with a history of anaphylaxis, angioedema, or urticaria after treatment with any form of penicillin, including ampicillin or amoxicillin. Patients who are unable to tolerate an oral antibiotic may be treated with ampicillin, ceftriaxone, or cefazolin administered intramuscularly or intravenously. For ampicillin-allergic patients who are unable to tolerate an oral agent, therapy is recommended with parenteral cefazolin, ceftriaxone, or clindamycin.

Regimens for Respiratory Tract Procedures

A variety of respiratory tract procedures reportedly cause transient bacteremia with a wide array of microorganisms[1]; however, no published data conclusively demonstrate a link between these procedures and IE. Antibiotic prophylaxis with a regimen listed in Table 5 may be considered **(*Class IIb, LOE C*)** for patients with the conditions listed in Table 3 who undergo an invasive procedure of the respiratory tract that involves incision or biopsy of the respiratory mucosa, such as tonsillectomy and adenoidectomy. We do not recommend antibiotic prophylaxis for bronchoscopy unless the procedure involves incision of the respiratory tract mucosa. For patients listed in Table 3 who undergo an invasive respiratory tract procedure to treat an established infection, such as drainage of an abscess or empyema, we recommend that the antibiotic regimen administered to these patients contain an agent active against viridans group streptococci (Table 5). If the infection is known or suspected to be caused by *Staphylococcus aureus*, the regimen should contain an agent active against *S aureus*, such as an antistaphylococcal penicillin or cephalosporin, or vancomycin in patients unable to tolerate a β-lactam. Vancomycin should be administered if the infection is known or suspected to be caused by a methicillin-resistant strain of *S aureus*.

Recommendations for GI or GU Tract Procedures

Enterococci are part of the normal flora of the GI tract. These microorganisms may cause intra-abdominal infection or infection of the hepatobiliary system. Such infections are often polymicrobial, with a mix of aerobic and anaerobic Gram-negative and Gram-positive microorganisms, but among these varied bacteria, only enterococci are likely to cause IE. Enterococci may cause urinary tract infections, particularly in older males with prostatic hypertrophy and obstructive uropathy or prostatitis.

The administration of prophylactic antibiotics solely to prevent endocarditis is not recommended for patients who

undergo GU or GI tract procedures, including diagnostic esophagogastroduodenoscopy or colonoscopy **(*Class III, LOE B*)**. This is in contrast to previous AHA guidelines that listed GI or GU tract procedures for which IE prophylaxis was recommended and those for which prophylaxis was not recommended.[1] A large number of diagnostic and therapeutic procedures that involve the GI, hepatobiliary, or GU tract may cause transient enterococcal bacteremia. The possible association between GI or GU tract procedures and IE has not been studied as extensively as the possible association with dental procedures.[145] The cases of IE temporally associated with a GI or GU tract procedure are anecdotal, with either a single or very small number of cases reported.[83] No published data demonstrate a conclusive link between procedures of the GI or GU tract and the development of IE.[145] Moreover, no studies exist that demonstrate that the administration of antimicrobial prophylaxis prevents IE in association with procedures performed on the GI or GU tract.

There has been a dramatic increase in the frequency of antimicrobial-resistant strains of enterococci to penicillins, vancomycin, and aminoglycosides.[146–151] These antibiotics were recommended for IE prophylaxis in previous AHA guidelines.[1] The significance of the increased frequency of multiresistant strains of enterococci on prevention of IE in patients who undergo GI or GU tract procedures is unknown. The high prevalence of resistant strains of enterococci adds further doubt about the efficacy of prophylactic therapy for GI or GU tract procedures.

Patients with infections of the GI or GU tract may have intermittent or sustained enterococcal bacteremia. For patients with the conditions listed in Table 3 who have an established GI or GU tract infection or for those who receive antibiotic therapy to prevent wound infection or sepsis associated with a GI or GU tract procedure, it may be reasonable that the antibiotic regimen include an agent active against enterococci, such as penicillin, ampicillin, piperacillin, or vancomycin **(*Class IIb, LOE B*)**; however, no published studies demonstrate that such therapy would prevent enterococcal IE.

For patients with the conditions listed in Table 3 scheduled for an elective cystoscopy or other urinary tract manipulation who have an enterococcal urinary tract infection or colonization, antibiotic therapy to eradicate enterococci from the urine before the procedure may be reasonable **(*Class IIb, LOE B*)**. If the urinary tract procedure is not elective, it may be reasonable that the empiric or specific antimicrobial regimen administered to the patient contain an agent active against enterococci **(*Class IIb, LOE B*)**.

Amoxicillin or ampicillin is the preferred agent for enterococcal coverage for these patients. Vancomycin may be administered to patients unable to tolerate ampicillin. If infection is caused by a known or suspected strain of resistant enterococcus, consultation with an infectious diseases expert is recommended.

Recommendations for Procedures on Infected Skin, Skin Structure, or Musculoskeletal Tissue

These infections are often polymicrobial, but only staphylococci and β-hemolytic streptococci are likely to cause IE. For patients with the conditions listed in Table 3 who undergo a surgical procedure that involves infected skin, skin structure, or musculoskeletal tissue, it is reasonable that the therapeutic regimen administered for treatment of the infection contain an agent active against staphylococci and β-hemolytic streptococci, such as an antistaphylococcal penicillin or a cephalosporin (Table 5 for dosage; ***Class IIb, LOE C***). Vancomycin or clindamycin may be administered to patients unable to tolerate a β-lactam or who are known or suspected to have an infection caused by a methicillin-resistant strain of staphylococcus.

A summary of the major changes in these updated recommendations for prevention of IE compared with previous AHA recommendations is shown in Table 6.

TABLE 6. Summary of Major Changes in Updated Document

We concluded that bacteremia resulting from daily activities is much more likely to cause IE than bacteremia associated with a dental procedure.
We concluded that only an extremely small number of cases of IE might be prevented by antibiotic prophylaxis even if prophylaxis is 100% effective.
Antibiotic prophylaxis is not recommended based solely on an increased lifetime risk of acquisition of IE.
Limit recommendations for IE prophylaxis only to those conditions listed in Table 3.
Antibiotic prophylaxis is no longer recommended for any other form of CHD, except for the conditions listed in Table 3.
Antibiotic prophylaxis is recommended for all dental procedures that involve manipulation of gingival tissues or periapical region of teeth or perforation of oral mucosa only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE (Table 3).
Antibiotic prophylaxis is recommended for procedures on respiratory tract or infected skin, skin structures, or musculoskeletal tissue only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE (Table 3).
Antibiotic prophylaxis solely to prevent IE is not recommended for GU or GI tract procedures.
The writing group reaffirms the procedures noted in the 1997 prophylaxis guidelines for which endocarditis prophylaxis is not recommended and extends this to other common procedures, including ear and body piercing, tattooing, and vaginal delivery and hysterectomy.

Specific Situations and Circumstances

Patients Already Receiving Antibiotics

If a patient is already receiving long-term antibiotic therapy with an antibiotic that is also recommended for IE prophylaxis for a dental procedure, it is prudent to select an antibiotic from a different class rather than to increase the dosage of the current antibiotic. For example, antibiotic regimens used to prevent the recurrence of acute rheumatic fever are administered in dosages lower than those recommended for the prevention of IE. Individuals who take an oral penicillin for secondary prevention of rheumatic fever or for other purposes are likely to have viridans group streptococci in their oral cavity that are relatively resistant to penicillin or amoxicillin. In such cases, the provider should select either clindamycin, azithromycin, or clarithromycin for IE prophylaxis for a dental procedure, but only for patients shown in Table 3. Because of possible cross-resistance of viridans

group streptococci with cephalosporins, this class of antibiotics should be avoided. If possible, it would be preferable to delay a dental procedure until at least 10 days after completion of the antibiotic therapy. This may allow time for the usual oral flora to be reestablished.

Patients receiving parenteral antibiotic therapy for IE may require dental procedures during antimicrobial therapy, particularly if subsequent cardiac valve replacement surgery is anticipated. In these cases, the parenteral antibiotic therapy for IE should be continued and the timing of the dosage adjusted to be administered 30 to 60 minutes before the dental procedure. This parenteral antimicrobial therapy is administered in such high doses that the high concentration would overcome any possible low-level resistance developed among mouth flora (unlike the concentration that would occur after oral administration).

Patients Who Receive Anticoagulants

Intramuscular injections for IE prophylaxis should be avoided in patients who are receiving anticoagulant therapy **(*Class I, LOE A*)**. In these circumstances, orally administered regimens should be given whenever possible. Intravenously administered antibiotics should be used for patients who are unable to tolerate or absorb oral medications.

Patients Who Undergo Cardiac Surgery

A careful preoperative dental evaluation is recommended so that required dental treatment may be completed whenever possible before cardiac valve surgery or replacement or repair of CHD. Such measures may decrease the incidence of late prosthetic valve endocarditis caused by viridans group streptococci.

Patients who undergo surgery for placement of prosthetic heart valves or prosthetic intravascular or intracardiac materials are at risk for the development of infection.[152] Because the morbidity and mortality of infection in these patients are high, perioperative prophylactic antibiotics are recommended **(*Class I, LOE B*)**. Early-onset prosthetic valve endocarditis is most often caused by *S aureus*, coagulase-negative staphylococci, or diphtheroids. No single antibiotic regimen is effective against all these microorganisms. Prophylaxis at the time of cardiac surgery should be directed primarily against staphylococci and should be of short duration. A first-generation cephalosporin is most often used, but the choice of an antibiotic should be influenced by the antibiotic susceptibility patterns at each hospital. For example, a high prevalence of infection by methicillin-resistant *S aureus* should prompt the consideration of the use of vancomycin for perioperative prophylaxis. The majority of nosocomial coagulase-negative staphylococci are methicillin-resistant. Nonetheless, surgical prophylaxis with a first-generation cephalosporin is recommended for these patients **(*Class I, LOE A*)**.[107] In hospitals with a high prevalence of methicillin-resistant strains of *S epidermidis*, surgical prophylaxis with vancomycin is reasonable but has not been shown to be superior to prophylaxis with a cephalosporin **(*Class IIB, LOE C*)**. Prophylaxis should be initiated immediately before the operative procedure, repeated during prolonged procedures to maintain serum concentrations intraoperatively, and continued for no more than 48 hours postoperatively to minimize emergence of resistant microorganisms **(*Class IIa, LOE B*)**. The effects of cardiopulmonary bypass and compromised renal function on antibiotic concentrations in serum should be considered and dosages adjusted as necessary before and during the procedure.

Other Considerations

There is no evidence that coronary artery bypass graft surgery is associated with a long-term risk for infection. Therefore, antibiotic prophylaxis for dental procedures is not needed for individuals who have undergone this surgery. Antibiotic prophylaxis for dental procedures is not recommended for patients with coronary artery stents **(*Class III, LOE C*)**. The treatment and prevention of infection for these and other endovascular grafts and prosthetic devices are addressed in a separate AHA publication.[152] There are insufficient data to support specific recommendations for patients who have undergone heart transplantation. Such patients are at risk of acquired valvular dysfunction, especially during episodes of rejection. Endocarditis that occurs in a heart transplant patient is associated with a high risk of adverse outcome (Table 3).[153] Accordingly, the use of IE prophylaxis for dental procedures in cardiac transplant recipients who develop cardiac valvulopathy may be reasonable, but the usefulness is not well established **(*Class IIb, LOE C*;** Table 4). The use of prophylactic antibiotics to prevent infection of joint prostheses during potentially bacteremia-inducing procedures is not within the scope of this document.

Future Considerations

Prospective placebo-controlled, double-blinded studies of antibiotic prophylaxis of IE in patients who undergo a bacteremia-producing procedure would be necessary to evaluate accurately the efficacy of IE prophylaxis. Additional prospective case-control studies are needed. The AHA has made substantial revisions to previously published guidelines on IE prophylaxis. Given our current recommendations, we anticipate that significantly fewer patients will receive IE prophylaxis for a dental procedure. Studies are necessary to monitor the effects, if any, of these recommended changes in IE prophylaxis. The incidence of IE could change or stay the same. Because the incidence of IE is low, small changes in incidence may take years to detect. Accordingly, we urge that such studies be designed and instituted promptly so that any change in incidence may be detected sooner rather than later. Subsequent revisions of the AHA guidelines on the prevention of IE will be based on the results of these studies and other published data.

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*Modest.

†Significant.

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*Modest.

†Significant.

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Correction

In the AHA Guideline by Wilson et al, ñPrevention of Infective Endocarditis: Guidelines From the American Heart Association: A Guideline From the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group,ò that published online on April 19, 2007 (DOI: 10.1161/CIRCULATIONAHA.106.183095), several changes are needed. After online publication of these guidelines, the writing group was made aware that there was confusion among the readership regarding the use of the language ñRecommendedò in the title of Tables 3 and 4 and ñmay be reasonableò or ñmay be consideredò in the text when referring to our Class IIb recommendations. The writing group has clarified this by revising the wording in the tables and changing the language in the text to ñis reasonable.ò According to existing American Heart Association policy for wording of classes of recommendations, this change in language is accompanied by a shift in the class of recommendation from IIb to IIa as detailed in the errata.

1. Since the online publication of this article, the American Academy of Pediatrics and the International Society of Chemotherapy for Infection and Cancer* have added their endorsements.
2. On page 1736, in the footnotes section, the following footnote applies to the endorsement by the International Society of Chemotherapy for Infection and Cancer: ñ*If these guidelines are applied outside of the United States of America, adaptation of the recommended antibiotic agents may be considered with respect to the regional situation.ò
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    c. The last entry should read: ñAlthough these guidelines recommend changes in indications for IE prophylaxis with regard to selected dental procedures (see text), the writing group reaffirms that those medical procedures listed as not requiring IE prophylaxis in the 1997 statement remain unchanged and extends this view to vaginal delivery and hysterectomy and tattooing. Additionally, the committee advises against body piercing for patients in Table 3 because of the possibility of bacteremia, while recognizing there are minimal published data regarding the risk of bacteremia or endocarditis associated with body piercing.ò
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14. On page 1748, second column, first paragraph, the second sentence has been modified to read: ñFor patients with the conditions listed in Table 3 who undergo a surgical procedure that involves infected skin, skin structure, or musculoskeletal tissue, it may be reasonable that the therapeutic regimen administered for treatment of the infection contain an agent active against staphylococci. . . .ò
15. On page 1749, first column, last paragraph, the last sentence has been modified to read: ñIn hospitals with a high prevalence of methicillin-resistant strains of *S epidermidis*, surgical prophylaxis with vancomycin may be reasonable but has not been shown to be superior to prophylaxis. . ..ò
16. On page 1749, second column, under the heading ñOther Considerationsò, the penultimate sentence has been modified to read: ñAccordingly, the use of IE prophylaxis for dental procedures in cardiac transplant recipients who develop cardiac valvulopathy is reasonable, but the usefulness is not well established (***Class IIa, LOE C***; Table 4).ò

These changes have been made in the current print (*Circulation*. 2007;116:1736ï 1754) and online versions of the article.

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Correction

In the AHA Guideline by Wilson et al, ñPrevention of Infective Endocarditis: Guidelines From the American Heart Association: A Guideline From the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group,ò that published online on April 19, 2007 (DOI: 10.1161/CIRCULATIONAHA.106.183095), several changes are needed. After online publication of these guidelines, the writing group was made aware that there was confusion among the readership regarding the use of the language ñRecommendedò in the title of Tables 3 and 4 and ñmay be reasonableò or ñmay be consideredò in the text when referring to our Class IIb recommendations. The writing group has clarified this by revising the wording in the tables and changing the language in the text to ñis reasonable.ò According to existing American Heart Association policy for wording of classes of recommendations, this change in language is accompanied by a shift in the class of recommendation from IIb to IIa as detailed in the errata.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Prevention and Management of Pain in the Neonate: An Update

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

AMERICAN ACADEMY OF PEDIATRICS
Committee on Fetus and Newborn and Section on Surgery

CANADIAN PAEDIATRIC SOCIETY
Fetus and Newborn Committee

ABSTRACT

The prevention of pain in neonates should be the goal of all caregivers, because repeated painful exposures have the potential for deleterious consequences. Neonates at greatest risk of neurodevelopmental impairment as a result of preterm birth (ie, the smallest and sickest) are also those most likely to be exposed to the greatest number of painful stimuli in the NICU. Although there are major gaps in our knowledge regarding the most effective way to prevent and relieve pain in neonates, proven and safe therapies are currently underused for routine minor yet painful procedures. Every health care facility caring for neonates should implement an effective pain-prevention program, which includes strategies for routinely assessing pain, minimizing the number of painful procedures performed, effectively using pharmacologic and nonpharmacologic therapies for the prevention of pain associated with routine minor procedures, and eliminating pain associated with surgery and other major procedures.

INTRODUCTION

Objectives

This updated statement is intended for health care professionals who care for neonates (preterm to 1 month of age). The objectives are to:

1. emphasize that despite increased awareness of the importance of pain prevention, neonates in the NICU continue to be exposed to numerous painful minor procedures daily as part of their routine care;
2. present objective means of assessing neonatal pain by health care professionals;
3. describe effective strategies to prevent and treat pain associated with routine minor procedures; and
4. review appropriate methods to prevent and treat pain associated with surgery and other major procedures.

Background

The prevention of pain in neonates is an expectation of parents.[1] However, there are major gaps in our knowledge regarding the most effective way to accomplish this. Although it may not be possible to completely eliminate pain in neonates, much can be done to reduce the amount and intensity of pain. The prevention of

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Key Words
pain, neonates

Abbreviations
IVH—intraventricular hemorrhage
PVL—periventricular leukomalacia
ROP—retinopathy of prematurity

pain is important not only because it is an ethical expectation but also because repeated painful exposures can have deleterious consequences.[2–21] These consequences include altered pain sensitivity[5,7–9] (which may last into adolescence[15]) and permanent neuroanatomic and behavioral abnormalities, as found in animal studies.[5,14] It seems that altered pain sensitivity can be ameliorated if effective pain relief is provided.[7,17] There is growing concern that the long-term consequences of repeated pain in vulnerable neonates may also include emotional, behavioral, and learning disabilities[3,4,6,10,13,16]; however, there are no definitive data in humans. During the last few years, there has been considerable interest in the diagnosis and treatment of acute pain in the neonate, but there has been little published on the related subjects of stress and chronic pain in this population. In the original statement, stress and chronic pain were briefly discussed in addition to acute pain.[2] However, neither chronic pain nor stress has been specifically defined for the neonate, and only an intuitive understanding of these concepts is possible. Therefore, this updated statement deals primarily with acute pain prevention.

Neonates at greatest risk of neurodevelopmental impairment as a result of preterm birth (ie, the smallest and sickest neonates) are also those most likely to be exposed to the greatest number of painful stimuli in the NICU,[18] creating a "double-hit" phenomenon. Although effective pain relief is now usually provided for neonates during and after a major surgical procedure,[21] pain-reducing therapies are often underused for the numerous minor procedures that are a part of routine medical and nursing care for neonates.[20,21] Because the most effective and safest ways to prevent pain in the neonate are unknown, striking a proper balance between effective pain relief and avoidance of serious adverse effects from pain medications is a major challenge for caregivers. The subject of pain in the neonate was recently the focus of the Newborn Drug Development Workshop sponsored by the National Institute of Child Health and Human Development and the US Food and Drug Administration. The reader is referred to their publications for a detailed review and their discussions.[22–24]

ASSESSMENT OF PAIN AND STRESS IN THE NEONATE

Optimal pain management requires competent pain assessment, which can be especially difficult to perform in neonates. The pain-assessment tool used should be multidimensional, including measurements for both physiologic and behavioral indicators of pain, because neonates cannot self-report.[25–29] Physiologic indicators of pain include changes in heart rate, respiratory rate, blood pressure, oxygen saturation, vagal tone, palmar sweating, and plasma cortisol or catecholamine concentrations. Behavioral indicators include changes in facial expressions, body movements, and crying, but these may be absent in some neonates who are neurologically impaired or pharmacologically paralyzed.

When pain is prolonged, striking changes occur in the infant's physiologic and behavioral indicators. During episodes of prolonged pain, neonates enter a state of passivity with few, if any, body movements; an expressionless face; decreased heart rate and respiratory variability; and decreased oxygen consumption, all suggestive of a marked conservation of energy. Prolonged or repeated pain also increases the response elicited by future painful stimuli (hyperalgesia) and even by usually nonpainful stimuli (allodynia). Therefore, pain scales that are used in postoperative neonates should be sensitive to the changes in response that can occur when pain is prolonged.[27]

The most commonly used assessment tools are listed in Table 1.[30–45] For each tool, the physiologic and behavioral indicators of pain are described, the population for which they have been validated are delineated, and unique aspects are listed. Whatever assessment tools are used, continual multidisciplinary training of staff in the recognition of neonatal pain and in the use of the chosen pain-assessment tools should be provided.[26] Although in recent years, increased interest and research in the assessment of pain and stress in the neonate has occurred, there remains a need to develop a tool to measure pain in pharmacologically paralyzed and severely neurologically impaired infants.[40]

REDUCING PAIN FROM BEDSIDE CARE PROCEDURES

Neonates in the NICU often experience painful procedures during routine care,[10,21] such as needle insertions,[46–51] suctioning,[47,52,53] gavage-tube placement,[51,52,54] and tape removal,[52] as well as stressful disruptions, including diaper changes,[54] chest physical therapy,[54] physical examinations,[51] nursing evaluations,[52] and exposure to environmental stimuli.[20] Despite increased awareness by caregivers that neonates in the NICU frequently experience pain, effective pain relief for these routine procedures is often underused.[20,21,55] As discussed more completely later, the continuous infusion of morphine in ventilated preterm neonates may not effectively prevent acute pain from minor painful procedures and may increase adverse events.[56,57] However, there are other effective methods of preventing minor procedural pain in neonates, which should be used routinely. As part of a comprehensive pain-prevention program,[19,58,59] each neonatal unit should develop strategies to minimize the number of minor painful or stressful procedures and provide effective nonpharmacologic and/or pharmacologic pain relief for all procedures.

Reduction of Painful Events

Clearly, the most effective way of reducing minor procedural pain in the neonate is to reduce the number of procedures performed.[58] There currently is a paucity of

TABLE 1 **Pain-Assessment Tools**

Assessment Tool	Physiologic Indicators	Behavioral Indicators	Gestational Age Tested	Assesses Sedation	Scoring Adjusts for Gestational Age	Nature of Pain Assessed
PIPP: Premature Infant Pain Profile	Heart rate, oxygen saturation	Brow bulge, eyes squeezed shut, nasolabial furrow	28–40 wk	No	Yes	Procedural and postoperative pain
CRIES: Crying, Requires Oxygen Saturation, Increased Vital Signs, Expression, Sleeplessness	Heart rate, oxygen saturation	Crying, facial expression, sleeplessness	32–36 wk	No	No	Postoperative pain
NIPS: Neonatal Infant Pain Scale	Respiratory patterns	Facial expression, cry, movements of arms and legs, state arousal	28–38 wk	No	No	Procedural pain
N-PASS: Neonatal Pain Agitation and Sedation Scale	Heart rate, respiratory rate, blood pressure, oxygen saturation	Crying, irritability, behavior state, extremities tone	0–100 d of age and adjusts score on the basis of gestational age	Yes	Yes	Ongoing and acute pain and sedation
NFCS: Neonatal Facing Coding System	None	Facial muscle group movement	Preterm and term neonates, infants at 4 mo of age	No	No	Procedural pain
PAT: Pain Assessment Tool	Respirations, heart rate, oxygen saturation, blood pressure	Posture, tone, sleep pattern, expression, color, cry	Neonates	No	No	Acute pain
SUN: Scale for Use in Newborns	Central nervous system state, breathing, heart rate, mean blood pressure	Movement, tone, face	Neonates	No	No	Acute pain
EDIN: Echelle de la Douleur Inconfort Nouveau-Ne' (Neonatal Pain and Discomfort Scale)	None	Facial activity, body movements, quality of sleep, quality of contact with nurses, consolability	25–36 wk (preterm infants)	No	No	Prolonged pain
BPSN: Bernese Pain Scale for Neonates	Heart rate, respiratory rate, blood pressure, oxygen saturation	Facial expression, body posture, movements, vigilance	Term and preterm neonates	No	No	Acute pain

research regarding effective ways to accomplish this, but strategies for reducing the number of procedures that neonates experience should be developed and their effectiveness should be tested.[55] Such an approach might include reducing the number of bedside disruptions in care.[55,60,61] Other strategies might include bundling interventions, eliminating unnecessary laboratory or radiographic procedures, using transcutaneous measurements when possible, and minimizing the number of repeat procedures performed after failed attempts.[58]

Nonpharmacologic Pain Prevention for Minor Procedures

A variety of nonpharmacologic pain-prevention and -relief techniques have been shown to effectively reduce pain from minor procedures in neonates. These include use of oral sucrose/glucose,[62–76] breastfeeding,[77] nonnutritive sucking,[49,78] "kangaroo care" (skin-to-skin contact),[55,58] facilitated tuck (holding the arms and legs in a flexed position),[79] swaddling,[80] and developmental care, which includes limiting environmental stimuli, lateral positioning, the use of supportive bedding, and attention to behavioral clues.[61] These measures have been shown to be useful in preterm and term neonates in reducing pain from a heel stick,[68,70–73,79,80] venipuncture,[62,64,65,67,74,77,81] and subcutaneous injections[81] and are generally more effective when used in combination than when used alone.[63,65,68,69,80,82] Concentrated oral sucrose has been widely studied. Oral sucrose eliminates the electroencephalographic changes associated with a painful procedure[83] in a neonate, but the mechanism of pain relief by sucking oral sucrose is not known for certain. In one study, endogenous endorphin concentrations did not increase with administration of oral sucrose as originally proposed.[84] Although the intraoral administration of sucrose to preterm infants without suckling is effective, intragastric administration is not.[72] Concentrated oral glucose has also been used and diminishes the pain response of venipuncture, but it does not decrease oxygen consumption or energy expenditure, suggesting there may still be a stress response.[85]

A wide range of oral sucrose doses have been used in neonates for pain relief, but an optimal dose has not been established.[75,86] The dosage range of sucrose for reducing pain in neonates is 0.012 to 0.12 g (0.05–0.5 mL of 24% solution).[75,86] Some authors have suggested that multiple doses for a procedure (2 minutes before and 1–2 minutes after) are more effective than a single dose.[73,75] The long-term safety of multiple doses of oral sucrose for painful procedures in neonates has not been established.[87] Additional research is needed to fully understand the mechanism of action, optimal dose, and safety of repeated doses of oral sucrose in neonates; nevertheless, available data suggest that this is an effective means of alleviating pain for many minor neonatal procedures. Because oral sucrose reduces but does not eliminate pain in neonates, it should be used with other nonpharmacologic measures to enhance its effectiveness.

Topical Anesthetic Pain Prevention for Minor Procedures

Topical anesthetics can effectively reduce pain from some procedures such as a venipuncture,[62,88–90] lumbar puncture,[91] and intravenous catheter insertion[91] in term and preterm neonates. These agents must be applied for a sufficient length of time before the procedure (usually 30 minutes for neonates), and they are not effective for a heel-stick blood draw,[92,93] because the pain from heel sticks is primarily from squeezing the heel and not from the lancet.[48] Other nonpharmacologic means of alleviating pain mentioned previously should be used for heel sticks. Topical anesthetics were not effective for peripheral intravenous central catheter placement in one trial.[94] There is a risk of methemoglobinemia after use of topical lidocaine-prilocaine cream in certain situations.[95,96] The risks can be minimized if used no more than once daily, on intact skin only, and not with other drugs known to cause methemoglobinemia.[97,98]

Prolonged Mechanical Ventilation

Many preterm neonates receiving intensive care undergo prolonged mechanical ventilation, and its use defines a population of patients experiencing numerous minor painful procedures as described previously. The routine use of continuous pain medication and sedatives for ventilated preterm neonates has been evaluated.[24] Two large randomized, controlled trials of the continuous use of intravenous morphine primarily as a potential means of decreasing poor neurologic outcome in preterm neonates receiving mechanical ventilation were published recently.[56,57] In both studies, additional open-label morphine was allowed if infants were considered to be in pain. In the first study,[56] continuous morphine infusion was used for 7 days or less as clinically needed. In this study, morphine had no apparent analgesic effect and did not alter the risk of a poor neurologic outcome (severe intraventricular hemorrhage [IVH], periventricular leukomalacia [PVL], or death). In the second study,[57] a continuous morphine infusion was used for up to 14 days. In this study, morphine use reduced pain scores slightly but did not alter the risk of severe IVH, cystic PVL, or a composite outcome (severe IVH, cystic PVL, or death within 28 days). In a subsequent analysis, the authors concluded that the use of morphine prolonged the duration of mechanical ventilation.[99] No large studies on the continuous infusion of fentanyl in ventilated preterm infants have been published, but the literature includes many smaller studies that have recently been reviewed.[24] In these studies, fentanyl seemed to result in increased ventilator settings.[24] Concern about adverse respiratory effects of continuous opioid infusions in chronically ventilated preterm infants and lack

of a demonstrated long-term benefit suggest that their routine use cannot be recommended at this time.

Midazolam has been evaluated as a sedative in mechanically ventilated preterm infants. A *Cochrane Database Systematic Review*[100] recently concluded that there were insufficient data to promote use of midazolam because of a lack of demonstrated benefit and concern for an increased risk of poor neurologic outcome. This conclusion was supported by another recent review.[24] Ketamine hydrochloride was evaluated in a randomized, controlled trial for relief of procedural pain associated with endotracheal suctioning in ventilated preterm neonates.[101] However, these authors concluded that ketamine was only modestly effective at reducing pain scores and did not alter physiologic responses in heart rate and systemic blood pressure.

REDUCING PAIN FROM SURGERY

Pain is an inevitable consequence of surgery at every age. Pain is of particular importance in the neonate because of the evidence of improved clinical outcomes, including decreased mortality, when adequate pain control is achieved.[19,102] Tissue injury, which occurs during all forms of surgery, elicits profound physiologic responses. The more marked these responses to surgery, the greater the morbidities and mortality.[103] Thus, minimizing the endocrine and metabolic responses to surgery by decreasing pain has been shown to significantly improve outcomes in neonatal surgery. Although it would now be considered unethical to perform surgery without anesthesia, the appropriate levels of anesthesia for various surgical procedures have not been well investigated. Improving pain management and improving outcomes in the neonate require a coordinated strategy of pain reduction, which must be multidimensional, requires a team approach, and should be a first priority in perioperative management. Despite fears that analgesics (opiates in particular) may lead to hypotension or respiratory depression and an increase in postoperative complications, such effects have never been shown in randomized, controlled trials. Indeed, postoperative inotrope requirements were decreased by high-dose opioids in neonates after cardiac surgery,[104] and postoperative respiratory compromise associated with the pain of a thoracotomy can be relieved by adequate analgesia.[105,106]

Because of the physiologic and metabolic immaturity of the neonate, doses of medications that are effective for the reduction of pain may be close to the doses that cause toxicity. Therefore, the concept of a "balanced analgesia" has arisen, whereby several approaches to pain reduction can be used simultaneously to decrease the dosage required of each medication and, thereby, reduce toxicity. Early and effective pain treatment is associated with a lower total dose of medications, although therapy should be guided by ongoing pain assessment. The developmental pharmacology of the agents used must also be kept in mind. For example, fentanyl, a drug that is metabolized rapidly in older infants, has a half-life averaging approximately 10 hours in the neonate,[107] and clearance is even lower in preterm infants.[108] The residual effects of intraoperative medications also need to be considered. Muscle relaxants completely prevent behavioral pain responses and may last for several hours postoperatively.

As far as possible, stress and preoperative pain should be relieved before surgical interventions. An infant who is stressed and disturbed, unclothed, hypothermic, overstimulated by noise and light, and already experiencing pain will have elevated basal concentrations of adrenal cortical and medullary hormones and will be susceptible to further stress and complications postoperatively. However, there has been little direct investigation of the effects of preoperative analgesia in neonates. A full discussion of intraoperative strategies to reduce pain in neonates is beyond the scope of this statement. However, anesthesia of sufficient depth to prevent intraoperative pain and stress responses must be provided to decrease postoperative analgesic requirements. For some procedures, regional anesthesia is an effective way of controlling intraoperative pain in neonates, but a detailed discussion about regional anesthesia is also beyond the scope of this statement.

Postoperatively, opioids can be given by continuous infusion or by regular bolus. Randomized trials do not show any substantial benefit of continuous infusion of opioids over intermittent dosing, probably because of the long half-life of many of these agents in the neonate.[109] More recently developed rapidly metabolized agents given by infusion hold promise for nurse-controlled anesthesia using a pump (the nurse providing additional boluses of medication as needed). This technique has not been widely investigated but holds promise for reducing the total dose of and complications from opioids.

Intravenous nonsteroidal antiinflammatory agents such as ketorolac and ketoprofen are well established as a means of reducing postoperative opioid requirements in adults. A small number of randomized, controlled trials in children have also shown effective analgesia, with a reduction in morphine requirements leading to reduced postoperative vomiting compared with an opioid-based analgesic.[110] However, bleeding time may be increased,[111] and some reports[112] show an increase in postoperative clinical bleeding, although there are no randomized, controlled trials that have included neonates. A case series of infants younger than 6 months after abdominal surgery suggested a reduction in morphine requirements when ketorolac was used.[113] Lacking any substantial evidence in the neonatal period, nonsteroidal antiinflammatory agents cannot be recommended for use as an adjunct to postoperative anesthesia outside a prospective clinical trial.

Acetaminophen administered orally postoperatively

has been shown to reduce morphine requirements after tonsillectomy.[114] It is associated with less postoperative vomiting than with an opioid-based analgesic[115] and does not affect coagulation. Studies in neonates seem to be limited to use for circumcision, in which it is ineffective for operative and immediate postoperative pain but decreases later postoperative pain scores at 6 hours.[116] Acetaminophen should not be used alone for severe pain but can be considered for use during the later postoperative period, after minor procedures, or as an adjunct to other measures. Dosing guidelines based on extensive literature review have been developed,[117] and a population kinetic study with a large sample size produced similar guidelines.[118] However, rectal acetaminophen should be used cautiously because of erratic absorption.

Although there are few data specific to the neonate, regional analgesia can provide effective postoperative pain relief in some situations.[119,120] There has been little systematic study of ancillary comfort measures in the postoperative neonate. Despite the importance of good pharmacologic treatment, the nonpharmacologic means of reducing pain in neonates discussed previously can also be used postoperatively and should be part of a coordinated effort to reduce the pain and stress experienced by infants during the postoperative period.

REDUCING PAIN FROM OTHER MAJOR PROCEDURES

Intercostal Drains

Insertion of a chest drain for pneumothorax or pleural fluid drainage is a painful procedure that is sometimes required in an emergency situation. There have been no prospective studies of analgesia for the insertion of chest tubes in the neonate. The recommendations, therefore, are based on general principles.[19] Infiltration of the skin site with a local anesthetic before incision has long-lasting effects on pain responses (see above) and should be used routinely unless there is life-threatening instability. Slow infiltration reduces pain from lidocaine infiltration.[121] Although there are no available data on the use of opioids before or after chest-tube insertion for pain prevention, this seems to be a reasonable approach. Nonpharmacologic means of reducing pain in neonates should be used also.

Chest-Drain Removal

Removal of the chest drain is also known to be very painful.[122] A prospective study of methohexital for chest-tube removal in the neonate has demonstrated good pain control without significant respiratory compromise.[123] In older children, low-dose morphine and topical lidocaine-prilocaine cream were equally effective.[122]

Intubation

The experience of being intubated is unpleasant[124,125] and painful.[21] Morphine seems not to reduce the occurrence of severe hypoxia with bradycardia during intubation, probably because of the delayed onset of action.[126] Opioids with a more rapid onset of action, such as fentanyl, are probably preferable.[127] In a randomized trial, thiopentone was shown to reduce apparent pain in neonates undergoing intubation.[128] Methohexital in an uncontrolled study was associated with smooth intubating conditions and no apparent distress during intubation.[129] Studies on medications for use during endotracheal intubation are needed to address the requirements for analgesia, prevention of adverse physiologic responses (particularly bradycardia), and pharmacologic paralysis. This complex issue will be discussed further in a forthcoming statement from the American Academy of Pediatrics and Canadian Paediatric Society on the use of medications for elective intubation of neonates.

Retinal Examination and Surgery for Retinopathy of Prematurity

Retinal examinations for retinopathy of prematurity (ROP) are painful,[130,131] and the pain is not completely relieved by use of oral sucrose.[132,133] Topical anesthetics are used often, but their effectiveness is limited.[134] Retinal surgery is also painful and leads to substantial physiologic disturbance that is not adequately treated with topical anesthesia.[130] There are limited data on the effective prevention of pain from ROP surgery. One small uncontrolled study suggested that continuous intravenous infusion of remifentanil effectively reduced pain from laser therapy for ROP.[135]

Circumcision

Pain relief for circumcision should always be provided. The American Academy of Pediatrics has published a separate statement on this subject.[136]

RECOMMENDATIONS

Assessment of Pain and Stress in the Neonate

1. Caregivers should be trained to assess neonates for pain using multidimensional tools.
2. Neonates should be assessed for pain routinely and before and after procedures.
3. The chosen pain scales should help guide caregivers in the provision of effective pain relief.

Reducing Pain From Bedside Care Procedures

1. Care protocols for neonates should incorporate a principle of minimizing the number of painful disruptions in care as much as possible.
2. Use of a combination of oral sucrose/glucose and other nonpharmacologic pain-reduction methods (nonnutritive sucking, kangaroo care, facilitated tuck,

swaddling, developmental care) should be used for minor routine procedures.

3. Topical anesthetics can be used to reduce pain associated with venipuncture, lumbar puncture, and intravenous catheter insertion when time permits but are ineffective for heel-stick blood draws, and repeated use of topical anesthetics should be limited.
4. The routine use of continuous infusions of morphine, fentanyl, or midazolam in chronically ventilated preterm neonates is not recommended because of concern about short-term adverse effects and lack of long-term outcome data.

Reducing Pain From Surgery

1. Any health care facility providing surgery for neonates should have an established protocol for pain management. Such a protocol requires a coordinated, multidimensional strategy and should be a priority in perioperative management.
2. Sufficient anesthesia should be provided to prevent intraoperative pain and stress responses to decrease postoperative analgesic requirements.
3. Pain should be routinely assessed by using a scale designed for postoperative or prolonged pain in neonates.
4. Opioids should be the basis for postoperative analgesia after major surgery in the absence of regional anesthesia.
5. Postoperative analgesia should be used as long as pain-assessment scales document that it is required.
6. Acetaminophen can be used after surgery as an adjunct to regional anesthetics or opioids, but there are inadequate data on pharmacokinetics at gestational ages less than 28 weeks to permit calculation of appropriate dosages.

Reducing Pain From Other Major Procedures

1. Analgesia for chest-drain insertion comprises all of the following:
   a. general nonpharmacologic measures;
   b. slow infiltration of the skin site with a local anesthetic before incision unless there is life-threatening instability (if there was inadequate time to infiltrate before insertion of the chest tube, local skin infiltration after achieving stability may reduce later pain responses and later analgesic requirements); and
   c. systemic analgesia with a rapidly acting opiate such as fentanyl.
2. Analgesia for chest-drain removal comprises the following:
   a. general nonpharmacologic measures and
   b. short-acting, rapid-onset systemic analgesic.
3. Although there are insufficient data to make a specific recommendation, retinal examinations are painful, and pain-relief measures should be used. A reasonable approach would be to administer local anesthetic eye drops and oral sucrose.
4. Retinal surgery should be considered major surgery, and effective opiate-based pain relief should be provided.

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Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

Prevention and Management of Positional Skull Deformities in Infants

abstract

FREE

Positional skull deformities may be present at birth or may develop during the first few months of life. Since the early 1990s, US pediatricians have seen an increase in the number of children with cranial asymmetry, particularly unilateral flattening of the occiput, likely attributable to parents following the American Academy of Pediatrics "Back to Sleep" positioning recommendations aimed at decreasing the risk of sudden infant death syndrome. Positional skull deformities are generally benign, reversible head-shape anomalies that do not require surgical intervention, as opposed to craniosynostosis, which can result in neurologic damage and progressive craniofacial distortion. Although associated with some risk of positional skull deformity, healthy young infants should be placed down for sleep on their backs. The practice of putting infants to sleep on their backs has been associated with a drastic decrease in the incidence of sudden infant death syndrome. Pediatricians need to be able to properly differentiate infants with benign skull deformities from those with craniosynostosis, educate parents on methods of proactively decreasing the likelihood of the development of occipital flattening, initiate appropriate management, and make referrals when necessary. This report provides guidance for the prevention, diagnosis, and management of positional skull deformity in an otherwise normal infant without evidence of associated anomalies, syndromes, or spinal disease. *Pediatrics* 2011;128:1236–1241

INTRODUCTION

Flattening of the occiput and asymmetrical skull molding may be caused by mechanical factors that act on the head in utero or during early infancy. This common condition has been referred to by many names such as benign positional molding, posterior plagiocephaly, occipital plagiocephaly, plagiocephaly without synostosis, and deformational plagiocephaly. Ancient civilizations recognized the malleability of the rapidly growing newborn skull and intentionally deformed skulls by selective positioning and using external constraints to achieve cultural distinction. The term "plagiocephaly" is a Greek derivative that means "oblique head." Most skull deformities present at birth are the result of in utero or intrapartum molding.[1] Associated conditions involve uterine constraint, especially in cases of multiple-birth infants, and forces exerted on the skull during complex delivery associated with forceps or vacuum-assisted delivery.[2–4] Infants born prematurely also have a greater incidence of skull deformity attribut-

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KEY WORDS

infant, positional skull deformity, cranial asymmetry, sleep positioning, SIDS, Back to Sleep, tummy time

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able to molding after birth.[5] Most of these deformities improve spontaneously during the first few months of life if the infant does not rest his or her head predominantly on the flattened area of the skull. If the infant continues to rest his or her head on the flattened side of the occiput, an initially occipital plagiocephalic deformity may be perpetuated or worsened by gravitational forces[6–8] and will be referred to in the remainder of this report as positional skull deformity as it relates to otherwise normal infants. Plagiocephaly is less commonly caused by unilateral lambdoidal or unilateral coronal craniosynostosis, which is a progressive and potentially devastating condition that requires early detection and surgical management. The clinical differentiation of benign positional skull deformity from craniosynostosis is well documented in the literature.[9–11] A long narrow head, known as dolichocephaly, can be positional from breech presentation, familial, or caused by sagittal craniosynostosis. Occipital flattening and atypical shape also may be caused by craniosynostosis, particularly bilateral lambdoid craniosynostosis. However, the incidence of isolated lambdoid craniosynostosis is quite rare, estimated to be approximately 3 in 100 000 births (0.003%).[12]

If the positional skull deformity develops postnatally, an initially typical, rounded skull shape may become flattened occipitally as a result of static supine positioning. Associated torticollis or "wryneck" may occur as a consequence of hemorrhage (within the sternocleidomastoid muscle) and/or subsequent scarring within the sternocleidomastoid muscle or muscle shortening caused by persistent, unidirectional positioning and limited neck motion resulting in plagiocephaly.[13]

The incidence of positional skull deformity has been estimated to be as low as 1 in 300 live births to as high as 48% of typical healthy infants younger than 1 year, depending on the sensitivity of the criteria used to make the diagnosis.[14] Since the American Academy of Pediatrics Task Force on Infant Positioning and Sudden Infant Death Syndrome (SIDS) in 1992 recommended that healthy infants be positioned supine for sleeping, the incidence of SIDS has decreased from 1.2 per 1000 live births in 1992 to 0.56 per 1000 live births in 2001.[3,6,15] Coincident with this decrease in SIDS has been a drastic increase in positional skull deformity, estimated at approximately 13% in healthy singleton infants,[14,15] which makes this a relatively common issue to be faced by the pediatrician caring for infants and their families.

Mild positional skull deformity may persist in some children into adolescence. Minor craniofacial asymmetry can be detected in a significant number of adults; however, there are few current cases of positional skull deformity serious enough to be acknowledged by patients.[12]

Families are often concerned that positional skull deformity may cause developmental delays. Although there have been no rigorous prospective studies to address this concern, there is currently no evidence to suggest that positional skull deformity causes developmental delays.[8,16–18] There has been some early motor skill developmental delay of all infants placed supine related to upper body strength and rolling over, which resolves over time.[19] Long-term follow-up studies have primarily been retrospective and questionnaire in nature and have not noted delays in cognitive or neurologic function.[18,20–22] As might be suspected, conditions that cause delayed or abnormal development may predispose to positional skull deformity (eg, infants with hypotonia or hypertonia).[23,24]

Concerns have been raised over vision development[25] and mandibular asymmetry,[26] but a causal link to positional skull deformity has not been established.[16] Likewise, there has been no credible medical evidence to support concerns brought up in lay literature associating positional skull deformity to otitis media, temporomandibular joint (TMJ) syndrome, scoliosis, or hip dislocation.

PREVENTION

The pediatrician or other primary care clinician should educate parents as well as other health care professionals, such as those in newborn care units, on methods for decreasing the risk of development of positional skull deformity and its treatment. A certain amount of prone positioning, or "tummy time," while the infant is awake and being observed is recommended to help prevent the development of flattening of the occiput and to facilitate development of the upper shoulder girdle strength necessary for timely attainment of certain motor milestones.[27] Beginning at birth, most positional skull deformity also can be prevented by nightly alternating the supine head position (ie, left and right occiputs) during sleep and periodically changing the orientation of the infant to outside activity, such as is likely to occur at the door of the room. Avoidance of prolonged placement indoors in car safety seats and swings should be discouraged. Documentation of these educational discussions and notation of infants' positive physical findings longitudinally are important.

DIAGNOSIS

Positional skull deformity risk factors (multiple births, large for gestational age, oligohydramnios, breech or transverse position, etc) should be noted at birth, and positional skull deformity should be screened for at each health supervision visit up to 1 year of age to

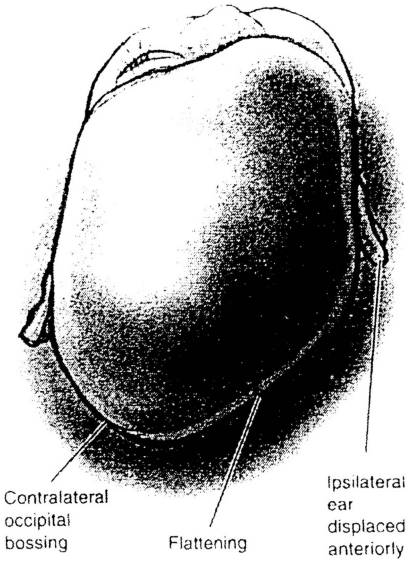

FIGURE 1
Positional molding. Adapted with permission from Lin KY, Ogle RC, Jane JA, eds. *Craniofacial Surgery: Science and Surgical Technique.* Philadelphia, PA: WB Saunders Company; 2002.

detect deformities that occur after birth as delineated in *Bright Futures*. Transient molding (caput, cephalhematoma) may be present at birth and obscure the true head shape. The diagnosis of positional skull deformity in infancy is made primarily on the basis of history and is confirmed by the physical examination. It is important for the pediatrician or other examiner to look down at the top of the head, view the position of the ears, and note the position of the cheekbones (maxilla). By doing this, the typical plagiocephalic positional skull deformity, which forms a parallelogram, will be observed. In addition to the usually unilateral flattening of the occipital area, there may be ipsilateral frontal (forehead) and parietal bossing, cheekbone prominence, and anterior ear displacement ipsilateral to the flattened occiput (Fig 1).

In contrast to deformational plagiocephaly, true craniosynostosis (either unilateral coronal or, much less commonly, lambdoid) most commonly yields a trapezoidal head shape in which there is flattening of both the occipital and frontal regions on the affected side. Uncommonly, lambdoid craniosynostosis can produce a parallelogram head shape, although the affected ear is displaced posteriorly and inferiorly in contrast to deformational plagiocephaly, with which it is displaced anteriorly. There is also tilting of the posterior skull base with prominence of the mastoid. Facial deformities are minimal if present at all. Normal and abnormal physical findings should be documented.

Examination of the face also may lead to detection of abnormalities such as head tilt and contralateral facial flattening. An assessment of neck movements also should be made to confirm or rule out the presence of torticollis. Infants with torticollis have some limitation of active rotation of their heads away from the flattened side of the occiput. The rotating-chair or stool test is a procedure that assists in the diagnosis of torticollis associated with positional skull deformity. The examiner sits on a rotating chair or stool and holds the infant facing the parent: the parent attempts to keep the infant interested in maintaining eye contact while the examiner rotates with the infant on the chair or stool and observes the infant's head movements. The difference between movement toward and away from the flattened side is helpful in making the diagnosis of torticollis associated with positional skull deformity.

SKULL RADIOGRAPHS AND CRANIAL COMPUTED TOMOGRAPHY SCANS

Because the diagnosis of positional skull deformity is made on the basis of history, findings on physical examination, and resolution over time with positional intervention, imaging studies are unnecessary in most situations. In addition, if obtained, their interpretations may be misleading to clinicians, particularly in the case of computed tomography (CT) scans. For the infant born with a normal head shape that progressively changes during the first weeks postnatally, no studies should be performed. Imaging studies should be reserved for infants born with deformities or those that do not improve over the first several weeks with repositioning. To minimize the risk of radiation exposure and the possible need for sedation, it is recommended that imaging studies be ordered by the specialist, because most craniofacial surgeons reserve radiographic imaging or CT scans for those patients who are suspected of having craniosynostosis and/or require surgical intervention.[16] Radiographs and other imaging studies are also rarely indicated for infants with torticollis unless it is progressive or associated with other clinical findings.

MANAGEMENT

Management of positional skull deformity involves preventive counseling for parents, mechanical adjustments, and exercises. Parental compliance with the management plan is pivotal in lessening the likelihood and severity of positional skull deformity. Skull-molding helmets are an option for patients with severe deformity or skull shape that is refractory to therapeutic physical adjustments and position changes.[28] Surgery is rarely necessary but may be indicated in severe refractory cases of positional skull deformity.[29] However, infants with craniosynostosis typically require surgical correction and skull reconstruction. Early surgical intervention results in less invasive procedures because an infant's normal brain growth assists in remodeling the skull postoperatively. Minimally invasive surgery is now available to some infants identified with craniosynostosis in the first months of life.

Preventive Counseling

To prevent the deformity, parents should be counseled during the new-

born period (by 2–4 weeks of age) when the skull is maximally deformable. Parents should be instructed to lay the infant down to sleep in the supine position, alternating positions (ie, left and right occiputs). When awake and being observed, the infant should spend time in the prone position for at least 30 to 60 minutes/day. The infant should spend minimal time in car seats (when not a passenger in a vehicle)[30] or other seating that maintains supine positioning. Aside from potentially preventing positional skull deformity, routine awake tummy time has been shown to enhance infant motor developmental scores during the first 15 months of life. Once positional skull deformity has developed, these same preventive strategies may be used to minimize progression. In addition, it is important to monitor head shape closely until there is confidence that improvement will continue, usually when the infant is old enough to sit, crawl, and spend less time on his or her back and until any associated torticollis is completely corrected. The prevalence of positional skull deformity generally peaks at 4 months and will begin to show significant improvement by 6 months of age.[16,31–33]

Mechanical Adjustments and Exercises

Once positional skull deformity is diagnosed, the parent should be made aware of the condition and the mechanical adjustments that can be instituted. In general, most infants improve if the appropriate measures are conducted for a 2- to 3-month period.[5] These measures include positioning the infant so that the rounded side of the head is placed dependent against the mattress. In addition, the position of the crib in the room may be changed to require the child to look away from the flattened side to see the parents and others in his or her room. The pediatrician should continue to encourage supervised tummy time on firm surfaces when the infant is awake and being observed. Torticollis perpetuates the position of the head on the flattened side and can add to a greater facial deformity. Therefore, if torticollis is present, neck-motion exercises should be taught to the parents as part of management. Neck exercises should be performed with each diaper change. There are 3 repetitions per exercise, and it is estimated to take approximately 2 additional minutes per diaper change. One hand is placed on the child's upper chest, and the other hand rotates the child's head gently so that the chin touches the shoulder. This is held for approximately 10 seconds. The head is then rotated toward the opposite side and held for the same count. This will stretch out the sternocleidomastoid muscle. Next, the head is tilted so that the infant's ear touches his or her shoulder. Again, the position is held for a count of 10 and repeated for the opposite side. This second exercise stretches the trapezius muscle. In addition, the parents may be taught the previously mentioned rotating-chair or stool technique as a therapy to enhance neck motion in the infant.

Referral

If there is progression or lack of improvement of the skull deformity after a trial of mechanical adjustments, then referral to a pediatric neurosurgeon with expertise in craniofacial malformations or to a craniofacial surgeon or craniofacial team should be considered by 4 to 6 months of age. The purpose of this referral is to obtain the expertise of the craniofacial specialist to assess the diagnosis and to direct the subsequent management, which may include molding helmets or surgery. In addition, referral to a physical therapist may be considered if torticollis does not improve with neck-stretching exercises within 2 to 3 months.

Skull-Molding Helmets

Ancient civilizations recognized the malleability of the rapidly growing newborn skull and intentionally deformed skulls by selective positioning and using external constraints to achieve a culturally desired skull form. Conversely, skull-molding helmets can be used to correct atypical skull shapes, and similar devices are now proposed for this purpose. There is currently no evidence that molding helmets work any better than positioning for infants with mild or moderate skull deformity. Because more than half of the infants will improve by 6 months of age, repositioning should be attempted as the initial treatment for infants younger than 6 months. In most situations, an improvement in response to repositioning and neck exercise is seen over a 2- to 3-month period if these measures are instituted as soon as the condition is recognized. For severe deformity, the best use of helmets occurs in the age range of 4 to 12 months[20,34] because of the greater malleability of the young infant skull bone and the normalizing effect of the rapid growth of the brain. There is less modification of the cranial configuration and more compliance problems when used after 12 months of age.[16] The use of helmets and other related devices seems to be beneficial primarily when there has been a lack of response to mechanical adjustments and exercises. Although there is some limited evidence that molding helmets may work faster for children with severe deformities, there were significant methodologic flaws associated with these studies, and there is evidence that long-term outcomes (2–3 years after treatment) may not result in a substantial benefit from helmet use.[16] In particular, a recent study of 161 children treated with po-

sitional changes only showed that 87% had achieved significant improvements, 61% achieved normal skull contours, and only 4% had severe residual deformities by the time of preschool.[35]

Although there have been few published studies, complications of helmet use seem to be low. Cost of helmets can be significant and extremely variable depending on the provider or vendor.

Surgery

Surgical correction for positional skull deformity is currently not recommended except possibly under unusual circumstances in which a child has persistent, severe deformities that have not adequately been corrected despite all other nonoperative measures.

SUMMARY

In most cases, the diagnosis and successful management of positional skull deformity can be assumed by the pediatrician or other primary health care clinician. This management includes examination for and counseling regarding positional skull deformity in the newborn period and at health supervision visits during infancy, as well as monitoring for improvement or progression. For the mild-to-moderate deformity, positioning and observation is the recommended treatment. Both positional changes and molding helmets are options for the infant with severe deformity. Cranial orthoses should be reserved for severe cases of deformity or for the infant whose deformity does not improve after 6 months of age. Referral to a pediatric neurosurgeon with expertise in craniofacial malformations, a craniofacial surgeon, or a craniofacial team should be considered if there is progression or lack of improvement after a trial of mechanical adjustments or suspicion of craniosynostosis.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Nutrition

Prevention of Pediatric Overweight and Obesity

ABSTRACT. The dramatic increase in the prevalence of childhood overweight and its resultant comorbidities are associated with significant health and financial burdens, warranting strong and comprehensive prevention efforts. This statement proposes strategies for early identification of excessive weight gain by using body mass index, for dietary and physical activity interventions during health supervision encounters, and for advocacy and research.

ABBREVIATION. BMI, body mass index.

INTRODUCTION

Prevention is one of the hallmarks of pediatric practice and includes such diverse activities as newborn screenings, immunizations, and promotion of car safety seats and bicycle helmets. Documented trends in increasing prevalence of overweight and inactivity mean that pediatricians must focus preventive efforts on childhood obesity, with its associated comorbid conditions in childhood and likelihood of persistence into adulthood. These trends pose an unprecedented burden in terms of children's health as well as present and future health care costs. A number of statements have been published that address the scope of the problem and treatment strategies.[1–6]

The intent of this statement is to propose strategies to foster prevention and early identification of overweight and obesity in children. Evidence to support the recommendations for prevention is presented when available, but unfortunately, too few studies on prevention have been performed. The enormity of the epidemic, however, necessitates this call to action for pediatricians using the best information available.

DEFINITIONS AND DESCRIPTION OF THE PROBLEM

Body mass index (BMI) is the ratio of weight in kilograms to the square of height in meters. BMI is widely used to define overweight and obesity, because it correlates well with more accurate measures of body fatness and is derived from commonly available data—weight and height.[7] It has also been correlated with obesity-related comorbid conditions in adults and children. Clinical judgment must be used in applying these criteria to a patient, because obesity refers to excess adiposity rather than excess weight, and BMI is a surrogate for adiposity. The pediatric growth charts for the US population now include BMI for age and gender, are readily available online (http://www.cdc.gov/growthcharts), and allow longitudinal tracking of BMI.[8]

BMI between 85th and 95th percentile for age and sex is considered at risk of overweight, and BMI at or above the 95th percentile is considered overweight or obese.[9,10] The prevalence of childhood overweight and obesity is increasing at an alarming rate in the United States as well as in other developed and developing countries. Prevalence among children and adolescents has doubled in the past 2 decades in the United States. Currently, 15.3% of 6- to 11-year-olds and 15.5% of 12- to 19-year-olds are at or above the 95th percentile for BMI on standard growth charts based on reference data from the 1970s, with even higher rates among subpopulations of minority and economically disadvantaged children.[10,11] Recent data from the Centers for Disease Control and Prevention also indicate that children younger than 5 years across all ethnic groups have had significant increases in the prevalence of overweight and obesity.[12,13] American children and adolescents today are less physically active as a group than were previous generations, and less active children are more likely to be overweight and to have higher blood pressure, insulin and cholesterol concentrations and more abnormal lipid profiles.[14,15]

Obesity is associated with significant health problems in the pediatric age group and is an important early risk factor for much of adult morbidity and mortality.[15,16] Medical problems are common in obese children and adolescents and can affect cardiovascular health (hypercholesterolemia and dyslipidemia, hypertension),[14,17–19] the endocrine system (hyperinsulinism, insulin resistance, impaired glucose tolerance, type 2 diabetes mellitus, menstrual irregularity),[20–22] and mental health (depression, low self-esteem).[23,24] Because of the increasing incidence of type 2 diabetes mellitus among obese adolescents and because diabetes-related morbidities may worsen if diagnosis is delayed, the clinician should be alert to the possibility of type 2 diabetes mellitus in all obese adolescents, especially those with a fam-

ily history of early-onset (younger than 40 years) type 2 diabetes mellitus.[25] The psychologic stress of social stigmatization imposed on obese children may be just as damaging as the medical morbidities. The negative images of obesity are so strong that growth failure and pubertal delay have been reported in children practicing self-imposed caloric restriction because of fears of becoming obese.[26] Other important complications and associations include pulmonary (asthma, obstructive sleep apnea syndrome, pickwickian syndrome),[27–32] orthopedic (genu varum, slipped capital femoral epiphysis),[33,34] and gastrointestinal/hepatic (nonalcoholic steatohepatitis)[35] complications. All these disturbances are seen at an increased rate in obese individuals and have become more common in the pediatric population. The probability of childhood obesity persisting into adulthood is estimated to increase from approximately 20% at 4 years of age to approximately 80% by adolescence.[36] In addition, it is probable that comorbidities will persist into adulthood.[16,37] Thus, the potential future health care costs associated with pediatric obesity and its comorbidities are staggering, prompting the surgeon general to predict that preventable morbidity and mortality associated with obesity may exceed those associated with cigarette smoking.[10,38]

Although treatment approaches for pediatric obesity may be effective in the short term,[39–44] long-term outcome data for successful treatment approaches are limited.[45,46] The intractable nature of adult obesity is well known. Therefore, it is incumbent on the pediatric community to take a leadership role in prevention and early recognition of pediatric obesity.

RISK FACTORS

Development of effective prevention strategies mandates that physicians recognize populations and individuals at risk. Interactions between genetic, biological, psychologic, sociocultural, and environmental factors clearly are evident in childhood obesity. Elucidation of hormonal and neurochemical mechanisms that promote the energy imbalance that generates obesity has come from molecular genetics and neurochemistry. Knowledge of the genetic basis of differences in the complex of hormones and neurotransmitters (including growth hormone, leptin, ghrelin, neuropeptide Y, melanocortin, and others) that are responsible for regulating satiety, hunger, lipogenesis, and lipolysis as well as growth and reproductive development will eventually refine our understanding of risk of childhood overweight and obesity and may lead to more effective therapies.[47,48]

Genetic conditions known to be associated with propensity for obesity include Prader-Willi syndrome, Bardet-Biedl syndrome, and Cohen syndrome. In these conditions, early diagnosis allows collaboration with subspecialists, such as geneticists, endocrinologists, behavioralists, and nutritionists, to optimize growth and development while promoting healthy eating and activity patterns from a young age. For example, data suggest that growth hormone may improve some of the signs of Prader-Willi syndrome.[49–51]

It has long been recognized that obesity "runs in families"—high birth weight, maternal diabetes, and obesity in family members all are factors—but there are likely to be multiple genes and a strong interaction between genetics and environment that influence the degree of adiposity.[47,48,52,53] For young children, if 1 parent is obese, the odds ratio is approximately 3 for obesity in adulthood, but if both parents are obese, the odds ratio increases to more than 10. Before 3 years of age, parental obesity is a stronger predictor of obesity in adulthood than the child's weight status.[54] Such observations have important implications for recognition of risk and routine anticipatory guidance that is directed toward healthy eating and activity patterns in families.

There are critical periods of development for excessive weight gain. Extent and duration of breastfeeding have been found to be inversely associated with risk of obesity in later childhood, possibly mediated by physiologic factors in human milk as well as by the feeding and parenting patterns associated with nursing.[55–58] Investigations of dietary factors in infancy, such as high protein intake or the timing of introduction of complementary foods, have not consistently revealed effects on childhood obesity. It has been known for decades that adolescence is another critical period for development of obesity.[59] The normal tendency during early puberty for insulin resistance may be a natural cofactor for excessive weight gain as well as various comorbidities of obesity.[60] Early menarche is clearly associated with degree of overweight, with a twofold increase in rate of early menarche associated with BMI greater than the 85th percentile.[61] The risk of obesity persisting into adulthood is higher among obese adolescents than among younger children.[54] The roles of leptin, adiponectin, ghrelin, fat mass, and puberty on development of adolescent obesity are being actively investigated. Data suggest that adolescents who engage in high-risk behaviors, such as smoking, ethanol use, and early sexual experimentation also may be at greater risk of poor dietary and exercise habits.[62]

Environmental risk factors for overweight and obesity, including family and parental dynamics, are numerous and complicated. Although clinical interventions cannot change these factors directly, they can influence patients' adaptations to them, and the physician can advocate for change at the community level. Food insecurity may contribute to the inverse relation of obesity prevalence with socioeconomic status, but the relationship is a complex one.[63] Other barriers low-income families may face are lack of safe places for physical activity and lack of consistent access to healthful food choices, particularly fruits and vegetables. Low cognitive stimulation in the home, low socioeconomic status, and maternal obesity all predict development of obesity.[64] In research settings, there is accumulating evidence for the detrimental effects of overcontrolling parental behavior on children's ability to self-regulate energy intake. For example, maternal-child feeding practices, maternal perception of daughter's risk of overweight,[65] maternal restraint, verbal prompting to eat at mealtime, attentiveness to noneating behavior, and close parental monitoring[66] all may promote undesired

consequences for children's eating behaviors. Parental food choices influence child food preferences,[67] and degree of parental adiposity is a marker for children's fat preferences.[68] Children and adolescents of lower socioeconomic status have been reported to be less likely to eat fruits and vegetables and to have a higher intake of total and saturated fat.[69–71] Absence of family meals is associated with lower fruit and vegetable consumption as well as consumption of more fried food and carbonated beverages. Although our understanding of the development of eating behaviors is improving, there are not yet good trials to demonstrate effective translation of this knowledge base into clinical practices to prevent obesity. At a minimum, however, pediatricians need to proactively discuss and promote healthy eating behaviors for children at an early age and empower parents to promote children's ability to self-regulate energy intake while providing appropriate structure and boundaries around eating.

Widespread and profound societal changes during the last several decades have affected child rearing, which in turn has affected childhood patterns of physical activity as well as diet. National survey data indicate that children are currently less active than they have been in previous surveys. Leisure activity is increasingly sedentary, with wide availability of entertainment such as television, videos, and computer games. In addition, with increasing urbanization, there has been a decrease in frequency and duration of physical activities of daily living for children, such as walking to school and doing household chores. Changes in availability and requirements of school physical education programs have also generally decreased children's routine physical activity, with the possible exception of children specifically enrolled in athletic programs. All these factors play a potential part in the epidemic of overweight.[72]

National survey data indicate that 20% of US children 8 to 16 years of age reported 2 or fewer bouts of vigorous physical activity per week, and more than 25% watched at least 4 hours of television per day.[73] Children who watched 4 or more hours of television per day had significantly greater BMI, compared with those watching fewer than 2 hours per day.[73] Furthermore, having a television in the bedroom has been reported to be a strong predictor of being overweight, even in preschool-aged children.[74] Some cross-sectional data have found significant correlation between obesity prevalence and television viewing,[75–77] but others have not.[78,79] The results of a randomized trial to decrease television viewing for school-aged children has provided the strongest evidence to support the role of limiting television in prevention of obesity. In this study, decreasing "media use" without specifically promoting more active behaviors in the intervention group resulted in a significantly lower increase in BMI at the 1-year follow-up, compared with the control group.[80] Additional support for the importance of decreasing television viewing comes from controlled investigations that demonstrated that obese children who were reinforced for decreasing sedentary activity (and following an energy-restricted diet) had significantly greater weight loss than those who were reinforced for increasing physical activity.[42] These findings have important implications for anticipatory guidance and provide additional support for recommendations to limit television exposure for young children.[2]

EARLY RECOGNITION

Routine assessments of eating and activity patterns in children and recognition of excessive weight gain relative to linear growth are essential throughout childhood. At any age, an excessive rate of weight gain relative to linear growth should be recognized, and underlying predisposing factors should be addressed with parents and other caregivers. The Centers for Disease Control and Prevention percentile grids for BMI are important tools for anticipatory guidance and discussion of longitudinal tracking of a child's BMI. Significant changes on growth patterns (eg, upward crossing of weight for age or BMI percentiles) can be recognized and addressed before children are severely overweight.[81] An increase in BMI percentiles should be discussed with parents, some of whom may be overly concerned and some of whom may not recognize or accept potential risk.[82]

Although data are extremely limited, it is likely that anticipatory guidance or treatment intervention before obesity has become severe will be more successful. Discussions to raise parental awareness should be conducted in a nonjudgmental, blame-free manner so that unintended negative impact on the child's self-concept is avoided.[24] Data from adult patient surveys indicate that those who were asked by their physician about diet were more likely to report positive changes.[83] Similarly, the efficacy of physicians discussing physical activity,[84] breastfeeding,[85] and smoking prevention[86] is well documented. Thus, pediatricians are strongly encouraged to incorporate assessment and anticipatory guidance about diet, weight, and physical activity into routine clinical practice, being careful to discuss habits rather than focusing on habitus to avoid stigmatizing the child, adolescent, or family.

ADVOCACY

Abundant opportunities exist for pediatricians to take a leadership role in this critical area of child health, including action in the following areas: opportunities for physical activity, the food supply, research, and third-party reimbursement. Change is desperately needed in opportunities for physical activity in child care centers, schools, after-school programs, and other community settings. As leaders in their communities, pediatricians can be effective advocates for health- and fitness-promoting programs and policies. Foods that are nutrient rich and palatable yet low in excess energy from added sugars and fat need to be readily available to parents, school and child care food services, and others responsible for feeding children. Potential affordable sources include community gardens and farmers' market projects. Advertising and promotion of energy-dense, nutrient-poor food products to children may need to be regulated or curtailed. The increase in

carbonated beverage intake has been linked to obesity[87]; therefore, the sale of such beverages should not be promoted at school. Pediatricians are encouraged to work with school administrators and others in the community on ways to decrease the availability of foods and beverages with little nutritional value and to decrease the dependence on vending machines, snack bars, and school stores for school revenue. Regarding physical activity, advocacy is sorely needed for physical education programs that emphasize and model learning of daily activities for personal fitness (as opposed to physical education limited to a few team sports).

New initiatives for pilot projects to test prevention strategies have been funded by the National Institutes of Health and other organizations, but a long-term commitment of substantial funds from many sources and to many disciplines will be needed to attack this serious, widespread, and potentially intractable problem. Support for development and testing of primary prevention strategies for the primary care setting will be critical. Likewise, investment of substantial resources will be required for development of effective treatment approaches for normalizing or improving body weight and fitness and for determining long-term effects of weight loss on comorbidities of childhood obesity. Collaboration and coalitions with nutrition, behavioral health, physical therapy, and exercise physiology professionals will be needed. Working with communities and schools to develop needed counseling services, physical activity opportunities, and strategies to reinforce the gains made in clinical management is also important.

Pediatric referral centers will need to develop specialized programs for treatment of complex and difficult cases, and for research into etiology and new methods of prevention and treatment. Efforts are needed to ensure adequate health care coverage for preventive and treatment services. Even when serious comorbidities are documented, insurance reimbursement is limited.[88] Lack of reimbursement is a disincentive for physicians to develop prevention and treatment programs and presents a significant barrier to families seeking professional care.

SUMMARY/CONCLUSIONS

1. Prevalence of overweight and its significant comorbidities in pediatric populations has rapidly increased and reached epidemic proportions.
2. Prevention of overweight is critical, because long-term outcome data for successful treatment approaches are limited.
3. Genetic, environmental, or combinations of risk factors predisposing children to obesity can and should be identified.
4. Early recognition of excessive weight gain relative to linear growth should become routine in pediatric ambulatory care settings. BMI (kg/m^2 [see http://www.cdc.gov/growthcharts]) should be calculated and plotted periodically.
5. Families should be educated and empowered through anticipatory guidance to recognize the impact they have on their children's development of lifelong habits of physical activity and nutritious eating.
6. Dietary practices should be fostered that encourage moderation rather than overconsumption, emphasizing healthful choices rather than restrictive eating patterns.
7. Regular physical activity should be consciously promoted, prioritized, and protected within families, schools, and communities.
8. Optimal approaches to prevention need to combine dietary and physical activity interventions.
9. Advocacy is needed in the areas of physical activity and food policy for children; research into pathophysiology, risk factors, and early recognition and management of overweight and obesity; and improved insurance coverage and third-party reimbursement for obesity care.

RECOMMENDATIONS

1. Health supervision
   a. Identify and track patients at risk by virtue of family history, birth weight, or socioeconomic, ethnic, cultural, or environmental factors.
   b. Calculate and plot BMI once a year in all children and adolescents.
   c. Use change in BMI to identify rate of excessive weight gain relative to linear growth.
   d. Encourage, support, and protect breastfeeding.
   e. Encourage parents and caregivers to promote healthy eating patterns by offering nutritious snacks, such as vegetables and fruits, low-fat dairy foods, and whole grains; encouraging children's autonomy in self-regulation of food intake and setting appropriate limits on choices; and modeling healthy food choices.
   f. Routinely promote physical activity, including unstructured play at home, in school, in child care settings, and throughout the community.
   g. Recommend limitation of television and video time to a maximum of 2 hours per day.
   h. Recognize and monitor changes in obesity-associated risk factors for adult chronic disease, such as hypertension, dyslipidemia, hyperinsulinemia, impaired glucose tolerance, and symptoms of obstructive sleep apnea syndrome.
2. Advocacy
   a. Help parents, teachers, coaches, and others who influence youth to discuss health habits, not body habitus, as part of their efforts to control overweight and obesity.
   b. Enlist policy makers from local, state, and national organizations and schools to support a healthful lifestyle for all children, including proper diet and adequate opportunity for regular physical activity.
   c. Encourage organizations that are responsible for health care and health care financing to provide coverage for effective obesity prevention and treatment strategies.
   d. Encourage public and private sources to direct funding toward research into effective strategies to prevent overweight and obesity and to maximize limited family and community re-

sources to achieve healthful outcomes for youth.

e. Support and advocate for social marketing intended to promote healthful food choices and increased physical activity.

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POLICY STATEMENT

Prevention of Rotavirus Disease: Updated Guidelines for Use of Rotavirus Vaccine

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Infectious Diseases

ABSTRACT

This statement updates and replaces the 2007 American Academy of Pediatrics statement for prevention of rotavirus gastroenteritis. In February 2006, a live oral human-bovine reassortant rotavirus vaccine (RV5 [RotaTeq]) was licensed as a 3-dose series for use in infants in the United States. The American Academy of Pediatrics recommended routine use of RV5 in infants in the United States. In April 2008, a live, oral, human attenuated rotavirus vaccine (RV1 [Rotarix]) was licensed as a 2-dose series for use in infants in the United States. The American Academy of Pediatrics recommends routine immunization of infants in the United States with rotavirus vaccine. The American Academy of Pediatrics does not express a preference for either RV5 or RV1. RV5 is to be administered orally in a 3-dose series with doses administered at 2, 4, and 6 months of age; RV1 is to be administered orally in a 2-dose series with doses administered at 2 and 4 months of age. The first dose of rotavirus vaccine should be administered from 6 weeks through 14 weeks, 6 days of age. The minimum interval between doses of rotavirus vaccine is 4 weeks. All doses should be administered by 8 months, 0 days of age. Recommendations in this statement also address the maximum ages for doses, contraindications, precautions, and special situations for administration of rotavirus vaccine. *Pediatrics* 2009;123:1412–1420

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Key Words
rotavirus vaccine, rotavirus gastroenteritis

Abbreviations
RV1—live, oral human attenuated rotavirus vaccine
AAP—American Academy of Pediatrics
RV5—live, oral human-bovine reassortant rotavirus vaccine
RR—relative risk
CI— confidence interval
CDC—Centers for Disease Control and Prevention

SUMMARY OF CHANGES TO THE RECOMMENDATIONS FROM THE 2007 STATEMENT

1. Recommendations now include a second rotavirus vaccine, live, oral human attenuated rotavirus vaccine (RV1) (Rotarix [GlaxoSmithKline, Rixensart, Belgium]), administered in a 2-dose series at 2 and 4 months of age.
2. Maximum ages for doses:
   - Maximum age for dose 1 of rotavirus vaccine is now 14 weeks, 6 days of age (previous recommendation: 12 weeks of age).
   - Maximum age for the last dose of rotavirus vaccine is now 8 months, 0 days of age (previous recommendation: 32 weeks of age).
3. The minimum interval between doses of rotavirus vaccine is 4 weeks (previous recommendation: 4 to 10 weeks between doses).
4. The rationale to consider rotavirus immunization of HIV-exposed or HIV-infected infants is described.
5. Rotavirus vaccine may be administered at any time before, concurrent with, or after administration of any blood product, including antibody-containing blood products. The previous recommendation was to defer immunization for 42 days after receipt of an antibody-containing product, if possible.

PURPOSE OF REVISED RECOMMENDATIONS AND RATIONALE

The purpose of this statement is to update recommendations of the American Academy of Pediatrics (AAP) for routine use of rotavirus vaccine in infants, which originally were published in *Pediatrics* in January 2007.[1] Updated recommendations are needed, because a second rotavirus vaccine has been licensed, and the 2 licensed rotavirus vaccines differ in composition and US Food and Drug Administration–licensed schedule of administration (Table 1).

Rotavirus is the most common cause of severe gastroenteritis in infants and young children worldwide. Before

TABLE 1 Profiles of Rotavirus Vaccines Licensed in United States

Profile	RV5 (RotaTeq)	RV1 (Rotarix)
Type of vaccine	Live attenuated oral	Live attenuated oral
Parent rotavirus strain	Bovine strain WC3	Human strain 89–12
Composition	Five human-bovine reassortant strains	Single human strain RIX4414
G and P types	G1P[5] G2P[5] G3P[5] G4P[5] G6P[8]	G1P[8]
Labeled indication	Immunization against rotavirus gastroenteritis caused by G1, G2, G3, and G4	Immunization against rotavirus gastroenteritis caused by G1, G3, G4, and G9
Labeled age of administration, wk	6 through 32[a]	6 through 24[a]
Dosing, mo of age	2, 4, and 6	2 and 4
Formulation	Liquid requiring no reconstitution	Vial of lyophilized vaccine with a prefilled oral applicator of liquid diluent
How supplied	Single-dose squeezable plastic tube	Tip cap and rubber plunger of the oral applicator contain dry natural latex rubber; the vial stopper and transfer adapter are latex-free
Volume per dose, mL	2	1
Preservatives	None	None
Shelf life, mo	24	24
Storage	Store refrigerated at 2°–8°C (36°–46°F), protect from light, and administer as soon as possible after being removed from refrigeration	Storage before reconstitution: refrigerate vials of lyophilized vaccine at 2°–8°C (36°–46°F) and protect from light; store diluent at 20°–25°C (68°–77°F). Storage after reconstitution: administer within 24 h of reconstitution; may be stored refrigerated at 2°–8°C (36°–46°F) or at room temperature up to 25°C (77°F)

[a] The AAP recommends 8 months, 0 days as maximum age for the last dose of vaccine.

initiation of the rotavirus immunization program, it was estimated that nearly every child in the United States was infected with rotavirus by 5 years of age, and most infected children developed gastroenteritis. Each year, rotavirus causes more than 400 000 physician visits, more than 200 000 emergency department visits, 55 000 to 70 000 hospitalizations, 20 to 70 childhood deaths, and direct and indirect costs in excess of $1 billion.[2–5]

VACCINES

Pentavalent Human-Bovine Reassortant Rotavirus Vaccine

In February 2006, a live, oral human-bovine reassortant rotavirus vaccine (RV5) (RotaTeq [Merck and Co, Whitehouse Station, NJ]) was licensed for use in the United States. RV5 contains 5 live reassortant rotavirus strains. The rotavirus parent strains of the reassortant viruses were isolated from human and bovine hosts. Four reassortant rotaviruses express 1 of the outer-capsid proteins (G1, G2, G3, or G4) from the human rotavirus parent strain and the attachment protein (P7[5]) from the bovine rotavirus parent strain. The fifth reassortant virus expresses the attachment protein (P1A[8]) from the human rotavirus parent strain and the outer-capsid protein G6 from the bovine rotavirus parent strain. RV5 is given to infants as 3 oral doses.

Monovalent Human Rotavirus Vaccine

A second rotavirus vaccine (RV1) was licensed on April 3, 2008, for use in the United States. The vaccine contains the RIX4414 strain of the human rotavirus G1P[8]. The RIX4414 strain was developed further from rotavirus strain 89–12, which originally was derived from a young boy in Cincinnati, Ohio. RV1 is administered to infants as 2 oral doses.

The safety and efficacy of RV5 and RV1 for prevention of rotavirus gastroenteritis in healthy infants have been evaluated in 11 randomized, controlled trials involving more than 146 000 infants worldwide (Table 2), including 3 randomized, controlled trials for RV5[6–8] and 7 randomized, controlled trials for RV1.[9–15]

SAFETY

Reactogenicity

Both vaccines are well tolerated and have a low reactogenicity profile when given alone. They do not cause clinically significant increases in reactogenicity when coadministered with other routine childhood vaccines.[16,17]

For both vaccines, the incidence of fever, vomiting, diarrhea, and irritability were measured in the clinical trials. For RV5, no significant difference versus placebo was observed in the incidence of fever or severe fever and irritability or severe irritability. A 3% increase in the incidence of diarrhea and vomiting was observed with RV5, but these symptoms were mild and did not require treatment.[6,8,18] For RV1, no difference versus placebo was observed in the incidence of diarrhea, fever or severe fever, vomiting or severe vomiting, and irritability or severe irritability within 14 days of immunization with any dose.[9,10,13,15] There was no statistically significant increased risk for death or other serious adverse events noted with either vaccine compared with placebo.

TABLE 2 Performance of Rotavirus Vaccines Licensed in United States in Clinical Trials

Profile	RV5 (RotaTeq)	RV1 (Rotarix)
Safety profile	No increase in fever or irritability, slight increase in mild diarrhea and vomiting	No increase in fever, irritability, diarrhea, or vomiting
Intussusception	Not associated	Not associated
Shedding, %	9 (of recipients after dose 1, rarely after subsequent doses)	25 (after first dose peak excretion around day 7)
Efficacy against any rotavirus gastroenteritis, %	74	87
Efficacy against severe rotavirus gastroenteritis, %	98	85–96
Efficacy against health care encounters	Significantly reduced No. of hospitalizations, physician office visits, emergency department visits	Significantly reduced No. of hospitalizations and need for medical attention
Efficacy according to serotype against severe rotavirus gastroenteritis, %	G1 (95%), G2 (88%), G3 (93%), G4 (89%), and G9 (100%)	In Latin America: G1 (91%), G2 (41%), G3, G4, and G9 (87%) In Europe: G1 (96%), G2 (86%), G3 (94%), G4 (95%), G9 (85%)

Efficacy cannot be compared between vaccines, because 2 different severity scales were used in the clinical trials.

[a] In Latin America.

[b] In Europe.

Intussusception

Two trials were designed specifically to evaluate the risk of intussusception after vaccine administration.[8,11] The risk of intussusception was no greater for either rotavirus vaccine than that observed in placebo recipients. For RV5, during the 42 days after each dose of vaccine, 6 cases of intussusception were reported among 28 038 vaccine recipients, and 5 cases were reported in 27 965 placebo recipients (relative risk [RR]: 1.2 [95% confidence interval (CI): 0.3–5.0]). During the 12 months after each dose of RV5, 12 cases of intussusception were reported among vaccine recipients and 15 in placebo recipients (RR: 0.8 [95% CI: 0.3–1.8]).[8] For RV1, during the 31 days after each dose of vaccine, 6 cases of intussusception were reported in 31 673 vaccine recipients, and 7 cases were reported in 31 552 placebo recipients (RR: 0.9 [95% CI: 0.3–2.4]). In a subset of infants, during the 12 months after each dose of RV1, 4 cases of intussusception were reported among vaccine recipients and 14 in placebo recipients (RR: 0.3 [95% CI: 0.1–0.8]).[11]

Although neither RV5 nor RV1 has been associated with intussusception in large prelicensure trials, rigorous postlicensure monitoring for safety end points is necessary because of possible differences in the characteristics of infants receiving the vaccine in routine use compared with the clinical trials and the large numbers of infants being immunized. In addition, background cases of intussusception that are unrelated to vaccine are expected to occur in the weeks after immunization by chance alone.

With more than 14 million doses of RV5 distributed in the United States since 2006, the Centers for Disease Control and Prevention (CDC) Immunization Safety Office summary of postlicensure safety monitoring of RV5 does not indicate that immunization with RV5 is associated with intussusception.[19] Further monitoring is ongoing. Rigorous postlicensure monitoring for safety end points has also been initiated for RV1.

Shedding and Transmission

Vaccine virus shedding in stool has been documented with both rotavirus vaccines. Rotavirus shedding occurs in approximately 9% of RV5 recipients after dose 1 but rarely after subsequent doses.[18] No cases of transmission of RV5 have been documented. Shedding and transmission are not considered significant safety concerns because of the attenuated nature of the rotavirus vaccine strains. For RV1, live rotavirus shedding in stool occurs in approximately 25% of recipients, with peak excretion occurring around day 7 after dose 1. Transmission of virus has not been evaluated. There have been a few cases of documented transmission to contacts. The rate of transmission is unknown, but no known cases have developed symptoms of rotavirus gastroenteritis.[10]

EFFICACY

The efficacy of rotavirus vaccines was evaluated against the following end points in healthy infants: rotavirus gastroenteritis of any severity (RV5 and RV1); severe rotavirus gastroenteritis (RV5 and RV1); rotavirus gastroenteritis requiring an office visit (RV5) or medically attended visit (RV1); rotavirus gastroenteritis requiring hospitalization (RV5 and RV1) or an emergency department visit (RV5); and rotavirus gastroenteritis caused by different rotavirus serotypes (G1P[8], G2P[4], G3P[8], G4P[8], and G9P[8]) (RV5 and RV1).

Efficacy was demonstrated for each vaccine in prelicensure clinical trials. Vaccine efficacy studies demonstrated 85% to 98% protection against severe rotavirus disease and 74% to 87% protection against any rotavirus disease. The efficacy of RV5 after completion of a 3-dose regimen against rotavirus gastroenteritis of any severity was 74%.[8] In European infants, the efficacy of RV1 against rotavirus gastroenteritis of any severity was 87%.[14] The efficacy against rotavirus gastroenteritis of any severity was not measured in the Latin American trial of RV1.[11]

The severity of rotavirus gastroenteritis in these clinical trials was assessed by using different clinical scales

(Vesikari scale for RV1 and Clark scale for RV5). A recent study that compared the clinical scales found that they differ primarily in their definition of severe cases.[20] The authors of this study concluded that the use of different evaluation scales affects the ability to compare the effectiveness of rotavirus vaccines.

Efficacy of RV5 against severe rotavirus gastroenteritis was 98%.[8] Data indicate that efficacy of RV1 against severe rotavirus gastroenteritis over the first rotavirus season in Europe was 96%, and efficacy against severe disease in Latin America was 85%.[11,14]

Efficacy against rotavirus gastroenteritis hospitalizations for RV5 was 96%.[8] For rotavirus gastroenteritis-associated emergency department visits, efficacy after the third dose of RV5 was 94%.[8] Efficacy of RV1 against any rotavirus gastroenteritis hospitalization in Europe was 96%, and efficacy against hospitalizations in Latin America was 85%.[11,14]

Rotavirus immunization reduced the need for any medical attention attributable to rotavirus gastroenteritis. For RV5, data indicate that immunization reduced the number of office visits by 86%.[8] Data available for RV1 from Europe indicate that efficacy in prevention of acute rotavirus gastroenteritis requiring medical attention (from a visit to a doctor to hospitalization) is 84% through the end of the second season of follow-up.[14]

Efficacy has been established for both vaccines against clinically important outcomes for the most prevalent circulating serotypes (G1P[8], G3P[8], G4P[8], G9P[8], and G2P[4]).[8,11,14] Efficacy of RV5 against rotavirus gastroenteritis-associated hospitalization or emergency department visits was demonstrated against G1 (95%), G2 (88%), G3 (93%), G4 (89%), and G9 (100%) serotypes, although relatively few non-G1 rotavirus cases were reported.[8] In Latin America, efficacy of RV1 against severe rotavirus episodes caused by serotype G1 strains, homologous to the vaccine strain, was 91%, and efficacy against strains that share only the P[8] antigen (G3, G4, and G9) was 87%.[11] For serotype G2P[4] rotavirus, which does not share either the G or the P antigen with the RV1 vaccine strain, efficacy was 41%. In the European trial, efficacy of RV1 against severe rotavirus episodes caused by serotype G1 strains was 96%; efficacy was also demonstrated against G3 (94%), G4 (95%), and G9 (85%) serotype strains.[14] For serotype G2P,[4] rotavirus efficacy was 86%.

Data for efficacy of fewer than 3 doses of RV5 and fewer than 2 doses of RV1 are limited. The protective effect of RV1 against any grade of severity of rotavirus gastroenteritis observed immediately after receipt of dose 1 and before receipt of dose 2 was 90%.[14] Published data on the efficacy of fewer than 3 doses of RV5 are not available.

Interchangeability of Rotavirus Vaccines

No studies have addressed the interchangeability of the rotavirus vaccines. However, there is no theoretical reason to expect that risk of adverse events would be increased if the series included more than 1 product, compared with the risk of adverse events of a series containing only 1 product. In addition, although it is possible that effectiveness of a series that contained both products could have been reduced compared with a complete series with 1 product, the effectiveness of a series that contained both products is likely to have been greater than an incomplete series with 1 product.

Postlicensure Vaccine Effectiveness of RV5 in the United States

To summarize rotavirus activity during the 2007–2008 rotavirus season, the CDC analyzed data from the National Respiratory and Enteric Virus Surveillance System and the New Vaccine Surveillance Network.[21] Compared with the 15 previous seasons (1991–2006), rotavirus activity during the 2007–2008 rotavirus season was delayed in onset by 2 to 4 months and reduced in magnitude by more than 50%. Additional surveillance and epidemiologic studies are needed to confirm the impact of rotavirus immunization on the 2007–2008 rotavirus season and to monitor the impact of the vaccine on the disease incidence, geographical distribution, and timing of rotavirus disease during future seasons. Studies also are needed to monitor serotype distribution and possible strain replacement in future seasons.

Efficacy in Special Populations

Studies have shown that either rotavirus vaccine can be administered to infants who are being breastfed without the efficacy of the vaccines being affected.[9,11,22] An uninterrupted schedule of breastfeeding was permitted in infants participating in prelicensure clinical trials of both vaccines.

Coadministration of each rotavirus vaccine with commonly administered pediatric vaccines has been evaluated. Both RV1 and RV5 can be coadministered with diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP), *Haemophilus influenzae* type b vaccine (Hib), inactivated poliovirus vaccine (IPV), hepatitis B vaccine (HPV), and pneumococcal conjugate vaccine with no observed immune interference.[16,17]

Few data are available on the efficacy, safety, and reactogenicity of rotavirus vaccine in infants with underlying conditions. Studies of HIV-infected infants are ongoing for RV1 and are planned for RV5.

Evidence indicates that RV5 can be given safely to otherwise healthy preterm infants born at more than 32 weeks of gestation (median: 34 weeks of gestation), according to postnatal age, on the same schedule as for infants born at term.[23] Overall, 3 doses of RV5 reduced the rate of hospitalizations and emergency department visits in preterm infants attributable to rotavirus gastroenteritis by 100%. The vaccine also prevented 73% of rotavirus gastroenteritis cases of any severity. Studies examining administration of RV1 in preterm infants are ongoing.

COST/BENEFIT ANALYSIS

In a published analysis using estimates of rotavirus disease burden, vaccine efficacy, vaccine coverage rates, and health care costs in the late 1990s, investigators estimated that a national rotavirus immunization pro-

gram for the United States in which 3 doses of RV5 are administered at 2, 4, and 6 months of age to a single birth cohort of 4 million infants would result in 255 000 fewer physician visits, 137 000 fewer emergency department visits, 44 000 fewer hospitalizations, and 13 fewer deaths per year in children younger than 5 years.[5] At a manufacturer price of $62.50 (2006 dollars) per dose, a 3-dose RV5 immunization series would cost $138 per case averted, $3024 per serious case averted, and $197 190 per life-year saved. In 2008, the CDC conducted an updated analysis of a rotavirus immunization program in the United States and concluded that the cost-effectiveness of a 3-dose RV5 vaccine program and a 2-dose RV1 vaccine program would be similar (CDC, unpublished data, 2008). The cohort model used in the study by Widdowson et al[5] was used. At an estimated total immunization cost per child for 3 doses of RV5 of $218 and 2 doses of RV1 of $208, immunization cost per case averted was $139 for RV5 and $94 for RV1. The cost per life-year saved was $198 546 for RV5 and $128 400 for RV1. Although the median estimates in this model suggest small increased cost-effectiveness of 2-dose RV1 vaccine over 3-dose RV5 vaccine, the CDC concluded that these differences in median estimates might not translate into a true difference for a program because of variation in the actual cost of vaccine to providers, possible differences in the costs for administration and shipping of each product, and the field vaccine effectiveness of a product's full or partial series.[24] For example, if there is as high a vaccine efficacy after dose 1 for the 3-dose RV5 vaccine as reported after the first dose of RV1, the difference between the 2 vaccines will be much smaller.

Rotavirus vaccine may be more cost-effective than calculations to date, if immunization provides indirect protection to unimmunized children and children who failed to have an adequate immune response to vaccine.

CONTRAINDICATIONS AND PRECAUTIONS

Contraindications

- Rotavirus vaccine should not be administered to infants who have a history of a severe allergic reaction (eg, anaphylaxis) after a previous dose of rotavirus vaccine or to a vaccine component (AIII [see Appendix]).
- Latex rubber is contained in the RV1 oral applicator, so infants with a severe (anaphylactic) allergy to latex should not receive RV1 (AIII). The RV5 dosing tube is latex-free.

Precautions

- Altered immunocompetence: Practitioners should consider the potential risks and benefits of administering rotavirus vaccine to infants with known or suspected altered immunocompetence; consultation with an immunologist or infectious diseases specialist is advised (CIII). Children and adults who are immunocompromised because of congenital immunodeficiency, hematopoietic stem cell transplantation, or solid organ transplantation sometimes experience severe or prolonged rotavirus gastroenteritis. However, no published safety or efficacy data are available for administration of rotavirus vaccine to infants who are immunocompromised or potentially immunocompromised, including infants:
  - with primary and acquired immunodeficiency states, including cellular immunodeficiencies, and hypogammaglobulinemic and dysgammaglobulinemic states;
  - with blood dyscrasias, leukemia, lymphomas, or other malignant neoplasms affecting the bone marrow or lymphatic system;
  - on immunosuppressive therapy (including high-dose systemic corticosteroids [≥2 mg/kg per day of prednisone or equivalent]); or
  - who are HIV-exposed or HIV-infected. However, the decision whether to immunize HIV-exposed or HIV-infected infants should be made on the basis of the following considerations:
    - HIV infection may be presumptively excluded by 4 to 8 weeks of age, before the first rotavirus vaccine dose is given, in infants born to HIV-infected mothers in the United States who are not breastfeeding (infants in the United States born to HIV-infected mothers should not be breastfed);
    - HIV-exposed infants in the United States who are not breastfeeding can be identified as HIV-infected by 4 to 8 weeks of age;
    - Preliminary data with 1 of the licensed vaccines have shown the vaccine to be safe when given to HIV-infected infants in Africa;
    - Vaccine strains of rotavirus are considerably attenuated.
- Moderate-to-severe acute gastroenteritis: Rotavirus vaccine should not be administered to infants with acute, moderate-to-severe gastroenteritis until the condition improves. However, infants with mild acute gastroenteritis may be immunized, particularly if the delay in immunization might be substantial and might make the child ineligible to receive vaccine (eg, 15 weeks, 0 days of age or older before the vaccine series is started or older than 8 months, 0 days at the time of the last dose) (CIII).
  - Rotavirus vaccine has not been studied in infants with concurrent acute gastroenteritis. In these infants, the immunogenicity and efficacy of rotavirus vaccine theoretically can be compromised. For example, infants who receive oral poliovirus vaccine (OPV) during an episode of acute gastroenteritis, in some circumstances, have diminished poliovirus antibody responses.
- Moderate-to-severe acute illness: Immunization should not be delayed because of mild respiratory tract illness or other mild acute illness with or without fever. In contrast, as with all other vaccines, the pres-

ence of a moderate or severe acute illness with or without fever is a precaution to administration of rotavirus vaccine. Infants with a moderate-to-severe acute illness should be immunized as soon as they have recovered from the acute phase of the illness (BIII).

- This precaution avoids superimposing any potential adverse effects of the vaccine on the underlying illness or mistakenly attributing a manifestation of the underlying illness to the vaccine.

- Preexisting chronic gastrointestinal diseases: Infants with preexisting gastrointestinal tract conditions (eg, congenital malabsorption syndromes, Hirschsprung disease, short-gut syndrome) who are not undergoing immunosuppressive therapy should benefit from receiving rotavirus vaccine, and the AAP believes the benefits outweigh the theoretical risks (CIII).
  - No data are available on the safety and efficacy of rotavirus vaccine for infants with preexisting chronic gastrointestinal tract disease.
- Previous history of intussusception: Practitioners should consider the potential risks and benefits of administering rotavirus vaccine to infants with a previous history of intussusception (BIII).
  - Compared with infants who have never had intussusception, infants with a history of intussusception are at higher risk of a repeat episode of intussusception. No data are available on the administration of rotavirus vaccine to infants with a previous history of intussusception. Available data do not indicate that RV5 or RV1 are associated with intussusception. A previously licensed rotavirus vaccine that is no longer available (RotaShield [Wyeth-Lederle Vaccines, Radnor, PA]) was associated with an increased risk of intussusception.
- Infants with spina bifida or bladder exstrophy: Latex rubber is contained in the RV1 oral applicator. The RV5 dosing tube is latex-free. Some experts, therefore, prefer that infants with spina bifida or bladder exstrophy, who are at high risk of acquiring latex allergy, receive RV5 instead of RV1 to minimize latex exposure in these children (CIII). However, if RV1 is the only rotavirus vaccine available, it should be given, because the benefit of immunization is considered to be greater than the risk of sensitization.

RECOMMENDATIONS

Routine Administration

- The AAP recommends routine immunization of infants in the United States with rotavirus vaccine. The AAP does not express a preference for either of the 2 licensed rotavirus vaccines, RV5 and RV1, for use in infants in the United States (AI).
- RV5 is to be administered orally in a 3-dose series with doses administered at 2, 4, and 6 months of age. RV1 is to be administered orally in a 2-dose series with doses administered at 2 and 4 months of age (Table 3) (AI).

TABLE 3 Recommended Schedule for Administration of Rotavirus Vaccine

Recommendations	RV5 (RotaTeq)	RV1 (Rotarix)
No. of doses in series	3	2
Recommended ages for doses	2, 4, and 6 mo	2 and 4 mo
Minimum age for first dose	6 wk	6 wk
Maximum age for first dose	14 wk 6 d	14 wk 6 d
Minimum interval between doses	4 wk	4 wk
Maximum age for last dose	8 mo 0 d	8 mo 0 d

- The first dose of rotavirus vaccine should be administered from 6 weeks, 0 days of age through 14 weeks, 6 days of age. Immunization should not be initiated for infants 15 weeks, 0 days of age or older because of insufficient data on safety of the first dose of rotavirus vaccine in older infants (CIII).
- The minimum interval between doses of rotavirus vaccine is 4 weeks. All doses should be administered by 8 months, 0 days of age (RV5, AI; RV1, CIII).
- For infants to whom the first dose of rotavirus vaccine is inadvertently administered at 15 weeks, 0 days of age or older, the remainder of the rotavirus immunization series should be completed according to the schedule, because timing of the first dose should not affect the safety and efficacy of the subsequent dose(s) (BIII).
- Infants who have had rotavirus gastroenteritis before receiving the full series of rotavirus immunization should begin or complete the schedule following the age and interval recommendations, because the initial rotavirus infection provides only partial protection against subsequent rotavirus disease (AII).
- Breastfeeding before or after receipt of rotavirus vaccine is encouraged. Breastfed infants should be immunized according to the same schedule as nonbreastfed infants (AI).
- As with all other vaccines, rotavirus vaccine may be administered to infants with minor acute illness (eg, mild gastroenteritis or mild upper respiratory tract infection, with or without fever) (AIII).

Simultaneous Administration

- Rotavirus vaccine may be administered concurrently with diphtheria and tetanus toxoids and acellular pertussis vaccine, *Haemophilus influenzae* type b vaccine, inactivated poliovirus vaccine, HBV, and pneumococcal conjugate vaccine (AI).
- Rotavirus vaccine may be administered concurrently with trivalent inactivated influenza vaccine for infants older than 6 months. Live-attenuated influenza vaccine is not licensed for immunization of children younger than 2 years (BIII).

- The infant's immune response to trivalent inactivated influenza vaccine administered at the same time as rotavirus vaccine has not been studied. However, the general recommendations issued by the Advisory Committee on Immunization Practices (ACIP) of the CDC noted that an inactivated vaccine (eg, inactivated influenza vaccine) may be administered either simultaneously or at any time before or after a different inactivated vaccine or live vaccine (eg, rotavirus vaccine).

Interchangeability of Rotavirus Vaccines

- The AAP recommends that the rotavirus vaccine series be completed with the same product whenever possible (AIII).
- Rotavirus immunization should not be deferred because the product used for a previous dose(s) is unknown or is not available. In such a circumstance, the health care professional should continue or complete the series with the product available. If any dose in the series was RV5 or the vaccine product is unknown for any dose in the series, a total of 3 doses of rotavirus vaccine should be administered (CIII). All doses should be given by 8 months, 0 days of age.

Special Situations

- Preterm infants (those born at less than 37 weeks' gestation): Preterm infants should be immunized on the same schedule and with the same precautions as for term infants and under the following conditions: the infant's postnatal age meets the age requirements for rotavirus vaccine (eg, from 6 weeks through 14 weeks, 6 days of age for the first dose) and the infant is clinically stable (RV5, AI; RV1, BIII).
  - Data suggest that preterm infants are at increased risk of hospitalization from rotavirus or other viral pathogens associated with gastroenteritis during their first year of life. In clinical trials, rotavirus vaccine seemed to be generally well tolerated in a relatively small number of preterm infants. Although the lower level of maternal antibody against prevalent rotavirus serotypes in very preterm infants theoretically could increase the risk of adverse events from rotavirus vaccine, the AAP believes the benefit of immunizing infants when they are age-eligible and clinically stable outweighs the theoretical risks.
- Preterm infants in the NICU or nursery: Preterm infants who are age-eligible and clinically stable may be immunized at the time of discharge from the NICU or nursery (BIII).
  - Vaccine strains of rotavirus are shed in stools of immunized infants, so if an infant were to be immunized with a rotavirus vaccine while still needing care in the NICU or nursery, at least a theoretical risk exists for vaccine virus being transmitted to infants in the same unit who are acutely ill (moderate-to-severe illness is a precaution for immunization) and preterm infants who are not age-eligible for vaccine. The AAP believes that, in usual circumstances, the risk from shedding outweighs the benefit of immunizing infants who are age-eligible for vaccine but who will remain in the NICU or nursery after immunization.
- Readmission of an immunized preterm infant to the NICU or nursery: If an infant immunized with a rotavirus vaccine requires readmission to the NICU or nursery within 2 weeks after receipt of vaccine, contact precautions should be instituted for the readmitted infant and should be maintained for 2 to 3 weeks after vaccine administration (BIII).
- Exposure of immunocompromised people to immunized infants: Infants living in households with people who have or are suspected of having an immunodeficiency disorder or impaired immune status can be immunized (BIII).
  - Vaccine virus (attenuated rotavirus) is shed in the stool of infants after rotavirus immunization. However, no data are available on risk of transmission of vaccine virus to household contacts and the risk for any subsequent disease. Vaccine virus is shed more commonly and for longer periods after receipt of RV1 than after receipt of RV5. The majority of experts believe the protection of an immunocompromised household member afforded by immunizing the infant in the household and preventing wild-type rotavirus disease outweighs the small risk for transmitting vaccine virus to an immunocompromised household member and any subsequent risk of vaccine virus-associated disease. Vaccine virus is shed during the first weeks after administration of rotavirus vaccine; hand-washing after diaper changing is always recommended.
- Exposure of pregnant women to immunized infants: Infants living in households with pregnant women should be immunized according to the same schedule as infants in households without pregnant women (BIII).
  - The majority of women of childbearing age have preexisting immunity to rotavirus; therefore, the risk of infection and any subsequent theoretical risk of disease from potential exposure to the attenuated vaccine virus are believed to be very low.
- Regurgitation of vaccine: The practitioner should not readminister a second dose of rotavirus vaccine to an infant who regurgitates, spits out, or vomits during or after administration of vaccine (BIII).
  - No data exist on the benefits or risks associated with readministering a dose. The infant should receive the remaining recommended doses of rotavirus vaccine following the routine schedule (with a 4-week minimum interval between doses).
- Hospitalization after immunization: If a recently immunized infant is hospitalized for any reason, no pre-

cautions other than standard precautions need to be taken to prevent the spread of vaccine virus in the hospital setting (BIII).

- Infants who have recently received or will receive an antibody-containing blood product: Rotavirus vaccine may be administered at any time before, concurrent with, or after administration of any blood product, including antibody-containing products, according to the routinely recommended schedule for rotavirus vaccine among infants who are eligible for immunization (BIII).
  - In theory, infants who have recently received an antibody-containing blood product might have an attenuated immune response to a dose of rotavirus vaccine. However, 2 or 3 doses of vaccine are administered in the full rotavirus vaccine series, so adequate protection is anticipated, and no increased risk of adverse events is expected.

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APPENDIX 1 Infectious Diseases Society of America-US Public Health Service Grading System for Ranking Recommendations in Clinical Guidelines

Category, Grade	Definition
Strength of recommendation	
A	Good evidence to support a recommendation for use
B	Moderate evidence to support a recommendation for use
C	Poor evidence to support a recommendation
Quality of evidence	
I	Evidence from ≥1 properly randomized, controlled trial
II	Evidence from ≥1 well-designed clinical trial, without randomization; from cohort or case-controlled analytical studies (preferably from >1 center); from multiple time series; or from dramatic results from uncontrolled experiments
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees

Adapted from Canadian Task Force on the Periodic Health Examination. *Can Med Assoc J.* 1979;121(9):1193–1254.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Prevention of Sexual Harassment in the Workplace and Educational Settings

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Workforce

ABSTRACT

The American Academy of Pediatrics is committed to working to ensure that workplaces and educational settings in which pediatricians spend time are free of sexual harassment. The purpose of this statement is to heighten awareness and sensitivity to this important issue, recognizing that institutions, clinics, and office-based practices may have existing policies.

STATEMENT OF THE PROBLEM

Although this policy statement focuses on medical schools and hospitals, the same principles apply to other professional settings including publicly and privately supported clinics and office-based practices regardless of the number of employees.

More than one third of female physicians perceive that they have been sexually harassed. Research supports the significance of the problem in the medical education setting. According to a study of female physicians, sexual harassment has been found to be more common among individuals in medical school (20%) or during internship, residency, or fellowship (19%) than in practice (11%).[1] Although conventional wisdom has held that sexual harassment is perpetrated only on women, 13.5% of sexual harassment charges brought to the Equal Employment Opportunity Commission in 2001 were from men. This represented an almost twofold increase in reports by men compared with the previous decade.[2] Despite increasing awareness about sexual harassment in the workplace, a survey of hospital human resources managers in 2002 indicated that among the sexual harassment allegations lodged over 4.5 years, physicians were the reported perpetrators 15% of the time, up from 10% 7 years earlier, and 10% of sexual harassment complaints were filed by men.[3]

Gender discrimination and/or sexual harassment were reported in all academic contexts by 69% of female and 33% of male graduating medical students in a 1997 survey of 14 US medical schools, with 63% of women and 30% of men describing these problem behaviors during their core clerkships.[4] In another survey of 1001 graduating students from 8 US medical schools, 21% of the female students and 2% of the male students reported that they had experienced some form of sexual harassment in medical school.[5] In a 1991 survey of second-year residents about their working and learning environment, 63% of female respondents reported having experienced at least 1 episode of sexual harassment or discrimination.[6] A survey of full-time faculty at 24 US medical schools found that 52% of female and 5% of male faculty indicated that they had been sexually harassed by a superior or

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Key Words
sexual harassment, gender discrimination, sexual orientation, office or institutional policies and guidelines

Abbreviation
AAP—American Academy of Pediatrics

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colleague; the reported incidence of sexual harassment was almost twice as high in non–primary care compared with primary care specialties.[7]

Sexual harassment in the workplace and in educational settings creates an environment that demeans people and may have a negative impact on individual performance and effectiveness as well as organizational productivity and unit morale. Female medical residents who experienced disrespectful behavior, including sexual harassment, were shown to be 11 times more likely to score high for possible problem drinking compared with their female counterparts who experienced no harassment.[8] Female medical school faculty members who were sexually harassed scored lower on career-satisfaction scales despite equivalent academic achievement.[7] Two studies of university employees demonstrated that those who experienced sexual harassment experienced adverse alcohol-related outcomes and increased utilization of either mental health or health services.[9,10] Although these examples highlight problems in hospital and educational settings as they apply to students, residents, and other employees, there is no reason to believe that other settings such as clinics or physician offices are immune to the effects of this unwelcome behavior. Sexual harassment is certain to affect employees at all levels.

Although sensitivity to this complex issue has been heightened recently, much confusion exists, even about exactly what constitutes sexual harassment, as well as about modalities appropriate for dealing with the problem. It is incumbent on employers, organizations, and institutions to represent all their constituents, male and female, and provide education and guidance to facilitate eradication of this destructive behavior. In particular, medical schools and training programs must be aware of the prevalence of the problem and have action plans available. It is also important to recognize that most medical schools and university hospitals will have separate sexual harassment policies with disparate policies and procedures in place, so grievances from medical students, residents, or staff members may need to be handled in very different ways. The first step is a proactive approach based on fair policy development. Due process is a particularly important component, because false accusations may be made. Policy development, therefore, will also need to address those who are falsely accused. Second, dissemination of grievance and complaint procedures, followed by a prompt response to all complaints, should be the standard in all health care settings, from a small office-based practice to more formal institutional or educational settings.

BACKGROUND

Title VII of the Civil Rights Act of 1964 states that it is unlawful for an employer to discriminate against an individual because of gender[11]; sexual harassment is one form of gender discrimination. Sexual harassment is defined by the Equal Employment Opportunity Commission as follows:

> Unwelcome advances, requests for sexual favors, and other verbal and physical conduct of a sexual nature constitute sexual harassment when: 1) submission to such conduct is made explicitly or implicitly a term or condition of an individual's employment; 2) submission to or rejection of such conduct by an individual is used as a basis for employment decisions affecting such individuals; or 3) such conduct has the purpose or effect of substantially interfering with an individual's work performance or creating an intimidating, hostile or offensive work environment.[12]

Thus, there are 2 general aspects of sexual harassment.[13] The first aspect involves the "quid-pro-quo" or "this-for-that" situation, when submission to unwelcome sexual conduct becomes a condition of employment or personnel action (items 1 and 2 in the aforementioned definition). The second aspect involves the creation of a "hostile work environment" (item 3 in the definition).

Sexual harassment is not gender specific, nor is it always clear-cut. Its presence, however, is noted throughout the entire workforce, which includes all health care personnel. To determine if certain conduct constitutes harassment, various factors may be taken into consideration:

- whether the conduct was unwelcome, unsolicited, or offensive;
- whether the conduct was repeated, particularly if it was repeated despite a warning that it was unwelcome or offensive;
- whether the behavior involved a supervisor-subordinate relationship in which one individual had "power" over another;
- the substance and severity of the conduct: verbal, physical, hostile, disruptive, continuous, pervasive, or provoking;
- whether preferential treatment of individuals in the workplace, on the basis of their sexual behavior, had a negative impact on others in the working environment[14]; and
- whether a "reasonable person" would be substantially negatively affected by similar circumstances.[15]

Notwithstanding all the law, literature, and discussion on this issue, even very well-meaning people remain confused and concerned about what really constitutes sexual harassment. Until very recently, sexual harassment of men by other men was not explicitly defined by Title VII; discrimination based on sexual orientation was generally not considered sexual harassment. However, a number of court cases and surveys of undergraduate students, medical students, and physicians make us reconsider these long-held beliefs. In a landmark case

brought to the US Supreme Court in 1997, a man filed a complaint against his employer after being subjected to egregious "hazing" behaviors involving groping and physical contact by co-workers. The court held that same-sex harassment is actionable under Title VII and that men, as well as women, are entitled to protection.[16]

Although not much research has been published on sexual harassment of gays and lesbians in medicine, in a survey conducted by the US-based Gay and Lesbian Medical Association, 59% of gay and lesbian medical students and physicians reported job-related discrimination.[17] A survey of gay and lesbian Yale students and community members indicated that 65% were targets of verbal insults, 25% received threats of physical violence, and 42% were physically abused because of their sexual orientation. Of both male and female respondents, 12% indicated that they were sexually harassed or assaulted because of their sexual orientation.[18] A survey of gay and lesbian third- and fourth-year medical students applying for residency was conducted in parallel with a survey of family practice program directors to assess attitudes and biases about sexual orientation. More than 70% of the medical students indicated that their specialty choice was influenced by their own perceptions of how other physicians in a given field would accept them. Furthermore, 8% of family medicine program directors regarded disclosure about an applicant's homosexuality in a negative light, 25% demonstrated a neutral perspective, and 67% demonstrated an accepting attitude.[19]

Certain egregious behaviors clearly represent sexual harassment. Rape or indecent assault, as well as using one's position of authority by offering rewards or threatening to influence another person's career on the basis of sexual favors, are agreed on as clearly constituting sexual harassment. At the other end of the spectrum, most people agree that it is acceptable behavior for a person to respectfully compliment someone's appearance. However, repetitive unwelcome requests or leering, gesturing, or making insulting, sexually oriented comments also constitute sexual harassment. Although consensual sexual relationships with no duress generally do not fall within the rubric of sexual harassment, they nonetheless may still be ethically inappropriate (if not sexual harassment) in the workplace if, for example, a supervisor-subordinate relationship exists. The American Medical Association has taken a firm stand on this issue in their policy titled "Sexual Harassment and Exploitation Between Medical Supervisors and Trainees" and suggests that even consensual sexual relationships between supervisors and trainees are not acceptable.[20] Thus, it may be important for an institution, organization, or employer (including medical school administration, faculty members, and program directors) to address, as well, standards of conduct that are broader in scope than just those that are considered sexual harassment.

What constitutes a "hostile environment" is often unclear but may certainly include sexually oriented posters, pictures, or calendars as well as sexually explicit jokes or comments. Touching is considered to be sexual in some cases but not in others. Common sense should prevail. The best solution to the problem of sexual harassment is prevention. Individuals working in all medical education and health care delivery settings should take steps to ensure open communication, dissemination of institutional policies, and creation of an environment in which individuals can safely communicate their discomfort to those harassing them.

The American Academy of Pediatrics (AAP) concurs with the American Medical Association policy[21] that dictates that all medical training programs develop and implement a policy that specifically addresses sexual harassment and exploitation. The Accreditation Council for Graduate Medical Education's institutional requirements, which apply to all residency programs in all specialties, mandate that "[t]he Sponsoring Institution must have written policies covering sexual and other forms of harassment" and that "[t]he Sponsoring Institution retains responsibility for the quality of GME [graduate medical education] even when resident education occurs in other institutions." This and other policies must be contained in, or referenced as part of, the resident's agreement of appointment.[22] These institutional requirements direct sponsoring institutions to maintain master affiliation agreements with major participating institutions and program letters of agreement or memoranda of understanding in compliance with program requirements. Resident education, therefore, is conducted at each site where residents rotate, with the expressed understanding that some harassment policy will apply. Some locations, such as major academic affiliations, may have their own harassment policies. According to Patricia M. Surdyk, PhD (Executive Director, Accreditation Council for Graduate Medical Education Institutional Review Committee, written communication, March 2006), the master affiliation agreement and/or program letters of agreement with individual sites such as physician offices would clarify which harassment policies apply in such cases. Residents must both be protected in all situations in which they find themselves as part of the education program, and likewise are expected to adhere to policies governing behavior at all locations.

Although the vast majority of hospitals have formal written policies on sexual harassment,[3] many private medical groups and office-based practices may not have such policies in place. As medical professionals, interactions with patients, parents, and caregivers may also be subject to close scrutiny and potential accusations of impropriety. The AAP offers guidance on this through a number of resources including a policy statement, "Appropriate Boundaries in the Pediatrician-Family-Patient

Relationship."[23] The rules that apply to conduct with co-workers should also apply to behavior at the bedside and during office visits. Although it is not required by law that private medical offices have in place official policies regarding sexual harassment, having such a policy may offset many potential claims from employees in this setting as well. Resources are now available to private practitioners to guide them in establishing such office policies. One author has suggested that employers develop a simple written policy on sexual harassment, which should include a step-by-step grievance procedure.[24] The sexual harassment policy should be made available in the employee handbook and posted in the office; employees may also benefit from 1 or more sexual harassment training sessions.[25] Several sample sexual harassment policies that can be adapted for medical offices and individual physicians are available online.[26,27]

RECOMMENDATIONS

Sexual harassment has important implications for men and women and for all individuals involved in health care delivery. Reference literature provides guidance regarding the scope of protection, liabilities, and remedies for sexual harassment.[28] Irrespective of the specifics of the law, all individuals desire and deserve a workplace in which they are treated with appropriate respect in a comfortable environment conducive to effective teamwork and optimal productivity. As such, leaders and employers must set the pace in affirmatively combating sexual harassment in the workplace regardless of the number of employees.[29] Several recommendations for corporate, academic, and office-based practice settings include:

- Educate people to avoid sexually offensive behavior.
- Establish written procedures to address sexual harassment issues and achieve problem and grievance resolution.
- Ensure that the rights of both parties are considered and both are afforded due process.

The following are additional suggestions for decreasing the incidence of sexual harassment in the workplace and educational settings:

- Encourage supervisors, physicians, and administrators to set an example by serving as positive role models.
- Investigate all complaints promptly and confidentially.
- Follow-up on all complaints.
- Sensitize employees through an interactive training process.
- Consider using an outside mediator to evaluate any complaints of sexual harassment (especially for smaller health care organizations).[30]

Risk management requires communication of clear definitions of acceptable standards of behavior, treatment of all complaints as serious matters, discipline for offenders, and steps to prevent subsequent offenses. In addition, once a complaint has been adjudicated, efforts must be taken to ensure a smooth transition for the employees coming back into the workplace. Follow-up counseling and/or periodic meetings individually with the party or parties involved should be provided as warranted.

The AAP recognizes that its constituents work in a broad spectrum of settings, often moving from the office, to a hospital, and to an educational environment within a single day. The size and nature of each organization are important factors in determining the degree of formality required to accomplish the eradication of sexual harassment. It is our intent that this policy statement be used in concert with any existing procedures. The purpose of this statement is to heighten awareness and sensitivity to this important issue and encourage reassessment of existing policies in all medical practice and educational settings.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT
Guidance for the Clinician in Rendering Pediatric Care

Sheila Gahagan, MD; Janet Silverstein, MD; and the Committee on Native American Child Health and Section on Endocrinology

Prevention and Treatment of Type 2 Diabetes Mellitus in Children, With Special Emphasis on American Indian and Alaska Native Children

ABSTRACT. The emergence of type 2 diabetes mellitus in the American Indian/Alaska Native pediatric population presents a new challenge for pediatricians and other health care professionals. This chronic disease requires preventive efforts, early diagnosis, and collaborative care of the patient and family within the context of a medical home. ***Pediatrics*** **2003;112:e328–e347. URL: http://www.pediatrics.org/cgi/content/full/112/4/e328;** ***type 2 diabetes mellitus, children, American Indian, Alaska Native, Native American, pediatric population.***

ABBREVIATIONS. AI/AN, American Indian/Alaska Native; AAP, American Academy of Pediatrics; IHS, Indian Health Service; CDC, Centers for Disease Control and Prevention; ADA, American Diabetes Association; PCOS, polycystic ovarian syndrome; BMI, body mass index; HbA_{1c}, glycosylated hemoglobin; OGTT, oral glucose tolerance test; FBG, fasting blood glucose; FPG, fasting plasma glucose; SMBG, self-monitoring of blood glucose; ACE, angiotensin-converting enzyme; LDL, low-density lipoprotein; HDL, high-density lipoprotein; NDEP, National Diabetes Education Program; NPH, neutral protamine Hagedorn; TZD, thiazolidinedione.

STATEMENT OF THE PROBLEM

Type 2 diabetes mellitus* is a new morbidity in children and adolescents.[1–4] For pediatric patients, it heralds earlier onset of cardiovascular disease, retinopathy, nephropathy, and neuropathy, with risk of impaired quality of life and premature death. The emergence of type 2 diabetes mellitus in young people is believed to be associated with changes in physical activity and nutrition that are ubiquitous in modern society. Not all populations are equally affected. American Indian/Alaska Native (AI/AN) children in the United States and Canada have a higher rate of this disease than do children of other ethnicities. Mexican American and black children are at increased risk. Vulnerable populations that exhibit new disease trends may be seen as the "canary in the coal mine," warning of hazards present for the entire population. In US children, the prevalence of type 2 diabetes mellitus is expected to exceed that of type 1 diabetes mellitus within 10 years. There is a compelling need for additional research, primary and secondary prevention efforts, and evidence-based treatment for youth with type 2 diabetes mellitus.

PURPOSE

These guidelines have been developed to assist in clinical decision making by primary health care professionals and are not intended to replace existing management protocols for the medical treatment of diabetes.[5] It is assumed that clinical care will be individualized for each child and adolescent. In keeping with the spirit of community pediatrics and the *Healthy People 2010* objectives, the American Academy of Pediatrics (AAP) believes that medical care for AI/AN children, like that of all other children, should be provided within a medical home, which "ideally should be accessible, continuous, comprehensive, family centered, coordinated, compassionate, and culturally effective. It should be delivered or directed by well-trained physicians who provide primary care and manage and facilitate essentially all aspects of pediatric care. The physician should be known to the child and family and should be able to develop a partnership of mutual responsibility and trust with them."[6]

METHODS

The AAP Committee on Native American Child Health, in collaboration with the Indian Health Service (IHS) Diabetes Program, the Centers for Disease Control and Prevention (CDC), and the AAP Section on Endocrinology, developed these guidelines to improve the medical care for AI/AN children with type 2 diabetes mellitus and those at risk of type 2 diabetes mellitus. This effort was greatly assisted by the 2000 American Diabetes Association (ADA) consensus statement on type 2 diabetes mellitus in children and adolescents.[2,3]

These guidelines were developed after a review of published data on type 2 diabetes mellitus in American Indian and First

The recommendations in this report do not indicate an exclusive course of treatment or serve as a standard of care. Variations, taking into account individual circumstances, may be appropriate.

*Type 1 diabetes mellitus is characterized by a lack of insulin production. Type 2 diabetes mellitus is a metabolic disorder secondary to an inability to appropriately use or make adequate insulin.

Nations† children[7–23] and are adapted from the medical literature on adults with type 2 diabetes mellitus.[5,24–29]

These guidelines were developed to support the role of the general pediatrician or other primary health care professional as the front line for care. The treatment of most AI/AN children with type 2 diabetes mellitus will be managed by primary health care professionals with specialty consultation. It is hoped that these guidelines will serve as a framework for the development of diabetes care programs and strategies aimed at decreasing the devastating impact of type 2 diabetes mellitus on AI/AN children and their families and communities. A section on primary prevention of type 2 diabetes mellitus is included and is based on existing data.

PRIMARY AND SECONDARY PREVENTION

Prevention must take highest priority and should focus on decreasing the risk, incidence, and consequences of type 2 diabetes mellitus among AI/AN children. Primary prevention efforts by primary health care professionals are recommended in 2 arenas: 1) general community health promotion and health education and 2) clinically based activities. Clinically based health promotion activities should not duplicate community-wide health promotion but instead should offer additive benefits. For example, if significant health education is offered at the community level, then motivational interviewing and collaborative problem solving can be offered in the clinical setting. When type 2 diabetes mellitus is the established diagnosis, secondary prevention efforts by primary health care professionals are important for the prevention of complications (eg, vascular, neural, renal, retinal). Early diagnosis and optimal medical care are the keys to effective secondary prevention.

To be effective, prevention efforts need a strong community base and acceptance. Current evidence suggests that modifiable risks for type 2 diabetes mellitus include obesity and lack of breastfeeding.[30] Primary prevention efforts can focus on the prevention of obesity in children and the promotion of breastfeeding. Preventing obesity in women of childbearing age is another primary prevention goal, because exposure to the environment of a diabetic pregnancy places the fetus at increased risk of future onset of diabetes.[30]

Community Activities

Community prevention activities are being developed in AI/AN communities on the basis of each tribe's unique needs and resources. Development and implementation of these activities should have the endorsement of appropriate tribal authorities. Ideally, these activities are multidisciplinary (eg, medical, nutrition, public health, nursing, health education) and include local businesses, community recreational programs, Head Start programs, and schools.[31,32] Tribal food and nutrition programs (eg, Special Supplemental Nutrition Program for Women, Infants, and Children; US Department of Agriculture's Food Distribution and Food Stamp program) have a prominent role in promoting foods that minimize the risk of obesity. Community programs and services should develop consistent messages and supply foods that assist in decreasing the prevalence of obesity. Studies to evaluate the effectiveness of community-based obesity and diabetes risk reduction efforts are in progress.[33,34]

Health care professionals can play a crucial role in their communities by raising community awareness about the importance of programs and facilities for physical activity and resources for healthy nutrition.[35] The powerful influence of physicians extends outside the clinic when they thoughtfully advocate for healthy lifestyles and good nutrition practices within the community.

Pediatricians and other health care professionals should advocate for school policy that requires daily physical activity for every child and for physical fitness programs in the school and community. They should urge stores, restaurants, and schools to offer low-caloric density foods of high nutritional value in appropriate portions. Lack of physical activity is associated with the development of obesity, type 2 diabetes mellitus, and cardiovascular morbidity and mortality. Despite information on the importance of exercise, a low proportion of high school students participate in daily physical education classes.[36,37] Increasing physical activity should include participating in at least 30 minutes of physical activity daily, limiting sedentary activity (eg, watching television, playing video games, using a computer) to no more than 1 to 2 hours per day, and participating in sports. Community recreation programs and schools should encourage youth to participate in events that require physical activity. The community leadership should receive information on and understand the importance of physical activity and the value of having programs and facilities available for youth. Recommendations and programs should respect family, culture, and community values.

Health care professionals can use their expertise to provide prevention messages to the community on healthful lifestyles and good nutrition via local media (eg, radio, television, newspapers, posters). Prevention messages need to be thoughtfully developed to resonate with community and tribal culture and beliefs. Youth involvement in community prevention efforts can be highly effective.

Community involvement in the promotion and support of healthful lifestyles reinforces recommendations made in the health care setting. The engagement and empowerment of communities is critical for overall success in decreasing the disease burden of type 2 diabetes mellitus for the AI/AN population. Schools are integral in the successful management of type 2 diabetes mellitus (and other chronic illnesses) and potentially are important resources for promoting children's diabetes self-care, including blood glucose monitoring, appropriate recognition and treatment of hypoglycemia, and treatment of acute hyperglycemia.

Clinically Based Primary and Secondary Prevention Activities

Health care professionals have influential roles in preventing type 2 diabetes mellitus among at-risk

†First Nations is the term used in Canada to identify Native or Aboriginal people. In this article, this term is used when citing research done in Canada.

youth via direct patient care contacts. Children with 1 or more risk factors (see "Case Finding") identified by the ADA consensus panel on type 2 diabetes mellitus in children should be monitored closely.[2,3] Identification of disorders associated with insulin resistance, such as acanthosis nigricans, polycystic ovarian syndrome (PCOS), and family history of diabetes, should trigger education and the initiation of prevention activities.

Children whose body mass index‡ (BMI; see also "Physical Assessment") is greater than the 85th percentile for their age§ should receive appropriate counseling on nutrition, weight control, and physical activity. This is especially important because there is evidence that type 2 diabetes mellitus can be delayed or prevented by lifestyle interventions. These children may require treatment for hypertension and hyperlipidemia and should return for follow-up evaluation and additional lifestyle intervention within 3 months.

Until results of current prevention trials with oral hypoglycemic agents in youth are available, intervention using glucose-lowering drugs for prevention of diabetes is not recommended. (These medications are, however, recommended for treatment of children with diagnosed type 2 diabetes mellitus.)

Knowledgeable health care professionals (eg, nutritionists, health educators, physicians, nurses, community outreach workers) should guide nutrition interventions in AI/AN children and their families. Any intervention needs to consider growth and development in children. The most effective approach is appropriate reduction of calories along with increased energy expenditure. Specific recommendations need to be individualized, and continued evaluation is crucial for long-term success. Individualized plans are based on collaboration with the child and the family to assess food preferences, timing and location of meals and snacks, food preparation, and desire to change behaviors. Family resources and the availability of low-calorie nutritious foods in the community must be considered. Pharmacologic therapy to decrease weight is not recommended for children until more safety and efficacy data are available. Very low-calorie diets and high-protein diets are contraindicated, except in a well-controlled research setting. Quick-fix weight loss programs are unsafe for children and rarely result in long-term weight control; furthermore, they do not promote lasting, healthful eating behaviors. Weight loss programs with the best results combine exercise and dietary components with behavior modification.[38] Accomplishing changes in the child's eating behavior and activity relies on changes made by the entire family.

‡BMI is a measure based on weight and stature (kg/m^2). A simple calculation can be made as follows: weight in pounds divided by height in inches, divided by height in inches again, and multiplied by 703.
§Growth charts developed by the CDC; see "Physical Assessment" for Web site address.

IDENTIFICATION

The prevalence of type 2 diabetes mellitus in AI/AN children as well as AI/AN adults is higher than among other ethnic groups.[2,3,18] Among Pima Indian adolescents 15 to 19 years of age, the prevalence of type 2 diabetes mellitus estimated through screening increased significantly during the past 2 decades and reached 5% in the 1992–1996 time period.[19] (Although population-based prevalence estimates are not available for children and adolescents in the United States, a retrospective review estimated an incidence of 7.2 per 100 000 for black and white children and adolescents in southwestern Ohio in 1994.[20]) In Manitoba, Canada, the prevalence of type 2 diabetes mellitus diagnosed through screening was 3.6% for First Nations girls (0% for boys) 10 to 19 years of age in 1996–1997.[15] The prevalence of diagnosed diabetes (all types) among youth 15 to 19 years of age receiving services from the IHS was 0.45% in 1996, reflecting a 54% increase since 1988.[21] In Montana and Wyoming IHS clinics, the prevalence of diagnosed diabetes (all types) was 0.23% among American Indian youth 0 to 19 years of age in the period 1997–1999.[22,23] Therefore, the high burden of diabetes on AI/AN communities and their youth deserves specific research efforts directed toward better case identification.

Population-Based Screening

Many AI/AN communities are interested in population-based screening for type 2 diabetes mellitus. The evidence that microvascular complications of diabetes are strongly associated with previous hyperglycemia raises interest in earlier diagnosis during the asymptomatic period.[39] However, population-based screening for type 2 diabetes mellitus in high-risk children is not recommended, except as part of research efforts to advance knowledge about optimal prevention, diagnosis, and treatment.[40–43] Population-based screening remains controversial, because there are no data from controlled trials showing that earlier diagnosis improves long-term outcome. It is essential that studies be performed to determine the specificity, sensitivity, and cost-benefit of screening for type 2 diabetes mellitus in high-risk populations of children and adolescents.

The World Health Organization has recommended that before embarking on population-based screening, the following criteria be met[44]:

1. The condition should be an important health problem.
2. There should be an accepted treatment for patients with recognized disease.
3. Facilities for diagnosis and treatment should be available.
4. There should be a recognizable latent or early symptomatic stage.
5. There should be a suitable test or examination.
6. The test should be acceptable to the population.
7. The natural history of the condition, including development from latent to declared disease, should be understood adequately.

8. There should be an agreed policy on whom to treat as patients.
9. The cost of case finding should be economically balanced in relation to possible expenditure on medical care as a whole.
10. Case finding should be a continuing process and not a once-and-for-all project.

Although some of these criteria can be met, a key aspect to the second criterion is that there must be evidence that earlier identification improves clinical outcomes before the costs of this endeavor can be justified under nonresearch protocol.[44] The first results from the Diabetes Prevention Program show that diet and exercise delay the onset of diabetes and normalize blood glucose in adults.[45] Therefore, it is important to identify children and adolescents who are at risk of developing diabetes, such as those with obesity and signs of insulin resistance, to begin lifestyle management programs that could prevent and delay the development of diabetes. Many of these children will have impaired glucose tolerance.

Before beginning screening programs, health care systems and institutions must identify resources for intervention for people who will be identified with type 2 diabetes mellitus or altered glucose metabolism by the screening program. Screening programs can cause harm if effective treatment is not available.

If universal screening were performed in the United States on the basis of the ADA risk criteria for type 2 diabetes mellitus in youth, then 10% of US adolescents (2.5 million) 12 to 19 years of age would be tested.[43] This screening would not yield a large number of new diagnoses because of the low prevalence of type 2 diabetes mellitus in the general adolescent population.[46]

Screening efforts have been implemented as part of research initiatives for some high-risk populations. Among the Pima Indians, screening has been performed by the National Institutes of Health since 1965 as part of a longitudinal epidemiologic study. Because of the high prevalence of type 2 diabetes mellitus among Pima Indian children identified by the epidemiologic study, current efforts focus on measuring glycosylated hemoglobin (HbA_{1c}) concentration in children who are at risk and referring them for a 2-hour oral glucose tolerance test (OGTT) if the HbA_{1c} concentration is more than 5.5%.[18] Another survey conducted in 1996–1997 in 717 First Nations school youth 4 to 19 years of age from Manitoba identified 6 new cases and 2 previously identified cases by using the fasting blood glucose (FBG) concentration.[15] A survey of 276 Navajo students 13 to 20 years of age at 2 high schools found 1 case of diabetes and 8 cases of impaired glucose tolerance or impaired FBG concentration.[8] Future studies may identify specific criteria for screening children for type 2 diabetes mellitus in AI/AN populations.

Earlier diagnosis of diabetes may prevent or slow the development of complications if active treatment is implemented early and proves efficacious. In a world of limited resources, the benefits of screening efforts need to be assessed and balanced with those of other programs that may benefit the same population.

Some IHS areas and Indian tribes are developing screening and intervention programs for obesity and hypertension in youth. These efforts will result in identifying youth who are at increased risk of type 2 diabetes mellitus and have the potential to benefit from primary prevention interventions.

Case Finding

Although population-based screening is not recommended, early case finding and early initiation of treatment may prevent some sequelae of type 2 diabetes mellitus. Overweight children who have entered puberty (or who are older than 10 years) are considered at risk by the ADA if they meet 2 of the following criteria[2,3]:

- Family history of type 2 diabetes mellitus in first- or second-degree relative
- Race or ethnicity is American Indian, Alaska Native, black, Hispanic, or Asian/Pacific Islander
- Presence of a condition associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, PCOS)

The following are definitions for being at risk for overweight[47]:

- BMI between the 85th and 95th percentiles for age and sex
- Weight-for-height ratio between the 85th and 95th percentiles

The following are definitions for being overweight:

- BMI greater than the 95th percentile for age and sex
- Weight-for-height ratio greater than the 95th percentile
- Weight greater than 20% of the ideal weight for height

The term "obese" is not defined for children by the CDC. Health care professionals should be knowledgeable about risk factors and make appropriate decisions to test individual patients.

Diagnosis (Clinic Based)

The diagnosis of type 2 diabetes mellitus in a child or an adolescent usually will be made by an astute health care professional in a clinical setting rather than as a result of a screening program. Knowledge of the aforementioned risk factors will assist the health care professional in considering and making the diagnosis when the patient is asymptomatic. Symptomatic and asymptomatic disease manifestations are described in "Pharmacologic Management on the Basis of Clinical Manifestations."

Specialists should be consulted for children and adolescents in whom diabetic ketoacidosis is detected. Furthermore, subspecialty consultation is indicated for children with hyperglycemia (FBG >250 mg/dL [>13.9 mmol/L]) but without the clinical features, family history, or physical characteristics

commonly associated with type 2 diabetes mellitus. In such cases, diagnostic differentiation between type 1 and type 2 diabetes mellitus may require additional studies, such as autoimmune markers (islet cell antibodies, glutamic acid decarboxylase antibodies), challenge tests with high-calorie nutritional supplements (eg, Sustacal and Boost Nutritional Energy Drink [Mead Johnson Nutritionals, Evansville, IN]) or glucagon, or assays of insulin or C peptide. Children with type 2 diabetes mellitus may have normal or high C peptide and fasting insulin concentrations. However, children with type 2 diabetes mellitus with toxic effects of glucose attributable to prolonged hyperglycemia before diagnosis may have transient low insulin concentrations and may benefit from a short course of subcutaneous insulin therapy. Specialty consultation also should be sought when youth are unable to achieve treatment goals in a reasonable time frame or when complications occur. Specialty consultation is helpful for youth with hyperlipidemia and hypertension.

The subspecialist often is a pediatric endocrinologist. However, the primary health care professional (eg, pediatrician, family physician, internist) who is responsible for the diabetes clinic in an AI/AN health care facility may be a clinically competent expert in the management of type 2 diabetes mellitus. In geographically isolated locations, telemedicine may facilitate specialty consultation.

ONGOING EVALUATION AND MONITORING FOR TYPE 2 DIABETES MELLITUS IN CHILDREN

History and Psychosocial Assessment

A complete medical history, including a review of systems, is essential at diagnosis and at regular intervals (Table 1), with special attention to emotional disorders; eating disorders; alcohol, tobacco, and drug use; and family support. Emotional and behavioral disorders, particularly depression, have been associated with diabetes.[48–57] Psychosocial assessment is recommended at diagnosis and informally at every visit. Assessment may be performed on the basis of patient history or by using a standardized screening tool.[58,59] A social worker or a psychologist on the diabetes team can assist with this evaluation. If depression or another emotional disorder is identified, then treatment and referral should be initiated promptly.

Health care professionals and dietitians should screen for eating disorders as part of the standard nutrition evaluation for all children with type 2 diabetes mellitus.[60] Binge eating and bulimia are significant concerns. Psychiatrically defined eating disorders are differentiated from culturally normal behaviors, some of which may be unhealthful.

The use of alcohol, tobacco, and drugs should be evaluated in all children and adolescents in whom diabetes is newly diagnosed, and it should be reevaluated, at least informally, at every visit. The family's attitudes toward the use of these and other substances should be evaluated as well. Alcohol use may aggravate hypoglycemia caused by sulfonylureas or insulin and increase the risk of lactic acidosis in patients who use metformin.

Family support is essential to the child or adolescent with type 2 diabetes mellitus. The family's strengths and needs should be assessed so that necessary assistance can be offered. This assessment should include positive and negative role models in the home, availability of healthful foods (eg, fresh fruits and vegetables), financial resources, parental literacy, cultural beliefs about health and illness, and the family's understanding of diabetes. The involvement of the whole family in dietary and activity changes will promote successful management of the child's diabetes. A family history of diabetes and cardiovascular disease will influence the meaning of this illness within the family. Support services for the family may include health education, financial services, social services, mental health counseling, transportation, and home visiting. Socially disorganized families need early psychologic and social work intervention.

Physical Assessment

Although a complete physical examination is recommended for all children at diagnosis, special attention should be given to the following elements (Table 2).

Weight and height should be plotted on a growth chart. The weight goal should be based on BMI (weight [kg]/height^2 [m^2]). (The Web site for growth charts[61] is: www.cdc.gov/nchs/about/major/nhanes/growthcharts/charts.htm.) Weight should be measured at each visit, but height may be measured twice a year.

The blood pressure goal is less than the 90th percentile on the basis of height and weight standards. Blood pressure is assessed at each visit. Blood pressure control is discussed in "Reducing Cardiovascular Risk"[62,63] (Table 3).

The skin, especially the back of the neck, the underarms, and the groin, should be evaluated for acanthosis nigricans, a thickened, hyperpigmented

TABLE 1. Ongoing Evaluation and Monitoring After Diagnosis: History

History Component	Frequency*	Recommendations
Interval history	Initially every 3 months	Include ROS
Psychosocial assessment	↓	May use standardized questionnaire[78,79]
Eating disorder	↓	Binge eating, bulimia
Substance abuse	↓	Alcohol, tobacco, drugs
Family assessment	↓	Strengths, needs

ROS indicates review of systems.
* Frequency of detailed history may decrease in case of metabolic control and low-risk social circumstances to every 6 to 12 months.

TABLE 2. Ongoing Evaluation and Monitoring After Diagnosis: Physical Examination

Physical Examination Component	Frequency	Recommendations
Weight	Initially every 3 mo*	
Height, BMI	Initially every 3 mo*	
Blood pressure	Initially every 3 mo*	
Skin	Every 12 mo	Acanthosis nigricans, hirsutism, tinea, acne
Foot	Every 12 mo but visual foot check every 3 mo	Pedal pulses, neurologic examination, nails

* May decrease to every 6 months if linear growth is complete and glucose is well controlled.

skin condition (Fig 1). Acanthosis nigricans often correlates with high BMI and insulin resistance. The resolution of acanthosis nigricans may be a useful marker for decreasing insulin resistance.[64] Insulin resistance may improve as weight decreases. The improvement of the skin condition as a result of better metabolic control is highly desirable to adolescents. Therefore, identification of this condition is especially useful as a motivator for adolescents. Other treatable skin conditions may occur in association with insulin resistance, including tinea capitis, tinea corporis, and tinea pedis. Hirsutism or significant acne may be markers of hyperandrogenism in girls. Hirsutism is related to hyperinsulinism and is another potential motivating factor for adolescents to accomplish nutritional and physical activity goals.[65–67]

A thorough visual inspection of the feet, including pedal pulses (posterior tibial and dorsalis pedis) and a neurologic examination are recommended shortly after diagnosis and then annually (Fig 2). The monofilament examination for foot sensation is included to assess protective sensation.[68] This examination is performed using the 5.07 (10-g) Semmes-Weinstein nylon monofilament mounted on a holder that has been standardized to deliver a 10-g force when applied properly. Because the sensory deficits appear first in the most distal portions of the foot and progress proximally in a "stocking" distribution, the toes are the first areas to lose protective sensation. The examination should include assessment for treatable nail conditions, such as paronychia and ingrown toenails. The main purpose of the foot examination in children is to teach that foot care is an important health habit.

A funduscopic examination with dilation to detect signs of diabetic retinopathy is recommended shortly after diagnosis and then annually by an experienced eye care professional.[69,70]

Yeast vaginitis and balanitis are commonly seen in children and adolescents with type 2 diabetes mellitus.[71] Inspection of the vulva and penis should be included in the physical examination to screen for these disorders. Tanner staging of children and adolescents with type 2 diabetes mellitus should be performed every 3 to 6 months until puberty is complete, because early onset of puberty is noted in overnourished children.[72,73] A gynecologic examination for girls and a genital examination for boys may provide an opportunity to obtain additional sexual history and to offer abstinence and contraceptive counseling. Menstrual irregularities may be symptoms of PCOS in postpubertal girls.

Laboratory Evaluation

The fasting plasma glucose (FPG) concentration is the standard test for diagnosis. Monitoring is based on the FPG concentration and additional blood glucose measurements throughout the day. Fasting is defined as no consumption of food or any beverage other than water for at least 8 hours before testing. Most monitoring is performed by self-monitoring of blood glucose (SMBG) concentrations. Tables 4 and 5 include diagnostic and self-monitoring values.

The 2-hour postprandial glucose test provides information about glucose metabolism that is not provided by FPG measurement. It can be used for diagnosis together with FPG testing and must be used for monitoring.

Measurement of HbA_{1c} concentration should be performed quarterly. The results should be available at the time of the patient visit and discussed with the patient. Technology is available to perform rapid HbA_{1c} testing. Many diabetes clinics have standing orders for the performance of HbA_{1c} testing before the health care professional's consultation and discussion with the patient. The HbA_{1c} result can verify SMBG data and is useful for identifying the need to adjust insulin dosage when SMBG data are unavailable. Setting realistic short- and long-term goals in consultation with a pediatric endocrinologist or other health care professional knowledgeable about childhood type 2 diabetes mellitus is recommended whenever possible. The HbA_{1c} concentration goal is less than 7.0% (or <1% above the laboratory reference range). This may not be achievable for all patients. Realistic goals should be individualized for each patient. HbA_{1c} concentration greater than 8.0% is associated with a substantial increase in complications.[74] Any sustained decrease is beneficial.

It is important to screen for proteinuria at diagnosis and annually. Testing for microalbuminuria is indicated if proteinuria is absent. Microalbuminuria is a high urinary albumin concentration that is not detected on routine dipstick testing. Microalbuminuria is defined as a urinary albumin excretion of 20 to 200 μg per minute (30–300 mg per day). Annual screening for microalbuminuria permits early identification and treatment of patients who are at risk of nephropathy. The recommended method of detection is the measurement of the albumin-creatinine ratio in a spot urine collection. An alternative method uses reagent tablets or dipsticks that detect microalbuminuria. When positive, the results of rapid tests should be confirmed by the urinary albumin-creatinine ratio in a timed urine collection. A patient is not designated as having microalbuminuria unless 2 of 3 collections performed within a 3- to 6-month period show increased concentrations. This test is not valid if the patient has a urinary tract infection or during menses. Although microalbuminuria may be encountered in patients in whom type 2

TABLE 3. Classification of Hypertension

Age (Years)	High Normal (mm Hg)*	Significant Hypertension (mm Hg)†	Severe Hypertension (mm Hg)‡
6–9	Systolic: 111–121	Systolic: 122–129	Systolic: >129 (129)§
	Diastolic: 70–77	Diastolic: 70–85	Diastolic: >85 (84)
10–12	Systolic: 117–122	Systolic: 126–133	Systolic: >133 (134)
	Diastolic: 75–81	Diastolic: 82–89	Diastolic: >89 (89)
13–15	Systolic: 124–135	Systolic: 136–143	Systolic: >143 (149)
	Diastolic: 77–85	Diastolic: 86–91	Diastolic: >91 (94)
16–18	Systolic: 127–141	Systolic: 142–149	Systolic: >149 (159)
	Diastolic: 80–91	Diastolic: 92–97	Diastolic: >97 (99)
>18	Not given	Systolic: [140–179]‖	Systolic: >(179)
	Not given	Diastolic: [90–109]	Diastolic: >(109)

* 90th to 94th percentile for age, boys and girls combined.
† 95th to 98th percentile for age, boys and girls combined.
‡ 99th percentile for age, boys and girls combined.
§ The values in parentheses are those used for the classification of severe hypertension by the 26th Bethesda Conference on cardiovascular disease and athletic participation.
‖ Because the Second Task Force did not discuss youth older than 18 years, the values in brackets are those for mild and moderate hypertension given by the 26th Bethesda Conference.
Adapted from American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Athletic participation by children and adolescents who have systemic hypertension. *Pediatrics.* 1997;99:637–638

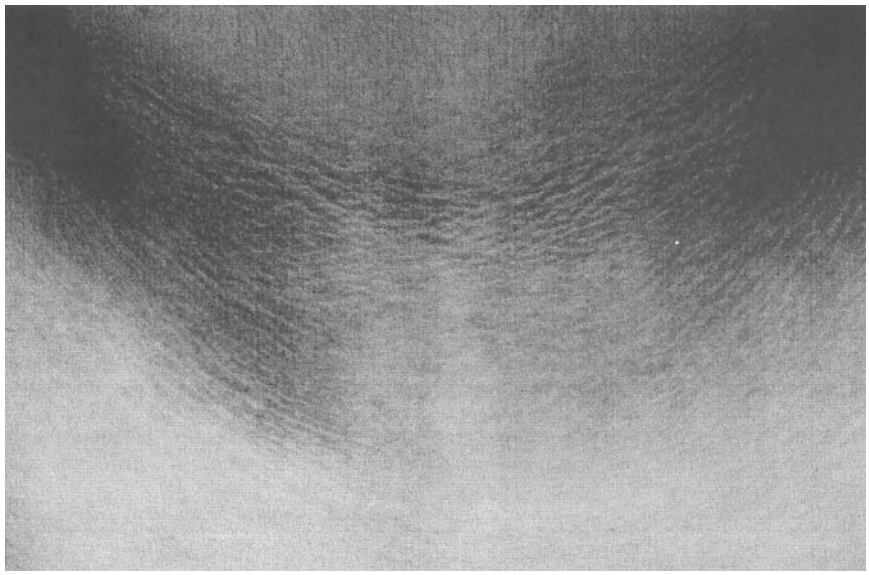


Fig 1. Acanthosis nigricans on the neck.

diabetes mellitus is newly diagnosed, proteinuria is the hallmark of diabetic nephropathy (Fig 3).[19,75,76]

The serum creatinine concentration should be determined at diagnosis and when indicated for drug therapy. Annual serum creatinine screening is indicated for patients with hypertension or microalbuminuria and for people taking angiotensin-converting enzyme (ACE) inhibitors.

A fasting lipid profile, including total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglyceride concentrations, should be performed after diagnosis. The fasting lipid profile is best obtained after initial metabolic stabilization (1–3 months after diagnosis). The primary goal of therapy is to lower the LDL concentration,[77] which is discussed further in "Reducing Cardiovascular Risk."

Liver function tests, including aspartate transaminase and alanine transaminase, should be performed before initiation of oral hypoglycemic therapy. Additional monitoring may be required depending on the person's drug regimen.

The concentrations of C peptide and insulin should not be measured routinely.[2,3] When differentiation between type 1 and type 2 diabetes mellitus is difficult, consultation with a subspecialist with expertise in type 2 diabetes mellitus in children and adolescents is recommended. There currently is no definitive diagnostic tool to differentiate between type 1 and type 2 diabetes mellitus. The differentiation typically is made clinically on the basis of obesity, family history, ethnicity, age, pubertal status, and evidence of insulin resistance (eg, acanthosis nigricans, PCOS).

TREATMENT

Goals of Treatment

The goals of treatment are adequate metabolic control (HbA_{1c} concentration <7%) and prevention of

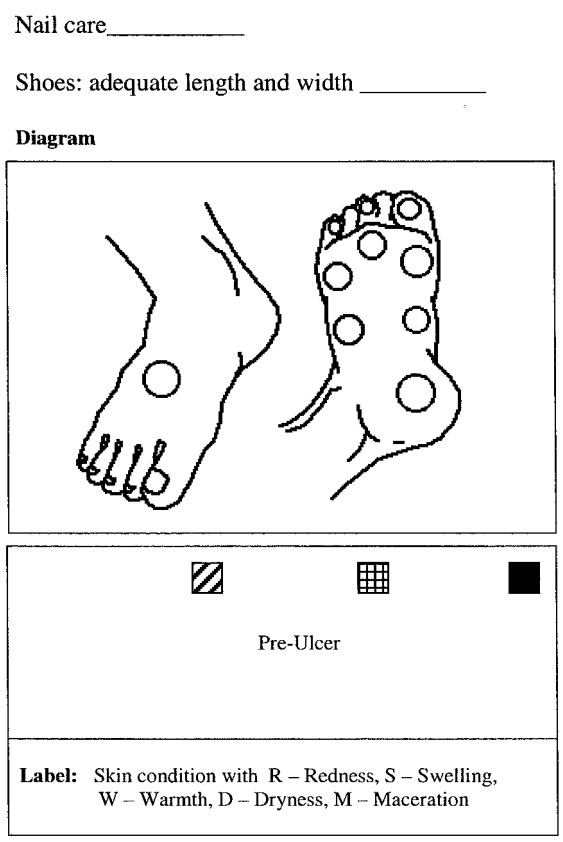


Fig 2. Foot screening for youth with diabetes.

microvascular and macrovascular complications. More specific treatment objectives include the following:

- Eliminating symptoms of hyperglycemia
- Assisting the patient in maintaining a reasonable body weight (weight stabilization)
- Decreasing cardiovascular risk factors: hypertension, hyperlipidemia, hyperglycemia, microalbuminuria, sedentary lifestyle, and use of tobacco products
- Achieving overall improvement in the child's physical and emotional well-being

Recommended treatment modalities include dietary modification, increased physical activity, decreased sedentary behaviors, and pharmacologic intervention (primarily metformin and insulin). Therapy to achieve these goals should be individualized on the basis of the child's age, other illnesses, lifestyle, self-management skills, and level of motivation. Education and other interventions that enhance self-care behaviors are essential for the successful management of type 2 diabetes mellitus. In general, weight loss is not recommended for prepubertal children. Children with morbid obesity and resultant health consequences, such as sleep apnea, may be referred to a subspecialist for weight reduction or a multidisciplinary child obesity clinic. Weight stabilization is the goal until girls are menstruating and boys have reached Tanner stage 5. After pubertal growth is complete, weight loss may be appropriate.

TABLE 4. Impaired Glucose Metabolism

Test	Impaired	Diagnostic for Diabetes
Fasting glucose	≥110 mg/dL and <126 mg/dL	≥126 mg/dL
Impaired 2-h OGTT	≥140 mg/dL and <200 mg/dL	≥200 mg/dL

Barriers to Care

A functional and supportive environment is key in the treatment of children and adolescents with type 2 diabetes mellitus. One of the most serious barriers to achieving the goals of management is a dysfunctional family situation. The medical model of focusing only on the identified patient instead of treating the entire family further decreases the effectiveness of care.

Additional barriers exist for AI/AN youth. Environmental obstacles (eg, harsh climate, lack of transportation, limited access to healthy foods) create difficulties. Specific tribal or cultural issues, including beliefs and feelings about diabetes, may interfere with optimal self-care. For example, many families have a fatalistic attitude about diabetes: "My parents died of diabetes. I have it, and my children are going to get it." Eating and mood disorders, life stresses, and low self-esteem are common obstacles. Lack of appropriate role models, particularly healthy individuals living with diabetes, creates significant hardship for AI/AN children with diabetes. A low level of reading comprehension and proficiency in English may add additional barriers for some families. Furthermore, substance abuse is particularly problematic for many AI/AN children and their families. The health care system's frequent lack of understanding and respect for cultural beliefs may be a barrier to achieving optimal self-care. Many strategies have been shown to help overcome such barriers, including the use of trained professional interpreters, cultural competence and humility training for health care professionals and staff, and inclusion of members of the community in the design of clinical services.

Team Management

Multidisciplinary team management is strongly recommended for youth with type 2 diabetes mellitus. A primary health care professional alone usually cannot provide focused diabetes education, nutrition management, and psychosocial support. The team usually is composed of a physician, a registered di-

TABLE 5. Ongoing Evaluation and Monitoring After Diagnosis: Laboratory Evaluation*

Test	Frequency	Recommendations
SMBG	Fasting and 2-h postprandial glucose daily	Individualized
FPG test	Initially and ongoing	
2-h postprandial glucose test	At diagnosis and as needed	
HbA_{1c}	Every 3 mo	
Urinalysis	Every 12 mo	
Microalbuminuria	Every 12 mo	
Creatinine	At diagnosis	And per protocol if there is hypertension, microalbuminuria, or ACE inhibitor treatment
Lipid profile	At diagnosis and every 12 mo	
LFTs	At diagnosis	Before initiating oral hypoglycemic agents

LFT indicates liver function test.
*More frequent monitoring at diagnosis, during initiation of new treatment, and during metabolic changes (illness, stress, increased activity, and growth).

etitian, a nurse clinician, a social worker, and the patient and the family. The patient and the family are integral members of the team, and participation of the child or adolescent with the diabetes team should be frequent and ongoing. The diabetes team monitors the patient's knowledge about diabetes and its acute and chronic complications. The team also assesses and monitors the patient's knowledge and attitudes toward nutrition and physical activity. In addition, the team promotes the use of medications, SMBG, and problem-solving skills. Screening for barriers to self-care is recommended at each visit. The team assists in identification of achievable self-care goals that are appropriate for age and development level.

Many AI/AN health care facilities have existing diabetes clinics with multidisciplinary teams. It is highly recommended that these clinics organize a pediatric component so that youth receive developmentally appropriate care.

Lifestyle Modifications

The cornerstones of initial treatment of type 2 diabetes mellitus are acquiring and integrating healthful behaviors in nutrition, exercise, and weight management. Frequent contact with the health care team is required to accomplish these goals. The approach to healthful living must be emphasized throughout diabetes treatment. Initially, type 2 diabetes mellitus in asymptomatic youth may be managed by lifestyle modification without adjunctive medication. Basic diabetes education, counseling, and SMBG should be included. The natural history of type 2 diabetes mellitus is one of progressive insulin insufficiency and deterioration of metabolic control.[78–84] Therefore, close monitoring and follow-up are important. Eventually, most people with type 2 diabetes mellitus require medication to achieve adequate metabolic control (Tables 4 and 5).

Resources

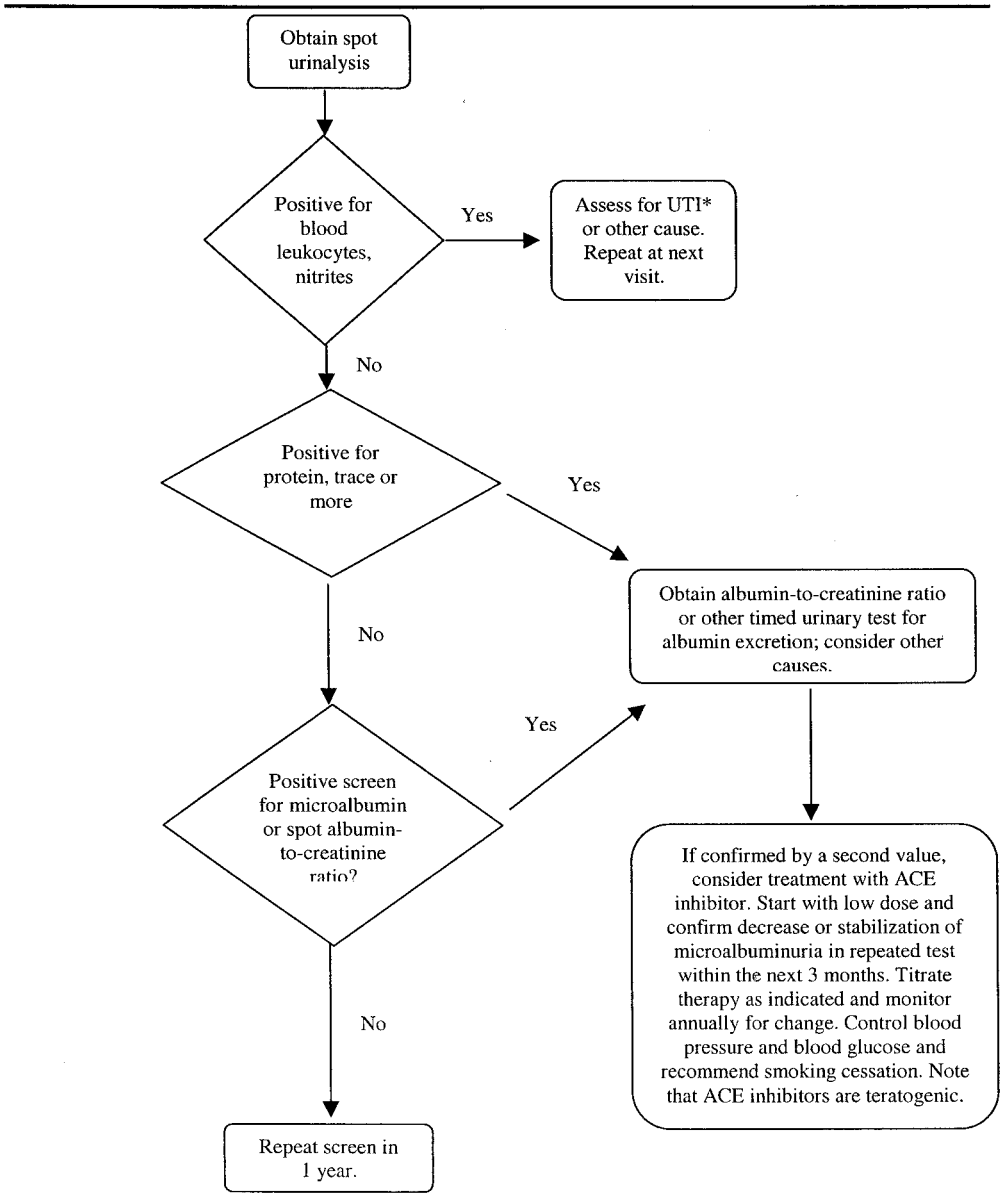
Many resources are available for health care professionals and their patients to help achieve therapeutic goals. However, there is a great need for more culturally sensitive educational materials. Information prepared for adults often is confusing to children and adolescents. Furthermore, resources for children and families with type 1 diabetes mellitus do not apply easily to families affected by type 2 diabetes mellitus.

The National Diabetes Education Program (NDEP) is a federally sponsored initiative of the National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health, the CDC, and more than 200 public and private partners to improve treatment and outcomes for people with diabetes, promote early diagnosis, and, ultimately, prevent the onset of diabetes. The objectives of the NDEP are to:

- Increase public awareness of the seriousness of diabetes and its risk factors and strategies for preventing diabetes and its complications
- Improve understanding about diabetes and its control and promote better self-management behaviors among people with diabetes
- Improve health care professionals' understanding of diabetes and its control and promote an integrated approach to care
- Promote health care policies that improve the quality of and access to diabetes care

Target audiences include people with diabetes and their families (with special attention to Hispanic, black, and Asian Americans; Pacific Islanders; and the AI/AN population); the general public; health care professionals; and health care payers, purchasers, and policy makers.

The NDEP has convened a Diabetes in Children and Adolescents Work Group to address awareness and education issues related to children with diabetes, including the growing emergence of type 2 diabetes mellitus in youth. Furthermore, the NDEP American Indian/Alaska Native Work Group is focusing on youth with diabetes. The NDEP aims to assist health care professionals in increasing their knowledge about type 2 diabetes mellitus in children and adolescents; diabetes education materials for patients and health care professionals can be obtained from NDEP. For more information about the NDEP, see its Internet site at http://www.ndep.nih.gov or call 800-438-5383. Materials for educators about the management of diabetes in school settings are available.



* UTI indicates urinary tract infection.

Fig 3. Annual evaluation and treatment for microalbuminuria.

The ADA has a useful diabetes education program called WIZDOM, which includes specific patient education material in English and Spanish for youth with type 2 diabetes mellitus. Information can be found at the following Internet site: http://www.diabetes.org/wizdom/pod.asp.

MANAGEMENT TOOLS

Self-monitoring of Blood Glucose

The frequency of SMBG should be individualized. Daily fasting and 2-hour postprandial (after-dinner) glucose measurements are recommended.[5] More frequent monitoring is recommended during initiation of treatment. Furthermore, monitoring frequency should be increased during the following situations: insulin treatment, medication dosage adjustments, initiation of new therapies, increased activity, rapid growth, illness, and emotional stress. The frequency of SMBG may be negotiated with the patient and the family. For people who take insulin, the recommended frequency is before every meal and at bedtime. The recommended method is a blood glucose meter with memory. It can be instructive for patients to record their blood glucose results in a log to determine patterns. Reviewing these results with the patient at each visit is recommended. Many patients on medication will learn to make their own dosage adjustments on the basis of blood glucose patterns.

- Ideal targets: more than 50% of SMBG concentrations within target range:
  - Fasting: 80 to 120 mg/dL (4.4–6.7 mmol/L)
  - Postprandial (2 hours after start of meal): 100 to 160 mg/dL (5.6–8.9 mmol/L)
  - Bedtime: 100 to 160 mg/dL (5.6–8.9 mmol/L)

Medical Nutrition Therapy

Meal planning, nutrition education, and exercise are primary treatment strategies for type 2 diabetes mellitus. All people with diabetes should receive regular nutrition counseling and consult with a registered dietitian or nutritionist or a diabetes educator at least every 6 to 12 months. Some children may require more frequent evaluation and counseling. The success of the child in adopting healthful eating habits is much more likely when the entire family follows the dietary recommendations. Other family members may be able to serve as role models. Assisting the family and the patient in change related to eating behavior is recommended.[85] For example, some families will choose to purchase more fruits and vegetables and make them more readily available to all family members. Families may choose to discourage eating outside of mealtimes and make rules about limiting eating while watching television. Weight management must be individualized for the patient initially and in follow-up visits. Each encounter is an opportunity for nutritional education.

Diabetes Education

Patients and their families require diabetes self-care information that is culturally relevant. It is important to recognize that there are many different tribal cultures. The National Standards for Diabetes Care and Patient Education provide guidelines for education program development with criteria specific for Native American health care facilities.[86] In addition, adolescents have distinct needs related to the culture of youth.

Education alone is not enough to motivate people to adopt more healthful behaviors. Children and adolescents, in particular, are not easily motivated by long-term health consequences, which seem irrelevant to them. They are more likely to be influenced by immediate concerns, such as physical attractiveness, feelings of well-being and acceptance, and their desire to be able to do more in school or sports. The use of motivational interviewing or collaborative problem solving may be useful in helping children and adolescents make and maintain necessary behavior changes.

Physical Activity Education

Physical activity is a cornerstone of the management of type 2 diabetes mellitus. Physical goals should be stated concretely. Exercise is associated with improvement in short- and long-term metabolic control,[87,88] and physical activity improves insulin sensitivity. All patients should be assessed for level of fitness and current exercise routines. Recommendations should be based on the patient's needs and current condition. It is important to assess the opportunities available within the family and the community. Adaptive physical education classes may be helpful for children who are overweight. Youth with obesity and type 2 diabetes mellitus are not likely to participate in organized sports, so other physical activity strategies are needed. Activities of daily living can be adapted to increase physical fitness.[88–91] Sedentary activities should be limited, and positive alternatives should be emphasized. When making behavioral changes, simple, achievable goals promote efficacy. Children and adolescents are more likely to accept fitness goals when they are framed in terms of feeling better, looking better, or doing more.[31]

Preconception Counseling and Management

A sexual activity history should be obtained at diagnosis in postpubertal youth. Counseling about the necessity of metabolic control for healthful pregnancy outcomes should start at puberty. Abstinence counseling should be provided, if appropriate. Family planning options should be discussed with adolescents who are or may become sexually active. Pregnancy should be deferred until optimal glycemic control has been achieved to decrease first-trimester risks to the fetus, including congenital heart disease, caudal regression, and neural tube defects, and third-trimester risks of macrosomia, neonatal hypoglycemia, and hypocalcemia, all of which are common in preexisting type 2 diabetes mellitus and gestational diabetes. All oral hypoglycemic agents are contraindicated during pregnancy. Furthermore, treatment of diabetes may increase fertility and the likelihood of pregnancy in young women. Metformin, in particular, may improve ovarian function and ovulation.

Immunizations

Usual childhood immunizations (including hepatitis B, influenza, and pneumococcal immunizations) are recommended. Tuberculosis screening by purified protein derivative should be documented once after the diagnosis of diabetes and performed at appropriate intervals, as indicated by community-specific tuberculosis prevalence.

Dental Examinations

Dental examinations are recommended every 6 months. Periodontal disease is more common in people with diabetes than in those without and has been called the sixth complication of diabetes (the other 5 complications involve the heart, kidney, eyes, skin, and feet).[92–94]

DECREASING CARDIOVASCULAR RISK

Identification and Treatment of Hyperlipidemia

Children with type 2 diabetes mellitus are at risk of hyperlipidemia, which compounds their risk of premature cardiovascular disease. Although the American Heart Association recommends that children's total cholesterol concentration be less than 170 mg/dL (<4.40 mmol/L) and the LDL concentration be less than 110 mg/dL (<2.84 mmol/L), the ADA recommends a lower target concentration for LDL in adults with diabetes[28,87,95]: less than 100 mg/dL (<2.59 mmol/L). Because of the higher risk of cardiovascular disease in children with diabetes, the lower acceptable value recommended by the ADA is preferred. A lipoprotein analysis after a 12-hour fast is recommended to obtain triglyceride concentrations for computation of accurate LDL concentra-

tions,[95] although recent evidence indicates non-HDL cholesterol is a better predictor of atherogenesis than LDL cholesterol. If a fasting measurement is not possible, then a measurement of the HDL concentration, along with the total cholesterol concentration, will provide an alternative. Other reliable analyses of the lipid profile may become available in the future. Children with an LDL concentration more than 100 mg/dL (>2.59 mmol/L) or a total cholesterol concentration more than 170 mg/dL (>4.40 mmol/L) should receive advice about other risk factors for cardiovascular disease, such as smoking and sedentary lifestyle. High triglyceride concentrations are increasingly recognized as an additional cardiovascular risk factor for people with diabetes. In addition to studies showing the benefit of decreasing the cholesterol concentration in adults, the Bogalusa Heart Study provides evidence that risk factors, such as a low HDL concentration, high triglyceride and LDL concentrations, and smoking, have clinical significance for development of cardiovascular disease beginning in childhood.[96–98]

The American Heart Association Step-One diet should be initiated for children with high total cholesterol or LDL concentrations. The Step-One diet includes fewer than 30% of total calories from fat, fewer than 10% of total calories from saturated fat, 10% or fewer calories from polyunsaturated fat, and cholesterol of no more than 100 mg/1000 cal. If cholesterol concentrations do not normalize despite a history of adherence to the Step-One diet, then the Step-Two diet is used. The Step-Two diet is lower in total cholesterol (67 mg/1000 cal) and saturated fat (<7% of total cal). People who follow these diets should be reevaluated every 6–12 months. More information about the Step-One and the Step-Two diets can be found on the American Heart Association's Internet site at http://www.americanheart.org. The assistance of a registered dietitian or other qualified nutrition professional is necessary to ensure adequacy of nutrients, vitamins, and minerals. Glycemic control, as well as therapy with metformin, can help to lower triglyceride and LDL concentrations. Cholesterol-lowering drug therapy should be considered for children older than 10 years if an adequate trial of diet therapy is unsuccessful after 6 to 12 months. An LDL concentration of 100 mg/dL or more (≥2.59 mmol/L) and 1 of the following risk factors or physical inactivity indicate a need for cholesterol lowering medication: family history of premature cardiovascular disease (55 years or younger), cigarette smoking, high blood pressure, low HDL concentration (<35 mg/dL [<0.91 mmol/L]), and obesity (≥95th percentile weight for height).

The recommended cholesterol-lowering medications for children include cholestyramine and colestipol hydrochloride. These medications are difficult to take because of the frequency of dosing and adverse gastrointestinal effects. Although the efficacy and safety of these medications have been documented in children, long-term data on improved morbidity and mortality are lacking.[77] The 3-hydroxy-3-methylglutaryl coenzyme A reductase inhibitors (statins) are now approved for use in children who have familial hyperlipidemia and are 10 years of age and older. They are being used and tested in pediatric populations for other indications. Rhabdomyolysis is a known adverse effect, and safety during pregnancy has not been proved. Specialty consultation may be helpful for treating youth with hyperlipidemia.

Blood Pressure Control

In adults, tight blood pressure control has been shown to have a greater impact on cardiovascular disease risk reduction than blood glucose control.[99–102] Systemic hypertension is defined as systolic or diastolic pressure greater than or equal to the 95th percentile for age.[103] However, for children with type 2 diabetes mellitus, the blood pressure goal is less than the 90th percentile. Accurate blood pressure measurement is critical to the evaluation of suspected hypertension. The patient should be resting and comfortable. Cuff size, the position of the arm, the person's position (sitting or supine), and the speed of inflation and deflation of the cuff can affect the measurement. The cuff bladder width should be approximately 40% of the arm circumference midway between the olecranon and the acromion. The arm should be supported, and the cubital fossa should be at the level of the heart. The bell of the stethoscope should be placed over the brachial artery pulse. The cuff should be inflated to 20 mm Hg above the point at which the radial pulse disappears. The cuff is then deflated at a rate of 2 to 3 mm Hg per second. Automated devices are not as accurate for determining diastolic pressure. The diagnosis of hypertension should be confirmed in 3 separate consecutive examinations. For mild hypertension (slightly above the 95th percentile), the initial assessment should evaluate the possibility of renal disease. The evaluation of severe hypertension (≥99th percentile for age) should include an echocardiogram.

Conservative management (eg, lifestyle changes, such as weight decrease in postpubertal patients, nutrition, and exercise) is recommended as initial therapy. Sodium restriction may be difficult for adolescents. Significant reduction in blood pressure may be noted with weight loss and exercise programs. If blood pressure reduction is not achieved by lifestyle changes, then drug therapy will be necessary. ACE inhibitors are the usual first-line agents because of cardiovascular and renal benefits.[104,105] Because ACE inhibitors are teratogenic, another agent might be preferable for girls of childbearing age. Beta-blockers are an alternative unless the child is taking insulin, as symptoms of hypoglycemia may be masked.

Smoking and Alcohol Cessation and Prevention and Increasing Physical Activity

Smoking cessation and prevention of smoking initiation are essential for decreasing the risk of cardiovascular problems. Smoking is associated with an increased incidence of diabetes in adults.[106] It is important to screen for tobacco use and advise or refer for tobacco cessation if use is confirmed. Tobacco use information should be updated at each visit. Because

of the greatly increased risk of macrovascular and microvascular disease in people who have diabetes and smoke,[107] children and adolescents who do not smoke or use other tobacco products should receive positive reinforcement and information about the importance of continued abstinence.

Alcohol affects insulin production and increases insulin resistance, which also increases the risk of cardiovascular complications. The independent risk of cardiovascular complications associated with alcohol consumption by people with diabetes is a long-term hazard for youth with diabetes. A more immediate risk is hypoglycemia caused by alcohol consumption.

Alcohol use may aggravate the hypoglycemia caused by sulfonylureas or insulin treatment, and it may increase the risk of lactic acidosis for patients who use metformin. Alcohol and drug use should be assessed at every visit. Adolescents are at risk of substance abuse, which may interfere with the achievement of treatment goals. Anticipatory guidance regarding alcohol avoidance is recommended, including for children and adolescents who do not use alcohol or other drugs. The benefits of not drinking should be emphasized. The effectiveness of creative strategies should be evaluated.

Increasing physical activity is a positive way to decrease risk of cardiovascular complications.

Treatment of Microalbuminuria

Microalbuminuria is a sign of incipient diabetic nephropathy and is a risk factor for cardiovascular complications. Microalbuminuria may be encountered in people who have a new diagnosis of type 2 diabetes mellitus. Proteinuria, conversely, is the hallmark of diabetic nephropathy. ACE inhibitors are indicated for proteinuria or microalbuminuria and have been shown to slow the rate of progression of nephropathy in adults. Improved glycemic and blood pressure control slows the progression of nephropathy. ACE inhibitors are an additional important treatment modality, as shown in the evaluation and treatment algorithm (Fig 3).

PHARMACOLOGIC MANAGEMENT ON THE BASIS OF CLINICAL MANIFESTATIONS

The options for pharmacologic treatment include insulin; oral hypoglycemic agents, especially metformin; and any combination thereof. Intensive blood glucose control with insulin or sulfonylureas has been shown to decrease microvascular but not macrovascular complications.[79] The choice of medications is discussed in relation to the patient's status at diagnosis. The following sections are given in order of increasing severity and decreasing incidence.

Impaired Glucose Metabolism

Patients with impaired glucose tolerance and impaired fasting glucose have glucose concentrations too high to be considered normal but do not meet the diagnostic criteria for diabetes. They are considered to have prediabetes. Patients with impaired fasting glucose have FPG‖ concentrations of 110 mg/dL or more (≥6.1 mmol/L) but less than 126 mg/dL (<7.0 mmol/L). Patients with prediabetes have 2-hour OGTT results between 140 and 200 mg/dL (7.8 and 11.1 mmol/L [Table 5]). Compared with the FPG, the 2-hour OGTT will identify more people as having impaired glucose tolerance. Although the 2-hour OGTT is more sensitive than the FPG, it is not as reproducible. It is, therefore, important to identify which test was used for diagnosis. An increase in the postprandial glucose concentration precedes an increase in the FPG concentration in adults. The natural history of impaired glucose tolerance in children and adolescents has not been studied. The US Diabetes Prevention Program has shown that lifestyle interventions are more effective than metformin and both approaches are more promising than conventional treatment in reducing progression to diabetes in adults with impaired glucose tolerance.[108] Similarly, a study of Finnish adults was interrupted because of the success of the lifestyle intervention arm.[109] Patients with prediabetes and their families should receive nutrition and physical activity intervention and support. Their risk of diabetes should be discussed. Monitoring of weight, nutrition, physical activity, and FPG should be performed regularly (at least every 3 months). Some diabetes centers recommend SMBG for high-risk patients with impaired glucose metabolism.

Asymptomatic Diabetes

People with diabetes may be identified as part of community-based case-finding efforts or by primary health care professionals who test asymptomatic children and youth who are at risk of type 2 diabetes mellitus. Patients with an FPG concentration of 126 mg/dL or more (≥7.0 mmol/L) or a 2-hour plasma glucose concentration of 200 mg/dL or more (≥11.1 mmol/L), using a glucose load of 75 g of anhydrous glucose dissolved in water, but who do not have polyuria, polydipsia, or weight loss are considered to have asymptomatic type 2 diabetes mellitus. When diabetes is identified early, treatment with lifestyle modifications and SMBG (fasting and postprandial) may be instituted. If plasma glucose or HbA_{1c} concentrations remain increased for 3 months, then treatment with oral agents or insulin should be started. Patients who attain euglycemia through lifestyle modification should be monitored every 3 months.

People with an FPG concentration greater than 250 mg/dL (>13.9 mmol/L) should be treated as if they have symptoms, even if they report none.

Symptomatic Diabetes Without Ketoacidosis

Symptoms include polyuria and polydipsia, nocturia, sleep apnea, vaginitis, dysuria, and even weight loss. Many families do not recognize polyuria and polydipsia in adolescents. Educational ap-

‖When glucose concentration is measured in a laboratory, plasma glucose concentration is measured. When a self-monitoring system is used, blood glucose concentration is measured; in most cases, these values are similar.

proaches to raise adolescent awareness about the potential significance of the symptoms of increased thirst and urination could encourage teenagers to alert their families and primary health care professionals.

Insulin

Initial treatment with subcutaneous insulin is suggested for children with FPG concentrations greater than 250 mg/dL (>13.9 mmol/L) and for children who are symptomatic. First Nations children with type 2 diabetes mellitus have been treated with subcutaneous insulin for 2 to 6 weeks followed by abrupt discontinuation of treatment with acceptable metabolic control.[110]

The use of insulin in children and adolescents with type 2 diabetes mellitus is safe.[2,3,111–113] Preliminary data suggest that early insulin therapy may preserve beta cell function in type 1 diabetes mellitus. This may be true in type 2 diabetes mellitus as well.[114,115] Symptomatic youth often have evidence of the toxic effects of glucose or a transient deterioration of beta cell function brought on by prolonged hyperglycemia. Thus, insulin often is needed for initial metabolic control. When C peptide or insulin concentrations are obtained at diagnosis, they may be uncharacteristically low. Therefore, if C peptide concentrations are measured to determine whether a patient has type 1 or type 2 diabetes mellitus, then it is best to wait until adequate metabolic control is obtained.

The recommended starting dose of insulin is individualized from 0.5 to 1.0 U/kg body weight per day. Additional insulin may be given if blood glucose concentrations do not fall below 150 mg/dL (8.3 mmol/L) before meals. Insulin dosage must be adjusted to achieve target blood glucose concentrations. Children and adolescents with type 2 diabetes mellitus often require much higher doses of insulin because of insulin resistance. Insulin regimens must be individualized. Some patients may require only intermediate-acting insulin (isophane [neutral protamine Hagedorn (NPH)] or lente) given once or twice daily. Others may require short- or rapid-acting insulin (regular or lispro/aspart) and intermediate-acting insulin (NPH or lente) with a distribution of two thirds of the total dose before breakfast and one third of the total dose before dinner.[116] As with type 1 diabetes mellitus, an initial regimen might be to give the morning dose as one third regular or lispro/aspart and two thirds NPH or lente and the evening dose as one half regular or lispro/aspart and one half NPH or lente.[117] It may be more physiologically appropriate to give the evening intermediate-acting insulin at bedtime.[118] Lispro and aspart have certain advantages over regular insulin—its action profile provides insulin coverage for meals, and the dose can be adjusted according to the amount of food to be eaten. Other regimens that have proved successful are the use of the long-acting insulin glargine in conjunction with an oral hypoglycemic agent that increases endogenous insulin secretion to cover meals.

These dosage recommendations are to be considered a starting point, because insulin dosing must be adjusted on the basis of the blood glucose concentration. As metabolic control is achieved, insulin dosages start to decrease. It is not necessary to initiate insulin treatment with frequent dosing of rapid-acting insulin before meals. Using intermediate- and rapid-acting insulin early in treatment permits more rapid stabilization of glucose concentrations. When the health care professional judges that insulin will be required over the long-term, the person may be taught to give bolus insulin doses before meals, depending on the amount of carbohydrate to be consumed. Oral agents may be started once the glucose concentration is stabilized, and the insulin dosage gradually can be weaned. The glucose concentration usually is stable between 3 and 4 weeks after the initiation of therapy.[29]

Oral Agents

The recently completed United Kingdom Prospective Diabetes Study demonstrated that type 2 diabetes mellitus is a progressive disorder that can be treated initially with oral agent monotherapy.[79,80] Current recommendations for adults suggest beginning oral monotherapy if target glycemic goals are not achieved within 1 to 3 months of initial intervention of lifestyle modification. This period may not be practical for many AI/AN youth because of greater barriers to achieving activity and nutritional goals. A longer period may be warranted only if there is slow and steady improvement in achieving target glycemic goals.

Metformin is the only oral hypoglycemic agent approved for use in children. Data are not yet available regarding the safety, efficacy, or dosing of the other oral agents used to treat type 2 diabetes mellitus in children, although such data are available for adults. The biguanides (eg, metformin) and the sulfonylureas (eg, glyburide) have been part of the clinical experience in the treatment of type 2 diabetes mellitus in children. Sulfonylureas have been used for several years in the treatment of maturity-onset diabetes of youth, a set of rare, genetically determined diabetes. Use of metformin has increased in recent years, and clinical trials are in progress.

Metformin

The ADA consensus statement recommends that "if treatment goals with nutrition education and exercise are not met, pharmacologic therapy is indicated. The first oral agent should be metformin."[2,3,118] Metformin works by decreasing hepatic glucose production and enhancing insulin sensitivity. It is contraindicated for people with renal or hepatic disease, conditions that lead to hypoxia (eg, unstable asthma), or severe infection or those who abuse alcohol. It should be withheld before radiographic studies requiring the administration of radiocontrast dye. Metformin improves ovarian function, especially in women with PCOS, making family planning and contraception (when indicated) important. Lactic acidosis rarely has been reported.[119] Gastrointestinal adverse effects, such as

abdominal discomfort and diarrhea, occur in approximately 20% to 30% of people who take metformin. These effects can be minimized by slowly titrating the dose and beginning with 250 mg each day, increasing to 250 mg twice daily, and finally increasing to 500 mg twice daily, if necessary. In adults, 80% to 85% of the maximal glucose-lowering effect is observed with a daily dose of 1500 mg. Most children who require treatment are at or above normal adult weight. Therefore, beginning at a dose of 500 mg per day would be considered safe. In adults, a clinically significant response at a dosage of less than 1500 mg per day is unusual. Metformin is supplied as 500- and 850-mg tablets and extended-release tablets. The maximum recommended daily dosage of metformin is 2550 mg. The current cost of metformin is approximately twice that of a second-generation sulfonylurea. However, less costly generic medications should soon be available. Advantages of metformin include decreased weight gain, possible weight loss, lower insulin concentrations, and improved lipid profile.[29,120]

Sulfonylureas

The primary mechanism of action of the sulfonylureas is enhancement of insulin secretion. In adults in whom type 2 diabetes mellitus has recently been diagnosed, good results have been achieved with mild to moderate fasting hyperglycemia (220–240 mg/dL [12.2–13.3 mmol/L]), good beta cell function as reflected by a high fasting C peptide concentration, and the absence of islet-cell or glutamic acid decarboxylase antibodies. No sulfonylureas are currently approved for use in children, although studies in the pediatric population with second-generation agents are ongoing. In most studies in adults, sulfonylureas have had neutral or slightly beneficial effects on plasma lipid concentrations. Weight gain is common with use, a negative effect in patients in whom weight loss is a major goal. Most pediatric endocrinologists use sulfonylureas with other agents when monotherapy with metformin or insulin sensitizers has failed. First-generation sulfonylureas (chlorpropamide, tolazamide, acetohexamide, and tolbutamide) must be given in higher doses than second-generation sulfonylureas (glyburide, glipizide, and glimepiride). The second-generation sulfonylureas are largely free of drug interactions. The major adverse effect associated with sulfonylureas is hypoglycemia. Most of the hypoglycemic action of the sulfonylurea is observed with a daily dose that represents half of the maximally effective dose. Sulfonylureas may potentiate the hypoglycemia associated with alcohol use. Therefore, alcohol consumption is contraindicated when a person is taking a sulfonylurea. Other adverse effects are uncommon but include nausea; vomiting; and skin reactions, including rashes, purpura, and pruritus. Leukopenia, thrombocytopenia, hemolytic anemia, and cholestasis have been reported. Although a 1970 study[121] suggested that sulfonylureas may exacerbate coronary artery disease in people with type 2 diabetes mellitus, the ADA issued a statement in 1979 opposing any formal restrictions on use of the sulfonylurea agents on the basis of interpretation of that study. In addition, the United Kingdom Prospective Diabetes Study found no increased incidence of coronary artery disease for patients with type 2 diabetes mellitus who were assigned to intensive therapy with sulfonylureas, compared with patients who received dietary therapy without medications. The sulfonylureas have an additional advantage of low cost. Table 6 outlines the characteristics of select sulfonylureas.[122,123]

Repaglinide

Repaglinide is a new agent. Like the sulfonylureas, it enhances the release of insulin, but the response is quicker and of shorter duration than that of sulfonylureas. Repaglinide's glucose-lowering effect is additive to the glucose-lowering effect of metformin. Furthermore, repaglinide has no significant effect on plasma lipid concentrations. Repaglinide must be taken before each meal because of its short duration of action. Thus, its primary effect is on the postprandial blood glucose concentration.

Thiazolidinediones

Thiazolidinediones (TZDs) work primarily by increasing insulin sensitivity in muscle and adipose tissue with a lesser effect on hepatic glucose uptake. The first TZD to be marketed in the United States, troglitazone, was taken off the market because of hepatotoxic effects. However, the newer agents in this class seem to have an improved safety profile. Although not approved for children, clinical trials in the pediatric population are in progress. Because TZDs increase insulin sensitivity, they have a favor-

TABLE 6. Pharmacologic Characteristics of Sulfonylureas[123]

Characteristics	Tolbutamide	Tolazamide	Chlorpropamide	Glipizide	Glyburide
Relative potency	1	5	6	100	150
Duration of action (h)	6–10	16–24	24–72	16–24	18–24
Dose (mg)					
Range	500–3000	100–1000	100–500	2.5–40*	1.25–20
Average	1500	250	250	10	7.5†
Doses per day (*n*)	2–3	1–2	1	1–2	1–2
Dosage forms available (mg)	250, 500	100, 250, 500	100, 250	5, 10	1.25, 2.5, 5
Diuretic	Yes	Yes	No	No	Yes
Frequency of severe hypoglycemia (%)	1	1	4–6	2–4	4–6
Overall frequency of side effects (%)	3	4	9	6	7

* Studies have shown that the maximum effective dose of glipizide is 10 mg/dL. Doses above this may cause decreased efficacy.
† Glyburide is available worldwide as better-absorbed micronized preparations. These preparations are available in 1.5-, 1.75-, 3-, 3.7-, and 6-mg tablets.

able effect on HDL and triglyceride concentrations. Studies in adults indicate that TZDs result in a 1% to 2% decrease in HbA_{1c} values when used as monotherapy, although monotherapy is not recommended. Adverse effects include weight gain and fluid retention. TZDs may decrease the effectiveness of oral contraceptives. Another disadvantage is the high cost of this class of drugs. Dosing with pioglitazone hydrochloride is initiated at 15 mg daily with or without food. The dose can be increased after 8 to 12 weeks if the decrease in HbA_{1c} is inadequate. The maximum daily dosage is 45 mg for monotherapy and 30 mg for combined therapy. The dosage does not need to be adjusted for patients with renal disease. Pioglitazone is available as 15-, 30-, and 45-mg tablets. Rosiglitazone maleate initially is given as a single 4-mg dose. The dose may be increased to 4 mg twice daily or 8 mg daily if the response is inadequate after 8 to 12 weeks; however, the maximum dosage is 8 mg daily. Like pioglitazone, rosiglitazone can be given with or without meals and does not need dosage adjustment for patients with renal failure. It is available in 4- and 8-mg tablets.

Acarbose

The α-glucosidase inhibitor acarbose was introduced in the United States in the late 1990s. It primarily affects postprandial glucose concentrations by delaying carbohydrate digestion.[124–126] Its major adverse effect, flatulence, has limited its acceptance in the pediatric population.

Combining Oral Agents

A maximal dose of a single oral agent (metformin or a sulfonylurea) may not maintain long-term acceptable glycemic control, according to ADA guidelines (FPG concentration <140 mg/dL [<7.8 mmol/L] or HbA_{1c} value <8.0%).¶ Because type 2 diabetes mellitus is a progressive disease with decreasing beta cell function, most people with an initial acceptable response to monotherapy will require additional agents as their disease progresses.[127–129] Randomized, placebo-controlled studies of combination therapy support the effectiveness of this strategy for decreasing FPG and HbA_{1c} concentrations.[130–132] When beta cells fail, insulin will need to be added to the therapeutic regimen.

Because metformin promotes weight loss and decreases lipid concentrations, it is preferred for use by overweight people with type 2 diabetes mellitus and dyslipidemia. The dose of metformin or sulfonylureas can be increased over a 4- to 8-week period until acceptable glucose control is achieved or the maximum dose is reached. If monotherapy fails with metformin, then a sulfonylurea should be added. It is prudent to assess whether the person is taking the medication as directed before initiating combination therapy. Patients may not take their medication for a variety of reasons, including denial of illness; fear of being labeled diabetic; fear of adverse effects, such as hypoglycemia; actual adverse symptoms; and lack of knowledge about the need for long-term treatment. If combination therapy with 2 oral agents does not achieve the desired therapeutic goal, then bedtime insulin or a third oral agent may be considered. Referral to a specialist in type 2 diabetes mellitus for children and adolescents is recommended when combination therapy has failed.

¶The ADA currently recommends intensifying treatment on the basis of HbA_{1c} concentration <8%. However, the recommended target goal for HbA_{1c} concentration is <7%.

Symptomatic Diabetes With Ketoacidosis

Diabetic ketoacidosis is defined by a bicarbonate concentration less than 15 mmol/L (<15 mEq/L) and/or pH less than 7.25. Type 2 diabetes mellitus may manifest with ketosis and, uncommonly, with ketoacidosis. Therefore, clinical presentation with ketoacidosis does not preclude the diagnosis of type 2 diabetes mellitus.

Insulin

Children with diabetic ketoacidosis require initial treatment with intravenous insulin followed by subcutaneous insulin. High doses may be required because of the insulin resistance characteristic of type 2 diabetes mellitus.[133] Health care professionals, nurses, and laboratory professionals who care for a large number of patients with diabetic ketoacidosis are more likely to have the necessary clinical competence to provide this high-acuity care. When care by such personnel is not possible, consultation with a subspecialist is recommended. Excellent treatment protocols and guidelines are available for the treatment of ketoacidosis.[134–137] Once the patient's condition is stable, the important lifestyle modifications discussed previously can be addressed. As people often are willing to consider major lifestyle changes during a crisis, this may be an optimal teachable moment.[137]

CONCLUSION

Type 2 diabetes mellitus in AI/AN youth is an alarming new morbidity that, without intervention, will lead to significant increased morbidity and mortality during adulthood. Health care professionals must address multiple medical and psychosocial concerns within the context of a medical home with the goal of coordinating comprehensive services from health care professionals and the community. Health care professionals who care for families affected by type 2 diabetes mellitus face the challenge of motivating people to adopt significant behavioral changes.

Several interventions have proved effective in preventing diabetes complications among adults, and evaluation of these interventions in children with type 2 diabetes mellitus is urgently needed. It is expected that clinical trials using behavioral and treatment interventions for children with diabetes will be developed. More knowledge about current care, gaps in care, and the natural history of the disease is forthcoming. Finally, results of research efforts in primary prevention of type 2 diabetes mellitus for adults and youth soon will be available. The increasing evidence base will challenge current treat-

ment guidelines and ultimately improve the health of children with type 2 diabetes mellitus over their lifetimes.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Native American Child Health and Committee on Injury and Poison Prevention

The Prevention of Unintentional Injury Among American Indian and Alaska Native Children: A Subject Review

ABSTRACT. Among ethnic groups in the United States, American Indian and Alaska Native (AI/AN) children experience the highest rates of injury mortality and morbidity. Injury mortality rates for AI/AN children have decreased during the past quarter century, but remain almost double the rate for all children in the United States. The Indian Health Service (IHS), the federal agency with the primary responsibility for the health care of AI/AN people, has sponsored an internationally recognized injury prevention program designed to reduce the risk of injury death by addressing community-specific risk factors. Model programs developed by the IHS and tribal governments have led to successful outcomes in motor vehicle occupant safety, drowning prevention, and fire safety. Injury prevention programs in tribal communities require special attention to the sovereignty of tribal governments and the unique cultural aspects of health care and communication. Pediatricians working with AI/AN children on reservations or in urban environments are strongly urged to collaborate with tribes and the IHS to create community-based coalitions and develop programs to address highly preventable injury-related mortality and morbidity. Strong advocacy also is needed to promote childhood injury prevention as an important priority for federal agencies and tribes.

ABBREVIATIONS. AI, American Indian; AN, Alaska Native; IHS, Indian Health Service; AAP, American Academy of Pediatrics.

More than 700 000 American Indian and Alaska Native (AI/AN) children younger than 19 years old live in the United States.[1] These AI/AN children experience higher rates of morbidity and mortality from unintentional injuries than do other US children. The 881 injury deaths to AI children between 1992 and 1994 translate to an overall rate of 52.3 deaths per 100 000 children per year. This rate is almost twice the US rate of 28.3 per 100 000 children for all races (1993).[2] Rates of injury deaths are high for rural and urban AI/AN populations.[3]

Although rates of injury death have dropped considerably during the past 25 years, they remain disproportionately high among AI/AN children for the most common causes of injury. Fatality rates for motor vehicle occupant injuries are 3 times higher for AI/AN children than for white and black children.[1] Pedestrian-motor vehicle collision deaths are almost 4 times that for all US races combined, and drowning, the second leading cause of injury death, occurs at rates almost 2 times higher than those for white and black children. Native American children also die as a result of fire and burn injury at 2.8 times the rate of white children.

Some of the recognized important risk factors for unintentional injury mortality among AI/AN children include poverty, alcohol abuse, substandard housing, limited access to emergency medical services, rural residences, and low seat belt use rates.[2,4–8] The high rates of injury-related death and disability make it especially important to emphasize and intensify injury prevention efforts within this population.

Injury prevention specialists use media campaigns, targeted education, safety technology, environmental modification, and passage of laws and regulations to achieve their aims. Each of these approaches has been used successfully by the tribes, often working in close partnership with the Indian Health Service (IHS) Injury Prevention Program. Some examples of successful injury prevention programs for AI/AN communities include a program promoting winter coats with flotation devices in Alaska to prevent drowning[9]; a livestock control program to reduce motor vehicle collisions with large animals[10]; and the Navajo Nation motor vehicle occupant safety program to boost seat belt use.[11]

The sovereignty of tribes provides special challenges to the regulatory and legislative approach to injury control in AI/AN communities. Safety laws vary considerably among the 550 federally recognized tribes. Although some tribes fall under the jurisdiction of state laws (eg, California, Oklahoma, and Alaska), many enact their own laws and tribal codes. According to a recent inventory of tribal laws relating to occupant safety, only 14% of the responding tribes had passed their own laws requiring seat belt use, 46% had adopted state laws, and the remainder had no relevant law.[12] The regulatory and legislative approach is complex and may often require working with each tribe separately, similar to the enactment of laws in states.

The AI/AN groups are culturally and linguistically diverse with more than 200 native languages still spoken. Although similarities exist among some tribes, such as the Pueblo tribes, most tribes have unique cultural practices. Intervention strategies should account for these differences. For example, the promotion of the use of child safety seats is a well-accepted form of prevention for motor vehicle

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

crash injury, but the method used to promote them may need to be tailored to the cultural beliefs of the specific tribe. In some tribes, discussions of mortality, risk, and harm are forbidden.[13] For example, health care professionals should not warn that death is a potential outcome if certain protective measures are not taken. One strategy used by the IHS Injury Prevention Program was to conduct a crash test using a cradle board to demonstrate the inadequacy of this device as a child vehicle restraint. Video footage of this test was sufficient to communicate the risk without having to predict risk of harm to the child.

Pediatricians can increase their understanding of tribal cultures in many ways. In many tribes, traditional healers, tribal elders, or community health workers can be approached respectfully and asked to provide guidance; in other tribes it may be more appropriate to work directly with the tribal health director. Many tribes have or are developing cultural centers to assist nonmembers to gain a greater understanding of the tribe.

Some general strategies also can be used to communicate with AI/AN patients. First, avoid comparisons between AI/AN people and people of other cultures. Second, providers should take extra time to convey information in a clear nonjudgmental style that is free of jargon. Common cultural attributes of the AI/AN people include cooperation and patience. They may respond quietly or ask few questions because of their beliefs about respect and consideration.

RECOMMENDATIONS

Because of concern about the high rate of childhood injury morbidity and mortality among AI/AN people, the American Academy of Pediatrics (AAP) supports the continued implementation and expansion of a broad-based injury prevention program among these populations. Pediatricians and others caring for AI/AN children should:

1. Form coalitions linking IHS and tribal injury control specialists with others interested in childhood injury control in the surrounding community and state. All should be encouraged to work within AI/AN communities to understand how best to introduce injury prevention strategies.
2. Respect tribal sovereignty and community-specific cultural factors when considering regulatory or legal approaches to injury prevention.
3. Provide assistance with advocacy for adoption of tribal seat belt and child car seat traffic safety laws or the adoption by tribes of state child motor vehicle safety laws. (The AAP and the IHS have developed model injury prevention legislation that may be helpful in some cases.)
4. Promote comprehensive seat belt and child car seat educational and media campaigns in AI/AN communities.
5. Support other targeted child safety efforts among rural and urban AI/AN populations that are known to be effective, including the promotion of bicycle helmet use, fire safety, the prevention of drowning and falls, and firearm safety. Pediatricians can facilitate injury prevention in the clinic by use of the AAP TIPP (The Injury Prevention Program) materials with patients.
6. Support efforts to improve the quality of injury-related data through the establishment of confidential comprehensive data systems to monitor the epidemiology of all medically reported injuries and the improvement of coding of health records to decrease racial misclassification.
7. Advocate for increased emphasis on and funding by tribal and federal programs (eg, the IHS, the Centers for Disease Control and Prevention, and the National Highway Traffic Safety Administration) of injury control initiatives and appropriate injury prevention research in AI/AN communities.
8. Urge the IHS, tribally operated, and urban health programs to implement injury prevention programs as a cost-effective use of health care dollars.

Pediatricians and others involved in child health care have an opportunity and a challenge to reduce injury-related morbidity and mortality among AI/AN children. If the challenge can be met, Native American children will be protected from injuries at least as well as other US children, who have seen a more favorable reduction in injury mortality in recent years.[14]

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American Academy of Pediatrics
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Policy Statement—Principles of Health Care Financing

abstract

FREE

The American Academy of Pediatrics advocates that all children must have health insurance coverage that ensures them access to affordable and comprehensive quality care. Access to care depends on the design and implementation of payment systems that ensure the economic viability of the medical home; support and grow the professional pediatric workforce; promote the adoption and implementation of health information technology; enhance medical education, training, and research; and encourage and reward quality-improvement programs that advance and strengthen the medical home. Health insurance plans must be portable from state to state, with administrative procedures to eliminate breaks and gaps in coverage to ensure continuous coverage from year to year. Plans should ensure free choice of clinicians and foster coordination with public and private community-based programs for infants, children, and adolescents through the age of 26. The scope of services provided by all health plans must include preventive, acute and chronic illness, behavioral, inpatient, emergency, and home health care. These plans must be affordable and have cost-sharing policies that protect patients and families from financial strain and are without risk of loss of benefits because of plan design, current illness, or preexisting condition. *Pediatrics* 2010;126:1018–1021

COMMITTEE ON CHILD HEALTH FINANCING

KEY WORDS

pediatric health insurance benefits, payment, insurance premiums, affordability, medical home, health information technology, pediatric training, vaccines

ABBREVIATIONS

AAP—American Academy of Pediatrics
CPT—Current Procedural Terminology
HCPCS—Healthcare Common Procedure Coding System

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INTRODUCTION

All children must have coverage that ensures them access to affordable and comprehensive quality care. Appropriate and adequate payment is essential to ensure the viability of the pediatric workforce to provide such care. Coverage and payment must provide access to pediatric primary care and comprehensive and coordinated medical subspecialty and surgical specialty services; developmental, behavioral, and mental health services; inpatient and emergency department care; home health care; dental care; and other specialized pediatric services within a medical home model of care. The principles outlined in this statement should be used to evaluate national and state health insurance reform proposals and to make ongoing improvements to private and public financing of health care for children and adolescents.

ACCESS TO HEALTH INSURANCE

All children and adolescents, from birth to 26 years of age, regardless of income, must have access to comprehensive health insurance. Quality health insurance should be guaranteed for every child, pregnant woman, family, and, ultimately, all individuals. Such coverage should be portable from state to state and continuous

from year to year with streamlined administrative procedures. It must ensure free choice of clinicians and foster coordination with public programs for children and adolescents. Ensuring access to health insurance must be a shared responsibility of parents, employers, and state and federal government agencies.

Recommendations

- All children up to 26 years of age in families with incomes up to 133% of the federal poverty level should have access to Medicaid or, at higher eligible incomes, the Children's Health Insurance Program (CHIP).
- Dependent children must not be denied coverage because of a preexisting condition, and their coverage should not be terminated because of illness.
- There must be no annual or lifetime limit on insurance benefits.
- For children whose families lose employer-sponsored health insurance, COBRA (Consolidated Omnibus Budget Reconciliation Act of 1985) premiums should remain at employer-sponsored rates. If the former employee is not able to afford that premium, there must be other health insurance options that will reduce the cost of coverage.
- For children ineligible for public coverage, national and state outreach efforts should be undertaken to educate their families on health insurance options and how to access care through the various public or private health care entities in their community.
- For children who remain uninsured despite access to public or private insurance, a safety-net system of care should be subsidized and offered through office-based practices in addition to community health centers and hospitals. For children whose families have access to employer or other group health insurance, financial incentives should be extended to employers to offer and maintain dependent coverage up to 26 years of age.
- Dependent premium contributions for family coverage should be a responsibility shared between the employer and employee. Employers should be encouraged to provide access to family coverage to all employees.
- When employers offer insurance coverage for dependent children, the premium rate calculations must be based on the requirements of the March 2010 Patient Protection and Affordable Care Act.

HEALTH INSURANCE COVERAGE

All children and adolescents must have a comprehensive age-appropriate benefit package. The health insurance package should cover all pediatric services including preventive and wellness services, acute, inpatient, and chronic care services, including developmental, pregnancy-related and other reproductive health, newborn care, mental and behavioral health, substance abuse disorders, emergency services, facilitative, habilitative, and rehabilitative services and devices, palliative, home health, and hospice care services, prescription drugs, vision care services, and oral health services reflecting the scope of benefits recommended by the American Academy of Pediatrics (AAP)[1] and the National Business Group on Health.[2]

Recommendations

- Preventive benefits for children and adolescents must be consistent with *Bright Futures*[3] recommendations, not the US Preventive Services Task Force recommendations.
- All benefits must be sufficient in amount, duration, and scope to achieve the best clinical outcome.
- Health insurers must work from a common definition of medical necessity so that health care services:
  - reflect the need to promote normal growth and development and prevent, diagnose, treat, ameliorate, or palliate the effects of physical, developmental, mental, behavioral, genetic, or congenital conditions, illness, injuries, or disability;
  - are in accordance with generally accepted standards of medical practice based on credible scientific evidence as would be published in peer-reviewed medical literature[4] or are evidence-informed by clinical experts in pediatric care when insufficient studies are available; and
  - reflect the appropriate type, frequency, duration, and setting for effective care for that particular condition and patient.
- Health plans must provide information about how they determine medical necessity, including how they use clinical evidence that supports coverage of interventions, how they incorporate the opinions of experts in child/adolescent medicine, how they assist families who seek to appeal a medical-necessity decision, and how and when coverage decisions will be made.
- All public and private payers should establish cost-sharing policies that ensure affordable health services. Cost-sharing policies should not shift cost to physicians, hospitals, and other health care providers and should not deter the use of medically necessary services.
- Cost-sharing must not be applied to

preventive care, including recommended immunizations, for children and adolescents.

- For children whose family income is below 133% of the federal poverty level, cost-sharing, premiums, and other fees should be prohibited. For children whose family income is between 133% and 200% of the federal poverty level, deductibles and cost-sharing should be nominal and only applied to nonessential services.
- There should be no deductibles for children whose family income is below 133% of the federal poverty level.
- Annual and lifetime out-of-pocket limits must be established to protect families from significant medical debt.
- The impact of cost-sharing, premiums, and other out-of-pocket expenses on access to care should be regularly assessed by state insurance commissioners or another appropriate state agency that governs health insurance to ensure access and affordability of coverage.

PAYMENT POLICIES TO SUPPORT FAMILY- AND PATIENT-CENTERED MEDICAL HOMES

There should be cooperation between payers, employers, physicians, and patients and their families so that medical home payment reforms are implemented in ways that ensure quality care, financial viability, and fairness for payers and providers so that children and adolescents receive all AAP-recommended services. These reforms should be based on the medical home principles adopted jointly by the AAP, American Academy of Family Physicians, American Osteopathic Association, and American College of Physicians.[5] The payment structure for comprehensive care should encompass recognition of relevant Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS) codes, optimal community-based care coordination, current quality-improvement activities, and up-front investments and support for medical home infrastructure, including health information technology.

Recommendations

The following should be required by all health plans:

- All private and public payers should adopt a comprehensive set of medical home payment reforms that include 3 components:
  1. Encounter-based fee component that recognizes and values evaluative/cognitive services, preventive counseling, telephone and e-mail communication, collaborative consultation, and team care as defined by CPT or HCPCS codes. These items should be paid as fee-for-service or integrated into enhanced capitation payments.
  2. A community-based care coordination fee, which recognizes the work of clinical and administrative staff who provide medical home services. Payment for these services should be as a per-member-per-month fee, with adjustments based on the complexity of the patient panel.
  3. A performance (pay-for-performance) or quality-improvement fee for evidence-based or evidence-informed process, structure, or outcome measures. Payment should be as a bonus, either on a per-member-per-month basis or as a fee-schedule increase.
- Payment for vaccine products must exceed the acquisition cost of each vaccine and the overhead expense associated with them. Any increase in a specific vaccine cost or new vaccine recommendation must be updated in a timely fashion, with retroactive compensation if there is any lag time to implement such change.
- Payment for vaccine-administration codes must cover costs of office overhead for scheduling, coordinating, educating patients and their families, pain management, staff time, supplies, and billing and should be, at minimum, 100% of the Medicare rate for each vaccine-administration CPT code.
- Payments for encounter-based visits should be closely tied to evidence-based or evidence-informed clinical decision-making. Methods used to determine payment should consider the child's age, symptom chronicity, severity of underlying health, and behavioral, social, and other problems and include a geographic adjustment.
- Payment policies should recognize and reward clinicians who provide population-based prevention and who promote continuous and coordinated care, including care coordination between generalists and specialists. Payment should be discouraged for clinics that provide episodic care for minor conditions.

SUPPORT FOR CLINICAL CARE, PAYMENT-SYSTEM REFORMS, AND TRAINING INNOVATIONS

At both national and state levels, expert pediatric advisory groups should be established to monitor progress related to health insurance access, comprehensive and affordable coverage, medical home implementation, payment reforms, and investments in innovation. There should be a federally funded pediatric-specific entity to support innovations in medical home implementation, education/training, quality im-

provement, health services research, and population-based prevention.

Recommendations

- Payment systems should be developed that reward high-quality, coordinated care.
- Care should be coordinated through collaborative practice involving primary care physicians and pediatric subspecialists.
- Access to pediatric medical subspecialists and surgical specialists should be improved. Concerted efforts should be aimed at recruitment, scholarship, loan support, and development of telemedicine technology for remote or physician-underserved locations.
- Clinical, community-based prevention programs that support population health, including but not limited to obesity and mental health, should be expanded.
- Clinical and population research should be supported with expanded efforts focusing on care coordination, self-management, preventive care, immunizations, behavioral health, children and adolescents with special health care needs, diabetes, depression, medication management, pregnancy and childbirth, and obesity.
- Transition planning from pediatric to adult health care should be promoted and implemented and should include training, consultation, and financial incentives to encourage early transition planning and the use of AAP recommendations.[6]
- Health care professionals should be trained to use advanced health information technology to support continuity of care and continuous quality improvement.
- Health literacy should be promoted for parents, children, and adolescents. A particular focus should be on low-income and non–English-speaking populations.
- Vaccine registries should be established at the local, state, and national levels with requirements that registries link providers and vaccine manufacturers so that practice-management systems, including electronic health records, contain recipient as well as vaccine product and administration details and ensure interoperability between vaccine registries and personal health records.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Prevention of Varicella: Update of Recommendations for Use of Quadrivalent and Monovalent Varicella Vaccines in Children

abstract

FREE

Two varicella-containing vaccines are licensed for use in the United States: monovalent varicella vaccine (Varivax [Merck & Co, Inc, West Point, PA]) and quadrivalent measles-mumps-rubella-varicella vaccine (MMRV) (ProQuad [Merck & Co, Inc]). It is estimated from postlicensure data that after vaccination at 12 through 23 months of age, 7 to 9 febrile seizures occur per 10 000 children who receive the MMRV, and 3 to 4 febrile seizures occur per 10 000 children who receive the measles-mumps-rubella (MMR) and varicella vaccines administered concurrently but at separate sites. Thus, 1 additional febrile seizure is expected to occur per approximately 2300 to 2600 children 12 to 23 months old vaccinated with the MMRV, when compared with separate MMR and varicella vaccine administration. The period of risk for febrile seizures is from 5 through 12 days after receipt of the vaccine(s). No increased risk of febrile seizures is seen among patients 4 to 6 years of age receiving MMRV. Febrile seizures do not predispose to epilepsy or neurodevelopmental delays later in life and are not associated with long-term health impairment. The American Academy of Pediatrics recommends that either MMR and varicella vaccines separately or the MMRV be used for the first dose of measles, mumps, rubella, and varicella vaccines administered at 12 through 47 months of age. For the first dose of measles, mumps, rubella, and varicella vaccines administered at ages 48 months and older, and for dose 2 at any age (15 months to 12 years), use of MMRV generally is preferred over separate injections of MMR and varicella vaccines. *Pediatrics* 2011;128:630–632

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS

MMRV, measles-mumps-rubella-varicella, vaccine, MMR, immunization

ABBREVIATIONS

MMR—measles-mumps-rubella vaccine
MMRV—measles-mumps-rubella-varicella vaccine

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INTRODUCTION

Since implementation of routine varicella vaccination in 1995, disease and death from varicella-zoster virus has declined significantly.[1–3] Two varicella-containing vaccines currently are licensed for use in the United States: monovalent varicella vaccine (Varivax [Merck & Co, Inc, West Point, PA], licensed in 1995) and quadrivalent measles-mumps-rubella-varicella vaccine (MMRV) (ProQuad [Merck & Co, Inc], licensed in 2005).

The American Academy of Pediatrics updated its statement on the prevention of varicella[4] in 2007 and reaffirmed that statement in 2010. The purpose of this brief vaccine policy statement is to provide additional data to update these recommendations.

BACKGROUND AND RATIONALE

Prelicensure studies of the MMRV indicated that fever was more common after MMRV (22%) than after measles-mumps-rubella (MMR) and varicella vaccines administered concurrently but at separate sites (15%) during the 0 through 42 days after receipt of the vaccine. The reasons for this are not fully understood, but the increased occurrence of fever might suggest a more vigorous immune response as a reaction to an increase in measles virus replication, as reflected in measles antibody titers. The measles, mumps, and rubella viruses in the MMRV are identical and of equal potency to those in the MMR vaccine, but the potency of the varicella-zoster virus is at least 7 times higher than the potency in the monovalent varicella vaccine. However, measles geometric mean titers (GMTs) measured 6 weeks after vaccination were higher among children who received the first dose of MMRV than among children who received the first dose of MMR vaccine and varicella vaccine administered concurrently but at separate sites; varicella GMTs were similar. Statistical modeling indicated that the level of the measles antibody titer after receipt of MMRV was associated positively with the rate of fever.

It was postulated at the time of licensure that the increased frequency of fever after the MMRV might correlate with an increased likelihood of febrile seizures. Postlicensure studies were conducted in 2008 and 2009 by the Centers for Disease Control and Prevention Vaccine Safety Datalink and Merck to evaluate this possibility.[5]

EVIDENCE TO SUPPORT POLICY/ RECOMMENDATION

Results of the Vaccine Safety Datalink and Merck studies were remarkably similar. After vaccination at 12 through 23 months of age, 7 to 9 febrile seizures occur per 10 000 children who receive the MMRV, and 3 to 4 febrile seizures occur per 10 000 children who receive the MMR and varicella vaccines administered separately. Thus, 1 additional febrile seizure is expected to occur per approximately 2300 to 2600 children 12 through 23 months old vaccinated with the MMRV compared with separate MMR and varicella vaccines. The period of increased risk for febrile seizures is from 5 through 12 days after receipt of the vaccine.

Among older children 4 through 6 years of age receiving the second dose of the MMRV, there is no evidence to suggest an increased risk of febrile seizures after MMRV vaccination compared with those who receive separate MMR and varicella vaccine injections at the same visit.

Febrile seizures do not predispose to epilepsy or neurodevelopmental delays later in life. Although they are frightening for parents, febrile seizures are not associated with long-term health impairment for the affected child.

POLICY OR RECOMMENDATION

The routinely recommended ages for measles, mumps, rubella, and varicella vaccination continue to be 12 through 15 months for dose 1 and 4 through 6 years for dose 2. The American Academy of Pediatrics recommends for the first dose at ages 12 through 47 months that either MMR and varicella vaccines administered separately or MMRV can be used. Use of separate MMR and varicella vaccines averts the slight increase in risk of fever and febrile seizures after MMRV administration but at the cost of the pain associated with an extra injection and the risk of an infant falling behind schedule if all vaccines indicated at that visit are not given. Providers who are considering administering MMRV should discuss the benefits and risks of both vaccination options with the parents or caregivers. Because parents need to be fully aware of the slight increase in risk of febrile seizures with the combination MMRV compared with separate MMR and varicella injections at the same visit, providers who face barriers to clearly communicating these benefits and risks for any reason (eg, language barriers) should administer MMR and varicella vaccines separately.

The risk of febrile seizures is not increased in older children who receive the second dose of MMRV. Therefore, when the first dose of measles, mumps, rubella, and varicella vaccines is administered at ages 48 months and older, and for dose 2 at any age (15 months through 12 years), use of the MMRV generally is preferred over separate injections of its equivalent component vaccines (ie, MMR and varicella vaccines) because of the decreased number of injections required with the MMRV.

A personal or family (such as sibling or parent) history of seizures is now a precaution for MMRV vaccination. Children with a personal or family history of seizures generally should be vaccinated with MMR and varicella vaccines, because the risks of using the MMRV in this group of children generally outweigh the benefits.

IMPLEMENTATION ISSUES

Fact sheets have been developed (www.cdc.gov/vaccines/vpd-vac/combovaccines/mmrv/vacopt-factsheet-hcp.htm), and the Vaccine Information Statement (VIS) has been updated (www.cdc.gov/vaccines/pubs/vis/downloads/vis-mmrv.pdf). Current availability of

the MMRV can be accessed at www.cdc.gov/vaccines/vac-gen/shortages/default.htm#4 (as of June 28, 2010).

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American Academy of Pediatrics
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POLICY STATEMENT

Preventive Oral Health Intervention for Pediatricians

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Section on Pediatric Dentistry and Oral Health

ABSTRACT

This policy is a compilation of current concepts and scientific evidence required to understand and implement practice-based preventive oral health programs designed to improve oral health outcomes for all children and especially children at significant risk of dental decay. In addition, it reviews cariology and caries risk assessment and defines, through available evidence, appropriate recommendations for preventive oral health intervention by primary care pediatric practitioners. *Pediatrics* 2008;122:1387–1394

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Key Words
pediatric oral health prevention, oral health intervention

Abbreviation
PATF—professionally applied topical fluoride

PURPOSE/INTRODUCTION

Review of Circumstances Leading to Development of This Policy

Oral health is an integral part of the overall health of children.[1] Dental caries is a common and chronic disease process with significant consequences. As health care professionals responsible for the overall health of children, pediatricians frequently confront morbidity associated with dental caries. Because caries is a nonclassic infectious process (arising from shifts in subpopulation ratios of established normal flora), pediatricians have an opportunity to prevent, intervene, and, in collaboration with dental colleagues, manage this disease.

Justification of Policy

The prevalence of dental caries for the youngest of children has not decreased over the past decade, despite improvements for older children.[2] Data from the Medical Expenditure Panel Survey revealed that 89% of infants and 1-year-olds had office-based physician visits annually, compared with only 1.5% who had dental visits. Consequently, visits to physicians outnumbered visits to dentists at 250 to 1 for this age group.[3] Because the youngest of the pediatric patient population visit the pediatrician more than the dentist, it is critical that pediatricians be knowledgeable about dental caries, prevention of the disease, and interventions available to the pediatrician and the family.

Rationale for Format

This policy statement is an effort to assist the primary care pediatric practitioner in addressing issues of dental caries and general oral health. The statement begins by building a knowledge base regarding the caries process that can serve as a foundation for understanding prevention and intervention strategies. After explaining the science of cariology, assessment of caries risk is described to assist the pediatrician in deciding which preventive and interventional strategies need to be used. Specific prevention and intervention strategies are then described and explained.

In addition, the concept and importance of the dental home as well as strategies for improving the connection of the medical and dental homes are presented. Last, recommendations are provided to assist the pediatrician with implementation of the provided information.

BACKGROUND CONCEPTS

Cariology

The most common oral disease encountered by children is dental caries. Dental caries is a nonclassic infectious disease[4] that results from an interaction between oral flora and dietary carbohydrates on the tooth surface. To adhere to tooth structure, oral flora utilize dietary sugars to create a sticky biofilm that is referred to as dental plaque. Dietary sugar can change the biochemical and microbiologic composition of dental plaque. In the presence of a high-carbohydrate diet, cariogenic organisms constitute a greater portion of the total bacterial population.[5,6] Acids

produced by bacterial fermentation of carbohydrates reduce the pH of dental plaque to the point at which demineralization of the enamel occurs. The initial carious lesion appears as an opaque white spot on the enamel, and progressive demineralization results in cavitations of the teeth. Dental caries is a process, and loss of tooth structure (a dental cavity) is an end stage in the process.[7]

Human dental flora, generally regarded as qualitatively stable once established and site specific to human dentition, is believed to consist of more than 1000 different organisms, of which only a limited number are associated with dental caries.[8] *Streptococcus mutans* is most strongly associated with dental caries and is considered to be an indicator organism of a subpopulation of cariogenic organisms. *S mutans*, like its related cariogenic cohorts, has the ability to adhere to enamel and is uniquely equipped to produce significant amounts of acid (acidogenic) and endure within that acidic environment (aciduric).

Dental flora adheres to the teeth by creating a tenacious and highly complex biofilm referred to as dental plaque. Dental plaque is capable of concentrating dietary sugars; therefore, the chronic consumption of sugary foods and liquids will continually recharge the plaque matrix, resulting in copious supplies of sugars within the plaque matrix. *S mutans* and other cariogenic flora will then ferment available sugars, resulting in high levels of lactic acid, a decreased local pH (~5.0), and demineralization of dental enamel (at an approximate pH of ≤5.5). Because *S mutans* and its aciduric cohorts continue to thrive at low pH, the resulting environment selects against nonaciduric flora, creating a shift in the subpopulation ratio of benign to aciduric flora. As this process continues over multiple generations, aciduric organisms incur an upregulation of virulence genes that allow them to thrive at even lower pH (4.0). Diet-mediated shifts in subpopulation ratios of dental flora are instigated by significant sugar intake (environmentally selecting for carious organisms). Therefore, significant sugar intake is a driving cause of the caries process.

Preventive Strategies

An understanding of normal dental flora serves as a foundation for the development of preventive strategies, with 2 important considerations. First, dental flora exists in a symbiosis with the human species. Second, only a small number of the organisms within dental flora cause caries. Therefore, our objective is not to eliminate all dental flora but to suppress the cariogenic bacteria within the flora.

Preventive strategies can be differentiated into 2 distinct categories. Primary prevention involves optimization of maternal dental flora before and during colonization of the oral flora of the infant (during eruption of the primary dentition). This invaluable mode of prevention provides an opportunity for a reduction in the mother's constitutionally virulent, aciduric flora and downregulation of virulence genes within the aciduric flora, decreasing the child's risk of dental decay, and is the basis for first dental visit recommendations at 1 year or earlier made by various medical and dental organizations. This mode of prevention and its adjuncts are reviewed in detail in a policy statement from the American Academy of Pediatrics, "Oral Health Risk Assessment Timing and Establishment of the Dental Home."[9]

Secondary prevention is the continual and ongoing management of subpopulation ratios of benign and aciduric flora within dental plaque. This mode of prevention consists of managing the balance between causative factors and protective factors and is critical for preventing and reversing the caries process. Secondary preventive strategies are hierarchical and currently consist of dietary counseling, oral hygiene instruction, and judicious administration of fluoride modalities. Therefore, although all preventive modalities are important, modification of diet is most important, followed by oral hygiene compliance and then administration of fluorides.

By controlling risk factors before disease occurs, the probability of preventing disease, both in the immediate future and the long-term, is improved. Preventive strategies for this complex, chronic disease require a comprehensive and multifocal approach that begins with caries risk assessment.

Caries Risk Assessment

Caries risk assessment, based on developmental, biological, behavioral, and environmental factors, evaluates the probability of enamel demineralization exceeding enamel remineralization over time. The goal of risk assessment is to anticipate and prevent caries initiation before the first sign of disease. During the period of 1999–2002, 41% of US children 2 to 11 years of age had caries in primary teeth.[2] An earlier study noted that 25% of children 5 to 17 years of age had 80% of carious permanent teeth.[10] Assessing each child's risk of caries and tailoring preventive strategies to specific risk factors are necessary for improving oral health in a cost-effective manner.

Caries risk assessment is very much a work in progress. In a systematic review of literature regarding risk factors in primary teeth of children aged 6 years and younger, a paucity of studies of optimal (ie, longitudinal) design was noted.[11] A study that evaluated the reliability of multiple risk indicators determined that there is no consistent combination of risk variables that provide a good predictor of caries risk when applied to different populations across different age groups.[12] The authors concluded that the best predictor of caries in primary teeth was previous caries experience, followed by parents' education and socioeconomic status.[12] Although previous caries experience cannot be used as a risk indicator for the predentate or very young child, white-spot lesions, as precursors to cavities, can be considered analogous to previous caries experience when assessing the risk of a very young patient. An analysis of National Health and Nutrition Examination Survey (NHANES) III data revealed that children from households with low income levels are more likely to experience caries and have higher levels of untreated caries than their counterparts from higher-income households.[13] Collectively, children enrolled in Special Supplemental Nutrition Pro-

gram for Women, Infants, and Children (WIC) programs, Head Start, or Medicaid are at higher risk than are children in the general population.

Caries risk factors unique to infants and young children include perinatal considerations, establishment of oral flora and host-defense systems, susceptibility of newly erupted teeth, dietary transitioning from breast and bottle feedings to cups and solid foods, and establishment of childhood food preferences. Although preterm birth per se is not a risk factor, a child with low birth weight may require a special diet or have developmental enamel defects or disabilities that increase caries risk. Early acquisition of *S mutans* is a major risk factor for early childhood caries and future caries experience.[14] A reduction of the salivary level of *S mutans* in highly infected mothers can inhibit or delay colonization of their infants.[15] Although evidence suggests that children are most likely to develop caries if *S mutans* is acquired at an early age, this may be compensated in part by other factors such as good oral hygiene and a noncariogenic diet.[11] High-risk dietary practices seem to be established early, probably by 12 months of age, and are maintained throughout early childhood.[16] In addition to the amount of sugar consumed, frequency of intake is important.[17] Sugar consumption likely is a more significant factor for those without regular exposure to fluorides.[18] Children experiencing caries as infants and toddlers have a much greater probability of subsequent caries in both the primary and permanent dentitions.[19]

Early risk assessment targets infants and young children who traditionally have yet to establish a dental home. Unrecognized disease and delayed care can result in exacerbated problems, leading to more extensive, costly, and time-consuming care.

Risk-assessment strategies most applicable for screening purposes include those that are acceptable to patients, reliable, inexpensive, and performed easily and efficiently and require limited equipment/supplies. The American Academy of Pediatric Dentistry (AAPD) has developed a caries risk-assessment tool for use by dentists and primary care practitioners familiar with the clinical presentation of caries and factors related to caries initiation and progression (see www.aapd.org/media/Policies_Guidelines/P_CariesRiskAssess.pdf).[20] Radiographic assessment and microbiologic testing have been included in the caries risk-assessment tool but are not required. In addition, the American Academy of Pediatrics has created *Oral Health Risk Assessment Training for Pediatricians and Other Child Health Professionals*, which provides a concise overview of the elements of risk assessment and triage for infants and young children (see www.aap.org/commpeds/dochs/oralhealth/screening.cfm).[21]

The chronic, complex nature of caries requires that risk be reassessed periodically to detect changes in the child's behavioral, environmental, and general health conditions. All available data must be analyzed to determine the patient's caries risk profile. Periodic reassessment allows the practitioner to individualize preventive programs and optimize the frequency of recall and dental radiographic examinations.

SPECIFIC PREVENTIVE STRATEGIES

Dietary Counseling

Dietary counseling for optimal oral health in children should be an essential part of general health counseling. The recent policy statement from the American Academy of Pediatrics on prevention of pediatric overweight and obesity highlighted concerns about health problems in overweight children, including cardiovascular, endocrine, and mental health problems, and the importance of promoting healthy eating behaviors. Consumption of juice and sugar-sweetened beverages has been linked to childhood obesity and caries development.[22–25]

Sugars are a critical factor in caries development. Caries risk is greatest if sugars are consumed at high frequency and are in a form that remains in the mouth for longer periods.[26] Sucrose is the most cariogenic sugar, because it can form glucan, which enables bacterial adhesion to teeth and limits diffusion and buffering of acids. Although starch-rich foods pose a low caries risk, mixtures of finely ground, heat-treated starch and sucrose (eg, cereals, potato or corn chips) are also cariogenic.[27]

Human milk by itself does not promote tooth decay.[28] However, breastfed infants are at risk of caries when they receive sugary liquids or eat foods with sugars and fermentable carbohydrates.[26]

Parents and caregivers should be counseled on the importance of reducing exposure to sugars in foods and drinks. To decrease the risk of dental caries and ensure the best possible health and developmental outcomes, it is recommended that parents do the following:

- Breastfeed infants during the first year of life and beyond as is mutually desired.[29]
- After nursing, remove the breast from a sleeping infant's mouth and cleanse the gums and teeth after feedings and before bedtime.
- Discourage a child's sleeping with a bottle; any bottle taken to bed should contain only water.
- Limit sugary foods and drinks to mealtimes.
- Avoid carbonated beverages and juice drinks (juice drinks contain high-fructose corn syrup and <100% natural juice).
- Encourage children to drink only water and milk between meals.
- Encourage children to eat fruits.
- Limit the intake of 100% fruit juice to no more than 4 oz per day.
- Foster eating patterns that are consistent with MyPyramid guidelines from the US Department of Agriculture.[30]

Optimal Use of Fluorides

Fluoride, a naturally occurring element, has been instrumental in the widespread decrease in dental caries.[31,32] The mechanisms of fluoride are both topical and systemic, with evidence pointing to a greater topical effect.[33]

Fluoride reduces enamel dissolution while it encourages remineralization.[34] Antimicrobial effects of fluorides at low pH are also significant.[35]

The delivery of fluoride includes community-based, professionally applied, and self-administered modalities. Water fluoridation is a community-based intervention that optimizes the level of fluoride in drinking water, resulting in preeruptive and posteruptive protection of the teeth.[36] Water fluoridation is a cost-effective means of preventing dental caries, with the lifetime cost per person equaling less than the cost of 1 dental restoration.[37,38] In short, fluoridated water is the cheapest and most effective way to deliver anticaries benefits to communities.

Professionally applied topical fluorides (PATFs) have their greatest effect preventing caries and must be applied at regular intervals.[39] PATFs include gel, foam, in-office rinse, and varnish. PATFs are safe and efficacious, with varnishes having the advantage of adherence to the tooth surface, decreasing likelihood of ingestion, and increasing time of contact between the fluoride and tooth surface.[37,39] In the primary dentition, varnish effectiveness (measured by percent of caries reduction) ranges from 30% to 63.2%,[40,41] and an analysis of the number of fluoride-varnish applications received resulted in a dose-response effect that was enhanced when coupled with counseling.[42] Finally, self-administered fluorides, including dietary fluoride supplementation and fluoridated toothpaste, have proven effective, providing low but protracted elevation of fluoride concentrations.[35,43] Caries reduction associated with self-administered fluoride supplementation ranges from 32% to 72% in the primary dentition.[40] In children and adolescents, fluoride toothpastes, mouth rinses, and gels reduce dental caries to a similar extent.[44]

The decision to use fluoride therapies must balance the risk of caries against the risk of enamel fluorosis (hypomineralization of the developing enamel caused by excess fluoride ingestion). Patients determined to be at increased risk of dental caries are candidates for more aggressive fluoride therapy utilization. Caries susceptibility and sources of dietary fluoride (eg, water supplies, beverages, prepared food, toothpaste) should be considered before recommending fluoride therapies.[45–48] Enamel fluorosis develops before tooth maturation and emergence, typically in children younger than 8 years.[49] The risk of enamel fluorosis is an aesthetic concern, with very mild or mild forms most commonly observed in the general population.[2,50]

ANTICIPATORY GUIDANCE

Anticipatory guidance is the process of providing practical, developmentally appropriate information about children's health to prepare parents for significant physical, emotional, and psychological milestones.[51] Anticipatory guidance during well-child visits is an effective tool to educate parents about maintaining children's health. Mirroring the pediatric model, the American Academy of Pediatric Dentistry advocates oral health anticipatory guidance.[52–55] Anticipatory guidance focused on oral health disease should be an integral part of preventive pediatrics. Information concerning the impact of diet on dental health and counseling in regards to oral hygiene, nonnutritive oral habits, and dental safety should be shared with parents. Therefore, in addition to dietary counseling and optimizing fluoride exposure, anticipatory guidance for oral health includes:

1. Infant oral hygiene instruction: Teeth should be brushed at least twice daily with caregiver supervision and assistance for children. For children with elevated dental caries risk, consider using a pea-sized amount of toothpaste or an amount equivalent to the child's fifth-digit fingernail. Flossing should begin as soon as adjacent teeth are in contact and for surfaces at which 2 teeth touch and they can no longer be cleansed with a toothbrush.
2. Counseling regarding nonnutritive oral habits: Use of pacifiers in the first year of life may prevent sudden infant death syndrome.[56] Sucking habits (eg, pacifiers or digits) of sufficient frequency, duration, and intensity may be associated with dentoalveolar deformations. Some changes persist past cessation of the habit. Professional evaluation is indicated for nonnutritive sucking habits that continue beyond 3 years of age.[53]
3. Age-appropriate information regarding dental injury prevention: Parents should cover sharp corners of household furnishings at the level of walking toddlers, ensure use of car safety seats, and be aware of electrical cord risk for mouth injury. Properly fitted mouth guards are indicated for youths involved in sporting activities that carry a risk of orofacial injury.

Anticipatory guidance is valuable, because it emphasizes prevention of dental problems rather than surgical or restorative care. Anticipatory guidance and well-child visits during the first 2 years of life decrease the number of hospitalizations among poor and near-poor children irrespective of race and health status.[57] Oral health anticipatory guidance can reduce dental expenditures.[58] In light of this evidence, oral health anticipatory guidance should be integrated as a part of comprehensive counseling during well-child visits.[59]

INTERPROFESSIONAL COLLABORATION AND ESTABLISHMENT OF A DENTAL HOME

To be successful in preventing dental disease, interventions must begin within the first year of life. Pediatricians are well positioned to initiate preventive oral health care by providing early assessment of risk, anticipatory guidance, and timely referral to establish a dental home. The American Academy of Pediatric Dentistry, the American Dental Association, and the American Association of Public Health Dentistry recommend that infants be scheduled for an initial oral examination within 6 months of the eruption of the first primary tooth but by no later than 12 months of age.

The pediatric community promotes the concept of a medical home to improve families' care utilization, seeking appropriate and preventive services with optimal compliance to recommendations. The concept of the

dental home is based on this model and is intended to improve access to oral care. A dental home is the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way.[52,60,61] A dental home should be able to provide the following:

1. an accurate risk assessment for oral diseases and conditions;
2. an individualized preventive dental health program based on risk assessment;
3. anticipatory guidance about growth and development issues (eg, maxillofacial and dentoalveolar development);
4. a plan for emergency dental trauma management;
5. information regarding care of teeth and oral soft tissues;
6. nutrition and dietary counseling;
7. comprehensive oral health care in accordance with accepted guidelines and periodicity schedules for pediatric oral health; and
8. referrals to dental specialists such as endodontists, oral surgeons, orthodontists, and periodontists when care cannot be provided directly within the dental home.

Lack of access to dental care can be a barrier to establishment of a dental home. Because of the specialized training and expertise, the dentist provides an ideal dental home; however, when a dentist is not available, the pediatric medical provider should fulfill the dictates of preventive oral health care until a dentist can be accessed and a dental home can be established. Therefore, primary care pediatric practitioners are an integral community component in the overall effort to address oral health issues (eg, access to care, preventive intervention). With the continuing challenges of access to dentistry coupled with preschool-aged children making many more visits to medical offices than to dental offices, primary care practitioners with oral health training have reported that they have provided preventive oral health services for their pediatric patients.[51,52] North Carolina primary care practitioners were able to integrate preventive dental services into their practices, increasing preventive services for young children who receive Medicaid benefits and whose access to dentists is restricted (eg, geographically or because of nonparticipation of dentists).[62] Often, the first step of timely establishment of a dental home is a referral from the physician. Although a report from the US Preventive Services Task Force on physicians' roles in preventing dental caries in preschool-aged children found referral by a primary care practitioner only partially effective in increasing dental visits,[40] another study[63] reported that dentists were more likely to see young children referred by primary care practitioners.

Primary care practitioners are able to identify children in need of a referral to a dentist.[64] After 2 hours of training in infant oral health, primary care pediatric practitioners accurately identified children with cavities with good specificity (92%–100%) and sensitivity (87%–99%).[40,63] These results suggest that dental screening can be incorporated into a busy pediatrics practice and that primary care pediatric practitioners can contribute significantly to the overall oral health of young children by encouraging parents to enroll their children in a dental home as early as possible.

In summary, the ideal setting for administration of oral health care is the dental home. When there is no access to a dentist, the pediatric medical provider should consider administering risk-based preventive oral health measures until a dental home can be made available. With preparation, primary care practitioners are routinely able to screen accurately and provide oral health anticipatory guidance for children. Furthermore, they are ideally positioned to refer children to a dental home in a timely manner. Establishing collaborative relationships between physicians and dentists at the community level is essential for increasing access to dental care for all children and improving their oral and overall health.

RECOMMENDATIONS FOR PRIMARY CARE PEDIATRIC PRACTITIONERS

1. An oral health risk assessment should be administered periodically to all children.
2. Oral health risk-assessment training should be recommended for medical practitioners who are in training programs and those who currently administer care to children.
3. Dietary counseling for optimal oral health should be an intrinsic component of general health counseling.
4. Anticipatory guidance for oral health should be an integral part of comprehensive patient counseling.
5. Administration of all fluoride modalities should be based on an individual's caries risk. Patients who have a high risk of caries are candidates for consideration of more intensive fluoride exposure after dietary counseling and oral hygiene instruction as compared with patients with a lower risk of caries (see Figs 1 and 2).
6. Supervised use of fluoride toothpaste is recommended for all children with teeth.
7. The application of fluoride varnish by the medical practitioner is appropriate for patients with significant risk of dental caries who are unable to establish a dental home.
8. Every child should have a dental home established by 1 year of age.
9. Collaborative relationships with local dentists should be established to optimize the availability of a dental home.

CONCLUSIONS

Oral health is an integral part of the overall health and well-being of children. A pediatrician who is familiar

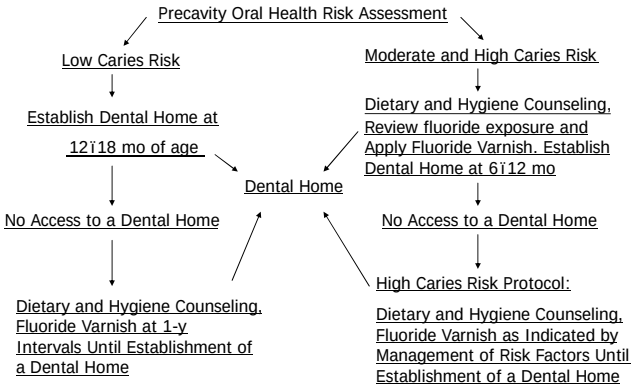

FIGURE 1
Pediatric medicine: oral health intervention algorithm.

- Å Appoint patient at 1-mo intervals ï 3.
- Å Review dietary intake of sugars sources (juices, etc) at each appointment.
- Å Assess oral hygiene at each appointment, (plaque/inflammation).
- Å Review fluoride exposure and apply fluoride varnish at each appointment if risk factors persist.
- Å At the third 1-mo visit, if all risk factors are well managed: Reappoint at 3 mo, review diet, hygiene, fluoride exposure, and apply fluoride varnish. If risk factors are not controlled: Continue with 1-mo recalls until risk factors are managed.
- Å At 3-mo recall interval, if all risk factors are well managed: Reappoint every 6 mo, review diet, hygiene, fluoride exposure, and apply fluoride varnish.

FIGURE 2
High caries risk protocol.

with the science of dental caries, capable of assessing caries risk, comfortable with applying various strategies of prevention and intervention, and connected to dental resources can contribute considerably to the health of his or her patients. This policy statement, in conjunction with the oral health recommendations of the American Academy of Pediatrics *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*, 3rd edition,[65] serves as a resource for pediatricians and other clinicians to be knowledgeable about addressing dental caries. With dental caries being such a common and consequential disease process in the pediatric population, it is essential that pediatricians include oral health in their daily practice of pediatrics.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Principles for the Development and Use of Quality Measures

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Steering Committee on Quality Improvement and Management and Committee on Practice and Ambulatory Medicine

ABSTRACT

The American Academy of Pediatrics and its members are committed to improving the health care system to provide the highest-quality and safest health care for infants, children, adolescents, and young adults. This statement is intended as a guide for pediatricians and pediatric leadership on the appropriate uses of quality measures and the criteria on which they should be based. The statement summarizes the current national efforts on quality measurement and provides a set of principles for the development, use, and evaluation of quality measures for improving children's health and health care. The American Academy of Pediatrics recommends that these measures address important issues for children; be appropriate for children's health and health care, scientifically valid, and feasible; and focus on what can be improved. In addition, the American Academy of Pediatrics supports reasonable principles for the oversight and implementation of pay-for-performance programs.

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Key Words
accountability, efficiency measures, outcome measures, pay-for-performance, process measures, quality, quality improvement, quality measures, quality of care, structure measures

Abbreviations
AAP—American Academy of Pediatrics
IOM—Institute of Medicine
EHR—electronic health record
ADHD—attention-deficit/hyperactivity disorder
PCPI—Physician Consortium for Performance Improvement
NQF—National Quality Forum
AQA—Ambulatory Care Quality Alliance
AHRQ—Agency for Healthcare Research and Quality
P4P—pay-for-performance
MOC—maintenance of certification

INTRODUCTION

The American Academy of Pediatrics (AAP) and its members are committed to improving the health care system to provide the highest-quality and safest health care for infants, children, adolescents, and young adults. This statement, based on available evidence and committee expertise, provides information on pediatric quality measurement and a set of principles for the development and appropriate use of quality measures. In addition, this information may be helpful for employer groups, health plans, and other organizations involved in the development and evaluation of child health quality measures.

OPPORTUNITIES FOR IMPROVEMENT IN CHILDREN'S HEALTH

Pediatricians and other child health clinicians strive to provide the best care for children and families. Despite excellent intentions and pockets of superb care, numerous studies, including the Commonwealth Fund's *Quality of Health Care for Children and Adolescents: A Chartbook*,[1] the *National Healthcare Disparities Report*,[2] and the *National Healthcare Quality Report*,[3] have shown considerable variation in outcomes of care across providers and communities[4–5] and in utilization, safety, and quality care for all children[6–8] as well as significant disparities in these dimensions for minority children. A major opportunity exists to improve care in a way that will make a real difference in the lives of children and families. To close the gaps in children's health care, an initial step is the use of measures to identify opportunities for improvement and track changes in quality over time as interventions are implemented.

DEFINING AND MEASURING QUALITY

The Institute of Medicine (IOM) defines quality of care as "the degree to which health care services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."[9] A quality measure is a quantification of the degree to which a desired health care process or outcome is achieved or the extent that a desirable structure to support health care delivery is in place.[8]

Quality measures assess 3 levels of health care and its intended results: structure, process, and outcome.[10] Structure measures address "sufficiency of resources and proper system design"[11] including organizational characteristics, such as the type of care provided (eg, primary or specialty) or the use of specific systems for improving care (eg, an electronic health record [EHR] or registry).

TABLE 1 **National Health Care Quality Report Matrix: Combines 4 of the IOM Health Care Quality Components and the FACCT Consumer Perspectives on Health Care Needs, With Equity as the Third Dimension**

Consumer Perspectives on Health Care Needs	Components of Health Care Quality			
	Safety	Timeliness	Effectiveness	Patient-Centeredness
Staying healthy	Fluoride only when needed	Access to well-child care	Immunizations	Social history assessment
Getting better	Drug-allergy check before prescribing medications	Access to urgent care	Appropriate antibiotics for upper respiratory infections	Family involvement during hospital rounds
Living with illness or disability	Medication reconciliation	Access to long-term care	Inhaled steroids for persistent asthma	Family involvement in developing long-term plan of care
Coping with the end of life	Avoid unnecessary painful interventions	Access to hospice care	Effective end-of-life pain management	Advance directive

Components of health care quality include (1) safety: "avoiding injuries to patients from care that is intended to help them"; (2) effectiveness: "providing services based on scientific knowledge to all who could benefit, and refraining from providing services to those not likely to benefit (avoiding overuse and underuse)"; (3) patient-centeredness: establishing "a partnership among practitioners, patients, and their families (when appropriate) to ensure that decisions respect patients' wants, needs, and preferences"; and (4) timeliness: "obtaining needed care and minimizing unnecessary delays in getting that care." Consumer perspectives on health care needs include (1) staying healthy: preventive care; (2) getting better: acute care; (3) living with illness or disability: chronic care; and (4) coping with the end of life: end-of-life care. Equity is "a crosscutting issue" that is "the provision of health care of equal quality to those who may differ in personal characteristics that are not inherently linked to health, such as gender, ethnicity, geographic location, socioeconomic status, or insurance coverage" and means that "quality of care is based on needs and clinical factors."

Process measures address the interaction between the patient and the provider.[11] How are care and services provided (eg, assessment, evaluation, diagnosis, and treatment)? How well is the patient able to access care once he or she accesses the health care system? Examples of process measures include the provision of a written asthma management plan to a family and the use of a standardized assessment to evaluate and diagnose comorbidities in a child with attention-deficit/hyperactivity disorder (ADHD).

Outcome measures describe how the care delivered affects the patient's health, health status, and function. Functional status, quality of life, and mortality are examples of outcome measures. Intermediate outcome measures are linked to end-point outcomes such as disability or death. Emergency department visits or hospitalizations attributable to asthma and control of blood pressure and high cholesterol are examples of intermediate measures.

Quality improvement efforts often focus on structural or process measures associated with health outcomes, because the outcomes of interest may occur too infrequently to demonstrate change in a practical time interval. For example, research has shown that the use of inhaled corticosteroids for persistent asthma, which can be assessed by use of a process measure, results in decreased hospitalizations and emergency department visits, which can be evaluated as outcome measures; therefore, an increase in the use of inhaled steroids has become a primary improvement objective in the care of children with persistent asthma.[12]

Frameworks for assessing and reporting health care quality[13] recommend that quality measures be available across a range of quality domains and address consumer needs across the continuum of care. The IOM[14] specified 6 domains for improving quality: safety, timeliness, effectiveness, efficiency, equity, and patient/family-centeredness. The Foundation for Accountability highlighted consumer needs with regard to navigating the health care system by identifying 4 domains: staying healthy, getting better (acute care), living with illness (chronic care), and care at the end of life.[13] FAACT, a now-closed national not-for-profit organization, coordinated the development of several child quality-measurement tools aligned with this framework under the rubric of the still-operating Child and Adolescent Health Measurement Initiative. Payers and purchasers are increasingly interested in measures of efficiency, which has been defined as the cost of care associated with a specified level of quality of care.[13]

Ultimately, quality measures should be available to address each domain of quality across all patient and family needs. Measures can be specific to conditions (eg, treatment of asthma in children), which is often the case for measures of clinical effectiveness. Other measures might cut across conditions to reflect a domain of quality (eg, health care–acquired infection, patient experience with care). The patient and family are key sources of information about many aspects of the quality of care they receive, in particular the degree to which care was family centered. The interface between the consumer and quality domains, as conceptualized by the IOM, is illustrated in Table 1.[13]

The inclusion of consumer perspectives on health care needs in the matrix is helpful in framing the pediatric approach to quality. A significant amount of pediatric health care, such as well-child care, focuses on the "staying healthy" part of the matrix. Management of conditions such as upper respiratory infections, acute otitis media, acute gastroenteritis, and bronchiolitis deals with "getting better." The component "living with illness or disability" addresses the fact that pediatricians routinely manage children with special health care needs (ie, congenital heart disease, cancer, chronic lung disease, diabetes, and ADHD). Also, as pediatricians treat increasing numbers of children with chronic illnesses, they may increasingly face management of end-of-life issues. Pediatric quality measures should also address

care at the beginning of life that affects infant mortality and morbidity and the transitions in care throughout the life span. For patients of all ages, safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity are important as well.

THE USE OF MEASURES

Measurement for continuous quality improvement can be used to help a practice or organization understand its own care processes, understand how its performance compares with others, and track measures in response to changes. Data can be used by a practice or organization to compare its performance with (1) itself over time, (2) other practices or organizations using the same measures and collecting data in the same way, and (3) exemplary practices or organizations.[12] Initial steps in improvement efforts involve the use of measures to document performance gaps followed by a plan to address needed changes, monitoring of performance, and outcome. Practices and providers are encouraged to engage in quality improvement as part of daily pediatric practice. When paired with continuing education, quality improvement can be part of the process of ongoing focus on optimal patient care.

The pediatric community has been very active in researching the effectiveness of health care quality improvement strategies. Researchers at the University of California in San Francisco who worked with a large health plan found that chlamydia screening and a broader set of adolescent-focused preventive services could be increased during well-adolescent visits.[15] Cloutier worked with public- and private-sector primary care providers to increase the use of care processes outlined in asthma guidelines,[16] and Lozano and colleagues found that leadership training and practice redesign using a nurse educator reduced asthma-symptom days,[17] a strategy that was highlighted as effective in a recent evidence review of asthma quality improvement strategies.[18] Current pediatric quality improvement research focuses on using health information technology to facilitate improvement in delivery of effective care and in patient safety.[19]

A recent review summarized the characteristics of ideal quality measures and concluded that significant barriers exist in using clinical quality measures at the provider level to distinguish the performance of 1 physician compared with another.[20] These barriers include (1) the lack of adequate sample size for reliable estimates of individual physician performance, (2) the challenges of adjusting for confounding patient factors, (3) the difficulty of attributing care to the individual physician, and (4) inadequate systems for collection and analysis of clinical data, particularly process data.

The IOM has outlined uses of quality measures that involve accountability as well as improvement, including (1) ensuring the rapid translation of clinical research into practice, (2) holding providers accountable for delivering high-quality care, (3) setting standards for participation in federally sponsored programs including Medicaid, the State Children's Health Insurance Program (SCHIP), Title V, and community health centers, (4) helping parents and purchasers make choices, (5) establishing benchmarks to stimulate quality improvement, and (6) conducting ongoing national surveillance on trends in quality.[21] These applications have the potential to involve a variety of users including consumers, providers, medical specialty boards, purchasers, payers, business coalitions, accrediting organizations, and government.

CURRENT STATUS OF NATIONAL QUALITY MEASUREMENT INITIATIVES

Several diverse health care stakeholders are interested in and are developing standardized quality measures. The Congressionally mandated *National Healthcare Disparities Report*[2] and *National Healthcare Quality Report*[3] included a broad set of performance and outcome indicators to monitor the nation's progress toward improved health care quality. Recent calls for measures by national organizations have yielded hundreds of submissions, which is proof of the tremendous activity in this area.

There are many organizations actively involved in the development and promulgation of quality measures. The American Medical Association Physician Consortium for Performance Improvement (PCPI) includes representatives from more than 140 US medical specialty and state medical societies, federal agencies, and other organizations convened to identify and develop evidence-based clinical quality measures that enhance quality of patient care and foster accountability. The AAP is a member of the PCPI and has developed pediatric measures for or relating to acute gastroenteritis, otitis media with effusion, and otitis externa through the PCPI process.[22]

The National Quality Forum (NQF) leads a national effort around quality measures with broad participation from various health care stakeholders including national, state, regional, and local groups that represent health care professionals, consumers, public and private purchasers, employers, hospitals, health plans, and other organizations involved in health care research or quality improvement. The NQF was created to improve American health care through the endorsement of consensus-based national standards for measurement and public reporting of health care performance data that provide meaningful information about whether care meets the 6 IOM quality domains.[23] The AAP is a member of the NQF.

The AAP also participates in the Ambulatory Care Quality Alliance (AQA), an increasingly important and growing multistakeholder collaborative that comprises medical specialty boards and societies, purchasers, consumers, health plans, and accrediting organizations with a mission to coalesce around a single standardized set of physician-level measures.[24] The AQA primary care measure set includes several measures deemed appropriate for use in child health care settings.

In 2006, the AQA and the Hospital Quality Alliance, a public-private collaboration to improve the quality of care provided by the nation's hospitals, formed a new national Quality Alliance Steering Committee to better coordinate the promotion of quality measurement, transparency, and improvement in care. The new steer-

ing committee will work closely with the Centers for Medicare and Medicaid Services and Agency for Healthcare Research and Quality (AHRQ).[25]

Various policy makers, payer organizations, and purchasers and employer groups are developing provider incentive or pay-for-performance (P4P) programs based on standardized measures to drive improvements in the quality of care. Many of these groups also are using measures for public reporting, an approach that requires rigorous evaluation and greater transparency in the development and use of these measures. Although there is little research on the effectiveness of reward programs on quality,[26] the current enthusiasm for P4P programs is based on the belief that these incentive efforts will lead to significant improvements in the quality of care.[27]

To date, most national quality measurement efforts have not focused on children. Measures exist for a few conditions and domains, such as asthma, patient safety, some preventive services (eg, immunizations, well-child care visits), and patient experience with care (eg, timeliness, communication, and respect). However, measures for other important pediatric issues, such as the evaluation of developmental assessment and perinatal/neonatal care, have not been frequently used.

Measurement activities that focus on children and adolescents include efforts to develop quality measures for Medicaid and the State Children's Health Insurance Program[28] and measures developed by the Child and Adolescent Health Measurement Initiative,[29] including the online data resource center for child and adolescent health.[30] The data resource center provides information about children's health, health care needs, and quality of care for many subgroups of children nationally and in each state.

The National Association of Children's Hospitals and Related Institutions, Child Health Corporation of America, Medical Management Planning/BENCHmarking Effort for Networking Children's Hospitals, and others have been working collaboratively to develop measure sets. These have focused on hospital care for children and adolescents to date.[31] The California Hospital Assessment and Reporting Taskforce, a voluntary statewide effort to measure inpatient quality, has focused on adult inpatient care but began reporting on select pediatric measures in 2007.

The National Committee on Quality Assurance has generated several pediatric measures for the Health Plan Employer Data and Information Set, including measures for child and adolescent immunization, overuse of antibiotics in pharyngitis, asthma treatment, and follow-up for ADHD.[32] In addition, the Health Plan Employer Data and Information Sheet 2006 reporting set includes Consumer Assessment of Healthcare Providers and Systems (CAHPS) 3.0H surveys directed to sampled adult and child Medicaid beneficiaries and sampled adults and children with commercial coverage who are managed care members. The child surveys include supplemental items that can be used to assess the experience of care for children with chronic conditions. In 2007, the AHRQ released clinician and group CAHPS surveys, including a child primary care survey.

The AHRQ recently released the Pediatric Quality Indicators, which can be used with hospital inpatient discharge data to identify potential quality improvement opportunities.[33]

Finally, the new Alliance for Pediatric Quality recently launched the Improve First plan to select improvement priorities on the basis of pediatric health care issues that have broad impact and for which there are ongoing, evidence-based improvement programs with associated quality measures.[34] The Alliance for Pediatric Quality was formed by 4 organizations recognized as leaders in pediatric care—the AAP, the American Board of Pediatrics, the Child Health Corporation of America, and the National Association of Children's Hospitals and Related Institutions—which came together to establish a unified voice for issues related to improving the quality of pediatric health care. The founding member organizations represent large segments of the pediatric health care community and bring unique and synergistic perspectives to the field of quality care for children. One of the first areas of focus for the Alliance for Pediatric Quality will be operationalizing quality improvement in pediatric health care through the use of quality measures, evidence-based medicine, health information technology, shared data, and policy to systematically improve children's health care.

Additional activities that will drive further focus on the use of quality measurement in practice include the adoption of maintenance of certification (MOC) by the American Board of Pediatrics,[35] which emphasizes assessment and improvement of quality of care in practice as a requirement for ongoing certification, and the Accreditation Council for Graduate Medical Education adoption of core competencies for physicians in training, which include competency in practice-based learning and quality improvement.[35]

Some health plans are beginning to incorporate MOC as 1 dimension of P4P programs. For example, Aetna Inc and UnitedHealthcare officially recognized the American Board of Internal Medicine's MOC in their respective P4P programs.[36] Under the American Board of Internal Medicine's MOC program, physicians complete Web-based tools called practice improvement modules that guide them through a quality improvement process that uses data collected from their own clinical practice.[37]

Quality measurement and assessment can be facilitated significantly through the use of well-designed and well-implemented EHRs. Programming specific measures into the design and production of EHRs would not only allow for standardization but also ease the burden of data collection and aggregation.[38] The AAP is working closely with the EHR industry and certification groups (eg, Certification Commission on Health Information Technology[39]) to ensure the inclusion of standard measures in the design and production of EHRs to facilitate quality data collection, which is incorporated into the workflow of clinical practice.

CHILD-SPECIFIC ISSUES

The 2004 IOM publication *Children's Health, the Nation's Wealth*[40] emphasizes the critical differences between chil-

dren and adults that warrant special attention to children's health. This report notes that data on children's health and its influences are needed to maximize the health of individuals from childhood through adulthood. Children represent a population with unique health care needs, often called the "4 Ds."[41]

- Development: Children experience rapid developmental changes during infancy, childhood, and adolescence. These changes should be taken into account when developing and using measures. For example, different schedules and types of immunizations should be measured at different ages. Developmental changes also affect the extent to which children's own assessments can be used to measure aspects of quality, such as patient-centeredness and timeliness.[42]
- Dependency: Children depend on caregivers for many aspects of care. Parents and guardians play substantial roles in aspects of quality, such as the actual use of prescribed drugs, devices, and services. Careful specification of data sources and risk adjustment are essential for adequately adjusting for factors that influence specific care.
- Differential epidemiology: Most adult and generic quality indicators focus on specific diseases rather than health. The relatively low rates of children with most specific serious chronic illnesses and disabilities can make quality measurement and use of measures difficult, because the provider, practice, and plan-level sample size may be too small for meaningful comparison. Measures of preventive services and cross-cutting measures of quality for children with special health care needs can be used in addition to condition-specific measures.[43]
- Demographics: Currently, two fifths of the nation's children are from minority groups[44] and almost one fifth live in poverty,[45] which are rates higher than those for adults.[46] Health care quality for children differs according to race, ethnicity, and income, and these factors are important to capture in measurement strategies.

These 4 Ds create unique challenges in development of valid quality measures for children and children's health care. It is necessary to consider these child-specific factors when developing and using appropriate quality measures for pediatric health care issues. In addition, children, adolescents, and families play an important role in providing information about the quality of clinical care. Learning about their experiences of care and engaging in partnerships to improve care are essential for achieving the best outcomes. One way to achieve this engagement is by using measures that address factors important to families.

Those who develop and use pediatric measures must acknowledge that much of children's health care is focused on promoting healthy development and prevention. In addition, because of the relatively low numbers of children with any 1 condition, non–condition-specific measures may need to be considered (eg, coordination of care for children with special health care needs).

RECOMMENDATIONS

The AAP and its members are committed to providing the best and safest health care for infants, children, adolescents, and young adults. The AAP strongly supports health care quality improvement endeavors and believes that measures are an important component of improving quality. The AAP believes that the primary purpose of quality measurement should be to identify opportunities to improve patient care and outcomes, including health status and satisfaction. The AAP supports the use of quality measures in the spirit of continuous quality improvement and affirms the importance of partnership with children and families in these improvement efforts. Toward this end, the AAP offers the following recommendations for quality measurement.

1. Measures should address important issues for children. Measures should address topics of substantial impact, whether defined by prevalence, severity, and/or functional status, and should be chosen for their potential influence on children's health by addressing a significant gap between current and ideal practice. In addition, measures should enable an assessment of systematic disparities in the quality of care for vulnerable groups.
2. Measures should be appropriate for children's health. Any effort to measure quality should take into account the unique features of children's health and health care and recognize the importance of development, dependency, demographics, and disparities. Measures must reflect the differential epidemiology in children as compared with adults and include patient and family participation.
3. Measures should be scientifically valid. Measures should be based on best evidence available and linked to evidence-based practice. The strength and quality of evidence on which the measures are based should be transparent and explicitly documented. The AAP will continue to produce evidence-based pediatric clinical practice guidelines, which will add to the foundation for the continued development of valid quality measures.
   In addition, measures should be reliable and be field-tested to demonstrate the potential for improvements in quality. Rigorous testing should clearly demonstrate that they accurately assess what they are intended to measure.
   When appropriate, measures should include risk adjustment or stratification to take into account factors beyond a practice's or health system's control, such as socioeconomic status, health insurance, and comorbid conditions.
4. Measures should be feasible. Collection of data to support the measures should not cause undue burden on the clinician or patients and families. Issues to be considered include the number of required measures, the time interval of collection, and the resources re-

quired for collection. Ideally, data automatically collected in patient care and other health care processes should be used for measurement. Measures must have clear definitions and specific instructions for collection. Data collection must include adequate sampling.

Measures should be appropriate for the use and setting proposed (eg, ambulatory or hospital care, primary or specialty care). Measures also should be tailored to various practice settings (eg, solo practice, large group practice, academic practice) as appropriate.

Measures and results should be easily interpretable by users. The format used to report measures should include appropriate data analysis and display and prove useful to clinicians. Measures displayed over time and augmented with control limits when enough data are available (eg, time-series charts) will dissuade users from misinterpreting random variation in the measure and can focus analysis of performance on important changes in care delivery, whether stimulated by quality improvement efforts or other factors. The interpretation of measures should include the use of methods to allow a focus on both the causes of variation and the benchmarks or targets.

In addition, collection and reporting of measures must ensure patient privacy.

5. Measures should address what can be improved. Quality measures should focus on improvable issues that clinicians and health systems can influence.

In addition to the recommendations defined above, the AAP also supports the P4P principles outlined by the American Academy of Family Physicians[47]:

1. focus on improved quality of care;
2. support the physician-patient relationship;
3. use evidence-based clinical guidelines;
4. involve practicing physicians in program design;
5. use reliable, accurate, and scientifically valid data;
6. provide positive physician incentives; and
7. offer voluntary physician participation.

CONCLUSIONS

The AAP and its members are committed to providing the highest-quality and safest health care for infants, children, adolescents, and young adults. Quality measurement is necessary for the continuous improvement of the health care system. As a result, national attention has increasingly focused on quality measurement; however, these national efforts often have failed to recognize the unique needs of children and their families. The pediatric community must take a leadership role.

The AAP is taking the lead in assessing quality measures proposed for children's health and health care by developing pediatric measures in collaboration with national health care quality organizations, monitoring the validity of measures developed by other organizations, and advocating for the appropriate use of measures to support improvement in the health care of children. These activities are strengthened by the AAP continuing to develop evidence-based pediatric clinical practice guidelines and being involved with the EHR industry and certification groups to facilitate quality data collection. The AAP will advocate for the use of pediatric measurement data, including use in public reporting, when data are based on validated pediatric measures that are appropriately constructed for quality improvement in children's health care and pediatric practices.

In partnership with the Alliance for Pediatric Quality and other organizations, the AAP will endeavor to ensure that quality metrics are used to accelerate changes in care that result in measurably improved health and outcomes for children and their families.

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Policy Statement—Professional Liability Insurance and Medicolegal Education for Pediatric Residents and Fellows

abstract

FREE

The American Academy of Pediatrics believes that pediatric residents and fellows should be fully informed of the scope and limitations of their professional liability insurance coverage while in training. The academy states that residents and fellows should be educated by their training institutions on matters relating to medical liability and the importance of maintaining adequate and continuous professional liability insurance coverage throughout their careers in medicine. *Pediatrics* 2011;128:624–629

BACKGROUND

The American Academy of Pediatrics (AAP) first developed a policy on professional liability coverage for pediatric residents in 1989.[1] The policy was updated to include fellows in training in 1993. In the 2000 iteration of the statement,[2] the original positions were strengthened to address changes in the professional liability insurance industry, the structure and settings of residency training, and mandated reporting to national health provider databanks of malpractice payments. The 2000 policy also emphasized the need to provide pediatricians-in-training with adequate professional liability insurance coverage. This revision of the policy statement updates the recommendations in light of the current requirements of the Accreditation Council of Graduate Medical Education (ACGME) for approved residency programs and emphasizes the need for medicolegal education for pediatric residents and fellows. Pediatric training programs are urged to voluntarily adopt the AAP recommendations.

MEDICAL LIABILITY AND RESIDENTS/FELLOWS

Because pediatric residents and fellows-in-training are closely supervised, their medical malpractice risks are theoretically less than those of other pediatricians. Under the legal doctrine of *respondeat superior*, "let the master answer," the educational institution that conducts the residency program is responsible for the medical care provided by its residents and fellows during training. Therefore, typically, the institution is liable for defense costs, settlements, and awards for malpractice attributed to physicians-in-training.[3] Their trainee status, coupled with their lack of financial assets, often precludes residents and fellows from being targeted in a malpractice suit. In those instances in which residents and fellows are named in a malpractice complaint,

COMMITTEE ON MEDICAL LIABILITY AND RISK MANAGEMENT

KEY WORDS

resident liability, graduate medical education, resident, fellow, medicolegal education, medical malpractice insurance, professional liability insurance, risk management

ABBREVIATIONS

AAP—American Academy of Pediatrics
ACGME—Accreditation Council on Graduate Medical Education
NPDB—National Practitioner Data Bank

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they are often dropped from the case early in the legal proceedings. However, they are often deposed as fact witnesses.

However, physicians-in-training are not entirely free from malpractice risks. Malpractice suits accounted for the majority of litigation involving medical residents from 1950 to 1989.[4] This prominent malpractice risk has continued, and from 1990 to 2007, 3 in 10 pediatricians were sued for malpractice at least once during their career in medicine, and approximately 1 in 10 was party to a malpractice suit from care provided during residency.[5] The mean number of months that elapsed between the alleged error or negligent event and the malpractice complaint being filed was 32 months in 2007, almost equivalent to the entire length of general pediatric residency training.[5] It is possible that those pediatric residents and fellows named as codefendants in medical liability cases will have already completed their residency by the time the claim is filed.

It is also possible that former residents and fellows may not know when they have been included in a malpractice claim. Depending on the specifications of the medical malpractice insurance policy, a settlement may be reached without the consent or knowledge of the defendants. In fact, pediatricians might not find out about the settlement until after the payment is reported to the National Practitioner Data Bank (NPDB). As of its most recent report in 2004, the Health Resources and Services Administration Bureau of Health Professionals noted that the NPDB contained 1669 malpractice payments made for the benefit of residents and interns, which is 1% of all malpractice payments for physicians.[6,7] The long-term effects of having a malpractice payment reported to the NPDB so early in a physician's career on his or her subsequent employability and insurability have yet to be studied.

GAUGING RISK FOR PEDIATRIC RESIDENTS AND FELLOWS

Pediatricians are exceptionally vulnerable to malpractice allegations because of the long tail associated with care rendered to patients under the age of majority. The tail is the length of time established by state law from when an incident involving a minor occurs or is discovered to when a malpractice claim can be filed. Every state has established a statute of limitations to allow extra time for a malpractice complaint involving a minor to be reported. Therefore, for most physicians, this lag time is measured in years, but for pediatricians, the statute of limitations is often measured in decades. In some states, the limitation period begins when the incident occurred, but in other states, the statute of limitations begins only after the injury is discovered.

Although pediatricians are not accused of malpractice as frequently as other specialists, when they are sued, the stakes are high. The Physician Insurers Association of America, whose member companies insure 60% of all physicians in private practice in the United States, reports that pediatricians had one of the highest average payments for settlements and court awards per claim at $395 997, behind only neurosurgeons, neurologists, obstetricians, and cardiovascular surgeons.[8,9]

CURRENT ACGME REQUIREMENTS FOR PROFESSIONAL LIABILITY INSURANCE

The AAP joins other responsible medical and hospital organizations in applauding the ACGME for requiring that any educational institution seeking accreditation of its residency and/or fellowship programs provide adequate professional liability insurance for its physicians-in-training. This requirement is specified in the ACGME *Institutional Residency Training Program Requirements* (see section II-D.4.f, effective July 1, 2007), as follows:

1. The sponsoring institution must provide residents with professional liability coverage and a summary of pertinent information regarding this coverage.
2. Liability coverage must include legal defense and protection against awards from claims reported or filed after the completion of the program(s) if the alleged acts or omissions of the residents are within the scope of the program(s).[10]

Despite the ACGME requirements, a large proportion of pediatric residents know little about their professional liability insurance coverage. A 1993 study of pediatric residents in Pennsylvania revealed that 90% did not know the policy limits of their liability insurance or whether a malpractice claim against them could be settled without their permission.[11] Deficiencies in pediatric residents' training about professional liability insurance persist. According to an AAP survey of graduating pediatric residents in 2007, only 52% reported receiving any instruction on medical liability insurance.[12] The AAP believes that pediatric residents and fellows should be fully informed of the rights and responsibilities afforded by their professional liability coverage and should be educated on important considerations applicable to maintaining adequate professional liability coverage throughout their careers in medicine.

AAP RECOMMENDATIONS

Given the severity of pediatric malpractice settlements and jury awards, the permanent nature of databank reports, and the prolonged length of the statutes of limitations for incidents that involve minors in many states, the AAP has strengthened and clarified its

recommendations on professional liability coverage for pediatric residents and fellows.

Therefore, the AAP reaffirms its recommendations that the ACGME's *Institutional Residency Training Program Requirements*[10] include the following:

1. Adequate Coverage

Pediatric training programs must provide adequate professional liability coverage (or its equivalent in military/governmental institutions) for their residents and fellows to indemnify them from liability for potential medical misadventures that may occur during training activities. This coverage should last throughout the training period and continue to provide coverage for these training activities after residents and fellows leave the program. This coverage must apply to all activities considered part of the training program's related learning experiences regardless of the setting (eg, rotations in private medical office settings, community-based clinics, out-of-state and overseas program training experiences, etc).

A. Professional liability coverage for residents and fellows must be comparable to that offered to other physicians employed by the hospital or training facility.
B. The residents and fellows policy should cover expenses associated with legal defense and should provide loss protection against malpractice awards and/or settlements.

2. Documented Proof of Insurance

Pediatric training programs must furnish resident and fellow applicants with detailed information on the professional liability coverage provided during training, and this information should be available for the applicant before selecting a training program. On acceptance into the program, each physician-in-training should receive a written description of his or her professional liability coverage. If the residency or fellowship program self-insures or insures its trainees under a master policy that also covers the teaching facility's professional staff, the contract that residents and fellows sign should clearly and explicitly state the provisions of the professional liability coverage applicable to physicians-in-training. Likewise, if physicians-in-training are covered under a separate policy written specifically for the program's residents and fellows, a copy of the insurance policy contract should be provided to each trainee.

3. Provisions of Professional Liability Insurance Policy

Whether covered under a master policy or a separate policy for trainees or self-insured by the institution, the resident/fellow should be provided, at a minimum, a written document that delineates the following specific provisions of the professional liability insurance policy.

A. The name of the company or institution that serves as the insurance carrier and appropriate contact information; if the training program self-insures its physicians-in-training for professional liability, that information should be clearly noted in writing as well.
B. The type of professional liability coverage provided for physicians-in-training (ie, occurrence, claims made, self-insured, or other); a brief explanation of the differences between various professional liability insurance products should be distinctly addressed in terms of what the variations mean to the insured resident or fellow both during training and after training is completed.
C. An explanation of how settlements are reached; residents and fellows should receive written descriptions of whether the policy allows the insurance carrier to settle a malpractice case without the permission and/or signature of the insured physician.

4. General Information on Liability Insurance

Residents and fellows should be educated on the following kinds of professional liability insurance policies.

A. Self-insurance—Many academic medical centers self-insure their staff. Instead of purchasing professional liability insurance, the resources of the training program (or its related institutions) will be used to cover any losses associated with medical malpractice claims or suits against the institution, supervising physicians, and/or physicians-in-training.
B. Occurrence—A type of professional liability insurance policy in which the insured is covered for any incident that occurs during the term of the policy regardless of when a claim arising from the incident is made. For example, if the alleged error or omission happened anytime during the residency training, it would be covered by the teaching facility's professional liability insurance, even if the claim is filed after the policy has expired. Occurrence policies are no longer commonly offered but may be available through select insurance carriers or if the program self-insures its residents and fellows.
C. Claims-made—An insurance policy that provides coverage for claims arising from incidents that both occur and are reported to the insurance company while the policy is in force. A claims-made policy is in effect from the starting date of the initial policy period and remains in force from that date until it is re-

newed. Once terminated, future claims that arise from incidents that occurred during the policy period are not covered. Typically, claims-made policies do not cover previous acts (liability for actions that took place before the effective date of the policy). Claims-made policies are often heavily discounted in the first years, but as the policies mature (usually after 5 years), the rates often increase and become comparable in price to occurrence policies. The major drawback of claims-made policies is the lack of coverage should they be terminated for any reason (eg, premiums are not paid or the physician completes training, changes employers, and/or medical malpractice insurers, moves to another state, or retires). Unless a special policy is purchased (ie, tail coverage), a physician can end up with a gap in coverage and possibly an uninsured malpractice claim.[9]

D. Claims-paid—A variant of claims-made insurance, this policy is a professional liability insurance that provides coverage for claims that arise from incidents that occur while the policy is in force. However, claims must be reported and paid before the policy is terminated.

E. Tail coverage—A supplemental policy to claims-made liability insurance that provides coverage for any incident that occurs while the claims-made insurance was in effect although the claim was filed after the insurer-policyholder relationship was terminated. Sometimes referred to as an extended reporting endorsement, tail coverage is necessary whenever a physician insured under a claims-made policy changes carriers, completes training, becomes disabled, retires, or dies.[13] Insurance carriers often have strict policies on when tail coverage can be purchased. Most commonly, insurance companies will offer the option to purchase the addition of tail coverage to an existing claims-made policy only before its coverage's termination, although likely at a higher price as the policy gets closer to its termination. Tail coverage, in fact, is never inexpensive. It can cost up to 3 times as much as the annual premium for a claims-made policy.[14]

F. Nose coverage—Supplemental insurance to a claims-made policy that provides coverage for previous acts or incidents that may have occurred before the claims-based policy went into effect but have not yet been filed as claims. Because the physician is seeking up-front coverage before securing a relationship with the insurance carrier, it is usually comparable in price to tail coverage.

5. Extracurricular Activities/Moonlighting

The residency program should inform its residents and fellows of the institution's definition of and policies concerning moonlighting and whether these activities are included in the program's professional liability coverage provided.[10] Residents and fellows should be given explicit documentation of any specific liability policy inclusion/exclusion clauses. In addition, the program should warn its trainees of the potential long-term liability exposure associated with moonlighting or other professional activities that are excluded from the program's liability insurance policy.

Pediatric training programs that are recognized by the ACGME currently are required to monitor the effects of outside activities, including moonlighting in or outside the primary hospital, to ensure that the quality of patient care, the educational experience, and duty-hour limitations are not compromised.[10] Accredited training programs must provide trainees with formal written policies on their participation in outside professional activities.

The AAP urges pediatric educational programs to notify physician trainees whether medical malpractice allegations that derive from such extracurricular activities are excluded from the training program's professional liability coverage for its residents and fellows. Trainees should be instructed not to assume that a nontraining extracurricular activity must be for pay or outside the primary training facility to be considered moonlighting. Some apparently benign activities may be considered external to the residency training experience and, thus, outside the scope of liability coverage provided by the training program. Pediatric residents and fellows who provide care outside of the auspices of the training program should verify that liability insurance with tail coverage is provided by the agency or health care facility at which the moonlighting activity occurs.

The program should give its physician trainees specific examples of what constitutes moonlighting to obviate potential misunderstanding. The following situations may be examples of extracurricular activities and, as such, are likely to be excluded from a training program's liability coverage for its residents and fellows: volunteering as a physician at a camp for children with special health care needs; serving as an infection-control consultant to a child care facility; providing sports physicals for a local high school; and staffing the emergency department in the primary training institution when not on official duty as a trainee.

If tail coverage is not provided and an individual tail policy to cover extracurricular activities is too costly for the resident or fellow to purchase, he or she should carefully reconsider the

potential costs, benefits, and risks of moonlighting.[15] If available, the residency program should inform its trainees that they can purchase supplemental coverage for any excluded activities as an add-on to the training program's standard professional liability insurance.

6. Settlement Decisions

The residency training program should inform its residents and fellows in writing whether their professional liability policy allows the insurer to settle malpractice claims without the signature of the parties named in the malpractice claim. Because federal law requires malpractice payments made on behalf of health care providers to be permanently registered in the NPDB, physicians-in-training should be given the right to make informed decisions on whether to settle a malpractice claim or to pursue litigation.

7. Statute of Limitations for Minors

Because the length of time for which a physician may be liable for previous acts is particularly long for incidents that involve pediatric patients, residents and fellows need to understand the provisions of the statute of limitations for minors in the state in which they are being trained. The training program should provide examples of how the length of exposure risk affects the residents' and fellows' current professional liability insurance coverage and future needs.

8. Notification of Suit and Participation in Defense

Should a pediatrician be named as a party to a suit that arises from events or actions that took place during his or her training period, it should be the program's responsibility to do the following.

A. Promptly and confidentially notify the current or former physician-in-training.
B. Provide paid time off for current residents and fellows to testify or provide a deposition in a malpractice case in which they are named. Time spent testifying or being deposed should be considered training-related business; therefore, it should not be deducted from the resident's vacation or other personal time.
C. Reimburse physicians-in-training for reasonable expenses incurred when required to testify or provide a deposition in a malpractice case.
D. Reimburse former physicians-in-training for necessary reasonable expenses incurred if required to testify or be deposed in a malpractice case for an alleged error or omission that occurred as part of the residency training program's educational experience. This provision would make it possible for former residents and fellows no longer in the vicinity of the training program to participate in their own defense without undue financial hardship.
E. Promptly and confidentially notify current or former physicians-in-training if the training program has filed a reportable action to the NPDB, the Health Integrity Protection Data Bank, or other federal or state repositories of disciplinary actions taken against physicians.

9. No Coverage Gaps

The pediatric training program should educate its residents and fellows on the importance of not allowing any gaps in professional liability coverage to occur, particularly during career changes (including, but not limited to, changing residency training programs, employers, or insurance carriers). The pediatric training program should also notify the residents and fellows of any changes in their exposure risk to malpractice claims and suits attendant on leaving the training program.

10. Other Liability Issues

The pediatric training program should educate its residents and fellows in risk management, medical record documentation, and other strategies for improving outcomes. Residents and fellows, however, should be aware of other types of liability such as, among others, sexual harassment, intentional acts, and failure to comply with health care regulations, which are not usually covered by medical malpractice liability insurance.

11. Career Changes

Pediatricians who are seeking new employment, particularly early in their careers, should make sure that there are no gaps in their malpractice insurance coverage. If the insurance that was in force during training was a claims-made policy, the resident or fellow either should negotiate tail coverage from the residency training institution or nose coverage from the prospective employer. In addition, pediatricians considering a claims-made/claims-paid policy through a new carrier should anticipate the need for coverage for their subsequent tail. If a new employer has offered to pay the premiums for the professional liability insurance, it is reasonable to request that the employer also be financially responsible for providing the tail coverage. It is reasonable for employers, however, to specify a minimum length of employment as a condition for the provision of tail coverage.

12. Voluntary Adoption

Until the ACGME requirements for accredited residency training programs are amended to reflect the specific provisions of this policy statement in full, the AAP urges pediatric training programs to adopt these recommenda-

tions voluntarily. By so doing, resident and fellow educators can adequately equip their trainees to make informed decisions regarding liability insurance coverage, risk management, and future employment risk coverage options. More importantly, medicolegal education programs prevent the careers of future pediatricians from being jeopardized by inadequate or interrupted liability coverage during or immediately after the training period.

13. AAP Support

The AAP will continue its partnership in educating residents and fellows as well as pediatricians beginning practice on medicolegal issues through its chapters, sections, and committees.

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POLICY STATEMENT

Professionalism in Pediatrics: Statement of Principles

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Bioethics

ABSTRACT

The purpose of this statement is to delineate the concept of professionalism within the context of pediatrics and to provide a brief statement of principles to guide the behavior and professional practice of pediatricians.

STATEMENT

Pediatricians and pediatric subspecialists occupy an important place in society as privileged and trusted advocates for the well-being of children. Within this environment, how should professionalism be defined, and what should it mean to the practicing provider? The purpose of this statement is to clarify the definition of professionalism in pediatric care and to translate these concepts into clinical practice. One of the unique aspects of professionalism within the pediatric context is the multilateral interactions of the child patient, the family, other health care and support services providers, and other pediatric professionals. The principles outlined here apply to trainees, pediatric training-program faculty, and private practitioners.

Educational initiatives in medical school curricula and continuing medical education for practicing pediatricians must include the principles and practice of professionalism. An appreciation of these concepts depends on an ability to define and assess professionalism within pediatrics.

On balance, the concept of professionalism in pediatrics is similar to that in other specialties in the field of medicine,[1–5] except that working with children creates unique circumstances that deserve special consideration. For example, an appreciation of the informed-consent process in pediatric practice requires the provider to consider how best to involve the child patient at a given developmental level into conversations and decision-making despite incomplete maturation. A definition of professionalism will include, but is not limited to, the principles set out by the American Board of Pediatrics as specific guidelines for the teaching and evaluation of professionalism as part of the core curriculum for residency training in pediatrics.[6] These principles are:

- Honesty and integrity—embody the principles of fairness, the ability to meet commitments and keep one's word, and the duty to be intellectually honest and straightforward in interactions with patients and peers and in all professional communication.
- Reliability and responsibility—represent accountability to children, families, other physicians, medical staff, community, and ultimately society. They require acceptance of responsibility for errors made, including the willingness to ac-

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knowledge and discuss errors and their consequences with the family and with peers, and collaborate in the search for systematic actions to prevent future harm.

- Respect for others—involves treating all persons with respect and regard for individual worth and dignity, including sensitivity to gender, race, and cultural differences as well as maintenance of patient confidentiality when appropriate.
- Compassion/empathy—the ability to understand children's and family members' reactions to pain, discomfort, and anxiety from their point of view, not that of the physician.
- Self-improvement—involves a commitment to lifelong learning and education.
- Self-awareness/knowledge of limits—the maturity to recognize when a problem involves knowledge or technical skills beyond the experience of the provider and to ask for consultation or assistance in those situations.
- Communication and collaboration—involve the recognition that patients' families and the health care team must work cooperatively with each other and communicate effectively to provide the best patient care and appropriate community interventions, including home health services; rehabilitation services such as occupational, speech, and physical therapy; and school reentry.
- Altruism and advocacy—refer to the unselfish regard or devotion to the welfare of others. Patient well-being should be the primary motivating factor in patient care, ahead of physicians' own interests and needs.

The integration of values that emphasize not only individual rights and freedoms but the teamwork that is essential to the practice of medicine is key to achieving one's professional goals within pediatrics. These values include:

- Responsibilities to patients and families—refer to the collaborative relationship that involves pediatricians, patients, and parents, with recognition of appropriate boundaries in patient care, and promotion of the concepts of respect for privacy, nondiscrimination, and conflict resolution. Pediatricians should not refuse to care for acutely ill children on the basis of the ability of the family to pay for services rendered. However, practice overhead expenses preclude the provision of comprehensive health services for every child whose family requests routine or preventive health services unless there is some means of compensation. The American Academy of Pediatrics believes that the medical care of infants, children, and adolescents should be accessible, continuous, comprehensive, family centered, coordinated, compassionate, culturally effective, and provided according to the medical home concept.[7]
- Responsibilities to other health professionals and health care and support services providers—entail treating each other and all other professionals, including individuals who provide ancillary services to patients, with integrity, honesty, and respect in daily interactions.
- Responsibilities to communities—refer to the collaborative relationship between a pediatrician and the wider community to address issues of advocacy for child health and effective use of health care and public health resources.
- Responsibilities to the profession—involve subscribing to and acting on the concepts of lifelong learning, willingness to teach and contribute to medical knowledge, engaging in self-care, treating one's team with respect, and communicating effectively; promoting the practice of medicine with integrity now and in the future; and working toward a system of medical regulation that combines professional, organizational, and patients' perspectives with a goal of strengthening the medical profession's accountability for its own performance.

This brief statement of principles emphasizes the core professional values that pediatricians and pediatric subspecialists should adopt and that will serve as an ethical foundation for quality health care for children and their families.

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American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Principles of Pediatric Patient Safety: Reducing Harm Due to Medical Care

STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT AND COMMITTEE ON HOSPITAL CARE

KEY WORDS

patient safety, quality improvement, culture of safety, medication errors, medical errors, adverse events, avoidable harm

ABBREVIATIONS

IOM—Institute of Medicine
AAP—American Academy of Pediatrics
CPOE—computerized physician order entry

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abstract

FREE

Pediatricians are rendering care in an environment that is increasingly complex, which results in multiple opportunities to cause unintended harm. National awareness of patient safety risks has grown in the 10 years since the Institute of Medicine published its report *To Err Is Human*, and patients and society as a whole continue to challenge health care providers to examine their practices and implement safety solutions. The depth and breadth of harm incurred by the practice of medicine is still being defined as reports continue to uncover a variety of avoidable errors, from those that involve specific high-risk medications to those that are more generalizable, such as patient misidentification. Pediatricians in all venues must have a working knowledge of patient-safety language, advocate for best practices that attend to risks that are unique to children, identify and support a culture of safety, and lead efforts to eliminate avoidable harm in any setting in which medical care is rendered to children. *Pediatrics* 2011;127:1199–1210

Patient safety is defined as "freedom from accidental injury" caused by medical care, such as harm or death attributable to adverse drug events, patient misidentifications, and health care–associated or health care–acquired infections.[1] Although patient safety is but 1 of the 6 domains of quality of care defined by the Institute of Medicine (IOM), it is undoubtedly one of the most pressing domains, given the IOM estimate that 44 000 to 98 000 inpatient deaths attributable to medical errors occur each year in the United States. The phrase "patient safety" may be mistakenly interpreted as the focus on injury-prevention strategies such as the use of car seats and helmets.[2] However, pediatricians can help champion the concept that pediatric patient safety means preventing injury to children caused directly by the health care system itself.

Over the past 10 years, patient safety has become a key priority for health systems. Starting with the 1999 IOM report, *To Err Is Human*, there have been dramatic increases in research, standards, collaborative efforts, education, and measures focused on patient safety.[1,3–6] In 2001, after recognizing the necessity to coherently guide and understand pediatric patient-safety issues, the American Academy of Pediatrics (AAP) published the statement "Principles of Patient Safety in Pediatrics,"[7] and in 2003 it published "Prevention of Medication Errors in the Pediatric Inpatient Setting."[8] In 2007, the AAP released the statement "Patient Safety in the Pediatric Emergency Care Setting."[9] Since

the publication of these seminal policy statements, much has been learned about pediatric patient safety.

This statement, "Principles of Pediatric Patient Safety: Reducing Harm Due to Medical Care," elucidates the current understanding of issues and practices to minimize pediatric medical errors and improve the quality of care. Three key issues are the focus of this statement: (1) the significance of pediatric patient safety; (2) the science behind the culture of safety; and (3) patient-safety strategies. (Definitions of patient-safety tools and terms and other references are provided in Appendices 1–4.)

SPECIAL CONSIDERATIONS FOR CHILDREN

Medical errors and patient harm differ in several ways for children compared with adults. First, children are at greater risk of medication errors than are adults because of children's development, demographics, dependency on parents and other care providers, and different epidemiology of medical conditions.[10] Errors in prescribing, dispensing, and administering medications represent a substantial portion of the preventable medical errors in children.[11–14] Second, computerized physician order entry (CPOE) systems that are designed for adults have limited effectiveness in reducing pediatric medication errors.[14] Also, efforts that eliminate catheter-related bloodstream infections in adults do not have the same effect for children.[15,16] Pediatric patient-safety efforts need to be researched further to determine the best strategies for reducing these preventable harms in children.

Reasons for the unique attributes of patient-safety problems and solutions for children are multifactorial.[17] Woods et al[17] detailed these factors as involving 3 key overarching domains: (1) physical characteristics; (2) developmental issues; and (3) minor legal status issues. Layered onto these distinguishing characteristics is a general patient-safety approach that involves 3 main strategies: (1) understanding the epidemiology of errors and having sources of error identification; (2) understanding the science behind improvement, including the safety culture; and (3) having a source of core patient-safety solutions. Each of these overarching strategies should be incorporated into pediatric patient-safety risk assessment and solution development, and attention should be paid to each of the unique domains of pediatric patient-safety risks as defined by Woods et al.

EPIDEMIOLOGY OF PEDIATRIC PATIENT HARM

Pediatric errors in the inpatient setting have been reviewed by several investigators.[18–20] The authors of 1 study reported 12.91 adverse events per 1000 hospital discharges among patients from birth through 15 years of age.[21] Negligence was determined in 27.6% of the events. Among 10 778 orders reviewed by Kaushal et al[13] in 2 academic pediatric hospitals, 616 medication errors (5.7% of all orders) were identified. One-fifth of these errors were near misses, and 1% caused patient harm. Adverse drug events were identified in 2.3% of hospitalizations, and 19% were deemed preventable. Serious errors occurred more often in critical care settings, and adverse drug events occurred 3 times more frequently among pediatric patients than among adults. In the Vermont Oxford Network, an analysis of medical errors in NICUs revealed that 47% of the errors involved medications, 11% involved patient misidentification, 7% involved delays or errors in diagnosis, and 14% involved errors in the administration or method of using a treatment.[22] In addition, a review of charts among 15 NICUs revealed that adverse event rates are more common than previously described.[23] Analysis of the Agency for Healthcare Research and Quality patient-safety indicators further revealed the breadth and variability of patient-safety events, revealing rates per 10 000 pediatric discharges of less than 1 (in-hospital postoperative hip fractures, transfusion reactions) to 68 (birth trauma), 103 (postoperative sepsis), and 703 (failure to rescue, failure to prevent a clinically important deterioration).[24]

Errors in pediatric emergency department (ED) settings may be attributable to improper patient identification, lack of experience of adult emergency staff with pediatrics, and challenges with performing technical procedures on and calculating medication doses for children.[25,26] Other sources of error include communication between prehospital and ED staff; among ED staff, particularly during change-of-shift sign-off; between ED and inpatient staff; and between ED staff and family members. Other important sources of error in the ED include diagnostic mistakes, medication errors, and environmental deficits such as equipment malfunction. In a Canadian pediatric ED, 100 prescribing errors and 39 medication-administration errors occurred per 1000 patients.[27]

Studies on errors in pediatric ambulatory care have been limited.[28] The Learning From Errors in Ambulatory Pediatrics study[29] found 147 medical errors reported from 14 practices. The largest group of errors was attributed to medical treatment (37%). Other errors included patient identification (22%); preventive care, including immunizations (15%); diagnostic testing (13%); patient communication (8%); and less frequent causes. Among medical treatment errors, 85% were medication errors. Of these errors, 55% were related to ordering, 30% were related to failure to order, 11% were re-

lated to administration, 2% were related to transcribing, and 2% were dispensing errors. In a prospective cohort study at 6 Boston, Massachusetts, area pediatric practices over a 2-month period, 3% of 1788 patients ($n = 57$) had preventable adverse drug events.[30] Although none of these events were found to be life-threatening, 8 (14%) were serious. The preventive strategies with the most preventive potential were improved communication between providers and parents and between pharmacists and parents. Among new prescriptions for 22 common medications in outpatient pediatric clinics, 15% were issued with potential dosing errors.[14] In addition, medication samples are often dispensed with inadequate documentation.[31]

THE SCIENCE OF PATIENT SAFETY

The Safety Culture

In addition to understanding the epidemiology of medical harm to children, the awareness and attitude of health care providers regarding patient safety is important. Specifically, a "culture of safety" is fundamental for avoiding patient harm and emphasizes improving systems rather than blaming individual people.

Society is demanding a safer health care system. State and federal agencies (eg, Centers for Medicare and Medicaid Services), certifying organizations (eg, the Joint Commission), and professional societies (eg, AAP, American Board of Pediatrics) also have patient-safety expectations. These combined forces are placing greater pressure on the health care community to develop a culture of safety in which leaders and members understand and act on the basis of a systems approach.

Human Factors Perspective

A culture of safety approaches human fallibility by concentrating on the conditions under which people work and building defenses to avert errors or mitigate their effects.[32] The culture of safety does not focus on errors of individual people, because errors within organizations that deal with high-hazard processes rarely have their ultimate cause rooted in individual behavior. High-reliability organizations recognize variability as a constant and are focused on minimizing that variability and its effects.[32] The basis for this framework in health care rests on research in high-hazard industries (eg, aviation, nuclear power, and petrochemical industries) that have significantly decreased the incidence of catastrophic events.[33–35] Although the complexity of medical care may present difficulties in creating a culture of safety, the science of human factors provides common principles that can endow all facets of our medical system with the resilience to avoid errors and adverse events.

The optimal culture of safety requires an organizational culture that supports 4 key elements: reporting, being just, being flexible, and learning. The goal of a culture of safety is to be an informed culture with constant attentiveness and commitment to avoiding failures such as giving a wrong dose of medicine or failing to wash hands before seeing patients; reluctance to simplify interpretation; commitment to resilience; deference to expertise; and sensitivity to systems-based practices.[36]

For an organization to be informed, it must be a "reporting culture." A reporting culture collects, analyzes, and disseminates data about medical errors and adverse events. Front-line staff must be willing and able to report errors and adverse events without fear of retribution. Crucial to this culture are the abilities to communicate easily, confidentially, or anonymously[37] to separate entities responsible for data analysis from those with disciplinary functions and to provide rapid and useful feedback.

Organizations with a "just culture" encourage and reward error-reporting by maintaining a nonpunitive environment. A just culture focuses on a systems approach to human fallibility while holding accountable those who intend to harm or intentionally fail to adhere to policies and procedures designed to keep patients safe.

An optimal culture of safety has a "flexible culture" that is capable of adapting effectively to changing demands. Although a flexible culture depends on a disciplined staff, it ignores rank to defer to technical expertise. For children, defining this expertise should include assessment of specific training and skills necessary to safely render care while attending to factors such as varied ages, disease states, and developmental needs. This culture depends on teamwork; shared values; use of well-tested standardized operating procedures and prospective risk assessment, such as failure modes and effects analysis; and investment in staff training.

Finally, a "learning culture" has the competence and will to make the right conclusions on the basis of safety information and to implement changes when needed. This culture learns from its mistakes through system-oriented assessments such as root-cause analysis; shares that learning throughout the whole organization; and does not hide its mistakes. A culture of safety promotes compassionate disclosure of its mistakes to those who have suffered harm from those mistakes.

These optimal human factors interact to create an informed system that perpetuates safety independent from individual personalities or external forces and provide a set of principles that promote a common culture of safety across our complex medical system.

PATIENT-SAFETY STRATEGIES

Despite best efforts, active error detection, and ideal safety culture, errors will inevitably occur in systems as complex as health care.[32,38] The 1999 IOM report identified key safety-design concepts to consider when striving to reduce medical errors. Additional guidance on creating systems can be found in the IOM principles for the design of safety systems in health care organizations[1] (Appendix 1).

Methods used to assess and resolve patient-safety issues incorporate the IOM's broad key safety-design concepts to improve reliability through redundancy, simplification, and standardization.[1] Specific goals, such as accurate patient identification and prevention of indwelling catheter infections, are amenable to the introduction of checklists, double-checks at the bedside, or forcing functions such as mandated bar-code scanning before a drug can be administered to a given patient.

Other safety goals, such as recognition of a change in a patient's status or encouraging patient and family involvement in the patient's care, require a composite of changes to health care systems and expectations of both providers and the consumer. Many institutions involve patients and families in critical care unit rounds, which is felt to enhance the prevention and identification of problems.[39] Patient- and family-centeredness play important roles in the culture of safety, including consideration of ethnic culture and language.[40]

Leadership

In *To Err Is Human*, the IOM addressed the need for national leaders to set goals for patient safety but also charged that "Chief Executive Officers and Boards of Trustees should be held accountable for making a serious, visible and ongoing commitment to creating safe systems of care."[1] This charge applies to leaders in all settings including solo practices. Leaders and clinicians who strive to improve patient safety need to appraise their organization's safety culture to determine the best means for implementing safety strategies.

Clinicians must be involved to ensure the success of patient safety as part of larger quality-improvement efforts. Roles vary and depend on the type of clinician, practice setting, and system. In all settings, individual physician participation includes taking responsibility for maintaining knowledge of patient-safety principles, providing patient and parent education, positively engaging safety efforts, and working effectively within a multidisciplinary structure. Although financial incentives may be used to facilitate involvement, providing physicians with data and reminders and ensuring their involvement in designing processes of care is most compelling.[41,42] Group leaders can perform a physician/practice patient-safety assessment on topics such as medication management or clinical (eg, laceration repair) or administrative (eg, acknowledgment of laboratory results) procedures.[43] Leaders also can initiate patient-safety projects such as creating a tracking system for high-risk pregnant teenagers or a tool for parents of children with special needs that clearly defines what changes in clinical status should prompt a call to which specific clinician[44,45] (see Appendix 3). System leaders also can use knowledge of organizational goals and external agency mandates to target changes with wider impact, such as a multidisciplinary approach toward medication reconciliation.[5]

In community and adult settings, there is an added need to advocate for pediatric-specific issues. Physician participation on key hospital committees, such as pharmacy and therapeutics, information technology, sedation, rapid-response team, and ambulatory clinical practice, is invaluable. Creation of a pediatric multidisciplinary safety committee that reports to the hospital or larger medical group board can be a productive way to link specialists and ancillary providers to ensure cross-communication on safety issues for children.

Role of Information Technology

Pediatric-specific technological support of safety endeavors is improving, yet most interventions are still in the development phase. Although information technology cannot solve all ails of patient safety, some safety issues are particularly amenable to information technology. Since publication of the AAP statement "Prevention of Medication Errors in the Pediatric Inpatient Setting," it has become more apparent that CPOE systems require robust decision support to be safe and effective.[7,46–48] Some decision-support rules for drug and dosing schedules and CPOE systems are commercially available for children; however, most of them are created locally.[11,49–51] Order sets, reminders, and clinical practice guidelines embedded within information systems increase adherence to best practice.[52,53] Use of electronic equipment—specifically, programmable "smart" infusion pumps—has resulted in improved documentation of medication errors and decreases in calculation and administration errors.[54–56]

Technological solutions to more generalized medical safety concerns have been applied to pediatric settings. Barcoding has been used to compare identification bands with medications and blood products before administration.[57] Computers can generate code sheets for bedside posting and link to a patient's most recently updated visit

list for patients within an enclosed system. Electronic patient-tracking systems assist with patient flow and notification of abnormal study results.[58] Although electronic health records have been reported to yield an overall economic benefit to ambulatory practice, only a small percentage of this financial gain is associated with proven improvements in patient safety, such as avoidance of adverse drug events.[59,60]

Despite noted advantages, some limitations to technological support still exist, such as variable ease of use, physician acceptance, cost, software integration into existing facility systems, standardization across systems, the increase in errors after implementation, and ability to address only a subset of potential medical errors.[60,61] Other examples of medical errors that currently elude decision-support programs include inappropriate selection of medication for the condition being treated and failure to recognize a change in patient status.

Patient-Safety Goals and Efforts

Current national patient-safety efforts are best described by the Joint Commission's national patient safety goals[6] and campaign initiatives by the Institute for Healthcare Improvement. The Joint Commission requires for all venues of patient care: verbal, written, and electronic communication of test results; information transfer at transitions of care (hand-offs); medication reconciliation; and ensurance of patient/family understanding of care plans.[5] The Joint Commission requires hospitals to reduce the risk of health care–associated infections such as multidrug-resistant organism infections, central line-associated bloodstream infections, and surgical-site infections and to improve recognition and response to changes in a patient's condition, for which many pediatric hospital rapid-response teams are using the Pediatric Early Warning System.[62] Family-centered care is of particular importance and value for children in high-risk settings such as the emergency department and for children with special needs.[63,64] Patients and families should be able to articulate care plans and demonstrate understanding of the anticipated treatment outcome. Stress and fatigue also have been associated with errors, and national efforts focused on reducing workplace stress for physician trainees and other staff are being promoted.[65–69] Diagnostic errors have been recognized as an important issue as well.[70] Medication management continues to be a specific focus for children because of variations in body weight, body surface area, organ system maturity, developmental stage of absorption and excretion ability, dependence on others for medication administration, and need for specially compounded formulations.[7] Accurate weight scales, standardized equipment throughout a system, drug dose-range limits, programmable "smart" infusion pumps for hospitals, and standardized order sets should be used.[52–56,71–73] Clinical pharmacists trained in pediatrics should be integrated into inpatient rounds and used for education of staff and families in all settings as often as possible.[42,73–75]

The AAP has launched webinars and Web sites and has partnered with other national leaders to offer specific tools, resources, and links to best health care safety practices for children[44,45,76–78] (Appendix 4). Collaborative implementation and measurement of both the process (adherence to practice) and clinical outcomes of shared strategies are necessary to track and refine care practices for all children.

RECOMMENDATIONS

Reducing pediatric patient harm attributable to medical care requires not only preventing errors but also identifying and reporting errors and adverse events, disseminating best practices, and cultivating a culture of safety. Many interventions to improve the culture of safety are available and are based on principles derived from the experience of other high-risk industries. These processes have been successful in reducing the incidence of catastrophic events, and their implementation in health care should be encouraged. The outcomes of these interventions should be rigorously measured with valid and reliable tools and monitored for their effectiveness in health care. Leadership is needed to continue to make and accelerate a transformation that acknowledges that providers (1) work in high-risk, complex environments, (2) are fallible, and therefore, medical errors do happen to children, (3) are independently and collectively accountable for patient safety, and (4) are integral to the success of systems change. Continuous system improvements are central to creating a culture of safety through reporting of errors and adverse events, being just and flexible, and learning and implementing change on the basis of experience and rigorous science.

The following are recommendations to ensure a comprehensive, accelerated approach toward pediatric patient safety:

1. Raise awareness and improve working knowledge of pediatric patient-safety issues and best practices throughout the pediatric community.
   a. Educate: Expand educational efforts to reach a broad scope of clinicians. Ensure that all clinicians can identify pediatric patient-safety issues in the med-

ical setting and describe what they can do to improve them both individually and within systems. Include patient-safety curricula for all child health trainees.

b. Network: Create standing patient-safety programming at national and regional meetings to encourage sharing of patient-safety issues and best practices among pediatric clinicians.

c. Create a safety culture: Challenge all organizations, including small practices, to adopt a plan that informs, supports, and educates on pediatric patient safety by using appropriate local examples. Strive to develop programs that support members to improve their safety culture in their clinical care settings.

d. Expand focus: Direct attention to ambulatory settings. The majority of work in patient safety to date has been in hospitals, yet the majority of children in this country interact primarily with the health care system in ambulatory settings. Develop patient-safety metrics for the ambulatory pediatric setting.

2. Act and advocate to minimize preventable pediatric medical harm by using information on pediatric-specific patient-safety risk.

   a. Develop pediatric-specific error-reporting: Develop and support broad-scale pediatric error-reporting systems and analysis of submitted events. Identify trends and areas in need of action by using these data to guide action on pediatric patient-safety risks.

   b. Foster leadership: Take individual responsibility for maintaining awareness of pediatric patient-safety issues. When possible, lead or participate in practice-based safety initiatives and quality or patient-safety committees in any setting, including ambulatory, hospital-based, community, or tertiary care centers. Spread the current hospital-based focus on patient safety to the ambulatory setting through designation of patient-safety officers for practices.

   c. Enhance family-centered care: Actively engage patients and families in safety at all points of care and address issues of ethnic culture, language, and literacy. Direct families to appropriate resources, and review patients' rights and responsibilities from the perspective of safety.

3. Improve health care outcomes for children by adhering to proven best practices for improving pediatric patient safety.

   a. Adhere to best practices: Disseminate and exercise proven patient-safety interventions such as vigilant hand-washing, time outs before procedures, and medication reconciliation, particularly in ambulatory settings and for children with special health care needs. Embed safety strategies, such as redundancy, forcing functions, bar-coding, standardized order sets, and office protocols (Appendix 2), whenever possible.

   b. Target drug safety: Focus efforts on medication safety by advocating for the development of effective and safe pediatric medications and formulations and for the withdrawal of medications with unfavorable risk/benefit ratios; developing, spreading, and advocating for pediatric-specific health care information technology for drug delivery; educating providers on methods to reduce medication errors; ensuring that providers maintain access to and proficiency in the use of a comprehensive and current pharmaceutical knowledge base; and creating policies that advocate for safe medication delivery to children in all health care settings.

   c. Redesign clinical systems: Instill safety-design concepts when renovating or creating medical care systems and processes. Focus on human-factor issues in patient safety and include pediatric-specific information technological advancements whenever possible (eg, when implementing bar-coding and CPOE systems).

   d. Support research: Expand research to identify and refine effective pediatric patient-safety interventions. Motivate national health care research-funding systems to include a mandatory pediatric patient-safety component.

CONCLUSIONS

The field of pediatric patient safety has matured much in recent years; there are now more robust epidemiology of errors for children, a deep understanding of the concept and measurement of a culture of safety, clear guidance on key elements of patient-safety solutions, and introduction of successful pediatric patient-safety solutions. Nonetheless, continued work is needed to infuse these data and concepts into everyday pediatric practice for all clinicians, and special attention should be paid to the training of new clinicians to ensure that the future workforce can exercise all the tenets of pediatric patient safety as part of their everyday work life. It is only through complete incorporation of the culture of safety, assumption of personal responsibility for patient care

outcomes, increasing examination of the risk areas for pediatric patient safety, and deployment and rigorous evaluation of systems enhancements that the risks of medical errors to children can be reduced further.

APPENDIX 2: GLOSSARY OF TERMINOLOGY

Adverse event: An injury that results from a medical intervention[1] or an event that results in unintended harm to the patient because of an act of commission or omission rather than the underlying disease or condition of the patient.[79]

Cause-and-effect diagram: A diagram that organizes potential causes into general categories, such as methods, materials, machines, and people, and illustrates the common relationships with quality characteristics.[80]

Checklist: "Algorithmic listing of actions to be performed in a given clinical setting . . . to ensure that, no matter how often performed by a given practitioner, no step will be forgotten."[81]

Clinical decision support: "Any system designed to improve clinical decision-making related to diagnostic or therapeutic processes of care. [Clinical decision-support systems] thus address activities ranging from the selection of drugs (eg, the optimal antibiotic choice given specific microbiologic data) or diagnostic tests to detailed support for optimal drug dosing and support for resolving diagnostic dilemmas."[81]

Control chart: A statistical tool used to distinguish variation in a process attributable to common causes and variation attributable to special causes.[80]

Error: Failure of a planned action to be completed as intended or use of a wrong plan to achieve an aim (the accumulation of errors results in accidents)[1] or the failure of a planned action to be completed as intended (ie, error of execution) and the use of a wrong plan to achieve an aim (ie, error of planning). Error also includes failure of an unplanned action that should have been completed (omission).[79]

Failure mode and effect analysis: "[A] methodological approach to analyzing potential problems, errors, and failures and evaluating the robustness of a product design" that "can be used to evaluate systems, product designs, processes, and services" and to identify "how a part, subsystem, or system might fail, as well as the impact of failure on safety and effectiveness. Thus, [failure mode and effect analysis] provides an opportunity to design a potential failure mode out of a product or process."[83]

Flowchart: A display of the various stages in a process in which different types of symbols are used to demonstrate the flow of product or service over time.[80]

Forcing function: "Constraints" designed into processes "that guide the user to the next appropriate action or decision."[1]

High-reliability organizations: Organizations such as "power grid dispatching centers, air traffic control systems, nuclear aircraft carriers, nuclear power generating plants, hospital emergency departments, wildland firefighting crews, aircraft operations, and accident investigation teams" that "operate under very trying conditions all the time and yet manage to have fewer than their fair share of accidents" have "a mindful infrastructure that continually does all of the following: tracks small failures; resists oversimplification; remains sensitive to operations; maintains capabilities for resilience; [and] takes advantage of shifting locations of expertise."[33]

Mistakes/slips: Mistakes are failures of planning, whereas slips are failures of execution.[1]

Pareto chart: A bar graph in which the "lengths of the bars represent frequency . . . and are arranged with longest bars on the left and the shortest to the right. In this way the chart visually depicts which situations are more significant."[84] Pareto charts are used to focus quality-improvement efforts on the basis of the "80/20" rule, which postulates that 80% of problems come from 20% of causes.

Process map: Same as a flowchart.

Root-cause analysis: A process for identifying the basic or causal factors that underlie variation in performance, including the occurrence or possible occurrence of a sentinel event. Typically, the analysis focuses primarily on systems and processes, not individual performance.[79]

Redundancy: Duplication of critical components of a system with the intention of increasing reliability of the system, usually in the case of a backup or fail-safe.

Run chart: Plot of data in time order.[80]

Smart infusion pumps: Intravenous pumps that contain a "brain" consisting of customized software that contains a drug library. This software transforms a conventional intravenous pump into a computer that alerts staff if an infusion is programmed outside of a particular medication's recommended parameters such as dose, dosing unit (eg, mg/kg per minute), rate, or concentration. Smart pumps log data about all such alerts, including the time, date, drug, concentration, programmed rate, and volume infused. In addition, smart pumps have free-flow protection, which includes safety features that are designed to prevent unintentional overdoses of medication or fluid.

Standardized order sets: Algorithmic listing of orders to be performed in a given clinical setting to ensure that, no

matter how often performed by a given practitioner, no step will be forgotten.

Trigger tool: Clinical data related to patient care indicating a reasonable probability that an adverse event has occurred or is occurring. An example of a trigger tool for an adverse drug event is a physician order for an antidote, a medication stop, or a dose decrease.[79,82]

APPENDIX 3: TOOLS, PROJECT GUIDES, AND CULTURE-OF-SAFETY INTERVENTIONS

AAP Tools and Project Guides

Chapter Quality-Improvement Resources

Many chapters, or leaders with quality-improvement knowledge, may not have the infrastructure or resources to implement quality-improvement activities. The following resources will help chapters and their partners move toward quality-improvement work and build chapter capacity to better support pediatric practices.

"A Resource Guide for Chapters, Building Local Capacity for Improvement" (based on the 4 principles of raising awareness, building knowledge, building infrastructure, and implementing improvements to improve the quality of care provided to children).

Measuring for quality improvement: the AAP policy statement "Principles for the Development and Use of Quality Measures" (AAP Steering Committee on Quality Improvement and Management and AAP Committee on Practice and Ambulatory Medicine).

Quality-improvement literature (evidence-based literature, reports, and other publications about the implementation science of quality improvement).

2007 chapter quality-improvement needs assessment (summary of needs-assessment findings and full report of needs-assessment findings).

"Who's Doing What?" A list of chapters involved in quality improvement (a list of quality-improvement activities in which chapters are involved).

Chapter quality-improvement champions and committee chairs (log in using AAP member ID and password to access a list of chapter quality-improvement champions and or quality-improvement committee chairs).

Chapter spotlight (the Chapter Quality Improvement Spotlight recognizes chapters that are making great strides in supporting their members in quality improvement and building infrastructure for quality-improvement work).

To access these resources, visit www.aap.org/member/chapters/caqi/index.html.

AAP Quality-Improvement Programs and Resources

Education in Quality Improvement in Pediatric Practice (EQIPP): EQIPP allows one to evaluate his or her practice online using tools that can be easily implemented to enhance patient care. The goal of eQIPP is to help physicians collect and analyze practice data over time to document improved quality of care. For more information, visit www.eqipp.org.

Quality Improvement Innovation Network (QuIIN): The QuIIN is a network of practicing pediatricians and their staff teams who use quality-improvement methods to test tools, interventions, and strategies to improve health care and outcomes for children and their families. The QuIIN serves as a practical working laboratory for pediatricians to test how improvements can be implemented in practice while sharing strategies and learning from colleagues who are members of the QuIIN. For more information, visit www.aap.org/qualityimprovement/quiin.

Medical home initiatives: The AAP's medical home Web site is the premier resource for improving the lives of children and youth with special health care needs and their families through a medical home. For more information, visit www.medicalhomeinfo.org.

Partnership for Policy Implementation (PPI): In June 2005, the AAP, with funding support from the federal Maternal and Child Health Bureau, launched the PPI, a pilot program to integrate health information technology functionalities into AAP policy. The goal of the PPI is to create fundamental paradigm shifts in the development of policy statements, clinical reports, technical reports, and clinical practice guidelines—specifically, how they are written. For more information, visit http://practice.aap.org/content.aspx?aid=2712 (log-in required).

Practice Management Online (PMO): The quality-improvement section of PMO provides pediatricians with theoretical and practical content as well as applicable tools that can be incorporated into the practice. Examples of topics included are quality-improvement basics, evidence-based medicine, improving and measuring quality in the pediatric practice, patient safety, and maintenance of certification for pediatricians. For more information, visit http://practice.aap.org.

Safer Health Care for Kids: This comprehensive Web-based resource center for pediatric safety information and strategies is designed for physicians, allied health professionals, administrators, parents, and caregivers who share a commitment to ensuring a safe health care environment for infants, children, adolescents, and young adults. For more information, visit www.aap.org/saferhealthcare.

AAP Steering Committee on Quality Improvement and Management (SCOQIM): The SCOQIM was established in 2001 in response to the increasing national emphasis on quality in health care and serves as the academy's integrated

voice for quality. The committee comprises pediatricians with expertise in quality improvement, health information technology, and evidence-based medicine. Committee priority areas include quality measurement, patient safety, evidence-based guideline development and implementation, open-access scheduling, and other innovative practice models. For more information, visit www.aap.org/visit/scoqim.htm.

APPENDIX 4: WEB LINKS TO OTHER ORGANIZATIONS WORKING ON PATIENT SAFETY TOOLS AND EDUCATION

1. Agency for Healthcare Research and Quality patient safety tools: www.ahrq.gov/qual/pips.
2. Alliance for Pediatric Quality: www.kidsquality.org.
3. Child Health Corporation of America: www.chca.com/index_flash.html.
4. Institute for Healthcare Improvement (IHI): www.ihi.org/ihi.
5. Institute for Healthcare Improvement Safety Webinars: www.ihi.org/IHI/Programs/AudioAndWebPrograms/WebandACTIONUsingtheIHIGlobalTriggerToolApril2009.htm.
6. Institute of Medicine: www.iom.edu/Global/Topics/Quality_Patient_Safety.aspx.
7. Institute for Safe Medication Practices: www.ismp.org/tools/abbreviations.
8. The Joint Commission: www.jointcommission.org/topics.patient_safety.aspx and www.jcrinc.com/jcr-quick-finder/.
9. National Association of Children's Hospitals and Related Institutions: www.childrenshospitals.net/AM/Template.cfm?Section=Homepage&Template=/customSource/homepage/homepage.cfm.
10. National Initiative for Child Health Quality: www.nichq.org.

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APPENDIX 1 IOM Key Safety-Design Concepts and Principles for the Design of Safety Systems in Health Care Organizations

	Examples/Components
Key safety-design concepts	
Make things visible so that the user can determine what actions are possible at any moment	Defibrillator dials should be clearly visible to the user on the front display
Simplify the structure of tasks to minimize the load on working memory, planning, or problem-solving	Concentrations for continuous-drip medications should be limited and standardized on the hospital formulary
Use affordances—characteristics of equipment or workspace that communicate how it is to be used	Oral syringes are designed to administer oral medications and cannot be connected to an intravenous line because of the bulbous tip, except with exceptional force
Use natural mappings—relationships between a control and its movement	Turning a medical instrument knob to the right should make the related dial needle point further to the right
Use constraints or "forcing functions" that guide the user to the next appropriate action or decision	CPOE systems can be programmed so that they do not allow the prescriber to proceed without the patient's weight and allergy history
Assume that errors will occur and design and plan for recovery by making it easy to reverse operations and hard to perform nonreversible ones	Machine-readable patient-identification systems, such as bar-coding, act as a final check to prevent harm in situations in which another patient's medication has been mistakenly retrieved to administer to the wrong patient
If applying the earlier strategies does not achieve the desired results, standardize actions, outcomes, layouts, and displays	Chemotherapy protocols and order sets should be standardized and preprinted or programmed into CPOE systems
Principles for the design of safety systems in health care organizations	
Provide leadership	Make patient safety a priority corporate objective
	Make patient safety everyone's responsibility
	Make clear assignments for and expectation of safety oversight
	Provide human and financial resources for error analysis and systems redesign
	Develop effective mechanisms for identifying and dealing with unsafe practitioners
Respect human limits in process design	Design jobs for safety
	Avoid reliance on memory
	Use constraints and forcing functions
	Avoid reliance on vigilance
	Simplify key processes
	Standardize work processes
Promote effective team functioning	Train in teams those who are expected to work in teams
	Include the patient (and/or family) in safety design and the process of care
Anticipate the unexpected	Adopt a proactive approach: examine processes of care for threats to safety and redesign them before accidents occur
	Design for recovery
	Improve access to accurate, timely information
Create a learning environment	Use simulations whenever possible
	Encourage reporting of errors and hazardous conditions
	Ensure no reprisals for reporting of errors
	Develop a working culture in which communication flows freely regardless of authority gradient
	Implement mechanisms of feedback and learning from error

Data source: Institute of Medicine. *To Err Is Human: Building a Safer Health System.* Washington, DC: National Academies Press; 2000.

ERRATA

Takata et al. Principles of Patient Safety: Reducing Harm Due to Medical Care. *Pediatrics.* 2011;127(6):1199–1210

An error occurred in the American Academy of Pediatrics policy statement "Principles of Patient Safety: Reducing Harm Due to Medical Care" published in the June 2011 issue of *Pediatrics* (2011;127[6]:1199-1210; doi:10.1542/2011-0967). Reference 82 (Takata GS et al, 2008) was incorrectly cited in the definition of Error on page 1205. It should have been cited in the definition of Trigger tool on page 1206, along with reference 79. We regret the error.

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Rabi et al. Room-Air Versus Oxygen Administration for Resuscitation of Preterm Infants: The ROAR Study. *Pediatrics.* 2011;128(2):e374–e381

An error occurred in this article by Rabi et al, titled "Room-Air Versus Oxygen Administration for Resuscitation of Preterm Infants: The ROAR Study" published in the August, 2011 issue of Pediatrics (2011; 128[2]: e374-e381; originally published online July 11, 2011; doi: 10.1542/2010-3130). On page e379, in the second paragraph under the heading Discussion, this reads: "In a recent study by Vento et al, preterm infants resuscitated with 90% oxygen needed fewer days of mechanical ventilation and oxygen supplementation compared with those resuscitated with 30% oxygen." This should have read: "In a recent study by Vento et al, preterm infants resuscitated with 30% oxygen needed fewer days of mechanical ventilation and oxygen supplementation compared with those resuscitated with 90% oxygen."

doi:10.1542/peds.2011-2853

American Academy of Pediatrics. Health Supervision for Children with Down Syndrome. *Pediatrics.* 2011;128(2):393–406

An error occurred in the American Academy of Pediatrics clinical report "Health Supervision for Children with Down Syndrome" published in the August 2011 issue of *Pediatrics* (2011;128[2]:393-406; originally published online July 25, 2011; doi10.1542/2011-1605). In Appendix 1 on page 406, the 24th row of the first column should read "If myelopathic signs or symptoms:" rather than "If myopathic signs or symptoms:". We regret the error.

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American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Probiotics and Prebiotics in Pediatrics

Dan W. Thomas, MD, Frank R. Greer, MD, and COMMITTEE ON NUTRITION; SECTION ON GASTROENTEROLOGY, HEPATOLOGY, AND NUTRITION

KEY WORDS
probiotics, prebiotics, pediatrics, supplements, nutrition

ABBREVIATIONS
LGG—*Lactobacillus rhamnosus* GG
FOS—fructo-oligosaccharide
IBD—inflammatory bowel disease
RCT—randomized controlled trial
CI—confidence interval
RR—relative risk
OR—odds ratio
NEC—necrotizing enterocolitis
CUC—chronic ulcerative colitis
IBS—irritable bowel syndrome
GOS—galacto-oligosaccharide
FDA—Food and Drug Administration

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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All clinical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

abstract

FREE

This clinical report reviews the currently known health benefits of probiotic and prebiotic products, including those added to commercially available infant formula and other food products for use in children. Probiotics are supplements or foods that contain viable microorganisms that cause alterations of the microflora of the host. Use of probiotics has been shown to be modestly effective in randomized clinical trials (RCTs) in (1) treating acute viral gastroenteritis in healthy children; and (2) preventing antibiotic-associated diarrhea in healthy children. There is some evidence that probiotics prevent necrotizing enterocolitis in very low birth weight infants (birth weight between 1000 and 1500 g), but more studies are needed. The results of RCTs in which probiotics were used to treat childhood *Helicobacter pylori* gastritis, irritable bowel syndrome, chronic ulcerative colitis, and infantile colic, as well as in preventing childhood atopy, although encouraging, are preliminary and require further confirmation. Probiotics have not been proven to be beneficial in treating or preventing human cancers or in treating children with Crohn disease. There are also safety concerns with the use of probiotics in infants and children who are immunocompromised, chronically debilitated, or seriously ill with indwelling medical devices.

Prebiotics are supplements or foods that contain a nondigestible food ingredient that selectively stimulates the favorable growth and/or activity of indigenous probiotic bacteria. Human milk contains substantial quantities of prebiotics. There is a paucity of RCTs examining prebiotics in children, although there may be some long-term benefit of prebiotics for the prevention of atopic eczema and common infections in healthy infants. Confirmatory well-designed clinical research studies are necessary. *Pediatrics* 2010;126:1217–1231

INTRODUCTION

Microbes are ubiquitous and are important factors in the overall health of humans as well as the Earth. Efforts to optimize the intestinal microbial milieu have increased the interest in adding probiotics and prebiotics to nutritional products. As with antibiotics, the use and efficacy of probiotics and prebiotics should be supported by evidenced-based medicine. The purpose of this clinical report is to review the medical uses of probiotics and prebiotics and to summarize what is currently known about their health benefits as dietary supplements added to food products marketed to children, including infant formula. The guidance in this report will help pediatric health care providers to make appropriate decisions regard-

ing the usefulness and benefit of probiotics and prebiotics for their patients.

DEFINITIONS

Probiotic: An oral supplement or a food product that contains a sufficient number of viable microorganisms to alter the microflora of the host and has the potential for beneficial health effects.[1–3]

Prebiotic: A nondigestible food ingredient that benefits the host by selectively stimulating the favorable growth and/or activity of 1 or more indigenous probiotic bacteria.[1–4]

Synbiotic: A product that contains both probiotics and prebiotics. Evidence for synergy of a specific prebiotic for a probiotic in the product is not essential. Synbiotics may be separate supplements or may exist in functional foods as food additives.[1–3]

Postbiotic: A metabolic byproduct generated by a probiotic microorganism that influences the host's biological functions.[5,6]

Functional food: Any modified food or food ingredient that provides a health benefit beyond that ascribed to any specific nutrient/nutrients it contains. It must remain a food, and it must demonstrate its effect in amounts normally expected to be consumed in the diet. Benefits may include functions relevant to improving health and well-being and/or reduction of risk of disease. Any food that contains probiotics or prebiotics is a functional food. An example of a functional food is live-culture yogurt that contains probiotic bacteria, prebiotics, and other dietary nutrients. Human milk may also be considered a functional food; it contains substantial amounts of oligosaccharides (prebiotics) and may contain some naturally occurring probiotic bacteria (10^3 of bifidobacteria per mL of expressed human milk, as reported in 1 study).[7]

WHAT ARE PROBIOTICS?

Probiotic microorganisms are typically members of the genera *Lactobacillus*, *Bifidobacterium*, and *Streptococcus*.[1–3,8–14] These bacteria are fermentive, obligatory, or facultative anaerobic organisms, which are typically nonmotile and of varying shapes. They typically produce lactic acid. Their inherent biological features enable them to predominate and prevail over potential pathogenic microorganisms in the human digestive tract. It is currently hypothesized that these microbes generate small molecular metabolic byproducts that exert beneficial regulatory influence on host biological functions, including short-chain fatty acids such as butyrate. These metabolic byproducts are sometimes referred to as "postbiotics" and may function biologically as immune modulators.[5,6,15] The most studied probiotic bacteria to date include *Lactobacillus rhamnosus* GG (LGG), *Bifidobacterium lactis*, and *Streptococcus thermophilus*. These probiotic bacteria are biologically different from the Gram-negative, motile, non–lactic-acid–producing bacteria such as *Klebsiella*, *Pseudomonas*, *Serratia*, and *Proteus* species, which also may be prominent flora in the human digestive system. These potentially harmful bacteria may translocate across the intestinal epithelium and could result in disease in humans.[16,17] Some yeasts and yeast byproducts have also been studied and have been frequently used as probiotic agents, such as the yeast *Saccharomyces boulardii*. Probiotic bacteria can be delivered and ingested separately as medicinals or supplements. They can also be mixed with, added to, or naturally exist in functional foods.

WHAT ARE PREBIOTICS?

Prebiotics are usually in the form of oligosaccharides, which may occur naturally but can also be added as dietary supplements to foods, beverages, and infant formula.[4] Although indigestible by humans, their presence in the digestive system selectively enhances proliferation of certain probiotic bacteria in the colon, especially *Bifidobacteria* species. Prebiotic oligosaccharides often contain fructose chains with a terminal glucose and typically consist of 10 or fewer sugar molecules. Examples of prebiotic oligosaccharides include fructo-oligosaccharides (FOSs), inulin, galacto-oligosaccharides (GOSs), and soybean oligosaccharides. Inulin is a composite oligosaccharide that contains several FOS molecules. The complex polysaccharides that constitute dietary fiber can also be considered to be prebiotic agents.

Although dietary nucleotides do not fit the exact definition of a prebiotic, they are prebiotic-like agents and have immunomodulating and direct intestinal biological properties.[18] Some infant formulas contain a limited amount of added free nucleotides (7–20 mg/dL).[18] Human milk, on the other hand, contains a substantial but variable amount of oligosaccharides (14 g/L) as well as free nucleotides (up to 20% of nonprotein nitrogen).[19] Some infant-formula manufacturers now add prebiotic oligosaccharides to their products.

Beverages and nutritional supplements marketed for older infants, children, and adults contain oligosaccharides and nucleotide additives in varying amounts.

INTESTINAL BACTERIAL COLONIZATION AND DEVELOPMENT OF THE INTESTINAL MUCOSAL DEFENSE SYSTEM

Similar to the fetus, an infant at the time of birth has a sterile gastrointestinal tract, but bacterial colonization occurs rapidly.[20–22] The newborn in-

fant's gestational age, mode of delivery, and diet seem to have significant effects on this process. Neonates who are born by Caesarian delivery, born preterm, and/or exposed to perinatal or postnatal antibiotics have a delay in intestinal commensal probiotic bacterial colonization. When delivered vaginally, breastfed infants and formula-fed infants have a similar pattern of bacterial colonization at 48 hours of age. However, by 7 days of age, approximately two-thirds of formula-fed infants have a predominance of *Bacteroides fragilis*, compared with only 22% of breastfed infants.[20]

Toward the end of the first month of life in developing countries, breastfed infants are found to have *Bifidobacteria*-predominant colonization, whereas formula-fed infants have equal colonization with *Bacteroides* and *Bifidobacteria* species. In resource-rich countries, however, differences are less pronounced between breastfed and formula-fed infants.[15]

The composition of intestinal microflora does not change significantly after infancy. Therefore, the composition of fecal flora in older children and adults is less variable and not as dependent on diet. In fact, beyond infancy, bacterial concentrations in the colon are typically 10^{12} colony-forming units per mL of intestinal contents (10-fold the total number of human cells in the human body), and anaerobic bacteria far outnumber aerobic coliforms.[23] Typically, 500 different bacterial species contribute to an adult's colonic microflora, but 99% of the microflora are accounted for by 30 to 40 species.[23] The descriptive terms of "microbiota" and "microbiome" are newer terms that are replacing such terms as "microflora" in an attempt by researchers in the field to better define one's microbial environment.[24] "Microbiota" refers to a population of microscopic organisms that inhabit a bodily organ or portion of a person's body, and human "microbiome" refers to the unique entire population of microorganisms and their complete genetic elements that inhabit one's body.

The intestinal mucosal defense system is an integral part of a sophisticated immunoregulatory network that includes the intestinal microflora.[21,25–30] Recognition of self- and non–self-antigens begins early in life, perhaps even in utero, and is significantly influenced by events that occur within the digestive system soon after birth. The immunoresponsiveness of the digestive system is significantly affected by the young infant's diet, state of bacterial colonization, and early exposure to potential infectious pathogens and antibiotics as well as the infant's genotype. It is thought that the occurrence of many diseases, both intestinal and nonintestinal, can be related to dysregulation or interference with the early development of the intestinal mucosal defense system.[28,29] Examples of these diseases include those thought to be atopic (asthma, eczema, and allergic rhinitis) or autoimmune (multiple sclerosis, type 1 diabetes mellitus, and chronic inflammatory bowel disease [IBD]).[28] Certainly, the overriding determining factor in development of the immune system is one's genetic predisposition.[25]

The molecular basis for innate and acquired immunity is thought to reside in the recognition and response of mature T lymphocytes to trigger molecules, such as those derived from dietary and bacterial-breakdown products within the intestinal tract.[29] Trigger molecules also include dietary nucleotides and oligosaccharides. Toll-like receptors located in the surface membrane of T lymphocytes facilitate recognition of these trigger molecules, which eventually leads to specialized T-lymphocyte recognition and response to subsequent exposure to the same or very similar molecules. Thus, T-lymphocyte recognition of specific oligosaccharides bound to intestinal pathogens plays an important role in preventing gastrointestinal illness.

Given these important influences on intestinal microflora colonization and immune function, the infant's early diet and intestinal microbial environment are thought to serve as pivotal factors in overall health. Probiotic bacteria, postbiotic bacterial byproducts, and dietary prebiotics are believed to exert positive effects on the development of the mucosal immune system. It is also believed that exposure to "nonbeneficial" microorganisms and antimicrobial agents in the newborn period may result in immune dysregulation in susceptible individuals and may lead to some chronic disease states. There is evidence that human milk contains mononuclear cells that traffic intestinally derived bacterial components from the mother to her infant. The ingested human milk containing the bacterial components derived from the mother are thought to influence her young infant's developing immune system. This process is termed "bacterial imprinting," and its overall biological effect requires further study.[31]

USE OF PROBIOTICS IN PREVENTION AND TREATMENT OF CLINICAL DISEASES

Reviews on the clinical applications of probiotics and prebiotics can be found in the references.[4,8–14] Results of evidence-based analyses of the clinical effectiveness of probiotics and prebiotics are discussed below. It must be stressed that the current lack of evidence of efficacy does not mean that future clinical research will not establish significant health benefits for probiotics and prebiotics.

Acute Infectious Diarrhea

Prevention of Acute Infectious Diarrhea

Results of published randomized controlled trials (RCTs) have indicated that there is modest benefit of giving probiotics in preventing acute gastrointestinal tract infections in healthy infants and children.[32–35] Most of the studies were conducted in child care centers. The strains of probiotics used included LGG, *S thermophilus*, *Lactobacillus casei*, *B lactis*, or *Lactobacillus reuteri* mixed with milk or infant formula or given as an oral supplement. Rotavirus was the most common cause of acute diarrhea in the RCTs.

In a double-blind, placebo-controlled trial by Weizman et al,[36] 201 infants (4–10 months of age) received either a probiotic-supplemented formula containing either *B lactis* or *L reuteri* or a control formula without an added probiotic over a 12-week study period. The study was conducted at 14 different child care centers over a 2-year period. Infants fed a probiotic-supplemented formula had fewer and shorter episodes of diarrhea than did infants in the control group. Infants in the control group had a mean of 0.59 days of diarrhea (95% confidence interval [CI]: 0.34–0.84 days) per infant compared with 0.37 days (95% CI: 0.08–0.66 days) in the *B lactis* and 0.15 days (95% CI: 0.12–0.18 days) in the *L reuteri* probiotic-supplemented study groups ($P < .001$). During the 12-week study period, the infants in the control group were found to have a mean of 0.31 episodes of diarrhea (95% CI: 0.22–0.44 episodes) compared with 0.12 episodes (95% CI: 0.05–0.21 episodes) and 0.02 episodes (95% CI: 0.01–0.05 episodes) in the *B lactis*– and *L reuteri*–supplemented study groups, respectively ($P < .001$). There was no significant effect found on the incidence of acute respiratory illnesses. In another study conducted in child care centers in France,[37] 928 healthy children were randomly assigned to be fed either standard yogurt or yogurt supplemented with *L casei* for 4 months. The children who were fed the probiotic-supplemented yogurt had fewer episodes of diarrhea during the study period than did those who were fed standard yogurt (15.9% vs 22%; $P = .03$).

The results of a meta-analysis of probiotic prevention of acute rotavirus gastroenteritis in child care centers indicated that approximately 7 children would need to have been given LGG to prevent 1 child from developing nosocomial rotavirus gastroenteritis in a child care center setting.[38] To date, the available data do not support routine use of probiotics to prevent nosocomial rotavirus diarrhea in child care centers. However, there may be special circumstances in which probiotic use in children in long-term health care facilities or in child care centers is beneficial. The use of the newly available pentavalent rotavirus vaccine in the United States[39] will likely be a more formidable preventative agent than the use of probiotics in reducing the incidence of the most common form of acute infantile infectious diarrhea.

Treatment of Acute Infectious Diarrhea

Well-conducted RCTs in healthy children in developed countries have provided good data on the therapeutic benefit of probiotics in children with acute infectious diarrhea. In a randomized, double-blind, placebo-controlled trial by Szymanski et al,[40] administration of LGG significantly shortened the duration of acute rotavirus diarrhea by a mean of 40 hours, but duration of diarrhea of any other etiology was not affected. Probiotic administration also shortened the time necessary for intravenous rehydration by a mean of 18 hours. Results of several other meta-analyses[41–43] and a Cochrane review[44] have been published on the benefit of probiotics for treatment of acute infectious diarrhea in children. These reports indicate that probiotics reduce the number of diarrheal stools and the duration of the diarrhea by approximately 1 day. The benefit is strain-dependent. LGG is the most effective probiotic reported to date and is dose-dependent for doses greater than 10^{10} colony-forming units. Probiotics also seem to be more effective when given early in the course of diarrhea and are most helpful for otherwise healthy infants and young children with watery diarrhea secondary to viral gastroenteritis but not invasive bacterial infections. Thus, there is evidence to support the use of probiotics, specifically LGG, early in the course of acute infectious diarrhea to reduce the duration by 1 day.

Antibiotic-Associated Diarrhea

Prevention of Antibiotic-Associated Diarrhea

Meta-analysis of published results of RCTs of probiotic use in the prevention of antibiotic-associated diarrhea in children indicates a beneficial effect.[45–48] Treatment with a probiotic was started when antibiotic therapy was initiated for treatment of an acute respiratory infection (otitis media) in most of these studies. Treatment with probiotics compared with placebo reduced the risk of developing antibiotic-associated diarrhea from 28.5% to 11.9% (relative risk [RR]: 0.44 [95% CI: 0.25–77]; $P = .006$).[45] LGG, *B lactis*, *S thermophilus*, and *S boulardii* have been the most common agents used in RCTs. Approximately 1 in 7 cases of antibiotic-associated diarrhea was prevented by the use of a probiotic.[45] Children in these studies received either a probiotic-supplemented formula or a separate

probiotic as preventive treatment. According to 1 reported meta-analysis, probiotic treatment significantly reduced odds of antibiotic-associated diarrhea as compared with placebo (odds ratio [OR]: 0.39 [95% CI: 0.25–0.62]; $P < .001$) for both the yeast byproduct *S boulardii* and LGG. There was no significant difference between the 2 treatments; the overall combined OR was 0.37 (95% CI: 0.26–0.53; $P < .001$) in favor of active probiotic treatment over placebo.[48] Thus, probiotics can be used to reduce the incidence of antibiotic-associated diarrhea.

Treatment of Antibiotic-Associated Diarrhea

There have been no published RCTs of children that have investigated the effect of probiotics for treatment of antibiotic-associated diarrhea. Thus, their use cannot be recommended. The clinician who is caring for a child with antibiotic-induced diarrhea must weigh the benefits of considering therapy with a probiotic or discontinuing or modifying the antibiotic treatment when possible. No RCTs have been published concerning treatment with probiotics of children with *Clostridium difficile* antibiotic-associated diarrhea.

Atopic Diseases

Prevention of Atopic Disease

As previously mentioned, the sequence of bacterial intestinal colonization of neonates and young infants is probably important in the development of the immune response.[21] Recognition by the immune system of self and nonself, as well as the type of inflammatory responses generated later in life, are likely affected by the infant's diet and acquisition of the commensal intestinal bacterial population superimposed on genetic predisposition. During pregnancy, the cytokine inflammatory-response profile of the fetus is diverted away from cell-mediated immunity (T-helper 1 [Th1] type) toward humoral immunity (Th2 type). Hence, the Th2 type typically is the general immune response in early infancy. The risk of allergic disease could well be the result of a lack or delay in the eventual shift of the predominant Th2 type of response to more of a balance between Th1- and Th2-type responses.[49] Administration of probiotic bacteria during a time period in which a natural population of lactic-acid–producing indigenous intestinal bacteria is developing could theoretically influence immune development toward more balance of Th1 and Th2 inflammatory responses.[50] The intestinal bacterial flora of atopic children has been demonstrated to differ from that of nonatopic children. Specifically, atopic children have more *Clostridium* organisms and fewer *Bifidobacterium* organisms than do nonatopic study subjects,[15,51] which has served as the rationale for the administration of probiotics to infants at risk of atopic diseases, particularly for those who are formula fed.

In a double-blinded RCT, LGG or a placebo was given initially to 159 women during the final 4 weeks of pregnancy. If the infant was at high risk of atopic disease (atopic eczema, allergic rhinitis, or asthma), the treatment was continued for 6 months after birth in both the lactating woman and her infant.[52] A total of 132 mother-infant pairs were randomly assigned to receive either placebo or LGG and treated for 6 months while breastfeeding. The primary study end point was chronic recurrent atopic eczema in the infant. Atopic eczema was diagnosed in 46 of 132 (35%) of these study children by 2 years of age. The frequency of atopic eczema in the LGG-treated group was 15 of 64 (23%) versus 31 of 68 (46%) in the placebo group (RR: 0.51 [95% CI: 0.32–0.84]; $P < .01$). The number of mother-infant pairs required to be treated with LGG to prevent 1 case of chronic recurrent atopic eczema was 4.5. By 4 years of age, eczema occurred in 26% of the infants in the group treated with LGG, compared with 46% in the placebo group (RR: 0.57 [95% CI: 0.33–0.97]; $P < .01$). However, only 67% of the original study group was analyzed at the 4-year follow-up. These results support a preventive effect for giving a probiotic to mothers late in pregnancy and to both mothers and infants during the first 6 months of lactation for the prevention of atopic eczema in infants who are at risk of atopic disease. However, these results have not been confirmed in subsequent clinical trials, as summarized in a recent review by Kopp and Salfeld.[53] Conversely, Taylor et al[54] found that probiotic supplementation did not reduce the risk of atopic dermatitis in children at high risk with the report of some increased risk of subsequent allergen sensitization. As concluded in a review by Prescott and Björkstén[55] and in a 2007 Cochrane review,[56] despite the encouraging results of some studies, there is insufficient evidence to warrant the routine supplementation of probiotics to either pregnant women or infants to prevent allergic diseases in childhood. Explanations for varied study results include host factors such as genetic susceptibility, environmental factors such as geographic region and diet, and study variables including probiotic strains and doses used.[55,57]

Treatment of Atopic Disease

In an RCT, 53 Australian infants with moderate-to-severe atopic dermatitis were given either *Lactobacillus fermentum* or placebo for 8 weeks. At final assessment at 16 weeks, significantly more children who received the probiotic had improved extent and severity of atopic dermatitis as measured by the Severity of Scoring of

Atopic Dermatitis (SCORAD) index over time compared with those who received placebo ($P = .01$).[58,59] These results are encouraging, but as summarized in a 2008 Cochrane review,[60] probiotics have not yet been proven to be effective in the treatment of eczema.

Prevention of Necrotizing Enterocolitis in Low Birth Weight Neonates

A newborn's gut is sterile at birth, with bacterial colonization beginning shortly after birth.[20–22] Preterm infants frequently have delayed and aberrant acquisition of the "normal" digestive microflora, possibly because of restricted enteral feedings and frequent use of antibiotic therapy.[61,62] Delayed enteral feeding, frequent use of antibiotic therapy, and altered acquisition of normal digestive microflora are believed to be primary contributing factors for the increased risk of necrotizing enterocolitis (NEC) in preterm infants[63,64] and is the rationale for probiotic supplements.

In a 2008 Cochrane review[65] based on 9 RCTs,[66–74] enteral probiotic supplementation significantly reduced both the incidence of NEC (stage II or more) (RR: 0.32 [95% CI: 0.17–0.60]) and mortality (RR: 0.43 [95% CI: 0.25–0.75]).[65] Nosocomial sepsis was not reduced significantly (RR: 0.93 [95% CI: 0.73–1.19]). A total of 1425 infants who were born at less than 37 weeks' gestational age and/or less than 2500 g birth weight were included in this meta-analysis. No systemic infections or serious adverse events that were directly attributed to the administered probiotic organism were reported for these RCTs. The authors concluded that the results of their analysis supported a change in clinical practice to supplement preterm infants who weighed more than 1000 g at birth with a probiotic. Data regarding the outcome of preterm extremely low birth weight infants who weighed less than 1000 g at birth could not be used by the authors to reliably estimate the efficacy and safety of probiotic supplementation to this high-risk group. A large RCT was recommended to investigate the potential benefit and safety of probiotic supplementation to extremely low birth weight infants.

However, because the of large heterogeneity of the studies included in the Cochrane review,[65] caution is urged in interpreting the results, which are somewhat problematic. The studies all used different probiotics, including LGG, *Bifidobacterium breve*, *Saccharomyces* species, and mixtures of *Bacteroides bifidus*, *S thermophilus*, *Lactobacillus acidophilus*, *and Bifidobacterium infantis*. Doses of individual probiotics varied and were administered with human milk feedings, formula feedings, or both human milk and formula feedings in some studies. Not all of the studies had the same end points, including the primary outcome of NEC. A second and larger study by Lin et al,[75] the results of which were published after the Cochrane review, repeated the 2005 study[71] by using a different mixture of probiotics: *L acidophilus* and *B bifidus*. The overall incidence of NEC and death was less in the second study[75] compared with that in the first[71] in the controls, and the second study revealed that probiotics did not reduce the incidence of sepsis compared with that in the first, and the intervention group actually had a higher incidence of sepsis. The number needed to treat to prevent 1 case of NEC was 27 in the first study by Lin et al[71] and 21 in the second study.[75] Another point that makes the data problematic is that the combinations of probiotics used in the Lin et al studies, which are the most convincing for NEC prevention, are not available in the United States. Not all probiotics have been studied; therefore, all probiotics cannot be generally recommended.

Treatment of Helicobacter pylori *Infection*

There is a modest and encouraging benefit in published RCT results for probiotics used as adjunctive therapy for *H pylori* gastritis in adults.[76] One RCT in children has been published,[77] and the results demonstrated that the probiotics-supplemented treatment group had better *H pylori* eradication than did the placebo group (84.6% vs 57.5%; RR: 1.47 [95% CI: 1.1–2.0]). The adverse effects of diarrhea, nausea, and vomiting in both the placebo and probiotic treatment group did not differ significantly. Thus, probiotics may be of some benefit in the eradication of *H pylori* in children, but more studies are required.

Chronic IBD

The term IBD is inclusive of patients with either chronic ulcerative colitis (CUC) or Crohn disease. It is estimated that approximately 40% to 70% of children and adult patients suffering with IBD routinely use alternative medicines, including probiotics, as adjunctive or replacement therapy for prescribed medications.[78–80] In theory, probiotics may be beneficial in the treatment of IBD.[21] It has been proposed that in individuals with genetic susceptibility to IBD, chronic inflammation occurs in response to commensal digestive microflora because of various inherited defects of innate inflammatory-response pathways. One such identified inherited defect found in patients with Crohn disease is a mutation of the *CARD15* gene on chromosome 16, which results in abnormal chronic inflammation in response to bacteria such as *Escherichia coli* in the digestive tract.[21] Hence, modulating the commensal intestinal bacterial environment with probiotic supplements

may reduce the inflammatory response in patients with IBD.[80]

Treatment of Chronic Ulcerative Colitis

Data from RCTs of probiotics for the treatment of adults with CUC are encouraging.[81–84] The administration of probiotics to adults with mild-to-moderate CUC disease activity has comparable efficacy when compared with treatment with anti-inflammatory drugs used to treat CUC, such as mesalamine, as reported in a recently published Cochrane review.[85] The same is true in adult patients with ileoanal pouchitis after colectomy surgery for CUC. Most of these studies use the probiotic mixture VSL#3 (Sigma-Tau Pharmaceuticals, Gaithersburg, MD), which is a combination of *S thermophilus*, *Bifidobacterium* species, and *Lactobacillus* species. The probiotic *E coli* Nissle 1917 (Ardeypharm GmbH, Herdacke, Germany) has also been used successfully to treat mild-to-moderate pouchitis or CUC in adults.[86] One RCT in which 29 children with newly diagnosed CUC were randomly assigned to receive either VSL#3 or a placebo for 1 year had promising results.[87] All study patients were also given standard corticosteroid induction therapy combined with mesalamine maintenance therapy. Remission occurred in 13 patients (92.8%) in the VSL#3 group and 4 patients (36.4%) in the placebo group ($P < .001$). Relapse occurred in 3 of 13 (23%) patients in the VSL#3 group versus 11 of 15 (73.3%) in the placebo group within the 1-year study period (RR: 0.32 [95% CI: 0.25–0.773]; $P = .014$). Although these results are promising, more studies are needed in larger numbers of children to substantiate the benefit of probiotics in managing children with mild-to-moderate CUC. Thus, probiotics for CUC cannot be generally recommended at this time without further confirmatory research.

Treatment of Crohn Disease

One RCT in which LGG was used in pediatric patients with Crohn disease resulted in no significant benefit.[88] Treating adults with Crohn disease with the probiotics *S boulardii,* LGG, and *E coli* Nissle 1917 has not yielded promising results thus far.[89–92] A recent Cochrane review indicated that there is, as yet, no proven benefit for maintaining remission by administering probiotics to adults with Crohn disease.[93] Because of the lack of efficacy, treatment of Crohn disease with probiotics cannot be recommended for children.

Irritable Bowel Syndrome and Constipation: Treatment

There has been a single published RCT of the treatment of irritable bowel syndrome (IBS) in children.[94] LGG reduced abdominal distension and discomfort in a group of 50 pediatric patients over a 6-week study period. Response to therapy was recorded and collected on a weekly basis by using the Digestive Symptom Rating Scale. Various probiotics were shown to be helpful in several other RCTs of treatment of IBS in adults.[95–97] One published RCT addressed the use of probiotics (LGG) or a placebo as adjunct therapy to a stool softener (lactulose) to treat functional constipation in 84 children.[98] LGG was not an effective adjunct to lactulose in treating constipation in children. Thus, probiotics may be of benefit in children with IBS on the basis of a single RCT, but a recommendation for them use cannot be made without further confirmatory studies. Probiotics cannot be recommended at this time for treatment of constipation.

Infantile Colic

Prevention of Colic

To date, no RCTs have been conducted with colic as a primary end point.

Treatment of Colic

Colic is a common condition that typically affects infants in the first 4 months of life. The primary mechanism remains unknown. Available evidence suggests that colic potentially has a number of independent causes, including dietary protein hypersensitivity.[99,100] A recent unblinded RCT examined the effect of the administration of *L reuteri* versus simethicone in the treatment of colic in 90 exclusively breastfed infants in Italy.[100] The administration of *L reuteri* improved the symptoms of colic (minutes of crying per day) within 1 week of treatment, compared with simethicone therapy. The breastfeeding mothers were instructed to eliminate dairy products from their diets during the study period to minimize potentially confounding adverse effects of dietary protein hypersensitivity. The authors of the study proposed several theories for a positive therapeutic benefit, including probiotic modulation of proinflammatory responses. Further confirmatory RCTs are required to recommend routine use of probiotics in the treatment of infantile colic in both breastfed and formula-fed infants. On the basis of limited information, probiotics may be of benefit in treatment of colic in exclusively breastfed infants, but more studies are needed before they can be recommended.

Extraintestinal Infections

Prevention of Extraintestinal Infections

In a 2001 RCT in 17 Finnish child care centers, 571 healthy children 1 to 6 years of age were studied for 7 months in winter.[33] Children were randomly assigned to receive milk 3 times per day with or without LGG. When the data were adjusted for age, children who were fed milk with LGG, compared with controls, did not have significantly fewer days with respiratory symptoms

or fewer days of child care absences because of illness. There were also no significant differences in the numbers of children with a doctor's diagnosis of infection or number of prescriptions for antibiotics when adjusted for age, although the trends favored the children who were fed milk with LGG. Thus, probiotics for the prevention of extraintestinal infections in children cannot be recommended at this time.

Treatment of Extraintestinal Infections

No RCTs in children have demonstrated definite beneficial effects of administering probiotics to treat extraintestinal infections. The beneficial effects that have been reported in uncontrolled trials in adults with 1 or more types of extraintestinal infection have typically used LGG as a supplement or probiotics added to dairy products.[101–103] Thus, probiotics are not recommended for children for treatment of extraintestinal infections.

Cancer: Prevention and Treatment

Results of published studies have demonstrated the positive benefits of functional foods, such as yogurt, and the administration of probiotics to prevent carcinogenic processes in animal models.[104] As yet, no published RCTs warrant recommendation of routine administration of probiotics to either treat or prevent cancer in adults or children.

USE OF PREBIOTICS IN PREVENTION AND TREATMENT OF CLINICAL DISEASES

Few RCTs have been conducted to evaluate the use of prebiotics in preventing or treating specific childhood diseases.[8]

Prevention and Treatment of Allergy

A 2007 Cochrane review[105] concluded that there was inconclusive evidence for giving prebiotics to prevent allergic disorders in infants. However, in 2008, Arslanoglu et al[106] reported on a 2-year follow-up of an RCT in 132 infants at risk of atopy because of parental atopy. Infants were fed a partially hydrolyzed formula with either an added mixture of FOS and GOS or maltodextrin placebo in the first 6 months of life. Those given the prebiotic mixture of FOS and GOS had a reduced incidence of atopic disease. Cumulative incidences of atopic eczema, recurrent wheezing, and allergic urticaria were higher in the maltodextrin placebo group (27.9%, 20.6%, and 10.3%, respectively) than in the intervention group (13.6%, 7.6%, and 1.5%) ($P = .05$). In a 2009 review, van der Aa et al[107] analyzed relevant publications to date and concluded that there is presently not enough evidence to support the use of probiotics, prebiotics, or synbiotics for the prevention or treatment of allergic dermatitis in children. Confirmatory studies of the benefits of prebiotics, especially for children fed formula that is not partially hydrolyzed or infants fed partially hydrolyzed formula, which are already being promoted to reduce the incidence of atopic disease, are needed before any recommendations can be made for the use of prebiotics in infants and toddlers to prevent infection or atopic disease.

Other Disorders

It has been shown that the addition of dietary fiber has ameliorated diarrheal stools when added to infant formula.[108] Prebiotics, such as oligosaccharides, inulin, and dietary fiber supplements that are contained in bran, psyllium, and barley fiber, are beneficial in maintaining clinical remission in adult patients with CUC,[109] but no RCT results support their use. There have been controlled animal research studies that have shown that prebiotics may prevent or lessen carcinogenic processes,[104] but there have been no RCTs in humans.

COMBINED PREBIOTICS AND PROBIOTICS TO PREVENT ALLERGY

Clinical benefit in preventing allergic diseases by co-therapy with probiotics and prebiotics in pregnant women and their infants was demonstrated in an RCT in Finland.[110] A total of 1223 pregnant women who had been identified to deliver infants who would be at high risk of atopic disease because of parental atopic disease history were randomly assigned to be given a mixture of 4 probiotic strains plus GOS or placebo daily for 2 to 4 weeks before delivery. After delivery, their infants then either received the same probiotic mixture plus GOS or the same placebo as the mother. Probiotic/prebiotic treatment showed no effect on the cumulative occurrence of allergic diseases but tended to reduce immunoglobulin E–associated (atopic) diseases (OR: 0.71 [95% CI: 0.50–1.00]; $P = .052$). Probiotic and prebiotic treatment reduced the occurrence of eczema (OR: 0.74 [95% CI: 0.55–0.98]; $P = .035$) and atopic eczema (OR: 0.66 [95% CI: 0.46–0.95]; $P = .025$). Confirmatory studies are necessary.

PREBIOTICS AND PROBIOTICS IN INFANT FORMULA

Prebiotics

As mentioned earlier in this review, human milk contains a number of substances that are prebiotic, the most plentiful of which are oligosaccharides.[19,30] Oligosaccharide prebiotics are also added to many commercially available dietary food supplements. Regarding their addition to infant formula, the European Commission's Scientific Committee on Food concluded in 2003[111] that they had no major concerns regarding the addition of oligosaccharides to infant formulas, including follow-up infant formulas (formulas modified especially for 6- to 12-month-old infants), up to a total

concentration of 0.8 g/dL in ready-to-feed formula products.

Few RCTs have examined the effects of adding prebiotic oligosaccharides to infant formula.[106,112,113] Boehm et al[113] studied the effect of the addition of oligosaccharides at a concentration of 1 g/dL to preterm infant formula for 1 month (90% GOSs and 10% FOSs). Stool bifidobacteria counts in the oligosaccharide-supplemented group increased significantly compared with the nonsupplemented group, and the bifidobacteria counts reached the range of a breastfed reference group. In a separate study, Moro et al[114] fed term infants the same oligosaccharide-supplemented formula. These infants had higher counts of bifidobacteria as well as lactobacilli in their stools. Schmelzle et al[115] conducted a multicenter trial that also examined the efficacy of the addition of prebiotics to infant formula. They reported good overall tolerance and no adverse effects during the 12-week study period. A large multicenter trial to evaluate the safety of FOS-supplemented infant formula was conducted in the United States in 2004.[116] The study demonstrated that infant growth was maintained during the 12-week study period for the FOS-supplemented infant-formula group without any adverse effects. After weaning infants from formula, the addition of prebiotics to solid food seems to have a bifidogenic effect, as shown by the results of a recently published RCT by Scholtens et al.[117] Infant formulas that contain either GOS or FOS are now marketed in the United States. However, more information, including data from RCTs, is needed before the efficacy of adding prebiotics to infant formulas can be determined.

Probiotics

Two infant formulas currently contain a probiotic. One contains *B lactis*, and the other contains LGG. These probiotics are only added to powdered formulas at present. The rationale for adding probiotic organisms to infant formula was discussed in the introduction of this clinical report. The overall health-benefit efficacy of adding probiotics to infant formula remains to be demonstrated in large RCTs.

SAFETY OF PROBIOTICS AND PREBIOTICS IN INFANTS AND CHILDREN

Concerns exist about the overall safety of administering probiotic products to high-risk patient groups, including adults, children, and term and preterm infants. Cases of serious infection have occurred and been reported in the literature.[10,118–125] Patients at risk would be those who are immunocompromised, including ill preterm neonates, and/or children who have intravenous catheters or other indwelling medical devices. In most cases, the offending organism that caused the sepsis seems to have stemmed from bacteria from the individual's own endogenous flora. Sepsis has also been reported in adults, children, and infants who received probiotic supplements.[118,124–126] Land et al[126] recently reported LGG probiotic sepsis occurring in immunocompromised infants and children. A medically fragile infant 6 weeks of age became septic with a strain of LGG that was being provided as a supplement. Molecular DNA-fingerprinting confirmed that the LGG probiotic supplement was the bacterial isolate from the infant. Neonatal sepsis and meningitis that were apparently associated with the administration of a probiotic supplement were also reported.[118,120]

A recent report focused on probiotic tolerance and safety in healthy term infants who were randomly assigned to be given a high-dose probiotic formula, a low-dose probiotic formula, or control formula for 18 months.[35] There were no apparent reported adverse events. All infants demonstrated normal growth. Reports of colic were significantly fewer in the 2 probiotic-formula–fed groups, and the frequency of health care visits and antibiotic use was less ($P < .001$) compared with those in the control formula group. In a separate study, Petschow et al[127] reported that healthy term infants given varying amounts of LGG in infant formula for 2 weeks resulted in good overall feeding tolerance with successful intestinal tract colonization, without adverse events.

The apparent safety to date of adding prebiotics to infant formula has been evaluated in the previously discussed RCTs reported by Boehm et al,[113] Moro et al,[114] Schmelzle et al,[115] and Bettler and Euler.[116]

SUMMARY ON SAFETY

The Committee on Nutrition of the European Society of Pediatric Gastroenterology, Hepatology and Nutrition previously concluded that more studies are required to establish the safety and efficacy of probiotic and prebiotic products in children.[12] To date, these products seem to be safe for healthy infants and children. The committee also stated that it would be optimal to have a centralized mechanism of oversight to ensure probiotic microorganism safety, identity, and genetic stability.[12] Centralized oversight and probiotic product monitoring was also recommended in a report from the Food and Agriculture Organization of the United Nations World Health Organization.[1,2,128] This organization supports the addition of prebiotic products to infant formulas designed as follow-up formulas meant for infants aged 5 months and older. It was reasoned that these infants are more likely to have a more mature immune response and established intestinal

colonization. In terms of oversight and product safety in the United States, products marketed as dietary supplements, such as probiotics, do not require premarket review and approval by the US Food and Drug Administration (FDA). However, probiotics or prebiotics that are marketed specifically for the treatment or prevention of a disease are classified as biological products and do require FDA review and approval. Infant formulas must be made with compliance with what are considered good manufacturing practices under the Infant Formula Act of 1980 and are under the regulatory auspices of the FDA[129] because these products are often used as the sole source of nutrition by infants during a critical period of growth and development. Additional statutory and regulatory requirements address appropriate infant formula manufacture, composition, and nutrient content. All ingredients used in infant formula must be safe and lawful—that is, food ingredients that are, to date, generally regarded as safe (GRAS) for use in infant formula and those that are used in accordance with the food-additive regulations of the FDA. Prebiotics and probiotics now being added to commercial infant formulas are classified as GRAS. Information on FDA regulations for infant formula and food ingredients and packaging may be found at www.fda.gov/Food/FoodSafety/ProductSpecificInformation/InfantFormula/default.htm and www.fda.gov/Food/FoodIngredientsPackaging/default.htm.

DEVELOPMENT OF THIS REPORT

The AAP Committee on Nutrition and Section on Gastroenterology, Hepatology, and Nutrition used review of the literature, including Cochrane reviews, and reports from other groups.[12,111,128] Comments also were solicited from committees, sections, and councils of the AAP; 9 entities responded. Additional comments were sought from the Centers for Disease Control and Prevention, the National Institutes of Health, the US Department of Agriculture, and the FDA because these governmental agencies have official liaisons to the Committee on Nutrition and were present during the development of the statement. For recommendations for which high levels of evidence are absent, the expert opinions and suggestions of the members of the Committee on Nutrition and other groups and authorities consulted were taken into consideration in developing this clinical report.

SUMMARY

1. Human milk, a natural prebiotic, is preferred for infants through 6 months of age.[130] The oligosaccharide content of human milk is substantial and is part of the prebiotic components of the human milk. Breastfed infants typically have a preponderance of naturally occurring probiotic bacteria in their digestive systems. There may be some naturally occurring probiotic bacteria contained in human milk.
2. There is some evidence in otherwise healthy infants and young children to support the use of probiotics early in the course of diarrhea from acute viral gastroenteritis and that use of probiotics reduces its duration by 1 day. However, the available evidence does not support the routine use of probiotics to prevent infectious diarrhea unless there are special circumstances. There is some evidence to support the use of probiotics to prevent antibiotic-associated diarrhea but no evidence that it is beneficial for treatment.
3. Although the results of some studies support the prophylactic use of probiotics during pregnancy and lactation and during the first 6 months of life in infants who are at risk of atopic disorders, further confirmatory evidence is necessary before a recommendation for routine use can be made.
4. There is some evidence to support the use of probiotics to prevent NEC in preterm infants with a birth weight of 1000 g or higher. However, the amount and specificity of which probiotic or mixture of probiotics to use is problematic, given the many unanswered questions from a review of the available literature. Furthermore, many of the probiotics used and cited in the literature for treatment in preterm infants are not readily available.
5. At the present time, the sustained or long-term benefit of using probiotics for treating disorders such as Crohn disease, IBS, constipation, and extraintestinal infections requires further RCTs and cannot be recommended in children. There may benefit for treating *H pylori* infections, CUC, and infantile colic with probiotics in childhood, but further studies are necessary.
6. Long-term health benefits of probiotics in the prevention of cancer, allergy, or other diseases or providing sustained beneficial results on the developing immune system beyond early infancy remain to be proven.
7. Addition of probiotics to powdered infant formulas has not been demonstrated to be harmful to healthy term infants. On the other hand, evidence of clinical efficacy for their addition is insufficient to recommend the routine use of these formulas. No RCTs have directly compared the health benefits of feeding human milk versus infant formula supplemented with probiotics.

8. Probiotics should not be given to children who are seriously or chronically ill until the safety of administration has been established.
9. Prebiotics may prove to be beneficial in reducing common infections and atopy in otherwise healthy children. However, confirmatory studies, especially in children fed formula that is not partially hydrolyzed, are needed before any recommendations can be made.
10. Addition of oligosaccharides as prebiotics to infant formula is not unreasonable but lacks evidence demonstrating clinical efficacy at this time. Cost/benefit studies are also necessary to support their addition to infant formulas.
11. Important questions remain in establishing the clinical applications for probiotics, including the optimal duration of probiotic administration as well as preferred microbial dose and species. The long-term impact on the gut microflora in children is unknown. It also remains to be established whether there is significant biological benefit in the administration of probiotics during pregnancy and lactation, with direct comparison to potential biological benefit derived from probiotic-containing infant formulas. Similar questions exist for the use of prebiotics.

Appendix 1 contains examples of currently available probiotic products and the probiotic content of various functional foods in the United States. This list demonstrates the wide variation in probiotic content in these products. Information about other probiotics can also be found on a Web site maintained by industry (www.usprobiotics.org).

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APPENDIX 1 Selected Dietary Supplements

Product	Active Ingredient	CFU Count per Dose
VSL#3	*S thermophilus, Bifidobacterium* species, *Lactobacillus* species	450 billion, combined
Culturelle	LGG	10 billion
Florastor	*S boulardii*	5 billion
GNC	*L acidophilus*	1.6 billion
	B bifidum	1.6 billion
CVS brand	*L acidophilus, Bifidobacterium longum*	1 billion
Nature Made	*L acidophilus*	500 million
Selected functional foods		
Dannon Activia yogurt	*Bifidus regularis*	100 000–1 million/g
Stonyfield Farm yogurt, refrigerated (not frozen)	*Lactobacillus bulgaricus, S thermophilus, L acidophilus, Lactobacillus casei, L reuteri, Bifidus* species	10 million/g, combined (throughout shelf-life)
Sweet acidophilus milk (Purity Dairy), refrigerated	*L acidophilus*	4 million/mL
Kefir, refrigerated (Lifeway Foods)	*B lactis, Lactobacillus casei, L acidophilus, Lactobacillus rhamnosus, Streptococcus diacetylactis, L plantarum, Saccharomyces florentinus, Leuconostoc cremoris, B longum, B breve*	20–40 million/mL
Nestle Good Start natural cultures	*B lactis*	10^7/100 kcal
Mead Johnson Nutramigen with Enflora LGG	LGG	10^7/100 kcal

CFU indicates colony-forming unit.

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TECHNICAL REPORT

Professionalism in Pediatrics

Mary E. Fallat, MD, Jacqueline Glover, PhD, and the Committee on Bioethics

ABSTRACT

The purpose of this report is to provide a concrete overview of the ideal standards of behavior and professional practice to which pediatricians should aspire and by which students and residents can be evaluated. Recognizing that the ideal is not always achievable in the practical sense, this document details the key components of professionalism in pediatric practice with an emphasis on core professional values for which pediatricians should strive and that will serve as a moral compass needed to provide quality care for children and their families.

INTRODUCTION

Professionalism has been a central and defining feature in medicine since Hippocrates.[1] The concept of professionalism is now receiving renewed attention because of advances in technology, managed care and other business arrangements in health care, and a growing sense of the erosion of public trust in the medical profession.[2]

Pediatricians have a special status in society as privileged and trusted advocates for the well-being of children. Pediatricians have a responsibility to use their knowledge, skills, and influence to advocate for children and their interests in all domains of society, not just in health care. A child's health is broadly understood to include emotional, social, educational, psychological, and spiritual well-being.

As the pediatrician-child/family relationship has been threatened over time with the imposition of a business model, it has become more important than ever to adopt a standard of professionalism for pediatricians. The ability to promote professionalism across the continuum of medical education, from medical school curricula through continuing medical education for practicing pediatricians, depends on the ability to define and assess professionalism in the context of pediatrics.[3,4] Various professional groups have supported the need for a normative definition of professionalism, and there is considerable overlap in the definitions that they have formulated.[5–8] The American College of Physicians astutely noted in its recent iteration of their ethics manual that written guidelines are not a substitute for the experience and integrity of individual physicians but may serve as a reminder of the shared duties and obligations of the medical profession.[9] Allowing that the ideal may not be fully achievable in the practical sense, the purpose of this document is to provide a background on professionalism in pediatrics that serves a dual role: (1) to provide a concrete overview of the ideals for which pediatricians should strive and (2) to describe standards of professional behavior by which practicing pediatricians and trainees can be evaluated. This document begins with a general discussion of statements concerning professionalism in pediatrics and proceeds to the application of these statements in the central relationships in

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
professionalism, pediatricians, physician-patient relations, medical student, resident

Abbreviations
ABP—American Board of Pediatrics
AAP—American Academy of Pediatrics
AMA—American Medical Association
HIPAA—Health Insurance Portability and Accountability Act

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pediatric practice—to patients and families, to students and residents, to other health professionals, to the profession, and to society in general.

STATEMENTS OF PROFESSIONALISM IN PEDIATRICS

The American Board of Pediatrics (ABP) began its discussion of professionalism when it defined the optimal attitudes, knowledge, clinical judgment, technical skills, and interpersonal skills that applicants should possess in its 1974 publication *Foundations for Evaluating the Competency of Pediatricians*.[10] Since 1976, residency program directors have been asked to evaluate interpersonal skills, work habits, and personal qualities of residents, and beginning in 1982, the ABP requested that program directors also evaluate and attest to applicants' ethical and moral behavior as it affects their professional performance.

The ABP continued its pediatric-specific efforts to clarify ethics and professionalism issues in practice with the pioneering 1987 publication "Teaching and Evaluation of Interpersonal Skills and Ethical Decision Making in Pediatrics."[11] Admittedly, the content area in ethics is not straightforward. To assist residents and pediatricians in practice with difficult ethical decisions, the American Academy of Pediatrics (AAP) Committee on Bioethics has been publishing guidelines on key ethical issues since 1983 (available at http://aappolicy.aappublications.org). Most recently, the ABP added more specific guidelines for the teaching and evaluation of professionalism as part of the core curriculum for residency training in pediatrics. The following 8 components of professionalism have been endorsed by the ABP as the most appropriate for teaching and evaluation[12]:

- Honesty and integrity—embody the principles of fairness, the ability to meet commitments and keep one's word, and the duty to be intellectually honest and straightforward in interactions with patients and peers and in all professional communication.
- Reliability and responsibility—represent accountability to children, families, other physicians, medical staff, community, and ultimately society. They require acceptance of responsibility for errors made, including the willingness to acknowledge and discuss errors, consequences, and alternatives with the family and with peers.
- Respect for others—involves treating all persons with respect and regard for individual worth and dignity, including sensitivity to gender, race, and cultural differences as well as maintenance of patient confidentiality when appropriate.
- Compassion/empathy—the ability to understand children's and family members' reactions to pain, discomfort, and anxiety from their point of view, not that of the physician.
- Self-improvement—involves a commitment to lifelong learning and education.
- Self-awareness/knowledge of limits—the maturity to recognize when a problem involves knowledge or technical skills beyond the experience of the provider and to ask for consultation or assistance in those situations.
- Communication and collaboration—involve the recognition that patients' families and the health care team must work cooperatively with each other and communicate effectively to provide the best patient care and social activism.
- Altruism and advocacy—refer to the unselfish regard or devotion to the welfare of others. Patient well-being should be the primary motivating factor in patient care, ahead of physicians' own interests and needs.

PEDIATRICIANS' RESPONSIBILITIES TO PATIENTS, FAMILIES, AND COMMUNITIES

The connotation of "good doctor" historically brings to mind a physician who embodies both the art and science of medicine. The concept is epitomized in the pediatrician who can give advice without being patronizing, who is concerned about how an illness and its consequences (financial, emotional, psychological) will affect the family, and who strives to help the child and/or parent understand a disease process and its natural history (compassion/empathy). This doctor is thorough and technically skillful and continually incorporates new knowledge into his or her practice (self-improvement).[13] To other physicians, a "good pediatrician" is a colleague with whom they would entrust the care of their own child.[14]

To be effective, the relationship between a pediatrician, his or her patient, other medical professionals, and the parent or surrogate (hereafter, "parent") of that child must be collaborative. The role of the parents is to take an interest in and responsibility for their child's health care, seek attention for medical problems in a timely manner, and communicate and work effectively with their child's pediatrician to create an acceptable treatment plan. In return, the pediatrician's obligation is to provide appropriate information regarding the child's health care, including the benefits, risks, and costs of all reasonable treatment alternatives (communication and collaboration). Parents should have their questions answered, feel free to seek second opinions, and be advised of the pediatrician's potential conflicts of interest (honesty and integrity). Pediatricians should communicate to parents any errors in patient care, including any consequences that have resulted or may result because of the error (honesty and integrity; reliability and responsibility).

Children, as patients, should be afforded continuous

access to care. On-call pediatricians should be responsive in a timely manner, coverage should be available during absences, and notice of closing a practice or changing participation in insurance plans is expected (curtailing access). Except in cases of emergency or in which state law allows otherwise, the permission of a parent will be necessary before a pediatrician can offer medical treatment to a child. Parents may accept or refuse a recommended medical treatment on behalf of their child. Pediatricians and pediatric medical subspecialists have a duty to respect the wishes of the child and family when these wishes are intended to do good (beneficence) and avoid harm (nonmaleficence). A child's parent usually is the most appropriate person to determine what actions will be in the best interest of the child (communication and collaboration; altruism and advocacy). Children and adolescents who desire to participate should be included in the decision-making process (patient assent) when their neurologic status, development, and level of maturity allow, although state laws that affect the minor's ability to consent to (provide legally binding authorization for) medical care are complex.[15]

Resolving Conflicting Goals of Care

Conflicts may occur when the parent, child, and physician fail to agree on what would be optimal care under a given set of circumstances. When pediatricians and parents disagree, the pediatrician should explain the basis for the disagreement, educate the parent, and attempt to meet the child's needs within the constraints that exist. In these cases, the physician must seek to understand the reason for the disagreement and determine if the child would be put at significant risk of serious harm by following the wishes of the child and/or parent. In cases in which serious harm to a child is likely if the parent's wishes are followed, the pediatrician must get a second opinion and act to protect the best interests of the child. Institutional ethics committees should be consulted for guidance, education, and advice regarding unusual or complicated ethical problems that involve the care and treatment of children.[16]

If a physician or other health care professional is unwilling to honor a family's refusal of intervention in a situation in which the family has chosen an established alternative, he or she should withdraw from the case and must provide reasonable assistance to the parent in making alternative arrangements for care. A physician may not discontinue care of a child as long as additional treatment is medically indicated or until another physician has assumed care.

Nondiscrimination, Societal Obligations, and Continuity of Care

The AAP believes that the medical care of infants, children, and adolescents should be delivered or directed by well-trained pediatricians who provide primary care and help to manage and facilitate essentially all aspects of pediatric care.[17] A pediatrician has broad authority to enter into or decline a medical relationship with a family except in emergency situations. Once a relationship is established, however, the pediatrician should assume responsibility for the medical care of the child and also recognize when the child needs to be referred to a pediatric medical subspecialist, pediatric surgical specialist, or other physician or qualified clinician for diagnosis or treatment of a condition or symptom complex outside of the physician's scope of practice (self-awareness/knowledge of limits).[18]

Pediatricians or pediatric subspecialists who offer their services to the public should not refuse to accept children into their practice because of race, color, religion, national origin, disability, sexual orientation, or any other basis that would constitute discrimination (respect for others). Pediatricians should not refuse to care for acutely ill children on the basis of the ability of the family to pay for services rendered. However, practice overhead expenses preclude the provision of comprehensive health services for every child whose family requests routine or preventive health services unless there is some means of compensation. The AAP believes that the medical care of infants, children, and adolescents should be accessible, continuous, comprehensive, family centered, coordinated, compassionate, culturally effective, and provided according to the medical home concept.[17] Pediatricians have a special obligation to work together to help secure access to health care for all children, including those who are uninsured or underinsured.[19]

Pediatricians have an obligation to refrain from providing nonbeneficial interventions and should also be good stewards of health care resources by using the most efficient means to diagnose a condition, using resources of optimal quality wisely, and helping to ensure that resources are available equitably.[5] A pediatrician may not refuse to treat a child whose condition is within the physician's current realm of competence solely because the child has a communicable disease. A pediatrician should honor requests for second opinions and should be available to provide guidance to the parents and child after they have obtained opinions from other physicians. Pediatricians and subspecialists to whom they refer their patients should make every effort to communicate effectively and in a timely manner with each other about their assessments of the patient and coordinate their treatment plans (reliability and responsibility).

Boundaries in Patient Care

Compassionate and empathetic care for the child historically has been balanced with the need to remain objective and avoid becoming overinvolved. Boundary violations can pose a serious threat to professional judgment.[20] An increase in trust and change in bound-

aries is likely to occur as a child/family-pediatrician relationship evolves. Boundary transgressions might include abusive behaviors, sexual behavior between the physician and the patient or members of the patient's family, a physician who treats family members, and gift-giving between a family and the physician.[21–23] The development of strong empathetic and nonromantic, nonsexual feelings of affection for a patient or family do not constitute boundary violations and are deeply valued by patients and families, and it provides an opportunity for personal growth for the pediatrician.

The pediatrician may wish to continue providing care for a patient who is an adolescent or a young adult (eg, during high school and college matriculation or for older children with special health care needs) to minimize fragmentation of care. The pediatrician, the family, and the patient should discuss whether, for any reason, the patient might instead wish to change physicians. Mature patients should be encouraged to take increasing responsibility for their personal health care by communicating directly with the pediatrician and making their own appointments while informing parents of these appointments. As the new patient-physician relationship evolves, it may be appropriate to develop an option under which the adolescent can obtain confidential care if needed.[24,25]

One of the most common and difficult boundary issues occurs when a pediatrician treats his or her own family members. Because the close relationship carries a potential for the pediatrician to lose objectivity or fail to explore sensitive issues and areas with the patient, family members should be encouraged to seek another pediatrician. Exceptions include underserved areas in which there may be only 1 pediatrician, which would make this impractical, or in the case of an emergency. Regarding nonurgent care rendered to minor patients, the American Medical Association (AMA) has stated, "In particular, minor children will generally not feel free to refuse care from their parents."[19] This same concern may carry over to medical care that is provided to minors by other relatives.

Occasionally, a pediatrician may receive a gift from a patient or the parents of a patient. Small gifts given in gratitude may sometimes be accepted if they do not affect professional clinical judgment. Repeated attempts at gift-giving or the offer of expensive gifts may represent an attempt by the family to consciously or unconsciously control the patient-physician interaction. Larger or more expensive gifts are clear and serious boundary transgressions unless they are given as a charitable donation to a nonprofit institution.[26] There is also a potential conflict of interest when patients who make large contributions to medical institutions receive preferential treatment (eg, they are seen immediately, moved to the top of the operating room schedule, etc).

Privacy and Access to Health Information

Respecting the privacy of patients and their families, including protecting the confidentiality of patient information, is a central feature of professionalism in pediatric practice. The importance of privacy has been underscored by federal regulation, known as the Privacy Rule, issued pursuant to the Health Insurance Portability and Accountability Act (HIPAA).[27,28] HIPAA was intended to create national standards to protect individual personal health information and give patients or their surrogates increased access to their medical charts.

Under the HIPAA Privacy Rule, parents have new rights to control and have access to the health information about their minor children, with limited exceptions. When a minor has the right to consent to care or a parent has agreed that the minor may receive confidential care, the minor may exercise his or her own rights to access and control protected health information. However, state or other applicable law governs if it has explicitly addressed disclosure of a minor's health information or medical charts to a parent. If state or other law does not define the parent's ability to access the child's health information, a licensed health care professional is allowed to exercise discretion to grant or deny such access.

The HIPAA Privacy Rule also dictates the need for privacy regarding patient identification that extends to inpatient rounds, patient charts, and telephone and casual conversations that formerly might have been conducted in public places such as elevators and hall corridors. Teaching conferences, computerized presentations, and radiographic exhibits all must avoid the use of patient identifiers and preferentially take place in areas where strict confidentiality can be preserved. Physicians are expected to take a leadership role in safeguarding the patient's privacy in contracts and organizational policies and procedures.[27]

Advocacy

At the very heart of professionalism is the pediatrician's commitment to put the interests of children and their families above his or her own. Altruism may be the defining feature of professionalism and the one that is most at risk with the corporate transformation of American health care. In particular, managed care arrangements can intensify the inherent conflict between the health care interests of children and the pediatricians' financial interests.[29]

Financial incentives to reduce or limit access to care are viewed by many as particularly problematic[29,30] and are a source of growing distrust of both pediatricians and managed care organizations. Pediatricians must not allow financial considerations to affect clinical judgment about a child's health and welfare. Managed care, with its emphasis on primary and preventive care, has the potential to increase access to a full range of pediatric

clinicians and services but can also result in underutilization of appropriate services.[30]

Pediatricians must be advocates for their patients. They should facilitate access to appropriate and effective pediatric services and challenge treatment-authorization policies that delay or deny needed treatments, including mental health services, social work services, developmental evaluations, occupational and physical therapy, child life interventions, dental services, and vision, hearing, and speech and language services. It is permissible and even desirable for pediatricians to discuss their concerns about specific insurance policies with parents and to ask parents to help by bringing these concerns to the attention of their insurance companies to effect a resolution.

Pediatricians should exercise due diligence in contracting with payers to avoid assuming legal or financial obligations that would put them in conflict with the health and well-being of their patients.[31] Physicians are legally responsible for the claims submitted for their professional services and for the accuracy and completeness of information in the medical chart. Pediatricians should ensure that coding and billing appropriately reflect the level of services provided to the patient.[32] To do so, some pediatricians choose to implement compliance programs in accordance with the guidance from the Office of Inspector General.[33,34] If an insurance company is perceived to be conducting business unethically, it should be reported to the relevant state board of insurance.

As advocates, pediatricians play a necessary role in quality assurance. This may include the need to provide feedback to referring physicians. A pediatrician should make every effort to determine all of the facts in a specific case before making a judgment about the quality of care that was rendered by another physician, particularly if opinions are being sought by the parents. Generally, feedback can and should ultimately be provided in an educational and noncritical manner to both provider and parent. The pediatrician receiving feedback should recognize this is an opportunity for learning. Qualifying feedback as a source of continuing education rather than criticism will help pediatricians care for future patients. Pediatricians, pediatric medical subspecialists, and pediatric surgical specialists should all respect one another as critical partners in the optimal delivery of care.

Information and Education

Pediatricians should inform and educate patients and parents and help them understand clinical recommendations and make informed choices among all reasonable care options and referrals. "Gag orders" or insurance policy clauses that prohibit the primary care physician from full disclosure of medical options and/or specialty referrals are never appropriate. Pediatricians are obligated to disclose the full range of medically, scientifically, legally, ethically, and practically acceptable treatment options, even those that are not included in the family's insurance coverage and those with which the pediatrician may philosophically disagree. Health plans must disclose all relevant information about benefits, including any restrictions in coverage and financial incentives that might negatively affect a child's access to care.[35,36] Descriptions should be clear, simply written, and easy for any family to understand. It remains the obligation of parents to understand their children's insurance benefits. Pediatricians cannot and should not be expected to counsel parents on the details of their insurance plans. Parents bear the ultimate responsibility to understand who and what is covered or not covered. In the inpatient setting, social workers and case managers often can assist with these issues.

Appeals Processes

Patients and families should have access to fair appeals processes, and pediatricians should be child advocates within that system. However, health plans are not obligated to pay for treatments that are not justifiable on clinical or scientific grounds even if some patients might desire them. Pediatricians should take an active role in the development of practice guidelines and familiarize themselves with the attributes/recommendations that will enable them to distinguish medical management guidelines that are based solely on cost/utilization data from those that are based on scientific evidence.[37]

MEDICAL SCHOOL TEACHING FACULTY RESPONSIBILITIES TO RESIDENTS AND STUDENTS

The obligations of medical school academic and clinical faculty to residents and students should include:

- Instructional development of academic competency—adequate, up-to-date academic preparation of residents and students to be competent and ethically responsible pediatricians.
- Modeling appropriate behaviors—using systems or standards that nurture professionalism, interdisciplinary collaboration, respect, and partnership with child and family, including a humane working environment.
- A caring and compassionate environment for learning—active involvement in bedside teaching, with fostering of an appropriate learning environment, including faculty treatment of residents and students.
- Fair assessment processes—fair assessment of professionalism, including remedial education, and one-on-one direct oversight with interim evaluations if there are problems.

Communication

Pediatric training should focus on providing a core foundation of knowledge, attributes, skills, and competencies to all pediatric residents regardless of their future career paths. Communication is a key element of medical practice. Clinicians should be capable of effective, respectful, and compassionate 2-way communication with patients, parents, and other members of the health care team. Health care communication must be formally taught, learned, and evaluated. Students and residents should be taught the principles of cultural effectiveness to enhance their understanding of the child and family in the context of the medical home.

Modeling Appropriate Behavior

Within pediatric training programs, residency program directors and pediatric faculty members must model the professional behavior they seek to instill in their trainees. Recently, both informal and formal residency curricula have become more challenging as a consequence of the 80-hour workweek limitation on house officers. Opportunities to model behavior can occur in the clinic, at the bedside, on the telephone, or in the patient's chart. Being able to communicate clearly in the medical chart and document medical care concisely and correctly are equally important as verbal communication with families, patients, physicians, and other health care professionals. Medical liability risk managers have described this as an area of professionalism that is in need of improvement and recommend use of the acronym OLFACTORY to help physicians improve their documentation skills: O = original, L = legible, F = factual, A = accurate, C = consistent, T = timely, O = objective, R = rational, and Y = yours.[38]

Clinical teachers must teach by example and be capable of demonstrating how to manage difficulties that occur in relationships with patients, medical staff, or colleagues; effectively and compassionately communicate with patients, families, colleagues, and members of the interdisciplinary team; gracefully and honestly acknowledge errors; confront poor practice in a colleague or trainee; and explain to children and parents when things have "gone wrong." Mentors of pediatric house officers and medical students should be aware of the process of socialization that exists and the various ways that trainees learn and internalize professional and humanistic values, attitudes, and behaviors. Students and residents may be more influenced by what is known as the "hidden curriculum" (what is taught by observing the daily behavior of health care professionals, both good and bad) than by formal training in ethics, although formal curricula in both ethics and professionalism are still valuable.[39] When pediatricians behave in ways that are contrary to ethical standards taught in formal courses, they reinforce the view that medicine is a profession that lacks integrity.[40] Perhaps more importantly, when pediatricians keep silent in the face of inappropriate behavior, the implication is that the status quo is acceptable, and the opportunity to discuss the professional behavior in the clinical context is lost. Currently, unprofessional and unethical physician behavior is often tolerated when it should not be. Students and residents should be encouraged and advised to evaluate faculty members as teachers of ethics, knowledge, and attitude, and faculty members should be encouraged to evaluate each other on the basis of professionalism as well as academic productivity.

Caring and Compassion

Caring and compassion are central to the effective practice of pediatrics. Students and residents must be taught to attend to the emotional, spiritual, and practical realities of illness and its effects on children and families as well as themselves.[41] Historically, medicine has defined its mission in terms of "curing" disease while overlooking illness (ie, the patient's experience of disease). Patients and families require a caring physician who is empathetic and strives to understand the illness experience of each child and affected family. How does one teach or remediate sensitivity and caring? Personal reflection, small-group discussions,[42,43] participation in family conferences, and longitudinal experiences with families who are living with chronic illness[44] are all examples of key strategies that may be used in nurturing professionalism among trainees. More focused methods include role modeling, one-on-one discussion, closer supervision, observation of resident interactions with families under stressful situations, and feedback sessions in which the resident specifically asks for guidance about how they could or should have handled difficult interactions with parents or patients.[45] Exposure to parent panels, former patients, and siblings of patients through small-group discussion; support group attendance; grand-rounds formats; use of standardized patients in teaching venues; and supervised role-playing are other ways.[46]

Because students and residents develop their professional identities over time, professionalism should be viewed as a developmental process across all stages of a medical career.[47,48] More emphasis on stress management is essential, and incoming residents might benefit from improved orientation regarding the demands of residency and ways of coping. In addition to learning how to care for others, young physicians also must learn to care for themselves.[49] Those who have their personal needs met are, in turn, more supportive of their patients' and families' needs,[50] and this self-nurturing will promote the ability to show compassion and empathy for others.[45] Those who create pediatric training programs need to be mindful of the ways that students and residents are treated. It is more likely that pediatricians in training will become caring and compassionate toward

their patients if they feel that they are treated in a caring and compassionate manner.

Fair Assessment Processes

Students and residents are expected to treat patients, families, medical staff, and colleagues fairly. In return, they must be treated fairly in the educational system. This will require developing clear expectations for performance, providing adequate opportunities to learn expected competencies and receive clear and frequent feedback, and providing remediation when necessary.[3,51–53] There should be a safe mechanism for students and residents to appeal evaluations with which they disagree, including those related to professionalism.

Documentation of deficiencies, mentoring, and personal counseling sessions are critical in the process. The principles and practice of professionalism that are being taught must be in place continually during the process of counseling and remediation. It is inappropriate for training directors and medical school faculty members to allow residents who have failed to develop appropriate professional skills despite counseling and remediation to complete the training program and qualify for the ABP examination process.

PEDIATRICIANS' RESPONSIBILITIES TO OTHER HEALTH CARE PROFESSIONALS: TEAM RESPECT AND COMMUNICATION

Pediatricians must treat each other and all other health care professionals with integrity, honesty, and respect in their daily interactions, because effective patient care depends on effective team functioning.[54] All health care professionals share a primary bond in their mutual ethical concern for patients. Respectful treatment includes being truthful and responsible, following through on commitments, honoring the expertise of other health care professionals, being open to learn from others, and being collaborative in patient care. Pediatricians should raise concerns about trainees, colleagues, and individual health care professionals directly with the relevant parties instead of verbalizing issues in front of patients, families, and/or staff. There should be no tolerance of verbal or physical abuse on the part of either physician or staff members, because it undermines credibility and effectiveness with patients and other health care professionals.

Pediatricians also have obligations to provide appropriate supervision and referral. The AAP acknowledges the crucial role that nonphysician health care professionals play in pediatric care and stresses the importance of working collaboratively with nurses, social workers, chaplains, nurse practitioners, physician assistants, and others.[55,56] Pediatricians should respect the contributions of other health care professionals but also acknowledge the appropriate limitations and roles of these professionals. The AAP states that the relationship among pediatric professionals is one of interdependence.[56] Incorporation of the input of these colleagues into the plan of care instead of treating it as separate and unrelated ensures effective, coordinated care.

Sexual harassment in the workplace and in educational settings creates an environment that demeans people and has a negative effect on individual performance and effectiveness as well as organizational productivity and unit morale. It is incumbent on employers, organizations, and institutions to represent all their constituents, male and female, and provide education and guidance that discourages this destructive behavior. In particular, medical schools and training programs must be aware of the prevalence of the problem and have action plans available.[57]

PEDIATRICIANS' RESPONSIBILITIES TO THE PROFESSION

Peer Review

Professional self-regulation is a privilege, not a right, and has to be earned continuously to sustain public confidence in the profession.[58] Work toward a system of medical regulation that combines professional, organizational, and patients' perspectives should be aimed at making the medical profession accountable for its performance.

The use of explicit standards (such as clinical practice guidelines that are based on evidence evaluation), the adoption of collective and personal responsibility for observing standards of practice, effective local medical regulation that is based on quality reviews, a systematic process for ensuring continuing medical education, and swift and effective strategies for dealing with physician misconduct are integral to maintaining a professional practice.

Ironically, science and technology have provided the medical profession with powerful tools that empower and enable physicians to extend and improve quality of life while exposing patients to the potential for iatrogenic harm.[13] Although members of the public appreciate what medical technology can achieve, they also have heightened awareness of the risk of medical errors[59] and the historic reluctance of the medical profession to admit to these errors. Professionalism demands that each health care professional know and accept his or her own limits. It is our responsibility to be open about risks and variations in performance, to communicate effectively, to act promptly to protect pediatric patients from poor practice, and to admit to the errors that are an expected and everyday occurrence in judgment-based clinical decision-making.[13,60]

There is a general reluctance of doctors to report colleagues whose performance falls below a minimum standard because of a lack of absolute clinical guidelines, the question of what constitutes an acceptable degree of variation in practice and outcome, the influence of case mix on outcomes, and other variables. Poor performance

or substandard performance can have protean causes including stress, burnout, the effects of physical or mental illness, death of a loved one, chronic fatigue, communication or systems-of-care failure, and others. Examples include lack of attention to detail, failure to return telephone calls or pages in a timely fashion when on call, or failure to follow-up with families regarding test results when promised. Addressing these issues requires active intervention tempered by concern, compassion, and understanding, because the primary professional obligation of patient safety is at stake.

Clear evidence of what constitutes poor or unsafe practice is more certain and widely recognized. Examples include practicing medicine under the influence of drugs or alcohol or with untreated mental health disorders, falsifying medical information, or intellectual dishonesty with colleagues or patients.[19] Physicians have an ethical obligation to report such behavior in accordance with the legal requirements in each state, and the profession should show its determination to confront poor practice. Alcohol or drug impairment should be reported to the hospital's in-house impairment program, the chief of pediatrics, or the chief of the hospital staff. Some medical societies or state licensing boards have external impaired-physician programs to which individuals can be referred. Issues of incompetence and remediation should be addressed by the appropriate clinical authority. The hospital peer-review body should be notified when appropriate, and sentinel events should be discussed thoroughly and reported to the Joint Commission. A sentinel event is defined by the Joint Commission as an unexpected occurrence that involves death or serious physical or psychological injury or the risk thereof. Serious injury specifically includes loss of limb or function. The phrase "or the risk thereof" includes any process variation for which a recurrence would carry a significant chance of a serious adverse outcome. Incompetence that poses an immediate threat to the health of children should be reported directly to the state licensing board. Physicians who are under investigation or have been charged should be protected from destructive gossip and rumors, and communication should be governed by the rules of confidentiality until such charges are proven or the physician is exonerated.

We are in the midst of a professional evolution in which the language of professional quality review and improvement is replacing professional solidarity. Medical societies' ethics committees, hospital credentials and utilization committees, morbidity and mortality reviews, and other forms of peer review have long been established by organized medicine to scrutinize physicians' professional conduct. Pediatricians in both academic and private practice should welcome and support these methods of ensuring good medical practice. They balance the pediatricians' right to exercise medical judgment freely with the obligation to do so wisely, compassionately, objectively, and temperately.[19] They also demand acceptance of the tenet that mistakes happen, can affect any system and, thus, involve any doctor, have to be discussed openly, and provide critical opportunities for learning and creating systematic improvement. In states where peer review is considered "discoverable" by state law, which allows physicians who are engaged in good-faith peer-review activities to be sued after case review, the peer-review process is undermined by the lack of confidentiality, and the effectiveness of peer review is limited.

Medical Testimony

Pediatricians are often called to court to testify on behalf of children in cases of suspected abuse and/or neglect. Whether as expert witnesses or witnesses of fact, pediatricians have ethical obligations to give honest, objective, and accurate information and should not accept a commitment as an expert witness outside their defined area of expertise. When medical malpractice is an issue, an expert witness is key to ensuring a fair hearing for the physician in question as well as for the patient and family. The AAP has articulated recommendations for pediatricians who provide expert witness testimony in medical malpractice cases.[61] It is unethical for expert witnesses to base their fees for testifying contingent on the outcome of the case.[62,63] Reliable, objective, and accurate expert witness testimony and a truthful analysis of the standard of care are extremely important in pediatric cases in which juries can be manipulated out of compassion for injured children and their families.[61]

A witness of fact who, in the case of medical malpractice, is the treating physician, whether as the defendant or the previous or subsequent treating physician, has an ethical obligation to be adequately prepared and to testify honestly and truthfully to the best of his or her medical knowledge. A witness of fact is not to be an advocate or a partisan in the legal proceeding.

PHARMACEUTICAL AND OTHER INDUSTRIES AND POTENTIAL CONFLICTS OF INTEREST

Issues of professionalism and the integrity of the profession as a whole are raised when pediatricians are the recipients of special marketing incentives such as gifts and other perquisites from representatives of the health care industry. Such behavior challenges the physician's clinical objectivity[64,65] and poses a conflict of interest between the patient's welfare and the physician's financial interests. Also, issues of justice are raised as the increased costs of marketing are passed on to children and their families. Despite these concerns, the AMA acknowledges the fact that gift-giving has been a customary practice in medicine with a beneficial educational and service function to physicians and patients. The AMA recently launched an initiative to educate physicians and members of the health care industry

about the AMA guidelines on appropriate gifts from industry. The AAP has endorsed the AMA guidelines regarding gifts to physicians from industry. The AMA guidelines do not prohibit gifts outright but offer 7 basic guidelines for their appropriateness[66]:

- Any gifts should primarily entail a benefit to patients (eg, education to improve patient care) and should not be of substantial value.
- Individual gifts of minimal value should be related to the physician's work (eg, pens, notepads).
- Meetings should be primarily dedicated, in both time and effort, to promoting scientific and educational activities and discourse.
- Subsidies for meetings should be accepted by the conference's sponsor, not individual participants.
- Subsidies should not be accepted directly or indirectly to pay for the costs of travel, lodging, or other personal expenses of physicians attending conferences, including compensation for the physician's time.
- Scholarship funds are permissible as long as the selection of students is made by the academic or training institution.
- No gifts should be accepted if there are "strings attached."

The American College of Physicians took a slightly different approach in its ethics manual,[50] and strongly discouraged the acceptance of all types of individual gifts, hospitality, trips, and subsidies from the health care industry. The American Medical Student Association took the toughest policy stand on gifts from the health care industry and advocated for outright prohibition. Their recently initiated PharmFree Campaign urges medical students to take a pledge to accept no money, gifts, or hospitality from the pharmaceutical industry; to seek unbiased sources of information; and to avoid conflicts of interest in their medical education and practice.[67]

The Compliance Program for Pharmaceutical Manufacturers of the Office of Inspector General provides clear examples of the expectations regarding the manufacturers' conduct and relationships with purchasers, research funding for educational programs, and potential conflicts of interest.[68] It is advisable for physicians to heed this guidance as it pertains to the professional relationship between physicians and representatives of pharmaceutical manufacturers.

SUMMARY

The provision of health care in contemporary society is increasingly complex. Pediatricians are being asked to care for more patients with more complicated medical and social histories, using more technology, and often with less time and compensation for the care of each patient. The degree of bureaucratic oversight is growing exponentially. In the practical sense, this leaves pediatricians at risk of losing sight of what called them into the health profession in the first place—a desire to care for children and their families. This report outlines the key components of professionalism in pediatric practice in the belief that an emphasis on core professional values will serve as a moral compass in these turbulent times and will invigorate pediatric practitioners with the enthusiasm to strive to provide the quality care to which they committed and for which they trained and sacrificed when they began their medical careers.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Pediatric Research

Promoting Education, Mentorship, and Support for Pediatric Research

ABSTRACT. Pediatricians have an important role to play in the advancement of child health research and should be encouraged and supported to pursue research activities. Education and training in child health research should be part of every level of pediatric training. Continuing education and access to research advisors should be available to practitioners and academic faculty. Recommendations to promote additional research education and support at all levels of pediatric training, from premedical to continuing medical education, as well as suggestions for means to increase support and mentorship for research activities, are outlined in this statement.

ABBREVIATIONS. AAP, American Academy of Pediatrics; NIH, National Institutes of Health; PROS, Pediatric Research in Office Settings.

INTRODUCTION

To promote the goal of the American Academy of Pediatrics (AAP) to advance the health and well-being of children and their families, it is necessary to enhance quality child health research in the 21st century. Pediatricians contribute significantly to child health research, and they should be supported to pursue research activities. Education in research methodology should be provided to all pediatricians-in-training, and continuing education and access to research advisors should be offered to practitioners and academic faculty. The AAP encourages efforts to identify and reduce barriers experienced by trainees, practitioners, and academic faculty pursuing research.

Approximately 10% of all graduates of pediatric residency programs pursue traditional research careers. Funding by the National Institutes of Health (NIH) to support research training in pediatrics, including individual fellowship grants, is at only 10% of the level of support provided for research training in internal medicine.[1] This discrepancy challenges the ability of pediatric departments to continue to produce pediatric scientists capable of becoming NIH-funded independent investigators[1] or investigators who are competitive for research support from other federal agencies (eg, Agency for Healthcare Research and Quality, Maternal and Child Health Bureau) and foundations. Furthermore, graduates of fellowship programs who have received research training are finding it difficult to secure the necessary resources to conduct meaningful research. Protected research time is decreased as a result of an increasing demand for clinical service and administrative responsibilities. For example, a recent survey of developmental-behavioral pediatricians showed that, even for those who had completed fellowship training, on average, only 6% of their time was spent on research activities; most of their time was spent on direct patient care.[2]

Most pediatricians choose careers as practitioners, clinician educators, or both. Research training early in their careers will facilitate an understanding of research methodologies and an ability to critically evaluate scientific papers and the evidence base for current and future clinical practice. This is required to create an evaluative culture among pediatricians.[3] As Chambers observed, "Practicing evidence-based medicine without knowing how the evidence is assembled is as absurd as managing asthma without knowledge of respiratory physiology."[4]

In many situations, the evidence base for pediatric topics is quite limited. Given adequate training and support, practitioners can be valuable contributors to this evidence base through clinical research and can participate as part-time clinical investigators. The highly successful Pediatric Research in Office Settings (PROS) network is one example of how pediatricians in practice settings have been major contributors to the expanding evidence base of clinical pediatrics.[5]

The need exists at all levels of pediatric training for education regarding the widest possible spectrum of child health research, including not only biomedical science but also epidemiology, public health, behavioral sciences, health services, prevention, quality measurement, and quality improvement. Advances in clinical medicine do not result solely from translation of advances in basic or biomedical sciences to patient care settings. The process is bidirectional, wherein knowledge gained in clinical settings also informs inquiry in the basic sciences. The recent reorganization of institutional review groups at the NIH to convene reviewers of the basic science and clinical research disciplines, as opposed to a system that promoted the review of basic science and clinical research proposals in distinct review groups, reflects the growing recognition that multidisciplinary collaboration improves the quality of all medical research. To ensure that this collaboration is productive, all pediatric clinicians and researchers will need an appreciation, and at least a limited understanding, of the full continuum of child health research.

The practice of clinical medicine and the conduct of medical research are multidisciplinary. Such a

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

multidisciplinary approach requires research training to provide exposure to multiple disciplines so that pediatric researchers can draw on the expertise of other professionals and contribute to ongoing research within other disciplines. Some pediatricians may benefit from seeking secondary degrees (PhD, MPH, etc) to enhance their own research capabilities.

The AAP encourages all groups involved in medical education to collaborate on the development of a curriculum in research methodology for pediatric trainees that introduces core skills of designing, conducting, and interpreting child health research. Different competencies will be required at different levels of training and practice. To be able to evaluate and use medical literature competently, all pediatricians will require a basic knowledge of scientific methods, research design fundamentals, and core statistical principles and a familiarity with related terminology. Experience in conducting literature reviews, including Internet-based searches,[6] and awareness of options for continuing medical education related to research are necessary to maintain these core competencies. For pediatricians planning to continue research activities beyond residency, additional training and experience will be required in designing research, collecting and coding data, conducting and interpreting data analyses, and communicating results and conclusions effectively through oral, written, and electronic means.

The research knowledge and skills of practitioners and academicians need to be enhanced through continuing medical education. Effective advisors must be readily available for pediatric residents, fellows, practitioners, and academicians to nurture the evolving research skills of pediatricians throughout their careers. Attention should be given to ensure that adequate access to research advisors is available for women, minorities, and other groups that are currently underrepresented in child health research.

It is a high priority to implement strategies to maximize incentives and minimize barriers to entering pediatric research careers, such as excessive debt, or to pursuing research within clinical settings, such as demands for increased clinical productivity.

RECOMMENDATIONS

Research Training Before Medical School

- Research training must begin early, ideally as a component of premedical course work.[7] Toward this goal, health researchers, including child health researchers, should encourage high school and college students to become involved in research, thereby promoting an early interest in, appreciation of, and commitment to health research. They are encouraged to use funding mechanisms provided by NIH and other funders to support such efforts.

Research Training in Medical School

- Medical schools should provide formal course work on research methods for health research; faculty from pediatric departments should be encouraged to participate in the design and teaching of such courses.
- Medical schools should consider recommending or requiring thesis projects for their students and should provide the protected time, necessary resources, and faculty advisors. Electives in research for credit (such as during the summer after the first and second year of medical school) or a year out for fellowship for medical students to permit completion of a research project are additional options that can be established to support early development of the skills needed to conduct quality research.
- Groups involved in medical education are urged to collaborate in the development of a research methodology curriculum that covers the core skills of designing, conducting, and interpreting health research that could be part of the preclinical curriculum. The curriculum should also include the ethical dimensions of research, including informed consent, protection of research subjects, conflict of interest, and patient privacy, which are relevant to a research curriculum for physicians at any level of training or practice. Federal training dollars could be leveraged to support innovation in curriculum for the integration of research education throughout the training and careers of physicians.

Research Training in Pediatric Residency Programs

- A research curriculum for pediatric residents, which can be integrated into a conference schedule, should be developed. The primary goal of this curriculum is to equip pediatric residents with the skills necessary to evaluate and use medical literature competently and should equip the resident with a basic knowledge of scientific methods, research design fundamentals, core statistical principles, and the means to conduct literature reviews.
- Pediatric residency programs should promote research electives in block rotations or as longitudinal protected time (such as 4–6 hours per week throughout the 3 years of residency) and encourage trainees to participate in a research project during their residency, as is currently required by approximately one quarter of pediatric residency programs in the United States.[8] Protected time, necessary resources, and faculty advisors are critical components in developing a research career or becoming involved in clinical research as a pediatric practitioner and should be readily available at all levels of pediatric training.
- The Residency Review Committee and the American Board of Pediatrics should review requirements for accreditation and certification and ascertain if current requirements promote attainment of necessary research knowledge.

Research Training in Pediatric Fellowship Programs

- Fellowship programs should include advanced formal course work in research methodology that covers the widest possible spectrum of child health research. A research methodology curriculum for all fellowships in pediatrics should be developed that will outline the minimal core

knowledge and skills expected of all child health researchers across subspecialties and general pediatrics to facilitate collaboration and to improve the quality and practical relevance of research conducted.
- Programs should assign all fellows to work with experienced faculty research preceptors. As recommended by Kelch and Novello,[9] programs should consider establishing a research advisory committee, similar to a doctoral thesis committee, to provide guidance to the trainee.
- To support mentorship, federal training grants should provide faculty salary support in addition to trainee stipends. Institutions applying for fellowship training support should describe their plans for mentorship activities. Federal agencies can develop means to offer, and perhaps even require, formal training for proposed research mentors as part of their agreement for funding fellowship programs.[10]

Research Training Within Continuing Medical Education

- For continuing education of practitioners and academic faculty, centers of excellence and professional organizations can establish training programs in which intensive, brief training in research methodology is provided.
- Opportunities for pediatric practitioners to participate in research activities should be expanded. Practice-based research networks, such as PROS,[5] as well as research mentoring programs (such as the recently created AAP research mentorship program for primary care pediatricians) are already affording many practitioners this opportunity. Efforts like these should be further promoted and expanded to reach practitioners previously underrepresented in these activities, especially those who care for minority and underserved populations.

Loan Forgiveness and Research Support

- Programs should be developed that provide federal support for repayment of educational debt for physicians pursuing careers in child health research[11,12] similar to those currently in place for physicians who practice clinical medicine in underserved communities or physicians who research acquired immunodeficiency syndrome, infertility, or contraception.
- Mechanisms should be developed for distribution of federal research funds to academic centers for start-up funding of child health research, especially for junior investigators.
- Secure and sustained resources need to be identified to cover costs of research education at all levels, including subsidizing faculty time, space, supplies, and equipment.
- Innovative means to promote financial support for child health research should be pursued. Because child health research is central to efforts to improve quality of medical care, mechanisms need to be explored by which managed care companies and health insurers could be encouraged to invest in health research generally, and particularly in child health research activities.
- Professional organizations providing oversight for training of pediatricians and major federal funders of child health research (eg, NIH, Health Resources and Services Administration, and Agency for Healthcare Research and Quality) should collect data to monitor the quality of pediatric research training, the number of pediatric researchers completing training and their productivity as researchers, and the level of support for child health research activities to ensure that there is ongoing progress in these areas. Training institutions and individual trainees should appreciate the importance of collaborating in these efforts.

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ERRATUM

An editing error occurred in a response to a letter to the editor that appeared in the April 2001 issue of *Pediatrics* entitled "Prenatal Treatment of Congenital Adrenal Hyperplasia: Author Differs With Technical Report." On page 805, the last sentence of the reply by Frias et al reads:

The memory of the tragedies associated with prenatal use of dexamethasone and thalidomide demands no less.

That sentence should read:

The memory of the tragedies associated with prenatal use of DES (diethylstilbestrol) and thalidomide demands no less.

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CLINICAL REPORT

Promoting the Participation of Children With Disabilities in Sports, Recreation, and Physical Activities

Guidance for the Clinician in Rendering Pediatric Care

Nancy A. Murphy, MD, Paul S. Carbone, MD, and the Council on Children With Disabilities

ABSTRACT

The benefits of physical activity are universal for all children, including those with disabilities. The participation of children with disabilities in sports and recreational activities promotes inclusion, minimizes deconditioning, optimizes physical functioning, and enhances overall well-being. Despite these benefits, children with disabilities are more restricted in their participation, have lower levels of fitness, and have higher levels of obesity than their peers without disabilities. Pediatricians and parents may overestimate the risks or overlook the benefits of physical activity in children with disabilities. Well-informed decisions regarding each child's participation must consider overall health status, individual activity preferences, safety precautions, and availability of appropriate programs and equipment. Health supervision visits afford pediatricians, children with disabilities, and parents opportunities to collaboratively generate goal-directed activity "prescriptions." Child, family, financial, and societal barriers to participation need to be directly identified and addressed in the context of local, state, and federal laws. The goal is inclusion for all children with disabilities in appropriate activities. This clinical report discusses the importance of physical activity, recreation, and sports participation for children with disabilities and offers practical suggestions to pediatric health care professionals for the promotion of participation.

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Key Words
disabilities, participation, sports, recreation

Abbreviation
CP— cerebral palsy

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THE BENEFITS OF physical activity are universal for all children, including those with disabilities. Although ~18% of children and adolescents in the United States have a chronic condition or disability, opportunities for their participation in fitness and activity programs, whether for leisure, recreation, or competition, are limited.[1] International efforts to promote the social and emotional well-being of children with disabilities through participation in recreational sports and physical fitness activities began with the first competitive sporting event for individuals with disabilities in 1948, followed by the first Paralympics competition in 1960, and the establishment of the Special Olympics in 1968.[2] The Special Olympics is now the largest recreational program for children with intellectual disabilities, with >1 million athletes in 125 countries.[3] Despite these efforts, children with disabilities have lower levels of cardiorespiratory fitness, lower levels of muscular endurance, and higher rates of obesity than typical children. In addition to the physiologic benefits of decreased body fat and increased fitness overall, regular physical activity for children with disabilities has been shown to help in controlling or slowing the progression of the chronic disease, improving overall health and function, and mediating the psychosocial impact of the condition on children and their families (J. H. Rimmer, PhD, written communication, 2007). Pediatricians and other medical home professionals may overestimate the risks or overlook the benefits of physical activity in children with disabilities. Parents often seek information about recreational opportunities, but some pediatricians are relatively unaware of the value of these opportunities for children with disabilities.[4] This clinical report discusses the importance of physical activity, recreation, and sports participation for children with disabilities and offers practical suggestions to pediatric health care professionals for the promotion of participation.

BENEFITS OF SPORTS PARTICIPATION

The term "participation" is defined by the World Health Organization as the nature and extent of a person's involvement in life situations and includes activities of self-care, mobility, socialization, education, recreation, and community life.[5] Participation in activities is the context in which people form friendships, develop skills and competencies, express creativity, achieve mental and physical health, and determine meaning and purpose in life.[6] Children with disabilities tend to be more restricted in their participation than their peers: a gap that widens as children become adults.[7] One way in which health care professionals can assist children with disabilities to

participate fully in the lives of their families and communities is by promoting participation in sports, recreation, and physical activities in the least restrictive environment.

The primary goals for increasing physical activity in children with disabilities are to reverse deconditioning secondary to impaired mobility, optimize physical functioning, and enhance overall well-being. Regular physical activity is essential for the maintenance of normal muscle strength, flexibility, and joint structure and function and may slow the functional decline often associated with disabling conditions.[8] Children with cerebral palsy (CP) are significantly weaker than age-matched controls, and strengthening and weight-bearing programs are recommended.[9] Moreover, female adolescents with CP have a lower self-concept than their counterparts without disability in the domains of physical appearance, social acceptance, athletic competence, and scholastic competence.[10] Adequate levels of muscular strength and endurance are associated with increased bone mass, reduction in injury from falls, and a greater ability to complete activities of daily living.[9,11] A strength-training program for young patients with CP demonstrated increased strength, improved mental well-being, and better overall function.[12] Another example is that of children with Down syndrome; although they have less muscle strength than typical children, they show increased exercise endurance and work capacity after participation in a specialized aerobic training program.[13]

The current epidemic of obesity associated with inactivity is a global health care concern for all children, including those with disabilities.[14] Children with disabilities are more likely than other children to be sedentary, placing them at higher risk of obesity and associated health conditions.[15] In fact, children with certain developmental disorders have higher prevalences of being at risk of overweight and being overweight than do children without developmental disorders.[16] Physical consequences of inactivity for persons with disabilities include reduced cardiovascular fitness, osteoporosis, and impaired circulation. In addition, the psychosocial implications of inactivity include decreased self-esteem, decreased social acceptance, and ultimately, greater dependence on others for daily living. Overall, the participation of children with disabilities in sports and physical activities can decrease complications of immobility.

Sports participation enhances the psychological well-being of children with disabilities through the provision of opportunities to form friendships, express creativity, develop a self-identity, and foster meaning and purpose in life.[17] Special Olympics participants show heightened self-esteem, perceived physical competence, and peer acceptance when compared with nonparticipants.[18] Parents of Special Olympians reported that their child's participation promoted social adjustment, life satisfaction, family support, and community involvement.[19] Such events provide a much-needed venue for informal peer support and sharing of experiences among families of children with disabilities.[20] Mildly strenuous exercise has been shown to reduce stereotypic movements, maladaptive behaviors, and fatigue in children with autism and other developmental disabilities.[15,17,21] Last, participation in regular physical activity can foster independence, coping abilities, competitiveness, and teamwork among children with disabilities.[22]

PREPARTICIPATION CONSIDERATIONS

Currently, a wide variety of sporting activities are accessible to children with disabilities, and guidelines are available to assist pediatricians in recommending activities appropriate for children with specific conditions.[23] The American Academy of Orthopedic Surgeons has developed a "participation possibility chart" that outlines sporting options for individuals with the most frequently occurring physical disabilities.[13] For example, it is recommended that children with Down syndrome, after being screened radiographically for atlantoaxial instability, participate in sports they enjoy, with the exception of those that involve contact or collision.[24] Similarly, children with asthma should have readily available medications for use before participation as needed and should be permitted to modify participation as needed for airway exacerbations or environmental conditions without negative ramifications. Rather than exclusion from sports participation, the goal is inclusion for all children with disabilities in appropriate activities. It is important that children are empowered with an "I can do" attitude rather than discouraged by the message "you can't do that."[2]

Properly designed and implemented programs of sports and physical activities for children with disabilities should target cardiovascular endurance, flexibility, balance, agility, and muscular strength and accessibility, safety, and enjoyment.[8] Strategies to minimize the risks of illness or injury to children with disabilities during sporting activities should be implemented before participation. Exercise that is of longer duration, greater frequency, and lower intensity compared with programs for typically developing children is recommended.[8] In the example of an adolescent with a cervical spinal cord injury, participation in wheelchair rugby should be permitted only after the athlete, parents, and coaches can readily recognize acute sweating, sudden and often severe headache, apprehension, and hypertension as autonomic dysreflexia and quickly identify and remove the triggering factor(s).[22] Latex-safe environments should be provided, and resuscitation medications should be readily accessible when children with spina bifida (25%–65% prevalence of latex allergies) are participating.[22]

Children with neurodevelopmental disabilities often demonstrate abnormalities of thermoregulation secondary to impaired vasomotor control, decreased muscle mass, and impaired central temperature-regulating mechanisms.[22] Anticholinergic medications may further increase the risk of hyperthermia in children with spinal cord injuries. Approximately one half of athletes in a Junior National Wheelchair Games competition experienced hyperthermia, and 9% of swimmers in the same study experienced hypothermia.[22] Careful attention must be directed at proper training, hydration, clothing,

and equipment. Some children with disabilities have impaired motor coordination, decreased endurance, limited mechanical efficiency, and osteopenia, factors that can predispose to musculoskeletal injuries and overuse syndromes. For example, athletes in wheelchairs have increased rates of shoulder overuse injuries and carpal tunnel syndrome.[2] Pediatricians are encouraged to access published resources for sports-specific and condition-specific guidelines regarding the participation of children with disabilities in sports and physical activities.[25]

Health supervision visits afford pediatricians, children with disabilities, and parents with opportunities to collaboratively generate goal-directed activity "prescriptions." The longitudinal relationship between the pediatrician, child, and family provides a broad and deep understanding of the implications of participation for each child. Conditions that may limit a child's participation or predispose the child to injury, individual preferences, and the availability of appropriate local programs must be individually considered. The child's current health status, the level of competition, the specific sport and position to be played, availability of protective or adaptive equipment, whether the sport can be modified to allow safer participation, and the ability of child and parent to understand and accept the risks involved must all be addressed before participation.[23]

For example, a child with autism and communication impairments might struggle with verbal instructions from coaches during certain team sports and benefit more from participation in individual sporting activities. Because standardized preparticipation forms may not adequately communicate the issues involved in safe participation for children with disabilities, alternative forms have been developed.[2] Overall, the sports preparticipation evaluation for children with disabilities may not occur in the context of a single office visit, but rather, over a period of time with input from physicians, coaches, physical education teachers, physical and occupational therapists, and others. The American Academy of Pediatrics policy statement on care coordination for children with special health care needs provides guidance on the complexities of this process.[26] With the proper guidance, the risk of injury to physically challenged children is no greater than that to athletes without disability.[22]

What Determines Participation?

The most frequently identified barriers to the active participation of children with disabilities in sports and physical recreation are the child's functional limitations (18%), high costs (15%), and lack of nearby facilities or programs (10%).[27] In fact, adolescents with disabilities cited the cost of specialized equipment as the most frequent reason for nonparticipation.[27] Participation is further influenced directly by time, the home environment, and the child's perceived self-competence and indirectly by social support from schools and communities, family demographics, and family and child preferences.[27] Families who engage in physical activities themselves tend to promote similar participation for their children with disabilities.[14,27] Moreover, inactive role models, competing demands and time pressures, unsafe environments, lack of adequate facilities, insufficient funds, and inadequate access to quality daily physical education seem to be more prevalent among populations with special needs.[14] Overall, environmental and family factors seem to be more significant determinants of participation than characteristics of the children themselves.[27] The establishment of short-term goals, emphasizing variety and enjoyment, and positive reinforcement through documented progress toward goals can help spark and sustain the motivation for participation.[8]

Many individuals with disabilities are still, to a large extent, socially segregated and experience negative societal stereotypes and low performance expectations, rendering them with limited opportunities for participation in group physical activities.[27] These attitudinal barriers in the community contribute to a lack of awareness regarding current programs and opportunities for participation. Although specialized programs are beneficial, the participation of children with disabilities with other children in community activities can reduce societal barriers. It is a common misconception that children with disabilities are susceptible to trauma and, therefore, should avoid rigorous sporting activities that are typically associated with injury. Although athletes with disabilities have rates of injury similar to those of other athletes, fear of injury frequently remains a barrier to participation. Overall, misconceptions and attitudinal barriers at the level of the individual, the family, and the community need to be addressed to integrate children of all abilities into recreational and sports activities.

The Right to Participate

Federal laws exist to protect the rights of children with disabilities to participate in sports and physical activities. The Individuals with Disabilities Education Act mandates free, appropriate public education in the least restrictive environment. Section 504 of the Rehabilitation Act of 1973 states that no individual shall be excluded because of disability in programs that receive federal funds.[28] Physical education is a federally mandated component of special education services, including the promotion of physical and motor fitness, fundamental motor skills, and skills in individual and group games and sports.[29] Pediatricians and parents of children with disabilities can advocate for programs of adapted physical education and recreation in each child's individualized education plan.[17] Schools are required to modify programs or activities according to the abilities of each child. Students with disabilities have the same right as all students to compete for inclusion on interscholastic teams that use performance criteria to determine who will participate.

Although national initiatives from the US Department of Health and Human Services (*Healthy People 2010*),[30] the Centers for Disease Control, and the American Academy of Pediatrics stress the daily participation of all students in programs of physical education, this

goal remains unmet. In fact, according to a 2000 study, only 8% of American elementary schools, 6.4% of middle schools, and 5.8% of high schools with existing physical education requirements provided daily physical education classes. More than three fourths of elementary, junior/middle, and senior high schools allow students to be exempted from required physical education; cognitive and physical disabilities are among the most common reasons for these exemptions.[31] The combined advocacy efforts of well-informed pediatricians, parents, educators, and others are needed to ensure and promote the participation of all children in sports and physical activity programs, each according to his or her abilities.

ADVICE FOR PEDIATRICIANS

Overall, it is important for pediatricians to:

1. Understand the benefits of the participation of children with disabilities in sports and physical activities.
2. Perform preparticipation evaluations for children with disabilities in collaboration with the child and family, pediatric specialists, therapists, coaches, and others.
3. Identify strategies to minimize risks of illness and injury related to participation through activity adaptations and safety precautions.
4. Recognize and reduce child, family, and societal barriers to the participation of children with disabilities in athletics.
5. Advocate for the participation of all children, including those with disabilities, in sports and physical activity programs.
6. Be aware of resources regarding appropriate sports and physical activity programs for children with disabilities in their local communities. The National Center of Medical Home Initiatives for Children with Special Needs (www.medicalhomeinfo.org/health/recreation.html) reviews the benefits of recreation for children with disabilities, provides information on national initiatives, and identifies Web sites of organizations such as Special Olympics and the National Center on Physical Activity and Disability.[32]

SUMMARY AND CONCLUSIONS

All children benefit from physical activity, and children with disabilities are no exception. Participation of children with disabilities in sports and physical activity programs promotes physical, emotional, and social well-being. Well-informed decisions regarding each child's participation must consider overall health status, individual activity preferences, safety precautions, and availability of appropriate programs and equipment. Child, family, financial, and societal barriers to participation need to be directly identified and addressed in the context of local, state, and federal laws. Pediatricians are urged to promote the participation of children with disabilities in competitive and recreational sports and physical activities. The benefits are substantial.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Sports Medicine and Fitness

Promotion of Healthy Weight-Control Practices in Young Athletes

ABSTRACT. Children and adolescents are often involved in sports in which weight loss or weight gain is perceived as an advantage. This policy statement describes unhealthy weight-control practices that may be harmful to the health and/or performance of athletes. Healthy methods of weight loss and weight gain are discussed, and physicians are given resources and recommendations that can be used to counsel athletes, parents, coaches, and school administrators in discouraging inappropriate weight-control behaviors and encouraging healthy methods of weight gain or loss, when needed. ***Pediatrics*** **2005;116:1557–1564;** ***athlete, weight gain, weight loss, wrestling, eating disorders.***

ABBREVIATION. NWCA, National Wrestling Coaches' Association.

INTRODUCTION

With the growth and advancement of youth sports, children and adolescents are becoming more involved in sports in which weight control is perceived to be advantageous for the individual and/or team. Bodybuilding, cheerleading, dancing, distance running, cross-country skiing, diving, figure skating, gymnastics, martial arts, rowing, swimming, weight-class football, and wrestling all emphasize thinness, leanness, and/or competing at the lowest possible weight. Other sports, such as football, rugby, basketball, and power lifting emphasize gaining weight by increasing lean muscle mass. In their attempt to lose weight and body fat or gain weight and muscle mass, some athletes resort to unhealthy weight-control practices,[1–5] which can potentially be harmful to their performance and/or their health. Pediatricians need to be able to recognize the young athlete who is at risk of developing unsafe weight-control practices and provide the athlete, family members, coaches, athletic trainers, and athletic directors with accurate information about healthy weight-control practices.

WEIGHT LOSS

Many athletes attempt to lose weight or body fat, hoping to improve performance, improve appearance, or meet weight expectations. Practices that are used to reduce weight include food restriction, vomiting, overexercising, diet-pill use, inappropriate use of prescribed stimulants or insulin, nicotine use, and voluntary dehydration (Table 1). Voluntary dehydration practices include fluid restriction, spitting, and the use of laxatives and diuretics, rubber suits, steam baths, and saunas. Weight loss becomes a problem when nutritional needs are not met or adequate hydration is not maintained.

Athletes may practice weight-control methods during the sports season only or year-round. These practices can impair athletic performance and increase injury risk. They also may result in medical complications including delayed physical maturation; oligomenorrhea and amenorrhea in female athletes; development of eating disorders; potential permanent growth impairment; an increased incidence of infectious diseases; changes in the cardiovascular, endocrine, gastrointestinal, renal and thermoregulatory systems; and depression.[1,4,6–9]

Dehydration

Hypohydration and dehydration are used by athletes in weight-sensitive sports in an attempt to lose weight or appear more lean and, thus, obtain a perceived advantage. Because the body does not store fluid or electrolytes before exercise, it is predisposed to dehydration.[10] The extent of the dehydration is determined by sweat loss and the inability or refusal to replace those losses with oral fluids.[11] On the basis of studies in adults, weight loss by dehydration results in suboptimal performance because of impaired strength, reaction time, endurance, and electrolyte imbalance and acidosis. It also may result in temporary learning deficits,[4,12–14] inability to concentrate, lethargy, mood swings, and changes in cognitive state.[15–20]

Hypohydration affects prolonged aerobic exercise more than it affects short, high-intensity anaerobic exercise.[10,21] In adults, a decrease in performance is seen when hypohydration is 2% or more (Table 2). Two to 3% hypohydration results in decreased reflex activity, maximal oxygen uptake, physical work capacity, and muscle endurance and impaired temperature regulation.[22] With additional hypohydration,

TABLE 1. Definition of Hydration

Euhydration: a normal state of body-water content
Dehydration: the process of incurring water deficit
Hypohydration: the extent (or level) of this deficit (usually described as percent of initial body weight)
Voluntary dehydration: purposeful restriction of fluids or use of measures to dehydrate oneself, often to produce weight loss

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TABLE 2. Effects of Various Levels of Hypohydration

Adults
2–3% hypohydration
Decreases reflex activity
Maximal oxygen uptake decreases by 10%[22]
Physical work capacity decreases by 22%[22]
Muscle strength decreases
Muscle endurance decreases
Impairment in temperature regulation
4–6% hypohydration
Maximal oxygen uptake decreases by 27%[22]
Physical work capacity decreases by 48%[22]
Muscle strength decreases more
Endurance time is reduced
Severe impairment in temperature regulation
Headaches, difficulty with concentration, impatience, sleepiness
>8% hypohydration
Heat cramps
Heat exhaustion
Heat stroke
Children
1% hypohydration
Reduces aerobic performance[25]
Increases core temperature[26]
No studies in children for higher levels of hypohydration exist

these parameters decrease even more,[22] and additional symptoms including reduced muscle strength, headache, difficulty concentrating, impatience, and sleepiness occur.[23] Dehydration retards the acclimation process and affects thermoregulation during exercise. The thermoregulatory effect of dehydration intensifies when athletes exercise. For every 1% hypohydration in adults, there is an associated increase of 0.1 to 0.4°C in body temperature.[23,24] When hypohydration exceeds 8%, heat cramps occur, followed by heat exhaustion and heat stroke (body temperature of more than 40.5°C or 105°F). These are serious, life-threatening events.

In children, 1% hypohydration is enough to induce a reduction in aerobic performance.[25] For ethical reasons, studies have not been performed in young children with greater levels of hypohydration. A study with 10- to 12-year-old boys who exercised intermittently in the heat suggested that the increase in their core temperature, at any level of hypohydration, was greater than in adults.[26]

Children have the following characteristics that are similar to adults:

1. Involuntary dehydration can occur with prolonged exercise even if the child is given fluids ad libitum.[11,26,27] This occurs principally when the fluids are unflavored.[28,29]
2. Dehydration causes greater body heat storage (excessive increase in core body temperature),[21,30] decreases blood volume, and results in reduced exercise tolerance,[28] increasing the risk of heat-related illness.[21,30–34]
3. Heat acclimation and training result in an increased sweating rate, which may provide heat dissipation by evaporation but also produces greater fluid loss.[28]
4. The likelihood of heat intolerance increases with conditions that are associated with excessive fluid loss (febrile state, gastrointestinal infection, diabetes insipidus, and diabetes mellitus), suboptimal sweating (spina bifida, sweating-insufficiency syndromes), excessive sweating (selective cyanotic congenital heart disease), abnormal sweating (cystic fibrosis), inadequate drinking (people with mental retardation and young children), abnormal hypothalamic thermoregulatory functions (anorexia nervosa, advanced undernutrition, previous heat-related illness), and obesity.[30,35,36]

Children have certain characteristics that, when compared with adults, predispose them to dehydration and heat illness, including the following:

1. Children produce more heat relative to body mass for the same exercise.[21,30,33]
2. Children have lower cardiac output for any given metabolic level.[30,33]
3. Children have higher thresholds before beginning to sweat.[34,35,37]
4. Sweating capacity is considerably lower in children,[30] reducing their ability to dissipate body heat by evaporation.[30,34,35,37]
5. Children become slightly more dehydrated with lower climatic and metabolic heat stress.
6. Children have a greater ratio of body surface area to body mass, which causes them to absorb heat more quickly when the ambient temperature exceeds skin temperature. Thus, a high level of solar radiation can be more detrimental to children.[28,30]
7. Children's ability to maintain thermohomeostasis during prolonged running in very hot or very cold environments is less efficient.[30,34,38]
8. Children are less efficient in dissipating heat in very hot environments.[11]
9. Children take longer to acclimate to hot, humid environments (2 weeks versus 1 week),[11,30] which increases their risk of heat-related disorders.[38,39]
10. Core body temperature increases more in children for the same level of hypohydration.[11,26]
11. Recent studies indicate that children's thirst is inadequate and that they become dehydrated easier (O. Bar-Or, MD, McMaster University and Chedoke Hospital, Hamilton, Ontario, Canada, verbal communication, October 1, 2003).

Children have a few characteristics that are beneficial in protecting them from dehydration in comparison with adults, including the following:

1. Children have shorter performance times in hot environments, and when exercising at the same intensity as adults. With shorter performance times, children are less likely to dehydrate themselves.[11,30]
2. Sodium and chloride concentrations in the sweat of prepubescent children are lower than those of pubescent children, who in turn have lower sodium losses than adults.[11]
3. Children's sweat rates are reduced, resulting in less sodium and chloride loss.

Dehydration over several days may be cumulative when the athlete who is dehydrated does not suffi-

ciently replace the fluid loss. An athlete may develop 2% to 3% hypohydration one day, not fully rehydrate overnight, and then on subsequent days dehydrate further by repeating the previous day's experience. This process leads to progressive dehydration, to the extent that the athlete becomes 5% to 8% hypohydrated. The greater the body-fluid deficit, the longer it takes to restore this deficit completely.[23] Replacement of intracellular fluids, when dehydration has occurred over 2 or 3 days, requires 48 hours.[40]

When children are given plain water, they will not replace their fluid losses completely. However, when children are given flavored drinks such as grape-, tropical-, or orange-flavored water, voluntary drinking increases by 44.5%,[28,41] a sufficient amount to replace their fluid losses completely.[11,28–30,32] When 6% carbohydrate and 18 mmol/L of sodium are added to flavored water, voluntary drinking is increased by an additional 45.5%.[28–30,41]

Prevention and Treatment of Dehydration

Sweat rates vary among athletes; therefore, one must consider each athlete individually and rely on previous experience with a particular athlete to estimate how much fluid he or she will require.[42]

Fluid ingested before, during, and after exercise reduces dehydration, core temperature, heart rate, and cardiac strain[6]; it maintains skin blood flow and increases exercise performance.[43,44] Thirst is a late indicator of dehydration in adolescents and adults; therefore, efforts must be made to maintain euhydration. The best way to assess hypohydration is to weigh the athlete before and after exercise. The amount of weight lost should be replaced with an equal volume of fluids before the next exercise session. The fluid should contain carbohydrates to replenish glycogen stores as well as sodium chloride.[11,21,45] The concentration of sodium in sports drinks is lower than the sodium concentration in the sweat of both adults and children.[41] Even if children drink enough sports drinks to maintain euhydration, their total body sodium would be decreased and their total sodium loss would not be replaced.[45] If this is repeated over several days and the sodium is not replaced in food or drink, symptomatic hyponatremia may develop.[45]

Food Restrictions/Binge-Purge Behavior

The most common way for athletes to attempt weight loss is by restricting food intake. They may develop other disordered eating behaviors such as purging, with or without bingeing, to decrease total energy (caloric) intake. Compulsive exercise or excessive exercise in addition to the normal training regimen also would be considered a form of purging. The spectrum of these disordered eating behaviors ranges from mild to severe, with the risk of development of an eating disorder and the associated morbidity and mortality increasing as the severity of the behavior increases.[46]

Disordered eating behaviors are prevalent in male and female athletes. Ten to 15% of high school boys who participate in "weight-sensitive sports" practice unhealthy weight-loss behaviors.[1,4,47] Numerous studies have reported these practices in wrestlers, with 1 study revealing that 80% of wrestlers lost weight for the wrestling season.[48] Eleven percent of wrestlers were found to have an eating disorder in 1 study,[49] and as many as 45% of wrestlers were found to be at risk of developing an eating disorder in other studies.[4,19,47]

Many studies have revealed an increased incidence of disordered eating behavior (food restriction, vomiting, laxative and diuretic use) in female athletes involved in weight-sensitive sports such as figure skating, gymnastics, diving, long-distance running, rowing, and swimming.[2,5,46] One study of young swimmers reported that 60% of average-weight girls and 18% of underweight girls were trying to lose weight.[50] Most of these swimmers were restricting food intake to lose weight; however, 15% were vomiting or using laxatives or diuretics. In the female athlete, decreased energy availability (calculated as dietary energy intake minus exercise energy expenditure) can lead to menstrual dysfunction, which can result in potential bone mineral density loss. This has been termed the "female athlete triad" (decreased energy availability or disordered eating, menstrual dysfunction, and bone mineral density loss).[3,51] All female athletes with oligomenorrhea or amenorrhea should be evaluated thoroughly to determine the underlying etiology. If low energy availability is the cause, the athlete should be counseled on increasing energy intake enough to resume normal menses.[3,51] If an eating disorder is suspected, referral to a multidisciplinary team of experts in this field is appropriate.

Healthy Weight Loss

Athletes usually require a greater energy (caloric) intake than do nonathletes.[21] The actual energy intake (number of calories) needed depends on the athlete's body composition, weight, height, age, stage of growth, and level of fitness as well as the intensity, frequency, and duration of exercise activity.[52] Athletes need to eat enough to cover the energy costs of daily living, growth, building and repairing muscle tissue, and participating in sport.[53] Athletes who want to lose weight should be counseled on the harmful effects of unhealthy weight-loss practices and inappropriate weight loss. They need to be informed that weight is not an accurate indicator of body fat or lean muscle mass and that body composition measurements can be much more helpful.[54]

Studies have shown that physique does not markedly influence performance except at the extreme ranges (ie, significant endomorphy or ectomorphy).[55] An excessive amount of body fat interferes with acclimation to heat and can decrease speed, endurance, and work efficiency.[4,56] Therefore, weight loss may be beneficial when it is achieved by healthy means and involves losing excess fat without reducing lean muscle mass or causing dehydration.[4] When weight is lost too rapidly or by significant reduction in energy (caloric) intake, lean muscle mass will be lost, which can affect performance negatively.[57]

Weight loss, when necessary, should be gradual

and should not exceed 1.5% of the total body weight, or 1 to 2 lb, each week.[52,56–59] Weight loss beyond these guidelines results in the breakdown and metabolism of muscle, making an athlete weaker.[52,56–60] To lose 1 lb of fat in 1 week, one must expend 14 700 kJ (3500 kcal) more than one consumes.[60] The ideal way to do this is to consume 7350 kJ (1750 kcal) fewer per week and expend 7350 kJ (1750 kcal) more per week by exercising.[56,60] An appropriate diet for most athletes consists of a minimum of 8400 kJ (2000 kcal) each day. Approximately 55% to 65% of the daily energy (caloric) intake should be from carbohydrates, 15% to 20% should be from protein, and 20% to 30% should be from fat.[52,57] The diet should be well balanced, consisting of foods from all groups of the food pyramid. When possible, the athlete should be counseled by a registered dietitian who has experience working with athletes and their families. Sports and Cardiovascular Nutritionists (SCAN), a practice group of the American Dietetic Association, can provide names of registered dietitians with expertise in nutrition and exercise (see www.eatright-.org, or call 800-877-1600, extension 5000).

Once weight has been lost and the desired weight is obtained, that weight should be maintained. Studies have shown that athletes who maintain their desired weight have higher resting metabolic rates than do athletes who are "cyclic" weight losers (177.2 vs 154.6 kJ/m^2 per hour, respectively).[61] They also have higher resting energy expenditures (7702.8 vs 6631.8 kJ/day, respectively) and oxygen consumption (266.5 vs 230.4 mL/minute, respectively).[61] Therefore, athletes who maintain a constant weight can eat more calories than the "cyclic" weight losers and maintain the same weight.[61]

With the exception of sports that require mandatory weigh-ins, coaches of most sports should not discuss weight or weight loss with an athlete. Many coaches inappropriately focus on weight instead of body composition and performance, and most coaches do not have an adequate nutritional background to counsel an athlete about weight loss. In addition, when a coach mentions weight loss to an athlete, that athlete is much more likely to begin harmful practices of weight control rather than consult with the appropriate professionals. Any weight loss desired by an athlete should be discussed with a health care professional, a registered dietitian, an athletic trainer (when appropriate), and the family. Athletes involved in sports that require mandatory weigh-ins should be discouraged from using harmful weight-loss practices and should be encouraged to compete at a weight that is appropriate for their age, height, physique, and stage of growth and development. Weigh-ins should take place in such a manner as to encourage good hydration and competing at a healthy weight. It has been determined that the safest and fairest procedure for wrestlers, to ensure that they are well hydrated at all times, is to have mat-side weigh-ins immediately before their matches.[62] This procedure ensures that competing wrestlers will be at or near the same weight during the match. A wrestler is prevented from dehydrating and weighing in at one weight, and then rehydrating and wrestling at a significantly higher weight while his or her opponent weighs in at his or her natural weight and wrestles at that weight. Mat-side weigh-ins would prevent wrestlers from competing when they are weak from dehydration and prevent the temptation of dehydrating themselves to the degree that is life threatening.

Weight and Body-Composition Measurement

An athlete's weight should typically fall between the 25th and 75th percentiles of weight for height for age (by National Center for Health Statistics guidelines),[63] although some athletes weigh more because of increased muscle mass. The use of body mass index (BMI) in athletes is not recommended; however, if used, most athletes should be between the 50th and 75th percentile for BMI.[64] BMI is a measure of one's weight relative to height and has been used as a fairly reliable indicator of total body fat (obesity) in adults. In 2000, the Centers for Disease Control and Prevention published guidelines for BMI in children and adolescents 2 years and older to aid in diagnoses of overweight and underweight.[64] BMI is not a perfect indicator of body fatness and may falsely classify some children, particularly adolescents, who are of normal fatness as being overweight.[65] Because weight and height velocities do not coincide exactly during the growth spurt and individual patterns of growth vary during this time, care must be taken to avoid a false diagnosis of overweight during puberty.[65] BMI also can be falsely elevated in an athlete or nonathlete with a muscular build as well as in someone who has a high torso-to-leg ratio.[65] Therefore, body-composition measurements (body fat and lean muscle mass), in addition to height-for-weight for age measurements, may be more useful in determining the physical status of an athlete.[54,57]

Anthropometric measurements can be performed to estimate lean muscle mass. For most well-nourished athletes, lean muscle mass should be greater than the 25th percentile.[57] Many methods are available to determine body fat.[4] The most precise method is underwater weighing; however, the equipment for underwater weighing is expensive and of limited availability. Other commonly used methods include skinfold-thickness measurements, air displacement, bioelectrical impedance measurements, girth measurements, and computerized calipers.[4,58] Skinfold measurements are easily performed by someone with experience using high-quality calipers (approximately $200). When performed in the correct manner, published reports on skinfold calibration show an error margin of ±3%.[66] Skinfold measurements can be taken from 3, 4, or 5 sites (right biceps, right triceps, right subscapular, right suprailiac, and right abdominal sites [regardless of whether the athlete is right-handed or left-handed, measurements are always performed on the right side]). The more sites used, the more accurate the results are. Instructions on how to perform skinfold measurements are available.[58,59]

No optimal values for body composition have been established for any sport. The association be-

tween performance and body composition must be individualized for each athlete. A specific percentage of body fat should never be recommended for an individual athlete, but rather a range that is realistic and appropriate.[67] The body fat of "reference adolescents" ranges from 12.7% to 17.2% for males and 21.5% to 25.4% for females.[68] "Low fat" is considered to be 10% to 13% for males and 17% to 20% for females. "Very low fat" is considered to be 7% to 10% for males and 14% to 17% for females.[69,70] Adolescent females who are meeting their energy (caloric) needs will be eumenorrheic.[51]

WEIGHT GAIN

Sports such as football, rugby, basketball, power lifting, and bodybuilding often motivate athletes to gain weight. If weight is gained improperly, it will lead to excess fat, resulting in decreased speed, endurance, and agility and poor acclimation to heat. Overweight athletes, later in life, are at an increased risk of hypercholesterolemia, gall bladder disease, cardiovascular disease, hypertension, and type 2 diabetes mellitus. Often, athletes use supplements (which may be of unproven value and potentially harmful) or anabolic compounds (which are harmful to athletes' health) to gain weight instead of evaluating their nutritional and training programs.

Before trying to change body composition, athletes must understand potential genetic limitations.[71] Athletes with a solid body build (mesomorphy) can expect to gain more weight than athletes with a slender body build (ectomorphy). Inadequate energy intake is often the limiting factor for athletes trying to increase muscle mass. They may overestimate the protein requirements and underestimate the need for carbohydrates.[71]

Healthy Weight Gain

The rate and amount of weight gained and specific muscles developed are determined by an athlete's genetic predisposition, training program, diet, and motivation.[71] To build 1 lb of muscle in 1 week, one must (1) consume 8400 to 10 500 kJ (2000–2500 kcal) more than one expends, (2) consume 1.5 to 1.75 g of protein per kg of body weight per day, and (3) participate in strength training. Consuming 1.5 to 1.75 g of protein per kg of body weight per day rarely is a problem; the average American diet contains 2 to 3 times that amount of protein.[56] If the athlete has not gained the desired weight despite an appropriate training program, adequate rest, and a nutritionally sound diet, it is appropriate to make a recommendation that he or she increase dietary fat.[71] Studies of elite athletes report dietary fat intakes ranging from 29% to 41% in males and 29% to 34% in females.[71] Increased energy (caloric) intake should always be combined with strength training to induce muscle growth and, therefore, increase muscle mass. Gains in muscle hypertrophy are best achieved by performing multiple sets of weight lifting with a relatively high number of repetitions (8–15 repetitions per set).[72] Young athletes should lift lighter weights with an increased number of repetitions under the supervision of a trained adult.[72] Weight gain needs to be gradual, because a gain in excess of 1.5% of body weight per week may result in unwanted fat.[56,60]

RECOMMENDATIONS

1. Physicians who care for young athletes should have knowledge of healthy weight-gain and weight-loss methods. They should understand minimal recommended weight, normal growth curves, and body composition measurements and be willing to educate athletes, families, coaches, athletic trainers, school administrators, and state and national organizations when appropriate. Physicians should understand that all athletes are unique and each athlete must be evaluated individually.
2. All physical examinations of young athletes should include a weight history and a history of eating patterns, hydration practices, eating disorders, heat illness, and other factors that may influence heat illness or weight control.
3. Physicians should be able to recognize early signs and symptoms of an eating disorder and obtain appropriate medical, psychological, and nutritional consultation for young athletes with these symptoms.
4. Nutritional needs for growth and development must be placed above athletic considerations. Fluid or food deprivation should never be allowed. There is no substitute for a healthy diet consisting of a variety of foods from all food groups with enough energy (calories) to support growth, daily physical activities, and sports activities. Daily caloric intake for most athletes should consist of a minimum of 8400 kJ (2000 kcal). Athletes need to consume enough fluids to maintain euhydration. Physicians should engage the services of a registered dietitian familiar with athletes to help with weight-control issues.
5. In sports for which weigh-ins are required, athletes' weight and body composition should be assessed once or twice per year. The most important assessment is obtained before the beginning of the sport season. This should include a determination of body fat and minimal allowable weight when the athlete is adequately hydrated (the National Wrestling Coaches' Association [NWCA] Internet Weight Classification Program is available at www.nwcaonline.com[58] or by calling 717-653-8009 [see Table 3 and Appendix]). Weigh-ins for competition should be performed immediately before competition.[62] Athletes should be permitted to compete in championship tournaments only at the weight class in which they have competed for most other athletic events that year.[58,59,62]
6. Male high school athletes should not have less than 7% body fat. This minimal allowable body fat may be too low for some athletes and result in suboptimal performance. Female athletes should consume enough energy (calories) and nutrients to meet their energy requirements and experience normal menses. There are no recommendations on body-fat percentages in female athletes.

7. A program for the purpose of gaining or losing weight should (*a*) be started early to permit a gradual weight gain or loss over a realistic time period, (*b*) permit a change of 1.5% or less of one's body weight per week, (*c*) permit the loss of weight to be fat loss and the gain of weight to be muscle mass, (*d*) be coupled with an appropriate training program (both strength and conditioning), and (*e*) incorporate a well-balanced diet with adequate energy (calories), carbohydrates, protein, and fat. After athletes obtain their desired weight, they should be encouraged to maintain a constant weight and avoid fluctuations of weight. A weight-loss plan for athletic purposes should never be instituted before the 9th grade.
8. Any athlete who loses a significant amount of fluid during sports participation should weigh in before and after practices, games, meets, and competitions. Each pound of weight loss should be replaced with 1 pt of fluid containing carbohydrates and electrolytes before the next practice or competition. Fluids should be available, and the drinking of such should be encouraged at all practices and competitions.
9. Weight loss accomplished by overexercising; using rubber suits, steam baths, or saunas; prolonged fasting; fluid reduction; vomiting; or using anorexic drugs, laxatives, diuretics, diet pills, insulin, stimulants, nutritional supplements, or other legal or illegal drugs and/or nicotine should be prohibited at all ages.[73,74]
10. Athletes who need to gain weight should consult their physician for resources on healthy weight gain and referral to a registered dietitian. They should be discouraged from gaining excessive weight, which may impair performance, increase the likelihood of heat illness, and increase the risk of developing complications from obesity.
11. Ergogenic aids and nontherapeutic use of supplements for weight management should be prohibited.[73,74]
12. Young athletes should be involved in a total athletic program that includes acquisition of athletic skills and improvement in speed, flexibility, strength, and physical conditioning while maintaining good nutrition and normal hydration. This should be done under the supervision of a coach who stresses a positive attitude, character building, teamwork, and safety.[75]

APPENDIX: CALCULATING MINIMAL WRESTLING WEIGHT

Calculation of a minimal safe wrestling weight using body-fat measurements was first performed in high school athletes.[18,76–80] In 1998, the National Collegiate Athletic Association[59] and the NWCA[58] incorporated this technique into a mandatory program designed to establish the minimal safe wrestling weight for collegiate wrestlers.[58] This program includes hydration testing, body-composition assessment, calculation of a lowest allowable weight class for each wrestler, development of a weight-loss plan for each wrestler (if appropriate), and a nutrition education program specific to wrestling. The wrestler's minimal wrestling weight is established by determining percent body fat when the wrestler is adequately hydrated (urine specific gravity of 1.020 or less for college wrestlers and 1.025 or less for high school wrestlers). If the wrestler is not well hydrated, the body-fat calculations will result in a low and unsafe minimum weight recommendation.[81] The National Federation of High Schools medical advisory committee has recommended that high school wrestling programs adopt the program of the NWCA by the 2004–2005 academic year.[4]

In establishing minimal weight, skinfold calipers (Lange skinfold calipers; Beta Technology Corp, Cambridge, MD), bioimpedance (Tanita, Arlington Heights, IL), air displacement (Bod Pod; Life Measurement, Inc, Concord, CA), and hydrostatic weighing are the only methods currently approved for body-composition measurements.[58,59] The NWCA formula requires skinfold measurements to be taken at the right triceps, right subscapular, and right abdominal sites (regardless of whether the athlete is right-handed or left-handed, measurements are always performed on the right side).[58]

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POSITION PAPER

Protecting Adolescents: Ensuring Access to Care and Reporting Sexual Activity and Abuse

Position Paper of the American Academy of Family Physicians, the American Academy of Pediatrics, the American College of Obstetricians and Gynecologists, and the Society for Adolescent Medicine

Position Statement

As physicians and other health care professionals, we have an ethical obligation to provide the best possible care for our adolescent patients. A key tenet for all health professionals is to ensure that adolescents have access to the health services they need, including sexual and reproductive health services. A medical evaluation that addresses sexual and reproductive health includes a careful assessment for abusive or unwanted sexual encounters and the reporting of such cases to the proper authorities. Protection of children and adolescents from predatory, coercive, or inappropriate sexual contact is an important goal of all physicians and health professionals. In meeting our ethical obligations to our adolescent patients, as well as to all of our patients who are children under the age of majority, we rely on our professional judgment, informed by clinical assessment, training, and experience, to address a patient's health conditions or a sensitive situation.

As the primary providers of health care to adolescents, we also have an obligation to make every reasonable effort to encourage adolescents to involve parents in their decisions, as parental support can, in many circumstances, increase the potential for dealing with the adolescent's needs on a continuing basis. If communication between the adolescent and parent cannot be facilitated, access to confidential health care for the adolescent patient must be ensured.

Laws requiring the reporting of sexual abuse exist in every state. There has been a recent trend in using these laws to require the reporting of adolescents' consensual sexual activity. In keeping with the medical and ethical responsibilities that we uphold, the American Academy of Family Physicians, American Academy of Pediatrics, American College of Obstetricians and Gynecologists, and the Society for Adolescent Medicine support the following guidance and principles for our professional members and for broad consideration in the development of public policy:

- Sexual activity and sexual abuse are not synonymous. It should not be assumed that adolescents who are sexually active are, by definition, being abused. Many adolescents have consensual sexual relationships.
- It is critical that adolescents who are sexually active receive appropriate confidential health care and counseling.
- Open and confidential communication between the health professional and the adolescent patient, together with careful clinical assessment, can identify the majority of sexual abuse cases.
- Physicians and other health professionals must know their state laws and report cases of sexual abuse to the proper authority, in accordance with those laws, after discussion with the adolescent and parent, as appropriate.
- Federal and state laws should support physicians and other health care professionals and their role in providing confidential health care to their adolescent patients.
- Federal and state laws should affirm the authority

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of physicians and other health care professionals to exercise appropriate clinical judgment in reporting cases of sexual activity.

Supporting Commentary

State Requirements for Reporting Sexual Abuse and Sexual Activity Vary

Every state has laws that require the reporting of child abuse, including sexual abuse, and every state also has laws that specify when sexual activity with a minor is illegal. Most states use age parameters in defining whether consensual sexual intercourse with a minor is illegal under the state's criminal code; these laws are often referred to as "statutory rape" laws. The state child abuse reporting laws vary widely in terms of whether or not they require reporting consensual sexual activity of a minor—or "statutory rape"—as child abuse.

Most states have laws allowing minors to consent to selected categories of medical care without parental consent. Examples include reproductive health services leading to the diagnosis and treatment of sexually transmitted infections (STI) and the diagnosis of pregnancy. These laws give physicians and other health care professionals the opportunity to practice medicine that responds to the best interest of their patients.

State Requirements Have a Significant Impact on Adolescents, Their Health and Their Families

Physicians and other health care professionals confront difficult choices in meeting their ethical obligations and complying with applicable laws. They are bound by their state reporting requirements. They also have an ethical obligation to ensure that their patients are protected from harm and that they will receive essential health care and support at present and in the future. Often, state reporting requirements do not allow sufficient opportunity for health care professionals to exercise sound medical judgment to meet these ethical obligations.

Well-intentioned but rigid laws can lead to outcomes that are both unintended and potentially damaging to the health of an adolescent. When a state's laws require that sexual intercourse with a minor be reported to law enforcement or child welfare agencies, a sexually active adolescent in a consensual relationship may be placed in the untenable situation of forgoing essential health care (e.g., contraception, screening or treatment for sexually transmitted diseases, etc.) or, if he or she seeks that care, being reported to state authorities. Also, the laws often do not take into consideration varying circumstances such as cases in which parents know about the relationship in which the adolescent is involved. In these situations, the legal implications for the parent may be considerable. A parent who knows about an adolescent's consensual sexual relationship and assists him or her in seeking health care may be reported under state abuse or neglect laws. Laws should not interfere with either an adolescent's access to confidential health care or a parent's ability to provide health supervision to his or her child.

A Significant Number of Adolescents are Sexually Active

According to the 2003 Youth Risk Behavior Surveillance Survey, 32% of 9th graders, 41% of 10th graders, 52% of 11th graders, and 61% of 12th graders have ever had sexual intercourse [1]. Among adolescent girls who are sexually active, more than two-thirds have sexual partners who are the same age or only a few years older [2,3]. Enforcement of "statutory rape" and child abuse reporting laws could potentially affect a very large number of adolescents.

Open Communication between the Health Professional and the Adolescent is Essential

Physicians and other health professionals should ensure that the adolescent has not voiced or otherwise indicated to his or her partner that sexual activity was unwanted or undesirable and that the partner is not placing physical or emotional pressure on the adolescent. Physicians and other health professionals should encourage communication about sexual decision-making between adolescents and their families, and should counsel sexually active adolescents about potential health risks.

The Vast Majority of Reportable Cases of Sexual Abuse and Sexual Coercion are Identifiable through Careful Clinical Assessment

These cases include adolescents in a sexual relationship with a family member, a person of authority (e.g., teacher, leader of a youth organization, etc.), or a member of the clergy. Also included are adolescents who are incapacitated by mental illness, mental retardation, drugs, or alcohol, and are unable to

comprehend, make informed decisions about, or consent to, sexual activity. In addition, any intimate relationships that are violent should be considered abusive. Physicians and other health professionals must know their state laws and report such cases to the proper authority, in accordance with state law, after discussion with the adolescent and parent, as appropriate.

The age of the sexually active adolescent, the degree to which the adolescent understands the consequences and responsibilities of sexual activity, and the discrepancy in years between the age of the adolescent and his or her partner are important considerations that must factor into reporting decisions. Although a wide discrepancy in age between partners is of concern when caring for the adolescent patient, partner age by itself is not indicative of exploitation or abuse. Verbal and physical coercion, as well as alcohol and drugs, are some of the strategies used by sexual predators to victimize adolescents. However, sexual abuse and exploitation of an adolescent may occur in any relationship, including those where the partners are the same age, younger, or older.

It is Essential that Adolescents Have Access to Confidential Health Care

The issue of confidentiality of care is a significant access barrier to health care. A recent study of girls under age 18 attending family planning clinics found that 47% would no longer attend if their parents had to be notified if they were seeking prescription birth control pills or devices, and another 10% would delay or discontinue sexually transmitted infection (STI) testing and treatment [4]. Mandatory reporting of sexual activity will likely raise barriers and prevent adolescents from seeking health care, thereby exposing them to preventable health risks (e.g., pregnancy, sexually transmitted disease, suicide). The long-term consequences of limiting access to health care for sexually active adolescents may include an increase in the prevalence of STIs, a rise in unintended teen pregnancy, and escalation in the number of mental and behavioral health issues, including the potential of partner violence. If these and other conditions are not diagnosed early and treated appropriately, adolescents may suffer adverse health outcomes.

Adolescents can have a range of problems, including some of such severity as to jeopardize their development and health, their future opportunities, and even their lives. These issues may be independent of, or related to, sexual activity. However, until a physician or health professional can meet with and make a professional assessment of the individual adolescent, these issues cannot be identified or addressed.

Legal Requirements and Interpretation of Laws that Impede the Provider/Patient Relationship are Detrimental to Adolescents

The medical community has a long-standing commitment to ensure appropriate protection of confidentiality for their adolescent patients. Physicians and other health care professionals are on the front line in assessing the individual emotional, physical, and behavioral needs of adolescent patients. From this unique vantage point, we are able to provide care and counseling to our young patients and to determine the appropriate course of action required in each circumstance, including whether and when to abrogate an adolescent patient's confidentiality. Federal and state laws should allow physicians and other health care professionals to exercise appropriate clinical judgment in reporting cases of sexual activity, (e.g., life-threatening emergencies, imminent harm, and/or suspected abuse). Ultimately, the health risks to adolescents are so compelling that legal barriers should not stand in the way of needed health care.

Further Reading

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Protecting Children From Sexual Abuse by Health Care Providers

COMMITTEE ON CHILD ABUSE AND NEGLECT

KEY WORDS
sexual abuse

ABBREVIATION
AAP—American Academy of Pediatrics

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abstract

FREE

Sexual abuse or exploitation of children is never acceptable. Such behavior by health care providers is particularly concerning because of the trust that children and their families place on adults in the health care profession. The American Academy of Pediatrics strongly endorses the social and moral prohibition against sexual abuse or exploitation of children by health care providers. The academy opposes any such sexual abuse or exploitation by providers, particularly by the academy's members. Health care providers should be trained to recognize and abide by appropriate provider-patient boundaries. Medical institutions should screen staff members for a history of child abuse issues, train them to respect and maintain appropriate boundaries, and establish policies and procedures to receive and investigate concerns about patient abuse. Each person has a responsibility to ensure the safety of children in health care settings and to scrupulously follow appropriate legal and ethical reporting and investigation procedures. *Pediatrics* 2011;128:407–426

INTRODUCTION

Pediatricians and other health care providers are entrusted with the responsibility to improve the health and well-being of children. However, recent allegations of the sexual abuse of hundreds of children by a pediatrician in the United States have reminded us that some among the pediatric profession may use their position of authority and trust to take advantage of their patients.[1] The prohibition against sexual misuse of one's patients goes back in history to Hippocrates, who said: "I will come for the benefit of the sick, remaining free of all intentional injustice, of all mischief and in particular of sexual relations with both male and female persons. . . ."[2] This ban is echoed by statements of the American Medical Association, the Canadian Medical Society, and the British General Medical Council.[2–4] The American Academy of Pediatrics (AAP) strongly endorses this social and moral prohibition, because it constitutes common justice; it is particularly important for pediatric patients, who have greater developmental vulnerability than adults. This policy statement provides guidance for health care professionals and parents faced with concerns of possible sexual abuse or exploitation and other abuse of children by pediatricians, other physicians, other health care professionals, and related health care personnel.

Preventing child sexual abuse is the primary concern of this statement (Table 1). Child sexual abuse is usually perpetrated by people who do not meet the criteria for a specific psychiatric sexual disorder and is defined by the act itself, which is criminal. Pedophilia and hebephilia

TABLE 1 Definitions

Child sexual abuse is defined as engaging children in sexual activities they cannot understand or consent to, including genital or anal contact; exposing the child to exhibitionism, voyeurism, or sexually explicit material; using the child in pornography; and pandering the child for sex by others.[5]
Pedophilia is defined in the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV)* as "over a period of at least 6 months, recurrent, intense sexually arousing fantasies, sexual urges, or behaviors involving sexual activity with a prepubescent child or children" and that having "acted on these sexual urges or the sexual urges or fantasies cause marked distress or interpersonal difficulties."[6]
Hebephilia and ephebophilia are defined similarly to pedophilia, but the sexual focus is on postpubertal minor girls and boys, respectively. Hebephilia is commonly used to include both sexual attractions.
Paraphilias are persistent, deviant patterns of primary sexual attraction. Included are attractions such as exhibitionism, fetishism, frotteurism, pedophilia, masochism, sadism, transvestitism, and voyeurism.

are less common psychiatric disorders of sexual attraction, on which a person may or may not act. The sexual abuse of children is, by no means, limited to adults with these psychiatric disorders. Sexual misconduct with patients is a subset of abuse of patients by health care providers and involves issues of inappropriate provider-patient boundaries and sexual behaviors.[7] The AAP statement on professionalism also provides guidance on appropriate provider behavior.[8] Child sexual contact can vary from a single, situational event to planned, compulsive, repetitive behavior. In the extreme, the provider's sexual orientation is to children and the provider repetitively acts on this drive, exhibiting and acting on the paraphilias, pedophilia, or hebephilia.

EPIDEMIOLOGY

The medical literature on the frequency of sexual abuse of pediatric patients by providers is sparse[9–11] compared with what is known about abuse of adult patients. Likewise, there are few data on the incidence of pedophilia among pediatricians. What is known about sexual misconduct by physicians comes from surveys of physicians, surveys of adult patients, and studies of abusive physicians and of children reported for sexual abuse concerns. Data on sexual abuse of adult patients and the physicians who abuse them are reported to provide context to the epidemiology and offender behavior of patient sexual abuse.

Surveys of physicians and patients have revealed that sexual relations between physicians and adult patients are not rare and involve approximately 10% of all medical specialists who care for adults.[12] Fifty-six percent of these physicians indicated that they had never received training in provider-patient sexual boundaries. Most of them believed that sexual contact with current patients is wrong, but only one-third of them opposed sexual contact with former patients.[12]

Among the general literature about health or counseling care provider sexual misconduct with clients is a study of patients who sought psychiatric or counseling care secondary to previous provider sexual acts.[13] Fifty-one percent of the offending providers were clergy, and 49% were health care professionals. Of the health care providers, 85% were from various counseling professions, 7.3% were physicians in medical specialties, and 3.7% were nurses. Likewise, in Ontario, Canada, in the 1980s, one-quarter of the health care providers who had been legally charged with patient sexual contact were psychiatrists. Surveys of psychiatrists revealed that 7% to 10% reported that they had had previous sexual contact with patients.[14]

Studies that examined reports of sexual misconduct by physicians have provided further epidemiologic data. A Canadian task force on sexual abuse of patients found that patients younger than 14 years accounted for 8.7% of these reports, whereas 80% of patients subjected to sexual contact were adult women.[3] Male providers were responsible for 91% of the sexual contacts. Among 567 physicians disciplined by their state medical disciplinary boards between 1989 and 1996 for sexually related offenses involving patients, pediatricians accounted for 14 disciplinary events (2.9%), although they represented 7.8% of all physicians.[15]

Recent national data suggest that approximately 8% of American children experience sexual victimization in a given year,[16] although significant underreporting occurs. Official reports of sexual abuse provide some information on child sexual abuse by health care providers. In an Indiana study of children in out-of-home settings, including both general medical and psychiatric facilities, 1.56% of hospitalized children experienced any form of maltreatment.[17] Approximately half of these hospitalized children's maltreatment was sexual abuse, which constituted 0.85% of all hospitalized children. Rates of abuse were similar in foster homes (overall abuse rate: 1.69%); 0.52% of the children in foster homes sustained sexual abuse. In comparison, rates of abuse were higher in residential homes, such as group homes, in which the overall abuse rate reached 12.0%, and 5.8% of the group-home children were sexually abused. One-third of the maltreatment in hospitals was at the hands of staff, compared with 25% in residential homes. In foster homes, caregivers were responsible for 78% of the maltreatment.

In a study of 38 complaints of pediatric patient abuse by hospital staff, 52.9% involved sexual issues.[9] Males were accused in 87% of these sexual complaints. Physicians represented only

14.3% of the accused, and other providers—nurses (42.9%), therapists (21.4%), and volunteers (21.4%)—were accused more often. Overall, 24% of the abuse complaints were felt to be substantiated by internal review by the hospital's child abuse program, and 18% remained indeterminate. Child protective services staff and police substantiated fewer cases than did hospital staff.

Some literature further characterized the sexual relations between physicians and adult patients and the attributes of practitioners who engage in sexual acts with patients. In an anonymous physician survey by Gartrell et al,[12] 42% of the physicians who had engaged in patient sexual contact had admitted doing so with more than 1 patient; 11 victims was the upper range. Male-physician-with-female-patient events constituted 89% of the reports, female-physician-with-male-patient events constituted 6%, male-physician-with-male-patient events constituted 4%, and female-physician-with-female-patient events constituted 1%. Many physicians reported ongoing sexual relationships with their adult patients that involved multiple encounters. Kardener et al[18] compared 59 physicians from adult specialties who acknowledged engaging in patient sexual contacts with 401 providers who denied such acts. Those who had engaged in sexual acts with patients were more likely to feel that provider-initiated, nonsexual affectionate physical contact with patients was appropriate. In addition, the physicians who admitted sexual contacts were more likely to perceive that such nonerotic physical contacts benefitted the patient and their relationship, contrary to the physicians who reported no sexual contact. It is unclear how these behaviors and attitudes with adult patients translate to pediatric patients, but rationalization and denial of effects on the patient seem to be a common thread.

Physicians who have sexual contact with patients come from all specialties of medicine. Most reported and recognized is inappropriate sexual contact between physicians and adult patients, which can vary from a single, opportunistic event to a pervasive, calculated pattern. When a single patient is involved, the physician may consider the events to represent consensual attraction while ignoring the inherent power differential in the relationship. Also ignored is the potential damage that may result. With multiple victims, the contacts are more likely predatory.

Child sexual offenders can have a "fixed" attraction to children or have a predominant sexual attraction to adults rather than to children but exhibit "regressed" sexual behavior by also sexually abusing children. Approximately half of the perpetrators of child sexual abuse have fixed (predominant) child attractions.[19] Those with fixed child sexual attractions are more likely to abuse strangers or casual acquaintances rather than family members. Fixed offenders select male victims more often (42%) than do regressed offenders (16%). Both types of offenders predominately use threats or intimidation (49%) or seduction or enticement (30%) to engage their victims. Twenty percent of offenses are violent or brutal. Both types of offenders tend to be consistent in the age and gender of victims they prefer and the type of abuse they perpetrate (eg, fondling versus penetration). Abuse by fixed offenders seems more often to be planned and to involve more victims, whereas that of regressed offenders is often impulsive.

Males are most often involved in sexual contact with patients. However, homosexual adults are no more likely to sexually abuse children than are heterosexual adults.[20] Jenny et al[21] also observed that among sexually abused children, the frequency of homosexual abusers was no different than their population prevalence.

Pedophilic molesters often choose vocations or activities that provide them access to children.[22] They carefully select victims, who are often vulnerable, and groom them for prolonged periods while assessing their response to gradually more intrusive sexual activities and their ability to remain silent. They also groom the child's parents and the community to trust them, or even depend on them, for isolated child supervision.

Childhood adversities, in particular, child sexual abuse, childhood family dysfunction, and childhood emotional abuse, likely play a significant role in the development of adult pedophilia.[23] However, most child sexual abuse victims do not become sex offenders. In a study of 224 sexually abused boys, 12% later committed sexual offenses.[24] Associated child neglect, lack of supervision, abuse by females, and intrafamilial violence were risk factors for their becoming offenders. Sexual abusers, in general, begin early in their lives. Forty percent of all sexual assaults against prepubertal children are perpetrated by older juveniles.[25] Some of these events provide the precedents for the development of adult pedophilia, which usually follows juvenile sexual offenses against younger children.

Several aspects of pediatric practice represent unique vulnerabilities for pediatric patients, including frequent, potentially private, contact with children. Pediatricians have a special responsibility to address these vulnerabilities and provide well-considered and well-implemented protections for the children in their care. However, any other field that provides frequent, potentially private, contact with children also has the same potential to at-

tract adults with a sexual orientation to children.[25] The prevalence of pedophilia in the general population and among pediatricians is unknown.[25,26]

In summary, the available literature suggests that a minority of physicians, including pediatricians in particular, engage in sexual relationships with patients. Most of these encounters are heterosexual and occur between adult providers and their adult patients. However, some children are victimized by health care providers including pediatricians. There are no circumstances in which any sexual relationship between a physician and pediatric patient is appropriate. Concern about the sexual abuse of children by a physician requires careful investigation. The following guidance is offered to parents and pediatricians who have concerns of sexual abuse by a pediatric health care provider.

NORMAL PEDIATRIC EXAMINATION PRACTICE

Physicians are responsible for assessing the physical health and development of children, including genital health and pubertal development. Many diseases involve anogenital structures, and genital diseases and anomalies can have important consequences for children. During the course of pediatric physical examinations, it is often appropriate and necessary to examine a child's anogenital region. Other body regions also are sexually sensitive, such as the female chest; the perception of what is a sensitive area will vary among individual children. In addition to the physical examination, the provider's history-taking and verbal interaction can involve sensitive topics.[27]

Bright Futures, which describes preventive care that is to be covered under the Affordable Care Act of 2010 (HR 2590 §2713), is a common source for guidance on age-appropriate examinations during well-child care.[28] It provides recommendations for genital examinations from the newborn to preadolescent to adolescent periods. The newborn examination should assess for anogenital anomalies and testicular descent. The first year of life is an important time to observe for diaper-area skin problems, dislocated hips, femoral pulses, hernias, and normal testicular descent. It is also appropriate to ensure normal male and female anatomy during infant examinations. Subsequently, it is reasonable to assess for genital normalcy, including lack of inflammation, rash, or premature maturation, during each annual examination. Beginning at approximately the 7- to 8-year visits, *Bright Futures* recommends evaluation for signs of normal maturation and development to assist in health surveillance and anticipatory guidance. From then, into adolescence, the male examination will involve inspection for hernias, hydroceles, varicoceles, and inflammatory conditions. The female examination will include inspection for maturation, hymenal normalcy and patency, hernias, and dermatologic and inflammatory conditions. Routine intravaginal examinations and Papanicolaou tests are currently not recommended until the age of 21 years.[29]

In addition to regular well-child examinations, anogenital examinations are appropriate in relation to specific illness complaints. The rule in deciding whether to perform an anogenital examination during acute care should be the pertinence of the examination to the specific complaint. For example, a health care provider would be remiss not to perform a rectal examination in a child with encopresis, but such a procedure would be inappropriate for a simple sore-throat complaint. It is important for pediatricians to not avoid sensitive but indicated examinations for fear of abuse accusations. Certain conditions, such as vaginal and anal anomalies, may require repeated examinations, treatment, or dilations. Whether to wear gloves for genital examinations is dictated by local standards of care. Examinations of infants often will not involve the use of gloves, whereas gloving should become routine by the time the child is a preschooler. Gloving will also be determined by the specific complaint.

Patients should be provided privacy during disrobing and appropriate draping during examinations. Again, the age of the patient and the individual child's and family's temperament will dictate the level of draping and gowning required. The child's comfort should be paramount.

The AAP recently revised its policy on the use of chaperones for pediatric examinations.[30] In general, examinations of younger children should be chaperoned by the child's parent or caregiver. As children become older, their caregivers and the children themselves should participate in the decision of whether to use a chaperone. A full explanation of the examination and the reason(s) for it is always warranted. Likewise, offers of chaperones are recommended, but the decision of whether to use one should be a joint decision of the patient, family, and provider. In general, it is wise for male providers to have a chaperone during female genital examinations. However, even same-gender examinations can be misunderstood and can benefit from chaperoning. The patient's wishes and comfort should determine the gender of the chaperone. Providers should check to determine whether their state or hospital has specific chaperoning mandates and, if so, should abide by them. Providers also should be alert to riskier situations for which they should direct the decision toward chaperone use.[27] Ex-

amples include the intoxicated adolescent, the child with developmental or behavioral difficulties, or the child who has been a sexual abuse victim. In these cases, normal examination practices may be misinterpreted as assaultive. False allegations of provider sexual abuse of patients do occur.[31] Being attuned to patient and parent cues and appropriately using nonfamily chaperones are the provider's best protections. Documenting the offer and use of chaperones in the medical record is good practice and provides additional practitioner protection.

INDICATORS OF POSSIBLE SEXUAL MISCONDUCT BY, OR PEDOPHILIA IN, PEDIATRICIANS

As in other situations of child sexual abuse, grooming behavior by a physician may occur to gain a child's confidence and acquiescence to subsequent abuse.[22,32] Grooming behavior includes perpetrator actions that increase the child's trust and dependence on the perpetrator while gradually obtaining the child's accommodation to sexual contacts. The intrusiveness of sexual activities may escalate slowly. Grooming may include the use of unusually "child-friendly" settings and unusual social contact beyond or outside the normal clinical interaction. Favors or gifts beyond minimal value may be given to the child. Pedophiles, similar to other sex abusers, may select emotionally vulnerable and needy victims.[22,32]

Practitioners who sexually abuse patients may have unique indications or frequencies for genital examinations. The examination techniques themselves may be idiosyncratic, such as involving inappropriately prolonged or intimate contact, contact intended to sexually stimulate the patient, examinations that lack normal gowning and draping for modesty, unnecessarily invasive examinations, or inappropriately ungloved contact. The examination or clinical interaction may be accompanied by inappropriate sexually suggestive, or sexually complimentary, comments. Parents or chaperones may be excluded from situations in which they would normally be present. For example, caregivers of preadolescent children may be excluded from examinations by the provider. The provider may tell the child not to tell the parents or caregivers about the encounter. Photographs of the child may be taken beyond those normally required for clinical documentation. Providers may share inappropriate details about their own personal, social, or sexual background. During the visit, offers of extracurricular contact and activities may be tendered. Unsolicited phone, e-mail, or text contacts, unrelated to clinical care needs, may be among the initial attempts to establish extracurricular interactions.

PREVENTION AND MANAGEMENT OF SEXUAL MISCONDUCT ISSUES THAT INVOLVE CLINIC AND HOSPITAL STAFF

All medical and health care staff involved in the care of children should be screened for past allegations of abusive behavior with children during the recruitment-and-hiring process, which should include careful checking of past employment situations and criminal and child abuse registry background checks. However, such procedures cannot be relied on to provide protection. Staley et al[33] reported that less than 1% of people who molest children have a criminal record.

Pediatric training programs should include education on appropriate professional boundaries, professional interactions during sexually sensitive or explicit discussions or examinations, and when and how to use examination chaperones. As part of the trainee's expected skills acquisition in the categories of "intrapersonal skills and communication" and "professionalism," programs should assess the success of this training. Assessment for inappropriate behavior will be most successful if it includes a review, which queries peers, parents, and nursing staff as well as physician mentors. Concerns about sexual misconduct or contact between a trainee and a patient should be reported to the appropriate state investigative and licensing authorities and may warrant discharge from the training program.

Institutions should have policies and training in place to educate staff about appropriate provider-patient boundaries[7] (Appendix A). Staff should be explicitly informed that sexual contact with patients and their caregivers is strictly forbidden. Policies about chaperoning of sensitive examinations should be implemented. Such examinations should only be conducted in formal examination or clinical settings.[27] Staff should be trained, particularly in settings in which child behavioral issues are likely, to recognize and defuse eroticized and/or disruptive child behavior. Policies and procedures should be in place for staff to report concerns of sexual impropriety (Appendix B). Staff should be educated about these policies and procedures and their responsibility to report concerns expeditiously. However, DesRoches et al[34] recently reported that physicians who are aware of impaired or incompetent colleagues only report two-thirds of these cases to the appropriate authorities. Staff should be taught that such underreporting will not be condoned. Institutions should have policies and procedures for investigating, managing, and reporting these complaints.[35]

Solo practitioners may present greater potential for both real and false accusations of sexual abuse. Their office staff may be less able to

provide chaperoning. Likewise, the power imbalance between the provider and his or her staff is more focused, staff exposure to different practice styles is more limited, and staff may be dissuaded from or lack an avenue for reporting concerns. As such, extra efforts to include safeguards are appropriate. Included might be patient handouts that describe examination policies about genital examinations and rigorous chaperone usage.

Examples of hospital policies on staff-patient boundaries (Appendix A); chaperones for outpatient care (Appendix C); and reporting, evaluation, and management procedures for staff allegations (Appendix B) are available at the end of this statement. These appendixes represent the policies developed by Seattle Children's; they are used by permission of Seattle Children's. They do not represent AAP policy. Although they are specific to a single large pediatric-only hospital, the intention is to provide guidance to others for policy development. The Centers for Disease Control and Prevention also provides advice about screening and monitoring staff, safe environments, and complaint evaluation and management for programs that involve youth.[35]

RESPONSE TO CONCERNS ABOUT CHILD SEXUAL MISCONDUCT BY A PEDIATRICIAN OR OTHER HEALTH CARE PROVIDER

Parents and medical staff should bring any suspicions of inappropriate sexual contacts or troubling events to the attention of the office manager or pediatric practice's medical director in cases that arise in pediatric offices. With institutional or hospital cases, concerns should be brought to the attention of the managing nurses and physicians of the involved service, the hospital's child protection program, the hospital administration, or the hospital's patient or parent advocate. Provisions for confidential reporting should be available. Because concerns may arise from misinterpreted but medically appropriate actions, it is preferable that designated hospital evaluators conduct an initial evaluation before reporting to mandated state investigative agencies. However, when there are conflicts of interest between the accused and the manager, lack of an appropriate manager, or fear of retribution, it may be necessary to report directly to mandated state investigative agencies.

When managers receive reports of possible abuse, the concerns need to be evaluated expeditiously, and appropriate steps should be taken to protect other patients from abuse during the investigation (see Appendix A for sample procedures). Likewise, steps should be taken to maintain the confidentiality and reputation of accused practitioners during the time at which complaints are investigated. Institutions should offer accused providers confidential, outside supportive services. The risk of provider psychological morbidity and self-harm can be significant.

In cases with more definite concerns for abuse that rise to the equivalent of a "reasonable cause to believe" that abuse has occurred, institutional staff are legally required to report, and parents can report to their state's protective services and/or the police. A contact listing for state agencies designated to receive and investigate reports of suspected child abuse and neglect is available from the US Department of Health and Human Services Child Welfare Information Gateway (www.childwelfare.gov/pubs/reslist/rl_dsp.cfm?rs_id=5&rate_chno=11–11172). For more information about the status of current individual state laws and related resources, contact the AAP Division of State Government Affairs (800-433-9016, ext 7799, or stgov@aap.org). Once it is determined that abuse concerns rise to this level, it is possible that concerns will become public and end the accused staff member's confidentiality. More substantive complaints also warrant reporting to the appropriate state professional licensing board. When within-hospital complaints are considered substantiated, they constitute a hospital "critical incident," which generally requires reporting to the state's hospital licensing commission and conducting a critical incident review directed at how policies and procedures could be improved to prevent such incidents. It is the responsibility of institutions to warn the public of such provider behavior through these formal channels, not simply to pass the provider and issue on to some other setting. Likewise, if concerns have become public but have been evaluated and found baseless, institutions, with the consent of the accused, should make public the exonerating findings.

OUTCOMES OF SEXUAL ABUSE BY PROVIDERS

The physical and psychological health consequences sustained by children and adults who have been victims of sexual abuse are significant, and children victimized by physicians will require assessment, followed by medical care and counseling, as indicated. Although not all children exposed to sexual abuse go on to experience sequelae, there is increased risk of a broad range of problems including emotional, behavioral, cognitive, social, and general health impairments. Included are both internalizing and externalizing psychiatric disorders.[36] Past sexual abuse is associated with a greater frequency of depression, anxiety, substance abuse, conduct/antisocial personality disorder, and suicidal ideation and attempts.[37] Other childhood associations have included poor self-esteem; posttraumatic stress dis-

order (PTSD); regressive, withdrawn, or neurotic behaviors; sexually inappropriate behaviors; eating disorders; delinquency; and general behavioral disorders.[38,39] Similar psychological problems remain more common in adults who were victims of childhood sexual abuse.[39,40] In a meta-analysis, childhood sexual abuse was correlated with adult anxiety disorders, depression, eating disorders, PTSD, sleep disorders, and suicide attempts.[41] Past victims of sexual abuse are at increased risk of further sexual victimization in childhood and adult life.[42] The absolute risk for victims of preadolescent sexual assault for some of these consequences of abuse include a 23% risk of PTSD and a 25% to 33% risk of subsequent major depression in young adulthood.[36] Physical and sexual abuse victims experience a doubling of their suicide risk.[42] A New Zealand study attributed 13% of the country's adult mental health burden to sexual abuse.[37] Specific data about the psychiatric morbidity of child sexual abuse in the medical setting are lacking. However, because such sequelae of sexual abuse generally are more common when the sexual abuse has been more frequent and more physically intrusive, is accompanied by other forms of abuse, or occurs in the setting of other family dysfunction,[36,39] isolated assaults by medical providers might result in less future morbidity. Adults who have been exposed to childhood abuse or have witnessed intimate partner violence use more health and mental health services and have poorer health status, more depression, and more interpersonal violence victimization than controls.[43] Although child abuse victimization is associated with the development of criminality and violent criminality, sexual abuse alone or associated with other forms of abuse is not associated with increased violent criminality.[44]

The effects of medical provider sexual contacts or abuse have been most studied in the context of adult psychiatric patients. Patients abused by male providers tend to have increased distrust of and anger directed toward men and to therapists in general and an increase in the number and severity of their mental health and psychosomatic symptoms.[45] In a study of adults who were seeking clinical mental health care after provider sexual contact, posttraumatic stress disorder, major depression, suicidality, misuse of prescription drugs and alcohol, disturbed interpersonal relationships, and employment disruption were all reported.[13] Eighteen percent of these patients were revictimized in subsequent counseling interactions.

Despite these reports of responses to sexual abuse in general and adult responses to sexual abuse by medical and counseling providers, there is no literature on the specific reactions of pediatric patients to medical provider sexual abuse.

Institutions should anticipate that sexual abuse victims and their parents will require assessment and likely will need follow-up counseling. They should assist in referring and financially supporting such efforts.

SUMMARY

It is the responsibility of pediatricians to protect and foster the health of their patients. As such, sexual encounters with patients are destructive and are strictly forbidden. Pediatricians have a responsibility to recognize and report sexually inappropriate acts by their colleagues and other medical staff. When they have "reasonable cause to suspect or believe" (individual states' reporting thresholds vary; providers should check their specific state's law) that abuse has occurred, they are legally required to report to appropriately mandated governmental investigative agencies and licensing boards. The sexual abuse of a child by a pediatrician is a devastating violation of ethical and legal behavior that can severely impair the child's future physical and mental health. When children are abused by those who are entrusted with their medical care, the profession has the responsibility to take the necessary actions to protect future patients from harm by those providers. These actions include helping families affected by abuse by ensuring proper emotional support. Pediatricians should also work with government agencies and licensing bodies to ensure that in the future children are protected from pediatricians and other health care providers who sexually abuse patients.

RECOMMENDATIONS

To protect and foster the health and to earn and maintain the trust of their patients:

1. It is the responsibility of pediatricians to protect and foster the health of their patients. As such, sexual encounters with patients are destructive and are strictly forbidden.
2. Pediatricians and health care providers should know that most sexual offenses of children occur at the hands of adults who have a primary sexual orientation to other adults. However, adults who have a primary sexual attraction to children constitute more risk for planned and multiple-victim child offenses. Sexual offenses are perpetrated by both heterosexual and homosexual offenders. Any sexual abuse of children by medical providers is a profound betrayal of their responsibility for patient well-being, trust, and medical ethics.
3. Medical trainees should be educated about appropriate provider-patient

boundaries and appropriate use of chaperones for examinations.

4. Employees of medical facilities for children should be screened for previous abuse of a child by them both through formal state registries and through contact with previous employers.
5. Pediatricians should be educated about the indications and techniques of the genital examination, should perform routine genital examinations during annual checkups, and should know the indications for performing genital examinations to evaluate other specific medical concerns.
6. Pediatricians must explain to parents and verbal children why they are performing each element of the examination and respect their need for modesty by providing appropriate draping and allowing privacy while changing. They should offer chaperones and provide them whenever requested or required as part of standard practice and local regulations or when the provider feels that a chaperone is needed.
7. Employees of medical facilities for children should be trained about staff-patient boundaries, chaperone use, and their responsibility to immediately report concerns of patient abuse by other staff members. Institutions should have policies and procedures in place to conduct these trainings.
8. Parents should be informed that they have a right to request chaperoned examinations. They should be aware that if they have concerns about sexually inappropriate examinations or provider actions, they should report to the clinic's or medical facility's administration. If their concerns are sufficient, they themselves have a right to report to their state's protective service for investigation.
9. All health care providers and health care institutions are legally mandated reporters for suspicions of child abuse. If health care providers or institutions have reasonable cause to suspect that another health care provider has sexually abused a child, they are legally mandated to report to protective services and/or the police.
    a. Institutions should have policies and procedures in place to receive and evaluate concerns for patient abuse.
    b. Accused employees should have complaints about them managed confidentially, sensitively, and expeditiously. They should be provided with independent, confidential support and counseling services during the investigation.
    c. Individuals and institutions are responsible for following legal guidelines about reporting concerns for child abuse to the appropriate institutional, local, and state authorities.
    d. Individuals and institutions should cooperate with appropriate protective, legal, and licensing agencies in their investigation of concerns for sexual abuse by medical providers.
    e. Institutions remain responsible for the future protection of patients from abuse. They should not pass problem providers along without appropriate notifications.
10. Institutions should assist victims of sexual abuse by staff to receive appropriate assessment and consideration of the need for counseling.

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POLICY: To foster an atmosphere of safety and healing, Children's staff [including employees, medical staff, post-graduate trainees, agency contractors, students, and volunteers] are required to maintain a professional relationship with patients and families.

PURPOSE: To assist hospital employees, medical staff, trainees, and volunteers to establish relationships with patients and families/significant others that are therapeutic, professional, and which have defined personal and professional boundaries.
To create an environment in which the discussion of what constitutes a professional relationship with families is routine and common within departments.

PROCEDURE: The **ADDENDUM below** describes the current standards and procedures.

Revised by:

Approved by Medical Executive Committee:

APPROVED BY:

Senior Vice President
Chief Nursing Officer

Pediatrician-in-Chief
Chief Medical Information Officer

President
Chief Operating Officer

ORIGINATED:
REVIEWED:
REVISED: 09/09/09

Additional Key Words: Professional Boundaries; Therapeutic Relationship

ADDENDUM:

I. Elements of a Professional Relationship
- A. A professional relationship requires clearly defined and consistently applied boundaries and limit setting in the context of caring for the patient and family.
- B. Staff interventions are defined by the scope of practice, clinical privileges, roles, and responsibilities and by the essential functions defined in Job Descriptions, and approved medical staff credentials or privileges.
- C. Establishing a professional relationship requires that staff maintain a clear sense of their own distinct identity, emotions, moral principles, spirituality, and personal life, while caring for the physical and emotional needs of the patient and family.
- D. A professional relationship respects patient and family rights and cultural differences. This includes consistent adherence to privacy and confidentiality guidelines, and all other relevant Children's policies.
- E. A professional relationship allows staff to advocate for the patient and family, empowering them to achieve their maximum level of independence and decision-making autonomy during and after the patient's hospitalization or illness.

II. Children's Responsibility in Supporting Professional Relationships
- A. The hospital strives to provide an environment that promotes well-defined boundaries for staff relationships with patients and families. Some characteristics of this environment include:
  1. Open communication and dialogue with peers, supervisors, and directors that include the discussion of boundary dilemmas and professional ethical behavior.
  2. Staff bereavement support as appropriate.
  3. Ethical consultation as indicated or requested.

APPENDIX A Continued

4. Employee Assistance Program consultation to support staff in helping to resolve personal issues contributing to blurred boundaries.
5. Physician Wellness Program to provide support for members of the medical staff and their families as well as residents and fellows.

III. Working with Patients and Families in a Professional Way

A. Some guiding principles to determine professional boundaries and the continuum of professional behavior include, but are not limited to, the following:
   1. Describe your role to the patient and family.
   2. Assess patient and family needs.
   3. Assist with referrals as needed.
   4. Provide care only within the scope of your practice.
   5. Provide care only within regularly scheduled work hours.
   6. Provide consistency in care and support to patients and families without preferential treatment.
   7. Limit communication and contact to subjects related to the care of the patient and services to meet family needs.

B. Refrain from and do not:
   1. Have social contact with patients or families outside of the scope of work.
   2. Provide child care outside of the scope of practice or work hours.
   3. Provide transportation to patients or families in personal vehicles.
   4. Share personal information or problems with patients or families (including home phone numbers, addresses, e-mails, and fax numbers).
   5. E-mail, phone, text, and access patient and/or family personal websites (Facebook, MySpace, Twitter, or other similar electronic sites) for non-clinical or personal use. Use of e-mail for clinical purposes must follow the guidelines outlined in the medical centerôs Computer User Responsibility.
   6. Directly receive gifts of significant monetary value from patients and families.
   7. Offer gifts or money to families or patients.
   8. Share religious or political beliefs with patients and families.
   9. Enter into a business relationship with a patient or family member outside the scope of oneôs position, e.g. hiring a patientôs parent to landscape a staff personôs home.

IV. Additional Rules and Expectations

A. Staff will not engage in a romantic, sexual, or intimate physical relationship with any patient, any member of a current patient's family, or any former patient under the age of 18.

B. Staff will not provide foster care or initiate adoption proceedings for a patient encountered in his or her role as a Childrenôs employee.

C. Staff will continuously evaluate relationships with patients and families using these guidelines.

D. Questions or concerns regarding the appropriateness of relationships with patients and families will be directed to the immediate supervisor, the Director of Human Resources, Seattle Childrenôs Hospital, or anyone in the supervisory chain of command.

E. Should staff or supervisors feel that a staff memberôs relationship with the patient or family member fails to meet these professional guidelines, counseling or other interventions may be indicated. If need be, the staff personôs relationship with the patient or family may be terminated.

F. Failure to maintain a professional relationship with patients and families may lead to corrective action, up to, and including dismissal.

POLICY: Childrenôs will report, investigate and follow up on any concerns of abuse or neglect of a child arising from the actions of a Childrenôs staff member.

PURPOSE: Childrenôs is committed to maintaining and promoting a safe environment for all patients and families. This policy outlines the process for oversight of investigation of alleged abuse or neglect by a Childrenôs staff member.

PROCEDURE: The **ADDENDUM below** describes the current standards and procedures.

Reviewed by:

Revised by:

Approved by Medical Executive Committee:

APPROVED BY:

Pediatrician-in-Chief Chief Medical Information Officer	Senior Vice President Chief Nursing Officer

ORIGINATED: _
REVIEWED: 10/09
REVISED:

Additional Key Words: CPS, CPT, SCAN, SCPP, Accused Staff, Allegation of Abuse, Child Protective Services, Childrenôs Protection Team, Complaint, Grievance, Human Resources, Patient Safety, Seattle Childrenôs Protection Program, Staff Allegation

ADDENDUM:

I. Applicability. This policy applies to acts by employees, volunteers, members of the medical staff, students, residents, fellows and trainees, all of whom are ñstaff membersò.

II. Initial Identification and Response:

A. Any person who becomes aware of a concern of abuse or neglect by a staff member will immediately notify:
   1. During normal business hours, the manager or medical staff leader of the relevant clinical area (unit, floor, clinic, etc.);
   2. Outside normal business hours, the nursing shift administrator.

B. If any person questions whether actions occurring during normal medical procedures or patient restraint are abusive, the manager, medical staff leader or nursing shift administrator will review the concerns and observations of all present to determine if the actions are consistent with normal practice.
   1. The following must be reported directly and immediately to the Seattle Childrenôs Protection Program (SCPP):
      a. If the patientôs care management team is not unanimous that the events were within normal procedures;
      b. If more than minor injury resulted; or
      c. If the concern creates **reasonable cause to believe** abuse has occurred.
   2. During regular weekday hours, 8:00 am ï 4:30 p.m., contact SCPP at.
   3. After hours and on weekends or holidays, page the on-call SCAN Medical Consultant urgently.
   4. The SCAN Medical Consultant will contact the SCPP Medical Director, Manager or a designee.

C. The manager, medical staff leader or nursing shift administrator should review allegations dealing with unwitnessed events with SCPP.

D. If there are concerns about physical injury or abuse to a child, the attending physician or Suspected Child Abuse or Neglect (SCAN) Medical Consultant should examine the child, recommend treatment of any injuries and document the exam in the patientôs medical record.

APPENDIX B Continued

E. The manager or medical staff leader of the relevant clinical area will, by the end of the business day on which they are notified of the concern:
   1. File an incident report.
   2. Consult with Human Resources.

III. SCPP Investigation and Management

A. The SCPP Manager will assign an appropriate individual to act as Case Manager. Appendices I and II outline the roles of the SCPP Manager and the assigned Case Manager. The Case Manager will usually be a SCAN Social Worker (SW).

B. Disposition of person involved in allegation of abuse:
   1. The supervisor of the involved staff member will immediately remove the person from any duties involving patient care interactions.
      a. If the involved staff member is a member of the medical staff, the SCPP Manager will notify the Department Chair or Division Chief, and the Pediatrician-in-Chief or Surgeon-in-Chief if appropriate, to remove the medical staff member from patient care duties.
      b. In addition, the SCPP Manager will notify the Medical Director of the incident, who will consider whether summary action under the Medical Staff Bylaws is warranted to protect patients. The SCPP Manager will keep the Medical Director informed of the status of the investigation for the same purpose. Upon receiving such notice from the SCPP Manager, the Medical Director will assure notice to:
         i. The Medical Staff Department Director, Division Chief, and Medical Staff President;
         ii. The Department Chair, Pediatrician-in-Chief or Surgeon-in-Chief, if appropriate;
         iii. The physician leader of any practice group where the medical staff member provides patient care;
         iv. The appropriate licensing authority; and
         v. The affected member of the medical staff.
   2. If possible prior to such removal of a Seattle Children's employee, the supervisor will consult with HR. If the supervisor and HR agree, the person may be assigned to non-patient care duties. This consultation will not delay the removal of the person from patient care interactions.
   3. If the person is not assigned to non-patient care duties, the staff member will be placed on immediate paid administrative leave.
   4. The staff member involved in the allegation shall cooperate in the investigation by participating in an interview on request or otherwise as requested by the Case Manager. Failure to cooperate with the investigation on request may be grounds for disciplinary action, up to immediate termination of employment or medical staff privileges or both.
   5. The supervisor of the staff member, working with HR in the case of a Seattle Children's employee, will designate a support person for the staff member.
   6. As a case involving a Seattle Children's employee progresses or is closed, HR will periodically re-evaluate the staff member's status (leave, terms of leave, reassignment, termination or otherwise) and modify it as appropriate.
   7. Any disciplinary action result for a Seattle Children's employee as a result of the investigation shall be documented under normal HR policies.

C. Evaluation:
   1. The Case Manager will conduct an evaluation of the allegation as soon as possible. Evaluation consists of at least the following:
      a. Interview with the person(s) bringing the concern.
      b. Interview with the staff member against whom the allegation has been made regarding the event. The Case Manager will include the person's supervisor in this interview.
      c. Interview with the patient's caregiver/parent(s)/legal guardians. The Case Manager may delegate this interview to an existing assigned social worker if appropriate in the circumstances.
      d. Interview with the patient when indicated. The Case Manager may delegate this interview to an existing assigned social worker if appropriate in the circumstances.

2. The affected child should have a trusted support person present during any interview.
3. The Case Manager will prepare a written evaluation summary.
4. In conducting the investigation outlined above, the Case Manager shall have the authority to conduct such interviews and engage in such additional investigation as the Case Manager deems reasonably necessary for the purposes of the investigation.

D. Reporting.
1. As soon as possible upon the completion of the evaluation, SCPP Manager will review the evaluation summary to determine whether the incident requires reporting to CPS, law enforcement or the Department of Health (for licensed facilities).
2. The SCPP Manager will also consult with the Associate Medical Director for Patient Safety to determine whether the incident requires reporting to the Department of Health as a sentinel event.
3. The SCPP Manager may consult with others, including the Case Manager, SCPP Medical Director, HR representative, Childrenôs general counsel, and others with expertise in the relevant area.

E. If the SCPP Manager determines that reasonable cause exists to believe that abuse or neglect of a child has occurred, the Case Manager will make the report to CPS or law enforcement.

F. If the Case Manager reports the case to CPS, the staff member will remain or be placed on paid administrative leave by his/her supervisor, in consultation with Human Resources (HR) in the case of a Seattle Childrenôs employee. The employee will remain available for any interviews with CPS or law enforcement.

G. The Case Manager will coordinate any patient interview by CPS, law enforcement and Department of Health (DOH) investigators with the patientôs care team. The affected child should have a trusted support person present during any such interview.

H. If CPS or law enforcement determine that the incident was abusive, the SCPP Manager will:
1. Make a report to the DOH at .

I. Consult with the Associate Medical Director for Patient Safety to determine whether the alleged event constitutes a sentinel event requiring a report to the Department of Health.

J. If no report of the incident is made to CPS or law enforcement
1. The Case Manager will advise the family of their right to consult CPS for outside review.
2. The SCPP Manager will advise the person initially identifying the concern of that personôs right or obligation to file an independent report with CPS.

IV. Documentation:

A. The Case Manager will:
1. Document the incident in the patientôs medical record on CIS in the Child Protection folder without identifying the person alleged to have acted improperly by describing the incident as **allegation of abuse by a third party with access to children**.
   a. The individual bringing the concern will not be identified in the record, but will be referred to as a parent, medical staff member, child, volunteer, etc.
   b. If the case is determined not to require reporting, a statement to this effect will be noted in the medical record.
2. Complete the Patient/Family Risk Assessment Form (PFRA).
3. Document all procedures and communications completed or in progress, including dates and times for each step.

B. The SCPP Manager will:
1. Attach all documentation to the appropriate electronic file in Centerpoint.
2. As appropriate, arrange for the Medical Records Department to secure the medical record or relevant portions of the medical record.
3. Request that CPS, law enforcement or DOH investigators provide Seattle Childrenôs with both verbal and written documentation of their disposition of the case.
4. Coordinate notification of the disposition of the case to all relevant parties.

C. If the allegation will affect the childôs on-going treatment or placement, the attending physician at discharge will provide a brief summary of the nature of the incident in the medical discharge summary, without reference to the name of the employee.

APPENDIX B Continued

V. Consequences ï Childrenôs Employee
- A. The SCPP Manager will report to HR any case where a report is made to CPS or law enforcement, or where CPS or law enforcement determines that the incident was abusive. HR shall take immediate action, which may range from continued administrative leave (with or without pay) up to termination of employment.
- B. In any other case, the SCPP Manager shall consult with the supervisor of the staff member involved in the allegation to communicate the results of the investigation. The supervisor shall consult with HR and determine what if any actions to take based on the circumstances of the event.

VI. Consequences ï Medical Staff Member.
- A. In any case where a report is made to CPS or law enforcement regarding a member of the medical staff, or where CPS or law enforcement determine that the incident was abusive, the SCPP Manager shall notify the Medical Director, who shall initiate a formal professional investigation under the Medical Staff Bylaws.
- B. Upon receiving such notice from the SCPP Manager, the Medical Director will assure notice to:
  1. The Medical Staff Department Director, Division Chief, and Medical Staff President;
  2. The Department Chair, Pediatrician-in-Chief or Surgeon-in-Chief, if appropriate;
  3. The physician leader of any practice group where the medical staff member provides patient care;
  4. The appropriate licensing authority; and
  5. The affected member of the medical staff.

APPENDIX I: Staff Allegation of Child Maltreatment Supervisor/Manager Checklist

The Seattle Childrenôs Protection Program (SCPP) provides leadership for staff allegation interventions. This includes case management, including further assessment and reporting, if indicated. Every effort will be made to maintain confidentiality for the patient, witness(es), reported and staff member of concern. When a report is made, the following are steps to be taken.

I. Supervisor/Manager of staff person of concern will:
- A. Gather initial information:
  1. Reporter Name
  2. Witness(es) Name
  3. Staff Person of Concern Name
  4. Patient Name
  5. Location
  6. Attending
  7. Nature of Incident
- B. Immediately contact Seattle Childrenôs Protection Program (SCPP) Manager or Medical Director by speaking in person to:
  1. During day shift Monday ï Friday, the SCPP manager, at ext. 7-2194
  2. After hours/weekends/holidays, SCAN physician, by calling the switchboard
- C. Complete the following:
  1. Emphasize need for confidentiality with all involved staff; instruct all involved individuals not to discuss the case until SCPP has arranged for the person to be contacted.
  2. Work closely with SCPP Case Manager to support investigation process
  3. Complete an incident report
  4. Obtain signed written statement from reporter and send to SCPP Manager (M/S), not to the medical record
  5. Notify patientôs Attending of the incident
     a. If there is potential physical injury, request that Attending or SCAN physician assess and treat patient, including photo documentation
  6. Place staff member on paid administrative leave, or into a ñno patient contactò role when determined by appropriate supervisor, HR and SCPP Manager pending completion of incident review
  7. Working with HR, become or designate a support person for the staff person of concern

8. Provide support to the reporter and witness(es) of the incident as needed
9. Assist the SCPP Case Manager with interviews of witness(es), reporter, and staff person of concern, and, if appropriate, with parent(s)/caregiver/legal guardians and child
10. Ensure the involved staff member is available as needed for interviews
11. With HR, periodically re-evaluate staff personôs employment status (leave, terms of leave, reassignment, or termination) as investigation proceeds
12. Assess and manage transition of employeeôs return to work if this is outcome of review, reemphasizing the need to maintain confidentiality with all involved

II. Documentation

A. Attending and/or SCAN physician will document any exam results and treatment attributable to the incident in the patientôs medical record

B. If the allegation will affect the childôs on-going treatment or placement, a brief summary of the nature of the incident will be summarized by the Attending physician in the medical discharge summary without reference to the name of the involved staff member

C. Any patient complaint or grievance will be managed and documented according to Admin. P & P, ñPatient Complaint or Grievanceò

III. Reporting Considerations

A. SCPP Manager will determine if case is to be reported to CPS, law enforcement and/or DOH

B. If reportable, the SCPP Case Manager will notify CPS and/or law enforcement, and the SCPP Manager will notify DOH.

APPENDIX II: Seattle Childrenôs Protection Program (SCPP) Manager and SCPP Case Manager Roles and Responsibilities

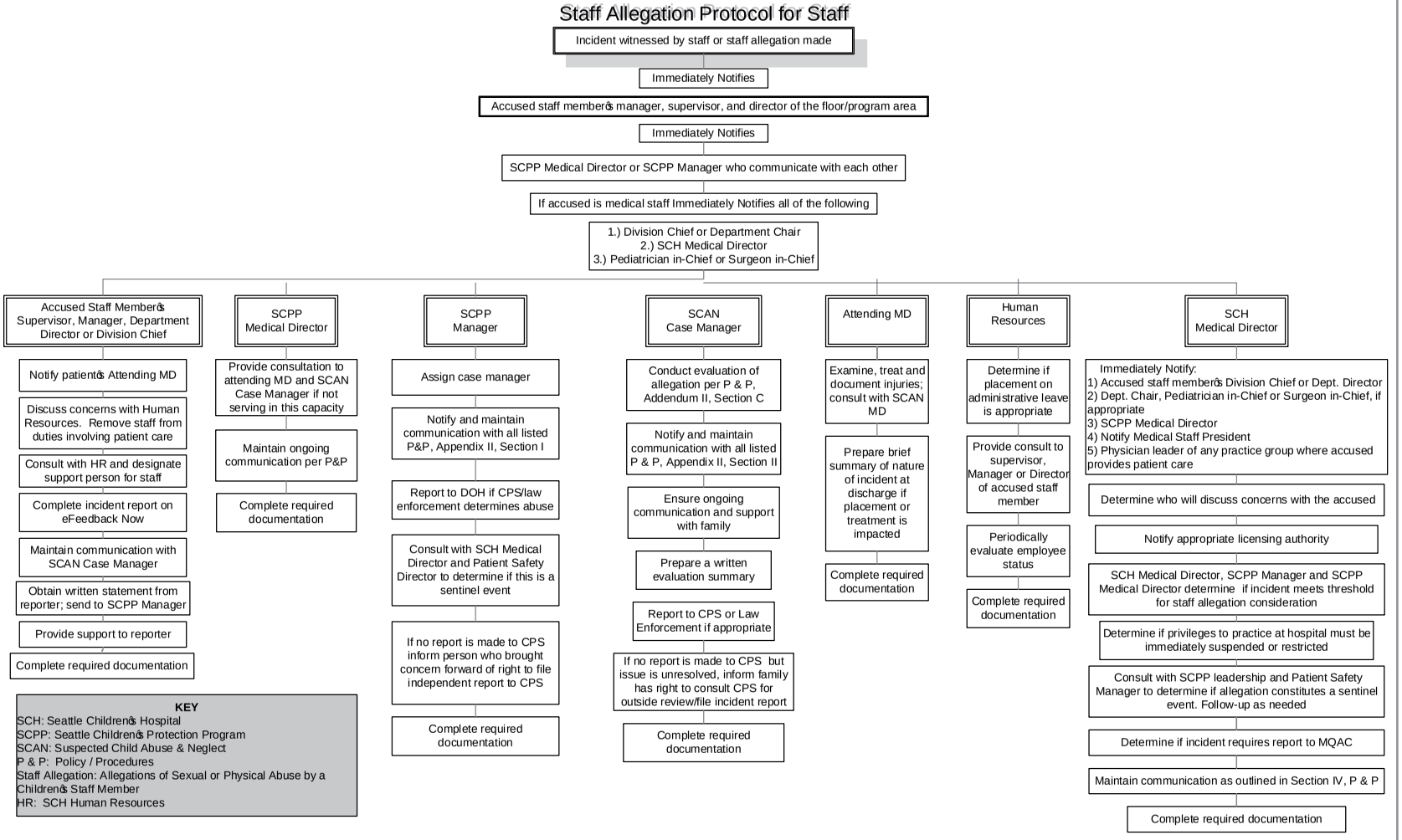
I. The SCPP Manager is responsible for communication (initially and ongoing) with the following:

A. Medical Director
B. Pediatrician-in-Chief or Surgeon-in-Chief, if appropriate
C. SCPP Medical Director
D. Administrator On Call (AOC) (who should notify the appropriate administrative leadership)
E. Clinical on Call (COC) (who should notify the appropriate medical leadership)
F. Chief Nurse
G. Vice President with oversight of SCPP
H. General Counsel
I. Risk Management
J. Human Resources
K. The Department of Health (DOH) (if required)
L. Associate Medical Director for Patient Safety, for consideration of reporting a sentinel event
M. Family and Patient Relations Manager
N. MarComm (if appropriate in the circumstances)
O. Case Manager

II. The Case Manager established under this policy is responsible for communication with the following:

A. Person bringing the concern
B. Any potential witness(es) to the incident
C. Staff memberôs supervisor
D. Staff member
E. Patientôs social worker, if involved
F. Patientôs caregiver/parent(s); and provide for, or arrange support as needed
G. Patient, when indicated
H. Patientôs attending physician
I. Patientôs PMD as appropriate
J. SCAN Medical Consultant, if involved
K. SCPP Manager
L. Child Protective Services (CPS) (if appropriate)
M. Law enforcement (if appropriate)
N. Unit Nursing Director or Clinical Manager

APPENDIX III: Organizational Chart of Staff Allegation Protocol



POLICY: Childrenôs Providers will offer a chaperone to patients or their families for all or any part of a physical exam or sensitive procedure occurring in ambulatory care. This policy assures that patients will be interviewed and examined in a secure and professional manner and serves to protect health care providers from misunderstandings, accusations or inappropriate behaviors regarding physical exams and procedures.

This policy applies to all ambulatory care activities occurring within the Childrenôs Health Care System. Any clinical area may in addition adopt more stringent guidelines.

Childrenôs staff will maintain professional relationships with patients and families.

PURPOSE: Childrenôs is committed to providing an environment where patients and staff feel safe and confident that clinical care is provided in a comfortable, secure, and professional manner.

PROCEDURE: The **ADDENDUM below** describes the current standards and procedures.

Reviewed by:

Revised by:

APPROVED BY:

Pediatrician-in-Chief Chief Medical Information Officer	Senior Vice President Chief Nursing Officer

ORIGINATED: _
REVIEWED::__
REVISED: **12/02/08**

BARRIER TECHNIQUES:

CLASS _I_ GLOVES _R_ EYE _A_ MASK _A_ GOWN _A_

Additional Key Words: Confidentiality, Detention, Exam, Examination, Family Centered Care, Genital Exams, Juvenile, Patient Safety, Privacy, Professional Relationship, Staff Safety, Sensitive Exams or Procedures, Touch, Touching

ADDENDUM:

I. Chaperones will be provided in all outpatient activities listed below unless the patient or legally authorized representative requests that a chaperone not be present.
- A. In those circumstances (refusal of chaperone) see **Section IX** below.
- B. Activities requiring chaperones:
  1. Specifically requested by the patient, the parent or legal guardian
  2. Requested by the health care practitioner (i.e. physician, mid-level provider, nurse, or other caregiver) and with the approval of the parent/legal guardian or patient
  3. A potentially sensitive examinations or procedures (i.e. genital, breast, rectal) will be conducted.
  4. See **Sections IV** for considerations applicable in such situations.
  5. Prior to undertaking any such potentially sensitive examination or procedure, the person who will perform it will offer a chaperone to the patient or the legal guardian, as appropriate in the circumstances.

APPENDIX C Continued

II. The following individuals may be considered as appropriate chaperones:
- A. Clinical staff (i.e. attending or consulting physicians, nurses, medical assistants) or other Childrenôs staff who have specifically been trained in patient contact.
- B. Family members for younger-aged children or at the request of an adolescent; **or**,
- C. Other individuals as designated by the patient or legal guardian.
  1. **Note**: Interpreters, office and non-clinical staff are not appropriate for chaperoning sensitive examinations or procedures.
  2. Trainees (e.g. students, interns, residents, fellows) may not act as chaperones for any faculty member.
     a. Trainees may act as chaperones for hospital personnel, such as radiology technologists.
  3. The patient or guardian should have the choice of the chaperoneôs gender.

III. Examinations and patient contacts will be limited to those warranted by the medical issues at hand.
- A. Patients will be draped appropriately for the type of contact and for modesty.
- B. Patients will be provided privacy when they dress or undress, and,
- C. The examiner will wear gloves when conducting genital exams or when there is contact with an older childôs genitals, consistent with community standards.

IV. Sensitive exams or procedures are those involving the breasts, genitals or rectum. Practitioners should in addition be alert to patient-or family-specific concerns about other parts of the body that the patient or family considers sensitive.
- A. The practitioner may determine, on an individual basis, that a chaperone will be required for a breast, rectal, genital or other potentially sensitive exam or procedure, taking into account:
  1. Physician/practitioner patient relationship.
  2. Patient concern or complaint; or,
  3. Patientôs pertinent mental health or developmental history.
- B. See **Section IX** below for cases where the patient or legal guardian declines a chaperone requested by the practitioner.

V. If a chaperone is utilized, sensitive inquiries and history-taking will respect patient confidentiality (per HIPAA regulations) and will be conducted outside the chaperoned physical exam/procedure.
- A. Medical trainees that are a part of the patient care team can be present as part of the normal care/training process.

VI. Chaperones provided by Childrenôs will be HIPAA trained and will respect patient confidentiality and privacy.

VII. Practitioners will be sensitive to historical cues that may heighten patient or family anxiety about provider contacts.
- A. Risk for misunderstanding or misinterpreting examinations is higher when:
  1. Children have experienced past abuse, particularly sex abuse victimization.
  2. Children/adolescents have developmental delays or acutely altered mental states (e.g. intoxications) or chronic altered mental states (e.g. mental illness).
  3. Patients are young or naïve to medical care, or are having their first clinical encounter with a health care provider.
  4. Patients are in juvenile detention settings.
  5. There are patient or family ethnic, cultural or religious considerations specific to the examination or procedure.

VIII. Some adolescents may wish to discuss their personal issues and be examined without their parents or a chaperone present.
- A. When possible, it is appropriate to ask adolescents about their chaperone preferences in private.
- B. When adolescents can consent for their own care, they may also make the decision about utilization of a chaperone.
  1. For those with impaired competence, the legal guardian will be involved in making the decision about having a chaperone present.

IX. A patient (who is authorized to consent to his/her own medical care) or the legal guardian may request that a chaperone not be present for a sensitive exam.
- A. Such, a request will be honored.
- B. However, in such a situation, the practitioner may judge the examination too problematic to complete.
- C. In such cases, the practitioner will make arrangements for subsequent evaluation of non-emergent issues or make an effort to transition patient care to another provider.
- D. In any such case involving emergency medical treatment, practitioners will assure that the patient receives a screening history and examination and any medically necessary stabilizing care.
- E. The practitioner will document the refusal for a chaperone in the medical chart.

X. Staff will not leave the exam room door open in lieu of providing a chaperone.

XI. Documentation:
- A. In the medical chart, practitioners will document:
  1. The name of the chaperone, **or**
  2. In case of refusal of a chaperone by the patient or legal guardian in circumstances described in **Section IX**, the fact that a chaperone was offered and that the patient or legal guardian declined the chaperone.
- B. In addition to the provider documentation, in the medical chart under **Add Hoc** charting, the Registered Nurse and/or Medical Assistance will document if a chaperone has been offered and accepted or declined.
- C. Follow steps below for documentation:
  1. Choose **Ad Hoc** charting under the **Chart** tab.
  2. Under the **Clinical Care** tab, click on **Patient Care Information**.
  3. Choose **Chaperone Form**.
  4. Either check **Accepted** or **Declined**.
  5. If accepted, then type in the **Name** of chaperone.
     a. Click on the binoculars to get a current employee list.
  6. Or, if there was a family member present for the examination, type their name in box.
  7. Type in the name of **Who Accepted** or **Declined** the Chaperone.
  8. Choose the relationship to the patient.

REFERENCES:

AAP Policy. The Use of Chaperones during the Physical Examination of the Pediatric Patient. *Pediatrics*. Vol. 98, No. 6, December, 1996:1202.

Use of Chaperones during Physical Exams. *Report of the Council on Ethical and Judicial Affairs*. American Medical Association June. 1998.

WAC 246-16-100.

AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness

AMERICAN ACADEMY OF OPHTHALMOLOGY

Eye Health and Public Information Task Force

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Protective Eyewear for Young Athletes

ABSTRACT. The American Academy of Pediatrics and American Academy of Ophthalmology strongly recommend protective eyewear for all participants in sports in which there is risk of eye injury. Protective eyewear should be mandatory for athletes who are functionally 1-eyed and for athletes whose ophthalmologists recommend eye protection after eye surgery or trauma.

ABBREVIATIONS. ASTM, American Society for Testing and Materials; ANSI, American National Standards Institute; CSA, Canadian Standards Association; HECC, Hockey Equipment Certification Council.

BACKGROUND

More than 42 000 sports and recreation-related eye injuries were reported in 2000.[1] Seventy-two percent of the injuries occurred in individuals younger than 25 years, 43% occurred in individuals younger than 15 years, and 8% occurred in children younger than 5 years.[1] Children and adolescents may be particularly susceptible to injuries because of their aggressive play, athletic maturity,[2–4] and poor supervision in some recreational situations.

The sports highlighted in this statement were chosen on the basis of their popularity and/or the high incidence of eye injuries in that sport. Participation rates and information on the severity of the injuries are unavailable; therefore, the relative risk of significant injuries cannot be determined for various sports. Baseball and basketball are associated with the most eye injuries in athletes 5 to 24 years old.[1]

The eye-injury risk of a sport is proportional to the chance of the eye being impacted with sufficient energy to cause injury. The risk is not correlated with the classification of sports into collision, contact, and noncontact categories. Instead, the risk of eye injury to the unprotected player is roughly categorized as high risk, moderate risk, low risk, and eye safe. The sports included in each of these categories are listed in Table 1.

EVALUATION

All athletes and their parents should be made aware of the risks associated with participation in sports and the availability of a variety of certified sports eye protectors. Although eye protectors cannot eliminate the risk of injury, appropriate eye protectors have been found to reduce the risk of significant eye injury by at least 90% when fitted properly.[4–6] It would be ideal if all children and adolescents wore appropriate eye protection for all eye-risk sports and recreational activities.

Physicians should strongly recommend that athletes who are functionally 1-eyed wear appropriate eye protection during all sports, recreational, and work-related activities. Functionally 1-eyed athletes are those who have a best corrected visual acuity of worse than 20/40 in the poorer-seeing eye.[1,4,7] If the better eye is injured, functionally 1-eyed athletes may be handicapped severely and unable to obtain a driver's license in many states.[8]

Athletes who have had eye surgery or trauma to the eye may have weakened eye tissue that is more susceptible to injury.[9] These athletes may need additional eye protection or may need to be restricted from certain sports; they should be evaluated and counseled by an ophthalmologist before sports participation.

PROTECTIVE EYEWEAR OPTIONS

Eye protection and different brands of sports goggles vary significantly in both the way they fit and their capacity to protect the eye from injury. An experienced ophthalmologist, optometrist, optician, physician, or athletic trainer can help an athlete select appropriate protective gear that fits well and provides the maximum amount of protection. Sports programs should assist indigent athletes in evaluating and obtaining protective eyewear.

There are 4 basic types of eyewear. The 2 types that are satisfactory for eye-injury risk sports include:

1. Safety sports eyewear that conforms to the requirements of the American Society for Testing and Materials (ASTM) standard F803 for selected sports (racket sports, baseball fielders, basketball, women's lacrosse, and field hockey).[10]
2. Sports eyewear that is attached to a helmet or for sports in which ASTM standard F803 eyewear is inadequate. Those for which there are standard

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TABLE 1. Categories of Sports Eye-Injury Risk to the Unprotected Player*

High Risk	Moderate Risk	Low Risk	Eye Safe
Small, fast projectiles	Tennis	Swimming	Track and field†
Air rifle	Badminton	Diving	Gymnastics
BB gun	Soccer	Skiing (snow and water)	
Paintball	Volleyball	Noncontact martial arts	
Hard projectiles, "sticks," close contact	Water polo	Wrestling	
Basketball	Football	Bicycling	
Baseball/softball	Fishing		
Cricket	Golf		
Lacrosse (men's and women's)			
Hockey (field and ice)			
Squash			
Racquetball			
Fencing			
Intentional injury			
Boxing			
Full-contact martial arts			

* Vinger PF. A practical guide for sports eye protection. *Phys Sports Med.* 2000;28(6). Available at: http://www.physsportsmed.com/issues/2000/06_00/vinger.htm

† Javelin and discus have a small but definite potential for injury. However, good field supervision can reduce the extremely low risk of injury to near-negligible.

specifications include youth baseball batters and base runners (ASTM standard F910), paintball (ASTM standard 1776), skiing (ASTM standard 659), and ice hockey (ASTM standard F513).[10] Other protectors with specific standards are available for football and men's lacrosse.

The 2 types of eyewear that are not satisfactory for eye-injury risk sports include:

1. Streetwear (fashion) spectacles that conform to the requirements of American National Standards Institute (ANSI) standard Z80.3.[11]
2. Safety eyewear that conforms to the requirements of ANSI standard Z87.1,[12] which is mandated by the Occupational Safety and Health Administration for industrial and educational safety eyewear.

Prescription or nonprescription (plano) lenses may be fabricated from any of several types of clear material, including polycarbonate. Polycarbonate is the most shatter-resistant clear lens material and should be used for all safety eyewear.[13]

PROTECTIVE EYEWEAR CERTIFICATION

Protectors that have been tested to an appropriate standard by an independent testing laboratory are often certified and should afford reasonable protection. The Protective Eyewear Certification Council has begun certifying protectors that comply with ASTM standard F803 (racket sports, basketball, baseball, women's lacrosse, and field hockey), ASTM standard F1776 (paintball), and ASTM standard F910 (youth baseball batters and base runners) standards.[10] The Canadian Standards Association (CSA) certifies products that comply with the Canadian racket-sport standard, which is similar to the ASTM standard.[10] The Hockey Equipment Certification Council (HECC) certifies ice hockey equipment including helmets and face shields. The National Operating Committee on Standards in Athletic Equipment certifies baseball and football helmets as well as the face protectors for men's lacrosse and football. For those sports with certified protectors, it is recommended that products bearing the Protective Eyewear Certification Council, CSA, HECC, or National Operating Committee on Standards for Athletic Equipment seals be used when available.

RECOMMENDATIONS

1. All youths involved in organized sports should be encouraged to wear appropriate eye protection.
2. The recommended sports-protective eyewear as listed in Table 2 should be prescribed. Proper fit is essential. Because some children have narrow facial features, they may be unable to wear even the smallest sports goggles. These children may be fitted with 3-mm polycarbonate lenses in ANSI standard Z87.1 frames designed for children.[12] The parents should be informed that this protection is not optimal, and the choice of eye-safe sports should be discussed.
3. Because contact lenses offer no protection, it is strongly recommended that athletes who wear contact lenses also wear the appropriate eye protection listed in Table 2.
4. An athlete who requires prescription spectacles has 3 options for eye protection: a) polycarbonate lenses in a sports frame that passes ASTM standard F803 for the specific sport; b) contact lenses plus an appropriate protector listed in Table 2; or c) an over-the-glasses eyeguard that conforms to the specifications of ASTM standard F803 for sports in which an ASTM standard F803 protector is sufficient.[10]
5. All functionally 1-eyed athletes should wear appropriate eye protection for all sports.
6. Functionally 1-eyed athletes and those who have had an eye injury or surgery must not participate in boxing or full-contact martial arts. (Eye protection is not practical in boxing or wrestling and is not allowed in full-contact martial arts.) Wrestling has a low incidence of eye injury. Although no standards exist, eye protectors that are firmly

TABLE 2. Recommended Eye Protectors for Selected Sports

Sport	Minimal Eye Protector	Comment
Baseball/softball (youth batter and base runner)	ASTM standard F910	Face guard attached to helmet
Baseball/softball (fielder)	ASTM standard F803 for baseball	ASTM specifies age ranges
Basketball	ASTM standard F803 for basketball	ASTM specifies age ranges
Bicycling	Helmet plus streetwear/fashion eyewear	
Boxing	None available; not permitted in the sport	Contraindicated for functionally 1-eyed athletes
Fencing	Protector with neck bib	
Field hockey (men and women)	ASTM standard F803 for women's lacrosse (goalie: full face mask)	Protectors that pass for women's lacrosse also pass for field hockey
Football	Polycarbonate eye shield attached to helmet-mounted wire face mask	
Full-contact martial arts	None available; not permitted in the sport	Contraindicated for functionally 1-eyed athletes
Ice hockey	ASTM standard F513 face mask on helmet (goaltenders: ASTM standard F1587)	HECC OR CSA certified Full-face shield
Lacrosse (men)	Face mask attached to lacrosse helmet	
Lacrosse (women)	ASTM standard F803 for women's lacrosse	Should have option to wear helmet
Paintball	ASTM standard F1776 for paintball	
Racquet sports (badminton, tennis, paddle tennis, handball, squash, and racquetball)	ASTM standard F803 for selected sport	
Soccer	ASTM standard F803 for selected sport	
Street hockey	ASTM standard 513 face mask on helmet	Must be HECC or CSA certified
Track and field	Streetwear with polycarbonate lenses/ fashion eyewear*	
Water polo/swimming	Swim goggles with polycarbonate lenses	
Wrestling	No standard available	Custom protective eyewear can be made

* Eyewear that passes ASTM standard F803 is safer than streetwear eyewear for all sports activities with impact potential.

fixed to the head have been custom made. The wrestler who has a custom-made eye protector must be aware that the protector design may be insufficient to prevent injury.

7. For sports in which a face mask or helmet with an eye protector or shield must be worn, it is strongly recommended that functionally 1-eyed athletes also wear sports goggles that conform to the requirements of ASTM standard F803 (for any selected sport).[10] This is to maintain some level of protection if the face guard is elevated or removed, such as for hockey or football players on the bench. The helmet must fit properly and have a chinstrap for optimal protection.
8. Athletes should replace sports eye protectors that are damaged or yellowed with age, because they may have become weakened and are, therefore, no longer protective.

REFERENCES

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RESOURCES

American Academy of Ophthalmology, Communications Department, PO Box 7424, San Francisco, CA 94120-7424.

Prevent Blindness America (formerly National Society to Prevent Blindness), 500 E. Remington Rd, Schaumburg, IL 60173.

American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

Providing a Primary Care Medical Home for Children and Youth With Cerebral Palsy

Gregory S. Liptak, MD, MPH, Nancy A. Murphy, MD, and THE COUNCIL ON CHILDREN WITH DISABILITIES

KEY WORDS
cerebral palsy, medical home, care coordination, patient care/methods

ABBREVIATIONS
PCP—primary care provider
CP—cerebral palsy
GMFCS—Gross Motor Function Classification System

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

FREE

All primary care providers will care for children with cerebral palsy in their practice. In addition to well-child and acute illness care, the role of the medical home in the management of these children includes diagnosis, planning for interventions, authorizing treatments, and follow-up. Optimizing health and well-being for children with cerebral palsy and their families entails family-centered care provided in the medical home; comanagement is the most common model. This report reviews the aspects of care specific to cerebral palsy that a medical home should provide beyond the routine health care needed by all children. *Pediatrics* 2011;128:e1321–e1329

INTRODUCTION

Primary care providers (PCPs) will encounter children with cerebral palsy (CP) in their practice. With a prevalence of 3.6 per 1000, more than 100 000 children in the United States are affected.[1] CP, as recently redefined (see sidebar), is not a single condition with a clear etiology. It includes a continuum of disorders of movement, posture, and coordination caused by a wide variety of nonprogressive conditions that affect the developing brain. It affects body functions and structures, activities, participation, and quality of life.[2] CP ranges in severity from isolated, mild spasticity in the legs to 4-limb involvement (quadriplegia) associated with cognitive impairments, seizures, and complete functional dependency.

SCREENING, SURVEILLANCE, AND DIAGNOSIS

The PCP engages in an integrated process designed to promote early identification of children with CP and expedite referrals to appropriate community services. The first step is to establish a diagnosis of CP. The second step is to identify and access interventions that are most likely to optimize the health and well-being of the child and family. CP is suspected in children who have delayed or abnormal motor development, especially in those with a history of prenatal, perinatal, or postnatal brain insults. A definite cause cannot be identified for many children who have CP. Table 1 lists some perinatal factors that are associated with CP. The American Academy of Pediatrics has developed guidelines on developmental surveillance and screening in practice[4]; these procedures can help with the early identification of children who are at increased risk of having CP.

Delayed motor development, abnormalities of muscle tone, and atypical postures suggest a diagnosis of CP.[5] A careful neurologic examina-

REVISED DEFINITION OF CP[46]: CP describes a group of permanent disorders of the development of movement and posture that cause activity limitations that are attributed to nonprogressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of CP are often accompanied by disturbances of sensation, perception, cognition, communication, and behavior and by epilepsy and secondary musculoskeletal problems.

LOCALIZATION:

Diplegia: lower extremities are affected more than upper extremities.

Quadriplegia (tetraplegia): upper and lower extremities are affected to the same degree.

Hemiplegia: 1 side (often upper extremity) is more substantially involved than its opposite counterpart.

Children with CP typically receive care from multiple providers including orthopedists and neurologists, as well as physical, occupational, and speech-language therapists. They may receive services through Early Intervention and school-based programs. For some children with mild CP, the pediatrician is the primary manager; however, most children with CP receive collaborative and shared care (comanagement) among multiple specialists, coordinated through the medical home. For children with severe disabilities, specialists may serve as the primary manager.[3]

Parents, teachers, and therapists often approach pediatricians for medical and habilitative recommendations. Physicians who are knowledgeable about medical and functional issues, including community resources, can empower families by listening and responding to their concerns. Children with CP and their families benefit from family-centered, evidence-based, coordinated, and collaborative care that is based on shared decision-making in the context of the medical home.

tion might reveal alterations or asymmetries in muscle tone, strength, reflexes, posture, and coordination. For example, the occurrence of hand preference before 12 months of age is often suggestive of hemiplegia. An 8-month-old child who demonstrates palmar thumbs (adducted thumbs with clenched fists), scissoring of the legs, and hyperreflexia might have spastic CP. Many infants with CP have persistent infantile reflexes including the Moro reflex and asymmetrical tonic neck responses. Although neurologic findings in CP might change during infancy (eg, a floppy neonate who develops spasticity by 6 months of age), the brain lesion in CP is nonprogressive. Some infants who are born prematurely, especially those who weigh less than 2000 g, might have transient changes in muscle tone but not develop CP. Their findings include increased adductor tone in the lower extremities, truncal arching, and head lag. The symptoms usually resolve between 8 and 12 months of age.[6] Developmental surveillance (eg, serial examinations separated by 1 or 2 months) might be helpful to determine if the child is developing typically or has significant delays or other neurologic findings that suggest CP. Repeated evaluations also help foster the doctor/family relationship. The PCP can diagnose a child with CP in many instances. If questions remain, the child can be referred to a child neurologist or developmental pediatrician.

TABLE 1 Perinatal factors associated with the occurrence of CP

Chorioamnionitis (maternal infection)
Maternal disorders of clotting (eg, factor V Leiden deficiency)
Birth weight < 2000 g
Intracranial hemorrhage
Newborn encephalopathy (recurrent seizures, hypotonia, coma)
Periventricular leukomalacia
Hydrocephalus
Congenital malformations

Neurodegenerative disorders such as leukodystrophies, lysosomal storage diseases, ataxia telangiectasia, and mitochondrial disorders are uncommon conditions that might initially mimic CP; however, unlike CP, the manifestations of these conditions worsen over time. Glutaric aciduria and dopa-responsive dystonia (Segawa syndrome) are 2 rare progressive but treatable conditions that might be confused with CP. It is important to differentiate spastic diplegic CP from familial spastic paraplegia, which is a heritable condition in which lower-extremity spasticity and weakness worsen over time. Occasionally, a child who has transient toe-walking might be suspected of having spastic diplegia. Children who have progressive deterioration of cognitive or motor skills (ie, losing milestones) and those who have significant diurnal variation in symptoms should be referred to a child neurologist or neurodevelopmental specialist for further evaluation.[7]

Pediatric providers who identify abnormalities of development, tone, or posture in infants and toddlers should share their concerns with the child's family to facilitate patient/family self-management and access to resources. This requires spending sufficient time with family members to provide detailed feedback and to answer all questions. Referral to an Early Intervention or preschool program should be initiated even if a definitive diagnosis has not yet been established. These programs can perform formal developmental evaluations with standardized measures (such as the Bayley Scales of Infant Development and the Peabody

TABLE 2 Diagnostic Assessment and Classification of Children With CP

Category	Examples
I. Motor abnormalities	
A. Type of motor disorder	Spasticity; dyskinesia (dystonia and choreoathetosis); ataxia; hypotonia
B. Functional motor abilities	
a. Gross motor	Ambulation
b. Use of hands and arms	Self-help skills
c. Oromotor and speech	Communication; eating and drinking
C. Musculoskeletal changes	Contractures; hip dysplasia; torsional deformities, including scoliosis; joint instability; osteoporosis; pain
II. Associated impairments	
A. Central nervous system	Cognitive deficits; seizures; hearing impairments; vision impairments; attentional problems; behavioral problems; sleep disturbances
B. Gastrointestinal	Constipation; gastroesophageal reflux disease; malnutrition; drooling; incontinence; dysphagia; complications associated with enteral feedings
C. Respiratory	Aspiration, acute and chronic; pneumonitis and pneumonia; restrictive lung disease, secretion management
D. Genitourinary	Incontinence; voiding dysfunction; recurrent urinary tract infections
E. Dental	Poor hygiene; caries; periodontal disease
III. Distribution	
A. Anatomic	Limbs (hemiplegia, diplegia, quadriplegia); trunk; bulbar region
B. Radiologic	Periventricular leukomalacia; damage to basal ganglia or thalamus
IV. Causation and timing	Hyperbilirubinemia; in utero stroke (cortical cerebral infarction)
V. Severity	Degree of involvement (eg, weakness); number of associated impairments; GMFCS

Developmental Motor Scales), provide therapeutic and educational services, and assist families in connecting to parent support groups. Some communities have local volunteer organizations that can help families with peer support and linkage to helpful resources. Family Voices, a national organization, has established family-to-family health information centers in most states.[8]

The American Academy of Neurology has established practice parameters for the diagnostic evaluation of a child with suspected CP.[8] A brain MRI scan should be obtained in all children suspected of having CP if the etiology has not been established (eg, by perinatal imaging).[7] Those with hemiplegia and quadriplegia are most likely to have radiographic abnormalities.[9] When appropriate, formal gait analyses may be performed to inform decisions regarding therapeutic, medical, and surgical interventions to maximize mobility. Similarly, radiographic swallow studies may be used to evaluate dysphagia and determine strategies for optimizing nutrition and minimizing aspiration events. All children suspected of having CP should be promptly referred for formal hearing and vision evaluations. Formal developmental testing and electroencephalography might be helpful in the care of some children.

ASSESSMENT FOR INTERVENTION PLANNING

After a diagnosis of CP is suspected (or established), the PCP should evaluate the child's overall function to determine which interventions would be most beneficial. Family goals, structure, and resources should be considered when developing treatment plans that might include clinical consultations, community-based programs, and educational services. Traditionally, children with CP are classified on the basis of distribution of affected limbs and the predominant type of tone or movement abnormality (eg, "spastic diplegia"). However, a complete assessment, necessary for appropriate prognostication and treatment planning, must also include assessment of associated impairments and overall severity of CP (see Table 2). The PCP can make these determinations through the history and physical examination. In addition, the PCP can categorize children according to the Gross Motor Function Classification System (GMFCS), which provides a measure of the overall severity of the disability.[10]

An ongoing summary form or checklist of the primary and associated conditions should be maintained in each child's medical record to expedite accurate, serial assessments. Nickel and Desch[11] have published extensive guidelines for the care of children and adolescents with CP. In addition to the list of conditions based on a review of systems,[12] information on activities and participation should be included. Table 3 lists some suggested information that could be included on this form. It is important to note that tone or movement abnormalities are often mixed rather than pure. For instance, spasticity and dystonia frequently co-occur. In such instances, a child tends to have a greater severity of functional impairment and disability and is less likely to benefit from common interventions such as selective dorsal rhizotomy or systemic medication. Most children with spasticity also have impairments of strength and coordination. Thus, reducing spasticity might

TABLE 3 Form for Tracking Medical Conditions, Activities, and Participation in Children With CP

Area	Status	Providers
Cerebral Palsy		
Type		
GMFCS		
Review of systems		
General		
Growth		
Nutrition		
Pain		
Sleep		
Mouth		
Drooling		
Swallowing		
Teeth		
Respiratory		
Aspiration		
Infections		
Restrictive lung disease		
Gastrointestinal		
Constipation		
Reflux		
Urinary		
Toilet training		
Voiding dysfunction		
Urinary infections		
Gynecologic		
Puberty		
Musculoskeletal		
Joint contractures		
Dislocations		
Scoliosis		
Osteoporosis		
Orthotic devices		
Neurologic		
Seizures		
Muscle tone		
Strength/weakness		
Attention (attention-deficit/hyperactivity disorder)		
Sleep		
Skin		
Pressure sores		
Activities and participation		
Communication		
Abilities		
Assistive devices		
Therapy (eg, speech therapy)		
Mobility		
Abilities		
Assistive devices		
Therapy (eg, physical therapy)		
Cognitive and academic functioning		
Scores from cognitive testing		
Educational placement		

"unmask" underlying weakness or dystonia and further limit function. Likewise, a pattern of spasticity in the limbs and hypotonia in the trunk and midline (including poor head control) is common in children with quadriplegic CP. Many communities have medical teams for children with CP that include orthopedics, physical therapy, occupational therapy, orthotics, neurosurgery, social work, and developmental pediatrics or physiatry. Referral to those programs might greatly benefit children and adolescents with more complex or severe involvement. Other children might benefit from consultations with specialists in pulmonology, gastroenterology, or endocrinology.

PROGNOSIS

Parents often ask about the severity of their child's CP and prognosis for independent ambulation.[13] Children with good head control at 9 months of age who bear weight through their hands while prone at 18 months, sit by 24 months, and crawl by 30 months have a good prognosis for independent ambulation.[14,15] The GMFCS[10] provides a measure of overall severity of CP. Children who are the most severely affected (GMFCS level V) have the highest rates of mortality and morbidity, including respiratory tract infections. For example, children who cannot lift their head in prone, cannot roll over, or require feeding by gastrostomy tube by 5 years of age have significantly higher mortality rates than other children with CP.[16] Children with intractable seizures or with recurrent aspiration pneumonitis also have worse prognoses. Although the brain lesion associated with CP is nonprogressive, individual function might decline across the life span. Thus, an ambulatory child with CP might opt for wheelchair mobility during adolescence to conserve time and energy; if this decision enhances participation in activities (eg, being able to go to the mall with friends), it should not be viewed as a failure. Ambulation status, IQ, quality of speech, and hand function predicted employment status in 1 group of youth with CP.[17]

ONGOING CARE IN THE MEDICAL HOME

Optimizing Practices

High-quality health care for children with CP depends on collaborations

TABLE 4 Recommended Components of Medical Homes for Children With CP[11,12]

Medical Home Component	Examples
Information systems that provide better quality of care and increased office efficiency	Use specific care plans for children with CP (medical summary, emergency plan, and action plan) Use American Academy of Pediatrics/American College of Emergency Physicians emergency information form for children with special needs[43] Have a registry of patients with CP to help track their progress and initiate contact
Redesigned offices that optimize patient flow and use of space	Have buildings, examination rooms, and equipment (scales, examination tables) that are accessible to children with disabilities[23]
Quality and safety that incorporate patient feedback, outcomes analysis, and evidence-based best practices	Use regular mechanisms (eg, surveys to get feedback from patients and families) Consult with parent advisors through a family advisory committee or other mechanism Keep informed about best practices in CP and resources (including family-to-family information centers) available in the community
Practice management that includes disciplined financial management and advocacy	Try to negotiate care coordination fee from local payers Use billing to reflect time and complexity of condition (eg, using a −25 modifier) Advocate with families to payers for coverage of medically necessary services
Services that include disease prevention, wellness promotion, and chronic disease management processes	Promote optimal nutrition and regular exercise Have specific chronic condition management visits (complex visits that are separate from well-child care) Employ a care coordinator
A process that encourages a collaborative approach to the patient's care, optimized use of the clinical team, prearranged relationships with other specialists, and strong communication within the practice	Have explicit comanagement with specialists
Access to care that offers group visits, e-visits, and same-day visits or a multilingual approach to care, when needed	Provide multilingual care Provide accessible information to patients with visual impairments

among parents; health care providers, including dentists[18]; and community agencies (eg, educational services, recreation programs, parent groups) with ongoing monitoring of the child's health and function. Table 4 offers recommendations for improving practices and their implications for children with CP.[19–21] PCPs are often asked to order or sanction therapies (physical, occupational, or speech) or assistive devices (wheelchairs, bath seats, communication devices, others). The American Academy of Pediatrics provides guidelines for the prescription of therapies[22] and communication devices.[23] The PCP has the right to decline ordering equipment that is of questionable value; referral to a specialist for further review of the request might be helpful. Clinical settings should be physically accessible; the Center for Universal Design offers guidelines for improving accessibility.[24] PCPs should be knowledgeable about community resources for individuals with CP and their families and facilitate linkages to appropriate services. Appendix 1 lists a few Internet sites relating to CP. Office visits for children with CP should be extended to allow for more in-depth evaluations and discussions. Billing should reflect time spent in direct and indirect care (eg, care coordination). Appendix 2 provides some billing codes used when treating children with CP.

Specific Interventions and Treatments

PCPs are often asked to provide specific recommendations to families about specialty care. This requires knowledge of evidence-based care. Many treatments have become common practice, despite a lack of evidence regarding the dose and duration of intervention or expected outcomes. Such interventions include speech and language therapy to improve verbal communication,[24] physical therapy for passive stretching of spastic muscles,[26,27] and sensorimotor integration therapy to promote function.[28]

Strengthening and Tone Management

Although Early Intervention services have generally improved outcomes for children, the specific interventions that most benefit children with CP are uncertain. In addition, therapeutic interventions change over time. For example, increasing emphasis is being placed on muscle strengthening and achieving functional goals. These changes make comparisons among programs difficult. Table 5 lists common interventions categorized according to their current evidence base.

The American Academy of Neurology has published guidelines on the pharmacologic treatment of spasticity in children and adolescents with CP.[29] Treatments recommended include injections of botulinum toxin into spastic muscles, as well as intrathecal baclofen. These interventions are usually not performed directly by PCPs. Systemic medications, including diazepam, baclofen,

TABLE 5 Therapies for Children With CP

Indication	Intervention	Comment
Therapies for which some evidence exists to support their effectiveness		
General	Muscle strengthening	Growing evidence supports its use
	Equine-assisted therapy (hippotherapy)	Increases social participation as well as strength and coordination
Ambulation	AFOs	Choice of specific type of AFO is often a judgment call
	Gait trainers, assistive devices; wheeled mobility	
Drooling	Glycopyrrolate, scopolamine patch, botulinum toxin injections, removal of salivary glands	Short-term improvement has been documented; less is known about long-term effects
Hemiplegia	Constraint-induced movement therapy	Optimal duration and intensity of therapy are uncertain, but several study reports have documented its effectiveness
Joint contractures, dislocations, deformations	Orthoses (like AFOs)	Surgery is more effective if linked with functional abilities (eg, gait)
	Orthopedic surgery	
Malnutrition	Gastrostomy feeding tube	Decision to use is often difficult for families; long-term benefits have not been well studied
Spasticity	Botulinum toxin (type A) injections	Most studies have been of gastrocnemius or biceps muscles
	Dorsal rhizotomy	Generally used for children who are ambulatory; long-term benefits are uncertain
Spasticity/dystonia	Intrathecal baclofen	One of the few interventions that is effective for both dystonia and spasticity
Therapies for which some evidence exists to refute their effectiveness		
General	Hyperbaric oxygen	Because CP is so heterogeneous, it is unlikely that all children would improve with a single therapy; benefits have not been proven
	Patterning	Interventions such as the Doman-Delacato method have been discredited[44]
Promising therapies for which data are insufficient		
General	Stem cell injection	
	Acupuncture	
Dyskinesia	Deep brain stimulation	
Mobility	Treadmill training	
	Neuromuscular electrical stimulation	
	Training in virtual environments	

AFO indicates ankle-foot orthosis.

tizanidine, and dantrolene have been used to diminish spasticity in children with CP, although they might cause weakness or excessive sedation. Moreover, few studies have documented functional gains in children who have been treated with systemic medications. Similarly, trihexyphenidyl (Artane) has been used in children with dystonia, but there is no convincing evidence of its effectiveness.[30] Interventions to reduce spasticity and promote function in children with CP are usually recommended in a sequence from least to most invasive (eg, ankle foot orthoses before intrathecal baclofen).

Nutrition and Growth

A key goal of the medical home for children with CP is to optimize nutritional status and physiologic growth. Children with severe CP often struggle with oral and/or pharyngeal dysphagia, which leads to inadequate intake of calories and nutrients. In addition, gastroesophageal reflux disease (GERD) and gastrointestinal dysmotility are common in children with CP. Aspiration events might occur primarily during feeding or secondarily from gastric refluxate. Appropriate positioning during feeding (head in midline, physiologic chin tuck) might reduce the risk of aspiration, and dietary modifications (thickened feedings, specialized formula, dietary supplements) might promote growth. Management of chronic constipation with regularly implemented bowel programs might reduce symptoms of feeding intolerance, GERD, and generalized discomfort that tend to exacerbate spasticity and disorders of sleep. However, these interventions alone might not be enough. Growth charts for children who have CP are available[31]; however, they only describe how certain samples of children with CP have grown and are not standards for how all children with CP should

grow. When feedings are prolonged, growth is inadequate, or aspiration risk is high, gastrostomy or jejunostomy tubes might be indicated.[32,33] It is important not to overfeed the child enterally. Children with significant GERD might benefit from an antireflux procedure, such as fundoplication at the time of the gastrostomy, although selection criteria are lacking.[34]

Other Comorbid Conditions

In general, the severity of a child's motor impairments and functional limitations correlate with the prevalence of comorbid conditions. Seizures are common among children with CP and are typically managed in consultation with pediatric neurologists. Because children with CP frequently have visual impairments, at least 1 ophthalmology evaluation is recommended. Visual field cuts might be subtle and, when present, can hinder stair negotiation, self-care activities, and academic performance. Cortical visual impairments and refractive errors might further compromise function. Similarly, all children with CP should undergo audiologic testing.

Children with more severe CP often develop osteoporosis over time, especially if they take anticonvulsant medications. Adequate intake of vitamin D and calcium might not completely stave off osteoporosis but can minimize early bone loss. Although it has been suggested that passive weight-bearing in standing frames might increase bone density in children with CP, there is a lack of evidence to support or refute such interventions.[35]

Children with CP, even the milder forms, are more likely than children without CP to have comorbid conditions such as learning disabilities, attention-deficit/hyperactivity disorder, and pervasive developmental disorders.[36] These conditions are managed in the same way that they are in children without CP. Some children with CP have intellectual and developmental disabilities (mental retardation) and might need advocacy from their medical homes for appropriate educational interventions. Impairments of communication might be addressed with augmentative communication devices such as an electronic voice-output communication aid.[23]

FAMILY SUPPORT

Because the child with CP is part of a larger family system, assessment of the family's functioning can help guide interventions and planning. This assessment should include evaluations of family stress, social capital, resources, priorities, and adjustment of parents and siblings to having a child with a disability in the family. By listening carefully to parental concerns, pediatricians can better address family concerns and children's needs. The current US health care system depends on parents to be willing and able to provide long-term care for their children with CP while also balancing competing family needs. However, parents of children with CP generally are in worse physical and emotional health than are parents of typically developing children.[37] For example, in 1 study, more than 70% of mothers of children with physical disabilities reported low back pain.[38] When the health of parents or caregivers is compromised, outcomes for their children with CP might suffer. Pediatricians should provide family-centered care for children with CP and their families, because such care reduces stress and enhances parental well-being.[39] Children with CP and their families might also benefit from referrals to community resources including parent support and advocacy groups, respite programs, and community programs for recreational and adaptive sports. Input from community experts regarding home modifications to reduce architectural barriers (ramps, lifts, roll-in showers) is often indicated but financially challenging. Families might need support in anticipating treatment decisions when their child's CP and secondary conditions are expected to be life-limiting. Such decisions might include writing orders to allow natural death or to provide supportive interventions such as tracheostomy tubes. The principles of palliative care can be helpful in those instances.

TRANSITION AND TRANSFER OF CARE

Adolescents with CP transition from pediatric to adult health care systems, from school to work, and from home to the community. Transitions are affected by physical or cognitive impairments as well as by community and attitudinal barriers such as limited recreational and employment opportunities and lack of peer acceptance.[40] Health-related transition culminates with the transfer of care to adult health care providers. For the person with CP, this transition is influenced by the severity of the disability, family and social supports, community resources, and the availability of interested and capable adult health care providers. To be effective, transition planning should begin when the adolescent is no older than 12 years.[41,42] Likewise, discussions regarding sexuality, including sexual vulnerability, should begin well before the person is an adolescent.[43] Issues of guardianship and informed consent should be addressed when youth with lifelong functional dependencies approach 18 years of age.[44]

APPENDIX 1: RESOURCES

American Academy for Cerebral Palsy and Developmental Medicine (AACPDM): www.aacpdm.org.

American Academy of Pediatrics, National Center for Medical Home Implementation: www.medicalhomeinfo.org.

CanChild Centre for Childhood Disability Research, McMaster University: www.canchild.ca.

Center for Medical Home Improvement: www.medicalhomeimprovement.org.

National Institute of Neurological Disorders and Stroke CP information page: www.ninds.nih.gov/disorders/cerebral_palsy/cerebral_palsy.htm.

Hemi-Kids (online support for children with hemiplegia or hemiplegic cerebral palsy): www.hemikids.org.

Pathways Awareness: www.pathwaysawareness.org.

The ARC: www.thearc.org.

United Cerebral Palsy (UCP): www.ucp.org.

APPENDIX 2: *INTERNATIONAL CLASSIFICATION OF DISEASES, NINTH REVISION, CLINICAL MODIFICATION* (ICD-9-CM) CODES FOR CP

343.0 Diplegia.

343.1 Congenital hemiplegia.

343.2 Quadriplegia.

343.3 Monoplegia.

343.4 Infantile hemiplegia (postnatal) NOS (not otherwise specified).

333.71 Athetoid (dystonic) CP.

334.1 Hereditary spastic paraplegia.

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Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

Providing a Primary Care Medical Home for Children and Youth With Spina Bifida

Robert Burke, MD, MPH, Gregory S. Liptak, MD, MPH, and THE COUNCIL ON CHILDREN WITH DISABILITIES

KEY WORDS
spina bifida, developmental disability, medical home, chronic condition, hydrocephalus, myelomeningocele, meningomyelocele

ABBREVIATIONS
NTD—neural tube defect
AFP—α-fetoprotein
UTI—urinary tract infection

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

FREE

The pediatric primary care provider in the medical home has a central and unique role in the care of children with spina bifida. The primary care provider addresses not only the typical issues of preventive and acute health care but also the needs specific to these children. Optimal care requires communication and comanagement with pediatric medical and developmental subspecialists, surgical specialists, therapists, and community providers. The medical home provider is essential in supporting the family and advocating for the child from the time of entry into the practice through adolescence, which includes transition and transfer to adult health care. This report reviews aspects of care specific to the infant with spina bifida (particularly myelomeningocele) that will facilitate optimal medical, functional, and developmental outcomes. *Pediatrics* 2011;128:e1645–e1657

INTRODUCTION

Myelomeningocele is a complex chronic condition that affects the child and the family as well as the health care and related service providers. Although the occurrence of spina bifida* is decreasing, every year more than 1500 children are born with spina bifida in the United States. More than 160 000 Americans younger than 18 years are affected by spina bifida, and the 30-year survival rate has improved to nearly 90%.[1] Diagnosis of spina bifida and other neural tube defects (NTDs) is now often made early in pregnancy through α-fetoprotein (AFP) screening and fetal ultrasonography, which provides time for decision-making and planning by families.

A child born with spina bifida faces a long and multifaceted path of medical and surgical care. The complexity and severity of spina bifida depends on the type and location of the defect as well as the occurrence of associated conditions. The average lifetime cost is more than $635 000.[2] Children 1 through 17 years of age with spina bifida have average medical expenditures 13 times greater than children without spina bifida.[3] The primary care management of spina bifida in the medical home provides an opportunity to optimize the child's outcomes with improved quality of care in a cost-effective, family-centered, coordinated system.

*Note: in this report, the term "spina bifida" is used interchangeably with "myelomeningocele."

BACKGROUND

Etiology and Risk

Spina bifida, anencephaly, and other NTDs occur as a result of defective neurulation or closure during the third week after conception of the embryonic neural fold, which becomes the neural tube. Failure of closure in a cephalic direction leads to the development of anencephaly; failure of closure in the caudal direction leads to spina bifida. Myelomeningocele arises as a failure of neurulation by approximately day 28 after conception. The primary defect in the neural tube then leads secondarily to the failure in the formation of portions of the spinal cord and the dorsal elements of the vertebral bodies and overlying tissues, which gives rise to the spina bifida sac. A lesion that involves elements of the spinal cord as well as the meninges within the sac is termed a myelomeningocele (or meningomyelocele). If the meninges but not the neuronal elements are involved, the lesion is classified as a meningocele. These 2 lesions represent open NTDs. Closed NTDs are those in which the overlying skin is intact and include lipomeningocele and lipomyelomeningocele as well as occult spina dysraphisms (Table 1).

The etiology of spina bifida includes genetic and environmental factors.[4] Spina bifida occurs worldwide and in all racial groups, although there are geographic and ethnic variations.[5] Genetic factors are likely to be related to the increased risk in some populations, notably the Irish, Scottish, and other northern Europeans.[6] This risk may be related to altered folate metabolism.[7] In the United States, a slightly higher rate occurs in families of Latin descent.[8] Chromosome disorders including trisomy 13 or 18 and microdeletion of 22q11 are linked to NTDs.[9] Exposure to some prenatal medications increases the risk of spina bifida. These medications include valproic acid, carbamazepine, isotretinoin, methotrexate and other folic acid antagonists, excess vitamin A or its analogs, and retinoic acid.[10] Maternal nutrition (especially folate deficiency), alcohol consumption, obesity, and fever, either attributable to illness or hot tub/sauna use, can increase risk, as does maternal diabetes mellitus.[11,12] Family history of previous NTDs is a significant risk factor, increasing the risk more than 20-fold (eg, from 0.1%–2.5%).[13,14]

Occurrence

In the United States, the birth prevalence of spina bifida has decreased to less than 1 in 1000 live births.[15] This reduction might be related to im-

TABLE 1 Spina Bifida: Types, Description, and Implications

Spina Bifida Type	Description	Clinical Implications
Myelomeningocele	Open NTD posterior vertebral defect and extrusion of spinal cord elements into a meningeal sac; location: cervical, thoracic, lumbar, and/or sacral spine; leads to paraplegia and insensitivity below the lesion and neurogenic bowel and bladder; associated defects include structural brain anomalies (Chiari II malformation, hydrocephalus, brainstem dysfunction abnormalities of the cerebrum and corpus callosum, learning disabilities, dislocated hips and clubbed feet)	Complex multisystem disorder that requires ongoing monitoring by spina bifida team, enhanced primary care in the medical home with bidirectional communication and comanagement with the multispecialty spina bifida care team, early-intervention and special education services, physical therapy and adaptive equipment, and developmental and learning monitoring
Meningocele	Closed NTD posterior vertebral defect without extrusion of spinal cord elements into a meningeal sac; location: cervical, thoracic, lumbar, and/or sacral spine; motor deficits are less likely than with myelomeningocele; structural brain anomalies and Chiari II malformation are less likely	Early closure of spina bifida sac; follow-up by spina bifida team; additional monitoring in the medical home; ongoing monitoring for neurologic function; early-intervention monitoring; periodic monitoring for possible late onset of neurologic signs
Occult spinal dysraphism/lipomeningocele	Closed NTD posterior vertebral defect and with fatty tumor that might contain neuronal elements; location: typically lumbar and/or sacral spine; leads to motor deficits if neuronal elements are involved; associated defects include tethered cord; structural brain anomalies and Chiari II malformation are unlikely	Early neurosurgical intervention; follow-up by spina bifida team; additional monitoring in the medical home; enhanced primary care in the medical home and with follow-up by the multispecialty spina bifida care team; ongoing monitoring for neurologic deficits; early-intervention monitoring
Spina bifida occulta	Benign closed NTD posterior vertebral defect only without a meningeal sac; location: lumbar-sacral spine; usually asymptomatic but can be associated with occult spina dysraphism; usually no associated defects	Monitoring and reassurance within the medical home
Tethered cord	Traction injury to the distal spinal cord caused by anomalous attachment of the spinal cord, which causes subtle and progressive loss in neural function; can occur with any NTD at any time, but often occurs with growth spurts; might be precipitated by ventricular shunt failure	Monitoring of all children and youth with open or closed NTD for signs of tethering; changes in lower extremity strength, function, or sensation; urinary incontinence or enuresis; changes in bowel function; or worsening scoliosis

Spina bifida is a general term for several malformations of the spine and its neural elements, which may be associated with neurologic, neuromotor, developmental, and orthopedic anomalies and are related to structural abnormalities of the brain and cranium.

proved prenatal nutrition, including folic acid supplementation for women of childbearing age and the mandatory enrichment of flour with folate as well as the termination of affected fetuses.[16,17] Despite folic acid fortification, infants continue to be born with NTDs and will need both immediate and long-term medical, surgical, and related interventions.[18]

Clinical Manifestations

The effects of spina bifida relate to the location and size of the defect and the presence of hydrocephalus, brain abnormalities such as the Chiari II malformation, and other neurologic and orthopedic conditions. Thoracic and higher lumbar myelomeningocele lesions are more likely to be associated with significant motor and sensory deficits and structural abnormalities in the lower extremities than are those in the lower lumber or sacral regions.[19] Functional defects of the urogenital and lower intestinal tract are likely at all levels.[20]

Hydrocephalus occurs in ~85% of infants with myelomeningocele and, in most cases, necessitates ventricular shunt placement. Once placed, shunts need to be monitored regularly for potential malfunction. In addition, hydrocephalus is associated with significant problems in learning and cognitive function.[21] After birth, the open spinal lesion needs to be protected from trauma, which could cause additional neurologic damage. In addition, if the lesion is leaking cerebrospinal fluid, measures to protect against infection (meningitis) are required. Surgical closure within 72 hours reduces the risks of infection and additional spinal cord injury.[22,23]

In addition to the primary deficits in motor and sensory function, children and youth with spina bifida experience a range of comorbid conditions including learning disabilities, problems with attention and executive function, dysfunction of upper extremities, strabismus, and seizures. They are also subject to other functional complications such as limitations of movement and ambulation, scoliosis, joint instability, fractures, bowel and bladder dysfunction, altered growth including precocious puberty, and obesity. These children and teenagers will need ongoing prevention because of the increased risk of developing latex allergies.[24] The physical and psychological consequences of impaired mobility and independence, altered appearance, and the long-term needs of the condition also require identification and intervention. The child's physical and developmental disabilities, limited mobility, and chronic health conditions can be barriers to social integration that can have lifelong consequences

TABLE 2 Systemic Effects of Myelomeningocele

System	Effects
Neurologic	
Central	Hydrocephalus, Chiari II malformation, dysgenesis of the corpus callosum
Cranial nerves	Vision, strabismus, hearing, speech, stridor, swallow
Spinal	Tethered cord, progressive loss of motor and sensory function
Motor	Paraplegia, upper extremity hypotonia
Sensory	Loss of sensation and proprioception
Cognitive	Cognitive deficits including learning disabilities, executive function disorders, attention-deficit/hyperactivity disorder
	Lower cranium nerve dysfunction
Vision	
Acuity	Visual acuity problems, rarely severe
Alignment	Strabismus, oculomotor disorders
Oromotor	Oromotor dysfunction, swallowing disorder
Respiratory	
Central	Central ventilatory disorder, apnea, sleep apnea, hypoventilation
Pulmonary	Aspiration, restrictive and obstructive lung disease, pneumonia
	Stridor
Gastrointestinal	
Swallow	Swallowing dysfunction; oral, pharyngeal
Neurogenic bowel	Constipation, soiling, accidents
Urologic	
Neurogenic bladder	Bladder atonia/dystonia, increased bladder pressure, leakage/incontinence, reflux, renal failure
UTI	Bacterial colonization, acute/chronic UTIs
Genital	
Insensitivity	Lack of sexual sensation, erectile dysfunction, and retrograde ejaculation in males
Infertility	Early pubertal onset and increased risk of NTD in infants of women with NTD
Orthopedic	
Spinal	Scoliosis/kyphosis
Extremities	Decreased mobility, hip dislocation, clubbed feet, osteopenia, fracture, linear growth abnormalities
Growth	
Stature	Short stature resulting from limb-length disorders and precocious puberty in females
Weight	Overweight and obesity
Psychology	
Anxiety/depression	Increased anxiety and depression
Behavior	Social isolation, anxiety, depression, immaturity, risk-taking behavior, at increased risk for abuse
Social	
Inclusion	Social isolation, limited friendship, physical and transportation barriers
Employment	Limited work experience, physical/society barriers, loss of health coverage or benefits

Myelomeningocele is the most serious and complex NTD and affects multiple body systems; the severity of these effects is related to the type and location of the NTD and the extent of neuronal injury.

(Table 2).[25] Thus, children with myelomeningocele are like children with spinal cord injuries with the addition of neurocognitive impairments.

The primary care physician plays a central role in long-term comprehensive care through collaborative comanagement with multiple medical and surgical specialists. It has long been recognized that the provider of primary care in the medical home must be knowledgeable about the unique medical issues of spina bifida and its developmental, educational, and social consequences.[26]

Prevention

The mandated supplementation of cereal flours with folic acid in 1998 in the United States and Canada has been linked to a reduction in the prevalence of NTDs.[27] Also, all women of childbearing age should ingest 400 μg (0.4 mg) of folate daily,[28] which may decrease the occurrence of NTDs by up to 70%. Women who have had a previous pregnancy with any NTD and women with spina bifida should take 10 times that dose or 4000 μg (4 mg) daily from the period before conception through the first trimester. On the basis of current American Academy of Pediatrics guidelines, the primary care physician should recommend folic acid to all sexually active females, not just those with a history of an NTD. Folate supplementation has not been the sole factor in reducing the occurrence of NTDs. Better overall nutrition, improved maternal health, and termination of affected pregnancies are additional factors.

DIAGNOSIS AND INITIAL COUNSELING OF THE FAMILY

Prenatal screening by measuring maternal serum AFP concentrations at 15 to 20 weeks of gestation has become the standard of care.[29] The AFP concentration is increased when fetal cerebrospinal fluid is released, as occurs with open myelomeningocele and anencephaly. Thus, a closed NTD might not be detected by measurement of the maternal serum AFP level. Elevated concentrations of AFP can be found in other fetal conditions, including twin pregnancies, ventral wall defects, fetal tumors, congenital nephrosis, and incorrect dating of the pregnancy. Although maternal serum AFP concentration is a useful screen, the results should be interpreted with caution. Maternal serum AFP concentrations more than 2.0 multiples of the median during weeks 15 to 20 after conception are considered abnormal and should be repeated. Abnormal concentrations are followed by high-resolution ultrasonography or other evaluations such as amniocentesis.

Ultrasonographic examination is used to screen for NTDs.[30] Two-dimensional ultrasonographic examination during the first trimester detects more than 90% of cases of anencephaly and more than 80% of encephaloceles but fewer than half of spina bifida cases. Second-trimester ultrasonography can increase the detection of spina bifida to 90% to 95%.[31]

Ultrasonographic examination can also help to monitor the fetus over time. It can be used to characterize the architecture of the spinal defect and the presence of and changes in cerebral ventricles over the course of the pregnancy and to identify other structural abnormalities. Fetal MRI provides additional information to better characterize the NTD, Chiari II defect, and status of ventricles and can detect previously unidentified abnormalities.[32]

Amniocentesis may be warranted if there are concerns that the NTD is related to a genetic or chromosome disorder or to confirm findings from ultrasonography or maternal serum tests. Measuring amniotic fluid AFP and amniotic fluid acetylcholinesterase can be useful for detection of an open NTD.[33] Chromosome analysis (karyotype) and microarray testing can be performed to determine if the NTD is related to chromosome aneuploidy, microdeletion, or another genetic condition.[34]

The process of fetal screening can be confusing and stressful for the expectant mother and her significant other. Counseling and support should be provided to the pregnant woman and her family about the screening procedures and their risks, results, and interpretation. This counseling should be provided by a medical geneticist, genetic counselor, and members of the fetal diagnosis team who are familiar with the procedures and are knowledgeable about the prognosis of NTDs. Counseling should include general information about spina bifida, obstetric care, choices about the pregnancy and delivery, neonatal care, surgery, the likelihood of hydrocephalus and its treatment, and the potential for disabilities and complications. The family should also be made aware of the services, care plan, and types of support that will be provided to them and the child. The option of fetal surgery to potentially reduce the extent of neurologic damage of an NTD and to reduce the need for ventricular shunting should be discussed. Families interested in pursuing fetal surgery should be referred to centers that provide fetal surgery for NTDs.[35]

Families may turn to the pediatric primary care provider for information and guidance when the primary care provider has a previous relationship with the family. In this case, it is essential that the primary care provider have ongoing communication with the prenatal diagnostic team to ensure that reliable and uniform information is provided to fam-

ily members as they look for answers and plan for options and decisions for the pregnancy and subsequent care.

THE ROLE OF THE PRIMARY CARE PROVIDER IN ONGOING CARE IN THE MEDICAL HOME

The optimal care of the infant, child, or youth with spina bifida is best provided by a multispecialty team and a primary care provider who collaborate to provide comprehensive and coordinated care and support to the child and family.[36] The spina bifida team typically includes a clinical nurse specialist or nurse practitioner; pediatric specialists in neurosurgery, orthopedics, urology, developmental pediatrics, and physical medicine; physical therapists; orthotists; psychologists; social workers; and health education professionals. All these specialists might not be available to all teams and for all clinic settings. The care team's goal should be to meet the individual needs of each child and family by providing comprehensive and coordinated care, support, and education to the patients and families and support and assistance to the primary care provider, the child's school or early-intervention program, and other service providers.[37]

The primary care provider's interventions may begin even before birth and continue through transfer to adult health care. Families that have a preexisting relationship with a primary care provider may turn to him or her for guidance and information at the time of prenatal diagnosis. In other cases, the family may select a primary care provider before or at the time of delivery. The primary care provider's confidence in caring for an infant with an NTD might vary depending on knowledge base and previous experience. The spina bifida team can be a valuable resource for the primary care provider to ensure optimal care. An in-depth understanding of the child's needs and those of the parents will develop through contacts during scheduled well-child visits and visits for acute illnesses or other concerns.

The primary care provider usually has *first contact* with the family, whether for routine or acute care. The care of the individual with spina bifida requires the primary care provider to be able to recognize and treat issues unrelated to the spina bifida (such as gastrointestinal or respiratory tract infections) while at the same time identifying and rapidly referring for conditions (eg, headaches or new-onset weakness) that might indicate serious problems (such as ventricular shunt malfunction). This ability requires knowledge about spina bifida and optimal communication. Specialists should routinely communicate with primary care providers by using a combination of technologies such as e-mail, telephone, and fax. Primary care providers should communicate acute symptoms or concerning changes in their patients (eg, headaches or urinary symptoms) to the specialty team.

Newborn Period

For the fetus identified with an NTD, ongoing prenatal planning and care are important, as is the timing, location, and method of delivery (ie, in a tertiary medical center). However, despite the availability of prenatal diagnosis, infants continue to present at delivery with previously unidentified open and closed NTDs. The obstetric and infant care teams should be prepared to address anticipated or unexpected birth of an infant with an open or closed NTD. At birth, a physician, using sterile nonlatex gloves, should assess the open lesion to document its location and size and to determine if it is leaking cerebrospinal fluid.[38] The lesion should be covered and protected using a sterile technique.[22] The dressing should not be removed or disturbed except by the neurosurgical team. The infant should be placed in a prone or lateral position to avoid pressure on the lesion. After stabilization in the delivery room, the infant should be shown to the parent(s) before being transported to the nursery. Admission to the NICU or transportation from an outlying hospital to a NICU should be promptly arranged. Initial neonatal examination of the infant with an open or suspected closed NTD should be performed shortly after birth and should include all the usual elements of a typical newborn physical examination but with particular attention for spinal irregularities, hemangiomata, hair tuft or abnormal pigmentation, dimples, or pits. Assessment of head circumference and tenseness of the anterior fontanel for signs of hydrocephalus, movement of the lower extremities, level of sensation, and deep tendon reflexes and anal wink should be noted. Abnormalities of the lower extremities and flexion or extension contractures of hips, knees, and ankles should be noted. Other physical or neurologic or congenital abnormalities, including structural anomalies of the heart, airway, gastrointestinal tract, ribs, and kidneys, should be assessed. Ventricular size should be evaluated soon after birth by ultrasonography, computed tomography (CT), or MRI; ultrasonography and MRI are better than CT scanning at identifying a Chiari II malformation.

Neurosurgical consultation should be obtained shortly after birth, and arrangements for surgical closure should be made within 72 hours after birth; this step further decreases the risk of central nervous system infection.[23] After repair of the myelomeningocele, head circumference should be measured regularly and carefully to

monitor for increase at a rate greater than the normal curve. On the basis of clinical evidence, the newborn infant should be monitored for the next few weeks to determine if a ventricular shunt is indicated. Serial neuroimaging using ultrasonography can identify the progression of hydrocephalus. The patient is reassessed every 3 to 10 days depending on the level of concern. Progressive hydrocephalus may cause the infant to develop irritability, vomiting, stridor, or poor feeding; 85% or more of infants with myelomeningocele will require a ventricular shunt.[39]

The newborn infant should be evaluated by a urologist before discharge. A baseline sonogram of the kidneys and bladder is typically performed to determine if the infant already has renal involvement or congenital abnormalities. Measurement of serum urea nitrogen (SUN) and creatinine concentrations, a voiding cystourethrogram, and direct measurement of the pressure within the bladder may be indicated as well.

Discharge planning should begin soon after birth and should ensure that all primary and specialty care is arranged before discharge. Communication is open among the specialists, spina bifida team, and support programs, including the early-intervention program, the primary care provider, and the family. A written discharge plan that focuses on the infant's individual and unique needs related to the NTD should be provided to all clinical and support programs and the family. Early follow-up with the primary care provider and the spina bifida team should be arranged.

Primary care of the infant and child with spina bifida within the medical home should ensure that all routine care, services, intervention, and immunizations are provided in line with American Academy of Pediatrics recommendations in *Bright Futures*, with addition of the specific recommendations for patients with spina bifida provided by the Spina Bifida Association of America and others (see "Resources").

Hydrocephalus

Because hydrocephalus develops in most children with open spina bifida (myelomeningocele) and in some children with closed lesions, head growth should be carefully monitored in all infants with spina bifida. Changes in head circumference percentile, the tension of the anterior fontanel, changes in mental status, vomiting, and changes in extraocular movement, such as strabismus or the sunset sign should be discussed with the neurosurgical team. Later, when the cranial sutures and fontanels close, the functional status of the ventriculoperitoneal shunt is determined by signs such as headache, irritability, changes in mental abilities, and vomiting.[40] Shunt failure can occur at any time—days, weeks, or even years after insertion. The primary care provider needs to become familiar with the signs and symptoms of shunt failure and should be in communication with the neurosurgical team.

Development

Most people with myelomeningocele have intelligence within the normal range, but most experience significant learning disabilities. These disabilities include nonverbal learning disorder, poor executive skills, attention deficits, and memory problems.[41,42] These cognitive difficulties might delay the child's maturation and impede his or her ability to acquire the skills needed to live independently, which in turn affects family members.[43] Recognition of these issues and interventions to optimize learning and independence are critical for optimizing learning and social participation.

Cognitive development is affected by several factors, including shunt infection, Chiari II malformation, hydrocephalus with repeat shunt replacements, and neuronal migration disorders (eg, hypoplasia of the corpus callosum). These factors distinguish myelomeningocele from other disorders that are limited to the spinal cord, such as lipomeningocele and traumatic paraplegia. Developmental and learning disorders may become evident at any time from infancy through adolescence; therefore, developmental surveillance should be part of all routine well-child visits. Particular attention should be paid to language and communication, and formal testing should be ordered if concerns develop. Because there is an increased risk of vision and hearing problems in children with spina bifida and hydrocephalus, testing and evaluation should be performed on a regular basis.

The primary care provider should remain in close contact with the child's early-intervention and school program to ensure that information is shared. The child's developmental status, with strengths and weaknesses noted, should be formally evaluated to ensure that appropriate needs are recognized and addressed. The primary care provider might need to provide information to the school program and, at times, advocate for the child and family for specific educational services. An emergency plan for the school should be developed and reviewed annually; it may contain information on medical conditions (eg, if the child develops signs of increased intracranial pressure) as well as a plan for evacuation from the school for the child with limited mobility.

Bowel Function

Almost all people with myelomeningocele have disorders of innervation of the lower intestinal tract and anus

with lower tract dysmotility and poor or absent sphincter control, which lead to fecal incontinence. Fecal incontinence can seriously impair social relations, limit independence, and lower self-esteem.

The management of incontinence is time-consuming; yet, initiating a bowel-management program early in development helps both the family and the child to develop a routine, effective program of management and self-care. The goals of a bowel-management program are to achieve continence and promote regular elimination of stool, which can be achieved with an individualized program that may use timed toileting, changes in diet, and oral laxatives, suppositories, and enemas, singly or in combination. At the initiation of a functional bowel program, constipation and fecal impaction may necessitate a bowel clean-out.

As children become older and capable of self-management, they might benefit from a surgical procedure called antegrade continence enema (ACE).[44] In the Malone antegrade continence enema (MACE) procedure, the appendix and cecum are used to create a catheterizable stoma.[45] In the ACE procedure, the cecum is brought up to the abdominal wall and an ostomy tube is inserted, which saves the appendix for urologic procedures. With either procedure, the patient is able to clean out the colon by irrigating it through the ostomy tube. The irrigation is performed daily or every other day; it may take as long as 2 hours to complete. The ACE/MACE can achieve fecal continence in ~85% of patients.

Urinary Tract Function

Almost all people with myelomeningocele have a neurogenic bladder. They may not be able to store urine in the bladder or may be unable to empty it. Failure to completely empty the bladder and elevated pressure within the bladder increase the risk of urinary tract infection (UTI) and renal tract injury resulting from urinary reflux and can lead to progressive damage to the upper urinary tract and kidneys, with the risk of progressive renal damage, which still occurs in youth and adults with spina bifida. Early evaluation of urinary tract structure and function by ultrasonography, radiographic imaging, and urodynamic testing beginning in infancy can help determine the status of the kidneys and bladder. Urologic treatment is aimed at normalizing pressure within the bladder, providing continence, and minimizing infection and reflux. Close attention to urinary tract function is important, because changes may indicate UTI or tethered cord, including tethering attributable to shunt malfunction. Some children or youth benefit from bladder augmentation or urinary diversion procedures to increase bladder capacity, improve urinary continence, and reduce the risk of progressive renal injury.

Management of the urinary tract typically begins with the early introduction of clean intermittent catheterization (CIC) beginning even in infancy and close monitoring for changes in bladder function. If CIC is unable to optimize pressures within the bladder, a vesicostomy (a hole placed in the abdominal wall into the bladder) may be indicated. Many patients are also maintained on medication to reduce vesicoureteral reflux. These and other interventions improve bladder pressures and urinary continence, which permits the child with myelomeningocele to function better in school and other social settings. The child/teenager is monitored over time for the occurrence of UTIs; some people with repeated infections may benefit from chronic antibiotic prophylaxis to reduce the risk of reinfection, although this is practiced less often now than in the past. Differentiating UTI that requires antibiotic treatment from bacteruria, which is often present but does not need to be treated, may be difficult and require consultation with a urologist.

The primary care provider should be aware of and monitor the child's adherence to the catheterization program while maintaining contact with the urology team regarding medications and interventions. Communication from the primary care provider to the specialist regarding UTIs and other urinary problems is critical. In the case of fever, nonspecific symptoms, or changes in urinary tract function, the primary care provider should maintain a high index of suspicion for UTI. The child should have urinalysis and urine culture obtained if there is a likelihood of bladder or kidney infection. Patterns of bacterial resistance to antibiotics should be carefully monitored. Oral and, occasionally, intravenous antibiotics will be required to treat UTIs in these children. Open and active communication between the primary care provider and the pediatric urology team is essential for maintaining optimal renal function and establishing urinary continence. Blood pressure should be monitored to identify hypertension.

Mobility

Mobility should be addressed from infancy through adulthood. Creeping or crawling gives an infant experiences with control and competence. Mobility aids for toddlers, whether wheeled or upright, continue this process. Being safely mobile in their homes and communities will help children and teenagers become more independent. Walking or using a wheelchair not only promotes confidence and independence but also helps with overall fitness and weight control. In prescrib-

ing wheelchairs or other assistive devices, the focus should be on optimizing age-appropriate functionality and independence for the child or teenager. Many teenagers with spina bifida can safely drive a car but need modifications with hand controls. Driving rehabilitation specialists can be helpful in identifying potential challenges to safe driving, providing appropriate driver training, and suggesting changes needed to the car to make it accessible.

Orthopedic Problems

Orthopedic problems occur in most children with myelomeningocele and tend to be more common and more complex with higher-level lesions; they affect activity more with increasing age and in obese patients.[46] Clubfeet, hip subluxation and dislocation, and knee instability or contractures may be present at birth, especially in patients with lumbar and thoracic lesions. Unbalanced muscle function leads to worsening of existing joint problems or to the onset of new orthopedic disorders. Correcting deformities, maintaining posture, and promoting ambulation to maximize function and independence are generally handled by orthopedists and physical therapists. There is also a need to diagnose and treat fractures, which are more common in children with myelomeningocele, who often have osteopenia. Fractures in insensate limbs may present with redness and swelling without pain and should be suspected by the primary care provider.

Scoliosis occurs in most children with lesions above the second lumbar vertebra (L2). Examination of the back and monitoring of the progression of scoliosis should be performed regularly by the spina bifida team and primary care provider, even in preschool-aged children. Progression of scoliosis should prompt a thorough neurologic evaluation and imaging to identify correctable causes such as tethered spinal cord, hydromyelia, or shunt malfunction and to maintain function. Motor and sensory function and bowel or bladder patterns should be part of the evaluation. The pediatric care provider should continue to monitor lower extremity function and identify any deterioration.

Skin Care

The loss of normal skin sensation and autonomic response to pressure or irritation places people with an NTD or spinal cord injury at risk of breakdown of skin as well as the formation of decubitus ulcerations. Injury to insensate skin can occur at any site of pressure or irritation, including the pelvic area from prolonged sitting, casting, or braces or even tight clothing; abrasion from seating or positioning equipment; or thermal injuries from any of a variety heat sources. Injury to insensate skin can be permanent damage that requires long-term, complicated, and costly treatment and causes additional disabilities.[47] Careful monitoring of skin integrity and for potential sources of injury should begin in infancy and continue along the life span. All sign of injury or breakdown of insensate skin should be treated promptly and vigorously to minimize the risk of complications.[48]

Adolescence

Teenagers face many physical, mental, emotional, and social changes. They must develop their own identities and interests and strive for greater independence. This transition period can be challenging, especially for teenagers with spina bifida. It is important for the parents, teenager, educational system, and health care providers to take an active role in encouraging growth, self-confidence, independence, and competency even before adolescence.

Fitness and well-being should be encouraged from an early age. Physical activity is especially important for those with spina bifida. Physical activity improves general health, reduces obesity, and improves confidence and self-image. Children and teenagers with spina bifida should be encouraged to engage in physical activities with friends and to participate in adapted sports. Attending summer camp or using accessible recreational facilities can also help with well-being and the development of self-care skills such as dressing, bathing, toileting, and mobility. The teenager should be educated to inspect areas of insensate skin while bathing and dressing and to report any signs of irritation or ulceration to prevent decubitus ulceration or other serious injury to the skin. By midadolescence, teenagers should make their own doctor appointments and participate in their individualized education plan (IEP) or 504 plan, if they have one. They should be encouraged to advocate for themselves in school and report problems such as teasing or bullying.[49,50]

The primary care provider should include children and youth in the discussion of their health and related issues from the early school years. Even before adolescence, children should be encouraged to participate actively in health care visits and report their concerns and accomplishments. By early adolescence, some time during each visit should be set aside for private discussions with the child. This time should be increased until the teenager has essentially private office visits with the doctor. Beginning in early adolescence, transition-related issues, such as education about spina bifida, treatments and medications, general health issues, and transition and transfer to adult health care, should be discussed. For some youth with significant cognitive impairment, the goal

of independent decision-making might not be achievable, and planning for personal and financial guardianship might be necessary. These and other topics can be introduced during health maintenance, preventive care, and acute care visits.

The primary care provider should develop an understanding of the mental health risks associated with spina bifida, including social isolation, learned helplessness, and low self-esteem. Youth with spina bifida are at increased risk of both anxiety and depression.[51] The primary care provider should evaluate these conditions and identify the patient's risk of suicide. Interventions such as increasing physical activity and teaching relaxation techniques may be beneficial. Counseling and support should be given to the teenager and family members by the primary care provider. Counseling through school- or community-based mental health professionals may be indicated before anxiety or depression worsens. Whenever these conditions persist or interfere with school or social activities, the adolescent should be referred to a mental health professional who is familiar with the mental health challenges of teenagers with disabilities.

Sexuality

Issues of sexuality in teenagers and young adults with spina bifida are often overlooked or actively avoided. For patients with spina bifida, a number of significant issues related to sexual maturation require attention. Precocious puberty is common in girls with myelomeningocele and hydrocephalus; girls with hydrocephalus have menarche at an average age of 10.9 to 11.4 years rather than the more typical 12.7 years for the average American girl. Precocious puberty affects the physical, physiologic, and emotional outcomes of sexual maturation, including linear growth.[52] The progression of puberty can be delayed by using leuprolide (Lupron), which provides additional time for emotional maturation and improved linear growth; this treatment is usually best managed by a pediatric endocrinologist. Topics of discussion that are important for girls with spina bifida include fertility, pregnancy, and contraceptive choices. Folate supplementation needs to be stressed. Female teenagers who are lonely or naive or have learning disabilities are at increased risk of being taken advantage of sexually or even subject to sexual assault.

For male teenagers, altered sensation, erectile dysfunction, and incontinence affect sexual behaviors, including intercourse.[53] The issues of sexual performance may require referral to a professional who is knowledgeable in male sexual disorders. Treatment with sildenafil (Viagra) or other medications may be beneficial. Sexuality is affected by self-esteem and self-image and might be an issue not addressed by the spina bifida team; the primary care provider might be the only one to address these issues and should initiate treatment or refer to specialty services when indicated.[54]

Transition to Adult Health Care

Transitions for adolescents and young adults with spina bifida should include the orderly transfer to accessible adult medical care as well as transitions in social, educational, vocational, and recreational areas.[55] As part of health care transition, all young people need to develop an understanding of their health care needs and begin to take responsibility for their health care decisions, as their cognitive and learning skills allow. Transition planning should focus on building competencies in self-care, fostering independence and self-advocacy, and assisting with supports and strategies for transfer to adult care providers.[56,57]

The medical home should be part of the transition process, which should include exploring educational and vocational options, obtaining skills for work, finding safe and dependable transportation, deciding on living arrangements, developing healthy social and personal relationships, obtaining medical insurance, and identifying both primary and specialty care providers who are knowledgeable in the care of adults with spina bifida. Transition planning and discussions within the medical home beginning early in adolescence can help to make these changes easier and outcomes more successful. Web sites such as the New York State Institute for Health Transition Training for Youth With Developmental Disabilities Ages 14–25 Years (http://healthytransitionsny.org), the Adolescent Health Transition Project (http://depts.washington.edu/healthtr), the Health Care Transition Initiative (http://hctransitions.ichp.ufl.edu), and the National Health Care Transition Center's Got Transition? page (http://gottransition.org) can provide guidance for families and the primary care provider.

Family Support

Spina bifida has a profound effect on the family, beginning with the prenatal diagnosis; at birth, the families have to face issues such as deformities and complex surgical interventions for closure of the spinal lesion and shunt placement for hydrocephalus. Later, the extent of physical and developmental disabilities becomes clearer. Families must deal with the increased demands for care, including procedures such as catheterization and range-of-motion exercises, more frequent medical appointments, and other interventions, all of which disrupt the family's

TABLE 3 Care of the Child and Youth With Spina Bifida: Potential Roles of the Pediatric Primary Care Provider

Time	Concerns	Actions
Fetuses (prenatal)	Diagnosis	Consult with diagnostic team
	Lesion: type and location	Review obstetric plan
	Other central nervous system findings (hydrocephalus, Chiari II malformation)	Review findings and implications with family
	Other physical findings (orthopedic, other)	Discuss options and plan
	Maternal and family stress and anxiety	Referral to spina bifida team
	Family choices and plan	Update primary care provider and other provider knowledge base
		Family education and support
		Communicate among family and all professionals
Newborns	Stabilization	Consult obstetric and neonatal teams, neurosurgery, others specialists
	Protection of lesion	Family support
	Examination	Monitor head growth
	Surgical closure	Neonatal screening and newborn hearing assessment
	Hydrocephalus	Discharge planning
	Motor function	Primary care and specialty follow-up
	Bowel and bladder function	
	Orthopedic conditions	
	Maternal/family anxiety and depression	
Infants	General health status	Health care per *Bright Futures* recommendations
	Growth	Referral to spina bifida team and support group
	Development	Referral to early-intervention program
	Immunizations	Monitor head growth and shunt function
	Spina bifida-specific concerns: hydrocephalus and shunt function, bowel and bladder function, UTI	Assess for feeding or swallow problems
		Discuss latex precautions
		Supplemental Security Income, Medicaid, and Medicaid Waiver
Preschool-aged children	General health status	Health care per *Bright Futures* recommendations
	Growth and development	Follow-up with spina bifida team and support group
	Spina bifida-specific concerns: vision and strabismus, motor function and mobility, hydrocephalus and shunt function, bowel and bladder function, UTI	Obtain early-intervention assessment, individualized family service plan
		Developmental team evaluation
		Discuss social inclusion and activities
		Bracing and ambulation
		Activity and weight management
		Dental referral
		Toileting
School-aged children	General health status	Health care per *Bright Futures* recommendations
	Growth and development	Follow-up with spina bifida team
	Weight control and healthy diet	School transition, service and support, Section 504/individualized education plan
	Spina bifida-specific concerns: motor function and mobility, hydrocephalus and shunt function, bowel and bladder function, tethered cord	Screen for attention-deficit/hyperactivity disorder, learning disabilities, and executive function disorders
		Bullying and safety
		Self-care and independence
		Physical activities and social group participation
		Neurology and physical therapy follow-up
Teens	General health status	Adolescent health care per American Academy of Pediatrics recommendations
	Weight control and healthy diet	Confidentiality and private visits
	Sexuality	Birth control and folic acid
	Psychosocial stressors	Health care transition
	Spina bifida specific concerns: motor function and mobility, tethered cord	Self-care and independence
	Developing independence	Driving and transportation
		Spina bifida teen support group
		Educational and vocational planning
Adults	General health status	Identify health care resources
	Weight control and healthy diet	Health insurance, Social Security Disability Income
	Spina bifida specific concerns: motor function and mobility, bowel and bladder management, skin care and pressure sores	Education and employment
		Living situation
		Spina bifida adult support group
		Transfer to accessible adult health care

Concerns and actions are not intended to be limited to a single time period but should be addressed and readdressed as part of ongoing health care across the life span.

hopes and plans for both the child and themselves as a family unit.

The ongoing care of the child with spina bifida strains each family member. It alters roles and expectations and decreases opportunities (eg, the parent who cannot go back to work or school). It adds anxiety and stress and even a sense of guilt, which can become the source of depression and friction; it increases the risk of family dysfunction and instability.[57] Adolescence often increases family stress.[58]

Spina bifida affects not only the patient but also his or her siblings, who are subject to stress and feelings of loss, guilt, frustration, and anger. These feelings have consequences for the sibling, for his or her relationship with the child with spina bifida, and for the entire family.[59,60] The psychosocial and emotional consequences of spina bifida on the patient, siblings, and family should be part of the overall care of the child with spina bifida. These factors should be addressed by both the spina bifida team and the primary care provider in the medical home. A family-centered approach to care and anticipation of potential problems will help to identify and address stressors early.

SUMMARY

The standard of care for children and youth with spina bifida remains a program of comprehensive and multidisciplinary support, and the medical home plays a central role. The pediatric primary care provider has frequent contact with the child, including well-child and acute health care visits, and by partnering with the child, parents, and specialty program, builds trust and can help address the medical, developmental, and psychosocial issues of childhood over time. The primary care provider also helps to manage ongoing care of the child's multisystem disorders and the unique nonmedical

TABLE 4 Primary Care Interventions Typically Provided to Children and Teenagers With Spina Bifida

Fetuses (prenatal)
Counsel families in planning and decision-making
Provide information on spina bifida
Options and assistance with family choices
Consult with obstetric, neonatal, and neurosurgical teams
Prenatal (fetal)/postnatal surgery
Discuss postnatal planning and treatment
Family support
Newborns
Postnatal care and stabilization
Surgical repair of spinal lesion
Monitoring and surgery for hydrocephalus
Family support
Referral to multidisciplinary spina bifida term
Primary and specialty follow-up
Infants
Provide early and frequent follow-up
Monitor hydrocephalus
Provide routine and diagnostic-specific primary care
Give family and sibling teaching and support
Discuss recurrence risk and prevention
Refer to early-intervention program
Communicate and coordinate with the spina bifida team
Toddlers
Preventive and well-child care
Developmental monitoring
Mobility
Growth and weight management
Preschool-aged children
Transition from early-intervention program to preschool program
Ambulation and mobility
Bowel and bladder program
Social inclusion
School-aged children
Identify and characterize learning abilities
Ensure appropriate school-based services, Individualized Educational Plan or 504 plan
Monitor secondary conditions including latex allergy
Encourage physical activities, friends, and household responsibilities
Plan for educational transition
Encourage independent self-care and toileting
Preteens
Begin health care transition planning
Advocate for physical activities, recreation and community inclusion,
Monitor progress in school
Address bullying and safety
Monitor growth and puberty
Encourage independence and self-advocacy
Develop and maintain friendships
Teens
Continue transition and transfer process to adult care, activities and social participation
Educate regarding spina bifida and self-care
Provide private health care visits
Provide anticipatory guidance regarding sexuality and reproduction
Encourage independence in health care decision-making
Monitor growth and vital signs (blood pressure)
Encourage physical activities
Manage weight and nutrition
Encourage cardiopulmonary health and fitness
Young adults
Transfer care to a provider of routine adult health care
Provide resources for specialty care: neurosurgery, orthopedics, urology, and others
Monitor weight and physical fitness
Provide information regarding finances such as Social Security Disability Income and health insurance
Monitor education and employment
Help to build and maintain friendships and social support groups
Monitor for deterioration and late-onset complications

issues related to spina bifida and is a first-line resource for patients and families in identifying and addressing strengths, problems, needs, and services.[37] The goals of primary care for children and youth with spina bifida should be to promote optimal health and well-being, to prevent secondary conditions and disabilities, to build on individual strengths and abilities, to help in the development of independence, and to promote social competence and inclusion—in short, to help patients become capable and contributing adults despite the challenges of their chronic health conditions.

The "Guidelines for Spina Bifida Health Care Services Throughout the Lifespan" and "Health Guide for Parents of Children Living With Spina Bifida" and other publications of the Spina Bifida Association (see www.sbaa.org) are useful resources for medical home providers. These and other resources can help in developing a care plan covering from birth through transition and transfer to adult health care, with focus on specific needs at each age and stage. Tables 3 and Table 4 outline some of these activities.

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American Academy of Pediatrics, Medical Home Initiatives for Children With Special Needs Project Advisory Committee. The medical home. *Pediatrics*. 2002;110(1 pt 1):184–186. Reaffirmed May 2008

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Provision of Educationally Related Services for Children and Adolescents With Chronic Diseases and Disabling Conditions

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on Children With Disabilities

ABSTRACT

Children and adolescents with chronic diseases and disabling conditions often need educationally related services. As medical home providers, physicians and other health care professionals can assist children, adolescents, and their families with the complex federal, state, and local laws, regulations, and systems associated with these services. Expanded roles for physicians and other health care professionals in individualized family service plan, individualized education plan, and Section 504 plan development and implementation are recommended. Recent updates to the Individuals With Disabilities Education Act will also affect these services. Funding for these services by private and nonprivate sources also continue to affect the availability of these educationally related services.

The complex range of federal, state, and local laws, regulations, and systems for special education and related services for children and adolescents in public schools is beyond the scope of this statement. Readers are referred to the American Academy of Pediatrics policy statement "The Pediatrician's Role in Development and Implementation of an Individual Education Plan (IEP) and/or an Individual Family Service Plan (IFSP)" for additional background materials. The focus of this statement is the role that health care professionals have in determining and managing educationally related services in the school setting.

This policy statement is a revision of a previous statement, "Provision of Educationally Related Services for Children and Adolescents With Chronic Diseases and Disabling Conditions," published in February 2000 by the Committee on Children With Disabilities (http://aappolicy.aappublications.org/cgi/content/full/pediatrics;105/2/448).

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Key Words
IEP, IDEA, Section 504, related services, special education, ICIDH-2, physician's role, children with chronic diseases and disabilities

Abbreviations
IDEA—Individuals With Disabilities Education Act
IEP—individualized education plan

FEDERAL LAWS

Related services such as speech therapy, occupational therapy, physical therapy, and nursing care are provided to students in school because they are related to the student's education. The term "related services" as currently defined in Part A of the Individuals With Disabilities Education Act (IDEA) includes the following[1]:

> . . . transportation and such developmental, corrective, and other supportive services (including speech-language pathology and audiology services, psychological services, physical and occupational therapy, recreation, including therapeutic recreation, social work services, counseling services, including rehabilitation counseling, orientation and

mobility services, and medical services, except that such medical services shall be for diagnostic and evaluation purposes only) as may be required to assist a child with a disability to benefit from special education, and includes the early identification and assessment of disabling conditions in children.

The legal justification for the provision of related services without qualifying for special education placement can be found in Section 504 of the Rehabilitation Act of 1973.[2] This section prohibits discrimination that is based on disability within federal and federally assisted programs. Regulations promulgated by the US Department of Education have more broadly defined the persons covered by this act, as well as the services that are to be provided. According to Section 504, all children must be provided with an appropriate education that "could consist of education in regular classes, education in regular classes with the use of supplementary services, or special educational and related services." Psychological testing and evaluation, counseling, physical and occupational therapy, medical services, speech pathology, audiology, and orientation mobility instruction are listed among the types of "developmental, corrective, and . . . support services" that may be provided to qualified persons. Thus, Section 504 states that children with chronic diseases and disabling conditions are entitled to appropriate modifications within their educational program to accommodate their special needs regardless of whether their classroom placement is considered regular education or special education. Some school systems have developed flexible, function-oriented "504 modification plans" for students. Unfortunately, some school systems still provide few services.[3] Children with chronic medical conditions, who usually function well in the standard classroom, still need consideration for related services. Examples of such children are those with asthma and allergies, who often find themselves at odds with their schools and school districts because of issues related to classroom modifications (eg, no pets in the classroom, having hand-washing facilities), curriculum modifications (eg, alternatives to standard physical education on an as-needed basis rather than the usual exclusion or full participation), and access to medications.

On December 3, 2004, the IDEA (Pub L No. 108-446)[4] was enacted. Most of the provisions of this law became effective July 31, 2005. The new law is likely to have a major impact on how students with disabilities are educated. Listed below are some of the key changes that occurred with the IDEA 2004.

- The long-established obligations for the individualized education plan (IEP) team to have short-term objectives for each child in his or her IEP will no longer be required as part of the annual goals.
- A child's progress report toward meeting the annual goals must be reported to the IEP team as in the previous IDEA legislation. With the new law, however, there is no longer a reference to "the extent to which the progress is sufficient to attain the goal by the end of the year." The amendments clarify that the transition process for a student with a disability now begins at age 16. In the past, only transition planning, but not the actual transition process, would begin at age 16.
- A new section allows IEP team members to be excused from attendance if their area is not being discussed. When this section is applied with new provisions allowing alternate means of meeting participation (eg, conference calls), consolidation of reevaluation meetings and other IEP meetings, and a pilot program authorizing up to 15 states to use multiyear IEPs, the combined effect is a transformation of the traditional IEP meeting that had been a face-to-face meeting that required all participants to sit around a table at the school.
- The Secretary of Education is authorized to approve proposals from up to 15 states to allow local school districts to offer, with parental consent, a multiyear IEP not to exceed 3 years.
- The Secretary of Education is authorized to grant waivers of statutory and regulatory requirements, for a period not to exceed 4 years, to 15 states that propose to reduce excessive paperwork and noninstructional time burdens. The Secretary is prohibited from waiving requirements related to civil rights or the right of a child to a free appropriate public education.
- Parents of a child who is transitioning from part C (early childhood) to part B (school-age) services can request that an invitation to the initial IEP meeting be sent to representatives of the part C system to assist with a smooth transition of services. This provision does not require a part C representative to attend, but it does encourage collaboration.
- Services comparable to those described in the IEP that are in effect before a child's transfer to a new school must be provided by the new school district. These services must continue until the previous IEP is adopted or a new IEP is developed, adopted, and implemented; regardless of whether the child is transferring in the same state or from another state, the child's previous IEP will be valid. This new provision will help parents of transferring students know what they can expect from their new schools.
- The procedural safeguards notice, which explains the specific rights and responsibilities of the parent in the special education process, will be routinely distributed only once per year. However, a copy will be distributed after the initial referral, when a parent makes a request for an evaluation, when a due process complaint has been filed, or if a parent requests a copy.

- Parents now have 2 years in which to exercise their due process rights after they knew or should have known that an IDEA violation has occurred. Other due process changes can be found at www.pacer.org/idea/2004/summary.htm. The due process hearing is an impartial procedure used to resolve disagreements over issues related to special education services that arise between a parent and a school division. The right of the parents or the school division to request a due process hearing is guaranteed by federal and state laws that govern the education of children with disabilities.
- The right of a student with a disability to stay in his or her current educational placement pending an appeal is eliminated for alleged violations of the school code that may result in a removal from the student's current educational placement for more than 10 days. Before this update of the IDEA, the student with a disability would have been allowed to stay in his or her current educational placement pending an appeal regardless of how many days the violation would have removed him or her from the current placement.
- A child is entitled to receive programming and services necessary to enable him or her to receive a free appropriate public education consistent with section 612(a)(1) during the period in which he or she is in an interim alternative education setting.
- Before the IDEA 2004, the burden was on the school district to show that the behavior resulting in a disciplinary action was not a manifestation of the child's disability before being allowed to apply the same disciplinary procedures as it used for nondisabled children. Other changes in discipline can also be found at www.pacer.org/idea/2004/summary.htm.[4]

Medically Necessary Versus Educationally Needed

Health care professionals frequently view educationally related services as medically necessary or helpful for children and adolescents with chronic diseases and disabling conditions. Although this is appropriate in the health care setting, it is not the standard for services mandated to be provided by public education systems. The additional proviso that the service must be necessary for education or special education is a key component in the laws. Related services are those services indicated as necessary for the child to maximize his or her special education program (ie, IEP). In other words, without the related services, the child might not be able to maximize his or her special education program. This difference in perspective and interpretation by physicians and other health care professionals and parents often leads to misunderstandings, frustrations, conflicts, and problems in the development and implementation of related services within school programs for children with disabilities. To best serve children with disabilities and their families, physicians and other health care professionals need to be familiar with these issues, their legal basis, and the special educational process and system. Maintaining this knowledge is a key function of the medical home provider for children with chronic diseases and disability conditions.[5] Readers are referred to the American Academy of Pediatrics policy statement "The Pediatrician's Role in Development and Implementation of an Individual Education Plan (IEP) and/or an Individual Family Service Plan (IFSP)"[6] for additional background materials.

In addition, functional classifications as suggested by the World Health Organization in its International Classification of Impairments, Disabilities, and Handicaps 2[7] offer many advantages to the current diagnostic systems used by the medical home provider for children with disabilities. In 2001, the World Health Organization approved the International Classification of Functioning, Disability, and Health as the international standard for conceptualizing, classifying, and coding function. It evaluates all children within the same structure and metric regardless of diagnosis. It highlights a child's unique strengths and needs for the purpose of directing interventions. This is particularly advantageous in the case of spectrum diagnoses such as autism and cerebral palsy in which a label alone is not sufficient to direct service interventions. A functional assessment of the child provides a more complete picture so that providers can better match resources and needs. Functional classification also looks at individuals within the context of their social and physical environment, taking into account the impact of human and technologic supports on an individual's "activities and participation." In addition, functional classification catalyzes interdisciplinary communication and collaboration by providing a common structure and language for discussion.

Challenges for Schools

Providing related services presents significant opportunities for the children served as well as challenges for the educational system. With greater numbers of children with chronic diseases and disabling conditions entering the school system and the increasing complexity of these conditions, many issues and problems have developed. The availability of services, designation of responsibility for their payment and provision, and conflicting legal imperatives, as well as other obstacles, result in vastly different services in various communities. The current trend of integration and inclusion of many children with a wide range of disabilities in "regular" classrooms and programs is making the provision of related services outside of traditional "special" educational settings a larger and more complex issue. Adequate classroom and school modifications (eg, ramps and accessible sinks and toilets) and support personnel (eg, instructional assistants, school nurses, and special education teachers) are needed in more classrooms and schools.

The difficulties in implementation of related services in schools are as varied and complicated as the disabilities of the children involved. These problems, among others, include:

- lack of clarity about which circumstances should result in a child's exclusion from school for medical reasons;
- uncertainty about the responsibility for, and administration of, complex nursing treatment or therapy in school[8];
- inconsistencies in state and local guidelines and interpretations about which health care professionals should prescribe the type and amount of physical, occupational, and speech therapies;
- uncertainty about medical liability for therapies administered in school;
- conflicting opinions about the appropriateness of some therapies used for children;
- concern about the rising cost of special education services and whether all treatment required in IEPs is warranted; and
- the frequent lack of provision of related services for children who may not qualify for special education but who have chronic diseases and disabling conditions that impair their ability and readiness to attend or participate in school.[9]

School-System Responsibility

In March 1999, the US Supreme Court ruled that complex nursing service (ventilator care) is a related service.[10] The difference between educationally related services and rehabilitation services is unclear. Court rulings have generally mandated that all therapies and equipment (eg, assistive devices) recommended in the IEP be reimbursed by the educational system.[11] However, this has not precluded the application of Medicaid or other public funding for payment of equipment or to support medical service provisions within the IEP for children with disabilities. Although private insurance carriers have generally declined reimbursement for therapies provided in the schools, in specific situations they may be responsible for payment of school-based services and frequently pay for community-based services. One example of private insurance carriers paying for these services would be during the summer when school is not in session. Even if insurance payment is an option, the parents may decide not to make claims against their insurance, because it would create a threat of financial loss, such as lowering the child's available lifetime medical benefits. Generally, school systems are not responsible for acute rehabilitation services.

In communities in which the school systems have borne the responsibility for implementing the IEP and funding most of the therapies, the educational authorities are increasingly concerned about the responsibility for overseeing the provision of complex nursing care and other related services for children with disabilities who attend public school. School systems also are concerned about insurance companies and managed care systems shifting funding responsibilities for rehabilitation and medical diagnostic services from health care to the school system. Each state's mandate to the local school system may vary in the degree that any such services are paid by the school system. The variability of school systems to assume responsibilities has the potential to (1) increase conflicts with local physicians and other agencies responsible for health care provision, (2) contribute to the disjointed nature of health care for children, and (3) result in unnecessary treatment at increased cost,[12] which depletes educational resources for other children.

The special needs of students with complex health conditions that require modifications in the school environment are also commonly documented in an individual student health plan, also known as a student services plan, nursing care plan, or student medications plan. Although these plans are not mandated by law in every state, such plans typically provide information on a student's chronic health condition, instructions on the administration of medication, and emergency contact information. A combination of IEP and individual student health plan is often necessary to help manage a student's health condition in the school and classroom settings.

The Physician's Role

The physician's role mandated by the IDEA as a related service is defined to include only the diagnosis and evaluation of the disability. However, in the context of the medical home, the physician's role also includes the medical management, supervision, and program planning for the child. The IDEA does not mandate that these additional roles be paid for by the public school. Parents often need an advocate for the child who can be objective in assessing the child's special needs and determining realistic expectations. Input from the medical home professionals also assists with placing services in a developmental context in which changes in needs are to be expected over time. The important medical services extend beyond IDEA mandates. Currently, the funding for the physician and other health care professionals' time to complete this role is lacking in most health insurance programs and is not funded by most federal and state funds for education. However, physicians can bill for their consultative services and for other related services with some private insurance plans, Medicaid, and the State Children's Health Insurance Program.

CONCLUSIONS

A multidisciplinary assessment within the school system is required in the initial evaluation of children to deter-

mine their eligibility for services within the educational system. It is also necessary to maintain a comprehensive multidisciplinary approach in the provision of these services, which should be coordinated with the child's medical home professional. The inequalities in the interpretation and provision of services between and within states and school districts need to be corrected. The developmental, educational, functional, and medical needs of the child or adolescent should be determined first, and then the appropriate services to meet these needs should be provided in a timely manner. Issues of who provides the appropriate services and how payment is to be made must be resolved in the context of maintaining the child in the appropriate educational environment.

RECOMMENDATIONS

1. Physicians and other health care professionals should be well informed about the medical and educational needs of children and adolescents with chronic diseases and disabling conditions.
2. Educational opportunities should be developed and made available to physicians and other health care professionals at local, state, and national levels.
3. Physicians and other health care professionals should be aware of the issues and inconsistencies in the IDEA, parts B and C, and Section 504 of the Rehabilitation Act of 1973.
4. Pediatricians, including pediatric subspecialists, and other health care professionals should objectively appraise the special needs of children and adolescents, determine realistic expectations, and advocate for children and adolescents by assisting with establishing an appropriate balance between the recommendations made by the school team and the desires of the family.
5. The initial pediatric focus for services should be on the child or adolescent with a disability and on his or her specific needs, and these needs should not necessarily determine the child's placement. Once these specific needs have been defined, the role of the school system and the role of community providers should be determined. The specific class placement should not determine the provision of related services in school.
6. Care coordination for children and adolescents with chronic and disabling conditions should take place in the medical home, and the medical home must include the primary care physician, pediatric specialists, and other health and human services professionals regardless of the location of, or source of payment for, these services.
7. Physicians and other health care professionals should take a more active role in the development and implementation of individualized family service plans.
8. Physicians and other health care professionals should get involved at the systems level. Physicians, especially pediatricians, should seek representation on local advisory and interagency committees that oversee programs for school placement of children and adolescents with chronic diseases and disabling conditions.

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INTERNET RESOURCES

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KidSource Online. Overview of ADA, IDEA, and Section 504. Available at: www.kidsource.com/kidsource/content3/ada.idea.html

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KidSource Online. National Information Center for Children and Youth With Disabilities. Available at: www.kidsource.com/NICHCY/index.html

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ADVOCACY SUPPORT RESOURCES

Family Voices. Available at: www.familyvoices.org

Technical Assistance Alliance for Parent Centers. Available at: www.taalliance.org

Parent Advocacy Coalition for Educational Rights. Available at: www.pacer.org

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT
Guidance for the Clinician in Rendering Pediatric Care

Joseph F. Hagan, Jr, MD, and the Committee on Psychosocial Aspects of Child and Family Health, and the Task Force on Terrorism

Psychosocial Implications of Disaster or Terrorism on Children: A Guide for the Pediatrician

ABSTRACT. During and after disasters, pediatricians can assist parents and community leaders not only by accommodating the unique needs of children but also by being cognizant of the psychological responses of children to reduce the possibility of long-term psychological morbidity. The effects of disaster on children are mediated by many factors including personal experience, parental reaction, developmental competency, gender, and the stage of disaster response. Pediatricians can be effective advocates for the child and family and at the community level and can affect national policy in support of families. In this report, specific children's responses are delineated, risk factors for adverse reactions are discussed, and advice is given for pediatricians to ameliorate the effects of disaster on children. ***Pediatrics*** **2005; 116:787–795;** ***terrorism, disaster preparedness, posttraumatic stress disorder, anxiety.***

ABBREVIATIONS. AAP, American Academy of Pediatrics; PTSD, posttraumatic stress disorder.

INTRODUCTION

In 1999, the Committee on Psychosocial Aspects of Child and Family Health of the American Academy of Pediatrics (AAP) provided guidelines for the role of the pediatrician in responding to the psychosocial implications of disasters on children.[1] Those guidelines delineated a plan for disaster preparedness and response to disaster and outlined the unique responsibility of the pediatrician at these junctures. Although that statement primarily considered natural disasters, it provided a sufficient theoretic outline for the American pediatrician's response to the terrorist attacks of September 11, 2001 in New York City, New York, and Washington, DC. The events of September 11th underscored the need for a more comprehensive resource for addressing the specific psychosocial effects of disaster on children. What has been learned of the effects on children from a tragedy of this magnitude has done much to augment our understanding of children's reactions to disaster and thus can shape planning for our response to future catastrophes to alleviate the psychosocial burden on children. Pediatricians can assist parents and community leaders not only in accommodating the unique needs of children during disasters but also by being cognizant of the psychological responses of children to reduce the possibility of long-term psychological morbidity and to help our children feel safe in their daily lives.

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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Disasters Defined

A disaster is a calamitous event that generally involves injury or loss of life and destruction of property; disasters can affect both small and large populations.[2] These events are traumatic and customarily outside the scope of normal human experience; thus, they are likely to involve psychological as well as physical injury.[2,3] For example, studies suggest that ~25% of adults experience symptoms of posttraumatic stress disorder (PTSD) after acute traumatic events (see Figs 1 and 2 for symptomatology in children).[4,5] The inherent resilience of children in conjunction with their specific psychological sensitivities leads to extremely variable rates of PTSD in children after acute trauma. However, the psychological effects of disaster on children are neither uniform nor universal in nature. It is widely accepted that the psychosocial manifestations in children after disaster are influenced greatly by the nature of disaster itself, the level of exposure to the disaster, the extent to which the children and those around them are personally affected by the disaster, and the individual characteristics of children, including their age and stage of development.[2,6–8] In addition, children are uniquely affected by disasters because they are afflicted not only by the trauma of the event but also by their parents' fear and distress.[7] Taken together, these considerations represent challenges to pediatricians and parents alike in recognizing and providing for the unique psychological needs of children.

Nature of Disasters

It is well recognized that the nature and extent of disaster can influence the psychological response of children. Acute events that produce relatively few disruptions in a child's social or living situation are generally less psychologically damaging than chronic traumatic events or events that lead to last-

DISORDER	COMMON DEVELOPMENTAL PRESENTATIONS
309.81 Posttraumatic Stress Disorder (PTSD) PTSD occurs following exposure to an event that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others. The child or adolescent has symptoms in each of the following three areas for more than 1 month, causing significant distress or impairment of functioning: (1) persistent reexperiencing of the trauma, (2) avoidance of stimuli associated with the trauma and diminished general responsiveness, and (3) increased arousal or hypervigilance. In infancy, a numbing of responsiveness may also occur. (see *DSM-IV* Criteria Appendix, p 339) **308.3 Acute Stress Disorder** (see *DSM-IV* Criteria Appendix, p 311)	**Infancy** Rarely diagnosed but may take the form of extra fears or aggressive behaviors in response to stress. **Early Childhood, Middle Childhood, Adolescence** In children, distressing dreams of the event may, within several weeks, change into generalized nightmares of monsters, of rescuing others, or of threats to self or others. Reliving of the trauma may occur through repetitive play. Children may also exhibit various physical symptoms, such as stomachaches and headaches. **SPECIAL INFORMATION** PTSD follows exposure to acute or chronic stressors that involve actual or threatened death or serious injury to the child or others. The child must have reacted with intense fear, disorganized or agitated behavior, or helplessness. Stressors may be acute or chronic, single or multiple. PTSD may be chronic and associated with significant morbidity. Symptoms of repetitive trauma re-enacting play and a sense of a foreshortened future may persist after distress is no longer present. PTSD must be distinguished from normal bereavement. Bereavement is characterized by sadness and recurrent thoughts, but not by persistent impairment of functioning (see Sadness and Related Symptoms cluster, p 153). Consider sexual abuse/rape (p 45). Because it may be difficult for children to report diminished interest in significant activities and constriction of affect, these symptoms should be carefully evaluated with reports from parents and teachers. In children, the sense of a foreshortened future may be evidenced by the belief that life will be too short to include becoming an adult.

Fig 1. *Diagnostic and Statistical Manual for Primary Care* (*DSM-PC*) description of PTSD. (Reproduced with permission from American Academy of Pediatrics. Child manifestations section: emotions and moods. In: Wolraich ML, Felice ME, Drotar D, eds. *The Classification of Child and Adolescent Mental Diagnoses in Primary Care: Diagnostic and Statistical Manual for Primary Care (DSM-PC) Child and Adolescent Version*. Elk Grove Village, IL: American Academy of Pediatrics; 1996:151.)

ing changes in the social environment.[6,9–12] It is not surprising that children react differently to natural disasters than they do to human-caused disasters.[2,5] Natural disasters such as storms and earthquakes are reported to have a less injurious psychological effect[8] on children than human-caused disasters in which harm is inflicted intentionally, such as war and terrorism, which are associated with higher levels of distress.[2] With inflicted disaster, greater psychopathology may result from children's witnessing intentional acts of violence, which are particularly incomprehensible for adults as well as children. Such disasters that defy the boundaries of human decency and rationale may engender additional horror. War entails chronic exposure to human-made violence, injury, destruction, and death. Children's responses to war are beyond the scope of this review and will not be discussed.

Thousands of children were affected significantly by the events of September 11th. Some were affected directly by losing a parent or family member, being displaced from their home or school, or witnessing the attacks.[13] Still hundreds of thousands more were touched indirectly by viewing the horrific images that consumed the media for weeks after the attacks or observing initial and ongoing responses of public figures and trusted adults. Certainly, a child's personal experience related to September 11th can be predictive of that child's response.[14]

Effects of Parental Reaction

To address the psychological effect of disaster on children adequately, it is necessary to examine the effect of disaster on parents. Among adults in Manhattan subsequent to the September 11th attacks, rates of PTSD and depression were twice that of the normal incidence.[15] Symptoms of PTSD declined in two thirds of the adult population in 3 months' time.

The purpose of this appendix is to provide details on the diagnostic categories for the *DSM-IV* disorders pertinent to children. The disorders are listed in alphabetical order.

Diagnostic criteria for Acute Stress Disorder 308.3

A. The person has been exposed to a traumatic event in which both of the following were present:

   (1) the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others
   (2) the person's response involved intense fear, helplessness, or horror

B. Either while experiencing or after experiencing the distressing event, the individual has three (or more) of the following dissociative symptoms:

   (1) a subjective sense of numbing, detachment, or absence of emotional responsiveness
   (2) a reduction in awareness of his or her surroundings (eg, "being in a daze")
   (3) derealization
   (4) depersonalization
   (5) dissociative amnesia (ie, inability to recall an important aspect of the trauma)

C. The traumatic event is persistently reexperienced in at least one of the following ways: recurrent images, thoughts, dreams, illusions, flashback episodes, or a sense of reliving the experience, or distress on exposure to reminders of the traumatic event.

D. Marked avoidance of stimuli that arouse recollections of the trauma (eg, thoughts, feelings, conversations, activities, places, people).

E. Marked symptoms of anxiety or increased arousal (eg, difficulty sleeping, irritability, poor concentration, hypervigilance, exaggerated startle response, motor restlessness).

F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning, or impairs the individual's ability to pursue some necessary task, such as obtaining necessary assistance or mobilizing personal resources by telling family members about the traumatic experience.

G. The disturbance lasts for a minimum of 2 days and a maximum of 4 weeks and occurs within 4 weeks of the traumatic event.

H. The disturbance is not due to the direct physiological effects of a substance (eg, a drug, a medication) or a general medical condition.

Diagnostic criteria for Posttraumatic Stress Disorder 309.81

A. The person has been exposed to a traumatic event in which both of the following were present:

   (1) the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others
   (2) the person's response involved intense fear, helplessness, or horror. **Note:** In children, this may be expressed instead by disorganized or agitated behavior.

Fig 2. Relevant Criteria of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*. (Reproduced with permission from American Academy of Pediatrics. Appendix C: sections of the relevant criteria of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*. In: Wolraich ML, Felice ME, Drotar D, eds. *The Classification of Child and Adolescent Mental Diagnoses in Primary Care: Diagnostic and Statistical Manual for Primary Care (DSM-PC) Child and Adolescent Version*. Elk Grove Village, IL: American Academy of Pediatrics; 1996:311, 339–304).

However, during this quarter year, children were deeply dependent on the affected parents for their emotional and psychological needs. Any effect of trauma on key or trusted adults can result in magnified psychological effect on the children they care for.[6] An adult's disordered mood or behavior can add to a child's fears. Distressed adults may fail to recognize a child's distress.

Studies since the September 11th attack demonstrate that parents recognize the effects of their reactions on their children. Furthermore, parents are concerned that they are not emotionally available to adequately address their children's fears or their children's concerns of fairness and justice.[7] This realization may be an added stress for parents, and 1 study reports a greater prevalence of mental distress in parents compared with nonparents, particularly in parents with symptoms of PTSD.[13]

B. The traumatic event is persistently reexperienced in one (or more) of the following ways:

(1) recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions. **Note:** In young children, repetitive play may occur in themes or aspects of the trauma are expressed.
(2) recurrent distressing dreams of the event. **Note:** In children, there may be frightening dreams without recognizable content.
(3) acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur on awakening or when intoxicated. **Note:** In young children, trauma-specific reenactment may occur.
(4) intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event

C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma) as indicated by three (or more) of the following:

(1) efforts to avoid thoughts, feelings, or conversations associated with the trauma
(2) efforts to avoid activities, places, or people that arouse recollections of the trauma
(3) inability to recall an important aspect of the trauma
(4) markedly diminished interest or participation in significant activities
(5) feeling of detachment or estrangement from others
(6) restricted range of affect (eg, unable to have loving feelings)
(7) sense of a foreshortened future (eg, does not expect to have a career, marriage, children, or a normal life span)

D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:

(1) difficulty falling or staying asleep
(2) irritability or outbursts of anger
(3) difficulty concentrating
(4) hypervigilance
(5) exaggerated startle response

E. Duration of the disturbance (symptoms in criteria B, C, and D) is more than 1 month.

F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.

***Specify* if:**
Acute: if duration of symptoms is less than 3 months
Chronic: if duration of symptoms is 3 months or more

***Specify* if:**
With Delayed Onset: if onset of symptoms is at least 6 months after the stressor

Fig 2. Continued.

Effects on Children

The long-term psychological morbidity among children as a result of the attacks on New York and Washington is still largely unknown. Experts suggest that the current mental health system has been ineffective in identifying and coping with the unique psychosocial burden that the events of September 11th have created.[8,16] Investigators report that a surprisingly large number of children in proximity to the areas of greatest devastation received some form of counseling after the attacks. In the Manhattan area, 22% of children from the community-at-large received some form of counseling after the attacks, which was a much greater rate of counseling than seen with similar tragedies such as the Oklahoma City bombing.[13,17] However, most of this counseling was received in schools. In the Washington area, the total number of children's visits to behavioral health clinics at military treatment facilities did not increase; however, there was a significant increase in the percentage of visits for anxiety disorders and acute stress reactions.[18] The lack of increase in visits to behavioral health clinics coupled with a high incidence of in-school counseling demonstrates that existing or informal therapeutic relationships were the primary source of support for most children after September 11th.[19] However, it is unlikely that these interventions were sufficient to offset psychological injury for children. After September 11th, children and adolescents reported being significantly more worried about how to cope with stressful things in their lives than before the attacks. It is curious that they reported talking to their pediatric primary health care professionals and parents more about

significant concerns in their lives after September 11th, whereas parents reported talking less to their children after September 11th about these same concerns.[20] It is likely that because of the differences in perception of communication between children and adults and the lack of formal psychological evaluations for most of our nation's youth, the psychological burden of many children was not adequately assessed or addressed. In addition, pediatric practitioners in the New York City tristate area reported gaps in their self-perceived knowledge and skills necessary to address the many mental health–related concerns that they encountered in patients after September 11th.[21]

For children who experience a traumatic event, some degree of behavioral symptoms and adjustment reactions are expected and are well within the normal limits of psychological response. The psychological responses of children to disasters can range from transient mild stress reactions to the more severe and prolonged consequences of PTSD.[22] These responses are influenced by the gender, developmental stage, inherent resilience, and social support of the child and the level of exposure of the child to the trauma.[2] Exposure to traumatic and violent events results in expressions of fear, anxiety, and depression.[23] In most cases, these reactions are within the realm of normal responses to a traumatic event, and as children are helped to learn to cope with this stress, their symptoms subside.[2,7]

Stages of Children's Response to Disaster

Parents and caregivers can expect children to respond to disaster in distinct stages.[2,7,24] The first stage, immediately after the disaster, includes reactions of fright, disbelief, denial, grief, and feelings of relief if loved ones have not been harmed.[2] A great deal of altruism is often displayed by children trying to help in the aftermath of such tragedies; this may help them develop resilience and also may be a marker of resilience.

The second stage occurs a few days to several weeks after the disaster and is characterized by developmental regression in many children and manifestations of emotional distress such as anxiety, fear, sadness and depressive symptoms, hostility and aggressive behavior toward others, apathy, withdrawal, sleep disturbances, somatization, pessimistic thoughts of the future, and play demonstrating themes related to the traumatic event.[2,8] Such symptoms are part of the normal recovery process for children after a traumatic disaster and can be expected to last for a few weeks.[2,7,24] Children who experience major loss or traumatic exposures or who are demonstrating marked distress or behavioral disorganization would benefit from counseling urgently, within 1 month of the event.

Children with adverse stress reactions and behavioral symptoms for longer than 1 month's time may be at increased risk of developing PTSD or violent and delinquent behaviors later in life.[7,23] In such cases, it is appropriate and necessary for children to receive counseling from a mental health specialist.[7]

Developmental Effects on Response to Trauma

Children of different developmental stages interpret the world differently and at their own distinctive pace.[7] Their developmental stage uniquely influences their response to traumatic events, and consequently, they display a great deal of variability in adjustment subsequent to traumatic events. Interventions to alleviate the psychological burden should be developmentally appropriate.[25]

The response of younger children to disaster is dominated by mood, anxiety, and behavioral symptoms.[6] They are largely unable to understand the intentions and logic of others and, consequently, have great difficulty distinguishing a deliberate action from an unintentional incident. As a result, in the face of disaster, young children are more concerned with the consequences, and older children are more aware of the underlying principles of a traumatic event.[7] Although older children also experience depression, their anxiety may take on specific and perhaps unrealistic forms and fears, and their behavioral reactions may be complicated by anger or despair as well as their past experiences. Older children are more sophisticated cognitively and, thus, can begin to comprehend the intent and reasoning of others and the implications of the event.

Traumatic and disrupting events can have adverse effects even on children who are too young to verbalize their distress. Although infants and toddlers may have no cognitive comprehension of a disaster, the destruction of routine and loss of loved ones can lead to regression and detachment.[2] In the first year of life, such experiences can manifest as increased crying and irritability, separation anxiety, and an exaggerated startle response.[22] Toddlers and preschool-aged children are likely to experience sleep terrors and nightmares and exhibit behavioral and skill regression manifesting as helplessness, clinging behavior, and increased temper tantrums.[22]

School-aged children often demonstrate the experience of trauma through play, expressing trauma-related themes and aggressive behavior.[2] Similar to their younger counterparts, sleep disturbances and regressive behaviors such as separation anxiety are often seen.[22] School-aged children also may become withdrawn or apathetic or exhibit somatization and behavioral problems. Although fear was the most common primary reaction to the events of September 11th among school-aged children, the developmental diversity of this age group leads to a wide range of responses to such trauma.[7]

Younger school-aged children are yet unable to comprehend another's reasoning or intent and, thus, concentrate on the direct consequences of the disaster. They tend to focus on specific details of the tragedy and on personal safety.[7] They fear injury or death of family members. Conversely, older school-aged children have a greater capacity for social cognition and empathy. They tend to display more empathy for families who were affected by the crisis, have a greater willingness to analyze how or why a tragedy occurred, and focus more on the safety of the society as a whole.[7]

The psychological response to disaster among adolescents most closely resembles that of adults; symptoms of depression and anxiety predominate.[6] However, this does not lessen their risk of developing significant psychological morbidity after the experience of a severe trauma. Adolescents are a particularly vulnerable group, because they are experiencing a period of complex transitions.[26] Children in this developmental stage may differ greatly in their interpretations and reactions to disasters depending on whether they have developed abstract reasoning abilities. Abstract thinking appears, on average, at 16 years of age. Most adolescents are still developing their emotional coping skills, are working to establish their independence and own identity, and are known to be especially susceptible to the development of major psychiatric disorders such as depression.[26] Disasters that result in a loss of lifestyle or loved ones can result in somatization, withdrawal, apathy, and depression.[2] They are likely to engage in risk-taking behaviors such as drug abuse and sexual relationships as mechanisms of coping with traumatic stress.[26] Suicidal thoughts and actions are a concern. In addition, the interference with identity development in adolescence can lead to significant behavioral and emotional problems throughout their lives. Adolescents may try to mask or withhold symptoms of adjustment reactions because they think they are abnormal or inappropriate reactions. Adolescents might attempt to protect other family members who may also be upset.[8] As a result, parents are at risk of underestimating the effects of disaster on their adolescents and may be in a disadvantaged position for getting their children the help that they need.[8]

Gender, Ethnicity, and Other Influences on Response to Trauma

Gender also has a decisive effect on the reaction of children to disaster. Boys display higher rates of behavioral symptoms and require a longer recovery period than girls.[2,6] More specifically, they tend to be more antisocial and display violent and aggressive behaviors and other externalizing symptoms. When faced with disaster, girls display more internalizing symptoms such as anxiety and mood disturbances.[2,6] However, they tend to be more expressive about their emotions than boys and have more frequent thoughts about the disaster.

Cultural differences may affect symptom expression. The experiences of people of Arab American, Persian American, and related ethnicities after the September 11th attacks are noteworthy. Replicating their experience during the Iran hostage crisis 25 years ago, many of these people experienced prejudice and bigotry in general, and some suffered unprovoked physical violence. Their patriotism was questioned, or it was suspected that they condoned the terrorist acts. American travelers were told by authorities to "report suspicious-looking" fellow travelers, with racial profiling as an unintended result. The description of some terrorists as "Islamic fundamentalists" has caused confusion regarding the Islamic religion and places its followers at risk for religious persecution. The teachings of Islam do not condone violent terrorist attacks.

Previous traumatic events such as personal experience of violence, abuse or neglect, foster care, or other stressors increase the risk of an adverse reaction to disaster. Previous experiences also predict more serious symptomatology, as noted in the New York City school experience.[14]

Tens of thousands of immigrant children and adolescents who enter the United States yearly have experienced disasters. Many immigrant families do not discuss their previous experiences with anyone outside their family, including their pediatricians. It is important that pediatricians recognize the possibility of preimmigration trauma as a potential cause of long-term psychological problems. Culturally unique responses to new traumas should be anticipated.

Other Risk Factors for Adverse Reactions

Although all children suffer to some degree from anxiety, fear, and depression when exposed to disaster, it is known that there is a subset of children who are at increased risk of developing long-term psychosocial morbidity and adverse reactions to trauma.[6–8] Children with poor social support, a history of psychopathology, or a shy and fearful nature are at greater risk of trauma-associated psychopathology.[6–8] Children who have experienced previous losses are also at an increased risk of adverse reactions to trauma. A disaster of any nature can awaken unresolved emotions and fears in children related to past crises.[8] Parents and pediatricians should be sensitive to seemingly unrelated concerns put forth by children during times of disaster. In addition, because children are intimately dependent on adults around them for feelings of safety and well-being, children whose family members have difficulty coping with disaster are also at increased risk of adverse reactions to trauma.[2,8]

Children who have had a high level exposure to or have otherwise experienced direct losses from a disaster are more susceptible to severe adverse reactions to trauma.[2,7,8] Direct witnessing of a traumatic event, victimization of the child or those close to the child, and the perception, correct or not, that one's life was in danger are known risk factors for adverse psychosocial symptoms after trauma.[8,27]

Children remote from catastrophic events by both location and experience are not immune to the acute and chronic psychopathologies related to disaster. Several studies have implicated indirect television exposure to disaster as a risk factor for children's reactivity.[8,17,27–29] The amount of information that a child will find valuable in understanding a disaster largely depends on a child's developmental stage.[8] Parents and caregivers should be aware that gruesome and disturbing details are likely unnecessary in facilitating a child's comprehension of a tragedy. Such information has a great potential to engender fear and may be psychologically injurious and thus impede a child's psychosocial recovery. In addition, the subjective response of a child to disaster has been demonstrated to have a high predictive value for

symptoms of PTSD.[27] Therefore, it is critical that a child's peritraumatic reaction and level of direct and indirect media exposure be monitored closely after traumatic events.

Living With Fear

This discussion has considered the responses of children and their communities to specific disaster events. Natural disasters such as earthquakes and floods and human-made disasters such as terrorist attacks and school shootings are single events. The body of literature and review described here address acute and chronic responses to individual events. Less is known about the effect of living in fear.

Is the documented recent and remarkable increase in mental health services for anxiety disorders and related conditions in children a response to the horror of September 11th or a reflection that American children no longer view their world as safe? Has our public policy of a "war on terrorism" protected, scared us, or both?

Do "terror alerts" protect or terrorize? At a minimum, such alerts should identify the seriousness of the concern and, when possible, the specifics of the risk. We should be told what our government is doing to protect us and what we might do to protect ourselves. Who benefits from alerts in which the risk is low or the anticipated events are unknown? Clearly, specific acts of defense or law enforcement may be indicated. Is there a difference between a law-enforcement alert and a public one?

The mandate to pediatricians and parents is clear. The world is perhaps a less safe place since 2001, but we are, for the most part, safe. We must allow our children to have hope. Even children living in unsafe communities or those affected by prejudice, racism, or violence depend on trusted adults to feel safe or protected so that they might anticipate a less stress-laden future. We must communicate to them that they and we are almost always safe from terrorist acts or natural disasters and that we as parents, health care professionals, and community members will take care of them as we take care of one another. Although some may feel the world is a more fearful place now (an opinion that is not universal), we can help our children live with this fear, adjust to it, and plan for the future rather than remain paralyzed in fear.

The Pediatrician and Disaster

The knowledge we have gained from the events of September 11th has revealed many opportunities to improve outcomes for children who are faced with disaster. The pediatrician must be intimately involved in community disaster-preparedness plans to ensure that the unique physical and emotional needs of children are met during times of disaster. Recommendations for disaster preparedness and planning can be found online at www.aap.org/terrorism. In addition, AAP chapters have presented important local initiatives for community preparedness.

When disaster occurs, the pediatrician will be affected. Although the thrust of this statement is to guide pediatric health care professionals in their work with patients and families, it must be acknowledged that we will be affected personally as well. The pediatrician's first response might need to be to ensure personal safety and that of family and colleagues. The experience of personal injury or loss will influence one's ability to respond professionally. The toll taken on us by fear, tension, sadness, and exhaustion must be recognized and demands proactive attention.[21]

During times of crisis, open dialogue with school officials and community leaders is necessary to ensure that psychological care is available to children. In such scenarios, pediatricians are instrumental in creating environments in their offices, homes, schools, and communities where it is safe and acceptable for children to ask questions and attempt to understand the events around them in a supportive atmosphere.[8]

Pediatricians are also significant resources in assisting families in the recovery period after traumatic events. Within their offices, they are often the first to recognize children and adolescents who are experiencing adverse emotional and psychological reactions to disaster.[8] It is helpful for the pediatrician to initiate this discussion; not asking a child what he or she thinks risks suggesting that the disaster is so bad that it cannot be talked about or managed. Often, when parents hear such a discussion, they are surprised at the content and nature of their child's thoughts regarding a disaster. Proper education for parents regarding what type of behaviors to expect from their children after disaster and the effect that their own reactions can have on the psychological stability of children is instrumental to the emotional well-being of our patients.

Immediate identification of the psychologically distressed child and timely referral for appropriate mental health services provides a major opportunity to improve outcomes for children exposed to disaster. The Pediatric Symptom Checklist (PSC)[30] or PSC-17[31] are recommended as appropriate and accessible screening tools.

ADVICE FOR PEDIATRICIANS

1. For additional study, consult the Web sites of the following organizations, which contain up-to-date information regarding children and disasters:
   - The AAP disaster-preparedness Web page (www.aap.org/terrorism) includes up-to-date listings on all aspects of disaster preparedness for children, including their psychological needs. It is well linked to collateral sites, but only approved links are included.
   - The National Center for Children Exposed to Violence of the Yale Child Study Center (www.nccev.org) includes disaster-specific data.
2. For advice dealing with the behavioral needs of children, consult the following sources:
   - The *Diagnostic and Statistical Manual for Primary Care* (*DSM-PC*) *Child and Adolescent Version*[32];
   - *Bright Futures in Practice: Mental Health, Volumes I and II*[30]; and

- *Feelings Need Checkups Too* (CD-ROM available from the AAP at www.aap.org/profed/childrencheckup.htm).

3. For community preparedness:
   - Serve as a resource for families and the community in providing disaster-preparedness plans appropriate for the unique needs of pediatric patients.
   - Collaborate with other professionals whose work affects children and their families, such as nurses, social workers, psychiatrists, and psychologists.
   - Recognize the importance of schools in disaster preparedness. Pediatricians may wish to work with their schools or state education department to be certain that sufficient disaster plans are in place. Help community leaders recognize that there is a high likelihood that a disaster affecting a community could occur while children are in school.
   - Help schools understand their roles in the aftermath of disaster. Practitioners may volunteer to serve as a resource in helping schools identify and manage children's emotional aftermath.
   - Discuss evacuation and relocation planning as an essential part of community disaster preparedness. Recognizing the substantial psychosocial morbidity associated with suddenly leaving home for a strange and unknown place, insist that planners recognize the unique needs of children and families. Reunification plans for children separated from their parents must be in place. First responders should be trained to understand the needs of children who witness violence or disaster.
   - Consider the resources available to families in your community. Part of psychosocial support entails helping families to identify concrete community resources that can meet their physical and emotional needs. Deficiencies in available resources detected after September 2001 can be identified and shared with community leaders.
4. For children and families:
   - Be aware of patients who are at risk of adverse reactions to trauma or the development of symptoms of PTSD.
   - Educate and counsel parents regarding the range of normal emotional and behavioral reactions of children to disaster and at what points they should be concerned; the effect of their own reactions to disaster on the psychological well-being of their children; and children who are at risk of psychological morbidity after disaster.
   - Help parents recognize the potential deleterious effects of indirect disaster exposure from media and the importance of helping children understand information at the developmentally appropriate level so that children are able to correctly process and understand what they see. Help parents understand that their adult need to know for purposes of reassurance typically works as a negative in children.
   - During times of crisis, stress to parents that children's media exposure should be limited and parents must be available to help children understand the relative importance of what they are seeing or hearing. For example, children may have little concept of space and need reassurance that events seen on television may in fact be quite distant from their homes.
   - After disaster, screen for anxiety in all patient encounters. A simple question and expression of concern can be seen as an effective brief intervention. For many children with supportive families, peers, teachers, and others, the reaction to traumatic experience resolves in a few months. A follow-up screening 4 to 6 months after the disaster would be appropriate to identify children with continuing symptoms who may need referral for additional services.
   - Be familiar with the symptoms of PTSD and be prepared to identify and refer children with the condition.
   - Recognizing that some children will have experienced extreme personal loss, be prepared to address bereavement with children and families.[33]

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American Academy of Pediatrics

Policy Statement

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Psychosocial Risks of Chronic Health Conditions in Childhood And Adolescence (RE9338)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Children With Disabilities and Committee on Psychosocial Aspects of Child and Family Health

Chronic health conditions affect many children and adolescents. These conditions are illnesses or impairments that are expected to last for an extended period of time and require medical attention and care that is above and beyond what would normally be expected for a child or adolescent of the same age, extensive hospitalization, or in-home health services. [1] These conditions include, among others, juvenile rheumatoid arthritis, asthma, cystic fibrosis, diabetes, spina bifida, hemophilia, seizure disorders, neuromuscular disease, acquired immunodeficiency syndrome, and congenital heart diseases. Although each specific condition may be relatively or extremely rare, when they are considered together, many children and adolescents are affected.

Health conditions may be characterized by their duration and their severity. Although these terms are often linked, they refer to different aspects of a health condition. A chronic condition is generally one that has lasted or is expected to last more than a defined period of time, usually 3 months or longer. Conditions vary widely in their onset, course, and duration. [2] Severity refers to the impact a condition has on a child's physical, intellectual, psychological, or social functioning. [3] This impact may occur as a result of persistent symptoms, required treatments, limitations of activity or mobility, or interference with school, recreation, work, and family activities.

Current estimates are that between 10 and 20 million American children and adolescents have some type of chronic health condition or impairment. Most of these conditions are relatively mild and interfere little with the children's ability to participate in usual childhood activities. [4] However, at least 10% of children with chronic conditions, ie, approximately 2% of those aged 0 to 21 years (1 to 2 million children and adolescents nationwide), have a chronic condition severe enough to have an impact on their daily lives.

Recent medical and surgical advances have markedly decreased the mortality rates for children and adolescents with chronic conditions. While previously many of these individuals died in childhood or adolescence, current data suggest that at least 90%, even those with severe conditions, survive at least to young adulthood. [5] Given this change in survival, health care for these children and adolescents must be expanded to include more than management of their chronic condition and intercurrent acute illnesses. Pediatric care should also maximize children's functional abilities and sense of well-being, their health-related quality of life, and their development into healthy and productive adults.

PSYCHOLOGICAL RISKS OF CHRONIC CONDITIONS

Over the past two decades, much research has examined the psychological functioning of children and adolescents with various specific health conditions. [6] Large, community-based studies [7,8] and national surveys [9] have assessed the risk of emotional, behavioral, and educational difficulties experienced by children and adolescents with a chronic health condition. Most of these studies have examined parents' ratings of behavioral and emotional status and have not identified specific psychological disturbances. These studies suggest that the majority of children and adolescents with chronic health conditions do not have identifiable mental health, behavioral, or educational difficulties. Children and their families are remarkably resilient in adapting to the additional stresses and challenges presented by a chronic health condition. Children, their siblings, and their parents often learn new coping strategies and show evidence of exceptional strength and mastery as a result. Nevertheless, these same studies show that children and adolescents with chronic conditions do have about twice the prevalence of psychological symptoms as compared to children without a chronic condition. Behavioral or emotional symptoms can be identified in approximately 10% of children overall and in about 20% of children with chronic health conditions.

It is not clear which specific characteristics of the child or adolescent, the family, and the health condition itself contribute most to resilience, to the stresses experienced, and to the risk of developing secondary emotional or behavioral difficulties. One might expect that the more severe the condition is, the greater the likelihood of psychological problems. Most studies show surprisingly little, if any, relationship between severity and problems with psychological adjustment. [6,10,11] The risk of psychological adjustment problems seems to reflect more the presence of a chronic condition than its severity. [12] In general, the increased risk of psychological problems affects children and

adolescents with all kinds of chronic conditions without great variation from one to another. There are characteristics of some conditions that do seem to be associated with higher rates of emotional or behavioral problems. For example, children who have chronic conditions that affect the central nervous system, especially seizure disorders, [7,9] and children and adolescents who have an associated long-term physical disability may be at a higher risk for psychological problems than children with other chronic conditions. [8] Dependence on others for daily activities may also contribute to their risk of psychosocial dysfunction. Specific health conditions may cause specific coping issues for children and adolescents, such as driving with epilepsy, issues involving sexuality for those with cystic fibrosis, or the social stigma of inflammatory bowel disease. However, children and adolescents with any type of chronic condition will have unique psychological stresses in addition to those faced by all children.

If neither the severity nor the type of condition adequately explains the risk of psychological problems, what family and child characteristics might predict this risk? Children's intelligence and temperament appear to contribute to their ability to adapt to the extra stresses of the illness. [13,14] Parents' self-esteem, mental health, social support network, and beliefs about health care all have an impact on the success of children's adaptation, [6,9,13,15] as does the cohesiveness, flexibility, and effectiveness of shared communication within the family. Current research efforts will likely identify additional factors associated with increased risks for psychological problems and factors that foster children's resilience. This information will provide pediatricians with more guidance regarding the prevention and identification of psychological difficulties when working with families whose children have chronic health conditions.

RECOMMENDATIONS FOR PEDIATRIC CARE

Primary care pediatricians have a central role in providing screening, preventive, and supportive services to children and adolescents with chronic health conditions and their families.

The usual pediatric model of assessing children's functioning in their family, in school, and with peers applies to those with a chronic health condition just as it does to all other children and adolescents. Pediatricians who take a comprehensive and family-based view of the broad clinical implications of childhood chronic conditions will recognize their critical role in diminishing the child's risk of psychological adjustment problems. Identifying children and families at risk for coping poorly with the stress of chronic health problems; assisting families to prevent psychological, social, and behavioral complications; and searching for early evidence of such problems should be part of regular pediatric care. Most of the stressful issues for families with children with chronic conditions can be anticipated and dealt with preventively through education and supportive counseling services provided appropriately by the pediatrician. It may be appropriate for some children and adolescents to be referred for mental health services.

Pediatricians should develop links with local schools and other agencies that provide support and services for children and families. Schools play a central role in the education and socialization of all children and often have resources that help with the prevention, identification, and management of psychosocial problems in their students, including those with health impairments. [16] Because increasing numbers of children with chronic conditions are in school from the age of 3 years, schools are a key resource in their long-term management. They frequently provide major assistance to families and to pediatricians in diminishing the psychosocial risks of chronic conditions.

Pediatricians can also help families by ensuring well-coordinated medical care and efficient and effective communication with the many professional providers of care involved with the family. They can help to ensure that families have access to local supportive networks for parents and for children. Also, pediatricians should provide appropriate information about the individual's illness and its management, recreational opportunities, and mechanisms to assist with the financial strain associated with chronic health conditions. [17]

The prevention of psychosocial complications of childhood chronic illness will be met best by a family- and community-centered approach in which the pediatrician assesses the skills and needs of the child and family, participates in planning and implementing comprehensive intervention programs, and supports families in the complex task of raising children and adolescents with chronic conditions. [17]

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This statement has been approved by the Council on Child and Adolescent Health.
The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Early Childhood, Adoption, and Dependent Care

Quality Early Education and Child Care From Birth to Kindergarten

ABSTRACT. High-quality early education and child care for young children improves their health and promotes their development and learning. Early education includes all of a child's experiences at home, in child care, and in other preschool settings. Pediatricians have a role in promoting access to quality early education and child care beginning at birth for all children. The American Academy of Pediatrics affords pediatricians the opportunity to promote the educational and socioemotional needs of young children with other advocacy groups. ***Pediatrics*** **2005;115:187–191;** ***early education, child care, early care and education, preschool, social and emotional development, early brain development, kindergarten readiness, indicators of quality, role of the pediatrician.***

ABBREVIATION. AAP, American Academy of Pediatrics.

QUALITY MATTERS

All of a child's early experiences, whether at home, in child care, or in other preschool settings, are educational. At present, 60% to 70% of children younger than 6 years regularly attend some type of out-of-home child care or early childhood program.[1] The arrangements families make for their children can vary dramatically, including care by relatives; center-based care, including preschool early education programs; family child care provided in the caregiver's home; and care provided in the child's home by nannies or babysitters.[2] How a family chooses this care is influenced by family values, affordability, and availability. For many families, high-quality child care is not affordable, which results in compromises.[3–5]

The indicators of high-quality early education and child care have been studied and are available in many formats (Table 1; see also www.childcareaware.org).[6,7] When care is consistent, developmentally sound, and emotionally supportive, there is a positive effect on the child and the family.[8–21] Children exposed to a poor-quality environment, whether at home or outside the home, are less likely to be prepared for school demands and more likely to have their socioemotional development derailed.[8–21] The inadequate outcomes of children in poor-quality care often cannot be fully remedied in the formal structure of the K-12 educational system because of the need for noneducational services such as mental and behavioral health care. To focus only on the education of children beginning with kindergarten is to ignore the science of early development and deny the importance of early experiences.

Early brain and child development research unequivocally demonstrates that human development is powerfully affected by contextual surroundings and experiences.[21] A child's day-to-day experiences affect the structural and functional development of his or her brain, including intelligence and personality.[21] Experiences influence every child's development and learning, and these experiences can be positive or negative, with long-term consequences for the child, family, and society.[21] Research of high-quality, intensive early childhood education programs for low-income children confirm lasting positive effects such as greater school success, higher graduation rates, lower juvenile crime, decreased need for special education services later, and lower adolescent pregnancy rates.[8–20] Children who attend high-quality early childhood programs demonstrate better math and language skills, better cognition and social skills, better interpersonal relationships, and better behavioral self-regulation than do children in lower-quality care.[8–20] Inferior-quality care, at home or outside the home, can have harmful effects on language, social development, and school performance that are more difficult to ameliorate, especially for children in schools with fewer resources.[8–20] The positive effects from high-quality programs and the negative effects from poor-quality programs are magnified for children from disadvantaged situations or with special needs, and yet these children are least likely to have access to quality early education and child care.[12,13] The out-of-home care arrangements for children of parents who work nontraditional hours such as evenings, weekends, or holidays also compound the access problems. Many families have no quality child care options in their immediate communities.[4,5,22]

BARRIERS TO HIGH-QUALITY EDUCATION AND CHILD CARE

Families struggle to provide quality early experiences for their children. Having a stay-at-home parent does not automatically ensure a child's emotional well-being, social competence, and kindergarten readiness. Stay-at-home parents need access to sound advice and support. Community interven-

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tions can improve parenting and early experiences for young children, but they are not universally available, even to high-risk families.[23] Families that rely on child care need access to affordable, high-quality programs. However, most child care centers in the United States are rated poor to mediocre in quality, with almost half meeting less than minimal standards.[12–15,22] Efforts to improve the quality of early education and child care through federal, state, and local public policies address licensing and regulation, teacher or caregiver education and compensation, and adequate funding.

State licensing standards are important for health, safety, and teacher qualifications, but they set a minimum standard, typically considerably below the recommendations of health and safety experts.[6] National organizations such as the American Academy of Pediatrics (AAP), American Public Health Association, National Association for the Education of Young Children, Child Welfare League of America, and Zero to Three have developed standards and voluntary systems of accreditation that are often higher than state licensing regulations. These regulations include information about physical space, staffing ratios, and staff training and compensation.

Adequate compensation of early education providers promotes quality, not only to attract quality directors and teachers but also to decrease staff turnover.[4,5] An underpaid and high-turnover workforce impedes stability and quality of programs. The low level of compensation (approximately $16 000 per year for a child care provider) makes attracting and keeping quality teachers extremely difficult for programs.[1] Yet, developmental brain science studies show that young children, especially infants and toddlers, need stable, positive relationships with their caregivers.[21]

Public funding for quality programs is inadequate, yet studies demonstrate that well-focused investments in quality early education and child care provide high public return.[24] Federal, state, and local funding levels do not provide sufficient resources, even when combined with parent fees, to ensure adequate training of the early education workforce and do not provide reasonable compensation and career advancement opportunities.[4,5] In many states, the cost of early education and child care programs is about twice as expensive as paying for 1 year of tuition at a 4-year public college.[3] The federal government and some communities have addressed the funding problems via subsidies, although many families who are eligible are not served.[4,5] Head Start serves only approximately 60% of all eligible 3- to 4-year-old children, Early Head Start serves less than 5% of all eligible infants and families, and less than one fifth of all eligible families are receiving federal child care subsidies.[4,5] Other innovative strategies promoting access to quality care and education include state initiatives to promote formal education and improved compensation for child care providers, linkages with health care professionals, public-private funding partnerships, and extending K-12 down to universal preschool programs. The real barrier to high-quality programs is a lack of infrastructure supporting quality, regardless of setting, and the necessary funding to make this happen. This infrastructure has to address, on a statewide or commu-

TABLE 1. Indicators of High Quality[7]

State licensing and program accreditation	The requirements for licensing generally ensure basic health and safety of a program but not necessarily high quality; state licensing requirements can be found online at http://nrc.uchsc.edu
Staff-to-child ratio and group size	
For centers	
Birth to 12 mo	1:3 with groups ≤6
13–30 mo	1:4 with groups ≤8
31–35 mo	1:5 with groups ≤10
3 y	1:7 with groups ≤14
4 and 5 y	1:8 with groups ≤16
Family child care	If there are no children <2 y: 1 adult/6 children; when there is 1 child <2 y: 1 adult/4 children; and when there are 2 children <2 y (the maximum), no other children are recommended
Director and staff experience and training	College degrees in early childhood education
	Child development associate's credential
	Ongoing inservice training
	Parent's first-hand observations of care
	Low turnover rate
Infection Control	Hand-washing with soap and running water after diapering, before handling food, and when contaminated by body fluids
	Children wash hands after toileting and before eating
	Routinely cleaned facilities, toys, equipment
	Up-to-date immunizations of staff and children
Emergency procedures	Written policies
	All staff and children familiar with procedures
	Up-to-date parent contact lists
Injury prevention	Play equipment safe, including proper shock-absorbing materials under climbing toys
	Universal Back-to-Sleep practices
	Developmentally appropriate toys and equipment
	Toxins out of reach
	Safe administration of medicines

nity level, high-quality standards, compensation and training for teachers, tracking of availability of services for parental referral, and a reliable financing system that makes these programs available (full day/full year, etc) and affordable in a coordinated way.[4,5] This same systematic approach to the education and socioemotional health of children who are cared for by stay-at-home parents is also necessary.

STEPS TOWARD QUALITY EARLY EDUCATION AND CHILD CARE

Pediatricians have an important role in helping their patients have the highest-quality early experiences possible and also in helping their communities raise the level of quality of care for all young children. Families and communities look to pediatricians for counsel and support in all areas affecting children, including providing quality experiences for children in their early years. Pediatricians can influence families, teachers, and policy makers as partners in improving access to and quality of early childhood educational experiences. Better quality and access will be realized only when the public demands that resources are dedicated to early education and child care as they are for K-12 education. An AAP book titled *The Pediatrician's Role in Promoting Health and Safety in Child Care* offers a detailed blueprint for pediatricians to take steps to improve the quality of care available to patients and includes specific strategies, activities, and resources that can be used in everyday practice.

RECOMMENDATIONS

For each patient, pediatricians are encouraged to

1. Ask families what care arrangements they have made for their infants and young children and support their efforts. Also, ask parents whether they care for other people's children in their home.
2. Provide a true medical home[25] for patients and participate in the 3-way partnership with parents and child care providers or early educators. Remember that access to out-of-home arrangements for children with special health care needs is facilitated when the child's pediatrician and pediatric subspecialists are available to help the early education professionals and child care providers understand the needs of these patients. The 1999 AAP policy statement "The Pediatrician's Role in Development and Implementation of an Individual Education Plan (IEP) and/or an Individual Family Service Plan (IFSP)" can be a resource.
3. Become familiar with the essential components of quality programs. As trusted family advisors responsible for the well-being of children, know the essential components of quality. The Early Education and Child Care Special Interest Group (www.healthychildcare.org) of the AAP Section on Community Pediatrics, which all AAP members and affiliate members are eligible to join, is available as a resource. The comprehensive book *Caring for Our Children*[6] lists the national standards for care of children in out-of-home settings.
4. Educate families about the benefits of quality programs that aid young children's safety and development. Using local information, direct families to the resources that will help them locate quality care and help develop strategies to make quality care affordable. This can be done using brochures (eg, *Choosing Child Care: What's Best for Your Family* by the AAP), checklists of quality, and referrals to the local child care resource and referral agency (www.childcareaware.org). A conversation with all families of young children will help promote quality through family education. Brochures and office displays can help facilitate this conversation in a busy practice. Remember to be a resource to families educating their young children at home. Zero to Three (www.zerotothree.org) is a tremendous resource for early brain and child development parent guides, and the AAP Literacy Promotion Technical Assistance program (www.aap.org/advocacy/literacypromo.htm) is a resource for pediatricians.

In their communities, pediatricians can

5. Educate policy makers about the science supporting the benefits from quality care and education and, conversely, the lost opportunities and setbacks that occur from poor-quality care. The resources listed at the end of this statement provide the background for conversations with policy makers about the benefits to children, families, and communities of investing in quality early education and child care. A specific place to start is working within the state to close the gaps between state regulations and the quality standards outlined in *Caring For Our Children*. Each AAP chapter has a legislative group that can help target these public policy makers with visits and letters. Nearly every AAP chapter also has a child care contact, a pediatrician who is familiar with the early education and child care needs in that chapter and has knowledge about local resources. Universal prekindergarten has been given recent focus in many states. Although this would be a tremendous beginning that pediatricians can support, we must continue to remind policy makers that prekindergarten is delivered in child care, schools, and other settings and that starting at 4 years of age will not reap the full benefits of quality early education and child care from birth. Also, conversations about quality should always emphasize that quality programs include parental involvement and strong socioemotional and other developmental elements in a safe, healthy environment.

At the national and state levels, pediatricians can

6. Work to improve funding and quality early experiences for children and facilitate more action by the national AAP and chapters. Recent national funding and systems to provide quality have been under attack in Congress, and most states' budget problems have led to decreased support for funding and access to quality care. Programs that have been shown to improve the quality of early experiences for young children, such as early home

visiting by nurses and early literacy family programs, need coordinated funding and universal implementation.

It will be only through collaborating with early childhood colleagues and combining the force of our sciences that we will successfully influence policy makers to foster the kind of holistic health we envision for all children.

Lead authors

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RESOURCES

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Child Care Resource and Referral Agencies. Local referral agencies that can assist families in finding quality, affordable programs can be found at www.childcareaware.org

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Rabies-Prevention Policy Update: New Reduced-Dose Schedule

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS

rabies, guidelines, prevention and control, vaccines, immunization, passive, immunization schedule, bites and stings

ABBREVIATION

PEP—postexposure prophylaxis

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

abstract

FREE

The Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention recommends reducing the number of doses from 5 to 4 of human diploid cell vaccine or purified chick embryo cell vaccine required for postexposure prophylaxis to prevent rabies in humans. The vaccine doses should be given on day 0 (first day of prophylaxis) and days 3, 7, and 14 after the first dose. For persons with immune suppression, the 5-dose regimen should continue to be used. Recommendations for the use of human rabies immunoglobulin remain unchanged. The American Academy of Pediatrics endorses these recommendations. *Pediatrics* 2011;127:785–787

INTRODUCTION

Rabies is a rapidly progressive encephalomyelitis with a very high case fatality rate. Approximately 55 000 people worldwide, nearly half of whom are children, die annually of rabies. Rabies is caused by RNA viruses in the family *Rhabdoviridae*, genus *lyssavirus*. In the Americas, only type 1 lyssavirus (rabies virus) circulates and is common in wild animals, particularly bats, coyotes, foxes, raccoons, and skunks, in the United States. Virus is transmitted in the saliva of rabid mammals after a bite or through contamination of an open wound or mucous membrane. The incubation period (1–3 months) is long enough to render immunization a highly effective strategy for postexposure prophylaxis (PEP). Approximately 20 000 to 30 000 persons receive PEP in the United States each year, and 1 to 3 cases of human rabies occurs annually. Between 2000 and 2007, 20 of 25 cases of human rabies reported in the United States were acquired within the United States. Among the 20 indigenously acquired cases, 17 were associated with bat rabies virus variants.

In the United States, animal rabies is common. Education of children to avoid contact with stray or wild animals is of primary importance. PEP is indicated once an exposure has occurred. PEP has never failed in the United States since the introduction of modern cell-derived vaccines in the 1970s. Keys to effective PEP have included prompt washing of the wound with copious amounts of soap and water, infiltration of human rabies immunoglobulin into and around the wound, and a 5-dose schedule of intramuscular vaccine administered over 28 days.

BACKGROUND AND RATIONALE

In 2007, when human rabies vaccine was in limited supply, the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention formed a rabies work group to review rabies vac-

cine options and then accepted its recommendations to adopt a 4-dose vaccination regimen. The recommendation was published in *Morbidity and Mortality Weekly Report: Recommendations and Reports* on March 19, 2010.[1]

EVIDENCE TO SUPPORT THE RECOMMENDATION

A detailed review of the evidence in support of a reduced, 4-dose schedule for human PEP has been published.[2]

- The induction of rabies-neutralizing antibody is a surrogate for an adequate immune response to vaccination and was achieved in all subjects (~1000) by day 14, when the fourth dose of cell-derived rabies vaccine was given.
- From observational studies that included persons likely exposed to confirmed rabid animals and with imperfect adherence to the 5-dose vaccine schedule, the Rabies Working Group estimated that more than 300 persons in the United States received only 3 or 4 doses annually, and there were no resulting cases of human rabies. Although human PEP failures do occur rarely worldwide, no cases have been attributed to the lack of receipt of the fifth rabies vaccine dose on day 28.
- In animal models ranging from rodents to nonhuman primates, timely PEP was important, but the absolute number of vaccine doses did not contribute to significant differences in survival rates.
- Adverse reactions to the modern cell-derived rabies vaccines are uncommon in children and, theoretically, will be the same or less common with 1 less vaccine dose.
- Preliminary economic assessments indicate that there would be a $16 million cost savings to the United States health care system by using the reduced-dose schedule.

POLICY OR RECOMMENDATIONS

1. Unchanged: For unvaccinated persons, the combination of rabies immunoglobulin and rabies vaccine is recommended for both bite and nonbite exposures regardless of the time interval between exposure and initiation of PEP. If PEP has been initiated and results of appropriate laboratory testing (ie, the direct fluorescent antibody test) indicate that the animal that caused the exposure was not rabid, PEP may be discontinued.
2. New: A regimen of four 1-mL vaccine doses of human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV) should be administered intramuscularly to previously unvaccinated, immunocompetent persons (Table 1). The first dose of the 4-dose regimen should be administered as soon as possible after exposure. However, the vaccine regimen may be started weeks to months after the exposure if signs and symptoms of rabies are not present. The date of the first dose is considered to be day 0 of the PEP series. Doses should then be administered on days 3, 7, and 14 after the first vaccination.
3. Unchanged: For persons with immunosuppression (see "Immunocompromised Children" in *Red Book*[4]), rabies PEP should be administered by using the 5-dose vaccine regimen (ie, 1 dose of vaccine on

TABLE 1 Rabies Postexposure Prophylaxis (PEP) Schedule—United States, 2010

Vaccination Status	Intervention	Regimen*
Not previously vaccinated	Wound cleansing	All PEP should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent (eg, povidine-iodine solution) should be used to irrigate the wounds.
	Human rabies immune globulin (HRIG)	Administer 20 IU/kg body weight. If anatomically feasible, the full dose should be infiltrated around and into the wound(s), and any remaining volume should be administered at an anatomical site (intramuscular [IM]) distant from vaccine administration. Also, HRIG should not be administered in the same syringe as vaccine. Because RIG might partially suppress active production of rabies virus antibody, no more than the recommended dose should be administered.
	Vaccine	Human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV) 1.0 mL, IM (deltoid area†), 1 each on days 0,§ 3, 7 and 14.¶
Previously vaccinated**	Wound cleansing	All PEP should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as povidine-iodine solution should be used to irrigate the wounds.
	HRIG	HRIG should not be administered.
	Vaccine	HDCV or PCECV 1.0 mL, IM (deltoid area†), 1 each on days 0§ and 3.

Reprinted with permission from Rupprecht CE, Briggs D, Brown CM, et al; Centers for Disease Control and Prevention. *MMWR Recomm Rep.* 2010;59(RR-2):6.

* These regimens are applicable for persons in all age groups, including children.

† The deltoid area is the only acceptable site of vaccination for adults and older children. For younger children, the outer aspect of the thigh may be used. Vaccine should never be administered in the gluteal area.

§ Day 0 is the day dose 1 of vaccine is administered.

¶ For persons with immunosuppression, rabies PEP should be administered using all 5 doses of vaccine on days 0, 3, 7, 14, and 28.

** Any person with a history of pre-exposure vaccination with HDCV, PCECV, or rabies vaccine adsorbed (RVA); prior PEP with HDCV, PCECV or RVA; or previous vaccination with any other type of rabies vaccine and a documented history of antibody response to the prior vaccination.

days 0, 3, 7, 14, and 28). The immunosuppressed patient should be tested for rabies virus–neutralizing antibody with the rapid fluorescent focus inhibition test 1 to 2 weeks after the fifth dose of vaccine. If an acceptable antibody response is not detected, the patient should be managed in consultation with an expert in rabies. Commercial rabies virus antibody tests that are not approved by the US Food and Drug Administration are not appropriate for use as a substitute for the rapid fluorescent focus inhibition test.

4. Unchanged: Sites of intramuscular vaccination remain unchanged (deltoid area in adults; anterolateral aspect of thigh or deltoid in children). The gluteal area should not be used.
5. Unchanged: Recommendations for rabies immunoglobulin use and PEP of previously vaccinated persons have not changed.[3]
6. Unchanged: No routine testing to document seroconversion in healthy patients who have completed PEP is necessary.
7. Unchanged: Recommendations for management and reporting of vaccine adverse events have not changed.
8. Unchanged: Pregnancy and breastfeeding are not contraindications to PEP.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Pediatric Research

Race/Ethnicity, Gender, Socioeconomic Status—Research Exploring Their Effects on Child Health: A Subject Review

ABSTRACT. Data on research participants and populations frequently include race, ethnicity, and gender as categorical variables, with the assumption that these variables exert their effects through innate or genetically determined biologic mechanisms. There is a growing body of research that suggests, however, that these variables have strong social dimensions that influence health. Socioeconomic status, a complicated construct in its own right, interacts with and confounds analyses of race/ethnicity and gender. The Academy recommends that research studies include race/ethnicity, gender, and socioeconomic status as explanatory variables only when data relevant to the underlying social mechanisms have been collected and included in the analyses.

During recent decades, our understanding of the biological and psychosocial bases of diseases affecting individual children has markedly increased.[1,2] The capacity to apply newly derived information from molecular and genetic science toward preventive child health care will continue to grow in the coming years. Although biological research is necessary and valid, studies that do not address the importance of social determinants as fundamental causes or contributors to disease and unfulfilled potential limit the scope and impact of research conclusions.[3]

In the United States, data on research participants and populations frequently include race, ethnicity, and gender as categorical variables, with the assumption that these variables exert their effects through innate or genetically determined biologic mechanisms. There is a growing body of research that suggests, however, that these variables have strong—and in many areas predominantly—sociological and psychological dimensions. Because data are collected and research questions are formulated in ways that generally do not include the social as well as biological dimensions of these variables,[4,5] it is often difficult to disentangle the biological from the social dimensions. The purpose of this subject review is to highlight the interrelationships among factors such as race, ethnicity, and gender, viewed as social constructs, along with socioeconomic status, and to stimulate appropriate definition and analysis of these variables within any study that proposes mechanisms of disease associated with them.

RACE AND ETHNICITY

It is standard practice to describe participants and populations in terms of "race" or "ethnicity." For example, the decennial census has classified respondents according to the 1977 Office of Management and Budget Directive 15, which includes 4 racial categories (American Indian or Alaskan Native, Asian or Pacific Islander, Black, and White) and 2 ethnic categories (Hispanic Origin and not of Hispanic Origin). The recent revision of this Directive[6] has expanded these categories to 5, by separating Asian from Pacific Islander and expanding the latter to "Native Hawaiian or other Pacific Islander," but the existence of this small number of categories limits investigators to use only those categories to frame and analyze questions. The Revised Directive 15 rejected the use of a "multiracial" category, but does recommend that the 2000 Census allow respondents to check more than 1 category.

Although race historically has been viewed as a biological construct, it is now known to be more accurately characterized as a social category that has changed over time and varies across societies and cultures.[7] Racial disparities in health generally do not reflect biologically determined differences in the genome or physiology.[8] Indeed, genetic differences between racial groups are small compared with genetic differences within groups, so racial differences in diseases are, to a significant degree, currently unexplained.[9] It is possible that racial prejudice (both individual and institutional) as a social stress on groups of children and families can influence health behaviors, such as eating habits, activity levels, and substance use and abuse that might place individual children at increased risk for both short-term and long-term health impairment and disease.[10–12] In addition to effects on behavior, racial prejudice may influence access to and the quality of health services.[11–13] Similarly, difficulties in definition and measurement, heterogeneities of populations, and ethnocentric interpretations of research data[8] make "ethnicity" an imprecise construct by which to attribute causal relationships. Given that race and ethnicity are similar in their social origins, that is, determined predominantly by the relationships among groups who define themselves or define others, the term race/ethnicity is becoming more widely used.

GENDER

Sex and gender are often used interchangeably, but the former is a biologic characteristic, defined by genetic and anatomic features, whereas the latter is a

social characteristic, determined by culturally defined roles and behaviors. Analogous to race/ethnicity, the development of gender is a function of relationships. Ironically, the genetic, physiologic, and behavioral differences between men and women have historically been deemphasized, if not ignored, in research that has extrapolated conclusions based on male populations to women. In recent years, recognition of the importance of considering differences between men and women as a salient independent variable in research led the National Institutes of Health to include women as participants for special consideration in clinical research grant applications, but the focus is primarily on the biological variable, that is, sex, rather than the social variable, gender.[14]

Inclusion of both men and women as participants in research studies is certainly a first step in understanding sex and gender differences in health and disease. However, given the health correlates of the differences in the social roles and behaviors of men and women, any differences found are not inevitable expressions of the biological factor. For example, the increased risk of anorexia and bulimia in girls likely reflects perceived social pressures to adhere to culturally prescribed norms for body shape and size. Furthermore, socially defined gender roles, expectations, and behavior can vary across both time and culture, as well as across subgroups of individuals, defined socially by race/ethnicity and socioeconomic status. For example, the social and psychological pressures experienced by an African-American woman might be very different from those experienced by a white woman, with these pressures having differential impact on the long-term trajectory of disease.[15]

SOCIOECONOMIC STATUS

Analysis of the relationship among biological and social variables is complicated, however, by the difficulty in operationalizing socioeconomic status, a complex concept consisting of 2 aspects, both of which may exert influences on health directly or through associated behaviors. One aspect includes resources, such as education, income, and wealth and the other includes status or rank, a function of relative positions in a hierarchy, such as social class.[16] A recent National Institutes of Health conference examined measures of socioeconomic status and proposed ways to incorporate a variety of these measures into health surveillance and research.[17]

Demonstrated racial/ethnic and gender "effects" may be intricately related to socioeconomic factors, because race/ethnicity interacts with and is confounded by social class or socioeconomic status. For example, environmental pollution may be more intense in impoverished areas and may even be sited in those areas because of discrimination based on race/ethnicity or class.[18] Consequently, it is difficult to disentangle the adverse consequences of that pollution from the effects of discrimination. Although most studies of such confounding and/or interaction have focused on adults, the need for inquiries into such factors affecting child health is equally strong. Little is known about the way that the relationships among these social factors influence the health of children or their effects on the trajectory of the development of adult disease.

Two domains of the relationship between socioeconomic status and health are particularly active areas of research, possibly shedding light on the complexity of the mechanisms whereby this multidimensional variable influences health. The first domain deals with the relationship between the extent of discrepancies in socioeconomic status and health. Numerous studies have documented the relationship between socioeconomic status and health.[19] Despite advances in quality and access to health care services, it is noteworthy that the discrepancy in health status between social classes has persisted over time, even though the specific diseases that produce morbidity and mortality have changed.[20] Furthermore, standard measures of health correlate with the extent of income discrepancy between rich and poor, and the extent of income inequality appears to explain more of the variation in health than is explained by other socioeconomic factors, even the absolute level of income.[20–22] Across industrialized countries, the greater the discrepancy in income distributions, the worse the health status of the entire population.[20] Data across individual states within the United States demonstrate a similar relationship.[21,22]

The second domain of the relationship between socioeconomic status and health explores the relationship between childhood socioeconomic conditions and adult health. In Finland, for example, the childhood socioeconomic status of adult men correlated more closely with ischemic heart disease during middle age than did their adult socioeconomic status.[23] Further research is needed to clarify how the socioeconomic status of children affects both their current and future health status.[24]

CONCLUSION

The American Academy of Pediatrics acknowledges that race/ethnicity, gender, and socioeconomic status can influence child health through social mechanisms. The Academy recommends that child health studies include these critical variables to improve their definitions and enhance our understanding of the effects that relationships (confounding and interactive) among these variables may have on research findings. It is no longer sufficient to use these categories as explanatory. If data relevant to the underlying social mechanisms have not been collected and are otherwise unavailable, researchers should discuss this as a limitation of the possible conclusions of the presented research. The Academy concurs with the conclusions of a recent workshop sponsored by the Centers for Disease Control and Prevention/Agency of Toxic Substances and Disease Registry. Considering the use of race and ethnicity in public health surveillance,[25] the workshop participants concluded that absent careful definitions and analysis, investigators and policymakers may draw erroneous conclusions about race/ethnicity as biologic contributors to illness. Similar errors may result from the failure to consider the social dimensions of gender.

The American Academy of Pediatrics believes that race/ethnicity, gender, and socioeconomic status are likely to emerge as important mediators of childhood health, as well as predictors of adult health status. The Academy recommends that pediatric investigators, in collaboration with social scientists, should develop and apply research methodologies in pediatric research that will result in careful definitions of, analysis of interactions among, and, ultimately, documentation of the effects of these variables on child health. Only then can effective preventive intervention strategies be developed and implemented during childhood to improve the health of our children and the adults into which they will grow.

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Technical Report—Racial and Ethnic Disparities in the Health and Health Care of Children

Glenn Flores, MD, THE COMMITTEE ON PEDIATRIC RESEARCH

KEY WORDS
health care disparities, ethnic groups, Hispanic Americans, African Americans, Asian Americans, Indians, North American

ABBREVIATIONS
CDC—Centers for Disease Control and Prevention
CI—confidence interval
AAP—American Academy of Pediatrics
AA—African American
API—Asian/Pacific Islander
AI/AN—American Indian/Alaska Native
ALL—acute lymphoblastic leukemia
ED—emergency department
SCHIP—State Children's Health Insurance Program
ADHD—attention-deficit/hyperactivity disorder
SES—socioeconomic status

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

OBJECTIVE: This technical report reviews and synthesizes the published literature on racial/ethnic disparities in children's health and health care.

METHODS: A systematic review of the literature was conducted for articles published between 1950 and March 2007. Inclusion criteria were peer-reviewed, original research articles in English on racial/ethnic disparities in the health and health care of US children. Search terms used included "child," "disparities," and the Index Medicus terms for each racial/ethnic minority group.

RESULTS: Of 781 articles initially reviewed, 111 met inclusion criteria and constituted the final database. Review of the literature revealed that racial/ethnic disparities in children's health and health care are quite extensive, pervasive, and persistent. Disparities were noted across the spectrum of health and health care, including in mortality rates, access to care and use of services, prevention and population health, health status, adolescent health, chronic diseases, special health care needs, quality of care, and organ transplantation. Mortality-rate disparities were noted for children in all 4 major US racial/ethnic minority groups, including substantially greater risks than white children of all-cause mortality; death from drowning, from acute lymphoblastic leukemia, and after congenital heart defect surgery; and an earlier median age at death for those with Down syndrome and congenital heart defects. Certain methodologic flaws were commonly observed among excluded studies, including failure to evaluate children separately from adults (22%), combining all nonwhite children into 1 group (9%), and failure to provide a white comparison group (8%). Among studies in the final database, 22% did not perform multivariable or stratified analyses to ensure that disparities persisted after adjustment for potential confounders.

CONCLUSIONS: Racial/ethnic disparities in children's health and health care are extensive, pervasive, and persistent, and occur across the spectrum of health and health care. Methodologic flaws were identified in how such disparities are sometimes documented and analyzed. Optimal health and health care for all children will require recognition of disparities as pervasive problems, methodologically sound disparities studies, and rigorous evaluation of disparities interventions. *Pediatrics* 2010;125:e979–e1020

INTRODUCTION

Racial/ethnic disparities in health and health care recently have received considerable attention. The Agency for Healthcare Research and Quality has issued an annual national health care disparities report since 2003.[1,2] Reduction and elimination of disparities is one of the major goals of *Healthy People 2010*,[3] part of the strategic plan of the Eunice Kennedy Shriver National Institute of Child Health and Human Development,[4] and part of the strategic imperatives of the Centers for Disease Control and Prevention (CDC).[5] A separate National Institutes of Health center devoted to minority health and health disparities (the National Center for Minority Health and Health Disparities) was founded in 2000.[6] The Institute of Medicine released a landmark monograph on disparities,[7] and a federal bipartisan bill targeting health care disparities recently was introduced.[8]

Little attention has been paid, however, to racial/ethnic disparities in the health and health care of children. For example, only 5 of 103 studies in the Institute of Medicine's extensive review of the literature on health care disparities specifically addressed racial/ethnic disparities in children's health care.[7] The purpose of this technical report, therefore, is to review and synthesize the published literature on racial/ethnic disparities in children's health and health care. The report begins with definitions of key terms and an overview of sociodemographic trends in minority children. Specific minority groups, the importance of racial/ethnic subgroups, studies of interventions to reduce racial/ethnic disparities, and methodologic issues are then reviewed.

DEFINITIONS

"Race/ethnicity" is defined as the child's racial or ethnic group (including "multiracial"), as designated by the parent and/or child. "Minority" will be the term used for children of nonwhite race/ethnicity. Although multiple definitions have been proposed for the term "disparities," the Health Resources and Services Administration definition of disparities was used, which defines disparities as "population-specific differences in the presence of disease, health outcomes, or access to care."[9]

METHODS

Only statistically significant disparities are reported herein (ie, those with either a *P* value of less than .05 or 95% confidence intervals [CIs] that are nonoverlapping with non-Latino white children). The only exception to this rule was inclusion of certain crude outcome rates in large population-based samples in which the differences were considered quantitatively or clinically significant (ie, when there was at least a 50% difference in rates between a specific racial/ethnic minority group and the white population). Only studies that examined racial/ethnic disparities in the context of comparisons to white children were included in the literature review. Notation was made of whether disparities included adjustment for relevant covariates. When appropriate data were available, secular trends for specific disparities are described. Unless otherwise noted, the reference group for any racial/ethnic disparity is non-Latino white children.

LITERATURE SEARCH

The scope of published literature on racial/ethnic disparities is broad. In addition, although racial/ethnic disparities in neonatal and infant mortality rates[10] and dental care[11] have been fairly well described, relatively little has been published on racial/ethnic disparities in children and adolescents. The terms that have been used to describe disparities also have been neither standardized nor consistent. As a consequence, the literature search was limited to only those studies that specifically examined racial/ethnic disparities for US children and adolescents, to ensure a focus on disparities and a body of literature in urgent need of a systematic review. Thus, articles on racial/ethnic disparities in neonatal and infant mortality and dental care were excluded, because disparities in these domains have comparatively been more well described, and articles on pediatric workforce diversity, an area that was addressed in a recent American Academy of Pediatrics (AAP) policy statement,[12] also were excluded.

The database used for the literature search was Ovid Medline; the search encompassed the years 1950 through the first week of March 2007. The initial search strategy included the terms "child" and "disparities" (both as medical subject heading terms and key words), which yielded 666 citations. To ensure that no relevant citations were missed, individual searches also were performed by using "disparities," "child," and Index Medicus terms for each racial/ethnic minority group, which yielded the following children's disparities references: "African continental ancestry group," $n = 35$; "Asian continental ancestry group," $n = 5$; "Pacific Islanders," $n = 2$; "Indians, North American," $n = 17$; "multiracial," $n = 1$; and "Hispanic Americans," $n = 55$. The initial total of all citations was, therefore, 781 articles. To ensure the consistency and reproducibility of this literature search, additional secondary references were not included from the citation lists of the primary articles included in the database.

Abstracts for all 781 articles were reviewed. Because the focus of the literature review was original, peer-reviewed articles in English on racial/ethnic disparities in the health and

health care of US children, review articles, editorials, commentaries, perspective pieces, theoretical or conceptual pieces, transcripts of speeches, letters to the editor, dental care articles, articles that addressed adults or the elderly, articles without analysis of racial/ethnic disparities, articles on neonatal or infant mortality issues, articles on workforce diversity, articles that did not examine disparities in the health of US children, and duplicate citations were excluded. Application of these exclusion criteria yielded 227 articles. The full print versions of these remaining 227 articles were reviewed, and reapplication of the exclusion criteria yielded a final database of 111 articles, 2 of which examined interventions aimed at reducing racial/ethnic disparities (and were considered separately).

SOCIODEMOGRAPHICS OF MINORITY CHILDREN IN THE UNITED STATES

The United States is experiencing a demographic surge in minority children (Fig 1). There are 31.4 million children (younger than 18 years old) of nonwhite race/ethnicity in the United States,[13] comprising 43% of children, and representing an 11% increase since 2000[14] and a 58% increase since 1990.[15] Since 2000, minorities have represented more than half of the population of the nation's 100 largest cities, and 42 of the 100 largest US cities are "minority majority" (defined as populations in which racial/ethnic minorities outnumber the white population).[16] In California, the largest state in the nation, minorities have outnumbered whites since 2000, and currently represent 57% of the state's population.[17,18] Conservative estimates indicate that minorities will constitute half of US children by 2040.[19]

Latinos are the largest and fastest-growing minority group of US children (Fig 1), representing 20% of children in America (equivalent to 15 million).[13,20] African Americans (AAs) are the second-largest minority group of US children, representing 15% of children in America (equivalent to 10.9 million)[13]; between 1990 and 2006, their population proportion slightly decreased. Asians/Pacific Islanders (APIs) are the third-largest minority group of US children, representing 4% of children in America (equivalent to 3 million)[13]; between 2000 and 2006, their population proportion grew by 14% (1990 US Census data are not available on API children). American Indians/Alaska Natives (AIs/ANs) represent 1% of children in America (equivalent to ~661 000)[13]; between 1990 and 2006, their population proportion decreased by 18%. The number of multiracial children in the United States (ie, self-designated by the caregiver as belonging to 2 or more races) in 2006 was 2.9 million, representing 4% of the US population of children,[13] a proportion that has not changed since 1990.

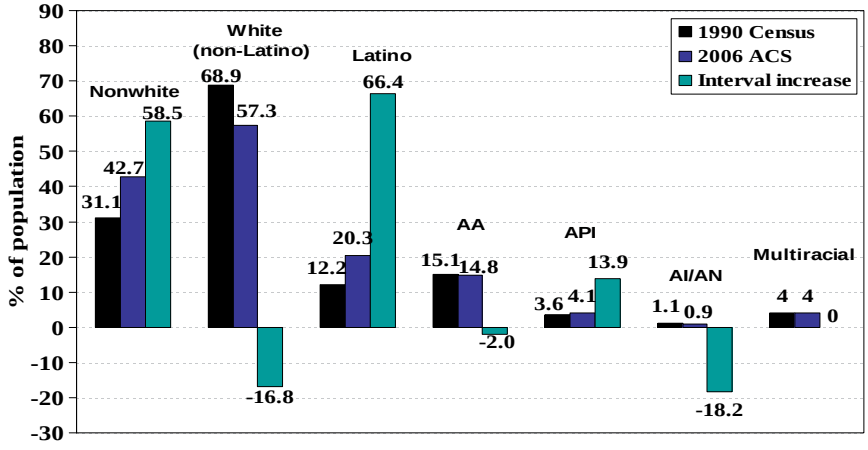

FIGURE 1

Growth of racial/ethnic minority population of US children between 1990 and 2006. ACS indicates American Community Survey. Data were unavailable for APIs for the 1990 US Census, so data depicted are from the 2000 US Census.

HEALTH AND HEALTH CARE DISPARITIES IN SPECIFIC RACIAL/ETHNIC GROUPS OF CHILDREN

African Americans

The vast majority of articles (94 of 109 [86%]) addressed disparities in AA children (Table 1).

Mortality

Eight articles documented AA/white disparities in mortality rates. Overall childhood mortality rates were found to be consistently higher for AA children; national data for a 43-year period revealed marked crude mortality-rate disparities in young children 1 to 4 years of age (twice that of white children) and older children 5 to 14 years of age and increases in the mortality-disparity ratio in the most recent 10-year period. Two other studies that adjusted for relevant covariates documented significantly higher mortality rates for AA children versus white children in the Detroit tri-county area for boys and older girls (10–19 years old) and among children without congenital anomalies in the state of Michigan. AA children also experience higher risks of death from drowning in a swimming pool, especially in public pools, with the drowning rate in hotel/motel pools disproportionately higher. Significant disease-specific mortality-rate disparities were identified for acute lymphoblastic leukemia (ALL), median age at death for Down syn-

TABLE 1 Disparities in the Health and Health Care of AA Children

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Access to care				
Lower accessibility to pediatric primary care providers Neighborhood AA race more strongly associated with access to pediatric primary care providers than neighborhood income	Analysis of spatial accessibility to pediatric primary care providers in Washington, DC	US Census data on all children and American Medical Association/American Osteopathic Association data on concentration of all pediatric primary care providers in Washington, DC	Not adjusted for covariates	27
Double the adjusted odds of having no usual source of care Double the adjusted odds of no health professional/doctor visit in past year	Analysis of household component of 1996 and 2000 MEPS	AA: $n = 2189$; Latino: $n = 4091$; Asian: $n = 325$; white: $n = 6362$	Adjusted for 8 covariates; double the adjusted odds of dissatisfaction with quality of care in 1996 but not 2000	28
Higher adjusted odds of appendicitis rupture	Cross-sectional analysis of full-year samples of hospital discharge records for acute appendicitis from California and New York children 4–18 y of age	California: AA, $n = 297$; Latino, $n = 4304$; API, $n = 459$; white, $n = 4017$; New York: AA, $n = 342$; Latino, $n = 444$; API, $n = 80$; white, $n = 2379$	Adjusted for 7 covariates	29
Higher adjusted proportion in fair or poor health among new SCHIP enrollees in Florida Lower adjusted proportion had usual source of care before SCHIP among new SCHIP enrollees in New York	Analysis of CHIRI data on new SCHIP enrollees in 4 states (<18 y old in Alabama, Kansas, and New York, and 11.5–17.9 y old in Florida)	Total sample: $n = 8975$[b]	Adjusted for 10 covariates	30
Before enrollment in SCHIP Lower adjusted rate of having usual source of care Higher adjusted rate of having unmet needs for health care	Interviews of parents in New York State at the time of SCHIP enrollment of their child (baseline) and 1 y after enrollment	Total sample: $N = 2644$[b] (baseline) and $N = 2290$ (1-y follow-up)	Adjusted for 12 covariates; 1 unadjusted quality-of-care disparity was noted but not adjusted for	31
Greater adjusted odds of not being referred to specialist by health care provider	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	AA: $n = 477$; Latino: $n = 817$; white: $n = 718$	Adjusted for 9 covariates	32
Adolescents				
Higher likelihood of fair to poor health among adolescents recently enrolled in SCHIP Less likely to use doctor's offices as their usual source of care among adolescents recently enrolled in SCHIP	Analysis of CHIRI telephone interview data of adolescents newly enrolled in SCHIP in Florida and New York (and their parents)	Total sample: $N = 2036$[b]	No multivariable adjustments performed	33
Significantly lower adjusted odds of use of substance abuse services among adolescents Significantly older age at first use of substance abuse services AA girls at particular risk of underuse of substance abuse services, with only 1 in 25 AA female teenaged substance abusers accessing substance abuse services	Analysis of 5 y of Tennessee Medicaid (TennCare) enrollment, encounter, and claims data for substance abuse services use by adolescents 12–17 y of age	AA: $n = 60\,104$; white: $n = 110\,552$	Adjusted for 4 covariates	34
Female adolescents: higher risk of skipping breakfast, obesity, lacking health insurance, needing but not getting medical care, any sexually transmitted disease, perpetrating violence, and being a victim of violence	Analysis of Add Health (waves 1 and 2), a nationally representative school-based study of youths in grades 7–12, with follow-up into adulthood	AA: $n = 3038$; Latino: $n = 2340$; API: $n = 1021$; AI/AN: $n = 136$; white: $n = 7728$	Prevalence in published tables was not adjusted; authors stated that adjustments for income and parental education had minimal influence on findings; significant disparities were identified by using 95% CIs that did not overlap with measure for white children; no formal statistical evaluation of disparities were provided in article	35

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Male adolescents: higher risk of perpetrating violence and being victim of violence				
Live birth rate for 15- to 17 y-old girls was >3 times higher	1990–1998 natality files from the National Vital Statistics system	Not provided	Expressed as rates per 1000; rates were not adjusted for any covariates	36
Birth rate for 15- to 17 y-old girls was 4–5 times higher AA/white disparity ratio worsened by 23% between 1990 and 1998	Analysis of vital records from the Illinois and Chicago departments of public health	Not provided	Not adjusted for covariates	37
Birth rate for 15- to 19-y-old girls more than twice as high	Birth certificate data reported to CDC National Center for Health Statistics	Not provided	Not adjusted for covariates; no *P* values or 95% CIs	38
Greater adjusted odds of alcohol testing among female adolescents admitted to EDs for traumatic injury	Analysis of data from the National Trauma Data Bank (includes 64 US institutions) on adolescents 12–17 y of age admitted to EDs with traumatic injury	AA: $n = 1760$; Latino: $n = 396$; white: $n = 5584$	Adjusted for 7 covariates	39
Asthma and allergies				
Highest asthma prevalence of any racial/ethnic group (26% higher vs white children) Highest asthma-attack prevalence of any racial/ethnic group (44% higher vs white children) Disparity vs white children has widened progressively over 16-y period, from 15% higher prevalence to 26% higher prevalence vs white children Higher asthma office-visit rate Triple the rate of asthma ED visits Triple the rate of hospital outpatient visits for asthma Ambulatory asthma-visit rate (all outpatient visit types) 1.6 times higher Hospitalization rate 3.6 times higher Hospitalization rate increased at more than double the rate of white children Highest asthma mortality rate of any racial/ethnic group, 4.6 times higher than that of white children Asthma mortality rate increased over 19 y (vs remained the same in white children)	Trends in asthma over time for children 0–17 y of age using data from 5 National Center for Health Statistics sources: National Health Interview Survey, National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey, National Hospital Discharge Survey, and mortality component of the National Vital Statistics system	Not provided	No statistical comparisons performed or 95% CIs provided; only unadjusted rates were presented	40
Greater likelihood of current asthma Greater likelihood of ED visit for asthma in past year	National database (NHIS)	AA: $n = 14\,487$; white: $n = 49\,042$	Adjusted for 8 covariates	41
Greater adjusted odds (adjusted odds ratio, 2.5 [95% CI: 1.3–4.8]) of physician-diagnosed asthma, even after adjustment for family income	Rhode Island Health Interview Survey	AA: $n = 142$; Latino: $n = 353$; white: $n = 1274$	Adjusted for 7 covariates	42

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Higher adjusted odds of asthma Lower adjusted odds of ambulatory visits Lower adjusted odds of prescriptions filled	Secondary analysis of 2 y of MEPS data on children 2–18 y of age	Total 1996 MEPS sample size: $N = 3955$; total 1997 MEPS sample size: $N = 5933$	Adjusted for 6–8 covariates; in 1 survey year but not the other, significantly lower adjusted odds of ED visits and internalizing and externalizing behavioral conditions	43
Higher asthma mortality rate, both for underlying cause and any mention	Analysis of 12 y of data from the multiple cause-of-death files from the National Center for Health Statistics	Total sample: $N = 4091$[a,b]	Unadjusted rates, not adjusted for SES or insurance coverage; asthma mortality rate also higher than that of Latino and API children	44
Higher adjusted odds of an asthma ED visit or hospitalization	Analysis of data from parent-response questionnaires administered in 26 randomly selected New York City public elementary schools	Total sample: $N = 5250$[b]	Adjusted for 4 covariates	45
Higher diagnosed asthma prevalence (18%) Higher total potential asthma burden (diagnosed plus possible but undiagnosed asthma)	Cross-sectional analysis of parent-report questionnaire data from 14 low-income, diverse Chicago public elementary schools	AA: $n = 2938$; Latino: $n = 6002$; white: $n = 1560$	Not adjusted for covariates	46
More than double the adjusted odds of having a current asthma diagnosis	Analysis of NHANES III on children 1–16 y of age	Total sample: $N = 11\,181$[b]	Adjusted for 14 covariates; sample size of those with asthma was not provided	47
Worse asthma physical health scores Lower adjusted odds of daily anti-inflammatory use for asthma	Cross-sectional study using parental telephone interviews and electronic records for Medicaid-insured children 2–16 y of age with asthma in 5 managed care organizations in California, Washington, and Massachusetts	AA: $n = 636$; Latino: $n = 313$; white: $n = 512$	Adjusted for SES, health status, age, gender, and other sociodemographic variables	48
Higher adjusted odds of cockroach allergen sensitivity Higher adjusted odds of dust mite allergen sensitivity Higher adjusted odds of mold allergen sensitivity	Cross-sectional analysis of children 6–16 y of age who participated in allergen testing in the NHANES III	AA: $n = 1502$; Mexican American: $n = 1546$; white: $n = 1116$	Adjusted for 8 covariates	49
Higher adjusted odds of asthma Higher adjusted odds of need for urgent medical care for asthma in past 12 mo	Analysis of data from the Los Angeles County Health Survey on children <18 y of age	AA: $n = 566$; Latino: $n = 3675$; API: $n = 361$; white: $n = 1278$	Adjusted for 8 covariates	50
Lower adjusted odds of use of β_2-agonists Lower adjusted odds of use of inhaled steroids	Analysis of data from the Childhood Asthma Severity Study, which used a 12-mo, retrospective, parent-reported questionnaire on asthma in a community sample of children <13 y of age and residing in Connecticut and Massachusetts	AA: $n = 139$; Latino: $n = 255$; white: $n = 549$	Adjusted for 9 covariates	51
Higher adjusted prevalence of asthma overall Among children with family income less than half the federal poverty level, higher prevalence of asthma	Analysis of NHIS data on children 0–17 y of age		Adjusted for 8 covariates; stratified analyses suggested disparities only for poorest children, but sample sizes for other strata may not have been adequate (and not indicated in study)	52

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Breastfeeding				
Lower proportion of children ever breastfed Lower proportion of children who received any human milk at 6 mo of age Lower proportion of children exclusively breastfed at 4 mo of age	Analysis of breastfeeding data on children 12–71 mo of age in the NHANES III (1988–1994)	AA: $n = 1845$; Mexican American: $n = 2118$; white: $n = 1869$	Not adjusted for any covariates	53
Cardiovascular and hypertension				
Higher relative risk of all strokes Higher relative risk of intracerebral hemorrhage Higher relative risk of subarachnoid hemorrhage Higher relative risk of ischemic stroke after exclusion of sickle cell disease	Analyses of databases of the Office of Statewide Health Planning and Development of California for 10 y on all admissions to nonfederal hospitals in California	Not provided	Not adjusted for covariates (except sickle cell disease)	54
Health status				
Lower adjusted odds of being in excellent/very good health	Analysis of cross-sectional data on children 0–19 y of age from the California Health Interview Survey	Total sample: $N = 19\,485$[b]	Adjusted for 4 covariates; higher adjusted odds of making a physician visit in the previous year	55
Higher adjusted likelihood of fair or poor health Higher adjusted likelihood of activity limitations Higher adjusted likelihood of school limitations	Analysis of NHIS data	AA: $n = 5776$; API: $n = 1088$; Latino: $n = 4785$; white: $n = 20\,717$	Not adjusted for family income or health insurance coverage (adjusted only for age, gender, and parental education); lower adjusted likelihood of acute respiratory illness and injuries; interactions noted between race/ethnicity and parental education for selected outcomes in selected groups	56
Greater adjusted scores of global stress in previous month among adolescents	Cohort of adolescents in grades 7–12 in 1 suburban Midwestern public school district	AA: $n = 550$; white: $n = 659$	Adjusted for 7 covariates; interaction noted between race and college education; stress related to racism not examined	57
Higher adjusted odds of poor, fair, or good health status (vs excellent/very good)	Analysis of data from National Survey of Early Childhood Health on children 4–35 mo of age	Total sample: $N = 2068$[b]	Adjusted for 8 covariates	58
Greater adjusted odds of not being in excellent or very good health	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	AA: $n = 477$; Latino: $n = 817$; white: $n = 718$	Adjusted for 9 covariates	32
HIV/AIDS				
Represent largest percentages of new HIV/AIDS diagnoses in every age group of children and adolescents and in perinatal transmission Number of new HIV/AIDS diagnoses in every age group of children and adolescents and in perinatal transmission exceed those of all other racial/ethnic groups combined Among females, percentages of new pediatric HIV/AIDS diagnoses are 4–9 times that for white females Among males, percentages of new pediatric HIV/AIDS diagnoses are 2–7 times that for white males	Diagnoses of HIV/AIDS reported to the CDC in 2001–2004 by 33 states that used confidential, name-based reporting of HIV/AIDS cases for at least 4 y	AA: $n = 11\,554$; Latino: $n = 3249$; white: $n = 3707$[a]	No 95% CIs or P values presented; not adjusted for SES or other covariates	59
Longer adjusted length of hospital stay for HIV-infected children	Cohort study of pediatric patients with HIV at 4 sites specializing in the care of pediatric HIV-infected patients	AA: $n = 390$; Latino: $n = 112$; white: $n = 66$	Adjusted for 8 covariates; inpatient length-of-stay data available on only 79 patients	60

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Hospitalizations				
Higher hospitalization rates for ACSCs Higher proportion of all hospital discharges attributable to ACSCs Asthma comprised much higher proportion of all ACSCs	Analysis of 6 y of data on children 1–14 y of age from National Hospital Discharge Surveys, US Census, and the NHIS	AA: $n = 17\,599$; white: $n = 66\,270$	Not adjusted for covariates; only examined 6 ACSCs White race category included all those with missing race	61
Immunization				
For children <48 mo old, lowest rate of being up-to-date on 4:3:1:3:3 immunization series Substantially greater delay and later mean age for all immunization categories and doses	Retrospective cohort study based on Chicago public schools' computerized immunization database on all children completing kindergarten in a 2-y period	Total sample: $N = 66\,556$[b]	Not adjusted for covariates	62
Infectious diseases (other than HIV/AIDS)				
Higher rate ratio of invasive pneumococcal disease among all 3 age groups analyzed (<2, 2–4, and 5–17 y of age)	Analysis of age- and race-specific pneumococcal disease incidence rates from the Active Bacterial Core Surveillance/Emerging Infections Program Network, an active, population-based surveillance system in 7 states, using data from between January 1, 1998, and December 31, 2002	Not stated for children	Not adjusted for covariates	63
Higher incidence rate of tuberculosis	Analysis of 8 y of data on children <15 y of age from the North Carolina Tuberculosis Information Management System database	AA: $n = 114$; Latino: $n = 33$; API: $n = 12$; white: $n = 21$	Not adjusted for any covariates	64
Injuries				
Firearm injury rate >13 times higher	Analysis of data from Minnesota Department of Health's Minnesota Trauma Data Bank on firearm injuries in children 0–19 y of age	Total sample: $N = 175$[b]	Not adjusted for covariates	65
Higher adjusted odds of not putting up stair gate Higher adjusted odds of not installing safety latches or locks on cabinets Higher adjusted odds of not turning down hot-water thermostat setting	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	AA: $n = 477$; Latino: $n = 817$; white: $n = 718$	Adjusted for 9 covariates	66
Mental health and behavioral/developmental issues				
Lower adjusted odds of receiving treatment for depression from a mental health specialist	Analysis of National Longitudinal Survey of Youth and the Child/Young Adult supplement, a nationally representative sample of 7- to 14-y-old children	Total sample: $N = 2482$[b]	Adjusted for 28 covariates; no differences for any visit or behavior problem visit	67
Lower adjusted odd of being diagnosed with ADHD without a learning disability Lower adjusted odd of being diagnosed with ADHD with a learning disability Lower adjusted odds among those with ADHD of receiving any prescription medication	Analysis of 5 y of the NHIS	AA: $n = 3562$; Latino: $n = 5552$; white: $n = 11\,287$	Adjusted for birth weight, income, and health insurance coverage	68

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Lower adjusted odds of any mental health service use Lower adjusted odds of outpatient mental health service use Lower adjusted odds of informal mental health service use (self-help groups, peer counseling, clergy counseling, or alternative healers)	Analysis of outcomes for a random sample of 6- to 18-y-old youths receiving services in ≥1 of 5 San Diego County public sectors of care (alcohol and drug abuse, child welfare, juvenile justice, mental health, and public school education services) over a 1.5-y period	AA: $n = 282$; Latino: $n = 332$; API: $n = 88$; white: $n = 554$	Parents and children with limited English proficiency were excluded; adjustment for 12 covariates	69
Among those with autism, receive diagnosis 1.4 y later than white children (after adjustment) Among those with autism, in mental health treatment an average of 13 mo longer than white children before receiving diagnosis of autism (after adjustment)	Analysis of 7 y of Philadelphia County Medicaid claims data for children and adolescents with autism	AA: $n = 242$; Latino: $n = 33$; white: $n = 118$	Adjusted for 3 covariates; Latino children did not significantly differ from AA children for any finding, but no direct Latino-white comparison made	70
Higher proportion of parents with children with ADHD had negative expectations about ADHD treatment (ie, thought treatment could not help) Among those with ADHD or at high risk for ADHD Lower adjusted odds of receiving professional evaluation for ADHD Lower adjusted odds receiving ADHD diagnosis Lower adjusted odds of currently receiving treatment for ADHD	District-wide stratified random sample of 1615 elementary-school children (kindergarten through 5th grade) in north central Florida public school; included telephone contacts, home visits, and teacher symptom-screening questionnaire	AA: $n = 201$; white: $n = 188$	Adjusted for 8 covariates, except parent-reported barriers, which were unadjusted	71
Higher adjusted odds of use of state-funded mental health services	Analysis of New York City data on receipt of services from state-funded mental health care facilities	Total sample: $N = 78\,085$ (including adults)[b]	Adjusted for 7 covariates	72
Higher adjusted odds of developmental delays (based on parental concerns)	Analysis of data from National Survey of Early Childhood Health on children 4–35 mo of age	Total sample: $N = 2068$[b]	Adjusted for 8 covariates	58
Lower adjusted odds of use of specialty mental health services among children for whom an investigation of abuse or neglect had been opened by the child welfare system	Analysis of data from the National Survey of Child and Adolescent Well-being on use of specialty mental health services for 1 y after contact with child welfare among a cohort of children 2–14 y of age	AA: $n = 899$; Latino: $n = 487$; white: $n = 1208$	Adjusted for 11 covariates and 2 interaction terms	73
Lower adjusted odds of receipt of psychotropic medications Lower adjusted odds of receipt of stimulant medications Lower adjusted odds of receipt of antidepressants Lower adjusted odds of receipt of neuroleptics	Cross-sectional analysis of computerized claims for children 2–19 y of age continuously enrolled in a mid-Atlantic state Medicaid program for 1 y	AA: $n = 112\,488$; white: $n = 56\,858$	Adjusted for 3 covariates; disparities persisted across 4 categories of Medicaid eligibility (SCHIP, Temporary Assistance to Needy Families [TANF], foster care, and Supplemental Security Income [SSI])	74
Higher adjusted odds of child's meals not being at the same time daily Higher adjusted odds of family eating lunch or dinner together less often than every day Higher adjusted odds of family never eating lunch or dinner together Watch an adjusted mean of 45 min more of television daily Higher adjusted odds of reading to child less often than every day Lower adjusted mean number of children's books in home	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	AA: $n = 477$; Latino: $n = 817$; white: $n = 718$	Adjusted for 9 covariates	66

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Mortality				
Higher adjusted rates of drowning in a swimming pool Higher adjusted rates of drowning in public pools, especially hotel/motel pools	Analysis of 4 y of national data from the Consumer Products Safety Commission on drowning deaths of children 5–24 y of age from death certificates, medical examiner reports, and newspaper clippings	AA: $n = 316$; Latino: $n = 81$; AI/AN: $n = 18$; white: $n = 222$	Adjusted for income; values expressed as rate ratios and 95% CIs, but no P values provided	75
Higher adjusted child mortality rate among boys in the Detroit tri-county area Higher adjusted child mortality rate among 10- to 19-y-old girls in the Detroit tri-county area	Combined death-certificate and census data on childhood mortality in 3 major metropolitan areas: Chicago, Detroit, and New York	AA: $n = 13\,744$; white: $n = 54\,846$	Adjusted for age, gender, and census tract income; no consistent adjusted disparities observed for other 2 cities analyzed (New York and Chicago)	76
Median age at death for those with Down syndrome substantially lower (25 vs 50 y among white individuals) Substantially lower average increase in median age at death for those with Down syndrome between 1968 and 1997 (0.7 vs 1.9 in white individuals)	Analysis of data from multiple-cause mortality files on all deaths with a diagnostic code for Down syndrome	Not indicated	Not adjusted for covariates; included in this analysis because Down syndrome customarily viewed as primarily a pediatric entity	77
Mortality from congenital heart defects 19% higher and declined more slowly over 18-y period Infant mortality rate for ventricular septal defect higher and persistently higher over 18-y period Lower increase of average age at death from congenital heart defects over time Average age at death from congenital heart defects 3–6 times lower About half the average age at death vs white individuals for 5 specific congenital heart defects: transposition of the great arteries, tetralogy of Fallot, ventricular septal defect, pulmonary valve anomalies, and single ventricle	Analysis of data from multiple-cause mortality files compiled by the National Center for Health Statistics from all death certificates filed in the United States with any mention of a congenital heart defect	Not indicated	Not adjusted for covariates; small sample sizes for children 1–4 y	78
Almost twice the mortality rate for children 1–4 y of age between 1950 and 1993 Black/white disparity ratio in mortality rate for children 1–4 y of age increased somewhat during the most recent 10-y period examined Approximately 50% higher mortality rate for children 5–14 y of age between 1950 and 1993 Black/white disparity ratio in mortality rate for children 5–14 y of age increased somewhat during most recent 10-y period examined	Analysis of 43 y of data on children 5–14 y of age from the National Vital Statistics System, the National Longitudinal Mortality Study, and the Area Resource File	Not indicated (except for two 3-y intervals)	Not adjusted for covariates; presented only as population rates; no statistical comparisons or 95% CIs	79
Higher adjusted relative risk of death among children without congenital anomalies	Retrospective cohort study of linked birth and death files for state of Michigan over 6-y period	Total mortality sample: $N = 8362$[b]	Adjusted for 4 covariates; no mortality disparities among children with congenital anomalies	80

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Higher adjusted risk of death among those with ALL	Analysis of 9 population-based registries of the National Cancer Institute's Surveillance, Epidemiology, and End Results program	AA: $n = 356$; Latino: $n = 504$; NA: $n = 61$; API: $n = 410$; white: $n = 3621$	Adjusted for 3 covariates; did not adjust for SES or insurance coverage	81
Higher adjusted odds of in-hospital death after congenital heart surgery	Analysis of data from the KID 2000 of the HCUP, limited to 19 states with adequate race/ethnicity data	AA: $n = 860$; Latino: $n = 1835$; white: $n = 4134$	Adjusted for 8 covariates	82
Nephrology				
Among those with end-stage renal disease, 2.4 times more likely to be on hemodialysis rather than peritoneal dialysis	Analysis of data from Medicare End-Stage Renal Disease registry on all Medicare-eligible children 0–19 y of age undergoing renal replacement therapy in the United States	AA: $n = 368$; white: $n = 870$	Adjusted for 10 covariates	83
Lower adjusted hemodialysis dose Four to 5 times greater adjusted likelihood of inadequate hemodialysis dose	Children and adolescents <18 y old within the North American Pediatric Renal Transplant Cooperative Study registry who began maintenance hemodialysis during a 6.5-y period and who received at least 6 consecutive mo of hemodialysis	AA: $n = 65$; white: $n = 46$	Adjusted for 6 covariates	84
Among children with end-stage renal disease, lower adjusted likelihood to be activated on the kidney transplant waiting list	National longitudinal cohort study using data from US Renal Data System on children 0–18 y of age with end-stage renal disease	AA: $n = 1122$; white: $n = 2162$	Adjusted for 5 covariates; stratified Kaplan-Meier analyses suggested that racial disparities may vary by SES, with significant differences in lowest but not highest SES quartile	85
Obesity, physical activity, and nutrition				
Select larger body size for ideal adult body size and ideal opposite-gender adult body size Less personal and family/peer concern about weight Significantly fewer trying to lose weight	Cross-sectional survey of random sample of all 4th- and 6th-graders in South Carolina public schools	AA: $n = 749$; white: $n = 848$	Adjusted for 2–3 covariates	86
Lower adjusted aerobic fitness level	Progressive treadmill protocol evaluation of aerobic fitness ($\dot{V}0_{2peak}$) of Los Angeles children 7–14 y of age, adjusting for gender, maturational stage, and body composition	AA: $n = 19$; Latino: $n = 36$; white: $n = 18$	Adjusted for 3 covariates but did not include SES	87
Higher adjusted odds of overweight	Analysis of height and weight data collected during 3 mo of physical fitness testing of students in grades 5, 7, and 9 in the Los Angeles County public school system	Total sample: $N = 281\ 630$[b]	Adjusted for 4 covariates	88
Higher adjusted likelihood of insulin resistance (cross-sectional assessment)	Analysis of 3 y of longitudinal data from the Princeton School District Study of 5th- to 12th-graders in 1 suburban Midwestern public school district	AA: $n = 542$; white: $n = 625$	Adjusted for 9 covariates; no significant association with change in insulin resistance over time	89
Higher prevalence of overweight in boys among 8th-graders (35%) and 10th-graders (35%) Higher prevalence of overweight in girls among 8th-graders (32%), 10th-graders (34%), and 12th-graders (28%) (highest prevalence among all racial/ethnic groups studied) Lower likelihood of eating breakfast regularly	Analysis of 10–17 y of data from Monitoring the Future, a nationally representative sample of students in the 8th, 10th, and 12th grades	Total sample: $N =$ 4800–17 074 per study interval, depending on grade and year[a]	Not adjusted for covariates	90

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Less likely to regularly exercise vigorously among girls Higher number of hours of television-viewing on average weekday Higher prevalence of overweight and obesity among girls (highest of any racial/ethnic group) More likely to consume >30% of calories as fat and >10% of calories as saturated fat (highest of any racial/ethnic group) Lower calcium intake	Cross-sectional survey of adolescents 11–18 y of age in 31 public schools in the Minneapolis, St Paul, and Osseo school districts of Minnesota	Total sample: $N = 4746$[b]	Not adjusted for covariates, but the authors stated that stratified analyses adjusting for grade and SES were performed but not reported, because they generally showed patterns similar to those of unadjusted analyses	91
Higher mean BMI Higher BMI percentile Lower mean consumption of fiber per 1000 kcal Lower mean scores on self-administered health knowledge questionnaire	Cross-sectional survey and weight and height measurements of all children in 5th grade in 2 middle schools in Scott County, Mississippi	AA: $n = 121$; Latino: $n = 70$; white: $n = 12$	Not adjusted for covariates; unclear what proportion of potential participants refused to participate	92
Higher prevalence of overweight Higher prevalence of overweight among 6- to 11-y-olds Higher prevalence of overweight among 12- to 19-y-olds Higher prevalence of overweight among girls Higher prevalence of overweight among 6- to 11-y-old girls Higher prevalence of overweight among 12- to 19-y-old girls Higher prevalence of at risk of overweight or overweight Higher prevalence of at risk of overweight or overweight among 12- to 19-y-olds Higher prevalence of at risk of overweight or overweight among girls Higher prevalence of at risk of overweight or overweight among 12- to 19-y-old girls	Analysis of NHANES data on children 2–19 y of age from 1999–2000 and 2001–2002	AA: $n = 1274$; Latino: $n = 1475$; white: $n = 1094$	Not adjusted for covariates	93
Higher adjusted odds of overweight Slower adjusted 1-mile run/walk time	Cross-sectional sample of California public school 5th, 7th, and 9th-graders (10–15 y of age)	AA: $n = 58\,491$; Latino: $n = 330\,758$; Asian: $n = 63\,292$; Pacific Islanders: $n = 7977$; Filipino: $n = 22\,598$; NA: $n = 7977$; white: 275 722	Adjusted for 2 covariates and stratified according to age	94
Ophthalmology				
Lower adjusted odds of being diagnosed with any eye or vision condition Lower adjusted odds of being diagnosed with an eye or vision condition other than conjunctivitis	Analysis of 6 y of data for children 0–17 y of age in the MEPS	Total sample: $N = 2813$[b]	Adjusted for 13 covariates; the authors concluded that disparities indicate possible underdiagnosis, undertreatment, or both	95
Orthopedic issues				
For treatment of supracondylar humerus fractures, more likely to undergo closed reduction with internal fixation (percutaneous pinning)	Retrospective examination of selected pediatric fractures in the KID of the HCUP	AA: $n = 207$; Latino: $n = 659$; white: $n = 1478$	Not adjusted for covariates; no disparities for femur or forearm fractures	96
Quality				
Lower adjusted odds of receiving any counseling during well-child visits	Cross-sectional analysis of 10 y of data on children 0–18 y of age from the National Ambulatory Medical Care Survey	Total sample: $N = 2892$[b]	Adjusted for 7 covariates	97

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Lower adjusted odds of receiving any screening during well-child visits Lower adjusted likelihood of meeting recommended number of well-child visits	Analysis of 3 y of data for children 0–17 y of age in the MEPS	AA: $n = 5137$; API: $n = 890$; Latino: $n = 9392$; white: $n = 14\,041$	Adjusted for 10 covariates	98
Children with cardiovascular disease had bidirectional Glenn surgery at significantly older median age (11 vs 6 mo of age among white infants) Children with cardiovascular disease had Fontan procedure at significantly older median age (60 vs 36 mo of age among white children)	Review of surgical database at Duke University Medical Center of all children who underwent bidirectional Glenn or Fontan stages of single-ventricle palliation over a 4-y period	AA: $n = 20$; white: $n = 47$	Although not adjusted for covariates, no significant differences found between AA and white children in median family income for either measure	99
Lower primary care provider strength-of-affiliation scores (unadjusted and adjusted) Lower primary care provider interpersonal relationship scores (unadjusted and adjusted [if required by managed care organization to stay in network])	Telephone survey of parents of random sample of 413 children attending elementary school in 3 suburban communities in San Bernardino County, California	AA: $n = 100$; API: $n = 91$; Latino: $n = 84$; white: $n = 102$	Adjusted for 11 covariates	100
Lower adjusted scores for timeliness of care Lower adjusted scores for health insurance plan service Lower adjusted scores for getting needed medical care	Analysis of parental survey data on children 0–17 y of age from the national CAHPS Benchmarking Database 1.0 administered by Medicaid sponsors comprising 33 health maintenance organizations from Arkansas, Kansas, Minnesota, Oklahoma, Vermont, and Washington	AA: $n = 1344$; Latino: $n = 842$; API: $n = 291$; AI/AN: $n = 330$; white: $n = 6328$	Adjusted for 4 covariates	101
Lower adjusted scores for comprehensiveness of primary care	Cross-sectional survey of parents of children in 228 classes, from kindergarten through 6th grade, at 18 elementary schools in a large urban school district in California	AA: $n = 458$; API: $n = 1158$; Latino: $n = 1292$; white: $n = 479$	Adjusted for 5 covariates	102
Greater adjusted odds of child being assigned to health care provider Greater adjusted odds of health care provider never/only sometimes understanding how parent prefers to rear child Greater adjusted odds of discussing violence in the community, smoking in the household, use of alcohol or drugs in household, trouble paying for child's needs, and spouse/partner supportive of parenting efforts	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	AA: $n = 477$; Latino: $n = 817$; white: $n = 718$	Adjusted for 9 covariates	32
Special health care needs				
Lower adjusted odds of receiving adequate time and information from child's health care provider, among children with special health care needs	Analysis of National Survey of Children With Special Health Care Needs	Total sample: $N = 38\,866$[b]	Adjusted for 6 covariates; no disparities in any unmet need or problem with specialty referral	103
Among children with special health care needs Higher adjusted odds of not identifying a regular clinician Lower adjusted odds of usual source of care being doctor's private office or health maintenance organization Average 2 fewer doctor visits per year	Analysis of data on children 0–17 y of age with special health care needs in the NHIS on disability	AA: $n = 1762$; Latino: $n = 1777$; white: $n = 6365$	Adjusted for 9–10 covariates	104
Among children with special health care needs Higher adjusted odds of child having no physician or nurse Higher adjusted odds of dissatisfaction with care	Analysis of data on children 0–17 y of age from National Survey of Children with Special Health Care Needs	Not indicated	Adjusted for 6 covariates	105

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Among children with special needs	Analysis of data on special needs children 0–17 y of age from the National Survey of Children With Special Health Care Needs	AA: $n = 3820$; Latino: $n = 3210$; white: $n = 28\,916$	Adjusted for 13 covariates	106
Greater adjusted odds of problems with ease of using health care services				
Surgery				
For those hospitalized for appendicitis	Analysis of data on children 1–17 y of age with appendicitis from the Nationwide Inpatient Sample and the KID	Total sample: $N = 428\,463$[b]	Not adjusted for covariates for time to operation, length of stay, or hospital charges; other outcomes include adjustment for 6 covariates	107
Longer time to operation (regardless of disease severity)				
Longer length of stay (regardless of disease severity)				
Higher hospital charges (regardless of disease severity)				
Higher adjusted odds of perforation or other complicating factors				
Lower adjusted odds of a laparoscopic procedure				
Transplantation				
Lower proportion (0%) received preemptive transplants	Retrospective analysis of transplant database at Cincinnati Children's Hospital	AA: $n = 37$; white: $n = 192$	Relatively small sample size of AA children; not adjusted for covariates	108
Fewer living transplants and more cadaveric transplants in most recent time period				
Cause of end-stage renal disease more likely to be acquired and less likely to be congenital or metabolic				
Approximately double the adjusted odds of heart transplantation graft failure	Analysis of 18 y of data from the United Network for Organ Sharing, including annual follow-up of transplant recipients	AA: $n = 717$; white: $n = 3510$	Adjustment for 13 covariates	109
Lower 5-y heart transplant graft survival rate				
Median heart transplant graft survival rate (5.3 y) ∼6 y lower than that for white children (11.0)				
Median age at heart transplant (8 y) 5 y older than that for white children (3 y)				
More likely to have HLA mismatch				
Use of health services				
Reduced physician visits under mandatory enrollment in managed care among those with Medicaid	Difference-in-difference analysis of pre/post impact of mandatory enrollment in managed care for Medicaid beneficiaries in 2 unnamed counties in an unnamed Midwestern state	AA: $n = 4891$; white: $n = 4460$	Adjusted for 3 covariates (all subjects enrolled in Medicaid, so no SES adjustment); no differences observed in hospitalizations or ED use	110
Higher adjusted likelihood of medically unnecessary EMS transports	Analysis of linked EMS and ED billing records for all EMS-to-hospital transports of children 0–17 y old originating in 3 counties in South Carolina over 27 mo	AA: $n = 4331$; Latino: $n = 75$; other: $n = 48$; white: $n = 1239$	Adjusted for 4 covariates	111
Greater adjusted odds of ≥1 y since last physician visit	Analysis of 3 y of NHIS data on children 0–17 y old	AA: $n = 17\,324$; Latino: $n = 12\,765$; API: $n = 2516$; AI/AN: $n = 1067$; white: $n = 62\,572$	Adjusted for 4 covariates	112
Lower adjusted number of physician visits in previous 12 mo				
Double the odds of suboptimal health status				
Among those hospitalized for pneumonia	Analysis of 3 y of data on children 0–17 y of age hospitalized for pneumonia from the National Inpatient Sample of the HCUP	AA: $n = 17\,095$; Latino: $n = 15\,152$; API: $n = 2050$; white: $n = 43\,180$	Adjusted for 6–7 covariates	113
Higher adjusted risk ratio of admission through EDs				
Lower adjusted odds of bronchoscopy				
Lower adjusted odds of mechanical ventilation				
Shorter adjusted length of stay				
Higher adjusted charges				

TABLE 1 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Among Medicaid-covered children	Analysis of data on North Carolina Medicaid-covered children 1–4 y of age from linked Medicaid, WIC service, and birth certificate data	AA: $n = 9288$; white: $n = 11\,351$[c]	Adjusted for 8–9 covariates	114
Lower adjusted odds of well-child care visit in previous year (at 1, 2, and 4 y of age)				
Lower adjusted odds of diagnosis and treatment for otitis media				
Lower adjusted odds of diagnosis and treatment for upper respiratory infections				
Lower adjusted odds of diagnosis and treatment for lower respiratory infections				
Lower adjusted odds of diagnosis and treatment for gastroenteritis				
Higher adjusted odds of diagnosis and treatment for asthma				
Lower adjusted outpatient Medicaid expenditures				
Lower adjusted ED Medicaid expenditures (for 3- and 4-y-olds)				
Lower adjusted prescription drug Medicaid expenditures				
Lower adjusted mean number of calls to doctor's office in past year	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	AA: $n = 477$; Latino: $n = 817$; white: $n = 718$	Adjusted for 9 covariates	32
Greater adjusted odds of at least 1 ED visit in previous year				

MEPS indicates Medical Expenditure Panel Survey; CHIRI, Child Health Insurance Research Initiative; Add Health, National Longitudinal Study of Adolescent Health; NHIS, National Health Interview Survey; NHANES, National Health and Nutrition Examination Survey; ACSC, ambulatory-care–sensitive condition; 4:3:1:3:3, combined series composed of ≥4 doses of diphtheria and tetanus toxoids and pertussis/diphtheria and tetanus toxoids/diphtheria and tetanus toxoids and acellular pertussis vaccine, ≥3 doses of poliovirus vaccine, ≥1 dose of measles-containing vaccine, ≥3 doses of *Haemophilus influenzae* type b vaccine, and ≥3 doses of hepatitis B vaccine; $\dot{V}o_2$, oxygen consumption per unit time; KID, Kid's Inpatient Database; HCUP, Healthcare Cost and Utilization Project; CAHPS, Consumer Assessment of Health Plans Study; EMS, Emergency Medical Services; WIC, Supplemental Nutrition Program for Women, Infants, and Children.

[a] Sample sizes include those 0 to 24 y of age, because those 15 to 24 y of age were grouped together.

[b] Sample sizes were not disaggregated in article according to race/ethnicity.

[c] Sample sizes for initial cohort (1-y-olds)

drome, congenital heart defects (both in terms of the fatality rate and a lower average age at death), and in-hospital death after congenital heart surgery.

Access to Care and Use of Services

Multiple noteworthy disparities were documented in access to health care and use of health services (Table 1). Disparities in access to care include higher rates than those of white children of unmet health care needs, lower rates of access to primary care providers (including race being more strongly associated with this outcome than income), a higher likelihood of having no usual source of care, greater odds of not being referred to a specialist by the health care provider, higher hospitalization rates for ambulatory care–sensitive conditions, and higher odds of appendicitis rupture (considered an access indicator, because it indicates failed access to timely, appropriate care early in the course of appendicitis). Disparities in the use of health services include lower physician-visit rates and higher odds of going 1 year or longer from the last physician visit, a higher rate of emergency department (ED) visits, greater likelihood of medically unnecessary Emergency Medical Services transports, fewer calls to physicians' offices, and, among those with Medicaid coverage, lower odds of well-child care and diagnosis and treatment for various pediatric conditions, and lower expenditures for outpatient and ED care and for prescriptions.

Prevention and Population Health

Disparities were identified in breastfeeding, immunization rates, injuries, obesity, physical activity, and nutrition (Table 1). Breastfeeding is significantly less likely among AA versus white infants, whether measured by ever being breastfed, the proportion exclusively breastfed, or the proportion receiving any human milk. AA children have the

lowest immunization rates for the primary immunization series and have substantially greater delays and a later mean age for multiple immunization categories and doses. They have a substantially higher firearm injury rate and, as young children, have higher odds of living in households without stair gates, cabinet safety latches or locks, or hot-water thermostat settings that have been turned down.

Studies consistently document higher rates of obesity and overweight in AA children (Table 1). One study also revealed selection of larger body size when asked to identify ideal adult body size; less personal, family, and peer concern about weight; and fewer children trying to lose weight. Disparities also have been identified in lower aerobic fitness levels, slower 1-mile run/walk time, lower likelihood of vigorous exercise in females, and higher numbers of television-viewing hours. Nutritional disparities include a higher likelihood of consuming more calories as fat and saturated fat, lower mean consumption of fiber and calcium, and lower likelihood of eating breakfast regularly.

Adolescent Health Issues

AA female adolescents have higher risks versus white female adolescents of skipping breakfast, being obese, lacking health insurance, needing but not getting medical care, having any sexually transmitted disease, perpetrating violence, and being a victim of violence (Table 1). Several studies have also documented live birth rates that are 2 to 5 times higher than for white female adolescents, and the disparity ratio has worsened over time. AA female adolescents also have greater adjusted odds of alcohol testing when seen in the ED for traumatic injury and are particularly at high risk of underusing substance abuse services. Male AA adolescents have a higher risk of perpetrating violence and being a victim of violence. For AA adolescents of both genders, higher risks were identified for underuse of substance abuse services, older age at first use of substance abuse services, and suboptimal health status and lower use of physicians' offices as the usual source of care among those recently enrolled in a State Children's Health Insurance Program (SCHIP).

Health Status

Multiple studies have documented health-status disparities for AA children, whether analyzing global health status or the prevalence of specific conditions (Table 1). Three studies revealed that AA children have higher adjusted odds of fair or poor health and lower odds of excellent or very good health. Higher rates of activity limitations, school limitations, and global stress also were noted. Significantly higher crude rates than in white children have been seen for all stroke categories (both hemorrhagic and ischemic), invasive pneumococcal disease, and tuberculosis. HIV/AIDS disparities are substantial, and include the largest percentages and numbers of new diagnoses in every age group of children and adolescents and via perinatal transmission, as well as longer adjusted lengths of stay for those who are hospitalized.

Asthma, Mental Health Care, and Special Health Care Needs

A particularly extensive body of literature is available on disparities for 3 specific issues: asthma, mental health care (including behavioral and developmental issues), and special health care needs (Table 1).

Several studies have documented that AA children have the highest asthma prevalence of any racial/ethnic group, and this prevalence is substantially higher than that for white children (Table 1). Secular-trend data indicate that this disparity has widened over time. Compared with white children, AA children also experience substantially higher rates of asthma mortality, hospitalizations, ED visits, and office visits, and the disparities in asthma mortality and hospitalizations have widened over time. Additional asthma disparities include higher attack prevalence; lower rates of filled prescriptions; higher potential disease burden (diagnosed plus possible but undiagnosed disease); worse asthma physical health scores; lower odds of use of β_2-agonists, inhaled steroids, and daily anti-inflammatory medication; and higher odds of sensitivities to cockroach, dust mite, and mold allergens.

Several key disparities were noted in mental health care and behavioral/developmental disorders. Most study results have indicated lower use of mental health services, including lower adjusted odds of any mental health service use, outpatient service use, informal service use (such as self-help and peer counseling), receiving treatment for depression from mental health specialists, and receipt of psychotropic, stimulant, antidepressant, or neuroleptic medications (Table 1). One study, however, found higher odds of use of state-funded mental health services in New York City. Higher adjusted odds of developmental delays have been noted, but underdiagnosis, undertreatment, and other disparities for attention-deficit/hyperactivity disorder (ADHD) were found in other studies, including lower adjusted odds of evaluation, receiving a diagnosis, and receiving medication or treatment, and higher proportions of parents with negative expectations about treatment helpfulness. AA children also were found to receive a diagnosis of autism 1.4 years later than white children and to be in mental health treatment an average of 13 months

longer than white children before receiving the autism diagnosis.

National data reveal several disparities for AA children with special health care needs (Table 1), including higher odds of having no regular health care provider, averaging fewer physician visits, being dissatisfied with care, encountering problems with ease of use of services, and not receiving adequate time and information from children's health care providers.

Quality

Numerous disparities were identified in quality of care (Table 1). Lower adjusted odds versus white children were noted for meeting the recommended number of well-child visits and receiving any counseling or screening during well-child visits. Lower adjusted scores were observed for timeliness of care, health insurance plan service, getting needed medical care, primary care comprehensiveness, primary care provider strength of affiliation, and primary care provider interpersonal relationships. Greater adjusted odds were found for the child being assigned to the health care provider; the provider never/only sometimes understanding how the parent prefers to rear the child; and the provider discussing violence in the community, smoking in the household, using alcohol or drugs in household, trouble paying for child's needs, and spouse/partner support of parenting efforts.

Among those with end-stage renal disease, AA children are substantially less likely than white children to be activated on the kidney transplant waiting list but are significantly more likely to receive hemodialysis rather than peritoneal dialysis and to receive an inadequate hemodialysis dose. AA children have lower odds than white children of being diagnosed with any eye or vision condition, are more likely to undergo closed reduction with internal fixation of supracondylar humerus fractures, undergo bidirectional Glenn and Fontan procedures at significantly older ages among those with cardiovascular disease, and have longer time to operation and lengths of stay, higher hospital charges, higher odds of perforation and other complications, and lowers odds of laparoscopic procedures among those with appendicitis. AA patients who have a heart transplant have double the odds of graft failure, lower graft survival rates, a median graft survival time that is 6 years lower, a median age at heart transplant that is 5 years greater, and a higher likelihood of HLA mismatch. AA children are less likely to receive preemptive kidney transplants, and they receive fewer living transplants and more cadaveric transplants.

Asians/Pacific Islanders

There were 24 articles (24 of 109 [22%]) that addressed disparities in API children (Table 2).

Mortality

Only 1 study (Table 2) examined mortality among APIs; it revealed that native Hawaiian children have a higher crude mortality rate than that of white children.

Access to Care and Use of Services

Several studies found disparities for API versus white children in access to health care and use of health services (Table 2). API children have greater adjusted odds of having no usual source of care, having made no visit to a physician or other health care provider in the past year, and going more than 1 year since the last physician visit, as well as a lower adjusted number of physician visits in the past year. Higher adjusted odds of appendicitis rupture also were noted. Among children with cancer, Pacific Islanders had significantly greater odds of death, untimely treatment, not completing treatment as recommended, and loss to follow-up.

Prevention and Population Health

Disparities were identified in injuries, lead intoxication, obesity, and nutrition (Table 2). Data from the state of Minnesota revealed triple the crude firearm injury rate of that in white children. API children were found to have the highest proportion of elevated blood lead concentrations in the state of Rhode Island and are the only racial/ethnic group whose rate increased over time. Higher adjusted odds of overweight occur among Pacific Islander, Filipino, and Asian children, and slower adjusted 1-mile run/walk times were noted for most age groups of API children. API children also have a lower calcium intake—the lowest of any racial/ethnic group.

Adolescent Health Issues

Compared with white adolescents, API adolescents were found to have lower adjusted odds of seatbelt use, sunscreen use, and weekly physical activity and greater adjusted daily hours of television/video-game screen time (Table 2).

Health Status

APIs have a higher adjusted likelihood than that of whites to have fair or poor health status (Table 2). Data from the state of Hawaii revealed that Filipino and Chinese boys have the highest rates of leukemia, and Chinese boys have the highest ALL rate.

Mental Health Care

API children have been found to have lower adjusted odds of any mental health service use, outpatient mental health service use, and 24-hour-care service use (ie, inpatient, residential, group-home, or alcohol/drug abuse treatment) (Table 2). New York City data, however, indicate higher ad-

TABLE 2 Disparities in the Health and Health Care of API Children

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Access to care				
Double to triple adjusted odds of having no usual source of care Double to triple adjusted odds of no health professional/doctor visit in previous year	Analysis of household component of the 1996 and 2000 MEPS	Asian: $n = 325$; AA: $n = 2189$; Latino: $n = 4091$; white: $n = 6362$	Adjusted for 8 covariates; 5 times the adjusted odds of dissatisfaction with quality of care in 2000 but not 1996	28
Higher adjusted odds of appendicitis rupture	Cross-sectional analysis of full-year samples of hospital discharge records for acute appendicitis from California and New York children 4–18 y of age	California: API, $n = 459$; AA, $n = 297$; Latino, $n = 4304$; white, $n = 4017$; New York: API, $n = 80$; AA, $n = 342$; Latino, $n = 444$; white, $n = 2379$	Adjusted for 7 covariates	29
Among children with cancer, compared with Hawaiian residents, Pacific Islanders had significantly greater odds of death, untimely treatment, not completing treatment as recommended, and loss to follow up	Retrospective case-comparison study	Pacific Islander: $n = 100$; Hawaiian residents: $n = 100$	Not adjusted for covariates	115
Adolescents				
Lower adjusted odds of seat belt use Lower adjusted odds of sunscreen use Lower adjusted odds of weekly physical activity Greater adjusted daily hours of television/video-game screen time	Analysis of California Health Interview Survey data on adolescents 12–17 y of age	API: $n = 376$; Latino: $n = 1515$; white: $n = 3263$	Adjusted for 5 covariates; interactions noted with generational status for certain outcomes	116
Cancer				
Among Hawaiian racial/ethnic groups, Filipino and Chinese boys have highest rates of leukemia, and Chinese boys have highest ALL rate	Tumor registry analysis	Total cancer cases: $N = 1237$	Adjusted only for age	117
Health status				
Higher adjusted likelihood of fair or poor health	Analysis of NHIS data	API: $n = 1088$; AA: $n = 5776$; Latino: $n = 4785$; white: $n = 20\,717$	Adjusted for 3 covariates (but not family income or health insurance coverage) Interactions between race/ethnicity and parental education for selected outcomes in selected groups	56
Injuries				
Triple the firearm injury rate	Analysis of data from Minnesota Department of Health's Minnesota Trauma Data Bank on fatal and nonfatal firearm injuries in children 0–19 y of age	Total sample: $N = 175$[a]	Not adjusted for covariates	65
Lead intoxication				
API children have the highest proportion of elevated blood lead levels (23%) in Rhode Island and are only group whose proportion increased over time	Rhode Island Department of Health Surveillance Data	Not stated	Not adjusted for SES or other covariates	118
Mental health and behavioral/developmental issues				
Lower adjusted odds of any mental health service use	Analysis of outcomes for random sample of 6- to 18-y-old youths receiving services in ≥1 of 5 San Diego County public sectors of care (alcohol and drug abuse, child welfare, juvenile justice, mental health, and public school education services) over 1.5-y period	API: $n = 88$; AA: $n = 282$; Latino: $n = 332$; white: $n = 554$	Parents and children with limited English proficiency were excluded	69

TABLE 2 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Lower adjusted odds of outpatient mental health service use Lower adjusted odds of 24-h-care service use (inpatient, residential group home, or alcohol/drug abuse treatment)			Adjusted for 12 covariates	
Higher adjusted odds of use of state-funded mental health services	Analysis of New York City data on receipt of services from state-funded mental health care facilities	Total sample: $N = 78\,085$ (including adults)[a]	Adjusted for 7 covariates	72
Mortality				
Approximately 50% higher mortality rate for children 1–4 y of age Almost 50% higher mortality rate for children 5–14 y of age	Analysis of 43 y of data on children 5–14 y of age from the National Vital Statistics System, the National Longitudinal Mortality Study, and the Area Resource File	Hawaiian residents: $n = 142$; white: 67 200	Not adjusted for covariates; presented only as population rates; no statistical comparisons or 95% CIs; small sample sizes for Hawaiian residents	79
Obesity, physical activity, and nutrition				
Higher adjusted odds of overweight among Pacific Islander children	Analysis of height and weight data collected during 3 mo of physical fitness testing of students in grades 5, 7, and 9 in the Los Angeles County public school system	Total sample: $N = 281\,630$[a]	Adjusted for 4 covariates; Asians (as opposed to Pacific Islanders) had lower adjusted odds (vs white children) of overweight	88
Lower calcium intake (lowest of any racial/ethnic group)	Cross-sectional survey of adolescents 11–18 y of age in 31 public schools in the Minneapolis, St Paul, and Osseo school districts of Minnesota	Total sample: $N = 4746$[a]	Not adjusted for covariates; the authors stated that stratified analyses adjusting for grade and SES were performed but not reported because they generally showed patterns similar to those of unadjusted analyses	91
Higher adjusted odds of overweight in Filipinos, Pacific Islanders, and Asians (but only in males for Asians) Slower adjusted 1-mile run/walk time	Cross-sectional sample of California public school 5th-, 7th-, and 9th-graders (10–15 y of age)	Asian: $n = 63\,292$; Pacific Islander: $n = 7977$; Filipino: $n = 22\,598$; AA: $n = 58\,491$; Latino: $n = 330\,758$; NA: $n = 7977$; white: 275 722	Adjusted for 2 covariates and stratified according to age; API children stratified as Asian, Filipino, and Pacific Islander; run/walk time differences not significant for certain specific age strata for Asian (2), Filipino (4), and Pacific Islander (7)	94
Quality				
Lower quality of primary care (according to parental assessment)	Cross-sectional survey of parents of elementary-school children 5–12 y of age in 1 school district, using Primary Care Assessment Tool	API: $n = 96$; AA: $n = 106$; Latino: $n = 96$; white: $n = 105$	Adjusted for 12 covariates; smaller sample size ($n = 135$) for full multivariable analysis may have had limited power to detect other disparities	119
Lower primary care provider interpersonal relationship scores (unadjusted and adjusted)	Telephone survey of parents of random sample of 413 children attending elementary school in 3 suburban communities in San Bernardino County, California	API: $n = 91$; AA: $n = 100$; Latino: $n = 84$; white: $n = 102$	Adjusted for 11 covariates	100
Among those in which the primary language spoken at home is a language other than English Lower adjusted scores for timeliness of care Lower adjusted scores for provider communication Lower adjusted scores for staff helpfulness	Analysis of parental survey data on children 0–17 y of age from the national CAHPS Benchmarking Database 1.0 administered by Medicaid sponsors comprising 33 health maintenance organizations from Arkansas, Kansas, Minnesota, Oklahoma, Vermont, and Washington	API: $n = 291$; AA: $n = 1344$; Latino: $n = 842$; AI/AN: $n = 330$; white: $n = 6328$	Adjusted for 4 covariates; no disparities for API children in households in which English is primary language; survey was administered only in English and Spanish	101

TABLE 2 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Lower adjusted scores for health insurance plan service				
Lower adjusted scores for getting needed medical care				
Lower adjusted ratings of child's health care				
Lower adjusted overall quality of primary care scores	Cross-sectional survey of parents of children in 228 classes, from kindergarten through 6th grade, at 18 elementary schools in a large urban school district in California	API: $n = 1158$; AA: $n = 458$; Latino: $n = 1292$; white: $n = 479$	Adjusted for 5 covariates	102
For those interviewed in English				
Lower adjusted scores on timely and convenient access to primary care				
Lower adjusted scores on how well primary care physician listens and explains during interactions				
Lower adjusted scores for comprehensiveness of primary care				
Lower adjusted scores on coordination of primary care				
Among those hospitalized for pneumonia	Analysis of 3 y of data on children 0–17 y of age hospitalized for pneumonia from the National Inpatient Sample of the HCUP	API: $n = 2050$; AA: $n = 17\,095$; Latino: $n = 15\,152$; white: $n = 43\,180$	Adjusted for 6–7 covariates	113
Lower adjusted odds of bronchoscopy				
Lower adjusted odds of mechanical ventilation				
Longer adjusted length of stay				
Higher adjusted charges				
Lower adjusted scores for interpersonal relationship with primary care provider	Telephone surveys on primary care experiences of children by using a random, cross-sectional sample of parents of elementary school children 5–12 y of age in a school district in San Bernardino, CA	API: $n = 88$; AA: $n = 94$; Latino: $n = 84$; white: $n = 92$	Adjusted for 9 covariates; findings held true regardless of whether there was patient/provider racial/ethnic concordance	120
Lower adjusted scores for specific primary care services available to child				
Use of health services	Analysis of cross-sectional data on children 0–19 y of age from the California Health Interview Survey	Total sample: $N = 19\,485$	Adjusted for 7 covariates	55
		API: $n = 890$; AA: $n = 5137$; Latino: $n = 9392$; white: $n = 14\,041$	Adjusted for 10 covariates	98
Lower adjusted odds of making a physician visit in the previous year	Analysis of 3 y of data for children 0–17 y of age in the MEPS	API: $n = 2516$; AA: $n = 17\,324$; Latino: $n = 12\,765$; AI/AN: $n = 1067$; white: $n = 62\,572$	Adjusted for 4 covariates	112
Lower adjusted likelihood of meeting recommended number of well-child visits	Analysis of 3 y of NHIS data on children 0–17 y of age			
Greater adjusted odds of ≥1 y since last physician visit				
Lower adjusted number of physician visits in previous 12 mo				
Greater adjusted odds of suboptimal health status				

MEPS indicates Medical Expenditure Panel Survey; NHIS, National Health Interview Survey; HCUP, Healthcare Cost and Utilization Project; CAHPS, Consumer Assessment of Health Plans Study.

[a] Sample sizes were not disaggregated in article according to race/ethnicity.

justed odds of use of state-funded mental health services.

Quality

Several studies have documented API disparities in primary care quality, including lower overall quality of primary care scores, lower primary care provider interpersonal relationship scores, and lower scores for specific primary care services available to the child (Table 2). Lower adjusted primary care quality scores have been found for 4 elements of care among API parents interviewed in English and 6 elements of care among API parents for whom the primary language spoken at home is not English. Among those hospitalized for pneumonia, API children have lower adjusted odds of bronchoscopy and mechanical ventilation, a longer adjusted length of stay, and higher adjusted charges.

Latinos

There were 66 articles (67 of 109 [61%]) that addressed disparities in Latino children (Table 3).

Mortality

Puerto Rican children 1 to 4 years of age were found to have a higher crude mortality rate than their white counterparts (Table 3). A higher drowning rate in neighborhood pools for Latinos also was found, along with higher swimming pool drowning rates in general for Latino male adolescents. Higher adjusted risks of death exist among Latinos (versus whites) with ALL and after congenital heart surgery.

Access to Care and Use of Services

Multiple studies have documented a wide range of disparities in access to care and use of services for Latino children (Table 3). In comparison with white children, Latino children have greater adjusted odds of being uninsured, having no usual source of care or health care provider, having made no physician visit in the past year, having gone 1 year or more since the last physician visit, making fewer physician visits in the past year, making fewer calls to physicians' offices, not being referred to a specialist, having a perforated appendicitis, and never or only sometimes getting medical care without long waits, getting timely routine care or telephone help, and getting brief wait times for medical appointments. Similar findings were noted in studies that focused on Latinos before or at the time of enrollment in SCHIP and among Mexican American children.

Prevention and Population Health

Disparities were identified in breastfeeding, injuries, obesity, physical activity, and nutrition (Table 3). Compared with white infants, a lower crude proportion of Mexican-American infants are ever breastfed. Latino households with children 4 to 35 months of age have lower adjusted odds than do white households of putting up stair gates. Multiple studies have documented significantly higher adjusted odds of overweight and obesity, including 2 studies that showed that Latinos have the highest adjusted rates of overweight and obesity of any racial/ethnic group. Physical-activity disparities included lower adjusted aerobic fitness, slower 1-mile run/walk times, higher average number of television-viewing hours on the average weekday, and lower regular vigorous physical activity among females. Lower calcium intake has been noted, as has as a higher likelihood of consumption of more than 10% of calories as saturated fat.

Adolescent Health Issues

Latina adolescents have a higher risk than do white adolescents of not having health insurance, perpetrating violence, and being a victim of violence. Disparities for male adolescents include a higher risk of no health insurance, going more than 2 years since the last physical examination, and being a victim of violence (Table 3). Latino adolescents recently enrolled in SCHIP have a higher crude likelihood of fair or poor health and are less likely to use physician's offices as their usual source of care. Latina adolescents 15 to 19 years of age have a crude birth rate 3 times higher than their white counterparts and the highest of any racial/ethnic group. Latino adolescents have a lower adjusted odds of being treated in the ED for sexually transmitted diseases, but male Latino adolescents with traumatic injuries have a higher adjusted odds of alcohol testing in the ED. Latino adolescents also have lower adjusted odds of bicycle helmet and sunscreen use.

Health Status

National data reveal a higher adjusted likelihood of fair or poor health in Latinos (Table 3). Compared with whites, Latinos also have twice the percentage of new HIV/AIDS diagnoses among those younger than 13 years old, in perinatal transmission, and among other pediatric cases. They also have a higher crude incidence rate of tuberculosis. In terms of Latino subgroups, both Mexican American and Puerto Rican children have higher adjusted odds of fair or poor health status.

Asthma, Mental Health Care, and Special Health Care Needs

An analysis of national data revealed that Latinos have a higher asthma prevalence than do whites, and there has been a substantial increase in Latino asthma prevalence over time (Table 3). Several studies have documented a particularly high asthma prevalence among Puerto Ricans. Other asthma disparities include higher adjusted odds of asthma ED visits, hospitalizations, activity limitations, and the need for urgent care in

TABLE 3 Disparities in the Health and Health Care of Latino Children

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Access to care				
Triple the adjusted odds of having no usual source of care Double the adjusted odds of no health professional/doctor visit in previous year	Analysis of Household Component of 1996 and 2000 MEPS	Latino: $n = 4091$; AA: $n = 2189$; Asian: $n = 325$; white: $n = 6362$	Adjusted for 8 covariates; double the adjusted odds of dissatisfaction with quality of care in 1996 but not 2000	28
Lower adjusted odds of having a regular source of care Lower adjusted odds of surety of accessing health care among adolescents Lower adjusted odds of being in excellent/very good health	Analysis of cross-sectional data on children 0–19 y of age from the California Health Interview Survey	Total sample: $N = 19\,485$	Adjusted for 7 covariates	55
Among Mexican American children Lower adjusted odds of always/usually obtaining appointment for regular or routine care Lower adjusted odds of always/usually obtaining care for illness or injury Lower adjusted odds of always/usually obtaining advice/help over telephone Higher adjusted odds of always/usually having a long wait in doctor's office	Cross-sectional, population-based, random-digit-dialing survey of parents/guardians of children 3–18 y of age residing in 111 counties in west Texas using 4 items from the CAHPS	Mexican American: $n = 2052$; white: $n = 2655$	Adjusted for 17 covariates; same finding when Mexican American children stratified by language spoken at home	121
Higher adjusted odds of appendicitis rupture in California	Cross-sectional analysis of full-year samples of hospital discharge records for acute appendicitis from California and New York children 4–18 y of age	California: Latino, $n = 4304$; API, $n = 459$; AA, $n = 297$; white, $n = 4017$; New York: API, $n = 80$; AA, $n = 342$; Latino, $n = 444$; white, $n = 2379$	Adjusted for 7 covariates; nonsignificant trend observed in New York	29
Higher adjusted proportion in fair or poor health among new SCHIP enrollees in Florida and New York Lower adjusted proportion had preventive care visits before SCHIP among new SCHIP enrollees in Florida and New York Lower adjusted proportion had usual source of care before SCHIP among new SCHIP enrollees in Florida and New York	Analysis of CHIRI data on new SCHIP enrollees in 4 states (<18 y old in Alabama, Kansas, and New York, and 11.5–17.9 y of age in Florida)	Total sample: $N = 8975$[b]	Adjusted for 10 covariates	30
Before enrollment in SCHIP Lower adjusted rate of having usual source of care Higher adjusted rate of having unmet needs for health care	Interviews of parents in New York State at the time of SCHIP enrollment of their child (baseline) and 1 y after enrollment	Total sample: $N = 2644$ (baseline) and $N = 2290$ (1-y follow-up)[b]	Adjusted for 12 covariates; 1 unadjusted quality-of-care disparity noted	31
Lower adjusted odds of always getting timely medical care without waits Lower adjusted odds of always getting timely telephone help for medical care	Analysis of CAHPS data on cross-sectional cohort from the MEPS	Latino: $n = 1236$; AA: $n = 700$; white: $n = 2184$	Adjusted for 6 covariates	122

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Lower adjusted odds of brief wait times for medical appointments Higher adjusted odds of never/only sometimes getting medical care without long waits Higher adjusted odds of never/only sometimes getting timely routine care Higher adjusted odds of never/only sometimes getting timely telephone help Higher adjusted odds of never/only sometimes getting brief wait times for medical appointments				
Greater adjusted odds of being uninsured Greater adjusted odds of not being referred to specialist by health care provider	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	Latino: $n = 817$; AA: $n = 477$; white: $n = 718$	Adjusted for 9 covariates	32
Adolescents				
Female adolescents: higher risk of no health insurance, perpetrating violence, and being a victim of violence Male adolescents: higher risk of no health insurance, last physical examination >2 y ago, and being a victim of violence	Analysis of Add Health (waves 1 and 2), a nationally representative school-based study of youths in grades 7–12, with follow-up into adulthood	Latino: $n = 2340$; AA: $n = 3038$; API: $n = 1021$; AI/AN: $n = 136$; white: $n = 7728$	Prevalence in published tables was not adjusted; the authors stated that adjustments for income and parental education had minimal influence on findings; significant disparities were identified by using 95% CIs that did not overlap with measure for white adolescents; no formal statistical evaluation of disparities was provided in article	35
Lower adjusted odds of bicycle helmet use Lower adjusted odds of sunscreen use	Analysis of California Health Interview Survey data on adolescents 12–17 y of age	Latino: $n = 1515$; API: $n = 376$; white: $n = 3263$	Adjusted for 5 covariates; interactions noted with generational status for certain outcomes	116
Live birth rate for adolescent girls 15–17 y of age >3 times higher (and highest for any racial/ethnic group)	1990–1998 natality files from the National Vital Statistics System	Not provided	Expressed as rates per 1000; rates not adjusted for any covariates	36
Higher likelihood of fair-to-poor health among adolescents recently enrolled in SCHIP Less likely to use doctor's offices as their usual source of care among adolescents recently enrolled in SCHIP	Analysis of CHIRI telephone interview data of adolescents newly enrolled in SCHIP in Florida and New York (and their parents)	Total sample: $N = 2036$[b]	Not adjusted for covariates	33
Lower adjusted odds of being treated for sexually transmitted infections in the ED	Analysis of 7 y of data from the National Hospital Ambulatory Medical Care Survey on children 12–19 y of age	Latino: $n = 1710$; AA: $n = 8170$; white: $n = 8930$	Adjusted for 4 covariates	123
Birth rate for 15- to 19-y-old girls almost 3 times as high	Birth certificate data reported to CDC National Center for Health Statistics	Not provided	Not adjusted for covariates; no *P* values or 95% CIs	38
Greater adjusted odds of alcohol testing among male adolescents admitted to EDs for traumatic injury	Analysis of data from the National Trauma Data Bank (includes 64 US institutions) on adolescents 12–17 y of age admitted to EDs with traumatic injury	Latino: $n = 396$; AA: $n = 1760$; white: $n = 5584$	Adjusted for 7 covariates	39

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Asthma and allergies				
Puerto Rican children have significantly higher adjusted odds of having current asthma (and are only racial/ethnic minority group with higher odds after adjustment for income and neighborhood factors)	Cross-sectional parental survey of 26 randomly selected New York City public elementary schools	Latino: $n = 2058$; AA: $n = 1171$; white: $n = 798$; Asian: $n = 646$	Adjusted for 4 covariates; Asian children had significantly lower adjusted odds of having current asthma (vs white children)	124
Higher adjusted odds of an asthma ED visit or hospitalization Higher adjusted odds of an asthma ED visit or hospitalization among Puerto Ricans, Dominicans, and "other Latinos" but not Mexicans	Analysis of data from parent-response questionnaires administered in 26 randomly selected New York City public elementary schools	Total sample: $N = 5250$[b]	Adjusted for 4 covariates	45
Higher diagnosed asthma prevalence among Puerto Rican children (22%) Higher total potential asthma burden (diagnosed plus possible but undiagnosed asthma) among Puerto Rican children	Cross-sectional analysis of parent-report questionnaire data from 14 low-income, diverse Chicago public elementary schools	Latino: $n = 6002$ (Puerto Rican: $n = 473$); AA: $n = 2938$; white: $n = 1560$	Not adjusted for covariates	46
Higher asthma prevalence Substantial rise in asthma prevalence over 11-y period (more than doubled)	Trends in asthma over time for children 0–17 y of age using data from 5 National Center for Health Statistics sources: National Health Interview Survey, National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey, National Hospital Discharge Survey, and Mortality Component of National Vital Statistics System	Not provided	Only unadjusted rates were presented; no differences or lower rate of asthma attack prevalence vs white children; no statistical comparisons performed or 95% CIs provided	40
Lower adjusted odds of daily anti-inflammatory use for asthma	Cross-sectional study using parental telephone interviews and electronic records for Medicaid-insured children 2–16 y of age with asthma in 5 managed care organizations in California, Washington, and Massachusetts	Latino: $n = 313$; AA: $n = 636$; white: $n = 512$	Adjusted for SES, health status, age, gender, and other sociodemographic variables	48
Higher adjusted odds of cockroach allergen sensitivity among Mexican American children Higher adjusted odds of dust mite allergen sensitivity among Mexican American children	Cross-sectional analysis of children 6–16 y of age who participated in allergen testing in the NHANES III	Mexican American: $n = 1546$; AA: $n = 1502$; white: $n = 1116$	Adjusted for 8 covariates; Mexican American children were the only Latino children examined	49
Higher adjusted odds of asthma-associated activity limitations Higher adjusted odds of need for urgent medical care for asthma in past 12 mo	Analysis of data from the Los Angeles County Health Survey on children <18 y of age	Latino: $n = 3675$; AA: $n = 566$; API: $n = 361$; white: $n = 1278$	Adjusted for 8 covariates	50
Lower adjusted odds of use of inhaled steroids Lower adjusted odds of use of inhaled steroids among those cared for in private practices	Analysis of data from the Childhood Asthma Severity Study, which used a 12-mo, retrospective, parent-reported questionnaire on asthma in a community sample of children <13 y of age residing in Connecticut and Massachusetts	Latino: $n = 255$; AA: $n = 139$; white: $n = 549$	Adjusted for 9 covariates	51

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
For Puerto Rican children, higher adjusted odds of physician-diagnosed asthma	Analysis of NHIS data on 3- to 17-y-olds currently symptomatic with wheezing	Puerto Rican: $n = 40$; Mexican: $n = 122$; AA: $n = 174$; white: $n = 610$	Adjusted for 10 covariates	125
Breastfeeding				
Lower proportion of children ever breastfed among Mexican American children	Analysis of breastfeeding data on children 12–71 mo of age in the NHANES III (1988–1994)	Mexican American: $n = 2118$; AA: $n = 1845$; white: $n = 1869$	Not adjusted for any covariates	53
Health status				
Higher adjusted likelihood of fair or poor health	Analysis of 3 y of NHIS data on children 0–17 y of age	Latino: $n = 12\,765$; API: $n = 2516$; AA: $n = 17\,324$; AI/AN: $n = 1067$; white: $n = 62\,572$	Adjusted for 4 covariates	112
HIV/AIDS				
Approximately twice the percentage of new HIV/AIDS diagnoses vs white children for those <13 y of age, perinatal transmission, and other pediatric cases Number of new HIV/AIDS diagnoses exceeds that for white children for those <13 y of age, perinatal transmission, and other pediatric cases Although Latino children constitute 14% of US children, number of new HIV/AIDS diagnoses among those 0–24 y of age[a] ($n = 3249$) almost equal to that of white individuals of same age ($n = 3707$)	Diagnoses of HIV/AIDS reported to the CDC in 2001–2004 by 33 states that used confidential, name-based reporting of HIV/AIDS cases for at least 4 y	Latino: $n = 3249$; AA: $n = 11\,554$; white: $n = 3707$[a]	No 95% CIs or P values presented for children; not adjusted for covariates	59
Infectious diseases (other than HIV/AIDS)				
Higher incidence rate of tuberculosis	Analysis of 8 y of data on children <15 y of age from North Carolina Tuberculosis Information Management System database	Latino: $n = 33$; AA: $n = 114$; API: $n = 12$; white: $n = 21$	Not adjusted for any covariates	64
Injuries				
Higher adjusted odds of not putting up stair gate	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	Latino: $n = 817$; AA: $n = 477$; white: $n = 718$	Adjusted for 9 covariates	66
Mental health and behavioral/developmental issues				
Significantly lower adjusted odds of externalizing behavioral disorders Significantly lower adjusted odds of ambulatory visits	Secondary analysis of 2 y of MEPS data on children 2–18 y of age	Total 1996 MEPS sample size: $N = 3955$; total 1997 MEPS sample size: $N = 5933$	Adjusted for 7–9 covariates	43
Lower adjusted likelihood of mental health services use among Medicaid-eligible adolescents in substance abuse treatment	Analysis of Oregon's substance abuse treatment database (Client Processing Monitoring System) for adolescents 12–17 y of age admitted to publicly funded treatment for a substance use disorder during a 9-y period	Total sample: $N = 25\,813$[b]	Adjusted for 17 covariates	126
Lower adjusted odds of receiving treatment for any condition from a mental health specialist	Analysis of National Longitudinal Survey of Youth and the Child/Young Adult supplement, a nationally representative sample of 7- to 14-y-old children	Total sample: $N = 2482$[b]	Adjusted for 28 covariates	67

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Lower adjusted odds of receiving treatment for behavior problems from a mental health specialist Lower adjusted odds of receiving treatment for depression from a mental health specialist				
Triple the adjusted odds of unmet need for mental health care	Cross-sectional analyses of data on children 3–17 y of age from the NHIS, the National Survey of American Families, and the Community Tracking Survey	Latino: $n = 695$; AA: $n = 867$; white: $n = 3049$	Adjusted for 8 covariates	127
Within 6 mo of a new episode of depression Lower adjusted odds of filling an antidepressant prescription Lower adjusted odds of any mental health visit Lower adjusted odds of any mental health visit or antidepressant prescription filled (combined)	Analysis of Washington state Medicaid claims for children 5–18 y of age	Latino: $n = 90$; AI/AN: $n = 154$; white: $n = 1048$	Adjusted for 5 covariates	128
Higher rate of unmet need for mental health services (no services among children with identified need)	Analysis of data from National Survey of America's Families for children 6–17 y of age	Latino: $n = 6022$; AA: $n = 6371$; white: $n = 31\,240$	Not adjusted for covariates	129
Higher adjusted odds of use of state-funded mental health services	Analysis of New York City data on receipt of services from state-funded mental health care facilities	Total sample: $N = 78\,085$ (including adults)[b]	Adjusted for 7 covariates	72
Substantially lower adjusted odds of receiving an ADHD diagnosis during outpatient primary care provider visits Substantially lower adjusted odds of receiving a stimulant prescription during outpatient primary care provider visits Substantially lower adjusted odds of receiving an ADHD diagnosis or stimulant prescription during outpatient primary care provider visits	Analysis of 6 y of data on children 3–18 y of age from National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey	Latino: $n = 4117$; AA: $n = 5074$; white: $n = 16\,406$	Adjusted for 3 covariates	130
Higher adjusted odds of developmental delays (based on parental concerns)	Analysis of data from National Survey of Early Childhood Health on children 4–35 mo of age	Total sample: $N = 2068$[b]	Adjusted for 8 covariates	58
Lower adjusted odds of use of specialty mental health services among children for whom an investigation of abuse or neglect had been opened by the child welfare system	Analysis of data from the National Survey of Child and Adolescent Well-being on use of specialty mental health services for 1 y after contact with child welfare among a cohort of children 2–14 y of age	Latino: $n = 487$; AA: $n = 899$; white: $n = 1208$	Adjusted for 11 covariates and 2 interaction terms; no longer significant adjusted odds in 1 of 3 models (when provider supply, linkage variables, and interactions added)	73
Higher adjusted odds of family never eating lunch or dinner together Higher adjusted odds of reading to child less than every day	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	Latino: $n = 817$; AA: $n = 477$; white: $n = 718$	Adjusted for 9 covariates	66

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Lower adjusted mean number of children's books in home				
Mortality				
Higher swimming pool drowning rates for adolescent boys Higher rates of drowning in neighborhood pools, including community shared apartment and housing complex pools	Analysis of 4 y of national data from the Consumer Products Safety Commission on drowning deaths of children 5–24 y of age from death certificates, medical examiner reports, and newspaper clippings	Latino: $n = 81$; AA: $n = 316$; AI/AN: $n = 18$; white: $n = 222$	Adjusted for income; values expressed as rate ratios and 95% CIs, but no P values were provided	75
Higher mortality rate for Puerto Rican children 1–4 y of age	Analysis of 6 y of data on children 5–14 y of age from the National Vital Statistics System, the National Longitudinal Mortality Study, and the Area Resource File	Puerto Rican: $n = 265$; white: $n = 67\,200$	Not adjusted for covariates; presented only as population rates; no statistical comparisons or 95% CIs; small sample sizes in 1979–1981 interval	79
Higher adjusted risk of death among those with ALL	Analysis of 9 population-based registries of the National Cancer Institute's Surveillance, Epidemiology, and End Results program	Latino: $n = 504$; AA: $n = 356$; AI/AN: $n = 61$; API: $n = 410$; white: $n = 3621$	Adjusted for 3 covariates; did not adjust for SES or insurance coverage	81
Higher adjusted odds of in-hospital death after congenital heart surgery	Analysis of data from the 2000 KID of the HCUP, limited to 19 states with adequate race/ethnicity data	Latino: $n = 1835$; AA: $n = 860$; white: $n = 4134$	Adjusted for 8 covariates; in full model, P value for Latino ethnicity was .05	82
Obesity, physical activity, and nutrition				
Significantly lower adjusted aerobic fitness level	Progressive treadmill protocol evaluation of aerobic fitness ($\dot{V}O_{2peak}$) of Los Angeles children 7–14 y of age, adjusting for gender, maturational stage, and body composition	Latino: $n = 36$; AA: $n = 19$; white: $n = 18$	Adjusted for 3 covariates but not SES	87
Double the adjusted odds of overweight Highest overweight prevalence of any racial/ethnic group	Analysis of height and weight data collected in 3 mo of physical fitness testing of students in grades 5, 7, and 9 in the Los Angeles County public school system	Total sample: $N = 281\,630$[b]	Adjusted for 4 covariates	88
Higher prevalence of overweight in boys among 8th-graders (35%), 10th-graders (40%), and 12th-graders (30%) (highest prevalence among all racial/ethnic groups studied) Higher prevalence of overweight in girls among 8th-graders (27%), 10th-graders (32%), and 12th-graders (19%) (highest prevalence among all racial/ethnic groups studied) Lower likelihood of eating breakfast regularly Less likely to regularly exercise vigorously among girls Higher number of hours of television-viewing on average weekday	Analysis of 10–17 y of data from Monitoring the Future, a nationally representative sample of students in the 8th, 10th, and 12th grades	Total sample: $N = 4800$–$17\,074$ per study interval, depending on grade and year[b]	Not adjusted for covariates	90

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Higher prevalence of overweight and obesity Boys more likely to consume >10% of calories as saturated fat Lower calcium intake	Cross-sectional survey of adolescents 11–18 y of age in 31 public schools in the Minneapolis, St Paul, and Osseo school districts of Minnesota	Total sample: $N = 4746$[b]	Not adjusted for covariates, but stratified analyses adjusting for grade and SES were performed but not reported because generally showed patterns similar to those of unadjusted analyses	91
Among Mexican Americans Higher prevalence of overweight Higher prevalence of overweight among 6- to 11-y-olds Higher prevalence of overweight among 12- to 19-y-olds Higher prevalence of overweight among boys (and highest of all racial/ethnic groups analyzed) Higher prevalence of overweight among 6- to 11-y-old boys (and highest of all racial/ethnic groups analyzed) Higher prevalence of overweight among 12- to 19-y-old boys Higher prevalence of overweight among girls Higher prevalence of at risk of overweight or overweight (and highest of all racial/ethnic groups analyzed) Higher prevalence of at risk of overweight or overweight among 6- to 11-y-olds Higher prevalence of at risk of overweight or overweight among 12- to 19-y-olds Higher prevalence of at risk of overweight or overweight among boys (and highest of all racial/ethnic groups analyzed) Higher prevalence of at risk of overweight or overweight among 6- to 11-y-old boys (and highest of all racial/ethnic groups analyzed) Higher prevalence of at risk of overweight or overweight among 12- to 19-y-old boys (and highest of all racial/ethnic groups analyzed) Higher prevalence of at risk of overweight or overweight among girls Higher prevalence of at risk of overweight or overweight among 12- to 19-y-old girls	Analysis of NHANES data on children 2–19 y old from 1999–2000 and 2001–2002	Latino: $n = 1475$; AA: $n = 1274$; white: $n = 1094$	Not adjusted for covariates; Mexican Americans only Latino group analyzed	93
Higher adjusted odds of overweight and highest adjusted odds of any racial/ethnic group Slower adjusted 1-mile run/walk time	Cross-sectional sample of California public school 5th, 7th, and 9th-graders (10–15 y old)	Latino: $n = 330\,758$; AA: $n = 58\,491$; Asian: $n = 63\,292$; Pacific Islander: $n = 7977$; Filipino: $n = 22\,598$; AI/AN: $n = 7977$; white: $n = 275\,722$	Adjusted for 2 covariates and stratified according to age	94

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Orthopedics				
For treatment of supracondylar humerus fractures, more likely to undergo closed reduction with internal fixation (percutaneous pinning)	Retrospective examination of selected pediatric fractures in the KID of the HCUP	Latino: $n = 659$; AA: $n = 207$; white: $n = 1478$	Not adjusted for covariates; no disparities seen for femur or forearm fractures	96
Quality				
Lower adjusted odds of receiving any counseling during well-child visits Shorter well-child visit duration	Cross-sectional analysis of 10 y of data on children 0–18 y of age from the National Ambulatory Medical Care Survey	Total sample: $N = 2892$[b]	No multivariable adjustments performed for visit duration; counseling findings were adjusted for 7 covariates	97
Lower primary care provider strength-of-affiliation scores (unadjusted and adjusted) Lower primary care provider interpersonal relationship scores (unadjusted and adjusted [if required by managed care organization to seek referral and to stay in network])	Telephone survey of parents of random sample of 413 children attending elementary school in 3 suburban communities in San Bernardino County, California	Latino: $n = 84$; AA: $n = 100$; API: $n = 91$; white: $n = 102$	Adjusted for 11 covariates	100
Among those in which the primary language spoken at home is a language other than English Lower adjusted scores for timeliness of care Lower adjusted scores for provider communication Lower adjusted scores for staff helpfulness Lower adjusted scores for health insurance plan service Lower adjusted ratings of child's personal doctor Lower adjusted ratings of specialist Lower adjusted ratings of health plan	Analysis of parental survey data on children 0–17 y of age from the national CAHPS Benchmarking Database 1.0 administered by Medicaid sponsors comprising 33 health maintenance organizations from Arkansas, Kansas, Minnesota, Oklahoma, Vermont, and Washington	Latino: $n = 842$; AA: $n = 1344$; API: $n = 291$; AI/AN: $n = 330$; white: $n = 6328$	Adjusted for 4 covariates; no disparities noted for Latino children in households in which English is primary language	101
Among those seen in the ED for acute gastroenteritis Lower adjusted likelihood to undergo >2 diagnostic tests Lower adjusted likelihood of having undergone radiography	All patients seen in the ED over a 6-mo period with a discharge diagnosis of acute gastroenteritis as identified through a computerized patient log	Latino: $n = 143$; AA: $n = 122$; white: $n = 132$	Adjusted for 7 covariates	131
Lower mean participatory decision-making score for child's physician	Cross-sectional, population-based, random-digit-dialing survey of parents/guardians of children 3–18 y of age residing in 111 counties in west Texas	Latino: $n = 1720$; white: $n = 2156$	Adjusted for 11 covariates	132
Lower adjusted scores for comprehensiveness of primary care	Cross-sectional survey of parents of children in 228 classes, from kindergarten through 6th grade, at 18 elementary schools in a large urban school district in California	Latino: $n = 1292$; API: $n = 1158$; AA: $n = 458$; white: $n = 479$	Adjusted for 5 covariates	102

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Among those hospitalized for pneumonia Higher adjusted risk ratio of admission through EDs Lower adjusted odds of bronchoscopy Lower adjusted odds of mechanical ventilation Longer adjusted length of stay Higher adjusted charges	Analysis of 3 y of data on children 0–17 y of age hospitalized for pneumonia from the National Inpatient Sample of the HCUP	Latino: $n = 15\,152$; API: $n = 2050$; AA: $n = 17\,095$; white: $n = 43\,180$	Adjusted for 6–7 covariates	113
Greater adjusted odds of child being assigned to health care provider Greater adjusted odds of parent being not very likely to recommend child's well-child care provider Greater adjusted odds of health care provider never/only sometimes understanding how parent prefers to rear child Greater adjusted odds of health care provider never/only sometimes understanding child's specific needs Greater adjusted odds of discussing violence in the community, and use of alcohol or drugs in household	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	Latino: $n = 817$; AA: $n = 477$; white: $n = 718$	Adjusted for 9 covariates	32
Special health care needs				
Among children with special health care needs Higher adjusted odds of being uninsured Higher adjusted odds of having no usual source of care Higher adjusted odds of not identifying a regular clinician Higher adjusted odds of not being satisfied with care Higher adjusted odds of being unable to get needed medical care Lower adjusted odds of usual source of care being doctor's private office or health maintenance organization Higher adjusted odds of not having seen doctor in previous 12 mo Average 2 fewer doctor visits per year	Analysis of data on children 0–17 y of age with special health care needs in the NHIS on disability	Latino: $n = 1777$; AA: $n = 1762$; white: $n = 6365$	Adjusted for 9–10 covariates	104
Lower adjusted odds of receiving adequate time and information from child's health care provider	Analysis of National Survey of Children With Special Health Care Needs	Total sample: $N = 38\,866$[b]	Adjusted for 6 covariates; no disparities in any unmet need or problem with specialty referral	103
Among children with special health care needs Higher adjusted odds of having no usual source of care Higher adjusted odds of having difficulty receiving referrals for specialty care	Analysis of data on children 0–17 y of age from the National Survey of Children With Special Health Care Needs	Not indicated	Adjusted for 6 covariates	105

TABLE 3 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Higher adjusted odds of dissatisfaction with care Higher adjusted odds of family members having to reduce or stop employment because of child's condition				
Among children with special health care needs Higher adjusted odds of not receiving family-centered care Higher adjusted odds of parents experiencing employment consequences as a result of child's condition	Analysis of data on children 0–17 y of age from the National Survey of Children With Special Health Care Needs	Latino: $n = 3424$; API: $n = 197$; AA: $n = 3833$; white: $n = 28\,967$	Adjusted for 6 covariates	133
Among children with special needs Greater adjusted odds of problems with ease of using health care services	Analysis of data on special-needs children 0–17 y of age from the National Survey of Children With Special Health Care Needs	Latino: $n = 3210$; AA: $n = 3820$; white: $n = 28\,916$	Adjusted for 13 covariates	106
Surgery				
For those hospitalized for appendicitis Longer time to operation (regardless of disease severity) Longer length of stay (regardless of disease severity) Higher hospital charges (regardless of disease severity) Higher adjusted appendicitis rate Higher adjusted odds of perforation or other complicating factors	Analysis of data on children 1–17 y of age with appendicitis from the Nationwide Inpatient Sample and the KID	Total sample: $N = 428\,463$[b]	Not adjusted for covariates for time to operation, length of stay, or hospital charges; other outcomes include adjustment for 6 covariates	107
Use of health services				
Greater adjusted odds of ≥1 y since last physician visit Lower adjusted number of physician visits in previous 12 mo Greater adjusted odds of suboptimal health status Greater adjusted odds among Puerto Rican children of suboptimal health status Mexican American children had greater adjusted odds of suboptimal health status and ≥1 y since last physician visit and made a lower adjusted number of physician visits in the previous year	Analysis of 3 y of NHIS data on children 0–17 y of age	Latino: $n = 12\,765$; AA: $n = 17\,324$; API: $n = 2516$; AI/AN: $n = 1067$; white: $n = 62\,572$	Adjusted for 4 covariates	112
Lower adjusted mean number of calls to doctor's office in previous year	Analysis of data on children 4–35 mo of age from the National Survey of Early Childhood Health	Latino: $n = 817$; AA: $n = 477$; white: $n = 718$	Adjusted for 9 covariates	32

MEPS indicates Medical Expenditure Panel Survey; CHIRI, Child Health Insurance Research Initiative; Add Health, National Longitudinal Study of Adolescent Health; NHIS, National Health Interview Survey; NHANES, National Health and Nutrition Examination Survey; KID, Kid's Inpatient Database; HCUP, Healthcare Cost and Utilization Project; CAHPS, Consumer Assessment of Health Plans Study; $\dot{V}o_2$, oxygen consumption per unit time.

[a] Sample sizes includes those 0 to 24 years of age, because the CDC grouped those 15 to 24 years of age together.

[b] Sample sizes were not disaggregated in article according to race/ethnicity.

the previous 12 months, as well as a higher potential asthma burden (diagnosed plus possible but undiagnosed asthma). Latinos have lower adjusted odds of use of inhaled steroids and of daily anti-inflammatory medications. Disparities among Latino subgroups (compared with white children) include higher adjusted odds of asthma ED visits and hospitalizations among Puerto Ricans, Dominicans, and "other Latinos" (except Mexican Americans) and higher adjusted odds of cockroach and dust mite allergen sensitivity among Mexican Americans.

Eleven studies documented Latino disparities in mental health care and behavioral/developmental issues (Table 3). Disparities included significantly higher unmet need for mental health care, and lower odds of any mental health visit, outpatient visits, antidepressant prescriptions, and receiving treatment from a mental health specialist for any condition, behavior problems, or depression. Latinos have higher odds of developmental delays but lower odds of being diagnosed with externalizing behavioral disorders. Lower odds were noted for use of mental health services among children being investigated for possible abuse or neglect and among Medicaid-eligible teenagers in substance abuse treatment, although 1 study found higher odds of use of state-funded mental health services in New York City. Latinos have substantially lower adjusted odds of receiving an ADHD diagnosis or receiving stimulant prescriptions during outpatient primary care visits. Young Latino children have higher adjusted odds of being read to less than every day, of having fewer numbers of children's books in the household, and of the family never eating lunch or dinner together.

Many disparities have been documented for Latino children with special health care needs, including higher adjusted odds of being uninsured, having no usual source of care, parental dissatisfaction with care, having unmet medical care needs, not having seen the physician in the past year, not receiving adequate time and information from the health care provider, averaging fewer doctor visits per year, experiencing difficulties receiving specialty referrals, having family members reduce or stop employment because of the child's condition, not receiving family-centered care, and experiencing problems with ease of use of health care services.

Quality

Compared with white children, Latino children have higher adjusted odds of being assigned to a health care provider and lower adjusted scores for comprehensiveness of primary care and primary care provider strength of affiliation, interpersonal relationship, and participatory decision-making (Table 3). Latino children have a shorter average well-child visit duration, lower adjusted odds of receiving any counseling during well-child visits, and greater adjusted odds of the parent not being very likely to recommend the child's health care provider, of the health care provider never or only sometimes understanding the child's specific needs and how the parent prefers to rear the child, and of the provider discussing violence in the community and use of alcohol or drugs in the household. Similar disparities in the quality of primary care were noted for Latino children living in households in which English is not the primary language spoken (in comparison with white children).

Among those seen in the ED with acute gastroenteritis, Latino children had lower adjusted odds than white children of undergoing 2 or more diagnostic tests and of having undergone radiography (Table 3). Among children with supracondylar humerus fractures, Latinos were more likely to undergo closed reduction with internal fixation.

American Indians and Alaska Natives

Sixteen articles (15%) addressed disparities in AI/AN children, which is the fewest articles for any racial/ethnic group (Table 4).

Mortality

AI/AN children have a higher age-specific crude mortality rate compared with that of white children, both in national and urban samples (Table 4). A higher adjusted risk of death also has been documented for AI/AN children with ALL.

Use of Health Services

AI/AN children have higher adjusted odds than white children of going 1 year or longer since their last physician visit (Table 4).

Prevention and Population Health

Data from the state of Minnesota reveal a firearm injury rate for AI/AN children that is more than 7 times higher than that for their white counterparts (Table 4). Several studies have documented higher adjusted odds of overweight and obesity among AI/AN children. Other studies have shown a slower adjusted 1-mile run/walk time and lower calcium intake among AI/AN boys.

Adolescent Health Issues

Female AI/AN adolescents have higher risks than their white counterparts of needing but not getting medical care and of perpetrating violence (Table 4). Male AI/AN adolescents have a higher risk than their white counterparts of skipping breakfast, having poor/fair health status, and perpetrating violence. National data from 2 studies revealed that the birth rate for AI/AN fe-

TABLE 4 Disparities in the Health and Health Care of AI/AN Children

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Adolescents				
Female adolescents: higher risks of needing but not getting medical care and perpetrating violence Male adolescents: higher risk of skipping breakfast, poor/fair health status, and perpetrating violence	Analysis of Add Health (waves 1 and 2), a nationally representative school-based study of youths in grades 7–12, with follow-up into adulthood	AI/AN: $n = 136$; AA: $n = 3038$; API: $n = 1021$; Latino: $n = 2340$; white: $n = 7728$	Prevalence in published tables not adjusted, but authors stated that adjustments for income and parental education had minimal influence on findings; significant disparities were identified by using 95% CIs that did not overlap with measure for white adolescents; no formal statistical evaluation of disparities provided	35
Live birth rate for adolescent girls 15–17 y of age >2 times higher	1990–1998 natality files from the National Vital Statistics System	Not provided	Expressed as rates per 1000; not adjusted for covariates	36
Birth rate for 15–19 y-old girls almost 3 times as high	Birth certificate data reported to the CDC National Center for Health Statistics	Not provided	Not adjusted for covariates; no *P* values or 95% CIs	38
Injuries				
Firearm injury rate >7 times higher	Analysis of data from Minnesota Department of Health's Minnesota Trauma Data Bank on fatal and nonfatal firearm injuries in children 0–19 y of age	Total sample: $N = 175$[a]	Not adjusted for covariates	65
Mental health and behavioral/developmental issues Lower adjusted likelihood of mental health services use among Medicaid-eligible and non–Medicaid-eligible adolescents in substance abuse treatment	Analysis of Oregon's substance abuse treatment database (Client Processing Monitoring System) for adolescents 12–17 y of age admitted to publicly funded treatment for a substance use disorder during a 9-y period	Total sample: $N = 25\,813$[a]	Adjusted for 17 covariates	126
Within 6 mo of a new episode of depression Lower adjusted odds of filling an antidepressant prescription Lower adjusted odds of any mental health visit or antidepressant prescription filled	Analysis of Washington State Medicaid claims for children 5–18 y of age	AI/AN: $n = 154$; Latino: $n = 90$; white: $n = 1048$	Adjusted for 5 covariates	128
Mortality				
Significantly higher age-specific mortality rate among 1- to 14-y-old urban children (vs urban white children)	Vital statistics data for 10 y from King County, Washington	Not stated for this outcome	Not adjusted for covariates	134
Approximately 50% higher mortality rate for children 1–4 y of age Higher mortality rate for children 5–14 y of age	Analysis of 6 y of data on children 5–14 y of age from the National Vital Statistics System, the National Longitudinal Mortality Study, and the Area Resource File	AI/AN: $n = 1336$; white: $n = 67\,200$	Not adjusted for covariates; presented only as population rates; no statistical comparisons or 95% CIs	79
Higher adjusted risk of death among those with ALL	Analysis of 9 population-based registries of the National Cancer Institute's Surveillance, Epidemiology, and End Results program	AI/AN: $n = 61$; AA: $n = 356$; API: $n = 410$; Latino: $n = 504$; white: $n = 3621$	Adjusted for 3 covariates; not adjusted for SES or insurance coverage	81
Obesity physical activity and nutrition				
Higher adjusted odds of overweight	Analysis of height and weight data collected in 3 mo of physical fitness testing of students in grades 5, 7, and 9 in the Los Angeles County public school system	Total sample: $N = 281\,630$[a]	Adjusted for 4 covariates	88

TABLE 4 Continued

Disparity (vs White Children)	Study Design	Sample Size(s)	Notes	Ref No.
Higher prevalence of overweight and obesity (highest prevalence of any racial/ethnic group for boys) Lower calcium intake among boys	Cross-sectional survey of adolescents 11–18 y of age in 31 public schools in the Minneapolis, St Paul, and Osseo school districts of Minnesota	Total sample: $N = 4746$[a]	Not adjusted for covariates, but authors stated that stratified analyses adjusting for grade and SES were performed but not reported because they generally showed patterns similar to those of unadjusted analyses	91
Higher adjusted odds of overweight Slower adjusted 1-mile run/walk time	Cross-sectional sample of California public school 5th-, 7th-, and 9th-graders (10–15 y old)	AI/AN: $n = 7977$; AA: $n = 58\,491$; Asian: $n = 63\,292$; Filipino: $n = 22\,598$; Latino: $n = 330\,758$; Pacific Islander: $n = 7977$; white: 275 722	Adjusted for 2 covariates and stratified according to age; run/walk times not significantly different for 2 older strata for both genders	94
Ophthalmology				
Lower adjusted odds of being diagnosed with any eye or vision condition	Analysis of 6 y of data for children 0–17 y of age in the MEPS	Total sample: $N = 2813$[a]	Adjusted for 13 covariates; the authors concluded that disparities indicated possible underdiagnosis, undertreatment, or both; no disparities in being diagnosed with an eye or vision condition other than conjunctivitis	95
Quality				
Lower adjusted scores for timeliness of care Lower adjusted scores for provider communication Lower adjusted scores for health insurance plan service Lower adjusted ratings of child's personal doctor Lower adjusted ratings of health plan	Analysis of parental survey data on children 0–17 y of age from the CAHPS Benchmarking Database 1.0 administered by Medicaid sponsors comprising 33 health maintenance organizations from Arkansas, Kansas, Minnesota, Oklahoma, Vermont, and Washington	AI/AN: $n = 330$; AA: $n = 1344$; API: $n = 291$; Latino: $n = 842$; white: $n = 6328$	Adjusted for 4 covariates	101
Use of health services				
Greater adjusted odds of ≥1 y since last physician visit More than double the adjusted odds of suboptimal health status and highest prevalence of any racial/ethnic group	Analysis of 3 y of NHIS data on children 0–17 y of age	AI/AN: $n = 1067$; API: $n = 2516$; AA: $n = 17\,324$; Latino: $n = 12\,765$; white: $n = 62\,572$	Adjusted for 4 covariates	112

MEPS indicates Medical Expenditure Panel Survey; Add Health, National Longitudinal Study of Adolescent Health; NHIS, National Health Interview Survey; CAHPS, Consumer Assessment of Health Plans.

[a] Sample sizes were not disaggregated in article according to race/ethnicity.

male adolescents is 2 to 3 times higher than that of white adolescents.

Health Status

AI/AN children have higher adjusted odds than do white children of being in poor or fair health and the highest prevalence of these suboptimal health ratings of any racial/ethnic group (Table 4).

Mental Health Care

Within 6 months of a new episode of depression, AI/AN children have lower adjusted odds than white children of any mental health visit or antidepressant prescription being filled. AI/AN youth in treatment for substance abuse also have a lower adjusted likelihood of mental health services use.

Quality

Compared with the parents of white children, the parents of AI/AN children gave lower adjusted scores for their child's health care timeliness, health care provider communication, and health insurance plan service, and lower adjusted ratings for their child's personal doctor and health plan (Table 4). National data also reveal lower adjusted odds of being diagnosed with any eye or vision condition.

Multiracial Children

The search terms did not yield any articles on disparities among multiracial children.

DISPARITIES AMONG RACIAL/ETHNIC SUBGROUPS

Fifteen studies (14%) included analyses of disparities in 1 or more racial/ethnic subgroup (in comparison with white children). Five studies of APIs (21% of all studies of APIs) and 10 studies of Latinos (15% of all studies of Latinos) examined racial/ethnic subgroup disparities; none of the analyses for AA or AI/AN children included subgroup analyses.

STUDIES EVALUATING INTERVENTIONS TO REDUCE DISPARITIES

The search terms yielded only 2 studies that evaluated interventions to reduce racial/ethnic disparities (Table 5). A quasi-experimental evaluation of a school-based Internet and video intervention that focused on health snacks and gym labs resulted in significant reductions in dietary fat intake among all 3 minority groups as well as among those in the white group, and significant increases in physical activity among low-income children in all 3 minority groups and white children. It was unclear, however, what the control group received, there was no overall difference between intervention and control children in fat-intake reduction, and participants in

TABLE 5 Results of Studies Evaluating Interventions to Reduce Disparities in the Health and Health Care of Minority Children

Disparity Targeted	Findings	Study Design	Sample Size(s)	Notes	Ref No.
Nutrition and exercise in middle-school children	Dietary fat intake significantly reduced in intervention-group girls for AA, Latino, AI/AN, and white children; significantly increased physical activity among those with lowest income among AA, Latino, Asian, and white children	Quasi-experimental evaluation of a 4-session Internet and video intervention with healthy snack and gym labs; intervention occurred in 2 urban, low- to middle-income middle schools (gym lab in 1) in the Midwest	AA: $n = 58$; white: $n = 47$; Asian: $n = 9$; Latino: $n = 4$; AI/AN: $n = 4$	Small sample sizes from only 2 schools; unclear what control group received (if anything); unclear when postintervention evaluation occurred; no overall difference between intervention and control children in fat intake reduction; both groups actually decreased their amount of physical activity	135
Immunization rates among 0- to 2-y-olds	No statistically significant differences (vs white children) in postintervention population immunization rates for 24-mo-olds among AA and Latino children; no statistically significant difference (vs white children) in postintervention population immunization rate for Latino (but not AA) 12-mo-olds	Prepopulation/postpopulation study in Monroe County, New York, of impact of community-wide reminder, recall, and outreach system for childhood immunizations administered by lay outreach workers in 8 practices (expanded to 10 after 4 y). Outcomes were monitored in a 10% random sample selected from suburban practices and a 25% random sample from urban practices.	Total sample: $N = 20\,132$[a]	9%–74% of cohort (depending on study region) did not receive intervention; immunization rates unadjusted (not adjusted for any potential confounders)	136

[a] Sample sizes were not disaggregated in article according to race/ethnicity.

both the intervention and control groups decreased their amount of physical activity.

A preintervention and postintervention study in an upstate New York county of the effects of a community-wide reminder, recall, and outreach system for childhood immunizations resulted in no statistically significant differences from 24-month-old white children in postintervention immunization rates for 24-month-old AA and Latino children, and no statistically significant difference between only Latino and white 12-month-old children in postintervention immunization rates. Up to 74% of the cohort, however, did not receive the intervention in some county regions, and the immunization rates were not adjusted for confounders.

METHODOLOGIC ISSUES

Failure to evaluate children separately from adults was the most common reason for exclusion of studies from the final database, accounting for 27 (22%) of the excluded studies. Another commonly encountered methodologic issue was the combination of all nonwhite children into 1 group, which occurred in 11 (9%) of the excluded studies. An additional 10 studies (8%) failed to provide a white comparison group. Among the 109 studies in the final database, 27 (22%) did not perform multivariable or stratified analyses to ensure that racial/ethnic disparities persisted after adjustment for socioeconomic status (SES) and other potential confounders.

IMPLICATIONS

Extensiveness and Pervasiveness of Disparities

A comprehensive review of the literature revealed that racial/ethnic disparities in children's health and health care are quite extensive, pervasive, and persistent. Disparities were noted across the spectrum of health and health care, including in mortality rates, access to care and use of services, prevention and population health, health status, adolescent health, chronic diseases, special health care needs, quality of care, and organ transplantation. In addition, the data indicate that racial/ethnic disparities are persisting or worsening over time, at least in the few areas for which data from secular-trend studies are available, such as overall mortality rates, elevated blood lead concentrations, and asthma prevalence, mortality, and hospitalizations.

Mortality and Chronic Disease

Although racial/ethnic disparities in adult mortality[21] and chronic disease[22] rates have received much attention, little attention has been paid to these issues in children (other than for infant mortality). Nevertheless, review of the literature identified disparities in mortality rates for all 4 major racial/ethnic groups of US children. The extent and diversity of these mortality-rate disparities are concerning: these disparities include substantially greater risks than for white children of all-cause mortality; death from drowning, from ALL, from congenital heart defects, and after congenital heart defect surgery; and an earlier median age at death for those with Down syndrome and congenital heart defects. Additional research is needed to determine whether other racial/ethnic disparities exist in childhood mortality rates, the causes of these disparities, and interventions that are effective in reducing or eliminating mortality-rate disparities.

Extensive childhood disparities were found for chronic diseases, including asthma, cancer, eye disorders, HIV/AIDS, kidney disease, mental health, special health care needs, and stroke. In particular, multiple studies have been conducted on disparities in asthma, mental health, and special health care needs. Nevertheless, many gaps exist in the literature, and further study is needed to determine the etiology of and effective interventions for disparities in childhood chronic diseases.

Disparities as a Quality Issue

It has been suggested that a useful approach to addressing racial/ethnic disparities in children's health care is to frame disparities as a quality-of-care issue.[23] This review of the literature identified multiple racial/ethnic disparities in the quality of children's health care, including inequalities in the quality of primary care, asthma care, cardiovascular surgery, mental health care, pneumonia hospitalizations, ophthalmologic care, orthopedic conditions, and care of children with end-stage renal disease. Additional study is warranted, not only of the etiology and pervasiveness of disparities in the quality of pediatric care, but also of interventions that would be effective in achieving quality improvement among racial/ethnic minority children.

Research Implications

In the course of reviewing the disparities literature, certain key methodologic and research issues were identified. Attention to these issues has the potential to advance the field and enhance the rigor of studies. A total of 48 studies were excluded from the database because they combined all minority children into a nebulous "nonwhite" category, failed to include a comparison group consisting of white children, or did not perform separate analyses with children disaggregated from adults.

Occasionally, there may be statistically legitimate reasons to not compare study findings for specific minority racial/ethnic groups with those of white children (such as when there truly are

small sample sizes for specific minority groups in the study population). The recurrent findings in the literature, however, of combining minority children into a "nonwhite group" and failure to collect data for specific, populous minority groups of children raise several key issues. It is critical that current and future pediatric research be relevant, meaningful, and generalizable for all children. The explosive growth in racial/ethnic diversity of US children makes it imperative that pediatric research funding not ignore specific questions or populations. In addition, as new interventions, practices, and technologies are evaluated, it is important to consider translational research on the application of these innovations to diverse populations and settings.

Almost one-quarter of the excluded studies did not use multivariable or stratified analyses to adjust for covariates that might confound disparities findings. For several domains, such as mental health, asthma, and vision disorders, there is an unresolved issue that warrants further investigation; it is unclear whether (1) a general quality issue exists for minority children of underdiagnosis and undertreatment of certain conditions, (2) there is a lower prevalence of these conditions in certain groups, (3) racial/ethnic differences occur in access or treatment preferences, or (4) some combination of these phenomena apply.

More disparities research is needed on API and AI/AN children, because a paucity of studies on these groups was identified. The few studies that examined relevant subgroups of racial/ethnic minority children identified noteworthy racial/ethnic disparities. More research is needed on childhood disparities among black subgroups (such as AAs versus Caribbean blacks versus recent African immigrants), Latinos (such as Mexican Americans, Puerto Ricans, and Cuban Americans), AIs/ANs (such as major tribal groups), and APIs (such as Chinese Americans versus Vietnamese versus Hmong). Our call for more studies on racial/ethnic subgroup disparities echoes a recommendation published 15 years ago by the AAP Task Force on Minority Children's Access to Pediatric Care that more attention be paid to the heterogeneity of API populations.[24]

Limitations

Certain limitations of this literature review should be noted. The literature search consisted of studies from 1950 through March 2007, so studies after March could not be included. Because the search strategies only identified published citations with "disparities" as a key word, studies that reported disparities or disparities interventions but did not use this key word would have been missed; in particular, research from earlier years before the "disparities" term enjoyed wider usage would have been overlooked. The focus was on racial/ethnic disparities, so studies that documented a lack of disparities were not reviewed. Only 21 studies, however, were excluded that found no significant differences according to race/ethnicity, equivalent to 9% of the database of full-print studies examined, and 17% of all exclusions.

Interventions to Reduce Disparities

This literature review identified only 2 studies that evaluated interventions to reduce racial/ethnic disparities in children's health and health care and that also compared the minority group to a white group, and none was a randomized, controlled trial. These findings suggest that there is a need for rigorous evaluations of interventions aimed at reducing childhood disparities, especially in light of the substantial number of studies identified that documented a wide variety of racial/ethnic disparities in children's health and health care.

Only articles that examined racial/ethnic disparities in the context of comparisons to white children were included in the literature review. For certain health outcomes for which racial/ethnic disparities are well documented, published studies may only have focused on disparities interventions limited to a single minority group. Because the literature-search inclusion criteria required comparison between a minority group and a white group, successful disparities-intervention studies limited to a single minority group were excluded, by necessity, from this technical report, such as recent randomized trials of interventions to insure uninsured Latino children and prevent HIV in AA girls.[25,26]

CONCLUSIONS

This technical report documents that racial/ethnic disparities in children's health and health care are extensive, pervasive, and persistent. Disparities were noted across the spectrum of health and health care, including in mortality rates, access to care and use of services, prevention and population health, health status, adolescent health, chronic diseases, special health care needs, quality of care, and organ transplantation. Methodologic flaws were identified in how such disparities are documented and analyzed. Without recognition of child health disparities as pervasive problems, sound methodologies to assess the magnitude of disparities, and rigorous evaluation of disparities interventions, the pediatric community will not be able to realize the vision of the AAP to attain optimal physical, men-

tal, and social health and well-being of all infants, children, adolescents, and young adults.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Environmental Health

Radiation Disasters and Children

ABSTRACT. The special medical needs of children make it essential that pediatricians be prepared for radiation disasters, including 1) the detonation of a nuclear weapon; 2) a nuclear power plant event that unleashes a radioactive cloud; and 3) the dispersal of radionuclides by conventional explosive or the crash of a transport vehicle. Any of these events could occur unintentionally or as an act of terrorism. Nuclear facilities (eg, power plants, fuel processing centers, and food irradiation facilities) are often located in highly populated areas, and as they age, the risk of mechanical failure increases. The short- and long-term consequences of a radiation disaster are significantly greater in children for several reasons. First, children have a disproportionately higher minute ventilation, leading to greater internal exposure to radioactive gases. Children have a significantly greater risk of developing cancer even when they are exposed to radiation in utero. Finally, children and the parents of young children are more likely than are adults to develop enduring psychologic injury after a radiation disaster. The pediatrician has a critical role in planning for radiation disasters. For example, potassium iodide is of proven value for thyroid protection but must be given before or soon after exposure to radioiodines, requiring its placement in homes, schools, and child care centers. Pediatricians should work with public health authorities to ensure that children receive full consideration in local planning for a radiation disaster.

ABBREVIATIONS. TMI, Three Mile Island; KI, potassium iodide; SI, International System of Units; CT, computed tomography (scan); NRC, Nuclear Regulatory Commission; FDA, Food and Drug Administration.

INTRODUCTION

Several large-scale radiation disasters have befallen children in the past, including the detonation of nuclear bombs in Hiroshima and Nagasaki, Japan; the nuclear power plant disaster in Chernobyl; and exposure to a cesium-127 source scavenged from an abandoned hospital in Brazil. In each case, postevent medical surveillance proved that children were disproportionately affected after radiation exposure.

In recent years, accidents at several nuclear power plants have proven such events can lead to the widespread discharge of radioactive materials into the environment. Additionally, acts of domestic terrorism involving chemical and biological weapons have recently occurred, raising fears about the intentional use of a radioactive device against a civilian population that includes children. Because of these threats, there is a need for pediatricians to become more informed about the issues that would occur in the case of a significant radiologic event.

HISTORY

Several historical events have shaped our understanding of the consequences of radiation disasters. The atomic bomb blasts in Hiroshima and Nagasaki in 1945 during World War II remain the most defining moments in the consequences of a nuclear exposure. The Avalon Project at Yale Law School[1] estimated that in Hiroshima, the bomb released power equal to 15 kilotons of trinitrotoluene (TNT), killing an estimated 66 000 and injuring 69 000 of the 255 000 exposed. The Nagasaki release, containing a 22-kiloton force, killed an estimated 39 000 among the 195 000 exposed. In 1954, fallout from nuclear weapons tests on Bikini Island fell on neighboring islands, producing significant health effects in children; of 32 Marshallese exposed to fallout before 20 years of age, 4 developed thyroid cancer and 1 developed leukemia.[2] This event led the American Academy of Pediatrics to establish the Committee on Radiation Hazards and Congenital Malformations, the predecessor to the Committee on Environmental Health.[2]

On March 28, 1979, a nuclear power plant, Three Mile Island (TMI), had a near "meltdown" (overheating of the fuel rods and a release of radiation) that produced negligible doses among people living nearby: a maximum of 0.001 Sv (100 mrem) and an average dose to the community of 0.00001 Sv (1 mrem).[3] The TMI accident brought into question the safety of nuclear power plants and the potential consequences of a power plant mishap.[4,5] Immediate administration of potassium iodide (KI) was recommended for those living near TMI, but it was not available. There were no biological effects of the exposure but significant psychologic sequelae occurred.[4,5]

In April 1986, a power plant in Chernobyl (also known as Chornobyl), Ukraine, had a mishap that produced a meltdown. The area around the reactor was heavily contaminated with plutonium, cesium, and radioactive iodine. An estimated 120 million Ci of radioactive material were released, contaminating

more than 21 000 km^2 of land, with the greatest areas of fallout occurring in Ukraine, Belarus, and the Russian Federation.[6,7] Approximately 135 000 people were permanently evacuated.[8] A total of almost 17 million people, including 2.5 million younger than 5 years of age, were exposed to excess radiation.[7] The first delayed effect, beginning 4 years after exposure, was the occurrence of a great excess of cases of thyroid cancers in children and adolescents, especially among those younger than 4 years of age at the time of the accident.[9] Seventeen years later, the area remains uninhabited because of persistent concerns about environmental contamination.

On September 13, 1987, in Goiania, Brazil, a lead canister containing 1400 Ci of radioactive cesium was left in a building when it was abandoned by radiotherapists. The canister was taken and opened by looters. Children played with the material inside, rubbing it on their bodies so they glowed in the dark.[10] An estimated 250 people were exposed, with some receiving radiation doses as high as 10 Sv (1000 rem); 4 died of acute radiation sickness.[11] Victims developed radiation-associated illnesses that ranged from significant skin injury (radiation burns) to acute radiation sickness to long-term health problems. Thousands of people rushed to emergency departments because of fear of contamination.[10] Mitigation efforts required the removal of 6000 tons of clothing, furniture, dirt, and other materials.[12]

SOURCES OF POTENTIAL RADIATION EXPOSURE

Humans are exposed to an estimated average of 0.0036 Sv (360 mrem) of radiation annually. This radiation exposure comes from a number of natural and manmade sources, including cosmic radiation and radon, cigarette smoke, medical devices, home appliances, and pharmaceutical agents. Air flight is associated with cosmic radiation exposure; a flight from New York to London results in an estimated 0.00005 to 0.0001 Sv (5–10 mrem) of radiation exposure. Radiation exposure from medical radiography can range from 0.00005 to 0.0001 Sv (5–10 mrem) for a chest radiograph to as much as 0.05 Sv (5000 mrem) for computed tomography (CT).[13]

Radiologic threats can be unintentional or intentional. Unintentional threats include power plant disasters such as Chernobyl and TMI. Intentional threats are associated with military conflict or terrorism. Three major types of radiation disaster threats are 1) the detonation of a nuclear weapon; 2) damage of a facility that contains nuclear material (eg, a nuclear waste reprocessing facility, food irradiation plant, or nuclear power plant); and 3) dispersal of nuclear material, either by detonation of a conventional explosive (a radioactive dispersal device or "dirty bomb") or the release of nuclear materials in transit. Any of these occurrences could result from human error or terrorist activity.

Terrorist use of a radioactive dispersal device is considered the most likely present-day threat.[14] Radioactive dispersal devices are designed to use radioactive material obtained from relatively accessible sources, such as university research laboratories or hospital radiation therapy centers.[14,15] Although they would not produce significant damage to nearby structures, these devices could render an area uninhabitable; as little as 1 Ci of radioactive material can be dispersed several blocks, forcing evacuation and closure of that area.

In the United States, there are 103 active nuclear reactors in 66 power plants across 31 states.[16] Nuclear power plants pose several distinct radiation risks. The most important of these risks is the potential for release of radioiodines into the environment. Additionally, spent reactor fuel rods, which are typically retained by the nuclear power plant for many years, present a radiation hazard that is distinct from an incident that releases a radioactive cloud.

Since the 1990s, the possibility of a terrorist group creating a nuclear weapon has become more possible.[17] A low-yield detonation device (<10 kilotons) would require only a small amount of plutonium or highly enriched uranium, both of which are thought to be obtainable in the current era.[10]

RADIATION CHARACTERISTICS AND TERMINOLOGY

Unstable atoms, in an effort to achieve stability, emit energy in the form of ionizing radiation. Ionizing radiation is a type of high-frequency energy that has adverse biologic effects, including damage to DNA, production of free radicals, disruption of chemical bonds, and production of new macromolecules.[17,18] Ionizing radiation can be particulate and electromagnetic. Radionuclides, elements that emit ionizing radiation, exist naturally (eg, uranium) or can be manmade (plutonium).

There are 5 types of ionizing radiation: α-particles, β-particles, γ-rays, x-rays, and neutrons.[14] Each has different characteristics and behaviors. α-Particles consist of 2 protons and 2 neutrons; they are extremely heavy with a limited ability to penetrate clothing or skin. However, when inhaled or ingested, they can penetrate epithelial tissue layers to a 50-μm depth, sufficient to produce cellular injury (explaining the association between the α-emissions of inhaled radon and development of lung cancer). β-Particles, consisting of electrons only, have greater penetrance than do α-particles. They can produce internal injury when inhaled or ingested as well as skin injury. Unlike α-particles, which originate primarily from natural sources, β-particles most commonly come from radionuclides used in medicine (eg, xenon) or created as by-products of nuclear reactors (eg, radioactive iodines).[19] Neutrons are a powerful but uncommon type of radiation, emitted only after a nuclear detonation. Neutrons are highly destructive, producing 10 times more tissue damage than γ-rays produce.[15]

γ-Rays and x-rays are part of the electromagnetic spectrum. Unlike α- and β-particles, these rays have no mass. γ-Rays are emitted from radioactive materials, including cesium and cobalt, or after a nuclear detonation. Having high energy and no mass, γ-rays are highly penetrant. X-rays, which are unlikely to be encountered in a radiation disaster, transfer energy along shorter paths with little scatter, whereas neu-

trons have greater mass and transfer energy along longer paths.

The units of measure of energy absorbed from x-rays and γ-rays are the rad (radiation absorbed dose) and the rem (roentgen equivalent man—a weighting or quality factor). The rem is based on greater relative biologic effectiveness (RBE) of doses from particulate radiation, such as neutrons. Thus, (rem) = (rad) × RBE. The rad and rem have been replaced by Gray (1 Gy = 100 rad) and Sievert (1 Sv = 100 rem), respectively, in accordance with the International System of Units (SI). The unit of activity for radiation emission of a radionuclide is Ci (curie) or, in SI, the Becquerel (Bq). These units and other terminology are summarized in the Appendix. The radionuclides and radioactive emissions associated with a radiation disaster are listed in Table 1.

CONSEQUENCES OF A RADIATION DISASTER

Radiation Biology

Radiation exposure can be divided into external, internal, whole body, or partial body. Internal irradiation can occur after inhalation of a radioactive gas or ingestion of contaminated food (including produce, grains, and milk from goats or cows that have been grazing on contaminated fields). Radiation effects can be direct, interacting with target tissues; or indirect, producing free radicals or other harmful molecules. The cellular effects of radiation are highly variable, correlating directly with the cell's typical rate of division and inversely with the extent of cell differentiation.[14] The sensitivity of tissues to radiation, from most to least, is: lymphoid > gastrointestinal > reproductive > dermal > bone marrow > nervous system. Ionizing radiation produces chromosome breaks in a variety of somatic cells; these breaks can persist for decades after exposure and may account for increased rates of cancer after irradiation. Other significant modulators of cellular injury after radiation exposure include dose, type of radiation, and age of the exposed person.[17]

Health Effects

Health effects after a radiation exposure will depend greatly on the circumstances surrounding the release. For example, after detonation of a nuclear weapon or radioactive dispersal device, there may be thermal or blast injury in addition to radiation exposure. In contrast, a nuclear power plant disaster can produce a radioactive cloud with no associated blast.

Specific health outcomes after radiation exposure are typically divided into short-term and long-term; short-term effects appear within days to weeks after exposure, and long-term effects appear months to years later. Short-term effects are dependent on the degree of radiation exposure and the tissue irradiated. Nausea and vomiting appear after exposures as little as 0.75 to 1.0 Gy (75–100 rad); a hematopoietic syndrome (severe lymphoid and bone marrow suppression) typically appears after 3.0 to 6.0 Gy (300–600 rad) exposures and may cause death in 8 to 50 days. Postirradiation lymphocyte counts correlate strongly with dose received; if the lymphocyte count decreases by more than 50% within 24 to 48 hours, a moderate radiation exposure or worse has occurred. Bone marrow and lymphoid depression lead to anemia and an increased risk of infection; the decrease in platelets can lead to generalized bleeding.[15] The mean lethal dose ($LD_{50/60}$), that is, the radiation dose for which 50% of an exposed population would be expected to die within 60 days, is 4.0 Gy (400 rads). Long-term effects (described below), include psychologic injury and increased cancer risk.

VULNERABILITIES IN CHILDREN

Children have a number of vulnerabilities that place them at greater risk of harm after radiation exposure. Because they have a relatively greater minute ventilation compared with adults, children are likely to have greater exposure to radioactive gases (eg, those emitted from a nuclear power plant disaster). Nuclear fallout quickly settles to the ground, resulting in a higher concentration of radioactive material in the space where children most commonly live and breathe. Studies of airborne pollutants are needed to test the long-held belief that the short stature of children brings them into greater contact than adults with fallout as it settles to earth. Radioactive iodine is transmitted to human breast milk, contaminating this valuable source of nutrition to infants. Cow milk, a staple in the diet of most

TABLE 1. Radionuclides Produced After a Radiation Disaster

Element	Symbol	Source	Radiation	Respiratory Absorption	Gastrointestinal Absorption	Primary Toxicity	Treatment
Americium	^{241}Am	NWD	Alpha	75%	Minimal	Skeletal, liver deposition, bone marrow suppression	DTPA, EDTA
Cesium	^{137}Ce	MF	Beta, gamma	Complete	Complete	Whole body irradiation	Prussian blue
Cobalt	^{60}Co	MF, FI	Beta, gamma	High	<5%	Whole body irradiation	Supportive
Iodine*	^{131}I	NWD, NPP	Beta, gamma	High	High	Thyroid ablation, cancer	Potassium iodide
Phosphorous	^{32}P	MF	Beta	High	High	Rapidly dividing cells	Aluminum hydroxide antacids
Plutonium	$^{238,239}Pu$	NW, NWD	Alpha, gamma	High	Minimal	Lung, bone, liver	DTPA, EDTA
Strontium	^{90}Sr	NWD	Beta, gamma	Limited	Moderate	Bone-follows calcium	Supportive

Adapted from Jarrett DG. *Medical Management of Radiological Casualties*. Bethesda, MD: Armed Forces Radiobiology Research Institute; 1999.

NWD indicates nuclear weapon detonation; DTPA, diethylenetriaminepentaacetic acid; EDTA, edetic acid (ethylene-dinitrillo tetraacetic acid); MF, medical and research facilities; FI, food irradiation facilities; NW, nuclear reactor waste sties; NPP, nuclear power plants.

* There are numerous radioiodines, including ^{132}I. However, ^{131}I is the most prevalent and clinically important radioisotope.

children, can also be quickly contaminated if radioactive material settles onto grazing areas.

In utero exposure to radiation also has important clinical effects, depending on the dose and form of the radiation; transmission of radionuclides across the placenta may occur, depending on the agent. After exposures to external radiation, fetal doses of 0.60 Sv (60 rem) have produced small head size and mental retardation (in Japanese atomic bomb survivors), when exposures occurred between 8 and 25 weeks of gestational age.[2] A dose-response effect was found in the occurrence of small head size without mental retardation, which occurred in fetuses exposed to ≥0.2 Sv (≥20 rem) between weeks 4 and 17 of gestation.

Radiation-induced cancers occur more often in children than in adults exposed to the same dose. Finally, children also have mental health vulnerabilities after any type of disaster, with a greater risk of long-term behavioral disturbances.[20–22]

MANAGEMENT

A radiation disaster would be followed by a massive, integrated federal, state, and local public health response. Relevant consequence management agencies at a federal level would include the US Department of Homeland Security, the Environmental Protection Agency, the Federal Emergency Management Agency, the Nuclear Regulatory Commission (NRC), the Department of Energy, and the Department of Justice. State and local departments of health, working closely with federal agencies, would develop the appropriate local response, for example, initiation of the emergency broadcast system, the implementation of disaster or evacuation plans, recommendations for evacuation versus sheltering, instructions to begin the administration of KI, and the creation of local shelters for displaced families.

Evacuation and Sheltering

Evacuation is the most important action after a radiation release has occurred, particularly after a radioactive cloud release in which there is time to escape exposure. However, in previous power plant mishaps, the radioactive cloud dispersed in minutes, making immediate evacuation impossible. Moreover, given the magnitude of the task of evacuating an entire population, which could include more than 500 000 residents (on the basis of the location of existing plants), evacuation plans may fail. Evacuation can be extremely chaotic, leading to motor vehicle crashes and other injuries, so caution should be exercised. Relocation may be temporary or long-term, depending on the environmental persistence of radioactivity. The decision to recommend rehabitation versus long-term relocation is made by federal, state, and local agencies on the basis of projected radiation dose levels, the environmental persistence of the radionuclide, physical damage to roads and buildings, and other factors that could affect the safety of the population.[23] If evacuation is impossible, a safe place should be sought within the home or another building. For example, the shielding factor (the ratio of dose received inside the structure to the dose which would be received if the structure were not in place[23]) for γ-rays after a radioactive cloud release is 0.9 for a wooden frame structure, 0.6 for a home basement, 0.4 for the basement of a masonry home, and 0.2 for a large office or industrial building.[23] The duration of sheltering required will depend on the extent of environmental contamination. Families should follow the instructions provided through the local emergency broadcasting system.

Treatment

The management of the child who has sustained significant radiation exposure is dependent on the type and degree of exposure as well as the presence of concomitant injuries.[14] Principles of disaster management, including containment, decontamination, prehospital care, and field triage, should be fully employed.[14] The first phase of managing pediatric radiation victims will be to determine if topical decontamination is warranted. Removal of clothing is responsible for more than 90% of the effectiveness of decontamination after a chemical or radiation exposure.[19] With the implementation of disaster protocols, emergency medical services will establish "hot," "warm," and "cold" zones; contaminated victims will be decontaminated in the field and then transported to a health care facility. However, because disaster victims may come to health care facilities by private vehicle, potentially bringing radioactive materials with them, hospitals and urgent care facilities should develop their own plans for management of a contaminated victim. The hospital radiation safety officer is a vital consultant in the management of patients; radiation detection devices should be placed at the site of care. Additionally, a site for the placement of contaminated clothing should be established. The skin should be washed with warm water; measures should be taken to prevent hypothermia. Children with radioactive material embedded in skin should undergo careful débridement that minimizes further tissue injury. Care to skin burns should be minimal; irrigation alone is recommended.[15,23] Irrigation solutions should be collected in containment vessels and disposed of properly.

Children who have no external contamination (eg, those who have inhaled radioactive material) can be treated according to routine protocols. However, biologic fluids, including saliva, blood, urine, and stool, may be contaminated and require special handling precautions.

Initial medical management includes careful assessment of airway, breathing, and circulation, particularly when there is the potential for blast or thermal injury.[14] Surgical intervention, if warranted, should be performed as soon as possible, ideally within 48 hours of irradiation before wound healing and immunity become impaired.[15]

Specific pharmacotherapy for victims of significant radiation exposure is limited; the decision to use these agents should be made after consulting with an authority on clinical management of radiation victims (eg, a consultant from the NRC or a radiation therapist). KI administration is the cornerstone of

preventive treatment after known or suspected exposure to radioactive iodine (radioiodines are common by-products of nuclear power plant activities and, therefore, likely to be emitted after a power plant incident).[14] Other drugs have been suggested[14] but have not been proven effective or without serious adverse effects, especially in children.

KI is the same compound used, in smaller quantities, to iodize table salt. When ingested immediately before, during, or shortly after exposure to radioiodines, KI "floods" the thyroid, blocking uptake of inhaled or ingested radioiodines. When taken promptly after a radioiodine release and at proper dose, KI is effective in preventing radiation-induced thyroid effects.[9] The Food and Drug Administration (FDA) currently recommends that KI be administered only after certain levels of radioiodine exposure, on the basis of risk-benefit analyses derived from the Chernobyl disaster, in which more than 18 million children and adults in Poland (immediately adjacent to Ukraine and Belarus) received at least 1 dose of KI.[9,24] The FDA recommends adhering to the guidance about the threshold for intervention and appropriate dosing but also recognizes that ". . . the exigencies of any particular emergency situation may mandate deviations from those recommendations. With that in mind, it should be understood that as a general rule, the risks of KI are far outweighed by the benefits with regard to prevention of thyroid cancer in susceptible individuals."[25]

Children and pregnant or lactating women should begin taking KI if the predicted thyroid exposure, as projected by government sources, is 0.05 Gy (5 rad) or more (Table 2).[9] Short-term adverse effects associated with KI use in Poland were generally mild, consisting of gastrointestinal tract distress or rash.

KI administration to newborns has been associated with evidence of transient decreases in thyroxine along with increases in thyroid-stimulating hormone. The FDA has therefore recommended that newborns who receive KI have their thyroid function monitored. On the basis of the rate of thyroid hormone synthesis in the newborn, monitoring of thyroid function by measurement of thyroid-stimulating hormone activity 2 to 4 weeks later should be sufficient after a single KI dose; longer periods would be needed for newborns who receive more than 1 dose of KI. The FDA has recommended KI for pregnant women for self-protection and for the protection of the fetus.[9] However, repeated KI dosing by pregnant women could produce neonatal hypothyroidism. The risks versus benefits of continued KI dosing by pregnant women depend on the probability of continued radioiodine exposure.

Radioiodine and KI are secreted into breast milk. For lactating women and their infants, expert consultants have firmly recommended that infants of exposed mothers should not breastfeed because of the risk to exposed infants of additional exposure to radioiodine from breast milk. Exposed women should temporarily cease breastfeeding unless there are no alternatives.[24] (This is contrary to FDA advice suggesting that infants whose mothers receive KI after radioiodine exposure may breastfeed.[9])

The FDA has recommended against repeated dosing of KI in pregnant women and neonates unless other protective measures (ie, evacuation, sheltering, and control of the food supply) are unavailable.[25] Young infants requiring repeat doses of KI should have their thyroid function closely monitored, and therapy with thyroid hormone should be instituted in cases in which hypothyroidism develops.[9] KI should not be given to individuals with known iodine sensitivity or to those with dermatitis herpetiformis or hypocomplementemic vasculitis (both rare conditions associated with an increased risk of iodine hypersensitivity). KI should be used with caution in individuals with thyroid disease (such as multinodular goiter, Graves disease, and autoimmune thyroiditis), especially if dosing extends beyond a few days.[25] Such individuals should have monitoring of thyroid function.

KI is currently made as a 130-mg and a 65-mg tablet. The tablet can be placed in any liquid and administered in an appropriate volume. Super saturated potassium iodide (SSKI) drops are available and can be administered if necessary; however, at their concentration of 1000 mg/mL, accurate dose titration for children would be difficult. The FDA has also released recent guidance for home preparation of KI for infants in children[26,27] (Tables 3 and 4). The FDA statement emphasizes the need to place KI in a tasty solution, because it is very salty; raspberry syrup best disguises the taste of KI. KI mixed with low-fat chocolate milk, orange juice, or flat soda (for example, cola) has an acceptable taste. Low-fat white milk and water do not hide the salty taste of KI.[26,27]

The protective effects of a dose of KI last approximately 24 hours. The need for more than a single dose will depend on several factors, including the ability to quickly evacuate the area of radiation contamination. If evacuation is not possible, KI should be given for the persistent presence of radioiodines (which have half-lives ranging from 5 hours to 7 days). Recommendations for continued dosing should be made by the Environmental Protection

TABLE 2. Guidelines for KI Administration*[9,24]

Patient	Exposure, Gy (rad)	KI Dose (mg)
>40 y of age	>5 (500)	130
18 through 40 y of age	≥0.1 (10)	130
Adolescents 12 through 17 y of age†	≥0.05 (5)	65
Children 4 through 11 y of age	≥0.05 (5)	65
Children 1 mo through 3 y of age‡	≥0.05 (5)	32
Birth through 1 mo of age	≥0.05 (5)	16
Pregnant or lactating women	≥0.05 (5)	130

* KI is useful for exposure to a radioiodine only. KI is given once only to pregnant women and neonates unless other protective measures (evacuation, sheltering and control of the food supply) are unavailable.
Repeat dosing should be on the advice of public health authorities.
† Adolescents weighing more than 70 kg should receive the adult dose (130 mg).
‡ KI from tablets or as a freshly saturated solution may be diluted in water and mixed with milk, formula, juice, soda, or syrup. Raspberry syrup disguises the taste of KI the best. KI mixed with low-fat chocolate milk, orange juice, or flat soda (eg, cola) have an acceptable taste. Low-fat white milk and water did not hide the salty taste of KI.

TABLE 3. Guidelines for Home Preparation of KI Solution Using 130-mg Tablet[26]

- Put 1 130-mg KI tablet in a small bowl and grind into a fine powder with the back of a spoon. The powder should not have any large pieces.
- Add 4 tsp (20 mL) of water to the KI powder. Use a spoon to mix them together until the potassium iodide powder is dissolved in the water.
- Add 4 tsp (20 mL) of milk, juice, soda, or syrup (eg, raspberry) to the KI/water mixture. The resulting mixture is 16.25 mg of KI per teaspoon (5 mL)
- Age-based dosing guidelines:
  - Newborn through 1 mo of age: 1 tsp
  - 1 month through 3 y of age: 2 tsp
  - 4 years through 17 y of age: 4 tsp (if child weighs more than 70 kg, give 1 130-mg tablet)

How already prepared potassium iodide mixture should be stored:

Potassium iodide mixed with any of the recommended drinks will keep for up to 7 days in the refrigerator.

The FDA recommends that the potassium iodide drink mixtures be prepared fresh weekly; unused portions should be discarded.

TABLE 4. Guidelines for Home Preparation of KI Solution Using 65-mg Tablet[27]

- Put 1 65-mg KI tablet in a small bowl and grind into a fine powder with the back of a spoon. The powder should not have any large pieces.
- Add 4 tsp (20 mL) of water to the KI powder. Use a spoon to mix them together until the potassium iodide powder is dissolved in the water.
- Add 4 tsp (20 mL) of milk, juice, soda, or syrup (eg, raspberry) to the KI/water mixture. The resulting mixture is 8.125 mg of KI per teaspoon (5 mL)
- Age-based dosing guidelines:
  - Newborn through 1 mo of age: 2 tsp
  - 1 mo through 3 y of age: 4 tsp
  - 4 y through 17 y of age: 8 tsp or 1 65-mg tablet (if child weighs more than 70 kg, give 2 65-mg tablets)

How already prepared potassium iodide mixture should be stored:

Potassium iodide mixed with any of the recommended drinks will keep for up to 7 days in the refrigerator.

The FDA recommends that the potassium iodide drink mixtures be prepared fresh weekly; unused portions should be discarded.

Agency, the NRC, or other federal or state agencies that will be conducting environmental assessment. Radioactive dispersal devices generally would not contain radioiodines, so administering KI after detonation of a radioactive dispersal device would be inappropriate.

Other aspects of clinical care after radiation exposure are listed in Table 5 and include serial complete blood cell counts with close monitoring of absolute lymphocyte count, administration of antiemetics as needed, rigorous infection control, and aggressive treatment of infectious illnesses. Management of infection is the mainstay of therapy, because victims have significant immunosuppression; neutropenia and lymphopenia may last for several weeks.[15,19] Should a severe radiation exposure occur, other interventions to consider (although sufficient data are currently lacking) include administration of hematopoietic growth factors, (eg, granulocyte colony-stimulating factor) and HLA antigen typing for victims in whom the need for bone marrow transplantation is anticipated.[17] Available data suggest that granulocyte- and granulocyte-macrophage colony-stimulating factors should be administered within 24 to 72 hours of radiation exposure for optimal efficacy.[23]

Management of the psychologic harm to children after a radiation disaster requires that pediatricians provide advice to parents and supportive counseling to children and families.[28–31] Pediatricians should screen children closely for the presence of adjustment reactions and stress responses after a disaster has occurred. They should additionally assist parents in identifying the early signs of adjustment reactions, particularly in toddlers and other children who may have difficulty verbalizing their feelings. Finally, children should be referred for mental health services in a timely manner when behavioral disturbances are found.[32]

Other specific clinical recommendations are available from the Oak Ridge Institute for Science and Education,[18] from the Armed Forces Radiobiology Research Institute,[19] and in recent clinical reviews.[14,17]

LATE EFFECTS

Cancer

Among long-term injuries to children, carcinogenesis is most important. Studies suggest that radiation exposure during childhood is associated with a greater risk of cancer than is exposure at other ages.[4,13] For example, the risk of breast cancer is increased in women who are exposed to high levels of radiation as children, especially if the radiation exposure occurs before the pubertal development of breast tissue.[13,33–35] A peak in childhood leukemia occurred 5 to 6 years after the detonation of the nuclear bomb in Hiroshima and Nagasaki. There were 46 cases among those who were then younger

TABLE 5. Diagnostic Measures to Consider in Victims of Radiation Exposure

Test	Timing
Nasal swab to identify inhalation*	Immediately
Skin swabs to identify external contamination*	Immediately and at frequent intervals
Urine and stool analysis to identify internal contamination*	Immediately and at 24 h
Complete blood cell and platelet counts	Daily for 1 wk
Absolute lymphocyte count	Every 12 h for 3 d
HLA antigen subtyping	Before lymphocyte count decreases
Lymphocyte cytogenetics	Before lymphocyte count decreases

* A radiation safety officer or other authority should be consulted in all aspects of management.
Adapted from Jarrett DG. *Medical Management of Radiological Casualties.* Bethesda, MD: Armed Forces Radiobiology Research Institute; 1999

than 19 years of age (16 acute lymphocytic, 18 acute myelogenous, 10 chronic myelogenous, and 2 other). The excess cases diminished 16 years after exposure.[36]

Radiation-induced thyroid cancer in children has been well characterized. In the Chernobyl disaster, a cloud of radioactive elements including radioiodines was released. In the area of fallout in the Ukraine, 577 children and adolescents developed thyroid cancer between 1991 and 1997 (compared with 59 cases of thyroid cancer in the 5 years preceding the disaster). The number was greatest among those who were exposed at 5 years of age or younger. The latency period was short and the cancer was aggressive. In most cases, the radiation dose was 0.50 Gy or more.[37] In the United States, published data suggest that elevated rates of thyroid cancers and adenomas occurred among a cohort of children exposed to fallout from nuclear weapons tests in Nevada between 1951 and 1958.[38] Benign thyroid neoplasms are more common than thyroid cancer after radiation exposure; these can produce morbidity because of the possible need for surgery and lifelong medical follow-up.

Radiation-induced tumors can be benign or malignant and are histologically indistinguishable from the same cancers in the general population. The latency period for carcinogenesis after radiation exposure is typically 2 to 3 years for leukemia and 10 or more years for thyroid cancer and other solid tumors.[2,14,23] The latency period for thyroid cancer in children exposed to radioiodines after the Chernobyl disaster was shorter; an increase was observed beginning 4 years after the event.[9]

Psychologic Effects

One of the most common and disabling consequences of radiation exposure is the development of chronic fear and anxiety. More than 6 years after Chernobyl, the large populations exposed in the 2 areas of fallout had a high prevalence of distress and behavioral disorders; 35.8% of respondents had a psychiatric diagnosis as defined by the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition*.[39] A significantly higher rate was found among mothers with children younger than 18 years of age.[8,23,40,41] In an 11-year follow-up study of mothers and their young children, there continued to be significant psychosocial morbidity, with significantly higher scores on measures of social isolation and negative life events.[42] Similarly, studies in Pennsylvania after the TMI incident found long-term behavioral disturbances in mothers of young children.[43,44] Local inhabitants performed worse on behavioral tasks, had a greater incidence of psychosomatic symptoms, and had higher concentrations of neuroendocrine stress hormones than did controls.[11] The Kemeny Commission, convened to investigate the consequences of the TMI disaster, concluded that mental stress would be the main effect of a nuclear reactor disaster.[11,45]

Studies of the Goiania disaster also demonstrated that stress and behavioral reactions can follow perceived exposure; those living in the area of radiation exposure and those unexposed had behavioral and cardiovascular-neuroendocrine effects that persisted for more than 3 years.[23] Emotional effects are even greater for those who witness injured or mortally wounded victims after a radiation disaster.[11] These behavioral consequences can disrupt interpersonal relationships, attitude, and social outlook, causing or contributing to chronic medical conditions including hypertension.[23] Psychobehavioral disturbances are further magnified when disasters are accompanied by the loss of a family home or lack of timely information.[8,46] Finally, disaster workers and health care professionals can be incapacitated by the emotional distress of a radiation disaster.[23] This distress has multiple origins, including the inability to enter contaminated areas to rescue victims and the difficulty in wearing personal protective equipment.

PREPARING FOR A RADIATION DISASTER

Clinical Issues

Local planning for a possible radiation disaster focuses on the creation of disaster management protocols, education of first responders and health care professionals, and acquisition of appropriate equipment and supplies. First responders should receive training in radiation consequence management, because they may unknowingly enter a radioactive area. Emergency physicians as well as pediatricians and other primary care physicians are potential medical responders to a radiation event and should also obtain training in this area.[18] Issues including emergency department configuration for the management of radiation-exposed individuals should be addressed.[18] Recent data indicate that most US hospitals remain unprepared for a nuclear event.[47]

In November 2001, the FDA issued updated guidance about KI use after exposure to radioactive iodine; KI is ineffective for other radionuclide exposures. According to these guidelines, the benefits of KI exceed its risks when a certain level of exposure has occurred (Table 2). KI efficacy is greatest when administered immediately before the exposure, at which time it can prevent 100% of radioiodine from reaching the thyroid. However, the efficacy of KI is 80%, 40%, and 7% when administered 2, 8, and 24 hours after exposure, respectively[48]; these rates are markedly lower in children who are iodine-deficient. KI appears to have little clinical value when administered 12 hours or more after exposure.

Currently, the NRC recommends that state and local governments consider providing KI to all citizens living within 10 miles of a nuclear power plant as a supplement to plans for evacuation and sheltering.[49] In December 2001, the NRC wrote to the 31 states that had or were located near 10 miles of a nuclear power plant, offering 2 KI pills for every person living within 10 miles of a plant.[50] If states and local governments adopt the plan to use KI, communities should consider storage of KI in schools and child care centers. Additionally, strategies that permit the rapid administration to large numbers of children (eg, an entire elementary school) should be developed. The appropriateness of KI distribution to all US families remains controversial.

Universal prescription of KI has not been recommended by the NRC or FDA because the risks of radioiodine exposure exist only in certain regions and because of the risk of inappropriate use. However, given its limitless shelf-life, low incidence of adverse effects,[9,24] and need for rapid administration, universal access should be considered. KI is available without a prescription at some pharmacies but is not yet widely available. KI may be purchased through the Internet; however, families should be cautioned against using the medication before consulting with authorities.[9] In April 2002, the FDA listed 2 products, Thyro-Block (MedPointe Inc, Somerset, NJ), and IOSAT (Anbex Inc, Palm Harbor, FL), which are approved for over-the-counter use as a thyroid-blocking agent in radiation emergencies.[25] In November 2002, the *Medical Letter of Drugs and Therapeutics* listed these and additionally listed ThyroSafe (Recip US, Honey Brook, PA) as an FDA-approved product.[51] IOSAT can be obtained at 866-283-3986 and through the Internet at www.nukepills.com; Thyro-Block can be obtained at 800-804-4147 and at www.nitro-pak.com; and Thyro-Safe can be obtained at 610-942-8972 and at www.thyrosafe.com.[51] KI also can be ordered from Anbex Inc at 727-784-3483 and at www.anbex.com.

Communities near a nuclear power plant should have access to KI as an adjunct to evacuation and sheltering. It is prudent for parents living within 10 miles of a nuclear reactor to keep KI in their homes. In addition, schools and child care centers located within a 10 mile radius of a nuclear power plant should have immediate access to KI. It is unclear, however, whether people within a larger radius should stockpile the drug. Although current recommendations call for those within a 10-mile radius to have access to KI, there have been recent concerns that a nuclear power plant mishap could discharge a radioactive cloud with far greater reach. In the Chernobyl disaster, changes in wind direction and rainfall resulted in an unevenly distributed deposition of radionuclides. The 3 most highly contaminated areas were the 20-mile zone surrounding the reactor; the Bryansk, Russia area and Gomel and Mogilev regions of Belarus (120 miles north-northeast of the reactor); and the Kaluga-Tula-Orel area of Russia (300 miles northeast of the reactor).[52]

As a result of these concerns, some have suggested that all people living within a 50-mile radius of a nuclear power plant should stockpile KI.[50] There have also been proposals for the stockpiling of KI by all those living within a 200-mile radius of a nuclear plant.[50] Because rapid and complete evacuation of a region is dependent on population density, a more cogent approach might be to vary the recommended KI distribution radius by population density. In population-dense regions, a 50-mile radius could be used, and areas with a lower population could adhere to the 10-mile radius recommendation.

The establishment of nuclear disaster response teams is also a part of community planning. Such teams should include mental health professionals who are trained to respond to the emotional and behavioral needs of children after a radiation event. Because children with psychologic trauma may be unable to verbalize their feelings, parents and pediatricians should be attentive to subtle signs of stress, anxiety, or depression.

Preparatory training exercises are also recommended. To date, involvement of pediatricians and mental health professionals in mock radiation disasters has been minimal. However, without these participants, mock disasters are likely to make unrealistic assumptions about the behavior of all victims, including children.[20] The inclusion of pediatricians and mental health specialists in planning will provide the opportunity to evaluate, improve, and enhance the response.

Public Health Actions

States and local governments have begun to develop strategies to protect their local population after a radiation release.[53] These include the establishment of threshold radiation concentrations that would require evacuation and educational campaigns for the public. All residents in at-risk areas should receive educational information and detailed emergency response plans.[53] Special plans should be made for children with disabilities.

Local hospitals also have a key role in the preparation for a radiation disaster. Policies of the Joint Commission on Accreditation of Healthcare Organizations require that health care facilities develop disaster management guidelines and that these guidelines be subject to twice-yearly drills. Because radiation events represent a unique catastrophe, hospitals should provide detailed guidance. Pediatricians may have the role of assisting hospitals in the development of plans for treating pediatric victims.

Schools and child care facilities should also be included in response plans, particularly if they are located within 10 miles of a nuclear power plant. School evacuation plans should be created and practiced. Many school districts have already been successful in creating algorithms for evacuation of children and their rapid reunification with parents.[54] School plans should consider the designation of an out-of-state relative or friend as a "family contact," because during a disaster, it is often easier to call long-distance than locally to find a family member. As with planning for all disasters, medical directives (eg, health care proxy) should be considered in the event the parent of an ill or injured child cannot be immediately contacted. Schools should have written plans that define locations within the school building or in nearby structures that would afford the best protection from a radiation cloud. School-based crisis-management teams that manage other events associated with psychologic trauma should be trained to respond to the consequences of a radiation disaster.

PREVENTION

Radioactive materials are used throughout the country, particularly in research and medical treatment. These radioisotopes are subject to theft or sab-

otage. For example, in 1996, a radiographer disappeared for approximately 2 weeks with a cache of radioactive iridium; in the same year, 2 radioactive cobalt sources were stolen from an abandoned industrial facility.[10] Many other confiscations of radioactive material have occurred.[55] These cases illustrate the ease with which radionuclides can be stolen and then used for the creation of a radioactive dispersal device. Stricter regulation and heightened surveillance of all high-dose radioactive materials is necessary to prevent such events from occurring.

The safety and vulnerability of nuclear power plants to terrorism has been questioned,[55,56] particularly since the events of September 11, 2001, when fuel-filled commercial airplanes were used as weapons.[14,57] Several acts of nuclear power plant sabotage have reportedly occurred in the past.[58] In addition to the risks associated with terrorist activity, the aging of US nuclear reactors has led to beliefs that a mishap is inevitable.[59] Concerned scientists and environmental advocates have long argued that nuclear power plants carry a risk of harm too great to justify their continued existence; calls for the shutdown of all US power plants have been building in recent years.[60] Currently, however, more than 20% of US electrical power is provided by nuclear power.[61] All sources of electrical energy have unwanted consequences or are currently unfeasible in terms of economic cost. Fossil fuel combustion releases carbon dioxide and other greenhouse gases as well as mercury, arsenic, and other pollutants; these emissions are associated with asthma, cancer, cardiovascular disease, and other chronic illnesses. Hydroelectric, solar, and wind energy, while clearly preferred, all have significant use limitations.[62] Until safer, sustainable sources of energy are available and with the need to decrease the use of fossil fuels, the immediate closure of existing nuclear plants may not be prudent.[62]

However, many have argued that future nuclear power plants should not be placed near heavily populated areas, and existing plants in densely populated regions should be decommissioned as quickly as possible. Additionally, the amount of nuclear wastes continues to grow; most are being stored in vulnerable, above-ground sites. Plans to create a large underground nuclear waste storage facility are nearly complete.[63] The proposed facility will house more than 77 000 tons of radioactive waste, delivered via an estimated 108 000 train and truck shipments over a 30-year period.[64] These plans, if implemented, will require intense security from terrorism, protection from crashes or other vehicular mishaps, and careful consideration of the potential for and effects of earthquakes in the vicinity.[65]

Through their daily practice, pediatricians can participate in the prevention of adverse effects of ionizing radiation. Radiation damage is incompletely repaired and adds throughout life.[66] Exposures from CT scans are high, compared with those from radiography, as noted in a joint statement of the Society for Pediatric Radiology and the National Cancer Institute.[67] The CT-scan dose to the brain is up to 600 times the dose to the chest from an anterior-posterior (AP) and lateral X-ray.[67] Children not only have greater susceptibility to radiogenic cancer[68] but also have longer life expectancies compared with adults, during which the latent period for cancer can be exceeded. The margin of safety for radiation effects diminishes as radiation exposures accumulate. Pediatricians can preserve the margin of safety by requesting radiologic procedures only when the benefits outweigh the risks and checking to ensure that CT operators are using settings appropriate for children.[69] Conservative use of diagnostic radiation procedures should decrease mortality and morbidity from the acute effects of a radiation disaster.

RECOMMENDATIONS FOR PEDIATRICIANS

1. Pediatricians should increase their knowledge about emergency medical aspects of radiation exposure.
2. Pediatricians should become familiar with local preparedness and evacuation protocols and work with public health agencies on their development.
3. Pediatricians should assist local schools and child care facilities in developing protocols to reunite children with their parents in the event a disaster.
4. All children at risk should receive KI before exposure, if possible, or immediately afterward. This will require that KI be available in homes located within 10 miles of a nuclear power plant. Child care facilities and schools within 10 miles of a nuclear power plant should plan to stockpile the agent. It may be prudent to consider stockpiling KI within a larger radius because of more distant windborne fallout, as occurred after Chernobyl; this will be determined by local and national public health authorities.
5. The risks and benefits of using KI should be discussed with parents. KI is available without a prescription, and families should be cautioned against using the medication before consulting with authorities.
6. Because radioiodines pass into breast milk, pediatricians should caution lactating mothers not to breastfeed their infants after the release of radioiodines, unless no alternative is available. The restriction is temporary, until public health authorities declare it safe to go back to breastfeeding. Public health authorities will also advise about the safe consumption of produce and milk after a radiation disaster.
7. The pediatrician should recognize and respond to the psychosocial consequences of disasters in children.[23,29,70]

RECOMMENDATIONS FOR GOVERNMENT

1. Pediatricians should be included in all aspects of planning for a radiation disaster. Disaster planning exercises should include pediatric casualties and victims with mock psychologic injuries.
2. Future sites for nuclear power facility construction should be selected to minimize the risk to populations. For existing power plants in popu-

lated regions, an accelerated timeline for decommissioning should be considered.
3. Guidelines for the population radius within which to recommend KI stockpiling should be developed; distribution plans should also be created.
4. The FDA should facilitate the development of a pediatric preparation of KI.
5. Plans should be developed for rapid communication with the public about evacuation versus sheltering, the safety of breast milk, and local food consumption.
6. Government planners should make mental health a high priority in the response plan for a radiation incident.

APPENDIX: GLOSSARY OF TERMS

Types of Radiation

Ionizing radiation: a high-frequency, low-amplitude form of radiation that interacts significantly with biological systems.
Alpha particle (α-particle): a particle emitted from the nucleus of an atom. It contains 2 protons and 2 neutrons and is identical to the nucleus of a helium atom. Having a very large mass, α-particles have poor penetration. They pose little hazard after external exposure but can produce tissue injury when inhaled or ingested.
Beta particle (β-particle): a high-speed particle, identical to an electron, emitted from the nucleus of an atom.
Neutrons: a powerful but uncommon type of radiation, emitted only after a nuclear detonation. Neutrons are highly destructive, producing 10 times more tissue damage than γ-rays produce.
Gamma-rays (γ-rays): a form of ionizing radiation having no mass. Like visible light, γ-rays are made of photons. γ-Rays have significant penetrance and are the most important external radiation hazard after a radiation disaster.
X-rays: like γ-rays, x-rays have no mass; their energy is emitted from electrons, and γ-rays are emitted from nuclei.

Radiation Exposure Terms

Becquerel (Bq): the International System of Units (SI) measurement of radioactivity, defined as decay events per second. 1 Bq = 1 disintegration per second.
Curie (Ci): the traditional measure of radioactivity, as measured by radioactive decay. 1 Ci = 3.7×10^{10} disintegrations per second.
Radiation absorbed dose (rad): the energy deposited by any type of radiation to any type of tissue or material. 1 rad = 0.01 Gray
Roentgen equivalent man (rem): the unit of *human* exposure to radiation. 1 rem = 0.01 Sievert
Gray (Gy): the SI unit for the energy deposited by any type of radiation, in joules per kilogram. 1 Gy = 100 rad
Sievert (Sv): the SI unit for measurement of human exposure to radiation, in joules per kilogram. 1 Sv = 100 rem
Weighting or Quality Factor: a term that correlates rem with rad (rem = rad $\times$ quality factor), based on factors including the type of radiation. The quality factor for β-particles, γ-rays, and x-rays is 1; therefore, with exposure to these forms of radiation, rad = rem. The quality factor for α-particles is 20 (1 rad = 20 rem).

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CLINICAL REPORT

Radiation Risk to Children From Computed Tomography

Guidance for the Clinician in Rendering Pediatric Care

Alan S. Brody, MD, Donald P. Frush, MD, Walter Huda, PhD, Robert L. Brent, MD, PhD, and the Section on Radiology

ABSTRACT

Imaging studies that use ionizing radiation are an essential tool for the evaluation of many disorders of childhood. Ionizing radiation is used in radiography, fluoroscopy, angiography, and computed tomography scanning. Computed tomography is of particular interest because of its relatively high radiation dose and wide use. Consensus statements on radiation risk suggest that it is reasonable to act on the assumption that low-level radiation may have a small risk of causing cancer. The medical community should seek ways to decrease radiation exposure by using radiation doses as low as reasonably achievable and by performing these studies only when necessary. There is wide agreement that the benefits of an indicated computed tomography scan far outweigh the risks. Pediatric health care professionals' roles in the use of computed tomography on children include deciding when a computed tomography scan is necessary and discussing the risk with patients and families. Radiologists should be a source of consultation when forming imaging strategies and should create specific protocols with scanning techniques optimized for pediatric patients. Families and patients should be encouraged to ask questions about the risks and benefits of computed tomography scanning. The information in this report is provided to aid in decision-making and discussions with the health care team, patients, and families.

INTRODUCTION

Computed tomography (CT) is a valuable and essential addition to the array of imaging modalities for children. CT uses x-rays to provide rapid, consistent, and detailed information about virtually any organ system in infants and children. Because x-rays are an integral component for image formation with CT, there is an obligatory radiation exposure during the CT examination. Ionizing radiation has been demonstrated to increase the risk of cancer in individuals exposed to high doses of radiation. Moreover, recent reports have discussed the potential risk of cancer that results from the lower radiation exposure from CT examinations. These publications have raised concerns on the part of pediatricians, patients, and families. A review of this literature, however, shows widely differing opinions concerning the cancer risk of diagnostic imaging studies. Although many different statements on ionizing-radiation risk exist in the literature, one principle has been supported consistently by the authors of articles to which this report refers: any estimated risk of a CT scan is far less than the likely benefit to the patient for indicated examinations.

This clinical report is intended to serve as a resource for pediatric health care

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Key Words
computed tomography, diagnostic imaging, ALARA, ionizing radiation, cancer

Abbreviations
CT—computed tomography
BEIR—Biological Effects of Ionizing Radiation
ALARA—as low as reasonably achievable

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professionals and to improve understanding of pediatric CT radiation and its potential risk in the development of cancer. The report also includes suggestions for an informed discussion of this issue between those who provide and those who receive care. It is important to understand that the purpose of this commentary is not to perform an exhaustive review of the literature regarding low-level radiation biological effects; rather, the purpose is to summarize current opinions about the risks of cancer from exposure to radiation from imaging studies and to provide pediatricians with information that will be helpful in discussions with patients and families/caregivers regarding the radiation risks of CT examinations and the important clinical advantages of these studies.

IONIZING RADIATION

Ionizing radiation is defined as high-energy radiation that is capable of producing ionization in the tissues through which it passes and can be absorbed. One gray (Gy) is the absorption of 1 joule (J) of radiation energy by 1 kg of matter. One Gy equals 100 radiation absorbed doses (rads). The sievert (Sv) takes into account the biological effects of radiation and is determined by multiplying the gray by a quality factor. It is important to realize that ionizing radiation is continuously present in our environment. This radiation exposure is termed "background radiation" and includes natural and man-made sources. Natural sources of radiation include cosmic rays, radon, radiation from terrestrial rock, and natural radionuclides. These sources account for most of the radiation exposure received by all inhabitants of the United States. The amount of background radiation varies depending on location. Residents of Denver, Colorado, for example, receive approximately twice the annual background radiation received by those who live at sea level. This is because of increased cosmic ray exposure at the higher elevation as well as increased terrestrial radiation from the rock in the surrounding mountains. In the United States, the average background radiation is approximately 3 mSv/year per person.

Man-made radiation includes that of industrial and medical origins, with the latter being the larger source by far. Medical radiation can be measured several different ways. For example, the exposure to radiation from diagnostic radiologic procedures can be described as the dose that strikes the surface of the body, or entrance dose. However, the entrance dose is higher than the average dose to which the entire body is exposed. This entrance dose will not necessarily reflect the risk, because different parts of the body vary in their sensitivity to the effects of ionizing radiation. For example, studies of the Japanese survivors of atomic bomb detonations have demonstrated that the lung is more sensitive to the oncogenic risks of high doses of radiation than the liver, which in turn is more sensitive than skeletal muscle or skin. Radiation energy deposited in an individual organ is the organ dose (measured in grays). When several organs are irradiated, the effective dose (measured in sieverts) is used to quantify the total patient risk and is computed by taking into account the dose to each organ as well as that organ's relative radiosensitivity (eg, lungs are more susceptible than skin).

For a given dose, there is a difference in cancer risk from radiation exposure to children compared with adults. There are several reasons for this difference. First, for the most part, tissues and organs that are growing and developing are more sensitive to radiation effects than those that are fully mature.[1,2] Second, the oncogenic effect of radiation may have a long (for example, decades) latent period. This latent period varies with the type of malignancy. Leukemia has a shorter period (approximately $\leq$10 years) than solid malignancies. An infant or child, therefore, has a longer life expectancy in which to manifest the potential oncogenic effects of radiation compared with older adults. For example, a solid radiation-induced malignancy with a 30-year latent period will more likely occur in a 10-year-old than in a 50-year-old, on the basis of life expectancy. Pierce et al[1] summarized the radiation cancer risk at different ages and stated that those exposed at 50 years of age have approximately one third of the risk of a 30-year-old and that "[p]rojection of lifetime risks for those exposed at age 10 is more uncertain. Under a reasonable set of assumptions, estimates for this group range from about 1.0–1.8 times the estimates for those exposed at age 30." This increased sensitivity varies with age, with the younger ages being more at risk. Because the risk varies with age, the increased pediatric risk compared with adults will also vary depending on exactly which age groups are compared.[1] Third, in the case of CT scanning, the radiation exposure from a fixed set of CT parameters results in a dose that is relatively higher for a child's smaller cross-sectional area compared with an adult.[3]

DIAGNOSTIC IMAGING

X-rays are used in radiography, fluoroscopy, angiography, and CT. The dose depends on patient factors (such as age and size), technical factors (equipment settings and procedure length), and equipment model. Nevertheless, it is helpful to be familiar with some representative doses for common imaging studies (Table 1).

Three factors have made CT scanning the focus of much of the recent interest in ionizing-radiation exposure from diagnostic imaging. First, CT scanning provides a disproportionately higher amount of the radiation exposure from diagnostic imaging. In 2000, Mettler et al[4] reported that CT scanning accounted for 11% of procedures that used ionizing radiation in a large academic radiology department but accounted for 67% of the radiation exposure. Second, indications for CT scanning and the number of CT scans are increasing rapidly. In a more recent study at the same institution, CT scan-

TABLE 1 **Estimated Medical Radiation Doses for a 5-Year-Old Child**

Imaging Area	Effective Dose, mSv	Equivalent No. of CXRs
3-view ankle	0.0015	1/14th
2-view chest	0.02	1
Anteroposterior and lateral abdomen	0.05	2½
Tc-99m[2] radionuclide cystogram	0.18	9
Tc-99m radionuclide bone scan	6.2	310
FDG PET[3] scan	15.3	765
Fluoroscopic cystogram	0.33	16
Head CT	4	200
Chest CT	3	150
Abdomen CT	5	250

CXR indicates chest radiograph; Tc-99m, technetium 99m; FDG PET, fluorodeoxyglucose positron emission tomography.
Data were provided by R. Reiman, MD (Duke Office of Radiation Safety [www.safety.duke.edu/RadSafety], written communication, 2006).

ning accounted for 15% of the procedures and 75% of the dose.[5] Third, CT scanning can be performed by using a wide range of techniques with variable radiation exposures that produce very similar image quality. With conventional ("plain") radiographs, an increase in radiation dose makes the image darker, and most individuals will recognize that the film was overexposed. However, changing the amount of radiation for a CT study affects the amount of mottle (or image noise) with little other effect on the appearance of the image. Above a level of diagnostic quality, this decrease in mottle with increasing radiation will have no effect on diagnostic accuracy of the CT study and may not even be appreciated, but the exposure may have been unnecessarily high, especially in children.[6] Until recently, the same CT-examination parameters were used for children and adults. In fact, a change in these parameters with a resultant reduction in dose, ranging from approximately 50% to 90%, has been shown to be satisfactory for a child's CT study.

RISKS OF IONIZING RADIATION FROM DIAGNOSTIC IMAGING

No published studies have directly attributed cancer to CT scanning, and it is important to recognize how difficult it would be to perform such a study. The lifetime risk of fatal cancer in the general population is approximately 1 in 5. To perform a study to detect an increase from 0.2000 (the 1-in-5 risk in the general population) to 0.2002 (the 1-in-5 risk seen in the general population plus a 1-in-5000 potential risk from a CT scan) would require hundreds of thousands to millions of subjects and extremely careful matching of the subjects in the study to ensure an accurate result. Until such a study is completed and verified by the scientific community, estimates of risk must be based on other forms of ionizing-radiation exposure, and some assumptions must be made to apply these risks to the risks from diagnostic imaging. The most widely used source of risk estimates comes from data on atomic bomb survivors.

CT scanners and other diagnostic imaging equipment use low-dose radiation, which is defined as a dose of less than approximately 100 mSv. There are numerous studies of populations receiving high doses of radiation above 500 mSv that have demonstrated an increased risk of cancer. These studies, reviewed in the 2005 report of the Biological Effects of Ionizing Radiation (BEIR) Committee of the National Academy of Sciences,[7] provided widely accepted evidence that, at higher exposures, the risk of cancer increases linearly with increasing dose until extensive cell killing takes place at very high exposures. The relationship between radiation exposure and cancer risk from low-dose radiation is less clear.

Because of the diversity of opinion and the many different studies that have been performed, a broad range of estimates of the risk of ionizing radiation from diagnostic imaging can be supported by selecting specific publications from the peer-reviewed literature. It is impossible to provide a complete review of this literature here, and without a complete review, any summary could be biased. To our knowledge, there are no reviews that are considered to be authoritative.

Statements that are based on expert panel reviews of available information are additional sources of estimates of the risks of low-level radiation. The BEIR Committee of the National Academy of Sciences recently released their seventh statement in 2005. The committee concluded that "the risk of cancer proceeds in a linear fashion at lower doses without a threshold and that the smallest dose has the potential to cause a small increased risk to humans."[7] The United Nations Subcommittee on Atomic Radiation 2000 report stated that "an increase in the risk of tumor induction proportionate to the radiation dose is consistent with developing knowledge and that it remains, accordingly, the most scientifically defensible approximation of low dose response."[8] The International Commission on Radiation Protection recommendations (2005) stated that "the weight of evidence on fundamental cellular processes supports the view that in the low dose range up to a few tens of mSv, it is scientifically reasonable to assume that in general and for practical purposes cancer risk will rise in direct proportion to absorbed dose in organs and tissues."[9]

In the absence of definitive evidence of the effects of low-level radiation, these consensus statements provide useful guidance. They suggest that it is reasonable to act on the assumption that the low-level radiation used in diagnostic imaging may have a small risk of causing cancer. If one assumes that radiation from a CT examination may cause cancer, it is reasonable that the medical community seek ways to decrease radiation exposure. Two ways to achieve this reduction are to use radiation doses that are as low as reasonably achievable (ALARA), which means that no more radiation should be used than is required to achieve the necessary diagnostic information, and to perform these studies only when they are necessary.

ROLE OF PEDIATRIC HEALTH CARE PROFESSIONALS

Pediatric health care professionals have an important role in the use of CT on children.[10] The health care professional ultimately decides whether a CT examination is necessary. With this important role comes a responsibility to recognize both the value of CT and its risks, which, as described previously, it is reasonable to assume are very small but real. The health care professional should also be able to discuss these risks in a manner that is informative and understandable to patients and families. One must recognize that the decision regarding a CT examination will often depend on the combination of the interaction with consultants, such as radiologists, and the family. There is a vast pool of information available on the Internet, much of which may be confusing with respect to CT, radiation, and cancer. The pediatric health care professional should be in a position to be able to answer questions and address concerns.

The pediatric health care professional is usually the first, and often the only, source of direct communication with the child and the family. This relationship carries with it an opportunity to inform and educate the family. Recent reviews that covered CT technology and its role in the imaging armamentarium[11,12] are salient for pediatric health care professionals. CT has an increasingly recognized role as the first, if not only, imaging examination for a wide variety of disorders that affect infants and children. What is most important to realize is that the use of CT is not infrequent in children and that the frequency of CT examinations is increasing. A recent review summarized investigations indicating that CT use has increased substantially over the last 1 to 2 decades, including estimates of at least 10% growth per year.[13] Currently, approximately 11% of CT examinations are performed on children,[4] which could account for more than 7 million pediatric CT examinations per year in the United States.[13,14] The use of CT for common problems such as trauma (closed head injury, skeletal evaluation including cervical spine assessment, and blunt abdominal trauma), appendicitis, and renal calculi has increased the frequency of CT examinations in adult and pediatric populations. Most clinicians believe that CT studies on children prevent hospitalization for head injuries and that negative findings in patients with acute onset of abdominal pain can obviate surgical explorations. These studies provide information that leads to earlier and more definitive diagnosis.

This increased use, however, must be based on a firm understanding that the CT study is the best study for the clinical situation being evaluated and that the possibility of a very small risk of cancer is considered when making the decision to order the study. The possible cancer risk is not clearly understood by many health care professionals, as concluded by 2 recent investigations. In the first investigation, Lee et al[15] surveyed emergency department patients, physicians, and radiologists. The results indicated that only 7% of patients indicated that there was any discussion outlining the radiation risks and benefits from an abdominal CT examination. In addition, only 9% of emergency department physicians believed that the lifetime risk of cancer was potentially increased by CT scanning. Moreover, 75% of physicians surveyed underestimated the accurate range for the equivalent number of chest radiographs for a CT examination (Table 1). In another recent investigation, Jacob et al[16] surveyed physicians in the United Kingdom and found that only 12.5% were aware of the potential association of CT radiation and cancer. Less than 20% correctly identified the relative radiation dose of CT examinations.[16] These studies support a continued and compelling need for radiation safety education for health care professionals and the public.

The pediatric health care professional should also be able to provide summary information to families on local practice patterns of radiology colleagues. It is reasonable to have information immediately available from the radiology practice in addition to that stated above. This information should include:

- additional expertise of the practice (pediatric radiology fellowship training, American Board of Radiology Certificate of Added Qualification, and current Maintenance of Certification in pediatric radiology);
- appropriate pediatric head and body CT protocols consisting of size- or age-based adjustments in scanner settings; and
- American College of Radiology accreditation of the CT scanners and the radiologists who interpret those studies in the practice.

An important role of the pediatric health care professional is to communicate with the radiologist to decide whether CT is the best study to perform. This consultation will vary from practice to practice, but it should be the goal of both parties to facilitate discussions on imaging strategies. These discussions provide an opportunity to share information, such as the number of studies using ionizing radiation to which the patient has been exposed. In addition to the pediatric health care professionals and radiologists, the integration of other care providers, such as surgical consultants or emergency department physicians, in decisions regarding pediatric CT policy or practice should also be fostered. Other imaging techniques such as ultrasonography or MRI may be suitable alternatives to CT examination, and they do not use ionizing radiation. If the CT examination is indicated and the radiology department uses a low-dose technique, another way to reduce CT dose is to limit the number of times (or phases) the child is scanned for the individual examination. It is very common for adult CT protocols to involve multiple scans through the same body part, which can double or triple the radia-

tion dose to the patient. For most indications for pediatric CT scans, a single pass through the body part of interest is usually sufficient for diagnostic purposes.

ROLE OF THE RADIOLOGIST

The value of having the pediatrician consult with the radiologist in the process of forming imaging strategies, such as with suspected appendicitis, as well as performing individual indicated CT examinations was discussed above. The importance of this consultation role should not be understated. The decision whether CT imaging should be obtained is determined, in large part, by the pediatric health care professional. However, the radiologist also has a responsibility to perform only those examinations that are appropriate. Any question by either party should trigger communication to be mutually certain about optimizing the child's care.

The radiologist also has a responsibility to create protocols and adjust scanning techniques on the basis of special considerations of pediatric patients.[17] These technical considerations have been reviewed recently for chest and abdomen CT.[12] In short, the exposure factors, many of which contribute to the radiation dose, must be adjusted. The amount of radiation necessary for diagnostic CT examinations in infants and young children is less than that in adults. If the same settings are used for both children and adults, children will receive an unnecessary and excessive amount of radiation. Many manufacturers now provide at least some basic pediatric guidelines, but it is still the decision of the radiology practice if these are to be used.

Additional expertise in pediatric imaging may be available in certain practice settings. Although this is not requisite for appropriate CT examinations on children, it would be unusual for a practice with this expertise not to align with the current recommendation of size-adjusted pediatric CT. Radiologists, regardless of whether they are fellowship-trained pediatric radiologists, should be able to provide either health care professionals or families with information on the CT protocols and techniques used and be able to discuss the radiation equivalent of CT, potential risks, and any additional techniques (such as breast shields) used in the practice. In addition, radiologists must keep up to date with rapidly evolving CT technology. For example, the newest multidetector array CT scanners are extremely fast (a complete infant chest examination is possible in approximately 1 second). This fast technology is accompanied by expanded uses in current applications as well as new applications. Furthermore, the radiology practice should also be able to keep pace with potential changes in radiation exposure from this technology as well as new technology to help manage radiation doses.[18]

CONCLUSIONS AND INFORMATION FOR FAMILIES AND PATIENTS

Concerns about radiation exposure are understandable, and questions should be encouraged, particularly when scientific communications are reported in the lay press.[19]

The following information can serve as a foundation for this discussion of CT examination and risks.

- Radiation is an essential component of a CT examination.
- The amount of radiation that a CT examination provides is low-level radiation.
- The cause-and-effect relationship between low-level radiation, such as with CT, and cancer is not certain, but expert panels that have examined this question have suggested that there is a small risk that increases with increasing dose.
- No direct connection between CT examinations and subsequent development of cancer has been demonstrated, so the risks of CT scans must be estimated, and these estimates vary depending on the information used.
- The amount of radiation that CT provides depends on many factors, especially the protocols used and equipment settings for the individual examination.
- In general, properly performed CT examinations of children should expose a child to much lower exposures than those for the same procedure on an adult.
- The potential benefit from an indicated CT examination is clinically recognized and documented and is far greater than the potential cancer risk.
- Radiologists are specialists in CT who are trained to use the least amount of radiation necessary (the ALARA principle, discussed previously).

In summary, there is wide agreement that the benefits of an indicated CT scan far outweigh the risks. It is the responsibility of those health care professionals who use CT scanning to ensure that each CT scan is indicated. It is the responsibility of radiology personnel to ensure that radiation risk is minimized by using the ALARA principle to determine the correct technique. The information provided in this clinical report is offered to aid in decision-making and discussions with the health care team, patients, and families.

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CLINICAL REPORT

Recognizing and Responding to Medical Neglect

Guidance for the Clinician in Rendering Pediatric Care

Carole Jenny, MD, MBA, and the Committee on Child Abuse and Neglect

ABSTRACT

A caregiver may fail to recognize or respond to a child's medical needs for a variety of reasons. An effective response by a health care professional to medical neglect requires a comprehensive assessment of the child's needs, the parents' resources, the parents' efforts to provide for the needs of the child, and options for ensuring optimal health for the child. Such an assessment requires clear, 2-way communication between the family and the health care professional. Physicians should consider the least intrusive options for managing cases of medical neglect that ensure the health and safety of the child.

INTRODUCTION

Pediatricians are sometimes confronted in practice by children whose medical needs are being neglected. In the United States, medical neglect accounts for 2.3% of all substantiated cases of child maltreatment.[1] This represents the "tip of the iceberg," because only the most egregious and intractable cases are likely to be reported to authorities.

Medical neglect usually takes 1 of 2 forms: failure to heed obvious signs of serious illness or failure to follow a physician's instructions once medical advice has been sought. Either of these situations can be fatal in some cases or can lead to chronic disability.[2]

Several factors are considered necessary for the diagnosis of medical neglect[3]:

1. a child is harmed or is at risk of harm because of lack of health care;
2. the recommended health care offers significant net benefit to the child;
3. the anticipated benefit of the treatment is significantly greater than its morbidity, so that reasonable caregivers would choose treatment over nontreatment;
4. it can be demonstrated that access to health care is available and not used; and
5. the caregiver understands the medical advice given.

In many cases, no harm will occur if the caregiver opts not to seek medical care for an ill child. For example, if children have high fevers caused by self-limited viral illnesses, they are unlikely to suffer adverse consequences if they do not receive medical care, even if they appear acutely ill. On the other hand, if a child with a stomachache caused by appendicitis fails to receive medical care, the results can be dangerous. However, when a procedure carries inherent danger or a drug has significant adverse effects, labeling a caregiver's reluctance to cooperate as neglect may be problematic.[2] In some situations, health care professionals may evaluate risks and benefits of drugs or procedures differently than families.

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Key Words
medical neglect, health literacy, physician-patient relationships, cultural competency

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REASONS THAT FAMILIES FAIL TO SEEK APPROPRIATE MEDICAL CARE

Many factors can lead to children not receiving appropriate medical care. It is important to consider these etiologies in planning for the alleviation of the problem. The child can be seen as the center of an ecological framework within which lack of medical care may result from interactions among a variety of interdependent factors.[4]

Patient and Parent Factors

Poverty or Economic Hardship

Many families lack financial resources to care for children with acute or chronic illnesses. For some parents, taking time from work to care for sick children can lead to decreased income or even loss of their jobs.

Lack of Access to Care

The number of children in the United States who do not have health insurance is estimated to be between 8.7 and 11.1 million.[5] Other barriers to access include geographic constraints (such as long distances to care and lack of transportation), lack of baby-sitters for siblings, lack of available health care professionals, and language barriers.

Family Chaos and Disorganization

Some families lack order and routine in their lives. Interactions are inconsistent and fragmented. Parents may be unable to respond to the children's needs in an effective manner. These families may have a difficult time responding appropriately to medical emergencies, and it may be even more difficult to meet the needs of chronically ill children who require ongoing medications and treatments.

Lack of Awareness, Knowledge, or Skills

Caregivers may not be aware of the signs or symptoms in their children that could indicate serious illness. They may not understand why a medication or treatment is prescribed or why it is important to follow through with their physicians' instructions.

Lack of Trust in Health Care Professionals

Some families may refuse advice because they lack trust in physicians or organized medicine because of what they have heard from friends or the media or because of previous negative experiences with the health care system.

Impairment of Caregivers

If a child's caregiver is developmentally delayed or mentally ill, he or she may not have the capacity to respond to the child's health care needs. Substance abuse can also interfere with normal caregiving. In cases in which parents cannot comprehend the child's need for care, the children might need protection from a social service agency if they are in danger, even if the parents are trying to meet the children's needs.

Caregiver's Belief Systems

Some caregivers have belief systems that are inconsistent with Western medicine. A parent of a child who has a serious illness may decide to rely on untested remedies or alternative medicines. Some caregivers will seek healing through religion rather than medical care. The special case of religiously motivated medical neglect is discussed further below.

The Child's Attitudes and Behavior

In some cases, particularly in adolescents, the child will reject medical care and refuse to comply with medications, treatments, or diet. Children might assert their independence by not cooperating or use their illness to gain attention from their parents or deflect family conflict. Children may also be influenced by their peers and may not want to accept the fact they are ill and need treatment. They may feel they are more likely to "fit in" with others if they are not ill.

Physician Factors

Pediatricians' Misunderstanding of Different Cultures

What some pediatricians may consider obvious medical neglect might be acceptable parenting practices in other cultures. It is important for pediatricians to have knowledge of the beliefs and practices of the families they serve.[6] If children are in danger, interventions necessary to protect them are indicated even if the parents think they are doing the right thing. However, pediatricians should work to understand others so they can effectively educate parents while respecting different cultures. Some American Indian/Alaska Native cultures actively encourage adolescent children to make their own decisions about medical care. If the adolescent makes a potentially harmful decision, the parents must be informed about the consequences of that decision and urged to intervene with the child, whether through persuasion or overruling the decision.

Lack of Parent Health Literacy and Lack of Communication in the Medical Setting

Communication between pediatricians and parents can be affected by the parents' level of health literacy. Health literacy is defined by the US Department of Health and Human Services as "the degree to which individuals have capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions."[7] Parents often misunderstand complicated medical instructions and explanations of the justifications for treatment. Likewise, physicians

may not clearly communicate or adequately assess caregivers' comprehension of complicated medical instructions and justifications for treatment.[8] This lack of understanding can lead to poor adherence by families. If parents and physicians do not speak the same language, this also can complicate communication. Pediatricians should be cognizant of the factors that limit effective communication with patients and parents and work to overcome those barriers.[9] The American Academy of Pediatrics policy statement "Ensuring Culturally Effective Pediatric Care"[10] provides excellent resources for pediatricians seeking information on cultural competency.

THE PEDIATRICIAN'S RESPONSE TO MEDICAL NEGLECT

When confronting a family in which a child is being medically neglected, the child's well-being should be the physician's first concern. Several management options are available to pediatricians. Generally, the least restrictive, most collaborative approach to the situation is the best. Whenever possible, the family should be assisted in understanding the need for obtaining necessary medical care. The management of medical neglect involves initially identifying the underlying problem that led to the neglect. Once this is done, the pediatrician has many options for rectifying the situation. The following suggested intervention options are listed from least restrictive to most restrictive.

1. If the parents are not fluent in English, access services in the community to facilitate translation.
2. Be sure the family's concerns are understood. The medical staff must understand the family's view of their child's medical condition and its proposed treatment. Recognizing the family as a partner in the decision-making process assures caregivers that their opinions are respected and opens the door to compromise and improved adherence.
3. Counsel the family about the need for care and educate the parents and patient. The parents should be educated about the dangers of the illness and the importance of seeking medical care and complying with treatment. The family's support should be enlisted in addressing the problem. Make sure the parents understand what medications are indicated, how they work, and when they are to be given. Special programs are available to teach parents and children about the management of some chronic illnesses such as diabetes and asthma.
4. In some cases, it will be helpful to expand the circle of caregivers who will help with the child's medical care. For example, the extended family of the child might be enlisted to assume some of the care responsibilities for the ill child.
5. Involve the family in the development of a medical plan. When physicians collaborate with their patients in the development of treatment plans, physicians and families can reach shared understanding of the etiology, prognosis, and treatment options. Engaging the caregivers throughout the planning process can empower families and enlist them in support of treatment plans.
6. When necessary, work with the family to develop a written contract that outlines exactly what care needs to be provided. Sometimes families have a difficult time keeping track of treatments, medications, and appointments, especially when they have a chronically ill child with complicated medical problems. A written contract that is agreed to by both the physician and the family can serve as a "blueprint" for the family to follow. It also provides the physician with documentation that the family understood and agreed to the care plan. If intervention is required later by social service agencies, this documentation can be helpful to demonstrate that the family was informed of the importance of the child's medical care. When contracting with families, physicians should make sure that the parents or caregivers can read and understand the care plan.
7. Enlist community resources to aid in caring for the child. Resources such as visiting nurses, transportation services, financial relief, and respite care should be used if needed and available. Some organizations that advocate for people with specific chronic illnesses will provide educational opportunities about disease management, support groups, or "peer counselors." Although organizing these interventions is often beyond the scope of pediatric practice, pediatricians should be aware of community resources that are available to support the families of their patients and be prepared to make appropriate referrals. The medical home must recruit and coordinate a multidisciplinary team to make decisions in complex cases of medical neglect. By gathering together the essential health and human services professionals involved in the case, treatment and rehabilitative regimens and services can be coordinated for the involved families. Enlist knowledgeable members from the family's cultural/ethnic/medical belief system to assist in understanding the actions of the family and to help the health and human services professionals meet the needs of the neglected child.
8. Arrange for directly observed therapy for children with chronic serious illnesses. Daily home visits by a nurse or paraprofessional could be considered in cases in which there is lack of compliance with medications. Roberts et al[11] reported on the use of directly observed therapy to ensure that HIV-positive children received their antiretroviral therapy. In

4 of 6 cases, this approach led to sustained decreases in the patients' viral loads and allowed the children to remain in their homes instead of being placed in foster care. Although this is an expensive alternative, it is less expensive than providing foster care for a medically complicated child.

9. A partial hospital or day-hospital program may be helpful in cases in which family dysfunction and lack of patient compliance are issues. In some areas, partial hospital programs offer medical and mental health care for chronically ill children. Such programs offer family, group, behavioral, and individual therapy as well as education for parents and children about coping with illness.[12] These programs, when available, are useful in treating children and families with complex histories in which chronic illness has been managed inadequately because of social and psychological factors.
10. Refer families to child protective services agencies to ensure that necessary medical care is received. When other options are not available or have not been successful, it may be necessary to involve child protective services if the child is being harmed (or potentially harmed) by lack of medical care. The child protective services agency should understand what the nature of the child's medical problem is and why appropriate medical care is critical to the child's health and development. In many areas, the child protective services system has access to resources for family support that might not be available otherwise. In extreme cases in which the family is not able to cooperate, placing the child in foster care may be the only option.

MEDICAL NEGLECT IN CHILDREN WITH SPECIAL HEALTH CARE NEEDS

Children with multiple medical problems can present a challenge to any parents. These children often require multiple regular medical appointments, multiple therapies such as physical, speech, and occupational therapy, medical equipment monitoring, special diets, and multiple medications. When the families of chronically ill children have limited resources, the challenges they present can be overwhelming. The primary care pediatrician can be helpful in providing a medical home that coordinates care and avoids duplication of services. A partnership with these families is critical so that problems can be identified and dealt with early. It is critical to always review the care plan so that the family can concentrate on therapies and interventions that are most likely to be beneficial and so that marginally effective therapies can be eliminated.

SPECIAL RESPONSIBILITIES OF PEDIATRICIANS CARING FOR CHRONICALLY ILL CHILDREN WHO MISS MULTIPLE APPOINTMENTS

Some parents with chronically ill children fail to keep multiple medical appointments. Depending on the seriousness of the child's illness, lack of medical care could adversely affect the child's health. In some cases, physicians inform such parents in writing that they will no longer be able to provide medical care for the child. When families tie up and then do not use scarce appointment slots, clinics are often unable to serve other families effectively. In other cases, clinic staff will contact the parents and simply reschedule the child for another appointment.

In either case, pediatricians should consider whether the child is at risk of harm because of the acts of the parents. If so, other interventions should be considered, including asking a clinic social worker or other staff member to discuss the problem with the parents, requesting a home visit by a nurse, or, in extreme cases, referring the family to the local child protective services agency. The important point is that each case needs to be considered individually to ensure the well-being of each child.

For chronically ill and complex patients, the medical home becomes an important asset in dealing with the competing demands for the caregivers' time and attention. In partnership with the families, primary care pediatricians can assist them in developing reasonable care plans involving many subspecialties and disciplines, such as physical and occupational therapy.

Pediatricians should work with families to facilitate the availability of appointment times that meet the demands parents face, such as jobs, child care, and transportation.

DETERMINING WHETHER A TREATMENT OFFERS SIGNIFICANT BENEFIT

One of the 5 factors that constitute medical neglect is caregivers refusing recommended health care that offers significant "net benefit" to the child. In many cases, the question of net benefit of a therapeutic modality can be debated. For example, if parents refuse medical intervention for a newborn infant at the limit of viability, is it medical neglect? In many cases, we do not have data on the relative benefits of various therapeutic interventions, and in some cases what one person would deem beneficial, another might think is of no value.

When these situations occur, it is important that the caregivers and health care professionals have an opportunity to communicate openly about their values and opinions. It is critical that these discussions be documented in the health record and acknowledged by providers and families. Involving a hospital's ethics committee can be helpful in resolving instances of conflicting opinions.[13]

RELIGIOUSLY MOTIVATED MEDICAL NEGLECT

Medical neglect evaluations should focus on the child's needs rather than the caregiver's motivations or justifications. Religious objections, therefore, should not be granted fundamentally different status from other types of objections.[14]

Although competent adults have the right to refuse life-saving medical care for themselves, the US Supreme Court has stated that parents do not have the right to deny their children necessary medical care.[14] The court made this clear in 1944 in *Prince v Massachusetts*.[15] "The right to practice religion freely does not include the liberty to expose the community or child to communicable disease, or the latter to ill health or death. . . . Parents may be free to become martyrs themselves. But it does not follow they are free, in identical circumstances, to make martyrs of their children. . . ."[15] The American Academy of Pediatrics has taken a firm stance on the rights of seriously ill children to receive life-saving medical care even if their parents subscribe to religious beliefs that are antithetical to medical care.[16]

SUMMARY

Medical neglect of children can cause harm or death. The pediatrician's responsibility is to the child. If parents or caregivers are not meeting the child's medical needs, the pediatrician is encouraged to work to ensure that the family has adequate resources to care for the child. The pediatrician has several important roles in working on behalf of medically neglected children, including engaging the family, understanding the family's circumstances, explaining the need for therapy, and collaborating with professionals and resources within the community to ensure that the child's health is optimized.

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American Academy of Pediatrics
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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Recommendation for Mandatory Influenza Immunization of All Health Care Personnel

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS
health care personnel, mandatory, influenza, immunization, vaccine, children, pediatrics

ABBREVIATIONS
HCP—health care personnel
CDC—Centers for Disease Control and Prevention

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abstract

FREE

The purpose of this statement is to recommend implementation of a mandatory influenza immunization policy for all health care personnel. Immunization of health care personnel is a critically important step to substantially reduce health care–associated influenza infections. Despite the efforts of many organizations to improve influenza immunization rates with the use of voluntary campaigns, influenza coverage among health care personnel remains unacceptably low. Mandatory influenza immunization for all health care personnel is ethically justified, necessary, and long overdue to ensure patient safety. *Pediatrics* 2010;126:809–815

INTRODUCTION

Health care–associated influenza outbreaks are a common and serious public health problem that contributes significantly to patient morbidity and mortality and creates a financial burden on health care systems. Annual immunization of health care personnel (HCP) is a matter of patient safety and necessary to significantly reduce health care–associated influenza infections. Immunization rates of 80% or higher are essential for providing the "herd immunity" needed to have a significant impact on transmission of influenza by HCP in medical settings, but overall immunization rates for HCP remain near 40%.[1]

Mandatory immunization is not a novel concept. Many health care facilities currently require specific vaccines and a tuberculin skin test as conditions for working in specific areas of the institution or for employment. Despite the sustained efforts of many organizations to improve influenza immunization rates with the use of voluntary campaigns, influenza coverage among HCP in the United States remains unacceptably low.

Mandatory programs for all HCP should be implemented nationwide. Mandating influenza vaccine for all HCP is ethically justified, necessary, and long overdue. Employees of health care institutions have both ethical and professional obligations to act in the best interests of the health of their patients. Medical and religious exemptions to required influenza immunization can be granted on an individual basis. Individual organizations and practices must decide at a local level the additional objections to vaccination, which may be required by state law (eg, philosophical), that are reasonable and the ones they are willing to accept for an individual to be granted an exception and be allowed to continue to work. Policies should be developed for management of exempted HCP during influenza season, including efforts to ensure patient and staff safety and to identify ill HCP.

BACKGROUND

Influenza Is a Significant Public Health Problem

Each year in the United States there are, on average, more than 36 000 deaths and 200 000 hospitalizations associated with the influenza virus, which makes influenza outbreaks a major public health concern.[2] Serious morbidity and mortality can result from influenza infection in any person of any age. Rates of serious influenza-related illness and death are highest among children younger than 2 years, seniors 65 years and older, and people of any age with medical conditions that place them at increased risk of having complications from influenza, such as pregnant women and those with underlying chronic cardiopulmonary, neuromuscular, and immunodeficient conditions. Transmission from an infected, previously healthy child or adult begins as early as 1 day before the onset of symptoms and persists for up to 5 to 7 days; infants and immunocompromised persons may shed virus even longer. Some infected individuals remain asymptomatic yet contagious.[3]

Immunization is the most effective way to prevent influenza outbreaks, so it is recommended for everyone 6 months of age and older.[2] Among healthy adults, including HCP, annual immunization with a vaccine antigenically well matched to circulating strains reduces laboratory-confirmed influenza cases by 70% to 90%.[1] In contrast, the vaccine has been shown to be less effective for some high-risk groups.[1] Many individuals at high risk of influenza and its associated complications are in frequent, close contact with HCP because of their need to seek inpatient and outpatient medical services.[1] Therefore, immunization of HCP is a critically important step for protecting those at risk from health care–associated influenza.

HCP Immunization Rates Remain Low

The growing understanding of the impact of influenza on all age and risk groups has prompted the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention (CDC) to expand annual influenza immunization recommendations to include all people aged 6 months and older.[4] This universal recommendation includes HCP and persons in training for health care professions, such as physicians, nurses, workers in hospital and outpatient care settings, medical emergency response workers, employees of nursing home and longer-term care facilities, and students in these professions.[1] There also is no contraindication to receiving influenza vaccine for HCP who are pregnant or breastfeeding.

The Advisory Committee on Immunization Practices began recommending influenza immunization for HCP in the early 1980s.[5] Despite this long-standing recommendation, overall immunization rates for HCP remain near 40%.[1] It is surprising that many HCP and the organizations that employ them have been inexcusably silent in addressing this patient safety issue. The low seasonal immunization rate among HCP prompted the US Department of Health and Human Services to make increasing HCP immunization rates to 60% a part of their *Healthy People 2010* objectives. However, even this modest objective has not been achieved in many institutions.[6] The gap is magnified when one considers that The Joint Commission estimates that influenza immunization rates of 80% or higher are essential for providing the herd immunity necessary to substantially reduce health care–associated influenza infections.[7]

During the 2009–2010 influenza season, it was recommended that HCP protect themselves against both the expected seasonal influenza strains and the 2009 pandemic H1N1 influenza A virus. The Advisory Committee on Immunization Practices recommended that HCP be a priority group to receive the 2009 H1N1 monovalent vaccine when it was first released, a time when its availability for the general public was limited.[8] In January 2010, the CDC estimated that the percentage of HCP receiving influenza vaccine[8] was as follows:

- 61.9% for seasonal influenza vaccine;
- 37.1% for 2009 H1N1 monovalent vaccine; and
- 34.7% for both vaccines.

Voluntary Programs Are Not Sufficient to Increase HCP Immunization Rates

Efforts to increase immunization rates among HCP have focused primarily on voluntary programs, which attempt to increase rates by ensuring that the vaccine is conveniently available and free of charge and providing influenza-prevention education and incentives or rewards to improve participation. A more comprehensive approach involves the use of signed declination statements coupled with education about risks and benefits of being immunized. However, use of declination statements in 22 hospitals resulted in only a modest increase in influenza immunization.[9] It is difficult to assess the overall effectiveness of declination statements, because the language and context can vary among programs, and multiple strategies for preventing influenza are often initiated simultaneously.[10]

These efforts may lead to an immediate increase in immunization rates, although a lasting effect has yet to be shown. The CDC has reported that an

employer recommendation was associated with two- and fourfold higher coverage rates for seasonal and 2009 H1N1 influenza vaccination, respectively, when compared with employers who made no recommendation. Coverage rates for both influenza vaccines improved by three- to eightfold when employers required influenza immunization of HCP.[8]

It seems that sustainability of herd immunity in health care settings can be achieved only through a mandated policy. Despite many organizations' efforts to improve influenza immunization rates with the use of voluntary campaigns, influenza coverage among US HCP remains unacceptably low at a rate of 44.4% between 2006 and 2007,[1] and even fewer receiving both seasonal and H1N1 vaccines during the 2009–2010 season. Voluntary programs have proven to be ineffective, in part because HCP have misconceptions regarding the risks and benefits of the vaccines. HCP were more likely to believe that seasonal influenza vaccine was safe when compared with the 2009 H1N1 vaccine (80.9% vs 66.6%), although the 2009 H1N1 vaccine was manufactured by using the same processes as seasonal vaccine and had undergone more extensive human safety testing. HCP also were more likely to report that seasonal influenza vaccine was worth the time and expense when compared with the 2009 H1N1 vaccine (74.2% vs 62.8%). Immunization coverage was higher among HCP in hospitals than in outpatient clinics and among HCP working in intensive care, burn, and obstetric units or around seriously ill patients. A survey conducted at 2 obstetric outpatient facilities revealed that 34% to 39% of the obstetric HCP surveyed did not receive yearly influenza immunizations.[11] HCP with a bachelor's degree or higher were more likely to be immunized against the 2009 H1N1 virus.[8]

The Joint Commission found that reasons HCP decline immunization include fear of getting influenza-like illness from the vaccine, fear of adverse effects, perceived low or no likelihood of developing influenza disease, and concern about exposure to thimerosal, among others.[7] With the use of live-attenuated influenza virus (LAIV) vaccine, some HCP expressed concern that the vaccine virus could be shed to vulnerable patients, infecting them with the influenza virus. Although LAIV recipients shed vaccine virus, much lower amounts are shed than during natural infection, and transmission is unlikely to occur. Serious illness has not been reported among unvaccinated, otherwise healthy persons who have been infected inadvertently with virus from LAIV vaccine.[1] These findings highlight the importance of educating HCP of the risks, benefits, and basic principles of influenza vaccination. Given the ineffectiveness of voluntary programs in increasing rates of HCP influenza immunization and the effectiveness of influenza immunization in decreasing infection among those most vulnerable to severe complications from influenza, mandatory programs must be implemented around the country.

Health Risks to Patient Populations Cared for by Unimmunized HCP

Mandatory influenza immunization of HCP is a matter of patient safety. The risk of transmission is augmented, because many HCP work when they are mildly symptomatic or ill, which puts their co-workers and patients at risk.[12] A serosurvey conducted in 4 acute care hospitals in the United Kingdom revealed that 23% of HCP had serologic evidence of influenza virus infection during a single influenza season; the majority reported mild illness or subclinical infection. One limitation of this study is that comprehensive culture or polymerase chain reaction–based surveillance was not also performed.[1]

It is well known that HCP can transmit influenza virus to patients and coworkers before the onset of symptoms or during symptomatic illness.[2] The results of 2 published studies highlight the negative effect that HCP infected with influenza can have on their patients.

- In a NICU, 19 of 54 (35%) infants were infected with influenza A as a result of health care–associated transmission; 6 became ill, and 1 died. Only 15% of staff survey respondents in this NICU had received influenza vaccine—67% of physicians and 9% of nurses. Fourteen percent of the employees reported taking time off from work because of illness, which suggests that these symptomatic personnel had a role in transmission.[13]
- During an outbreak of influenza in a bone marrow transplant unit, there were 7 cases of health care–associated influenza; 6 patients developed pneumonia, and 2 patients died.[14] Five staff members developed influenza-like illness during the outbreak. Surveys revealed a vaccination rate of 12% among unit staff. The hospital took measures the following influenza season to implement a multifaceted voluntary education program aimed at improving immunization rates. However, even with these aggressive measures, 42% of the staff on the bone marrow transplant unit remained unimmunized the following year.[14]

THE SOLUTION: MANDATORY IMMUNIZATION OF ALL HCP

Annual influenza epidemics account for 610 660 life-years lost, 3.1 million days of hospitalization, and 31.4 million outpatient visits.[15] Influenza in the

United States generates a cost burden estimated to be $87 billion per year.[15] The bulk of this cost is a result of work absenteeism and premature mortality. "Presenteeism," or working while symptomatic, also contributes a significant amount to the cost burden and decline in productivity associated with influenza infection. Influenza B virus infection in healthy adults impairs the ability to perform certain tasks to a level similar to that seen with sleep deprivation or alcohol consumption.[16] Presenteeism is a threat to patient safety. In addition, healthy adults who receive the influenza immunization have 25% fewer upper respiratory infections, 44% fewer physician visits, and 43% fewer sick days off, saving an average of $47 per person annually and highlighting the cost-effectiveness of immunization against influenza.[17] A decision-analytic computational simulation model that determined the cost/benefit of employer-sponsored workplace immunization from the employer's perspective found cost savings across diverse occupational groups in all seasonal influenza scenarios.[18]

Mandatory immunization is not a novel concept. All states have laws that require certain vaccines for school entry or attendance. Many health care facilities currently require specific vaccines and a tuberculin skin test as conditions for working in certain areas of the institution or for employment.[2,12] Despite this reality, implementation of mandatory influenza immunization programs for HCP continues to be controversial to some who argue that a mandatory program violates civil liberties. The US Supreme Court ruled in 1905 in *Jacobson v Massachusetts* that states have the power to require immunization if it is necessary for public health or safety of the people. The power of states to enforce immunization requirements or other public health initiatives is constitutionally permissible when the intervention:

- is a public health necessity;
- has proven to be effective;
- is not "gratuitously onerous or unfair"; and
- does not pose a health risk to the subject.

For example, school immunization laws are judicially sanctioned, which emphasizes the fact that mandatory immunization programs have long existed without infringing on constitutional rights.[19]

Evidence That Mandatory Influenza Vaccine Policy Increases Rates of Immunization

Each of the following examples resulted in a substantial increase in employee immunization rates, which demonstrates success with the implementation of a mandatory program.

- BJC Health care, a large nonprofit health care organization with approximately 26 000 employees, implemented a mandatory influenza immunization program in 2008 after voluntary models failed to increase rates above 80%.[20] BJC made influenza immunization a condition of employment as a patient safety initiative. Employees could be granted medical or religious exemptions on review by an occupational medicine professional. Medical exemptions were granted to 321 employees (1.2%), of which 107 were for an egg allergy, 83 for previous allergic reaction or allergy to an influenza vaccine component, and 15 for a history of Guillain-Barré syndrome. Exemptions were granted to 116 other employees, of whom 14 cited pregnancy,[20] although it is highly recommended that pregnant women receive influenza vaccine because of the documented increase in risk of serious complications, including death.[12] Religious exemptions were granted to 90 employees. The result was an immunization rate of 98.4% for the organization of 25 980 employees. Only 8 employees refused to be vaccinated, and their employment was terminated.[20]
- Seattle's Virginia Mason Medical Center implemented a mandatory influenza immunization program in 2005. The medical center reported a 99% immunization compliance rate among its employees.[7]
- The National Institutes of Health Clinical Center passed a mandatory influenza immunization policy in 2008. The policy required that employees who had patient contact be immunized or complete an online declination statement specifying the reason for refusal. The policy achieved 100% participation in that all 2754 employees who were identified to have direct patient contact were either immunized or formally declined vaccination. Compared with vaccination rates of 40% to 60% from previous years, the organization achieved an immunization rate of 88% (2424) among employees with patient contact. Of employees who formally declined, 36 reported medical contraindications to influenza vaccine, and 294 declined for other reasons such as concerns about adverse effects, belief that they were not at risk of influenza, or perceptions that the vaccine was ineffective or harmful. Philosophical reasons were cited 5 times as frequently as religious reasons for declining vaccination.[21]
- Hospital Corporation of America, which includes 163 hospitals, 112 outpatient centers, and 368 physician practices in 20 states, put a mandatory policy into effect in late 2009. The policy required all employees in contact with patients to either receive the annual influenza

vaccine or wear a surgical mask in patient areas. Before the policy, vaccination rates in Hospital Corporation of America facilities varied from 20% to 70%. This mandatory policy offered influenza vaccine to 140 599 HCP; 96% of these employees complied.[22]

A Mandatory Recommendation as a Public Health Intervention Is Justified

Medical and religious exemptions can be granted on an individual basis,[20,23] so mandating influenza immunization for HCP is ethically justified. The regulations of New York State's mandatory program highlight the details that compel individuals to be vaccinated to protect the public from seasonal and pandemic influenza.[24] Employees of health care institutions have an ethical and professional obligation to act in the best interest of the health of their patients. Three criteria that a public health intervention must meet to justify mandatory status have been proposed.[25]

1. **There should be clear medical value from the intervention to the individual.** The positive effects of the influenza vaccine on the health of the person immunized are well known.
2. **The public health benefit of the mandatory intervention must be clear to justify the infringement on personal liberties.** Populations staying at or frequenting hospitals are especially vulnerable to increased health risks from influenza. HCP were obliged to take preventive measures to protect patients when they joined the profession. The effects on the health of patients and on the loss of days worked by personnel have been sufficiently demonstrated.
3. **A mandate must be considered the only option.** Current rates of influenza immunization are unacceptably low among HCP, despite decades-long recommendations using myriad other strategies. When other approaches have failed, a mandate is a reliable way to achieve improvement. "If it is possible to obtain herd immunity, for example, without a mandate but through education, insurance coverage, public outreach and so on, then a mandate would not be needed and should not be used."[25] To satisfy a mandate, each health care facility should design, implement, and evaluate a program tailored to fit its particular needs.

Key Points to Consider in Implementing a Mandatory Influenza Immunization Policy

To maximize success when implementing a mandatory policy, relevant factors include:

- Having full support of health care leadership.
- Customizing the plan for each institution; the policy must be tailored to the geographic setting, educational resources, financial assets, local culture, and potential language barriers.
- Making vaccine free to all HCP.
- Publicizing the program to HCP at all levels by:
  - communicating program details regularly;
  - making presentations about influenza prevention and the program;
  - holding "question-and-answer" sessions; and
  - creating a volunteer team of staff HCP to offer education (and vaccine, if possible) to fellow HCP with concerns.
- Offering convenient times and locations for education and immunization administration, preferably within the institution; vaccinators should adapt to accommodate HCP schedules, including:
  - expanding available hours to receive vaccine;
  - increasing the number of locations at which vaccine is given; and
  - offering vaccine at various venues and gathering places within the institution.
- Using a universal form with defined acceptable medical and religious exemptions, which will be more effective, concrete, and uniform than requiring a physician's note.
- Creating a clear institutional policy for management of employees who are exempted from immunization.

These recommendations for the prevention and control of influenza in HCP will have a considerable impact on practice. Therefore, the American Academy of Pediatrics has developed implementation guidance on supply, payment, coding, and liability issues; these documents can be found at www.aapredbook.org/implementation.

CONCLUSIONS

Mandatory influenza immunization programs for HCP will benefit the health of employees, their patients, and members of the community. The influenza vaccine is safe, effective, and cost-effective. Health care organizations must work to assuage common fears and misconceptions about the influenza virus and the vaccine. Immunizing all HCP will serve as an example to patients and highlight the safety and effectiveness of annual immunization. HCP fail to lead by example if they recommend universal immunization, including influenza, to their patients but do not require it of themselves.

Data clearly show that an influenza vaccine mandate is necessary and

long overdue. Health care–associated influenza outbreaks are becoming more common, creating a financial burden on health care systems, and contributing to patient morbidity and mortality. Voluntary programs have failed to increase immunization rates to acceptable levels. Results from a recent CDC survey indicate that HCP who were subject to employer requirements for vaccination were more likely to be vaccinated, compared with those not subject to such requirements.[8] Large health care organizations have implemented highly successful mandatory annual influenza immunization programs without significant problems. The implementation of mandatory annual influenza immunization programs for HCP nationwide is long overdue. For the prevention and control of influenza, now is the time to put the health and safety of the patient first.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Recommendations for Administering Hepatitis A Vaccine to Contacts of International Adoptees

COMMITTEE ON INFECTIOUS DISEASES

KEYWORDS
hepatitis A, vaccines

ABBREVIATION
HAV—hepatitis A virus

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

abstract

FREE

The Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention and the American Academy of Pediatrics (AAP) recommend routine administration of hepatitis A vaccine for household members and close contacts, including baby-sitters, when children are adopted from countries with high or intermediate rates of hepatitis A infection. This policy expands previous AAP recommendations to immunize travelers to countries who are seeking to adopt a child in countries with high or medium hepatitis A endemicity. All previously nonimmune unvaccinated people who anticipate close exposure to international adoptees during the 60 days after their arrival should receive hepatitis A immunization, ideally 2 or more weeks before the arrival of the adopted child. *Pediatrics* 2011;128:803–804

INTRODUCTION

Hepatitis A virus (HAV) causes an acute liver infection that is most commonly acquired from exposure to people shedding virus in feces. Most infected children younger than 6 years are asymptomatic. Fewer than 10% of children younger than 4 years develop any symptoms after infection. Thirty percent to 40% of children 4 through 9 years of age are noted to have jaundice. Transmission is highest during the 1 to 2 weeks before jaundice or elevation of liver enzyme levels occurs and during the week after symptoms develop. Risk of transmission diminishes over time, but HAV can be found in stool for extended periods, particularly in neonates and young children. The incubation period is 15 to 50 days (average of 28 days). Some recent HAV outbreaks have been traced to international adoptees. Hepatitis A vaccine is recommended for all children 12 through 23 months of age, for people who are at increased risk of infection, for people who are at increased risk of severe hepatitis A disease, and for any person who desires immunity.[1]

BACKGROUND AND RATIONALE

During the period 1998–2008, approximately 18 000 children were adopted annually from foreign countries. Of these children, 99.8% were from countries with high or intermediate rates of HAV infection,[2] and 85% were younger than 5 years. The incidence of HAV infection in these countries is highest in children younger than 5 years. Hepatitis A vaccine is not routinely administered in these countries. In 2007, a case of fulminant HAV infection was reported in a grandmother of an asymptomatic 1-year-old adopted from Ethiopia who had a laboratory-

confirmed HAV infection. An investigation of this event identified 20 additional cases of acute hepatitis A in patients who had no international travel but had close personal contact with newly arriving internationally adopted children.[3]

Since 2007, the Centers for Disease Control and Prevention has received reports of 14 more clusters of acute HAV infection after exposure to asymptomatic newly arriving adoptees. In a 1998 outbreak, 12 secondary cases were identified, and there were 2 hospitalizations and tertiary cases in an elementary school. Data from 3 adoption clinics in the United States revealed that 1% to 6% of adoptees were acutely infected with HAV.

The risk of HAV infection in close contacts of international adoptees is estimated to be 106 per 100 000 contacts within the initial 60 days of arrival.[4] This rate is 100 times greater than that estimated for symptomatic HAV infection in the general US population.

NEW VACCINE RECOMMENDATIONS

On February 25, 2009, the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention updated its policy for hepatitis A vaccine. Hepatitis A vaccine is now recommended for all previously unvaccinated people who anticipate close personal contact with an international adoptee from a country of high or medium endemicity (see www.cdc.gov/mmwr/preview/mmwrhtml/rr5507a1.htm#Fig4) during the 60-day period after arrival. Close contacts include household members and baby-sitters. The first dose of the 2-dose series should be given as soon as adoption is planned, ideally 2 or more weeks before arrival of the adopted child. The second dose should be given to provide long-term immunity.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Recommendations for the Prevention of Perinatal Group B Streptococcal (GBS) Disease

COMMITTEE ON INFECTIOUS DISEASES AND COMMITTEE ON FETUS AND NEWBORN

KEY WORDS

group B *Streptococcus*, early onset, diagnosis, prophylaxis, penicillin allergy, treatment

ABBREVIATIONS

GBS—group B streptococcal/*Streptococcus*
IAP—intrapartum antibiotic prophylaxis
CDC—Centers for Disease Control and Prevention
CBC—complete blood cell

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

abstract

FREE

The Centers for Disease Control and Prevention (CDC) guidelines for the prevention of perinatal group B streptococcal (GBS) disease were initially published in 1996. The American Academy of Pediatrics (AAP) also published a policy statement on this topic in 1997. In 2002, the CDC published revised guidelines that recommended universal antenatal GBS screening; the AAP endorsed these guidelines and published recommendations based on them in the 2003 *Red Book*. Since then, the incidence of early-onset GBS disease in neonates has decreased by an estimated 80%. However, in 2010, GBS disease remained the leading cause of early-onset neonatal sepsis. The CDC issued revised guidelines in 2010 based on evaluation of data generated after 2002. These revised and comprehensive guidelines, which have been endorsed by the AAP, reaffirm the major prevention strategy—universal antenatal GBS screening and intrapartum antibiotic prophylaxis for culture-positive and high-risk women—and include new recommendations for laboratory methods for identification of GBS colonization during pregnancy, algorithms for screening and intrapartum prophylaxis for women with preterm labor and premature rupture of membranes, updated prophylaxis recommendations for women with a penicillin allergy, and a revised algorithm for the care of newborn infants. The purpose of this policy statement is to review and discuss the differences between the 2002 and 2010 CDC guidelines that are most relevant for the practice of pediatrics. *Pediatrics* 2011;128:611–616

INTRODUCTION

Group B streptococcal (GBS) disease has been a leading cause of neonatal morbidity and mortality since the 1970s.[1,2] Maternal colonization with GBS in the genitourinary or gastrointestinal tract and transmission to the infant during the labor-and-delivery process is the principal risk factor for early-onset invasive GBS disease.[3] Women who are identified as being GBS-colonized through culture-based screening are more than 25 times more likely to deliver an infant with early-onset infection than are women with negative prenatal cultures.[4] Identification of maternal colonization through universal, culture-based screening with intrapartum antibiotic prophylaxis (IAP) for women with positive screening results has been recommended since 2002.[5] This strategy, endorsed by the American Academy of Pediatrics, has been widely adopted in the United States and has resulted in an estimated 80% decrease in early-onset GBS infection.[6]

However, even in the era of universal screening, cases of GBS disease continue to occur.[7–11] To evaluate data published after the Cen-

TABLE 1 Evidence-Based Rating System Used to Determine Strength of Recommendations

Category	Definition	Recommendation
Strength of recommendation		
A	Strong evidence for efficacy and substantial clinical benefit	Strongly recommended
B	Strong or moderate evidence for efficacy, but only limited clinical benefit	Generally recommended
C	Insufficient evidence for efficacy, or efficacy does not outweigh possible adverse consequences	Optional
D	Moderate evidence against efficacy or for adverse outcome	Generally not recommended
E	Strong evidence against efficacy or for adverse outcome	Never recommended
Quality of evidence supporting recommendation		
I	Evidence from at least 1 well-executed randomized, controlled trial or 1 rigorously designed laboratory-based experimental study that has been replicated by an independent investigator	
II	Evidence from at least 1 well-designed clinical trial without randomization; cohort or case-controlled analytic studies (preferably from more than 1 center); multiple time-series studies; dramatic results from uncontrolled studies; or some evidence from laboratory experiments	
III	Evidence from opinions of respected authorities based on clinical or laboratory experience, descriptive studies, or reports of expert committees	

Adapted with permission from Centers for Disease Control and Prevention. Guidelines for the prevention and treatment of opportunistic infections among HIV-exposed and HIV-infected children: recommendations from CDC, the National Institutes of Health, the HIV Medicine Association of the Infectious Diseases Society of America, the Pediatric Infectious Diseases Society, and the American Academy of Pediatrics. *MMWR Recomm Rep.* 2009;58(RR-11):1–166.

ters for Disease Control and Prevention (CDC) issued guidelines for the prevention of GBS perinatal disease in 2002, the CDC called a meeting of clinical and public health representatives in June 2009. The goal of the meeting was to identify potentially modifiable reasons for continued GBS disease and to address these issues. The American Academy of Pediatrics was represented by members of its Committee on Infectious Diseases and Committee on Fetus and Newborn. The purpose of this policy statement is to review and discuss the differences between the 2002 and 2010 CDC guidelines that are most relevant for the practice of pediatrics. Table 1 outlines the evidence-based rating system that supports each recommendation; strength (indicated by a letter) and quality (indicated by a roman numeral) of evidence are shown in parentheses. The 2010 CDC guidelines can be accessed online (www.cdc.gov/groupbstrep/guidelines/guidelines.html).

LABORATORY DIAGNOSIS OF GBS COLONIZATION

The 2002 guidelines from the CDC recommended universal culture-based screening for GBS at 35 to 37 weeks of gestation. In the intervening years, new diagnostic technologies have been developed, including pigmented enrichment broths, chromogenic agars, DNA probes, and nucleic acid amplification tests (NAATs). These methods have been validated for antenatal testing for GBS colonization and are used in many clinical laboratories, which enables more rapid identification of GBS. A positive test result for GBS by culture, DNA probe, or NAAT performed during antenatal screening indicates colonization, and the woman should receive IAP. However, infants with early-onset GBS can be born to women with negative antenatal screening results, because all laboratory-screening methods are imperfect. Culture-based screening, especially if processing in the laboratory does not always follow the CDC guidelines, may not identify all colonized women.[7,11] Infants with signs and symptoms of sepsis should be managed according to the neonatal algorithm (Fig 1) and receive an initial antibiotic regimen that includes ampicillin regardless of maternal screening results.

Recommendations

- Options for GBS identification from culture of maternal vaginal/rectal swabs have been expanded to include a positive identification from chromogenic agar media. Identification of GBS directly by nucleic acid amplification tests (NAATs), such as commercially available polymerase chain reaction assays, can also be used after broth enrichment if laboratories have validated their NAAT performance and instituted appropriate quality controls (CII).

INTRAPARTUM ANTIBIOTIC PROPHYLAXIS

Penicillin and ampicillin have each been demonstrated in controlled clinical trials to be effective in preventing early-onset GBS disease when administered during labor.[12,13] Penicillin and ampicillin at the recommended dosages for IAP rapidly achieve therapeutic concentrations in the fetal circulation and then amniotic fluid. Cefazolin has similar pharmacokinetics when compared with penicillin, and IAP dosing achieves high intra-amniotic concentrations.[14–16] Cefazolin has been the preferred alternative for IAP for penicillin-allergic women at low risk of anaphylaxis since 2002, although it has been used uncommonly for this indication. At least 4 hours of IAP with one of these β-lactam antibiotics is effective

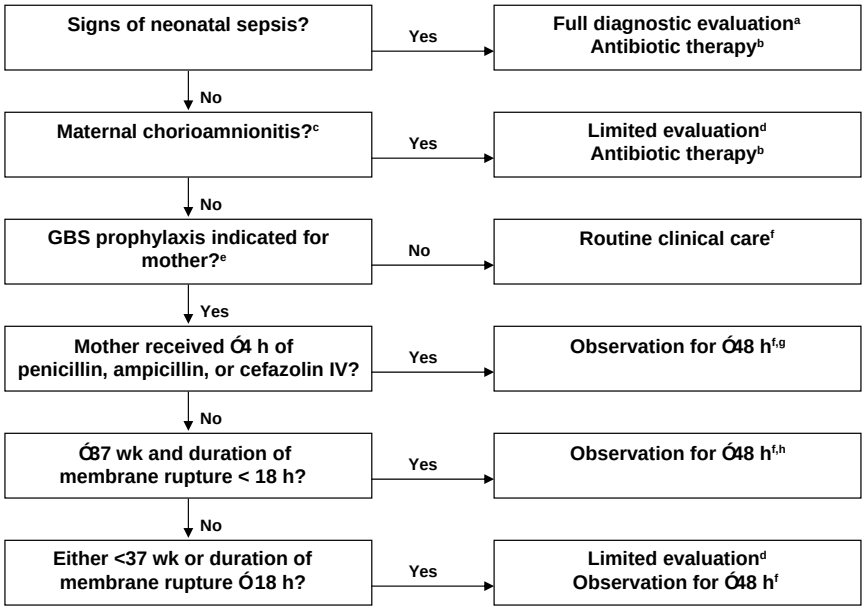

FIGURE 1

Algorithm for the prevention of early-onset GBS infection in the newborn. (Adapted with permission from Centers for Disease Control and Prevention. Prevention of perinatal group B streptococcal disease: prevention of perinatal group B streptococcal disease from CDC, 2010. *MMWR Recomm Rep.* 2010;59[RR-10]:1–32.) [a] Full diagnostic evaluation includes a blood culture; CBC count, including white blood cell differential and platelet counts; chest radiograph (if respiratory abnormalities are present); and lumbar puncture (if the patient is stable enough to tolerate procedure and sepsis is suspected). [b] Antibiotic therapy should be directed toward the most common causes of neonatal sepsis, including intravenous ampicillin for GBS and coverage for other organisms (including *Escherichia coli* and other Gram-negative pathogens) and should take into account local antibiotic-resistance patterns. [c] Consultation with obstetric providers is important in determining the level of clinical suspicion for chorioamnionitis. Chorioamnionitis is diagnosed clinically, and some of the signs are nonspecific. [d] Limited evaluation includes blood culture (at birth) and CBC count with differential and platelets (at birth and/or at 6–12 hours of life). [e] GBS prophylaxis is indicated if 1 or more of the following is true: (1) mother is GBS-positive within the preceding 5 weeks; (2) GBS status is unknown and there are 1 or more intrapartum risk factors, including <37 weeks' gestation, rupture of membranes for ≥18 hours, or temperature of ≥100.4°F (38.0°C); (3) GBS bacteriuria during current pregnancy; or (4) history of a previous infant with GBS disease. [f] If signs of sepsis develop, a full diagnostic evaluation should be performed, and antibiotic therapy should be initiated. [g] If at ≥37 weeks' gestation, observation may occur at home after 24 hours if other discharge criteria have been met, there is ready access to medical care, and a person who is able to comply fully with instructions for home observation will be present. If any of these conditions is not met, the infant should be observed in the hospital for at least 48 hours and until discharge criteria have been achieved. [h] Some experts recommend a CBC count with differential and platelets at 6 to 12 hours of age.[24] IV indicates intravenously.

in preventing early-onset GBS disease in neonates. The definition of adequate IAP has been clarified to include penicillin, ampicillin, or cefazolin for at least 4 hours before delivery. Duration of IAP shorter than 4 hours and all other regimens, including clindamycin and vancomycin, are considered to be inadequate prophylaxis for infants because of lack of data regarding efficacy and limited data regarding favorable pharmacokinetics. No clinical trials have evaluated the efficacy of non–β-lactam regimens for IAP in women with serious penicillin allergy. Although clindamycin is the most commonly chosen IAP regimen in the United States for penicillin-allergic women at low risk of anaphylaxis, current data indicate that approximately 20% of GBS isolates are resistant to clindamycin. Clindamycin should never be used for IAP if susceptibility testing of the mother's GBS isolate has not been performed. Several recent studies have revealed that susceptibility testing is rarely performed on GBS isolates,[5,6,17] and early-onset GBS disease has been reported in infants born to mothers who have received clindamycin IAP.[11,17]

Recommendations

- Penicillin remains the agent of choice for IAP, and ampicillin is an acceptable alternative (AI).
- Penicillin-allergic women who do not have a history of anaphylaxis, angioedema, respiratory distress, or urticaria after administration of penicillin or a cephalosporin should receive cefazolin (BII).
- Penicillin-allergic women at high risk of anaphylaxis should receive clindamycin if their GBS isolate is susceptible or vancomycin if their GBS isolate is intrinsically resistant to clindamycin (CIII).
- The definition of adequate IAP has been clarified to be at least 4 hours of penicillin, ampicillin, or cefazolin. The initial intravenous dose of penicillin is 5 million units; for ampicillin and cefazolin, the initial dose is 2 g (AIII).
- All other antibiotics, doses, or durations are considered inadequate for the purposes of neonatal management (AIII).

PREVENTION OF EARLY-ONSET GBS DISEASE

The revised 2010 GBS American Academy of Pediatrics guidelines for neonatal management were designed to broaden the scope to include all neonates, to increase the clarity of the recommendations, and to decrease unnecessary laboratory evaluations and empirical antibiotics for infants at low risk. Although this strategy will never prevent all infections, the revised guidelines should result in a further decrease in cases of perinatal GBS disease. The management of neonates continues to be based on clinical signs,

the presence of maternal risk factors for GBS neonatal disease, and the likely efficacy of IAP (or maternal antimicrobial treatment in the case of clinical or occult chorioamnionitis) in preventing early-onset disease. The revised infant management algorithm (Fig 1) is derived from recent data summarized in the published CDC document regarding the epidemiology of GBS disease and the usefulness of a "limited evaluation" of well-appearing neonates.

All newborn infants with signs suggestive of sepsis should have a full diagnostic evaluation, including a lumbar puncture if the infant is stable enough to undergo the procedure; 15% to 38% of infants with early-onset meningitis have sterile blood cultures, so evaluating the cerebrospinal fluid is required for optimal diagnostic sensitivity.[18–21] If the care provider believes that a noninfectious condition is responsible for the infant's signs (eg, transient tachypnea of the newborn) and there are no maternal risk factors for sepsis in an otherwise well-appearing infant, the lumbar puncture can be deferred or eliminated. Empirical antimicrobial therapy, typically intravenous ampicillin and gentamicin (unless local antibiotic-resistance patterns suggest the need for another combination), then should be initiated promptly. Chorioamnionitis continues to be a significant risk factor for early-onset GBS sepsis in infants born to GBS-colonized women. All well-appearing newborn infants born to women who have a clinical diagnosis of chorioamnionitis from their obstetric provider should undergo a "limited evaluation," which includes a complete blood cell (CBC) count and differential and a blood culture before initiation of empirical antimicrobial therapy. The sensitivity of the CBC count is improved if delayed for 6 to 12 hours after birth. Empirical therapy should be discontinued as soon as the clinical course and laboratory evaluation exclude sepsis.

The indications for maternal IAP remain unchanged and include 1 of more of the following: (1) GBS culture–positive within preceding 5 weeks; (2) GBS status unknown with 1 or more intrapartum risk factors including less than 37 weeks' gestation, prolonged rupture of membranes for $\geq$18 hours, or temperature of $\geq$100.4°F (38.0°C); (3) GBS bacteriuria during current pregnancy; and (4) history of a previous infant with GBS disease. When a cesarean delivery is performed before onset of labor with intact amniotic membranes, the risk of early-onset GBS disease among infants is extremely low[22,23]; therefore, IAP is not recommended as a routine practice for cesarean deliveries performed under these circumstances, regardless of the GBS colonization status of the woman or the gestational age of the infant.

In well-appearing newborn infants born to women without an indication for IAP, routine clinical care is indicated unless signs of sepsis develop. For well-appearing term newborn infants born to mothers with an indication for IAP to prevent GBS disease and receipt of 4 or more hours of penicillin, ampicillin or cefazolin at the appropriate doses before delivery, routine care, and 48 hours of observation continue to be recommended. However, if these infants meet other discharge criteria, including term birth and ready access to medical care, discharge can occur as early as 24 hours after birth. In this latter circumstance, follow-up care by a care provider within 48 to 72 hours is recommended.

In well-appearing term newborn infants whose mothers had an indication for GBS prophylaxis and rupture of membranes for $<$18 hours but who received inadequate IAP—either by duration before delivery or by inappropriate agent or dose—observation in the hospital for at least 48 hours is recommended. These infants would include infants born to women with a serious penicillin allergy who received either clindamycin or vancomycin. This revised recommendation is based on the poor sensitivity of the "limited-evaluation" assessments in this circumstance and also data indicating that signs of early-onset GBS sepsis appear in more than 98% of neonates within this interval of hospitalization. The authors of several studies have reported the sensitivity of an abnormal CBC count in predicting GBS sepsis to range from 41% to 68%, whereas the presence of clinical signs has a sensitivity of 92%.[24–27] The yield of blood culture can be low among newborn infants exposed to intrapartum antibiotics.[28] Finally, for all preterm neonates ($<$37 weeks of gestation) or for term newborn infants born in the setting of rupture of membranes 18 hours or more before delivery without adequate maternal IAP, a limited evaluation and observation for at least 48 hours is recommended.

Recommendations for Management of Newborn Infants

- All newborn infants with signs of sepsis should undergo a full diagnostic evaluation (including a lumbar puncture) and receive empirical antimicrobial therapy (AII).
- All well-appearing newborn infants born to women given a diagnosis of chorioamnionitis by their obstetrical provider should undergo a limited diagnostic evaluation (no lumbar puncture) and receive empirical antimicrobial therapy (AII).
- For all women who received adequate IAP defined as penicillin (preferred), ampicillin, or cefazolin (penicillin-allergic women at low

risk of anaphylaxis) for 4 or more hours before delivery, their newborn infants require only routine care and observation in the hospital for 48 hours (BIII). If these infants meet other discharge criteria, including term birth and ready access to medical care, discharge can occur as early as 24 hours after birth with follow-up care by a care provider within 48 to 72 hours (CII).

- Well-appearing term newborn infants whose mothers received no or inadequate IAP (including clindamycin or vancomycin) and had rupture of membranes for less than 18 hours require only observation for 48 hours (BIII).
- Well-appearing term infants born to women with no or inadequate IAP and rupture of membranes for 18 or more hours before delivery should undergo a "limited evaluation" (ie, blood culture and CBC count with differential and platelets at birth) and observation for at least 48 hours (BIII).
- All preterm infants born to women with no or inadequate IAP should undergo a limited evaluation and observation for at least 48 hours (BIII).

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Policy Statement—Recommendations for the Prevention of *Streptococcus pneumoniae* Infections in Infants and Children: Use of 13-Valent Pneumococcal Conjugate Vaccine (PCV13) and Pneumococcal Polysaccharide Vaccine (PPSV23)

abstract

Routine use of the 7-valent pneumococcal conjugate vaccine (PCV7), available since 2000, has resulted in a dramatic reduction in the incidence of invasive pneumococcal disease (IPD) attributable to serotypes of *Streptococcus pneumoniae* contained in the vaccine. However, IPD caused by nonvaccine pneumococcal serotypes has increased, and nonvaccine serotypes are now responsible for the majority of the remaining cases of IPD occurring in children. A 13-valent pneumococcal conjugate vaccine has been licensed by the US Food and Drug Administration, which, in addition to the 7 serotypes included in the original PCV7, contains the 6 pneumococcal serotypes responsible for 63% of IPD cases now occurring in children younger than 5 years. Because of the expanded coverage provided by PCV13, it will replace PCV7. This statement provides recommendations for (1) the transition from PCV7 to PCV13; (2) the routine use of PCV13 for healthy children and children with an underlying medical condition that increases the risk of IPD; (3) a supplemental dose of PCV13 for (*a*) healthy children 14 through 59 months of age who have completed the PCV7 series and (*b*) children 14 through 71 months of age with an underlying medical condition that increases the risk of IPD who have completed the PCV7 series; (4) "catch-up" immunization for children behind schedule; and (5) PCV13 for certain children at high risk from 6 through 18 years of age. In addition, recommendations for the use of pneumococcal polysaccharide vaccine for children at high risk of IPD are also updated. *Pediatrics* 2010;126:186–190

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS

pneumococcal vaccine, invasive pneumococcal disease, immunization, PCV7, PCV13, PPSV23

ABBREVIATIONS

PCV7—7-valent pneumococcal conjugate vaccine
IPD—invasive pneumococcal disease
PCV13—13-valent pneumococcal conjugate vaccine
AAP—American Academy of Pediatrics
PPSV23—23-valent pneumococcal polysaccharide vaccine
SIDS—sudden infant death syndrome

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INTRODUCTION

Invasive disease attributable to *Streptococcus pneumoniae* remains a significant public health problem in children despite widespread use of the 7-valent pneumococcal conjugate vaccine (PCV7) in US infants 2 through 23 months of age. PCV7 was also recommended for certain children 24 through 59 months of age. After the introduction of PCV7, dramatic decreases in invasive pneumococcal disease (IPD) attributable to vaccine serotypes were noted in children. A significant decrease in adult pneumococcal disease attributable to vaccine sero-

types was also seen. However, IPD attributable to serotypes not included in the PCV7 increased in frequency, which prompted the need for development of a pneumococcal conjugate vaccine with expanded coverage.[1]

On February 24, 2010, the US Food and Drug Administration licensed a new 13-valent pneumococcal polysaccharide-protein conjugate vaccine (PCV13) (Prevnar 13 [Wyeth Pharmaceuticals Inc, Madison, NJ]) for use in children 2 through 71 months of age. This new vaccine will replace the previously recommended PCV7. PCV13 contains the same 7 pneumococcal capsular polysaccharides found in PCV7 and 6 additional pneumococcal serotypes, which are now responsible for substantial rates of IPD in US children. The 13 capsular polysaccharides included in the vaccine are 1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F.

The American Academy of Pediatrics (AAP), through its Committee on Infectious Diseases, actively participated in the development of the recommendations for use of the new PCV13 vaccine, which were approved by the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention.[2] PCV13 will replace PCV7 and use the same routine and catch-up immunization schedules recommended for PCV7 for healthy children through 59 months of age and for children at high risk through 71 months of age. In addition, a single supplemental dose of PCV13 is recommended for healthy children 14 through 59 months of age and children at high risk 14 through 71 months of age who were completely immunized with PCV7. No active recall of children is recommended, but the supplemental dose should be given at the next appropriate medical visit of the child who has been completely immunized with PCV7.

A single dose of PCV13 may be administered to children 6 through 18 years of age who are at increased risk of IPD because of sickle cell disease, anatomic or functional asplenia, HIV infection or another immunocompromising condition, or presence of a cochlear implant or cerebrospinal fluid leak. Children at high risk who are 2 years old or older should also receive 23-valent pneumococcal polysaccharide vaccine (PPSV23) at least 8 weeks after their last dose of PCV13. A second dose of PPSV23 is recommended 5 years after the first dose for children with sickle cell disease, anatomic or functional asplenia, HIV infection, or other immunocompromising conditions.

BACKGROUND

IPD is a leading cause of morbidity and mortality throughout the world, and an estimated 14.5 million episodes occurred in children younger than 5 years in the year 2000, resulting in an estimated 826 000 pediatric deaths representing 11% of all deaths in children 1 through 59 months of age.[3] In the United States, before introduction of PCV7, an estimated 16 250 cases of IPD occurred annually in children younger than 5 years, and 80% of cases of IPD in children were attributable to 1 of the 7 serotypes contained in PCV7.[4] After widespread use of PCV7, IPD attributable to all pneumococcal serotypes decreased by 75% in children younger than 5 years and decreased by 45% overall when all age groups were considered, secondary to herd immunity. The reduction in IPD attributable to serotypes contained in PCV7 was even more dramatic (100% in children younger than 5 years and 94% when people of all ages were considered). After accounting for the indirect effects on incidence of IPD, the cost per life-year saved (estimated at $10 400) made PCV7 immunization a cost-effective intervention.[5] In an analysis of 753 cases of IPD in children who had been completely immunized with PCV7, only 4% were true "vaccine failures." The remaining cases were attributable to serotypes not contained in PCV7.[6]

Rates of IPD attributable to serotypes not contained in PCV7 have increased for all age groups since 2000. By 2006–2007, only 2% of IPD cases in children younger than 5 years were caused by PCV7 types, but the 6 additional serotypes included in the new PCV13 vaccine caused 63% of IPD cases in this age group. A report published in the *Morbidity and Mortality Weekly Report* estimated that 4600 cases of IPD occurred in US children younger than 5 years in 2007. Approximately 2900 of these cases (63%) were attributable to serotypes contained in PCV13 and would be potentially preventable with widespread use of PCV13.[7]

DISCUSSION

PCV13 was licensed by the Food and Drug Administration on the basis of safety and immunogenicity. The vaccine is available in single-dose, prefilled syringes that do not contain latex. The vaccine is a sterile solution of 13 capsular polysaccharides of *S pneumoniae*, with each capsular polysaccharide conjugated to a nontoxic variant of diphtheria toxin carrier protein. The vaccine contains no thimerosal or other preservatives but does contain polysorbate 80 and 0.125 mg of aluminum (as aluminum phosphate adjuvant) and succinate buffer.

Vaccine safety was studied in 13 controlled trials involving 4700 healthy infants 6 weeks through 15 months of age who received PCV13 and 2700 infants who received PCV7 as the control population. PCV13 was given simultaneously with other recommended childhood vaccines. Rates of local reactions at the injection site were not different between the 2 groups. Systemic reaction rates (fever, irritability,

sleep disturbances) were also not different between the PCV13 and PCV7 groups.

There were 3 deaths among the infants who received PCV13 (0.063%) and 1 death among the PCV7 recipients (0.036%). All infants died from sudden infant death syndrome (SIDS). The death rate from SIDS was consistent with the published background rates of SIDS in the United States.

Safety was also assessed in 354 patients 7 through 71 months of age who received at least 1 dose of PCV13 but had not previously received PCV7. An additional 284 children 15 through 59 months of age who had received at least 3 doses of PCV7 were given 1 or 2 doses of PCV13 and followed for adverse reactions. Vaccine was well tolerated in these groups, and no significant adverse events were reported.

Immunogenicity was assessed by measuring immunoglobulin G (IgG) antibody concentrations by enzyme-linked immunosorbent assay (ELISA) and by assessing functional antibody responses (opsonophagocytic activity). For 12 of the 13 serotypes, the percentage of children who achieved antibody responses of $\geq$0.35 μg/mL was similar to the percentage of children who achieved antibody responses of $\geq$0.35 μg/mL 1 month after the third dose of PCV7. For serotype 3 (not contained in PCV7), only 63.5% of children achieved an antibody concentration of $\geq$0.35 μg/mL. Functional opsonophagocytic antibody responses were elicited for all 13 serotypes. Responses after the fourth dose of PCV13 showed an increase in antibody concentrations measured by ELISA for all 13 serotypes.

PCV13 is currently being studied in children 72 months old and older with conditions that put them at high risk, but no data are currently available regarding safety or immunogenicity in this population of older children. However, on the basis of the experience with PCV7, it is likely that PCV13 will be as safe and effective in reducing the risk of pneumococcal disease in this high-risk, older population of children.

RECOMMENDATIONS

Children who have not previously received PCV7 or PCV13 or who are incompletely immunized with PCV7 or PCV13:

- PCV13 is recommended for all children 2 through 59 months of age and for children 60 through 71 months of age who have underlying medical conditions that increase their risk of pneumococcal disease or complications (Table 1).
- PCV13 is recommended as a 4-dose series given at 2, 4, 6, and 12 through 15 months of age (Table 2).
- For children within this age range who have received 1 or more doses of PCV7, the series should be completed with PCV13 when it is available in the office. Thus, previously administered PCV7 doses count toward completion of the recommended series (Table 3).
- The immunization schedule for infants and toddlers 2 through 59 months of age who have not received any previous PCV7 or PCV13 or who need "catch-up" immunization are the same as those published previously for PCV7, with PCV13 replacing PCV7 in the schedule (see Table 3.53 in *Red Book*[8] (p532)). The only addition to Table 3.53 is the extension of age in children with underlying medical condi-

TABLE 1 Underlying Medical Conditions That Are Indications for Pneumococcal Immunization Among Children, According to Risk Group: Advisory Committee on Immunization Practices, United States, 2010

Risk Group	Condition
Immunocompetent children	Chronic heart disease[a]
	Chronic lung disease[b]
	Diabetes mellitus
	Cerebrospinal fluid leaks
	Cochlear implant
Children with functional or anatomic asplenia	Sickle cell disease and other hemoglobinopathies
	Congenital or acquired asplenia or splenic dysfunction
Children with immunocompromising conditions	HIV infection
	Chronic renal failure and nephrotic syndrome
	Diseases associated with treatment with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; or solid organ transplantation
	Congenital immunodeficiency[c]

[a] Particularly cyanotic congenital heart disease and cardiac failure.
[b] Including asthma, if treated with prolonged high-dose oral corticosteroids.
[c] Includes B- (humoral) or T-lymphocyte deficiency; complement deficiencies, particularly C1, C2, C3, and C4 deficiency; and phagocytic disorders (excluding chronic granulomatous disease).

TABLE 2 Recommended Routine Immunization Schedule for PCV13 Among Infants and Children Who Have Not Received Previous Doses of PCV7 or PCV13, According to Age at First Dose: Advisory Committee on Immunization Practices, United States, 2010

Age at First Dose, mo	Primary PCV13 Series, No. of Doses[a]	PCV13 Booster Dose at 12–15 mo of Age, No. of Doses[b]
2–6	3	1
7–11	2	1
12–23	2	—
24–59 (healthy children)	1	—
24–71 (children with certain chronic diseases or immunocompromising conditions[c])	2	—

[a] Minimum interval between doses is 8 weeks except for children vaccinated at 12 months of age or younger for whom the minimum interval between doses is 4 weeks. The minimum age for administration of the first dose is 6 weeks.
[b] Given at least 8 weeks after the previous dose.
[c] For a complete list of conditions, see Table 1.

TABLE 3 Recommended Transition Schedule From PCV7 to PCV13 Vaccination Among Infants and Children, According to Number of Previous PCV7 Doses Received: Advisory Committee on Immunization Practices, United States, 2010

Infant Series			Booster Dose, ≥12 mo[a]	Supplemental PCV13 Dose, 14–59 mo[b]
2 mo	4 mo	6 mo		
PCV7	PCV13	PCV13	PCV13	—
PCV7	PCV7	PCV13	PCV13	—
PCV7	PCV7	PCV7	PCV13	—
PCV7	PCV7	PCV7	PCV7	PCV13

[a] No additional PCV13 doses are indicated for children 12 through 23 months of age who have received 2 or 3 doses of PCV before 12 months of age and at least 1 dose of PCV13 at 12 months of age or older.
[b] For children with underlying medical conditions (see Table 1), a single supplemental PCV13 dose is recommended through the age of 71 months.

tions, for whom PCV13 is recommended through 71 months of age.

Supplemental dose recommendation:

- A single supplemental dose of PCV13 is recommended for all healthy children 14 through 59 months of age who are fully immunized with PCV7. The supplemental dose should be given at least 8 weeks after the last dose of PCV7.
- For children fully immunized with PCV7 who have underlying medical conditions that increase their risk of pneumococcal disease or complications, a single supplemental dose of PCV13 is recommended for children 14 through 71 months of age, including children who may have previously received PPSV23.
- No active recall of patients is recommended. The supplemental dose should be given at the next medical visit of the child.

Children 6 through 18 years of age with conditions that place them at high risk:

- A single dose of PCV13 may be administered to children 6 through 18 years of age who are at increased risk of IPD because of sickle cell disease, anatomic or functional asplenia, HIV infection or other immunocompromising condition, or presence of cochlear implant or cerebrospinal fluid leaks, regardless of whether they have previously received PCV7 or PPSV23.

Use of PPSV23 among children 2 through 18 years of age who are at increased risk of IPD:

- Children with an underlying medical condition that increases the risk of IPD should receive PPSV23 at 2 years of age or as soon as possible after a diagnosis of chronic illness is made after the age of 2 years.
- Doses of PCV13 should be completed before PPSV23 is given, with a minimum interval of 8 weeks between the last dose of PCV13 and the dose of PPSV23.
- If a child has previously received PPSV23, he or she should also receive the recommended doses of PCV13.
- A second dose of PPSV23 is recommended 5 years after the first dose in children with sickle cell disease or functional or anatomic asplenia, HIV infection, or other immunocompromising conditions, but no more than 2 total doses of PPSV23 are recommended at this time.

IMPLEMENTATION OF THE NEW RECOMMENDATIONS

The introduction of a new vaccine may have considerable impact on the practice. Therefore, the AAP has developed implementation guidance on supply, payment, coding, and liability issues; these documents can be found at www.aapredbook.org/implementation.

PCV13 is approved for the Vaccines for Children (VFC) program through 18 years of age, and the vaccine will be covered by the Vaccine Injury Compensation Program. PPSV23 is not covered by the Vaccine Injury Compensation Program.

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Recommendations for Preventive Pediatric Health Care

Bright Futures
Prevention and health promotion for infants, children, adolescents, and their families™

Each child and family is unique; therefore, these **Recommendations for Preventive Pediatric Health Care** are designed for the care of children who are receiving competent parenting, have no manifestations of any important health problems, and are growing and developing in satisfactory fashion. **Additional visits may become necessary** if circumstances suggest variations from normal.

Developmental, psychosocial, and chronic disease issues for children and adolescents may require frequent counseling and treatment visits separate from preventive care visits.

These guidelines represent a consensus by the American Academy of Pediatrics (AAP) and Bright Futures. The AAP continues to emphasize the great importance of **continuity of care** in comprehensive health supervision and the need to avoid **fragmentation of care.**

	INFANCY								EARLY CHILDHOOD							MIDDLE CHILDHOOD						ADOLESCENCE										
Age[a]	Prenatal[b]	Newborn[c]	3–5 d[d]	By 1 mo	2 mo	4 mo	6 mo	9 mo	12 m	15 mo	18 mo	24 mo	30 mo	3 y	4 y	5 y	6 y	7 y	8 y	9 y	10 y	11 y	12 y	13 y	14 y	15 y	16 y	17 y	18 y	19 y	20 y	21 y
HISTORY																																
Initial/interval	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
MEASUREMENTS																																
Length/height and weight		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Head circumference		●	●	●	●	●	●	●	●	●	●	●																				
Weight for length		●	●	●	●	●	●	●	●	●	●																					
Body mass index												●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Blood pressure[e]		★	★	★	★	★	★	★	★	★	★	★	★	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
SENSORY SCREENING																																
Vision		★	★	★	★	★	★	★	★	★	★	★	★	●[f]	●	●	●	★	●	★	●	★	●	★	★	●	★	★	●	★	★	★
Hearing		●[g]	★	★	★	★	★	★	★	★	★	★	★	★	●	●	●	★	●	★	●	★	★	★	★	★	★	★	★	★	★	★	★
DEVELOPMENTAL/BEHAVIORAL ASSESSMENT																																
Developmental screening[h]								●			●		●																			
Autism screening[i]											●	●																				
Developmental surveillance[h]		●	●	●	●	●	●		●	●		●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Psychosocial/behavioral assessment		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Alcohol and drug use assessment																						★	★	★	★	★	★	★	★	★	★	★
PHYSICAL EXAMINATION[j]		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PROCEDURES[k]																																
Newborn metabolic/hemoglobin screening[l]		←	●	→																												
Immunization[m]		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Hematocrit or hemoglobin[n]						★			●		★	★		★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★
Lead screening[o]							★	★	●or★[p]		★	●or★[p]		★	★	★	★															
Tuberculin test[q]				★			★		★		★	★		★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★
Dyslipidemia screening[r]												★			★		★		★		★	★	★	★	★	★	★	★	←	●	→
STI screening[s]																						★	★	★	★	★	★	★	★	★	★	★
Cervical dysplasia screening[t]																						★	★	★	★	★	★	★	★	★	★	★
ORAL HEALTH[u]							★	★	●or★[u]		●or★[u]	●or★[u]	●or★[u]	●[v]			●[v]															
ANTICIPATORY GUIDANCE[w]	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

[a] If a child comes under care for the first time at any point on the schedule, or if any items are not accomplished at the suggested age, the schedule should be brought up to date at the earliest possible time.

[b] A prenatal visit is recommended for parents who are at high risk, for first-time parents, and for those who request a conference. The prenatal visit should include anticipatory guidance, pertinent medical history, and a discussion of benefits of breastfeeding and planned method of feeding per AAP statement "The Prenatal Visit" (2001) [URL: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;107/6/1456].

[c] Every infant should have a newborn evaluation after birth, breastfeeding encouraged, and instruction and support offered.

[d] Every infant should have an evaluation within 3 to 5 days of birth and within 48 to 72 hours after discharge from the hospital, to include evaluation for feeding and jaundice. Breastfeeding infants should receive formal breastfeeding evaluation, encouragement, and instruction as recommended in AAP statement "Breastfeeding and the Use of Human Milk" (2005) [URL: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;115/2/496]. For newborns discharged in less than 48 hours after delivery, the infant must be examined within 48 hours of discharge per AAP statement "Hospital Stay for Healthy Term Newborns" (2004) [URL: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;113/5/1434].

[e] Blood pressure measurement in infants and children with specific risk conditions should be performed at visits before age 3 years.

[f] If the patient is uncooperative, rescreen within 6 months per AAP statement "Eye Examination and Vision Screening in Infants, Children, and Young Adults" (1996) [URL: http://aappolicy.aappublications.org/cgi/reprint/pediatrics;98/1/153.pdf].

[g] All newborns should be screened per AAP statement "Year 2000 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs " (2000) [URL: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;106/4/798]. Joint Committee on Infant Hearing. Year 2007 position statement: principles and guidelines for early hearing detection and intervention programs. *Pediatrics.* 2007;120:898–921.

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[j] At each visit, age-appropriate physical examination is essential, with infant totally unclothed, older child undressed and suitably draped.

[k] These may be modified, depending on entry point into schedule and individual need.

[l] Newborn metabolic and hemoglobinopathy screening should be done according to state law. Results should be reviewed at visits and appropriate retesting or referral done as needed.

[m] Schedules per the Committee on Infectious Diseases, published annually in the January issue of *Pediatrics.* Every visit should be an opportunity to update and complete a child's immunizations.

[n] See AAP *Pediatric Nutrition Handbook,* 5th Edition (2003) for a discussion of universal and selective screening options. See also Recommendations to prevent and control iron deficiency in the United States. *MMWR Recomm Rep.* 1998;47(RR-3):1–36.

[o] For children at risk of lead exposure, consult the AAP statement "Lead Exposure in Children: Prevention, Detection, and Management" (2005) [URL: http://aappolicy.aappublications.org/cgi/content/full/pediatrics;116/4/1036]. Additionally, screening should be done in accordance with state law where applicable.

[p] Perform risk assessments or screens as appropriate, based on universal screening requirements for patients with Medicaid or high prevalence areas.

[q] Tuberculosis testing per recommendations of the Committee on Infectious Diseases, published in the current edition of *Red Book: Report of the Committee on Infectious Diseases.* Testing should be done on recognition of high-risk factors.

[r] "Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) Final Report" (2002) [URL: http://circ.ahajournals.org/cgi/content/full/106/25/3143] and "The Expert Committee Recommendations on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity." Supplement to *Pediatrics.* In press.

[s] All sexually active patients should be screened for sexually transmitted infections (STIs).

[t] All sexually active girls should have screening for cervical dysplasia as part of a pelvic examination beginning within 3 years of onset of sexual activity or age 21 (whichever comes first).

[u] Referral to dental home, if available. Otherwise, administer oral health risk assessment. If the primary water source is deficient in fluoride, consider oral fluoride supplementation.

[v] At the visits for 3 years and 6 years of age, it should be determined whether the patient has a dental home. If the patient does not have a dental home, a referral should be made to one. If the primary water source is deficient in fluoride, consider oral fluoride supplementation.

[w] Refer to the specific guidance by age as listed in Bright Futures Guidelines. (Hagan JF, Shaw JS, Duncan PM, eds. *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents.* 3rd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2008.)

● = to be performed ★ = risk assessment to be performed, with appropriate action to follow, if positive ←● → = range during which a service may be provided, with the symbol indicating the preferred age

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POLICY STATEMENT

Recommendations for Preventive Pediatric Health Care

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Practice and Ambulatory Medicine, Bright Futures Steering Committee

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Inside: Continuing Education Examination

Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States

Summary

Widespread use of fluoride has been a major factor in the decline in the prevalence and severity of dental caries (i.e., tooth decay) in the United States and other economically developed countries. When used appropriately, fluoride is both safe and effective in preventing and controlling dental caries. All U.S. residents are likely exposed to some degree to fluoride, which is available from multiple sources. Both health-care professionals and the public have sought guidance on selecting the best way to provide and receive fluoride. During the late 1990s, CDC convened a work group to develop recommendations for using fluoride to prevent and control dental caries in the United States. This report includes these recommendations, as well as a) critical analysis of the scientific evidence regarding the efficacy and effectiveness of fluoride modalities in preventing and controlling dental caries, b) ordinal grading of the quality of the evidence, and c) assessment of the strength of each recommendation.

Because frequent exposure to small amounts of fluoride each day will best reduce the risk for dental caries in all age groups, the work group recommends that all persons drink water with an optimal fluoride concentration and brush their teeth twice daily with fluoride toothpaste. For persons at high risk for dental caries, additional fluoride measures might be needed. Measured use of fluoride modalities is particularly appropriate during the time of anterior tooth enamel development (i.e., age <6 years).

The recommendations in this report guide dental and other health-care providers, public health officials, policy makers, and the public in the use of fluoride to achieve maximum protection against dental caries while using resources efficiently and reducing the likelihood of enamel fluorosis. The recommendations address public health and professional practice, self-care, consumer product industries and health agencies, and further research. Adoption of these recommendations could further reduce dental caries in the United States and save public and private resources.

INTRODUCTION

Dental caries (i.e., tooth decay) is an infectious, multifactorial disease afflicting most persons in industrialized countries and some developing countries (*1*). Fluoride reduces the incidence of dental caries and slows or reverses the progression of existing lesions (i.e., prevents cavities). Although pit and fissure sealants, meticulous oral hygiene, and appropriate dietary practices contribute to caries prevention and control, the most effective and widely used approaches have included fluoride use. Today, all U.S. residents are exposed to fluoride to some degree, and widespread use of fluoride has been a major factor in the decline in the prevalence and severity of dental caries in the United States and other economically developed countries (*1*). Although this decline is a major public

health achievement, the burden of disease is still considerable in all age groups. Because many fluoride modalities are effective, inexpensive, readily available, and can be used in both private and public health settings, their use is likely to continue.

Fluoride is the ionic form of the element fluorine, the 13th most abundant element in the earth's crust. Fluoride is negatively charged and combines with positive ions (e.g., calcium or sodium) to form stable compounds (e.g., calcium fluoride or sodium fluoride). Such fluorides are released into the environment naturally in both water and air. Fluoride compounds also are produced by some industrial processes that use the mineral apatite, a mixture of calcium phosphate compounds. In humans, fluoride is mainly associated with calcified tissues (i.e., bones and teeth) because of its high affinity for calcium.

Fluoride's ability to inhibit or even reverse the initiation and progression of dental caries is well documented. The first use of adjusted fluoride in water for caries control began in 1945 and 1946 in the United States and Canada, when the fluoride concentration was adjusted in the drinking water supplying four communities (*2–5*). The U.S. Public Health Service (PHS) developed recommendations in the 1940s and 1950s regarding fluoride concentrations in public water supplies. At that time, public health officials assumed that drinking water would be the major source of fluoride for most U.S. residents. The success of water fluoridation in preventing and controlling dental caries led to the development of fluoride-containing products, including toothpaste (i.e., dentifrice), mouthrinse, dietary supplements, and professionally applied or prescribed gel, foam, or varnish. In addition, processed beverages, which constitute an increasing proportion of the diets of many U.S. residents (*6,7*), and food can contain small amounts of fluoride, especially if they are processed with fluoridated water. Thus, U.S. residents have more sources of fluoride available now than 50 years ago.

Much of the research on the efficacy and effectiveness of individual fluoride modalities in preventing and controlling dental caries was conducted before 1980, when dental caries was more common and more severe. Modalities were usually tested separately and with the assumption that the method would provide the main source of fluoride. Thus, various modes of fluoride use have evolved, each with its own recommended concentration, frequency of use, and dosage schedule. Health-care professionals and the public have sought guidance regarding selection of preventive modalities from among the available options. The United States does not have comprehensive recommendations for caries prevention and control through various combinations of fluoride modalities. Adoption of such recommendations could further reduce dental caries while saving public and private resources and reducing the prevalence of enamel fluorosis, a generally cosmetic developmental condition of tooth enamel.

This report presents comprehensive recommendations on the use of fluoride to prevent and control dental caries in the United States. These recommendations were developed by a work group of 11 specialists in fluoride research or policy convened by CDC during the late 1990s and reviewed by an additional 23 specialists. Although the recommendations were developed specifically for the United States, aspects of this report could be relevant to other countries. The recommendations guide health-care providers and the public on efficient and appropriate use of fluoride modalities, direct attention to fluoride intake among children aged <6 years to decrease the risk for enamel fluorosis, and suggest areas for further research. This report focuses on critical analysis of the scientific evidence regarding the efficacy and effectiveness of each fluoride modality in preventing and controlling dental caries and on the use of multiple sources of fluoride.

The safety of fluoride, which has been documented comprehensively by other scientific and public health organizations (e.g., PHS [*8*], National Research Council [*9*], World Health Organization [*10*], and Institute of Medicine [*11*]) is not addressed.

HOW FLUORIDE PREVENTS AND CONTROLS DENTAL CARIES

Dental caries is an infectious, transmissible disease in which bacterial by-products (i.e., acids) dissolve the hard surfaces of teeth. Unchecked, the bacteria can penetrate the dissolved surface, attack the underlying dentin, and reach the soft pulp tissue. Dental caries can result in loss of tooth structure, pain, and tooth loss and can progress to acute systemic infection.

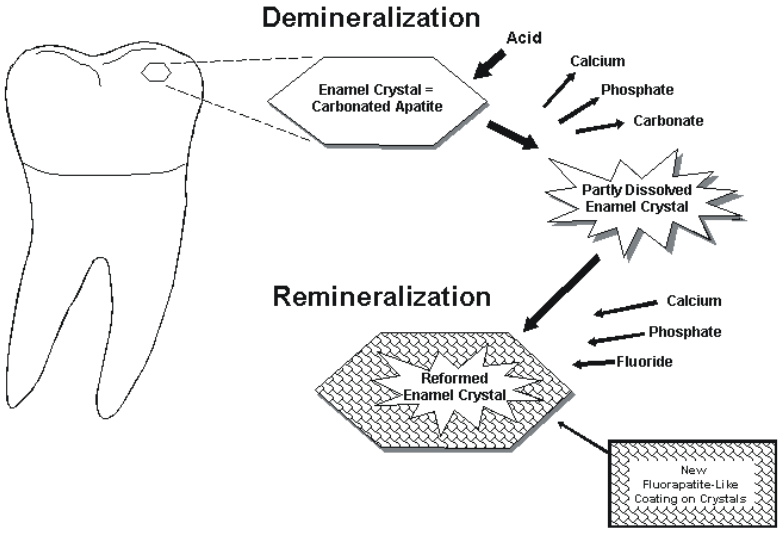
Cariogenic bacteria (i.e., bacteria that cause dental caries) reside in dental plaque, a sticky organic matrix of bacteria, food debris, dead mucosal cells, and salivary components that adheres to tooth enamel. Plaque also contains minerals, primarily calcium and phosphorus, as well as proteins, polysaccharides, carbohydrates, and lipids. Cariogenic bacteria colonize on tooth surfaces and produce polysaccharides that enhance adherence of the plaque to enamel. Left undisturbed, plaque will grow and harbor increasing numbers of cariogenic bacteria. An initial step in the formation of a carious lesion takes place when cariogenic bacteria in dental plaque metabolize a substrate from the diet (e.g., sugars and other fermentable carbohydrates) and the acid produced as a metabolic by-product demineralizes (i.e., begins to dissolve) the adjacent enamel crystal surface (Figure 1). Demineralization involves the loss of calcium, phosphate, and carbonate. These minerals can be captured by surrounding plaque and be available for reuptake by the enamel surface. Fluoride, when present in the mouth, is also retained and concentrated in plaque.

Fluoride works to control early dental caries in several ways. Fluoride concentrated in plaque and saliva inhibits the demineralization of sound enamel and enhances the remineralization (i.e., recovery) of demineralized enamel (*12,13*). As cariogenic bacteria metabolize carbohydrates and produce acid, fluoride is released from dental plaque in response to lowered pH at the tooth-plaque interface (*14*). The released fluoride and the fluoride present in saliva are then taken up, along with calcium and phosphate, by demineralized enamel to establish an improved enamel crystal structure. This improved structure is more acid resistant and contains more fluoride and less carbonate (*12,15–19*) (Figure 1). Fluoride is more readily taken up by demineralized enamel than by sound enamel (*20*). Cycles of demineralization and remineralization continue throughout the lifetime of the tooth.

Fluoride also inhibits dental caries by affecting the activity of cariogenic bacteria. As fluoride concentrates in dental plaque, it inhibits the process by which cariogenic bacteria metabolize carbohydrates to produce acid and affects bacterial production of adhesive polysaccharides (*21*). In laboratory studies, when a low concentration of fluoride is constantly present, one type of cariogenic bacteria, *Streptococcus mutans*, produces less acid (*22–25*). Whether this reduced acid production reduces the cariogenicity of these bacteria in humans is unclear (*26*).

Saliva is a major carrier of topical fluoride. The concentration of fluoride in ductal saliva, as it is secreted from salivary glands, is low — approximately 0.016 parts per million (ppm) in areas where drinking water is fluoridated and 0.006 ppm in nonfluoridated areas (*27*). This concentration of fluoride is not likely to affect cariogenic activity. However, drinking fluoridated water, brushing with fluoride toothpaste, or using other fluoride

FIGURE 1. The demineralization and remineralization processes lead to remineralized enamel crystals with surfaces rich in fluoride and lower in solubility



Source: Adapted from Featherstone JDB. Prevention and reversal of dental caries: role of low level fluoride. Community Dent Oral Epidemiol 1999;27:31–40. Reprinted with permission from Munksgaard International Publishers Ltd., Copenhagen, Denmark.

dental products can raise the concentration of fluoride in saliva present in the mouth 100- to 1,000-fold. The concentration returns to previous levels within 1–2 hours but, during this time, saliva serves as an important source of fluoride for concentration in plaque and for tooth remineralization (*28*).

Applying fluoride gel or other products containing a high concentration of fluoride to the teeth leaves a temporary layer of calcium fluoride-like material on the enamel surface. The fluoride in this material is released when the pH drops in the mouth in response to acid production and is available to remineralize enamel (*29*).

In the earliest days of fluoride research, investigators hypothesized that fluoride affects enamel and inhibits dental caries only when incorporated into developing dental enamel (i.e., preeruptively, before the tooth erupts into the mouth) (*30,31*). Evidence supports this hypothesis (*32–34*), but distinguishing a true preeruptive effect after teeth erupt into a mouth where topical fluoride exposure occurs regularly is difficult. However, a high fluoride concentration in sound enamel cannot alone explain the marked reduction in dental caries that fluoride produces (*35,36*). The prevalence of dental caries in a population is not inversely related to the concentration of fluoride in enamel (*37*), and a higher concentration of enamel fluoride is not necessarily more efficacious in preventing dental caries (*38*).

The laboratory and epidemiologic research that has led to the better understanding of how fluoride prevents dental caries indicates that fluoride's predominant effect is posteruptive and topical and that the effect depends on fluoride being in the right amount in the right place at the right time. Fluoride works primarily after teeth have erupted, especially when small amounts are maintained constantly in the mouth, specifically in dental plaque and saliva (*37*). Thus, adults also benefit from fluoride, rather than only children, as was previously assumed.

RISK FOR DENTAL CARIES

The prevalence and severity of dental caries in the United States have decreased substantially during the preceding 3 decades (*39*). National surveys have reported that the prevalence of any dental caries among children aged 12–17 years declined from 90.4% in 1971–1974 to 67% in 1988–1991; severity (measured as the mean number of decayed, missing, or filled teeth) declined from 6.2 to 2.8 during this period (*40–43*).

These decreases in caries prevalence and severity have been uneven across the general population; the burden of disease now is concentrated among certain groups and persons. For example, 80% of the dental caries in permanent teeth of U.S. children aged 5–17 years occurs among 25% of those children (*43*). To develop and apply appropriate and effective caries prevention and control strategies, identification and assessment of groups and persons at high risk for developing new carious lesions is essential (*44*). Caries risk assessment is difficult because it attempts to account for the complex interaction of multiple factors. Although various methods for assessing risk exist, no single model predominates in this emerging science. Models that take multiple factors into account predict the risk more accurately, especially for groups rather than persons. However, for persons in a clinical setting, models do not improve on a dentist's perception of risk after examining a patient and considering the personal circumstances (*45*).

Populations believed to be at increased risk for dental caries are those with low socioeconomic status (SES) or low levels of parental education, those who do not seek regular dental care, and those without dental insurance or access to dental services (*45–47*). Persons can be at high risk for dental caries even if they do not have these recognized factors. Individual factors that possibly increase risk include active dental caries; a history of high caries in older siblings or caregivers; root surfaces exposed by gingival recession; high levels of infection with cariogenic bacteria; impaired ability to maintain oral hygiene; malformed enamel or dentin; reduced salivary flow because of medications, radiation treatment, or disease; low salivary buffering capacity (i.e., decreased ability of saliva to neutralize acids); and the wearing of space maintainers, orthodontic appliances, or dental prostheses. Risk can increase if any of these factors are combined with dietary practices conducive to dental caries (i.e., frequent consumption of refined carbohydrates). Risk decreases with adequate exposure to fluoride (*44,45*).

Risk for dental caries and caries experience* exists on a continuum, with each person at risk to some extent; 85% of U.S. adults have experienced tooth decay (*48*). Caries risk can vary over time — perhaps numerous times during a person's lifetime — as risk factors change. Because caries prediction is an inexact, developing science, risk is dichotomized as low and high in this report. If these two categories of risk were applied to the U.S. population, most persons would be classified as low risk at any given time.

Children and adults who are at low risk for dental caries can maintain that status through frequent exposure to small amounts of fluoride (e.g., drinking fluoridated water and using fluoride toothpaste). Children and adults at high risk for dental caries might benefit from additional exposure to fluoride (e.g., mouthrinse, dietary supplements, and professionally applied products). All available information on risk factors should be considered before a group or person is identified as being at low or high risk for dental caries. However, when classification is uncertain, treating a person as high risk is prudent until further information or experience allows a more accurate assessment. This assumption

*For this report, the term "caries experience" is used to mean the sum of filled and unfilled cavities, along with any missing teeth resulting from tooth decay.

increases the immediate cost of caries prevention or treatment and might increase the risk for enamel fluorosis for children aged <6 years, but reduces the risk for dental caries for groups or persons misclassified as low risk.

RISK FOR ENAMEL FLUOROSIS

The proper amount of fluoride helps prevent and control dental caries. Fluoride ingested during tooth development can also result in a range of visually detectable changes in enamel opacity (i.e., light refraction at or below the surface) because of hypomineralization. These changes have been broadly termed enamel fluorosis, certain extremes of which are cosmetically objectionable (*49*). (Many other developmental changes that affect the appearance of enamel are not related to fluoride [*50*].) Severe forms of this condition can occur only when young children ingest excess fluoride, from any source, during critical periods of tooth development. The occurrence of enamel fluorosis is reported to be most strongly associated with cumulative fluoride intake during enamel development, but the severity of the condition depends on the dose, duration, and timing of fluoride intake. The transition and early maturation stages of enamel development appear to be most susceptible to the effects of fluoride (*51*); these stages occur at varying times for different tooth types. For central incisors of the upper jaw, for example, the most sensitive period is estimated at age 15–24 months for boys and age 21–30 months for girls (*51,52*).

Concerns regarding the risk for enamel fluorosis are limited to children aged ≤8 years; enamel is no longer susceptible once its preeruptive maturation is complete (*11*). Fluoride sources for children aged ≤8 years are drinking water, processed beverages and food, toothpaste, dietary supplements that include fluoride (tablets or drops), and other dental products. This report discusses the risk for enamel fluorosis among children aged <6 years. Children aged ≥6 years are considered past the age that fluoride ingestion can cause cosmetically objectionable fluorosis because only certain posterior teeth are still at a susceptible stage of enamel development, and these will not be readily visible. In addition, the swallowing reflex has developed sufficiently by age 6 years for most children to be able to control inadvertent swallowing of fluoride toothpaste and mouthrinse.

The very mild and mild forms of enamel fluorosis appear as chalklike, lacy markings across a tooth's enamel surface that are not readily apparent to the affected person or casual observer (*53*). In the moderate form, >50% of the enamel surface is opaque white. The rare, severe form manifests as pitted and brittle enamel. After eruption, teeth with moderate or severe fluorosis might develop areas of brown stain (*54*). In the severe form, the compromised enamel might break away, resulting in excessive wear of the teeth. Even in its severe form, enamel fluorosis is considered a cosmetic effect, not an adverse functional effect (*8,11,55,56*). Some persons choose to modify this condition with elective cosmetic treatment.

The benefits of reduced dental caries and the risk for enamel fluorosis are linked. Early studies that examined the cause of "mottled enamel" (now called moderate to severe enamel fluorosis) led to the unexpected discovery that fluoride in community drinking water inhibits dental caries (*57*). Historically, a low prevalence of the milder forms of enamel fluorosis has been accepted as a reasonable and minor consequence balanced against the substantial protection from dental caries from drinking water con-

taining an optimal concentration of fluoride, either naturally occurring or through adjustment (*11,53*). When enamel fluorosis was first systematically investigated during the 1930s and 1940s, its prevalence was 12%–15% for very mild and mild forms and zero for moderate and severe forms among children who lived in communities with drinking water that naturally contained 0.9–1.2 ppm fluoride (*53*). Although the prevalence of this condition in the United States has since increased (*8,58,59*), most fluorosis today is of the mildest form, which affects neither cosmetic appearance nor dental function. The increased prevalence in areas both with and without fluoridated community drinking water (*8*) indicates that, during the first 8 years of life (i.e., the window of time when this condition can develop), the total intake of fluoride from all sources has increased for some children.

The 1986–1987 National Survey of Dental Caries in U.S. School Children (the most recent national estimates of enamel fluorosis prevalence) indicated that the prevalence of any enamel fluorosis among children was 22%–23% (range: 26% of children aged 9 years to 19% of those aged 17 years) (*60,61*). Almost all cases reported in the survey were of the very mild or mild form, but some cases of the moderate (1.1%) and severe (0.3%) forms were observed. Cases of moderate and severe forms occurred even among children living in areas with low fluoride concentrations in the drinking water (*61*). Although this level of enamel fluorosis is not considered a public health problem (*53*), prudent public health practice should seek to minimize this condition, especially moderate to severe forms. In addition, changes in public perceptions of what is cosmetically acceptable could influence support for effective caries-prevention measures. Research into the causes of enamel fluorosis has focused on identifying risk factors (*62–65*). Adherence to the recommendations in this report regarding appropriate use of fluoride for children aged ≤6 years will reduce the prevalence and severity of enamel fluorosis.

NATIONAL GUIDELINES FOR FLUORIDE USE

PHS recommendations for fluoride use include an optimally adjusted concentration of fluoride in community drinking water to maximize caries prevention and limit enamel fluorosis. This concentration ranges from 0.7 ppm to 1.2 ppm depending on the average maximum daily air temperature of the area (*66–68*). In 1991, PHS also issued policy and research recommendations for fluoride use (*8*). The U.S. Environmental Protection Agency (EPA), which is responsible for the safety and quality of drinking water in the United States, sets a maximum allowable limit for fluoride in community drinking water at 4 ppm and a secondary limit (i.e., nonenforceable guideline) at 2 ppm (*69,70*). The U.S. Food and Drug Administration (FDA) is responsible for approving prescription and over-the-counter fluoride products marketed in the United States and for setting standards for labeling bottled water (*71*) and over-the-counter fluoride products (e.g., toothpaste and mouthrinse) (*72*).

Nonfederal agencies also have published guidelines on fluoride use. The American Dental Association (ADA) reviews fluoride products for caries prevention through its voluntary Seal of Acceptance program; accepted products are listed in the *ADA Guide to Dental Therapeutics* (*73*). A dosage schedule for fluoride supplements for infants and children aged ≤16 years, which is scaled to the fluoride concentration in the community drinking water, has been jointly recommended by ADA, the American Academy of Pediatric Dentistry (AAPD), and the American Academy of Pediatrics (AAP) (Table 1) (*44,74,75*). In 1997, the Institute of Medicine published age-specific recommendations

for total dietary intake of fluoride (Table 2). These recommendations list adequate intake to prevent dental caries and tolerable upper intake, defined as a level unlikely to pose risk for adverse effects in almost all persons.

TABLE 1. Recommended dietary fluoride supplement* schedule

	Fluoride concentration in community drinking water†		
Age	**<0.3 ppm**	**0.3–0.6 ppm**	**>0.6 ppm**
0–6 months	None	None	None
6 months–3 years	0.25 mg/day	None	None
3–6 years	0.50 mg/day	0.25 mg/day	None
6–16 years	1.0 mg/day	0.50 mg/day	None

* Sodium fluoride (2.2 mg sodium fluoride contains 1 mg fluoride ion).

† 1.0 parts per million (ppm) = 1 mg/L.

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TABLE 2. Recommended total dietary fluoride intake

Age	Reference weight*		Adequate intake†	Tolerable upper intake§
	kg	lb	mg/day	mg/day
0–6 months	7	16	0.01	0.7
6–12 months	9	20	0.5	0.9
1–3 years	13	29	0.7	1.3
4–8 years	22	48	1.1	2.2
≥9 years	40–76	88–166	2.0–3.8	10.0

* Values based on data collected during 1988–1994 as part of the third National Health and Nutrition Examination Survey.

† Intake that maximally reduces occurrence of dental caries without causing unwanted side effects, including moderate enamel fluorosis.

§ Highest level of nutrient intake that is likely to pose no risks for adverse health effects in almost all persons.

Source: Adapted from Institute of Medicine. Fluoride. In: Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. Washington, DC: National Academy Press, 1997:288–313.

FLUORIDE SOURCES AND THEIR EFFECTS

Fluoridated community drinking water and fluoride toothpaste are the most common sources of fluoride in the United States and are largely responsible for the low risk for dental caries for most persons in this country. Persons at high risk for dental caries might require more frequent or more concentrated exposure to fluoride and might benefit from use of other fluoride modalities (e.g., mouthrinse, dietary supplements, and topical gel, foam, or varnish). The effects of each of these fluoride sources on dental caries and enamel fluorosis are described.

Fluoridated Drinking Water and Processed Beverages and Food

Fluoridated drinking water contains a fluoride concentration effective for preventing dental caries; this concentration can occur naturally or be reached through water fluoridation, which is the controlled addition of fluoride to a public water supply. When fluoridated water is the main source of drinking water, a low concentration of fluoride is routinely introduced into the mouth. Some of this fluoride is taken up by dental plaque; some is transiently present in saliva, which serves as a reservoir for plaque fluoride; and some is loosely held on the enamel surfaces (*76*). Frequent consumption of fluoridated drinking water and beverages and food processed in fluoridated areas maintains the concentration of fluoride in the mouth.

Estimates of fluoride intake among U.S. and Canadian adults have ranged from ≤1.0 mg fluoride per day in nonfluoridated areas to 1–3 mg fluoride per day in fluoridated areas (*77–80*). The average daily dietary fluoride intake for both children and adults in fluoridated areas has remained relatively constant for several years (*11*). For children who live in optimally fluoridated areas, this average is approximately 0.05 mg/kg/day (range: 0.02–0.10); for children who live in nonfluoridated areas, the average is approximately half (*11*). In a survey of four U.S. cities with different fluoride concentrations in the drinking water (range: 0.37–1.04 ppm), children aged 2 years ingested 0.41–0.61 mg fluoride per day and infants aged 6 months ingested 0.21–0.54 mg fluoride per day (*81,82*).

In the United States, water and processed beverages (e.g., soft drinks and fruit juices) can provide approximately 75% of a person's fluoride intake (*83*). Many processed beverages are prepared in locations where the drinking water is fluoridated. Foods and ingredients used in food processing vary in their fluoride content (*11*). As consumption of processed beverages by children increases, fluoride intake in communities without fluoridated water will increase whenever the water source for the processed beverage is fluoridated (*84*). In fluoridated areas, dietary fluoride intake has been stable because processed beverages have been substituted for tap water and for beverages prepared in the home using tap water (*11*).

A study of Iowa infants estimated that the mean fluoride intake from water during different periods during the first 9 months of life, either consumed directly or added to infant formula or juice, was 0.29–0.38 mg per day, although estimated intake for some infants was as high as 1.73 mg per day (*85*). As foods are added to an infant's diet, replacing some of the formula prepared with fluoridated water, the amount of fluoride the infant receives typically decreases (*86*). The Iowa study also reported that infant formula and processed baby food contained variable amounts of fluoride. Since 1979, U.S. manufacturers of infant formula have voluntarily lowered the fluoride concentration of their products, both ready-to-feed and concentrates, to <0.3 ppm fluoride (*87*).

Drinking Water

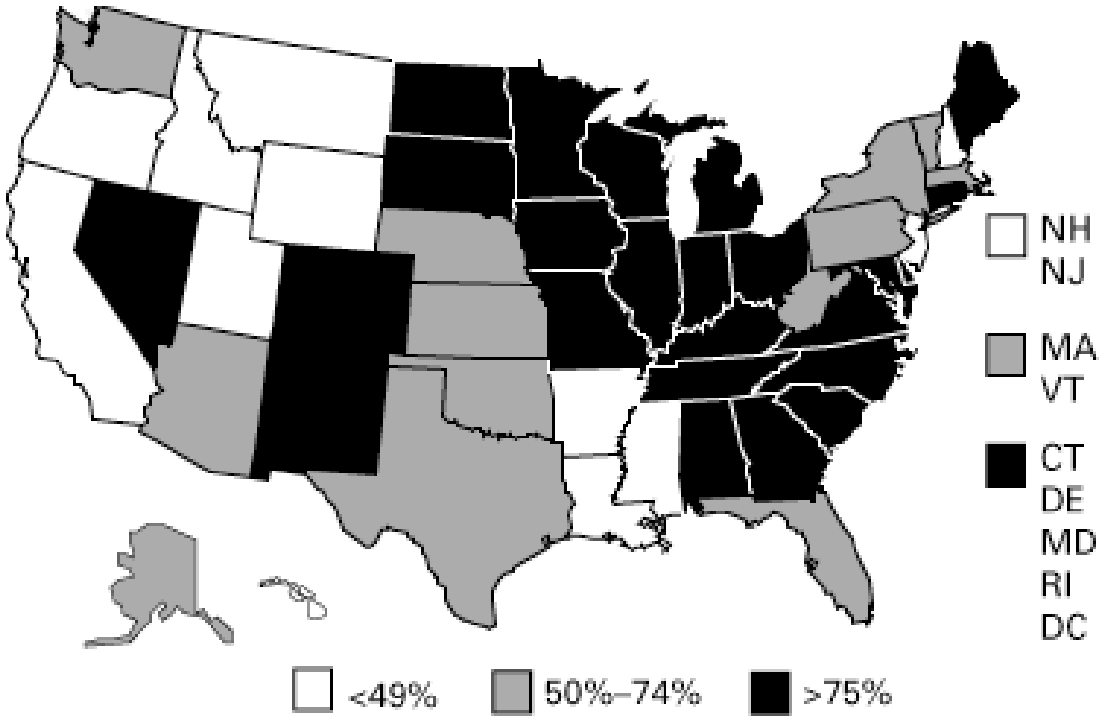
Community Water. During the 1940s, researchers determined that 1 ppm fluoride was the optimal concentration in community drinking water for climates similar to the Chicago area (*88,89*). This concentration would substantially reduce the prevalence of dental caries, while allowing an acceptably low prevalence (i.e., 10%–12%) of very mild and mild enamel fluorosis and no moderate or severe enamel fluorosis. Water fluoridation for caries control began in 1945 and 1946, when the fluoride concentration was

adjusted in the drinking water supplying four communities in the United States and Canada (*2–5*). This public health approach followed a long period of epidemiologic research into the effects of naturally occurring fluoride in drinking water (*53,57,88,89*).

Current federal fluoridation guidelines, maintained by the PHS since 1962, state that community drinking water should contain 0.7–1.2 ppm fluoride, depending on the average maximum daily air temperature of the area. These temperature-related guidelines are based on epidemiologic studies conducted during the 1950s that led to the development of an algebraic formula for determining optimal fluoride concentrations (*67,90–92*). This formula determined that a lower fluoride concentration was appropriate for communities in warmer climates because persons living in warmer climates drank more tap water. However, social and environmental changes since 1962 (e.g., increased use of air conditioning and more sedentary lifestyles) have reduced the likelihood that persons in warmer regions drink more tap water than persons in cooler regions (*7*).

By 1992, fluoridated water was reaching 144 million persons in the United States (56% of the total population and 62% of those receiving municipal water supplies) (*93*). Approximately 10 million of these persons were receiving water containing naturally occurring fluoride at a concentration of ≥0.7 ppm. In 11 states and the District of Columbia, >90% of the population had such access, whereas <5% received this benefit in two states. In 2000, a total of 38 states and the District of Columbia provided access to fluoridated public water supplies to ≥50% of their population (CDC, unpublished data, 2000) (Figure 2).

FIGURE 2. Percentage of state populations with access to fluoridated water through public water systems



Source: CDC, unpublished data, 2000.

Initial studies of community water fluoridation demonstrated that reductions in childhood dental caries attributable to fluoridation were approximately 50%–60% (*94–97*). More recent estimates are lower — 18%–40% (*98,99*). This decrease in attributable benefit is likely caused by the increasing use of fluoride from other sources, with the widespread use of fluoride toothpaste probably the most important. The diffusion or "halo" effect of beverages and food processed in fluoridated areas but consumed in nonfluoridated areas also indirectly spreads some benefit of fluoridated water to nonfluoridated communities. This effect lessens the differences in caries experience among communities (*100*).

Quantifying the benefits of water fluoridation among adults is more complicated because adults are rarely surveyed, their fluoride histories are potentially more varied, and their tooth loss or restorations might be caused by dental problems other than caries (e.g., trauma or periodontal diseases). Nevertheless, adults are reported to receive caries-preventive benefits from community water fluoridation (*99,101–103*). These benefits might be particularly advantageous for adults aged >50 years, many of whom are at increased risk for dental caries. Besides coronal caries, older adults typically experience gingival recession, which results in teeth with exposed root surfaces. Unlike the crowns of teeth, these root surfaces are not covered by enamel and are more susceptible to caries. Because tooth retention among older age groups has increased in recent decades in the United States (*39*), these groups' risk for caries will increase as the country's population ages. Older adults also frequently require multiple medications for chronic conditions, and many of these medications can reduce salivary output (*104*). Drinking water containing an optimal concentration of fluoride can mitigate the risk factors for caries among older adults. Studies have reported that the prevalence of root caries among adults is inversely related to fluoride concentration in the community drinking water (*105–107*).

Water fluoridation also reduces the disparities in caries experience among poor and nonpoor children (*108–111*). Caries experience is considerably higher among persons in low SES strata than among those in high SES strata (*39,46,112*). The reasons for this discrepancy are not well understood; perhaps persons in low SES strata have less knowledge of oral diseases, have less access to dental care, are less likely to follow recommended self-care practices, or are harder to reach through traditional approaches, including public health programs and private dental care (*48*). Thus, these persons might receive more benefit from fluoridated community water than persons from high SES strata. Regardless of SES, water fluoridation is the most effective and efficient strategy to reduce dental caries (*112*).

Enamel fluorosis occurs among some persons in all communities, even in communities with a low natural concentration of fluoride. During 1930–1960, U.S. studies documented that, in areas with a natural or adjusted concentration of fluoride of approximately 1.0 ppm in the community drinking water, the permanent teeth of 7%–16% of children with lifetime residence in those areas exhibited very mild or mild forms of enamel fluorosis (*53,113,114*). Before 1945, when naturally fluoridated drinking water was virtually the only source of fluoride, the moderate and severe forms of this condition were not observed unless the natural fluoride concentration was $\geq$2 ppm (*53*). The likelihood of a child developing the mild forms of enamel fluorosis might be higher in a fluoridated area than in a nonfluoridated area, but prevalence might not change in every community (*115,116*). The most recent national study of this condition indicated that its prevalence had increased in both fluoridated and nonfluoridated areas since the 1940s, with the

relative increase higher in nonfluoridated areas. In communities with drinking water containing 0.7–1.2 ppm fluoride, the prevalence was 1.3% for the moderate form of enamel fluorosis and zero for the severe form; thus, few cases of enamel fluorosis were likely to be of cosmetic consequence (*8,61*). Because combined fluoride intake from drinking water and processed beverages and food by children in fluoridated areas has reportedly remained stable since the 1940s, the increase in fluoride intake resulting in increased enamel fluorosis almost certainly stems from use of fluoride-containing dental products by children aged <6 years (*11*).

Two studies reported that extended consumption of infant formula beyond age 10–12 months was a risk factor for enamel fluorosis, especially when formula concentrate was mixed with fluoridated water (*62,63*). These studies examined children who used pre-1979 formula (with higher fluoride concentrations). Whether fluoride intake from formula that exceeds the recommended amount during only the first 10–12 months of life contributes to the prevalence or severity of enamel fluorosis is unknown.

Fluoride concentrations in drinking water should be maintained at optimal levels, both to achieve effective caries prevention and because changes in fluoride concentration as low as 0.2 ppm can result in a measurable change in the prevalence and severity of enamel fluorosis (*52,117*). Since the late 1970s, CDC has provided guidelines and recommendations for managers of fluoridated water supply systems at state and local levels to help them establish and maintain appropriate fluoride concentrations. CDC periodically updates these guidelines; the most recent revision was published in 1995 (*68*).

School Water Systems. In some areas of the United States where fluoridating a community's drinking water was not feasible (e.g., rural areas), the alternative of fluoridating a school's public water supply system was promoted for many years. This method was used when a school had its own source of water and was not connected to a community water supply system (i.e., stand-alone systems). Because children are at school only part of each weekday, a fluoride concentration of 4.5 times the optimal concentration for a community in the same geographic area was recommended (*118*) to compensate for the more limited consumption of fluoridated water. At the peak of this practice in the early 1980s, a total of 13 states had initiated school water fluoridation in 470 schools serving 170,000 children (*39*). Since then, school water fluoridation has been phased out in several states; the current extent of this practice is not known.

Studies of the effects of school water fluoridation in the United States reported that this practice reduced caries among schoolchildren by approximately 40% (*118–122*). A more recent study indicated that this effect might no longer be as pronounced (*123*).

Several concerns regarding school water fluoridation exist. Operating and maintaining small fluoridation systems (i.e., those serving <500 persons) create practical and logistical difficulties (*68*). These difficulties have occasionally caused higher than recommended fluoride concentrations in the school drinking water, but no lasting effects among children have been observed (*124–126*). In schools that enroll preschoolers in day care programs, children aged <6 years might receive more than adequate fluoride.

Bottled Water. Many persons drink bottled water, replacing tap water partially or completely as a source of drinking water. Water is classified as "bottled water" if it meets all applicable federal and state standards, is sealed in a sanitary container, and is sold for human consumption. Although some bottled waters marketed in the United States contain an optimal concentration of fluoride (approximately 1.0 ppm), most contain <0.3 ppm fluoride (*127–129*). Thus, a person substituting bottled water with a low fluoride concen-

tration for fluoridated community water might not receive the full benefits of community water fluoridation (*130*). For water bottled in the United States, current FDA regulations require that fluoride be listed on the label only if the bottler adds fluoride during processing; the concentration of fluoride is regulated but does not have to be stated on the label (Table 3). Few bottled water brands have labels listing the fluoride concentration.

TABLE 3. U.S. Food and Drug Administration (FDA) fluoride requirements for bottled water packaged in the United States

Annual average of maximum daily air temperature (F) where the bottled water is sold at retail	Maximum fluoride concentration (mg/L) allowed in bottled water	
	No fluoride added to bottled water	Fluoride added to bottled water
≤53.7	2.4	1.7
53.8–58.3	2.2	1.5
58.4–63.8	2	1.3
63.9–70.6	1.8	1.2
70.7–79.2	1.6	1
79.3–90.5	1.4	0.8

Note: FDA regulations require that fluoride be listed on the label only if the bottler adds fluoride during processing; the bottler is not required to list the fluoride concentration, which might or might not be optimal. FDA does not allow imported bottled water with no added fluoride to contain >1.4 mg fluoride/L or imported bottled water with added fluoride to contain >0.8 mg fluoride/L.
Source: US Department of Health and Human Services, Food and Drug Administration. 21 CFR Part 165.110. Bottled water. Federal Register 1995;60:57124–30.

Determining Fluoride Concentration. Uneven geographic coverage of community water fluoridation throughout the United States, wide variations in natural fluoride concentrations found in drinking water, and almost nonexistent labeling of fluoride concentration in bottled water make knowing the concentration of fluoride in drinking water difficult for many persons. Persons in nonfluoridated areas can mistakenly believe their water contains an optimal concentration of fluoride. To obtain the fluoride concentration of community drinking water, a resident can contact the water supplier or a local public health authority, dentist, dental hygienist, physician, or other knowledgeable source. EPA requires that all community water supply systems provide each customer an annual report on the quality of water, including the fluoride concentration (*131*). Testing for private wells is available through local and state public health departments as well as some private laboratories. If the fluoride concentration is not listed on the label of bottled water, the bottler can be contacted directly to obtain this information.

Fluoride Toothpaste

Fluoride is the only nonprescription toothpaste additive proven to prevent dental caries. When introduced into the mouth, fluoride in toothpaste is taken up directly by dental plaque (*132–134*) and demineralized enamel (*135,136*). Brushing with fluoride toothpaste also increases the fluoride concentration in saliva 100- to 1,000-fold; this concentration returns to baseline levels within 1–2 hours (*137*). Some of this salivary fluoride is taken up by dental plaque. The ambient fluoride concentration in saliva and plaque can increase during regular use of fluoride toothpaste *(132,133)*.

By the 1990s, fluoride toothpaste accounted for >90% of the toothpaste market in the United States, Canada, and other developed countries (*138*). Because water fluoridation is not available in many countries, toothpaste might be the most important source of fluoride globally (*1*).

Studies of 2–3 years duration have reported that fluoride toothpaste reduces caries experience among children by a median of 15%–30% (*139–148*). This reduction is modest compared with the effect of water fluoridation, but water fluoridation studies usually measured lifetime — rather than a few years' — exposure. Regular lifetime use of fluoride toothpaste likely provides ongoing benefits that might approach those of fluoridated water. Combined use of fluoride toothpaste and fluoridated water offers protection above either used alone (*99,149,150*).

Few studies evaluating the effectiveness of fluoride toothpaste, gel, rinse, and varnish among adult populations are available. Child populations have typically been used for studies on caries prevention because of perceived increased caries susceptibility and logistical reasons. However, teeth generally remain susceptible to caries throughout life, and topically applied fluorides could be effective in preventing caries in susceptible patients of any age *(151,152)*.

Most persons report brushing their teeth at least once per day (*153,154*), but more frequent use can offer additional protection (*139,141,155–158*). Brushing twice a day is a reasonable social norm that is both effective and convenient for most persons' daily routines, and this practice has become a basic recommendation for caries prevention. Whether increasing the number of daily brushings from two to three times a day results in lower dental caries experience is unclear. Because the amount and vigor of rinsing after toothbrushing affects fluoride concentration in the mouth and reportedly affects caries experience (*157–160*), persons aged ≥6 years can retain more fluoride in the mouth by either rinsing briefly with a small amount of water or not at all.

In the United States, the standard concentration of fluoride in fluoride toothpaste is 1,000–1,100 ppm. Toothpaste containing 1,500 ppm fluoride has been reported to be slightly more efficacious in reducing dental caries in U.S. and European studies (*161–164*). Products with this fluoride concentration have been marketed in the United States, but are not available in all areas. These products might benefit persons aged ≥6 years at high risk for dental caries.

Children who begin using fluoride toothpaste at age <2 years are at higher risk for enamel fluorosis than children who begin later or who do not use fluoride toothpaste at all (*62,63,165–170*). Because studies have not used the same criteria for age of initiation, amount of toothpaste used, or frequency of toothpaste use, the specific contribution of each factor to enamel fluorosis among this age group has not been established.

Fluoride toothpaste contributes to the risk for enamel fluorosis because the swallowing reflex of children aged <6 years is not always well controlled, particularly among children aged <3 years (*171,172*). Children are also known to swallow toothpaste deliberately when they like its taste. A child-sized toothbrush covered with a full strip of toothpaste holds approximately 0.75–1.0 g of toothpaste, and each gram of fluoride toothpaste, as formulated in the United States, contains approximately 1.0 mg of fluoride. Children aged <6 years swallow a mean of 0.3 g of toothpaste per brushing (*11*) and can inadvertently swallow as much as 0.8 g (*138,173–176*). As a result, multiple brushings with fluoride toothpaste each day can result in ingestion of excess fluoride (*177*). For this reason, high-fluoride toothpaste (i.e., containing 1,500 ppm fluoride) is generally contraindicated for children aged <6 years.

Use of a pea-sized amount (approximately 0.25 g) of fluoride toothpaste ≤2 times per day by children aged <6 years is reported to sharply reduce the importance of fluoride toothpaste as a risk factor for enamel fluorosis (*65*). Since 1991, manufacturers of fluoride toothpaste marketed in the United States have, as a requirement for obtaining the ADA Seal of Acceptance, placed instructions on the package label stating that children aged <6 years should use only this amount of toothpaste. Toothpaste labeling requirements mandated by FDA in 1996 (*72*) also direct parents of children aged <2 years to seek advice from a dentist or physician before introducing their child to fluoride toothpaste.

The propensity of young children to swallow toothpaste has led to development of "child-strength" toothpaste with lower fluoride concentrations (*176*). Such a product would be a desirable alternative to currently available products for many young children. Clinical trials outside the United States have reported that toothpaste containing 250 ppm fluoride is less effective than toothpaste containing 1,000 ppm fluoride in preventing dental caries (*178,179*). However, toothpaste containing 500–550 ppm fluoride might be almost as efficacious as that containing 1,000 ppm fluoride (*180*). A British study reported that the prevalence of diffuse enamel opacities (an indicator of mild enamel fluorosis) in the upper anterior incisors was substantially lower among children who used toothpaste containing 550 ppm fluoride than among those who used toothpaste containing 1,050 ppm fluoride (*181*). Toothpaste containing 400 ppm fluoride has been available in Australia and New Zealand for approximately 20 years, but has not been tested in clinical trials, and no data are available to assess whether toothpaste at this concentration has reduced the prevalence of enamel fluorosis in those countries. A U.S. clinical trial of the efficacy of toothpaste with lower fluoride concentrations, required by FDA before approval for marketing and distribution, has not been conducted (*182*).

Fluoride Mouthrinse

Fluoride mouthrinse is a concentrated solution intended for daily or weekly use. The fluoride from mouthrinse, like that from toothpaste, is retained in dental plaque and saliva to help prevent dental caries (*183*). The most common fluoride compound used in mouthrinse is sodium fluoride. Over-the-counter solutions of 0.05% sodium fluoride (230 ppm fluoride) for daily rinsing are available for use by persons aged >6 years. Solutions of 0.20% sodium fluoride (920 ppm fluoride) are used in supervised, school-based weekly rinsing programs. Throughout the 1980s, approximately 3 million children in the United States participated in school-based fluoride mouthrinsing programs (*39*). The current extent of such programs is not known.

Studies indicating that fluoride mouthrinse reduces caries experience among schoolchildren date mostly from the 1970s and early 1980s (*184–191*). In one review, the average caries reduction in nonfluoridated communities attributable to fluoride mouthrinse was 31% (*191*). Two studies reported benefits of fluoride mouthrinse approximately 2.5 and 7 years after completion of school-based mouthrinsing programs (*192,193*), but a more recent study did not find such benefits 4 years after completion of a mouthrinsing program (*194*). The National Preventive Dentistry Demonstration Program (NPDDP), a large project conducted in 10 U.S. cities during 1976–1981 to compare the cost and effectiveness of combinations of caries-prevention procedures, reported that fluoride mouthrinse had little effect among schoolchildren, either among first-grade students with high and low caries experience (*195*) or among all second- and fifth-grade

students (*196*). NPDDP documented only a limited reduction in dental caries attributable to fluoride mouthrinse, especially when children were also exposed to fluoridated water.

Although no studies of enamel fluorosis associated with use of fluoride mouthrinse have been conducted, studies of the amount of fluoride swallowed by children aged 3–5 years using such rinses indicated that some young children might swallow substantial amounts (*191*). Use of fluoride mouthrinse by children aged ≥6 years does not place them at risk for cosmetically objectionable enamel fluorosis because they are generally past the age that fluoride ingestion might affect their teeth.

Dietary Fluoride Supplements

Dietary fluoride supplements in the form of tablets, lozenges, or liquids (including fluoride-vitamin preparations) have been used throughout the world since the 1940s. Most supplements contain sodium fluoride as the active ingredient. Tablets and lozenges are manufactured with 1.0, 0.5, or 0.25 mg fluoride. To maximize the topical effect of fluoride, tablets and lozenges are intended to be chewed or sucked for 1–2 minutes before being swallowed. For infants, supplements are available as a liquid and used with a dropper.

In 1986, an estimated 16% of U.S. children aged <2 years used fluoride supplements (*197*). All fluoride supplements must be prescribed by a dentist or physician. The prescription should be consistent with the 1994 dosage schedule developed by ADA, AAPD, and AAP (Table 1). Because fluoride supplements are intended to compensate for fluoride-deficient drinking water, the dosage schedule requires knowledge of the fluoride content of the child's primary drinking water; consideration should also be given to other sources of water (e.g., home, child care settings, school, or bottled water) and to other sources of fluoride (e.g., toothpaste or mouthrinse), which can complicate the prescribing decision.

The evidence for using fluoride supplements to mitigate dental caries is mixed. Use of fluoride supplements by pregnant women does not benefit their offspring (*198*). Several studies have reported that fluoride supplements taken by infants and children before their teeth erupt reduce the prevalence and severity of caries in teeth (*98,199–207*), but several other studies have not (*19,208–212*). Among children aged 6–16 years, fluoride supplements taken after teeth erupt reduce caries experience (*213–215*). Fluoride supplements might be beneficial among adults who have limitations with toothbrushing, but this use requires further study.

A few studies have reported no association between supplement use by children aged <6 years and enamel fluorosis (*208,216*), but most have reported a clear association (*19,62,64,165,170,199–201,209,210,212,217–222*). In one study, the risk for this condition was high when supplements were used in fluoridated areas (odds ratio = 23.74; 95% confidence interval = 3.43–164.30) (*62*), a use inconsistent with the supplement schedule. Reports of the frequency of supplement use in fluoridated areas have ranged from 7% to 35% (*223–228*). In response to the accumulated data on fluoride intake and the prevalence of enamel fluorosis, the supplement dosage schedule for children aged <6 years was markedly reduced in 1994 when ADA, AAPD, and AAP jointly established the current schedule (Table 1) (*73*). The risk for enamel fluorosis among children this age attributable to fluoride supplements could be lower, but not enough information is available yet to evaluate the effects of this change.

When prescribing any pharmaceutical agent, dentists and physicians should attempt to maximize benefit and minimize harm (*229*). For infants and children aged <6 years, both a benefit of dental caries prevention and a risk for enamel fluorosis are possible. Although the primary (i.e., "baby") teeth of children aged 1–6 years would benefit from fluoride's posteruptive action, and some preeruptive benefit for developing permanent teeth could exist, fluoride supplements also could increase the risk for enamel fluorosis at this age (*138,223*).

Professionally Applied Fluoride Compounds

In the United States, dentists and dental hygienists have been applying high-concentration fluoride compounds directly to patients' teeth for approximately 50 years. Application procedures were developed on the assumption that the fluoride would be incorporated into the crystalline structure of the dental enamel and develop a more acid-resistant enamel. To maximize this reaction, a professional tooth cleaning was considered mandatory before the application. However, subsequent research has demonstrated that high-concentration fluoride compounds (e.g., those in gel or varnish) do not directly enter the enamel's crystalline structure (*230*). The compound forms a calcium fluoride-like material on the enamel's surface that releases fluoride for remineralization when the pH in the mouth drops. Thus, professional tooth cleaning solely to prepare the teeth for application of a fluoride compound is unnecessary; toothbrushing and flossing appear equally effective in improving the efficacy of high-concentration fluoride compounds (*231*).

Fluoride Gel and Foam

Because an early study reported that fluoride uptake by dental enamel increased in an acidic environment (*232*), fluoride gel is often formulated to be highly acidic (pH of approximately 3.0). Products available in the United States include gel of acidulated phosphate fluoride (1.23% [12,300 ppm] fluoride), gel or foam of sodium fluoride (0.9% [9,040 ppm] fluoride), and self-applied (i.e., home use) gel of sodium fluoride (0.5% [5,000 ppm] fluoride) or stannous fluoride (0.15% [1,000 ppm] fluoride) (*73*).

Clinical trials conducted during 1940–1970 demonstrated that professionally applied fluorides effectively reduce caries experience in children (*233*). In more recent studies, semiannual treatments reportedly caused an average decrease of 26% in caries experience in the permanent teeth of children residing in nonfluoridated areas (*191,234–236*). The application time for the treatments was 4 minutes. In clinical practice, applying fluoride gel for 1 minute rather than 4 minutes is common, but the efficacy of this shorter application time has not been tested in human clinical trials. In addition, the optimal schedule for repeated application of fluoride gel has not been adequately studied to support definitive guidelines, and studies that have examined the efficacy of various gel application schedules in preventing and controlling dental caries have reported mixed results. On the basis of the available evidence, the usual recommended frequency is semiannual (*151,237,238*).

Because these applications are relatively infrequent, generally at 3- to 12-month intervals, fluoride gel poses little risk for enamel fluorosis, even among patients aged <6 years. Proper application technique reduces the possibility that a patient will swallow the gel during application.

Fluoride Varnish

High-concentration fluoride varnish is painted directly onto the teeth. Fluoride varnish is not intended to adhere permanently; this method holds a high concentration of fluoride in a small amount of material in close contact with the teeth for many hours. Fluoride varnish has practical advantages (e.g., ease of application, a nonoffensive taste, and use of smaller amounts of fluoride than required for gel applications). Such varnishes are available as sodium fluoride (2.26% [2,600 ppm] fluoride) or difluorsilane (0.1% [1,000 ppm] fluoride) preparations.

Fluoride varnish has been widely used in Canada and Europe since the 1970s to prevent dental caries (*152,239*). FDA's Center for Devices and Radiological Health has cleared fluoride varnish as a medical device to be used as a cavity liner (i.e., to provide fluoride at the junction of filling material and tooth) and root desensitizer (i.e., to reduce sensitivity to temperature and touch that sometimes occurs on root surfaces exposed by receding gingiva) (*240*); FDA has not yet approved this product as an anticaries agent. Caries prevention is regarded as a drug claim, and companies would be required to submit appropriate clinical trial evidence for review before this product could be marketed as an anticaries agent. However, a prescribing practitioner can use fluoride varnish for caries prevention as an "off-label" use, based on professional judgement (*241*).

Studies conducted in Canada (*242*) and Europe (*243–246*) have reported that fluoride varnish is efficacious in preventing dental caries in children. Applied semiannually, this modality is as effective as professionally applied fluoride gel (*247*). Some researchers advocate application of fluoride varnish as many as four times per year to achieve maximum effect, but the evidence of benefits from more than two applications per year remains inconclusive (*240,246,248*). Other studies have reported that three applications in 1 week, once per year, might be more effective than the more conventional semiannual regimen (*249,250*).

European studies have reported that fluoride varnish prevents decalcification (i.e., an early stage of dental caries) beneath orthodontic bands (*251*) and slows the progression of existing enamel lesions (*252*). Studies examining the effectiveness of varnish in controlling early childhood caries are being conducted in the United States. Research on fluoride varnish (e.g., optimal fluoride concentration, the most effective application protocols, and its efficacy relative to other fluoride modalities) is likely to continue in both Europe and North America.

No published evidence indicates that professionally applied fluoride varnish is a risk factor for enamel fluorosis, even among children aged <6 years. Proper application technique reduces the possibility that a patient will swallow varnish during its application and limits the total amount of fluoride swallowed as the varnish wears off the teeth over several hours.

Fluoride Paste

Fluoride-containing paste is routinely used during dental prophylaxis (i.e., cleaning). The abrasive paste, which contains 4,000–20,000 ppm fluoride, might restore the concentration of fluoride in the surface layer of enamel removed by polishing, but it is not an adequate substitute for fluoride gel or varnish in treating persons at high risk for dental caries (*151*). Fluoride paste is not accepted by FDA or ADA as an efficacious way to prevent dental caries.

Combinations of Fluoride Modalities

Studies comparing various combinations of fluoride modalities have generally reported that their effectiveness in preventing dental caries is partially additive. That is, the percent reduction in the prevalence or severity of dental caries from a combination of modalities is higher than the percent reduction from each modality, but less than the sum of the percent reduction of the modalities combined. Attempts to use a formula to apply sequentially the percent reduction of an additional modality to the estimated remaining caries increment have overestimated the effect (*151,253*). For example, if the first modality reduces caries by 40% and the second modality reduces caries by 30%, then the calculation that caries will be reduced by a total of 58% (i.e., 40% plus 18% [30% of the 60% decay remaining after the first modality]) will likely be an overestimate.

QUALITY OF EVIDENCE FOR DENTAL CARIES PREVENTION AND CONTROL

Members of the work group convened by CDC identified the published research in their areas of expertise and evaluated the quality of scientific evidence for each fluoride modality in preventing and controlling dental caries. Evidence was drawn from the most relevant English-language, peer-reviewed scientific publications regarding the current effectiveness of fluoride modalities. Additional references were suggested by reviewers. Members used their own methods for critically analyzing articles. A formal protocol for duplicate review was not followed, but members collectively agreed on the grade reflecting the quality of evidence regarding each fluoride modality. Criteria used to grade the quality of scientific evidence (i.e., ordinal grading) was adapted from the U.S. Preventive Services Task Force (Box 1) (*254*). Grades range from I to III.

BOX 1. Grading system used for determining the quality of evidence for a fluoride modality

Grade	Criteria
I	Evidence obtained from one or more properly conducted randomized clinical trials (i.e., one using concurrent controls, double-blind design, placebos, valid and reliable measurements, and well-controlled study protocols).
II-1	Evidence obtained from one or more controlled clinical trials without randomization (i.e., one using systematic subject selection, some type of concurrent controls, valid and reliable measurements, and well-controlled study protocols).
II-2	Evidence obtained from one or more well-designed cohort or case-control analytic studies, preferably from more than one center or research group.
II-3	Evidence obtained from cross-sectional comparisons between times and places; studies with historical controls; or dramatic results in uncontrolled experiments (e.g., the results of the introduction of penicillin treatment in the 1940s).
III	Opinions of respected authorities on the basis of clinical experience, descriptive studies or case reports, or reports of expert committees.

Source: US Preventive Services Task Force. Guide to clinical preventive services. 2nd ed. Alexandria, VA: International Medical Publishing, 1996.

Community Water Fluoridation

Studies on the effectiveness of adjusting fluoride in community water to the optimal concentration cannot be designed as randomized clinical trials. Random allocation of study subjects is not possible when a community begins to fluoridate the water because all residents in a community have access to and are exposed to this source of fluoride. In addition, clinical studies cannot be conducted double-blind because both study subjects and researchers usually know whether a community's water has been fluoridated. Efforts to blind the examiners by moving study subjects to a neutral third site for clinical examinations, using radiographs of teeth without revealing where the subjects live, or including transient residents as study subjects have not fully resolved these inherent limitations. Early studies that led to the unexpected discovery that dental caries was less prevalent and severe among persons with mottled enamel (subsequently identified as a form of enamel fluorosis) were conducted before the caries-preventive effects of fluoride were known (*255*). In those studies, researchers did not have an a priori reason to suspect they would find either reduced or higher levels of dental caries experience in communities with low levels of mottled enamel. Researchers also had no reason to believe that patients selected where they lived according to their risk for dental caries. In that regard, these studies were randomized, and examiners were blinded.

Despite the strengths of early studies of the efficacy of naturally occurring fluoride in community drinking water, the limitations of these studies make summarizing the quality of evidence on community water fluoridation as Grade I inappropriate (Table 1). The quality of evidence from studies on the effectiveness of adjusting fluoride concentration in community water to optimal levels is Grade II-1. Research limitations are counterbalanced by broadly similar results from numerous well-conducted field studies by other investigators that included thousands of persons throughout the world (*256,257*).

School Water Fluoridation

Field trials on the effect of school water fluoridation were not blindly conducted and had no concurrent controls (*118*). Thus, the quality of evidence for this modality is Grade II-3.

Fluoride Toothpaste

Studies that have demonstrated the efficacy of fluoride toothpaste in preventing and controlling dental caries include all of the essential features of well-conducted clinical trials. These include randomized groups, double-blind designs, placebo controls, and meticulous procedural protocols. Taken together, the trials on fluoride toothpaste provide solid evidence that fluoride is efficacious in controlling caries (*144*). The quality of evidence for toothpaste is Grade I.

Fluoride Mouthrinse

Early studies of the efficacy of fluoride mouthrinse in reducing dental caries experience were randomized clinical trials (*184,185*) or studies that used historical control groups rather than concurrent control groups (*186–189*). The quality of evidence for fluoride mouthrinse is Grade I.

Dietary Fluoride Supplements

The only randomized controlled trial to assess fluoride supplements taken by pregnant women provides Grade I evidence of no benefit for their children. Many studies of the effectiveness of fluoride supplements in preventing dental caries among children aged <6 years have been flawed in design and conduct. Problems included self-selection into test and control groups, absence of concurrent controls, high attrition rates, and nonblinded examiners. Because of these flaws, the quality of evidence to support use of fluoride supplements by children aged <6 years is Grade II-3. The well-conducted randomized clinical trials on the effects of fluoride supplements on dental caries among children aged 6–16 years in programs conducted in schools provide Grade I evidence.

Fluoride Gel

The quality of evidence for using fluoride gel to prevent and control dental caries in children is Grade I. However, data were gathered when dental caries was more prevalent and severe than today. Subjects in earlier studies were probably more representative of persons who now would be characterized as being at high risk for caries.

Fluoride Varnish

The quality of evidence for the efficacy of high-concentration fluoride varnish in preventing and controlling dental caries in children is Grade I. Although the randomized controlled clinical studies that established Grade I evidence were conducted in Europe, U.S. results should be the same.

COST-EFFECTIVENESS OF FLUORIDE MODALITIES

Documented effectiveness is the most basic requirement for providing a health-care service and an important prerequisite for preventive services (e.g., caries-preventive modalities). However, effectiveness alone is not a sufficient reason to initiate a service. Other factors, including cost, must be considered (*254*). A modality is more cost-effective when deemed a less expensive way, from among competing alternatives, of meeting a stated objective (*258*). In public health planning, determination of the most cost-effective alternative for prevention is essential to using scarce resources efficiently. Dental-insurance carriers are also interested in cost-effectiveness so they can help purchasers use funds efficiently. Because half of dental expenditures are out of pocket (*259*), this topic interests patients and their dentists as well. Potential improvement to quality of life is also a consideration. The contribution of a healthy dentition to quality of life at any age has not been quantified, but is probably valued by most persons.

Although solid data on the cost-effectiveness of fluoride modalities alone and in combination are needed, this information is scarce. In 1989, the Cost Effectiveness of Caries Prevention in Dental Public Health workshop, which was attended by health economists, epidemiologists, and dental public health professionals, attempted to assess the cost-effectiveness of caries-preventive approaches available in the United States (*260*).

All other things being equal, fluoride modalities are most cost-effective for persons at high risk for dental caries. Because persons at low risk develop little dental caries, limited benefit is gained by adding caries-preventive modalities to water fluoridation and fluoride toothpaste, even those demonstrated to be effective among populations at high risk.

Members of the CDC work group reached consensus regarding the populations for which each modality would be expected to have the necessary level of cost-effectiveness to warrant its use.

Community Water Fluoridation

Health economists at the 1989 workshop on cost-effectiveness of caries prevention calculated that the average annual cost of water fluoridation in the United States was $0.51 per person (range: $0.12–$5.41) (*260*). In 1999 dollars,* this cost would be $0.72 per person (range: $0.17–$7.62). Factors reported to influence the per capita cost included

- Å size of the community (the larger the population reached, the lower the per capita cost);
- Å number of fluoride injection points in the water supply system;
- Å amount and type of system feeder and monitoring equipment used;
- Å amount and type of fluoride chemical used, its price, and its costs of transportation and storage; and
- Å expertise of personnel at the water plant.

When the effects of caries are repaired, the price of the restoration is based on the number of tooth surfaces affected. A tooth can have caries at >1 location (i.e., surface), so the number of surfaces saved is a more appropriate measure in calculating cost-effectiveness than the number of teeth with caries. The 1989 workshop participants concluded that water fluoridation is one of the few public health measures that results in true cost savings (i.e., the measure saves more money than it costs to operate); in the United States, water fluoridation cost an estimated average of $3.35 per carious surface saved ($4.71 in 1999 dollars*) (*260*). Even under the least favorable assumptions in 1989 (i.e., cities with populations <10,000, higher operating costs, and effectiveness projected at the low end of the range), the cost of a carious surface saved because of community water fluoridation ranged from $8 to $12 ($11–$17 in 1999 dollars*) (*260*), which is still lower than the fee for a one-surface restoration ($54 in 1995 or $65 in 1999 dollars†) (*261*).

A Scottish study conducted in 1980 reported that community water fluoridation resulted in a 49% saving in dental treatment costs for children aged 4–5 years and a 54% saving for children aged 11–12 years (*262*). These savings were maintained even after the secular decline in the prevalence of dental caries was recognized (*263*). The effect of community water fluoridation on the costs of dental care for adults is less clear. This topic cannot be fully explored until the generations who grew up drinking optimally fluoridated water are older.

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*US$ 1988 converted to US$ 1999 using the Consumer Price Index for All Urban Customers (CPI-Urban) (all items). More information is available at the U.S. Department of Labor, Bureau of Labor Statistics website at <http://stats.bls.gov/cpihome.htm>. Accessed June 25, 2001.

† US$ 1995 converted to US$ 1999 using CPI-Urban (dental services). More information is available at the U.S. Department of Labor, Bureau of Labor Statistics website at <http://stats.bls.gov/cpihome.htm>. Accessed June 25, 2001.

School Water Fluoridation

Costs for school water fluoridation are similar to those of any public water supply system serving a small population (i.e., <1,000 persons). In 1988, the average annual cost of school water fluoridation was $4.52 per student per year (range: $0.81–$9.72) (*264*). In 1999 dollars,* this cost would be $6.37 per person (range: $1.14–$13.69). Use of this modality must be carefully weighed in the current environment of low caries prevalence, widespread use of fluoride toothpaste, and availability of other fluoride modalities that can be delivered in the school setting.

Fluoride Toothpaste

Fluoride toothpaste is widely available, no more expensive than nonfluoride toothpaste, and periodically improved. Use of a pea-sized amount (0.25 g) twice per day requires approximately two tubes of toothpaste per year, for an estimated annual cost of $6–$12, depending on brand, tube size, and retail source (*265*). Persons who brush and use toothpaste regularly to maintain periodontal health and prevent stained teeth and halitosis (i.e., bad breath) incur no additional cost for the caries-preventive benefit of fluoride in toothpaste. Because of its multiple benefits, most persons consider fluoride toothpaste a highly cost-effective caries-preventive modality.

Fluoride Mouthrinse

Public health programs of fluoride mouthrinsing have long been presumed to be cost-effective, especially when teachers can supervise weekly rinsing in classrooms at no direct cost to the program. In other programs, volunteers or hourly workers provide supervision. Under these circumstances, administrators of fluoride mouthrinsing programs have claimed annual program costs of approximately $1 per child ($1.41 in 1999 dollars*) (*264*). This figure likely is an underestimate because indirect costs are not included (*196,266*). Fluoride mouthrinsing is a reasonable procedure for groups and persons at high risk for dental caries, but its cost-effectiveness as a universal, population-wide strategy in the modern era of widespread fluoride exposure is questionable (*267*).

Dietary Fluoride Supplements

Dietary fluoride supplements prescribed to persons cost an estimated $37 per year. Fluoride supplements in school programs have direct costs of approximately $2.50 per child ($3.52 in 1999 dollars*) for the tablet or lozenge (*264*); program administrative costs and considerations are similar to those in school mouthrinsing programs.

Professionally Applied Fluoride Compounds

High-concentration fluoride gel and varnish are effective in preventing dental caries, but because application requires professional expertise, they are inherently more expensive than self-applied methods (e.g., drinking fluoridated water or brushing with fluoride toothpaste). For groups and persons at low risk for dental caries, professionally applied methods are unlikely to be cost-effective (*268,269*). In the NPDDP study, prophy-

*US$ 1988 converted to US$ 1999 using CPI-Urban (all items). More information is available at the U.S. Department of Labor, Bureau of Labor Statistics website at <http://stats.bls.gov/cpihome.htm>. Accessed June 25, 2001.

lactic cleaning and gel application costs were $23 per year ($66 in 1999 dollars*) for semiannual applications, which prevented 0.03–0.26 decayed surfaces per year (*196*). A Swedish study claimed that fluoride varnish was cost-effective, but few supporting data were presented (*270*). Varnish might be cost-effective in Scandinavian school dental services, in which dental professionals regularly examine and treat each student, but the cost-effectiveness of fluoride varnish in public health programs in the United States remains undocumented. Whether fluoride varnish or gel would be most efficiently used in clinical programs targeting groups at high risk for dental caries or should be reserved for individual patients at high risk is unclear.

Combinations of Fluoride Modalities

Because the caries-preventive effects of a combination of fluoride modalities are only partially additive, estimates of the cost-effectiveness when adding a modality (e.g., fluoride mouthrinse for a group already drinking fluoridated water and using fluoride toothpaste) should take into account these smaller, incremental reductions in caries. This consideration is particularly relevant for groups and persons at low risk for caries (*253*). The scarcity of research on the cost-effectiveness of combinations limits the ability to draw more detailed conclusions.

RECOMMENDATIONS

In developing the recommendations for specific fluoride modalities that address public health and clinical practice and self-care, the CDC work group considered the quality of evidence of each modality's effect on dental caries, its association with enamel fluorosis, and its cost-effectiveness. The strength of the recommendation for each fluoride modality was determined by the work group, which adapted a coding system used by the U.S. Preventive Services Task Force (Box 2). The work group considered these factors when determining the population for which each recommendation applies (Table 4). The work

BOX 2. Coding system used to classify recommendations for use of specific fluoride modalities to control dental caries

Code	Criteria
A	Good evidence to support the use of the modality.
B	Fair evidence to support the use of the modality.
C	Lack of evidence to develop a specific recommendation (i.e., the modality has not been adequately tested) or mixed evidence (i.e., some studies support the use of the modality and some oppose it).
D	Fair evidence to reject the use of the modality.
E	Good evidence to reject the use of the modality.

Source: US Preventive Services Task Force. Guide to clinical preventive services. 2nd ed. Alexandria, VA: International Medical Publishing, 1996.

*US$ 1981 converted to US$ 1999 using CPI-Urban (dental services). More information is available at the U.S. Department of Labor, Bureau of Labor Statistics website at <http://stats.bls.gov/cpihome.htm>. Accessed June 25, 2001.

group recognized that some recommendations can only be addressed by health-care industries or agencies and that additional research is required to resolve some questions regarding fluoride modalities.

Before promoting a fluoride modality or combination of modalities, the dental-care or other health-care provider must consider a person's or group's risk for dental caries, current use of other fluoride sources, and potential for enamel fluorosis. Although these recommendations are based on assessments of caries risk as low or high, the health-care provider might also differentiate among patients at high risk and provide more intensive interventions as needed. Also, a risk category can change over time; the type and frequency of preventive interventions should be adjusted accordingly.

TABLE 4. Quality of evidence, strength of recommendation, and target population of recommendation for each fluoride modality to prevent and control dental caries

Modality*	Quality of evidence (grade)	Strength of recommendation (code)	Target population†
Community water fluoridation	II-1	A	All areas
School water fluoridation	II-3	C	Rural, nonfluoridated areas
Fluoride toothpaste	I	A	All persons
Fluoride mouthrinse	I	A	High risk§
Fluoride supplements			
Pregnant women	I	E	None
Children aged <6 years	II-3	C	High risk
Children aged 6–16 years	I	A	High risk
Persons aged >16 years	¶	C	High risk
Fluoride gel	I	A	High risk
Fluoride varnish	I	A	High risk

* Modalities are assumed to be used as directed in terms of dosage and age of user.

† Quality of evidence for targeting some modalities to persons at high risk is grade III (i.e., representing the opinion of respected authorities) and is based on considerations of cost-effectiveness that were not included in the studies establishing efficacy or effectiveness.

§ Populations believed to be at increased risk for dental caries are those with low socioeconomic status or low levels of parental education, those who do not seek regular dental care, and those without dental insurance or access to dental services. Individual factors that possibly increase risk include active dental caries; a history of high caries experience in older siblings or caregivers; root surfaces exposed by gingival recession; high levels of infection with cariogenic bacteria; impaired ability to maintain oral hygiene; malformed enamel or dentin; reduced salivary flow because of medications, radiation treatment, or disease; low salivary buffering capacity (i.e., decreased ability of saliva to neutralize acids); and the wearing of space maintainers, orthodontic appliances, or dental prostheses. Risk can increase if any of these factors are combined with dietary practices conducive to dental caries (i.e., frequent consumption of refined carbohydrates). Risk decreases with adequate exposure to fluoride.

¶ No published studies confirm the effectiveness of fluoride supplements in controlling dental caries among persons aged >16 years.

Public Health and Clinical Practice

Continue and Extend Fluoridation of Community Drinking Water

Community water fluoridation is a safe, effective, and inexpensive way to prevent dental caries. This modality benefits persons in all age groups and of all SES, including those difficult to reach through other public health programs and private dental care. Community water fluoridation also is the most cost-effective way to prevent tooth decay among populations living in areas with adequate community water supply systems. Continuation of community water fluoridation for these populations and its adoption in additional U.S. communities are the foundation for sound caries-prevention programs.

In contrast, the appropriateness of fluoridating stand-alone water systems that supply individual schools is limited. Widespread use of fluoride toothpaste, availability of other fluoride modalities that can be delivered in the school setting, and the current environment of low caries prevalence limit the appropriateness of fluoridating school drinking water at 4.5 times the optimal concentration for community drinking water. Decisions to initiate or continue school fluoridation programs should be based on an assessment of present caries risk in the target school(s), alternative preventive modalities that might be available, and periodic evaluation of program effectiveness.

Counsel Parents and Caregivers Regarding Use of Fluoride Toothpaste by Young Children, Especially Those Aged <2 Years

Fluoride toothpaste is a cost-effective way to reduce the prevalence of dental caries. However, for children aged <6 years, especially those aged <2 years, an increased risk for enamel fluorosis exists because of inadequately developed control of the swallowing reflex. Parents or caregivers should be counseled regarding self-care recommendations for toothpaste use for young children (i.e., limit the child's toothbrushing to $\leq$2 times a day, apply a pea-sized amount to the toothbrush, supervise toothbrushing, and encourage the child to spit out excess toothpaste).

For children aged <2 years, the dentist or other health-care provider should consider the fluoride level in the community drinking water, other sources of fluoride, and factors likely to affect susceptibility to dental caries when weighing the risk and benefits of using fluoride toothpaste.

Target Mouthrinsing to Persons at High Risk

Because fluoride mouthrinse has resulted in only limited reductions in caries experience among schoolchildren, especially as their exposure to other sources of fluoride has increased, its use should be targeted to groups and persons at high risk for caries (see Risk for Dental Caries). Children aged <6 years should not use fluoride mouthrinse without consultation with a dentist or other health-care provider because enamel fluorosis could occur if such mouthrinses are repeatedly swallowed.

Judiciously Prescribe Fluoride Supplements

Fluoride supplements can be prescribed for children at high risk for dental caries and whose primary drinking water has a low fluoride concentration. For children aged <6 years, the dentist, physician, or other health-care provider should weigh the risk for caries without fluoride supplements, the caries prevention offered by supplements, and the potential for enamel fluorosis. Consideration of the child's other sources of fluoride,

especially drinking water, is essential in determining this balance. Parents and caregivers should be informed of both the benefit of protection against dental caries and the possibility of enamel fluorosis. The prescription dosage of fluoride supplements should be consistent with the schedule established by ADA, AAPD, and AAP. Supplements can be prescribed for persons as appropriate or used in school-based programs. When practical, supplements should be prescribed as chewable tablets or lozenges to maximize the topical effects of fluoride.

Apply High-Concentration Fluoride Products to Persons at High Risk for Dental Caries

High-concentration fluoride products can play an important role in preventing and controlling dental caries among groups and persons at high risk. Dentists and other health-care providers must consider the risk status and age of the patient to determine the appropriate intensity of treatment. Routine use of professionally applied fluoride gel or foam likely provides little benefit to persons not at high risk for dental caries, especially those who drink fluoridated water and brush daily with fluoride toothpaste.

If FDA approves use of fluoride varnish to prevent and control dental caries, its indications for use will be similar to those of fluoride gel. Such varnishes have practical advantages for children aged <6 years at high risk.

Self-Care

Know the Fluoride Concentration in the Primary Source of Drinking Water

All persons should know whether the fluoride concentration in their primary source of drinking water is below optimal, optimal, or above optimal. This knowledge is the basis for all individual and professional decisions regarding use of other fluoride modalities (e.g., mouthrinse or supplements). Parents and caregivers of children, especially children aged <6 years, must know the fluoride concentration in their child's drinking water when considering whether to alter the child's fluoride intake. For example, in nonfluoridated areas where the natural fluoride concentration is below optimal, fluoride supplements might be considered, whereas in areas where the natural fluoride concentration is >2 ppm, children should use alternative sources of drinking water. Knowledge of the water's fluoride concentration is also key in public policy discussions regarding community water fluoridation.

Frequently Use Small Amounts of Fluoride

All persons should receive frequent exposure to small amounts of fluoride, which minimizes dental caries by inhibiting demineralization of tooth enamel and facilitating tooth remineralization. This exposure can be readily accomplished by drinking water with an optimal fluoride concentration and brushing with a fluoride toothpaste twice daily.

Supervise Use of Fluoride Toothpaste Among Children Aged <6 Years

Children's teeth should be cleaned daily from the time the teeth erupt in the mouth. Parents and caregivers should consult a dentist or other health-care provider before introducing a child aged <2 years to fluoride toothpaste. Parents and caregivers of children aged <6 years who use fluoride toothpaste should follow the directions on the label,

place no more than a pea-sized amount (0.25 g) of toothpaste on the toothbrush, brush the child's teeth (recommended particularly for preschool-aged children) or supervise the toothbrushing, and encourage the child to spit excess toothpaste into the sink to minimize the amount swallowed. Indiscriminate use can result in inadvertent swallowing of more fluoride than is recommended.

Consider Additional Measures for Persons at High Risk for Dental Caries

Persons at high risk for dental caries might require additional fluoride or other preventive measures to reduce development of caries. This additional fluoride can come from daily use of another fluoride product at home or from professionally applied, topical fluoride products. Other preventive measures might include dental sealants and targeted antimicrobial therapies. Parents and caregivers should not provide additional fluoride to children aged <6 years without consulting a dentist or other health-care provider regarding the associated benefits and potential for enamel fluorosis. Persons should seek professional advice regarding their risk status or that of their children.

Use an Alternative Source of Water for Children Aged ≤8 Years Whose Primary Drinking Water Contains >2 ppm Fluoride

In some regions in the United States, community water supply systems and home wells contain a natural concentration of fluoride >2 ppm. At this concentration, children aged ≤8 years are at increased risk for developing enamel fluorosis, including the moderate and severe forms, and should have an alternative source of drinking water, preferably one containing fluoride at an optimal concentration.

In areas where community water supply systems contain >2 ppm but <4 ppm fluoride, EPA requires that each household be notified annually of the desirability of using an alternative source of water for children aged ≤8 years. For families receiving water from home wells, testing is necessary to determine the natural fluoride concentration.

Consumer Product Industries and Health Agencies

Label the Fluoride Concentration of Bottled Water

Producers of bottled water should label the fluoride concentration of their products. Such labeling will allow consumers to make informed decisions and dentists, dental hygienists, and other health-care professionals to appropriately advise patients regarding fluoride intake and use of fluoride products.

Promote Use of Small Amounts of Fluoride Toothpaste Among Children Aged <6 Years

Labels and advertisements for fluoride toothpaste should promote use of a pea-sized amount (0.25 g) of toothpaste on a child-sized toothbrush for children aged <6 years. Efforts to educate parents and caregivers and to encourage supervised use of fluoride toothpaste among young children can reduce inadvertent swallowing of excess toothpaste.

Develop a Low-Fluoride Toothpaste for Children Aged <6 Years

Manufacturers are encouraged to develop a dentifrice for children aged <6 years that is effective in preventing dental caries but alleviates the risk for enamel fluorosis. A "child-strength" toothpaste with a fluoride concentration lower than current products could reduce the risk for cosmetic concerns associated with inadvertent swallowing of toothpaste.

Collaborate to Educate Health-Care Professionals and the Public

Professional health-care organizations, public health agencies, and suppliers of oral-care products should collaborate to educate health-care professionals and trainees and the public regarding the recommendations in this report. Broad collaborative efforts to educate health-care professionals and the public and to encourage behavior change can promote improved, coordinated use of fluoride modalities.

Further Research

Continue Metabolic Studies of Fluoride

Metabolic studies with animals and humans to determine the influence of environmental, physiological, and pathological conditions on the pharmacokinetics and effects of fluoride should continue. Research in these areas will enhance the knowledge base concerning fluoride use, thereby resulting in more effective and efficient use of fluoride.

Identify Biomarkers of Fluoride

As an alternative to direct fluoride intake measurement, biomarkers (i.e., distinct biological indicators) should be identified to estimate a person's fluoride intake and the amount of fluoride in the body. Identification of such biomarkers could allow more efficient research.

Reevaluate the Method of Determining Optimal Fluoride Concentration of Community Drinking Water

The current method of determining the optimal concentration of fluoride in community drinking water, which depends on the average maximum annual ambient air temperature, should be reevaluated because of the social and environmental changes that have occurred since it was adopted in 1962. Research into current consumption patterns of water, processed beverages, and processed foods is also needed. Such research will either validate the current method for determining optimal fluoride concentration in community drinking water or indicate improved methods.

Evaluate the Effect of Fluoride Mouthrinse, Fluoride Supplements, and Other Fluoride Modalities on Dental Caries

Additional clinical trials are needed to evaluate the current effect of fluoride mouthrinse, supplements, and other modalities on dental caries both individually and in combination. Cohorts of particular interest are groups and persons at high risk for dental caries, including older adults (i.e., those aged >50 years). Such research, as well as studies to determine the effects of new fluoride modalities and various combinations among groups and persons at high risk, could lead to more effective and efficient use of these interventions.

Study the Current Cost-Effectiveness of Fluoride Modalities

The increasing availability of multiple fluoride modalities and the lower caries prevalence in the United States indicate a need for current cost-effectiveness studies of fluoride modalities, especially logical combinations of regimens in populations with different caries risks. Such research will allow both more efficient use of resources and a better understanding of the additive effects of combined modalities.

Conduct Descriptive and Analytic Epidemiologic Studies

Descriptive and analytic epidemiologic studies should be conducted to determine the association between dental caries and fluoride exposure from several sources, as well as the current role of community water fluoridation in preventing coronal and root caries among adults. Studies should assess the effect of interruption or discontinuation of water fluoridation; the prevalence of fluorosis associated with different patterns of fluoride use and intake among various populations; and the relationship between objectively measured fluorosis and the aesthetic perceptions of persons, parents, and dentists and other health-care professionals. Studies are needed to refine methods of caries risk assessment. As appropriate, studies should use national, state, and local data. Research addressing these questions will improve understanding of the relationships between fluoride modalities and the benefits and unintended effects of their use.

Identify Effective Strategies to Promote Adoption of Recommendations for Using Fluoride

Effective strategies should be identified to promote adherence by parents, caregivers, children, adults, and health-care providers to recommendations regarding fluoride use. Such research could result in more effective behavior change, more efficient use of resources, improved caries prevention, and less enamel fluorosis.

CONCLUSION

When used appropriately, fluoride is a safe and effective agent that can be used to prevent and control dental caries. Fluoride has contributed profoundly to the improved dental health of persons in the United States and other countries. Fluoride is needed regularly throughout life to protect teeth against tooth decay. To ensure additional gains in oral health, water fluoridation should be extended to additional communities, and fluoride toothpaste should be used widely. Adoption of these and other recommendations in this report could lead to considerable savings in public and private resources without compromising fluoride's substantial benefit of improved dental health.

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MMWR™
MORBIDITY AND MORTALITY
WEEKLY REPORT

August 17, 2001 / Vol. 50 / No. RR-14

Recommendations and Reports

Continuing Education Activity Sponsored by CDC

Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States

EXPIRATION — August 17, 2002

You must complete and return the response form electronically or by mail by **August 17, 2002**, to receive continuing education credit. If you answer all of the questions, you will receive an award letter for 2.0 hours Continuing Medical Education (CME) credit, 0.2 Continuing Education Units (CEUs), or 2.6 contact hours Continuing Nursing Education (CNE) credit. If you return the form electronically, you will receive educational credit immediately. If you mail the form, you will receive educational credit in approximately 30 days. No fees are charged for participating in this continuing education activity.

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Continuing Nursing Education (CNE). This activity for 2.6 contact hours is provided by CDC, which is accredited as a provider of continuing education in nursing by the American Nurses Credentialing Center's Commission on Accreditation.

GOAL AND OBJECTIVES

This *MMWR* provides recommendations regarding the use of fluoride to prevent and control dental caries in the United States. These recommendations were prepared by CDC staff members and a work group of specialists in fluoride research or policy. This goal of this report is to increase appropriate use of fluoride modalities in preventing and controlling dental caries through improved professional understanding and practice. Upon completion of this continuing educational activity, the reader should be able to a) list the factors used in the decision to prescribe fluoride supplements; b) describe the recommendations for counseling patients on the use of fluoride products in oral self-care practices, especially for children aged <6 years; c) list the sources for determining the current level of fluoride delivered by a community water system; d) identify the factors used to assess caries risk; e) explain how fluoride prevents dental caries; f) describe the recommendations for choosing the appropriate fluoride modalities for patients; and g) list the risk factors for enamel fluorosis.

To receive continuing education credit, please answer all of the following questions.

1. Which of the following statements are true? (*Indicate all that apply.*)

A. The U.S. Environmental Protection Agency requires all community water systems to provide each customer an annual report that includes the fluoride concentration of their water.

B. Fluoridated community drinking water and toothpaste containing fluoride are the most common sources for fluoride in the United States.

C. A person at high risk for dental caries will not require more frequent exposure to fluoride than persons at low risk.

D. Water and other beverages provide <50% of a person's fluoride intake in the United States.

2. Which of the following persons are believed to be at greater risk for dental caries? (*Indicate all that apply.*)

A. Persons who do not seek dental treatment on a regular basis.

B. Persons with dental insurance.

C. Persons living in families with incomes below the poverty level.

D. Children with an older brother/sister having a history of high levels of dental decay.

3. Which of the following are risk factors for enamel fluorosis for children aged <6 years? (*Indicate all that apply.*)

A. Taking fluoride supplements in an area with fluoridated drinking water.

B. Not being allowed to deliberately swallow toothpaste.

C. Using a pea-sized amount of toothpaste no more than twice a day.

D. Ingesting too much fluoride from any source during critical periods of tooth development.

4. What is the most cost-effective measure to prevent dental caries in the United States?

A. Fluoridation of individual school water systems.

B. Use of a pea-sized amount of fluoride toothpaste twice a day.

C. Adding fluoride to the community water system.

D. Giving fluoride supplements to schoolchildren.

5. Which of the following statements regarding effective fluoride use are true? (*Indicate all that apply.*)

A. Community water fluoridation should be continued as a safe and inexpensive method to prevent dental caries.
B. Parents and caregivers should be provided information on use of fluoride toothpaste for children aged <6 years.
C. Other fluoride modalities (e.g., mouthrinse and professionally applied gels) should be targeted to patients at high risk for dental caries.
D. Fluoride supplements should be provided to children whose primary drinking water has a low fluoride concentration and who are at high risk for dental caries.

6. Enamel fluorosis is . . .

A. hypermineralization of the dentin.
B. hypomineralization of the enamel.
C. demineralization of the enamel.
D. demineralization of the dentin.

7. At what age should a fluoride supplement first be prescribed to a child at high risk for dental caries living in a community where the level of fluoride is below the optimal level?

A. Birth.
B. 3 months.
C. 6 months.
D. 9 months.

8. For which children at high risk should fluoride mouthrinses be used?

A. Those aged ≥2 years.
B. Those attending Head Start programs.
C. Those aged ≥6 years.
D. Those aged ≥2 years living in rural areas.

9. Currently, how many persons in the United States have access to fluoridated water in their communities?

A. 104 million.
B. 114 million.
C. 134 million.
D. 144 million.

10. What is the optimal concentration of fluoride in community water systems in the United States?

A. 0.7 parts per million (ppm).
B. 0.7–0.9 ppm.
C. 0.7–1.0 ppm.
D. 0.7–1.2 ppm.

11. Indicate your work setting.

A. State/local health department.
B. Other public health agency.
C. Hospital clinic/private practice.
D. Managed care organization.
E. Academic institution.
F. Other.

12. Which best describes your professional activities?

A. Family practice.
B. Pediatrics.
C. Nursing.
D. General dentistry.
E. Pediatric dentistry.
F. Dental hygiene.

13. I plan to use these recommendations as the basis for . . . (*Indicate all that apply.*)

A. health education materials.
B. insurance reimbursement policies.
C. local practice guidelines.
D. public policy
E. other.

14. Each month, approximately how many patients do you counsel regarding fluoride use?

A. None.
B. 1–5.
C. 6–15.
D. 16–24.
E. 25.

15. How much time did you spend reading this report and completing the exam?

A. 2–2.5 hours.
B. More than 2.5 hours but fewer than 3 hours.
C. 3–3.5 hours.
D. More than 3.5 hours but fewer than 4 hours.
E. More than 4 hours.

16. After reading this report, I am confident I can list the factors used in the decision to prescribe fluoride supplements.

A. Strongly agree.
B. Agree.
C. Neither agree or disagree.
D. Disagree.
E. Strongly disagree.

17. After reading this report, I am confident I can describe the recommendations for counseling patients on the use of fluoride products in oral self-care practices, especially for children aged <6 years.

A. Strongly agree.
B. Agree.
C. Neither agree or disagree.
D. Disagree.
E. Strongly disagree.

18. After reading this report, I am confident I can list the sources for determining the current level of fluoride delivered by a community water system.

A. Strongly agree.
B. Agree.
C. Neither agree or disagree.
D. Disagree.
E. Strongly disagree.

19. After reading this report, I am confident I can identify the factors used to assess caries risk.

A. Strongly agree.
B. Agree.
C. Neither agree or disagree.
D. Disagree.
E. Strongly disagree.

20. After reading this report, I am confident I can explain how fluoride prevents dental caries.

A. Strongly agree.
B. Agree.
C. Neither agree or disagree.
D. Disagree.
E. Strongly disagree.

21. After reading this report, I am confident I can describe the recommendations for choosing the appropriate fluoride modalities for patients.

A. Strongly agree.
B. Agree.
C. Neither agree or disagree.
D. Disagree.
E. Strongly disagree.

22. After reading this report, I am confident I can list the risk factors for enamel fluorosis.

A. Strongly agree.
B. Agree.
C. Neither agree or disagree.
D. Disagree.
E. Strongly disagree.

23. The objectives are relevant to the goal of this report.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

24. The figures, tables, and boxes are useful.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

25. Overall, the presentation of the report enhanced my ability to understand the material.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

26. These recommendations will affect my practice.

A. Strongly agree.
B. Agree
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

27. How did you learn about this continuing education activity?

A. Internet.
B. Advertisement (e.g., fact sheet, *MMWR* cover, newsletter, or journal).
C. Coworker/supervisor.
D. Conference presentation.
E. *MMWR* subscription.
F. Other.

Correct answers for questions 1–10

1. A,B; 2. A,C, D; 3. A,D; 4. C; 5. A,B,C,D; 6. B; 7. C; 8. C; 9. D; 10. D.

MMWR Response Form for Continuing Education Credit
August 17, 2001/Vol. 50/No. RR-14

Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States

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1. [ ] A [ ] B [ ] C [ ] D
2. [ ] A [ ] B [ ] C [ ] D
3. [ ] A [ ] B [ ] C [ ] D
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11. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F
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21. [ ] A [ ] B [ ] C [ ] D [ ] E
22. [ ] A [ ] B [ ] C [ ] D [ ] E
23. [ ] A [ ] B [ ] C [ ] D [ ] E
24. [ ] A [ ] B [ ] C [ ] D [ ] E
25. [ ] A [ ] B [ ] C [ ] D [ ] E
26. [ ] A [ ] B [ ] C [ ] D [ ] E
27. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F

Signature ***Date I Completed Exam***

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American Academy of Pediatrics
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POLICY STATEMENT

Red Reflex Examination in Neonates, Infants, and Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

AMERICAN ACADEMY OF PEDIATRICS
Section on Ophthalmology
AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS
AMERICAN ACADEMY OF OPHTHALMOLOGY
AMERICAN ASSOCIATION OF CERTIFIED ORTHOPTISTS

ABSTRACT

Red reflex testing is an essential component of the neonatal, infant, and child physical examination. This statement, which is a revision of the previous policy statement published in 2002, describes the rationale for testing, the technique used to perform this examination, and the indications for referral to an ophthalmologist experienced in the examination of children. *Pediatrics* 2008;122:1401–1404

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

Key Words
red reflex testing, Bruckner reflex, vision screening

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INTRODUCTION

Red reflex testing is vital for early detection of vision- and potentially life-threatening abnormalities such as cataracts, glaucoma, retinoblastoma, retinal abnormalities, systemic diseases with ocular manifestations, and high refractive errors. The American Academy of Pediatrics currently recommends red reflex assessment as a component of the eye evaluation in the neonatal period and during all subsequent routine health supervision visits[1] (see also Bright Futures, available at www.brightfutures.org).

The red reflex test uses transmission of light from an ophthalmoscope through all the normally transparent parts of a subject's eye, including the tear film, cornea, aqueous humor, crystalline lens, and vitreous humor. This light reflects off the ocular fundus, is transmitted back through the optical media and through the aperture of the ophthalmoscope, and is imaged in the eye of the examiner. Any factor that impedes or blocks this optical pathway will result in an abnormality of the red reflex. An abnormal red reflex can result from mucus or other foreign bodies in the tear film, corneal opacities, aqueous opacities, iris abnormalities affecting the pupillary aperture (pupil), cataracts, vitreous opacities, and retinal abnormalities including tumors or chorioretinal colobomata. Unequal or high refractive errors (need for glasses) and strabismus (eye misalignment) may also produce abnormalities or asymmetry of the red reflex. There may be significant variation in the red reflex in children from different racial or ethnic groups resulting from their differing levels of pigmentation of the ocular fundus. Nevertheless, the pediatrician who performs these evaluations on a regular basis will quickly become familiar with these variations in normalcy.

PERFORMING THE RED REFLEX TEST

The red reflex test is properly performed by holding a direct ophthalmoscope close to the examiner's eye with the ophthalmoscope lens power set at "0" (see Fig 1). In a darkened room, the ophthalmoscope light should then be projected onto both eyes of the child simultaneously from approximately 18 inches away. To be considered normal, a red reflex should emanate from both eyes and be symmetric in character. Dark spots in the red reflex, a markedly diminished reflex, the presence of a white reflex, or asymmetry of the reflexes (Bruckner reflex) are all indications for referral to an ophthalmologist who is experienced in the examination of children. The exception to this rule is a transient opacity from mucus in the tear film that is mobile and completely disappears with blinking.

All infants and children with a positive family history of retinoblastoma; congenital, infantile, or juvenile cataracts; glaucoma; or retinal abnormalities should be referred to an ophthalmologist who is experienced in the examination of children for a complete eye examination regardless of the status of the red reflex, because these children are at high risk of vision- and potentially life-threatening eye abnormalities. Age of referral to an ophthalmologist depends on specific risk factors (eg, genetic condition, familial eye disease, etc), which can vary

FIGURE 1
Red reflex examination. (Used with permission of Alfred G. Smith, MD, ©1991.)

in age of presentation. However, it is still valuable for the pediatrician to perform red reflex testing on these patients to help determine if it is necessary to expedite this referral. Whenever an opacity or tumor is suspected, an expedited referral is indicated. Because of the urgent nature of diagnosis, it is prudent for the pediatrician to contact the ophthalmologist personally about the possible diagnosis and express (and document) the urgency of the appointment to the parent. It is also essential that the ophthalmologist follow-up with patients, send timely reports to primary care physicians, and make sure that the transfer of care back to the referring physician is clean and understood by all parties.

The purpose of this policy statement, which is a revision of the previous statement published in 2002,[2] is to suggest a policy based on current knowledge and experience for examination of the eyes of neonates, infants, and children to minimize the risk of delay in diagnosis of serious vision-threatening or life-threatening disorders.

Occasionally, some pediatricians find that red reflex

testing can be facilitated by dilating the eyes of the subject. Although in infants, pupils are easily dilated by using various agents, significant complications sporadically have been reported with all commercially available dilating eye drops, including sympathomimetic agents such as phenylephrine and anticholinergic agents such as cyclopentolate hydrochloride and tropicamide. These complications include elevated blood pressure and heart rate,[3] urticaria,[4] cardiac arrhythmias,[5] and contact dermatitis.[6,7] However, pupillary dilation has been performed routinely for many years in almost all new patients seen by pediatric ophthalmologists, with a very low incidence of toxicity. Hence, this procedure seems to be safe when performed in an office setting on infants older than 2 weeks. Nevertheless, to minimize liability exposure, physicians should discuss with the parents the nature and purpose of the proposed diagnostic procedure and any potential risks associated with the procedure or accompanying medications, including but not limited to pain, discomfort, bradycardia, respiratory depression, and hypertension, and document the provision of this information in the medical chart. Such informed-consent precautions are particularly important when testing preterm infants. Preterm infants seem to be particularly sensitive to the adverse effects of mydriatic eye drops; consequently, the concentration of these pharmacologic agents should be reduced.[8]

SUGGESTED EYE DROPS FOR DILATION IN INFANTS

For infants younger than 9 months:

- A combination drop of 0.25% cyclopentolate with 2.5% phenylephrine (Cyclomydril [Alcon Laboratories, Fort Worth, TX]) approximately 15 minutes before examination.
- Note that atropine drops should be avoided in young infants because of the potential for anticholinergic adverse effects.
- For infants older than 9 months:
- Tropicamide 1%, phenylephrine 2.5% ophthalmic drops; give 1 drop of either or both approximately 15 minutes before red reflex testing.
- A combination drop of 0.25% cyclopentolate with 2.5% phenylephrine (Cyclomydril) approximately 15 minutes before examination.

RECOMMENDATIONS

- All neonates, infants, and children should have an examination of the red reflex of the eyes performed by a pediatrician or other primary care clinician trained in this examination technique before discharge from the neonatal nursery and during all subsequent routine health supervision visits.
- The result of the red reflex examination is to be rated as normal when the reflections of the 2 eyes viewed both individually and simultaneously are equivalent in color, intensity, and clarity and there are no opacities or white spots (leukokoria) within the area of either or both red reflexes.
- All infants or children with an abnormal Bruckner reflex or absent red reflex should be referred immediately to an ophthalmologist who is skilled in pediatric examinations.
- It is essential that the referring practitioner communicate the abnormal findings directly to the ophthalmologist and receive confirmation back from the ophthalmologist that proper follow-up consultation was performed.
- Infants or children in high-risk categories, including relatives of patients with retinoblastoma, infantile or juvenile cataracts, retinal dysplasia, glaucoma, or other vision-threatening ocular disorders that can present in infancy, should not only have red reflex testing performed in the nursery but also be referred to an ophthalmologist who is experienced in examining children for a complete eye examination regardless of the findings of the red reflex testing by the pediatrician.
- Infants or children in whom parents or other observers describe a history suspicious for the presence of leukokoria (a white pupil reflex) in 1 or both eyes should be examined by an ophthalmologist who is experienced in the examination of children, because small retinoblastoma tumors or other serious lesions may present in a subtle fashion.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Reducing the Number of Deaths and Injuries From Residential Fires

ABSTRACT. Smoke inhalation, severe burns, and death from residential fires are devastating events, most of which are preventable. In 1998, approximately 381 500 residential structure fires resulted in 3250 nonfirefighter deaths, 17 175 injuries, and approximately $4.4 billion in property loss. This statement reviews important prevention messages and intervention strategies related to residential fires. It also includes recommendations for pediatricians regarding office anticipatory guidance, work in the community, and support of regulation and legislation that could result in a decrease in the number of fire-related injuries and deaths to children.

ABBREVIATION. NFPA, National Fire Protection Association.

For persons of all ages, fires and burns are the fourth most common cause of unintentional injury-related death—after motor vehicles, falls, and poisoning by solids and liquids—causing more than 4000 deaths annually. Approximately 1000 of these deaths occur in children younger than 15 years. Among children younger than 1 year, fire- and burn-related deaths follow nonfirearm homicide and motor vehicle crashes as a leading cause of injury-related death. In children who are between 1 and 9 years of age, deaths from fire and burns are second only to those from motor vehicle injury.[1]

In 1998, an estimated 381 500 residential structure fires resulted in 3250 nonfirefighter deaths, 17 175 injuries, and approximately $4.4 billion in property loss.[2] Residential fires accounted for 74% of all structure fires, 81% of all fire-related deaths, and 74% of injuries resulting from fires. Home fires result in more than 90% of all unintentional fire- and burn-related deaths in children younger than 15 years.[3] Most fire-related deaths in all age groups occur as a result of smoke inhalation, rather than directly from burns.[4]

The rate of deaths from home fires for preschool children is more than double, relative to population, the rate for all age groups combined. In 1997, children playing with fire, usually matches or lighters, accounted for 8% of deaths from home fires and 2 of every 5 deaths from home fires in preschool children.[5,6] Also, young children may have difficulty escaping from burning buildings, even though a smoke alarm may be sounding.

Arson is thought or suspected to be the cause of 13% of 1993–1997 residential structure fires and to account for 19% of associated property loss. Children and adolescents younger than 18 years accounted for 52% of those arrested for arson in 1993–1997; more than one third were younger than 15 years.[7] Preteens may start fires in the course of an otherwise normal phase of development, but usually older juveniles who set fires often have serious psychological problems that may relate to stress, such as child abuse or learning disabilities.[7]

Each year, more than 50 000 acute hospital admissions result from the more than 1.25 million injuries from burns.[8] Although scalds make up a higher percentage of hospital admissions than burns from fires,[9,10] the fatality rate of those hospitalized from fires (12% in the first hospitalization) far exceeds that of other hospitalized patients with burns (3%).[9]

Data from 1996 indicate that cigarettes and other lighted tobacco products were the cause of 33% of residential fires that involved fatalities. Studies have demonstrated the feasibility of manufacturing "fire-safe" cigarettes that do not burn as long when they are not being actively smoked, which makes them less likely to ignite objects and cause a fire.[11]

Examination of trends from 1971 to 1991 shows a decline of approximately 50% in the rates of both fire- and burn-related deaths and acute hospital admissions for injuries from burns, most likely because of an increase in public fire and burn safety education, more widespread use of smoke alarms and automatic residential fire sprinkler systems, stronger building and fire codes and standards, and expansion in the network of burn treatment centers. Changes in lifestyle, such as declines in smoking and alcohol abuse, as well as changes in home cooking practices, have also contributed to this reduced incidence. The decrease in the number of hospitalizations for burn-related injury may, in part, also result from a treatment shift from the inpatient to the outpatient setting.[8]

Depending on the methodology,[12–14] annual economic loss from fire-related fatal and nonfatal unintentional injury is $3.8 to $61.4 billion. The figures keep rising, even though deaths and injuries keep falling, because of our growing awareness of the extent and longevity of harmful effects from fire injury.

PREVENTION MESSAGES AND INTERVENTION STRATEGIES

Deaths and injuries from residential fires may be mitigated by a variety of intervention strategies and

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

prevention messages, some of which are listed below. Others may be found in *Injury Prevention and Control in Children and Youth*, published by the American Academy of Pediatrics.[15]

- Children require close *adult supervision*.
- Functioning *smoke alarms* should be installed and maintained. Smoke alarms should be tested monthly, and batteries should be replaced at least once a year. Alarms with a flashing light in addition to a sound alarm should be installed in households with deaf or hard-of-hearing individuals, including one inside their bedrooms.
- An *escape plan* should be in place with at least 2 exits (when available) from every room of the house and a planned meeting place outside, in front, where everyone can wait for the fire department. The escape plan should be practiced at least every 6 months. (Practice sessions should not include potentially dangerous activities, such as climbing out of windows and using ladders.) If the home has an upper level, a noncombustible fire escape ladder should be available. A special escape plan that meets specific needs should be provided for small children, the aged, and individuals with disabilities. Neighbors of nonverbal, deaf, or hard-of-hearing children should be taught the sign language sign for "fire." Family and guests who are visiting overnight should briefly review a fire exit plan, just as if they were staying at a hotel.
- Preschool-aged children (3 years and older) can begin to *learn what to do in case of a fire*. Parents should teach children that the sound of a smoke alarm means go outside immediately and meet at a designated place and do not hide from firefighters. Because smoke rises, individuals should *crawl low on their hands and knees* under the smoke and toxic gases to exit a room filled with smoke. The cleanest air is 12 to 24 inches above the floor.
- In apartment buildings *elevators should not be used during a fire* because they may stop at a burning floor. Stairs should always be used to exit the building.
- Persons whose clothes catch fire should be taught to *stop, drop, and roll* to smother the flames and use cool running water immediately to begin treatment of the burn.
- Adults should learn from manufacturers' instructions or from their local fire department how to select and use a *fire extinguisher* properly; ie, when the fire is small and self-contained, and when they have a clear escape route available.
- Automatic home fire *sprinkler systems* are affordable and practical for many homes.
- All *caregivers* should be familiar with all possible exits of a house or apartment, instructed in the event of a fire about escape routes, instructed not to smoke, given emergency telephone numbers, and instructed to leave the house immediately with the children and call the fire department from a neighbor's house or an outside telephone.

Educational messages about the prevention of fires and burns are part of the work of the National Fire Protection Association (NFPA), the US Fire Administration, the US Consumer Product Safety Commission, and other organizations. The NFPA *Risk Watch* injury prevention curriculum, designed for children in preschool through grade 8 and their families, contains comprehensive fire and burn prevention messages, as well as other important injury prevention messages.[16] The NFPA also offers the *Learn Not To Burn* program, which focuses exclusively on fire and burn prevention.

RECOMMENDATIONS

1. As part of office anticipatory guidance, parents should be counseled about fire and burn prevention including adequate supervision of children, use of smoke alarms, escape plans, safe behavior in fires, and initial treatment of burns (stop, drop, and roll/cool and call), and other fire and burn prevention messages.[15] Material from the AAP TIPP (American Academy of Pediatrics, The Injury Prevention Program), and the NFPA may assist in this effort. Special planning information should be given to families having children with special needs.
2. School-aged children or adolescents who set fires are often crying out for help. They may have experienced a loss or failure, or may be stressed, abused, confused, angry, or frustrated. Pediatricians and parents should realize that these children and adolescents need psychological help; setting fires is a symptom of an underlying problem.
3. Pediatricians can work with other community members in the following activities:
   - encouraging adolescents and adults not to smoke;
   - working with media to increase public awareness of fire- and burn-related injury and prevention;
   - working with fire departments and local schools to provide comprehensive fire and burn prevention education to students and their families, and advocating for inclusion of this information in the school health education curriculum;
   - working with fire departments and other community agencies to distribute and install smoke alarms in giveaway programs targeted to areas at high risk for fires[17–19];
   - supporting the lowering of insurance premiums for sprinkler-protected buildings;
   - establishing or maintaining an adequate fire-response system; and
   - helping to sustain the network of burn centers that treat children.
4. Pediatricians should promote and support legislation and regulation to accomplish the following:
   - decrease the use of cigarettes and other smoking materials and/or promote the manufacture and substitution of fire-safe cigarettes—those that are less likely to start fires[15];
   - support a strong flame-retardant clothing law; and

- improve and enforce fire building codes and/or laws that require working smoke alarms and sprinkler systems in all new buildings and retrofit multiple-family rental units (building codes related to well-lighted hallways, wiring, appliances, heating devices, and sprinklers may also have an impact on reducing the number of fire-related injuries and deaths).[20]

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POLICY STATEMENT

Reducing the Risk of HIV Infection Associated With Illicit Drug Use

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric AIDS

ABSTRACT

Substance abuse, specifically the use of illicit drugs that are administered intravenously, continues to play a role in the transmission of human immunodeficiency virus type 1 (HIV-1) among adolescents and young adults (youth). Risks of HIV-1 infection may result from direct exposure to contaminated blood through sharing of injection drug equipment and from unsafe sexual practices (while under the influence of drugs and/or in exchange for drugs). Reducing the risk of HIV-1 infection that is associated with illicit drug use requires prevention education and prompt engagement in treatment. Providing patients with education, instruction on decontamination of used injection drug equipment, improved access to sterile syringes and needles, and postexposure prophylaxis may decrease their risk of acquiring HIV-1 infection. Pediatricians should assess risk behaviors as part of every health care encounter, including queries about tobacco, alcohol, and marijuana use. The risks and benefits of postexposure prophylaxis with antiretroviral drugs should be considered for youth with a single recent (within 72 hours) high-risk exposure to HIV-1 through sharing needles/syringes with an HIV-1–infected individual or having unprotected intercourse with an individual who engages in injection drug use. Such prophylaxis must be accompanied by risk-reduction counseling, appropriate referrals for treatment, and evaluation for pregnancy and associated sexually transmitted infections. There is an urgent need for more substance-abuse prevention and treatment programs, legislation that facilitates unencumbered access to sterile syringes, and expedient availability of reproductive health care services for sexually active youth, including voluntary HIV-1 counseling and testing.

BACKGROUND

Illicit drug use continues to play a major role in the transmission of human immunodeficiency virus type 1 (HIV-1) in the United States. Injection drug users, men who have sex with men and engage in injection drug use, and heterosexuals who have sexual contact with an injection drug user were responsible for 23% of reported acquired immunodeficiency syndrome (AIDS) cases among adults and adolescents in 2003.[1] Among youth 13 to 24 years of age, these transmission categories accounted for 13.4% of AIDS cases in 2003. Of the approximately 40 000 new HIV-1 infections each year in the United States, an estimated 50% occur among individuals younger than 25 years.[2–4] The most common mode of acquisition of HIV-1 infection among youth is sexual contact. Young women 13 to 24 years of age are infected most often by heterosexual exposure to partners with HIV-1 infection. Heterosexual contact was reported by 52% of females as their primary risk factor for HIV-1 infection, and 15% reported "no identified risk"

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Key Words
human immunodeficiency virus, HIV-1, adolescents, youth, substance abuse, injection drug use, postexposure prophylaxis, needle exchange

Abbreviation
PEP—postexposure prophylaxis

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because they did not know that their partner was infected with HIV-1.[3] Male-to-male sex accounts for 33% of HIV-1 infections in males 13 to 19 years of age and 62% of HIV-1 infections in males 20 to 24 years of age.[3] These young men commonly fail to disclose their sexual behavior for fear of rejection and alienation.[4] Of significant concern to public health officials and health care professionals is that these estimates may significantly underrepresent actual infections. Many youth have not been tested, and those who are aware of their HIV-1 infection status may not seek medical care, which poses a risk of unintended transmission and disease progression. For example, the prevalence of HIV-1 infection in a cohort of approximately 3500 young men who have sex with men in 7 US cities was found to be 7.2%. Approximately three fourths of these HIV-1–infected young men (15–22 years of age) were unaware of their HIV-1 serostatus.[5]

Risk factors for injection drug use may include tobacco, alcohol, and marijuana use[6–8] and depression.[9] Several recent studies have identified an association with illicit drug and alcohol use as well as high-risk sexual activity in youth who engage in body-modification practices, including tattoos, body piercing, and branding.[10–12] Drug dependence among youth also is associated with a history of childhood sexual abuse.[13]

There is a direct risk of HIV-1 transmission associated with sharing needles that are used to inject intravenous drugs or to apply tattoos and reusing tattoo ink(s). Youth may unintentionally put themselves at risk of acquiring HIV-1 by engaging in sexual activity while under the influence of illicit drugs or alcohol. In this scenario, youth may fail to use condoms and perhaps select particularly high-risk sexual partners.[14]

REDUCING THE RISK OF HIV-1 INFECTION ASSOCIATED WITH ILLICIT DRUG USE

Preventing and Treating Illicit Drug Use/Substance Abuse

The development and implementation of reproducible, efficacious strategies to prevent the onset of substance use is critical. These primary prevention efforts should begin early and be directed at children and adolescents who have not yet established a pattern of drug dependence or injection drug use. Initiatives should be coordinated and broadly based, with the involvement of families, schools, and community agencies including correction services/detention centers. At a community level, efforts also should be made to reach out to all youth. Homeless, runaway, and incarcerated youth are subpopulations that may be at higher risk. Pediatricians can and should take a leadership role in these initiatives. In clinical care settings, pediatricians should routinely assess patients for risk of substance use[15] and attendant comorbidities.[16] The HEADSS risk-assessment instrument[17] is one of a number[18] of useful approaches to identify substance abuse and other high-risk activities in adolescents. Even in the absence of current high-risk activities, pediatricians should discuss approaches that families can use to facilitate an interactive and ongoing dialogue regarding the use of illicit drugs, alcohol, and tobacco products[19]; the relationship of illicit drug use and unsafe sexual activity; and attendant health-related risks including the risk of HIV-1 acquisition.[20,21] Discussions of substance abuse[19] fit in appropriately with routine anticipatory guidance for adolescents, including discussions of sexuality,[22] sexual orientation,[23] condom use,[24] and contraception. These topics need to be discussed with a nonjudgmental approach,[20,23] with careful attention to local laws concerning confidentiality.[18,25,26] Pediatricians should also familiarize themselves with state laws that govern the delivery of medical services to minor youth.[18] Assurance of confidentiality is important to youth who may be reticent to share information regarding high-risk behaviors, depression, or sexual-identity concerns for fear of disclosure to parents. A confidentiality policy presented in the presence of youth and their parent(s) may encourage young people to share personal information more openly.[26]

Access to treatment programs is essential for youth with substance-abuse problems. Adolescent-specific programs are effective, but ongoing intervention is needed to avoid relapse.[27] Effective treatment for such youth is hampered by the dearth of available and affordable ambulatory and inpatient programs.[27,28] Of an estimated 1.4 million youth 12 to 17 years of age who required treatment for substance abuse in 2002, only 10% received services.[29] Only 7% of substance-abuse treatment centers provide services for individuals younger than 18 years.[29] The paucity of inpatient treatment facilities for substance abuse poses secondary risks of infection, untreated mental health issues, and academic failure. Such facilities need to be more readily accessible,[28] and treatment needs to be reimbursed adequately to ensure continued availability of services.[30] There also is a need to encourage medical insurance companies to provide adequate reimbursement to pediatricians who are willing to address substance-abuse problems in their practices.

Preventing Acquisition of HIV-1 Infection Among Those With a Substance-Abuse Problem

Education

Educational initiatives to reduce health risks that are associated with substance abuse should address all known drugs including alcohol and tobacco. Community-based programs can provide information to users of injection drugs and other illicit drugs about risky sexual behaviors that are linked to transmission and acquisition of HIV-1, the relationship between the exchange of sex for drugs and HIV-1 infection, and the protection to be gained from the proper use of condoms. Efforts should

be made to encourage cessation or reduction of illicit drug use, promote entry into substance-abuse treatment programs, to discourage the sharing of injection drug paraphernalia, to educate about safe sex practices, and to support access to mental health services. When helping youth with substance-abuse problems move into treatment, a nonconfrontational, empathetic approach is needed. Motivational enhancement therapy offers one such approach to helping youth accept care for substance-abuse problems.[15] The pediatrician can be an invaluable educational resource to youth-serving community-based organizations.

Decontamination of Used Injection Drug Equipment

A significant proportion of drug-dependent individuals are unwilling or unable to stop injection drug use and do not have access to new or sterile needles and syringes. Bleach disinfection of injection equipment is an important strategy to reduce the risk of HIV-1 infection from reusing or sharing needles and syringes when no safer options are available.[31] In a recent study of injection drug users, rinsing syringes with a 1:10 bleach solution (bleach to water) resulted in no recovery of viable HIV-1.[32] The disinfection procedure requires flushing the barrel of the syringe at least 2 times with a minimum of 30 seconds' exposure to the solution, followed by 1 to 2 rinses with clean water before reuse.[32]

Access to Sterile Syringes and Needles

The public health risks associated with shared use of injection drug paraphernalia have led many national and governmental entities not only to advocate for access to sterile syringes and needles but also to remove existing state laws that invoke criminal penalties for possession of injection drug equipment.[33] In many states, these laws have been crafted to provide a potentially legal safety net for physicians and pharmacists who prescribe or dispense needles and syringes. It is currently illegal for physicians to prescribe injection equipment for injection drug users in only 2 states: Delaware and Kansas. It is illegal for pharmacists to fill prescriptions for injection equipment for injection drug users in 4 states: Delaware, Kansas, Georgia, and Hawaii.[34]

In 2000, New Hampshire, New York, and Rhode Island adopted new syringe laws that partially or completely removed the requirement for a prescription to purchase syringes as well as legal penalties for syringe possession.[35] In Rhode Island, the prescription of syringes to patients who are injection drug users is provided in concert with an agreement to document this care in the medical record, to make syringe prescription a part of the patient's ongoing medical care, to include other harm-reduction strategies in the patient's care, to assist patients in disposing of used syringes safely, and to notify the pharmacy at the time of initial prescription.[36] That program seems to be associated with reductions in injection drug use risk behavior.[36] Such programs should be considered in other states.

Initiatives with the singular objective of increasing access to sterile injection drug equipment remain controversial, because they do not directly address the causes and broader consequences of injection drug use. Despite mounting evidence to counter concerns of escalating injection drug use resulting from unencumbered access to sterile equipment, the controversy remains an impediment for some states and cities to enact legislation to provide this service. Syringe-exchange programs reduce the risk of HIV-1 acquisition from use of shared needles,[37,38] and their association with other counseling and HIV-1 risk-reduction services leads to reduction of high-risk sexual behaviors as well, further enhancing the effectiveness of such programs to limit the spread of HIV-1 among those who engage in injection drug use as well as their sexual partners.[39,40] Syringe-exchange programs do not lead to an increase in injection drug use,[41] nor do they lead to formation of social networks that might enhance transmission of HIV-1 and other diseases.[42] Although prospective, randomized, controlled trials have not been feasible and not all programs have been able to demonstrate a protective effect against the spread of HIV-1 infection, the number of studies that have demonstrated benefits from needle-exchange programs, particularly those conducted within the context of comprehensive drug treatment, is now sufficient to support efforts to make such programs more widely available.[43]

Access to sterile equipment is most likely to be successful in reducing the risk of HIV-1 transmission if it operates in the context of a comprehensive program that provides counseling, opportunities to be engaged in prevention education, and opportunities to receive health care services and if it emphasizes treatment. The provision of clean needles and syringes to injection drug users who have access to treatment but are unwilling or unable to enter treatment or remain abstinent while in treatment may reduce the acquisition or transmission of HIV-1 infection. Syringe-exchange programs are currently available in 31 states, the District of Columbia, and Puerto Rico. Referral to substance-abuse programs was provided by 95% of the syringe-exchange programs. Injection drug users who are referred to substance-abuse treatment programs by syringe-exchange programs have short-term outcomes comparable to those referred by other resources.[34]

Postexposure Prophylaxis

In situations in which an HIV-1–uninfected adolescent has a single recent exposure (within 72 hours) to HIV-1 from sharing injection drug equipment with an HIV-1–infected individual, some experts will consider providing postexposure prophylaxis (PEP).[44] The risk of HIV-1 transmission for each episode of needle or syringe exposure is estimated at 0.67%. Pediatricians should be able

to provide their patients who have an at-risk exposure through injection drug use access to a system for prompt evaluation, counseling, and possible PEP.[45] However, for adolescents who continue needle sharing and, thus, potentially expose themselves to HIV-1, PEP is not routinely recommended, and behavioral interventions to reduce repeated exposure are more appropriate. Current US Public Health Service guidelines include consideration of PEP with combination antiretroviral therapy in patients after injection drug use if the likelihood of shared needles between an HIV-1–uninfected and HIV-1–infected person is significant, the event is sporadic rather than frequent, and combination antiretroviral therapy is begun within 72 hours of exposure.[46] PEP might also be considered for sexual exposure to an HIV-1–infected individual who engages in injection drug use. Additional information regarding PEP among pediatric and adolescent patients can be obtained from a recent AAP clinical report.[47] If PEP is provided, it is critical that risk-reduction counseling related to injection drug use and referral to appropriate substance-abuse treatment be provided concomitantly. Youth with possible percutaneous HIV-1 exposure attributable to injection drug use also should be assessed for hepatitis B and hepatitis C virus infection and, if not previously fully immunized, given hepatitis B vaccine.

CONCLUSIONS AND RECOMMENDATIONS

The transmission of HIV-1 is one of many adverse consequences of illicit drug use. Initiatives to reduce the risk of HIV-1 transmission should include the following.

1. Engaging youth in care
   - Engagement of a youth in his or her own health care is critical to achieving a physician-patient relationship in which honest discussions about high-risk behavior are possible. Pediatricians should review their state laws governing health care services available to minors without parental consent. Confidentiality policies should be developed and discussed with both the youth and parent(s) present. Pediatricians should advocate for services (mobile vans, drop-in centers) that can engage hard-to-reach youth populations such as homeless and runaway youth.

2. Preventing and treating substance abuse
   - Primary prevention activities in the community and in care settings should be directed at families of preadolescents and youth and should promote healthy lifestyles. Physicians should support frank discussion between families and their children to avoid the initiation of illicit drug use, including alcohol and tobacco use. Parents also should be given information and strategies on ways to incorporate dialogue about substance use and sexual activity in their homes.
   - Pediatricians should advocate for youth-friendly substance-abuse treatment facilities that are able to accommodate all youth, including those who are uninsured, underinsured, and undocumented. Pediatricians should familiarize themselves with referral sources for substance-abuse prevention and treatment and mental health services.

3. Preventing acquisition of HIV-1 infection
   - Pediatricians should assess HIV-1–related risk behaviors as part of every health care encounter.
   - Pediatricians should advocate for seamless access to reproductive health care services for youth and be aware of the close association of illicit drug use and high-risk sexual activity.
   - Pediatricians should advocate for unencumbered access to sterile syringes and improved knowledge about decontamination of injection equipment. Physicians should be knowledgeable about their states' statutes regarding possession of syringes and needles and available mechanisms for procurement. These programs should be encouraged, expanded, and linked to drug treatment and other HIV-1 risk-reduction education. It is important that these programs be conducted within the context of continuing research to document effectiveness and clarify factors that seem linked to desired outcomes.
   - For youth with a single recent (within 72 hours) high-risk exposure to HIV-1 through either sharing needles/syringes with an HIV-1–infected individual or engaging in unprotected intercourse with an individual who engages in injection drug use, the risks and benefits of PEP with antiretroviral drugs should be considered. Such prophylaxis must be accompanied by risk-reduction counseling and referral to appropriate substance-abuse treatment.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Nutrition

Reimbursement for Foods for Special Dietary Use

ABSTRACT. Foods for special dietary use are recommended by physicians for chronic diseases or conditions of childhood, including inherited metabolic diseases. Although many states have created legislation requiring reimbursement for foods for special dietary use, legislation is now needed to mandate consistent coverage and reimbursement for foods for special dietary use and related support services with accepted medical benefit for children with designated medical conditions.

ABBREVIATION. AAP, American Academy of Pediatrics.

BACKGROUND

Special foods are recommended by physicians to foster normal growth and development in some children and to prevent serious disability and even death in others. Many of these special foods are technically specialized formulas for which there may be a relatively small market, which makes them more expensive than standard formula. Since publication of the American Academy of Pediatrics (AAP) policy statement in 1994,[1] many states have created legislation for mandating reimbursement for foods for children with inborn errors of metabolism. Third-party payment for foods for special dietary use is inconsistent, however, and state statutes regarding reimbursement vary widely. Some states require coverage only for inherited metabolic diseases, such as phenylketonuria, and others include a range of metabolic conditions. Legislation is now needed to mandate consistent coverage and reimbursement for all aspects of foods for special dietary use and related supplies and services for children with designated medical conditions.

There is a great need for pediatricians and the AAP to take a leadership role in this area of child health affecting infants, children, and adolescents by building on the legislative advancements that have been made as a result of the 1994 policy.[1] A model bill (Pediatric Medical Nutrition Support Act) for proposed legislation is available on the AAP Web site (http://www.aap.org/policy/m972.html).

DEFINITION OF FOODS FOR SPECIAL DIETARY USE

The US Food and Drug Administration, in the Code of Federal Regulations,[2] defines special dietary use of foods as the following:

a. Uses for supplying particular dietary needs that exist by reason of a physical, physiologic, pathologic, or other condition, including but not limited to the conditions of diseases, convalescence, pregnancy, lactation, allergic hypersensitivity to food, [and being] underweight and overweight;
b. Uses for supplying particular dietary needs which exist by reason of age, including but not limited to the ages of infancy and childhood;
c. Uses for supplementing or fortifying the ordinary or usual diet with any vitamin, mineral, or other dietary property. Any such particular use of a food is a special dietary use, regardless of whether such food also purports to be or is represented for general use.

MEDICAL CONDITIONS COVERED

Diseases covered would include all chronic diseases or conditions of childhood requiring special dietary intervention, including inherited metabolic diseases (Table 1).

Many childhood chronic diseases (eg, inflammatory bowel disease, cystic fibrosis, celiac disease, cancer, congenital heart disease, renal failure, hepatic diseases) are associated with increased nutritional requirements and metabolic demands or with decreased nutrient intakes, limitations of digestion and absorption, and/or increased nutrient losses. An optimal state of nutrition is especially important in these children, and poor nutrition is associated with increased risk of infections, inadequate growth, and poor response to treatment modalities, including surgery.[3,4] The goals of nutritional support for children with these chronic illnesses include normal growth and development, promotion of catch-up growth, and improved clinical outcome. Specialized nutritional support is often required, including enteral tube feedings or parenteral nutrition.

Special nutritional supplements and feeding approaches often are required for infants and children with devastating neurologic diseases or impairments, such as severe cerebral palsy, and progressive neurodevelopmental diseases.[5]

TABLE 1. Medical Conditions for Which Foods for Special Dietary Use May Be Reimbursed*

Conditions requiring specific dietary components
Chronic pulmonary insufficiency
Congenital or acquired chronic cardiac insufficiency
Movement disorder (neuromuscular)
Catch-up growth in children attributable to undernutrition
Rett syndrome
Inflammatory bowel disease
Conditions requiring the alteration of specific dietary components
Short bowel syndrome (long-segment Hirschsprung disease, small intestinal atresia, necrotizing enterocolitis, volvulus, gastroschisis)
Intestinal pseudo-obstruction syndromes
Nonspecific malabsorption syndromes (eg, postviral gastroenteropathy, small intestinal bacterial overgrowth)
Intestinal lymphangiectasia
Abetalipoproteinemia
Microvillus inclusion disease
Eosinophilic gastroenteropathy
Partial villus atrophy attributable to food protein sensitivity
Intestinal transplantation
Exocrine pancreatic insufficiency (eg, cystic fibrosis, Schwachman syndrome, Johanson-Blizzard syndrome, Pearson syndrome, pancreatic hypoplasia, congenital trypsinogen deficiency)
Chronic liver disease with cholestasis
Impaired bile acid synthesis
Bile duct atresia
Interrupted enterohepatic circulation (eg, ileal resection, congenital malabsorption of bile acids, blind loop syndrome)
Enterokinase deficiency
Immunodeficiency states (eg, villus atrophy associated with immunodeficiency conditions, autoimmune enteropathy, or enterocolitis associated with immune deficiency)
Chylothorax
Conditions impairing adequate oral intake
Cystic fibrosis
Acquired immunodeficiency syndrome
Transplant patients: bone marrow, liver, kidney, heart, lung, or multiple organs
Cerebral palsy
Aspiration syndrome
Oral dysfunction
Pharyngeal dysfunction
Esophageal dysfunction
Neurologic disorders
Oral feeding aversion (resulting from chronic use of enteral tube feedings or parenteral nutrition)
Pancreatitis
Treatment of childhood cancer
Chronic renal failure, hemodialysis, and peritoneal dialysis
Anatomic, congenital, or postsurgical defects precluding oral nutritional intake (eg, craniofacial defects)
Metabolic disorders
Disorders of carbohydrate metabolism
Glycogen storage disease
Glucose transport protein deficiency
Galactosemia
Hereditary fructose intolerance
Pyruvate dehydrogenase complex deficiency
Phospho*enol*pyruvate carboxykinase deficiency
Disorders of lipid metabolism
Fasting chylomicronemia
Mitochondrial fatty acid oxidation defects (eg, α-ketoadipicaciduria, methylmalonicadipicaciduria, long-chain acyl-CoA dehydrogenase deficiency, and medium-chain acyl-CoA dehydrogenase deficiency)
β-ketothiolase deficiency
Succinyl-CoA ketoacid transferase
Other organic acidemias
Disorders of vitamin metabolism
Biotinidase deficiency
Holocarboxylase synthetase deficiency
Methylmalonicacidemia
Methylcrotonyl-CoA carboxylase deficiency
Thiamine-responsive maple syrup urine disease
Pyridoxine responsive seizures
Disorders of mineral metabolism
Hypercalcemia
Williams syndrome
Disorders of amino acid or nitrogen metabolism
Phenylketonuria
Cystinosis
Homocystinuria
Glutaric acidemia (types I and II)
Disorders of branched-chain amino acid metabolism (eg, disorders of leucine metabolism, isovaleric acidemia, maple syrup urine disease, 3-hydroxy-3-methylglutaricaciduria, 3-methylcrotonylglycinemia, 3-methylglutaconicaciduria)
Tyrosinemia (types I and II)
Lysinuric protein intolerance
Urea cycle defects (eg, ornithine transcarbamylase deficiency, hyperornithine-hyperammonemia-homocitrullinuria syndrome, argininemia, argininosuccinicaciduria, carbamyl phosphate synthetase deficiency, citrullinemia)
Methylmalonicacidemia
Propionicacidemia
Gyrate atrophy of the choroid and retina
Adrenoleukodystrophy
Miscellaneous mitochondrial disorders and mitochondrial electron transport defects

* List is not intended to be all inclusive.
CoA indicates coenzyme A.

Metabolic diseases include inborn errors of amino acid metabolism, such as phenylketonuria, maternal phenylketonuria, maple syrup urine disease, homocystinuria, methylmalonicacidemia, propionicacidemia, isovalericacidemia, and other disorders of leucine metabolism; glutaricaciduria type I and tyrosinemia types I and II; and urea cycle disorders. These are all disorders treatable by dietary modifications, which can prevent complications like severe mental retardation and death.[6] Manipulations of precursors and limitation of substrates in the diet form a major portion of available therapies. In the case of phenylketonuria, a special National Institutes of Health consensus panel recently recommended uniform policies to remove individual and family financial barriers to acquiring modified low-protein foods and outlined support services required to maintain appropriate phenylalanine concentrations.[7] Children with other metabolic disorders, including those of carbohydrate metabolism, lipid metabolism, vitamin or cofactor metabolism, or mineral metabolism, may also benefit from dietary interventions.

DEFINITION OF REIMBURSABLE EXPENSES

Any health insurance policy that is delivered, issued for delivery, renewed, extended, or modified in a particular state by any health care insurer and that provides coverage for a child should optimally provide coverage of foods for special dietary use of accepted medical benefit. This is meant to cover nutritional support costs over and above usual foods. In addition to the cost of the foods, all medical equipment and medical supplies necessary for the delivery of foods for special dietary use should be covered.

This includes but is not limited to administration tubing, bags, and pumps. Costs of management by health care professionals as necessary to administer or monitor the safe administration of foods for special dietary use should also be covered.

RECOMMENDATIONS

1. All foods for special dietary use with accepted benefit for treatment of a medical condition should be reimbursed as a medical expense, provided the costs are over and above usual foods. Individual and family financial barriers to obtaining these foods should be removed.
2. All states should enact legislation that would require health insurance policy providers to reimburse all foods for special dietary use with accepted medical benefit recommended by a physician to prevent death and serious disability or to foster normal growth and development.
3. All expenses for medical equipment and medical supplies necessary for the delivery of foods for special dietary use should be reimbursed.
4. Reimbursement for foods for special dietary use should be mandatory for the following:
   a. Any medical condition for which specific dietary components or the restriction of specific dietary components is necessary to treat a physical, physiologic, or pathologic condition resulting in inadequate nutrition.
   b. An inherited metabolic disorder, including but not limited to disorders of carbohydrate metabolism, lipid metabolism, vitamin metabolism, mineral metabolism, or amino acid and nitrogen metabolism.
   c. A condition resulting in impairment of oral intake that affects normal development and growth.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Bioethics

Religious Objections to Medical Care

ABSTRACT. Parents sometimes deny their children the benefits of medical care because of religious beliefs. In some jurisdictions, exemptions to child abuse and neglect laws restrict government action to protect children or seek legal redress when the alleged abuse or neglect has occurred in the name of religion. The American Academy of Pediatrics (AAP) believes that all children deserve effective medical treatment that is likely to prevent substantial harm or suffering or death. In addition, the AAP advocates that all legal interventions apply equally whenever children are endangered or harmed, without exemptions based on parental religious beliefs. To these ends, the AAP calls for the repeal of religious exemption laws and supports additional efforts to educate the public about the medical needs of children.

ABBREVIATION. AAP, American Academy of Pediatrics.

THE PROBLEM

The American Academy of Pediatrics (AAP) recognizes that religion plays a major role in the lives of many children and adults in the United States and is aware that some in the United States believe prayer and other spiritual practices can substitute for medical treatment of ill or injured children. Through legislative activity at the federal and state levels, some religious groups have sought, and in many cases attained, government recognition in the form of approved payment for this "nonmedical therapy" and exemption from child abuse and neglect laws when children do not receive needed medical care. The AAP opposes such payments and exemptions as harmful to children and advocates that children, regardless of parental religious beliefs, deserve effective medical treatment when such treatment is likely to prevent substantial harm or suffering or death.

The US Constitution requires that government not interfere with religious practices or endorse particular religions. However, these constitutional principles do not stand alone and may, at times, conflict with the independent government interest in protecting children.[1] Government obligation arises from that interest when parental religious practices subject minor children to possible loss of life or to substantial risk of harm.[2,3] Constitutional guarantees of freedom of religion do not permit children to be harmed through religious practices, nor do they allow religion to be a valid legal defense when an individual harms or neglects a child.[4]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Acute Illness or Injury

The AAP asserts that every child should have the opportunity to grow and develop free from preventable illness or injury.[5] Children also have the right to appropriate medical evaluation when it is likely that a serious illness, injury, or other medical condition endangers their lives or threatens substantial harm or suffering. Under such circumstances, parents and other guardians have a responsibility to seek medical treatment, regardless of their religious beliefs and preferences. Unfortunately, certain groups have obtained exemptions from legal sanctions and state child abuse and neglect reporting laws based on the child's "treatment" by spiritual means, such as prayer.[6] The overall effect has been to limit the government's ability to protect children from abuse or neglect.

The AAP is concerned about religious doctrines that urge parents to avoid seeking medical help when their children are seriously ill. Each year, some parents' religious views lead them to eschew appropriate medical care for their children, resulting in substantial harm or suffering or death due to treatable conditions such as meningitis, bowel obstruction, diabetes mellitus, or pneumonia (*Boston Globe.* August 12, 1993:1; *Pittsburgh Post-Gazette.* March 16, 1991:B1).[4,7] The AAP considers failure to seek medical care in such cases to be child neglect, regardless of the motivation. The basic moral principle of justice requires that children be protected uniformly by laws and regulations at the local, state, and federal levels. Parents and others who deny a child necessary medical care on religious grounds should not be exempt from civil or criminal action that otherwise would be appropriate. State legislatures and regulatory agencies should remove religious exemption clauses from statutes and regulations to ensure that all parents understand that they should seek appropriate medical care for their children.

Preventive Care

Some religious tenets hold that members should not seek or receive medical care for any condition, including pregnancy. These beliefs can result in increased perinatal and maternal mortality.[8] Some religious groups deny children the benefits of routine preventive care. For example, some parents, acting in accord with state laws, refuse to have their children immunized because of religious beliefs. The AAP does not support the stringent application of medical neglect laws when children do not receive recommended immunizations. Although the risk to unimmunized individuals is relatively low, serious ad-

verse reactions to vaccination are rare and the AAP strongly endorses universal immunization. Recent outbreaks of vaccine-preventable infectious diseases, with consequent serious complications and deaths, have been linked to groups that refused immunization for religious reasons.[9–12]

The AAP therefore supports the use of appropriate public health measures, such as mandatory mass vaccinations in epidemic situations, when necessary to protect communities and their unimmunized members. In addition, the AAP is concerned that children unimmunized for any reason may expose young children, not yet old enough to be protected, to infections such as pertussis or invasive *Haemophilus influenzae* disease. The risk is especially high in child care facilities. In such situations, all parents of children in the facility should be informed of the hazards.

Mature Minors

The weight given to parental religious beliefs in decisions affecting their children's well-being declines with the child's increasing age and development. That is, as minors mature, their interest in and capacity for participating in health care decisions affecting themselves increases, as does their ability to make decisions regarding their parents' religious views. The law and AAP policy recognize the doctrine of the "mature minor."[13] This concept acknowledges that many children, usually beginning in adolescence, can contribute to or make medical decisions, including those about life-sustaining treatment. Thus, in selected cases, disputes may be avoided when a minor has the capacity to make an independent decision in light of religious values and recommended medical therapy.

Need for Care and Respect

The AAP wishes to underscore its recognition of the important role of religion in the personal, spiritual, and social lives of many individuals and cautions physicians and other health care professionals to avoid unnecessary polarization when conflict over religious practices arises. Pediatricians should seek to make collaborative decisions with families whenever possible and should take great care when considering seeking authority to override parental preferences. Nevertheless, physicians who believe that parental religious convictions interfere with appropriate medical care that is likely to prevent substantial harm or suffering or death should request court authorization to override parental authority or, under circumstances involving an imminent threat to a child's life, intervene over parental objections. When caring for children whose prognoses are grave even with treatment, physicians should use restraint in pursuing a court order to initiate or continue treatment when parents object to it. In such situations, physicians should work with the parents and children to ensure provision of appropriate palliative care. Threatening or seeking state intervention should be the last resort, undertaken only when treatment is likely to prevent substantial harm or suffering or death. Even under these circumstances, physicians should respect parental religious beliefs and the role of parents in rearing their children. Of course, a physician may withdraw from these cases, after securing acceptable alternative medical care, when continuing in the doctor-patient-family relationship would violate the physician's own moral precepts.

The AAP emphasizes that all children who need medical care that is likely to prevent substantial harm or suffering or death should receive that treatment. The AAP opposes religious doctrines that advocate opposition to medical attention for sick children. Adherence to such views precludes appropriate assessment and intervention to protect the children. The AAP believes that laws should not encourage or tolerate parental action that prevents implementing appropriate medical treatment, nor should laws exempt parents from criminal or civil liability in the name of religion.

RECOMMENDATIONS

The AAP calls for all those entrusted with the care of children to:

1. show sensitivity to and flexibility toward the religious beliefs and practices of families;
2. support legislation that ensures that all parents who deny their children medical care likely to prevent death or substantial harm or suffering are held legally accountable;
3. support the repeal of religious exemption laws; and
4. work with other child advocacy organizations and agencies and religious institutions to develop coordinated and concerted public and professional action to educate state officials, health care professionals, and the public about parents' legal obligations to obtain necessary medical care for their children.

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The American Urological Association
Pediatric Vesicoureteral Reflux
Clinical Guidelines Panel

Report on

The Management of Primary Vesicoureteral Reflux in Children

Clinical Practice Guidelines

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The Pediatric Vesicoureteral Reflux Clinical Guidelines Panel consists of board-certified urologists and nephrologists who are experts in vesicoureteral reflux in children. This *Report on the Management of Primary Vesicoureteral Reflux in Children* was extensively reviewed by over 50 urologists throughout the country in the summer of 1996. The Panel finalized its recommendations for the American Urological Association (AUA) Practice Parameters, Guidelines and Standards Committee, chaired by Joseph W. Segura, MD, in November 1996. The AUA Board of Directors approved these practice guidelines in November 1996.

The Summary Report also underwent independent scrutiny by the Editorial Board of the *Journal of Urology*, was accepted for publication in November 1996, and appeared in its May 1997 issue. *A Guide for Parents* and *Evidence Working Papers* have also been developed; both are available from the AUA.

The AUA expresses its gratitude for the dedication and leadership demonstrated by the members of the Pediatric Vesicoureteral Reflux Clinical Guidelines Panel and by the consultants affiliated with Technical Resources International, Inc., in producing this guideline.

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Introduction

Vesicoureteral reflux refers to the retrograde flow of urine from the bladder into the ureter and, usually, into the collecting system of the kidney. In most individuals, reflux results from a congenital anomaly of the ureterovesical junction, whereas in others it results from high-pressure voiding secondary to posterior urethral valves, neuropathic bladder or voiding dysfunction. Between 3–5 percent of girls and 1–2 percent of boys experience a urinary tract infection before puberty (Jodal and Winberg, 1987). Approximately 40 percent of children with a urinary tract infection have reflux (Bourchier, Abbott and Maling, 1984; Drachman, Valevici and Vardy, 1984). Urinary tract infection is the most common bacterial disease during the first 3 months of life (Krober, Bass, Powell, et al., 1985) and accounts for approximately 6 percent of febrile illnesses in infants (Hoberman, Chao, Keller, et al., 1993). Reflux is a predisposing factor for pyelonephritis, which can result in renal injury or scarring, also termed reflux nephropathy. The most serious late consequence of reflux nephropathy is renal insufficiency or end-stage renal disease. Between 3.1–25 percent of children and 10–15 percent of adults with end-stage renal disease have reflux nephropathy (Arant, 1991; Avner, Chavers, Sullivan, et al., 1995; Bailey, Maling and Swainson, 1993). In addition, reflux nephropathy may result in renin-mediated hypertension and cause morbidity in pregnancy (Martinell, Jodal and Lidin-Jason, 1990).

The primary goals in the management of vesicoureteral reflux in children are to prevent pyelonephritis, renal injury and other complications of reflux. Children with reflux may be managed either medically or surgically. The rationale for medical management is prevention of urinary tract infection with daily antimicrobial prophylaxis, regular timed voiding and, in some cases, anticholinergic medication. These children also undergo periodic screening of the urine for infection and radiologic reassessment of the urinary tract for reflux and renal injury. Many children show spontaneous reflux resolution while receiving medical management. Surgical management of reflux consists of repair of the ureterovesical junction abnormality.

Although vesicoureteral reflux is common, there is disagreement regarding the optimal management, even among specialists caring for these children (Elder, Snyder, Peters, et al., 1992; International Reflux Study Committee, 1981). Because of the lack of consensus regarding management of this common condition, the American Urological Association (AUA) convened a panel of experts to develop treatment guidelines for children with vesicoureteral reflux. The panel was charged with the task of producing practice recommendations based primarily on outcomes evidence from the scientific literature. This *Report on the Management of Primary Vesicoureteral Reflux in Children* is the result of the panel's efforts. The panel members represent various geographic areas, ages, professional activities (academic medical centers, private practice, health maintenance organizations) and expertise (pediatric urology, pediatric nephrology), allowing a broad perspective on the management of reflux.

The recommendations in this report are to assist physicians specifically in the treatment of vesicoureteral reflux in children diagnosed following a urinary tract infection. The recommendations apply to children aged 10 years and younger with unilateral or bilateral reflux with or without scarring. The report therefore deals only peripherally with the diagnostic methods of identifying vesicoureteral reflux, renal scarring and management of children with reflux identified incidentally or by screening of asymptomatic siblings. In addition, the report does not pertain to reflux associated with neuropathic bladder, posterior urethral valves, bladder exstrophy or fixed anatomic abnormalities, such as ectopic ureterocele and ectopic ureter.

Because treatment recommendations are made jointly with the parents of the child, *A Guide for Parents,* based on this report, is available to assist the physician in discussing treatment options with the parents. A summary of this report has been published in the *Journal of Urology*, May 1997.

Table of Contents

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Executive Summary:

Management of primary vesicoureteral reflux in children

Methodology

In developing recommendations for the management of primary vesicoureteral reflux in children, the AUA Pediatric Vesicoureteral Reflux Guidelines Panel extensively reviewed the available literature on the treatment of pediatric reflux from January 1965 through December 1994 and extracted all relevant data to estimate as accurately as possible desirable and undesirable outcomes of the alternative treatment modalities. The panel followed an explicit approach to the development of practice policies, supplemented by expert opinion. The panel synthesized the evidence using techniques described by Eddy, Hasselblad and Schachter (1992) and Cooper and Hedges (1994). The methodology for these analyses was described by Hasselblad (in press). For a full description of the methodology, see Chapter 2.

Background

Vesicoureteral reflux refers to the retrograde flow of urine from the bladder into the upper urinary tract. Reflux is a birth defect but also may be acquired. Vesicoureteral reflux predisposes an individual to renal infection (pyelonephritis) by facilitating the transport of bacteria from the bladder to the upper urinary tract. The immunologic and inflammatory reaction caused by a pyelonephritic infection may result in renal injury or scarring. Extensive renal scarring causes reduced renal function and may result in renal insufficiency, end-stage renal disease, renin-mediated hypertension, reduced somatic growth and morbidity during pregnancy.

The primary goals of treatment in children with reflux are to prevent renal injury and symptomatic pyelonephritis. Medical therapy is based on the principle that reflux often resolves with time. The basis for surgical therapy is that, in select situations, ongoing vesicoureteral reflux has caused or has a significant potential for causing renal injury or other reflux-related complications and that elimination of the reflux condition will minimize their likelihood. Chapter 1 documents the various methods of diagnosis, treatment and surveillance and follow-up for children with primary vesicoureteral reflux.

Grading of reflux severity is important because more severe reflux is associated with higher rates of renal injury, and treatment success varies with reflux grade. The International Study Classification is the most common and is the grading system used in this report (International Reflux Study Committee, 1981).

Treatment alternatives and outcomes analysis

The panel considered 7 modalities as treatment alternatives, including:

- No treatment (intermittent antibiotic therapy for UTI);
- Bladder training (including timed voiding and other behavioral techniques);
- Antibiotic prophylaxis (continuous);
- Antibiotic prophylaxis and bladder training;
- Antibiotic prophylaxis, anticholinergics (for bladder instability), and bladder training;
- Open surgical repair; and
- Endoscopic repair.

Outcomes were identified as criteria by which effectiveness of treatment would be analyzed (see evidence matrix on page 21, Chapter 3), and the review of evidence was organized around this framework. The outcomes included intermediate outcomes (those not directly perceived by the patient or family but that are associated with or precede health outcomes), health outcomes (effects directly perceived in some way by patient or family), and harms of various forms of management. The following represents a brief summary of

the statistical analysis that was conducted and that formed the basis of the treatment recommendations.

Intermediate outcomes

Reflux resolution—medical therapy (continuous antibiotic prophylaxis)

The database included 26 reports with data pertaining to reflux resolution after medical therapy, comprising 1,987 patients (1,410 girls and 304 boys273 were not identified) and 2,902 ureters. The individual databases of Skoog, Belman and Majd (1987) and Arant (1992) and the data reported from the International Reflux Study, European Branch (Tamminen-Mobius, Brunier, Ebel, et al., 1992) were used to estimate the probability of reflux resolution with continuous antibiotic prophylaxis (see Figure 3 on page 24, Chapter 3). In general, a lower reflux grade correlated with a better chance of spontaneous resolution. Data for Grades I and II reflux showed no differences in regard to age at presentation or laterality (unilateral vs. bilateral). For Grade III, age and laterality were important prognostic factors, with increasing age at presentation and bilateral reflux decreasing the probability of resolution. Bilateral Grade IV reflux had a particularly low chance of spontaneous resolution. All of these estimates are subject to 2 restrictions: (1) estimates are only valid for up to 5 years after diagnosis; and (2) for Grade IV disease, estimates only apply to the time of diagnosis and are not age specific. No data were available for reflux resolution with intermittent antibiotic therapy.

In children with reflux and voiding dysfunction (frequency, urgency, urge incontinence, incomplete bladder emptying), available results from the series with control groups suggested that the reflux resolution rate increased with anticholinergic therapy and bladder training.

Reflux resolution—surgical therapy

In the articles reviewed by the panel, overall surgical success was reported in 959 of 1,008 patients (95.1 percent) and 7,731 of 8,061 ureters (95.9 percent). Surgical success was achieved in 108 of 109 ureters (99 percent) for Grade I, 874 of 882 (99.1 percent) for Grade II, 993 of 1,010 (98.3 percent) for Grade III, 386 of 392 (98.5 percent) for Grade IV and 155 of 192 (80.7 percent) for Grade V reflux.

For endoscopic therapy, most reports in the literature describe results of the use of polytetrafluoroethylene (Teflon™). Overall reflux was corrected in 77.1 percent of ureters after a single injection. Reflux was resolved after initial treatment in only 6 of 19 ureters (31.6 percent) with Grade V disease. Currently, no injectable substance has been approved for endoscopic antireflux surgery by the U.S. Food and Drug Administration.

Renal scarring

The panel felt that relevant data pertaining to renal scarring should be analyzed primarily from studies with a minimum of 5 years of follow-up. Four prospective trials comparing the outcomes of medical and surgical management included analysis of new renal scarring (Birmingham Reflux Study Group, 1987; Elo et al., 1983; Olbing et al., 1992; Weis et al., 1992). None of these trials showed a statistically significant difference in the rate of new renal scarring. In the European arm of the International Reflux Study, the rate of scarring was similar in patients receiving continuous antibiotic prophylaxis and those treated surgically (Olbing, Claesson, Ebel, et al., 1992). However, 80 percent of the new renal scars in the surgical group appeared by 10 months after randomization, whereas new renal scars appeared throughout the 5 years in the group managed medically (Tamminin-Mobius, Brunier, Ebel, et al., 1992). The Birmingham Reflux Study (1987) identified new scars after 5 years in only 6 percent and 5.2 percent of those treated medically and surgically, respectively, with no additional scars detected after 2 years of follow-up. In the prospective study by the Southwest Pediatric Nephrology Study Group of children younger than 5 years of age with Grades I, II or III reflux, normal kidneys at entry and with continuous antibiotic prophylaxis, 16 percent developed new scars (Arant, 1992). On the other hand, the International Reflux Study found new scars in 15.7 percent (medical) and 17.2 percent (surgical) of refluxing children in Europe and 21.5 percent (medical) and 31.4 percent (surgical) in North America (Olbing, Claesson, Ebel, et al., 1992; Weiss, Duckett and Spitzer, 1992). Few data were available to analyze the relationship between bacteriuria and new renal scarring in children with reflux.

Renal growth and function

On the basis of studies available to date, there is no evidence that renal growth is impaired in unscarred kidneys exposed to sterile reflux of any grade or that surgical correction of reflux facilitates growth of the kidney postoperatively. Surgical

correction of reflux stabilizes the glomerular filtration rate but has not been shown to lead to long-term improvement.

Health outcomes

Urinary tract infection

The panel reviewed 41 articles that described the incidence of urinary tract infection in children with vesicoureteral reflux treated with antibiotic prophylaxis or reimplantation surgery. In children with Grades III to IV reflux, the incidence of pyelonephritis was approximately 2.5 times higher in patients treated with antibiotic prophylaxis than in those treated surgically. The incidence of cystitis in patients with vesicoureteral reflux was not significantly different in patients treated medically or surgically. In children treated medically, recurrent symptomatic urinary tract infections were more common in children with voiding dysfunction than in those with normal bladder function.

Hypertension

In the reports reviewed by the panel, no statistically significant difference was found in the risk of hypertension related to treatment modality. However, these studies indicated that renal scarring increases the relative risk of hypertension to 2.92 (95 percent confidence interval 1.2–7.1), compared to the risk without renal scarring.

Uremia

It was not possible to demonstrate that even optimal treatment of reflux and urinary tract infection can prevent progressive renal failure and ultimately uremia after severe bilateral reflux nephropathy has been diagnosed.

Somatic growth

No evidence substantiated an effect of reflux treatment on somatic growth.

Morbidity during pregnancy

The panel performed a limited search of pertinent literature pertaining to reflux, renal insufficiency and adverse outcomes of pregnancy. Although the available data suggest a greater risk of morbidity from pyelonephritis in women who have persistent reflux during pregnancy, the sample size is small and only limited conclusions can be based on this evidence. The panel reviewed 5 studies that demonstrated that women with renal insufficiency exhibit an increased incidence of toxemia, preterm delivery, fetal growth retardation, fetal loss and deteriorating renal function.

Harms of medical treatment

Adverse drug reactions

Potential adverse reactions to antimicrobial prophylaxis include minor effects, such as skin rash, nausea, vomiting, abdominal pain, a bad taste in the mouth, marrow suppression as well as more serious side effects. Few studies dealing with the medical management of reflux included information on any drug reaction.

Harms of surgery

Obstruction

A total of 33 studies provided rates of obstruction after ureteral reimplantation for reflux. The likelihood of obstruction in the 33 series ranged from 0 to 9.1 percent with a combined rate of 2 percent in studies published after 1986. The reoperation rate ranged from 0.3 to 9.1 percent with an overall prevalence of 2 percent. There was no difference among various surgical techniques.

A total of 15 series provided detailed information about postoperative ureteral obstruction following endoscopic treatment of reflux. The 15 series included refluxing ureters treated using polytetrafluoroethylene or collagen as the injected substance. Seven (0.40 percent) persistent obstructions were reported.

Contralateral reflux

The development of contralateral reflux after unilateral ureteral surgery has been reported in numerous series. Of 1,566 ureters considered at risk there was an overall incidence of 142 reported new cases (9.1 percent) of contralateral reflux. The surgical method of reimplantation did not influence the likelihood of new contralateral reflux. Contralateral reflux generally resolves with time and surgical intervention is not usually recommended for at least 1 year.

Recommendations

The panel generated its practice policy recommendations on the basis of evidence-based outcomes and panel opinion, reflecting its clinical

experience in pediatric urology and pediatric nephrology. In this report, statements based on opinion are explicitly identified, and evidence-based recommendations are accompanied by appropriate references. Only a few recommendations could be derived purely from scientific evidence of a beneficial effect on health outcomes.

As a result, the recommendations were derived from a panel survey of preferred treatment options for 36 clinical categories of children with reflux. The treatment recommendations were classified as guidelines, preferred options and reasonable alternatives. Treatment options selected by 8 or 9 of the 9 panel members are classified as guidelines. Treatment options that received 5 to 7 votes are designated as preferred options, and treatment options that received 3 to 4 votes are designated as reasonable alternatives. Treatments that received no more than 2 votes are designated as having no support.

Assumptions

The recommendations listed on pages 5–7 are intended to assist physicians specifically in the treatment of vesicoureteral reflux in children diagnosed following a urinary tract infection. They apply only to children 10 years and younger with unilateral or bilateral reflux and with or without scarring. The recommendations assume that the patient has uncomplicated reflux (e.g., no voiding dysfunction, neuropathic bladder, posterior urethral valves, bladder exstrophy or fixed anatomical abnormalities).

Rationale for recommendations

Specific treatment recommendations for children with reflux with or without scarring are provided on pages 5–6. The panel's overall recommendations for all children follow. The panel's recommendations to offer continuous antibiotic prophylaxis as initial therapy are based on limited scientific evidence. Controlled studies comparing the efficacy of continuous antibiotic prophylaxis and intermittent therapy on health outcomes in children with reflux have not been performed. However, the opinion of the panel is that maintaining continuous urine sterility is beneficial in reducing the risk of renal scarring and this benefit outweighs the potential adverse effects of antibiotics.

Recommendations to proceed to surgery in children with reflux that has not resolved spontaneously are supported by limited scientific evidence: open antireflux surgery is 95–98 percent effective in correcting reflux, and in children with Grades III–IV reflux the risk of clinical pyelonephritis is 2–2.5 times higher in children treated with continuous prophylaxis than in those treated surgically. Nevertheless, randomized controlled trials of such children have shown that most children treated medically do not develop a urinary tract infection while receiving prophylaxis.

Recommendations for more aggressive treatment of girls than boys (e.g., for persistent Grades III–IV reflux in school-aged children) are based on epidemiological evidence that girls have a higher risk of urinary tract infection than boys. Recommendations for more aggressive treatment of Grade V reflux (e.g., surgical repair as initial therapy) are based on panel opinion that such cases are unlikely to resolve spontaneously over time, surgery is effective in resolving severe reflux and these benefits outweigh the potential harms of surgery. More aggressive recommendations for children who have renal scarring at diagnosis are based on panel opinion that such patients have a higher risk of progressive scarring and decreased renal-functional reserve.

An important variable in the scope of treatment is the presence of voiding dysfunction, a common occurrence among children with reflux. Such children may require more aggressive treatment with anticholinergics and bladder training in addition to antibiotic prophylaxis. Surgical repair of reflux is slightly less successful in children with voiding dysfunction and, thus, a higher threshold is necessary before surgery is recommended in such patients. Consequently, children with reflux should be assessed for voiding dysfunction as part of the initial evaluation.

Literature limitations and research priorities

Limitations of the literature

The panel attempted to rely on published evidence whenever possible. Many studies that addressed a particular issue could not be used quantitatively in the various syntheses because of inconsistent reporting of data, limited follow-up, incomplete description of treatments or poorly defined patient populations. Analyses were also complicated by the existence of at least 5 methods

(continued on page 8)

Treatment recommendations for children without scarring at diagnosis

Age at diagnosis: Infants (<1 year)

Initial treatment. Infants with Grades I–IV reflux should be treated initially with continuous antibiotic prophylaxis. In infants with Grade V reflux, continuous antibiotic prophylaxis is the preferred option for initial treatment.

Follow-up treatment. In infants who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued. For patients with persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic therapy, periodic cystography or surgery. Surgical repair is the preferred option, however, for patients with persistent unilateral Grades III–IV reflux. Patients with persistent bilateral Grades III–IV reflux or Grade V reflux should undergo surgical repair.

Age at diagnosis: Preschool children (ages 1–5 years)

Initial treatment. Preschool children with Grades I–II reflux or unilateral Grades III–IV reflux should be treated initially with continuous antibiotic prophylaxis. Continuous antibiotic prophylaxis is the preferred option in preschool children with bilateral Grades III–IV reflux. In patients with unilateral Grade V reflux, continuous antibiotic prophylaxis is the preferred option for initial treatment, although surgical repair is a reasonable alternative. In patients with bilateral Grade V reflux, surgical repair is the preferred option and continuous antibiotic prophylaxis is a reasonable alternative.

Follow-up treatment. In children who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued. In children with persistent Grades I–II reflux, there is no consensus regarding the role of continued antibiotic therapy, periodic cystography or surgery. Surgery is the preferred option for children with persistent Grades III–IV reflux. Patients with persistent Grade V reflux should undergo surgical repair.

Age at diagnosis: School children (ages 6–10 years)

Initial treatment. School children with Grades I–II reflux should be treated initially with continuous antibiotic prophylaxis. Continuous antibiotic prophylaxis is the preferred option for initial treatment of patients with unilateral Grades III–IV reflux. In patients with bilateral Grades III–IV reflux, surgical repair is the preferred option, although continuous antibiotic prophylaxis is a reasonable alternative. Patients with Grade V reflux should undergo surgical repair.

Follow-up treatment. In children who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued. In patients with persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic prophylaxis, periodic cystography or surgery. Surgery is the preferred option for persistent reflux in children with Grades III–IV reflux.

(continued on page 6)

Treatment recommendations for children with scarring at diagnosis

Age at diagnosis: Infants (<1 year)

Initial treatment. Infants with scarring at diagnosis and Grades I–IV reflux should be treated initially with continuous antibiotic prophylaxis. In infants with Grade V reflux and scarring, continuous antibiotic prophylaxis is the preferred option for initial treatment, and surgical repair is a reasonable alternative.

Follow-up treatment. In infants who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued. In patients with persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic prophylaxis, periodic cystography or surgery. In boys with persistent unilateral Grades III–IV reflux, surgical repair is the preferred option. Boys with persistent bilateral Grades III–IV reflux, girls with persistent Grades III–IV reflux, and boys and girls with persistent Grade V reflux should undergo surgical repair.

Age at diagnosis: Preschool children (ages 1–5 years)

Initial treatment. Preschool children with scarring at diagnosis and either Grades I–II reflux or unilateral Grades III–IV reflux should be treated initially with continuous antibiotic prophylaxis. Antibiotic therapy is the preferred option in children with bilateral Grades III–IV reflux and scarring, and surgical repair is a reasonable alternative. Surgery is the preferred option for patients with unilateral Grade V reflux. Patients with bilateral Grade V disease and scarring should undergo surgical repair as initial treatment.

Follow-up treatment. In children who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued. In patients with persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic prophylaxis, periodic cystography or surgery. Girls with persistent Grades III–IV reflux and boys with persistent bilateral Grades III–IV reflux should undergo surgical repair. Surgery is the preferred option for boys with persistent unilateral Grades III–IV reflux. For patients with persistent Grade V reflux who have not undergone surgery as initial treatment, surgical repair is the preferred option.

Age at diagnosis: School children (ages 6–10 years)

Initial treatment. School children with scarring at diagnosis and Grades I–II reflux should be treated initially with continuous antibiotic prophylaxis. In children with unilateral Grades III–IV reflux and scarring, antibiotic therapy is the preferred option. Patients with bilateral Grades III–IV reflux or Grade V reflux should undergo surgical repair as initial treatment.

Follow-up treatment. In children who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued. In patients who have persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic prophylaxis, periodic cystography or surgery. Patients with persistent unilateral Grades III–IV reflux who have not undergone surgery as initial treatment should undergo surgical repair.

(continued on page 7)

Other recommendations for children with reflux

In children with vesicoureteral reflux, urethral dilation and internal urethrotomy are not beneficial. In addition, cystoscopic examination of the ureteral orifices does not appear to aid in predicting whether reflux will resolve. In children with symptoms of voiding dysfunction, urodynamic evaluation may be helpful, but evocative cystometry is unnecessary in children with reflux and a normal voiding pattern.

In children with reflux who are toilet trained, regular, volitional low-pressure voiding with complete bladder emptying should be encouraged. If it is suspected that the child is experiencing uninhibited bladder contractions, anticholinergic therapy may be beneficial.

The clinician should provide parents with information about the known benefits and harms of available options, including continuous antibiotic prophylaxis, surgery and intermittent antibiotic therapy. The clinician should indicate to what extent the estimates of benefits and harms are based on scientific evidence or on opinion and clinical experience. Given the general lack of direct evidence that any one treatment option is superior to another (especially when total benefits, harms, costs and inconvenience are considered), parent and patient preferences regarding treatment options should generally be honored.

In children for whom antireflux surgery is chosen, the panel does not recommend the endoscopic form of therapy because of the lack of proven long-term safety and efficacy of the materials used for injection and the lack of approval of such materials by the U.S. Food and Drug Administration.

Follow-up evaluation should be performed at least annually, at which time the patient's height and weight should be recorded and a urinalysis should be performed. If the child has renal scarring, the blood pressure should be measured. In deciding how often to obtain follow-up cystography in children managed medically, the clinician should take into consideration the likelihood of spontaneous resolution (see Figure 3 on page 24, Chapter 3), the risk of continued antibiotic prophylaxis and the risks of radiologic study. In general, cystography does not need to be performed more than once per year.

used for grading reflux, nonuniformity in characterizing reflux grade and patient population, and lack of a standard method for reporting outcomes. Only 3 prospective randomized controlled trials compared medical to surgical therapy—the Birmingham Reflux Study (1987), the International Reflux Study in Children (Olbing, Claesson, Ebel, et al., 1992; Weiss, Duckett and Spitzer, 1992), and a study from Erasmus University, Rotterdam, The Netherlands (Scholtmeijer, 1991). The literature on certain issues, such as complication rates of surgery and adverse drug reactions, was limited and in some cases so sparse that judgments were made on the basis of expert opinion.

Research priorities

The panel identified many research areas as needing further investigation. Presently, there is little information regarding health outcomes pertaining to reflux, and a significant priority should be to continue to acquire this information.

Basic research into the pathogenesis as well as the genetics of vesicoureteral reflux is needed. Further randomized controlled trials studying the role of medical and surgical therapy using dimercaptosuccinic acid scan for evaluation of renal scarring are indicated. Future studies should stratify results by patient gender, age and reflux grade, reporting reflux resolution both by rate of ureteral and patient resolution. Also worthwhile would be studies to confirm the panel's finding that resolution of Grade III reflux depends on patient age or laterality (unilateral vs. bilateral) and the finding that resolution of Grades I and II reflux does not depend on age or laterality.

The extent to which reflux increases the risk of renal scarring associated with urinary tract infection and the mechanism of this effect deserves investigation. Comparison of the efficacy of intermittent and continuous antibiotic therapy would be beneficial. The role of voiding dysfunction in the pathogenesis of reflux and its risk on reflux complications, such as renal scarring and the complications of surgery, also deserve further investigation. Matched controlled studies of anticholinergic therapy and bladder training on reflux-related outcomes in children with voiding dysfunction are necessary.

Less traumatic methods of determining whether reflux is present should be developed as well as techniques of voiding cystourethrography that result in less radiation exposure. Analysis of the costs of reflux treatment and surveillance is important, particularly comparing those associated with medical and surgical therapy. The impact of screening at-risk populations and early medical or surgical intervention on reflux-related outcomes in such patients should be analyzed.

Development of minimally invasive techniques of antireflux surgery is indicated. Newer materials that can be used for endoscopic subureteral injection and that are safe in children should be studied.

The natural history of vesicoureteral reflux in adult women with persistent reflux deserves investigation, including an analysis of the morbidity of persistent reflux, and need for and efficacy of prophylaxis in pregnant and nonpregnant women.

Chapter 1:
Pediatric vesicoureteral reflux and its management

Background

Vesicoureteral reflux (VUR or "reflux") refers to the retrograde flow of urine from the bladder into the upper urinary tract. Normally, the ureter is attached to the bladder in an oblique direction, perforating the bladder muscle (detrusor) laterally and proceeding between the bladder mucosa and detrusor muscle (the "intramural" or submucosal tunnel) before entering the bladder lumen. As the bladder fills, the ureteral lumen is flattened between the bladder mucosa and detrusor muscle, creating a flap-valve mechanism that prevents VUR. Reflux occurs when the submucosal tunnel between the mucosa and detrusor muscle is short or absent and/or there is weak detrusor backing (Figure 1, page 10). In general, the severity of reflux correlates with the degree of deformity of the ureterovesical junction. Reflux is usually a birth defect. In some cases, reflux will disappear as the child grows. Reflux was described in the writings of Galen (Polk, 1965) and da Vinci (Lines, 1982). It was not until the observations of Hutch in 1952, however, that the relationship between reflux and acute pyelonephritis was appreciated (Hutch, 1952).

VUR predisposes an individual to renal infection (pyelonephritis) by facilitating the transport of bacteria from the bladder to the upper urinary tract. The inflammatory reaction caused by a pyelonephritic infection may result in renal injury or scarring. Extensive renal scarring impairs renal function and may result in renin-mediated hypertension, renal insufficiency, end-stage renal disease (ESRD), reduced somatic growth, and morbidity during pregnancy.

VUR may be primary or secondary. Primary VUR refers to reflux resulting from an anatomic deformity of the ureterovesical junction without a causative urinary tract abnormality that may cause reflux. Secondary VUR can result from increased bladder pressure (e.g., detrusor-sphincter discoordination, neuropathic bladder, posterior urethral valves), which destabilizes the ureterovesical junction; abnormal attachment of the ureter (ectopic ureter); or associated lower urinary tract abnormalities (e.g., ectopic ureterocele, prune belly syndrome, bladder exstrophy) that affect ureteral insertion.

The prevalence of reflux in healthy children is unknown but is estimated to be 1 percent (Arant, 1991). In 1993, in the United States approximately 15,000 individuals under 15 years of age were admitted to the hospital for a total of 62,000 days for treatment of pyelonephritis, and reflux was present in approximately 40–50 percent of these patients (U.S. Department of Health and Human Services, 1993).

Approximately 44,000 children are treated (inpatient and outpatient) for urinary tract infection (UTI) associated with VUR each year in the United States (Woodwell, 1993). Woodwell (1993) observed that of the 9.8 million outpatient visits made to urologists annually, 492,000 (5 percent of urologic practice) involve the health of children under age 15. Of these children seen for a variety of urinary complaints, 369,000 were boys and 123,000 were girls under 15 years. Other data (based on the 9.8 million reported visits) suggested that voiding symptoms, urine abnormalities, painful urination, enuresis, bladder symptoms, and UTI (all symptoms not initially related to a diagnosis of VUR) account for 3 million visits to urologists and represented 25.6 percent of symptoms requiring evaluation. Assuming uniform distribution of these complaints within urologic practice, 125,952 visits ($492{,}000 \times 0.256 = 125{,}952$) to urologists caring for children would encompass the symptoms listed above. Data from Lindberg, et al. (1975) estimate that 20 percent of symptomatic individuals will have reflux; therefore, 25,190 visits a year to urologists would include encounters for care and assessment of reflux ($125{,}952 \times 0.2 = 25{,}190$). Health Care Financing Administration data indicate that VUR is diagnosed in 7,000–14,000 hospitalized patients, and that 2 to 3 times as many children are seen as outpatients for evaluation and treatment of reflux.

The typical patient with VUR is a child younger than 10 years old who develops a UTI, either clinical pyelonephritis with fever, abdominal/flank pain, malaise and/or nausea, vomiting, or cystitis

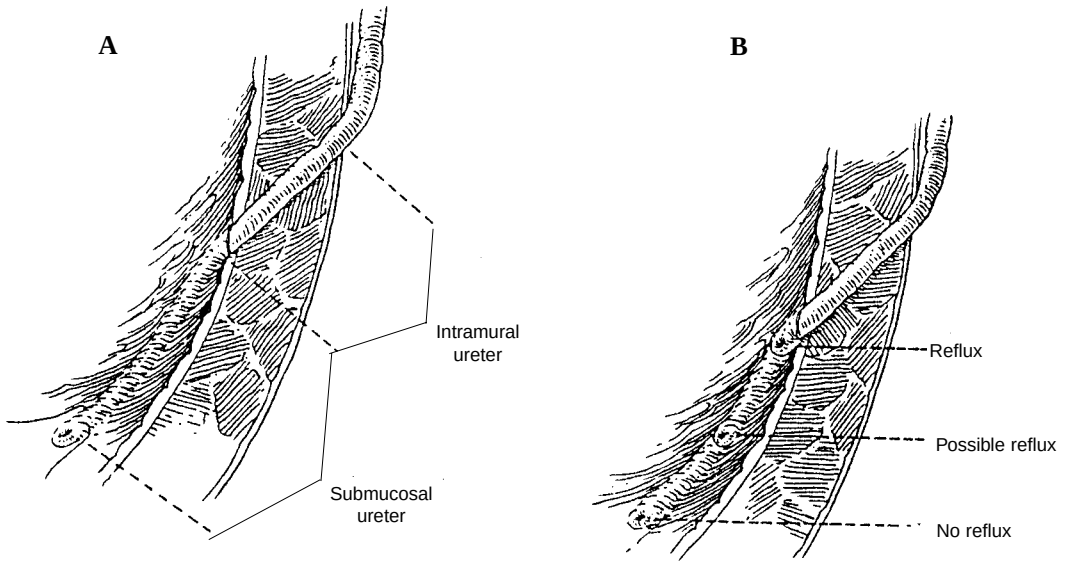

Figure 1. (A) Normal ureterovesical junction. Demonstration of length of intravesical submucosal ureteral segment. (B) Refluxing ureterovesical junction. Same anatomic features as nonrefluxing orifice, except for inadequate length of intravesical submucosal ureter, are shown. Some orifices reflux intermittently with borderline submucosal tunnels (Politano, 1975).

with dysuria, frequency, urgency, and often urge incontinence. Neonates and infants with VUR and pyelonephritis may have nonspecific symptoms.

The average age for diagnosis of reflux in children is 2–3 years. Approximately 75–80 percent of children with primary reflux diagnosed following a UTI are girls, presumably because the incidence of UTI in girls is greater than in boys after 6 months of age. The mean age for the onset of UTI in children is 2–3 years, corresponding to the average age when toilet training occurs. It is thought, by some, that during the process of toilet training, bladder-sphincter dyssynergia occurs, which predisposes to UTI, allowing children who also have VUR to be diagnosed.

A substantial proportion of children with VUR have incomplete maturation of bladder function, with symptoms of bladder instability characterized by urgency, frequency, and diurnal incontinence (van Gool, Hjalmas, Tamminen-Mobius, et al., 1992; Koff, 1992). Because the associated high intravesical pressures can contribute to reflux, assessment of voiding habits is important in evaluating children with VUR.

In recent years, reflux has been discovered prenatally by detection of fetal hydronephrosis, although the diagnosis of VUR is not made until postnatal studies are performed. Approximately 80 percent of these neonates are boys (Elder, 1992), and most have more severe reflux than do females with VUR discovered after UTI. This phenomenon may result from higher voiding pressures in male infants (and presumably fetuses) than in females (Hjalmas, 1976; Sillen, Bachelard, Hermanson, et al., 1996).

Reflux appears to be an inherited trait. For example, in 1 study of 354 siblings of 275 known patients with prior diagnosis of reflux, 34 percent had reflux, and 75 percent of these children were asymptomatic (Noe, 1992). In that study, 13 percent of siblings with reflux already had evidence of renal scarring, and 66 percent of these children had not had a documented UTI. In addition, as many as 67 percent of offspring of women with reflux also have reflux (Noe, Wyatt, Peeden, et al., 1992). Reflux is less common in African-American than in caucasian children (Skoog and Belman, 1991).

Reflux severity can be graded (Figure 2). Reflux grade is important because more severe reflux is associated with higher rates of renal injury, and treatment success varies with reflux grade. In addition, the reflux grade is an indirect indication of the degree of abnormality of the ureterovesical junction. Numerous grading systems have been used.

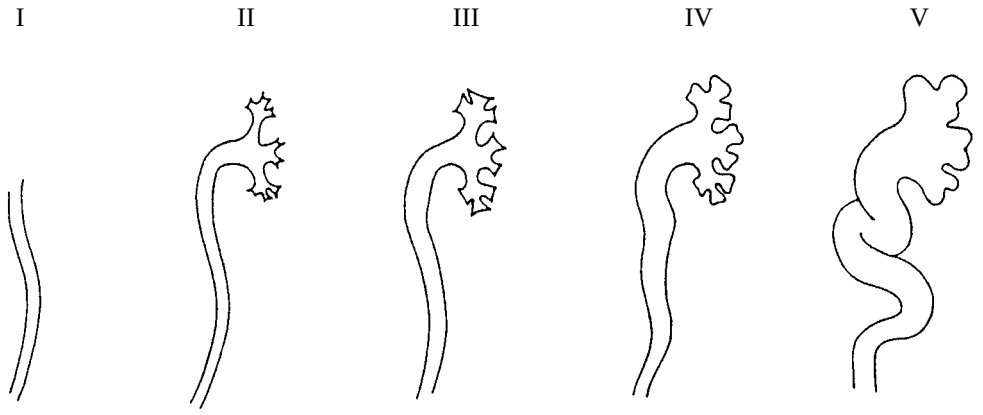

Figure 2. International Study Classification (International Reflux Study Committee, 1981)

The most common classifications are shown in Table 1. These classifications are based on a standard contrast voiding cystourethrogram. The International Study Classification, which was adopted by the International Reflux Study Committee in 1981, is the most common and is the grading system used in this report.

Pathophysiology of renal injury

The likelihood of renal injury after a UTI depends on bacterial virulence factors, the presence or absence of reflux, adherence characteristics of the uroepithelium, anatomic characteristics of the infected kidney, and host inflammatory response. During infection, certain bacteria, particularly those with P-fimbria, may ascend the ureter and enter the renal pelvis and calyces. Bacterial ascent is promoted by the presence of reflux. Intrarenal reflux (reflux from the minor calyx into the collecting duct) of infected urine results in renal parenchymal infection (pyelonephritis). In previously normal kidneys, this initial infection often occurs in the upper or lower poles, because these typically contain compound papillae that favor intrarenal reflux (Ransley and Risdon, 1979). Bacteria often produce an endotoxin, which causes a cellular and humoral immune response as well as an inflammatory response (Roberts, 1992). The sequel of the host reaction is renal parenchymal fibrosis, a renal injury termed reflux nephropathy.

Table 1. Common classifications of vesicoureteral reflux

Description	Grade/classification					
International Study Classification[1]	0	I	II	III	IV	V
Dwoskin-Perlmutter	0	1	2a	2b	3	4
Birmingham	0	1	2	←	3 →	
Australia/NZ		← Mild →		Moderate	← Severe →	
Great Britain		I	II (Voiding)	III (Filling and voiding)		IV (Dilatation)

[1] Classification used in this Report.

Reflux is an important risk factor for developing pyelonephritis. Pyelonephritis occurs in children with and without VUR, as well as in children in whom reflux has resolved spontaneously and in children whose reflux is undetected on a voiding cystourethrogram. In children who develop pyelonephritis, renal scarring results in as many as 40 percent (Rushton and Majd, 1992). Children younger than 5 years old appear to be at greatest risk of renal injury from pyelonephritis, but older children also may develop renal scarring. In 1 report of 34 children older than age 5 who had normal kidneys and who later developed renal scarring, nearly all had both UTI and reflux (Smellie, Ransley, Normand, et al., 1985).

In the neonate with prenatally diagnosed hydronephrosis, medium- or high-grade reflux often is diagnosed. In some of these neonates, typical patterns of renal scarring are found even though no bacteriuria is present. The cause of the renal abnormality is uncertain but may be secondary to abnormal induction of the metanephric blastema by the ureteral bud (Mackie and Stephens, 1975) and/or possibly high voiding pressures during renal development.

Although reflux associated with bacteriuria may cause renal scarring, sterile VUR is not thought to result in renal injury unless abnormally elevated bladder pressures exist (i.e., with posterior urethral valves, neuropathic bladder, bladder outlet obstruction, or detrusor-sphincter dyssynergia) (Ransley and Risdon, 1979).

Diagnosis

In most cases, reflux is diagnosed during evaluation of a UTI. In some cases reflux is diagnosed "incidentally" during screening of patients at risk, for example, those who have a sibling with reflux (Noe, 1992; Wan, Greenfield, Ng, et al., 1996), a mother with reflux (Noe, Wyatt, Peeden, et al., 1992), a multicystic kidney (Selzman and Elder, 1995) or hydronephrosis (Elder, 1992).

The panel did not undertake a formal evaluation of the radiologic literature regarding the accuracy of various methods of diagnosing reflux or detecting upper urinary tract changes secondary to or associated with reflux, because these considerations were deemed outside the scope of treatment guidelines in a child with VUR.

Diagnosis of VUR requires catheterization of the bladder, instillation of a solution containing iodinated contrast or a radiopharmaceutical and radiologic imaging of the lower and upper urinary tract, termed a voiding cystourethrogram (VCUG) or radionuclide cystogram, respectively. The bladder and upper urinary tracts are imaged during bladder filling and voiding. Reflux occurring during bladder filling is termed low-pressure or passive reflux, and reflux occurring during voiding is termed high-pressure or active reflux. Children with passive reflux are less likely to show spontaneous reflux resolution than children who exhibit only active reflux (Mozley, Heyman, Duckett, et al., 1994). Radiation exposure during radionuclide cystography is less than with standard contrast cystography. In the past, many children underwent cystography under general anesthesia. However, this method is flawed because normal micturition does not occur under anesthesia. Other methods for detecting reflux, such as indirect cystography and renal ultrasound, are thought to be less accurate (Blane, DiPietro, Zerin, et al., 1993; de Sadeleer, de Boe, Keuppens, et al., 1994).

Assessment of upper urinary tract

The goal of upper tract imaging is to assess whether renal scarring and associated urinary tract anomalies are present. In a child with VUR, the upper urinary tract can be evaluated by one of several techniques, including renal cortical scintigraphy (renal scan), excretory urography (intravenous pyelography, or IVP), and renal ultrasound. Radiopharmaceuticals used for renal scanning include dimercaptosuccinic acid (DMSA), glucoheptonate, and mercaptoacetyltriglycine (MAG-3). On an IVP, renal scarring is evident from reduction in the thickness of the renal cortex. Several specific patterns of renal scarring have been described (Smellie, Edwards, Hunter, et al., 1975). Renal sonography, a noninvasive method of evaluating the kidney, can show hydronephrosis, renal duplication with an obstructed upper pole and gross renal scars. The surface areas of the kidney on renal sonography roughly correlate with differential renal function (Sargent and Gupta, 1993).

Following an episode of pyelonephritis, renal scarring usually is apparent on scintigraphy within 3 months, but may not be apparent on an IVP or sonography until 1–2 years later.

Assessment of lower urinary tract

The goal of lower urinary tract assessment is to determine whether the bladder empties satisfactorily, whether a bladder abnormality such as a paraureteral diverticulum is present, and in males, to assure that no bladder outlet obstruction such as posterior urethral valves is present. This information is often obtained from the voiding cystourethrogram. At times, bladder trabeculation may be present and suggest that voiding dysfunction is present. Cystoscopic examination of the ureteral orifices has not been helpful in predicting whether spontaneous resolution of a child's reflux is likely (Bellinger and Duckett, 1984; Mulcahy and Kelalis, 1978). Evocative cystometry also does not appear to provide useful information in children with normal voiding function. However, urodynamics may be beneficial in children with voiding dysfunction.

Treatment methods

The primary goals of treatment in children with reflux are to prevent pyelonephritis, renal injury and other complications of reflux. Medical therapy is based on the principle that VUR often resolves over time, and that the morbidity or complications of reflux may be prevented nonsurgically. The basis for surgical therapy is that in selected situations, ongoing VUR has caused or has a significant potential for causing renal injury or other reflux-related complications and that elimination of reflux will minimize the likelihood of these problems. The 7 treatment modalities for VUR considered by the panel follow:

- No treatment (intermittent antibiotic therapy for UTI);
- Bladder training (including timed voiding and other behavioral techniques);
- Antibiotic prophylaxis (continuous);
- Antibiotic prophylaxis and bladder training;
- Antibiotic prophylaxis, anticholinergics (for bladder instability), and bladder training;
- Open surgical repair; and
- Endoscopic repair.

Neither urethral dilation nor urethrotomy have been found to be beneficial in the treatment of children with reflux (Forbes, Drummond, and Nogrady, 1969; Hendrey, Stanton, and Williams, 1973; Kaplan, Sammons, and King, 1973).

No treatment

This management modality involves treating patients with UTI with antibiotics at each occurrence. The philosophy of this therapy is that prompt diagnosis and treatment of UTI will eliminate or minimize the risk of reflux-associated renal infection. Because the continuous antibiotic prophylaxis approach has been used in recent years, few data are available on the intermittent treatment approach.

Bladder training

Bladder training refers to regular, volitional, complete emptying of the bladder through behavioral conditioning to achieve balanced, low-pressure voiding with coordinated relaxation of the external sphincter and pelvic floor during voiding. Measures include a voiding schedule (e.g., every 2–3 hours), complete emptying of the bladder during micturition, re-education in proper voiding dynamics if voiding dysfunction is present, and elimination of constipation. The practice also includes genital and perineal hygiene. The goal of bladder training is to reduce the likelihood of developing UTI and reduce voiding pressure. Infrequent voiding, detrusor-sphincter dyssynergia, and constipation can increase the likelihood of bacteriuria (Smith and Elder, 1994).

Antibiotic prophylaxis

Continuous antibiotic prophylaxis has become the cornerstone in the initial management of patients with reflux. This form of therapy is based on the observations of Lenaghan, Whitaker, Jensen, et al. (1976), who reported that 21 percent of previously normal refluxing kidneys showed scarring on follow-up with intermittent antibiotic therapy, and Smellie, Edwards, Hunter, et al. (1975), who found that children on continuous antibiotic prophylaxis who were kept free of infection did not develop new renal scarring.

Drugs commonly used for prophylaxis include sulfamethoxazole-trimethoprim, trimethoprim alone, and nitrofurantoin, generally administered once daily at a dose calculated to be one-fourth to one-third of the dose necessary to treat an acute infection (Birmingham Reflux Study Group, 1987; Cardiff-Oxford Bacteriuria Study Group, 1978;

Goldraich and Goldraich, 1992; Hannerz, Wikstad, Celsi, et al., 1989; Hanson, Hansson, and Jodal, 1989; Pinter, Jaszai, and Dober, 1988; Smellie, Gruneberg, Bantock, et al., 1988). Prophylaxis usually is continued until reflux resolves or until the risk of reflux to the individual is considered to be low. Many clinicians treating children with reflux obtain urine specimens periodically for urinalysis and/or culture, although the frequency of urine sampling varies widely (Elder, Snyder, Peters, et al., 1992).

Medical management with antibiotic prophylaxis is considered to be successful if the child remains free of infection, develops no new renal scarring, and the reflux resolves spontaneously. On the other hand, breakthrough UTI, the development of new renal scars, or failure of reflux to resolve would be considered failure of medical management. Noncompliance (Smyth and Judd, 1993), allergic reaction, or side effects to the prescribed medication may preclude medical management or lead to its failure.

Antibiotic prophylaxis and bladder training

Many clinicians emphasize the principles of bladder training when placing children with VUR on antimicrobial prophylaxis. Most studies in the literature do not specify whether attention to bladder training was emphasized in the treatment plan, and assessment of the contribution of bladder training to outcome has not been studied in any controlled trials.

Antibiotic prophylaxis, anticholinergics and bladder training

Before toilet training, voiding is an automatic process. During toilet training, however, children may demonstrate a discoordinated pattern, with incomplete relaxation of the external sphincter during voiding, resulting in high intravesical pressure and incomplete bladder emptying. The terms bladder instability, uninhibited bladder contractions, and pediatric unstable bladder refer to reflex detrusor contractions at low bladder volumes. Children with bladder instability typically experience frequency, urgency, and urge incontinence, and girls with this condition may cross their legs or squat down to try to avoid incontinence. Anticholinergic medication, in conjunction with timed voiding, is thought to improve the symptoms of dysfunctional voiding. Typical anticholinergic medications (also often classified as antimuscarinic/antispasmodic agents) include oxybutynin chloride, propantheline bromide, and hyoscyamine.

Open surgical repair

Open surgical management involves modifying the abnormal ureterovesical attachment to create a 4:1 to 5:1 ratio of length of intramural ureter to ureteral diameter. Numerous techniques have been described, and each has undergone minor modifications. The primary techniques evaluated by the panel include intravesical operations, including the Politano-Leadbetter (Politano and Leadbetter, 1958), Glenn-Anderson (Glenn and Anderson, 1967), Cohen transtrigonal (Cohen, 1975) and Paquin and Gil-Vernet procedures, and extravesical operations, including the Lich-Gregoir procedure (Gregoir, 1974) and detrusorrhaphy (Zaontz, Maizels, Sugar, et al., 1987). Surgical techniques for management of children with refluxing megaureter and reflux associated with ureteral duplication were evaluated separately. Studies dealing with laparoscopic correction of reflux, bladder neck plasty/Y-V plasty, and nephrectomy or partial nephrectomy as management for reflux were not reviewed.

Endoscopic repair

The technique of endoscopic injection of polytetrafluoroethylene paste (polytef, Teflon™), for the correction of VUR was reported in 1986 by O'Donnell and Puri (1986). The technique involves injecting 0.1–1 ml of polytef paste into the submucosa deep to the affected ureter. The injected bolus provides a firm buttress against which the ureteric roof may be compressed with rising intravesical pressure. This operative procedure, termed the "STING" (subtrigonal injection) has become very popular, particularly in Europe, because it is less invasive than open surgical techniques and can be performed as an outpatient procedure under general anesthesia. If the initial injection fails to correct reflux, the procedure can be repeated. Polytef is an inert material, yet the long-term safety of this foreign material in the bladder has not been documented (Aaronson, 1995; Puri, 1995). Furthermore, polytef has not been approved by the U.S. Food and Drug Administration for use in the treatment of reflux.

Another substance that has been used for endoscopic therapy is cross-linked bovine collagen (Leonard, Canning, Peters, et al., 1991). Other materials for injection currently under investigation

include autologous collagen, a mixture of cross-linked dextran and hyaluronadan, polyvinyl alcohol foam (Ivalon), polydimethylsiloxane, blood, fat, chondrocytes embedded in biodegradable polymer, bioactive glass, and detachable balloons. The panel did not review studies focusing on the use of these materials. Until an injectable substance is developed with acceptable known risks, open surgical correction of reflux remains the surgical treatment of choice. Nevertheless, the appeal of a safe and effective outpatient procedure for the correction of reflux will undoubtedly continue to stimulate investigation of this technique.

Surveillance and follow-up

In a child with VUR, periodic surveillance is generally recommended to monitor for UTI, because the complications of reflux often occur when infection is present. No guidelines exist for frequency of monitoring (e.g., monthly, every 3 months) or type of surveillance (urine dipstick, dipstick with microscopy, urine culture, or a combination) (Elder, Snyder, Peters, et al., 1992). If the child has symptoms of a UTI, a urine culture should be performed, even if the urinalysis is normal.

Follow-up radiologic testing is performed to monitor the status of reflux, that is, whether it is present (worse, improved, no change) or absent. In addition, studies to determine whether renal injury has occurred may also be performed. In children undergoing medical or surgical therapy, no guidelines exist for frequency or type of follow-up (Elder, Snyder, Peters, et al., 1992).

In a child receiving medical therapy, follow-up cystography is generally performed every 12–18 months. The radionuclide cystogram is preferred by many, because the radiation dose to the gonads is significantly lower than that with a standard contrast cystogram (Conway, King, Belman, et al., 1972). The 2 techniques are sufficiently dissimilar, therefore, the assessment of reflux severity may not be comparable. With digital fluoroscopy equipment and a “tailored” or individualized contrast cystogram performed by a pediatric radiologist, the radiation dose also is significantly lower than that with a standard VCUG (Kleinman, Diamond, Karellas, et al., 1994). In a child with reflux that appears to have resolved spontaneously by cystography, as many as 20 percent might show reflux if the study were repeated in 1 year (Arant, 1992). Most clinicians do not obtain a second cystogram, unless recurrent urinary tract infections have occurred. In addition, periodic upper tract imaging studies (ultrasound, IVP, renal scintigraphy) are often performed, although the ability of these tests to detect renal scarring and growth is variable. In a child treated surgically, follow-up lower and upper tract studies are generally performed at least one time to assess the success of the surgical procedure and to determine whether any complications have occurred.

The panel did not perform an assessment of the accuracy of these tests, nor is there any agreement on the effect these tests have on outcomes. Such studies do, however, document the status of the reflux problem.

Chapter 2: Methodology

The AUA Pediatric Vesicoureteral Reflux Panel developed the recommendations in this *Report on the Management of Primary Vesicoureteral Reflux in Children* following an explicit approach to the development of practice policies (Eddy, 1992) supplemented by expert opinion. The explicit approach provides mechanisms that take into account the relevant factors for making selections from alternative interventions. The use of scientific evidence in estimating the outcomes of intervention is emphasized.

To develop recommendations for this report, the panel undertook an extensive review of the literature on vesicoureteral reflux and extracted data.

The panel reviewed the evidence tabulated in the database and focused attention on randomized, controlled studies wherever possible. The level of availability and quality of the data from which outcomes could be estimated are displayed on the evidence matrix on page 21.

Expert opinion was polled by questionnaire or survey in a blinded fashion when scientific evidence was lacking. The panel generated its practice policy recommendations on the basis of evidence-based outcomes and on expert opinion. In this report, statements based on opinion are explicitly identified, and evidence-based recommendations are accompanied by appropriate references. The recommendations were derived from a survey of preferred treatment options for 36 clinical categories of children with reflux. The treatment recommendations were classified as follows:

- **Guidelines:** Treatment recommendations selected by 8 or 9 of the 9 panel members are classified as guidelines and are strongly worded using "should"; e.g., "Children with Grade V reflux should undergo surgical repair."
- **Preferred options:** Treatment recommendations that received 5 to 7 votes are worded with this classification.
- **Reasonable alternatives:** Treatment recommendations that received 3 to 4 votes are worded with this classification.
- **No consensus:** Treatment recommendations that received no more than 2 votes are worded with this classification and are not to be considered recommendations.

Literature search

The reference database was developed from MEDLINE literature searches encompassing the period January 1965 through December 1994. The search strategy was all-inclusive, using vesico-ureteral-reflux as the major or minor medical subject heading (MeSH keyword). It was important to use this specific form of vesico-ureteral-reflux because similar alternatives (e.g., vesicoureteric reflux) do not capture all reflux articles. All of the citations were imported into a Papyrus Bibliography System (Research Software Design, Portland, OR) and assigned a Papyrus Reference Number. Articles were accepted on the basis of specific criteria (outlined on page 17), as well as the interpretability of the data and inclusion of new data (relative to older published reports updating ongoing studies). A total of 3,207 references were retrieved and reviewed. Of these, 413 (13 percent) were selected for initial panel review. From this group, 168 were accepted for analysis (5.2 percent of initially retrieved articles). Bibliographies of reflux literature from 1960–1965 were reviewed manually to identify any relevant articles that would not have been retrieved electronically; however, no articles from which data could be extracted were identified in this manner. The articles from which outcomes data were extracted are listed in Table A-1 (Appendix A) and are the basis for the panel's analysis of vesicoureteral reflux.

Evidence on some outcomes was reviewed from selected articles that were not analyzed systematically, due to the nature of the material or the lack of a significant number of adequate articles. These areas included the impact of reflux on pregnancy, hospitalization due to antireflux surgery and due to pyelonephritis, adverse drug reactions, adverse effects of surveillance testing, and other surgical harms.

Article selection and data extraction

After identifying articles from the literature search, the panel reviewed the abstracts and selected relevant citations for data extraction. Criteria for admissible evidence included (1) English language and (2) peer-reviewed studies of primary VUR in children younger than 10 years old. The initial exclusions were based on article title, keywords (other than vesicoureteral reflux) or review of the abstract, if present. Specific exclusion criteria included review articles, non–English language studies, non–peer-reviewed studies, older duplicate studies, animal studies, adult studies, case reports with fewer than 5 patients, laboratory studies, studies without treatment outcomes, studies of secondary reflux, letters, editorials, and data from unpublished material.

Each article was accepted for inclusion or rejected on the basis of the treatment outcome data it contained. Inclusion or exclusion of each article was verified by 2 panel members in consultation with the panel chair. Articles were rejected by consensus of the 2 reviewers and the panel chair. Two individual panel members extracted data from each accepted article, and the data were tabulated on the data retrieval form developed by the panel (Appendix B). Each data retrieval sheet was reviewed by the panel chair, providing triple review for each article. Figures A-1–A-4 (Appendix A) list the articles reviewed and accepted by year, the source of the articles, the type of study for the accepted articles, and the reason for article rejection. From this review, reports were accepted for inclusion in the working bibliographic database.

The data were entered into a FoxPro™ (Microsoft Corp.) database. All computer entries were reviewed to ensure accuracy. The tabulated data were categorized according to the pediatric vesicoureteral reflux evidence matrix to facilitate review and to identify areas where limited or no data exist.

Limitations of the literature

The panel attempted to rely on published evidence whenever possible. Many studies that addressed a particular issue could not be used quantitatively in the various syntheses because of inconsistent reporting of data, limited time of follow-up, incomplete description of treatments utilized, or poorly defined patient populations. In addition, many of the datasets that were extracted still contained some deficiencies. Practical problems were encountered in analysis of the scientific literature as follows:

- Only 3 prospective randomized controlled trials (RCTs) compared medical with surgical therapy: the Birmingham Reflux Study, the International Reflux Study in Children, and a study from Erasmus University, Rotterdam, The Netherlands. The strongest evidence for the comparison of efficacy of treatments comes from these RCTs. Because even RCTs can have methodological problems, additional analyses were conducted on cohort studies for selected issues. In general, the results from these analyses were consistent with those of the RCTs.
- At least 5 different methods are used for grading reflux (see Table 1, page 11). The International Study Classification is currently the most common method for reporting data on reflux, and the Dwoskin-Perlmutter System corresponds closely to this grading system. The other systems tend to combine higher reflux grades, frequently making it difficult to extract outcomes data for specific grades of reflux.
- Many studies did not report outcomes by separate reflux grade, and instead combined various grades. Often, the results were not broken down by initial grade of reflux. In some cases, an attempt was made to adjust for this statistically; in other cases, the results were excluded from the analyses. (See Appendix C.)
- Although reflux is diagnosed more frequently in girls than in boys and the sequelae of reflux may be different in girls and boys, most outcomes were not reported separately by patient gender. The literature and data available suggested no difference in resolution by gender.
- No standard method was used for reporting outcomes in children with reflux. Some studies reported selected outcomes on reflux by patient grade, and other studies reported outcomes by ureteral grade. Some studies reported demographic data by patient data and outcome by ureteral data, or vice versa. Consequently, the panel had to assess which information was more important. For example, are patients with unilateral Grade II or III reflux more likely to show

reflux resolution than those with bilateral Grade II or bilateral Grade III reflux? Are patients with bilateral reflux, Grade IV on one side and Grade III on the other, as likely to show reflux resolution as patients with Grade IV reflux on one side and Grade I or II reflux on the other side?

- In series reporting outcomes of surgical correction of reflux, the duration of follow-up tended to be shorter than that in series of medical therapy. Thus, determining the long-term incidence of outcomes such as renal scarring and UTI after surgical therapy was difficult.
- In most series of reflux resolution on medical therapy, the resolution rate by year of follow-up was not provided, and patients were included with varying lengths of follow-up. This factor made combining the data in these series difficult.
- Few studies reported side effects of medical therapy or provided the reasons for changing the prophylactic medication. In addition, most studies of medical therapy did not stratify outcomes by specific antibiotic prophylaxis, making it impossible to analyze whether a particular form of prophylaxis is better than another.

  Issues such as adverse drug reactions or complication rates from surgery are most accurately estimated from large cohort samples taken from the same populations about which inferences are to be made. The literature on issues such as complication rates and adverse reactions was usually based on a convenience sample. In some cases, the information was so sparse that judgments had to be made on the basis of expert opinion.
- Most studies of reflux resolution on medical therapy did not stratify results by patient age, making it difficult to determine whether, for a specific grade of reflux, younger children are more likely than older children to experience reflux resolution. In addition, some studies reported the number of children who had reflux resolution at specific ages, but the initial reflux grade and the age at diagnosis in these patients were not provided.

Combining the evidence

To generate an evidence matrix (see page 21), estimates of the probabilities and/or magnitudes of the outcomes are required for each alternative intervention. Ideally, these come from a synthesis of the evi]dence, either from all available studies or a subset of high-quality data. Some cells in the evidence matrix were derived from a single dataset. If several studies had some degree of relevance to a particular cell or cells of the evidence matrix, the panel used more complicated methods of data synthesis—the Confidence Profile Method (Eddy, Hasselblad, and Shachter, 1992)—as a general framework, and the FAST*PRO software computer package (Eddy and Hasselblad, 1992) for calculations. The more complicated analyses were conducted using logistic models with random effects (Hasselblad, in press), and these calculations were performed using EGRET software (Statistics and Epidemiology Research Corp., 1993). The use of these logistic models for estimating parameters with dichotomous outcomes is described in Appendix C.

Panel members used expert opinion to address outcomes in the evidence matrix for which direct evidence was lacking, recognizing the limitations of opinion as a basis for reaching conclusions about effectiveness. They completed a mailed questionnaire in which they were asked to contrast, on the basis of their opinions and clinical experience, the relative effectiveness of several treatment options (e.g., anticholinergic therapy, bladder training, continuous antibiotic prophylaxis, surgery) in relation to various intermediate and health outcomes. The questionnaire also explored their opinions regarding the natural history and pathogenesis of VUR and the risk of adverse effects from continuous antibiotic prophylaxis and surgical repair. These pooled estimates, which were later presented at a panel meeting to help the group fill in the evidence matrix, are cited in this report along with an explicit statement that they originate from a panel survey and are gross estimates based on expert opinion and not on scientific data.

Dataset analysis

In addition, the panel was able to obtain the datasets of the large studies of Skoog and Belman (1991)[1] and Arant (1992). Analysis of these datasets provided a unique chance to answer some specific questions about resolution of reflux. In particular, the studies were used to determine whether

[1] Provided by Regina O'Donnell of Washington, D.C.

age of presentation affected resolution rates. Standard survival analyses were completed, and parametric analysis was used so that results could be combined across the 2 studies where appropriate. In general, a Weibull hazard model was used, and in many cases the exponential model (a special case of the Weibull model) was appropriate because it involved fewer parameters. Goodness of fit statistics were used to determine the adequacy of each model.

Analytic process

The recommendations in this report were developed on the basis of the scientific evidence and expert opinion, summarized according to the above methodology. A structured approach was used to translate the information into recommendations: confidential voting on standardized questions was conducted to give each panel member an equal voice in the recommendations, and explicit language was used to clarify the rationale for the recommendations and to document whether the assumptions were based on scientific evidence or expert opinion. After systematically reviewing the strengths and limitations of the evidence for each of the principal outcomes in the evidence matrix, panel members completed a confidential survey in which they designated preferred treatments for children presenting initially with reflux and for those with persistent reflux following initial treatment. Separate survey forms (see example in Appendix D) were completed for 36 clinical scenarios that incorporated all possible combinations of patient age (infancy, ages 1–5, ages 6–10), reflux severity (Grades I–II, Grades III–IV, Grade V), laterality (unilateral, bilateral) and the presence or absence of renal scarring at diagnosis. Voting was conducted in September 1995 and again in May 1996 after new data on spontaneous resolution rates became available. Recommended treatments were classified as guidelines, preferred options, reasonable alternatives, or no consensus, as defined on page 16.[2]

The text that resulted from this protocol was presented to the panel for review. Although the panel edited the text to improve consistency and readability, the panel did not deviate from the above protocol, either in determining what to recommend or in the wording of the recommendations. For example, even if some panel members believed that surgical repair is a reasonable alternative for specific clinical situations, the group did not recommend surgery if it received fewer than 3 votes on the survey. Finally, working with a facilitator, the panel listed individually the explicit arguments that formed the rationale for each of its recommendations. These arguments are summarized in Rationale for Recommendations (page 53), which also specifies whether the assumptions are based on scientific evidence or expert opinion. Special caveats about the limited scope of the recommendations (e.g., applying only to patients with uncomplicated reflux) also were made explicit. The final text that resulted from this process appears on pages 49–53.

[2] An exception occurred in evaluating treatments for patients with persistent reflux, because the denominator (the number of panel members voting) was less than 9 if any panel members recommended surgery as initial treatment (i.e., they would not participate in voting for additional treatments). Accordingly, votes for persistent reflux were classified as guidelines if a treatment received 85–100 percent of the total votes or as preferred option if it received 50–84 percent of total votes. No treatments for persistent reflux were classified as reasonable alternatives; if a treatment received no more than 50 percent of the votes, the text stated that there was no consensus. Because of the small sample size in this voting process, a change in the vote of a single panel member could affect the strength of the recommendations (e.g., making a “preferred option” a “guideline”). When differences due to rounding error resulted in illogical discrepancies in the recommendations (e.g., recommending more aggressive treatment for unilateral than for bilateral reflux), the response rate for the overall class of patients was used to calculate the strength of the recommendations.

Chapter 3:
Outcomes analysis for treatment alternatives

Intermediate outcomes and health benefits and harms

Health outcomes are the effects of a medical condition or intervention on patients that are directly perceived in some way by the patient or family. Harms are health outcomes that have a negative impact on the well-being of the patient, ranging from the impact of an acute illness or diagnostic testing (such as a VCUG), to the need for surgery or hospitalization, to death. Health benefits are generally expressed as a reduction in the severity or frequency of a harm.

It is important to distinguish between outcomes directly experienced and appreciated by a patient or parent (health outcomes) and those that patients cannot feel or experience but that are either associated with or precede health outcomes (intermediate outcomes). A patient or parent is only concerned about reflux if it causes symptoms that negatively affect them or if it has the potential to cause such problems. For example, although a direct relationship may be evident between reflux and pyelonephritis, it is the clinical condition of pyelonephritis with fever, pain, and hospitalization that is experienced by the patient. Similarly, renal scarring itself may not affect a patient's well-being, but possible sequelae of hypertension, renal insufficiency, clinical renal failure, symptoms of azotemia, or the need for dialysis, have direct impact. Consequently, reflux and reflux grade are intermediate outcomes, as are renal scarring, serum creatinine, or asymptomatic bacteriuria. In contrast, symptomatic UTI, azotemia, growth failure, as well as the need for x-ray studies, medications, surgery, or dialysis are health outcomes.

Many studies reported in the literature record only intermediate outcomes because the causal connection between intermediate outcomes and health outcomes is assumed or inferred. Analyses of intermediate outcomes are important in developing practice guidelines, but a firm causal connection with health outcomes is essential for validity and relevance.

Analysis of data quality

The evidence matrix on page 21 presents the outcomes of interest, indicating health outcomes, intermediate outcomes and harms for various forms of management, including no treatment, medical therapy and surgical therapies. Areas in which good (defined as 2 or more datasets available), fair (1 well-done dataset), and poor (very little) data are available are indicated. In some areas, a significant amount of interpretable information is available to integrate into a clinical decision, while in others a surprising lack of evidence was found. The areas lacking useful outcomes data highlight the deficiencies in the literature on VUR and emphasize the need for well-developed studies to address areas of uncertainty. The text following the evidence matrix notes areas in which relative benefits and harms may differ by patient population (e.g., different patient ages and grades of reflux).

Analysis of outcomes

The following sections detail the analysis of the variables included on the evidence matrix. The information is organized in relation to outcomes listed on the left side of the evidence matrix, beginning with intermediate outcomes.

Intermediate outcomes

Resolution and diminution of reflux

Over time a considerable proportion of children with reflux will experience resolution or diminution in reflux grade. Because the significance of diminution in reflux grade was difficult to assess, the panel used reflux resolution as an indication of success.

Medical therapy. The database included 26 reports with data pertaining to reflux resolution after medical therapy, encompassing 1,987 patients

(continued on page 22)

Evidence matrix: quality of data–studies of primary vesicoureteral reflux

Key: Good | Fair | Poor | NA Not applicable | No data

Good = 2 or more datasets, Fair = one well-done dataset, Poor = very little data

	No treatment[1]	Bladder training[2]	Antibiotic prophylaxis	Antibiotic prophylaxis & bladder training	Antibiotic prophylaxis, anti-cholinergics & bladder training	Open surgical repair[3]	Endo-scopic repair[4]
Intermediate outcomes (not considered admissible evidence of effectiveness)							
Decrease grade of reflux							
Duration of reflux							
Renal scarring							
Renal growth							
Renal function							
Health outcomes							
UTI							
Pyelonephritis							
Cystitis							
Hypertension							
Uremia							
Growth							
Morbidity during pregnancy[5]							
Death							
Harms (medical treatment)							
Adverse drug reactions						NA	
Hospitalization							
Adverse effects of surveillance testing							
Harms (surgery)							
Obstruction	NA						
Bleeding/transfusion							
Infection							
Contralateral reflux							
Bladder injury							
Pain							
Hospitalization							
Adverse effects of surveillance testing							

Health benefits are positive outcomes that patients can feel or experience directly.
Intermediate outcomes are pathophysiological outcomes that lead to, or are associated with, the development of health outcomes.

1. Includes intermittent antibiotic therapy for episodic UTI.
2. Includes timed voiding and other behavioral techniques.
3. Politano-Leadbetter, Glenn-Anderson, transtrigonal (Cohen), Lich-Gregoir, Paquin, Gil-Vernet, detrusorrhaphy, etc. Also includes repair of duplication anomalies (e.g., common sheath reimplant, ureteroureterostomy, partial nephrectomy).
4. Teflon™, collagen, Ivalon, blood, fat, etc.
5. Women with reflux/reflux nephropathy appear to have a higher risk of UTIs and/or pyelonephritis during pregnancy. UTIs during pregnancy can result in eclampsia, premature delivery, reduced fetal growth and possible fetal loss. Pyelonephritis would require maternal hospitalization. If there is pre-existing renal functional impairment secondary to reflux nephropathy, deterioration of renal function may occur during pregnancy.

(1,410 girls and 304 boys or a ratio of girl to boy, 4.3:1) and 2,902 ureters. In those studies in which the reflux could be classified as unilateral or bilateral, the distribution of ureters was almost equal (767 and 763, respectively). To accommodate a clinically relevant management strategy, children were divided into groups by age at diagnosis as follows: younger than age 1 year; preschool (1–5 years); and school age (6–10 years). The panel excluded from its consideration teenage youths and adults.

The data in these reports were difficult to collate because: (1) the minimum length of follow-up was often 6 months or less; (2) some studies did not report reflux resolution specifically but rather combined resolution and reduction in reflux grade; (3) some studies reported reflux resolution by ureter, and others reported reflux resolution by patient; (4) data showing reflux resolution often combined multiple grades of reflux, particularly in the older literature that did not use either the International or the Dwoskin-Perlmutter System of grading reflux; (5) reflux was not usually assessed annually for all patients, making it difficult to evaluate reflux by year in the majority of studies; and (6) some studies only reported the age at resolution of reflux, making it impossible to determine the actual range of time to reflux resolution.

For these reasons, 3 datasets were used to estimate the probability of reflux resolution as a function of initial grade, age at presentation and initial grade of reflux and laterality (unilateral/bilateral). The individual databases from the studies of Skoog, Belman, and Majd (1987) and Arant (1992) allowed analysis of these specific parameters, whereas the study of Tamminen-Mobius, Brunier, Ebel, et al. (1992) only provided summary resolution curves and sample sizes. The Arant dataset provided information on children with initial grades of I, II and III for ages 0–60 months. The Skoog dataset provided information primarily on Grades II and III for all ages. The Tamminen-Mobius study provided information primarily on Grade IV for all ages, but the results were not available by age. The study of McLorie, McKenna, Jumper, et al. (1990) was also analyzed for Grades III and IV reflux in a manner similar to Tamminen-Mobius, but was not included because the study data were not adequately described for analysis using the Weibull model determined to be the most appropriate for the analysis of the other studies.

The survival curves of these studies were fitted to the data. The results were pooled using an empirical Bayes model (Hedges and Olkin, 1985) when 2 or more studies provided information for a single risk category. The data for Grades I and II did not show any differences by age or laterality. For Grade III reflux, however, age and laterality were important.

Table 2 (page 23) shows the estimated chance of resolution for a child with reflux of a given grade, age and laterality (unilateral/bilateral). For example, assume that a child aged 30 months (2½ years) is diagnosed with unilateral Grade III reflux. Table 2 indicates that the chance of that child's reflux resolving in the next year is 13.4 percent. The chance of that same child experiencing reflux resolution in 3 years is 35.1 percent. The chance of resolution does not depend on how long the child has had reflux before diagnosis or treatment. If reflux does not resolve in the child described previously in the first year, the chance of resolution for the next year is still 13.4 percent. However, the table indicates 25 percent due to patients dropping out once their reflux resolved. For example, 100 patients, age 25–60 months, are diagnosed with Grade III, unilateral reflux. The first year, 13.4 percent will resolve. Therefore, approximately 87 patients remain. During the second year, another 13.4 percent of the 87 patients will resolve, leaving 75 patients with reflux, which means 25 percent of the original 100 patients resolved. A graphic presentation of the data is provided in Figure 3 on page 24.

All of these estimates are subject to 2 restrictions: (1) the estimates are only valid for up to 5 years after diagnosis; and (2) for Grade IV, the estimates only apply to the time of diagnosis, and they are not age specific. Children younger than 1 year with Grade IV reflux may have a higher chance of resolution, and children older than age 5 may have a lower probability.

The mean age at reflux resolution is 4.6–6.8 years (Skoog, Belman, and Majd, 1987; Bellinger and Duckett, 1984). The age beyond which reflux is unlikely to undergo spontaneous resolution is not well documented, however. Goldraich and Goldraich (1992) reported that almost all 10-year-old girls with persistent Grade I or II reflux underwent reflux resolution by age 13. In contrast, only 50 percent of 10-year-old boys with Grade I or II reflux showed resolution by age 13. Few 10-year-old girls or boys with Grade III or IV showed reflux resolution between 10 and 13 years of age. Lenaghan, Whitaker, Jensen, et al. (1976) reported that of 83 refluxing ureters that resolved, reflux resolution occurred after age 14 in 22 (27 percent).

Table 2. Medical therapy–Percent chance of reflux resolution after specified number of years[1]

Risk category (age in months) (number of patients on which estimates are based)	Percent chance (95% confidence interval)				
	1 year	2 years	3 years	4 years	5 years
Grade I[2] (N=15)	39.3 (24.6–51.1)	63.1 (43.2–76.1)	77.6 (57.2–88.3)	86.4 (67.7–94.3)	91.8 (75.7–97.2)
Grade II[2] (N=250)	28 (24.1–31.7)	48.1 (42.3–53.4)	62.7 (56.2–68.1)	73.1 (66.8–78.2)	80.6 (74.8–85.1)
Grade III, unilateral, age 0–24 (N=27)	21.4 (10.8–30.8)	38.2 (20.4–52.1)	51.5 (29–66.8)	61.9 (36.6–77.1)	70 (43.5–84.1)
Grade III, unilateral, age 25–60 (N=27)	13.4 (4.6–21.4)	25 (8.9–38.3)	35.1 (13.1–51.5)	43.8 (17.1–61.9)	51.3 (20.9–70.1)
Grade III, unilateral, age 61–120 (N=15)	10.8 (3.5–17.5)	20.5 (6.9–32)	29.1 (10.2–43.9)	36.7 (13.4–53.8)	43.6 (16.5–61.9)
Grade III, bilateral, age 0–24 (N=62)	12.7 (7–18.1)	23.8 (13.5–32.9)	33.5 (19.5–45)	41.9 (25.1–55)	49.3 (30.3–63.1)
Grade III, bilateral, age 25–60 (N=53)	7 (3.1–10.8)	13.5 (6.1–20.4)	19.6 (9–28.9)	25.2 (11.8–36.6)	30.5 (14.6–43.4)
Grade III, bilateral, age 61–120 (N=14)	2.6 (0.7–4.5)	5.2 (1.4–8.8)	7.7 (2.1–13)	10.1 (2.8–16.9)	12.5 (3.5–20.7)
Grade IV, unilateral[3] (N=28)	16.1 (8.5–23.1)	29.7 (16.4–40.8)	41 (23.5–54.5)	50.5 (30–65)	58.5 (36–73.1)
Grade IV, bilateral[3] (N=96)	4.5 (1–7.9)	6.4 (2–15.1)	7.8 (3–21.8)	8.9 (4–28)	9.9 (4.9–33.7)

[1] The yearly rate of reflux resolution remains constant for each group.
[2] No difference shown by age or laterality (unilateral/bilateral); therefore, these categories were combined.
[3] Estimates only apply to the time of diagnosis and are not age specific.

Medical resolution of reflux in patients with voiding dysfunction. Many children have voiding disorders exhibited by bladder and external sphincter discoordination along with bladder instability that contribute to VUR (Hinman and Baumann, 1973; Hinman, 1986; Allen, 1977, 1978). Clinically, these children in addition to having reflux and UTIs also have a combination of day and night-time enuresis, holding maneuvers, constipation, encopresis, and abdominal pain. The voiding disturbances are primarily a learned phenomenon that significantly increase voiding pressures resulting in decompensation of the ureterovesical junction and reflux. Inappropriate contraction of the voluntary external sphincter during detrusor contraction causes a functional obstruction to urinary flow with the development of elevated intravesical pressure. Many children perform this maneuver to delay bladder emptying while playing games, watching television, or being involved in other activities.

The cornerstone of treatment of patients with voiding dysfunction includes bladder retraining (timed voiding, relaxed voiding, biofeedback) with or without pharmacologic intervention directed at decreasing bladder or sphincter hyperactivity. Children with concomitant constipation or encopresis are often placed on a bowel program. Three prospective studies have found that neither urethral dilatation nor urethrotomy benefited children with VUR (Forbes, Drummond, and Nogrady, 1969; Kaplan, Sammons, and King, 1973; Hendry, Stanton, and Williams, 1973).

The panel selected 2 series that specifically examined the impact of voiding dysfunction on the course of reflux resolution without any intervention

(continued on page 26)

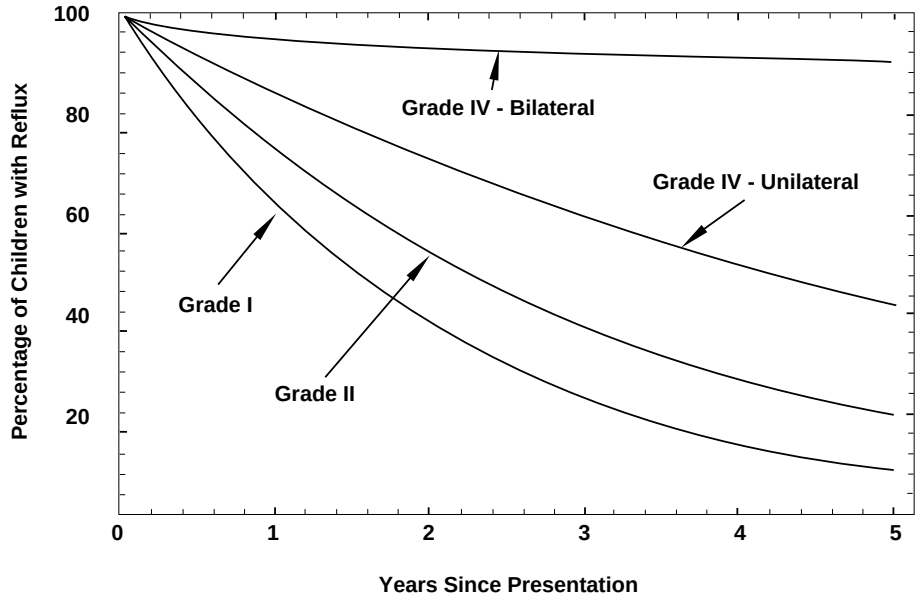

Figure 3-a. Percent chance of reflux persistence, grades I, II and IV, for 1 to 5 years following presentation

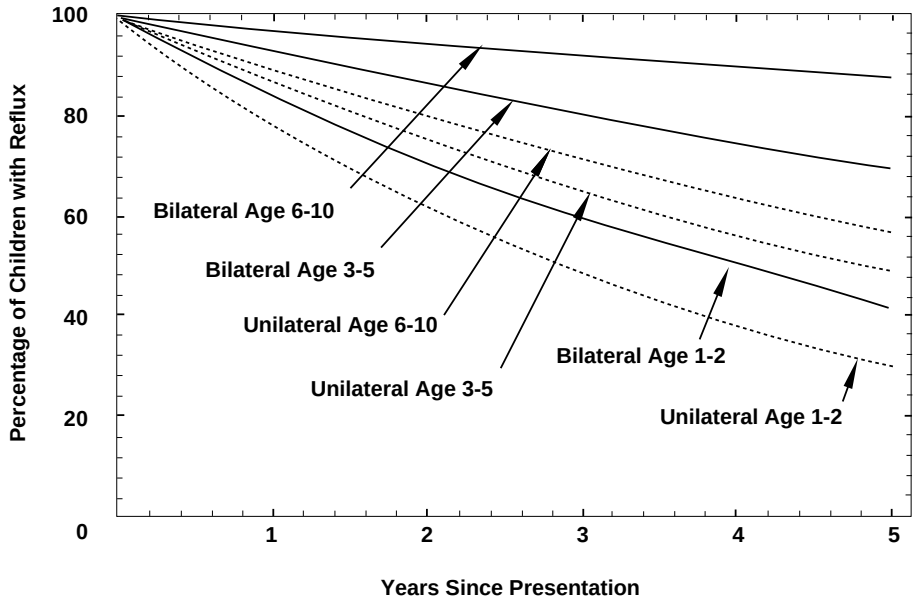

Figure 3-b. Percent chance of reflux persistence by age at presentation, grade III, for 1 to 5 years following presentation

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Source: Based on the databases from the studies of: Arant, 1992; Skoog, Belman, and Majd, 1987; and Tamminen-Mobius, Brunier, Ebel, et al., 1992.

Table 3. Medical resolution of reflux in patients with voiding dysfunction (untreated)

	Inclusion criteria	# Patients and/or # ureters	Resolution (patients)	Resolution (ureters)	Resolution by grade					Treatment regimen	Follow-up period
					I	II	III	IV	V		
Van Gool, Hjalmas, Tamminen-Mobius, et al., 1992	Patients in IRSC with questionnaire suggestive of voiding dysfunction	37/-	4/37 (11%)*		Patients predominantly with Grade III and IV reflux					Daily antibiotic prophylaxis	5 years
Van Gool, Hjalmas, Tamminen-Mobius, et al., 1992	Patients in IRSC with questionnaire not suggestive of voiding dysfunction (control group for above)	147/-	36/147 (25%)*		Patients predominantly with Grade III and IV reflux					Daily antibiotic prophylaxis	5 years
Koff and Murtagh, 1983	Patients with voiding dysfunction with uninhibited contractions on urodynamic evaluation (noncompliant with treatment of voiding dysfunction)	8/12		4/12 (33%)	0/3	1/4	2/3	1/2	0/0	Daily antibiotic prophylaxis Patients were noncompliant with • Anticholinegic medication • Bowel/bladder retraining program	Range 1.5–7 years (mean, 3.9 years)

* $p < 0.05$

directed at abnormal bladder function (van Gool, Hjalmas, Tamminen-Mobius, et al., 1992; Koff and Murtagh, 1983) (Table 3, page 25). In the International Reflux Study in Children, the rate of spontaneous reflux resolution in 37 patients with mild voiding dysfunction was 11 percent (4/37) compared with 25 percent (36/147) in a similar group without voiding dysfunction ($p < 0.05$) at 5 years of follow-up (van Gool, Hjalmas, Tamminen-Mobius, et al., 1992). In addition, recurrent symptomatic UTIs were more common in the group with voiding dysfunction (44 percent) compared with those with normal bladder function (25 percent) during 5 years of follow-up. Despite the increased propensity for symptomatic infections, the International Reflux Study in Children could not demonstrate a correlation between new renal scarring and the presence or absence of voiding dysfunction. Koff and Murtagh (1983) demonstrated a low reflux resolution rate in a small group of 8 children with voiding dysfunction who were noncompliant with treatment of their bladder dysfunction. The reflux resolution rate was 33 percent (4/12 ureters: Grade I, 0/3; Grade II, 1/4; Grade III, 2/3; Grade IV, 1/2) at a mean follow-up of 3.9 years. The rate of symptomatic and asymptomatic infections was 63 percent in this group over the same follow-up. These studies suggest that non-treatment of voiding dysfunction is associated with a lower spontaneous reflux resolution rate and an increased risk of UTI.

Resolution in patients receiving antibiotic prophylaxis, anticholinergics and bladder retraining. Improving voiding dynamics with bladder retraining and pharmacologic intervention can bring about diminution of both voiding and storage pressures. Five clinical series (not randomized controlled trials) specifically examined the role of bladder training and/or pharmacologic intervention in addition to antibiotic prophylaxis in the treatment of children with VUR (Table 4 on pages 27-28). In each study, different inclusion criteria were used to define each treatment group. In addition, each used a variety of techniques to improve bladder training (timed voiding, relaxed voiding, or biofeedback) with single or multiple pharmacologic agents (oxybutynin, imipramine, baclofen, flavoxate, dicyclomine, and diazepam) directed at decreasing bladder or sphincteric hyperactivity. The rate of UTIs for each group over the same period was 16, 63 and 71 percent, respectively. This study concluded that treatment of voiding dysfunction, as demonstrated by uninhibited contractions on urodynamic evaluation, increased the reflux resolution rate and decreased the rate of UTI. Seruca (1989) compared a group of patients prospectively studied and treated for voiding dysfunction with a retrospective control group of patients who were not treated. The overall reflux resolution rate (by ureter) was 92 percent for the former group and 54 percent for the latter. The follow-up period was not specified. Reflux resolution rates in the other 3 studies, which did not include any controls, are also summarized in Table 4. The wide variation in results (37–83 percent) is likely due to differences in inclusion criteria, treatment regimens, and follow-up period.

Available results from the series with control groups suggest that the reflux resolution rate increases with active treatment of those patients with a clinical history suggestive of voiding dysfunction. Given the variability of treatment regimens and the disparity of results, there is a need for controlled, matched studies in this area.

Medical resolution of reflux in patients with duplicated systems. Among the 168 articles reviewed by the panel, 14 included data on patients with duplicated collecting systems. Five studies included data on spontaneous resolution of reflux in patients receiving medical prophylaxis. The 14 studies reporting data on ureteral duplication included 498 patients or at least 546 affected renal units. Three studies, representing a total of 45 patients, did not report data on renal units. Assuming that each of the 45 patients had at least 1 affected renal unit, the total units would approximate 591 renal units or more. Duplication was identified predominantly in girls, with a ratio of 1 male (57) to 5.6 female (322) individuals.

Although 2 reports presented controlled studies comparing single ureteral reflux to duplicated systems (Husmann and Allen, 1991; Ben-Ami, Gayer, Hertz, et al., 1989), limited data are available on medical treatment of reflux in the patients with duplicated systems. The data show that within the population of patients with duplicated systems, Grades I–II may be treated medically whereas Grades III, IV, and V have been treated surgically in most cases. Data on resolution by grade in patients receiving medical treatment are minimal compared with those in patients with duplicated systems treated surgically. Table 5 on page 29 provides data from the 5 studies, including data on resolution in patients with duplicated systems receiving medical therapy.

(continued on page 29)

Table 4. Medical resolution of reflux in patients with voiding dysfunction (treated)

	Inclusion criteria	# Patients and/or # ureters	Resolution (patients)	Resolution (ureters)	Resolution by grade					Treatment regimen	Follow-up period
					I	II	III	IV	V		
Koff and Murtagh, 1983	Patients with voiding dysfunction with uninhibited contractions on urodynamic evaluation (compliant with treatment of voiding dysfunction)	26/43		19/43 (44%)	5/9	3/10	7/11	2/10	2/3	Daily antibiotic prophylaxis treatment for voiding dysfunction: • anticholinergic medication (oxybutynin) • Bowel and bladder retraining program.	Range 1.5-7 years (mean, 3.9 years)
Koff and Murtagh, 1983	Normal urodynamic evaluation (control group for above 2 groups)	28/47		8/47 (17%)	1/3	3/11	4/17	0/9	0/7	Antibiotic prophylaxis	Range 1.5 - 7 years (mean, 3.9 years)
Seruca, 1989	Elevated bladder pressures during bladder filling and/or voiding, with or without abnormal perineal muscle activity	53/74	46/53	68/74 (92%)	8/8	33/33	26/27	1/4	0/2	Daily antibiotic prophylaxis for 6 months, then stopped. Baclofen, flavoxate, dicyclomine, or diazepam given individually or in combination for each type of bladder dysfunction seen on urodynamic evaluation for 12-30 months. 2 patients treated for constipation.	Unknown
Seruca, 1989	Retrospective “control” group from 1980-85 (for the above group)	48/67		36/67 (54%)	12/12	22/35	2/18	0/2	—	Daily antibiotic prophylaxis	Unknown

Table 4. Medical resolution of reflux in patients with voiding dysfunction (treated) (continued)

	Inclusion criteria	# Patients and/or # ureters	Resolution (patients)	Resolution (ureters)	Resolution by grade					Treatment regimen	Follow-up period
					I	II	III	IV	V		
Homsy, Nsouli, Hamburger, et al., 1985	Urodynamic demonstration of detrusor hyperreflexia (15) or detrusor hyperreflexia or dyssynergia (25)	40/53		27/53 (51%)	4/5	18/32	5/8	0/8	—	Daily antibiotic prophylaxis. Oxybutinin for 3-18 months Constipation treated with diet and softeners.	Unknown
Nasrallah and Simon, 1984	History consistent with voiding dysfunction	15/18		15/18 (83%)	4/4	6/7	3/4	2/3	—	Daily antibiotic prophylaxis. Detrusor hyperreflexia: oxybutynin Sphincter spasm: counseling and bladder retraining Nocturnal enuresis: imipramine Small bladder syndrome: imipramine & bladder retraining Detrusor areflexia: Bethanecol and timed voiding.	2 years minimum
Scholtmeijer and Griffiths, 1990	Detrusor instability on video-urodynamic	20/27		10/27 (37%)	1/1	6/13	3/8	0/5	—	Daily antibiotic prophylaxis. Anticholinergic medication	1 year

Table 5. Reflux resolution in patients with duplicated systems treated medically

Study	Grade	Patients in whom reflux resolved	Patients treated medically	Follow-up
Husmann and Allen, 1991	II	7 (10%)	71	0.5–5 years
Peppas, Skoog, Canning, et al., 1991	I–V	10 (14%)	70	Not stated
Kaplan, Nasrallah, and King, 1978	Not stated	5 (22%)	23	Not stated
Lee, Diamond, Duffy, et al., 1991	I–V	19 (50%)	38	1–11 years
Ben–Ami, Gayer, Hertz, et al., 1989	I–IV	14 (44%)	32	Min. 1 year
Total		**55 (24%)**	**234**	

The 5 studies, representing 234 patients, included data on follow-up of patients considered medically stable for variable periods from 1–5 years. Reflux resolution occurred in 24 percent of patients (55/234). The range of time to resolution varied from 24 months (Husmann and Allen, 1991) to 39–68 months (Lee, Diamond, Duffy, et al., 1991). The studies including matched control populations showed that the chance of resolution in patients with duplicated systems is lower or equal to that in patients with single systems (Husmann and Allen, 1991; Ben-Ami, Gayer, Hertz, et al., 1989).

Resolution—Open surgery. The panel reviewed 86 reports outlining open surgical success, encompassing 6,472 patients and 8,563 ureters (see Table E-1, Appendix E). Because results were reported in 1 of these 2 categories, the data represent different populations. Surgical success is defined as an open operation performed through an abdominal incision that corrected VUR without postoperative ureteral obstruction and that was confirmed by postoperative cystography. Surgical success was obtained both with "standard" techniques such as the Politano-Leadbetter procedure (16 reports), Cohen transtrigonal procedure (12 reports), Lich-Gregoir with modifications (13 reports) and Gil-Vernet (4 reports), and with mixtures of the above procedures (that could not be separated) or unique operations that could not be classified within the above procedures (44 reports).

Overall, surgical success was reported by patients in 959 of 1,008 patients (95.1 percent), or reported by ureter in 7,731 of 8,061 ureters (95.9 percent). When surgical success was reported by reflux grade, a smaller database was available for analysis. Surgical success was achieved in 108 of 109 ureters (99 percent) for Grade I reflux, 874 of 882 ureters (99.1 percent) for Grade II, 993 of 1,010 (98.3 percent) for Grade III, 386 of 392 (98.5 percent) for Grade IV, and 155 of 192 (80.7 percent) for Grade V. Surgical success in Grade V reflux, which was treated using a wide variety of procedures, is shown in Table E-2, Appendix E. Surgical success was also analyzed by surgical technique when that information was available (Table E-3, Appendix E).

Overall, the data on surgical success by any technique suggest a narrow range of success rates centering around 95 percent. Surgical success is most likely in Grades I–III, with at least median success in Grade IV reflux. For Grade V, the success rate ranges from 34 to 100 percent.

Resolution—Endoscopic therapy. Endoscopic therapy is a newer form of surgical treatment for reflux and refers to the subureteric injection of some material under the refluxing ureteral orifice. The technique and its limitations are described in Chapter 1. Most reports in the literature describe results of the use of polytetrafluoroethylene (Teflon™) (Table 6 on page 30). If the procedure is unsuccessful, as assessed by postoperative VCUG, it may be repeated. The results of this type of therapy are difficult to interpret because success is often described as resolution or reduced grade of reflux after 1, 2, 3, or even 4 injection procedures. Most reports focus on reflux resolution by ureter

Table 6. Results of endoscopic correction (Teflon™) for vesicoureteral reflux

Study	Grade	Procedures[1]				Patient cure (1 injection)
		1st	2nd	3rd	Obstruction	
Puri and O'Donnell, 1987	IV-V	28/42	6/12	3/6	0/42	
Sweeney and Thomas, 1987	All	99/153			1/153[2]	
King and Gollow, 1988	III-IV	31/36	4/5		0/36	
Farkas, Moriel, and Lupa, 1990	All	79/88				44/52
	II-IV	79/84	4/5	0/1	0/84	44/49
	V	0/4				0/3
Lacombe, 1990	All	132/174	6/8			67/100
Sauvage, Saussine, Laustriat, et al., 1990	All	159/210			0/210	
	I-II	25/33			0/33	
	III	76/93			0/93	
	IV	52/70			0/70	
	V	6/14			0/14	
Dodat and Takvorian, 1990	All	181/213			2/213	
	I-II	84/94				
	III	80/93				
	IV	23/29				
	V	0/1				
Puri, 1990	II-V	113/143	19/23	3/4	1/143	
Schulman, Pamart, Hall, et al., 1990	All	139/173			2/173	
Davies and Atwell, 1991	All	26/40	6/7		1/40	
Bhatti, Khattak, and Boston, 1993	All	152/206	28/41	1/1	0/206	65/88
Total		**1139/1478 (77.1%)**	**73/101 (72.3%)**	**7/12 (58.3%)**	**7/1300 (0.5%)**	

[1] Results by ureter; lst, 2nd, and 3rd refer to specific treatment.
[2] Eight other ureters reported to be obstructed, but did not need surgical correction.

rather than by patient. Overall, reflux was corrected in 77.1 percent of ureters after a single injection. However, reflux was resolved after the initial treatment in only 6 of 19 ureters (32 percent) with Grade V reflux. In patients with a completely duplicated system, reflux was corrected in 58.1 percent of ureters after 1 injection (Table 7 on page 31).

Success with collagen injections is even more difficult to interpret because reflux correction may not be durable. For example, in 1 report of 60

Table 7. Reflux resolution following endoscopic correction (Teflon™) for vesicoureteral reflux, duplicated systems

Study	Grade	Procedures[1] 1st	2nd	3rd	Obst
Farkas, Moriel, and Lupa, 1990	III-IV	13/16			0/16
Sauvage, Saussine, Laustriat, et al., 1990	All	9/13			0/13
Dodat and Takvorian, 1990	All	8/10			
Schulman, Pamart, Hall, et al. 1990	All	11/19			
Dewan and O'Donnell, 1991	All	13/35	6/19	6/19	1/35
Total		**54/93 (58.1%)**			**1/64 (1.6%)**

[1] Results by ureter; lst, 2nd, and 3rd refer to specific treatment.

ureters with primary reflux, 47 (78 percent) showed resolution 1 month after treatment, but only 29 of 47 (61 percent) still showed resolution at 1 year (Leonard, Canning, Peters, et al., 1991). In another series, all 97 treated ureters showed resolution immediately after injection, but reflux recurred in 40 ureters (41.2 percent) at 1 month and in 5 more ureters (5.2 percent) at 1 year following therapy (Frey, Berger, Jenny, et al., 1992). Whether more systems would begin to reflux with time because of implant degradation or migration is uncertain.

At present, endoscopic treatment remains an investigational procedure in the United States, awaiting testing of a material that has proven benefit and safety.

Renal scarring

Renal scarring is an important outcome in the long-term assessment of results of medical or surgical therapy. Renal scarring may predispose to hypertension requiring medical therapy. Extensive renal scarring may cause renal insufficiency and end-stage renal disease, with its attendant morbidity and mortality.

The presence of renal scarring is documented on imaging studies, including renal scan (DMSA, MAG-3), excretory urography (IVP) and renal sonography. These techniques have certain limitations. For example, there is variable sensitivity among these studies in their ability to detect renal scars. Furthermore, timing of the imaging study is important; a renal scar may be evident on DMSA scan within 6 months of an episode of pyelonephritis, whereas it may not be apparent on IVP or sonography for 1–2 years. Early identification of renal inflammation by DMSA during an episode of pyelonephritis does not necessarily indicate that these areas will later develop scarring, however. Interpretation of the studies is variable among radiologists (Patel, Charron, Hoberman, et al., 1993). In an individual with renal scarring, it may be difficult to distinguish between a new scar adjacent to the existing one and progression of an old scar. Finally, in an individual who is found to have a renal scar on the first imaging study of the kidney, it is impossible to determine whether the scar resulted from infection or was congenital, since 20–40 percent of neonates with prenatally diagnosed hydronephrosis secondary to VUR have renal parenchymal abnormalities at birth (Elder, 1992).

Renal scarring may be new or progressive. The finding of new renal scarring suggests that a new renal injury has occurred since the previous imaging study. Progressive renal scarring, on the other hand, may represent either extension of the original renal injury or may result from a newer renal insult.

Prevention of new renal scarring is one of the primary goals of treatment of VUR. Most studies of reflux have not assessed this specific outcome. When interpreting the results of various studies pertaining to reflux, it is important to understand the limitations of each type of imaging study used in the evaluation of renal scarring (see page 12). Unless otherwise indicated, studies that combined patients with both new and progressive renal scarring have not been included in the panel's analysis.

Table 8. Scarring after treatment in prospective trials of surgery compared with antibiotic treatment for vesicoureteral reflux

Study	Population	Method of evaluation	Treatment	Follow-up	New scarring
Elo, Tallgren, Alfthan, et al., 1983	Matched uncontrolled follow-up study with 40 girls in each arm. Mean age of 5.2 years	IVP	Medical—antibiotic, primarily sulfisoxazole	4.3 years (average)	7.5% (3/40)
			Surgery—Politano-Leadbetter procedure	4.3 years (average)	17.5% (7/40)
Birmingham Reflux Study Group, 1987	161 children younger than age 15 years, allocated randomly to either surgery or antibiotic treatment	IVP	Medical treatment	5 years	6% (5/84)
			Surgical treatment	5 years	5.2% (4/77)
Olbing, Claesson, Ebel, et al., 1992	306 children younger than age 11 years, with nonobstructive Grades III or IV VUR and with previous UTI	IVP	Medical treatment	5 years	15.7% (19/121)
			Surgical treatment	5 years	17.2% (20/116)
Weiss, Duckett, and Spitzer, 1992	Infants and children with Grades III and IV primary VUR	IVP	Medical treatment	4½ years	21.5% (14/65)
			Surgical treatment	4½ years	31.4% (16/51)

Four prospective trials comparing the outcomes of medical and surgical management included analysis of new renal scarring (Table 8 on page 32). None of these trials showed a statistically significant difference in the rate of new renal scarring. The combined relative risk slightly favored medical management but was not statistically significant (see Figure 4 on page 33). In the European arm of the International Reflux Study (Olbing, Claesson, Ebel, et al., 1992), the rate of scarring was similar among those managed medically and those treated surgically; however, 80 percent of the new renal scars in the surgical group appeared by 10 months after randomization, whereas new renal scars appeared throughout the 5 years in the group managed medically.

Several single-arm studies also reported rates of new scarring after medical or surgical treatment. The combined risk for new scarring for 14 such medical reports was 4.1 percent (range, 0–24.7 percent) (Aggarwal, Verrier-Jones, Asscher, et al., 1991; Arant, 1992; Bellinger and Duckett, 1984; Ben-Ami, Sinai, Hertz, et al., 1989; Birmingham Reflux Study Group, 1987; Burge, Griffiths, Malone, et al., 1992; Cardiff-Oxford Bacteriuria Study Group, 1978; Edwards, Normand, Prescod, et al., 1977; Homsy, Nsouli, Hamburger, et al., 1985; Husmann and Allen, 1991; Jakobsen, Genster, Olesen, et al., 1977; Koff and Murtagh, 1983; Scholtmeijer and Griffiths, 1988; Shah, Robins, and White 1978), and for 7 such surgical reports was 4.6 percent (range, 0–16.7 percent) (Beetz, Schulte-Wisserman, Tröger, et al., 1989; Birmingham Reflux Study Group, 1987; Burge, Griffiths, Malone, et al., 1992; Carpentier, Bettink, Hop, et al., 1982; Hjalmas, Lohr, Tamminen-Mobius, et al., 1992; Scholtmeijer and Griffiths, 1988; Scott, Blackford, Joyce, et al., 1986). These reports are difficult to compare directly, however, because the length of follow-up and distribution of reflux grades varied among the studies. In the majority of these studies, the minimum follow-up

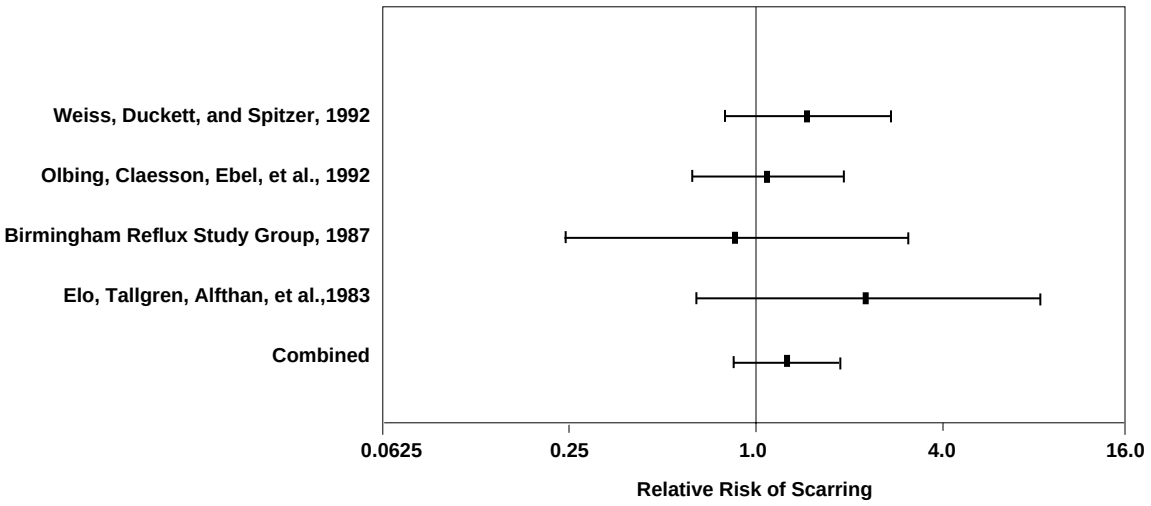

Figure 4. Relative risk of new scarring for surgery compared with antibiotic treatment

Analysis from 4 prospective trials of the risk of new scarring after surgery compared to that after medical treatment showed that the combined relative risk slightly favored medical management but was not statistically significant.

was 3 months. Furthermore, identification of renal scarring in most studies has depended on intravenous urography, but the quality of films and expertise of radiologists were probably inconsistent. The Birmingham Reflux Study (1987) identified new scars after 5 years in only 6 percent and 5.2 percent of children treated medically and surgically, respectively, with no additional scars detected after 2 years of follow-up. On the other hand, the International Reflux Study found new scars in 15.7 percent (medical) and 17.2 percent (surgical) of refluxing children in Europe and 21.5 percent (medical) and 31.4 percent (surgical) in North America (Table 8). When patients with VUR discovered before 5 years of age whose kidneys were of normal size by planimetry and had no evidence of renal scarring on initial intravenous urography were treated medically and followed for 5 years, renal scarring was detected in 10 percent of patients with Grades I or II reflux and 28 percent of those with Grade III VUR. Of the scars, 42 percent were detected after 1 year of follow-up, 25 percent after 3 years and 33 percent after 5 years (Arant, 1992). More recently, renal scarring has been confirmed on DMSA scan within 6 months after acute pyelonephritis in children (Rushton and Majd, 1992).

Renal scarring: Relationship to bacteriuria. Because VUR is most frequently diagnosed after an infant or child presents with UTI and animal models of ascending pyelonephritis (via surgically created VUR) reliably produce renal scarring, the 2 events, when they occur clinically, are often thought to be causally related. Renal scarring is often detectable on the initial renal imaging study obtained following the diagnosis of UTI, and is proportional to the severity of VUR and the sensitivity of the technique. This observation suggests that previous undiagnosed UTIs may have occurred, which resulted in pyelonephritic injury. However, new or progressive renal scarring during follow-up is less common, despite additional episodes of bacteriuria.

The panel attempted to analyze the relationship between bacteriuria and new renal scarring in children with reflux. However, few data are available that would permit such an analysis. Only 14 reports described the frequency of UTI in children with and without new or progressive renal scarring (Aggarwal, Verrier-Jones, Asscher, et al., 1991; Anderson and Rickwood, 1991; Arant, 1992; Beetz, Schulte-Wissermann, Tröger, et al., 1989; Birmingham Reflux Study Group, 1983; Birmingham Reflux Study Group, 1987; Cardiff-Oxford Bacteriuria Study Group, 1978; Edwards, Normand, Prescod, et al., 1977; Goldraich and Goldraich, 1992; McLorie, McKenna, Jumper, et al., 1990; Shah, Robins, and White, 1978; Skoog, Belman,

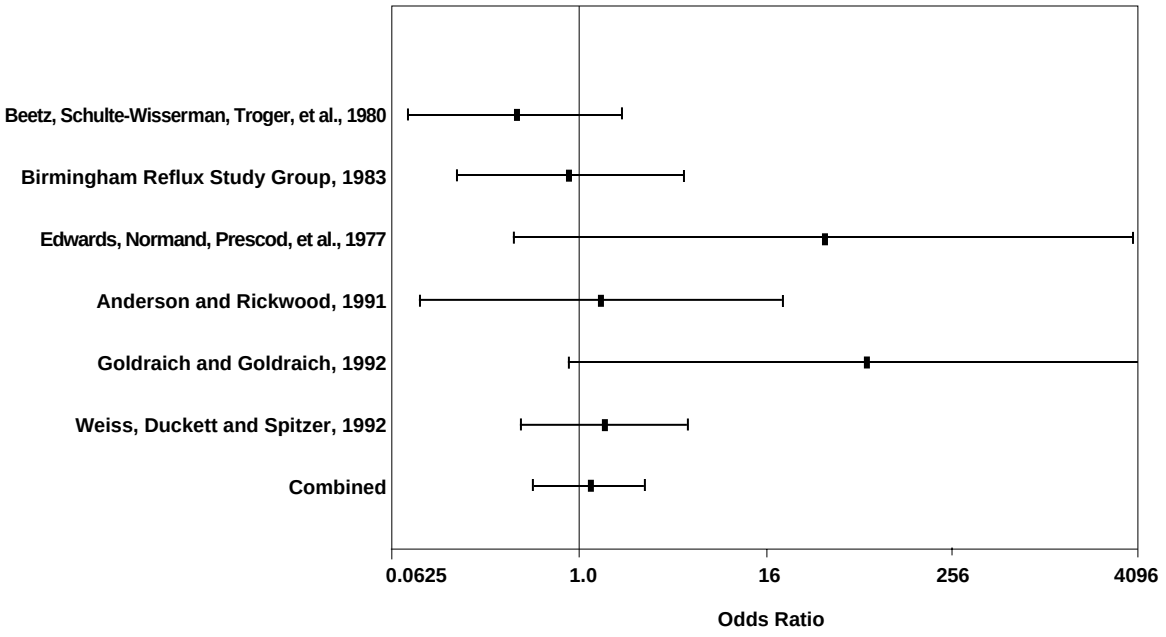

Figure 5. New or progressive scarring and bacteriuria

Analysis of the relationship of bacteriuria and renal scarring in children with reflux showed that the risk of developing new or progressive scarring was 1.18 times as great for an individual with UTI as that for an individual without infection (i.e., the risk is only slightly increased).

and Majd, 1987; Smellie, Gruneberg, Leakey, et al., 1976; Weiss, Duckett, and Spitzer, 1992). Most of these studies provided information only for the presence or absence of bacteriuria in those with new or progressive scarring, and not for those who did not develop such scarring. Using the empirical Bayes method of Hedges and Olkin (1985), an estimated odds ratio of 1.18 (95% CI 0.52–2.68) is derived (see Figure 5 on page 34). In other words, the risk of developing new or progressive scarring for an individual with UTI is 1.18 times as great as that for an individual without infection, that is, the risk of developing new or progressive scarring is only slightly increased.

Several factors may contribute to this surprising lack of association between scarring and infection in children with reflux. First, few of the reports characterized the types of infections (febrile, nonfebrile, asymptomatic) in these children. Febrile UTIs are more likely to represent renal parenchymal inflammation, and thus place the patient at greater risk for scarring than does nonfebrile UTI. In the study by Goldraich and Goldraich (1992), all 7 of the children with new renal scars by DMSA scan had a febrile UTI in the previous year. The remainder of the reports were not as precise. In addition, the progressive scarring recorded may have been the result of a UTI that occurred before treatment (medical or surgical) was initiated. The radiologic technique used to detect new or progressive scarring may not have been sufficiently sensitive to evaluate this parameter properly. Furthermore, once the initial diagnosis of UTI and VUR has been made, most parents/patients are more likely to be attuned to the symptoms of UTI (particularly fever), and patients are more likely to receive prompt diagnosis and treatment. In addition, it is possible that UTIs were under-reported to the investigator by referring physicians, or that suspected UTIs (or episodes of unexplained fever) may have been treated with an antibiotic without urine culture. For example, in a study of 50 febrile infants, all of whom underwent protocol urine culture, 15 ultimately found to have bacteriuria initially had received diagnoses other than UTI (Hoberman, Chao, Keller, et al., 1993).

Renal growth

A clinical impression, supported by many reports, is that renal growth is impaired when VUR

is present (Scott and Stansfield, 1968; Lyon, 1973; Redman, Scriber, and Bissada, 1974), especially with Grades IV and V reflux (Pinter, Jaszai, and Dober, 1988; McRae, Shannon, and Utley, 1974), or recurrent infection (Peratoner, Messi, and Fonda, 1984; Scott and Stansfield, 1968; Kelalis, 1971). Moreover, accelerated renal growth has been recorded after reflux was corrected (Carson, Kelalis, and Hoffman, 1982; Atwell and Vijay, 1978; Willscher, Bauer, Zammuto, et al., 1976; Scott and Stansfield, 1968) or during adolescence (Claesson, Jacobsson, Jodal, et al., 1981). Most studies with useful data on renal growth have been conducted retrospectively without an appropriate control group and for durations of follow-up in which some patients may have been followed no more than 1 year (Atwell and Cox, 1981; Atwell and Vijay, 1978; Willscher, Bauer, Zammuto, et al., 1976). Standardized methods for assessing renal growth have seldom been used, making comparisons among studies difficult. Furthermore, many patients have renal scarring when reflux is recognized or develop new or progressive scarring during follow-up (Birmingham Reflux Study Group, 1987; Bellinger and Duckett, 1984; Weiss, Duckett, and Spitzer, 1992; Olbing, Claesson, Ebel, et al., 1992; Smellie, Edwards, Normand, et al., 1981).

Renal growth is most often assessed as renal length measured from intravenous urography or, more commonly in recent years, by renal ultrasonography. Before interpreting data obtained using these techniques, it must be recognized that the distance between the table top and tray alters the renal image projected onto the film (Riggs, 1977). Renal dimensions are distorted when the distance between the x-ray source and film is altered and magnified when urographic films are taken when the patient is in the prone position. Poor technique or inadequate bowel preparation may obscure the exact margins of the renal outline. With renal ultrasonography, the angle of the transducer to the longitudinal aspect of the kidney may distort renal dimensions.

Of the various estimates of renal size from renal length, standards exist only for normal—not scarred—kidneys (Hodson, Drewe, Karn, et al., 1962; Hodson, Davies, and Prescod, 1975; Eklof and Ringertz, 1976; Rosenbaum, Korngold, and Teele, 1984). Moreover, some kidneys are “short and fat” while others are “long and thin.” Renal scarring is noted most often in upper or lower poles (Hannerz, Wikstad, Johansson, et al., 1987). Renal size can be assessed more reproducibly by estimating planimetric surface area (Claesson, Jacobsson, Olsson, et al., 1981). This two-dimensional measurement of renal parenchyma surface area from a standardized urographic film is not compromised by differences in renal width or hydronephrosis. In addition, identification of parenchymal thinning may be a more sensitive indicator of renal scarring in the small but growing kidney (Olbing, Claesson, Ebel, et al., 1992). Even when a parenchymal scar is not obvious, discrepancies in renal size between kidneys suggest unilateral disease in the smaller kidney, especially when compensatory hypertrophy in the contralateral kidney results in its being larger than expected for age, body length, or vertebral height (Claesson, Jacobsson, and Jodal, 1981). Renal size cannot be estimated from any radionuclear study currently in use. Even when a kidney contributes more than 50 percent of total renal function on a radionuclide scan, normal renal size cannot be presumed.

Two reported studies provide data on renal growth in patients with reflux treated either medically or surgically; each was conducted prospectively and had a minimum of 5 years of follow-up in every patient. The Birmingham Reflux Study (1987) used renal length whereas the International Reflux Study (Weiss, Duckett, and Spitzer, 1992) employed planimetric surface area—both taken from intravenous urography. At the outset of both studies, each treatment group included many patients with previous renal scarring. No differences in renal growth were detected between groups in either study. Another study that was not conducted prospectively reported similar findings—no difference in renal growth during medical management or after surgical correction of reflux (Peratoner, Messi, and Fonda, 1984). However, patients in both treatment groups had kidneys that were smaller than normal or that grew suboptimally during the follow-up period. The number of kidneys that were small because of renal scarring or parenchymal thinning was not reported. On the basis of clinical studies available to date, there is no evidence to support the notion that in the absence of voiding dysfunction, renal growth is impaired in unscarred kidneys exposed to sterile reflux of any grade (Arant, 1992; Smellie, Edwards, Normand, et al., 1981) or that surgical correction of reflux facilitates growth of the kidney postoperatively (Birmingham Reflux Study Group, 1987; Peratoner, Messi, and Fonda, 1984; Beetz, Hohenfellner, Schofer, et al., 1991; Weiss, Duckett, and Spitzer, 1992).

Renal function

The rationale for identifying reflux early is to introduce treatment that best prevents scarring and preserves renal function. Scott, Blackford, Joyce, et al. (1986) reported marked improvement in glomerular filtration rate (GFR) for most patients in whom reflux was corrected surgically. Using the same technique for measuring GFR, however, Poulsen, Johannesen, Nielsen, et al. (1989) found that GFR was preserved during nonsurgical management of children with reflux. During long-term observations, others have found no adverse effect of continued sterile reflux on kidney function (Birmingham Reflux Study Group, 1987; Weiss, Duckett, and Spitzer, 1992). In prospective, controlled treatment trials, surgical correction of even severe reflux has had no benefit on GFR 5 years later (Birmingham Reflux Study Group, 1987; Weiss, Duckett, and Spitzer, 1992).

When renal scarring is severe but unilateral, renal function would be expected to be normal. Even when both kidneys are scarred, overall renal function may be preserved by compensatory changes in structure and function of remaining nephrons (Berg, 1992). In fact, the degree of renal functional impairment in patients with reflux nephropathy has been related directly to parenchymal size of both kidneys (Claesson, Jacobsson, Jodal, et al., 1981). Serum creatinine concentration will remain within the range of normal values for age until scarring reduces functional nephron mass sufficiently to lower GFR. When renal function is decreased below normal for age, one must conclude that maximal functional compensation has taken place already in kidneys that are small or scarred.

A radionuclide study that reports an allocation of the percent of isotope excreted by right and left kidneys cannot be used to interpret overall renal function. Total GFR should be corrected to 1.73 m^2 body surface area and calculated by timed urine collection and clearance methodology, from serum creatinine and height (Schwartz formula) or from another radionuclide study that measures and reports actual GFR as well as split functions. No decision to remove a kidney or surgically correct VUR can be made on the basis of split functions alone. When a patient has bilateral renal scarring, every functioning nephron should be conserved because each contributes to overall renal function.

Health outcomes

Urinary tract infection

Most infants and children with VUR present with UTI, usually acute pyelonephritis with the attendant risk of renal parenchymal injury (Weiss, Tamminen-Mobius, Koskimies, et al., 1992). The relationship between renal injury (presumably pyelonephritic scarring) and UTI complicated by acute pyelonephritis has been examined (Martinell, Claesson, Lidin-Janson, et al., 1995). UTIs were characterized retrospectively by conventional criteria (e.g., fever) as either acute pyelonephritis, cystitis or unspecified. Of the 45 patients with renal scarring, 33 (73 percent) had acute pyelonephritis as their first UTI, compared with 18/42 (43 percent) who did not have renal scarring ($p < .001$).

Pyelonephritis can result in destruction of one or more lobes of the kidney with replacement of normal kidney by fibrotic tissue (renal scarring). In addition to short-term morbidity, the long-term consequences of renal scarring include hypertension and functional impairment, both most frequently seen after loss of critical mass of kidney tissue. Thus, prevention of UTI, and particularly acute pyelonephritis, is an important goal in the management of infants and children with VUR.

UTI may occur following diagnosis of reflux and initiation of therapy. If it occurs in a child receiving antibiotic prophylaxis, the infection may occur because of antibiotic resistance to the prophylactic antibiotic (in which case the organism is resistant to the antimicrobial) or because of non-compliance with therapy (in which case the organism is usually sensitive to the antimicrobial). Children who have undergone successful surgical therapy often do not continue to receive antibiotic prophylaxis after the imaging studies demonstrating reflux resolution have been performed. In these children, development of UTI is independent of the previous structural abnormality and secondary to host uroepithelial adherence characteristics and bacterial virulence factors.

The panel reviewed 41 articles that reported the incidence of UTI (as defined by bacteriuria, regardless of clinical symptoms) in children with VUR treated either with antibiotic prophylaxis or reimplantation surgery. The International Reflux Study in Children randomized infants and children with Grades III and IV VUR to either medical or surgical management. In the European branch of the study (Jodal, Koskimies, Hanson, et al., 1992), 59

of 151 surgical patients (39.1 percent) had at least 1 UTI during the 5-year follow-up (0.65 per 100 patient-months), compared with 59 of 155 medical patients (38.1 percent) (0.63 per 100 patient-months). In the U.S. branch (Weiss, Duckett, and Spitzer, 1992), 21 of 64 surgical patients (32.8 percent) (1.8 per 100 patient-months) compared with 20 of 68 medical patients (29.4 percent) (2.3 per 100 patient-months) had at least 1 UTI during the 5-year follow-up. There was no significant difference in UTI rate between medical and surgical treatment either in the European or the U.S. data. The incidence of UTI in a third uncontrolled, but matched (n = 40 each) study was 2.81 per 100 patient-months following surgery and 3.34 per 100 patient-months with medical management with a comparable duration of follow-up (Elo, Tallgren, Alfthan, et al., 1983). Combining data from all 3 studies yields a relative risk of 0.97 (95% CI 0.79–1.19), indicating almost no difference between the 2 treatments with respect to the risk of bacteriuria. In support of this observation, another study (Beetz, Schulte-Wissermann, Tröger, et al., 1989) reported an incidence of UTI after surgery alone that was comparable to the surgical arms of the 2 randomized controlled trials, and a study of UTI with antibiotic prophylaxis alone (Hanson, Hansson, and Jodal, 1989) reported rates comparable to those in the medical arms of the 2 randomized controlled trials.

Because the risk of renal injury is related to acute pyelonephritis rather than to UTI in general, incidence rates of acute pyelonephritis were compared in both the European and U.S. branches of the International Reflux Study in Children. In the European branch (Jodal, Koskimies, Hanson, et al., 1992), acute pyelonephritis was observed in 15 of 151 surgical patients (9.3 percent) (0.17 per 100 patient-months) compared with 33 of 155 medical patients (21.3 percent) (0.35 per 100 patient-months) (p = 0.03). In the U.S. branch (Weiss, Duckett, and Spitzer, 1992), 5 of 64 surgical patients (7.8 percent) (0.3 per 100 patient-months) compared with 15 of 68 medical patients (22.1 percent) (0.7 per 100 patient-months) had at least 1 episode of acute pyelonephritis (p = 0.085). In the nonrandomized and uncontrolled, but matched study (Elo, Tallgren, Alfthan, et al., 1983), 72.5 percent medical patients compared with 22.5 percent surgical patients (1.41 per 100 patient-months medical and 0.44 per 100 patient-months surgical) had acute pyelonephritis. Combining the data from the 3 studies, the relative risk of acute pyelonephritis with surgical treatment is 0.39 (95% CI 0.26–0.58) compared with medical treatment (Figure 6). An additional uncontrolled and unmatched study examined the incidence of acute pyelonephritis with either surgery or medical therapy (Amar, Singer, and Chabra, 1976). Follow-up varied from 1–14 years. Acute pyelonephritis was reported in

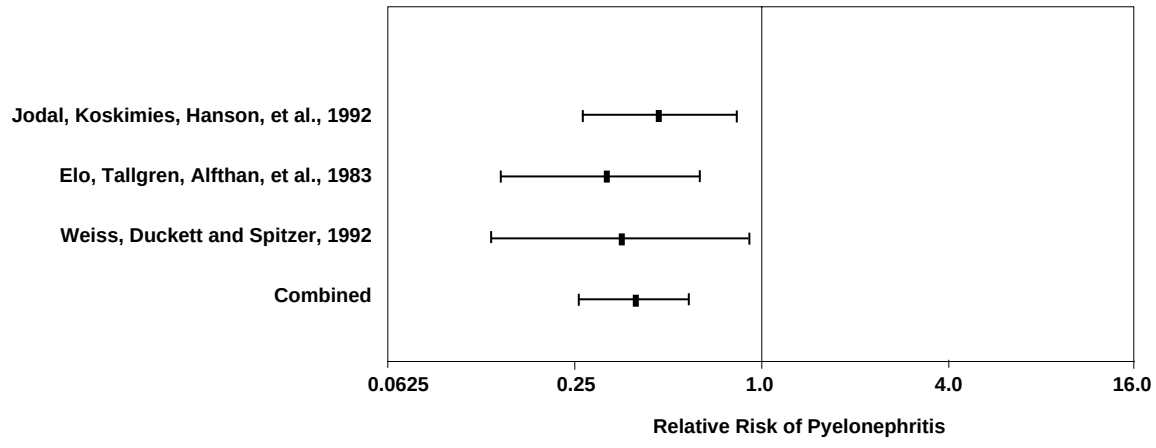

Figure 6. Relative risk of pyelonephritis for surgery compared with antibiotic treatment

Analysis of the risk of acute pyelonephritis after surgery compared to that after medical treatment showed the combined relative risk significantly favored surgical treatment. The combined relative risk of acute pyelonephritis with surgical treatment is 0.39 (95% CI 0.26–0.58) compared with medical treatment.

none of 111 surgical patients compared with 5 of 99 medical patients. In a study of surgical patients only (Willscher, Bauer, Zammuto, et al., 1976), 223 children were followed postoperatively for 0.5–7 years. Three of 175 girls (1.7 percent) had acute pyelonephritis. In a study of medical patients only (Hanson, Hansson, and Jodal, 1989), 12 of 44 (27.3 percent) girls who were treated for 860 months developed acute pyelonephritis (1.44 per 100 patient-months).

In summary, of the few studies that were adequate for analysis, the overall incidence of UTI in patients with VUR was not significantly different in patients treated with antibiotic prophylaxis (medical management) or ureteral reimplantation (surgical management). The incidence of acute pyelonephritis was significantly greater with medical management. Despite the risk of renal parenchymal injury from acute pyelonephritis and its potential for healing with scarring, the incidence of scarring was no greater in medical than in surgical patients (Jodal, Koskimies, Hanson, et al., 1992; Weiss, Duckett, and Spitzer, 1992). The factors that may account for the surprising lack of an association between new or progressive renal scarring and pyelonephritis in the literature are discussed on pages 33–34.

Hypertension

Reflux nephropathy is considered one of the most common causes of severe hypertension in children, when it is examined in a retrospective fashion (i.e., of those who present with severe hypertension, reflux nephropathy is a frequent diagnosis). The panel reviewed 10 studies that reported blood pressure (BP) measurements after reimplantation surgery. Only 2 characterized the patient population sufficiently to provide meaningful analysis. Wallace, Rothwell, and Williams (1978) reported longer than 10-year follow-up of 166 children with VUR treated surgically. Of 158 preoperative BP measurements that were compared with the American Academy of Pediatrics 1977 BP norms, 24 (15.2 percent) had BP higher than the 95th percentile for age and sex (either systolic, diastolic, or both.) Hypertension was defined as a BP of ‡140/90 in their follow-up, because all 141 subjects were older than 14 years of age. Eighteen (12.8 percent) were hypertensive. Of these, 7 had preoperative bilateral renal scarring (of 38 with this finding on IVU) and 7 had preoperative unilateral renal scarring (of 62 with this finding on IVU). In Beetz' series (Beetz, Schulte-Wissermann, Tröger, et al., 1989), 189 children were evaluated at least 5 years after successful VUR surgery. Ten patients (5.3 percent), all of whom were older than age 14, were found to be hypertensive (BP > 140/90). Of 61 patients with renal scarring (all preoperative), 7 (11.5 percent) were hypertensive at the time of follow-up compared with 3 of 128 patients (2 percent) of those without scarring. Preoperative BP levels were not reported.

Lenaghan, Whitaker, Jensen, et al. (1976) reported hypertension (defined as >140/90) in 10 of 102 children (9.8 percent) treated nonsurgically, who were followed-up for 5–18 years. Patients with scarred kidneys were not distinguished from those without scarring.

Thus, no statistically significant difference was found in the risk of hypertension related to treatment modality (medical or surgical). These studies indicated that renal scarring increases the relative risk of hypertension to 2.92 (95% CI 1.2–7.1), compared with the risk in patients without renal scarring.

Numerous medications are used to treat hypertension in children and adults with renal scarring. Angiotensin-converting enzyme inhibitors, which may be used for treatment of those with renin-mediated hypertension, may be associated with some side effects (Kim and Swartz, 1993). In addition, use of these drugs during pregnancy may cause oligohydramnios and irreversible neonatal renal failure (Rosa, Bosco, Graham, et al., 1989).

Uremia

Since 1987, the North American Pediatric Renal Transplant Cooperative Study has registered virtually all children with end-stage renal disease (ESRD), defined as a GFR so low that only kidney dialysis or transplantation will sustain life. Although overlap of diagnostic categories (e.g., hypoplasia, dysplasia, obstructive uropathy) is likely, VUR was the primary diagnosis in 3.1 percent of this population (Avner, Chavers, Sullivan, et al., 1995). Those with VUR who develop ESRD typically have been those who present with reduced GFR and bilaterally small, scarred kidneys. It is thought that independent of further pyelonephritic injury, these patients have sustained the loss of a critical mass of renal tissue, such that progressive loss of function due to glomerulosclerosis is mediated by maladaptive hemodynamic events (Neuringer and Brenner, 1993).

Although UTI is the most frequent presentation of VUR, it is less commonly the presentation of those patients with impaired GFR, virtually all of

whom have bilateral extensive renal scarring on the initial kidney imaging study. Also, antenatal detection of bilateral hydronephrosis has identified a population of neonates with severe bilateral VUR and impaired GFR before any UTI has occurred. How many patients develop uremia from congenital reflux nephropathy (or dysplasia associated with VUR), rather than after acquired reflux nephropathy from 1 or more pyelonephritic events, remains unknown. Thus, it would not be possible to demonstrate that even optimal treatment of VUR and UTI can prevent progressive renal failure and, ultimately, uremia, once bilateral reflux nephropathy has been diagnosed.

Somatic growth

Two studies mentioned somatic growth associated with nonsurgical VUR treatment and follow-up (Pinter, Jaszai, and Dober, 1988; Smellie, Preece, and Paton, 1983). Neither study substantiated an effect of VUR treatment on somatic growth.

Morbidity during pregnancy

Because of the known association between bacteriuria and adverse outcomes in pregnancy, there is a common perception that the increased risks of pyelonephritis and renal scarring in patients with vesicoureteral reflux may potentially result in increased morbidity during pregnancy in women who have persistent reflux. The panel did not undertake an extensive literature search of references pertaining to the association between reflux and adverse outcomes of pregnancy. However, based on a more selective review, what follows is the panel's current understanding of this association.

One of the potential late complications of VUR and/or pyelonephritic scarring in females is maternal and fetal morbidity. Maternal problems include pyelonephritis, septicemia, renal scarring, hypertension, toxemia, and reduction in renal function, which in some women progresses to ESRD. Fetal complications include preterm delivery, low birth weight, and fetal loss.

On the basis of a retrospective review of 26 studies that included a total of 82,364 pregnancies, approximately 4–7 percent of pregnant women have asymptomatic bacteriuria (Sweet, 1977). If asymptomatic bacteriuria is not treated, pyelonephritis is common. From a combination of 18 studies of pregnant bacteriuric women who were not treated with antibiotics, 28 percent of 1,699 women developed pyelonephritis (Sweet, 1977). Kass (1960) observed a 42-percent incidence of pyelonephritis in 48 patients when asymptomatic bacteriuria in pregnancy was not treated. When bacteriuria was eliminated, pyelonephritis did not occur (Kass, 1960). Women with a history of UTI in childhood appear to have a higher risk of asymptomatic bacteriuria. Martinell, Jodal, and Lidin-Janson (1990) and Sacks, Roberts, Verrier Jones, et al. (1987) found an incidence of 37 percent (24/65 pregnancies) and 50 percent (24/48 pregnancies), respectively. If renal scarring was present, the risk increased to 47 percent (9/19) (Martinell, Jodal, and Lidin-Janson, 1990) and 60 percent (9/15) (Sacks, Roberts, Verrier-Jones, et al., 1987).

Pregnant women with pyelonephritic renal scarring appear to be at higher risk for pyelonephritis than those without renal scarring. In a study of 41 pregnant women with a history of childhood UTI, Martinell, Jodal, and Lidin-Janson (1990) reported an incidence of 21 percent (4/19) in those with scarring compared with 5 percent (1/22) in those without renal scarring. Jacobson (1991) reported that 3 of 30 pregnant women with renal scarring developed pyelonephritis.

The relationship between asymptomatic bacteriuria and maternal/fetal complications is controversial. A meta-analysis of 17 cohort studies including 23,298 patients showed that in women with asymptomatic bacteriuria, the risk of preterm delivery was 2 times higher and the risk of having a low-birthweight baby was 1.5 times higher compared with women without bacteriuria (Romero, Oyarzun, Mazor, et al., 1989). Kincaid-Smith and Bullen (1965) demonstrated that women with bacteriuria at their first prenatal visit had a 2.9 times higher risk of fetal loss during the second and third trimesters, the risk of preterm delivery was 2.7 times higher and the risk of pre-eclampsia was 1.8 times higher than that in women without bacteriuria. Many of these women also had underlying renal scarring. Schieve, Handler, Hershow, et al. (1994) reported on the effects of pyelonephritis during pregnancy on maternal and fetal outcome. Of the 25,476 mother/infant pairs studied, 7.7 percent had a documented UTI. In those with pyelonephritis, the risk of perinatal death was 2.6 times higher and the risk of preterm delivery or low birth weight was 2.5 times higher than in those without UTI.

In women with reflux nephropathy and reduced renal function, the risk of complications is considerable. In addition to pyelonephritis, potential problems include further reduction in GFR, toxemia, preterm delivery, and fetal loss (see Table 9 on page 40). Women with renal scarring and chronic

Table 9. Maternal and fetal complications in patients with moderate or severe renal insufficiency

Study	Further decrease in renal function	Toxemia	Preterm delivery	Fetal growth retardation	Fetal loss
Kincaid-Smith and Fairley, 1987					
95 women - 227 pregnancies, normal renal function	2%	13%	—	—	9%
42 women - 118 pregnancies, SCr > 1.25 mg%	8%	36%	—	—	24%
Becker, Ihle, Fairley, et al., 1986					
20 women, SCr 2.3–4.5 mg%, including:					
6 women preg. duration >12 wk.	100%1	—	—	—	—
14 women preg. duration <12 wk	29%2	—	—	—	—
Cunningham, Cox, Harstad, et al., 1990					
37 women, SCr 1.4–9.4 mg%	16%3, 4	60%	40%	—	—
+ chronic htn	24%	80%	57%	38%	54%
+ toxemia, including:	—	—	53%	—	—
26 women, SCr 1.4–2.5 mg% (ave. 1.7)	19%	—	30%	35%	8%
+ chronic htn	29%	79%	43%	36%	—
11 women, SCr >2.6 mg% (ave. 4.8)	9%		86%	43%	18%
+ chronic htn	14%	86%	86%	43%	—
Jungers, Houillier, Forget, et al., 1991					
104 women with reflux nephropathy-254 pregnancies	—	—	—	—	13%
14 women, 19 pregnancies, SCr >1.5 mg% at conception	—	—	—	—	63%
+ htn	—	—	—	—	75%
14 women, SCr 2–5.5 mg% at conception	36%5	—	—	—	—
Jones and Hayslett, 1996					
67 women - 82 pregnancies, SCr‡1.4 mg%	43%6	—	59%	37%	7%
67 pregnancies, SCr 1.4–2.4 mg%	—	—	55%	31%	9%
15 pregnancies, SCr ‡2.5 mg%	—	—	73%	57%	0%

[1] Rapid deterioration in renal function in all 6 women; 4 progressed to ESRD within 2 years post delivery.
[2] Four with uncontrolled hypertension had rapid deterioration in renal function with progression to ESRD; 10 had slow deterioration in renal function over 7 years but not to ESRD.
[3] Renal deterioration defined by an increase in SCr of 50% during pregnancy.
[4] Of 7 patients without deterioration of renal function during pregnancy, 6 later had deterioration of renal function and 4 required dialysis within a mean interval of 39 months.
[5] Five of 14 patients had accelerated deterioration of renal function with progression to ESRD in 6 months to 4 years.
[6] During pregnancy and up to 6 weeks postpartum; 31% after 6 months postpartum.

hypertension who are receiving angio-tensin-converting enzyme inhibitor therapy (captopril, enalapril) are at particular risk for oligohydramnios and neonatal renal failure, which may be irreversible (Rosa, Bosco, Graham, et al., 1989). This class of drugs, which often is extremely effective, should not be used during pregnancy (Cunningham and Lindheimer, 1992).

The morbidity of persistent reflux during pregnancy has not been studied extensively. Williams, Davies, Evans, et al. (1968) found that 21 percent of women with asymptomatic bacteriuria during pregnancy had reflux on VCUG performed 6 months postpartum, compared with 1.7 percent in a randomly selected group of women examined immediately postpartum (Heidrick, Mattingly, and Amberg, 1967). Martinell, Jodal, and Lidin-Janson (1990) reported that pyelonephritis occurred during pregnancy in 3 of 8 women with reflux, but only 2 of 33 in those without reflux. In the 8 patients with reflux, pyelonephritis occurred in 3 of 9 of pregnancies managed with continuous antibiotic prophylaxis and 2 of 4 managed without prophylaxis.

In this series, reflux generally was Grade I or II. Heidrick, Mattingly, and Amberg (1967) reported that 3 of 9 women with reflux developed pyelonephritis during pregnancy compared with 15 of 312 women without reflux. Although the data suggest a greater risk of morbidity from pyelonephritis in women who have persistent reflux during pregnancy, the sample size is small and only limited conclusions can be made on the basis of this evidence.

Few studies have focused on the outcomes of pregnancies of women with surgically treated reflux. Fryczkowski, Maruszewska, Paradysz, et al. (1991) reported that in 59 pregnancies in 34 women who had undergone antireflux surgery in childhood, 65 percent (22/34) had a UTI during pregnancy, but the incidence of pyelonephritis was not reported. Mansfield, Snow, Cartwright, et al. (1995) studied 62 women who underwent antireflux surgery as children and compared them with 21 women with uncorrected childhood reflux who had not had radiologic follow-up and whose reflux status was unknown. In the surgically treated group, 40 percent (57/141) of pregnancies were complicated by a UTI (18 percent pyelonephritis; 22 percent cystitis). In the uncorrected group, 1.3 percent (1/75) had pyelonephritis and 13.3 percent (10/75) had cystitis. The 2.5 times higher incidence of UTIs demonstrated in the surgically treated group has not yet been explained adequately but may be related to host factors that subject them to a higher inherent risk of UTI. In this retrospective study, no data were presented concerning the initial presentations, voiding dysfunction, indications for patient selection for surgery, or extent of renal scarring. Antibiotic prophylaxis during pregnancy was inconsistently prescribed. There was no significant difference in the rate of fetal loss in the 2 groups. Although these studies indicate that UTIs are common during pregnancy in patients who have undergone antireflux surgery, data are not presented on the effect of antireflux surgery on subsequent pyelonephritis.

Death

Death can be attributed to VUR only indirectly. Unrecognized or inadequately treated UTI may result in urosepsis and death, which occurred frequently in the pre-antibiotic era. Moreover, death could occur as a complication of anesthesia or surgery performed to correct VUR. In a patient with renal scarring who develops hypertension which, after a period of being asymptomatic, may result in heart failure or encephalopathy, death could result if treatment were unsuccessful. Women with bilateral renal scarring, even those with no previous symptoms, may exhibit acute deterioration of renal function during pregnancy and require aggressive treatment to prevent death; some of these women regain renal function after delivery, while others do not (Jacobson, Eklof, Eriksson, et al., 1989). Progressive deterioration of renal function over many years in patients with severe bilateral renal scarring is a major cause of ESRD in patients younger than 30 years of age (Arant, 1991; Pistor, Scharer, Olbing, et al., 1985; Salvatierra, Kountz, and Belzer, 1973; Mathew, 1987). The average mortality rate for patients on chronic dialysis in the United States is about 25 percent each year (Bloembergen, Port, Mauger, et al., 1994). Others die as a complication of renal transplantation. While none of these causes of death is the immediate consequence of untreated VUR, the possibility of an association cannot be ignored.

Harms of medical treatment

Adverse drug reactions

Antibiotic prophylaxis. One of the mainstays of the medical management of VUR is antimicrobial prophylaxis. The usual medications administered are trimethoprim/sulfamethoxazole, trimethoprim alone, and nitrofurantoin. The dose prescribed for prophylaxis typically is one-fourth to one-third of the dose recommended for full therapy. The incidence of drug-related adverse effects is lower with reduced dosages. Most reports describing adverse drug reactions pertain to adult patients taking the full dosage of the medication (Lawson and Paice, 1982).

Potential adverse reactions to antimicrobial prophylaxis include minor effects such as nausea, vomiting, abdominal pain, and bad taste in the mouth, as well as more serious side effects (Table 10 on page 42). Very few studies dealing with the medical management of reflux have reported minor effects. Determining whether abdominal complaints are related to medication or some other factor is often difficult. Underreported side effects may contribute to the lack of compliance with medication in some cases, and the need to change antibiotic prophylaxis because of side effects is also probably underreported. Bacterial resistance to antibiotic prophylaxis may also occur and is discussed in the section on UTI (page 36).

Reported side effects of trimethoprim/sufamethoxazole prophylaxis are uncommon. Uhari, Nuutinen,

Table 10. Adverse effects of antimicrobials commonly prescribed for antibiotic prophylaxis in children

Antibiotic	Adverse reactions
Cotrimoxazole	Skin rash/urticaria, nausea, vomiting, anorexia, dental caries (1–4%)
	Rare (<0.1%): serious dermatologic, hematologic, cardiovascular, central nervous system, endocrine, renal, hepatic effects
Trimethoprim	Skin rash/urticaria, nausea, vomiting, anorexia (2.5–7%)
	Rare (<0.1%): serious dermatologic, hematologic, cardiovascular, central nervous system, endocrine, renal, hepatic effects
Nitrofurantoin	Nausea, vomiting, abdominal pain 34% (less with macrocrystals) Headache, dizziness (less with macrocrystals); skin rash/urticaria
	Rare (<0.1%): hematologic, cardiovascular, central nervous system, gastrointestinal, hepatic, respiratory, dermatologic effects

Source: Computerized Clinical Information System, March 1996 (Micromedex, Inc., Denver CO); American Hospital Formulary Service Drug Information, 1995.

and Turtinen (1996) reported that medication was changed because of adverse effects in 15 percent of children receiving sulfonamides and 8 percent receiving trimethoprim. The most common adverse effect is allergic skin reaction, usually from the sulfa, and accounts for 90 percent of nonfatal drug reactions (Lawson and Paice, 1982). Uhari, et al. (1996) reported that 4.5 percent of children receiving prophylaxis developed urticaria, with an incidence of 7.4 events per 100 years at risk. Allergic skin reaction may occur after several weeks or months of therapy, but anaphylaxis is rare. Although neutropenia, thrombocytopenia and/or eosinophilia occur in 12–34 percent of children taking full-dose trimethoprim/sulfamethoxazole for only 10 days (Asmar, Maqbool, and Dajani, 1981), the incidence of these side effects in children receiving prophylactic dosages for periods as long as 1 year ranged from 0 percent (Smellie, Gruneberg, Normand, et al., 1982; Uhari, Nuutinen, and Turtinen, 1996) to 41 percent (Holland, Kazee, Duff, et al., 1982). In the latter study, in children with a white blood count (WBC) less than 5000/mm3, the WBC level normalized by the following visit in all cases. Another potential problem is dental caries related to the fructose in the liquid preparation, but this can be prevented by having the children brush their teeth after taking the drug. Other side effects include nausea, vomiting, abdominal pain, hepatotoxicity, and significant hypersensitivity reaction, but these effects have been reported only anecdotally in children. Although sulfamethoxazole and trimethoprim compete for sequential sites in the metabolic pathway of bacterial folic acid synthesis, children receiving prophylaxis have not developed folic acid deficiency. Trimethoprim/sulfamethoxazole is the most common drug associated with reactions requiring hospital admission, although the drug accounted for only 0.07 percent of hospital admissions (Mitchell, Lacouture, Sheehan, et al., 1988).

Trimethoprim alone has been reported to cause side effects in as many as 27 percent of patients (Brendstrup, Hjelt, Petersen, et al., 1990). Reported side effects included nausea, vomiting, or abdominal pain in 14 percent of patients, bad taste in the mouth in 6 percent, and headache, dizziness, dermatitis and pruritus in 8 percent. Of children receiving trimethoprim prophylaxis, 8 percent changed the drug because of side effects (Uhari, Nuutinen, and Turtinen, 1996). Hematologic and allergic reactions are uncommon (Smellie, Gruneberg, Normand, et al., 1982).

The incidence of side effects associated with nitrofurantoin depends on the drug preparation. Nitrofurantoin suspension is tolerated poorly, and as many as 55 percent of children taking this medication experience a side effect, including nausea, vomiting, or abdominal pain in 34 percent, bad taste in the mouth in 27 percent, and headache, dizziness, dermatitis, pruritus or fever in 12 percent; 30 percent changed the medication because of side effects (Brendstrup, Hjelt, Petersen, et al., 1990). Many of these effects may be eliminated by administering nitrofurantoin macrocrystals. The capsule may be opened and placed in the children's

food if they are unable to swallow the capsules. One group of children using the macrocrystals experienced no adverse effects (Lohr, Nunley, Howards, et al., 1977). Hematologic side effects are infrequent (Holland, Kazee, Duff, et al, 1982). More serious adverse reactions are extremely rare, with 1 study documenting only 40 reports out of 8.6 million uses (Coraggio, Gross, and Roscelli, 1989). Approximately 32 percent of children younger than age 2 years and 10 percent older than 2 years of age taking nitrofurantoin prophylaxis changed therapy because of adverse reactions (Uhari, Nuutinen, and Turtinen, 1996). In that study, it was not indicated whether children were receiving the suspension or macrocrystal preparation.

Anticholinergics. In children with bladder instability and VUR, anticholinergic therapy and timed voiding are often recommended in addition to antibiotic prophylaxis. Although several reports describe the frequency of reflux resolution in these patients, few descriptions of the adverse effects of anticholinergic medications are available. One reason for this lack of information may be that the dosage of anticholinergic medication is usually titrated to the lowest effective dose in each child, providing the maximum therapeutic effect in reducing bladder instability while minimizing the side effects. Facial flushing can be brought on more easily in warm or hot temperatures; thus, a lower dose may be necessary in summer or warm climates. A dry mouth is common. This side effect may be particularly bothersome to some children, yet have minimal effect on others. Table 11 lists possible adverse effects of the most commonly prescribed anticholinergic medications.

Hospitalization of patients receiving medical treatment

Many studies reported occurrences of UTI in children with reflux who received medical therapy, and some distinguished between episodes of clinical pyelonephritis and cystitis (Cardiff-Oxford Bacteriuria Study Group, 1978; Hanson, Hansson, and Jodal, 1989; Weiss, Duckett, and Spitzer, 1992). However, none of the studies reported on the proportion of children experiencing clinical pyelo-nephritis who required hospitalization.

Children with clinical pyelonephritis often have fever, and flank or abdominal pain, and may experience nausea, vomiting, and diarrhea. Decisions about whether to admit a child to the hospital for intravenous antibiotic therapy and rehydration vary, and may depend on duration and severity of symptoms, hydration status, sensitivity pattern of the bacterial strain and the child's age. If a child is hospitalized for pyelonephritis, in 1992 the mean length of stay was 4.1 days (U.S. Department of Health and Human Services, 1993).

Harms of surgery

Ureteral obstruction is a recognized complication following ureteral reimplantation. The other harms of surgical treatment of VUR occur less frequently. Many reports do not describe harms explicitly. Others indicate isolated events within the series, and these reports were used to review the types and approximate frequencies of surgical complications of antireflux surgery. The panel recognizes, however, that due to underreporting, the absence of reported complications in many studies may be misleading and that the actual complication rates may exceed reported values.

Table 11. Adverse effects of anticholinergic medications most commonly prescribed for bladder instability in children

Antibiotic	Adverse reactions
Oxybutynin chloride	Xerostomia (usually dose related) 40–45% vasodilation, facial flushing, mydriasis, decreased sweating, tachycardia, blurred vision, drowsiness, constipation (5–30%)
	Rare (< 0.1%): urinary retention, urticaria, hallucinations
Hyoscyamine	Xerostomia, decreased sweating, mydriasis, drowsiness, restlessness, blurred vision, tachycardia (5–30%)
	Rare (< 0.1%): Central nervous system effects, urinary retention, urticaria, speech disturbances
Propantheline	Xerostomia, constipation, cycloplegia (5–30%)
	Rare (<0.1%): Central nervous system, cardiovascular, endocrine, renal effects

Source: Computerized Clinical Information System, March 1996 (Micromedex, Inc., Denver, CO); American Hospital Formulary Service Drug Information, 1995.

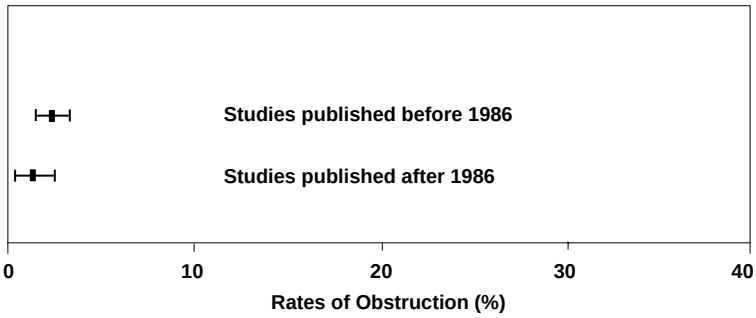

Figure 7. Combined rates of obstruction after surgery

Analysis of 33 studies showed that the rate of obstruction after ureteral reimplantation for VUR was 2 percent in studies after 1986 compared to a rate of approximately 4 percent in studies before 1986.

Obstruction

Thirty-three studies provided rates of obstruction after ureteral reimplantation for VUR (Table E–4, Appendix E). Figure 7 (page 44) shows the rate of obstruction in studies before and after 1986. All studies used either renal ultrasonography or intravenous pyelography to detect hydronephrosis indicative of obstruction. The likelihood of obstruction in the 33 series ranged from 0–9.1 percent, with a combined rate of 2 percent after 1986 (95% CI 1–4). The rate of obstruction was similar for different types of repair. Fourteen studies provided data regarding reoperation for obstruction (Table E-5, Appendix E). The reoperation rate ranged from 0.3–9.1 percent, with an overall incidence of 2 percent. On the basis of these studies, nearly every case of obstruction leads to reoperation so that the best estimate of obstruction is probably the proportion of patients requiring reoperation (2 percent).

Obstruction following endoscopic treatment of reflux. Fifteen series provided detailed information about postoperative ureteral obstruction following the subureteric injection technique as described by O'Donnell and Puri (1984) (Farkas, Moriel, and Lupa, 1990; Sauvage, Saussine, Laustriat, Becmeur, et al., 1990; Dodat and Takvorian, 1990; Puri, 1990; King and Gollow, 1988; Schulman, Pamart, Hall, et al., 1990; Sweeney and Thomas, 1987; Dewan and O'Donnell, 1991; Kaminetsky and Hanna, 1991; Davies and Atwell, 1991; Leonard, Canning, Peters, et al., 1991; Bhatti, Khattak, and Boston, 1993; Frey, Berger, Jenny, et al., 1992; Dewan and Guiney, 1992; Lipsky and Wurnschimmel, 1993). Using renal ultrasound or excretory urography, the incidence of transient dilation was reported in 2 series at 17 and 23 percent (Sweeney and Thomas, 1987; Bhatti, Khattak, and Boston, 1993). The 15 series included a total of 1,741 refluxing ureters treated using either Teflon™ (1,437 ureters) or collagen (304 ureters) as the injected substance. Seven (0.40 percent) persistent obstructions were reported, requiring ureteral reimplantation in 5, ureteral catheter drainage (5 days) in 1, and an unknown treatment in 1 (Dodat and Takvorian, 1990; Puri, 1990; Schulman, Pamart, Hall, et al., 1990; Sweeney and Thomas, 1987; Dewan and O'Donnell, 1991). All persistent obstructions reported occurred in patients with reflux who were treated with Teflon™. The amount of experience with the technique that the centers had gained when the obstructions occurred was not reported. In 10 of the 15 centers, persistent obstructions were not reported.

Bleeding

Although hematoma was reported in only 2 of 771 patients (0.26 percent) undergoing Politano-Leadbetter or Cohen transtrigonal ureteral reimplantation (Brandell and Brock, 1993; Ehrlich, 1985; Ehrlich, 1985; Broaddus, Zickerman, Morrisseau, et al., 1978; Price, Johnson, and Marshall, 1970; Garrett and Switzer, 1966; So, Brock, and Kaplan, 1981; Jonas, Many, Boichis, et al., 1974; Pypno, 1987; Ahmed and Tan, 1982), it occurred in 15 of 1,257 patients (1.2 percent) who received surgery using the Lich-Gregoir method (Arap, Abrao, and Menezes-de-Goes, 1981; Zaontz, Maizels, Sugar, et al., 1987; Funke, Chiari, and Planz, 1980; Marberger, Altwein, Straub, et al., 1978; McDuffie, Litin, and Blundon, 1977; Hampel, Richter-Levin, and Gersh, 1977; Hohenfellner, 1971; Houle, McLorie, Heritz, et al., 1992;

Wacksman, Gilbert, and Sheldon, 1992). In 1 study of the Lich-Gregoir technique, hematoma was reported in 13 of 371 patients (3.5 percent) (Marberger, Altwein, Straub, et al., 1978). Although bleeding from the bladder is thought to be less common after the Lich-Gregoir method than after the intravesical methods (Politano-Leadbetter, transtrigonal Cohen, or Glenn-Anderson advancement), specific data relating to this factor are not available.

Infection

Surgical wound infection following antireflux surgery was reported explicitly in only 2 cases (Garrett and Switzer, 1966). Other series did not report the occurrence or specific absence of this complication.

Bladder injury/voiding dysfunction

Several reports of temporary voiding dysfunction after extravesical ureteral surgery for reflux have been published. The incidence was as high as 15 percent in several series (Houle, McLorie, Heritz, et al., 1992; Wacksman, Gilbert, and Sheldon, 1992; Zaontz, Maizels, Sugar, et al., 1987). In most cases, the voiding dysfunction was associated with bilateral ureteral surgery and was self-limiting. However, intermittent catheterization, which may be problematic for families, was required during the period of voiding dysfunction. Late follow-up suggests that essentially all patients are likely to fully regain voiding efficiency (Fung, McLorie, Jain, et al., 1995). The overall incidence associated with the Lich-Gregoir method was 10 of 125 (8%), in contrast to no reported cases after intravesical techniques.

Contralateral reflux

The occurrence of contralateral reflux (CLR) after unilateral ureteral surgery has been reported in numerous series. It is important to determine not only the initial incidence (usually found at first postoperative cystography) but also the persistence of CLR over time. The presence of resolved VUR in the non-operated ureter has been thought to be a major risk factor for recurrence with contralateral operation, but evidence for this clinical impression is lacking. A recent report demonstrated this relationship in a small group of patients with unilateral antireflux surgery (Ross, 1995).

The incidence and persistence of contralateral reflux were estimated from reports that specifically indicated the occurrence of CLR, including some in which the incidence was zero. By definition this included only unilateral reimplantation or unilateral subureteric injection of Teflon™ in which a contralateral ureter was present. A total of 1,566 ureters were considered at risk, with an overall incidence of 142 reported new CLR (9.07 percent). Not all of these reports included adequate follow-up information, which was used to estimate persistence of the reflux. When specified, the type of surgical procedure was examined in terms of its effect on new CLR.

The rate of new CLR in studies reported before 1986 (13.4 percent) was higher than that reported after 1986 (4.7 percent). Although the reasons for this difference are unclear, an increase in the practice of contralateral reimplantation in case of any suspicion of prior reflux after 1986 and recognition of the influence of voiding dysfunction in reflux management in recent years may also have contributed to the difference. Reflux grade did not significantly affect the rate of contralateral reflux, although the rate was highest for Grade IV reflux at 3.7 percent compared with 1.5 percent for Grades I and II (Table 12). The surgical method of reimplantation did not influence the likelihood of new CLR. The rate of CLR after endoscopic treatment using Teflon™ was 2.9 percent and was not significantly different from that for other open surgical methods of correction.

Table 12. Estimated percentage chance of contralateral reflux for studies reported in 1987 or later (by grade and surgical method)

Factor	Estimate (95% confidence interval)
Grade	
Grade I/II	1.52% (0–5.49%)
Grade III	2.80% (0–12.73%)
Grade IV	3.66% (0–12.67%)
Grade V	2.53% (0–9.77%)
Surgical method	
Politano-Leadbetter	5.21% (1.29–10.31%)
Transtrigonal	1.90% (0.25–4.24%)
Lich-Gregoir	2.33% (0.26–5.39%)
Open surgery - other	5.07% (1.47–9.63%)
Teflon™	2.95% (0–10.58%)

Recent studies have offered some new insight. Ross, Kay, and Nasrallah (1995) reported a high incidence of CLR in ureters with previously demonstrated VUR. Diamond, Rabinowitz, Hoenig, et al. (1996) indicate that CLR is related to the grade of VUR rather than to the surgical technique.

Although uniform duration of follow-up is not available, the overall resolution rate of new CLR was 52.1 percent with 28.7 percent persisting at time of follow-up.

Follow-up was usually 1–2 years after surgical reimplantation; 13.8 percent of patients with new CLR underwent surgical correction at varying points of follow-up. Little follow-up data are available for patients reported after 1986. Clearly, an early decision to operate would mask possible spontaneous resolution.

Postoperative pain

No specific data are available regarding pain after surgical repair of VUR. Recent advances in pediatric pain management have altered the approach to pain management in children after major surgery. The increasingly widespread use of epidural analgesia and patient-controlled analgesia have markedly improved pain control after many surgical procedures (Cain, Husmann, McLaren, et al., 1995). Continuous epidural analgesia is particularly well suited to antireflux surgery because it reduces incisional pain as well as the intensity and frequency of bladder spasms, a common occurrence after reimplantation surgery. Urethral catheterization is necessary while the epidural catheter is in place. Although no objective data are available, these complications appear to be less severe after extravesical reimplantation, in part because of the usually shorter period of catheterization. Several studies have reported the use of intravesical repairs without postoperative catheter drainage (Brandell and Brock, 1993).

Hospitalization after antireflux surgery

The length of hospitalization in children undergoing open antireflux surgery was reported in 10 studies, with a total of 637 patients and 826 ureters (Table 13). The mean stay varied from 2.4 days (Zaontz, Maizels, Sugar, et al., 1987) to 13.9 days (Rezmi, Ozen, Erkan, et al., 1984). The length of stay appeared to vary with the surgical technique and whether postoperative ureteral stents were used.

Following extravesical forms of ureteroneocystostomy (e.g., detrusorrhaphy), Zaontz, Maizels, Sugar, et al. (1987) reported a mean length of stay of 2.4 days. Wacksman, Gilbert, and Sheldon (1992), reporting a similar surgical technique, had a longer hospital stay of 4.2–5.2 days. Patients undergoing intravesical techniques of antireflux surgery (Cohen, Leadbetter-Politano, Glenn-Anderson) had hospital stays averaging 2.7–10.6 days (Brock, 1983; Burbige, 1991; Fort, Selman, and Kropp, 1983).

Temporary ureteral stents generally are used after ureteroneocystostomy with tapering, a technique utilized in children with Grade V and some with Grade IV reflux. Some clinicians also use postoperative stents in lower grades of reflux to maintain the patency of the newly-created

Table 13. Mean and range of hospital stay for surgical therapy of vesicoureteral reflux

Study	Patients	Ureters	Reimplantation type1	Mean hospital stay (days)	Hospital stay range with/ without catheterization
Hampel, Richter-Levin, and Gersh, 1977	51	83	LG	4	Not stated
So, Brock, and Kaplan, 1981	52	87	GA, LP	5	3 to 9 days
Fort, Selman, and Kropp, 1983	63		GA, LP, Cohen, Hutch	10.6/9.3	6–12/3–16 days
Remzi, Ozen, Evkan, et al., 1984	89	143	LP	13.94	11.6/15.3 days[2]
Ehrlich, 1985	63	74	Kalicinski	6	Unstated
Pypno, 1987	43	80	Cohen	8.6	5–14 days
Zaontz, Maisels, Sugar, et al., 1987	79	120	Detruss.	2.4	1 to 6 days
Burbige, 1991	120	180	LP, Cohen	4.2/5.6	5–7/3–5 days
Wacksman, Gilbert, and Sheldon, 1992	132	211	Detruss.	4.2–5.2	Not stated
Brock, 1993	34	57	GA, LP, Cohen	5.4/2.7	4–8/2–4 days
Totals	637	826			

[1] GA=Glenn-Anderson; LP=Leadbetter-Politano.
[2] Remzi reports the average stay with a urethral catheter/suprapubic tube. His patients had no ureteral catheters.

ureterovesical junction. In general, patients with ureteral stents have had a longer length of stay (5.4–5.6 days) than nonstented patients (2.7–4.2 days) (Brock, 1993; Burbige, 1991).

Concerns regarding length of stay were not raised in the United States until relatively recently and now are emphasized because of the increasing cost of medical care in this country. In a review of 186 children undergoing ureteroneocystostomy from 1986 to 1994, McCool and Joseph (1995) found that the mean length of stay had decreased from 3.6–2.3 days. It is likely that average lengths of stay for children undergoing open antireflux surgery will continue to decrease.

Most endoscopic interventions for reflux are treated as outpatient procedures or require less than 24-hour in-hospital stays.

Adverse effects of surveillance testing

Risk of urinalysis

Routine urinalysis and urine cultures carry very little risk except skin sensitivity to cleansing agents. There is potential for misinterpretation of urinalysis and/or urine culture due to inappropriate collection and/or contamination that may result in erroneous diagnosis of UTI and therefore inappropriate therapeutic decisions.

Risk of radiologic evaluation

Surveillance evaluation using radiologic techniques represents a major component of follow-up in patients with reflux. Risks of surveillance for the various methods can be divided into risks related to physical manipulation in the performance of the test and risk from contrast or radiation.

Renal imaging

Harms from physical manipulation. All imaging techniques using contrast or radioactive tracer require administration via venipuncture, which may be stressful to infants and children and their parents to a variable degree. In addition, extravasation of the imaging agent into the soft tissues may cause inflammation, particularly with iodinated contrast, but this complication is uncommon. Ultrasonographic studies appear to have little significant impact on children, either from the direct manipulation or from the transmitted sound waves.

Risk of contrast. Adverse reactions to intravenous contrast media are uncommon in the pediatric population. Minor reactions with IVP (ionic contrast media) occur in 6 percent and include nausea, vomiting, urticaria, flushing, pruritus, and headache (Gooding, Berdon, Brodeur, et al., 1975). Major reactions, including cardiac arrest, pulmonary edema, apnea, seizures, bronchospasm,

Table 14. Radiation exposure in upper urinary tract imaging[1]

Study		Kidney	Bladder wall	Ovaries	Testes	Whole body	Typical dose
				Urography (rad/film)			
IVP[2]							
6 mo.	AP	—	—	0.0072	0.00092	0.2[3]	—
	Pelvis	—	—	0.024	0.023		—
4 yr.	AP	—	—	0.011	0.0012	0.3[3]	—
	Pelvis	—	—	0.033	0.055		
12 yr.	AP	—	—	0.035	0.0054	0.5[3]	—
	Pelvis	—	—	0.038	0.075		
				Scintigraphy (rad/mCi)			
Tc-99m-MAG-3 renogram		0.014	0.48	0.026	0.016	0.007	3.25 mCi
Tc-99m-DTPA renogram							
2 hr void		0.090	0.12	0.011	0.007	0.006	9.75 mCi
4 hr void		0.090	0.27	0.015	0.011		
Tc-99m-DMSA renal scan		0.850	0.07	0.014	0.006	0.016	3.25 mCi

[1] References: IVP—Kirks, 1991; MAG-3 and DTPA—Stabin, Taylor, Eshima, et al., 1992; MPI, 1985.
[2] Typical IVP is 2–3 films.
[3] 4 films.

Table 15. Radiation exposure in lower tract imaging (rad)[1]

Study	Kidney	Bladder wall	Ovaries	Testes	Whole body	Typical dose
VCUG[2]	—	—	0.208	—	—	—
VCUG (tailored; low-dose)[3]	—	—	0.029	—	—	—
Tc-99m cystography	<0.001	0.025	0.002	<0.001	<0.001	1 mCi

[1] References: Bisset, Strife, and Dunbar, 1987; Conway, King, Betman, et al., 1972; Kleinman, Diamond, Karellas, et al., 1994; Willi and Treves, 1983.
[2] Exposure variable and depends on fluoroscopy time and number of films taken; Bisset et al., 1987.
[3] Assuming digital fluoroscopic time over the bladder of 3 to 5 seconds; Kleinman et al., 1994.

laryngeal edema, and shock, are rare. In a large group of pediatric patients, the incidence of serious reactions to ionic contrast media was 0.5 percent, but there were no deaths (Gooding et al., 1975). The risk of adverse reaction with nonionic contrast media is significantly less (Bisset, Strife, and Kirks, 1991). There is no risk of allergy to agents used for scintigraphy.

Radiation exposure. The average radiation exposure in children undergoing upper urinary tract evaluation is shown in Table 14, page 47. The average annual radiation exposure in the environment is 0.250 rad (Mettler and Upton, 1995).

Cystography

Harms from physical manipulation and contrast. McAlister, Cacciarelli, and Shackelford (1974) describe atypical cases involving complications of cystography, and suggest ways of avoiding complications in clinical experience. Zerin and Shulkin (1992) studied 228 children who had voiding cystourethrograms or radionuclide cystograms and noted irritative voiding symptoms in 70 (35.1 percent). Three patients developed fever, and urine cultures were negative in all. Sixty-three of 228 patients received no postprocedural prophylaxis, and postcatheterization symptoms were only slightly higher (37 percent) compared with 34.5 percent in the nonantibiotic group. No significant difference in symptoms was reported between children having nuclear cystograms and those having contrast cystograms. There is a risk of inducing a UTI if the procedure is not performed using sterile technique. Individuals allergic to iodinated contrast do not develop an allergic reaction during VCUG.

The psychological consequences of cystographic studies have not been formally addressed, but anecdotal experience suggests that many children sustain varying degrees of psychological trauma from catheterization.

Radiation exposure. The average radiation exposure in children undergoing lower urinary tract studies is shown in Table 15.

Chapter 4: Treatment recommendations

Only a few recommendations can be derived purely from scientific evidence of a beneficial effect on health outcomes (as opposed to intermediate outcomes; see page 20). Evidence of the efficacy of medical management on health outcomes is available only for Grades I–IV reflux. Control data are lacking to compare outcomes for intermittent with those for continuous antibiotic therapy. Open surgical repair, although proven to cure reflux in 90–98 percent of patients, has not been demonstrated to improve health outcomes other than pyelo-nephritis; for this outcome, the evidence suggests that children with Grade III or IV reflux receiving continuous antibiotic prophylaxis are 2.5 times more likely to develop pyelonephritis than children who have undergone successful antireflux surgery. Accordingly, based on health outcomes data alone, health outcomes for medical and surgical treatment can be compared only for children with Grade III or IV reflux. Even for these patients, available outcomes data provide little information on whether the benefits of treatment exceed its potential risks, nor do they aid the clinician in selecting the most appropriate treatment options for initial therapy or for persistent reflux. Thus, evidence-based recommendations provide limited practical guidance for the clinician. The need for further outcomes research is addressed in Chapter 5.

The following more detailed recommendations, which generally lack empirical scientific support, reflect the clinical experience and opinion of the panel. The panel recognizes the limitations of relying on opinion as a basis for generating practice guidelines. This description of practice patterns is instead offered as an aid to clinicians interested in more detailed recommendations and in the perspective of pediatric urologists and nephrologists who specialize in reflux care. Full documentation of the panel's underlying rationale for the recommendations is provided: statements based on opinion are explicitly identified, and evidence-based recommendations are accompanied by appropriate references to outcomes analyses in Chapter 3 (see Rationale for recommendations, page 52).

As outlined in Chapter 2, the recommendations were derived from a survey of preferred treatment options for 36 clinical categories of children with reflux. The recommendations are based on the outcomes analysis presented in detail in Chapter 3 and on the clinical experience and opinion of the panel. Treatment options selected by 8 or 9 of the 9 panel members are classified as guidelines and given the strongest recommendation language. (The word "should" is used to indicate treatment options in this category; e.g., "Children with Grade V reflux should undergo surgical repair.") Treatment options that received 5 to 7 votes are designated as preferred options, and treatment options that received 3 to 4 votes are designated as reasonable alternatives. Treatments that received no more than 2 votes are designated as having no consensus and are not recommended.

Assumptions

The treatment modalities considered included (1) no treatment (including intermittent antibiotic therapy); (2) bladder training; (3) continuous antibiotic prophylaxis; (4) antibiotic prophylaxis and bladder training; (5) antibiotic therapy, bladder training and anticholinergics; (6) open surgical repair; and (7) endoscopic repair. These modalities are described in Chapter 1. The recommendations assume that the patient has uncomplicated reflux (e.g., no breakthrough UTI, voiding dysfunction, duplex systems, or other comorbid conditions); see Special considerations below regarding the care of patients with additional complications. The recommendations apply only to the scope of the topic of this report (see Chapter 2) and therefore do not address diagnosis of reflux, treatment of patients over age 10, management of reflux complicated by other factors (see Special considerations below) or surveillance testing.

Special considerations

The treatment recommendations apply only to patients with uncomplicated reflux. More aggressive treatment interventions may be indicated for children with breakthrough UTI or other medical

complications, such as renal insufficiency, new or progressive scarring, obstructive congenital anomalies of the upper urinary tract (e.g., ureteropelvic junction), solitary kidney, intrarenal reflux, secondary reflux (e.g., neuropathic or iatrogenic reflux, reflux associated with structural urologic anomalies such as ureterocele, ectopic ureter, posterior urethral valves, prune-belly syndrome, or exstrophy), or other medical comorbid conditions. There is limited direct evidence that duplication anomalies increase the risk of developing persistent reflux; surgical cure rates appear to be comparable with duplex and single systems (see Chapter 3, page 26). Treatment options may be countermanded by such factors as antibiotic allergies, intolerance or noncompliance, limitations in surgical skills and inadequate hospital facilities. Finally, the intensity of treatment may need to be modified depending on the nature of the doctor-parent-patient relationship and to accommodate such factors as limited access to care and personal preference.

An important variable in the scope of treatment is the presence of concurrent voiding dysfunction, a common occurrence among children with reflux. Because resolution of voiding dysfunction may be accompanied by resolution or diminution of reflux, such children may require more aggressive treatment with antibiotics, anticholinergics, and bladder training (e.g., timed voiding, biofeedback, parental monitoring of voided volumes). Surgical repair of reflux is less successful in children with voiding dysfunction, and thus a higher threshold is necessary before surgery is recommended in such patients. Children with reflux should therefore be assessed for voiding dysfunction as part of their initial evaluation.

Recommendations

The recommendations that follow emphasize the importance of shared decision-making in the management of reflux. The treatment recommendations are tabulated in Table 16 on pages 52–53.

Recommendations for children without scarring at diagnosis

Age at diagnosis: Infants (<1year)

Initial treatment. Infants with Grades I–IV reflux should be treated initially with continuous antibiotic prophylaxis. In infants with Grade V reflux, continuous antibiotic prophylaxis is the preferred option for initial treatment.

Follow-up treatment. In infants who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued (see Duration of medical management, page 51). For patients with persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic therapy, periodic cystography, or surgery. Surgical repair is the preferred option, however, for patients with persistent unilateral Grades III–IV reflux. Patients with persistent bilateral Grades III–IV reflux or Grade V reflux should undergo surgical repair.

Age at diagnosis: Preschool children (ages 1–5 years)

Initial treatment. Preschool children with Grades I–II reflux or unilateral Grades III–IV reflux should be treated initially with continuous antibiotic prophylaxis. Continuous antibiotic prophylaxis is the preferred option in preschool children with bilateral Grades III–IV reflux. In patients with unilateral Grade V reflux, continuous antibiotic prophylaxis is the preferred option for initial treatment, although surgical repair is a reasonable alternative. In patients with bilateral Grade V reflux, surgical repair is the preferred option and continuous antibiotic prophylaxis is a reasonable alternative.

Follow-up treatment. In children who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued (*see* Duration of medical management, page 51). In children with persistent Grades I–II reflux, there is no consensus regarding the role of continued antibiotic therapy, periodic cystography or surgery. Surgery is the preferred option for children with persistent Grades III–IV reflux. Patients with persistent Grade V reflux should undergo surgical repair.

Age at diagnosis: School children (ages 6–10 years)

Initial treatment. School children with Grades I–II reflux should be treated initially with continuous antibiotic prophylaxis. Continuous antibiotic prophylaxis is the preferred option for initial treatment of patients with unilateral Grades III–IV reflux. In patients with bilateral Grades III–IV reflux, surgical repair is the preferred option, although continuous antibiotic prophylaxis is a reasonable alternative. Patients with Grade V reflux should undergo surgical repair.

Follow-up treatment. In children who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued (see Duration of medical management, page 51). In patients with persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic prophylaxis, periodic cystography, or surgery. Surgery is the preferred option for persistent reflux in children with Grades III–IV reflux.

Recommendations for children with scarring at diagnosis

Age at diagnosis: Infants (<1 year)

Initial treatment. Infants with scarring at diagnosis and Grades I–IV reflux should be treated initially with continuous antibiotic prophylaxis. In infants with Grade V reflux and scarring, continuous antibiotic prophylaxis is the preferred option for initial treatment, and surgical repair is a reasonable alternative.

Follow-up treatment. In infants who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued (see Duration of medical management). In patients with persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic prophylaxis, periodic cystography, or surgery. In boys with persistent unilateral Grades III–IV reflux, surgical repair is the preferred option. Boys with persistent bilateral Grades III–IV reflux, girls with persistent Grades III–IV reflux, and boys and girls with persistent Grade V reflux should undergo surgical repair.

Age at diagnosis: Preschool children (ages 1–5 years)

Initial treatment. Preschool children with scarring at diagnosis and either Grades I–II reflux or unilateral Grades III–IV reflux should be treated initially with continuous antibiotic prophylaxis. Antibiotic therapy is the preferred option in children with bilateral Grades III–IV reflux and scarring, and surgical repair is a reasonable alternative. Surgery is the preferred option for patients with unilateral Grade V reflux. Patients with bilateral Grade V disease and scarring should undergo surgical repair as initial treatment.

Follow-up treatment. In children who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued (see Duration of medical management). In patients with persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic prophylaxis, periodic cystography, or surgery. Girls with persistent Grades III–IV reflux and boys with persistent bilateral Grades III–IV reflux should undergo surgical repair. Surgery is the preferred option for boys with persistent unilateral Grades III–IV reflux and girls with bilateral Grades III–IV reflux. For patients with persistent Grade V reflux who have not undergone surgery as initial treatment, surgical repair is the preferred option.

Age at diagnosis: School children (ages 6–10 years)

Initial treatment. School children with scarring at diagnosis and Grades I–II reflux should be treated initially with continuous antibiotic prophylaxis. In children with unilateral Grades III–IV reflux and scarring, antibiotic therapy is the preferred option. Patients with bilateral Grades III–IV reflux or Grade V reflux should undergo surgical repair as initial treatment.

Follow-up treatment. In children who continue to demonstrate uncomplicated reflux, antibiotic prophylaxis should be continued (see Duration of medical management). In patients who have persistent Grades I–II reflux after this period of prophylaxis, there is no consensus regarding the role of continued antibiotic prophylaxis, periodic cystography, or surgery. Patients with persistent unilateral Grades III–IV reflux who have not undergone surgery as initial treatment should undergo surgical repair.

Duration of medical management

The recommendations refer to "persistent reflux" but do not specify the amount of time that must elapse before VUR is considered persistent. Little scientific evidence exists for determining how long to continue antibiotic prophylaxis before recommending surgical repair, and this decision is therefore left to clinical discretion in consultation with parents. The duration of reflux is an important consideration. As indicated in Table 2 (page 23), which is based on the model described in Chapter 2 and Appendix C, the probability that reflux will resolve spontaneously depends on the duration and grade of reflux. Other factors to consider include the patient's surgical candidacy, comorbidities, tolerance of antibiotics, socioeconomic factors, compliance to medications and follow-up, and parental preferences and concerns.

(continued on page 54)

Table 16. Treatment recommendations

Recommendations were derived from a survey of preferred treatment options for 36 clinical categories of children with reflux. The recommendations are classified as follows:

Guidelines = Treatments selected by 8 or 9 of 9 panel members, given the strongest recommendation language.
Preferred Options = Treatments selected by 5–7 of 9 panel members.
Reasonable Alternatives = Treatments selected by 3–4 of 9 panel members.
No Consensus = Treatments selected by no more than 2 of 9 panel members.

The treatment recommendations apply to both boys and girls with primary vesicoureteral reflux.

Treatment recommendations for children without scarring at diagnosis

Clinical presentation (age at presentation)		**Treatment**					
		Initial (antibiotic prophylaxis or open surgical repair)			**Follow-up[1]** (continued antibiotic prophylaxis, cystography or open surgical repair)		
VUR grade laterality	Age (years)	Guideline	Preferred option	Reasonable alternative	Guideline	Preferred option	No consensus[2]
I-II Unilateral or bilateral	<1	Antibiotic prophylaxis					Boys and girls
	1-5	Antibiotic prophylaxis					Boys and girls
	6-10	Antibiotic prophylaxis					Boys and girls
III-IV Unilateral or bilateral	<1	Antibiotic prophylaxis			Bilateral: Surgery if persistent[3]	Unilateral: Surgery if persistent[3]	
	1-5	Unilateral: Antibiotic prophylaxis	Bilateral: Antibiotic prophylaxis			Surgery if persistent[3]	
	6-10		Unilateral: Antibiotic prophylaxis Bilateral: Surgery	Bilateral: Antibiotic prophylaxis		Surgery if persistent[3]	
V Unilateral or bilateral	<1		Antibiotic prophylaxis		Surgery if persistent[3]		
	1-5		Bilateral: Surgery Unilateral: Antibiotic prophylaxis	Bilateral: Antibiotic prophylaxis Unilateral: Surgery	Surgery if persistent[3]		
	6-10	Surgery					

[1]For patients with persistent uncomplicated reflux after extended treatment with continuous antibiotic therapy.
[2]No consensus was reached regarding the role of continued antibiotic prophylaxis, cystography, or surgery.
[3]See Duration of Reflux in the text regarding the length of time that clinicians should wait before recommending surgery.

Table 16. Treatment recommendations (continued)

Recommendations were derived from a survey of preferred treatment options for 36 clinical categories of children with reflux. The recommendations are classified as follows:

Guidelines = Treatments selected by 8 or 9 of 9 panel members, given the strongest recommendation language.
Preferred Options = Treatments selected by 5–7 of 9 panel members.
Reasonable Alternatives = Treatments selected by 3–4 of 9 panel members.
No Consensus = Treatments selected by no more than 2 of 9 panel members.

The treatment recommendations apply to both boys and girls with primary vesicoureteral reflux.

Treatment recommendations for children with scarring at diagnosis

Clinical presentation (age at presentation)		**Treatment**					
		Initial (antibiotic prophylaxis or open surgical repair)			**Follow-up[1]** (continued antibiotic prophylaxis, cystography or open surgical repair)		
VUR grade laterality	Age (years)	Guideline	Preferred option	Reasonable alternative	Guideline	Preferred option	No consensus[2]
I-II Unilateral or bilateral	<1	Antibiotic prophylaxis					Boys and girls
	1-5	Antibiotic prophylaxis					Boys and girls
	6-10	Antibiotic prophylaxis					Boys and girls
III-IV Unilateral	<1	Antibiotic prophylaxis			Girls: Surgery if persistent[3]	Boys: Surgery if persistent[3]	
	1-5	Antibiotic prophylaxis			Girls: Surgery if persistent[3]	Boys: Surgery if persistent[3]	
	6-10		Antibiotic prophylaxis		Surgery if persistent[3]		
III-IV Bilateral	<1	Antibiotic prophylaxis			Surgery if persistent[3]		
	1-5		Antibiotic prophylaxis	Surgery	Surgery if persistent[3]		
	6-10	Surgery					
V Unilateral or bilateral	<1		Antibiotic prophylaxis	Surgery	Surgery if persistent[3]		
	1-5	Bilateral: Surgery	Unilateral: Surgery			Surgery if persistent[3]	
	6-10	Surgery					

[1]For patients with persistent uncomplicated reflux after extended treatment with continuous antibiotic therapy.
[2]No consensus was reached regarding the role of continued antibiotic prophylaxis, cystography, or surgery.
[3]See Duration of Reflux in the text regarding the length of time that clinicians should wait before recommending surgery.

Other management recommendations

In children with VUR, at initial evaluation the urine should be assessed for infection and proteinuria, and the child's height, weight, and blood pressure should be measured. If the child shows evidence of renal scarring, hydronephrosis, or has a solitary kidney, or known underlying renal disease, a serum creatinine should also be obtained.

In children with VUR, urethral dilation and internal urethrotomy are not beneficial. In addition, cystoscopic examination of the ureteral orifices does not appear to aid in predicting whether reflux will resolve (see Chapter 1, page 12). Furthermore, evocative cystometry is unnecessary in children with reflux and normal voiding function. However, in children with symptoms of voiding dysfunction, urodynamic evaluation may be beneficial.

The personal preferences of parents (and, at older ages, patients) must be considered in weighing the benefits and harms of treatment options. The clinician should provide parents with information about the known benefits and harms of available options, including continuous antibiotic prophylaxis, surgery, and intermittent antibiotic therapy. The clinician should indicate to what extent the estimates of benefits and harms are based on scientific evidence or on opinion and clinical experience. Given the general lack of direct evidence that any 1 treatment option is superior to another (especially when total benefits, harms, costs, and inconvenience are taken into consideration), parents' and patients' preferences regarding treatment options should generally be honored. To the extent that parents seek physicians' advice on how to proceed, the specific treatment guidelines are offered (Table 16 on pages 52–53).

In children with reflux, a urine culture should be obtained if there are symptoms and/or signs of a UTI. In a child with a suspected UTI, proper specimen collection is important. In girls and uncircumcised boys who are not toilet trained, a urinalysis or urine culture obtained from a contaminated bag specimen may yield an erroneous diagnosis of infection and therefore result in inappropriate management decisions. In such children, a urine specimen obtained by catheterization or suprapubic aspiration is encouraged to minimize the likelihood of a false-positive diagnosis of UTI.

Follow-up evaluation should be performed at least annually, at which time the patient's height and weight should be recorded. In addition, a urinalysis should be performed. If renal scarring has been demonstrated, the blood pressure should also be measured, irrespective of whether the child has reflux that is persistent, resolved spontaneously, or has been corrected surgically.

In deciding how often to obtain follow-up cystography, the clinician should take into consideration the likelihood of spontaneous resolution (see Table 2 on page 23), the risks of continued antibiotic prophylaxis, and the risks of radiologic study. In general, cystography does not need to be performed more than once per year.

In children with reflux who are toilet trained, regular, volitional low-pressure voiding with complete bladder emptying should be encouraged. If it is suspected that the child is experiencing uninhibited bladder contractions, anticholinergic therapy may be beneficial.

In children in whom antireflux surgery is chosen, the panel does not recommend the endoscopic form of therapy because of the lack of proven long-term safety and efficacy of most materials used for injection and the lack of approval of such materials by the U.S. Food and Drug Administration.

Rationale for recommendations

The following recommendations to offer continuous antibiotic prophylaxis as initial therapy are based on limited scientific evidence. No controlled studies have demonstrated that continuous antibiotic prophylaxis achieves better health outcomes in children with reflux than intermittent treatment of UTI. The opinion of the panel, however, is that maintaining continuous urine sterility is beneficial in reducing the risk of renal scarring and that this benefit outweighs the potential adverse effects of antibiotics.[3] Observational data from patients with

[3] The argument for continuous antibiotic prophylaxis is especially compelling during infancy, when diagnosing UTI is difficult. Recommendations to initiate antibiotic therapy when reflux is diagnosed in school children, even when the reflux is mild (Grades I–II), are based on the panel's belief that such children continue to face a risk of scarring and that this risk is independent of grade.

Grades I–III reflux suggest that at least 50 percent of reflux cases resolve within 3–5 years of continuous antibiotic prophylaxis (see Chapter 3). For Grades I–IV reflux, the panel generally favors continuous antibiotic prophylaxis over immediate surgical repair because it is less invasive and is associated with fewer risks over the short term.

Recommendations to proceed to surgery in cases that have not resolved spontaneously while the patient was receiving continuous antibiotic prophylaxis are supported by limited scientific evidence: open antireflux surgery is 95–98 percent effective in correcting reflux, and the risk of pyelonephritis is 2–2.5 times greater in children with Grades III–IV reflux managed medically compared with surgically treated patients. The expert opinion of most panel members is that surgery also reduces the risk of pyelonephritis in girls with Grades I–II reflux and in boys and girls with Grade V reflux. Panel members believe that breakthrough UTI increases the risk of renal scarring. Although the International Reflux Study showed no difference between medical and surgical treatment in the incidence of new renal scarring at 5 years, 80 percent of new renal scars in the surgical group appeared by 10 months after randomization, and thus the rate of new renal scarring between 1 and 5 years following randomization was higher in the medical group. Some panel members believe that with longer follow-up, the incidence of new renal scars in the surgical group will be less than in the medical group. Some panel members also believe that females with unresolved reflux are more likely to experience pyelonephritis during pregnancy than women without reflux, although women who have had antireflux surgery also develop pyelonephritis. The panel believes that the benefits of immediate correction of reflux in patients for whom surgery was recommended, even when coupled with its risks, outweigh the potential harms of continuous antibiotic prophylaxis (e.g., inconvenience of long-term therapy, adverse drug reactions, periodic surveillance testing).

More aggressive recommendations for the treatment of girls than of boys (e.g., for persistent Grades III–IV reflux in school children) are based on epidemiologic evidence that girls face a higher risk of acquiring UTI than do boys (see Chapter 3, page 36). More aggressive recommendations for the treatment of Grade V reflux (e.g., surgical repair as initial therapy) are based on the panel's opinion that such cases are unlikely to resolve spontaneously on antibiotic therapy, that surgery is effective in resolving severe reflux and that these benefits outweigh the potential harms of surgery. More aggressive recommendations for children who have renal scarring at diagnosis are based on the panel's opinion that such patients face a higher risk of progressive scarring and decreased renal functional reserve.

The panel's treatment recommendations are based on its opinion that the benefits of treatment outweigh the potential harms. There is little scientific evidence to confirm these assumptions, however, and therefore clinicians and parents may choose other options if they assign different weights to potential outcomes. For example, some clinicians and parents may not share the panel's opinion that the benefits of one-time surgical correction of persistent reflux, even when coupled with its potential harms, outweigh the inconvenience, cost, and risk of side effects from long-term antibiotic prophylaxis. Choosing continuous or intermittent antibiotic therapy under such circumstances is appropriate given the lack of scientific evidence to suggest otherwise.

Chapter 5: Research priorities

Many aspects of primary VUR remain incompletely understood. The panel identified the following areas as needing further investigation.

Development of VUR: The cause of the maldevelopment of the ureterovesical junction is unknown. Because VUR is often related to voiding dysfunction, research into the development of the autonomic nervous system of the bladder and its effect on morphological bladder development may allow an understanding of the pathoembryology of VUR.

VUR is greater in severity in newborn boys than girls. This phenomenon may be secondary to elevated voiding pressures in the newborn male (Gierup, 1970; Hjalmas, 1976; Sillen, Bachelard, Harmanson et al., 1996). Whether these differences result from dissimilar forms of urethral development and/or autonomic nervous system development is unknown. Investigation of the bud theory of Mackie and Stephens (1975) as applied to VUR is suggested to better understand the relationship between reflux and renal scarring that may be present at birth. Determination of whether fetal reflux has a "water hammer" effect deserves study.

Further investigation of the neurologic changes of the pediatric bladder with maturation that could influence bladder function and physiology, particularly voiding pressures, is needed. Studies should evaluate whether anatomic changes at the bladder neck or a functional disorder of the striated sphincter or bladder neck could account for elevated intravesical pressures.

Reflux resolution: The panel found evidence, based on a few large studies, that resolution of Grades I and II reflux may not depend on patient age or laterality (i.e., unilateral or bilateral). In Grade III reflux, on the other hand, it was suggested that patient age and laterality were important prognostic considerations. In Grade IV reflux, only laterality could be evaluated. Confirmation of these concepts by other large centers would be worthwhile. Furthermore, refinement of predictive criteria for reflux resolution by patient age, reflux grade, and laterality would be useful. In addition, further study of the likelihood of resolution of low-grade reflux during adolescence, as described by Lenaghan, Whitaker, Jensen, et al. (1976) and by Goldraich and Goldraich (1992), is necessary.

Renal scarring: The development of renal scarring in children with reflux is incompletely understood. Further investigation of the roles of bacterial virulence factors and host immune and inflammatory responses in the evolution of renal scarring is necessary. Studies should evaluate methods of affecting the host immune or inflammatory response that could reduce renal scarring during pyelonephritis (Roberts, 1992). Investigation of why younger children, particularly those under 1–2 years of age, appear to be more likely than older children to develop renal scarring from pyelonephritis would be useful.

It is well recognized that pyelonephritis and renal scarring can occur in children without reflux. The extent to which reflux increases the risk of renal scarring and the mechanism of this effect deserve investigation.

The panel attempted to analyze the association between new and progressive scarring in children undergoing medical or surgical treatment for reflux and bacteriuria. Because of extremely limited data, this relationship could not be evaluated. Further investigation into the factors leading to new renal scarring in children with reflux is important. In addition, assessment of whether there are long-term differences in the incidence of new scars in children managed medically and surgically is necessary.

Further analysis of the risk factors for end-stage renal disease, particularly the relative contributions of "congenital" scarring, intervening infection, voiding dysfunction, and hypertension management, would be useful.

More randomized prospective trials comparing the incidence and timing of new scarring, as assessed by DMSA scan, in children with Grades III and IV reflux are important, because previous studies, which used IVP for scar detection, have been difficult to interpret. Whether the risk of new scarring in a child with Grade III or IV reflux decreases as reflux grade decreases or reflux resolves should also be analyzed.

Voiding dysfunction: The role of voiding dysfunction in the pathogenesis of VUR and its risk in reflux complications, such as renal scarring, deserves further investigation. The role of urodynamic studies in infants and children with reflux,

with or without voiding dysfunction, should be evaluated (Sillen, Bachelard, Harmanson, et al., 1996). Matched, controlled studies of anticholinergic therapy and bladder retraining on reflux-related outcomes in children with voiding dysfunction are also necessary.

Medical therapy: A comparative analysis of the efficacy of various forms of antibiotic prophylaxis in preventing infection and renal scarring would be important. Furthermore, studies to assess the duration and dosage of prophylaxis are indicated. An evaluation of the adverse effects of various forms of continuous antibiotic prophylaxis in children and examination of the proportion who do not tolerate prophylaxis or who develop resistance would be important. In addition, compliance with prophylaxis regimens should be evaluated, in particular comparing those who have received prophylaxis for less than 6 months with those who have received therapy for more than 2 years. In addition, a trial comparing reflux-related outcomes in children receiving continuous prophylaxis with those in children receiving intermittent therapy, particularly comparing children younger than age 5 years with older children, would be prudent. Whether anticholinergic therapy is beneficial in children with reflux but no sign of voiding dysfunction should be studied. The short- and long-term risk of stopping prophylaxis in individuals with reflux who have been infection-free deserves evaluation. The efficacy of periodic surveillance, urinalysis, and urine culture in asymptomatic children with reflux should be studied.

Surgical therapy: Development of new techniques of antireflux surgery, particularly minimally invasive techniques, is indicated. Newer materials that can be used for endoscopic subureteral injection and that are safe in children should be studied. Whether current techniques of antireflux surgery cause transient increases in upper tract pressures, potentially resulting in renal injury, should be studied. In addition, the mechanism for new-onset contralateral reflux in children undergoing unilateral antireflux surgery should be studied further, and methods of preventing contralateral reflux should be developed. More effective techniques should be developed for surgical therapy in children with Grade V reflux. In addition, whether early correction of reflux in children with Grade V reflux alters reflux-related outcomes should be analyzed further.

Bladder function/training: Whether bladder training alters reflux-related outcomes deserves study. In addition, whether reflux resolution is enhanced after successful toilet training and maturation of bladder function should be evaluated. Whether pharmacologic manipulation, beyond simple anticholinergic therapy, could be useful in normalizing bladder dynamics should also be studied.

Imaging: The effect of voiding cystourethrography on children should be analyzed, and less traumatic methods of determining whether reflux is present should be developed. Techniques of voiding cystourethrography that result in less radiation exposure, such as the tailored low-dose fluoroscopic method (Diamond, Kleinman, Spevak, et al., 1996), should be developed. Clinicians should refine the ideal duration of time between cystograms in children being treated for reflux. In addition, the role of newer forms of renal imaging, such as SPECT, helical CT and power Doppler ultrasound, in the diagnosis of acute pyelonephritis and renal scarring, should be studied. Furthermore, the indications for obtaining a voiding cystourethrogram in a child with a UTI should be refined. Efforts should be made to determine prognostic criteria for likelihood of reflux resolution based on bladder volume and pressure at which reflux occurs and volume of refluxing urine.

Genetics of reflux: Further evaluation of the genetics of reflux deserves study. The current literature has not separately analyzed the incidence of pure primary sibling reflux and reflux associated with voiding dysfunction. The gene for VUR should be identified.

Screening for reflux: Many groups of children undergo screening for primary reflux, including siblings of offspring of index patients with reflux and children with a multicystic kidney or a solitary kidney. The impact of screening and early intervention (medical or surgical) on reflux-related outcomes should be analyzed.

Circumcision and UTI: Whether circumcision of neonates with prenatally detected VUR diminishes the incidence of UTI and other reflux-related outcomes deserves study.

Reflux and pregnancy: The natural history of VUR in adult women with persistent reflux deserves study, including a comparison of the morbidity of reflux and need for and efficacy of prophylaxis in pregnant and non-pregnant women. Such an analysis should compare various grades of reflux with and without renal scarring. Comparison of the reflux-related outcomes and morbidity of pregnancy in women who had spontaneous reflux

resolution or antireflux surgery during childhood and those with uncorrected reflux is of utmost importance.

Social and economic factors: An analysis of the costs of reflux treatment and surveillance is important, in particular a comparison of the costs associated with medical and surgical therapy of children with various grades of reflux. In addition, studies of how reflux and its treatment and the need for surveillance affect patient/family dynamics and quality of life deserves study.

Randomized controlled trials: Although the International Reflux Study in children was successful in analyzing many reflux-related outcomes, data related to scarring were based on assessment by IVP rather than DMSA renal scan. Further randomized controlled trials studying the role of medical and surgical therapy using DMSA scan for evaluation are indicated. The long-term outcomes (>10 years) of previously randomized children with unresolved reflux at 5 years should be compared with children undergoing successful surgical or medical therapy.

Future clinical studies of children with reflux should analyze specific reflux-related health outcomes and stratify the results by patient gender, age, and reflux grade. Studies should report reflux resolution both by rate of ureteral resolution and patient resolution. Ideally, reports of UTI and renal scarring will analyze these outcomes for 5–10 years after reflux resolution.

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Appendix A: Literature review—Papyrus references

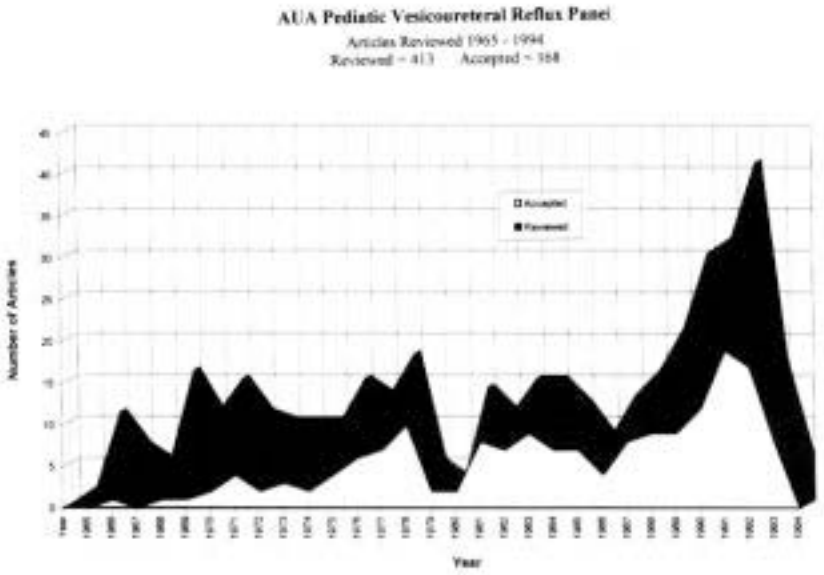

Figure A-1

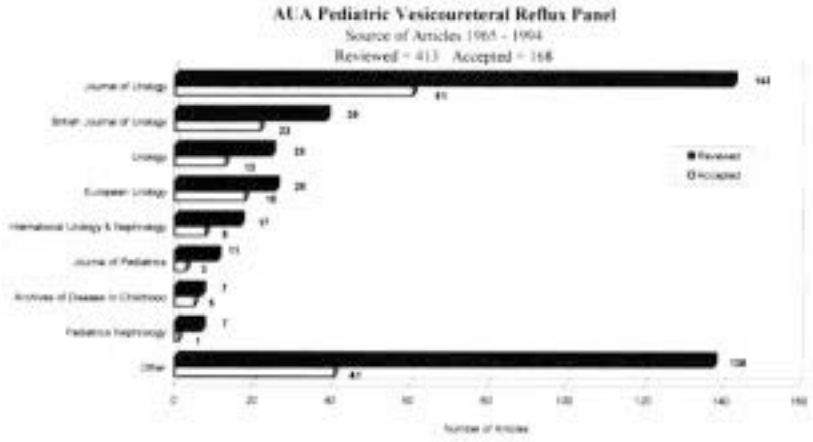

Figure A-2

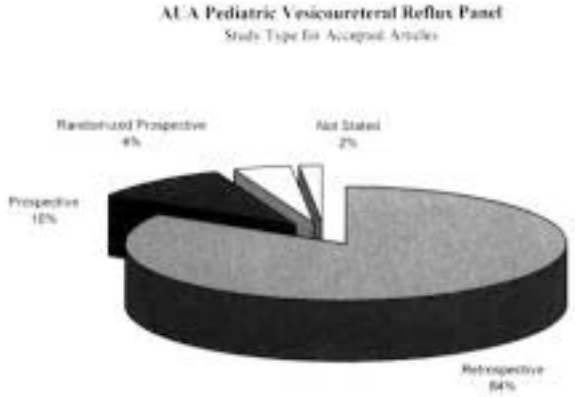

Figure A-3

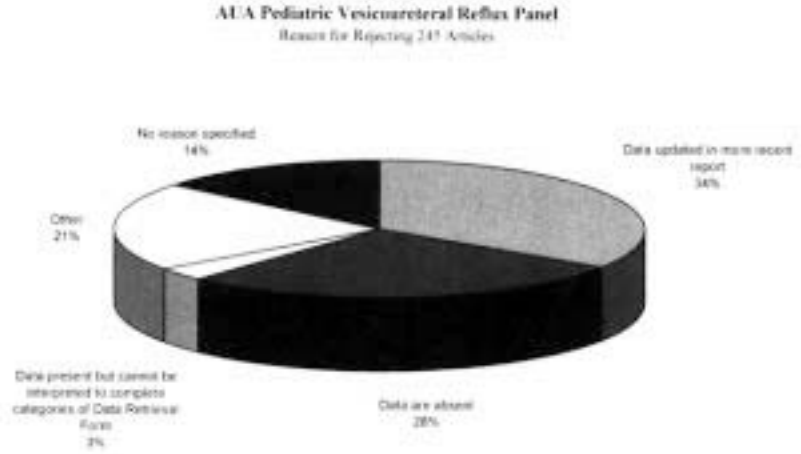

Figure A-4

Table A-1: Papyrus Reference Bibliography—Alphabetic by Author

Papyrus Reference	Journal	Year	Volume	Pages	Title	Author
674	Archives of Disease in Childhood	1991	66	1284-6	Covert bacteriuria:long term follow-up	Aggarwal, V.K., Verrier-Jones, K., Asscher, A.W., Evans, C., and Williams, L.A.
252	Journal of Urology	1983	129	787-91	Application of the pull-through technique of transverse advancement ureteral reimplantation	Ahmed, S.
65		1988	140	1092-4	Vesicoureteral reflux in complete ureteral duplication: surgical options	Ahmed, S., Boucaut, H.A.
345	Journal of Urology	1978	120	332-3	Results of ureteral reimplantation in patients with intrarenal reflux	Ahmed, S., Smith, A.J.
301	Journal of Urology	1982	127	970-73	Complications of transverse advancement ureteral reimplantation: diverticulum formation	Ahmed, S., Tan, H.
321	Pediatrics	1980	65	78-80	The conservative management of vesicoureteric reflux: a review of 121 children	Aladjem, M., Biochis, H., Hertz, M., Herzfeld, S., and Raviv, U.
462	Southern Medical Journal	1973	66	305-7	Modification of the ureteral advancement procedure for vesicoureteral reflux	Allen, T.D.
401	Clinical Pediatrics	1976	15	562-9	The practical management of vesicoureteral reflux in children. A review of 12 years' experience with 236 patients.	Amar, A.D., Singer, B., and Chabra, K.
614	British Journal of Urology	1991	67	267-71	Features of primary vesicoureteric reflux detected by prenatal sonography.	Anderson, P.A., Rickwood, A.M.
646	Journal of Urology	1992	148	1683-7	Medical management of mild and moderate vesicoureteral reflux: followup studies of infants and young children. A preliminary report of the Southwest Pediatric Nephrology Study Group.	Arant, B.S., Jr.
304	European Urology	1981	7	263-7	Treatment and prevention of complications after extravesical antireflux technique	Arap, S., Abrao, E.G., and Menezes-de-Goes, G.
305	European Urology	1981	7	257-62	Growth of the kidney following unilateral antireflux surgery	Atwell, J.D., Cox, P.A.
75	European Urology	1990	17	307-9	'Sting' procedure in the treatment of secondary reflux in children	Aubert, D., Zoupanos, G., Destuynder, O., and Hurez, F.
591	European Urology	1991	19	39-44	Long-term follow-up of children with surgically treated vesicorenal reflux:renal growth	Beetz, R., Hohenfellner, R., Schofer, O., Singhof, S., and Riedmiller, H.
42	European Urology	1989	16	366-71	Long-term follow-up of children with surgically treated vesicorenal reflux: postoperative incidence of urinary tract infections, renal scars and arterial hypertension	Beetz, R., Schulte-Wissermann, H., Troger, J., Riedmiller, H., Mannhardt, W., Schofer, O., and Hohenfellner, R.
209	Contributions to Nephrology	1984	39	81-93	Vesicoureteral reflux: a comparison of non-surgical and surgical management	Bellinger, M.F., Duckett, J.W.

Papyrus Reference	Journal	Year	Volume	Pages	Title	Author
46	Pediatric Radiology	1989	19	308-10	The natural history of reflux in the lower pole of duplicated collecting systems: a controlled study	Ben-Ami, T., Gayer, G., Hertz, M., Lotan, D., and Boichis, H.
497	Journal of Pediatric Surgery	1970	5	622-7	Ureteroneocystostomy in refluxing ureteric duplication: indications, technique and results	Bettex, M., Kummer-Vago, M., and Kuffer, F.
630	British Journal of Urology	1993	71	221-5	Efficacy and causes of failure of endoscopic subureteric injection of Teflon in the treatment of primary vesico-ureteric reflux	Bhatti, H.A., Khattak, H., and Boston, V.E.
245	British Medical Journal - Clinical Research	1983	287	171-4	Prospective trial of operative versus non-operative treatment of severe vesicoureteric reflux: two years' observation in 96 children	Birmingham Reflux Study Group
256	Journal of Urology	1983	129	543-4	The use of lower ipsilateral ureteroureterostomy to treat vesico-ureteral reflux or obstruction in children with duplex ureters	Bockrath, J.M., Maizels, M., and Firlit, C.F.
58	British Journal of Urology	1988	62	531-6	Primary vesicoureteric reflux treated by antireflux ureterocystostomy at the vertex of the bladder. A 12-year follow-up and analysis of operative failure	Bradic, I., Batinica, S. and Husar, J.
412	British Journal of Urology	1975	47	525-30	Antireflux ureterocystostomy at the vertex of the bladder	Bradic, I., Pasini, M., and Vlatkovic, G.
789	Urology	1993	42 (12/6)	705-7	Ureteral reimplantation: postoperative management without catheters	Brandell, R.A., Brock, J.W., 3d
359	Urology	1978	11	139-41	Incidence of later ureteral obstruction after antireflux surgery in infants and children	Broaddus, S.B., Zickerman, P.M., Morrisseau, P.M., and Leadbetter, G.W., Jr.
93	Journal of Urology	1989	142	499-500	Open versus endoscopic surgery in the treatment of vesicoureteral reflux	Brown, S.
117	European Urology	1988	314	7-40	Antireflux procedure by Lich-Gregoir. Indications and results	Bruhl, P., van-Ahlen, H., and Mallmann, R.
333	Journal of Urology	1979	121	648-9	Extravesical ureteroplasty	Bruskewitz, R., Sonneland, A.M., and Waters, R.F.
678	Journal of Urology	1991	146	1352-3	Ureteral reimplantation: a comparison of results with the cross-trigonal and Politano-Leadbetter techniques in 120 patients.	Burbige, K.A.
636	Journal of Urology	1992	148	1743-5	Fetal vesicoureteral reflux: outcome following conservative postnatal management	Burge, D.M., Griffiths, M.D., Malone, P.S., and Atwell, J.D.
488	Journal of Urology	1971	106	290-4	Ureteroureterostomy for reflux in duplex systems	Burns, A., Palken, M.
355	Lancet	1978	1	889-93	Sequelae of covert bacteriuria in schoolgirls. A four-year follow-up study.	Cardiff-Oxford Bacteriuria Study Group
181	European Urology	1985	11	181-3	Surgical treatment of vesicoureteral reflux with bilateral medialization of the ureteral orifices	Carini, M., Selli, C., Lenzi, R., Barbagli, G., and Costantini, A.

272	British Journal of Urology	1982	54	230-3	Reflux--a retrospective study of 100 ureteric reimplantations by the Politano-Leadbetter method and 100 by the Cohen technique	Carpentier, P.J., Bettink, P.J., Hop, W.C., and Schroder, F.H.
300	Journal of Urology	1982	127	1146-8	Renal growth in small kidneys after ureteroneocystostomy	Carson, C.C., Kelalis, P.P., and Hoffman, A.D.
495	Journal of Urology	1971	105	720-4	Management of reflux in total duplication anomalies	Daines, S.L., Hodgson, N.B.
612	British Journal of Urology	1991	67	536-40	Primary vesicoureteric reflux: treatment with subureteric injection of Polytef paste	Davies, N., Atwell, J.D.
688	Journal of Urology	1991	146	636-8	Effectiveness of trigonoplasty to treat primary vesicoureteral reflux	De-Gennaro, M., Appetito, C., Lais, A., Talamo, M., Capozza, N., and Caione, P.
66	Journal of Urology	1988	140	1089-91	Vesicoureteral reflux in boys	Decter, R.M., Roth, D.R., and Gonzales, E.T., Jr.
673	Urology	1992	39	162-4	Endoscopic correction of primary vesicoureteric reflux in children	Dewan, P.A., Guiney, E.J.
592	European Urology	1991	19	35-8	Polytef paste injection of refluxing duplex ureters	Dewan, P.A., ODonnell, B.
17	European Urology	1990	17	304-6	Treatment of vesicoureteral reflux in children by endoscopic injection of Teflon. Review of 2 years of experience	Dodat, H., Takvorian, P.
642	Journal of Urology	1992	148	1674-5	Surgical results: international Reflux Study in Children--United States branch	Duckett, J.W., Walker, R.D., and Weiss, R.
260	British Journal of Urology	1982	54	672-6	Results of conservative management of vesicoureteric reflux in children	Dunn, M., Smith, P.J.
370	Journal of Urology	1977	118	826-8	Ipsilateral ureteroureterostomy for vesicoureteral reflux in duplicated ureters	Duthoy, E.J., Soucheray, J.A., and McGroarty, B.J.
459	Journal of Urology	1973	109	888-90	Vesicoureteral reflux in children: a computerized review	Dwoskin, J.Y., Perlmutter, A.D.
373	British Medical Journal	1977	2	285-8	Disappearance of vesicoureteric reflux during long-term prophylaxis of urinary tract infection in children	Edwards, D., Normand, I.C., Prescod, N., and Smellie, J.M.
180	Journal of Urology	1985	134	668-70	The ureteral folding technique for megaureter surgery	Ehrlich, R.M.
267	Journal of Urology	1982	128	554-7	Success of the transvesical advancement technique for vesicoureteral reflux	Ehrlich, R.M.
670	British Journal of Urology	1992	69	294-302	Comparison of DMSA scintigraphy with intravenous urography for the detection of renal scarring and its correlation with vesicoureteric reflux	Elison, B.S., Taylor, D., Van-der-Wall, H., Pereira, J.K., Cahill, S., Rosenberg, A.R., Farnsworth, R.H., and Murray, I.P.
257	Journal of Urology	1983	129	343-6	Character of urinary tract infections and pyelonephritic renal scarring after antireflux surgery	Elo, J., Tallgren, L.G., Alfthan, O., and Sarna, S.
284	Scandinavian Journal of Urology & Nephrology	1981	15	243-8	The role of vesicoureteral reflux in paediatric urinary-tract infection	Elo, J., Tallgren, L.G., Sarna, S., Alfthan, O., and Stenstrom, R.

Papyrus Reference	Journal	Year	Volume	Pages	Title	Author
6	Journal of Urology	1990	144	534-6	Endoscopic correction of vesicoureteral reflux: Our experience with 115 ureters	Farkas, A., Moriel, E.Z., and Lupa, S.
620	Journal of Urology	1991	145	542-6	The detection of reflux nephropathy in infants by 99mtechnetium dimercaptosuccinic acid studies.	Farnsworth, R.H., Rossleigh, M.A., Leighton, D.M., Bass, S.J., and Rosenberg, A.R.
274	European Urology	1982	8	193-5	Bilateral Cohen's antireflux procedure with a single submucosal tunnel	Faure, G., Ben-Salah, S., dEscoffier, P.L., and Revol, M.
477	Journal of Urology	1972	107	862-4	Vesicoureteral reflux and ureteral duplication in children	Fehrenbaker, L.G., Kelalis, P.P., and Stickler, G.B.
816	International Urology & Nephrology	1993	25 (2)	141-6	Primary vesicoureteral reflux in children under one year of age: the case for conservative management.	Fichtner, J., Iwasaki, K., Shrestha, G., and Ikoma, F.
255	Journal of Urology	1983	129	545-7	A retrospective analysis of the use of ureteral stents in children undergoing ureteroneocystotomy	Fort, K.F., Selman, S.H., and Kropp, K.A.
657	Journal of Urology	1992	148	718-23	Subureteral collagen injection for the endoscopic treatment of vesicoureteral reflux in children. Followup study of 97 treated ureters and histological analysis of collagen implants.	Frey, P., Berger, D., Jenny, P., and Herzog, B.
684	International Urology & Nephrology	1991	23	231-6	Evaluation of the course of pregnancy, delivery and the condition of the newborn infant in women operated on for vesicoureteral reflux in childhood.	Fryczkowski, M., Maruszewska, J., Paradysz, A., and Maruszewski, W.
141	International Urology & Nephrology	1986	18	397-402	Operative treatment of bilateral vesicoureteral reflux by our own method of ureter reimplantation	Fryczkowski, M., Paradysz, A.
310	International Urology & Nephrology	1980	12	119-22	Complications after extravesical antireflux operations	Funke, P.J., Chiari, R., and Planz, K.
566	Journal of the American Medical Association	1966	195	636-8	Antireflux surgery in children	Garrett, R.A., Switzer, R.W.
150	Journal of Pediatric Surgery	1986	21	697-701	Follow-up of renal morphology and growth of 141 children operated for vesicoureteral reflux: a retrospective computerized study	Ginalski, J.M., Michaud, A., and Genton, N.
184	Journal of Urology	1985	134	304-7	Transverse ureteral advancement technique of uretero neocystostomy (Cohen reimplant) and a modification for difficult cases (experience with 121 ureters)	Glassberg, K.I., Laungani, G., Wasnick, R.J., and Waterhouse, K.
675	Archives of Disease in Childhood	1991	66	1282-3	Imaging in urinary tract infection	Gleeson, F.V., Gordon, I.
641	Journal of Urology	1992	148	1688-92	Followup of conservatively treated children with high and low grade vesicoureteral reflux: a prospective study	Goldraich, N.P., Goldraich, I.H.
418	Urology	6	1975	273-86	Management of children with urinary tract infections: the Stanford experience	Govan, D.E., Fair, W.R., Friedland, G.W., and Filly, R.A.
222	Zeitschrift fur Kinderchirugie	39	1984	52-4	Renal growth after antireflux surgery in infants	Hagberg, S., Hjalmas, K., Jacobsson, B., and Sillen, U.
383	Journal of Urology	117	1977	355-7	Extravesical repair of primary vesicoureteral reflux in children	Hampel, N., Richter-Levin, D., and Gersh, I.

249	Journal of Urology	129	1983	1022-3	Management of unilateral reflux by ipsilateral ureteroneocystostomy--is it sufficient?	Hanani Y., Goldwasser, B., Jonas, P., Hertz, M., and Many, M.
288	Urology	18	1981	562-6	Early surgical correction of massive refluxing megaureter in babies by total ureteral reconstruction and reimplantation	Hanna, M.K.
90	Acta Radiologica	30	1989	391-4	Influence of vesicoureteral reflux and urinary tract infection on renal growth in children with upper urinary tract duplication	Hannerz, L., Wikstad, I., Celsi, G., and Aperia, A.
54	Scandinavian Journal of Infectious Diseases	21	1989	201-4	Trimethoprim-sulphadiazine prophylaxis in children with vesico-ureteric reflux	Hanson, E., Hansson, S., and Jodal, U.
294	Urology	18	1981	241-3	Bilateral or unilateral ureteroneocystostomy for unilateral reflux	Harty, J.I., Howerton, L.W., Jr.
368	Birth Defects Original Article Series	13	1977	367-71	Contralateral reflux: the rationale for a conservative approach	Hirsch, S., Fitzgerald, J.
643	Journal of Urology	148	1992	1657-61	Surgical results in the International Reflux Study in Children (Europe)	Hjalmas, K., Lohr, G., Tamminen-Mobius, T., Seppanen, J., Olbing, H., and Wikstrom, S.
483	South African Medical Journal	45	1971	1063-4	Therapy of vesico-ureteral reflux in children	Hohenfellner, R.
177	Journal of Urology	134	1985	1168-71	Effects of oxybutynin on vesicoureteral reflux in children	Homsy, Y.L., Nsouli, I., Hamburger, B., Laberge, I., and Schick, E.
658	Journal of Urology	148	1992	704-7	Extravesical nondismembered ureteroplasty with detrusorrhaphy: a renewed technique to correct vesicoureteral reflux in children	Houle, A.M., McLorie, G.A., Heritz, D.M., McKenna, P.H., Churchill, B.M., and Khoury, A.E.
616	Journal of Urology	145	1991	1022-3	Resolution of vesicoureteral reflux in completely duplicated systems: fact or fiction?	Husmann, D.A., Allen, T.D.
376	British Journal of Urology	49	1977	119-27	Vesico-ureteral reflux in children	Jakobsen, B.E., Genster, H., Olesen, S., and Nygaard, E.
22	British Journal of Urology	65	1990	413-17	Results of surgical treatment of severe vesicoureteric reflux. Retrospective study of reflux grades 4 and 5	Jansen, H., Scholtmeijer, R.J.
650	Journal of Urology	148	1992	1650-2	Infection pattern in children with vesicoureteral reflux randomly allocated to operation or long-term antibacterial prophylaxis. The International Reflux Study in Children.	Jodal, U., Koskimies, O., Hanson, E., Lohr, G., Olbing, H., Smellie, J., and Tamminen-Mobius, T.
426	British Journal of Urology	47	1975	153-9	The congenital refluxing megaureter: experiences with surgical reconstruction	Johnston, J.H., Farkas, A.
438	Israel Journal of Medical Sciences	10	1974	603-7	Ureteroneocystostomy in children with vesicoureteral reflux. Experience with 150 reimplanted ureters	Jonas, P., Many, M., Boichis, H., and Hertz, M.
594	Urology	37	1991	244-7	Endoscopic treatment of vesicoureteral reflux in children with	Kaminetsky, J.C., Hanna, M.K.
346	Journal of Urology	120	1978	220-2	Reflux in complete duplication in children	Kaplan, W.E., Nasrallah, P., and King, L.R.
666	Archives of Disease in Childhood	67	1992	506-8	Vesicoureteric reflux and renal scars in asymptomatic siblings of children with reflux	Kenda, R.B., Fettich, J.J
68	Australian & New Zealand Journal of Surgery	58	1988	569-71	The endoscopic correction of vesico-ureteric reflux	King, P.A., Gollow, I.

Papyrus Reference	Journal	Year	Volume	Pages	Title	Author
586	International Urology & Nephrology	22	1990	531-5	Surgical management of vesicoureteral reflux by modified Gil-Vernet method	Kliment, J., Fetisov, I., and Svitac, J.
230	Journal of Urology	130	1983	1138-1	The uninhibited bladder in children: effect of treatment on recurrence of urinary infection and on vesicoureteral reflux resolution	Koff, S.A., Murtagh, D.S.
214	Contributions to Nephrology	39	1984	211-20	The uninhibited bladder in children: effect of treatment on vesicoureteral reflux resolution	Koff, S.A., Murtagh, D.
135	British Journal of Urology	60	1987	36-8	Correction of reflux with the ureteric crossover method. Clinical experience in 50 patients	Kondo, A., Otani, T.
15	European Urology	17	1990	318-20	Ureterovesical reimplantation after failure of endoscopic treatment of reflux by submucosal injection of polytef paste	Lacombe, A.
687	Journal of Urology	146	1991	657-9	Duplex reflux: a study of 105 children	Lee, P.H., Diamond, D.A., Duffy, P.G., and Ransley, P.G.
394	Journal of Urology	115	1976	728-30	The natural history of reflux and long-term effects of reflux on the kidney	Lenaghan, D., Whitaker, J.G., Jensen, F., and Stephens, F.D.
622	Journal of Urology	145	1991	115-19	Endoscopic injection of glutaraldehyde cross-linked bovine dermal collagen for correction of vesicoureteral reflux	Leonard, M.P., Canning, D.A., Peters, C.A., Gearhart, J.P., and Jeffs, R.D.
51	European Urology	16	1989	200-3	Lich-Gregoir anti-reflux operation: a surgical experience and 5-20 years of follow-up in 149 ureters	Linn, R., Ginesin, Y., Bolkier, M., and Levin, D.R.
692	British Journal of Urology	18	1993	52-5	Endoscopic treatment of vesicoureteric reflux with collagen. Five years' experience	Lipsky, H., and Wurnschimmel
417	Quarterly Journal of Medicine	44	1975	481-9	Childhood urinary infection associated with vesico-ureteric reflux	MacGregor, M.E., Freeman, P.
254	Urology	21	1983	232-5	Management of massively refluxing megaureters	Maggiolo, L.F., Lockhart, J.L., and Politano, V.A.
347	Journal of Urology	120	1978	216-19	The Lich-Gregoir antireflux plasty: experiences with 371 children	Marberger, M., Altwein, J.E., Straub, E., Wulff, S.H., and Hohenfellner, R.
372	Urology	10	1977	19-22	Ureteral reimplantation: Lich method	McDuffie, R.W., Litin, R.B., and Blundon, K.E.
5	Journal of Urology	144	1990	537-40	High grade vesicoureteral reflux: analysis of observational therapy	McLorie, G.A., McKenna, P.H., Jumper, B.M., Churchill, B.M., Gilmour, R.F., and Khoury, A.E.
443	Lancet	1	1974	1310-12	Effect on renal growth of reimplantation of refluxing ureters	McRae, C.V., Shannon, F.T., and Utley, W.L.
195	Journal of Urology	133	1985	388-90	Reoperative ureteroneocystostomy: review of 69 patients	Mesrobian, H.G., Kramer, S.A., and Kelalis, P.P.

840	European Urology	23 (3)	1993	379-81	Effects of submucosal Teflon paste injection in vesicoureteric reflux: results with 1-and 2-year follow-up data.	Michael, V., Davaris, P., Arhontakis, A., and Androulakakis, P.A.
817	European Urology	24 (1)	1993	111-15	Endoscopic correction of vesico-ureteric reflux in duplex systems.	Miyakita, H., Ninan, G.K., and Puri, P.
344	Journal of Urology	120	1978	336-7	Non-operative treatment of vesicoureteral reflux	Mulcahy, J.J., Kelalis, P.P.
286	British Journal of Urology	53	1981	542-4	Improvement in renal function following ureteric reimplantation of vesicoureteric reflux	Mundy, A.R., Kinder, C.H., Joyce, M.R., Chantler, C., and Haycock, G.B.
205	Urology	24	1984	243-5	Reflux and voiding abnormalities in children	Nasrallah, P.F., Simon, J.W.
637	Journal of Urology	148	1992	1739-42	The long-term results of prospective sibling reflux screening	Noe, H.N.
176	Journal of Urology	134	1985	1172-5	The role of dysfunctional voiding in failure or complication of ureteral reimplantation for primary reflux	Noe, H.N.
534	British Journal of Urology	41	1969	6-13	Vesico-ureteric reflux in infants and children: results of supervision, chemotherapy and surgery	ODonnell, B., Moloney, M.A., and Lynch, V.
144	British Medical Journal - Clinical Research	293	1986	1404-6	Endoscopic correction of primary vesicoureteric reflux: results in 94 ureters	ODonnell, B., Puri, P.
649	Journal of Urology	148	1992	1653-6	Renal scars and parenchymal thinning in children with vesicoureteral reflux: a 5-year report of the International Reflux Study in Children (European Branch)	Olbing, H., Claesson, I., Ebel, K.D., Seppanen, U., Smellie, J.M., Tamminen-Mobius, T., and Wikstad, I.
12	European Urology	17	1990	330-2	A new antireflux operation	Orikasa, S.
798	British Journal of Urology	72 (9/3)	1993	373-5	Intravesical ureteric plication and reimplantation for megaureters in children.	Ozen, H.A., Tekgul, S., Erkan, I., and Bakkaloglu, M.
403	Urology	7	1976	276-8	Reflux in opposite ureter after successful correction of unilateral vesicoureteral reflux	Parrott, T.S., Woodard, J.R.
677	Journal of Urology	146	1991	1594-5	Nonsurgical management of primary vesicoureteral reflux in complete ureteral duplication: is it justified?	Peppas, D.S., Skoog, S.J., Canning, D.A., and Belman, A.B.
204	International Journal of Pediatric Nephrology	5	1984	83-8	Evaluation of kidney growth in vesico-ureteral reflux	Peratoner, L., Messi, G., and Fonda, E.
107	Journal of Urology	140	1988	121-4	Medical treatment of vesicoureteral reflux detected in infancy	Pinter, A.B., Jaszai, V., and Dober, I.
25	Scandinavian Journal of Urology and Nephrology	125	1989	29-34	Vesico-ureteral reflux. II. The longterm outcome of kidney function in non-surgical treatment	Poulsen, E.U., Johannesen, N.L., Nielsen, J.B., Jrgensen, T.M., and Anderson, A.J.
21	Lancet	335	1990	1320-2	Endoscopic correction of primary vesicoureteric reflux by subureteric injection of polytetrafluoroethylene	Puri, P.
115	Journal of Pediatric Surgery	22	1987	1087-91	Endoscopic correction of grades IV and V primary vesicoureteric reflux: six to 30 month follow-up in 42 ureters	Puri, P., ODonnell, B.
124	International Urology & Nephrology	19	1987	141-3	Antireflux operations without catheter	Pypno, W.
182	British Journal of Urology	57	1985	406-9	Unilateral ureteric reimplantation for primary vesicoureteric reflux in children. A policy re-evaluated	Quinlan, D., ODonnell, B.

Papyrus Reference	Journal	Year	Volume	Pages	Title	Author
332	Urology	13	1979	248-52	Primary massive reflux in children	Rabinowitz, R., Barkin, M., Schillinger, J.F., Jeffs, R.D., and Cook, G.T.
461	Urologia Internationalis	28	1973	56-64	Surgical correction of vesicoureteral reflux. Description of technique and results	Ravasini, G., Pagano, F.
183	Turkish Journal of Pediatrics	26	1984	175-9	15 years of experience in the surgical treatment of vesicoureteral reflux in children	Remzi, D., Ozen, H.A., Erkan, I., and Kendi, S.
356	Urology	11	1978	231-6	Megaureters in children	Retik, A.B., McEvoy, J.P., and Bauer, S.B.
827	European Journal of Pediatrics	152 (6/6)	1993	523-5	Primary vesicoureteral reflux in infants with a dilated fetal urinary tract.	Ring, E., Petritsch, P., Riccabona, M., Haim-Kuttnig, M., Vilits, P., Rauchenwald, M., and Fueger, G.
679	International Urology & Nephrology	23	1991	437-40	Screening of asymptomatic siblings of patients with vesicoureteral reflux	Sahin, A., Ergen, A., Balbay, D., Basar, I., Ozen, H., and Remzi, D.
680	International Urology & Nephrology	23	1991	31-5	The fate of contralateral ureter after ipsilateral reimplantation in unilateral vesicoureteric reflux	Sargin, S.Y. Ergen, A., Ozen, H.A., Ozkardes, H., Tekgul, S., Erkan, I., and Bakkaloglu, M.
16	European Urology	17	1990	310-13	Analysis and perspectives of endoscopic treatment of vesicoureteral reflux in children with a 20-month follow-up	Sauvage, P., Saussine, C., Laustriat, S., Becmeur, F., Bientz, J., Christmann, D., Roy, E., and Marcellin, L.
685	Child. Nephrol. Urol.	11	1991	29-32	Treatment of vesicoureteric reflux: results after 3 years in a prospective study	Scholtmeijer, R.J.
18	Journal of Pediatric Surgery	25	1990	669-71	The role of videourodynamic studies in diagnosis and treatment of vesicoureteral reflux	Scholtmeijer, R.J., Griffiths, D.J.
114	British Journal of Urology	61	1988	205-9	Treatment of vesicoureteric reflux. Preliminary report of a prospective study	Scholtmeijer, R.J., Griffiths, D.J.
74	European Urology	17	1990	314-17	Vesicoureteral reflux in children: endoscopic treatment	Schulman, C.C., Pamart, D., Hall, M., Janssen, F., and Avni, F.E.
128	Journal of Urology	138	1987	950-2	Endoscopic treatment of vesicoureteral reflux in children	Schulman, C.C., Simon, J., Pamart, D., and Avni, F.E.
157	British Journal of Urology	58	1986	119-24	Renal function following surgical correction of vesico-ureteric reflux in childhood	Scott, D.J., Blackford, H.N., Joyce, M.R., Mundy, A.R., Kinder, C.H., Haycock, G.B., and Chantler, C.

377	British Journal of Urology	49	1977	109-18	The management of ureteric reflux in children	Scott, J.E.
540	Archives of Disease in Childhood	43	1968	323-8	Treatment of vesico-ureteric reflux in children	Scott, J.E., Stansfeld, J.M.
94	Journal of Urology	142	1989	494-8	Vesicoureteral reflux and voiding dysfunction: a prospective study	Seruca, H.
354	Archives of Disease in Childhood	53	1978	210-17	Renal scarring and vesicoureteric reflux	Shah, K.J., Robins, D.G., and White, R.H.
618	Pediatrics	87	1991	538-43	Primary vesicoureteral reflux in the black child	Skoog, S.J., Belman, A.B.
130	Journal of Urology	138	1987	941-6	A nonsurgical approach to the management of primary vesicoureteral reflux	Skoog, S.J., Belman, A.B., and Majd, M.
611	Pediatric Nephrology	2	1988	12-17	Prophylactic co-trimoxazole and trimethoprim in the management of urinary tract infection in children	Smellie, J.M., Gruneberg, R.N., Bantock, H.M., and Prescod, N.
389	British Medical Journal	2	1976	203-6	Long-term low-dose co-trimoxazole in prophylaxis of childhood urinary tract infection: clinical aspects	Smellie, J.M., Gruneberg, R.N., Leakey, A., and Atkin, W.S.
313	Journal of Urology	125	1981	551-3	Ureteral reimplantation without catheters	So, E.P., Brock, W.A., and Kaplan, G.W.
105	European Urology	14	1988	214-15	Correction of vesicoureteral reflux by the Gil-Vernet procedure	Solok, V., Erozenci, A., Kural, A., and Oner, A.
96	British Journal of Urology	63	1989	245-50	Physical growth velocity during conservative treatment and following subsequent surgical treatment for primary vesicoureteric reflux	Sutton, R., Atwell, J.D.
116	Annales de Radiologie	30	1987	478-81	Evaluation of sub-ureteric Teflon injection as an antireflux procedure	Sweeney, L.E., Thomas, P.S.
648	Journal of Urology	148	1992	1662-6	Cessation of vesicoureteral reflux for 5 years in infants and children allocated to medical treatment. The International Reflux Study in Children	Tamminen-Mobius, T., Brunier, E., Ebel, K.D., Lebowitz, R., Olbing, H., Seppanen, U., and Sixt, R.
212	Contributions to Nephrology	39	1984	238-46	Unstable bladder activity and the rate of resolution of vesico-ureteric reflux	Taylor, C.M.
262	British Journal of Urology	54	1982	494-8	Micturition symptoms and unstable bladder activity in girls with primary vesicoureteral reflux	Taylor, C.M., Corkery, J.J., and White, R.H.
131	British Medical Journal - Clinical Research	295	1987	237-41	Prospective trial of operative versus non-operative treatment of severe vesicoureteric reflux in children: five years' observation. Birmingham Reflux Study Group	The Birmingham Reflux Study Group
246	Journal of Urology	129	1983	1198-9	Initial results with the Cohen cross-trigonal ureteroneocystotomy	Wacksman, J.
348	Journal of Urology	119	1978	814-6	Management of vesicoureteral reflux	Wacksman, J., Anderson, E.E., and Glenn, J.F.
660	Journal of Urology	148	1992	359-61	Results of the renewed extravesical reimplant for surgical correction of vesicoureteral reflux	Wacksman, J., Gilbert, A., and Sheldon, C.A.

Papyrus Reference	Journal	Year	Volume	Pages	Title	Author
327	British Journal of Urology	50	1978	479-84	The long-term follow-up of surgically treated vesicoureteric reflux	Wallace, D.M., Rothwell, D.L., and Williams, D.I.
479	Journal of Urology	107	1972	466-8	Unilateral ureteroneocystostomy: the fate of the contralateral ureter	Warren, M.M., Kelalis, P.P., and Stickler, G.B.
647	Journal of Urology	148	1992	1667-73	Results of a randomized clinical trial of medical versus surgical management of infants and children with grades III and IV primary vesicoureteral reflux (United States). The International Reflux Study in Children.	Weiss, R., Duckett, J. and Spitzer, A.
396	Journal of Urology	115	1976	722-5	Renal growth and urinary infection following antireflux surgery in infants and children	Willscher, M.K., Bauer, S.B., Zammuto, P.J., and Retik, A.B.
388	Journal of Pediatrics	89	1976	743-7	Infection of the urinary tract after anti-reflux surgery	Willscher, M.K., Bauer, S.B., Zammuto, P.J., and Retik, A.B.
129	Journal of Urology	138	1987	947-9	Detrusorrhaphy: extravesical ureteral advancement to correct vesicoureteral reflux in children	Zaontz, M.R., Maizels, M., Sugar, E.C., and Firlit, C.F.
640	Journal of Urology	148	1992	1699-1702	Historical clues to the complex of dysfunctional voiding, urinary tract infection and vesicoureteral reflux. The International Reflux Study in Children	van Gool, J.D., Hjalmas, K., Tamminen-Mobius, T., and Olbing, H.

Total Number of Articles = 168

Appendix B: Data extraction form

VUR Data Retrieval Page 1 of ____

Cover Sheet - A_VUR.DB

Reference No.

Journal:

Year: Vol: Pages:

Author(s):

Title:

Institution:

1. STUDY TYPE (Enter from list, Appendix 1) Acquisition years

Accepted/Rejected: (circle one) A / R

If Rejected, Why ? (circle one or explain)
D = Data updated in more recent report
A = Data are absent
U = Data present but cannot be interpreted to complete categories of Data Retrieval Form
O = Other

Study Quality

	Worst - Best (0 - 10)		(Y or N)
Well defined Patient groups		Exclude Voiding Dysfunction	
Well defined Outcomes		Follow-up Rate > 50%	
Well defined Exclusions		Prospective / Randomized	
Definition of Norms		> 50 patients total	
		Cystoscopy used for Dx	

Overall Study Comments (Use to identify biases to internal and external validity, or other issues which may be of interest to the panel - see instructions for details. Continue on back, if necessary)

List References (or attach bibliography):

Keywords:

(Enter number, see Appendix 1)

Reviewer:

Time to Complete: *(minutes)*

Date:

(Reviewer 1 - Red)
(Reviewer 2 - Blue)
(Composite - Yellow)

VUR Data Retrieval Page 2 of ____

Cover Sheet - C_VUR_R*.DB

Reference No.

2.DEMOGRAPHICS - TOTAL Population

TOTAL Patients: (Indicate Number) TOTAL Renal Units: (Indicate Number)

Intervention	Patients 1° Rx	Patients 2° Rx	Ureters 1° Rx	Ureters 2° Rx	Inclusion Criteria
Medical					
Surgery					
Endoscopic					
Control					

The following data should reflect the entire study population.

**** 1 ****
Sex Male Female
Age <1 1 to 5 >5
Mean Min Max

**** 2 ****
Presentation UTI PNDx Sib Incid
Complete Duplication Single Dupl
Upper Pole Reflux only
Lower Pole Reflux only
Reflux into both Systems
Unilat/Bilat Unilat Bilat Solitary Kidney
Voiding Dysfunction Pres None Not Stated
IRR Pres None Not Stated

Mode of Dx: VCUG RNC

Reflux Classification Code (see appendix 1)

Reflux Grade:

	Patients %	Patients x	Patients y	Ureters %	Ureters x	Ureters y
Grade:						
Grade:						
Grade:						
Grade:						
Grade:						
Grade:						

**** 1 *** If outcomes are analyzed in separate groups characterized by one or more these parameters, a separate set of sheets (pp 4-7) should be filled out for each group.

**** 2 **** The following group of parameters will usually be qualifiers and not segregators. If outcomes are analyzed in separate groups characterized by one or more these parameters, a separate set of sheets (pp 4-7) should be filled out for each group

VUR Data Retrieval Page 3 of ____

Cover Sheet - C_VUR_R*.DB

Reference No.

Define the various groupings that are detailed on the attached sheets. (pp. 4-7)
Each Group should have a separate set of sheets (pp. 4-7). See Appendix 2 for Codes.

	Sex	Age	Dupl	Grade	Uni/Bi	1° Rx	2° Rx	AV	F/U (years)	F/U Code	Other (Describe)
Group 0											
Group 1											
Group 2											
Group 3											
Group 4											
Group 5											
Group 6											
Group 7											
Group 8											
Group 9											
Group 10											
Group 11											
Group 12											
Group 13											
Group 14											
Group 15											
Group 16											
Group 17											
Group 18											
Group 19											
Group 20											
Group 21											
Group 22											
Group 23											
Group 24											
Group 25											
Group 26											
Group 27											
Group 28											
Group 29											
Group 30											

VUR Data Retrieval Page 4 of ____

Dx & Rx Data - D_VUR_R*.DB

Reference No. Group

2.DEMOGRAPHICS - of PARTICULAR Group

TOTAL Patients: (this group) (Indicate Number) TOTAL Renal Units: (this group) (Indicate Number)

Intervention	Patients 1° Rx	Patients 2° Rx	Ureters 1° Rx	Ureters 2° Rx	Inclusion Criteria
Medical					
Surgery					
Endoscopic					
Control					

*(*** see 1 on page 2, bottom)*
Sex Male Female
Age <1 1 to 5 >5
Mean Min Max

*(*** see 2 on page 2, bottom)*
Presentation UTI PNDx Sib Incid
Complete Duplication Single Dupl
Upper Pole Reflux only
Lower Pole Reflux only
Reflux into both Systems
Unilat/Bilat Unilat Bilat Solitary Kidney
Voiding Dysfunction Pres None Not Stated
IRR Pres None Not Stated

Mode of Dx: VCUG RNC

3. INITIAL

	Patients %	Patients x	Patients y	Ureters %	Ureters x	Ureters y	Definition
Scarring							
Infections							
Hypertension							
Proteinuria							
Impaired Function							
Mean CrCrClr							
ESRD							
Small Kidney							
Short stature							
Voiding Dysfunction							
Other							

Comments

Appendix B (continued)

VUR Data Retrieval Page 5 of ____

Reference No. ____ Group ____

4.1 Medical
(Y or N)

Cont Prophylaxis ____ Agent(s) ____ TMX/SUL ____ NF ____ Cef ____ PCN/TR ____ GNT ____

Intermit Prophylaxis ____ NotSp ____

Anticholinergics ____ Agent(s) Ditropan ____ Other ____

4.2 Surgery
(Y or N)

OPEN

P-L ____ G-A ____ T-T ____ L-G ____ Pag ____

G-V ____ Detrus ____ B. Neck ____ Tapering ____

Not Stated ____ Other ____

ENDOSCOPIC

Teflon ____ Collag ____ Ivalon ____ Blood ____ Fat ____

Not Stated ____ Other ____

DUPLICATION

Ureteroureterostomy ____ Partial Nephrectomy ____ Common Sheath Reimplant ____

Reimplant of Lower Pole Ureter only ____ 2° Excision of Stump ____

Not Stated ____ Other ____

OTHER

Nephrectomy ____ Nephroureterectomy ____

Not Stated ____ Other ____

Mean Hospital Stay (Days) ____

Comments: ____

VUR Data Retrieval Page 6 of ____

Outcomes Data - O_VUR_R*.DB

Reference No. ____ Group ____

4.3 OUTCOMES

Resolution data is: (circle one) A. Actual B. Actuarial C. Kaplan-Meier

	Patients %	Patients x	Patients y	Ureters %	Ureters x	Ureters y	Definitions
Spontaneous Resolution							
1 year							
2 years							
3 years							
4 years							
5 years							
>5 years							
All Not spec							
Reduced							
Worsened							
Cross Over to Surgery							
Surgical Cure							
New Scarring							
Progr Scarring							
Infections (NS)							
Cystitis							
Febrile 1							
2 to 3							
>3							
Febrile (Unknown number)							
Asymptomatic							
No of Breakthru							
Hypertension							
Proteinuria							
Impaired Function							
Mean CrCr/Clr							
ESRD							
Impaired Growth							
Kidney							
Somatic							
Voiding Dysfunction							
Side Effects (Medical Rx)							
None							
Total Number							
Allergic							
Hematologic							
Alter Rx							
Other							
Not Stated							
Complications (Surgical - 3 mo perioperative)							
New Contralateral VUR							
Ipsilateral VUR							
Disappears with time							
Persists req Surgery							
Persists not req Surgery							
REOP Obstruction							
Obstruction no REOP							
Infection (UTI)							
Other							
Not Stated							

VUR Data Retrieval Page 7 of ____

Outcomes Data - O_VUR_R*.DB (con't)

Reference No. ____ Group ____

Relationship of Scarring to Bacteriuria, if known for this particular group:

Bacteriuria (since Rx)	New or Progressive Scarring Y	New or Progressive Scarring N
Y		
N		

(Enter the number of Patients in each box)

Outcomes Comments: ____

Follow-up Data

5. FOLLOW-UP

Mean	Min	Max

VCU	RNC	U/S	IVP	C/S	CrCl	Interval
						Initial
						Subsequent

Detection of Scarring DMSA ____ IVP ____ U/S ____

Measurement of Renal Growth Planimetry ____ Length ____

Measurement of Renal function Serum Cr ____ CrCl ____ EDTA ____ DMSA ____

Comments ____

Appendix C: Methodology for combining parameters

Combining relative risks from several different studies is problematic. Several meta-analytic techniques can be used. A fixed effects analysis assumes that the studies all estimate the same parameter (relative risk). The opposite of a fixed effects model is a random effects model. In a random effects model, the parameter does not remain constant from study to study, but rather varies randomly, and the center of the distribution of the parameter of interest must be estimated. This methodology is especially appropriate for combining relative risks from pediatric reflux studies, because the populations used by each study have different mixes of grades, laterality and gender.

One standard method of combining parameters using random effects models is the empirical Bayes (EB) method (Hedges and Olkin, 1985). For this method, we assume that each θ_j estimates a different parameter, θ_j, with known variance, σ_j^2. The θ_j's are assumed to be a sample from a normal distribution with mean μ and variance τ^2. That is, mother nature chooses parameters for each study at random from a normal distribution with mean μ and variance τ^2. The likelihood is proportional to

$$L \propto \exp\left[-\sum_{j=1}^{m} [(\theta_j - \mu)^2 / (\tau^2 + \sigma_j^2) + \ln(\tau^2 + \sigma_j^2)] / 2 \right].$$

Maximum likelihood estimates can be calculated directly using a modified Gauss-Newton algorithm (Hasselblad, 1994) or the EM Algorithm (Dempster, Laird, and Rubin, 1977).

For dichotomous outcomes, such as rates of renal scarring, the same model can be used for the parameters, but the underlying distribution of the parameters is assumed to be binomial instead of normal. This can be accomplished by fitting a multiple logistic regression model with random effects. The EGRET software package (Statistics and Epidemiology Research Corporation, 1993) can be used to estimate such models. This model can be generalized to include multiple variables of interest.

The following example illustrates the use of the method to estimate the effect of both treatment and grade on renal scarring. A dataset was created for each subgroup of each renal scarring study when the study gave results by grade (see Table C-1). Dummy variables were created for each grade to indicate the effect of grade. Grades IV and V were combined because there were so few subjects. Some studies gave their results for a group of grades, and these presented special analysis problems. For those studies, the fraction of subjects in each grade was used in place of the dummy variables. To understand this, assume that one study had 40 percent in grade II and 60 percent in grade III. Then each individual in grade II should be assigned a one for the dummy for grade II and a zero for the other dummies. If this was actually done for all subjects in both grades and the dummy variables were then averaged, the result would be the fraction for each dummy as proposed. A small number of studies did not give a grade distribution, and for these studies an average grade distribution was assigned.

The data in Table C-1 were analyzed using multiple logistic regression analysis. The model assumes that the effects of each content factor are additive (in the log-odds space). Thus, the analysis results must be converted back to probabilities and relative risks. The results for this example are shown in Table C-2.

TABLE C-1. Dataset Created from the Medical and Surgical Studies of New Scarring (per Ureter)

Study	New Scars	Sample Size	Grade I	Grade II	Grade III	Grade IV/V	Surgery (1=yes)
Ben-Ami, Sinai, Hertz, et al., 1989	0	4	1	0	0	0	0
	0	28	0	.5	.5	0	0
	3	5	0	0	0	1	0
Scholtmeijer and Griffiths, 1988	0	12	1	0	0	0	0
	1	36	0	1	0	0	0
	1	31	0	0	1	0	0
	0	12	0	0	0	1	0
Birmingham Reflux Study Group, 1987	5	111	0	.1	.4	.5	0
Homsy, Nsouli, Hamburger, et al., 1985	0	53	.09	.06	.15	.15	0
Bellinger and Duckett, 1984	1	165	.15	.55	.18	.12	0
Koff and Murtagh, 1983	3	47	.06	.23	.36	.34	0
	2	55	.21	.25	.25	.26	0
Shah, Robins, and White, 1978	1	13	0	1	0	0	0
	4	47	0	0	.40	.60	0
Cardiff-Oxford Bacteriuria Study Group, 1978	0	28	1	0	0	0	0
	1	41	0	1	0	0	0
	1	12	0	0	.40	.60	0
Edwards, Normand, Prescod, et al., 1977	2	121	.15	.18	.49	.14	0
Jakobsen, Genster, Olesen, et al., 1977	0	193	.21	.35	.17	.25	0
Husmann and Allen, 1991	13	142	0	1	0	0	0
Burge, Griffiths, Malone, et al., 1992	0	6	1	0	0	0	0
	0	3	0	1	0	0	0
	0	14	0	0	1	0	0
	0	17	0	0	0	1	0
	0	4	0	0	0	1	0
Arant 1992	1	11	1	0	0	0	0
	5	40	0	1	0	0	0
	9	33	0	0	1	0	0
Aggarwal, Verrier-Jones, Asscher, et al., 1991	0	10	1	0	0	0	0
	0	10	0	1	0	0	0
	2	11	0	0	.40	.60	0
Beetz, Schulte-Wissermann, Tröger, et al., 1989	9	264	.09	.52	.31	.10	1
Scholtmeijer and Griffiths, 1988	2	10	0	0	1	0	1
	1	24	0	0	0	1	1
Birmingham Reflux Study Group, 1987	4	104	0	.1	.4	.5	1
Scott, Blackford, Joyce, et al., 1986	0	97	0	.1	.4	.5	1
Carpentier, Bettink, Hop, et al., 1982	0	100	.35	.5	.28	.12	1
Burge, Griffiths, Malone, et al., 1992	0	21	.14	.05	.28	.53	1
Hjalmas, Lohr, Tamminen-Mobius, et al., 1992	20	237	0	0	.11	.89	1

TABLE C-2. Results of the Multiple Logistic Regression Analysis With Random Effects Using the Data in Table C-1

Variable	Coefficient	Std.Err.Beta	p-value	Odds/Odds ratio
Grade I	-6.125	(1.57)	<.001	.002187
Grade II	-3.739	(.397)	<.001	.02377
Grade III	-3.332	(.770)	<.001	.03573
Grade IV or V	-2.841	(.538)	<.001	.05836
Surgery	-.02613	(.452)	.954	.9742
Random effect term	1.368	(.316)		

The combination of rates, such as complication rates, is a special case of the analysis just described. The general use of a linear model with random effects can be applied to either continuous or dichotomous data. Most standard meta-analytic methods, such as inverse variance weighting and the Mantel-Haenszel method, are special cases of the methods just described.

References for Appendix C

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Appendix D: Recommendations questionnaire—Sample page

American Urological Association, Inc.
Vesicoureteral Reflux Guidelines
Panel Survey Questionnaire

NAME:

Question No.

Age: **Grade:** **Characteristics:**

A. What would be your initial treatment? (check one)

Boys	Girls	
_____	_____	a. Intermittent treatment
_____	_____	b. Continuous Antibiotic Prophylaxis (go to B)
_____	_____	c. Surgery

How strongly do you feel about this recommendation? (circle one)

Boys:	low	medium	high
Girls:	low	medium	high

B. If uncomplicated reflux persists, you would continue prophylaxis until age:
(boys) _____ (girls) _____ , and then:

Boys	Girls	
_____	_____	a. discontinue treatment and cystography
_____	_____	b. discontinue treatment and continue cystography until age: (boys) _____ (girls) _____
_____	_____	c. operate
_____	_____	d. discontinue treatment: continue cystography and, if reflux persists until age: (boys)_____ (girls) _____ , then operate.

How strongly do you feel about this recommendation? (circle one)

Boys:	low	medium	high
Girls:	low	medium	high

Appendix E: Data presentation

TABLE E-1. RESOLUTION OF REFLUX AFTER OPEN SURGERY

Author/ Papyrus #	Number of Patients	Number of Ureters	Surgical Procedure[1]	Surgical Success (Patients)	Surgical Success (Ureters)	Grade I/ Total	Grade II/ Total	Grade III/ Total	Grade IV/ Total	Grade V/ Total
Linn 51	60	101	L-G	55/60						
Beetz 42	189	242	L-G		238/242					
Jansen 22	80	106	Mix,P-L,C,L-G	96/106						
Fryczkowski 14	50	103	Author's own		103/103		8/8	48/48	44/44	3/3
Bellinger 209	207	338	Mix,P-L,G-A,C	197/207		?/12	?/80	?/102	?/115	?/26
Glassberg 184	60	101	C		101/101	1/1	10/10	23/23	32/32	35/35
Remzi 183	89	143	P-L		118/143					
Quinlan 182	51	51	Mix, L-P, C		50/51					
Sutton 96	22	22	P-L		22/22		1/1	8/8	13/13	
Solok 105	14	22	G-V		18/22		4/4	9/9	4/5	1/4
Decter 66	30		Mix P-L,G-A,C	30/30		1/1	5/5	10/10	9/9	5/5
Carini 181	14		G-V	13/14			3/3	8/9	2/2	
Ehrlich 120		31	K		31/31					
Scott 157	56	97	C	52/56						
Kondo 135	32	64	C		57/57		12/12		45/45	
Zaontz 129	79	120	D		111/120		57/58	42/47	15-Dec	
Birmingham 131	77	107	L-P, C		105/107		105/107			
Breuhl 117	146	190	L-G		188/190		46	106	32	6
Pypno 124	43	80	C		80/80		6	53	10	
Bradic 58	618	792	Anterior D		792/824		43	378	403	
Hanani 249	105		P-L, G-A	98/105						
Faure 274	136	272	C		270/272					
Carpentier 272	200	100	P-L		88/100	8	46	31	10	5
Carpentier 272		100	C		97/100	12	55	25	8	0
Ehrlich 267	135	229	C		226/229			74	102	53
Maggiolo 254	15	28	TH		24/28					24/28
Ahmed 252	28	38	C		37/38			4/4	12/12	21/22
Wacksman 24	36?	52	C		51/52	5/5	6/6	24/24	11/11	5/6
Hagberg 222	13	15	P-L		14/15					
Jakobsen 376	80		L-P Bischoff (2)	68/80						
McDuffie 372	51	78	L-G		73/76					
Retik 356	8	9	TH		9/9					
Marberger 347	371	429	L-G		419/429					
Wachsman 348			P-L			10/1	62/67	50/54		
Wachsman 348			G-A			2/2	39/40	25/26		
Wachsman 348			P				8/8	7/7 misc	10/19	
Harty 294	35	35	L-P		35/35	2/2	6/6	23/23		
Hanna 288	13	22	TH		21/22					21/22

[1]L-G = Lich-Gregoir; P-L = Politano-Leadbetter; C = Cohen (transtrigonal); G-A = Glenn-Anderson; K = Kalicinski; D = Detrusorrhaphy; TH = Tailoring Hendren; P = Paquin; G-V = Gil-Vernet; U = Ureterostomy; H = Hutch

TABLE E-1. RESOLUTION OF REFLUX AFTER OPEN SURGERY (continued)

Author/ Papyrus #	Number of Patients	Number of Ureters	Surgical Procedure[1]	Surgical Success (Patients)	Surgical Success (Ureters)	Grade I/ Total	Grade II/ Total	Grade III/ Total	Grade IV/ Total	Grade V/ Total
Scott 540	31	46	? type		38/46					
Bradic 412	90	106	Anterior D		91/93					
Hohenfellner 4	96		L-G	92/96						
Parrott 403		253	P		253/253					
Hampel 383	51	83	L-G		78/83					
Scott 377	163		Mod. P-L	157/163						
Duckett 642	87	154	C, P-L		153/154			18/153	135/153	
Burbige 678	33		C	33/33						
Burbige 678	37		P-L	37/37						
Brandell 789	34		Mixed,G-A,P-L,C	57/57	7/7	12/12	20/20	8/8	5/5	
Oezem 798	11	11	Starr Plic		5/11					5/11
Wacksman 660		202	D		202/202	1/1	63/63	112/112	22/22	4/4
De Gennaro 6	47	69	G-V		68/69		25/25	39/39	3/4	
Houle 658	45	65	D		62/65	6/6	16/16	23/23	13/14	4/6
Garrett 566	58	96	P-L		95/96					
Kliment 586	60	96	G-V	54/60						
Bettex 497	27	29	P-L		25/29					
Ravasini 461	22	37	Mod. G-A		37/37					
Jonas 438	86	150	Mix P-L, G-A		132/150					
Hjalmas 643	151	237			191/237					
Hjalmas 643	83	131	P-L							
Hjalmas 643	39	59	L-G							
Hjalmas 643	27	41	C							
Hjalmas 643	2	4	G-A							
Hjalmas 643	1	2	Mod. H							
Willscher 388+	223	342	P-L		338/342					
Hirsch 368	61	91	Unknown		84/91					
Broaddus 359	40	73	P-L		73/73	6/6	28/28	15/15	13/13	2/2
Rabinowitz 332	54	80	TH		25/25					25/25
So 313	52	87	Mix G-A, P-L		82/87					
Funke 310	142	176	L-G		168/176					
Atwell 305	112	106	P-L		106/106	14/14	16/16	43/43	33/33	
Arap 304	300	520	L-G		514/520	29/29	307/307	184/184		
Ahmed 301	205	296	C		294/296	13/13	101/101	119/121	61/61	
Carson 300	200		Unknown	194/200						
Mundy 286	73	80	Mix P-L,C		80/80					
Elo 284	49		P-L	47/49						
Brockrath 256	11	13	U		11/13					
Fort 255	63		Mix,G-A,P-L,C,H	47/50						
Govan 418	61	105	H		88/105					
Govan 418			P-L		14/17					
Burns 488	15		U		6/6					
Burns 488			H		7/9					

[1]L-G = Lich-Gregoir; P-L = Politano-Leadbetter; C = Cohen (transtrigonal); G-A = Glenn-Anderson; K = Kalicinski; D = Detrusorrhaphy; TH = Tailoring Hendren; P = Paquin; G-V = Gil-Vernet; U = Ureterostomy; H = Hutch

TABLE E-1. RESOLUTION OF REFLUX AFTER OPEN SURGERY (continued)

Author/ Papyrus #	Number of Patients	Number of Ureters	Surgical Procedure[1]	Surgical Success (Patients)	Surgical Success (Ureters)	Grade I/ Total	Grade II/ Total	Grade III/ Total	Grade IV/ Total	Grade V/ Total
Lee 687	23		P-L for duplex	18/23						
Scholtmeijer 685		49	Unknown		46/49	1/2	3/3	6/10	21/23	6/7
Sargin 680	30	30	MixP-L,G-A,C,P,		30/30			12/12	18/18	
Allen 462	20	29	Mod. G-L	18/19						
Mc Rae 443	39	63	Mix H,P,L-P		40/53					
McGregor 417	4		Unknown	4/4						
Amar 401	111		Mod. P-L	109/111						
Brown 93	51	79	C		75/76	18	18	15/15	40/3	
Johnston 426	17	29	TH		16/29					
Peratoner 204	38	50	Unknown		50/50		2/2	17/17	31/31	
Ginalski 150	141	229	Mix P-L, C		229/229	10/1	87/87	106/106	26/26	
Nasrallah 205	9	16	Unknown		4/16					
Fehrenbaker 4	16		Unknown duplic		13/16					
Marra 969	3	3	Unknown		3/3			1/1	2/2	

[1]L-G = Lich-Gregoir; P-L = Politano-Leadbetter; C = Cohen (transtrigonal); G-A = Glenn-Anderson; K = Kalicinski; D = Detrusorrhaphy; TH = Tailoring Hendren; P = Paquin; G-V = Gil-Vernet; U = Ureterostomy; H = Hutch

TABLE E-2. GRADE V REFLUX: RESOLUTION AFTER OPEN SURGERY

Author/ Papyrus #	Number of Patients	Number of Patients	Surgical Procedure[1]	Surgical Success (Ureters)	Grade V/ Total
Johnston 426	17	29	TH	16/29	
Rabinowitz 332	54	80	TH	25/25	25/25
Oezem 798	11	11	Starr Plic	5/11	5/11
Hanna 288	13	22	TH	21/22	21/22
Retik 356	8	9	TH	9/9	
Maggiolo 254	15	28	TH	24/28	24/28
Ehrlich 120		31	K	31/31	
Total	118	210		131/155	75/86
Percent				84.50%	87.2

[1]TH = Tailoring Hendren; K = Kalicinski

TABLE E-3. RESOLUTION OF REFLUX AFTER OPEN SURGERY

Author/ Papyrus #	Number of Patients	Number of Ureters	Surgical Procedure[1]	Surgical Success (Patients)	Surgical Success (Ureters)	Grade I/ Total	Grade II/ Total	Grade III/ Total	Grade IV/ Total	Grade V/ Total
Scholtmeijer 685		49	Unknown		46/49	1/2	3/3	6/10	21/23	6/7
Brown 93	51	79	C		75/76	18	18	15/15	40	3
Ahmed 301	205	296	C		294/296	13/13	101/101	119/121	61/61	
Burbige 678	33		C	33/33						
Wacksman 246	36	52	C		51/52	5/5	6/6	24/24	11/11	5/6
Ahmed 252	28	38	C		37/38			4/4	12/12	21/22
Ehrlich 267	135	229	C		226/229			74	102	53
Carpentier 272		100	C		97/100	12	55	25	8	0
Faure 274	136	272	C		270/272					
Pypno 124	43	80	C		80/80		6	53	10	
Kondo 135	32	64	C		57/57		12/12		45/45	
Scott 157	56	97	C	52/56						
Glassberg 184	60	101	C		101/101	1/1	10/10	23/23	32/32	35/35
Total	**815**	**1408**		**85/89**	**1288/1301**	**19/19**	**117/117**	**185/187**	**116/116**	**61/63**
Percent				**95.50%**	**99%**	**100%**	**100%**	**98.90%**	**100%**	**96.80%**
Politano-Leadbetter Procedure										
Lee 687	23		P-L for duplex	18/23						
Govan 418			P-L		14/17					
Elo 284	49		P-L	47/49			5/6	28	8/9	
Atwell 305	112	106	P-L		106/106	14/14	16/16	43/43	33/33	
Broaddus 359	40	73	P-L		73/73	6/6	28/28	15/15	13/13	2/2
Willscher 388+396	223	342	P-L		338/342					
Bettex 497	27	29	P-L		25/29					
Garrett 566	58	96	P-L		95/96					
Burbige 678	37		P-L	37/37						
Scott 377	163		Mod. P-L	157/163						
Harty 294	35	35	L-P		35/35	2/2	6/6	23/23		
Wachsman 348			P-L			10/10	62/67	50/54		
Hagberg 222	13	15	P-L		14/15					
Carpentier 272	200	100	P-L		88/100	8	46	31	10	5
Sutton 96	22	22	P-L		22/22		1/1	8/8	13/13	
Remzi 183	89	143	P-L		118/143					
Total	**1091**	**961**		**259/272**	**928/978**	**32/32**	**118/124**	**139/143**	**67/68**	**2/2**
Percent				**95.20%**	**94.90%**	**100%**	**95.20%**	**97.20%**	**98.50%**	**100%**
Lich-Gregoir Procedure										
Zaontz 129	79	120	D		111/120		57/58	42/47	12/15	
Breuhl 117	146	190	L-G		188/190		46	106	32	6
Hampel 383	51	83	L-G		78/83					
Wacksman 660		202	D		202/202	1/1	63/63	112/112	22/22	4/4
Allen 462	20	29	Mod. G-L	18/19						
Arap 304	300	520	L-G		514/520	29/29	307/307	184/184		

TABLE E-3. RESOLUTION OF REFLUX AFTER OPEN SURGERY (continued)

Author/ Papyrus #	Number of Patients	Number of Ureters	Surgical Procedure[1]	Surgical Success (Patients)	Surgical Success (Ureters)	Grade I/ Total	Grade II/ Total	Grade III/ Total	Grade IV/ Total	Grade V/ Total
Funke 310	142	176	L-G		168/176					
Houle 658	45	65	D		62/65	6/6	16/16	23/23	13/14	4/6
Hohenfellner	96		L-G	92/96						
Marberger 347	371	429	L-G		419/429					
McDuffie 372	51	78	L		73/76					
Beetz 42	189	242	L-G		238/242					
Linn 51	60	101	L-G	55/60						
Total	**1550**	**2235**		**165/175**	**2053/2013**	**36/36**	**443/4431**	**361/361**	**47/51**	**8/10**
Percent				**94.30%**	**97.60%**	**100%**	**100%**	**100%**	**92.20%**	**80%**
Gil-Vernet Procedure										
Solok 105	14	22	G-V		18/22		4/4	9/9	4/5	1/4
Carini 181	14		G-V	13/14			3/3	8/9	2/2	
De Gennaro 688	47	69	G-V		68/69		25/25	39/39	3/4	
Kliment 586	60	96	G-V	54/60						
Total	**162**	**187**		**67/74**	**86/91**		**29/29**	**48/48**	**7/9**	**1/4**
Percent				**90.50%**	**94.50%**		**100%**	**100%**	**77.70%**	**25%**
Paquin Procedure										
Wachsman 348			Paquin				8/8	7/7 misc.	10/19	
Parrott 403		253	Paquin		253/253					
Total		**253**			**253/253**					
Percent					**100%**					

TABLE E-4. STUDIES OF OBSTRUCTION AFTER OPEN SURGERY

Study	Rate (By ureter)	Estimate (95% Confidence Interval)
Orikasa, 1990	0/92	0.000 (0.000, 0.032)
Ehrlich, 1985	1/78	0.013 (0.000, 0.039)
Bellinger and Duckett, 1984	7/338	0.021 (0.007, 0.038)
Hagberg, Hjalmas, Jacobsson, et al., 1984	1/15	0.067 (0.000, 0.206)
Maggiolo, Lockhart, and Politano, 1983	0/28	0.000 (0.000, 0.105)
Carpentier, Bettick, Hop, et al., 1982	3/200	0.015 (0.001, 0.036)
Ahmed and Tan, 1982	11/304	0.036 (0.016, 0.060)
Arap, Abrao, and Menezes-de-Goes, 1981	5/520	0.010 (0.002, 0.020)
Broaddus, Zickerman, Morrisseau, et al., 1978	4/73	0.055 (0.009, 0.119)
Hampel, Richter-Levin, and Gersh, 1977	0/83	0.000 (0.000, 0.036)
Willscher, Bauer, Zammuto, et al., 1976	4/342	0.012 (0.002, 0.026)
Govan, Fair, Friedland, et al., 1975	8/105	0.076 (0.028, 0.135)
Jonas, Many, Boichis, et al., 1974	3/150	0.020 (0.002, 0.048)
Garrett and Switzer, 1966	4/96	0.042 (0.007, 0.090)
Duckett, Walker, and Weiss, 1992	0/154	0.000 (0.000, 0.019)
Wacksman, Gilbert, and Sheldon, 1992	0/211	0.000 (0.000, 0.014)
Burbige, 1991	1/180	0.006 (0.000, 0.021)
Bradic, Batinica, and Husar, 1988	10/824	0.012 (0.005, 0.021)
Sutton and Atwell, 1989	3/36	0.083 (0.007, 0.197)
Pypno, 1987	0/80	0.000 (0.000, 0.037)
Zaontz, Maizels, Sugar, et al., 1987	0/120	0.000 (0.000, 0.025)
Birmingham Reflux Study Group, 1987	0/107	0.000 (0.000, 0.028)
Kondo and Otani, 1987	2/100	0.020 (0.000, 0.056)
Ehrlich, 1982	0/229	0.000 (0.000, 0.013)
Faure, Ben-Salah, dEscoffier, et al., 1982	1/272	0.004 (0.000, 0.011)
Mundy, Kinder, Joyce, et al., 1981	0/17	0.000 (0.000, 0.171)
Hanna, 1981	1/22	0.045 (0.000, 0.139)
McDuffie, Litin, and Blundon, 1977	1/78	0.013 (0.000, 0.039)
Johnston and Farkas, 1975	3/33	0.091 (0.008, 0.214)
Ravasini and Pagano, 1973	0/37	0.000 (0.000, 0.080)
Allen, 1973	0/29	0.000 (0.000, 0.102)
Hjalmas, Lohr, Tamminen-Mobius, et al., 1992	8/237	0.034 (0.012, 0.060)
Houle, McLorie, Heritz, et al., 1992	0/65	0.000 (0.000, 0.046)

TABLE E-5. STUDIES OF REOPERATION FOR OBSTRUCTION

Study	Rate (By ureter)	Estimate (95% Confidence Interval)
Ehrlich, 1985	1/78	0.013 (0.000, 0.039)
Bellinger and Duckett, 1984	7/338	0.021 (0.007, 0.38)
Hagberg, Hjalmas, Jacobsson, et al., 1984	1/15	0.067 (0.000, 0.206)
Ahmed and Tan, 1982	1/304	0.003 (0.000, 0.010)
Broaddus, Zickerman, Morrisseau, et al., 1978	4/73	0.055 (0.009, 0.119)
Govan, Fair, Friedland, et al., 1975	6/105	0.057 (0.016, 0.110)
Jonas, Many, Boichis, et al., 1974	3/150	0.020 (0.002, 0.048)
Garrett and Switzer, 1966	4/96	0.042 (0.007, 0.090)
Burbige, 1991	1/180	0.006 (0.000, 0.021)
Bradic, Batinica, and Husar, 1988	10/824	0.012 (0.005, 0.021)
Sutton and Atwell, 1989	3/36	0.083 (0.007, 0.197)
Hanna, 1981	1/22	0.045 (0.000, 0.139)
Johnston and Farkas, 1975	3/33	0.091 (0.008, 0.214)
Hjalmas, Lohr, Tamminen-Mobius, et al., 1992	7/237	0.030 (0.009, 0.055)

Index

V

Notes

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This report on the Management of Primary Vesicoureteral Reflux was developed by the Pediatric Vesicoureteral Reflux Clinical Guidelines Panel of the American Urological Association, Inc.

This report is intended to furnish to the skilled practitioner a consensus of clear principles and strategies for quality patient care, based on current professional literature, clinical experience and expert opinion. It does not establish a fixed set of rules or define the legal standard of care, pre-empting physician judgment in individual cases.

An attempt has been made to recommend a range of generally acceptable modalities of treatment, taking into account variations in resources and in patient needs and preferences. It is recommended that the practitioner articulate and document the basis for any significant deviation from these parameters.

Finally, it is recognized that conformance with these guidelines cannot ensure a successful result. The parameters should not stifle innovation, but will, themselves, be updated and will change with both scientific knowledge and technological advances.

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Report on the Management of Primary Vesicoureteral Reflux in Children

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Report of the National Consensus Conference on Family Presence during Pediatric Cardiopulmonary Resuscitation and Procedures

Deborah Parkman Henderson RN PhD

Jane F. Knapp MD

Introduction

The National Consensus Conference on Family Presence during Pediatric Cardiopulmonary Resuscitation and Procedures was held in Washington, DC, on September 7-8, 2003. The concept, funding, planning and organization for the conference were the Ambulatory Pediatric Association (APA) Presidential Project of James Seidel, M.D., Ph.D. Dr. Seidel was in the final stages of preparation for chairing the conference when he died on July 25, 2003. In Dr. Seidel's absence, the conference was chaired by Deborah Parkman Henderson R.N., PhD, his co-investigator, and Jane F. Knapp, M.D, a colleague.

The National Consensus Conference on Family Presence during Pediatric Procedures and Cardiopulmonary Resuscitation was funded by a grant to the APA from the Maternal Child Health Bureau (MCHB) Partnership for Children. This meeting brought together a panel of over 20 appointed representatives from a multidisciplinary, diverse group of national organizations interested in the emergency care of children. The conference was part of a multiphase process designed with the goal of publishing consensus guidelines useful for defining policy regarding family presence (FP) during pediatric procedures and CPR in the Emergency Department (ED). It is also possible that the consensus panel recommendations could be applied to other settings.

Panel members completed a review of the literature prior to attending the conference. This review, along with results of a pre-conference questionnaire, formed the basis of the discussion during the conference. During the two day conference the participants completed the outline of the guidelines presented here. We believe these recommendations are a powerful testimony to Dr. Seidel's vision for promoting FP through multidisciplinary consensus building. Beyond that vision, however, we hope that the guidelines will make a difference in improving the quality of children's health care.

Historical Perspective

Many health care providers trained during a time when FP during pediatric invasive procedures (IP) and CPR was discouraged and restricted. The rationale was that allowing parents to be present during IP and CPR would be distracting to the health care provider and potentially even harmful for the parents and/or child.[1-3] This practice appears to have been more supported by tradition rather than actual evidence. Yet, this traditional approach has created strong, enduring attitudes and beliefs.

In 1982, the Director of Pastoral Care for Foote Hospital in Jackson, Michigan had an experience where a policeman's wife pleaded to be with her husband while he was undergoing CPR for a heart attack. Uncertain what to do, he hurriedly asked the doctor for permission to bring the woman to her husband's side. This event initiated the development of a program that allowed for the presence of family members during resuscitation. The published accounts of the Foote Hospital experience prompted many hospitals and EDs to re-examine their approach to FP.[4,5] This process sparked an often polarizing debate among health care providers who expressed strong opinions on both sides of the issue. It also provided the impetus for research to critically study family, patient, and provider attitudes and the numerous other concerns that had been raised regarding FP.

The Emergency Nurses Association (ENA) took a proactive stand regarding FP in 1993 when they adopted a resolution to support the option of FP during invasive procedures (IP) and resuscitation.[6] The current ENA position statement continues to support the option for FP and additionally calls for further research related to the impact of FP, the development and dissemination of educational resources, the collaboration of specialty organizations to develop multidisciplinary guidelines and the

establishment of policies and procedures allowing the option of FP during IP and CPR.(www.ena.org)

The American Heart Association reviewed the ethical aspects of CPR and emergency cardiovascular care for the 2000 guidelines.[7] This included a literature review regarding FP during resuscitation attempts. The AHA now recommends that healthcare providers should offer the opportunity to be present during CPR to family members whenever possible.[7]

Statement of the Problem

A decade after the adoption of the ENA resolution on FP, few EDs have written policies regarding FP during IP and CPR. [8] Although many family members and health care providers support the option of FP, parents frequently are not given the option to remain with their child during IP and CPR. Moreover, there remains a lack of collaborative, multidisciplinary guidelines among professional and specialty organizations with an interest in children's healthcare. Barriers to the formulation of consensus guidelines are as basic as the definition of a family member and under what circumstances a family member should be excluded. Controversies such as who makes the decision regarding FP and whether FP increases the risk of litigation remain.

The intention of this conference was to use the UCLA-Rand Appropriateness Method (RAM) methodology to arrive at multidisciplinary consensus recommendations that could be used by health care providers to formulate guidelines for FP during pediatric procedures and resuscitation in the ED.

Literature Review

Excellent reviews and summaries of the research on FP, including studies focused on pediatric patients, have been published. [7,9-14] Although much of the literature concerns acute care settings, a small number of articles relate to intensive care settings.[9,10] Assumptions may be made that parental experience and expectations are the same in these settings, but this has not been studied. Many findings are consistent among a number of published reports and studies. Most parents prefer to stay with their children during procedures and resuscitation.[13,15-19] Children feel less stress when parents are allowed to remain during procedures.[20-25] Among physicians, the likelihood of being in favor of allowing parental presence increases with experience, confidence and competence at dealing with procedures, resuscitation and distressed relatives.[3,12,26] As the invasiveness of procedures increases to CPR (perceived as the most invasive) physicians vary more in their attitudes and are less comfortable with parental presence.[13,28-29] Physicians and nurses differ in their attitudes toward FP. Nurses, generally, are more supportive of FP.[18,29-30] Parents want to be given the option to be present with their child and along with nurses and physicians have expressed the desire to be part of the decision making process.[19,28,31] Although parents want to be present, they seldom ask unless they have been encouraged to do so. Healthcare providers should offer the opportunity to family member whenever possible.[9,32-34] A trained support person is of prime importance to the success of FP during procedures.[5] This support person should be assigned to the family to answer questions, describe and clarify the proceedings and offer comfort.[35] Education appears to be effective in changing nursing and other staff attitudes regarding FP.[37-38]

Health care providers have raised a number of concerns to explain their hesitancy and reluctance regarding FP.[3,26] These are summarized in Table 1. Many studies have attempted to examine these attitudes critically. One study found that children were more cooperative and less fearful when parents were present during dental procedures.[38] Others have found that both families and providers have found parental presence to be beneficial without deleterious effect on interactions or provider performance.[15,25,26,39] Rather than criticizing the quality of care, the majority of family members who were allowed to witness resuscitation felt that everything possible was done for the patient.[5,27,41-43,48] Most reports on FP document no disruptions in patient care and describe family members as quiet observers.[18,43-46]

Table 2 is a summary of the perceived benefits of FP. Many of the studies supporting the benefits of FP during IP and CPR have already been mentioned. It appears that once institutions have

incorporated FP into their practice, staffs have remained supportive.[12,26,43] Family members who were present for procedures or during resuscitation reported that they were glad that they had done so and would choose to do it again.[26,43] Results from psychological examinations suggest that family members present during resuscitation have more positive grieving behavior than family members not present during resuscitation.[46] Although there are no data regarding the risk of litigation and FP, reduced risk behavior was reported by healthcare providers whose attention to patient needs for privacy and pain management were prompted by the presence of family members.[26,46] Those who have reported their experience with FP have not reported increased litigation.[47]

Critical appraisal of the FP literature notes that it is in the initial stages of development with many limitations that frequently include methodological flaws that limit interpretation and prevent comparison of results.[14] Most of the studies are survey or observational in nature and few randomized controlled trials exist. The Institute of Medicine Committee on Palliative and End-of-Life Care for Children and Their Families recommends that additional systematic research on bereavement outcomes and other consequences of parental presence policies be conducted.[48] They note that prospective studies could follow families through the entire process from the discussion of presence during resuscitation to the aftermath including follow-up during bereavement. Additional research would serve to increase the depth of understanding regarding the effect of FP on patients, family members and health care providers, in both acute care and intensive care settings, and provide direction on the best practices for education, implementation of programs and provision of care.

Method

The UCLA-RAM was used to develop recommendations for FP in the ED. This method is a modification of the Delphi method, a structured process for collecting and condensing knowledge from a group of experts through a series of questionnaires. The RAM was originally used to assist in determining the relative weight of benefits and harms of medical procedures, [49-53] but has also been used to develop other medical guidelines and recommendations.54-61 RAM methodology in this case included 1) recruitment of a panel of experts 2) a literature search and compilation of journal articles, 3) development of a list of issues and definitions, 4) design and distribution of first round questionnaire (pre-survey) to the expert panel, 5) expert panel completion of first round questionnaire and subsequent review of the literature, 6) meeting of the expert panel, with presentation of first round results and discussion of definitions and significant issues (Day 1 of meeting); 7) development of second round questionnaire with addition of issues identified during Day 1 of the meeting; 8) presentation of results of second round questionnaire to the expert panel, with discussion and development of agreement on recommendations (Day 2 of the meeting); 9) circulation of the final document for approval by the expert panel.

The expert panel included appointed representatives and guests from the organizations in Table 3. The panel represented a variety of disciplines, pediatric subspecialties (emergency medicine, critical care, and surgery) and educational backgrounds, several having more than one degree (BS-2, EMT-P-1, MS-1, MD-6, MSW/LCSW-2, RN-2, PhD-2). All but two panel members were under 50 years of age, all panel members had experience with FP over 20 times (11/13), and 14 panel members were parents.

Round 1 Survey:

In preparation for the meeting, a Medline search was initiated using key words (individually and combined): family presence, parental presence, presence of relatives, family members, family-witnessed resuscitation, emergency department procedures, pediatric resuscitation, pediatric emergency, and invasive procedures. Forty-one relevant articles dating from 1981 to 2003 were found and collated for review by the expert panel. The articles consisted of personal accounts or position statements (19); review articles (8), and research articles, mostly surveys of bereaved families (14). The Round 1 questionnaire was developed for the meeting after reviewing the articles and identifying areas of interest. The questionnaire included 9 attitudinal questions about parental presence during invasive procedures and resuscitation, using a 4-point Likert scale. Other questions included what type of training should be required for professionals assisting with parental presence, what types of professionals are appropriate for accompanying the family, under what circumstances

participants felt it was appropriate to exclude the family, and what barriers existed to including the family during invasive procedures and resuscitation. The panel was also asked about benefits and drawbacks to allowing parental presence, and what family members or others should be included, if any. Demographic information asked of the panel included the amount of personal experience they had with parental presence, whether the individual was a parent, the individual's age and professional degrees.

Results

All panel members returned the initial survey except one whose appointment came too late to allow return of the survey prior to the meeting. There was only one change in panel membership during the duration of the project. The results of both the first and second round surveys are shown in Table 4.

Conference Day 1

Journal articles concerning FP had been reviewed prior to the conference; additional articles were distributed at the outset at the recommendation of panel members. During the first day of the meeting, the results of the first round survey were presented, with issues identified for further discussion. Results of the first survey showed that 1)all panel members agreed that parental presence should be an option for minor procedures, and 2)most panel members agreed that FP should be an option during all procedures. (Table 4) Panel members' comments about drawbacks in providing the option of FP included 1) possible family interference with procedures, 2) lack of sufficient staff to assist the family, resulting increased costs with implementation, and 3) concerns about the psychological effects on staff. Possible benefits noted included 1) a calming effect for both parent and child, 2) giving the family a sense of control and involvement in the child's care, 3) family awareness of how much was done for the child. Specific terms for use in developing guidelines related to FP were discussed and definitions agreed upon. (Table 5) Because of the broad scope of FP issues, panel members were divided by self-selection into three groups for discussion: Legal-Ethical; Education; and Policy and Procedure. Each of these groups met separately to discuss the topics, and presented the results of the discussion to the entire panel. Areas and issues that had not been identified in the first questionnaire were added to the second round questionnaire. Participants were then asked to complete the second round questionnaire, and the results were tallied prior to the second day meeting. Several issues remained unresolved on the first day, including some key definitions, and possible reasons for not presenting the option of FP. These were left to be discussed on the second day.

Conference Day Two

The second day of the conference began with a presentation of the results of the second round of the survey. There were some notable shifts in the thinking of the panel members from Round 1 to Round 2: 1)there was a trend to allowing parental presence in more invasive procedures such as resuscitation, lumbar puncture, closed reduction of fractures and tapping of a shunt; 2)there was an increase in the feeling that additional training was needed for those who accompany the family during procedures; 3)there were fewer reasons given for exclusion of the families; 4)the panel became more flexible in allowing individuals with a significant relationship to the patient to be present during procedures and CPR. (Table 4) The discussion then turned to an important unresolved issue from the first day of the conference. This was whether the consensus guidelines should use the focused terminology of "parental presence" or the more generalized "family presence". An additional issue of discussion considered the definition of a family member. For the purposes of these guidelines, panel members agreed to the broader term "family presence" and defined family member as a person over 18 years with an established relationship (relative or significant other, including single parents, grandparent as parent, and others) with the patient. Although the panel agreed to the age of 18 years as a general guideline, they also recognized the need for case-specific assessment and decision making. This means, for example, that a teen parent of a child should not be excluded from being present during a procedure or CPR on the basis of age alone.

The panel saw the primary purpose of FP as a supportive presence for the child. This supportive presence would occur during all of the activities from preparation of the family until the end of treatment. They felt that FP should be considered for all families and offered as an option with certain restrictions. Family presence should be offered as an option when the care of the child will not be interrupted and after an assessment for: 1) combative and threatening behavior; 2) extreme

emotional volatility; 3) behaviors consistent with intoxication or altered mental status 4) disagreement among family members and 5) threat to the safety of the health care team. When a family is not offered the option of FP the reason(s) for exclusion should be consistent with one or more of the above restrictions and should be well documented.

The assessment of the family for the conditions noted above should be made by a facilitator who is a member of the patient care team and has the responsibility of presenting the option for FP. Although the panel favored a team decision regarding FP they acknowledged that in cases of disagreement one team member must be ultimately responsible for decision making. That responsibility must rest with the team leader, usually a physician in the hospital setting. The panel recognized that preparation for instances of disagreement must be made well in advance through written policy and procedures. The patient's bedside was not seen as an appropriate forum for spur-of-the-moment debates.

The panel felt that a qualified facilitator should be identified and pre-assigned for some procedures and all instances of CPR. A person is qualified to be a facilitator when they are: 1) a member of the health care team; 2) have been appropriately trained on the knowledge, attitudes and skills necessary for providing the option for FP and 3) are familiar with hospital policy. The panel felt that any of the professionals listed in Table 6 could be trained as qualified facilitators.

The panel also discussed the definition of "invasive procedure". It was decided that it was unnecessary to arrive at an inclusive definition for invasive procedures. The term "procedure" could be used. For procedures the need for a facilitator can be determined on a case-by-case basis. For example, if the family member is prepared and has been present for procedures previously with no adverse effects, there is no need for a separate facilitator. In the case of procedures, the facilitator can have direct patient care responsibilities. In situations of resuscitation, the facilitator should also be familiar with hospital policy and a member of the health care team but it is recommended that they not be involved in the direct care of the patient during the resuscitation.

Process

The process for FP begins with assessment of the family and presentation of the option to be present by a qualified facilitator. The family is prepared and supported through the procedure or resuscitation by the facilitator. This preparation and support may include: an explanation of the procedure of CPR, advance description of the environment and the patient's appearance, provision of sensory and other information, discussion of the family member's role, instructions on where to stand in the treatment room, obtaining/assuring use of protective clothing/equipment, escorting of the family member into and out of the treatment room, providing comfort to the family member, reassessment of the appropriateness of the family member's presence and giving permission to leave. The facilitator can also have an important role in the orderly transition of care and in follow-up after the procedure or in the circumstance of the child's death.

Ethical and Legal Considerations

The panel carefully considered ethical and legal ramifications of FP. This could occur in institutions with and without written FP policies. For example, what are the legal ramifications of denying FP during CPR and procedures? These are currently unknown. The panel did feel that if there is a hospital policy, the staff must be educated as part of implementation and that the policy should be followed to minimize risk. Each hospital must develop its own policies, with review by their own legal counsel. In considering the legal and ethical issues regarding FP, the panel identified a number of exclusionary criteria that they felt could be appropriately outlined as part of policy and when included in written policy should minimize risk. These have been included in the initial assessment. Other potential exclusionary criteria discussed were: possible criminal cases, and potential child abuse cases. In these instances no consensus was reached. The panel believed that hospitals should consider legal review of their policies. Important principles were that the person who is the most appropriate first choice to be present during CPR and procedures is the patient's legal guardian. A policy whose motivation is to represent the best interest of the child should also minimize legal risk.

Patient and Family Rights

The issues of patient and family rights are related to the topics of legal and ethical ramifications of establishing or not establishing policy regarding FP. The panel believed that families have the right to

be with their child and provide support. In most cases this will be the parents. However, the panel recognized that in certain circumstances the parents may not be part of the child's life and other caregivers have adopted the parenting role. They believed that the definition of family must be sufficiently broad to include the important people in a child's life. In the absence of the legal guardian/s other family members who are available can be considered for FP. The issue of who is included and considered appropriate for FP was viewed as a child advocacy issue where decisions are made in the best interest of patient care and are not in conflict with the Health Information Portability and Accountability Act (HIPAA) or other confidentiality policy. Furthermore, they believed that children have the right to have supportive care and to the choice of support. They felt that the patient may, in many circumstances, be able to assist with decision-making about who should be present during a procedure and that ethically this could be done at any age. The panel urged that the needs of chronically ill children be addressed in the same way as others. The panel did not endeavor to arrive at consensus regarding the presence of other children in the room during procedures or CPR.

The panel noted that a critical key step in implementing policy regarding the option for FP is education of healthcare providers. It has been demonstrated that education is effective in changing attitudes and that comfort with FP comes with experience and confidence. Training in FP should be a part of medical and nursing school curricula and a core competency for residency training. In the hospital setting, all of those with potential patient contact must be educated on the option for FP and relevant hospital policy; this can be role specific. Those who have been identified as qualified facilitators must be trained regarding the knowledge, attitudes and skills needed for providing the option of FP.

There is a need for educational programs that present the option of FP, including current evidence of benefits, barriers and solutions, and cultural and diversity issues. Education should also include coping with family groups in discord, and methods for diffusing volatile situations. Safety is always a primary concern, so education should address staff safety, and exit strategies for family members who become overwhelmed. These programs should promote a multidisciplinary approach, train competent facilitators and establish model procedures. Educational methods can vary but advanced role-playing has been recommended by providers experienced in offering the option of FP.[5]

During the discussion it became evident that the consideration of FP is not limited to the ED/hospital setting. Out-of-hospital providers frequently perform procedures or initiate resuscitation in the presence of family members, often in the family's home. The panel emphasized the importance of FP education and training for all levels of healthcare providers. The panel also recommended several directions for future research regarding FP to assist in identifying best practices and long term effects of FP. (Table 7)

Summary

From the beginning of the conference, there was remarkable unanimity among the panel members about the importance of providing the option of FP during procedures and cardiopulmonary resuscitation. The panel agreed on some important recommendations, shown in Table 7. The barriers to implementation of FP were generally agreed to be greatest when healthcare providers 1)had little experience with the process, 2)had not been given adequate education about the positive effects of FP for the child and family; 3)felt anxious about being observed while the family was present, and 4)were concerned about legal issues. There were also concerns about increased costs of providing the option of FP although these were lessened after panel discussion.

MacLean's survey showed that only 5% of nurses worked in critical care and emergency units or departments that had written policies allowing FP during CPR and procedures, even when over 45% of these settings allowed it, and many respondents had personally taken family members to the bedside during resuscitation or procedures.[8] Given the substantial agreement in our multidisciplinary panel about the importance of providing this option, why do so few health care settings support FP with written policies and procedures, and what would be necessary to increase implementation of FP? Traditional practices, attitudes, and healthcare behaviors are learned throughout professional training, and traditional beliefs are that families are emotional, lack understanding of procedures, and may be critical of procedures they do not understand. These beliefs will have to change in order to increase acceptance of FP. In healthcare, change is usually a process that involves education and

research. Today, healthcare providers may also need administrative and legal support to overcome resistance.

Education
To increase implementation of FP, education would have to include not just the teaching of knowledge and skills, but changes in attitude. After two days of deliberation, the panel agreed that education would be of considerable importance in increasing the number of healthcare facilities and settings that provide the option of FP, and support it with written policies and procedures. This education should be provided in core curricula, in-service education, and in orientation classes. All of the panel members also indicated that this additional training was needed by all types of healthcare professionals, including, physicians, nurses, prehospital care providers, social workers, mental health professionals, those involved in pastoral care, and any others that could be involved in the process of providing support for FP during procedures and cardiopulmonary resuscitation. This education should also be provided for safety officers, who are often called upon in these situations, with little training in how to manage stressed families.

Research
The panel felt strongly that more information is needed to determine short and long-term outcomes of FP on healthcare providers, families, and patients. Preferably, multicenter research should be conducted to determine not only the effects of FP, but to identify best practices, legal issues, and to assess what additional costs FP might incur. The panel discussed the relationship of FP with pain management, noting that as pain management improves, healthcare providers may be more willing to include the family in the treatment setting. More research is needed to examine this relationship and how children's pain affects the willingness of healthcare providers to offer the option of FP.

Legal Issues
The panel emphasized the importance of developing appropriate exclusionary criteria to assure the safety of patients, families, and staff. The panel felt that written policies showing reasons for excluding the family would be the best protection for healthcare personnel if the family were not allowed to be present. Documentation in medical records should include reasons for exclusion when appropriate. In addition, the panel suggested that legal review of all written policies would be essential.

We believe that the number of organizations, disciplines and pediatric subspecialties represented at the conference demonstrates an important commitment to improving the care of children and families through communication, collaboration and consensus building. It is our hope that the work of the multidisciplinary panel will provide the additional impetus needed to make offering the option of FP a routine part of the emergency care of children during procedures and CPR.

Table 1. Reasons Given by Health Care Providers for Concern Regarding FP [1-3]
The event may be too traumatic for the family
Clinical care will be impeded
Family members might become too emotional or out of control
Escalating negative behavior of children
Time required to orient parentsStaff may experience increased stress with the family present
ED rooms are too crowded
Staff are focused on the patient and may not be available to assist family members
The shortage of nurses
Risk of increased liability
Witnessing resuscitation may exacerbate the grieving process
The procedure may be interpreted as chaotic
Resuscitation will be prolonged
Health care providers will be intimidated by the family's presence
Family will witness insensitive comments by health care providers

Table 2. Perceived Benefits of Family Presence During Procedures [9,16, 18,26,42,47]

Family sees that everything possible was done for their relative
Reduction of anxiety and fear
Feeling of being supportive and helpful to the patient and the staff
Sharing critical information about the patient and the patient's condition
Maintaining the patient-family relationship
Closure on a life shared together
Facilitating the grieving process in the ED and later at home
Reduced risk behavior among health care providers regarding the patients privacy and pain

Table 3. Organizations Represented at the Conference
Ambulatory Pediatric Association
American Academy of Pediatrics
American College of Emergency Physicians
American College of Surgeons
American Heart Association
American Pediatric Surgical Association
American Psychological Assn
American Trauma Society
Agency for Healthcare Research and Quality
Association of Professional Chaplains
Child Life Council
Emergency Nurses Association
National Association of Children's Hospitals and Related Institutions
National Association of Emergency Medical Technicians
National Association of Pediatric Nurse Practitioners
National Association of Social Workers
Society for Academic Emergency Medicine
Society of Critical Care Medicine
U.S. Department of Health and Human Services, Maternal and Child Health Bureau, Emergency Medical Services for Children National Resource Center*
Vince Hutchins School of Public Health*
* - guest organizations

TABLE 4
PARENTAL PRESENCE QUESTIONNAIRE
RESULTS

Round 1Survey results are shown in parentheses ( ), and Round 2 survey results are shown in bold numbers. 4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly disagree

Statement				
1. Parental presence should be allowed during suturing of minor lacerations **Avg.** (3.86) **3.87**	Strongly Agree	Agree	Disagree	Strongly Disagree
	(12)**13**	(2)**2**	**0**	**0**
2. Parental presence should be allowed when phlebotomy is being performed. **Avg.** (3.14) **3.87**	Strongly Agree	Agree	Disagree	Strongly Disagree
	(12)**13**	(2)**2**	**0**	**0**
3. Parental presence should be allowed during all procedures. **Avg.** (3.14) **3.43**	Strongly Agree	Agree	Disagree	Strongly Disagree
	(6)**8**	(5)**5**	(2)**0**	(1)**1**

4. Parental presence should be allowed during closed reduction of limb fractures. **Avg.** (3.39) **3.79**	Strongly Agree (6)**10**	Agree (6)**4**	Disagree **1**	Strongly Disagree **0**
5. Parental presence should be allowed during lumbar puncture. **Avg.** (3.72) **3.79**	Strongly Agree (10)**11**	Agree (4)**3**	Disagree **0**	Strongly Disagree **0**
6. Parental presence should not be allowed during any procedures. **Avg.** (1.22) **1.2**	Strongly Agree (0)**1**	Agree (1)**0**	Disagree (1)**1**	Strongly Disagree (12)**13**
7. Parental presence should be allowed during bone marrow aspiration **Avg.** (1.41) **1.40**	Strongly Agree (8)**11**	Agree (3)**3**	Disagree (1)**0**	Strongly Disagree (0)**1**
8. Parental presence should be allowed during tapping of a shunt **Avg.** (3.59) **3.67**	Strongly Agree (7)**12**	Agree (6)**2**	Disagree (1)**0**	Strongly Disagree (0)**1**
9. Parental presence should be allowed during attempted resuscitation (CPR) **Avg.** (3.22) **3.87**	Strongly Agree (6)**13**	Agree (6)**2**	Disagree (1)**0**	Strongly Disagree (1)**0**

****Note: the use of the term "procedures" is used from this point on to include all types of procedures including resuscitation**

10. What type of training (if any) would be necessary for healthcare professionals (physicians/nurses) who accompany the family during procedures? (*Numbers represent the number of panel member responses)*

(0) **0** No additional training needed
(12) **15** Inservice education about specific issues involved in parental presence
(12) **13** Inservice education about procedures for accompanying parents
(10) **9** Crisis intervention training

11. What type of training (if any) would be necessary for mental health professionals (social workers, other mental health professionals) who accompany the family during procedures?

(0) **0** No additional training needed
(12) **15** Inservice education about specific issues involved in parental presence
(14) **13** Inservice education about procedures for accompanying parents
(9) **9** Crisis intervention training

12. What type of training (if any) would be necessary for clergy/pastoral care professionals who accompany the family during procedures?

(0) **0** No additional training needed
(12) **14** Inservice education about specific issues involved in parental presence
(13) **13** Inservice education about procedures for accompanying parents
(9) **9** Crisis intervention training

When parents are allowed to be present during procedures they are often accompanied by a healthcare or other professional for support. Please circle the number corresponding to your feelings about whether you agree or disagree as to the appropriateness of the following professionals performing this service.

Round 1Survey results are shown in parentheses ( ), and Round 2 survey results are shown in bold numbers. 4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly

disagree

Type of Professional	Responses	Average
13. Nurses	Strongly Agree Agree Disagree Strongly Disagree (10)**12** (4)**2** (0)**0** (0)**0**	(3.78)**3.86**
14. Clergy/Pastoral Care	Strongly Agree Agree Disagree Strongly Disagree (4)**7** (9)**8** (1)**0** (0)**0**	(3.22)**3.47**
15. Child life specialists	Strongly Agree Agree Disagree Strongly Disagree (5)**12** (7)**3** (2)**0** (0)**0**	(3.22)**3.78**
16. Social workers	Strongly Agree Agree Disagree Strongly Disagree (8)**13** (5)**2** (1)**0** (0)**0**	(3.50)**3.87**
17. Physicians	Strongly Agree Agree Disagree Strongly Disagree (5)**9** (7)**5** (3)**1** (0)**0**	(3.0)**3.53**
18. No one needed	Strongly Agree Agree Disagree Strongly Disagree (0)**0** (0)**1** (1)**1** (12)**10**	(1.08)**1.25**
19.Other **Techs/Aides** **Psychologists** **Translation Svcs.**	Strongly Agree Agree Disagree Strongly Disagree (1)**1** (1)**0** (0)**0**	

20. Which of the following do you think are appropriate reasons for excluding parents/caretakers from being present during procedures? *(Check any you feel may apply)*

(0) 0 Parents may observe errors being made.
(6) 2 Parents may be emotionally overwhelmed by the experience.
(2) 2 Parents may faint.
(2) 3 Parents may become hysterical.
(5) 6 Parents may interfere with professionals.
(3) 0 Parents may not understand why certain procedures are being performed.
(1) 0 Parents may obtain false impressions about their child's care.
(11) 8 There are insufficient staff members to cope with the parents.
(0) 0 Observing procedures may encourage parents to initiate lawsuits.
(4) 0 Staff members may be uncomfortable with parental presence.
(1) 1 The child may be less cooperative if parents are present.
(2) 1 There are no appropriate reasons.
_____ Other:

21. How often do you feel the following are barriers to allowing parental presence?

Round 1Survey results are shown in parentheses ( ), and Round 2 survey results are

shown in bold numbers. 4 = Strongly Agree, 3 = Agree, 2 = Disagree, 1 = Strongly disagree

Barriers	*Number of Responses*
22. Staff discomfort **Avg.** (3.22) **3.27**	Frequently Sometimes Not Often Rarely (5)**6** (7)**8** (2)**0** (0)**1**
23. Physician discomfort **Avg.** (3.58) **3.36**	Frequently Sometimes Not Often Rarely (8)**7** (6)**6** (0)**0** (0)**1**
24. Financial barrierst **Avg.** (1.79) **1.74**	Frequently Sometimes Not Often Rarely (0)**1** (4)**3** (3)**2** (7)**9**
25. Lack of protocols/procedures for parental presence **Avg.** (2.86) **3.20**	Frequently Sometimes Not Often Rarely (4)**5** (6)**8** (2)**1** (2)**1**
26. Risk management issues **Avg.** (2.28) **2.73**	Frequently Sometimes Not Often Rarely (3)**2** (6)**5** (3)**3** (2)**5**
27. Insufficient staff to assist in family presence **Avg.** (2.72) **2.00**	Frequently Sometimes Not Often Rarely (3)**4** (8)**8** (1)**2** (2)**1**
28. Lack of time **Avg.** (2.64) **3.00**	Frequently Sometimes Not Often Rarely (1)**3** (7)**4** (2)**3** (4)**5**
29. Lack of space for parental presence **Avg.** (2.14) **1.80**	Frequently Sometimes Not Often Rarely (2)**0** (4)**4** (2)**4** (6)**7**
30. Other *(Please specify)*	

31. Who should be allowed to be present during procedures? *(Please check one only.)*
(0) 0 No parents or caretakers
(7) 3 Parents or caretakers only
(1) 0 One parent or caretaker only
(0) 3 Any family members that the parents or caretakers select
(3) 3 Any family members that the parents or caretakers select, except children under 12 years of age.
(3) 6 Any individuals that the parents or caretakers select

32. Do you think there would be added costs for implementing a protocol in parental presence?
Yes (9) **13** No (4) **2**

Table 5. Definitions Used for the Purposes of the Discussion	
Family Member	A person over 18 years old with an established relationship (relative or significant other) with the patient.
Family Presence	Attendance of family members in a location that allows visual or physical contact with the patient during procedures or CPR
Procedure	An intervention involving manipulation of the body or penetration of the body's natural barriers.
Restrictions	Situations that might necessitate a family member's being escorted from or being prevented from entering the treatment room.
Resuscitation	A sequence of events including invasive procedures that are initiated to sustain life or prevent further deterioration of the patient's condition.

Table 6. Professionals Qualified to Be Family Presence Facilitators

Nurses
Clergy/Pastoral Care
Child life specialists
Social workers
Physicians

Table 7. Panel Recommendations for Family Presence

Consensus Recommendations

1. Consider FP as an option for all families during pediatric procedures and CPR.
2. Offer FP as an option when the care to the child will not be interrupted and after an assessment for:
    - Combative and threatening behavior· Extreme emotional volatility· Behaviors consistent with intoxication or altered mental status
    - Disagreement among family members
    - Threat to the safety of the healthcare team
3. If family is not provided with the option for FP, document the reasons why FP was not offered.
4. Consider the safety of the healthcare team at all times.
5. In-hospital, transport and transfer settings should have written policies and procedures for FP, these should include but not be limited to:
    - Definition of a facilitator
    - Definition of family member, legal guardian, etc.
    - Definition of procedure
    - Preparation of the family, including explanations, descriptions, role of the family
    - Process of escorting the family in and out of the treatment room
    - Handling disagreements (wording)
    - Providing support for the staff
6. Healthcare policies regarding FP should undergo legal review.
7. Educate all healthcare providers
    - Include education in FP in all core curricula for health care providers at all levels.
    - Include this education also in health settings as part of hospital orientation.
8. Promote research to include, but not be limited to investigation of:
    - Best methods for education of providers
    - Long term outcomes of FP on the patient, family, and staff.
    - Best means of approaching and instructing families.
    - Best practices for FP.
    - Reasons why families may decline the opportunity to be present
    - Cost-effectiveness of FP
    - Potential legal ramifications of implementing or not implementing FP· Relation of FP to consent issues regarding tissue donation or autopsy.
    - Relation of FP to pain management?

Note: When possible, research methodology such as randomized, controlled trials should be used, including multicenter trials.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT
Guidance for the Clinician in Rendering Pediatric Care

Douglas S. Diekema, MD, MPH; and the Committee on Bioethics

Responding to Parental Refusals of Immunization of Children

ABSTRACT. The American Academy of Pediatrics strongly endorses universal immunization. However, for childhood immunization programs to be successful, parents must comply with immunization recommendations. The problem of parental refusal of immunization for children is an important one for pediatricians. The goal of this report is to assist pediatricians in understanding the reasons parents may have for refusing to immunize their children, review the limited circumstances under which parental refusals should be referred to child protective services agencies or public health authorities, and provide practical guidance to assist the pediatrician faced with a parent who is reluctant to allow immunization of his or her child. ***Pediatrics*** **2005;115:1428–1431;** ***immunization, parental refusals, medical neglect, vaccine refusal.***

ABBREVIATION. AAP, American Academy of Pediatrics.

OVERVIEW OF THE PROBLEM

The immunization of children against a multitude of infectious agents has been hailed as one of the most important health interventions of the 20th century.[1–3] Immunizations have eliminated smallpox infection worldwide, driven polio from North America, and made formerly common infections like diphtheria, tetanus, measles, and invasive *Haemophilus influenzae* infections rare occurrences. By one account, pediatric immunizations are responsible for preventing 3 million deaths in children each year worldwide.[3] Despite this success, some parents continue to refuse immunizations for their children. The number of pertussis cases has increased steadily in the United States over the past 20 years, and Web sites critical of immunization are prominent on the Internet, a source that many parents rely on for health information.[4] It is ironic that the remarkable success of vaccine programs has resulted in a situation in which most parents have no memory of the devastating effects of illnesses such as poliomyelitis, measles, and other vaccine-preventable diseases, making it more difficult for them to appreciate the benefits of immunization.

According to a periodic survey of fellows of the American Academy of Pediatrics (AAP) on immunization-administration practices, 7 of 10 pediatricians reported that they had had a parent refuse an immunization on behalf of a child in the 12 months preceding the survey.[5] Measles-mumps-rubella vaccine was refused most frequently, followed by varicella vaccine, pneumococcal conjugate vaccine, hepatitis B vaccine, and diphtheria and tetanus toxoids and pertussis vaccines. Four percent of pediatricians had refused permission for an immunization for their own children younger than 11 years. When faced with parents who refuse immunization, almost all pediatricians reported that they attempt to educate parents regarding the importance of immunization and document the refusal in the patient's medical record. A small number of pediatricians reported that they always (4.8%) or sometimes (18.1%) tell parents that they will no longer serve as the child's physician if, after educational efforts, the parents continue to refuse permission for an immunization.[5]

The AAP strongly endorses universal immunization. However, for universal childhood immunization programs to be successful, parents must comply with immunization recommendations. The problem of parental refusal of immunization for children is an important one for pediatricians. Parents may have many reasons for refusing immunization. Some parents may object to immunization on religious or philosophical grounds, some may object to what seems to be a painful assault on their child, and others may believe that the benefits of immunization do not justify the risks to their child. Many commonly held beliefs about the risks of immunization are not supported by available data, and they frequently originate from the unsupported claims of organizations that are critical of immunization. These antivaccine information sources not only propagate unproven claims regarding vaccines but also may undermine the physician-family relationship by challenging the parents' trust of the medical profession.

What should the pediatrician do when faced with a parent who refuses to consent to immunizations for a child? The goal of this clinical report is to provide guidance to the pediatrician faced with this difficult situation. The physician faced with a parent who refuses to immunize a child faces 3 important and distinct issues that will be addressed in this report. First, are there situations in which parents who withhold immunizations from their children risk harming them sufficiently that their decision constitutes actionable medical neglect and should be reported to

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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state child protective services agencies? Second, are there situations in which a parental decision to withhold immunization from a child puts other individuals at risk of harm sufficient to justify public health intervention? Finally, how should the pediatrician respond to a parent who refuses immunizations for his or her child?

PARENTAL REFUSALS AND THE BEST INTERESTS OF CHILDREN

Health care professionals and parents are bound by the duty to seek medical benefit for and minimize harm to children in their care. When faced with the decision to immunize a child, the welfare of the child should be the primary focus. However, parents and physicians may not always agree on what constitutes the best interest of an individual child. In those situations, physicians may need to tolerate decisions they disagree with if those decisions are not likely to be harmful to the child.[6] Although decision-making involving the health care of children should be shared between physicians and parents, parental permission must be sought before children receive medical interventions, including immunizations.[7] Parents are free to make choices regarding medical care unless those choices place their child at substantial risk of serious harm.

Whether parents place their children at substantial risk of serious harm by refusing immunization will depend on several factors, including the probability of contracting the disease if unimmunized and the morbidity and mortality associated with infection. The results of such an analysis will also vary depending on the prevalence of disease in the community in which the child resides or the areas in which the child is likely to travel. The balance between the risks and benefits to a given individual favors immunization most strongly when rates of immunization in the community are low and disease prevalence is high. In most cases, however, as immunization rates increase and disease prevalence decreases, the balance may tip the other way.[8,9] Although the benefits of a measles-vaccine program, for example, clearly outweigh the risks at a population level,[10] an unimmunized child living in a well-immunized community derives significant indirect protection from herd immunity.[11] Even in a community with high immunization rates, the risk assumed by an unimmunized child is likely to be greater than the risks associated with immunization. However, the risk remains low, and in most cases the parent who refuses immunizations on behalf of his or her child living in a well-immunized community does not place the child at substantial risk of serious harm.

The role of the physician in these situations is to provide parents with the risk and benefit information necessary to make an informed decision and to attempt to correct any misinformation or misperceptions that may exist. For example, in a national survey of parents, 25% believed falsely that their child's immune system could become weakened as a result of too many immunizations.[12] Exploring and addressing parental concerns may be an effective strategy with reluctant parents. Only in rare cases in which the decision of a parent places a child at substantial risk of serious harm may the health care professional be obligated to involve state agencies in seeking to provide the necessary immunization over the parents' objections. For example, for the situation in which a child has sustained a deep and contaminated puncture wound, it might be justifiable to challenge the decision of a child's parents to refuse treatment with tetanus vaccine. In these situations, the health care professional would involve the appropriate state child protective services agency because of the concern about medical neglect. It would be up to the state agency to decide whether immunization would be required. Although this role of the state has been recognized as constitutionally valid in the United States, courts have closely examined such actions, showing reluctance to require medical treatment over the objection of parents "except where immediate action is necessary or where the potential for harm is rather serious."[13]

COMMUNITY INTERESTS AND PUBLIC HEALTH

The benefits provided by most vaccines extend beyond benefit to the individual who is immunized. There is also a significant public health benefit. Parents who choose not to immunize their own children increase the potential for harm to other persons in 4 important ways.[14] First, should an unimmunized child contract disease, that child poses a potential threat to other unimmunized children. Second, even in a fully immunized population, a small percentage of immunized individuals will either remain or become susceptible to disease. These individuals have done everything they can to protect themselves through immunization, yet they remain at risk. Third, some children cannot be immunized because of underlying medical conditions. These individuals derive important benefit from herd immunity and may be harmed by contracting disease from those who remain unimmunized. Finally, immunized individuals are harmed by the cost of medical care for those who choose not to immunize their children and whose children then contract vaccine-preventable disease.

A parent's refusal to immunize his or her child also raises an important question of justice that has been described as the problem of "free riders."[14–16] Parents who refuse immunization on behalf of their children are, in a sense, free riders who take advantage of the benefit created by the participation and assumption of immunization risk or burden by others while refusing to participate in the program themselves. The decision to refuse to immunize a child is made less risky because others have created an environment in which herd immunity will likely keep the unimmunized child safe. These individuals place family interest ahead of civic responsibility. Although such parents do reject what many would consider to be a moral duty, coercive measures to require immunization of a child over parental objections are justified only in cases in which others are placed at substantial risk of serious harm by the parental decision.

Compulsory immunization laws in the United

States have been upheld repeatedly as a reasonable exercise of the state's police power in the absence of an epidemic or even a single case.[17,18] They also have been found to be constitutional even for cases in which the laws conflict with the religious beliefs of individuals.[19]

When others are placed at substantial risk of serious harm, the range of choices of the individual may be restricted. With regard to immunization, the key question becomes whether the harms associated with unimmunized individuals are great enough to make restrictions permissible. In times of epidemic disease, when an effective vaccine can end the epidemic and protect those individuals who have not yet contracted the disease, the answer clearly is yes.

In a highly immunized population in which disease prevalence is low, the risk of disease from the small number of children who remain unimmunized does not usually pose a significant-enough health risk to others to justify state action.[20] Diseases with very high morbidity and mortality (such as smallpox), however, might create a situation in which even a single case of infection would justify mandatory immunization of the population. For most routine vaccines, less forcible alternatives can be used justifiably to encourage parents to immunize children because of the public health benefit. In the case of vaccines routinely recommended for children, the AAP supports the use of appropriate public health measures, education, and incentives for immunization.[7] Because unimmunized children do pose a risk to other children who lack immunity to vaccine-preventable infections, the AAP also supports immunization requirements for school entry.

RESPONDING TO PARENTS WHO REFUSE IMMUNIZATION FOR THEIR CHILDREN

What is the pediatrician to do when faced with a parent who refuses immunization for his or her child? First and most important, the pediatrician should listen carefully and respectfully to the parent's concerns, recognizing that some parents may not use the same decision criteria as the physician and may weigh evidence very differently than the physician does.[21] Vaccines are very safe, but they are not risk free; nor are they 100% effective.[22] This poses a dilemma for many parents and should not be minimized. The pediatrician should share honestly what is and is not known about the risks and benefits of the vaccine in question, attempt to understand the parent's concerns about immunization, and attempt to correct any misperceptions and misinformation.[23–25] Pediatricians should also assist parents in understanding that the risks of any vaccine should not be considered in isolation but in comparison to the risks of remaining unimmunized. For example, although the risk of encephalopathy related to the measles vaccine is 1 in 1 million, the risk of encephalopathy from measles illness is 1000 times greater.[22] Parents can also be referred to one of several reputable and data-based Web sites for additional information on specific immunizations and the diseases they prevent (see pages 52 and 53 of the *Red Book*[25] for a list of Internet resources related to immunization).

Many parents have concerns related to 1 or 2 specific vaccines. A useful strategy in working with families who refuse immunization is to discuss each vaccine separately. The benefits and risks of vaccines differ, and a parent who is reluctant to accept the administration of 1 vaccine may be willing to allow others.

Parents also may have concerns about administering multiple vaccines to a child in a single visit. In some cases, taking steps to reduce the pain of injection, such as those suggested in the *Red Book*,[26] may be sufficient. In other cases, a parent may be willing to permit a schedule of immunization that does not require multiple injections at a single visit.

Physicians should also explore the possibility that cost is a reason for refusing immunization. For a parent whose child does not have adequate preventive care insurance coverage, even the administrative costs and copayments associated with immunization can pose substantial barriers. In such cases, the physician should work with the family to help them obtain appropriate immunizations for the child.

For all cases in which parents refuse vaccine administration, pediatricians should take advantage of their ongoing relationship with the family and revisit the immunization discussion on each subsequent visit. As respect, communication, and information build over time in a professional relationship, parents may be willing to reconsider previous vaccine refusals.

Continued refusal after adequate discussion should be respected unless the child is put at significant risk of serious harm (as, for example, might be the case during an epidemic). Only then should state agencies be involved to override parental discretion on the basis of medical neglect. Physician concerns about liability should be addressed by good documentation of the discussion of the benefits of immunization and the risks associated with remaining unimmunized. Physicians also may wish to consider having the parents sign a refusal waiver (a sample refusal-to-immunize waiver can be found at www.cispimmunize.org/pro/pdf/RefusaltoVaccinate_2pageform.pdf). In general, pediatricians should avoid discharging patients from their practices solely because a parent refuses to immunize his or her child. However, when a substantial level of distrust develops, significant differences in the philosophy of care emerge, or poor quality of communication persists, the pediatrician may encourage the family to find another physician or practice. Although pediatricians have the option of terminating the physician-patient relationship, they cannot do so without giving sufficient advance notice to the patient or custodial parent or legal guardian to permit another health care professional to be secured.[27] Such decisions should be unusual and generally made only after attempts have been made to work with the family. Families with doubts about immunization should still have access to good medical care, and maintaining the relationship in the face of disagreement conveys respect and at the same time allows the child access to medical care. Further-

more, a continuing relationship allows additional opportunity to discuss the issue of immunization over time.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Restraint Use on Aircraft

ABSTRACT. Occupant protection policies for children younger than 2 years on aircraft are inconsistent with all other national policies on safe transportation. Children younger than 2 years are not required to be restrained or secured on aircraft during takeoff, landing, and conditions of turbulence. They are permitted to be held on the lap of an adult. Preventable injuries and deaths have occurred in children younger than 2 years who were unrestrained in aircraft during survivable crashes and conditions of turbulence. The American Academy of Pediatrics recommends a mandatory federal requirement for restraint use for children on aircraft. The Academy further recommends that parents ensure that a seat is available for all children during aircraft transport and follow current recommendations for restraint use for all children. Physicians play a significant role in counseling families, advocating for public policy mandates, and encouraging technologic research that will improve protection of children in aircraft.

ABBREVIATIONS. AAP, American Academy of Pediatrics; CSSs, child safety seats; FAA, Federal Aviation Administration; NTSB, National Transportation Safety Board; CFR, Code of Federal Regulations; CAMI, Civil Aeromedical Institute; SAE, Society of Automotive Engineers.

INTRODUCTION

Children younger than 2 years are the only occupants who, under current federal regulation, are not required to be restrained or secured on aircraft during takeoff, landing, and conditions of turbulence; even items such as coffee pots must be secured. This practice relating to nonrestraint of children on airplanes is inconsistent with all occupant protection recommendations of the American Academy of Pediatrics (AAP) in which priority has been placed on safe transportation of children. Many child safety seats (CSSs) used in motor vehicles are also approved for use on aircraft. The Federal Aviation Administration (FAA) has stated that proper use of an approved CSS for aircraft enhances child safety in the event of turbulence or a crash, and the FAA informs parents that a "safety seat can be the most important carry-on item of all."[1] The FAA strongly recommends but has not yet mandated that all children who fly, regardless of age, should be restrained in the appropriate CSS for their weight and size used in conjunction with the aircraft seat belt.

In a 1996 report to the President of the United States, the White House Commission on Aviation Safety and Security stated that it is inappropriate for infants to be afforded a lesser degree of protection than that for older passengers.[2] The Commission recommended that the FAA revise its regulations to require that all occupants be restrained in aircraft during takeoff, landing, and conditions of turbulence and that all infants and small children whose weight is less than 40 lb and whose height is less than 40 in be restrained in an aircraft-approved CSS. The Association of Flight Attendants and the National Transportation Safety Board (NTSB) have called for federal regulation requiring appropriate restraint use.[3–5] The NTSB has also called for the FAA to develop standards for CSS use in aircraft. The FAA has argued that a mandatory requirement for CSS use on aircraft will result in more injuries and deaths to infants and toddlers because parents would not be willing to buy a ticket to reserve a seat for the infant and would opt to travel by car instead[6]; however, no data support this argument.

CURRENT POLICY FOR CHILDREN

Children younger than 2 years are currently allowed to be held in an adult's lap throughout a commercial aircraft flight, as stipulated by the US Code of Federal Regulations (CFR).[7] Alternatively, parents may choose to use a CSS certified under the Federal Motor Vehicle Safety Standards and Regulations for travel in aircraft and motor vehicles.[8] Airlines are required to accommodate the use of approved CSSs for young children with tickets; however, the child must occupy a window seat in a nonexit row. Although many airlines offer discounted rates for children younger than 2 years, these rates are often not advertised, and parents must ask to receive a reduced-rate ticket. If parents want to ensure that the child has a passenger seat in which the CSS can be used, they must purchase a ticket. If the child is held on the lap of an adult, no fare is charged for the child. Children 2 years and older are required to sit in their own passenger seat under the same regulations that apply to all other passengers.

In 1995, in the aftermath of serious and sometimes unexpected events of turbulence, the FAA issued a public advisory to airlines urging the use of seat belts at all times when passengers are seated.[6] Some airlines now comply, but the requirement does not apply to children younger than 2 years because they are not required to be restrained at any time during the flight.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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BACKGROUND

Approximately 25 000 commercial flights depart from and arrive at US airports daily.[9] Although it is estimated that 4.6 million children younger than 2 years fly on US domestic airlines annually, inaccuracies in the passenger manifest, which contains the names of all passengers as required by the US CFR, make it difficult to obtain precise numbers. The NTSB has issued safety recommendations that require standardized reporting of all passengers.[10]

The risk of death or serious injury in an aircraft is exceedingly small. Using data from 1990 forward not controlled for age, the risk of death was calculated at 1 in 8 million.[11] During 1996, there were 319 passenger fatalities and 77 serious injuries on US air carriers operating under the CFR. These data are not provided by year of age of passenger but include all scheduled and nonscheduled services on commercial and cargo carriers.[12] Analysis of aircraft crashes from 1976 through 1979 in which there were fatalities and survivors revealed that unrestrained infant passengers had a relative mortality risk of 5.9 (United States) and 9.6 (worldwide), compared with restrained adult passengers. It could not be determined whether the higher risk of mortality for infants was attributable to lack of restraint use, fragility of infants, or both.[13]

In a study comparing persons fatally injured in aircraft in 1980 and 1990, blunt injury (in particular, head injury) from deceleration forces was the most important threat to survival. Head injuries were listed as the immediate cause of death in 33% of those younger than 15 years.[14] As with other forms of transportation, effective restraint systems decrease the probability of head injury.

Turbulence is the leading cause of nonfatal injuries to aircraft passengers and flight attendants. From 1981 through 1997, there were 342 reports of turbulence affecting major airlines. Three passengers died, 80 had serious injuries, and 769 had minor injuries.[15]

A child on the lap of an adult cannot be effectively restrained in a motor vehicle or aircraft crash. A child who travels on the lap of another occupant or unrestrained in a motor vehicle has a substantially greater risk of injury and death, compared with a restrained child.[16–18] Hazards associated with the on-lap position are also well documented in aircraft crash investigations. Three children on the laps of adults were fatally injured and others nonfatally injured in the 1987 crash in Denver, CO, the 1989 crash in Sioux City, IA, and the 1994 crash in Charlotte, NC—which were all caused by turbulence.[19–21] The NTSB has reported 2 crashes in which CSSs were used and provided protection to children.[3]

CERTIFICATION OF CSSs FOR USE ON AIRCRAFT

The FAA's Civil Aeromedical Institute (CAMI) has conducted studies on CSSs for use with aircraft seats. Crash testing of CSSs using child dummies in 1993 revealed that rear-facing CSSs performed well and could be installed with contemporary aircraft seat belts. However, 6 of the 8 tests with forward-facing CSSs resulted in Head Impact Criteria values of more than 1000, which is the threshold for serious head impact in adults. Difficulty was encountered in securing some of the forward-facing CSSs to the aircraft seats. Moving the anchor points rearward resulted in improved performance of many CSSs; however, most aircraft have seats with poor belt anchor geometry.[22]

Certain restraints that are approved for use in motor vehicles are prohibited for use in aircraft (14 CFR 121.311).[7] When tested, vest and harness type systems allowed excessive forward body excursion, causing the test dummy to slide off of the front of the seat, potentially impacting the seat in front and resulting in injuries.[22,23] Shield type booster seats are incompatible with aircraft seats because of the seatback breakover feature common on airplanes.

POTENTIAL NEW TECHNOLOGY

Testing has shown that aircraft seat belts alone do not adequately protect a child younger than 3 years.[22,23] The CAMI has developed and fully tested a prototype aircraft seat insertion platform, which can be inserted under the CSS and secured to the aircraft seat with the seat belt. Seat belts attached to the platform are used to secure the CSS. The platform improves ease of installation and decreases the forward excursion of the CSS. A CSS designed for use in aircraft that could be used forward or rear facing is a second alternative. One such device is already approved and is being sold. A third alternative is modifying a certain number of passenger seats on each aircraft to accommodate and ensure adequate performance of CSSs. A relatively simple and low-cost modification has been successfully demonstrated at CAMI. The Society of Automotive Engineers (SAE) has recently adopted a performance standard for CSSs installed on airplane passenger seats.[24] The objective of this standard is to establish performance criteria for CSSs when installed in airplane seats. The methods of meeting the SAE standard and the pass/fail criteria are similar to those already imposed on CSSs by automotive regulations (49 CFR 571.213). Inclusion of the SAE standard in automotive regulations for CSSs should be considered.

A national symposium was held by the NTSB in 1999 to explore operation, design, regulations, and experience with CSSs nationally and internationally.[25] At this meeting, FAA Administrator Jane Garvey announced ". . . We [FAA] are committed to 2 things—mandating the use of child restraint systems in aircraft and assuring that children are accorded the same level of safety as are adults." This statement clearly implies the FAA plans to move forward with regulatory actions mandating the use of effective CSSs in airplanes.

ENFORCEMENT OF EXISTING RESTRAINT REQUIREMENTS FOR CHILDREN

The NTSB has documented events in which children 2 years and older have been transported on the lap of an adult. The NTSB has been concerned about the inadequacy and lack of enforcement of passenger protection regulations and has recommended that

the FAA implement measures for enforcing restraint regulation for children 2 years and older.[26]

RECOMMENDATIONS

Consistent with national policies requiring restraint use in all vehicles, the AAP recommends that regulations be promulgated to ensure that all passengers, including those younger than 2 years, are afforded optimal protection during all phases of commercial and general aircraft flights. The AAP believes that children should be afforded the same protection as other passengers and that restraint use in aircraft for children younger than 2 years should be mandatory during takeoff, landing, and conditions of turbulence and should be recommended as much as feasible during flight as it is for all other passengers.

Pediatricians, federal agencies, and airlines are encouraged to work together to accomplish the following:

1. Implement mandatory restraint use requirements using aircraft-approved restraint systems and discontinue the policy of allowing children younger than 2 years to be held on the lap of an adult on aircraft.
2. Enforce current requirements for children older than 2 years, some of whom travel unrestrained and without tickets.
3. Establish standards for appropriate restraint use in aircraft for all children. Amend the CFR[7] by adding a section on child restraint requirements on aircraft providing intrastate, interstate, or overseas transportation. Establish age and weight recommendations for use of CSSs similar to those for motor vehicles.
4. Provide information on current recommendations for the restraint of children younger than 4 years similar to AAP recommendations for restraint use in motor vehicles as follows[27]:
   - Children should be placed in a rear-facing CSS that is properly secured and installed until they are at least 1 year old *and* at least 20 lb in body weight.
   - A forward-facing seat labeled for use on aircraft should be used for children at least 1 year old and 20 to 40 lb in body weight. The AAP is aware of the problems found by the CAMI study with forward-facing seats but believes that these seats afford more protection to children than do seat belts alone, no restraint use, or being held on a lap. The CSS manufacturers label seats that fit and can be satisfactorily restrained to an aircraft seat.
   - According to the FAA, CSSs should not exceed 16 in wide for best fit in aircraft seats; this is especially important in small commuter aircraft.
   - Children who weigh more than 40 lb can be secured in the aircraft seat belt.[28]
5. Establish international standards through the International Civil Aviation Organization requiring that passengers on civil aircraft be restrained during takeoff and landing and when directed by the captain of the aircraft.
6. On all types of passenger aircraft, pursue technologic solutions for improving restraint systems for children who are inadequately protected by existing child restraints or seat belt systems.
7. Educate all airline personnel who have contact with families regarding the importance of, and the requirements for, age-appropriate restraint use on aircraft. This includes travel agents, reservation/gate agents, and cabin crew.
8. The airlines should make available to families CSSs that are compatible and effective in aircraft.
9. Encourage airlines to offer a discounted fare (or a rebate) for restrained children.

Pediatricians should convey the following information to parents:

1. All children should travel properly restrained on aircraft.
2. Similar to travel in motor vehicles, a child is best protected when properly restrained in a CSS appropriate for the age, weight, and height of the child, meeting standards for aircraft until the child weighs more than 40 lb and can use the aircraft seat belt. Child safety seat systems manufactured to US standards for aircraft use after February 26, 1985, bear the label: "This restraint is certified for use in motor vehicles and aircraft" in red letters.[28]
3. Families should explore options for ensuring that each child has an aircraft seat. Currently, to ensure that a child has a seat for the CSS, families must purchase a ticket and should specify a window seat next to the parent in a nonexit row for the CSS. However, it is suggested that parents ask the airline whether the purchase of a seat is required to use a CSS and consider asking for the information in writing. Parents should also ask and be advised about discounted fares and compare the benefits of various airlines. If no discounted or free fare is offered by any airline and it is not feasible to purchase a ticket, parents should select flights that are likely to have empty seats. Parents should inquire about the carrier's policy regarding use of empty seats. Parents who are traveling with CSSs should be reminded that they can request assistance from the airlines between connecting flights.
4. Parents can obtain additional information on safe air travel for children from the FAA (1-800-FAA-SURE and http://www.faa.gov/).

There is a need for accurate exposure data. Accurate passenger manifests should be generated to include all passengers on all flights. Standard reporting for all passenger injuries should be established and made available by age of passenger and restraint use. Epidemiologic studies and the evaluation of preventive measures may thus be conducted.

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ERRATUM

In the policy statement "Human Embryo Research," published in the September issue of *Pediatrics* (2001;108:813–816), 2 errors occurred. In the first paragraph under "Introduction," the second sentence should read:

> "Pluripotent stem cells are a specialized subpopulation of cells capable of developing into most (ectoderm, mesoderm, and endoderm), but not all, human tissue and may be derived from human embryos."

On the roster for the Committee on Bioethics, one of the liaison's credentials were listed erroneously. His name should read "Ernest F. Krug III, MDiv, MD, American Board of Pediatrics."

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Policy Statement—Ritual Genital Cutting of Female Minors

BOARD OF DIRECTORS

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

The American Academy of Pediatrics (AAP) reaffirms its strong opposition to female genital cutting (FGC) and counsels its members not to perform such procedures. As typically practiced, FGC can be life-threatening. Little girls who escape death are still vulnerable to sterility, infection, and psychological trauma.

The AAP does not endorse the practice of offering a "clitoral nick." This minimal pinprick is forbidden under federal law and the AAP does not recommend it to its members.

The AAP is steadfast in its goal of protecting all young girls from the harms of FGC.

AMERICAN ACADEMY OF PEDIATRICS

Council on Child and Adolescent Health

The Role of Home-Visitation Programs in Improving Health Outcomes for Children and Families

ABSTRACT. Traditional pediatric care is often based on the assumption that parents have the basic knowledge and resources to provide a nurturing, safe environment and to provide for the emotional, physical, developmental, and health care needs of their infants and young children. Unfortunately, many families have insufficient knowledge of parenting skills and an inadequate support system of friends, extended family, or professionals to help with these vital tasks. Home-visitation programs offer an effective mechanism to ensure ongoing parental education, social support, and linkage with public and private community services. This statement reviews the history and current research on home-visitation programs and provides recommendations about the pediatrician's role in supporting and using home visitation.

HISTORY OF HOME-VISITATION PROGRAMS

Home visitation for parents is a widespread early-intervention strategy in most industrialized nations other than the United States. In most countries, home health visiting is free, voluntary, not income-related, and embedded in comprehensive maternal and child health systems. Although a causative link has not been demonstrated conclusively, countries with extensive home visitor programs generally have lower infant mortality than does the United States. This is despite per capita health spending in the United States that far exceeds expenditures in other industrialized countries.[1] Denmark established home visiting by law in 1937 after a pilot program was successful in lowering infant mortality. France provides free prenatal care and home visits by midwives or nurses to provide education about smoking, nutrition, alcohol and other drug use, housing, and other health-related issues. In England, every prospective mother is visited at home at least once before birth, with six more visits typically occurring before the child is 5 years of age.[2] In the United States, home-visitation services have been perceived by many as too costly and unnecessary for all new families.

Home-visitation programs began in the United States in the late 19th century. Public health nurses and social workers provided in-home education and health care to women and children, primarily in poor urban environments.[3,4] At the beginning of the 20th century, the New York City Health Department implemented a home visitor program, using student nurses to instruct mothers about breastfeeding and hygiene. This program reduced the high mortality rate of inner-city infants from summer diarrhea when previous efforts of private agencies had failed.[5] In the late 20th century, as funding for public health nurses has declined relative to the need, home-visitation programs have focused on families with special problems such as premature or low-birth-weight infants, children with developmental delay, teenage parents, and families at risk for child abuse or neglect.[6]

Almost 20 years ago, Dr C Henry Kempe suggested that to ensure the right of every child to comprehensive care, every pregnant woman be assigned a home health visitor who would work with the family until the child began school.[7] Insurance companies declined to pay for this service because of a lack of empirical evidence to support its effectiveness. Kempe continued to advocate home visiting vigorously, suggesting that it could play a major role in the prevention of child abuse. He reiterated these ideas in the 1978 Abraham Jacobi Award Address.[8] In 1980, the American Academy of Pediatrics held a conference on home visitation. The conferees were unable to find sufficient research on home visitation to recommend it as national policy.[4]

In the 1992 Jacobi Award Address, Sia[9] renewed Kempe's arguments, citing additional information about the effectiveness of health-related home-visitation programs in Hawaii in improving health and social outcomes for children. The publication in 1988 of Schorr's book, *Within Our Reach: Breaking the Cycle of Disadvantage*,[10] encouraged Sia and other advocates in Hawaii to move ahead with the first statewide home-visitation program. Begun in 1993, this program currently is the subject of two rigorously designed outcome studies and has stimulated research and development of similar programs in other states.[11]

POTENTIAL BENEFITS OF HOME-VISITATION PROGRAMS

A small but growing body of research has supported the effectiveness of home-visitation programs. The following benefits have been found as an outcome of some, but not all, home visitor programs:[12]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Prenatal Effects

- Increased use of prenatal care[6,13]
- Increased birth weight[6,13]
- Decreased preterm labor and increased length of gestation[6,13]
- Increased use of health and other community resources (eg, prenatal visits, well-child visits, family planning, programs for women, infants, and children [WIC], and immunizations)[6,13]
- Improved nutrition during pregnancy[13]
- Fewer urinary tract infections during pregnancy[13]
- Increased attendance at childbirth classes[13]
- Decrease in maternal smoking[6,13]
- Greater interest by fathers in the pregnancy[6,13]
- Increase in the number of mothers having a labor room companion[6,13]

Postnatal Effects

- Fewer subsequent pregnancies[14,15]
- Increased spacing between pregnancies[6,14]
- Increased length of maternal employment[6,14]
- Increased rate of return to, or retention in, school by mothers[6]
- Fewer emergency department visits[16]
- Fewer accidental injuries and poisonings resulting in a visit to the physician[16]
- Decrease in the number of verified incidents of child abuse and neglect[6,15,16]
- Decrease in physical punishment and restriction of infants, with an increase in use of appropriate discipline for older children[14,17]
- Improved maternal–child interaction and maternal satisfaction with parenting[6,12]
- Increased use of appropriate play materials at home[16]
- Improved growth in low-birth-weight infants[12]
- Higher developmental quotients in infants visited[18]

Long-term Effects

A 15-year follow-up study of families who received a mean of nine home visits by nurses during pregnancy and 23 home visits up to their child's second birthday has demonstrated the following long-term benefits:

- Fewer subsequent pregnancies[15]
- Reduced maternal criminal behavior[15]
- Decrease in use of welfare[15]
- Decrease in verified incidents of child abuse and neglect[15]
- Less maternal behavioral impairment attributable to alcohol and drug abuse[15]

The observed effect of home-visitation programs seems to be greatest in high-risk populations, such as mothers who are teenagers, unmarried, poor, or have been abused themselves, and in children who are preterm or low birth weight. [15]

PERTINENT VARIABLES IN HOME-VISITATION PROGRAMS

Home visitors may be professionals or paraprofessionals, volunteers or paid workers. The services they provide may be social, health-related, or educational and may be targeted to an individual child or to an entire family.[6] They are not intended to replace office-based pediatric care, but rather to supplement and reinforce it. Caution is advised in comparing the outcomes of different home-visitation programs, because they may vary in important ways, including the following:

- Use of trained paraprofessionals versus professional nurses
- Volunteers versus paid visitors
- Onset of services (first trimester vs later; before birth vs after)
- Duration of services (eg, until the second birthday or beyond)
- Frequency of visits
- Universal availability to families versus selective application to families at risk
- Training of providers
- Aim and scope of program
- Intervention strategies used (simple social support vs active intervention, education, and advocacy)
- Adequacy of supervision of visitors
- Ratio of families to visitors
- Client variables and demographics
- Level of risk in families served
- Clients' perception of need for services

ELEMENTS OF SUCCESSFUL HOME-VISITATION PROGRAMS

Olds has made a plea that health and human services groups not make recommendations about, design, or implement home-visitation programs without considering the empirical evidence about the types of programs that are more successful.[14] Current research indicates that more successful programs contain the following elements:[8,14]

1. A focus on families in greater need of services (as opposed to universal programs that may avoid stigmatizing families but might dilute scarce resources), including families with low-birth-weight and preterm infants; children with chronic illness and disabilities; low-income, unmarried teenage mothers; parents with low IQs; and families with a history of substance abuse;
2. Intervention beginning in pregnancy and continuing through the second to fifth year of life;
3. Flexibility and family specificity, so that the duration and frequency of visits and the kinds of services provided can be adjusted to a family's need and risk level;
4. Active promotion of positive health-related behaviors and specific qualities of infant care-giving instead of focusing solely on social support;
5. A broad multiproblem focus to address the full complement of family needs (as opposed to a focus on a single domain such as increasing birth weights or reducing child abuse);
6. Measures to reduce family stress by improving its social and physical environments; and
7. Use of nurses or well-trained paraprofessionals.

COST-EFFECTIVENESS OF HOME VISITATION

Are home-visitation programs cost-effective? Olds writes that "a major portion of the cost for home visitation can be offset by avoided foster care placements, hospitalizations, emergency room visits, and child protective service worker time incurred during the same period that the home visitor program is provided. The long-range financial savings to the community are in all likelihood substantially greater, as is the reduction of human suffering."[6] Olds reports that current home-visitation programs cost between $300 and $1750 per family per year depending on the level and frequency of services provided. Even the most expensive programs pay for themselves by the time the children are 4 years old. Approximately 80% of the cost savings comes from reduction in welfare payments and food stamps, with one third of the savings coming from reduction in unintended subsequent pregnancies.[8,14]

NEED FOR EVALUATION AND SAFETY

Many small home-visitation programs are being developed and implemented around the country. In the absence of careful design, attention to empirical findings from previous research on home-visitation programs, and high standards for field experimentation, it will be difficult to determine whether public and private monies are well spent. Public funding measures for home-visitation programs should require both continuous examination of outcome measures and the ability to make midcourse corrections.[8,14] Accrediting may be a key component to providing some degree of uniformity, accountability, and quality in home-visitation programs. Home-visitation programs also must ensure the safety of their visitors and protect them from the violence often found in the environment of families with the highest needs.[19]

LIAISON WITH PRIMARY PROVIDERS

Home visitors can be health care advocates to improve access to providers of health care. Home visitors can be partners with pediatricians and other clinicians, working in the home setting to provide essential education and supportive services to at-risk children and families and to improve adherence to medical prevention and treatment regimens. Home-visitation programs include a "degree of social support that is difficult to provide in most clinical settings; outreach and liaison between the pediatrician, the family, and the community; involvement with socioeconomic issues that directly affect the well-being of the child and family; reinforcement and follow-up of preventive care, peer helper support, as well as encouragement, by the home health visitor who has the advantage of being with the family in its own home—a more accepting, less threatening setting for the family."[6]

Home-visitation programs should be integrated into a community's existing health care system, expanding the effectiveness of private providers, health maintenance organizations, and public health nurses. Visitation programs can provide or supplement services that are constrained by managed care or budgetary reductions. Aspects of home-visitation services for pregnant women, infants, and preschool children already are provided in many communities through public and home health agencies, parent–child services, hospitals, and private agencies. In some areas, home-visitation programs have linked with Head Start and other community-based family support programs to provide continuous services from conception to the start of school.[20]

CONCLUSION

Home-visitation programs can be an effective early-intervention strategy to improve the health and well-being of children, particularly if they are embedded in comprehensive community services to families at risk.[4] Home-visitation programs are not a panacea, sufficient unto themselves to reverse or prevent the damaging effects on children of poverty and inadequate or inexperienced parenting. Successful home-visitation programs require physician support and participation.

RECOMMENDATIONS

The American Academy of Pediatrics encourages pediatricians to:

1. Recognize that home-visitation programs are complimentary to office-based practice and part of a continuum of care;
2. Become familiar with the outcomes of home-visitation programs and the variables that enhance favorable outcomes;
3. Become aware of and coordinate with the types of home-visitation programs that exist in their area;
4. Advocate for home health visitors as members of the health care family and partners in obtaining information about factors that affect patients' health and assist in the implementation of health care recommendations. In this process, pediatricians should become familiar with the concept of "The Medical Home" as described by Brewer et al[21] and developed by Sia[9];
5. Support referral of high-risk parents to home-visitation programs as early as possible, ideally before or at the time of the prenatal visit to the pediatrician;
6. Be willing to participate in the planning, implementation, and evaluation of home-visitation programs in their communities;
7. Be available to participate in the education and evaluation of home visitors or ensure that home-visitation activities have adequate support;
8. Advocate that home-visitation programs be incorporated into managed health care plans, on a cost-added basis to avoid being compromised by capitation; and
9. Advocate at the local, state, and national levels for the funding, development, and careful evaluation of quality home-visitation programs.

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American Academy of Pediatrics
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POLICY STATEMENT

Role of the Medical Home in Family-Centered Early Intervention Services

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on Children With Disabilities

ABSTRACT

There is growing evidence that early intervention services have a positive influence on the developmental outcome of children with established disabilities as well as those who are considered to be "at risk" of disabilities. Various federal and state laws now mandate the establishment of community-based, coordinated, multidisciplinary, family-centered programs that are accessible to children and families. The medical home, in close collaboration with the family and the early intervention team, can play a critical role in ensuring that at-risk children receive appropriate clinical and developmental early intervention services. The purpose of this statement is to assist the pediatric health care professional in assuming a proactive role with the interdisciplinary team that provides early intervention services.

EARLY INTERVENTION LEGISLATION

Various federal and state laws now mandate the establishment of community-based, coordinated, multidisciplinary, family-centered programs that are accessible to children with established disabilities or those who are "at risk" of disabilities and their families. Early intervention services are designed to meet the needs of children from birth to 36 months of age who have delays in 1 or more areas of physical, cognitive, communication, social, emotional, or adaptive development. Services are also available to children who have a diagnosed condition that has a high probability of resulting in delayed development. States must offer early intervention services to children with delayed development or those with an established disability. States also have the option of serving those who are at risk for poor developmental outcomes. The type and extent of services are determined through the development of an individualized family service plan (IFSP). In designing the IFSP, the family plays a lead role in the assessment of resources, priorities, and concerns in conjunction with a care coordinator.[1,2]

By federal statute, available services must include:

- early identification, screening, and assessment services;
- care-coordination services;
- medical services only for diagnostic or evaluation purposes;
- family training, counseling, and home visits;
- special instruction;
- speech and language pathology and audiology services;
- occupational and physical therapy;

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Key Words
early intervention

Abbreviations
IFSP—individualized family service plan
IDEA—Individuals With Disabilities Education Act
AAP—American Academy of Pediatrics

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- psychological services;
- health services that are necessary to enable the infant or toddler to benefit from other early intervention services;
- social work services;
- vision services;
- assistive technology devices and services; and
- transportation, interpretation services, and other related costs that are necessary to enable a family to receive other services.[3,4]

Access to these services has been mandated because early intervention is important if children with disabilities are to achieve their full potential. During the past 25 years, the US Congress has taken a series of steps to promote improved infant and child developmental outcomes through early intervention services. The first major federal legislation was passed in 1975, when the Education for All Handicapped Children Act (Pub L No. 94-142) established the right of children between 5 and 18 years of age to a free, appropriate public education and related services; providing services to children 3 to 5 years of age was optional. The Education of the Handicapped Amendments of 1986 (Pub L No. 99-457) supported the development of early intervention programs for infants and children from birth to 3 years of age with disabilities or delayed development. The law also mandated that a free and appropriate public education be provided by the states' education departments for 3- to 5-year-olds by the 1990–1991 school year. It established guidelines and regulations for the development of far-reaching, coordinated, multidisciplinary services for these children and their families. In 1990, it was amended again as the Individuals With Disabilities Education Act (IDEA [Pub L No. 101-476]). One component of IDEA, Part H (now known as Part C), the Program for Infants and Toddlers With Disabilities, required states to develop and implement community-based systems of care that are coordinated, family centered, and culturally effective, with greater interagency collaboration. Part H required early identification and provision of services to infants and toddlers with delayed development and those with established conditions with a high probability of delay and, at the state's option, those who would be at risk of experiencing delayed development if early intervention services were not provided. Part H required that identified children be referred for a free comprehensive, multidisciplinary evaluation by a team of professionals who, with the family, decide which services are needed. The services that are determined to be necessary are listed on the IFSP, and the needs are reevaluated at least annually. A care coordinator is appointed to help the family access services. Subsequently, Part C of the IDEA Amendments of 1997 (Pub L No. 105-17) encouraged the states that did not serve the at-risk population to track and monitor these children so that they could be referred when needed.[2,3]

The Individuals With Disabilities Education Improvement Act of 2004 (IDEA 2004 [Pub L No. 108-446]) broadened the eligibility criteria for early intervention services. The 2004 legislation required referral for all children involved in substantiated cases of neglect or abuse, children affected by substance abuse or exposed to family violence, and children who are homeless or wards of the state. IDEA 2004 also permitted, at the states' discretion, families to choose to have their child continue in early intervention services until they are eligible for kindergarten.[5]

RATIONALE FOR EARLY INTERVENTION

Until 3 decades ago, in the absence of laws that mandated access to educational services for all children regardless of the degree of disability, many children with developmental disabilities and their families had few choices except state hospital–sponsored custodial care or an isolated homebound existence. Since then, much has been accomplished in the field of health care and special education for children with disabilities. Recent advances in medical expertise and technology have improved the developmental potential, health, and survival rate of infants and children with special health care needs. These advances have enabled children with special health care needs to participate more fully in public education. Neurocognitive research has demonstrated that there are optimal periods for all children during which the brain is particularly efficient at specific types of learning. Well-designed, timely early intervention can improve the outcome and the quality of life of young children at risk of developing cognitive, social, or emotional impairment.[6–9] The early childhood years present a singular opportunity to influence lifelong development and prevent or minimize developmental problems in children with disabilities or those who are at risk of developing disabilities.

THE BENEFITS OF EARLY INTERVENTION

Pediatric health care professionals have a major role in early identification and referral for children with established delays in development as well as children who are at risk of delays. The National Early Intervention Longitudinal Study[10] found that the age at first concerns was later for children with developmental delays (11.1 months) compared with children with diagnosed conditions (eg, Down syndrome) (2.3 months) and children with at-risk conditions (eg, prematurity) (2.1 months). The time between first concerns and development of an IFSP was also longer for children with developmental delays (8.9 months) compared with children with diagnosed conditions (7.1 months) and children with risk conditions (5.9 months). Children with developmental

delays were older than children with diagnosed conditions and risk conditions at the time of the IFSP. Male children with delays entered services at later ages than did female children with delays. White children with delays entered services slightly later than did children of other ethnicities with delays. No gender or ethnicity differences regarding age at entry within diagnosed conditions or at-risk groups were found. Sixty-four percent of families found doctors or other health professionals to be very helpful. Most parents felt that early intervention services helped their child's development and that their family was better off with these services. These findings were not as strong for low-income families or if the child had poor health.

These data suggest that pediatric health care professionals can improve early identification and referral for children at biological and environmental risks as well as those with delayed development without known risk factors. The American Academy of Pediatrics (AAP) has published an algorithm for developmental surveillance and screening in early childhood that can assist the medical home in this process.[11]

Coordinated, community-based, multidisciplinary programs for early intervention have been established for children and their families. The types and severity of the conditions that affect children with disabilities are varied, and so are the intensity and extent of the services provided. Despite these differences, however, studies that evaluated the efficacy of early intervention programs showed that, from a public-policy standpoint, they have achieved much.[12] Recent literature has revealed that these programs may be effective not only in improving some individual child cognitive outcomes but also in leading to important improvements in family function.[11,13–15] Reviews of the literature suggest that for children from birth to 3 years of age, global interventions that are focused on positive family interactions generally are more effective than those that are focused only on the child, but services must be individualized. Early intervention services generally are more effective for children with milder disabilities than for those with severe disabilities.[16] The greatest effect occurs when early intervention services combine child-focused educational activities with explicit attention to parent-child interaction patterns while strengthening the caregiver-child relationship.[6]

Results of the Early Intervention Collaborative Study showed that, despite the great variability of child and family function and of the types and extent of services offered, most young children in early intervention programs improved in all domains of functioning.[17] The Infant Health and Development Program is a multicentered, randomized, controlled, nationwide study of low birth weight preterm infants (and their families) who received coordinated health and developmental services for the first 3 years of life. Children who had received comprehensive, multidisciplinary early intervention services scored higher at 3 years of age on tests of mental abilities than did children who received health services alone. Within the intervention group, cognitive and academic achievement in children with higher birth weight was maintained at 8 years of age.[18–22] School outcomes for children in the intervention group were consistently better than for children who did not receive intervention. Several aspects of family development were also enhanced by the Infant Health and Development Program.

Another long-term study, the Carolina Abecedarian Project, recently revealed that poor children who received early educational intervention starting in infancy had higher scores on mental, reading, and math tests than did children who did not receive the intervention. The participants were assessed at 21 years of age and were found to have completed more years of education, were more likely to attend a 4-year college, and were older when their first child was born.[23]

There has been considerable growth in the field of research regarding efficacy of various treatment modalities for children with specific disabilities. It is important to consider this research when prescribing or providing advice regarding early intervention services. For example, for those with cerebral palsy, data suggest that a functional/behavioral approach warrants initial consideration. Muscle strength training should also be considered for children with cerebral palsy.[1] Additional guidelines for prescribing therapy services for children with motor disabilities were published by the AAP in 2004.[24]

Lipkin and Schertz's review[1] of the literature on early intervention for children with Down syndrome suggested that early intervention may be beneficial in preventing declines in IQ. Preliminary findings have raised promise for treadmill training and augmentative communication to improve outcomes.

Evidence for the benefits of early intervention for children with autism is stronger. The evidence suggests that early, intensive (at least 20 hours/week) behavioral and/or developmental services are helpful in improving communication and social skills,[1,25] but more research is needed (including ongoing research) regarding the types and intensity of services.

The parents and family, as the primary caregivers, play a vital role in ensuring the health and well-being of children. The focus of health and developmental services has evolved from a child-centered, traditional "medical" model to a family-centered "developmental" model. That is, those who coordinate services take into consideration the important contributions of the family unit, the stressors that affect families (social, financial, and/or psychological), and the ability of families to adapt to new challenges. The pediatric health care professional, as the central figure in the medical home, must be attuned to special family circumstances that influence children with

special health care needs. The pediatric health care professional must involve family members in all areas of planning, delivery, and evaluation of health and developmental services. Communication between parents and pediatric health care professionals should be open, comprehensible, culturally sensitive, and sincere, showing mutual respect.[26]

The pediatric health care professional, because of his or her unique training, interest, and commitment, should be a vital member of the early intervention health team. The pediatric health care professional is the most appropriate health care consultant, coordinator, and source of referral for clinical services for children with special health care needs and their families. Whether in a local pediatric health care professional's office or in a multispecialty referral center, these children and their families should be offered comprehensive care that is family centered, continuous, compassionate, and culturally sensitive. Regardless of the pediatric health care setting, this care can be provided in accordance with the precepts of the medical home.[2,27]

RECOMMENDATIONS

The role of the pediatric health care professional caring for children with disabilities and their families should include:

- Surveillance and screening of all infants to identify established disabilities or risks of delayed development following the AAP algorithm.[11] The algorithm contains recommendations to perform surveillance at all well-child visits and administration of a standardized screening tool at the 9- and 18-month visits and again at either the 24- or 30-month visit.
- Referring children with delayed development or established risk factors promptly to early intervention services. The AAP and the US Department of Education Office of Special Education Programs have collaborated to develop a referral form, which accompanies this statement.
- Arranging for medical etiologic diagnostic evaluation as appropriate. Guidelines for evaluation of children with delayed development have been published by the AAP[28] and the American Academy of Neurology.[29] Guidelines for diagnostic assessment of cerebral palsy also are available.[30,31] In addition, the AAP,[32,33] the American Academy of Neurology,[34] and the American Academy of Child and Adolescent Psychiatry[35] have published guidelines for assessment of children with autistic spectrum disorders.
- Being aware of the services and resources available in the community for the child and family and helping to coordinate the health component of the services.
- Collaborating with the family and care coordinator to provide medical input into development of the IFSP while ensuring that goals are functional in nature. Efforts at collaboration have been hampered by lack of payment for these services.
- Advocating for the child's access to the appropriate medical subspecialty and surgical specialty services.
- Supporting families in choosing evidence-based and best practices that meet the specific needs of their child.
- Ensuring that periodic, objective measures of progress are made and used to guide ongoing intervention design.
- Providing continuity of health care, including prescribing specific rehabilitative therapies as appropriate and periodically reviewing the need to continue such services on the basis of the achievement of common goals.
- Periodic and ongoing counseling for the family regarding the child's progress and treatment and management options.
- Helping to provide ongoing services that are aimed at preventing secondary disabilities.
- Maintaining a central medical database that contains pertinent diagnostic and consultative information.
- Negotiating for proper payment for time and effort spent on care coordination,[36] counseling services, and other direct services.
- Advocating for equal access to early intervention programs for all eligible children in need.
- Advocating for ongoing evaluation of early intervention programs through quality assurance and other performance measures.
- Representing state AAP chapters on local and state interagency coordination councils.
- Monitoring and supporting research that uses optimal methodologies to further clarify appropriate treatment modalities for children with specific disabilities.

CONCLUSIONS

By providing leadership for the medical home and as a member of the early intervention team, pediatric health care professionals can help set the standard of care in their communities for children with disabilities or those who are at risk of developmental delays. Through ongoing consultation with developmental and rehabilitation therapists, services and therapy prescriptions should be provided with specific treatment goals in mind. Treatment plans should be regularly and periodically reviewed and revised, if necessary, or renewed if indications show that they are accomplishing their intended purpose.

It is vital for pediatric health care professionals to be sensitive to their role as the medical care provider on the

early intervention team, promoting appropriate education and therapy for children with disabilities. An environment should be created in which the pediatric health care professional, family, and other service providers work together in a caring, collegial, and compassionate atmosphere that ensures that early intervention services are of high quality, accessible, continuous, comprehensive, and culturally effective.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Role of the Pediatrician in Youth Violence Prevention

CONTRIBUTORS:
COMMITTEE ON INJURY, VIOLENCE, AND POISON PREVENTION

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violence, victimization, adolescent, interpersonal relations, child advocacy

ABBREVIATION
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abstract

Youth violence continues to be a serious threat to the health of children and adolescents in the United States. It is crucial that pediatricians clearly define their role and develop the appropriate skills to address this threat effectively. From a clinical perspective, pediatricians should become familiar with *Connected Kids: Safe, Strong, Secure*, the American Academy of Pediatrics' primary care violence prevention protocol. Using this material, practices can incorporate preventive education, screening for risk, and linkages to community-based counseling and treatment resources. As advocates, pediatricians may bring newly developed information regarding key risk factors such as exposure to firearms, teen dating violence, and bullying to the attention of local and national policy makers. This policy statement refines the developing role of pediatricians in youth violence prevention and emphasizes the importance of this issue in the strategic agenda of the American Academy of Pediatrics. *Pediatrics* 2009;124:393–402

INTRODUCTION

A periodic survey of 1632 American Academy of Pediatrics (AAP) members administered by the AAP Task Force on Violence in the late 1990s indicated that injury as a result of violence is a substantial problem being confronted by pediatricians in practices across the country.[1] More than half of the respondents reported having recently seen a child who had sustained an intentional injury as a result of child maltreatment, and more than one third reported having recently treated a child with an injury resulting from domestic or community violence. Most pediatricians feel that they have an important role to play in the prevention of such injuries, and there is evidence to suggest that parents and community leaders also perceive a central role for pediatricians in the prevention of youth violence.[2–4] However, many pediatricians feel ill prepared to screen for and manage forms of violence other than child maltreatment.

In 1999, the AAP published a comprehensive policy statement outlining and defining the emerging role of pediatricians in the prevention of youth violence.[5] This statement represented the culmination of 3 years of focused, strategic thinking and outlined possible interventions that could be woven into routine health maintenance and preventive care practice. The 1999 statement also identified opportunities for pediatricians to assume leadership roles in violence prevention education and advocacy in community-based and out-of-office settings.

Although awareness of youth violence as a key issue in pediatrics has increased since publication of the 1999 statement, AAP periodic survey results have demonstrated a continued need for training and support for pediatricians.[6,7] In response, violent-injury prevention has assumed a higher priority within the AAP,[8] and several ongoing efforts have been initiated, such as the AAP Violence Prevention Symposium (2003); National Chapter Injury Prevention Conference (2005); appointment of a violence prevention subcommittee to the national Committee on Injury, Violence, and Poison Prevention (2005); and the publication of *Connected Kids: Safe, Strong, Secure* (2006).[8] At both the organizational policy and clinical practice levels, the AAP is striving to prepare and engage pediatricians in specific activities aimed at reducing the burden of intentional injuries borne by children in the United States.

This revised policy statement updates the evolving epidemiology of intentional injury, identifies important emerging issues related to violence prevention in children, and reaffirms the basic tenets that support the recommendations made in the original statement 10 years ago. Key new areas highlighted in this revised policy statement incorporate new information and resources concerning bullying and dating violence, and provide further specific counseling guidance for pediatricians

BACKGROUND

Over the last 2 decades of the 20th century, violence emerged as a major public health problem that disproportionately affects children, adolescents, and young adults. Despite recent declines in rates of violent deaths, nonfatal firearm injuries, and violence-related behaviors, such as fighting and weapon carrying,[9–15] homicide remains the second leading cause of death for all children 1 to 19 years of age.[16,17] Significant ethnic disparities in youth violence exposure persist. For example, homicide is the second leading cause of death in the United States for ages 15 to 19, but it is the leading cause of death among black 15- to 24-year-olds.[18]

Cross-national analyses have demonstrated similar rates of violence-related behaviors among adolescents in this country compared with international peers, yet the United States continues to lead the industrialized world in rates of youth homicide and suicide.[19–21] Approximately 3% of direct medical expenses in this country are related to interpersonal assault injuries, and the total cost to society of gun violence is approximately $100 billion, of which $15 billion is attributable to firearm injuries to children.[22–24]

The potential risks and behavioral consequences associated with early childhood exposure to violence in the home and/or witnessing violence in the community are profound. Over the past decade, there has been a great deal of scholarly attention devoted to elucidating those factors that confer risk or promote resilience.[25–28] It is recognized that there is a great deal of overlap among contextual factors, including family dynamics, community norms, and cultural beliefs and practices, that all play critically important roles in determining individual outcomes.[29] Primary care pediatricians routinely have access to young people involved in violence-related behaviors and are particularly well positioned to advise parents and caregivers.[30] Pediatricians are also likely to be aware of community-based resources such as prenatal and early intervention home visitation programs that have demonstrated promise in reducing the subsequent burden of intentional injury borne by young children.[31,32]

Myriad promising primary care interventions have been developed, but few have been evaluated in a scientifically controlled fashion.[33–35] To that end, several governmental health and organized medicine entities, including the Centers for Disease Control and Prevention, the Office of the Surgeon General, the American Medical Association, and the Agency for Healthcare Research and Quality, have sought to synthesize the burgeoning research literature in this area to help identify effective approaches.[36–39] The AAP has also developed and published a number of policy statements and other reports specifically related to addressing youth violence from an evidence-based, best-practices perspective.[40–43] However, the most comprehensive effort to date undertaken by the AAP is the primary care violence prevention protocol titled *Connected Kids: Safe, Strong, Secure*. Developed as a multiyear project supported in part by the Office of Juvenile Justice and Delinquency Prevention of the Department of Justice, *Connected Kids* is a carefully constructed resource aimed specifically at facilitating the primary health care professional's ability to incorporate intentional injury prevention tools and messages into everyday practice.

Another important recent development in the field of violence prevention has been the recognition of the primary importance of resilience factors that enable children and young adults to adapt successfully to stress, including exposures to violence. Scientific support for the crucial role of resilience stems from a number of sources, including analysis of data stemming from the National Longitudinal Study of Adolescent Health.[26,28] This statement discusses *Connected Kid*s, bullying prevention, and dating violence. The related key issues of firearms and media violence[42,43] are included in other AAP policy statements.

CONNECTED KIDS: SAFE, STRONG, SECURE

Connected Kids: Safe, Strong, Secure is a program launched by the AAP in 2005 that addresses violence prevention in the context of routine child health care. The development of *Connected Kids* involved the input of more than 100 experts as well as extensive input from parents and adolescents during a 3-year process.[8,44,45] The final AAP product consists of a clinical guide, 21 parent/patient information brochures, and supporting training materials (see Tables 1–3).

Because of the recent recognition of the primary importance of individual and family resilience discussed above, the *Connected Kids* program implements a strength-based approach to anticipatory guidance, helping parents and families raise resilient children. This approach results in a much broader approach to anticipatory guidance than previous, risk-based approaches. In addition, each topic area specifically addresses the social ecology of childhood by including information about the child's development, the parent's feelings and reactions in response to the child's development and behavior, and specific practical suggestions to help families connect to existing community resources.[46] Feasibility and qualitative field tests conducted in early 2005 yielded enthusiastic results, and rigorous program evaluation using existing practice-based networks is planned. The first randomized, controlled trial published to date of a primary care intervention designed to affect youth involvement in violent behavior demonstrated efficacy in the reduction of both fighting and fighting-related injuries.[47] The availability of an AAP tool like *Connected Kids* has great promise and potential to similarly affect children across the country as pediatricians become comfortable integrating its use into their practices. *Connected Kids* is coordinated with the third edition of *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*[48] and provides assistance in implementation of the *Bright Futures* psychosocial and safety themes. More detailed information is available from the AAP Web site (www.aap.org).

BULLYING

Bullying is a form of aggression in which 1 or more children repeatedly and intentionally intimidate, harass, or physically harm a victim who is perceived as unable to defend herself or himself.[49,50] An issue of emerging concern has been the association of bullying behavior, particularly among young school-aged children, with the subsequent development of serious

TABLE 1 Training Resource From AAP *Connected Kids: Safe, Strong, Secure*: Infancy and Early Childhood

INFANCY AND EARLY CHILDHOOD: PRENATAL TO 4-YEAR-OLD VISITS			
VISIT	**INTRODUCE**	**REINFORCE**	**BROCHURES**
2 Days to 4 Weeks	● What Babies Do ● Coping with parental Frustration ● Parent Mental Health ● Parent Support[79]		1. Welcome to the World of Parenting!
2 and 4 Months	● Child Care[80] ● Family[79] ● Safe Environment[81] ● Parenting Style[82] ● Bonding and Attachment	● Parent Mental Health ● Parent Support	2. Parenting Your Infant
6 and 9 Months	● Establishing Routines ● Discipline = Teaching[82] ● Reducing child access to firearms[42] ● Modeling Behavior	● Parent Support ● Child Care ● Safe Environment ● Bonding and Attachment	3. How Do Infants Learn? 4. Your Child Is On the Move: Reduce the Risk of Gun Injury
12 and 15 Months	● Child Development and Behavior[82]	● Parenting Style ● Reducing child access to firearms Modeling Behavior ● Safe Environment	5. Teaching Good Behavior: Tips on How to Discipline
18 Months and 2 Years	● Child's Assets ● Guided Participation ● Media[43,83]	● Parent Support ● Reducing child access to firearms Child Development and Behavior ● Establishing Routines	6. Playing Is How Toddlers Learn 7. Pulling the Plug on TV Violence
3 and 4 Years	● Peer Playing ● Safety in Others' Homes[42] ● Talking About Emotions ● Promoting Independence	● Modeling Behavior ● Guided Participation	8. Young Children Learn a Lot When They Play

TABLE 2 Training Resource From AAP *Connected Kids: Safe, Strong, Secure*: Middle Childhood

MIDDLE CHILDHOOD: 5- TO 10-YEAR-OLD VISITS			
VISIT	**INTRODUCE**	**REINFORCE**	**BROCHURES**
5 Years	● Establishing Routines and Setting Limits[82]	● Child Development and Behavior ● Child's Assets ● Safety in Others' Homes ● Promoting Independence	9. Growing Independence: Tips for Parents of Young Children
6 Years	● Teaching Behavior ● Bullying Prevention ● Out-of-School Time	● Modeling Behavior ● Establishing Routines and Setting Limits	10. Bullying: It's Not OK
8 Years	● School Connections ● Alcohol and Drug abuse prevention[84] ● Interpersonal Skills	● Reducing child access to firearms ● Promoting Independence ● Establishing Routines and Setting Limits ● Bullying	11. Drug Abuse Prevention Starts With Parents 12. Friends Are Important: Tips for Parents
10 Years	● Child Mental Health ● School Performance	● Media ● Out-of-School Time	13. Everybody Gets Mad: Helping Your Child Cope with Conflict

TABLE 3 Training Resource From AAP *Connected Kids: Safe, Strong, Secure*: Adolescence

ADOLESCENCE			
VISIT	**INTRODUCE**	**REINFORCE**	**BROCHURES**
Early:	● Family Time Together	● Reducing youth access to firearms Establishing Routines and Setting Limits	14. Talking With Your Teen: Tips for Parents
11 to 14 Years	● Peer Relationships ● Support System ● Staying Safe ● Teen Mental Health ● Conflict Resolution Skills ● Healthy Dating ● Gaining Independence	● Alcohol and Drug abuse prevention ● School Performance	15. Staying Cool When Things Heat Up 16. Expect Respect: Healthy Relationships 17. Teen Dating Violence: Tips for Parents
Middle:	● Plans for the Future	● Alcohol and Drug abuse prevention	18. Teen Suicide and Guns
15 to 17 Years	● Firearms and Suicide Prevention, including reducing child access to firearms[42,85] ● Depression prevention[85] ● Resiliency	● Peer Relationships ● Healthy Dating ● Gaining Independence	19. Next Stop—Adulthood: Tips for Parents
Late:	● Transition to Independence	● Peer Relationships	20. Help Stop Teenage Suicide
18 to 21 Years	● Negotiating a New Environment (Post-High School)	● Plans for the Future ● Depression prevention	21. Connecting With Your Community

assault behaviors. A comprehensive analysis stimulated by the rare but high-profile, multiple-casualty, school-based events in Pearl, Mississippi; West Paducah, Kentucky; Jonesboro, Arkansas; Springfield, Oregon; and Littleton, Colorado in the late 1990s brought into acute focus just how serious a precursor bullying may be.[51] Several professional medical organizations, including the American Medical Association and the Society for Adolescent Medicine, have directed specific attention by way of formal policy or resolution to the issue of youth bullying, often within the context of the broader problem of youth violence.[52,53] Also, the Health Resources and Services Administration of the US Department of Health and Human Services recently launched phase II of a major multiyear awareness campaign thematically titled "Take a Stand, Lend a Hand: Stop Bullying Now."[54]

Although bullying among school-aged children has been well described in other parts of the world, until recently, epidemiologic characterization of the depth and extent of the problem in the United States has been lacking. Nansel et al[55] at the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the National Institutes of Health have created a bullying epidemiology working group and are comparatively analyzing both domestic and international data sets. They have established a prevalence baseline of 30% for children either bullying and/or being bullied on the basis of a large sample of 6th- to 10th-graders.[56] They have also begun to critically analyze the true associations of bullying with some of the traditional violence-related behavioral markers, including weapon carrying and frequent fighting. Bullying and being bul-

lied are both associated with higher rates of weapon carriage and fighting serious enough to result in injury.[57,58] These associations seem to be stronger for bullies than for targets. Also of great concern are the more subtle psychosocial consequences that can be associated with bullying behavior, including the subsequent development of depression and suicidal ideation.[59,60] These problems are more likely to result from the indirect, relational bullying behaviors that are more typically engaged in by young girls and that can be notoriously elusive to identify.[61]

A growing literature has also begun to explore bullying's relationship with somatic conditions, disease morbidity, and the development of long-term behavioral exposures and outcomes manifesting in adulthood.[62–65] The emergence of portable technologies, such as cellular telephones, digital cameras, and personal digital assistants and ready accessibility to social networking Internet sites has led to the advent of technology-assisted bullying behavior—a phenomenon known as "cyberbullying."[66,67]

European researchers have been active for more than 30 years in developing interventions around bullying prevention. The most successful programs have been implemented in Scandinavia on the basis of the model developed by Norwegian investigator Dan Olweus.[68] The Olweus Bullying Prevention Program is a school-based model that has been replicated, refined, and evaluated many times internationally. Olweus proposes specific programmatic interventions at the school-wide, classroom, and individual levels on the basis of the insight that each bullying episode involves 3 groups of children: bullies and their acolytes, victims, and bystanders. However, there is a paucity of published reports in the peer-reviewed literature describing implementation and controlled evaluation of the Olweus Bullying Prevention Program in the United States.[69] It is clear that in this country, it must first be accepted that bullying behaviors cannot be considered a normative rite of passage and that they can be precursors for more serious downstream consequences. In terms of primary prevention, early parenting behaviors such as cognitive stimulation and emotional support have been shown to confer resilience against the future development of bullying behaviors in elementary-aged schoolchildren.[70] Promotion and reinforcement of such parenting skills plus recognition, screening, and appropriate referral as secondary prevention strategies are essential ways that pediatricians can collectively contribute to this aspect of youth violence prevention.

DATING VIOLENCE

The past decade has also seen more attention focused on relationship violence in adolescence, specifically teen dating violence. Depending on case definition and reporting methodology, estimates of the prevalence of teen dating violence have been reported to range from 9% to 46%.[71–73] With most US teenagers dating by middle adolescence,[74,75] it is important that pediatricians be aware of the precursors, symptoms, and behaviors associated with teen dating violence. Appropriate from a developmental standpoint, nascent prevention efforts in this area have focused primarily on peer-group–targeted interventions. One such school-based program that used a randomized, controlled methodology demonstrated efficacy for reducing self-reported teen dating violence victimization and perpetration rates at intervals up to 4 years after intervention.[76–78]

Because routine care-oriented intervention opportunities are more limited in adolescence and preadolescence, it is important that pediatricians avail and extend themselves as community resources to those entities that most influence the development of teen behavior. These would almost certainly include middle and high schools and, depending on the specific constitution of a given community, might also include faith-based organizations, local Boys and Girls Clubs, and/or other prosocial organizations. Most critical, however, is the role of the pediatrician as an information repository for parents and families. Early anticipatory guidance about adolescent cognitive and social development, relationship dynamics, and the risks of teen dating violence is paramount as part of a primary prevention strategy. The *Connected Kids: Safe, Strong, Secure* set of resource materials for early adolescence includes a "tips for parents" brochure on teen dating violence (see Tables 1–3). These materials and associated prompts are available in structured electronic formats to facilitate incorporation in electronic health records and associated decision-support tools.

THE ROLE OF THE PEDIATRICIAN: RECOMMENDATIONS

There are 4 domains in which pediatricians should be expected to employ their skills and influence in the implementation of youth violence prevention strategies: clinical practice, advocacy, education, and research.

Clinical Practice

Clinical practice for intervention, management, and prevention of youth violence should include:

- a working familiarity with the *Connected Kids: Safe, Strong, Secure* primary care violence prevention protocol;
- use of a comprehensive approach, exemplified by the *Connected Kids*

protocol for anticipatory guidance, screening, and counseling of children and families during the course of routine health maintenance (key elements of the protocol should be built into the practice flow sheets or electronic health record age-based prompts; parent and youth education materials should be readily accessible, either as printed material or printed at the time of visit);

- appropriate and timely treatment and/or referral for violence-related problems identified; and
- maintenance of an accurate database of community-based counseling and treatment resources. Whenever applicable, this database should be available through the practice's electronic health record system or linked to the practice's internal and external Web sites.

Advocacy

Pediatricians should advocate for:

- adequate publicly supported community-based behavioral health services;
- protection of children from exposure to firearms;
- bullying awareness by teachers, educational administrators, parents, and children coupled with adoption of evidence-based prevention programs;
- responsible programming on television, video, cable, the Internet, and video game formats that minimizes youth exposure to violent images, messages, and themes;
- the role of health professionals as appropriate public health messengers through print, electronic, or online media; and
- incorporation of content related to youth violence prevention in electronic health records, including screening prompts and links to parent education materials.

Education

Pediatricians should exercise every available opportunity to learn more about violence prevention through:

- formal continuing medical education or professional development programs;
- learning about community resources for children and adolescents; and
- elective course or rotation work in either medical school or postgraduate training.

Research

Pediatricians can contribute to needed research by:

- participating in practice-based research in the area of youth violence prevention;
- contributing data to existing intentional injury surveillance systems; and
- advocating for municipally supported, legislatively mandated active local injury surveillance systems.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT
Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine

Role of Pediatricians in Advocating Life Support Training Courses for Parents and the Public

ABSTRACT. Available literature suggests a need for both initial cardiopulmonary resuscitation basic life support training and refresher courses for parents and the public as well as health care professionals. The promotion of basic life support training courses that establish a pediatric chain of survival spanning from prevention of cardiac arrest and trauma to rehabilitative and follow-up care for victims of cardiopulmonary arrest is advocated in this policy statement and is the focus of an accompanying technical report. Immediate bystander cardiopulmonary resuscitation for victims of cardiac arrest improves survival for out-of-hospital cardiac arrest. Pediatricians will improve the chance of survival of children and adults who experience cardiac arrest by advocating for cardiopulmonary resuscitation training and participating in basic life support training courses as participants and instructors. ***Pediatrics*** **2004;114:1676;** ***basic life support training courses, cardiopulmonary resuscitation, CPR, cardiac arrest, community education, parents, school children, automated external defibrillator, chain of survival.***

INTRODUCTION

Childhood out-of-hospital cardiac arrest is a traumatic event for the entire community. Outcome is determined by timeliness of implementation of cardiopulmonary resuscitation. The establishment of a pediatric chain of survival for victims of cardiopulmonary arrest is advocated in this policy statement. Pediatricians are asked to advocate for basic life support training whenever possible in their local community.

RECOMMENDATIONS

1. Pediatricians should promote parental education in pediatric basic life support. Families of children with special health care needs, neonatal intensive care unit graduates, children who have ready access to water, or children who are active in water sports should be especially encouraged to undergo training and should be assisted in obtaining access to the training.
2. Pediatricians should encourage and collaborate with parents to promote basic life support training for adolescents, parents, caregivers, school personnel, youth leaders, and coaches to build the "chain of survival" in the community.
3. Basic life support training for the aforementioned groups should be advocated in policy advisory discussions at all governmental levels with a goal of making the training readily available and affordable.
4. Pediatricians and pediatric subspecialty providers should lead by example by taking and teaching basic life support training courses.

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AMERICAN ACADEMY OF PEDIATRICS

TECHNICAL REPORT

Lee A. Pyles, MD; Jane Knapp, MD; and the Committee on Pediatric Emergency Medicine

Role of Pediatricians in Advocating Life Support Training Courses for Parents and the Public

ABSTRACT. Available literature suggests a need for both initial cardiopulmonary resuscitation training and refresher courses. The establishment of a pediatric chain of survival for victims of cardiopulmonary arrest is the focus of this technical report and is advocated in the accompanying policy statement. Immediate bystander cardiopulmonary resuscitation for victims of cardiac arrest improves survival for out-of-hospital cardiac arrest. Pediatricians will improve the chance of survival of children and adults who experience cardiac arrest by advocating for basic life support training and participating in basic life support courses as participants and teachers. *Pediatrics* **2004;114:e761–e765. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2004-2021,** ***basic life support training courses, cardiopulmonary resuscitation, CPR, cardiac arrest, community education, parents, school children, automated external defibrillator, chain of survival.***

ABBREVIATIONS. SIDS, sudden infant death syndrome, CPR, cardiopulmonary resuscitation, AED, automated external defibrillator, EMT, emergency medical technician, AAP, American Academy of Pediatrics, HIV, human immunodeficiency virus.

INTRODUCTION

Pediatricians advocate for the health of children not only at local, state, and national levels but also with individual families and children. Pediatric basic life support training should include injury and cardiopulmonary arrest prevention information and be advocated the same way injury prevention and other preventive pediatric counseling are promoted. In fact, the "chain-of-survival" concept advocated in the Pediatric Advanced Life Support Course is a model in which each critical link in survival from prevention of trauma and cardiac arrest to rehabilitative and secondary preventative care of the survived arrest victim is optimized.[1] Pediatric out-of-hospital cardiac arrest carries a poor prognosis, which seems to be improved only by on-scene application of basic life support.[2] New information regarding sudden infant death syndrome (SIDS) and sudden cardiac death in children prompts careful attention to the role of the public in the chain of survival for an infant or child who experiences cardiac arrest.[3–6] Ventricular fibrillation has been newly considered as an important cause of cardiac arrest in children and adolescents in several recent studies,[3,7] which underscores the importance of basic life support training for the public, because cardiopulmonary resuscitation (CPR) before attempted defibrillation may improve the chances of successful defibrillation.[8] Use of automated external defibrillators (AEDs) in children experiencing sudden cardiac arrest has been advocated by the American Heart Association. This recommendation includes children older than 1 year.[9]

All 50 states have now passed laws authorizing use of AEDs.[10] Efficacy has been demonstrated by Atkins et al[7] in children older than 8 years. These recent observations, along with the progressive improvement in survival of infants and children who undergo cardiac surgery for repair and palliation of congenital cardiac defects, suggest a need to promote pediatric basic life support training for people who could have an opportunity to save the life of a child who experiences sudden cardiac arrest.[11] The epidemiology of sudden cardiac arrest in childhood suggests that pediatricians should advocate for pediatric basic life support training for parents, baby-sitters, child care providers, school personnel and coaches, and other youth leaders. Pediatricians can act as advocates and opinion leaders by serving as participants and instructors in CPR classes in medical settings and communities.[12] Although survival rates from currently available studies after out-of-hospital pediatric CPR are discouraging, the survival rate for in-hospital CPR and for those who achieve return of spontaneous circulation before arrival in an emergency department should stimulate researchers and pediatricians to advocate strongly for pediatric basic life support training for the public to increase the available pool of at-the-scene responders to pediatric cardiopulmonary arrest. The need for establishment and maintenance of an adequate airway in a child cannot be overemphasized. The establishment of a pediatric chain of survival is advocated in the accompanying policy statement.[13] The available information suggests that outcomes will improve for the newly apneic or fibrillating child who receives prompt CPR.[2]

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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Pediatric Cardiac and Respiratory Arrest: Success in Resuscitation

Eisenberg et al[14] investigated 119 pediatric cases of out-of-hospital cardiac arrest in King County, Washington, spanning a period from 1976 to 1982. The most common cause of cardiac arrest was SIDS (32%), followed by submersion (22%). Six percent of patients with basic emergency medical technician (EMT) care and 7% with EMT and paramedic care survived to hospital discharge. Of 103 patients for whom electrocardiogram rhythm strips were available, 9 (9%) showed ventricular fibrillation. The majority of patients (77%) showed asystole. Losek et al[15] also investigated out-of-hospital pediatric cardiopulmonary arrest and found few neurologically intact survivors (9 of 114 [8%]). In contrast, Innes and et al[16] showed a 70% success rate, with initial resuscitation of 41 children with inpatient pediatric cardiopulmonary arrest, 10 of whom (24%) were neonates. At 12-month follow-up, 37% were still alive. Attempts were initially successful in 82% of primary respiratory arrest, compared with 36% of cardiac arrests. These data from the inpatient setting suggest a marked improvement in survival with timely application of adequate CPR.

Sirbaugh et al[17] reported on 300 children in Houston in 1999 who were apneic and pulseless outside the hospital. Eleven percent showed a return of pulse. Six patients survived to hospital discharge, 1 with intact neurologic status. Thirteen patients (4%) showed ventricular fibrillation. Eleven percent of the total arrests were believed to result from cardiac causes, and 37% were ascribed to SIDS. Basic CPR was performed by bystanders in 79 (26%) cases. Twenty-two percent of children who arrested at home received bystander CPR, compared with 36% of those who had a cardiac arrest at another location. Sixty-five patients had serious water submersions and were given bystander CPR. Of the 65, 41 (63%) had return of spontaneous circulation before emergency medical services arrived and were not included in the 300 patients. Studies that analyze the outcomes of children who are pulseless and apneic on arrival of emergency medical services professionals and discard cases of successful bystander CPR may introduce a negative bias into the consideration of outcome of out-of-hospital child CPR by negating the bystander CPR. As an aside, in consideration of possible changes in the incidence of ventricular fibrillation and change in survival statistics, no new studies of etiology of cardiac arrest in children have been published, subsequent to the decrease in frequency of SIDS in association with the American Academy of Pediatrics (AAP) "Back to Sleep" campaign.[18]

Gausche et al[19] investigated 830 pediatric patients requiring airway management; 596 patients experienced cardiac arrest. The patients had been randomly assigned to receive bag-valve-mask ventilation or endotracheal intubation. Seventy-one percent and 72% of the children experienced cardiopulmonary arrest in the 2 groups, respectively. Eight percent of subjects from each group survived the arrest. Etiology of the arrest and the number of children who experienced ventricular fibrillation (4%) were provided in a recently published follow-up study.[20]

Hickey et al[21] investigated out-of-hospital cardiopulmonary arrest and found that 9 of 41 patients (22%) who initially presented to the Columbus Children's Hospital emergency department with a documented cardiac rhythm showed ventricular fibrillation or ventricular tachycardia. Of 21 patients with documented rhythm who were secondarily transferred to the hospital, 5 (24%) presented with ventricular tachycardia or fibrillation. These shockable rhythms are thought to have a higher likelihood of successful resuscitation compared with asystole. Of 23 patients who had cardiac arrest and return of spontaneous circulation in the field, 14 (61%) survived to hospital discharge.

BASIC LIFE SUPPORT TRAINING FOR PARENTS AND CAREGIVERS

CPR training has been advocated for parents and caregivers of premature infants, ventilator- and tracheostomy-dependent infants, infants who have undergone cardiac surgery or arrhythmia treatment, and others.[22] The AAP has recommended CPR training for parents and asked pediatricians to identify families with residential swimming pools beginning in the perinatal period for extra targeted counseling regarding drowning prevention.[23] Efficacy of CPR training for parents has been demonstrated in a variety of ways. Moser et al[24] showed that CPR training promoted a sense of control and reduced anxiety in parents of neonatal intensive care unit graduates. These authors studied 480 parents who were trained in CPR in 3 randomized groups: instructor-taught CPR, instructor-taught CPR plus social support, or a self-training video module.[25] Sixty-three percent of subjects were able to demonstrate successful CPR after training. A larger proportion had received one of the instructor methods rather than the self-training video. Less-educated learners and those with better psychosocial adjustment to their child's illness demonstrated slightly lower successful CPR performance rates.

Concerns about CPR training resulting in increased anxiety for parents are unsupported by scientific data.[26–28] CPR training for parents of infants with congenital heart disease fostered a sense of empowerment in these parents and helped relieve anxiety.

BASIC LIFE SUPPORT TRAINING FOR THE PUBLIC

Basic Life Support Training for School Children

Basic life support training for children in schools has been investigated by several groups.[29–31] Plotnikoff and Moore[31] as well as Van Kerschaver et al[32] showed CPR training to an acceptable level in their studies in children as young as 11 and 12 years of age. Plotnikoff and Moore demonstrated a marked decline in performance as early as 5 months after training. Decay of motor skills was more significant than that of cognitive knowledge. Poor performance at retest 5 months after training was felt to indicate

that a refresher course was needed at a shorter interval in this age group. The importance of retraining and the significance of diminution of skills and knowledge over time cannot be overemphasized.[32] Children may especially benefit from an overtraining effect. CPR training in schools in Hampshire, England, was performed in children 7 to 16 years of age. Training was offered in 26% of schools and was provided by school staff in 50.9% of schools and by statutory ambulance services in 30.9% of schools.[30] Other trainers were members of the Red Cross and the St John Ambulance Brigade. Peer-assisted training for boys from Cardiff, Wales, resulted in a lower percentage who reported willingness to provide CPR in an emergency, compared with boys trained by teachers or with girls trained by either method.[33] Vanderschmidt et al[34] demonstrated the need for skills practice and the importance of emphasis on discrete versus continuous skills (ie, teaching basic life support as a series of steps rather than a continuous action). Performance deterioration was noted at 3 months. Basic life support training in school has been recommended for high school students by the AAP.[35]

Basic Life Support Training for School Personnel and Youth Leaders

Basic life support training for the public has been investigated in a variety of settings and by using a variety of methodologies. The AAP has also advocated basic life support training for lifeguards. These recommendations are based on the assessment that basic life support training can augment other injury-prevention strategies in saving lives.

Basic Life Support Training Skills Retention

Studies of pediatric basic life support skills retention in parents trained in preparation for discharge of high-risk infants show retention of skills 2 months after training in a study by Berden et al[36] and 4 months after training in a study by Dracup et al.[37] Deterioration of skills has been uniformly seen 6 and 12 months after training in these studies, respectively. Berden et al[36] suggested a need for a training interval of at most 3 to 6 months for nurses. Hands-on practice by parents was shown to result in improved skills retention in a study by Komelasky and Bond.[38] In this study, it was noted that a predominance of trainees were the infants' mothers.

Barriers to Basic Life Support Training and Implementation

The study of Platz et al[39] involved interviews of 100 family members of cardiac patients. Barriers to CPR included concern for risk of harm to the victim or lack of knowledge and skill to help. Forty-nine percent reported previous CPR training. Fifty-nine percent of people who underwent CPR training did so for a job requirement. Only 7% had trained within the past year. Only 2% recalled a recommendation from a health care professional that they obtain CPR training. An additional, frequently identified barrier to CPR is risk of contracting human immunodeficiency virus (HIV) infection.[40] The lower rate of willingness to perform CPR in the boys trained in the peer-assisted program in Cardiff, Wales, pointed out the importance of how the potential barriers to CPR are presented and discussed in a training program.[33]

Concern for the risk of HIV infection is considered a barrier to bystander CPR performance in many recent studies. However, in a study from Sweden, the bystander CPR rate was higher in public places (53%) than for cardiac arrest in the home (23%).[41] Overall, bystander CPR was attempted for 36% of cardiac arrests, resulting in a 2.5 times increased likelihood of survival if bystander CPR was provided (95% confidence interval: 1.9–3.1). Concern for risk of spread of disease from mouth-to-mouth resuscitation is a major issue even for prehospital emergency care providers.[42] In their evaluation of willingness to perform mouth-to-mouth resuscitation by New York City emergency medical services professionals, Hew et al[42] found that 57% of 77 EMTs and 100% of 27 paramedics said that they would refuse to perform mouth-to-mouth resuscitation. The study suggested a need for education regarding risks of infection along with CPR training and a need for strategic placement of barrier masks for mouth-to-mouth resuscitation. The risk of infection with HIV is low with contact during CPR: 0.09% for health care workers with mucous-membrane contact with HIV-positive persons.[43–45]

Fear of harming the person who requires CPR rescue has resulted in concern for application of bystander CPR.[39,46] Adverse effects of CPR on people surviving CPR to hospital admission were no different for people rescued by bystanders versus advanced life support providers in a review of chest radiographs.[47]

Good Samaritan laws protect any layperson or professional who renders first aid to victims of injury.[48] These state statutes provide immunity to health care professionals except in the case of gross negligence. Health care professionals are not covered in the normal conduct of their jobs. Laws in Louisiana, Minnesota, and Vermont termed "failure-to-act statutes" compel all citizens to aid a victim in need. None of these state laws compel a layperson or health care professional to render emergency aid that could result in their own personal danger. The American College of Emergency Physicians has endorsed statutory protection for Good Samaritan acts, including actions of emergency physicians who respond to in-hospital emergencies.[49]

Concern for the cost and outcome of resuscitation in children may decrease health care professionals' enthusiasm for CPR training programs. Ronco et al[50] reported a 10% survival to hospital discharge for out-of-hospital arrest victims who received CPR. They noted an average cost of $100000 for each survivor and $10000 for each nonsurvivor. Cost-effectiveness of CPR was not investigated, nor was cost of ongoing care of survivors. They did not consider years of potential life lost of nonsurvivors. An overall cost analysis has not been attempted for pediatric out-of-hospital arrest victims. Health care professionals should be reminded that the Hickey et al study[21] and others[15–17] suggest that the best out-

comes are obtained for children who respond to basic life support interventions.

SUMMARY

Basic life support training should be advocated for anyone who has a chance to provide a link in the chain of survival for a victim of cardiac arrest. Pediatric out-of-hospital arrest victims do less well than similar adult patients and less well than in-hospital pediatric patients. The disparity between the different cardiac arrest survival rates suggests a need to stress application of CPR by any available individual in the pediatric setting.[2,12,15] The poor outcomes for children who achieve return of spontaneous circulation only after application of advanced life support interventions demands increased emphasis on basic life support training for anyone who has more than casual contact with children.[15,17,20,21] Pediatricians can improve overall community health by advocating for basic life support training for resuscitation of child and adult cardiac arrest victims and by participating in basic life support courses as students and teachers. The best outcomes will still be obtained through prevention of cardiac arrest. To this end, additional investigations to identify children who are at imminent risk of respiratory arrest as well as those with heart rhythm and structural abnormalities are needed, along with investigations to prevent injury, if we are to improve the lives of children and families.

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POLICY STATEMENT

The Role of Preschool Home-Visiting Programs in Improving Children's Developmental and Health Outcomes

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on Community Pediatrics

ABSTRACT

Child health and developmental outcomes depend to a large extent on the capabilities of families to provide a nurturing, safe environment for their infants and young children. Unfortunately, many families have insufficient knowledge about parenting skills and an inadequate support system of friends, extended family, or professionals to help with or advise them regarding child rearing. Home-visiting programs offer a mechanism for ensuring that at-risk families have social support, linkage with public and private community services, and ongoing health, developmental, and safety education. When these services are part of a system of high-quality well-child care linked or integrated with the pediatric medical home, they have the potential to mitigate health and developmental outcome disparities. This statement reviews the history of home visiting in the United States and reaffirms the support of the American Academy of Pediatrics for home-based parenting education and support. *Pediatrics* 2009;123:598–603

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Key Words
child health, development, home visiting, preschool, education

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INTRODUCTION AND HISTORY

Home visiting is not a single clearly defined methodology of providing service to children and families. The term "home visiting" is used differently in varied contexts. In this review, we limit our discussion to the use of preschool home-based parenting support to enhance developmental, health, and safety outcomes. Home visiting for parents is an early-intervention strategy in many industrialized nations outside of the United States. In many other countries, home health visiting is free, voluntary, and embedded in a comprehensive maternal and child health system. Although a causative link has not been demonstrated conclusively, countries with extensive home-visiting programs generally have lower infant mortality rates than does the United States, despite per capita health spending in the United States that far exceeds expenditures in other industrialized countries.[1]

Home visiting is deeply rooted in history, going back at least to Elizabethan times in England and endorsed as a strategy by Florence Nightingale in the 19th century.[2,3] Home visiting existed in the United States in the 1880s when public health nurses and social workers provided in-home education and health care to urban women and children. At the beginning of the 20th century, successful reductions in mortality from summer diarrhea in central New York City were demonstrated after using student nurses in the home to instruct mothers about hygiene and breastfeeding.[4] Denmark established home visiting in 1937 after a pilot program showed lower infant mortality rates associated with home visiting. France provides free prenatal care and home visits by midwives or nurses who educate families about smoking, nutrition, drug use, housing, and other health-related issues.[5] In some European countries, many traditional child health-promotion services of American pediatricians are provided by public health nurses, often within the home.[6]

In the last quarter of the 20th century, home visiting gained renewed attention as a strategy for prevention of child abuse and neglect, promotion of child development and parental effectiveness, and reduction of health disparities.[7] C. Henry Kempe, MD, called for a home visitor for every pregnant mother and preschool-aged child in his 1978 Abraham Jacobi Award address.[8] He suggested that integral to the provision of every child's right to comprehensive care is the assignment of a home health visitor who would work with the family until each child began school.[9] His call to action was reiterated by Cal Sia, MD, in the 1992 Jacobi Award address, in part on the basis of his experience with a pioneering initiative to take home visiting statewide as a tool for preventing child abuse and neglect in the

Hawaii Healthy Start effort.[10] Focusing on highly stressed families, this program has expanded and evolved into Healthy Families America and is one of the most rigorously studied of all the family-support initiatives in the United States.[11] Another pioneer in modern home visiting, David Olds, PhD, initiated the Nurse Home Visitation Program with families at risk in Elmira, New York, in 1978 and continues to study the effect of this intervention today. Within the education community, Parents as Teachers (PAT) has gained prominence as a program for promoting child development and school readiness after achieving promising results in Missouri.[12] In New Zealand, Scotland, and other countries, recent development of home-visiting efforts have replicated American models, thus indicating that the promise seen in this country with home visiting is envisioned beyond our shores.[13,14] Lisbeth Schorr, in her 1988 book *Within Our Reach: Breaking the Cycle of the Disadvantaged*, stated:

> "[Home-visiting] programs that succeed in helping the children and families who live in the shadows are intensive and comprehensive, flexible, and staffed by professionals with the time and skills to establish solid relationships with their clients. Intensive medical care for fragile newborn or aged patients who are barely clinging to life, costly though it may be, encounters no general resistance. Intensive care for fragile families requires similar support."[15]

In 1998, the American Academy of Pediatrics called for pediatricians to advocate for the inclusion of home visitors as part of the health care team and for the funding, development, and continued evaluation of home visiting in the promotion of children's health outcomes.[16] Shortly thereafter, this sense of optimism about the promise of home visiting was dampened by new information indicating limitations in the effectiveness of existing models. As comprehensive studies and new reviews of old programs developed, it became apparent that, as in other forms of support for developing children, home visiting may not, in all cases, be as efficacious as its advocates had hoped.[17]

HOME VISITING IS NOT A PANACEA

Although much energy, effort, and research have gone into the development of home-visiting programs, the extent of potential benefits is still inadequately delineated and understood. An ambitious evaluation in 1999 of a statewide home visiting program in Hawaii failed to demonstrate any substantial improvements in either maternal or child development and health outcomes.[18] Although these findings contradicted previous smaller studies and evaluations of earlier pilot programs, the comprehensiveness of this evaluation led to further examination of the evidence base for home visiting. In considering these apparent inconsistencies, it is best to remember that home-visiting programs are heterogeneous in their makeup, thereby compounding the difficulties associated with their evaluation. Programs vary in their approaches and are designed to achieve a variety of goals. Documentation that a home-visiting program design is effective in a particular setting may not support the use of other home-visiting models in that same setting.[19] This heterogeneity cannot be avoided. It is doubtful that an optimal, cost-effective approach will be successful for all outcomes in a diverse array of situations.[20]

Some of the most studied home-visiting efforts have a primary focus on the prevention of child abuse and neglect. Other programs have a strong focus on child development and school readiness or an interest in parental lives, including encouraging mothers and helping them become self-sufficient through further schooling, employment, and delay of future pregnancies.[17,21] Direct provision of health care, enhancement of child development, and support of parenting and mother-child interaction are additional primary goals of some programs.[21]

Most programs provide families with social support and are built on the development of a trusting relationship between the home visitor and parents. These relationships are designed to promote parent effectiveness and help engender strong bonds between the adults and children within families. Case management, linkages to community-based services, skill building for parents, child development education, and improvement in maternal health are common components of programs.[14]

By focusing on families most at risk, programs seek to diminish disparities in health and developmental outcomes. Controversy exists as to whether to use a universal approach, designed to work with all families in a defined geographic area, versus a program focused on populations most at risk of poor outcomes. Most studies indicate that very high-risk groups are more likely to show benefit from home visiting,[22] yet programs focused just on these groups may suffer from stigmatization and lack of acceptance on the part of families being visited. Some risk factors may interfere with the effectiveness of home visitation. For example, substantial evidence exists that families most plagued by domestic violence are least likely to respond to home-visiting support.[23] Other factors that hamper success of home visiting include limited family resources, family mental illness, and families not motivated to participate in the programs.[24] Thus, the very risk factors that make children vulnerable interfere with the effectiveness of the programs that are designed to help them.

Some programs use professional nurses or masters-prepared personnel as their home visitors; others use trained paraprofessionals who are often members of the target community and culturally linked with the families they visit. Although paraprofessionals usually are associated with lower salary costs,[25] the efficacy of the professional-based model is better established. Families may perceive nurse home visitors as more valuable because of their ability to identify and intervene with medical issues. Nurse-based home-visiting programs tend to have better staff retention compared with those that employ paraprofessionals, perhaps contributing to program effectiveness.[26,27] Likewise, programs in which paraprofessionals remained involved over a 2-year time period were more likely to demonstrate effectiveness than those with shorter durations of involvement.[28]

Additional barriers measuring the effectiveness of home-visiting services include variable effects noted at

different program sites, the need to tailor programs to the community, retention of families receiving services, maintaining program intensity, turnover in home visitors, and a drift over time in program focus. Other differences include the intensity of service, the duration of service, the caseloads of the home visitors, the population targeted for services, and training level of the visitors. To be successful, programs must focus on the risk factors that result in disparities in child outcomes, and misidentification of these factors is likely to result in poor program effectiveness.[29]

Within the context of the great heterogeneity of home-visiting programs, generalizations as to their effectiveness have been elusive and difficult to interpret. Frequently, pilot projects have shown positive effects, but many of the studies involving these small initiatives have methodologic flaws. Evaluations of home-visiting programs taken to scale have been mixed and sometimes disappointing in their findings. By itself, home visiting may be insufficient to result in satisfactory improvements in health and social outcomes.[30] It is clear that home-visiting programs are not a panacea for solving the problems of delayed child development and child abuse prevention but one of many tools to be used in a careful and thoughtful manner. Expectations for home visiting need to be tempered by realistic examinations of the current understanding of program effectiveness. Deanna Gomby, in a comprehensive review published in *The Future of Children*, noted

> "that no home visiting model produces impressive or consistent benefits in child development or child health. Several models produce some benefits in parenting and perhaps in the prevention of child abuse and neglect, but only on some of the measures used to assess these outcomes. . .these research results should not dissuade us from action. Children continue to grow, and their families continue to want and need support and services. It is up to us to strengthen existing services and craft new approaches to meet the needs of families and children."[17]

BENEFITS OF HOME-VISITING PROGRAMS

The wide-ranging nature of home-visiting programs and evaluations makes it difficult to draw definitive conclusions about potential benefits. A number of recent meta-analyses have made the task less arduous. Several large literature reviews, including those conducted by the US Task Force on Community Preventive Services,[20,28] one conducted by a British Task Force,[30] and a 2000 study by the Canadian Task Force on Preventive Care,[31] revealed strong evidence to support the effectiveness of perinatal and early childhood programs in preventing child abuse and neglect but no effect when paraprofessionals were used as visitors. A report from the US Surgeon General concluded that nurse home visiting has shown significant effects on the incidence of violence, delinquency, and other related risk factors.[32] Benefits in child development and child health are less clear, and the evidence for their support is inconsistent. Meta-analyses of home visiting published both in the United States and Europe report sufficient evidence that home visiting, when appropriately provided, can:

- improve parenting skills and the quality of the home environment[21,30,33];
- ameliorate several child behavioral problems, including sleep problems[21];
- improve intellectual development among children, especially among those with a low birth weight or failure to thrive[30,34];
- enhance maternal life course such as employment and education[17,21,30];
- reduce the frequency of unintentional injury and the prevalence of home hazards[30];
- improve detection and management of postpartum depression[34];
- possibly improve the attachment between infants and their parents[34];
- enhance the quality of social supports to mothers[30]; and
- improve rates of breastfeeding.[30]

Existing meta-analyses include the following characteristics of successful home-visiting programs:

- Socially deprived mothers show the greatest benefits from home visiting.[34]
- Professional or nurse-based home visiting is generally advantageous for clients.[35] The role of lay paraprofessional home visitors is less known, but paraprofessionals may be helpful depending on the goals and objectives of the home-visiting program and the length of engagement with the home visitor. An advantage of lay home visitors may be the notable cultural bond between the home visitor and mother. Paraprofessional home visitors require more intensive guidance, training, supervision, and support from professionals. Families with significant or complex difficulties require the support of professional home visiting.[36]
- Home visits may be useful for children born preterm or with low birth weight and may result in positive effects on child development. Without sustained support, these positive effects may fade as children grow older.[30,34]
- Services of longer duration and greater intensity correlate with higher degrees of effectiveness.[30,34]
- Generally, the more risk factors present in a child's life, the more likely that developmental outcomes will be affected. However, those families with the poorest functioning are often unresponsive to engagement and intervention. The relationship between benefit and risk status is also not linear. It seems that those at the greatest risk and those at the least risk of poor outcomes are less likely to benefit from home visiting than others.[37]

COST-EFFECTIVENESS OF HOME VISITING

Successful home-visiting programs involve extensive staff development and supervision, the creation of appropriate protocols, adequate supervision, and quality

assurance. Adequate funding is of paramount importance for home visiting to be successful. Cost-sharing issues among local, state, and national funding sources as well as the political nature of funding are major obstacles to program development. These programs are expensive, and their costs are a significant impediment to implementation.

Limited data exist to support the notion that home visiting is cost-effective. Successful programs are associated with reduced emergency department visits, decreases in foster care assignments, fewer hospitalizations, and savings in child protective services expenditures. Home visiting for the purpose of support and observation of newborns with low birth weight who are sent home early has been shown to be cost-effective by saving significant costs for the health insurer while improving overall health status.[38] Unfortunately, the savings from home-visiting efforts often accrue at some point in the future to entities other than the payer of the initial program. Home-visiting programs focused on social issues, child abuse, domestic violence, or child development, even if cost-effective, are unlikely to save costs in the health care sector. However, in all likelihood, the long-term financial savings to the community are substantial, as is the reduction of human suffering.[7,39] Cost savings in these instances will accrue to a variety of educational and social programs that are usually government funded. For these reasons, mechanisms for funding home visiting may be more appropriate from sources other than traditional third-party health care insurance. Payment sources will have to be tailored to the individual goals of each home-visiting program.

LINKING HOME VISITING TO THE PEDIATRIC MEDICAL HOME

Pediatric primary care continues to evolve in an increasingly complex world with shifting morbidities and mortalities and expanding responsibilities for the child health care professional. Recently, Perrin noted:

> "Primary care clinicians face. . .problems where teamwork in practice can greatly improve the services families receive. Especially in high risk communities, many families need access to a wide range of social and other supportive services. . .services that pediatricians know relatively little about."[40]

A 2006 Commonwealth Fund publication reiterated this suggestion with a call for a team approach as key to high-performing systems of well-child care. Such systems require graduated levels of services to fit the acuity and range of need for individual patients and families.[41]

Home visitors may well be essential members of these teams and augment the services of the traditional medical home.[34] Home visitors can be health care advocates and improve access to providers of health care. They can be partners with pediatricians and other clinicians, working in the home setting to provide essential education and supportive services to at-risk children and families and to improve adherence to medical preventive and treatment regimens. They can enhance developmentally oriented anticipatory guidance with individualized content that meets families' individual needs.[42] Home-visiting programs include a

> "degree of social support that is difficult to provide in most clinical settings; outreach and liaison between the pediatrician, the family, and the community; involvement with socioeconomic issues that directly affect the well-being of the child and family; reinforcement and follow-up of preventive care, peer helper support, as well as encouragement by the home health visitor who has the advantage of being with the family in its own home, a more accepting, less threatening setting for the family.[7]

Thus, home-visiting services should not be seen as replacing the contribution of the pediatric health care team but as a complementary service that enhances children's health and developmental trajectories.

In this context, appeals for home visiting linked to well-child care have been frequent, but the "how" and "why" of these linkages are poorly defined and require additional investigation. Little investigative work has been performed in the area of using home visiting linked to the pediatric medical home. One Colorado study showed that paraprofessional home visiting, when combined with an early-intervention program focused on children with developmental delays, resulted in improved involvement with the program.[25] In North Carolina, the combination of a public health department's home-visiting program with links into private physician's offices was helpful in overcoming personal and structural barriers to care.[43] The Commonwealth Fund's Healthy Steps intervention included home visiting by masters-level healthy development specialists with significant gains in the quality of well-child care, although the multifactorial nature of this intervention made it difficult to evaluate the effectiveness of the home-visiting component.[44–46] A South Carolina study showed that a program that linked school-based home visitors to group well-child visits resulted in greater retention of anticipatory guidance and improved satisfaction with care.[47]

These initiatives provide a glimpse into the potential of linking home visitors with the pediatric medical home. A working partnership between home visitors and pediatricians providing well-child care may provide, for those families most at risk, an intensive level of support resulting in better health outcomes. Home-visiting programs should be integrated into a community's existing health care system, expanding the effectiveness of private health care professionals, health maintenance organizations, and public heath nurses. Such integration should be undertaken cautiously with the knowledge that little is yet known to guide the optimal relationships between pediatric medical homes and home-based parenting support. The development of these relationships requires an ongoing evaluation to determine their effectiveness in the enhancement of optimal health and developmental outcomes for all of our children.

RECOMMENDATIONS

1. Sufficient evidence exists to endorse home-visiting services by nurses to prevent child abuse and neglect for at-risk families. Programs that are comprehensive in scope, are intensive in the visit schedule, involve

positive interactions with parents, target high-risk families, and are performed by professionally trained home visitors are known to be successful. Pediatricians should encourage the further expansion and development of programs for the prevention of child abuse and neglect.

2. Substantial evidence exists to support the use of home visiting as a strategy for addressing inequities in children's health status, school readiness, and development. Pediatricians should advocate for additional research and work to define the critical elements of such programs. Pediatricians should work with policy makers to ensure that elements found to be critical for success are applied to home-visiting practice.
3. Home-visiting programs should be comprehensive in nature but have clear primary goals and objectives supported by evidence-based strategies.
4. Pediatricians and others interested in the welfare of children should recognize the limitations of data supporting home-visiting efforts and the need to balance expenditures against the unsupported possible promise of such programs. Further investigative work needs to be performed to define the elements of cost-effective home visiting.
5. Little research has been performed on the linkage of home visitors to pediatric medical homes, which is an area that deserves attention. There is ample reason to believe that the synergy of home visitors working with pediatric clinicians could have positive effects on child health and development. Home visitors should be considered to be a complementary collaborative partner in the provision of developmental assessment and other components of well-child services, especially for at-risk populations. Communication between home visitors and pediatricians ideally should be free flowing while adhering to privacy regulations.
6. As experts in child development, pediatricians should become aware of and participate in development of home-visiting programs in their communities. They should be willing to participate in the planning, implementation, and evaluation of home-visiting programs and work to ensure that the methodologic contents of programs are evidence based.
7. Home-visiting services may have effects that are wide ranging and important to the health and welfare of young children but beyond the scope of traditional pediatric health care. As such, funding streams should be developed that do not rely solely on health insurance mechanisms. Home-visiting services can be cost-effective. Those sectors of society that are most likely to accrue benefit in future cost savings from the social and educational effects of home visiting should contribute to the funding of programs.

NATIONAL HOME-VISITING MODELS

- Early Head Start: www.ehsnrc.org
- Healthy Families America: www.healthyfamiliesamerica.org
- Home Instruction for Parents of Preschool Youngsters: www.hippyusa.org
- Nurse Family Partnership: www.nursefamilypartnership.org
- The Parent-Child Home Program: www.parent-child.org
- Parents as Teachers: www.parentsasteachers.org

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Role of Pulse Oximetry in Examining Newborns for Congenital Heart Disease: A Scientific Statement from the AHA and AAP

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KEY WORDS

diagnostic techniques and procedures, outcomes research, health policy, pulse oximetry, heart defects, congenital, tests

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abstract

BACKGROUND: The purpose of this statement is to address the state of evidence on the routine use of pulse oximetry in newborns to detect critical congenital heart disease (CCHD).

METHODS AND RESULTS: A writing group appointed by the American Heart Association and the American Academy of Pediatrics reviewed the available literature addressing current detection methods for CCHD, burden of missed and/or delayed diagnosis of CCHD, rationale of oximetry screening, and clinical studies of oximetry in otherwise asymptomatic newborns. MEDLINE database searches from 1966 to 2008 were done for English-language papers using the following search terms: congenital heart disease, pulse oximetry, physical examination, murmur, echocardiography, fetal echocardiography, and newborn screening. The reference lists of identified papers were also searched. Published abstracts from major pediatric scientific meetings in 2006 to 2008 were also reviewed. The American Heart Association classification of recommendations and levels of evidence for practice guidelines were used. In an analysis of pooled studies of oximetry assessment performed after 24 hours of life, the estimated sensitivity for detecting CCHD was 69.6%, and the positive predictive value was 47.0%; however, sensitivity varied dramatically among studies from 0% to 100%. False-positive screens that required further evaluation occurred in only 0.035% of infants screened after 24 hours.

CONCLUSIONS: Currently, CCHD is not detected in some newborns until after their hospital discharge, which results in significant morbidity and occasional mortality. Furthermore, routine pulse oximetry performed on asymptomatic newborns after 24 hours of life, but before hospital discharge, may detect CCHD. Routine pulse oximetry performed after 24 hours in hospitals that have on-site pediatric cardiovascular services incurs very low cost and risk of harm. Future studies in larger populations and across a broad range of newborn delivery systems are needed to determine whether this practice should become standard of care in the routine assessment of the neonate. *Pediatrics* 2009;124:823–836

Congenital heart disease occurs in 9 of every 1000 livebirths.[1] Approximately one quarter of these children will have critical congenital heart disease (CCHD), which by definition requires surgery or catheter intervention in the first year of life.[2] Congenital malformations are one of the

leading causes of infant death in the United States and other developed nations, and CCHD is responsible for more deaths than any other type of malformation.[3,4] Most newborns with CCHD can be diagnosed by echocardiography, palliated with prostaglandin infusion, and treated with surgery or transcatheter interventions. In the current era, congenital heart surgery allows for repair or palliation of nearly all types of congenital heart malformations. Congenital heart surgery, together with transcatheter interventions, has resulted in a marked improvement in survival for those with CCHD.[5] Intervention is typically performed in the first weeks of life to optimize hemodynamics and prevent end-organ injury associated with delayed diagnosis. Because timely recognition of CCHD could improve outcomes, it is important to identify and evaluate strategies to enhance early detection. Pulse oximetry has been proposed as one such strategy, and legislation has been proposed to support this practice.[6]

The present statement reviewed the existing data to evaluate the potential role of pulse oximetry in examining newborns for CCHD. A writing group was appointed by the American Heart Association (AHA) and the American Academy of Pediatrics to evaluate the available literature addressing current detection methods for CCHD, burden of missed and/or delayed diagnosis of CCHD, rationale of oximetry screening, and clinical studies of oximetry in otherwise asymptomatic newborns. Comprehensive searches of the MEDLINE database from 1966 to 2008 were done for English-language publications in scientific journals using the following search terms: congenital heart disease, pulse oximetry, physical examination, murmur, echocardiography, fetal echocardiography, and newborn screening. The reference lists of identified papers were also searched. Published abstracts from major pediatric scientific meetings in 2006 to 2008 were also reviewed. The AHA classification of recommendations and levels of evidence for practice guidelines were used. The classification of recommendations and levels of evidence are shown in Table 1.

PREVALENCE AND SCOPE OF THE PROBLEM

Currently, children with CCHD are diagnosed by a variety of mechanisms. Neonates with CCHD may be diagnosed in the newborn nursery on the basis of physical examination findings, such as heart murmurs, tachypnea, or overt cyanosis. These findings are not always evident before hospital discharge, which may occur before 48 hours of life. A recent study from the United Kingdom suggested that 25% of infants with CCHD were not diagnosed with heart disease until after discharge from the newborn nursery.[7] The median age of diagnosis in these cases was 6 weeks. A recent publication from the United States suggested that delayed or missed diagnosis occurs in 7 per 100 000 livebirths.[8] However, because these data are derived from a birth defect surveillance program with passive and thus incomplete case ascertainment, this calculation most likely represents a minimum estimate.

Newborns with CCHD are susceptible to profound, sudden worsening in clinical status in the first days and weeks of life. These acute physiological changes correspond to changes in pulmonary vascular resistance and closure of the ductus arteriosus. In neonates with CCHD, the ductus arteriosus is often essential for maintaining either pulmonary or systemic blood flow. These CCHD defects are considered *ductus arteriosus–dependent lesions* (Table 2). The newborn hospitalization provides a critical window for caregivers to identify CCHD lesions in order to avoid hemodynamic embarrassment. The timing of constriction or closure of the ductus arteriosus also explains why children with CCHD may be particularly vulnerable to cardiovascular collapse soon after discharge from the newborn nursery.

Morbidity and Sequelae

With the advent of prostaglandin therapy for ductus arteriosus–dependent lesions, many previously lethal con-

TABLE 1 Classification of Recommendations and Level of Evidence

Classification of recommendations
- Class I: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is beneficial, useful, and effective and should be performed. Benefit>>>risk.
- Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.
  - Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy. It is reasonable to perform procedure/administer treatment. Benefit>>risk. Additional studies with focused objectives needed.
  - Class IIb: Usefulness/efficacy is less well established by evidence/opinion. Procedure/treatment may be considered. Benefit≥risk. Additional studies with broad objectives needed; additional registry data would be helpful.
- Class III: Conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful/effective and in some cases may be harmful. Risk≥benefit. No additional studies needed. Procedure/treatment should not be performed/administered because it is not helpful and may be harmful.

Level of evidence
- A: Data derived from multiple randomized clinical trials or meta-analyses
- B: Data derived from a single randomized trial or nonrandomized studies
- C: Only consensus opinion of experts, case studies, or standard of care

TABLE 2 CCHD Lesions and Associated Clinical Characteristics

Lesion	Prevalence[a]	Hypoxemia	Ductus Arteriosus Dependent
Outflow tract defects			
Tetralogy of Fallot	6.1	Most	Uncommon
D-transposition of the great arteries	4.0	All	Uncommon
Double-outlet right ventricle	1.7	Some	Some
Truncus arteriosus	1.0	All	None
TAPVC	1.2	All	None
Ebstein anomaly	0.6	Some	Some
Right obstructive defects			
Tricuspid atresia	0.5	All	Some
Pulmonary atresia, intact septum	0.8	All	All
Pulmonic stenosis, atresia	6.3	Some	Some
Left obstructive defects			
Hypoplastic left heart	3.3	All	All
Coarctation of the aorta	4.7	Some	Some
Aortic arch atresia or hypoplasia	1.0	Some	All
Aortic valve stenosis (critical)	1.6	Uncommon	Some
Other major heart defects	12.4	Some	Some

TAPVC indicates total anomalous pulmonary venous connection.
[a] Per 10 000 livebirths. Data are derived from the Metropolitan Atlanta Congenital Defects Program.[1]

genital heart conditions that present with severe hypoxemia, shock, and acidosis in the newborn period are now survivable. The severity of organ damage is a function of the extent of insult, differential flow to organs as the neonatal circulation responds to the hypoxic/ischemic insult, and the oxygen requirement of each organ.

Among sequelae of neonatal hemodynamic compromise, the most important long-term effects relate to the consequences of brain injury from ischemia and reperfusion, because the brain has the highest oxygen requirement of any organ. Cerebrovascular pressure autoregulation and reactivity to CO_2 are affected by hypoxic/ischemic injury, which renders the brain particularly vulnerable to hypotension and decreased cardiac output.[9] Such hemodynamic instability is prevalent among neonates with CCHD who present with shock. Furthermore, preoperative events may interact with genetic mutations and both intraoperative and postoperative factors in determining later neurodevelopmental outcome.[10]

Using brain magnetic resonance imaging, a number of investigators have demonstrated acute brain injury in the newborn with CCHD before surgical intervention. Periventricular leukomalacia, which occurs secondary to vulnerability of the immature oligodendrocyte to hypoxia/ischemia, free radical attack, and excitotoxicity, and likely circulating cytokines, has been found on magnetic resonance imaging in up to 39% of neonates with CCHD.[11–14]

Children with CCHD are reported to experience more frequent impairments in motor function, speech and language, visual-motor-perceptual function, and executive function, as well as increased use of special services.[10,15–22] The greatest frequency of adverse outcomes is found among those with a single ventricle with obstruction to systemic outflow, such as hypoplastic left heart syndrome.[23] In this lesion, systemic perfusion occurs through the patent ductus arteriosus, and ductus closure results in shock and end-organ damage. Prenatal diagnosis of hypoplastic left heart syndrome has been reported in certain studies to reduce early neurological morbidity, with fewer adverse perioperative neurological events such as coma,[24] although earlier age at surgery has not been shown to result in better long-term neurodevelopmental outcomes.[23] One could infer that because delayed diagnosis is associated with damage to various end organs, it might also lead to hypoxic/ischemic brain injury; however, further studies are needed to demonstrate a true causal relationship.

Death Due to Delayed Diagnosis

A number of children with CCHD are so severely compromised at presentation that they die before surgical intervention. For example, investigators have reported that between 3% and 6% of neonates with dextro-transposition of the great arteries died because of hemodynamic compromise before surgical intervention could be offered.[25,26] In a study from the Baltimore-Washington metropolitan area in the 1980s, Kuehl and colleagues[27] reported that among 4360 children with any form of congenital heart disease, 76 (1.7%) died before the identification of heart disease. Delayed or missed diagnosis of CCHD accounted for 1.4 deaths per 10 000 livebirths in that series. In 1994, Abu-Harb and colleagues[28] reported on death due to unrecognized CCHD in infancy over a 6-year period in a region of northern England. Fifty-six of 185 children died in infancy, and 27 (48%) of these deaths resulted from sequelae of undetected CCHD. The great majority of these subjects had CCHD lesions that might have manifested hypoxemia. In another study from the United Kingdom, Wren and colleagues[29] reported that 25% of CCHD lesions were not diagnosed until after hospital discharge, even in the most recent era. The data from these United Kingdom studies suggested that delayed or missed diagnosis of CCHD accounted for 0.4 to 2.0 deaths per 10 000 livebirths.

With the increased use of prenatal ultrasound and a better understanding

of the presentation of CCHD in the past decade, the risk of death before diagnosis has undoubtedly declined, although it is still likely to be important.[30] Two recent studies have reported that the rate of mortality due to delayed diagnosis of CCHD is an order of magnitude lower than in the older studies discussed in the previous paragraph. First, a presentation from a study from metropolitan Atlanta, Ga, that used a population-based surveillance system reported that death due to delayed diagnosis of CCHD occurred in 1.0 of every 100 000 livebirths and may be decreasing with time[31]; however, this estimate could be understated, because in that study, only deaths that occurred before arrival at a hospital or before the child could be stabilized were attributed to delayed diagnosis. Another preliminary study from California reported 2.0 deaths per 100 000 livebirths related to delayed diagnosis of CCHD.[32] Presumably, earlier recognition of CCHD in these patients could have prevented death in at least some of these cases.

Impairment in cardiovascular function from delayed diagnosis may also adversely impact survival during neonatal cardiovascular surgery and recovery. Certain studies that compared outcomes in prenatal and postnatal diagnosis of CCHD have reported better short-term results for those who were diagnosed prenatally.[25,33] However, numerous other studies have failed to document any survival benefit of prenatal diagnosis among infants undergoing congenital heart surgery.[34,35]

In summary, delayed or missed diagnosis is associated with significant morbidity, the most significant being hypoxic/ischemic brain injury. In addition, delayed diagnosis appears to lead directly and indirectly to higher mortality in this population, although the number of deaths that might be prevented through pulse oximetry screening remains to be determined. Methods to improve early detection of CCHD appear warranted.

Customary Practice

Children with CCHD are identified in a variety of ways. Since the late 1980s, prenatal ultrasound has been used to screen for congenital anomalies. An anatomic ultrasound is typically performed at 18 to 20 weeks' gestation. During this process many, but not all, cases of CCHD can be identified by a methodical scan.[36] When CCHD is identified by this approach, the patient is often referred to a pediatric cardiologist for confirmatory imaging and counseling. With knowledge that the fetus has CCHD, the newborn can be delivered in a hospital capable of providing intensive care, including prostaglandin, as well as mechanical ventilation. The newborn can be stabilized and transferred to a congenital heart center.

Prenatal ultrasound, performed by those with specific training in congenital heart disease, can identify a variety of CCHD lesions; however, numerous studies have reported that even when fetal ultrasound is routinely performed during pregnancy, fewer than 50% of cases of CCHD are identified. Most of the published literature comes from European countries, which tend to have more centralized healthcare systems and uniform practices vis-à-vis prenatal ultrasound.[30,37–41] As such, these systems may represent the best-case scenario for population prenatal ultrasound screening. In the United States, many congenital surgery referral centers have reported prenatal detection rates >50% for functional single-ventricle lesions,[35,42] although the detection rate is generally <30% for CCHD lesions with 2-ventricle circulation.[43,44] These studies from referral centers may be biased toward higher detection rates, and population-based data on prenatal detection of CCHD in the United States are sparse.

There are several factors that might account for the relatively low prenatal CCHD detection rate. The quality of anatomic ultrasounds varies considerably.[45,46] A number of medical professionals, including radiologists, perinatologists, and general obstetricians with varying degrees of training, as well as technicians, perform these ultrasounds.[47] In addition to concerns about the quality, there may be limited access to prenatal ultrasound. In the United States, an anatomic ultrasound is not performed in all women.[48] The availability of anatomic ultrasound is likely to be particularly limited in certain racial/ethnic or low-socioeconomic-status groups.[49] Therefore, although prenatal ultrasound plays an important part in the timely identification of CCHD, population-based data demonstrate that this methodology by itself is insufficient to identify a high proportion of cases.

After birth, screening for congenital heart disease by primary care providers is currently accomplished by physical examination within the first 24 hours of life and on subsequent nursery visits. Supplemental tests, including electrocardiograms, pulse oximetry, and chest radiographs, are often obtained in suspicious cases. Echocardiograms can be done either with or without pediatric cardiology consultation. This strategy blends diagnostic assessment approaches from the 1950s to 1970s with the increasing availability of echocardiography. It results in substantial case identification but is regarded as inefficient and costly and misses a significant number of newborns with CCHD.[55]

Skilled physical examination, a sensitive and specific screening tool in

older children, does not always distinguish between neonates with and without congenital heart disease.[50,56] Hypoxemia is difficult to detect in newborns, and the transitional circulation masks important clinical findings such as absent femoral pulses while the ductus arteriosus remains patent. Reports of the late detection of coarctation of the aorta have been published since the 1960s.[51] Perhaps most importantly, physical examination skills are on the decline in current trainees.[52]

Heart murmurs have a prevalence of between 0.6% and 4.2% in newborns and are mistakenly considered a hallmark of heart disease.[53,54] They often do not accompany critical heart defects, particularly those with valve atresia and transposition. Flow murmurs of the transitional circulation, transient tricuspid regurgitation, and small ventricular septal defects are common and of no clinical importance in newborns. Conversely, murmurs of many important complex heart defects, such as tricuspid atresia with ventricular septal defect, double-outlet right ventricle, and total anomalous pulmonary venous return, emerge only after the decline in pulmonary resistance and after neonatal discharge and are often heard but not considered pathological. Practicing pediatricians currently have limited experience in discriminating innocent from pathological murmurs. In a contemporary series in which echocardiography was performed to evaluate for possible heart disease based on suspicious physical examination, fewer than 15% of subjects were found to have significant congenital heart disease.[55]

Clinical experience and epidemiological observations suggest that although physical examination, electrocardiogram, and chest radiograph are useful in identifying many cases of serious congenital heart disease postnatally, they do not have sufficient sensitivity and specificity to detect all cases. Echocardiography, although an essential diagnostic tool, has serious limitations as a universal screening tool, particularly its cost.[56] When used as a screening tool, echocardiography has a high frequency of either false-positive results (usually related to the transitional circulation) or recognition of clinically benign diagnoses (eg, small muscular ventricular septal defects). In addition, there may be an inadequate supply of trained personnel who could perform this screening with a reasonable degree of accuracy. Therefore, there is considerable interest in improving the detection of CCHD with novel diagnostic techniques.

PULSE OXIMETRY AND DETECTION OF CCHD

A common feature of many forms of congenital heart disease is hypoxemia. Hypoxemia results from the mixing of systemic and venous circulations or parallel circulations as one might see in dextro-transposition of the great arteries. Hypoxemia may result in obvious cyanosis. However, generally, 4 to 5 g of deoxygenated hemoglobin is needed to produce visible central cyanosis, independent of hemoglobin concentration.[57] For the typical newborn with a hemoglobin concentration of 20 g/dL, cyanosis will only be visible when arterial oxygen saturation is <80%; if the infant only has a hemoglobin concentration of 10 g/dL, the saturation must be <60% before cyanosis is apparent.[58] Importantly, those children with mild hypoxemia, with arterial oxygen saturation of 80% to 95%, will not have visible cyanosis. Moreover, the identification of cyanosis is particularly problematic in black and Hispanic neonates because of skin pigmentation.[57]

The majority of CCHD lesions present with some degree of hypoxemia in the newborn period. Table 2 demonstrates the frequency of the most common forms of CCHD based on data from the Metropolitan Atlanta Congenital Birth Defects Surveillance Program[53] and the likelihood of having some degree of hypoxemia in the newborn period. To improve timely detection of CCHD, a number of investigators have proposed that pulse oximetry be considered as a complementary modality to the newborn physical examination.[59,60]

Pulse oximetry was developed in the early 1970s based on the different absorption spectra between oxygenated and deoxygenated hemoglobin.[61] Deoxygenated hemoglobin absorbs light in the red band (600 to 750 nm), whereas oxygenated hemoglobin absorbs light in the infrared band (850 to 1000 nm). The ratio of light absorbance at these 2 wavelengths correlates with the saturation of hemoglobin in the capillaries.[62] Pulse oximetry has the potential to identify hypoxemia that might not otherwise produce visible cyanosis, especially among darkly pigmented newborns.

Pulse oximetry is used routinely in the assessment of young children in neonatal intensive care units and emergency departments and has been proposed as an adjunct to the assessment of the newborn in the delivery room.[63] As such, some have proposed that pulse oximetry be considered as a vital sign equivalent in importance to pulse, respirations, and blood pressure.[64] Contemporary use of pulse oximetry has thus already contributed to heightened recognition of congenital heart disease in neonates.

Clinical Studies of Oximetry Screening

Pulse oximetry has gained wide acceptance as a noninvasive method to determine oxygen saturation ($Sp0_2$). The method does not require calibration and is able to provide instantaneous

data that correlate well with blood gas measurements. O'Brien and colleagues[65] have defined reference data for oxygen saturation in healthy full-term infants during their first 24 hours of life. The median value at 20 to 24 hours of life (97.8%) is similar to the results for healthy full-term infants between 2 and 7 days of age (97.6%).[66] Other investigators have reported similar results.[67,68] Beginning in the 1990s, investigators began to explore the possible role of neonatal oximetry in identifying CCHD that might otherwise go undetected. Initially, investigators demonstrated that in neonates with known CCHD, pulse oximetry measurements were significantly lower than in age-matched control subjects. Using a cutoff of 95% in lower-extremity saturation, Hoke and colleagues[59] suggested that 81% of neonates with CCHD could be identified. Given this association, the question arose as to whether oximetry can successfully identify CCHD in a population of newborns not otherwise suspected of having heart disease. To date, several published studies[55,59,60,69–75] have used newborn oximetry to screen for CCHD (Table 3). Most studies were relatively small, and screening protocols differed with respect to both age at screening and cutoff levels for an abnormal screen. Nonetheless, the cumulative experience of these investigations provides a framework for evaluation of the test characteristics of newborn oximetry screening. The results of these studies and differences in study protocols are described below.

Because newborns with CCHD may have clinical deterioration in the first 48 hours of life, one would ideally use oximetry screening soon after delivery. However, arterial oxygen saturation varies considerably in the first 24 hours, with many healthy newborns having arterial saturations of less than 95%. As such, oximetry screening before 24 hours of life can result in a significant number of false-positive results. A study from the United Kingdom reported that the false-positive rate was as high as 5% when oximetry screening was performed in the first 24 hours compared with 1% at the time of hospital discharge.[76] Therefore, to achieve an acceptable specificity, testing >24 hours after birth would appear to be the most reasonable strategy. This screening strategy assumes that the majority of newborns will not be discharged on the first day of life. With early discharge at less than 24 hours of age, many infants would not be screened.

The establishment of a cutoff threshold for an abnormal $Sp0_2$ is important. Other factors being constant, a higher threshold will increase sensitivity and at the same time decrease specificity. Setting the $Sp0_2$ cutoff value closer to the normal level will decrease the number of false-negative screening results at the cost of increasing the number of false-positive screening results. Conversely, a lower $Sp0_2$ threshold will lower sensitivity and raise specificity. Although a number of $Sp0_2$ thresholds have been proposed, many investigators believe that an $Sp0_2$ of ≤95% is appropriate. In studies of healthy populations, the distribution of $Sp0_2$ measured in a lower extremity at 24 hours was reported to be 97.3±1.3%.[68] One study suggested that $Sp0_2$ <92% be considered a positive sign of hypoxemia; however, others have argued that a low threshold is likely to result in a number of infants with CCHD being misclassified as normal without markedly improving specificity.[77]

Most published studies of oximetry screening for CCHD have been performed at relatively low altitude. It is known, however, that arterial saturation in children and adults is lower at high altitudes, especially above 5000 ft. Several investigators have reported the normal $Sp0_2$ values for neonates at high altitude.[77,78] Bakr and colleagues[78] reported a mean $Sp0_2$ of

TABLE 3 Results of Studies Examining Oximetry Screening for CCHD

Study's First Author	n	Age at Screening, h	Probe Location	Cutoff for Normal	FP	FP Rate, %	TP	FN	TN	PPV, %	NPV, %	Sensitivity, %	Specificity, %
Hoke[59]	2876	<24	H+F	≥92/<7	53	1.84	4	0	2819	7.0	98.1	100.0	100
Richmond[71]	5626	11.7	F	≥95	51	0.91	9	4	5621	15.0	99.9	69.2	99.8
Koppel[60]	11 281	72	F	≥96	1	0.01	3	2	11 275	75.0	99.98	60.0	99.9
Reich[55]	2114	>24	H+F	≥95/<4	2	0.09	1	1	2110	33.3	99.95	50.0	99.9
Bakr[72]	5211	31.7	H+F	≥94	1	0.02	3	2	5211	75.0	99.9	60.0	99.9
Rosati[73]	5292	72	F	≥96	1	0.02	2	1	5288	66.7	100	66.7	100
Arlettaz[69]	3262	8	F	≥95	7	0.21	17	3	3235	70.8	99.9	85.0	99.8
Kawalec[70]	27 200	26	F	≥95	13	0.05	7	1	27 179	35.0	99.9	87.5	99.9
Meberg[74]	50 008	6	F	≥95	324	0.65	43	NA	NA	11.7	NA	NA	NA
Sendelbach[75]	10 976	4	F	≥96	636	4.5	0	1	10 340	0	99.9	0	95.5
All studies	123 846				1089	0.87	89	15	122 762	16.4	99.9	75[a]	99.3
Studies >24 h	51 098				18	0.035	16	7	51 063	47.0	99.9	69.6	99.9

FP indicates false-positive; TP, total positive; FN, false-negative; TN, total negative; PPV, positive predictive value; NPV, negative predictive value; H+F, hand and foot; F, foot; and NA, not available.

[a] Excludes study by Meberg et al[74] because false-negative data were not included.

95.4% at 24 hours of life from a population evaluated at 5300 ft. Presumably, one would need to establish a different threshold for high-altitude populations to maintain a reasonable balance between sensitivity and specificity of oximetry screening. Pilot projects are currently under way to examine how high altitude impacts newborn screening with oximetry.

Another variation among published oximetry screening studies has been the position of the pulse oximetry probe with respect to the upper or lower extremity. Previous investigators have demonstrated slightly lower Spo_2 measurements in the lower extremity than in the upper extremity in the newborn at 24 hours of life due to shunting at the level of the ductus arteriosus.[68] In general, the mean difference between the Spo_2 in the upper and lower extremities is <1%; however, some newborns with CCHD may have a more profound difference in saturation between the upper and lower body. For example, neonates with some forms of left obstructive heart lesions, such as critical coarctation of the aorta, in which the ductus arteriosus supplies a portion of the systemic flow, may have lower Spo_2 readings in legs than in the arm.[59]

Some investigators proposed that oximetry screening should include measurements of both upper and lower extremities and that differences in Spo_2 of more than 3% or 4% be used to identify newborns with CCHD who might otherwise be missed by measuring lower-extremity Spo_2 alone.[55,79] One study that examined newborns with known CCHD suggested that the addition of upper and lower measurements would increase sensitivity from 89.4% to 92.4% without a decrease in specificity.[79] However, these data were not obtained in the setting of a screening birth cohort but rather among those with known CCHD. It is possible that the inclusion of both upper and lower Spo_2 measurements would result in a significantly higher false-positive rate. Moreover, screening both upper and lower extremities would increase the time required to screen a single newborn. Therefore, a single lower-extremity reading would appear to be the most appropriate for the purposes of large-scale screening.

The results of published studies using oximetry screening to detect CCHD in a representative birth population are shown in Table 3. Ten studies with a total of 123 846 infants screened reported a mean of 0.87% of infants with false-positive screens but a false-positive rate of 0.035% when screening was done after 24 hours; however, there was remarkable dispersion in reported screening performance. Five studies reported a low false-positive rate (≤0.1%) when measurements were made after 24 hours of life. The low false-positive rate is somewhat surprising given the reported variation of Spo_2 reported in normal newborn populations. It is not known whether there might be a publication bias in that only studies with favorable specificity might be published. A low false-positive rate would reduce the number of unnecessary echocardiograms. Nine of 10 studies listed in Table 3 reported sensitivity of <90%, ranging from 0% to 87%. This is explained in part by the fact that hypoxemia is not present in some forms of CCHD (Table 2).

False-positive results can be a cause for concern in public health newborn screening programs that are based on the laboratory analysis of dried blood spot specimens collected on filter paper cards. These false-positive results typically require families to be notified to bring their child in for further testing, and there can be a delay of several days before the results of such testing become available. False-positive newborn screening results have been reported to sometimes result in lasting parental anxiety and possibly elevated use of healthcare services.[80] In the case of pulse oximetry, this type of psychosocial risk of harm is very unlikely to be a problem in the typical hospital setting for infants not subject to early discharge. A positive test result leads to an immediate referral for an echocardiogram, and the results are reported before discharge. However, when the birth center does not have ready access to cardiac consultation, delay in hospital discharge or transfer to another facility may result in anxiety and added stress.

Oximetry screening may be less effective at identifying some CCHD lesions at greatest risk for acute cardiovascular compromise, namely, obstructive left heart lesions. A published analysis of oximetry has suggested that the difficulty in detecting hypoplastic left heart syndrome, aortic stenosis, and coarctation of the aorta limits the usefulness of this screening tool.[81] However, it should be noted that nearly all forms of CCHD—even those unrelated to left heart obstruction—can result in serious morbidity and even death when diagnosis is delayed.[25,31] Moreover, oximetry can detect a significant number of newborns with obstructive left heart lesions and right-to-left shunting at the ductus arteriosus (Table 4). In published series, hypoplastic left heart syndrome was detected in all cases, and coarctation of the aorta was detected in just over half the cases. Studies that have obtained Spo_2 measurements on newborns with known CCHD have similarly reported that a lower-extremity Spo_2 of ≤95% detected hypoplastic left heart syndrome in all cases and critical coarctation of the aorta in the majority of cases.[59,79]

Several studies of screening oximetry have reported incidental findings of

TABLE 4 Detection of CCHD Lesions From Screening Studies, Assuming a Positive Screen as Spo2 ≤95%

	Kao[82]	Hoke[59]	Richmond[71]	Koppel[60]	Reich[55]	Bakr[72]	Rosati[73]	Arlettaz[69]	Kawalec[70]	Total	Percent	95% CI
DORV	0	0	0	0	0	0	0	3/3	0	3/3	100	44–100
HLHS	0	0	0	0	0	0	0	3/3	2/2	5/5	100	57–100
PA	0	0	3/3	0	0	1/1	0	1/1	0	5/5	100	57–100
d-TGA	2/2	1/1	3/3	0	1/1	0	0	2/2	0	9/9	100	70–100
TAPVC	0	0	0	2/2	1/2	1/1	1/1	0	1/1	6/7	85.7	47–97
Truncus	0	0	0/1	1/1	2/2	1/1	0	3/3	0	7/8	87.5	53–92
TA	0	0	0	0	0	0	0	0	1/1	1/1	100	21–100
AA/AS	2/3	0	0	0	0	0	0	1/1	0	3/4	75.0	30–100
TOF	5/5	1/1	1/4	0	2/3	0	0	0	0	9/13	69.2	49–87
AVSD	2/2	0	0	0	1/1	0	0	1/2	0	4/5	80.0	38–96
CoA	0/3	1/1	2/3	0/1	0	0	1/2	1/1	3/4	8/15	53.3	30–75
PS	0	1/1	0/1	0	0	0/1	0	1/3	0	2/6	33.3	10–70

CI indicates confidence interval; DORV, double-outlet right ventricle; HLHS, hypoplastic left heart syndrome; PA, pulmonary atresia; d-TGA, dextro-transposition of the great arteries; TAPVC, total anomalous pulmonary venous connection; Truncus, truncus arteriosus; TA, tricuspid atresia; AA/AS, aortic atresia/aortic stenosis; TOF, tetralogy of Fallot; AVSD, atrioventricular septal defect; CoA, coarctation of the aorta; and PS, pulmonary stenosis.

persistent fetal circulation, defined as elevated pulmonary vascular resistance and right-to-left shunting at the ductus arteriosus. In some reports, these cases have been reported as false-negative findings. In other studies, the investigators have emphasized the benefits of identifying these patients.[69] The finding of persistent fetal circulation in otherwise healthy newborns may be of benefit to medical care.[83] An understanding of the outcome of newborns who are asymptomatic with a decreased lower-extremity Spo_2 will be needed to understand whether identification of this population is a true benefit of oximetry screening.

LIMITATIONS AND CHALLENGES TO NEWBORN PULSE OXIMETRY IN DETECTION OF CCHD

There are technical limitations to oximetry measurement in the newborn. As noted above, the mean Spo_2 in the newborn at >24 hours of age is 97% to 98%; however, when continuous pulse oximetry is used, multiple investigators have demonstrated periodic and/or sustained desaturation below 95% during sleep, feeding, and crying.[65,68,84,85] Sustained rather than variable hypoxemia is consistent with the diagnosis of cyanotic congenital heart disease. Low oximetry readings in the setting of normal arterial oxygen saturation have been reported by multiple investigators.[76,86,87] In fact, falsely low oximetry readings in the newborn population are known to be associated with low peripheral perfusion and motion artifact,[88,89] probe placement site and partial probe detachment,[90] and hyperbilirubinemia or dyshemoglobinemias. It is known that technical differences between the various types of oximeters in general use include measurement of functional or fractional oxygen saturation, preset signal-averaging times, and methods for the exclusion of motion artifact.[91] There has been some research into the variability among various commercially available pulse oximeters; however, most of the variability occurs in the cyanotic range (<90%) or at the highest saturations (99% to 100%). The peak performance of the commercially available oximeters occurs in the range of 92% to 97%.[92] Therefore, in the critical range for oximetry screening (94% to 97%), the variability of the most commonly used oximeters should be negligible.

There has also been concern that pulse oximeters may not be as accurate in darkly pigmented adults and children. At low Spo_2 levels (<70%), commercially available oximeters appear to overestimate arterial saturation by 3% in darkly pigmented subjects.[93] However, when Spo_2 is >90%, measurement bias related to skin pigmentation appears negligible (<0.2%). Lastly, the quality of oximetry measurements may be lower when performed in a screening setting.[94]

When neonates are identified as having hypoxemia (Spo_2 ≤95%), it is necessary to evaluate them for CCHD. Although physical examination, chest radiography, and electrocardiography can assist in this process, echocardiography is now considered the definitive diagnostic modality. Whenever possible, the echocardiograms should be interpreted by pediatric cardiologists; major errors in the interpretation of a newborn echocardiogram by trained pediatric cardiologists are rare.[95]

Although the majority of metropolitan areas in the United States have access to pediatric subspecialists, such as pediatric cardiologists, availability in rural areas can be limited. Approximately 15% of births in the United States occur in nonmetropolitan areas.[96] In these settings, echocardiograms are often performed by sonographers without formal pediatric training and are interpreted by adult cardiologists. Several investigators have found that the accuracy of pediatric echocardiograms interpreted by adult cardiologists is low.[95,97] One alternative is to use telemedicine, in which echocardiograms are interpreted distantly at a pediatric referral center.[98,99] The accu-

racy may be improved by direct guidance of the sonographers by a pediatric cardiologist via videoconferencing. This approach, which has been shown to be efficient and accurate, may be required to enhance detection of CCHD in rural or underserved areas. Another option is for newborns with suspected CCHD to be transported to a tertiary center. This strategy, however, would be expensive and impractical in many cases.

The cost of routine pulse oximetry performed on asymptomatic newborns after 24 hours of age includes both the direct cost of the pulse oximetry and the follow-up costs of any additional examinations and transfers. The largest direct cost component is staff time. At experienced centers, it may take a technician only 45 seconds on average to perform pulse oximetry on a newborn infant. The cost of diagnostic evaluation of infants who are referred for further examination after pulse oximetry depends on the frequency of referral, the duration of the diagnostic evaluation, and the ability for the evaluation to be performed without transfer to another center. A detailed cost accounting, to be reported elsewhere, indicates an average cost of approximately $1 per asymptomatic newborn infant, which includes the cost of diagnostic evaluations, in hospitals with moderate obstetric volume and ready access to pediatric echocardiography. Further work is needed to assess the cost and yield of routine pulse oximetry examination of newborns in a wider range of settings.

Oximetry to enhance the detection of CCHD has been considered previously in an evidence review sponsored by the United Kingdom's National Health Service Health Technology Assessment program.[100] The investigators observed that pulse oximetry is much more effective than current clinical practice in identifying infants with CCHD and more accurate and much less expensive than screening all newborns with echocardiography. The incremental cost per timely diagnosis of life-threatening congenital heart defects was calculated to be approximately $10 000 for pulse oximetry and $10 million for screening echocardiography. Although pulse oximetry was regarded as more promising than either the current practice or other options, the report called for further research to improve estimates of test performance and to inform timing, diagnostic, and management strategies and to "investigate the psychosocial effects of newborn screening for congenital heart disease" (p 127).[100] Another report has suggested families were quite receptive to newborn screening with pulse oximetry, with 99.8% of a sample of parents in Poland reported to approve of the screening technique.[70]

SUMMARY

The association of delayed diagnosis of CCHD with mortality, morbidity, and disability provides a rationale for strategies such as pulse oximetry assessment to improve early detection. Some studies have reported a reasonable detection rate with pulse oximetry; however, the usefulness of oximetry in clinical practice is not well established (Class IIb, Level of Evidence C; Level of Evidence C corresponds to observational studies [case-control and cohort design]). Additional studies in larger populations and across a broad range of newborn delivery systems are needed to determine whether this practice should become the standard of care in the routine assessment of the neonate.

Currently, pulse oximetry is being performed routinely in some delivery centers in the United States and elsewhere.[101] Because pulse oximetry cannot detect all cases of CCHD, the diagnoses in some infants will be missed until after discharge from the newborn nursery. Such cases will provoke the question of whether the newborn oximetry screen was performed accurately. Therefore, it is reasonable for centers that routinely use pulse oximetry to ensure the fidelity of oximetry measurements through periodic quality assessment. Parents and caretakers should also be informed that pulse oximetry cannot detect all cases of CCHD, and hence, a negative test result does not exclude the possibility of heart disease.

Call for Future Studies

Collaborative studies among hospitals conducting routine pulse oximetry should analyze pooled data and report detection, false-positive rates, and false-negative rates of CCHD. A pilot study of pulse oximetry screening has recently completed enrollment at 6 English hospitals by the National Institute for Health Research.[102] In addition, a comprehensive assessment of the impact of pulse oximetry assessment and early detection of CCHD on morbidity, postoperative survival, and hospital costs will allow a more critical evaluation of the economic impact of efforts to improve timely diagnosis of CCHD.

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[a] Modest.

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[a] Significant.

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POLICY STATEMENT

Role of the School Nurse in Providing School Health Services

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on School Health

ABSTRACT

The school nurse has a crucial role in the seamless provision of comprehensive health services to children and youth. Increasing numbers of students enter schools with chronic health conditions that require management during the school day. This policy statement describes for pediatricians the role of the school nurse in serving as a team member in providing preventive services, early identification of problems, interventions, and referrals to foster health and educational success. To optimally care for children, preparation, ongoing education, and appropriate staffing levels of school nurses are important factors for success. Recommendations are offered to facilitate the working relationship between the school nurse and the child's medical home. This statement has been endorsed by the National Association of School Nurses.

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Key Words
school nursing, school nurse, school health services

SCHOOL NURSE DEFINITION

The National Association of School Nurses defines school nursing as:

> A specialized practice of professional nursing that advances the well-being, academic success, and lifelong achievement of students. To that end, school nurses facilitate positive student responses to normal development; promote health and safety; intervene with actual and potential health problems; provide case management services; and actively collaborate with others to build student and family capacity for adaptation, self-management, self-advocacy, and learning.[1]

BACKGROUND

After the child's home, school represents the second most influential environment in a child's life. As more students enter schools with health or mental health problems, pediatricians face the challenge of managing their care throughout the school day. The school nurse is the health care representative on site. An understanding of the school nurse's role is essential to ensure coordinated care. There is a recognized relationship between health and learning, as there is between school nurse availability and student well-being and educational success.[2–4] The role of the school nurse encompasses both health and educational goals.[5–7] Students today may face family crises, homelessness, immigration, poverty, and violence, which increase both their physical and mental health needs. School nurses perform a critical role within the school health program by addressing the major health problems experienced by children. This role includes providing preventive and screening services, health education and assistance with decision-making about health, and immunization against preventable diseases. In addition, school nurses may provide interventions for acute and chronic illness, injuries and emergencies, communicable diseases, obesity, substance use and abuse, adolescent pregnancy, mental health, dental disease, nutrition, and sexually transmitted infections.[8–13] School nurses need to be physically present in schools to address these responsibilities appropriately. Improved student outcomes result where schools have a full-time school nurse.[3] Inadequate staffing threatens the school nurse's role as medical home extender.

School nurses are well positioned to take the lead for the school system in partnering with school physicians, community physicians, and community organizations. They facilitate access to Medicaid and the State Children's Health Insurance Program to help families and students enroll in state health insurance programs and may assist in finding a medical home for each student who needs one.

This policy statement has been endorsed by the National Association of School Nurses.

SCHOOL NURSE ROLE

The National Association of School Nurses identifies 7 core roles that the school nurse fulfills to foster child and adolescent health and educational success.[13] The roles are overarching and are applicable to school nurses at all levels of practice, in all geographic settings, and with all clients.

1. The school nurse provides direct care to students.[13] The school nurse provides care for injuries and acute illness for all students and long-term management of students with special health care needs. Responsibilities include assessment and treatment within the scope of professional nursing practice, communication with parents, referral to physicians, and provision or supervision of prescribed nursing care. An individualized health care plan is developed for students with chronic conditions, and when appropriate, an emergency plan is developed to manage potential emergent events in the school setting (eg, diabetes, asthma). Ideally, this health plan is aligned with the management plan directed by the child's pediatrician and regularly updated through close communication. The school nurse is responsible for management of this plan and communication about the plan to all appropriate school personnel.

   The school nurse has a unique role in provision of school health services for children with special health needs, including children with chronic illnesses and disabilities of various degrees of severity. Children with special health needs are included in the regular school classroom setting as authorized by federal and state laws. As a leader of the school health team, the school nurse must assess the student's health status, identify health problems that may create a barrier to educational progress, and develop a health care plan for management of the problems in the school setting. The school nurse ensures that the student's individualized health care plan is part of the individualized education plan (IEP),[14] when appropriate, and that both plans are developed and implemented with full team participation, which includes the student, family, and pediatrician.

2. The school nurse provides leadership for the provision of health services[13] As the health care expert within the school, the school nurse assesses the overall system of care and develops a plan for ensuring that health needs are met. Responsibilities include development of plans for responding to emergencies and disasters and confidential communication and documentation of student health information.

3. The school nurse provides screening and referral for health conditions.[13] Health screenings can decrease the negative effects of health problems on education by identifying students with potential underlying medical problems early and referring them for treatment as appropriate. Early identification, referral to the medical home, and use of appropriate community resources promote optimal outcomes. Screening includes but is not limited to vision, hearing, and BMI assessments (as determined by local policy).

4. The school nurse promotes a healthy school environment.[13] The school nurse provides for the physical and emotional safety of the school community by monitoring immunizations, ensuring appropriate exclusion for infectious illnesses, and reporting communicable diseases as required by law. In addition, the school nurse provides for the safety of the environment by participating in environmental safety monitoring (playgrounds, indoor air quality, and potential hazards). The school nurse also participates in implementation of a plan for prevention and management of school violence, bullying, disasters, and terrorism events. The school nurse may also coordinate with school counselors in developing suicide prevention plans. In addition, if a school determines that drug testing is a part of its program, school nurses should be included in school district and community planning, implementation, and ongoing evaluation of this testing program.[15]

5. The school nurse promotes health.[13] The school nurse provides health education by providing health information to individual students and groups of students through health education, science, and other classes. The school nurse assists on health education curriculum development teams and may also provide programs for staff, families, and the community. Health education topics may include nutrition, exercise, smoking prevention and cessation, oral health, prevention of sexually transmitted infections and other infectious diseases, substance use and abuse, immunizations, adolescent pregnancy prevention, parenting, and others. School nurses also promote health in local school health councils.

6. The school nurse serves in a leadership role for health policies and programs. As a health care expert within the school system, the school nurse is a leader in the development and evaluation of school health policies. These policies include health promotion and protection, chronic disease management, coordinated school health programs, school wellness policies, crisis/disaster management, emergency medical condition management, mental health protection and intervention, acute illness management, and infectious disease prevention and management.[16]

7. The school nurse is a liaison between school personnel, family, health care professionals, and the community.[14] The school nurse participates as the health expert on the IEP[17] and 504[18] teams. IEP teams identify the special education needs of students; 504 teams plan for reasonable accommodations for students' special needs that impact their educational programs.[18] As the case manager for students with health problems, the school nurse ensures that there is adequate communication and collaboration among the family, physicians, and providers of community resources. This is a crucial interface for the pediatrician and the school nurse to ensure consistent, coordinated care. The school nurse also works with community organizations and primary care physicians to make the community a healthy place for all children and families.

SCHOOL NURSE ACTIVITIES

The range of school health services varies by school district. The following health services are the minimum

that should be offered, according to the American Academy of Pediatrics (AAP) manual *School Health: Policy and Practice*:[19]

- Assessment of health complaints, medication administration, and care for students with special health care needs;
- A system for managing emergencies and urgent situations;
- Mandated health screening programs, verification of immunizations, and infectious disease reporting; and
- Identification and management of students' chronic health care needs that affect educational achievement.

The AAP recognizes the need for appropriate management of student health conditions in its policy statement, "Guidelines for Administration of Medication in School."[20] It also recognizes the need for policies for emergency medical situations that can occur in school and the school nurse's role in developing and implementing these policies.[21,22] The school nurse serves as an extension of traditional community health services, ensuring continuity, compliance, and professional supervision of care within the school setting.

SCHOOL HEALTH SERVICES TEAM

The school nurse functions as a leader and the coordinator of the school health services team. The team may also include a school physician, licensed practical nurses, health aides and clerical staff, school counselors, school psychologists, school social workers, and substance abuse counselors. The health team may also expand to create a coordinated school health team that integrates health services, health education, physical education, nutrition services, counseling/psychological/social services, healthy school environment, health promotion for staff, and family/community involvement.[23] Occupational therapists, physical therapists, and speech-language pathologists may also be part of the school health team. A pediatrician often fills the school physician role, because pediatricians are knowledgeable about general pediatrics, school health, and adolescent health. School physicians review guidelines, policies, and programs related to health care in schools. In some schools, a pediatric or family nurse practitioner functions as the school nurse and may provide additional services. Unlicensed assistive personnel (unlicensed individuals who are trained to perform as an assistant to the licensed nurse) may be part of the school health services team. Although they may possess state certification in medication administration as a nursing assistant or other nursing tasks, they must be trained and supervised by the school nurse in accordance with state nurse practice laws to perform delegated nursing tasks. Under this approach, the school nurse has the responsibility to decide which nursing tasks may be delegated and to whom within the school setting, in accordance with state laws and regulations.

Some schools may have a school-based health center in or adjacent to the school, which may provide primary care and psychosocial services. The school nurse coordinates the activities of the school health services team with the child's primary care physician and/or with the school-based health center to provide continuity of care and prevent duplication of services.

PROFESSIONAL PREPARATION FOR SCHOOL NURSES

The AAP supports the goal of professional preparation for all school nurses and recommends the use of appropriately educated and selected school nurses to provide school health services. The National Association of School Nurses has determined that the minimum qualifications for the professional school nurse should include licensure as a registered nurse and a baccalaureate degree from an accredited college or university. There should be a process by which additional certification or licensure for the school nurse is established by the appropriate state board. The AAP supports national certification of school nurses by the National Board for Certification of School Nurses.[24]

CONCLUSION

The AAP supports having a full-time school nurse in every school as the best means of ensuring a strong connection with each student's medical home. Interim steps toward achieving this ideal can be made by achieving the Healthy People 2010 goal, which states that districts should employ at least 1 nurse per 750 students, with variation, depending on the community and student population.[25] Schools with high percentages of students with special health needs would require more intensive ratios of nurse to students; for example, 1 nurse per 225 students when students require daily professional nursing services or interventions, and 1 nurse per 125 when students have complex health needs.[26] The presence of the school nurse in every school allows the school physician to work most efficiently in providing the coordinated care that each student requires.

The AAP recommends and supports the continued strong partnership among school nurses, school physicians, other school health personnel, and pediatricians. These partners serve the health of children and youth best by facilitating the development of a coordinated school health program, facilitating access to a medical home for each child,[27] and integrating health, education, and social services for children at the community level. School nurses, as part of a coordinated school health program, contribute to meeting the needs of the whole child and supporting their success in school.[28]

RECOMMENDATIONS

1. Pediatricians should establish a working relationship with the school nurses who care for their patients with chronic conditions to ensure that individual patients' health plans are executed effectively within the school. In addition, pediatricians' communications with school nurses concerning their patients should be sufficiently clear and detailed to guide school nurses in overseeing the care of individual children.

2. Pediatricians can offer direct support of school nurses by serving on school wellness policy committees, school health advisory committees, emergency preparedness committees, or other school-related decision-making bodies. In addition, local physicians may be asked to consult on or assist in writing school health-related policies.
3. School-based screening for vision, hearing, or other conditions may require coordination between local physicians and the school nurse to ensure students are referred for additional evaluation and treatment, and for communication with students, families, school administration, and the community.
4. Pediatricians should play an active role in supporting the availability and continuing education of the school nurse. This role may encompass updates on new AAP recommendations and research findings that would keep the school nurse's practice as aligned as possible with current AAP policy.

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POLICY STATEMENT

The Role of Schools in Combating Illicit Substance Abuse

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on School Health and Committee on Substance Abuse

ABSTRACT

Disturbingly high levels of illicit drug use remain a problem among American teenagers. As the physical, social, and psychological "home away from home" for most youth, schools naturally assume a primary role in substance abuse education, prevention, and early identification. However, the use of random drug testing on students as a component of drug prevention programs requires additional, more rigorous scientific evaluation. Widespread implementation should await the result of ongoing studies to address the effectiveness of testing and evaluate possible inadvertent harm. If drug testing on students is conducted, it should never be implemented in isolation. A comprehensive assessment and therapeutic management program for the student who tests positive should be in place before any testing is performed. Schools have the opportunity to work with parents, health care professionals, and community officials to use programs with proven effectiveness, to identify students who show behavioral risks for drug-related problems, and to make referrals to a student's medical home. When use of an illicit substance is detected, schools can foster relationships with established health care experts to assist them. A student undergoing individualized intervention for using illicit substances merits privacy. This requires that awareness of the student's situation be limited to parents, the student's physician, and only those designated school health officials with a need to know. For the purposes of this statement, alcohol, tobacco, and inhalants are not addressed.

THE EFFECT OF SUBSTANCE ABUSE ON CHILDREN IN SCHOOL

Students spend the major part of their day in school. The school environment provides a standard against which young people test behavior.[1] School personnel often serve as highly influential role models by which preadolescents and adolescents judge themselves. Adolescents who perceive that their teachers care about them are less likely to initiate marijuana use, cigarette smoking, drinking to get drunk, and other health risk behaviors.[2] Relationships with teachers and counselors are among the most important and formative ones for many students, especially middle school students.[2] Students who are poorly bonded to school are also less likely to recognize that substance use may reduce the likelihood of them achieving their future goals.[3]

The use of mind-altering chemicals has deleterious effects on school performance.[4–7] Students under the influence of such substances are not ready to learn and are at risk of long-term impairment of cognitive ability and memory.[7,8] Substance use is frequently associated with a lack of motivation and self-discipline as well as reduced school attendance.[9,10] Safety issues also are of concern. Marijuana, like alcohol, is associated with increased risk of motor vehicle crashes and

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Key Words
substance abuse, drug, drug screens, adolescent, school health

Abbreviation
AAP—American Academy of Pediatrics

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death.[11–14] In addition, substance abuse is correlated with antisocial and violent behavior, such as bringing guns and knives to school, as well as other risk-taking behaviors.[15–18]

Schools, working in collaboration with community partners and health care professionals, are well situated to identify students with signs and symptoms of illicit drug abuse.[19–21] Poor school performance, underachievement, and truancy may be manifestations of substance use and indicate the need for evaluation and referral of these students to their medical home, where causes for this behavior can be determined. Medical home providers can use screening tools and resources available from federal, state, and local agencies, many of which are categorized both geographically and topically on the Internet (see Fig 1).[22]

Although recent data have suggested that prevalence of substance abuse has been decreasing in recent years, illicit substance abuse remains a major problem among American youth.[23–26] The degree of illicit substance abuse among students has translated into an ongoing societal search for ways to address this problem, including community- and school-based prevention programs, stricter law enforcement techniques, and, more recently, the use of laboratory testing programs within schools.

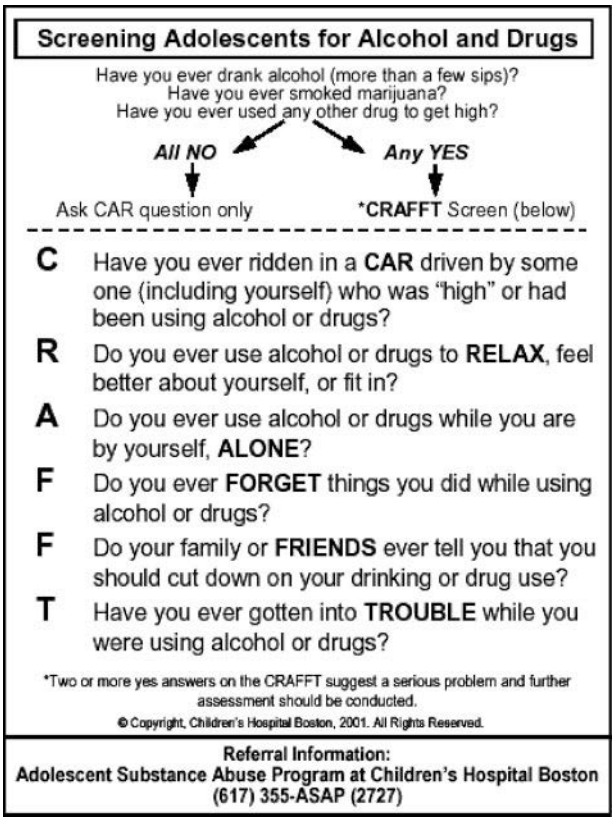

FIGURE 1
CRAFFT screening tool for adolescent substance abuse. (Reproduced with permission from the Center for Adolescent Substance Abuse Research, Children's Hospital Boston; 2001.)

SCHOOL-BASED DRUG-SCREENING PROGRAMS

In June 2002, the US Supreme Court broadened the authority of public schools to test students for illicit drugs by allowing random drug testing for all middle and high school students who participate in competitive extracurricular activities.[27] Some schools and districts are performing drug tests or are considering them for students in competitive sports, other physically active extracurricular activities (eg, school band, cheerleading), and, in some cases, all extracurricular activities (eg, chess club, debate team). Students may be excluded from the activity until they have been cleared through a screening process.[28,29] The type of screening performed varies widely (eg, urine, hair sample), as do the specific drugs included in the screen and the response to a positive drug-test result. Technical issues regarding illicit drug testing are addressed in a separate American Academy of Pediatrics (AAP) policy statement on drug testing[30] and in a forthcoming addendum to that statement concerning drug testing in schools and at home.[31]

Consequences of a positive drug-test result may include punitive measures, further student assessment, counseling, therapy, and/or rehabilitation. Random drug testing of students may affect specific students or groups of students differently. The benefits and risks of drug testing as a component of a comprehensive program to prevent or reduce substance abuse in such groups as nonusers, first-time and/or occasional users, and more frequent or addicted users must be determined by scientific studies. Implementation of random drug testing of students should await these results. The optimal means of assessing the implications of a positive drug-test result is an evaluation of the student by a health care professional who is trained or experienced in this process.

Some societal leaders support broad drug testing as an aid in the prevention of drug use and possible early identification of youth who have used drugs, thereby facilitating appropriate assessment and therapeutic referral. Others, including many parents and pediatricians, are concerned that school-based drug testing could unnecessarily label or stigmatize a child and compromise personal and family privacy. The Health Insurance Portability and Accountability Act applies to medical facilities, but children and adolescents do not have the same safeguards to privacy of medical information in the school. Recording positive drug-test results on students' permanent educational records (under guidelines of the Family Educational Rights and Privacy Act), which are accessible to many school personnel, could have negative and long-term consequences. Strict attention to issues of confidentiality must be ensured.

It has not yet been established that drug testing does not cause harm. The following should be considered:

1. Students involved with illicit drugs may decrease their involvement in extracurricular activities to

avoid drug testing. According to the National Institute on Out-of-School Time (www.niost.org), students who spend time in extracurricular activities are 49% less likely to use drugs. Without engagement in such activities, adolescents have a higher likelihood of dropping out of school, becoming pregnant, joining gangs, pursuing or increasing their use of drugs, and/or engaging in other risky behaviors.[32–34]

2. Positive drug-test results may cause increased family conflict rather than improve the home situation for the student.
3. Drug testing of adolescents is not performed for public safety. Even adults have mixed responses to the idea of widely applied drug testing. Although many support the idea of drug testing as a necessary measure for public safety from intoxicated or impaired pilots, bus drivers, police officers, and others, they often voice concerns when the application becomes more pervasive and random.
4. Dollars spent on drug testing may be more effectively spent on drug prevention programs or well-established counseling programs.
5. Drug testing youth who have not been implicated in using drugs may be perceived as being unfair and, thereby, may reduce trust and connectedness with their school, which are essential for maintaining lines of communication.[2,33–35]

Without evidence available to weigh the effectiveness of drug screening against the potentially harmful consequences, such programs should be limited in schools to those that are carefully controlled and comprehensive in scope.[36,37]

DRUG EDUCATION AT SCHOOL

Schools may adopt a variety of alternatives to drug testing to address the issue of substance abuse, including offering after-school programs, incorporating life-skills training into drug education curricula, helping parents become better informed, providing counseling, identifying problem behaviors for early intervention, and promptly referring students to health care professionals for assessment and intervention. School-based health centers should have the capacity to counsel students who are in need of such treatment plans and connect students to available community resources.

Schools are appropriate settings for drug prevention programs for 3 reasons: (1) prevention must focus on children before their beliefs and expectations about substance abuse are established; (2) schools offer the most systematic way of reaching young people; and (3) schools can promote a broad spectrum of drug-related educational policies.[36] Resources for the preparation of teachers, counselors, and other school personnel may be a valuable adjunct.[19,20]

Educators are challenged to make the facts about drug abuse meaningful to children and adolescents without enticing them to try drugs. There are many curricula designed for school use that have been proven to be effective and are delivered to students in ways that are interesting, interactive, and developmentally appropriate.[36,38,39] Although many program approaches are available, some effective programs focus on enhancing students' problem-solving skills or aiding them to evaluate the influence of the media. Other effective programs help improve students' self-esteem, reduce stress and anxiety, or increase activities. These skills are taught by using a combination of methods including demonstration, practice, feedback, and praise.[40]

Another proven approach is "life-skills training," designed to teach skills to confront a problem-specific focus, emphasizing the application of skills directly to the problem of substance abuse. One of the most studied programs is LifeSkills Training (National Health Promotion Associates, White Plains, NY), a universal school-based prevention approach (most often focused on 7th-graders) that teaches general personal and social skills training combined with drug-refusal skills and normative education. LifeSkills Training produces positive behavioral effects on alcohol, tobacco, and illicit drug use. This approach, with booster sessions that follow the initial program, is most effective.[5] These effects continue years after the intervention.[36,41,42] Many effective curricula and drug prevention programs use interactive materials and maximize group interactions with organized activities.[36,38,39,43,44] Studies have demonstrated convincingly that the effects of school programs can be amplified substantially when community components are added.[20]

PARTNERSHIP BETWEEN SCHOOLS, MEDICAL HOME PROVIDERS, AND DRUG REHABILITATION PROGRAMS

Schools may partner with rehabilitation programs to provide care for a student to help successfully reintegrate him or her. Educational planning is an integral part of after-care contracts that pediatricians, mental health professionals, or rehabilitation programs form with students and their families. The school's roles in such a collaborative relationship include identifying any underlying learning disabilities that may have contributed to the problem, making special accommodations for students when necessary, providing remedial work so that students can catch up with their classmates, helping to reinforce expectations for students to attend school and to comply with follow-up or monitoring as prescribed by the health care professional or rehabilitation facility, and assisting with finding after-school programs. It is also important for students who have used substances to be assigned at least 1 trusted adult who is available in the school building to help them if they feel they need it. Those who are assigned to work with the student's drug problems must know how to respect confidentiality of

treatment. This adult or another school health professional, school administrator, or designated staff member should be assigned to work with the student's pediatrician and rehabilitation personnel to communicate the student's progress or failure to progress.

The roles of pediatricians, mental health professionals, and rehabilitation programs in this collaborative relationship are to identify any mental health diagnoses and notify the schools of their relevance to the student's safety at school, to the student's educational program, and to school personnel or operations in general. Health care professionals also need to provide schools with treatment plans that may affect the school day while maintaining the student's confidentiality to the extent that is possible.

COMMUNITY COLLABORATION WITH SCHOOLS

Communities can send a clear and consistent message by developing and implementing a broad, comprehensive approach to dealing with substance abuse. Schools can serve as a focal point for such a community-wide effort. Community agencies can partner with schools to help monitor illicit drug use patterns in the local region to direct specific educational and preventive programs. Substance abuse problems that are associated with other mental health conditions can best be dealt with through comprehensive mental health programs that are capable of addressing prevention and intervention of both conditions. More information is available in the AAP policy statement on mental health in schools.[45] School personnel should receive ongoing training, preferably by a health care professional who is skilled at the recognition of and risk factors for substance use and related disorders so that each staff member is able to guide faculty, parents, families, and others who are concerned about such use. As part of their community/school program to counter substance abuse, the community should provide regular activities that are supportive alternatives to the abuse of drugs.

RECOMMENDATIONS FOR PEDIATRICIANS

Pediatricians should not support drug testing in schools. If testing is performed at all, it should only be done as part of a funded, comprehensive approach to addressing substance abuse in the school and in the community. Examination of alternative approaches should be carefully evaluated for effectiveness and cost.

Because of ongoing concerns about the implications of school-based drug-screening programs, the AAP membership should support and promote alternative school-based efforts to combat substance abuse. In addition, pediatricians should:

1. Serve as a medical home and resource for patients and their families and offer primary (ie, universal approaches designed to target all patients or potential users before a problem occurs) and secondary (ie, approaches targeted at patients who have screened positive for high-risk behaviors such as tobacco, alcohol, or inhalant use) prevention of illicit drug use.
2. Identify patients with personal, medical, mental health, social, or academic problems who might be at high risk for drug abuse. Consider the use of screening tools and questionnaires, such as the Guidelines for Adolescent Preventive Services surveys (www.ama-assn.org/ama/pub/category/1980.html) and the CRAFFT tool,[22] in the care of adolescent populations to identify patients who might need additional assessment and treatment. Mental health problems such as anxiety, depression, attention-deficit/hyperactivity disorder, and other diagnoses may coexist with substance abuse. The patient's progress should be monitored carefully so that ongoing assistance can be provided.
3. Support communication strategies that maintain patient/student confidentiality while coordinating treatment among the medical home provider, the family, and school-based programs.
4. Promote awareness of changing patterns of illicit drug use through local resources as well as through AAP chapter and district channels.
5. Raise awareness about mental health and rehabilitation services related to drug use that are available within the community to aid the student, family, and school.
6. Support and advise communities on the importance of clear and consistent community-wide messaging on illicit substance use and the promotion of activities that are free of drug and alcohol use.
7. Become familiar with the local school district's substance abuse prevention and health promotion programs.

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Safe at School Statement of Principles

Diabetes must be managed 24 hours a day, 7 days a week. Effective diabetes management during the many hours a child with diabetes spends at school and school-related activities is vital to the short- and long-term health of a child living with diabetes.

Effective diabetes management is crucial:

- for the immediate safety of students with diabetes;
- for the long-term health of students with diabetes;
- to ensure that students with diabetes are ready to learn and to participate fully in school activities; and
- to minimize the possibility that diabetes-related emergencies will disrupt classroom activities.

Such management requires a team effort that includes school personnel, the student with diabetes, the student's parents/guardians, and the family's health care providers.

The undersigned organizations endorse the following principles to ensure diabetes is properly managed whenever a child with diabetes is present at school or a school-related activity.

1. All school staff members who have responsibility for a student with diabetes should receive training that provides a basic understanding of the disease and the student’s needs, how to identify medical emergencies, and which school staff members to contact with questions or in case of an emergency.

2. The school nurse holds a primary role of coordinating, monitoring, and supervising the care of a student with diabetes. However, in addition to any full- or part-time school nurse, a small group of school staff members should receive training from a qualified health care professional in routine and emergency diabetes care so that a staff member is always available for younger or less-experienced students who require assistance with their diabetes management (e.g., administering insulin, checking their blood glucose, choosing appropriate food) and for all students with diabetes in case of an emergency (including administration of glucagon). These staff members should be school personnel who have volunteered to do these tasks and do not need to be health care professionals.

3. Children possessing the necessary skills and maturity to do so should be permitted to self-manage their disease in the classroom or wherever they are in conjunction with a school-related activity. Such self-management should include monitoring blood glucose and responding to blood glucose levels with needed food and medication while utilizing appropriate safety protocols.

Organizations endorsing the Safe at School Statement of Principles

American Academy of Pediatrics

American Association of Clinical Endocrinologists

American Association of Diabetes Educators

American Diabetes Association

American Dietetic Association

Children with Diabetes

Disability Rights Education and Defense Fund

Juvenile Diabetes Research Foundation

Lawson Wilkins Pediatric Endocrine Society

Pediatrics Endocrine Nursing Society

AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Safe Transportation of Newborns at Hospital Discharge

ABSTRACT. All hospitals should set policies that require the discharge of every newborn in a car safety seat that is appropriate for the infant's maturity and medical condition. Discharge policies for newborns should include a parent education component, regular review of educational materials, and periodic in-service education for responsible staff. Appropriate child restraint systems should become a benefit of coverage by Medicaid, managed care organizations, and other third-party insurers.

ABBREVIATIONS. FMVSS, Federal Motor Vehicle Safety Standard; AAP, American Academy of Pediatrics; NHTSA, National Highway Traffic Safety Administration.

All newborns discharged from hospitals should be transported home in car safety seats that meet Federal Motor Vehicle Safety Standard (FMVSS) 213 and that are selected to meet the specific transportation needs of healthy newborns, premature infants, or infants with special health care needs.

In 1996, 1780 children (newborns to 14 years of age) were killed, and 305 000 were injured as occupants in motor vehicles.[1] Of the fatalities, 60% were unrestrained. The fatality rate for infants was higher than any other age group, 4.4/100 000.[2] In 1996, 653 children (newborns through 4 years of age) were killed as occupants in motor vehicles. Of these fatalities, 52% were unrestrained.

The American Academy of Pediatrics (AAP) has made major contributions to child passenger safety, including contributions to the passage of legislation in all 50 states that requires the use of car safety seats or child restraint devices for infants and young children. Assuring that newborns are restrained properly when riding for the first time establishes the pattern for continued compliance with a measure that can save their lives or prevent serious injury. Correctly used car safety seats are 71% effective in preventing fatalities attributable to car crashes and 67% effective in preventing injury that requires hospitalization. With 100% correct use, about 53 000 injuries and 500 deaths could be prevented each year in the United States among children from birth to 4 years of age.[3]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

RECOMMENDATIONS

1. In conjunction with their medical staff, all hospitals with services for newborns should develop policies for the discharge of newborns in car safety seats that are crash tested and meet the FMVSS 213. These policies should be developed in consultation with a car seat expert who has successfully completed the National Highway Traffic Safety Administration (NHTSA) 4-day course.[4] Although the resources of hospitals and patients vary greatly, at discharge *every* newborn should be properly restrained in a car safety seat.
2. Pediatricians should work with these hospitals in establishing hospital policies that clearly define staff roles for each required task. Also, pediatricians should reinforce the need for compliance with these policies with both hospital staff and parents/guardians. Hospital policies related to newborns should include the following:
   - Methods by which expectant parents will be informed, before delivery, of the importance of using car safety seats and potential problems with vehicle incompatibility. Parents should be advised through prenatal classes, their obstetrical provider, or pediatric prenatal visits to obtain a car safety seat, properly secure it in their vehicle, and resolve compatibility issues before delivery. This is especially important because physicians frequently discharge infants after only a short hospital stay.
   - Designation of an individual responsible for implementing hospital policies and procedures related to discharge of newborns in car safety seats that are used properly. Hospital policy also should include designation of an individual or team specifically trained to assess the needs of infants with special health care needs with regard to the selection of the most appropriate child safety seat.[5–8] Hospitals should develop a policy to ensure provision of a period of observation in a car safety seat before hospital discharge for each infant born at <37 weeks' gestation to monitor for possible apnea, bradycardia, or oxygen desaturation.[5] Provision for periodic in-service education of staff responsible for parent and guardian education on correct use of car safety seats. Those responsible for training other hospital staff and parents and guardians should have successfully completed the NHTSA 4-day course.[4]

- Provision of regular periodic review by a designated person who has completed the NHTSA 4-day course of all materials distributed to parents and guardians of newborns about proper car safety seat use. Hospitals should ensure that information is current, relevant, and accurate, with date of publication or revision noted.[9]
- Provisions to make available an appropriate car safety seat by sale, short-term loan, or donation to parents before discharge if the parents are unable to provide their own. Hospitals should consider giving a low-cost infant car seat, which can also be used for generic instruction, to parents at discharge as a gift.
- Assessment of the degree of compliance with the policies and procedures on discharge in child safety seats in routine quality assurance surveillance by hospital staff. Hospital staffs should take appropriate actions to correct deficiencies when present.

Admission orders for newborns should include an order written by a physician for parent instruction about use of child safety seats. This should be included as a part of standard admission orders to ensure its completion before discharge.

Discharge policies for newborns should include the following:

- Determination of the most appropriate car safety seat for each newborn according to maturity and medical condition by a designated hospital employee.
- Provision of information and training for parents and guardians should be presented before discharge on the generic issues related to correct use of car safety seats. Hands-on teaching including "return demonstration" should be a part of this instruction. The installation of a specific car seat in a specific car must be the parent's responsibility. Resources to address these issues are available from the AAP.[10,11]
- A period of observation in a car safety seat before hospital discharge should be provided to each infant born at <37 weeks' gestation to monitor for possible apnea, bradycardia, or oxygen desaturation.[5]
- Pediatricians with other child health and safety advocates should work for coverage of appropriate child restraint systems as a benefit of coverage by Medicaid, managed care organizations, and other third-party insurers. Until that time, hospitals are encouraged to have a giveaway or loan program for parents who cannot afford to purchase a car seat.

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CLINICAL REPORT

Safe Transportation of Preterm and Low Birth Weight Infants at Hospital Discharge

Guidance for the Clinician in Rendering Pediatric Care

Marilyn J. Bull, MD, William A. Engle, MD, the Committee on Injury, Violence, and Poison Prevention and the Committee on Fetus and Newborn

ABSTRACT

Safe transportation of preterm and low birth weight infants requires special considerations. Both physiologic immaturity and low birth weight must be taken into account to properly position such infants. This clinical report provides guidelines for pediatricians and other caregivers who counsel parents of preterm and low birth weight infants about car safety seats. *Pediatrics* 2009;123:1424–1429

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Key Words
safe transportation, preterm, premature, low birth weight, car safety seats, car beds

Abbreviation
FMVSS—Federal Motor Vehicle Safety Standard

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

INTRODUCTION

Improved survival rates and earlier discharge of preterm (<37 weeks' gestation at birth) and low birth weight (<2500 g at birth) infants have increased the number of small infants who are being transported in private vehicles. Car safety seats that are used correctly are 71% effective in preventing fatalities attributable to passenger car crashes in infants.[1] To ensure that preterm and low birth weight infants are transported safely, the proper selection and use of car safety seats or car beds are necessary.

Federal Motor Vehicle Safety Standard (FMVSS) 213, which establishes design and dynamic performance requirements for child-restraint systems, applies to children weighing up to 65 lb. However, the standard has no minimum weight limit and does not address the relative hypotonia and risk of airway obstruction in preterm or low birth weight infants. Most rear-facing car safety seats are designated by the manufacturer for use by infants weighing more than 4 or 5 lb, with some designated for use from birth regardless of weight.

Infant dummies as small as 3.3 lb have been shown to be satisfactorily restrained in standard rear-facing car safety seats during crash tests.[2,3] Test dummies, however, cannot replicate the airway and tone variables that occur in preterm infants, and there is no information on restraint of infants who weigh less than 3.3 lb (1.5 kg).

Rear-facing car safety seats provide the best protection in a frontal crash, because the forces are transferred from the back of the restraint to the infant's back, the strongest part of an infant's body. The restraint also supports the infant's head. Severe tensile forces on the neck in flexion are also prevented by use of rear-facing car safety seats.[4]

The long-term experience and documented protective value of car safety seats make them the preferred choice for travel for all infants who can maintain cardiorespiratory stability in the semireclined position.[4] A car bed that meets FMVSS 213 may be indicated for infants who manifest apnea, bradycardia, or low oxygen saturation when positioned semireclined in a car safety seat.[2,5] Of note, some preterm and term infants positioned in car beds and car safety seats seem to have similar rates of apnea, bradycardia, and oxygen desaturation.[6,7]

A car bed is designed to accommodate an infant in a fully reclined position and is oriented in the vehicle seat perpendicular to the direction of travel. An infant is secured in the car bed with an internal harness, and the car bed is secured to the vehicle with the vehicle's seat belt. Car beds, like car safety seats, have specific weight requirements designated by the manufacturer and, like car safety seats, should be used according to manufacturer recommendations.

The size of the infant, especially for those born preterm, is an important consideration when selecting a car safety seat or car bed.[2,8] Weight, length, neurologic maturation, and associated medical conditions (especially bronchopulmonary dysplasia) all influence the potential risk of respiratory compromise for infants in seating devices.[6,9]

Preterm infants are subject to an increased risk of oxygen desaturation, apnea, and/or bradycardia,[10] especially when placed in a semireclined position in car safety seats.[5,11–13] Furthermore, frequent cardiorespiratory events and

intermittent hypoxia may adversely affect later neurodevelopment, psychosocial behavior, and academic achievement.[14,15] In 1 study, mental development in preterm infants with 5 or more cardiorespiratory events during 210 hours or more of cardiorespiratory monitoring was associated with a lower mental development index on the Bayley Scales of Infant Development (95.8 vs 100.4; $P = .04$)[14]; physical developmental indices were not different (94.4 vs 91.7; $P = .37$). It is unclear whether the association of cardiorespiratory events and lower mental development reflects an underlying abnormality or a negative consequence of the events. It is rational, if practical, to attempt to reduce the frequency and severity of cardiorespiratory events experienced by preterm infants seated in car safety seats to minimize potential neurodevelopmental sequelae. Therefore, car safety seat monitoring in the infant's own car safety seat before discharge from the hospital should be considered for all infants less than 37 weeks' gestation at birth to determine if physiologic maturity and stable cardiorespiratory function are present, as recommended in the American Academy of Pediatrics publication *Guidelines for Perinatal Care*.[16] Because information is limited about the severity and frequency of adverse outcomes in preterm infants who experience cardiorespiratory events, including those events that occur while in car safety seats, additional research is needed.[17]

Many infants are discharged from the hospital with cardiac/apnea monitors, supplemental oxygen, and, occasionally, portable ventilators, suction machines, batteries, and other equipment. These objects are heavy and could cause injury if they were to hit the child or another vehicle occupant in the event of a sudden stop or crash. Although there is no commercially available securement system for portable medical equipment, restraint is recommended.[18]

No data are available to establish a specific age or neurodevelopmental status at which an infant with respiratory compromise who was discharged from the hospital in a car bed can safely transition to a semireclined car safety seat. Before discontinuing use of a car bed, the physician can consider arranging for a follow-up study to determine when the infant can travel semireclined without apnea, bradycardia, or oxygen desaturation. The time to perform the test may vary depending on the rate of growth and neurologic maturation of the infant and the infant's respiratory status and should be determined by the treating physician.

Car safety seats are used frequently for positioning infants for purposes other than travel. Potential detrimental effects of excessive use of infant seating devices, including exacerbation of gastroesophageal reflux and potentiation of plagiocephaly, have been documented.[19,20] Use of car safety seats for purposes other than travel also may increase the risk of adverse cardiorespiratory and other adverse medical events.

CLINICAL IMPLICATIONS

Several important considerations for transportation of preterm and low birth weight infants at risk for recurrent oxygen desaturation, apnea, or bradycardia include the following.

1. The increased frequency of oxygen desaturation and episodes of apnea or bradycardia while sitting in car safety seats suggests that preterm infants should have a period of observation in a car safety seat, preferably their own, before hospital discharge. This period of observation should be performed with the infant carefully positioned for optimal restraint and the car safety seat placed at an angle that is approved for use in the vehicle. A period of observation for a minimum of 90 to 120 minutes or the duration of travel, whichever is longer, is suggested.[5,6,11,21]
2. Hospital staff who are trained in positioning infants properly in the car safety seat and in detecting apnea, bradycardia, and oxygen desaturation should conduct the car safety seat observation.
3. Hospitals should develop protocols to include car safety seat observation before discharge for infants born at less than 37 weeks' gestation.[22] Some hospital protocols include car safety seat observations for infants at risk of obstructive apnea, bradycardia, or oxygen desaturation other than those born at less than 37 weeks' gestation. Examples include infants with hypotonia (eg, Down syndrome or congenital neuromuscular disorders), infants with micrognathia (Pierre Robin sequence), and infants who have undergone congenital heart surgery.[9]
4. Families should be taught by trained hospital staff how to position the infant properly in the car safety seat.
5. The duration of time the infant is seated in a car safety seat should be minimized. Parents should be advised that car safety seats should be used only for travel.
6. A conventional car safety seat that allows for proper positioning of the preterm infant should be selected if a semiupright position can be maintained safely by the infant. Better observation of the infant may be possible when the child is in a rear-facing car safety seat adjacent to an adult rather than in a car bed. In addition, the protection provided by a rear-facing car safety seat is better documented than the protection provided by car beds.[4]
7. If events documented on cardiorespiratory monitoring in a car safety seat are deemed significant by the treating physician or the hospital policy, interventions to reduce the frequency of desaturation and episodes of apnea and bradycardia are recommended (eg, use of car bed; supplemental oxygen; continued hospitalization or further medical assessment). If a car bed is considered, a similar period of cardiorespiratory monitoring while the infant is in the car bed should be performed before discharge.
8. Infants with documented oxygen desaturation, apnea, or bradycardia in a semiupright position should travel in a supine or prone position in an FMVSS 213–approved car bed after an observation period

that is free of such events as described in point 1 above. This may need to be revised as new evidence becomes available from future research. Specific information regarding currently available car beds can be obtained from several resources.[23]

9. Before transitioning from a car bed, a period of observation of an infant for apnea, bradycardia, and oxygen desaturation in the infant's own semireclined car safety seat should be considered. The study can be performed as a home oxypneumocardiogram, as an outpatient polysomnogram, or as an observed outpatient clinical evaluation performed similarly to that described in point 1 above.
10. Infants at risk of respiratory compromise in car safety seats may be at similar risk with use of other upright equipment, including infant swings, infant seats, backpacks, slings, and infant carriers. Consideration should also be given to limiting the use of these devices until the child's respiratory status in a semireclined position is stable.[24]
11. Infants for whom home cardiac and apnea monitors are prescribed should use this monitoring equipment during travel and have portable, self-contained power available for at least twice the duration of the expected transport time.
12. Commercially available securement systems for portable medical equipment such as monitors are not available; therefore, this equipment should be wedged on the floor or under the vehicle seat to minimize the risk of it becoming a dangerous projectile in the event of a crash or sudden stop.[2,8]

Proper positioning of preterm and low birth weight infants in car safety seats is important for minimizing the risk of respiratory compromise. Specific national guidance for selecting car safety seats and positioning preterm and low birth weight infants includes the following.

1. Infants should ride facing the rear as long as possible and to the highest weight and length allowed by the manufacturer of the seat for greatest protection.[25-27] By the time infants weigh 20 lb or reach the top length allowed by the manufacturer of the seat, they should ride facing the rear in infant seats or convertible car safety seats approved for rear-facing use at higher weights and lengths. Most convertible car safety seats are approved for rear-facing use up to 30 to 35 lb and 36 in. Parents of infants born preterm may benefit from specific counseling about this concept.
2. Infant-only car safety seats with 3-point or 5-point harness systems or convertible car safety seats with 5-point harness systems provide optimum comfort, fit, and positioning for the preterm or low birth weight infant. A small infant should not be placed in a car safety seat with a shield, abdominal pad, or arm rest because of potential breathing difficulty behind the shield or injury to an infant's face and neck during a sudden stop or crash.[2,21]
3. Car safety seats with the shortest distances from the crotch strap to the seat back should be selected to reduce the potential for the infant to slip forward feet-first under the harness (ie, "submarining"). Some car safety seats have crotch-to-seat back distances as short as 5.5 in, which may accommodate some preterm or low birth weight infants well. A small rolled diaper or blanket between the crotch strap and the infant may be added to reduce the risk of submarining (Fig 1) in smaller infants. A car safety seat with multiple harness-strap slots provides more choice and may be more suitable for small but rapidly growing infants. Ideally, car safety seats with harness straps that can be positioned at or below the shoulders should be selected.[21]

FIGURE 1
Car safety seat with a small cloth between crotch strap and infant, retainer clip positioned at the midpoint of the infant's chest, and blanket rolls on both sides of the infant.

4. The infant should be properly positioned in the car safety seat, with buttocks and back flat against the back of the car safety seat. The harness must be snug, and the car safety seat's retainer clip should be positioned at the midpoint of the infant's chest, not on the abdomen or in front of the neck (Fig 1).
5. Some car safety seats come with head-support systems as standard equipment. Many head-support systems, however, are sold as aftermarket products and may decrease the safety provided by the seat and harness system, because they introduce slack into harness straps. Only products that come with the seat or are sold by the manufacturer for use with their specific seat should be used. Most very small infants require positioning support in addition to the head support that comes with the seat. Blanket rolls may be placed on both sides of the infant to provide lateral support for the head and trunk (Fig 1).
6. The rear-facing car safety seat should be reclined approximately 45° or as directed by the instructions

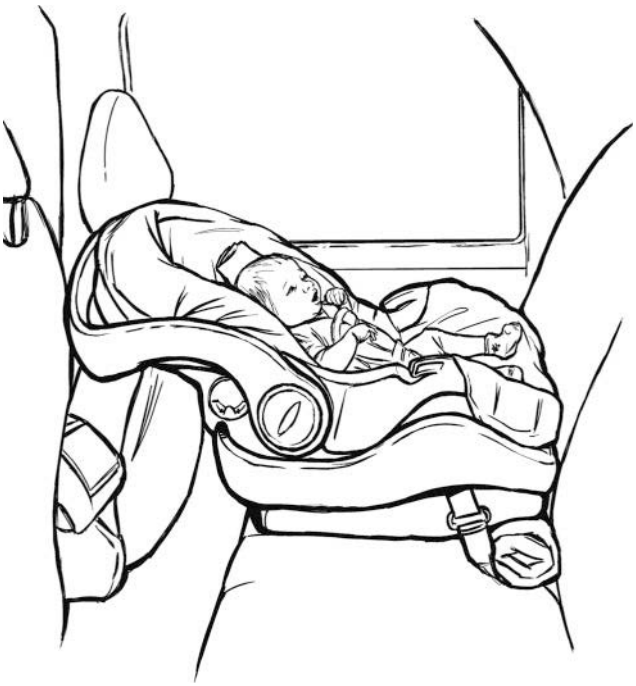

FIGURE 2
Seat with tightly rolled towel to recline seat halfway back at a 45° angle.

provided with the car safety seat. If the vehicle seat slopes and the seat is too upright, the infant's head may fall forward. A lightweight, noncompressible object, such as a tightly rolled blanket or pool "noodle," may be placed under the car safety seat to achieve the appropriate angle. Some car safety seats have built-in angle indicators and angle adjusters to assist with achieving the proper angle (Fig 2).

7. A rear-facing car safety seat should never be placed in the front passenger seat of any vehicle equipped with a passenger-side front air bag because of risk of death or serious injury from the impact of the air bag. In some vehicles without rear seating positions, the air bag can be deactivated when the front seat is used for a child passenger. The back seat is the safest place for all children to travel.[28,29]
8. Infants riding in the rear seat may be more difficult to observe, and whenever possible, parents should arrange for an adult to be seated in the rear seat adjacent to the infant. In the event of a monitor alarm, if a second caregiver is not available, the driver may need to come safely to a stop and assess the infant.
9. An infant should never be left unattended in a car safety seat inside or out of the car.

RESEARCH IMPLICATIONS

1. Studies are needed to gather more information on the severity and frequency of adverse outcomes in preterm infants who experience cardiorespiratory events, including those events that occur while in car safety seats.
2. Studies need to be conducted to determine the risk factors associated with cardiorespiratory events among preterm and low birth weight infants and criteria that indicate neurodevelopmental and physiologic maturity required for an infant to be positioned upright without respiratory compromise.
3. Studies should be designed to assess the correlation of car safety seat monitoring performed in the hospital, while stationary in the car, and while traveling.
4. Methods should be developed to better determine the relative protection provided by rear-facing car safety seats and car beds.
5. Design of car safety seats should be encouraged to specifically meet the positioning and transportation needs of preterm and low birth weight infants.
6. Methods should be developed to better secure heavy medical equipment, such as monitors and oxygen, in vehicles.
7. The efficacy of various protocols for car safety seat monitoring and car safety seats for different patient populations of at-risk infants needs to be determined.

SUMMARY

Proper selection and use of car safety seats or car beds are important for ensuring that preterm and low birth weight infants are transported as safely as possible.

The increased frequency of oxygen desaturation or episodes of apnea or bradycardia experienced by preterm and low birth weight infants positioned semireclined in car safety seats may expose them to increased risk of cardiorespiratory events and adverse neurodevelopmental outcomes.

It is suggested that preterm infants should have a period of observation of 90 to 120 minutes (or longer, if time for travel home will exceed this amount) in a car safety seat before hospital discharge. Educating parents about the proper positioning of preterm and low birth weight infants in car safety seats is important for minimizing the risk of respiratory compromise. Providing observation and avoiding extended periods in car safety seats for vulnerable infants and using car seats only for travel should also minimize risk of adverse events.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness

Safety in Youth Ice Hockey: The Effects of Body Checking

ABSTRACT. Ice hockey is a sport enjoyed by many young people. The occurrence of injury can offset what may otherwise be a positive experience. A high proportion of injuries in hockey appear to result from intentional body contact or the practice of checking. The American Academy of Pediatrics recommends limiting checking in hockey players 15 years of age and younger as a means to reduce injuries. Strategies such as the fair play concept can also help decrease injuries that result from penalties or unnecessary contact.

Ice hockey is played by approximately 200 000 children in the United States[1] and a similar number in Canada. It is classified as a collision sport by the American Academy of Pediatrics because of the intentional body contact, called body checking, that occurs. Because collisions in this sport may occur at high speeds, participants are at risk for serious injury. In recent years, an increase in the number of serious head and neck injuries related to body checking has alarmed the hockey community and has led to a reassessment of the role of body checking in the various classifications of youth hockey[2–4]: mite—ages 8 and 9 years; squirt—ages 10 and 11 years; peewee—ages 12 and 13 years; and bantam—ages 14 and 15 years.

In the 1960s, an alarming number of facial injuries in youth hockey players led to the mandatory use of helmets with a face mask.[5] The acceptance and use of the combination helmet–face mask was remarkably successful in virtually eliminating facial trauma. However, shortly after the introduction of the helmet–face mask, an increase in the number of neck and spinal injuries was noted.[4] The improvement in equipment with the helmet–face mask[1,6] was believed to create a false sense of protection from serious injury. A similar situation was observed in football. With additional protection afforded by improved helmets and face masks in the 1950s, there was an increase in cervical spine injuries. The number of spinal injuries did not start decreasing until rule changes in the 1970s prohibited head-first contact. Rule changes instituted in the mid-1970s substantially decreased, but did not eliminate, these tragic injuries. The ice hockey community wanted to learn from the experience in football and avoid a paradoxical increase in injury as a response to wearing protective equipment. This concern led to investigations of the incidence and causes of head, neck, and spine injuries.[7–9]

A Canadian study in 1984[2] revealed 42 spinal injuries in hockey players reported to the Committee on Prevention of Spinal Injuries. The median age of the injured players was 17 years. Of the 42 players, 28 had spinal cord injuries, of which 17 had complete paralysis below the vertebral level of the injury. Being body checked from behind, resulting in a collision with the boards, was the most common mechanism of injury. A 1987 study[7] of high school hockey players revealed that head and neck injuries accounted for 22% of the total number of injuries. The same study showed that body checking was associated with 38% of the total number of injuries. Sixty-six percent of the players surveyed believed that the requirement of a face mask allowed them to be more aggressive in their style of play. The authors of this study recommended rule changes to limit or eliminate body checking to reduce injuries.

A more recent US study reported injuries in youth hockey players 9 to 15 years old.[1] Head and neck injuries accounted for 23% of the total number of injuries. Body checking accounted for 86% of all injuries that occurred during games. Fifty-five percent of the players thought that their helmets and face masks protected them from injuries. Of particular interest is that size differences among players in this series increased with age, with bantam-level players (ages 14 and 15 years) showing the most variation, with reported differences between the smallest and largest players of 53 kg in body weight and 55 cm in height. The bantam-level players sustained the most injuries (54%).

Another Canadian study[10] compared peewee-level players (ages 12 and 13 years) from a league that allowed body checking with another league that did not. Players in the league that allowed body checking had a fracture rate 12 times higher than the rate of the other league. Body checking in combination with substantial differences in size and strength among players was believed to contribute to the high injury rate, with some players being nearly twice as heavy and twice as strong as other players. Players in the same age group could vary significantly in the amount of force they could impart on another player and/or withstand from another player. In 1990, the Canadian Academy of Sports Medicine reported that although the incidence of serious injuries at the mite and squirt level was quite low, serious injuries were noted at the peewee level. Therefore, they recommended banning body checking at the peewee level (ages 12 and 13 years) and below.[11]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

An innovative, unique concept for improved sportsmanship and injury reduction in youth hockey called fair-play has been introduced recently.[12] The fair-play concept of scoring ice hockey games, seasons, or tournaments was developed in response to the perceived increase in violence in youth hockey. The system rewards teams and individual players with few penalties and punishes teams and players with larger numbers of penalties. The authors of this concept believe that the system decreases penalties, intimidation, and violence during hockey and creates a climate that promotes fun and player development.

The potential benefits for the fair-play concept are demonstrated in a recent study[13] involving a youth hockey tournament. The participants were high school students younger than 20 years old, who played the qualifying rounds of the tournament using fair-play guidelines (points are awarded for playing without excessive penalties) and the championship round following regular rules. When the fair-play and regular rules portions of the tournament were compared, the injury rate was 4 times higher during the regular rules portion of the tournament. A doubling of the number of penalties and injury rate during the championship round occurred when fair-play rules were suspended.

CONCLUSION

Studies have shown that a high proportion of youth hockey injuries are attributable to checking and that limiting checking can reduce injuries. Disparities in size and strength can further increase the risk for serious injury from checking and other collisions. Variations in size and strength are present in all age groups but are most pronounced among the bantam-level players (ages 14 to 15 years). Therefore, minimizing checking and other high-impact collisions in this age group could further reduce injuries.

RECOMMENDATIONS

In the interest of enhancing safety in youth ice hockey, the American Academy of Pediatrics recommends the following.

1. Body checking should not be allowed in youth hockey for children age 15 years or younger.
2. Good sportsmanship programs, such as the fair-play concept, have been shown to reduce injury and penalty rates and should be adopted for all levels of youth hockey.
3. Youth hockey programs need to educate players, coaches, and parents about the importance of knowing and following the rules as well as the dangers of body checking another player from behind.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

School Bus Transportation of Children With Special Health Care Needs

ABSTRACT. School systems are responsible for ensuring that children with special needs are safely transported on all forms of federally approved transportation provided by the school system, and a plan should be developed to provide the most current and proper support to children with special transportation requirements. This statement provides current guidelines for the protection of child passengers with specific health care needs, including those with a tracheostomy, those requiring use of car seats, or those transported in wheelchairs. Guidelines that apply to general school transportation should be followed, including the training of staff, provision of nurses or aides if needed, establishment of a written emergency evacuation plan, and a comprehensive infection control program.

Research provides the basis for recommendations concerning occupant securement for children in wheelchairs and children with other special needs who are transported on a school bus. Pediatricians can help their patients by being aware of guidelines for restraint systems for children with special needs and by remaining informed of new resources. Pediatricians can also play an important role at the state and local level in the development of school bus specifications.

ABBREVIATIONS. FMVSS, Federal Motor Vehicle Safety Standards; IEP, Individual Education Plan; IFSP, Individual Family Service Plan; OSHA, Occupational Safety and Health Administration.

INTRODUCTION

Many preschool-aged and school-aged children with special needs are transported in school buses. The Individuals With Disabilities Education Act 1997 (Public Law 105-17) has established requirements for preschool children ages 3 to 5 to have access to related services (ie, audiology and occupational therapy). It also requires that infants and toddlers (birth to 3 years of age) have access to these same services; however, it does not specify how these children are to be transported to these services if they are to be conducted outside of the child's natural home or school environment. Although the provider could vary from state to state, it is often the responsibility of the school systems to provide these related services to infants and toddlers.

The Federal Motor Vehicle Safety Standards and Regulations (FMVSS) 222 (School Bus Passenger Seating and Crash Protection) established safety requirements for school bus interiors, but it applied only to able-bodied children. However, a 1994 amendment to FMVSS 222 applied to the securement of wheelchairs and their occupants in school buses.[1] National recommended standards for special education school buses were revised in May 1995 by the Twelfth National Standards Conference on School Transportation.[2]

Wheelchairs are the primary mode of transport on the school bus for many children with special needs. Most wheelchairs have not been developed as certified transit devices and are not currently subjected to any crash-testing requirements. A certified transit wheelchair is one that meets voluntary design and performance requirements for use as a seat by their occupant when traveling in a motor vehicle. Rehabilitation therapists can help identify products that are certified by the manufacturer to meet this standard. Whenever possible a certified transit wheelchair should be used for school bus transportation.[3] Research has provided a basis for recommendations concerning occupant securement for children who must ride in a wheelchair or children with other special needs who are transported on a school bus.[1,4–6]

RECOMMENDATIONS

1. Any child who can assist with transfer or be reasonably moved from a wheelchair, stroller, or special seating device to a seat belt or child restraint system complying with FMVSS 213 (Child Restraint Systems) should be so transferred for transportation. The vehicle seat should be forward facing, equipped with dynamically tested occupant restraints, and provided for the vehicle at the point of manufacture. The unoccupied wheelchair also should be secured adequately in the vehicle to prevent it from becoming a dangerous projectile in the event of a sudden stop or crash.[7]
2. Passenger seats that have a seat belt or child restraint system attached should have a reinforced frame and meet the requirements of FMVSS 208 (Occupant Crash Protection), FMVSS 209 (Seat Belt Assemblies), and FMVSS 210 (Seatbelt Anchorages). The manufacturer of the school bus should be consulted regarding the noted requirements when ordering or retrofitting an existing school bus.[8]
3. All children weighing less than 50 lb should be secured in an appropriate child restraint or safety vest meeting the requirements of FMVSS 213.[8]

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

4. Child safety seats or safety vests must be secured to the bus seat in a manner prescribed and approved by the manufacturer of the safety device. The child restraint should not be secured on a school bus seat adjacent to an emergency exit.
5. Child safety seats used to transport children who weigh less than 20 lb or are younger than 1 year should be attached to the school bus seat in a rear-facing position. A child restraint that is approved for rear facing for greater weights should be considered for a child who weighs 20 lb before 1 year of age.
6. Occupied wheelchairs should be secured in a forward-facing position.
7. Three-wheeled, cart-type units and other wheelchair or stroller-type devices should not be permitted for occupied transport in a school bus unless results of impact tests demonstrate that the device can be secured under impact loading conditions. Any wheelchair or stroller-type unit designed and approved by a manufacturer for transportation must be used according to manufacturer's instructions.
8. Wheelchairs should be secured with fastening devices that are attached to the floor. Any occupied wheelchairs should be secured with 4-point tie-down devices. These tie-down systems should be dynamically tested with a dummy the size of a 50th percentile adult male or with a dummy at the appropriate size for the type of wheelchair used. They must have demonstrated capabilities for restraining the wheelchair during a frontal impact with force conditions of 30 mph and 20*g*. The wheelchair securement system must not apply restraint to the occupant and should attach to the frame of the wheelchair rather than to the wheels. The occupant should be restrained to the wheelchair with a separate device.
9. Lap boards and metal or plastic trays attached to the wheelchair or to adaptive equipment should be removed before loading and should be secured separately for transport.
10. An occupant restraint system that has been tested at force conditions of 30 mph and 20*g* for upper torso restraint (ie, shoulder harness) and lower torso restraint (ie, lap belt over pelvis) should be provided for each wheelchair-seated occupant.
11. Any liquid oxygen transported in a school bus should be securely mounted and fastened to prevent damage and exposure to intense heat. An appropriate sign indicating that oxygen is in use should be placed in the school bus.

ADDITIONAL CONSIDERATIONS FOR PASSENGER TRANSPORTATION

The following considerations should be incorporated into the school system plan for the transportation requirements of children with special needs:

1. In accordance with state laws and regulations, a nurse or an aide with appropriate medical training can provide necessary on-board assistance and support to most children with tracheostomies who may require suctioning or emergency care during school bus transport. School systems should consider providing nurses or aides when medically necessary to help reduce the potential for respiratory and other related problems occurring while the children are on the school bus. This assistance should be included where appropriate in the child's Individual Education Plan (IEP) or the family's Individual Family Service Plan (IFSP).
2. School transportation staff should participate in the development of the transportation portion of the IEP or IFSP for children who may need special transportation requirements and medical procedures.
3. School bus transportation staff should have annual access to training programs and resource material in special needs transportation to ensure that they can provide the most current and proper support to children with special transportation requirements. Transportation staff who work with children with special needs can carry out their daily responsibilities when provided with documented training from a team of professionals, including therapists, nurses, and certified child passenger safety technicians that ensures consistent and proper restraint for children with special needs on school buses.[9,10]
4. The caregiver (family, guardian, foster parent) of a child with special needs should be informed of the importance of incorporating appropriate and safe transportation specifications in the child's IEP or IFSP.
5. The caregiver of a child with special needs and the designated bus driver for the child's bus route should share information addressing the specific needs of the child transported before and during the school year. An emergency medical information card should be kept on the bus for each student transported. Transportation personnel should adhere to the school district's policy regarding confidentiality of student information.
6. School systems can help ensure optimum protection for children with special needs during school bus transport by establishing a written plan that outlines procedures for emergency evacuation for each child and by requiring, at the minimum, an evacuation drill for each school year that enables the transportation staff to practice evacuating children under their care. Local emergency response personnel should be invited to participate in evacuation drills.
7. Children who are supported by technology may be at increased risk of acquiring infectious diseases. All caregivers should wash their hands before and after providing direct care for students including toileting, tracheostomy, or gastrostomy care. Standard (universal) precautions should be used when caring for all children when exposed to blood or blood-containing body fluids. Schools should follow the legal requirements of their states or the Occupational Safety and Health Administration (OSHA) with respect to all immunizations, including hepatitis B immunization. Chil-

dren and adults who are in the recommended categories should receive yearly influenza immunization.[11,12] Transportation staff should be provided with training and supplies that prepare them to carry out universal precaution practices and procedures.[10]

The American Academy of Pediatrics encourages states to address and support the transportation requirements of children with special needs. Pediatricians can help their patients by being aware of general guidelines for evaluating restraint systems for children with special needs and remaining informed of new resources as they become available. Periodically updated information on specific restraint systems for children with special needs can be obtained through the Academy.[13] In addition, pediatricians can play important roles at local and state levels to assist in the evaluation and development of school bus specifications responsive to the safe transportation requirements of children with special needs.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on School Health

School Health Assessments

ABSTRACT. Comprehensive health assessments often are performed in school-based clinics or public health clinics by health professionals other than pediatricians. Pediatricians or other physicians skilled in child health care should participate in such evaluations. This statement provides guidance on the scope of in-school health assessments and the roles of the pediatrician, school nurse, school, and community.

ABBREVIATION. AAP, American Academy of Pediatrics.

The American Academy of Pediatrics (AAP) has endorsed the importance of comprehensive periodic health assessments. The AAP also has endorsed the concept of the medical home,[1] which refers to the belief that all health care for children and adolescents should be managed by 1 personal health care professional or group of professionals who assume responsibility for the ongoing care of the child. The medical home approach has been shown to improve compliance with health care recommendations and to lower the cost of health care.[2] The AAP also recommends that each comprehensive periodic health assessment visit beginning at 3 years of age should include attention to school health issues. Whenever possible, these assessments should be provided by the child's primary care physician at regular health supervision visits and should be performed as recommended in the *Guidelines for Health Supervision III*[3] from the AAP. Additional visits may be necessary if circumstances suggest variations from normal.

Several different types of routine health assessments are performed in schools. In many schools, part of the core school health services nurses perform, often with the assistance of health aides, include mandated health screening for all students. This may include screening for vision, hearing, blood pressure, and scoliosis. If abnormalities are detected, students are referred to their medical homes for further assessment and treatment if indicated. Actions taken and recommendations for school intervention and/or follow-up must be conveyed to the school nurse so he or she can document the resolution of the situation, which initiated with the screening at school.

The school in communities where students do not have access to medical homes or a school-based health center may provide additional physical examination and assessment services. In these instances, a school nurse, public health nurse, nurse practitioner, physician assistant, or physician performs the school health assessment, often with the assistance of other allied health personnel. A pediatrician or other physician skilled in child health care should participate in the planning and supervising of these assessments. School districts that use school-based health examinations should contract with nearby pediatricians for consultation on the management of problems identified during the assessments.[4] Each child should be examined individually (rather than in groups) to ensure adequate attention to individual problems and concerns and to protect confidentiality and the child's sense of modesty. Parents should consent to the school health evaluation and be present, particularly in the primary grades. Adequate time should be allocated to ensure that all elements of the assessment are addressed. Schools who assume the role of the medical home for their students must partner with a pediatrician, other licensed physicians, or hospital to provide after-hours and holiday emergency or urgent care.

ELEMENTS OF COMPREHENSIVE HEALTH EXAMINATIONS RELATING TO SCHOOL HEALTH

1. An assessment on entry into school should include a review of the medical history with attention to physical, emotional, or family problems that might influence school achievement. Previous participation in preschool experiences should be included in the history. The assessment should include a careful evaluation of language, motor, social, and adaptive development and immunization status.[5] Private physicians or physicians and mid-level health professionals used by the school system should collaborate with designated school officials to design protocols. These protocols should be used to initiate appropriate referrals available in the school or the community and provide placement in the educational system as deemed appropriate by the findings of the medical history, physical examination, and developmental assessment.
2. Subsequent visits should include a history that focuses on new medical problems, medications, changes in the child's developmental and psychosocial status, and an update on school progress and problems. The frequency of subsequent health assessments will vary depending on the child's functional status but should be in compli-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

ance with the AAP-recommended periodicity schedule for child health supervision visits.

3. A complete age-appropriate unclothed physical examination should be performed by a physician or mid-level professional. It should include, but not be limited to, the assessment of height, weight, physical and sexual maturation, and blood pressure. A screening evaluation should be performed to evaluate visual acuity, auditory acuity, emotional maturity, language, dental condition, and motor skills.[6] Any abnormal findings should be monitored by the physician.
4. In the United States, children of various ages participate in sports or physical education sponsored by the school. It is important for the health care professional to be familiar with the physical assessment and requirements to appropriately approve participation in such activities. This assessment should be combined with the health examination and interval history when possible, although it may be performed separately. In any case, the uniqueness of a detailed comprehensive physical examination that includes endurance and muscular assessment must be recognized. Specific descriptions of such an assessment are available.[7,8]
5. The health examination should identify specific health needs and problems that might require cooperation among community resources, and school officials may want to organize the community health professionals and community resources to integrate services available and provide easy access to these services. These services may support administration of medications, physical therapy, problems with access to buildings, anticipated absences, behavioral and emotional needs, special location in class (eg, for visual or auditory problems), or other conditions requiring the assistance of the classroom teacher or school nurse. Easy access to the services will become more important as increasing numbers of chronically ill or disabled students or students with special needs attend classes in their neighborhood schools. The frequency with which these issues are reviewed will depend on the student's specific needs. Direct communication among school personnel, parents, and the physician should occur to determine the requirements of children with special health care needs.
6. Anticipatory guidance for students and parents for physical fitness, nutrition, cardiovascular risk reduction, injury and violence prevention, sexual development and sex education, stress management, alcohol and other drug abuse, and tobacco use should be provided. Anticipatory guidance should be provided for parents about their role in promoting school achievement and learning as priorities in their child's life. Guidance also may be provided to assist parents in helping their child develop responsibility, independence, and self-reliance in the educational process.

THE SCHOOL'S ROLE

A well-organized system within the school that includes a comprehensive health record must be established for accumulating and recording current health information for each student. When a child changes schools, this information must be transferred to the new location. Information from health records should pass freely between the child's medical home and the school nurse and vice versa (with appropriate permission from the parents and/or adolescent). The school nurse and appropriate classroom teacher should review the child's health record, preferably before initiation of school year. For the student with chronic illness or with special health needs or for the child who must take medication during school hours, the school health record may require more frequent review. The school health record should include the following information: name, birth date, and sex of student; parent or guardian contact information; name, address, and telephone number of the child's primary health care physician; dentist and other medical specialists; immunization status and dates of immunizations; pertinent ongoing health problems; medications to be taken by the child; allergies; previous athletic injuries; and restrictions for athletics. Each school district should develop its own system for maintaining the confidentiality of the comprehensive health record. Access to this record should be based on the need to know and should require consent of the student, parent, or both.

A separate emergency information file available to all school personnel should be kept in the administration office and should contain the following information: the names, addresses, and telephone numbers (work and home) of parents or guardians; persons to contact in case of emergency; parental consent forms; and the names, addresses, and telephone numbers of physicians, consultants, dentists, and medical insurance carrier.

CONCLUSION AND RECOMMENDATIONS

In addition to providing a medical home, the pediatrician should be an advocate for students in the school setting and should promote effective communication among school officials, families, and the health care community. Collaboration among pediatricians, school nurses, and the community can ensure that children have access to appropriate and comprehensive screenings and assessments whether offered in the child's medical home or at the school site. The AAP recommends that:

1. All children should receive ongoing care in a medical home in a community practice, clinic, or school-based health center.
2. Core school health services including screening should be planned and implemented under the supervision of the school nurse and school physician when one is present and coordinated with the child's medical home.
3. Any additional health assessments performed in the schools where many students do not have medical homes should follow *Guidelines for Health Supervision III* from the AAP.
4. On completion of the school health assessment, any positive findings requiring medical subspecialist or surgical subspecialist referral, should be

performed in conjunction with the child's primary care provider.

5. Where schools assume medical care for students without medical homes, arrangements must be made to provide coordinated after-hours care for these children when school-based facilities or personnel are not available.
6. Herding of students for school physicals should be denounced because it provides quick superficial evaluation but may not address students complete health care needs.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on School Health

School Health Centers and Other Integrated School Health Services

ABSTRACT. This statement offers guidelines on the integration of expanded school health services, including school-based and school-linked health centers, into community-based health care systems. Expanded school health services should be integrated so that they enhance accessibility, provide high-quality health care, link children to a medical home, are financially sustainable, and address both long- and short-term needs of children and adolescents.

BACKGROUND INFORMATION

There are a number of core screening, diagnostic, treatment, and health counseling services that every school should provide[1] and that most schools already do provide.[2] These include management of medical emergencies, medication delivery, services for children with special health care needs, referral of common health problems (such as injury, asthma, behavioral and emotional difficulties), and health screens (such as vision and hearing screens).

Increasingly, schools are used as health access sites for students to receive increased and improved access to care that they are not receiving elsewhere.[3–5] A program with expanded health services may provide, for example, on-site immunizations, full health histories and physical examinations, or on-site therapy for children with special mental health needs. These services provide numerous benefits and potential benefits, including:

1. Students of all ages in some rural areas do not have reasonable access to any other medical services.
2. Less classroom time is lost to travel time.
3. Follow-up compliance may be better.
4. Adolescents, for a variety of reasons (eg, emancipation, independence, desire for confidentiality), often will not seek out or take advantage of services in traditional settings.[6]
5. Families that are not accustomed to using primary or preventive services available to them in traditional settings can be taught to use them through schools.
6. Behavioral risk assessments and ongoing preventive strategies that address major causes of youth mortality (suicide, homicide, accidental injury) often require a degree of access to health and mental health services that schools can provide. Mental health services on a school site can reduce time away from school to travel to regular mental health appointments. When a mental health clinic's presence on a school site is accompanied by close collaboration with school staff, then enhanced behavioral observation and clinical management also occur.

Schools that offer these expanded health services may do so through either school-linked or school-based health centers. "School-based" and "school-linked" are terms used to distinguish between services delivered on school campuses from those coordinated at the school but delivered off campus. In school-linked models, school health professionals collaborate with local community clinics, hospitals, and/or other health professionals and agencies. Some schools have characteristics of both school-linked and school-based models, such as mobile medical service vans that park intermittently outside various school sites.

Health centers' services range from full comprehensive services (preventive and acute care as well as mental health services) to only one component of this care. Many operate from a regular school health office; others are modern, sophisticated, and well-equipped clinics. Some offer services around the clock and every day, while in others a health team from a local practice or clinic visits the school site one half-day per week. Often school staffs do not provide health services; rather community health professionals provide services on a school site through an interagency agreement. The rich diversity of existing models[7] does not allow for simplistic categorization. This diversity exists at every level of education, from preschool to high school.

It is essential that health services provided by the educational sector are integrated with health education, social services, and health services provided elsewhere in the community. It is important that school-based services should not supplant services that could be delivered elsewhere, unless that is part of the agreed-on design. The American Academy of Pediatrics believes that all children and adolescents require a "medical home."[8] All models of health care delivery should aspire to provide health supervision and medical care that is continuous, comprehensive, family centered, culturally sensitive, compassionate, coordinated, and provided by a pediatrician or another physician or health care provider who is well-trained in child and adolescent health.

CHALLENGES

Some challenges for school health centers or for any model of expanded school health services are:

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

1. There is great variability in the degree to which school-based and school-linked services integrate with the medical home and to other community services and the degree to which they complement community services to meet student needs.
2. There is great variability in the degree to which school-based and school-linked services integrate with other components of the school system. School health centers cannot optimally assist students unless they are closely integrated with the school nurse (where one exists), the school's health educational program, and with other traditional or core school programs.[9]
3. Expanded school health services carry inherent and unique issues of patient confidentiality, consent, compliance, and continuity that need different solutions than they would in traditional health care settings and in schools without expanded health services.
4. Fair reimbursement for school-delivered health services is frequently difficult to achieve.[10]

If not addressed, all these issues can remain emotionally, morally, and politically charged, often paralyzing efforts to establish the best and most sustainable intervention and prevention programs. By adhering to a few basic guidelines, schools and their communities may avoid costly redundancies in health care delivery and unnecessary gaps in services.

INTEGRATED SCHOOL HEALTH SERVICES

"Integrated school health services" refers to a community-based approach to identifying the needs of children and youth, then matching them to available resources in the educational, health care, and social services sectors. All stakeholders, usually the school system, community health care providers, families, social service agencies, health plans, managed care organizations, and public health departments, must first decide on common goals and objectives for improving educational performance and child and adolescent health.

This should be based on a comprehensive community needs assessment—the first step in any decision to expand school health services.[1] The district or school and local child health and social services professionals must work closely with parents and community groups to evaluate the current status of child health and determine unmet needs. Services already available to children should not be duplicated unless the school is considered by stakeholders to be the only way to make these services accessible. A needs assessment should be developed that is supported by credible data and conducted by those knowledgeable of existing health care resources and health data in their community. It should be an ongoing process built permanently into the program.

Integrated school health services should have a governing structure that establishes communication among various professional disciplines and agencies, and designs and guides the service delivery program. Membership is at an authority level that ensures appropriate agency participation. Representatives in the administrative structure include students (especially adolescents), parents, pediatricians and other health care providers, school nursing personnel, local health department representatives, school administrators, and educators. It may also include faculty of local institutions of higher education, social service providers, representatives of managed care organizations, public and private mental health care agencies, and representatives of local government and local business, cultural, ethnic, and religious communities. In an integrated school health services plan, school-nursing personnel and, if one exists, the school's own physician or medical consultant, should be involved in the planning and direction of the program.

Once a needs assessment is complete and stakeholders are established, the extent and type of services provided through an integrated school health service program needs to be determined. Services might include any of the following: screening for acute and chronic health problems; preventive health care (disease prevention and health promotion); acute illness care; family planning and reproductive health care; mental health services; social services; substance abuse counseling; dental services; nutritional services; health counseling and education; and transportation to a traditional provider. The decision to choose an enhanced school health office, to link with a nearby community health agency, or to set up a school-based health center is based on what can best complement existing resources.

Last in the process of setting up an integrated school health services plan are formally written agreements and goals. To protect the collaboration from the threats of turf and control conflicts between agencies or to provide a more efficient management structure, some communities may choose to establish a nonprofit corporation to administer the program. More typically the school, school district, or one of the community health or social entities becomes the fiscal and lead agency. In these formal agreements, a formalized communication plan and a plan for collaboration with the medical home (provider or clinic) and health and social service agencies in the community should be included.

School-based health services are often provided by certified nurse practitioners, physician assistants, or licensed or credentialed mental health professionals (social workers, psychologists, etc). Pediatricians or other physicians from a community practice or clinic or from the public health sector frequently serve as medical directors. The medical director, along with the school principal and school-based health professionals, decide on day-to-day activities, protocols, and quality assurance. The activities of the clinical personnel should reflect the decisions of the broader-based governing structure as described above. If primary medical services are delivered on a school site by a nonphysician provider, telephone back-up from a pediatrician or other physician should be available at all times. It is important to establish where students will receive after-hours and weekend telephone and triage services. Onsite consultation, supervision, and quality assurance with periodic chart

review are part of an integrated school health services plan.

Integrated school health service programs require a sound financial base. Sources of funds may include private health insurance plans; traditional school health funds; an Early and Periodic Screening, Diagnostic, and Treatment program; Medicaid; Chapter I; Title X; Title XX; and other government programs.[11]

Among populations with high managed care penetration, there are additional considerations and possibilities.[12] Students enrolled in managed care plans have primary care providers assigned to them. Typically these providers are outside of the school system, they receive monthly capitation funds, and they are expected to provide all primary health care. A number of financial arrangements are possible for this population.[13–17] Health plans may agree to compensate school-based clinical activities on a fee-for-service basis, while still compensating their community-based providers at the same or a reduced amount. School clinics may also be compensated on a capitated basis. In some communities, health plans expect the school's reimbursement to come not from them, but directly from the students' capitated health care providers. In this latter model, there is usually a large portion of the student population that shares one common medical group or community clinic as its primary care provider. These clinicians or their designees come onto the school site to provide services for their patients. The school operates as a satellite location for a traditional primary care agency. In this model, the need to reimburse school providers through a separate agreement with managed care organizations is not necessary. Often, mental health services are contracted out or carved out from managed care health plans, so that mental health providers who work on school sites are compensated no differently than those working in traditional off-school site settings.

Advocacy for new mechanisms of health care financing at both state and national levels may be needed to ensure that dollars flow to all health and human service providers so that there is a seamless web of services for the child and family.

RECOMMENDATIONS

The Academy recommends that the medical service component of an integrated and comprehensive school health program meet the provisions of the current policy statements and manuals of the Academy, ie, "The Medical Home,"[8] *School Health: Policy and Practice*,[18] "Recommendations for Preventive Pediatric Health Care,"[19] "School Health Assessments,"[20] and "Qualifications and Utilization of Nursing Personnel Delivering Health Services in Schools."[21]

1. School-based health care providers must communicate with each student's existing sources of health care, eg, the primary care provider, when there is one. When necessary, and based on the specific design for that school, arrangements may also be made with neighborhood health programs, mental health programs, and health maintenance organizations. This communication needs to established at the onset, and may be via telephone, fax, e-mail, or post. Care should be taken not to disrupt existing services.
2. Part of every integrated health services program charter must be to introduce each student and family to a traditional medical home whenever this is possible in a community. An integrated school health program must include activities that prepare the large portion of students who will inevitably graduate or transfer from school each year. Examples of such activities are those that assist families with health insurance eligibility determinations, applications for insurance, selection of a non–school-based primary care provider, and registration at a community-based clinical practice that will serve as the students' medical home. Even if students receive most services at a school health center, families should be taught when and how to make preventive health appointments, to travel to their medical-home site independently, and to become familiar with a permanent primary care provider of their choice.
3. Parents should be encouraged to be primarily and intimately involved in the health education and health supervision of their children.
4. Issues of medical liability and confidentiality should be identified and addressed during a registration process. Typically a standard parent permission form is prepared as a component of registration for the school-based clinic so that students may receive services. At the very least, this should include permission for the school health center to exchange information with the primary care provider and with the school's traditional health staff (eg, school nurse, school counselor) for matters that pertain to a child's well-being at school. If the school's plan includes provisions for adolescents to receive services without parent notification or health plan billing, this too must be addressed at the time of registration.
5. A comprehensive review of existing resources and funding mechanisms must be done, preferably as part of the initial community assessment. Financial support for providers who supply in-school and after-hours health care should be included. Schools should not rely solely on temporary foundation grants. These funds are appropriate to use for start-up costs and to fund health care costs for students ineligible for any health insurance program. A variety of possible models of funding should be explored. Design and choose a system that is acceptable to all parties at financial risk and that does not fragment continuity of care in an attempt to capture dollars. A long-term funding plan is optimally developed before the integrated school health services program is initiated.
6. An ongoing process of evaluation should be incorporated into all integrated school health programs. Programs should adopt clearly stated goals and then design an ongoing data-based needs assessment. Programs must have the means to collect data and establish mechanisms for anal-

ysis and reporting. Quality assurance and improvement are important parts of the evaluation. Systematic evaluation should provide information about whether the integrated school health services approach is effective and worth the investment.

SUMMARY

Schools can successfully expand access to health care services for all students, particularly underserved populations, when the program includes careful community assessment and endorsement, is integrated with the school's existing health program, has a sound plan for financial sustainability, and pays adequate attention to quality assurance, evaluation, promotion, and integration with a medical home. School health services can be an effective vehicle for integrating psychosocial care and education with medical care.

Pediatricians practicing in public and private sectors should become actively involved in any community effort to develop an integrated school health services initiative. A well-designed integrated health services program, when coupled with comprehensive school health education, could significantly advance the state of health of the nation's children, youth, and families.

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American Academy of Pediatrics
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TECHNICAL REPORT

School Readiness

Pamela C. High, MD, and the Committee on Early Childhood, Adoption, and Dependent Care and Council on School Health

ABSTRACT

School readiness includes the readiness of the individual child, the school's readiness for children, and the ability of the family and community to support optimal early child development. It is the responsibility of schools to be ready for all children at all levels of readiness. Children's readiness for kindergarten should become an outcome measure for community-based programs, rather than an exclusion criterion at the beginning of the formal educational experience. Our new knowledge of early brain and child development has revealed that modifiable factors in a child's early experience can greatly affect that child's learning trajectory. Many US children enter kindergarten with limitations in their social, emotional, cognitive, and physical development that might have been significantly diminished or eliminated through early identification of and attention to child and family needs. Pediatricians have a role in promoting school readiness for all children, beginning at birth, through their practices and advocacy. The American Academy of Pediatrics affords pediatricians many opportunities to promote the physical, social-emotional, and educational health of young children, with other advocacy groups. This technical report supports American Academy of Pediatrics policy statements "Quality Early Education and Child Care From Birth to Kindergarten" and "The Inappropriate Use of School 'Readiness' Tests."

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school readiness, kindergarten, early education, children's well-being, social and emotional development, role of the pediatrician

Abbreviation
AAP—American Academy of Pediatrics

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EARLY EXPERIENCE MATTERS

All of a child's early experiences, whether at home, in child care, or in other preschool settings, are educational. When early experiences are consistent, developmentally sound, and emotionally supportive, there are positive effects on the child and the family. To focus only on the education of children beginning with kindergarten is to ignore the science of early development and to deny the importance of early experiences. Our current understanding of the importance of early experiences in early brain development and cognitive and social-emotional outcomes for children and the recent US policy agenda aimed at maximizing educational encounters and outcomes for all children converge in our contemporary conceptualization of school readiness. Children who enter school ready to learn are expected to achieve more academically. Academic success has been linked to improved social, economic, and health outcomes.[1–3]

HOW HAS SCHOOL READINESS BEEN DEFINED?

"Ready to Learn" became a national mantra in 1991, when the National Education Goals Panel adopted as its first goal that "by the year 2000, all children will enter school ready to learn."[4] This panel identified readiness in the child as determined by a set of interdependent developmental trajectories. Three components of school readiness were broadly described as:

1. Readiness in the child, defined by:
   - Physical well-being and motor development, including health status, growth, and disability;
   - Social and emotional development, including turn-taking, cooperation, empathy, and the ability to express one's own emotions;
   - Approaches to learning, including enthusiasm, curiosity, temperament, culture, and values;
   - Language development, including listening, speaking, and vocabulary, as well as literacy skills, including print awareness, story sense, and writing and drawing processes; and
   - General knowledge and cognition, including sound-letter association, spatial relations, and number concepts.

2. School's readiness for children, ensured by:
   - Facilitating smooth transition between home and school, including cultural sensitivity;
   - Striving for continuity between early care and education programs and elementary school;
   - Using high-quality instruction, appropriate pacing, and understanding that learning occurs in the context of relationships;
   - Demonstrating commitment to the success of every child through awareness of the needs of individual children, including the effects of poverty and race, and trying to meet special needs within the regular classroom;
   - Demonstrating commitment to the success of every teacher;
   - Introducing approaches that raise achievement, such as parent involvement and early intervention for children falling behind;
   - Altering practices and programs if they do not benefit children;
   - Serving children in their communities;
   - Taking responsibility for results; and
   - Having strong leadership.
3. Family and community supports contributing to child readiness:
   - Mothers should receive excellent prenatal care and children should receive comprehensive health care, optimal nutrition, and daily physical activity, so that children arrive at school with healthy minds and bodies;
   - All children should have access to high-quality preschool; and
   - As their child's first teacher, every parent should devote time daily to helping their child learn and should have access to education and support to be an effective teacher.

WHAT DETERMINES SCHOOL READINESS?

An individual child's school readiness is determined in large measure by the environment in which he or she lives and grows. The Child Welfare League of America described a vision for the United States in which every child is healthy and safe and develops to his or her full capacity.[5] Five universal needs of all children were described. First, children need the very basics of proper nutrition, economic security, adequate clothing and shelter, appropriate education, and primary and preventive physical and mental health services. Second, children need strong nurturing relationships within their families, their communities, and their peer groups. Third, children need opportunities to develop their talents and skills and to contribute to their communities. Children with indications of disability need early assessment and intervention to prevent later, more-serious problems. Fourth, children need protection from injury, abuse, and neglect, as well as from exposure to violence and discrimination. Fifth, children have a basic need for healing. When we have not been able to protect them, children need us to ease the effects of any harm they have suffered by providing emotional support, by addressing physical and mental health care needs, and by sometimes making amends through restorative judicial practices. Meeting these needs requires collaborative comprehensive approaches, so that children become a priority at the levels of the family, the community, and the nation.[5]

Education and child development literature has focused on 4 major conceptualizations of school readiness. The "idealist/nativist" view suggests that children are ready for school when they mature to the level of having self-control, peer relations, and the ability to follow directions and that this process is endogenously determined. In this construct, environment plays only a minor role and little can be done to accelerate this process. In contrast, the "empiricist/environmentalist" view of readiness is determined by what children know (eg, colors, shapes, counting, and address) and how they behave. This is understood as the direct result of what the child has been taught. In both of these constructs, the solution to a child's failure to achieve a universal level of proficiency would be to give the child more time to mature or to learn these more-basic concepts, by placing the child in less-demanding programs.[6] However, research shows that age is a less-important influence on developmental progress than is schooling. In one study, the independent effects of schooling were 4 times greater than those of age on kindergarten performance.[7] In a similar study, any age-associated academic advantage provided at first grade entry dissipated within a few years.[8]

A third perspective on school readiness is a "social constructivist" model, which rejects the idea that readiness is an endogenous process or a defined set of knowledge and sees readiness in social and cultural terms. The focus of this model is on the community and its values and expectations, rather than on the child. A potential problem with this view is the lack of focus on the individual child.

The final construct of readiness that has been proposed is an "interactional relational" model. In this perspective, the focus is on the child and the environment and also on the ongoing interaction between them. This theory focuses on helping all children learn, and it suggests that educational success depends on the reciprocal relationship between the school and the child, particularly on the mentorship of the teacher.[6] This fourth model has gained the greatest recognition by developmentalists, because it is most consistent with the current understanding of the importance of early experiences and early relationships, especially in promoting child development.[9]

INAPPROPRIATE USE OF SCHOOL READINESS TESTING

There are 6 fundamental misconceptions prevalent regarding school readiness, which serve mostly to keep children out of school, rather than ensuring that chil-

dren will be ready and capable when they reach kindergarten. These misconceptions are as follows. (1) Learning happens only at school. (2) Readiness is a specific condition within each child. (3) Readiness can be measured easily. (4) Readiness is mostly a function of time (maturation), and some children need a little more. (5) Children are ready to learn when they can sit quietly at a desk and listen. (6) Children who are not ready do not belong in school.[10]

An emphasis on kindergarten readiness that looks only at the skills of a child places an undue burden of proof of readiness on that child and is particularly unfair because of economic, experiential, and cultural inequities in our society. Typical or normal development in 4- and 5-year-old children is highly variable, and labeling children at such an early age may cause them to be isolated from a more-appropriate learning environment.

In a 1988 national survey, 10% to 50% of children in various states who were eligible to enter kindergarten on the basis of age did not enter because of readiness test scores.[11] A follow-up survey in 1996[12] did show a response to growing concerns about misuse of these kinds of data. Most states had moved away from readiness testing by developing policies against the use of such testing, by issuing publications on appropriate assessment in early childhood, or by providing professional development opportunities in early childhood assessment. However, local districts in many states continue to use standardized testing for young children. Although the definition of kindergarten eligibility in every state is based on child age, many states continue to conduct standard statewide screening or assessment, to allow local districts to choose their own instruments of assessment, and to develop statewide readiness assessments. Few states have no assessment of readiness, and methods for addressing children with special needs are determined locally in most states.[13]

The current disparity between school and child readiness may be because schools are not prepared to offer the necessary and appropriate educational setting for age-eligible children, not because children cannot learn in an appropriate educational setting. If there is a predetermined set of skills necessary for school enrollment, then commitment to promoting universal readiness must address early-life inequities in experience. This may be accomplished by providing access to opportunities that promote educational success, recognize and support individual differences among children, and establish reasonable and appropriate expectations of children's capabilities at school entry for all children.[14] The data gained from testing children at kindergarten entry need to be interpreted carefully. Ideally, data can be used as a tool to help prepare schools for the diverse group of children they will be serving, rather than as a means of excluding children from formal education at their potential entry point. It is the responsibility of the schools to be ready for all children and to work with families to make the school experience more positive for all children, even those who may be at varying stages of readiness. School programs should be flexible and adaptable to each child's level of readiness.

With an increasing national emphasis on school performance and accountability, it is likely that readiness assessment will become more prevalent. Assessing young children is difficult theoretically, psychometrically, and logistically. However, the question is becoming how to assess children, rather than whether they should be assessed. An important remaining issue is how these data will be used. The potential for misuse of these data, with long-lasting effects, is great. Nonetheless, data on the condition of children entering school can be important for interpreting later accountability measures and can help us understand how well early childhood programs perform in raising the developmental level of young children before school entry.

HOW READY ARE US CHILDREN AS THEY ENTER KINDERGARTEN?

A landmark study by the National Center for Education and Statistics surveyed a nationally representative sample of 22 000 first-time kindergarten students and their schools, classroom teachers, and families. The study was designed to gather information about the entry status of the nation's kindergarteners, to inform educational policy and practice. Information was obtained regarding children's cognitive, emotional, social, and physical development, as well as their family interactions and home literacy environment. In the study, children "at risk for school difficulty" were defined as children whose mothers had less than a high school education, children who came from single-mother families, children who had received public assistance, and children who lived in families whose primary language was not English.[15,16]

Fifty-one percent of parents of children who entered kindergarten for the first time in 1998 rated their child's general health as excellent, and 32% rated it as very good. Kindergarteners whose mothers had higher levels of education, who were from 2-parent families, whose families had not used public assistance, and who were of white non-Hispanic descent were rated as having generally better health by their parents. Six percent of the first-time kindergartners were experiencing vision problems, and 3% were identified as having hearing problems. In that study, 12% of boys and 11% of girls were at risk of overweight, defined as BMI at or above age- and gender-specific guidelines. The risk was greater for children whose mothers had not attained a bachelor's degree and for children from homes where the primary language spoken was not English.[15,16]

The study attempted to examine the social and emotional status of first-time kindergartners. Teachers reported that 10% to 11% of children often argued or fought with others or angered easily, and 77% often formed friendships. Single parents were more likely to report behavior problems, such as fighting, arguing, and getting angry. Parents with partners, those with higher education, and those who had not received public assistance were more likely to have kindergartners with prosocial behaviors, such as often forming friendships. Teachers were less likely than parents to report that children were eager to learn (75% vs 92%). Children with lower maternal education, those from single-

mother homes, and those whose families had received public assistance were less likely to be viewed as eager to learn by their teachers.[15,16]

Variability also was seen in home literacy environments and in family interactions for first-time kindergartners. Forty-five percent of parents reported reading with their child every day, but this value decreased to 36% if mothers had less than a high school education, 38% if English was not the primary language spoken at home, 35% for black non-Hispanic children, and 39% for Hispanic children. Almost three fourths of parents reported having more than 25 children's books at home, but this was true for only 38% of kindergartners whose mothers had not graduated from high school and only 35% of those from homes where English was not the primary language spoken. Only approximately one half of kindergartners from black non-Hispanic, Hispanic, or Native American families had more than 25 children's books at home. In contrast, more families that had some of these risks engaged in singing and in exercise and game-playing with their young children. Although 45% of parents overall sang with their children daily, this increased to 51% in single-mother families, 49% in families that had received some public assistance, and 54% in black non-Hispanic families. Twenty-two percent of parents exercised and played games with their children daily. This value increased to 27% for mothers who had not completed high school, 24% for single-mother families, 29% for families that had received some public assistance, 29% for black non-Hispanic families, and 31% for Native American families.[15,16]

Early academic competencies were also surveyed in the study. In 1998 in the United States, as children entered kindergarten for the first time, two thirds recognized their letters, and 29% also recognized beginning sounds; 94% recognized single numerals and shapes and could count to 10, and 58% could count beyond 10, sequence patterns, and use nonstandard units of length to compare objects. Of those children, 37% demonstrated strong print familiarity skills, including knowing that print reads from left to right and knowing where to go when a line of print ends. Kindergartners' performance on math, reading, and general knowledge items increased with the level of their mothers' education and was higher for children from 2-parent families.[15,16]

Overall, children with few risk factors were more likely to have attained these various proficiencies and were in better general health than were children at risk. Follow-up evaluation of the same children in the spring of first grade showed that children who demonstrated early literacy skills and who came from a positive literacy environment, who possessed a positive approach to learning, and who enjoyed very good or excellent general health at kindergarten entry performed better in both reading and mathematics after 2 years of formal schooling than did children who did not have these resources. The relationships between the resources children possessed at kindergarten entry and their reading and mathematics performance in the spring of first grade remained significant after controlling for the influence of children's poverty status and their race/ethnicity.[17]

When these children were evaluated after 4 years of education, in the spring of third grade, children with more family risk factors (eg, living below the poverty level, primary language spoken in the home was not English, mother had not completed high school, and single-parent home) demonstrated lower mean achievement scores in reading, mathematics, and science. Over that time, children with more family risk factors made smaller gains in math and reading, so that the achievement gaps between disadvantaged and more-advantaged children grew wider over the first 4 years of school. The third-graders completed self-descriptive questionnaires evaluating internalizing (eg, shy, withdrawn, or sad) and externalizing (eg, fighting, arguing, or distractibility) behavior problems. Overall problem behavior scores were low; however, children with lower achievement and more family risk factors tended to rate themselves higher on both of the problem behavior scales.[18]

These findings, although they are disturbing, are not surprising to pediatricians, who have long been advocates for underserved pediatric populations. This inequity in school readiness, which is apparent at school entry and is associated with persistent academic underachievement and social-emotional risk, points to a need to address these differences before children enter kindergarten, especially for families and children at risk.

CHILDREN WITH SPECIAL EDUCATIONAL NEEDS

When discussing the issue of school readiness, it is critical to discuss the approximately 20% of children identified as having special educational needs. Foremost in this discussion is the importance of not using screening instruments or testing by nonprofessionals to label children or to place them in special education classes.[19] Farran and Shonkoff[20] argued that children with disabilities are of 2 primary types, namely, normative and nonnormative. Those who are classified as normative constitute only 2% of the population; they may suffer from blindness, deafness, autism, moderate/profound mental retardation, or some type of significant language impairment. It is understood that regular general education may not be appropriate for them. Nonnormative children constitute 18% of the population. Children in this population group may be categorized as having learning disabilities, mild mental retardation, or social and emotional maladjustment. These nonnormative categories may be a reflection more of what society accepts as normal behavior than of a lack of ability or development. The authors warned that "as more and more types of children are excluded because they are deemed not ready, smaller and smaller differences among the remaining children will be accented and new categories will be developed."[20]

It is important to point out that the number of children receiving special education services increases each year. There was a 64% increase in enrollment in special education categories in the public schools between 1976 and 1999, whereas total enrollment of children in elementary and secondary schools increased by less than 12% in that time period. Also, almost 2 million more children were labeled as having learning disabilities in

1999 than in 1977. However, there were 364 000 fewer children labeled as mentally retarded and 234 000 fewer children who were categorized as having speech impairments.[21]

HOW CAN SCHOOLS AND COMMUNITIES PROMOTE SCHOOL READINESS?

Much less has been studied about the readiness of schools and communities to meet the needs of the diverse population of children.[22] One approach to identifying and tracking indicators of school and community preparedness is the School Readiness Indicators: Making Progress for Young Children program, a partnership of 16 states funded by the David and Lucile Packard Foundation, the Ford Foundation, and the Ewing Marion Kauffman Foundation. This initiative has 3 goals, that is, (1) to create a set of measurable indicators related to and defining school readiness that can be tracked at the state and local levels; (2) to have states adopt this indicator-based definition of school readiness, to fill in gaps in data, to track data, and to report findings to their citizens; and (3) to stimulate policies, programs, and other actions to improve the ability of children to read at grade level by third grade. Sample systems indicators tracked by this group include (1) the proportion of children with health coverage; (2) the proportion of 3- and 4-year-old children enrolled in high-quality early education and child care programs; (3) the proportion of schools offering universal access to full-day kindergarten; (4) the proportion of children with hearing, vision, or dental problems not detected at school entry; (5) the number of adults enrolled in adult education programs or programs teaching English as a second language per 100 adults seeking those services; (6) the proportion of births to mothers with less than a 12th-grade education; and (7) the proportion of children younger than 6 years of age in foster care who have had more than 2 placements in 24 months. The complete set of indicators selected by each state is available at the initiative Web site (www.gettingready.org). It is the belief of those investigators that this work will play an important role in shaping the educational agenda for young children and their families across the country.[23,24]

WHAT PEDIATRICIANS CAN DO TO PROMOTE SCHOOL READINESS

Pediatricians can and do promote school readiness in the children they serve, in many ways. In their day-to-day practices in medical homes, pediatric providers promote optimal nutrition, growth, and physical health as part of health maintenance, including provision of immunizations and anticipatory guidance. Their guidance regarding developmental and behavioral issues and concerns can help parents enhance their nurturing relationships with their children. By providing ongoing surveillance and information regarding injury prevention, pediatric providers can help protect children from injury and abuse. Pediatricians can screen for psychosocial risks, such as family violence, maternal depression, substance abuse, and lack of connection to community and family supports. They can counsel families with these kinds of needs and refer them to appropriate resources within the community. Pediatricians can emphasize improved identification of children with delays in their development by integrating regular, systematic, developmental screening and surveillance into their practices.[25] Children identified as having delays and children at risk of delays can then be referred to community-based services, such as early intervention programs, home visitation programs, Head Start, and special education programs available through school departments. After referral, pediatricians can monitor children's participation and progress as a result of the referral.

As part of daily practice, pediatric providers can promote the "5 Rs" of early education, that is, reading together as a daily family activity; rhyming, playing, and cuddling together often; routines and regular times for meals, play, and sleeping, which help children know what they can expect and what is expected from them; praise as reward for everyday successes; and reciprocal and nurturing relationships, which are the foundations of healthy child development. Pediatricians can integrate literacy promotion into their practices toward this end.

Pediatricians should be well informed regarding interventions of known benefit to young children. A review of the effects of low income (the unifying factor associated with developmental risk) on child development identified many evidence-based interventions that have proven efficacy in improving psychosocial outcomes for children at risk.[26] Head Start for healthy preschoolers from low-income families has been shown consistently to improve vocabulary, early writing, and early mathematics scores. Long-term follow-up studies demonstrated remarkable differences for children who participated in these programs, compared with control children, in educational attainment, home ownership, incarceration rates, and employment.[27–30] A study of the economic features of investing in a 1-year, high-quality, universal, preschool education in California estimated a $7000 net present-value benefit per child. This benefit equaled a return of $2.62 for every $1 invested, with an annual return rate of 10% over 60 years. This model did not include other benefits to society, such as the improved health and well-being of participating children and the potential intergenerational transmission of favorable benefits.[31]

Economists at the Federal Reserve Bank of Minneapolis examined the rate of return on investment for early education in Minnesota. When considering the Perry Preschool Program, which provided high-quality preschool to 3- and 4-year-old children in poverty, they found a "real" return on investment, adjusted for inflation, of 16%, with at least 75% of those benefits going to the general public.[32] The benefit/cost ratio (the ratio of the aggregate program benefits over the life of the child to the input of costs) was found to be greater than 8:1.[33]

Other evidence-based interventions with substantial effects on school readiness include early intervention programs for formerly preterm infants, which have been shown to prevent developmental delay, to improve grade retention, and to accelerate placement into special

education.[34–36] Food supplement programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children, have been shown to reduce rates of low birth weight[37] and iron deficiency.[38–40] Children attending schools with school nutrition programs have improved scores on standardized academic tests.[41] Home visiting by nurses has been shown consistently to reduce rates of childhood injury, to increase fathers' involvement, to reduce family welfare dependency, and to improve school readiness.[42] Housing subsidies have resulted in improved neighborhood safety and reduced exposure to violence.[43] In addition, clinic-based, literacy-promoting programs that include the provision of children's books and anticipatory guidance about the importance of reading aloud with young children have been shown to enhance language development in toddlers[44] and preschoolers.[45]

Programs and policies that are without proven efficacy but are deemed likely to have positive effects on child development include housing policies to decrease frequent moves, smoking cessation programs for parents and pregnant women, improved access to high-quality health care, and identification and treatment of maternal depression and other mental health problems.[26,46]

As respected child advocates and political consultants, pediatricians can promote school readiness by advocating for provision of services that are evidence-based and that demonstrate efficacy in promoting optimal early brain and child development. Some examples include (1) access to health care, including mental health services, for all children; (2) standards for state Medicaid and Early and Periodic Screening, Diagnosis, and Treatment programs that conform, at a minimum, to American Academy of Pediatrics (AAP) recommendations[47]; (3) full funding for Head Start (which now must turn away 4 of 10 eligible children because of lack of resources), for Early Head Start (which now serves <5% of eligible children and families), and for federal child care subsidies (now available to only 1 of 5 eligible families)[48,49]; and (4) improved funding for and infrastructure to support the provision of high-quality, universal, early education and child care from birth to kindergarten for all families, as described in a policy statement from the AAP.[50]

Pediatricians can advocate, individually and through collaboration in their own communities, with their AAP chapters on the state level and in coordination with the AAP Washington office on the national level. AAP chapters can be the centers for advocacy because they have experience, resources, and established relationships with policymakers who will be making decisions at the state level.[51,52] The AAP offers opportunities to affect these policies on a national level through the Federal Advocacy Action Network.. Opportunities also exist for pediatricians to get involved in State Early Childhood Comprehensive Systems activities in their states. The goal of this federally funded initiative is to implement a comprehensive early childhood system that promotes the health and well-being of young children, enabling them to enter school ready and able to learn (for more information, see www.healthychildcare.org).

CONCLUSIONS

School readiness needs to become an outcome measure for community-based programs, rather than an exclusion criterion at the educational starting gate. Indeed, kindergarten should no longer be viewed as the beginning of a child's educational experience. Our new knowledge of early brain and child development has demonstrated that modifiable factors in a child's early experience can greatly affect that child's learning trajectory. Three qualities that are necessary for children to be ready for school are intellectual skills, motivation to learn, and strong social-emotional capacity and support.[9] These qualities are influenced by the health and well-being of the families and neighborhoods in which children are raised. Many US children enter kindergarten with limitations in their social-emotional, physical, and cognitive development that might have been significantly diminished or eliminated through early recognition of and attention to child and family needs. There is much that pediatricians can do to address and to diminish these discrepancies.

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POLICY STATEMENT

School Transportation Safety

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Injury, Violence, and Poison Prevention and Council on School Health

ABSTRACT

This policy statement replaces the previous version published in 1996. It provides new information, studies, regulations, and recommendations related to the safe transportation of children to and from school and school-related activities. Pediatricians can play an important role at the patient/family, community, state, and national levels as child advocates and consultants to schools and early education programs about transportation safety.

INTRODUCTION

School transportation plays a consistent and long-term role in the lives of children from preschool through high school. Pediatricians can participate by serving as resources, educators, consultants, and advocates for school transportation safety at the local, state, and federal levels. This revised policy statement provides updated recommendations that can enhance community systems for addressing safe transportation for children to and from school and school-related activities.

Expectations for school transportation and school bus safety should be upheld in an ongoing commitment from communities and states to ensure that children travel to and from school safely. The National Highway Traffic Safety Administration (NHTSA) School Bus Safety Program is committed to reducing school bus crashes, injuries, and fatalities.[1] Congress has indicated that school transportation should be held to the highest level of safety.[2] In addressing school transportation, all modes of travel must be considered, and measures must be taken to promote safety for each mode.

Modes of School Transportation

The Committee on School Transportation Safety of the Transportation Research Board studied the various modes of travel and associated risks for schoolchildren.[3] Estimates of trips per year by mode of transportation during school hours were: passenger vehicle with adult driver, 45%; school buses, 25%, other buses, 2%; passenger vehicle with teen driver, 14%; bicycle, 2%; and walking, 12%. These estimates are limited, because they do not include school bus travel for extracurricular activities during or after normal school hours or during vacations. School bus crashes occur disproportionately on high-speed roads at night during transportation to and from extracurricular activities.[4]

Annually during normal school travel hours, 23.5 million children are transported on 457 000 school buses, totaling 5.8 billion student trips and 3.13 billion miles.[5] Each child who uses school bus transportation travels, on average, 1300 miles per school year. These estimates do not include school or school-related travel during nonschool hours.

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Key Words
school transportation, school bus, travel on school bus, getting to and from school

Abbreviations
NHTSA—National Highway Traffic Safety Administration
NTSB—National Transportation Safety Board
FMVSSs—federal motor vehicle safety standards
AAP—American Academy of Pediatrics

School Transportation Injury

Annually, there are, on average, 815 student deaths and 152 250 injuries related to school travel during normal school travel hours. (These data are underestimates, because they do not include school-related trips or school bus crashes outside of school hours, and reporting is voluntary.) Two percent of the deaths and 4% of the injuries occurred in school buses. Seventy-five percent of the deaths and 84% of the injuries occurred in passenger vehicles. The fatality rates descend in the following order: (1) passenger vehicles with teen drivers, 55%; (2) passenger vehicles with adult drivers, 20%; (3) walking (pedestrians), 16%; (4) bicyclists, 6%; and (5) school and other buses, 2%. The injury rates descend in the following order: (1) passenger vehicles with teen drivers, 51%; (2) passenger vehicles with adult drivers, 33%; (3) walking (pedestrian), 6%; (4) bicycles, 5%; and (5) school and other buses, 5%.[3]

The Fatality Analysis Reporting System[6] includes fatality data on all school bus–related crashes, not just those during school hours. In the year 2001, 141 persons were killed. Of the fatalities, 16% were pedestrians, 9% were school bus passengers, 4% were school bus drivers, 3% were bicyclists, and the rest (68%) were occupants of other vehicles or other nonmotorists. Of the 22 child pedestrian fatalities, 82% were struck by the school bus. Data from the General Estimates System indicate that 13 000 persons are injured annually in school bus crashes.[7] Of those injured, 46% (5980) were school bus occupants, 8% were school bus drivers, 38% were occupants of other vehicles, and fewer than 0.05% each were pedestrians, pedal cyclists, and nonmotorists.[8] However, the National Transportation Safety Board (NTSB) determined that school bus crash data are incomplete and that injuries cannot be reliably estimated.[9] The first emergency department–based study of nonfatal school bus–related injuries found that the number of injuries (17 000 annually to children 0–19 years of age) greatly exceeded previously published estimates. Motor vehicle crashes were the most frequent injury mechanism.[10]

RECOMMENDATIONS

School Bus Travel

The National Traffic and Motor Vehicle Safety Act of 1966 and the upgrades in the School Bus Safety Amendments of 1974 authorize the Department of Transportation to issue minimum standards for new school buses manufactured for sale in the United States.[11] There are 35 federal motor vehicle safety standards (FMVSSs) that apply to school buses. Large school buses that carry more than 16 passengers are not required to be equipped with seat belts. The long-standing American Academy of Pediatrics (AAP) recommendation that seat belts be installed on all new school buses is further discussed later in this statement. Small school buses (weighing <10 000 pounds) built in accordance with FMVSSs are equipped with lap belts. Vehicles, including multipurpose vehicles that carry 11 or more persons that are sold or leased for transporting students to or from school or school-related events, are required to meet the FMVSS requirements applicable to school buses. States may prescribe additional regulations that apply to the use of any vehicle used to transport preprimary, primary, and secondary school students.[12]

The AAP recommends that all guidelines for safe transportation of all preschool- and school-aged children be applied during all school and school-related trips regardless of the hours of operation.

Preschool-Aged Children

Many school systems provide transportation for preschool-aged children. The NHTSA studies demonstrated that preschool-aged children were safest when properly transported in child safety restraint systems that meet FMVSSs 213 and 225.[13] In January 2001, the Department of Health and Human Services issued transportation safety requirements for Head Start transportation. Within 5 years, transportation was limited to school buses or "allowable alternate vehicles." This provision has since been extended to June 30, 2007. That is, on July 1, 2007, all Head Start children must be transported in a compliant vehicle, unless a waiver has been granted. All vehicles must be equipped with a communication system for emergencies, first aid kit, fire extinguisher, and seat belt cutter. Children weighing 50 pounds or less were required to travel in FMVSS 213–approved child restraints; this has since been updated to apply to children under the weight threshold of FMVSS 213 for approved child restraints (currently 65 pounds). As of January 2004, vehicles must be equipped to use child restraints. Retrofit of lap belts or child-restraint anchorage to properly secure the child safety restraint system to the school bus seat is allowed and must be reinforced according to the applicable FMVSS.[13] The driver must have a commercial driver's license and undergo criminal background checks. As of January 2004, all vehicles must have a bus monitor. Each Head Start agency is required to provide pedestrian-safety education for parents and children. An extension to January 18, 2006, for implementation of the requirement to provide car safety seats and bus monitors was allowed for Head Start programs that filed an application by April 1, 2004. A final rule was published on October 4, 2006, authorizing the Department of Health and Human Services to issue waivers from this requirement to Head Start grantees. The NHTSA has a curriculum for child passenger safety technicians, materials available regarding proper use of child safety restraint systems in school buses, and child passenger training materials for school bus drivers.

The AAP has recommended and advocated that school districts provide height- and weight-appropriate

car safety seats and restraint systems that meet FMVSSs for all preschool-aged children. These systems include booster seats for which a 3-point belt is available for installation. The AAP also supports the Head Start transportation safety requirements.

The AAP further recommends that school-based as well as non–school-based child programs follow guidelines for safe transportation. This includes all early education and child care programs and applies to car-pool transportation as well. The AAP Moving Kids Safely in Child Care program is the first national occupant-protection curriculum for child care providers and administrators; it provides detailed guidelines for safe transportation of all children.[14]

School-Aged Children: Occupant Protection on School Buses

Compartmentalization has been the occupant-protection system for children in large school buses for more than 30 years and was the only available protection before child-restraint systems and seat belts were available for use in the school bus environment. Compartmentalization is provided by seats that are closely spaced with high, energy-absorbing seat backs. Data from real-world crashes comparing seat belt use versus compartmentalization only do not exist. However, recent studies have revealed that compartmentalization does not offer optimal protection and is not consistent with current technology and messages for children and families regarding the use of car safety seats and seat belts in all motor vehicles.[9,15,16]

The NTSB, through a series of crash investigations, determined that compartmentalization as a method of occupant protection on school buses is incomplete. Compartmentalization does not provide protection during lateral (side) impacts with vehicles of large mass or in rollover collisions, because passengers do not always remain completely within the compartment. The NTSB recommended the development and implementation of a seat and restraint system that restrains passengers in the seating compartment. The NTSB also recommended the development of performance standards and requirements for school bus occupant-protection systems on newly manufactured school buses. The NTSB further recommended on-board recording devices to facilitate improved data collection in crashes.[9] For optimal protection of all children, the AAP concurs with these recommendations.

The NHTSA conducted a study of school bus occupant protection in 2000 and determined that lap/shoulder belts on school buses performed best in dummy crash-testing compared with unbelted occupants, compartmentalization, and lap belts. Head-injury measurements were significantly lower with use of lap/shoulder belts than for use of compartmentalization or lap belts. In crash tests, the lap/shoulder belt restraint systems effectively kept the dummies in their seats.[16]

The State of California Vehicle Code requires newly manufactured school buses to have a lap/shoulder belt restraint system, effective 2004 for small school buses and 2005 for large school buses.[17] At the time of this publication, the states of Florida, Louisiana, New Jersey, and New York and many local school districts have passed school bus seat belt laws.[18]

The AAP recommends that all children travel in age-appropriate, properly secured child-restraint systems when transported in all motor vehicles, including school buses, to ensure the safest ride possible. The AAP further recommends that all newly manufactured school buses be equipped with lap/shoulder restraint systems that can also accommodate car safety seats, booster seats, and harness systems. The AAP recognizes the added benefit of improved student behavior and consistent habits of restraint use when traveling in motor vehicles. Policies on seat belt use have been found to improve student behavior and reduce driver distraction.[4,19,20] School districts must ensure the appropriate education of administrators, students, teachers, drivers, and parents in the use of occupant-protection devices.

School Bus Safety Features

The AAP recommends that all school buses, including private, parochial, and contractual, that are used for school and all school-related activity transportation be in compliance with all applicable federal regulations. Buses built before 1977 should be retired from use, because they are deficient in several significant safety standards.[4]

Effective December 2, 1993, the FMVSSs were revised to require mirrors to improve driver visibility in front of and along both sides of school buses.[21] In addition, districts should consider installing strobe lights for use during reduced-visibility conditions, an external loudspeaker system to enable the driver to communicate with children outside the bus, and loading and backing alarms or pulsating backup horns.[22] School bus blind areas created by school bus bodies or mirrors are considerable.[23] Electronic sensor systems are available but have not been evaluated adequately to determine their effectiveness.[4] The AAP recommends that blind spots created by mirror systems and other vehicle-design aspects should be addressed by improved technology designed to decrease both crash and pedestrian injury risks because of limited visibility of a child by the bus driver.

The Children's School Bus Exposure Study, prepared for the California Air Resources Board, found that diesel buses can have significantly higher on-board diesel-related pollutant concentrations than other vehicles because of intrusion of the bus's own exhaust into the cabin.[24] Increased exposure from commuting by school bus was estimated to increase a child's lifetime cancer risk by approximately 4%, increase the incidence of lower respiratory symptoms by approximately 6%, and increase daily hospitalizations for asthma by approxi-

mately 1%. Several states and local governments have adopted airborne toxic control measures that limit school bus idling and idling at schools.[25,26] Bus idling also contributes to poor indoor air quality inside schools from unfiltered air that enters through open doors. The AAP recommends that states adopt measures to protect school-aged children from exposure to toxic air contaminants.[27] Additional measures to reduce children's exposure to vehicle-related pollutants include replacement of older buses, use of alternate-fueled or particulate-trap–equipped buses, retrofitting buses with better emission-control technologies, minimizing bus caravanning, use of cleaner buses on longer routes, having passengers sit at the front of the bus if it is not full, and minimizing idling.[24,28]

School Bus Transportation of Children With Special Medical Needs

Children with special needs and who are older than the preschool-aged child and require special restraint systems should be evaluated individually to determine the most appropriate system that meets their needs for positioning during travel, regardless of their age, weight, and height. Specific recommendations are outlined in the AAP policy statement on school bus transportation of children with special needs.[29]

The use of wheelchairs is common for school bus transportation of children with disabilities. The AAP recommends that states adopt the requirements for use of wheelchairs on school buses outlined in the 1995 National Standards for School Buses[22] and the AAP policy statement on school bus transportation of children with special needs.[29]

School Bus Driver Selection, Training, and Performance

The Transportation Research Board stated that variations in school bus driver recruitment, selection, training practices, and rates of pay are likely to be associated with variations in driver safety performance.[3] In another report, the Transportation Research Board recommended that all states provide formal training for school bus drivers, including training on school bus driver responsibility in ensuring safety of the children inside the bus and in loading zones.[4]

The AAP believes that national standards for the selection, training, and regulation of school bus drivers should be established and implemented to ensure optimal driver performance.

To meet basic requirements, school bus drivers should:

- maintain a valid commercial driver's license;
- be at least 21 years of age;
- show proof of an annual health history, assessment, and physical examination, including vision and hearing assessments, that document the absence of conditions that may compromise driving and child supervision;
- successfully complete a written or oral test covering driver duties, bus-operating procedures, traffic and school bus laws and regulations, record keeping, emergency and crash-related procedures, first aid, basic appreciation of the developmental stages and needs of preschool and school-aged children, child-supervision responsibilities, and transportation of passengers with special needs;
- maintain a satisfactory driving record as determined by the school district;
- successfully pass a review for a criminal record (including convictions of child sexual abuse and incidents or arrests for driving under the influence of alcohol or other drugs) that is reviewed annually; and
- pass a test for illicit drugs and alcohol as required by the district (mandatory testing is recommended if it is not already required).

To demonstrate operational and driving skills, school bus drivers should:

- pass a driving performance test and demonstrate safe loading and unloading procedures;
- demonstrate physical capability to successfully accomplish student evacuation; and
- demonstrate correct use of all occupant-protection systems that may be available on the school bus, including use of car safety seats, seat belt systems, and occupant-protection systems that are used by children with special medical or health needs.

Children with conditions such as anaphylactic allergies, severe asthma, diabetes, attention-deficit/hyperactivity disorder, autism or pervasive developmental disorder, and other chronic conditions may have health and safety issues during transport to and from school and school-related events. For that reason, the following are important:

- Drivers should be included in school plans for children with special medical and transportation needs.
- School bus drivers need to be aware of and prepared to intervene appropriately to ensure the safety of the individual child as well as all children on the trip. Interventions may require training beyond basic first aid.

School Bus Passenger Instruction

Passengers of all ages need to be taught safe riding and pedestrian behavior regardless of the frequency of school bus use. Instruction should include safe pedestrian practices going to and from the bus stop; safe behavior while waiting for the bus; safe practices for boarding and dis-

embarking the bus; safe behavior on the bus, including the use of child-restraint systems and seat belts when present; and procedures for emergency situations. Escort services for children crossing streets and roads should be considered.[30]

School Bus Passenger Supervision

Adult supervision on school buses should focus on ensuring that passengers stay seated and use age-appropriate car safety seats, seat belts, and other occupant-protection systems; ensuring that passengers keep their arms and heads inside the windows; assisting in emergency circumstances; assisting passengers with special needs; and escorting children across roadways. A second adult (other than the driver) serving as a monitor on the school bus can best meet these objectives. The Transportation Research Board states that it is generally agreed that monitors would enhance safety and reduce injuries by 25% to 75%; however, the cost estimate is high ($1.9 billion).[4]

School Bus Routes and Stops

Bus routes should be planned so that the bus does not have to back up, traffic disruptions are minimized, good fields of vision are provided at all stops, and the need for children to cross a street to board or leave the bus is minimized.[4] Escorting children across streets has the greatest potential for injury reduction.[4] Roads, traffic flow, traffic-control devices, and speed-limit enforcement should be maintained to optimize the safety of children.

Bicyclist and Pedestrian Travel to and From School

The motor, cognitive, and behavioral characteristics and abilities and limitations of children of different ages must be considered when assessing supervision needs necessary for students walking to and from school. There is no evidence that generic pedestrian-safety education is effective in reducing pedestrian injury. Bicyclists should be required to wear bicycle helmets properly.[31] Children using nonmotorized vehicles for school and school-related trips should be required to use safety equipment, including helmets.[32] Bicycle helmet use laws and enforcement increase helmet use.[33] Driver education in school zones, including drivers who drop off and pick up students, must be addressed. Most drivers exceed speed limits in school zones.[34] Safe Routes to School, an international movement, promotes infrastructure, environmental measures, enforcement, policy change, and education to enhance and promote safe walking.[35]

School-Zone Improvements

School-zone improvements would enhance the safety of all schoolchildren whether they walk, bike, take the school bus, or are dropped off and picked up with a passenger vehicle. These measures include marked drop-off and pick-up areas that are separate from school buses, school-zone speed-limit enforcement at 25 miles/hour, development of safe routes to school, and well-trained adult crossing guards. Crossing guards have been effective in improving pedestrian safety and have improved speed compliance and traffic control.[36] The NHTSA issued guidelines for a uniform approach for traffic controls for school areas that were designed to enhance the safety of pedestrians. These guidelines further recommend that a school-route travel plan be developed systematically by school, law enforcement, and traffic officials.[37] A multidisciplinary approach, involving school administrators, parent-teacher organizations, city planners, and law enforcement that includes infrastructure design as well as education of both students and drivers, offers potential to decrease death and injury to children in school zones.[38]

The AAP recommends the implementation of measures to improve the environmental infrastructure, including student supervision and crossing guards.

The Pediatrician's Role

The pediatrician should promote school transportation safety at 4 levels: patient and family, community, state, and national. Pediatricians can serve as child advocates and consultants to child care and schools about transportation safety.

For school bus travel, the AAP emphasizes its long-standing position that seat belts be installed on all newly manufactured school buses. Three-point seat belts provide the best protection for school-aged children who have outgrown car safety seats.

Patient and Family Counseling

1. When addressing child passenger safety, inform families that the AAP has guidelines and policy statements for safe transportation of schoolchildren in school buses and other vehicles used for preschool, school, and child care transportation. In particular, inform parents that the AAP recommends that all children who travel in school buses use age- and size-appropriate child-restraint systems and 3-point seat belts when they have outgrown child-restraint systems. Pediatricians should nevertheless counsel parents that large school buses, even when not equipped with seat belts, are the safest mode of school transportation.
2. Inform patients and families about the importance of bicycle helmets and other safety measures for children riding bicycles.
3. Inform parents that teens traveling together, especially with a teen driver, to and from school and to school-related events are at high risk of crash involvement and injury.
4. Promote passage and parent and community enforcement of graduated driver licensing laws, which

reduce fatal crash involvement of 16-year-old drivers by 16% to 21%.[39,40]

Community Role

5. Serve as a consultant to local parent groups, transportation directors, or school boards on the physical, cognitive, and psychosocial development of children as related to school transportation. Provide AAP guidelines and policy statements related to school transportation and teen driving.
6. Provide resources for communities to address safe routes for children who walk or bike to school.
7. Promote mandatory requirements for children to use bicycle helmets.
8. Advocate implementation of the recommendations of applicable policy statements at local school district meetings. Advocate for school districts to enforce graduated driver licensing laws.
9. Work with communities to plan for the transportation of children in planning new school sites and modifying existing sites.
10. Advocate for 3-point seat belt systems in all newly manufactured school buses

State Role

11. Serve as a consultant to state directors of school transportation to ensure that children's needs and AAP guidelines are addressed in school transportation plans.
12. Advocate for mandatory bicycle helmet use laws and enforcement.
13. Share information from AAP policy statements.
14. Serve as a resource and consultant to the state department of education regarding training of bus drivers in areas relating to child passenger safety and child development and behavior.
15. Serve as a resource and consultant to the state department of education on pedestrian and bicycle safety for schoolchildren.

National Role

16. Encourage research to support continued improvement in school bus design and school-zone safety.
17. Advocate for mandated complete collection and reporting of data on fatalities and injuries by school districts and school bus transportation companies for all crash and noncrash events involving the school bus and multipurpose vehicles.

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RESOURCE LIST

American Academy of Pediatrics, American Public Health Association, National Resource Center for Health, Safety in Child Care. *Caring for Our Children: National Health and Safety Performance Standards—Guidelines for Out-of-Home Child Care Programs.* Elk Grove Village, IL: American Academy of Pediatrics; 2002 [Guidelines for transportation of children are given.]

American Academy of Pediatrics, Healthy Child Care America. *Moving Kids Safety in Child Care.* Elk Grove Village, IL: American Academy of Pediatrics; 2002 [A curriculum for child care providers and administrators that covers seat restraints, route planning, air bag safety, car safety seats, booster seats, and more is provided.]

American Academy of Pediatrics. *Safe Transportation of Children With Special Needs: A Guide for Families.* Elk Grove Village, IL: American Academy of Pediatrics; 2002 [Information applicable to the safe transportation of children with special needs is provided.]

US Department of Transportation, Federal Highway Administration. Safe routes to school Web site. Available at: http://safety.fhwa.dot.gov/saferoutes [The goal of Safe Routes to School is to empower communities to get more children traveling safely to school on foot or bike with greater frequency. Available resources include, but are not limited to, information on federal funding, state contacts, and links to other Web sites including the National Safe Routes to School Clearinghouse.]

International Walk to School Web site. Available at: www.iwalktoschool.org

US Environmental Protection Agency. Clean school bus USA. Available at: www.epa.gov/otaq/schoolbus [provides clinicians and communities information on how to reduce pollution caused by school buses]

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on School Health

School-Based Mental Health Services

ABSTRACT. More than 20% of children and adolescents have mental health problems. Health care professionals for children and adolescents must educate key stakeholders about the extent of these problems and work together with them to increase access to mental health resources. School-based programs offer the promise of improving access to diagnosis of and treatment for the mental health problems of children and adolescents. Pediatric health care professionals, educators, and mental health specialists should work in collaboration to develop and implement effective school-based mental health services. ***Pediatrics*** **2004;113:1839–1845;** ***school, mental health, school-based health center, SBHC, medical home, adolescent, prevention, intervention, confidentiality, assessment, referral, evaluation, school counselor, risk behavior, resilience, individualized education program, IEP, therapy, special education, special needs, curricular, managed care, emotional disorder.***

ABBREVIATIONS. SBHC, school-based health center; AAP, American Academy of Pediatrics; IEP, individualized education program.

"*The burden of suffering experienced by children with mental health needs and their families has created a health crisis in this country.*"[1]

David Satcher, MD, PhD

Pediatric health care professionals increasingly are becoming aware of the high level of mental health needs of children. School violence, high dropout rates, bullying, high suicide and homicide rates, and increased levels of high-risk behaviors are reported commonly across the United States. The human and economic toll of inadequately addressing these mental health problems is significant. Untreated mental health disorders lead to higher rates of juvenile incarcerations, school dropout, family dysfunction, drug abuse, and unemployment.

The proportion of pediatric patients in which psychosocial problems are seen in primary care has increased from 7% to 19% over the past 20 years.[2] According to the 2001 US Surgeon General's report on children's mental health,[1] 20% of children need active mental health interventions, 11% have significant functional impairment, and 5% have extreme functional impairment. These data were derived from the Methodology for Epidemiology of Mental Disorders in Children and Adolescents study, which also found that 13% of children and adolescents have anxiety disorders, 6.2% have mood disorders, 10.3% have disruptive disorders, and 2% have substance abuse disorders, for a total of 20.9% having 1 or more mental health disorders. The Great Smoky Mountain Study of Youth found that 27% of children 9, 11, and 13 years of age have mental health impairment and 20% have a diagnosable mental health condition. This study also found that only 21% of children with mental health problems receive mental health services.[3] Similarly, the Ontario Child Health Study found that only 20% of children with emotional disorders had received mental or social services during the 6 months before the survey despite existence of universal health insurance in Canada.[4] Mental health and substance abuse issues are the most common reasons for visits to school-based health centers (SBHCs).[5]

Another potential indicator of the mental health of our children and adolescents may be the prevalence of risk behaviors. In the 2001 Youth Risk Behavior Survey coordinated by the Centers for Disease Control and Prevention, 30% of youth reported episodic heavy drinking, 14% reported frequent cigarette use, 24% reported using marijuana within the last month, and 9% reported a suicide attempt during the past 12 months.[6] In the United States, suicide is the third leading cause of death in youth 10 to 19 years of age. Homicide is the fourth leading cause of death for children 5 to 14 years of age and the second leading cause of death for youth 15 to 19 years of age.[7]

Acknowledging that mental health needs are significant, physicians must identify and address the barriers to mental health services. A recent American Academy of Pediatrics (AAP) policy statement addressed insurance and managed care barriers.[8] Many families will not address their mental health needs if their health insurance does not offer adequate coverage. Additional barriers include lack of transportation, financial constraints, child mental health professional shortages, and stigmas related to mental health problems. These barriers may help to explain why 40% to 60% of families who begin therapy terminate prematurely[9] and why most people attend only 1 to 2 sessions before terminating services.[10] Another significant barrier is the paucity of training in medical school and primary care residency programs. Pediatricians often are professionally unprepared and usually have inadequate appointment

time to address the mental health needs of children and adolescents. As a result, pediatricians may not uncover significant mental health problems. The medical home model does not require that pediatricians personally provide all services required by the families and children that they treat. This can be accomplished through collaboration and coordination with other agencies, such as mental health agencies, or mental health services provided in schools. Pediatricians can enhance the medical home model by improving communication with schools on mental health concerns of their patients and can improve access to mental health services by encouraging and supporting school-based mental health services.

School-based mental health services are evolving as a strategy to address these concerns by removing barriers to accessing mental health services and improving coordination of those services. School-based mental health services offer the potential for prevention efforts as well as intervention strategies. More than 75% of pediatricians support the provision of psychological and counseling services in schools, which include assessments, interventions, and referrals.[11] Schools are the primary providers of mental health services for many children.[3,12,13] School-based mental health services range from minimal support services provided by a school counselor to a comprehensive, integrated program of prevention, identification, and treatment within a school. In some schools, comprehensive mental health services are provided in an SBHC. There are now more than 1300 SBHCs, with most providing mental health services.[14]

SCHOOL-BASED MENTAL HEALTH SERVICES

One way to categorize components of a school or district's mental health program is to consider a 3-tiered model of services and needs. The first tier is an array of preventive mental health programs and services. Activities in this tier need to be ubiquitous so that they target all children in all school settings. Preventive programs are those that focus on decreasing risk factors and building resilience, including providing a positive, friendly, and open social environment at school and ensuring that each student has access to community and family supports that are associated with healthy emotional development. A sense of student "connectedness" to schools has been found to have positive effects on academic achievement and to decrease risky behaviors.[15] For example, schools should provide students with multiple and varied curricular and extracurricular activities, thereby increasing the chances that each student will feel successful in some aspect of school life. Schools also should provide numerous opportunities for positive individual interactions with adults at school so that each student has positive adult role models and opportunities to develop a healthy adult relationship outside his or her family. Schools can provide families with support services and should implement "prevention" curricula (eg, curricula that decrease risk-taking behaviors). Behavioral expectations, rules, and discipline plans should be well publicized and enforced school-wide. A recent review of effective programs is available for schools and those who advise schools on development of their preventive programs.[16]

The second tier consists of targeted mental health services that are designed to assist students who have 1 or more identified mental health needs but who function well enough to engage successfully in many social, academic, and other daily activities. Services in this tier would include the provision of group or individual therapy to students. For students in special education for learning problems who also have behavioral problems, this tier also may consist of the behavioral components of these students' individualized education programs (IEPs) or individual health service plans that address these students' behavioral issues.

The third tier of health services targets the smallest population of students and addresses needs of children with severe mental health diagnoses and symptoms. These students require the services of a multidisciplinary team of professionals, usually including special education services, individual and family therapy, pharmacotherapy, and school and social agency coordination.[17]

Outcome studies on school-based mental health models are limited, as are outcome studies on typical delivery methods of outpatient mental health services. The Bridges Project is a model that uses the 3-tiered model in schools and has demonstrated positive outcomes with improved school attendance, improved school grades, and improved scores on the Child Behavior Checklist and the Behavior and Emotional Rating Scale.[18]

Preventive Strategies

As they develop the first tier of services (a comprehensive mental health prevention program), each school and district should involve school nurses; pediatricians and other primary care physicians; mental health, social services, and other community agencies; and parents. The program should include: 1) multiple opportunities for students to build developmental assets and resilience to other stresses[19]; 2) behavior and discipline plans; and 3) mental health curricula (eg, violence prevention[20]) that are incorporated into other health education curricula (refer to Fig 1 for a visual description of these tiers of mental health in schools).

Behavior and discipline plans should be schoolwide and provide clear and consistent behavior expectations and consequences. School staff training should teach educators, administrators, and support staff specific fundamentals: 1) building a supportive school environment; 2) the essential components of behavior management techniques; and 3) early recognition of mental health problems. Many schools have prepared teachers, school nurses, and other staff members successfully to volunteer in student assistance programs, whereby these staff members lead after-school support groups designed to help students express themselves to their peers and adults within a safe, comfortable environment.

Schools should have multidisciplinary student-support teams that include school nurses, school

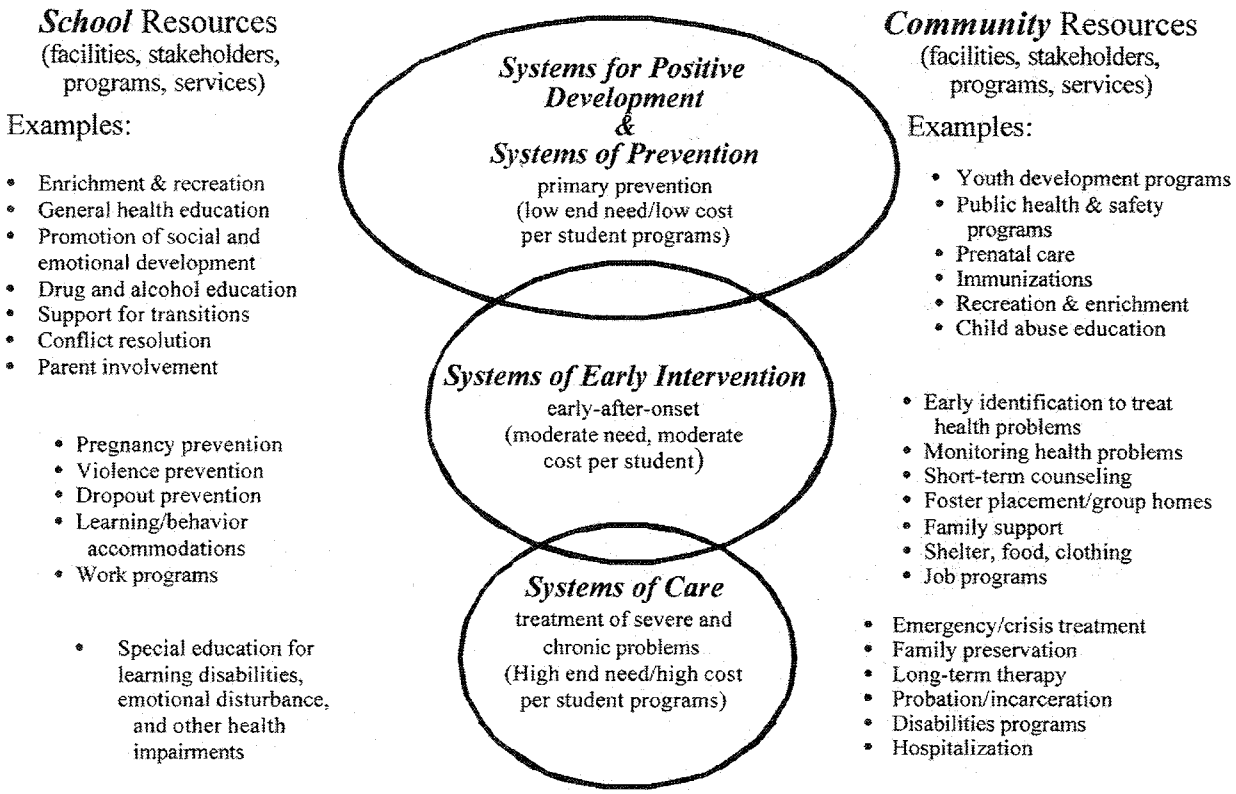

Fig 1. A comprehensive, multifaceted, and integrated approach to addressing barriers to learning and promoting healthy development. Adapted from various public domain documents written by H.S. Adelman and L. Taylor and circulated through the Center for Mental Health in Schools at the University of California (Los Angeles).

personnel, mental health consultants, and school physicians to review and plan evaluations and intervention strategies for students experiencing problems at school or otherwise identified as having potential mental health problems.

Schools can develop relationships with agencies that assist them with external stressors for students, including but not limited to housing, nutrition, clothing, employment, safety in their neighborhood, and after-school care. Support services for families can be established through the development of collaborative relationships with family resource centers. Other social agencies, public health departments, and providers of community-based services are also important partners.

Advantages of Basing Mental Health Services at School

Unlike preventive mental health services and those related to special education, the provision of other mental health services such as individual, group, or family counseling is optional for schools, yet many schools realize the value of helping families meet mental health needs and recognize distinct advantages to providing these services within the school system. One advantage of the familiar setting of school for provision of mental health services is that students and families avoid the stigma and intimidation they may feel when they go to an unfamiliar and perhaps less culturally compatible mental health settings. Of course, receiving services at school may put students at risk of another form of stigmatization, that is, stigmatization by their peers. This issue must be addressed on both a programmatic level (eg, discretion, strategic scheduling of appointments, private waiting areas) and individually with each student receiving services. Providing school-based mental health services eliminates the need for transportation of students to and from off-site appointments and facilitates parent participation in mental health appointments, because many parents live within walking distance of neighborhood schools. These advantages may encourage more parents to seek mental health care for their children and more students to self-refer for treatment. Kaplan et al[21] showed that adolescents with access to SBHCs with mental health services were 10 times more likely than students without such access to initiate a visit for a mental health or substance abuse concern (98% of such visits were at an SBHC). The convenience and comfort of having school-based mental health services also may promote a longer-lasting commitment to following through with all recommended therapy.

In addition to eliminating barriers to access to care, school-based mental health services offer the potential to improve accuracy of diagnosis as well as assessment of progress. One of the major challenges to providing mental health services to students is gaining access to information concerning the functionality of the student in various environments. Schools have a wealth of opportunities to acquire information on how children deal with physical and social stresses and challenges and on how they perform in the academic setting, on community-related roles in

which children engage (eg, in sports, with younger children as a mentor, etc), and on the nature and extent of many sorts of interpersonal relationships (eg, adults, peers).

Mental Health Service Delivery Models

Schools have a convoluted history of involvement in mental health since the late 1890s, when psychology clinics were placed in some schools in Philadelphia, Pennsylvania.[22] Today, some schools have mental health curricula and offer students the services of a wide array of social and mental health professionals, including social workers; guidance counselors; school psychologists; mental health therapists providing group, child, and/or family therapy; and mental health units within SBHCs. These services may be provided by schools or public or private mental health professionals or agencies. The following 3 models are not mutually exclusive. Many schools offer components of more than 1 of these models.

1. School-supported mental health models
   - Social workers, guidance counselors, and school psychologists are employed directly by the school system.
   - Separate mental health units exist within the school system.
   - School nurses serve as a major portal of entry for students with mental health concerns.
2. Community connections models
   - A mental health agency or individual delivers direct services in the school part-time or full-time under contract.
   - Mental health professionals are available within an SBHC or are invited into after-school programs.
   - There is a formal linkage to an off-site mental health professional and/or to a managed care organization.
3. Comprehensive, integrated models
   - A comprehensive and integrated mental health program addresses prevention strategies, school environment, screening, referral, special education, and family and community issues and delivers direct mental health services.
   - SBHCs provide comprehensive and integrated health and mental health services within the school environment.

A recent pilot study[23] on cost of care reported that school-based mental health services were less expensive than private or community-based mental health services. Therefore, cost of providing mental health services at school, versus traditional settings, should not be an inhibiting factor for health insurers (private or Medicaid) and managed care organizations that are already resolved to providing these services somewhere.

Currently, there is great diversity in the scope of mental health services delivered in the school setting. Unfortunately, there is no comprehensive report available on the extent of mental health services offered in schools across the country. Although some schools may not offer any clearly defined mental health programs, most of them offer at least a school guidance counselor. Some schools have specific mental health programs offered on campus through local mental health agencies (multiprofessional groups, outpatient clinics of hospitals, agencies that provide mental health services under Medicaid), local mental health professionals, or arrangements with managed care organizations. Other schools have mental health programs through an SBHC. In a survey of SBHCs performed by Making the Grade,[14] 25% of visits to SBHCs were for mental health reasons. Almost 60% of all SBHCs offer mental health services, averaging 33 hours per week of coverage by a mental health professional.[14]

SPECIAL EDUCATION AND MENTAL HEALTH SERVICES

When providing a mental health service is an integral part of the child's education, the mental health service is mandated by law to be provided by schools. Severe conduct disorders, psychoses, and severe emotional problems are examples of mental health disorders that often impede the student's ability to be educated in a general education program. Rarely, when attention-deficit disorders are not readily treated by medications and the severity precludes students from benefiting from even a modified regular educational program and environment, students with this disorder are placed in a special education program. Services for students with these diagnoses who qualify for special education on the basis of their mental health status may include provision of classrooms with a high teacher-to-student ratio, special education teachers who have been trained to deal with disordered conduct and emotional problems, availability of child psychiatrists and/or psychologists who can help teachers troubleshoot difficult situations, IEPs that include detailed behavior management plans, and ability of the school to deliver multiple medications and monitor the benefits and adverse effects of these medications at school. These services may be provided in either separate or integrated schools. Often, these students attend their neighborhood school but are placed in special classrooms. Other students can be completely integrated with regular education students. Some schools or classrooms operate as day-treatment programs, but they are located on school campuses and have an educational component. As with other services, mental health services provided as part of a student's IEP should allow the student to be in the least restrictive school setting, have clear goals and objectives that are individualized to each student's particular needs, have well-outlined activities that are specifically designed to meet educational program goals, and have designated personnel to carry out the activities. If the school provides transportation to school or school-sponsored extracurricular activities or field trips, accommodations need to be considered so that students do not miss mental health appointments and yet can participate to the fullest extent possible in extracurricular activities. Many of the services that schools provide to these students may be reimbursed through Medicaid pro-

grams for students who are eligible for and enrolled in Medicaid.

CHALLENGES IN SCHOOL-BASED MENTAL HEALTH PROGRAMS

Several challenges exist in school-based mental health care. First, services must be coordinated with the medical home (usually this will be a primary care physician), mental health professionals, and social agencies. Otherwise, services may be duplicated or crucial patient needs may be overlooked. Second, services must be integrated within the school environment so that school personnel view the mental health services as an integral part of the educational system. Integration necessitates gaining the support of the school administration and staff, obtaining confidential space, working with school schedules to minimize missed class time, and avoiding turf issues. Third, because parents are a vital element in mental health treatment for children, creative strategies must be devised to solicit parental involvement in school-based intervention services, not merely parental consent. Finally, because confidentiality of mental health information is mandated by law, a well-defined system must be developed. There must be written, informed consent that is designed to protect confidential information but allow sharing of information that pertains to a student's education and socialization at school or that needs to be shared to ensure the safety of students and staff. School staff members must understand and honor confidentiality, and students and parents should be encouraged to allow sharing of information that would improve the student's success at school. Breaking confidentiality should never be taken lightly but would be necessary when a student is thought to be likely to harm himself or herself or others. Without these confidentiality policies, students and their parents will not trust the mental health care system and may undermine the intent of the services. Specific issues regarding adolescent confidentiality are discussed in the AAP policy statement "Confidentiality in Adolescent Health Care."[24]

School staff members and mental health professionals need to be sensitive to the appropriateness of dealing with certain health issues. It may be determined, for example, that for certain students who are victims of sexual abuse, services are more confidentially provided at a site off the school campus.

Screening for mental health illness differs significantly from early identification of mental illness. A screening program, for example, might evaluate all students in a 6th-grade class for mental illness, whereas an early-identification program would educate staff to recognize early signs and symptoms of illness. Many screening tools have been established for mental health and have been shown to be effective when used in physicians' offices. There is not any scientific evidence yet to support performing school-based screening programs using these tools.

RECOMMENDATIONS FOR SCHOOLS

1. The mental health program (preventive strategies and mental health services) should be coordinated with educational programs and other school-based health services. School social workers, guidance counselors, school psychologists, school nurses, and all mental health therapists should plan preventive and intervention strategies together with school administrators and teachers as well as with families and community members.
2. Preventive mental health programs should be developed that include a healthy social environment, clear rules, and expectations that are well publicized. Staff members should be trained to recognize stresses that may lead to mental health problems as well as early signs of mental illness and refer these students to trained professionals within the school setting.
3. Mental health referrals (within the school system as well as to community-based professionals and agencies) should be coordinated by using written protocols, should be monitored for adherence, and should be evaluated for effectiveness.
4. School-based specific diagnostic screenings, such as for depression, should be implemented at school only if they have been supported by peer-reviewed evidence of their effectiveness in that setting.
5. Roles of all the various mental health professionals who work on campus with students should be defined so that they are understood by students, families, all school staff members, and the mental health professionals themselves.
6. Group, individual, and family therapies should be included as schools arrange for direct services to be provided at school sites. Alternatively, referral systems should be available for each of these modes of therapy so that students and families receive the mode of therapy most appropriate to their needs.
7. It should be documented that mental health professionals providing services on site in school (whether hired, contracted, or invited to school sites to provide services) have training specifically in child and adolescent mental health (appropriate for students' ages) and are competent to provide mental health services in the school setting.
8. Private, confidential, and comfortable physical space should be provided at the school site. Often, this is not difficult for schools if mental health services are provided after school hours. Having school-based services should not preclude the opportunity for mental health services to be provided at nonschool sites for situations in which therapy at school for a student may be ill advised (eg, a student who feels uncomfortable discussing a history of sexual abuse at the school setting). During extended school breaks, schools must provide continued access to mental health services.
9. Staff members should be provided with opportunities to consult with a child psychiatrist or clinical psychologist (on or off the school site) so that they may explore specific difficult situations or student behaviors and review school policies,

programs, and protocols related to mental health.
10. Quality-assurance strategies should be developed for mental health services provided at school, and all aspects of the school health program should be evaluated, including satisfaction of the parent, student, third-party payers, and mental health professionals.
11. Confidentiality of health information should be maintained, as mandated by law.

RECOMMENDATIONS FOR PEDIATRICIANS AND OTHER PROVIDERS OF PRIMARY CARE FOR CHILDREN AND ADOLESCENTS

The following recommendations are targeted to individual pediatricians and/or groups of physicians such as local chapters of the AAP:

1. An ecologic view of mental health should be taken, and support structures should be built not just for individual patients but also for the community. Pediatricians should advocate for schools to develop comprehensive mental health programs with a strong preventive component that focuses on building strengths and resilience, not just on problems, and that involves students' families.
2. Pediatricians should develop a relationship with local schools, serve on school health advisory councils, and promote school-based mental health services (as outlined in "Recommendations for Schools").
3. Management of one's own patients with mental health problems should be coordinated with school-based mental health professionals.
4. Mental health services should be included in IEPs for patients enrolled in a special education program.
5. Pediatricians should advocate for financial and institutional changes that are likely to provide medical homes and families with the option of access to mental health services through school settings, such as coverage of school-based mental health services by health insurers and school billing of Medicaid for school-based mental health services payable under this program.
6. Pediatricians should work with schools to help identify strategies and community resources that will augment school-based mental health programs.
7. Outcomes-based research should be performed on the effectiveness of various school-based mental health models that are designed to improve psychosocial and academic outcomes.
8. Pediatricians, through enhanced collaboration and communication with school mental health service professionals, can strengthen the medical-home model and improve the mental health of their patients.

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Scope of Health Care Benefits for Children From Birth Through Age 26

COMMITTEE ON CHILD HEALTH FINANCING

KEY WORDS

ancillary services, diagnosis, durable medical equipment, emergency care, health care insurance benefits, hospitalization, preventive services, physician services, prescriptions, therapeutic services

ABBREVIATIONS

AAP—American Academy of Pediatrics

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abstract

FREE

The optimal health of all children is best achieved with access to appropriate and comprehensive health care benefits. This policy statement outlines and defines the recommended set of health insurance benefits for children through age 26. The American Academy of Pediatrics developed a set of recommendations concerning preventive care services for children, adolescents, and young adults. These recommendations are compiled in the publication *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents,* third edition. The Bright Futures recommendations were referenced as a standard for access and design of age-appropriate health insurance benefits for infants, children, adolescents, and young adults in the Patient Protection and Affordable Care Act of 2010 (Pub L No. 114–148). *Pediatrics* 2012;129:1–5

This policy statement sets forth recommendations for the design of a comprehensive benefit package that covers infants, children, adolescents, and young adults through age 26 and is consistent with the Maternal and Child Health Plan Benefit Model: Evidence-Informed Coverage.[1] These benefit recommendations apply to all public and private health plans. The services outlined in this statement encompass medical care, preventive care, critical care, pediatric surgical care, behavioral health services, and oral health for all children, including those with special health care needs.

That payment schedules must cover the fixed and variable costs of providing the services is implied in the identification of services and products necessary to ensure the health of children. In addition, payments should be adequate so that physicians, pediatric service providers, and manufacturers will have continued incentive to remain in (or enter into) the business of caring for the health and developmental needs of children. Because of the variety and complexity of systems for delivering care and for providing payments, a complete discussion is beyond the scope of this statement; however, without adequate payment there is significant risk that children and families will be unable to access services and products needed to maintain and promote health in children. This risk is compounded by the recognition that health in adulthood is predicted by health in childhood. It is critical to stress that adequate payment for the provision of child health care services is a vital investment in life span health.

This statement replaces the 2006 statement "Scope of Health Care Benefits for Children from Birth Through Age 21."[2]

ESSENTIAL BACKGROUND

All infants, children, adolescents, and young adults through 26 years of age must have access to comprehensive health care benefits to ensure their optimal health and well-being. These benefits must be available through Medicaid, the Children's Health Insurance Program (CHIP), and private health insurance plans, whether the plan sponsor is a commercial insurance company, a self-funded employer, or other arrangement. The Patient Protection and Affordable Care Act of 2010 (Pub L No. 111-148) also mandated the establishment of health insurance exchanges, wherein health plans must provide a minimum set of health benefits. The minimum health benefits for pediatrics include essential services, such as preventive care, hospitalization, ambulatory patient services, emergency medical services, maternity and newborn care, and mental health and substance abuse disorder services. Also included in the set of benefits are behavioral health, rehabilitative, and habilitative services and devices; laboratory services; chronic disease management; and oral, hearing, and vision care. Some of these benefits may be available or provided through the educational and public health systems for children with special needs and children who are uninsured or have inadequate coverage.

Health care benefits should begin with the full array of services recommended by the American Academy of Pediatrics (AAP). Coverage determinations of existing interventions should be based on evidence of usefulness and understanding of risks. Health care benefit coverage should reflect changes in treatment modalities and should adapt to new evidence and changes in standards of care, as well as innovations in care. Recognizing the importance of scientific evidence does not mean that coverage of existing interventions should be denied in the absence of conclusive scientific evidence. If sufficient scientific evidence for an intervention is not available, professional standards of care must be considered. If professional standards of care do not exist or are outdated or contradictory, decisions about existing interventions must be based on consensus pediatric expert opinion (according to the AAP working definition in "Model Contractual Language for Medical Necessity for Children").[3] The benefits should be delivered in an efficient manner by appropriately trained professionals, including primary care pediatricians and other generalists, pediatric medical subspecialists, pediatric surgical specialists, and pediatric dental professionals. These services should be delivered and coordinated in a comprehensive, patient- and family-centered, physician-led medical home—the setting for primary care delivered or directed by well-trained physicians who are known to the child and family, who have developed a partnership of mutual responsibility and trust with them, and who provide accessible, continuous, coordinated, and comprehensive care. These services should include but are not limited to the following broad categories: preventive services; physician/health care provider services; emergency care; hospitalization and other facility-based care; therapeutic services/durable medical equipment/ancillary services; and laboratory, diagnostic, assessment, and testing services.

PREVENTIVE SERVICES

Preventive services primarily assess risk factors for, or prevent the development of, medical conditions or developmental disorders that affect health or development. Preventive services include the following:

A. Health supervision with comprehensive preventive care, according to the AAP "Recommendations for Preventive Pediatric Health Care,"[4] and *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*.[5]
B. Immunizations according to recommendations included in the most current version of the "Recommended Childhood and Adolescent Immunization Schedules."[6]
C. Educational, counseling, and support services for all children, including but not limited to the following:
    1. Anticipatory guidance relating to normal growth and development;
    2. Tobacco-cessation counseling and treatment services for children and/or household contacts; and
    3. Services related to the maintenance of a healthy weight—prevention, management, and treatment of pediatric obesity, malnutrition, eating disorders, or nutritional deficiency, including nutrition counseling and follow-up with physician or credentialed nutritionist and all necessary laboratory services, including evaluation of risk factors.
D. Preventive pediatric oral health services, including the following:
    1. Oral health risk assessment, fluoride varnish, sealants, and similar preventive oral care;
    2. Provision of anticipatory guidance examinations and/or diagnostic investigations; and
    3. Oral surgery, including moderate sedation and general anesthesia services, as indicated, to treat oral health problems.
E. Early intervention services for mental health/substance abuse.
F. Preventive vision services, including screenings and examinations by individuals trained in the care of children for the purpose of

early identification of vision problems.

G. Preventive audiology services, including screening and evaluations by professionals trained in the care of children to provide early detection and diagnosis of hearing problems. These services include newborn and other age-appropriate hearing screenings.

H. Preventive reproductive health services, including coverage for counseling and education to promote healthy choices regarding sexuality, as well as appropriate and effective means of minimizing risks of sexually transmitted diseases and preventing unintended pregnancy. Coverage should also be provided for transition of care to other specialists for treatment of pregnancy in young women or appropriate specialists for children with sexually transmitted diseases for whom treatment is beyond the scope of usual pediatric care.

I. Preventive prenatal care, including prenatal consultation with a pediatrician, as well as counseling and services for all pregnancy and fetal management options, including evaluation of psychological risk factors that may affect the health and safety of the infant or family.

J. Preventive postpartum care, including the following:
   1. Newborn screening for metabolic and genetic disorders, as well as hearing screening and other appropriate tests;
   2. Prompt follow-up visit in the physician's office (as in between 48 and 72 hours following discharge) when indicated by the infant's condition and/or on the recommendation of the infant's physician;
   3. Lactation counseling to increase successful breastfeeding initiation and duration; and
   4. A reasonable length of stay for the newborn infant to permit identification and treatment of early problems and to ensure that the family is able and prepared to care for the infant at home.

PHYSICIAN/HEALTH CARE PROVIDER SERVICES

Physician/health care provider services are delivered (1) in the primary care/medical home setting, (2) by a medical subspecialist or surgical specialist in coordination with the child's primary care physician, or (3) under the direction of the primary care physician in the patient's home or other setting. These services are directed toward diagnosis, appropriate treatment, rehabilitation, or palliative care of diseases and congenital or acquired health conditions. Physician/health care provider services include the following:

A. Diagnosis and treatment of medical conditions.

B. Educational counseling and support services for all children (see also the previous section on preventive services).

C. Transition to adult medical care services for youth.

D. Palliative and hospice care for children with serious or life-threatening conditions.

E. Pediatric medical subspecialty services, including team subspecialty care, family planning, and reproductive services.

F. Pediatric surgical care, including the following:
   1. Pediatric surgical care and surgical specialty services, including comprehensive repair of congenital anatomic malformations; and
   2. Anesthesia and acute and chronic pain management services provided by clinicians with training and expertise in special considerations of pediatric anesthesia care.

G. Behavioral health services, including the following:
   1. Mental health services, including (a) diagnostic evaluation and care planning/coordination services; (b) age-appropriate counseling interventions, including individual, group, or family therapy; family-child interaction training; and behavioral therapy training; (c) psycho-educational testing; (d) crisis management; (e) inpatient and day treatment; and (f) residential care. These services should be covered for behavioral and mental health problems that occur in childhood, impair child or family function, threaten the future health of the child, or impair social relationships and/or academic success.
   2. Services for disorders relating to substance use, abuse, and dependence, including (a) screening, early intervention, and crisis management; (b) appropriate treatment interventions; (c) inpatient and outpatient treatment; and (d) residential care.
   3. Comprehensive medical and psychological evaluation, treatment, and care coordination for suspected or substantiated child physical, emotional, or sexual abuse and/or neglect in both inpatient and outpatient settings.
   4. Individual and family grief and bereavement counseling.

H. Prenatal and neonatal services, including the following:
   1. Genetic counseling and related services, as indicated;

2. Prenatal case management, including consultation with a pediatrician;
3. Care in response to complications resulting from problems during pregnancy, labor, or delivery;
4. Care of all newborn infants, including the following:

a. attendance of a pediatric- or neonatology-trained provider for management of high-risk deliveries or where mandated by hospital regulations;
b. health supervision;
c. treatment of congenital anomalies and other medical and surgical conditions; and
d. newborn intensive care services.

I. Physician-directed, accurate pediatric medical information shared by telephone, telemedicine, e-mail, and/or other Internet services for established and new patients related to pediatric care. This information may include responses to patient or family questions, or may consist of outreach to specific patients relating information deemed important to their health, which may not merit the need for an office visit intervention. These communications should be compliant with regulations of the Health Insurance Portability and Accountability Act of 1996 (HIPAA [Pub L No. 104-191]).

J. Home health care services, where appropriate.

K. Coverage of medical home– or physician-based care coordination and/or case management services (case management may be provided by a case manager or other qualified health care provider working collaboratively with the patient's family and health care team to develop, monitor, and revise a plan to meet the patient's immediate and ongoing health care needs; all children with special health care needs and women with high-risk pregnancies should have access to and coverage for case-management services), including arrangement, coordination, sharing of information among care providers, and monitoring of health care and developmental services to meet the needs of a patient and his or her family.[7]

EMERGENCY CARE, HOSPITALIZATIONS, AND OTHER FACILITY-BASED CARE

These services address acute health care needs, ongoing illness, health or developmental conditions, or injury.

A. Emergency medical and trauma services specifically for children. These services should be covered without regard to preferred provider networks or preferred facility designations, if facility selection is involuntary.

B. Inpatient hospital and critical care services, including labor and delivery/birth center services, acute care, psychiatric care, inpatient rehabilitation, and substance abuse services.

C. Intermediate or skilled nursing facility care in residential and rehabilitative/habilitative settings.

D. Telemedicine services for emergency departments or inpatient facilities that do not have pediatric coverage for critically ill children.

E. Emergent and nonemergent transfer/transport to a hospital or health facility, between health facilities, and between home and health facilities when indicated.

THERAPEUTIC SERVICES/DURABLE EQUIPMENT/ANCILLARY SERVICES

These include specialty services performed in the health care provider's office or delivered in the patient's home or a health care facility, as well as products needed for maintenance of health or treatment of disease.

A. Coverage for medications, biologics, or other compounds included in the US Pharmacopeia with evidence of safety and effectiveness for the treatment of specific conditions.

B. Pediatric oral health services, including the following:
1. Restorative pediatric dental care, including oral surgery with appropriate sedation or anesthesia as needed to correct dental or oral health problems; and
2. Orthodontic services and appliances to correct problems with tooth and jaw alignment that contribute to other medical conditions.

C. Vision services, including corrective lenses, surgery, or other treatments by professionals trained in the care of children, and access to pediatric ophthalmologists for treatment of medical conditions of the eye.

D. Corrective audiology and speech therapy services, delivered by those trained in the care of children. These services include assistive technology (hearing aids, cochlear implants, and so forth) and speech therapy services for children with speech delay.

E. Nutritional evaluation and counseling services by pediatricians, dietitians, nutritionists, and other therapists for eating disorders (including primary obesity, anorexia, and bulimia) and specific nutritional deficiencies.

F. Special diets, infant formulas, nutritional supplements, and delivery (feeding) devices for nutritional

support and disease-specific metabolic needs.

G. Physical, occupational, speech (including speech-generating devices), and respiratory therapy for rehabilitation and habilitation provided in medical centers, private/public-sector offices, schools, residential settings, and the home.

H. Home health care services, including but not limited to physician supervision of care, therapies, private-duty nursing, and home health aides.

I. Rehabilitative and habilitative services and devices.

J. Rental, purchase, maintenance, and service of durable medical equipment, including but not limited to the following:
   1. Equipment necessary to administer aerosolized medications and monitor their effects (nebulizer, spacers for inhalers, peak flow meters);
   2. Glucometers, insulin pumps, and enteral nutrition pumps;
   3. Breast pumps and accessories;
   4. Prostheses/braces, wheelchairs, lifts, and other mobility aids;
   5. Ventilators, positive airway pressure devices, and other pulmonary treatment and monitoring equipment;
   6. Cardiorespiratory monitors, such as pulse oximeters or apnea monitors;
   7. Home dialysis equipment;
   8. Automated home blood pressure monitors; and
   9. Equipment for home-based treatment of newborn jaundice.

K. Disposable medical supplies, including but not limited to the following:
   1. Diapers for developmentally compromised patients;
   2. Urine catheters and ostomy supplies;
   3. Tracheostomy care needs, suction catheters for managing pulmonary secretions, and other tubing and/or mask needs;
   4. Tubing for delivering intravenous or enteral fluids; and
   5. Test strips, lancets, syringes, needles, insulin pump supplies, and other diabetic supplies.

L. Respite services for caregivers of children with special health care needs.

LABORATORY, DIAGNOSTIC, ASSESSMENT, AND TESTING SERVICES

These include services that determine the risk, presence, severity, prognosis, or cause of an illness or testing for diagnosing a specific illness, injury, or disability.

A. Laboratory and pathology services.

B. Diagnostic, assessment, and therapeutic services, such as radiology services, and including age-appropriate sedation as needed.

C. Standardized assessment and monitoring tools for identification, diagnosis, and monitoring of educational, developmental, behavioral, and mental health conditions.

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Special Article

Practice parameter: Screening and diagnosis of autism

Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Child Neurology Society

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Article abstract—Autism is a common disorder of childhood, affecting 1 in 500 children. Yet, it often remains unrecognized and undiagnosed until or after late preschool age because appropriate tools for routine developmental screening and screening specifically for autism have not been available. Early identification of children with autism and intensive, early intervention during the toddler and preschool years improves outcome for most young children with autism. This practice parameter reviews the available empirical evidence and gives specific recommendations for the identification of children with autism. This approach requires a dual process: 1) routine developmental surveillance and screening specifically for autism to be performed on all children to first identify those at risk for any type of atypical development, and to identify those specifically at risk for autism; and 2) to diagnose and evaluate autism, to differentiate autism from other developmental disorders.

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This statement has been endorsed by the American Academy of Audiology, the American Occupational Therapy Association, the American Speech–Language–Hearing Association, the Autism National Committee, Cure Autism Now, the National Alliance for Autism Research, and the Society for Developmental Pediatrics.

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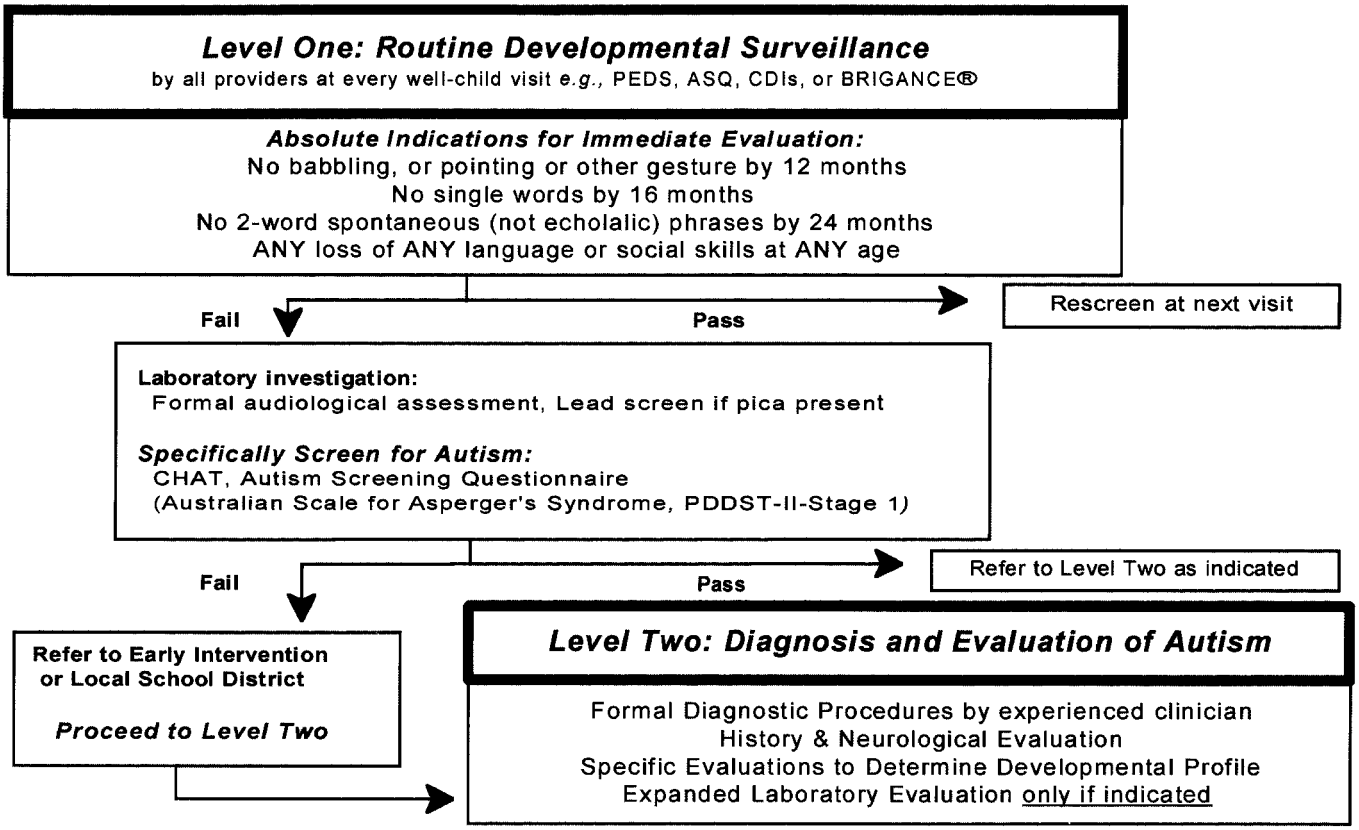

Figure. Practice parameter algorithm.

Autism, autistic spectrum, and pervasive developmental disorders encompass a wide continuum of associated cognitive and neurobehavioral disorders, including the core-defining features of impaired socialization, impaired verbal and nonverbal communication, and restricted and repetitive patterns of behavior (table).[1] Between 60,000 and 115,000 children under 15 years of age in the United States meet diagnostic criteria for autism based on recent prevalence estimates of 10 to 20 cases per 10,000 people. In 1,300 families recently surveyed, the average age at diagnosis of autism was about 6 years, despite the fact that most parents felt something was wrong by 18 months of age and usually sought medical assistance by age 2 years.[2] Fewer than 10% of the children were diagnosed at initial presentation; another 10% were either told to return if their worries persisted, or that their child "would grow out of it." The rest were referred to another professional (at a mean age of 40 months), of which only 40% were given a formal diagnosis, 25% were told "not to worry," and 25% were referred to a third or fourth professional. Almost 20% reported that they either had to exert considerable pressure to obtain the referrals or pay privately. Over 30% of parents referred to subsequent professionals reported that no help was offered (e.g., with education, therapy, or referrals to parent support groups), and only about 10% reported that a professional explained their child's problems. Almost half of the families reported that the school system and other parents were the major source of assistance over time, rather than the medical health care community.

The diagnosis of autism often is not made until 2 to 3 years after symptoms are recognized, primarily because of concerns about labeling or incorrectly diagnosing the child. Identifying children with autism and initiating intensive, early intervention during the preschool years results in improved outcomes for most young children with autism.[3-7] Early diagnosis of autism and early intervention facilitates earlier educational planning, provisions for family supports and education, management of family stress and anguish, and delivery of appropriate medical care and treatment.[3-7]

Clinically identifying children with autism requires two levels of investigation, each addressing a distinct component of patient management (figure).[1] The first level, *Routine Developmental Surveillance and Screening Specifically for Autism*, should be performed on all children and involves first identifying those at risk for any type of atypical development, followed by identifying those specifically at risk for autism. Mental retardation or other medical or neurodevelopmental conditions require separate evaluations and are not within the scope of this document.

The second level, *Diagnosis and Evaluation of Autism*, involves a more in-depth investigation of already identified children and differentiates autism from other developmental disorders. In-depth diagnosis and

Table *Diagnostic Criteria for 299.00 Autistic Disorder*

A. A total of six (or more) items from (1), (2), and (3), with two from (1), and at least one each from (2) and (3):

1. Qualitative impairment in social interaction, manifest by at least two of the following:
   - Marked impairment in the use of multiple nonverbal behaviors, such as eye-to-eye gaze, facial expression, body postures, and gestures, to regulate social interaction
   - Failure to develop peer relationships appropriate to developmental level
   - Lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by lack of showing, bringing, or pointing out objects of interest)
   - Lack of social or emotional reciprocity
2. Qualitative impairment in communication, as manifest by at least one of the following:
   - Delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
   - In individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
   - Stereotyped and repetitive use of language, or idiosyncratic language
   - Lack of varied, spontaneous make-believe, or social imitative play appropriate to developmental level
3. Restrictive repetitive and stereotypic patterns of behavior, interests, and activities, as manifested by at least one of the following:
   - Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
   - Apparently inflexible adherence to specific nonfunctional routines or rituals
   - Stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
   - Persistent preoccupation with parts of objects.

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years:

1. Social interaction
2. Language as used in social communication
3. Symbolic or imaginative play

C. The disturbance is not better accounted for by Rett's disorder or childhood disintegrative disorder.

The other pervasive developmental disorders include Asperger's disorder, Rett syndrome, childhood disintegrative disorder, pervasive developmental disorder—not otherwise specified (PDD-NOS), or atypical autism.

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Detailed information on other PDD diagnoses can be found in the comprehensive background paper.[1]

evaluation are important in determining optimal interventional strategies based on the child's profile of strengths and weaknesses. For these two areas of investigation, specific clinical questions were defined (see Appendix 2), clinical evidence was summarized, and diagnostic recommendations were developed.

Evidence and recommendations are presented in three sections. The first two sections, *Level One: Routine Developmental Surveillance and Screening Specifically for Autism,* and *Level Two: Diagnosis and Evaluation of Autism,* first present the empiric data for each question and are followed by recommendations linked to the specific evidence. Each is followed by a section on *Recommendations for Research.* The third section, *Consensus-Based General Principles of Management*, presents additional recommendations based on broad consensus. Additional information about autism, including behavioral aspects associated with the core defining deficits, methodology, and clinical evidence are described in the background paper.[1] Specific information about the recommended developmental screening and diagnostic tools can be found at *http://www.aan.com* under *AAN Resources: Practice Statements: Official AAN Practice Statements: Autism, Screening and diagnosis of.*

Description of the process. Experts in the surveillance/screening and diagnosis of autism were selected by 11 professional organizations (see Appendix 1) and convened in June 1998 and January 1999. They reviewed and evaluated the quality of the evidence from the published literature, developed a consensus of evidence-based management recommendations, and published a comprehensive background paper on the surveillance, screening, and diagnosis of autism.[1] Evidence reviewed for this parameter was identified through literature searches using MEDLINE and PsychINFO. Relevant articles were included from all languages using the following search terms: autistic; OR autism; OR pervasive, and NOT treatment. This search produced over 4,000 citations, from which 2,750 studies met the following inclusion criteria: clinical papers published since 1990; review papers and meta-analyses developed for DSM-IV; and the overview of the *National Institutes of Health State of the Science Conference on Autism in 1995.* Relevant book chapters and books were also included, as identified by the expert panel.

The strength of the evidence for each relevant article and book chapter was ranked using the defined criteria shown in Appendix 3. Recommendations were thereby derived based on the strength of the evidence and stratified (**Standard, Guideline,** or **Practice Option**) as defined in Appendix 3.

Level one: routine developmental surveillance and screening specifically for autism. *Analysis of the evidence.* When and how often should developmental surveillance/screening be performed? Approximately 25% of children in any primary care practice show developmental issues. However, fewer than 30% of primary care providers conduct standardized screening tests at well-child appointments.[8-10] The American Academy of Pediatrics (AAP) stresses the

importance of a flexible, continual developmental surveillance process at each well-child visit, and recommends eliciting and valuing parental concerns, probing regarding age-appropriate skills in each developmental domain, and observing each child.[11]

What are the appropriate developmental screening questionnaires that provide sensitive and specific information? Developmental screening tools have been formulated based on screening of large populations of children with standardized test items. Sensitive and specific developmental screening instruments include: the Ages and Stages Questionnaire, the BRIGANCE® Screens, the Child Development Inventories, and the Parents' Evaluations of Developmental Status.[1]

The Denver-II (DDST-II, formerly the Denver Developmental Screening Test-Revised) has been the traditional tool used for developmental screening, but research has found that it is insensitive and lacks specificity. The Revised Denver Pre-Screening Developmental Questionnaire (R-DPDQ) was designed to identify a subset of children who needed further screening. However, studies have shown that it detected only 30% of children with language impairments and 50% of children with mental retardation.[12-15]

How are conventional developmental milestones defined? Conventional developmental language milestones are based on normative data from numerous standardized language instruments for infants.[16-19] Lack of acquisition of the following milestones within known accepted and established ranges is considered abnormal: no babbling by 12 months; no gesturing (e.g., pointing, waving bye-bye) by 12 months; no single words by 16 months; no 2-word spontaneous (not just echolalic) phrases by 24 months; and any loss of any language or social skills at any age. Failure to meet these milestones is associated with a high probability of a developmental disability.

Do parents provide reliable information regarding their child's development? Several studies encompassing 737 children showed that parental concerns about speech and language development, behavior, or other developmental issues were highly sensitive (i.e., 75% to 83%) and specific (79% to 81%) in detecting global developmental deficits.[20-22] However, the absence of such concerns had modest specificity in detecting normal development (47%).[20] An additional study that combined parental concern with a standardized parental report found this to be effective for early behavioral and developmental screening in the primary care setting.[23]

Can autism be reliably diagnosed before 36 months of age? Because there are no biological markers for autism, screening must focus on behavior. Recent studies comparing 109 autistic and 33 typically developing children demonstrated that problems with eye contact, orienting to one's name, joint attention, pretend play, imitation, nonverbal communication, and language development are measurable by 18 months of age.[24-27] These symptoms are stable in children from toddler age through preschool age. Retrospective analysis of home videotapes have also identified behaviors that distinguish infants with autism from other developmental disabilities as early as 8 months of age.[28-30]

Current screening methods may not identify children with milder variants of autism, those without mental retardation or language delay, such as verbal individuals with high-functioning autism and Asperger's disorder, or older children, adolescents, and young adults.

Is there an increased risk of having another child with autism (recurrence)? The incidence of autism in the general population is 0.2%, but the risk of having a second (or additional) autistic child increases almost 50-fold to approximately 10 to 20%.[31-34]

What tools are available with appropriate psychometric properties to specifically screen for autism? Appropriately sensitive and specific autism screening tools for infants and toddlers have only recently been developed, and this continues to be the current focus of many research centers. The Checklist for Autism in Toddlers (CHAT) for 18-month-old infants, and the Autism Screening Questionnaire for children 4 years of age and older, have been validated on large populations of children. However, it should be noted that the CHAT is less sensitive to milder symptoms of autism, as children later diagnosed with PDD-NOS, Asperger's, or atypical autism did not routinely fail the CHAT at 18 months.[27,35]

The Pervasive Developmental Disorders Screening Test–II (PDDST-II) for infants from birth to 3 years of age, the Modified Checklist for Autism in Toddlers (M-CHAT) for infants at 2 years of age, and the Australian Scale for Asperger's Syndrome for older verbal children, are currently under development or validation phases.[1]

What screening laboratory investigations are available for developmental delay, with or without suspicion of autism? *Formal audiologic evaluation.* The Committee on Infant Hearing of the American Speech–Language–Hearing Association developed guidelines for the audiologic assessment of children from birth through 36 months of age.[36] They recommended that all children with developmental delays, particularly those with delays in social and language development, have a formal audiologic hearing evaluation. Three studies have documented that conductive, sensorineural, or mixed hearing loss can co-occur with autism, and that some children with autism may be incorrectly thought to have peripheral hearing loss.[37,38] In addition, transient conductive hearing loss associated with otitis media with effusion can also occur in children with autism.

Audiologic assessment of such children requires modifications of traditional test techniques and environments (e.g., operant test procedures).[39,40] Electrophysiologic procedures are useful for estimating hearing sensitivity and for examining middle ear, cochlear, and VIIIth nerve or auditory brainstem pathway integrity.[41,42] Evoked otoacoustic emissions are useful for examining cochlear (sensory) function,

and is a frequency-specific, as well as a time- and cost-efficient procedure.[43] Frequency-specific auditory brainstem response (ABR) is the single most useful electrophysiologic procedure for use in estimating hearing thresholds, and has been demonstrated to be highly correlated with behavioral hearing thresholds in children who hear normally and in children who have sensorineural hearing loss.[42]

Lead screening. Children with developmental delays who spend an extended period in the oral–motor stage of play (where everything "goes into their mouths") are at increased risk for lead toxicity, especially in certain environments. The prevalence of pica in this group can result in high rates of substantial or recurrent exposure to lead. The National Center for Environmental Health of the Centers for Disease Control and Prevention recommends that children with developmental delays, even without frank pica, should be screened for lead poisoning.[44] Blood lead levels in children with autism are elevated.[1] In one study, the mean blood lead level in 18 autistic children was higher than in 16 nonautistic "psychotic" children or in 10 normal siblings; 44% of the autistic and psychotic children had lead levels significantly above the mean compared with control subjects.[45] In a more recent study, 17 autistic children treated for lead poisoning were compared with 30 children without autism. The autistic children were older at diagnosis, had higher lead levels, and most were reexposed despite close monitoring of their environment.[46]

Level one evidence-based recommendations. *Clinical practice recommendations.*

1. Developmental surveillance should be performed at all well-child visits from infancy through school-age, and at any age thereafter if concerns are raised about social acceptance, learning, or behavior (**Guideline**).
2. Recommended developmental screening tools include the Ages and Stages Questionnaire, the BRIGANCE® Screens, the Child Development Inventories, and the Parents' Evaluations of Developmental Status (**Guideline**).
3. Because of the lack of sensitivity and specificity, the Denver-II (DDST-II) and the Revised Denver Pre-Screening Developmental Questionnaire (R-DPDQ) are not recommended for appropriate primary-care developmental surveillance (**Guideline**).
4. Further developmental evaluation is required whenever a child fails to meet any of the following milestones (**Guideline**): babbling by 12 months; gesturing (e.g., pointing, waving bye-bye) by 12 months; single words by 16 months; two-word spontaneous (not just echolalic) phrases by 24 months; loss of any language or social skills at any age.
5. Siblings of children with autism should be carefully monitored for acquisition of social, communication, and play skills, and the occurrence of maladaptive behaviors. Screening should be performed not only for autism-related symptoms but also for language delays, learning difficulties, social problems, and anxiety or depressive symptoms (**Guideline**).
6. Screening specifically for autism should be performed on all children failing routine developmental surveillance procedures using one of the validated instruments—the CHAT or the Autism Screening Questionnaire (**Guideline**).
7. Laboratory investigations recommended for any child with developmental delay and/or autism include audiologic assessment and lead screening (**Guideline**). Early referral for a formal audiologic assessment should include behavioral audiometric measures, assessment of middle ear function, and electrophysiologic procedures using experienced pediatric audiologists with current audiologic testing methods and technologies (**Guideline**). Lead screening should be performed in any child with developmental delay and pica. Additional periodic screening should be considered if the pica persists (**Guideline**).

Recommendations for research.

1. Develop and validate appropriate autism screening tools with adequate sensitivity and specificity in children younger than 1 year of age that could be used by a wide range of practitioners.
2. Current methods of screening for autism may not identify: 1) children with milder variants of the disorder; 2) children without mental retardation or language delay, such as verbal individuals with high functioning autism and Asperger's disorder; or 3) older children, adolescents, and young adults. Additional tools are needed to help identify and evaluate these groups of patients.
3. Studies are needed to provide insight into the emergence of early auditory behaviors that are considered atypical and may be prevalent in children with autism. Studies are also needed on the audiologic characteristics of individuals with autism to help assess peripheral hearing sensitivity and suprathreshold responses.

Level two: diagnosis and evaluation of autism. *Analysis of the evidence.* Who should diagnose autism? Although educators, parents, and other health care professionals identify signs and symptoms characteristic of autism, a clinician experienced in the diagnosis and treatment of autism is usually necessary for accurate and appropriate diagnosis.[25,47,48] Clinicians must rely on their clinical judgment, aided by guides to diagnosis, such as DSM-IV and the *Tenth Edition of the International Classification of Diseases* (ICD-10), as well as by the results of various assessment instruments, rating scales, and checklists. These instruments and criteria should be used by practitioners not as experienced in the diagnosis of autism.

What are the medical and neurologic concerns in evaluating children with autism? *Familial prevalence.* Family studies have shown that there is a 50-fold to 100-fold increase in the rate of autism in first-degree relatives of autistic children. Within these families, there are also elevated rates of social difficulties; higher incidences of cognitive, communication, learning and executive function deficits; increased stereotyped behaviors; and anxiety, affective, language, and pragmatic disorders.[33,49-55] Monozygotic twin pair studies have also shown a high concordance rate (60%) for DSM-IV Autistic Disorder, 71% for the broader autistic spectrum phenotype, and 92% for an even broader phenotype of social and communication deficits with stereotyped behaviors that nonetheless were clearly differentiated from normal. In contrast, no concordance for autism was noted in dizygotic twin pairs and only 10% were concordant for some form of cognitive, social or language deficit.[56,57]

Large head circumference without frank neuropathology. Children with autism have a larger head circumference; only a small proportion have frank macrocephaly.[33,57-61] Large head size may not necessarily be present at birth, but may appear in early to mid-childhood, perhaps indicating an increased rate of brain growth. Neuroimaging studies in autism also found larger brain volumes without associated neuropathology.[62,63]

Association with tuberous sclerosis complex (TSC) and less often with Fragile X (FraX) syndrome. Seventeen to over 60% of mentally retarded individuals with TSC are also autistic, and these patients commonly have epilepsy.[64-67] In contrast, the number of autistic individuals with TSC has been estimated to be between 0.4% and 3%.[66] This rate increases to 8% to 14% if epilepsy is also present.[66]

Clinical studies report that 3% to 25% of patients with FraX have autism.[68-70] However, no evidence of FraX in autistic individuals was found using cytogenetic (not DNA analysis) techniques;[71] with molecular genetic analyses, only a few autistic individuals were shown to have FraX.[72]

What are the specific deficits of the autistic child's developmental profile? *Speech, language, and verbal and nonverbal communication.* Verbal and nonverbal communication deficits seen in autism are far more complex than simple speech delay, but overlap with developmental language disorders or specific language impairments. Expressive language function ranges from complete mutism (as often seen in children 2 to 3 years of age) to verbal fluency, though verbal abilities are often accompanied by many errors in word meaning (semantics) or language and communicative deficits in social contexts (social-pragmatics).[73-75]

Cognitive deficits. Many autistic individuals demonstrate a particular pattern on intellectual tests that is characteristic of autism, i.e., performance IQ (PIQ) higher than verbal IQ (VIQ), and specific intersubtest scatter, with Block Design typically the highest subtest and Comprehension usually the lowest. However, the PIQ–VIQ split is severity dependent. When Full Scale IQ (FSIQ) and VIQ are both above 70, 80% of autistic individuals will have no significant VIQ–PIQ disparity, and the remainder are evenly divided between those with PIQ $>$ VIQ and those with PIQ $<$ VIQ.[76]

The DSM-IV defines the diagnosis of mental retardation as the combination of subaverage intellectual functioning (IQ $<$ 70) and concurrent deficits in adaptive functioning. Autistic individuals have poorer adaptive function than would be predicted by IQ alone.[77]

Sensorimotor deficits. Impairments of gross and fine motor function are reported as being common in autistic individuals, and are recognized as hypotonia, limb apraxia, or motor stereotypies. Motor deficits are more severe in individuals with lower IQ scores.[78] Hand or finger mannerisms, body rocking, or unusual posturing are reported in 37% to 95% of individuals, and often manifest during the preschool years.[24,58,78] Sensory processing abilities are aberrant in 42% to 88% of autistic individuals and include preoccupation with sensory features of objects, over- or underresponsiveness to environmental stimuli, or paradoxical responses to sensory stimuli.[79]

Neuropsychological, behavioral, and academic impairments. Specific neuropsychological impairments can be identified, even in young children with autism, that correlate with the severity of autistic symptoms.[80] Performance on tasks that rely on rote, mechanical, or perceptual processes are typically spared; deficient performance exists on tasks requiring higher-order conceptual processes, reasoning, interpretation, integration, or abstraction. Dissociations between simple and complex processing are reported in the areas of language, memory, executive function, motor function, reading, mathematics, and perspective-taking.[80-83] There is no reported evidence that confirms or excludes a diagnosis of autism based on these cognitive patterns alone.

When and what laboratory investigations are indicated for the diagnosis of autism? *Genetic testing.* A chromosomal abnormality reported in possibly more than 1% of autistic individuals involves the proximal long arm of chromosome 15 (15q11-q13), which is a greater frequency than other currently identifiable chromosomal disorders.[84-86] Those with the 15q abnormalities typically have moderate to profound mental retardation. The duplication is usually maternally inherited, either pseudodicentric 15 (inverted duplication 15) or other atypical marker chromosomes, with one or two extra copies of the area roughly corresponding to the typical Angelman syndrome (AS)/Prader Willi Syndrome (PWS) deletion region of approximately four million base pairs. Conversely, AS is usually due to a deletion of maternally inherited 15q11-q13 material and has been found in patients with autism and profound mental retardation.[85,87]

Metabolic testing. Inborn errors in amino acid, carbohydrate, purine, peptide, and mitochondrial metabolism, as well as toxicologic studies have been

studied, but the percentage of children with autism who have a metabolic disorder is probably less (and some experts agree that it is considerably less) than 5%.[88,89]

Electrophysiologic testing. The prevalence of epilepsy in autistic children has been estimated at 7[90] to 14%,[91] whereas the cumulative prevalence by adulthood is estimated at 20% to 35%.[90,91] Seizure onset peaks in early childhood and again in adolescence. Mental retardation, with or without motor abnormalities and family history of epilepsy, was a significant risk factor for the development of seizures in autistic individuals.[92-95]

It is unclear whether there is a relationship between autism and an early regressive course (before 36 months), childhood disintegrative disorder ([CDD] after 36 months), Landau–Kleffner syndrome, and electrical status epilepticus during slow wave sleep (ESES). Autism with regression and CDD have both been associated with seizures or epileptiform sleep-deprived EEG (with adequate sampling of slow wave sleep).[96-98] A higher incidence of epileptiform EEG abnormalities in autistic children with a history of regression has been reported when compared to autistic children with clinical epilepsy.[97] Seizures or epileptiform discharges were more prevalent in children with regression who demonstrated cognitive deficits. Regression in cognition and language in adolescence associated with seizure onset has also been observed, but little is known about its cause or prevalence. There may be a causal relationship between a subgroup of children with autistic regression and EEG-defined "benign focal epilepsies."[99] There is insufficient evidence to suggest a role for event-related potentials or magnetoencephalography in the evaluation of autism.

Neuroimaging. CT studies, ordered as standard assessments of children diagnosed with autism during the 1970s and 1980s, reported a wide range of brain imaging abnormalities and suggested that there was an underlying structural disorder in patients with autism. This view changed when Damasio et al.[100] demonstrated that such abnormalities were incidental to coexisting anatomic disorders unrelated to autism. A very low prevalence of focal lesions or other structural abnormalities was found; their inconsistent localization marked them as coincidental. Prevalence of lesions on MRI in children with autism is similar to normal control subjects.[101] CT and MRI studies of autistic subjects screened to exclude those with disorders other than autism confirmed the absence of significant structural brain abnormalities.[63]

Functional imaging modalities such as functional MRI (fMRI), single-photon emission CT (SPECT), or positron-emission tomography (PET) are currently only research tools in the evaluation of autism. There is no evidence to support a role for functional neuroimaging studies in the clinical diagnosis of autism at the present time.[1]

Other tests. There is insufficient evidence to support the use of other tests such as hair analysis for trace elements, celiac antibodies, allergy testing (particularly food allergies for gluten, casein, candida, and other molds), immunologic or neurochemical abnormalities, micronutrients such as vitamin levels, intestinal permeability studies, stool analysis, urinary peptides, mitochondrial disorders (including lactate and pyruvate), thyroid function tests, or erythrocyte glutathione peroxidase studies.[1]

Level two: evidence-based recommendations. *Clinical practice recommendations.*

1. Genetic testing in children with autism, specifically high resolution chromosome studies (karyotype) and DNA analysis for FraX, should be performed in the presence of mental retardation (or if mental retardation cannot be excluded), if there is a family history of FraX or undiagnosed mental retardation, or if dysmorphic features are present (**Standard**). However, there is little likelihood of positive karyotype or FraX testing in the presence of high-functioning autism.
2. Selective metabolic testing (**Standard**) should be initiated by the presence of suggestive clinical and physical findings such as the following: if lethargy, cyclic vomiting, or early seizures are evident; the presence of dysmorphic or coarse features; evidence of mental retardation or if mental retardation cannot be ruled out; or if occurrence or adequacy of newborn screening for a birth is questionable.
3. There is inadequate evidence at the present time to recommend an EEG study in all individuals with autism. Indications for an adequate sleep-deprived EEG with appropriate sampling of slow wave sleep include (**Guideline**) clinical seizures or suspicion of subclinical seizures, and a history of regression (clinically significant loss of social and communicative function) at any age, but especially in toddlers and preschoolers.
4. Recording of event-related potentials and magnetoencephalography are research tools at the present time, without evidence of routine clinical utility (**Guideline**).
5. There is no clinical evidence to support the role of routine clinical neuroimaging in the diagnostic evaluation of autism, even in the presence of megalencephaly (**Guideline**).
6. There is inadequate supporting evidence for hair analysis, celiac antibodies, allergy testing (particularly food allergies for gluten, casein, candida, and other molds), immunologic or neurochemical abnormalities, micronutrients such as vitamin levels, intestinal permeability studies, stool analysis, urinary peptides, mitochondrial disorders (including lactate and pyruvate), thyroid function tests, or erythrocyte glutathione peroxidase studies (**Guideline**).

Recommendations for research.

1. Studies are needed to further identify the usefulness of electrophysiologic techniques to clarify the

role of epilepsy in autism, especially in children with a history of regression.
2. Additional studies to examine potential genetic and/or environmental factors and their relationship to the etiology of autism are needed.
3. Continuing efforts might focus on identifying contributing genes to determine whether the behavioral syndromes (which constitute the basis of DSM-IV and ICD-10) have actual biological validity.
4. Evaluation of environmental factors (e.g., nonspecific infections or other immunologically mediated events) that might contribute to triggering the expression of autistic symptoms or regression requires additional study.

Consensus-based general principles of management. The following recommendations are based on consensus agreement by the participating organizations involved in the development of this parameter.[1]

Surveillance and screening. In the United States, states must follow federal Public Law 105-17: the Individuals with Disabilities Education Act Amendments of 1997–IDEA'97, which mandates immediate referral for a free appropriate public education for eligible children with disabilities from the age of 36 months, and early intervention services for infants and toddlers with disabilities from birth through 35 months of age.

Diagnosis. The diagnosis of autism should include the use of a diagnostic instrument with at least moderate sensitivity and good specificity for autism. Sufficient time should be planned for standardized parent interviews regarding current concerns and behavioral history related to autism, and direct, structured observation of social and communicative behavior and play. Recommended instruments include[1]:

Diagnostic parental interviews

The Gilliam Autism Rating Scale

The Parent Interview for Autism

The Pervasive Developmental Disorders Screening Test–Stage 3

The Autism Diagnostic Interview–Revised

Diagnostic observation instruments

The Childhood Autism Rating Scale

The Screening Tool for Autism in Two-Year-Olds

The Autism Diagnostic Observation Schedule-Generic

Medical and neurologic evaluation. Perinatal and developmental history should include milestones; regression in early childhood or later in life; encephalopathic events; attentional deficits; seizure disorder (absence or generalized); depression or mania; and behaviors such as irritability, self-injury, sleep and eating disturbances, and pica. The physical and neurologic examination should include: longitudinal measurements of head circumference and examination for unusual features (facial, limb, stature, etc.) suggesting the need for genetic evaluation; neurocutaneous abnormalities (requiring an ultraviolet [Wood's] lamp examination); gait; tone; reflexes; cranial nerves; and determination of mental status, including verbal and nonverbal language and play.

Evaluation and monitoring of autism. The immediate and long-term evaluation and monitoring of autistic individuals requires a comprehensive multidisciplinary approach, and can include one or more of the following professionals: psychologists, neurologists, speech–language pathologists and audiologists, pediatricians, child psychiatrists, occupational therapists, and physical therapists, as well as educators and special educators. Individuals with mild autism should also receive adequate assessments and appropriate diagnoses.

Reevaluation within 1 year of initial diagnosis and continued monitoring is an expected aspect of clinical practice because relatively small changes in the developmental level affect the impact of autism in the preschool years. In general, there is no need to repeat extensive diagnostic testing; however, follow-up visits can be helpful to address behavioral, environmental, and other developmental concerns.

Speech, language, and communication evaluation. A comprehensive speech–language–communication evaluation should be performed on all children who fail language developmental screening procedures by a speech–language pathologist with training and expertise in evaluating children with developmental disabilities. Comprehensive assessments of both preverbal and verbal individuals should account for age, cognitive level, and socioemotional abilities, and should include assessment of receptive language and communication, expressive language and communication, voice and speech production, and in verbal individuals, a collection and analysis of spontaneous language samples to supplement scores on formal language tests.

Cognitive and adaptive behavior evaluations. Cognitive evaluations should be performed in all children with autism by a psychologist or other trained professional. Cognitive instruments should be appropriate for the mental and chronologic age, provide a full range (in the lower direction) of standard scores and current norms independent of social ability, include independent measures of verbal and nonverbal abilities, and provide an overall index of ability. A measure of adaptive functioning should be collected for any child evaluated for an associated cognitive handicap. Consensus-based recommendations for using specific instruments include the Vineland Adaptive Behavior Scales and the Scales of Independent Behavior–Revised.[1]

Sensorimotor and occupational therapy evaluations. Evaluation of sensorimotor skills by a qualified experienced professional (occupational therapist or physical therapist) should be considered, including assessment of gross and fine motor skills, praxis, sensory processing abilities, unusual or stereotyped mannerisms, and the impact of these components on the autistic person's life. An occupational therapy

evaluation is indicated when deficits exist in functional skills or occupational performance in the areas of play or leisure, self-maintenance through activities of daily living, or productive school and work tasks. Although not routinely warranted as part of all evaluations of children with autism, the Sensory Integration and Praxis Tests may be used on an individual basis to detect specific patterns of sensory integrative dysfunction.

Neuropsychological, behavioral, and academic assessments. These assessments should be performed as needed, in addition to the cognitive assessment, to include social skills and relationships, educational functioning, problematic behaviors, learning style, motivation and reinforcement, sensory functioning, and self-regulation. Assessment of family resources should be performed by appropriate psychologists or other qualified health care professionals and should include assessment of parents' level of understanding of their child's condition, family (parent and sibling) strengths, talents, stressors and adaptation, resources and supports, as well as offer appropriate counseling and education.

Disclaimer. The Quality Standards Subcommittee (QSS) of the American Academy of Neurology (AAN) seeks to develop scientifically sound, clinically relevant practice parameters for the practice of neurology. Practice parameters are strategies for patient management that assist physicians in clinical decision making. A practice parameter is one or more specific recommendations based on analysis of evidence of a specific clinical problem. These might include diagnosis, symptoms, treatment, or procedure evaluation. This evidence-based review addresses the major management issues health care providers face in surveying, screening, and diagnosing children with autism. The clinical evidence is reviewed, management recommendations provided, and areas of continued research identified. This statement is provided as an educational service of the American Academy of Neurology. It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved.

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Appendix 1

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Representatives were named from the following associations: Barbara Cutler, EdD, and Susan Goodman, JD (Autism National Committee); Cheryl Trepagnier, PhD (Autism Society of America); Daniel H. Geschwind, MD, PhD (Cure Autism Now); and Charles T. Gordon, MD (National Alliance for Autism Research). The National Institutes of Health also named liaisons to serve on this committee, including Marie Bristol–Power, PhD (National Institute of Child Health and Human Development); Judith Cooper, PhD (National Institute of Deafness and Communication Disorders); Judith Rumsey, PhD (National Institute of Mental Health); and Giovanna Spinella, MD (National Institute of Neurological Disorders and Stroke).

Appendix 2

Clinical questions addressed for surveillance, screening and diagnosing children with autism

Routine developmental surveillance and screening for autism

1. When and how often should developmental surveillance/screening be performed?
2. What are the appropriate developmental screening questionnaires that provide sensitive and specific information?
3. How are conventional developmental milestones defined?
4. Do parents provide reliable information regarding their child's development?
5. Can autism can be reliably diagnosed before 36 months of age?
6. Is there an increased risk of having another child with autism (recurrence)?
7. What screening laboratory investigations are available for developmental delay, with or without suspicion of autism?
8. What tools are available with appropriate psychometric properties to specifically screen for autism?

Diagnosis and evaluation of autism

1. Who should diagnose autism?
2. What are the medical and neurologic concerns in evaluating children with autism?
3. What are the specific deficits of the autistic child's developmental profile?
4. When and what laboratory investigations are indicated for the diagnosis of autism?

Appendix 3

Definitions for strength of the evidence

Class I. Must have all of a through d. a) Prospective study of a well-defined cohort which includes a description of the nature of the population, the inclusion/exclusion criteria, demographic characteristics such as age and sex, and seizure type. b) The sample size must be adequate with enough statistical power to justify a conclusion or for identification of subgroups for whom testing does

or does not yield significant information. c) The interpretation of evaluations performed must be done blinded to outcome. d) There must be a satisfactory description of the technology used for evaluations (e.g., EEG, MRI).

Class II. Must have a or b. a) Retrospective study of a well-defined cohort which otherwise meets criteria for class 1a, b and 1d. b) Prospective or retrospective study which lacks any of the following: adequate sample size, adequate methodology, a description of inclusion/exclusion criteria, and information such as age, sex and characteristics of the seizure.

Class III. Must have a or b. a) A small cohort or case report. b) Relevant expert opinion, consensus, or survey.

A cost-benefit analysis or a meta-analysis may be class I, II, or III, depending on the strength of the data upon which the analysis is based.

Definitions for strength of the recommendations

Standard. A principle for patient management that reflects a high degree of clinical certainty (usually requires one or more Class I studies that directly address the clinical question, or overwhelming Class II evidence when circumstances preclude randomized clinical trials).

Guideline. A recommendation for patient management that reflects moderate clinical certainty (usually requires one or more Class II studies or a strong consensus of Class III evidence).

Practice option. Strategy for patient management for which clinical utility is uncertain (inconclusive or conflicting evidence or opinion).

Appendix 4

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THE ORTHOPAEDIC FORUM

Screening for Idiopathic Scoliosis in Adolescents

An Information Statement*

By B. Stephens Richards, MD, and Michael G. Vitale, MD

Executive Summary

Many states mandate school screening to identify children at risk for scoliosis, though recent studies have cast some controversy on the effectiveness of routine scoliosis screening. Previous studies have both supported and discouraged routine screening.

Prevention of severe scoliosis is a major commitment of physicians caring for children with spinal deformities. For this reason, the American Academy of Orthopaedic Surgeons (AAOS), the Scoliosis Research Society (SRS), the Pediatric Orthopaedic Society of North America (POSNA), and the American Academy of Pediatrics (AAP) convened a task force to examine issues related to scoliosis screening and to put forth the present information statement. The societies acknowledge the important role of a systematic review of the literature as well as the role of consensus expert opinion in the common situation where the available evidence does not yet exist to speak definitely for, or against, an evaluation or intervention.

Costs involved with scoliosis screening are relatively low on a societal level and may justify the possibility of preventing surgery in adolescents with scoliosis. Adolescents without significant spinal deformity who are referred to a specialist for evaluation often do not require radiographs. For those who do need radiographic evaluation, it is important to know that the radiation exposure using current-day radiographic techniques, including digital radiography, is significantly smaller than in the past.

Opponents to scoliosis screening have focused on concerns about a low predictive value of screening and the cost-effectiveness of referral. There have also been concerns about the possibility of unnecessary treatment, including brace use, and the effect of exposure to radiation when radiographs are obtained.

With regard to early treatment in those adolescents detected with moderate scoliosis, the available data neither definitively support nor refute the efficacy of bracing. To most effectively answer this, a well-organized level I study is needed. Such a study, a five-year multicenter randomized controlled trial of bracing sponsored by the National In-

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**This statement has been reviewed by the Boards of Directors of the American Academy of Orthopaedic Surgeons (September 2007), Scoliosis Research Society (August 2007), Pediatric Orthopaedic Society of North America (August 2007), and the American Academy of Pediatrics (September 2007). All four boards have endorsed this statement. The American Academy of Orthopaedic Surgeons notes that the statement was developed as an educational tool based on the opinion of the authors. It is not a product of a systematic review. Readers are encouraged to consider the information presented in this Opinion Statement and reach their own conclusions.*

stitutes of Health/National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIH/NIAMS), is currently under way.

In 1996, the United States Preventive Services Task Force (USPSTF) concluded that there was insufficient evidence to make a recommendation for, or against, screening. However, in 2004, the USPSTF changed their position and recommended against the routine screening of asymptomatic adolescents for idiopathic scoliosis. The AAOS, SRS, POSNA, and AAP have concerns that this change in position by the USPSTF came in the absence of any significant change in the available literature, in the absence of any change in position statements by the AAOS, SRS, POSNA, and AAP, and in the absence of any significant input from specialists who commonly care for children with scoliosis.

As the primary care providers for adolescents with idiopathic scoliosis, the AAOS, SRS, POSNA, and AAP do not support any recommendation against scoliosis screening, given the available literature.

Information Statement:

Screening for Idiopathic Scoliosis in Adolescents

Purpose

The purpose of the current information statement is to provide material to patients, physicians, and decision makers regarding issues related to screening for scoliosis. Screening is defined as a clinical, rather than radiographic, examination.

Introduction

Adolescent idiopathic scoliosis is a spine deformity characterized by lateral and rotational curvature of the spine. It usually becomes evident in the early adolescent years and, although significant progress has been made in the genetic study of this disorder, its cause presently remains unknown, thus the label "idiopathic" scoliosis. Curve progression is unpredictable, though a subset of children with adolescent idiopathic scoliosis may exhibit rapid progression. Every year, thousands of operations are performed for the primary diagnosis of adolescent idiopathic scoliosis in patients between the ages of 10 and 18. This spinal disorder can have a significant impact on the physical and psychosocial health of affected individuals.

Prevention of severe scoliosis is a major commitment of orthopaedic surgeons caring for spinal deformities. Beginning in 1984, the AAOS and the SRS formally endorsed the concept of school screening for the early detection of scoliosis in children whose deformities may have gone unnoticed. This endorsement was based on the assumption that early detection in those children at risk for worsening would lead to the institution of nonoperative treatment that could have a positive impact on the long-term natural history of this disorder. Without treatment, many curves could be expected to worsen over the long-term, with some of them eventually needing surgical intervention. In addition, those children with more significant scoliosis, who may have no other symptoms, could be detected by clinical screening at a time when surgical treatment for their deformity could be performed most effectively.

Screening for Scoliosis—The Evidence For and Against

Routine clinical screening for scoliosis continues to be controversial with less than half of the states in the United States currently legislating school screening. Previous studies have both supported[1,2] and discouraged routine screening[3-5]. There have been no recent scientific publications on screening for scoliosis.

In 1993, Montgomery and Willner[2] supported the routine use of school screening. They reported that the introduction of school screening programs decreased the relative risk of progression into a surgical range by a factor of eight. They obtained an eight times greater risk of deterioration of the curve to 45°, which would be diagnosed as qualifying for surgery, without the screening program and without modifying the indications for treatment before and after the implementation of the screening program. Their conclusion was that screening decreased the demand for surgery because scoliosis would be detected at a younger age with smaller curves, thus having a better prognosis.

Conversely, other investigators provided different conclusions. Yawn et al.[3] reported on a population-based school screening program in Rochester, Minnesota. In this retrospective cohort study, 4.1% of the 2242 children screened positively and were referred for evaluation. The positive predictive value was low (0.05) and they concluded that roughly 450 children would need to be screened for every child who subsequently received treatment as a result of screening. A limitation of this study is that the community in Rochester is not representative of the general population, with more than 90% of the population being white, having higher-than-average income, and having excellent access to specialized care.

A year later, the same investigators[4] examined issues related to charges, including the primary care visit, orthopaedic surgeon visit, and radiographs. The total costs were estimated to be $34.40 per child screened, $4,198.67 per case identified, and $15,115.20 per child treated. These estimates were significantly higher than those previously reported.

Twenty years ago, Morais et al.[5] concluded that the prevalence of the disease was too low to benefit from a screening program. The authors commented on their concern of radiation exposure that the children may have undergone following clinical screening. Of note, radiation exposure is significantly reduced with current techniques of shielding, the use of special films, and the institution of digital radiography.

Each of the above studies has significant flaws with regard to methodological rigor. To date, no level I evidence studies have been performed

on screening for scoliosis, and such a study is unlikely to be performed at the current time. Therefore, definitive conclusions regarding the effectiveness of scoliosis screening cannot be made from the available evidence in the literature. This concern was echoed by the 1996 USPSTF report which concluded that there was insufficient evidence to make a recommendation for, or against, screening[6]. However, in 2004, the USPSTF changed their recommendation[7]. Citing a low predictive value of screening, a relatively small percentage of children whose curves progress, and the possibility of unnecessary treatment including brace use, they issued a recommendation against the routine screening of asymptomatic adolescents for idiopathic scoliosis. Of note, the Task Force's change in their recommendation was largely based on a change in methodological approach of the USPSTF, rather than any real change in available information.

A recent article (May 2007) examined professional opinion concerning the effectiveness of bracing relative to observation in adolescent idiopathic scoliosis[8]. The authors polled a group of clinicians with significant experience with scoliosis treatment. While there was significant variability in opinion among the expert panel, on average, the expert panel felt that bracing would decrease the risk of progression in premenarchal patients by 20% to 30%, depending on the exact clinical scenario. Thus, it appears that many of those who most commonly treat scoliosis perceive a potential positive effect of bracing.

Representing the primary care providers for adolescents with idiopathic scoliosis, the AAOS, SRS, POSNA, and AAP do not support any formal recommendations against scoliosis screening, given the available literature. All four societies recognize the benefits that can be provided by effective clinical screening programs, including (1) the potential prevention of deformity progression by brace treatment and (2) the earlier recognition of severe deformities requiring operative correction.

Treatment for Those Detected from Scoliosis Screening

In general, treatment must attempt to alleviate current problems and symptoms and to ultimately alter long-term natural history. Brace treatment for scoliosis is the most effective primary nonoperative method used over the past 40 years. In recent years, refinements have been made in identifying which patients with idiopathic scoliosis may benefit most with this treatment[9].

With the information available in the literature today, it is difficult to speak with absolute certainty about the effectiveness of bracing. There are no level I evidence bracing studies currently in the literature. Though nearly all brace studies are level III or level IV evidence studies, many of them represent important and well-organized research and most conclude that brace treatment is effective in diminishing curve progression[10-29]. The most common parameter used to assess the effectiveness of brace treatment is the amount of curve progression that occurs, usually with success defined by curve progression of ≤5 degrees at maturity. The other parameter used to assess the success of brace treatment is the prevention of surgery. A recent evidence-based review of the literature reported a 20% to 24% risk of needing surgery despite best efforts at bracing[30]. The risk of surgery without any brace treatment in the same patient population is currently unknown. This fact alone emphasizes the importance that a level I evidence study could have in clarifying the effectiveness of brace treatment in preventing the need for surgery. Such a study, a five-year multicenter randomized controlled trial of bracing sponsored by the NIH/NIAMS, is currently under way.

Scoliosis Screening in 2007

Although the AAOS, SRS, POSNA, and AAP recognize that support for scoliosis screening has limitations, the potential benefits that patients with idiopathic scoliosis receive from early treatment of their deformities can be substantial. Scoliosis screening, whether in the physician's office, nurses' clinics, or school environment, provides the opportunity to diagnose the condition and make referral for appropriate medical care. Brace treatment in children with significant scoliosis may avoid the need for surgical intervention. Those with deformities in need of surgery may be identified by screening at a time when operative intervention can be performed most effectively. Many of these patients may otherwise go undetected, particularly in patient populations underserved by medicine.

Females achieve adolescence about two years before males and are afflicted with a magnitude of scoliosis, requiring treatment three to four times more frequently than males. As a result, if scoliosis screening is undertaken, the AAOS, SRS, POSNA, and AAP agree that females should be screened twice, at age 10 and 12 (grades 5 and 7), and boys once, at age 13 or 14 (grades 8 or 9).

The AAOS, SRS, POSNA, and AAP believe that school screening personnel should be educated in the detection of spinal deformity. Screening should always include the forward bending test, the most specific test for true scoliosis, though no single test is completely reliable for screening. Therefore, considerable judgment on the part of the screener is necessary to achieve an appropriate referral rate and to avoid unnecessary referrals. To meet the objectives of scoliosis screening programs, the AAOS, SRS, POSNA, and AAP recognize the need to limit the number of referrals of those individuals suspected of having scoliosis.

The AAOS, SRS, POSNA, and AAP maintain their commitment to avoid the inappropriate use of spine radiographs. Not all children referred as a result of screening require radiographs. If radiographs are needed, physicians should take necessary precautions to limit the patient's exposure to radiation.

Educational materials that provide more specific guidelines for conducting school screening programs for scoliosis are available to physicians and school authorities.

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AMERICAN ACADEMY OF PEDIATRICS

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AMERICAN ASSOCIATION FOR PEDIATRIC OPHTHALMOLOGY AND STRABISMUS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Screening for Retinopathy in the Pediatric Patient With Type 1 Diabetes Mellitus

ABSTRACT. Diabetic retinopathy (DR) is the leading cause of blindness in young adults in the United States. Early identification and treatment of DR can decrease the risk of vision loss in affected patients. This clinical report reviews the risk factors for the development of DR and screening guidance for pediatric patients with type 1 diabetes mellitus. ***Pediatrics*** **2005;116:270–273;** ***type 1 diabetes mellitus, diabetic retinopathy, ophthalmic screening.***

ABBREVIATIONS. DR, diabetic retinopathy; DCCT, Diabetes Control and Complications Trial.

BACKGROUND

Type 1 diabetes mellitus is one of the most common metabolic disorders in children, with a prevalence of approximately 2 per 1000 school-aged children in the United States. The prevalence of type 1 diabetes mellitus increases with age, and the overall incidence of the disease may be increasing. Although the incidence of type 2 diabetes in children is increasing, there are no data or guidelines regarding ophthalmic screening in children with this disorder. Diabetic retinopathy (DR) is one of the most important complications of type 1 diabetes mellitus, representing the leading cause of blindness in young adults. There are 3 main components of a strategy to minimize the risk of visual loss attributable to DR: (1) provide the most effective treatment of the underlying metabolic disorder and its comorbidities; (2) develop optimal treatment modalities for patients with ocular disease; and (3) identify risk factors for the development of ocular disease and implement effective screening programs to identify at-risk patients. The first 2 have been evaluated in well-conducted, large, prospective trials.

Optimizing Metabolic Control

The efficacy of providing intensive treatment of the underlying metabolic disorder was evaluated by the Diabetes Control and Complications Trial (DCCT),[1] which clearly demonstrated the benefits of improving glycemic control and decreasing hemoglobin A1c concentrations in decreasing the complication rate. In this study, patients who received intensive treatment with either an insulin pump or 3 or more daily insulin injections, frequent phone calls and clinic visits, and self-management education substantially decreased their risk of both onset and progression of retinopathy, compared with patients treated with conventional therapy. The risk of retinopathy was decreased by 53% in children 13 to 17 years of age and with no retinopathy at study entry, and the risk of retinopathy progression was decreased by 70% in those who had retinopathy at the beginning of the study.[2]

One of the concerns regarding the institution of intensive metabolic control had been the potential for the acceleration of DR on the basis of a report by Daneman et al[3] of 4 patients with poorly controlled diabetes mellitus and short stature who developed macular edema and severe proliferative DR shortly after initiation of appropriate insulin therapy. This complication was evaluated in patients enrolled in the DCCT, and early worsening over the first 6 to 12 months was found to be more prevalent in patients with intensive treatment (13.1%) compared with patients with conventional treatment (7.6%).[4] However, the long-term outcomes in the patients with early worsening were the same or better than those treated with conventional therapy. The Kroc Collaborative Study Group[5] also found that early worsening of DR was not sustained and was not associated with a worse long-term outcome. Additionally, the benefits of intensive therapy continued to be evident 7 years after the end of the DCCT, as demonstrated in the Epidemiology of Diabetes Interventions and Complications study.[6–8] Thus, in most cases the potential for early worsening should not restrict institution of intensive glycemic control.

Optimizing Treatment of Retinopathy

The development of optimal treatment modalities for ocular disease has also been evaluated in several

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studies, one of the most important of which is the Early Treatment of Diabetic Retinopathy Study.[9] This large study evaluated the benefit of early treatment for 2 ocular complications of type 1 diabetes mellitus, diabetic macular edema, and proliferative DR. Studies clearly demonstrated that patients with high-risk characteristics of these disorders experienced a marked improvement in outcome after laser therapy.[9,10] The risk of moderate vision loss (eg, a doubling of the visual angle or 20/20 vision reduced to 20/40) from diabetic macular edema was decreased by approximately 50% with appropriate focal laser photocoagulation for clinically significant macular edema (from approximately 25% without treatment to approximately 12% with treatment). The risk of severe vision loss (best corrected vision of 5/200 or worse) from proliferative DR was decreased to <2% with appropriate scatter (panretinal) laser photocoagulation.

Identification of Risk Factors for Ocular Disease

DR typically follows a predictable progression.[11] Early nonproliferative DR is characterized by changes in retinal blood flow and other microvascular changes, which may lead to ischemia, small retinal hemorrhages, and leakage of exudative fluid within the retina. More severe nonproliferative DR is characterized by intraretinal microvascular abnormalities, more extensive hemorrhages and microaneurysms, and changes in venous caliber and tortuosity, reflecting progressive capillary closure and retinal ischemia. Proliferative DR is marked by fibrovascular proliferations on either the optic disk (new vessels on the disk) or new vessels elsewhere on the retina. Proliferative DR may cause vision loss by vitreous hemorrhage or contraction of fibrovascular tissue with subsequent retinal detachment. Laser surgery is promptly indicated when an eye approaches or reaches high-risk proliferative DR. High-risk proliferative DR is clearly defined and characterized by one or more of the following lesions: (1) new vessels on the optic disk approximately one fourth to one third disk area or more in size; (2) new vessels on the optic disk less than one fourth the disk area in size when fresh vitreous hemorrhage or preretinal hemorrhage is present; or (3) new vessels elsewhere on the retina greater than or equal to one half the disk area in size when fresh vitreous hemorrhage or preretinal hemorrhage is present.

The goal of a regular eye examination is to identify and treat patients before the development of vision-threatening complications. Diabetic macular edema can be present with any level of nonproliferative or proliferative DR. The role of ophthalmologic screening programs for DR will be the focus of this report.

FACTORS THAT AFFECT ONSET OF DR

Several epidemiologic studies have evaluated risk factors for development of DR. Some of these factors are amenable to treatment, resulting in a decreased risk of DR, such as optimizing metabolic control as reported in the DCCT, discontinuing smoking, avoiding obesity, and monitoring blood pressure. Other factors such as patient age, duration of disease, and the effects of puberty and pregnancy are not modifiable. The impact of the individual risk factors may be difficult to isolate, because they are not independent of one another (ie, the longer the duration of the disease, the older the patient will be).

Duration of Disease

The duration of diabetes is unequivocally one of the most important risk factors for the development of DR. Essentially all studies demonstrate that the risk of DR increases with time in individuals with diabetes. In a study of 996 patients who had been diagnosed with type 1 diabetes mellitus when they were younger than 30 years, Klein et al[12] found that the prevalence of DR increased from 17% for patients with diabetes for less than 5 years to 98% for patients with diabetes for 15 or more years. The prevalence of proliferative DR increased from 1% in patients with diabetes for less than 10 years to 67% in patients with diabetes for 35 or more years. A few studies have reported mild DR in children with duration of disease as short as 1 to 2 years,[13,14] but in most studies the duration is 3 or more years, with typical durations of 8 to 10 years before development of DR.[15,16]

Age

The effect of age on the development of DR is linked to the duration of the disease (patients with longer durations are typically older). What is clear is that young children (younger than 10 years) with type 1 diabetes mellitus are at minimal risk of the development of significant ocular complications. The presence of any DR before 10 years of age has been reported rarely,[13,14] and these cases have been mild. In a series of 996 patients with type 1 diabetes mellitus who had been diagnosed before 30 years old, Klein et al[12] found that mild DR was identified in only 1 patient in the first decade of life, and moderate DR was identified in 1 patient between 10 and 14 years of age. Neither of these patients required treatment. In a follow-up study of 634 patients by Klein et al,[17] no patient who was younger than 10 years at the time of diagnosis of type 1 diabetes mellitus developed proliferative DR within 10 years of diagnosis. In a comprehensive review of the literature, no report of proliferative DR could be found in a patient in the first decade of life.

Puberty

The effect of puberty on the development of DR has been difficult to clearly elucidate. Although the duration of diabetes before puberty affects the onset of DR,[14,18] there is good evidence that the hormonal changes associated with puberty exert an effect that is independent of age and duration of disease. Rogers et al,[19] in a study of 76 patients, found a significantly higher prevalence of DR in late pubertal subjects compared with prepubertal subjects despite similar duration of disease and similar glycosylated hemoglobin concentrations. In a similar study, Murphy et al[20] found that the relative risk of having DR in a pubescent group of children compared with a prepubescent group was 4.8.

Pregnancy

Pregnancy represents another well-established risk factor for DR. Several studies have demonstrated progression of DR during pregnancy.[21–24] Factors that exacerbate the acceleration of DR during pregnancy include poor metabolic control, hypertension, and a baseline degree of retinopathy. The large studies of pregnancy and DR do not include pediatric patients, and we are unaware of any study that specifically addresses the effects of pregnancy in adolescent patients with type 1 diabetes mellitus.

GUIDELINES FOR OPHTHALMIC SCREENING FOR DR

Screening guidelines for DR have been published previously by the American Academy of Pediatrics,[25] the American Academy of Ophthalmology,[26] and the American Diabetes Association.[27] The recommendations regarding pediatric patients with type 1 diabetes mellitus are similar. The American Academy of Ophthalmology recommends annual screening beginning 5 years after the onset of diabetes.[26] The guidelines from the American Diabetes Association include annual screening beginning 3 to 5 years after diagnosis of diabetes once the patient is 10 years or older.[27] The American Academy of Pediatrics recommends an initial examination 3 to 5 years after diagnosis if older than 9 years, with annual follow-ups thereafter.[25]

The recommendations reflect the fact that the incidence of DR in young children is negligibly small, and therefore children younger than 9 years do not require screening for DR. The incidence of retinopathy in young adolescents is also very low, particularly for proliferative DR. Although the risk of DR typically does not increase significantly until 8 to 10 years after diagnosis, the recommendation for annual screening beginning 3 to 5 years after diagnosis (in children who are older than 9 years) is reasonable, given that DR has been reported occasionally within this time.

Because children with type 1 diabetes mellitus are at a greatly increased risk of visual loss over the course of their lives, special attention should be given to identifying other causes of visual loss in these patients. Screening for potentially treatable visual disorders such as amblyopia is recommended for all children[28] and should be performed with particular care in children with type 1 diabetes mellitus. Patient and parent education regarding the benefits of optimal metabolic control is also beneficial early in the course of the disease.

IMPLEMENTATION

The development of appropriate screening strategies for detecting DR in patients with type 1 diabetes mellitus is important, but guidelines are of little use if they are not implemented. Unfortunately, studies that evaluate this aspect of care have been discouraging. In a study by Witkin and Klein[29] that included 902 young patients with type 1 diabetes mellitus, 26% had never had an ophthalmologic examination, including 11% of patients at high risk of visual loss. In an Australian study that was performed before and one year after distribution of ophthalmic screening guidelines, McCarty et al[30] found that the guidelines had been distributed successfully, but there was no significant change in management practice. The usefulness of digital photography in detecting retinopathy has been demonstrated.[31] This technology holds great promise but is unlikely to become widely used until it can be performed rapidly, simply, and at a reasonable cost. Studies that evaluate methods to improve implementation of guidelines could potentially provide great benefit to patients with type 1 diabetes mellitus.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Technical Report—Secondhand and Prenatal Tobacco Smoke Exposure

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KEY WORDS
tobacco, smoke, cigarette, environmental tobacco, nicotine, secondhand, smoke free, cigar, smokeless

ABBREVIATIONS
SHS—secondhand tobacco smoke
AAP—American Academy of Pediatrics
NRT—nicotine-replacement therapy

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abstract

Secondhand tobacco smoke (SHS) exposure of children and their families causes significant morbidity and mortality. In their personal and professional roles, pediatricians have many opportunities to advocate for elimination of SHS exposure of children, to counsel tobacco users to quit, and to counsel children never to start. This report discusses the harms of tobacco use and SHS exposure, the extent and costs of tobacco use and SHS exposure, and the evidence that supports counseling and other clinical interventions in the cycle of tobacco use. Recommendations for future research, policy, and clinical practice change are discussed. To improve understanding and provide support for these activities, the harms of SHS exposure are discussed, effective ways to eliminate or reduce SHS exposure are presented, and policies that support a smoke-free environment are outlined. *Pediatrics* 2009; 124:e1017–e1044

INTRODUCTION

Secondhand tobacco smoke (SHS) is exhaled smoke, the smoke from burning tobacco, and smoke from the filter or mouthpiece end of a cigarette, pipe, or cigar. It contains many poisons, including nicotine (a pesticide), carbon monoxide, ammonia, formaldehyde, hydrogen cyanide, nitrogen oxides, phenol, sulfur dioxide, and others.[1] In 1992, the US Environmental Protection Agency classified SHS as a class A known human carcinogen.[2]

Tobacco use is a cycle of addiction and exposure that can begin at conception and persist throughout life.[3] Most (~80%) users of tobacco start before 18 years of age, prompted by exposure to parental and peer tobacco use, smoking in movies and media, advertising directed toward children and adolescents, and other factors.[4–11] More than 126 million nonsmokers are exposed to SHS in the United States, and the most common site of SHS exposure is the home.[1,12,13] Children, especially preschool-aged children, are more heavily exposed than adults, perhaps because they spend the most time near their parents[13,14] (Fig 1). The proportion of nonsmokers with detectable levels of cotinine (the primary metabolite of nicotine in humans) in serum fell from 88% in 1988–1991 to 43% in 2001–2002, corresponding to the decline in the rate of tobacco use.[14] The proportion of women who reported smoking during pregnancy has decreased by 50% over the past 15 years (from ~20% in 1989[15] to ~10% in 2004[16]), although many experts question the accuracy of self-reported tobacco use because of the social undesirability of smoking during pregnancy.[17] Tobacco use and smoking

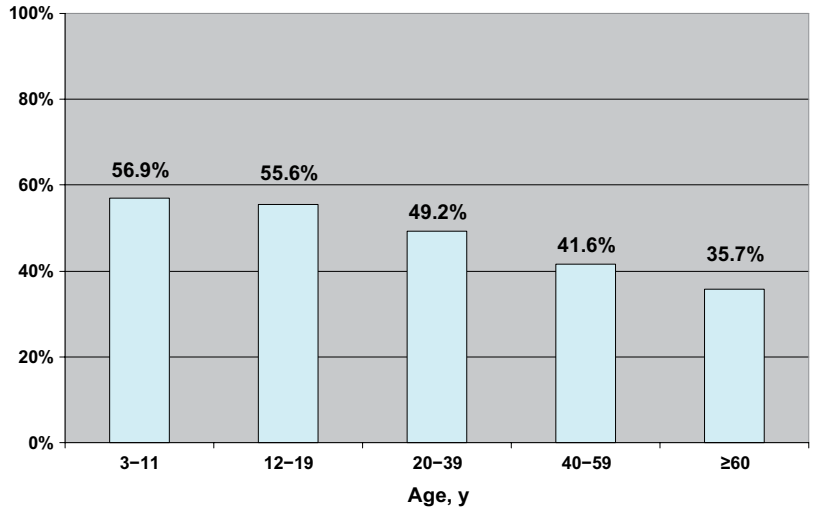


FIGURE 1
Prevalence of SHS exposure, indicated by a serum cotinine level of ≥0.05 ng/mL, United States, 2001–2002.[1]

rates are highest among American Indian and Alaska Native individuals.[18]

As with many risky health behaviors, the prevalence of tobacco use is greatest among adults who live below the poverty line and those with less than a high school education.[18] Correspondingly, children who live in poverty are more likely to be exposed to SHS than others.[19] In a study of serum cotinine levels in nonsmokers, black and white children had higher levels than did Hispanic children.[14] Differences in metabolism of nicotine may contribute to these higher concentrations.[20]

EFFECTS OF SHS EXPOSURE

The reports of direct health effects of SHS exposure are numerous and growing in number. The most recent comprehensive reports are the 2006 US Surgeon General's report, *The Health Consequences of Involuntary Exposure to Tobacco Smoke*,[1] and California's *Proposed Identification of Environmental Tobacco Smoke as a Toxic Air Contaminant*.[21] The major conclusions from the Surgeon General's report relevant to children are summarized in Table 1. In addition to confirming the conclusions of the US Surgeon General, the authors of the California report found sufficient evidence to impute a causal association

TABLE 1 Major Conclusions of the Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General[1]

Exposure Type	Disease	Conclusion (Page No.)
Maternal exposure to SHS during pregnancy	Preterm delivery	The evidence is suggestive but not sufficient to infer a causal relationship (195).
	Low birth weight	The evidence is sufficient to infer a causal relationship (205).
Maternal exposure to SHS during pregnancy and postnatal SHS exposure	Childhood cancer, leukemia, lymphoma, and brain tumors	The evidence is suggestive but not sufficient to infer causal relationships (242).
Postnatal SHS exposure	Sudden infant death	The evidence is sufficient to infer a causal relationship (194).
	Lower respiratory illnesses	The evidence is sufficient to infer a causal relationship. The increased risk for lower respiratory illnesses is greatest from smoking by the mother (292).
	Middle-ear disease	The evidence is sufficient to infer a causal relationship between parental smoking and middle-ear disease in children, including acute and recurrent otitis media and chronic middle-ear effusion.
		The evidence is suggestive but not sufficient to infer a causal relationship between parental smoking and the natural history of middle-ear effusion (309).
	Cough, phlegm, wheeze, breathlessness, asthma	The evidence is sufficient to infer a causal relationship between SHS exposure from parental smoking and the onset of wheeze illnesses in early childhood (375).
		Among school-aged children, the evidence is sufficient to infer a causal relationship (355).
		The evidence is suggestive but not sufficient to infer a causal relationship between SHS exposure from parental smoking and the onset of childhood asthma (375).
		Among school-aged children, the evidence is sufficient to infer a causal relationship between parental smoking and ever having asthma (355).
Maternal smoking during pregnancy and postnatal SHS exposure	Lung function	The evidence is sufficient to infer a causal relationship between maternal smoking during pregnancy and persistent adverse effects on lung function across childhood (399).
		The evidence is sufficient to infer a causal relationship between exposure to SHS after birth and a lower level of lung function during childhood (399).

between SHS exposure of girls and an increased incidence of breast cancer, particularly in premenopausal women.[21] Many other effects for which the supporting evidence is incomplete or less compelling have been reported (Appendix 1).

One of the significant consequences of prenatal tobacco exposure is sensitization of the fetal brain to nicotine, which results in increased likelihood of addiction when the brain is exposed to nicotine at a later age. Studies of rodents[22–24] and primates[25] that were exposed prenatally to tobacco have demonstrated subtle brain changes that persist into adolescence and are associated with tobacco use and nicotine addiction.[26,27] Population-based human studies have demonstrated associations between prenatal tobacco exposure and early tobacco experimentation[28] as well as increased likelihood of tobacco use as an adolescent and adult.[29,30] Other studies showed associations between parental tobacco use and increased rates of child experimentation with tobacco and smoking uptake.[7,31–34] Most of these studies did not control for prenatal tobacco or postnatal SHS exposure, which makes it difficult to draw conclusions about the influence of SHS exposure, because the 3 factors are linked. By definition, in households with a smoker, someone presents a role model of smoking, which may further increase the likelihood of initiation of tobacco use by preadolescents and adolescents.[7,35]

The evidence supporting the association of SHS exposure of children with respiratory illnesses is strong. Increased rates of lower respiratory illness, middle-ear infections, tonsillectomy and adenoidectomy, cough, asthma and asthma exacerbations, hospitalizations, and sudden infant death syndrome have been reported.[1,21] The scope of these illnesses is huge: it has been estimated that SHS exposure causes asthma symptoms in 200 000 to 1 000 000 children and contributes to as many as 8000 to 26 000 new cases of asthma per year.[36] SHS exposure exacerbates many chronic diseases. Children with sickle cell disease who are exposed to SHS have a higher risk of crises that require hospitalization than do unexposed children.[37]

Another effect of SHS exposure is increased school absenteeism. Analysis of data from the Third National Health and Nutrition Examination Survey showed that SHS-exposed children were twice as likely to miss 6 or more school days per year than were unexposed children (odds ratio: 2.0 [95% confidence interval: 1.4–2.8]).[38] A study of California schoolchildren showed that SHS-exposed children had a similar increased risk of absence from school, with risk increasing as the number of household smokers increased (relative risk: 1.29 [95% confidence interval: 1.02–1.63]).[39]

Children and the elderly represent a disproportionate share of fire victims, and smoking materials are the most common ignition source of fatal residential fires.[40–43] It has been estimated that smoking causes approximately 30% of US fire deaths overall, with at least 100 000 fires each year caused by children playing with ignition materials. The rate of fire deaths has decreased as smoking has decreased.[44] The technology of "fire-safe" cigarettes has been available for many years, although implementation of the technology was blocked by the tobacco industry for years.[45] In 2004, New York implemented a law that requires all cigarettes sold in the state to have "reduced ignition propensity."[46] Since then, many states and Canada have adopted similar laws.

COSTS TO FAMILIES

The cost of buying tobacco products is considerable; a family in which 1 member smokes 1 pack per day would spend more than $1600 on cigarettes each year (average price per pack in 2007: $4.49).[47] These expenditures can reduce a family's ability to meet essential needs; among low-income families, food insecurity is more likely if a family member uses tobacco.[48]

There are other, hidden costs to a family that are attributable to tobacco use. A 1997 analysis of National Longitudinal Survey of Youth data showed that tobacco users' wages were reduced by 4% to 8%, even after controlling for differences in education and other characteristics. The authors hypothesized that these differences were attributable to a combination of discrimination against tobacco users, increased absenteeism, poor health, and self-selection of jobs that include employer-provided health insurance at the expense of lower wages.[49] An additional effect may be decreased ability of SHS-exposed adults to care for children, because SHS exposure causes premature death and disease in nonsmokers, including coronary heart disease and lung cancer.[1]

COSTS TO SOCIETY

Estimates of the high medical costs of children's exposure to SHS and tobacco use in general have been made, several of which are summarized in Table 2. The health care cost of tobacco use, in both dollars and disease, is tremendous and is estimated to be more than $260 million each day in the United States.[50] Smoking by parents alone contributed estimated direct medical expenditures of $4.6 billion and loss-of-life costs of $8.2 billion in 1993.[51,52] A study that used National Medical Expenditure Survey data showed that health care costs for respiratory illnesses alone were increased by $120 per year for children 5 years or younger and by $175 per year for children 2 years or younger who were exposed to SHS by maternal

TABLE 2 Some Costs of Tobacco Use and SHS Exposure

Item	Cost	Source	Years Data Collected	Citation
Smoking during pregnancy: neonatal health care	Smoking-attributable fraction for neonatal costs: 2.2% (all states); $700/infant born to a mother who smoked during pregnancy	Centers for Disease Control and Prevention Pregnancy Risk Assessment Monitoring System (PRAMS) database	1995	Adams et al (2002)[136]
SHS exposure of pregnant women: early intervention services delivered to children with developmental delay attributed to maternal SHS exposure during pregnancy	$99 million for early-intervention services delivered to 8300 New York City children ($11 900/child)	New York City data	2002	Miller et al (2006)[137]
SHS exposure of children: health care costs	9% of total direct medical costs in the first year of life	Birth cohort study in Hong Kong	1997–1998	Leung et al (2003)[51]
SHS exposure of children: respiratory disease, sudden infant death, burns, costs to the family	Direct medical expenditures of $4.6 billion; loss-of-life costs of $8.2 billion	Literature synthesis	1980–1996	Aligne and Stoddard (1997)[3]
SHS exposure of children: medical expenditures for childhood respiratory illness	Respiratory-related health care expenditures: 19% of expenditures for childhood respiratory conditions ($120/child aged ≤5 y; $175/child aged ≤2 y)	National Medical Expenditure Survey	1987	Stoddard and Gray (1997)[52]
Overall smoking in the United States	6%–8% of total annual expenditures for health care, with some estimates up to 14%	Literature synthesis	Through 1998	Warner et al (1999)[138]

smoking (1995 dollars).[52] Tobacco users are more likely to be absent from work, to be disabled, and to die prematurely. The corresponding loss of productivity was estimated to be $92 billion for the period 1997–2001.[53]

INTERVENTIONS

Although household smoking bans reduce children's SHS exposure, even a strict ban does not eliminate exposure.[52,54] SHS can enter the home in the air, on dust, in or on clothing, or via the smoker's exhaled breath.[55] Nearly 90% of households of nonsmokers have an indoor smoking ban; households that include smokers have a much lower rate of smoking bans.[56–58] Individuals who consider SHS exposure to be harmful are most likely to report having an indoor home smoking ban.[57,59–62] Fewer parents ban smoking in the car than in the home,[56,59,61,63] although recent state legislative efforts to outlaw smoking in a car carrying a child may increase the rate of car bans.†

There is strong evidence that adult tobacco users can successfully quit and that counseling and pharmacotherapies help them succeed. Each year, 4% to 9% of tobacco users quit without support[64]; tobacco users who receive counseling and use pharmacotherapies significantly increase their likelihood of quitting.[65]

The 2008 update of the US Public Health Service clinical practice guideline, *Treating Tobacco Use and Dependence*,[65] provides guidelines for clinical practice and presents meta-analyses of approximately 8700 scientific articles on cessation of tobacco use. The review covers assessment of tobacco use; brief, intensive clinical interventions; systems interventions; pharmacotherapies; special populations such as pregnant women, children, and teenagers; and other topics such as weight gain and cost-effectiveness.

Addressing Tobacco Dependence in the Pediatric Setting

The US Public Health Service guideline recommends that all clinicians strongly advise patients who use tobacco to quit and states: "Clinicians in a pediatric setting should offer smoking cessation advice and interventions to parents that limit children's exposure to second-hand smoke."[65] Few studies have evaluated ways to protect children from SHS exposures through promotion of smoking bans or tobacco-cessation interventions delivered to family members through pediatric practices. Interventions that have been successful in decreasing the SHS exposure of children generally provide intensive, home-based counseling[66,67]; these interventions have not been translated effectively from academic to community settings.[68,69] In a randomized trial of practice-based counseling and reminders to promote tobacco cessation by mothers, Groner et al[70] reported no significant effect of the intervention on cessation, although mothers in the intervention group re-

†For more information on states with bans on smoking in cars that carry children, contact the American Academy of Pediatrics (AAP) Division of State Government Affairs.

ported smoking outside more often than did mothers in the control group. A Cochrane collaboration review of programs to reduce exposure of children to SHS concluded that "brief counseling interventions, successful in the adult health setting when coming from physicians, cannot be extrapolated to adults in the setting of child health."[71]

Despite the paucity of evidence supporting the effectiveness of counseling delivered in the pediatric setting, the arguments for asking about tobacco use and SHS exposure, advising all families to make their home and cars smoke free, counseling users to quit, and referring users to cessation programs are compelling. The pediatric visit provides many opportunities to deliver tobacco use-cessation counseling to parents. Because parents of younger children are themselves typically young and healthy, many see their child's pediatrician more often than they see their own primary care clinician. Pediatric visits offer many "teachable moments"[72] to discuss tobacco use, from both the prevention and cessation perspectives, and parents may be motivated to change their behavior for the benefit of their child's health. Another important counseling opportunity is the new parent who quit using tobacco during pregnancy: 48% to 70% of mothers who quit smoking during pregnancy relapse after delivery.[73–76]

Barriers to Counseling Parents

Because it is an accepted role of the pediatrician to counsel parents in behavior changes that will improve the life and health of their child, including changes in sensitive areas such as diet and discipline, one might expect that counseling parents to make their homes and cars smoke free or to quit using tobacco would be included routinely in the pediatric visit. However, many opportunities to counsel parents are missed. Tanski et al[77] reported that during the period 1997–1999, only 1.5% of ambulatory care visits, 4.1% of well-child visits, 4.4% of acute illness visits for asthma, and 0.3% of acute illness visits for otitis media included delivery of tobacco counseling. One possible reason for these low rates of counseling may be concerns about alienation of the parent.[78,79] However, many parents who smoke welcome advice to quit; in a sample of Vermont parents who smoked, 52% said they would welcome a pediatrician's advice to quit using.[80] Other studies of parents have concurred.[80–83]

Other challenges to counseling parents in the pediatric setting are writing prescriptions for cessation medications and the lack of a charting system for parents. Prescription of medications used to support cessation attempts by their child's pediatrician is accepted by parents; in a 2003 telephone survey of parents who smoked, 85% of respondents reported that it was acceptable for their child's doctor to prescribe a smoking-cessation medication for them.[84] Only 8% had received such a prescription; in a different survey of pediatricians,[78] only 13% said they would prescribe or recommend nicotine-replacement therapy (NRT) to parents who smoke and have children 5 years or younger.

Although writing prescriptions for people who are not patients raises concerns about propriety, malpractice, and ethics, writing prescriptions for family members of a patient has precedent. For instance, prophylactic therapy or immunization for household members of a person exposed to invasive *Haemophilus influenzae* type b disease, hepatitis A, meningococcal disease, head lice, pertussis, plague, scabies, or varicella is recommended by the AAP Committee on Infectious Diseases.[85] Many of the antibiotic agents used for these treatments are associated with significant adverse effects and a prescription is required, whereas several NRT products are available without a prescription.‡ However, the need for good record-keeping persists, and some clinicians may decide to set up a separate chart for their patients' household members.

Practices may adopt strategies to encourage parents to seek care from their own clinicians or seek help from other cessation resources, including local or state health departments. A key aspect of this counseling is to convey the importance of seeking help and the benefits of cessation programs that fit the needs of the parent, including both appropriate counseling and pharmacotherapy.

Other concerns include lack of time and reimbursement for services. As of 2006, 76.5% of states (including the District of Columbia) provided Medicaid coverage for some component of tobacco use treatment,[86] and of those, only 1 (New Mexico) offered coverage for all of the treatments recommended in the US Public Health Service guideline.[65] Coverage provided by private insurance plans varies widely, and few plans cover over-the-counter NRTs or individual face-to-face counseling.[87] The lack of coverage for tobacco-dependence treatments that have been shown to be both efficacious and cost-effective is an important issue in healthy policy.

Coding for SHS Exposure and Treatment

To further develop the evidence supporting the benefits of tobacco-dependence treatment in the pediatric setting, coding for diagnosis and treatment is important. Two codes may be particularly useful[88]:

‡Except for people 18 years or younger or if required for reimbursement or insurance coverage.

- 989.84 (toxic effects of tobacco); and
- V15.89 (other specified personal history presenting hazards to health [list SHS exposure as the hazard]).

Similarly, naming SHS as a factor in insurance claims, death certificates, and other documents can aid in assessing the effects of SHS exposure on health and the need for reimbursement for treatment of SHS exposure.

Tobacco-Cessation Treatment of Adults

There is strong evidence that adult tobacco users can successfully quit and that counseling and pharmacotherapy help them succeed.[65] Each attempt to quit increases the likelihood of success. Without counseling, 4% to 9% of tobacco users quit each year[64]; with counseling and pharmacotherapies, 17% to 44% of attempts are successful.[89]

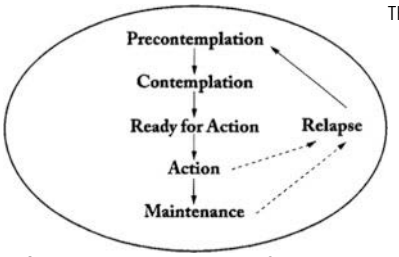
In adult medical care settings, simply asking about tobacco use and SHS exposure and recommending that users quit has been shown to increase the number of quit attempts and the success rates of those attempts.[65] Counseling does not need to be extensive and is additive, resulting in an increase in quit attempts, and the success rates of quit attempts as the amount of counseling delivered increases even if the counseling is delivered over the course of several visits.

Tailoring the message to the needs of the individual increases the likelihood of success. Although tobacco-cessation counseling is equally effective with women as with men, women may more often have concerns about weight gain or be using nicotine to alleviate depression. Studies of counseling tailored to women have suggested that addressing these gender-specific issues may increase success.[65] Counseling of pregnant women has been also shown to be effective; the US Public Health Service guideline[65] recommends more intensive counseling, particularly person-to-person psychosocial interventions that exceed the minimal advice to quit. Counseling techniques and resources tailored to pregnant women are available (www.ahrq.gov/path/tobacco.htm#Pregnant).

The most successful counseling and behavioral therapies to promote cessation include problem-solving/skills training and social supports. Most structured counseling is based on the "stages-of-change" theory, which explains how individuals change personal behaviors.[90] When used in the context of tobacco-use cessation, the goal is to help a user progress through 6 stages in a stepwise manner (Table 3). Specific counseling methods, such as motivational interviewing, may help identify and overcome barriers to cessation. Motivational interviewing is a client-centered, directive counseling method to enhance readiness for change by helping clients explore and resolve ambivalence toward change[91] (Table 4). Both stages-of-change theory and motivational interviewing techniques can be used to understand and address health behaviors other than tobacco use.

The process of effective tobacco-use cessation counseling can be broken into 5 steps, called the 5 A's: ask, advise, assess, assist, and arrange follow-up (Table 5).[65] Identifying the benefits to the child of parental smoking cessation may be an important motivation to parents. Not every parent will be ready to consider quitting. Using the 5 R's (Table 6) to help overcome

TABLE 3 Stages of Change[90]



The theory supporting stages of change is that people progress through several stages on their way to a behavior, and to change the behavior, they must pass through several stages as well. When used in the context of tobacco-use cessation, the goal is to help a user progress through 6 stages in a stepwise manner. Structured cessation counseling based on the stages of change focuses on helping the precontemplator become a contemplator, a contemplator become ready for action, etc, until the user enters termination and no longer perceives any cues to use tobacco.

Precontemplation is the period in which users are not thinking about quitting (at least not within the next 6 mo). Educating the user in the harms of tobacco use to themselves and their children may help the tobacco user move toward the contemplation stage.

Contemplation is the period of time in which users are seriously thinking about quitting within the next 6 mo but are not ready to start the process. Addressing barriers to quitting and helping parents overcome their fear of living without tobacco by discussing each barrier may move users toward preparing to quit.

Ready for action is the period during which users seriously think about quitting in the next month. The definition also applies to users who have tried to quit in the previous year. These users are ready to learn about quitting and are ready to set a quit date. The clinician should be prepared to help the user follow through with a quit date in the next 4 to 6 wk.

Action is the period ranging from 0 to 6 mo after users quit. This is the busiest period of change. The clinician can help the (now former) user avoid relapse by reminding him or her of successes and the reasons for quitting.

Maintenance is the period beginning 6 mo after action started and continuing until tobacco use is terminated as a problem. Maintenance involves development of new responses to situations that might trigger relapse. In this stage, clinicians continue to provide support for the quitter to remain tobacco free.

Relapse is technically any time the user, or ex-user, moves back in the cycle, but the person is usually thought of as a user who has quit for some period of time and uses tobacco again.

Termination is when the addictive behavior is entirely extinguished; this may take years.

TABLE 4 Principles of Motivational Interviewing[91]

Express Empathy	Acceptance Facilitates Change
	Skillful, reflective listening is fundamental.
	Ambivalence is normal.
Develop discrepancy	The client, rather than the counselor, should present the arguments for change.
	Change is motivated by a perceived discrepancy between present behavior and important personal goals or values.
Roll with resistance	Avoid arguing for change.
	Resistance is not directly opposed.
	New perspectives are invited but not imposed.
	The client is a primary resource in finding answers and solutions.
	Resistance is a signal to respond differently.
Support self-efficacy	A client's belief in the possibility of change is an important motivator.
	The client, not the counselor, is responsible for choosing and carrying out change.
	The counselor's own belief in the client's ability to change becomes a self-fulfilling prophecy.

barriers to cessation can provide a framework for counseling.[65]

Correctly used pharmacotherapy significantly increases the odds of success.[65] NRT products are available without prescription in patch, gum, and lozenge forms. NRT nasal spray and inhalers require prescriptions. Most NRT products are priced comparably to the cost of smoking a pack of cigarettes each day. Because these products are not available as single units, this cost can be prohibitive for many patients (ie, $50 or more for 1 package). NRTs are relatively easy to use, and some forms can provide rapid relief for difficult moments. However, NRT products have not been as successful in improving long-term cessation rates during pregnancy[92] or when used by adolescents[93] as they have been in the general population. Bupropion and varenicline are available only by prescription; both reduce the number and severity of urges to smoke, with results for varenicline somewhat better than for bupropion.[94] Clinicians should be familiar with NRTs and other pharmacotherapies used to treat tobacco dependence and promote their use for adolescent and young adult patients and parents. The American Academy of Family Physicians has an excellent guide (see "Prescribing Guidelines" at www.aafp.org/online/en/home/clinical/publichealth/tobacco/nrt.html for quick access to information on dosing, precautions, and adverse effects of tobacco-cessation medications that have been approved by the US Food and Drug Administration).

Many users make multiple attempts to quit before succeeding, and although most relapses occur early in the quitting process, some occur months or even years later.[65] Because of the chronic relapsing nature of tobac-

TABLE 5 A Systematic Method for Counseling About Tobacco: The 5 A's[65]

Ask
- Obtain a tobacco-use and SHS-exposure history for all patients and their parents/households, including current use or exposure as well as use or exposure before and during pregnancy.
- Ask about SHS exposures in child care settings and homes visited by the child.
- Use charting prompts or other cues to increase initiation of history-taking and documentation of family tobacco use and SHS exposures. When selecting or designing electronic health records and paper records, include tobacco-history-documentation prompts in the selection and design criteria.
- Questions asked should be phrased to limit misunderstanding about whether the query is about smoking "in (inside) the home" or smoking status of household members. When asking about smoking inside the home, say "does anyone smoke inside your home, even in the basement or garage?" rather than "does anyone smoke around the baby?"

Advise
- Provide information about elimination of children's SHS exposure to all parents and information about tobacco-use cessation, as indicated. Provide strong messages on harm from SHS exposure.
- Engage parents in discussions about their tobacco use. Provide a strong quit-using message that is clear. For example, you can say, "As your child's doctor, I think the very best thing you can do for your health and your child's health is to quit smoking." Personalize the child's health risk by saying, "It is very likely that Alicia's ear infections are worsened by your smoking," or, "Paul's asthma attacks may improve if he is not exposed to your smoking; it is important that you quit smoking."

Assess
- Determine the parent's readiness to quit. Is the parent a precontemplator or a contemplator? Is he or she ready to quit within the next month?

Assist
- Precontemplation stage: Provide a motivational message (the 5 R's [see Table 6]).
- Contemplation stage: If parents are not ready to set a quit date, ask them to make a list of everything they like and do not like about smoking to help get them thinking about tobacco use in a more specific way.
- Preparation stage: Help them set a quit date. Address their concerns about quitting, including withdrawal symptoms and perceived barriers to quitting. Perceived barriers to quitting can be addressed by educating the user about the quitting process, including what to expect and how long symptoms will last, weight gain, triggers to smoking, feelings of deprivation, and flagging motivation. Acute nicotine withdrawal can last from several days to weeks after cessation, typically peaking between 1 and 3 wk after the last cigarette is smoked.[65]
- Refer to supports such as quit-smoking groups, community quitlines, and other supports, as available.

Arrange follow-up
- Plan to follow-up on any behavioral commitments that parents make on follow-up visits for health care maintenance or for ongoing medical problems.

TABLE 6 Counseling to Overcome Resistance to Quitting Tobacco Use: The 5 R's[65]

Relevance
Ask parents to consider the personal importance of quitting.
Advise parents that (1) their personal health will improve (they will feel better physically and perform better in physical activities, they will have fewer wrinkles and their skin will not age as fast, food will taste better, their sense of smell will improve), (2) the children's health will improve (they will have healthier infants and children, they will set a good example for children), (3) their home, car, clothing, and breath will smell better, (4) they will save money, and (5) they will be able to say they are a "former smoker" and can stop worrying about quitting and about exposing others to smoke.
Try to personalize the benefits of quitting to the parents' situation.
Risks
Ask parents to identify the negative consequences of tobacco use.
Highlight the consequences that seem most relevant.
Rewards
Ask parents to identify the benefits of quitting.
Highlight the benefits that seem most relevant.
Roadblocks
Help parents to identify barriers to quitting.
Identify possible solutions such as pharmacotherapy or changes in daily patterns that may alleviate those barriers.
Repetition
Repeat the message every time parents who use tobacco visit the office.
Convey to tobacco users that most people make several quit attempts before they are successful.

co dependence, pediatricians should continue to deliver the "stay-quit" message whenever possible. Relapse-prevention counseling is especially important right after the quit date and can be delivered during scheduled office visits, during telephone calls, on postcards, or by using other methods.[65]

If a "lapse" occurs, discuss the cues that promoted the lapse and what the parent learned about cues and quitting. It is important to remind the parent that the urge to smoke lasts only a few minutes, so distraction techniques can be helpful during "craving attacks."[65] Other topics to address include the parent's success to date and anticipatory guidance regarding weight gain, cravings, environmental cues, and other tobacco users in the household or family.

Quitlines and Other Resources

A variety of resources are available to clinicians to guide care. The US Public Health Service clinical practice guideline[65] presents information on how to assess tobacco use; brief and intensive clinical interventions; systems interventions; pharmacotherapy; special populations such as pregnant women, children, and teenagers; and special topics such as weight gain and cost-effectiveness. The national Quit Line, 1-800-QUIT NOW, provides evidence-based, effective telephone counseling and is available throughout the United States. In many states, "fax-back" forms can be used to refer a tobacco user to the Quit Line directly, rather than instructing the patient or parent to call the Quit Line. The use of fax-back referrals has been shown to significantly increase the number of tobacco users who use the Quit Line.[95] The American Cancer Society, the American Lung Association, and many hospitals provide group counseling and other cessation resources. Appendix 2 describes many resources for clinicians and tobacco users.

COST AND EFFECTIVENESS OF TREATING TOBACCO USE AND NICOTINE ADDICTION

Tobacco-use counseling, NRT products, and other tobacco-addiction treatments have been shown to be both cost-effective and efficacious when used in the internal medicine or family practice setting to treat adult smokers.[65,76,96,97] The benefits of insurance coverage of cessation interventions, whether intensive or minimal, accrue to both insurers and employers.[98] Brief physician-delivered smoking-cessation counseling is more cost-effective than many other widely recommended screening tests and interventions.[99]

PERSONAL AND PROFESSIONAL POLICIES

Tobacco is a product that, when used as intended, causes significant morbidity and mortality. Accepting funds from the tobacco industry for support of activities, regardless of whether it is related to tobacco control, is contradictory to the mission of health promotion for children and their families.

The tobacco industry has demonstrated their intent to manipulate public opinion,[100] scientific research,[101–107] regulation,[108] and education[109–111] to promote tobacco products throughout the world. Furthermore, by funding prestigious researchers at respected institutions, the tobacco industry gains credibility. Many articles demonstrating the intent of the tobacco industry to promote smoking and tobacco use, as demonstrated by documents internal to the industry, have been published. The American Legacy Foundation maintains the Legacy Tobacco Documents Library at the University of California, San Francisco (http://legacy.library.ucsf.edu); much of the literature on the tobacco industry is based on the documents in the library. One additional example of the influence of the tobacco industry on the practice of medicine is a successful effort to invalidate and remove the ICD (International Classification of Diseases) e-code for SHS exposure on Medicare billing form 1500. The code became available in 1994 and remained invalid until at least 2004. This apparently mi-

nor step has had a significant effect on our understanding of SHS exposure.[112]

PUBLIC POLICIES

A growing number of communities and states have implemented statewide bans on smoking in public places.§ Bans on smoking at workplaces, restaurants, child care settings, public parks, and beaches and in other public venues have been extremely successful in decreasing and, in some cases, eliminating SHS exposure.[113] Other positive effects of bans are increases in quitting attempts and successes,[96,114–117] increased prevalence of smoke-free homes and cars in the surrounding community,[61,118,119] improved air quality and health outcomes for employees[120–122] and children,[123] and decreased social acceptability of tobacco use.[58,124,125] Studies of restaurants and bars that compared income before and after a ban have shown no adverse effect on the economics of the hospitality industry.[126] Enforcement of smoke-free policies in public space typically is not an issue after a break-in period.[1]

Mass-media campaigns and comprehensive community interventions contribute to the overall social unacceptability of SHS exposure of children.[113,127,128]

Other areas of public policy in which tobacco use should be addressed include housing, child care settings, and foster care. Several groups are leading efforts to make multiunit housing smoke free, and many cooperative apartment buildings and condominiums already have done so. Appendix 3 lists several resources on this issue. Most states regulate smoking in child care settings, although many allow smoking on the premises when children are not present, resulting in exposure of children to "thirdhand" smoke. The National Resource Center for Health and Safety in Child Care and Early Education provides a list of state regulations applicable to child care settings (http://nrc.uchsc.edu/STATES/states.htm). Exposure of foster children to SHS has been prohibited by several states and counties.[129] The National Voice of Foster Parents, an organization of and for foster parents, supports legislation and rules that prohibit the use of tobacco in foster homes and vehicles used to transport foster children.[130] It is important to provide treatment for tobacco dependence when implementing and enforcing these restrictions.

TOBACCO-CONTROL EDUCATION

Although there have been many successes in efforts to reduce the prevalence and harms of smoking, the pediatric community lags behind the internal medicine, family medicine, and obstetric/gynecology communities in tobacco-control and education efforts.[131–133] Using provider education and having providers implement self-reminder systems to ensure that tobacco cessation is raised during the clinical examination has been shown to be effective, especially when used as part of a multicomponent clinical program.[65] Training in best practices in smoking-cessation counseling is not required in medical schools, pediatric clerkships, or pediatric residency programs, with the sole exception of such training listed in the program requirements for residency and fellowship education in adolescent medicine.[134,135] This absence of educational requirements in these key training periods is critical, because clinical practices may become established during training and difficult to change after completion of training.[131–133] All clinicians should be skilled in counseling to prevent tobacco use and SHS exposure and for tobacco-use cessation.

RESEARCH

There are significant gaps in the body of evidence related to pediatric tobacco control. Study of prevention approaches and interventions to limit SHS exposures in primary care settings are particularly needed. Other areas that require further study include pharmacologic effects of nicotine; use and efficacy of NRT products and other pharmacotherapy used to treat nicotine addiction of children, pregnant women, and families; effects of SHS exposure of children; and the effect of indoor air-quality laws and price/tax controls.

SUMMARY

SHS exposure of children and their families causes significant morbidity and mortality. Pediatricians have many opportunities to advocate for elimination of SHS exposure of children in their personal and professional roles.

§For more information on states with public smoking bans, contact the AAP Division of State Government Affairs.

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APPENDIX 1: DISEASES AND OTHER ADVERSE HEALTH EVENTS WITH WHICH SHS OR PRENATAL TOBACCO-SMOKE EXPOSURE HAS BEEN ASSOCIATED

Note that these studies have not been critically evaluated. The reader is advised to perform his or her own evaluation before drawing conclusions. See www.aap.org/richmondcenter/AAP_Tobacco_Policy.html for updates.

Effects on the Fetus of Prenatal Tobacco Exposure Attributable to Maternal Tobacco Use

Increased risk of:

- Growth abnormalities, including
  - low birth weight[1–15] and amplification of risk of low birth weight in fetus' with cystic fibrosis[16] and
  - intrauterine growth retardation/small for gestational age[1,5,12,17]
- Delivery complications, including
  - premature rupture of membranes,[17]
  - placenta previa and abruption,[17–20]
  - preterm delivery, stillbirth, spontaneous abortion,[1,3,5,11,15,17–22] and
  - admission to NICUs[3]
- Orofacial clefts[23–31] (recent studies have been less supportive, although Honein et al[32] found fairly strong evidence for specific types of clefts)
- Septal and right-sided obstructive cardiac defects[33]
- Increased systolic blood pressure at 2 months of age[34]

Effects on the Fetus of Prenatal Tobacco Exposure Attributable to Maternal SHS Exposure

Increased risk of:

- Decreased birth weight,[35–39]
- Fetal mortality,[36,40] and
- Preterm delivery[36] and spontaneous abortion[40]

Effects on the Child of Prenatal Tobacco Exposure Attributable to Maternal Tobacco Use

Increased risk of:

- Nicotine-withdrawal symptoms during the neonatal period[41]
- Infant death
  - from all causes[3,13,17,18,40] and
  - from sudden infant death syndrome[3,17,18,42–45]
- Persistent pulmonary hypertension of the newborn[46]
- Poor sleep[47]
- Infection, including neonatal infection[18,48]
- Hypoparathyroidism[49]
- Respiratory effects, including
  - reduced lung function in infants and children,[50–53]
  - lower respiratory tract illnesses (such as pneumonia and bronchiolitis),[54]
  - increased diagnosis of asthma[55] and use of bronchodilating drugs,[47] and
  - otitis media[56,57]
- Poor growth[58]
- Behavioral and neurocognitive effects, including
  - abnormal neonatal neurobehavior, developmental delay, attention-deficit/hyperactivity disorder, conduct disorder and other aggressive behaviors,[59–61] and psychiatric disorders,[62–87] and
  - speech-processing ability[88]
- Febrile seizures[89]
- Experimentation with tobacco and addiction to tobacco as an older child or adult[76,90–92]
- Gastrointestinal disease, including
  - colic,[93–96]
  - pyloric stenosis,[97] and
  - diabetes[98]
- Legg-Calvé-Perthes disease[99]
- Some cancers[100–103]
- Development of allergies[104,105]
- Hospitalization for any illness[106–113]
- Office visits for any illness[106–110]
- Hyperopia[114]
- Significant reductions in cortical gray matter and total parenchymal volumes and head circumference[115]
- Altered development of white matter microstructure[116]
- Craniosynostosis[117] (rather weak evidence)

Effects on the Child of Prenatal Tobacco Exposure Attributable to Maternal SHS Exposure

Increased risk of:

- Reduced cognitive development[118]
- Conduct disorder[59]

Effects on Breastfeeding Attributable to Maternal Tobacco Use or SHS Exposure

Increased risk of:

- Decreased initiation and duration of breastfeeding[119–125]
- Decreased iodine levels in human milk[126]

Effects on the Child of SHS Exposure

Increased risk of:

- Allergic sensitization[111,127–152]
- Poor sleep, in breastfed infants[153]
- Lower respiratory disease, including
  - persistent decreased lung function,[106–109,137,139,149,154] amplified in children with cystic fibrosis,[16]
  - infections,[137,139,151,154–157]
  - bronchiolitis,[158] wheezing,[47] and use of bronchodilating drugs,[47]
  - asthma prevalence,[159] and
  - frequency and severity of asthma exacerbations‖

‖Refs 106, 110, 111, 128, 134, 140, 149, 156, 157, and 160–185.

- Upper respiratory infections, including
  - otitis media,¶
  - cough[106,110,111,189,190] and use of cough medicines,[47]
  - rhinitis[47] and nasal obstruction,[192]
  - tonsillectomy, adenoidectomy, and placement of pressure-equalizing tubes,[168,179,180,193,194] and
  - respiratory complications associated with anesthesia[195–199]
- Infections, including
  - invasive meningitis,[200,201]
  - infection with *Mycobacterium tuberculosis* in children who live in a household with a patient with tuberculosis,[202] and
  - infection with *Helicobacter pylori*[203,204]
- Hospitalization for
  - any illness,[106,110,111,113,205–207]
  - respiratory disease,# and
  - serious infections[206]
- Gastrointestinal disease, including
  - colic[47,93–96,209] and
  - reflux[209–211]
- Increased complications of type 1 diabetes mellitus[212] (study was small, included active smokers)
- Behavioral and neurocognitive effects[69,70,85–87,213,214]
- Dental disease[215,216]
- School absences[106,110,112,139,217,218]
- Molecular, genetic, and cellular changes[219–222]
- Experimentation with tobacco and addiction to tobacco as an older child or adult[110,223–226]
- Injury and death attributable to fires[110,227–231]
- Hyperopia[114]

¶Refs 106, 110, 111, 160, 165, 177, 178, 182, 183, and 186–191.

#Refs 54, 106, 110, 111, 129, 134, 205, and 208.

Effects on the Adult of Prenatal Tobacco Exposure Attributable to Maternal Tobacco Use

Increased risk of:

- Asthma[232]
- Elevated cholesterol levels in young adults[233]
- Hypertension[234]
- Younger age at menopause[235] (suggestive)

Effects on the Adult of Childhood SHS Exposure

Increased risk of:

- Altered lipid profiles and endothelium effects in adolescents and young adults[236–238]
- Asthma[232,239]
- Chronic dry cough and phlegm[240]
- Lung cancer, leukemia, and lymphoma, as an adult[220,221,241,242]
- Increased risk of spontaneous abortion in women exposed as children to SHS by both parents[243,244]

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APPENDIX 2: RESOURCES

See www.aap.org/richmondcenter/AAP_Tobacco_Policy.html for updates.

General

1-800-QUIT-NOW

- http://1800quitnow.cancer.gov: 1-800-QUIT-NOW is the toll-free national telephone counseling service to help people stop smoking or quit other forms of tobacco use.

Addressing Tobacco in Healthcare

- www.atmc.wisc.edu: The Addressing Tobacco in Healthcare Research Network, supported by the Robert Wood Johnson Foundation, connects researchers, health care providers, and other partners interested in developing and implementing changes to health care systems that will improve the delivery of evidence-based tobacco-dependence treatment.

Agency for Healthcare Research and Quality

- www.ahrq.gov
- www.ahrq.gov/clinic/tobacco/tobaqrg.pdf—clinical practice guideline *Treating Tobacco Use and Dependence*: This Public Health Service guideline contains strategies and recommendations designed to assist clinicians, tobacco-dependence treatment specialists, and health care administrators, insurers, and purchasers in delivering and supporting effective treatments for tobacco use and dependence.
- www.ahrq.gov/clinic/tobacco/tobaqrg.htm—*Treating Tobacco Use and Dependence*, quick reference guide for clinicians: This is a quick how-to guide to assist clinicians in implementing the clinical practice guidelines.
- www.ahrq.gov/clinic/tobacco/clinhlpsmksqt.htm—Helping Smokers Quit: A Guide for Clinicians: This guide gives clinicians easy access to information to help their patients quit smoking. The tool is based on the 5 A's approach to cessation intervention (ask, advise, assess, assist, and arrange) and offers other helpful resources.

Alliance for the Prevention and Treatment of Nicotine Addiction

- www.aptna.org: The mission of the Alliance for the Prevention and Treatment of Nicotine Addiction is to work toward reduction in tobacco-caused morbidity and mortality by providing services that promote effective treatment and prevention of nicotine addiction. Services are targeted to health care providers, clinicians, administrators, organizations, and educational institutions to promote policies that lead to an increase in implementing effective smoking-cessation strategies among high-risk tobacco users.

American Academy of Allergy Asthma & Immunology

- www.aaaai.org: The American Academy of Allergy Asthma & Immunology is the largest professional medical specialty organization in the United States, representing allergists, asthma specialists, clinical immunologists, allied health professionals, and others with a special interest in the research and treatment of allergic disease.

American Academy of Family Physicians

- www.aafp.org/online/en/home/clinical/publichealth/tobacco.html: This Web site provides up-to-date resources for clinicians. In particular, there is an excellent resource on pharmacotherapies used to treat tobacco dependence: www.aafp.org/online/en/home/clinical/publichealth/tobacco/nrt.html

American Academy of Pediatrics

- www.aap.org: The AAP is a 60 000-member organization dedicated to the health and well-being of infants, children, adolescents, and young adults.
- AAP Julius B. Richmond Center: www.aap.org/richmondcenter
- Committee on Environmental Health: www.aap.org/visit/cmte16.htm
- Department of Community Pediatrics: www.aap.org/commpeds

American Cancer Society

- www.cancer.org: The American Cancer Society is the nationwide community-based voluntary health organization dedicated to eliminating cancer as a major health problem.

American College of Obstetricians and Gynecologists

- www.acog.org/departments/dept_web.cfm?recno=13: The American College of Obstetricians and Gynecologists is the leading group of professionals providing health care for women. It has several resources for providers and patients.

American Legacy Foundation

- www.americanlegacy.org: The American Legacy Foundation concentrates on tobacco prevention and cessation, because smoking is the largest preventable cause of death in America. Its programs are working to engage all Americans in the dialogue about tobacco and to foster an understanding about its harmful effects.

American Lung Association

- www.lungusa.org: Founded in 1904 to fight tuberculosis, the American Lung Association fights lung disease in all its forms, with special emphasis on asthma, tobacco control, and environmental health.

Ask and Act

- www.aafp.org/online/en/home/clinical/publichealth/tobacco.html: The American Academy of Family Physicians' new tobacco use-cessation campaign encourages 100% of family physicians to ask about the tobacco-use habits of all their patients and act on that information.

Centers for Disease Control and Prevention

- www.cdc.gov
- www.cdc.gov/tobacco—Office on Smoking and Health: The Office on Smoking and Health offers information on all aspects of tobacco control and prevention.
- www.cdc.gov/tobacco/quit_smoking/cessation/practical_guide—A Practical Guide to Working with Health-Care Systems on Tobacco-Use Treatment: This guide was designed to increase public health professionals' comfort with and skill in establishing collaborative relationships with leaders of health care systems and to facilitate the creation of long-term partnerships that promote effective system-wide tobacco-use treatment.
- www.cdc.gov/tobacco/media_communications/countermarketing/mcrc/index.htm—Media Campaign Resource Center for Tobacco Prevention and Control: The Media Campaign Resource Center provides access to effective media campaign materials for tobacco-use prevention.

The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General

- www.surgeongeneral.gov/library/secondhandsmoke: US Surgeon General Richard H. Carmona issued this comprehensive scientific report (June 2006), which concludes that there is no risk-free level of exposure to SHS.

The Health Consequences of Smoking: A Report of the Surgeon General

- www.cdc.gov/tobacco/data_statistics/sgr/sgr_2004/index.htm: A comprehensive report on the hazards of smoking and the benefits of quitting published by the US Department of Health and Human Services in May 2004.

Motivational Interviewing

- www.motivationalinterview.org: Motivational interviewing is a client-centered, directive method for enhancing intrinsic motivation to change by exploring and resolving ambivalence. This Web site is intended to provide resources for those seeking information on motivational interviewing. It includes general information about the approach as well as links, training resources, and information on reprints and recent research.

National Tobacco Technical Assistance Consortium

- www.ttac.org: The National Tobacco Technical Assistance Consortium: is dedicated to assisting organizations in building and developing highly effective tobacco-control programs.

Professional Assisted Cessation Therapy

- www.endsmoking.org: Professional Assisted Cessation Therapy is an independent consortium of leaders in the treatment of tobacco dependence whose mission is to lower barriers to broader use of cessation therapy through education and advocacy.

Smoke Free Homes

- www.kidslivesmokefree.org: Smoke Free Homes' mission is to reduce secondhand smoke exposure of children by increasing the awareness and understanding of the health benefits of creating smoke-free environments for children among members of the pediatric community.

Smokefree.gov

- www.smokefree.gov: This National Institutes of Health Web site was developed by using evidenced-based research. The site features "LiveHelp," which connects smokers with a cessation counselor via instant messaging, and an interactive Web-based cessation guide based on the National Cancers Institute's "Clearing the Air" booklet.

US Environmental Protection Agency Smoke-Free Homes

- www.epa.gov/smokefree: This site offers a wealth of information on the health effects of SHS on children and helps families establish a smoke-free home.

Medical Students

Smoking Cessation: Effective Intervention Strategies

- http://nosmoking.msm.edu: This course is a collaborative effort of the Morehouse School of Medicine and the Mercer School of Medicine. It is intended primarily for medical students, who can register to receive academic curriculum credit.

Prevention and Cessation Education for Medical Students

- www.teachtobacco.org: Prevention and Cessation Education for Medical Students (PACE) is a consortium of 12 US medical schools funded by the National Cancer Institute to assess and improve tobacco teach-

ing. PACE aims to successfully incorporate tobacco education modules into a number of US medical schools to ensure that graduating students at these schools will be able to skillfully perform tobacco use-prevention and -cessation counseling for children, adolescents, and adults.

Nurses

Helping People Quit Smoking: Nursing Best Practice Guidelines

- www.rnao.org/smokingcessation: This training Web site developed by the Registered Nurses Association of Ontario comprises a minicourse and 4 modules focusing on how nurses can provide brief interventions for smoking cessation.

Tobacco-Free Nurses

- www.tobaccofreenurses.org: A smoking-cessation site tailored for nurses and nursing students who want to quit smoking.

Perinatal

Mom's Quit Connection

- www.snjpc.org/mqc: Mom's Quit Connection is a free program of the Southern New Jersey Perinatal Cooperative that provides cessation counseling to pregnant and parenting women and teenagers who want to stop smoking. Perinatal smoking-cessation community and professional education programs are offered to health care providers, schools, and service agencies, including a practice-based, on-site American College of Obstetricians and Gynecologists 5 A's brief intervention training for clinicians.

The National Partnership for Smoke-Free Families

- www.helppregnantsmokersquit.org: Smoke-Free Families is a national program supported by the Robert Wood Johnson Foundation working to discover the best ways to help pregnant smokers quit before, during, and after pregnancy. This Web site provides information about effective, evidence-based smoking-cessation treatments to care professionals and consumers.

Counseling and Treatment Trainings, Including Systems Change

CEASE: Clinical Effort Against SHS Exposure

- www.massgeneral.org/children/professionals/cease/default.aspx: The Clinical Effort Against SHS Exposure program was developed by child health care clinicians to help other child health care clinicians adjust their office setting to address parental tobacco use in a routine and effective manner.

Clean Air for Healthy Children & Families

- www.cleanairforhealthychildren.org: The Clean Air for Healthy Children & Families program is a smoking-cessation counseling training program primarily targeted to health care professionals who care for pregnant women, mothers, and caregivers of young children and teenagers.

Mayo Clinic Nicotine Dependence Center

- www.mayoclinic.org/ndc-rst: The Nicotine Dependence Center offers educational activities to health care professionals who are interested in incorporating nicotine-dependence treatment into their practice and/or developing a service to meet the needs of tobacco-dependent patients.

Quitters Win, No Ifs, Ands or Butts

- www.mdhelpquit.org: This Web-based continuing education activity examines smoking cessation in primary care, with the goal of affecting physicians' clinical practices regarding smoking-cessation counseling and use of valuable resources such as "quitlines."

Rx for Change

- http://rxforchange.ucsf.edu: Rx for Change: Clinician-Assisted Tobacco Cessation is a comprehensive, turnkey, tobacco use-cessation training program that equips health professional students and licensed clinicians with state-of-the-art knowledge and skills for assisting patients with quitting.

Smoking Cessation in the Pediatric Office

- www-cme.erep.uab.edu/scpo/index.html: Sponsored by the University of Alabama, among others, this program assists pediatric health care providers in determining the smoking status of the parents of pediatric patients and influencing those who smoke to quit.

TobaccoCME.com

- www.tobaccocme.com: TobaccoCME.com is a Web-based program that provides training in tobacco treatment that prepares physicians to provide clinical tobacco interventions for prevention and cessation.

Treating Tobacco Use and Dependence

- www.medscape.com/viewprogram/3607: A continuing medical education credit course for physicians, nurses, and pharmacists developed by the University of Wisconsin Center for Tobacco Research and Intervention and offered through Medscape.

University of Massachusetts Center for Tobacco Prevention and Control Tobacco Treatment Specialist: Training and Certification Program

- www.umassmed.edu/tobacco/index.aspx: The Tobacco Treatment Spe-

cialist: Training and Certification Program is a nationally recognized, professional certification program.

University of Medicine and Dentistry of New Jersey School of Public Health's Tobacco Dependence Program

- www.tobaccoprogram.org: The Tobacco Dependence Program has developed certified trainings to prepare professionals to provide intensive specialist treatment for tobacco dependence.

Youth

Helping Young Smokers Quit

- www.helpingyoungsmokersquit.org: The Helping Young Smokers Quit initiative works to fill a gap in knowledge about the numbers and distribution of youth cessation programs, as well as the types of treatment approaches and program components that are currently offered across the United States.

Youth Tobacco Cessation Collaborative

- www.youthtobaccocessation.org: The Youth Tobacco Cessation Collaborative was created to address the gaps in knowledge about what cessation strategies are most effective in assisting youth to quit smoking.

Patients and Consumers

1-800-QUIT-NOW

- http://1800quitnow.cancer.gov: 1-800-QUIT-NOW is the toll-free national telephone counseling service to help people stop smoking or quit other forms of tobacco use. Spanish-speaking counselors are available.

Become an EX

- www.becomeanex.org: This free quit plan sponsored by the American Legacy Foundation uses a systematic program to help prepare a customized quitting plan for each person.

Freedom From Smoking Online

- www.ffsonline.org: This online smoking-cessation program sponsored by the American Lung Association is an interactive course designed to educate and modify the behavior patterns of a smoker. Freedom From Smoking Online can be accessed day or night, 7 days per week, on any schedule the smoker chooses. It is ready whenever a smoker wants to start the process of quitting and is free of charge (registration is required).

Nicotine Anonymous

- www.nicotine-anonymous.org: Nicotine Anonymous welcomes all those seeking freedom from nicotine addiction, including those using cessation programs and nicotine-withdrawal aids. The organization offers group support and recovery using the "12 steps," as adapted from Alcoholics Anonymous, to achieve abstinence from nicotine.

QuitNet

- www.quitnet.com: This Web site includes a quitting guide, a national directory, pharmaceutical product overview, and Web resource directory with links to other online resources, programs, and self-help materials. Registered users can access customized advice, peer support, quitting tools and tips, and referrals to counselors.

Smokefree.gov

- www.smokefree.gov: This National Institutes of Health Web site was developed by using evidence-based research. The site features "LiveHelp," which connects smokers with a cessation counselor via instant messaging, and an interactive Web-based cessation guide based on the National Cancer Institute's "Clearing the Air" booklet.

SHS Exposure Reduction

California EPA Office of Environmental Health Hazard Assessment

- www.oehha.ca.gov: This office's overall mission is to protect and enhance public health and the environment by scientific evaluation of risks posed by hazardous substances.
- www.oehha.ca.gov/air/environmental_tobacco/kidets041906.html—Secondhand Smoke Tobacco Smoke & Children's Health. Also available in Spanish at www.oehha.ca.gov/air/environmental_tobacco/pdf/smoke2final_span.pdf.

US Environmental Protection Agency Smoke-Free Homes

- www.epa.gov/smokefree: This site offers a wealth of information on the health effects of SHS on children and helps families establish a smoke-free home. Materials are available in Spanish.

Policy and Advocacy

Addressing Tobacco in Health Care

- www.atmc.wisc.edu: The Addressing Tobacco in Healthcare Network, supported by the Robert Wood Johnson Foundation, connects researchers, health care providers, and other partners interested in developing and implementing changes to health care systems that will improve the delivery of evidence-based tobacco-dependence treatment.

Allergy & Asthma Network Mothers of Asthmatics

- www.aanma.org: AANMA is a national nonprofit network of families whose desire is to overcome, not cope with, allergies and asthma.

American Legacy Foundation

- www.americanlegacy.org: The American Legacy Foundation was established in March 1999 as a result of the Master Settlement Agreement between a coalition of attorneys general in 46 states and 5 US territories and the tobacco industry. The foundation is dedicated to promoting tobacco-free generations.

Americans for Nonsmokers' Rights

- www.no-smoke.org: Americans for Nonsmokers' Rights is the leading national lobbying organization dedicated to nonsmokers' rights, taking on the tobacco industry at all levels of government to protect nonsmokers from SHS and youth from tobacco addiction.

Campaign for Tobacco-Free Kids

- http://tobaccofreekids.org: The campaign is dedicated to protecting children from tobacco addiction by raising awareness of its use.

Global Tobacco Research Network

- http://tobaccoresearch.net: The Global Tobacco Research Network's mission is to enhance research by promoting collaboration and partnerships, providing information, facilitating training, and sharing research tools with the goal of reducing the burden of disease and death caused by tobacco.

Institute for Global Tobacco Control

- www.jhsph.edu/global_tobacco: Established in 1998 in the Department of Epidemiology at the Johns Hopkins Bloomberg School of Public Health, the Institute for Global Tobacco Control works to prevent death and disease from tobacco use through research, education, and policy development.

National Action Plan for Tobacco Cessation

- www.ctri.wisc.edu/Researchers/NatActionPlan%2002–04.pdf: This report, prepared by the Interagency Committee on Smoking and Health's Subcommittee on Cessation, outlines a series of feasible, science-based action steps to promote smoking cessation, reduce smoking prevalence, and prevent millions from starting to smoke.

National African American Tobacco Education Network

- www.naaten.org: The National African American Tobacco Education Network is a collaborative of national African American stakeholders that have an interest in establishing or augmenting tobacco prevention and control activities within their organizations as well as the African American community.

National African American Tobacco Prevention Network

- www.naatpn.org: The National African American Tobacco Prevention Network is a national organization dedicated to facilitating the development and implementation of comprehensive and community-competent tobacco-control programs to benefit communities and people of African descent.

National Latino Council on Alcohol and Tobacco Prevention

- www.nlcatp.org: The National Latino Council on Alcohol and Tobacco Prevention is the only Latino national organization dedicated solely to reducing the harm caused by alcohol and tobacco in the Latino community through research, advocacy, policy analysis, community education, training, and information dissemination.

North American Quitline Consortium

- www.naquitline.org: The North American Quitline Consortium seeks to unite quitline professionals in the United States and Canada to enable them to work together to increase access to and the effectiveness of quitline services that help people in their quitting attempts.

Policy Advocacy on Tobacco and Health

- www.thepraxisproject.org: Policy Advocacy on Tobacco and Health is an initiative of the Praxis Project Inc, designed to simultaneously build bridges between tobacco-control policy initiatives and strengthen the voice and capacity of communities of color in the tobacco-control movement.

Smoke Free Movies

- www.smokefreemovies.ucsf.edu: This project aims to sharply reduce the US film industry's usefulness to the tobacco industry's domestic and global marketing.

Smoking Cessation Leadership Center

- http://smokingcessationleadership.ucsf.edu: The Smoking Cessation Leadership Center is a national program office of the Robert Wood Johnson Foundation that aims to increase smoking-cessation rates and increase the number of health professionals who help smokers quit.

Tar Wars

- www.tarwars.org: Tar Wars is a pro-health, tobacco-free education program and poster contest of the American Academy of Family Physicians designed to discourage tobacco use among fourth- and fifth-grade students.

Tobacco.org

- www.tobacco.org: Tobacco news and information.

Tobacco Policy Change

- www.tobaccopolicychange.org: This national initiative of the Robert Wood Johnson Foundation was created to provide resources and technical assistance for community, regional, and national organizations and tribal groups interested in advocating for effective tobacco use-prevention and -cessation policy initiatives.

UAMS Smoke-Free Hospital Toolkit

- www.uams.edu/coph/reports/smokefree_toolkit: This guide for implementing smoke-free policies was developed by the University of Arkansas for Medical Sciences College of Public Health.

UMICH Implementing a Smoke-Free Environment CD and Toolkits

- www.med.umich.edu/mfit/tobacco/freeenvironment.htm: The University of Michigan Health System's Tobacco Consultation Service has developed a CD and toolkits to guide hospitals and other health care facilities on the steps to creating a smoke-free workplace.

Research

Academic Pediatric Association: Pediatric Tobacco Issues Special Interest Group (The "Cig SIG")

- www.ambpeds.org/specialInterestGroups/sig_ped_tobacco.cfm: The "Cig SIG's" mission is to bring members and friends of the Academic Pediatric Association together for networking, dissemination of information, and discussion of research and funding opportunities, education, health care delivery, public policy, and advocacy related to pediatric tobacco control.

Global Tobacco Research Network

- http://tobaccoresearch.net: The Global Tobacco Research Network's mission is to enhance research by promoting collaboration and partnerships, providing information, facilitating training, and sharing research tools with the goal of reducing the burden of disease and death caused by tobacco.

Society for Research on Nicotine and Tobacco

- www.srnt.org: This Web site provides information on the latest research, abstracts, publications, and events related to nicotine and tobacco.

University of Wisconsin Center for Tobacco Research and Intervention

- www.ctri.wisc.edu: The University of Wisconsin Center for Tobacco Research and Intervention was founded and is directed by Michael Fiore, MD, MPH, and is recognized internationally as a leading authority on tobacco-use treatment.

APPENDIX 3: SMOKE-FREE MULTIUNIT HOUSING

See www.aap.org/richmondcenter/AAP_Tobacco_Policy.html for updates.

Community Initiatives

California

- www.smokefreehousing.org—California Smoke Free Housing Project: Smokefreehousing.org was created to provide a source for accessing information on smoke-free housing in Northern California.
- www.smokefreeapartments.org—Southern California Smokefree Apartment House Registry: A free information service for owners and managers of smoke-free apartment buildings, condominiums, townhouses, and rental houses and for prospective tenants. It is based in southern California and is starting out with names of owners and managers in the Los Angeles area who offer smoke-free housing.

Maine

- www.smokefreeforme.org/tenant.php—Smoke Free For Maine: A Web site on tenants' and landlords' rights in ensuring a smoke-free housing environment. A page on the Web site addresses public housing.

Michigan

- www.tcsg.org/sfelp/apartment.htm—The Smoke-Free Environments Law Project: Based in Ann Arbor, this Web site includes methods to help create a smoke-free housing environment and addresses issues of public opinion and frequently asked questions about the smoke-free housing market.

Oregon

- http://smokefreeoregon.com/index.php—Smokefree Oregon: A Web site dedicated to helping landlords, tenants, bar owners, and bar goers create a smoke-free environment.

Utah

- www.tobaccofreeutah.org/aptcondoguide.html—Utah Smoke-Free apartment and condominium guide: The statewide directory is a listing of rental properties that provide smoke-free housing in the state of Utah.

Washington

- www.metrokc.gov/health/tobacco/housing.htm—The Seattle and King County Tobacco Prevention Program: Includes a "how-to" guide and PowerPoint presentation for landlords, ten-

ants, and housing authorities to stop smoking in their housing developments.

West Virginia

- www.wvsmokefreehousing.com—West Virginia Smoke-Free Housing Project

National

- www.s-fhc.com—Smoke-Free Housing Consultants: This site will help you understand the demand for, advantages of, and legalities of owning or managing smoke-free apartment and condominium buildings. Smoke-Free Housing Consultants is available for consultation in all states that do not currently have a state- or tax-funded smoke-free housing advisory organization. They will refer you to someone in your area that can help you if an agency is working on this problem in your area.
- www.tcsg.org/sfelp/fha_01.pdf—Federal Fair Housing Act and the Protection of Persons Who Are Disabled by SHS in Most Private and Public Housing:
- www.no-smoke.org/goingsmokefree.php?dp=d11—How landlords can prohibit smoking in rental housing

AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

Danette Glassy, MD; Judith Romano, MD; and the Committee on Early Childhood, Adoption, and Dependent Care

Selecting Appropriate Toys for Young Children: The Pediatrician's Role

ABSTRACT. Play is essential for learning in children. Toys are the tools of play. Which play materials are provided and how they are used are equally important. Adults caring for children can be reminded that toys facilitate but do not substitute for the most important aspect of nurture—warm, loving, dependable relationships. Toys should be safe, affordable, and developmentally appropriate. Children do not need expensive toys. Toys should be appealing to engage the child over a period of time. Information and resources are provided in this report so pediatricians can give parents advice about selecting toys.

Children learn from the time they are born, and parents/guardians are primarily responsible for providing quality experiences from which their children learn. Parents often ask their pediatrician for advice about appropriate toys, books, and computer or video games, because they know that these tools may be important in their child's development. Pediatricians can use questions about toys as opportunities to discuss the importance of a child's environment at home and in child care. A young child's growth and development can be supported and enhanced through play. Toys bring parents or caregivers and children together in play. Early brain development is enhanced through these relationships.[1] These discussions are also an opportunity for the pediatrician to help parents understand the role of play in all areas of development, including cognitive, language, social, physical, and emotional development.

Toys can provide a bridge for a child's interactions with parents or other caregivers.[1] Although toys should never be used as a substitute for loving, unconditional attention from parents and other caregivers, toys can enhance these interactions. When adults participate in the play of children, learning is enhanced.[1] Parents are able to observe the skills their child currently has and also help expand those skills. For example, if an 18-month-old who is starting to enter the world of pretend play is building a tower with blocks, a parent can introduce the idea that the blocks can also become a garage for the cars or a house for the stuffed animals. A child's self-esteem and level of mastery are also enhanced when adults participate in play.[1] Toys can facilitate the development of relationships as parent and child share in the mutual joy and delight of new discoveries.[1]

When pediatricians advise parents, it is important to stress that toys serve a supportive role in enhancing a child's development. Play materials should match the developmental and individual needs of each child. Some children may need toys that have been adapted to accommodate a motor, visual, or other disability.[2] All children benefit from toys that promote safe physical activity.

Some toys pose emotional or social risks. Graphic depictions of violence presented in an interactive way, such as in some computer or video games, can lead to acts of violence by the child.[3,4] Although video games are rated, even those deemed for "everyone" may contain significant violence.[5] Toy weapons or other toys that promote violence should be discouraged. Parents also should consider whether a toy promotes negative racial, ethnic, cultural, or gender stereotypes. The toys parents provide (or do not provide) send children a message about what is valued.

Some toy marketing includes claims that specific toys will facilitate specific developmental milestones. There is no scientific evidence to suggest that any toy is necessary or sufficient for optimal learning. These advertisements can promote misinformation, inappropriate expectations, and unnecessary expenditures. Even worse is the unfounded guilt parents experience when they cannot afford or choose not to make such purchases.

Government regulations, improved safety standards for the manufacture and use of toys, and product testing have made most toys safe when used appropriately for recommended ages and stages of development. Just because a product is on the market, though, does not mean it is safe. In determining toy safety, the characteristics of the toy should be considered as well as how the toy might be used or abused and the amount of supervision or help needed for safe play. It is important for pediatricians to be familiar with current recommendations about

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

toy safety and guidelines on the safe cleaning and maintenance of toys.[6–10]

Pediatricians can use the information provided in this report to guide them in selecting and maintaining the toys in their office and make this information available to parents (see resource list). Although there appears to be no increased rate of acute illness for children who have just visited a pediatrician's office,[11] toys in the office should be routinely cleaned. Toys that are available in a pediatric office and how they are maintained will serve as a model for parents.

ADVICE FOR PEDIATRIC OFFICES

1. Office toys should be safe for all ages.
   - Do not provide small toys or toys with easily dislodged parts that fit in an infant's or toddler's mouth.[2,5–8]
   - Do not provide toys with loose string, rope, ribbons, or cord.[2,6–9]
   - Do not provide toys with sharp edges.[2,6–9]
   - Do not provide toys that make loud or shrill noises.[2,6–9]
   - Provide only toys made of nontoxic materials.[2,6–9]
   - Always store toys safely, and avoid toy chests with lids.[2,6–9]
   - Choose toys that are easily and routinely cleaned. When possible, each time a toy has been in contact with saliva or other body fluids, it should be sanitized (2 minutes of contact with a 10% bleach solution [1 tablespoon of household bleach per quart of water], made fresh daily, or use of an Environmental Protection Agency-registered sanitizing solution according to manufacturer's instructions), then rinsed and air dried.[10]
2. Office toys should be engaging and encourage creativity.[2,6]
3. Offices should include at least as many developmentally appropriate books and magazines as toys.
4. Posters from the American Academy of Pediatrics and the Consumer Product Safety Commission concerning toys and safety recalls should be prominently displayed in the office.
5. For a list of appropriate and safe toys, see the Goodson and Bronson resource *Which Toy for Which Child*, available by order or online.[9]

ADVICE FOR PARENTS AND CAREGIVERS

1. Keep in mind that the most educational toy is one that fosters the interaction of an adult with a child in supportive, unconditional play. Toys are never substitutes for the attention of devoted caregivers.[1]
2. Provide children with safe, affordable toys that are developmentally appropriate. Include toys that help promote learning and growth in all areas of development. Avoid toys that discourage children from using their imaginations. Social/emotional and cognitive skills are developed and enhanced as children use play to work out real-life problems.[2,6–9]
3. Make a thoughtful selection of toys and remember that a good toy does not have to be trendy or expensive.[2,6]
4. Use books and magazines to play and read together.
5. Be skeptical of educational or developmental claims made by advertisers, especially product claims of intellectual enhancement.
6. Seek the pediatrician's advice in distinguishing between safe and unsafe toys (see resource list).[2,6–9]
7. Remember that some toys promote violence or negative social, racial, or gender stereotypes. These toys are not recommended for children.[3]
8. Limit video game and computer game use. Total screen time, including television and computer use, should be less than 1 to 2 hours per day.[4] Children younger than 5 years should play with computer or video games only if they are developmentally appropriate, and they should be accompanied by the parent or caregiver.[1]
9. For a list of appropriate and safe toys, see the Goodson and Bronson resource *Which Toy for Which Child*, available by order or online.[9]

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Sexuality, Contraception, and the Media

abstract

FREE

From a health viewpoint, early sexual activity among US adolescents is a potential problem because of the risk of pregnancy and sexually transmitted infections. New evidence points to the media adolescents use frequently (television, music, movies, magazines, and the Internet) as important factors in the initiation of sexual intercourse. There is a major disconnect between what mainstream media portray—casual sex and sexuality with no consequences—and what children and teenagers need—straightforward information about human sexuality and the need for contraception when having sex. Television, film, music, and the Internet are all becoming increasingly sexually explicit, yet information on abstinence, sexual responsibility, and birth control remains rare. It is unwise to promote "abstinence-only" sex education when it has been shown to be ineffective and when the media have become such an important source of information about "nonabstinence." Recommendations are presented to help pediatricians address this important issue. *Pediatrics* 2010;126:576–582

THE COUNCIL ON COMMUNICATIONS AND MEDIA

KEY WORDS
sexual activity, adolescents, media, television

ABBREVIATIONS
STI—sexually transmitted infection
TV—television

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INTRODUCTION

Early sexual activity among teenagers can be problematic. According to the 2009 Youth Risk Behavior Survey, 46% of all high school seniors have had sexual intercourse, and 14% have had 4 partners or more.[1] Although pregnancy rates have generally been decreasing since 1991, the United States still has the highest teen pregnancy rate in the Western world,[2] and for the first time in 15 years, the birth rate increased 3% from 2005 to 2006.[3] Early intercourse also increases the risk of contracting a sexually transmitted infection (STI), including HIV, and adolescents have one of the highest STI rates of any age group.[4] Although 15- to 24-year-olds account for only one-quarter of the sexually active population in the United States, they contract nearly half of all new STIs every year.[4] A recent study by the Centers for Disease Control and Prevention revealed that 1 in 4 teenagers has had an STI.[5] Ten percent of young women who had first had sex in their teenage years reported that their first time was involuntary, and the younger they were, the more likely that was the case.[6]

WHAT CHILDREN AND TEENAGERS LEARN FROM THE MEDIA

American children and teenagers spend more than 7 hours/day with a variety of different media.[7] Those media are filled with sexual messages and images, many of which are unrealistic.[2] On television (TV), which remains the predominant medium in terms of time spent for all young people, more than 75% of prime-time programs contain sexual

content, yet only 14% of sexual incidents mention any risks or responsibilities of sexual activity.[8,9] Talk about sex on TV can occur as often as 8 to 10 times per hour.[10] Between 1997 and 2001 alone, the amount of sexual content on TV nearly doubled.[9]

So-called reality TV has also entered the picture. In 1997, there were only 3 reality dating shows; by 2004, there were more than 30.[11] Some shows, such as *Temptation Island*, bring participants together for the sole purpose of seeing who "hooks up." A study of college students revealed that viewing such shows correlated with beliefs in a double standard—that men are sex driven and that men and women are sexual adversaries.[11] It is interesting to note that the less sexually experienced students were more likely than sexually experienced students to be watching reality shows, which suggests the importance of such programs for sexual socialization.[12,13]

In addition to TV, other media provide frequent messages about sexual behavior.

- Music continues to be a major source of sexual suggestiveness. In 1 study, 40% of lyric lines contained sexual material, and only 6% contained healthy sexual messages.[14] An analysis of the 279 most popular songs in 2005 revealed that 37% contained sexual references and that degrading sexual references were common.[15]
- Virtually every R-rated teen movie since the 1980s has contained at least 1 nude scene and, often, several instances of sexual intercourse (eg, the *American Pie* movie series).[16] Teen movies also contain distorted views of romance and normal adolescent sexuality.[16–18]
- Teen magazines are popular with preadolescent and adolescent girls and devote an average of 2.5 pages per issue to sexual topics.[19] Coverage of sex as a health issue in magazines is more common than on TV, but the overarching focus seems to be on deciding when to lose one's virginity.[12,20]
- The Internet has become an abundant source of both sexual information and pornography that cannot be regulated.[21,22] Online pornography is now a $1 billion industry.[12] In a national sample of 1500 10- to 17-year-olds, nearly half of the Internet users had been exposed to online pornography in the previous year.[23] In addition, unwanted sexual solicitations and harassment are not uncommon,[24] although they may not be as frequent as parents fear.[25]
- Social networking Web sites and home pages enable teenagers to present themselves publicly, sometimes in sexually suggestive ways.[12,26] One study of 233 teen home pages revealed that nearly 10% mentioned sex, and girls were 3 times more likely to do so than boys.[27] A recent study of 500 publicly available MySpace profiles revealed that nearly one-quarter of them referenced sexual behaviors.[28] Also, a national survey of nearly 1300 teenagers and young adults revealed that 20% reported having sent or posted nude pictures or videos of themselves ("sexting").[29]
- Advertisements often use sex to sell. Women are as likely to be shown in suggestive clothing (30%), partially clad (13%), or nude (6%) as they are to be fully clothed.[30] As one expert noted, "When sexual jokes are used to sell everything from rice to roach-killer, from cars to carpets, it's hard to remember that sex can unite two souls, can inspire awe. Individually, these ads are harmless enough, sometimes even funny, but the cumulative effect is to degrade and devalue sex."[31] Advertisements for erectile dysfunction drugs are ubiquitous. In the first 10 months of 2004, the makers of these drugs spent nearly $350 million on advertising.[32] At the same time, advertisements for birth control products are rare.[2]

Because so many sex education programs have recently been focused on abstinence only, the media have arguably become one of the leading sex educators in the United States today.[2] Adolescents frequently cite the media as a source of sexual information.[2] For example, in a national survey the media rivaled parents and schools as a source of information about birth control.[33] The media are powerful sources for behavioral "scripts" concerning sexual situations, especially for inexperienced teenagers.[2,34] Yet, parents and legislators fail to understand that although they may favor abstinence-only sex education (despite the lack of any evidence of its effectiveness),[35] the media are decidedly not abstinence only. In fact, the United States has some of the most sexually suggestive media in the world.[2] American media make sex seem like a harmless sport in which everyone engages, and results of considerable research have indicated that the media can have a major effect on young people's attitudes and behaviors.[12–18] In fact, the media may function as a "superpeer" in convincing adolescents that sexual activity is a normative behavior for young teenagers.[2,36,37] In a survey of 2100 11- to 17-year-old girls, only the 11-year-olds reported that they did not feel pressure from the media to begin having sex.[38]

IMPACT OF SEXUAL CONTENT ON ADOLESCENT BEHAVIOR

Numerous studies have delineated the media's powerful influence on adolescents' sexual attitudes, values, and beliefs.[2,39–42] Unlike the media violence re-

search literature, in which some 2000 studies exist, there have been only a handful of studies on the effects of sexual content on actual behavior. At least a dozen correlational studies have examined the relationship between the amount of sexual content viewed on TV and early onset of sexual intercourse.[43–53] The most recent studies have revealed that (1) listening to sexually degrading lyrics is associated with earlier sexual intercourse,[40,53] (2) black female teenagers' exposure to rap music videos or X-rated movies is associated with the likelihood of multiple sexual partners or testing positive for an STI,[49] (3) teenagers whose parents control their TV-viewing habits are less sexually experienced,[51,52] and (4) exposure to sexual content in the media is a significant factor in the intention to have sex in the near future.[52–54]

Nine longitudinal studies have given potential answers to the question of whether sexy media contribute to early sexual activity, and the answer seems to be "yes."[41,55–62] Results of 7 of these studies have shown that exposure to sexual content in TV and other media in early adolescence—particularly for white teenagers—can as much as double the risk of early sexual intercourse. Adolescents whose parents limit their TV-viewing are less likely to engage in early sex.[58] Younger children who have viewed adult-oriented TV shows and movies are more likely to begin having sexual intercourse earlier.[61] The study samples together total nearly 10 000 teenagers nationwide, and the most ambitious studies included other media such as movies, music, and magazines.[57] In addition, a recent study revealed that early exposure to sexual content doubled the risk of teen pregnancy.[60] Clearly, the media play a major role in determining whether certain teenagers become sexually active earlier rather than later,[63] and sexually explicit media may be particularly important.[41,64]

CONTRACEPTIVE ADVERTISING

The United States is the only Western nation that still subscribes to the dangerous myth that giving teenagers access to birth control—and media represent a form of access—will make them sexually active at a younger age. Other countries advertise birth control products widely and have a much lower rate of teen pregnancy.[12,16] Although the teen birth rate had been declining in the United States up until 2005–2006, it has declined just as much or more in other countries. A recent study revealed that 86% of the recent decline in teen pregnancies could be attributed to increased contraceptive use, and only 14% was attributable to increased abstinence.[65] The recent 3% increase in teen births could be a "blip," or it could be attributable to an increase in abstinence-only sex education and the concomitant reduction in accurate information about contraception.[66–68]

Eight peer-reviewed, controlled clinical trials have revealed that giving teenagers freer access to condoms does not increase their sexual activity or encourage virginal teenagers to begin having sex, but it does increase the use of condoms among those who are already sexually active.[69–76] Advertising condoms, birth control pills, and emergency contraception on TV and radio could further decrease the teen pregnancy rate. Yet, several networks refuse such advertisements.[77,78]

Telling teenagers, "Wait until you're older to begin having sex, but if you can't wait, use birth control" is a double message. But, it is a double message that every teenager in America can understand and benefit from, and it is consistent with normal adolescent psychology, because it acknowledges that adolescents do not always listen to their elders.[2] In 2007, both CBS and FOX refused a condom advertisement as "inappropriate" because it mentioned preventing pregnancy rather than preventing HIV/AIDS.[78] Advertisements for emergency contraception are virtually nonexistent on American TV, despite the fact that every year, American women have 3 million unplanned pregnancies, which lead to 1.3 million abortions. Advertising for emergency contraceptives could be an important way to reduce the number of abortions in the United States.[79]

POSITIVE IMPACT

The media can be powerful vehicles for sexual health education. Socially responsible messages can be embedded into mainstream programming—a practice dubbed "entertainment-education" or "edutainment."[39] Collaborative efforts between the Kaiser Family Foundation and the producers of the hit TV show *ER* resulted in successful story lines about the risks of human papillomavirus and the usefulness of emergency contraception.[80] In 2002, *Friends* aired an episode about condoms, and 27% of a national sample of teenagers saw the program; many of them reported that they talked about condom effectiveness with an adult as a direct result of the episode.[81] In 2008, a study showed that viewers of a *Gray's Anatomy* episode learned that HIV-positive women could still have HIV-negative infants.[82] The Soap Opera Summit in Hollywood and international efforts to embed story lines into popular soap operas are other examples of prosocial efforts. The media giant Viacom and the Kaiser Family Foundation have launched an ambitious project to produce $120 million worth of public service announcements and print advertisements concerning HIV/AIDS and to encourage Viacom producers to include story lines in their TV shows that will raise AIDS awareness.[83] Such ef-

forts demonstrate that the entertainment industry can be receptive to outside input and that healthier content can be introduced into mainstream media without government pressure or the threat of censorship.

Mass media have also been used proactively to increase parent-child communication about sex. In North Carolina, a mass media campaign using billboards and radio and TV public service announcements delivered the message, "Talk to your kids about sex. Everyone else is." In follow-up research, exposure to the message correlated significantly with parents talking to their children about sex during the following month.[84]

RECOMMENDATIONS

1. Pediatricians can help parents and teenagers to recognize the importance of the media by asking at least 2 media-related questions at each well visit[77]: (1) How much time do you spend daily with entertainment media? and (2) Is there a TV set or Internet access in your bedroom? Research has shown that bedroom TVs are associated with greater substance use and sexual activity by teenagers.[85] A recent study revealed that office-based counseling is effective and could result in nearly 1 million more children and adolescents adhering to the American Academy of Pediatrics recommendation to limit media time to less than 2 hours/day.[86]
2. Pediatricians should counsel parents to recognize the importance of the media, exert control over their children's media choices, keep their children's bedrooms free of TVs and Internet connections, and avoid letting their children see PG-13– and R-rated movies that are inappropriate for them.[61,87,88] Pediatricians and parents also need to be aware of the importance of social networking sites and how they work so that they can effectively counsel children and adolescents about them.[89]
3. Pediatricians and child advocacy groups should encourage the entertainment industry to produce more programming that contains responsible sexual content and that focuses on the interpersonal relationship in which sexual activity takes place (Table 1). One way to do this would be to hold annual seminars for writers, producers, and directors in Hollywood, perhaps in cooperation with other groups. Similarly, Madison Avenue and advertisers need to be encouraged to stop using sex to sell products. Educational seminars might help to achieve this goal.
4. Pediatricians should urge schools to insist on comprehensive sex education programs (to counter the influence of sexually suggestive and explicit media) that incorporate basic principles of media literacy into their sex education programs. Studies have shown that effective media literacy programs can be protective against unhealthy media effects.[90,91] Federal money should be spent on comprehensive sex education programs but not on abstinence-only programs, which have been found to be ineffective.[35,65–68,92–94]
5. Pediatricians should urge the broadcast industry to air advertisements for birth control products. The federal government also needs to encourage the advertising of birth control, especially emergency contraceptives.
6. Pediatricians should urge the broadcast industry to limit advertisements for erectile dysfunction drugs until after 10 PM.
7. Pediatricians should urge the broadcast media to include healthy messages about sex and sexuality in their programming, especially in media that children and early teenagers use most frequently.[95]
8. Pediatricians, the broadcast industry, the federal government, and private foundations should support further research into the impact of sexual content in the media on children's and adolescents' knowledge and behavior.[96] A national task force on children, adolescents, and the media should be convened by child advocacy groups in conjunction with the Centers for Disease Control and Prevention and/or the National Institutes of Health to study the issue of children, adolescents, and media, devise new research, locate funding sources, and make recommendations to Congress, the broadcast industry, and the American people.

TABLE 1 Guide to Responsible Sexual Content in TV, Films, and Music: Some Suggestions for the Presentation of Responsible Sexual Content

Recognize sex as a healthy and natural part of life.
Parent and child conversations about sex are important and healthy and should be encouraged.
Demonstrate that not only the young, unmarried, and beautiful have sexual relationships.
Not all affection and touching must culminate in sexual intercourse.
Portray couples having sexual relationships with feelings of affection, love, and respect for one another.
Consequences of unprotected sex should be discussed or shown.
Miscarriage should not be used as a dramatic convenience for resolving an unwanted pregnancy.
Use of contraceptives should be indicated as a normal part of a sexual relationship.
Avoid associating violence with sex or love.
Rape should be depicted as a crime of violence, not one of passion.
The ability to say "no" should be recognized and respected.

Modified from Haffner DW, Kelly M. Adolescent sexuality in the media. *SIECUS Rep.* March/April, 1987:9–12.

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CLINICAL REPORT

Self-injectable Epinephrine for First-Aid Management of Anaphylaxis

Guidance for the Clinician in Rendering Pediatric Care

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ABSTRACT

Anaphylaxis is a severe, potentially fatal systemic allergic reaction that is rapid in onset and may cause death. Epinephrine is the primary medical therapy, and it must be administered promptly. This clinical report focuses on practical issues concerning the administration of self-injectable epinephrine for first-aid treatment of anaphylaxis in the community. The recommended epinephrine dose for anaphylaxis in children, based primarily on anecdotal evidence, is 0.01 mg/kg, up to 0.30 mg. Intramuscular injection of epinephrine into the lateral thigh (vastus lateralis) is the preferred route for therapy in first-aid treatment. Epinephrine autoinjectors are currently available in only 2 fixed doses: 0.15 and 0.30 mg. On the basis of current, albeit limited, data, it seems reasonable to recommend autoinjectors with 0.15 mg of epinephrine for otherwise healthy young children who weigh 10 to 25 kg (22–55 lb) and autoinjectors with 0.30 mg of epinephrine for those who weigh approximately 25 kg (55 lb) or more; however, specific clinical circumstances must be considered in these decisions. This report also describes several quandaries in regard to management, including the selection of dose, indications for prescribing an autoinjector, and decisions regarding when to inject epinephrine. Effective care for individuals at risk of anaphylaxis requires a comprehensive management approach involving families, allergic children, schools, camps, and other youth organizations. Risk reduction entails confirmation of the trigger, discussion of avoidance of the relevant allergen, a written individualized emergency anaphylaxis action plan, and education of supervising adults with regard to recognition and treatment of anaphylaxis.

INTRODUCTION

Anaphylaxis is an acute, life-threatening reaction, usually mediated by an immunologic mechanism involving immunoglobulin E, that results in sudden systemic release of mast-cell and basophil mediators such as histamine and tryptase.[1] Anaphylaxis has many clinical presentations, but respiratory compromise and cardiovascular collapse cause the greatest concern, because they can potentially lead to fatalities. Although a variety of different triggers for anaphylaxis episodes have been identified, food and insect stings are the most common identifiable triggers reported in the community setting.[2–4] Food allergies[5] and other allergies have increased in the past several years, and pediatricians increasingly need to prescribe emergency care plans for patients in the event of anaphylaxis outside the hospital/medical setting. Epinephrine is the primary medical therapy for a life-threatening allergic reaction.[1] This clinical report focuses on practical issues concerning the administration of self-injectable epinephrine for first-aid treatment of

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anaphylaxis in the community. In addition, several quandaries in management will be identified and possible solutions described.

DEFINITION AND FEATURES OF ANAPHYLAXIS

There is no current, universally accepted definition of anaphylaxis; however, at a recent symposium cosponsored by the National Institutes of Health and the Food Allergy & Anaphylaxis Network, the following definition was proposed: "Anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death."[6,7] Three clinical criteria for anaphylaxis based on symptoms and history were also proposed at the symposium. These criteria, as well as various signs and symptoms that may occur during anaphylaxis, are listed in Table 1. The clinician must also appreciate that certain disorders may appear to be anaphylaxis but are not (eg, vasovagal syncope or panic attack). Fatal anaphylaxis in the pediatric population has particularly been associated with known preexisting asthma, failure to administer epinephrine promptly, and the adolescent age group.[8,9]

TABLE 1 Clinical Criteria for Diagnosing Anaphylaxis (Fulfilling Any 1 Criterion Indicates That Anaphylaxis Is Highly Likely)[7]

Criterion 1	Acute onset of an illness (minutes to several hours) with involvement of the skin and/or mucosal tissue (eg, generalized hives, pruritus, or flushing, swollen lips/tongue/uvula) and at least 1 of the following: a. Respiratory compromise (eg, dyspnea, wheeze/bronchospasm, stridor, reduced peak expiratory flow, hypoxemia) b. Reduced blood pressure or associated symptoms of end-organ dysfunction (eg, hypotonia [collapse], syncope, incontinence)
Criterion 2	Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours): a. Involvement of the skin/mucosal tissue (eg, generalized hives, itch/flush, swollen lips/tongue/uvula) b. Respiratory compromise (eg, dyspnea, wheeze/bronchospasm, stridor, reduced peak expiratory flow, hypoxemia) c. Reduced blood pressure or associated symptoms (eg, hypotonia [collapse], syncope, incontinence) d. Persistent gastrointestinal symptoms (eg, crampy abdominal pain, vomiting)
Criterion 3	Reduced blood pressure after exposure to known allergen for that patient (minutes to several hours)

Less common presentations also occur (eg, sudden isolated hypotension without a known allergen exposure). Additional symptoms and signs that may occur during anaphylaxis include morbilliform rash, conjunctival erythema, pruritus and tightness in the throat, dysphagia, dysphonia, hoarseness, dry staccato cough, sensation of pruritus in the external auditory canals, nasal pruritus, nasal congestion, rhinorrhea, sneezing, chest pain, dysrhythmia, feeling of faintness/dizziness (near-syncope), paleness, cyanosis, confusion/altered mental status, an aura of doom, and uterine contractions. Skin signs aid in recognition but may be absent or not observed in 10% of children with anaphylaxis; moreover, they may not be observed in reactions that end in fatality.

The clinical criteria were adapted from Sampson HA, Muñoz-Furlong A, Campbell RL, et al. *J Allergy Clin Immunol*. 2006;117:391–397.

ROLE OF EPINEPHRINE

Epinephrine, the medication of choice for first-aid treatment of an episode of anaphylaxis, is a direct-acting sympathomimetic agent with effects on many target organs, including increased vasoconstriction, decreased mucosal edema, increased inotropy/chronotropy, and bronchodilation. In addition, epinephrine downregulates further mast-cell release of histamine, tryptase, and other mediators of inflammation. Delayed administration of epinephrine in anaphylaxis is associated with poor outcomes including fatality.[8–11] Oral H_1 antihistamines are not an optimal first-line therapy for anaphylaxis, because they have a slow onset of action (1 or more hours), primarily relieve cutaneous symptoms, and do not relieve respiratory symptoms or shock.[12] For children with known preexisting asthma who experience anaphylaxis, administration of an asthma-reliever medication (such as the inhaled selective β_2-adrenergic agonist albuterol) may provide adjunctive therapy for wheezing, coughing, and shortness of breath but does not relieve upper airway edema or shock, and therefore does not replace injected epinephrine in anaphylaxis management.

ROUTE OF ADMINISTRATION OF EPINEPHRINE

For first-aid treatment of anaphylaxis, administration of epinephrine by either the subcutaneous or intramuscular route has been recommended traditionally. However, studies on the rate of absorption of epinephrine injected by different routes and in different locations (eg, arm or thigh) have shown significant differences in time to peak concentrations, favoring intramuscular injection in the lateral thigh (vastus lateralis muscle), which leads promptly to peak plasma epinephrine concentrations. In a prospective, randomized, blinded study of children at risk of anaphylaxis,[13] the time to maximum epinephrine concentrations was 8 ± 2 minutes after injection of 0.30 mg of epinephrine from an EpiPen (Dey LP, Napa, CA) intramuscularly in the vastus lateralis. In contrast, the time to maximum plasma epinephrine concentration was 34 ± 14 minutes (range: 5–120 minutes) after injection of 0.01 mg/kg of epinephrine subcutaneously in the deltoid region.[13] These findings have been confirmed and extended in a randomized, double-blind, placebo-controlled crossover study in adults.[14] On the basis of studies in an animal model of anaphylaxis, achieving high plasma and tissue concentrations of epinephrine may be critical for reversal of hypotension.[15] The ½-inch (14.29-mm) needle on autoinjectors likely provides an intramuscular dose in most children, although it may not do so in obese adolescents, especially girls.[16]

It is not ethical to perform randomized, double-blind, placebo-controlled comparative studies on route of administration of epinephrine in children who are experiencing anaphylaxis, so definitive evidence-based recommendations on route of dosing cannot be made. On the

basis of the aforementioned available data at this time, intramuscular injection of epinephrine into the lateral thigh seems to be the preferred route for therapy in first-aid treatment. Intravenous administration carries risks of dilution errors and dosing errors, and many of the serious adverse effects attributed to epinephrine have followed large overdoses given intravenously. This route of administration should be reserved for those with severe anaphylaxis that does not respond to intramuscular epinephrine and/or individuals with anaphylaxis who are being treated in hospital settings.

EPINEPHRINE DOSING FOR FIRST-AID TREATMENT IN THE COMMUNITY

The recommendation for epinephrine dosing in children with anaphylaxis, based primarily on anecdotal evidence, is to inject 0.01 mg/kg, up to 0.30 mg.[17–19] Epinephrine autoinjectors are currently available in 2 fixed doses: 0.15 and 0.30 mg. Physicians, therefore, face a quandary with regard to dosing children who do not weigh approximately 15 kg (33 lbs [for whom the 0.15-mg dose is ideal]) or 30 kg (66 pounds or more [for whom the 0.30-mg dose is recommended]). The *Physician's Desk Reference*[20] and product inserts provide ambiguous advice and place the responsibility of dose selection entirely on the prescribing physician. Not surprisingly, therefore, both autoinjector doses are dispensed across almost the entire pediatric age range, indicating the potential for overdosing with the 0.15-mg dose in many infants, overdosing with the 0.30-mg dose in some young children, and underdosing with the 0.15-mg dose in many adolescents.[21] In a prospective, randomized, double-blind, parallel-group study of children at risk of anaphylaxis who self-injected either EpiPen 0.30 mg or EpiPen Jr 0.15 mg, pharmacologic effects such as pallor, tremor, and anxiety were observed transiently after injection of both doses, and additional effects including palpitations, headache, and nausea were observed in those who received the higher dose.[22] This study showed that the therapeutic effects of epinephrine could not be dissociated from the nontherapeutic effects. In the absence of availability of additional fixed doses (eg, 0.05, 0.10, 0.20, and 0.25 mg) in autoinjectors, the manufacturers' advice should be taken in the context of these benefits and risks.

The Risks of Prescribing an Epinephrine Ampule, Syringe, and Needle

Physicians face a particularly difficult dilemma in prescribing epinephrine doses for infants and children who weigh less than 15 kg (33 lb). One option may be to prescribe an epinephrine ampule/syringe/needle and instruct caregivers on how to draw up and inject epinephrine using these supplies. This approach was studied in 18 parents who were trained in the technique and whose speed and accuracy of drawing up an infant epinephrine dose (0.09 mL) was compared with that of 54 physicians and nurses (controls).[23] The parents took significantly ($P < .05$) longer than the controls to draw up the dose. The mean ± SEM times for drawing up doses were 142 ± 13 seconds (range: 83–248 seconds) for parents, 52 ± 3 seconds (range: 30–83 seconds) for physicians, 40 ± 2 seconds (range: 26–71 seconds) for general duty nurses, and 29 ± 0.09 seconds (range: 27–33 seconds) for emergency department nurses. The epinephrine content of the doses drawn up by parents, who were asked to draw up 0.09 mL, ranged from 0.004 to 0.151 mL (ie, nearly 40-fold). There was no correlation between speed of drawing up the epinephrine and accuracy of dosing. Parents had many concerns about successfully preparing and administering a dose by this method and about teaching other caregivers to use the method. The study was undertaken in a relaxed atmosphere, and one might expect more difficulties if the dosing were undertaken by laypersons while a child was experiencing anaphylaxis.[24]

Unfortunately, the current lack of autoinjectors with a low or adjustable dose and the problems involved with prescribing an epinephrine ampule along with a syringe/needle require that the physician and family arrive at a reasonable compromise for safe and effective administration of epinephrine in the event of anaphylaxis. In a survey of 29 pediatricians, 80% responded that they would prescribe the 0.15-mg autoinjector dose for a child who weighs 10 kg (22 lb); 100% responded that they would prescribe it for a child who weighs 15 kg (33 lb); and 70% responded that they would prescribe it for a child who weighs 20 kg (44 lb).[25] In a study of epinephrine-dispensing patterns,[21] 72% of prescriptions for infants younger than 6 months (weighing less than approximately 7 kg [15 lb]) were for a 0.15-mg autoinjector, and 20% were for ampule/syringe/needle; 95% of prescriptions for infants 6 to 12 months of age (likely weighing up to approximately 10 kg [22 lb]) were for a 0.15-mg autoinjector. Until a wider range of epinephrine autoinjector doses is available, pediatricians are forced to consider prescribing an autoinjector with a known, albeit not ideal, dose rather than risk likely overdosing or underdosing with ampule/syringe/needle.

Epinephrine Autoinjectors: 0.15 or 0.30 mg?

In the absence of a strong evidence base and a larger selection of premeasured autoinjector doses, and in light of studies showing elevated plasma concentrations and relatively modest adverse effects in children who weigh approximately 25 kg (55 lb) injected with approximately a 1.2-fold overdose of intramuscular epinephrine, it seems appropriate to switch most children from the 0.15-mg dose to the 0.30-mg dose at approximately 25 kg (55 lb)—that is, to provide a slightly higher dose (0.012 mg/kg) rather than an underdose (0.006 mg/kg) for a 25-kg (55-lb) child. For children who have asthma

or other additional risk factors for fatality from anaphylaxis, switching to the higher dose at a lower weight might be considered.[19] There are no data at this time to support specific recommendations for children who weigh less than 15 kg (33 lb). It is not known whether the adverse effects from a previously studied 1.2-fold overdose are similar in infants and very young, small children to those reported in children who weigh approximately 25 kg (55 lb). Considering the ease of use of self-injectable epinephrine compared with the ampule/syringe/needle technique and the preferences of pediatricians[21,25] and parents,[23] it seems reasonable to consider autoinjectors containing 0.15 mg of epinephrine for otherwise healthy infants/young children who weigh 10 to 25 kg (22–55 lb), although the physician is cautioned that manufacturers suggest alternative modalities for those who weigh less than 15 kg (33 lb). Clearly, specific clinical circumstances must be considered in this decision. For infants who weigh less than 10 kg (22 lb), dosing with 0.15-mg autoinjectors would exceed 1.5-fold overdosage, and although this situation is unacceptable from the standpoint of autoinjector availability, it is apparent that many pediatricians opt for the certainty of an autoinjector dose compared with the uncertainty of an ideal dose when the epinephrine ampule/syringe/needle technique is used.[21] Still, physicians and families should consider and discuss the benefits and risks of choosing between an autoinjector or epinephrine ampule/syringe/needle for this age group on a case-by-case basis. Current dilemmas in selecting a dose and factors that may sway a decision to switch to a particular dose unit are listed in Table 2. Lack of worldwide availability of autoinjectors[26] often requires prescription of the less costly epinephrine ampule/syringe/needle technique in developing countries despite the fact that it requires additional training, is error prone, and may lead to delay in injection.[23] Preloading the syringe with an appropriate dose of epinephrine is a possible partial solution, but contamination and degradation of the drug, particularly in hot climates, are serious concerns.[27]

Repeating the Epinephrine Dose

Anecdotal evidence generally suggests that in the absence of a response to epinephrine, the epinephrine injection may be repeated at 5- to 20-minute intervals.[1,28] Retrospective studies have suggested that a sec-

TABLE 2 **Epinephrine Autoinjectors for Infants and Children: Dilemmas in Dosing and Possible Solutions[19]**

Patient's Weight, kg (lb)	Optimal Dose (0.01 mg/kg), mg	Availability of Autoinjector[a]	Alternatives/Implications[b]	Comments/Recommendations[c]
≤10 (≤22)	≤0.10	No	Fixed-dose 0.15-mg autoinjector provides ≥1.5-fold overdose; ampule/syringe/needle technique may lead to delay in injection and inaccurate dosing	Evaluate degree of overdose vs ability to use ampule/syringe/needle; no specific evidence base for decision except that ampule/syringe/needle technique is delay and error prone, and autoinjector (0.15 mg) is more commonly prescribed for infants by physicians forced to choose
15 (33)	0.15	Yes	0.15-mg autoinjector provides optimum dose	Prescribe autoinjector (0.15 mg)
20 (44)	0.20	No	0.15-mg autoinjector provides 1.3-fold underdose; 0.30-mg autoinjector provides 1.5-fold overdose	Usually prescribe 0.15-mg autoinjector, but increasing weight of child over 20 kg and high risk on the basis of clinical history[d] may be considered an appropriate rationale for prescribing a 0.30-mg autoinjector
25 (55)	0.25	No	0.15-mg autoinjector provides 1.7-fold underdose; 0.30-mg autoinjector provides 1.2-fold overdose	Usually prescribe 0.30-mg autoinjector; a small overdose in a healthy child generally carries a low risk of adverse effects compared with the risk of an underdose during anaphylaxis
≥30 (≥66)	0.30	Yes	0.30-mg autoinjector provides optimum dose	Prescribe autoinjector (0.30 mg)

[a] For situations in which an autoinjector containing an appropriate dose is not available, the situation is never truly acceptable, because using an epinephrine ampule/syringe/needle (see text) is prone to delay in dosing or inaccurate dosing. However, until such autoinjectors are manufactured and fixed doses of 0.05, 0.10, 0.20, and 0.25 mg are available in addition to the 0.15- and 0.30-mg doses currently available, the physician has to determine the risk versus the benefit of selecting a fixed dose that is either too low or too high and the risk/benefit of an optimal technique of administration (autoinjector) versus a technique (ampule/syringe/needle) that may be prone to delay and error in the hands of non–health care professionals.

[b] There are no studies that have provided details about risks of overdose and underdose of epinephrine in the context of first-aid treatment of anaphylaxis at most dose ranges, particularly in children who weigh less than 15 kg (33 lb). It is presumed, on the basis of limited data, that otherwise healthy children (normal cardiac status, not taking other sympathomimetics, tricyclic antidepressants, or monoamine oxidase inhibitors, etc) would tolerate modest overdoses of epinephrine. In older children not experiencing anaphylaxis, a 1.2-fold overdose has been associated with adverse pharmacologic effects.

[c] Distributors' recommendations regarding autoinjector indications for weight/age differ from country to country, but an alternative form of epinephrine for self-injection, such as ampule/syringe/needle rather than an autoinjector, has been suggested for children who weigh less than 15 kg (33 lb). The perceived comfort and ability of families and caregivers to provide accurate doses of epinephrine for infants using an epinephrine ampule/syringe/needle should be considered in deciding the best modality and the potential degree of overdose or underdose if an autoinjector were prescribed. Although not per manufacturer's advice, it is suggested that the available evidence (error rates of ampule/syringe/needle of no dose to almost 40-fold overdose in the hands of non–health care professionals, adverse pharmacologic effects of a modest overdose in a healthy child, lack of additional fixed-dose autoinjectors) may warrant prescription of a 0.15-mg autoinjector for most healthy children who weigh 10 kg (22 lb) and more; however, individual circumstances may vary. Depending on the circumstances, provision of an autoinjector to those who weigh less than 10 kg (22 lb) may also be warranted.

[d] In addition to consideration of body weight, clinical issues that may add risk to underdosing and indicate a relative benefit for a higher dose may include 1 or more of the following: concurrent asthma; previous anaphylaxis to peanut, tree nut, milk, egg, seafood, and/or fin fish; poor access to emergency services; and/or lack of supervision.

ond dose may be required in 18% to 35% of cases, although data in this regard are limited.[29,30] As stated previously, some of the effects of epinephrine (pallor, tremor, anxiety, and palpitations) and even severe adverse effects (such as cough from pulmonary edema) can mimic some of the symptoms of anaphylaxis. Caregivers should be aware of these issues and avoid unnecessary repeat dosing.

In some adults experiencing anaphylaxis who were raised from the supine to the upright position during transport to a hospital, death occurred suddenly, presumably from an "empty-ventricle syndrome" caused by blood pooling in the legs during anaphylactic shock.[31] The implications of this observation for children, who more typically succumb to respiratory insufficiency during anaphylaxis and who often vomit during anaphylaxis, are not known. Nevertheless, caregivers should be advised that individuals with severe anaphylaxis who may benefit from being in a supine position with legs raised should remain in that position and be transported that way by emergency personnel until advanced care can be accessed (eg, additional medications and intravenous fluids).

PRESCRIPTION OF SELF-INJECTABLE EPINEPHRINE

The primary indication for prescription of self-injectable epinephrine is a history of anaphylaxis in an individual who may re-encounter the triggering agent outside of a medical setting or who has idiopathic anaphylaxis, which is uncommon in childhood. Identification of individuals who have experienced anaphylaxis is not necessarily easy. It is clear that persons with a previous episode of anaphylaxis that was characterized by respiratory or cardiovascular compromise to a trigger that may be encountered outside the hospital should carry self-injectable epinephrine, but only approximately 70% of individuals with anaphylaxis have respiratory symptoms, and even fewer (only approximately 10%) experience cardiovascular symptoms.[32] Skin manifestations such as urticaria, angioedema, flushing, or itching occur in more than 80% of children with anaphylaxis. When present, these symptoms are helpful in the recognition of anaphylaxis; when absent, they make the recognition of anaphylaxis more difficult.[32] Moreover, acute generalized urticaria and angioedema alone may not necessarily warrant a diagnosis of "anaphylaxis" (a point of controversy). However, on the basis of available evidence, self-injectable epinephrine should be prescribed for a child who has experienced generalized acute urticaria after an insect sting, because the risk of a more severe reaction from a future sting is approximately 10%.[33] Finally, physicians cannot assume that patients and caregivers necessarily recognize and report all symptoms, because even trained health care professionals underrecognize anaphylaxis.[2] For all of these reasons, a high index of suspicion is needed to identify those who have had anaphylaxis and require an epinephrine prescription.

An additional point of judgment regarding prescription of self-injectable epinephrine is that a physician may identify a child who has not yet experienced anaphylaxis but may nevertheless be at increased risk of anaphylaxis and may warrant prescription of self-injectable epinephrine. Vander Leek et al[34] showed that among 24 young children with peanut allergy whose first reaction was isolated to the skin after ingestion or skin contact, 18 (75%) experienced symptoms beyond the skin in a subsequent reaction. Indeed, severity of a previous reaction is a poor guide to symptoms during a future reaction.[9,11,35] In young children with peanut- or tree nut–related anaphylaxis, episodes may worsen progressively with time, perhaps related to the fact that increased numbers of such children develop asthma as they get older.[36] Asthma, which is associated with severe and fatal anaphylaxis,[8,9,28] is an important comorbidity that should influence the decision to prescribe self-injectable epinephrine. Some "high-risk" circumstances that may justify prescription of self-injectable epinephrine in the absence of previous anaphylaxis are summarized in Table 3.[18,37,38] Definitive evaluations of such children by an allergy/immunology specialist with American Board of Allergy and Immunology certification or international equivalent should be encouraged.[39]

In summary, epinephrine should be prescribed for children who have experienced anaphylaxis and may re-encounter the trigger outside of a hospital setting. In some circumstances, epinephrine for self-injection should be prescribed for persons who have not experienced anaphylaxis but are at increased risk of anaphylaxis on the basis of their specific comorbid medical conditions and medical-social evaluation.

INSTRUCTIONS FOR WHEN TO USE EPINEPHRINE

Physicians should carefully instruct patients and families on the indications for, and the technique for using,

TABLE 3 **Examples of Factors That May Indicate the Need to Prescribe Epinephrine for Persons "at Risk" of Anaphylaxis[18,37,38]**

Reaction history
Reaction to trace allergen exposure
Repeat exposures likely
Specific food triggers known to be associated with severe/fatal reactions (eg, peanut, tree nut, seafood, milk)
Generalized urticaria from insect venom
Certain comorbidities
Asthma
Use of nonselective β-blockers
Additional factors
Initial reaction details unclear, possible anaphylaxis
Those living in a remote area away from medical care/access

An at-risk person can be, for example, one with a confirmed allergy to food or insect venom who has not experienced anaphylaxis. Note: a first episode of anaphylaxis can be fatal.[10,11]

self-injectable epinephrine. Prompt administration of epinephrine is clearly indicated for treatment of significant respiratory or cardiovascular symptoms of anaphylaxis, but considerable judgment is required in many actual or possible allergic reactions in which life-threatening symptoms have not yet developed but may develop. Previous guidelines have suggested that epinephrine should be administered promptly at the onset of symptoms after exposure to an allergen that had previously caused anaphylaxis and possibly even in the absence of symptoms if there was a known exposure to an allergen that previously caused anaphylaxis with cardiovascular collapse.[28] Generalized acute urticaria itself is not a life-threatening symptom, yet in the context of a known exposure to an allergen that previously triggered anaphylaxis, the recommendation for an exposure outside of a medical setting is to inject epinephrine.[28] Whether an individual with generalized acute urticaria has "anaphylaxis" and should be given epinephrine is controversial. In many circumstances, astute clinical judgment is required to differentiate symptoms that may mimic aspects of an episode of anaphylaxis (eg, viral syndrome with acute urticaria, asthma, choking, a panic episode) or represent a mild allergic reaction that does not require epinephrine. In the community setting, individuals who experience anaphylaxis, whose judgment may be clouded by anxiety or central nervous system symptoms, or caregivers without medical training, whose judgment may be clouded by anxiety, are required to evaluate symptoms.[39] Consequently, physicians should always instruct these individuals to err on the side of injecting epinephrine rather than waiting too long.[28]

Individuals and caregivers are often reluctant to use self-injectable epinephrine in anaphylaxis despite instruction to do so. This probably occurs for a variety of reasons, including failure to recognize anaphylaxis; spontaneous recovery from a previous episode; incorrectly thinking the episode is mild; reliance on oral H_1 antihistamines or asthma-relief inhalers such as albuterol; fear of needles and injections; epinephrine autoinjector not being available; and concern about adverse effects of epinephrine.[19] In contrast to transient pallor, tremor, anxiety, and palpitations, which are common and anticipated pharmacologic effects of epinephrine, serious adverse effects are generally not a concern for otherwise healthy children, although they have been reported when epinephrine was given in overdose, especially when it was administered intravenously in an overdose, given at an inappropriately high concentration, or infused too rapidly.[11,22,40]

It seems that adolescents are at particular risk of fatal anaphylaxis, possibly because they are more likely to engage in risky behaviors, fail to recognize triggers, deny symptoms, and not carry or use emergency medications.[8,9] Additional efforts to provide anaphylaxis education for adolescents and their friends and peers are needed.

Prompt administration of epinephrine for anaphylaxis is key. Sampson et al[9] described 6 children with fatal reactions to food, all of whom had asthma, previous reactions to foods, and delay in treatment with epinephrine. None of the children received epinephrine before onset of severe respiratory symptoms (obvious respiratory distress, retractions, wheezing, and, in some cases, cyanosis), and 7 children in the same study with near-fatal food anaphylaxis received epinephrine before or within 5 minutes of severe respiratory symptoms. Only 1 of the children with fatal reactions had cutaneous symptoms; in contrast, all of those with near-fatal reactions had cutaneous symptoms. This raises the concern that absence of, or failure to recognize, skin symptoms and other symptoms could result in a delay in treatment and a poor outcome. Among 32 food-anaphylaxis fatalities recorded in a registry maintained through the Food Allergy & Anaphylaxis Network,[8] all but 1 individual had a known allergy to the food, only 10% had self-injectable epinephrine available, peanut or tree nut caused 94% of the reactions (milk and fish caused the others), most of those who died were adolescents or young adults, and 96% had asthma.

Gold and Sainsbury[41] surveyed families of children for whom self-injectable epinephrine was prescribed for a previous reaction with respiratory or cardiovascular involvement. Although recurrences were common, epinephrine was injected in only 12% of subsequent reactions. When it was given, although it was seldom injected before onset of respiratory or cardiovascular symptoms, it resulted in a significantly lower hospitalization rate and reduced morbidity.

When developing an anaphylaxis emergency action plan for an individual to use in the community in the absence of a health care professional, presumably for a circumstance in which definitive diagnosis is unlikely, it seems advisable to instruct patients/caregivers to inject epinephrine promptly when symptoms occur after known exposure to a trigger that previously caused a significant reaction. For the occasional child or adolescent who has idiopathic anaphylaxis, where "exposure" is an irrelevant issue, a symptom-based approach is required.

Patients and caregivers must also be instructed in the techniques of autoinjector use or epinephrine ampule/syringe/needle use. Although the autoinjector devices are not particularly difficult to use, errors are common.[25] The injection may be given through clothing, although care must be taken to avoid obstructions such as seams or items in pockets. Accidental injection of epinephrine into a digit can cause vasoconstriction and necrosis and should be promptly evaluated and treated, if necessary, with warming, topical nitroglycerin cream, or locally injected phentolamine or other vasodilator.[42] Review

and practice of injection technique using "trainers" and review of manufacturer's educational materials (eg, DVDs) are strongly recommended. Proper storage of the epinephrine, away from extremes of temperature and direct sunlight to protect the drug from degradation, is also important. Degradation may occur without discoloration or precipitation.[43] It is important to remind patients and families to check autoinjector expiration dates and renew prescriptions promptly.

Preparation for first-aid treatment of anaphylaxis additionally requires medical home development and review of a personalized anaphylaxis emergency action plan that lists potential anaphylaxis symptoms and gives instructions for the indications for self-injectable epinephrine, the technique for using epinephrine autoinjectors, and the necessity of taking the patient to an emergency department after an epinephrine injection. Downloadable examples of written plans that can be personalized are available through the Food Allergy & Anaphylaxis Network Web site (www.foodallergy.org/actionplan.pdf [in English] or www.foodallergy.org/spanishaction.pdf [in Spanish]) and from the American Academy of Allergy, Asthma and Immunology Web site (www.aaaai.org/members/resources/anaphylaxis_toolkit/action_plan.pdf).[39] The emergency action plan and coaching with regard to use of self-injectable epinephrine should be reviewed with the patient on a regular basis. Additional important considerations include diagnostic confirmation/reconfirmation of the triggering allergen, instructions with regard to trigger avoidance (for foods, insect stings, etc), and medical identification (eg, bracelet, wallet card[39]). When relevant, specific preventive measures should be recommended (eg, for venom anaphylaxis, allergen-specific immunotherapy should be instituted to provide long-lasting protection).[44] For exercise-induced anaphylaxis, physicians should recommend appropriate avoidance of food or medication co-triggers, and if no co-trigger has been identified, they should advise individuals to avoid ingestion of anything within 3 to 4 hours of strenuous exercise. Evaluation by an allergy/immunology specialist (with American Board of Allergy and Immunology or international equivalent certification) is typically required to address these issues. Lay organizations such as the Food Allergy & Anaphylaxis Network (www.foodallergy.org) are an important resource for educational materials and support. Omission of these preventive strategies may contribute to poor outcomes.[9,11]

In summary, epinephrine is the drug of choice for first-aid treatment of anaphylaxis and should be injected promptly in the event of an anaphylactic reaction or when progression to anaphylaxis is likely and advanced care is not promptly available. Asthma puffers and/or antihistamines cannot be depended on in anaphylaxis.[39]

SPECIAL ISSUES FOR SCHOOLS

Protection of children at risk of anaphylaxis while in school, child care, or camp requires a concerted effort.[28] Several organizations have developed thoughtful summaries of shared responsibilities concerning food allergies for use by schools, children, adolescents, and parents (a list is available online at www.foodallergy.org/school/SchoolGuidelines.pdf). The physician should work with school administrators, teachers, school nurses, and others to ensure that an appropriate diagnosis has been obtained and that an appropriate anaphylaxis emergency action plan is prescribed.

SUMMARY

1. Epinephrine is the medication of choice for first-aid treatment of an episode of anaphylaxis. Prompt injection of epinephrine is nearly always effective in the treatment of anaphylaxis, and delayed injection of epinephrine is associated with poor outcomes including fatality. Antihistamines and, for those with asthma, inhaled selective β_2-adrenergic agonists such as albuterol provide adjunctive therapy but cannot replace epinephrine. Advanced care for anaphylaxis should be sought promptly (call 911 or equivalent for additional care and emergency transport to a hospital/emergency department) after epinephrine injection for first-aid treatment of anaphylaxis.
2. The recommended epinephrine dose for anaphylaxis in children, based primarily on anecdotal evidence, is 0.01 mg/kg, up to 0.30 mg.
3. On the basis of the available data at this time, intramuscular injection of epinephrine into the lateral thigh (vastus lateralis) seems to be the preferred route for therapy in first-aid treatment, assuming that an early peak epinephrine concentration is important to effective management. Intravenous administration of epinephrine carries increased risks of dilution errors and dosing errors, with consequent increased risk of overdose and adverse effects such as cardiac dysrhythmias.
4. Epinephrine autoinjectors, preferred for ease of use compared with an ampule, syringe, and needle, are currently available in only 2 fixed doses: 0.15 and 0.30 mg. The lack of additional autoinjector doses is a serious concern. Nevertheless, pediatricians are advised to prescribe the optimal dose from an autoinjector for each child, even when that dose cannot possibly be precisely 0.01 mg/kg. On the basis of current, albeit limited, data, it seems reasonable to recommend autoinjectors with 0.15 mg of epinephrine for otherwise healthy young children who weigh 10 to 25 kg (22–55 lb) and autoinjectors with 0.30 mg of epinephrine for those who weigh approximately 25 kg (55 lb) and more. However, specific clinical

circumstances must be considered when making these decisions. For children who weigh less than 10 kg (22 lb), the physician and family should weigh the risks of delay in dosing and dosing errors when an ampule/syringe/needle is used against accepting non-ideal autoinjector doses, taking into consideration the specific health needs of the individual child and abilities of the caregivers.

5. Epinephrine should be prescribed for children who have experienced anaphylaxis who may re-encounter the trigger outside of a health care setting. In some circumstances, epinephrine for self-injection should be prescribed for persons who have not yet experienced anaphylaxis but are at increased risk of anaphylaxis on the basis of their specific trigger for anaphylaxis, comorbid medical conditions such as asthma, and/or limited ability to recognize anaphylaxis.
6. Epinephrine should always be prescribed in the context of an anaphylaxis emergency action plan developed by the medical home with the families. Effective care for individuals at risk of anaphylaxis requires a comprehensive management approach. Patients and caregivers must be carefully instructed on the technique for use of, and indications for, self-injectable epinephrine, how to recognize the symptoms of anaphylaxis, and the need to activate emergency services (call 911 or equivalent) in the event of anaphylaxis. Instructions on allergen avoidance are key. Optimally, evaluation by an allergy/immunology specialist with American Board of Allergy and Immunology or international equivalent certification should be obtained to confirm allergic triggers, to provide education on trigger avoidance, and to initiate specific preventivetreatment (eg, venom-injection immunotherapy for insect-sting anaphylaxis). Written emergency action plans and review of care plans in the child's medical home with specific responsibilities for school, child care, or camp personnel; families; and children are needed to ensure a safe environment for those at risk.

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An error occurred in the American Academy of Pediatrics clinical report "Self-injectable Epinephrine for First-Aid Management of Anaphylaxis" published in the March 2007 issue of *Pediatrics* (doi:10.1542/peds.2006-3689). On page 640, under the heading Epinephrine Autoinjectors: 0.15 or 0.30 mg?, line 10, the authors wrote: "(0.012 mg/kg) rather than an underdose (0.06 mg/kg)." It should read: "(0.012 mg/kg) rather than an underdose (0.006 mg/kg)."

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT

Guidance for the Clinician in Rendering Pediatric Care

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Sexual Orientation and Adolescents

ABSTRACT. The American Academy of Pediatrics issued its first statement on homosexuality and adolescents in 1983, with a revision in 1993. This report reflects the growing understanding of youth of differing sexual orientations. Young people are recognizing their sexual orientation earlier than in the past, making this a topic of importance to pediatricians. Pediatricians should be aware that some youths in their care may have concerns about their sexual orientation or that of siblings, friends, parents, relatives, or others. Health care professionals should provide factual, current, nonjudgmental information in a confidential manner. All youths, including those who know or wonder whether they are not heterosexual, may seek information from physicians about sexual orientation, sexually transmitted diseases, substance abuse, or various psychosocial difficulties. The pediatrician should be attentive to various potential psychosocial difficulties, offer counseling or refer for counseling when necessary and ensure that every sexually active youth receives a thorough medical history, physical examination, immunizations, appropriate laboratory tests, and counseling about sexually transmitted diseases (including human immunodeficiency virus infection) and appropriate treatment if necessary.

Not all pediatricians may feel able to provide the type of care described in this report. Any pediatrician who is unable to care for and counsel nonheterosexual youth should refer these patients to an appropriate colleague. *Pediatrics* **2004;113:1827–1832;** ***sexual orientation, adolescents, homosexuality, gay, lesbian, bisexual.***

ABBREVIATIONS. STD, sexually transmitted disease; HIV, human immunodeficiency virus; AAP, American Academy of Pediatrics; AIDS, acquired immunodeficiency syndrome.

INTRODUCTION

Pediatricians are being asked with increasing frequency to address questions about sexual behavior and sexual orientation. It is important that pediatricians be able to discuss the range of sexual orientation with all adolescents and be competent in dealing with the needs of patients who are gay, lesbian, bisexual, or transgendered or who may not identify themselves as such but who are experiencing confusion with regard to their sexual orientation. Young people whose sexual orientation is not heterosexual can have risks to their physical, emotional, and social health, primarily because of societal stigma, which can result in isolation.[1,2] Because self-awareness of sexual orientation commonly occurs during adolescence, the pediatrician should be available to youth who are struggling with sexual orientation issues and support a healthy passage through the special challenges of the adolescent years. Pediatricians may be called on to help parents, siblings, and extended families of nonheterosexual youth. Also, nonheterosexual youth and adults are part of peer groups with whom all pediatric patients and their parents spend time in the neighborhood, at school, or at work. Thus, pediatricians may be called on to help promote better understanding of issues involving nonheterosexual youth.

Gay, lesbian, and bisexual people in the United States have unique health risks. The US Department of Health and Human Services has identified 29 *Healthy People 2010* objectives in which disparities exist between homosexual or bisexual persons and heterosexual persons. These focus areas include access to care, educational and community-based programs, family planning, immunization and infectious disease, sexually transmitted diseases (STDs) including human immunodeficiency virus (HIV) infection, injury and violence prevention, mental health and mental disorders, substance abuse, and tobacco use.[3]

DEFINITIONS

Sexual orientation[4,5] refers to an individual's pattern of physical and emotional arousal toward other persons. Heterosexual individuals are attracted to persons of the opposite sex, homosexual individuals are attracted to persons of the same sex, and bisexual individuals are attracted to persons of both sexes. Homosexual males are often referred to as "gay"; homosexual females are often referred to as "lesbian." In contrast, gender identity is the knowledge of oneself as being male or female, and gender role is the outward expression of maleness or femaleness. Gender identity and gender role usually conform to anatomic sex in both heterosexual and homosexual individuals. Exceptions to this are transgendered individuals and transvestites. Transgendered individuals feel themselves to be of a gender different from their biological sex; their gender identity does not match their anatomic or chromosomal sex. Transvestites are individuals who dress in the clothing of the opposite gender and derive pleasure from such ac-

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

tions; their gender role does not match societal norms. Transgendered individuals and transvestites can be heterosexual, homosexual, or bisexual.

Sexual orientation is not synonymous with sexual activity or sexual behavior (the way one chooses to express one's sexual feelings). Certain sexual behaviors can put individuals of any sexual orientation at risk of pregnancy (penile-vaginal sexual intercourse) and/or certain diseases (penile-vaginal, oral, and anal sexual intercourse). Especially during adolescence, individuals may participate in a variety of sexual behaviors. Many homosexual adults report having relationships and sexual activity with persons of the opposite sex as adolescents,[6,7] and many adults who identify themselves as heterosexual report sexual activity with persons of the same sex during adolescence.[8–10] Also, many youth label themselves as gay, lesbian, or bisexual years after labeling their attractions as such.[11] In addition, adolescents may also self-identify as nonheterosexual without ever being sexually active. Pediatricians need to understand that they should inquire about sexual attraction or orientation even when youth do not report being gay or lesbian.

ETIOLOGY AND PREVALENCE

Homosexuality has existed in most societies for as long as recorded descriptions of sexual beliefs and practices have been available.[4] Societal attitudes toward homosexuality have had a decisive effect on the extent to which individuals have hidden or made known their sexual orientation.

Human sexual orientation most likely exists as a continuum from solely heterosexual to solely homosexual. In 1973, the American Psychiatric Association reclassified homosexuality as a sexual orientation or expression and not a mental disorder.[12] The mechanisms for the development of a particular sexual orientation remain unclear, but the current literature and most scholars in the field state that one's sexual orientation is not a choice; that is, individuals do not choose to be homosexual or heterosexual.[8,11]

A variety of theories about the influences on sexual orientation have been proposed.[5] Sexual orientation probably is not determined by any one factor but by a combination of genetic, hormonal, and environmental influences.[2] In recent decades, biologically based theories have been favored by experts. The high concordance of homosexuality among monozygotic twins and the clustering of homosexuality in family pedigrees support biological models. There is some evidence that prenatal androgen exposure influences development of sexual orientation, but postnatal sex steroid concentrations do not vary with sexual orientation. The reported association in males between homosexual orientation and loci on the X chromosome remains to be replicated. Some research has shown neuroanatomic differences between homosexual and heterosexual persons in sexually dimorphic regions of the brain.[5] Although there continues to be controversy and uncertainty as to the genesis of the variety of human sexual orientations, there is no scientific evidence that abnormal parenting, sexual abuse, or other adverse life events influence sexual orientation.[4,5] Current knowledge suggests that sexual orientation is usually established during early childhood.[1,2,4,5]

The estimated proportion of Americans who are homosexual is imprecise at best, because surveys are hampered by the stigmatization and the climate of fear that still surround homosexuality. Past studies asked more often about sexual behavior and not sexual orientation. Kinsey et al,[9,13] from their studies in the 1930s and 1940s, reported that 37% of adult men and 13% of adult women had at least 1 sexual experience resulting in orgasm with a person of the same sex and that 4% of adult men and 2% of adult women are exclusively homosexual in their behavior and fantasies. A more recent review of various US studies estimated that 2% of men are exclusively homosexual and 3% are bisexual.[14] Other current studies conclude that somewhere between 3% and 10% of the adult population is gay or lesbian, and perhaps a larger percentage is bisexual.[4,5] Sorenson[15] surveyed a group of 16- to 19-year-olds and reported that 6% of females and 17% of males had at least 1 sexual experience with a person of the same sex. Remafedi et al,[10] in a large, population-based study of junior and senior high school students performed in the late 1980s that measured sexual fantasy, emotional attraction, and sexual behavior, found that more than 25% of 12-year-old students felt uncertain about their sexual orientation. This uncertainty decreased with the passage of time and increasing sexual experience to only 5% of 18-year-old students. Only 1.1% of students reported themselves as predominantly homosexual or bisexual. However, 4.5% reported primary sexual attractions to persons of the same sex, which better reflects actual sexual orientation. The Garofalo et al study,[16] based on the 1995 Massachusetts Youth Risk Behavior Survey, found that 2.5% of youth self-identified as gay, lesbian, or bisexual.

These data illustrate the complexity of labeling sexual orientation in adolescents. Health care professionals should be aware that a large number of adolescents have questions about their sexual feelings; some are attracted to and may have sexual relations with people of the same sex, and a small number may know themselves to be gay or lesbian.

SPECIAL NEEDS OF NONHETEROSEXUAL AND QUESTIONING YOUTH

The overall goal in caring for youth who are or think they might be gay, lesbian, or bisexual is the same as for all youth: to promote normal adolescent development, social and emotional well-being, and physical health. If their environment is critical of their emerging sexual orientation, these adolescents may experience profound isolation and fear of discovery, which interferes with achieving developmental tasks of adolescence related to self-esteem, identity, and intimacy.[17,18] Nonheterosexual youth often are subjected to harassment and violence; 45% of gay men and 20% of lesbians surveyed were victims of verbal and physical assaults in secondary school specifically because of their sexual orientation.[1,19]

Nonheterosexual youth are at higher risk of dropping out of school, being kicked out of their homes, and turning to life on the streets for survival. Some of these youth engage in substance use, and they are more likely than heterosexual peers to start using tobacco, alcohol, and illegal drugs at an earlier age.[20] Nonheterosexual youth are more likely to have had sexual intercourse, to have had more partners, and to have experienced sexual intercourse against their will,[20] putting them at increased risk of STDs including HIV infection. In a recent study of HIV seroprevalence, 7% of 3492 15- to 22-year-old males who have sex with males living in 7 US cities were HIV-seropositive. Among adolescent males who have sex with males, HIV seroprevalence rates in descending order were highest among black adolescents, then "mixed race or other" adolescents, and then Hispanic adolescents and were lowest among Asian and white adolescents.[21] Women having sex with women have the lowest risk of any STD, but lesbian adolescents remain at significant risk because they are likely to have had sexual intercourse with males. Youth in high school who identify themselves as gay, lesbian, or bisexual; engage in sexual activity with persons of the same sex; or report same-sex romantic attractions or relationships are more likely to attempt suicide, be victimized, and abuse substances.[20,22] Although only representing a portion of youth who someday will self-identify as gay, lesbian, or bisexual, school-based studies have found that these adolescents, compared with heterosexual peers, are 2 to 7 times more likely to attempt suicide,[16,19,23,24] are 2 to 4 times more likely to be threatened with a weapon at school,[16,23] and are more likely to engage in frequent and heavy use of alcohol, marijuana, and cocaine. It is important to note that these psychosocial problems and suicide attempts in nonheterosexual youth are neither universal nor attributable to homosexuality per se, but they are significantly associated with stigmatization of gender nonconformity, stress, violence, lack of support, dropping out of school, family problems, acquaintances' suicide attempts, homelessness, and substance abuse.[2,25] In addition to suicidality, young gay and bisexual men might also suffer body image dissatisfaction and disordered eating behaviors for some of the same reasons.[26]

Nonheterosexual youth are represented within all populations of adolescents, all social classes, and all racial and ethnic groups. Ethnic minority youth who are nonheterosexual are required to manage more than one stigmatized identity, which increases their level of vulnerability and stress.[27] They retain their minority status when they seek help in the predominately white gay and lesbian support communities. In addition, sexual minority youth are represented among handicapped adolescents, homeless adolescents, and incarcerated youth.[1]

Most nonheterosexual youths are "invisible" and will pass through pediatricians' offices without raising the issue of sexual orientation on their own. Therefore, health care professionals should raise issues of sexual orientation and sexual behavior with all adolescent patients or refer them to a colleague who can. Such discussions normalize the notion that there is a range of sexual orientation. The portrayal of openly gay or lesbian characters in media is starting to change how adolescents view these differences. Even adolescents who are quite sure of their own heterosexuality are likely to have friends, relatives, teachers, etc whom they know or suspect to be gay or lesbian or who are struggling with questions about their sexual orientation. Rather than asking patients whether they have a "boyfriend" or "girlfriend," pediatricians could ask, "Have you ever had a romantic relationship with a boy or a girl?" or "When you think of people to whom you are sexually attracted, are they men, women, both, neither, or are you not sure yet?" By doing so, pediatricians open the door to additional communication and start to break down stereotypes and stigmatization. It implies that any of the options is possible and that an adolescent may not be sure of his or her sexual orientation. If these issues are addressed, specifically targeted medical screening, medical treatment, and anticipatory guidance can be provided to adolescents who need it. Pediatricians can have an important positive effect on young people and their families by addressing sexual orientation and sexual behavior on several levels: office and hospital policies, clinical care, and community advocacy.[2]

OFFICE PRACTICE: ENSURE A SAFE AND SUPPORTIVE ENVIRONMENT

A pediatric encounter may give adolescents a rare opportunity to discuss their concerns about their sexual orientation and/or activities. Adolescents' level of comfort in the pediatric office sets the tone for their other health care interactions. The way sexuality and other important personal issues are discussed also sets an example for all adolescents and their parents. In the office, pediatricians are encouraged to[28]:

1. Assure the patient that his or her confidentiality is protected.[29]
2. Implement policies against insensitive or inappropriate jokes and remarks by office staff.
3. Be sure that information forms use gender-neutral, nonjudgmental language.
4. Consider displaying posters, brochures, and information on bulletin boards that demonstrate support of issues important to nonheterosexual youth and their families (eg, the American Academy of Pediatrics [AAP] brochure "Gay, Lesbian, and Bisexual Teens: Facts for Teens and their Parents").
5. Provide information about support groups and other resources to nonheterosexual youth and their friends and families if requested.

COMPREHENSIVE HEALTH CARE FOR ALL ADOLESCENTS

Pediatricians are not responsible for labeling or even identifying nonheterosexual youth. Instead, the pediatrician should create a clinical environment in which clear messages are given that sensitive personal issues including sexual orientation can be discussed whenever the adolescent feels ready to do so. A major obstacle to effective medical care is adoles-

cents' misunderstanding of their right to confidential care.[30] The pediatrician should be ready to raise and discuss issues of sexual orientation with all adolescents, particularly those in distress or engaged in high-risk behaviors. The pediatrician should be able to explore the adolescent's understanding and concerns about sexual orientation, dispel any misconceptions, provide appropriate medical care and anticipatory guidance, and connect the adolescent to appropriate supportive community resources. Pediatricians are encouraged to[29,31]:

1. Be aware of the special issues surrounding the development of sexual orientation.[29]
2. Assure the patient that his or her confidentiality is protected.[29]
3. Discuss emerging sexuality with all adolescents.[32]
   - Be knowledgeable that many heterosexual youth also may have sexual experiences with people of their own sex. Labeling as homosexual an adolescent who has had sexual experiences with persons of the same sex or is questioning his or her sexual orientation could be premature, inappropriate, and counterproductive.
   - Use gender-neutral language in discussing sexuality; use the word "partner" rather than "boyfriend" or "girlfriend," and talk about "protection" rather than just "birth control."
   - Give evidence of support and acceptance to adolescents questioning their sexual orientation.
   - Provide information and resources regarding gay, lesbian, and bisexual issues to all interested adolescents.
   - Ask all adolescents about risky behaviors, depression, and suicidal thoughts.
   - Encourage abstinence, discourage multiple partners, and provide "safer sex" guidelines to all adolescents.[33] Discuss the risks associated with anal intercourse for those who choose to engage in this behavior, and teach them ways to decrease risk.
   - Counsel all adolescents about the link between substance use (alcohol, marijuana, and other drugs) and unsafe sexual intercourse.
   - Ask all adolescents about personal experience with violence including sexual or intimate-partner violence.

   Provide additional screening and education as indicated for each adolescent's sexual activity:
   - STD testing from appropriate sites[34]
   - HIV testing with appropriate support and counseling[35]
   - Pregnancy testing and counseling[36,37]
   - Papanicolaou testing
   - Hepatitis B and, when appropriate, hepatitis A immunization
4. Ensure that colleagues to whom adolescents are referred or with whom you consult are respectful of the range of adolescents' sexual orientation.

SPECIAL CONSIDERATIONS FOR NONHETEROSEXUAL YOUTH

For adolescents who self-identify as gay, lesbian, or bisexual, pediatricians should be particularly aware of several points:

1. Be prepared to refer adolescents' care if you have personal barriers to providing such care. Many individuals have strong negative attitudes about homosexuality or may simply feel uncomfortable with the subject. Even discomfort expressed through body language can send a very damaging message to nonheterosexual youth. It is an ethical and professional obligation to make an appropriate referral in these situations for the good of the child or adolescent.
2. Assure the patient that his or her confidentiality is protected.[29] Discuss with adolescents and, if appropriate, their parents whether they wish to have their sexual orientation recorded in office and hospital charts. Many nonheterosexual adults prefer to have this information recorded so that health care professionals will not assume heterosexuality.
3. Help the adolescent think through his or her feelings carefully; strong same-sex feelings and even sexual experiences can occur at this age and do not define sexual orientation.
4. Carefully identify all risky behaviors (sexual behaviors; use of tobacco, alcohol, and drugs; etc) and offer advice and treatment if indicated.
5. Ask about mental health concerns and evaluate or refer patients with identified problems.
6. Offer support and advice to adolescents faced with or anticipating conflicts with families and/or friends.
7. Encourage transition to adult health care when age-appropriate.

Pediatricians should be aware that the revelation of an adolescent's homosexuality (also called disclosure or "coming out") has the potential for intense family discord.[1,2,28] In many families, it precipitates physical and/or emotional abuse or even expulsion. The pediatrician can advise the adolescent to use certain language that may be helpful at the time of disclosure, such as "I am the same person, you just know one more thing about me now." However, there is no one disclosure technique that will preclude negative reactions. Parents, siblings, and other family members may require professional help to deal with their confusion, anger, guilt, and feelings of loss, and professionals who work with adolescents may be required to intervene on the adolescent's behalf. If the pediatrician has a relationship with the parents from ongoing primary care, he or she can be an important initial source of support and information. However, adolescents should be counseled to think carefully about the consequences of disclosure and to take their time in sharing information that could have many repercussions.[1]

With regard to parents of nonheterosexual adolescents, pediatricians are encouraged to:

1. Advise adolescents about whether, when, and how to disclose their nonheterosexuality to their parents. If unsure, assist the adolescent in finding a knowledgeable professional who can help.
2. Be knowledgeable about the process of disclosure.

3. Be supportive of parents of adolescents who have disclosed that they are not heterosexual. Most states have chapters of Parents and Friends of Lesbians and Gays (PFLAG) to which interested families may be referred.
4. Remind parents and adolescents that gay and lesbian individuals can be successful parents themselves.[38–41]
5. Be prepared to refer parents if you do not feel personally comfortable accepting this responsibility.

COMMUNITY ADVOCACY

Despite AAP statements issued in 1983[42] and 1993[43] urging excellent clinical care for nonheterosexual adolescents, these patients still experience many risks to their physical and mental health and safety that occur outside the scope of usual office practice. Some pediatricians may wish to take a broader role in their communities to help decrease these risks. Pediatricians could model and provide opportunities for increasing awareness and knowledge of homosexuality and bisexuality among school staff, mental health professionals, and other community leaders. They can make themselves available as resources for community HIV and acquired immunodeficiency syndrome (AIDS) education and prevention activities. It is critical that schools find a way to create safe and supportive environments for students who are or wonder about being nonheterosexual or who have a parent or other family member who is nonheterosexual. Support from respected pediatricians can facilitate these efforts greatly. Pediatricians who choose to be active on these issues may wish to[2,28]:

1. Help raise awareness among school and community leaders of issues relevant to nonheterosexual youth.
2. Help with the discussion of when and how factual materials about sexual orientation should be included in school curricula and in school and community libraries.
3. Support the development and maintenance of school- and community-based support groups for nonheterosexual students and their friends and parents.
4. Support HIV and AIDS prevention and education efforts.
5. Develop and/or request continuing education opportunities for health care professionals related to issues of sexual orientation, nonheterosexual youth, and their families.

SUMMARY OF PHYSICIAN GUIDELINES

The AAP reaffirms the physician's responsibility to provide comprehensive health care and guidance in a safe and supportive environment for all adolescents, including nonheterosexual adolescents and young people struggling with issues of sexual orientation. Some pediatricians might choose to assume the additional role of advocating for nonheterosexual youth and their families in their communities. The deadly consequences of HIV and AIDS, the damaging effects of violence and ostracism, and the increased prevalence of adolescent suicidal behavior underscore the critical need to address and seek to prevent the major physical and mental health problems that confront nonheterosexual youths in their transition to a healthy adulthood.

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CLINICAL REPORT

Sexuality of Children and Adolescents With Developmental Disabilities

Guidance for the Clinician in Rendering Pediatric Care

Nancy A. Murphy, MD, Ellen Roy Elias, MD, for the Council on Children With Disabilities

ABSTRACT

Children and adolescents with developmental disabilities, like all children, are sexual persons. However, attention to their complex medical and functional issues often consumes time that might otherwise be invested in addressing the anatomic, physiologic, emotional, and social aspects of their developing sexuality. This report discusses issues of puberty, contraception, psychosexual development, sexual abuse, and sexuality education specific to children and adolescents with disabilities and their families. Pediatricians, in the context of the medical home, are encouraged to discuss issues of sexuality on a regular basis, ensure the privacy of each child and adolescent, promote self-care and social independence among persons with disabilities, advocate for appropriate sexuality education, and provide ongoing education for children and adolescents with developmental disabilities and their families.

INTRODUCTION

Sexual development is a multidimensional process, intimately linked to the basic human needs of being liked and accepted, displaying and receiving affection, feeling valued and attractive, and sharing thoughts and feelings. It not only involves anatomic and physiologic functioning, but it also relates to sexual knowledge, beliefs, attitudes, and values. Sexuality should be considered in a context that extends beyond genital sex to include gender-role socialization, physical maturation and body image, social relationships, and future social aspirations.[1] Like all adolescents, teens with disabilities may express desires and hopes for marriage, children, and normal adult sex lives. In fact, adolescents with physical disabilities are as sexually experienced as their peers without disabilities.[2] However, parents and health care professionals are often pessimistic regarding the potential of children with disabilities to enjoy intimacy and sexuality in their relationships.[3] People with disabilities are often erroneously regarded as childlike, asexual, and in need of protection. Conversely, they may be viewed as inappropriately sexual or as having uncontrollable urges.[4] People without disabilities are more willing to accept people with disabilities as fellow employees or casual friends and less willing to accept them as dating, sexual, or marriage partners.[5] Societal and psychosocial barriers may be more of a hindrance to an adolescent's sexual development than the limitations of the disability itself.[3]

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Key Words
sexuality, developmental disabilities, spina bifida, precocious puberty, sexual abuse

Abbreviations
STD—sexually transmitted disease
UN—United Nations

PUBERTY AND SPECIAL CONSIDERATIONS

Puberty in US children typically has an onset between 8.5 and 13 years of age in females and between 9 and 14 years of age in males. Among children with cerebral palsy, puberty tends to begin earlier and end later than in typically developing children.[6] The median age of menarche for white females with cerebral palsy is 14.0 years, contrasting with 12.8 years in the general population. In general, children with neurodevelopmental disabilities are 20 times more likely to experience early pubertal changes.[7] Although idiopathic precocious puberty occurs in approximately 1 in 1000 girls, the incidence approaches 20% among females with spina bifida.[8] Although the reasons for this increased incidence are poorly understood, malformations of the central nervous system and nutritional influences on the hypothalamic-pituitary axis are known to affect the timing of puberty.[9] Precocious puberty can further challenge children with disabilities, who may be socially immature, by affecting an already altered body image and self-esteem, increasing the complexity of self-care and hygiene activities, and heightening the risk of sexual victimization. Gonadotropin-releasing hormone agonists can effectively manage true central precocious puberty in most females.[10]

All females deserve appropriate gynecologic care, including children and adolescents with developmental disabilities. During the first 2 years after menarche, anovulatory menstrual cycles are generally associated with abnormal uterine bleeding; however, thyroid disease, anticonvulsant therapy, and neuroleptic medications may also contribute to these symptoms.[11] If the adolescent is not sexually active, a pelvic examination is rarely indicated.[12] When pelvic examinations are indicated, females with disabilities should be informed about the procedures and instruments to be used and approached with respect for their personal privacy. Adolescents should be given the option of having a trusted caregiver present during the examination. Positioning during the pelvic examination should be modified as needed to accommodate the needs of women with orthopedic or neuromuscular disorders. Rather than stirrups, frog-leg position, V position, or elevation of the legs without hip abduction may increase comfort and decrease anxiety when examinations are indicated. Rectoabdominal examinations may offer an acceptable alternative to pelvic examinations and are best performed after the bowel has been evacuated by an enema.[12]

Adolescents and young adults with disabilities must be well informed when making decisions regarding abstinence, contraception, and pregnancy. For example, some antiepileptic medications induce hepatic enzyme activity and decrease the effectiveness of oral and implanted contraceptives.[9] The risk of thrombotic diseases in females with mobility impairments needs to be considered when prescribing estrogen-progestin–containing contraceptives such as pills, transdermal patches, and vaginal contraceptive rings.[13] Barrier devices, including condoms, cervical caps, and diaphragms, require motivation, cognitive understanding, and physical dexterity.[1] In addition, these devices often contain latex, which are contraindicated in the presence of latex sensitivities. Polyurethane male and female condoms are available but provide less protection against pregnancy and transmission of sexually transmitted diseases (STDs) and are more likely to break during sexual intercourse when compared with latex condoms.[14,15] However, nonlatex condoms still provide an acceptable alternative for those with latex sensitivity or allergy.[16] Although depot medroxyprogesterone acetate, an injectable contraceptive, can effectively minimize or eliminate menstrual flow, prolonged use has been linked recently to bone density loss in healthy adolescent females, which may not reverse completely after discontinuation of the medication.[17] Adolescents who are already at risk of osteopenia from chronic medical conditions may be at even greater risk of bone mineral density loss from depot medroxyprogesterone acetate use. Historically, sterilization of minors with developmental disabilities was performed without appropriate regard for their decision-making capacities, abilities to care for children, feelings, or interests. Such decisions should be made only in the context of the individual's capacity to make decisions, the consequences of reproduction for the person and any children that might be born, and applicable local, state, and federal laws.[18,19]

Most adolescents with myelomeningocele desire to marry and have children, but fewer than 20% have sought information regarding their sexual or reproductive function and only 16% of those who were sexually active have used contraception.[20] Adolescents with myelomeningocele and spinal cord injury have unique educational and medical needs that must be addressed to enjoy safe and satisfying sexual lives. When genital sensation is diminished or absent, alternative ways to appreciate sexual pleasure and satisfaction should be discussed. Fertility is generally preserved in females but reduced in males with spina bifida and spinal cord injury. Prepregnancy counseling should include informing women with spina bifida of the 5 in 100 risk of bearing children with neural tube defects, the protective effect of folate supplementation, and the potential complications associated with pregnancy. When 4 mg per day of folate is taken for at least 3 months before and during the first month of pregnancy, the recurrence risk is reduced by 50% to 75%.[21] Because unplanned pregnancies can occur, females of childbearing age with myelomeningocele may be offered the option of taking 4 mg per day of folate on an ongoing basis.[22]

PSYCHOSOCIAL CONSIDERATIONS

Early social experiences play a critical role in the psychosexual development of children and adolescents and may be limited or qualitatively different between a parent and child when a disability is present. Key milestones of adolescent development include attaining an adult body capable of reproducing, having and maintaining intimate relationships, managing a range of complex emotions, and independently thinking and problem solving.[23] The successful attainment of these developmental goals by individuals with disabilities may be hindered directly by functional limitations or indirectly by intentional or unintentional social isolation. Adolescents with physical and developmental disabilities generally participate in fewer social activities and intimate relationships when compared with typically developing peers, and most report that they lack information on parenthood, birth control, and STDs.[24]

Promoting independence and the acquisition of socially appropriate behaviors involves teaching and reinforcing skills for children with disabilities. Just as children learn academic concepts starting with the basics and moving to the more complex, they develop social independence in a developmentally appropriate, stepwise manner. A critical component of social and sexual maturity is attaining independence in basic self-care tasks. Whereas typically developing children complete self-care tasks independently by 8 years of age, children with disabilities may need frequent cues, supervision, formalized instruction, adaptive technology, and reinforcement in these activities well into adolescence and adulthood to achieve and maintain successes.

It is important to encourage the development of self-esteem in children with disabilities. Like all children, those with disabilities feel better about themselves and are more readily accepted by peers when provided with stylish and age-appropriate clothing that is easily donned and doffed. Social development is largely experiential, and children with disabilities generally have fewer opportunities for social interactions than their typically developing peers. Promoting typical teen activities, such as going to the mall or a movie with peers or participating in social activities at school, may require extra parental planning but afford invaluable opportunities to develop social skills. By mastering appropriate greetings, eye contact, body language, issues of personal space, self-advocacy skills, and telephone and computer skills, children build a strong foundation for the development of more complex social skills.

ISSUES OF SEXUAL ABUSE

The National Center on Child Abuse and Neglect has reported that children with disabilities are sexually abused at a rate that is 2.2 times higher than that for children without disabilities.[25] Other investigators have similarly reported significantly higher rates of sexual abuse among children with disabilities.[12,26] The US Department of Justice reports that 68% to 83% of women with developmental disabilities will be sexually assaulted in their lifetimes and less than half of them will seek assistance from legal or treatment services.[27] Children and adolescents with disabilities may be more vulnerable to sexual abuse because of dependence on others for intimate care, increased exposure to a large number of caregivers and settings, inappropriate social skills, poor judgment, inability to seek help or report abuse, and lack of strategies to defend themselves against abuse.[28] These fears may lead parents to protect their children from unsupervised social contacts and even from knowledge about sex. Some fear that talking about sexuality will promote sexual behavior. Yet, lack of education poses greater risks. When sexual questions and behaviors of individuals are freely discussed within a family, sexual development is promoted and the likelihood of abuse may be reduced or eliminated.[5,29] Children can learn to be assertive in protecting the privacy of their own bodies and in reporting violations to trusted adults.

The United Nations (UN) Convention on the Rights of the Child has established international recognition that all children have the right to respect for privacy and protection from exploitation and abuse.[30] Pediatricians can advocate for children with disabilities to ensure that their rights are upheld. Clinicians should recognize that when children with disabilities demonstrate alterations in bowel and bladder patterns, appetite, sleep, mood, behaviors, and community participation, they may be subjects of sexual abuse, and clinicians should thoroughly investigate these possibilities.

SEXUALITY EDUCATION

To overcome barriers to discussing the sexual development of children with disabilities, pediatricians can introduce issues of physical, cognitive, and psychosexual development to parents and their children at an early age and continue discussions at most visits throughout adolescence and young adulthood. When sexuality is discussed routinely and openly, conversations are easier to initiate, more comfortable to continue, and more effective and informative for all participants. Clinicians can explore the expectations of parents for their child's sexual development while providing general, factual information about sexuality in people with similar disabilities. With insights into the normal stages of child and adolescent sexual development, parents can better understand their own child's behaviors. For example, by recognizing that masturbation is normal toddler behavior, parents can better understand and shape the self-stimulatory behaviors of their teenager who functions developmentally at the level of a 3-year-old child. The problem is not the child's behaviors per se but the inability to distinguish between behaviors that are publicly and privately appropriate.

Children need to be provided developmentally appropriate sexuality education to help them attain a life with more personal fulfillment and protect them from exploitation, unplanned pregnancy, and STDs. An underlying premise of sexuality education is that sexuality is a source of pleasure and a basis for bonding and human relationships. One goal of sexuality education in its broadest sense is to give children a sense of being attractive members of their genders with expectations of having satisfying adult relationships. As an aspect of social functioning, sexuality education must incorporate the family's values on issues ranging from personal modesty to adult sexuality. This goal is best accomplished when parents are the principle teachers and offer sexuality education appropriate to the cognitive and functional abilities of their child.

Topics of substance abuse, sexual development, sexual orientation, STDs, contraception (including abstinence), and the health implications of pregnancy should be discussed with all adolescents, including those with disabilities. The pediatrician who understands typical sexual development and appreciates the unique cognitive and emotional abilities of each child is best equipped to discuss these topics in a way that each child can understand. In the context of the medical home, pediatricians can advocate for independence in children with disabilities by discussing many of these issues in private with the child while also informing the parents of the topics of discussion.

Children with disabilities have the right to the same education about sexuality as their peers, but often there must be modification to the program to allow the information to be presented in such a way that the child can understand and learn it. Modifications such as simplifying information, teaching in a special needs rather than a regular education setting, using special teaching materials such as anatomically correct dolls, role playing, and frequently reviewing and reinforcing the material may be required.[31,32] Individualized education plans (IEPs) should include the provision of sexuality education for children with disabilities. An appropriate program for children with disabilities includes the following topics: body parts, pubertal changes, personal care and hygiene, medical examinations, social skills, sexual expression, contraception strategies, and the rights and responsibilities of sexual behavior. Many adolescents with disabilities receive inadequate information regarding sexuality or do not understand the information presented. Among surveyed adults with cerebral palsy, 52% requested more education regarding sexuality.[33] Educational materials are available to promote successful sexuality education for all children, and pediatricians are encouraged to help identify materials to meet the individual needs of the children and families for whom they care.

THE PEDIATRICIAN'S ROLE

Pediatricians can facilitate the gradual transition of children with disabilities into adulthood by addressing sexual development and encouraging open discussion with children and their families, beginning in early childhood and continuing into early adulthood. However, there are several barriers. First, open and detailed discussion about sexuality may be hindered by discomfort among parents, children, and pediatricians on the basis of cultural, religious, and personal experiences. Second, acute medical and developmental issues may occupy most of the clinical visit, leaving only a few minutes for time-consuming discussions. Third, parents may infantilize their children with developmental disabilities, especially if there are long-term needs for assistance with self-care activities such as toileting, bathing, and dressing. Typically developing teenagers are unlikely to let their parents forget their quest for independence, but children with disabilities, particularly those with impairments of communication, may be less likely to do so. Finally, it is natural for caregivers to fall into comfortable patterns of behavior and interaction with their children, thus overlooking opportunities for their children to achieve greater maturity and independence. Pediatricians are in a unique position to advocate for successful transition of adolescents with disabilities and their families into adulthood.

Pediatricians, in the context of the medical home, play a critical role in the development of sexuality in children with disabilities. The pediatrician is encouraged to:

1. discuss issues of physical development, maturity, and sexuality on a regular basis, starting during early childhood and continuing through the adolescent years;
2. ensure the privacy of each child and adolescent;
3. assist parents in understanding how the cognitive abilities of their children affect behavior and socialization;
4. encourage children with disabilities and their parents to optimize independence, particularly as related to self-care and social skills;
5. be aware of special medical needs, such as modified gynecologic examinations, latex-free protection from STDs and unplanned pregnancies, and genetic counseling when appropriate;
6. recognize that children with disabilities are at an increased risk of sexual abuse and monitor for early indications of abuse;
7. advocate for developmentally appropriate sexuality education in home, community, and school settings;
8. encourage parents to be the principal teachers of developmentally appropriate sexuality education for

their children, incorporating family values, cultural traditions, and religious beliefs; and

9. provide families with information regarding appropriate community programs that address issues of sexuality for children and adolescents with disabilities.

CONCLUSIONS

The UN Convention on the Rights of the Child has established international recognition that all children have needs and are entitled to have their needs met. The needs of children include respect for privacy, opportunities for play, access to education, access to appropriate guidance and support, protection from exploitation and abuse, and opportunities to be listened to and respected. The UN Convention on the Rights of the Child challenges traditional views of children as passive recipients of care and protection and asserts that children with disabilities have the same rights as children without disabilities.[30] Pediatricians should incorporate guidance on sexuality education, socially appropriate behavior, and sexual abuse prevention into the clinical supervision of all children, including children with disabilities.

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INTERNET RESOURCES

Disability Solutions. Available at: www.disabilitysolutions.org
James Stanfield: Sex Education & Relationships. Available at: www.stanfield.com/sexed.html
Diverse City Press, Inc. Available at: www.diverse-city.com
YAI/National Institute for People With Disabilities Network. Available at: www.yai.org
Sexual Health Network. Available at: http://sexualhealth.com
Family Village General Library. Sexuality and disabilities. Available at: www.familyvillage.wisc.edu/general/sexuality.htm
Sexuality Information and Education Council of the United States. Annotated bibliography: sexuality and disability. Available at: www.siecus.org/pubs/biblio/bibs0009.html
National Information Center for Children and Youth With Disabilities. Sexuality education for children and youth with disabilities. Available at: www.nichcy.org/pubs/outprint/nd17txt.htm
dbpeds.org. Sexuality education for persons with developmental disabilities: selected resources. Available at: www.dbpeds.org/articles/detail.cfm?TextID=141
Reynolds LA. People with mental retardation & sexual abuse. Available at: www.open.org/~people1/articles/article_sex_abuse.htm
Univesity of Michigan Health System. Sexuality and kids with disabilities or chronic illness. Available at: www.med.umich.edu/1libr/yourchild/disabsex.htm
Parent Advocacy Coalition for Educational Rights. Available at: www.pacer.org
Healthy & Ready to Work National Center. What's health got to do with transition? Everything! Available at: www.hrtw.org
DisabilityExchange.org. Available at: www.disabilityexchange.org
Center for Children With Special Needs. Available at: www.cshcn.org/linkages/Linkages-Winter-05.cfm

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Committee on Psychosocial Aspects of Child and Family Health and Committee on Adolescence

Sexuality Education for Children and Adolescents

ABSTRACT. Children and adolescents need accurate and comprehensive education about sexuality to practice healthy sexual behavior as adults. Early, exploitative, or risky sexual activity may lead to health and social problems, such as unintended pregnancy and sexually transmitted diseases, including human immunodeficiency virus infection and acquired immunodeficiency syndrome. This statement reviews the role of the pediatrician in providing sexuality education to children, adolescents, and their families. Pediatricians should integrate sexuality education into the confidential and longitudinal relationship they develop with children, adolescents, and families to complement the education children obtain at school and at home. Pediatricians must be aware of their own attitudes, beliefs, and values so their effectiveness in discussing sexuality in the clinical setting is not limited.

ABBREVIATIONS. STD, sexually transmitted disease; HIV, human immunodeficiency virus; AIDS, acquired immunodeficiency syndrome; AAP, American Academy of Pediatrics.

BACKGROUND

Recent federal surveys for the Department of Health and Human Services have found a decline in sexual activity among adolescents 15 to 19 years of age in the United States during the last decade.[1] However, initiation of sexual intercourse during adolescence remains the norm for American youth.[1] Rates of hormonal contraception and condom use have risen throughout the last 5 years and adolescent birth rates have been decreasing,[2] yet the percentage of births to unmarried women of all ages, including adolescents, remains high.[2,3] Among women 15 to 19 years of age, most pregnancies are unintended,[3,4] and approximately 1 in 3 end in abortion.[3]

Overall rates of sexually transmitted diseases (STDs) in the United States are among the highest in the industrialized world. Every year, an estimated 1 in 4 (approximately 3 million) sexually active adolescents acquire an STD.[5] Additionally, only 57% of the 1 in 3 adolescents who reported having been sexually active in the past 3 months reported that they had used barrier contraception the last time they had intercourse.[6]

Children most likely to engage in earlier sexual activity include children with learning problems or low academic attainment; children with other social, behavioral, or emotional problems (including mental health disorders and substance abuse); those from low-income families; children of some ethnic minorities; victims of physical and sexual abuse; and children in families with marital discord and low levels of parental supervision.[7,8] Risky sexual behaviors, defined as having multiple partners, having sex with strangers, or having intercourse without a latex condom, are also associated with alcohol consumption.[7,8] Many gay, lesbian, and bisexual youth are also at high risk because of unsafe sexual practices with same or opposite sex partners and because of increased rates of depression, dropping out of school, homelessness (running away or being thrown out of the home), and substance abuse.[9]

In the Youth Risk Behavior Surveillance survey conducted by the Centers for Disease Control and Prevention, almost all (>90%) adolescents reported having received human immunodeficiency virus (HIV) prevention education in school in 1997, and many also reported discussing HIV and acquired immunodeficiency syndrome (AIDS) with a parent or guardian.[6] However, the content of such discussions may not provide complete information. Additionally, school-based interventions do not provide confidential opportunities for individual risk assessments or targeted preventive counseling. Although as many as two thirds of adolescent patients reported wanting information about STDs and pregnancy from their physicians, many fewer have ever discussed these issues with their physician.[10] In fact, fewer than half of primary care providers routinely ask adolescents about their sexual activity, and far fewer ask specifically about STDs, condom use, sexual orientation, number of partners, or sexual abuse,[11] despite the fact that care guidelines universally recommend obtaining comprehensive sexual histories from adolescents.[12–14] Slightly more than half of adolescents who reported having a health care visit reported that they had an opportunity to talk alone (without a parent or other adult present) with their physician,[15] and fear of disclosure was a major reason for adolescents having missed care they believed that they needed.[16]

SOURCES, CONTENT, AND EFFECTIVENESS OF SEXUALITY EDUCATION PROGRAMS

Sexuality education classes have become a routine part of junior high and high school curricula in many parts of the country.[1] Sexuality education is also often a component of community-based programs targeting pregnancy prevention, substance abuse prevention, violence reduction, youth development,

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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or reproductive health services. Several sexuality education programs that were evaluated using quasi-experimental or experimental designs had impact on the sexual behavior of adolescents.[17] To delay onset of sexual debut, it is necessary to present programs to fifth and sixth graders. Abstinence-only programs have not demonstrated successful outcomes with regard to delayed initiation of sexual activity or use of safer sex practices.[8,17] Effective programs tend to provide practical skills, such as exercising control and increasing communication and negotiation skills through role playing or interactive discussion. Programs that encourage abstinence as the best option for adolescents, but offer a discussion of HIV prevention and contraception as the best approach for adolescents who are sexually active, have been shown to delay the initiation of sexual activity and increase the proportion of sexually active adolescents who reported using birth control. Programs that have linked educational curricula with access to reproductive health services and comprehensive community-based interventions have also documented reductions in pregnancy rates.[18–20] Despite these findings, among the 69% of public schools that provide district-wide sexuality education, 14% treat abstinence as an option for adolescents, 51% teach abstinence as the preferred option for adolescents but permit discussion about contraception as an effective means of protection against unintended pregnancy and STDs (an abstinence-plus policy), and more than 1 in 3 (35%) teach abstinence only, with discussion of contraception prohibited or limited to discussion of its lack of effectiveness.[21]

ROLE OF THE PEDIATRICIAN

The American Academy of Pediatrics (AAP) has published policy statements about sexuality and adolescence.[22–24] Pediatricians are in an ideal position to provide longitudinal sexuality education to children and adolescents as part of preventive health care, and many tools are available to guide their efforts.[22–24] Additionally, pediatricians' efforts may be useful in complementing school or community-based programs.

Unlike school-based instruction, discussion of sexuality with pediatricians provides opportunities for personalized information, for confidential screening of risk status, and for health promotion and counseling. Children and adolescents may ask questions, discuss potentially embarrassing experiences, or reveal highly personal information to their pediatricians. Families and children may obtain education together or in a separate but coordinated manner. Prevention and counseling can be targeted to the needs of youth who are and those who are not yet sexually active and to groups at high risk for early or unsafe sexual activity.[7,8]

Recommendations for pediatricians are as follows:

1. Put sexuality education into a lifelong perspective. Actively encourage parents to discuss sexuality and contraception consistent with the family's attitudes, values, beliefs, and circumstances beginning early in the child's life. Do not impose values on the family. Be aware of the diversity of family circumstances, such as families with same-sex parents. Guide these families or refer them to agencies or clinicians that can help them if they report difficulties or if you are not comfortable assisting them.
2. Encourage parents to offer sexuality education and discuss sex-related issues that are appropriate for the child's or adolescent's developmental level.
   - Use proper terms for anatomic parts.
   - Discuss masturbation and other sexual behaviors of all children, even those as young as preschool age, openly with parents.
   - Initiate discussions about sexuality with children at relevant opportunities, such as the birth of a sibling or pet. Encourage parents to answer children's questions fully and accurately. Offer parents resources to assist their communication efforts at home.
3. Provide sexuality education that respects confidentiality and acknowledges the individual patient's and family's issues and values.
   - Promote communication and safety within social relationships between partners.[25] Ask about special friendships and relationships and explore their character. Complement school-based sexuality education, which typically emphasizes unintended pregnancy, STDs, and other potential risks of sex. When appropriate, acknowledge that sexual activity may be pleasurable but also must be engaged in responsibly.
   - Address knowledge, questions, worries, or misunderstandings of children and adolescents regarding anatomy, masturbation, menstruation, erections, nocturnal emissions ("wet dreams"), sexual fantasies, sexual orientation, and orgasms. Information regarding availability and access to confidential reproductive health services and emergency contraception should also be discussed with early adolescents and with parents. During these discussions, also be open and nonjudgemental toward those with homosexual or bisexual experiences or orientation (see the AAP statement "Homosexuality and Adolescence"[9]).
   - Acknowledge the influence of media imagery on sexuality as it is portrayed in music and music videos, movies, television, print, and Internet content.
   - Obtain a comprehensive sexual history from all adolescents, including knowledge about sexuality, sexual practices, partners and relationships, sexual feelings and identity, and contraceptive practices and plans.
   - In discussing reasons to delay sexual activity or use contraception, frame the suggestions in terms of the individual's development, language, motivation, and history. Be sensitive to cultural and family norms, values, beliefs, and attitudes, and integrate these factors into health promotion or behavior change counseling. Also be aware of the potential for, and ask about,

abuse or coercion in relationships or sexual activity.

- Counsel parents about sexuality. Suggest opportunities for them to provide guidance about abstinence and responsible sexual behavior to their children. Encourage reciprocal and honest dialogue between parents and children. Counsel parents and adolescents about circumstances that are associated with earlier sexual activity, including early dating, excessive unsupervised time, truancy, and alcohol use.[7,8] Ensure that adolescents have opportunities to practice social skills, assertiveness, control, and rejection of unwanted sexual advances.[17]

4. Provide specific, confidential, culturally sensitive, and nonjudgmental counseling about key issues of sexuality.
   - ***General counseling***. Counsel children and parents about normal sexual development before the onset of sexual activity, and encourage parent-child communication about sexuality. Parents should be encouraged to discuss explicit expectations for abstinence, for delaying sexual activity, and for responsible expression of one's sexuality. Advise children and adolescents to discontinue high-risk sexual behavior and avoid or discontinue coercive relationships.[26] Discourage alcohol and other drug use and abuse not only for the direct benefits to the adolescent's health but also to prevent unwanted sexual activity or adverse consequences of sexual activity. Some pediatricians may want to consider the use of established curricula to ensure that all major points are covered.[27] Additionally, handouts to reinforce safe sex practices and responsible decision-making should be available in the office or clinic. Pediatricians may directly provide this counseling, and other members of the office staff, such as nurses, social workers, or health educators, may also provide counseling and health education.
   - ***Preventing unintended pregnancy***. Discuss methods of birth control with male and female adolescents ideally before the onset of sexual intercourse (see the AAP statement "Contraception and Adolescents"[22]). Barrier methods should always be used during intercourse in combination with spermicide or with hormonal contraceptives. Providing access to contraception for adolescents who are sexually active is an important method of reducing pregnancy rates.[26]
   - ***Strategies to avoid STDs, including HIV infection and AIDS***. Abstinence should be promoted as the most effective strategy for preventing HIV infection and other STDs as well as for prevention of pregnancy. Adolescents who become sexually active need additional advice and health care services. Adolescents should be counseled regarding the importance of consistent use of safer sex precautions. Pediatricians should assist adolescents in practicing communication and negotiation skills regarding use of condoms in every sexual encounter[28] and should consider providing adolescents with information and demonstrations about how condoms should be used. Comprehensive recommendations for HIV counseling, testing, and partner notification are addressed in detail in the AAP statement "Adolescents and Human Immunodeficiency Virus Infection: The Role of the Pediatrician in Prevention and Intervention."[29]
5. Provide appropriate counseling or referrals for children and adolescents with special issues and concerns.
   - ***Gay, lesbian, and bisexual youth***. Maintain nonjudgmental attitudes and avoid a heterosexual bias in history taking to encourage adolescents to be open about their behaviors and feelings (see the AAP statement "Homosexuality and Adolescence"[9]).[30,31] If adolescents are certain of homosexual or bisexual orientation, discuss advantages and potential risks of disclosure to family and peers, and support families in accepting children who identify themselves as gay, lesbian, or bisexual. Adolescents who are homosexual should be screened carefully for depression, risk of suicide, and adjustment-related mental health problems. Similar issues are important to children unsure of their sexual orientation.
   - ***Children and adolescents with disabilities***. Rates of sexual activity for adolescents with disabilities are the same as those for adolescents without disabilities.[32] However, children in special education may not receive sexuality education in school. Children and youth with disabilities should be provided developmentally appropriate sexuality education. Parents may need reassurance and support in getting sexuality education for children and adolescents with disabilities. Discussions should be initiated with parents or guardians of children with disabilities at a young age to encourage self-protection and acceptable forms of sexual behavior. Community resources and support groups may also be of assistance.
   - ***Other children at risk***. Identify children at risk for early or coercive and unintended sexual behaviors at an early age. Children who have been victims of physical or sexual abuse or have witnessed sexual violence or physical abuse; children with precocious puberty; and children with social risk factors, such as learning problems, drug or alcohol use, and antisocial behavior, may be at increased risk. Provide or arrange for counseling about sexuality for these children or adolescents. Refer to mental health services if appropriate.
6. Routine gynecologic services should be provided to female adolescents who have become sexually active. Screening for cervical cancer and STDs should be performed for sexually active females, and screening for STDs should be performed for sexually active males, as recommended in *Guidelines for Health Supervision III*.[12]

7. Become knowledgeable about sexuality education offered in schools, religious institutions, and other community agencies. Encourage schools to begin sexuality education in the fifth or sixth grade as a component of comprehensive school health education and to use curricula that provide effective and balanced approaches to puberty, abstinence, decision-making, contraception, and STD and HIV prevention strategies and information about access to services. Because nearly one third of school districts do not provide any information about contraception regardless of whether students are sexually active or at risk,[21] pediatricians should consider presenting material at the school. The American College of Obstetricians and Gynecologists publishes the *Adolescent Sexuality Kit: Guides for Professional Involvement*.[33] This series addresses AIDS, date rape, contraceptive options, and other topics that may be useful to pediatricians who plan to provide sexuality education. Participate in community activities to monitor the effectiveness of prevention strategies and revise approaches to decrease the rate of untoward outcomes. Consider serving as a referral source for students who need comprehensive reproductive health services.
8. Work with local public planners to develop a comprehensive strategy to decrease the rates of unsafe adolescent sexual behavior and adverse outcomes.

RECOMMENDATIONS

1. Every pediatrician should integrate sexuality education into clinical practice with children from early childhood through adolescence. This education should respect the family's individual and cultural values.
2. Educational materials, such as handouts, pamphlets, or videos, should be available to reinforce office-based educational efforts.
3. Pediatricians should be knowledgeable about community services that provide appropriate high-quality sexuality education and additional services that children, adolescents, or families need.
4. Pediatricians should consider participating in the development and implementation of sexuality education curricula for schools or in public efforts to decrease the rates of unsafe adolescent sexual behavior and adverse outcomes.
5. Linguistically appropriate materials could be provided in the office or the pediatrician should have a way of helping children, adolescents, and their families get information in their language of choice.

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ERRATUM

In "Tobacco's Toll: Implications for the Pediatrician" by the AAP Committee on Substance Abuse, Catherine A. McDonald, MD, was omitted from the list of consultants due to an oversight. The statement was published in the April 2001 issue of *Pediatrics*. (*Pediatrics.* 2001;107(4):794–798.)

American Academy of Pediatrics
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POLICY STATEMENT

Shopping Cart–Related Injuries to Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Injury, Violence, and Poison Prevention

ABSTRACT

Shopping cart–related injuries to children are common and can result in severe injury or even death. Most injuries result from falls from carts or cart tip-overs, and injuries to the head and neck represent three fourths of cases. The current US standard for shopping carts should be revised to include clear and effective performance criteria to prevent falls from carts and cart tip-overs. Pediatricians have an important role as educators, researchers, and advocates to promote the prevention of these injuries.

BACKGROUND

Injuries associated with shopping carts are an important cause of pediatric morbidity, especially among children younger than 5 years.[1–6] An estimated 24 200 children younger than 15 years, 20 700 (85%) of whom were younger than 5 years, were treated in US hospital emergency departments in 2005 for shopping cart–related injuries.[7] The most common anatomic site of injury is the head and neck region, accounting for 74% of shopping cart–related injuries among children younger than 15 years, 79% among children younger than 5 years, and 92% among children younger than 1 year. Approximately 4% of children younger than 15 years treated in an emergency department for a shopping cart–related injury require admission to the hospital. Children younger than 5 years account for 93% of these hospital admissions. Fractures are the most common injury resulting in admission, representing 45% of all hospitalizations.[1] Deaths have been reported from falls from shopping carts and cart tip-overs.[8,9]

Injuries to children associated with shopping carts occur via several mechanisms: falling from carts, carts tipping over, and other mechanisms such as becoming entrapped in a cart, falling off a cart while riding on the outside, striking against a cart, and being run over by a cart.[2] Falls from shopping carts and cart tip-overs accounted for 58% and 26% of injuries, respectively, in one study.[2] Among children younger than 2 years in this study, tip-over injuries accounted for 38% of shopping cart–related injuries.[2] Additional details regarding pediatric shopping cart–related injuries are available in the accompanying technical report[10] and a patient safety sheet for distribution to families,[11] both in this month's *Pediatrics Electronic Pages*.

PREVENTION

Increased prevention of shopping cart–related injuries can be achieved by public education, adult supervision, separation of the child from the hazard, legislation, safety design, and revision of the current shopping cart safety standard (American

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See related Technical Report on page e540.

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All policy statements from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.

Key Words
shopping cart, injury, children, safety, injury prevention

Abbreviation
ASTM—American Society for Testing and Materials

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Society for Testing and Materials [ASTM] F2372-04).[12] Details are included in the accompanying technical report.[10]

RECOMMENDATIONS

1. The current US standard (ASTM F2372-04) for shopping carts should be revised to include clear and effective performance criteria for shopping cart child-restraint systems and cart stability to prevent falls from carts and cart tip-overs. To the extent possible, the US Consumer Product Safety Commission should closely monitor compliance and enforce the performance standard for shopping carts.
2. The US Consumer Product Safety Commission should continue to monitor closely the trends of shopping cart–related injuries to children. This will be important for evaluating the effectiveness of ASTM F2372-04.
3. Existing and future state and federal laws regarding shopping cart safety should incorporate an effective performance standard to prevent falls from carts and cart tip-overs, and parents should only transport their child in carts that meet this minimum safety standard.
4. Child health and advocacy professionals and organizations should advocate for a revision of ASTM F2372-04 to include clear and effective performance criteria for shopping cart child-restraint systems and cart stability to prevent falls from carts and cart tip-overs.
5. Health care professionals, child advocates, and parents should encourage businesses that provide customers with shopping carts to adopt safety strategies to help prevent shopping cart–related injuries to children. These may include supervised in-store child-play areas; pick-up areas or assistance bringing purchases to the vehicle to help parents avoid placing their children in carts to take them through parking lots; cart modifications to improve child restraint and cart stability; strollers or wagons provided for in-store use; in-store and community-wide consumer education and warnings; and customer incentives (such as stickers for children, other giveaway items, or cash off at the register) to adopt shopping cart safety behaviors.
6. Health care professionals should educate patients' families about the risks of transporting children in shopping carts, especially about falls from carts and cart tip-overs.
7. Health care professionals should inform the public through the media about shopping cart hazards.
8. The effectiveness of education programs and public-awareness initiatives regarding shopping cart safety should be evaluated.
9. Because of the current variability of shopping cart design and stability and because most parents are not able to ascertain the relative safety of a cart by visual inspection, parents should carefully consider the potential for injury before transporting their child in a shopping cart. Parents are strongly encouraged to seek alternatives to transporting their child in a shopping cart until an effective revised performance standard for shopping cart safety is implemented in the United States.
10. If a parent chooses to transport his or her child in a shopping cart, then an effective, age- and size-appropriate restraining device should be worn by the child at all times. Children should not be left unattended in a shopping cart, be allowed to stand up in a cart, be transported in the basket, or ride on the outside of a cart.

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TECHNICAL REPORT

Shopping Cart–Related Injuries to Children

Gary A. Smith, MD, DrPH, for the Committee on Injury, Violence, and Poison Prevention

ABSTRACT

An estimated 24 200 children younger than 15 years, 20 700 (85%) of whom were younger than 5 years, were treated in US hospital emergency departments in 2005 for shopping cart–related injuries. Approximately 4% of shopping cart–related injuries to children younger than 15 years require admission to the hospital. Injuries to the head and neck represent three fourths of all injuries. Fractures account for 45% of all hospitalizations. Deaths have occurred from falls from shopping carts and cart tip-overs. Falls are the most common mechanism of injury and account for more than half of injuries associated with shopping carts. Cart tip-overs are the second most common mechanism, responsible for up to one fourth of injuries and almost 40% of shopping cart–related injuries among children younger than 2 years. Public-awareness initiatives, education programs, and parental supervision, although important, are not enough to prevent these injuries effectively. European Standard EN 1929-1:1998 and joint Australian/New Zealand Standard AS/NZS 3847.1:1999 specify requirements for the construction, performance, testing, and safety of shopping carts and have been implemented as national standards in 21 countries. A US performance standard for shopping carts (ASTM [American Society for Testing and Materials] F2372-04) was established in July 2004; however, it does not adequately address falls and cart tip-overs, which are the leading mechanisms of shopping cart–related injuries to children. The current US standard for shopping carts should be revised to include clear and effective performance criteria for shopping cart child-restraint systems and cart stability to prevent falls from carts and cart tip-overs. This is imperative to decrease the number and severity of shopping cart–related injuries to children. Recommendations from the American Academy of Pediatrics regarding prevention of shopping cart–related injuries are included in the accompanying policy statement.

BACKGROUND

Injuries associated with shopping carts are an important cause of pediatric morbidity, especially among children younger than 5 years.[1–6] An estimated 24 200 children younger than 15 years, 20 700 (85%) of whom were younger than 5 years, were treated in US hospital emergency departments in 2005 for shopping cart–related injuries. Fifty-one percent of these injured children were female.[7] The most common anatomic site of injury is the head and neck region, accounting for 74% of shopping cart–related injuries among children younger than 15 years, 79% among children younger than 5 years, and 92% among children younger than 1 year. Injury to a finger represents 10% of injuries, and injury to another site on the upper or lower extremities accounts for 12% of the cases. Among children

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See related Policy Statement on page 825

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Key Words
injury, pediatric, children, trauma, falls, shopping cart, restraint, seat belt, prevention

Abbreviations
CPSC—US Consumer Product Safety Commission
ASTM—American Society for Testing and Materials
AAP—American Academy of Pediatrics

younger than 15 years who are treated and released home from the emergency department, contusions and abrasions (43%) and lacerations (22%) are the most common injuries. Approximately 4% of children younger than 15 years treated in an emergency department for a shopping cart–related injury require admission to the hospital. Children younger than 5 years account for 93% of these hospital admissions. Fractures are the most common injury resulting in admission, representing 45% of all hospitalizations.[1] Deaths have been reported from falls from shopping carts and cart tip-overs.[8,9]

The height of a fall and the energy-absorbing capacity of the surface on which a child lands are major determinants of the likelihood and severity of injury. In one study of shopping cart–related injuries to children, more than two thirds of children landed on hard surfaces such as linoleum (53%) or asphalt or concrete (15%). Although most injuries occurred inside stores, 16% of cases occurred in store parking lots.[2]

Injuries to children associated with shopping carts occur via several mechanisms: falling from carts, carts tipping over, and other mechanisms such as becoming entrapped in a cart, falling off a cart while riding on the outside, striking against a cart, and being run over by a cart.[2] The most common mechanism is a fall from a shopping cart, representing 58% of the cases in one study.[2] Another 26% of children are injured when a cart tips over. This is the second most common mechanism of injury and occurs primarily among children younger than 2 years.[2] In one emergency department–based study, tip-over injuries accounted for 38% of all shopping cart–related injuries among children younger than 2 years.[2]

The mechanism of injury is associated with the child's position in the cart. Falls from the cart are associated with the child standing in the cart basket, and tip-over injuries are associated with the sitting position. Siblings often contribute to cart tip-overs when attempting to climb in or out of a cart or when standing up in a cart. In one study, 56% of cart tip-over injuries involved the action of a sibling.[2] Parents are present at the time of injury in more than 90% of episodes. Shopping cart–related injuries rarely are caused by a malfunction of the cart.[2]

PREVENTION

Shopping cart–related injuries to children are common and can result in severe injury and death. Prevention efforts should focus on falls from carts and cart tip-overs.

Public Education

When used alone, public education and warnings are not adequate to prevent shopping cart–related injuries to children. One study demonstrated that an intensive educational effort with flyers, signs, and audiotaped messages over the public address system in stores resulted in limited change (from 1% to 14%) in shopping cart seat belt use by shoppers, and when a study representative approached shoppers with young children to encourage use of seat belts, belt usage increased to 51%.[10] Another study found that shopping cart–restraint usage increased from 15% to 49% when study personnel greeted shoppers with young children at the entrance to stores and recommended the use of appropriate shopping cart restraints if they were going to transport a child in a cart. Although there was a significant improvement in restraint use, half of the children were still being transported in shopping carts without adequate restraint.[11]

Adult Supervision

It is difficult to browse shelves in a store and closely supervise a child in a shopping cart at the same time. More than 80% of adults leave their children unattended at least once during a shopping trip.[12] Shopping cart–related injuries can and do occur in the time it takes to reach for something on a shelf. The fact that more than 90% of parents are present at the time of injury indicates that adult supervision will not reliably prevent these injuries.

Separating the Child From the Hazard

Providing adult caregivers with alternatives to placing a child in a cart while they shop can effectively prevent shopping cart–related injuries. Some stores provide supervised play areas for children. Parents may be able to arrange for another adult to accompany them and watch the child during a shopping trip. Other parents may be able to transport a young child in a stroller, wagon, frontpack, or backpack. An older child can be asked to walk. Some parents may be able to leave their child at home with an adult while they shop, but this is not an option for many others. Some stores offer shopping via the Internet with or without home delivery.

Shopping Cart Safety Design and a National Performance Standard

The most effective injury prevention strategies are those that do not require frequent human action and vigilance.[13] Therefore, modifying the design of shopping carts to automatically prevent falls and tip-overs offers the best preventive solution for shopping cart–related injuries. Adequate safety design must provide for effective child restraint to prevent falls from the cart and must also ensure adequate shopping cart stability to prevent tip-overs.

Child-restraint systems for shopping carts can be active or passive. Active restraint systems require action by the parent to secure the child in the restraint and are, therefore, less effective. The most commonly used active restraint is a lap belt. In some shopping carts, 3-point or 5-point harnesses are used in the cart seat area, in infant carriers attached to the cart basket, or in combination with an attachment to shopping carts that places toddler-aged children on plastic seats between the shopper and the rear of the cart. All of these systems require the

shopper to initially secure the child correctly in the restraint and to remain vigilant to ensure that the child stays in the restraint. As previously noted, attempts to modify shoppers' safety behaviors to increase the number of children appropriately restrained while being transported in shopping carts have had limited success.[10,11]

A passive (or automatic) child-restraint system for shopping carts could also be used that would result in increased restraint use. Such a system could be designed to automatically secure the child in place when the child is seated in the cart. It could also be designed to prevent the cart from moving while carrying a child passenger unless the automatic restraint was engaged. In 1994, the inventor of an automatic child restraint for carts petitioned the US Consumer Product Safety Commission (CPSC) to require automatic restraints on shopping carts, but this petition was denied.[14]

Not all types of buckles on child-restraint systems are equally child resistant. Nineteen (27%) of 70 children 2 to 3 years of age in one study were able to open 1 of 3 types of buckles.[15] The CPSC was petitioned in 1999 to require that buckles that fasten child-restraint systems in various products, including shopping carts, meet a child-resistance standard. The petition requested that the buckles be required to use a double-action release mechanism in which 2 distinctly separate actions are necessary for buckle release. Currently, infant crib side rails, medicine bottles, and some stroller and high chair buckles use double-action safety mechanisms to prevent children from defeating them. Citing a lack of evidence to support the petition and recognizing that buckles are only one part of a restraint system, the CPSC denied this petition in August 2000.[16]

In February 2002, the CPSC issued a report with findings from its 2-year Child Restraint Project.[17] The report analyzed why restraint systems fail and made recommendations for voluntary standards that would address these failures. It focused on high chairs and strollers, because these products account for most incidents of reported restraint failure among juvenile products. The findings of the Child Restraint Project can help direct the development of a performance requirement for a child-restraint system in shopping carts.

Child-restraint systems in shopping carts have limitations. Their effectiveness in preventing falls is unknown, and they do not adequately protect against injuries in shopping cart tip-overs. An infant restrained in a carrier seat bolted across the top of the cart basket or a child restrained in the seating area high in the cart may actually increase the likelihood of a tip-over by contributing to a higher center of gravity. The use of shopping cart restraints may also create a false sense of security among some parents. Because up to 38% of shopping cart–related injuries to children younger than 2 years are associated with cart tip-overs, the use of restraining devices alone will not adequately protect children in this age group unless cart stability is also ensured.

Because the severity of a fall is related to the height of the fall, locating the seating position for a child closer to the ground is a desirable modification of cart design. Cart designs introduced during recent years incorporate this solution by locating the child in a stroller-like seat or a miniature model of a motor vehicle in front of a smaller-sized shopping cart basket.[18,19] Placing the child lower in the cart lowers the center of gravity and, thereby, decreases tip-over potential. These modifications also accommodate large toddlers and preschool-aged children who are too big to fit in the typical seating position in a cart and, therefore, are often placed unrestrained in the cart basket. Because toddlers and preschool-aged children are commonly injured by a fall from the cart basket, these cart modifications offer an important alternative location for these children to ride more safely.

Shopping carts vary significantly in design characteristics including height, weight, center of gravity, and wheelbase dimensions. Some carts have a relatively narrow wheelbase in relation to their height, which makes them more likely to tip over. An important variable affecting rearward tip-over potential is the location of the handle and child seating area in relation to the rear axle. If a vertical line is dropped from the handle, the horizontal distance between that line and the rear axle can vary significantly. The greater this horizontal distance, the more likely downward pressure on the handle will cause the cart to tip over backward. A vertical force as little as 16 lb applied downward on the handle is all that is required to tip some carts over.[20] An average adult can apply this amount of force without difficulty with forearms resting on the top of the cart handle. In addition, if the child seating area is located farther rearward in relation to the rear axle of the cart, or if the child in the seating area leans toward the rear of the cart, the cart will more easily tip over backward.

Parents and other child caregivers cannot be expected to ascertain the relative stability of a shopping cart by visual inspection. Most parents, therefore, are unable to make informed decisions regarding the safety of transporting their child in the cart. For this reason, an effective US performance standard for shopping carts is needed. European Standard EN 1929-1:1998[21] has been implemented in 19 countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. Australia and New Zealand also have a joint national standard, AS/NZS 3847.1:1999.[22]

European Standard EN 1929-1:1998 was approved by the European Committee for Standardization on April 30, 1998. This is part of a series of standards for shopping carts currently under preparation. It contains requirements for the construction, performance, testing, and

safety specifications for general-purpose self-service shopping carts with or without a child-carrying seat. This standard includes a cart-stability test but does not contain specifications for shopping cart accessories, including child safety restraints.[21] The joint Australian/New Zealand Standard AS/NZS 3847.1:1999 was approved on behalf of the Council of Standards Australia on October 30, 1998, and on behalf of the Council of Standards New Zealand on October 19, 1998. It was published January 5, 1999. This standard specifies materials, construction, performance, and testing requirements for shopping carts with and without a child-carrying seat for children up to 18 kg in body weight (approximately 3 years of age). It includes a cart-stability test and a child-restraint requirement. However, there is no performance standard for the restraint system. The standard states that the child restraint "may take any form, examples being a strap or straps or a tray table. If straps are provided, the minimum shall be a waist strap or straps."[22] A shopping cart–performance standard for the United States should include a clear and comprehensive performance requirement for the child safety restraint system in the cart to adequately address cart-related pediatric injuries.

The CPSC denied petitions to promulgate mandatory standards for shopping carts in 1975,[23] automatic child restraints in carts in 1994,[14] and preventing cart tip-overs in 1998.[20] At the time the petition was denied in 1975, the industry indicated that it would pursue development of a voluntary standard for shopping carts, but no action was taken until 2002. Thomas H. Moore, 1 of 3 CPSC commissioners who reviewed the petition in 1998 requesting a performance standard to prevent shopping cart tip-overs, indicated in a written minority opinion that he favored deferring a decision on the petition and pursuing a voluntary standard with the industry.[24] The CPSC engineering staff stated at that time that it would be "a relatively straightforward matter" to develop a performance standard for shopping cart stability.[25] However, the other 2 commissioners did not agree with Moore, and the petition was denied. In 1995, an industry spokesman articulated the view that "injuries involving shopping carts are due to consumer misuse of the product and are not flaws in the current design or a lack of safety mechanism."[26] In September 2002, American Society for Testing and Materials (ASTM) International formed Subcommittee F15.56 on Shopping Carts to develop a voluntary standard for shopping carts. The Standard Consumer Safety Performance Specification for Shopping Carts F2372-04 was published in July 2004.[27]

However, unlike the standards in 21 other countries, the ASTM standard does not address shopping cart stability. Stating that there were "not sufficient frequencies and severity of 'tip-over' injuries, relating to the cart's stability, to warrant requirements and testing for 'tip-over,' "[28] the ASTM subcommittee voted to overrule the negative vote of the American Academy of Pediatrics (AAP) against the draft standard and the recommendation of the AAP that a stability performance standard and test procedure be included in the shopping cart standard.

In addition, ASTM F2372-04 states under section 7.4.1, "Buckles or closures shall be tested in parallel with 16 CFR 1700."[27] The regulation at 16 CFR 1700 describes the testing procedure for poison-prevention packaging. It is not entirely consistent with the testing needs of shopping cart buckles or closures and would need to be modified to be applicable. Because test procedures must be specified exactly if they are to be applied uniformly and be enforceable, the language in section 7.4.1 is inadequate. It should be revised to describe the test procedure in precise terms as it applies to shopping cart–restraint systems. More importantly, section 7.4.1 only provides for the testing of buckles or closures and does not test the entire restraint system. A child may not be able to defeat the buckle while easily wiggling out of the restraint. A comprehensive test procedure for the entire restraint system, testing its ability to keep children safely restrained, is needed for adequate protection of children. This is critical for preventing falls from carts, which is the leading injury mechanism. The AAP also raised these concerns in its negative vote against the draft standard, but the subcommittee again voted the objections of the AAP as nonpersuasive.

Thus, the ASTM F2372-04 standard does not adequately address falls and tip-overs, the leading mechanisms of shopping cart–related injury to children. Indeed, it does not address cart stability to prevent tip-overs at all. Until a revised standard is adopted that establishes clear and effective performance criteria to protect against both of these injury mechanisms, parents and other caregivers will not be able to make informed decisions regarding injury risk when placing a child in a shopping cart, because the cart may not provide minimum acceptable safety protections under the current standard.

Shopping Cart Safety Legislation

New York state statute currently requires every commercial business that provides its customers with shopping carts with seats for children to equip and maintain not less than 25% of its carts with child restraints.[29] Shopping cart child-restraint legislation was introduced in Massachusetts[30] and Minnesota[31] in 1999 but was not enacted. State laws such as these would be strengthened by incorporation of an effective performance standard for shopping cart child-restraint systems and stability. Although state laws have the potential to promote shopping cart safety for children, without an effective shopping cart–performance standard, the existing New York law and the other bills that have been introduced will not be sufficient to prevent shopping cart–related injuries to children. No federal legislation regarding shopping cart safety has been introduced to date.

RECOMMENDATIONS

Recommendations from the AAP regarding prevention of shopping cart–related injuries are included in the accompanying policy statement.[32]

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment

abstract

FREE

Despite a major decrease in the incidence of sudden infant death syndrome (SIDS) since the American Academy of Pediatrics (AAP) released its recommendation in 1992 that infants be placed for sleep in a nonprone position, this decline has plateaued in recent years. Concurrently, other causes of sudden unexpected infant death that occur during sleep (sleep-related deaths), including suffocation, asphyxia, and entrapment, and ill-defined or unspecified causes of death have increased in incidence, particularly since the AAP published its last statement on SIDS in 2005. It has become increasingly important to address these other causes of sleep-related infant death. Many of the modifiable and nonmodifiable risk factors for SIDS and suffocation are strikingly similar. The AAP, therefore, is expanding its recommendations from focusing only on SIDS to focusing on a safe sleep environment that can reduce the risk of all sleep-related infant deaths, including SIDS. The recommendations described in this policy statement include supine positioning, use of a firm sleep surface, breastfeeding, room-sharing without bed-sharing, routine immunizations, consideration of using a pacifier, and avoidance of soft bedding, overheating, and exposure to tobacco smoke, alcohol, and illicit drugs. The rationale for these recommendations is discussed in detail in the accompanying "Technical Report—SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment," which is included in this issue of *Pediatrics* (www.pediatrics.org/cgi/content/full/128/5/e1341). *Pediatrics* 2011;128:1030–1039

INTRODUCTION

Sudden infant death syndrome (SIDS) is a cause assigned to infant deaths that cannot be explained after a thorough case investigation, including a scene investigation, autopsy, and review of the clinical history.[1] Sudden unexpected infant death (SUID), also known as sudden unexpected death in infancy, is a term used to describe any sudden and unexpected death, whether explained or unexplained (including SIDS), that occurs during infancy. After case investigation, SUIDs can be attributed to suffocation, asphyxia, entrapment, infection, ingestions, metabolic diseases, arrhythmia-associated cardiac channelopathies, and trauma (accidental or nonaccidental). The distinction between SIDS and other SUIDs, particularly those that occur during an observed or unobserved sleep period (sleep-related infant deaths), such as ac-

TASK FORCE ON SUDDEN INFANT DEATH SYNDROME

KEY WORDS

SIDS, sudden infant death, infant mortality, sleep position, bed-sharing, tobacco, pacifier, immunization, bedding, sleep surface

ABBREVIATIONS

SIDS—sudden infant death syndrome
SUID—sudden unexpected infant death
AAP—American Academy of Pediatrics

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

TABLE 1 Summary and Strength of Recommendations

Level A recommendations
Back to sleep for every sleep
Use a firm sleep surface
Room-sharing without bed-sharing is recommended
Keep soft objects and loose bedding out of the crib
Pregnant women should receive regular prenatal care
Avoid smoke exposure during pregnancy and after birth
Avoid alcohol and illicit drug use during pregnancy and after birth
Breastfeeding is recommended
Consider offering a pacifier at nap time and bedtime
Avoid overheating
Do not use home cardiorespiratory monitors as a strategy for reducing the risk of SIDS
Expand the national campaign to reduce the risks of SIDS to include a major focus on the safe sleep environment and ways to reduce the risks of all sleep-related infant deaths, including SIDS, suffocation, and other accidental deaths; pediatricians, family physicians, and other primary care providers should actively participate in this campaign
Level B recommendations
Infants should be immunized in accordance with recommendations of the AAP and Centers for Disease Control and Prevention
Avoid commercial devices marketed to reduce the risk of SIDS
Supervised, awake tummy time is recommended to facilitate development and to minimize development of positional plagiocephaly
Level C recommendations
Health care professionals, staff in newborn nurseries and NICUs, and child care providers should endorse the SIDS risk-reduction recommendations from birth
Media and manufacturers should follow safe-sleep guidelines in their messaging and advertising
Continue research and surveillance on the risk factors, causes, and pathophysiological mechanisms of SIDS and other sleep-related infant deaths, with the ultimate goal of eliminating these deaths entirely

These recommendations are based on the US Preventive Services Task Force levels of recommendation (www.uspreventiveservicestaskforce.org/uspstf/grades.htm).
Level A: Recommendations are based on good and consistent scientific evidence (ie, there are consistent findings from at least 2 well-designed, well-conducted case-control studies, a systematic review, or a meta-analysis). There is high certainty that the net benefit is substantial, and the conclusion is unlikely to be strongly affected by the results of future studies.
Level B: Recommendations are based on limited or inconsistent scientific evidence. The available evidence is sufficient to determine the effects of the recommendations on health outcomes, but confidence in the estimate is constrained by such factors as the number, size, or quality of individual studies or inconsistent findings across individual studies. As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion.
Level C: Recommendations are based primarily on consensus and expert opinion.

cidental suffocation, is challenging and cannot be determined by autopsy alone. Scene investigation and review of the clinical history are also required. Many of the modifiable and nonmodifiable risk factors for SIDS and suffocation are strikingly similar. This document focuses on the subset of SUIDs that occurs during sleep.

The recommendations outlined herein were developed to reduce the risk of SIDS and sleep-related suffocation, asphyxia, and entrapment among infants in the general population. As defined by epidemiologists, risk refers to the probability that an outcome will occur given the presence of a particular factor or set of factors. Although all of the 18 recommendations cited below are intended for parents, health care providers, and others who care for infants, the last 4 recommendations are also directed toward health policy makers, researchers, and professionals who care for or work on behalf of infants. In addition, because certain behaviors, such as smoking, can increase risk for the infant, some recommendations are directed toward women who are pregnant or may become pregnant in the near future.

Table 1 summarizes the major recommendations, along with the strength of each recommendation. It should be noted that there have been no randomized controlled trials with regards to SIDS and other sleep-related deaths; instead, case-control studies are the standard.

Because most of the epidemiologic studies that established the risk factors and on which these recommendations are based include infants up to 1 year of age, these recommendations for sleep position and the sleep environment should be used consistently for infants up to 1 year of age. Individual medical conditions might warrant that a physician recommend otherwise after weighing the relative risks and benefits.

For the background literature review and data analyses on which this policy statement and recommendations are based, please refer to the accompanying "Technical Report—SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment," available in the online version of this issue of *Pediatrics*.[2]

RECOMMENDATIONS

1. Back to sleep for every sleep—To reduce the risk of SIDS, infants should be placed for sleep in a supine position (wholly on the back) for every

sleep by every caregiver until 1 year of life.[3–7] Side sleeping is not safe and is not advised.[4,6]

a. The supine sleep position does not increase the risk of choking and aspiration in infants, even those with gastroesophageal reflux, because they have protective airway mechanisms.[8,9] Infants with gastroesophageal reflux should be placed for sleep in the supine position for every sleep, with the rare exception of infants for whom the risk of death from complications of gastroesophageal reflux is greater than the risk of SIDS (ie, those with upper airway disorders, for whom airway protective mechanisms are impaired),[10] including infants with anatomic abnormalities such as type 3 or 4 laryngeal clefts who have not undergone antireflux surgery. Elevating the head of the infant's crib while the infant is supine is not recommended.[11] It is ineffective in reducing gastroesophageal reflux; in addition, it might result in the infant sliding to the foot of the crib into a position that might compromise respiration.

b. Preterm infants are at increased risk of SIDS,[12,13] and the association between prone sleep position and SIDS among low birth weight infants is equal to, or perhaps even stronger than, the association among those born at term.[14] Preterm infants and other infants in the NICU should be placed in the supine position for sleep as soon as the infant is medically stable and significantly before the infant's anticipated discharge, by 32 weeks' postmenstrual age.[15] NICU personnel should endorse safe-sleeping guidelines with parents of infants from the time of admission to the NICU.

c. There is no evidence that placing infants on the side during the first few hours of life promotes clearance of amniotic fluid and decreases the risk of aspiration. Infants in the newborn nursery and infants who are rooming in with their parents should be placed in the supine position as soon as they are ready to be placed in the bassinet.

d. Although data to make specific recommendations as to when it is safe for infants to sleep in the prone or side position are lacking, studies that have established prone and side sleeping as risk factors for SIDS include infants up to 1 year of age. Therefore, infants should continue to be placed supine until 1 year of age. Once an infant can roll from supine to prone and from prone to supine, the infant can be allowed to remain in the sleep position that he or she assumes.

2. Use a firm sleep surface—A firm crib mattress, covered by a fitted sheet, is the recommended sleeping surface to reduce the risk of SIDS and suffocation.

a. A crib, bassinet, or portable crib/play yard that conforms to the safety standards of the Consumer Product Safety Commission and ASTM International (formerly the American Society for Testing and Materials) is recommended.[16] In addition, parents and providers should check to make sure that the product has not been recalled. Cribs with missing hardware should not be used, and the parent or provider should not attempt to fix broken components of a crib, because many deaths are associated with cribs that are broken or have missing parts (including those that have presumably been fixed). Local organizations throughout the United States can help to provide low-cost or free cribs or play yards for families with financial constraints.

b. Only mattresses designed for the specific product should be used. Mattresses should be firm and maintain their shape even when the fitted sheet designated for that model is used, such that there are no gaps between the mattress and the side of the crib, bassinet, portable crib, or play yard. Pillows or cushions should not be used as substitutes for mattresses or in addition to a mattress. Soft materials or objects such as pillows, quilts, comforters, or sheepskins, even if covered by a sheet, should not be placed under a sleeping infant. If a mattress cover to protect against wetness is used, it should be tightly fitting and thin.

c. Infants should not be placed for sleep on beds because of the risk of entrapment and suffocation.[17,18] In addition, portable bed rails should not be used with infants because of the risk of entrapment and strangulation.

d. The infant should sleep in an area free of hazards, such

as dangling cords, electric wires, and window-covering cords, because they might present a strangulation risk.

e. Sitting devices, such as car safety seats, strollers, swings, infant carriers, and infant slings, are not recommended for routine sleep in the hospital or at home.[19–23] Infants who are younger than 4 months are particularly at risk, because they might assume positions that can create risk of suffocation or airway obstruction. When infant slings and cloth carriers are used for carrying, it is important to ensure that the infant's head is up and above the fabric, the face is visible, and that the nose and mouth are clear of obstructions.[24] After nursing, the infant should be repositioned in the sling so that the head is up, is clear of fabric, and is not against the adult's body or the sling. If an infant falls asleep in a sitting device, he or she should be removed from the product and moved to a crib or other appropriate flat surface as soon as is practical. Car safety seats and similar products are not stable on a crib mattress or other elevated surfaces.[25–29]

3. Room-sharing without bed-sharing is recommended—There is evidence that this arrangement decreases the risk of SIDS by as much as 50%.[5,7,30,31] In addition, this arrangement is most likely to prevent suffocation, strangulation, and entrapment that might occur when the infant is sleeping in an adult bed.

   a. The infant's crib, portable crib, play yard, or bassinet should be placed in the parents' bedroom close to the parents' bed. This arrangement reduces SIDS risk and removes the possibility of suffocation, strangulation, and entrapment that might occur when the infant is sleeping in the adults' bed. It also allows close parental proximity to the infant and facilitates feeding, comforting, and monitoring of the infant.

   b. Devices promoted to make bed-sharing "safe" (eg, in-bed co-sleepers) are not recommended.

   c. Infants may be brought into the bed for feeding or comforting but should be returned to their own crib or bassinet when the parent is ready to return to sleep.[6,32] Because of the extremely high risk of SIDS and suffocation on couches and armchairs,[3,5,6,31,32] infants should not be fed on a couch or armchair when there is a high risk that the parent might fall asleep.

   d. Epidemiologic studies have not demonstrated any bed-sharing situations that are protective against SIDS or suffocation. Furthermore, not all risks associated with bed-sharing, such as parental fatigue, can be controlled. Therefore, the American Academy of Pediatrics (AAP) does not recommend any specific bed-sharing situations as safe. Moreover, there are specific circumstances that, in epidemiologic studies, substantially increase the risk of SIDS or suffocation while bed-sharing. In particular, it should be stressed to parents that they avoid the following situations at all times:

      i. Bed-sharing when the infant is younger than 3 months, regardless of whether the parents are smokers or not.[5,7,31–34]

      ii. Bed-sharing with a current smoker (even if he or she does not smoke in bed) or if the mother smoked during pregnancy.[5,6,34–36]

      iii. Bed-sharing with someone who is excessively tired.

      iv. Bed-sharing with someone who has or is using medications (eg, certain antidepressants, pain medications) or substances (eg, alcohol, illicit drugs) that could impair his or her alertness or ability to arouse.[7,37]

      v. Bed-sharing with anyone who is not a parent, including other children.[3]

      vi. Bed-sharing with multiple persons.[3]

      vii. Bed-sharing on a soft surface such as a waterbed, old mattress, sofa, couch, or armchair.[3,5,6,31,32]

      viii. Bed-sharing on a surface with soft bedding, including pillows, heavy blankets, quilts, and comforters.[3,38]

   e. It is prudent to provide separate sleep areas and avoid co-bedding for twins and higher-order multiples in the hospital and at home.[39]

4. Keep soft objects and loose bedding out of the crib to reduce the risk of SIDS, suffocation, entrapment, and strangulation.

   a. Soft objects, such as pillows and pillow-like toys, quilts, comfort-

ers, and sheepskins, should be kept out of an infant's sleeping environment.[40–45]

b. Loose bedding, such as blankets and sheets, might be hazardous and should not be used in the infant's sleeping environment.[3,6,46–51]

c. Because there is no evidence that bumper pads or similar products that attach to crib slats or sides prevent injury in young infants and because there is the potential for suffocation, entrapment, and strangulation, these products are not recommended.[52,53]

d. Infant sleep clothing that is designed to keep the infant warm without the possible hazard of head covering or entrapment can be used.

5. Pregnant women should receive regular prenatal care—There is substantial epidemiologic evidence linking a lower risk of SIDS for infants whose mothers obtain regular prenatal care.[54–57]

6. Avoid smoke exposure during pregnancy and after birth—Both maternal smoking during pregnancy and smoke in the infant's environment after birth are major risk factors for SIDS.

a. Mothers should not smoke during pregnancy or after the infant's birth.[1,58–61]

b. There should be no smoking near pregnant women or infants. Encourage families to set strict rules for smoke-free homes and cars and to eliminate secondhand tobacco smoke from all places in which children and other nonsmokers spend time.[62,63]

c. The risk of SIDS is particularly high when the infant bedshares with an adult smoker.[5,6,34–36]

7. Avoid alcohol and illicit drug use during pregnancy and after birth—There is an increased risk of SIDS with prenatal and postnatal exposure to alcohol or illicit drug use.

a. Mothers should avoid alcohol and illicit drugs periconceptionally and during pregnancy.[64–70]

b. Parental alcohol and/or illicit drug use in combination with bed-sharing places the infant at particularly high risk of SIDS.[7,37]

8. Breastfeeding is recommended.

a. Breastfeeding is associated with a reduced risk of SIDS.[71–73] If possible, mothers should exclusively breastfeed or feed with expressed human milk (ie, not offer any formula or other non–human milk–based supplements) for 6 months, in alignment with recommendations of the AAP.[74]

b. The protective effect of breastfeeding increases with exclusivity.[73] However, any breastfeeding has been shown to be more protective against SIDS than no breastfeeding.[73]

9. Consider offering a pacifier at nap time and bedtime—Although the mechanism is yet unclear, studies have reported a protective effect of pacifiers on the incidence of SIDS.[3,7,32] The protective effect persists throughout the sleep period, even if the pacifier falls out of the infant's mouth.

a. The pacifier should be used when placing the infant for sleep. It does not need to be reinserted once the infant falls asleep. If the infant refuses the pacifier, he or she should not be forced to take it. In those cases, parents can try to offer the pacifier again when the infant is a little older.

b. Because of the risk of strangulation, pacifiers should not be hung around the infant's neck. Pacifiers that attach to infant clothing should not be used with sleeping infants.

c. Objects such as stuffed toys, which might present a suffocation or choking risk, should not be attached to pacifiers.

d. For breastfed infants, delay pacifier introduction until breastfeeding has been firmly established,[74] usually by 3 to 4 weeks of age.

e. There is insufficient evidence that finger-sucking is protective against SIDS.

10. Avoid overheating—Although studies have revealed an increased risk of SIDS with overheating,[75–78] the definition of overheating in these studies varied. Therefore, it is difficult to provide specific room-temperature guidelines for avoiding overheating.

a. In general, infants should be dressed appropriately for the environment, with no more than 1 layer more than an adult would wear to be comfortable in that environment.

b. Parents and caregivers should evaluate the infant for signs of overheating, such as sweating or the infant's chest feeling hot to the touch.

c. Overbundling and covering of the face and head should be avoided.[79]

d. There is currently insufficient evidence to recommend the use of a fan as a SIDS risk-reduction strategy.

11. Infants should be immunized in accordance with recommendations of the AAP and the Centers for Disease Control and Prevention—There is no evidence that there is a causal relationship between immunizations and SIDS.[80] Indeed, recent evidence suggests that immunization might have a protective effect against SIDS.[81–83] Infants should also be seen for regular well-child checks in accordance with AAP recommendations.

12. Avoid commercial devices marketed to reduce the risk of SIDS—These devices include wedges, positioners, special mattresses, and special sleep surfaces. There is no evidence that these devices reduce the risk of SIDS or suffocation or that they are safe.

    a. The AAP concurs with the US Food and Drug Administration and Consumer Product Safety Commission that manufacturers should not claim that a product or device protects against SIDS unless there is scientific evidence to that effect.

13. Do not use home cardiorespiratory monitors as a strategy to reduce the risk of SIDS—Although cardiorespiratory monitors can be used at home to detect apnea, bradycardia, and, when pulse oximetry is used, decreases in oxyhemoglobin saturation, there is no evidence that use of such devices decreases the incidence of SIDS.[84–87] They might be of value for selected infants but should not be used routinely. There is also no evidence that routine in-hospital cardiorespiratory monitoring before discharge from the hospital can identify newborn infants at risk of SIDS.

14. Supervised, awake tummy time is recommended to facilitate development and to minimize development of positional plagiocephaly.

    a. Although there are no data to make specific recommendations as to how often and how long it should be undertaken, supervised, awake tummy time is recommended on a daily basis, beginning as early as possible, to promote motor development, facilitate development of the upper body muscles, and minimize the risk of positional plagiocephaly.[88]

    b. Diagnosis, management, and other prevention strategies for positional plagiocephaly, such as avoidance of excessive time in car safety seats and changing the infant's orientation in the crib, are discussed in detail in the recent AAP clinical report on positional skull deformities.[88]

15. Health care professionals, staff in newborn nurseries and neonatal intensive care nurseries, and child care providers should endorse the SIDS risk-reduction recommendations from birth.[89–91]

    a. Staff in NICUs should model and implement all SIDS risk-reduction recommendations as soon as the infant is clinically stable and significantly before anticipated discharge.

    b. Staff in newborn nurseries should model and implement these recommendations beginning at birth and well before anticipated discharge.

    c. All physicians, nurses, and other health care professionals should receive education on safe infant sleep.

    d. All child care providers should receive education on safe infant sleep and implement safe sleep practices. It is preferable that they have written policies.

16. Media and manufacturers should follow safe-sleep guidelines in their messaging and advertising.

    Media exposures (including movie, television, magazines, newspapers, and Web sites), manufacturer advertisements, and store displays affect individual behavior by influencing beliefs and attitudes.[89,91] Media and advertising messages contrary to safe-sleep recommendations might create misinformation about safe sleep practices.[92]

17. Expand the national campaign to reduce the risks of SIDS to include a major focus on the safe sleep environment and ways to reduce the risks of all sleep-related infant deaths, including SIDS, suffocation, and other accidental deaths. Pediatricians, family physicians, and other primary care providers should actively participate in this campaign.

    a. Public education should continue for all who care for infants, including parents, child care providers, grandparents, foster parents, and babysitters, and should include strategies for overcoming barriers to behavior change.

    b. The campaign should continue to have a special focus

on the black and American Indian/Alaskan Native populations because of the higher incidence of SIDS and other sleep-related infant deaths in these groups.

c. The campaign should specifically include strategies for increasing breastfeeding while decreasing bed-sharing and eliminating tobacco smoke exposure.

d. These recommendations should be introduced before pregnancy and ideally in secondary school curricula for both boys and girls. The importance of maternal preconceptional health and avoidance of substance use (including alcohol and smoking) should be included in this training.

e. Safe-sleep messages should be reviewed, revised, and reissued at least every 5 years to address the next generation of new parents and products on the market.

18. Continue research and surveillance on the risk factors, causes, and pathophysiological mechanisms of SIDS and other sleep-related infant deaths, with the ultimate goal of eliminating these deaths entirely.

a. Education campaigns need to be evaluated, and innovative intervention methods need to be encouraged and funded.

b. Continued research and improved surveillance on the etiology and pathophysiological basis of SIDS should be funded.

c. Standardized protocols for death-scene investigations should continue to be implemented. Comprehensive autopsies that include full external and internal examination of all major organs and tissues (including the brain), complete radiographs, metabolic testing, and toxicology screening should be performed. Training about how to conduct comprehensive death-scene investigation offered to medical examiners, coroners, death-scene investigators, first responders, and law enforcement should continue, and resources for maintaining training and conduct of these investigations need to be allocated. In addition, child death reviews, with involvement of pediatricians and other primary care providers, should be supported and funded.

d. Improved and widespread surveillance of SIDS and SUID cases should be implemented and funded.

e. Federal and private funding agencies should remain committed to all aspects of the aforementioned research.

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TECHNICAL REPORT

SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment

TASK FORCE ON SUDDEN INFANT DEATH SYNDROME

KEY WORDS

SIDS, sudden infant death, infant mortality, sleep position, bed-sharing, tobacco, pacifier, immunization, bedding, sleep surface

ABBREVIATIONS

CPSC—Consumer Product Safety Commission
AAP—American Academy of Pediatrics
SIDS—sudden infant death syndrome
SUID—sudden unexpected infant death
ICD—*International Classification of Diseases*
ASSB—accidental suffocation and strangulation in bed
5-HT—5-hydroxytryptamine
OR—odds ratio
CI—confidence interval

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

FREE

Despite a major decrease in the incidence of sudden infant death syndrome (SIDS) since the American Academy of Pediatrics (AAP) released its recommendation in 1992 that infants be placed for sleep in a nonprone position, this decline has plateaued in recent years. Concurrently, other causes of sudden unexpected infant death occurring during sleep (sleep-related deaths), including suffocation, asphyxia, and entrapment, and ill-defined or unspecified causes of death have increased in incidence, particularly since the AAP published its last statement on SIDS in 2005. It has become increasingly important to address these other causes of sleep-related infant death. Many of the modifiable and nonmodifiable risk factors for SIDS and suffocation are strikingly similar. The AAP, therefore, is expanding its recommendations from being only SIDS-focused to focusing on a safe sleep environment that can reduce the risk of all sleep-related infant deaths including SIDS. The recommendations described in this report include supine positioning, use of a firm sleep surface, breastfeeding, room-sharing without bed-sharing, routine immunization, consideration of a pacifier, and avoidance of soft bedding, overheating, and exposure to tobacco smoke, alcohol, and illicit drugs. The rationale for these recommendations is discussed in detail in this technical report. The recommendations are published in the accompanying "Policy Statement—Sudden Infant Death Syndrome and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment," which is included in this issue (www.pediatrics.org/cgi/doi/10.1542/peds.2011-2220). *Pediatrics* 2011;128:e1341–e1367

METHODOLOGY

Literature searches using PubMed were conducted for each of the topics in this technical report and concentrated on articles published since 2005 (when the last policy statement[1] was published). In addition, to provide additional information regarding sleep-environment hazards, a white paper was solicited from the US Consumer Product Safety Commission (CPSC).[2] Strength of evidence for recommendations[3] was determined by the task force members. Draft versions of the policy statement[4] and technical report were submitted to relevant committees and sections of the American Academy of Pediatrics (AAP) for review and comment. After the appropriate revisions were made, a

final version was submitted to the AAP Executive Committee and Board of Directors for final approval.

SUDDEN INFANT DEATH SYNDROME AND SUDDEN UNEXPECTED INFANT DEATH: DEFINITIONS AND DIAGNOSTIC ISSUES

Sudden Infant Death Syndrome and Sudden Unexpected Infant Death

Sudden infant death syndrome (SIDS) is a cause assigned to infant deaths that cannot be explained after a thorough case investigation that includes a scene investigation, autopsy, and review of the clinical history.[5] Sudden unexpected infant death (SUID), also known as sudden unexpected death in infancy (SUDI), is a term used to describe any sudden and unexpected death, whether explained or unexplained (including SIDS), that occurs during infancy. After case investigation, SUIDs can be attributed to suffocation, asphyxia, entrapment, infection, ingestions, metabolic diseases, and trauma (accidental or nonaccidental). The distinction between SIDS and other SUIDs, particularly those that occur during an observed or unobserved sleep period (sleep-related infant deaths), such as accidental suffocation, is challenging and cannot usually be determined by autopsy alone. Scene investigation and review of the clinical history are also required. A few deaths that are diagnosed as SIDS are found, after further specialized investigations, to be attributable to metabolic disorders or arrhythmia-associated cardiac channelopathies.

Although standardized guidelines for conducting thorough case investigations have been developed,[6] these guidelines have not been uniformly adopted across the more than 2000 US medical examiner and coroner jurisdictions.[7] Information from emergency responders, scene investigators, and caregiver interviews can provide additional evidence to assist death certifiers (ie, medical examiners and coroners) in accurately determining the cause of death. However, death certifiers represent a diverse group with varying levels of skills and education as well as diagnostic preferences. Recently, much attention has been focused on reporting differences among death certifiers. At one extreme, some certifiers have abandoned using SIDS as a cause-of-death explanation.[7] At the other extreme, some certifiers will not classify a death as suffocation in the absence of a pathologic marker of asphyxia at autopsy (ie, pathologic findings diagnostic of oronasal occlusion or chest compression[8]), even with strong evidence from the scene investigation that suggests a probable accidental suffocation.

US Trends in SIDS, Other SUIDs, and Postneonatal Mortality

To monitor trends in SIDS and other SUIDs nationally, the United States classifies diseases and injuries according to the *International Classification of Diseases* (ICD) diagnostic codes. This classification system is designed to promote national and international comparability in the assignment of cause-of-death determinations; however, this system might not provide the optimal precision in classification desired by clinicians and researchers. In the United States, the National Center for Health Statistics assigns a SIDS diagnostic code (ICD-10 R95) if the death is classified with terminology such as SIDS (including presumed, probable, or consistent with SIDS), sudden infant death, sudden unexplained death in infancy, sudden unexpected death in infancy, or sudden unexplained infant death on the certified death certificate. A death will be coded as "other ill-defined and unspecified causes of mortality" (ICD-10 R99) if the cause of the death is reported as unknown or unspecified. A death is coded as "accidental suffocation and strangulation in bed" (ASSB) (ICD-10 W75) when the terms "asphyxia," "asphyxiated," "asphyxiation," "strangled," "strangulated," "strangulation," "suffocated," or "suffocation" are reported, along with the terms "bed" or "crib." This code also includes deaths while sleeping on couches and armchairs.

Although SIDS was defined somewhat loosely until the mid-1980s, there was minimal change in the incidence of SIDS in the United States until the early 1990s. In 1992, in response to epidemiologic reports from Europe and Australia, the AAP recommended that infants be placed for sleep in a nonprone position as a strategy for reducing the risk of SIDS.[9] The "Back to Sleep" campaign was initiated in 1994 under the leadership of the National Institute of Child Health and Human Development as a joint effort of the Maternal and Child Health Bureau of the Health Resources and Services Administration, the AAP, the SIDS Alliance (now First Candle), and the Association of SIDS and Infant Mortality Programs.[10] The Eunice Kennedy Shriver National Institute of Child Health and Human Development began conducting national surveys of infant care practices to evaluate the implementation of the AAP recommendation. Between 1992 and 2001, the SIDS rate declined, and the most dramatic declines occurred in the years immediately after the first nonprone recommendations, consistent with the steady increase in the prevalence of supine sleeping (Fig 1).[11] The US SIDS rate declined from 120 deaths per 100 000 live births in 1992 to 56 deaths per 100 000 live births in 2001, representing a decrease of 53% over 10 years. However, from 2001 to 2006 (the latest year from which data are available), the rate has remained constant (Fig 1). In 2006, 2327 infants

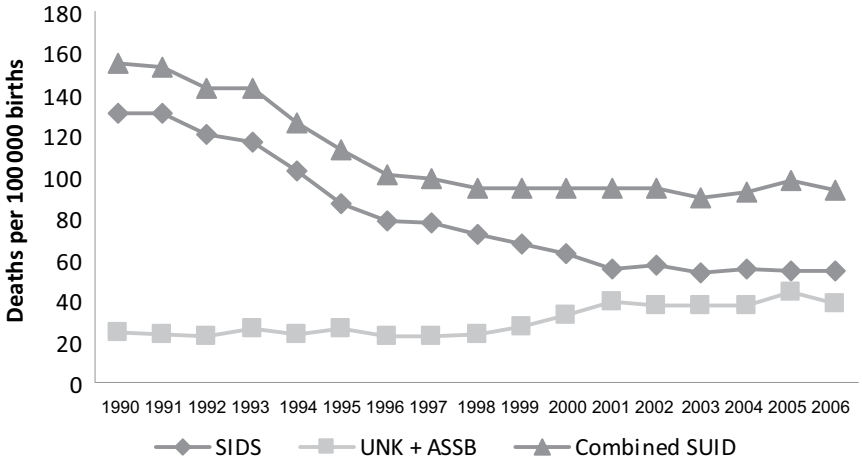

FIGURE 1
Trends in SIDS and other SUID mortality: United States 1990–2006. UNK indicates ill-defined or unspecified deaths.

died from SIDS. Although SIDS rates have declined by more than 50% since the early 1990s, SIDS remains the third-leading cause of infant mortality and the leading cause of postneonatal mortality (28 days to 1 year of age).

The all-cause postneonatal death rate has followed a trend similar to the SIDS rate: there was a 29% decline from 1992 to 2001 (from 314 to 231 per 100 000 live births). From 2001 until 2006, postneonatal mortality rates have also remained fairly unchanged (from 231 to 224 per 100 000 live births); the average decline is 3%.[12]

Several recent studies have revealed that some deaths previously classified as SIDS are now being classified as other causes of infant death (eg, accidental suffocation and other ill-defined or unspecified causes).[13,14] Since 1999, much of the decline in SIDS rates might be explained by increasing rates of these other causes of SUID, particularly over the years 1999–2001.[13,15] A notable change is in deaths attributable to ASSB. Between 1984 and 2004, ASSB infant mortality rates more than quadrupled, from 2.8 to 12.5 deaths per 100 000 live births,[15] which represents 513 infant deaths attributed to ASSB in 2004 compared with 103 in 1984.

Sleep Position

The apparent leveling of the previously declining SIDS rate is occurring coincident with a slowing in the reduction of the prevalence of prone positioning. The prevalence of supine sleep positioning, as assessed from an ongoing national sampling, increased from 13% in 1992 to 72% in 2001. From 2001 until 2010, the prevalence of supine sleep positioning has been fairly stagnant (prevalence in 2010: 75%).[11]

The 1998 and 2005 AAP policy statements and the Back to Sleep campaign not only addressed the importance of back sleeping but also provided recommendations for other infant care practices that may reduce the risk of SIDS and other sleep-related infant deaths.[1,9] Unfortunately, the ability to measure the prevalence of these other risk factors is limited by lack of data. Death certificates are useful for monitoring trends in SIDS mortality, but the circumstances and events that lead to death are not captured in vital statistics data.[16] The Centers for Disease Control and Prevention recently began to pilot a SUID case registry that will provide supplemental surveillance information about the sleep environment at the time of death, infant health history, and the comprehensiveness of the death scene investigation and autopsy. These factors will better describe the circumstances surrounding SIDS and other sleep-related infant deaths and assist researchers in determining the similarities and differences between these deaths.

Racial and Ethnic Disparities

SIDS mortality rates, similar to other causes of infant mortality, have notable racial and ethnic disparities (Fig 2).[17] Despite the decline in SIDS in all races and ethnicities, the rate of SIDS in non-Hispanic black (99 per 100 000 live births) and American Indian/Alaska Native (112 per 100 000 live births) infants was double that of non-Hispanic white infants (55 per 100 000

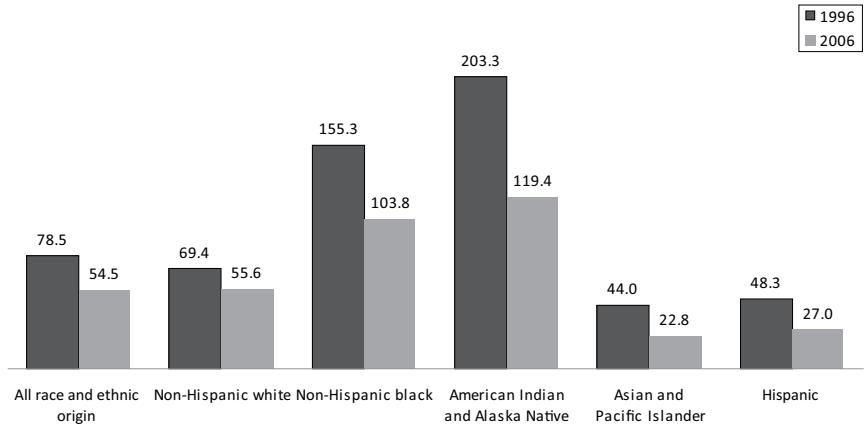

FIGURE 2
Comparison of US rates of SIDS according to maternal race and ethnic origin in 1996 and 2006.

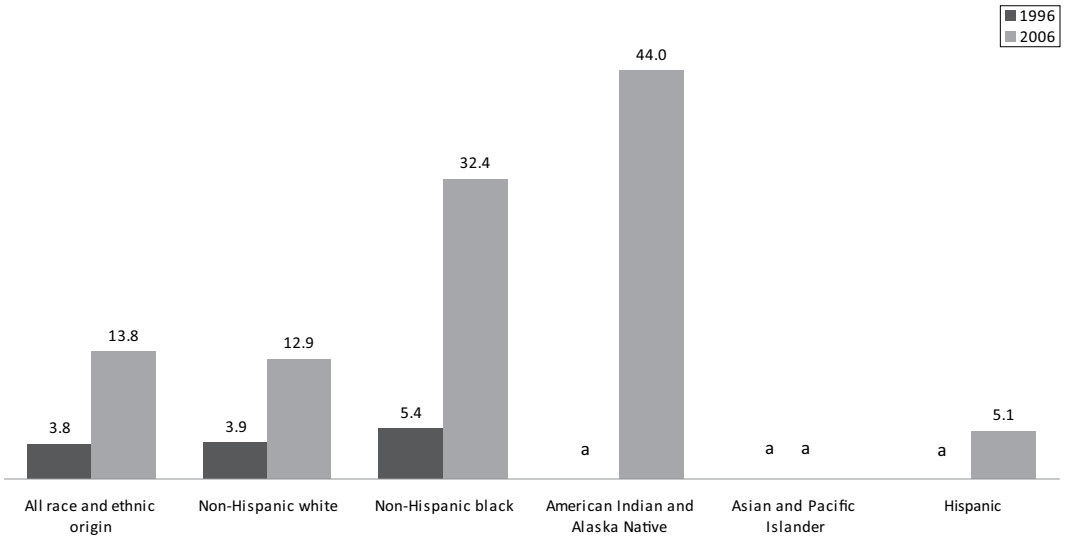

FIGURE 3

Comparison of US rates of death resulting from ASSB according to maternal race and ethnic origin in 1996 and 2006. [a] The figure does not meet standards of reliability or precision on the basis of fewer than 20 deaths in the numerator.

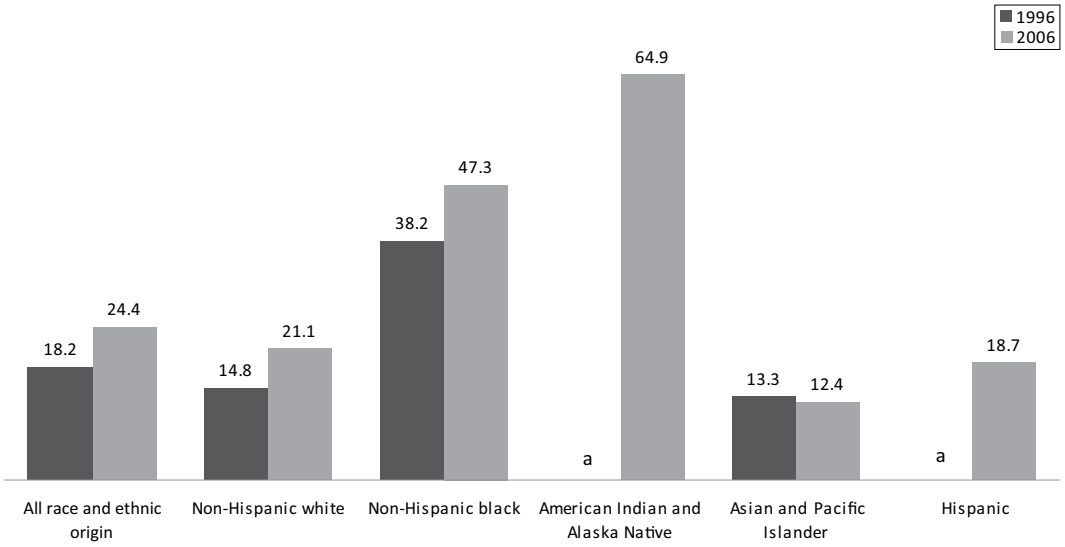

FIGURE 4

Comparison of US rates of cause ill-defined or unspecified death according to maternal race and ethnic origin in 1996 and 2006. [a] The figure does not meet standards of reliability or precision on the basis of fewer than 20 deaths in the numerator.

live births) in 2005 (Fig 2). SIDS rates for Asian/Pacific Islander and Hispanic infants were nearly half the rate for non-Hispanic white infants. Furthermore, similar racial and ethnic disparities have been seen with deaths attributed to both ASSB (Fig 3) and ill-defined or unspecified deaths (Fig 4). Differences in the prevalence of supine positioning and other sleep-environment conditions among racial and ethnic populations might contribute to these disparities.[17] The prevalence of supine positioning in 2010 among white infants was 75%, compared with 53% among black infants (Fig 5). The prevalence of supine sleep positioning among Hispanic and Asian infants was 73% and 80%, respectively.[11] Parent-infant bed-sharing[18–20] and use of soft bedding are also more common among black families

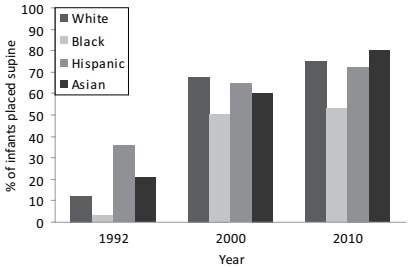

FIGURE 5

Prevalence of supine sleep positioning according to maternal race and ethnic origin, 1992–2010. Data source: National Infant Sleep Position Study.[11]

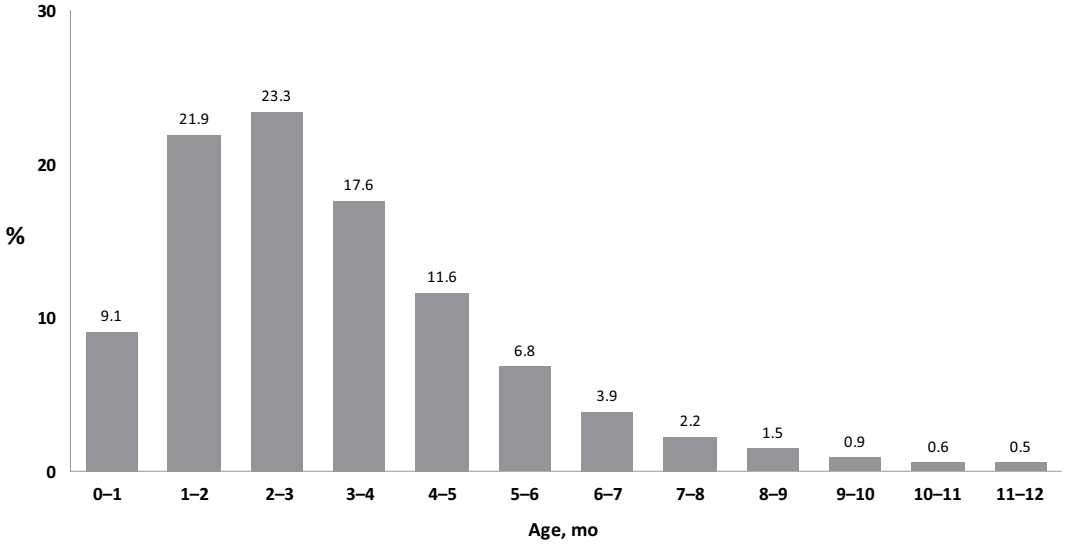

FIGURE 6
Percent distribution of SIDS deaths according to age at death: United States, 2004–2006.

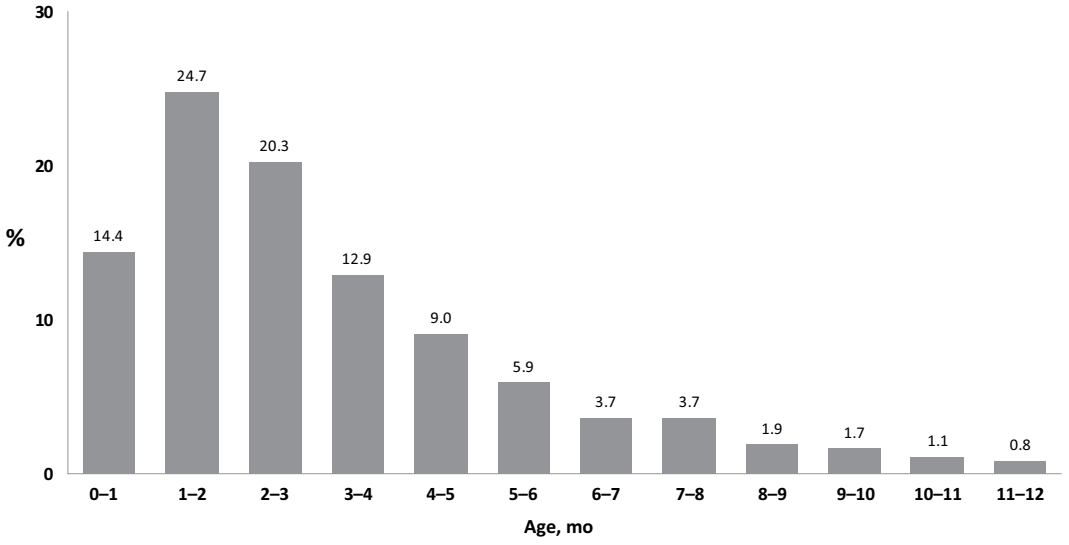

FIGURE 7
Percent distribution of deaths caused by ASSB according to age at death: United States, 2004–2006.

than among other racial/ethnic groups.[21,22] Additional work in promoting appropriate infant sleep position and sleep-environment conditions is necessary to resume the previous rate of decline (observed during the 1990s) for SIDS and all-cause postneonatal mortality.

Age at Death

Ninety percent of SIDS cases occur before an infant reaches the age of 6 months. The rate of SIDS peaks between 1 and 4 months of age. Although SIDS was once considered a rare event during the first month of life, in 2004–2006, nearly 10% of cases coded as SIDS occurred during the first month. SIDS is uncommon after 8 months of age (Fig 6).[14] A similar age distribution is seen for ASSB (Fig 7).

Seasonality of SIDS

A pattern in seasonality of SIDS is no longer apparent. SIDS deaths have historically been observed more frequently in the colder months, and the fewest SIDS deaths occurred in the warmest months.[23] In 1992, SIDS rates had an average seasonal change of 16.3%, compared with only 7.6% in 1999,[24] which is consistent with reports from other countries.[25]

PATHOPHYSIOLOGY AND GENETICS OF SIDS

A working model of SIDS pathogenesis includes a convergence of exogenous triggers or "stressors" (eg, prone

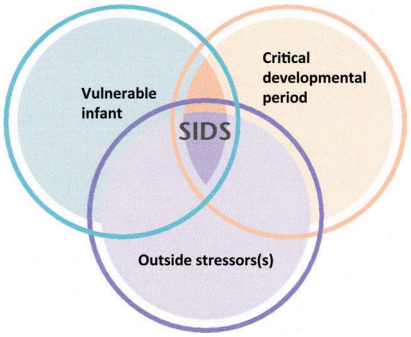

FIGURE 8
Triple-risk model for SIDS.[26]

sleep position, overbundling, airway obstruction), a critical period of development, and dysfunctional and/or immature cardiorespiratory and/or arousal systems (intrinsic vulnerability) that lead to a failure of protective responses (see Fig 8).[26] Convergence of these factors ultimately results in a combination of progressive asphyxia, bradycardia, hypotension, metabolic acidosis, and ineffectual gasping, leading to death.[27] The mechanisms responsible for dysfunctional cardiorespiratory and/or arousal protective responses remain unclear but might be the result of in utero environmental conditions and/or genetically determined maldevelopment or delay in maturation. Infants who die from SIDS are more likely to be born at low birth weight or growth restricted, which suggests an adverse intrauterine environment. Other adverse in utero environmental conditions include exposure to nicotine or other components of cigarette smoke and alcohol.

Recent studies have explored how prenatal exposure to cigarette smoke may result in an increased risk of SIDS. In animal models, exposure to cigarette smoke or nicotine during fetal development alters the expression of the nicotinic acetylcholine receptor in areas of the brainstem important for autonomic function,[28] alters the neuronal excitability of neurons in the nucleus tractus solitarius (a brainstem region important for sensory integration),[29] and alters fetal autonomic activity and medullary neurotransmitter receptors.[30] In human infants, there are strong associations between nicotinic acetylcholine receptor and serotonin receptors in the brainstem during development.[31] Prenatal exposure to tobacco smoke attenuates recovery from hypoxia in preterm infants,[32] decreases heart rate variability in preterm[33] and term[34] infants, and abolishes the normal relationship between heart rate and gestational age at birth.[33] Moreover, infants of smoking mothers exhibit impaired arousal patterns to trigeminal stimulation in proportion to urinary cotinine levels.[35] It is important to note also that prenatal exposure to tobacco smoke alters the normal programming of cardiovascular reflexes such that there is a greater-than-expected increase in blood pressure and heart rate in response to breathing 4% carbon dioxide or a 60° head-up tilt.[36] These changes in autonomic function, arousal, and cardiovascular reflexes might all increase an infant's vulnerability to SIDS.

Brainstem abnormalities that involve the medullary serotonergic (5-hydroxytryptamine [5-HT]) system in up to 70% of infants who die from SIDS are the most robust and specific neuropathologic findings associated with SIDS and have been confirmed in several independent data sets and laboratories.[37–40] This area of the brainstem plays a key role in coordinating many respiratory, arousal, and autonomic functions and, when dysfunctional, might prevent normal protective responses to stressors that commonly occur during sleep. Since the Task Force on Sudden Infant Death Syndrome report in 2005, more specific abnormalities have been described, including decreased 5-HT_{1A} receptor binding, a relative decrease in binding to the serotonin transporter, and increased numbers of immature 5-HT neurons in regions of the brainstem that are important for autonomic function.[41] These findings are not confined to nuclei containing 5-HT neurons but also include relevant projection sites. The most recent study report described in these same regions decreased tissue levels of 5-HT and tryptophan hydroxylase, the synthesizing enzyme for serotonin, and no evidence of excessive serotonin degradation as assessed by levels of 5-hydroxyindoleacetic acid (the main metabolite of serotonin) or ratios of 5-hydroxyindoleacetic acid to serotonin.[30] A recent article described a significant association between a decrease in medullary 5-HT_{1A} receptor immunoreactivity and specific SIDS risk factors, including tobacco smoking.[40] These data confirm results from earlier studies in humans[39,41] and are also consistent with studies in piglets that revealed that postnatal exposure to nicotine decreases medullary 5-HT_{1A} receptor immunoreactivity.[42] Animal studies have revealed that serotonergic neurons located in the medullary raphe and adjacent paragigantocellularis lateralis play important roles in many autonomic functions including the control of respiration, blood pressure, heart rate, thermoregulation, sleep and arousal, and upper airway patency. Engineered mice with decreased numbers of 5-HT neurons and rats or piglets with decreased activity secondary to 5-HT_{1A} autoreceptor stimulation have diminished ventilator responses to carbon dioxide, dysfunctional heat production and heat-loss mechanisms, and altered sleep architecture.[43] These studies linked SIDS risk factors with possible pathophysiology.

There is no evidence of a strong heritable contribution for SIDS. However, genetic alterations have been observed that may increase the vulnera-

bility to SIDS. Genetic variation can take the form of common base changes (polymorphisms) that alter gene function or rare base changes (mutations) that often have highly deleterious effects. Several categories of physiologic functions relevant to SIDS have been examined for altered genetic makeup. Genes related to the serotonin transporter, cardiac channelopathies, and the development of the autonomic nervous system are the subject of current investigation.[44] The serotonin transporter recovers serotonin from the extracellular space and largely serves to regulate overall serotonin neuronal activity. Results of a recent study support those in previous reports that polymorphisms in the promoter region that enhance the efficacy of the transporter (L) allele seem to be more prevalent in infants who die from SIDS compared with those reducing efficacy (S)[45]; however, at least 1 study did not confirm this association.[46] It has also been reported that a polymorphism (12-repeat intron 2) of the promoter region of the serotonin transporter, which also enhances serotonin transporter efficiency, was increased in black infants who died from SIDS[44] but not in a Norwegian population.[45]

It has been estimated that 5% to 10% of infants who die from SIDS have novel mutations in the cardiac sodium or potassium channel genes that result in long QT syndrome as well as in other genes that regulate channel function.[44] A recent report described important new molecular and functional evidence that implicates specific *SCN5A* (sodium channel gene) β subunits in SIDS pathogenesis.[47] The identification of polymorphisms in genes pertinent to the embryologic origin of the autonomic nervous system in SIDS cases also lends support to the hypothesis that a genetic predisposition contributes to the etiology of SIDS. There have also been a number of reports of polymorphisms or mutations in genes that regulate inflammation,[48,49] energy production,[50–52] and hypoglycemia[53] in infants who died from SIDS, but these associations require more study to determine their importance.

ISSUES RELATED TO SLEEP POSITION

The Supine Sleep Position Is Recommended for Infants to Reduce the Risk of SIDS; Side Sleeping Is Not Safe and Is Not Advised

The prone or side sleep position can increase the risk of rebreathing expired gases, resulting in hypercapnia and hypoxia.[54–57] The prone position also increases the risk of overheating by decreasing the rate of heat loss and increasing body temperature compared with infants sleeping supine.[58,59] Recent evidence suggests that prone sleeping alters the autonomic control of the infant cardiovascular system during sleep, particularly at 2 to 3 months of age,[60] and can result in decreased cerebral oxygenation.[61] The prone position places infants at high risk of SIDS (odds ratio [OR]: 2.3–13.1).[62–66] However, recent studies have demonstrated that the SIDS risks associated with side and prone position are similar in magnitude (OR: 2.0 and 2.6, respectively)[63] and that the population-attributable risk reported for side sleep position is higher than that for prone position.[65,67] Furthermore, the risk of SIDS is exceptionally high for infants who are placed on their side and found on their stomach (OR: 8.7).[63] The side sleep position is inherently unstable, and the probability of an infant rolling to the prone position from the side sleep position is significantly greater than rolling prone from the back.[65,68] Infants who are unaccustomed to the prone position and are placed prone for sleep are also at greater risk than those usually placed prone (adjusted OR: 8.7–45.4).[63,69,70] Therefore, it is critically important that every caregiver use the supine sleep position for every sleep period.

Despite these recommendations, the prevalence of supine positioning has remained stagnant for the last decade.[71] One of the most common reasons that parents and caregivers cite for not placing infants supine is fear of choking or aspiration in the supine position.[72–80] Parents often misconstrue coughing or gagging, which is evidence of a normal protective gag reflex, for choking or aspiration. Multiple studies in different countries have not found an increased incidence of aspiration since the change to supine sleeping.[81–83] There is often particular concern for aspiration when the infant has been diagnosed with gastroesophageal reflux. The AAP supports the recommendations of the North American Society for Pediatric Gastroenterology and Nutrition, which state that infants with gastroesophageal reflux should be placed for sleep in the supine position, with the rare exception of infants for whom the risk of death from gastroesophageal reflux is greater than the risk of SIDS[84]—specifically, infants with upper airway disorders for whom airway protective mechanisms are impaired, which may include infants with anatomic abnormalities, such as type 3 or 4 laryngeal clefts, who have not undergone antireflux surgery. Elevating the head of the infant's crib while the infant is supine is not effective in reducing gastroesophageal reflux[85,86]; in addition, this elevation can result in the infant sliding to the foot of the crib into a position that might compromise respiration and, therefore, is not recommended.

The other reason often cited by parents for not using the supine sleep position is the perception that the infant is uncomfortable or does not sleep

well.[72–80] An infant who wakes frequently is normal and should not be perceived as a poor sleeper. Physiologic studies have found that infants are less likely to arouse when they are sleeping in the prone position.[87–95] The ability to arouse from sleep is an important protective physiologic response to stressors during sleep,[96–100] and the infant's ability to sleep for sustained periods might not be physiologically advantageous.

Preterm Infants Should Be Placed Supine as Soon as Possible

Infants born prematurely have an increased risk of SIDS,[101,102] and the association between prone sleep position and SIDS among low birth weight infants is equal to, or perhaps even stronger than, the association among those born at term.[69] Therefore, preterm infants should be placed supine for sleep as soon as their clinical status has stabilized. The task force supports the recommendations of the AAP Committee on Fetus and Newborn, which state that hospitalized preterm infants should be placed in the supine position for sleep by 32 weeks' postmenstrual age to allow them to become accustomed to sleeping in that position before hospital discharge.[103] Unfortunately, preterm and very low birth weight infants continue to be more likely to be placed prone for sleep after hospital discharge.[104,105] Preterm infants are placed prone initially to improve respiratory mechanics[106,107]; although respiratory parameters are no different in the supine or prone positions in preterm infants who are close to discharge,[108] both infants and their caregivers likely become accustomed to using the prone position, which makes it more difficult to change. One study of NICU nurses found that only 50% of nurses place preterm infants supine during the transition to an open crib, and more than 20% never place preterm infants supine or will only place them supine 1 to 2 days before discharge.[109] Moreover, very prematurely born infants studied before hospital discharge have longer sleep duration, fewer arousals from sleep, and increased central apneas while in the prone position.[88] The task force believes that neonatologists, neonatal nurses, and other health care professionals responsible for organizing the hospital discharge of infants from NICUs should be vigilant about endorsing SIDS risk-reduction recommendations from birth. They should model the recommendations as soon as the infant is medically stable and significantly before the infant's anticipated discharge. In addition, NICUs are encouraged to develop and implement policies to ensure that supine sleeping and other safe sleep practices are modeled for parents before discharge from the hospital.

Newborn Infants Should Be Placed Supine Within the First Few Hours After Birth

Practitioners who place infants on their sides after birth in newborn nurseries continue to be a concern. The practice likely occurs because nursery staff believe that newborn infants need to clear their airways of amniotic fluid and may be less likely to aspirate while on their sides. No evidence that such fluid will be cleared more readily while in the side position exists. Finally, and perhaps most importantly, if parents observe health care professionals placing infants in the side or prone position, they are likely to infer that supine positioning is not important[110] and, therefore, might be more likely to copy this practice and use the side or prone position at home.[77,80,111] The AAP recommends that infants be placed on their backs as soon as they are ready to be placed in a bassinet.

Once an Infant Can Roll From the Supine to Prone and From the Prone to Supine Position, the Infant Can Be Allowed to Remain in the Sleep Position That He or She Assumes

Parents and caregivers are frequently concerned about the appropriate strategy for infants who have learned to roll over, which generally occurs at 4 to 6 months of age. As infants mature, it is more likely that they will roll. In 1 study, 6% and 12% of 16- to 23-week-old infants placed on their backs or sides, respectively, were found in the prone position; among infants aged 24 weeks or older, 14% of those placed on their backs and 18% of those placed on their sides were found in the prone position.[112] Repositioning the sleeping infant to the supine position can be disruptive and might discourage the use of supine position altogether. Although data to make specific recommendations as to when it is safe for infants to sleep in the prone position are lacking, the AAP recommends that these infants continue to be placed supine until 1 year of age. If the infant can roll from supine to prone and from prone to supine, the infant can then be allowed to remain in the sleep position that he or she assumes. To prevent suffocation or entrapment if the infant rolls, soft or loose bedding should continue to be removed from the infant's sleep environment. Some caregivers use such bedding to prevent an infant from rolling, but this bedding could cause suffocation and entrapment. Parents can be reassured by the information that the incidence of SIDS begins to decline after 4 months of age (Fig 6).

Supervised, Awake Tummy Time on a Daily Basis Can Promote Motor Development and Minimize the Risk of Positional Plagiocephaly

Positional plagiocephaly, or plagiocephaly without synostosis (PWS), can be associated with supine sleeping position (OR: 2.5).[113] It is most likely to result if the infant's head position is not varied when placed for sleep, if the infant spends little or no time in awake, supervised tummy time, and if the infant is not held in the upright position when not sleeping.[113–115] Children with developmental delay and/or neurologic injury have increased rates of PWS, although a causal relationship has not been demonstrated.[113,116–119] In healthy normal children, the incidence of PWS decreases spontaneously from 20% at 8 months to 3% at 24 months of age.[114] Although data to make specific recommendations as to how often and how long tummy time should be undertaken are lacking, supervised tummy time while the infant is awake is recommended on a daily basis. Tummy time should begin as early as possible to promote motor development, facilitate development of the upper body muscles, and minimize the risk of positional plagiocephaly. The AAP clinical report on positional skull deformities[120] provides additional detail on the prevention, diagnosis, and management of positional plagiocephaly.

SLEEP SURFACES

Infants Should Sleep in a Safety-Approved Crib, Portable Crib, Play Yard, or Bassinet

Cribs should meet safety standards of the CPSC, Juvenile Product Manufacturers Association, and the ASTM International (formerly the American Society for Testing and Materials), including those for slat spacing, snugly fitting and firm mattresses, and no drop sides.[121] The AAP recommends the use of new cribs, because older cribs might no longer meet current safety standards, might have missing parts, or might be incorrectly assembled. If an older crib is to be used, care must be taken to ensure that there have been no recalls on the crib model, that all of the hardware is intact, and that the assembly instructions are available.

For some families, use of a crib might not be possible for financial reasons or space considerations. In addition, parents might be reluctant to place the infant in the crib because of concerns that the crib is too large for the infant or that "crib death" (ie, SIDS) only occurs in cribs. Alternate sleep surfaces, such as portable cribs/play yards and bassinets might be more acceptable for some families, because they are smaller and more portable. Local organizations throughout the United States can help to provide low-cost or free cribs or play yards. If a portable crib/play yard or bassinet is to be used, it should meet the following CPSC guidelines: (1) sturdy bottom and wide base; (2) smooth surfaces without protruding hardware; (3) legs with locks to prevent folding while in use; and (4) firm, snugly fitting mattress.[121] In addition, other AAP guidelines for safe sleep, including supine positioning and avoidance of soft objects and loose bedding, should be followed. Mattresses should be firm and should maintain their shape even when the fitted sheet designated for that model is used, such that there are no gaps between the mattress and the side of the bassinet, playpen, portable crib, or play yard. Only mattresses designed for the specific product should be used. Pillows or cushions should not be used as substitutes for mattresses or in addition to a mattress. Any fabric on the sides or a canopy should be taut and firmly attached to the frame so as not to create a suffocation risk for the infant. Portable cribs, play yards, and bassinets with vertical sides made of air-permeable material may be preferable to those with air-impermeable sides.[122] Finally, parents and caregivers should adhere to the manufacturer's guidelines regarding maximum weight of infants using these products.[122,123] If the product is a combination product (eg, crib/toddler bed), the manual should be consulted when the mode of use is changed.

There are no data regarding the safety of sleepers that attach to the side of an adult bed. However, there are potential safety concerns if the sleeper is not attached properly to the side of the adult bed or if the infant moves into the adult bed. Therefore, the task force cannot make a recommendation for or against the use of bedside sleepers. In addition, infants should not be placed for sleep on adult-sized beds because of the risk of entrapment and suffocation.[124] Portable bed rails (railings installed on the side of the bed that are intended to prevent a child from falling off of the bed) should not be used with infants because of the risk of entrapment and strangulation.[125]

Car Seats and Other Sitting Devices Are not Recommended for Routine Sleep at Home or in the Hospital, Particularly for Young Infants

Some parents let their infants sleep in a car seat or other sitting device. Sitting devices include but are not restricted to car seats, strollers, swings, infant carriers, and infant slings. Parents and caregivers often use these devices, even when not traveling, because they are convenient. One study found that the average young infant spends 5.7 hours/day in a car seat or similar sitting device.[126] However, there are multiple concerns about using sitting devices as a usual infant sleep location. Placing an infant in such devices can potentiate gastro-

esophageal reflux[127] and positional plagiocephaly. Because they still have poor head control and often experience flexion of the head while in a sitting position, infants younger than 1 month in sitting devices might be at increased risk of upper airway obstruction and oxygen desaturation.[128–132] In addition, there is increasing concern about injuries from falls resulting from car seats being placed on elevated surfaces.[133–137] An analysis of CPSC data revealed 15 suffocation deaths between 1990 and 1997 resulting from car seats overturning after being placed on a bed, mattress, or couch.[136] The CPSC also warns about the suffocation hazard to infants, particularly those who are younger than 4 months, who are carried in infant sling carriers.[138] When infant slings are used for carrying, it is important to ensure that the infant's head is up and above the fabric, the face is visible, and that the nose and mouth are clear of obstructions. After nursing, the infant should be repositioned in the sling so that the head is up and is clear of fabric and the adult's body.

BED-SHARING

Room-Sharing Without Bed-Sharing Is Recommended

The terms "bed-sharing" and "cosleeping" are often used interchangeably, but they are not synonymous. Cosleeping is when parent and infant sleep in close proximity (on the same surface or different surfaces) so as to be able to see, hear, and/or touch each other.[139,140] Cosleeping arrangements can include bed-sharing or sleeping in the same room in close proximity.[140,141] Bed-sharing refers to a specific type of cosleeping when the infant is sleeping on the same surface with another person.[140] Because the term cosleeping can be misconstrued and does not precisely describe sleep arrangements, the AAP recommends use of the terms "room-sharing" and "bed-sharing."

The AAP recommends the arrangement of room-sharing without bed-sharing, or having the infant sleep in the parents' room but on a separate sleep surface (crib or similar surface) close to the parents' bed. There is evidence that this arrangement decreases the risk of SIDS by as much as 50%[64,66,142,143] and is safer than bed-sharing[64,66,142,143] or solitary sleeping (when the infant is in a separate room).[53,64] In addition, this arrangement is most likely to prevent suffocation, strangulation, and entrapment, which may occur when the infant is sleeping in the adult bed. Furthermore, room-sharing without bed-sharing allows close proximity to the infant, which facilitates feeding, comforting, and monitoring of the infant.

Parent-infant bed-sharing is common. In 1 national survey, 45% of parents responded that they had shared a bed with their infant (8 months of age or younger) at some point in the preceding 2 weeks.[19] In some racial/ethnic groups, the rate of routine bed-sharing might be higher.[18–20] There are often cultural and personal reasons why parents choose to bed-share, including convenience for feeding (breastfeeding or with formula) and bonding. In addition, many parents might believe that their own vigilance is the only way that they can keep their infant safe and that the close proximity of bed-sharing allows them to maintain vigilance, even while sleeping.[144] Some parents will use bed-sharing specifically as a safety strategy if the infant sleeps in the prone position[21,144] or if there is concern about environmental dangers such as vermin and stray gunfire.[144]

Parent-infant bed-sharing continues to be highly controversial. Although electrophysiologic and behavioral studies have offered a strong case for its effect in facilitating breastfeeding[145,146] and although many parents believe that they can maintain vigilance of the infant while they are asleep and bed-sharing,[144] epidemiologic studies have shown that bed-sharing can be hazardous under certain conditions.[147–150] Bed-sharing might increase the risk of overheating,[151] rebreathing[152] or airway obstruction,[153] head covering,[152,154–156] and exposure to tobacco smoke,[157] which are all risk factors for SIDS. A recent meta-analysis of 11 studies that investigated the association of bed-sharing and SIDS revealed a summary OR of 2.88 (95% confidence interval [CI]: 1.99–4.18) with bed-sharing.[158] Furthermore, bed-sharing in an adult bed not designed for infant safety exposes the infant to additional risks for accidental injury and death, such as suffocation, asphyxia, entrapment, falls, and strangulation.[159,160] Infants, particularly those in the first 3 months of life and those born prematurely and/or with low birth weight, are at highest risk,[161] possibly because immature motor skills and muscle strength make it difficult to escape potential threats.[158] In recent years, the concern among public health officials about bed-sharing has increased, because there have been increased reports of SUIDs occurring in high-risk sleep environments, particularly bed-sharing and/or sleeping on a couch or armchair.[162–165]

There Is Insufficient Evidence to Recommend Any Bed-Sharing Situation in the Hospital or at Home as Safe; Devices Promoted to Make Bed-Sharing "Safe" Are Not Recommended

Epidemiologic studies have not found bed-sharing to be protective against SIDS and accidental suffocation for any subgroups of the population. It is acknowledged that there are some cultures for which bed-sharing is the norm and SIDS rates are low, but there

are other cultures for which bed-sharing is the norm and SIDS rates are high. In general, the bed-sharing practiced in cultures with low SIDS rates is often different from that in the United States and other Western countries (eg, with firm mats on the floor, separate mat for the infant, and/or absence of soft bedding). It is statistically much more difficult to demonstrate safety (ie, no risk) in small subgroups. Breastfeeding mothers who do not smoke and have not consumed alcohol or arousal-altering medications or drugs are 1 such subgroup. Furthermore, not all risks associated with bed-sharing (eg, parental fatigue) can be controlled. The task force, therefore, believes that there is insufficient evidence to recommend any bed-sharing situation in the hospital or at home as safe. In addition, there is no evidence that devices marketed to make bed-sharing "safe" (eg, in-bed cosleepers) reduce the risk of SIDS or suffocation or are safe. Such devices, therefore, are not recommended.

There Are Specific Circumstances in Which Bed-Sharing Is Particularly Hazardous, and It Should Be Stressed to Parents That They Avoid the Following Situations at All Times

The task force emphasizes that certain circumstances greatly increase the risk with bed-sharing. Bed-sharing is especially dangerous when 1 or both parents are smokers (OR: 2.3–17.7)[64,65,158,166,167]; when the infant is younger than 3 months (OR: 4.7–10.4), regardless of parental smoking status[64,66,143,158,168,169]; when the infant is placed on excessively soft surfaces such as waterbeds, sofas, and armchairs (OR: 5.1–66.9)[62,64,65,143,169]; when soft bedding accessories such as pillows or blankets are used (OR: 2.8–4.1)[62,170]; when there are multiple bed-sharers (OR: 5.4)[62]; and when the parent has consumed alcohol (OR: 1.66).[66,171] There is also a higher risk of SIDS when the infant is bed-sharing with someone who is not a parent (OR: 5.4).[62]

A retrospective series of SIDS cases indicated that mean maternal body weight was higher for bed-sharing mothers than for non–bed-sharing mothers.[172] The only case-control study to investigate the relationship between maternal body weight and bed-sharing did not find an increased risk of bed-sharing with increased maternal weight.[173]

Infants May Be Brought Into the Bed for Feeding or Comforting but Should Be Returned to Their Own Crib or Bassinet When the Parent Is Ready to Return to Sleep

The risk of bed-sharing is higher the longer the duration of bed-sharing during the night.[64,65,167,169] Returning the infant to the crib after bringing him or her into the bed for a short period of time is not associated with increased risk.[65,169] Therefore, if the infant is brought into the bed for feeding, comforting, and bonding, the infant should be returned to the crib when the parent is ready for sleep. Because of the extremely high risk of SIDS, accidental suffocation, and entrapment on couches and armchairs,[62,64,65,143,169] infants should not be fed on a couch or armchair when there is high risk that the parent may fall asleep.

It Is Prudent to Provide Separate Sleep Areas and Avoid Cobedding for Twins and Higher-Order Multiples in the Hospital and at Home

Cobedding of twins and other infants of multiple gestation is a frequent practice, both in the hospital setting and at home.[174] However, the benefits of cobedding twins and higher-order multiples have not been established.[175–177] Twins and higher-order multiples are often born prematurely and with low birth weight, so they are at increased risk of SIDS.[101,102] Furthermore, there is increased potential for overheating and rebreathing while cobedding, and size discordance might increase the risk of accidental suffocation.[176] Most cobedded twins are placed on their sides rather than supine.[174] Finally, cobedding of twins and higher-order multiples in the hospital setting might encourage parents to continue this practice at home.[176] Because the evidence for the benefits of cobedding twins and higher-order multiples is not compelling and because of the increased risk of SIDS and suffocation, the AAP believes that it is prudent to provide separate sleep areas for these infants to decrease the risk of SIDS and accidental suffocation.

BEDDING

Pillows, Quilts, Comforters, Sheepskins, and Other Soft Surfaces Are Hazardous When Placed Under the Infant or Loose in the Sleep Environment

Bedding is used in infant sleep environments for comfort and safety.[178] Parents and caregivers who perceive that infants are uncomfortable on firm surfaces will often attempt to soften the surface with blankets and pillows. Parents and caregivers will also use pillows and blankets to create barriers to prevent the infant from falling off the sleep surface (usually an adult bed or couch) or to prevent injury if the infant hits the crib side. However, such soft bedding can increase the potential of suffocation and rebreathing.[54,56,57,179–181] Pillows, quilts, comforters, sheepskins, and other soft surfaces are hazardous when placed under the infant[62,147,182–187] or left loose in the infant's sleep area[62,65,184,185,188–191] and can increase SIDS risk up to fivefold independent of sleep position.[62,147] Several reports have also described that

in many SIDS cases, the heads of the infants, including some infants who slept supine, were covered by loose bedding.[65,186,187,191] It should be noted that the risk of SIDS increases 21-fold when the infant is placed prone with soft bedding.[62] In addition, soft and loose bedding have both been associated with accidental suffocation deaths.[149] The CPSC has reported that the majority of sleep-related infant deaths in its database are attributable to suffocation involving pillows, quilts, and extra bedding.[192,193] The AAP recommends that infants sleep on a firm surface without any soft or loose bedding. Pillows, quilts, and comforters should never be in the infant's sleep environment. Specifically, these items should not be placed loose near the infant, between the mattress and the sheet, or under the infant. Infant sleep clothing that is designed to keep the infant warm without the possible hazard of head covering or entrapment can be used in place of blankets; however, care must be taken to select appropriately sized clothing and to avoid overheating. If a blanket is used, it should be thin and tucked under the mattress so as to avoid head or face covering. These practices should also be modeled in hospital settings.

Wedges and Positioning Devices Are not Recommended

Wedges and positioning devices are often used by parents to maintain the infant in the side or supine position because of claims that these products reduce the risk for SIDS, suffocation, or gastroesophageal reflux. However, these products are frequently made with soft, compressible materials, which might increase the risk of suffocation. The CPSC has reports of deaths attributable to suffocation and entrapment associated with wedges and positioning devices. Most of these deaths occurred when infants were placed in the prone or side position with these devices; other incidents have occurred when infants have slipped out of the restraints or rolled into a prone position while using the device.[2,194] Because of the lack of evidence that they are effective against SIDS, suffocation, or gastroesophageal reflux and because there is potential for suffocation and entrapment, the AAP concurs with the CPSC and the US Food and Drug Administration in warning against the use of these products. If positioning devices are used in the hospital as part of physical therapy, they should be removed from the infant sleep area well before discharge from the hospital.

Bumper Pads and Similar Products Are not Recommended

Bumper pads and similar products that attach to crib slats or sides are frequently used with the thought of protecting infants from injury. Initially, bumper pads were developed to prevent head entrapment between crib slats.[195] However, newer crib standards that require crib slat spacing to be less than 2⅜ inches have obviated the need for crib bumpers. In addition, infant deaths have occurred because of bumper pads. A recent report by Thach et al,[196] who used CPSC data, found that deaths attributed to bumper pads were from 3 mechanisms: (1) suffocation against soft, pillow-like bumper pads; (2) entrapment between the mattress or crib and firm bumper pads; and (3) strangulation from bumper pad ties. However, the CPSC believes that there were other confounding factors, such as the presence of pillows and/or blankets, that might have contributed to many of the deaths in this report.[2] Thach et al[196] also analyzed crib injuries that might have been prevented by bumper pad use and concluded that the use of bumper pads only prevents minor injuries. A more recent study of crib injuries that used data from the CPSC National Electronic Injury Surveillance System concluded that the potential benefits of preventing minor injury with bumper pad use were far outweighed by the risk of serious injury such as suffocation or strangulation.[197] In addition, most bumper pads obscure infant and parent visibility, which might increase parental anxiety.[195] There are other products that attach to crib sides or crib slats that claim to protect infants from injury. However, there are no published data that support these claims. Because of the potential for suffocation, entrapment, and strangulation and lack of evidence to support that bumper pads or similar products that attach to crib slats or sides prevent injury in young infants, the AAP does not recommend their use.

PRENATAL AND POSTNATAL EXPOSURES (INCLUDING SMOKING AND ALCOHOL)

Pregnant Women Should Seek and Obtain Regular Prenatal Care

There is substantial epidemiologic evidence that links a lower risk of SIDS for infants whose mothers obtain regular prenatal care.[198–200] Women should seek prenatal care early in the pregnancy and continue to obtain regular prenatal care during the entire pregnancy.

Smoking During Pregnancy, in the Pregnant Woman's Environment, and in the Infant's Environment Should Be Avoided

Maternal smoking during pregnancy is a major risk factor in almost every epidemiologic study of SIDS.[201–204] Smoke in the infant's environment after birth is a separate major risk factor in a few studies,[202,205] although separating this variable from maternal smoking before birth is problematic. Thirdhand smoke refers to residual contamination from tobacco smoke after the cigarette has been extinguished[206]; there is no research to date on the signifi-

cance of thirdhand smoke with regards to SIDS risk. Smoke exposure adversely affects infant arousal[207–213]; in addition, smoke exposure increases risk of preterm birth and low birth weight, both of which are risk factors for SIDS. The effect of tobacco smoke exposure on SIDS risk is dose-dependent. Aside from sleep position, smoke exposure is the largest contributing risk factor for SIDS.[149] It is estimated that one-third of SIDS deaths could be prevented if all maternal smoking during pregnancy were eliminated.[214,215] The AAP supports the elimination of all tobacco smoke exposure, both prenatally and environmentally.[216,217]

Avoid Alcohol and Illicit Drug Use During Pregnancy and After the Infant's Birth

Several studies have specifically investigated the association of SIDS with prenatal and postnatal exposure to alcohol or illicit drug use, although substance abuse often involves more than 1 substance and it is difficult to separate these variables from each other and from smoking. However, 1 study of Northern Plains American Indians found that periconceptional maternal alcohol use (adjusted OR: 6.2 [95% CI: 1.6–23.3]) and maternal first-trimester binge drinking (adjusted OR: 8.2 [95% CI: 1.9–35.3])[218] were associated with increased SIDS risk independent of prenatal cigarette smoking exposure. Another study from Denmark, which was based on prospective data about maternal alcohol use, also found a significant relationship between maternal binge drinking and postneonatal infant mortality, including SIDS.[219]

Postmortem studies of Northern Plains American Indian infants revealed that prenatal cigarette smoking was significantly associated with decreased serotonin receptor binding in the brainstem. In this study, the association of maternal alcohol drinking in the 3 months before or during pregnancy was of borderline significance on univariate analysis but was not significant when prenatal smoking and case-versus-control status were in the model.[39] However, this study had limited power for multivariate analysis because of its small sample size. One study found an association of SIDS with heavy alcohol consumption in the 2 days before the death.[220] Although some studies have found a particularly strong association when alcohol consumption occurs in combination with bed-sharing,[64–66,221] other studies have not found interaction between bed-sharing and alcohol to be significant.[167,222]

Studies investigating the relationship of illicit drug use and SIDS have focused on specific drugs or illicit drug use in general. In utero exposure to opiates (primarily methadone and heroin) has been shown in retrospective studies to be associated with an increased risk of SIDS.[223,224] With the exception of 1 study that did not show increased risk,[225] population-based studies have generally shown an increased risk with in utero cocaine exposure.[226–228] However, these studies did not control for confounding factors. A prospective cohort study found the SIDS rate to be significantly increased for infants exposed in utero to methadone (OR: 3.6 [95% CI: 2.5–5.1]), heroin (OR: 2.3 [95% CI: 1.3–4.0]), methadone and heroin (OR: 3.2 [95% CI: 1.2–8.6]), and cocaine (OR: 1.6 [95% CI: 1.2–2.2]), even after controlling for race/ethnicity, maternal age, parity, birth weight, year of birth, and maternal smoking.[229] In addition, a meta-analysis of studies that investigated an association between in utero cocaine exposure and SIDS found an increased risk of SIDS to be associated with prenatal exposure to cocaine and illicit drugs in general.[230]

BREASTFEEDING

Breastfeeding Is Recommended

Earlier epidemiologic studies were not consistent in demonstrating a protective effect of breastfeeding on SIDS*; some studies found a protective effect,[67,239,240] and others did not.† Because many of the case-control studies demonstrated a protective effect of breastfeeding against SIDS in univariate analysis but not when confounding factors were taken into account,[62,184,198,231,238] these results suggested that factors associated with breastfeeding, rather than breastfeeding itself, are protective. However, newer published reports support the protective role of breastfeeding on SIDS when taking into account potential confounding factors.[243–245] Studies do not distinguish between nursing and expressed human milk. In the Agency for Healthcare Research and Quality's "Evidence Report on Breastfeeding in Developed Countries,"[243] multiple outcomes, including SIDS, were examined. Six studies were included in the SIDS-breastfeeding meta-analysis, and in both unadjusted and adjusted analysis, ever breastfeeding was associated with a lower risk of SIDS (summary OR: 0.41 [95% CI: 0.28–0.58]; adjusted summary OR: 0.64 [95% CI: 0.51–0.81]). The German Study of Sudden Infant Death, the largest and most recent case-control study of SIDS, found that exclusive breastfeeding at 1 month of age halved the risk of SIDS (adjusted OR: 0.48 [95% CI: 0.28–0.82]). At all ages, control infants were breastfed at higher rates than SIDS victims, and the protective effect of partial or exclusive breastfeeding remained statistically significant after adjustment for confounders.[244] A recent meta-analysis that included 18 case-control studies revealed an unadjusted summary OR for any breast-

*Refs 62, 65, 67, 184, 198, and 231–239.
†Refs 62, 184, 198, 231, 238, 241, and 242.

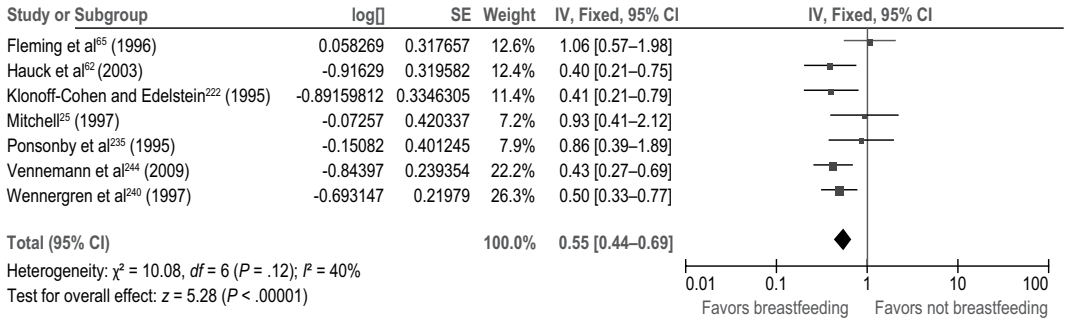

FIGURE 9
Multivariable analysis of any breastfeeding versus no breastfeeding. log[ ] indicates logarithm of the OR; weight, weighting that the study contributed to the meta-analysis (according to sample size); IV, fixed, 95% CI: fixed-effect OR with 95% CI.[245]

feeding of 0.40 (95% CI: 0.35–0.44). Seven of these studies provided adjusted ORs, and on the basis of these studies, the pooled adjusted OR remained statistically significant at 0.55 (95% CI: 0.44–0.69) (Fig 9).[245] The protective effect of breastfeeding increased with exclusivity, with a univariable summary OR of 0.27 (95% CI: 0.24–0.31) for exclusive breastfeeding of any duration.[245]

Currently in the United States, 73% of mothers initiate breastfeeding, and 42% and 21% are still breastfeeding at 6 and 12 months, respectively.[246] Non-Hispanic black mothers are least likely to initiate or to still be breastfeeding at 6 and 12 months (54%, 27%, and 12%, respectively), whereas Asian/Pacific Islander mothers initiate and continue breastfeeding more than other groups (81%, 52%, and 30%, respectively). Rates for initiating and continuing breastfeeding at 6 and 12 months for non-Hispanic white mothers are 74%, 43%, and 21%; rates for Hispanic mothers are 80%, 45%, and 24%; and rates for American Indian/Alaskan Native mothers are 70%, 37%, and 19%, respectively.

Physiologic sleep studies have found that breastfed infants are more easily aroused from sleep than their formula-fed counterparts.[247,248] In addition, breastfeeding results in a decreased incidence of diarrhea, upper and lower respiratory infections, and other infectious diseases[249] that are associated with an increased vulnerability to SIDS and provides overall immune system benefits from maternal antibodies and micronutrients in human milk.[250,251] Exclusive breastfeeding for 6 months has been found to be more protective against infectious diseases compared with exclusive breastfeeding to 4 months of age and partial breastfeeding thereafter.[249]

If a Breastfeeding Mother Brings the Infant Into the Adult Bed for Nursing, the Infant Should Be Returned to a Separate Sleep Surface When the Mother Is Ready for Sleep

Several organizations promote the practice of mother-infant bed-sharing (ie, sleeping in the same bed) as a way of facilitating breastfeeding.[142,252,253] Breastfeeding is a common reason given by mothers for bed-sharing with their infants.[254] Studies have found an association between bed-sharing and longer duration of breastfeeding, but their data cannot determine a temporal relationship (ie, it is not known whether bed-sharing promotes breastfeeding or if breastfeeding promotes bed-sharing, or if women who prefer 1 practice are also likely to prefer the other).[255] Although bed-sharing may facilitate breastfeeding, it is not essential for successful breastfeeding.[256,257] Furthermore, 1 case-control study found that the risk of SIDS while bed-sharing was similar regardless of breastfeeding status, which indicates that the benefits of breastfeeding do not outweigh the increased risk associated with bed-sharing.[258]

PACIFIER USE

Consider Offering a Pacifier at Nap Time And Bedtime

Several studies[62,66,167,231,259–262] have found a protective effect of pacifiers on the incidence of SIDS, particularly when used at the time of last sleep. Two meta-analyses revealed that pacifier use decreased the risk of SIDS by 50% to 60% (summary adjusted OR: 0.39 [95% CI: 0.31–0.50][263]; summary unadjusted OR: 0.48 [95% CI: 0.43–0.54][264]). Two later studies not included in these meta-analyses reported equivalent or even larger protective associations.[265,266] The mechanism for this apparent strong protective effect is still unclear, but lowered arousal thresholds, favorable modification of autonomic control during sleep, and maintaining airway patency during sleep have been proposed.[247,267–270] It is common for the pacifier to fall from the mouth soon after the infant falls asleep; even so, the protective effect persists throughout that sleep period.[247,271] Two studies have shown that pacifier use is most protective when used for all sleep periods.[169,266] However, these studies also

showed increased risk of SIDS when the pacifier was usually used but not used the last time the infant was placed for sleep; the significance of these findings is yet unclear.

Although some SIDS experts and policy-makers endorse pacifier use recommendations that are similar to those of the AAP,[272,273] concerns about possible deleterious effects of pacifier use have prevented others from making a recommendation for pacifier use as a risk reduction strategy.[274] Although several observational studies[275–277] have found a correlation between pacifiers and reduced breastfeeding duration, the results of well-designed randomized clinical trials indicated that pacifiers do not seem to cause shortened breastfeeding duration for term and preterm infants.[278,279] The authors of 1 study reported a small deleterious effect of early pacifier introduction (2–5 days after birth) on exclusive breastfeeding at 1 month of age and on overall breastfeeding duration (defined as any breastfeeding), but early pacifier use did not adversely affect exclusive breastfeeding duration. In addition, there was no effect on breastfeeding duration when the pacifier was introduced at 1 month of age.[280] A more recent systematic review found that the highest level of evidence (ie, from clinical trials) does not support an adverse relationship between pacifier use and breastfeeding duration or exclusivity.[281] The association between shortened duration of breastfeeding and pacifier use in observational studies likely reflects a number of complex factors such as breastfeeding difficulties or intent to wean.[281] A large multicenter, randomized controlled trial of 1021 mothers who were highly motivated to breastfeed were assigned to 2 groups: mothers advised to offer a pacifier after 15 days and mothers advised not to offer a pacifier. At 3 months, there were no differences in breastfeeding rates between the 2 groups; 85.8% of infants in the offer-pacifier group were exclusively breastfeeding compared with 86.2% in the not-offered group.[282] The AAP policy statement on breastfeeding and the use of human milk includes a recommendation that pacifiers can be used during breastfeeding, but implementation should be delayed until breastfeeding is well established.[283]

Some dental malocclusions have been found more commonly among pacifier users than nonusers, but the differences generally disappeared after pacifier cessation.[284] In its policy statement on oral habits, the American Academy of Pediatric Dentistry states that nonnutritive sucking behaviors (ie, fingers or pacifiers) are considered normal for infants and young children and that, in general, sucking habits in children to the age of 3 years are unlikely to cause any long-term problems.[285] There is an approximate 1.2- to 2-fold increased risk of otitis media associated with pacifier use, particularly between 2 and 3 years of age.[286,287] The incidence of otitis media is generally lower in the first year of life, especially the first 6 months, when the risk of SIDS is the highest.[288–293] However, pacifier use, once established, may persist beyond 6 months, thus increasing the risk of otitis media. Gastrointestinal infections and oral colonization with *Candida* species were also found to be more common among pacifier users than nonusers.[289–291]

The literature on infant digit-sucking and SIDS is extremely limited. Only 1 case-control study from the Netherlands has reported results.[262] This study did not find an association between usual digit-sucking (reported as "thumb-sucking") and SIDS risk (OR: 1.38 [95% CI: 0.35–1.51]), but the wide CI suggests that there was insufficient power to detect a significant association.

OVERHEATING, FANS, AND ROOM VENTILATION

Avoid Overheating and Head Covering in Infants

There is clear evidence that the risk of SIDS is associated with the amount of clothing or blankets on an infant and the room temperature.[182,218,294,295] Infants who sleep in the prone position have a higher risk of overheating than do supine sleeping infants.[182] It is unclear whether the relationship to overheating is an independent factor or merely a reflection of the increased risk of SIDS and suffocation with blankets and other potentially asphyxiating objects in the sleeping environment. Head covering during sleep is of particular concern. In a recent systematic review, the pooled mean prevalence of head covering among SIDS victims was 24.6% compared with 3.2% among control infants.[154] It is not known whether the risk associated with head covering is attributable to overheating, hypoxia, or rebreathing.

There has been some suggestion that room ventilation may be important. One study found that bedroom heating, compared with no bedroom heating, increases SIDS risk (OR: 4.5),[235] and another study has also demonstrated a decreased risk of SIDS in a well-ventilated bedroom (windows and doors open) (OR: 0.4).[296] In 1 study, the use of a fan seemed to reduce the risk of SIDS (adjusted OR: 0.28 [95% CI: 0.10–0.77]).[297] However, because of the possibility of recall bias, the small sample size of controls using fans ($n = 36$), a lack of detail about the location and types of fans used, and the weak link to a mechanism, this study's results should be interpreted with caution. On the basis of available data, the task force cannot make a recommendation on the use

of a fan as a SIDS risk-reduction strategy.

SWADDLING

Although Swaddling May Be Used as a Strategy to Calm the Infant and Encourage Use of Supine Position, There Is Not Enough Evidence to Recommend It as a Strategy for Reducing the Risk of SIDS

Many cultures and newborn nurseries have traditionally used swaddling, or wrapping the infant in a light blanket, as a strategy to soothe infants and, in some cases, encourage sleep in the supine position. Swaddling, when done correctly, can be an effective technique to help calm infants and promote sleep.[298] Some have argued that swaddling can alter certain risk factors for SIDS, thus reducing the risk of SIDS. For instance, it has been suggested that the physical restraint associated with swaddling may prevent infants placed supine from rolling to the prone position.[299] One study's results suggested a decrease in SIDS rate with swaddling if the infant was supine,[182] but it was notable that there was an increased risk of SIDS if the infant was swaddled and placed in the prone position.[182] Although a recent study found a 31-fold increase in SIDS risk with swaddling, the analysis was not stratified according to sleep position.[171] Although it may be more likely that parents will initially place a swaddled infant supine, this protective effect may be offset by the 12-fold increased risk of SIDS if the infant is either placed or rolls to the prone position when swaddled.[182,300] Moreover, there is no evidence that swaddling reduces bed-sharing or use of unsafe sleep surfaces, promotes breastfeeding, or reduces maternal cigarette smoking.

There is some evidence that swaddling might cause detrimental physiologic consequences. For example, it can cause an increase in respiratory rate,[301] and tight swaddling can reduce the infant's functional residual lung capacity.[299,302,303] Tight swaddling can also exacerbate hip dysplasia if the hips are kept in extension and adduction.[304–307] This is particularly important, because some have advocated that the calming effects of swaddling are related to the "tightness" of the swaddling. In contrast, "loose" or incorrectly applied swaddling could result in head covering and, in some cases, strangulation if the blankets become loose in the bed. Swaddling may also possibly increase the risk of overheating in some situations, especially when the head is covered or the infant has an infection.[308,309] However, a recent study found no increase in abdominal skin temperature when infants were swaddled in a light cotton blanket from the shoulders down.[302]

Impaired arousal has often been postulated as a mechanism that contributes to SIDS, and several studies have investigated the relationship between swaddling, arousal, and sleep patterns in infants. Physiologic studies have demonstrated that, in general, swaddling decreases startling,[301] increases sleep duration, and decreases spontaneous awakenings.[310] Swaddling also decreases arousability (ie, increases cortical arousal thresholds) to a nasal pulsatile air-jet stimulus, especially in infants who are easily arousable when not swaddled but less so in infants who have high arousal thresholds when not swaddled.[301] One study found decreased arousability in infants at 3 months of age who were not usually swaddled and then were swaddled but found no effect on arousability in routinely swaddled infants.[301] In contrast, another group of investigators showed decreased arousal thresholds[310] and increases in autonomic (subcortical) responses[311] to an auditory stimulus when swaddled. Thus, although swaddling clearly promotes sleep and decreases the number of awakenings, the effects on arousability to an external stimulus remain unclear. There is accumulating evidence, however, that there are only minimal effects of routine swaddling on arousal. In addition, there have been no studies investigating the effects of swaddling on arousal to more relevant stimuli such as hypoxia or hypercapnia.

In summary, it is recognized that swaddling is one of many child care practices that can be used to calm infants and promote sleep. However, there is insufficient evidence to recommend routine swaddling as a strategy for reducing the incidence of SIDS. Moreover, as many have advocated, swaddling must be correctly applied to avoid possible hazards such as hip dysplasia, head covering, and strangulation. It is important to note that swaddling does not reduce the necessity to follow recommended safe sleep practices.

IMMUNIZATIONS AND SIDS

Infants Should Be Immunized in Accordance With Recommendations of the AAP and Centers for Disease Control and Prevention

The incidence of SIDS peaks at a time when infants are receiving numerous immunizations. Case reports of a cluster of deaths shortly after immunization with diphtheria-tetanus-pertussis in the late 1970s created concern of a possible causal relationship between vaccinations and SIDS.[312–315] Case-control studies were performed to evaluate this temporal association. Four of the 6 studies found no relationship between diphtheria-tetanus-pertussis vaccination and subsequent SIDS,[316–319] and results of the other 2 studies suggested a temporal relationship but only in specific subgroup anal-

ysis.[320,321] In 2003, the Institute of Medicine of the National Academy of Sciences reviewed available data and concluded that "[t]he evidence favors rejection of a causal relationship between exposure to multiple vaccinations and SIDS."[322] Additional subsequent large population case-control trials consistently have found vaccines to be protective against SIDS[323–325]; however, confounding factors (social, maternal, birth, and infant medical history) might account for this protective effect.[326] It also has been theorized that the decreased SIDS rate immediately after vaccination was attributable to infants being healthier at time of immunization, or "the healthy vaccinee effect."[327] Recent illness would both place infants at higher risk of SIDS and make them more likely to have immunizations deferred.[328]

Recent studies have attempted to control for confounding by social, maternal, birth, and infant medical history.[323,325,328] In a meta-analysis, Vennemann et al[328] found a multivariate summary OR for immunizations and SIDS to be 0.54 (95% CI: 0.39–0.76), which indicates that the risk of SIDS is halved by immunization. The evidence continues to show no causal relationship between immunizations and SIDS and suggests that vaccination may have a protective effect against SIDS.

HOME MONITORS, SIDS, AND APPARENT LIFE-THREATENING EVENTS

There Is no Evidence That Apparent Life-Threatening Events Are Precursors to SIDS, and Infant Home Monitors Should Not Be Used as a Strategy for Preventing SIDS

For many years it was believed that apparent life-threatening events were the predecessors of SIDS, and home apnea monitors were used as a strategy for preventing SIDS.[329] However, there is no evidence that home monitors are effective for this purpose.[330–333] The task force concurs with the AAP Committee on Fetus and Newborn, which has recommended that infant home monitoring not be used as a strategy to prevent SIDS, although it can be useful for some infants who have had an apparent life-threatening event.[334]

POTENTIAL TOXICANTS AND SIDS

There Is no Evidence Linking Various Toxicants to SIDS

Many theories link various toxicants and SIDS. Currently, no studies have substantiated a causal relationship between metals, such as silver, cadmium, cobalt, lead, or mercury, and SIDS.[335–337] Although an ecological study found correlation of the maximal recorded nitrate levels of drinking water with local SIDS rates in Sweden,[338] no case-control study has demonstrated a relationship between nitrates in drinking water and SIDS. Furthermore, an expert group in the United Kingdom analyzed data pertaining to a hypothesis that SIDS is related to toxic gases, such as antimony, phosphorus, or arsenic, being released from mattresses[339,340] and found the toxic-gas hypothesis to be unsubstantiated.[341] Finally, 2 case-control studies found that wrapping mattresses in plastic to reduce toxic gas emission did not protect against SIDS.[191,342]

HEARING SCREENS

Newborn Hearing Screens Should Not Be Used as a Screening Test for SIDS

A single, small, retrospective case-control study examined the use of newborn transient evoked otoacoustic emission hearing screening tests as a tool for identifying infants at subsequent risk of SIDS.[343] Infants who subsequently died from SIDS did not fail their hearing tests but, compared with controls, showed a decreased signal-to-noise ratio score in the right ear only (at frequencies of 2000, 3000, and 4000 Hz). Methodologic concerns have been raised about the validity of the study methods used in this study,[344,345] and these results have not been substantiated by others. A larger but non–peer-reviewed report of hearing screening data in Michigan revealed no relationship between hearing screening test results and SIDS cases.[346] Until additional data are available, hearing screening should not be considered as a valid screening tool for determining which infants might be at subsequent risk of SIDS. Furthermore, an increased risk of SIDS should not be inferred from an abnormal hearing screen result.

EDUCATIONAL INTERVENTIONS

Educational and Intervention Campaigns Are Often Effective in Altering Practice

Intervention campaigns for SIDS have been extremely effective, especially with regard to avoidance of prone positioning.[347] Furthermore, there is evidence that primary care–based educational interventions, particularly those that address caregiver concerns and misconceptions about safe sleep recommendations, can be effective in altering practice. For instance, addressing concerns about infant comfort, choking, and aspiration while the infant is sleeping prone is helpful.[348,349] Similar interventions for improving behavior of medical and nursing staff and child care providers have shown that these professionals have similar concerns about the supine sleep position.[350–353] Primary care providers should be encouraged to develop quality improvement initiatives to improve

adherence with safe sleep recommendations among their patients.

MEDIA MESSAGES

Media and Manufacturers Should Follow Safe Sleep Guidelines in Their Messaging and Advertising

A recent study found that, in magazines targeted toward childbearing women, more than one-third of pictures of sleeping infants and two-thirds of pictures of infant sleep environments portrayed unsafe sleep positions and sleep environments.[354] Media exposures (including movie, television, magazines, newspapers, and Web sites), manufacturer advertisements, and store displays affect individual behavior by influencing beliefs and attitudes. Frequent exposure to health-related media messages can affect individual health decisions,[355,356] and media messages have been quite influential in decisions regarding sleep position.[77,80] Media and advertising messages contrary to safe sleep recommendations may create misinformation about safe sleep practices. Safe sleep messages should be reviewed, revised, and reissued at least every 5 years to address the next generation of new parents and products on the market.

RECOMMENDATIONS

The AAP's recommendations for a safe infant sleeping environment to reduce the risk of both SIDS and other sleep-related infant deaths are specified in the accompanying policy statement.[4]

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Skateboard and Scooter Injuries

ABSTRACT. Skateboard-related injuries account for an estimated 50 000 emergency department visits and 1500 hospitalizations among children and adolescents in the United States each year. Nonpowered scooter-related injuries accounted for an estimated 9400 emergency department visits between January and August 2000, and 90% of these patients were children younger than 15 years. Many such injuries can be avoided if children and youth do not ride in traffic, if proper protective gear is worn, and if, in the absence of close adult supervision, skateboards and scooters are not used by children younger than 10 and 8 years, respectively.

ABBREVIATION. CPSC, US Consumer Product Safety Commission.

OVERVIEW

In the past decade, there has been a resurgence in recreational skateboarding, and with it, there has been an increased number of injuries. In 1996, an estimated 5.8 million children and adolescents younger than 18 years in the United States had participated in skateboarding, and an estimated 750 000 had done so at least weekly.[1] During the past 25 years, the annual incidence of skateboard-related injuries peaked at 150 000 in 1977 and subsequently decreased to 16 000 in 1983. This decrease was likely related to decreased skateboard activity. More recently, with increasing popularity of the sport, the number of injured individuals younger than 20 years has increased from an estimated 24 000 in 1994 to approximately 51 000 in 1999.[2] In 1997, 1500 children required hospitalization for an injury sustained while skateboarding, and in most cases, the injury was to the head.

According to the US Consumer Product Safety Commission (CPSC), approximately 90% of all children and adolescents treated for skateboard-related injuries in 1999 were males.[2] The ankle, wrist, and face were the 3 most common areas injured, accounting for 38% of all injuries treated. Only 5% were severe (defined as concussions or internal injuries), whereas moderate injuries (long bone fractures or dislocations) accounted for 31%. Deaths were rare. Of those children injured seriously enough to require hospitalization at a children's hospital or pediatric trauma center, 25% were hit by a motor vehicle.[3]

Nonpowered lightweight scooters have become very popular in just a short time. These are made of lightweight aluminum with small, low-friction wheels similar to those on in-line skates. They weigh less than 10 lb and can be folded to enhance portability. Preliminary data from the CPSC indicate that an estimated 9400 people (94% younger than 15 years) were injured while using nonpowered scooters between January and August 2000. Injury frequency increased considerably during the summer months. Children younger than 8 years accounted for 31% of those injured. Approximately one third of all injuries were fractures or dislocations. Head and face injuries accounted for 29% of all injuries, whereas wrist, elbow, lower arm, and knee injuries together accounted for 34%.

The CPSC recommends that children younger than 8 years not use scooters without close supervision.[4] The CPSC further recommends that all riders use a helmet that meets their standards as well as knee and elbow pads. Children should not ride scooters on streets, at night, or on any surfaces that have water, sand, gravel, or dirt.[5]

Young children may be at high risk of injury from skateboards and scooters because their judgment of their own skills and strength is often poor, as is their ability to judge foot or vehicular traffic. Their center of gravity is higher than that of older children and adults, their neuromuscular system is not well developed, and they are not sufficiently able to protect themselves from injury. For these developmental reasons, children younger than 5 years should not ride skateboards, and those between 6 and 10 years of age should be closely supervised while skateboarding. Children younger than 8 years are at greater risk of scooter injuries than are older children and should not use them.

At the time this policy statement was developed, the increase in use of skateboards and scooters was too new for the effectiveness of these recommendations to be assessed. These preliminary recommendations were based on studies concerning the effectiveness of protective gear for in-line skating and bicycling. More time will need to pass to determine whether the popularity of skateboards and scooters will increase or wane and to assess the effectiveness of recommendations.

The American Academy of Pediatrics recommends the following:

1. Children younger than 10 years[6] should not use skateboards without close supervision by an adult or responsible adolescent. Children younger than 5 years should not use skateboards[7]; instead, parents and pediatricians should encourage them to

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

undertake activities that are more developmentally appropriate.
2. Skateboards must never be ridden in or near traffic, regardless of traffic volume.
3. "Skitching a ride," or holding on to the side or rear of a moving vehicle while riding a skateboard, should never be done. It is particularly dangerous because the rider cannot accommodate a sudden stop or swerve of the vehicle.
4. Pediatricians should advise parents, teachers, and others to strongly recommend that all skateboarders wear a helmet and other protective gear (including wrist guards, elbow pads, and knee pads) to prevent or reduce the severity of injuries resulting from falls.[8] Use of protective clothing, such as gloves, is not sufficient.[9] The helmet should be a bicycle helmet that complies (and is so labeled) with the CPSC standard[10] or a multisport helmet that complies with the N-94 standard established by the Snell Memorial Foundation.[11] The N-94 standard requires that helmets pass multiple impact tests to the back during laboratory testing.
5. Communities should continue to develop skateboarding parks and encourage youth to practice there. These parks are preferred to home-constructed ramps and jumps, because they are more likely to be monitored for safety and separate the skateboarder from pedestrian and motor vehicle traffic. Existing guidelines for such parks should be standardized.[12]
6. Until additional information is available, pediatricians should counsel parents on the use of nonpowered scooters according to the following CPSC recommendations[4]:
   - Children younger than 8 years should not ride scooters without close adult supervision.
   - Children should not ride scooters in streets, in traffic, or at night.
   - Children should wear helmets, knee pads, and elbow pads while using scooters.
7. The Academy strongly emphasizes the need to monitor the amount and nature of nonpowered scooter use and resultant injuries.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Snowmobiling Hazards

ABSTRACT. Snowmobiles continue to pose a significant risk to children younger than 15 years and adolescents and young adults 15 through 24 years of age. Head injuries remain the leading cause of mortality and serious morbidity, arising largely from snowmobilers colliding, falling, or overturning during operation. Children also were injured while being towed in a variety of conveyances by snowmobiles. No uniform code of state laws governs the use of snowmobiles by children and youth. Because evidence is lacking to support the effectiveness of operator safety certification and because many children and adolescents do not have the required strength and skills to operate a snowmobile safely, the recreational operation of snowmobiles by persons younger than 16 years is not recommended. Snowmobiles should not be used to tow persons on a tube, tire, sled, or saucer. Furthermore, a graduated licensing program is advised for snowmobilers 16 years and older. Both active and passive snowmobile injury prevention strategies are suggested, as well as recommendations for manufacturers to make safer equipment for snowmobilers of all ages.

ABBREVIATIONS. NEISS, National Electronic Injury Surveillance System; CPSC, US Consumer Product Safety Commission; AAP, American Academy of Pediatrics.

The popularity of snowmobiles in the snowbelt has increased[1–3] along with their size and speed. The National Electronic Injury Surveillance System (NEISS) of the US Consumer Product Safety Commission (CPSC) reported that there has been no decline in snowmobile injuries during the past 10 years. The average annual number of snowmobile injuries treated in emergency departments in 1997 and 1998 was more than 10 000. Of these injuries, 10% occurred in children younger than 15 years, and another 25% occurred in adolescents and young adults 15 through 24 years of age. Between January 1992 and December 1997, the Death Certificate Data Files of the CPSC recorded 51 deaths in children younger than 16 years that were directly attributable to snowmobiles. This number is almost certainly an undercount. The CPSC does not routinely acquire death certificates involving collisions with licensed motor vehicles.

For both the number of reported deaths and injuries, males were 3 times more likely than females to be the victims. Head injuries were the leading cause of injury and death.[3–5] Most deaths and serious injuries occurred as a result of the operators striking fixed objects, such as a tree, cable or wire, or another vehicle.[3] Children younger than 16 years were injured or killed when they fell from their snowmobiles, had the vehicle roll over them, or crashed the snowmobile into other snowmobiles, vehicles, or stationary objects (D. Tinsworth, written communication, January 21, 2000). Near-drowning events in children younger than 16 years were infrequent, and only 1 child drowned after encountering thin ice, in contrast to the prominence of drowning as a cause of death for older teenagers and adults.[4,5] Frostbite and hypothermia, recognized hazards,[6,7] were reported infrequently. Other injuries occurred during loading and unloading the snowmobile and when the body of the operator struck different parts of the snowmobile during sudden stops. Burns associated with refueling also have been documented.

More than 50 children in the NEISS sample were injured while being towed when their sled, tube, tire, or saucer overturned, struck an object, or was hit by another vehicle. In general, children younger than 8 years who were injured or killed from incidents involving snowmobiles tended to be passengers on snowmobiles or sleds.

Other problems associated with snowmobile operation that were reported in the literature include hearing loss from prolonged exposure to excess engine noise[8] and white finger syndrome arising from the effects of cold weather and hand/arm vibration from the handlebars of the snowmobiles.[9] Common factors identified in other studies and contributing to snowmobile incidents include operator error, speeding, traveling on inappropriate terrain, nighttime operation, and alcohol use.[1,5,10–12]

Most, but not all, states require that off-road vehicles be registered. Many states require a valid driver's license to operate a snowmobile on public lands or, where permitted, on roads. Some states mandate that children and youth be directly supervised or accompanied by an adult on the snowmobile or have successfully completed an approved snowmobile safety course. Such certification not only allows for children as young as 8 years to ride alone in some states but also permits certificate holders who are 14 years and older to serve as substitutes for adults to supervise inexperienced and noncertified child operators. In some states, there are no age restrictions. A few states have made helmets mandatory for operators younger than 16 years. Snowmobiling on private property is exempt from restrictions.[3]

Evidence is lacking that operator safety certifica-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

PEDIATRICS (ISSN 0031 4005).

tion courses adequately educate children and youth to operate snowmobiles safely. The influence of sanctioned courses on snowmobile-related injuries to individuals younger than 16 years has not been assessed. In jurisdictions where this option is available, scientifically rigorous evaluations should be performed.

RECOMMENDATIONS

Previous American Academy of Pediatrics (AAP) recommendations[13] have been updated.

Recommendations for children younger than 16 years include the following:

1. Recreational operation of snowmobiles is inappropriate for children and younger adolescents. Children younger than 16 years should not operate snowmobiles. Furthermore, children younger than 6 years do not have the strength or stamina to be transported safely as passengers on snowmobiles. Winter recreational activities for children should be developmentally appropriate.
2. Advertisements that promote snowmobiling should not be directed toward young adolescents, and advertisements should not depict young adolescents driving snowmobiles.

Recommendations for the protection of snowmobilers 16 years and older include the following:

1. Graduated licensing for snowmobile operators is recommended, consistent with the AAP policy on graduated licensing for motor vehicle drivers.[14] Although no direct evidence exists for the effectiveness of graduated licensing on teenage motor vehicle operators of snowmobiles, graduated licensing has been shown to be effective in reducing motor vehicle-related deaths among teenagers. Newly licensed operators should be restricted to snowmobiling during daylight hours on groomed trails only, with zero tolerance for alcohol consumption. To operate a snowmobile safely, persons should acquire a learner's permit by taking a state-sanctioned course.
2. Snowmobilers should travel at safe speeds, especially on unfamiliar or rugged terrain where hazards, such as difficult-to-see barbed wire, may be encountered. A speed-limiting governor, to limit the maximum speed, is suggested for newly licensed operators.
3. Irrespective of age, snowmobilers should avoid the use alcohol or other drugs before or during the operation of a snowmobile. Adults should reinforce this message by setting a good example.
4. Snowmobilers should wear well-insulated protective clothing, including goggles and waterproof snowmobile suits, gloves, and rubber-bottomed boots. All drivers and passengers should wear helmets approved by Snell or another standards organization for use while operating motorized vehicles such as motorcycles and snowmobiles. Operators should carry a first aid kit, a survival kit that includes flares, and if practical, a cellular phone. Snowmobilers should travel in groups of 2 or more and only on designated, marked trails away from roads, waterways, railroads, and pedestrian traffic. The weather forecast should be checked before snowmobiling. Operators should know the signs of hypothermia and regularly check for frostbite.
5. Snowmobilers should avoid snowmobiling on ice if they are uncertain about its thickness or condition. The condition of the trails also should be determined, and where appropriate, avalanche danger should be ascertained.
6. Snowmobilers should not carry more than 1 passenger. Headlights and taillights should be on at all times to improve the visibility of the snowmobile to other vehicle operators.
7. Use of a saucer, tube, tire, sled, or skis to pull someone behind a snowmobile is not recommended. If the need should arise to tow a person, the risk of injury is reduced by using a sled or cutter attached to the snowmobile by a rigid bar connection. The driver should travel at a slow speed over level terrain away from trees, rocks, and other vehicles, and a spotter should be used to watch the individual(s) being towed.
8. Snowmobiles must be well-maintained. Appropriate precautions should be taken by persons when fueling snowmobiles to avoid burns and when loading snowmobiles on and off trailers to prevent strains and crush injuries.

Recommendations for manufacturers include the following:

1. Snowmobile manufacturers should incorporate mechanical enhancements such as seating and handlebar design to improve rider comfort and safety, as well as to reduce hand-arm vibration to minimize white finger syndrome and numbness. Manufacturers should also attenuate sound levels generated by snowmobiles, improve headlight luminance, and add a Global Positioning System device (overhead satellites provide exact current latitudes and longitudes) to all snowmobiles. Manufacturers are urged to improve snowmobile braking, steering, and stability. Emission standards for snowmobiles should be improved.
2. Helmet designs need to be improved to minimize visor fogging and improve hearing protection. Safety standards for snowmobile helmets should be developed, and snowmobile helmets should be formally certified. Helmet manufacturers should consider adding features, such as built-in radio channels for communication and weather monitoring.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on School Health

Soft Drinks in Schools

ABSTRACT. This statement is intended to inform pediatricians and other health care professionals, parents, superintendents, and school board members about nutritional concerns regarding soft drink consumption in schools. Potential health problems associated with high intake of sweetened drinks are 1) overweight or obesity attributable to additional calories in the diet; 2) displacement of milk consumption, resulting in calcium deficiency with an attendant risk of osteoporosis and fractures; and 3) dental caries and potential enamel erosion. Contracts with school districts for exclusive soft drink rights encourage consumption directly and indirectly. School officials and parents need to become well informed about the health implications of vended drinks in school before making a decision about student access to them. A clearly defined, district-wide policy that restricts the sale of soft drinks will safeguard against health problems as a result of overconsumption.

BACKGROUND AND INFORMATION

Overweight

Overweight is now the most common medical condition of childhood, with the prevalence having doubled over the past 20 years. Nearly 1 of every 3 children is at risk of overweight (defined as body mass index [BMI] between the 85th and 95th percentiles for age and sex), and 1 of every 6 is overweight (defined as BMI at or above the 95th percentile).[1] Complications of the obesity epidemic include high cholesterol, high blood pressure, type 2 diabetes mellitus, coronary plaque formation, and serious psychosocial implications.[2–6] Annually, obesity-related diseases in adults and children account for more than 300 000 deaths and more than $100 billion per year in treatment costs.[7–9]

Soft Drinks and Fruit Drinks

In the United States, children's daily food selections are excessively high in discretionary, or added, fat and sugar.[10–15] This category of fats and sugars accounts for 40% of children's daily energy intake.[10] Soft drink consumers have a higher daily energy intake than nonconsumers at all ages.[16] Sweetened drinks (fruitades, fruit drinks, soft drinks, etc) constitute the primary source of added sugar in the daily diet of children.[17] High-fructose corn syrup, the principle nutrient in sweetened drinks, is not a problem food when consumed in smaller amounts, but each 12-oz serving of a carbonated, sweetened soft drink contains the equivalent of 10 teaspoons of sugar and 150 kcal. Soft drink consumption increased by 300% in 20 years,[12] and serving sizes have increased from 6.5 oz in the 1950s to 12 oz in the 1960s and 20 oz by the late 1990s. Between 56% and 85% of children in school consume at least 1 soft drink daily, with the highest amounts ingested by adolescent males. Of this group, 20% consume 4 or more servings daily.[16]

Each 12-oz sugared soft drink consumed daily has been associated with a 0.18-point increase in a child's BMI and a 60% increase in risk of obesity, associations not found with "diet" (sugar-free) soft drinks.[18] Sugar-free soft drinks constitute only 14% of the adolescent soft drink market.[19] Sweetened drinks are associated with obesity, probably because overconsumption is a particular problem when energy is ingested in liquid form[20] and because these drinks represent energy added to, not displacing, other dietary intake.[21–23] In addition to the caloric load, soft drinks pose a risk of dental caries because of their high sugar content and enamel erosion because of their acidity.[24]

Calcium

Milk consumption decreases as soft drinks become a favorite choice for children, a transition that occurs between the third and eighth grades.[12,15] Milk is the principle source of calcium in the typical American diet.[11] Dairy products contain substantial amounts of several nutrients, including 72% of calcium, 32% of phosphorus, 26% of riboflavin, 22% of vitamin B_{12}, 19% of protein, and 15% of vitamin A in the US food supply.[25] The percent daily value for milk is considered either "good" or "excellent" for 9 essential nutrients depending on age and gender. Intake of protein and micronutrients is decreased in diets low in dairy products.[19,26] The resulting diminished calcium intake jeopardizes the accrual of maximal peak bone mass at a critical time in life, adolescence.[27] Nearly 100% of the calcium in the body resides in bone.[27] Nearly 40% of peak bone mass is accumulated during adolescence. Studies suggest that a 5% to 10% deficit in peak bone mass may result in a 50% greater lifetime prevalence of hip fracture,[28] a problem certain to worsen if steps are not taken to improve calcium intake among adolescents.[29]

STATEMENT OF PROBLEM

Soft drinks and fruit drinks are sold in vending machines, in school stores, at school sporting events, and at school fund drives. "Exclusive pouring rights" contracts, in which the school agrees to promote one brand exclusively in exchange for money, are being signed in an increasing number of school districts across the country,[30] often with bonus incentives tied to sales.[31] Although they are a new phenomenon, such contracts already have provided schools with more than $200 million in unrestricted revenue.

Some superintendents, school board members, and principals claim that the financial gain from soft drink contracts is an unquestioned "win" for students, schools, communities, and taxpayers.[31,32] Parents and school authorities generally are uninformed about the potential risk to the health of their children that may be associated with the unrestricted consumption of soft drinks. The decision regarding which foods will be sold in schools more often is made by school district business officers alone rather than with input from local health care professionals.

Subsidized school lunch programs are associated with a high intake of dietary protein, complex carbohydrates, dairy products, fruits, and vegetables.[16] The US Department of Agriculture, which oversees the National School Lunch Program, is concerned that foods with high sugar content (especially foods of minimal nutritional value, such as soft drinks) are displacing nutrients within the school lunch program, and there is evidence to support this.[26]

There are precedents for using optimal nutrition standards to create a model district-wide school nutrition policy,[33] but this is not yet a routine practice in most states. The discussion engendered by the creation of such a policy would be an important first step in establishing an ideal nutritional environment for students.

RECOMMENDATIONS

1. Pediatricians should work to eliminate sweetened drinks in schools. This entails educating school authorities, patients, and patients' parents about the health ramifications of soft drink consumption. Offerings such as real fruit and vegetable juices, water, and low-fat white or flavored milk provide students at all grade levels with healthful alternatives. Pediatricians should emphasize the notion that every school in every district shares a responsibility for the nutritional health of its student body.
2. Pediatricians should advocate for the creation of a school nutrition advisory council comprising parents, community and school officials, food service representatives, physicians, school nurses, dietitians, dentists, and other health care professionals. This group could be one component of a school district's health advisory council. Pediatricians should ensure that the health and nutritional interests of students form the foundation of nutritional policies in schools.
3. School districts should invite public discussion before making any decision to create a vended food or drink contract.
4. If a school district already has a soft drink contract in place, it should be tempered such that it does not promote overconsumption by students.
   - Soft drinks should not be sold as part of or in competition with the school lunch program, as stated in regulations of the US Department of Agriculture.[34]
   - Vending machines should not be placed within the cafeteria space where lunch is sold. Their location in the school should be chosen by the school district, not the vending company.
   - Vending machines with foods of minimal nutritional value, including soft drinks, should be turned off during lunch hours and ideally during school hours.
   - Vended soft drinks and fruit-flavored drinks should be eliminated in all elementary schools.
   - Incentives based on the amount of soft drinks sold per student should not be included as part of exclusive contracts.
   - Within the contract, the number of machines vending sweetened drinks should be limited. Schools should insist that the alternative beverages listed in recommendation 1 be provided in preference over sweetened drinks in school vending machines.
   - Schools should preferentially vend drinks that are sugar-free or low in sugar to lessen the risk of overweight.
5. Consumption or advertising of sweetened soft drinks within the classroom should be eliminated.

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CLINICAL REPORT

Special Requirements of Electronic Health Record Systems in Pediatrics

Guidance for the Clinician in Rendering Pediatric Care

S. Andrew Spooner, MD, MS, and the Council on Clinical Information Technology

ABSTRACT

Some functions of an electronic health record system are much more important in providing pediatric care than in adult care. Pediatricians commonly complain about the absence of these "pediatric functions" when they are not available in electronic health record systems. To stimulate electronic health record system vendors to recognize and incorporate pediatric functionality into pediatric electronic health record systems, this clinical report reviews the major functions of importance to child health care providers. Also reviewed are important but less critical functions, any of which might be of major importance in a particular clinical context. The major areas described here are immunization management, growth tracking, medication dosing, data norms, and privacy in special pediatric populations. The American Academy of Pediatrics believes that if the functions described in this document are supported in all electronic health record systems, these systems will be more useful for patients of all ages.

INTRODUCTION

Child health care providers often find that clinical information systems have limited usefulness in pediatrics,[1,2] because they seem to be designed for adult care. For the purposes of this report, we use the definition of the electronic health record (EHR) system proposed by the Institute of Medicine:

> "An EHR system includes (1) longitudinal collection of electronic health information for and about persons, where health information is defined as information pertaining to the health of an individual or health care provided to an individual; (2) immediate electronic access to person- and population-level information by authorized, and only authorized, users; (3) provision of knowledge and decision-support that enhance the quality, safety, and efficiency of patient care; and (4) support of efficient processes for health care delivery. Critical building blocks of an EHR system are the electronic health records (EHR) maintained by providers. . .and by individuals (also called personal health records)."[3]

The definition proposed by the Institute of Medicine is functional in nature. It assumes that an EHR system must provide these features to be of value. Even for child health care providers, this definition is valid, and this set of features is likely to provide value to most practitioners. However, as has been noted previously,[2] when viewed from the perspective of the child health care provider, these features may fall short either in the details of how they are implemented or by omitting functions that are more routine in pediatric care than in any other primary care practice. This report provides a look at these key functional requirements through the lens of the child health care provider and augments these requirements with

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Key Words
electronic health record, pediatrics, technology

Abbreviations
EHR—electronic health record
AAP—American Academy of Pediatrics
HL7—Health Level Seven
NCVIA—National Childhood Vaccine Injury Act
CCHIT—Certification Commission for Health Information Technology

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the additional functions that child health care providers use in their daily practice of medicine. This report focuses on the clinical functions of the EHR system operated by the health care provider, as opposed to the more administrative functions in the practice-management system (such as appointment management, insurance eligibility determination, and billing). However, it is assumed that the EHR system in the pediatric setting is fully connected to the practice-management system through an appropriate interface or through software integration of the 2 systems.

PEDIATRIC FUNCTIONS

In 2001, the American Academy of Pediatrics (AAP) published a description of the features that would be desirable in a clinical information system to be used in pediatrics.[2] Almost none of these features were purely pediatric. For example, that statement called for medication dosing by weight and for opportunities to record information about guardianship. There are certainly instances of medication dosing by body weight in adult medicine, and many adults have guardians. Yet, these features are vastly more important in pediatrics, so it is appropriate to refer to them as "pediatric functions." Several of these functions that are of critical importance to pediatric practice are discussed in greater detail here. Others are of less general importance but have been identified as desirable by members of the Pediatrics Data Standards Special Interest Group of Health Level Seven (HL7),[4] an international health data standards development organization in which the AAP participates (www.hl7.org).

CRITICAL PEDIATRIC EHR FUNCTIONAL AREAS

There are some functional areas that are so critical to the care of infants, children, and adolescents that their absence results in the system impeding quality pediatric care.

Immunization Management

Recording Immunization Data

The ability to record multiple immunizations efficiently is critical for pediatric health maintenance activities. State and federal regulations add a complexity to the process of recording immunization administration that is absent for medications. Systems designed to record adult immunizations and other medications naturally allow the practitioner to record data such as the manufacturer, lot number, date, site, route of administration, and expiration date. The nature of immunization practices in children adds some requirements to this list, in particular, data required by the Vaccines for Children (VFC) program[5] and the National Childhood Vaccine Injury Act (NCVIA) of 1986 (42 USC §§300aa-1–300aa-34).[6,7] The VFC program, a federal program by which eligible children are provided vaccine at no charge, requires providers to maintain a separate stock of vaccine, to assess eligibility for the program, and to submit reports to the program. All of these activities require support from the information system used to track immunization data. The NCVIA has numerous implications for immunization data recording. Among these is the requirement to deliver to the parent (or equivalent health decision-maker) a vaccine information statement (VIS) and to record when it was given and which version of the VIS was given. The NCVIA also mandates that health care providers report adverse events associated with vaccines; although this applies equally to adult providers, automation of this reporting capability would be of particular interest to child health care providers, who give the bulk of vaccines. The Centers for Disease Control and Prevention's National Immunization Program (www.cdc.gov/nip) specifies these information-management requirements in detail. EHR systems also need to manage the record of consent for vaccine administration. Vaccine refusal[8] by a parent or patient requires the recording of refusal reasons and recording of which refused vaccines were offered.

Linking to Immunization Information Systems

Most states and several local jurisdictions have electronic immunization-information systems or registries.[9–11] The EHR should allow interoperability with these systems, including the ability to download, upload, and synchronize a child's immunization history. Some technical standards already exist for immunization information system functions and communications with them.[12,13]

Immunization Decision Support

Systems for encoding rules about which immunizations are due and when they are projected to be due in the future have been in existence for years.[14] For an EHR system to fully support pediatric practice, it must be able to take previous immunization data and derive, at the point of care, logical conclusions about the currency of immunization and recommend the appropriate immunizations. This functionality requires an understanding of the individual antigens present in each vaccine and analysis of when, in what form, and at what age in the child's life each antigen was—or was supposed to be—administered. There may also be local variations in this functionality based on local epidemiology. These functions might be built into the system or be derived from immunization registries or third-party programs accessed via a network. If the logic is built into the EHR system itself, there should be a way to easily update the logic to reflect changes to immunization rules and to handle new vaccines and new antigen combinations.

Growth Tracking

Graphical Representation

Child health care providers make important judgments about a child's health by visual inspection of a plot of a child's body measurements (usually weight, height, head circumference, BMI) over time. Plots show the progression of measured values over time against curves of predicted growth or percentile curves. Ideally, the visual plot should be visible at the top level of an individual record or require minimal effort for viewing. The EHR system should allow the representation of percentile curves from a usual source (Centers for Disease Control and Prevention [www.cdc.gov/growthcharts]) or other sources that may provide these curves for special populations.[15] The system should allow magnification ("zooming") of the plot to allow inspection of areas of the plot in which measurements have been frequently made. Users ought to be able to derive growth-velocity data from 2 selected data points. The system should distinguish height from length. Also, the system should accommodate corrections for preterm birth in the graphical display of body measurements.

Percentile Calculations

In addition to representation of body measurements, the percentile value of any particular body measurement against a defined distribution is desirable. Such percentile values should be calculated and displayed at the time of data entry. Percentile values should also be available for decision-support functions of the EHR system.

Medication Dosing

Dosing by Body Weight

The predominant method for calculating pediatric drug dosages is to compute them on the basis of body weight. When a current body weight is available, the EHR system should be able to incorporate it into the prescribing process and suggest doses on the basis of accepted references. Failing this, the EHR system should make weight visible in all displays associated with drug dosing. When a current body weight is not available, the system should react to this appropriately by requesting its input. For medications that require adjustment of dose as the child's weight increases, the intended dosage per unit of body weight should be recordable and maintained as an aspect of the prescription. Systems should be able to determine if a body weight obtained in the past is too old to be used in decision support (eg, last month's weight would be appropriate for an adolescent but not a neonate). Entries of height, weight, and head circumference should be checked against age-based norms so that users can be warned of possible errors. As in adult care, medication dosing by body surface area or ideal weight should also be available; however, the equations for the estimation of body surface area and ideal body weight in children are different from those in adult care.

Dose-Range Checking

With or without dosing decision support, an EHR system should be able to check drug doses posthoc by using accepted pediatric references and advise the user when no pediatric references exist.

Rounding to Safe and Convenient Doses

Many medications for infants and young children are supplied in liquid form. Because parents and other caregivers must measure a volume of liquid for each dose of medication, child health care providers must compute a volume for each dose, round it to a convenient volume, and spend time educating caregivers on the proper volume to administer. EHR systems that facilitate prescribing should support prescriptions expressed in the volume of drug to be administered and avoid expressing the prescription solely in terms of the mass of the drug.

Age-Based Dosing Decision Support

For the case in which dosing guidelines or formulary benefits vary with age or gestational age,[16] the system should incorporate those data into its decision support.

Dosing for the School Day

Pediatricians must often write prescriptions in which the medication is divided in 2 labeled packages—one for home administration and one for administration during the day at school, child care, or another care setting. EHR systems should provide the capability to generate instructions to the pharmacy to dispense a medication in this way.

Patient Identification

Newborn Identification

Although many EHR systems depend on the use of a government-issued identification number (usually the Social Security number), newborn infants do not receive these numbers for a significant period of time after birth. EHR systems should allow the registration of patients without such identifiers and allow retrieval of information on the basis of any temporary identifiers that may be used.

Prenatal Identifiers

An EHR system that allows storage of prenatal data (eg, from a fetal imaging procedure) should allow the logical connection of these data to the postnatal record once the child's record is established in the system.

Name Changes

Infants undergo name changes because of changes in family structure or the need to change the temporary

name assigned at the birth hospital. Because clinical data are connected to the old names, EHR systems need to support retrieval of data via search on previous names.

Ambiguous Sex

In the case of a child with ambiguous genitalia, an EHR system ought to allow the assignment of sex as unknown and to operate normally until the sex of the patient is assigned.

Norms for Pediatric Data

Numeric Data

Norms for almost all numeric data (such as laboratory results, body measurements, scores on standardized assessments, and vital signs) change as the child grows. For many of these data, norms change continuously with age, so it is insufficient to provide merely a handful of normative ranges. Developers should assume that all numeric data collected in a pediatric context have changing norms over the lifespan and should provide ways of flagging abnormal values at any age. Percentile values and *z* scores (number of SDs from the mean) should be available for those few data for which the distributions are known, such as height, weight, head circumference, and BMI.

Nonnumeric Data

Whenever an EHR system distinguishes normal from abnormal in nonnumeric data (eg, flagging the presence of a physical sign as abnormal), it should consider age in the interpretation of normality. For example, if "unable to feed self" is considered to be a universally abnormal finding in the interpretation of a functional assessment, then the system is not taking the functional capabilities of young children into account.

Complex Normative Relationships

Not all normative data are based solely on age. In the case of blood pressure, normative values are determined by age (to the nearest month), gender, and height percentile.[17] Similarly, peak flow meter norms depend on age, height, and gender.[18] Methods for flagging abnormal values that are based on age alone are insufficient for blood pressure and peak expiratory flow and may be insufficient for other measurements in pediatric patients.

Gestational Age

For neonates, chronologic age (expressed simply as the time since birth) is insufficient for medication-prescribing decision support, normative ranges for laboratory data, normative definitions for physical examination findings, and guideline-application support. Gestational age, chronologic age, and corrected age are each unique and important ways to present age of a neonate[16]; EHR systems need to record each of these expressions for age and allow for their use in decision support.

Privacy

Adolescent Privacy

Laws about age of consent vary from state to state[19] and according to presenting problem.[20–22] Adolescents who present for treatment of mental health disorders, for example, may consent to their treatment at an earlier age than the age of majority in most states.[19,23] Some states also have laws regarding parental notification whereby interpretation is based on the patient's age and presenting problem.[24] Practices that serve adolescents typically have policies with respect to what portion of an adolescent's care should be handled with special privacy protections (eg, in some jurisdictions, the adolescent must give explicit permission for the parent to review his or her records). These privacy protections may require the flagging of protected information. Therefore, EHR systems should support privacy policies that vary by age and according to presenting problem and diagnosis and be flexible enough to handle the policies of individual practices. Furthermore, if an EHR system handles record-keeping for consent for treatment, it should provide for the recording of assent for treatment (from an underaged adolescent or child) combined with parental informed permission[25,26] as well as consent for treatment (from an adolescent) combined with a record of parental involvement.[25] The separation of the patient's consent and the parent's or guardian's consent is particularly important in the area of testing for drugs of abuse.[27] Pregnancy is another area in which the records of patient and parental consent, assent, and permission may be less straightforward than in adult care.[28]

Children in Foster or Custodial Care

When a child is removed from the care of his or her parents, as in the case of foster care, complex issues of confidentiality of medical information arise.[29] Licensed foster parents may consent to routine medical and dental treatment for minors placed with them pursuant to a court order or with the voluntary consent of the person having the legal custody of the minor. The pediatrician should document the authority of a foster parent to give consent to medical treatment by obtaining a copy of the court order. Parents who no longer have custody may still have the right to access their children's medical records and be involved with health care decisions unless their parental rights have been terminated. EHR systems that purport to manage consent for treatment and information access will need to be able to record these details.

Consent by Proxy

Children often present for nonurgent health care in the company of an adult who is not the custodial parent or

guardian. The best way to prevent confusion about consent for care in this situation is to record the custodial parents' wishes as to which adult can consent to which child's care and under what limitations.[30] EHR systems that manage consent for treatment should support this sort of data-recording.

Adoption

Records of children who are undergoing adoption proceedings or who have been adopted may need special privacy handling, as in a case where state law offers special protections for the identity of adoptees. The EHR systems should allow flagging of these data for special privacy protection. In some states, the preadoption record may need to be separated entirely from any postadoption record by using 2 distinct patient identities.

Guardianship

The identity of a child's guardian and guarantor, although most commonly the parent, can become complicated outside the bounds of the "typical" 2-parent household. The EHR system must provide the flexibility to indicate the broad variety of adults in the child's life who may play some role in medical or financial decision-making. The system should draw a distinction between the patient's guardian and his or her financial guarantor. In those cases in which a court has appointed a guardian for a minor, the ability of the guardian to consent to medical treatment depends on the type of treatment being sought and the scope of authority the court has granted. If more than routine care is required, the pediatrician should document the authority of the guardian to give consent by obtaining a copy of the official certified letters of guardianship. The EHR system should support this record-keeping.

Emergency Treatment

When EHR systems support the recording of consent and assent for treatment, they should be flexible enough to allow for the emergency treatment of minors, in which the parent or legal guardian may be absent, and the usual procedures for consent must change.[20]

PEDIATRIC TERMINOLOGY

Some of the barriers that child health care providers encounter in the application of EHR systems relate not to functions of the system but to the inappropriate terminology used to express concepts (eg, physical examination findings, developmental milestones, diagnoses) in the EHR system's user interface. These terminology systems differ from systems such as the *International Classification of Diseases, 9th Edition, Clinical Modification*,[31] which is used to encode diagnoses for insurance claims. Rather, these terminology systems are used to allow the precise encoding of clinical concepts by the user in lieu of free text.[32] EHR systems generally use a terminology developed by a third party or by the EHR system developers themselves. A complete treatment of special terminology requirements is outside the scope of this report. The AAP and its members should advocate for the inclusion in these systems of historical findings, psychosocial risk factors, family structural details, social history, physical examination findings, developmental problems, behavioral issues, congenital syndromes, and diagnoses of particular importance to pediatrics. The US government's Consolidated Health Informatics Initiative,[33] which specifies which terminology system should be used in which clinical domain within government-sponsored health-information systems, should help focus the advocacy effort of the AAP. It is important to note, however, that no health-information system directly managed by the US federal government deals primarily with children.

DATA PRECISION

There is a broad category of functionality that may limit an EHR system's usefulness in pediatric practice: the ability to handle data at an appropriate numeric precision and graphical resolution. For example, body weight to the nearest gram is commonly accepted as an appropriate precision in neonatal facilities. As another example, an EHR system may present growth curves of height, weight, and head circumference, complete with appropriate normative curves for comparison. However, if those curves are available in only 1 graphical resolution, measurements obtained frequently (daily weight measurements, weekly head circumference measurements, etc) may become impossible to analyze visually. Age in the newborn nursery should be expressed in units at least down to the hour, if not to the minute. The units for age (days, weeks, months, years) need to grow with the age of the child, as appropriate. Developers of EHR systems should consider how the small changes in numeric data that one sees in the care of young patients affect data-recording and display.

OTHER PEDIATRIC FUNCTIONS

This report outlines the major areas of functionality that are relatively more important in pediatric care than in adult care. There are, of course, many other functions that are important, such as the ability to:

- archive and manage patient data for a statutorily defined period of time;
- provide educational materials that are appropriate to both parents and children and at varying reading levels;
- create pedigree diagrams;
- display age at all times throughout the user interface;
- select age-based documentation templates and order sets on the basis of a patient's age;

- indicate whether a guideline applies to a patient on the basis of age; and
- indicate the source of patient data, especially when the source is not the patient or the parent (eg, the school teacher or child care worker).

PEDIATRIC EHR SYSTEM FUNCTIONALITY STANDARDS

HL7 is an organization that was founded in 1987 to set international standards for how health information is exchanged between information systems. It expanded its scope beyond data interchange to include specifications for EHR system functions through its Electronic Health Record Technical Committee. The Electronic Health Record Technical Committee, which was founded in 2001, published its first balloted standard for EHR system functions in 2004.[34] This standard is being used as the basis for the EHR system certification process specified by the federal Office of the National Coordinator for Health Information Technology (created by Executive Order 13335, April 28, 2004, and authorized by Congress [FR Doc No. 05-16446, Filed August 18, 2005]). The purpose of certification is to set a minimum level of functionality that EHR systems will have to meet to qualify for special treatment, such as participation in pay-for-performance programs.[35,36] By contract with the Office of the National Coordinator for Health Information Technology, the Certification Commission for Health Information Technology (CCHIT [www.cchit.org]) is charged with establishing a certification process by which EHR system software may be declared eligible for pay-for-performance incentives designed to promote care facilitated by an information system. The CCHIT has several pediatricians working on its committees to ensure that pediatric functions are incorporated into the certification process. As of this writing, patient-care scenarios of the CCHIT that were designed to test functionality exclude infants. The HL7 Pediatric Data Standards Special Interest Group is working with the HL7 Electronic Health Record Technical Committee to ensure that the pediatric functions mentioned in this statement are included in the HL7 EHR functional model and, therefore, will become a part of EHR system certification processes in the future. The current EHR system functional model may be obtained from the HL7 Web site (www.hl7.org).

THE FUTURE OF THE PEDIATRIC EHR SYSTEM

In the wake of the rapid uptake of EHR systems in the years since the first AAP statement,[37,38] national groups have expressed increased interest in standardizing the features of EHR systems and certifying their functions.[39] Child health care providers want to be sure that pediatric functions, terminology, and data precision are built into these standards and certification processes. They want this not only to make their own systems more effective in improving the health of children but also to make all EHR systems more useful for patients of all ages. The AAP is working proactively to ensure that knowledgeable pediatricians who can thoroughly explain child health care issues are invited to address the groups that set these standards. This report should serve as a guide for these efforts to represent the interests of child health care providers and present a guide to individual practitioners who are evaluating a given system's ability to perform in the pediatric environment.

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POLICY STATEMENT

Spectrum of Noninfectious Health Effects From Molds

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Environmental Health

ABSTRACT

Molds are eukaryotic (possessing a true nucleus) nonphotosynthetic organisms that flourish both indoors and outdoors. For humans, the link between mold exposure and asthma exacerbations, allergic rhinitis, infections, and toxicities from ingestion of mycotoxin-contaminated foods are well known. However, the cause-and-effect relationship between inhalational exposure to mold and other untoward health effects (eg, acute idiopathic pulmonary hemorrhage in infants and other illnesses and health complaints) requires additional investigation. Pediatricians play an important role in the education of families about mold, its adverse health effects, exposure prevention, and remediation procedures.

BACKGROUND

Outdoors, fungi break down organic matter such as fallen leaves and dead trees and are ecologically beneficial. The most common outdoor molds are *Cladosporium* species, *Aspergillus* species, *Penicillium* species, *Alternaria* species, *Candida* species, *Botrytis* species, and *Helminthosporium* species. The most prevalent indoor molds in nonproblem homes are *Cladosporium* species, *Penicillium* species, *Alternaria* species, *Streptomyces* species, *Epicoccum* species, and *Aspergillus* species.[1] Indoors, molds usually are not a problem unless the spores encounter persistently humid or wet areas, at which point colonies begin to grow. Household areas such as air conditioners, basements, bathrooms, crawl spaces, pillows, refrigerator seals, sinks, shower grout, windowsills, and other places where standing water occurs are potential problem areas. Leaks in roofs, water-damaged walls, potted plants, or even pet urine can contribute to mold growth. Carpeting, ceilings, paneled or hollow walls, and wicker or straw baskets are other potential reservoirs if moisture accumulates.

Exposures to mold vary, reflecting regional differences, local climate (humidity and wind), home construction, use of varying heating and cooling systems, humidifiers, dehumidifiers, and air-filtering devices. Outdoor factors such as shade, organic debris near the home, and landscape maintenance also influence indoor mold concentrations. Air filters and dust control can decrease airborne concentrations of molds in the indoor environment.

Molds have the potential to cause a variety of adverse health effects. They affect health by both immune- and non–immune-related mechanisms. Immunologically, molds produce allergens that may lead to immunoglobulin E–mediated responses such as allergic rhinitis/conjunctivitis and asthma. Less common responses include allergic bronchopulmonary aspergillosis, allergic fungal sinusitis, and hypersensitivity pneumonitis. Nonimmune effects include infection, irritation

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Key Words
mold exposure, health effects, allergies, hypersensitivity pneumonitis, mycotoxins, hemosiderosis, water damage, remediation, prevention

Abbreviations
AIPH—acute idiopathic pulmonary hemorrhage
IOM—Institute of Medicine
CDC—Centers for Disease Control and Prevention
EPA—Environmental Protection Agency

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of mucous membranes, and reactions from toxins (mycotoxins). When mycotoxin-producing molds contaminate food products, the ingested mycotoxins can adversely affect specific target organs including the central nervous system, the gastrointestinal tract, and the kidneys. Certain mycotoxins have also been associated with hepatocellular carcinoma in persons infected with hepatitis B virus. Serious health problems from mold ingestion are very rare and tend to occur mainly in the agricultural setting.

Inhaled mycotoxins have been linked with acute idiopathic pulmonary hemorrhage (AIPH) in infants. The first report suggesting a relationship between AIPH and the mold *Stachybotrys* species came from Cleveland, Ohio, in the 1990s.[2] The Institute of Medicine (IOM) conducted a comprehensive review of the literature on the adverse health effects of mold.[3] The authors concluded that there was insufficient evidence to determine if mold exposure to *Stachybotrys* species was associated with AIPH in part because of problems with data collection and lack of available, standardized tools for exposure assessment. The IOM recommended further surveillance and additional research. Although the causal association between AIPH in infants has not been firmly established, the Cleveland study, additional case series, case reports from independent sources, and basic scientific studies in animal models have provided some evidence of plausibility. Epidemiologic studies suggest that exposure to secondhand cigarette smoke may be an additional risk factor. Ongoing work in toxicology and epidemiology will provide further insight into these issues in the future. The Centers for Disease Control and Prevention (CDC) is continuing surveillance for AIPH in metropolitan areas in states with the highest prevalence. Several systematic reviews are available,[3–5] and the accompanying technical report[6] (available online) describes mold-related clinical effects in more detail.

In addition to the adverse health effects associated with exposures to mold, there are health risks associated with living in damp indoor environments.[7–11] These risks include respiratory symptoms such as wheezing, coughing, and hay fever. The IOM study found sufficient evidence of an association between mold and other agents in damp indoor environments and upper and lower respiratory tract symptoms, as well as asthma symptoms in sensitized persons. However, there was insufficient information to determine if mold exposure was associated with the development of asthma. Similarly, no conclusions could be drawn for an association with neuropsychiatric symptoms, skin rashes, or rheumatologic illnesses.

PREVENTION/REMEDIATION

Mold spores are ubiquitous in the environment, and it is impossible to keep mold spores completely out of the house. The challenge is to keep the spores from colonizing and growing. Therefore, the key to mold control is moisture control. The aforementioned water-prone household areas should be kept as dry as possible. Actions that will help reduce indoor air humidity and prevent condensation include venting appliances that produce moisture (clothes dryers and stoves) to the outside and using a bathroom fan or opening a window when showering or bathing. When there is inadequate bathroom ventilation, using a towel to wipe shower walls and using a fan or space heater for a short period of time may diminish excessive moisture accumulation. Dehumidifiers can be used to reduce humidity to a target level of less than 50%. Bathrooms and basements should be left uncarpeted. Organic materials kept indoors, such as plants, wood, or paper products, can accumulate excess moisture and can serve as potential reservoirs of mold growth. Because outdoor molds are easily tracked inside, leaves should be discarded. Parents should be aware that playing on or near piles of leaves exposes their children to increased levels of mold spores. This increased exposure could contribute to increased symptoms among children with asthma/allergies. Condensation on pipes and ductwork within interior and exterior structure walls are other potential problem areas. Insulating cold water pipes and increasing the air temperature may help.

Remediation of water-damaged items from previous flooding or rainwater is needed to prevent mold amplification and its potential effects of upper respiratory irritation, allergic sensitization, and/or exacerbation of underlying mold allergy; remediation will also reduce the risk of structural damage to the building. Timely (within 24 hours) water cleanup and removal of water-damaged items after a flood are important.

Currently, there is insufficient information to reliably state what levels of mold exposure can result in adverse health effects and to specify what levels constitute a "dampness problem." Additional research is needed in this area to find a dose-response relationship that can help predict what the adverse health consequences of mold are. Environmental sampling may be useful to identify the source if there is a suspicion of mold (eg, musty odor) but no visible mold growth. It may also be necessary for diagnosis and treatment of mold-related illnesses, insurance purposes, or litigation. Consultation with pediatric experts in pulmonary medicine, allergy/immunology, environmental health, or physicians with expertise in occupational environmental health may be helpful in the interpretation of such environmental data.

If environmental sampling for mold is done, it should be performed by professionals, such as industrial hygienists or indoor environmental quality consultants, who have expertise in evaluating indoor mold/dampness problems. Although no formal certification process for mold evaluation exists, guidelines are available.[12–14]

Reliable air sampling can be expensive and requires

expertise and specialized equipment. If air sampling is conducted, an outdoor air sample should be collected at the same time for comparison. In general, the levels and types of molds should be similar indoors (in nonproblem buildings) and outdoors. Higher indoor concentrations of mold, a predominance of one type, or a difference in types of molds found indoors versus outdoors suggest an indoor mold problem.

Assays to detect mycotoxins and microbial volatile organic compounds in environmental samples and blood have been developed and can serve as important tools for researchers studying pathogenesis of disease. However, the tests, including immunoassays for mold, have not been standardized for clinical use, and it is not clear what levels are associated with health effects.[15]

The US Environmental Protection Agency (EPA) and the CDC offer practical guidelines for mold control and cleanup in the home setting (available at www.cdc.gov/health/mold.html or by calling 800-438-4318). According to current EPA guidelines, individuals can usually clean up mold-contaminated areas less than 10 ft.[2] If there has been extensive water damage, mold growth covers more than 10 ft,[2] the heating, ventilating, and air conditioning (HVAC) system is involved, or the water and/or mold damage was caused by sewage or flood water, consider hiring a professional and consulting the EPA guide "Mold Remediation in Schools and Commercial Buildings."[16]

Mold abatement can be difficult, and use of biocides, such as sodium hypochlorite (eg, household bleach), is controversial. Some experts believe that bleach merely decolorizes mold and that dead mold is still allergenic. However, recent evidence suggests that there is loss of skin-test reactivity to the treated mold in some sensitized individuals.[17] The CDC recommends removal of mold growth from hard surfaces with commercial products, soap and water, or a bleach solution of 1 cup of bleach to 1 gallon of water.[18] This approach is recommended for use on nonporous materials such as tile floors, countertops, metal objects, plastic, glass, and other hard nonabsorbent materials. Concrete and brick surfaces may also be cleaned this way. In general, mold may be difficult to remove from porous materials such as carpet, drywall, or wood products, and bleach (and other cleaning products) may affect the structural integrity of the material. With extensive water and mold damage, porous materials are best discarded. When deciding to use bleach for mold remediation, its accessibility and affordability must also be taken into account. If bleach is used, it should not be combined with ammonia or other household cleaning products, and the area should be well ventilated during use. Guidelines are also available from the CDC (1600 Clifton Rd, Atlanta, GA 30333 or online at the aforementioned Web address). More detailed information on mold cleanup after flooding is also available.[19]

HUMIDIFIERS

Many parents use cool mist humidifiers or vaporizers when children have colds or when the air is dry in winter. These devices, if not properly cleaned, can serve as reservoirs for mold growth. In addition, increased humidity can contribute to increased dust mite populations and mold in the indoor environment. A systematic review in the *Cochrane Database of Systematic Reviews* assessed the effects of inhaling heated water vapor in the treatment of the common cold by comparing symptoms, viral shedding, and nasal resistance after a naturally or experimentally induced common cold.[20] Three of the 6 identified trials showed slight benefit on the symptoms of the common cold; however, neither viral shedding nor viral titers decreased. Therefore, the benefit in symptoms must be balanced with the risk of increased growth and exposure to house dust mites and mold with increased humidity. If used, they should be used for a limited period of time, and they must be cleaned frequently to prevent mold growth and according to the manufacturers' instructions.

AIR CLEANERS

People with allergies and asthma may use air cleaners to decrease concentrations of mold spores in the air. Different air-filtration systems are available that remove particles (including mold spores) from the air, including electrostatic filters/precipitators, and high-efficiency particulate air (HEPA) filters.[21] Certain air cleaners, often called "air purifiers," emit large amounts of ozone and should be avoided. These ozone generators, often advertised as purifiers that cleanse the air of microbes, can produce high concentrations of ozone in an indoor environment, and the EPA and other regulatory agencies have cautioned against their use.[22,23] Filters on central forced-air systems and furnaces should be changed periodically according to the manufacturers' recommendations. Upgrading to a medium-efficiency filter (rated at 20%–50% efficiency at removing particles between 0.3 and 10 μm) will improve air quality and is economical. Electrostatic filters/precipitators in central furnace and air conditioning systems may be beneficial for airborne particles but are only effective when turned on. Room HEPA filters are also beneficial. However, they only work in a single room, and the noise generated may not be acceptable.

RECOMMENDATIONS TO PEDIATRICIANS

1. Because there are established health hazards, inquire about the presence of mold as part of a "healthy-home" inventory. Questions about a child's environment are basic to a comprehensive pediatric health history.[24] Questions can be incorporated during visits for health supervision or sick visits. Asking about a child's environment should be routine for children

with common illnesses, such as allergic rhinitis/conjunctivitis and asthma, as well as for those with less common illnesses, such as hypersensitivity pneumonitis.

2. Provide guidance to parents of all children about:
   a. the adverse health effects of mold exposure, especially the causal relationship between mold and allergic illness and respiratory symptoms; and
   b. preventing and reducing mold exposure in the immediate indoor and outdoor environments.
3. Educate families on mold remediation. Visible signs of mold growth (eg, discolored patches or cottony or speckled growth on walls or furniture, evidence of dampness or water damage or an earthy musty odor in a particular area) suggest a damp environment and mold growth. In areas where flooding has occurred, prompt cleaning (within 24 hours) of walls and other flood-damaged items is necessary to prevent mold growth. Testing the environment for specific molds is usually not necessary. In general, individuals can perform mold cleanup for areas less than 10 ft.[2]
4. When treating an infant with AIPH, inquire about mold and water damage in the home. Report cases of AIPH to state health departments. Although a causal relationship between AIPH and damp, moldy indoor environments has not been firmly established, the knowledge is incomplete at this time. Therefore, it is prudent to recommend that parents of infants with AIPH try to find and eliminate sources of chronic moisture and mold growth before the child returns to the home. Avoidance of exposure to secondhand cigarette smoke is always recommended, but especially in cases of AIPH.
5. Be aware that there are no uniformly accepted, valid, quantitative environmental sampling methods or serologic tests to assess exposures to mold and other agents associated with damp indoor environments. There are also no accepted valid airborne levels of mold that predict adverse health effects.
6. Be aware that there is currently no method to test humans for toxigenic mold exposure.[25]
7. Be aware that mold-contaminated foods (especially grains) can contain harmful amounts of mycotoxins. The US Department of Agriculture has set allowable limits in certain food items and has some routine monitoring in place to prevent harmful ingestion of mycotoxin-contaminated foods. Inquire about dietary history if a mycotoxin-induced illness is suspected.

RECOMMENDATIONS TO GOVERNMENT

1. Support research to determine the effects of molds on human health, such as:
   a. ongoing surveillance of the prevalence of AIPH in infants; and
   b. longitudinal studies on the effects of indoor mold exposure in early childhood on the development of asthma and other respiratory illnesses.
2. Support research to improve methods for quantitative assessment of exposures to indoor molds for use in further epidemiologic studies. Promote research in investigating links between exposures to indoor molds and adverse health effects.
3. Support research to determine fungal biological markers in diagnostic tests.
4. Recommend that remediation of water damage in homes and other buildings be performed promptly. Educate landlords and individuals responsible for building maintenance that damp buildings are unhealthy. They should not wait for medical complaints before starting remediation.
5. Routinely test and publish toxin limits in food and beverages.
6. The CDC, EPA, and building-management–related government agencies should continue to develop and promote education and training programs to improve efforts to avoid or reduce dampness and dampness-related health risks. Targeted programs should be developed for the general public, health professionals, and people involved in design, construction, management, and building maintenance.
7. Outdoor air mold and pollen concentrations should be monitored more extensively and added to the Air Quality Index (http://airnow.gov). The government should encourage and support programs such as the National Allergy Bureau, which monitors and reports outdoor mold and pollen counts (www.aaaai.org/nab).
8. Promote lay public education programs that properly inform US citizens about what the proven and, more importantly, unproven health effects of mold exposure are.

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TECHNICAL REPORT

Spectrum of Noninfectious Health Effects From Molds

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ABSTRACT

Molds are multicellular fungi that are ubiquitous in outdoor and indoor environments. For humans, they are both beneficial (for the production of antimicrobial agents, chemotherapeutic agents, and vitamins) and detrimental. Exposure to mold can occur through inhalation, ingestion, and touching moldy surfaces. Adverse health effects may occur through allergic, infectious, irritant, or toxic processes. The cause-and-effect relationship between mold exposure and allergic and infectious illnesses is well known. Exposures to toxins via the gastrointestinal tract also are well described. However, the cause-and-effect relationship between inhalational exposure to mold toxins and other untoward health effects (eg, acute idiopathic pulmonary hemorrhage in infants and other illnesses and health complaints) is controversial and requires additional investigation. In this report we examine evidence of fungal-related illnesses and the unique aspects of mold exposure to children. Mold-remediation procedures are also discussed.

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Key Words
mold exposure, health effects, allergies, hypersensitivity pneumonitis, mycotoxins, hemosiderosis, water damage, remediation, prevention

Abbreviations
Ig—immunoglobulin
ABPA—allergic bronchopulmonary aspergillosis
AFS—allergic fungal sinusitis
RAST—radioallergosorbent test
OR—odds ratio
CT—computed tomography
CF—cystic fibrosis
VOC—volatile organic compound
MVOC—microbial volatile organic compound
FAO—Food and Agriculture Organization of the United Nations
WHO—World Health Organization
DON—4-deoxynivalenol
CFU—colony-forming unit(s)
CI—confidence interval
CDC—Centers for Disease Control and Prevention
AIPH—acute idiopathic pulmonary hemorrhage
IOM—Institute of Medicine
SBS—sick building syndrome
EPA—Environmental Protection Agency

BACKGROUND

Neither plant nor animal, fungi are a group of eukaryotic (possessing a true nucleus) nonphotosynthetic microorganisms. The almost 100 000 recognized fungal species include mildews, molds, mushrooms, puffballs, rusts, slime molds, smuts, truffles, and yeast. Molds are multicellular fungi that grow as a mass of branching, interlacing filaments (hyphae) known as a mycelium. Although the terms mold and fungi are commonly interchanged, all molds are fungi but not all fungi are molds.

Outdoors, fungi break down organic matter such as fallen leaves and dead trees and are ecologically beneficial. Indoors, molds usually are not a problem unless the spores encounter persistently humid or wet areas, and then colonies begin to grow. Mold flourishes in many household areas such as air conditioners, basements, bathrooms, crawl spaces, ground floors, refrigerator seals, sinks, shower grout, windowsills, and other places where standing water occurs. Leaks in roofs, water-damaged walls, damp basements, plant pots, or even pet urine contribute to mold growth. Carpeting, ceilings, paneled or hollow walls, pillows, and wicker or straw baskets may serve as reservoirs for mold proliferation if there is moisture accumulation.

Exposure to mold varies, reflecting regional differences; the effect of the local climate (humidity and wind); home construction; and use of varying heating and cooling, humidifying, dehumidifying devices, and air-filtering devices. Outdoor factors such as shade, organic debris near the home, and landscape maintenance also influence indoor concentrations. Indoor characteristics such as electrostatic

filters and dust control are associated with lower levels of mold-spore isolation. Because typical urban residents spend more than 90% of their time indoors, there is potential for exposure to mold when homes are contaminated.[1]

The most common outdoor molds are *Cladosporium* species, *Aspergillus* species, *Penicillium* species, *Alternaria* species, *Candida* species, *Botrytis* species, and *Helminthosporium* species. The most prevalent indoor molds in nonproblem homes are *Cladosporium* species, *Penicillium* species, *Alternaria* species, *Streptomyces* species, *Epicoccum* species, and *Aspergillus* species.[2]

In children and adults, molds have the potential to adversely affect health by both immune- and non–immune-related mechanisms (Table 1). The cell walls of fungi are formed of chitin (acetylglucosamine polymers), β-1(1–3)-D-glucans, polysaccharides and mucopolysaccharides, waxes, and pigments. The glucans are endotoxin-like substances that may be irritating and stimulate the immune system. During growth, fungi produce and release new enzymes and secondary metabolites that can be allergenic (eg, enzymes), irritating (eg, volatile metabolites), or toxic for other forms of life (eg, mycotoxins and antimicrobial agents).

Immunologically, molds produce allergens that may lead to sneezing, runny nose, red eyes, and other manifestations. Nonimmune effects include irritation of mucous membranes, infection, and reactions from toxic (mycotoxins) or microbial (endotoxins) byproducts. The scope of toxin-mediated effects is controversial and is being widely studied and debated in medical, scientific, insurance, and legal circles.

The purpose of this technical report is to describe mold-related clinical illness in children and to summarize the evidence of health effects in damp, moldy environments. Assessment of exposures to mold and prevention strategies will be presented. The infectious complications of fungi are beyond the scope of this article.

IMMUNE-MEDIATED HEALTH EFFECTS OF MOLD EXPOSURE

Type I reactions are mediated by immunoglobulin (Ig) E and are the basis of most allergic reactions, including immune responses, to mold exposure. The main types of IgE-mediated responses are allergic rhinitis/conjunctivitis and asthma. Other less common immune-mediated responses are allergic bronchopulmonary aspergillosis (ABPA), allergic fungal sinusitis (AFS), and hypersensitivity pneumonitis.

TABLE 1 **Noninfectious Health Effects Associated With Exposure to Molds**

Immune
Allergic rhinitis/conjunctivitis
Asthma
Hypersensitivity pneumonitis
ABPA
AFS
Nonimmune
Irritant symptoms
Inhalation fever (humidifier fever, organic dust toxic syndrome)
AIPH in infants
Toxin-mediated diseases (primarily associated with ingestions of nuts or grains contaminated with toxigenic molds)

Allergic Rhinitis

In the pediatric population, as many as 10% of children and 20% to 30% of adolescents have allergic rhinitis, and the prevalence is increasing.[3] The most common adverse health effect associated with mold exposure is allergic rhinitis. Fungi belonging to the group Deuteromycotina (*Fungi imperfecti*), particularly *Alternaria* species and *Cladosporium species*, are the most commonly studied. The second National Health and Nutrition Examination Survey noted that the most prevalent fungal IgE antibody was for *Alternaria* species (7%).[4] Studies suggest that the fungal cell wall component β-D-glucan may play a role in altering the host immune response to antigens leading to development of a T-helper type 2 or proallergenic-type response (interleukins 4 and 5, which preferentially enhance IgE synthesis and eosinophil differentiation) in the host.[5] Mold exposure is a strong irritant factor and worsens symptoms of any preexisting allergic disease in the same manner as other specific irritants such as tobacco smoke, ozone, or cold air.

The Joint Task Force on Practice Parameters in Allergy, Asthma, and Immunology has published guidelines for the diagnosis and treatment of allergic rhinitis.[6] The principal symptoms of allergic rhinitis are sneezing, rhinorrhea, and/or nasal blockage. The diagnosis requires the correlation of symptoms with a history of exposure to an allergen and in vitro demonstration of IgE antibodies by allergy skin tests or a radioallergosorbent test (RAST) for specific IgE antibodies in blood. However, the sensitivity and specificity of skin testing with mold antigens is poor. Commercially available fungal extracts are mixtures of soluble materials from spores, mycelia, cellular metabolites, and cytoplasm. Therefore, the panel of fungal allergen extracts available to clinicians may not accurately reflect the true mold-exposure profile in most indoor environments. Furthermore, cross-reactivity between different fungal extracts clearly exists, but to what extent is not known. Determination of mold-specific IgE antibodies (RAST, enzyme-linked immunosorbent assay) is costly. RASTs and related tests have lower sensitivity as well.

Asthma

The National Asthma Education Program's expert panel report defines asthma as "a lung disease with the following characteristics: 1) airway obstruction that is reversible; 2) airway inflammation; and 3) increased airway responsiveness to a variety of stimuli."[7] The panel states that the prevalence of asthma is approximately 10% in

the pediatric population and that it continues to increase. Asthma and allergic rhinitis frequently coexist, and there is evidence of a connection between allergic rhinitis and asthma. A cohort study of college freshmen with and without allergic rhinitis showed that allergic rhinitis almost tripled the risk (10.5% vs 3.6%) for the development of new asthma over the 20-year follow-up period.[8] The National Health and Nutritional Examination Survey report showed that when a skin-test result was positive for *Alternaria* species, the odds ratio (OR) of having asthma was 5.[4]

There is increasing evidence that fungi are an important environmental trigger for asthma exacerbations. High levels of basidiospores in the environment have been associated with asthma exacerbations in New Orleans, Louisiana.[9] Positive bronchial challenges in individuals with positive skin-test results have been noted with *Alternaria* species, *Basidiomycetes* species, *Cladosporium* species, *Penicillium* species, and others.[10,11] A case-control study investigated 11 young patients with asthma who experienced respiratory arrest (2 fatal cases) in seasons when high levels of *Alternaria* spores are present. Of the 11 patients, 10 had positive *Alternaria* skin-test results, compared with 31% of the controls, suggesting that *Alternaria* exposure was a risk factor for respiratory arrest.[12] Epidemiologic studies also suggest an association between dampness and mold in homes and asthma symptoms[13–17]; this association will be discussed further in "Health Risks Associated With Damp Indoor Environments."

In addition to airborne fungi, certain skin organisms (dermatophytes) can cause sensitization and antigen exposure in some patients with asthma. One study reported patients with asthma, chronic fungal skin infection, and immediate hypersensitivity to *Trichophyton* species. Patients demonstrated both upper and lower airway sensitization to dermatophyte antigens after bronchial and nasal challenge.[18] The diagnosis and treatment of asthma are well described in the National Asthma Education Program's expert panel report.[7]

Hypersensitivity Pneumonitis

Hypersensitivity pneumonitis, or extrinsic allergic alveolitis, is a group of immunologically mediated lung diseases in which the repeated inhalation of certain antigens provokes a hypersensitivity reaction with granulomatous inflammation and fibrosis in the gas-exchanging portion of the lung. Causative agents of hypersensitivity pneumonitis include bacteria (eg, thermophilic actinomycetes), fungi (eg, *Trichosporon cutaneum*), animal proteins (eg, avian), and chemicals (eg, diisocyanates). These antigens are typically less than 3 μm in diameter and are easily inhaled into the distal bronchial tree and alveoli, where they are cleared via the local lymphatic drainage into the hilar nodes, which induces an IgG antibody response. Antibody alone is not sufficient to cause disease; cytotoxic delayed hypersensitivity involving $CD8^+$ cytotoxic lymphocytes is required. A type III reaction is suggested by the presence of precipitating antibody to the offending antigen, immune complex deposition, and activation of the complement cascade, the resulting C5 activates macrophages. A type IV reaction is suggested by an increased percentage of T lymphocytes in bronchoalveolar lavage fluid, with a strong predominance of $CD8^+$ lymphocyte subsets, a low CD4-to-CD8 T-lymphocyte ratio, and the presence of granulomas on lung biopsy. Hypersensitivity pneumonitis must be distinguished from a number of nonallergic, inflammatory reactions such as "inhalation fevers," toxic alveolitis, and organic dust toxic syndrome, which is also associated with the inhalation of high levels of organic dust.

Genetics may play an important role in determining susceptibility to the development of hypersensitivity pneumonitis, because only a small proportion of exposed persons is ultimately affected. Studies have shown an association between HLA types A2 W15 and DQw3 and hypersensitivity pneumonitis.[19,20]

The prevalence of hypersensitivity pneumonitis in children is unknown. In a review of 86 pediatric cases of hypersensitivity pneumonitis, 17% were mold related; the mean age was 10 years, and the youngest patient was 8 months old.[21] Table 2 lists the fungal agents associated with hypersensitivity pneumonitis in childhood.[22]

The 3 stages of hypersensitivity pneumonitis development are acute lymphocytic infiltration, subacute granuloma formation, and chronic fibrosis. Subacute and chronic presentations are more common in children; the acute form is more common in adults.

In the acute form, symptoms of hypersensitivity pneumonitis mimic influenza (fever, myalgias, arthralgias, dyspnea, and cough, occasionally with cyanosis); these symptoms occur a few hours after exposure and resolve in 12 to 24 hours without specific treatment. Physical examination reveals an ill-appearing child with fever, dyspnea, and bibasilar crackles. Chest radiographic findings include poorly defined micronodules found predominantly in the upper and middle lung fields. High-resolution computed tomography (CT) demonstrates ground-glass attenuation of the lung fields.

In the subacute stage of hypersensitivity pneumonitis, there is an insidious onset of exertional dyspnea and fatigue. Cough can occur several days to weeks after exposure. The patient might have a subacute or chronic course, interspersed with acute exacerbations related to intermittent or seasonal exposure to the antigen(s).

The chronic form is characterized by insidious and progressive development of dyspnea and pulmonary fibrosis in a patient who has not experienced acute symptoms. The most common symptoms are exercise intolerance, cough, weight loss, and fever. On physical examination, approximately two thirds of these patients

TABLE 2 **Fungal Agents Associated With Hypersensitivity Pneumonitis**

Agent	Disease	Source
Thermoactinomyces vulgaris	Farmer's lung	Plant mold
Thermoactinomyces sacchari	Bagassosis	Sugarcane residue
Alternaria species	Woodworker's lung	Wood mold
Aspergillus clavatus	Malt worker's lung	Grain mold
Aspergillus species	Tobacco worker's lung	Tobacco mold
	Greenhouse lung	Greenhouse soil
Aureobasidium pullulans	Sequoiosis	Sequoia dust mold
Botrytis cinerea	Winegrower's lung	Grape mold
Candida albicans	Sax lung	Saxophone mouthpiece
Cephalosporium species	Basement lung	Contaminated basement (sewage/mold)
Cladosporium species	Hot-tub lung	Ceiling mold
Cryptostroma corticale	Maple-bark disease	Maple bark mold
	Greenhouse lung	Greenhouse soil
Epicoccum nigrum	Shower-curtain lung	Shower mold
Penicillium casei	Cheese washer's lung	Cheese mold
Penicillium chrysogenum	Woodworker's lung	Wood dust mold
Penicillium frequentans	Suberosis	Cork mold
Penicillium species	Domiciliary pneumonitis	House mold
Pullularia fungus	Sauna taker's disease	Sauna mold
Stachybotrys species	Domiciliary pneumonitis	House mold
Trichosporon cutaneum[a]	Summer-type hypersensitivity pneumonitis	Mold in Japanese homes
Mixed ameba, fungi, and bacteria	Air-conditioner lung	Cold mist and other humidifiers
	Ventilation pneumonitis	

[a] Association with HLA-DQw3.

have crackles and one third have digital clubbing. Chest radiographs show interstitial infiltrates with varying degrees of fibrosis and possible honeycomb appearance. The following criteria are considered essential for the diagnosis:

1. symptoms compatible with hypersensitivity pneumonitis;
2. evidence of exposure to appropriate antigen by history or detection of antibody in serum and/or bronchoalveolar lavage;
3. findings compatible with hypersensitivity pneumonitis on chest radiograph or high-resolution CT;
4. bronchoalveolar lavage lymphocytosis (40%–80%) with a predominance of CD4 (acute) or CD8 (chronic) T lymphocytes (if bronchoalveolar lavage is performed);
5. pulmonary histologic changes compatible with hypersensitivity pneumonitis (if open or video-assisted lung biopsy has been performed); and
6. positive "natural challenge" (reproduction of symptoms and laboratory abnormalities after exposure to the suspected agent).

Minor criteria include bibasilar crackles, decreased diffusing capacity, and arterial hypoxemia.

Confirmation of the diagnosis requires 4 major and 2 minor criteria and the exclusion of other diseases with similar symptoms and signs.[23] Despite the term "hypersensitivity," hypersensitivity pneumonitis is not associated with increased concentrations of IgE or eosinophils in the blood or lung. However, test results for rheumatoid factor are often positive. Treatment consists of antigen avoidance in all cases and steroid therapy in severe cases. There has been 1 case report of resolution of symptoms after installation of filters in an air-conditioning system, which lowered mold-colony counts.[24,25] The overall prognosis for children with hypersensitivity pneumonitis is excellent. In the 67 pediatric cases of hypersensitivity pneumonitis with reported outcomes, 65 children improved or became asymptomatic, 1 patient worsened, and 1 patient died.[21]

Allergic Bronchopulmonary Aspergillosis

ABPA is an immunologically mediated lung disease that occurs primarily in patients with asthma and cystic fibrosis (CF). *Aspergillus fumigatus* represents the most common etiologic agent, but other causative fungi include *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus terreus*, *Candida* species, *Curvularia* species, *Dreschlera* species, and *Penicillium* species. The alveolar deposition rate is highest for agents approximately 3 μm in size, such as *Acremonium* species, *Aspergillus* species, and *Penicillium* species. The fungi are not invasive but rather colonize the respiratory tract. The resultant hypersensitivity reactions are both IgE mediated (type I) and IgG mediated (type III). Estimated prevalences of ABPA range from 0.25% to 0.8% in children with asthma and 7% to 11% in children with CF.[26]

Asthma is usually present 5 to 10 years before the diagnosis, and the presence of atopy (allergic skin-test reactivity and hay fever) increases the risk. The clinical

course is characterized by recurrent acute episodes with intervening remission. Symptoms range from acute recurrent asthma exacerbations with wheeze, cough, and chest radiographic infiltrates to generalized systemic features of fever, anorexia, headache, and malaise. Abnormal sputum production occurs in more than half of patients and is characterized by solid chunks of "dirty-green–" to beige-colored sputum plugs. In addition to recurrent wheezing, long-standing illness may lead to digital clubbing and bronchiectasis. Characteristic radiographic patterns for bronchiectasis include the "gloved finger" and "toothpaste" shadows, air fluid levels from dilated central bronchi, and tramline shadows (edematous bronchial walls).[27,28] CT is the most sensitive tool for the detection of bronchiectasis.[29]

The Rosenberg criteria for ABPA are the most widely used and remain the diagnostic standard:

1. asthma or CF with peripheral blood eosinophilia;
2. immediate cutaneous reactivity to *A fumigatus*;
3. precipitating (IgG) antibodies to *A fumigatus*;
4. elevated serum-specific IgE antibodies to *A fumigatus*;
5. elevated total serum IgE (>500 IU/mL);
6. peripheral blood eosinophilia ($>1.0 \times 10^9$/L);
7. pulmonary infiltrates (or history of) on chest radiographs; or
8. central bronchiectasis.

Not all of the criteria are needed for diagnosis. The first 5 are essential, and having 6 is generally required to confirm the diagnosis. However, continued diagnostic testing may be required for months to years to fulfill all of the criteria. In addition, a positive sputum culture for *A fumigatus* is not essential for the diagnosis, because up to 40% of patients have negative cultures.[30]

Corticosteroids modulate inflammation and immunologic reactivity and are the mainstay of treatment. The use of antifungal agents to decrease the fungal burden arising from colonization remains controversial.[31]

Allergic Fungal Sinusitis

The combination of nasal polyposis, crust formation, and sinus cultures yielding a fungal agent is known as AFS. It is estimated that approximately 5% to 10% of patients with chronic rhinosinusitis have AFS. In a review of 263 cases, 168 yielded positive fungal cultures. Of these, 87% were organisms of dematiaceous genera (*Bipolaris*, *Curvularia*, *Exserohilum*, *Alternaria*, *Drechslera*, *Helminthosporium*, and *Fusarium*); only 13% yielded *Aspergillus*.[32] AFS is similar in pathophysiology to ABPA. First, an atopic host is exposed to fungi through normal nasal respiration, thus providing an initial antigenic stimulus. Type I (IgE)– and type III (immune complex)–mediated reactions then trigger an eosinophilic inflammatory response. The resulting inflammation leads to obstruction of the sinus ostia, which may be accentuated by anatomic factors such as septal deviation or turbinate hypertrophy, resulting in stasis within the sinuses. The end result is an allergic mucin that fills the involved sinuses. The clinical presentation may be dramatic, giving rise to visual loss, facial dysmorphia, or complete nasal obstruction. Alternatively, patients may present with chronic sinusitis and nasal polyposis with a gradual increase in production of nasal crusts. Pain is uncommon. Physical findings may include exophthalmus, facial dysmorphia, or intracranial extension. The production of allergic mucin is characteristic of AFS. Grossly, allergic fungal mucin is thick, tenacious, and highly viscous in consistency; its color may vary from light tan to brown or dark green. This characteristic appearance has lead to the use of such descriptive terms as "peanut butter" and "axle grease." There is no consensus concerning diagnostic criteria for AFS. Medical treatment of AFS requires long-term immunotherapy and/or corticosteroids and fungistatic antimicrobial agents (oral and/or topical). Surgical removal of all fungal mucin is a crucial component.[33]

NON–IMMUNE-MEDIATED HEALTH EFFECTS

Irritation

Volatile organic compounds (VOCs) produced by fungi can provoke symptoms in susceptible individuals in a manner similar to nonmold irritants such as tobacco smoke, formaldehyde, or ozone. Symptoms of exposure to microbial VOCs (MVOCs) can include eye, nose, and throat irritation; headache; and fatigue. MVOCs are low molecular weight alcohols, aldehydes, and ketones. The principal volatile compound produced by many molds is 1-octen-3-ol, which has a characteristic mushroom odor. The MVOC 2-octen-1-ol may account for the musty odor of many molds; geosmin (1,10 dimethyl-9 decalol), produced by *Aspergillus versicolor*, has a characteristic earthy odor. The human nose is very sensitive to mold odors, often more so than current analytical instruments. Animal data indicate that the median lethal dose of many of these compounds is high,[34] but inhalation may provoke acute respiratory responses that range from a feeling of stuffiness to frank wheezing. The effects of prolonged low-level exposure are not known.

Inhalation Fever (Humidifier Fever and Organic Dust Toxic Syndromes)

Inhalation fever (influenza-like, self-limited syndromes including humidifier fever and organic dust toxic syndromes) have been reported in occupational or agricultural settings after acute exposures to high concentrations of microbial agents including bacteria, fungi, and associated microbial byproducts.[35] Humidifier fever is a flu-like illness occurring a few hours after exposure to aerosols generated from forced air-conditioning and hu-

midifier systems. Symptoms include fever, headache, chills, myalgia, and, less prominently, pulmonary symptoms. It usually subsides within 24 hours without residual effects. The high attack rate and the short-term effects may indicate that toxins or endotoxin-like reactions are involved. The onset occurs after intense exposure in a single day, but tachyphylaxis occurs on frequent repeated exposures. Hence, humidifier fever is sometimes called "Monday fever," because symptoms occur only on the first day back to work despite similar antigen exposure throughout the week. The pathogenesis of humidifier fever is not completely understood but has been related to excessive growth of microorganisms in humidifier reservoirs, air conditioners, and aquaria. Microorganisms implicated include amoebas, bacteria, fungi, and parasites.[36]

Similarly, organic dust toxic syndrome is a self-limited inhalation fever syndrome occurring after the inhalation of organic dusts from moldy or damp silage, hay, or other agricultural dusts or contaminated wood chips from mulching. Clinically, fever, chills, cough, minimal dyspnea, chest tightness, myalgias, malaise, nausea, and headache occur 4 to 12 hours after exposure. Symptoms of eye and mucous membrane irritation and dry cough are often reported during the acute exposure. It is postulated that organic dust toxic syndrome results from endotoxin-like reactions to high doses of microbial byproducts.[35]

More severe acute lung injury after exposure to damp and moldy organic materials in an agricultural setting also has been reported. The syndrome of toxin-related acute lung injury includes prominent respiratory symptoms, radiographic infiltrates on chest radiographs, and hypoxemia. In 1 case report, a patient developed acute pulmonary edema, presumably resulting from a severe organic dust toxic syndrome reaction or other toxin-mediated injury caused by fungal byproducts, after exposure to high levels of *Penicillium* species contaminating moldy oranges in a storehouse.[35]

Mycotoxins and Associated Health Effects of Mycotoxin Exposure

The fungi that produce mycotoxins are called "toxigenic fungi." The amount, if any, and type of mycotoxin produced depends on a complex and poorly understood interaction of factors that include (1) species of fungus, (2) genetic pattern of the particular strain of the species, (3) maturity of the colony, (4) available food source, (5) amount of water available, (6) temperature, (7) light amounts and wavelengths, (8) presence or absence of competition, (9) presence or absence of specific gases, (10) presence or absence of essential metals, and (11) other unknown factors. Thus, it does not necessarily follow from the presence of a toxigenic species that mycotoxins are present.

Mycotoxins are primarily found in spores and have been identified in the spores of *Acremonium* species, *Alternaria* species, *Aspergillus* species, *Cladosporium* species, *Cylindrocarpon* species, *Fusarium* species, *Mycothecium* species, *Penicillium* species, *Pithomyces* species, *Stachybotrys* (*S atra*, *S alternans*, or *S chartarum*), and *Trichoderma* species (see Table 3 for mycotoxin-producing molds and their health effects). Routes of exposure include ingestion, inhalation, and skin contact. Because mycotoxin-producing molds are lipid soluble, they are easily absorbed via the airways or through the skin. By convention, the term "mycotoxin" excludes mushroom toxins; therefore, the hallucinogenic toxins such as lysergic acid will not be discussed.

Toxic effects from the ingestion of moldy foods have been known for centuries. Although "St Anthony's fire" was described in the Middle Ages, it was not until the 19th century that the chemicals responsible for ergot poisoning were isolated. The fungus *Claviceps purpurea*

TABLE 3 **Mycotoxin-Producing Molds and Their Health Effects**

Fungus	Mycotoxin	Adverse Health Effect
Alternaria alternate	Tenuazonic acid	Hepatotoxic and nephrotoxic, hemorrhagic
Aspergillus flavus	Aflatoxins	Hepatotoxic, carcinogenic
Aspergillus fumigatus	Fumitremorgens	Tremorgenic
Aspergillus nidulans	Sterigmatocystin	Hepatotoxic, carcinogenic
Aspergillus ochraceus	Ochratoxin A	Hepatotoxic and nephrotoxic, carcinogenic
Cladosporium species	Epicladosporic acid	Immunosuppressive
Fusarium moniliforme	Fumonisins	Neurotoxic, hepatotoxic and nephrotoxic
Fusarium poae	T-2 toxin	Hemorrhagic and immunosuppressive
Fusarium sporotrichioides	Trichothecenes	Causes alimentary tract aleukia (nausea, vomiting)
Penicillium expansum	Patulin	Nephrotoxic and carcinogenic
	Citrinin	
Penicillium griseofulvum	Griseofulvin	Hepatotoxic, carcinogenic, teratogenic
Pithomyces chartarum	Sporidesmin	Hepatotoxic; causes photosensitization, eczema
	Phylloerythrin	
Stachybotrys chartarum	Satratoxins toxins	Immunosuppressive, hematotoxic
	Verrucarins	Inflammatory, immunosuppressive
	Roridins	Causes dermatitis; hematotoxic, hemorrhagic

grows on rye and contains a number of toxic alkaloids (eg, ergotamine and ergonovine), which are used in the treatment of migraine headaches or as uterine stimulants. The epidemic form of ergotamine poisoning attributable to the ingestion of contaminated rye is rarely seen. Ingestion of 1 g of ergot has been fatal; ergotamine has caused gangrene in doses of 10 mg/day. Circulatory changes are attributable both to prolonged vasoconstriction and to intimal hyperplasia and thrombosis. Symptoms of acute or chronic ergotamine poisoning include vomiting, diarrhea, burning abdominal pain, severe muscle pains, ischemic peripheral gangrene, headache, psychotic behavior, muscle tremors, convulsions, and coma. Treatment is based on symptoms and includes the use of vasodilators and analgesic agents.

Because mycotoxins are natural contaminants of food sources, they cannot be totally eliminated before consumption. The following mycotoxins have well-described adverse health effects.[37]

Aflatoxins

Aflatoxins are produced by certain strains of *Aspergillus* species. They were first discovered after an epidemic that killed 100 000 turkeys in the 1960s. The toxin was found in moldy Brazilian peanuts that were included in the feed. Later, these naturally occurring mycotoxins were discovered in barley, corn, other nuts, and wheat. The maximum concentrations of aflatoxins allowed in food are set by the US Food and Drug Administration. The limits for food and milk are 20 and 0.5 parts per billion (ppb), respectively. Levels up to 300 ppb are allowed in feed for livestock and poultry. A recent outbreak of aflatoxin-related jaundice in Kenya resulted from widespread contamination of locally grown maize, which occurred during storage of the maize under damp conditions. Of the 317 cases, the case fatality rate was 39%. The level of toxin in food samples ranged from 20 to 8000 ppb.[38]

Citrinin

Citrinin is found in the *Penicillium* species. It typically contaminates barley, corn, rye, and wheat. Adverse health effects include fatty infiltration and necrosis of the liver and nephrotoxicity. Because this mycotoxin is destroyed by food processing, there are no Food and Drug Administration regulations or guidelines.

Fumonisins

Fumonisins are produced by *Fusarium* species. They are commonly found in corn and are detectable in tortilla flour. They have been implicated in equine leukoencephalomalacia. The mechanism of action involves the inhibition of the sphingolipid synthesis, resulting in disruption of sphingomyelin. In humans, no toxic effects have been described, but there may be an association with the development of esophageal carcinoma. The Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) recommend a maximum tolerable intake at 2 μg/kg of body weight per day.

Ochratoxins

Ochratoxins have been isolated from *Aspergillus* and *Penicillium* species and are found in barley, cocoa, coffee, corn, soybeans, and wheat. They inhibit protein synthesis and produce most of their adverse affects in the gastrointestinal tract and kidneys. The FAO/WHO recommend a tolerable weekly intake of 100 μg/kg. Suggested tolerance levels for infant cereals and foods are 5 and 1 μg/kg, respectively.

Patulin

Patulin is produced by *Aspergillus* and *Penicillium* species and other mold species that grow in fruits such as apples, grapes, and pears. Because it is carcinogenic in animals, there are concerns about the possibility of carcinogenicity in children who drink large amounts of fruit juice, especially apple juice. There is a recommended limit of 50 μg/kg of patulin in apple juice and cider. Sulfur dioxide, a common food preservative for dry foods and juices, degrades the toxin.

Trichothecenes

Trichothecenes are metabolites that are produced by a number of fungi including *Fusarium*, *Mycothecium*, *Stachybotrys*, *Trichoderma*, and *Cephalosporium* species. There are almost 150 natural trichothecenes, of which at least 40 are mycotoxins. They are found in crops and animal feed (particularly hay and straw) contaminated with *Fusarium* species. Levels in the range of 0.5 to 40 mg/kg of T-2 toxin, 4-deoxynivalenol (DON), and nivalenol are detected in corn, peanuts, rice, and wheat. In commercial foods, such as corn, flour, popcorn, potato, wheat flour, breakfast cereals, and infant food, trichothecene levels are much lower, in the range of 0.03 to 0.5 mg/kg.

There are 4 main groups of trichothecenes. Group A includes the highly toxic T-2 toxin and diacetoxyscirpenol. Group B includes DON and nivalenol. Group C is produced by *Baccharis megapotamica* and is the least common. Group D includes roridins produced by *Mycothecium roridum*, verrucarin produced by *Mycothecium verrucaria*, and satratoxins produced by *S chartarum*. Only group D trichothecenes are produced by *S chartarum*. Setting tolerance levels for trichothecenes is difficult because of the mixtures of toxins with different toxicities. The FAO/WHO Joint Expert Committee recommends a provisional maximum tolerable daily intake of 1 μg/kg for DON and 60 μg/kg for T-2 toxin. *S chartarum* has gained recent media attention as the "toxic mold." *S chartarum* is a shiny, black mold that grows only on water-soaked cellulose. It is unusual to find it indoors because of the chronic waterlogged condition necessary

for its growth. Thus, the black mold commonly found on bathroom tile and grout is not *Stachybotrys*. In addition to the trichothecenes, *S chartarum* isolates can produce a number of other mycotoxins (Table 4).

CLINICAL EFFECTS LINKED TO *Stachybotrys* MYCOTOXINS

The first reported cases of stachybotryotoxicosis in humans occurred in the 1940s. Russians who handled contaminated hay or slept on straw-filled mattresses experienced dermatitis, pain and inflammation of the mucous membranes, burning nasal passages, tightness of the chest, bloody rhinitis, cough, fever, headache, and fatigue. Later studies reported similar symptoms in individuals exposed to *S chartarum*.[39,40] A case-control study by Johanning et al[40] was the first investigation of *Stachybotrys*-associated complaints and building-related illness. Comprehensive testing of immunologic indices using a test battery developed by the National Institute for Occupational Safety and Health to detect immunomodulation from exposure to xenobiotics was used to study the red and white blood cell systems, serum chemistry, immune function, and Ig antibodies. Results showed that the workers with direct contact with moldy materials or working in locations with the highest airborne *Stachybotrys* levels (range: 116 to more than 20 000 colony-forming units [CFU]) required temporary or permanent removal because of severely increased symptoms after return to the building with *Stachybotrys* contamination as compared with unexposed controls. Fingertip skin inflammation in 3 women handling moldy horticulture pots made of recycled paper that had visible black masses of *Stachybotrys conidia* as well as *Chaetomium perithecia* and other fungi has been reported. The illness, described as painful, inflamed efflorescences at the fingertips, followed by scaling, was attributed to the effects of a mycotoxin. However, no tests were performed to determine the etiologic agent or the mechanism (allergic or irritant contact dermatitis, toxicity, or infection).[41]

TABLE 4 ***Stachybotrys* Toxins**

Macrocyclic Trichothecenes	Enzymes
3 acetyl-deoxynivalenol	β -Glucanase
Citrinin	1,3-Endoglucanases
DON	Farnesyl-protein transferase
Diacetoxyscirpenol	Sesquiterpenes
Isosatratoxins F, G, S, and H	SMTP-3, SMTP-4, SMTP-5, and SMTP-6
Kampanols	Stachybocins A, B, and C
Nivalenol	Stachybotramide
Phenylspirodrimanes (9)	Stachybotrin C
Roridin A	Staplabin
Satratoxins F, G, and H	Staplabin analogs: SMTP-7 and SMTP-8
T-2 tetraol	Triprenyl phenol metabolites
T-2 toxin	
Verrucarin A	
Verrucarol	
Vomitoxin	

Idiopathic Pulmonary Hemorrhage

The first cluster of idiopathic pulmonary hemorrhage in infants was reported from Greece in the 1980s.[42] Other reported clusters of the illness have been reported throughout the United States, but the first report to implicate *S chartarum* was a community-based case-control study in Cleveland, Ohio.[43] Investigators found an association between exposure to water-damaged buildings and *S chartarum* with acute pulmonary hemorrhage/hemosiderosis in infants. The calculated OR was 16.25 (95% confidence interval [CI]: 2.55 to infinity). Case infants were also more likely to have had close relatives with pulmonary hemorrhage (OR: 33.14; 95% CI: 5.10 to infinity). In addition, 50% of the case infants experienced recurrent pulmonary hemorrhage after returning to their homes.[43] Of note, the OR associated with exposure to cigarette smoke in the cases was 7.9. Also of note was that none of the children had been breastfed. A study by Etzel et al[44] revealed a greater than 4-fold increase in all fungi and a more than 10-fold increase in *S chartarum* concentrations in case homes compared with control homes. The high prevalence of *S chartarum* in the Cleveland cluster-area homes (65%) was unusual; other studies in North America have detected it in less than 3% of homes. Other toxin-producing species were identified, including *A versicolor*, *Penicillium aurantiogriseum*, and *Penicillium chrysogenum*, but the differences between case and control homes for these molds were not significant. To test for interaction with environmental tobacco smoke, a multivariate matched analysis assessed the impact of *S chartarum* concentration and exposure to environmental tobacco smoke, finding an OR of 21 (95% CI: 1.07 to 7.5×10^6), for an increase of 10 U in the mean concentration of *S chartarum* in the presence of environmental tobacco smoke.[44,45] Reexamination of these data years later led the Centers for Disease Control and Prevention (CDC) to conclude that "a possible association between acute pulmonary hemorrhage/hemosiderosis in infants and exposure to molds, specifically, *S chartarum*, was not proven."[46] When 1 outlier case was excluded, the OR dropped from 9.8 to 1.5. Although the OR was lower, it remained significant (OR: 1.5; 95% CI: 1.1 to 2.5). Problems with the data collection (oversampling of air samples from case homes) and nonstandardized methods to generate artificial aerosols for sampling (vacuuming carpets and pounding on furnace ducts and furniture) were noted, leaving the hypothesis unproven. However, additional cases from ongoing surveillance in Cleveland continue to show an association between acute idiopathic pulmonary hemorrhage (AIPH) and water-damaged homes in conjunction with exposure to cigarette smoke.[47] A recent study of toxin production by the fungal isolates in victims' homes was performed. Isolates of *S chartarum* and *Memnoniella echinata* (a fungus closely related to *S chartarum*) were isolated from homes of the case infants and then ana-

lyzed both for cytotoxicity and specific toxins. The most common toxins were satratoxin H and roridin, and the results showed that the levels of cytotoxicity correlated with the levels of these trichothecenes. However, there was no relationship between cytotoxicity and the origin of the isolate (a case home or a control home).[48]

Case reports from other cities have also been published.[49,50] A report from Kansas City, Missouri, described a 1-month-old male with pulmonary hemorrhage.[49] Questioning of the family identified a recent water leak in the home after hail damage to the roof. The leak occurred in a closet of the bedroom where the infant slept. The mother also smoked cigarettes. *Stachybotrys* spores were collected from the infant's bedroom, along with several other mold species. High quantities of several potent trichothecenes were detected. The mycotoxins roridin and satratoxins were also identified. It is hypothesized that these toxins interfere with synthesis of type IV collagen and other endothelial basement membrane components, leading to increased capillary fragility and hemorrhage. It is postulated that infants are particularly sensitive to the effects of the toxins because of their rapid lung growth.[49]

S chartarum was first isolated from a patient in a case report by Elidemir et al.[51] The mold was isolated from bronchoalveolar lavage of a 7-year-old boy with a 2-year history of chronic, nonproductive cough accompanied by intermittent low-grade fever, malaise, fatigue, and decreased appetite. His bronchoalveolar lavage showed 26% hemosiderin-laden macrophages and grew *S chartarum*. *S chartarum* was also recovered from the child's water-damaged farm home. Within a month of relocating to his grandmother's house, his cough resolved, his appetite improved, and his weight increased by 2 kg.

Because the relationship among idiopathic pulmonary hemorrhage, pulmonary hemorrhage, and AIPH in infants is not clearly understood in terms of rate, etiology, and risk factors, the CDC formed a working group for the investigation and surveillance of infants with AIPH.[52] The group recommended a case definition for AIPH in infants and a plan for retrospective surveillance for AIPH in infants. The definition of a case of AIPH in an infant uses the term "pulmonary hemosiderosis" as a pathologic finding to denote the possible occurrence of pulmonary hemorrhage and not to describe a clinical syndrome. CDC criteria for a confirmed case of AIPH include pulmonary hemorrhage in a previously healthy infant younger than 1 year with a gestational age of more than 32 weeks, no history of problems that might cause pulmonary hemorrhage, and a condition that meets all of the following 3 criteria:

1. abrupt or sudden onset of overt bleeding or obvious evidence of blood in the airway, including epistaxis, hemoptysis, or frank blood in the airway below the larynx at visualization, not caused by any medical procedure (eg, laryngoscopy or intubation) or identification of hemosiderin-laden macrophages (>20% of pulmonary macrophages containing hemosiderin on bronchoalveolar lavage or biopsy specimen); a source of bleeding from the nose and oropharynx should be ruled out at the time of admission;
2. severe-appearing illness leading to acute respiratory distress or respiratory failure resulting in hospitalization in a PICU or NICU with intubation and mechanical ventilation; and
3. diffuse unilateral or bilateral pulmonary infiltrates visible on radiographs or CT of the chest; chest radiographic or CT findings should be documented within 48 hours of examination of the infant.

A previously healthy infant should:

1. have been discharged from the hospital after birth with an uneventful course before the occurrence of bronchoalveolar hemorrhage;
2. have neither never been previously intubated nor required respiratory support with oxygen;
3. not have evidence of physical abuse;
4. not have any abnormality identified on admission that would explain the bleeding; and
5. not have neonatal medical problems that can cause pulmonary hemorrhage.

Less stringent criteria define probable and suspected cases.

Currently, the CDC is in the process of a retrospective review for AIPH among infants in metropolitan areas in states with the highest death rates and with 100 or more deaths associated with pulmonary hemorrhage among infants from 1979 to the present.

Experimental animal models of *Stachybotrys* mycotoxicosis in mice are limited. In 1 study, intranasal exposure to spores of *S chartarum* containing satratoxins caused severe intraalveolar, bronchiolar, and interstitial inflammation with hemorrhagic exudation.[53]

The Institute of Medicine (IOM) conducted a comprehensive review of the literature on the adverse health effects of mold and dampness in indoor spaces, including the literature on *Stachybotrys* species and pulmonary hemorrhage.[54] They concluded that there was insufficient evidence to determine if mold exposure to *Stachybotrys* species was associated with AIPH, in part because of problems with data collection and lack of available, standardized tools for exposure assessment. The IOM recommended further surveillance and additional research.

In summary, although the causal association between AIPH in infants has not been firmly established, the Cleveland study, additional case series, case reports from independent sources, and basic scientific studies in ani-

mal models have provided some evidence of plausibility. Epidemiologic studies suggest that exposure to secondhand cigarette smoke may be an additional risk factor. Ongoing work in toxicology and epidemiology will provide more insight in the future.

CLINICAL EFFECTS LINKED TO OTHER MYCOTOXINS

Neurologic Toxicity

Ingestion of 3-nitropropionic acid produced by *Arthrinium* species is thought to cause "moldy sugarcane" or "kodua" poisoning. Symptoms include dystonia, convulsion, carpopedal spasm, and coma.[55] Cyclopiazonic acid produced by *Penicillium* species and *Aspergillus* species has also been linked to kodua poisoning. Clinically, patients have somnolence, tremors, and giddiness.[56] Other fungal components, such as VOCs, may produce neurologic effects. There is no evidence of neurologic injury associated with inhalation of mycotoxins. Patients, their parents, and clinicians have raised concerns regarding potential neurotoxicity from mold exposure, and the scant literature has been reviewed.[57]

Gastrointestinal Toxicity

Mold-contaminated food products are known to cause nausea, vomiting, abdominal pain, and diarrhea when ingested. High concentrations of trichothecenes destroy skin layers and cause acute necrosis. The mucosa of the mouth, esophagus, and intestine can be affected, and necrosis and inflammation can occur.[55,58]

Renal Toxicity

Ochratoxins (found in cereals, coffee, bread, and meat) produced by *Penicillium* species and *Aspergillus* species are associated with Balkan endemic nephropathy.[37]

Teratogenic Effects

Zearalenone produced by *Fusarium* species (F-2 toxin) possesses estrogenic activity and causes infertility and fetal malformations in animal models. Human studies have not been performed.

Cancer

Studies performed in Asia and Africa have shown that chronic consumption of aflatoxins in food increases the risk of developing hepatocellular carcinoma. However, coinfection with hepatitis B virus is an important synergistic factor that affects the carcinogenicity of aflatoxins.[59] There is no evidence linking inhaled mycotoxins to human malignancy.

SICK BUILDING SYNDROME

Sick building syndrome (SBS) was originally defined by the WHO as an excess prevalence of work-related irritations of the skin and mucous membranes and other symptoms reported by workers in modern office buildings.[60] Clinical features typically include eye, nose, and throat problems, dermatitis, drowsiness, difficulty in concentrating, headache, and fatigue. Chemical contaminants, bioaerosols, poor ventilation, odor perception, thermal comfort, and psychological factors have been suggested as causal factors. Some have suggested that the term SBS be abandoned for its lack of clarity. "Nonspecific building-related illness" as a new term has been proposed by some experts. Although individual symptoms of SBS have been associated with damp, moldy environments, the constellation of symptoms together has not been systematically evaluated in epidemiologic studies.

HEALTH RISKS ASSOCIATED WITH DAMP INDOOR ENVIRONMENTS

In the previous sections we have discussed the clinical spectrum of noninfectious health effects associated with exposures to mold; however, the pediatrician may be asked what the scientific evidence is for health risks associated with living in damp indoor environments. In the past 10 to 20 years, numerous epidemiologic studies have reported on health effects attributed to damp or moldy indoor environments or mycotoxins, and these findings were reviewed.[7,13,14,61]

In one of the first epidemiologic studies, Brunekreef et al[62] found associations between self-reported mold exposures and respiratory symptoms (wheeze, cough, hay fever) in a survey of more than 4600 US children (7–11 years of age). After taking into account other home environmental factors such as environmental tobacco smoke, the adjusted OR for wheeze was 1.79 (95% CI: 1.44 to 2.32). A Canadian survey of more than 13 000 children found associations between wheeze and cough and self-reported dampness or mold (adjusted OR: 1.89; 95% CI: 1.61 to 2.20).[15] Among the more recent studies, in a prospective cohort of 849 infants with a family history of asthma, investigators found associations between measures of mold exposure (reported persistent mold or mildew in previous 12 months or air concentrations of *Penicillium* species and humidifier use) and cough and wheezing.[63,64] In a case-control study of 272 children, there was an increased risk of allergic sensitization among those in homes with a high level of mold spores in the winter (as determined by dust collection), even after adjusting for dust mite levels, especially in children who had lived in the same home since birth.[65] Many of the larger studies were cross-sectional surveys, often with self-reported symptoms and exposures, and could be subject to bias. However, an analysis of a subset that used surveyor assessment of a damp environment found associations between respiratory systems (eg, cough and wheeze) and the presence of mold.[13] Taken together, Bornehag et al[13] found that large surveys and smaller case-control studies with more objective surveyor assessments found a consistent increase

in risk of respiratory symptoms among those who lived in a damp environment.

Dampness can be associated with dust mites and bacterial growth. However, associations between "dampness" and health have been found in areas with little dust mite exposure (eg, in northern Scandinavia) or after taking mite exposure into account in the analysis.[13]

Because of increasing public concern regarding health effects of mold spurred, in part, by reports of cases of pulmonary hemorrhage in infants in Cleveland linked to *Stachybotrys* species and a great deal of attention in the mass media, the CDC asked the IOM to conduct a comprehensive review of the scientific literature regarding the relationship between damp or moldy indoor environments and adverse health effects.

The authors of the IOM report (summarized in Table 5) found sufficient evidence of an association between mold and other agents in damp indoor environments and upper and lower respiratory tract symptoms, as well as asthma symptoms in sensitized persons.[54] There was insufficient information to determine if mold exposure was associated with the development of asthma. Similarly, the IOM reported that there was insufficient evidence to determine if mold exposure to *S chartarum* was associated with idiopathic infantile pulmonary hemorrhage because of the limitations of previous epidemiologic studies.[43–46] The IOM report also noted that other conditions reported with a damp indoor environment, including constitutional or neuropsychiatric symptoms, skin rashes, and rheumatologic diseases, were poorly studied, and no conclusions could be drawn.

Although inhalation fevers have been reported in occupational or agricultural settings after acute exposures to high concentrations of fungal agents, it would be very unusual to have concentrations of bioaerosols comparable to those experienced in inhalation/humidifier fever in most homes or public buildings. However, the IOM report noted that physicians should consider the syndrome in cases of highly contaminated indoor environments.[54] As noted previously, although individual symptoms of SBS have been associated with damp moldy environments, the constellation of symptoms together has not been systematically evaluated in epidemiologic studies. The authors of another systematic review of the literature reviewed 13 studies on fungi, mycotoxins, and the indoor environment and also concluded that there is inadequate evidence to support a causal relationship between symptoms or illness among building occupants and exposure to mycotoxins.[66]

Similarly, the American College of Occupational and Environmental Medicine review and policy statement on "Adverse Human Health Effects of Molds in the Indoor Environment" concluded that "current scientific evidence does not support the proposition that human health has been adversely affected by inhaled mycotoxins in the home, school, or office environment."[67]

There are few data assessing the health benefits of decreasing exposure to damp environments. A before-and-after intervention study in the Pacific Northwest examined health-related complaints in 37 building occupants before and after relocation from a water-damaged building.[68] The health survey revealed a high prevalence of multiple symptoms, with a predominance of neurobehavioral (fatigue, headache, and difficulty concentrating) and upper respiratory tract complaints. Public health officials were contacted and conducted a walk-through evaluation of the building. They found evidence of moisture incursion throughout the building. Mold odors were detected, and *S chartarum* was isolated from the baseboard of one of the walls. The authors concluded that the toxigenic mold was likely to be present within all the wet walls of the building and that symptoms reported by building occupants were consistent with toxigenic mold exposure. They strongly recommended that the occupants be relocated. Comparison of symptoms before and after relocation showed that most symptoms were significantly less prevalent after relocation ($P < .0001$). The majority (70%) described their overall health as "better" since relocation, and equal proportions (15%) described their overall health as "same" and "worse." A causal relationship between the symptoms and the toxigenic fungi is difficult to prove because of the study design and the subjective nature of self-reported symptoms.

TABLE 5 Findings of the IOM Report: Association Between Health Outcomes and the Presence of Mold or Other Agents in Damp Indoor Environments

Sufficient evidence of an association
Upper respiratory tract symptoms (nasal and throat)
Wheeze
Cough
Asthma symptoms in sensitized persons
Hypersensitivity pneumonitis in sensitized persons
Limited or suggested evidence of an association
Lower respiratory tract illness (eg, pneumonia, frequent colds) in children
Inadequate or insufficient evidence to determine whether an association exists
Dyspnea
Skin symptoms
Asthma development
Gastrointestinal tract problems
Airflow obstruction (in otherwise healthy persons)
Fatigue
Chronic obstructive pulmonary disease
Neuropsychiatric symptoms
Inhalation fevers (nonoccupational exposures)
Cancer
Lower respiratory illness in otherwise healthy adults
Reproductive effects
AIPH in infants
Rheumatologic and other immune diseases

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ASSESSMENT, REMEDIATION, AND PREVENTION

Assessing Exposures to Indoor Mold

The diagnosis of mold-related illness and issues related to exposure as a cause of disease is problematic. Because of our incomplete knowledge of what agents in damp indoor environments (and what amount of exposure) contribute to health effects, there are no uniformly accepted, valid, quantitative environmental sampling methods or serologic tests to assess exposures to mold and other agents associated with damp indoor environments. Because of uncertainties in the exposure assessments used in health studies, federal and state regulatory agencies have not established health-based guidelines for exposure limits for indoor biological agents (ie, what air concentrations of mold spores are unlikely to cause health risk). Sampling cannot be used to check a building's compliance, because no federal mold guidelines exist. In this section, we summarize the available exposure-assessment methods, discuss their limitations, and provide some practical guidelines for the practicing physician. *Guidance for Clinicians on the Recognition and Management of Health Effects of Mold Exposure and Moisture Indoors* provides an excellent discussion of environmental assessment strategies (see "Resource for Pediatricians").

Environmental Assessment and Sampling

Methods for sampling of indoor fungi were recently reviewed and include visual inspection, bulk or surface sampling (eg, culturing pieces of damp or discolored wallboard), and air sampling.[69] Air sampling may include measurement of total spore concentration (number of spores per m^3) or viable (ie, culturable) spore concentration (CFU/m^3). Air fungal capturing devices may have a variation of up to 1000-fold between specimens obtained from the same source. Single samples from either the suspected or control area cannot provide scientifically meaningful conclusions because of the lack of statistical and practical significance. Some texts suggest at least 16 samples over 4 time periods.[70,71]

Burge[70] has suggested some rules of thumb as evidence of mold overgrowth in the indoor environment (although proposed levels are not necessarily associated with symptoms): (1) more than 200 CFU/m^3 of air or 500 spores per m^3*; (2) a CFU count 10 times higher than a noncomplaint environment; (3) CFU counts exceeding those outdoors by order of magnitude (10×); and (4) a single fungus accounting for more than half of the total. However, the criteria proposed by Burge need additional evaluation.

To date, the majority of population-based epidemiologic studies have used questionnaires regarding signs of dampness (eg, visible mold, recent water damage, musty smell, etc) as measures of exposure or inspections with trained investigators, but these methods are difficult to quantify. Recently, studies have begun to quantify exposures to mold with environmental sampling of air or dust for spores or fungal byproducts, including toxins. There is a clear need for establishing consistent methods for quantifying indoor exposures to mold for use in future health studies. Thus, the Environmental Protection Agency (EPA) and other environmental agencies have not set numeric standards for indoor concentrations of mold or mold spores regarding the levels at which adverse health impacts are associated.

Another inherent limitation of the interpretation of environmental sampling is that the sampling is conducted over a limited period (ie, snapshot of potential exposure), and measurements are often made after the development of illness or symptoms. Because production and release of mold spores and mycotoxins vary substantially, depending on physiologic and environmental factors, exposure measurements may not always track with past exposures.

Another complicating fact is that multiple species of molds are usually found in damp indoor environments; for example, exclusive exposure to *Stachybotrys* species is rare. Many fungi known to produce toxins, allergens, and irritant chemical compounds are usually found in large numbers in buildings with water problems and fungal contamination. Thus, attributing causation to one particular mold species from epidemiologic studies alone may be problematic.

Although results of environmental sampling should be interpreted with caution, the clinical and epidemiologic evidence to date suggests that damp, moldy indoor environments are unhealthy, and we outline a practical approach for assessing mold in the indoor environment in Table 6. Additional clinical evaluation tools for the recognition and management of mold and moisture-related illnesses are available (http://oehc.uchc.edu/clinser/indoor.htm).

Should I Test for Mold? What Tests Should I Order?

In clinical practice, extensive documentation of indoor fungal growth may not be necessary, depending on concerns of the occupants. Visible signs of mold growth (eg, discolored patches or cottony or speckled growth on walls or furniture, evidence of dampness or water damage or an earthy musty odor in a particular area) suggest a damp environment and mold growth. If a child with persistent asthma symptoms is sensitized to mold and there is visible mold growth in the home, efforts should be focused on cleanup and addressing the moisture problem to prevent recurrence. Additional documentation of mold exposure with sampling is not necessary.

*Spores per m^3 is the unit of measurement for total spores (both viable and nonviable); CFU/m^3 measures viable spores only. Spores per m^3 is a better indicator of potential mycotoxin exposure, assuming that mold spores contain mycotoxins.

TABLE 6 **Guidelines for Pediatricians Considering Possible Illness Related to Damp, Moldy Indoor Spaces**

When to consider indoor mold-related illness[a]
Chronic respiratory symptoms of unclear etiology
Poorly controlled asthma, perennial allergic rhinitis, or chronic sinusitis
Respiratory symptoms or recurrent influenza-like symptoms in a moldy environment
Suspected or diagnosed hypersensitivity pneumonitis, ABPA, or fungal sinusitis
Unexplained pulmonary hemorrhage, especially in infants
Assessing exposures to molds: helpful questions
Have you seen any mold or mildew on walls, floors, ceilings, or carpets, including your basement (evidence of discolored patches or cottony or speckled growth on walls or furniture)?
Have you noticed a musty or earthy smell indoors?
Has the home been flooded?
Is there any water-damaged wood or cardboard in the house?
Has there been a roof or plumbing leak, standing water in the home or areas with chronic dampness/moisture, including the basement?
Is there often condensation (fog) on the inside of the windows and/or cold inside surfaces?
Have humidifiers or air-conditioner drip pans been checked for mold overgrowth?
Are symptoms better away from the house?
Describe your basement dwellings and conditions at school or other places where you routinely spend time.
Environmental assessment
Work with an experienced industrial hygienist or investigator.
Methods: visual inspection, bulk sampling, and air sampling of visible or culturable fungal spores.
Serologic testing may be helpful in some settings.[a]

[a] Physicians should also consider and rule out other possible non–mold-related etiologies. For symptoms attributable to mycotoxin ingestion, see text.

Environmental inspection and sampling may be useful to identify the source if there is a suspicion of mold (eg, musty odor) but no visible mold growth. In addition, environmental inspection and sampling for mold may be necessary as part of the diagnostic evaluation and treatment plan when certain medical conditions are being considered (eg, hypersensitivity pneumonitis, ABPA, or acute pulmonary hemorrhage in infants). Environmental sampling for mold may also be necessary for insurance purposes or litigation. Consultation with pediatricians who have expertise in pulmonary medicine, allergy/immunology, or environmental health or physicians who have expertise in occupational environmental health may be helpful.

If environmental sampling for mold is done, the study should be performed by professionals, such as industrial hygienists or indoor air-quality consultants, who have expertise in evaluating indoor mold/dampness problems. An industrial hygienist and contractor may work together to identify the moisture problem and conduct sampling. There is currently no formal certification process for mold evaluation; however, guidelines for appropriate evaluation have been outlined.[72,73]

In addition to visual inspection, bulk sampling (culturing materials [eg, wood, particle board suspected of mold contamination]) may be used to document whether materials are contaminated. Surface sampling (cultured swabs of surfaces) may be used to document whether discoloration on surfaces is the result of fungal growth. Reliable air sampling can be expensive and requires expertise and specialized equipment. If air sampling is conducted, an outdoor air sample should be collected at the same time for comparison. In general, the levels and types of fungi found indoors (in nonproblem buildings) should be similar to those found outdoors. Exceptions may occur (eg, when there are extremely low concentrations of mold spores outdoors after a snowfall). Higher concentrations of fungal spores, a predominance of one type of fungal spores, or a difference in types of fungi found in indoor versus outdoor air samples suggest an indoor mold problem.

Other assays to detect fungi, mycotoxins, and MVOCs in environmental samples have been developed. One caveat is that the half-life of the important mycotoxins, such as the trichothecenes, is several hours, and individuals present for medical evaluation long after the acute exposure. Thus, current mycotoxin assays of blood specimens or environmental samples can serve as important tools for researchers studying pathogenesis of disease; however, the tests have not been standardized for clinical use, and it is not clear at which levels health effects are associated.

Laboratory Tests for Human Exposure to Molds or Toxins

Because fungi produce antigenic proteins that can lead to an immunologic response, medical evaluations of people concerned about exposures to mold or fungi may include laboratory testing. Trout et al[74] recently reviewed the role of immunoassay for fungal antibodies in evaluating patients in various clinical settings. The authors concluded that immunoassays are a useful adjunct to a complete evaluation, but in general, the assays

should not be used as the only means of primary assessment. Problems include lack of standardized fungal extracts and cross-reactivity among fungal species. Although the immunoassays are suggestive of exposure to mold or fungi (which are widespread in nature), the current assays cannot specify when the exposure occurred or reliably identify the particular type of mold or fungus involved. Because of these limitations, results of the immunoassays must be interpreted in the context of the clinical setting and other supporting diagnostic tests.

Thus, detection of IgE specific to common outdoor molds by skin testing or serologic testing indicates sensitization and is supportive of fungal allergies or allergy in general. However, a positive test result does not necessarily mean that the agent is the cause of the patient's symptoms. Similarly, detection of antibody by precipitin testing is often used to confirm exposure to a suspected antigen in an evaluation for hypersensitivity pneumonitis. However, asymptomatic farmers and pigeon breeders may have positive precipitin test results.[75] Conversely, some patients with clinically confirmed hypersensitivity pneumonitis will have negative antibody test results, presumably because of poorly standardized antigens, low concentrations of IgG, or incorrect identification of the causative agent.

Currently, no tests can reliably determine if a person was exposed to *S chartarum* mold, its toxins, or other molds commonly found in damp environments. A few physicians have used immunoassays to determine if their patients have been exposed to *S chartarum* mold. However, these immunoassays for *S chartarum* have not been proven to be valid for use in clinical evaluation. For instance, an isotype-specific immunoassay developed for IgE, IgG, and IgA to *S chartarum* is cross-reactive with antibodies to *A fumigatus* and *Alternaria alternata*, 2 common outdoor fungi.[74]

In 1 small study, Barnes et al[76] found IgE and IgG directed against *S chartarum* in a general population in Kansas City, Missouri. Enzyme immunoassay indicated that 65 (49.2%) of 132 serum samples tested contained IgG against *S chartarum*, and 13 (9.4%) of 139 serum samples tested contained IgE against *S chartarum*, suggesting either that *S chartarum* antibodies developed without history of overt clinical disease or that the presence of *S chartarum* may be a false-positive result. Furthermore, persons who become ill after exposure to *S chartarum* may not develop IgG or IgE anti-*Stachybotrys* antibodies.

Presence of antibodies to hemolysin produced by *S chartarum* has been suggested as a biomarker of exposure to *S chartarum*.[77] However, additional studies are needed to determine the sensitivity and specificity of testing for these antibodies.[74] A discussion of the possible misinterpretation of *Stachybotrys* serology is available.[78]

Prevention

It is impossible to keep mold spores out of the house. They come in through windows and doors, and humans and pets bring them in from the outside. The challenge is to keep the spores from colonizing and growing. Therefore, the key to mold control is moisture control. Actions that will help reduce indoor air humidity and prevent condensation include venting appliances that produce moisture (clothes dryers and stoves) to the outside and using a bathroom fan or opening a window when showering or bathing. When there is inadequate bathroom ventilation, using a towel to wipe shower walls and turning a fan or space heater on for a short period of time may diminish excessive moisture accumulation. Dehumidifiers can be used in areas with consistently elevated humidity levels, with a target humidity level of less than 50%. Dehumidifiers reduce ambient humidity but do not significantly reduce growth on surfaces in contact with ground water. To effectively control additional growth on damp surfaces, the water source must be eliminated. Bathrooms and basements should be left uncarpeted, and other indoor organic sources such as plants, wood, and paper products should be eliminated. Outdoors, fallen leaves can harbor mold and should be collected and discarded in a timely fashion. Parents should be aware that playing on or near piles of leaves exposes their children to increased levels of mold spores. This increased exposure could contribute to increased symptoms among children with asthma/allergies.

Actions that will help prevent condensation include reducing humidity; increasing ventilation by opening doors or using fans; covering cold surfaces, such as cold water pipes, with insulation; and increasing the air temperature.

Air Cleaners

People with allergies and asthma may use certain air cleaners such as air-filtration units, electrostatic precipitators, and ozone generators to eliminate bacteria, mold, and chemical contaminants from the air. Filters on central forced-air systems and furnaces should be changed periodically, according to the manufacturers' recommendations. Upgrading to a medium-efficiency filter (rated at 20%–50%) will improve air quality and is economical. Electrostatic filters/precipitators in central furnace and air-conditioning systems may be beneficial for airborne particles but are only effective when turned on. Room high-efficiency particulate air (HEPA) filters may be beneficial. However, they only work in a single room, and the noise generated may not be acceptable.

Ozone generators often advertised as "air purifiers" are touted to cleanse the air of microbes. However, ozone-producing air-cleaning devices may produce indoor concentrations of ozone high enough to reduce lung function. A study conducted by the EPA ran an

ozone generator in a test home at its maximum setting. When the room's air was sampled, ozone levels were found exceeding 0.3 ppm. This level is equal to a stage 1 smog alert, when local air-pollution–control districts advise the public to avoid some outdoor activities. These levels far exceed some states' ambient 1-hour standard for ozone of 0.09 ppm. High ozone effectively destroys microbes in water; however, air levels must reach extremely hazardous levels (50–100 times the outdoor air-quality standards) to be effective. Other electronic air cleaners, such as electrostatic precipitators and ionizers, produce ozone as a byproduct, and certain units generate potentially unhealthy levels. These devices should be cleaned and maintained regularly to minimize ozone emissions.[79]

Air-cleaning devices such as air-filtration units and electrostatic precipitators have the capacity, in theory, to remove airborne spores. However, their effectiveness in decreasing air concentrations of spores in damp indoor spaces and decreasing respiratory symptoms are unproven.

Humidifiers

Many parents use cool-mist humidifiers or vaporizers when children have colds or when the air is dry in winter. A systematic review in the *Cochrane Database of Systematic Reviews* assessed the effects of inhaling heated water vapor in the treatment of the common cold by comparing symptoms, viral shedding, and nasal resistance after a naturally or experimentally induced common cold.[80] Six randomized trials with 319 participants were identified. The results supported the use of warm-vapor inhalations in the common cold in terms of relief of symptoms (OR: 0.31 [95% CI: 0.16 to 0.60]; relative risk: 0.56 [95% CI: 0.4 to 0.79]). Results on symptom score indices were equivocal, but none demonstrated a worsening of scores. There was no evidence of decreased viral shedding measured by virus isolation in nasal secretions or measurement of viral titers in nasal washings from the treatment group. Minor adverse effects caused by thermal stress were reported in all the studies.

The potential benefit in cold symptoms must be balanced with the risk of increased growth and exposure to house dust mites and mold with increased humidity. Therefore, the general use of humidifiers should be avoided. If used for treatment of the common cold, their use should be limited, and they must be cleaned frequently to prevent mold growth and according to the manufacturers' instructions.

Remediation

Indoor water damage and/or mold overgrowth should be remediated to avoid irritant upper respiratory effects, possible sensitization to mold, possible injury from mycotoxins, and/or exacerbation of underlying mold allergy and to avoid structural damage to the building. A Finnish case-control investigation examined whether exposure to molds in the school was associated with an increased occurrence of respiratory symptoms and whether renovation of water-damaged areas affected the respiratory health of the exposed children. Results showed a significant decrease in respiratory symptoms after renovation.[81]

Who Should Perform the Cleanup?

According to current EPA guidelines, an individual can usually clean up areas less than 10 ft.[2] If there has been a lot of water damage and/or mold growth covers more than 10 ft^2; the heating, ventilation, and air conditioning (HVAC) system is involved; or the water and/or mold damage was caused by sewage or flood water, it may be wise to consider hiring a professional and consulting the EPA guide "Mold Remediation in Schools and Commercial Buildings."[82]

Cleanup Guidelines

The CDC[83] and EPA[84] (or call 800-438-4318) offer practical guidelines for cleaning up mold problems. The main way to control mold is to remove the water source and high-humidity conditions that promote spore growth. In the event of flooding, use fans or heaters to dry out the area if it has been less than 48 hours since the flood. After 48 hours, mold may already be forming on surfaces, and the use of fans would only act to disseminate them. Certain moldy materials, such as carpets and ceiling tiles, may be difficult to clean and should be discarded. When cleaning moldy areas, individuals should take precautions to limit exposure to airborne mold. In general, nonporous surfaces with mold growth can be cleaned with soap and water. Biocides are substances that can destroy living organisms, and a biocide, such as chlorine bleach, may also be used. EPA guidelines include avoiding breathing in mold or mold spores (N-95 respirator) and wearing gloves and goggles. If possible, the person with symptoms from mold exposure should not perform the cleanup.

The CDC has published extensive guidelines for mold cleanup.[85] Advice includes removal of mold growth from hard surfaces with commercial products, soap and water, or a bleach solution of 1 cup of bleach in 1 gallon of water. For extensive mold growth after the floods of Hurricane Katrina, the CDC recommendations included use of bleach.[86] Bleach is not recommended for use on porous surfaces, because its ionic structure prevents it from penetrating the materials; it also accelerates the deterioration of materials and wears down the fibers of porous materials. The use of bleach remains controversial. The debate centers, in part, on the belief that dead mold still retains its ability to trigger reactions in susceptible hosts. The first study to test the effect of allergic

individuals of mold spores treated with common household bleach found that the bleach not only kills mold but also neutralizes the mold allergens that cause mold-related health complaints. Specifically, a spray application of sodium hypochlorite–containing disinfectants onto mold-contaminated building materials killed *A fumigatus*, modified the surface characteristics of *A fumigatus conidia*, reduced recognition of *A fumigatus* mold by enzyme-linked immunosorbent assay, and resulted in loss of skin-test reactivity to the treated mold in individuals allergic to *A fumigatus*.[87]

If bleach is used, it should not be combined with ammonia or other household cleaning products, and the area should be well ventilated during use.

ADDITIONAL CONSIDERATIONS IN MEDICAL MANAGEMENT

Patient care for mold- or dampness-related illness often focuses on medical therapy, and remediation and/or environmental control of excessive mold growth is not emphasized. If remediation is not possible, removal of the patient from the environment should be seriously considered when the condition is severe or progressive over time, especially for serious illness such as hypersensitivity pneumonitis or poorly controlled asthma.

For families who rent, many housing conditions may be beyond their immediate control. Tenants have basic housing rights, and health departments and legal aid services may be able to help.[88] Pediatricians can play an important role in advocating for patients and their families by working with the local public health department and housing officials to address these issues.

CONCLUSIONS

Cause-and-effect relationships between fungal exposure and allergic disease, asthma, and hypersensitivity pneumonitis are consistently supported by epidemiologic studies. Evidence of adverse health effects of ingested mycotoxins is also abundant. However, the best evidence of a possible causal relationship between inhaled mycotoxins and respiratory illness is a single case-control study of AIPH in infants from Cleveland. Indoor dampness, by itself, seems to be associated with increased respiratory illness and symptoms, although the exact mechanism and etiologic agents are not known. Because the indoor environment is a source of many different exposures (bacteria, tobacco smoke, dampness, dust and dust mites, pet dander, and mold), it is impossible to unequivocally attribute a cause-and-effect relationship to any one specific agent. There is substantial evidence that damp, moldy environments are unhealthy, and the CDC and the EPA have developed guidelines for cleaning up the mold and fixing the moisture problem.

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RESOURCES FOR PARENTS

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US Environmental Protection Agency. Indoor air: mold. Available at: www.epa.gov/mold

Centers for Disease Control and Prevention, Department of Health and Human Services. Mold. Available at: www.cdc.gov/mold

RESOURCE FOR PEDIATRICIANS

Storey E, Dangman KH, DeBernardo RL, et al. *Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors*. Farmington, CT: University of Connecticut, Division of Occupational and Environmental Medicine; 2004. Available at: http://oehc.uchc.edu/clinser/MOLD%20GUIDE.pdf

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Sport-Related Concussion in Children and Adolescents

Mark E. Halstead, MD, Kevin D. Walter, MD, and THE COUNCIL ON SPORTS MEDICINE AND FITNESS

KEY WORDS

concussion, sports, head injury, mild traumatic brain injury, return to play, athletes, second-impact syndrome, postconcussion syndrome

ABBREVIATIONS

CIS—concussion in sport
LOC—loss of consciousness
SAC—Standardized Assessment of Concussion
BESS—Balance Error Scoring System
SCAT2—Sport Concussion Assessment Tool 2
CT—computed tomography

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

FREE

Sport-related concussion is a "hot topic" in the media and in medicine. It is a common injury that is likely underreported by pediatric and adolescent athletes. Football has the highest incidence of concussion, but girls have higher concussion rates than boys do in similar sports. A clear understanding of the definition, signs, and symptoms of concussion is necessary to recognize it and rule out more severe intracranial injury. Concussion can cause symptoms that interfere with school, social and family relationships, and participation in sports. Recognition and education are paramount, because although proper equipment, sport technique, and adherence to rules of the sport may decrease the incidence or severity of concussions, nothing has been shown to prevent them. Appropriate management is essential for reducing the risk of long-term symptoms and complications. Cognitive and physical rest is the mainstay of management after diagnosis, and neuropsychological testing is a helpful tool in the management of concussion. Return to sport should be accomplished by using a progressive exercise program while evaluating for any return of signs or symptoms. This report serves as a basis for understanding the diagnosis and management of concussion in children and adolescent athletes. *Pediatrics* 2010;126:597–615

INTRODUCTION

Since 1999, an extensive amount of research and media coverage has been dedicated to sport-related concussions. Young athletes pose a unique challenge, because their brains are still developing and may be more susceptible to the effects of a concussion. Even 10 years ago, a young athlete with a "ding" or low-grade concussion would have been allowed to return to sports as soon as 15 minutes after his or her symptoms had cleared. Since then, more extensive research has provided medical professionals with a better understanding of the symptomatic course and risk of potential long-term complications from concussions. As a result, management has evolved. Unfortunately, many parents, coaches, and young athletes still seem to believe that youth is a period of indestructibility. Concussion education in youth and high school sports communities is complicated by the misconception that a concussion may be "toughed out" and does not require a physician visit. Research and carefully documented experience show otherwise, although to the people who believe those misconceptions, it may seem as though the landscape of managing concussion has changed overnight.

Some organizations, such as the American College of Sports Medicine and National Athletic Trainers Association, have addressed sport-

related concussions in position statements.[1,2] Three international symposia on concussion in sport (CIS) have been held since 2001, although none focused exclusively on the pediatric athlete.[3–5] Although the Canadian Paediatric Society published guidelines on the management of the pediatric concussion, new research has been conducted since that statement.[6] This report outlines the current state of knowledge on pediatric and adolescent sport-related concussions.

DEFINITION

A clear definition of concussion requires consensus among researchers, clinicians, and patients, each of whom require a different construct for understanding the injury. Some advocate using the term "concussion," and others advocate using the term "mild traumatic brain injury" (mTBI). A recent study highlighted a general misinterpretation that an injury described as a concussion is less severe than one described as mild traumatic brain injury, which may result in a premature return to school and activity.[7] In this clinical report, we will refer to the injury as concussion.

The first of 3 international symposia on CIS was held in Vienna, Austria, in 2001.[3] From that meeting came a new consensus definition for a sport-related concussion, with minor revisions occurring in the 2 subsequent symposia held in Prague, Czech Republic, in 2004[4] and Zurich, Switzerland, in 2008.[5] The Zurich statement defined concussion as "a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces"[5] and includes 5 major features:

1. Concussion may be caused either by a direct blow to the head, face, or neck or elsewhere on the body with an "impulsive" force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
3. Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness (LOC). Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that in a small percentage of cases, postconcussive symptoms may be prolonged.
5. No abnormality on standard structural neuroimaging studies is seen in concussion.

Biokinetics and Pathophysiology

The biokinetics that induce a concussion consist primarily of acceleration-deceleration and rotational forces.[8,9] It has been proposed that greater force is required to produce an injury to the pediatric brain than to the adult brain.[10] Adults typically develop more intracranial injury in association with skull fractures than do children.[11] These findings may be related to the developing brain and skull, but it is unclear whether this model applies to sport-related concussion.

The pathophysiology of a concussion, as described from animal models, starts with a disruption of the neuronal membrane, which results in a potassium efflux to the extracellular space with a subsequent release of glutamate, an excitatory amino acid.[12] Glutamate potentiates further potassium efflux, which results in the depolarization and suppression of neuronal activity. To restore ion balance, the sodium-potassium ion pumps increase activity, which results in excessive adenosine triphosphate consumption and glucose utilization.[13] Lactate accumulates and cerebral blood flow decreases, which leads to a proposed "energy crisis."[13] A large amount of calcium also accumulates in cells, which may impair oxidative metabolism and allow for the initiation of biochemical pathways that result in cell death.[13] After the increase in glucose metabolism, there is a subsequent hypometabolic state that may persist for up to 4 weeks after injury.[14,15] Because the pathophysiology has only been established from animal models, it is still unclear whether this can be applied to the sport-related concussion.[16]

Grading Scales

There are more than 25 different published grading systems for concussions.[17] They were developed through expert opinion and rely heavily on LOC and a few symptoms, such as confusion and amnesia, to determine the severity of the concussion and subsequent return to play. The 3 concussion-grading scales most commonly used are the American Academy of Neurology,[18] Colorado Medical Society,[19] and Cantu[20,21] grading systems. In recent consensus statements, the CIS group recommended abandoning the use of grading scales and endorsed using several evaluation measures to individually guide return-to-play decisions.[3–5] In the 2004 Prague statement, the CIS group subsequently introduced the classification of concussions into simple and complex groups.[4] These groups were subsequently abandoned in the 2008 Zurich statement, because the delineation was also arbitrary and not found to be useful in managing concussion.[5] The current recommendation remains the abandonment of previous grading scales for a symptom-based approach for determination of return to play.[5]

EPIDEMIOLOGY OF CONCUSSION

It is commonly reported that 300 000 sport-related concussions occur each

year, although it was estimated in a recent review that up to 3.8 million recreation- and sport-related concussions occur annually in the United States. The large variance is attributable to original estimates including concussions that only involved LOC.[22,23] This highlights the difficulty with concussion epidemiology because of underreporting and the lack of widespread use of an injury surveillance system in youth sports.[24,25] With increasing access to recreational and organized (club and school) sports, as well as better awareness and recognition of the injury, the number of diagnosed concussions will likely increase. Because of the large numbers of participants in youth and high school sports, concussions in the pediatric and adolescent age groups account for the majority of sports-related concussions.

Concussions represent an estimated 8.9% of all high school athletic injuries.[26] Data are significantly lacking about concussions in grade school and middle school athletes, which highlights the need for more research about concussions in this younger age group.

Girls are reported to have a higher rate of concussion than boys in similar sports.[26–30] The reason for this difference is unknown, although some have theorized that female athletes have weaker neck muscles and a smaller head mass than their male counterparts.[31,32] Alternatively, male athletes may be more reluctant to report their injuries for fear of removal from competition, which may result in the incidence of concussion in boys being underestimated.[24,33]

The sport with highest risk of concussion in high school is football (Table 1).[26] In girls' sports, the rate of concussion is highest in girls' soccer and girls' basketball. Rugby, ice hockey, and lacrosse also account for higher rates of concussions but are often club sports, which limits their data inclusion in the larger high school sports epidemiologic studies.[34–37]

TABLE 1 Concussion Rates in High School Sports

Sport	Injury Rate, per 1000 Athlete Exposures
Football	0.47–1.03[a,b]
Girls' soccer	0.36[a]
Boys' lacrosse	0.28–0.34[c,d]
Boys' soccer	0.22[a]
Girls' basketball	0.21[a]
Wrestling	0.18[a]
Girls' lacrosse	0.10–0.21[c,d]
Softball	0.07[a]
Boys' basketball	0.07[a]
Boys' and girls' volleyball	0.05[a]
Baseball	0.05[a]

[a] Data from Gessel LM, Fields SK, Collins CL, Dick RW, Comstock RD. Concussions among United States high school and collegiate athletes. *J Athl Train.* 2007;42(4):495–503.
[b] Data from Guskiewicz KM, Weaver NL, Padua DA, Garrett WE. Epidemiology of concussion in collegiate and high school football players. *Am J Sports Med.* 2000;28(5):643–650.
[c] Data from Lincoln AE, Hinton RY, Almqueist JL. Head, face, and eye injuries in scholastic and collegiate lacrosse: a 4-year prospective study. *Am J Sports Med.* 2007;35(2):207–215.
[d] Data from Hinton RY, Lincoln AE, Almquist JL. Epidemiology of lacrosse injuries in high school-aged girls and boys: a 3-year prospective study. *Am J Sports Med.* 2005;33(9):1305–1314.

SIGNS AND SYMPTOMS

The signs and symptoms of concussion fall into 4 categories: physical, cognitive, emotional, and sleep (Table 2).[38] Headache is the most frequently reported symptom.[39] LOC occurs in less than 10% of concussions but is an important sign that may herald the need for further imaging and intervention.[40–42] Along with LOC, amnesia may be an important indicator of more serious injury.[40] The athlete should be evaluated for retrograde (before the event) and anterograde (after the event) amnesia by asking questions about details of events before and after the injury. The symptoms of retrograde amnesia may improve over time.[43] Often, the athlete hears peers, family, and coaches discuss events surrounding the injury and, subsequently, may falsely report remembering more about the injury. Mental fogginess may be a good predictor of a slower recovery from concussion in athletes.[44]

The signs and symptoms of concussion are similar to depression, anxiety, and attention-deficit disorders. In patients with preexisting mental health disorders, concussion may exacerbate those symptoms and make them more difficult to control. It is important to monitor this population carefully and consider altering existing care plans. Patients with learning disabilities and cognitive delays will also exhibit similar signs and symptoms, which can increase the challenge of managing their concussion.

Several factors may complicate the recognition of concussion for the athlete. Athletes may not recognize that they have concussion symptoms because of poor understanding of a concussion and its associated symptoms or from cognitive impairment from the injury itself. Symptoms may not ap-

TABLE 2 Signs and Symptoms of a Concussion

Physical	Cognitive	Emotional	Sleep
Headache	Feeling mentally "foggy"	Irritability	Drowsiness
Nausea	Feeling slowed down	Sadness	Sleeping more than usual
Vomiting	Difficulty concentrating	More emotional	Sleeping less than usual
Balance problems	Difficulty remembering	Nervousness	Difficulty falling asleep
Visual problems	Forgetful of recent information		
Fatigue	Confused about recent events		
Sensitivity to light	Answers questions slowly		
Sensitivity to noise	Repeats questions		
Dazed			
Stunned			

pear until several hours after a concussive episode.[4] In addition, young athletes may not be forthcoming with their symptoms for fear of activity restrictions.

A number of immediate motor phenomena, such as tonic posturing or convulsive movements, may accompany a concussion.[5] These immediate responses are uncommon, are generally benign, and require nothing more than standard management of the underlying concussion.[5,45] Although a brief seizure immediately after a concussive impact may not be problematic, any athlete who has a seizure after concussion should be transported emergently to a medical facility for further evaluation.

An athlete may be followed through his or her recovery with the use of the postconcussion symptom scale (Table 3). Although there are several variations, a 22-item symptom list is most commonly used. The scale is a 7-point Likert scale graded from 0 (no symptoms) to 6 (severe symptoms). An athlete may be more likely to report symptoms if given a graded scale than if asked a "yes" or "no" question. These scales have validity but have not been assessed adequately for reliability.[46,47] Results of a recent analysis of various symptom scales suggest that a 13-item checklist may be more helpful, but further research is needed to validate that recommendation.[48] Symptom scales have not been adequately studied in the grade school athlete.[47] At any age, it is important to make sure the patient understands what each symptom means and is able to complete the symptom scale independent of parental influence. Athletes with preinjury depression, sleep disturbances, and/or attention-deficit/hyperactivity disorder may not be expected to have a total score of 0 on a symptom scale before considering return to play. The evaluator must take a thorough history of the patient and account for these problems when making decisions about return to play.

TABLE 3 Postconcussion Symptom Scale (no Symptoms, 0; Moderate, 3; Severe, 6)

Headache	0	1	2	3	4	5	6
Nausea	0	1	2	3	4	5	6
Vomiting	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Fatigue	0	1	2	3	4	5	6
Trouble falling to sleep	0	1	2	3	4	5	6
Excessive sleep	0	1	2	3	4	5	6
Loss of sleep	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Light sensitivity	0	1	2	3	4	5	6
Noise sensitivity	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervousness	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Numbness	0	1	2	3	4	5	6
Feeling "slow"	0	1	2	3	4	5	6
Feeling "foggy"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Visual problems	0	1	2	3	4	5	6

Use of the postconcussion symptom scale: The athlete should complete the form, on his or her own, by circling a subjective value for each symptom. This form can be used with each encounter to track progress toward symptom resolution. Many athletes may have some of these reported symptoms at a baseline, such as concentration difficulties in the patient with attention-deficit disorder or sadness in an athlete with underlying depression. This must be taken into consideration when interpreting the score. Athletes do not need a total score of 0 to return to play if they had symptoms before their concussion. This scale has not been validated to determine concussion severity.

Physical exertion and cognitive exertion, such as doing schoolwork, reading, playing video games, using a computer, and watching television, may worsen symptoms, although no link to long-term outcomes has been described. Athletes can develop symptoms during and after exertion, which indicates incomplete recovery.

INITIAL ASSESSMENT

On the Field

As with all acute head and neck injuries, initial assessment of the "ABCs" (airway, breathing, and circulation) and stabilization of the cervical spine are of the utmost importance. Cervical spine injury should be assumed in any athlete who is found to be unconscious after head or neck trauma. Maintaining adequate cervical spine stabilization is critical until neurologic function in all 4 limbs is evaluated and found to be intact and the athlete has no reported neck pain or cervical spine tenderness on palpation. If this evaluation cannot be accomplished or if a qualified medical professional is not available on the field, transport to an emergency facility is warranted. An athlete who was not unconscious or who quickly regained consciousness and is not suspected of having a cervical spine injury can be further evaluated on the sidelines.

Initial sideline evaluation should include an inquiry into the athlete's symptoms, a neurologic examination, and evaluation of the athlete's cognition by using one of several available sideline assessment tools, such as the Maddocks questions,[49] Standardized Assessment of Concussion (SAC),[50] Balance Error Scoring System (BESS),[51] or Sport Concussion Assessment Tool 2 (SCAT2).[5] The SCAT2 (Appendix 1) was released in the CIS Zurich statement as an enhanced version of the original SCAT introduced in the CIS Vienna statement and includes the majority of accepted sideline assessments in a comprehensive evaluation.[3,5]

The Maddocks questions are a brief set of questions to evaluate orientation as well as short- and long-term memory related to the sport and current game.[49] The questions are for sideline use only and are included in the SCAT2.[5] Examples of questions include "What team did you play last week?" and "Did the team win the last game?"

The BESS is an assessment of postural stability that is performed with the subject in 3 positions, first on a firm surface and then on a 10-cm-thick piece of foam. The 3 positions include

standing flat on both feet with hands placed on the iliac crests, standing on a single leg on the nondominant foot, and standing flat on both feet with eyes closed. Each assessment lasts 20 seconds. A score is obtained by totaling the number of errors the athlete makes over the 6 tests.[51] The BESS seems to have a practice effect and also seems to be affected not only by the environment in which the test is conducted but also by how soon after exercise the test is given.[52–55] There are concerns of intra-rater and inter-rater reliability as well as determining the most reliable components of the individual tests.[56,57] On the basis of these studies, it seems beneficial to test an athlete more than 15 minutes after cessation of exercise and in a setting in which he or she will be doing follow-up assessments, rather than on the sideline.

The SAC has been shown to have little to no practice effect.[52,53] Baseline assessments with an SAC test can be helpful in interpreting postinjury results. Any decrease from the baseline score on an SAC was found to be 95% sensitive and 76% specific for a concussion.[58] The SAC has not been validated for use in the grade school athlete.

The newer SCAT2 incorporates both the BESS and the SAC; however, the full SCAT2 evaluation has not been researched since its release with the Zurich concussion statement. Because the SCAT2 has not yet been studied, the Zurich statement authors recommended relying on the SAC score until prospective studies are conducted on the SCAT2.[5]

If a concussion is identified, the athlete should be removed from the remainder of the practice or game(s) on that day.[5] The athlete should continue to be monitored for several hours after the injury to evaluate for any deterioration of his or her condition. Referral to the emergency department is warranted if an athlete experiences repeated vomiting, severe or progressively worsening headache, seizure activity, unsteady gait or slurred speech, weakness or numbness in the extremities, unusual behavior, signs of a basilar skull fracture, or altered mental status resulting in a Glasgow Coma Score of less than 15.

In the Office/Emergency Department

When the athlete is evaluated initially in the office or emergency department after a concussion, a thorough history, including signs and symptoms as well as details of any previous head injuries; head and neck examination; neurologic examination, including gait and balance assessment (such as the BESS, Romberg test, and tandem gait); and assessment of cognitive function, including relevant portions of the SAC or SCAT2, should be performed. Although the use of terms such as a "ding" or "getting your bell rung" has been discouraged because they may minimize the severity of the injury, athletes may be more inclined to give a positive history if those terms are used.[59] The athlete should also be monitored for any deterioration of his or her condition. If there is concern for a structural brain abnormality, neuroimaging should be considered. Athletes and their parents or caregivers should be instructed which signs and symptoms to follow when at home and given clear guidelines on what would necessitate a return to the emergency department or pediatrician's office.[60] Even if an athlete's symptoms clear on the same day of the concussion and the assessment in the office or emergency department is normal, the athlete should not be allowed to return to play that same day. There is still debate about whether periodically waking the athlete during the night is necessary, because there may be more benefit from uninterrupted sleep than frequent awakenings, which may exacerbate symptoms.

NEUROIMAGING

Conventional neuroimaging is typically normal in a concussive injury. Routine imaging using computed tomography (CT) or MRI contributes little to concussion evaluation and management.[5] Although rare, a concussive blow can be associated with a cervical spine injury, skull fracture, or any of the 4 types of intracranial hemorrhage (subdural, epidural, intracerebral, or subarachnoid).[61]

Neuroimaging should be considered whenever suspicion of an intracranial structural injury exists. Signs and symptoms that increase the index of suspicion for more serious injury include severe headache; seizures; focal neurologic findings on examination; repeated emesis; significant drowsiness or difficulty awakening; slurred speech; poor orientation to person, place, or time; neck pain; and significant irritability.[38] Any patient with worsening symptoms should also undergo neuroimaging. Patients with LOC for more than 30 seconds may have a higher risk of intracranial injury, so neuroimaging should be considered for them.[60] Normal neuroimaging results in the acute phase of injury may not rule out a chronic subdural hematoma or subsequent neurobehavioral dysfunction.[61]

CT is the test of choice to evaluate for intracranial hemorrhage during the first 24 to 48 hours after injury.[62,63] It is also a superior imaging modality for detection of skull fractures.[64] CT is faster, more cost-effective, and easier to perform than MRI. Although numerous criteria have been developed to guide neuroimaging decisions after head trauma, none are sensitive and specific enough to diagnose all intracranial pathology.[65–69]

A 2010 Canadian study evaluated clinical criteria to determine who may be

at high risk of a structural brain injury identified on CT scan after a head injury.[70] Approximately 22% of the head injuries in this study were sport-related. Patients with a Glasgow Coma Scale score of less than 15 at 2 hours after injury, suspected open or depressed skull fracture, history of worsening headache, and irritability on examination were found to be at highest risk for a structural brain injury identified on a CT scan that needed neurosurgical intervention. One of the criteria for inclusion in this study was a witnessed LOC. Because LOC is noted in less than 10% of sport-related concussions, these criteria may not be applicable to all sport-related concussions.

MRI provides the ability to detect cerebral contusion, petechial hemorrhage, and white matter injury at a level superior to CT.[65] An MRI may be more appropriate if imaging is needed for an athlete 48 hours or longer after an injury and is best coordinated through the primary care or specialist physician evaluating the athlete. Newly emerging MRI modalities, such as gradient echo and perfusion and diffusion tensor imaging, are better than conventional MRI at detecting white matter alteration, especially in the pediatric population.[71,72] However, there is a paucity of research at this time that limits the clinical usefulness of these newer MRI modalities.

Functional imaging can be used to measure metabolic and hemodynamic changes in the brain.[71] Functional MRI is noninvasive and shows patterns that correlate with symptoms during concussion, such as more widespread brain activation while symptomatic compared with preinjury levels.[73] Other functional imaging modalities such as positron emission tomography (PET), magnetic resonance spectroscopy (MRS), and single-photon emission CT (SPECT) offer promise but are still in the early stages of development.[74] Functional neuroimaging will likely provide a more accurate picture of the injury and may help predict recovery better than structural neuroimaging, but further research and wider availability of this imaging modality is needed before it can be recommended.[74,75]

TABLE 4 Internet Resources

Computerized neuropsychological tests
US Army Medical Department, Automated Neuropsychological Assessment Metrics (ANAM): www.armymedicine.army.mil/prr/anam.html
CogState: www.cogstate.com/go/sport
Headminder: www.headminder.com
ImPACT: www.impacttest.com
Information on head injury
Centers for Disease Control and Prevention Heads Up Toolkit for High School Sports: www.cdc.gov/concussion/HeadsUp/high_school.html
Centers for Disease Control and Prevention Heads Up Toolkit for Schools: www.cdc.gov/concussion/HeadsUp/schools.html
Centers for Disease Control and Prevention Heads Up Toolkit for Physicians: www.cdc.gov/concussion/HeadsUp/physicians_tool_kit.html

NEUROPSYCHOLOGICAL TESTING

Neuropsychological testing has become more commonplace in the evaluation of the athlete with concussion as a means to provide an objective measure of brain function. Neuropsychological testing is one of several tools in the assessment of an athlete with concussion but does not independently determine if an athlete has experienced a concussion or when he or she may safely return to play.[3–5] Currently, testing is performed by using one of several computerized neuropsychological tests including ANAM (Automated Neuropsychological Assessment Metrics), CogState, HeadMinder, and ImPACT (see Table 4) or through pencil-and-paper testing administered by a neuropsychologist. ANAM was initially developed for use in the military, whereas the other tests were developed specifically for sport-related concussion.

Each of the computerized tests has published data on test-retest reliability, and all have demonstrated deficits in concussed athletes compared with their baseline assessments.[76–84] One critique of the computerized tests is that the vast majority of studies have been conducted by the developers of the tests, which raises some concern for bias, because some independent study results have suggested slightly less reliable results.[85,86] A few of these computerized tests have been widely adopted at all levels of sport participation.

More rigorous pencil-and-paper testing conducted formally by a neuropsychologist is also an option, although test-retest reliability has been questioned.[87] Given the large number of athletes with concussion and relative scarcity of neuropsychologists, accessibility to these providers may often be challenging and may not be covered by insurance carriers.[88] Although the clinical neuropsychologist is often the most experienced person to interpret neuropsychological tests, nonneuropsychologists may be trained to interpret them as well, which is an important advantage of the commercially available computerized tests.[89]

If computerized or pencil-and-paper neuropsychological testing is available, ideally a baseline or preinjury test should be obtained. Baseline testing is best performed before the start of the athlete's season. Testing should be performed in a quiet environment, free of noise or distractions, while the athlete is well rested rather than immediately after exercise. Many teams and schools will administer tests in computer laboratories proctored by a

person with experience with the test, which allows for baseline testing of large groups of athletes over a short period of time.

There are no evidence-based guidelines or validated protocols about when to administer the computerized neuropsychological test after a concussion. Some administer the test while an athlete is symptomatic to provide objective data to the family and athlete regarding the injury and again when asymptomatic to help guide return to sport. Others administer the test only after an athlete has become asymptomatic to document that the athlete's cognitive function has returned to baseline. A symptomatic athlete should not be returned to play even with normal neuropsychological testing. If no baseline test is available for the athlete, his or her results can often be compared with age-established norms for the test. Interpretation of the tests should be performed by a neuropsychologist or physician who is experienced with these tests. Further research needs to be conducted to determine the optimum time and protocol for administering the computerized neuropsychological tests.

The optimum time frame for repeating baseline neuropsychological testing, if conducted, is still not well established, especially for the developing brain. A study that evaluated high school athletes with pencil-and-paper testing found stabilization of baseline scores between the 9th and 10th grades.[90] Another study of college athletes found stable scores over a 2-year period on a computerized test.[91] One must also consider that there is a lack of published baseline data in athletes younger than 12 years. There is currently no established, validated computerized neuropsychological test for the grade school athlete, although at the time of this clinical report, a computerized test for use in athletes younger than 12 years is being developed.

If an athlete is suffering from postconcussive symptoms over several months or has had multiple concussions, formal assessment by a neuropsychologist may be beneficial, specifically to identify areas for which the athlete may need academic accommodations.

MANAGEMENT

The goal of managing a young athlete with concussion is to hasten recovery by ensuring that the athlete is aware of and avoids activities and situations that may slow recovery. It is important to stress to patients and their parents to allow adequate time for full physical and cognitive recovery. Treating young athletes with a concussion is uniquely challenging, because their brains are still developing. Unfortunately, the lack of published data on the preadolescent athlete hinders evidence-based decision-making in this age group.[92] Also, there is a lack of consensus among physicians and certified athletic trainers as to how to evaluate and treat an athlete with concussion, despite widely available published guidelines.[88,93,94]

Medication Use

At the present time, there is currently no evidence-based research regarding the use of any medication in the treatment of the concussed pediatric athlete.[95] There is no evidence demonstrating the efficacy of the common use of nonsteroidal anti-inflammatory drugs (NSAIDs) or acetaminophen in alleviating the symptoms or shortening the course of an athlete's concussion. In 1 animal study, chronic administration of ibuprofen was found to worsen cognitive outcome after a traumatic brain injury.[96] It is commonly recommended that NSAIDs or aspirin be avoided immediately after a suspected head injury for fear of potentiating the risk of intracranial bleeding. Because no studies have documented any harm from use of NSAIDs after a sport-related concussion, this remains more of a theoretic risk.

Medication may be considered for those athletes with more prolonged symptoms such as difficulty concentrating, headache, sleep disturbances, and depression. Continued medication use to control concussion symptoms indicates incomplete recovery. Before considering a return to play, any medications used to reduce symptoms must be stopped and the athlete must remain symptom-free off medication.[5]

Cognitive Rest

Many athletes will report increased symptoms with cognitive activities after a concussion, which makes intuitive sense because the concussion is a functional rather than structural injury of the brain. Athletes with concussion often have difficulty attending school and focusing on schoolwork, taking tests, and trying to keep up with assignments, especially in math, science, and foreign-language classes. Reading, even for leisure, commonly worsens symptoms.

To prevent exacerbation of the athlete's symptoms and allow for continued recovery, "cognitive rest" is recommended. This rest may include a temporary leave of absence from school, shortening of the athlete's school day, reduction of workloads in school, and allowance of more time for the athlete to complete assignments or take tests. Taking standardized tests while recovering from a concussion should be discouraged, because lower-than-expected test scores may occur.[5,97] Test scores obtained while the athlete is recovering from concussion are likely not representative of true ability. Communication with school nurses, administrators, and teachers to be sure they understand these recommendations is imperative.

After reintegration into school, a student should be allowed adequate time to make up assignments, and the overall volume of make-up work should be reduced. Because students physically look well, it is not uncommon for teachers and other school officials to underestimate the difficulties that a student is experiencing and may downplay the need for cognitive rest. Education of teachers, counselors, and school administrators regarding the cognitive effects that a concussion may have on a student is important.

Other activities that require concentration and attention, including playing video games, using a computer, and viewing television, should also be discouraged, because they may exacerbate symptoms. If phonophobia is a significant symptom, exposure to loud music or the use of portable electronic music devices with headphones should be avoided. Sunglasses may be considered for athletes with significant photophobia.[98] Athletes often have slowed reaction times after a concussion and may need to avoid driving temporarily.

Physical Rest

After a concussion, all athletes should be withheld from physical exertion until they are asymptomatic at rest. With the proposed energy crisis in the brain,[13] increased energy demand in the brain from physical activity may exacerbate symptoms and has the potential to prolong recovery.[99] An athlete in the acute phase of a concussion should be restricted from physical activity. However, results of preliminary studies that evaluated patients with postconcussion syndrome have shown potential benefit from subsymptom threshold exercise training, which involves short durations of light cardiovascular activity without inducing symptoms.[100,101] Further research needs to be conducted before making formal recommendations regarding this treatment.

Broad restrictions of physical activity should be recommended, including not only the sport or activity that resulted in the concussion but also any weight training, cardiovascular training, physical education classes, and even sexual activity.[102] Leisure activities such as bike-riding, street hockey, and skateboarding should also be restricted, because they may impose a risk of additional head injury or symptom exacerbation. Assessment of mental health is also important, because a concussion may result in depression, in part from the injury itself but also from the prolonged time away from sports, difficulties in school, and sleep disturbances.

Recent Legislation

In May 2009, the state of Washington was first to pass a law regarding concussion management in young athletes. Also known as the Zackery Lystedt law, named after the then–13-year-old who sustained a serious head injury while playing football, this law requires school boards, in conjunction with the state interscholastic activity association, to develop educational materials and guidelines for athletes, coaches, and parents. The law also requires that parents and athletes sign an informed-consent form acknowledging the dangers of concussions before participation in sports. Finally, an athlete must be removed from any game if suspected of having a concussion and may not return until evaluated and given clearance to return to play from a licensed health care professional.[103] Many other states have subsequently either passed or are considering similar legislation.

RETURN TO PLAY

Determining when an athlete returns to play after a concussion should follow an individualized course, because each athlete will recover at a different pace. Under no circumstances should pediatric or adolescent athletes with concussion return to play the same day of their concussion. The phrase, "When in doubt, sit them out!" is paramount in the management of a pediatric or adolescent concussion.[3] No athlete should return to play while still symptomatic at rest or with exertion. Although the vast majority of athletes with concussion will become asymptomatic within a week of their concussion, numerous studies have demonstrated a longer recovery of full cognitive function in younger athletes compared with college-aged or professional athletes[104–108]—often 7 to 10 days or longer.[109] Because of this longer cognitive recovery period, although they are asymptomatic, there should be a more conservative approach to deciding when pediatric and adolescent athletes can return to play.

Concussion Rehabilitation

Initially proposed in 2000 by the Canadian Academy of Sport Medicine and endorsed by the CIS group in Vienna, a graded return-to-play protocol after a concussion is recommended.[3,110] This may also be referred to as "concussion rehabilitation." Once asymptomatic at rest, the athlete progresses in a stepwise fashion (Table 5) through the protocol as long as he or she remains asymptomatic. This progress may be monitored by the parent or an athletic trainer if proper instructions are given on how to proceed. Each step should take at least 24 hours, and it will take an athlete a minimum of 5 days to progress through the protocol to resume full game participation, provided symptoms do not return. A return of symptoms indicates inadequate recovery from the concussion. If symptoms return while on the protocol, once the athlete is asymptomatic again for 24 hours, the previous step may be at-

TABLE 5 Concussion Rehabilitation/Stepwise Return to Play

Rehabilitation Stage	Functional Exercise
1. No activity	Complete physical and cognitive rest
2. Light aerobic activity	Walking, swimming, stationary cycling at 70% maximum heart rate; no resistance exercises
3. Sport-specific exercise	Specific sport-related drills but no head impact
4. Noncontact training drills	More complex drills, may start light resistance training
5. Full-contact practice	After medical clearance, participate in normal training
6. Return to play	Normal game play

Each stage in concussion rehabilitation should last no less than 24 hours with a minimum of 5 days required to consider a full return to competition. If symptoms recur during the rehabilitation program, the athlete should stop immediately. Once asymptomatic after at least another 24 hours, the athlete should resume at the previous asymptomatic level and try to progress again. Athletes should contact their health care provider if symptoms recur. Any athlete with multiple concussions or prolonged symptoms may require a longer concussion-rehabilitation program, which is ideally created by a physician who is experienced in concussion management.

tempted again. Any athlete who continues to have a return of symptoms with exertion should be reevaluated by his or her health care provider. An athlete who has recovered from prolonged postconcussion syndrome or with a history of multiple concussions may need a longer period of time to progress through each step.

PREVENTION

Although preventing all concussions is unlikely, many attempts have been made to reduce the risk of concussion for athletes. These attempts include modifications to protective gear, rule changes, trying to identify athletes at risk, and continuing to educate everyone involved with youth and high school sports about the dangers of concussions.

Mouth Guards

The use of mouth guards for reducing the risk of dental trauma is well established. The role of the mouth guard in preventing concussions is more controversial. Although several studies have evaluated various mouth guards, none have conclusively demonstrated that mouth guards reduce the risk of concussion.[111–116]At this point in time, mouth guards are recommended to reduce dental trauma, but further studies are needed to evaluate their role in reducing the risk of concussions.

Helmets/Headgear

Helmets in sports have been shown in laboratory studies to reduce impact forces to the head. However, reduction in concussion incidence has not been consistently seen, despite the use of helmets. One study evaluated newer football helmet technology in high school athletes, which demonstrated a 31% decrease in relative risk and 2.3% decrease in absolute risk for sustaining a concussion.[117] Laboratory studies of a newer helmet technology suggest a potential 10% decrease in risk of reproduced concussion hits.[118] Continued technologic advances should be applauded, but further independent research and evaluation of these advances is necessary before they can be reported to reduce concussion incidence. Helmets should be assessed to meet the requirements of the National Operating Committee on Standards for Athletic Equipment for newly constructed or reconditioned helmets and should be appropriately fit for each individual athlete.

Helmets have been demonstrated to reduce concussion incidence in skiing and snowboarding and are recommended for these sports.[119–121] In a study of concussed hockey players wearing helmets with full face shields compared with half-face shield helmets, players wearing the full face shield helmet returned to play sooner, but there was no demonstrated decrease in risk or incidence of concussion between the 2 groups.[122]

Results of soccer headgear studies have revealed mild protection from concussion from players colliding heads but not from heading the ball.[123] Headgear seems to protect against soft-tissue injuries, such as lacerations, contusions, and abrasions, and is more likely to be worn by female soccer players.[123,124] Most studies have been found to have significant limitations in evaluating the potential for reducing concussions.[125] Prospective data are not currently sufficient to support recommending universal use of headgear in soccer.[126] Heading the ball in soccer is felt to be safe, if performed properly.[126] Avoiding heading does not prevent concussions.[126]

Genetic Testing

The presence of genetic markers (eg, apolipoprotein E4 gene, S-100 calcium-binding protein gene) and neuron-specific enolase have been evaluated as possible predisposing risk factors for concussion. However, the few studies conducted on younger athletes have not demonstrated significant differences in head injury characteristics or outcomes of athletes who possess these genetic markers.[127–129]At this time, genetic testing is not recommended for evaluating young athletes with concussion.

Education

Education and recognition remain the most important components of improving the care of athletes with concussions. Education should target all the key individuals involved, including athletes, parents, coaches, school administrators, athletic directors, teachers, athletic trainers, physicians, and other health care providers. Previous studies have demonstrated poor knowledge of concussion recognition

and management by players, coaches, and even clinicians.[130–133]

In 2005, the Centers for Disease Control and Prevention (CDC) published a series of concussion toolkits, titled "Heads Up," for coaches, practicing clinicians, teachers, and school counselors. These toolkits are available free from the CDC via the Internet.[134] A survey of coaches showed high satisfaction with the CDC toolkit.[135]

COMPLICATIONS

Long-term Effects

The long-term effects of concussions in athletes of all ages are cause for considerable concern. With a lack of long-term prospective studies in high school and younger athletes who sustained concussions, there are more questions than conclusive answers. An 18-year-old multisport athlete with a history of concussions from football was reported to have autopsy findings of chronic traumatic encephalopathy, previously only reported in professional football players and professional boxers.[136,137]

Athletes with 3 or more concussions are more likely to have had LOC, postevent amnesia, confusion, and 3 to 4 abnormal on-field markers of concussion.[138] Three months after a concussion, children 8 to 16 years of age have been found to have persistent deficits in processing complex visual stimuli.[139] Athletes with 2 or more concussions who had not been concussed in the previous 6 months performed similarly on neuropsychological testing as did athletes without a history of concussions who were concussed within in the previous week.[140] Compared with similar students without a history of concussion, athletes with 2 or more concussions also demonstrate statistically significant lower grade-point averages.[140] More research is needed to investigate the long-term effects of concussions at all ages of childhood and adolescence.

Second-Impact Syndrome

Second-impact syndrome occurs when an athlete who has sustained an initial head injury sustains a second head injury before the symptoms associated with the first have fully cleared. Second-impact syndrome results in cerebral vascular congestion, which often can progress to diffuse cerebral swelling and death.[141]

Although there is debate whether the cerebral swelling is attributable to 2 separate hits or a single hit, there is no question that pediatric and adolescent athletes seem to be at the highest risk of this rare condition, because all reported cases are of athletes younger than 20 years.[142] In addition, since 1945, more than 90% of the head injury–related fatalities from sports recorded by the National Center for Catastrophic Sports Injury Research occurred in athletes in high school or younger.[143] Catastrophic football head injuries are 3 times more likely to occur in high school athletes than in college athletes.[144]

Postconcussion Syndrome

A clear definition for postconcussion syndrome does not exist. The World Health Organization (WHO) established a definition of the presence of 3 or more of the following symptoms after a head injury: headache; dizziness; fatigue; irritability; difficulty with concentrating and performing mental tasks; impairment of memory; insomnia; and reduced tolerance to stress, emotional excitement, or alcohol.[145] However, the WHO definition does not specify a minimum duration of these symptoms to make the diagnosis.

Postconcussion syndrome is defined in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* as 3 months' duration of 3 or more of the following symptoms: fatigue; disordered sleep; headache; vertigo/dizziness; irritability or aggressiveness; anxiety or depression; personality changes; and/or apathy. Younger patients often demonstrate significant decline in school performance. Neuropsychological testing usually demonstrates difficulty in attention or memory.[146]

A recently proposed definition of postconcussive syndrome is the presence of cognitive, physical, or emotional symptoms of a concussion lasting longer than expected, with a threshold of 1 to 6 weeks of persistent symptoms after a concussion to make the diagnosis.[147]

Retirement From Sports

As with determining return to play, determining when to retire an athlete from 1 or multiple sports is often difficult for all involved. No evidence-based guidelines exist for the consideration of retiring an athlete from a sport.[148] It has been proposed that any athlete who has sustained 3 concussions in an individual season or has had postconcussive symptoms for more than 3 months should be strongly considered for a prolonged period of time away from sports.[149,150] If a clinician is not comfortable making a determination about the length of time to withhold the athlete from sports or is contemplating permanent removal from sports, referral to a specialist with expertise in sport-related concussion is recommended.

CONCLUSIONS AND GUIDANCE FOR CLINICIANS

1. Sport-related concussions are common in youth and high school sports. Limited data are available on concussions in grade school athletes, and further research is needed.
2. Concussion has many signs and symptoms, some of which overlap

with other medical conditions. LOC is uncommon, and if it lasts longer than 30 seconds, it may indicate more significant intracranial injury.

3. Results of structural neuroimaging, such as CT or MRI, generally are normal with a concussion.
4. Neuropsychological testing can be helpful to provide objective data to athletes and their families after a concussion. Neuropsychological testing is 1 tool in the complete management of a sport-related concussion and alone does not make a diagnosis or determine when return to play is appropriate.
5. Athletes with concussion should rest, both physically and cognitively, until their symptoms have resolved both at rest and with exertion. Teachers and school administrators should work with students to modify workloads to avoid exacerbation of symptoms.
6. The signs and symptoms of a concussion typically resolve in 7 to 10 days in the majority of cases. Some athletes, however, may take weeks to months to recover.
7. Any pediatric or adolescent athlete who sustains a concussion should be evaluated by a health care professional, ideally a physician with experience in concussion management, and receive medical clearance before returning to play.
8. Pediatric and adolescent athletes should never return to play while symptomatic at rest or with exertion. Athletes also should not be returned to play on the same day of the concussion, even if they become asymptomatic. The recovery course is longer for younger athletes than for college and professional athletes, and a more conservative approach to return to play is warranted.
9. The long-term effects of concussion are still relatively unknown, and further longitudinal research is needed to offer further guidance to athletes of all ages.
10. Education about sport-related concussion is integral to helping improve awareness, recognition, and management.
11. The safety and efficacy of medications in the management of sport-related concussion has not been established.
12. Retirement from contact or collision sports may be necessary for the athlete with a history of multiple concussions or with long symptomatic courses after his or her concussion.
13. New evidence-based protocols for the diagnosis and management of concussion should be incorporated into pediatric training modules and competencies.

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SCAT2

Sport Concussion Assessment Tool 2

Name

Sport/team

Date/time of injury

Date/time of assessment

Age Gender M F

Years of education completed

Examiner

What is the SCAT2?[1]

This tool represents a standardized method of evaluating injured athletes for concussion and can be used in athletes aged from 10 years and older. It supersedes the original SCAT published in 2005[2]. This tool also enables the calculation of the Standardized Assessment of Concussion (SAC)[3,4] score and the Maddocks questions[5] for sideline concussion assessment.

Instructions for using the SCAT2

The SCAT2 is designed for the use of medical and health professionals. Preseason baseline testing with the SCAT2 can be helpful for interpreting post-injury test scores. Words in Italics throughout the SCAT2 are the instructions given to the athlete by the tester.

This tool may be freely copied for distribtion to individuals, teams, groups and organizations.

What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific symptoms (like those listed below) and often does not involve loss of consciousness. Concussion should be suspected in the presence of **any one or more** of the following:

- Symptoms (such as headache), or
- Physical signs (such as unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour.

Any athlete with a suspected concussion should be REMOVED FROM PLAY, medically assessed, monitored for deterioration (i.e., should not be left alone) and should not drive a motor vehicle.

Symptom Evaluation

How do you feel?

You should score yourself on the following symptoms, based on how you feel now.

	none	mild			moderate		severe
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6

Total number of symptoms (Maximum possible 22)

Symptom severity score
(Add all scores in table, maximum possible: 22 x 6 = 132)

Do the symptoms get worse with physical activity? Y N

Do the symptoms get worse with mental activity? Y N

Overall rating

If you know the athlete well prior to the injury, how different is the athlete acting compared to his / her usual self? Please circle one response.

no different	very different	unsure

APPENDIX 1
THE SCAT2.

Cognitive & Physical Evaluation

1 Symptom score (from page 1)

22 **minus** number of symptoms ____ of 22

2 Physical signs score

Was there loss of consciousness or unresponsiveness? ☐ Y ☐ N

If yes, how long? ____ minutes

Was there a balance problem/unsteadiness? ☐ Y ☐ N

Physical signs score (1 point for each negative response) ____ of 2

3 Glasgow coma scale (GCS)

Best eye response (E)

No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4

Best verbal response (V)

No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5

Best motor response (M)

No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6

Glasgow Coma score (E + V + M) ____ of 15

GCS should be recorded for all athletes in case of subsequent deterioration.

4 Sideline Assessment – Maddocks Score

"I am going to ask you a few questions, please listen carefully and give your best effort."

Modified Maddocks questions (1 point for each correct answer)

At what venue are we at today?	0	1
Which half is it now?	0	1
Who scored last in this match?	0	1
What team did you play last week/game?	0	1
Did your team win the last game?	0	1

Maddocks score ____ of 5

Maddocks score is validated for sideline diagnosis of concussion only and is not included in SCAT 2 summary score for serial testing.

5 Cognitive assessment

Standardized Assessment of Concussion (SAC)

Orientation (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1

Orientation score ____ of 5

Immediate memory

"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order."

Trials 2 & 3:

"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."

Complete all 3 trials regardless of score on trial 1 & 2. Read the words at a rate of one per second. Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do not inform the athlete that delayed recall will be tested.

List	Trial 1	Trial 2	Trial 3	Alternative word list		
elbow	0 1	0 1	0 1	candle	baby	finger
apple	0 1	0 1	0 1	paper	monkey	penny
carpet	0 1	0 1	0 1	sugar	perfume	blanket
saddle	0 1	0 1	0 1	sandwich	sunset	lemon
bubble	0 1	0 1	0 1	wagon	iron	insect
Total						

Immediate memory score ____ of 15

Concentration

Digits Backward:

"I am going to read you a string of numbers and when I am done, you repeat them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."

If correct, go to next string length. If incorrect, read trial 2. One point possible for each string length. Stop after incorrect on both trials. The digits should be read at the rate of one per second.

		Alternative digit lists		
4-9-3	0 1	6-2-9	5-2-6	4-1-5
3-8-1-4	0 1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0 1	1-5-2-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0 1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6

Months in Reverse Order:

"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November ... Go ahead"

1 pt. for entire sequence correct

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan 0 1

Concentration score ____ of 5

[1] This tool has been developed by a group of international experts at the 3rd International Consensus meeting on Concussion in Sport held in Zurich, Switzerland in November 2008. The full details of the conference outcomes and the authors of the tool are published in British Journal of Sports Medicine, 2009, volume 43, supplement 1.
The outcome paper will also be simultaneously co-published in the May 2009 issues of Clinical Journal of Sports Medicine, Physical Medicine & Rehabilitation, Journal of Athletic Training, Journal of Clinical Neuroscience, Journal of Science & Medicine in Sport, Neurosurgery, Scandinavian Journal of Science & Medicine in Sport and the Journal of Clinical Sports Medicine.

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APPENDIX 1
Continued.

6 Balance examination

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[6]. A stopwatch or watch with a second hand is required for this testing.

Balance testing

"I am now going to test your balance. Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."

(a) Double leg stance:
"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."

(b) Single leg stance:
"If you were to kick a ball, which foot would you use? [This will be the dominant foot] *Now stand on your non-dominant foot. The dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

(c) Tandem stance:
*"Now stand heel-to-toe with your **non-dominant foot** in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

Balance testing – types of errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If a athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

Which foot was tested: ☐ Left ☐ Right
(i.e. which is the **non-dominant** foot)

Condition	Total errors
Double Leg Stance (feet together)	of 10
Single leg stance (non-dominant foot)	of 10
Tandem stance (non-dominant foot at back)	of 10
Balance examination score (30 **minus** total errors)	of 30

7 Coordination examination

Upper limb coordination

Finger-to-nose (FTN) task: *"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended). When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose as quickly and as accurately as possible."*

Which arm was tested: ☐ Left ☐ Right

Scoring: 5 correct repetitions in < 4 seconds = 1

Note for testers: Athletes fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. Failure should be scored as 0.

Coordination score of 1

8 Cognitive assessment

Standardized Assessment of Concussion (SAC)

Delayed recall

"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."

Circle each word correctly recalled. Total score equals number of words recalled.

List	Alternative word list		
elbow	candle	baby	finger
apple	paper	monkey	penny
carpet	sugar	perfume	blanket
saddle	sandwich	sunset	lemon
bubble	wagon	iron	insect

Delayed recall score of 5

Overall score

Test domain	Score
Symptom score	of 22
Physical signs score	of 2
Glasgow Coma score (E + V + M)	of 15
Balance examination score	of 30
Coordination score	of 1
Subtotal	**of 70**
Orientation score	of 5
Immediate memory score	of 5
Concentration score	of 15
Delayed recall score	of 5
SAC subtotal	**of 30**
SCAT2 total	**of 100**
Maddocks Score	**of 5**

Definitive normative data for a SCAT2 "cut-off" score is not available at this time and will be developed in prospective studies. Embedded within the SCAT2 is the SAC score that can be utilized separately in concussion management. The scoring system also takes on particular clinical significance during serial assessment where it can be used to document either a decline or an improvement in neurological functioning.

Scoring data from the SCAT2 or SAC should not be used as a stand alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion.

APPENDIX 1
Continued.

Athlete Information

Any athlete suspected of having a concussion should be removed from play, and then seek medical evaluation.

Signs to watch for

Problems could arise over the first 24-48 hours. You should not be left alone and must go to a hospital at once if you:

- Have a headache that gets worse
- Are very drowsy or can't be awakened (woken up)
- Can't recognize people or places
- Have repeated vomiting
- Behave unusually or seem confused; are very irritable
- Have seizures (arms and legs jerk uncontrollably)
- Have weak or numb arms or legs
- Are unsteady on your feet; have slurred speech

Remember, it is better to be safe.
Consult your doctor after a suspected concussion.

Return to play

Athletes should not be returned to play the same day of injury. When returning athletes to play, they should follow a stepwise symptom-limited program, with stages of progression. For example:

1. rest until asymptomatic (physical and mental rest)
2. light aerobic exercise (e.g. stationary cycle)
3. sport-specific exercise
4. non-contact training drills (start light resistance training)
5. full contact training after medical clearance
6. return to competition (game play)

There should be approximately 24 hours (or longer) for each stage and the athlete should return to stage 1 if symptoms recur. Resistance training should only be added in the later stages.
Medical clearance should be given before return to play.

Tool	Test domain	Time	Score			
		Date tested				
		Days post injury				
SCAT2	Symptom score					
	Physical signs score					
	Glasgow Coma score (E + V + M)					
	Balance examination score					
	Coordination score					
SAC	Orientation score					
	Immediate memory score					
	Concentration score					
	Delayed recall score					
	SAC Score					
Total	**SCAT2**					
Symptom severity score (max possible 132)						
Return to play			☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N

Additional comments

Concussion injury advice (To be given to concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. It is expected that recovery will be rapid, but the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, dizziness, worsening headache, double vision or excessive drowsiness, please telephone the clinic or the nearest hospital emergency department immediately.

Other important points:

- **Rest and avoid strenuous activity for at least 24 hours**
- **No alcohol**
- **No sleeping tablets**
- **Use paracetamol or codeine for headache. Do not use aspirin or anti-inflammatory medication**
- **Do not drive until medically cleared**
- **Do not train or play sport until medically cleared**

Clinic phone number

Patient's name

Date/time of injury

Date/time of medical review

Treating physician

Contact details or stamp

APPENDIX 1
Continued.

American Academy of Pediatrics
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Guidance for the Clinician in Rendering Pediatric Care

Clinical Report—Sports Drinks and Energy Drinks for Children and Adolescents: Are They Appropriate?

abstract

FREE

Sports and energy drinks are being marketed to children and adolescents for a wide variety of inappropriate uses. Sports drinks and energy drinks are significantly different products, and the terms should not be used interchangeably. The primary objectives of this clinical report are to define the ingredients of sports and energy drinks, categorize the similarities and differences between the products, and discuss misuses and abuses. Secondary objectives are to encourage screening during annual physical examinations for sports and energy drink use, to understand the reasons why youth consumption is widespread, and to improve education aimed at decreasing or eliminating the inappropriate use of these beverages by children and adolescents. Rigorous review and analysis of the literature reveal that caffeine and other stimulant substances contained in energy drinks have no place in the diet of children and adolescents. Furthermore, frequent or excessive intake of caloric sports drinks can substantially increase the risk for overweight or obesity in children and adolescents. Discussion regarding the appropriate use of sports drinks in the youth athlete who participates regularly in endurance or high-intensity sports and vigorous physical activity is beyond the scope of this report. *Pediatrics* 2011;127:1182–1189

Sports and energy drinks are a large and growing beverage industry now marketed to children and adolescents for a variety of uses. Marketing strategies for sports drinks suggest optimization of athletic performance and replacement of fluid and electrolytes lost in sweat during and after exercise, and marketing strategies for energy drinks purport a boost in energy, decreased fatigue, enhanced concentration, and mental alertness. Sports drinks are different products than energy drinks; therefore, the terms should not be used interchangeably. Sports drinks are flavored beverages that often contain carbohydrates, minerals, electrolytes (eg, sodium, potassium, calcium, magnesium), and sometimes vitamins or other nutrients. Although the term "energy" can be perceived to imply calories, energy drinks typically contain stimulants, such as caffeine and guarana, with varying amounts of carbohydrate, protein, amino acids, vitamins, sodium, and other minerals.

With children and adolescents, careful consideration is necessary when selecting a beverage to hydrate before, during, or after exercise and outside of physical activity to prevent excessive sugar and caloric intake that may encourage dental erosion, overweight, and obesity.[1]

COMMITTEE ON NUTRITION AND THE COUNCIL ON SPORTS MEDICINE AND FITNESS

KEY WORDS

sport drinks, energy drinks, obesity, caffeine

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Pediatric athletes can benefit from using sports drinks that contain carbohydrates, protein, or electrolytes[2]; however, for the average child engaged in routine physical activity, the use of sports drinks in place of water on the sports field or in the school lunchroom is generally unnecessary. Stimulant-containing energy drinks have no place in the diets of children or adolescents.[3] Excessive regular consumption of carbohydrate-containing beverages increases overall daily caloric intake without significant additional nutritional value. Therefore, frequent consumption adversely affects the appropriate balance of carbohydrate, fat, and protein intakes needed for optimal growth, development, body composition, and health. This report defines and categorizes selected popular sports and energy drinks, reviews their contents, and examines the evidence for and against the use of sports and energy drinks in children and adolescents. Recommendations are provided for counseling patients, parents, government policy-makers, and administrators who run both school programs and youth sports organizations with regard to appropriate use of sports drinks. It is not intended to be a guide for the use or effectiveness of these drinks in children and adolescents involved in competitive endurance, repeated-bout sports (such as tournaments in which the athlete may have prolonged exposure to a hot, humid environment or be subjected to prolonged, repetitive exercise, often without adequate recovery time in between competitions), or other prolonged vigorous physical activities, because these uses have been reviewed elsewhere.[4]

DEVELOPMENT OF THIS REPORT

The American Academy of Pediatrics Committee on Nutrition (CON) and Council on Sports Medicine and Fitness (COSMF) conducted a thorough review of the literature from 2000 to 2009. Various approaches were used, including numerous PubMed searches. Reference lists from related studies, reviews, editorials, and position statements from other professional organizations were used. Search terms included sports drinks, energy drinks, children, and adolescents. The recent Institute of Medicine report on school health[3] and position statements on this subject from the American Dietetic Association and American College of Sports Medicine[2] were reviewed for this report. Comments were solicited from committees, sections, and councils of the American Academy of Pediatrics; 7 entities responded. For recommendations for which high levels of evidence are absent, the expert opinions and suggestions of the CON, the COSMF, and other groups/authorities consulted were taken into consideration in development of this clinical report.

DEFINITION AND CATEGORIZATION OF SPORTS DRINKS VERSUS ENERGY DRINKS

Sports drinks are beverages that may contain carbohydrates, minerals, electrolytes, and flavoring and are intended to replenish water and electrolytes lost through sweating during exercise. In contrast, the term "energy drink" refers to a very different type of beverage. Today's energy drinks also contain substances that act as nonnutritive stimulants, such as caffeine, guarana, taurine, ginseng, L-carnitine, creatine, and/or glucuronolactone, with purported ergogenic or performance-enhancing effects. Tables 1 and 2 list some popular commercially available sports drinks and energy drinks and their respective contents.

COMPONENTS OF SPORTS AND ENERGY DRINKS AND THEIR INDICATIONS

Water

Water is an essential part of the daily diet. Adequate hydration is necessary for maintaining normal cardiovascular, thermoregulatory, and many other physiologic functions during exercise and routine daily activity. In children, maturation and body size are the primary determinants of the necessary daily water intake. The quantity of water needed to maintain a euvolemic state is influenced by a number of fac-

TABLE 1 Contents of a Sampling of Sports Drinks per Serving (240 mL [8 oz])

Product	Manufacturer	Calories	Carbohydrate, g	Sodium, mg	Potassium, mg	Vitamins	Other
All Sport Body Quencher	All Sport, Inc	60	16	55	60	C	—
All Sport Naturally Zero	All Sport, Inc	0	0	55	60	B_3, B_5, B_6, B_{12}	—
Gatorade	PepsiCo Inc	50	14	110	30	—	—
Gatorade Propel	PepsiCo Inc	10	3	35	—	B_3, B_5, B_6, B_{12}, C, E	—
Gatorade Endurance	PepsiCo Inc	50	14	200	90	—	Calcium, magnesium
Gatorade G2	PepsiCo Inc	20	5	110	30	—	—
Powerade Zero	Coca-Cola Company	0	0	100	25	B_3, B_6, B_{12}	—
Powerade	Coca- Cola Company	78	19	54	—	—	Iron
Powerade Ion4	Coca-Cola Company	50	14	100	25	B_3, B_6, B_{12}	—
Accelerade	Pacific Health Laboratories, Inc	80	15	120	15	E	Calcium, protein

Selection of the specific sports drinks listed was based on the most commonly available products at the time this report was under development.

TABLE 2 Contents of a Sampling of Energy Drinks per Serving (240 mL [8 oz])

Product	Manufacturer	Calories	Carbohydrate, g	Sodium, mg	Potassium, mg	Caffeine, mg	Calcium, mg	Vitamins	Taurine, mg	Guarana, mg	Other
Java Monster	Hansen Natural Corporation	100	17	340	240	[a]	180	A, B_2, B_3, B_6, B_{12}, C, D	1000	[a]	Inositol, ginseng, L-carnitine, glucuronolactone, phosphorus
Java Monster Lo-Ball	Hansen Natural Corporation	50	6	230	60	[a]	90	B_2, B_3, B_6, B_{12}, C, D	—	—	Inositol, ginseng, L-carnitine, glucuronolactone, phosphorus
Monster Energy	Hansen Natural Corporation	100	27	180	—	[a]	—	B_2, B_3, B_6, B_{12}, C	1000	[a]	Inositol, L-carnitine, ginseng, glucuronolactone
Monster Low Carb	Hansen Natural Corporation	10	3	180	—	[a]	—	B_2, B_3, B_6, B_{12}	1000	[a]	Inositol, L-carnitine, ginseng, glucuronolactone
Red Bull	Red Bull GmbH	106	27	193	—	77	—	B_3, B_5, B_6, B_{12}	[a]	—	Inositol, glucuronolactone
Red Bull Sugar Free	Red Bull GmbH	9.6	3	193	—	77	—	B_3, B_5, B_6, B_{12}	[a]	—	Inositol, glucuronolactone
Power Trip Original Blue	Power Trip Beverages, Inc	100	26	190	—	105	—	B_3, B_5, B_6, B_{12}, C	1000	23	Inositol, glucuronolactone
Power Trip "0"	Power Trip Beverages, Inc	5	0	190	—	105	—	B_3, B_5, B_6, B_{12}, C	1000	23	Inositol, glucuronolactone
Power Trip the Extreme	Power Trip Beverages, Inc	110	30	130	—	110	—	B_2, B_3, B_5, B_6, B_{12}, C	1300	30	Inositol, glucuronolactone
Rockstar Original	Rockstar, Inc	140	31	40	—	80	—	B_2, B_3, B_5, B_6, B_{12}	1000	25	Ginseng, inositol, ginkgo, L-carnitine
Rockstar Sugar Free	Rockstar, Inc	10	0	125	—	80	—	B_2, B_3, B_5, B_6, B_{12}	1000	25	Ginseng, inositol, ginkgo, L-carnitine
Full Throttle	Coca-Cola Company	110	28	85	—	[a]	—	B_3, B_5, B_6, B_{12}	—	—	—

Selection of the specific energy drinks listed was based on the most commonly available products at the time this report was under development.
[a] The amount was not specified on the nutritional content label.

tors such as diet, medications, illnesses, and chronic health conditions. With exercise, daily water needs can increase quickly and dramatically on the basis of environmental conditions (eg, heat, humidity, sun exposure), exercise time and intensity, heat-acclimatization state, and individual sweat rates. Therefore, a deliberate increase in water intake is frequently required during exercise to avoid significant dehydration and related health consequences such as heat illness.[5]

Dehydration is caused by a mismatch between body water loss (through sweating, respiration, urine production, and fecal loss), and water intake. Significant dehydration can be associated with premature fatigue, impaired sports performance, cognitive changes, possible electrolyte abnormalities (sodium deficit), and increased risk of heat illness.[6,7] Effective management of hydration, which optimizes performance and minimizes risk of heat illness in the setting of prolonged vigorous sports participation, is complex and beyond the scope of this report. Children and adolescents should be taught to drink water routinely as an initial beverage of choice as long as daily dietary caloric and other nutrient (eg, calcium, vitamins) needs are being met. Water is also generally the appropriate first choice for hydration before, during, and after most exercise regimens. Children should have free access to water, particularly during school hours.[1,2]

Carbohydrates

Carbohydrates are the most important source of energy for an active child or adolescent. However, daily carbohydrate intake must be balanced with adequate intake of protein, fat, and other nutrients. In general, there is little need for carbohydrate-containing beverages other than the recommended daily intake of fruit juice and low-fat

milk. However, for youth who exercise with prolonged vigorous intensity, blood glucose becomes an increasingly important energy source as muscle glycogen stores decrease and the use of circulating (blood) carbohydrates rises, which results in a need to supply an ongoing carbohydrate energy substrate to avert fatigue and maintain performance. The use of a carbohydrate-containing beverage by a child or adolescent in this situation is the most appropriate use of a commercial sports drink. The carbohydrate content of sports and energy drinks varies widely. Sports drinks contain 2 to 19 g of carbohydrates (glucose and fructose forms) per serving (240 mL [8 oz]), and the carbohydrate content of energy drinks ranges from 0 to 67 g per serving. The caloric content of sports drinks is 10 to 70 calories per serving, and the caloric content of energy drinks ranges from 10 to 270 calories per serving (Tables 1 and 2). Excessive intake of carbohydrate-containing beverages beyond what is needed to replenish the body during or after prolonged vigorous exercise is unnecessary and should be discouraged.[8] Sports and energy drinks are not indicated for use during meals or snacks as a replacement for low-fat milk or water. Excessive caloric intake can result from routine dietary intake of carbohydrate-containing beverages such as sports drinks, energy drinks, or soft drinks. This excessive caloric intake can substantially increase the risk for overweight and obesity in children and adolescents and should be avoided.[1,2]

Caffeine and Other Stimulants

Many children and adolescents perceive the need to increase or boost energy levels. The body's need for energy in the form of carbohydrate and other dietary fuel sources is best provided through balanced nutrition. Energy drinks often provide carbohydrate, but the primary source of energy in these drinks is caffeine—one of the most popular stimulants taken today. It is unfortunate that many young people knowingly ingest large amounts of caffeine in a variety of forms despite the fact that regular intake has many noted negative health effects.

Caffeine has been shown to enhance physical performance in adults by increasing aerobic endurance and strength, improving reaction time, and delaying fatigue.[9–11] However, these effects are extremely variable, dose dependent, and, most importantly, have not been studied in children and adolescents. Ergogenic effects have been reported with doses of 3 to 6 mg/kg. Some athletes who desire to achieve performance enhancement may voluntarily reach daily caffeine intakes of up to 13 mg/kg of body weight.

Caffeine is absorbed by all body tissues. It is structurally similar to adenosine and, thus, can bind in its place to cell membrane receptors, which results in a subsequent block of adenosine's actions. The effects of caffeine on various organ systems include increases in heart rate, blood pressure, speech rate, motor activity, attentiveness, gastric secretion, diuresis, and temperature. Sleep disturbances or improved moods are considered variable and individualized effects.[12–17] Caffeine can increase anxiety in those with anxiety disorders,[17] and it is known also to play a role in triggering arrhythmias.[18]

There is heightened awareness of the risks of caffeine use, abuse, and even toxicity in children and adolescents.[19,20] In 2005, the American Association of Poison Control Centers reported more than 4600 calls received for questions regarding caffeine. Of these calls, 2600 involved patients younger than 19 years, and 2345 patients required treatment, although the number of pediatric patients who required treatment was not defined.[21,22] Energy drinks contain large and varied amounts of caffeine, often much more per serving than cola. Parents and children should be cautioned about the difficulties in being aware of how much caffeine is ingested depending on the product and the serving size, as differentiated from the product size. The actual caffeine content for many energy drinks is not easily identified on product packaging or via the Internet. The total amount of caffeine contained in some cans or bottles of energy drinks can exceed 500 mg (equivalent to 14 cans of common caffeinated soft drinks) and is clearly high enough to result in caffeine toxicity.[23] A lethal dose of caffeine is considered to be 200 to 400 mg/kg.[24]

Additional concerns regarding the use of caffeine in children include its effects on the developing neurologic and cardiovascular systems[14] and the risk of physical dependence and addiction. Because of the potentially harmful adverse effects and developmental effects of caffeine, dietary intake should be discouraged for all children.[14,20] Avoidance of caffeine in young people poses a great societal challenge because of the widespread availability of caffeine-containing substances and a lack of awareness of potential risks. The primary dietary source of caffeine for children is soft drinks, which contain approximately 24 mg per serving (240 mL [8 oz]).[25] Ellison et al[26] reported that children 6 to 10 years old ingested caffeine on an average of 8 of 10 days. Other authors have reported variable caffeine intakes of up to 16 mg/day by 7- to 8-year-olds, 24 mg/day by 9- to 10-year-olds, and 37.4 mg/day by 5- to 18-year-olds.[27] Symptoms of caffeine withdrawal include headache, fatigue, decreased alertness, drowsiness, difficulty concentrating, decreased desire to socialize, flulike symptoms, irritability, depressed

mood, muscle pain or stiffness, and nausea or vomiting.[28]

Guarana

Guarana is a plant extract that contains caffeine.[29] It is marketed to increase energy, enhance physical performance, and promote weight loss. One gram of guarana is equal to approximately 40 mg of caffeine.[30] Thus, the presence of guarana in an energy drink is a cause for concern, because it increases the total caffeine level in the beverage.[31]

Electrolytes

Electrolytes (primarily sodium and potassium) are often found in sports and energy drinks (Tables 1 and 2). Sodium content varies from approximately 25 to 200 mg, and potassium content generally ranges from 30 to 90 mg per serving (240 mL [8 oz]). For most children and adolescents, daily electrolyte requirements are met sufficiently by a healthy balanced diet; therefore, sports drinks offer little to no advantage over plain water.[32] During or after participation in short training or competition sessions, athletes generally do not need supplemental electrolyte replacement. However, caution should be taken with athletes who are inappropriately restricting their dietary sodium or who drink excessive amounts of water, because they may be more susceptible to serious electrolyte abnormalities. Electrolyte-replacement requirements in the setting of prolonged vigorous exercise or in excessively hot or humid conditions vary widely because of large variations in sweat rates. Severe electrolyte abnormalities that occur in each of these settings are serious and potentially life-threatening situations and are discussed in detail elsewhere.[5,32]

Amino Acids/Protein

Specific amino acids are added to some sports and energy drinks (Table 2). Protein has been shown to enhance muscle recovery when ingested promptly after exercise; accordingly, a small subset of sports drinks that contain protein or amino acids are often marketed as "muscle-recovery drinks." The ingestion of protein (the major source of amino acids) should occur throughout the day as part of a normal diet to allow the body free access to necessary amino acids. Most children and adolescents who eat a well-balanced diet easily get their recommended daily allowance of protein (1.2–2.0 g of protein per kg), even those who are engaged in regular sports activities.[33] If a food source of protein is unavailable, an amino acid–containing sports drink can be used immediately after prolonged vigorous exercise for muscle recovery. Low-fat milk is a good option for use as a postexercise protein-recovery drink. The optimal ratio of carbohydrate/protein intake is likely individual and is affected by personal tolerance, dietary practices, metabolism, and exercise type and duration.

Additional, heavily marketed effects of specific amino acids in sports and energy drinks have not been supported by appropriate clinical trials. Enhanced immune function (glutamine), vasodilatation (arginine), enhanced lipolysis (L-carnitine, which is not technically an amino acid), and caffeine-potentiating effects (taurine) are among the most commonly described.[34–36] Taurine does have an inotropic effect on cardiac muscle similar to that of caffeine.[24] Like caffeine, taurine has physiologic effects on the intracellular calcium concentration in smooth muscles that may cause coronary vasospasm.[37] In general, the use of amino acids in energy drinks in place of traditional dietary sources is not supported by the scientific literature and, therefore, is discouraged for children and adolescents. Use of stimulant-containing energy drinks with or without amino acid supplementation is always discouraged.

Vitamins and Minerals

Many sports and energy drinks contain several B vitamins, vitamin C, calcium, and magnesium. There is no advantage to consuming these vitamins and minerals in drinks, because they can be easily obtained from a well-balanced diet. For further details, see the *Pediatric Nutrition Handbook*.[1]

HARMFUL DENTAL EFFECTS OF SPORTS AND ENERGY DRINKS

Dental Erosion

Dental erosions from sports and energy drinks are of concern in children and adolescents. Bartlett et al[38] found enamel erosion in 57% of 11- to 14-year-olds in a cluster sample of adolescents. Most sports and energy drinks have a pH in the acidic range (pH 3–4). A pH this low is associated with enamel demineralization.[39] Citric acid is frequently included in sports and energy drinks and has been found to be highly erosive, because its demineralizing effect on the enamel continues even after the pH has been neutralized.[40]

Extent of Use and Misuse

Sports and energy drink consumption by children and adolescents is widespread and continues to grow. O'Dea[41] studied 78 adolescents and found that 56.4% used sports drinks and 42.3% consumed energy drinks during the 2 weeks before the survey. Adolescents consumed these products for various reasons including good taste, quenched thirst, and extra energy needed to improve sports performance. Most notably, the adolescents did not differentiate between sports and energy drinks and cited the same benefits for both beverages. None of the adolescents surveyed mentioned potential problems referable to the

consumption of these beverages, and they did not distinguish use on the basis of the degree of athletic participation.[41]

Physically active children and adolescents and their parents are often unaware of the additional nutrient and fluid needs relative to exercise. Sports drinks have an important, specific role in the diet of young athletes who are engaged in prolonged vigorous sports activity—primarily to rehydrate and replenish carbohydrate, electrolytes, and water lost during exercise.[2] However, confusion about energy by young people can lead to unintentional ingestion of energy drinks when their goal is simply to rehydrate and replenish carbohydrate, electrolytes, and water with sports drinks. Using energy drinks instead of sports drinks for rehydration can result in ingestion of potentially large amounts of caffeine or other stimulant substances and the adverse effects previously described. Of additional concern is the intentional use of energy drinks by adolescents who desire stimulant effects to combat fatigue and increase energy during sports and school activities. Advertisements that target young people are contributing to the confusion rather than effectively distinguishing between sports and energy drinks. Furthermore, marketing fails to identify appropriate sources and amounts of energy substrate that should be consumed by children and adolescents.[42]

ASSESSMENT OF USE/MISUSE IN THE OFFICE

As part of each yearly checkup, it is important for pediatric health care providers to review a patient's nutritional status (food and fluid intake) and quantify physical activity. Routine questions that specifically address the use of sports and energy drinks are recommended. Parents may be unaware of their use, or they may, in fact, promote their use, which opens the door to provide education about these drinks for both patients and their parents. Frequent consumption of energy drinks may identify students at risk of substance use and/or other health-compromising behavior.[43] Education on proper dietary and sleep habits may help combat fatigue in adolescents and may decrease the common "stimulant-seeking behaviors."

Stimulant toxicity should be reported to local poison control centers. The ability to use tracking methods for sources of stimulant substances, such as energy drinks, will improve our understanding of dietary habits and facilitate the development of appropriate public health measures to prevent misuse and abuse.[19]

Given the current epidemic of childhood overweight and obesity, we recommend the elimination of calorie-containing beverages from a well-balanced diet, with the exception of low-fat or fat-free milk, because it contains calcium and vitamin D, which are particularly important for young people.

SPORTS AND ENERGY DRINKS ARE NOT INDICATED AS NORMAL FLUID CONSUMPTION IN SCHOOLS

Sales of sports and energy drinks in schools are increasing. Having agreed voluntarily to phase out full-calorie sodas from schools by the 2009–2010 school year, beverage manufacturers are heavily promoting sports drinks as a healthier alternative. In 2006, sports drinks were the third-fastest growing beverage category in the United States, after energy drinks and bottled water, according to the trade journal *Beverage Digest*.[44] The trade group representing beverage manufacturers reported that sports drinks increased their market share in schools from 14.6% in 2004 to 20% in the 2006–2007 school year. During the same period, the market share for full-calorie sodas decreased from 39.9% to 29.8%.[44]

A few school districts have already fought policy battles over sports drinks, and Connecticut became the first, and so far only, state to have passed legislation barring sports drinks and enhanced waters in schools.[45] Bills have been introduced in the US Congress to set new nutritional standards for the foods and drinks that schools sell to students outside cafeterias.[45]

In April 2007, the Institute of Medicine published a report titled *Nutrition Standards for Foods in Schools*,[3] in which it recommended a healthier eating environment for children and adolescents in this country. Relevant to sports and energy drinks, its recommendations for schools included:

- limit sugars in food and drink;
- have water available at no cost;
- restrict carbonated, fortified, or flavored waters;
- restrict sports drinks to use by athletes only during prolonged, vigorous sports activities;
- prohibit energy drink use, even for athletes; and
- prohibit the sale of caffeinated products in school.

CLINICAL IMPLICATIONS: GUIDANCE FOR THE PEDIATRICIAN

Regarding consumption of sports and energy drinks by children and adolescents, the pediatrician is encouraged to:

- Improve the education of children and adolescents and their parents in the area of sports and energy drinks. This education must highlight the difference between sports drinks and energy drinks and their associated potential health risks.

- Understand that energy drinks pose potential health risks primarily because of stimulant content; therefore, they are not appropriate for children and adolescents and should never be consumed.
- Counsel that routine ingestion of carbohydrate-containing sports drinks by children and adolescents should be avoided or restricted. Intake can lead to excessive caloric consumption and an increased risk of overweight and obesity as well as dental erosion.
- Educate patients and families that sports drinks have a specific limited function for child and adolescent athletes. These drinks should be ingested when there is a need for more rapid replenishment of carbohydrates and/or electrolytes in combination with water during periods of prolonged, vigorous sports participation or other intense physical activity.
- Promote water, not sports or energy drinks, as the principal source of hydration for children and adolescents.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Guidance for the Clinician in Rendering Pediatric Care

Clinical Reports—Standard Terminology for Fetal, Infant, and Perinatal Deaths

CAPT Wanda Denise Barfield, MD, MPH, and the COMMITTEE ON FETUS AND NEWBORN

KEYWORD
fetal mortality

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abstract

Accurately defining and reporting perinatal deaths (ie, fetal and infant deaths) is a critical first step in understanding the magnitude and causes of these important events. In addition to obstetric health care providers, neonatologists and pediatricians should know the current US definitions and reporting requirements for live births, fetal deaths, and infant deaths. Correct identification of these vital events will improve our local, state, and national data so that these deaths can be better addressed and reduced. *Pediatrics* 2011;128:177–181

INTRODUCTION

Perinatal mortality comprises the combination of fetal deaths and neonatal deaths. In the United States in 2005, the fetal mortality rate for gestations of at least 20 weeks (6.2 fetal deaths per 1000 live births and fetal deaths)[1] was similar to the infant mortality rate (6.9 infant deaths per 1000 live births).[2] Depending on the definition used, fetal mortality contributes to approximately 40% to 60% of perinatal mortality. Understanding the etiologies of these events and predicting risk begins with accurately defining cases; the collection and analysis of reliable statistical data are an essential part of in-depth investigations on local, state, and national levels.

Fetal and infant deaths occur within the clinical practice of several types of health care providers. Although obstetric practitioners report fetal deaths, certain situations can occur during a delivery in which viability or possibility of survival is unclear; the pediatrician or neonatologist may attend the delivery to assess the medical condition of the fetus or infant, assess previable gestational age, provide care as indicated, and report a subsequent infant death, if it occurs. Incorrectly defining and reporting fetal deaths and early infant deaths may contribute to misclassification of these important events and result in inaccurate fetal and infant mortality rates.[3] Within this context, the American Academy of Pediatrics provides definitions and reporting requirements of fetal death, live birth, and infant death in an effort to emphasize that neonatologists and pediatricians play an important role in recording accurate and timely information surrounding these events. This role includes making the determination of the specific vital event during delivery, recording information surrounding the event on the appropriate certificate or report in compliance with state-specific requirements, and ensuring completeness and accuracy of the information, including the underlying cause of death when known. Although guidance for these definitions is provided elsewhere,[4–6] it may not be readily available to pediatricians in the delivery room.

Both the collection and use of information about fetal, infant, and perinatal deaths have been hampered by lack of understanding of differences in definitions, statistical tabulations, and reporting requirements among providers and state, national, and international bodies. Distinctions can and should be made between the definition of an event and the reporting requirements for the event. The definition indicates the meaning of a term (eg, live birth, fetal death). A reporting requirement is that part of the defined event for which reporting is mandatory.

DEFINITIONS

A fetus is defined from 8 weeks after conception until term while in the uterus. An infant is live born and younger than 365 days of age. Challenges in consistent definitions of fetal and infant death mostly stem from perception of viability, which should not change the definition of the event. In other words, an extremely preterm infant born at 16 weeks' gestation may be defined as a live birth but is not currently viable outside of the womb. On the basis of international standards set by the World Health Organization,[7] the National Center for Health Statistics of the Centers for Disease Control and Prevention defines live birth, fetal death, infant death, and perinatal death as follows.[4]

Live Birth

The complete expulsion or extraction from the mother of a product of human conception, irrespective of the duration of pregnancy, which, after such expulsion or extraction, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, regardless of whether the umbilical cord has been cut or the placenta is attached. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.

Fetal Death

Death before the complete expulsion or extraction from the mother of a product of human conception, irrespective of the duration of pregnancy, that is not an induced termination of pregnancy. The death is indicated by the fact that, after such expulsion or extraction, the fetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.

For statistical purposes, fetal deaths are further subdivided as "early" (20–27 weeks' gestation) or "late" (≥28 weeks' gestation). The term "stillbirth" is also used to describe fetal deaths at 20 weeks' gestation or more. Fetuses that die in utero before 20 weeks' gestation are categorized specifically as miscarriages.

Infant Death

A live birth that results in death within the first year (<365 days) is defined as an infant death. Infant deaths are further subdivided as early neonatal (<7 days), late neonatal (7–27 days), neonatal (<28 days), or postneonatal (28–364 days).

Perinatal Death

Perinatal death is not a reportable vital event, per se, but is used for statistical purposes. Perinatal deaths refer to fetal deaths and live births with only brief survival (days or weeks) and are grouped on the assumption that similar factors are associated with these losses. Three definitions of perinatal deaths are in use:

- Perinatal death, definition I, includes infant deaths that occur at less than 7 days of age and fetal deaths with a stated or presumed period of gestation of 28 weeks or more.
- Perinatal death, definition II, includes infant deaths that occur at less than 28 days of age and fetal deaths with a stated or presumed period of gestation of 20 weeks or more.
- Perinatal death, definition III, includes infant deaths that occur at less than 7 days of age and fetal deaths with a stated or presumed gestation of 20 weeks or more.

From national and international perspectives, perinatal deaths have important implications for both public health and clinical interventions. However, the interpretations of these definitions vary globally on the basis of cultural perspectives, clinical definitions of viability, and availability of information. The National Center for Health Statistics currently classifies perinatal deaths according to the first 2 definitions. Definition I is used by the National Center for Health Statistics and the World Health Organization to make international comparisons to account for variability in registering births and deaths between 20 and 27 weeks' gestation.[8] However, definition II is more inclusive and, hence, is more appropriate for monitoring perinatal deaths throughout gestation, because the majority of fetal deaths occur before 28 weeks' gestation.

REPORTING REQUIREMENTS

In the United States, states and independent reporting areas (ie, New York City, Washington DC, and the US territories) register the certificates of live birth, death, and fetal death. These certificates/reports include clinical information. Challenges in consistent reporting of fetal death, in particular, stem from the variation in reporting requirements among states.[9] Recommended definitions and reporting requirements are issued through the

TABLE 1 Reporting Requirements for Fetal Death According to State or Reporting Area, 2005

Criteria	State/Reporting Area
Gestational age criteria only	
All periods	Arkansas, Colorado, Georgia, Hawaii, New York,[a] Rhode Island, Virginia, Virgin Islands
≥16 wk	Pennsylvania
≥20 wk	Alabama, Alaska, California, Connecticut, Florida, Illinois, Indiana, Iowa, Maine, Maryland,[b] Minnesota, Nebraska, Nevada, New Jersey, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Texas, Utah, Vermont,[c] Washington, West Virginia, Wyoming
≥5 mo	Puerto Rico
Both gestational age and birth weight criteria	
≥20 wk or ≥350 g	Arizona, Idaho, Kentucky, Louisiana, Massachusetts, Mississippi, Missouri, New Hampshire, South Carolina, Wisconsin, Guam
≥20 wk or ≥400 g	Michigan
≥20 wk or ≥500 g	District of Columbia
Birth weight criteria only	
≥350 g	Delaware,[d] Kansas, Montana[d]
≥500 g	New Mexico, South Dakota, Tennessee[e]

[a] Includes New York city, which has separate reporting.
[b] If gestational age is unknown, weight of ≥500 g.
[c] If gestational age is unknown, weight of ≥400 g, ≥15 oz.
[d] If weight is unknown, ≥20 weeks' completed gestation.
[e] If weight is unknown, ≥22 completed weeks' gestation.
Data source: National Center for Health Statistics, National Vital Statistics Reports.

Model State Vital Statistics Act and Regulations (the Model Law).[10,11] The Model Law recommends fetal death reporting for deaths that occur at 350 g or more or, if the weight is unknown, of 20 completed weeks' gestation or more. However, states have the authority to register these vital events and might not necessarily follow the Model Law, which results in differences in birth weight and gestational age criteria for reporting fetal deaths (Table 1). States also vary in the quality of the data reported, which includes missing data.[9]

All live births, regardless of gestational age, are reported as vital record events. Infant deaths involve both the reporting of a live birth event and a death event using a certificate of live birth and a certificate of death, respectively. Information from the certificate of live birth, including demographic information, selected maternal risk factors, maternal labor and delivery information, and infant weight and gestational age, are linked to information on the infant death certificate to include cause-of-death information. The fetal death certificate or report, a single document, includes maternal demographic information, selected maternal risk factors, labor and delivery information, and information about the fetus to include weight, gestational age, and cause of death. Accurate completion of these vital records is important for generating accurate data to determine the magnitude and causes of fetal, infant, and perinatal deaths.

PRACTICAL CONSIDERATIONS

A flow diagram for the determination of appropriate reporting of perinatal deaths was developed by the National Association for Public Health Statistics and Information Systems (Fig 1). The diagram delineates the sequence of reporting and can be used in delivery rooms to appropriately report perinatal events. Induced termination of pregnancy is included in the flow diagram but is beyond the scope of this report.

In the circumstance of delivery events in which the fetus is of uncertain viability, if the infant is determined to be a live birth, the event is reported regardless of birth weight, length of gestation, survival time, or other clinical information (eg, Apgar scores). If fetal death is determined, the event should be reported by the obstetric health care provider on the basis of state criteria and should include both birth weight and gestational age. The appropriate use of these definitions should be reflected in the medical record. Fetal deaths should not be assigned Apgar scores or be admitted to the nursery or NICU. Although the actual evaluation and management of fetal and infant death is beyond the scope of this guidance and has been reported elsewhere,[12] a postmortem examination of the fetus or infant and placenta should be conducted whenever possible.

In summary, the accurate and timely reporting of live birth and fetal and infant death is the cornerstone of perinatal mortality data. Because reducing fetal and infant mortality is among the nation's health goals, accurate definitions of these events are essential for understanding causes and researching potential solutions.

RECOMMENDATIONS

1. Physicians should accurately define and report vital events as follows:
   - Live birth: The complete expulsion or extraction from the mother of a product of human conception, irrespective of the duration of pregnancy, which, after such expulsion or extraction, breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, regardless of whether the umbilical cord has been cut or the placenta is attached. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.
   - Fetal death: Death before the complete expulsion or extraction

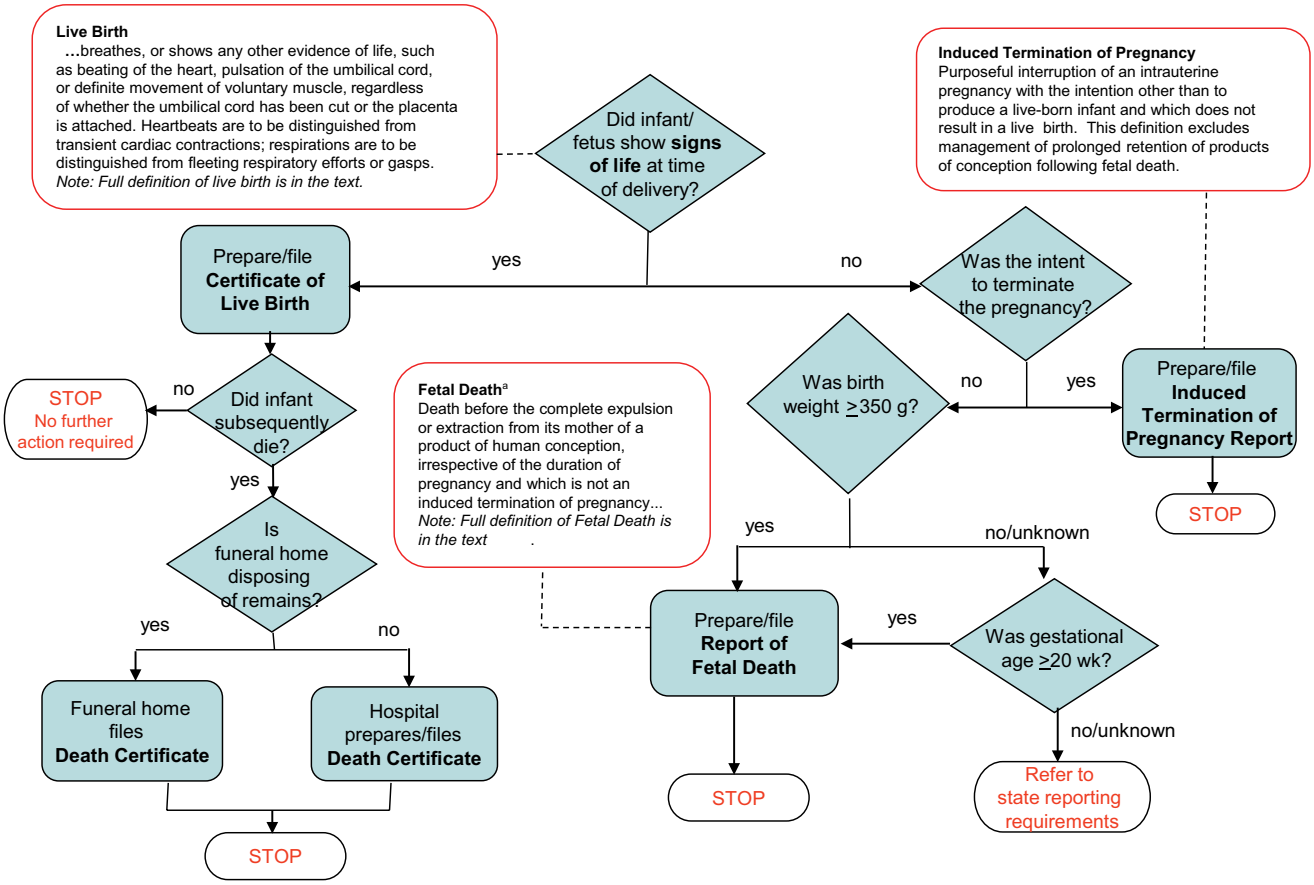

FIGURE 1

Hospital guidelines for reporting live births, infant deaths, fetal deaths, and induced terminations of pregnancy. [a] For most states, a report of fetal death is required when the birth weight is 350 g or greater or the gestational age is 20 weeks or older. Adapted with permission from the National Association for Public Health Statistics and Information Systems (www.naphsis.org).

from the mother of a product of human conception, irrespective of the duration of pregnancy, that is not an induced termination of pregnancy. The death is indicated by the fact that, after such expulsion or extraction, the fetus does not breathe or show any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles. Heartbeats are to be distinguished from transient cardiac contractions; respirations are to be distinguished from fleeting respiratory efforts or gasps.

- Infant death: A live birth that results in death within the first year (<365 days).

2. Physicians should obtain accurate information on state law to ensure that the fetal death certificate/report is filed according to state requirements.
3. Physicians should obtain accurate information to complete reporting of live births, infant deaths, and fetal deaths (in support of obstetrician reporters) to include pertinent demographic information, maternal medical history, and fetal or infant diagnoses. An autopsy of the fetus or infant and examination of the placenta should be performed when possible.

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POLICY STATEMENT

State Children's Health Insurance Program Achievements, Challenges, and Policy Recommendations

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Child Health Financing

ABSTRACT

This policy statement reviews the impressive progress of the State Children's Health Insurance Program since its enactment in 1997 and identifies outstanding challenges and state and federal policy recommendations. The American Academy of Pediatrics urges Congress to reauthorize SCHIP to strengthen its historic gains. The following set of recommended strategies for reauthorization pertain to funding, eligibility and enrollment, coverage, cost sharing, payment and provider-network capacity, and quality performance.

INTRODUCTION

The State Children's Health Insurance Program (SCHIP), enacted in 1997 as Title XXI of the Social Security Act (Pub L No. 105–33), has achieved remarkable progress in its brief history. As a result of SCHIP, health insurance has been extended to millions of children from low-income families, and rates of uninsurance among this population have declined by 2.2 million, from 23% in 1997 to 14.4% in 2004.[1] Access to health care has been vastly improved.[2] Specifically, because of SCHIP, more children have a medical home, more children receive preventive care and immunizations, and fewer children have an unmet need for dental care.[2–7] Family satisfaction and quality of care have also improved significantly under SCHIP.[4,7] Income and racial/ethnic gaps in health insurance coverage and access to care have also narrowed.[8] SCHIP also has had positive spillover effects on the Medicaid program.[9] As a result of SCHIP outreach, millions of potentially eligible but uninsured children have been enrolled in Medicaid.[10] Eligibility-determination processes have been simplified, and coordination between SCHIP and Medicaid has become increasingly effective.[2] The landmark SCHIP legislation allowed states to design their SCHIP programs as expansions of Medicaid, as separate non-Medicaid programs, or as combinations of the two. Unlike Medicaid, SCHIP is not an entitlement. It is capped at the amount that is funded by Congress and the states. States were able to pursue different approaches for offering the most comprehensive, affordable coverage possible for near-poor children and their families. SCHIP is important now more than ever because of concerns about the increased numbers of children with obesity, diabetes, mental health disorders, asthma, and other chronic conditions and the importance of ensuring that these children will be given timely and continuous access to health care services over the span of childhood and adolescence.

Despite the program's widely acknowledged success and popularity, several

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Key Words
SCHIP, Medicaid, reauthorization, uninsured, health insurance

Abbreviations
SCHIP—State Children's Health Insurance Program
AAP—American Academy of Pediatrics
FPL—federal poverty level

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outstanding challenges have been identified by SCHIP officials, enrolled families, participating pediatricians and other health care professionals, and health service researchers. These challenges pertain to (1) ensuring adequate funding, (2) extending the reach of SCHIP to all potentially eligible children and to more uninsured children and families at higher income levels, (3) improving benefit coverage in non-Medicaid plans, (4) maintaining affordable premiums and other forms of cost sharing, (5) providing adequate payments and strengthening provider-network capacity, and (6) improving quality performance. This policy statement identifies recommended strategies in each of these 6 areas, which the American Academy of Pediatrics (AAP) believes will further the program's success in the next decade.

BACKGROUND

In 2005, SCHIP programs provided health insurance to 4 million children nationwide.[11] States selected different approaches to provide health insurance under SCHIP; 21 states created a combination Medicaid and non-Medicaid program, 18 states created a non-Medicaid program, and 17 states and territories and the District of Columbia created a Medicaid program.[12] In 27 states and the District of Columbia, eligibility levels are established at the congressional target of 200% of the federal poverty level (FPL), and in 13 states, eligibility has been extended to children with family incomes above 200% of the FPL. Eligibility extends up to 300% of the FPL in 5 states (Connecticut, Maryland, Missouri, New Hampshire, and Vermont) and 350% of the FPL in 1 state (New Jersey).

The original funding-allocation formula for SCHIP, which will expire in 2007, is based on each state's share of low-income children, its share of low-income uninsured children, and the state's cost of providing health care services. Funds not spent by states within an allotted time are redistributed to other states according to a specific formula. Unfortunately, in fiscal year 2007, 17 states face SCHIP funding shortfalls that amount to approximately $1 billion according to the Center on Budget and Policy Priorities.[13] Shortfalls occurred because of the size of the population of uninsured children, the growth in the population of children from low-income families, the growing instability of employment-based health insurance, and inflation.

In addition to the very serious federal budget shortfalls, since 2001 states have experienced significant budget shortfalls that have adversely affected their ability to sustain their SCHIP programs. The most common cost-cutting response has been to limit outreach and enrollment; few states have actually lowered eligibility or benefits or imposed significantly higher cost-sharing requirements.[14] These cost-cutting actions resulted in a first-ever dip in enrollment in 2003.[15]

The scope of coverage for SCHIP programs in the 39 states that are offering a non-Medicaid plan to some or all of their SCHIP enrollees, although not as comprehensive as Medicaid coverage, still (with few exceptions) far exceeds benefits in employer-sponsored health insurance plans.[16] Similarly, although premium rates, copayments, and other dollar limits impose financial burdens for some families, they are still markedly less than those in private health insurance plans, and families consider them reasonable and affordable.[17]

Provider payment rates, however, are generally low—well below commercial rates—and in many states are at the same level as Medicaid rates. Medicaid professional fees were estimated to be approximately 70% of Medicare rates in 2004 according to the 2006 AAP Pediatric Medical Cost Model developed by actuaries at Reden & Anders.[18]

The AAP recommends the following improvements to strengthen SCHIP:

1. Ensure adequate funding

   - Establish a new funding-formula approach that relies on a combination of national and state data that does not penalize states for successfully enrolling uninsured children, that takes into account state variations in the costs of providing care, and that extends the period during which redistributed funds can be spent.
   - Set the budget baseline for SCHIP at a rate significantly higher than the level set in law for the final year of SCHIP's initial authorization to avoid future budget shortfalls.

2. Extend eligibility and enrollment

   - Establish a performance-based outreach fund that rewards states that are more successful in enrolling uninsured children who are eligible for public coverage.
   - Continue to improve on administrative simplification to facilitate enrollment and reenrollment, including shortened forms, streamlined verification requirements, online enrollment, and renewal assistance. In addition, grant states the flexibility to automatically enroll children into SCHIP (and Medicaid) on the basis of findings of other means-tested programs such as the Supplemental Nutrition Program for Women, Infants, and Children (WIC), the National School Lunch Program, and the Food Stamp Program.
   - Encourage presumptive eligibility for all children by allowing health care professionals and designated agencies to grant eligibility for up to 60 days while a child goes through the enrollment process. In addition, encourage states to adopt 12-month continuous eligibility for SCHIP-enrolled (and Medicaid-enrolled) children.

- Allow households with children in both Medicaid and SCHIP to enroll in the same program to ensure continuity among siblings with their pediatric medical home.
- Encourage expansion of SCHIP to include adolescents 19 through 21 years of age and allow emancipated minors eligibility for SCHIP on the basis of their own income. In addition, eliminate eligibility restrictions for dependents of state employees if they qualify on the basis of income.
- Encourage higher income eligibility levels (>200% of the FPL) and discontinue the practice of counting family assets to extend eligibility to more uninsured children.[19]
- Offer SCHIP buy-in options for children whose family incomes are above their state's SCHIP eligibility level but who do not have access to or cannot afford comprehensive private health insurance.
- Allow states to cover legal immigrant children who enter the United States on or after August 1996. These children, under the 1996 Welfare Law, are ineligible for Medicaid and SCHIP coverage during their first 5 years in the United States. Other complex rules restrict legal immigrant children from gaining public coverage until they are citizens.
- Allow states to draw down Medicaid/SCHIP matching funds when employers pay for a share of the cost of coverage for children of low-income families enrolled in Medicaid or SCHIP.
- Encourage waiver applications of the Centers for Medicare and Medicaid Services to expand SCHIP coverage for uninsured pregnant women and parents if states have already maximized comprehensive coverage and full enrollment of children.

3. Support comprehensive coverage
   - Preserve Medicaid benefit coverage in states with Medicaid SCHIP programs.
   - Encourage states to adopt SCHIP benefit packages that are consistent with the AAP policy statement "Scope of Health Care Benefits for Children From Birth Through Age 21,"[20] including oral health services, the full range of mental health services, and substance abuse treatment. Preventive care, immunization standards, and periodicity schedules also should be consistent with current AAP requirements. In addition, definitions of medical necessity should adhere to AAP recommendations.[21]
   - Extend eligibility for the Vaccines for Children Program to all children enrolled in non-Medicaid SCHIP programs.
   - Eliminate the prohibition against partial benefit packages to allow states with non-Medicaid SCHIP programs to provide additional wrap-around coverage to children, especially those with special health care needs who have inadequate private health insurance.
4. Maintain affordable coverage
   - Eliminate differences in copayments and coinsurance for physical and mental health services.
   - Adopt cost-sharing policies that do not shift cost to pediatricians, hospitals, and other health care professionals and do not deter the use of medically necessary services. Deductibles and coinsurance should not be used; rather, cost sharing should be in the form of income-adjusted premiums and copayments.
   - Maintain policy that requires all preventive services under SCHIP to be exempt from cost sharing.
5. Improve provider payments and network capacity
   - Establish payment rates under SCHIP for pediatric services that are at least equal to the most current Medicare RBRVS (Resource-Based Relative Value Scale) rates.
   - Ensure adequate payment when new vaccines and other new technologies are introduced. Under capitated arrangement, states should ensure that provisions are made to reimburse physicians for all vaccine-related overhead costs (vaccine product-acquisition and administration costs) of the new vaccines until new contracts are negotiated. In addition, physicians should receive payment for the expenses associated with the administration of each vaccine.
   - Adopt financial incentives for medical homes, especially in the care of children with special needs, including chronic care management, child and family education, and coordination and consultation with pediatric specialists and other support services.
   - Provide financial incentives for pediatric practices that adopt quality-performance goals.
   - Recognizing the dearth of pediatric subspecialists nationwide, encourage the inclusion of pediatric subspecialists, and the academic medical centers in which they practice, in managed care plan networks, and encourage coordination and communication between pediatric subspecialists and primary care practitioners.
   - Identify new mechanisms to designate and support safety net providers, including office-based pediatric practices and hospitals that specialize in the care of children, who serve a certain proportion of publicly insured children.

- Ensure medical home and pediatric subspecialty network continuity in SCHIP and Medicaid when children switch managed care plans and when children switch between the 2 sources of coverage.

6. Strengthen quality performance

   - Adopt a consistent conceptual framework (eg, the framework of the Institute of Medicine) to assess health care quality across SCHIP programs that takes into account the unique features of child health and health care.[22] Performance goals for states and the plans with which they contract should consist of short-term and long-term health care outcomes, including monitoring eligibility thresholds and projected enrollment volume, program retention, access to medical care, assessments of process and outcomes of pediatric care, and family and provider satisfaction.
   - Improve the collection and analysis of individual-level enrollment data and claims-based utilization data.
   - Involve pediatricians, pediatric subspecialists, pediatric mental health professionals, pediatric dentists, and other pediatric clinicians and families, including those who represent special populations, in continuously reviewing and evaluating each state's SCHIP.
   - Expand funding support for SCHIP evaluations and allow greater access to state data for research.
   - Measures should be appropriate for children's health. Any effort to measure quality should take into account the unique features of child health and health care. In addition, pediatric and family representatives should be included in all measurement efforts at the national, state, and local levels.

CONCLUSIONS

SCHIP has a proud history on which to build. To achieve continued success in reducing uninsurance among children and ensuring access to high-quality pediatric care, the AAP recommends that Congress and state policy makers adopt these important recommendations.

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RESIDENTS' ATTITUDES ABOUT DUTY HOURS REGULATIONS

"To better understand the perspectives of residents on the effects of the ACGME duty hours restrictions, Jennifer S. Myers, MD, and colleagues performed a multi-site survey of internal medicine and surgery residents, focusing on residents who were in training both before and after implementation of the new regulations. The survey questions were designed to elicit opinions in three areas: quality of patient care and safety, residency education, and quality of resident life. . . . Medical and surgical residents' opinions of quality of care and medical errors were similar to each other. Both groups of residents felt that the quality of care had decreased slightly after implementation of the new regulations, but that the continuity of care had decreased a great deal. They also felt that errors attributable to continuity of care had increased, but that errors related to resident fatigue had decreased. Residents felt that the new rules had created a 'shift-work' mentality among housestaff, but did not believe that the quality of program graduates had changed. In addition, they felt that their quality of life had improved substantially since the implementation of the regulations. . . . The authors note that the survey results indicate that medical errors related to fatigue might have been replaced with errors related to discontinuity of care as a result of duty hours reform. Furthermore, duty hours reform has not resulted in significantly more hours of sleep per week for residents. Residents have also reported reductions in bedside teaching and in opportunities for mentoring from attending physicians. The authors state that these unintended consequences of duty hours reductions will need to be addressed as residency programs adapt their educations programs to meet regulatory requirements."

Myers JS. *Academic Physician & Scientist*. February 2007
Noted by JFL, MD

American Academy of Pediatrics
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POLICY STATEMENT

Strength Training by Children and Adolescents

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Council on Sports Medicine and Fitness

ABSTRACT

Pediatricians are often asked to give advice on the safety and efficacy of strength-training programs for children and adolescents. This statement, which is a revision of a previous American Academy of Pediatrics policy statement, defines relevant terminology and provides current information on risks and benefits of strength training for children and adolescents.

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Key Words
children, adolescents, strength training, resistance training, Olympic weightlifting

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STRENGTH TRAINING (ALSO known as resistance training) is a common component of sports and physical fitness programs for young people, although some adolescents may use strength training as a means to enhance muscle size for improving appearance. Strength-training programs may include the use of free weights, weight machines, elastic tubing, or an athlete's own body weight. The amount and form of resistance used and the frequency of resistance exercises are determined by specific program goals. Table 1 defines common terms used in strength training.

BENEFITS OF STRENGTH TRAINING

In addition to the obvious goal of getting stronger, strength-training programs may be undertaken to try to improve sports performance and prevent injuries, rehabilitate injuries, and/or enhance long-term health. Similar to other physical activity, strength training has been shown to have a beneficial effect on several measurable health indices, such as cardiovascular fitness, body composition, bone mineral density, blood lipid profiles, and mental health.[1,2] Recent studies have shown some benefit to increased strength, overall function, and mental well-being in children with cerebral palsy.[3,4] Resistance training is being incorporated into weight-control programs for overweight children as an activity to increase the metabolic rate without high impact. Similar to the geriatric population, strength training in youth may stimulate bone mineralization and have a positive effect on bone density.[5,6]

Multiple studies have shown that strength training, with proper technique and strict supervision, can increase strength in preadolescents and adolescents.[7,8] Frequency, mode (type of resistance), intensity, and duration all contribute to a properly structured program. Increases in strength occur with virtually all modes of strength training of at least 8 weeks' duration and can occur with training as little as once a week, although training twice a week may be more beneficial.[7–12] Appropriately supervised programs emphasizing strengthening of the core (focusing on the trunk muscles, eg, the abdominal, low back, and gluteal muscles) are also appropriate for children and theoretically benefit sports-specific skill acquisition and postural control. Unfortunately, gains in strength, muscle size, or power are lost ~6 weeks after resistance training is discontinued.[1,13]

In preadolescents, proper resistance training can enhance strength without concomitant muscle hypertrophy. Such gains in strength can be attributed to a neurologic mechanism whereby training increases the number of motor neurons that are "recruited" to fire with each muscle contraction.[11,14–16] This mechanism accounts for the increase in strength in populations with low androgen concentrations, including female individuals and preadolescent boys. In contrast, strength training augments the muscle growth that normally occurs with puberty in boys and girls by actual muscle hypertrophy.[12,14,17,18]

Strength training is a common practice in sports in which size and strength are desirable. Unfortunately, results are inconsistent regarding the translation of increased strength to enhanced youth athletic performance.[1,14,19,20] Preventive exercise (prehabilitation) refers to strength-training programs that address areas commonly subjected to overuse injuries, such as providing rotator cuff and scapular stabilization exercises preventively to reduce overuse injuries of the shoulder in overhead sports. There is limited evidence to suggest that prehabilitation may help decrease injuries in adolescents, but it is unclear whether it has the same benefit in preadolescent athletes,[1,21,22] and there is no evidence that strength training will reduce the incidence of catastrophic sports-related injuries in youth. Recent research suggested a possible reduction in sports-related anterior cruciate ligament injuries in adolescent girls

TABLE 1 **Definition of Terms**

Term	Definition
Strength training	The use of resistance methods to increase one's ability to exert or resist force. The training may include use of free weights, the individual's own body weight, machines, and/or other resistance devices to attain this goal.
Core strengthening	Focusing a strengthening program to the muscles that stabilize the trunk of the body. The training emphasizes strengthening of the abdominal, low back, and gluteal muscles as well as flexibility of muscular attachments to the pelvis, such as the quadriceps and hamstring muscles.
Set	A group of repetitions separated by scheduled rest periods (eg, 3 sets of 20 reps).
Reps	Abbreviation for repetitions.
One-rep max (1RM)	The maximum amount of weight that can be displaced in a single repetition.
Concentric contraction	The muscle shortens during contraction (eg, arm curl, leg press).
Eccentric contraction	The muscle lengthens during contraction (eg, lowering a weight).
Isometric contraction	The muscle length is unchanged during contraction (eg, wall sits: athlete holds the position of feet planted flat on ground with knees at a 90° angle and back against the wall).
Isokinetic contraction	The speed of muscle contraction is fixed through the range of motion.
Progressive resistive exercises	An exercise regimen in which the athlete progressively increases the amount of weight lifted and/or the number of repetitions. The more repetitions, the greater the work performed and the greater the endurance development. The more weight lifted, the greater the strength development.
Plyometric exercises	Repeated eccentric and concentric muscle contractions, such as jumping up onto and down from a platform.
Weightlifting	A competitive sport that involves maximum lifting ability. Weightlifting (which is sometimes called Olympic lifting) includes the "snatch" and the "clean and jerk."
Power lifting	A competitive sport that also involves maximum lifting ability. Power lifting includes the "dead lift," the "squat," and the "bench press."
Body building	A competition in which muscle size, symmetry, and definition are judged.

when strength training was combined with specific plyometric exercises.[23] Plyometric exercises enable a muscle to reach maximum strength in a relatively short time span through a combination of eccentric and concentric muscle contractions, such as jumping up onto and down from a platform.

RISKS OF STRENGTH TRAINING

Much of the concern over injuries associated with strength training come from data from the US Consumer Product Safety Commission's National Electronic Injury Surveillance System,[24] which has estimated the number of injuries connected to strength-training equipment. The data from the National Electronic Injury Surveillance System neither specify the cause of injury nor separate recreational from competitive injuries that result from lifting weights. Muscle strains account for 40% to 70% of all strength-training injuries, with the hand, low back, and upper trunk being commonly injured areas.[24,25] Most injuries occur on home equipment with unsafe behavior and unsupervised settings.[24] Injury rates in settings with strict supervision and proper technique are lower than those that occur in other sports or general recess play at school.[26,27]

Appropriate strength-training programs have no apparent adverse effect on linear growth, growth plates, or the cardiovascular system,[1,10,11,28,29] although caution should be used for young athletes with preexisting hypertension, because they may require medical clearance to reduce the potential for additional elevation of blood pressure with strength training if they exhibit poorly controlled blood pressure. Youth who have received chemotherapy with anthracyclines may be at increased risk for cardiac problems because of the cardiotoxic effects of the medications, and resistance training in this population should be approached with caution.[30] Specific anthracyclines that have been associated with acute congestive heart failure include doxorubicin, daunomycin/daunorubicin, idarubicin, and possibly mitoxantrone. Youth with other forms of cardiomyopathy (particularly hypertrophic cardiomyopathy), who are at risk for worsening ventricular hypertrophy and restrictive cardiomyopathy or hemodynamic decompensation secondary to an acute increase in pulmonary hypertension, should be counseled against weight training. Individuals with moderate to severe pulmonary hypertension also should refrain from strenuous weight training, because they are at risk for acute decompensation with a sudden change in hemodynamics.[31] Young people with Marfan syndrome with a dilated aortic root also are counseled against participation in strength-training programs. Young athletes with seizure disorders should be withheld from strength-training programs until clearance is obtained from a physician. Overweight children may appear to be strong because of their size but often are unconditioned with poor strength and would require the same strict supervision and guidance as is necessary with any resistance program.

GUIDELINES FOR STRENGTH TRAINING

A medical evaluation of the child before beginning a formal strength-training program can identify risk factors for injury and provide an opportunity to discuss previous injuries, low-back pain, medical conditions, training goals, motives for wanting to begin such a program, techniques, and expectations from both the child and the parents. Youth should be reminded that strength training is only a small part of an overall fitness or sports program. Although research supports the safety and efficacy of resistance training for children, it is not necessary or appropriate for every child. Youth who are interested in getting bigger and stronger should be discouraged from considering the use of anabolic steroids and other performance-enhancing substances and should be provided with information regarding the risks and health consequences of using such substances. More patient-friendly information on performance-enhancing substances is available at www.aap.org/family/sportsshorts12.pdf. The American Academy of

Pediatrics (AAP) strongly condemns the use of performance-enhancing substances and vigorously endorses efforts to eliminate their use among children and adolescents.[32,33]

Because balance and postural control skills mature to adult levels by ~7 to 8 years of age,[34] it seems logical that strength programs need not start before achievement of those skills. Children also should have advanced to a certain level of skill proficiency in their sport before embarking on a disciplined strength-training program for the strength to have some potential value.

Strength gains can be acquired through various types of strength-training methods and equipment; however, most strength-training machines and gymnasium equipment are designed for adult sizes and have weight increments that are too large for young children. Free weights require better balance control and technique but are small and portable, provide small weight increments, and can be used for strengthening sports-specific movements.

Explosive and rapid lifting of weights during routine strength training is not recommended, because safe technique may be difficult to maintain and body tissues may be stressed too abruptly. This restrictive concept is applied to strength training, as opposed to the competitive sport of weightlifting, which is sometimes referred to as Olympic lifting. The sport of weightlifting is distinct from common strength training, because it involves specific types of rapid lifts, such as the "snatch" and the "clean and jerk."

Prepubertal youngsters are involved in competitive weightlifting, but philosophies often vary between Western nations and Eastern European nations.[35] Limited research on weightlifting as a sport has revealed that children have participated with few injuries,[35–37] and some programs have low rates of injury because they require stringent learning of techniques before adding any weight. As with general strength training, strict supervision and adherence to proper technique are mandatory for reducing the risk for injury. Clearly, this is an area in which more research is necessary to substantiate low injury rates as more youngsters continue to be involved with competitive weightlifting. Because of the limited research regarding prepubertal injury rates in competitive weightlifting, the AAP remains hesitant to support participation by children who are skeletally immature and is opposed to childhood involvement in power lifting, body building, or use of the 1-repetition maximum lift as a way to determine gains in strength.

For the purposes of this policy statement, the research regarding strength gains and the recommendations regarding youth involved in lifting weights apply specifically to the activity of strength training as an adjunct to exercise and sports participation.

When children or adolescents undertake a strength-training program, they should begin with low-resistance exercises until proper technique is perfected. When 8 to 15 repetitions can be performed, it is reasonable to add weight in 10% increments. Increasing the repetitions of lighter resistance may be performed to improve endurance strength of the muscles in preparation for repetitive-motion sports. Exercises should include all muscle groups, including the muscles of the core, and should be performed through the full range of motion at each joint. For achievement of gains in strength, workouts need to be at least 20 to 30 minutes long, take place 2 to 3 times per week, and continue to add weight or repetitions as strength improves. Strength training >4 times per week seems to have no additional benefit and may increase the risk for an overuse injury. Proper technique and strict supervision are mandatory for safety reasons and to reduce the risk for injury. Proper supervision is defined as an instructor-to-student ratio no more than 1:10 and an approved strength-training certification, as discussed in Table 2. Proper 10- to 15-minute warm-up and cool-down periods with appropriate stretching techniques also are recommended. Guidelines have been proposed by the AAP (as follows), the American Orthopaedic Society for Sports Medicine,[38] and the National Strength and Conditioning Association.[39,40]

Young people who want to improve sports performance generally will benefit more from practicing and perfecting the skills of their sport than from strength training alone, although strength training should be part of a multifaceted approach to exercise and fitness. If long-term health benefits are the goal, then strength training should be combined with an aerobic training program.

RECOMMENDATIONS

1. Proper resistance techniques and safety precautions should be followed so that strength-training programs for preadolescents and adolescents are safe and effective. Whether it is necessary or appropriate to start such a program and which level of proficiency the youngster already has attained in his or her sport activity should be determined before a strength-training program is started.
2. Preadolescents and adolescents should avoid power lifting, body building, and maximal lifts until they reach physical and skeletal maturity.
3. As the AAP has stated previously, athletes should not use performance-enhancing substances or anabolic steroids. Athletes who participate in strength-training programs should be educated about the risks associated with the use of such substances.
4. When pediatricians are asked to recommend or evaluate strength-training programs for children and adolescents, the following issues should be considered:
   a. Before beginning a formal strength-training program, a medical evaluation should be performed by a pediatrician or family physician. Youth with uncontrolled hypertension, seizure disorders, or a history of childhood cancer and chemotherapy should be withheld from participation until additional treatment or evaluation. When indicated, a referral may be made to a pediatric or family physician sports medicine specialist who is familiar with various strength-training methods as well as risks and benefits for preadolescents and adolescents.
   b. Children with complex congenital cardiac disease (cardiomyopathy, pulmonary artery hyperten-

TABLE 2 Certification Organizations

Certification	Requirements	Examination Content	Recertification	NCCA	Web Address
National Council on Strength and Fitness Certified Personal Trainer (NCSF-CPT)	18 y of age, high school diploma or equivalent	150 MC questions, 3-h proctored examination	Every 2 y, 10 CEUs	Yes	www.ncsf.org
National Academy of Sports Medicine Certified Personal Trainer (NASM-CPT)	18 y age, CPR certification	120 MC questions, 2-h proctored examination	2.0 NASM CEUs	Yes, 2003	www.nasm.org
National Strength and Conditioning Association Certified Personal Trainer (NSCS-CPT)	18 y of age, high school diploma or equivalent, CPR certification	140 questions, 3-h proctored examination	3 y, 6 CEUs; 2 different categories (conference, research publications, etc)	Yes, 1996	www.nsca-lift.org
National Strength and Conditioning Association Certified Strength and Conditioning Specialist (NSCS-CSCS)	BA/BS degree or chiropractor degree, CPR certification	Scientific 80-question, 1.5-hour proctored examination, practical 110 MC 2.5-hour proctored examination	3 y, 6 CEUs as above	Yes, 1996	www.nsca-lift.org
American Council on Exercise (ACE) Personal Trainer	18 y of age, adult CPR certification	150 MC questions, proctored examination, 2 written simulations	2 y, 2.0-hour ACE approved	Yes, 2003	www.acefitness.org
American Council on Exercise (ACE) Clinical Exercise Specialist	18 y of age, adult CPR certification, 300 h of work experience, current ACE-PT	150 MC questions, proctored examination	2 y, 2.0-hour ACE approved	Yes, 2003	www.acefitness.org
National Federation of Professional Trainers (NFPT)	18 y of age, high school diploma or equivalent, 2 y of experience	120 MC questions, 2-h proctored examination	2 CEC per year	Yes, 2005	www.nfpt.com
American College of Sports Medicine (ACSM) Certified Personal Trainer	High school diploma or equivalent, adult CPR certification	150 MC questions, proctored examination	3 y, CEC 45 h	Yes	www.acsm.org
American College of Sports Medicine (ACSM) Health Fitness Instructor	Associate's or bachelor's degree in health-related field, adult CPR certification	Written examination, 140 MC questions, proctored examination	3 y, CEC 60 h	Yes	www.acsm.org
International Fitness Professional Association (IFPA)	No requirements	105 questions at certification site	2 y, 12 CEC	No	www.ifpa-fitness.com
American Fitness Professional Association (AFPA) Personal Trainer	18 y of age, high school diploma or equivalent, adult CPR certification	Home examination, 90 d to complete	2 y, 16 CEC	No	www.Afpafitness.com
International Sports Science Association (ISSA)	No requirements	Home examination			www.issaonline.com
National Strength Professional Association (NSPA) Personal Trainer	18 y of age, adult CPR certification	Two 10-h lectures, written/practical examination, 50 MC questions, 5 practicals	2 y, 24 NSPA CEC	No	www.nspainc.com

As of 2006, instructor certifications received by the following groups are certified by the National Committee for Certifying Agencies (NCCA): National Strength and Conditioning Association, American College of Sports Medicine, American Council on Exercise, National Council on Sports & Fitness, National Academy of Sports Medicine, and the National Federation of Professional Trainers. CPR indicates cardiopulmonary resuscitation; MC, multiple choice; CEC, continuing education credits, CEU, continuing education unit.

sion, or Marfan syndrome) should have a consultation with a pediatric cardiologist before beginning a strength-training program.

c. Aerobic conditioning should be coupled with resistance training if general health benefits are the goal.

d. Strength-training programs should include a 10- to 15-minute warm-up and cool-down.

e. Athletes should have adequate intake of fluids and proper nutrition, because both are vital in maintenance of muscle energy stores, recovery, and performance.

f. Specific strength-training exercises should be learned initially with no load (no resistance). Once the exercise technique has been mastered, incremental loads can be added using either body weight or other forms of resistance. Strength training should involve 2 to 3 sets of higher repetitions (8 to 15) 2 to 3 times per week and be at least 8 weeks in duration.

g. A general strengthening program should address all major muscle groups, including the core, and exercise through the complete range of motion. More sports-specific areas may be addressed subsequently.

h. Any sign of illness or injury from strength training should be evaluated fully before allowing resumption of the exercise program.

i. Instructors or personal trainers should have certification reflecting specific qualifications in pediatric strength training. See Table 2 for the various avenues of certification and certifying organizations.

j. Proper technique and strict supervision by a qualified instructor are critical safety components in any strength-training program involving preadolescents and adolescents.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Substance Use Screening, Brief Intervention, and Referral to Treatment for Pediatricians

abstract

FREE

As a component of comprehensive pediatric care, adolescents should receive appropriate guidance regarding substance use during routine clinical care. This statement addresses practitioner challenges posed by the spectrum of pediatric substance use and presents an algorithm-based approach to augment the pediatrician's confidence and abilities related to substance use screening, brief intervention, and referral to treatment in the primary care setting. Adolescents with addictions should be managed collaboratively (or comanaged) with child and adolescent mental health or addiction specialists. This statement reviews recommended referral guidelines that are based on established patient-treatment–matching criteria and the risk level for substance abuse. *Pediatrics* 2011;128:e1330–e1340

COMMITTEE ON SUBSTANCE ABUSE

KEY WORDS

alcohol, screening, SBIRT, substance abuse

ABBREVIATIONS

SBIRT—screening, brief intervention, and referral to treatment
AAP—American Academy of Pediatrics
BNI—brief negotiated interview

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INTRODUCTION

Although it is common for adolescents and young adults to try mood-altering chemicals, including nicotine, it is important that this experimentation not be condoned, facilitated, or trivialized by adults including parents, teachers, and health care providers. Use of alcohol and other drugs remains a leading cause of morbidity and mortality for young people in the United States.[1,2] Even the first use of alcohol or another drug can result in tragic consequences such as unintentional injury or death. All substance use involves health risks that can occur long before there is drug addiction, and teenagers seem to be particularly susceptible to health risk–taking behaviors and injuries related to alcohol, tobacco, and other drug use.[3,4] In addition, research has established that adolescence is a period of neurodevelopmental vulnerability for developing addictions; age at first use is inversely correlated with lifetime incidence of developing a substance use disorder.[4–6]

The pediatrician has a well-recognized and important professional and societal role in the prevention, detection, and management of all pediatric health risks and disorders, including tobacco, alcohol, and other drug use among children and adolescents. Consistent with *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*,[7] primary care practitioners are ideally suited for preventing problem behaviors and consistently screening for them, including the development of mental health disorders and psychosocial problems, among which are substance use and addiction. The nonuse message should be reinforced by pediatricians through clear and consistent information presented to patients, parents, and other family members

TABLE 1 Substance Use Spectrum and Goals for Office Intervention

Stage	Description	Office Intervention Goals
Abstinence	The time before an individual has ever used drugs or alcohol (more than a few sips)	Prevent or delay initiation of substance use through positive reinforcement and patient/parent education
Experimentation	The first 1–2 times that a substance is used and the adolescent wants to know how intoxication from using a certain drug(s) feels	Promote patient strengths; encourage abstinence and cessation through brief, clear medical advice and educational counseling
Limited use	Use together with ≥1 friends in relatively low-risk situations and without related problems; typically, use occurs at predictable times such as on weekends	Promote patient strengths; further encourage cessation through brief, clear medical advice and educational counseling
Problematic use	Use in a high-risk situation, such as when driving or babysitting; use associated with a problem such as a fight, arrest, or school suspension; or use for emotional regulation such as to relieve stress or depression	As stated above, plus initiate office visits or referral for brief intervention to enhance motivation to make behavioral changes; provide close patient follow-up; consider breaking confidentiality
Abuse	Drug use associated with recurrent problems or that interferes with functioning, as defined in the *DSM-IV-TR*	Continue as stated above, plus enhance motivation to make behavioral changes by exploring ambivalence and triggering preparation for action; monitor closely for progression to alcohol and other drug addiction; refer for comprehensive assessment and treatment; consider breaking confidentiality
Addiction (dependence)	Loss of control or compulsive drug use, as defined in the *DSM-IV-TR* as "dependence"	As stated above, plus enhance motivation to accept referral to subspecialty treatment if necessary; consider breaking confidentiality; encourage parental involvement whenever possible

DSM-IV-TR indicates *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision.*

while developing and maintaining a trusting patient care relationship.[8] To decrease the health burden associated with substance use and substance use disorders, the Substance Abuse and Mental Health Services Administration recommends that universal screening for substance use, brief intervention, and/or referral to treatment (SBIRT) become a part of routine health care.[9] As a group, adolescents are at the highest risk of experiencing substance use–related acute and chronic health consequences, so they are also the age group likely to derive the most benefit from universal SBIRT. Specific SBIRT tools and strategies have well-documented efficacy for adult alcohol and drug use.[10,11] More recently, developmentally appropriate tools and strategies have been designed specifically for use with adolescents.[12–15]

Experience with substances can be considered a spectrum that varies from primary abstinence to addiction. The goal of applying universal SBIRT with adolescents is to identify an individual's experience along this spectrum and institute the appropriate intervention for each adolescent at every health care visit. Table 1 outlines a conceptual framework for the adolescent substance use spectrum and provides stage-correlated goals for optimal primary care office intervention.

Incorporating SBIRT practices into the primary care routine interfaces well with structured psychosocial interview schemes in common use, such as HEADSS or SSHADESS.[16,17] Following the HEADSS acronym guides the adolescent interview through questions about home, education, activities, drug and alcohol use, sexuality, and suicide. The SSHADESS interview framework covers the same life areas and underscores resiliency by identifying the patient's perceived and realized strengths before exploring environmental context and risks. Structured tools can be easily incorporated into the written or electronic health record to remind the practitioner to conduct screening and document the results. Recent research has established that adolescents who present for either urgent or follow-up care appointments are more likely to report alcohol and drug use and other high-risk behaviors when compared with those who present for well care, so substance use screening is recommended whenever an adolescent presents for outpatient care.[18] In recognition of the challenges posed by conducting health-risk screening amid the time constraints and competing medical needs found in nearly every practice context, the National Institute on Alcohol Abuse and Alcoholism is developing an empirically based 2-question alcohol use screen as part of a guide for interdisciplinary health care personnel for assessing adolescent alcohol use and then responding to the screening results. Because alcohol use is often the first risk behavior in which adolescents engage, alcohol-only screening may be a reasonable approach when time does not permit a full psychosocial interview.[19] The expectation remains that soon thereafter a full psychosocial interview, including strengths promotion and risk screening, will be conducted during a scheduled follow-up appointment. Whenever a child or adolescent has a positive alcohol-only screening result, a full psychosocial evaluation should be conducted as soon as possible, because underage drinking is associated

with a greater likelihood of other risk behaviors.[20]

This policy statement builds on the American Academy of Pediatrics (AAP) statements on tobacco, alcohol, and other drug use by providing pediatricians with additional guidance and tools for boosting their confidence and competence in preventing, detecting, and influencing the course of adolescent substance use.[8] The SBIRT framework presented here is similar in structure to the "ask, advise, refer" recommendation for tobacco use. For detailed information about providing care for adolescents who use tobacco, see the AAP technical report "Tobacco as a Substance of Abuse."[21]

SCREENING

Screening is a procedure applied to populations and is intended to identify people with a disease, condition, or symptom. Screening does not yield a formal diagnosis but, rather, guides further decision-making. Screening an adolescent for substance use is designed to determine if the adolescent has used alcohol or other drugs in the previous 12 months and, if so, to delineate the associated level of risk.

Succinct screens for adolescent substance abuse are available and outlined in the AAP statements "Tobacco, Alcohol, and Other Drugs: The Role of the Pediatrician in Prevention, Identification, and Management of Substance Abuse"[8] and "Alcohol Use by Youth and Adolescents: A Pediatric Concern."[22] The CRAFFT screen is a validated, developmentally appropriate, brief, easy-to-use screen with good discriminative properties for determining high risk of substance use disorders in the adolescent age group treated in primary care.[12] Use of this screening tool has been researched more extensively than any other substance use screening method in the adolescent age group. As a measure of risk, each "yes" answer to the 6 CRAFFT questions is scored as 1 point, so as the score increases, there is a corresponding greater likelihood of having a substance use disorder (ie, meets the diagnostic criteria for having substance abuse or substance dependence [addiction] delineated in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*[23] [DSM-IV-TR]). Recently, the CRAFFT tool was effectively integrated into an adolescent SBIRT algorithm and toolkit produced for Massachusetts practitioners by a collaborative led by the Massachusetts Department of Public Health Bureau of Substance Abuse Services.[14] This statement will lead the practitioner through this time-efficient, research-informed adolescent SBIRT algorithm (Fig 1).

The SBIRT algorithm starts with a 2-step method of using the CRAFFT screening tool. First, the clinician asks 3 specific opening questions to determine if the adolescent has used alcohol or other drugs in the previous 12 months, and the answers to these questions determine what portion of the CRAFFT screen is indicated (Fig 1 [start at the top center]). Adolescents who answer "no" to all 3 opening questions (Fig 1, upper left) are still asked the "C" (or "car") question to determine if they have placed themselves at risk by riding with an alcohol- or drug-"influenced" or intoxicated driver. Those who answer "yes" to any of the opening questions are asked all 6 CRAFFT questions (Fig 1, upper right). This 2-step screening may be accomplished by interview with the physician or office staff or by self-administered written or electronic survey. As with all psychosocial interviews, screening for substance use is most informative when conducted confidentially without a parent or guardian present. Before screening, both patients and parents should be well informed about the confidentiality policy followed in that practice setting, including the safety-related limits that justify whether to continue or break confidentiality.[24]

BRIEF INTERVENTION

Brief intervention describes a screening outcome-responsive conversation that focuses on encouraging a patient to make healthy choices and personal behavior changes regarding risky activity such as substance use. In primary care pediatrics, the term "brief intervention" encompasses a spectrum of responses that includes providing patients who report no substance use with brief positive feedback about their ability to make healthy choices. When the screening process reveals alcohol or other drug use, the indicated brief intervention ranges from providing brief advice to using a brief negotiated interview based on motivational techniques to encourage the desired behavior change or acceptance of a referral for treatment.

Low Risk: Abstinence

Screening should be conducted whenever possible, regardless of visit type, and should always be included as part of the annual well-adolescent visit. Adolescents who report no use of tobacco, alcohol, or other drugs *and* answer "no" to the "car" question of the CRAFFT screen are at low risk of having a substance use disorder. It is important that these patients receive praise and encouragement for making smart decisions and healthy choices (Fig 1, upper left ["no to all opening questions"]).[17] Experience is showing that even a few positive words from a physician can delay initiation of alcohol use by adolescents.[25] Anticipatory guidance to avoid riding with a driver who has been drinking or using drugs is always appropriate.

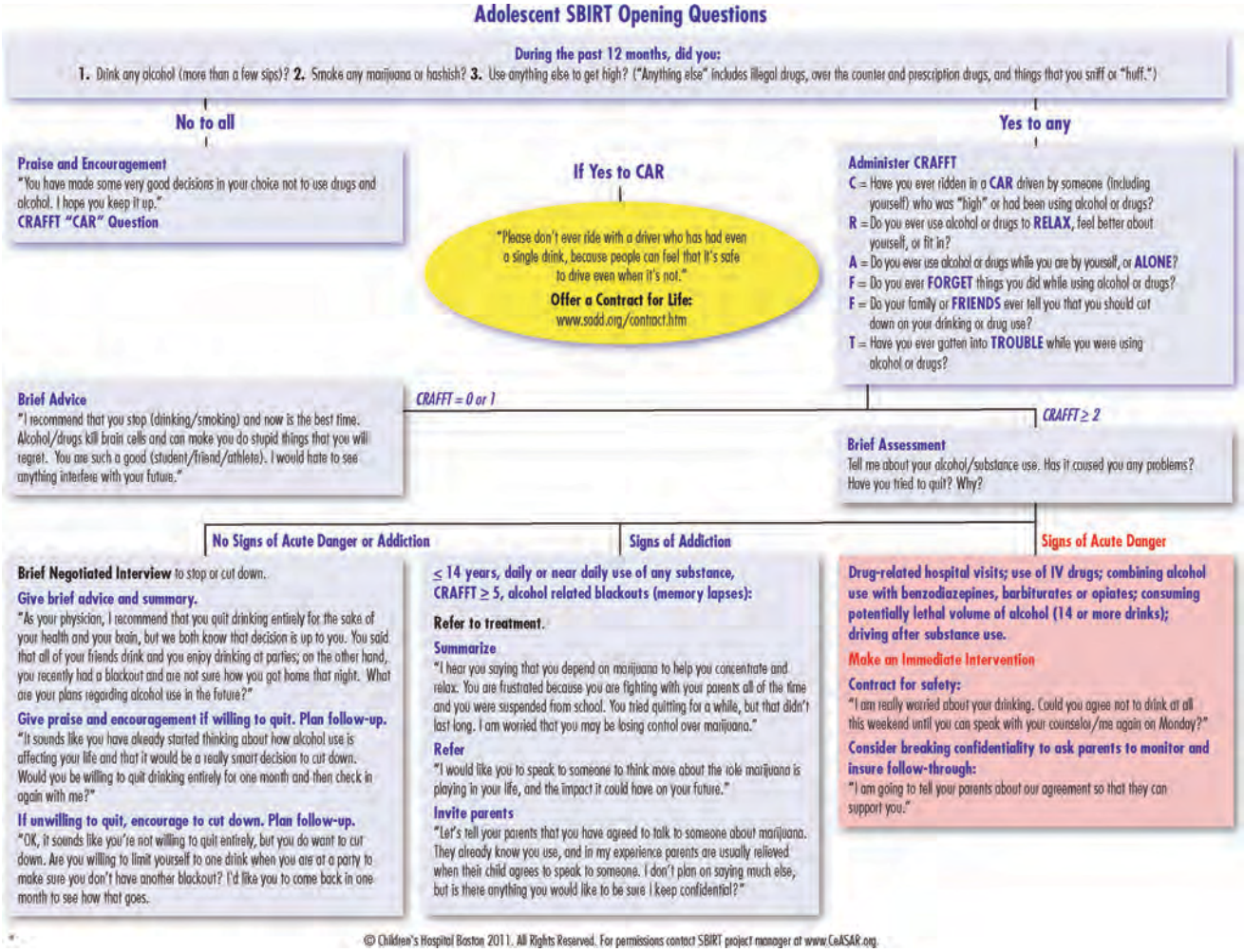

FIGURE 1
Adolescent SBIRT algorithm. (Reprinted with permission from the Adolescent Substance Abuse Program, Children's Hospital Boston.)

Driving Risk

All adolescents who report driving after alcohol or drug use or riding with a driver who has been using alcohol or drugs (ie, answer "yes" to the "car" question) should receive educational counseling regarding the associated danger (Fig 1, top-center oval). Ask adolescents to make a safety plan and commit to avoiding future driving/riding risks. The Contract for Life developed by Students Against Destructive Decisions (SADD) is a short, thought-provoking statement that can be used to facilitate development of a safety plan between an adolescent and a parent or other responsible adult.[26] This contract can be downloaded from the SADD Web site (www.saddonline.com/contract.htm). Pediatricians should consider breaking confidentiality if the adolescent cannot or will not commit to avoiding riding with a driver who has been using alcohol and/or drugs or avoiding their own alcohol or other drug use and driving—the basis for their positive response to the "car" question.

Moderate Risk: CRAFFT-Negative

Adolescents who have begun using alcohol or drugs and score 0 or 1 on the CRAFFT screen are considered at moderate risk of having substance use–associated problems (Fig 1, middle-left side). These adolescents may benefit from brief intervention consisting of both clear advice to stop alcohol and other drug use and educational counseling about the health effects of drug use (eg, "Recent research has confirmed that brain growth continues into at least the 20s, and alcohol poisons developing brain cells"). Brief intervention for adolescents in this category should also include recognition of strengths and positive personal and family attributes (eg, "You are such a good student, it would be a shame to let alcohol interfere with your education").

High Risk: CRAFFT-Positive

Adolescents who test positive on the CRAFFT screen, defined as having a

CRAFFT score of 2 or greater, are at high risk of having a substance use disorder. The middle right side of the SBIRT algorithm shows that the adolescent with a positive CRAFFT-screen result should undergo further assessment to detect whether the alcohol and/or other drug use indicates acute danger or "red flags" for addiction and to reveal the level of conviction the adolescent has for engaging in behavior change. To look for a pattern of increasing alcohol or other drug use, ask adolescents about their drug use history, their experience with any alcohol- or other drug-associated problems or troubles, and whether they have made quit attempts and why. A well-conducted assessment that encourages an adolescent to discuss problems associated with drug use and reasons for quit attempts is consistent with motivational-interviewing or motivational-enhancement techniques for supporting positive behavior change and can be the first step of brief intervention for this level of substance use.

Signs of Acute Danger

An adolescent who reports experience with certain risk behaviors, such as having a drug-related hospital visit, using intravenous drugs, combining sedatives (including alcohol, benzodiazepines, barbiturates, or opioids), consuming a potentially lethal volume of alcohol (≥14 drinks), or driving or engaging in other potentially dangerous activity after alcohol or drug use, shows clear signs of acute danger that warrant immediate intervention (Fig 1, lower-right rectangle). If any sign of addiction is also present, the corresponding lower-middle portion of the Fig 1 algorithm will guide the medically indicated action, which is treatment referral. The next step when addiction is not yet a concern is to ask the adolescent to commit to avoiding the behavior(s) and consider using a simple written contract to document this commitment. If the adolescent is unwilling or unable to commit or seems to underestimate the significance of alcohol or other drug use, consider breaking confidentiality to protect patient safety. Adolescents who choose to disclose such high-risk behaviors to a clinician might be asking for help. If breaking confidentiality is required to protect safety, discuss with the adolescent exactly what you will disclose and what you can keep confidential. Often, teens are most concerned about protecting small details (ie, which friends are involved, where they obtained substances, etc) that would have minimal impact on their immediate safety plan and can be kept confidential. Design a plan that involves the parent(s) or another responsible adult, professional counselors, and other substance abuse–related services. Schedule close follow-up to ensure patient compliance and safety.

Red Flags for Addiction

Probable substance addiction is indicated by red-flag findings, including a CRAFFT score of 2 or more in an adolescent aged 14 years or younger, daily or near-daily use of any substance, a CRAFFT score of 5 or higher, and alcohol-related blackouts (memory lapses) (Fig 1, lower-middle rectangle). Breaking confidentiality to protect patient safety is, again, a key consideration. Parents should be involved in this process whenever possible, because most adolescents will not follow through with a referral on their own. In most cases, parents will already be highly suspicious or aware of their adolescent's drug use, although they might underestimate the extent or severity. Adolescents might be willing to include their parent(s) in a discussion of recommendations, particularly if the clinician can present any concerns and recommendations in the context of positive patient and family attributes, such as mentioning the adolescent's honesty when screened or willingness to undergo further assessment. An adolescent with an addiction red flag should be referred for detailed evaluation and subspecialty treatment that is as specific to adolescents with substance use disorders as possible (see "Referral to Treatment").

No Signs of Acute Danger or Addiction

Adolescents who have had relatively minor consequences associated with their substance use should be engaged in a brief negotiated interview (BNI) based on motivational principles to encourage abstinence or risk reduction (Fig 1, lower-left rectangle). In contrast to brief advice, a BNI involves a negotiation that attempts to reduce substance use and related risk behaviors by using the negative aspects of substance use as reported by the adolescent. The BNI is based on the principles of motivational interviewing, which is a counseling approach in which a clinician encourages a patient to explore the effects of his or her current behavior on personal interests or goals. These principles align well with established pediatric medical home practices of providing confidential care and building a trust relationship and rapport. Motivational-interviewing or BNI techniques are particularly useful for adolescents who have experienced problems associated with alcohol or drug use but remain ambivalent about continued use or have not yet considered the possibility of changing their behavior. A full review of motivational interviewing is beyond the scope of this statement; interested readers are referred to the seminal work by Miller and Rollnick.[27]

Brief negotiated interviews have been used successfully to reduce both alcohol[28–30] and marijuana[31] use by adoles-

I,_____ , agree to not drink alcohol, use drugs, or take anyone else's medication for the next _____ days. I also will not provide drugs, alcohol, or prescription medications for anyone else during this time. In addition, I agree to not drive a motor vehicle while under the influence of drugs or alcohol, nor will I ride with a driver who has been drinking or using drugs.
I will come to my follow-up appointment with _____on _____.
Signed, _____

Date: _____

FIGURE 2
Abstinence challenge. (Reprinted with permission from the Adolescent Substance Abuse Program, Children's Hospital Boston.)

cents in emergency care settings. These studies all used multicomponent interventions delivered by peer health educators. To date, no study has examined the effectiveness of this type of intervention when conducted by clinicians working with adolescents in the primary care setting, although these techniques have been used and studied extensively with adult patients. We recommend that clinicians performing a BNI in primary care (1) summarize information from the assessment (see above), (2) repeat for emphasis any problems associated with substance use identified by the adolescent, and (3) ask the adolescent whether he or she would like to make changes in the future (eg, "I understand that you really enjoy smoking marijuana with your friends. On the other hand, you were suspended from the basketball team after the coach caught you with marijuana, and you are worried that having a 'record' of marijuana use might be bad for your college applications. What are your plans regarding marijuana use in the future?"). Telling adolescents who are invested in their substance use to stop using substances can trigger resistance, whereas asking about their own plans might present an opportunity for positive feedback (eg, "It sounds as if you have already thought this through. I fully support your decision to quit using for now"). When an adolescent professes interest in making a behavior change, consider asking for a signed commitment not to use alcohol or other drugs for a defined time period (Fig 2). Patients who are not willing to try complete abstinence might agree to risk reduction. In these cases, discuss concrete parameters for tracking progress.

All patients who have had a brief negotiated interview need follow-up to ensure patient compliance and safety. Adolescents who have met their goals can benefit from both a discussion of the pros and cons of their decreased substance use and reinforced motivation toward sustained behavior change. Those who were unable to meet their own goals might benefit from more extensive and individual counseling targeted specifically at substance use provided by an allied mental health professional such as a social worker or psychologist. Referral to interdisciplinary mental health professionals within the same practice setting often optimizes patient compliance. Research on the effectiveness of individual substance abuse counseling with motivational interviewing in particular has shown decreased harmful behaviors in adolescents, including decreased frequency of alcohol use and episodes of drinking and driving, alcohol-related injuries, and other problems.[29,32–36] In addition, an arm of the Cannabis Youth Treatment Study[37] revealed that motivational enhancement therapy using motivational-interviewing techniques plus cognitive behavioral therapy had greater cost-effectiveness and efficacy when compared with family therapy and psychoeducational support.

REFERRAL TO TREATMENT

Referral to treatment describes the facilitative process that provides patients identified as needing more extensive evaluation and treatment with access to appropriate services. In accordance with the SBIRT algorithm (Fig 1), signs of acute danger or red flags for addiction usually indicate the need for referral to adolescent-specific specialty care.

Addiction is a neurologically based, chronic, relapsing disorder that requires long-term management and monitoring. Any adolescent who meets the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* criteria for substance dependence should be assessed by a professional experienced with adolescent addiction.[23] Because resistance and denial (ie, lack of insight) are intrinsic to substance use disorders and are expected at this stage of the disease, the patient and/or family might be unwilling to pursue an evaluation that is clearly indicated. Despite this potential challenge, it is important for the pediatrician to remain engaged with the patient and family and supportive during discussions and decision-making about the patient's care options. Motivational-interviewing strategies can often be helpful in encouraging an adolescent and/or the family to accept a referral.

It is essential that pediatricians establish effective working relationships with alcohol and other drug treatment professionals and facilities in their communities to ensure that adolescent patients have access to treatment that is appropriate for their developmental, psychosocial, medical, and mental health needs. Adolescent patients with alcohol or other drug use disorders should be

managed collaboratively (or comanaged) with child and adolescent mental health or addiction specialists whenever possible and scheduled for medical home office visits throughout the recovery process.

Deciding where to refer an adolescent in need of treatment is often complicated by limited treatment availability and insurance-coverage complexities. In most cases, pediatricians refer adolescent patients to a mental health or addiction specialist to conduct a comprehensive biopsychosocial assessment and determine the appropriate level of care from the treatment spectrum, which ranges from outpatient substance abuse counseling to long-term residential treatment programs. In 2001, the American Society of Addiction Medicine revised its comprehensive national guidelines for placement, continued stay, and discharge for patients with alcohol and other drug problems, devised separate guidelines for adults and adolescents, and detailed 5 broad levels of care that range from early intervention to medically managed intensive inpatient treatment and correspond to addiction severity, related problems, and potential for behavior change and recovery[38] (Table 2).

An essential part of assisting the substance-using adolescent is becoming familiar with available community options, such as education and prevention services for those identified early in their substance use, or treatment modalities such as treatment-locator mechanisms and patient-treatment–matching criteria. The Center for Substance Abuse Treatment has published evidence-based treatment and assessment protocols, manuals, and facility-contact information (available at www.chestnut.org/li/apss/CSAT/protocols/index.html). To help identify treatment options throughout the country, the Substance Abuse and Mental Health Services Administration maintains a comprehensive and easy-to-use substance abuse treatment facility locator on its Web site (www.samhsa.gov/treatment/index.aspx). This site also includes both a buprenorphine physician and treatment program locator and an opioid treatment program directory. Opioid addiction and alcohol abuse are the primary indications for medication-assisted treatment in adult populations, and buprenorphine is effective for managing withdrawal of opioid-dependent adolescents and facilitating treatment completion.[39,40]

Successful addiction treatment usually involves more than 1 level of care during a long recovery process. Most patients in addiction treatment consider themselves "recovering" rather than "recovered" in recognition of their lifelong potential for relapse. Whether treatment begins in outpatient or inpatient care, it should continue at a level appropriate for the patient's recovery process, often through sequential or overlapping therapeutic levels that usually include participation in a formal structured program, 12-step self-help groups (eg, Alcoholics Anonymous, Alateen, Narcotics Anonymous), continued after-care programs, and self-help recovery work.

Medical home follow-up plays a key role for all patients in recovery. Relapse can be prevented, but because it often occurs, it should be anticipated as a potential part of the recovery process. Relapse should be viewed not as failure but as a learning opportunity important to the recovery process. Pediatricians have an important supportive role when a patient relapses and once again should initiate referral to treatment. By collaborating with addiction medicine specialists and other mental health professionals and working with the school, the family, and third-party payers, the pediatrician plays a central and essential role in the substance abuse treatment and recovery process for children and adolescents.

CRITERIA FOR THE SELECTION OF A SUBSTANCE ABUSE TREATMENT PROGRAM

The following criteria were based on Substance Abuse and Mental Health Services Administration and Center for Substance Abuse Treatment standards as optimal goals for inpatient or outpatient substance abuse treatment programs that serve the pediatric population.[41] The program will:

1. View drug and alcohol abuse as a primary disease rather than a symptom.
2. Include a comprehensive patient evaluation and developmentally appropriate management and treatment referral plan for associated medical, emotional, and behavioral problems identified.
3. Maintain rapport with the patient's pediatrician to facilitate seamless after-care and primary care follow-up.
4. Adhere to an abstinence philosophy. Drug use is a chronic disease, and a drug-free environment is essential. Tobacco use should be prohibited, and nicotine-cessation treatment should be provided as part of the overall treatment plan. Continued tobacco, alcohol, or other drug use should be viewed as a need for more treatment rather than discharge or refusal to treat.
5. Maintain a low patient-to-staff ratio.
6. Employ treatment professionals who are knowledgeable in both addiction treatment and child and adolescent behavior and development.
7. Ensure that professionally led support groups and self-help groups are integral parts of the program.

TABLE 2 Substance Use Treatment

Outpatient	
Group therapy	Group therapy is a mainstay of substance abuse treatment for adolescents with substance use disorders. It is a particularly attractive option, because it is cost-effective and takes advantage of the developmental preference for congregating with peers. However, group therapy has not been extensively evaluated as a therapeutic modality in this age group, and existing research has produced mixed results.[46,48]
Family therapy	Family-directed therapies are the best validated approach for treating adolescent substance abuse. A number of modalities have been demonstrated effective. Family counseling typically targets domains that figure prominently in the etiology of substance use disorders in adolescents: family conflict, communication, parental monitoring, discipline, child abuse/neglect, and parental substance use disorders.[46]
Intensive outpatient program	IOPs serve as an intermediate level of care for patients who have needs that are too complex for outpatient treatment but do not require inpatient services. These programs allow people to continue with their daily routine and practice newly acquired recovery skills both at home and at work. IOPs generally comprise a combination of supportive group therapy, educational groups, family therapy, individual therapy, relapse prevention and life skills, 12-step recovery, case management, and aftercare planning. The programs range from 2 to 3 h/d, 2–5 d/wk, and last 1–3 months. These programs are appealing, because they provide a plethora of services in a relatively short period of time.[49,a]
Partial hospital program	Partial hospitalization is a short-term, comprehensive outpatient program in affiliation with a hospital that is designed to provide support and treatment for patients with substance use disorders. The services offered at these programs are more concentrated and intensive than regular outpatient treatment; they are structured throughout the entire day and offer medical monitoring in addition to individual and group therapy. Participants typically attend sessions for 7 or 8 h/d, at least 5 d/wk, for 1–3 weeks. As with IOPs, patients return home in the evenings and have a chance to practice newly acquired recovery skills.[50,b]
Inpatient/residential	
Detoxification	Detoxification refers to the medical management of symptoms of withdrawal. Medically supervised detoxification is indicated for any adolescent who is at risk of withdrawing from alcohol or benzodiazepines and might also be helpful for adolescents withdrawing from opioids, cocaine, or other substances. Detoxification may be an important first step but is not considered definitive treatment. Patients who are discharged from a detoxification program should then begin either an outpatient or residential substance abuse treatment program.[47,48]
Acute residential treatment	ART is a short-term (days to weeks) residential placement designed to stabilize patients in crisis, often before entering a longer-term residential treatment program.[47] ART programs typically target adolescents with co-occurring mental health disorders.
Residential treatment	Residential treatment programs are highly structured live-in environments that provide therapy for those with severe substance abuse, mental illness, or behavioral problems that require 24-hour care. The goal of residential treatment is to promote the achievement and subsequent maintenance of long-term abstinence and equip each patient with both the social and coping skills necessary for a successful transition back into society. Residential programs are classified as short-term ($<$30 d) or long-term ($\geq$30 d). Residential programs generally comprise individual and group-therapy sessions plus medical, psychological, clinical, nutritional, and educational components. Residential facilities aim to simulate real living environments with added structure and routine to prepare patients with the framework necessary for their lives to continue drug- and alcohol-free after completion of the program.[51,c]
Therapeutic boarding school	Therapeutic boarding schools are educational institutions that provide constant supervision for their students by a professional staff. These schools offer a highly structured environment with set times for all activities; smaller, more specialized classes; and social and emotional support. In addition to the regular services offered at traditional boarding schools, therapeutic schools also provide individual and group therapy for adolescents with mental health or substance use disorders.[52,d]

IOP indicates intensive outpatient program; ART, acute residential treatment.

[a] See www.ncbi.nlm.nih.gov/books/NBK25875.

[b] See www.cignabehavioral.com/web/basicsite/provider/pdf/levelOfCareGuidelines.pdf.

[c] See www.ncbi.nlm.nih.gov/books/NBK25881.

[d] See www.ncbi.nlm.nih.gov/books/NBK24159.

8. Maintain separate treatment groups for patients at varying developmental levels (adolescents versus young adults versus older adults).
9. Involve the entire family in the treatment, and relate to the patients and their families with compassion and concern. Strive to reunify the family whenever possible.
10. Ensure that follow-up and continuing care are integral parts of the program.
11. Offer patients an opportunity to continue academic and vocational education and assistance with restructuring family, school, and social life. Consider formal academic and cognitive skills assessment, because unidentified weaknesses might contribute to emotional factors that contribute to the substance use.
12. Keep the family apprised of costs and financial arrangements for inpatient and outpatient care and facilitate communication with managed care organizations.

13. Be located as close to home as possible to facilitate family involvement, although separation of the adolescent from the family might be indicated initially.

DUAL DIAGNOSIS

The fact that other psychiatric disorders occur with increased frequency in adolescents who use tobacco, alcohol, or other drugs raises additional diagnostic and therapeutic considerations.[42–44] This potential for dual diagnosis makes it essential for the pediatrician to be knowledgeable about the prevalence of co-occurring psychiatric diagnoses and how they manifest so that comprehensive assessment of a substance-using adolescent can include screening for any coexisting disorders and timely referral to the most suitable and effective treatment available.

BILLING AND PAYMENT ISSUES FOR PEDIATRICIANS

Time-based *Current Procedural Terminology* (CPT) codes are available specifically for tobacco use—cessation counseling and for structured alcohol/substance abuse screening and brief intervention (SBI) counseling. Medicare uses time-based G-codes for structured SBI services. Medicaid has established H-codes, which individual states must "turn on" (ie, approve) for reimbursement, although many states have not yet completed this activation process. G-codes and H-codes are located in the Healthcare Common Procedural Coding System (HCPCS) level II code set. A comprehensive fact sheet on coding substance use screening and SBIRT is available at the AAP Practice Management Online site (http://practice.aap.org/content.aspx?aid=2914), and further clarification can be addressed through the AAP coding hotline (AAPCodinghotline@aap.org) and the annually updated AAP publication *Coding for Pediatrics*.[45] Insurers differ markedly in their coding interpretation and reimbursement rates. Certain substance use diagnoses might be considered mental health disorders that require "carve-out" contract services provided by mental health specialists and are not allowable as reimbursable primary care provider services. Furthermore, physicians should be aware that when an adolescent is covered by a parent's insurance policy and the insurance company sends the policyholder an explanation of benefits that includes defined diagnostic codes, the adolescent patient's confidentiality is at risk of compromise.

RECOMMENDATIONS FOR PEDIATRICIANS

The AAP recommends that pediatricians:

1. Become knowledgeable about all aspects of SBIRT through training program curricula or continuing medical education that provide current best-practices training.
2. Become knowledgeable about the spectrum of substance use and the patterns of nicotine, alcohol, and other drug use, particularly by the pediatric population in their practice area.
3. Ensure appropriate confidentiality in care by becoming familiar and complying with state and federal regulations that govern health information privacy, including the confidential exchange of substance use and treatment information.
4. Screen all adolescent patients for tobacco, alcohol, and other drug use with a formal, validated screening tool, such as the CRAFFT screen, at every health supervision visit and appropriate acute care visits, and respond to screening results with the appropriate brief intervention.
5. Augment interpersonal communication and patient care skills by becoming familiar with motivational-interviewing techniques.
6. Develop close working relationships with qualified and licensed professionals and programs that provide the range of substance use prevention and treatment services, including tobacco cessation, that are necessary for comprehensive patient care.
7. Facilitate patient referrals through familiarity with the levels of treatment available in the area and application of the multidimensional assessment criteria to determine the intensity of services needed.
8. Make referrals to adolescent-appropriate treatment for youth with problematic use or a substance use disorder.
9. Consider throughout the SBIRT process that psychiatric disorders can co-occur in adolescents who use psychoactive substances.
10. Stay abreast of coding regulations, strategies, and updates to bill for tobacco, alcohol, and other drug use SBIRT services.
11. Advocate that heath care institutions and payment organizations provide mental health and substance use services across the pediatric/adolescent ages and developmental stages while ensuring parity, quality, and integration with primary care and other health services.

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CLINICAL REPORT

Suicide and Suicide Attempts in Adolescents

Guidance for the Clinician in Rendering Pediatric Care

Benjamin N. Shain, MD, PhD, and the Committee on Adolescence

ABSTRACT

Suicide is the third-leading cause of death for adolescents 15 to 19 years old. Pediatricians can take steps to help reduce the incidence of adolescent suicide by screening for depression and suicidal ideation and behavior. This report updates the previous statement of the American Academy of Pediatrics and is intended to assist the pediatrician in the identification and management of the adolescent at risk of suicide. The extent to which pediatricians provide appropriate care for suicidal adolescents depends on their knowledge, skill, comfort with the topic, and ready access to appropriate community resources. All teenagers with suicidal thoughts or behaviors should know that their pleas for assistance are heard and that pediatricians are willing to serve as advocates to help resolve the crisis.

INTRODUCTION

The number of adolescent deaths that result from suicide in the United States had been increasing dramatically during recent decades until 1990, when it began to decrease modestly. In 2003, there were 3988 suicides among people 15 to 24 years old; 1487 (11% of deaths) were among those 15 to 19 years old, and 2501 (13% of deaths) were among those 20 to 24 years old.[1] The true number of deaths from suicide actually may be higher, because some of these deaths may have been recorded as "accidental."[2]

From 1950 to 1990, the suicide rate for adolescents 15 to 19 years old increased by 300%,[3] but from 1990 to 2003, the rate in this age group decreased by 35%.[1] Adolescent boys 15 to 19 years old had a suicide rate that was 6 times greater than that of their female counterparts, whereas the rate of suicide attempts was twice as high among girls than among boys.[4] The ratio of attempted suicides to completed suicides among adolescents is estimated to be 50:1 to 100:1.[5] Suicide affects young people from all races and socioeconomic groups, although some groups seem to have higher rates than others. American Indian/Alaska Native males have the highest suicide rate, and black women have the lowest rate of suicide. A statewide survey of students in grades 7 through 12 found that 28.1% of bisexual and homosexual boys and 20.5% of bisexual and homosexual girls had reported attempting suicide.[6] The 2003 Youth Risk Behavior Survey of students in grades 9 through 12 in the United States indicated that during the 12 months before the survey, 28.6% of students felt sad or hopeless almost every day for at least 2 weeks in a row, 16.5% had planned a suicide attempt, 8.5% had attempted suicide, and 2.9% had made a suicide attempt that required medical attention.[4]

Firearms, used in half of completed suicides among people 15 to 19 years of age, were the leading method of suicide for boys in this age group in 2003 (54% of

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Abbreviation
FDA—Food and Drug Administration

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suicides) and the second-leading method for girls (29%).[1] Suicide attempts that involve a firearm usually are fatal, because there is little chance for rescue. Firearms in the home, regardless of whether they are kept unloaded or stored locked, are associated with a higher risk of completed adolescent suicide.[7,8] In 1 study, when firearms were present in the home, each of the practices of securing the firearm (keeping it locked and unloaded) and the ammunition (keeping it locked and stored away from the firearm) were associated with reduced risk of youth shootings that resulted in unintentional or self-inflicted injury or death.[9] Parents must be warned about the lethality of firearms in the home and advised strongly to remove them from the premises or, at least, to secure them.[10] Ingestion of pills is the most common reported method of attempted suicide among adolescents.[11] However, the incidence of suicide attempts using other methods, such as hanging, is not known, because victims who do not die may not be brought for medical treatment.[11]

Youth seem to be at much greater risk from media exposure than adults and may imitate suicidal behavior seen on television.[12] Media coverage of an adolescent's suicide may lead to cluster suicides, with the magnitude of additional deaths proportional to the amount, duration, and prominence of the media coverage.[12]

ADOLESCENTS AT INCREASED RISK

Although no specific tests are capable of identifying a suicidal person, specific risk factors exist.[11,12] The clinician should use care in interpreting risk factors, however, because risk factors are common, whereas suicide is infrequent. In addition, the lack of most risk factors does not make an adolescent safe from suicide.

Fixed risk factors include family history of suicide or suicide attempts, male gender, parental mental health problems, gay or bisexual orientation, a history of physical or sexual abuse, and a previous suicide attempt. Social and environmental risk factors include the presence of firearms in the home, impaired parent-child relationship, living outside of the home (homeless or in a corrections facility or group home), difficulties in school, neither working nor attending school, social isolation, and presence of stressful life events such as legal or romantic difficulties or an argument with a parent. Personal mental health problems that predispose to suicide include depression, bipolar disorder, substance abuse or dependence, psychosis, posttraumatic stress disorder, panic attacks, and a history of aggression, impulsivity, or severe anger. More than 90% of adolescent suicide victims met criteria for a psychiatric disorder before their death. Immediate risk factors include agitation, intoxication, and a recent stressful life event. More information is available from the American Academy of Child and Adolescent Psychiatry[11] and Gould et al.[12]

INTERVIEWING THE ADOLESCENT

Primary care pediatricians should be comfortable screening for suicide and mood disorders by asking about emotional difficulties, identifying lack of developmental progress, and estimating level of distress, impairment of functioning, and level of danger to self and others. If needed, referral should then be made for appropriate mental health evaluation and treatment. This clinical report goes into more detail than is needed for this basic assessment. In areas where the resources necessary to make a timely mental health referral are lacking, pediatricians are strongly encouraged to obtain extra training and become competent in providing a more in-depth assessment.

The best way to assess for suicidal ideation is by directly asking or screening via self-report. Self-administered scales can be useful for screening, because adolescents may disclose information about suicidality on self-report that they deny in person. Scales, however, tend to be oversensitive and underspecific and lack predictive value (see the American Academy of Child and Adolescent Psychiatry practice parameter[11]). Adolescents who endorse suicidality on a scale should always be assessed clinically.

One approach to initiate a confidential inquiry into suicidal thoughts or concerns is to ask a general question such as, "Have you ever thought about killing yourself or wished you were dead?" The question is best placed in the middle or toward the end of a list of questions about depressive symptoms. Regardless of the answer to the first question, the next question should be, "Have you ever done anything on purpose to hurt or kill yourself?" If the response to either question is positive, the pediatrician should obtain more detail (eg, nature of past and present thoughts and behaviors, time frame, intent, who knows and how did they find out). Inquiry should include suicide plans ("If you were to kill yourself, how would you do it?"), whether there are firearms in the home, and the response of the family. No data indicate that inquiry about suicide precipitates the behavior. In a screening program, asking high school students about suicidal ideation and behavior did not create distress or increase suicidal ideation, even in high-risk students.[13]

The adolescent should be interviewed separately from the parent, because the patient may be more likely to withhold important information in the parent's presence. Information should also be sought from parents and others as appropriate. Although confidentiality is important in adolescent health care, for adolescents at risk to themselves or others, safety takes precedence over confidentiality; the adolescent should understand that at the onset. Pediatricians need to inform appropriate people when they believe an adolescent is at risk of suicide. As much as is possible, the sequence of events that preceded the threat should be determined, current problems and conflicts should be identified, and the

degree of suicidal intent should be assessed. In addition, pediatricians should assess individual coping resources, accessible support systems, and attitudes of the adolescent and family toward intervention and follow-up.[14]

Questions should also be asked to elicit known risk factors. In particular, all adolescents, especially any patients who show psychosocial or adaptive difficulties, should be screened regularly for symptoms of mood disorders and should be asked about suicidal ideation, physical and sexual abuse, substance use, and sexual orientation. Screening at acute care visits, when possible, is desirable, because mental health problems may manifest more strongly at these times.[15]

Care in interviewing needs to be taken, because abrupt intrusive questions could result in a reduction of rapport and a lower likelihood of the adolescent sharing mental health concerns. This is especially true during a brief encounter for an unrelated concern. Initial questions should be open-ended and relatively nonthreatening. Examples include "Aside from [already stated non–mental health concern], how have you been doing?" "Is there anything that has been stressing you lately?" "How have things been going with _ [school, friends, parents, sports]?" When possible, more detailed questions should then follow, particularly during routine care visits or when a mental health concern is stated or suspected.

Suicidal thoughts or comments should never be dismissed as unimportant. Statements such as, "You've come really close to killing yourself," may, if true, acknowledge the deep despair of the youth and communicate to the adolescent that the interviewer understands how close to acting he or she has been. Such disclosures should be met with reassurance that the patient's pleas for assistance have been heard and that help will be sought.

Serious mood disorders, such as major depressive disorder or bipolar disorder, may present in adolescents in several ways.[16] Some adolescents may come to the office with complaints similar to those of depressed adults, having symptoms such as sad or down feelings most of the time, crying spells, guilty or worthless feelings, markedly diminished interest or pleasure in most activities, significant weight loss or weight gain or increase or decrease in appetite, insomnia or hypersomnia, fatigue or loss of energy, diminished ability to think or concentrate, and thoughts of death or suicide. The clinician should also look for adolescent manifestations of symptoms (Table 1).[17] Some adolescents may present with irritability rather than depressed mood as the main manifestation. Other adolescents present with somatic symptoms such as abdominal pain, chest pain, headache, lethargy, weight loss, dizziness and syncope, or other nonspecific symptoms.[18] Others present with behavioral problems such as truancy, deterioration in academic performance, running away from home, defiance of authorities, self-destructive behavior, vandalism, alcohol or other drug abuse, sexual acting out, and delinquency.[19]

Typically, symptoms of depression, mania, or a mixed state (depression and mania coexisting or rapidly alternating) can be elicited with careful questioning but may not be immediately obvious. Mania is characterized by irritability or euphoria along with symptoms that include decreased need for sleep, talking a lot, racing thoughts, grandiosity, distractibility, agitation or increased goal-directed activity, or excessive involvement in pleasurable activity that has a high potential for painful consequences (eg, running away, sexual activity, putting self in dangerous situations).[16] Mania was once thought to occur only rarely in youth. However, approximately one fifth of all patients with bipolar disorder have their first episode during adolescence, although the prevalence in adolescents is still controversial. Developmental variations in presentation, symptomatic overlap with other disorders, and lack of clinician awareness

TABLE 1 **Depressive Symptoms and Examples in Adolescents**

Signs and Symptoms of Major Depressive Disorder	Signs of Depression Frequently Seen in Youth
Depressed mood most of the day	Irritable or cranky mood; preoccupation with song lyrics that suggest life is meaningless
Decreased interest/enjoyment in once-favorite activities	Loss of interest in sports, video games, and activities with friends
Significant weight loss/gain	Failure to gain weight as normally expected; anorexia or bulimia; frequent complaints of physical illness; eg, headache, stomach ache
Insomnia or hypersomnia	Excessive late-night TV; refusal to wake for school in the morning
Psychomotor agitation/retardation	Talk of running away from home, or efforts to do so
Fatigue or loss of energy	Persistent boredom
Low self-esteem; feelings of guilt	Oppositional and/or negative behavior
Decreased ability to concentrate; indecisive	Poor performance in school; frequent absences
Recurrent suicidal ideation or behavior	Recurrent suicidal ideation or behavior (writing about death; giving away favorite toys or belongings)

(Reprinted with permission from the *Diagnostic and Statistical Manual of Mental Disorders*. Washington, DC: American Psychiatric Association; 2000.)

have all led to underdiagnosis or misdiagnosis.[20] Red flags for mania in adolescents include episodes of rage, grossly overreacting to limit setting or other circumstances that the adolescent does not desire, and having good days and bad days. Mixed states may be particularly dangerous, because the adolescent may have hopelessness associated with depression and agitation, impulsivity, and the ability to get things done associated with mania.

MANAGEMENT OF THE SUICIDAL ADOLESCENT

Management depends on the degree of immediate and intermediate risk (see the American Academy of Child and Adolescent Psychiatry practice parameter[11] for a review and the article by Kaye et al[21] for a practical guide to pediatric mental health evaluation, treatment, and systems of care). Unfortunately, no one can accurately predict suicide, so even experts can only determine who is at higher risk. Examples of adolescents at high risk include those with a plan or recent suicide attempt with a high probability of lethality; stated current intent to kill themselves; recent suicidal ideation or behavior accompanied by current agitation or severe hopelessness; and impulsivity and profoundly dysphoric mood associated with bipolar disorder, major depression, psychosis, or a substance use disorder. An absence of factors that indicate high risk, especially in the presence of a desire to receive help and a supportive family, suggests a lower risk but not necessarily a low risk. Low risk is difficult to determine. For example, an adolescent who has taken 8 ibuprofen tablets may have thought that it was a lethal dose and may do something more lethal the next time. Alternatively, the adolescent may have known that 8 ibuprofen tablets is not lethal and took the pills as a rehearsal for a lethal attempt. In the presence of a recent suicide attempt, the lack of current suicidal ideation may also be misleading if none of the factors that led to the attempt have changed or the reasons for the attempt are not understood. The benefit of the doubt is generally on safety in the management of the suicidal adolescent.

The term "suicide gesture" should not be used, because it gives a false sense of security. "Suicide attempt" is a more appropriate term for any deliberately self-harmful behavior or action that could reasonably be expected to produce self-harm and is accompanied by some degree of intent or desire for death as well as thinking by the patient at the time of the behavior that the behavior had even a small possibility of resulting in death. In a less-than-forthcoming patient, intent may be inferred by the lethality of the behavior, such as taking a large number of pills, or by an affirmative answer to a question such as, "At the time of your action, would you have thought it okay if you had died?"

Adolescents who initially may seem at low risk, joke about suicide, or seek treatment for repeated somatic complaints may be asking for help the only way they can. Their concerns should be assessed thoroughly. Adolescents who are judged to be at low risk of suicide should still receive close follow-up, referral for a timely mental health evaluation, or both if they should have any significant degree of dysfunction or distress from emotional or behavioral symptoms.

For adolescents who seem to be at moderate or high risk of suicide or have attempted suicide, a mental health professional should be consulted immediately during the office visit. Options for immediate evaluation include hospitalization, transfer to an emergency department, or an appointment the same day with a mental health professional.

Intervention should be tailored to the adolescent's needs. Adolescents with a responsive and intact family, good peer relations and social support, hope for the future, and a desire to resolve conflicts may require only a brief crisis-oriented intervention.[22] In contrast, adolescents who have made previous attempts, exhibit a high degree of intent to commit suicide, show evidence of serious depression or other psychiatric illness, are abusing alcohol or other drugs, have low impulse control, or have families who are unwilling to commit to counseling are at high risk and may require psychiatric hospitalization and long-term psychiatric and psychologic intervention.

Although no controlled studies have been conducted to prove that admitting adolescents at high risk to a psychiatric unit saves lives,[11] the safest course of action is hospitalization, thereby placing the adolescent in a safe and protected environment. An inpatient stay will allow time for a complete medical and psychiatric or psychologic evaluation with initiation of therapy in a controlled setting. The choice of hospital unit depends on available facilities in the area, health and mental health insurance, and managed care policies. Medical units that hospitalize adolescents must be staffed to manage both the medical and psychiatric needs of suicidal adolescents.[23] Proper medical intervention and treatment are essential for stabilization and management of patients' conditions. After the adolescent's condition has been stabilized medically, a comprehensive emotional and psychosocial assessment must be completed before discharge. Inquiry should be made into the events that preceded the attempt, the adolescent's current problems, and the presence of current or previous psychiatric illness and self-destructive behavior. In addition to an in-depth psychologic evaluation of the adolescent, family members should be interviewed to obtain additional information to help explain the adolescent's suicidal thoughts or attempt. This information includes detailed questions about the adolescent's medical, emotional, social, and family history with special attention to signs and symptoms of mood disorders, stress, substance abuse, impulsivity, and anger. With parental permission and adolescent assent,

teachers and family friends also may provide useful information.

All adolescents who attempt suicide need a comprehensive outpatient treatment plan before discharge. Specific plans are needed, because adherence with outpatient therapy often is poor. Most adolescents who are examined in emergency departments and referred to outpatient facilities fail to keep their appointments. This is especially true when the appointment is made with someone other than the medical home practitioner or the person who performed the initial assessment.[24] Continuity of care, therefore, is of paramount importance. Medical home practitioners can enhance continuity and adherence by maintaining contact with suicidal adolescents even after referrals are made. All firearms should be removed from the home, because adolescents may still find access to locked guns stored in their home. Potentially lethal medication should be locked up. Vigorous treatment of the underlying psychiatric disorder is important in decreasing short-term and long-term risk. Contracting with the adolescent against suicide has not been proven effective in preventing suicidal behavior.[11] The technique may still be helpful in assessing risk in that refusal to agree to either not harm oneself or tell a specified person about intent to harm oneself is ominous.

Working with a suicidal adolescent typically provokes anxiety in those who are providing treatment. Suicide risk can only be reduced, not eliminated, and risk factors provide no more than guidance. Much of the information regarding risk factors is subjective and must be elicited from the adolescent, who may have his or her own agenda. Of course, clinicians' anxiety may be reduced with knowledge and experience. Just as importantly, clinicians need to be aware of their own anxiety to prevent interference in treatment and overreaction or underreaction.

ANTIDEPRESSANT MEDICATIONS AND SUICIDE

A complete review of the pharmacologic treatment of adolescent mood disorders is beyond the scope of this report. However, the Food and Drug Administration (FDA) directive of October 2004 and heavy media coverage make the use of antidepressant medications worth mentioning. The FDA directed pharmaceutical companies to label all antidepressant medications distributed in the United States with a black-box warning "to alert health care providers to an increased risk of suicidality (suicidal thinking and behavior) in children and adolescents being treated with these agents."[25] The FDA did not prohibit the use of these medications in youth but called on clinicians to balance increased risk of suicidality with clinical need and to monitor closely "for clinical worsening, suicidality, or unusual changes in behavior." The warning particularly stressed the need for close monitoring during the first few months of treatment and after dose changes.

The FDA advisory panel was aware that this warning could have the unintended effect of limiting access to necessary and effective treatment,[17] and reported prescriptions of antidepressants for children and adolescents decreased by 19% in the third quarter of 2004 and 16% in the fourth quarter compared with the year before.[26] Concern has been expressed that this reduction of antidepressant prescribing may be related to the 18.2% increase in US youth suicides (1737–1935) from 2003 to 2004 after a decade of steady declines.[27]

A recent example of the effectiveness of these medications in adolescents is the Treatment for Adolescents With Depression Study,[28] a large, well-designed study that found that a combination of fluoxetine and cognitive behavioral therapy led to significant clinical improvement in 71% of adolescents with major depression. This compared with improvement of 61% for fluoxetine alone, 43% for cognitive behavioral therapy alone, and 35% for placebo. Those who were treated with fluoxetine showed approximately twice the rate of self-harm adverse events compared with those who were not treated with fluoxetine.[28] However, despite adolescents with the highest suicide risk being excluded from the study, 29% of the depressed patients reported suicidal thoughts before the start of treatment. After 12 weeks of treatment, this decreased to 10% across all groups, with the combined-treatment group showing significantly more of a decrease than those in the placebo group.

The warning by the FDA was prompted by a finding that in 24 clinical trials that involved more than 4400 child and adolescent patients and 9 different antidepressant medications, spontaneously reported suicidal ideation or behavior was present in 4% of the subjects who were taking medication and 2% of the subjects who were taking a placebo. Contradictory findings of a slight reduction of suicidality, however, were found when subjects were asked at each visit about suicidal ideation and behavior. The latter method does not rely on spontaneous reports and is considered to be more reliable than event reports.[17]

Furthermore, a reanalysis of the data including 7 additional studies and using a random-effects model showed only a 0.7% increase in the risk of suicidal ideation or behavior.[29] The random-effects model is considered to provide a more conservative estimate of effect compared with the fixed-effect model used by the FDA, because it does not assume homogeneity across studies as does the fixed-effects model.

No suicides occurred during any of the studies. Suicidal ideation and behavior are common, and suicides are vastly less common, which makes it difficult to relate a change in one to a change in the other.[17] Furthermore, the 28% decrease in completed suicides in the 10- to

19-year-old age group over the past decade may be at least partly a result of the increase of youth antidepressant prescribing over the same time period. Analyzing US data by dividing the country into 588 2-digit zip-code zones showed a significant ($P < .001$) 0.23-per-100 000 annual decrease in adolescent suicide with every 1% increase in antidepressant prescribing.[30]

Regardless of whether the use of antidepressant medications changes the risk of suicide, depression is an important suicide risk factor, and careful monitoring of adolescents' mental health and behavioral status is critically important, particularly when initiating or changing treatment. The FDA warning states, "All pediatric patients being treated with antidepressants for any indication should be observed closely for clinical worsening, suicidality, and unusual changes in behavior, especially during the initial few months of a course of drug therapy, or at times of dose changes (either increases or decreases). Ideally, such observation would include at least weekly face-to-face contact with patients or their family members or caregivers during the first 4 weeks of treatment, then visits every other week for the next 4 weeks, then at 12 weeks, and as clinically indicated beyond 12 weeks. Additional contact by telephone may be appropriate between face-to-face visits."[31]

The American Psychiatric Association and the American Academy of Child and Adolescent Psychiatry have recommended a different monitoring approach[17] that enlists the parents or guardians in the responsibility for monitoring and individualizing the frequency and nature of monitoring to the needs of the patient and the family. This approach potentially increases the effectiveness of monitoring and provides greater flexibility, thus reducing a barrier to prescribing. Warning signs for family members to contact the prescribing physician are listed in Table 2.[17]

Patients should not abruptly stop antidepressant medications, because withdrawal effects may include agitation and increased depression. Pediatricians should convey to parents the importance of consulting with the prescribing physician before stopping medication or changing the dose.

TABLE 2 **Treatment With Antidepressant Medication: Warning Signs for Family Members to Contact the Physician**

New or more frequent thoughts of wanting to die
Self-destructive behavior
Signs of increased anxiety/panic, agitation, aggressiveness, impulsivity, insomnia, or irritability
New or more involuntary restlessness (akathesia), such as pacing or fidgeting
Extreme degree of elation or energy
Fast, driven speech
New onset of unrealistic plans or goals

(Reprinted with permission from the *Diagnostic and Statistical Manual of Mental Disorders*. Washington, DC: American Psychiatric Association; 2000.)

SUMMARY

1. Adolescent suicide is an important public health problem.
2. Knowledge of risk factors may assist in the identification of adolescents who are at higher risk.
3. It is important to know and use appropriate techniques for interviewing potentially suicidal adolescents.
4. Mood disorders in adolescents have a variety of presentations.
5. Management options depend on the degree of suicide risk.
6. Treatment with antidepressant medications has risks and benefits.

ADVICE FOR PEDIATRICIANS

1. Ask questions about mood disorders, suicidal thoughts, sexual orientation, and other risk factors associated with suicide in routine history taking throughout adolescence, preferably at both acute care and routine care visits.
2. Recognize the medical and psychiatric needs of the suicidal adolescent and work closely with families and health care professionals involved in the management and follow-up of youth who are at risk or have attempted suicide. Develop working relationships with emergency departments and colleagues in child and adolescent psychiatry, clinical psychology, and other mental health professions to optimally manage the care of adolescents who are at risk of suicide. Because mental and physical health services are often provided through different systems of care, extra effort is necessary to ensure good communication, continuity, and follow-up through the medical home.
3. Because resources for adolescents and physicians vary by community, become familiar with local, state, and national resources that are concerned with treatment of psychopathology and suicide prevention in youth, including local hospitals with psychiatric units, mental health agencies, family and children's services, crisis hotlines, and crisis intervention centers. Have a list of relevant telephone numbers easily available in the office.
4. Educate yourself and your patients about the risks and benefits of antidepressant medications and provide reassurance that the medications are relatively safe and depression is relatively dangerous.
5. Carefully monitor patients with depression, especially after the initiation of antidepressant medication treatment and dose changes.

6. Because there is great variation among general pediatricians in training and comfort with assessing and treating patients with mental health problems, as well as in access to appropriate mental health resources, consider additional training and ongoing education in diagnosing and managing adolescent mood disorders, especially if practicing in an underserved area. Pediatricians without such skills still have an important role in screening all patients and referring patients when necessary.
7. During routine evaluations, ask whether firearms are kept in the home, and discuss with parents the increased risk of adolescent suicide with the presence of firearms. Specifically for adolescents at risk of suicide, advise parents to remove guns and ammunition from the house and secure supplies of potentially lethal medications.
8. Know the risk factors (eg, signs and symptoms of depression) associated with adolescent suicide and serve as a resource on the issue of adolescent suicide for parents, teachers, school personnel, clergy, and members of community groups who work with youth.
9. Advocate for benefit packages in health insurance plans to ensure that adolescents have access to preventive and therapeutic mental health services that adequately cover the treatment of clinically significant mental health disorders.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Supplemental Security Income (SSI) for Children and Youth With Disabilities

abstract

The Supplemental Security Income (SSI) program remains an important source of financial support for low-income families of children with special health care needs and disabling conditions. In most states, SSI eligibility also qualifies children for the state Medicaid program, providing access to health care services. The Social Security Administration (SSA), which administers the SSI program, considers a child disabled under SSI if there is a medically determinable physical or mental impairment or combination of impairments that results in marked and severe functional limitations. The impairment(s) must be expected to result in death or have lasted or be expected to last for a continuous period of at least 12 months. The income and assets of families of children with disabilities are also considered when determining financial eligibility. When an individual with a disability becomes an adult at 18 years of age, the SSA considers only the individual's income and assets. The SSA considers an adult to be disabled if there is a medically determinable impairment (or combination of impairments) that prevents substantial gainful activity for at least 12 continuous months. SSI benefits are important for youth with chronic conditions who are transitioning to adulthood. The purpose of this statement is to provide updated information about the SSI medical and financial eligibility criteria and the disability-determination process. This statement also discusses how pediatricians can help children and youth when they apply for SSI benefits. *Pediatrics* 2009;124:1702–1708

COUNCIL ON CHILDREN WITH DISABILITIES

KEY WORDS
Social Security income, SSI, children with disabilities, children with special health care needs, disability income

ABBREVIATIONS
SSI—Supplemental Security Income
SSA—Social Security Administration
SSDI—Social Security Disability Insurance
DDS—disability-determination services
SGA—substantial gainful activity

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THE SUPPLEMENTAL SECURITY INCOME PROGRAM FOR CHILDREN

The Supplemental Security Income (SSI) program was established by the Social Security Amendments of 1972 (Pub L No. 92-603) and replaced several federal programs including Old-Age Assistance, Aid to the Blind, Aid to the Permanently and Totally Disabled, and other grants to the states. The SSI program makes monthly payments to people who have low income and limited resources (assets) and are 65 years or older, blind, or disabled. It was the first government program to provide cash payments for the benefit of children with disabilities. The first payments were made under SSI in January 1974. The number of child recipients of SSI has grown substantially since it was first introduced. As of December 2005, more than 1 million children younger than 18 years were eligible for SSI benefits.[1] The SSI program continues to be administered by the Social Security Administration (SSA).

The SSI program remains an important program of the federal government for children and adolescents with disabilities/special needs.[2–4] SSI is a nationwide program that:

- provides monthly cash payments based on family income and resources;
- qualifies a child for Medicaid health care benefits in most states; and
- ensures referral of children who receive SSI to state Title V children with special health care needs programs.

SSI VERSUS SOCIAL SECURITY DISABILITY INSURANCE

SSI is often confused with Social Security Disability Insurance (SSDI). The SSI program makes payments to children with disabilities/special needs who are younger than 18 years, and eligibility is based on family/individual income and assets. The definition of disability for children under SSI is different from the definition of disability for adults. SSI payments are funded through general revenues of the federal government but can be supplemented by the states. SSDI benefits are funded by Social Security (Federal Insurance Contributions Act [FICA]) taxes, which workers and self-employed people pay into the Social Security trust fund. Any child, disabled or not, can receive SSDI benefits if a parent is disabled or retired and is entitled to Social Security benefits, or if a parent dies, having worked long enough under Social Security. The child must be younger than 18 years (or 18–19 years of age and still in high school) and unmarried. For SSDI, there are no income or asset limits; however, SSDI is based on employment history and payment of Social Security taxes. An adult who was disabled before 22 years of age may be eligible for child's benefits if a parent is deceased or receiving retirement or disability benefits. The SSA considers this a "child's" benefit, because it is paid on a parent's Social Security earnings record. The disability decision is made by using the disability rules for adults. An individual who is entitled to receive SSDI benefits becomes eligible for Medicare after a 2-year waiting period. There are different listings of medical impairments that may qualify for either SSI or SSDI, although both are based on an individual's disability precluding them from gainful employment.

Approximately two thirds of US states and the District of Columbia provide Medicaid eligibility to people who are eligible for SSI benefits. In these states, the SSI application is also the Medicaid application, and eligibility for Medicaid starts the same month as that for SSI. A small number of states* use the same rules to decide eligibility for Medicaid as the SSA uses for SSI but require the filing of a separate application, and others* use their own eligibility rules for Medicaid, which are different from federal SSI rules, and a separate application for Medicaid must be filed.[5]

The last major change to the SSI program was in 1996, when the Personal Responsibility and Work Opportunity Reconciliation Act (Pub L No. 104-193) changed the definition of disability for children to require a medically determinable impairment or combination of impairments that results in marked and severe functional limitations. This legislation also removed the individualized functional assessment step from the disability-determination process, which had been in place since February 1990.

*For more information about current related laws, please contact the American Academy of Pediatrics Division of State Government Affairs (www.aap.org/advocacy/stgov.htm).

ELIGIBILITY

Disability Criteria

Under current regulations, the SSA considers a child (birth to age of 18 years) to be disabled if:

- the child has a medically determinable physical or mental impairment (or combination of impairments) that results in marked and severe functional limitations; and
- the disability has lasted or is expected to last at least 1 year or is expected to result in death (within 1 year).[6,7]

Financial/Resource Eligibility Criteria

The financial and resource eligibility criteria for SSI are complicated. Although there are general guidelines, there are many exceptions. Therefore, the information provided here should be used as a general guide. The upper income limits for eligibility for the SSI program (Table 1) are higher in most states than for other federal or state programs, such as Medicaid or a State Children's Health Insurance Program (SCHIP). There are also limits on the amount of total assets (resources), such as jewelry, savings accounts, or checking accounts, that a family can have. In 2009, the limit on assets is $2000 if 1 parent lives in the household and $3000 if 2 parents live in the household.

BENEFITS

Children on SSI receive a monthly payment based on the income of the child and other family members in the household. The federal benefit rate in 2009 is $674 per month for an individual and $1011 for a couple. The total SSI payment varies according to state, because some states supplement the federal benefit rate with state funds. SSI eligibility also automatically qualifies a child for Medicaid in most states.

TABLE 1 SSI Income Eligibility

No. of Other Children Without a Disability in Household	Maximum Earned Monthly Income, $[a]		Maximum Unearned Monthly Income, $[a]	
	1-Parent Household	2-Parent Household	1-Parent Household	2-Parent Household
0	2821	3495	1388	1725
1	3158	3832	1725	2062
2	3495	4169	2062	2399
3	3832	4506	2399	2736
4	4169	4843	2736	3073
5	4506	5180	3073	3410
6	4843	5517	3410	3747

Shown is parents' maximum monthly income (in dollars) for a child with disability to be eligible for SSI in states that do not supplement SSI payments (for the year 2008). Amounts are adjusted each year to reflect inflation. The maximum levels are higher in states that supplement SSI.

[a] Rules related to "earned" and "unearned" income are complex. A chart cannot show a maximum amount when some of the family's monthly income is earned and some is unearned. If the family's total estimated income is close to the limit for earned income, a child may still qualify for SSI.

The income eligibility requirements for SSI continue to be more liberal, in general, than those for Medicaid. Therefore, the SSI program continues to provide children with disabilities access to the health care services that they might not otherwise be able to afford.[3] In addition, the Deficit Reduction Act of 2005 included passage of the Family Opportunity Act, a long-sought program that gives states the opportunity to provide Medicaid coverage to children with special health care needs who would qualify for SSI if not for family income and/or resources. Under the Family Opportunity Act, states have the option to expand Medicaid coverage to children up to the age of 18 with family incomes up to 300% of the federal poverty level who meet the SSI disability standard but whose family income exceeds current eligibility levels. The Family Opportunity Act includes provisions that require limits on cost-sharing and interaction with employer-sponsored insurance when families have access to insurance in which the employer provides at least 50% of the costs of the annual premium.[8] Several states also exempt SSI recipients from mandated enrollment in Medicaid managed-care arrangements. In addition, all state Title V children with special health care needs programs are mandated to assist children who receive SSI in accessing health and other supportive services.

APPLICATION PROCESS

If there is any possibility that a child is eligible for SSI, the parent or guardian should apply on behalf of the child. Some states require that families apply for SSI before they will consider the child's eligibility for state programs. Table 2 provides detailed information about how families can apply for SSI benefits for a child with disabilities.

DETERMINATION OF ELIGIBILITY FOR SSI

Presumptive Disability

Presumptive disability allows payments to begin quickly when there is a very strong likelihood that the child will be found to be disabled once all the evidence is obtained. Children for whom 1 of the following conditions is alleged may meet the requirements for a presumptive-disability decision, which can be made at the local SSA office. These conditions are:

- amputation of a leg at the hip;
- total blindness;
- total deafness;
- bed confinement or immobility without use of a wheelchair, walker, or crutches as a result of a recent change in a long-standing condition, excluding recent accident or recent surgery;
- stroke (cerebral vascular accident) that occurred more than 3 months ago, and the child has continued marked difficulty in walking or using a hand or arm;
- cerebral palsy, muscular dystrophy or muscular atrophy, and marked difficulty in walking, speaking, or coordinating the hands or arms;
- Down syndrome;
- severe mental deficiency (mental retardation) in a child aged 7 years and older;
- symptomatic HIV infection;
- birth weight of less than 1200 g and an age of 1 year or younger;
- birth weight between 1200 and 2000 g related to specific gestational ages and an age of 1 year or younger;
- HIV infection, confirmed by a medical source, and the file contains form SSA-4814 or SSA-4815;
- terminal cancer/illness with a life expectancy of 6 months or less, with confirmation by telephone or in a signed statement from a physician, or in hospice care, with confirmation from a physician or knowledgeable hospice official;
- allegation of spinal cord injury causing inability to ambulate without a walker or equivalent device 2 weeks after a spinal cord injury, with confirmation from an appropriate medical professional;
- end-stage renal disease with ongoing dialysis, and the file contains a completed form CMS-2728 (End-Stage Renal Disease Medical Evidence Report-Medicare Entitlement and/or Patient Registration); or
- allegation of amyotrophic lateral sclerosis (ALS or Lou Gehrig disease).

TABLE 2 What to Tell Families About SSI Application, Disability Determination, and Appeals Procedures: SSI Citizenship and Residency Eligibility Criteria

How to apply
To apply for SSI benefits for a disabled child, parents should call the toll-free number for the SSA (1-800-772-1213) to make an appointment for a telephone interview or visit a local Social Security office to complete an application.
If parents make an appointment for a telephone interview, an SSA claims interviewer will contact them. The interviewer will provide general information to parents about the financial, medical, disability, and functional criteria used to determine SSI eligibility. This information is provided to help parents decide whether to proceed with the application process. The SSA prefers that parents use the telephone process because, according to the SSA, it is more efficient for both the parents and the SSA.
What parents need to know
The telephone line is often busy, but they should keep trying.
The SSA interviewer will gather information about family income, financial resources, and the child's citizenship/residency status.
On the basis of the above-listed information, the interviewer will indicate whether it appears that the child is financially eligible for SSI.
Financial eligibility for adults (≥18 y) is based only on what the young adult owns and/or earns; parental income/assets are not considered in the determination.
The interviewer will ask the parents if they want to file an application for the child.
They have a right to request and file an application even if it does not appear that the child qualifies financially.
They will need to be prepared to provide the interviewer with information about all the medical sources who have treated or examined the child for the alleged conditions, including their complete names, addresses, telephone numbers, and dates of treatment.
Application forms completed by telephone will be mailed to the parents' home for signature.
The telephone interviewer should not suggest that the child does (or does not) appear to meet the SSI disability criteria.
The date of the telephone interview serves as the protective filing date, so there is no loss of payments. Parents should keep a record of all contacts with the SSA, including the name, date, and telephone number (including the extension) of the person with whom they spoke.
The process of determining disability can take several months or more.
Applying at the SSA field office
If parents choose to go to a local SSA field office, they should call either the local office or the toll-free number to make an appointment. This will ensure that an SSA staff person will be available to take the application and will reduce the amount of waiting time when filing an application. If parents cannot gather all of the required information by the time of the appointment, they should still go to the SSA field office at that time to begin the application process, thus establishing a protective filing date. When the SSA has the needed information about family income and financial resources, they will determine the financial eligibility for SSI.
SSI citizenship and residency eligibility criteria
To be eligible for SSI, a child must be a US citizen or a naturalized citizen. For SSI disability purposes, a child is an individual who is younger than 18 y. Children who are authorized to remain in the United States by the Immigration and Naturalization Service may also qualify. The child must also reside in 1 of the 50 states, the District of Columbia, or the Northern Mariana Islands. Children who live in Puerto Rico, Guam, and the US Virgin Islands may be US citizens but do not meet the SSI requirements for residency. The exception is children of military personnel who are assigned to overseas duty.

The field-office staff may base presumptive disability decisions on observations they make during interviews or on the documentation from medical or other health care professionals. Medical or psychological staff of the state disability-determination services (see next section) may make such decisions with respect to any impairment, not just those listed here.

A child who has been found to be disabled under a presumptive disability decision may receive SSI payments for up to 6 months while the formal evaluation of eligibility is conducted. For the determination of a presumptive disability, the pediatrician who treats a child with 1 of these conditions should provide the parents with a statement about the diagnosis and the severity of the child's condition. Parents can request a presumptive disability decision for their child on the basis of this statement.

Disability Determination

Each state has an agency that makes disability determinations on behalf of the SSA.[5] States use a variety of names for these agencies; however, they are generically known as disability-determination services (DDSs). State DDS offices operate under federal regulations and instructions issued by the SSA. Once the representative in the SSA office determines that the child is a US citizen and appears to qualify financially, he or she sends information about the child's disability and a list of additional sources of information to the DDS office. (Additional information about citizen and residency requirements is included in Table 2.) The DDS agency uses a team that consists of a disability examiner and medical or psychological professionals to decide whether a child is eligible for SSI on the basis of the available medical and nonmedical evidence.[9,10]

The decision-making team attempts to develop a complete medical and functional history for the child for at least the 12 months preceding the application for SSI. DDS staff members do not examine the child. Information is requested from physicians, hospitals, psychologists, schools, teachers, therapists, social workers, parents, friends, relatives, the child, and anyone else who may be able to provide relevant information about the child's impairment(s) and functioning. The determination of disability by the DDS agency is based primarily on the written information submitted, especially the child's medical records. It is essential, therefore, for pediatricians and other professionals to forward appropriate records or to provide a complete, detailed summary report.

Role of the Primary Care Physician

The primary care physician, as provider of the medical home, is uniquely positioned to act as both repository for this information and facilitator for submission of the summary report. However, the role of treating physicians is to provide accurate, timely, impartial information, not to decide whether an individual is disabled. The DDS team will make the disability decision by using information from the primary care physician and many other sources. A pediatrician's medical report in support of a child's application for SSI should:

- use specific terms and include results from specific clinical tests (if they have been obtained) mentioned in the childhood Listing of Impairments from the SSA[7];
- include at least a 12-month medical history of the child;
- provide complete, detailed clinical findings (including any results of physical, intelligence, developmental, and mental status examinations);
- include complete, detailed laboratory findings (eg, blood pressure, radiographic films, and chromosome test results);
- specify the diagnosis (statement of disease or injury on the basis of signs, symptoms, and laboratory findings);
- review treatments prescribed with response and prognosis;
- state the probable duration of the impairment;
- include an assessment of the child's physical or mental abilities to function in an age-appropriate manner and to perform age-appropriate daily activities; and
- describe the nature and limiting effects of the impairment(s) on the child's ability to function in an age-appropriate manner and to perform age-appropriate daily activities.

If the available information provided by those who treat the child is insufficient for determining disability, the DDS agency can arrange and pay for a consultative examination by a treating physician or, if a treating physician is unable or unwilling to conduct the examination, by an independent physician. On the basis of all the available information, the DDS agency follows a 3-step process[11] ("sequential evaluation") to make a determination. The steps of this process and the decision criteria are described in the next paragraph. The DDS agency then informs the SSA of the decision and sends a written notification of the decision to the parents (or other applicant). If the claim is denied, the decision notice includes the reasons and provides information about the right to appeal the decision.

THE 3-STEP EVALUATION PROCESS

At step 1, the examiner determines whether the child is engaging in substantial gainful activity (SGA)—that is, working and earning more than $980/month ($1640/month for a blind individual).† If the child is engaging in SGA, the claim is denied. If the child is not engaging in SGA, the examiner goes to step 2 of the evaluation process.

At step 2, a medical or psychological consultant determines, on the basis of available documentation, whether the child has an impairment or combination of impairments that is severe. "Severe" is defined as more than a minimal or slight limitation in a child's ability to function in an age-appropriate manner. If the child's impairment is a slight abnormality or combination of slight abnormalities that causes no more than minimal functional limitations, the SSI claim is denied. If it is determined that the impairment is severe, the examiner proceeds to step 3.

At step 3, the medical or psychological consultant determines whether the child's impairment is the same as ("meets") or is medically equivalent in severity to ("equals") 1 of the conditions on the Listing of Impairments from the SSA.[7] The DDS team will find that a child's impairment (or combination of impairments) meets a listed condition only when the symptoms, signs, and laboratory findings are the same as the findings included in the criteria in the SSI listings for that impairment. If a child's impairment meets a listing, then that child is determined to be disabled and is eligible for SSI benefits. If the child's impairment does not meet a listing, the medical consultant must determine if the child's impairment is "medically equivalent in severity" to any listed impairment. If it is not, the medical consultant must determine if the child's impairment functionally equals any listed impairment by considering how the child functions compared with children of the same age without impairments.

TRANSITIONING YOUTH

SSI can be an important source of financial support and health benefits (by linked Medicaid eligibility) for young adults with disabilities. Once an individual with a disability becomes an adult at 18 years of age, the DDS agency determines his or her eligibility for SSI by using the adult definition of disability—that is, inability to perform SGA. Approximately one third of children who receive SSI will lose their SSI eligibility because of the change in disability criteria effective at 18 years of age, based on disability and financial resources. However, children with severe impairments who were not eligible for SSI as children because the family did not meet financial eligibility

†These represent 2008 income levels.

requirements often become eligible for SSI after their 18th birthday. The SSA regards individuals aged 18 years and older, even if they live with their parents, to be a household of 1 for purposes of determining financial eligibility. These individuals must meet the adult definition of disability to be found disabled. Adults on SSI are generally eligible for services through their state vocational rehabilitation agency as well as a variety of work incentives and supports, including the Medicaid Buy-In Program, which has been introduced in a number of states. Each state has at least 1 Benefits Planning and Outreach Assistance organization that can help individuals to understand SSI and SSDI benefits as well as work incentives.

RECOMMENDATIONS

Pediatricians, individually and through state chapters of the American Academy of Pediatrics, should continue efforts to make families aware of the SSI program and provide assistance with the SSI application process. Such efforts can ensure that program benefits intended for children and youth with medically eligible conditions will be received. These efforts should include:

- in conjunction with the medical home model,[12] designating at least 1 member of the office staff to remain up-to-date on SSI policies and procedures;
- making up-to-date information about the SSI program available to families;
- obtaining a copy of the Listing of Impairments from the SSA and using this document as a basis for providing specific, detailed reports to the DDS agency in support of children's applications for SSI benefits;
- promoting methods of increasing office efficiency for timely completion of reports provided to the DDS agency;
- following the Pediatric Consultative Examination Guidelines of the SSA when performing consultative examinations of children; the guidelines are available through the DDS agency ("The Green Book"[10]);
- supporting and facilitating the ongoing distribution of SSA brochures to inform professionals and families about the SSI program; and
- inviting staff members from the SSA and DDS to participate in local and statewide educational meetings and workshops organized by American Academy of Pediatrics chapters.

WEB RESOURCES

Social Security Administration: www.ssa.gov

Benefit Eligibility Screening Tool: https://secure.ssa.gov/apps7/best/benefits

SSA disability programs: www.ssa.gov/disability/index.htm

SSA health and school professionals: www.ssa.gov/disability/professionals/index.htm

SSA employment support for people with disabilities: www.ssa.gov/work/index.html

SSA publications: www.ssa.gov/pubs/englist.html

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COUNCIL ON CHILDREN WITH DISABILITIES EXECUTIVE COMMITTEE, 2008–2009

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Clinical Report—Supporting the Health Care Transition From Adolescence to Adulthood in the Medical Home

abstract

Optimal health care is achieved when each person, at every age, receives medically and developmentally appropriate care. The goal of a planned health care transition is to maximize lifelong functioning and well-being for all youth, including those who have special health care needs and those who do not. This process includes ensuring that high-quality, developmentally appropriate health care services are available in an uninterrupted manner as the person moves from adolescence to adulthood. A well-timed transition from child- to adult-oriented health care is specific to each person and ideally occurs between the ages of 18 and 21 years. Coordination of patient, family, and provider responsibilities enables youth to optimize their ability to assume adult roles and activities. This clinical report represents expert opinion and consensus on the practice-based implementation of transition for all youth beginning in early adolescence. It provides a structure for training and continuing education to further understanding of the nature of adolescent transition and how best to support it. Primary care physicians, nurse practitioners, and physician assistants, as well as medical subspecialists, are encouraged to adopt these materials and make this process specific to their settings and populations. *Pediatrics* 2011;128:182–200

AMERICAN ACADEMY OF PEDIATRICS, AMERICAN ACADEMY OF FAMILY PHYSICIANS, AND AMERICAN COLLEGE OF PHYSICIANS, TRANSITIONS CLINICAL REPORT AUTHORING GROUP

KEY WORDS

health care transition, youth transition, medical home, children with special health care needs, primary care, adolescent health, quality improvement

ABBREVIATIONS

AAP—American Academy of Pediatrics
MCHB—Maternal and Child Health Bureau
CCM—chronic condition management
EHR—electronic health record

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1. INTRODUCTION AND METHODOLOGY

With reasonable biological certainty, most adolescents transition to adulthood. There is much less certainty about the manner in which health care professionals support this transition. Transition planning, when present at all, can be inexplicit, incomplete, or late, and when necessary, the transfer of care to an adult medical home and to adult medical subspecialists involves more of a drift away from pediatric care rather than a clearly planned and executed handoff. In 2002, a consensus statement coauthored by the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), and the American College of Physicians (ACP)-American Society of Internal Medicine was published, stating the importance of supporting and facilitating the transition of adolescents with special health care needs* into adulthood.[1] This statement represented the shared perspectives of health care professionals, families, youth, researchers,

*The Maternal and Child Health Bureau (MCHB) defines children and youth with special health care needs as "[t]hose who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally."[21]

and policy-makers. It provided foundational guidance for health care processes that include health care planning and information exchange, for professional education and certification, and for insurance and payment reform. Its conclusions and critical steps remain widely accepted standards that have informed the development of pilot projects, model practices, and national initiatives to improve support for transitioning youth. The US Department of Health and Human Service's Maternal and Child Health Bureau (MCHB) has been instrumental in promoting the importance of seamless, effective, and comprehensive services for all youth and families during this major life transition.[2]

After nearly a decade of effort, widespread implementation of health transition supports as a basic standard of high-quality care has not been realized. To date, only limited progress can be documented in the achievement of the consensus statement's 6 critical steps. Although 2 National Surveys of Children With Special Health Care Needs indicate improvements between 2001 and 2006, there has been only limited achievement of national health policy goals related to transition.[3,4] Outcomes-related research efforts have, so far, failed to fully address the transition needs of adolescents with or without chronic conditions.[5] A recent national survey revealed that pediatricians remain poorly informed about the conclusions of the consensus statement and that most pediatric practices neither initiate transition planning early in adolescence nor offer transition-support services, which have been found to be critical for ensuring a smooth transition to the adult health care model.[6] The survey authors noted that "gaps in transition support are due in part to limited staff training; lack of an identified staff person responsible for transition; financial barriers; and anxiety on the part of pediatricians, adolescents, and their parents about planning for their future health care."[7] Other authors have cited the lack of developmentally appropriate tools for assessing child and family readiness for transition as a barrier to transition.[8,9]

The result is that many pediatricians, youth, and families have found a limited availability of adult providers with whom to arrange a smooth transition of care.[10–14] In addition, evidence indicates that many adult providers feel unprepared to care for young adults with complex chronic conditions. In some cases, there is no identified adult primary care or specialty provider to whom care can be transitioned. Lack of time, adequate payment, and training have been cited as major barriers to transition.[15] Workforce shortages exist and are anticipated to worsen for physicians and other health professionals providing care for adults of all ages. In the face of an aging population that needs care, these shortages may be an obstacle to the delivery of primary care to more young adults with or without special health care needs.[16]

Family physicians caring for youth note that no transfer of primary care will be needed; nevertheless, there is a need to implement an adult model of care; plan for the transfer of specialty care to adult medical subspecialists; and support broader transition planning that includes issues such as educational attainment, career choices, and independent living needs. Internists find it challenging to care for a child or youth with special health care needs when the youth lacks preparation to be his or her own health advocate and the referring physician sends only minimal information about the youth and/or his or her condition.[17] Despite the recent spread of the family-centered medical home model for the redesign of primary care, payment reforms for non–encounter-based services (such as transition planning and care coordination) still have not materialized to a significant degree. Finally, with relatively few model practices exemplifying high-quality transition supports, training providers in the principles of health care transition remains challenging.

When there are obstacles, there are also opportunities. The need is stronger than ever for the seamless transfer of care and personal health information from pediatric care settings to more adult settings and for all youth to function as independently as possible in promoting their own health as adults. The 2007 AAP Annual Leadership Forum designated the resolution "transitioning youth with special health care needs to adult health care" as a top-10 priority. *Bright Futures* provides a framework for anticipatory guidance throughout childhood and adolescence that encourages parental support of self-management and independent decision-making about health.[18] Explicitly planned care as the product of a partnership among health care professionals, youth, and families has become an essential characteristic of the primary care medical home for which recognition standards have become more firmly established, such as the Physician Practice Connection for the Patient-Centered Medical Home of the National Committee on Quality Assurance and the Medical Home Index of the Center for Medical Home Improvement.[19,20] Providing high-quality transition care and support may become one of the standards that both pediatric and adult primary care practices would need to meet to be recognized as a medical home and become eligible for new payment scenarios.

These new opportunities have set the stage for a reaffirmation of the principles in the original consensus state-

ment by the AAP, American Academy of Family Physicians, and American College of Physicians. All 3 professional groups also recognize the need to translate those principles into practical operational guidance for the care of all children and youth as they transition to adulthood. Although youth with special health care needs require a broader range of considerations during their transitions, all youth need education, guidance, and planning to prepare to assume appropriate responsibility for their own health and well-being in adulthood.[21] Most youth with chronic illnesses will survive into adulthood and, depending on the severity and specifics of their disability, should transition to an adult model of care. After the age of majority,† all youth deserve to be treated as adults and to experience an adult model of care, although some people may require decision-making support from a third-party proxy, such as through guardianship or power of attorney. Recent evidence has shown that higher executive function affecting impulsivity and decision-making continues to mature through the mid-20s. Older adolescents and young adults may require guided decision-making assistance from clinicians and family members as they enter adult systems of care.[22] Nevertheless, most youth will benefit from advance planning and preparation for that experience regardless of whether they remain with their pediatric provider or medical subspecialist after the age of 18.

This report assumes that it is the youth, not the clinician, who is transitioning in his or her movement from one stage of life and development to another. The actions of the youth's medical home involve not the transition of care but, rather, the transfer of some or all elements of care to an adult medical home setting or, in the case of a family medicine medical home, to an adult medical home model. The medical home visit is a different process when the patient has reached the age of majority; adult patients have specific considerations and necessitate providers' attention to new requirements such as adopting consent for treatment processes and Health Insurance Portability and Accountability Act (HIPAA)–compliant forms. Health care transfer is an element of transition and has a defined end point that may vary from patient to patient. Because both transition and transfer are influenced by environmental, socioeconomic, medical, and other factors, it is the responsibility of the medical home—in partnership with patients and their families—to coordinate efforts that ensure optimal outcomes for every patient.

The patient- and family-centered medical home model of primary care includes 3 distinct but interrelated care processes: preventive care; acute illness management; and chronic condition management (CCM). CCM constitutes an explicit and defined approach that involves planned and proactive care rooted in evidence- and consensus-based guidelines, written care plans, and active care coordination. The medical home uses a registry to track the status of its patients with special health care needs and may stratify the registry in terms of the severity or complexity of the patient's condition. Those with more complex conditions may be identified for written care plans, care coordination, and a more intense, amplified transition plan. CCM also includes an explicit approach to comanagement with medical subspecialists in which the roles of primary and specialty care are clearly articulated. (Comanagement involves an explicit and transparent process in which providers involved in a patient's care determine—in collaboration with the patient or family—which provider will be responsible for which aspects of the patient's care. Comanagement can occur between primary care providers and 1 or more medical subspecialists. It might also occur during the transfer of care from a pediatric to an adult setting.) Transition activities for youth with special health care needs should include a comanagement-transition plan that articulates the process and timing for the transfer of care from pediatric to adult medical subspecialists. (These components of CCM are described in greater detail later in this report.)

This clinical report aims to advance the practice-based implementation of planning, decision-making, and documentation processes for youth who are approaching transition, including those who have special health care needs and those who do not. It intends to provide a structure for training, continuing education, and research to further the understanding of best practices for transition of adolescents to adult care. It does not detail the activities conducted by receiving providers who accept patients into an adult model of medical home care. Because there is currently only limited outcome literature about transition, this clinical report is based on expert opinion and consensus recommendations rather than on specific evidence. The report provides a decision-making algorithm (Fig 1) for all youth, beginning at 12 years of age. The algorithm includes a branch with expanded, generic guidelines for transitioning youth with special health care needs who require CCM.[23] These chronic condition guidelines can, in turn, provide a template for later, more detailed, and specialized applications of the algorithm to specific conditions and specialty care

†The "age of majority" is a legal definition of the age at which a person is considered to be an adult. In most states, this age is 18 years; exceptions are Alabama and Nebraska (19 years) and Washington, DC, and Mississippi (21 years).

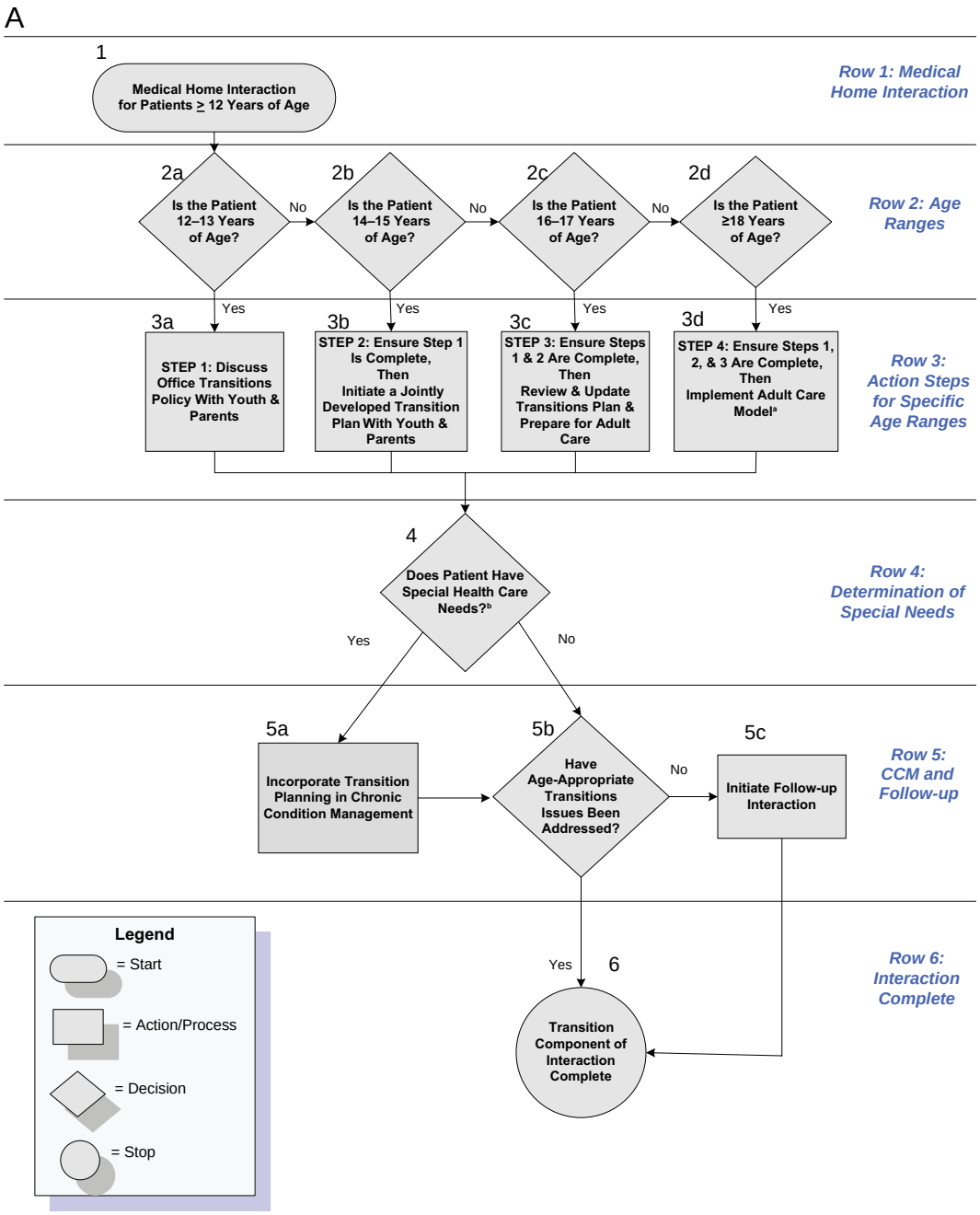


FIGURE 1

A, Health care transition-planning algorithm for all youth and young adults within a medical home interaction. [a] For pediatric practices, transfer to adult provider; [b] the MCHB defines children with special health care needs as "[t]hose who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally." B, Reverse side of the algorithm.[21]

situations. These guidelines, recommendations, and resources will also be useful to the medical subspecialist engaging in the transition process; primary care providers and medical subspecialists are encouraged to make this process specific for their own needs.

Methodology

The AAP and the National Center for Medical Home Implementation (a cooperative agreement between the AAP and the MCHB) have prioritized the issue of transitioning youth from a pediatric to an adult medical home with the goal of facilitating the effective transition of all youth from pediatric to ap-

B

ALGORITHM COMPONENT	DESCRIPTIVE TEXT
Medical Home Interaction for Patients ≥12 Years of Age	***1.*** Initiate first step in the health care transition planning process at age 12.
Is the Patient 12–13 Years of Age? / Is the Patient 14–15 Years of Age? / Is the Patient 16–17 Years of Age? / Is the Patient ≥18 Years of Age?	***2a, 2b, 2c, 2d. Age Ranges.*** By age 12, conduct surveillance to assess any special health care needs. Start actual transition planning by age 14. By ages 16–17, transition planning should be well established. At age 18, initiate an adult model of care for most youth, even if there is no transfer of care. If transition planning does not occur on the schedule described by the algorithm, a concentrated effort is required (eg, special visits) to complete the process successfully.
STEP 1: Discuss Office Transitions Policy with Youth & Parents	***3a.*** Every practice should have a written transition policy that is prominently displayed and discussed with youth and families. The policy should explicitly state the practice's expectations and care process for the health care transition of their adolescent patients to an adult model of care.
STEP 2: Ensure Step 1 is Complete, then Initiate a Jointly Developed Transition Plan with Youth & Parents	***3b.*** The practice should use a standard transition plan that can be adapted for each patient's needs. This tool should include components to obtain an accurate assessment of the patient's ability to transition successfully. Providers should interview youth and family members to identify needs and assess the intentions and motivations for youth independence.
STEP 3: Ensure Steps 1 & 2 are Complete, then Review & Update Transitions Plan & Prepare for Adult Care	***3c.*** Transition plans must be reviewed regularly and updated as necessary. The provider must also perform surveillance for changes in the youth's medical status and address youth and family concerns that may warrant changes in transition goals. Failure to achieve transition-readiness goals warrants reevaluation of the existing plan and increased frequency of medical home interventions/visits. A "pretransfer" visit to the adult medical home could be conducted during the year before the transfer.
STEP 4: Ensure Steps 1, 2, & 3 are Complete, then Implement Adult Care Model* **for pediatric practices transfer to adult provider*	***3d.*** Transition to an adult model of care occurs appropriate for youth's developmental level, which is followed as appropriate by transfer to an adult medical home. Complete medical records should be delivered to the adult provider, along with a portable summary, which is also provided to the patient or guardian. For children and youth with special health care needs, direct communication between pediatric and adult providers is essential, because adult medical personnel may be unfamiliar with certain pediatric conditions.
Does Patient Have Special Health Care Needs?**	***4.*** Transition planning for children and youth with special health care needs should include specific CCM activities such as use of registries; care plans; care coordination; CCM office visits; and comanagement with medical subspecialists. Transition goals must be individualized to account for variations in the complexity of a youth's condition and in the youth's intellectual ability and guardianship status.
Incorporate Transition Planning in Chronic Condition Management	***5a.*** Youth with special health care needs require an expanded transition-planning process. Transition planning in CCM includes addressing the exchange of complex health information; competencies for self-care; transfers of specialty care; and issues related to insurance, entitlements, guardianship, and eligibility for adult services. In a medical home, such youth may have a written care plan as part of the medical record. At age 14, this plan should include a section titled "transition plan," which should be expanded and developed as the youth approaches age 18 and beyond.
Have Age-Appropriate Transitions Issues Been Addressed?	***5b.*** Use of transition-planning tools and readiness checklists facilitate the provider's ability to ensure that all age-appropriate transition issues have been addressed. Each action step must be completed in order, even if it means the provider has to schedule specific visits to initiate and complete steps missed earlier in the process to catch up before the next visit.
Initiate Follow-up Interaction	***5c.*** Focused tasks involving little detail or complexity can be addressed by the medical home care coordinator, medical provider, or other appropriate staff through telephone or electronic media. More complex issues may necessitate face-to-face office visits.
Transition Component of Interaction Complete	***6.*** The provider is finished with the transition tasks for that specific interaction or visit; transition planning is an ongoing activity that occurs at every interaction.

FIGURE 1
Continued.

propriate adult care. The Executive Committee and staff of the AAP Council on Children With Disabilities (COCWD) are leading the transitions initiative, which has received funding support from the National Center for Medical Home Implementation and the COCWD. The ultimate goal of this initiative is to help medical home providers, patients, and their families ensure a successful transition to appropriate adult care.

In 2008, the AAP convened a meeting to review and provide advice on proposed transition initiatives. Current literature and activities were highlighted, and areas in which assistance is needed for pediatric providers to properly address transitioning youth to adult care within their practice were identified. The first activity of the transitions initiative was to develop a clinical report to provide pediatric providers with the information they need to facilitate youth receiving high-quality, developmentally appropriate health care services as they transition to adulthood. A Transitions Clinical Report Authoring Group was subsequently assembled and cochaired by Drs Carl Cooley and Paul Sagerman. Other disciplines and/or groups represented on the authoring group include pediatric primary care and subspecialty physicians, adult health care providers, family members, and a young adult who recently completed his own health care transition.

These stakeholders partnered to develop this clinical report on the importance of youth receiving high-quality, developmentally appropriate health care services as they transition to adulthood. It provides practitioners with a clear time line and algorithmic protocol for succeeding in this process. A draft version of this clinical report underwent extensive peer review by committees, councils, sections, and additional groups within the AAP as

well as by external people or groups who were either identified as experts in the field or had requested the reviewing opportunity. The resulting comments were incorporated into the report, as appropriate. It is expected that all subsequent AAP transition initiatives will use the publication of this clinical report, and the guidance therein, as a foundation for education, training, and quality measurement.

2. GETTING READY FOR TRANSITION

Transition planning should be a standard part of providing care for all youth and young adults, and every patient should have a transition plan regardless of his or her specific health care needs. Successful transition involves the engagement and participation of the medical home team (physicians, nurse practitioners, physicians assistants, nurses, care coordinators), the family and other caregivers, and the individual youth collaborating in a positive and mutually respectful relationship (ie, one that honors diversity and is consistent with each family's cultural and religious beliefs). The medical home team does not engage in transition planning alone; rather, it jointly creates and implements the plan with the youth and his or her family/caregivers. The medical home team facilitates a process that is planned, smooth, and patient- and family-centered. The parents' role is to actively engage in the process and move in and out of the decision-making position as appropriate. The youth's role is to maximize his or her independence and primacy in the decision-making process to foster lifelong functioning and self-determination. The receiving adult providers also need to be identified and engaged and, as needed, to provide developmentally appropriate support for the family and young adult during the transition process. This process is described in both the algorithm and "Adult Medical Home (Receiving Provider): Roles and Responsibilities."

a. Provider Readiness

A key component of supporting the transition process is the primary care medical home having an explicit office policy that describes the practice's approach to health care transition, including the age and process at which youth shift to an adult model of care. This office policy applies to all youth (both with and without special health care needs), guides the process, and helps the youth and family members (or other caregivers) understand both their and the medical home team's roles and responsibilities. The office transition policy should be visible and readily available to patients and their families, including depicting them in brochures, posters, and/or Web-based information about the practice. This office policy should clearly describe the goal of transition as part of lifelong preparation for a successful adult life and articulate how transition planning facilitates the patient's movement from a pediatric to an adult care mode.[17] Additional components of the office policy are described later in the algorithm.

To achieve the goal of transition planning as a standard of care, the medical home team must receive training and technical assistance to implement transitions effectively and adopt transition-related practices (eg, discussing the office transition policy, assessing family and youth transition readiness, developing referral relationships in the adult care system). Adult medical homes and medical subspecialists may need to build their capacities to provide services to young adult patients, particularly those with cognitive impairments and other special health care needs. Education and clinical experience for medical home team members will provide essential skills for the successful transition of youth both with and without special needs. Issues of provider readiness are described further in "Adult Medical Home (Receiving Provider): Roles and Responsibilities."

b. Family Readiness

The medical home team members must understand and address patients' and parents' perspectives and needs during transition and recognize that this process is complex and potentially emotional for parents and other caregivers/guardians. Although families make multiple transitions during their children's lives, for many parents, the pediatrician has been a constant, and they may find transition from the known to the unknown to be stressful. This is particularly likely to be true for parents of children with special health care needs. To make the process smoother for all involved, transition planning must anticipate and address challenges that parents may face as the youth enters adulthood.

It is important for physicians and other health care professionals to engage parents and youth with education and information about their role in the transition process. This education should include information about how the health care environment changes when the youth legally becomes an adult at 18 years of age as well as differences between pediatric and adult medicine models. The provider's goals are to normalize the transition process, address the families' anxieties or questions, and foster a team approach to help facilitate the acquisition of skills and tools that the youth can use both in transition and beyond. The family members or other caregivers should be engaged and open to the process (eg, learning about any upcoming changes in health coverage), encourage autonomous decision-making

and self-care on the part of the youth, and share their questions and/or concerns with the provider as they adjust to their role shifting from primary decision-maker and caregiver to a more supportive role.

c. Youth Readiness

For transition planning to succeed, providers, and parents/caregivers must view the youth as the driver in the process and encourage the youth to assume increasing responsibility for his or her own health care to the fullest extent possible. Empowering youth through transitions fosters the development of self-management skills and tools needed for them to gain more control in, and over, their lives.[24] Although this is the case for youth both with and without special health care needs, it is particularly critical for the former, who may require a broader range of considerations during the transition process.[25]

Although this report presents optimal ages for initiating and conducting transition planning, it is never too early to begin conversations among the provider, family/caregivers, and patient about planning for the future. This is especially true for children with special health care needs. For this population, it is likely that similar conversations are occurring in the educational system regarding Individualized Education Plans (IEPs); these various conversations can reinforce and buttress one another.[25] Prioritizing and reinforcing the value of independence and decision-making as part of the transition-planning process not only reinforces such messages on the part of providers, family members/other caregivers, and the broader community but also facilitates the patient's successful transition to adult medical care and active participation in maintaining his or her own health.

3. FRAMING THE ALGORITHM

An algorithm is a finite list of steps connected by various decision-making points that can be taken to move from a known beginning to a predictable end state. As a decision-making tool, an algorithm presents clear-cut questions that, when answered, delineate standardized pathways that lead to the process's next step(s) and a desired outcome. Clinical algorithms have long been popular and effective tools for helping clinicians understand and implement a diagnostic, therapeutic, or management process. Algorithms also provide a logic model for the incorporation of processes of care into electronic health records (EHRs). Algorithms have been included recently in AAP policy documents as strategies to support health care professionals to develop a pattern and practice to address developmental concerns in children from birth through 3 years of age and to engage in early identification of children with autism spectrum disorders.[23,26]

The algorithm contained in this clinical report (Fig 1) specifies the protocol for managing the transition process; assists physicians and other health care professionals to implement the transition process; and provides a transition structure for youth and their families. It is intended for use by clinicians within a medical home setting as a "jumping-off point" for the identification of youth who have reached a point in their lives at which health care transition should be integrated as a routinely recognized part of the office visit. Individual steps along the transition process will vary from one youth to the next depending on individual patient, family/caregiver, health care professional, and community-resource factors. The transition process is best initiated by the time a child is 12 years of age and ideally should occur during a health maintenance or CCM visit. Transfer itself should occur within the 18- to 21-year age range, although it can occur earlier because some internists accept new patients at 15 years of age, particularly if they see other family members as well. Some youth may experience a variety of health care settings as they move from pediatric to adult models of care (eg, while in college or military service), but these settings are not likely to provide a comprehensive medical home. Youth should either remain in their pediatric medical home or be well established in their adult medical home while receiving episodic care in these settings.

a. Explanation of the Algorithm Components

Row 1: Medical Home Interaction

Medical Home Interaction for Patients ≥12 Years of Age

All youth, regardless of whether they have identified special health care needs, should be assessed for transition readiness. Preparation for adult life should be a routinely addressed topic for any health maintenance visit that occurs within the medical home during the adolescent years. The *Bright Futures* initiatives provide content materials on this subject matter.[20] Medical homes can provide appropriate transition services, support, and planning. Transition planning with patients and families must be initiated during an office visit to allow face-to-face communication, because the parties involved may not have previously considered this subject matter. Subsequent medical home transition-planning "interactions" may include, but not be limited to, office visits for health maintenance or acute illness, CCM visits, nursing visits, telephone or e-mail consultations, provision of office policies, and/or record reviews and updates. It is of paramount impor-

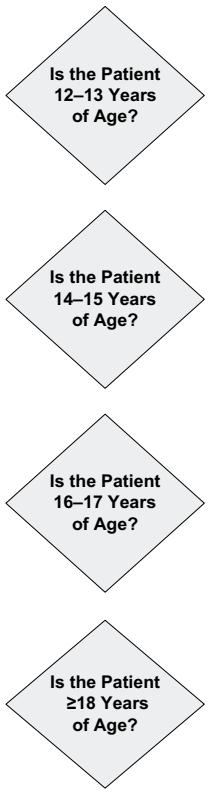
tance that the primary care medical home recognize which youth in the practice have reached the age for transition planning and prompt these families to come in for a visit to initiate the process. Each action step does not require a separate medical home visit, and multiple action steps can be addressed during a visit, although doing so requires a greater investment of time and resources.

Although opinions differ on the age for initiating the transition process, the most appropriate time is early adolescence, when youth become developmentally capable of engaging in activities regarding their personal futures. Therefore, this clinical report recommends initiating the first step in the health care transition-planning process at the age of 12, which allows sufficient time to adequately prepare patients, families, and medical providers before the youth legally becomes an adult at the age of 18. Several clinical studies have found this age to be an appropriate time to initiate the process to most successfully affect the transition's outcome.[27–29]

Children and youth with special health care needs and their families may benefit from discussions regarding adult transitioning that begin earlier than 12 years of age, depending on specific patient circumstances. Expectations for vocation, independent living, guardianship, reproduction, life expectancy, and other topics should be discussed at the earliest possible opportunity with parents and/or other appropriate caregivers if it is determined that the child's transition process will be different from that of children without special health care needs. In addition, some children with chronic medical conditions (eg, asthma or diabetes) may be introduced to developmentally appropriate self-care at ages younger than 12. The timing of these discussions must be individualized.

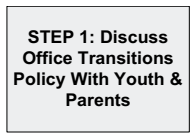
Row 2: Age Ranges

The second row of the algorithm assists health care providers in developing a practice of recognizing the need for transition for all patients 12 years or older. The use of emerging health information technology is likely to aid in this process (eg, through registries and age-related prompts). The age ranges presented in the algorithm are designed to aid the provider in assessing the most appropriate ages for implementing specific stages of transition planning. For most patients, this appropriateness is determined by age, whereas for others, it may be modified on the basis of developmental considerations. The provider's flexibility and judgment are important in this process. Actual transition planning should be initiated at the age of 14. The goal is to identify patients who are either entering or within the 14- to 15-year age range to initiate the development of a patient-specific transition plan at the child's next visit.



Row 3: Action Steps for Specific Age Ranges

Transition is a dynamic and fluid process that includes 4 major action steps. Each of the first 3 action steps (discussion of medical home transition policy, initiation of transition plan, and review/update of the transition plan) lays the foundation for the next. The fourth action step (implementation of an adult care model) prepares the youth and/or caregiver for the transfer to an adult care model. Regardless of the age at which the patient's transition process is initiated, the 4 action steps for transition planning must be accomplished in a linear fashion. For example, if transition is being initiated for a 16-year-old who presents for a health maintenance visit, steps 1 and 2 of the algorithm must be completed before moving to step 3 (the age-appropriate stage for a 16-year-old). As noted, a separate medical home visit is not required for each action step, and multiple action steps can be addressed in a single visit.



In (3a) step 1, the provider shares and discusses the office transition policy with the youth and his or her family or other caregivers. As described previously, every pediatric practice should have a well-defined policy that clearly states the expectations for the health care transition of their adolescent patients to an adult model of care. This policy should be displayed in a location where youth and their caregivers can easily read it (eg, posted in front offices and waiting rooms and described in brochures and on the practice's Web site). The policy should reflect the appropriate level of health literacy, reading and language proficiency, and cultural norms for the population the practice serves. Components of the

office transition policy include, but are not limited to:

- the expected age of patient transfer to an adult model of health care;
- the patient's responsibilities in preparing for transition;
- the parent, family, and/or caregiver responsibilities in preparing for transition; and
- the medical provider's responsibilities in preparing for transition.

In addition to posting the transitions policy, providers should provide a written copy of the office policy to all patients who are aged 12 or older and their families. Optimally, this policy is provided before a face-to-face encounter between the family/caregivers and the medical provider to allow the patient and family/caregivers sufficient time to become familiar with the policy and prepare any questions they may have before the office visit. Office policies can be given to the transitioning youth and family/caregivers while in the waiting room or be sent to their home before the visit. The delivery and discussion of the office transition policy should be documented in the patient's medical records. Medical home providers should be familiar with each of the transition policy's components to facilitate discussion and respond to questions posed during the office visit. Having a transitions policy that is presented early to the patient and family and other caregivers removes any doubt about the timing of transfer and raises awareness that the medical home will be a valuable support for those who need additional assistance.

For youth without special health care needs, no further transition-specific activities are required until the 14- to 15-year visits. For adolescents with special health care needs, however, the period from 12 to 14 years of age is likely to be spent beginning preparations for transition readiness. For this reason, during the 12- to 13-year visits, the medical home provider must identify those patients who are at risk of having a more complicated transition because of special medical, developmental, social, and/or environmental needs. Some children with particularly complex health care needs may benefit from the early implementation of a formal transition plan before the age of 14.

STEP 2: Ensure Step 1 Is Complete, Then Initiate a Jointly Developed Transition Plan With Youth & Parents

In (3b) step 2, the medical home provider initiates a transition plan that is jointly developed with the youth and his or her parents. Starting at age 14 (or before, for some children with special health care needs, as described previously), a formal transition plan should be initiated for all youth and placed in the medical record for review during future office visits. The written plan should document the youth's current readiness to assume a greater role in self-management of his or her health care, the steps to be conducted to achieve a successful transition, and the transmittal of information to the youth and family/caregivers. It forms the basis for records to be provided to the receiving provider and youth on the transfer of care between the ages of 18 and 21. Implementation and review of the transition plan can be an important measurable quality-improvement effort on the part of the medical home.

The starting point for this step is the recognition of patient capabilities and delineation of responsibilities between patient, family and other caregivers, and medical providers for overall patient care. Practices should select a readiness-assessment tool to use that can be modified for specific patient situations. Readiness tools reveal areas of both strength and weakness on which patient education can be focused to accomplish future goals in self-management. Regardless of the tool chosen, it should contain specific minimum components that provide an accurate, point-in-time assessment of the individual patient's ability to transition successfully. (These components are described below. Many readiness-assessment tools and skills checklists exist for conducting this assessment; some are listed in "Resources.")

No matter what tool is used to assess and document readiness, providers should interview family members or other caregivers and the youth independently of one another to identify needs and assess intentions and motivations for the patient's independence. The identification of special health care needs (medical or otherwise) requires the medical home to be proactive in facilitating relationships between the youth and appropriate community and/or state resources.

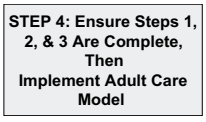
STEP 3: Ensure Steps 1 & 2 Are Complete, Then Review & Update Transitions Plan & Prepare for Adult Care

In (3c) step 3, the medical home provider reviews and updates the transition plan and works with the patient to engage in the transition process. The transition plan documentation should be reviewed on a regular basis to promote recognition by the patient, the family/caregivers, and the provider of successes and/or deficits in readiness preparation. Medical providers and caregivers can reprioritize the readiness goals with respect to changes in the youth's medical status and/or concerns on the part of the caregivers. Although the number of times this review occurs depends on the frequency of the patient's visits to the medical home, it should be conducted at least

annually. Focused efforts and intensified communication (among the patient, family members and other caregivers, and providers) may uncover systemic roadblocks or deficiencies in the patient's abilities to achieve previous expectations.

If there has been a failure to achieve transition-readiness goals, a reevaluation of the existing plan is warranted; it may be necessary to increase the frequency of medical home interventions or visits. Because 16- to 17-year-olds are significantly closer to the age of expected transfer of care to an adult model, accomplishing transition goals may not be feasible within the annual health maintenance schedule. Readiness plans will require revision on the basis of the outcome of such communication.

Successful transition requires the identification of an adult care medical home, and completion of this task is one of the most important for pediatric providers. The patient and/or family (and other caregivers) may need assistance identifying available and qualified adult care providers; when they select an adult provider, it is the pediatric medical home's responsibility to ensure appropriate communication of any and all medical needs to the receiving provider. In the final year before transfer from the pediatric medical home, the youth and family/caregivers might benefit from a visit with the potential adult provider(s) to explore the potential of a long-term relationship. Pediatric care occurring within a family medicine practice obviates the need for such a visit but not the need for preparation for an adult model of care.



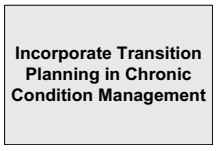
In (3d) step 4, the medical home provider implements an adult care model or affects the transfer to an adult medical home provider. After documented completion of the readiness goals in the individual youth's transition plan, the pediatric provider's role is to facilitate transfer of care to an adult medical home. For young adults with complex health care issues, direct communication between pediatric and adult providers is essential, because adult medical personnel may be unfamiliar with certain pediatric conditions.[17] For youth with complex needs, families are almost always a significant part of this conversation, because they are likely to be highly involved in not only caring for the youth but also arranging for, and supervising, others who provide care. The provider, youth, and family must jointly prepare a portable medical summary and, for children with special health care needs, a care plan, which should be delivered to the patient (or his or her legal guardian) and to the receiving provider. EHRs should also be provided to the adult provider. Medication reconciliation should be performed by the pediatric medical home before the record is transferred and by the receiving adult medical home when the record is received. (The components of this summary are described in "Implementing the Algorithm.")

Health care transition does not necessarily end with transfer. Some patients and/or caregivers may need additional support from the adult medical home to complete specific transition tasks. Providing this support through care coordination and consultation within the adult medical home optimizes the patient's self-management skills. In addition, the pediatric provider should make himself or herself available to the adult provider as a resource for any needed information or assistance during the immediate posttransfer period.

Row 4: Determination of Special Needs

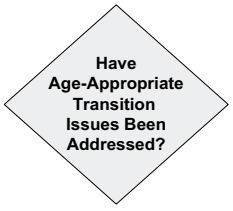
The transition process may be simpler for youth without disabilities or chronic health conditions compared with those with special health care needs. If the youth has no special health care needs, the provider's primary task is to ensure that all age-appropriate transition issues are addressed and that a smooth transfer to an adult model of care occurs. For the youth with special health care needs, the transition process should be initiated at the age of 12 and may necessitate specific CCM activities (these components are described below). The MCHB definition encompasses a wide variety of conditions and range of severities, including children with developmental disabilities and chronic illnesses as well as those with mental health and behavioral disorders.[21] The development of patient registries to aid in the identification of these children is a core component of CCM within the medical home model. An important feature of such planning is the recognition that many tasks that lead to patient self-management are beyond the capability of young adults whose medical conditions include cognitive challenges. Transition goals must be individualized to account for such variations.

Row 5: CCM and Follow-up



To the extent possible, basic transition planning and preparation for an adult

health care model should be the same for children and youth with and without special health care needs. For many children and youth with chronic medical, developmental, and/or behavioral conditions, however, an expanded process of transition planning is necessary to address the exchange of more complex health information, competencies for self-care, and the transfer of specialty care from pediatric to adult medical subspecialists. In addition, broader transitional issues related to health insurance, entitlements, guardianship, and eligibility for adult community-based services must be addressed also. In a medical home, some youth with special health care needs will have a written care plan as part of the medical record that can serve as a script for care coordination and care planning. At the age of 14, this written care plan should begin to include a section titled "transition plan"; this transition section should be developed steadily as the youth approaches the age of 18 and beyond. (Transition planning in CCM is more described fully below.)



Regardless of whether the child has special health care needs, providers should ensure that age-appropriate transition issues have been addressed at every medical home visit and that the process is on track. Use of appropriate transition-planning tools and readiness checklists will facilitate the provider's ability to answer this question. The act of "addressing" transition issues is not synonymous with the successful completion of the process, however. Identification of items in need of attention, and the formulation of plans to accomplish them, may be sufficient to complete this action step. If patients have fallen behind the transition-planning schedule, providers are likely to need to schedule a special visit to complete all of the tasks related to transition planning.

Follow-up interactions may take one of several forms. Focused tasks that involve little detail or complexity can be addressed by staff such as the medical home care coordinator or medical provider via telephone communication or electronic media (eg, secure e-mail). Larger or more complex issues may necessitate 1 or more face-to-face office visits, which should not be relegated to the next periodic health maintenance visit.

Row 6: Interaction Complete

This point does not mean that the office visit is complete or that the provider does not continue to provide care, merely that the part of the process of providing care that centers around transition planning has been completed for this specific office visit or interaction.

4. IMPLEMENTING THE ALGORITHM

Every youth who reaches the age of transition from a pediatric medical home or becomes a legal adult within his or her current medical home needs to have a basic transition plan developed through collaboration among the youth, family, and provider. Those with special health care needs require additional components specifically to address their chronic care management (see "Integrating Transition Planning Into CCM for Children and Youth With Special Health Care Needs").

a. Transition Plan Components for Every Child and Youth

There are 4 recommended components for a transition plan, each of which can be augmented by the use of specific tools to facilitate the work of the provider, youth, and family.

1. *Assess* for transition readiness. The provider, family, and youth begin by articulating realistic goals for transition and identifying new skills that will be needed by the patient to meet those goals successfully. Although it is not the main focus of the medical home, the assessment should be "person-centered" and include identification of other areas of readiness for transition into the adult world in general, including education/vocation, independent living, and patient awareness of medical needs and age-appropriate preventive care, as outlined by resources such as *Bright Futures*.[18] Numerous tools are available in the form of "readiness checklists" that allow providers to obtain a baseline idea of the current capacity of the youth, family and other caregivers, and providers to successfully achieve the outlined goals. Transition progress should be measured through periodic reassessment using the same checklists at each visit (see "Resources" for selected transition-readiness materials).
2. *Plan* a dynamic and longitudinal process for accomplishing realistic goals. The first step of transition planning is the establishment of goals that allow the youth to achieve as seamless a transition as possible. A formal, written transition plan that outlines specific actions that are necessary to meet the stated goals should be part of the patients' medical record by the

age of 14. The written transition plan should account for cultural, developmental, organizational, and contingency-related concerns. In general, categories recommended to be incorporated into the transition plan include the plan's main goal(s), identification of who within the medical home will be responsible for overseeing and/or coordinating the plan, the time line for accomplishing stated goals, the skills required by the youth to achieve maximum self-management, the families' or other caregivers' role, and an articulation of proposed financing of the youth's adult health care (see "Resources" for selected transition-planning tools).

3. *Implement* the plan through education of all involved parties and empowerment of the youth in areas of self-care. After the transition plan has been outlined and goals have been established, specific activities to ensure that the youth acquires needed skills should begin. Examples of these goals include the ability to schedule one's own medical appointments, obtain medications, have a one-on-one dialogue with a medical provider, and be familiar with one's medical history and any needed medications. Ongoing discussion of the transition plan at all health care visits is a key step in accomplishing transition goals. This should be a dynamic process that begins gradually and is continually assessed at regular intervals. The timing of these reassessments depends on the capacity of the youth and his or her family and other caregivers as well as the amount of time remaining until the anticipated transfer of care to the adult medical home. The transition-readiness checklists used during the initial assessment to establish goals (outlined previously) are the tools of choice for documenting successful accomplishment of specific goals and tasks. It is highly recommended that a medical home use the same checklists throughout the entire transition process for an individual patient to provide continuity over time and assist youth, families, and providers to stay "on track" regarding specific goals that have yet to be accomplished.

   Throughout this process, the provider should continually strengthen the partnership with the patient and family members and other caregivers by engaging in active dialogue and information-sharing to empower the youth to take on new roles, as appropriate. It is important to recognize that, at the age of maturity, the youth becomes a legal adult (except when guardianship by another person has been obtained). As a result of confidentiality laws, the youth should be seen alone unless other arrangements have been legally made. One to 2 years before the anticipated transfer of medical care, the pediatric provider should assist the youth and/or family/caregivers to identify potential adult practices, prepare the appropriate documentation for transition, and suggest that the youth interview the adult practice before making a final transfer.

4. *Document* progress to enable ongoing reassessment and movement of medical information to the receiving (adult care) provider. Many excellent tools for documenting the transition process exist, including some that can be used within an EHR system and others that are paper-based. For example, providers might place a transition front sheet on the patient's chart or use a "dashboard" tool in the patient's EHR at the age of 12. Both of these methods work well in flagging important actions that have occurred and/or need to be scheduled as part of the transition process. Regardless of the specific tool used, it should provide a flexible method for assessing the youth's readiness for transition and progress made toward that goal. Gathering relevant information to document the patient's transition progress is of paramount importance as the anticipated transfer date approaches. It is well documented that a common barrier to adult medical providers' acceptance of transitioning youth is a lack of accompanying medical documentation.[16] It is critical that medical documentation be portable and include 3 components: (1) the transition plan (see above); (2) longitudinal readiness checklists (see above), which demonstrate both successes and deficits in self-management skills; and (3) a portable medical summary. The portable medical summary contains basic medical and social data to give adult medical providers the information necessary to begin assuming care for the patient. All youth receive this portable medical summary, because the data it contains are essential topics and elements that are critical to the transition summary. Although the categories of the medical summary are appropriate for all chronic health conditions, specific information should be tailored to the patient's conditions.

b. Integrating Transition Planning Into CCM for Children and Youth With Special Health Care Needs

Transition planning applies to all children and youth and should follow the steps defined in the algorithm. The presence of chronic health conditions and/or developmental disabilities (ie,

children or youth with special health care needs) imposes specific primary care requirements on the family-centered medical home characterized as CCM. Effective CCM, in turn, demands additional considerations related to transition planning. CCM involves an explicit, planned process of coordinated, proactive care aimed at achieving the best possible clinical and functional outcomes for the individual patient and for the population of patients with chronic conditions. While following the general sequence and timing of the transition algorithm, transition planning for children or youth with special health care needs will usually be incorporated into the broader CCM process. Early in the transition-planning process, it will be important to determine whether the youth is likely to be a completely independent decision-maker as an adult or require decision-making support from a third-party proxy such as through guardianship or power of attorney. Even with these considerations in mind, it is important to plan with the youth and family/caregivers to achieve the maximum possible participation of the youth in the transition-planning process.

1. Registry. The family-centered medical home CCM process may include a registry of the practice's patients with special health care needs. The registry should be searchable on the basis of patient age so that youth who are ready for each stage of the transition process (see algorithm) can be identified. The registry might also include fields indicating which steps in the transition process are due for completion, have been completed, or are past due for completion. Additional fields unique to the transition of children or youth with special health care needs might include "discussed guardianship," "identified adult subspecialists," etc.
2. Care Plan. Some children or youth with special health care needs will have an action-oriented care plan for tracking current problems and health-related needs including what action is needed, who will be responsible, and by when the action should have occurred. When a child or youth with special health care needs enters the age group covered in the transition algorithm, the action-oriented care plan should begin to contain a transition section that will become the youth's transition plan. The incorporation of the transition plan into the general action-oriented care plan will ensure integration of transition planning with other health-related actions.
3. Care Coordination. Care coordination is one of the foundations of the family-centered medical home and assumes special importance for children or youth with special health care needs who utilize the health care system frequently and who may have multiple health care and other service providers. Those who coordinate health care for the child or youth with special health care needs will need to take into consideration the youth's transition plan and the current stage of the transition-planning process. Care coordination may be instrumental in supporting the transfer of care from various pediatric medical subspecialists to their adult specialty counterparts.
4. CCM Visits. The family-centered medical home provides periodic CCM visits that may occur in addition to health maintenance and acute illness management visits to monitor the status of patients with chronic conditions and implement/update their care plans. These CCM visits would provide the occasions for transition education and planning.
5. Comanagement. Explicit comanagement between primary care physicians and medical subspecialists ensures communication and prevents both omissions and redundancies of care. It explicitly identifies the respective roles of the primary care medical home and the medical subspecialists in a manner that is clear to each provider and the youth and family and other caregivers. The locus of management may shift from time to time between primary care and specialty care depending on the youth's age and the complexity and acuity of specific health problems. Comanagement with medical subspecialists assumes particular importance for transition planning, because it provides the framework in which to plan for and implement the transfer of care from pediatric subspecialists to adult medical subspecialists and surgical specialists. Comanagement may also be the context for a dialogue of explicit communications between the youth's medical home and the future adult medical home provider. Comanagement planning with respect to transition planning should include the timing and process for specific transfers of care in each relevant specialty area. In some cases, the plan may be to retain a pediatric subspecialist into adulthood because of the absence of appropriately qualified adult medical subspecialists.

It should be noted that some diagnosis-specific programs, including clinics for hemophilia and cystic fibrosis, have established strong programs to guide subspecialty transfer. The National Hemophilia Foundation established a nationwide network of

hemophilia diagnostic and treatment centers and, in 2003, adopted transition guidelines that provide age-related recommendations. These models and transition guidelines acknowledge that there are continuing areas for improvement such as addressing preventive health needs or promoting the adult model of decision-making by young adult patients.[30,31]

i. Components of the Transition Plan for Youth With Special Health Care Needs: Necessary Information for the Receiving Provider, Patient, and Family Members/Caregivers

In addition to the items in the transition plan for all youth (described previously), additional components should be included in transition plans and records for youth with disabilities and/or special health care needs. All transition plans should be tailored to the individual patient and his or her needs.

Additional data elements that are likely to be included in the transfer documentation for youth with special health care needs include baseline functional and neurologic status; the patient's cognitive status, including formal test results and date of administration, when possible; condition-specific emergency treatment plans and contacts; and the patient's health education history and assessment of his or her understanding regarding health conditions, treatments, and prognosis with particular attention to entry into adult life, including procreation potential and genetic information.

Information about advance directives should include an identification of the decision-maker proxy or guardian and any history of advance-directive planning. For patients with communication impairments, the transition documentation should include the patient's communication preferences and anticipated needs for accommodations in both communication and clinical care (ie, use of sign language interpreter, augmentative communication device, etc).

ii. Components of the Transition Plan for Youth With Special Health Care Needs: Assessment and Documentation of Readiness

As part of the transition-planning process, a member of the medical home team should regularly assess the patient and his or her family and other caregivers on progress toward achieving transition readiness and preparation for adult life. Interventions to address individual difficulties and/or provide extra resources should be conducted during visits. Education and empowerment techniques should be used to ensure that development of needed skills is embraced by the patient and families and continues to occur. Providers must ensure that they document both the patient's and family's progress toward successfully completing the plan's components as well as any plan revisions. A formal method should be used to document the stepwise completion of developmentally appropriate tasks required to prepare the transitioning patient for adult life. Flow sheets, registry reminders, and planned visit templates for specific ages are all possible means to do so. In addition, documentation is particularly important in certain specific areas.

Insurance Coverage

The 2010 Patient Protection and Affordable Care Act (PPACA) health care reform legislation will affect coverage, access to care, and care coordination in the short-term and/or long-term. Specific provisions of the PPACA expand children's and youth's access to coverage and ongoing care, including changes that permit children to remain on their parent's insurance until the age of 26; eliminate insurers' ability to exclude coverage on the basis of preexisting conditions; improve coverage portability; create a high-risk pool insurance for people who cannot access coverage through other sources; enhance Medicaid payment to primary care physicians; and mandate that nearly all people (including young adults) have coverage. Although these changes are likely to prove beneficial, it is likely that parents, caregivers, and transitioning youth alike will need assistance to understand this complex legislation and its impact on their lives and the transition process. In addition, PPACA provisions are to be implemented over time, and youth must be encouraged to proactively plan to avoid suffering substantial coverage gaps and/or delays in coverage because of "preexisting conditions" until 2014, when this practice is prohibited under PPACA. In addition, age eligibility and coverage requirements may vary for programs such as Title V, Medicaid, Supplemental Security Income (SSI), and Social Security Disability Income (SSDI). Youth with chronic conditions should be encouraged to evaluate future employment options that are most likely to offer insurance coverage for high-risk people (ie, employers who participate in large group plans and, thereby, spread out risk). Parental employment-based coverage limitations also vary widely; although a few plans cover adults with disabilities who are dependents of their parents, they are the exception. Because of the critical nature of insurance coverage for people with special health care needs, it is essential that providers discuss insurance issues with these patients and document plans to ensure continued coverage.

Self-Advocacy

Critical topic areas for the empowerment of youth with special health care needs include self-advocacy and

making plans about decision-making status, educational and/or employment opportunities, living arrangements, and community-inclusive opportunities. It is critical to encourage families to initiate training and decision-making opportunities for children with special health care needs at a young age. Families should receive assistance from experts in self-advocacy when considering the range of potential support, which may include personal informal advocates, power of attorney, and limited-to-full guardianship. Important resources include organizations, such as Family Voices; local chapters of The Arc; and lawyers who are experienced in disability issues. Because of the importance of self-advocacy for youth with special health care needs, it is essential that providers initiate conversations about decision-making and begin to plan advocacy support for these youth far in advance of the age of majority.

Legal Issues

The assessment of the patient's potential capacity to consent occurs as part of the ongoing CCM process. Providers should suggest goals and action steps that help youth achieve their fullest potential and participate as much as possible in assent and consent processes during their clinical care. It is critical that youth and family members and other caregivers alike understand the significant health system changes associated with the age of majority, including support-service or program-eligibility changes, selective service registration requirements, consent and confidentiality provisions, and guardianship issues. Youth and family members/caregivers need to think about how health care decisions will be made once the youth turns 18. Because of the particular importance of legal issues for youth with special health care needs, it is essential that providers ensure that both the patients and family members understand and are prepared for legal changes associated with adulthood. In addition, problems can arise when a youth is incapacitated and unable to direct his or her own care. Preparing a health care proxy or power of attorney for the young adult will avert such a situation.

Health Education

People with chronic conditions should receive periodic, updated health education about their condition. Necessary information includes an understanding of the patient's specific condition; typical disease process and prognosis; current treatment and treatment options; medication knowledge; self-assessment; and self-care issues, especially in defining emergent situations and responses. Particular attention should be paid to issues of puberty that may not have presented earlier, such as sexual expression, reproductive issues, and genetic transmission. Because of the importance of the patient's understanding his or her own condition, it is essential for providers to document that this information has been provided to, and understood by, the patient.

Caregiver's Issues

Assessment of family/caregiver adaptation is another component of the transition-readiness assessment for families of children and youth with chronic conditions. Attention should be paid to coping on the part of the youth, his or her parents and siblings, and any other appropriate family members and other caregivers. Parents and caregivers must adapt to the transition of authority from parent to youth that occurs when the youth has the capacity to accept the transfer and may experience grief if the child lacks the capacity to assume independent decision-making. For this reason, providers must be ready to help parents and caregivers cope with the life changes associated with chronic conditions as well as with transfer planning. Because these situations can be stressful for the youth and family members/caregivers alike, it is essential that providers assess patients' coping mechanisms and provide referrals for additional care, as appropriate.

5. ADULT MEDICAL HOME (RECEIVING PROVIDER): ROLES AND RESPONSIBILITIES

The transition of a young adult will make it necessary to identify an adult practice that is prepared to accept the patient and provide the full range of care and care coordination in an appropriate, patient-centered care model. Most young adults are healthy and require only the continuation of health maintenance and promotion and the availability of an adult medical home when acute illnesses arise. Yet, even the population of young adults without special health care needs includes those with adolescent-type risky behaviors, mental health issues, and reproductive health needs that require enhanced attention. Young adults with disabilities and chronic medical conditions are more vulnerable to failures in the transition of health care services and require more attention from providers and the health care system. Fundamentally, clinical hurdles and process hurdles present major challenges for a successful move to adult-oriented care for young adults with special health care needs.

The transition of a young adult necessitates the identification of an adult practice that is prepared to accept the patient and provide the full range of care and care coordination in an appropriate patient-centered care model. Shortages in the adult medical home workforce may limit future ca-

pacity to do so. Thus, clinical hurdles largely encompass deficits in education and/or experience of some adult providers to effectively care for this diverse patient population, as well as financial disincentives that limit access to adult-oriented care. The authors of several recent articles have explored the perspective of adult providers participating in the medical transition of young adults with special health care needs. Okumura et al[15] found that, when adult medical care providers were exposed to the process of transitioning young adults in the context of their residency training experiences, they were much more likely to incorporate it into their practices after residency. Anecdotally, however, these residency training experiences are not common, and many practicing physicians have learned "on the job" to manage patients with complex needs. A recent survey of internists' needs when accepting a transitioning youth revealed that education in congenital and childhood-onset conditions was critical.[17] In addition, the respondents cited the need for identified medical subspecialists to help with management decisions. Although adult medical providers have the role of assuming the care and management of these youth, they should not be expected to do so without supports that are more readily available to pediatric providers.

Caring for young adults with special health care needs may represent a challenge that some adult primary care practices are currently not prepared to meet. Further work is needed to characterize, demonstrate, and teach an adult model of care that is responsive to the particular needs of all young adults and sensitive to the specific challenges associated with providing high-quality care to young adults with specific chronic conditions (eg, autism, cerebral palsy, intellectual disability, sickle cell disease). Ideally, the health care payment system would encourage early and ongoing professional relationships with pediatric providers in anticipation of transitions and also support comanagement with pediatric primary care and medical subspecialty providers while the patient is becoming established with the adult practice. At some point, the responsibility for the transitioning young adult will become that of the adult provider, at which time, the adult provider and his or her clinical team should assume a key role in supporting the young adult and his or her family and other caregivers in finding a new balance in the adult medical setting. The transitioning youth's developmental and functional abilities may influence the transition's success. The continued involvement of the family/caregivers should be expected and encouraged during this transition period. In addition, working with the family and other caregivers and other supports to ensure adequate health care insurance and financing for these youth is a major goal of transition.

Second, process hurdles include challenges in the communication of appropriate medical records; community resources; preparation of the young adult and his or her family/caregivers to integrate into an adult-focused medical system; and issues related to payment. Adult providers should not expect a "handoff" from pediatric practices but, rather, a "handshake." Establishing collegial relationships between pediatric and adult medical providers is important for facilitating ongoing access to medical care for patients in transition. Although every transition is different, the best transitions include several core elements. Receivers (providers to whom the youth transitions for care) may reasonably expect that, as the adult medical home team, they will be provided with concise and accurate medical information about the youth and his or her condition, as described previously. In addition, receivers should ensure that:

- the responsible party for medical decision-making has been clearly identified;
- unambiguous adult consent and confidentiality policies have been explained to the patient and his or her family and other caregivers;
- communication has occurred about how the practice operates for issues such as paperwork and medication refills; and
- access to the practice for routine and after-hours care has been discussed with the patient and his or her family and other caregivers.

Although many young adult patients will transition to adult practices from pediatric-based practices, the unique relationship that many family physicians have with their patients allows for ongoing care throughout the life span. Although transfer of care many not occur in these situations, it is likely that young adults with special health care needs have pediatric subspecialists who may wish to facilitate transfer to their adult counterparts. The family physician has the special responsibility to be aware of these needs and, in some situations, to potentially play the role of both the "sender" and "receiver."

Certainly, successful transition is a test of the degree to which a practice operates within the ideals encompassed in the medical home model of care. A team approach to the challenges of transition is necessary for facilitating the level of care for which adult providers strive. Inclusion of local public health and community-based resources should be considered whenever possible to ensure that the medical home approach is followed,

particularly for vulnerable patient populations with special health care needs.

Payment for Health Care Transition Work

The steps involved in the health care transition algorithm are intended to be part of existing office visits using well-established billing codes. For youth without special health care needs, transition preparation and planning would be incorporated into regularly scheduled health maintenance visits and billed as such (Current Procedural Terminology [CPT] codes 99394 and 99395). For youth with special health care needs who have sufficient complexity to justify periodic CCM visits in addition to health maintenance visits, health care transition preparation and planning are intended to occur during a CCM visit billed as a prolonged encounter with an established patient (CPT codes 99214 or 99215). Such visits can be documented as involving counseling for more than 50% of the visit. Youth with highly complex needs may require a CCM visit in which the counseling provided is devoted entirely to transition, but these visits are still reimbursable when using the prolonged-encounter codes and the counseling rule. Activity outside of office encounters involved in the management of a youth's transition plan (whether it stands alone or is incorporated into a more general care plan for a chronic condition) constitutes "care plan oversight." Such work may involve phone calls to prospective adult primary care physicians or medical subspecialists, conversations with the youth and family regarding transition plans, or communication with community agencies integral to the transition process. These activities can be billed by using care plan oversight CPT codes 99374 (15–29 minutes) and 99375 (≥30 minutes) through which the physician can bill monthly for the cumulative time spent on care (or transition) plan oversight. Similar coding and billing options may be exercised after the transfer of care from a pediatric medical home to an adult medical home.

6. CLINICAL GUIDANCE AND FUTURE SUGGESTIONS

This report attempts to address the need for guidance to aid practitioners' implementation of youth transition planning into practice. Yet, transitions cannot occur in a vacuum. Systemic barriers that have been reported as factors that hamper clinicians from implementing needed changes include lack of training and payment for transition activities, receivers to accept these patients, research to identify best practices, and advocacy to advance the research results. Increased training on the critical skill of transitioning can be integrated into an adolescent medicine rotation in internal medicine and into the adolescent medicine and continuity clinic rotations for pediatric residents. Med-peds, pediatrics, and family medicine residencies may provide significant training opportunities in this area. Dually boarded med-ped physicians would seem ideally equipped to care for transitioning adolescents and young adults and to assist in the training of other primary care generalist physicians regarding care over this age range. Unfortunately, the med-peds workforce remains too small and is not likely to grow sufficiently to affect the health care transition of most youth and young adults.

Graduate medical education programs may also provide a forum for pediatric and adult providers to build and maintain relationships that are needed to enhance collaboration and improve communication, ultimately facilitating comanagement of complex conditions. Payment is a crucial element in the promotion of transition planning. Incorporating transition planning into CCM is a process that costs time and money and should be included in conversations about care coordination and payment. Further research is required to define best practices, clinical pathways, and cost-effectiveness for transition planning. Quality-improvement science may provide additional methodologies to inform the understanding of potential strategies. Once best practices are identified, advocacy and education efforts will need to be directed toward several areas including:

- enhanced payment for transition services;
- case-finding of those in need of transition services who are not receiving them;
- insurance coverage for patients in need of transition planning;
- standards of care and credentialing of providers;
- training for primary care physicians and medical subspecialists to promote transitions within the medical home; and
- promotion of training and clinical learning experience on transition and transfer of youth and young adults (both with and without special needs) for trainees in all medical fields.

7. CONCLUSION

A well-timed, well-planned, and well-executed transition from child- to adult-oriented health care, ideally occurring between the ages of 18 and 21, enables youth to optimize their ability to assume adult roles and activities. For this reason, transition planning should be a standard part of providing care for all youth and young adults, and every patient should have an individualized transition plan regardless of his or her specific health care

needs. The AAP, American Academy of Family Physicians, and American College of Physicians recognize that providers need assistance to accomplish this goal. Education of practicing and resident physicians in training is essential for the integration of the concepts of the patient- and family-centered medical home, the principles of transition of care, and the processes for successful transfer of care. Therefore, this clinical report provides a consensus on activities to support the practice-based implementation of transition planning for youth with and without special health care needs. It describes a series of activities designed to ensure that uninterrupted, high-quality, and developmentally appropriate health care services are available to patients moving from adolescence to adulthood. The clinical report provides a clear time line, beginning at 12 years of age, to assist providers in implementing the 4 specific activities in transition: discussing the medical home transition policy; initiating a transition plan; reviewing/updating the transition plan; and implementing an adult care model. It also includes an algorithm that specifies the protocol for managing the transition process, helps providers implement the transition process, and provides a transition structure for patients and their families. The algorithm includes a branch with expanded, generic guidelines for transitioning youth with special health care needs who require CCM. Primary care providers and medical subspecialists are encouraged to make this process specific for their own and their patients' needs.

8. RESOURCES

a. General Resources

- National Health Care Transition Center (www.gottransition.org).
- Family Voices, Inc (www.familyvoices.org).
- Family-to-Family Health Information & Education Center (www.bridges4kids.org/f2f).
- Kids as Self Advocates (KASA) (www.fvkasa.org).
- National Alliance to Advance Adolescent Health (www.thenationalalliance.org).

b. Transition Care Plans

- AAP/National Center for Medical Home Implementation (www.medicalhomeinfo.org/how/care_delivery/transitions.aspx).
- British Columbia Ministry of Children and Family Development, "Transition Planning for Youth With Special Needs" (www.mcf.gov.bc.ca/spec_needs/pdf/support_guide.pdf).
- University of Washington, Adolescent Health Transition Project (http://depts.washington.edu/healthtr).

c. Transition Assessment and Evaluation Tools

- AAP/National Center for Medical Home Implementation (www.medicalhomeinfo.org/health/trans.html).
- JaxHATS, evaluation tools for youth and caregivers and training materials for medical providers (www.jaxhats.ufl.edu/docs).
- Texas Children's Hospital transition template (http://leah.mchtraining.net/bcm/resources/tracs).
- Carolina Health and Transition Project (CHAT) (www.mahec.net/quality/chat.aspx?a=10).
- University of Washington, Adolescent Health Transition Project (http://depts.washington.edu/healthtr).
- Wisconsin Community of Practice on Transition (www.waisman.wisc.edu/wrc/pdf/pubs/THCL.pdf).

d. Portable Medical Summaries

- AAP/National Center for Medical Home Implementation (www.medicalhomeinfo.org/how/care_delivery/transitions.aspx).
- National Diabetes Education Program (www.YourDiabetesInfo.org or www.ndep.nih.gov).
- Sick Kids (www.sickkids.ca/good2go).
- University of Washington, Adolescent Health Transition Project, medical summary (http://depts.washington.edu/healthtr/medsum/portable_medsum.pdf).

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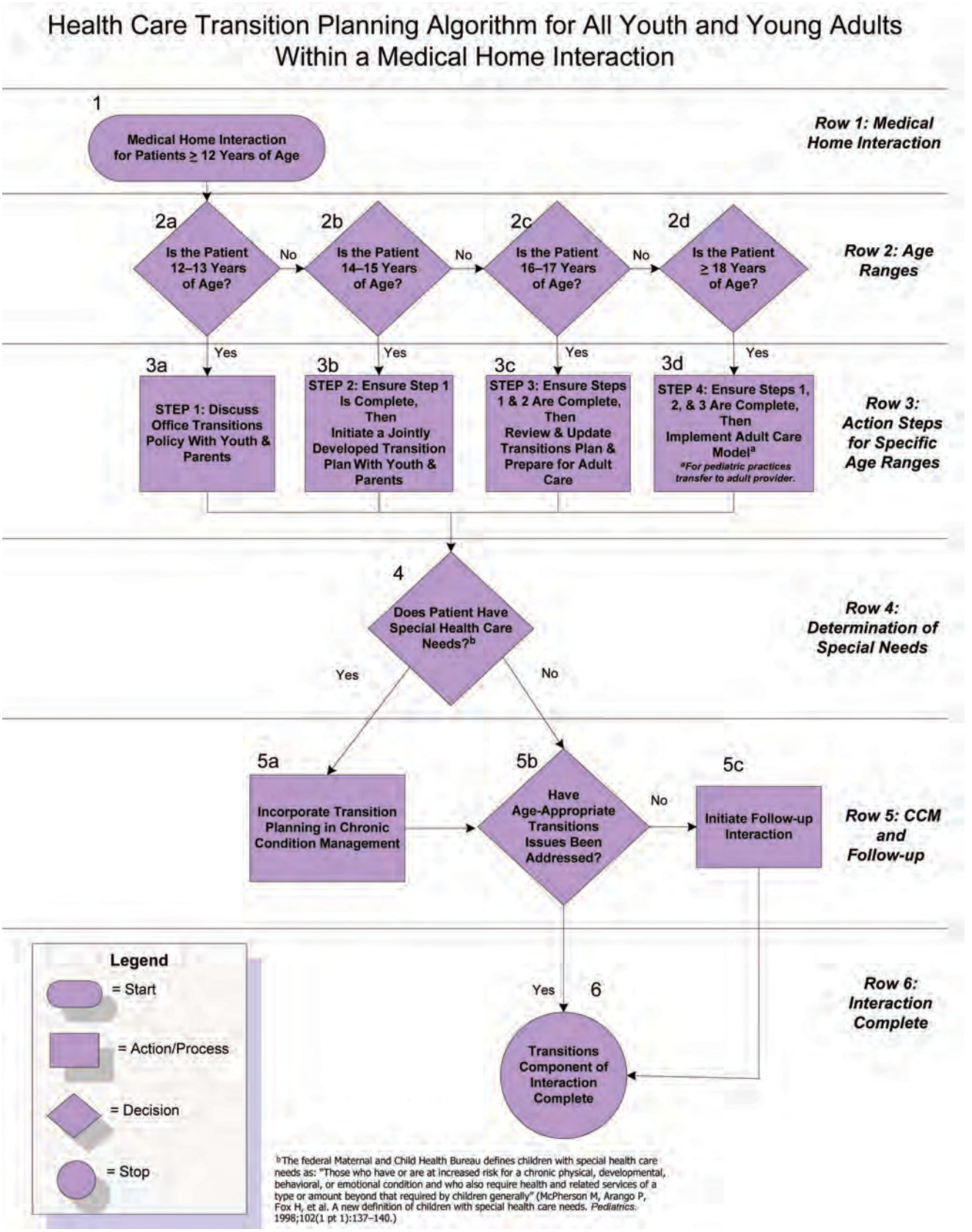
Health Care Transition Planning Algorithm for All Youth and Young Adults Within a Medical Home Interaction
1
Medical Home Interaction for Patients ≥ 12 Years of Age
Row 1: Medical Home Interaction
2a
Is the Patient 12–13 Years of Age?
No
2b
Is the Patient 14–15 Years of Age?
No
2c
Is the Patient 16–17 Years of Age?
No
2d
Is the Patient ≥ 18 Years of Age?
Row 2: Age Ranges
Yes
Yes
Yes
Yes
3a
STEP 1: Discuss Office Transitions Policy With Youth & Parents
3b
STEP 2: Ensure Step 1 Is Complete, Then Initiate a Jointly Developed Transition Plan With Youth & Parents
3c
STEP 3: Ensure Steps 1 & 2 Are Complete, Then Review & Update Transitions Plan & Prepare for Adult Care
3d
STEP 4: Ensure Steps 1, 2, & 3 Are Complete, Then Implement Adult Care Model[a]
[a]For pediatric practices transfer to adult provider.
Row 3: Action Steps for Specific Age Ranges
4
Does Patient Have Special Health Care Needs?[b]
Row 4: Determination of Special Needs
Yes
No
5a
Incorporate Transition Planning in Chronic Condition Management
5b
Have Age-Appropriate Transitions Issues Been Addressed?
No
5c
Initiate Follow-up Interaction
Row 5: CCM and Follow-up
Legend
= Start
= Action/Process
= Decision
= Stop
Yes
6
Transitions Component of Interaction Complete
Row 6: Interaction Complete
[b]The federal Maternal and Child Health Bureau defines children with special health care needs as: "Those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally" (McPherson M, Arango P, Fox H, et al. A new definition of children with special health care needs. Pediatrics. 1998;102(1 pt 1):137–140.)

APPENDIX 1

Medical Home Interaction for Patients ≥ 12 Years of Age

1. Initiate first step in the health care transition planning process at age 12.

Is the Patient 12–13 Years of Age? | Is the Patient 14–15 Years of Age? | Is the Patient 16–17 Years of Age? | Is the Patient ≥ 18 Years of Age?

2a, 2b, 2c, 2d. Age Ranges. By age 12, conduct surveillance to assess any special health care needs. Start actual transition planning by age 14. By ages 16-17, transition planning should be well established. At age 18, initiate an adult model of care for most youth, even if there is no transfer of care. If transition planning does not occur on the schedule described by the algorithm, a concentrated effort is required (eg, special visits) to successfully complete the process.

3a. Every practice should have a written transition policy that is prominently displayed and discussed with youth and families. The policy should explicitly state the practice's expectations and care process for the health care transition of their adolescent patients to an adult model of care.

STEP 1: Discuss Office Transitions Policy with Youth & Parents

STEP 2: Ensure Step 1 Is Complete Then Initiate a Jointly Developed Transition Plan With Youth & Parents

3b. The practice should utilize a standard transition plan that can be adapted for each patient's needs. This tool should include components to obtain an accurate assessment of the patient's ability to successfully transition. Providers should interview youth and family members to identify needs and to assess the intentions and motivations for youth independence.

3c. Transitions plans must be reviewed regularly and updated as necessary. The provider must also perform surveillance for changes in the youth's medical status and address youth and family concerns that may warrant changes in transition goals. Failure to achieve transition readiness goals warrants reevaluation of the existing plan, and increased frequency of medical home interventions/visits. A "pretransfer" visit to the adult medical home could be conducted during the year before the transfer.

STEP 3: Ensure Steps 1 & 2 Are Complete, Then Review & Update Transitions Plan & Prepare for Adult Care

STEP 4: Ensure Steps 1, 2, & 3 Are Complete, Then Implement Adult Care Model[a]

[a]For pediatric practices transfer to adult provider

3d. Transition to an adult model of care occurs appropriate for youth's developmental level. This is followed as appropriate by transfer to an adult medical home. Complete medical records should be delivered to the adult provider, along with a portable summary, which is also provided to the patient or guardian. For children and youth with special health care needs, direct communication between pediatric and adult providers is essential, as adult medical personnel may be unfamiliar with certain pediatric conditions.

4. Transition planning for children and youth with special health care needs should include specific chronic condition management (CCM) activities such as: use of registries; care plans; care coordination; CCM office visits; and comanagement with medical subspecialists. Transition goals must be individualized to account for variations in the complexity of a youth's condition and in the youth's intellectual ability and guardianship status.

Does Patient Have Special Health Care Needs?[b]

Incorporate Transition Planning in Chronic Condition Management

5a. Youth with special health care needs require an expanded transition planning process. Transition planning in CCM includes addressing the exchange of complex health information; competencies for self-care; transfers of specialty care; and issues related to insurance, entitlements, guardianship, and eligibility for adult services. In a medical home, such youth may have a written care plan as part of the medical record. At age 14, this plan should include a section titled "transition plan," which should be expanded and developed as the youth approaches age 18 and beyond.

5b. Use of transition planning tools and readiness checklists facilitate the provider's ability to ensure that all age-appropriate transition issues have been addressed. Each action step must be completed in order, even if this means the provider has to schedule specific visits to initiate and complete steps missed earlier in the process in order to catch up before the next visit.

Have Age-Appropriate Transitions Issues Been Addressed?

Initiate Follow-up Interaction

5c. Focused tasks involving little detail or complexity can be addressed by the medical home care coordinator, medical provider, or other appropriate staff through telephone or electronic media. More complex issues may necessitate face-to-face office visits.

6. The provider is finished with the transition tasks for that specific interaction or visit; transition planning is an ongoing activity that occurs at every interaction.

Transitions Component of Interaction Complete

AMERICAN ACADEMY OF PEDIATRICS

Committee on Pediatric AIDS

Surveillance of Pediatric HIV Infection

ABSTRACT. Pediatric human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) surveillance should expand to include perinatal HIV exposure and HIV infection as well as AIDS to delineate completely the extent and impact of HIV infection on children and families, accurately assess the resources necessary to provide services to this population, evaluate the efficacy of public health recommendations, and determine any potential long-term consequences of interventions to prevent perinatal transmission to children ultimately determined to be uninfected as well as for those who become infected. Ensuring the confidentiality of information collected in the process of surveillance is critical. In addition, expansion of surveillance must not compromise the established, ongoing surveillance system for pediatric AIDS. An expanded pediatric HIV surveillance program provides an important counterpart to existing American Academy of Pediatrics and American College of Obstetricians and Gynecologists recommendations for HIV counseling and testing in the prenatal setting.

BACKGROUND

The goals of surveillance for pediatric human immunodeficiency virus (HIV) infection and acquired immunodeficiency syndrome (AIDS) are to 1) determine the scope of the pediatric HIV epidemic and collect data on trends in the incidence of pediatric infection, 2) characterize the spectrum of disease and modes of transmission, 3) assess when children are identified in the course of their disease so that linkage with needed medical and social services can be improved, 4) project the course of the epidemic to provide needed resources, 5) evaluate the impact of public health recommendations and programs, and 6) facilitate evaluation of the impact of in utero exposure to therapies to reduce perinatal transmission on the long-term outcome of HIV-infected and uninfected children.

The Centers for Disease Control and Prevention (CDC), in conjunction with the Council of State and Territorial Epidemiologists (CSTE), has proposed expanding national surveillance for pediatric HIV infection by adding standardized, confidential reporting of HIV infection in children to the current reporting system for pediatric AIDS.[1] In 1989 and 1993, the CSTE recommended that all states conduct surveillance for HIV infection in children by instituting uniform reporting requirements under policies that maintain confidentiality and security of HIV/AIDS surveillance data. In 1995, the CSTE recommended adding pediatric HIV infection to the national public health surveillance system, and since January 1996, data on reported cases of pediatric HIV infection have been provided in *Morbidity and Mortality Weekly Report*.

Currently, >50% of states conduct confidential surveillance of HIV infection in children. Most of these states also conduct surveillance for perinatal HIV exposure (reporting of HIV antibody positivity). State and local health departments then follow up these cases to determine the child's ultimate infection status and progression to AIDS. The pediatric HIV/AIDS case report form currently allows for reporting at multiple time points for children (ie, at perinatal exposure, HIV infection determination, AIDS diagnosis, and death).

This statement reviews the purposes of the HIV/AIDS surveillance system and discusses the advantages and limitations to the public and to individual children and families of expanding HIV surveillance for children, and recommends the level of surveillance appropriate at this time.

PURPOSE OF SURVEILLANCE

A public health surveillance system should provide ongoing, systematic collection, analysis, evaluation, and dissemination of data describing and monitoring important public health events. These data are used to determine the need for public health interventions and to plan, implement, and evaluate resulting programs and actions. Surveillance systems should be simple and acceptable to those reporting the health event. The majority of cases under surveillance should be detectable in a timely manner and therefore should represent the occurrence of the health event over time and its distribution in the population.[2]

The CDC and state and local health departments have conducted surveillance for AIDS in children and adults since 1981. Such surveillance has provided essential data for characterizing the AIDS epidemic, evaluating trends in opportunistic infections such as *Pneumocystis carinii* pneumonia (PCP), allocating resources for prevention and treatment, and projecting the future impact of disease. The characterization of AIDS is empiric and captures only patients with severely symptomatic HIV infection and therefore detects only a portion of the population

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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infected. Reporting limited to AIDS patients severely underestimates resource needs for the increasing population of HIV-infected and HIV-exposed children.

DISTINGUISHING BETWEEN INDIVIDUAL TESTING AND INFECTION SURVEILLANCE

It is important to distinguish between testing of an individual and surveillance for infection or disease. HIV testing of pregnant women or their newborns that is linked to patient identifiers is performed for clinical care and should be conducted only with consent. The purpose of named HIV testing is to engage a woman in continuing care for herself and her infant. Compliance with medical care is likely to be greatest when the woman feels she has made an informed judgment regarding HIV testing for herself or her infant. The AAP and American College of Obstetricians and Gynecologists (ACOG) recommend that all pregnant women receive HIV education and counseling as part of regular prenatal care. Additionally, it is recommended strongly that HIV testing be performed in all pregnant women with their consent, with documentation in the event of refusal of testing.[3,4] HIV testing under such conditions provides direct benefit to the woman and child.

Surveillance usually has indirect benefits to the individual through general improvement in the public health. The surveillance process occurs independently of the individual patient, and is accomplished by reporting of selected conditions detected by the health care provider, along with identifiers, to local and state health departments. In recommending that any condition be deemed reportable to public health agencies, it is important to weigh the public health benefits of surveillance, the extent of provisions for confidentiality and security of the information reported on individuals, and how acceptable reporting is to providers.

RATIONALE FOR PEDIATRIC HIV INFECTION SURVEILLANCE

Early in the HIV epidemic, surveillance was limited to end-stage disease, AIDS, because an agreed-on syndrome was defined for which no diagnostic test existed and the etiology was not known. Even when diagnosis of HIV infection became possible by serologic testing, interventions were not yet identified that could change the course of the disease. Initial reports of pediatric HIV infection indicated that AIDS progressed rapidly in most HIV-infected children; the epidemic was newly recognized, and only symptomatic disease, primarily in young children, was appreciated. It was expected, therefore, that surveillance for AIDS would provide a good surrogate for evaluating the magnitude of HIV infection in children.

As it became possible to make a definitive diagnosis of infection in the absence of symptoms, it was discovered that not all children with HIV infection die in the first several years of life. Current natural history studies clearly document a bimodal age distribution for the survival of children with pediatric HIV infection. The median age at onset of HIV-related symptoms is 14 months, but the rapid progression to AIDS during the first year of age occurs in only 10% to 30% of perinatally infected infants. Most children infected do not develop AIDS until a median age of 4 to 6 years or older,[5–8] and a significant minority of infected children may survive beyond the age of 8 to 9 years without developing AIDS. [9–11]

Substantial medical and social service resources are needed for the care of children who are exposed to and infected with HIV. The CDC estimates that 12 240 HIV-infected children were living in the United States at the end of 1993, only 22% of whom had developed AIDS.[12] On an annual basis since then, an estimated additional 6500 infants have been born to HIV-infected women, 1630 of whom, in the absence of intervention, were infected each year based on an estimated 25% vertical transmission rate. Use of zidovudine during pregnancy and labor and in the neonatal period theoretically could lower the number of infected children born annually to 520, and this is recommended by the US Public Health Service (PHS) and the AAP.[13–16] However, health care resources are still required for the larger group of HIV-exposed infants for monitoring during the initial 6 weeks of zidovudine prophylaxis, initiation of prophylaxis to prevent PCP as per the current PHS recommendations,[17] and diagnostic testing during the first 6 months of age to determine infection status. Additionally, all children with in utero exposure to antiretroviral drugs require follow-up for any long-term consequences of such exposure.[16]

In recent years, various technologic and medical advances have been made in the detection and treatment of pediatric HIV infection. Current tests permit HIV infection to be diagnosed in nearly all perinatally infected infants no later than age 6 months,[18,19] and most such infants have positive virologic tests by 1 month of age. Early intervention with prophylaxis for PCP[17] has been shown to decrease the occurrence of this infection significantly and reduce early death.[20] There have been important changes in the recommendations for prophylaxis against PCP in children. Prophylaxis should start in all infants born to HIV-positive women at 4 to 6 weeks of age (which may be before infant HIV infection status has been determined definitively), and should be discontinued in children subsequently found to be uninfected continued in all HIV-infected children through at least the first year of age regardless of the $CD4^+$ lymphocyte count.[17] Antiretroviral therapy has prolonged life and, with other supportive therapeutic modalities, modified the course of disease.[21–24]

Finally, the results of AIDS Clinical Trials Group Protocol 076 indicate that a regimen of zidovudine given during pregnancy, labor, and delivery and to the newborn can reduce the risk of perinatal HIV transmission by two thirds.[13] These findings have led to PHS recommendations regarding use of zidovudine to reduce perinatal transmission[15,16] and for HIV counseling and voluntary testing of all pregnant women in the United States.[3,25] With the availability of specific interventions for the prevention and treatment of HIV infection and the complications associated with infection, surveillance for AIDS alone is

less useful for projecting resource needs and planning intervention programs.

HIV infection in children usually is indicative of HIV infection in a family unit. Regardless of the symptom status of the child, considerable health and social service resources are necessary to meet the needs of such families. Therefore, data on the numbers of children born to HIV-infected women and of HIV infection in children would have great usefulness.

IMPORTANT CONSIDERATIONS REGARDING PEDIATRIC HIV SURVEILLANCE

Surveillance of HIV-Infected and HIV-Exposed Infants

When contemplating nationwide expansion of pediatric HIV surveillance, it is important to consider whether reporting should include children who have been exposed to HIV, as well as those known to be infected. Children born to HIV-infected mothers may require evaluation for up to 18 months to determine definitively whether the child is uninfected. Continuing medical monitoring is necessary in such children, and appropriate clinical management dictates that certain interventions (eg, PCP prophylaxis) be initiated pending diagnostic evaluation. Therefore, to delineate fully the impact of HIV infection in children and estimate the medical and social service resources necessary for their care, reporting would optimally include infants of indeterminate status as well as those who are infected. Such data help evaluate the implementation and effectiveness of interventions to reduce perinatal transmission and of recommendations for prophylaxis against PCP. The ability to evaluate the potential long-term impact of such regimens on uninfected as well as HIV-infected children would be facilitated.

There are potential benefits for the mother (as well as other siblings and family members) of reporting of perinatal HIV exposure and/or pediatric HIV infection. The health department, the pediatric health care provider, and the maternal health care provider can work together to refer the mother to medical and social services for her own care, including appropriate counseling regarding HIV and its transmission, immunologic monitoring, antiretroviral treatment, prophylaxis for opportunistic infections, and evaluation of other family members for HIV infection.

Early treatment should be available to mothers and children. This will require enhancement of ambulatory specialized care in inner-city and rural areas and financial resources at local, state, and national levels to meet this obligation. Surveillance data are needed for determining resource allocation. The impact of HIV infection on children and the resultant health care requirements can be accurately determined by a surveillance system that includes reporting of children with perinatal HIV exposure as well as those with definite HIV infection and AIDS. Such data are critical to enable the most complete and reliable appraisal of current and future resource needs.

Many states have already implemented systems for surveillance of HIV-exposed infants. State and local health departments have provided information to the health care providers who report the information on their patients about referrals to available health care and social service resources for the patient and his/her family members.[26] It also has helped to evaluate the implementation of public health recommendations. Additional information from these states will be important to evaluate the usefulness of surveillance of HIV-exposed children.

Important considerations in surveillance for HIV exposure include concerns about confidentiality, particularly for the majority of infants who will be found to be uninfected. The benefits and limitations of maintaining identifiers of such uninfected children in the surveillance system need careful consideration.

Confidentiality Concerns

The confidentiality of HIV/AIDS case reports is critical in HIV/AIDS surveillance. The CDC and state health departments have policies and procedures to maintain security and confidentiality of disease surveillance records, and most states have additional specific confidentiality laws for patient-related HIV data. At the federal level, no patient names are collected and surveillance records are protected by assurance of confidentiality that prohibits the unauthorized disclosure of individual identifying information. Names are removed from patient records and unique coded identifiers are assigned, and the encrypted data are transmitted to the CDC. Federal funding for HIV/AIDS surveillance to state and local health departments is contingent on the ability of the health department to ensure the security and confidentiality of personal identifying information collected as part of surveillance activities.

The reporting of named identifiers to the state or local health department ensures that health departments can eliminate duplicate reports, provide referrals to services, and conduct follow-up to monitor the occurrence of severe illness and death. The state also can evaluate completeness of reporting by matching AIDS case registries with birth and death registries or hospital discharge records, and investigate cases of epidemiologic importance, such as those with no identified risk or unusual laboratory and clinical characteristics.

Although there are clear benefits to named reporting, a concern that it might deter individuals from undergoing HIV testing has been raised. However, a study that evaluated the impact of state reporting policies on personal plans to seek HIV testing found no evidence that such name-reporting was related to a decrease in the numbers of people reporting previous and planned HIV testing.[27] In addition, such reporting has assisted in providing public health services to newly diagnosed HIV-infected persons and in attracting increased funding for outpatient care and support services.[28]

Specific confidentiality provisions are in place to prevent disclosure of surveillance data identifiers to outside parties in all states. However, individual states maintain the authority to legislate disclosure when deemed important for public health purposes.

For example, two state legislatures have issued statutes containing confidentiality provisions, but that require notification of selected parties by the health department regarding reported cases of pediatric HIV infection or AIDS. Statutes in Illinois and South Carolina require that health department officials give notice of the identity of a reported HIV-infected child to the principal of the school in which the child is enrolled (in South Carolina, this applies only to public schools). Legislation requiring that school officials be notified of a child's HIV infection status is not consistent with published policies of a number of medical, educational, and public health organizations, including the AAP[29] and the PHS.[30] These policies evolve from the beliefs that notification of school officials by state or local public health agencies without the knowledge of the family is not consistent with the interests of children or their families, and compromises the rights of families to inform or not inform the schools.

Impact on Mothers and Families Identified Through Pediatric HIV/AIDS Reporting

All infants with perinatal exposure to HIV have HIV-infected mothers, and reporting of HIV exposure or infection in infants constitutes indirect knowledge of maternal serostatus. It has been speculated that some women might be deterred from having their infants evaluated for HIV for fear of identification of their status and potential social stigmatization. However, this has not been substantiated, and the knowledge that a regimen of zidovudine can reduce significantly the risk of perinatal HIV transmission has provided a strong impetus for pregnant women to learn their HIV infection status early in pregnancy.

Seroprevalence Surveys

Serologic testing of blood specimens that are not linked to individual patient identifiers for the purposes of surveillance has provided important information regarding the extent of the HIV epidemic. In pediatrics, because the presence of HIV antibody in the newborn reflects the infection status of the child's mother, the unlinked testing of neonatal filter paper blood specimens for HIV antibody has provided information regarding the distribution and prevalence of HIV infection in childbearing women. The population-based National HIV Survey in Childbearing Women, which was suspended by the PHS in May 1995, was used to examine HIV infection trends among women and children and to identify geographic areas in greatest need of prevention and treatment resources. Data from this survey, for example, demonstrated an increase in HIV infection among childbearing women in rural areas of the southeastern United States and was used to target and obtain funding for epidemiologic studies and prevention/service programs for these areas.[31]

With recommendations that PCP prophylaxis begin at 4 to 6 weeks of age and the discovery that zidovudine given to pregnant women and their infants can reduce significantly the risk of perinatal transmission, a few states have instituted or are considering legislation to require mandatory HIV testing of all newborns, with subsequent identification and informing of seropositive mothers. However, it is critical to recognize that testing of newborn blood specimens does not identify infected mothers early enough to permit initiation of zidovudine therapy during pregnancy to reduce perinatal transmission and therefore prevent HIV infection in children. Recognizing this, rather than mandating newborn HIV testing, a few states have passed legislation to require routine prenatal HIV education and HIV testing for all pregnant women, an approach more likely to reduce perinatal HIV infection.

The conduct of the serosurvey of childbearing women is important to evaluate trends in HIV infection in childbearing women and project resource needs. In conjunction with surveillance of HIV exposure, such a serosurvey permits evaluation of counseling and testing recommendations and validation of the efficacy of the surveillance system.[32] The PHS, AAP, and ACOG recommend that all women receive HIV education and counseling as part of their regular prenatal care. Additionally, it is strongly recommended that HIV testing be performed in all pregnant women with their consent, with documentation in the event of refusal of testing.[3,4,25] In areas in which pregnant women have been provided the opportunity to gain knowledge of their HIV serostatus, concerns about the conduct of an unlinked serosurvey would be diminished. Therefore, the AAP supports reinstitution of the serosurvey in areas in which the PHS, ACOG, and AAP recommendations for HIV counseling and testing in the prenatal setting have been implemented.

CONCLUSION

The AAP believes that there would be significant benefits to expanding surveillance for pediatric HIV infection nationwide through the addition of confidential reporting of perinatal HIV exposure and HIV infection in children to the ongoing surveillance of AIDS. However, confidentiality is crucial, and such information must be safeguarded and protected from unwarranted disclosures.

RECOMMENDATIONS

1. The AAP supports expanding HIV/AIDS surveillance in children to include reporting of HIV infection and AIDS status in all states and territories of the United States. This expansion must include appropriate safeguards for confidentiality.
2. With confidentiality provisions and adequate resources to ensure that there is no detrimental effect on ongoing surveillance for HIV infection and AIDS, the AAP supports additional expansion of HIV surveillance to include reporting of HIV-exposed infants.
3. The AAP opposes linkage of pediatric HIV infection reporting with disclosure to school and child care personnel as well as to other nonpublic health service organizations.
4. The reporting format should be simple and easy to implement for the health care community responsible for reporting to the health department.

5. The AAP reaffirms that all pregnant women should receive HIV education and counseling as part of regular prenatal care, and recommends strongly that HIV testing should be performed in all pregnant women with their consent, with documentation in the event of refusal of testing.
6. In areas in which AAP, ACOG, and PHS recommendations for HIV education, counseling, and testing in the prenatal setting have been implemented, seroprevalence surveys to determine the rate of HIV infection among childbearing women should be reimplemented.
7. Access to care for HIV-infected children and mothers is essential. However, the availability of resources to facilitate such access may depend on data documenting the extent of the problem in these populations. Therefore, expansion of HIV/AIDS surveillance should not be delayed until access problems have been resolved completely.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Sports Medicine and Fitness and Committee on Injury and Poison Prevention

Swimming Programs for Infants and Toddlers

ABSTRACT. Infant and toddler aquatic programs provide an opportunity to introduce young children to the joy and risks of being in or around water. Generally, children are not developmentally ready for swimming lessons until after their fourth birthday. Aquatic programs for infants and toddlers have not been shown to decrease the risk of drowning, and parents should not feel secure that their child is safe in water or safe from drowning after participating in such programs. Young children should receive constant, close supervision by an adult while in and around water.

ABBREVIATION. AAP, American Academy of Pediatrics.

Drowning is a leading cause of unintentional injury and death in the pediatric age group. In the United States, drowning rates are the highest among children ages 1 through 2 years. In Arizona, California, Florida, and Texas, drowning is the leading cause of death in this age group.[1] Other reported medical risks to infants and toddlers that involve being in water include hypothermia,[2,3] water intoxication,[4–6] and the spread of communicable diseases.[7] Serious consequences from these medical conditions are rare and can generally be reduced by following existing guidelines published by the American Red Cross[8] and the YMCA.[9] The policy statement published in 1993 by the American Academy of Pediatrics (AAP) entitled "Drowning in Infants, Children, and Adolescents"[10] also provides an excellent review of the subject. This AAP policy statement on infant swimming programs is an update of the 1985 policy.[11]

Infant and toddler aquatic programs are popular throughout the United States. An estimated 5 to 10 million infants and preschool children participate in formal aquatic instruction programs. Infant and preschool programs have been developed by such organizations as the American Red Cross[8] and the YMCA.[9,12] These programs, which focus on aquatic adjustment and swimming readiness skills, may also include water safety instruction for parents and guardians. They provide enjoyment for parents and children but were not designed to teach children to become accomplished swimmers or to survive independently in the water. Other infant/toddler aquatic programs, however, attempt to develop water survival skills.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Regardless of the program design or focus, infant and toddler aquatic programs are unable to ensure that children will understand water hazards, use appropriate avoidance strategies, or attain program safety goals. Currently, no data are available to determine if infant and toddler aquatic programs increase or decrease the likelihood of drowning. Programs that claim to make children safe in water or safe from drowning are misrepresenting what is possible and are giving parents a false sense of security about their child's safety in the water.

Swimming skills (ie, the ability to perform standard swimming strokes) should be distinguished from water safety skills (ie, survival flotation, energy conservation "swimming," or poolside safety behavior). Without specific training, children can perform rudimentary swimming movements in the water sometime around their first birthday.[13] The types of swimming movements a young child first demonstrates are not traditional strokes, such as the front crawl, but are more basic movements similar to the dog paddle. The optimum time to master more complex skills of swimming has not been thoroughly researched and has not been determined. A recent study by Blanksby et al[14] showed that swimming skills can be acquired more readily once motor development has reached the 5-year-old level. Although some children may acquire swimming skills earlier, Parker and Blanksby[15] found that children younger than 4 years require longer instructional periods to learn skills and are limited by their neuromuscular capacity. Therefore, having children begin swimming lessons at an earlier age does not translate to a more rapid mastery of aquatic skills or a higher level of swimming proficiency compared with those taking lessons at a later age.

The effects of training on the acquisition of water survival skills in young children have been studied by Asher et al[16] In a population of children averaging 34 months of age, water survival skills were enhanced after a training program. Safety training, however, did not result in a significant increase in the poolside safety skills of these children. The correlation between measurable safety skills and risk of drowning has not been established.

For any water safety or swimming class, children learn better if they are developmentally ready, properly motivated, positively reinforced, and if the experience is enjoyable. When instruction attempts to optimize learning by reducing fear of water, children may unwittingly be encouraged to enter the water without supervision.

Regardless of an infant's or toddler's apparent

level of comfort and competence in or around water, constant close supervision by an adult is necessary to prevent drowning and near-drowning. Even a brief lapse in supervision can have tragic results.[17–20] The concept of "touch supervision" has been advocated, which requires the caregiver to be within an arm's reach or able to touch the swimmer at all times.

RECOMMENDATIONS

Until more clear-cut scientific evidence exists on the effects of infant and toddler aquatic programs, the AAP recommends the following:

1. Children are generally not developmentally ready for formal swimming lessons until after their fourth birthday.
2. Aquatic programs for infants and toddlers should not be promoted as a way to decrease the risk of drowning.
3. Parents should not feel secure that their child is safe in water or safe from drowning after participation in such programs.
4. Whenever infants and toddlers are in or around water, an adult should be within an arm's length, providing "touch supervision."
5. All aquatic programs should include information on the cognitive and motor limitations of infants and toddlers, the inherent risks of water, the strategies for prevention of drowning, and the role of adults in supervising and monitoring the safety of children in and around water.
6. Hypothermia, water intoxication, and communicable diseases can be prevented by following existing medical guidelines and do not preclude infants and toddlers from participating in otherwise appropriate aquatic experience programs.
7. Pediatricians should support data collection, drowning prevention research, and legislation aimed at reducing the risk of drowning in young children in and around water.

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American Thoracic Society

Targeted Tuberculin Testing and Treatment of Latent Tuberculosis Infection

THIS OFFICIAL STATEMENT OF THE AMERICAN THORACIC SOCIETY WAS ADOPTED BY THE ATS BOARD OF DIRECTORS, JULY 1999. THIS IS A JOINT STATEMENT OF THE AMERICAN THORACIC SOCIETY (ATS) AND THE CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC). THIS STATEMENT WAS ENDORSED BY THE COUNCIL OF THE INFECTIOUS DISEASES SOCIETY OF AMERICA (IDSA), SEPTEMBER 1999, AND THE SECTIONS OF THIS STATEMENT AS IT RELATES TO INFANTS AND CHILDREN WERE ENDORSED BY THE AMERICAN ACADEMY OF PEDIATRICS (AAP), AUGUST 1999.

Executive Summary

This statement provides new recommendations for targeted tuberculin testing and treatment regimens for persons with latent tuberculosis infection (LTBI) and updates previously published guidelines (1, 2). This statement is issued in recognition of the importance of these activities as an essential component of the TB Elimination Strategy promoted by the U.S. Public Health Service Advisory Council on the Elimination of Tuberculosis, and reports the deliberations of expert consultants convened by the American Thoracic Society (ATS) and Centers for Disease Control and Prevention (CDC).

Isoniazid for 6-12 mo has been the mainstay of treatment for LTBI in the United States for more than 30 yr. However, the application of isoniazid for LTBI has been limited because of poor adherence, due to the relatively long duration of treatment required, and because of concerns about toxicity. Therefore, there has been interest in the development of shorter, rifampin-based regimens as alternatives to isoniazid for the treatment of LTBI. During the past decade, a series of studies of "short-course" treatment of LTBI in persons with human immunodeficiency virus (HIV) infection has been undertaken. The results of these trials have recently become available, and the in-depth analyses of these and prior studies of isoniazid form the scientific basis of the treatment guidelines presented in this report. In addition, many changes to previous recommendations regarding testing for and treatment of LTBI are presented (Table 1).

TARGETED TUBERCULIN TESTING

Targeted tuberculin testing for LTBI is a strategic component of tuberculosis (TB) control that identifies persons at high risk for developing TB who would benefit by treatment of LTBI, if detected. Persons with increased risk for developing TB include those who have had recent infection with *Mycobacterium tuberculosis* and those who have clinical conditions that are associated with an increased risk for progression of LTBI to active TB (see Tables 2 and 3). Following that principle, targeted tuberculin testing programs should be conducted only among groups at high risk and discouraged in those at low risk. Infected persons who are considered to be at high risk for developing active TB should be offered treatment of LTBI irrespective of age.

Based on the sensitivity and specificity of the purified protein derivative (PPD) tuberculin skin test and the prevalence of TB in different groups, three cut-points have been recommended for defining a positive tuberculin reaction: ≥ 5 mm, ≥ 10 mm, and ≥ 15 mm of induration (see Table 7). For persons who are at highest risk for developing active TB if they are infected with ***M. tuberculosis*** (i.e., persons with HIV infection, who are receiving immunosuppressive therapy, who have had recent close contact with persons with infectious TB, or who have abnormal chest radiographs consistent with prior TB), ≥ 5 mm of induration is considered positive. For other persons with an increased probability of recent infection or with other clinical conditions that increase the risk for progression to active TB, ≥ 10 mm of induration is considered positive. These include recent immigrants (i.e., within the last 5 yr) from high prevalence countries; injection drug users; residents and employees of high-risk congregate settings (including health care workers with exposure to TB); mycobacteriology laboratory personnel; persons with clinical conditions such as silicosis, diabetes mellitus, chronic renal failure, leukemias and lymphomas, carcinoma of the head or neck and lung, weight loss of ≥ 10% ideal body weight, gastrectomy, and jejunoileal bypass; and children younger than 4 yr of age or infants, children, and adolescents exposed to adults in high-risk categories. For persons at low risk for TB, for whom tuberculin testing is not generally indicated, ≥ 15 mm of induration is considered positive.

TREATMENT OF LATENT TUBERCULOSIS INFECTION

In this report, treatment recommendations use an adaptation of the rating system from recent U.S. Public Health Service documents (3) that grades the strength of the recommendation (A, B, or C) and the quality of evidence supporting the recommendation (I, II, or III). Four regimens are recommended for the treatment of adults with LTBI. (See Tables 8 and 10 for detailed recommendations, dosages, and contraindications.)

This Statement is one of four Statements on the diagnosis, treatment, prevention, and control of tuberculosis. The Statement updates and revises information on the treatment of latent tuberculosis infection in (1) Treatment of tuberculosis and tuberculosis infection in adults and children. Am J. *Respir. Crit. Care Med.* 1994;149:1359–1374, and information on screening for tuberculosis in (2) Control of tuberculosis. *Am. Rev. Respir. Dis.* 1992;146:1623–1633. **For information on the treatment of tuberculosis, refer to (1). For information on management of contacts and organization of control programs, refer to (2). For information on diagnostic methods, refer to (3) Diagnostic standards and classification of tuberculosis in adults and children. Am.** *J. Respir. Crit. Core Med.* 2000;161 :**1376-I 395.**

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Drugs	Duration (mo)	Interval	Rating* (Evidence)† HIV−	HIV+
Isoniarid	9	Daily	A (II)	A (II)
		Twice weekly	B (II)	B (II)
Isoniazid	6	Daily	B (I)	C (I)
		Twice weekly	B (II)	C (I)
Rifampin-pyrazinamide	2	Daily	B (II)	A (I)
	2-3	Twice weekly	C (II)	C (I)
Rifampin	4	Daily	B (II)	B (III)

* A = preferred; B = acceptable alternative; C = offer when A and B cannot be given.
† I = randomized clinical trial data; II = data from clinical trials that are not randomized or were conducted in other populations; III = expert opinion.

The isoniazid daily regimen for 9 mo is recommended because prospective, randomized trials in HIV-negative persons indicate that 12 mo of treatment is more effective than 6 mo of treatment. However, in subgroup analyses of several trials the maximal beneficial effect of isoniazid is likely achieved by 9 mo, and minimal additional benefit is gained by extending therapy to 12 mo. When compared with placebo, both 6-mo and 12-mo regimens are effective in HIV-positive patients; however, these regimens have not been compared with each other in randomized trials.

Although a 9-mo regimen of isoniazid is the preferred regimen for the treatment of LTBI, a 6-mo regimen also provides substantial protection and has been shown to be superior to placebo in both HIV-negative and HIV-positive persons. In some situations, treatment for 6 mo rather than 9 mo may provide a more favorable outcome from a cost-effectiveness standpoint. Thus, based on local conditions, health departments or providers may conclude that a 6-mo rather than a 9-mo course of isoniazid is preferred.

Both the 9-mo and 6-mo isoniazid regimens may be given intermittently (i.e., twice weekly). When isoniazid is given intermittently, it should be administered only as directly observed therapy (DOT).

The 2-mo daily regimen of rifampin and pyrazinamide is recommended on the basis of a prospective randomized trial of treatment of LTBI in HIV-infected persons that showed the 2-mo regimen to be similar in safety and efficacy to a 12-mo regimen of isoniazid. Twice-weekly treatment with rifampin and pyrazinamide for 2 or 3 mo may be considered when alternative regimens cannot be given. This intermittent regimen should always be administered as DOT. Some experts recommend that the 2-mo regimen of daily rifampin and pyrazinamide also be given by DOT, which can consist of five observed and two self-administered doses each week. In situations in which rifampin cannot be used (e.g., HIV-infected persons receiving protease inhibitors), rifabutin may be substituted.

Rifampin given daily for 4 mo is recommended on the basis of the efficacy of a similar regimen in (I) a prospective randomized trial of tuberculin-positive persons with silicosis and (2) a nonrandomized trial in persons exposed to individuals with isoniazid-resistant TB. This option may be especially useful for patients who cannot tolerate isoniazid or pyrazinamide.

Before beginning treatment of LTBI, active TB should be ruled out by history, physical examination, chest radiography, and, when indicated, bacteriologic studies.

Special considerations for treatment of LTBI apply to the following populations:

- When isoniazid is chosen for treatment of LTBI in persons with HIV infection or those with radiographic evidence of prior TB, 9 mo rather that 6 mo is recommended.
- For pregnant, HIV-negative women, isoniazid given daily or twice weekly for 9 or 6 mo is recommended. For women at risk for progression of LTBI to disease, especially those who are infected with HIV or who have likely been infected recently, initiation of therapy should not be delayed on the basis of pregnancy alone, even during the first trimester. For women whose risk for active TB is lower, some experts recommend waiting until after delivery to start treatment.
- For children and adolescents, isoniazid given either daily or twice weekly for 9 mo is the recommended regimen.
- For contacts of patients with isoniazid-resistant, rifampin-susceptible TB, rifampin and pyrazinamide given daily for 2 mo is recommended, and for patients with intolerance to pyrazinamide, rifampin given daily for 4 mo is recommended.
- For persons who are likely to be infected with isoniazid- and rifampin-resistant (multidrug) TB and who are at high risk for developing TB, pyrazinamide and ethambutol or pyrazinamide and a quinolone (i.e., levofloxacin or ofloxacin) for 612 mo are recommended. Immunocompetent contacts may be observed or treated for at least 6 mo, and immunocompromised contacts (e.g., HIV-infected persons) should be treated for 12 mo.

TABLE 1

CHANGES FROM PRIOR RECOMMENDATIONS ON TUBERCULIN TESTING AND TREATMENT OF LATENT TUBERCULOSIS INFECTION (LTBI)

Tuberculin testing

- Emphasis on targeted tuberculin testing among persons at high risk for recent LTBI or with clinical conditions that increase the risk for tuberculosis (TB), regardless of age; testing is discouraged among persons at lower risk
- For patients with organ transplants and other immunosuppressed patients (e.g., persons receiving the equivalent of ≥ 15 mg/d of prednisone for 1 mo or more), 5 mm of induration rather than 10 mm of induration as a cut-off level for tuberculin positivity
- A tuberculin skin test conversion is defined as an increase of ≥ 10 mm of induration within a 2-yr period, regardless of age

Treatment of latent tuberculosis infection

- For human Immunodeficiency virus (HIV)-negative persons, isoniarid given for 9 mo is preferred over 6-mo regimens
- For HIV-positive persons and those with fibrotic lesions on chest X-ray consistent with previous TB, isoniazid should be given for 9 mo instead of 12 mo
- For HIV-negative and HIV-positive persons, rifampin and pyrazinamide should be given for 2 mo
- For HIV-negative and HIV-positive persons, rifampin should be given for 4 mo

Clinical and laboratory monitoring

- Routine baseline and follow-up laboratory monitoring can be eliminated in most persons with LTBI, except for those with HIV infection, pregnant women (or those in the immediate postpartum period), and persons with chronic liver disease or those who use alcohol regularly
- Emphasis on clinical monitoring for signs and symptoms of possible adverse effects, with prompt evaluation and changes in treatment, as indicated

CLINICAL AND LABORATORY MONITORING

Once patients have been identified and then tested for LTBI, they should receive an initial clinical evaluation. They should also receive follow-up evaluations at least monthly (if receiving isoniazid alone or rifampin alone) and at 2, 4, and 8 wk (if receiving rifampin and pyrazinamide). This evaluation should include questioning about side effects and a brief physical assessment checking for signs of hepatitis. Patients should be ed-

ucated about the side effects associated with treatment of LTBI and advised to stop treatment and promptly seek medical evaluation when they occur.

Baseline laboratory testing is not routinely indicated for all patients at the start of treatment for LTBI (see Table 8). Patients whose initial evaluation suggests a liver disorder should have baseline hcpatic measurements of serum aspartate aminotransferase (serum glutamic oxaloacetic transaminase) (AST [SGOT]) or alanine aminotransferase (serum glutamic pyruvic transaminase) (ALT [SGPT]) and bilirubin. Baseline testing is also indicated for patients with HIV infection, pregnant women, and women in the immediate postpartum period (i.e., within 3 mo of delivery), persons with a history of chronic liver disease (e.g., hepatitis B or C, alcoholic hepatitis, or cirrhosis), persons who use alcohol regularly, and persons at risk for chronic liver disease. Baseline testing is not routinely indicated in older persons. However, such testing may be considered on an individual basis, particularly for patients who are taking other medications for chronic medical conditions. Active hepatitis and end-stage liver disease are relative contraindications to the use of isoniazid or pyrazinamide for treatment of LTBI.

Routine laboratory monitoring during treatment of LTBI is indicated for persons whose baseline liver function tests are abnormal and other persons at risk for hepatic disease. Laboratory testing may also be indicated for the evaluation of possible adverse effects that occur during the course of treatment (e.g., liver function studies for patients with symptoms compatible with hepatotoxicity or a uric acid measurement to evaluate complaints of joint pain). Some experts recommend that isoniazid should be withheld if transaminase levels exceed three times the upper limit of normal if associated with symptoms and five times the upper limit of normal if the patient is asymptomatic.

Introduction

HISTORY OF TREATMENT OF LATENT TUBERCULOSIS INFECTION AND RELEVANCE TO TUBERCULOSIS CONTROL

For more than three decades, treatment of persons with latent *Mycobacteriunz tuberculosis* infection (LTBI) to prevent the development of active disease has been an essential component of tuberculosis (TB) control in the United States (4). In the United States and other countries with a low incidence of TB, most new, active cases have occurred among persons who were once infected, contained this infection, and then later developed active TB (5). The identification and treatment of infected persons at highest risk for developing disease benefit both infected persons and susceptible persons in their communities. Until recently, isoniazid was the only drug proven effective and thus recommended for treatment of LTBI.

Shortly after isoniazid was found to be effective for the treatment of TB, clinical trials were begun to assess the ability of the drug to prevent progression of primary disease in children. When it was found that this intervention was highly effective, larger trials were begun to evaluate the drug for treatment of infected contacts of TB patients and of other persons at high risk (e.g., those with radiographic evidence of prior, untreated TB) (6). In 1965, isoniazid treatment of LTBI was first recommended for general use by the American Thoracic Society (ATS) (7). This initial statement recommended isoniazid for persons with evidence of previously untreated TB and persons with recent tuberculin skin test conversions, including all children younger than 3 yr of age with a positive tuberculin skin test. In 1967, ATS and PHS broadened the recommendations to include all persons who had had a purified protein derivative (PPD) tuberculin skin-test reaction of $\geq$ 10 mm. The recommendations stated that chemoprophylaxis is mandatory for (I) persons with inactive cases of TB who were not previously treated and their contacts, (2) persons with tuberculin skin test conversions, (3) persons with specified medical conditions, and (4) all persons younger than 20 yr of age who had had positive tuberculin skin tests (8). With widespread use of such an inexpensive drug that had "virtually no side effects," it was believed that "chemoprophylaxis [could] reduce future morbidity from TB in high risk groups by some 50 to 75 percent" (8).

However, despite this belief, the goal of reducing TB morbidity by such a substantial percentage through the administration of isoniazid was never reached. In 1970, among several thousand persons who began isoniazid treatment as a result of an outbreak of TB on Capitol Hill in the District of Columbia, 19 persons developed clinical signs of liver disease and two persons died of hepatic failure attributed to isoniazid (9). The recognition that isoniazid was associated with potentially fatal hepatitis led to the development of guidelines regarding pretreatment screening and monitoring to minimize the risk for severe complications (10). In 1974, following a study to quantify the risk for isoniazid-related hepatitis (11), guidelines for treatment of LTBI were updated. The revised guidelines excluded low-risk persons aged older than 35 yr of age as candidates for treatment (12).

Subsequent controversy over the appropriate age cut-off for these low-risk, tuberculin-positive persons ensued, with one group concluding that the risks of treatment of LTBI outweighed the benefits for young adults (13). This controversy and resulting confusion led to a decrease in the use of isoniazid for treating persons with LTBI—even persons at high risk for whom treatment was indicated (14). In 1983, the guidelines were further revised to recommend routine clinical and laboratory monitoring for persons aged older than 35 yr of age and other persons at risk for hepatotoxicity (15). Recent studies have suggested that since the advent of routine monitoring, the risk for severe hepatotoxicity has been substantially reduced (16).

Because widespread use and the potential impact of isoniazid treatment of LTBI became limited by actual and perceived toxicity and patient nonadherence because of the relatively long period of treatment required, alternatives to isoniazid were suggested (17). The introduction of rifampin, which appeared to be a better sterilizing agent than isoniazid, suggested the possibility that rifampin-based regimens might be safer, more effective, and shorter. The occurrence of the human immunodeficiency virus (HIV) epidemic and the need to evaluate the efficacy of treatment for LTBI in persons coinfected with HIV and *M. tuberculosis* led to a series of studies of short-course treatment of LTBI in HIV-infected persons (18). The results of these studies have recently become available and have contributed substantially to guidelines on treatment of LTBI in persons with HIV infection (3).

RELATIONSHIP OF TUBERCULIN TESTING TO TREATMENT OF LATENT TUBERCULOSIS INFECTION

As the rate of active TB in the United States has decreased, identification and treatment of persons with latent infection who are at high risk for active TB have become essential components of the TB elimination strategy promoted by the PHS Advisory Council on the Elimination of Tuberculosis (19). Because testing persons for infection and provision of treatment are interrelated, these recommendations include sections on program activities aimed at identifying high-risk infected persons and tuberculin skin testing, as well as recommendations on the use of new, short-course treatment regimens.

CHANGE IN NOMENCLATURE

Identification of persons with LTBI has previously been accomplished by widespread tuberculin skin testing of individuals or groups at variable risk for TB. In many situations, this screening was done with limited consideration of the risk for TB in the population(s) being tested. To focus on groups at the highest risk for TB, the term "targeted tuberculin testing" is used in these guidelines to encourage directed program activities.

Although the terms "preventive therapy" and "chemoprophylaxis" have been used for decades, they have also been confusing. "Preventive therapy" has referred to the use of a simple regimen (usually isoniazid) to prevent the development of active TB disease in persons known or likely to be infected with *M. tuberculosis,* but it rarely results in true primary prevention (i.e., prevention of infection in persons exposed to persons with infectious TB). To describe the intended intervention more accurately, this report uses the terminology "treatment of LTBI" rather than "preventive therapy" or "chemoprophylaxis." This change in nomenclature will hopefully promote greater understanding of the concept for both patients and providers, resulting in more widespread implementation of this essential TB control strategy.

Scientific Rationale

TARGETED TUBERCULIN TESTING

Groups at Risk and Risk Factors for Infection with *M. tuberculosis*

Targeted tuberculin testing for LTBI identifies persons at high risk for TB who would benefit by treatment of LTBI, if detected. Persons at high risk for TB (i.e., risk substantially greater than that of the general U.S. population) have either been infected recently with ***M. tuberculosis*** or have clinical conditions that are associated with an increased risk of progression of LTBI to active TB (Tables 2 and 3). Screening of low-risk persons and testing for administrative purposes (e.g., certification of school teachers) should be replaced by targeted testing.

Persons or groups with presumed recent M. tuberculosis ***infection.*** Persons infected with ***M. tuberculosis*** are at greatest risk for developing disease shortly after infection has occurred (Table 2). In two controlled trials examining the efficacy of treatment of LTBI among contacts of persons with active TB and among patients in mental hospitals, the tuberculin skin tests of 1472 participants in the placebo groups of the trials converted from negative to positive. Among persons whose tests converted, 19 developed disease in the first year of follow-up (12.9 cases per 1000 person-years) compared with 17 persons in the subsequent 7 yr of follow-up (1.6 cases per 1,000 person-years) (6). In a study of TB vaccines given to British schoolchildren, 2550 unvaccinated participants' tuberculin skin tests converted. Of these, 121 (4.7%) developed clinical TB within 15 yr of entry into the study: 54% developed disease during the first year after infection and 82% developed disease within 2 yr of infection (20).

In designing and planning targeted testing programs, several groups of persons can be identified as being at increased risk for being recently infected with ***M. tuberculosis.*** A high prevalence of either LTBI or active TB has been documented among close contacts of persons with infectious pulmonary TB (21); both of these characteristics are likely attributable to recent contact with infectious persons. Likewise, persons whose tuberculin skin tests convert from negative to positive within a period of 2 yr are presumed to have been infected recently.

Persons who have immigrated from areas of the world with high rates of TB have incidence rates that approach those of their countries of origin for the first several years after arrival in the United States (22). This high rate likely results from infection with *M. **tuberculosis*** in the native country before immigration and progression to disease soon after arrival in the United States. This hypothesis is supported by (I) DNA fingerprinting studies with restriction fragment length polymorphism (RFLP) interpreted to correlate with low rates of recent transmission of TB among foreign-born case patients in the United States (23) and (2) other data indicating that with time, the incidence of TB in foreign-born persons declines to approach that of the U.S. population (24).

Children, especially those younger than 5 yr of age, who have a positive tuberculin skin test are likely to be in the early stage of LTBI and are at high risk for progression to active disease, with the potential for disseminated TB (25). The risk for developing active TB is also increased in adolescents and young adults (25).

Recent U.S. studies (including RFLP studies) have helped characterize certain epidemiologically defined groups of persons with high rates of TB transmission and increased risk for being recently infected (e.g., homeless persons, those with HIV infection, and injection drug users) (23, 26). In addition, persons who reside or work in institutional settings (e.g., hospitals, homeless shelters, correctional facilities, nursing homes, and residential homes for patients with AIDS [27]) with persons at risk for TB may have an ongoing risk for acquiring TB infection. However, the risk for transmission varies greatly, and the likelihood that a specific institution is a site of transmission of ***M. tuberculosis*** can be determined only by local epidemiological data.

Clinical conditions associated with progression to active tuberculosis. HIV infection contributes most to an increased risk for progression of LTBI to active TB. Rates of progression to TB among HIV-infected persons have ranged from 35 to 162 per 1000 person-years of observation (Table 2) (28). In a prospective cohort study of persons with HIV infection in the United States, the annual risk of active TB among persons with a positive tuberculin test was 45 cases per 1000 person-years (29). Injection drug users also have an increased risk for progressing to active TB (10 cases per 1000 person-years) (30), and this risk is even greater for injection drug users coinfected with HIV and TB (76 cases per 1000 person-years) (31). These higher rates may reflect increased transmission, more recent infection in this population, and the increased risk associated with injection drug use and HIV infection.

The risk for active TB is also increased in (I) persons with pulmonary fibrotic lesions seen on chest radiographs (presumed to be from prior, untreated TB) and (2) underweight persons. Persons with fibrotic lesions on chest radiographs consistent

TABLE 2

INCIDENCE OF ACTIVE TUBERCULOSIS (TB) IN PERSONS WITH A POSITIVE TUBERCULIN TEST, BY SELECTED RISK FACTORS

Risk Factor	TB Cases/l ,000 Person-vears
Recent TB infection	
infection < 1 yr past	12.9 (6)*
Infection l-7 yr past	1.6
Human immunodeficiency virus	
(HIV) infection	35.0-l 62 (28)
Injection drug use	
HIV seropositive	76.0 (31)
HIV seronegative or unknown	10.0 (31)
Silicosis	68 (36)
Radiographic findings consistent with prior TB	2.0-I 3.6 (32-34)
Weight deviation from standard	
Underweight by ≥ 15%	2.6 (35)
Underweight by 1 0–14%	2.0
Underweight by 5–9%	2.2
Weight within 5% of standard	1.1
Overweight bv ≥ 5%	0.7

* Numbers in parentheses are reference numbers.

TABLE 3

RELATIVE RISK* FOR DEVELOPING ACTIVE TUBERCULOSIS (TB), BY SELECTED CLINICAL CONDITIONS

Clinical Condition	Relative Risk
Silicosis	30 (37, 38)'
Diabetes *mellitus*	2.0–4.1 (42-44)
Chronic renal failure/hemodialysis	10.0-25.3 (39-41)
Castrectomy	2-5 (45–47)
Jejunoileal bypass	27-63 (48, 49)
Solid organ transplantation	
Renal	37 (50)
Cardiac	20-74 (51, 52)
Carcinoma of head or neck	16 (53)

* Relative to control population; independent of tuberculin-test status.
† Numbers in parentheses are reference numbers.

with prior, healed TB have a risk for progression to active TB of 2.0-13.6 per 1000 person-years of observation (32-34). A study of 23,541 U.S. Naval recruits with tuberculin reactions ≥ 10 mm demonstrated that recruits who were ≥ 15% underweight from the standard weight for their height had a risk of progression to disease that was twofold that of persons who were within 5% of the standard weight for their height and more than threefold that of persons who were overweight (35).

Studies indicate that several other clinical conditions increase the risk for active TB, although participants in these studies were not stratified by tuberculin-test status (Table 3).

Tuberculin-positive persons with silicosis have an approximately 30-fold greater risk for developing TB (36-38). Persons with chronic renal failure who are on hemodialysis also have an increased risk: 10–25 times greater than the general population (3941). Persons with diabetes mellitus have a risk for developing active TB that is twofold to fourfold greater than persons without diabetes mellitus, and this risk is likely greater in persons with insulin-dependent or poorly controlled diabetes (42-44). Other clinical conditions that have been associated with active TB include gastrectomy with attendant weight loss and malabsorption (45–47), jejunoileal bypass (48, 49), renal (50) and cardiac (51, 52) transplantation, carcinoma of the head or neck (53), and other neoplasms (e.g., lung cancer, lymphoma, and leukemia [54]).

Persons receiving prolonged therapy with corticosteroids and other immunosuppressive agents may be at risk for reactivation of TB, but the exact risk is unknown (1). Because prednisone (or its equivalent) given > 15 mg/d for 2-4 wk suppresses tuberculin reactivity (55, 56), and because lower doses or those given intermittently are not associated with TB, this dose is likely the lower limit that could predispose persons to develop TB (57). Reactivation of TB is more likely to occur in persons receiving higher doses of corticosteroids for prolonged periods of time, especially in populations at high risk for TB, but specific thresholds of dose and duration that could increase the risk for TB are unknown (58). Persons who use alcohol may be at increased risk for acquiring or developing TB, but given the many other potential risk factors that commonly occur among such persons, alcohol use has been difficult to identify as a separate risk factor for TB (2, 42, 59, 60).

Operational Considerations

In ***A Strategic Plan for the Elimination of Tuberculosis in The United States,*** published by CDC in 1989 (61), the responsibility for detection and treatment of LTBI in high-risk groups was assigned directly to public health agencies. At that time, the administration of skin tests, interpretation of test results, and intensive follow-up required to ensure adherence with and to prevent side effects of isoniazid treatment were believed to be beyond the scope of most private health care providers.

However, in 1995, CDC published recommendations on targeted testing and treatment of LTBI that emphasized the importance of health departments in assisting local providers in the development, implementation, and evaluation of TB screening programs appropriate for their communities (2). This recommendation was based on the recognition that changes in the organization, delivery, and financing of health care in the United States have led to most routine tuberculin testing being done outside of the public health system (62). For example, populations that previously received clinical services, including diagnosis of LTBI, at public health clinics are now increasingly being enrolled as members of managed care organizations.

Because health departments might lack access to high-risk populations and the resources necessary to undertake targeted testing programs, the participation of other health care providers is essential to ensure the successful implementation of community efforts to prevent TB in high-risk groups. Community sites where persons at high risk may be accessed and where targeted testing programs have been evaluated include neighborhood health centers (63), jails (64), homeless shelters (65), inner-city sites (66), methadone (67) and syringe/needle-exchange programs (68), and other community-based social service organizations (69).

DIAGNOSIS OF LATENT TUBERCULOSIS INFECTION

Tuberculin Skin Testing

The tuberculin skin test is the only proven method for identifying infection with ***M. tuberculosis*** in persons who do not have TB disease. Although the available tuberculin skin-test antigens are < 100% sensitive and specific for detection of infection with ***M. tuberculosis,*** no better diagnostic methods have yet been devised. Proper use of the tuberculin skin test requires knowledge of the antigen used (tuberculin), the immunologic basis for the reaction to this antigen, the technique(s) of administering and reading the test, and the results of epidemiologic and clinical experience with the test. Detailed information on these topics is provided in the ATS/CDC Statement ***Diagnostic Standards and Classification of Tuberculosis in Adults and Children (70).***

Immunologic basis for the tuberculin reaction. Infection with ***M. tuberculosis*** produces a delayed-type hypersensitivity reaction to certain antigenic components (tuberculins) that are contained in extract of culture filtrate of the organism. Purified protein derivative (PPD) tuberculin, which is used for most skin testing, is isolated from culture filtrate by protein precipitation.

The reaction to intracutaneously injected tuberculin is a delayed-type (cellular) hypersensitivity (DTH) reaction, and infection by ***M. tuberculosis*** usually results in a DTH response to PPD tuberculin that is detectable 2-12 wk after infection (71). However, a DTH reaction to PPD tuberculin may also indicate infection with various nontuberculous mycobacteria or vaccination with Bacille Calmette-Guérin (BCG), a live attenuated mycobacterial strain derived from ***Mycobacterium bovis.*** Delayed hypersensitivity reactions to tuberculin usually begin 5-6 h after injection, reach a maximum at 48-72 h, and subside over a period of a few days, although positive reactions often persist for up to 1 wk (72).

Sensitivity and specificity of skin-test reactions. Knowledge of tuberculin-test sensitivity and specificity, as well as positive predictive value, is required to interpret skin-test reactions properly. For persons with LTBI and normal immune responsiveness, test sensitivity approaches 100% (73). However, false-positive tuberculin tests occur in persons who have been infected with nontuberculous mycobacteria and in persons who have received BCG vaccine. These false-positive reactions result in a lower specificity and a low positive predictive value in persons who have a low probability of LTBI. The general U.S. population currently has an estimated ***M. tuberculosis*** infection rate of 5–10%, and children entering school in many areas of the country have a 0.1–1% prevalence of infection. Even if the test has a specificity approaching 99%, testing of persons in such low-prevalence groups would result in most positive tests being false-positive tests (71). However, the specificity of the test is also dependent on the criterion used to define a "positive" test. The specificity can be improved by progressively increasing the reaction size that separates positive from negative reactors (at the expense of decreasing test sensitivity) (73).

Previous BCG vaccination. Intracutaneous inoculation with

BCG is currently used in many parts of the world as a vaccine against tuberculosis. Tuberculin reactivity caused by BCG vaccination generally wanes with the passage of time but can be boosted by the tuberculin skin test. Periodic skin testing may prolong reactivity to tuberculin in vaccinated persons (74). No reliable method has been developed to distinguish tuberculin reactions caused by vaccination with BCG from those caused by natural mycobacterial infections, although reactions of ≥ 20 mm of induration are not likely caused by BCG (75).

HIV infection and anergy testing. HIV-infected persons may have a compromised ability to react to tuberculin skin tests because of cutaneous anergy associated with progressive HIV immunosuppression (76). However, the usefulness of anergy testing in selecting tuberculin-negative, HIV-infected persons who might benefit from treatment of LTBI has not been demonstrated (77).

Chest Radiographs

In persons with LTBI, the chest radiograph is usually normal, although it may show abnormalities suggestive of prior TB. Previous, healed TB can produce various radiographic findings that usually differ from those associated with active TB. Dense pulmonary nodules, with or without visible calcification, may be seen in the hilar area or upper lobes. Smaller nodules, with or without fibrotic scars, are often seen in the upper lobes, and upper-lobe volume loss often accompanies these scars. Nodules and fibrotic lesions of previous, healed TB have well-demarcated, sharp margins and are often described as "hard." Bronchiectasis of the upper lobes is a nonspecific finding that sometimes occurs from previous pulmonary TB. Pleural scarring may be caused by prior TB but is more commonly caused by trauma or other infections. Nodules and fibrotic scars may contain slowly multiplying tubercle bacilli with substantial potential for future progression to active TB (32). Conversely, calcified nodular lesions (calcified granulomas) and apical or basal pleural thickening pose a lower risk for future progression to active TB.

Sputum Examinations

The presumptive diagnosis of active pulmonary TB is often made on the basis of microscopic examination of a stained sputum smear for acid-fast bacilli (AFB). Confirmation of the diagnosis usually requires identification of ***M. tuberculosis in*** culture. In asymptomatic persons with normal chest radiographs, AFB are rarely seen on sputum smear examination, and tubercle bacilli are not found in cultures of respiratory specimens. However, some HIV-infected persons with sputum culture-positive TB have been described as having normal chest radiographs.

TREATMENT OF LATENT TUBERCULOSIS INFECTION

Isoniazid

Experimental studies. Before clinical trials of isoniazid for the treatment of LTBI were begun in the United States, its efficacy was demonstrated in guinea pigs. In a study conducted by PHS, guinea pigs receiving varying doses of isoniazid were challenged with virulent tubercle bacilli (78). Those animals receiving a daily dosage of at least 5 mg/kg were protected (i.e., survival was comparable to control animals who were not challenged with the bacillus). On the basis of these studies, the dose of 5 mg/kg was chosen for clinical studies in humans.

Clinical trials in HIV-negative persons. Many randomized, controlled clinical trials of isoniazid for the treatment of LTBI were conducted in the 1950s and 1960s (6). These trials were conducted in seven countries, both industrialized and developing, and involved more than 100,000 participants at risk for TB, including children with primary TB, contacts of active case patients, persons who had had tuberculin skin reactions, institutionalized patients with mental disease, and persons with inactive TB. Most studies compared 12 mo of isoniazid with placebo. The outcomes measured in these studies included progression of primary TB, tuberculin conversion in uninfected contacts, prevention of TB in infected persons, and recurrence of disease. The effectiveness of treatment, as measured by the decrease in TB among all persons participating in these trials, varied from 25 to 92%. However, when analysis was restricted to persons who were compliant with the medication, the protective efficacy was approximately 90%. Substantial protection was conferred even if pill taking was irregular but sustained, suggesting the possibility that intermittent treatment may be efficacious.

Only one trial, conducted by the International Union Against Tuberculosis (IUAT) (32), was designed to evaluate various durations of isoniazid. In this trial, a placebo regimen was compared with isoniazid regimens lasting for 3, 6, and 12 mo among persons with fibrotic pulmonary lesions consistent with inactive TB. The 5-yr incidence rates of tuberculosis were 1.43% for placebo compared with 1.13, 0.50, and 0.36% for the 3-, 6-, and 12-mo regimens, respectively (Table 4). The rates indicated a 65% effectiveness for the 6-mo isoniazid regimen and 75% effectiveness for the 12-mo regimen; persons who received 6 mo of isoniazid had a 40% higher risk for TB compared with those who received 12 mo of therapy.

The difference in the two regimens is magnified when study subjects who received "almost all" of the monthly drug allotments for their scheduled duration of therapy and who were believed to have taken ≥ 80% of the medication each month were compared. In this subgroup, which constituted 78% of the entire study population, the resulting 5-yr incidence rates were 1.5% for persons receiving placebo compared with 1.0, 0.5, and 0.1% for the 3-, 6-, and 12-mo regimens, respectively. In this analysis, isoniazid taken for 6 mo was 69% efficacious and for 12 mo was 93% efficacious; participants on the 6-mo

TABLE 4

EFFICACY OF VARIOUS DURATIONS OF ISONIAZID PREVENTIVE THERAPY FOR PERSONS WITH FIBROTIC LESIONS, BY LENGTH OF TREATMENT-INTERNATIONAL UNION AGAINST TUBERCULOSIS (IUAT) TRIAL, 1969-1977

	5-yr Tuberculosis Incidence* (% Reduction)			
Group	Placebo	12 wk	24 wk	52 wk
All participants (n = 27,830)†	14.3	11.3 (21)	5.0 (65)	3.6 (75)
Adherent participants* (n = 21,635)§	15	9.4 (31)	4.7 (69)	1.1 (93)
Fibrotic lesions $< 2\ cm^2$ (n = 18,663)†	11.6	9.2 (20)	4.0 (66)	4.2 (64)‖
Fibrotic lesions $> 2\ cm^2$ (n = 8,428)§	21.3	16.2 (24)	7.0 (67)	2.4 (89)

* Per 1000 person-years.

† Comoaring placebo to 24 and 52 wk. $p < 0.05$: differences between placebo and 12 wk and between 24 and 52 wk not significant.

‡ Collected pill calendars for "almost all" of the months assigned for their regimen and had taken at least 80% of the pills from the calendar by the time of the next monthly visit.

§ For all interregimen comparisons ($p < 0.05$).

‖ Persons who developed tuberculosis on 52-wk regimen and had small fibrotic lesions were less likely to have collected pill calendars (47%) than all other groups (≥ 80%) ($p < 0.001$).

Source: International Union Against Tuberculosis Committee on Prophylaxis. 1982. Efficacy of vaious durations of isoniazid thereapy for tuberculosis: five years of follow-up in the IUAT trial. *Bull.* WHO 60:555–564.

TABLE 5

TUBERCULOSIS MORBIDITY RATES PER 1000 HOUSEHOLD CONTACTS, BY PERCENTAGE OF PILLS TAKEN AND DURATION OF THERAPY DURING PARTICIPATION IN U.S. PUBLIC HEALTH SERVICE TRIAL

Percentage of Pills Taken	Duration of Therapy (*mo*)	Placebo			Isoniazid			Percentage Change
		Population*	Case Patients+	Rate‡	Population*	Case Patients+	Rate‡	
≥ 80%	10-12	5094	127	24.9	4802	38	7.9	-68.3
≥ 80%	1-9	752	14	18.6	767	12	15.6	-16.1
60–79%	≥ 10	953	25	26.2	804	9	11.2	-57.3
40–59%	≥ 10	368	7	19.0	438	4	9.1	-52.1

* Excludes contacts who were tuberculin negative both at admission and at 12 mo.
† Excludes case patients who stopped taking pills because they developed active disease (29 placebo, five isoniazid).
‡ Rate for 10 yr of observation.
Source: Adapted from Ferebee, S. H. 1970. Controlled chemoprophylaxis trials in tuberculosis: a general review. *Adv. Tuberc. Res.* 17:28–106.

regimen had a fourfold higher risk for TB than those on the 12-mo regimen. Although the incidence of TB was similar for persons with small lesions (< 2 cm^2) assigned the 6-mo and 12-mo regimens, such persons were less adherent to treatment. The 12-mo regimen provided a substantial reduction in risk compared with the 6-mo regimen among compliant persons with small lesions (Table 4).

Additional information on the efficacy and effectiveness of different lengths of therapy with isoniazid for the treatment of LTBI has been derived from a randomized study of household contacts conducted by PHS (21). Among persons believed to have taken ≥ 80% of their assigned medication during the months they took isoniazid, those who took medication for at least 10 mo experienced a 68% reduction in TB (Table 5). In contrast, among persons who took ≥ 80% of the medication for < 10 mo, only a 16% reduction in the TB rate occurred. The same data can be further examined to determine whether reduction in the rate of TB was affected more by duration of therapy or the amount of medication. The effectiveness of isoniazid decreased slightly for less compliant patients who took 40–79% of the prescribed medication during the 10-mo period (52–57% reduction compared to 68% reduction), suggesting that even an intermittent treatment regimen would be effective if taken for at least 10 mo (Table 5).

In a community-based study conducted in Bethel, Alaska (79), persons who took < 25% of the prescribed annual dose had a threefold higher risk for TB than those who took ≥ 50% of the annual dose. However, a more recent analysis of study data indicated that the efficacy decreased significantly if < 9 mo of isoniazid was taken (Figure 1) (80).

Effectiveness data from the IUAT study, published data on isoniazid-associated hepatitis, and cost information obtained from a survey of U.S. TB programs were used to assess the cost effectiveness of various durations of isoniazid (81). The cost per case of TB prevented with the 6-mo regimen was determined to be half of the cost as either the 3-mo or 12-mo regimens. This cost-effectiveness analysis was largely responsible for the widespread adoption of the 6-mo regimen of isoniazid for the treatment of LTBI in HIV-seronegative persons with normal chest radiographs (82). However, the protection conferred by taking at least 9 mo of isoniazid is greater than that conferred by taking 6 mo; it is not likely that further protection is conferred by extending the duration of treatment from 9 to 12 mo (80).

Clinical trials in HIV-positive persons. Seven randomized, controlled trials have evaluated different regimens for the treatment of LTBI infection in persons with HIV infection (Table 6). Five of these studies evaluated isoniazid regimens using comparison groups that either received a placebo or were not actively treated.

In the first study, conducted in Haiti during 19861992, 12 mo of daily isoniazid resulted in a substantial reduction in TB (83%) among tuberculin-positive persons (83). Protection was constant over the 4 yr of follow-up after treatment. Two other studies, which evaluated 6 mo of isoniazid taken daily by tuberculin-positive persons, had differing results: the drug provided a significant level of protection in Uganda (68%) (84) but did not provide a significant level of protection in Kenya (40%) (85). A fourth study evaluated a 6-mo, twice-weekly regimen of isoniazid in both tuberculin-positive and -negative persons in Zambia (86). The overall level of protection was minimal but significant (38%). Although the level of protection among tuberculin-positive persons was higher (70%), it was not significant because of the limited number of persons in this group.

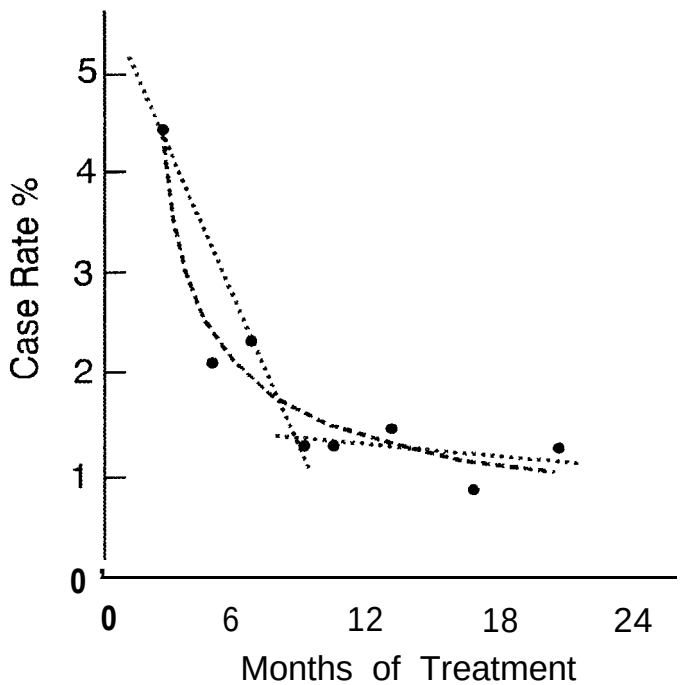

Figure 1. Tuberculosis case rates (%) in the Bethel Isoniazid Studies population according to the number of months isoniazid was taken in the combined programs. Dots represent observed values; thin line, the calculated curve (y = a + b/x); and ***dotted lines*** **the** calculated values based on the first four and the last five observations (y = a + bx). Source: Comstock, G. W. 1999. How much isoniazid is needed for prevention of tuberculosis among immunocompetent adults? *Int. J. Tuberc.* Lung *Dis.* 3:847–850. Reprinted by permission of the International Union Against Tuberculosis and Lung Disease.

TABLE 6

PROSPECTIVE, RANDOMIZED CLINICAL TRIALS OF PREVENTIVE THERAPY OF TUBERCULOSIS (TB) IN PERSONS INFECTED WITH HUMAN IMMUNODEFICIENCY VIRUS (HIV)

Study (Reference no.)	Study Subjects' Purified Protein Derivative (PPD) Status* (n)	Drug Regimen (mo)	No. TB Cases (%)	TB Rate/100 Person-years	Relative Risk of TB (95% Confidence Interval)
Pape (83)	PPD+ (25)	Placebo, daily (12)	6 (24)	10.0	1
Haiti 1986–1992	PPD+ (38)	Isoniazid 300 mg, daily (12)	2 (5)	1.7	0.17 (0.03-0.83)
	PPD− (35)	Placebo, daily (12)	5 (14)	5.7	1
	PPD- (20)	Isoniazid 300 mg, daily (12)	2 (10)	3.2	0.56 (0.1 l-2.5)
Whalen (84)	PPD+ (464)	Placebo, daily (6)	21 (5)	3.41	1
Uganda 1993-1997	PPD+ (536)	Isoniazid 300 mg, daily (6)	7 (1)	1.08	0.32 (0.14-0.76)
	PPD+ (556)	Isoniazid 300 mg/rifampin 600 mg, daily (3)	9 (2)	1.32	0.41 (0.19-0.89)
	PPD+ (462)	Isoniazid 300 mglrifampin 600 mg/pyrazinamide 2000 mg, daily (3)	10 (2)	1.73	0.43 (0.20-0.92)
	Anergic (323)	Placebo, daily (6)	10 (3)	3.06	1
	Anergic (395)	Isoniazid 300 mg, daily (6)	9 (2)	2.53	0.75 (0.30-l .89)
Hawken (85)	PPD+/− (342)	Placebo, daily (6)	23 (7)	3.86	1
Kenya 1992-1996	PPD+/− (342)	Isoniazid 300 mg, daily (6)	25 (7)	4.29	0.92 (0.49-l .71)
	PPD+ (67)	Placebo, daily (6)		8.03	1
	PPD+ (69)	Isoniazid 300 mg, daily (6)		5.59	0.60 (0.23-l .60)
	PPD− (235)	Placebo, daily (6)		2.73	1
	PPD− (224)	Isoniazid 300 mg, daily (6)		3.28	1.23 (0.55-2.76)
Mwinga (86)	PPD+/− (350)†	Placebo (isoniazid), twice weekly (6)	44 (13)	8.06	1
Zambia 1992-1996	PPD+/− (352)†	Isoniazid 900 mg, twice weekly (6)	27 (8)	4.94	0.62 (0.38-0.99)
	PPD+/− (351)†	Rifampin 600 mg/pyrazinamide 3500 mg twice weekly (3)	25 (7)	4.65	0.58 (0.35-0.95)
Gordin (87)	Anergic (257)	Placebo, daily (6)	6 (2)	0.9	1
United States 1991-1996	Anergic (260)	Isoniazid 300 mg, daily (6)	3 (1)	0.4	0.48 (0.12-l .91)
Halsey (110)	PPD+ (370)	Isoniazid, 600-800 mg, twice weekly (6)	14 (4)	1.7	1
Haiti 1990–1994	PPD+ (380)	Rifampin 450–600 mg/pyrazinamide 1500-2500 mg, twice weekly (2)	19 (5)	1.8	1.1
Gordin (111)	PPD+ (792)	Isoniazid 300 mg, daily (12)	26 (3)	1.1	1
United States, Mexico, Haiti, Brazil 1991–1997	PPD' (791)	Rifampin 600 mg/pyrazinamide 20 mg/kg, daily (2)	19 (2)	0.8	0.67 (0.36-l .24)

* PPD+ = PPD ≥ 5 mm; PPD− = PPD < 5 mm.

† Percentage tuberculin-positive; 27% in placebo, 23% in isoniazid, and 22% in rifampin/pyrazinamide.

Source: Adapted from Cohn, D. L., and W. M. El-Sadr. 2000. Treatment ot latent tuberculosis infection. In L. B. Reichman and E. Hershfield, editors. Tuberculosis: A Comprehensive International Approach, 2nd ed. Marcel Dekker, New York. 471–502.

The Uganda study also evaluated the 6-mo regimen of daily isoniazid in anergic persons, as did the fifth study conducted in the United States (87). In both studies, the level of protection against TB was low, and neither study demonstrated a significant level of protection.

Additional evaluations of isoniazid were conducted in tuberculin-negative persons who were not assessed for anergy (83, 85, 86). The level of protection provided by isoniazid among this population was not significant in any of the studies. Thus, for HIV-infected persons, treatment should be targeted at tuberculin-positive persons. A recently published meta-analysis of these trials supports this conclusion (88).

Safety and tolerability. In 1965, when isoniazid was first recommended in the United States for treatment of LTBI, it was not thought to cause severe toxicity. In the PHS studies conducted among TB contacts, the percentage of persons stopping treatment because of suspected drug reactions was low and approximately equivalent for the placebo and isoniazid groups (21). The occurrence of hepatitis was rare and was not assumed to be caused by isoniazid. However, studies conducted in the late 1960s suggested that isoniazid did cause hepatitis and indicated that asymptomatic increase in hepatic transaminases occurred among persons receiving the drug (89). It was not until the 1970s, when several persons receiving isoniazid for LTBI died from hepatitis, that the likelihood of isoniazid hepatitis was understood (9).

The largest and most comprehensive study of isoniazid hepatitis was conducted by PHS during 1971-1972 (11). In this survey, nearly 14,000 persons who received isoniazid were monitored for the development of hepatitis. The overall rate of probable isoniazid hepatitis was 1%, but it was age related, with no cases occurring among persons younger than 20 yr of age and the highest rate (2.3%) occurring among persons older than 50 yr of age. An association of hepatitis also was found with alcohol consumption, with rates being fourfold higher among persons consuming alcohol daily than among those who did not drink alcohol. Rates among males and females were equivalent and were lower among black males and higher among Asian males compared with rates among white males. Hepatitis rates were lower among participants in the IUAT trial, although the same positive association with age was observed (32). In the PHS surveillance study, eight deaths from hepatitis occurred among the participants, seven of which were among persons living in Baltimore. Several years after completion of the study, a review of death certificates showed a marked increase in deaths from cirrhosis during 1972 in Baltimore and surrounding counties, suggesting that another cofactor may have been associated with the cluster of deaths observed in the study (90).

A comprehensive analysis of deaths from isoniazid-associated hepatitis in the United States found that women may be at increased risk of death (91). Other reports have suggested that the risk for isoniazid-associated hepatitis may be in-

creased by the administration of the drug to pregnant women in the third trimester and the immediate postpartum period (92) or by the concomitant administration of acetaminophen (93). Although experimental evidence suggests that acetaminophen hepatotoxicity is potentiated by isoniazid (94), a more detailed study of deaths from isoniazid-associated hepatitis did not implicate acetaminophen as a factor (95).

Isoniazid-related deaths continue to be reported. However, the likelihood of this occurrence can be greatly reduced by careful monthly monitoring and stopping of medication if symptoms occur (96). In a recent study, seven of eight patients receiving a liver transplant following the development of fulminant, isoniazid-related hepatitis continued to take the drug for a least 10 d after onset of symptoms of hepatotoxicity (97).

Following the PHS surveillance study, guidelines on the use of isoniazid for the treatment of LTBI were revised to recommend that low-risk persons older than 35 year of age with reactive tuberculin skin tests not be treated, that no more than 1 mo drug supply be issued at a time, and that monthly questioning and education about signs and symptoms of hepatitis should be routine (12). The guidelines were further revised to recommend baseline and periodic liver-function tests for persons at risk for hepatotoxicity, including persons aged 35 yr of age or older (15).

More recently, a survey found that many public health TB clinics now use clinical, rather than biochemical, monitoring for hepatotoxicity during treatment of LTBI (98). Clinical monitoring is based on educating patients about the symptoms of hepatotoxicity and instructing them to stop treatment immediately if such symptoms occur and to report to the clinician for evaluation. After using clinical monitoring exclusively, one public health TB clinic reported only 11 cases of clinical hepatotoxicity (one of which required hospitalization) and no deaths among more than 11,000 persons with LTBI during isoniazid treatment over a 7-yr period (99). Based on this emerging experience with clinical monitoring, some authorities have called for the establishment of new recommendations for drug toxicity monitoring "that are congruent with established therapeutic/toxicity relationships" (98).

Recent studies of isoniazid treatment of LTBI in HIV-infected persons have demonstrated that the medication was well tolerated and not associated with substantial increases in hepatic side effects. In a recent meta-analysis of placebo-controlled trials, adverse drug reactions were slightly but not significantly more common among persons receiving isoniazid (88).

Despite the high efficacy and relative safety of isoniazid treatment for LTBI, its use has been frequently debated; much literature has been published regarding whether and when to prescribe isoniazid (13, 100–102). However, because the arguments embodied in that literature emerged more than two decades ago, in a different environmental context with different risks and contingencies, its appropriateness to current circumstances is uncertain.

Although the likelihood that a patient treated with isoniazid would develop hepatitis was low, it presented a valid argument against the use of isoniazid among persons who had no increased risk for developing active TB. Most of the arguments concerning the use of this drug, which appeared from the 1970s through the early 1980s, focused on persons at low risk for reacting to tuberculin, primarily those 35 yr of age or older who were likely at higher risk for isoniazid-associated hepatitis than younger patients.

Because the debate over whether to prescribe or withhold isoniazid for persons older than 35 yr of age at low risk for reacting to tuberculin involved a trade-off between risk for developing active TB versus risk for developing isoniazid-induced hepatitis, decision analysis was used by most investigators (103). Despite many analyses, the decision to treat persons at low risk for reacting to tuberculin at any age continued to be controversial. Although various analyses supported both sides of the debate, none of the calculated benefits of isoniazid was substantial.

Short-course Regimens

Experimental studies in animals. Because of high rates of nonadherence with the long duration of isoniazid (i.e., 612 mo) and the rare occurrence of fatal isoniazid hepatitis, short-course, rifampin-containing treatment regimens have recently been evaluated. The studies evaluating rifampin were based on data from several studies in mouse models of chronic TB. One study compared isoniazid with regimens of rifampin alone; rifampin and pyrazinamide; and isoniazid, rifampin, and pyrazinamide (104). The rifampin-only regimen sterilized lung and spleen tissues within 4 mo, and the combination of rifampin and pyrazinamide sterilized tissues within 2 mo. The isoniazid, rifampin, and pyrazinamide regimen was of intermediate efficacy, taking longer than the rifampin and pyrazinamide regimen to sterilize tissues. The isoniazid regimen had not sterilized tissues by the end of 6 mo.

The apparent superiority of the rifampin-pyrazinamide regimen over the regimen containing the same two drugs plus isoniazid might be explained by impaired absorption of rifampin when given simultaneously with other drugs in mice (105). Support for this hypothesis came from a study using a Cornell mouse model (106) that compared 6-wk regimens of rifampin, rifampin-isoniazid, rifampin-pyrazinamide, and rifampin-pyrazinamide-isoniazid, with delayed administration of rifampin when given with other drugs. The efficacy of all three regimens was similar, with trend toward a lower colony count in spleens of animals given more drugs, and lower colony counts in the lungs of mice given rifampin-isoniazid. Experimental studies have also suggested that rifabutin alone, taken daily, and rifabutin-isoniazid, taken twice weekly, may effectively treat LTBI in 3 mo (107).

Clinical trials in HIV-negative persons. The only randomized clinical trial to evaluate rifampin-containing regimens among HIV-seronegative persons was conducted in tuberculin-positive persons with silicosis in Hong Kong (36). In this study, daily regimens of 6 mo of isoniazid, 3 mo of rifampin, or 3 mo of isoniazid and rifampin were compared with a 6-mo placebo control. Analyzing only those patients who were assumed to be compliant yielded an estimate of efficacy in preventing TB of 63% for the 3-mo rifampin regimen, 48% for the 6-mo isoniazid regimen, and 41% for the 3-mo isoniazid-rifampin regimen. All of these differences were significantly different from the placebo regimen but were not statistically different from each other. The annual incidence rate was about 7% per year in the placebo group and about 4% per year in the three active-treatment regimens combined.

The largest programmatic experience using rifampin-based treatment of LTBI comes from Blackburn, England, where children at increased risk of TB have been treated with daily rifampir-isoniazid since 1981 (108). During 1981-1996, the treatment duration was shortened from 9 to 3 mo, and the proportion of pediatric TB case patients as a percentage of all reported cases decreased from 25 to 4%. Although not a controlled clinical trial, these data suggest that this intervention has been highly effective in reducing the rate of childhood TB in this city. Thus, this regimen is currently recommended for the treatment of both adults and children with LTBI in the United Kingdom (109).

Clinical trials in HIV-positive persons. Most clinical trials of rifampin-based treatment of LTBI have been conducted among HIV-infected persons (Table 6); two were placebo controlled. The Uganda study also evaluated regimens of isoniazid–rifampin and isoniazid-rifampin-pyrazinamide taken daily for 3 mo in tuberculin-positive persons (84). The isoniazid-rifampin regi-

men provided 59% protection, and the three-drug regimen with pyrazinamide provided 57% protection-levels similar to those provided by 6 mo of isoniazid alone. The Zambia study also evaluated a self-administered regimen of rifampin and pyrazinamide taken twice weekly for 3 mo (86). The level of protection was 42%, similar to that conferred by the 6-mo, twice-weekly isoniazid regimen. Among tuberculin-positive persons, the level of protection conferred by rifampin and pyrazinamide was 70%, comparable with that conferred by 6 mo of isoniazid taken twice weekly, but not statistically significant.

In two trials, rifampin and pyrazinamide regimens have been compared with regimens of isoniazid alone in tuberculin-positive persons. A second study conducted in Haiti during 1990-1994 compared twice-weekly regimens of 6 mo of isoniazid and 2 mo of rifampin and pyrazinamide, with half of the doses directly observed (110). Protection at 12 mo was similar in the two groups, and, compared with the rate of TB observed among patients who received placebo in the earlier Haiti trial, the twice-weekly regimens were estimated to have reduced the risk for TB by approximately 80%. A multinational study comparing a 12-mo regimen of isoniazid taken daily with a 2-mo regimen of rifampin and pyrazinamide taken daily was conducted in the United States, Haiti, Brazil, and Mexico (111). A total of 1583 patients were enrolled and followed for an average of 3 yr. The annual risk of culture-confirmed TB was 0.8% for patients assigned the 2-mo regimen and 1.1% for patients assigned the 12-mo isoniazid regimen, a difference that was not significant.

In conclusion, as evidenced by the large multinational study, a 2-mo regimen of rifampin and pyrazinamide taken daily provides protection against TB equivalent to a 12-mo regimen of isoniazid taken daily. The data supporting the use of a twice-weekly rifampin and pyrazinamide treatment regimen are less conclusive. The only study that has evaluated a rifampin-alone regimen, the Hong Kong study in persons with silicosis, suggests that daily rifampin for 3 mo provides similar protection to that conferred from 6 mo of isoniazid (36). In the Uganda study, 3-mo regimens of (I) isoniazid and rifampin and (2) isoniazid, rifampin, and pyrazinamide provided protection equivalent to that of 6 mo of isoniazid (84).

All of the studies of treatment of LTBI in HIV-infected persons included death and/or progression of HIV disease as endpoints. In the earlier Haiti study, isoniazid likely conferred protection against progression of HIV disease among tuberculin-positive subjects (83). In the multinational study, persons receiving the 2-mo regimen had lower mortality rates and less progression of HIV disease, although these differences were not statistically significant (111). In none of the other studies was active treatment protective against death or HIV progression.

Safety and tolerability. Before the conduct of the studies in HIV-infected persons, a pilot study to assess the safety and tolerability of short-course regimens was conducted in 402 HIV-seronegative adults in North America (112, 113). Participants were randomized to receive either 2 mo of rifampin and pyrazinamide, 4 mo of rifampin only, or 6 mo of isoniazid. The rifampin-pyrazinamide regimen was associated with a higher number of AST elevations of >100 IU (17 compared with only one in the rifampin group and five in the isoniazid group) and more frequent adverse reactions resulting in drug discontinuation (15 compared with none in the rifampin group and two in the isoniazid group). The rates of adverse reactions and abnormal AST elevations were higher than those reported in studies involving HIV-positive populations and those described in a clinical trial of isoniazid, rifampin, and pyrazinamide for the treatment of active TB in HIV-seronegative persons (114).

Two smaller pilot studies of rifampin and pyrazinamide treatment of LTBI using identical protocols were conducted in adults in Poland (115) and children in Germany (116). The results of the study in Poland were similar to those in the study in North America; the children in Germany tolerated the regimens well and did not experience changes in hepatic function.

In the Hong Kong study of patients with silicosis, no significant differences were noted in the occurrence of severe adverse reactions in the three drug regimens studied (36). However, patients receiving isoniazid had a higher incidence of abnormal liver function tests during treatment.

In the clinical trials involving HIV-infected persons, a trend of increased adverse reactions occurred among persons taking a daily regimen that included pyrazinamide. The Uganda study reported that persons taking the three-drug, pyrazinamide-containing regimen had higher rates of paresthesias, arthralgias, and significant increases in serum AST (84). The multinational study reported minimal increases in the number of persons receiving the 2-mo rifampin and pyrazinamide regimen who had the drugs permanently discontinued, most commonly because of nausea and vomiting and narcotic withdrawal (111). However, abnormal liver function tests were more common among patients taking isoniazid.

In the Haiti study conducted during 1990–1994 and the Zambia study, regimens of twice-weekly rifampin and pyrazinamide were well tolerated. In the Haiti study, no severe adverse reactions were observed; rates of abnormal liver function were low (1–3%) and did not differ by regimen (110). In the Zambia study, 3% of persons given isoniazid stopped treatment because of an adverse reaction compared with 4% of those given rifampin and pyrazinamide (86). Biochemical hepatitis was more frequent in the isoniazid group, whereas rash was more common in persons receiving rifampin and pyrazinamide.

Adherence

Testing for and treating LTBI requires several steps, including administering the test, reading the test, medically evaluating infected persons, initiating treatment, and completing therapy. Because persons with LTBI are not clinically ill and may not be motivated to undergo treatment, nonadherence occurs commonly in all steps of the treatment process.

The health care system can compromise patient adherence to testing and treatment of LTBI (117). A lengthy referral process may discourage patients from being evaluated for a positive tuberculin test or initiating treatment for LTBI. Long waiting times in the clinic may also discourage patients from attending follow-up visits. Other factors that may affect adherence with testing and treatment include the clinic's hours of operation, distance of the clinic from the patient's home, the cleanliness of the clinic, and the attitude of clinic staff.

Since the advent of effective chemotherapy for active TB, adherence to treatment regimens has been recognized as a substantial problem for TB control--especially for treatment of LTBI. Recent data reported to CDC indicate that only 60% of patients who start treatment for LTBI complete at least 6 mo of treatment (CDC, TB Program Management Reports); adherence is influenced by the length of therapy, complexity of the regimen, and side effects of the medications. Adherence to treatment decreases with time, whereas the efficacy of the regimen increases with the length of therapy (32). Patients may be more adherent to the 2-mo regimen of rifampin and pyrazinamide because of the shorter length of therapy; however, this regimen also involves taking multiple medications, and patients may not tolerate this regimen as well as isoniazid, thus potentially resulting in nonadherence.

The Haiti study of rifampin and pyrazinamide taken twice weekly and the multinational study both reported better adherence with the shorter, 2-mo regimens. In the Haiti study, 74% of

persons assigned to the 2-mo rifampin and pyrazinamide regimen were believed to have taken ≥ 80% of the prescribed medication compared with 55% of persons taking isoniazid for 6 mo (110). Nonadherence was similar during the first 2 mo of therapy for both groups. The multinational study reported an 80% completion rate for persons assigned to the 2-mo rifampin and pyrazinamide regimen compared with 69% for the 12-mo isoniazid regimen (111). In the pilot study of HIV-seronegative persons, during the first 2 mo of therapy about 60% of those assigned to the rifampin and pyrazinamide regimen were judged to be nonadherent, compared with about 20% of those assigned to the 6-mo isoniazid regimen (113). However, overall completion rates were lower for the isoniazid regimen because of continued nonadherence during the last 4 mo of therapy.

Determinants of adherence to treatment of TB and LTBI are not well understood (118). For example, demographic factors are not reliable predictors of adherence. However, culturally influenced beliefs and attitudes may result in misinformation about TB and may adversely affect adherence (119). The main strategies that have been employed to promote adherence with treatment of LTBI are patient education (120), the use of lay health workers from the patient's social and/or cultural group (118, 121), incentives (e.g., cash payments) (122), and directly observed therapy (DOT) (64).

The intervention most likely to improve adherence for treatment of LTBI has been DOT, which requires direct observation of the patient ingesting each dose of medication and usually includes the provision of comprehensive services that attempt to meet the patient's basic needs and the use of incentives and enablers (123-125). Although randomized trials have yet to be reported, available information suggests that DOT leads to higher rates of completion than self-supervised therapy, and, under certain circumstances, is more cost effective (67).

Recommendations

IMPLEMENTATION OF TARGETED TUBERCULIN TESTING

Decision to Tuberculin Test Is Decision to Treat

Targeted tuberculin testing programs should be designed for one purpose: to identify persons at high risk for TB who would benefit by treatment of LTBI. Following that principle, targeted tuberculin testing programs should be conducted among groups at risk for recent infection with ***M. tuberculosis*** and those who, regardless of duration of infection, are at increased risk for progression to active TB (Table 7). With the exception of initial testing of persons at low risk whose future activity will place them at increased risk of exposure (e.g., employment in a setting where TB transmission may occur), screening of low-risk persons is discouraged because it diverts resources from activities of higher priority. In addition, a substantial proportion of tuberculin-test-positive persons from low-risk populations may have false-positive skin tests (73).

Testing is also discouraged unless a plan has been developed to complete a course of treatment in persons found to have LTBI. Such planning should include arrangements for medical evaluation (e.g., chest radiographs) of persons with positive skin tests and for the medical supervision of the course of treatment.

Identification and Access to High-risk Groups

A flexible approach to identifying high-risk groups is recommended, and state and local public health agencies are encouraged to analyze their TB case reports and data obtained from tuberculin skin testing to identify high-risk groups based on local trends in the epidemiology of TB. Thus designing and conducting skin-test-screening surveys to determine whether population groups are at high risk for TB may be desirable. Populations at risk can be accessed at HIV treatment facilities, drug treatment centers, homeless shelters, community health centers and schools serving foreign-born persons, and selected community-based organizations. Mandated skin-testing programs (e.g., those that formerly were conducted among teachers and foodhandlers) should be discouraged unless the targeted groups contain substantial proportions of persons at high risk (126).

Role of the Health Department

In this community-based approach to targeted testing and treatment of LTBI, the health department TB program should be instrumental in planning and coordination, setting performance standards, and overseeing quality of service. The health department is responsible for assessing the community's TB problem, identifying high-risk groups based on the local epidemiology of TB, and ascertaining the sites of most convenient access to those groups. In addition, the health department should assume responsibility for organizing the community-based approach, recruiting health professionals, educating such professionals about TB, and motivating them to institute targeted testing and treatment programs. The health department should also serve as advisor, consultant, and facilitator to community providers and institutions that conduct testing and treatment programs. The health department should assist in identifying potential funding sources and ensure linkages with essential clinical and consultation sources. It should provide in-service training on tuberculin skin testing and treatment, written protocols for activities including patient tracking and skin testing, and patient and provider educational material translated into appropriate languages. The health department may also need to provide chest radiography and subsidize the supply of antituberculosis drugs. Finally, the health department should be responsible for providing or facilitating the ongoing evaluation of community-based targeted testing and treatment programs, including development and monitoring of program indicators (e.g., rates of skin tests administered that are read, proportion of tests read that are positive, and initiation and completion rates of treatment). The health department should also routinely collect and review these data to determine yield and relative effectiveness of targeted testing and treatment of LTBI in the community.

To achieve a high rate of acceptance of testing and completion of treatment in a community-based program, barriers to success should be anticipated, identified, and managed. The concept of taking drugs to treat a latent infection that is not causing current health problems is unfamiliar to most persons, and education of the patient is essential (120). Other known barriers include culturally derived health beliefs that differ from those of Western medicine, inability to communicate with medical providers in one's primary language, inability to afford the costs of medical evaluation and treatment, and lack of access to medical care (118). Patients should not be expected to pay directly for public health interventions (e.g., testing, evaluation, and treatment of LTBI). The more convenient this process of testing and treatment, the more likely patients will adhere to therapy-especially as targeted testing and treatment of LTBI are extended beyond the province of public health TB clinics to sites where primary health care is delivered.

DIAGNOSIS OF LATENT TUBERCULOSIS INFECTION

Tuberculin Skin Testing

Administering and reading tests. The tuberculin test, like all medical tests, is subject to variability, but many of the inherent variations in administering and reading tests can be avoided by careful attention to details. The preferred skin test for ***M. tuberculosis*** infection is the intradermal, or Mantoux, method. It is administered by injecting 0.1 ml of 5 tuberculin units (TU) PPD intradermally into the dorsal or volar surface of the forearm. Tests should be read 48-72 h after test administration, and the transverse diameter of induration should be recorded in millimeters. Multiple puncture tests (i.e., Tine and Heaf) and PPD strengths of 1 TU and 250 TU are not sufficiently accurate and should not be used.

Interpreting skin-test reactions. Based on the sensitivity and specificity of the tuberculin skin test and the prevalence of TB in different groups, three cut-off levels have been recommended for defining a positive tuberculin reaction: $\geq$ 5 mm, $\geq$ 10 mm, and $\geq$ 15 mm of induration (Table 7). For persons who are at highest risk for developing TB disease if they become infected with ***M. tuberculosis,*** a cut-off level of $\geq$ 5 mm is recommended. Persons who are immunosuppressed because of disease (e.g., HIV infection) or drugs (e.g., systemic corticosteroids) have a high likelihood of developing TB disease if they are infected with ***M. tuberculosis.*** Likewise, persons who have had recent close contact with an infectious TB case patient and those with abnormal chest radiographs consistent with prior TB are at high risk for TB. Thus, to ensure that persons at highest risk are evaluated and appropriately treated, the sensitivity provided by a $\geq$ 5 mm cut-off for a positive test is appropriate.

A reaction of $\geq$ 10 mm of induration should be considered positive for those persons with an increased probability of recent infection or with other clinical conditions that increase the risk for TB (e.g., recent immigrants from high-prevalence countries and injection drug users) (Table 7). In addition to those groups listed, high-prevalence populations identified by analysis of local epidemiologic data should be targeted for testing.

TABLE 7

CRITERIA FOR TUBERCULIN POSITIVITY, BY RISK GROUP

Reaction ≥ 5 mm of Induration	Reaction ≥ 10 mm of Induration	Reaction ≥ 15 mm of Induration
Human immunodeficiency virus (HIV)-positive persons	Recent immigrants (Le., within the last 5 yr) from high prevalence countries	Persons with no risk factors for TB
Recent contacts of tuberculosis (TB) case patients	Injection drug users	
Fibrotic changes on chest radiograph consistent with prior TB	Residents and employees+ of the following high-risk congregate settings: prisons and jails, nursing homes and other long-term facilities for the elderly, hospitals and other health care facilities, residential facilities for patients with acquired immunodeficiency syndrome (AIDS), and homeless shelters	
Patients with organ transplants and other immunosuppressed patients (receiving the equivalent of ≥ 15 mg/d of prednisone for 1 mo or more)	Mycobacteriology laboratory personnel	
	Persons with the following clinical conditions that place them at high risk: silicosis, diabetes mellitus, chronic renal failure, some hematologic disorders (e.g., leukemias and lymphomas), other specific malignancies (e.g., carcinoma of the head or neck and lung), weight loss of ≥ 10% of ideal body weight, gastrectomy, and jejunoileal bypass	
	Children younger than 4 yr of age or infants, children, and adolescents exposed to adults at high-risk	

. Risk of TB in patients treated with corticosteroids increases with higher dose and longer duration.
† For persons who are otherwise at low risk and are tested at the start of employment, a reaction of ≥ 15 mm induration is considered positive.
Source: Adapted from Centers for Disease Control and Prevention. Screening for tuberculosis and tuberculosis infection in high-risk populations: recommendations of the Advisory Council for the Elimination of Tuberculosis. M.M.W.R. 1995;44(No. RR-1 1):19–34.

Routine tuberculin testing is not recommended for populations at low risk for LTBI. However, if these persons are tested (e.g., at entry into a work site where risk for exposure to TB is anticipated and a longitudinal tuberculin testing program is in place), a higher cut-off of ≥ 15 mm is recommended.

Skin-test conversion. For persons with negative tuberculin skin-test reactions who undergo repeat skin testing (e.g., health care workers), an increase in reaction size of ≥ 10 mm within a period of 2 yr should be considered a skin-test conversion indicative of recent infection with ***M. tuberculosis.***

Previous vaccination with BCG. Tuberculin skin testing is not contraindicated for persons who have been vaccinated with BCG, and the skin-test results of such persons can be used as described to support or exclude the diagnosis of ***M. tuberculosis*** infection. However, no method can reliably distinguish tuberculin reactions caused by vaccination with BCG from those caused by natural mycobacterial infections. Therefore, a positive reaction to tuberculin in BCG-vaccinated persons indicates infection with ***M. tuberculosis*** when the person tested is at increased risk for recent infection or has medical conditions that increase the risk for disease (Table 7).

Anergy testing in persons infected with HIV. Anergy testing is not recommended for routine use in persons who are infected with HIV or otherwise immunocompromised (77). However, it may assist in guiding individual treatment decisions in selected situations.

Chest Radiographs

A chest radiograph is indicated for all persons being considered for treatment of LTBI to exclude active pulmonary TB. Children younger than 5 yr of age should have both posterior–anterior and lateral radiographs. All other persons should receive posterior-anterior radiographs; additional radiographs should be performed at the physician's discretion. Because of the risk for progressive and/or congenital TB, pregnant women who have a positive tuberculin skin test or who have negative skin-test results but who are recent contacts of persons with infectious TB disease should have chest radiographs (with appropriate shielding) as soon as feasible, even during the first trimester of pregnancy.

If chest radiographs are normal and no symptoms consistent with active TB are present, tuberculin-positive persons may be candidates for treatment of LTBI. If radiographic or clinical findings are consistent with pulmonary or extrapulmonary TB, further studies (e.g., medical evaluation, bacteriologic examinations, and a comparison of the current and old chest radiographs) should be done to determine if treatment for active TB is indicated.

Sputum Examinations

Sputum examination is not indicated for most persons being considered for treatment of LTBI. However, persons with chest radiographic findings suggestive of prior, healed TB infections should have three consecutive sputum samples, obtained on different days, submitted for AFB smear and culture. Most persons with radiographs that show only calcified pulmonary nodules do not require bacteriologic examination. HIV-infected persons with respiratory symptoms who are being considered for treatment of LTBI should also have sputum specimens submitted for mycobacterial examination, even if the chest radiograph is normal. If the results of sputum smears and cultures are negative and respiratory symptoms can be explained by another etiology, the person is a candidate for treatment of LTBI. If bacteriologic results are negative but the activity or etiology of a radiographic abnormality is questionable, further evaluation with bronchoscopy or needle aspiration biopsy should be undertaken. Single drug treatment of LTBI should not be started until active TB has been excluded. In such situations, multidrug therapy can be started and continued pending results of sputum cultures. A repeat chest film should be obtained to exclude active TB, as indicated by improvement in the abnormality even in the presence of negative cultures.

TREATMENT OF LATENT TUBERCULOSIS INFECTION

Individual Drugs

Zsoniazid. Isoniazid is the most widely used of the antituberculosis agents-it is bactericidal, relatively nontoxic, easily administered, and inexpensive. Isoniazid is highly active against *M. tuberculosis* (most strains being inhibited ***in vitro*** by concentrations of 0.05-0.20 μg/ml). Absorption from the gas-

trointestinal tract is nearly complete, with peak serum concentrations of 2-5 μg/ml occurring 0.5–2.0 h after administration of a 300-mg dose. The drug penetrates well into all body fluids and cavities, producing concentrations similar to those found in serum. Hepatitis is the most severe toxic effect of isoniazid, and alcohol consumption may increase toxicity (Table 8). Peripheral neuropathy, caused by interference with metabolism of pyridoxine, is associated with isoniazid administration but is uncommon at a dose of 5 mg/kg. In persons with conditions in which neuropathy is common (e.g., diabetes, uremia, alcoholism, malnutrition, and HIV infection), pyridoxine should be given with isoniazid. Pregnant women and persons with sei-

TABLE 8

MEDICATIONS TO TREAT LATENT TUBERCULOSIS INFECTION: DOSES, TOXICITIES, AND MONITORING REQUIREMENTS

	Oral Dose (*mg/kg*) (Maximum Dose)						
	Daily		Twice Weekly*				
Drug	Adults	Children	Adults	Children	Adverse Reactions	Monitoring	Comments
Isoniazid	5 (300 mg)	1 O-20 (300 mg)	15 (900 mg)	20-40 (900 mg)	Rash Hepatic enzyme elevation Hepatitis Peripheral neuropathy Mild central nervous system effects Drug interactions resulting in increased phenytoin (Dilantin) or Disulfiram (Antabuse) levels	Clinical monitoring monthly Liver function tests† at baseline in selected cases‡ and repeat measurements if Baseline results are abnormal Patient is pregnant, in the immediate postpartum period, or at high risk for adverse reactions Patient has symptoms of adverse reactions	Hepatitis risk increases with age and alcohol consumption Pyridoxine (vitamin B_6, 1 O-25 mg/d) might prevent peripheral neurophathy and central nervous system effects
Rifampin	10 (600 mg)	1 O-20 (600 mg)	10 (600 mg)	—	Rash Hepatitis Fever Thrombocytopenia Flu-like symptoms Orange-colored body fluids (secretions, urine, tears)	Clinical monitoring at Weeks 2, 4, and 8 when pyrazinamide given Complete blood count, platelets, and liver function tests† at baseline in selected cases‡ and repeat measurements if Baseline results are abnormal Patient has symptoms of adverse reactions	Rifampin is contraindicated or should be used with caution in human immunodeficiency virus (HIV)-infected patients taking protease inhibitors (PIs) or nonnucleoside reverse transcriptase inhibitors (NNRTIs) Decreases levels of many drugs (e.g., methadone, coumadin derivatives, glucocorticoids, hormonal contraceptives, estrogens, oral hypoglycemic agents, digitalis, anticonvulsants, dapsone, ketoconazole, and cyclosporin) Might permanently discolor soft contact lenses
Rifabutin	5 (300 mg)§		5 (300 mg)¶	—	Rash Hepatitis Fever Thrombocytopenia Orange-colored body fluids (secretions, urine, tears) With increased levels of rifabutin Severe arthralgias Uveitis Leukopenia	Clinical monitoring at Weeks 2, 4, and 8 when pyrazinamide given Complete blood count, platelets, and liver function tests† at baseline in selected cases‡ and repeat measurements if Baseline results are abnormal Patient has symptoms of adverse reactions Use adjusted daily dose of rifabutin and monitor for decreased antiretroviral activity and for rifabutin toxicity if rifabutin taken concurrently with PIs or NNRTIs§	Rifabutin is contraindicated for HIV-infected patients taking hard-gel saquinavir or delavirdine; caution is also advised if rifabutin is administered with soft-gel saquinavir Reduces levels of many drugs (e.g., PIs, NNTRIs, methadone, dapsone, ketoconazole, coumadin derivatives, hormonal contraceptive, digitalis, sulfonylureas, diazepam, p-blockers, anticonvulsants, and theophylline) Might permanently discolor contact lenses
Pyrazinamide	15-20 (2.0 g)	—	50 (4.0 g)	—	Gastrointestinal upset Hepatitis Rash Arthralgias Gout (rare)	Clinical monitoring at Weeks 2, 4, and 8 Liver function tests' at baseline in selected cases‡ and repeat measurements if Baseline results are abnormal Patient has symptoms of adverse reactions	Treat hyperuricemia only if patient has symptoms Might make glucose control more difficult in persons with diabetes Should be avoided in pregnancy but can be given after first trimester

* All intermittent dosing should be administered by directly observed therapy.

† AST or ALT and serum bilirubin.

‡ HIV infection, history of liver disease, alcoholism, and pregnancy.

§ If nelfinavir, indinavir, amprenavir, or ritonavir is administered with rifabutin, blood concentrations of these protease inhibitors decrease. Thus, the dose of rifabutin is reduced from 300 mg to 150 mg/d when used with nelfinavir, indinavir, or amprenavir; and to 150 mg (two or three times a week) when used with ritonavir. If efavirenz is adminiistered with rifabutin, blood concentrations of rifabutin decrease. Thus, when rifabutin is used concurrently with efavirenz, the daily dose of rifabutin should be increased from 300 mg to 450 mg or 600 mg. Pharmacokinetic studies suggest that rifabutin might be given at usual doses with nevirapine. It is not currently known whether dose adjustment of rifabutin is required when used concurrently with soft-gel saquinavir or nevirapine. For patients receiving multiple PIs or a PI in combination with an NNRTI, drug interactions with rifabutin are likely more complex; in such situations, the use of rifabutin is not recommended until additional data are available.

zure disorders should also take both pyridoxine and isoniazid. Mild central nervous system effects are common with isoniazid and may necessitate adjustments in the timing of administration of the drug to enhance compliance. The interaction of isoniazid and phenytoin increases the serum concentration of both drugs. When these drugs are given concomitantly, the serum level of phenytoin should be monitored. No known interactions exist between isoniazid and the antiretroviral medications used for the treatment of HIV infection.

Rifutnpin. Rifampin is a rifamycin derivative that is bactericidal for ***M. tuberculosis.*** Most strains of ***M. tuberculosis*** are inhibited ***in vitro*** by concentrations of 0.5 kg/ml. It is quickly absorbed from the gastrointestinal tract, with peak serum concentrations of 7-14 μg/ml occurring 1.5-3.0 h after ingestion. Although approximately 75% of the drug is protein bound, it penetrates well into tissues and cells. Penetration through noninflamed meninges is poor, but therapeutic concentrations are achieved in cerebrospinal fluid when the meninges are inflamed. The most common adverse reaction to rifampin is gastrointestinal upset. Other reactions include skin eruptions, hepatitis, and, rarely, thrombocytopenia (Table 8). The frequency of these reactions is low. Because rifampin induces hepatic microsomal enzymes, it may accelerate clearance of drugs metabolized by the liver (e.g., methadone, coumadin derivatives, glucocorticoids, hormonal contraceptives, oral hypoglycemic agents, digitalis, anticonvulsants, dapsone, ketoconazole, and cyclosporin). By accelerating the metabolism of estrogen, rifampin may interfere with the effectiveness of oral contraceptives. In persons with HIV infection who are taking HIV protease inhibitors, rifampin is usually contraindicated because drug interactions between rifampin and these agents can lead to increased rifampin levels and decreased protease-inhibitor levels, resulting in increased risk for rifampin toxicity and decreased protease-inhibitor efficacy. Rifampin is also contraindicated or should be used with caution in HIV-infected patients who are taking non-nucleoside reverse transcriptase inhibitors (NNRTIs). Intermittent administration of doses of rifampin > 10 mg/kg may be associated with thrombocytopenia, an influenza-like syndrome, hemolytic anemia, and acute renal failure. However, these reactions are uncommon at the recommended dose of 10 mg/kg/d. Rifampin is excreted in urine, tears, sweat, and other body fluids and colors them orange. Patients should be advised of discoloration of body fluids and of possible permanent discoloration of soft contact lenses.

Pyrazinamide. Pyrazinamide is bactericidal for ***M. tuberculosis*** in an acid environment. The drug is active against organisms in macrophages, presumably because of the acid environment within the cell. At a pH of 5.5, the minimal inhibitory concentration of pyrazinamide for ***M. tuberculosis*** is 20 μg/ml. Absorption from the gastrointestinal tract is nearly complete, with peak serum concentrations of 30-50 μg/ml occurring approximately 2 h after ingestion with doses of 20-25 mg/kg. The most common side effect of pyrazinamide is gastrointestinal upset (Table 8). The most severe adverse reaction is liver injury. No substantial increase in hepatotoxicity results from adding 15-30 mg/kg of pyrazinamide to a regimen of rifampin during 2 mo of therapy for active TB (114). Hyperuricemia also occurs, but acute gout is uncommon (127). No known interactions exist between pyrazinamide and antiretroviral medications.

Rifabutin. Rifabutin is another rifamycin that is highly active against ***M. tuberculosis.*** Its mechanism of action is the same as that of rifampin, so that most rifampin-resistant strains are also resistant to rifabutin. Most strains of ***M. tuberculosis*** are inhibited by concentrations of 0.1 μg/ml. A dose of 300 mg results in peak serum concentrations of 5 μg/ml after 2-3 h. The major advantage of rifabutin is the longer serum half-life and reduced hepatic induction of microsomal metabolism compared with that of rifampin. Rifabutin is extensively metabolized in the liver (and to a lesser extent in the intestinal wall); only 8% of a dose is excreted unchanged in the urine. Doses of up to 300 mg daily are usually well tolerated. Side effects attributed to rifabutin include rash, gastrointestinal intolerance, neutropenia, myalgias, and dysguesia. Hepatotoxicity is rare, but rifabutin can cause drug-induced hepatitis. Rates of side effects increase when rifabutin is administered with a CYP-3A4 inhibitor (e.g., clarithromycin); side effects that have been noted under these circumstances include uveitis (128) and abnormal skin pigmentation (129). Similar to rifampin, rifabutin can also decrease concentrations and clinical efficacy of methadone, coumadin derivatives, glucocorticoids, hormonal contraceptives, oral hypoglycemic agents, digitalis, anticonvulsants, dapsone, ketoconazole, and cyclosporin, as well as itraconazole, P-blockers, and theophylline. Doses of these medications may have to be increased when administered with rifabutin. When administered with rifabutin, protease inhibitors, used for the treatment of HIV infection, may lead to increased levels of rifabutin and decreased levels of the protease inhibitor; however, these effects are generally less than those that occur with rifampin and can be accommodated by dose adjustments (Table 8). NNRTIs, used for the treatment of HIV infection, may also necessitate rifabutin dose adjustment.

Treatment Regimens

Treatment of LTBI is an essential part of the strategy to eliminate TB in the United States. Persons with LTBI who are included among those at increased risk for TB should be offered treatment. The choice of the specific treatment regimen is based on many considerations as detailed in the following sections.

U.S. ***Public Health Service Rating System.*** To help clinicians make informed treatment decisions based on the most current research results, evidence-based ratings are assigned to the drug treatment recommendations (general recommendations have no rating) (Table 9). The ratings system is similar to that used in previous PHS documents (3) and includes a letter and a Roman numeral: the letter indicates the strength of the recommendation, and the Roman numeral indicates the quality of the evidence supporting the recommendation. Thus, clinicians can use the ratings to differentiate between recommendations based on data from clinical trials and those based on the opinions of experts familiar with the relevant clinical practice and scientific rationale for such practice (when clinical trial data are not available).

TABLE 9

ADAPTED PUBLIC HEALTH SERVICE RATING SYSTEM FOR THE STRENGTH OF TREATMENT RECOMMENDATIONS AND QUALITY OF EVIDENCE

Strength of the recommendation
A. Preferred; should generally be offered
B. Alternative; acceptable to offer
C. Offer when preferred or alternative regimens cannot be given
D. **Should generally not be offered**
E. Should never be offered
Quality of evidence supporting the recommendation
I. At least one randomized trial with clinical endpoints
II. Clinical trials that either are not randomized or were conducted in other populations
III. **Expert opinion**

Recommended regimens. Four regimens are recommended for the treatment of adults with LTBI (Table 10). The antituberculosis medications used in these regimens have varying doses, toxicities, and monitoring requirements (Table 8). All patients being given twice-weekly treatment should receive DOT, because nonadherence to intermittent dosing results in a larger proportion of the total doses missed than does daily dosing. DOT should be used whenever feasible, especially with 2-mo regimens and in certain settings (e.g., some institutional settings, community outreach programs, and for some persons living in households with patients who are receiving home-based DOT for active TB).

Isoniazid for 9 mo. The isoniazid daily regimen for 9 mo receives an A recommendation. Prospective, randomized trials of up to 12 mo of therapy in HIV-uninfected persons suggest that the maximal beneficial effect of isoniazid is achieved by 9 mo; minimal additional benefit is gained by extending treatment to 12 mo. Thus, this updated recommendation represents a shortening of the previous recommendation of isoniazid daily for 12 mo for HIV-infected persons and a lengthening of the previously recommended 6 mo for HIV-uninfected persons (1). Both 12-mo and 6-mo regimens of isoniazid have substantially reduced rates of TB in HIV-infected persons compared with placebo (88), but the 6-mo regimen has not been directly compared with the 12-mo regimen in HIV-infected persons. Thus, the recommendation for 9 mo of isoniazid in HIV-infected persons is based on extrapolation of available data. Intermittent dosing of 9 mo of isoniazid for treatment of LTBI has not been studied comparatively. However, analogous with the continuation phase of treatment for active TB (where twice-weekly dosing is equivalent to daily dosing), twice-weekly dosing of isoniazid is also acceptable for treatment of LTBI, but is recommended at the B level as an acceptable alternative regimen.

Isoniazid for 6 mo. Although a 9-mo regimen of isoniazid is the preferred treatment of LTBI for an individual patient, a 6-mo regimen also provides substantial protection and has been demonstrated to be superior to placebo in both HIV-infected and HIV-uninfected persons (32, 84). From a societal perspective, treatment for 6 mo rather than 9 mo may provide a more cost-effective outcome (81). Thus, based on individual situations, health departments or other providers may prefer to concentrate efforts in ensuring the implementation of a 6-mo rather than a 9-mo course of isoniazid. Isoniazid for 6 mo, taken either daily or twice weekly, is recommended at the B level for HIV-negative persons and at the C level for HIV-positive persons. The shorter regimen is not recommended for children or persons with radiographic evidence of prior tuberculosis.

Rifampin and pyrazinamide for 2 mo. The 2-mo daily regimen of rifampin and pyrazinamide is recommended on the basis of a prospective randomized trial of treatment of LTBI in HIV-infected persons that demonstrated the 2-mo regimen to be similar in safety and efficacy to a 12-mo regimen of isoniazid (111). Although this regimen has not been evaluated in HIV-uninfected persons with LTBI, the efficacy is not expected to differ significantly. However, the toxicities may be increased (113); therefore, the recommendation is made at the A level for HIV-infected persons and at the B level for HIV-uninfected persons until further data are available. Two randomized, prospective trials of intermittent dosing of rifampin and pyrazinamide for 2 and 3 mo, respectively, have been reported in HIV-infected persons (86, 110); in neither case was the sample size adequate to conclude with certainty that efficacy was equivalent to daily dosing. Moreover, both studies compared the twice-weekly rifampin and pyrazinamide regimen to the 6-mo isoniazid regimen. Therefore, rifampin and pyrazinamide given twice weekly for 2-3 mo may be considered when alternative regimens cannot be given. This recommendation is made at the C level.

Rifampin for 4 mo. Rifampin given daily for 3 mo has resulted in better protection than placebo in treatment of LTBI

TABLE 10

RECOMMENDED DRUG REGIMENS FOR TREATMENT OF LATENT TUBERCULOSIS (TB) INFECTION IN ADULTS

Drug	interval and Duration	Comments	Rating* (Evidence)? HIV-	HIV+
Isoniazid	Daily for 9 mo†,§	In human immunodeficiency virus (HIV)-infected patients, isoniazid may be administered concurrently with nucleoside reverse transcriptase inhibitors (NRTIs), protease inhibitors, or non-nucleoside reverse transcriptase inhibitors (NNRTIs)	A (II)	A (II)
	Twice weekly for 9 mo†,§	Directly observed therapy (DOT) must be used with twice-weekly dosing	B (II)	B (II)
Isoniazid	Daily for 6 mo§	Not indicated for HIV-infected persons, those with fibrotic lesions on chest radiographs, or children	B (I)	C (I)
	Twice weekly for 6 mo§	DOT must be used with twice-weekly dosing	B (II)	C (I)
Rifampin plus pyrazinamide	Daily for 2 mo	May also be offered to persons who are contacts of patients with isoniazid-resistant, rifampin-susceptible TB	B (II)	A (I)
		In HIV-infected patients, protease inhibitors or NNRTIs should generally not be administered concurrently with rifampin; rifabutin can be used as an alternative for patients treated with indinavir, nelfinavir, amprenivir, ritonavir, or efavirenz, and possibly with nevirapine or soft-gel saquinavir‖		
	Twice weekly for 2-3 mo	DOT must be used with twice-weekly dosing	C (II)	C (I)
Rifampin	Daily for 4 mo	For persons who cannot tolerate pyrazinamide	B (II)	B (III)
		For persons who are contacts of patients with isoniazid-resistant, rifampin-susceptible TB who cannot tolerate pyrazinamide		

* Strength of recommendation: A = preferred; B = acceptable alternative; C = offer when A and B cannot be given.

†Quality of evidence: I = randomized clinical trial data; II = data from clinical trials that are not randomized or were conducted in other populations; III = expert opinion.

‡ Recommended regimen for children younger than 18 yr of age.

§ Recommended regimens for pregnant women. Some experts would use rifampin and pyrazinamide for 2 mo as an alternative regimen in HIV-infected pregnant women, although pyrazinamide should be avoided during the first trimester.

‖ Rifabutin should not be used with ritonavir, hard-gel saquinavir, or delavirdine. When used with other protease inhibitors or NNRTIs, dose adjustment of rifabutin may be required (see Table 8).

in HIV-uninfected persons with silicosis in a randomized prospective trial (36). However, because the patients receiving rifampin had a high rate of active TB (4%), experts have concluded that a 4–mo regimen would be more prudent when using rifampin alone. This 4-mo rifampin regimen is recommended at the B level for both HIV-infected and HIV-uninfected persons. This option may be useful for patients who cannot tolerate isoniazid or pyrazinamide.

Choice of regimen. Because more than one regimen can be used to treat LTBI, health care providers should discuss options with the patient, and, when possible, help patients make the decision, unless medical indications dictate a specific regimen. Discussion should include the length and complexity of the regimens, possible adverse effects, and potential drug interactions.

Completion of treatment. Completion of therapy is based on total number of doses administered-not on duration of therapy alone. The 9-mo regimen of daily isoniazid should consist of 270 doses, at minimum, administered within 12 mo, allowing for minor interruptions in therapy. The 6-mo regimen of isoniazid should consist of at least 180 doses administered within 9 mo. Twice-weekly isoniazid regimens should consist of at least 76 doses administered within 12 mo for the 9-mo regimen and 52 doses within 9 mo for the 6-mo regimen. The daily regimen of rifampin (or rifabutin) and pyrazinamide should consist of at least 60 doses to be administered within 3 mo. The regimen of daily rifampin alone should consist of at least 120 doses administered within 6 mo.

Ideally, patients should receive medication on a regular dosing schedule until completion of the indicated course. However, in practice some doses may be missed, requiring the course to be lengthened. When reinstituting therapy for patients who have interrupted treatment, clinicians might need to continue the regimen originally prescribed (as long as needed to complete the recommended duration of the particular regimen) or renew the entire regimen if interruptions were frequent or prolonged enough to preclude completion of treatment as recommended. In either situation, when therapy is restored after an interruption of more than 2 mo, a medical examination to rule out active TB disease is indicated.

Special considerations.

Treatment of HIV-infected persons. Recommendations for HIV-infected adults largely parallel those for HIV-uninfected adults, although the quality of evidence and strengths of the recommendations vary (Table 10). However, when isoniazid is chosen for treatment of LTBI in persons with HIV infection, 9 mo is recommended rather that 6 mo. In addition, rifampin is generally contraindicated or should be used with caution in persons who are taking protease inhibitors (PIs) or NNRTIs (169). Experts have recommended that for HIV-infected persons who are candidates for treatment of LTBI and need PI or NNRTI therapy, rifabutin can be substituted for rifampin in some circumstances; rifabutin can safely be used with indinavir, nelfinavir, amprenavir, ritonavir, and efavirenz, but not with hard-gel saquinavir, or delavirdine. Caution is advised if rifabutin is administered with soft-gel saquinavir, because data regarding use of rifabutin with soft-gel saquinavir or nevirapine are limited.

No specific data have been generated for treatment of LTBI with rifabutin-containing regimens, but such a recommendation is supported by analogy with treatment for active TB (where rifabutin can be substituted for rifampin with no loss of efficacy) and by experimental studies in mice (107, 130). Rifabutin can be administered at one half the usual daily dose (i.e., reduced from 300 mg to 150 mg/d) with indinavir, nelfinavir, or amprenavir or at one-fourth the usual dose (i.e., 150 mg every other day or three times a week) with ritonavir. The daily rifabutin dose is 450 mg or 600 mg when used with efavirenz; pharmacokinetic studies suggest that rifabutin might be given at usual doses with nevirapine. For patients receiving multiple PIs or a PI in combination with an NNRTI, drug interactions with rifabutin are likely more complex; in such situations, the use of rifabutin is not recommended until additional data are available. The substitution of rifapentine for rifampin is not recommended because rifapentine's safety and effectiveness have not been established for patients infected with HIV (131). Furthermore, the drug interactions between rifapentine and HIV protease inhibitors have not been studied in detail, although one study has indicated that rifapentine causes substantial reduction in the serum level of indinavir when the drugs are given together (132).

In tuberculin-negative, HIV-infected persons, treatment of LTBI has not been effective (3). However, most tuberculin-negative HIV-infected contacts of patients with active TB should receive treatment for presumptive LTBI-even when repeat testing after contact has ended is not indicative of LTBI. Furthermore, some experts recommend treatment of possible LTBI for HIV-infected residents of institutions that pose an ongoing high risk for exposure to ***M. tuberculosis (e.g.,*** prisons, jails, and homeless shelters).

Persons with fibrotic lesions/suspected disease. For patients who have a chest radiograph demonstrating old fibrotic lesions thought to represent previous infection with TB and a positive tuberculin skin test ($\geq$ 5 mm) without evidence of active disease and no history of treatment for TB, three acceptable regimens can be used for treatment. These regimens include 9 mo of isoniazid, 2 mo of rifampin plus pyrazinamide, or 4 mo of rifampin (with or without isoniazid), providing that infection with drug-resistant organisms is judged to be unlikely. Patients who begin multidrug therapy for suspected pulmonary TB but are subsequently determined not to have active disease (i.e., AFB cultures are negative and chest radiographs are stable) should complete treatment with at least 2 mo of a regimen containing rifampin and pyrazinamide if the tuberculin skin test is positive and other causes of the radiographic abnormalities have been excluded.

Persons with evidence suggestive of healed, primary TB (i.e., calcified solitary pulmonary nodules, calcified hilar lymph nodes, and apical pleural capping) are not at increased risk for TB. Their risk for TB and need for treatment of LTBI should be determined by consideration of other risk factors and the size of the tuberculin reaction (Table 7).

Pregnancy and lactation. Pregnancy has minimal influence on the pathogenesis of TB or the likelihood of LTBI progressing to disease (133, 134). Although one study demonstrated a decrease in lymphocyte reactivity to tuberculin during pregnancy (135), other studies have not demonstrated an effect of pregnancy on cutaneous delayed hypersensitivity to tuberculin (136, 137). The current classification scheme for interpreting the Mantoux tuberculin skin test is likely valid in pregnancy, although it has not been verified in this group of women. There is no evidence that the tuberculin skin test has adverse effects on the pregnant mother or fetus (138).

Pregnant women should be targeted for tuberculin skin testing only if they have a specific risk factor for LTBI or for progression of LTBI to disease. Although the need for treatment of active TB during pregnancy is unquestioned, the treatment of LTBI in pregnant women is more controversial. Some experts prefer to delay treatment until after delivery because pregnancy itself does not increase the risk of progression to disease, and two studies suggest that women in pregnancy and the early postpartum period may be vulnerable to isoniazid hepatotoxicity (91, 92). However, because conditions that promote hematogenous spread of organisms to the placenta (e.g., recent

infection and HIV infection) or progression of LTBI to disease can endanger both the mother and baby (139), many experts agree that pregnant women with these conditions and LTBI should be treated during pregnancy and have careful clinical and laboratory monitoring for hepatitis. The possible risk for isoniazid hepatotoxicity must be weighed against the risk for developing active TB and the consequences to both the mother and her child should active disease develop.

Extensive use of isoniazid during pregnancy has indicated that although it readily crosses the placental barrier, the drug is not teratogenic even when given during the first 4 mo of gestation (140). Regarding rifampin, one study revealed that 3% of 446 fetuses exposed in *utero* to rifampin had abnormalities (i.e., limb reductions, central nervous system abnormalities, and hypoprothrombinemia) compared with 2% for ethambutol and 1% for both isoniazid and controls (138). Hemorrhagic disease of the newborn has been described following the use of rifampin in the mother (141). However, extensive experience with the use of rifampin to treat TB in pregnant women suggests it is safe in most circumstances. Although pyrazinamide has been used to treat TB in pregnant women, no published data exist concerning the effects of the drug on the fetus. Thus, although pyrazinamide may be considered after the first trimester in women with HIV infection (142), it should otherwise be avoided.

The preferred regimen for treatment of LTBI in pregnant women is isoniazid, administered either daily or twice weekly. Although rifampin is probably safe, no efficacy data support its use. For women at high risk for progression of LTBI to disease, especially those who are infected with HIV or who have been infected recently, initiation of therapy should not be delayed on the basis of pregnancy alone, even during the first trimester. For these women, careful clinical and/or laboratory monitoring for hepatitis should be undertaken. Pregnant women taking isoniazid should receive pyridoxine supplementation.

Toxic effects of antituberculosis drugs delivered in breast milk have not been reported. One study concluded that a breastfeeding infant would develop serum levels of no more than 20% of the usual therapeutic levels of isoniazid for infants and $< 11\%$ of other antituberculosis drugs (143). Breastfeeding is not contraindicated when the mother is being treated for LTBI. However, infants whose breastfeeding mothers are taking isoniazid should receive supplemental pyridoxine. The amount of isoniazid provided by breast milk is inadequate for treatment of the infant.

Children and adolescents. Several fundamental aspects of the natural history and treatment of LTBI in children must be considered when making recommendations about therapy. Infants and young children (i.e., those younger than 5 yr of age) with LTBI have been infected recently, and are at high risk for progression to disease. Data suggest that untreated infants with LTBI have up to a 40% likelihood of developing TB (144). The risk for progression decreases gradually through childhood. Infants and young children are more likely than older children and adults to develop life-threatening forms of TB, especially meningeal and disseminated disease. Children with LTBI have more years at risk to develop TB than adults. Isoniazid therapy for LTBI appears to be more effective for children than adults, with several large clinical trials demonstrating risk reduction of 70–90% (145, 146). The risk for isoniazid-related hepatitis is minimal in infants, children, and adolescents, who generally tolerate the drug better than adults (147, 148). Isoniazid therapy is widely accepted for use in children. Because of differences in pathogenesis of TB infection and disease in children compared with adults, information from clinical trials involving adults cannot be applied directly to children without confirmatory pediatric trials. The only published efficacy trials of treatment of LTBI in children have studied isoniazid alone.

The only recommended regimen for treatment of LTBI in HIV-uninfected children is a 9-mo course of isoniazid as self-administered daily therapy or by DOT twice weekly. Routine monitoring of serum liver enzyme concentrations is not necessary but should be considered in children at risk for hepatic disease. When children taking antituberculosis therapy develop hepatitis, a search for causes other than isoniazid or other drugs should be undertaken and the therapy discontinued. Routine administration of pyridoxine is not recommended for children taking isoniazid, but should be given to (I) breastfeeding infants, (2) children and adolescents with diets likely to be deficient in pyridoxine, and (3) children who experience paresthesias while taking isoniazid.

Isoniazid given twice weekly has been used extensively to treat LTBI in children, especially schoolchildren and close contacts of case patients (125). On the basis of clinical experience, this method of administration is safe, but its effectiveness has not been established definitively. DOT should be considered when it is unlikely that the child and family will be adherent to daily self-administration.

In the United States, rifampin alone has been used for the treatment of LTBI in infants, children, and adolescents when isoniazid could not be tolerated or the child has had contact with a case patient infected with an isoniazid-resistant but rifamycin-susceptible organism (149). However, no controlled clinical trials have been conducted. A 3-mo regimen of rifampin and isoniazid has been used in England, with programmatic data suggesting that the regimen is effective (108). No reports have been published concerning the efficacy of rifampin and pyrazinamide therapy in children with LTBI, although a randomized study involving a limited number of children indicated that this regimen was well tolerated (116).

No studies have been published regarding the efficacy of any form of treatment for LTBI in HIV-infected children. The American Academy of Pediatrics currently recommends a 9-mo course of isoniazid (150). Most experts recommend that routine monitoring of serum liver enzyme concentrations be performed and pyridoxine given when HIV-infected children are treated with isoniazid. The optimal length of rifampin therapy in children with LTBI is not known; however, the American Academy of Pediatrics recommends 6 mo of treatment (150).

Contacts of patients with tuberculosis.

CONTACTS OF PATIENTS WITH DRUG-SUSCEPTIBLE TUBERCULOSIS. Persons who are contacts of patients with drug-susceptible TB and who have positive tuberculin skin-test reactions (≥ 5 mm) should be treated with one of the recommended regimens-regardless of age (Table 10). In addition, some tuberculin-negative contacts should be considered for treatment. Because of susceptibility to severe disease, children younger than 5 yr of age with negative skin tests should be treated and another skin test performed 8-12 wk after contact has ended. If the repeat skin test is positive, treatment should continue for the recommended period of time; if the repeat skin test is negative, the treatment should be stopped. Immunosuppressed persons, including those with HIV infection, who are contacts of persons with active TB should also receive treatment, even if repeat skin testing does not indicate LTBI.

CONTACTS OF PATIENTS WITH ISONIAZID-RESISTANT TUBERCULOSIS. No definitive data exist concerning treatment of contacts who have been exposed to patients with probable or confirmed isoniazid-resistant TB. A decision analysis and Delphi methodology have been used to recommend either rifampin alone or in combination with isoniazid or ethambutol when the risk of isoniazid-re-

sistant infection is > 50% (151). An expert panel has recommended use of rifampin for vulnerable contacts (e.g., those with HIV infection) of patients with isoniazid-resistant TB (152).

In an outbreak of isoniazid- and streptomycin-resistant TB among homeless persons, six (9%) of 71 persons with skin tests that converted who received no preventive therapy developed TB, compared with three (8%) of 38 who received isoniazid, and zero of 98 persons who received rifampin or isoniazid and rifampin (153). Similarly, of 157 high school students who took rifampin after being exposed to a patient with isoniazid-resistant, active TB, none developed TB during the second year of the study (149). However, one episode of rifampin prophylaxis failure was reported among contacts of a case patient with isoniazid-resistant TB in a community outbreak (154).

For contacts of patients with isoniazid-resistant, rifampin-susceptible TB, a 2-mo regimen of rifampin and pyrazinamide is recommended. For patients with intolerance to pyrazinamide, a 4-mo regimen of rifampin alone is recommended. In situations in which rifampin cannot be used, rifabutin can be substituted.

CONTACTS OF PATIENTS WITH MULTIDRUG-RESISTANT TUBERCULOSIS. The occurrence of outbreaks of multidrug-resistant TB (MDR TB) (i.e., TB caused by strains of *M. tuberculosis* resistant to at least isoniazid and rifampin) and the rise in resistance rates worldwide have focused attention on options for treatment of persons exposed to and presumed to be infected by such organisms (155). As with exposure to isoniazid-resistant TB, this problem has not been evaluated in prospective studies. A Delphi technique among 31 experts failed to achieve consensus on the management of such persons (156).

Persons infected with isoniazid- and rifampin-resistant organisms are unlikely to benefit from treatment with regimens containing these agents. Therefore, use of a regimen containing other agents active against *M. tuberculosis* should be considered. When possible, selection of drugs for such a regimen should be guided by *in vitro* susceptibility test results from the isolate to which the patient was exposed and is presumed infected.

For persons who are likely to be infected with MDR TB and at high risk of developing TB, pyrazinamide and ethambutol or pyrazinamide and a fluoroquinolone (i.e., levofloxacin or ofloxacin) for 6-12 mo are recommended, if the organisms from the index case-patient are known to be susceptible to these agents (157). Immunocompetent contacts may be observed without treatment or treated for at least 6 mo; immunocompromised contacts (e.g., HIV-infected persons) should be treated for 12 mo. Side effects of pyrazinamide and fluoroquinolones include gastrointestinal symptoms and hepatic transaminase elevations (158). All persons with suspected MDR TB infection should be followed for at least 2 yr, irrespective of treatment. Expert consultation should be sought for the treatment of persons exposed to patients with MDR TB.

No studies have been published regarding treatment of LTBI in children following exposure to multidrug-resistant TB. Ethambutol at 15 mg/kg is safe in children (159). The combination of pyrazinamide and cthambutol for 9-12 mo is recommended if the isolate is susceptible to both drugs. Long-term use of fluoroquinolones in children should bc avoided. Deleterious effects on growing cartilage have been observed in animals treated with fluoroquinolones (160), although no defects in bone growth occurred among a limited number of children with cystic fibrosis treated with ciprofloxacin or ofloxacin (161). When pyrazinamide and ethambutol cannot be used, many experts recommend using a combination of two other drugs to which the infecting organism is likely susceptible (162,163).

Low-risk tuberculin test reactors. When treatment of LTBI is being considered for persons who are at low risk for developing TB, the decision should be based on factors such as likelihood of drug toxicity if treatment is given and likelihood of TB transmission to vulnerable contacts (e.g., infants and HIV-infected persons) if treatment were not given and the patient were to develop active TB. Included in this decision are the patient's preferences and values. When the assessed risk of drug toxicity exceeds the anticipated benefits of therapy, treatment for LTBI is not usually appropriate.

BCG-vaccinated persons. A history of BCG vaccination, with or without a BCG scar, should not influence the decision regarding whether to treat LTBI. The criteria previously described should be applied without modification (164).

Directly observed therapy and measures to increase adherence. Any regimen that is given intermittently (i.e., twice weekly) should be given only under direct observation. Some experts recommend that the 2-mo regimen of daily rifampin and pyrazinamide also be given by DOT, which, for ease of administration, may consist of five observed and two self-administered doses each week.

Patients with the highest priority for DOT are those at the highest risk of progression from latent to active TB, including persons with HIV infection and young children who are contacts of infectious patients with pulmonary TB. DOT may be conveniently and effectively used for the treatment of household contacts of patients receiving DOT for active TB and for treatment observed by staff members in certain facilities (e.g., schools and homeless shelters).

If it is not possible to provide DOT to enhance adherence with treatment of LTBI, the prescribed regimen should be incorporated into patients' daily routines. Medical providers can encourage adherence to treatment by establishing rapport with patients. Providers should explain in simple, clear language what LTBI is, the health threat it presents, and how it is eradicated. Patients should be encouraged to ask questions. Patient education should ideally be conducted in the patient's primary language, or through a medical interpreter, if necessary. Each visit between patient and medical provider during therapy is an opportunity to reinforce the patient's understanding of LTBI and its treatment.

In addition to education about potential drug toxicity, patients should be told about common side effects and counseled on drug management. (For example, medications should be taken with food when gastrointestinal symptoms have occurred after medication was taken on an empty stomach, and salicylic acid can be used for symptomatic treatment of arthralgia caused by pyrazinamide.)

Most interventions to improve adherence require substantial financial resources. Providing flexible clinic hours, reducing waiting times for patients, spending time with patients to counsel and educate, and directly observing patients ingesting medications increase operating expenses. Even the least intensive approaches to improve adherence increase program costs. The costs of these approaches to improving patient adherence underscore the need to target tuberculin testing and treatment of LTBI to those groups with an increased risk for recent infection or those persons at high risk for progression to active TB, if infected. In addition, programs should invest in approaches to increase adherence, especially for those persons who are at greatest risk for progressing to disease. Better success in motivating patients to accept and to complete treatment is necessary to achieve the full potential of this intervention to protect persons from TB and to reduce the incidence of the disease in the community.

Pretreatment Evaluation and Monitoring of Treatment

Pretreatment evaluation. The pretreatment evaluation of persons who are targeted for treatment of LTBI provides an op-

portunity for health care providers to (I) establish rapport with patients, (2) discuss the details of the patients' risk for TB, (3) emphasize the benefits of treatment and the importance of adherence to the drug regimen, (4) review possible adverse effects of the regimen, including interactions with other drugs, and (5) establish an optimal follow-up plan. The evaluation should include an interview conducted in the patients' primary language with assistance of qualified medical interpreters, if necessary.

The patient history should document risk factors for TB, prior treatment for TB or LTBI, and preexisting medical conditions that constitute a contraindication to treatment or are associated with an increased risk for adverse effects of treatment. A detailed history of current and previous drug therapy should be obtained, with particular attention to previous adverse reactions to drugs contemplated for treatment of LTBI, and to current use of drugs which may interact with the drugs used for treatment. Women receiving rifampin and oral contraceptives are at increased risk for becoming pregnant and should be advised to consider an additional form of contraception. Practitioners should consider using a standardized history form to ensure that all elements of the pretest evaluation are thoroughly covered for each patient.

Baseline laboratory testing is not routinely indicated for all patients at the start of treatment for LTBI (Table 8). Patients whose initial evaluation suggests a liver disorder should have baseline hepatic measurements of serum AST (SGOT) or ALT (SGPT) and bilirubin. Baseline testing is also indicated for patients infected with HIV, pregnant women and those in the immediate postpartum period (i.e., within 3 mo of delivery), persons with a history of liver disease (e.g., hepatitis B or C, alcoholic hepatitis or cirrhosis), persons who use alcohol regularly, and others who are at risk for chronic liver disease. Baseline testing is no longer routinely indicated in persons older than 35 yr of age. However, such testing may be considered on an individual basis, particularly for patients who are taking other medications for chronic medical conditions. Active hepatitis and end-stage liver disease are relative contraindications to the use of isoniazid or pyrazinamide for treatment of LTBI.

Monitoring of treatment. Clinical monitoring is indicated for all patients; this involves education of patients about the symptoms and signs that can result as adverse effects of the drug(s) being prescribed and the need for prompt cessation of treatment and clinical evaluation should symptoms occur. These include any of the following: unexplained anorexia, nausea, vomiting, dark urine, icterus, rash, persistent paresthesias of the hands and feet, persistent fatigue, weakness ***or*** fever lasting 3 or more days, abdominal tenderness (especially right upper quadrant discomfort), easy bruising or bleeding, and arthralgia (Table 8). Clinical monitoring begins at the first visit and should be repeated at each monthly visit. At monthly visits, patients should be instructed to interrupt therapy and contact their providers immediately upon the onset of such symptoms or any unexplained illness occurring during treatment.

Patients being treated for LTBI should receive a clinical evaluation, including a brief physical assessment checking for signs of hepatitis, at least monthly if receiving isoniazid alone or rifampin alone and at 2, 4, and 8 wk if receiving both rifampin and pyrazinamide (Table 8). These evaluations represent opportunities to review the indications for treatment, adherence with therapy since the last visit, symptoms of adverse drug effects and drug interactions, and plans to continue treatment. As with the baseline evaluation, a standardized questionnaire may facilitate those interviews.

Routine laboratory monitoring during treatment of LTBI is indicated for patients whose baseline liver function tests are abnormal and for other persons at risk for hepatic disease (Table 8). In addition, laboratory testing (e.g., liver function studies for patients with symptoms compatible with hepatotoxicity or a uric acid measurement to evaluate patients who develop acute arthritis) should be used to evaluate possible adverse effects that occur during the course of treatment. Some experts recommend that isoniazid be withheld if a patient's transaminase level exceeds 3 times the upper limit of normal if associated with symptoms and five times the upper limit of normal if the patient is asymptomatic.

Reporting of serious adverse events. Practitioners and other health professionals should report serious adverse events associated with the treatment of LTBI to the U.S. Food and Drug Administration's MedWatch program. Serious adverse events include those associated with hospitalization, permanent disability, or death. Reporting may be by mail, telephone (1-800-FDA-1088), fax (1-800-FDA-0178), or the Internet site (www.fda.gov/medwatch).

Priorities for Future Research

DIAGNOSIS

The only widely available method to detect LTBI is the tuberculin skin test. However, the specificity of the test is decreased by cross reactions from BCG vaccination and sensitization by nontuberculous mycobacteria. When used in populations in which the risk for TB is low, the test's positive predictive value is poor. In addition, the requirement that the person tested return for the test to be read 48-72 h after test administration creates operational problems. Thus, more specific and sensitive tests are needed to diagnose LTBI and to identify persons at greatest risk for progressing to active disease. Especially useful would be tests that distinguish skin-test reactions caused by TB infection from those caused by BCG vaccination or infection with nontuberculous mycobacteria, tests that correlate with the presence of living organisms, and tests that accurately identify LTBI in immunodeficient persons.

OPERATIONAL RESEARCH

Acceptability, Tolerability, and Effectiveness of Daily Rifampin and Pyrazinamide

More data are needed regarding the acceptability, tolerability, and effectiveness of the 2-mo regimen of daily rifampin and pyrazinamide in HIV-negative persons. Data are especially needed from older adults and children.

Intermittent Rifampin-containing Regimens

No studies of rifampin alone taken twice weekly for the treatment of LTBI have been conducted. Data from two studies in HIV-infected persons that included intermittent (i.e., twice weekly) rifampin and pyrazinamide administration suggested that these regimens were effective (86,110). Before additional trials of intermittent rifampin regimens are undertaken, animal model data are needed to compare these regimens with regimens using other longer-acting rifamycin derivatives (see EFFICACY STUDIES OF NEW DRUGS).

Isoniazid Taken Twice Weekly

It is unlikely that a formal efficacy study of intermittent isoniazid for the treatment of LTBI will be undertaken, unless it is included as a control arm for studies of newer regimens. However, several TB-control programs have had considerable experience using this regimen. Data from these programs should be examined, especially as they relate to acceptability and completion of treatment. The analysis of aggregate data available in TB programs may also be useful in estimating the effectiveness of this regimen.

Studies in Children and Pregnant Women

Studies are needed to provide information regarding the use of newer regimens for the treatment of LTBI in children and pregnant women. The safety of pyrazinamide for pregnant women and their fetuses should be determined. More information is needed regarding hepatotoxicity of isoniazid in pregnant and postpartum women. Studies are needed to establish the safety and effectiveness of rifampin alone and rifampin plus pyrazinamide for treatment of LTBI in infants, children, and adolescents. The best target populations for these studies would be HIV-infected children in places in which TB is prevalent and household contacts of TB case patients. In addition, the effectiveness of twice-weekly regimens for treatment of LTBI in children should be confirmed. Data concerning the safety and effectiveness of alternative therapies for MDR LTBI in children are needed. Finally, epidemiologic research to determine the best tools to identify children at high risk for LTBI should be undertaken.

Reporting and Monitoring in New Settings

These recommendations call for the establishment of LTBI treatment programs in new community settings (e.g., managed care organizations and neighborhood clinics). Consequently, operational research will be needed to evaluate the implementation of these programs in settings other than health departments. These studies should assess the knowledge base of treating clinicians and identify the obstacles to be overcome for the successful implementation of community-based LTBI treatment programs.

Combination Rifampin and Pyrazinamide Preparations

If field and programmatic data establish the effectiveness and acceptability of the rifampin and pyrazinamide regimen for the treatment of LTBI, the availability of a combination product would facilitate its administration. However, the argument concerning the usefulness of combination products in preventing the emergence of drug resistance in patients with active TB is not as compelling for persons being treated for LTBI. Nonetheless, methods to facilitate provision of this treatment and increase adherence (e.g., blister packs containing medication for 2 wk of treatment for several different body weights) would be useful.

EFFICACY STUDIES OF NEW DRUGS

No novel compounds currently can be considered candidates for the treatment of LTBI. However, several rifamycin derivatives with half-lives substantially greater than rifampin are of interest because of the possibility of widely spaced, intermittent administration. In experimental studies involving mice, the combination of rifapentine and isoniazid given once weekly for 3 mo was as active as rifampin and pyrazinamide given daily for 2 mo (165). Rifalazil, which has an even longer half-life, is more active than rifapentine and perhaps could be dosed less frequently without compromising efficacy (166). The class of nitroimidazole compounds is also of interest because of their potential activity against dormant tubercle bacilli (167). Unfortunately, no animal models of LTBI exist that optimize the preclinical evaluation of new drugs.

STUDIES OF IMMUNOMODULATORS AND VACCINES

Recent studies have indicated that immunotherapy with specific cytokines and immunomodulators may be beneficial to response to TB treatment. However, their application in the treatment of LTBI is uncertain. Some epidemiologic studies have suggested that high levels of certain cytokines (e.g., interferon gamma) may protect against the development of active TB. If further studies support this finding, interventions that stimulate production of protective cytokines may have a role in the treatment of LTBI. The development of a postinfection vaccine to be administered to persons with LTBI has been given high priority (168).

DECISION/COST-EFFECTIVENESS ANALYSES

Focus on Testing for and Treatment of Latent TB Infection in High-risk and Diverse Populations

Future decision and cost-effectiveness analyses should be expanded to include targeted testing. Instead of beginning at the "treat-don't-treat" point, new models might be most useful if they begin with the decision of whether to test. These studies should focus on groups at high risk and specific subgroups char-

acterized by varied risks and benefits of treatment. Using this conceptual framework will help place decision modeling more clearly into a "real world" context, incorporating the linked contingencies that exist.

Comparison of Strategies Using Both Shorter and Longer Treatment Regimens.

Future decision and cost-effectiveness analyses should compare the shorter course regimens to the longer, 9-mo regimen of daily isoniazid. These analyses will benefit from investigations of the toxicities and efficacies of shorter regimens. In addition, although adherence presumably will be better with shorter treatment regimens, the rifampin and pyrazinamide regimen may be less well-tolerated in some groups of patients, thus resulting in low adherence. Decision and cost-effectiveness analyses should explore a range of toxicities in the models until investigations better establish these risks. By investigating the effect of a range of toxicities and adherence on the decision outcome, studies can help identify priority areas for research. Updated analyses on the use of alternate regimens for the treatment of drug-resistant LTBI are also needed.

Use of Multiple Analytic Perspectives

When two different perspectives are relevant for a decision, both perspectives should be modeled and analyzed. For example, when the benefits to an individual person with LTBI are different from the benefits to the public, both perspectives must be made explicit in decision models. When decision analysis is inadequate to deal with public health issues (e.g., reduction in contagion), additional models are needed to augment views of the benefits and costs of following each viable course of action.

Policies designed to target and treat populations at high risk for TB are motivated by the need to benefit the individual patient as well as the health of the public by averting active disease in persons most likely to develop it. As policies are instituted that identify high-risk groups for testing and treatment, the social and ethical ramifications of these policies must be considered. The individual persons who comprise many of the high-risk groups targeted for testing and treatment often represent disenfranchised segments of urban populations (e.g., persons who are homeless, incarcerated, and medically underserved, and residents in long-term care facilities). Ideally, the outcomes and utilities that are used in these decision models will incorporate the values and preferences of these patients and the outcomes important to the general public.

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Fatal and Severe Hepatitis Associated With Rifampin and Pyrazinamide for the Treatment of Latent Tuberculosis Infection -- New York and Georgia, 2000

One of the recommended treatments for latent tuberculosis infection (LTBI) is a 9-month regimen of isoniazid (INH); a 2-month regimen of rifampin (RIF) and pyrazinamide (PZA) is an alternative in some instances. In September 2000, a man in New York died of hepatitis after 5 weeks of RIF-PZA, and in December, a woman in Georgia was admitted to a hospital because of hepatitis after 7 weeks of this regimen. This report summarizes the findings of the investigations of these incidents, which underscore the need for clinical monitoring for adverse effects in all patients receiving treatment for LTBI.

Case 1

A 53-year-old incarcerated man received 600 mg (6.7 mg/Kg) RIF and 1750 mg (19 mg/Kg) PZA daily after screening revealed a tuberculin skin test (TST) with 20 mm induration and no radiologic or clinical findings of active tuberculosis (TB). His risk factors for TB included previous work as a medical orderly, homelessness, and multiple incarcerations. He had a history of hypertensive heart disease and alcoholism without evidence of chronic liver disease. He was not known to inject drugs.

RIF-PZA was standard treatment for LTBI at the jail. Baseline and 1-month serum aminotransferase and bilirubin levels were measured routinely. The patient's baseline aminotransferase levels were slightly higher than the upper-normal limits. He was instructed to stop taking RIF-PZA if he developed symptoms suggestive of hepatitis. He also received 325 mg enteric-coated aspirin daily, 90 mg extended-release nifedipine, and 50 mg hydrochlorothiazide. Nurses supervised the administration of all medication to assure compliance.

Blood specimens tested on day 33 of treatment revealed alanine aminotransferase (ALT) 1734 U/L (normal range: 0--41 U/L), aspartate aminotransferase (AST) 1449 U/L (normal range: 0--38 U/L), and total bilirubin 4.2 mg/dL (normal range: 0--1.0 mg/dL). Blood cell counts showed leukocytosis. On day 35, RIF-PZA was discontinued when the test results were received. On the same day, a correctional officer urged the patient to visit the infirmary because of poor appetite and lassitude that had developed over several days; he declined. Five days after the cessation of RIF-PZA, the patient was evaluated in the infirmary for jaundice and altered mental status and was admitted to a hospital. Serum total bilirubin peaked at 17.8 mg/dL and blood ammonia at 378 μmol/L (normal range: 17--47 μmol/L). He died 3 days after admission.

On postmortem histology, the liver had bridging necrosis, lymphocytic infiltration, focal cholestasis, increased fibrosis, and micronodular cirrhosis. Results were negative for serum anti-A IgM, antibody to hepatitis B core antigen (anti-HBc), antibody to hepatitis B surface antigen (anti-HBs), and antibody to hepatitis C virus (anti-HCV). Antinuclear antibody (ANA) was undetectable. Hepatitis B and C were undetectable by polymerase chain reaction assays. The reported cause of death was liver necrosis and failure as a result of hepatitis following LTBI treatment.

Case 2

A 59-year-old woman received 600 mg (7.2 mg/Kg) RIF and 2000 mg (24 mg/Kg) PZA daily after testing revealed a TST with 27 mm induration and no findings for active TB. She chose this regimen because of suspected exposure to drug-resistant TB and concern about liver injury from INH. In addition to RIF-PZA, she received beclomethasone dipropionate nasal spray, budesonide inhalation powder, and albuterol inhalation aerosol for nasal allergies and asthma. She had no history of liver disease, rarely drank alcohol, and did not inject drugs. She was vaccinated against hepatitis A but not B. She had a history of anaphylactic reactions to penicillin and an estrogen sulfates blend. Baseline ALT and AST, bilirubin levels, and blood cell counts were normal. She was instructed to contact her health-care provider about adverse effects during treatment. On day 2 of treatment, she reported queasiness. On day 17, her blood tests were repeated: serum aminotransferase and bilirubin levels were normal, and her eosinophil count, which had been 157 cells/μL, was 510 cells/μL (normal range: 50--550 cells/μL).

She subsequently experienced malaise, anorexia, and feverishness, and she occasionally took one bismuth subsalicylate chewable tablet. On the 49th and last day of treatment, she returned to her health-care provider and was admitted to a hospital because of jaundice and altered mental status. AST was 986 U/L (normal range: 7--40 U/L), ALT 1735 U/L (normal range: 17--63 U/L), and total bilirubin 11.4 mg/dL (normal range: 0.1--1.1 mg/dL). The bilirubin peaked at 27.5 mg/dL after 14 days. Peak eosinophil count was 2580 cells/μL. No ova or protozoa were detected by stool examinations. Serum ANA was 1:640 (speckled pattern). Antibody (not IgM) to hepatitis A virus was detected. Test results were negative for hepatitis B surface antigen (HBsAg), anti-HBs, and anti-HCV. After receiving 40 mg prednisone daily, the symptoms and laboratory abnormalities slowly abated, and she was released after 25 days in the hospital.

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Editorial Note:

Case 1 is the first report to CDC of fatal hepatitis associated with the RIF-PZA regimen for LTBI, although sporadic cases of liver injury have been attributed to PZA used in treatment regimens for TB disease (*1*). Both cases illustrate that the usually well-tolerated regimens for LTBI occasionally can result in severe adverse effects and that clinical monitoring is crucial during treatment. In these cases, biochemical monitoring did not help to avoid severe liver injury and does not substitute for clinical monitoring (*2*). Idiosyncratic liver injury can be

caused by hypersensitivity, as suspected for case 2, or by toxic drug metabolites. Other cases have implicated various medicines and alcohol as potential co-factors for INH liver injury (*3*,*4*). A similar association has not been assessed for RIF and PZA because of small case numbers.

Patients with LTBI and risk factors for active TB should be offered treatment (*1*,*5*). Health-care providers should instruct and frequently remind patients about the initial symptoms of hepatitis (e.g., fatigue, nausea, abdominal pain, and anorexia) and the importance of stopping medication if symptoms develop (*2*). In this report, both patients continued taking their medicines while symptoms were developing, a phenomenon also reported for INH-associated hepatitis (*4*).

CDC's Division of Tuberculosis Elimination is interested in receiving reports of severe hepatitis in patients being treated for LTBI. To report possible cases, telephone (404) 639-8125.

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Update: Fatal and Severe Liver Injuries Associated With Rifampin and Pyrazinamide for Latent Tuberculosis Infection, and Revisions in American Thoracic Society/CDC Recommendations --- United States, 2001

During February 12--August 24, 2001, a total of 21 cases of liver injury associated with a 2-month rifampin-pyrazinamide (RIF-PZA) regimen for the treatment of latent tuberculosis infection (LTBI) was reported to CDC. These 21 cases are in addition to two previously reported RIF-PZA--associated cases (*1*). Cases of liver injury have occurred each year since 1999. CDC also received reports of 10 cases associated with other LTBI treatment regimens; however, risk for liver injury cannot be compared among treatment regimens in part because the number of patients treated for LTBI with each treatment regimen is unknown. This report provides preliminary information about the 21 cases associated with RIF-PZA and the revised recommendations on selecting appropriate LTBI therapy for patients and monitoring the use of RIF-PZA to treat LTBI (*2*). In most instances, the 9-month isoniazid (INH) regimen is preferred for the treatment of patients with LTBI. RIF-PZA may be used in selected cases and requires more intensive clinical and laboratory monitoring than previously recommended.

A case was defined as liver injury (i.e., clinical and laboratory findings consistent with hepatitis) leading to hospital admission or death of a patient being treated for LTBI with RIF-PZA. The median age of the 21 patients was 44 years (range: 28--73 years) and 12 were men. For patients in which the information was known, jaundice was reported in 15 of 18, and human immunodeficiency virus (HIV) test results were negative for all 11 who were tested. One patient had been diagnosed with hepatitis C disease at the start of RIF-PZA treatment. Three of the 21 RIF-PZA--associated cases occurred when patients received this regimen after recovering from INH-associated liver injury. One case was associated with a patient who received RIF-PZA after taking INH without problems.

Of the 21 patients with RIF-PZA--associated liver injury, 16 recovered and five died of liver failure. No patient received a liver transplant. The five patients who died had LTBI diagnosed under the current recommendations, and each had indications for RIF-PZA treatment (*2*). Patient 1 was a 68-year-old man who had diabetes and a positive tuberculin skin test (TST) result, patient 2 was a 62-year-old woman who had a TST conversion detected by employee screening, and patient 3 was a 36-year-old man who had a TST conversion during incarceration. Patient 4 was a 32-year-old woman who had emigrated from a high-prevalence country to the United States in 2000 and had a positive TST result of 20 mm induration, and patient 5 was a

34-year-old man who had emigrated from a high-prevalence country to the United States in 1988 and had a positive TST result of 22 mm induration. Patient 3 had HIV risk factors but a negative serology result; the other four did not have HIV risk factors. Patients 2, 4, and 5 were tested and had negative serology results. Patients 2 and 3 received RIF-PZA after recovering from INH-associated liver injury.

PZA dosages for the five patients were 19, 18, 23, 20, and 16 mg/kg/d (recommended dose: 15--20 mg/kg/d). After liver injury was diagnosed, all patients were tested for hepatitis A (acute), B (acute and chronic), and C. Patients 2 and 5 had serologic evidence of previous hepatitis A. Patient 5 had serologic evidence of past hepatitis B. Patient 1 had idiopathic nonalcoholic steatotic hepatitis confirmed by biopsy in 1997, and patient 3 used injection drugs and alcohol, although reportedly not during RIF-PZA treatment. Patient 2 had no risks for chronic liver disease and had neither a liver biopsy nor an autopsy. Patients 4 and 5 had autopsies; microscopic examination of the liver of patient 5 revealed acute hepatic necrosis, and results are pending for patient 4. Patients 1 and 2 were taking other medicines* that have been associated with idiosyncratic liver injury. All five patients had onset of liver injury during the second month of the 2-month course of treatment. Patients 1 and 3 continued RIF-PZA an estimated 3 days and 14 days, respectively, after symptom onset; the exact duration of RIF-PZA treatment could not be determined for patients 2 and 4. Patient 5 developed symptoms at the completion of treatment. Patients 1, 2, 4, and 5 received 30-day supplies of RIF-PZA. Patient 3 received directly observed therapy daily, but a language barrier possibly hampered patient education and communication about symptoms. Patient 4 also may have faced a language barrier.

Reported by: State and territorial health depts. Div of Tuberculosis Elimination, National Center for HIV, STD, and TB Prevention, CDC.

Editorial Note:

During June, tuberculosis (TB) and liver disease specialists consulted by CDC analyzed case reports and assessed current guidelines on the use of RIF-PZA and noted that the 2-month RIF-PZA regimen was well tolerated in LTBI treatment trials among HIV-infected persons (*3*--*5*). Although clinical trials of RIF-PZA did not include HIV-uninfected persons, the number of reports of severe liver injury among persons presumed or known not to be infected with HIV was unexpected. CDC continues to investigate the rate and risk factors for liver injury. To reduce the risk for liver injury associated with RIF-PZA therapy, the American Thoracic Society and CDC, with the endorsement of the Infectious Diseases Society of America, have prepared recommendations that supercede previous guidelines (*2*).

1. The 2-month RIF-PZA treatment regimen for LTBI should be used with caution, especially in patients concurrently taking other medications associated with liver injury, and those with alcoholism, even if alcohol use is discontinued during treatment. RIF-PZA is not recommended for persons with underlying liver disease or for those who have had INH-associated liver injury. Persons being considered for treatment with RIF-PZA should be informed of potential hepatotoxicity and asked whether they have had liver disease or adverse effects from INH.
2. For persons not infected with HIV, 9 months of daily INH remains the preferred treatment for LTBI; 4 months of daily RIF is an acceptable alternative. Two months of daily RIF-PZA may be useful when completion of longer treatment courses is unlikely and when the patient can be monitored closely.
3. Available data do not suggest excessive risk for severe hepatitis associated with RIF-PZA treatment among HIV-infected persons. In a large multinational trial, HIV-infected patients treated with RIF-PZA had lower rates of serum aminotransferase (AT) elevations than those given INH alone (*3*). The RIF-PZA regimen also was well tolerated when

given twice weekly to HIV-infected persons in Zambia and Haiti (*4*,*5*). However, experience from trials may not translate to all clinical practice settings, and it may be prudent to use 9 months of daily INH for treatment of HIV-infected persons with LTBI when completion of treatment can be assured.

4. No more than a 2-weeks supply of RIF-PZA (with a PZA dose ≤20 mg/kg/d and a maximum of 2 gm/d) should be dispensed at a time to facilitate periodic clinical assessments. Patients should be reassessed in person by a health-care provider at 2, 4, and 6 weeks of treatment for adherence, tolerance, and adverse effects, and at 8 weeks to document treatment completion. At each visit, health-care providers conversant in the patients' language should instruct patients to stop taking RIF-PZA immediately and seek medical consultation if abdominal pain, emesis, jaundice, or other hepatitis symptoms develop. Provider continuity is recommended for monitoring.
5. A serum AT and bilirubin should be measured at baseline and at 2, 4, and 6 weeks of treatment in patients taking RIF-PZA. Because some side effects may occur in the second month of treatment, patients should be monitored throughout the entire course of treatment. Asymptomatic serum AT increases are expected and usually do not require that treatment be stopped (*2*,*3*). However, treatment should be stopped and not resumed for any of these findings: AT greater than five times the upper limit of normal range in an asymptomatic person, AT greater than normal range when accompanied by symptoms of hepatitis, or a serum bilirubin greater than normal range.

The following considerations are crucial in deciding whom to test and treat for LTBI:

1. The purpose of targeted testing is to find and treat persons who have both LTBI and high risk for TB disease (e.g., recent exposure to a contagious case) (*2*). Persons at low risk for developing TB and who have had a TST for other reasons, such as baseline TST of health-care workers, are not necessarily candidates for treatment if found to be infected (*2*).
2. Treatment is recommended for foreign-born persons from countries with a high prevalence of TB who have LTBI and who have been in the United States <5 years (*2*). After 5 years, treatment decisions should be made on the same basis as other patients.
3. Because sporadic severe INH-associated liver injury still occurs, patients taking INH should be monitored as recommended (*2*).

CDC is collecting reports of severe liver injury (i.e., leading to hospital admission or death) in persons receiving any regimen for LTBI. Reports are being analyzed to assess contributing factors. Report possible cases to the Division of Tuberculosis Elimination; telephone (404) 639-8125.

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* One patient was taking hydrochlorothiazide; and the other was taking lisinopril, metformin, and aspirin.

† All *MMWR* references are available on the Internet at <http://www.cdc.gov/mmwr>. Use the search function to find specific articles.

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Update: Adverse Event Data and Revised American Thoracic Society/CDC Recommendations Against the Use of Rifampin and Pyrazinamide for Treatment of Latent Tuberculosis Infection---United States, 2003

CDC has reported previously surveillance data of severe liver injury in patients treated for latent tuberculosis infection (LTBI) with a daily and twice-weekly 2-month* regimen of rifampin with pyrazinamide (RZ). On the basis of these initial reports, CDC cautioned clinicians in the use of this therapy with advised additional monitoring (*1*--*4*). To estimate the incidence of RZ-associated severe liver injury and provide more precise data to guide treatment for LTBI, CDC collected data from cohorts of patients in the United States who received RZ for the treatment of LTBI during January 2000--June 2002 and for whom data were reported to CDC through June 6, 2003. This report summarizes the analysis, which found high rates of hospitalization and death from liver injury associated with the use of RZ. On the basis of these findings, the American Thoracic Society (ATS) and CDC now recommend that this regimen should generally not be offered to persons with LTBI. The revised ATS/CDC recommendations described in this report have been endorsed by the Infectious Diseases Society of America (IDSA). Clinicians are advised to use the recommended alternative regimens for the treatment of LTBI (Table). Rifampin and pyrazinamide (PZA) should continue to be administered in multidrug regimens for the treatment of persons with active tuberculosis (TB) disease (*5*).

For surveillance purposes, a case of severe liver injury was defined as one leading to the hospitalization or death of a patient being treated for LTBI with RZ (*2*). During October 2000--June 2003, CDC received reports of 48 patients who had confirmed cases; 33 (69%) cases occurred in the second month of treatment. A total of 11 (23%) patients died†, including two persons known to be infected with human immunodeficiency virus (HIV).

A two-phase retrospective survey was conducted to estimate the incidence of severe liver injury among persons receiving RZ for treatment of LTBI. In December 2001 (phase I), CDC sent a questionnaire by e-mail to TB-control programs in 12 large cities and all 50 states, asking them to identify programs and health-care providers prescribing RZ for treatment of LTBI. All controllers responded, and in February 2002, CDC staff called the programs and health-care providers identified as prescribing RZ for LTBI to confirm its use. In September 2002 (phase II), CDC mailed a second questionnaire to the 150 health-care providers identified during the first phase, requesting aggregate cohort data for January 2000--June 2002; 109 (78%) health-care providers responded by June 6, 2003.

Of 7,737 patients who were reported to have started RZ for treatment of LTBI during the survey period, 5,980 (77%) received daily doses, and 1,757 (23%) received twice-weekly doses. A total of 204 patients discontinued using RZ because of aspartate aminotransferase (AST) concentrations greater than five times the upper limit of normal (rate: 26.4 per 1,000 treatment initiations; 95% confidence interval (CI) = 22.8--30.0). An additional 146 patients discontinued using RZ because of symptoms of hepatitis (rate: 18.9 per 1,000 treatment initiations; 95% CI = 17.4--20.4).

Of the 48 cases of severe liver injury reported to CDC through passive surveillance, 30 also were detected in the second phase of the survey. Of the 18 patients whose cases were not detected, six patients had liver injuries outside the survey period, five patients' health-care providers did not respond to the questionnaire, and seven (six of whom were in private practice) were not identified in the first phase of the survey. Of the 30 patients whose cases were detected, 23 (77%) recovered, and seven (23%) died. On the basis of these 30 cases, the estimated rates of hospitalization and death during the survey period were 3.0 (95% CI = 1.8--4.2) and 0.9 (95% CI = 0.2--1.6) per 1,000 treatment initiations, respectively.

Reported by: *State and territorial health depts. Div of Tuberculosis Elimination, National Center for HIV, STD, and TB Prevention, CDC.*

Editorial Note:

The CDC cohort analysis found that the rates of severe liver injury and death related to the use of RZ are higher than the rates for isoniazid (INH)-associated liver injury in the treatment of LTBI. Although initial studies attributed hospitalization rates as high as 5.0 per 1,000 treatment initiations and mortality rates as high as 1.0 per 1,000 to INH (*6,7*), studies conducted since 1991 involving more than one million persons treated with INH have reported hospitalization rates of 0.1--0.2 (median: 0.15) and mortality rates of 0--0.3 per 1,000 (median: 0.04) (*4,8,9*). This decrease from earlier studies might reflect careful selection of patients and active monitoring for early signs of adverse events. In addition to the survey on the use of RZ described in this report, recent studies have reported episodes of liver injury and hospitalization associated with RZ for treatment of LTBI (*10,11*), including the need for transplantation in one patient (*12*). Among first-line agents in the treatment of active TB disease, pyrazinamide (PZA) might be the most hepatotoxic (*13*).

These data and other recent studies (*4,10,11,14--16*) were reviewed by TB experts[§] at a meeting held during the 99th International ATS Conference in Seattle, Washington, on May 12, 2003, to discuss proposed revisions to guidelines for the treatment of LTBI. ATS and CDC now recommend that this regimen should generally not be offered to persons with LTBI for either HIV-negative or HIV-infected persons. On the basis of the investigation of potential cofactors in the 48 patients with serious liver injury, this regimen should never be offered to patients who 1) are concurrently taking other medications associated with liver injury; 2) drink excessive amounts of alcohol, even if alcohol use is discontinued during treatment; 3) have underlying liver disease; or 4) have a history of INH-associated liver injury.

If the potential benefits of this regimen outweigh the risk for severe liver injury and death associated with it, use of RZ might be considered in carefully selected patients, but only if 1) the preferred or alternative regimens (i.e., 9 months of daily or biweekly INH, 6 months of daily or biweekly INH, or 4 months of daily rifampin) are judged not likely to be completed and 2) oversight by a clinician with expertise in the treatment of LTBI can be provided. A TB/LTBI expert should be consulted before RZ is offered. In addition, patients should be asked whether they have had liver disease or adverse effects from taking INH or other drugs, informed of potential hepatotoxicity of the RZ regimen, and advised against the concurrent use of potentially hepatotoxic drugs, including over-the-counter drugs such as acetaminophen.

To facilitate periodic clinical assessments of persons taking an RZ regimen (2), clinicians should dispense no more than a 2-week supply (with a daily PZA dose of <20.0 mg/kg/d [maximum daily PZA dose: 2.0 g], and a twice-weekly dose of <50.0 mg/kg/d [maximum twice-weekly PZA dose: 4.0 g]). Patients should be reassessed in person by a health-care provider at 2, 4, 6, and 8 weeks of treatment for adherence, tolerance, and adverse effects. The 8-week assessment also should be used to document treatment completion. At each visit, health-care providers who speak the patient's own language should instruct the patient to stop taking RZ immediately and seek medical consultation if abdominal pain, emesis, jaundice, or other symptoms of hepatitis develop. Provider continuity is recommended for optimal monitoring.

For persons taking this regimen, serum aminotransaminases (AT) and bilirubin should be measured at baseline and at 2, 4, 6, and 8[¶] weeks of treatment. Because the majority of these patients had onset of symptoms of liver injury after the fourth week of therapy (Figure), patients should be monitored throughout the entire course of treatment. Use of RZ should be discontinued immediately and not resumed for any of

the following findings: 1) AT greater than five times the upper limit of normal range in an asymptomatic person, 2) AT greater than normal range when accompanied by symptoms of hepatitis, or 3) a serum bilirubin concentration greater than the normal range, whether or not symptoms are present.

The risk for progression from LTBI to active TB is increased substantially in persons with HIV infection (*4*). Therefore, as recommended previously for the treatment of all persons in whom LTBI is diagnosed, voluntary HIV counseling and testing should be offered routinely.

For progression to TB disease to be prevented, persons with LTBI should be identified in contact investigations and targeted screening programs and should complete treatment with safe and effective regimens. The successful treatment of LTBI is an essential component of the TB elimination strategy in the United States (*4*). In addition to this report, CDC and its partners are sending a letter to TB-control programs in 12 large cities and all 50 states and organizations active in TB control (e.g., the National Coalition to Eliminate Tuberculosis). To reach clinicians who are treating patients with LTBI, primary care medical associations (e.g., the American Medical Association and the American College of Physicians) are distributing this report to their members. This report and the letter are available at http://www.cdc.gov/tb. The letter is being added to the April 2000 CDC Targeted Tuberculin Testing and Treatment of Latent TB Infection Guidelines, and existing provider educational materials are being revised.

The recommendations against the use of RZ for treatment of LTBI described in this report do not apply to the appropriate use of rifampin and PZA in multidrug regimens for the treatment of persons with active TB disease. In these circumstances, the risk for morbidity and mortality from TB disease is substantially greater than with LTBI. Rifampin and PZA are essential components of recommended ATS/CDC/IDSA regimens that render patients noninfectious rapidly and are effective in curing patients with drug-susceptible *M. tuberculosis* strains within 6 months (*5*).

CDC continues to collect reports of severe liver injury leading to hospital admission or death in persons receiving any treatment for LTBI. Health-care providers are encouraged to report such events to CDC's Division of Tuberculosis Elimination, telephone 404-639-8442. Details of the RZ survey analysis and the case series will be described in a separate publication.

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* The twice-weekly rifampin and pyrazinamide regimen for treatment of LTBI was specified to be completed within 2--3 months.

† Of the 11 deaths, eight were reported previously (*1*--*3*).

§ Representatives from state and local TB-control programs and health departments and hospitals, National TB Centers, ATS, the National Coalition to Eliminate Tuberculosis, the National Tuberculosis Controllers Association, Infectious Diseases Society of America, the American College of Chest Physicians, and CDC. CDC met separately with the Food and Drug Administration.

¶ In the interim revised recommendations, biochemical monitoring at 2, 4, and 6 weeks was recommended (*2*); however, because of the occurrence of serious adverse events late in the course of RZ treatment, monitoring at 8 weeks has been added.

Table

TABLE. Revised drug regimens for treatment of latent tuberculosis infection (LTBI) in adults*

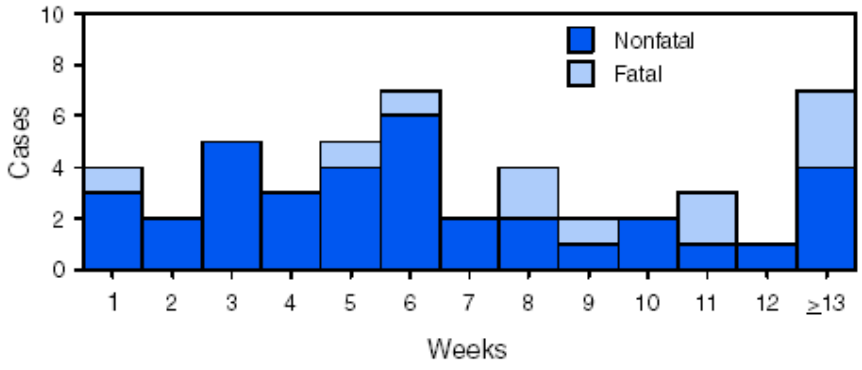
Drug	Interval and duration	Comments†	Rating§ (Evidence)¶ HIV-negative	HIV-infected
Isoniazid	Daily for 9 months**††	In HIV-infected persons, isoniazid may be administered concurrently with nucleoside reverse transcriptase inhibitors (NRTIs), protease inhibitors, or non-nucleoside reverse transcriptase inhibitors (NNRTIs).	A (II)	A (II)
	Twice weekly for 9 months**††	Directly observed therapy (DOT) must be used with twice-weekly dosing.	B (II)	B (II)
Isoniazid	Daily for 6 months††	Not indicated for HIV-infected persons, those with fibrotic lesions on chest radiographs, or children.	B (I)	C (I)
	Twice weekly for 6 months††	DOT must be used with twice-weekly dosing.	B (II)	C (I)
Rifampin§§	Daily for 4 months	Used for persons who are contacts of patients with isoniazid-resistant, rifampin-susceptible TB. In HIV-infected persons, most protease inhibitors or delavirdine should not be administered concurrently with rifampin. Rifabutin with appropriate dose adjustments can be used with protease inhibitors (saquinavir should be augmented with ritonavir) and NNRTIs (except delavirdine). Clinicians should consult web-based updates for the latest specific recommendations.	B (II)	B (III)
Rifampin plus pyrazinamide (RZ)	Daily for 2 months	RZ generally should not be offered for treatment of LTBI for HIV-infected or HIV-negative persons.	D (II)	D (II)
	Twice weekly for 2–3 months		D (III)	D (III)

* Adapted from CDC. Targeted tuberculin testing and treatment of latent tuberculosis infection. MMWR 2000;49(No. RR-6).
† Interactions with human immunodeficiency virus (HIV)–related drugs are updated frequently and are available at http://www.aidsinfo.nih.gov/guidelines.
§ Strength of the recommendation:
A. Both strong evidence of efficacy and substantial clinical benefit support recommendation for use. Should always be offered.
B. Moderate evidence for efficacy or strong evidence for efficacy but only limited clinical benefit supports recommendation for use. Should generally be offered.
C. Evidence for efficacy is insufficient to support a recommendation for or against use, or evidence for efficacy might not outweigh adverse consequences (e.g., drug toxicity, drug interactions) or cost of the treatment or alternative approaches. Optional.
D. Moderate evidence for lack of efficacy or for adverse outcome supports a recommendation against use. Should generally not be offered.
E. Good evidence for lack of efficacy or for adverse outcome support a recommendation against use. Should never be offered.
¶ Quality of evidence supporting the recommendation:
I. Evidence from at least one properly randomized controlled trial.
II. Evidence from at least one well-designed clinical trial without randomization from cohort or case-controlled analytic studies (preferably from more than one center), from multiple time-series studies, or from dramatic results from uncontrolled experiments.
III. Evidence from opinions of respected authorities based on clinical experience, descriptive studies, or reports of expert committees.
** Recommended regimen for persons aged <18 years.
†† Recommended regimens for pregnant women.
§§ The substitution of rifapentine for rifampin is not recommended because rifapentine's safety and effectiveness have not been established for patients with LTBI.

Return to top.

Figure

FIGURE. Number* of cases of liver injury among persons starting refampin and pyrazinamide, by outcome and week of symptom onset after initiation of therapy — United States, October 2000–June 2003



* N = 47. One other patient reported no symptoms but was hospitalized for increased aminotransaminases.

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POLICY STATEMENT

The Teen Driver

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Injury, Violence, and Poison Prevention
Committee on Adolescence

ABSTRACT

Motor vehicle–related injuries to adolescents continue to be of paramount importance to society. Since the original policy statement on the teenaged driver was published in 1996, there have been substantial changes in many state laws and much new research on this topic. There is a need to provide pediatricians with up-to-date information and materials to facilitate appropriate counseling and anticipatory guidance. This statement describes why teenagers are at greater risk of motor vehicle–related injuries, suggests topics suitable for office-based counseling, describes innovative programs, and proposes preventive interventions for pediatricians, parents, legislators, educators, and other child advocates.

MAGNITUDE OF THE PROBLEM

Motor vehicle crashes continue to be the leading cause of death for 16- to 20-year-olds, accounting for approximately 5500 occupant fatalities annually (27 deaths per 100 000 population).[1] Each year, approximately 450 000 teenagers are injured, and 27 000 of them require hospitalization.[1,2] Of those killed, approximately 63% are drivers and 37% are passengers. Two thirds of the teenagers who die in automobile crashes are male.[1]

In 2004, 7700 teenaged drivers were involved in a crash in which someone died. Although the 12 million adolescent drivers represent only approximately 6% of total drivers, they account for approximately 14% of the fatal crashes.[3] In terms of total crashes per million miles driven, 16- to 19-year-olds have a crash rate almost twice that of 20- to 24-year-olds, almost 3 times that of 25- to 29-year-olds, and more than 4 times that of 30- to 69-year olds.[4] Within the 16- to 19-year age range, the youngest drivers have the highest risk. The crash rate for 16-year-olds (35 crashes per million miles) is much higher than that even for 17-year-olds (20 crashes per million miles) and is almost 9 times greater than that of the general population of drivers (4 crashes per million miles).

ADOLESCENT RISK FACTORS

Inexperience

The adolescent, as a novice driver, lacks the experience and ability to perform many of the complex tasks of ordinary driving. Compared with experienced drivers, the novice adolescent driver is less proficient in detecting and responding to hazards and controlling the vehicle, especially at higher speeds. The risk of having a crash during the learner-permit stage is low, because the teenager is supervised and is generally not driving in high-risk conditions.[4] In contrast, data from Nova Scotia show that the highest crash rate is seen during the first month after the teenager gets his or her license (120 crashes per 10 000 drivers).[5] After

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Key Words
teen driver, graduated driver licensing, adolescent, car

Abbreviations
BAC—blood alcohol concentration
ADHD—attention-deficit/hyperactivity disorder
GDL—graduated driver licensing

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the first month, the crash rate decreases rather quickly over the next 5 months (70 crashes per 10 000 drivers) and then shows a slower decline for the next 18 months (50 crashes per 10 000 drivers). Because rapid improvement is seen over such a short time period, inexperience appears to be a much more important factor in crash rates than young age. Although these data also show that driver experience improves driving skills, traditional driver education programs usually provide only 6 hours of on-the-road training.

Risk Taking

It is normal for adolescents to take chances, succumb to peer pressures, overestimate their abilities, and have emotional mood swings. These behaviors can all place the teenaged driver at greater risk of having automobile crashes. Males seem to be at especially high risk, possibly as a result of social norms and media images that equate fast driving and ability to perform difficult driving maneuvers as masculine.[6] In 2004, 38% of male and 25% of female drivers 15 to 20 years of age involved in fatal crashes were speeding at the time of the crash.[7] These rates were higher than for any other age group. It must be stressed, however, that the great majority of nonfatal crashes involving 16-year-old drivers result from inexperience rather than from speeding or patently risky behavior.[8]

There is evidence from MRI research that the prefrontal cortex (the area of the brain responsible for planning, impulse control, and executive decision-making) does not mature fully until the early to mid-20s.[9] Although some legislators are using such brain-development research to support limits on teenaged driving, no scientific data have yet been published that link driving behavior to neuroimaging findings.

Teenaged Passengers

With adolescent drivers, the chance of being involved in a car crash is directly proportional to the number of teenaged passengers being transported.[4,10] Compared with driving alone, 16- to 17-year-olds have a 40% increased risk of crashing when they have 1 friend in the car, double the risk with 2 passengers, and almost 4 times the risk with 3 or more teenaged passengers. This relationship was not seen with adult drivers and is much less marked with 18- to 19-year-old drivers.[4]

The most dangerous way a teenager can get to and from school is by driving in a car with a teenaged driver.[11] Open-campus school lunch policies, in which groups of teenagers drive away from school to eat, are also associated with high crash rates.[12] The underlying reasons that teenaged passengers increase driving risk are not clear. In addition to general distraction, intentional encouragement of risky driving behavior and other social interactions may play a role. For both male and female teenaged drivers, the presence of a male passenger results in faster speeds and more risky driving behaviors than does the presence of a female passenger.[13]

Nighttime Driving

Young teenaged drivers (16- and 17-year-olds) have a higher rate of nighttime crashes than do drivers of any other age group. Before nighttime driving curfews were instituted widely, only 14% of the miles driven by 16- to 17-year-old drivers occurred between 9 PM and 6 AM, yet this time period accounted for 32% of fatal crashes in this age group. Although nighttime restrictions for teenagers commonly limit driving after midnight, 58% of the fatal nighttime crashes occur in the 3-hour period before midnight.[14] For young teenaged drivers, fatal nighttime crashes are more likely to be associated with multiple teenaged passengers, speeding, and alcohol use.[15] Although it is inherently more difficult to drive in the dark for drivers of all ages, fatigue and lack of practice may play a greater role for teenagers.

Alcohol, Marijuana, and Medications

During the period 1982–2001, fatal alcohol-related crash rates decreased by 60% for 16- to 17-year-old drivers.[16] In 1982, 31% of teenagers fatally injured had an especially high blood alcohol concentration (BAC) of 0.10% or greater, but this statistic dropped to 12% by 1995–2001. Teenagers drink and drive less often than adults, but their crash risks are higher than adults when they do drink, especially at low and moderate BACs.[17] In the 2005 Youth Risk Behavior Surveillance Study, 9.9% of 9th- through 12th-graders said that in the last month they had driven after drinking, and 28.5% admitted to riding with a driver who had been drinking.[18]

The prevalence of acute marijuana use among drivers is estimated to be 1% to 6%.[19] Of those drivers involved in severe injury crashes, positive cannabis levels or self-reports of recent use have been found in higher numbers (6%–25%),[19–21] suggesting a relationship between marijuana and crashes. Much, but not all, of this relationship may be the result of other risky driving habits (positive BAC, no seat belt, speeding, sleepy while driving) that often are associated with marijuana use.[19,20]

In a study of 414 injured drivers (all ages) in Colorado, urine toxicology assays detected marijuana more frequently than alcohol (17% vs 14%).[22] Evidence from experimental studies has demonstrated impaired performance on various driving skills tests after the use of marijuana.[23] Furthermore, when just moderate doses of alcohol and marijuana were used together, a dramatic deterioration in driving performance (swerving, slowed reaction time) resulted.

A variety of prescription and over-the-counter medications, such as sedatives, analgesics, sedating antihistamines, stimulants, and antihypertensives, may have detrimental effects on driving abilities. Drug combinations and drugs mixed with alcohol can be especially

problematic. A single 50-mg dose of diphenhydramine has been shown to have a greater effect on driving performance than a BAC of 0.10%.[24] Failure to warn patients about the possibility of driving impairment from medications has resulted in successful lawsuits against physicians.

Safety Belts

As with adults, low safety belt use by teenagers results in preventable injuries and deaths. Approximately 82% of all motorists wear safety belts, but the rate reported by the National Center for Statistics and Analysis for 16- to 24-year-olds is 77%.[25] In a study of teenaged drivers who were observed arriving at high school, only 62% were wearing their seat belts.[26] The passengers of these teenaged drivers wore restraints only 47% of the time. Analysis of fatal crashes with teenaged drivers demonstrates that safety belt use is lower in high-risk situations (driving under the influence of alcohol, nighttime driving, having multiple teenaged passengers, when the car is older, and when the driver is male or unlicensed or has a suspended license). Safety belts were used by only 18% of drivers with a BAC of 0.10% or higher, compared with 40% of sober drivers.[27]

For teenaged occupants, approximately 58% of those who were killed in automobile crashes in 2004 were unbelted.[1] Because safety belts have been shown to be 45% effective in preventing front-seat fatalities, many of these deaths could have been prevented.[28] Air bags alone have been found to be only 10% effective in preventing deaths.[29] The reasons teenagers give for not wearing seat belts include not "cool," peer pressure, wrinkles clothes, traveling short distance, and feeling that "nothing will happen to me."[30] Almost half of teenagers (47%) say they feel that safety belts are "as likely to cause harm as to help," 27% said wearing a safety belt makes them "worry more about being in an accident," and 30% indicated they would feel "self-conscious if they were going against the group norm in wearing safety belts."[31] Only 27% of the actors playing motor vehicle occupants in 25 recent G-rated and PG-rated films were portrayed wearing safety belts.[32]

Vehicles Driven

There is evidence that adolescents are more likely than adults to drive smaller and older-model cars, especially if the teen is the owner of the car.[33,34] This is problematic, because smaller cars provide less crash protection than larger cars, and older-model cars often have fewer modern safety features.[35] When teenagers drive sport utility vehicles, they are significantly more likely to have a rollover than are drivers older than 24 years.[36] Sporty cars with high-performance features may encourage speeding.[37] One survey showed that parents choose cars for their teenagers more on the basis of price and style than on the basis of safety features.[33]

Distractions Including Cellular Phones

Distractions are contributing factors for motor vehicle crashes for both adolescents and adults. Eating, drinking, and adjusting the radio or the climate controls each cause more crashes than cellular phone use.[38] Cellular phone use has been estimated to increase crash rates by fourfold,[39] and hands-free models are not associated with significantly less risk.[40] There is some evidence that distractions may be a greater problem for the inexperienced driver. Distracted novice drivers tend to glance away from the road for longer periods of time, during which they have trouble responding to hazards and staying in their lane.[41]

Unlicensed Drivers

Drivers without valid licenses (unlicensed, revoked, suspended) tend to be younger and male, are more apt to have been involved in a fatal nighttime crash or to have a recent conviction for driving while intoxicated, and are more likely to have had multiple license suspensions. Approximately 5% of drivers younger than 20 years who have been involved in a fatal crash were driving with their license suspended or revoked, and 10% had never held a license.[42] Unlicensed teenaged drivers are 5 times more likely to have had a conviction for driving while intoxicated and 3 times more likely to have had a previous license suspension than are fatally injured teenagers with valid licenses.[3]

Attention-Deficit/Hyperactivity Disorder

Teenaged drivers with attention-deficit/hyperactivity disorder (ADHD) are 2 to 4 times more likely to be injured in a motor vehicle crash than are their peers without ADHD.[43] They are also more likely to have repeat traffic citations and to have their licenses suspended or revoked. Driving performance of teenagers with ADHD seems to improve with psychostimulant medication, primarily because of decreased errors of inattentiveness.[44] Compared with 3-times-a-day dosing of methylphenidate, longer-acting, controlled-release medication may result in better driving throughout the day and, particularly, during the evening hours.[45]

PROPOSED INTERVENTIONS

Graduated Licensing Systems

Since the American Academy of Pediatrics published the 1996 statement on the teenaged driver, almost all states have enacted some form of a graduated driver licensing (GDL) law. In the traditional 2-stage approach, after the novice passed vision and knowledge tests, he or she obtained a learner's permit. Because most states had no requirement for the permit to be held for a minimum time period, many teens moved quickly through this learning stage without much chance to develop adequate driving skills.[46] Once a specified age was reached,

the teenaged driver passed a road test and obtained an unrestricted license.

In contrast, in a GDL system, there are 3 stages: a learner's permit, an intermediate or provisional stage, and a regular driver's license. Each stage has specific components, restrictions, and minimum time requirements. To graduate to the next stage, the novice must spend the required time at the lower stage, acquire and demonstrate proficiency in driving skills, and not incur a driving violation for a defined period. The provisional stage, with its restrictions, is designed to give the novice a chance to gain extensive driving experience under low-risk conditions. Although currently there are inadequate research data to determine exactly when the permit and provisional stages should begin and for how long they should last, some consensus of expert opinion does exist.[47]

Initial evaluations of GDL programs have been encouraging. In Florida, the first state to pass a GDL law, the number of fatal crashes for 15- to 17-year-olds decreased by 9% in the year after the law was instituted.[48] A *Cochrane Database* review of 13 GDL programs found reductions in total crashes (26%–41%), crashes resulting in injuries (4%–43%), and crashes resulting in hospitalizations (35%) for 16-year-old drivers. Furthermore, these crash rates remained decreased for multiple years after the new GDL laws went into effect.[49] It is unlikely that safer driving by young teenagers is the main reason for decreased crash rates seen with GDL. Data show that after GDL laws are passed, there are fewer licensed young drivers and they are driving fewer unsupervised miles because of the imposed restrictions.[50] Between 1993 and 2003, the percentage of 16-year-olds who became licensed decreased by 26%, and there was a 13% decrease for 17-year-olds and a 5% decrease for 18-year-olds.[51] Over the same 10-year period, the likelihood that a 16-year-old license holder would be involved in a fatal crash remained unchanged (73–74 crashes per 100 000 license holders). Fatal crash rates per licensed driver were also unchanged for older teenaged drivers.

In addition to delay in licensure, it appears that the 3 provisions of GDL responsible for the most benefit are (1) limits on nighttime driving, (2) restrictions on the number of passengers during the intermediate stage, and (3) requirements that novice drivers remain crash and violation free for a certain period of time before advancing to the next level.[52] Unfortunately, many states have not incorporated these components into their laws. As of March 2006, the Insurance Institute for Highway Safety's evaluation of GDL laws rated 23 states and the District of Columbia as "good," 15 states as "fair," 11 states as "marginal," and 1 state as "poor."[53] For 15- to 17-year-old drivers, data from 1992–2002 show that good GDL programs decreased fatal crashes by 19%, fair programs reduced nighttime crashes by 13% (but had no effect on daytime crashes), and marginal laws had no measured benefit.[54]

Nighttime and Passenger Restrictions

Although GDL laws are effective, it is difficult to know how much each individual restriction contributes to improved crash and injury rates. Historically, when jurisdictions implemented general curfew ordinances for teenagers, crash and injury rates decreased substantially.[55] In the decade between 1993 and 2003, the percentage of fatal crashes that occurred between midnight and 5 AM remained unchanged (10%) for 16-year-old drivers.[51] Recently published evidence shows that in states with a driving restriction that starts before midnight, there has been a 13% decrease in evening crash fatalities for 15- to 17-year-old drivers.[54] Although there are no crash data to support the practice, many states exempt school, work, and religious activities from the nighttime driving restriction. The Insurance Institute for Highway Safety supports such an exemption, stating that "the intention is not to deny essential driving at night, but to limit high-risk recreational driving."[47]

Driving with fewer teenaged passengers has been proven safer. For 16-year-old drivers from 1993–2003, the proportion of fatal crashes involving teenaged passengers decreased from 53% to 44%.[51] Data from 1992–2002 for 15- to 17-year-old drivers show that the decrease in teenaged fatalities from passenger restrictions was more the result of fewer teenagers being put at risk rather than a substantial reduction in the "distraction factor" associated with teenaged passengers.[54] Unfortunately, many teenagers do not comply with a passenger restriction, many parents do not support it, and police frequently do not enforce it. As of March 2006, 44 states and the District of Columbia restrict nighttime driving to some degree, but only 21 states have driving curfews that start before midnight. Sixteen states still have not implemented any form of passenger restriction, and only 3 states and the District of Columbia maintain the passenger restriction until the driver is 18 years of age.[53]

Driver Education

Traditional driver education programs contain 30 hours of classroom and 6 hours of on-road instruction. Several reviews of the literature have shown that such courses are not effective in creating safe drivers and decreasing crash risk.[56] In fact, some studies show that high school driver education programs encourage early licensure of the youngest, most dangerous drivers, with resulting increased crashes, injuries, and deaths.[57,58] GDL laws provide an opportunity to redesign driver education for teenagers. Several states have recognized that traditional driver education courses do not have adequate behind-the-wheel training and have added GDL requirements for 20 to 50 hours of supervised driving (5–10 hours at night) during the initial permit stage. Furthermore, a

2-step approach has been suggested (but not yet widely implemented or evaluated) in which the basic course in vehicle handling and "rules of the road" are taught during the permit stage. In the second step, the intermediate stage, the student would be required to take a more advanced safety course in which skills such as hazard recognition, avoidance of risk, and adjusting to road and weather conditions are taught.[59] Courses that teach skid control and advanced maneuvering techniques should be avoided by novice drivers, because they can encourage overconfidence and a more aggressive driving style, resulting in increased crash rates.[60]

It has been suggested that driving experience, not training, is the key to becoming a safer driver.[61] When permit and provisional stages are shortened and training time is reduced for graduates of formal driver education programs, crash rates increase.[62] Some states have lowered the permit age to allow for more supervised practice, but this could potentially lead to early licensure of the youngest, most dangerous drivers.

The American Automobile Association and other organizations sell driver education materials including instruction manuals, log books, videotapes, and CD-ROMs that are designed to help parents supervise this on-road training.[63] Relatively inexpensive driving-simulation programs for use on a home computer may be beneficial in helping students learn to identify road hazards.[63,64] Whether practice on such simulators translates into safer driving or decreased crashes remains to be shown.

Alcohol-Related Measures

Two types of alcohol-related regulations exist: minimum drinking-age laws and drunk-driving laws. The latter include "zero-tolerance" alcohol laws and regulations for licensure suspension or revocation. All 50 states currently have minimum drinking-age laws that prohibit the sale of alcohol to anyone younger than 21 years. An analysis of 46 scientific studies on the efficacy of raising the minimum legal drinking age to 21 years showed a 17% median decrease in fatal automobile crashes in adolescents.[65] The National Highway Traffic Safety Administration estimates that minimum legal drinking-age laws have saved the lives of almost 24 000 18- to 20-year-olds since 1975.[3] Unfortunately, youth can still obtain alcohol relatively easily, and underaged drinkers are rarely caught or punished. For example, a study in a metropolitan area of northern California showed that minors were able to purchase alcohol in 39% of attempts.[66]

By 1998, all states had passed zero-tolerance laws that set a maximum BAC of 0.02% or less for young drivers. An offender is faced with administrative (not involving the courts) suspension or revocation of his or her driver's license. Meta-analysis of several studies revealed that fatal crash rates decreased 9% to 24% after zero-tolerance laws were enacted.[65] These laws work both by deterring youth through fear of losing their driver's license if they drive after drinking and by reinforcing the broad community disapproval of drinking and driving. Although underaged drinking is prevalent and often tolerated, drinking and driving has become less socially acceptable among youth.[67] There is evidence that drunk driving is influenced more by friends' approval or disapproval than by fear of arrest and sanction.[68]

Although youth and community educational programs such as Mothers Against Drunk Driving (MADD) and Students Against Destructive Decisions (SADD) have the potential to change knowledge and attitudes, there is little evidence to prove that they have a direct effect on youth drinking and alcohol-related driving.[67] Using a designated driver has become common, but in many instances the designated driver does not abstain from drinking alcoholic beverages.[69] On the other hand, there is significant evidence that sobriety checkpoints, an aggressive enforcement strategy, can decrease crash rates by approximately 20%.[65] Sobriety checkpoints are designed to be a deterrent to alcohol-related driving and are most effective when heavily publicized so that drivers perceive that there is a significant chance they will be caught and arrested.

Improved Safety Belt Laws

There are 2 types of safety belt laws: primary and secondary. With a primary law, a police officer can issue a citation when he or she simply observes an unbelted occupant. With secondary laws, a safety belt citation can be written only after the officer has stopped the car for another infraction. As of September 2005, 21 states and the District of Columbia have primary laws, but many of those laws are limited to the driver and front-seat passengers.[70] Safety belt use is approximately 85% in states with primary laws but only 75% in states with secondary laws.[71] Teenaged drivers killed during 1995–2000 were wearing safety belts 47% of the time in states with primary laws but only 30% of the time in states with secondary laws.[72]

Highly visible strict enforcement is the key to increasing use of restraints. People will buckle up if they perceive that they are likely to be fined. Selective traffic enforcement programs with intense media publicity and increased police patrols have been shown, at least in the short term, to increase safety belt use by 8% to 24% and decrease fatal and nonfatal injuries by 7% to 15%.[29]

GDL laws that include requirements that prohibit graduation to the next phase for a safety belt citation may be effective.[73] Although many states do require all passengers with an intermediate licensed driver to be restrained, many parents and teenagers may not be aware of this regulation.[74] Community programs that combine education, peer-to-peer persuasion, publicized enforcement (especially in schools), and parental monitoring may have some potential for increasing safety

belt use among teenagers.[73,75] Economic incentives may also increase safety belt use.[76] Technologic solutions, such as electronic safety belt reminders, safety belt use recorders, and interlock systems that do not allow the car stereo to function unless the safety belt is fastened, may be valuable but require further evaluation.[73]

Parental Interventions

With regard to teenaged driving, parents have several roles: (1) give permission for the teenager to obtain a license, (2) control access to the vehicle, (3) set family restrictions and punishments for infractions, (4) influence selection of the vehicle, (5) be a driving instructor and supervisor, and (6) serve as a role model for safe driving. Unfortunately, parents are often completely unaware of their teenager's risky driving habits.[77] They tend to place more restrictions on the details of the trip (permission, destination, time home) than on dangerous driving conditions (eg, night driving with teenaged passengers).[78]

Risky teenaged driving behaviors, traffic violations, and crashes are less common when parents impose strict limitations.[79] Although not yet studied in great detail, parent-teenager written driving contracts that clearly delineate rules and consequences may result in better communication, more restrictions, and safer parent and teenager attitudes.[78,80,81] To date, there is insufficient evidence that such contracts improve driver safety or decrease violations and crashes.

Emerging technologies, such as on-board cameras and computers, allow parents to determine whether their teenager is driving safely, but this approach has not yet been evaluated. Finally, parents must recognize their importance as positive role models in terms of safe driving and safety belt use. Parents with bad driving records are much more likely to have children who get traffic citations and are involved in motor vehicle crashes.[82]

RECOMMENDATIONS

Because motor vehicle crashes pose a major, continuing threat to the health of teenagers, the American Academy of Pediatrics makes the following recommendations.

Anticipatory Guidance by Pediatricians

Pediatricians should:

- Know their state laws regarding teenaged drivers, the teenaged driver-licensing process, and physician reporting requirements for medical conditions that could impair driving ability.
- Distribute educational materials about local GDL programs and teenaged driver safety to their adolescent patients (see Appendix 1).
- Alert parents and teenagers to high-risk situations for teenaged drivers (Table 1).

TABLE 1 Contributors to Teenaged Driver Crashes and Injury

Lack of driver experience
Young age at licensure
Failure to use safety belts
Inadequate hazard-perception skills
Distraction (cellular phone, food, drink, music)
Transporting teenaged passengers
Nighttime driving
Speeding and reckless driving
Fatigue
Unsafe vehicle choice
Alcohol use
Drug or medication use
Inadequate parental limit setting
Unlicensed or revoked license
ADHD

- Encourage seat belt use.
- Discourage distractions when driving (eating, drinking, music, cellular phones).
- Encourage teenager-parent written contracts (see Appendix 2 for sample) that place restrictions on the teenaged driver. At a minimum, parents should place restrictions on nighttime driving (preferably after 9:00 PM) and limits on the number of teenaged passengers. Initially, the rules should be fairly strict, but they can be relaxed as the teenager becomes older and gains more driving experience.
- Counsel teenagers about the dangers of driving while impaired (under the influence of alcohol, drugs, or medications or feeling ill, tired, depressed, or angry). Encourage a "safe-ride" agreement in which the teenager agrees to call the parent rather than drive while impaired and the parent promises to assist in arranging a ride home in a nonjudgmental manner.
- Encourage parents to require that the vehicle driven by the teenager is safe and in good condition.
- Advise parents that in many states, they have the authority to request that the driver's license of their minor child be revoked.
- Encourage parents to be positive role models.
- Advise parents about the various driving schools, Web sites, computer driving simulations, and parent-supervised driving lessons that are available (Appendix 1).

Community Advocacy by Pediatricians

Pediatricians should:

- Support community efforts that encourage safe teenaged driving.
- Work with schools to encourage safety belt use and discourage alcohol use.
- Discourage school systems from continuing traditional driver education programs that are ineffective and encourage licensure of young teenagers.

TABLE 2 **Essential Features That Should Be Mandated in GDL Systems**

1. A learner-permit phase that starts no earlier than 16 y of age and lasts at least 6 mo
2. A minimum of 30 h (preferably 50 h) of adult-supervised, on-road driving during the permit stage (at least 5–10 of these supervised practice hours should be at night)
3. A provisional (intermediate) stage, with restrictions, that lasts until 18 y of age
4. A nighttime driving restriction (9:00 PM to 5:00 AM until driving with provisional license for 6 mo, followed by a midnight to 5:00 AM restriction until 18 y of age)
5. Passenger limits (unless supervised by an adult)
   a. First 6 mo with provisional license: no teenaged passengers
   b. Until 18 y of age: no more than 1 teenaged passenger
6. Prompt imposition of fines, remedial driver classes, or license suspension for violation of passenger or curfew restrictions
7. Use of safety belts and appropriate child restraints by all occupants
8. No cellular phone use while in the provisional stage
9. Zero tolerance for alcohol and provisions for administrative license revocation for drunk driving, excessive speeding, or reckless driving
10. Documented safe driving record before full licensure is granted

It is suggested that states also consider a requirement for additional supervised driver experience/education (focused on hazard recognition and risk avoidance) during the provisional stage and a requirement for an additional on-road test to graduate from provisional to full licensure.

- Discourage school policies that allow students to drive off campus for lunch.
- Encourage police to enforce GDL and seat belt laws.
- Collaborate with police and media to promote sobriety checkpoints and safety belt education and enforcement programs.

Legislative Advocacy by Pediatricians

Pediatricians should:

- Support strong GDL legislation in their states (Table 2).
- Support improvement and enforcement of laws designed to limit the purchase, possession, and consumption of alcohol by underage adolescents.
- Support primary enforcement of safety belt laws for all occupants.

Involvement of the Alcoholic Beverage and Entertainment Industries in Encouraging Responsible Behavior

Pediatricians should:

- Encourage the alcoholic beverage industry to eliminate advertising aimed at youth.
- Encourage the media to avoid portrayal of speeding and reckless driving in contexts that invite imitation.
- Encourage the media to show universal use of safety belts.

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APPENDIX 1: RESOURCES FOR PEDIATRICIANS

1. American Academy of Pediatrics (www.aap.org): pediatricians can purchase a parent-teen driver agreement and fact sheet for use in their practices.
2. National Highway Traffic Safety Administration (NHTSA) (www.nhtsa.gov): the NHTSA Web site contains a booklet and a downloadable brochure about GDL (go to Traffic Safety: New Drivers). The site also has information about impaired and distracted driving, occupant protection, and other driving issues. Detailed motor vehicle crash statistics are available in the annual traffic safety facts report.
3. Insurance Institute for Highway Safety (IIHS) (www.iihs.org): the IIHS Web site contains a huge amount of information about teenaged driving and GDL programs, including specific information about the laws in each state (go to Laws & Regulations, then State Law Facts). There is also a downloadable brochure about GDL, a list of commonly asked questions about GDL, and an excellent review of the topic (Graduated Licensing: A Blueprint for North America).
4. National Safety Council (NSC) (www.nsc.org): the NSC has a publication (available for $10) titled *Teen Driver: A Family Guide to Teen Driver Safety*. This 68-page publication describes the science behind GDL recommendations and contains easy-to-understand advice for parents about setting limits and developing a teenager-parent contract.
5. AAA Foundation for Traffic Safety (www.aaafoundation.org): the AAA Foundation sells a CD-ROM with an interactive driver-simulation program for use on a personal computer (DriverZed, $13). The teenaged driver gets a chance to practice identifying and reacting to a variety of dangerous on-road situations. Similar computer simulation programs may be available from automobile insurance companies.
6. Safe Young Drivers (www.safeyoungdrivers.com): this Web site is maintained by Phil Berardelli, who wrote the book *Safe Young Drivers: A Guide for Parents and Teens*. The book (approximately $12–$15) is organized into 10 driving lessons with suggested drills and driving maneuvers to practice. The Web site has a long list of frequently asked questions about driver education.
7. Centers for Disease Control and Prevention (www.cdc.gov/ncipc): this site contains fact sheets and references about teenaged drivers and GDL. The Web-based Injury Statistics Query and Reporting System (WISQARS) can be used to find motor vehicle–related mortality and injury data according to age, gender, state, and region.
8. Network of Employers for Traffic Safety (www.trafficsafety.org): the "Novice Driver Roadmap" (available for $15) is a series of 8 practice drives, each with specific skills to be mastered. The program also contains information for the adult driving coach.
9. Substance Abuse and Mental Health Services Administration (www.samhsa.gov): the Children and Families section of the Web site contains information for parents about talking to teenagers about underaged drinking and impaired driving.
10. Daimler-Chrysler's "Road Ready Teens" (www.roadreadyteens.org): the site contains a parent guide, teen quiz, and computerized teenaged driving contract that can be easily personalized and printed.
11. Ford's "Driving Skills for Life" (www.realworlddriver.com): this Web site contains tips for parents and teenagers as well as a short program of slides and videos that focuses on hazard recognition, vehicle handling, space management, and speed management.
12. Some individual states have Web sites that contain information about their GDL programs, license-application requirements, and driver training guides for parents.
13. Several automobile insurance companies have helpful information about discounts and reward programs for teenaged drivers with excellent driving records and good grades in school.

APPENDIX 2: SAMPLE TEEN DRIVER CONTRACT

I will drive carefully and cautiously and will be courteous to other drivers, bicyclists, and pedestrians at all times. I will obey all traffic lights, stop signs, other street signs, and road makings. I will never use the car to race or to try to impress others.

I promise that I will:

- stay within the speed limit and drive safely.
- drive only when I am alcohol and drug free.
- be a passenger only with drivers who are alcohol and drug free.
- always wear a seat belt and make all my passengers buckle up.
- drive with both hands on the wheel.
- never eat, drink, or use a cellular phone while I drive.
- drive only when I am alert and in emotional control.
- never give rides to hitchhikers.

If I am impaired in any way that interferes with my ability to drive safely, I will call my parents for a ride home.

I will drive only when I have permission to use the car and I will not let anyone else drive the car unless I have permission. I will respect laws about drugs and alcohol and never allow any alcohol or illegal drugs in the car. I will only drive someone else's car if I have parental permission. I will pay for all traffic citations or parking tickets.

I will complete my family responsibilities and will maintain good grades at school.

I will contribute to the costs of gasoline, maintenance, and insurance as listed below:

_____

I agree to the following restrictions, but understand that these restrictions will be modified by my parents as I get more driving experience and demonstrate that I am a responsible driver.

For the next _____ months, I will not drive after _____ o'clock at night.
For the next _____ months, I will not transport more than ____ teenaged passengers (unless I am supervised by a responsible adult).
For the next _____ months, I won't adjust the stereo or air conditioning/heater while the car is moving.
For the next _____ months, I will not drive in bad weather.

I understand that I am not permitted to drive to "off limit" locations or on roads and highways listed below:

_____

(continued on next page)

I AGREE TO FOLLOW ALL THE RULES AND RESTRICTIONS IN THIS CONTRACT. I UNDERSTAND THAT MY PARENTS WILL IMPOSE PENALTIES (SEE BELOW), INCLUDING REMOVAL OF MY DRIVING PRIVILEGES, IF I VIOLATE THE CONTRACT. I ALSO UNDERSTAND THAT MY PARENTS WILL ALLOW ME GREATER DRIVING PRIVILEGES AS I BECOME MORE EXPERIENCED AND AS I DEMONSTRATE THAT I AM ALWAYS A SAFE AND RESPONSIBLE DRIVER.

Penalties for contract violations:

Drove after drinking alcohol or using drugs.....No driving for ____ months
Got ticket for speeding or moving violation.....No driving for ____ months
Violated night restriction.....No driving for ____ weeks/months
Violated passenger restriction.....No driving for ____ weeks/months
Broke promise about seat belts (self and others).....No driving for ____ weeks/months
Drove on a road or to an area that is "off limits".....No driving for ____ weeks/months

Signatures:

Driver_____ Date_____

Parent (or guardian)_____ Date_____

Parent (or guardian)_____ Date_____

Suggested Restrictions: Initially the restrictions on teenaged driving should be strict (no teenaged passengers and no driving after 9:00 PM). After the teenager demonstrates 6 months of SAFE driving, the restrictions may be relaxed to some degree (1 teenaged passenger, no driving after 10:00 PM or 11:00 PM). After 12 months of demonstrated safe driving, parents may choose to relax the restrictions further, depending on the maturity level of their teenager. Once the teenager obtains a full license (usually after 18 years of age), nighttime and passenger restrictions can be removed. In states with nighttime and passenger restrictions, parents should strongly consider setting stricter limits than required by law, especially for the most novice teenaged driver.

American Academy of Pediatrics

Policy Statement

Pediatrics Volume 98, Number 2 August, 1996, pp.305-307

Testing for Drugs of Abuse in Children and Adolescents (RE9628)

AMERICAN ACADEMY OF PEDIATRICS

Committee on Substance Abuse

*** ABSTRACT. The American Academy of Pediatrics (AAP) recognizes the abuse of psychoactive drugs as one of the greatest problems facing children and adolescents and condemns all such use. Diagnostic testing for drugs of abuse is frequently an integral part of the pediatrician's evaluation and management of those suspected of such use. "Voluntary screening" is the term applied to many mass non-suspicion-based screening programs, yet such programs may not be truly voluntary as there are often negative consequences for those who choose not to take part. Participation in such programs should not be a prerequisite to participation in school activities. Involuntary testing is not appropriate in adolescents with decisional capacity--even with parental consent--and should be performed only if there are strong medical or legal reasons to do so. The AAP reaffirms its position that the appropriate response to the suspicion of drug abuse in a young person is the referral to a qualified health care professional for comprehensive evaluation.**

The widespread abuse of psychoactive drugs has resulted in an increase in laboratory testing to identify abusers. The significant health and social consequences of drug abuse are intensified in the pediatric population because of the added possibilities of long-term effects in a developing person. Furthermore, immature minors are often unable to make informed, autonomous decisions about their health care, creating an impediment to diagnosis and treatment.[1,2] This statement defines the position of the American Academy of Pediatrics (AAP) on laboratory testing for drugs of abuse.

The abuse of psychoactive drugs among children, adolescents, and adults is an issue of national importance.[3] Concerns have focused not only on the physiologic and behavioral impact of drug abuse on the developing child and adolescent but also on the public health hazards that drug abusers pose to others.[4] This statement presents issues relevant to laboratory testing to identify drug users and does not discuss drug abuse in children and adolescents, which the academy strenuously opposes. Proposals for involuntary urine drug screening programs are also discussed. Testing for drugs of abuse in neonates, however, is discussed in another statement by the AAP.[5] Testing student athletes for performance-enhancing drugs not identified by routine urine toxicology tests, such as anabolic steroids and growth hormone, is not addressed.

SCREENING VERSUS DIAGNOSTIC TESTING

Screening refers to a test, examination, or procedure performed on a population to identify asymptomatic disease in apparently well persons for the purpose of early detection and treatment. Screening tests are rarely diagnostic, and confirmatory tests are usually required for a definitive diagnosis.[6,7] Diagnostic testing, however, involves specific procedures that are performed when the possibility of a disease is identified by screening, medical or social history, or physical examination. The following examples apply these principles to the identification of drug abuse. An example of screening would be the random testing of the urine of each adolescent who presents to the pediatrician's office, whereas an example of diagnostic testing would be the analysis of an individual patient's urine in whom specific signs and symptoms are indicative of substance abuse. Other examples of diagnostic testing include the laboratory confirmation of suspected drug abuse as a contributory cause of acute injuries in an adolescent patient in the emergency department and the monitoring of abstinence as part of an agreed-to substance abuse treatment program.[1,5]

The procedure used for both screening and diagnostic testing is commonly known as a urine drug screen. A drug screen ordered from a laboratory should not be confused with a drug screening program. A drug screen is a battery of tests performed on a specimen to identify the presence of one or more drugs. A laboratory report that indicates the presence of drugs should be based on a confirmatory test of high specificity. In addition, the laboratory must be certified, with the clinician being aware of its capabilities and limitations for drug testing, because these vary from facility to facility.[6,7]

INVOLUNTARY VERSUS VOLUNTARY TESTING

Voluntary testing is an imprecise concept when implemented in a population that is generally considered incompetent to consent. Therefore, testing can only be truly voluntary among young people considered competent, including many older adolescents.[2] (Decisional competency in this statement refers to the patient's ability to understand the relationship between the use of a drug, its consequences, and testing for the presence of the drug in the patient's body. The patient whose cognitive development has reached the stage of formal operational thinking approaches an ability for decisional competency. This developmental achievement reflects an ability to conceptualize cause-and-effect phenomena.)[8] However, it is not clear why such individuals would volunteer to be tested, because those who are using drugs will presumably decline. Those who have not used drugs for several days or longer may consent to testing to obtain a negative test result. Voluntary testing, therefore, is not likely to detect most drug users.

Although so-called voluntary programs may have some perceived benefits, such as providing a legitimized reason to reject peer pressure, they also can be used to coerce a person into being screened. If the majority of a group, such as an athletic team, agrees to be screened, those who refuse may be stigmatized to a degree that they feel forced into submitting. Such required voluntary group screening programs are not truly voluntary. For these reasons, the primary focus of this statement is on proposals to screen adolescents involuntarily.

REASONS FOR INVOLUNTARY SCREENING

Two reasons are generally advanced for involuntary drug screening to identify drug abuse: health promotion by identifying candidates for treatment and identifying abusers for purposes of punishment.

Health Promotion by Identifying Candidates for Treatment

The AAP does not object to diagnostic testing for the purpose of drug abuse treatment. Testing should be approached in a fashion similar to diagnostic testing for other diseases, which includes obtaining informed consent from individuals with decisional capacity. Involuntary testing would be justified only if the adolescent were at risk of serious harm that could be averted only if the specific drug were identified. If the treatment and therapy would not be changed by testing, involuntary testing would not be justified.[9-12]

Involuntary drug screening is often a condition of high school sports participation. In June 1995, a US Supreme Court ruling held that random drug testing of high school athletes is constitutional.[13] Screening would be an appropriate school requirement if the purpose were to identify conditions that, when combined with physical activity, may be hazardous to the student's health. Requiring the involuntary screening of athletes for illicit drug use, however, is often not motivated primarily by this consideration.[11,14] If the promotion of good health were the primary purpose of drug screening, the entire adolescent population--not only athletes--would be required to undergo screening because of the prevalence of illicit drug, alcohol, and tobacco use. The social, personal, and financial costs of such a program would be prohibitive, and the implication of a comprehensive non-suspicion-based screening program would be far reaching.

Because serious legal consequences may result from a positive drug screen, it is a minimal requirement that there be candid discussion regarding confidentiality and the need for informed consent from a competent individual.[2] If confidentiality issues are adequately addressed, a competent adolescent may consent to testing and counseling without the knowledge of parents, police, or school administrators.

Identification for Purposes of Punishment

Minors should not be immune from the criminal justice system, but physicians should not initiate or participate in a criminal investigation except when required by law, as in the case of court-ordered drug testing or child abuse reporting. Legal requirements for testing include an existing statute or a specific binding order. Physician involvement in police work creates the risk of establishing an adversarial rather than therapeutic relationship with a patient. There also may be constitutional objections to such activities based on privacy considerations, immunities against unwarranted search and seizure, and protection from self-incrimination. If an individual is suspected of criminal behavior, the police should obtain authorization to search for drugs and/or test for drug abuse unless specifically mandated by local statute.

Similarly, pediatricians should cautiously regard requests to initiate drug screening programs in schools where results might be used for punitive purposes or where confidentiality may be difficult to maintain. A positive therapeutic relationship with a child or adolescent should always be of paramount concern.[15] Therefore, physicians should avoid involvement with involuntary screening programs or participation in covert drug testing.

PRACTICAL CONSIDERATIONS

Screening or testing under any circumstances is improper if clinicians cannot be reasonably certain that the laboratory results are valid and that patient confidentiality is assured. This requires careful attention to the collection of specimens; the labeling, storage, and transfer of specimens to the laboratory; the avoidance of errors in recording or communicating results; the protection of the confidentiality of results; and the assurance that the techniques for identification of drugs are reliable, particularly with regard to minimizing false-positive results.[6,7] Because the consequences of inaccurate results can have profound implications, it is especially important that physicians be assured of the reliability, validity, and limitations of the testing system used.

CONCLUSIONS AND RECOMMENDATIONS

1. The AAP is opposed to the nontherapeutic use of psychoactive drugs by children and adolescents.
2. The appropriate response to suspicion of drug abuse is referral of the child or adolescent to a qualified health care professional for evaluation, counseling, and treatment as needed.
3. The role of pediatricians is one of prevention, diagnosis, counseling, and treatment or appropriate referral for care.
4. Voluntary screening may be a deceptive term, in that there often are negative consequences for those who decline to volunteer. Parental permission is not sufficient for involuntary screening of the older, competent adolescent, and the AAP opposes such involuntary screening. Consent from the older adolescent may be waived when there is reason to doubt competency or in those circumstances in which information gained by history or physical examination strongly suggests that the young person is at high risk of substance abuse.[16]
5. Diagnostic testing for the purpose of drug abuse treatment is within the ethical tradition of health care, and in the competent patient, it should be conducted noncovertly, confidentially, and with informed consent in the same context as for other medical conditions.
6. Involuntary testing in a minor who lacks the capacity to make informed judgments may be done with parental permission. Parental permission is not sufficient for involuntary testing of the adolescent with decisional capacity, and the AAP opposes such involuntary testing. Suspicion that an adolescent may be using a psychoactive drug does not justify involuntary testing, and it is not sufficient justification to rely solely on parental agreement to test the patient. Testing adolescents requires their consent unless: (1) a patient lacks decision-making capacity; or (2) there are strong medical indications or legal requirements to do so.
7. Notwithstanding the Supreme Court ruling,[13] students and student athletes should not be singled out for involuntary screening for drugs of abuse. Such testing should not be a condition for participation in sports or any school functions except for health-related purposes. Suspicion of drug use warrants a comprehensive evaluation by a qualified health care professional.

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Pediatrics. 1995;95:314-317

---------- *This statement has been approved by the Council on Child and Adolescent Health.*
The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

reaffirmed 5/99.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

POLICY STATEMENT

Testing for Drugs of Abuse in Children and Adolescents: Addendum—Testing in Schools and at Home

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Substance Abuse and Council on School Health

ABSTRACT

The American Academy of Pediatrics continues to believe that adolescents should not be drug tested without their knowledge and consent. Recent US Supreme Court decisions and market forces have resulted in recommendations for drug testing of adolescents at school and products for parents to use to test adolescents at home. The American Academy of Pediatrics has strong reservations about testing adolescents at school or at home and believes that more research is needed on both safety and efficacy before school-based testing programs are implemented. The American Academy of Pediatrics also believes that more adolescent-specific substance abuse treatment resources are needed to ensure that testing leads to early rehabilitation rather than to punitive measures only.

BACKGROUND

In 1996, the American Academy of Pediatrics (AAP) published (and reaffirmed in 2006) a policy statement titled "Testing for Drugs of Abuse in Children and Adolescents," which opposed involuntary testing of adolescents for drugs of abuse.[1] The policy statement also stated that laboratory testing for drugs under any circumstances is improper unless the patient and clinician can be assured that the test procedure is valid and reliable and patient confidentiality is ensured. This policy statement was published shortly after a 1995 US Supreme Court ruling (*Vernonia v Acton* [515 US 646]) held that random drug testing of high school athletes is constitutional. Since that time, national interest in school-based drug testing has increased. In June 2002, the US Supreme Court, in a 5-to-4 decision, ruled that public schools have the authority to perform random drug tests on all middle and high school students participating in extracurricular activities (*Board of Education v Earls* [536 US 822, 122 S Ct 2559, 153 L Ed 2 days 735 {2002}]). Writing for the majority, Justice Clarence Thomas wrote, "Testing students who participate in extracurricular activities is a reasonably effective means of addressing the School District's legitimate concerns in preventing, deterring and detecting drug use." Shortly after this Supreme Court ruling, the President's Office of National Drug Control Policy published a guidebook designed to encourage schools to incorporate drug-testing policies for all students.[2]

Interest in drug testing of adolescents reaches beyond public schools. During recent years, a substantial number of companies have begun to market home

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adolescence, substance-related disorders, substance abuse detection

Abbreviation
AAP—American Academy of Pediatrics

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drug-testing products directly to parents.[3] Products that identify alcohol and drugs in urine, saliva, and hair are now available at retail outlets and via the Internet. Pediatricians may be asked about home drug testing by parents of their adolescent patients. Pediatricians involved in school health may be asked to assist in implementing school-based drug-testing programs. For these reasons, the Committee on Substance Abuse has conducted a review of the available science on drug testing of adolescents and is issuing this addendum to the 1996 policy statement. Although much has been written on the pros and cons of testing adolescents for drugs, relatively little has been published in peer-review scientific journals.

BENEFITS AND RISKS OF DRUG TESTING IN SCHOOLS AND AT HOME

School- and home-based drug testing poses a number of potential benefits and risks. On the positive side, both procedures would likely increase the number of adolescents who are screened for use of illicit drugs. Population-based screening also offers the potential for providing early intervention and treatment services to more adolescents. The Office of National Drug Control Policy guidebook states: "Results of a positive drug test should not be used merely to punish a student. Drug and alcohol use can lead to addiction, and punishment alone may not necessarily halt this progression. However, the road to addiction can be blocked by timely intervention and appropriate treatment."[2] Proponents of drug testing also claim that the existence of a school- or home-based drug-testing program will help adolescents refuse drugs and provide legitimate reasons to resist peer pressure to use drugs, although these claims are not yet proven. On the negative side, drug testing poses substantial risks—in particular, the risk of harming the parent-child and school-child relationships by creating an environment of resentment, distrust, and suspicion.[4] In addition to the effects on the individual adolescent, the safety and efficacy of random drug testing requires additional scientific evaluation. Broad implementation of random drug testing as a component of a comprehensive drug-use prevention program should await the results of these studies.

Currently, there is little evidence of the effectiveness of school-based drug testing in the scientific literature. Goldberg et al[5] compared 2 schools, one of which implemented a mandatory drug-testing program for student athletes and the other of which did not. They found at follow-up that the use of illicit drugs, but not alcohol, was significantly lower among athletes who were drug tested. However, they also found that athletes who were drug tested experienced an increase in known risk factors for drug use, including an increase in normative views of use, belief in lower risk of use, and poorer attitudes toward the school.

A larger observational study by Yamaguchi et al,[6] which analyzed data from the national Monitoring the Future study, found no association between school-based drug testing and students' reports of drug use. Among the nationally representative group of more than 300 schools, drug testing was most commonly conducted "for cause" (ie, suspicion; 14% of schools) and was far less commonly required for student athletes (4.9% of schools) or students participating in other extracurricular activities (2.3% of schools). Regardless of the reason it was performed, drug testing was not significantly associated with reduction in the use of marijuana or any other illicit drug among students in any grade studied (ie, 8th, 10th, or 12th grade). However, 1 observational study is not sufficient to establish causation or lack of causation. In addition, no detail was provided regarding the extent of drug testing in the study schools, and at some schools, it may have been minimal. Further scientific investigation is warranted.

Laboratory testing for drugs of abuse is a technically complex procedure. To ensure the validity of the specimen, urination must be directly observed, which is a potentially embarrassing procedure for all involved, or the collector must use a fairly complex and expensive federally approved protocol, which involves documentation of a continuous chain of custody in handling and includes temperature testing and controls for adulteration and dilution.[7] Few schools will have sufficient staff with proper training to implement these costly procedures, and a recent survey of pediatricians, adolescent medicine specialists, and family physicians found that few physicians will be able to help, because less than 25% are familiar with proper procedures for collection, validation, and interpretation of urine drug tests.[8] Similarly, most parents cannot implement the federal collection protocol and, for ethical and developmental reasons, should not directly observe their teenaged children urinating. Although drug testing of hair and saliva is available, validity has not been firmly established. Questions remain regarding how passive exposure to drugs as well as differences among races and sexes can affect hair testing.[9–12] In addition, hair testing is more likely to be useful in detecting historical drug use rather than current use.[9,13] Oral fluid testing (ie, saliva or oral swab), by contrast, gives a more accurate picture of current use.[14] However, accuracy of oral fluid testing varies across drugs of abuse. Oral fluid testing performs well in detecting the use of opiates and methamphetamine, but it performs poorly in detecting the use of benzodiazepines and cannabinoids.[15–17]

Interpretation of drug tests can also be complex. School staff members and/or parents need to be able to assess possible false-positive results, especially when screening test results are positive for amphetamines or opioids. Over-the-counter cold medications containing pseudoephedrine can cause false-positive screening re-

sults for amphetamine, although follow-up testing with gas chromatography and mass spectrometry is highly specific and can reliably confirm the presence of amphetamine.[17] Ingestion of foods that contain poppy seeds makes interpretation of drug testing more difficult, because it can cause screening and gas chromatography and mass spectrometry results to be falsely positive for morphine and/or codeine.[18]

It is fairly easy to defeat drug tests, and most drug-involved youth are all too familiar with ways to do so. Even properly collected specimens must have checks for validity (eg, urine specific gravity and creatinine), because the easiest way to defeat a drug testing is by simple dilution.[19] Even when properly collected and validated, urine drug tests yield very limited information. With the exception of marijuana, the window of detection for most drugs of abuse is 72 hours or less.[19] Therefore, negative test results indicate only that the adolescent did not use a specific drug during the past several days. Even adolescents with serious drug problems may have negative test results on most occasions.[20] Standard drug-testing panels also do not detect many of the drugs most frequently abused by adolescents, such as alcohol, ecstasy (3,4-methylenedioxymethamphetamine [MDMA]), and inhalants, and information on the limitations of screening tests and ways to defeat them is widely available to adolescents via the Internet.[3] Widespread implementation of drug testing may, therefore, inadvertently encourage more students to abuse alcohol, which is associated with more adolescent deaths than any illicit drug but is not included in many standard testing panels. Mandatory drug testing may also motivate some drug-involved adolescents to change from using drugs with relatively less associated morbidity and mortality, such as marijuana, to those that pose greater danger (eg, inhalants) but are not detected by screening tests. No studies have yet been conducted on this important issue. Safety of randomly testing adolescents for the use of drugs should be scientifically established before it is widely implemented.

Drug testing may also be perceived by adolescents as an unwarranted invasion of privacy. A policy statement is being developed by the Council on School Health on the role of schools in combating substance abuse. It will discuss the potential risks of school-based drug testing and alternative approaches to school-based prevention of drug abuse. Few physicians support school-based testing of adolescents for drugs; a national survey of physicians (pediatrics, family medicine, and adolescent medicine) found that 83% disagreed with drug testing in public schools.[20]

A key issue at the heart of the drug-testing dilemma is the lack of developmentally appropriate adolescent substance abuse and mental health treatment.[21] Adequate resources for assessment and treatment must be available to students who have positive test results. However, many communities lack substance abuse treatment services dedicated to adolescents, and adult substance abuse treatment programs may be inappropriate and ineffective for adolescents.[21] Federal support for school-based drug testing should include an allocation of resources that will facilitate greater access to adolescent substance abuse treatment.

ADDITIONAL CONCLUSIONS AND RECOMMENDATIONS

1. The AAP supports rigorous scientific study of both the safety and efficacy of school- and home-based drug testing of adolescents.
2. The AAP recommends that school- and home-based drug testing not be implemented before its safety and efficacy are established and adequate substance abuse assessment and treatment services are available.
3. The AAP encourages parents who are concerned that their child may be using drugs or alcohol to consult their child's primary care physician or other health professional rather than rely on school-based drug screening or use home drug-testing products.
4. The AAP recommends that health care professionals who obtain drug tests or assist others in interpreting the results of drug tests be knowledgeable about the relevant technical aspects and limitations of the procedures.

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AMERICAN ACADEMY OF PEDIATRICS

CLINICAL REPORT
Guidance for the Clinician in Rendering Pediatric Care

John W. Kulig, MD, MPH; and the Committee on Substance Abuse

Tobacco, Alcohol, and Other Drugs: The Role of the Pediatrician in Prevention, Identification, and Management of Substance Abuse

ABSTRACT. Substance abuse remains a major public health concern, and pediatricians are uniquely positioned to assist their patients and families with its prevention, detection, and treatment. The American Academy of Pediatrics has highlighted the importance of such issues in a variety of ways, including its guidelines for preventive services. The harmful consequences of tobacco, alcohol, and other drug use are a concern of medical professionals who care for infants, children, adolescents, and young adults. Thus, pediatricians should include discussion of substance abuse as a part of routine health care, starting with the prenatal visit, and as part of ongoing anticipatory guidance. Knowledge of the nature and extent of the consequences of tobacco, alcohol, and other drug use as well as the physical, psychological, and social consequences is essential for pediatricians. Pediatricians should incorporate substance-abuse prevention into daily practice, acquire the skills necessary to identify young people at risk of substance abuse, and provide or facilitate assessment, intervention, and treatment as necessary. *Pediatrics* 2005;115:816–821; *tobacco, alcohol, drugs, substance abuse.*

ABBREVIATION. AAP, American Academy of Pediatrics.

PERVASIVENESS OF DRUG USE

In a recent public opinion poll of Americans' views of the top 2 or 3 problems facing adolescents today, 67% identified drugs or drug abuse, 13% identified alcohol abuse, and 6% identified smoking. In the same poll, a question assessing Americans' views of the seriousness of 36 health problems revealed that drug abuse (82%) was rated higher than cancer (78%), followed by drunk driving (75%), smoking (68%), and alcohol abuse (65%).[1]

The pattern of substance abuse among adolescents has changed significantly during the past 35 years. Before the late 1960s, it was predominantly adults who were abusing alcohol and other psychoactive drugs, including tobacco. Beginning in the late 1960s and early 1970s, substance abuse became widespread among adolescents and, more recently, among preadolescents. Alcohol and tobacco as well as opiates, cocaine, amphetamines, barbiturates, marijuana, hallucinogens, anabolic steroids, and prescription and nonprescription medications and inhalants (volatile substances) are used and abused by many adolescents and a growing number of preadolescents.[2] Tobacco use in these groups represents a significant health threat and is associated with an increased likelihood of future use of marijuana and other illicit drugs.[3,4] In *Healthy People 2010*,[5] multiple national goals have been established to decrease child and adolescent substance use (Table 1).

Three periodic surveys track national trends in use of alcohol, tobacco, and other drugs by adolescents: (1) the annual Monitoring the Future Study[6] of students in grades 8, 10, and 12; (2) the biannual Youth Risk Behavior Survey[7] of students in grades 9 through 12; and (3) the annual National Household Survey on Drug Abuse (renamed in 2003 to the National Survey on Drug Use and Health),[8] in which computer-assisted interviewing is conducted in the home for residents 12 years and older. In reviewing survey data and published reports, pediatricians should be aware that adolescent substance use may be reported as lifetime, annual, 30-day, 2-week, or daily.

Alcohol and tobacco use often begins in adolescence or earlier. Data analysis from the National Survey on Drug Use and Health[9] demonstrates that adolescents who smoke or drink experience immediate negative health consequences and report poorer health during adolescence than those who do not. Alcohol is involved in more than one third of the deaths attributable to unintentional injury, homicide, and suicide, which together account for 76% of mortality in the 15- to 19-year age group. By the end of high school, 77% of students have tried alcohol, and 46% have done so by eighth grade. More than half (58%) of 12th-grade students and one fifth (20%) of 8th-grade students report having been drunk at least once in their life.[6] Tobacco is associated with the 5 leading causes of death in adult Americans, accounting for 435 000 deaths annually.[10] By the 12th grade, 54% of American youth have tried cigarettes and 24% are current smokers.[6] Alcohol and tobacco are often referred to as licit (or lawful) drugs, but in the United States the legal age for use of alcohol remains 21 years or older, and the legal minimum age for purchase of tobacco remains 18 years.

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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TABLE 1. *Healthy People 2010*: Child- and Adolescent-Specific Goals for Substance Use[5]

7-2	Increase the proportion of middle, junior high, and senior high schools that provide school health education to prevent health problems in the following areas: unintentional injury; violence; suicide; tobacco use and addiction; alcohol and other drug use; unintended pregnancy, HIV/AIDS, and sexually transmitted diseases; unhealthy dietary patterns; inadequate physical activity; and environmental health.
16-18	Reduce the occurrence of fetal alcohol syndrome.
26-1	Reduce deaths and injuries caused by alcohol- and drug-related motor vehicle crashes.
26-6	Reduce the proportion of adolescents who report that they rode, during the previous 30 days, with a driver who had been drinking alcohol.
26-9	Increase the age and proportion of adolescents who remain alcohol- and drug-free.
26-10	Reduce past-month use of illicit substances.
26-11	Reduce the proportion of persons engaging in binge drinking of alcoholic beverages.
26-14	Reduce steroid use among adolescents.
26-15	Reduce the proportion of adolescents who use inhalants.
26-16	Increase the proportion of adolescents who disapprove of substance abuse.
26-17	Increase the proportion of adolescents who perceive great risk associated with substance abuse.
27-2	Reduce tobacco use by adolescents.
27-3	Reduce the initiation of tobacco use among children and adolescents.
27-4	Increase the average age of first use of tobacco products by adolescents and young adults.
27-7	Increase tobacco-use cessation attempts by adolescent smokers.
27-9	Reduce the proportion of children who are regularly exposed to tobacco smoke at home.
27-14	Reduce the illegal buy rate among minors through enforcement of laws prohibiting the sale of tobacco products to minors.
27-16	Eliminate tobacco advertising and promotions that influence adolescents and young adults.
27-17	Increase adolescents' disapproval of smoking.

Overall, more than half (51%) of American youth have tried an illicit (unlawful) drug by the time they complete high school. Data obtained in 2003 from the Monitoring the Future survey document a second year of decline in the use of ecstasy (3,4-methylenedioxymethamphetamine [MDMA]) by adolescents and young adults, with lifetime prevalence of 8.3% by the 12th grade, reversing a sharp increase that began in 1998 and peaked at 11.7% in 2001. Lifetime use of marijuana (46%), amphetamines (14%), tranquilizers (10%), barbiturates (9%), lysergic acid diethylamide (LSD [6%]), and inhalants (11%) showed gradual decreases among high-school seniors. Lifetime use held steady for cocaine (8%), anabolic steroids (4%), heroin (2%), and 3 of the "club drugs": Rohypnol, gammahydroxybutyrate (GHB), and ketamine (each less than 2%). Among 12th-graders, no drug showed increased use in 2003. Divergence in trends for substance use is attributable in part to perceived benefits and perceived risks of each drug. Perception of risks often lags behind perception of benefits; thus, newly introduced drugs experience a "grace period," as was seen with ecstasy. Older drugs may be rediscovered by youth, in a process termed "generational forgetting," as knowledge of adverse consequences fades.[6]

Possible factors implicated in changing patterns of substance use include a decrease in perceived risk, fewer school-based substance-abuse prevention programs, pervasive messages in the electronic and print media as well as advertisements that glamorize tobacco and alcohol, and changing patterns of parenting in the 1990s.[2,11] The perception that casual use of recreational drugs is not a significant concern is held by many adults as well, including a sizable number of pediatricians surveyed by the American Academy of Pediatrics (AAP) in 1995. Although the prevalence of drug use may vary from community to community, there is general agreement that use of tobacco and alcohol at an early age is a predictive factor for use of other drugs, use of a greater variety of drugs, and use of more potent agents.[3,4] Furthermore, the onset of tobacco addiction occurs primarily among children. Most adults who smoke began to do so before 19 years of age, at an average age of 12 years; most were regular smokers by 14 years of age. Thus, it is critical for pediatricians to be knowledgeable about smoking prevention and treatment measures. Youth-oriented prevention and cessation interventions can be successful, as demonstrated by a recent decrease in tobacco use.[12] Cigarette smoking among adolescents continued to decrease significantly in 2003, extending a trend that began in 1997. Daily smoking by eighth-graders decreased by half (10.4% to 4.5%) since the recent peak in 1996.[6]

BARRIERS TO PHYSICIAN INVOLVEMENT

Data from a periodic survey of AAP members[13] in 1995 indicate that fewer than 50% of pediatricians screen adolescent patients for substance abuse. Primary barriers to physician involvement in prevention, screening, and management of substance abuse include: (1) time constraints associated with high patient volume; (2) inadequate reimbursement relative to the time and effort required to address sub-

stance-abuse disorders with patients and their families; (3) physician fear of alienating or labeling patients and their families; (4) inadequate education and training in substance abuse and addiction; (5) lack of dissemination to physicians of research supporting positive treatment outcomes and negative effects of failure to intervene early in substance abuse; and (6) lack of information about how to access referral and treatment resources. A White House conference[14] recently defined 3 levels of core competencies for clinicians to address substance-abuse issues, ranging from screening and referral to assuming responsibility for long-term treatment.

MAXIMIZING THE PEDIATRIC EVALUATION

Given their longstanding relationship with patients and their families, primary care pediatricians may be the only health care professionals in a position to recognize problems with substance abuse as they develop. This relationship may also facilitate referral and provide support through the process of substance-abuse evaluation and treatment and during recovery and aftercare.

Adolescent substance abuse may be the most commonly missed pediatric diagnosis. Primary care pediatricians, pediatric medical subspecialists, and pediatric surgical specialists need to maintain a high index of suspicion and be aware of both the medical and behavioral presentations of substance use as well as its association with psychiatric comorbidity. Newly published resources provide guidelines for pediatric office assessment of substance abuse.[2,15]

Appropriate interviewing techniques are critical in obtaining a comprehensive substance-abuse history. Confidentiality is central in this issue, and the most useful information will be obtained in an atmosphere of mutual trust and comfort. Adolescents should be interviewed privately during each office visit with assurance of limited confidentiality.[16] This approach is appropriate for many preadolescents as well.

Although substance abuse commonly has behavioral manifestations, pediatricians should recognize medical manifestations as well. Even an apparently straightforward complaint such as headache or sore throat may be associated with underlying substance use. Trauma, chronic cough, chest pain, worsening asthma unresponsive to therapy, or abdominal complaints associated with gastritis, hepatitis, and even pancreatitis may be signs of substance abuse. Open-ended questions are usually the most nonthreatening to the patient, and an empathic, nonjudgmental style of interviewing facilitates the development of an honest doctor-patient relationship. It may be helpful to begin with questions about the patient's attitudes toward use of tobacco, alcohol, and other drugs within his or her environment (home, school, and friends) rather than probing personal beliefs or habits. This questioning may lead logically to inquiry about the patient's experiences with tobacco, alcohol, and other drugs. Many clinicians use structured interviews and questionnaires to elicit a substance-abuse history.[2] The CRAFFT questionnaire was validated recently as 1 of the few brief screening tools specific to identifying adolescent alcohol and substance abuse (Table 2).[17]

TABLE 2. CRAFFT: Questions to Identify Adolescents With Substance Abuse Problems[17]

C	Have you ever ridden in a *c*ar driven by someone (including yourself) who was "high" or had been using alcohol or drugs?
R	Do you ever use alcohol or drugs to *r*elax, feel better about yourself, or fit in?
A	Do you ever use alcohol or drugs while you are by yourself, or *a*lone?
F	Do you ever *f*orget things you did while using alcohol or drugs?
F	Do your family or *f*riends ever tell you that you should cut down on your drinking or drug use?
T	Have you ever gotten into *t*rouble while you were using alcohol or drugs?

Two or more "yes" answers suggest that the adolescent may have a serious problem with substance abuse, and additional assessment is warranted.

Research has identified multiple risk and protective factors that influence adolescent substance use (Table 3).[2,18–21] Obtaining an age-appropriate psychosocial history such as family and peer relationships, academic progress, nonacademic activities, acceptance of authority, degree of self-esteem, and ongoing episodes of intrafamilial or extrafamilial conflict may reveal risk and/or protective factors for current or future substance abuse. These issues should be part of a routine history when a patient 8 years or older is seen for health care.

Family history is especially important, because substance abuse among family members is associated with childhood behavior problems, school problems, and multiple somatic complaints. It is estimated that 1 in 5 children grows up in a home in which there is someone who abuses alcohol or other drugs.[22] Inquiry regarding the extent of tobacco, alcohol, or other drug use by family members and peers should be a part of the routine history of every child who is seen in the pediatrician's office. After questioning, an age-appropriate discussion of the possible consequences of such use should be held with the child and his or her parent or guardian. If this discussion reveals a family history of chemical dependency, the pediatrician should address the issue and make appropriate referrals for care.

Inquiry regarding other risk behaviors is also important in dealing with the issue of substance abuse. Research suggests behaviors such as early sexual activity, membership in gangs, illegal use of firearms, use of drugs while riding in or driving a motor vehicle, and engaging in other illegal activities are clustered: those who engage in 1 risk behavior are more likely to engage in others.[4]

Information should be obtained on the adolescent's use of specific drugs, including tobacco and alcohol; the extent of such use; settings in which the use occurs; and the degree of social, educational, and vocational disruption attributable to drug use. Continually updated Web sites (Table 4) may be useful in obtaining general information about substance abuse, following national trends, and identifying

TABLE 3. Risk and Protective Factors Associated With Adolescent Use of Tobacco, Alcohol, and Other Drugs[2,18–21]

	Risk Factors	Protective Factors
Individual	Early initiation of substance use	Late initiation of substance use
	Attitude favorable to substance use	Perceived risk of substance use
	Low self-esteem or poor coping skills	Positive sense of self, assertiveness, social competence
	Early antisocial or delinquent behavior	
	Psychopathologic problems, particularly depression	
	Attention-deficit/hyperactivity disorder	Pharmacotherapy for attention-deficit/hyperactivity disorder
	Conduct disorder or aggressive behavior	
	Sensation seeking, impulsivity, distractibility	Resilient temperament
	Perinatal complications or brain injury	
	Low intensity of religious beliefs and observance	High intensity of religious beliefs and observance
	Rebelliousness and alienation from the dominant values of society and conventional norms	Positive social orientation, adoption of conventional norms about substance use
Family	Permissive or authoritarian parenting	Authoritative parenting, parental monitoring of activities
	Parental and older sibling use of alcohol, tobacco, or other drugs	Clearly communicated parental expectation of nonuse and clear rules of conduct consistently enforced
	Family history of alcoholism	Parent in recovery
	High levels of family conflict	Positive, supportive relationships with family
	Parental divorce during adolescence	Open communication with parents
	Child abuse and neglect or sexual abuse	Supportive relationships with prosocial adults
Peers	Friends who drink, smoke, or use other drugs	Friends not engaged in substance use
	Perceived peer drug use	Peer disapproval of substance use
School	Poor academic achievement and school failure	Good academic achievement and school success
	Low interest in school and achievement	High academic aspirations
Community	Disorganization in the community or neighborhood	Less acculturation and higher ethnic identification
	Availability of tobacco and alcohol	Increased legal smoking and drinking ages
	Marketing of tobacco and alcohol	Increased excise taxes on tobacco and alcohol
	Availability of licit and illicit drugs	Strict law enforcement
Sociocultural	Media portrayal of substance use	Media literacy
	Advertising licit substances	Comprehensive, theory-based antidrug education programs

TABLE 4. Internet Resources

Government agency Web sites
National Institute on Drug Abuse: www.drugabuse.gov
National Institute on Alcohol Abuse and Alcoholism: www.niaaa.nih.gov
Substance Abuse and Mental Health Services Administration: www.samhsa.gov
National survey Web sites
Monitoring the Future: www.monitoringthefuture.org
Youth Risk Behavior Surveillance: www.cdc.gov/nccdphp/dash/yrbs
National Survey on Drug Use and Health: http://oas.samhsa.gov/nhsda.htm
Street-drug name Web sites
Office of National Drug Control Policy: www.whitehousedrugpolicy.gov/streetterms/default.asp
Addictions & Life Page: www.cox-internet.com/dabster/slang.htm

drugs of abuse by their "street names," which often vary by geographic region. Adolescents may display varying degrees of honesty when discussing their use of tobacco, alcohol, and other drugs. Use may be exaggerated or minimized, and the pediatrician may need to rely on other contextual clues such as mood, appearance, and physical and behavioral symptoms (such as illegal activity or problems at home or school) to fully assess usage patterns.

DRUG TESTING

Laboratory investigation (drug testing) may be used when it is necessary to determine the cause of dysfunctional behavior and other changes in mental status or suspicious physical findings. It is important to differentiate between screening and testing for drugs of abuse. "Screening" is a technique used to evaluate broad populations, such as screening all athletes trying out for a school team. "Testing," on the other hand, implies evaluation on the basis of a clinical suspicion of use. Guidelines published by the AAP[23] as well as issues of consent and confidentiality[16] should be considered when deciding whether to use drug testing in the diagnosis and management of substance abuse. When obtaining urine for testing, it is critical that accidental or purposeful contamination, dilution, or substitution be avoided. Office policies should be developed to preserve the chain of custody in processing urine specimens for testing. Knowledge about the capability of the laboratory to identify specific substances and the sensitivity and specificity of the procedures used is necessary when such testing is ordered.[24]

Initially, a clinical history of substance abuse may obviate the need for testing. In general, testing should be performed only with the patient's consent. Exceptions include situations in which the patient's mental status or judgment is impaired. Testing is often used as a routine component of treatment and maintenance of abstinence.

OFFICE MANAGEMENT

The preadolescent or adolescent who admits repeated use of alcohol, tobacco, or other drugs re-

quires careful evaluation to determine appropriate intervention and treatment. Any substance use by preadolescents carries extraordinary risk because of the likelihood of progression to the use of additional and more dangerous substances and the effect of such use on physical, physiologic, neurologic, and emotional development.

Intervention is required for any patient when substance use is having an effect on academic, social, or vocational functioning. Use of substances in association with other risk behaviors also warrants immediate intervention. Substance abuse in adolescence is often associated with psychiatric comorbidity, such as depression, bipolar disorder, posttraumatic stress disorder, oppositional-defiant disorder, attention-deficit/hyperactivity disorder, schizophrenia, bulimia nervosa, and social phobia.[25] Referral of adolescents with suspected "dual diagnosis" to a mental health professional for additional evaluation and management is indicated.[25] Clinicians may wish to refer to the *Diagnostic and Statistical Manual for Primary Care (DSM-PC) Child and Adolescent Version* for assistance in classification of substance use behaviors.[26]

Adolescents may be more able to accept that they need help if they are shown how their use has progressed from occasional use in safe situations to more regular use in more risky situations. Discussing reasons and motivations to quit using tobacco, alcohol, and other drugs may encourage the adolescent to consider changing such behaviors and to recognize the importance of seeking treatment. Pediatricians with an interest in substance-abuse treatment may also consider implementing brief, office-based interventions incorporating motivational interviewing and cognitive-behavioral therapy for their substance-abusing patients.[27,28] Help may consist of 1 or more of the following approaches: counseling (family or individual); behavioral therapy; inpatient or outpatient drug treatment; psychologic evaluation and/or testing; psychiatric assessment; and drug detoxification. Environmental changes such as living in a different community with a relative may be integrated with any of these options. Pediatricians can be most helpful if they are familiar with the referral resources within their communities, including private and public facilities, those offering inpatient and outpatient treatment, and the capability to treat adolescents from diverse backgrounds. Availability of the pediatrician for follow-up after successful treatment is essential for relapse prevention.[28]

A far more common scenario is the use of drugs, particularly alcohol and marijuana, as an occasional activity without disruption of behavior or academic performance. Because many adolescents and their families do not regard such use as a health issue, the pediatrician will need to offer advice regarding the associated risks although no such advice has been solicited. At other times, the pediatrician may be asked to help resolve a conflict between parent and child over the use of these drugs. Thus, pediatricians need to be knowledgeable, objective, and able to give adolescents and their families accurate information on the health and safety hazards of using tobacco, alcohol, and other drugs. Recently published AAP statements have addressed alcohol,[29] tobacco,[30] and marijuana[31] use as well as indications for management and referral of patients.[32]

Even infrequent casual use poses increased risk of serious problems, including abuse, date rape, and intentional or unintentional injury. Of 1023 consecutive admissions at 1 trauma unit (two thirds from automobile crashes), approximately half of the patients tested positive for alcohol, marijuana, or both. Positive tests for both were found in one third of those affected, and marijuana and alcohol alone each accounted for one third.[33] Death and serious injury often result from risk-taking behavior while impaired.

Pediatricians hold valued, respected positions with their patients and their patients' families and within the community. Armed with the knowledge of normal adolescent development, the pediatrician has the unique ability to provide appropriate anticipatory guidance and counseling in substance-abuse prevention and to place tobacco, alcohol, and other drug use in the context of risk behavior in general, which may lead to the identification of other risk behaviors and provide the opportunity to intervene by encouraging protective behaviors.

ADVICE FOR PEDIATRICIANS

The AAP advises the following actions to promote the pediatrician's role in the prevention and management of tobacco, alcohol, and other drug abuse.

1. Pediatricians are encouraged to:
   - Be knowledgeable about the prevalence, patterns, cultural differences, and health consequences of substance abuse in their community; incorporate substance-abuse prevention into anticipatory guidance at routine and episodic office visits; be aware of the manifesting signs and symptoms of substance abuse, the association with other risk behaviors, and the possibility of dual diagnoses with other mental health disorders; be able to screen for and evaluate the nature and extent of substance use among patients and their families; be aware of confidentiality issues related to substance abuse, including obtaining patient consent before drug testing; be aware of community services for evaluation, referral, and treatment of substance-abuse disorders; and be available to provide aftercare for adolescent patients completing substance-abuse treatment programs and to assist in their reintegration into the community.
   - Serve as a community resource for smoking prevention and cessation and as a community resource for evidence-based substance-abuse prevention initiatives.
   - Advocate for community-based prevention and treatment services.
2. Patients and their families should be advised that even casual use of alcohol, tobacco, and other

drugs by children and adolescents, regardless of amount or frequency, is illegal and has potential adverse health consequences.

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Technical Report—Tobacco as a Substance of Abuse

Tammy H. Sims, MD, MS AND THE COMMITTEE ON SUBSTANCE ABUSE

KEY WORDS
tobacco use, smoking, adolescents, youth, smoking cessation

ABBREVIATIONS
AAP—American Academy of Pediatrics
FDA—Food and Drug Administration

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abstract

Tobacco use is the leading preventable cause of morbidity and death in the United States. Because 80% to 90% of adult smokers began during adolescence, and two thirds became regular, daily smokers before they reached 19 years of age, tobacco use may be viewed as a pediatric disease. Every year in the United States, approximately 1.4 million children younger than 18 years start smoking, and many of them will die prematurely from a smoking-related disease. Moreover, there is recent evidence that adolescents report symptoms of tobacco dependence early in the smoking process, even before becoming daily smokers. The prevalence of tobacco use is higher among teenagers and young adults than among older adult populations. The critical role of pediatricians in helping to reduce tobacco use and addiction and secondhand tobacco-smoke exposure in the pediatric population includes education and prevention, screening and detection, and treatment and referral. *Pediatrics* 2009;124:e1045–e1053

TOBACCO AS A SUBSTANCE OF ABUSE

Tobacco products contain the addictive drug nicotine as well as many other toxic chemicals. The use of tobacco, in any form, can lead to addiction, significant morbidity, and premature death. There are several different ways in which tobacco is used, including smokeless chewing tobacco and snuff, as well as tobacco that is smoked through a hookah or water pipe or as a cigar (large cigar, cigarillo, or little cigar), bidi, kretek, or cigarette. Because cigarette smoking is the most prevalent method of tobacco use, it will be the predominant focus of this report. Tobacco smoke contains thousands of toxic chemicals, including many known carcinogens. There is no safe method, level, frequency, or duration of tobacco use or exposure.[1] Moreover, smokeless tobacco is not a safe alternative to cigarette smoking. A policy statement[2] and additional technical report[3] from the American Academy of Pediatrics (AAP) accompany this technical report.

Nicotine in tobacco is a powerfully addictive substance with multiple physiologic and psychological effects. Like many other drugs of addiction, it activates the same brain reward system involved in pleasurable activities such as eating and sexual activity.[4,5] Tobacco withdrawal symptoms make it difficult for individuals to quit, are variable among individuals, and usually include unpleasant effects such as anxiety, irritability, difficulty concentrating, restlessness, impatience, hunger, tremor, racing heart, sweating, dizziness, nicotine craving, insomnia, drowsiness, headaches, digestive disturbances, and depression.[6] The addictive nature of nicotine combined with the unpleasant withdrawal

symptoms experienced when individuals try to quit are what make nicotine dependence such a chronic, relapsing disease.

EPIDEMIOLOGY OF TOBACCO USE

Tobacco addiction usually begins in childhood or adolescence.[7,8] Children younger than 10 years have reported experimenting with tobacco. Every year in the United States, approximately 1.4 million children younger than 18 years start smoking, and many of them will die prematurely from a smoking-related disease.[9] The prevalence of tobacco use among teenagers and young adults is comparable to and slightly higher than prevalence rates among other adult populations. According to data from the 2007 National Health Interview Survey, an estimated 19.7% of all adults in the United States are current cigarette smokers. In comparison, 20% of high school students are current smokers.[10] The prevalence of current cigarette use is highest among 12th-grade students (26.5%), followed by 11th-grade (21.6%), 10th-grade (19.6%), and 9th-grade (14.3%) students.[10] Unfortunately, the prevalence of quitting (ie, the percentage of those who have ever smoked and who are now former smokers) is lower among younger age groups than among older adults. Approximately 21.3% of male and 18.7% of female high school students in the United States are current cigarette smokers, defined as use in the previous 30 days. Rates of current smokers are highest among non-Hispanic white high school students (23.2%), followed by Hispanic (16.7%) and non-Hispanic black (11.6%) students.[10] Among US middle school students, approximately 6.3% are current cigarette smokers, and estimated rates are slightly higher for girls (6.4%) than for boys (6.3%). Approximately 6.5% of white students, 6.8% of Hispanic students, 5.5% of black students, and 2.6% of Asian American students in middle school are current cigarette smokers.[11] Cigarette-smoking estimates in the US adult population according to age are as follows: 18 to 24 years: 23.9%; 25 to 44 years: 23.5%; 45 to 64 years: 21.8%; and 65 years or older: 10.2%.[12]

In the United States, approximately 7.9% of high school students are current smokeless-tobacco users, defined as use of smokeless tobacco on at least 1 day during the 30 days before the survey. The prevalence of current smokeless-tobacco use is higher among male (13.4%) than among female (2.3%) students and higher among white (10.3%) than among Hispanic (4.7%) or black (1.2%) students. Regarding current cigar use, 13.6% of high school students had smoked cigars, cigarillos, or little cigars on at least 1 day during the 30 days before the survey. Overall, the prevalence of current cigar use was higher among male (19.4%) than among female (7.6%) students and higher among white (14.8%) than among Hispanic (12.7%) and black (10%) students.[10]

Education and Socioeconomic Status

There is an inverse relationship between rates of cigarette smoking and both socioeconomic status and education in young people and adults. For example, in 2006, smoking a half-pack or more per day was approximately 3 times as prevalent among 12th-graders who were not going to college as among those who were college bound (13.0% vs 3.9%, respectively). Among survey respondents of college age (1–4 years past high school), those not enrolled in college had a dramatically higher rate of half-pack-a-day smoking than those who were in college (17.0% vs 4.9%, respectively).[13] Cigarette-smoking prevalence is highest for adults with a general education development (GED) diploma (46.0%) or 9 to 11 years of education (35.4%) and lowest for adults with an undergraduate college degree (9.6%) or a graduate college degree (6.6%).[12]

Tobacco Use and Mental Illness

Nicotine dependence is more common among adults with mental health disorders such as schizophrenia and depression. Likewise, in youth, tobacco use may be a marker for mental health problems such as depression and anxiety disorders.[14–19] Tobacco use may represent a means of self-treating symptoms often associated with these disorders.[20] Depending on the population studied, 55% to 90% of individuals with other mental disorders smoke, compared with approximately 20% in the general population. Mood disorders, anxiety, and other substance use–related disorders may be more common in individuals who smoke than in those who are former smokers and those who have never smoked.[14–19]

Facilities that offer mental health services often do not treat tobacco addiction[21,22]; however, inpatient mental health and substance abuse treatment facilities with no-smoking policies have been successful in promoting smoking cessation, even among adolescents.[23,24] Monihan et al[25] reported that after implementing a smoking ban, some inpatient psychiatric facilities noted an increase in staff satisfaction and a significant decrease in violence and behavioral problems related to smoking habits. These results lend support to the recommendation that inpatient facilities should offer tobacco-addiction treatment.

Tobacco Use Among Lesbian, Gay, Bisexual, and Transgender Youth

Studies show that lesbian, gay, bisexual, and transgender youth are significantly more likely than heterosexual youth to engage in high-risk behaviors (such as fighting, substance use, and

alcohol use).[26,27] Adolescents who report same-sex attraction or activity were 2.5 times as likely to smoke at least weekly compared with heterosexuals; bisexual/lesbian girls were 9.7 times more likely.[28] Ryan et al[29] found that 59% of teenagers who classified themselves as lesbian, gay, or bisexual reported using tobacco (compared with 35% of heterosexual teenagers), and almost half tried their first cigarette before 13 years of age. Lesbian and gay teenagers are also 4 times more likely than their heterosexual counterparts to use smokeless-tobacco products. Given that these youth are at considerable risk of tobacco use, population-specific tobacco-prevention and -cessation strategies are warranted.

INITIATION OF TOBACCO USE AND ONSET OF ADDICTION

Initiation of tobacco use is considered multifactorial. Several factors are involved in influencing youth to experiment with tobacco, including socioenvironmental (eg, advertising/media influences, peer influences, parental influences, ethnic and gender factors), psychological (eg, psychiatric illness or history, child development, weight concerns), and biological (eg, genetics) factors.[8,30–38] Teenagers with at least 1 smoking parent are twice as likely to become smokers compared with teenagers whose parents do not smoke.[39] This is attributed to the availability of tobacco products in the home, modeling of the behavior, and the hypothesized role of nicotine receptor priming as a result of being exposed to nicotine in utero and secondhand smoke after birth.

Studies of twins and cigarette smoking have indicated that genetic influences play a crucial role in smoking initiation, persistence, and ability to quit smoking, with the heritability of smoking initiation considered to be 50% and that for smoking persistence to be 70%.[40–43] It is hypothesized that multiple polymorphic genes are involved, with each modestly increasing the risk of developing nicotine dependence.[40,41,44,45] These genes affect nicotine metabolism as well as the dopamine receptors and transporters that mediate reward in the brain nucleus accumbens.[46]

Peer influences are also important in the uptake of tobacco use; teenagers with more friends who smoke are more likely to start smoking. Teenagers who have an inaccurately high perception of smoking prevalence among their peers and who believe that smoking is popular among the elite/successful elements of society are more likely to smoke.[47] Studies have also shown among adolescent girls a relatively consistent association between having higher body weight or concerns about weight and a greater likelihood of smoking.[48]

Nicotine is the primary addictive component in tobacco. Like other drug addictions, nicotine addiction is a chronic condition with the potential for periods of relapse and remission throughout life. The time interval from experimentation or initiation of tobacco use to regular use varies considerably among individuals but typically averages 2 to 3 years.[8] Experts traditionally believed that nicotine addiction developed after 2 or 3 years of regular tobacco use, but recent evidence has shown that symptoms of nicotine addiction may be apparent in some youth after short-term use of tobacco.[49–51] DiFranza et al[51] demonstrated that 10% of youth who become hooked on cigarettes exhibit "loss of autonomy" within 2 days of first inhaling from a cigarette, and 25% demonstrate evidence within 1 month. The study also revealed that even adolescents who smoke only a few cigarettes per month and those who have smoked as few as 100 cigarettes can suffer physical and psychological withdrawal symptoms when they attempt to quit using tobacco and are deprived of nicotine. Despite not yet being daily smokers, these youth may benefit from help to overcome withdrawal symptoms. Adolescent tobacco users often underestimate the addictive nature of nicotine. Of adolescent smokers who reported believing that they would not be smoking in 5 years, approximately 75% were still smoking 5 to 6 years later.[8] The younger a person is when starting tobacco use, the more likely he or she is to become heavily addicted to nicotine and experience more difficulty with trying to quit.[52] This is likely related to the vulnerability of the developing brain, because animal research has shown that the adolescent brain is more susceptible than the adult brain to the reinforcing effects of nicotine.[53]

SOURCES OF TOBACCO USED BY YOUTH

Youth obtain tobacco from a variety of sources. Noncommercial sources of tobacco include friends, siblings, parents, relatives, and even baby-sitters.[54] Youth most commonly obtain their first cigarettes from friends or siblings, although stealing their first cigarettes from parents is not uncommon.[54] After the first cigarette, those who continue to smoke typically will rely on same-aged friends as their first steady source.[55] Sharing cigarettes among friends is very common. In 1 study, 99% of young smokers reported having, at some time, obtained tobacco from friends.[54]

The 2007 Monitoring the Future survey revealed that 56% of 8th-graders and 78% of 10th-graders said cigarettes were easy for them to get.[56] Although all states have laws that prohibit the sale of tobacco products to people younger than 18 years, the level of enforcement of these prohibitions varies.

The 2003 National Survey on Drug Use and Health revealed that among 12- to 17-year-olds who had smoked in the previous month, more than three quarters of them (77%) had purchased their own cigarettes. More than half (53.3%) had directly purchased their own cigarettes; 63.3% had given money to others to buy cigarettes for them; nearly one third (30.5%) had purchased cigarettes from a friend, family member, or someone at school; and a small portion had purchased cigarettes over the Internet or through the mail (2.6% and 2.9%, respectively). In addition, 62% had "bummed" cigarettes from others, and 13.1% had taken cigarettes from others without asking, with 0.8% having stolen cigarettes from a store. Older underaged smokers were more likely to buy directly in stores than were younger smokers.

TOBACCO AS A GATEWAY DRUG

Tobacco is often described as a gateway drug that can lead to the use and abuse of other substances. Teenagers who smoke are 3 times more likely than nonsmokers to use alcohol, 8 times more likely to use marijuana, and 22 times more likely to use cocaine.[1,57] Smoking has been associated with other high-risk behaviors including high-risk sexual practices, such as having multiple sexual partners or unprotected sex, and perpetration of youth violence.[8,58] In fact, tobacco use is an individual risk factor for youth violence.[58]

EFFECTS OF TOBACCO USE

Smoking harms nearly every organ of the body, causing many diseases and reducing the health of smokers as well as those exposed to secondhand smoke[1] (see Table 1 and the accompanying AAP policy statement[2] and technical report[3]). The adverse health effects from cigarette smoking account for an estimated 438 000 deaths each year in the United States. Although most people are aware of the negative health consequences of tobacco use in adults, youth also experience negative health consequences attributable to tobacco use. Smoking impairs lung growth and results in decreased lung function. A smoker's resting heart rate is, on average, 2 to 3 beats per minute faster than that of a nonsmoker. Also, smokers experience more coughing as well as more frequent and severe respiratory illnesses. Smokers have less physical endurance and tend to experience shortness of breath even with minimal exertion.[1] Nicotine staining of teeth can be identified early by pediatric dentists. Smokeless-tobacco use is associated with periodontal disease, gum recession, leukoplakia, and cancers of the oral cavity.[8,59]

TABLE 1 Major Conclusions of the 2004 Surgeon General Report[1]

Smoking harms nearly every organ of the body, causing many diseases and reducing the health of smokers in general.
Quitting smoking has immediate and long-term benefits, reducing risks of diseases caused by smoking and improving health in general.
Smoking cigarettes with lower machine-measured yields of tar and nicotine provides no clear benefit to health.
The list of diseases caused by smoking has been expanded to include abdominal aortic aneurysm, acute myeloid leukemia, cataract, cervical cancer, kidney cancer, pancreatic cancer, pneumonia, periodontitis, and stomach cancer. These are in addition to diseases previously known to be caused by smoking, including bladder, esophageal, laryngeal, lung, oral, and throat cancers; chronic lung diseases; coronary heart and cardiovascular diseases; and reproductive effects and sudden infant death syndrome.

Smoking poses some additional risks for women and girls. As a direct consequence of smoking, lung cancer now exceeds breast cancer as the leading cause of cancer-related deaths in women. Women who smoke also have an increased risk of other cancers, including cancers of the oral cavity, pharynx, larynx, esophagus, pancreas, kidney, bladder, and uterine cervix.[1] Women who smoke double their risk of developing coronary heart disease and increase by more than 10-fold their likelihood of dying from chronic obstructive pulmonary disease.[1] Moreover, cigarette smoking increases the risk of infertility, preterm delivery, stillbirth, low birth weight, and sudden infant death syndrome.[1]

PREVENTION

Effective strategies for preventing adolescent tobacco use include public health approaches as well as individual strategies. Some public health approaches that may be effective include restricting the promotion of tobacco products in general and specifically prohibiting promotions aimed at children, including laws prohibiting the sale of tobacco to minors and raising the price of tobacco through aggressive taxation.[60] Also, changing the social norm about the normality and acceptability of tobacco use is an effective prevention strategy that can be accomplished through the use of school smoking bans, health education, household smoking bans, and restrictions on smoking in public places.[22,61,62] As part of the 1998 Master Settlement Agreement between 46 states' attorneys general and the 4 largest tobacco companies in the United States, the tobacco manufacturers agreed to stop using cartoon characters in their advertisements, advertising on billboards, and putting their brand names on articles such as clothing and also agreed to avoid targeting children and adolescents with marketing and advertising.[63] However, the tobacco industry has continued to devise new ways to target product marketing to children through using print ads, sponsoring motor sports, and depicting smoking in movies.

Pediatricians and parents have important roles in preventing tobacco use by children and adolescents. Pediatri-

cians should use anticipatory guidance to implement and encourage individual patient-level strategies to educate patients and families and prevent tobacco use and exposure. Children should be screened for smoking risks beginning by 5 years of age. All clinical encounters should include inquiries about tobacco use and secondhand smoke exposure and clear documentation of the information in the medical record. Children and adolescents should be warned about the harmful effects of tobacco and the ease with which experimentation progresses to addiction and regular use.[50,51] Because children with smoking parents are more likely to smoke and to start at an earlier age, screening for parental tobacco use is an important preventive measure.[64] Parents should be advised to maintain smoke-free households and vehicles and to articulate clear messages that they expect their children to remain smoke free. Parental attitudes, opinions, and feelings about their children's smoking status greatly influence whether children will smoke, even when parents smoke.[65–67]

PUBLIC POLICIES FOR TOBACCO-USE REDUCTION

Comprehensive tobacco-control programs should include interventions that have been proven effective in preventing tobacco-use initiation among youth and young adults, promote cessation among adults and youth, and eliminate secondhand smoke exposure and tobacco-related disparities. The ideal comprehensive approach to tobacco control includes population-based and individual-level interventions.[61,68] Population-based interventions include clean indoor-air legislation, tobacco tax increases, restricted youth access to tobacco, and mass-media anti-tobacco campaigns.[61,68] Individual-level interventions include treatment services that have been proven to increase tobacco-cessation rates, such as behavioral counseling and pharmacotherapy.

The progress that has been made thus far in reducing youth smoking rates has been accomplished through a combination of such strategies, including raising tobacco taxes, passing legislation that limits minors' access to tobacco products and prohibits smoking in public places, and running aggressive media countermarketing campaigns.[69] Studies have demonstrated that youth are particularly susceptible to tobacco advertising and promotions. One important source of tobacco promotions is movies. Tobacco is depicted in 56% of films with Motion Picture Association of America ratings of G, PG, or PG-13—the films children are most likely to see—and in 87.5% of films with an R rating.[70] Research has indicated that exposure to movie smoking is a primary independent risk factor for youth smoking initiation.[36,71] Given the prevalence of protobacco images in movies viewed by children and the impact it has on smoking initiation among youth, there is a critical need to support the Smoke Free Movies effort. The Motion Picture Association of America recently agreed to consider whether a film depicts smoking when determining its ratings of movies.

Youth tobacco users are also very price sensitive, so raising tobacco taxes causes a dramatic decrease in youth tobacco-use rates. Raising taxes also leads to more adults seeking smoking-cessation services.[60,61] Clean indoor-air legislation also correlates with more tobacco-use cessation. The American Legacy Foundation's social marking campaign, Truth (www.thetruth.com), has been independently associated with significant declines in youth smoking.[72]

Cigarette warning labels are an important component of comprehensive tobacco-control and smoking-cessation efforts. In 1984, Congress enacted the Comprehensive Smoking Education Act (Pub L No. 98–474), which required rotation of the following 4 black-and-white text messages on the side of cigarette packages:

1. Surgeon General's Warning: Smoking causes lung cancer, heart disease, emphysema, and may complicate pregnancy.
2. Surgeon General's Warning: Quitting smoking now greatly reduces serious risks to your health.
3. Surgeon General's Warning: Smoking by pregnant women may result in fetal injury, premature birth, and low birth weight.
4. Surgeon General's Warning: Cigarette smoke contains carbon monoxide.

For the past 20 years, there have been no changes to US cigarette package warning labels; however, several other countries, including Canada, Australia, Thailand, South Africa, Singapore, and Poland, have mandated stronger health warnings on cigarette packages by requiring the addition of graphic images, detailed statistical information about tobacco-use health risks, and information about how to quit smoking. In a study that compared US and Canadian warning labels, young adult (18–24 years of age) focus-group participants perceived the larger, more graphic Canadian warning labels to be more informative and more likely to attract a smoker's attention.[73] Hammond et al[74] found that large, comprehensive warnings on cigarette packages are more likely to get noticed and have been rated as more effective by smokers in deterring them from smoking. Active discussion and advocacy efforts in the United States currently focus on legislation that passed in 2009, giving the US Food and Drug Administration (FDA) the authority to regulate tobacco products and

TABLE 2 Brief Interventions to Treat Tobacco Dependence[7,81]: The 6 A's for Brief Intervention to Treat Tobacco Dependence

Anticipate risk of tobacco use	Routinely ask parents about smoking. Make parents aware of age of smoking onset. Discuss health effects of tobacco use. Be aware of populations at increased risk of tobacco initiation.
Ask about tobacco use	Identify and document tobacco-use status and secondhand smoke exposure for every patient at every visit.
Advise to quit	In a clear, strong, and personalized manner, urge every tobacco user to quit and nonusers to remain tobacco free. (Focus on short-term effects with youth; remind parents of their responsibility as role models.)
Assess willingness to make a cessation attempt	Is the tobacco user willing to make a cessation attempt at this time? (Assess risk of future tobacco use; praise and reinforce healthy decisions; help youth practice refusal skills.)
Assist in cessation attempt	For the patient willing to make a cessation attempt, use counseling to help him or her quit. (Set a quit date; provide brief counseling and self-help materials; refer to quit line.)
Arrange follow-up	Schedule follow-up contact, preferably within the first week after the cessation date. (Monitor progress and problems; reinforce antismoking messages; discuss possibility of relapse and ways to prevent relapse.)

marketing and strengthen warning labels.

CLINICAL PRACTICES FOR TOBACCO-USE REDUCTION

Studies have indicated that most adolescent and young adult smokers want to quit and even try to quit smoking, but few are successful. In 2007, the percentage of high school smokers who made a quit attempt ranged from 43.4% to 62.5%, with a median of 55.7%.[75] Although youth report a desire to quit and quit attempts, few seek medical help with quitting.[76,77] A number of possible reasons have been cited for this, including the lack of smoking-cessation modalities proven effective for youth, youth not believing that quitting tobacco use warrants professional help, youth preferring privacy, and available cessation programs not addressing the unique concerns and issues most relevant to youth tobacco users.[76] When pediatricians do provide medical care related to tobacco use, they must uphold confidentiality standards established through pediatric and adolescent medicine professional organizations and supported by state laws.[78–80]

Although extensive scientific evidence supports best-practice recommendations and strategies for tobacco dependence treatment in adults, the scientific evidence for treating tobacco use and dependence effectively in adolescents is still evolving.[7] The recently released Public Health Service clinical practice guideline, "Treating Tobacco Use and Dependence: 2008 Update," states that counseling has been shown to be effective in the treatment of adolescent smokers.[7] The cognitive-behavioral counseling approach involves establishing awareness of tobacco use, identifying motivations to quit, preparing to quit, and providing strategies for maintaining abstinence after cessation. The 5 A's model, as out-

TABLE 3 Smoking-Cessation Medications[7]

Medication[a]	Dose	Adverse Effects, Precautions, Warnings, and Contraindications
Bupropion	Begin treatment 1–2 wk before quit date; 150 mg/day for 3 d, 150 mg twice daily for 7–12 wk after quit date	Adverse effects: insomnia, dry mouth; contraindications: monoamine oxidase (MAO) inhibitor use in past 14 d, history of seizure or eating disorder
Nicotine gum: 2 mg if <25 cigarettes per day, 4 mg if ≥25 cigarettes per day	At least 1 piece every 1–2 h for the first 6 wk (≤24 pieces per day)	Adverse effects: mouth soreness, hiccups, dyspepsia; acidic drinks interfere with absorption of nicotine
Nicotine inhaler: 4 mg of nicotine per cartridge (80 inhalations)	6–16 cartridges per day	Acidic drinks interfere with absorption of nicotine
Nicotine lozenge: 2 mg if first cigarette >30 min after waking, 4 mg if first cigarette <30 min after waking	1 lozenge every 1–2 h for first 6 wk (at least 9 lozenges per day), 1 every 2–4 h during weeks 7–9, then 1 every 4–8 h (≤20 lozenges per day)	Adverse effects: nausea, hiccups, heartburn; acidic drinks interfere with absorption of nicotine
Nicotine nasal spray: a dose is 0.5 mg per nostril (1 mg total)	1–2 doses per hour (minimum: 8 doses per day; maximum 40 doses per day)	Adverse effects: nasal irritation, nasal congestion; precaution: do not use in people with severe reactive airways disease
Nicotine patch	21 mg/24 h for 4 wk, 14 mg/24 h for 2 wk, and 7 mg/24 h for 2 wk (step-down dosage) or 15 mg/16 h for 8 wk (single dosage)	Adverse effects: local skin reaction, insomnia, and/or vivid dreams
Varenicline (Chantix [Pfizer, Mission, KS])	Start treatment 1 wk before quit date; 0.5 mg/d for 3 d, 0.5 mg twice daily for 4 d, 1 mg twice daily for 3 mo	Precaution: decrease dose if kidney disease ; warning: depressed mood, agitation, behavior changes, suicidal ideation, and suicide have been reported; adverse effects: nausea, trouble sleeping, abnormal/vivid dreams

[a] See FDA package insert for more complete information.

lined in the Public Health Service guideline, has been modified for children and adolescents.[7] The AAP has advocated a sixth A—anticipate—that takes into account child development and the importance of anticipatory guidance in pediatric practice[81] (see Table 2). Counseling for children and adolescents should be developmentally appropriate and relevant across various age groups. Behavioral counseling from a health care professional can range in intensity from brief advice and encouragement to quit, to more intense multisession group-therapy programs, to proactive telephone quit lines, to interactive computer-based programs. The Public Health Service guideline recommends that all clinicians strongly advise patients who use tobacco in any form to quit.[7]

Pediatricians should be familiar with the pharmacotherapies for smoking cessation that have been approved by the FDA, including various forms of nicotine-replacement therapy, the antidepressant bupropion, and a nicotine receptor partial agonist, varenicline, although none of these have been approved by the FDA for tobacco cessation in people younger than 18 years (see Table 3). A few studies have examined the use of pharmacotherapy agents in helping youth quit smoking; however, most of the studies have suffered from small sample sizes, limited power, and high attrition rates. Although nicotine-replacement medications have been shown to be safe in adolescents, there is little evidence that these medications or bupropion are effective in promoting long-term abstinence among adolescent smokers. They are, therefore, not recommended as components of pediatric tobacco intervention by the Public Health Service guideline.[7]

ADDITIONAL RESEARCH NEEDED

There are major gaps in the scientific literature used to support decisions regarding youth tobacco control. Although there are challenges to conducting this research, including recruitment and retention, researchers have been making steady progress. Some areas that require further study in youth populations include the factors that motivate tobacco-cessation attempts, safety and effectiveness of tobacco-cessation pharmacotherapy in adolescents, use and efficacy of telephone quit lines, and Web-based strategies for engaging youth in tobacco cessation.

CONCLUSIONS

Smoking remains the most common preventable cause of illness and death in the United States. Smokeless-tobacco and secondhand smoke exposure cause additional morbidity and mortality. Clinicians caring for pediatric patients should provide tobacco-use and exposure prevention and cessation education and advice, screening and counseling, and intervention and referral for patients and their families.

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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Tobacco Use: A Pediatric Disease

abstract

Tobacco use and secondhand tobacco-smoke (SHS) exposure are major national and international health concerns. Pediatricians and other clinicians who care for children are uniquely positioned to assist patients and families with tobacco-use prevention and treatment. Understanding the nature and extent of tobacco use and SHS exposure is an essential first step toward the goal of eliminating tobacco use and its consequences in the pediatric population. The next steps include counseling patients and family members to avoid SHS exposures or cease tobacco use; advocacy for policies that protect children from SHS exposure; and elimination of tobacco use in the media, public places, and homes. Three overarching principles of this policy can be identified: (1) there is no safe way to use tobacco; (2) there is no safe level or duration of exposure to SHS; and (3) the financial and political power of individuals, organizations, and government should be used to support tobacco control. Pediatricians are advised not to smoke or use tobacco; to make their homes, cars, and workplaces tobacco free; to consider tobacco control when making personal and professional decisions; to support and advocate for comprehensive tobacco control; and to advise parents and patients not to start using tobacco or to quit if they are already using tobacco. Prohibiting both tobacco advertising and the use of tobacco products in the media is recommended. Recommendations for eliminating SHS exposure and reducing tobacco use include attaining universal (1) smoke-free home, car, school, work, and play environments, both inside and outside, (2) treatment of tobacco use and dependence through employer, insurance, state, and federal supports, (3) implementation and enforcement of evidence-based tobacco-control measures in local, state, national, and international jurisdictions, and (4) financial and systems support for training in and research of effective ways to prevent and treat tobacco use and SHS exposure. Pediatricians, their staff and colleagues, and the American Academy of Pediatrics have key responsibilities in tobacco control to promote the health of children, adolescents, and young adults. *Pediatrics* 2009;124:1474–1487

COMMITTEE ON ENVIRONMENTAL HEALTH, COMMITTEE ON SUBSTANCE ABUSE, COMMITTEE ON ADOLESCENCE, AND COMMITTEE ON NATIVE AMERICAN CHILD HEALTH

KEY WORDS

tobacco, smoke, cigarette, environmental tobacco, nicotine, secondhand, smoke free, cigar, smokeless

ABBREVIATIONS

SHS—secondhand tobacco smoke
AAP—American Academy of Pediatrics
DoD—Department of Defense

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BACKGROUND

Tobacco use is the leading preventable cause of death and illness in the United States, causing more than 443 000 deaths each year.[1] The consequences of tobacco use include harms to the health of the fetus, such as low birth weight and sudden infant death; harms to children from tobacco use and secondhand tobacco-smoke (SHS) exposure, including respiratory illness, infection, and decreased lung function; the uptake and establishment of tobacco use and nicotine addiction by the

next generation; fires attributable to smoking; the economic costs of purchasing tobacco and tobacco-use materials; litter and debris from tobacco products; additional cleaning and maintenance of facilities in which tobacco is used; the health care and emotional costs of diseases associated with tobacco use and SHS exposure; and the costs to families and society because of poor health and lost productivity.[2]

Most tobacco users (~80%) started using tobacco products before 18 years of age.[3] Initiation of tobacco use is often instigated by exposure to tobacco use by parents or peers, depiction in movies and other media, advertising targeting children and adolescents, and other environmental and cultural factors.[3–12] The connection between children and tobacco use is so strong that the commissioner of the US Food and Drug Administration declared tobacco use a "pediatric disease" in 1995.[13]

Tobacco use is a pediatric disease because of the extent of harms to children caused by tobacco use and SHS exposure, the relationship of pediatric tobacco use and exposure to adult tobacco use, the existence of effective interventions to reduce tobacco use,[14] and the documented underuse of those interventions.[15] This statement provides guidance for providers of pediatric services, including the American Academy of Pediatrics (AAP) and its members, and summarizes other AAP policies that have addressed tobacco use and control.

Because tobacco use has significant effects on children and families, its management has been reviewed in many AAP policies and official documents.[16–18] The information and recommendations described in this statement are consistent with recommendations in the other AAP publications cited as well as with tobacco policies from other clinical professional membership organizations, including the Academic Pediatric Association,[19] the American Academy of Allergy Asthma & Immunology,[20] the American Academy of Family Practice,[21] the American Academy of Pediatric Dentistry,[22] and the American Medical Association.[23,24] The policy is accompanied by 2 technical reports: "Secondhand and Prenatal Tobacco Smoke Exposure"[25] and "Tobacco as a Substance of Abuse."[26]

The AAP recognizes the dangers of tobacco use and SHS exposure to children's health. Tobacco control was named a strategic priority by the AAP in 2005, and the Julius B. Richmond Center of Excellence (www.aap.org/richmondcenter), dedicated to the elimination of children's exposure to tobacco and SHS, was established in 2007 to foster tobacco-control initiatives at the AAP.

TERMS USED AND THEIR DEFINITIONS

The term "tobacco" includes all smoked and smokeless forms. The term "tobacco control" refers to any and all aspects of efforts to reduce or eliminate tobacco use in any form, except ceremonial uses, where legal. The term "parent" is meant to include anyone acting in the role of parent, including legal guardians and foster parents. "Community" is used broadly and includes local-, city-, county-, state-, national-, and international-level groups and organizations.

THE ROLE OF PEDIATRICIANS IN TOBACCO CONTROL

Pediatricians have important roles in efforts to reduce family tobacco use and SHS exposure. In their practices, they can (1) provide counseling to expectant parents to quit using tobacco products and avoid SHS exposure during and after pregnancy, (2) assist new parents in their efforts to continue their tobacco use-abstinence or -cessation efforts after delivery, (3) counsel parents to prevent and eliminate children's exposure to SHS, (4) counsel preadolescents and adolescents to prevent initiation of tobacco use, and (5) counsel adolescents and parents to quit using tobacco. Important adjuncts to these efforts include quitlines and pharmacotherapies for tobacco-use cessation.[14,27,28] Quitlines (toll-free telephone-based tobacco use-cessation services that offer evidence-based information and counseling support, including referral of the tobacco user to his or her primary care provider for pharmacotherapies) are an effective way to deliver tobacco use-cessation services.[28] Quitlines are available throughout the United States, Canada, and many other countries. Pharmacotherapies approved for adult use, including nicotine-replacement products and medications such as varenicline and bupropion, are extremely effective in promoting tobacco-use cessation when used in conjunction with cessation counseling.[14]

AAP members are uniquely positioned to disseminate information about the effects of tobacco use and effective tobacco-control methods through their practices and other efforts. In addition to practice-based efforts in tobacco control, other roles for pediatricians include participating in community, advocacy, and media campaigns that inform the public of the harms of tobacco use, SHS exposure, and the risks of tobacco-use initiation; promoting treatment; and helping to enact and enforce laws and regulations that limit access to tobacco and promote tobacco control.

TOBACCO CONTROL AND PUBLIC POLICY

Legislative and regulatory efforts that have been effective in controlling and eliminating tobacco use include clean indoor-air legislation, taxes on tobacco products, restricting youth access to

tobacco products, mass-media campaigns, tobacco-advertising restrictions, and comprehensive community interventions.[29] Interventions in single arenas have not been sufficient to achieve tobacco control. The most effective strategies use multiple interventions that target different aspects of tobacco control, including school-based programs, anti–tobacco-use advertisements, and enforcement of existing tobacco-control policies.[30] Many successful public-policy changes have begun with the efforts of individuals—including pediatricians—who initiated, supported, and led tobacco-control efforts in their practices, communities, professional organizations, and legislatures. A promising effort, supported by the AAP, is the recent federal law that grants the US Food and Drug Administration regulatory control over tobacco.

ECONOMICS OF TOBACCO USE AND SHS EXPOSURE

Tobacco use is costly, and the resulting harms are completely preventable. Health care costs attributable to tobacco use and SHS exposure are estimated to be in the billions of US dollars annually.[31–34] Other costs attributable to tobacco use and SHS exposure include loss of life and productivity,[35,36] income diverted to purchase tobacco-use materials,[37,38] and fires.[39–43] Treatments for tobacco use and dependence are among the most efficacious and cost-effective preventive services in both the short-term and long-term[2,14,44] and are second only to childhood immunization in terms of cost-effectiveness.[2,45–48]

THE TOBACCO INDUSTRY

The goal of the tobacco industry is profit, not health. Tobacco industry–sponsored research programs have been designed to gain an air of legitimacy and produce results favorable (or less unfavorable) to tobacco use.[49] The tobacco industry has attempted to present the evidence of harms from tobacco use and SHS exposure as "controversial."[50] Youth exposure to tobacco industry–sponsored prevention advertising does not prevent tobacco use, and industry-sponsored prevention programs that target parents may actually promote youth tobacco use.[51]

SOCIOECONOMICALLY DISADVANTAGED CHILDREN AND ADOLESCENTS

The prevalence of cigarette smoking is greatest among adults who live below the poverty line and those who have not completed high school[52]; accordingly, SHS exposure disproportionately affects children who live in low-income households.[52] Use of other forms of tobacco is similarly distributed according to income and education levels.[53] The costs associated with tobacco use exacerbate the health harms to children by decreasing available family funds while increasing the likelihood of poor health in their parents, which can lead to decreased family income[54] and stratification of tobacco use in the population that is least able to afford the consequences.[55]

TOBACCO USE AND PSYCHIATRIC AND SUBSTANCE USE DISORDERS

People with psychiatric and substance use disorders, including youth and young adults, are far more likely to use tobacco than those in the general population,[56–61] yet they are less likely to have a diagnosis of and receive treatment for nicotine addiction.[62–64] These people deserve treatment of their nicotine addiction and can successfully quit using tobacco.[14] Although people with psychiatric and substance use disorders are more likely to relapse in their tobacco-cessation efforts than the population at large, there is little evidence that nicotine withdrawal will escalate psychiatric symptoms.[14] One study of patients in a maximum-security forensic hospital showed a decrease in sick calls, total disruptive behavior, and verbal aggression after a smoking ban was implemented.[65] Several psychiatric facilities, including facilities for adolescents, have successfully eliminated tobacco use.[66,67] Because nicotine withdrawal may unmask psychiatric symptoms or disorders, this potential should be anticipated, and treatment of these symptoms or disorders should be considered an adjunct to treatment of tobacco use and dependence.[68]

TOBACCO AND ALASKA NATIVE AND AMERICAN INDIAN PEOPLE

Tobacco-use and smoking rates are highest among Alaska Native and American Indian people.[69–73] In addition to the high prevalence of smoking in these groups, the use of smokeless tobacco is common, even among adolescents and children.[74,75] Smokeless tobacco has been used by Alaska Native parents to calm their children while they are teething.[76] It is important to note that traditional ceremonial use of tobacco does not include smoking cigarettes, the use of smokeless tobacco, or the use of other commercial tobacco products.[70,77] Although traditional ceremonial uses of tobacco still play a role within many American Indian tribes, every effort should be made to prevent nontraditional uses.

TOBACCO USE AND MILITARY SERVICE

Historically, tobacco use and smoking have been accepted, even encouraged, by the military services. More recently, the US Department of Defense (DoD) took an active approach to reducing tobacco use by members of the military services. Subsidized sales of tobacco products were eliminated in 1996,[78] most DoD-operated facilities are smoke free (see DoD instruction No. 1010.15, January 2, 2001, for exceptions), and resources for tobacco-use

prevention and cessation are widely available.[79] These and other efforts have contributed to a decline in cigarette use by military personnel from 51% (1980) to 32% (2005).[80] Despite these efforts, the prevalence of tobacco use remains higher in military personnel than in comparable civilian populations.

ORGANIZATION OF THE POLICY STATEMENT

Because of the effects of tobacco use on children and their families and the extent to which tobacco permeates our society, the recommendations in this policy statement are numerous and detailed. The recommendations to pediatricians address personal and professional behavior as well as clinical practices. The recommendations to government and policy makers include public actions needed to eliminate SHS exposure, support prevention and treatment of tobacco use and dependence, support control of tobacco product-distribution, and expand research. Three overarching principles can be identified: (1) there is no safe way to use tobacco; (2) there is no safe level or duration of exposure to SHS[81]; and (3) the financial and political power of individuals and organizations should be used to support tobacco control and eliminate tobacco use. Many AAP statements have tobacco-related content and provide additional detail on specific topics (Table 1), and additional resources are available (Table 2).

TABLE 1 AAP Policy Statements With Tobacco-Related Content

AAP Statement	URL
Tobacco, Alcohol, and Other Drugs: The Role of the Pediatrician in Prevention and Management of Substance Abuse	www.pediatrics.org/cgi/content/full/115/3/816
Tobacco's Toll: Implications for the Pediatrician	www.pediatrics.org/cgi/content/full/107/4/794
Breastfeeding and the Use of Human Milk	www.pediatrics.org/cgi/content/full/115/2/496
Secondhand and Prenatal Tobacco Smoke Exposure	www.pediatrics.org/cgi/content/full/124/5/e1017
Tobacco as a Substance of Abuse	www.pediatrics.org/cgi/content/full/124/5/e1045
Health Care for Children and Adolescents in the Juvenile Correctional Care System	www.pediatrics.org/cgi/content/full/107/4/799
Indications for Management and Referral of Patients Involved in Substance Abuse	www.pediatrics.org/cgi/content/full/106/1/143
Health Supervision for Children With Sickle Cell Disease	www.pediatrics.org/cgi/content/full/109/3/526
Health Supervision for Children With Turner Syndrome	www.pediatrics.org/cgi/content/full/111/3/692
Sexual Orientation and Adolescents	http://aappolicy.aappublications.org/cgi/content/full/pediatrics;113/6/1827#R3#R3
Reducing the Number of Deaths and Injuries From Residential Fires	www.pediatrics.org/cgi/content/full/105/6/1355

RECOMMENDATIONS TO PEDIATRICIANS

1. Personal Behavior
   A. Maintain a tobacco-free environment at home, at work, at play, and in vehicles. Do not smoke or use tobacco in any way. Encourage family members and friends to do the same. Do not wear or display tobacco products, advertisements, or promotional items on your person or property.
   B. Consider tobacco control when making financial decisions. Support smoke-free restaurants, hotels, and other venues as well as print and electronic media companies that decline tobacco advertising. Review your personal financial holdings and divest or avoid tobacco stocks (Table 2).
2. Professional Behavior
   A. Patronize tobacco- and smoke-free venues. Hold conferences and meetings at smoke-free locations in smoke-free jurisdictions (Table 2).
   B. Support comprehensive tobacco control and prevention, education, and cessation programs and policies in schools and your community. Participate in education of community leaders and elected officials about tobacco control. Promote linkages among community resources and organizations related to tobacco control. Serve as a conduit for information about the harms of tobacco use and common challenges to prevention and cessation and as an advocate for tobacco control in your community. Be available to provide profes-

TABLE 2 Resources

Resource	URL
Listing of tobacco stocks	www.famri.org/tobacco_co_list/index.php
Smoke-free hotels	www.smokefreeaccommodations.com; www.freshstay.com/?gclid=CIPY_dr9j5QCFQuwGgod0hvMew; www.smoke-freehotels.com
Smoke-free jurisdictions	www.smokefreeworld.com
Pediatric clinical practice systems that support tobacco control	www.aap.org/richmondcenter
Tobacco-free magazines	www1.tobaccocme.com/PageReq?id=940:20998
Antitobacco messages to children	www.healthywomen.org/b2s/pg10.html
Coding for tobacco-related diagnoses and treatments	www.kidslivesmokefree.org/pdf/CodingCorner_AAPnewsarticle.pdf (AAP Coding Corner); www.surgeongeneral.gov/tobacco/treating_tobacco_use08.pdf (*Treating Tobacco Use and Dependence: 2008 Update*)
Global strategies	www.who.int/tobacco/framework/en (World Health Organization Framework Convention on Tobacco Control)

sional consultation for these programs. Advocate for community-based tobacco-use prevention and treatment services, including services in residential facilities (see Table 1 for related AAP policy statements with more extensive discussions of these facilities).

C. Support clean-air and smoke-free–environment ordinances and legislation in your community and state, particularly for environments in which children learn, live, and play, such as schools, multiunit housing, public parks, child care settings, public beaches, sidewalks, restaurants, and sporting arenas. These environments should be smoke free even when children are not present.

3. Clinical Practice

A. For the office, clinic, or hospital facility

i. Provide tobacco-free environments in all work settings, indoors and outdoors, and in all vehicles, including employees' vehicles used professionally or on work property. Enforce this policy. Some employers insist on no tobacco use by their employees during work hours and while performing official duties; some employers do not hire tobacco users.[82] Consider implementation of these or similar policies.

ii. Encourage and provide support for your employees' efforts to quit tobacco use, including fostering their use of prescription and nonprescription medications, counseling, and other evidence-based methods. When selecting a health insurer for employees, contract with one that provides tobacco-use and -dependence treatment benefits, including coverage for tobacco-use–cessation counseling.

iii. Use office systems that promote cessation and prevention of tobacco use. The most effective way to change clinical practice is to change the "system" of care delivery to one that promotes best practices in cessation and prevention of tobacco use. Resources that facilitate such office-systems changes are available (Table 2). One of the most important changes is to use paper or electronic health records that require documentation of tobacco use and SHS exposure status. This information should be readily available, easy to use, and easy to find. The use of cues to promote counseling in tobacco-use prevention and cessation in the clinical encounter is very effective.[14]

iv. Eliminate tobacco advertising from all materials associated with your clinical practice, including magazines and other media in patient care and waiting areas (Table 2).

v. Do not accept funding from the tobacco industry. The tobacco industry is defined as companies that support or engage in manufacturing, advertising, promotion, exportation, or importation of tobacco or tobacco products.

B. For patients and their family members

i. Ask about and document tobacco use and SHS exposure at all clinical encounters, including prenatal visits, nursery visits, and well- and sick-child visits, whether inpatient or outpatient. Include prenatal exposure as well as SHS exposure from in-home child care providers and family and other household members in these inquiries. Responses should be prominently recorded in the patient's record. This is more likely to be successful if all members of the staff are included in this effort.[14]

ii. Know the harms of tobacco use and SHS exposure and educate patients and their families about those harms.

a. Counsel children and parents about the harms of tobacco use and SHS exposure.

b. Include tobacco in all discussions of substances of abuse and risky behaviors. Discussion and anticipatory guidance about tobacco use should ideally begin by 5 years of age and emphasize resisting the influence of advertising and rehearsal of peer-refusal skills. Be aware of confidentiality issues related to tobacco use and other substance abuse, including testing for nicotine and its metabolites.

c. Encourage parents to start discussions of tobacco use with their children early in their life and continue to do so throughout childhood and adolescence; these discussions should include delivery of clear messages disapproving of tobacco use. Both parents and children should be counseled that

it is not safe to "experiment" with tobacco, because nicotine is so highly addictive and there is no safe way to use tobacco. Tobacco dependence can begin almost as soon as use begins, with some users exhibiting signs of dependence with only occasional or monthly use.[83,84] As a result, prevention of tobacco use is one of the most important messages you can deliver.

d. When discussing safety, instruct parents and caregivers that cigarettes and other lighted tobacco products are the cause of a significant proportion of residential fires that result in fatalities. All smoking materials are dangerous and should be kept out of the reach of children.

iii. Advocate for tobacco-free homes, cars, schools, child care programs, playgrounds, and other venues.

a. Advise avoidance of SHS exposure and suggest ways to eliminate SHS exposure. Counsel all families to make their homes and cars completely "smoke free." The dangers of SHS and the risk of modeling tobacco use should be discussed with parents and caregivers, particularly those who smoke, and reinforced with culturally and ethnically appropriate resources and cessation referrals.[25]

b. Advise parents to inquire about policies on tobacco use when selecting schools, child care programs, and other venues for their children. There should be no tobacco use in or around the premises, regardless of whether children are present.

C. For patients or family members who use tobacco or who are exposed to SHS

i. Advise all families to make their homes and cars smoke free, and urge all tobacco users to quit. Provide appropriate advice and counseling to foster tobacco users to quit. Routinely offer help and referral to those who use tobacco—even if the person is not your patient. Be familiar with evidence-based guidelines for treatment of tobacco use and dependence and apply them to patients and their families.[14] There is a growing body of literature on the effectiveness of pediatric clinician-provided treatment for parental nicotine addiction that demonstrates a role for pediatricians in this effort.[14,85,86]

a. Pharmacotherapy is an effective component of tobacco use-cessation treatment in adults.[14] Encourage tobacco users to include these medications in their quit plan, whenever appropriate. Be familiar with and offer information and instruction on correct use. Many nicotine-replacement products are available without a prescription, although prescriptions are required for any nicotine-containing product if the patient is younger than 18 years.

Most (85%) parents who smoke consider it acceptable for their child's pediatrician to prescribe a smoking-cessation medication for them,[87] but few pediatricians do so.[88] Liability concerns, record-keeping challenges, and lack of insurance reimbursement are cited as barriers to prescribing these products to parents.[89] In response to these concerns, the American Medical Association adopted a policy statement in 2005 supporting the practice of pediatricians addressing parental smoking.[90]

Pediatricians who choose not to prescribe pharmacotherapies should make referrals to cessation services and recommend that parents discuss pharmacotherapies with their health care providers or purchase over-the-counter products.

b. Be familiar with tobacco-use–cessation services in your community and provide referrals to these programs for your patients and their families. Memorize the national quitline telephone number (1-800-QUIT NOW), prominently post it, and provide it to all tobacco users. Whenever possible, proactively enroll tobacco users in cessation programs, using "fax-back" or similar programs. Such referrals are more effective in connecting the tobacco user to the resource than referrals that

require the tobacco user to initiate the contact.

ii. Counsel all parents, including those who smoke, on how to deliver antitobacco messages and ways to discuss the addictive nature of nicotine.

a. When parents or caregivers use tobacco, their children are more likely to experiment with tobacco and to begin to use tobacco regularly. Maintain a high index of suspicion for early onset of tobacco use by these children. It can be a particularly powerful message when the parent or caregiver who uses tobacco advises the child never to start using tobacco[91] (Table 2).

b. Help patients and families understand that even casual use of tobacco by children and adolescents, regardless of amount or frequency, is illegal and associated with adverse health consequences.

iii. Code for tobacco use and SHS exposure and bill for treatment. Consider SHS exposure a risk factor when justifying immunizations, respiratory syncytial virus prophylaxis, and other care. The additional time needed to counsel families about tobacco use should be documented and billed as the counseling that it is (Table 2). Whenever appropriate, list on death certificates that tobacco use or SHS exposure was the cause of or a contributor to death.

iv. Tobacco use by mothers is not a contraindication to breastfeeding, but tobacco use immediately before and during breastfeeding is strongly discouraged. Nicotine and its metabolites are present in human milk, and all tobacco users, including breastfeeding mothers, should make their home smoke free immediately and quit using tobacco products as soon as possible. Infants of mothers who smoke and breastfeed are more likely to be weaned at a younger age and to experience other adverse effects. For a more complete discussion of tobacco use by breastfeeding mothers, see specific AAP policy statements (Table 1).

v. SHS exposure may arise as a concern when children are involved in custody disputes. The AAP supports a healthy environment for children, meaning that the physical, emotional, and educational environment should provide support, nourishment, and education. Custody arrangements are complex agreements that should be decided on the basis of the best interests of the child, and all aspects of the child's well-being should be considered. All parents should be encouraged to eliminate their child's exposure to SHS; however, custody arrangements based solely on tobacco use or SHS exposure may not be in the overall best interests of the child.

D. Special considerations for populations at high risk of harm from tobacco or of tobacco use

i. Emphasize the significant health harms of tobacco use and SHS exposure when treating children with chronic diseases or health risks such as preterm birth, low birth weight, asthma, diabetes, cystic fibrosis, and sickle cell disease. Several AAP policy statements have addressed tobacco use and SHS exposure in children with chronic diseases (Table 1), including sickle cell disease and Turner syndrome. When preparing future AAP policies, guidelines, and other products, authors should consider and mention the effects of tobacco use and SHS exposure on the subject addressed. Whenever relevant, AAP products should provide information on or access to information about treatment of tobacco use and dependence and SHS exposure.

ii. When assessing mental health and substance abuse, include assessment of tobacco use and SHS exposure. Urge adolescent substance abuse treatment programs to treat tobacco dependence in their patients and their families. Treatment for nicotine addiction, if indicated, should be part of any inpatient or outpatient treatment plan. Closely monitor such individuals for changes in their symptom and adverse-effect profile during early nicotine withdrawal.

iii. The following groups of people are more likely to use tobacco than those in the general population and should be counseled accordingly:

a. Lesbian, gay, bisexual, and transgender children and youth[92,93] (Table 1).

b. Alaska Native and American Indian people. Respect for

ceremonial tobacco use should be demonstrated.

c. Current or former military personnel.

RECOMMENDATIONS FOR GOVERNMENT AND ADVOCACY

Whenever new public policy is developed or existing policy is revised, the wide range of consequences of tobacco use on children and their families should be considered. Local, county, state, and federal policies should support and enforce tobacco control. The AAP, through its chapters, committees, councils, sections, and staff, can provide information and support for public-policy advocacy efforts. See www.aap.org/advocacy.html for further information or contact chapter leadership.

1. Tobacco-Free Environments

   A. The use of tobacco products in all indoor and outdoor public places should be prohibited. Federal, state, and local governments should enact and enforce laws that mandate the provision of smoke-free environments in all public places and require employers to provide smoke-free work environments for their employees.

   B. Health care and educational facilities should be completely tobacco free, inside and outside, at all times. This includes all buildings, grounds, parking lots, satellite facilities, vehicles, and temporary venues. Tobacco-dispensing machines and sale of tobacco products should be banned from schools, hospitals, affiliated clinics, and pharmacies. The only exception to this ban would be legitimate research centers that study tobacco use or cessation.

2. Treatment of Tobacco Use and Dependence

   A. Clinicians should be trained and skilled in counseling to prevent tobacco use and SHS exposure and the treatment of tobacco use and dependence. Medical schools, nursing schools, residency training programs, fellowship programs, and continuing medical education programs should include training in tobacco-use treatment and the prevention of tobacco use and SHS exposure.

   B. Treatment of tobacco use and dependence should be available to patients and their families in both inpatient and outpatient settings. Children's hospitals and pediatric inpatient and outpatient facilities should specifically address the tobacco use of parents and other family members.

   C. Proactive enrollment in cessation programs such as "fax-back" quitlines should be implemented in every jurisdiction and be available through all clinical settings, including pediatric settings.[28] The additional staff and resources needed to implement a proactive program should be supported.

   D. Public and private employers should develop or provide access to tobacco-use–cessation programs for their employees and provide employee incentives for participation in these programs. Incentives, such as tax exemptions, should be offered to public and private employers who offer tobacco-use–cessation programs for their employees.

   E. All public and private health insurance should provide coverage for comprehensive tobacco-cessation treatment, including counseling (individual and group) and medications (both prescription and over-the-counter) that have been shown to be effective. Health insurance should provide adequate reimbursement for services related to the treatment of tobacco use and SHS exposure of children and families, including behavioral modification treatments and US Food and Drug Administration–approved pharmacotherapies.

3. Tobacco-Use Prevention. Local, state, and federal authorities should promote programs that contribute to the prevention and decrease of tobacco use by youth, including programs that discourage tobacco use, support antitobacco advertising, and teach skills to resist peer and advertising influences. Evidence-based antitobacco education, as recommended by the Centers for Disease Control and Prevention,[30] the US Surgeon General,[94] and the Institute of Medicine,[95] should be provided to students at all levels of education, including early childhood, elementary, secondary, and higher. It is important to differentiate between genuine effective tobacco-prevention curricula and those developed and supported by the tobacco industry, which have been shown to encourage tobacco use.[96,97]

4. Tobacco Product Control

   A. Control access to tobacco products.

      i. Sales and distribution of tobacco to youth should be strictly prohibited. Venues for unsupervised purchase of tobacco products, such as vending machines and online merchants, should be eliminated. All tobacco products should be placed behind sales counters to reduce

shoplifting. Provision of tobacco products to youth by adults should be made illegal, with significant consequences for noncompliance. Sales of tobacco products should be eliminated from schools, including secondary schools; health care facilities; military bases; and other sites that serve youth and young adults. The promotional distribution of tobacco products should be prohibited.

ii. The sale of tobacco products on the same premises as pharmacies should be eliminated, including pharmacies located in supermarkets.

B. Control marketing of tobacco products.

i. All tobacco products should be labeled to warn users of the health hazards of tobacco use. Warnings should use clear wording, in the strongest possible terminology, and be in the primary language of the country in which the product is sold. Warnings should be prominently displayed on packaging (occupying >50% of the front), on advertisements, and on displays at tobacco sales facilities. These warnings should be rotated to present a new warning on a regular basis.[98]

ii. Advertising of tobacco products should be banned from all media, events, and venues, including the Internet. Products such as t-shirts, sports equipment, and other items should not bear messages or images that depict tobacco products or promote tobacco use. All forms of advertising and media, especially advertising and media aimed at children, adolescents, and young adults, should not contain messages that promote tobacco use or images of tobacco or tobacco use. The single exception is historically accurate depictions of real people who used tobacco.

iii. Sales of candy cigarettes, cigars, and other products that imitate tobacco products or smoking should be banned. These products have been shown to promote tobacco use by children and youth.[99,100] The sale or dispensing of electronic or e-cigarettes, which imitate smoking while delivering nicotine to the user, should also be banned.

iv. Exposure to and depiction of tobacco use should be reduced in films, videos, DVDs, and television programs. The evidence is very strong that depiction of tobacco use in films, videos, DVDs, and television programs is a significant factor in the uptake of tobacco use by children and youth.[9] The following 4 steps should be taken:

a. Any new film that shows or implies tobacco use should be given a Motion Picture Association of America† rating of R. The only exceptions should be when the presentation of tobacco clearly and unambiguously reflects the risks and consequences of tobacco use or the depicted tobacco use is necessary to represent that of a real historical figure who actually used tobacco.

b. It should be certified that no one working on or associated with the production received anything of value (money, gifts, publicity, loans, or anything else) in exchange for using or displaying tobacco products. The closing credits of every film depicting tobacco use or displaying images of tobacco products should contain such a declaration.

c. Definitive and unambiguous antismoking ads (not produced or funded by a tobacco company) should be required to preview before any film with any tobacco presence. This should occur in any distribution channel and regardless of the rating for the film.

d. Tobacco brand identification and tobacco brand imagery (such as billboards) should be eliminated from movies.

C. Use tax policies, funding, and evidence to control tobacco.

i. Local, state, and federal tax policies should support tobacco control. Higher taxes have been shown to deter the purchase and use of tobacco and prompt cessation attempts; accordingly, local, state, and federal taxes on tobacco products should be implemented and/or increased. The revenue from these taxes can be used to support evidence-based tobacco-control programs. Tax deductions for advertising tobacco

†The Motion Picture Association of America (MPAA) is the organization that provides the G, PG, PG-13, R, and NC-17 ratings for movies.

products and tobacco-farming price supports and subsidies should be eliminated. Alternative revenue sources should be developed for and promoted to tobacco farmers.

ii. The evidence-based recommendations of *Best Practices for Comprehensive Tobacco Control Programs*[30] should be funded and implemented. Proceeds of the Tobacco Master Settlement Agreement[101] should be used for tobacco-control activities, as intended. More information about state expenditures of funds from the Tobacco Master Settlement Agreement is available from the AAP Division of State Government Affairs.

D. Other aspects of tobacco-control recommendations

i. Foster families should provide smoke-free environments to children whenever possible but specifically in the home and in vehicles used to transport children. These spaces should remain smoke free even when children are not present to reduce the exposure via off-gassing or "thirdhand smoke."‡ Although the smoking status of foster parents need not be a barrier to program participation, smoking-cessation treatments should be made available to foster parents. Evidence of smoking in the home or in vehicles should be assessed during required inspections. Evidence of smoking in the home or in vehicles should be considered a possible reason for removal of foster families from the program and for selecting alternative, smoke-free environments for children.

ii. Traditional sacred tobacco use by American Indian and Alaska Native people should be preserved while preventing nicotine addiction. Images, names, and icons from American Indian culture, such as "Noble," "Geronimo," "Red Man," and "American Spirit," should not be used to "brand" and market tobacco products to US and international markets.

iii. All cigarettes should be required to use "fire-safe" technology, which makes them less likely to cause fires (Table 1).

5. Research

B. Funding should not be accepted from the tobacco industry.

C. Pediatric tobacco-control research should be considered a high priority and funded accordingly. Priorities include development of evidence-based curricula to educate pediatric clinicians on the health effects of SHS exposure, nicotine addiction, and tobacco use as well as effective treatments for tobacco use and nicotine addiction. The spectrum of pediatric tobacco control includes prevention of youth tobacco use and dependence, treatment of youth tobacco dependence, prevention and treatment of SHS exposure of children, and prevention and treatment of tobacco use and SHS exposure of pregnant women.

i. Research in basic science, clinical outcomes, behavior, family structure and tobacco use, health services, underserved populations, health education, and policy analysis must be included in this comprehensive research effort.

ii. Funding for training the next generation of investigators in pediatric tobacco control should be supported.

iii. Translation of research on effective interventions to promote smoking cessation and reduction of SHS exposure from adult to pediatric settings is needed. Transdisciplinary efforts to maximize the positive effects on children of these research endeavors should be encouraged and supported.

6. International Tobacco Control

A. The World Health Organization Framework Convention on Tobacco Control should be ratified by the United States (Table 2). However, any resulting federal legislation to implement the Framework Convention should expressly not preempt stronger state or local restrictions.

B. As an exporter of tobacco, the United States should conform to all domestic policies when making treaties, agreements, and other arrangements with other governments. Tobacco products sold on American Indian reservations and tobacco products manufactured for export markets should be required to conform to the same requirements as tobacco products intended for the US market, except when the destination country has stronger requirements.

‡Thirdhand smoke is the smoke residue that is left in an environment after smoking has ceased. Some components of thirdhand smoke persist for weeks and provide a lasting source of exposure.

CONCLUSIONS

Tobacco use is the leading preventable cause of death and illness in the United States. Pediatricians and other clinicians who care for children are uniquely positioned to assist patients and families with prevention and treatment. Pediatricians and the AAP have key responsibilities in tobacco control and place a high priority on these goals for the health of children.

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American Academy of Pediatrics
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POLICY STATEMENT

Toward Transparent Clinical Policies

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Steering Committee on Quality Improvement and Management

ABSTRACT

Clinical policies of professional societies such as the American Academy of Pediatrics are valued highly, not only by clinicians who provide direct health care to children but also by many others who rely on the professional expertise of these organizations, including parents, employers, insurers, and legislators. The utility of a policy depends, in large part, on the degree to which its purpose and basis are clear to policy users, an attribute known as the policy's transparency. This statement describes the critical importance and special value of transparency in clinical policies, guidelines, and recommendations; helps identify obstacles to achieving transparency; and suggests several approaches to overcome these obstacles.

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Key Words
evidence-based practice guidelines, clinical policies, transparency, professional societies

Abbreviation
AAP—American Academy of Pediatrics

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INTRODUCTION

The mission of the American Academy of Pediatrics (AAP) is to promote the attainment of optimal physical, mental, and social health and well-being for all children. To aid in the accomplishment of this mission, the AAP develops clinical policies that are valued highly by members who provide direct health care to children, members of other organizations that share similar goals, and by parents, payers, and legislators. The utility of a policy depends, in large part, on the degree to which its purpose and basis are clear to policy users. This attribute is referred to as the policy's transparency. The purpose of this policy statement is to describe the critical importance and special value of transparency in clinical policies, guidelines, and recommendations; to identify obstacles to achieving transparency; and to suggest several approaches to overcome these obstacles. The term "policy" is used to refer generally to policies, guidelines, recommendations, and other similar statements.

The purpose of creating most clinical policies is to improve processes and outcomes of care by decreasing inappropriate variation in practice and increasing the implementation of effective strategies of health promotion and disease management. Such policies serve to guide clinical practice by summarizing the accumulated scientific evidence and combining it with the opinions of expert clinicians to define courses of action that are appropriate for patient care. Policies may provide guidance about:

- educating or counseling patients about their health and health care;
- implementing effective strategies of health promotion and disease management;
- using tests appropriately;
- monitoring patient status;
- defining criteria for diagnosis;
- performing procedures;
- prescribing medications and devices;
- referring for specialized care;
- documenting in the medical record;
- outlining ethical behaviors;
- defining an appropriate setting for care;
- promoting patient well-being;
- preparing clinicians and facilities to provide safe and effective care; and/or
- advocating on behalf of patients[1] and pediatricians.

Policies that are intended to influence the clinical actions of health care professionals should be based on the best available evidence and should include guidance regarding the application of such evidence to the individual patient.

Application of policy recommendations, like all clinical decision-making, is attended by some degree of uncertainty. Will this treatment be effective for this patient at this time? Will the patient suffer from an adverse effect that will interfere with successful treatment? Will the cost of the regimen make it impossible for the family to adhere to the prescribed intervention? Astute clinicians weigh the anticipated benefits of a policy recommendation against potential risks, harms, and costs viewed in the context of the patient's individual situation and preferences. Users' confidence that a given policy will result in particular benefits, risks, harms, and costs is enhanced when the policy is based on the best available clinical research and is free from bias and when the evidence and reasoning that support the policy are explicitly stated.

TRANSPARENCY

Transparency requires explicit statements regarding the reasons for developing a policy and explaining how published scientific evidence, pathophysiologic reasoning, clinicians' experiences, and perceptions of society's and patients' values are weighed. It also requires disclosure of potential biases of policy authors. Transparency allows potential users to judge the credibility of a policy by observing how the policy authors arrived at a result; thus, it has the potential to promote acceptance of the judgments and choices that have been made.

OPPORTUNITIES TO IMPROVE POLICY

Policies will decrease inappropriate variability in practice only when they are accepted and adhered to by clinicians. Obstacles to the successful acceptance and implementation of a policy include concern about lack of credibility and bias on the part of policy writers; poor understanding of the process of policy formulation; apparent or actual lack of scientific evidence to support policies; and poorly articulated or vague policy statements. Each of these obstacles has the potential to diminish the user's confidence in the policy and, thereby, the authority and utility of a statement.

Confidence in Policy Makers

Ultimately, the authority accorded to a policy depends on the policy authors' credibility as child health experts. It is valuable for policies to include a concise summary of the breadth of skills and experience represented on the writing team. In general, national specialty societies, such as the AAP, and their policy-writing committees are accorded a high level of credibility by members and other users, because policy authors are considered to have considerable scientific knowledge and clinical expertise and to share and represent the values of stakeholders in the policy.[2]

Concerns may also be raised about policy authors' potential biases. Despite the best intentions, policy authors may be influenced—consciously or unconsciously—by financial, personal, and intellectual conflicts in the development of policy. Potential conflicts of interest of all members of the formulating body must be declared. Disclosure of conflicts allows the reader to interpret the policy in light of those potential conflicts and permits other members of the policy-writing team to decide how to interpret contributions from a potentially conflicted team member. Public recognition of potential conflicts may also make policy authors more cognizant of otherwise-unrecognized biases.

Understanding of the Process of Policy Formulation

An explicit statement of the purpose of the policy can help users to understand the values applied by the policy authors. For example, if the goal of a policy is to decrease inappropriate practice variation when scientific evidence supports a particular clinical practice, it may be interpreted differently from a policy with a goal of diminishing cost or influencing funding decisions.

The process of policy formulation should include a complete review of the available scientific evidence and formulation of guidance based on a combination of evidence and expert consensus. Because the validity of the guidance depends on these processes, an explicit statement of how evidence, expertise, and values were weighed by policy authors can help policy users to understand how best to apply the policy recommendations. The approved process of the AAP for creation of recommendations in evidence-based practice guidelines, for example, calls on policy authors to appraise evidence quality and make an explicit judgment regarding anticipated benefits, harms, risks, and costs.[3] These declarations are summarized in a statement of evidence quality and strength of recommendation for each recommendation in a guideline.

Availability of Evidence

For many situations in pediatric health care, high-quality evidence is not yet available.[4] Because evidence is often absent or conflicting, many statements will inevitably be based largely on expert opinion. This is entirely appropriate, provided the basis is readily apparent to the critical reader. Indeed, it is when evidence is lacking, scant, or conflicting that expert guidance is most often sought. In these situations, policy authors must rely on lower-quality evidence, such as reasoning based on basic principles or expert consensus, to formulate coherent recommendations.

It is particularly important that users of a policy be aware if the policy relies on lower-quality evidence so they may be alert to the publication of new information and so those to whom the policy is applied are aware of the relatively tenuous state of the supporting evidence. Moreover, an understanding of the quality

of supporting evidence should influence the expectations of payers and those who define legal standards of care. When policies are written in a spirit of full disclosure, policy users will be aware of the potential for change when new evidence becomes available and will be more likely to understand, and accept, changes in policy. Moreover, expectations of adherence should be lower when evidence quality is limited or there is a balance between anticipated benefits versus harms, risks, and costs.

Vague Policy Statements

Thoughtfully crafted statements that reflect hours of travail by policy authors may be difficult to put into practice consistently because of lack of clarity.[5,6] Ambiguous policy statements are those that are capable of being interpreted in more than one way. It seems obvious that policy statements that are intended to improve the consistency of clinical care should not be ambiguous. Yet, policy implementers regularly complain about the lack of clarity of published policies. A related problem is that authors often deliberately introduce vagueness into policy by using terms with meanings that lack precise boundaries.[7]

Reasons for intentionally creating vague recommendations include:

- insufficient evidence (commonly, the scientific literature in pediatrics has not addressed critical topics, or the conclusions of published studies are suspect because of methodologic flaws);
- inability to achieve consensus among the authors regarding evidence quality, anticipated benefits and harms, or interpretation of the published literature;
- legal considerations (ie, unwillingness to create a potential legal "standard of care");
- economic reasons (one approach is clearly best but may not be affordable or cost-effective); and
- ethical/religious issues (such as attitudes about the "burden" or "futility" of care, premarital sex, or the use of blood products).

An explicit statement of the reasons for writing deliberately vague recommendations can help users interpret and apply them.

RECOMMENDATIONS

The Steering Committee on Quality Improvement and Management makes these recommendations to improve transparency and credibility of policy documents while recognizing the challenges involved in their full implementation.

1. Enhance the credibility of policy-making groups. Policy-writing panels should seek input from major stakeholders who are likely to apply the policy themselves or be influenced by it and from experts in the area of interest. Policy authors should disclose potential and actual conflicts of interest that might affect their policy writing and describe how they are addressed.
2. Make the process of policy formulation clear to users. A statement should include an explicit statement of the reason it was decided to make policy in this area and the intended goals of the statement. Authors should describe how the evidence was selected and assessed and what evidence exists to support the policy. Authors should clearly note when consensus and expert opinion have been required to formulate policy.
3. Improve the clarity of recommendations to facilitate implementation. Policy authors should be explicit about the exact circumstances under which a recommended action should be performed (decidability) and should describe precisely how that action should be performed when those circumstances exist (executability). By improving the decidability and executability of policies, such precision would improve consistent application of recommendations. If vagueness is introduced intentionally, the rationale should be documented.
4. Train skilled policy authors. Effectively implementing these recommendations will require training of policy authors in critical appraisal of evidence; differentiating questions of evidence and expertise from questions of value; consensus building; and understanding the policy-formation process. Opportunities for such training should be developed and sustained.

CONCLUSIONS

Professional societies, government agencies, and other organizations have created a vast array of policies that are widely used and highly valued. When such policies advise actions that have significant clinical and resource implications, it is particularly important that the policy-writing process explicitly recognize uncertainty and include careful literature review; systematic appraisal of evidence quality; weighing of anticipated benefits, harms, and costs; and documentation of the process. Every policy should be subject to a scheduled periodic review with reaffirmation, revision, or retirement as possible outcomes.

The solutions proposed in this statement may be applied as new policies are created or when policies are revised. Such gradual implementation will also help to ensure both continuity and accurate transformation to more transparent formats. Ensuring a high degree of transparency by standardizing the process for assessing the quality of evidence and strength of recommendations and defining reasons for deliberate vagueness will facilitate the work of policy developers, achieve better methodologic consistency across the broad range of clinical and policy statements, and thereby sustain and enhance the credibility of an organization's policies.

STEERING COMMITTEE ON QUALITY IMPROVEMENT AND MANAGEMENT, 2007–2008

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Injury and Poison Prevention

Transporting Children With Special Health Care Needs

ABSTRACT. Children with special health care needs should have access to proper resources for safe transportation. This statement reviews important considerations for transporting children with special health care needs and provides current guidelines for the protection of children with specific health care needs, including those with a tracheostomy, a spica cast, challenging behaviors, or muscle tone abnormalities as well as those transported in wheelchairs.

ABBREVIATION. FMVSS, Federal Motor Vehicle Safety Standard.

All children, including those with special health care needs, should have access to proper resources for safe transportation. Families and health care professionals should be informed of basic guidelines for selecting restraints, positioning children into them, and securing these restraints in all types of vehicles, primarily the family vehicle and school bus.[1] Parents should be informed of the resources available for proper restraint of children with special health care needs during travel[2] and thereby avoid use of substandard products, makeshift restraint systems, or unsafe methods of securement in motor vehicles.

Federal Motor Vehicle Safety Standard (FMVSS) 213, which regulates design and performance of child restraint systems, does not recognize that children with special needs may require the use of special occupant restraint systems.[3] The standard also does not regulate specific design and performance criteria for occupant protection devices that can provide safe seating for children with disabilities. Crash testing of car safety seats that meet FMVSS 213 has been done with test dummies representing children without special medical problems that would affect restraint use in motor vehicles. The biomechanical effects of a crash on test dummies representative of children with special medical needs in any restraint system have not been studied. Further research is needed, including development of such test dummies by the National Highway Traffic Safety Administration to address these concerns.

Children with special needs should not be exempt from the requirements of each state's laws regarding child restraint and seat belt use. Pediatricians can serve as resources for information to legislators, policy makers, and law enforcement professionals, as well as school officials who may be unaware of the importance and availability of occupant protection systems for children with special needs.

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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IMPORTANT CONSIDERATIONS

1. The rear seat is the safest place for all children, and rear-facing car safety seats must never be placed in the front seat of a vehicle that has a front passenger air bag. The impact of a deploying air bag can severely injure or kill an infant or small child. Children may also be at risk of injury if they are out of position or lie against the door of a vehicle with a side air bag.
2. For a child with special health care needs who requires frequent observation during travel and for whom no adult is available to accompany the child in the back seat, an air bag on/off switch should be considered for the vehicle.
3. Instructions provided by the manufacturer of the vehicle and the manufacturer of the car safety seat must be followed.
4. Plans for procurement of the most appropriate restraint and training for the proper use of the device and its installation in the vehicle should be incorporated into hospital discharge planning for all children with special needs.[4] Any child with a medical problem should have a special care plan that includes what to do during transport if a medical emergency occurs.
5. Parents, health care professionals, and educators should be encouraged to incorporate a child's special transportation needs into the individual education plan developed with the school.
6. There have been rapid changes in development and availability of resources for safer transportation of children with special needs. The current version of the American Academy of Pediatrics' "*Car Seat Shopping Guide for Children With Special Needs*" should be a helpful reference for health care professionals, parents, and school transportation providers.[5]
7. For additional information on transporting newborns or premature infants and children with special needs on school buses, refer to the appropriate policy statements by the American Academy of Pediatrics.[6,7]

GUIDELINES FOR PROTECTION

Although research has been limited, current information suggests the following guidelines be adhered to when selecting an appropriate occupant protection system and positioning a child with special needs properly.

General: Infants and Young Children

1. The child restraint system should meet FMVSS 213.[3] Standard child restraint devices may be used for many children with special health care needs, and, whenever possible, a standard child restraint is the preferable choice. Use of a "special" child restraint system for a child with health care needs often may be postponed until a child exceeds the physical limitations of a car safety seat.
2. Car restraint systems should not be modified or used in a manner other than that specified by the manufacturer unless the modified restraint system has been crash tested and has met all applicable Federal Motor Vehicle Safety Standards approved by the National Highway Traffic Safety Administration.
3. Infant-only car safety seats with capacity to recline are useful for infants with many medical problems, especially respiratory conditions. Some convertible car safety seats also can be used in the rear-facing position for children up to a weight of 13.5 kg (30 lb). These restraints may be especially useful for children with poor head and neck control.
4. If the child's head drops forward while in a rear-facing car safety seat because the position of the seat is too upright, a roll of cloth can be wedged in the vehicle seat crease and under the car safety seat base at the child's feet, so that the child reclines at no more than a 45° angle or as specified in the manufacturer's instructions (Fig 1).
5. Premature and small infants should not be placed in car safety seats with a harness-tray/shield combination or an armrest that could directly contact the infant's neck or face during an impact.[4,7,8]
6. Car safety seats with five-point harnesses anchored at both shoulders, both hips, and between the legs, can be adjusted to provide good upper torso support for many children with special needs.

General: Older Children and Adolescents

1. When a child has outgrown a car safety seat, other choices are available for proper and secure occupant restraint. Some systems provide for full support for the child's head, neck, and back and accommodate children up to 47.2 kg (105 lb). Others, such as the conventional E-Z-On Vest (E-Z-On Products, Jupiter, FL), can be used to provide additional trunk support for a child who already has stable neck control. Tethers, additional lap seat belts, or appropriate tie-down systems are required for some of these devices and should be a consideration for selection and proper use (Fig 2).
2. Some older children with disabilities can be transported in a special needs belt-positioning booster or a conventional belt-positioning booster for trunk support. The booster seats help to position the shoulder and lap belt across the child's chest and pelvis.
3. Conventional lap-shoulder belt systems may also be useful in providing for chest restraint of some children with special needs. Lap-shoulder belts should be used properly. Lap belts should be low and flat across the child's hips, and the shoulder belt should be snug across the chest. If a lap belt lies on the child's abdomen or if a shoulder belt rests on a child's neck, use of a belt-positioning booster seat will help assure proper placement of the belts. The shoulder belt should never be placed underneath the child's arm(s) or behind the child's back.

TRACHEOSTOMIES

Infants and children with a tracheostomy should not use child restraint systems with a harness-tray/shield combination or an armrest. On sudden impact, the child could fall forward causing the tracheostomy to contact the shield or armrest, possibly resulting in injury and a blocked airway.[9] A rear-facing car safety seat with a three-point harness or a

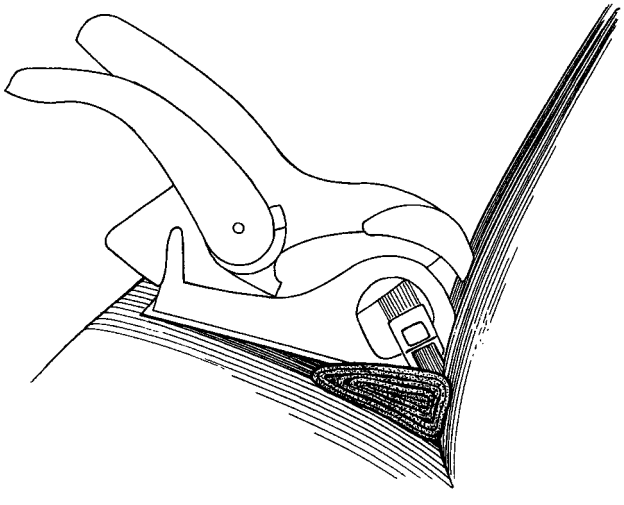

Fig 1. Rear-facing seat with wedge to recline seat at a 45° tilt.

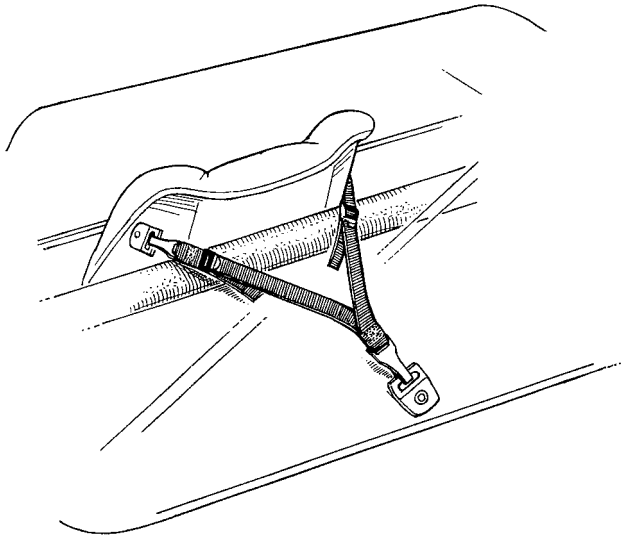

Fig 2. Large child forward-facing safety seat with tether anchored to vehicle.

car safety seat with a five-point harness should be selected for children with a tracheostomy.

MUSCLE TONE ABNORMALITIES

1. For toddlers with poor head control, a convertible car safety seat approved by the manufacturer for use in a semireclining position when facing forward may be beneficial.
2. Crotch rolls, made with a rolled towel or a diaper, may be added between the child's legs and the crotch strap to keep the hips against the back of the seat and prevent the child from slumping forward in the seat. This modification should be used for any child who cannot maintain appropriate posture.
3. Lateral support may be provided with rolled blankets, towels, or foam rolls (Fig 3).
4. Soft padding that does not alter the function of the harness may be positioned behind the neck and on either side of the head to promote anatomic alignment. However, padding should never be placed behind or under the child in the seat.[10] Soft padding (such as blankets, pillows, or soft foam) compresses on impact and can prevent harness straps from maintaining a secure, tight fit on a child's body (Fig 3).
5. A foam roll or rolled blanket may be placed under a child's knees to inhibit hypertonicity or opisthotonic posturing (Fig 3).

PRONE AND SUPINE POSITIONING OF INFANTS

Infants who must lie prone after surgical repair of myelomeningocele or infants who must lie prone to maintain an open airway, such as those with Pierre Robin sequence, may require a restraint that allows prone positioning.[5,11,12]

SPICA CASTS

1. For children with spica casts, a specially modified convertible car safety seat, the Spelcast (Snug Seat, Inc, Matthews, NC), has cut-away sides and seat bottom that provide room for a comfortable and snug fit into the restraint system (Fig 4). This seat fits infants up to a weight of 9.0 kg (20 lb) (rear-facing position) and toddlers who weigh up to 18.0 kg (40 lb) (front-facing position).
2. Many older toddlers and preschool and school-aged children in body or hip spica casts have limited resources available for safe transport in motor vehicles. One resource, the modified E-Z-On Vest, has performed satisfactorily during dynamic crash testing with a test dummy weighted to 47.2 kg (105 lb) and is available commercially. Two sets of seat belts routed through the vest are used to secure the child at the child's side against the vehicle seat. An ancillary belt loops around the casted leg or legs at the knees and is routed through the other seat belt (Fig 5). When it is not possible to fit a child onto a vehicle seat, use of an ambulance for transport is recommended. For lateral positioning on the vehicle seat (eg, as required by a car bed restraint or the modified E-Z-On Vest), position the child's head as far as possible from the side of the vehicle (Fig 6).

Fig 3. Child in convertible car seat with soft padding behind the neck, on either side of the head and along the sides to promote anatomic alignment. Foam roll or rolled blanket may be placed under knees to inhibit hypertonicity.

Fig 4. Child with spica cast seated in modified seat with cut-away sides and seat bottom.

CHALLENGING BEHAVIOR

1. Older children with hyperactivity, autism, or emotional problems may require a safety restraint

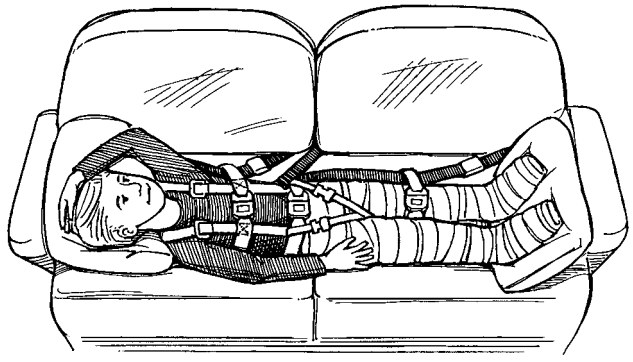

Fig 5. Child with modified E-Z-On Vest (E-Z-On Products, Inc, Jupiter, FL).

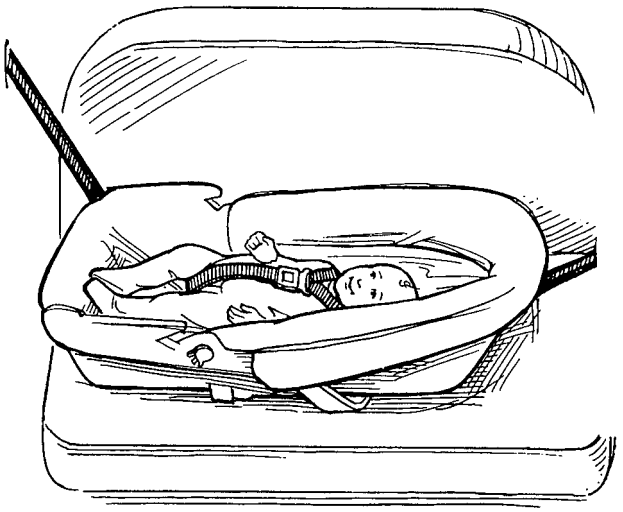

Fig 6. Infant positioned supine in the Ultra Dream Ride car bed (Cosco, Columbus, IN).

that is less likely to be unbuckled by the child. High back booster seats with internal harnesses that have seat belts routed underneath the seat base may be helpful in reducing the child's likelihood of unbuckling the restraint during travel. Large child car safety seats with a 5-point harness may be required for children weighing over 40 lb who cannot be restrained in a belt positioning booster seat with only a lap/shoulder harness.

2. Vests with rear back closure also may be helpful for use with children who have behavioral problems that may interfere with safe travel.[5]

WHEELCHAIR TRANSPORTATION

Any child who can assist with transfer or be "reasonably" moved from a wheelchair, stroller, or special seating device to the original manufacturer's forward-facing vehicle seat equipped with dynamically-tested occupant restraints or be "reasonably" moved to a child restraint system complying with FMVSS 213 requirement should be so transferred for transportation. The unoccupied wheelchair also should be secured adequately in the vehicle to prevent it from becoming a dangerous projectile in the event of a sudden stop or crash.[13]

Occupied wheelchair(s) should be secured in a forward-facing position. Any occupied wheelchair should be secured with four-point tie-down devices. Lap boards or metal or plastic trays attached to the wheelchair or to adaptive equipment should be removed and secured separately for transport. An occupant restraint system that has been tested at 30 mph and 20G force conditions and that includes upper torso restraint (ie, shoulder harness) and lower torso restraint (ie, a lap belt over the pelvis) should be provided for each wheelchair-seated occupant.[14] Head bands should not be used to restrain the child's head separately from the torso.

EQUIPMENT TRANSPORTATION

1. When a child with special needs is in transit, ancillary pieces of medical equipment (eg, walkers, crutches, oxygen tanks, monitors) should be secured on the vehicle floor; underneath a vehicle seat or wheelchair; or to the bus seat, bus floor, or bus wall below the window line so that they do not become a projectile during a crash and strike an occupant.
2. Electrical equipment for use during transit should have portable self-contained power for twice the expected duration of the trip. For improved safety, lead acid batteries or electrically powered wheelchairs or other mobile seating devices and respiratory systems should be converted, when possible, to gel-cell or dry-cell batteries. To house and protect batteries during everyday use, transportation, and collision, the use of external battery boxes is recommended.

RESOURCE AVAILABILITY

The National Easter Seal Society (800–221-6827) can assist identifying local community resources for procurement of specific restraint systems.[5]

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Clinical Practice Guideline

Treating Tobacco Use and Dependence: 2008 Update

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Public Health Service
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Guideline Update Development and Use

The 2008 update to *Treating Tobacco Use and Dependence*, a Public Health Service-sponsored Clinical Practice Guideline, is the result of an extraordinary partnership among Federal Government and nonprofit organizations comprised of the Agency for Healthcare Research and Quality; Centers for Disease Control and Prevention; National Cancer Institute; National Heart, Lung, and Blood Institute; National Institute on Drug Abuse; Robert Wood Johnson Foundation; American Legacy Foundation; and University of Wisconsin School of Medicine and Public Health's Center for Tobacco Research and Intervention. Each member of this consortium is dedicated to improving the Nation's public health, and their participation in this collaboration clearly demonstrates a strong commitment to tobacco cessation.

This Guideline is an updated version of the 2000 *Treating Tobacco Use and Dependence* Guideline. It is the product of a private-sector panel of experts ("the Panel"), consortium representatives, and staff. The update was written to include new, effective clinical treatments for tobacco dependence that have become available since the 2000 Guideline was published. *Treating Tobacco Use and Dependence: 2008 Update* will make an important contribution to the quality of care in the United States and the health of the American people.

The Panel employed an explicit, science-based methodology and expert clinical judgment to develop recommendations on the treatment of tobacco use and dependence. Extensive literature searches were conducted, and critical reviews and syntheses were used to evaluate empirical evidence and significant outcomes. Peer reviews were undertaken and public comment invited to evaluate the validity, reliability, and utility of the Guideline for clinical practice. The Panel's recommendations primarily are based on published, evidence-based research. When the evidence was incomplete or inconsistent in a particular area, the recommendations reflect the professional judgment of Panel members.

The recommendations herein may not be appropriate for use in all circumstances and are designed particularly for clinical settings. Decisions to adopt any particular recommendation must be made by clinicians in light of available resources and circumstances presented by individual patients and in light of new clinical information such as that provided by the U.S. Food and Drug Administration (FDA).

This Public Health Service-sponsored Clinical Practice Guideline update gives hope to the 7 out of 10 smokers who visit a clinician each year. This Guideline urges every clinician, health plan, and health care institution to make treating tobacco dependence a top priority during these visits. Please ask your patients two key questions: "Do you smoke?" and "Do you want to quit?" followed by use of the recommendations in this Guideline.

Abstract

Treating Tobacco Use and Dependence: 2008 Update, a Public Health Service-sponsored Clinical Practice Guideline, is a product of the Tobacco Use and Dependence Guideline Panel ("the Panel"), consortium representatives, consultants, and staff. These 37 individuals were charged with the responsibility of identifying effective, experimentally validated tobacco dependence treatments and practices. The updated Guideline was sponsored by a consortium of eight Federal Government and nonprofit organizations: the Agency for Healthcare Research and Quality (AHRQ); Centers for Disease Control and Prevention (CDC); National Cancer Institute (NCI); National Heart, Lung, and Blood Institute (NHLBI); National Institute on Drug Abuse (NIDA); American Legacy Foundation; Robert Wood Johnson Foundation (RWJF); and University of Wisconsin School of Medicine and Public Health's Center for Tobacco Research and Intervention (UW-CTRI). This Guideline is an updated version of the 2000 *Treating Tobacco Use and Dependence: Clinical Practice Guideline* that was sponsored by the U.S. Public Health Service, U. S. Department of Health and Human Services.

An impetus for this Guideline update was the expanding literature on tobacco dependence and its treatment. The original 1996 Guideline was based on some 3,000 articles on tobacco treatment published between 1975 and 1994. The 2000 Guideline entailed the collection and screening of an additional 3,000 articles published between 1995 and 1999. The 2008 Guideline update screened an additional 2,700 articles; thus, the present Guideline update reflects the distillation of a literature base of more than 8,700 research articles. Of course, this body of research was further reviewed to identify a much smaller group of articles that served as the basis for focused Guideline data analyses and review.

This Guideline contains strategies and recommendations designed to assist clinicians; tobacco dependence treatment specialists; and health care administrators, insurers, and purchasers in delivering and supporting effective treatments for tobacco use and dependence. The recommendations were made as a result of a systematic review and meta-analysis of 11 specific topics identified by the Panel (proactive quitlines; combining counseling and medication relative to either counseling or medication alone; varenicline; various medication combinations; long-term medications; cessation interventions for individuals with low socioeconomic status/limited

formal education; cessation interventions for adolescent smokers; cessation interventions for pregnant smokers; cessation interventions for individuals with psychiatric disorders, including substance use disorders; providing cessation interventions as a health benefit; and systems interventions, including provider training and the combination of training and systems interventions). The strength of evidence that served as the basis for each recommendation is indicated clearly in the Guideline update. A draft of the Guideline update was peer reviewed prior to publication, and the input of 81 external reviewers was considered by the Panel prior to preparing the final document. In addition, the public had an opportunity to comment through a *Federal Register* review process. The key recommendations of the updated Guideline, *Treating Tobacco Use and Dependence: 2008 Update,* based on the literature review and expert Panel opinion, are as follows:

Ten Key Guideline Recommendations

The overarching goal of these recommendations is that clinicians strongly recommend the use of effective tobacco dependence counseling and medication treatments to their patients who use tobacco, and that health systems, insurers, and purchasers assist clinicians in making such effective treatments available.

1. Tobacco dependence is a chronic disease that often requires repeated intervention and multiple attempts to quit. Effective treatments exist, however, that can significantly increase rates of long-term abstinence.

2. It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting.

3. Tobacco dependence treatments are effective across a broad range of populations. Clinicians should encourage every patient willing to make a quit attempt to use the counseling treatments and medications recommended in this Guideline.

4. Brief tobacco dependence treatment is effective. Clinicians should offer every patient who uses tobacco at least the brief treatments shown to be effective in this Guideline.

5. Individual, group, and telephone counseling are effective, and their effectiveness increases with treatment intensity. Two components of counseling are especially effective, and clinicians should use these when counseling patients making a quit attempt:

   - Practical counseling (problemsolving/skills training)

   - Social support delivered as part of treatment

6. Numerous effective medications are available for tobacco dependence, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents).

   - Seven first-line medications (5 nicotine and 2 non-nicotine) reliably increase long-term smoking abstinence rates:
     - Bupropion SR
     - Nicotine gum
     - Nicotine inhaler
     - Nicotine lozenge
     - Nicotine nasal spray
     - Nicotine patch
     - Varenicline

   - Clinicians also should consider the use of certain combinations of medications identified as effective in this Guideline.

7. Counseling and medication are effective when used by themselves for treating tobacco dependence. The combination of counseling and medication, however, is more effective than either alone. Thus, clinicians should encourage all individuals making a quit attempt to use both counseling and medication.

8. Telephone quitline counseling is effective with diverse populations and has broad reach. Therefore, both clinicians and health care delivery systems should ensure patient access to quitlines and promote quitline use.

9. If a tobacco user currently is unwilling to make a quit attempt, clinicians should use the motivational treatments shown in this Guideline to be effective in increasing future quit attempts.

10. Tobacco dependence treatments are both clinically effective and highly cost-effective relative to interventions for other clinical disorders. Providing coverage for these treatments increases quit rates. Insurers and purchasers should ensure that all insurance plans include the counseling and medication identified as effective in this Guideline as covered benefits.

The updated Guideline is divided into seven chapters that provide an overview, including methods (Chapter 1); information on the assessment of tobacco use (Chapter 2); clinical interventions, both for patients willing and unwilling to make a quit attempt at this time (Chapter 3); intensive interventions (Chapter 4); systems interventions for health care administrators, insurers, and purchasers (Chapter 5); the scientific evidence supporting the Guideline recommendations (Chapter 6); and information relevant to specific populations and other topics (Chapter 7).

A comparison of the findings of the updated Guideline with the 2000 Guideline reveals the considerable progress made in tobacco research over the brief period separating these two publications. Tobacco dependence increasingly is recognized as a chronic disease, one that typically requires ongoing assessment and repeated intervention. In addition, the updated Guideline offers the clinician many more effective treatment strategies than were identified in the original Guideline. There now are seven different first-line effective agents in the smoking cessation pharmacopoeia, allowing the clinician and patient many different medication options. In addition, recent evidence provides even stronger support for counseling (both when used alone and with other treatments) as an effective tobacco cessation strategy; counseling adds to the effectiveness of tobacco cessation medications, quitline counseling is an effective intervention with a broad reach, and counseling increases tobacco cessation among adolescent smokers.

Finally, there is increasing evidence that the success of any tobacco dependence treatment strategy cannot be divorced from the health care system in which it is embedded. The updated Guideline contains new evidence that health care policies significantly affect the likelihood that smokers

will receive effective tobacco dependence treatment and successfully stop tobacco use. For instance, making tobacco dependence treatment a covered benefit of insurance plans increases the likelihood that a tobacco user will receive treatment and quit successfully. Data strongly indicate that effective tobacco interventions require *coordinated interventions*. Just as the clinician must intervene with his or her patient, so must the health care administrator, insurer, and purchaser foster and support tobacco intervention as an integral element of health care delivery. Health care administrators and insurers should ensure that clinicians have the training and support to deliver consistent, effective intervention to tobacco users.

One important conclusion of this Guideline update is that the most effective way to move clinicians to intervene is to provide them with information regarding multiple effective treatment options and to ensure that they have ample institutional support to use these options. Joint actions by clinicians, administrators, insurers, and purchasers can encourage a culture of health care in which failure to intervene with a tobacco user is inconsistent with standards of care.

Fiore MC, Jaén CR, Baker TB, et al. *Treating Tobacco Use and Dependence: 2008 Update.* Clinical Practice Guideline. Rockville, MD: U.S. Department of Health and Human Services. Public Health Service. May 2008.

The complete Guideline author list can be found on the title page.

Acknowledgments

This Guideline would not have been possible without the collaborative efforts of many individuals and organizations. Each made significant contributions throughout the process of updating this document. Although too numerous to list here, the Contributors section of this publication provides a listing of support staff, individual peer reviewers, and others. Some individuals and organizations, however, deserve special mention.

The Panel wishes to acknowledge the support and guidance provided by the consortium partners in general and their dedicated, hard-working representatives in particular. In addition to the Guideline Liaisons, the Panel gratefully acknowledges the extraordinarily supportive efforts and substantial contributions of Jean Slutsky, Director, Center for Outcomes and Evidence, AHRQ, and the staff at the Office of Communications and Knowledge Transfer, AHRQ; Sandra Cummings, Deputy Director of Operations, Publishing Team; Harriett Bennett, Public Affairs and Marketing Specialist; and Julius Patterson, Guideline Managing Editor.

The Panel also wishes to thank Victor Hasselblad, PhD, who served the project as statistical consultant.

Contents

Tables

Strategies

Figures

Executive Summary

Context

The 1996 *Smoking Cessation Clinical Practice Guideline*[1] emphasized the dire health consequences of tobacco use and dependence, the existence of effective treatments, and the importance of inducing more smokers to use such treatments. It also called for newer, even more effective tobacco dependence treatments. All of these points still are germane. Nevertheless, heartening progress has been made in tobacco control since that time, and this progress is part of a larger pattern of change that stretches back over the past 40 years. This progress reflects the achievements of clinicians, the public health community, scientists, government agencies, health care organizations, insurers, purchasers, and smokers who have successfully quit. As a result, the current prevalence of tobacco use among adults in the United States (about 20.8%) is less than half the rate observed in the 1960s (about 44%).[2,3]

This Guideline concludes that tobacco use presents a rare confluence of circumstances: (1) a highly significant health threat;[4] (2) a disinclination among clinicians to intervene consistently;[5] and (3) the presence of effective interventions. This last point is buttressed by evidence that tobacco dependence interventions, if delivered in a timely and effective manner, significantly reduce the smoker's risk of suffering from smoking-related disease.[6-13] Indeed, it is difficult to identify any other condition that presents such a mix of lethality, prevalence, and neglect, despite effective and readily available interventions.

Although tobacco use still is an enormous threat, the story of tobacco control efforts during the last half century is one of remarkable progress and promise. In 1965, current smokers outnumbered former smokers three to one.[14] During the past 40 years, the rate of quitting has so outstripped the rate of initiation that, today, there are more former smokers than current smokers.[15] Moreover, 40 years ago smoking was viewed as a habit rather than a chronic disease. No scientifically validated treatments were available for the treatment of tobacco use and dependence, and it had little place in health care delivery. Today, numerous effective treatments exist, and tobacco use assessment and intervention are considered to be requisite duties

of clinicians and health care delivery entities. Finally, every state now has a telephone quitline, increasing access to effective treatment.

The scant dozen years following the publication of the first Guideline have ushered in similarly impressive changes. In 1997, only 25 percent of managed health care plans covered any tobacco dependence treatment; this figure approached 90 percent by 2003,[16] although this increased coverage often includes barriers to use. Numerous states added Medicaid coverage for tobacco dependence treatment since the publication of the first Guideline so that, by 2005, 72 percent offered coverage for at least one Guideline-recommended treatment.[16-18] In 2002, The Joint Commission (formerly JCAHO), which accredits some 15,000 hospitals and health care programs, instituted an accreditation requirement for the delivery of evidence-based tobacco dependence interventions for patients with diagnoses of acute myocardial infarction, congestive heart failure, or pneumonia (*www.coreoptions.com/new_site/jcahocore.html*; hospital-specific results: *www.hospitalcompare.hhs.gov*). Finally, Medicare, the Veterans Health Administration, and the United States Military now provide coverage for tobacco dependence treatment. Such policies and systems changes are paying off in terms of increased rates of assessment and treatment of tobacco use.

Data show that the rate at which smokers report being advised to quit smoking has approximately doubled since the early 1990s.[19-22] Recent data also suggest a substantial increase in the proportion of smokers receiving more intensive cessation interventions.[23,24] The National Committee for Quality Assurance (NCQA) reports steady increases for both commercial insurers and Medicaid in the discussion of both medications and strategies for smoking cessation.[25] Finally, since the first Guideline was published in 1996, smoking prevalence among adults in the United States has declined from about 25 percent to about 21 percent.[26]

An inspection of the 2008 Guideline update shows that substantial progress also has been made in treatment development and delivery. Telephone quitlines have been shown to be effective in providing wide access to evidence-based cessation counseling.[27,28] Seven U.S. Food and Drug Administration (FDA)-approved medications for treating tobacco dependence are now available, and new evidence has revealed that particular medications or combinations of medications are especially effective.

This Guideline update also casts into stark relief those areas in which more progress is needed. There is a need for innovative and more effective counseling strategies. In addition, although adolescents appear to benefit from counseling, more consistent and effective interventions and options for use with children, adolescents, and young adults clearly are needed. Smoking prevalence remains discouragingly high in certain populations, such as in those with low socioeconomic status (SES)/low educational attainment, some American Indian populations, and individuals with psychiatric disorders, including substance use disorders.[3] New techniques and treatment delivery strategies may be required before the needs of these groups are adequately addressed. Moreover, although much of the available data come from randomized clinical trials occurring in research settings, it is imperative that new research examine implementation of effective treatments in real-world clinical settings. Finally, new strategies are needed to create consumer demand for effective treatments among tobacco users; there has been little increase in the proportion of smokers who make quit attempts, and too few smokers who do try to quit take advantage of evidence-based treatment that can double or triple their odds of success.[29] New research and communication efforts must impart greater hope, confidence, and increased access to treatments so that tobacco users in ever greater numbers attempt tobacco cessation and achieve abstinence. To succeed, all of these areas require adequate funding.

Thus, this 2008 Guideline update serves as a benchmark of the progress made. It should reassure clinicians, policymakers, funding agencies, and the public that tobacco use is amenable to both scientific analysis and clinical interventions. This history of remarkable progress should encourage renewed efforts by clinicians, policymakers, and researchers to help those who remain dependent on tobacco.

Guideline Origins

This Guideline, *Treating Tobacco Use and Dependence: 2008 Update,* a Public Health Service-sponsored Clinical Practice Guideline, is the product of the Treating Tobacco Use and Dependence Guideline Panel ("the Panel"), government liaisons, consultants, and staff. These individuals were charged with the responsibility of identifying effective, experimentally validated tobacco dependence clinical treatments and practices. This Guideline update is the third Public Health Service Clinical Practice Guideline published on

tobacco use. The first Guideline, the 1996 *Smoking Cessation Clinical Practice Guideline No. 18,* was sponsored by the Agency for Healthcare Policy and Research (AHCPR, now the Agency for Healthcare Research and Quality [AHRQ]), U.S. Department of Health and Human Services (HHS). That Guideline reflected scientific literature published between 1975 and 1994. The second Guideline, published in 2000, *Treating Tobacco Use and Dependence*, was sponsored by a consortium of U. S. Public Health Service (PHS) agencies (AHRQ; Centers for Disease Control and Prevention [CDC]; National Cancer Institute [NCI]; National Heart, Lung, and Blood Institute [NHLBI]; National Institute on Drug Abuse [NIDA]) as well as the Robert Wood Johnson Foundation (RWJF) and the University of Wisconsin Center for Tobacco Research and Intervention (UW-CTRI). That Guideline reflected the scientific literature published from 1975 to 1999. The current 2008 update addresses literature published from 1975 to 2007.

The updated Guideline was written in response to new, effective clinical treatments for tobacco dependence that have been identified since 1999. These treatments promise to enhance the rates of successful tobacco cessation. The original 1996 Guideline was based on some 3,000 articles on tobacco treatment published between 1975 and 1994. The 2000 Guideline required the collection and screening of an additional 3,000 articles published between 1995 and 1999. The 2008 Guideline update screened an additional 2,700 articles; thus, the present Guideline update reflects the distillation of a literature base of more than 8,700 research articles. This body of research of course was further reviewed to identify a much smaller group of articles, based on rigorous inclusion criteria, which served as the basis for focused Guideline data analyses and review.

The 2008 updated Guideline was sponsored by a consortium of eight Federal Government and private nonprofit organizations: AHRQ, CDC, NCI, NHLBI, NIDA, American Legacy Foundation, RWJF, and UW-CTRI. All of these organizations have as their mission reducing the human costs of tobacco use. Given the importance of this issue to the health of all Americans, the updated Guideline is published by the PHS, HHS.

Guideline Style and Structure

This Guideline update was written to be applicable to all tobacco users—those using cigarettes as well as other forms of tobacco. Therefore, the terms "tobacco user" and "tobacco dependence" will be used in prefer-

ence to "smoker" and "cigarette dependence." In some cases, however, the evidence for a particular recommendation consists entirely of studies using cigarette smokers as participants. In these instances, the recommendation and evidence refers to "smoking" to communicate the parochial nature of the evidence. In most cases, though, Guideline recommendations are relevant to all types of tobacco users. Finally, most data reviewed in this Guideline update are based on adult smokers, although data relevant to adolescent smokers are presented in Chapter 7.

The updated Guideline is divided into seven chapters that integrate prior and updated findings:

Chapter 1, Overview and Methods, provides the clinical practice and scientific context of the Guideline update project and describes the methodology used to generate the Guideline findings.

Chapter 2, Assessment of Tobacco Use, describes how each patient presenting at a health care setting should have his or her tobacco use status determined and how tobacco users should be assessed for willingness to make a quit attempt.

Chapter 3, Clinical Interventions for Tobacco Use and Dependence, summarizes effective brief interventions that can easily be delivered in a primary care setting. In this chapter, separate interventions are described for the patient who is *willing* to try to quit at this time, for the patient who is *not yet willing* to try to quit, and for the patient who has recently quit.

Chapter 4, Intensive Interventions for Tobacco Use and Dependence, outlines a prototype of an intensive tobacco cessation treatment that comprises strategies shown to be effective in this Guideline. Because intensive treatments produce the highest success rates, they are an important element in tobacco intervention strategies.

Chapter 5, Systems Interventions, targets health care administrators, insurers, and purchasers, and offers a blueprint to changes in health care delivery and coverage such that tobacco assessment and intervention become a standard of care in health care delivery.

Chapter 6, Evidence and Recommendations, presents the results of Guideline literature reviews and statistical analyses and the recommendations

that emanate from them. Guideline analyses address topics such as the effectiveness of different counseling strategies and medications; the relation between treatment intensities and treatment success; whether screening for tobacco use in the clinic setting enhances tobacco user identification; and whether systems changes can increase provision of effective interventions, quit attempts, and actual cessation rates. The Guideline Panel also made specific recommendations regarding future research needs.

Chapter 7, Specific Populations and Other Topics, evaluates evidence on tobacco intervention strategies and effectiveness with specific populations (e.g., HIV-positive smokers; hospitalized smokers; lesbian/gay/bisexual/transgender smokers; smokers with low SES/limited educational attainment; smokers with medical comorbidities; older smokers; smokers with psychiatric disorders, including substance use disorders; racial and ethnic minorities; women smokers; children and adolescents; light smokers; pregnant smokers; and noncigarette tobacco users). The Guideline Panel made specific recommendations for future research on topics relevant to these populations. This chapter also presents information and recommendations relevant to weight gain after smoking cessation, with specific recommendations regarding future research on this topic.

Findings and Recommendations

The key recommendations of the updated Guideline, *Treating Tobacco Use and Dependence: 2008 Update*, based on the literature review and expert Panel opinion, are as follows:

Ten Key Guideline Recommendations

The overarching goal of these recommendations is that clinicians strongly recommend the use of effective tobacco dependence counseling and medication treatments to their patients who use tobacco, and that health care systems, insurers, and purchasers assist clinicians in making such effective treatments available.

1. Tobacco dependence is a chronic disease that often requires repeated intervention and multiple attempts to quit. Effective treatments exist, however, that can significantly increase rates of long-term abstinence.

2. It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting.

3. Tobacco dependence treatments are effective across a broad range of populations. Clinicians should encourage every patient willing to make a quit attempt to use the counseling treatments and medications recommended in this Guideline.

4. Brief tobacco dependence treatment is effective. Clinicians should offer every patient who uses tobacco at least the brief treatments shown to be effective in this Guideline.

5. Individual, group, and telephone counseling are effective, and their effectiveness increases with treatment intensity. Two components of counseling are especially effective, and clinicians should use these when counseling patients making a quit attempt:

   - Practical counseling (problemsolving/skills training)

   - Social support delivered as part of treatment

6. Numerous effective medications are available for tobacco dependence, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents).

   - Seven first-line medications (5 nicotine and 2 non-nicotine) reliably increase long-term smoking abstinence rates:

     – Bupropion SR
     – Nicotine gum
     – Nicotine inhaler
     – Nicotine lozenge
     – Nicotine nasal spray
     – Nicotine patch
     – Varenicline

- Clinicians also should consider the use of certain combinations of medications identified as effective in this Guideline.

7. Counseling and medication are effective when used by themselves for treating tobacco dependence. The combination of counseling and medication, however, is more effective than either alone. Thus, clinicians should encourage all individuals making a quit attempt to use both counseling and medication.

8. Telephone quitline counseling is effective with diverse populations and has broad reach. Therefore, clinicians and health care delivery systems should both ensure patient access to quitlines and promote quitline use.

9. If a tobacco user currently is unwilling to make a quit attempt, clinicians should use the motivational treatments shown in this Guideline to be effective in increasing future quit attempts.

10. Tobacco dependence treatments are both clinically effective and highly cost-effective relative to interventions for other clinical disorders. Providing coverage for these treatments increases quit rates. Insurers and purchasers should ensure that all insurance plans include the counseling and medication identified as effective in this Guideline as covered benefits.

Guideline Update: Advances

A comparison of the findings of the 2008 Guideline update with the 2000 Guideline reveals the considerable progress made in tobacco research over the brief period separating these two works. Among many important differences between the two documents, the following deserve special note:

- The updated Guideline has produced even stronger evidence that counseling is an effective tobacco use treatment strategy. Of particular note are findings that counseling adds significantly to the effectiveness of tobacco cessation medications, quitline counseling is an effective intervention with a broad reach, and counseling increases abstinence among adolescent smokers.

- The updated Guideline offers the clinician a greater number of effective medications than were identified in the previous Guideline. Seven

different effective first-line smoking cessation medications are now approved by the FDA for treating tobacco use and dependence. In addition, multiple combinations of medications have been shown to be effective. Thus, the clinician and patient have many more medication options than in the past. The Guideline also now provides evidence regarding the effectiveness of medications relative to one another.

- The updated Guideline contains new evidence that health care policies significantly affect the likelihood that smokers will receive effective tobacco dependence treatment and successfully stop tobacco use. For instance, making tobacco dependence a benefit covered by insurance plans increases the likelihood that a tobacco user will receive treatment and quit successfully.

Future Promise

The research reviewed for this 2008 Guideline update suggests a bright future for treating tobacco use and dependence. Since the first AHCPR Clinical Practice Guideline was published in 1996, encouraging progress has been made in tobacco dependence treatment. An expanding body of research has produced a marked increase in the number and types of effective treatments and has led to multiple new treatment delivery strategies. These new strategies are enhancing the delivery of tobacco interventions both inside and outside health care delivery systems. This means that an unprecedented number of smokers have access to an unprecedented number of effective treatments.

Although the data reviewed in this Guideline update are encouraging and portend even greater advances through future research, for many smokers, the progress has been an undelivered promissory note. Most smokers attempting to quit today still make unaided quit attempts,[29-32] although the proportion using evidence-based treatments has increased since the publication of the 1996 AHCPR Guideline.[33-35] Because of the prevalence of such unaided attempts (those that occur without evidence-based counseling or medication), many smokers have successfully quit through this approach.[6,36] It is clear from the data presented in this Guideline, however, that smokers are significantly more likely to quit successfully if they use an evidence-based counseling or medication treatment than if they try to quit without such aids. Thus, a future challenge for the field is to ensure that smokers, clinicians, and health systems have accurate

information on the effectiveness of clinical interventions for tobacco use, and that the 70 percent of smokers who visit a primary care setting each year have greater access to effective treatments. This is of vital public health importance because the costs of failure are so high. Relapse results in continuing lifetime exposure to tobacco, which leads to increased risk of death and disease. Additional progress must be made in educating clinicians and the public about the effectiveness of clinical treatments for tobacco dependence and in making such treatments available and attractive to smokers.

Continued progress is needed in the treatment of tobacco use and dependence. Treatments should be even more effective and available, new counseling strategies should be developed, and research should focus on the development of effective interventions and delivery strategies for populations that carry a disproportionate burden from tobacco (e.g., adolescents; pregnant smokers; American Indians and Alaska Natives; individuals with low SES/limited educational attainment; individuals with psychiatric disorders, including substance use disorders). The decrease in the prevalence of tobacco use in the United States during the past 40 years, however, has been a seminal public health achievement. Treatment of tobacco use and dependence has played an important role in realizing that outcome.

Chapter 1 Overview and Methods

Introduction

Tobacco use has been cited as the chief avoidable cause of illness and death in our society and accounts for more than 435,000 deaths each year in the United States.[37,38] Smoking is a known cause of multiple cancers, heart disease, stroke, complications of pregnancy, chronic obstructive pulmonary disease (COPD), and many other diseases.[4] In addition, recent research has documented the substantial health dangers of involuntary exposure to tobacco smoke.[4] Despite these health dangers and the public's awareness of those dangers, tobacco use remains surprisingly prevalent. Recent estimates are that about 21 percent of adult Americans smoke,[3] representing approximately 45 million current adult smokers.[3,39] Moreover, tobacco use remains a pediatric disease.[40-42] Each day, about 4,000 youth ages 12 to 17 years smoke their first cigarette, and about 1,200 children and adolescents become daily cigarette smokers.[43-44] As a result, new generations of Americans are at risk for the extraordinarily harmful consequences of tobacco use.

Tobacco use exacts a heavy cost to society as well as to individuals. Smoking-attributable health care expenditures are estimated at $96 billion per year in direct medical expenses and $97 billion in lost productivity.[28] It has been estimated that the per pack additional cost of smoking to society is approximately $7.18 per pack,[45] and the combined cost of each pack to society and the individual smoker and family is nearly $40.[46] If all smokers covered by state Medicaid programs quit, the annual savings to Medicaid would be $9.7 billion after 5 years.[47]

Despite the tragic consequences of tobacco use, clinicians and health care systems often fail to treat it consistently and effectively. For instance, in 1995, about the time of the release of the first clinical practice guideline, smoking status was identified in only about 65 percent of clinic visits, and smoking cessation counseling was provided in only 22 percent of smokers' clinic visits.[48,49] Moreover, treatment typically was offered only to patients already suffering from tobacco-related diseases.[48] This pattern gradually began to improve as of 2005, with up to 90 percent of smokers reporting they had been asked about smoking status and more than 70 percent reporting having received some counseling to quit.[23,50,51] However, the failure to assess and intervene consistently with all tobacco users continues despite sub-

stantial evidence that even brief interventions can be effective among many different populations of smokers.[52-58] Also, the use of effective medications is low. Among current smokers who attempted to stop for at least 1 day in the past year, only 21.7 percent used cessation medication.[33]

This Guideline concludes that tobacco use presents a rare confluence of circumstances: (1) a highly significant health threat;[4] (2) a lack of consistent intervention by clinicians; and (3) the presence of effective interventions. This last point is buttressed by evidence that tobacco use interventions, if delivered in a timely and effective manner, can rapidly reduce the risk of suffering from smoking-related disease.[6-13] Indeed, it is difficult to identify any other condition that presents such a mix of lethality, prevalence, and neglect, despite effective and readily available interventions.

Significant barriers interfere with clinicians' assessment and treatment of smokers. Many clinicians lack knowledge about how to identify smokers quickly and easily, which treatments are effective, how such treatments can be delivered, and the relative effectiveness of different treatments.[59-62] Additionally, clinicians may fail to intervene because of inadequate clinic or institutional support for routine assessment and treatment of tobacco use[48,60,63] and for other reasons such as time constraints, limited training in tobacco cessation interventions, a lack of insurance coverage for tobacco use treatment, or inadequate payment for treatment.[64-67]

Rationale for Guideline Development and Periodic Updates

In the early 1990s, the Agency for Healthcare Policy and Research ([AHCPR] now the Agency for Healthcare Research and Quality [AHRQ]) convened an expert panel to develop the *Smoking Cessation Clinical Practice Guideline* (the "Guideline"), Number 18 in the AHCPR series of Clinical Practice Guidelines. The need for this Guideline was based on several factors, including tobacco use prevalence, related morbidity and mortality, the economic burden imposed by tobacco use, variation in clinical practice, availability of methods for improvement of care, and availability of data on which to base recommendations for care. More than 1 million copies of the 1996 Guideline and its affiliated products were disseminated. The original Guideline recommendations inspired changes in diverse health care settings such as managed care organizations and the Veterans Health Administration. The original Guideline also provided a framework for edu-

cating clinicians, administrators, and policymakers about the importance of tobacco dependence and its treatment. It stimulated discussions that addressed the development of tobacco dependence treatment programs at the Federal and State levels and by professional medical organizations.

Significant new research findings regarding tobacco use and its treatment led to the 2000 Guideline update, which was authored by the expert panel that developed the 1996 Guideline. The 2000 Guideline update was a product of the U. S. Public Health Service (PHS), sponsored by a consortium of private and public partners, including AHRQ; National Cancer Institute (NCI); National Heart, Lung, and Blood Institute (NHLBI); National Institute on Drug Abuse (NIDA); Centers for Disease Control and Prevention (CDC); Robert Wood Johnson Foundation (RWJF); and University of Wisconsin School of Medicine and Public Health Center for Tobacco Research and Intervention (UW-CTRI).

The 2000 Guideline, titled *Treating Tobacco Use and Dependence,* comprised specific evidence-based recommendations to guide clinicians, tobacco treatment specialists, insurers, purchasers, and health care administrators in their efforts to develop and implement clinical and institutional changes that support the reliable identification, assessment, and treatment of patients who use tobacco. This title underscores three truths about tobacco use.[68] First, all tobacco products—not just cigarettes—exact devastating costs on the Nation's health and welfare. Second, for most users, tobacco use results in true drug dependence, comparable to the dependence caused by opiates, amphetamines, and cocaine.[69-72] Third, both chronic tobacco use and dependence warrant clinical intervention and, as with other chronic disorders, these interventions may need to be repeated over time.[73,74]

The 2000 *Treating Tobacco Use and Dependence* document was the most widely disseminated Guideline ever released by AHRQ, with more than 5 million copies of the Guideline and related products distributed. Moreover, it has had an enormous influence on tobacco use treatment and policy worldwide, serving as the basis for Guidelines in Australia, Canada, Chile, Japan, Portugal, and Switzerland, among other countries.

The continued expansion of new scientific findings on the effective treatment of tobacco use led to calls for the current update, *Treating Tobacco Use and Dependence: 2008 Update*. The 2008 update reviewed scientific

evidence from 1975 to 2007 on selected topics and in total reviewed more than 8,700 scientific publications. The result of this methodologically rigorous review is an updated set of recommendations on effective counseling and medication treatments and institutional policies that can guide clinicians, specialists, and health systems in intervening with tobacco users. Appendix D summarizes new recommendations and changes to the 2000 Guideline.

The clinician audience for this Guideline update is all professionals who provide health care to tobacco users. This includes: physicians, nurses, physician assistants, medical assistants, dentists, hygienists, respiratory therapists, psychologists, mental health counselors, pharmacists, and others. The ultimate beneficiaries of the Guideline are tobacco users and their families.

Most tobacco users in the United States are cigarette smokers. As a result, the majority of clinician attention and research in the field has focused on the treatment and assessment of smoking. Clinicians, however, should intervene with all tobacco users, not just with those who smoke cigarettes. To foster a broad implementation of this Guideline update, every effort has been made to describe interventions so that they are relevant to all forms of tobacco use. In some sections of this Guideline, the term "smoker" is used instead of "tobacco user." The use of the term "smoker" means that all relevant evidence for a recommendation arises from studies of cigarette smokers. Additional discussion of noncigarette forms of tobacco use is found in Chapter 7.

The 2008 Guideline update generally is consistent with the findings of the 2000 Guideline (see Appendix D). It also is important to note that other Guidelines and analyses on the treatment of tobacco dependence have been published with essentially consistent findings, including those from the American Psychiatric Association,[75,76] the American Medical Association,[77] the American Dental Association,[78] the American Nurses Association,[79] the American College of Obstetricians and Gynecologists, the Institute of Medicine,[80] the United Kingdom Guideline,[81] and the Cochrane Collaboration (*www.cochrane.org/index.htm*). Finally, throughout the Guideline update, the terms "tobacco use treatment" and "tobacco dependence treatment" will be used interchangeably to emphasize the fact that both chronic use and dependence merit clinical intervention.

Tobacco Dependence as a Chronic Disease

Tobacco dependence displays many features of a chronic disease. Only a minority of tobacco users achieve permanent abstinence in an initial quit attempt. The majority of users persist in tobacco use for many years and typically cycle through multiple periods of remission and relapse. A failure to appreciate the chronic nature of tobacco dependence may impede clinicians' consistent assessment and treatment of the tobacco user over time.

Epidemiologic data suggest that more than 70 percent of the 45 million smokers in the United States today report that they want to quit, and approximately 44 percent report that they try to quit each year.[3] Unfortunately, most of these efforts are both unaided and unsuccessful. For example, among the 19 million adults who attempted to quit in 2005,[39] only 4 to 7 percent were likely successful.[82,83] These statistics may discourage both smokers and clinicians.

Modern approaches to treating tobacco use and dependence should reflect the chronicity of tobacco dependence. A chronic disease model recognizes the long-term nature of the disorder with an expectation that patients may have periods of relapse and remission. If tobacco dependence is recognized as a chronic disease, clinicians will better understand the relapsing nature of the condition and the requirement for ongoing, rather than just acute, care. The existence of numerous effective treatments gives the clinician and patient many options should repeated quit attempts be needed.

A chronic disease model emphasizes for clinicians the importance of continued patient education, counseling, and advice over time. Although most clinicians are comfortable in counseling their patients about other chronic diseases such as diabetes, hypertension, or hyperlipidemia, many believe that they are less effective in providing counseling to patients who use tobacco.[84,85] As with these other chronic disorders, clinicians should be encouraged to provide tobacco-dependent patients with brief advice, counseling, and appropriate medication. It is important for clinicians to know that assessing and treating tobacco use generally leads to greater patient satisfaction with health care.[23,50,86-88] Moreover, policy changes (e.g., tax increases, smoke-free ordinances) often lead smokers to seek treatment for this chronic disease.

In updating the Guideline, the Panel has presented evidence-based analytic findings in a format accessible and familiar to practicing clinicians. Although this should aid clinicians in the assessment and treatment of tobacco users, clinicians should remain cognizant that relapse is likely and that it reflects the chronic nature of dependence. Most smokers who ultimately quit smoking experience episodes of relapse on the way to success. Relapse should not discourage the clinician or the tobacco user from renewed quit attempts.

Coordination of Care: Institutionalizing the Treatment of Tobacco Dependence

Increasing evidence shows that the success of any tobacco dependence treatment strategy cannot be divorced from the health care system in which it is embedded. Data strongly indicate that the consistent and effective delivery of tobacco interventions requires *coordinated interventions*. Just as a clinician must intervene with his or her patient, so must the health care administrator, insurer, and purchaser ensure the provision of tobacco dependence treatment as an integral element of health care delivery. Health care purchasers and insurers should ensure that evidence-based tobacco dependence counseling and medications are a covered and available health insurance benefit for all enrollees and that enrollees are aware of such benefits. Health care administrators also should provide clinicians with the training and institutional support and systems to ensure consistent identification of and intervention with patients who use tobacco. Therefore, insurers, purchasers, and health care organizations should promote the utilization of covered treatments and assess usage and outcomes in performance measurement systems.[89] Finally, increasing evidence shows that, for maximum public health benefit, access to effective treatments should be increased during and following the implementation of population-level tobacco control policies (i.e., tobacco tax increases and clean indoor air laws), which boost motivation and support for quitting efforts.[90]

Guideline Development Methodology

Introduction

Panel recommendations are intended to provide clinicians with effective strategies for treating patients who use tobacco. Fundamentally, this document is a clinical practice guideline. Recommendations were influ-

enced by two goals. The first was to identify effective treatment strategies. The second was to formulate and present recommendations that can be implemented easily across diverse clinical settings (e.g., primary care and specialty clinics; pharmacies; hospitals, including emergency departments; worksites; and school-based clinics) and patient populations.

The Guideline update is based on three systematic reviews of the available scientific literature. The first review occurred during the creation of the original Guideline published in 1996 and included literature published from 1975 through 1994. The second review was conducted for the 2000 Guideline and included literature from 1995 through January 1999. The third review was conducted on literature published from 1999 to June 2007. The three data sets were combined into a single database that was used for the 2008 analyses.

The Panel identified randomized placebo/comparison controlled trials as the strongest level of evidence for the evaluation of treatment effectiveness. Thus, evidence derived from randomized controlled trials serves as the basis for meta-analyses and for almost all of the recommendations contained in this Guideline. Questions have been raised about medication placebo controls because individuals sometimes guess their actual medication condition at greater than chance levels.[91] It is possible, therefore, that the typical randomized control trial does not control completely for placebo effects. This should be borne in mind when appraising the results of the medication meta-analyses. Further, in studies of counseling, it often is not possible to control for a nonspecific placebo effect.

The Panel occasionally made recommendations in the absence of randomized controlled trials when faced with an important clinical practice issue for which other types of evidence existed. This Guideline clearly identifies the level or strength of evidence that serves as the basis for each of its recommendations.

Topics Included in the Guideline

The Panel identified tobacco use as the targeted behavior and tobacco users as the clinical population of interest. Tobacco dependence treatments were evaluated for effectiveness, as were interventions aimed at modifying both clinician and health care delivery system behavior. At the start of the 2008 update process, Guideline Panel members, outside experts, and

consortium representatives were consulted to determine those aspects of the 2000 Guideline that required updating. These consultations resulted in the following chief recommendations that guided the update efforts: (1) to conduct new literature reviews and meta-analyses on topics distinguished by their public health importance and for which significant new evidence is available; (2) to review previous recommendations and to identify a subset of recommendations for which to review new data; special attention was paid to clinical situations for which the Panel had previously achieved consensus in the absence of relevant controlled trials ("C"-level recommendations) to ensure that these still warranted Guideline Panel support; (3) to consider anew the strategies that might be used in clinical settings to deliver brief tobacco dependence interventions (see Chapter 3); and (4) to identify important topics for future research. Eleven topics out of 64 considered were chosen by the Panel for updated meta-analysis (see Table 1.1).

Table 1.1. Topics chosen by the 2008 Guideline Panel for updated meta-analysis

Effectiveness of proactive quitlines
Effectiveness of combining counseling and medication relative to either counseling or medication alone
Effectiveness of varenicline
Effectiveness of various medication combinations
Effectiveness of long-term medication use
Effectiveness of tobacco use interventions for individuals with low SES/limited formal education
Effectiveness of tobacco use interventions for adolescent smokers
Effectiveness of tobacco use interventions for pregnant smokers
Effectiveness of tobacco use interventions for individuals with psychiatric disorders, including substance use disorders
Effectiveness of providing tobacco use interventions as a health benefit
Effectiveness of systems interventions, including provider training and the combination of training and systems interventions

This Guideline update was specifically intended to review the evidence regarding clinical treatment of tobacco dependence. Interventions for the primary prevention of tobacco use were not examined in detail, with the exception of interventions directly relevant to clinical practice. Readers also may refer to the 1994 Surgeon General's Report, *Preventing Tobacco Use Among Young People*[41] and the 2000 Surgeon General's Report, *Reducing Tobacco Use,*[6] for information on the primary prevention of tobacco

use. Community-level interventions (e.g., mass media campaigns) that are not usually implemented in primary care practice settings were not addressed. For more information on community-based tobacco use prevention, refer to the Centers for Disease Control and Prevention *Guide to Community Preventive Services*.[92] The Guideline update did not examine evidence regarding unaided quit attempts as this Guideline focused on clinical interventions. Finally, the use of exposure reduction strategies[93] (strategies in which tobacco users alter, rather than eliminate, their use of nicotine or tobacco in an attempt to reduce or avoid its harmful consequences) were not considered due to a lack of data and the fact that they are beyond the scope of a clinical practice guideline focused on treating tobacco use and dependence. Current research does not offer answers to key questions regarding exposure reduction strategies: their population-wide impact on cessation and initiation of smoking, their long-term benefits as compared with those of a strategy focused on tobacco abstinence, and their success in reducing long-term exposure to tobacco toxins.

This Guideline update is designed for two main audiences: first, clinicians; and second, health care administrators, insurers, and purchasers. It is designed to be used in a wide variety of clinical practice settings, including private medical practices; dental offices; pharmacies; academic health centers; mental health and substance abuse treatment clinics; telephone quitlines; managed care organizations; public health department clinics; hospitals, including emergency departments; and school or worksite clinics. The ultimate beneficiaries of the Guideline are tobacco users and their families.

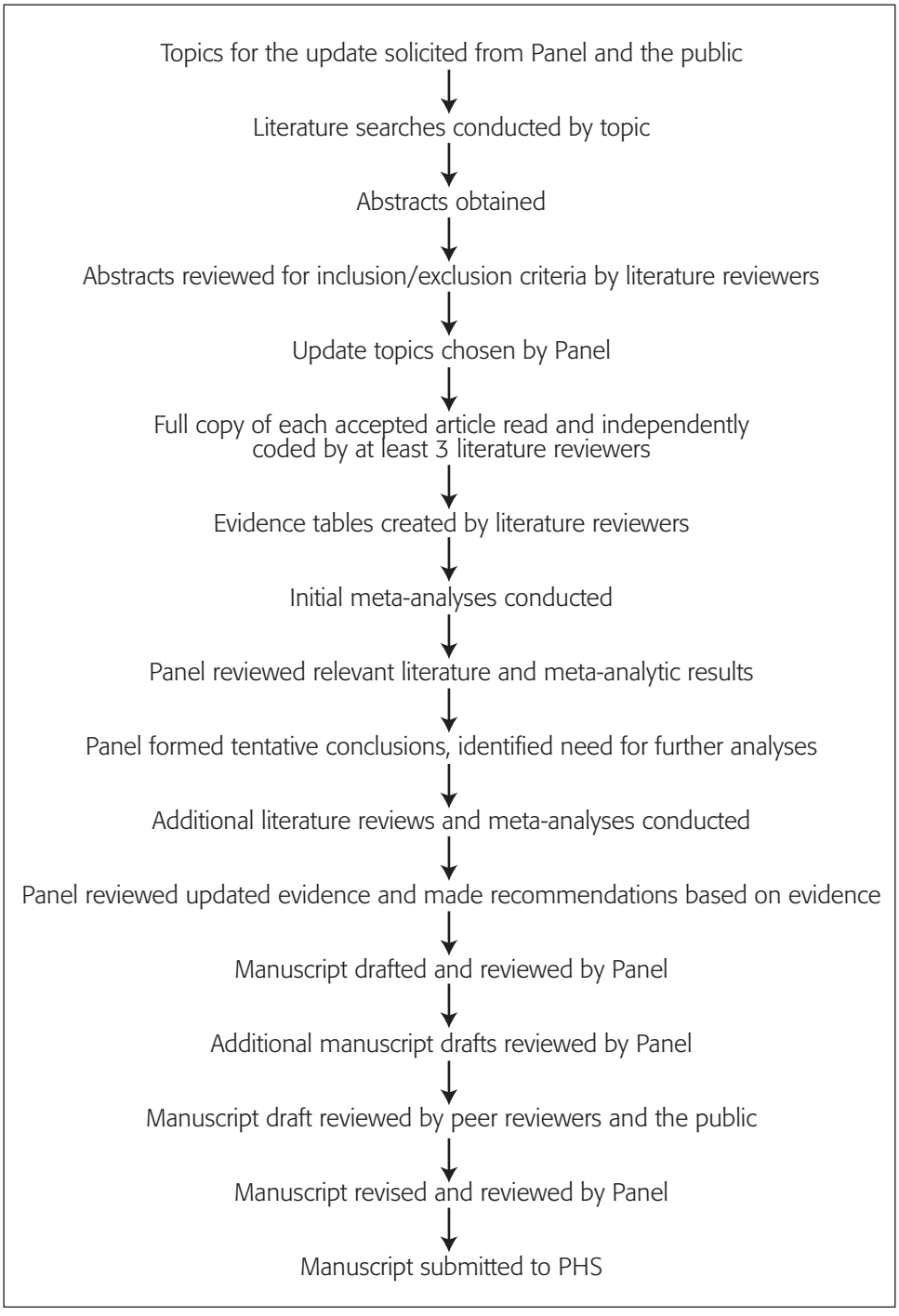
Guideline Development Process

The 2008 Guideline update development process (see Figure 1.1) was initiated in mid-2006. The methodology was consistent with that followed by the 2000 Guideline except where specifically identified below.

Selection of Evidence

Published, peer-reviewed, randomized controlled studies were considered to constitute the strongest level of evidence in support of Guideline recommendations. This decision was based on the judgment that randomized controlled trials provide the clearest scientifically sound basis for judging

Figure 1.1. 2008 Guideline development process



comparative effectiveness. Most of these randomized trials, however, were conducted with individuals who proactively sought treatment and who volunteered to fulfill various research requirements. It is possible that these individuals were more highly motivated to quit smoking than the typical smoker encountered in a clinical practice setting. Thus, the percentage abstinent estimates supplied with the meta-analyses may overestimate the actual level of abstinence produced by some of the treatments in real-world settings. Analyses conducted for the previous Guideline editions, though, suggest that the treatment effect sizes (odds ratios or ORs) are relatively stable across individuals seeking treatment ("treatment seekers") and those recruited via inclusive recruitment strategies ("all-comers"). Randomized controlled trials were exclusively used in meta-analyses. However, the Panel recognized that variations in study inclusion criteria sometimes were warranted. For instance, research on tobacco interventions in adolescents frequently assigns interventions on the basis of larger units, such as schools. These units, rather than individuals, were allowed to serve as units of analysis when analyzing interventions for adolescents. In such cases, studies were combined for inclusion in meta-analyses if the study satisfied other review criteria. A similar strategy was followed in the review of health systems research.

In certain areas, research other than randomized clinical trials was evaluated and considered to inform Panel opinion and judgment, though not submitted to meta-analysis. This occurred with topics such as tobacco dependence treatment in specific populations, tailoring interventions, and cost-effectiveness of tobacco dependence treatment.

Literature Review and Inclusion Criteria

Approximately 8,700 articles were screened to identify evaluable literature. This figure includes approximately 2,700 articles added to the literature since publication of the 2000 Guideline. These articles were obtained through searches of 11 electronic databases and reviews of published abstracts and bibliographies. An article was deemed appropriate for meta-analysis if it met the criteria for inclusion established *a priori* by the Panel. These criteria were that the article: (a) reported the results of a randomized, placebo/comparison controlled trial of a tobacco use treatment intervention randomized on the patient level (except as noted above); (b) provided followup results at least 5 months after the quit date (except in the case of studies evaluating tobacco dependence treatments

for pregnant smokers); (c) was published in a peer-reviewed journal; (d) was published between January 1975 and June 2007; (e) was published in English; and (f) was one of the 11 topics chosen to be included in the 2008 update (see Table 1.1). It is important to note that the article-screening criteria were updated for the 2008 Guideline update. Additionally, articles were screened for relevance to safety, economic, or health systems issues. As a result of the original and update literature reviews, more than 300 articles were identified for possible inclusion in a meta-analysis, and more than 600 additional articles were examined in detail by the Panel. These latter articles were used in the formulation of Panel recommendations that were not supported by meta-analyses. The literature search for the update project was validated by comparing the results against a search conducted by the CDC and through review by the expert Panel.

When individual authors published multiple articles meeting the meta-analytic inclusion criteria, the articles were screened to determine whether they contained unique data. When two articles reported data from the same group of subjects, both articles were reviewed to ensure that complete data were obtained. The data were treated as arising from a single study in meta-analyses.

Preparation of Evidence Tables

Two Guideline staff reviewers independently read and coded each article that met inclusion criteria. The reviewers coded the treatment characteristics that were used in data analyses (see Tables 6.1 and 6.2 in Chapter 6). The same general coding procedure employed during the 2000 Guideline process was employed during the update. When adjustments to the coding process were made, articles coded with the original process were re-coded to reflect the changed coding (e.g., more refined coding criteria were used for the coding of treatment intensity).

A third reviewer then examined the coding of both reviewers and adjudicated any differences. Discrepancies that could not be resolved through this process were adjudicated by the project manager, Panel chair, and/or the Panel's senior scientist. Finally, each article accepted for a meta-analysis had key fields reviewed by the project manager as a final quality check. The data then were compiled and used in relevant analyses and/or Panel deliberations. Analyses done for the 2000 Guideline revealed that intervention coding categories could be used reliably by independent raters.[94]

Outcome Data

Six-month followup after the quit date is a standard followup duration for reporting data from clinical trials. Therefore, focusing on a 6-month timepoint in meta-analyses allowed the investigators to capture the greatest number of studies for analysis. Also, research indicates that a high percentage of those who ultimately return to smoking will do so by 6 months.[95-98] Because a strict adherence to a 6-month timepoint would have eliminated a significant number of studies, a 1-month window was permitted such that studies with 5 months of followup data were included, but 6-month data were used if both 5- and 6-month data were available. When quit rates were provided for longer endpoints, outcome data from the endpoint closest to 6 months were used, so long as they did not exceed 3 years. Outcome data beyond 3 years rarely were available and were not included in the Guideline analyses. In the area of medication treatment, the inclusive meta-analysis reported in Table 6.26 was repeated with longer term outcome data (10–14 month postquit). This additional meta-analysis largely replicated the results of the meta-analysis based on a 6-month followup time frame. This suggested that the shorter, more inclusive, followup timepoint captured effect sizes that were similar to those yielded by the use of longer followup timepoints. There was one exception to the selection of followup data described above. In the case of pregnancy studies, both predelivery and postdelivery (5 months) outcomes were analyzed.

Panel staff also coded biochemical confirmation of self-reported tobacco use abstinence. Previous Guideline analyses show that studies with and without biochemical confirmation yield similar meta-analysis results. Therefore, meta-analyses presented in the Guideline reflect a pooling of these studies. If both biochemically confirmed and nonconfirmed data were available from the same study, however, the confirmed data were used in analyses. As in the 2000 Guideline, only studies that used biochemical verification were used in the meta-analyses of pregnant smokers because of the under-reporting of smoking status by pregnant women.

All of the new meta-analyses conducted for the 2008 Guideline were based exclusively on intent-to-treat data, in which the denominator was the number of participants randomized to treatment and the numerator was the number of abstinent participants contacted at followup. Some meta-analyses conducted for the 1996 and 2000 Guideline comprised a small number of studies in which the denominator consisted only of participants

who completed treatment. The vast majority of studies across all analyses reported intent-to-treat data and these data were used if both types of data were available.

Studies were coded for how the outcome measures were reported—"point prevalence," "continuous," or "unknown/other." If abstinence data were based on tobacco use occurrence within a set time period (usually 7 days) prior to a followup assessment, the outcome measure was coded as "point prevalence." "Continuous" was used when a study reported abstinence based on whether study subjects were continuously abstinent from tobacco use since their quit day. "Unknown/other" was used when it was not possible to discern from the study report whether the authors used a point prevalence or continuous measure for abstinence or if abstinence was measured from some point other than the quit day.

As in the 1996 and 2000 Guidelines, a point prevalence outcome measure (7-day point prevalence, when available), rather than continuous abstinence, was used as the chief outcome variable. Point prevalence was preferred for several reasons. First, this was the modal reporting method among the analyzable studies. Second, continuous abstinence data may underestimate the percentage of individuals who are abstinent at particular followup timepoints, although some data suggest that these rates are similar.[99] Finally, most relapse begins early in a quit attempt and persists.[95-97,100-102] A point prevalence measure taken at 6 months certainly would capture the great majority of those relapse events. Therefore, whenever possible, 7-day point prevalence abstinence data were used. If point prevalence data were not available, the preferred alternative was continuous abstinence data.

Meta-Analytic Techniques

The principal analytic technique used in this Guideline update was meta-analysis. This statistical technique estimates the impact of a treatment or variable across a set of related investigations. The primary meta-analytic model used in this and the previous two Guidelines was logistic regression using random effects modeling. The modeling was performed at the level of the treatment arm, and study effects were treated as fixed. The panel methodologist chose to employ random effects modeling, assuming that both the subject populations and the treatment elements analyzed would

vary from study to study (e.g., counseling might be done somewhat differently at two different sites). Random effects modeling is well suited to accommodate such variation among studies.[103] The statistician used the EGRET Logistic Normal Model.[104] A complete and detailed review of the meta-analytic methods used in the Guideline can be found in the *Smoking Cessation Guideline Technical Report No. 18,* available from AHRQ as AHCPR Publication No. 97-N004. The specific articles used in each meta-analysis included in the 2008 Guideline can be found at *www.surgeongeneral.gov/tobacco/gdlnrefs.htm*.

In general, meta-analysis was used only with studies with randomization at the level of subject. In some areas (health systems changes, adolescents), however, studies often involved randomization at another level (e.g., clinician, clinic, etc.). Such studies were used in meta-analyses of a small number of topics when such studies occurred in sufficient numbers to permit inferences. Screening of such articles considered factors such as data nonindependence, the evaluation of pre-intervention or baseline status, and the number and types of higher level units.

The initial step in meta-analysis was the selection of studies that were relevant to the treatment characteristic being evaluated. After relevant studies were identified (i.e., those that contained a self-help intervention if self-help treatments were being evaluated), Panel staff reviewed the studies to ensure that they passed screening criteria. Some screening criteria were general (e.g., study presents greater than 5 months of followup data), whereas other criteria were specific to the type of treatment characteristic evaluated (i.e., in the analysis of quit lines, screening ensured that treatment arms were not confounded with differing intensities of in-person counseling).

The separate arms (treatment or control groups) in each study then were inspected to identify confounders that could compromise interpretation. Seriously confounded arms were excluded from analysis. Relevant characteristics of each arm were then coded to produce meaningful analytic comparisons. Criteria for performing a meta-analysis included: (1) the Guideline Panel judged the topic to be addressed in the meta-analysis as having substantial clinical significance; (2) at least two studies meeting selection criteria existed on the topic and the studies contained suitable within-study control or comparison conditions (e.g., each study had to contribute at least two arms that would permit the estimation of within-study effects); and (3) there was an acceptable level of interstudy homogeneity in the

analyzed variable or treatment so as to permit meaningful inference (e.g., an analyzed treatment was sufficiently similar across various studies so that combining studies was meaningful).

Limitations of Meta-Analytic Techniques. Several factors can compromise the internal validity of meta-analyses. For example, publication biases (particularly the tendency to publish only those studies with positive findings) may result in biased summary statistics. The complement to publication bias is the "file-drawer effect," in which negative or neutral findings are not submitted for publication. In addition, either the magnitude or the significance of the effects of meta-analyses may be influenced by factors such as the frequency with which treatments occurred in the data set and by the extent to which treatments co-occurred with other treatments. All else being equal, a treatment that occurs infrequently in the data set is less likely to be found significant than a more frequently occurring treatment. Also, when two treatments co-occur frequently in the same groups of subjects, it is difficult to apportion statistically the impact of each. In addition, comparability biases can exist when substantially different groups or treatments are coded as being the same (e.g., when treatments are similar only on a superficial attribute).

The generalizability of meta-analytic findings was evaluated for previous Guideline editions with respect to whether patients sought cessation treatment ("self-selected") or whether treatment was delivered without the patient seeking it ("all-comers," as when cessation treatment occurred as an integral part of health care). Conducting separate meta-analyses in these different subject populations yielded very similar findings across a variety of treatment dimensions (e.g., treatment format, treatment intensity). No other population characteristic (e.g., years smoked, severity of dependence) was explored in meta-analyses.

Interpretation of Meta-Analysis Results. The meta-analyses yielded logistic regression coefficients that were converted to odds ratios. The meaning or interpretation of an odds ratio can be seen most easily by means of an example depicted in a 2 x 2 table. Table 1.2 contains data showing the relation between maternal smoking and low birth-weight in infants. Data are extracted from Hosmer and Lemeshow, 2000.[105] The odds of a low birth-weight infant if the mother smokes are 30:44, or 0.68 to 1. The odds of a low birth-weight infant if the mother does not smoke are 29:86, or 0.34 to 1. The odds ratio may be estimated as (30/44)/(29/86) = 2.02 to 1. There-

fore, the odds ratio can be seen roughly as the odds of an outcome on one variable, given a certain status on another variable(s). In the case above, the odds of a low birth-weight infant are about double for women who smoke compared with those who do not.

Table 1.2. Relation between maternal smoking and low birth-weight in infants

		Maternal smoking		
		Yes	No	
Low birth-weight	Yes	30	29	59
	No	44	86	130
		74	115	189

Once odds ratios were obtained from the meta-analyses, 95 percent confidence intervals (C.I.) were estimated around the odds ratios. An odds ratio is only an estimate of a relation between variables. The 95 percent confidence interval presents an estimate of the precision of the particular odds ratio obtained. If the 95 percent confidence interval for a given odds ratio does not include "1," then the odds ratio represents a statistically significant difference between the evaluated treatment and the reference or control condition at the 0.05 level. The confidence intervals generally will not be perfectly symmetrical around an odds ratio because of the distributional properties of the odds ratio. The confidence intervals do not reveal whether active treatments differ significantly from one another, only whether they differ from the comparison condition (e.g., placebo medication, no contact). In the inclusive meta-analysis on medications, comparisons of an active medication versus the nicotine patch were accomplished via *a posteriori* contrasts, not on the basis of nonoverlapping confidence intervals.

After computing the odds ratios and their confidence intervals, the odds ratios were converted to abstinence percentages and their 95 percent confidence intervals (based on reference category abstinence rates). Abstinence percentages indicate the estimated long-term abstinence rate achieved under the tested treatment or treatment characteristic. The abstinence percentage results are approximate estimates derived from the odds ratio data. Therefore, they essentially duplicate the odds ratio results but are presented because their meaning may be clearer for some readers. Because the placebo/control abstinence percentage for a particular analysis is calculated exclusively from the studies included within that meta-analysis, these abstinence percentages vary across the different analyses. Therefore, the

odds ratios and abstinence rates presented across the different tables are estimated relative to different placebo or control conditions.

How To Read the Data Tables

Table 1.3 depicts results from one of the meta-analyses reported in this Guideline update. This table presents results from the analysis of the effects of proactive telephone counseling (see Formats of Psychosocial Treatments in Chapter 6). In this table, the comparison condition, or "reference group," for determining the impact of different treatment options was smokers who received minimal or no counseling or self-help. The "Estimated odds ratio" column reveals that treatment conditions receiving proactive telephone counseling had an odds ratio of 1.6. The odds ratio indicates a statistically significant effect because the lower boundary of the confidence interval did not include "1." This odds ratio means that when smokers receive proactive telephone counseling, they are more than one and one-half times more likely to remain abstinent than if they had received minimal or no counseling or self-help.

Table 1.3. Meta-analysis (2008): Effectiveness of and estimated abstinence rates for proactive telephone counseling compared to minimal interventions, self-help, or no counseling (n = 9 studies)

Intervention	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Minimal or no counseling or self-help	11	1.0	10.5
Quitline counseling	11	1.6 (1.4–1.8)	15.5 (13.8–17.3)

The column labeled "Estimated abstinence rate" shows the abstinence percentages for the two treatment conditions. For instance, the reference condition (minimal or no counseling) in the analyzed data set was associated with an abstinence rate of 10.5 percent. Consistent with the odds ratio data reviewed above, proactive telephone counseling produced modest increases in abstinence rates (15.5%).

The total number of studies included in each meta-analysis is provided within the title of the corresponding table. A list of published articles used in each meta-analysis can be found at: *www.surgeongeneral.gov/tobacco/gdlnrefs.htm*. Finally, the 2008 Guideline update includes meta-analyses

completed for the 1996, 2000, and 2008 Guidelines. In the title of each meta-analysis, the year in which it was first published is provided.

The column labeled "Number of arms" specifies the number of treatment groups across all analyzed studies that contributed data to the various treatment conditions (e.g., Quitline counseling was provided in 11 treatment arms). Therefore, this column depicts the number of treatment groups relevant to each analyzed category. Because a study may have multiple treatment groups, the number of treatment arms may exceed the number of studies included in a meta-analysis.

The outcome data in the tables may include findings from both studies with "all-comers" (individuals who did not seek a treatment intervention) and "self-selected" populations, studies using point-prevalence and continuous abstinence endpoints, and studies with and without biochemical confirmation, except where otherwise described. Some meta-analyses (such as those evaluating medications) included predominantly studies with "self-selected" populations who volunteered for intensive treatment. In addition, in medication studies, both experimental and control subjects typically received substantial counseling. Both of these factors might have produced higher abstinence rates in reference or placebo subjects than typically are observed among self-quitters. Finally, although there is an important scientific distinction between "efficacy" and "effectiveness,"[106] this 2008 clinical update uses the term "effectiveness" exclusively, recognizing that the majority of the studies summarized here reflect efficacy research, which requires random assignment and a high degree of experimental control. This was done for purposes of clarity for the intended clinical audience.

Strength of Evidence

Every recommendation made by the Panel bears a strength-of-evidence rating that indicates the quality and quantity of empirical support for the recommendation. Each recommendation and its strength of evidence reflects consensus of the Guideline Panel.

The three strength-of-evidence ratings are described below:

A. Multiple well-designed randomized clinical trials, directly relevant to the recommendation, yielded a consistent pattern of findings.

B. Some evidence from randomized clinical trials supported the recommendation, but the scientific support was not optimal. For instance, few randomized trials existed, the trials that did exist were somewhat inconsistent, or the trials were not directly relevant to the recommendation.

C. Reserved for important clinical situations in which the Panel achieved consensus on the recommendation in the absence of relevant randomized controlled trials.

As noted previously, the Panel evaluated evidence from nonrandomized trials to inform members' understanding of certain topics (e.g., policy issues). If treatment recommendations were based primarily on such evidence, they were of the "C" level and depended on the consistency of findings across different studies. In some areas, the highest quality evidence does not depend on randomized trials (e.g., cost-effectiveness). In these areas, the strength-of-evidence rating depended on the number, quality, and consistency of the studies and evidence. Finally, the Panel declined to make recommendations when there was no relevant evidence or the evidence was too weak or inconsistent to support a recommendation.

Caveats Regarding Recommendations

The reader should note some caveats regarding Guideline recommendations. First, an absence of studies should not be confused with a proven lack of effectiveness. In certain situations, there was little direct evidence regarding the effectiveness of some treatments, and in these cases the Panel usually rendered no opinion. Second, even when there were enough studies to perform a meta-analysis, a nonsignificant result does not prove ineffectiveness. Rather, nonsignificance merely indicates that effectiveness was not demonstrated given the data available.

The primary emphasis of this Guideline update is to identify effective interventions, not to rank-order interventions in terms of effectiveness. The most important goal of the analytic process is to identify effective interventions. Selection or use of particular intervention techniques or strategies usually is a function of practical factors: patient preference, time available, training of the clinician, cost, and so on. The Panel believes clinicians should choose the most appropriate intervention from among

the effective interventions identified in this Guideline update, given clinical circumstances. An excessive emphasis on relative effectiveness might discourage clinicians from using interventions that have a small but reliable impact on quit rates. One meta-analysis that is new to this update does provide focused tests of the relative effectiveness of different interventions. Specifically, the inclusive meta-analysis of the tobacco use medications involved *a posteriori* tests of medication effectiveness versus the nicotine patch (Table 6.28). These tests of relative effectiveness were conducted on this topic because: (1) numerous treatments were available for comparison; (2) selection from among the various tobacco use medications has been noted as an important clinical concern;[107-109] and (3) the various interventions are somewhat interchangeable and widely available so that the clinician or patient might be able to select a medication based on effectiveness. Finally, the panel occasionally identified an intervention as superior to another in the absence of formal statistical contrasts; some interventions were so superior to control or no-treatment conditions that the Panel clearly identified them as superior to another intervention. For instance, although minimal person-to-person contact can increase smoking abstinence rates over no-treatment conditions, there is little doubt that longer person-to-person interventions have greater impact (see Chapter 6).

External Review of the Guideline

For the present update, the Panel and consortium members invited 106 reviewers to make comments. In addition, a draft of the Guideline was published in the *Federal Register* in September 2007 for public comment. A total of 81 invited reviewers and 15 members of the public supplied written comments. Peer reviewers included clinicians, health care administrators, social workers, counselors, health educators, researchers, consumers, key personnel at selected Federal agencies and State tobacco control programs, and others. All peer reviewers made financial disclosure statements, which were provided to the Panel. Reviewers were asked to evaluate the Guideline based on five criteria: validity, reliability, clarity, clinical applicability, and utility. Comments from the peer reviewers and public were incorporated into the Guideline when appropriate. Two individuals made oral presentations to the Guideline Panel during an advertised open presentation period.

Organization of the Guideline Update

This updated Guideline is divided into seven chapters that reflect the major components of tobacco dependence treatment (see Figure 1.2 for the treatment model):

Chapter 1, Overview and Methods, provides an overview and rationale for the updated Guideline, as well as a detailed description of the methodology used to review the scientific literature and develop the original and updated Guidelines.

Chapter 2, Assessment of Tobacco Use, establishes the importance of determining the tobacco use status of every patient at every visit.

Chapter 3, Clinical Interventions for Tobacco Use and Dependence, is intended to provide clinicians with guidance as they use brief interventions to treat tobacco users willing to quit, tobacco users unwilling to make a quit attempt at this time, and tobacco users who have recently quit.

A. For the Patient Willing To Quit, provides brief clinical approaches to assist patients in quit attempts.

B. For the Patient Unwilling To Quit, provides brief clinical approaches designed to motivate the patient to make a quit attempt.

C. For the Patient Who Has Recently Quit, provides clinicians with strategies designed to reinforce a former tobacco user's commitment to stay tobacco-free and assist patients who have relapsed.

Chapter 4, Intensive Interventions for Tobacco Use and Dependence, provides clinicians with more intensive strategies to treat tobacco users.

Chapter 5, Systems Interventions, targets health care administrators, insurers, purchasers, and other decisionmakers who can affect health care systems. This chapter provides these decisionmakers with strategies to modify health care systems to improve the delivery of tobacco treatment services.

Chapter 6, Evidence and Recommendations, presents the evidentiary basis for the updated Guideline recommendations.

A. Counseling and Psychosocial Evidence: Provides recommendations and analysis results regarding screening for tobacco use and specialized assessment, advice, intensity of clinical interventions, type of clinician, format, followup procedures, types of counseling and behavioral therapies, and the combination of counseling and medication.

B. Medication Evidence: Provides recommendations and analysis results regarding the seven first-line medications, combination medications, second-line medications, and other medication issues.

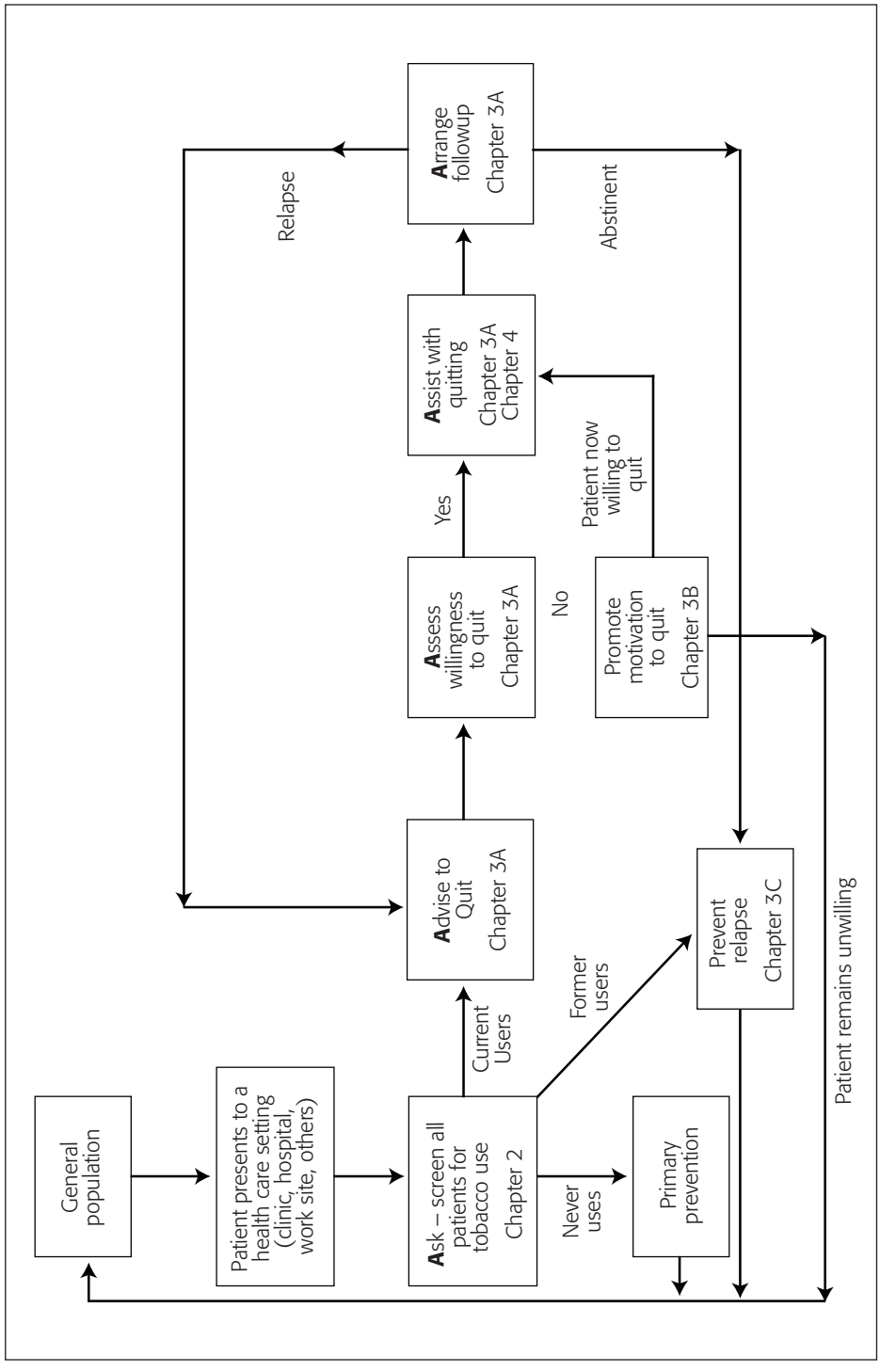
C. Systems Evidence: Provides recommendations and analysis results regarding systems changes, including provider training, cost-effectiveness, and health insurance coverage for tobacco use treatments.

Chapter 7, Specific Populations and Other Topics, provides information on specific populations, including HIV-positive smokers; hospitalized smokers; lesbian/gay/bisexual/transgender smokers; smokers with low SES/limited formal education; smokers with medical comorbidities; older smokers; smokers with psychiatric disorders, including substance use disorders; racial and ethnic minorities; women smokers; children and adolescents; light smokers; and noncigarette tobacco users. This chapter also presents information and recommendations relevant to weight gain after quitting smoking, with specific recommendations regarding future research on this topic.

References

Given the volume of literature referenced in this Guideline, references are listed at *www.surgeongeneral.gov/tobacco/gdlnrefs.htm*, rather than in this document. This was done to manage the length of this Clinical Guideline update and to facilitate electronic searches and manipulation of the references. Within this Web site, text references are numbered to match the numbers in this Guideline update. References to randomized control trials used in all of the meta-analyses (1996, 2000, 2008) are listed separately and by table number and title. The entire Guideline update, with and without references, can be downloaded from the site.

Figure 1.2. Model for treatment of tobacco use and dependence



Chapter 2 Assessment of Tobacco Use

At least 70 percent of smokers see a physician each year, and almost one-third see a dentist.[19,110] Other smokers see physician assistants, nurse practitioners, nurses, physical and occupational therapists, pharmacists, counselors, and other clinicians. Therefore, virtually all clinicians are in a position to intervene with patients who use tobacco. Moreover, 70 percent of smokers report wanting to quit,[111] and almost two-thirds of smokers who relapse want to try quitting again within 30 days.[112] Finally, smokers cite a physician's advice to quit as an important motivator for attempting to stop smoking.[113-118] These data suggest that most smokers are interested in quitting, clinicians and health systems are in frequent contact with smokers, and clinicians have high credibility with smokers.

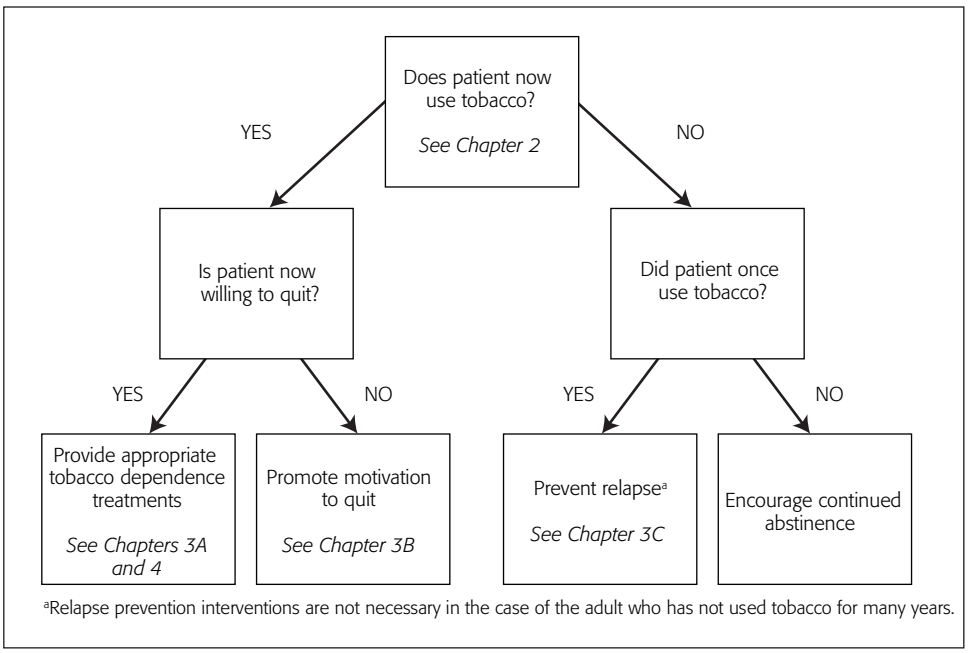
Unfortunately, clinicians and health systems do not capitalize on this opportunity consistently. According to the National Committee for Quality Assurance's (NCQA) *State of Health Care Quality Report*,[119] there has been some improvement in tobacco dependence clinical intervention for the insured population. In 2005, 71.2 percent of commercially insured smokers received cessation advice (up slightly from 69.6% in 2004); and 75.5 percent of Medicare smokers received advice to quit, up 11 percentage points from 2004 for this group. Despite this progress, there is a clear need for additional improvement. Only 25 percent of Medicaid patients reported any practical assistance with quitting or any ensuing followup of their progress.[22] Only one-third of adolescents who visited a physician or dentist report receiving counseling about the dangers of tobacco use, according to the 2000 National Youth Tobacco Survey.[120] Pregnant women who smoke were identified at 81 percent of physician visits but received counseling at only 23 percent of these visits.[121] In addition, few smokers get specific help with quitting. Recent Healthcare Effectiveness Data and Information Set (HEDIS) data showed that only 39 percent of smokers reported that their clinician discussed either medications or counseling strategies to quit (*www.web.ncqa.org/tabid/59/Default.aspx*). To capitalize on this opportunity, the 2008 Guideline update provides empirically validated tobacco treatment strategies designed to spur clinicians, tobacco treatment specialists, and health systems to intervene effectively with patients who use tobacco.

The first step in treating tobacco use and dependence is to identify tobacco users. As the data analysis in Chapter 6 shows, the identification of smok-

ers itself increases rates of clinician intervention. Effective identification of tobacco use status not only opens the door for successful interventions (e.g., clinician advice and treatment), but also guides clinicians to identify appropriate interventions based on patients' tobacco use status and willingness to quit. Based on these findings, the Guideline update recommends that clinicians and health care systems seize the office visit for universal assessment and intervention. Specifically, ask every patient who presents to a health care facility if s/he uses tobacco (Ask), advise all tobacco users to quit (Advise), and assess the willingness of all tobacco users to make a quit attempt at this time (Assess) (the first 3 of the 5 A's; see Chapter 3).

Screening for current or past tobacco use will result in four possible responses: (1) the patient uses tobacco and is willing to make a quit attempt at this time; (2) the patient uses tobacco but is not willing to make a quit attempt at this time; (3) the patient once used tobacco but has since quit; and (4) the patient never regularly used tobacco. This Clinical Practice Guideline is organized to provide the clinician with simple but effective interventions for all of these patient groups (see Figure 2.1).

Figure 2.1. Algorithm for treating tobacco use



[a]Relapse prevention interventions are not necessary in the case of the adult who has not used tobacco for many years.

Chapter 3 Clinical Interventions for Tobacco Use and Dependence

Background

This section of the Guideline presents specific strategies to guide clinicians providing brief interventions (less than 10 minutes). These brief interventions can be provided by all clinicians but are most relevant to clinicians who see a wide variety of patients and are bound by time constraints (e.g., physicians, nurses, physician assistants, nurse practitioners, medical assistants, dentists, hygienists, respiratory therapists, mental health counselors, pharmacists, etc.). The strategies in this chapter are based on the evidence described in Chapters 6 and 7, as well as on Panel opinion. Guideline analysis suggests that a wide variety of clinicians can implement these strategies effectively.

Why should members of a busy clinical team consider making the treatment of tobacco use a priority? The evidence is compelling: (1) clinicians can make a difference with even a minimal (less than 3 minutes) intervention (see Chapter 6); (2) a relation exists between the intensity of intervention and tobacco cessation outcome (see Chapter 6); (3) even when patients are not willing to make a quit attempt at this time, clinician-delivered brief interventions enhance motivation and increase the likelihood of future quit attempts[122] (see Chapter 6); (4) tobacco users are being primed to consider quitting by a wide range of societal and environmental factors (e.g., public health messages, policy changes, cessation marketing messages, family members); (5) there is growing evidence that smokers who receive clinician advice and assistance with quitting report greater satisfaction with their health care than those who do not;[23,87,88] (6) tobacco use interventions are highly cost effective (see Chapter 6); and (7) tobacco use has a high case fatality rate (up to 50% of long-term smokers will die of a smoking-caused disease[123]).

The goal of these strategies is clear: to change clinical culture and practice patterns to ensure that every patient who uses tobacco is identified,

advised to quit, and offered scientifically sound treatments. The strategies underscore a central theme: it is essential to provide at least a brief intervention to every tobacco user at each health care visit. Responsibility lies with both the clinician and the health care system to ensure that this occurs. Several observations are relevant to this theme. First, although many smokers are reluctant to seek intensive treatments,[124,125] they nevertheless can receive a brief intervention every time they visit a clinician.[66,126] Second, institutional support is necessary to ensure that all patients who use tobacco are identified and offered appropriate treatment (see Chapter 5, Systems Interventions: Importance to Health Care Administrators, Insurers, and Purchasers). Third, the time limits on primary care physicians in the United States today (median visit = 12–16 minutes),[127,128] as well as reimbursement restrictions, often limit providers to brief interventions, although more intensive interventions would produce greater success. Finally, given the growing use of electronic patient databases, smoker registries, and real-time clinical care prompts, brief interventions may be easier to fit into a busy practice and may be implemented in a variety of ways.

This chapter is divided into three sections to guide brief clinician interventions with three types of patients: (A) current tobacco users willing to make a quit attempt at this time; (B) current tobacco users unwilling to make a quit attempt at this time; and (C) former tobacco users who have recently quit. Patients who have never used tobacco or who have been abstinent for an extended period should be congratulated on their status and encouraged to maintain their tobacco-free lifestyle.

Given that more than 70 percent of tobacco users visit a physician and more than 50 percent visit a dentist each year,[129] it is essential that these clinicians be prepared to intervene with all tobacco users. The five major components (the "5 A's") of a brief intervention in the primary care setting are listed in Table 3.1. It is important for a clinician to *ask* the patient if he or she uses tobacco (Strategy A1), *advise* him or her to quit (Strategy A2), and *assess* willingness to make a quit attempt (Strategy A3). Strategies A1 to A3 need to be delivered to each tobacco user, regardless of his or her willingness to quit.

If the patient is willing to quit, the clinician should *assist* him or her in making a quit attempt by offering medication and providing or referring for counseling or additional treatment (Strategy A4), and *arrange* for fol-

Table 3.1. The "5 A's" model for treating tobacco use and dependence

Ask about tobacco use.	Identify and document tobacco use status for every patient at every visit. (Strategy A1)
Advise to quit.	In a clear, strong, and personalized manner, urge every tobacco user to quit. (Strategy A2)
Assess willingness to make a quit attempt.	Is the tobacco user willing to make a quit attempt at this time? (Strategy A3)
Assist in quit attempt.	For the patient willing to make a quit attempt, offer medication and provide or refer for counseling or additional treatment to help the patient quit. (Strategy A4) For patients unwilling to quit at the time, provide interventions designed to increase future quit attempts. (Strategies B1 and B2)
Arrange followup.	For the patient willing to make a quit attempt, arrange for followup contacts, beginning within the first week after the quit date. (Strategy A5) For patients unwilling to make a quit attempt at the time, address tobacco dependence and willingness to quit at next clinic visit.

lowup contacts to prevent relapse (Strategy A5). If the patient is unwilling to make a quit attempt, the clinician should provide a motivational intervention (Strategies B1 and B2) and *arrange* to address tobacco dependence at the next clinic visit. The Strategy tables below (A1–A5) comprise suggestions for the content and delivery of the 5 A's. The strategies are designed to be brief and require 3 minutes or less of direct clinician time. These intervention components constitute the core elements of a tobacco intervention, but they need not be applied in a rigid, invariant manner. For instance, the clinician need not deliver all elements personally. One clinician (e.g., a medical assistant) may ask about tobacco use status; and a prescribing clinician (e.g., physician, dentist, physician assistant, nurse practitioner) may deliver personal advice to quit, assess willingness to quit, and assist with medications, but then refer the patient to a tobacco intervention resource (e.g., a tobacco cessation quitline, health educator) that would deliver additional treatment to the patient. The clinician would remain responsible for the patient receiving appropriate care and subsequent followup, but, as with other sorts of health care, an individual clinician would not need to

deliver all care personally.[130] Evidence indicates that full implementation of the 5 A's in clinical settings may yield results that are superior to partial implementation.[131]

The effectiveness of tobacco intervention may reflect not only the contributions of the individual clinician, but also the systems and other clinical resources available to him or her. For instance, office systems that institutionalize tobacco use assessment and intervention will greatly foster the likelihood that the 5 A's will be delivered (see Chapter 5). The 5 A's, as described in Table 3.1, are consistent with those recommended by the NCI[132,133] and the American Medical Association,[77] as well as others.[75,134-137] The clinical situation may suggest delivering these intervention components in an order or format different from that presented, however. For example, clinical interventions such as: Ask/Assess, Advise, Agree on a goal, Assist, Arrange followup; Ask and Act; and Ask, Advise, and Refer have been proposed.[116,130,138-140]

When "Assisting" smokers, in addition to counseling, all smokers making a quit attempt should be offered medication, except when contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents). See Tables 3.2 to 3.11 for guidelines for prescribing medication for treating tobacco use and dependence.

A. For the Patient Willing To Quit

Strategy A1. *Ask*—Systematically identify all tobacco users at every visit

Action	Strategies for implementation
Implement an officewide system that ensures that, for *every* patient at *every* clinic visit, tobacco use status is queried and documented.[a]	Expand the vital signs to include tobacco use, or use an alternative universal identification system.[b] **VITAL SIGNS** Blood Pressure: _____ Pulse: _____ Weight: _____ Temperature: _____ Respiratory Rate: _____ Tobacco Use (circle one): Current Former Never

[a] Repeated assessment is *not* necessary in the case of the adult who has never used tobacco or has not used tobacco for many years and for whom this information is clearly documented in the medical record.

[b] Alternatives to expanding the vital signs include using tobacco use status stickers on all patient charts or indicating tobacco use status via electronic medical records or computerized reminder systems.

Strategy A2. *Advise*—Strongly urge all tobacco users to quit

Action	Strategies for implementation
In a *clear, strong, and personalized* manner, urge every tobacco user to quit.	Advice should be: • *Clear*—"It is important that you quit smoking (or using chewing tobacco) now, and I can help you." "Cutting down while you are ill is not enough." "Occasional or light smoking is still dangerous." • *Strong*—"As your clinician, I need you to know that quitting smoking is the most important thing you can do to protect your health now and in the future. The clinic staff and I will help you." • *Personalized*—Tie tobacco use to current symptoms and health concerns, and/or its social and economic costs, and/or the impact of tobacco use on children and others in the household. "Continuing to smoke makes your asthma worse, and quitting may dramatically improve your health." "Quitting smoking may reduce the number of ear infections your child has."

Strategy A3. *Assess*—Determine willingness to make a quit attempt

Action	Strategies for implementation
Assess every tobacco user's willingness to make a quit attempt at the time.	Assess patient's willingness to quit: "Are you willing to give quitting a try?" • If the patient is willing to make a quit attempt at the time, provide assistance (see Chapter 3A, Strategy A4). – If the patient will participate in an intensive treatment, deliver such a treatment or link/refer to an intensive intervention (see Chapter 4). – If the patient is a member of a special population (e.g., adolescent, pregnant smoker, racial/ethnic minority), consider providing additional information (see Chapter 7). • If the patient clearly states that he or she is unwilling to make a quit attempt at the time, provide an intervention shown to increase future quit attempts (see Chapter 3B).

Strategy A4. *Assist*—Aid the patient in quitting (provide counseling and medication)

Action	Strategies for implementation
Help the patient with a quit plan.	*A patient's preparations for quitting:* • ***S****et a quit date.* Ideally, the quit date should be within 2 weeks. • ***T****ell* family, friends, and coworkers about quitting, and request understanding and support. • ***A****nticipate* challenges to the upcoming quit attempt, particularly during the critical first few weeks. These include nicotine withdrawal symptoms. • ***R****emove* tobacco products from your environment. Prior to quitting, avoid smoking in places where you spend a lot of time (e.g., work, home, car). Make your home smoke-free.
Recommend the use of approved medication, except when contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents).	Recommend the use of medications found to be effective in this Guideline (see Table 3.2 for clinical guidelines and Tables 3.3–3.11 for specific instructions and precautions). Explain how these medications increase quitting success and reduce withdrawal symptoms. The first-line medications include: bupropion SR, nicotine gum, nicotine inhaler, nicotine lozenge, nicotine nasal spray, nicotine patch, and varenicline; second-line medications include: clonidine and nortriptyline. There is insufficient evidence to recommend medications for certain populations (e.g., pregnant women, smokeless tobacco users, light smokers, adolescents).
Provide practical counseling (problemsolving/skills training).	*Abstinence.* Striving for total abstinence is essential. Not even a single puff after the quit date.[141] *Past quit experience.* Identify what helped and what hurt in previous quit attempts. Build on past success. *Anticipate triggers or challenges in the upcoming attempt.* Discuss challenges/triggers and how the patient will successfully overcome them (e.g., avoid triggers, alter routines). *Alcohol.* Because alcohol is associated with relapse, the patient should consider limiting/abstaining from alcohol while quitting. (Note that reducing alcohol intake could precipitate withdrawal in alcohol-dependent persons.) *Other smokers in the household.* Quitting is more difficult when there is another smoker in the household. Patients should encourage housemates to quit with them or to not smoke in their presence. For further description of practical counseling, see Table 6.19.

Strategy A4. *Assist*—Aid the patient in quitting (provide counseling and medication) (continued)

Action	Strategies for implementation
Provide intratreatment social support.	Provide a supportive clinical environment while encouraging the patient in his or her quit attempt. *"My office staff and I are available to assist you." "I'm recommending treatment that can provide ongoing support."* For further description of intratreatment social support, see Table 6.20.
Provide supplementary materials, including information on quitlines.	*Sources:* Federal agencies, nonprofit agencies, national quitline network (1-800-QUIT-NOW), or local/state/tribal health departments/quitlines (see Appendix B for Web site addresses). *Type:* Culturally/racially/educationally/age-appropriate for the patient. *Location:* Readily available at every clinician's workstation.
For the smoker unwilling to quit at the time	See Section 3B.

Strategy A5. *Arrange*—Ensure followup contact

Action	Strategies for implementation
Arrange for followup contacts, either in person or via telephone.	*Timing*: Followup contact should begin soon after the quit date, preferably during the first week. A second followup contact is recommended within the first month. Schedule further followup contacts as indicated. *Actions during followup contact*: For all patients, identify problems already encountered and anticipate challenges in the immediate future. Assess medication use and problems. Remind patients of quitline support (1-800-QUIT-NOW). Address tobacco use at next clinical visit (treat tobacco use as a chronic disease). For patients who are abstinent, congratulate them on their success. If tobacco use has occurred, review circumstances and elicit recommitment to total abstinence. Consider use of or link to more intensive treatment (see Chapter 4).
For smokers unwilling to quit at the time	See Section 3B.

Table 3.2. Clinical guidelines for prescribing medication for treating tobacco use and dependence

Who should receive medication for tobacco use? Are there groups of smokers for whom medication has not been shown to be effective?	All smokers trying to quit should be offered medication, except when contraindicated or for specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents; see Chapter 7).
What are the first-line medications recommended in this Guideline update?	All seven of the FDA-approved medications for treating tobacco use are recommended: bupropion SR, nicotine gum, nicotine inhaler, nicotine lozenge, nicotine nasal spray, nicotine patch, and varenicline. The clinician should consider the first-line medications shown to be more effective than the nicotine patch alone: 2 mg/day varenicline or the combination of long-term nicotine patch use + *ad libitum* nicotine replacement therapy (NRT). Unfortunately, there are no well-accepted algorithms to guide optimal selection among the first-line medications.
Are there contraindications, warnings, precautions, other concerns, and side effects regarding the first-line medications recommended in this Guideline update?	All seven FDA-approved medications have specific contraindications, warnings, precautions, other concerns, and side effects. Refer to FDA package inserts for this complete information and FDA updates to the individual drug tables in this document (Tables 3.3–3.9). (See information below regarding second-line medications.)
What other factors may influence medication selection?	Pragmatic factors also may influence selection, such as insurance coverage, out-of-pocket patient costs, likelihood of adherence, dentures when considering the gum, or dermatitis when considering the patch.
Is a patient's prior experience with a medication relevant?	Prior successful experience (sustained abstinence with the medication) suggests that the medication may be helpful to the patient in a subsequent quit attempt, especially if the patient found the medication to be tolerable and/or easy to use. However, it is difficult to draw firm conclusions from prior failure with a medication. Some evidence suggests that re-treating relapsed smokers with the same medication produces small or no benefit,[142,143] whereas other evidence suggests that it may be of substantial benefit.[144]

Table 3.2. Clinical guidelines for prescribing medication for treating tobacco use and dependence (continued)

What medications should a clinician use with a patient who is highly nicotine dependent?	The higher-dose preparations of nicotine gum, patch, and lozenge have been shown to be effective in highly dependent smokers.[145-147] Also, there is evidence that combination NRT therapy may be particularly effective in suppressing tobacco withdrawal symptoms.[148,149] Thus, it may be that NRT combinations are especially helpful for highly dependent smokers or those with a history of severe withdrawal.
Is gender a consideration in selecting a medication?	There is evidence that NRT can be effective with both sexes;[150-152] however, evidence is mixed as to whether NRT is less effective in women than men.[153-157] This may encourage the clinician to consider use of another type of medication with women, such as bupropion SR or varenicline.
Are cessation medications appropriate for light smokers (i.e., < 10 cigarettes/day)?	As noted above, cessation medications have not been shown to be beneficial to light smokers. However, if NRT is used with light smokers, clinicians may consider reducing the dose of the medication. No adjustments are necessary when using bupropion SR or varenicline.
When should second-line agents be used for treating tobacco dependence?	Consider prescribing second-line agents (clonidine and nortriptyline) for patients unable to use first-line medications because of contraindications or for patients for whom the group of first-line medications has not been helpful. Assess patients for the specific contraindications, precautions, other concerns, and side effects of the second-line agents. Refer to FDA package inserts for this information and to the individual drug tables in this document (Tables 3.10 and 3.11).
Which medications should be considered with patients particularly concerned about weight gain?	Data show that bupropion SR and nicotine replacement therapies, in particular 4-mg nicotine gum and 4-mg nicotine lozenge, delay—but do not prevent—weight gain.
Are there medications that should especially be considered for patients with a past history of depression?	Bupropion SR and nortriptyline appear to be effective with this population[158-162] (see Chapter 7), but nicotine replacement medications also appear to help individuals with a past history of depression.

Table 3.2. Clinical guidelines for prescribing medication for treating tobacco use and dependence (continued)

Should nicotine replacement therapies be avoided in patients with a history of cardiovascular disease?	No. The nicotine patch in particular has been demonstrated as safe for cardiovascular patients. See Tables 3.3–3.9 and FDA package inserts for more complete information.
May tobacco dependence medications be used long-term (e.g., up to 6 months)?	Yes. This approach may be helpful with smokers who report persistent withdrawal symptoms during the course of medications, who have relapsed in the past after stopping medication, or who desire long-term therapy. A minority of individuals who successfully quit smoking use *ad libitum* NRT medications (gum, nasal spray, inhaler) long-term. The use of these medications for up to 6 months does not present a known health risk, and developing dependence on medications is uncommon. Additionally, the FDA has approved the use of bupropion SR, varenicline, and some NRT medications for 6-month use.
Is medication adherence important?	Yes. Patients frequently do not use cessation medications as recommended (e.g., they do not use them at recommended doses or for recommended durations); this may reduce their effectiveness.
May medications ever be combined?	Yes. Among first-line medications, evidence exists that combining the nicotine patch long-term (> 14 weeks) with either nicotine gum or nicotine nasal spray, the nicotine patch with the nicotine inhaler, or the nicotine patch with bupropion SR, increases long-term abstinence rates relative to placebo treatments. Combining varenicline with NRT agents has been associated with higher rates of side effects (e.g., nausea, headaches).

Table 3.3. Clinical use of bupropion SR (See FDA package insert for more complete information.)

	Clinical use of bupropion SR 150 (FDA approved)
Patient selection	Appropriate as a first-line medication for treating tobacco use
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. Bupropion has not been shown to be effective for tobacco dependence treatment in pregnant smokers. (Bupropion is an FDA pregnancy Class C agent.) Bupropion has not been evaluated in breastfeeding patients. *Cardiovascular diseases* – Generally well-tolerated; occasional reports of hypertension.

Table 3.3. Clinical use of bupropion SR (See FDA package insert for more complete information.) (continued)

	Clinical use of bupropion SR 150 (FDA approved)
Precautions, contraindications, and side effects *(continued)*	*Side effects* – The most common reported side effects were insomnia (35–40%) and dry mouth (10%). *Contraindications* – Bupropion SR is contraindicated in individuals who have a history of seizures or eating disorders, who are taking another form of bupropion, or who have used an MAO inhibitor in the past 14 days.
Dosage	Patients should begin bupropion SR treatment 1–2 weeks before they quit smoking. Patients should begin with a dose of 150 mg every morning for 3 days, then increase to 150 mg twice daily. Dosage should not exceed 300 mg per day. Dosing at 150 mg twice daily should continue for 7–12 weeks. For long-term therapy, consider use of bupropion SR 150 mg for up to 6 months postquit.
Availability	Prescription only
Prescribing instructions	*Stopping smoking prior to quit date* – Recognize that some patients may lose their desire to smoke prior to their quit date or will spontaneously reduce the amount they smoke. *Dosing information* – If insomnia is marked, taking the PM dose earlier (in the afternoon, at least 8 hours after the first dose) may provide some relief. *Alcohol* – Use alcohol only in moderation.
Cost[a]	1 box of 60 tablets, 150 mg = $97 per month (generic); $197 to $210 (Brand name)

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

Table 3.4. Clinical use of nicotine gum (See FDA package insert for more complete information.)

	Clinical use of nicotine gum (FDA approved)
Patient selection	Appropriate as a first-line medication for treating tobacco use
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. Nicotine gum has not been shown to be effective for treating tobacco dependence in pregnant smokers. (Nicotine gum is an FDA pregnancy Class D agent.) Nicotine gum has not been evaluated in breastfeeding patients.

Table 3.4. Clinical use of nicotine gum (See FDA package insert for more complete information.) (continued)

	Clinical use of nicotine gum (FDA approved)
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list) (continued)	*Cardiovascular diseases* – NRT is not an independent risk factor for acute myocardial events. NRT should be used with caution among particular cardiovascular patient groups: those in the immediate (within 2 weeks) postmyocardial infarction period, those with serious arrhythmias, and those with unstable angina pectoris. *Side effects* – Common side effects of nicotine gum include mouth soreness, hiccups, dyspepsia, and jaw ache. These effects are generally mild and transient and often can be alleviated by correcting the patient's chewing technique (see *prescribing instructions,* below).
Dosage	Nicotine gum (both regular and flavored) is available in 2-mg and 4-mg (per piece) doses. The 2-mg gum is recommended for patients smoking less than 25 cigarettes per day; the 4-mg gum is recommended for patients smoking 25 or more cigarettes per day. Smokers should use at least one piece every 1 to 2 hours for the first 6 weeks; the gum should be used for up to 12 weeks with no more than 24 pieces to be used per day.
Availability	OTC only
Prescribing instructions	*Chewing technique* – Gum should be chewed slowly until a "peppery" or "flavored" taste emerges, then "parked" between cheek and gum to facilitate nicotine absorption through the oral mucosa. Gum should be slowly and intermittently "chewed and parked" for about 30 minutes or until the taste dissipates. *Absorption* – Acidic beverages (e.g., coffee, juices, soft drinks) interfere with the buccal absorption of nicotine, so eating and drinking anything except water should be avoided for 15 minutes before or during chewing. *Dosing information* – Patients often do not use enough *prn* NRT medicines to obtain optimal clinical effects. Instructions to chew the gum on a fixed schedule (at least one piece every 1–2 hours) for at least 1–3 months may be more beneficial than *ad libitum* use.
Cost[a]	2 mg (packaged in different amounts), boxes of 100–170 pieces = $48 (quantity used determines how long supply lasts) 4 mg (packaged in different amounts), boxes of 100–110 pieces = $63 (quantity used determines how long supply lasts)

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

Table 3.5. Clinical use of the nicotine inhaler (See FDA package insert for more complete information.)

	Clinical use of nicotine inhaler (FDA approved)
Patient selection	Appropriate as a first-line medication for treating tobacco use
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. The nicotine inhaler has not been shown to be effective for treating tobacco dependence in pregnant smokers. (The nicotine inhaler is an FDA pregnancy Class D agent.) The nicotine inhaler has not been evaluated in breastfeeding patients. *Cardiovascular diseases* – NRT is not an independent risk factor for acute myocardial events. NRT should be used with caution among particular cardiovascular patient groups: those in the immediate (within 2 weeks) postmyocardial infarction period, those with serious arrhythmias, and those with unstable angina pectoris. *Local irritation reactions* – Local irritation in the mouth and throat was observed in 40% of patients using the nicotine inhaler. Coughing (32%) and rhinitis (23%) also were common. Severity was generally rated as mild, and the frequency of such symptoms declined with continued use.
Dosage	A dose from the nicotine inhaler consists of a puff or inhalation. Each cartridge delivers a total of 4 mg of nicotine over 80 inhalations. Recommended dosage is 6–16 cartridges/day. Recommended duration of therapy is up to 6 months. Instruct patient to taper dosage during the final 3 months of treatment.
Availability	Prescription only
Prescribing instructions	*Ambient temperature* – Delivery of nicotine from the inhaler declines significantly at temperatures below 40°F. In cold weather, the inhaler and cartridges should be kept in an inside pocket or other warm area. *Absorption* – Acidic beverages (e.g., coffee, juices, soft drinks) interfere with the buccal absorption of nicotine, so eating and drinking anything except water should be avoided for 15 minutes before or during use of the inhaler. *Dosing information* – Patients often do not use enough *prn* NRT medicines to obtain optimal clinical effects. Use is recommended for up to 6 months, with gradual reduction in frequency of use over the last 6–12 weeks of treatment. Best effects are achieved by frequent puffing of the inhaler and using at least six cartridges/day.
Cost[a]	1 box of 168 10-mg cartridges = $196 (quantity used determines how long supply lasts)

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

Table 3.6. Clinical use of the nicotine lozenge (See FDA package insert for more complete information.)

	Clinical use of nicotine lozenge (FDA approved)
Patient selection	Appropriate as a first-line medication for treating tobacco use
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. The nicotine lozenge has not been shown to be effective for treating tobacco dependence for pregnant smokers. The nicotine lozenge has not been evaluated in breastfeeding patients. Because the lozenge was approved as an OTC agent, it was not evaluated by the FDA for teratogenicity. *Cardiovascular diseases* – NRT is not an independent risk factor for acute myocardial events. NRT should be used with caution among particular cardiovascular patient groups: those in the immediate (within 2 weeks) postmyocardial infarction period, those with serious arrhythmias, and those with unstable angina pectoris. *Side effects* – The most common side effects of the nicotine lozenge are nausea, hiccups, and heartburn. Individuals on the 4-mg lozenge also had increased rates of headache and coughing (less than 10% of participants).
Dosage	Nicotine lozenges are available in 2-mg and 4-mg (per piece) doses. The 2-mg lozenge is recommended for patients who smoke their first cigarette more than 30 minutes after waking, and the 4-mg lozenge is recommended for patients who smoke their first cigarette within 30 minutes of waking. Generally, smokers should use at least nine lozenges per day in the first 6 weeks; the lozenge should be used for up to 12 weeks, with no more than 20 lozenges to be used per day.
Availability	OTC only
Prescribing instructions	*Lozenge use* – The lozenge should be allowed to dissolve in the mouth rather than chewing or swallowing it. *Absorption* – Acidic beverages (e.g., coffee, juices, soft drinks) interfere with the buccal absorption of nicotine, so eating and drinking anything except water should be avoided for 15 minutes before or during use of the nicotine lozenge. *Dosing information* – Patients often do not use enough *prn* NRT medicines to obtain optimal clinical effects. Generally, patients should use 1 lozenge every 1–2 hours during the first 6 weeks of treatment, using a minimum of 9 lozenges/day, then decrease lozenge use to 1 lozenge every 2–4 hours during weeks 7–9, and then decrease to 1 lozenge every 4–8 hours during weeks 10–12.
Cost[a]	2 mg, 72 lozenges per box = $34 (quantity used determines how long supply lasts) 4 mg, 72 lozenges per box = $39 (quantity used determines how long supply lasts)

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

Table 3.7. Clinical use of the nicotine nasal spray (See FDA package insert for more complete information.)

	Clinical use of nicotine nasal spray (FDA approved)
Patient selection	Appropriate as a first-line medication for treating tobacco use
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. Nicotine nasal spray has not been shown to be effective for treating tobacco dependence in pregnant smokers. (Nicotine nasal spray is an FDA pregnancy Class D agent.) Nicotine nasal spray has not been evaluated in breastfeeding patients. *Cardiovascular diseases* – NRT is not an independent risk factor for acute myocardial events. NRT should be used with caution among particular cardiovascular patient groups: those in the immediate (within 2 weeks) postmyocardial infarction period, those with serious arrhythmias, and those with unstable angina pectoris. *Nasal/airway reactions* – Some 94% of users report moderate to severe nasal irritation in the first 2 days of use; 81% still reported nasal irritation after 3 weeks, although rated severity typically was mild to moderate. Nasal congestion and transient changes in sense of smell and taste also were reported. Nicotine nasal spray should not be used in persons with severe reactive airway disease. *Dependency* – Nicotine nasal spray produces higher peak nicotine levels than other NRTs and has the highest dependence potential. Approximately 15–20% of patients report using the active spray for longer periods than recommended (6–12 months); 5% used the spray at a higher dose than recommended.
Dosage	A dose of nicotine nasal spray consists of one 0.5-mg dose delivered to each nostril (1 mg total). Initial dosing should be 1–2 doses per hour, increasing as needed for symptom relief. Minimum recommended treatment is 8 doses/day, with a maximum limit of 40 doses/day (5 doses/hour). Each bottle contains approximately 100 doses. Recommended duration of therapy is 3–6 months.
Availability	Prescription only
Prescribing instructions	*Dosing information* – Patients should not sniff, swallow, or inhale through the nose while administering doses, as this increases irritating effects. The spray is best delivered with the head tilted slightly back.
Cost[a]	$49 per bottle (quantity used determines how long supply lasts)

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

Table 3.8. Clinical use of the nicotine patch (See FDA package insert for more complete information.)

	Clinical use of the nicotine patch (FDA approved)	
Patient selection	Appropriate as a first-line medication for treating tobacco use	
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. The nicotine patch has not been shown to be effective for treating tobacco dependence treatment in pregnant smokers. (The nicotine patch is an FDA pregnancy Class D agent.) The nicotine patch has not been evaluated in breastfeeding patients. *Cardiovascular diseases* – NRT is not an independent risk factor for acute myocardial events. NRT should be used with caution among particular cardiovascular patient groups: those in the immediate (within 2 weeks) postmyocardial infarction period, those with serious arrhythmias, and those with unstable angina pectoris. *Skin reactions* – Up to 50% of patients using the nicotine patch will experience a local skin reaction. Skin reactions usually are mild and self-limiting, but occasionally worsen over the course of therapy. Local treatment with hydrocortisone cream (1%) or triamcinolone cream (0.5%) and rotating patch sites may ameliorate such local reactions. In fewer than 5% of patients, such reactions require the discontinuation of nicotine patch treatment. *Other side effects* – insomnia and/or vivid dreams	
Dosage	Treatment of 8 weeks or less has been shown to be as efficacious as longer treatment periods. Patches of different doses sometimes are available as well as different recommended dosing regimens. The dose and duration recommendations in this table are examples. Clinicians should consider individualizing treatment based on specific patient characteristics, such as previous experience with the patch, amount smoked, degree of dependence, etc.	
Availability	OTC or prescription	
Type	Duration	Dosage
Step-Down Dosage	4 weeks then 2 weeks then 2 weeks	21 mg/24 hours 14 mg/24 hours 7 mg/24 hours
Single Dosage	Both a 22 mg/24 hours and an 11 mg/24 hours (for lighter smokers) dose are available in a one-step patch regimen.	

Table 3.8. Clinical use of the nicotine patch (See FDA package insert for more complete information.) (continued)

	Clinical use of the nicotine patch (FDA approved)
Prescribing instructions	*Location* – At the start of each day, the patient should place a new patch on a relatively hairless location, typically between the neck and waist, rotating the site to reduce local skin irritation. *Activities* – No restrictions while using the patch *Dosing information* – Patches should be applied as soon as the patient wakes on the quit day. With patients who experience sleep disruption, have the patient remove the 24-hour patch prior to bedtime, or use the 16-hour patch (designed for use while the patient is awake).
Cost[a]	7 mg, box = $37 (quantity used determines how long supply lasts) 14 mg, box = $47 (quantity used determines how long supply lasts) 21 mg, box = $48 (quantity used determines how long supply lasts)

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

Table 3.9. Clinical use of varenicline (See FDA package insert for more complete information.)

	Clinical use of varenicline (FDA approved)
Patient selection	Appropriate as a first-line medication for treating tobacco use
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. Varenicline has not been shown to be effective for treating tobacco dependence in pregnant smokers. (Varenicline is an FDA pregnancy Class C agent.) Varenicline has not been evaluated in breastfeeding patients. *Cardiovascular diseases* – Not contraindicated *Precautions* – Use with caution in patients with significant kidney disease (creatinine clearance < 30mL/min) or who are on dialysis. Dose should be reduced with these patients. Patients taking varenicline may experience impairment of the ability to drive or operate heavy machinery.

Table 3.9. Clinical use of varenicline (See FDA package insert for more complete information.) (continued)

	Clinical use of varenicline (FDA approved)
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list) (continued)	*Warning* – In February 2008, the FDA added a warning regarding the use of varenicline. Specifically, it noted that depressed mood, agitation, changes in behavior, suicidal ideation, and suicide have been reported in patients attempting to quit smoking while using varenicline. The FDA recommends that patients should tell their health care provider about any history of psychiatric illness prior to starting this medication, and clinicians should monitor patients for changes in mood and behavior when prescribing this medication. In light of these FDA recommendations, clinicians should consider eliciting information on their patients' psychiatric history. *Side effects* – Nausea, trouble sleeping, abnormal/vivid/strange dreams
Dosage	Start varenicline 1 week before the quit date at 0.5 mg once daily for 3 days, followed by 0.5 mg twice daily for 4 days, followed by 1 mg twice daily for 3 months. Varenicline is approved for a maintenance indication for up to 6 months. Note: Patient should be instructed to quit smoking on day 8, when dosage is increased to 1 mg twice daily.
Availability	Prescription only
Prescribing instructions	*Stopping smoking prior to quit date* – Recognize that some patients may lose their desire to smoke prior to their quit date or will spontaneously reduce the amount they smoke. *Dosing information* –To reduce nausea, take on a full stomach. To reduce insomnia, take second pill at supper rather than bedtime.
Cost[a]	1 mg, box of 56 = $131 (about 30-day supply)

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

Table 3.10. Clinical use of clonidine (See FDA package insert for more complete information.)

	Clinical use of clonidine (not FDA approved for smoking cessation)
Patient selection	Appropriate as a second-line medication for treating tobacco use
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. Clonidine has not been shown to be effective for tobacco cessation in pregnant smokers. (Clonidine is an FDA pregnancy Class C agent.) Clonidine has not been evaluated in breastfeeding patients. *Activities* – Patients who engage in potentially hazardous activities, such as operating machinery or driving, should be advised of a possible sedative effect of clonidine. *Side effects* – Most commonly reported side effects include dry mouth (40%), drowsiness (33%), dizziness (16%), sedation (10%), and constipation (10%). As an antihypertensive medication, clonidine can be expected to lower blood pressure in most patients. Therefore, clinicians should monitor blood pressure when using this medication. *Rebound hypertension* – When stopping clonidine therapy, failure to reduce the dose gradually over a period of 2–4 days may result in a rapid increase in blood pressure, agitation, confusion, and/or tremor.
Dosage	Doses used in various clinical trials have varied significantly, from 0.15–0.75 mg/day by mouth and from 0.10–0.20 mg/day transdermal (TTS), without a clear dose-response relation to treatment outcomes. Initial dosing is typically 0.10 mg b.i.d. PO or 0.10 mg/day TTS, increasing by 0.10 mg/day per week if needed. The dose duration also varied across the clinical trials, ranging from 3–10 weeks.
Availability	Oral – Prescription only Transdermal – Prescription only
Prescribing instructions	*Initiate* – Initiate clonidine shortly before (up to 3 days), or on the quit date. *Dosing information* – If the patient is using transdermal clonidine, at the start of each week, he or she should place a new patch on a relatively hairless location between the neck and waist. Users should not discontinue clonidine therapy abruptly.
Cost[a]	Oral – .1 mg, box of 60 = $13 (daily dosage determines how long supply lasts) Transdermal – 4-pack TTS = $106

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

Table 3.11. Clinical use of nortriptyline (See FDA package insert for more complete information.)

	Clinical use of nortriptyline (not FDA approved for smoking cessation)
Patient selection	Appropriate as a second-line medication for treating tobacco use
Precautions, warnings, contraindications, and side effects (see FDA package insert for complete list)	*Pregnancy* – Pregnant smokers should be encouraged to quit without medication. Nortriptyline has not been shown to be effective for tobacco cessation in pregnant smokers. (Nortriptyline is an FDA pregnancy Class D agent.) Nortriptyline has not been evaluated in breastfeeding patients. *Side effects* – Most commonly reported side effects include sedation, dry mouth (64–78%), blurred vision (16%), urinary retention, lightheadedness (49%), and shaky hands (23%). *Activities* – Nortriptyline may impair the mental and/or physical abilities required for the performance of hazardous tasks, such as operating machinery or driving a car; therefore, the patient should be warned accordingly. *Cardiovascular and other effects* – Because of the risk of arrhythmias and impairment of myocardial contractility, use with caution in patients with cardiovascular disease. Do not co-administer with MAO inhibitors.
Dosage	Doses used in smoking cessation trials have initiated treatment at a dose of 25 mg/day, increasing gradually to a target dose of 75–100 mg/day. Duration of treatment used in smoking cessation trials has been approximately 12 weeks, although clinicians may consider extending treatment for up to 6 months.
Availability	Nortriptyline HCl – prescription only
Prescribing instructions	*Initiate* – Therapy is initiated 10–28 days before the quit date to allow nortriptyline to reach steady state at the target dose. *Therapeutic monitoring* – Although therapeutic blood levels for smoking cessation have not been determined, therapeutic monitoring of plasma nortriptyline levels should be considered under American Psychiatric Association Guidelines for treating patients with depression. Clinicians may choose to assess plasma nortriptyline levels as needed.[163] *Dosing information* – Users should not discontinue nortriptyline abruptly because of withdrawal effects. Overdose may produce severe and life-threatening cardiovascular toxicity, as well as seizures and coma. Risk of overdose should be considered carefully before using nortriptyline.
Cost[a]	25 mg, box of 60 = $24 (daily dosage determines how long supply lasts)

[a] Cost data were established by averaging the retail price of the medication at national chain pharmacies in Atlanta, GA, Los Angeles, CA, Milwaukee, WI , Sunnyside, NY, and listed online during January 2008 and may not reflect discounts available to health plans and others.

B. For the Patient Unwilling To Quit

Promoting the Motivation To Quit

All patients entering a health care setting should have their tobacco use status assessed routinely. Clinicians should advise all tobacco users to quit and then assess a patient's willingness to make a quit attempt. For patients not ready to make a quit attempt at the time, clinicians should use a brief intervention designed to promote the motivation to quit.

Patients unwilling to make a quit attempt during a visit may lack information about the harmful effects of tobacco use and the benefits of quitting, may lack the required financial resources, may have fears or concerns about quitting, or may be demoralized because of previous relapse.[164-167] Such patients may respond to brief motivational interventions that are based on principles of Motivational Interviewing (MI),[168] a directive, patient-centered counseling intervention.[169] There is evidence that MI is effective in increasing future quit attempts;[170-174] however, it is unclear that MI is successful in boosting abstinence among individuals motivated to quit smoking.[173,175,176]

Clinicians employing MI techniques focus on exploring a tobacco user's feelings, beliefs, ideas, and values regarding tobacco use in an effort to uncover any ambivalence about using tobacco.[169,177,178] Once ambivalence is uncovered, the clinician selectively elicits, supports, and strengthens the patient's "change talk" (e.g., reasons, ideas, needs for eliminating tobacco use) and "commitment language" (e.g., intentions to take action to change smoking behavior, such as not smoking in the home). MI researchers have found that having patients use their own words to commit to change is more effective than clinician exhortations, lectures, or arguments for quitting, which tend to increase rather than lessen patient resistance to change.[177]

The four general principles that underlie MI are: (*1) express empathy, (2) develop discrepancy, (3) roll with resistance,* and *(4) support self-efficacy.*[168,179] Specific MI counseling strategies that are based on these principles are listed in Strategy B1. Because this is a specialized technique, it may be beneficial to have a member of the clinical staff receive training in motivational interviewing. The content areas that should be addressed in a motivational counseling intervention can be captured by the "5 R's": relevance, risks, rewards, roadblocks, and repetition (Strategy B2). Research suggests that the "5 R's" enhance future quit attempts.[169,180]

Strategy B1. Motivational interviewing strategies

Express empathy.	• Use open-ended questions to explore: – The importance of addressing smoking or other tobacco use (e.g., "How important do you think it is for you to quit smoking?") – Concerns and benefits of quitting (e.g., "What might happen if you quit?") • Use reflective listening to seek shared understanding: – Reflect words or meaning (e.g., "So you think smoking helps you to maintain your weight."). – Summarize (e.g., "What I have heard so far is that smoking is something you enjoy. On the other hand, your boyfriend hates your smoking, and you are worried you might develop a serious disease."). • Normalize feelings and concerns (e.g., "Many people worry about managing without cigarettes."). • Support the patient's autonomy and right to choose or reject change (e.g., "I hear you saying you are not ready to quit smoking right now. I'm here to help you when you are ready.").
Develop discrepancy.	• Highlight the discrepancy between the patient's present behavior and expressed priorities, values, and goals (e.g., "It sounds like you are very devoted to your family. How do you think your smoking is affecting your children?"). • Reinforce and support "change talk" and "commitment" language: – "So, you realize how smoking is affecting your breathing and making it hard to keep up with your kids." – "It's great that you are going to quit when you get through this busy time at work." • Build and deepen commitment to change: – "There are effective treatments that will ease the pain of quitting, including counseling and many medication options." – "We would like to help you avoid a stroke like the one your father had."
Roll with resistance.	• Back off and use reflection when the patient expresses resistance: – "Sounds like you are feeling pressured about your smoking." • Express empathy: – "You are worried about how you would manage withdrawal symptoms." • Ask permission to provide information: – "Would you like to hear about some strategies that can help you address that concern when you quit?"
Support self-efficacy.	• Help the patient to identify and build on past successes: – "So you were fairly successful the last time you tried to quit." • Offer options for achievable small steps toward change: – Call the quitline (1-800-QUIT-NOW) for advice and information. – Read about quitting benefits and strategies. – Change smoking patterns (e.g., no smoking in the home). – Ask the patient to share his or her ideas about quitting strategies.

Strategy B2. Enhancing motivation to quit tobacco—the "5 R's"

Relevance	Encourage the patient to indicate why quitting is personally relevant, being as specific as possible. Motivational information has the greatest impact if it is relevant to a patient's disease status or risk, family or social situation (e.g., having children in the home), health concerns, age, gender, and other important patient characteristics (e.g., prior quitting experience, personal barriers to cessation).
Risks	The clinician should ask the patient to identify potential negative consequences of tobacco use. The clinician may suggest and highlight those that seem most relevant to the patient. The clinician should emphasize that smoking low-tar/low-nicotine cigarettes or use of other forms of tobacco (e.g., smokeless tobacco, cigars, and pipes) will not eliminate these risks. Examples of risks are: • *Acute risks:* Shortness of breath, exacerbation of asthma, increased risk of respiratory infections, harm to pregnancy, impotence, infertility. • *Long-term risks:* Heart attacks and strokes, lung and other cancers (e.g., larynx, oral cavity, pharynx, esophagus, pancreas, stomach, kidney, bladder, cervix, and acute myelocytic leukemia), chronic obstructive pulmonary diseases (chronic bronchitis and emphysema), osteoporosis, long-term disability, and need for extended care. • *Environmental risks:* Increased risk of lung cancer and heart disease in spouses; increased risk for low birth-weight, sudden infant death syndrome (SIDS), asthma, middle ear disease, and respiratory infections in children of smokers.
Rewards	The clinician should ask the patient to identify potential benefits of stopping tobacco use. The clinician may suggest and highlight those that seem most relevant to the patient. Examples of rewards follow: • Improved health • Food will taste better • Improved sense of smell • Saving money • Feeling better about oneself • Home, car, clothing, breath will smell better • Setting a good example for children and decreasing the likelihood that they will smoke • Having healthier babies and children • Feeling better physically • Performing better in physical activities • Improved appearance, including reduced wrinkling/aging of skin and whiter teeth

Strategy B2. Enhancing motivation to quit tobacco—the "5 R's" (continued)

Roadblocks	The clinician should ask the patient to identify barriers or impediments to quitting and provide treatment (problemsolving counseling, medication) that could address barriers. Typical barriers might include: • Withdrawal symptoms • Fear of failure • Weight gain • Lack of support • Depression • Enjoyment of tobacco • Being around other tobacco users • Limited knowledge of effective treatment options
Repetition	The motivational intervention should be repeated every time an unmotivated patient visits the clinic setting. Tobacco users who have failed in previous quit attempts should be told that most people make repeated quit attempts before they are successful.

C. For the Patient Who Has Recently Quit

Treatments for the Recent Quitter

Smokers who have recently quit face a high risk of relapse. Although most relapse occurs early in the quitting process,[96,101,181] some relapse occurs months or even years after the quit date.[181-184] Numerous studies have been conducted to identify treatments that can reduce the likelihood of future relapse. These studies attempt to reduce relapse either by including special counseling or therapy in the cessation treatment, or by providing additional treatment to smokers who have previously quit. In general, such studies have failed to identify either counseling or medication treatments that are effective in lessening the likelihood of relapse,[185] although there is some evidence that special mailings can reduce the likelihood of relapse.[186,187] Thus, at present, the best strategy for producing high long-term abstinence rates appears to be use of the most effective cessation treatments available; that is, the use of evidence-based cessation medication during the quit attempt and relatively intense cessation counseling (e.g., four or more sessions that are 10 minutes or more in length).

Ex-smokers often report problems that have been worsened by smoking withdrawal or that coexisted with their smoking. If a clinician encounters a tobacco user who recently quit, the clinician might reinforce the patient's

success at quitting, review the benefits of quitting, and assist the patient in resolving any residual problems arising from quitting (Strategy C1). Such expressions of interest and involvement on the part of the clinician might encourage the patient to seek additional help with cessation should she or he ultimately relapse. When the clinician encounters a patient who is abstinent from tobacco and is no longer engaged in cessation treatment, the clinician may wish to acknowledge a patient's success in quitting. The abstinent former smoker also may experience problems related to cessation that deserve treatment in their own right (see Strategy C2).

Strategy C1. Intervening with the patient who has recently quit

The former tobacco user should receive congratulations on any success and strong encouragement to remain abstinent.

When encountering a recent quitter, use open-ended questions relevant to the topics below to discover if the patient wishes to discuss issues related to quitting:

- The benefits, including potential health benefits, the patient may derive from cessation
- Any success the patient has had in quitting (duration of abstinence, reduction in withdrawal, etc.)
- The problems encountered or anticipated threats to maintaining abstinence (e.g., depression, weight gain, alcohol, other tobacco users in the household, significant stressors)
- A medication check-in, including effectiveness and side effects if the patient is still taking medication

Strategy C2. Addressing problems encountered by former smokers

A patient who previously smoked might identify a problem that negatively affects health or quality of life. Specific problems likely to be reported by former smokers and potential responses follow:

Problems	Responses
Lack of support for cessation	• Schedule followup visits or telephone calls with the patient. • Urge the patient to call the national quitline network (1-800-QUIT-NOW) or other local quitline. • Help the patient identify sources of support within his or her environment. • Refer the patient to an appropriate organization that offers counseling or support.
Negative mood or depression	• If significant, provide counseling, prescribe appropriate medication, or refer the patient to a specialist.

Strategy C2. Addressing problems encountered by former smokers (continued)

Problems	Responses
Strong or prolonged withdrawal symptoms	• If the patient reports prolonged craving or other withdrawal symptoms, consider extending the use of an approved medication or adding/combining medications to reduce strong withdrawal symptoms.
Weight gain	• Recommend starting or increasing physical activity. • Reassure the patient that some weight gain after quitting is common and usually is self-limiting. • Emphasize the health benefits of quitting relative to the health risks of modest weight gain. • Emphasize the importance of a healthy diet and active lifestyle. • Suggest low-calorie substitutes such as sugarless chewing gum, vegetables, or mints. • Maintain the patient on medication known to delay weight gain (e.g., bupropion SR, NRTs—particularly 4-mg nicotine gum[147]—and lozenge. • Refer the patient to a nutritional counselor or program.
Smoking lapses	• Suggest continued use of medications, which can reduce the likelihood that a lapse will lead to a full relapse. • Encourage another quit attempt or a recommitment to total abstinence. • Reassure that quitting may take multiple attempts, and use the lapse as a learning experience. • Provide or refer for intensive counseling.

Chapter 4 Intensive Interventions for Tobacco Use and Dependence

Background

Intensive tobacco dependence treatment can be provided by any suitably trained clinician. The evidence in Chapter 6 shows that intensive tobacco dependence treatment is more effective than brief treatment. Intensive interventions (i.e., more comprehensive treatments that may occur over multiple visits for longer periods of time and that may be provided by more than one clinician) are appropriate for any tobacco user willing to participate in them; neither their effectiveness nor cost-effectiveness is limited to a subpopulation of tobacco users (e.g., heavily dependent smokers).[188-194] In addition, patients, even those not ready to quit, have reported increased satisfaction with their overall health care as tobacco counseling intensity increases.[50,88]

In many cases, intensive tobacco dependence interventions are provided by clinicians who specialize in the treatment of tobacco dependence. Such specialists are not defined by their certification, professional affiliation, or by the field in which they trained. Rather, specialists view tobacco dependence treatment as a primary professional role. Specialists possess the skills, knowledge, and training to provide effective interventions across a range of intensities. They often are affiliated with programs offering intensive treatment interventions or services (e.g., programs with staff dedicated to tobacco interventions in which treatment involves multiple counseling sessions, including quitlines). In addition to offering intensive treatments, specialists sometimes conduct research on tobacco dependence and its treatment.

As noted above, substantial evidence shows that intensive interventions produce higher success rates than do less intensive interventions. In addition, the tobacco dependence interventions offered by specialists represent an important treatment resource for patients even if they received tobacco dependence treatment from their own clinician.

The advent of state tobacco quitlines available through a national network at 1-800-QUIT-NOW (1-800-784-8669) means that intensive, specialist-delivered interventions are now available to smokers on an unprecedented basis. In addition to providing their own clinical tobacco dependence interventions, clinicians and health systems can take advantage of this availability by implementing systems that regularly refer patients to quitlines either directly or using fax referrals (e.g., via "fax-to-quit" referral procedures).[195-199]

Specialists also may contribute to tobacco control efforts through activities such as the following:

- Serving as a resource to nonspecialists who offer tobacco dependence services as part of general health care delivery. This might include training nonspecialists in counseling strategies, providing consultation on difficult cases or for inpatients, and providing specialized assessment services for high-risk populations.

- Developing, evaluating, and implementing changes in office/clinic procedures that increase the rates at which tobacco users are identified and treated.[200]

- Conducting evaluation research to determine the effectiveness of ongoing tobacco dependence treatment activities in relevant institutional settings.

- Developing and evaluating innovative treatment strategies that may increase the effectiveness and utilization of tobacco dependence treatments.

Strategies for Intensive Tobacco Dependence Intervention

Table 4.1 highlights Guideline findings based on meta-analyses and Panel opinion (see Chapters 6 and 7) that are particularly relevant to the implementation of intensive treatment programs. The findings in Table 4.1 support recommendations for components of an intensive intervention (Table 4.2). Of course, implementation of this strategy depends on factors such as resource availability and time constraints.

Table 4.1. Findings relevant to intensive interventions

Intensive counseling is especially effective. There is a strong dose-response relation between counseling intensity and quitting success. In general, the more intense the treatment intervention, the greater the rate of abstinence. Treatments may be made more intense by increasing (a) the length of individual treatment sessions and (b) the number of treatment sessions.
Many different types of providers (e.g., physicians, nurses, dentists, psychologists, social workers, cessation counselors, pharmacists) are effective at increasing quit rates; involving multiple types of providers can enhance abstinence rates.
Individual, group, and telephone counseling are effective tobacco use treatment formats.
Particular types of counseling strategies are especially effective. Practical counseling (problemsolving/skills-training approaches) and the provision of intratreatment social support are associated with significant increases in abstinence rates.
Medications such as bupropion SR, nicotine replacement therapies, and varenicline consistently increase abstinence rates. Therefore, their use should be encouraged for all smokers except in the presence of contraindications or for specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents). In some instances, combinations of medications may be appropriate. In addition, combining counseling and medication increases abstinence rates.
Tobacco dependence treatments are effective across diverse populations (e.g., populations varying in gender, age, and race/ethnicity).

Table 4.2. Components of an intensive tobacco dependence intervention

Assessment	Assessments should determine whether tobacco users are willing to make a quit attempt using an intensive treatment program. Other assessments can provide information useful in counseling (e.g., stress level, dependence; see Chapter 6A, Specialized Assessment).
Program clinicians	Multiple types of clinicians are effective and should be used. One counseling strategy would be to have a medical/health care clinician deliver a strong message to quit and information about health risks and benefits, and recommend and prescribe medications recommended in this Guideline update. Nonmedical clinicians could then deliver additional counseling interventions.
Program intensity	There is evidence of a strong dose-response relation; therefore, when possible, the intensity of the program should be: *Session length* – longer than 10 minutes *Number of sessions* – 4 or more

Table 4.2. Components of an intensive tobacco dependence intervention (continued)

Program format	Either individual or group counseling may be used. Telephone counseling also is effective and can supplement treatments provided in the clinical setting. Use of self-help materials and cessation Web sites is optional. Followup interventions should be scheduled (see Chapter 6B).
Type of counseling and behavioral therapies	Counseling should include practical counseling (problemsolving/skills training) (see Table 6.19) and intratreatment social support (see Table 6.20).
Medication	Every smoker should be offered medications endorsed in this Guideline, except when contraindicated or for specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents; see Table 3.2 for clinical guidelines and Tables 3.3–3.11 for specific instructions and precautions). The clinician should explain how medications increase smoking cessation success and reduce withdrawal symptoms. The first-line medications include: bupropion SR, nicotine gum, nicotine inhaler, nicotine lozenge, nicotine nasal spray, nicotine patch, and varenicline. Certain combinations of cessation medications also are effective. Combining counseling and medication increases abstinence rates.
Population	Intensive intervention programs may be used with all tobacco users willing to participate in such efforts.

Chapter 5 Systems Interventions—Importance to Health Care Administrators, Insurers, and Purchasers

Background

Efforts to integrate tobacco intervention into the delivery of health care require the active involvement of clinicians, health care systems, insurers, and purchasers of health insurance. Such integration represents an opportunity to increase rates of delivering tobacco dependence treatments, quit attempts, and successful smoking cessation.[201]

In contrast to strategies that target only the clinician or the tobacco user, systems strategies are intended to ensure that tobacco use is systematically assessed and treated at every clinical encounter. Importantly, these strategies are designed to work synergistically with clinician- and patient-focused interventions, ultimately resulting in informed clinicians and patients interacting in a seamless way that facilitates the treatment of tobacco dependence.[202-204]

Several considerations argue for the adoption of systems-level tobacco intervention efforts. First, such strategies have the potential to substantially improve population abstinence rates. Levy et al. estimated that, over time, widespread implementation of such strategies could produce a 2 percent to 3.5 percent reduction in smoking prevalence rates.[205] Second, despite recent progress in this area, many clinicians have yet to use evidence-based interventions consistently with their patients who use tobacco.[23,48,51] Some evidence indicates that institutional or systems support (e.g., adequate clinician training or automated smoker identification systems) improves the rates of clinical interventions.[206-208] Finally, agents such as administrators, insurers, employers, purchasers, and health care delivery organizations have the potential to craft and implement supportive systems, policies, and environmental prompts that can facilitate the delivery of tobacco dependence treatment for millions of Americans. For example, managed care organizations and other insurers influence

medical care through formularies, performance feedback to clinicians, specific coverage criteria, and marketing approaches that prompt patient demand for particular services.[139,209] Purchasers also have begun to use tobacco measures in pay-for-performance initiatives in which managed care organizations, clinics, and individual physicians receive additional reimbursement by achieving specific tobacco treatment-related goals. Indeed, research clearly shows that systems-level changes can reduce smoking prevalence among enrollees of managed health care plans.[210-212]

Unfortunately, the potential benefits of a collaborative partnership among health care organizations, insurers, employers, and purchasers have not been fully realized. For example, treatments for tobacco use (both medication and counseling) are not provided consistently as paid services for subscribers of health insurance packages.[213-215] Although substantial progress has been made since the publication of the first Guideline in 1996,[1,216-218] neither private insurers nor state Medicaid programs consistently provide comprehensive coverage of evidence-based tobacco interventions.[206,214,219] Findings such as these resulted in the *Healthy People 2010* objective:

> *Increase insurance coverage of evidence-based treatment for nicotine dependency to 100 percent.*[220]

In sum, without supportive systems, policies, insurance coverage, and environmental prompts, the individual clinician likely will not assess and treat tobacco use consistently. Therefore, just as clinicians must assume responsibility to treat their patients for tobacco use, so must health care administrators, insurers, and purchasers assume responsibility to craft policies, provide resources, and display leadership that results in a health care system that delivers consistent and effective tobacco use treatment.

Cost-Effectiveness of Tobacco Use Treatments

Tobacco use treatments are not only clinically effective, but are cost-effective as well. Tobacco use treatments, ranging from clinician advice to medication to specialist-delivered intensive programs, are cost-effective in relation to other medical interventions such as treatment of hypertension and hyperlipidemia and to other preventive interventions such as periodic mammography.[194,221-224] In fact, tobacco use treatment has been referred to as the "gold standard" of health care cost-effectiveness.[225] Tobacco use treatment remains highly cost-effective, even though a single application

of any effective treatment for tobacco dependence may produce sustained abstinence in only a minority of smokers. Finally, evidence-based tobacco dependence interventions produce a favorable return on investment from the perspective of both the employer and health plan due to reduced health care consumption and costs.[226-228] The cost-effectiveness of Guideline recommendations for tobacco use treatment is addressed in detail in Chapter 6.

Recommendations for Health Care Administrators, Insurers, and Purchasers

Health care delivery administrators, insurers, and purchasers can promote the treatment of tobacco dependence through a systems approach. Purchasers (often business entities or other employers, State or Federal units of government, or other consortia that purchase health care benefits for a group of individuals) should make tobacco assessment and coverage of treatment a contractual obligation of the health care insurers and/or clinicians who provide services to them. In addition to improving the health of their employees or subscribers, providing coverage for tobacco dependence treatment will result in lower rates of absenteeism[229,230] and lower utilization of health care resources.[229,231] Health care administrators and insurers should provide clinicians with assistance to ensure that institutional changes promoting tobacco dependence treatment are implemented universally and systematically. Various institutional policies would facilitate these interventions, including:

- Implementing a tobacco user identification system in every clinic (Systems Strategy 1).
- Providing adequate training, resources, and feedback to ensure that providers consistently deliver effective treatments (Systems Strategy 2).
- Dedicating staff to provide tobacco dependence treatment and assessing the delivery of this treatment in staff performance evaluations (Systems Strategy 3).
- Promoting hospital policies that support and provide tobacco dependence services (Systems Strategy 4).

- Including tobacco dependence treatments (both counseling and medication) identified as effective in this Guideline as paid or covered services for all subscribers or members of health insurance packages (Systems Strategy 5).

These strategies are based on the evidence described in Chapter 6, as well as on Panel opinion.

Strategies for Health Care Administrators, Insurers, and Purchasers

Systems Strategy 1. Implement a tobacco user identification system in every clinic

Action	Strategies for implementation
Implement an office-wide system that ensures that for *every* patient at every clinic visit, tobacco use status is queried and documented.	Office system change: Expand the vital signs to include tobacco use, or implement an alternative universal identification system. Responsible staff: Nurse, medical assistant, receptionist, or other individual already responsible for recording the vital signs. These staff must be instructed regarding the importance of this activity and serve as nonsmoking role models. Frequency of utilization: Every visit for every patient, regardless of the reason for the visit.[a] System implementation steps: Routine smoker identification can be achieved by modifying electronic medical record data collection fields or progress notes in paper charts to include tobacco use status as one of the vital signs. VITAL SIGNS Blood Pressure: _____ Pulse: _____ Weight: _____ Temperature: _____ Respiratory Rate: _____ Tobacco Use (circle one): Current Former Never

[a] Repeated assessment is not necessary in the case of the adult who has never used tobacco or who has not used tobacco for many years, and for whom this information is clearly documented in the medical record.

Systems Strategy 2. Provide education, resources, and feedback to promote provider intervention

Action	Strategies for implementation
Health care systems should ensure that clinicians have sufficient training to treat tobacco dependence, clinicians and patients have resources, and clinicians are given feedback about their tobacco dependence treatment practices.	*Educate* all staff. On a regular basis, offer training (e.g., lectures, workshops, inservices) on tobacco dependence treatments, and provide continuing education (CE) credits and/or other incentives for participation. *Provide resources* such as ensuring ready access to tobacco quitlines (e.g., 1-800-QUIT-NOW) and other community resources, self-help materials, and information about effective tobacco use medications (e.g., establish a clinic fax-to-quit service, place medication information sheets in examination rooms). *Report* the provision of tobacco dependence interventions on report cards or evaluative standards for health care organizations, insurers, accreditation organizations, and physician group practices (e.g., HEDIS, The Joint Commission, and Physician Consortium for Performance Improvement). *Provide feedback* to clinicians about their performance, drawing on data from chart audits, electronic medical records, and computerized patient databases. Evaluate the degree to which clinicians are identifying, documenting, and treating patients who use tobacco.

Systems Strategy 3. Dedicate staff to provide tobacco dependence treatment, and assess the delivery of this treatment in staff performance evaluations

Action	Strategies for implementation
Clinical sites should communicate to all staff the importance of intervening with tobacco users and should designate a staff person (e.g., nurse, medical assistant, or other clinician) to coordinate tobacco dependence treatments. Nonphysician personnel may serve as effective providers of tobacco dependence interventions.	*Designate* a tobacco dependence treatment coordinator for every clinical site. *Delineate* the responsibilities of the tobacco dependence treatment coordinator (e.g., ensuring the systematic identification of smokers, ready access to evidence-based cessation treatments [e.g., quitlines], and scheduling of followup visits). *Communicate* to each staff member (e.g., nurse, physician, medical assistant, pharmacist, or other clinician) his or her responsibilities in the delivery of tobacco dependence services. Incorporate a discussion of these staff responsibilities into training of new staff.

Systems Strategy 4. Promote hospital policies that support and provide inpatient tobacco dependence services

Action	Strategies for implementation
Provide tobacco dependence treatment to all tobacco users admitted to a hospital.	*Implement* a system to identify and document the tobacco use status of all hospitalized patients. *Identify* a clinician(s) to deliver tobacco dependence inpatient consultation services for every hospital and reimburse them for delivering these services. *Offer* tobacco dependence treatment to all hospitalized patients who use tobacco. *Expand* hospital formularies to include FDA-approved tobacco dependence medications. *Ensure* compliance with The Joint Commission regulations mandating that all sections of the hospital be entirely smoke-free and that patients receive cessation treatments. *Educate* hospital staff that first-line medications may be used to reduce nicotine withdrawal symptoms, even if the patient is not intending to quit at this time.

Systems Strategy 5. Include tobacco dependence treatments (both counseling and medication) identified as effective in this Guideline as paid or covered services for all subscribers or members of health insurance packages

Action	Strategies for implementation
Provide all insurance subscribers, including those covered by managed care organizations (MCOs), workplace health plans, Medicaid, Medicare, and other government insurance programs, with comprehensive coverage for effective tobacco dependence treatments, including medication and counseling.	*Cover* effective tobacco dependence treatments (counseling and medication) as part of the basic benefits package for all health insurance packages. *Remove* barriers to tobacco treatment benefits (e.g., copays, utilization restrictions). *Educate* all subscribers and clinicians about the availability of covered tobacco dependence treatments (both counseling and medication), and encourage patients to use these services.

Chapter 6 Evidence and Recommendations

Background

The recommendations summarized in Chapters 2, 3, 4, and 5 are the result of a review and analysis of the existing tobacco treatment literature. This chapter reports that review and analysis and describes the effectiveness of various treatments, assessments, and implementation strategies. This chapter also addresses which treatments or assessments are effective, how they should be used, and how they should be implemented within a health care system.

The Panel identified topics that warranted new analyses for the 2008 update based on several criteria: they were important, supported by substantial new literature, and/or addressed issues not considered in prior Guidelines. The number of topics selected for new analyses was limited by the Public Health Service Guideline Update contract parameters. The 2008 Guideline Update Panel selected 11 topics for new analysis (see Table 1.1), based in part on input from tobacco control researchers and practitioners. These 11 topics and related categories are represented in Table 6.1. Type of outcome analyses varied across the different topics. In most analyses, long-term abstinence (6 months or more) was the outcome measure of interest; in others, it was the rate of smoker identification or intervention delivery. In addition to these new topics, Table 6.2 lists the topics that previously were analyzed for the 1996 and 2000 Guidelines. Importantly, the Guideline Update Panel reviewed all recommendations from the 1996 and 2000 Guidelines that did not undergo updated meta-analyses. For these prior recommendations, the Panel reviewed relevant literature since 1999 to determine whether the prior recommendation merited retention, modification, or deletion. See Appendix D for comparison of 2000 and 2008 Guideline recommendations.

The analyses reported in this chapter almost exclusively addressed treatments for cigarette smoking, as opposed to the use of other forms of tobacco, as the small number of studies on the use of noncigarette tobacco products, other than smokeless tobacco, precluded their separate analysis.

Finally, the Panel attempted to analyze treatment and assessment strategies that constitute distinct approaches that exist in current clinical practice.

The Panel chose categories within each analyzed topic according to three major criteria. First, some categories reflected generally accepted dimensions or taxonomies. An example of this is the categorical nature of the clinician types (physician, psychologist, nurse, and so on). Second, information on the category had to be available in the published literature. Many questions of theoretical interest had to be abandoned simply because the requisite research literature was not available. Third, the category had to occur with sufficient frequency to permit meaningful statistical analysis. Therefore, the cutpoints of some continuous variables (e.g., total amount of contact time) were determined so there were a sufficient number of studies within each analytical category to permit meaningful analysis.

In ideal circumstances, the Panel could evaluate each characteristic by consulting randomized controlled trials relevant to the specific categories in question. Unfortunately, with the exception of medication interventions, very few or no randomized controlled trials are designed to address the effects of specific treatment or assessment characteristics of interest. Moreover, treatment characteristics frequently are confounded with one another. For example, comparisons among clinicians often are confounded with the type of counseling and the format and intensity of the interventions. Therefore, direct, unconfounded comparisons of categories within a particular analysis type often were impossible. These characteristics nevertheless were analyzed because of their clinical importance, and because it was possible to reduce confounding by careful selection of studies and by statistical control of some confounding factors.

Table 6.1. Topics meta-analyzed for the 2008 Guideline update

Characteristics analyzed	Categories of those characteristics
Quitline	• No quitline intervention • Use of a proactive quitline • Use of a proactive quitline in combination with medication • Number of quitline sessions
Combining counseling and medication	• Medication alone • Counseling alone • Medication and counseling combined

Table 6.1. Topics meta-analyzed for the 2008 Guideline update (continued)

Characteristics analyzed	Categories of those characteristics
Medications	• Placebo medication • Bupropion SR • Clonidine • Nicotine gum • Nicotine inhaler • Nicotine lozenge • Nicotine nasal spray • Nicotine patch • Nortriptyline • Varenicline • Long-term medication • Single medication • Combination of medications • High-dose nicotine patch
Providing tobacco treatment as a health care insurance benefit	• Not providing coverage for tobacco treatment • Providing services as a covered insurance benefit
Systems features	• No intervention • Clinician training • Clinician training and reminder systems
Specific populations	• Adolescent smokers, pregnant smokers, smokers with psychiatric disorders, including substance use disorders and smokers with low socioeconomic status/limited formal education (see Chapter 7 for description)

Table 6.2. Topics meta-analyzed for the 1996 and 2000 Guidelines and included in the 2008 Guideline update (but not re-analyzed)

Characteristics analyzed	Categories of those characteristics
Screen for tobacco use	• No screening system in place • Screening system in place
Advice to quit	• No advice to quit • Physician advice to quit
Intensity of person-to-person clinical contact	• No person-to-person intervention • Minimal counseling (longest session ≤ 3 minutes in duration) • Low intensity counseling (longest session > 3 minutes and ≤ 10 minutes in duration) • Higher intensity counseling (longest session > 10 minutes) • Total amount of contact time • Number of person-to-person treatment sessions

Table 6.2. Topics meta-analyzed for the 1996 and 2000 Guidelines and included in the 2008 Guideline update (but not re-analyzed) (continued)

Characteristics analyzed	Categories of those characteristics
Type of clinician	• No clinician • Self-help materials only • Nonphysician health care clinician (e.g., psychologist, counselor, social worker, nurse, dentist, graduate student, pharmacist, tobacco treatment specialist) • Physician • Number of types of clinicians
Formats of psychosocial intervention	• No contact • Self-help/self-administered (e.g., pamphlet, audiotape, videotape, mailed information, computer program) • Individual counseling/contact • Group counseling/contact • Proactive telephone counseling/contact • Number of types of formats
Self-help interventions	• No self-help intervention • Number of self-help interventions • Self-help interventions
Types of counseling and behavioral therapies	• No counseling • No person-to-person intervention or minimal counseling • General: problemsolving/coping skills/relapse-prevention/stress-management approach • Negative affect/depression intervention • Weight/diet/nutrition intervention • Extratreatment social support intervention • Intratreatment social support intervention • Contingency contracting/instrumental contingencies • Rapid smoking • Other aversive smoking techniques • Cigarette fading/smoking reduction prequit • Acupuncture
Over-the-counter (OTC) medication	• Placebo OTC nicotine patch therapy • OTC nicotine patch therapy

Additional topics that were important and clinically relevant—but did not lend themselves to analysis due to a lack of long-term abstinence data—nevertheless were considered by the Panel through a review of the existing literature. The strength of evidence associated with these recommended actions for clinical interventions was at the "B" or "C" level (see below), reflecting the fact that they are not based primarily on meta-analyses.

This chapter addresses the treatment and assessment characteristics outlined in Tables 6.1 and 6.2 and is divided into three sections: (1) evidence for counseling and psychosocial interventions; (2) evidence for medication interventions; and (3) evidence for systems changes. For each topic, background information, clinical recommendations, and the basis for those recommendations are provided. As described in Chapter 1, each recommendation was given a strength-of-evidence classification based on the criteria shown in Table 6.3. Finally, for many topics, recommendations for further research are provided.

Table 6.3. Summary of strength of evidence for recommendations

Strength-of-evidence classification	Criteria
Strength of Evidence = A	Multiple well-designed randomized clinical trials, directly relevant to the recommendation, yielded a consistent pattern of findings.
Strength of Evidence = B	Some evidence from randomized clinical trials supported the recommendation, but the scientific support was not optimal. For instance, few randomized trials existed, the trials that did exist were somewhat inconsistent, or the trials were not directly relevant to the recommendation.
Strength of Evidence = C	Reserved for important clinical situations in which the Panel achieved consensus on the recommendation in the absence of relevant randomized controlled trials.

A. Counseling and Psychosocial Evidence

1. Screening and Assessment

Screen for Tobacco Use

Recommendation: All patients should be asked if they use tobacco and should have their tobacco use status documented on a regular basis. Evidence has shown that clinic screening systems, such as expanding the vital signs to include tobacco use status or the use of other reminder systems such as chart stickers or computer prompts, significantly increase rates of clinician intervention. (Strength of Evidence = A)

The Panel relied on the meta-analyses from the original 1996 Guideline to determine the impact of tobacco screening systems. Tobacco screening

systems were evaluated in terms of their impact on two outcomes: the rate of tobacco treatment by clinicians, and the rate of cessation by patients who smoke.

Identifying Tobacco Users: Impact on Clinical Intervention. Nine studies met the selection criteria and were meta-analyzed as part of the 1996 Guideline to assess the impact of screening systems on the rate of smoking cessation intervention by clinicians. The results of this meta-analysis are shown in Table 6.4. Implementing clinic systems designed to increase the assessment and documentation of tobacco use status markedly increases the rate at which clinicians intervene with their patients who smoke.

Table 6.4. Meta-analysis (1996): Impact of having a tobacco use status identification system in place on rates of clinician intervention with their patients who smoke (n = 9 studies)[a]

Screening system	Number of arms	Estimated odds ratio (95% C.I.)	Estimated rate of clinician intervention (95% C.I.)
No screening system in place to identify smoking status (reference group)	9	1.0	38.5
Screening system in place to identify smoking status	9	3.1 (2.2–4.2)	65.6 (58.3–72.6)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Identifying Tobacco Users: Impact on Tobacco Cessation. Three studies met the selection criteria and were meta-analyzed as part of the 1996 Guideline to assess the impact of identifying smokers on actual rates of smoking cessation. The results of this meta-analysis are shown in Table 6.5. These results, combined with the results from Table 6.4, show that having a clinic system in place that identifies smokers increases rates of clinician intervention but does not, by itself, produce significantly higher rates of smoking cessation.

Strategy A1 (see Chapter 3A) and Systems Strategy 1 (see Chapter 5) detail an approach for including tobacco use status as a vital sign with systematic prompts and reminders. Although the data assessing this intervention were gathered exclusively from cigarette smokers, the Panel believed

that these results are generalizable to all tobacco users. This approach is designed to produce consistent assessment and documentation of tobacco use. Evidence from controlled trials shows that this approach increases the probability that tobacco use is assessed and documented consistently.[54,232] However, documenting smoking status is not by itself sufficient to promote treatment by clinicians.[233] Systems changes beyond smoker identification strategies are likely to be needed to increase rates of cessation advice and intervention.[139,234-237]

Table 6.5. Meta-analysis (1996): Impact of having a tobacco use status identification system in place on abstinence rates among patients who smoke (n = 3 studies)[a]

Screening system	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No screening system in place to identify smoking status (reference group)	3	1.0	3.1
Screening system in place to identify smoking status	3	2.0 (0.8–4.8)	6.4 (1.3–11.6)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Specialized Assessment

Recommendation: Once a tobacco user is identified and advised to quit, the clinician should assess the patient's willingness to quit at this time. (Strength of Evidence = C)

If the patient is willing to make a quit attempt at this time, interventions identified as effective in this Guideline should be provided. (See Chapters 3A and 4.)

If the patient is unwilling to quit at this time, an intervention designed to increase future quit attempts should be provided. (See Chapter 3B.)

Recommendation: Tobacco dependence treatment is effective and should be delivered even if specialized assessments are not used or available. (Strength of Evidence = A)

Every individual entering a health care setting should receive an assessment that determines his or her tobacco use status and interest in quitting. The patient should be asked, "Are you willing to make a quit attempt at this time?" Such an assessment (willing or unwilling) is a necessary first step in treatment. In addition, every patient should be assessed for physical or medical conditions that may affect the use of planned treatments (e.g., medication).

The clinician also may want to perform specialized assessments of individual and environmental attributes that provide information for tailoring treatment and that predict quitting success. Specialized assessments refer to the use of formal instruments (e.g., questionnaires, clinical interviews, or physiologic indices such as carbon monoxide, serum nicotine/cotinine levels, and/or pulmonary function) that may be associated with cessation outcome (in addition, the reader may find other assessments relevant to medication use and specific populations when selecting treatment). Some of the variables targeted by specialized assessments that predict quitting success are listed in Table 6.6.

Several considerations should be kept in mind regarding the use of specialized assessments. First, there is little consistent evidence that a smoker's status on a specialized assessment is useful for treatment matching. The one exception is that persons who are highly nicotine dependent may benefit more from higher nicotine gum or lozenge doses (see Medication Evidence; Section B of Chapter 6). More importantly, the Panel found that, regardless of their standing on specialized assessments, all smokers have the potential to benefit from tobacco dependence treatments. Therefore, delivery of tobacco dependence treatments should not depend on the use of specialized assessments. Finally, tailored interventions based on specialized assessments do not consistently produce higher long-term quit rates than do nontailored interventions of equal intensity. Some promising studies exist, however, that suggest that individualizing self-help materials may be beneficial (see Individually Tailored and Stepped-Care Interventions, page 92).[238-245] In addition, the Panel recognizes that some effective interventions, such as general problemsolving (see Types of Counseling and Behavioral Therapies, on page 96), entail treatment tailoring based on a systematic assessment that occurs as an integral part of treatment.

Table 6.6. Variables associated with higher or lower abstinence rates

Variables associated with higher abstinence rates	
Variable	**Examples**
High motivation	Tobacco user reports a strong motivation to quit.
Ready to change	Tobacco user is ready to quit within a 1-month period.
Moderate to high self-efficacy	Tobacco user is confident in his or her ability to quit.
Supportive social network	A smoke-free workplace and home; friends who do not smoke in the quitter's presence.
Variables associated with lower abstinence rates	
Variable	**Examples**
High nicotine dependence	Tobacco user smokes heavily (≥ 20 cigarettes/day), and/or has first cigarette of the day within 30 minutes after waking in the morning.
Psychiatric comorbidity and substance use	Tobacco user currently has elevated depressive symptoms, active alcohol abuse, or schizophrenia.
High stress level	Stressful life circumstances and/or recent or anticipated major life changes (e.g., divorce, job change).
Exposure to other smokers	Other smokers in the household.

The existing evidence suggests that treatment can be effective despite the presence of risk factors for relapse (e.g., high nicotine dependence, other smokers in the home), but abstinence rates in smokers with these characteristics tend to be lower than rates in those without these characteristics.[246-248]

Future Research

The following topics regarding specialized assessment require additional research:

- Whether treatment adjustment based on specialized assessments can improve long-term abstinence rates

- Whether working to change the social network can improve abstinence rates (e.g., intervening with other smokers in the household to change their smoking patterns, teaching quitting support, or encouraging a smokefree home)

- Disparities in screening and assessment in specific populations

2. Treatment Structure and Intensity

Advice To Quit Smoking

Recommendation: All *physicians* should strongly advise every patient who smokes to quit because evidence shows that physician advice to quit smoking increases abstinence rates. (Strength of Evidence = A)

For these recommendations, the 2008 Guideline Panel relied on meta-analyses performed for the 1996 Guideline. Seven studies were included in the 1996 meta-analysis of the effectiveness of physician advice to quit smoking. In the studies used in this analysis, the modal length of clinician intervention was 3 minutes or less. Two studies in this analysis used interventions lasting about 5 minutes. Results of the meta-analysis on physician advice are shown in Table 6.7. This analysis shows that brief physician advice significantly increases long-term smoking abstinence rates. These results were also supported by a more recent, independent meta-analysis.[56]

Advice by physicians was examined in the Table 6.7 meta-analysis from the 1996 Guideline; there were too few studies to examine advice delivered by any other type of clinician, although one study found that advice to quit from health care providers in general did significantly increase quit rates.[249] The analysis for total amount of contact time (see Table 6.9) indicates that minimal counseling (advice) delivered by a variety of clinician types increases long-term abstinence rates. Also, studies have shown that dentists and dental hygienists can be effective in assessing and advising smokeless/spit tobacco users to quit[250] (see Chapter 7). Given the large number of smokers who visit a clinician each year, the potential public health impact of universal advice to quit is substantial.[56]

Table 6.7. Meta-analysis (1996): Effectiveness of and estimated abstinence rates for advice to quit by a physician (n = 7 studies)[a]

Advice	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No advice to quit (reference group)	9	1.0	7.9
Physician advice to quit	10	1.3 (1.1–1.6)	10.2 (8.5–12.0)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Future Research

The following topics regarding advice to quit require additional research:

- Effectiveness of advice to quit smoking given by clinicians other than physicians (e.g., nurses, nurse practitioners, pharmacists, dentists, dental hygienists, tobacco treatment specialists, physician's assistants)
- Cumulative effectiveness of combined advice from physicians and other types of clinicians

Intensity of Clinical Interventions

Recommendation: Minimal interventions lasting less than 3 minutes increase overall tobacco abstinence rates. Every tobacco user should be offered at least a minimal intervention, whether or not he or she is referred to an intensive intervention. (Strength of Evidence = A)

Recommendation: There is a strong dose-response relation between the session length of person-to-person contact and successful treatment outcomes. Intensive interventions are more effective than less intensive interventions and should be used whenever possible. (Strength of Evidence = A)

Recommendation: Person-to-person treatment delivered for four or more sessions appears especially effective in increasing abstinence rates. Therefore, if feasible, clinicians should strive to meet four or more times with individuals quitting tobacco use. (Strength of Evidence = A)

These recommendations are supported by three separate meta-analyses conducted for the 2000 Guideline: one involving session length, one involving total amount of contact time, and one involving the number of sessions.

Table 6.8. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for various intensity levels of session length (n = 43 studies)[a]

Level of contact	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No contact	30	1.0	10.9
Minimal counseling (< 3 minutes)	19	1.3 (1.01–1.6)	13.4 (10.9–16.1)
Low-intensity counseling (3-10 minutes)	16	1.6 (1.2–2.0)	16.0 (12.8–19.2)
Higher intensity counseling (> 10 minutes)	55	2.3 (2.0–2.7)	22.1 (19.4–24.7)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Session Length. Forty-three studies met selection criteria for comparison across various session lengths. Whenever possible, session length was categorized based on the maximum amount of time the clinician spent with a smoker addressing tobacco dependence in a single contact. Minimal counseling interventions were defined as 3 minutes or less, low-intensity counseling was defined as greater than 3 minutes to 10 minutes, and higher intensity counseling interventions were defined as greater than 10 minutes. Interventions could involve multiple patient-clinician contacts, with the session length determined for coding purposes as the length of time of the longest session. These levels of person-to-person contact were compared with a no-contact reference group involving study conditions in which subjects received no person-to-person contact (e.g., self-help-only conditions). There is a dose-response relation between session length and abstinence rates. As Table 6.8 shows, all three session lengths (minimal counseling, low-intensity counseling, and higher intensity counseling) significantly increased abstinence rates over those produced by no-contact conditions. However, there was a clear trend for abstinence rates to increase across these session lengths, with higher intensity counseling producing the highest rates.

Total Amount of Contact Time. Thirty-five studies met the selection criteria for the analysis assessing the impact of total contact time. The amount of contact time was calculated from the text as the total time accumulated (the number of sessions multiplied by the session length). When the exact time was not known for minimal and low-intensity interventions, they were assigned median lengths of 2 and 6.5 minutes, respectively. The total amount of contact time was then categorized as no-contact, 1–3 minutes, 4–30 minutes, 31–90 minutes, 91–300 minutes, and greater than 300 minutes. As Table 6.9 shows, any contact time significantly increased abstinence rates over those produced by no contact. However, there was a clear trend for abstinence rates to increase across contact time, up to the 90-minute mark. There was no evidence that more than 90 minutes of total contact time substantially increases abstinence rates.

Table 6.9. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for total amount of contact time (n = 35 studies)[a]

Total amount of contact time	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No minutes	16	1.0	11.0
1–3 minutes	12	1.4 (1.1–1.8)	14.4 (11.3–17.5)
4–30 minutes	20	1.9 (1.5–2.3)	18.8 (15.6–22.0)
31–90 minutes	16	3.0 (2.3–3.8)	26.5 (21.5–31.4)
91–300 minutes	16	3.2 (2.3–4.6)	28.4 (21.3–35.5)
> 300 minutes	15	2.8 (2.0–3.9)	25.5 (19.2–31.7)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Number of Sessions. Forty-six studies involving at least some person-to-person contact met selection criteria for the analysis addressing the impact of number of treatment sessions. Zero or one session was used as the reference group. As shown in Table 6.10, multiple treatment sessions increase smoking abstinence rates over those produced by zero or one session. The evidence suggests a dose-response relation between number of sessions and treatment effectiveness.

It is important to note that although the use of more intensive interventions (i.e., longer sessions, more sessions) may produce enhanced abstinence rates, these interventions may have limited reach (affect fewer smokers) and may not be feasible in some primary care settings. For instance,

not all smokers are interested in participating in an intensive intervention, and not all smokers may have access to or be able to afford services that can provide intensive interventions. Finally, the clinician can link the patient to additional treatment options, such as quitlines or other intensive cessation treatment programs, to provide additional person-to-person treatment.

Future Research

The following topics regarding intensity of person-to-person contact require additional research:

- Effects of treatment duration, timing, and spacing of sessions (i.e., the number of days or weeks over which treatment is spread). For instance, does front loading sessions (having the majority of the sessions during the first few weeks of a quit attempt) or spacing sessions throughout the quit attempt yield better long-term abstinence rates?
- Methods to increase the appeal and utilization of intensive treatments
- Effectiveness of intensive inpatient treatment programs

Table 6.10. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for number of person-to-person treatment sessions (n = 46 studies)[a]

Number of sessions	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
0–1 session	43	1.0	12.4
2–3 sessions	17	1.4 (1.1–1.7)	16.3 (13.7–19.0)
4–8 sessions	23	1.9 (1.6–2.2)	20.9 (18.1–23.6)
> 8 sessions	51	2.3 (2.1–3.0)	24.7 (21.0–28.4)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Type of Clinician

Recommendation: Treatment delivered by a variety of clinician types increases abstinence rates. Therefore, all clinicians should provide smoking cessation interventions. (Strength of Evidence = A)

Recommendation: Treatments delivered by multiple types of clinicians are more effective than interventions delivered by a single type of clinician. Therefore, the delivery of interventions by more than one type of clinician is encouraged. (Strength of Evidence = C)

Clinician Types. Twenty-nine studies met selection criteria for the 2000 meta-analysis examining the effectiveness of various types of clinicians providing tobacco use treatment. These analyses compared the effectiveness of interventions delivered by different types of clinicians with interventions in which there were no clinicians (e.g., when there was no intervention or the intervention consisted of self-help materials only). Tobacco use treatments delivered by any single type of health care provider, such as a physician or other clinician (e.g., nurse, psychologist, dentist, or counselor), or by multiple clinicians, increase abstinence rates relative to interventions in which there is no clinician (e.g., self-help interventions). None of the studies in these analyses involved medication, but they did involve psychosocial intervention, principally counseling. Results are shown in Table 6.11. Results suggest that physicians and other clinicians are similarly effective in delivering tobacco cessation counseling. New research reviewed since the 2000 Guideline suggests that trained peer counselors also may be effective.[251-253]

Number of Clinician Types. Thirty-seven studies met selection criteria for the 2000 analysis examining the effectiveness of multiple clinicians used in smoking cessation interventions. "Multiple clinicians" refers to the number of different *types* of clinicians (if a nurse and a physician each delivered parts of an intervention, two types of clinicians would be involved). Tobacco use treatments delivered by two or more types of clinicians increase abstinence rates relative to those produced by interventions in which there is no clinician (Table 6.12). However, the number of clinician types is confounded with treatment intensity. For instance, if an individual meets with a physician for a medication consultation and then talks to a health educator about the quit plan, that is two clinicians and two sessions. The number of contacts may be more important than the number of clinicians providing treatment.

Table 6.11. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for interventions delivered by different types of clinicians (n = 29 studies)[a]

Type of clinician	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No clinician	16	1.0	10.2
Self-help	47	1.1 (0.9–1.3)	10.9 (9.1–12.7)
Nonphysician clinician	39	1.7 (1.3–2.1)	15.8 (12.8–18.8)
Physician clinician	11	2.2 (1.5–3.2)	19.9 (13.7–26.2)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.12. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for interventions delivered by various numbers of clinician types (n = 37 studies)[a]

Number of clinician types	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No clinician	30	1.0	10.8
One clinician type	50	1.8 (1.5–2.2)	18.3 (15.4–21.1)
Two clinician types	16	2.5 (1.9–3.4)	23.6 (18.4–28.7)
Three or more clinician types	7	2.4 (2.1–2.9)	23.0 (20.0–25.9)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Future Research

The following topics regarding type of clinician require additional research:

- Effectiveness of specific types of clinicians (e.g., quitline counselors, trained peer counselors, nurses, physician assistants, pharmacists, social workers)
- Relative effectiveness of various numbers and types of clinicians, with the intensity of the intervention held constant

Formats of Psychosocial Treatments

Recommendation: Proactive telephone counseling, group counseling, and individual counseling formats are effective and should be used in smoking cessation interventions. (Strength of Evidence = A)

Recommendation: Smoking cessation interventions that are delivered in multiple formats increase abstinence rates and should be encouraged. (Strength of Evidence = A)

Recommendation: Tailored materials, both print and Web-based, appear to be effective in helping people quit. Therefore, clinicians may choose to provide tailored self-help materials to their patients who want to quit. (Strength of Evidence = B)

Format Types. Overall format type (delivery mode) recommendations rest on the 2000 Guideline meta-analysis, although new focused analyses of proactive quitlines were conducted for the 2008 update. Fifty-eight studies met selection criteria and were included in the 2000 meta-analysis comparing different types of formats (see Table 6.13). Tobacco use treatment delivered by means of proactive telephone counseling/contact (quitlines, call-back counseling), individual counseling, and group counseling/contact all increase abstinence rates relative to no intervention.

Self-Help. The 2000 format meta-analysis also evaluated the effectiveness of self-help interventions (e.g., pamphlets/booklets/mailings/manuals, videotapes, audiotapes, referrals to 12-step programs, reactive telephone hotlines/helplines [see Glossary], computer programs/Internet, and lists of community programs). Interventions delivered by means of widely varied self-help materials (whether as stand-alone treatments or as adjuvants) appear to increase abstinence rates relative to no intervention in this particular analysis. However, the effect of self-help was weak and typically not significant across analyses conducted for the 2000 Guideline (see Tables 6.13 and 6.15).

Number of Formats. Fifty-four studies met selection criteria and were included in the 2000 meta-analysis comparing the number of format types used for tobacco use treatment. The self-help treatments included in this analysis occurred either by themselves or in addition to other treatments. Tobacco use treatment that used three or four format types was especially effective. Results of this analysis are shown in Table 6.14.

Self-Help: Focused Analyses. Because the format meta-analysis revealed self-help to be of marginal effectiveness, another analysis was undertaken in 2000 to provide additional, focused information on self-help. Studies were accepted for the 2000 analysis if the presence of self-help materi-

als constituted the sole difference in treatment arms. In the main format analysis, some treatment arms differed on factors other than self-help *per se* (e.g., intensity of counseling). The treatments that accompanied self-help material in the focused analysis ranged from no advice or counseling to intensive counseling. The results of this analysis were comparable to those in the larger format analysis (i.e., self-help was of marginal effectiveness).

For the 2000 Guideline analysis, 21 studies met selection criteria to evaluate the effectiveness of providing multiple types of self-help interventions (e.g., pamphlets, videotapes, audiotapes, and reactive hotlines/helplines). The results provide little evidence that the provision of multiple types of self-help, when offered without any person-to-person intervention, significantly enhances treatment outcomes (see Table 6.15).

Two final 2000 meta-analyses addressed the impact of self-help brochures *per se*. In one analysis, brochures were used as the only intervention. In the other analysis, self-help brochures were used in addition to counseling. In neither analysis did self-help significantly boost abstinence rates.

Table 6.13. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for various types of formats (n = 58 studies)[a]

Format Number	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No format	20	1.0	10.8
Self-help	93	1.2 (1.02–1.3)	12.3 (10.9–13.6)
Proactive telephone counseling	26	1.2 (1.1–1.4)	13.1 (11.4–14.8)
Group counseling	52	1.3 (1.1–1.6)	13.9 (11.6–16.1)
Individual counseling	67	1.7 (1.4–2.0)	16.8 (14.7–19.1)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.14. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for number of formats (n = 54 studies)[a]

Number of formats[b]	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No format	20	1.0	10.8
One format	51	1.5 (1.2–1.8)	15.1 (12.8–17.4)
Two formats	55	1.9 (1.6–2.2)	18.5 (15.8–21.1)
Three or four formats	19	2.5 (2.1–3.0)	23.2 (19.9–26.6)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.
[b] Formats included self-help, proactive telephone counseling, group, or individual counseling.

Table 6.15. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for number of types of self-help (n = 21 studies)[a]

Factor	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No self-help	17	1.0	14.3
One type of self-help	27	1.0 (0.9–1.1)	14.4 (12.9–15.9)
Two or more types	10	1.1 (0.9–1.5)	15.7 (12.3–19.2)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Quitlines. Both the substantial growth in quitline research and the implementation of a national network of tobacco quitlines (available through 1-800-QUIT-NOW) led the 2008 Guideline Panel to identify quitline effectiveness as a topic deserving focused meta-analyses. Nine studies met selection criteria and were analyzed for the 2008 Guideline update comparing the effectiveness of a quitline intervention versus minimal or no contact or self-help materials. This differs from the 2000 meta-analysis (Table 6.13) in that the current analysis focused on study arms that used quitline intervention alone rather than telephone counseling that may have occurred with other types of interventions. For the purpose of this analysis, quitlines are defined as telephone counseling in which at least some of the contacts are initiated by the quitline counselor to deliver tobacco use interventions, including call-back counseling. Quitlines significantly increase abstinence rates compared to minimal or no counseling interventions (Table 6.16).[254] In a second 2008 meta-analysis of quitlines, six studies were analyzed comparing the effect of adding quitline counseling to medication versus medication alone. The addition of quitline counseling to medication significantly improves abstinence rates

compared to medication alone (see Table 6.17). These analyses suggest a robust effect of quitline counseling and are consistent with a recent independent analysis[254] and with the recently released Centers for Disease Control and Prevention's *Guide to Community Preventive Services*.[92]

Table 6.16. Meta-analysis (2008): Effectiveness of and estimated abstinence rates for quitline counseling compared to minimal interventions, self-help, or no counseling (n = 9 studies)[a]

Intervention	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Minimal or no counseling or self-help	11	1.0	8.5
Quitline counseling	11	1.6 (1.4–1.8)	12.7 (11.3–14.2)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.17. Meta-analysis (2008): Effectiveness of and estimated abstinence rates for quitline counseling and medication compared to medication alone (n = 6 studies)[a]

Intervention	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Medication alone	6	1.0	23.2
Medication and quitline counseling	6	1.3 (1.1–1.6)	28.1 (24.5–32.0)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Individually Tailored and Stepped-Care Interventions. Recent research has focused on the use of individually tailored materials. Tailored materials are those that are designed to address smoker-specific variables, such as support sources, recency of quitting, and concerns about quitting. Tailored materials can either be print materials, such as letters mailed to patients, or Web-based materials such as interactive Web sites.[238,242] Some applications of tailoring have been shown to be effective and to have broad reach.[241,245,255,256] The Panel also considered the use of stepped-care interventions (see Glossary) and concluded that there is not enough evidence to recommend a stepped-care approach as a basis for tailoring.[257,258] However, these approaches warrant future research.

Computerized Interventions. E-health or Internet interventions have the potential to be accessed by a large percentage of the smoking population, permit extensive tailoring of content to the tobacco user's needs or characteristics, and, due to low personnel costs, are likely to be inexpensive to deliver. Such interventions may be used as stand-alone or adjuvant treatments. These programs typically collect information from the tobacco user and then use algorithms to tailor feedback or recommendations. They also typically permit the user to select from various features, including extensive information on quitting, tobacco dependence, and related topics. Current applications permit multiple iterations of feedback, development and monitoring of a quit plan, and proactive e-mail prompts to users.[259,260] Optimal features of Web site resources have not yet been identified; some sites may be confusing and may not exploit the tailoring potential of this medium.[261] Clearly, more research is needed to identify their optimal structures, features, and contents.[262-265]

E-health tobacco interventions generally have yielded positive results. In a recent review of the use of these interventions with adult tobacco users, Walters et al. found that 7 of 15 studies with adults reported significantly improved outcomes over control conditions.[259] Hall et al. combined computerized individualized feedback designed to motivate smokers using principles of the Stages of Change model with six 30-minute sessions of counseling and the nicotine patch. This was compared with untailored self-help material. Significant improvement due to the more intensive treatment was found at 18-month followup.[266] Strecher et al. compared a multifaceted Web-based intervention (tailored cessation guide based on cognitive-behavioral principles, a medication adherence intervention, tailored e-mails, and a behavioral support person) in concert with the nicotine patch. This was contrasted with the patch alone. Favorable outcomes were obtained at 3 months postquit.[241] Similar positive effects also have been reported for a population study using computer-generated reports based on the Stages of Change model[267] and a Web site study offered in a worksite program.[268] A study with adolescents[269] reported positive results due to access to a complex intervention that comprised an interactive computer intervention, clinician advice, brief motivational interviewing, and telephonic booster sessions. The control condition was information about eating more fruits and vegetables. Null results with computerized or computer-tailored interventions also have been obtained (see, e.g., Velicer et al.[270] and Aveyard et al.[271]). Moreover, in many of the studies yielding positive results, the Web-based intervention is just one

element of a complex intervention, or is considerably more intense than the comparison intervention. Given the potential reach and low costs of such interventions, however, they remain a highly promising delivery system for tobacco dependence.

Future Research

The following topics regarding formats require additional research:

- Which combinations of formats are most effective
- Relative effectiveness of different types of self-help interventions, including computer-based interventions
- Effectiveness of tailoring
- Effectiveness of fax-to-quit programs and other programs designed to increase quitline use
- Effective features of Web-based interventions
- Effect of computer-delivered interventions as a format versus the effect of the content of the intervention
- Optimal methods to decrease barriers and increase the appeal and use of effective counseling treatments

Followup Assessment and Procedures

Recommendation: All patients who receive a tobacco dependence intervention should be assessed for abstinence at the completion of treatment and during subsequent contacts. (1) Abstinent patients should have their quitting success acknowledged, and the clinician should offer to assist the patient with problems associated with quitting (see Chapter 3C, For the Patient Who Has Recently Quit). (2) Patients who have relapsed should be assessed to determine whether they are willing to make another quit attempt. (Strength of Evidence = C)

If the patient is willing to make another quit attempt, provide or arrange additional treatment (see Chapter 3A, For the Patient Willing To Quit).

If the patient is not willing to try to quit, provide or arrange an intervention designed to increase future quit attempts (see Chapter 3B, For the Patient Unwilling To Quit).

All patients should be assessed with respect to their smoking status during followup clinical contacts. In particular, assessments within the first week after quitting should be encouraged.[272,273] Abstinent patients should receive reinforcement for their decision to quit, be congratulated on their success at quitting, and be encouraged to remain abstinent (see Chapter 3C, Strategy C1). The existing evidence does not show that these steps will prevent relapse, but continued involvement on the part of the clinician may increase the likelihood that the patient will consult the clinician in later quit attempts should they be needed. Clinicians also should inquire about and offer to help the patient with potential problems related to quitting (see Chapter 3C, Strategy C2), such as significant weight gain or residual withdrawal symptoms.

Patients who have relapsed should again be assessed for their willingness to quit. Patients who currently are motivated to make another quit attempt should be encouraged to use a tobacco dependence intervention (see Chapter 3A, For the Patient Willing To Quit). Clinicians may wish to increase the intensity of psychosocial treatment at this time or refer the patient to a tobacco dependence specialist/program for a more intensive treatment if the patient is willing. In addition, medication should be offered again to the patient, if appropriate. If the previous quit attempt included medication, the clinician should review whether the patient used the medication in an effective manner and determine whether the medication was helpful. Based on this assessment, the clinician should recommend retreatment with the same medication, another medication, or a combination of medications (see Tables 6.26–6.28). Patients who have relapsed and are unwilling to quit at the current time should receive a brief intervention designed to increase future quit attempts (see Chapter 3B).

Future Research

The following topics regarding followup assessment and treatments require additional research:

- Optimal timing and types of relapse prevention interventions
- Effectiveness of various formats for relapse prevention treatments (e.g., effectiveness of telephone contacts in reducing the likelihood of relapse after a minimal intervention)

3. Treatment Elements

Types of Counseling and Behavioral Therapies

Recommendation: Two types of counseling and behavioral therapies result in higher abstinence rates: (1) providing smokers with practical counseling (problemsolving skills/skills training), and (2) providing support and encouragement as part of treatment. These types of counseling elements should be included in smoking cessation interventions. (Strength of Evidence = B)

Sixty-four studies met selection criteria for meta-analyses in 2000 to examine the effectiveness of interventions using various types of counseling and behavioral therapies. The results, shown in Table 6.18, reveal that four specific types of counseling and behavioral therapy categories yield statistically significant increases in abstinence rates relative to no-contact (i.e., untreated control conditions). These categories are: (1) providing practical counseling such as problemsolving/skills training/stress management; (2) providing support during a smoker's direct contact with a clinician (intratreatment social support); (3) intervening to increase social support in the smoker's environment (extratreatment social support); and (4) using aversive smoking procedures (rapid smoking, rapid puffing, other smoking exposure). A separate analysis was conducted eliminating studies that included the use of U.S. Food and Drug Administration (FDA)-approved medications. The results of this analysis were substantially similar to the main analysis.

Table 6.18. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for various types of counseling and behavioral therapies (n = 64 studies)[a]

Type of counseling and behavioral therapy	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No counseling/behavioral therapy	35	1.0	11.2
Relaxation/breathing	31	1.0 (0.7–1.3)	10.8 (7.9–13.8)
Contingency contracting	22	1.0 (0.7–1.4)	11.2 (7.8–14.6)
Weight/diet	19	1.0 (0.8–1.3)	11.2 (8.5–14.0)
Cigarette fading	25	1.1 (0.8–1.5)	11.8 (8.4–15.3)
Negative affect	8	1.2 (0.8–1.9)	13.6 (8.7–18.5)
Intratreatment social support	50	1.3 (1.1–1.6)	14.4 (12.3–16.5)
Extratreatment social support	19	1.5 (1.1–2.1)	16.2 (11.8–20.6)
Practical counseling (general problemsolving/skills training)	104	1.5 (1.3–1.8)	16.2 (14.0–18.5)
Other aversive smoking	19	1.7 (1.04–2.8)	17.7 (11.2–24.9)
Rapid smoking	19	2.0 (1.1–3.5)	19.9 (11.2–29.0)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

The 2008 Guideline Panel decided not to recommend extratreatment social support in the current Guideline update. This change was based on recent literature on extratreatment social support that does not show a strong effect for helping smokers identify and utilize support outside of the treatment relationship.[274-276] Aversive smoking was recommended in the 2000 Guideline. However, new studies that have been conducted since the 2000 Guideline, including a Cochrane Review, cast doubt on the effectiveness of aversive smoking.[277] Because of this and the side effects of this treatment, the Guideline Panel decided not to recommend the use of aversive smoking therapy in the 2008 update.

The strength of evidence for the 2008 Guideline update recommendations regarding practical counseling and intratreatment social support did not warrant an "A" rating for several reasons. First, the evidence reviewed indicated that tobacco use treatments rarely used a particular type of counsel-

ing or behavioral therapy in isolation. Second, various types of counseling and behavioral therapies tended to be correlated with other treatment characteristics. For instance, some types of counseling and behavioral therapies were more likely to be delivered using a greater number of sessions across longer time periods. Third, all of these types of counseling and behavioral therapies were compared with no-contact/control conditions. Therefore, the control conditions in this meta-analysis did not control for nonspecific or placebo effects of treatment. This further restricted the ability to attribute effectiveness to particular types of counseling and behavioral therapies *per se*. Fourth, the studies used in this analysis often tailored the types of counseling and behavioral therapies to the needs of specific populations being studied, thereby affecting the generalizability of the study results. Fifth, there was considerable heterogeneity within each type of counseling and behavioral therapy.

Tables 6.19 and 6.20 outline elements of practical counseling (problemsolving/skills training) and intratreatment social support, respectively. These tables are designed to help clinicians using these counseling and behavioral therapies. It must be noted, however, that these treatment labels are nonspecific and include heterogeneous treatment elements. The effectiveness of encouragement and support as part of treatment is consistent with the literature regarding the importance of providing a caring, empathic, and understanding context in making other health behavior changes.[278-280]

Table 6.19. Common elements of practical counseling (problemsolving/skills training)

Practical counseling (problemsolving/ skills training) treatment component	Examples
Recognize danger situations – Identify events, internal states, or activities that increase the risk of smoking or relapse.	• Negative affect and stress • Being around other tobacco users • Drinking alcohol • Experiencing urges • Smoking cues and availability of cigarettes
Develop coping skills – Identify and practice coping or problemsolving skills. Typically, these skills are intended to cope with danger situations.	• Learning to anticipate and avoid temptation and trigger situations • Learning cognitive strategies that will reduce negative moods • Accomplishing lifestyle changes that reduce stress, improve quality of life, and reduce exposure to smoking cues • Learning cognitive and behavioral activities to cope with smoking urges (e.g., distracting attention; changing routines)

Table 6.19. Common elements of practical counseling (problemsolving/skills training) (continued)

Practical counseling (problemsolving/ skills training) treatment component	Examples
Provide basic information – Provide basic information about smoking and successful quitting.	• The fact that any smoking (even a single puff) increases the likelihood of a full relapse • Withdrawal symptoms typically peak within 1–2 weeks after quitting but may persist for months. These symptoms include negative mood, urges to smoke, and difficulty concentrating. • The addictive nature of smoking

Table 6.20. Common elements of intratreatment supportive interventions

Supportive treatment component	Examples
Encourage the patient in the quit attempt.	• Note that effective tobacco dependence treatments are now available. • Note that one-half of all people who have ever smoked have now quit. • Communicate belief in patient's ability to quit.
Communicate caring and concern.	• Ask how patient feels about quitting. • Directly express concern and willingness to help as often as needed. • Ask about the patient's fears and ambivalence regarding quitting.
Encourage the patient to talk about the quitting process.	Ask about: • Reasons the patient wants to quit. • Concerns or worries about quitting. • Success the patient has achieved. • Difficulties encountered while quitting.

Acupuncture. A separate meta-analysis was conducted in 2000 to evaluate the effectiveness of acupuncture. Evidence, as shown in Table 6.21, did not support the effectiveness of acupuncture as a tobacco use treatment. The acupuncture meta-analysis comparing "active" acupuncture with "control" acupuncture (see Glossary) revealed no difference in effectiveness between the two types of procedures. These results suggest that any effect of acupuncture might be produced by other factors such as positive expectations about the procedure. These results are consistent with the more recent Cochrane analysis.[281] Moreover, the Guideline Panel did not identify scientific literature to support the effectiveness of the more recent electrostimulation or laser acupuncture treatments for tobacco use.

Hypnosis. The 1996 Guideline did not conduct a separate meta-analysis on hypnosis because few studies met inclusion criteria, and those that did used very heterogeneous hypnotic procedures. There was no common or standard intervention technique to analyze. Literature screening for the 2000 Guideline revealed no new published studies on the treatment of tobacco dependence by hypnosis that met the inclusion criteria; therefore, this topic was not reexamined. Moreover, an independent review of nine hypnotherapy trials by the Cochrane Group found insufficient evidence to support hypnosis as a treatment for smoking cessation.[282] In contrast to the Cochrane Review and other reviews, a small recent study reported preliminary positive results with hypnotherapy.[283]

Other Interventions. The number of studies was insufficient to accurately appraise the effectiveness of other types of counseling and behavioral therapies, such as physiological feedback, restricted environmental stimulation therapy,[284] and the use of incentives.[285]

Table 6.21. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for acupuncture (n = 5 studies)[a]

Treatment	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Placebo	7	1.0	8.3
Acupuncture	8	1.1 (0.7–1.6)	8.9 (5.5–12.3)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Future Research

The following topics regarding types of counseling and behavioral therapies require additional research:

- Effectiveness of motivational interventions, cigarette fading, and physiological feedback of smoking effects
- Mechanisms through which counseling interventions exert their effects
- Effectiveness of specific counseling interventions among various patient populations (e.g., those with cancers; chronic obstructive pulmonary disease [COPD]; psychiatric disorders, including substance use disorders; and atherosclerosis)

- Effectiveness of smokefree policies, particularly smokefree homes and worksites, on increasing interest in, and the effectiveness of, tobacco dependence treatment[286]

- Effectiveness of family systems interventions as a means to increase support

Combining Counseling and Medication

Recommendation: The combination of counseling and medication is more effective for smoking cessation than either medication or counseling alone. Therefore, whenever feasible and appropriate, both counseling and medication should be provided to patients trying to quit smoking. (Strength of Evidence = A)

Recommendation: There is a strong relation between the number of sessions of counseling, when it is combined with medication, and the likelihood of successful smoking cessation. Therefore, to the extent possible, clinicians should provide multiple counseling sessions, in addition to medication, to their patients who are trying to quit smoking. (Strength of Evidence = A)

Evidence in this Guideline update supports the independent effectiveness of both counseling interventions and medication interventions. In the 2008 Guideline update, the Panel evaluated whether combining counseling and medication improved cessation rates relative to using either of these treatments alone.

Providing Counseling in Addition to Medication. Eighteen studies met selection criteria to evaluate the effectiveness of providing counseling in addition to medication versus medication alone. The results of this 2008 meta-analysis indicate that providing counseling in addition to medication significantly enhances treatment outcomes (see Table 6.22). These same 18 studies also were analyzed to examine the relation of counseling intensity when it was used in combination with a medication. Results revealed that two or more sessions significantly enhance treatment outcomes, and more than eight sessions produced the highest abstinence rates (see Table 6.23). The counseling provided in these studies was delivered either in person or via telephone.

Table 6.22. Meta-analysis (2008): Effectiveness of and estimated abstinence rates for the combination of counseling and medication vs. medication alone (n = 18 studies)[a]

Treatment	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Medication alone	8	1.0	21.7
Medication and counseling	39	1.4 (1.2–1.6)	27.6 (25.0–30.3)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.23. Meta-analysis (2008): Effectiveness of and estimated abstinence rates for the number of sessions of counseling in combination with medication vs. medication alone (n = 18 studies)[a]

Treatment	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
0–1 session plus medication	13	1.0	21.8
2–3 sessions plus medication	6	1.4 (1.1–1.8)	28.0 (23.0–33.6)
4–8 sessions plus medication	19	1.3 (1.1–1.5)	26.9 (24.3–29.7)
More than 8 sessions plus medication	9	1.7 (1.3–2.2)	32.5 (27.3–38.3)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Providing Medication in Addition to Counseling. The effect of adding medication to counseling also was examined. Nine studies met inclusion criteria and provided 24 arms to compare medication and counseling with counseling alone. The results of this 2008 meta-analysis indicate that providing medication in addition to counseling significantly enhances treatment outcomes (see Table 6.24).

Table 6.24. Meta-analysis (2008): Effectiveness of and estimated abstinence rates for the combination of counseling and medication vs. counseling alone (n = 9 studies)[a]

Treatment	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Counseling alone	11	1.0	14.6
Medication and counseling	13	1.7 (1.3–2.1)	22.1 (18.1–26.8)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Medication and/or counseling are effective and should be provided as stand-alone interventions when it is not feasible to do both or the patient is not interested in both. By combining medication and counseling, however, the clinician can significantly improve abstinence rates. The clinician providing the medication does not need to be the clinician providing the counseling. It may be that a physician, dentist, physician assistant, or nurse practitioner could prescribe medicine, and counseling could be provided by a health educator, dental hygienist, tobacco treatment specialist, pharmacist, or quitline. Adherence to treatment, both medication and counseling, is important for optimal outcomes. Even though there is compelling evidence that both counseling and medications increase smoking cessation success, the clinician should encourage the patient to make a quit attempt even if she or he declines such treatment.

Future Research

The following topics regarding the combination of counseling and medication require additional research:

- Optimal timing and length of counseling and medication interventions (e.g., timing and spacing of postquit counseling sessions)
- Effectiveness and acceptability/appeal of different counseling formats and techniques (e.g., computer-based counseling, quitline counseling, motivational interviewing)
- Strategies to address misconceptions about effective counseling and medication treatments
- Relative cost-effectiveness of various treatment combinations

For Smokers Not Willing To Make a Quit Attempt At This Time

Recommendation: Motivational intervention techniques appear to be effective in increasing a patient's likelihood of making a future quit attempt. Therefore, clinicians should use motivational techniques to encourage smokers who are not currently willing to quit to consider making a quit attempt in the future. (Strength of Evidence = B)

Evidence suggests that a variety of motivational interventions can increase the motivation for behavior change. These interventions have varied contents and labels (e.g., individualized motivational intervention, motivational consulting, and motivational interviewing; see e.g., Chan et al.,[170] Butler et al.,[171] and Brown et al.[173]). The motivational intervention that has perhaps the greatest level of support and content specificity is motivational interviewing.

Motivational interviewing (MI) is a specific counseling strategy that is intended to increase a person's motivation for behavior change.[168] MI comprises a variety of strategies that are designed to help individuals resolve ambivalence about such change.[175] The technique has been used successfully to help individuals attempt and achieve many types of behavior change, including reduced drinking and illicit drug use, and reduction of HIV risk behaviors.[175,287,288]

Several studies have shown that MI techniques appear to be effective in motivating smokers to make quit attempts. A randomized controlled trial of an MI-based intervention among 137 smokers with cancer found that MI significantly increased quit attempts compared to an advice condition.[289] Another study found that a single session of MI, versus either brief psychoeducational counseling or advice, significantly increased the proportion of patients with schizophrenia who contacted a tobacco dependence treatment provider and attended an initial treatment session.[174] A third study showed that two 45-minute individual counseling sessions based on MI principles yielded higher levels of intention to quit smoking among adolescents than did a brief advice condition.[173] No differences in quitting attempts or quitting success were seen in that study, however. Studies that used motivational approaches that shared features of MI (but that were not

MI) yielded a mixed pattern of results, with some studies showing significant increases in quit attempts (see, e.g., Butler et al.[171]); others showed only trends in that direction.[170] Finally, one study that targeted unmotivated smokers showed that counseling based on the "5 R's" (see Chapter 3, Strategy B2) significantly increased the odds of making a quit attempt that lasted at least 24 hours.[169]

The available evidence shows that the reviewed motivational interventions such as MI increase quit attempts when used with individuals not already interested in quitting. The evidence does not show that such interventions are reliably effective as cessation treatments,[173,175,290] nor is there consistent evidence that MI-induced quit attempts translate into higher long-term abstinence rates. Evidence also shows that such interventions are more effective in smokers with little pre-existing motivation to quit.[171,173] Finally, some evidence suggests that extensive training is needed before competence is achieved in the MI technique.[175,291]

Physiological Monitoring/Biological Marker Feedback To Motivate Smokers To Quit

Investigators have sought to determine whether feedback regarding either smoking effects or disease risk motivates quit attempts. Modest evidence indicates that such feedback motivates quit attempts.[292] One small study found that multifaceted feedback involving CO level, vital capacity measurement, and discussion of pulmonary symptoms led to more quit attempts among smokers identified during routine medical screening.[293] In a second study, feedback regarding CO level and genetic susceptibility to cancer was associated with a greater likelihood of quit attempts 1 year later.[294] Although these results are encouraging, there is too little information to evaluate definitively the effects of physiological feedback.[284] In addition, there is insufficient information as to how this feedback affects those at different levels of readiness to quit. It also is unclear whether feedback that a person is *not* at high risk would encourage continued smoking. Finally, data are mixed regarding the effectiveness of feedback as a cessation versus motivational intervention. That is, data are mixed as to whether or not feedback increases abstinence rates.[284,295,296]

Future Research

The following topics require additional research:

- Effectiveness of motivational interviewing and related techniques, including the impact of brief motivational interviewing strategies delivered in primary care settings

- Effectiveness of physiological monitoring and biological marker feedback to motivate smokers to quit and increase abstinence rates

B. Medication Evidence

Recommendation: Clinicians should encourage all patients attempting to quit to use effective medications for tobacco dependence treatment, except where contraindicated or for specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents). (Strength of Evidence = A)

As with other chronic diseases, the most effective treatment of tobacco dependence requires the use of multiple clinical modalities. Medications are a vital element of a multicomponent approach. The clinician should encourage all patients initiating a quit attempt to use one or a combination of effective medications, although medication use may not be appropriate with some patient groups (e.g., those with medical contraindications, those smoking fewer than 10 cigarettes a day, pregnant/breastfeeding women, smokeless tobacco users, and adolescent smokers). The Guideline Panel identified seven first-line (FDA-approved) medications (bupropion SR, nicotine gum, nicotine inhaler, nicotine lozenge, nicotine nasal spray, nicotine patch, and varenicline) and two second-line (non-FDA-approved for tobacco use treatment) medications (clonidine and nortriptyline) as being effective for treating smokers. Each has been documented to increase significantly rates of long-term smoking abstinence. These results are consistent with other independent reviews.[158,297-300] No other medication treatments were consistently supported by the available scientific evidence.

In this update, the Panel conducted an inclusive meta-analysis of medications that complements the inclusive meta-analysis of psychosocial interventions that was conducted for the 2000 Guideline. For this meta-analysis, all medication trials with at least two studies of a particular medication,

at an appropriate dose and duration, were entered into one analysis. This inclusive medication meta-analysis allows for the comparison of particular medications to both placebo controls and other active medications (Table 6.26), and makes greater use of all information in the available studies. Note also that, although all of these studies were published in peer-reviewed journals, a number of the studies were supported by the pharmaceutical industry.

The medication meta-analysis included predominantly studies with "self-selected" populations (see Chapter 1, Overview and Methods). In addition, in medication studies both experimental and control subjects in the studies typically received substantial counseling. Both of these factors tend to produce higher abstinence rates than typically are observed among self-quitters.

The studies submitted to the inclusive medications meta-analysis were screened and categorized prior to analysis. Screening removed medications for which there were too few acceptable studies to submit to meta-analysis (e.g., the nicotine lozenge, selegeline), and removed study arms that were confounded (e.g., two different medication conditions had counseling adjuvants of different intensities). Decisions about cutscores for treatment duration and dose categories were designed to be consistent with package insert information and data on effectiveness (i.e., prior data indicated rough clinical equivalence of certain dosages). Therefore, although there was an attempt to achieve some uniformity across the medications, decisions about dose and duration categories necessarily were made on a medication-by-medication basis. It is important to note that some medication categories, and some medication recommendations, do not conform with manufacturers' recommendations (e.g., the use of a nicotine patch dose > 25 mg per day). Table 6.25 shows the dosage and duration inclusion criteria for normal course, long-term, and high-dose medication classifications. In the case of medication combinations, the combinations typically comprised two standard-length medication regimens. In one combination, however, *ad libitum* NRT (gum or spray) was paired with long-term nicotine patch use ("patch [long-term] + *Ad Lib* NRT"). Different medications were grouped together into a single use category (e.g., grouping nicotine gum and spray together into the "Long-term *Ad Lib* NRT" condition) when the grouping was clinically and conceptually meaningful and when it permitted greater use of the available research evidence. Analyses were conducted for both 6- and 12-month outcomes, and the results of the

12-month analyses were very similar to the 6-month results shown in Table 6.26.

Table 6.25. Coding rules for medication duration and dose

Medication	Coding	Meaning
Nicotine Patch	Usual duration	6–14 weeks
	Long duration	> 14 weeks
	Usual dose/day	15 mg/16 hours/day 21 mg/24 hours/day
	High dose	> 25 mg/day
Nicotine Gum	Usual duration	6–14 weeks
	Long duration	> 14 weeks
Nicotine Inhaler and Nasal Spray	Usual duration	Up to 6 months
	Long duration	> 6 months
Bupropion SR	Usual duration	Up to 14 weeks
	Usual dose/day	150 mg once daily or twice daily
Varenicline	Usual duration	Up to 14 weeks
	Usual dose/day	1 mg daily or 1 mg twice daily (analyzed separately)

Recommendations Regarding Individual Medications: First-Line Medications

First-line medications are those that have been found to be safe and effective for tobacco dependence treatment and that have been approved by the FDA for this use, except in the presence of contraindications or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents). These first-line medications have an established empirical record of effectiveness, and clinicians should consider these agents first in choosing a medication. For the 2008 update, the first-line medications are listed in Table 6.26 by size of the odds ratio and in the text alphabetically by generic name.

Table 6.26. Meta-analysis (2008): Effectiveness and abstinence rates for various medications and medication combinations compared to placebo at 6-months postquit (n = 83 studies)[a]

Medication	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Placebo	80	1.0	13.8
Monotherapies			
Varenicline (2 mg/day)	5	3.1 (2.5–3.8)	33.2 (28.9–37.8)
Nicotine Nasal Spray	4	2.3 (1.7–3.0)	26.7 (21.5–32.7)
High-Dose Nicotine Patch (> 25 mg) (These included both standard or long-term duration)	4	2.3 (1.7–3.0)	26.5 (21.3–32.5)
Long-Term Nicotine Gum (> 14 weeks)	6	2.2 (1.5–3.2)	26.1 (19.7–33.6)
Varenicline (1 mg/day)	3	2.1 (1.5–3.0)	25.4 (19.6–32.2)
Nicotine Inhaler	6	2.1 (1.5–2.9)	24.8 (19.1–31.6)
Clonidine	3	2.1 (1.2–3.7)	25.0 (15.7–37.3)
Bupropion SR	26	2.0 (1.8–2.2)	24.2 (22.2–26.4)
Nicotine Patch (6–14 weeks)	32	1.9 (1.7–2.2)	23.4 (21.3–25.8)
Long-Term Nicotine Patch (> 14 weeks)	10	1.9 (1.7–2.3)	23.7 (21.0–26.6)
Nortriptyline	5	1.8 (1.3–2.6)	22.5 (16.8–29.4)
Nicotine Gum (6–14 weeks)	15	1.5 (1.2–1.7)	19.0 (16.5–21.9)
Combination therapies			
Patch (long-term; > 14 weeks) + *ad lib* NRT (gum or spray)	3	3.6 (2.5–5.2)	36.5 (28.6–45.3)
Patch + Bupropion SR	3	2.5 (1.9–3.4)	28.9 (23.5–35.1)
Patch + Nortriptyline	2	2.3 (1.3–4.2)	27.3 (17.2–40.4)
Patch + Inhaler	2	2.2 (1.3– 3.6)	25.8 (17.4–36.5)
Patch + Second generation antidepressants (paroxetine, venlafaxine)	3	2.0 (1.2–3.4)	24.3 (16.1–35.0)
Medications not shown to be effective			
Selective Serotonin Re-uptake Inhibitors (SSRIs)	3	1.0 (0.7–1.4)	13.7 (10.2–18.0)
Naltrexone	2	0.5 (0.2–1.2)	7.3 (3.1–16.2)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Bupropion SR (Sustained Release)

Recommendation: Bupropion SR is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = A)

Bupropion SR was the first non-nicotine medication shown to be effective for smoking cessation and was approved by the FDA for that use in 1997. Its possible mechanisms of action include blockade of neuronal re-uptake of dopamine and norepinephrine and blockade of nicotinic acetylcholinergic receptors. It is contraindicated in patients with a seizure disorder, a current or prior diagnosis of bulimia or anorexia nervosa, use of a monoamine oxidase (MAO) inhibitor within the previous 14 days, or in patients taking another medication that contains bupropion. Bupropion SR is available exclusively as a prescription medication and can be used in combination with nicotine replacement therapies. Suggestions regarding the clinical use of bupropion SR are provided in Table 3.3.

Twenty-four studies generated the 26 arms that served as the basis for estimating the bupropion SR effect. The bupropion SR dose was 150 mg for 3 of these study arms, and 300 mg for the other 22 of these arms (one study did not report dose). As Table 6.26 reveals, bupropion SR approximately doubles the likelihood of long-term (> 5 month) abstinence from tobacco use as compared to placebo treatment. These results are consistent with other independent reviews.[299]

Nicotine Replacement Therapies (NRTs)

Nicotine replacement therapy (NRT) medications deliver nicotine with the intent to replace, at least partially, the nicotine obtained from cigarettes and to reduce the severity of nicotine withdrawal symptoms.

Nicotine Gum

Recommendation: Nicotine gum is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = A)

Recommendation: Clinicians should offer 4 mg rather than 2 mg nicotine gum to highly dependent smokers. (Strength of Evidence = B)

Nicotine gum currently is available exclusively as an OTC medication and is packaged with important instructions on correct usage, including chewing (see Table 3.4 for information on the clinical use of nicotine gum). Nine studies generated the 15 study arms that served as the basis for estimating the effect of nicotine gum. In addition, another four studies generated the six arms that served as the basis for the estimation of effects of long-term gum use (directed use beyond 14 weeks). Two arms used gum for 52 weeks, and the other four arms used gum for 24–26 weeks. Table 6.26 reveals that regular course and long-term nicotine gum use increased the likelihood of long-term abstinence by about 50 percent compared to placebo treatment. These results are consistent with other independent reviews.[300]

Nicotine Inhaler

Recommendation: The nicotine inhaler is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = A)

The nicotine inhaler currently is available exclusively as a prescription medication. The nicotine inhaler is not a true pulmonary inhaler, but rather deposits nicotine in the oropharynx, from which it is absorbed across the mucosa. See Table 3.5 for suggestions regarding the clinical use of the nicotine inhaler. Six studies generated the six arms that served as the basis for estimating the nicotine inhaler effect. As Table 6.26 shows, the inhaler approximately doubled smokers' likelihood of long-term abstinence from tobacco as compared to placebo treatment. These results are consistent with other independent reviews.[300]

Nicotine Lozenge

Recommendation: The nicotine lozenge is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = B)

Nicotine lozenge is available exclusively as an OTC medication and is packaged with important instructions for correct usage (see Table 3.6). Only one randomized controlled trial of the nicotine lozenge was available for review.[301] Therefore, the nicotine lozenge was not included in the inclusive meta-analysis (Table 6.26). The data from this study of more than 1,800 smokers found that the 2-mg lozenge for low-dependent smokers (smoke

a first cigarette 30 minutes or more after waking) approximately doubled and the 4-mg lozenge for highly dependent smokers (smoke a first cigarette within 30 minutes of waking) approximately tripled the odds of abstinence at 6 months postquit as compared to placebo treatment. See Table 6.27 for the study results. These results are consistent with other independent reviews.[300]

Table 6.27. Effectiveness of the nicotine lozenge: Results from the single randomized controlled trial

Lozenge dose	N for active/N for placebo	Odds Ratio (95% C.I.)	Continuous abstinence rates at 6 months (Active/Placebo)
2 mg	459/458	2.0 (1.4–2. 8)	24.2/14.4
4 mg	450/451	2.8 (1.9–4.0)	23.6/10.2

Nicotine Nasal Spray

Recommendation: Nicotine nasal spray is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = A)

The nicotine nasal spray currently is available exclusively as a prescription medication. See Table 3.7 for suggestions regarding the clinical use of the nicotine nasal spray. Four studies generated the four study arms that served as the basis for estimating the nasal spray effect. As Table 6.26 reveals, the nasal spray more than doubles the likelihood of long-term abstinence from tobacco as compared to placebo treatment.

Nicotine Patch

Recommendation: The nicotine patch is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = A)

Nicotine patches currently are available both as an OTC medication and as a prescription medication. Awareness of this prescription option is important for insurance plans that include coverage only for prescription medications. Suggestions for the clinical use of the nicotine patch are provided in Table 3.8.

Twenty-five studies generated the 32 study arms that served as the basis for estimating the nicotine patch effect. Of these 32 arms, the peak dose used was 14 or 15 mg in 6 study arms and 21–25 mg in 25 arms (one study did not report dose). As Table 6.26 shows, the nicotine patch almost doubled the likelihood of long-term abstinence compared to placebo treatment. These results are consistent with other independent reviews.[300]

The meta-analysis also addressed the effectiveness of long-term and high-dose nicotine patch therapy. As noted in Table 6.25, high-dose therapy was coded when the highest dose used exceeded 25 mg. This often was achieved by using two patches per day as a dosing regimen. Four studies generated four analyzable study arms with peak patch dosages of 30 mg (2 arms), 35 mg (1 arm), and 42 mg (1 arm). In some of these high-dose arms, patch use was of regular duration (14 weeks or less), although in other arms the duration of directed patch use exceeded 14 weeks.

Table 6.25 shows that long-term patch therapy was coded when the duration of directed patch use exceeded 14 weeks. All of the long-term patch studies used regular-dose patch regimens (15–25 mg). Eight studies generated 10 study arms that served as the basis for estimating the effect of long-term patch therapy. Table 6.26 shows that both long-term therapy and high-dose patch therapy approximately doubled the likelihood that a smoker would achieve long-term abstinence relative to placebo treatment. Thus, neither high-dose nor long-term patch therapy appeared to produce benefit above and beyond that of nicotine patch therapy at the regular duration (6–14 weeks) and dose (14–25 mg).

A time trend analysis of the nicotine patch studies based on data from the current meta-analysis revealed no significant change in the effectiveness of the nicotine patch during the approximately 15 years it has been available.

Varenicline

Recommendation: Varenicline is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = A)

Varenicline is a non-nicotine medication that was approved by the FDA for the treatment of tobacco dependence in 2006. Its mechanism of action is presumed to be due to its partial nicotine receptor agonist and antagonist effects. It is well tolerated in most patients. However, a recent publication

reported two case reports of exacerbations of existing psychiatric illness, schizophrenia and bipolar illness, in patients who took varenicline.[302,303] In contrast, one recent smoking cessation study using varenicline included smokers with mental illness (depression, bipolar disorder, and/or psychosis) and reported no evidence that varenicline worsened the patients' mental illness.[304] Importantly, the FDA noted that patients with psychiatric illness were not included in the studies conducted for the approval of this medication.

In February 2008, the FDA added a warning regarding the use of varenicline. Specifically, it noted that depressed mood, agitation, changes in behavior, suicidal ideation, and suicide have been reported in patients attempting to quit smoking while using varenicline. The FDA recommends (1) that patients tell their health care provider about any history of psychiatric illness prior to starting this medication; and (2) that clinicians monitor patients for changes in mood and behavior when prescribing this medication. In light of these FDA recommendations, clinicians should consider eliciting information on their patients' psychiatric history.

Because varenicline is eliminated almost entirely unchanged in the urine, it should be used with caution in patients with severe renal dysfunction (creatinine clearance < 30 ml per min). Varenicline is available exclusively as a prescription medication and is not recommended for use in combination with NRT because of its nicotine antagonist properties. One recent review[297] found that varenicline increased odds of quitting over that of bupropion SR with a minimal to moderate side effect profile. Suggestions regarding the clinical use of varenicline are presented in Table 3.9.

The FDA dosing recommendation for varenicline is a total of 2 mg per day (1 mg twice daily). However, there is evidence that a dose of 1 mg per day also is effective.[305] Therefore, the effectiveness of both doses was addressed in the inclusive meta-analysis. Four studies generated five study arms that served as the basis for estimating the effect of 2 mg varenicline. Two studies generated the three study arms that served as the basis for estimating the effect of 1 mg varenicline. As Table 6.26 shows, the 1 mg total daily dose of varenicline approximately doubles, and the 2 mg total daily dose of varenicline approximately triples, a smoker's likelihood of long-term abstinence from tobacco as compared to placebo treatment. This suggests that the 1 mg per day dose is a viable alternative to the 2 mg per day dose, should the patient experience dose-related side effects.

Evidence indicates that varenicline is well-tolerated for periods up to 1 year[306] and that extended treatment may prove useful in reducing the likelihood of relapse.[307] More research is needed, however, to evaluate varenicline as a relapse prevention medication, to assess its long-term effects, and to evaluate its effectiveness in specific populations.

Interactions of First-Line Tobacco Use Medications With Other Drugs

The goal of treating tobacco use and dependence is abstinence from tobacco products. In achieving this goal, the metabolic effects of tobacco abstinence must be understood with respect to potential changes in homeostasis that occur in response to quitting and, eventually, the elimination of nicotine from the body. This is particularly important for smokers who are on other medications for chronic disease state management because they essentially are in a homeostatic metabolic condition and the titration of their chronic disease medications may have been influenced by their smoking status.

The polycyclic aromatic hydrocarbons in tobacco smoke are metabolic inducers of some isoforms of the hepatic cytochrome P450.[308] Thus, when smokers quit and the P450 system returns to its basal level of functioning, the concentration of drugs metabolized by these particular CYP isoforms may increase. As a result, smokers who quit can experience side effects from supratherapeutic drug levels of caffeine, theophylline, fluvoxamine, olanzapine, and clozapine. This can have serious consequences for selective drugs such as clozapine, with its associated agranulocytosis.[309]

Although nicotine is metabolized by CYP2A6, it does not appear to induce, in a clinically significant way, CYP enzymes. Thus, when a smoker is switched from cigarettes to a nicotine replacement product, changes in drug metabolism are similar to those seen when quitting without NRT.

Nicotine produces sympathetic activation that may reduce the sedative effects of benzodiazepines, and the vasoconstrictive effects of nicotine may decrease subcutaneous absorption of insulin. Nicotine also may attenuate the ability of beta-blockers to lower blood pressure and heart rate and may lessen opioid analgesia. When nicotine replacement products are withdrawn, adjustments in these types of medications may be necessary.

The metabolism of bupropion is mediated primarily by CYP2B6. Three categories of drugs could have clinically significant interactions with bupropion: drugs affecting CYP2B6, drugs metabolized by CYP2D6, and general enzyme inducers/inhibitors.[310] Drugs that affect CYP2B6 metabolism, such as cyclophosphamide and orphenadrine, potentially could alter bupropion metabolism. Bupropion and its metabolites inhibit CYP2D6[311,312] and could affect the impact of agents metabolized by this enzyme (e.g., tricyclic antidepressants, antipsychotics, type 1C anitarrhythmics, or certain beta-blockers). Due to the extensive metabolism of bupropion, enzyme inducers (e.g., carbamazepine, phenobarbital, phenytoin) and inhibitors (e.g., valproate, cimetidine) may alter its plasma concentration. Bupropion can lower seizure threshold. It should be used with caution with medications that can also lower seizure threshold.[310,313] Specifically, use of bupropion within 14 days of discontinuation of therapy with any MAO inhibitor is contraindicated.

Varenicline is eliminated unchanged by kidney excretion and thus is believed to pose no metabolic effects. Cimetidine inhibits the renal secretion of varenicline, although the magnitude of the interaction is small. No significant drug-drug interactions are known.[314]

Recommendations Regarding Second-Line Medications

Second-line medications are medications for which there is evidence of effectiveness for treating tobacco dependence, but they have a more limited role than first-line medications because: (1) the FDA has not approved them for a tobacco dependence treatment indication; and (2) there are more concerns about potential side effects than exist with first-line medications. Second-line medications should be considered for use on a case-by-case basis after first-line medications (either alone or in combination) have been used without success or are contraindicated. The listing of the second-line medications is alphabetical by generic name.

Clonidine

Recommendation: Clonidine is an effective smoking cessation treatment. It may be used under a physician's supervision as a second-line agent to treat tobacco dependence. (Strength of Evidence = A)

Three studies generated three analyzable study arms that served as the basis for estimating clonidine's effects on long-term abstinence. These studies all were conducted prior to 1997. Table 6.26 reveals that the use of clonidine approximately doubles abstinence rates when compared to a placebo. These studies varied the clonidine dose from 0.1 to 0.75 mg per day. The drug was delivered either transdermally or orally. It should be noted that abrupt discontinuation of clonidine can result in symptoms such as nervousness, agitation, headache, and tremor, accompanied or followed by a rapid rise in blood pressure and elevated catecholamine levels.

Clonidine is used primarily as an antihypertensive medication and has not been approved by the FDA as a medication for treating tobacco use and dependence. Therefore, clinicians need to be aware of the specific warnings regarding this medication as well as its side-effect profile. Additionally, a specific dosing regimen for the use of clonidine in smoking cessation has not been established. The Guideline Panel chose to recommend clonidine as a second-line as opposed to first-line agent because of the warnings associated with clonidine discontinuation, variability in dosages used to test this medication, and lack of FDA approval. As such, clonidine should be considered for treating tobacco use under a physician's monitoring with patients unable to use first-line medications because of contraindications or with patients who were unable to quit when using first-line medications. An independent review[298] indicated that clonidine is effective in promoting smoking abstinence, but prominent side effects limit its usefulness. Suggestions regarding clinical use of clonidine are provided in Table 3.10.

Nortriptyline

Recommendation: Nortriptyline is an effective smoking cessation treatment. It may be used under a physician's supervision as a second-line agent to treat tobacco dependence. (Strength of Evidence = A)

Four studies generated the five analyzable study arms that served as the basis for estimating the effect of nortriptyline on long-term abstinence. Nortriptyline dosages were 75 mg per day (3 arms) and 100 mg per day (2 arms), with treatment lasting from 6 to 13 weeks across the five arms. As Table 6.26 shows, nortriptyline almost doubles a smoker's likelihood of achieving long-term abstinence from tobacco as compared to placebo treatment. A recent independent review[158] also indicated that nortriptyline is effective in treating tobacco dependence. Suggestions regarding the

clinical use of nortriptyline are provided in Table 3.11. Nortriptyline is used primarily as an antidepressant and has not been evaluated or approved by the FDA as a medication for treating tobacco use and dependence. Clinicians need to be aware of the specific warnings regarding this medication as well as its side-effect profile. Because of the side-effect profile and the lack of FDA approval for tobacco dependence treatment, nortriptyline is recommended as a second-line rather than a first-line agent. As such, nortriptyline should be considered for treating tobacco use under a physician's direction with patients unable to use first-line medications because of contraindications or with patients who were unable to quit using first-line medications.

Combination Medications

Recommendation: Certain combinations of first-line medications have been shown to be effective smoking cessation treatments. Therefore, clinicians should consider using these combinations of medications with their patients who are willing to quit. Effective combination medications are:

- **Long-term (> 14 weeks) nicotine patch + other NRT (gum and spray)**
- **The nicotine patch + the nicotine inhaler**
- **The nicotine patch + bupropion SR (Strength of Evidence = A)**

The number and variety of analyzable articles was sufficient to assess the effectiveness of five combinations of medications relative to placebo. Only the patch + bupropion combination has been approved by the FDA for smoking cessation.

Nicotine Patch + Bupropion SR

Three studies yielded three analyzable study arms that served as the basis for estimating the effect of the nicotine patch + bupropion SR on long-term abstinence. Both the patch and bupropion SR were used at standard durations and doses (see Table 6.25).

Nicotine Patch + Nicotine Inhaler

Two studies generated two arms that served as the basis for estimating the effect of the nicotine patch + the nicotine inhaler. The 15-mg patch was used in both studies at a regular treatment duration. The directed duration of use of the inhaler was 12 weeks in one arm and 26 weeks in the other arm.

Long-Term Nicotine Patch Use + *Ad Libitum* NRT

Three studies yielded three analyzable study arms that served as the basis for estimating the effect of long-term nicotine patch use + *ad libitum* NRT use. All arms involved nicotine patch therapy that exceeded 14 weeks, with durations that ranged from 18 to 24 weeks. The *ad libitum* NRT condition involved nicotine gum in two arms and the nicotine nasal spray in one arm. The two gum arms both used 2-mg gum, with directed use lasting 26 weeks in one arm and 52 weeks in another arm. The third arm involved nicotine nasal spray, with directed use lasting 52 weeks.

Nicotine Patch + Nortriptyline

Two studies generated three analyzable arms that served as the basis for estimating the effects of the nicotine patch + nortriptyline. The 21-mg nicotine patch served as the highest patch dose in all study arms, and the nortriptyline dose was 75 mg per day in one arm and 100 mg per day in the other arm. Both medications were used for standard durations (8–14 weeks).

Nicotine Patch + Second Generation Antidepressants

Three studies yielded three analyzable arms that served as the basis for estimating the effects of second generation antidepressants + the nicotine patch. The antidepressants used included the specific serotonin re-uptake inhibitor paroxetine (20 mg per day for 9 weeks for 2 arms), and the atypical antidepressant venlafaxine (22 mg per day for 21 weeks). The 21- or 22-mg patch served as the highest patch dose, with the duration of patch therapy being 6 or 8 weeks.

Effectiveness of Medication Combinations

Table 6.26 displays the 2008 meta-analytic results describing the effectiveness data for the five medication combinations. The data reveal that the nicotine patch + bupropion SR, the nicotine patch + inhaler, the long-term nicotine patch + *ad libitum* NRT, the nicotine patch + nortriptyline, and the nicotine patch + second generation antidepressants all significantly increased a smoker's likelihood of abstinence relative to placebo treatment. A meta-analysis using 12-month abstinence rates had similar results. The first three medication combinations involve only first-line medications and therefore are recommended for use as first-line treatments.

Decisions about use of a medication combination may be based on considerations other than abstinence. Evidence indicates, for instance, that a combination of medication may result in greater suppression of tobacco withdrawal symptoms than does the use of a single medication.[148,315,316] Patient preferences also may play a role, because some combinations of medications may produce more side effects and cost more than individual medications.[315,317,318]

Relative Effectiveness of Medications

Information on the relative effectiveness of medications may help the clinician and patient select an appropriate medication intervention. To this end, all medication conditions in Table 6.26 were compared with the nicotine patch. The nicotine patch was selected as a comparison condition because more study arms were available for this condition than for any other, and because this condition was of moderate effectiveness relative to other conditions (see Table 6.26; OR = 1.9). Contrasts between all treatments were not conducted because of concerns about Type I error due to multiple testing. Also, a conservative Hochberg[319] adjustment to the alpha level was used so that only treatments that were substantially different in effectiveness would be found to be significantly different. These comparisons of the different medications should be viewed as suggestive rather than definitive. For instance, the studies of one type of medication may differ from studies evaluating a different medication on numerous bases such as year of publication, type of population, and newness of the medication. It is possible that such differences could have affected the relative size of the odds ratios obtained for the different medications. Existing studies that provide head-to-head comparisons of medications

(which were included in this meta-analysis) provide an additional source of information on this topic.

The *a posteriori* tests resulted in three treatment conditions being statistically different from the effectiveness of the nicotine patch when it is used at regular doses and durations. The 2 mg per day varenicline and the combination of long-term patch use + *ad libitum* NRT (gum or spray) were both found to produce significantly greater likelihood of long-term abstinence than the patch by itself (see Table 6.28). Two treatments produced a lower likelihood of long-term abstinence: selective serotonin re-uptake inhibitors (SSRIs) and naltrexone. The analyses presented in Table 6.28 represent 6-month abstinence rates. Similar conclusions were reached in a meta-analysis of 12-month abstinence rates.

Table 6.28. Meta-analysis (2008): Effectiveness of and abstinence rates of medications relative to the nicotine patch (n = 83 studies)[a]

Medication	Number of arms	Estimated odds ratio (95% C. I.)
Nicotine Patch (reference group)	32	1.0
Monotherapies		
Varenicline (2 mg/day)	5	1.6 (1.3–2.0)
Nicotine Nasal Spray	4	1.2 (0.9–1.6)
High-Dose Nicotine Patch (> 25 mg; standard or long-term)	4	1.2 (0.9–1.6)
Long-Term Nicotine Gum (> 14 weeks)	6	1.2 (0.8–1.7)
Varenicline (1 mg/day)	3	1.1 (0.8–1.6)
Nicotine Inhaler	6	1.1 (0.8–1.5)
Clonidine	3	1.1 (0.6–2.0)
Bupropion SR	26	1.0 (0.9–1.2)
Long-Term Nicotine Patch (> 14 weeks)	10	1.0 (0.9–1.2)
Nortriptyline	5	0.9 (0.6–1.4)
Nicotine Gum	15	0.8 (0.6–1.0)
Combination therapies		
Patch (long-term; > 14 weeks) + NRT (gum or spray)	3	1.9 (1.3–2.7)
Patch + Bupropion SR	3	1.3 (1.0–1.8)

Table 6.28. Meta-analysis (2008): Effectiveness of and abstinence rates of medications relative to the nicotine patch (n = 83 studies)[a] (continued)

Medication	Number of arms	Estimated odds ratio (95% C. I.)
Combination therapies		
Patch + Nortriptyline	2	0.9 (0.6–1.4)
Patch + Inhaler	2	1.1 (0.7–1.9)
Second-generation antidepressants & Patch	3	1.0 (0.6–1.7)
Medications not shown to be effective		
Selective Serotonin Re-uptake Inhibitors (SSRIs)	3	0.5 (0.4–0.7)
Naltrexone	2	0.3 (0.1-0.6)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Precessation NRT Use

Recent studies have investigated the use of NRT prior to a quit attempt. Some of these studies involved smokers who are planning to quit, and others involved smokers who were not willing to quit but who were willing to reduce their smoking. The use of NRT while smoking contradicts NRT package inserts. The existence of multiple studies on this prequit medication strategy led the Panel to review this topic as part of this Guideline update. The results of this review (see below) suggest that NRT prior to quitting may be effective in increasing abstinence rates, but the Panel chose not to recommend this intervention (see below). If this strategy is used clinically, patients should be advised to cease NRT use if they develop symptoms of nicotine toxicity (e.g., nausea, vomiting, dizziness).

Precessation Use of NRT Among Patients Making a Quit Attempt. Two randomized controlled studies examined the effect of initiating the use of NRT prior to a quit attempt among patients making a quit attempt. One study examined the use of nicotine patches, either active or placebo, 2 weeks prior to quitting, after which all participants received active patches for 12 weeks following the quit day.[320] Results revealed no differences in adverse events, and smokers who had received the active patches during the prequit period were more likely to be abstinent at 6 months postquit. In a second study, Rose and colleagues[321] found that precessation patch use significantly increased abstinence rates at 4 weeks postquit but not at 6 months.

Finally, a small pilot study found that prequit patch use was well tolerated by smokers wanting to quit.[322] Given the limited data on this strategy, the Panel declined to recommend precessation use of NRT among patients making a quit attempt. However, this topic warrants further research.

Use of NRT Among Patients Unwilling to Make a Quit Attempt at This Time. Research has examined the use of NRT in patients who are not currently willing to make a quit attempt but who state that they are willing to reduce their smoking. In general, these studies found that NRT used in this way increased the likelihood that smokers will make a quit attempt and succeed in quitting. Sufficient studies were available to meta-analyze this topic for the Guideline update. Five studies generated five arms that met criteria for the analysis of the effect of NRT compared to placebo with smokers not willing to quit (but who were willing to reduce the number of cigarettes smoked and use a nicotine replacement medication). As Table 6.29 shows, the use of NRT more than doubled the likelihood that a smoker would be abstinent at 12 months, despite the smoker's unwillingness to make a quit attempt at the time of initial assessment. The nicotine replacement products in these studies included nicotine gum (2 or 4 mg for 6–12 months), the nicotine inhaler (10 mg for 6–24 months), the nicotine patch (16-hour 15-mg patch for up to 6 months), or the choice of a combination of these medications.

Because of the selective participant inclusion criteria and other aspects of this research, it is unclear that the results described above would be relevant to the broader population of smokers unwilling to quit. For instance, most patients in the studies included in the analysis in Table 6.29 were not offered a cessation intervention prior to study induction. It is possible that some of the participants would have opted for a free cessation treatment had it been offered. Also, in some instances, the recruitment material may have made it clear that treatment was available only for those uninterested in quitting. It is unclear how this perceived contingency affected the sample. Further, it is not clear if the results would be true for only those interested in reducing their smoking and not for uninterested patients, in general. Additionally, there was concern that if clinicians routinely asked about interest in cutting down, this might suggest to tobacco users that reduction confers health benefits, is a recommended strategy for persons trying to quit, or is a recommended goal of treatment (rather than quitting smoking)—and that these perceptions might decrease the proportion of smokers willing to make a quit attempt. Because of such concerns, the Panel

decided not to recommend medication use as a standard intervention for smokers unwilling to quit. A recent Cochrane analysis[323] found that NRT significantly increased quit rates among smokers not initially motivated to quit. The authors concluded, however, that there was insufficient evidence to recommend this as a standard treatment approach with this population. The Panel believes that this topic warrants further research.

Table 6.29. Meta-analysis (2008): Effectiveness of and abstinence rates for smokers not willing to quit (but willing to change their smoking patterns or reduce their smoking) after receiving NRT compared to placebo (n = 5 studies)[a]

Intervention	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Placebo	5	1.0	3.6
Nicotine replacement (gum, inhaler, or patch)	5	2.5 (1.7–3.7)	8.4 (5.9–12.0)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Medications Not Recommended by the Guideline Panel

Antidepressants Other Than Bupropion SR and Nortriptyline

Smoking is significantly more prevalent among individuals with a past history of depression, and these individuals have more difficulty quitting smoking than do smokers without a past history of depression.[324-328] One antidepressant, bupropion SR, has been documented as effective for treating tobacco use and approved by the FDA for this use (see Bupropion SR [sustained release], page 110). Nortriptyline also has been documented to be effective (see Nortriptyline, page 117), although the FDA has not evaluated this medication for treatment of tobacco dependence. The Panel's review of the extant literature revealed a sufficient body of research to evaluate one class of antidepressants that is dissimilar from both bupropion SR and nortriptyline: selective serotonin re-uptake inhibitors (SSRIs).

Selective Serotonin Re-Uptake Inhibitors (SSRIs)

Two studies yielded three analyzable arms that served as the basis for estimating the effects of SSRIs. Sertraline (200 mg per day) served as the medication in one arm, and fluoxetine (30 to 60 mg per day) served as the medication in the other two arms. The treatment duration was 10 weeks in all arms. Results showed that treatment with SSRIs did not significantly increase the likelihood of abstinence relative to placebo treatment. These results are consistent with other independent reviews[299] (see Table 6.26).

Anxiolytics/Benzodiazepines/Beta-Blockers

A few trials have evaluated anxiolytics and other agents that reduce the somatic signs or the symptoms of anxiety. Early individual trials of propranolol, a beta-blocker,[329] and diazepam, an anxiolytic,[330] did not reveal a beneficial effect for these drugs compared with control interventions. Likewise, of the early studies assessing the anxiolytic buspirone that met inclusion criteria, only one revealed evidence of effectiveness relative to placebo.[331] Further studies of buspirone have failed to replicate this effect.[332-334] These results are consistent with other independent reviews.[333] Because of a lack of data, no meta-analyses were conducted, and no conclusions were drawn regarding the effectiveness of anxiolytics in smoking cessation.

Opioid Antagonists/Naltrexone

Two studies yielded the analyzable study arms that served as the basis for estimating the effects of the opiate antagonist naltrexone. Table 6.26 reveals that naltrexone treatment did not increase the likelihood of abstinence relative to placebo treatment. These results are consistent with other independent reviews.[335] Two studies[336,337] also examined whether naltrexone added to the effectiveness of the nicotine patch. The studies used different naltrexone and patch dosing regimens. The patch use regimen in one study did not meet meta-analysis inclusion criteria. Therefore, these patch + naltrexone studies could not be submitted to meta-analysis. Neither study reported significant benefit from adding naltrexone to the nicotine patch.

Silver Acetate

Due to limitations of the literature available regarding silver acetate, this agent was not included in the inclusive meta-analysis. Several randomized clinical trials[338-340] of silver acetate, however, revealed no beneficial effects for smoking cessation; a Cochrane review concurs with this finding.[341]

Mecamylamine

In the single study that compared mecamylamine alone to placebo, no effectiveness was noted.[342] Another early study compared a combination of mecamylamine plus the nicotine patch to placebo and found a significant effect for this combination.[343] A more recent study comparing nicotine patch alone to nicotine patch plus mecamylamine found no significant differences.[344] These findings are consistent with other independent reviews.[345] Because of these findings, the Panel drew no conclusions regarding mecamylamine as a monotherapy.

Extended Use of Medications

For some patients, it may be appropriate to continue medication treatment for periods longer than is usually recommended. Results of the inclusive meta-analysis indicated that long-term patch and gum use are effective. Evidence indicates that the long-term use of gum may be more effective than a shorter course of gum therapy (Table 6.26). The Lung Health Study, of almost 4,000 smokers with evidence of early COPD, reported that approximately one-third of long-term quitters still were using nicotine gum at 12 months,[346] and some for as long as 5 years, with no serious side effects.[347] Other studies also have found that, among patients given free access to nicotine gum, 15 to 20 percent of successful abstainers continue to use the gum for a year or longer.[348] Thus, it may be that certain groups of smokers may benefit from long-term medication use. Although weaning should be encouraged for all patients using medications, continued use of such medication clearly is preferable to a return to smoking with respect to health consequences. This is because, unlike smoking, these medications do not (a) contain non-nicotine toxic substances (e.g., "tar," carbon monoxide, formaldehyde, benzene); (b) produce sharp surges in blood nicotine levels; and/or (c) produce strong dependence.[349,350] Finally, it should be noted that the medication treatment that produced the largest effects on abstinence rates, of those analyzed, involved long-term nicotine patch therapy + *ad libitum* NRT (Table 6.26).

Use of NRT in Cardiovascular Patients

Soon after the nicotine patch was released, the media reported a possible link between the use of this medication and cardiovascular risk. This question has been studied systematically since that time. Separate analyses now have documented the lack of an association between the nicotine patch and acute cardiovascular events,[351-356] even in patients who continued to smoke while on the nicotine patch,[357] although a recent study raised questions regarding NRT use in intensive care units.[358] Because of inaccurate media coverage in the past, it may be important to inform patients who are reluctant to use NRTs that there is no evidence of increased cardiovascular risk with these medications. Note that package inserts recommend caution in patients with acute cardiovascular diseases (see Tables 3.3–3.11).

Future Research

The following pharmacotherapeutic topics require additional research:

- Relative effectiveness and safety of the seven FDA-approved medications, in general and for specific subpopulations (e.g., women; adolescents; older smokers; smokeless tobacco users; individuals with psychiatric disorders, including substance use disorders; postmyocardial infarction patients) and for long-term treatment
- Use of combined tobacco dependence medications in general and for specific subpopulations (e.g., highly dependent smokers)
- Effectiveness of long-term medications
- Effectiveness of prequit NRT use in increasing abstinence rates
- Strategies to address widespread misconceptions about effective smoking cessation medications and common barriers to their appropriate use
- Effectiveness of MAO inhibitors, especially for those with depression

Use of Over-the-Counter Medications

Recommendation: Over-the-counter nicotine patch therapy is more effective than placebo, and its use should be encouraged. (Strength of evidence = B)

No new studies were identified for the 2008 update that examined the effectiveness of nicotine patch versus placebo patch in an OTC setting. Based on the 2000 Guideline, there were three placebo-controlled studies with six arms that met selection criteria for the meta-analysis of medication interventions in OTC settings. These three studies specifically examined the effect of patch versus placebo. The only additional treatments in these studies were a self-help manual, instructions contained in the package, or written directions for using the patch. As shown in Table 6.30, the use of the nicotine patch in OTC settings nearly doubles abstinence rates when compared to a placebo. These results are consistent with a more recent (2003) meta-analysis of active versus placebo patch in an OTC setting that found an odds ratio of 2.5 (95% C.I. = 1.8–3.6) for active nicotine patch.[359] A study that did not meet inclusion criteria for meta-analysis reported low abstinence rates when the nicotine patch was used in the OTC setting.[360] Too few studies were done in the OTC setting to permit meta-analysis of the OTC effect of any other medication. The "B" strength of evidence rating reflects the Panel's concern about the external validity of the studies designed to reflect the OTC context.

The FDA has approved nicotine gum, the nicotine lozenge, and the nicotine patch for OTC use. The patches and gum are identical to those previously available only via prescription. Although the OTC status of these medications has increased their availability and use,[361] this does not reduce the clinician's responsibility to intervene with smokers or insurers/managed care organizations/payers to cover the costs of such treatment. Moreover, OTC availability may enhance the capacity of a broad array of clinicians to intervene comprehensively when treating tobacco dependence.

All clinicians have specific responsibilities regarding these products, such as encouraging their use when appropriate, identifying patients with specific contraindications, providing counseling and followup, encouraging total abstinence during a quit attempt, offering instruction on appropriate use, addressing common patient misconceptions, and providing prescriptions

when needed for select populations to ensure reimbursement (e.g., Medicaid patients). Additionally, patients should be urged to read the package insert and consult with their pharmacist. Finally, the clinician should advise patients regarding the selection and use of medications, whether purchased OTC or by prescription. Debate has arisen in the field regarding the effectiveness of OTC NRT use. For instance, a population-based study found no long-term effects of OTC nicotine patch use.[34] However, cross-sectional surveys have methodolgical constraints (e.g., patients may self-select certain treatments based on dependence or perceived difficulty of quitting).[362]

Table 6.30. Meta-analysis (2000): Effectiveness of and estimated abstinence rates for OTC nicotine patch therapy (n = 3 studies)[a]

OTC therapy	Number of arms	Odds Ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Placebo	3	1.0	6.7
OTC nicotine patch therapy	3	1.8 (1.2–2.8)	11.8 (7.5–16.0)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Future Research

Important topics for future research are:

- Effectiveness of nicotine patch, gum, and lozenge when access is OTC
- Extent to which individuals use medications appropriately when access is OTC
- Extent to which the effectiveness of OTC medication is enhanced by other treatments (e.g., pharmacist counseling, telephone counseling, computer self-help resources, clinician interventions)
- Extent to which OTC status increases or reduces the use of medications by poor or minority populations
- Strategies for improving the accessibility and appropriate use of OTC medications

C. Systems Evidence

Clinician Training and Reminder Systems

Recommendation: All clinicians and clinicians-in-training should be trained in effective strategies to assist tobacco users willing to make a quit attempt and to motivate those unwilling to quit. Training appears to be more effective when coupled with systems changes. (Strength of Evidence = B)

Meta-analyses were conducted to analyze the effects of clinician training and other systems changes. It was necessary to include studies in these analyses in which higher level units (clinicians or clinical sites) served as units of randomization. This strategy was adopted because relatively few studies in this area of research randomized individual patients to treatment or intervention conditions. Studies randomized at higher level units were considered for the analyses only if the study's analytic plan accounted for the dependency of data nested under such units or if the outcome, such as providing advice to quit, was analyzed at the same level as the randomization (e.g., clinician or clinic level). In fact, however, the few studies that analyzed data at the level of the clinician or clinic shared no common outcomes and could not be used in the meta-analysis.

Table 6.31 depicts meta-analytic results for studies that examined the effects of training on abstinence outcomes. Only two studies, somewhat heterogenous, were available for this analysis. Thus, although the meta-analysis showed a significant effect of training, the Panel elected to assign this recommendation a "B" strength of evidence.

Table 6.31. Meta-analysis (2008): Effectiveness of and estimated abstinence rates for clinician training (n = 2 studies)[a]

Intervention	Number of arms	Odds Ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
No intervention	2	1.0	6.4
Clinician training	2	2.0 (1.2–3.4)	12.0 (7.6–18.6)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Clinician training and other systems changes are intended to increase rates of tobacco use assessment and intervention. Therefore, additional meta-analyses were conducted to ascertain the effects of systems changes on

outcomes such as clinician assessment of smoking status ("Ask"), provision of treatment ("Assist"), and arranging for treatment followup ("Arrange"). Thus, these meta-analyses focused on systems change impact on specific clinician behaviors. In the analyzed studies, clinician behavior was assessed via patient report or chart review (not via clinician report). Analyses of such clinician behaviors are of public health significance because of evidence that the provision of treatment has been shown to lead to higher tobacco cessation rates.

As noted in Table 6.32, training clinicians increases the percentage of smokers who receive treatment, such as a discussion of benefits/obstacles to quitting or strategies to prevent relapse, medication, and provision of support. Further, combining clinician training with a charting system, such as chart reminder stickers or treatment algorithms attached to the chart, increases rates of tobacco use assessment (Table 6.33), setting a quit date (Table 6.34), providing materials (Table 6.35), and arranging for followup (Table 6.36). Thus, clinician training, especially when coupled with other systems changes such as reminder systems, increases the rates at which clinicians engage in tobacco interventions that reliably boost tobacco cessation. The *Guide to Community Preventive Services*[92] found insufficient evidence to recommend provider education systems as stand-alone interventions, separate from other system changes, but does recommend provider education when part of other system changes such as reminder systems.

Table 6.32. Meta-analysis (2008): Effectiveness of clinician training on rates of providing treatment ("Assist") (n = 2 studies)[a]

Intervention	Number of arms	Odds Ratio (95% C.I.)	Estimated rate (95% C.I.)
No intervention	2	1.0	36.2
Clinician training	2	3.2 (2.0–5.2)	64.7 (53.1–74.8)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.33. Meta-analysis (2008): Effectiveness of clinician training combined with charting on asking about smoking status ("Ask") (n = 3 studies)[a]

Intervention	Number of arms	Odds Ratio (95% C.I.)	Estimated rate (95% C.I.)
No intervention	3	1.0	58.8
Training and charting	3	2.1 (1.9–2.4)	75.2 (72.7–77.6)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.34. Meta-analysis (2008): Effectiveness of training combined with charting on setting a quit date ("Assist") (n = 2 studies)[a]

Intervention	Number of arms	Odds Ratio (95% C.I.)	Estimated rate (95% C.I.)
No intervention	2	1.0	11.4
Training and charting	2	5.5 (4.1–7.4)	41.4 (34.4–48.8)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.35. Meta-analysis (2008): Effectiveness of training combined with charting on providing materials ("Assist") (n = 2 studies)[a]

Intervention	Number of arms	Odds Ratio (95% C.I.)	Estimated rate (95% C.I.)
No intervention	2	1.0	8.7
Training and charting	2	4.2 (3.4–5.3)	28.6 (24.3–33.4)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.36. Meta-analysis (2008): Effectiveness of training combined with charting on arranging for followup ("Arrange") (n = 2 studies)[a]

Intervention	Number of arms	Odds Ratio (95% C.I.)	Estimated rate (95% C.I.)
No intervention	2	1.0	6.7
Training and charting	2	2.7 (1.9–3.9)	16.3 (11.8– 22.1)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

These meta-analyses support the finding that clinician training increases the delivery of effective tobacco use treatments. Training elements provided in these interventions included didactic presentation of material, group discussions, and role playing. These studies also examined a range of clinician training, from formal training during residency to onsite clinician training within the community.

Training should be directed at both clinicians-in-training as well as practicing clinicians. Training should be reinforced throughout the clinicians' education and practice.[363-368] Such training has been shown to be cost-effective.[369] For clinicians-in-training, most clinical disciplines currently neither

provide training nor require competency in tobacco use interventions,[370] although this is improving slowly.[371,372] One survey of U.S. medical schools found that most medical schools (69%) did not require clinical training in tobacco dependence treatment.[373] The National Cancer Institute's Prevention and Cessation Education in Medical Schools (PACE) reported that, in 2004, about 36 percent of medical school courses offered about 10 hours of tobacco-related teaching over 4 years,[374] and PACE has developed competencies for graduating medical students.[375]

Similarly, the American Dental Education Association has guidelines recommending tobacco use cessation clinical activities (TUCCA) education for dental and dental hygiene students and, in 1998, 51 percent of dental schools reported clinical training in this area.[376] Tobacco-related curricula may be taught as part of a preventive medicine or substance abuse course or as a class by itself. Similar recommendations would be relevant to virtually all other clinical disciplines. Training in tobacco use interventions should not only transmit essential treatment skills (see Chapter 3), but also should inculcate the belief that tobacco dependence treatment is a standard of good clinical practice.[130,208,250]

Several factors would promote the training of clinicians in tobacco intervention activities:[370]

- Inclusion of education and training in tobacco dependence treatments in the required curricula of all clinical disciplines
- Evaluation of effective tobacco dependence treatment knowledge and skills in licensing and certification exams for all clinical disciplines
- Adoption by medical specialty societies of a uniform standard of competence in tobacco dependence treatment for all members

Finally, clinicians who currently use any tobacco product should participate in treatment programs to stop their own tobacco use permanently. Clinicians are important role models for their patients, and those who use tobacco probably are less likely to counsel their patients to quit.[377] Therefore, it is heartening that many types of clinicians have dramatically decreased their own tobacco use during the past 40 years,[378] although this has not been universal.

Future Research

The following topics regarding clinician training require additional research:

- Effectiveness of training programs for other health disciplines, such as nursing, psychology, dentistry (including hygienists), social work, and pharmacy
- Effective elements in successful training programs (e.g., continuing medical education, interactive components)
- Combined effect of multiple systems changes, such as clinician training, reminder systems, clinician feedback, incentive payments, and recruitment of opinion leaders

Cost-Effectiveness of Tobacco Dependence Interventions

Recommendation: The tobacco dependence treatments shown to be effective in this Guideline (both counseling and medication) are highly cost-effective relative to other reimbursed treatments and should be provided to all smokers. (Strength of Evidence = A)

Recommendation: Sufficient resources should be allocated for systems support to ensure the delivery of efficacious tobacco use treatments. (Strength of Evidence = C)

Smoking exacts a substantial financial burden on the United States. A recent report of the Centers for Disease Control and Prevention estimated that tobacco dependence costs the Nation more than $96 billion per year in direct medical expenses and $97 billion in lost productivity.[28] Given these substantial costs, research has focused on the economic impact and cost-effectiveness of tobacco cessation interventions.

Tobacco use treatments, ranging from brief clinician advice to specialist-delivered intensive programs, including medication, have been shown not only to be clinically effective, but also to be extremely cost-effective relative to other commonly used disease prevention interventions and

medical treatments. Cost-effectiveness analyses have shown that tobacco dependence treatment compares favorably with routinely reimbursed medical interventions such as the treatment of hypertension and hypercholesterolemia, as well as preventive screening interventions such as periodic mammography or Papanicolaou smears.[222,224,379-382] For example, the cost per life-year saved of tobacco dependence treatment has been estimated at $3,539,[194] which compares favorably to hypertension screening for men ages 45 to 54 ($5,200) and annual cervical screening for women ages 34 to 39 ($4,100).[383] Treating tobacco dependence also is important economically in that it can prevent the development of a variety of costly chronic diseases, including heart disease, cancer, and pulmonary disease. In fact, tobacco dependence treatment has been referred to as the "gold standard" of health care cost-effectiveness.[225]

Cost-effectiveness can be measured in a variety of ways, including cost per quality-adjusted-life-year saved (QALY), cost per quit, health care costs and utilization pre- and postquit, and return on investment (ROI) for coverage of tobacco dependence treatment.

Cost per Quality-Adjusted-Life-Year Saved and Cost per Quit

Numerous analyses have estimated the cost per QALY saved resulting from use of effective tobacco dependence interventions.[187,222,380,384-389] In general, evidence-based tobacco use interventions compare favorably with other prevention and chronic disease interventions such as treatment of hypertension and mammography screening when using this criterion. Specific analyses have estimated the costs of tobacco use treatment to range from a few hundred to a few thousand dollars per QALY saved.[228,385] Separate analyses have computed the estimated costs of treatment in terms of the cost per quit. Compared to other interventions, the cost of tobacco use treatments has been modest, ranging from a few hundred to a few thousand dollars per quit.[194,212,384,390-393]

Managed Care Organizations (MCOs) often assess the per member per month (PMPM) cost of a benefit, and the PMPM cost for tobacco use treatment has been assessed in a variety of settings. In general, the PMPM cost for tobacco use treatments has been low relative to other covered benefits, ranging from about $0.20 to about $0.80 PMPM.[210,228,391,394]

Health Care Costs and Utilization Pre- and Postquit

A substantial body of research has investigated the effect of tobacco use treatment on health care costs.[395-399] A synthesis of these findings suggests that: (1) among individuals who quit tobacco use, health care costs typically increase during the year in which smokers quit then decline progressively, falling below those of continuing smokers for 1 to 10 years after quitting; (2) in general, smokers' health care costs begin to rise in the time period immediately prior to quit attempts; and (3) higher health care utilization predicts smoking cessation among smokers with and without chronic diseases. These findings suggest that quitting smoking often occurs in response to serious and expensive health problems. Such research also suggests that increases in health care costs, including hospitalizations, during the year of quitting may be a cause rather than a consequence of successful smoking cessation.

Return on Investment for Coverage of Tobacco Dependence Treatment

The ROI tool is used frequently to estimate the amount of time it takes for an expenditure to earn back some or all of its initial investment. The economic arguments supporting the decision to provide insurance coverage for tobacco use treatments would be enhanced if the costs of such coverage are modest compared to economic benefits resulting from successful cessation (reductions in health care expenditures, increased productivity, and/or other costs).

Studies have documented that tobacco dependence treatments provide a timely return on investment when considered by the employer. Such analyses have concluded that providing coverage for tobacco use treatment for employees often produces substantial net financial savings through increased health care savings, increased productivity, reduced absenteeism, and reduced life insurance payouts.[229,400-402]

Financial savings are more difficult to attain for a health plan given factors such as member turnover, the difficulty of attributing reduced health care expenditures to tobacco dependence, and the absence of economic benefits resulting from productivity gains. Although most analyses have

not demonstrated cost savings, insurance coverage of evidence-based tobacco dependence treatments are highly cost-effective relative to other frequently paid-for health care services. One recent effort to simulate the financial implications of covering tobacco use treatments by MCOs found that at 5 years, coverage of tobacco use treatment cost an MCO a modest $0.61 PMPM, with quitters gaining an average of 7.1 years of life and a direct coverage cost of about $3,500 for each life-year saved.[228] The authors concluded that coverage of such cost-effective tobacco use treatment programs by MCOs should be strongly encouraged. Another study examined the trend in health care costs for former smokers over 7 years postquitting compared to continuing smokers.[395] The authors found that, by the seventh year, former smokers' cumulative costs (including increased cost in the year they quit) were lower than those of continuing smokers. A more recent analysis concluded that at 10 years, the ROI of providing a comprehensive tobacco use treatment benefit, considering only health care costs, ranged from 75 percent to 92 percent, indicating that health care savings alone have repaid more than three-fourths of the investment.[229] Other analyses have shown that multiple tobacco use treatment components, including telephone counseling and various medications,[227,403,404] yield a favorable ROI. The American Health Insurance Plans (AHIP) has provided a Web link for health plans to compute their ROI for the provision of tobacco use treatment: *www.businesscaseroi.org/roi/default.aspx*.

Tobacco cessation treatment is particularly cost-effective in certain populations, such as hospitalized patients and pregnant women. For hospitalized patients, successful tobacco abstinence not only reduces general medical costs in the short term, but also reduces the number of future hospitalizations.[9,355,405] Tobacco dependence interventions for pregnant women are especially cost-effective because they result in fewer low birth-weight babies and perinatal deaths; fewer physical, cognitive, and behavioral problems during infancy and childhood; and yield important health benefits for the mother.[406,407] One study found that interventions with U.S. pregnant smokers could net savings up to $8 million in direct neonatal inpatient costs given the cost of an intervention ($24–$34) versus the costs saved ($881) for each woman who quits smoking during pregnancy.[408] Another study showed that, for each low-income pregnant smoker who quit, Medicaid saved $1,274.[409] A simulation study found that a 1 percent decrease in smoking prevalence among U.S. pregnant women would save $21 million (1995 dollars) in direct medical costs in the first year.[406,410,411]

Tobacco Dependence Treatment as a Part of Assessing Health Care Quality

Recommendation: Provision of Guideline-based interventions to treat tobacco use and dependence should remain in standard ratings and measures of overall health care quality (e.g., NCQA HEDIS). These standard measures should also include measures of outcomes (e.g., use of cessation treatment, short- and long-term abstinence rates) that result from providing tobacco dependence interventions. (Strength of Evidence = C)

The provision of tobacco dependence treatment should be increased by: (1) attention to health organization "report cards" (e.g., HEDIS, The Joint Commission, Physician Consortium for Performance Improvement, National Quality Forum, Ambulatory Quality Alliance),[89,412-414] which support smoker identification and treatment; (2) accreditation criteria used by The Joint Commission and other accrediting bodies that include the presence of effective tobacco assessment and intervention policies; and (3) increasing the use of tobacco-related measures in pay-for-performance initiatives.

Future Research

The following topics regarding cost-effectiveness and health systems require additional research:

- Cost-effectiveness of the various tobacco dependence treatments, both short- and long-term
- Optimal ways to remove systemic barriers that prevent clinicians from effectively delivering tobacco dependence treatments
- Systemic interventions to encourage provider and patient utilization of effective tobacco dependence treatments
- Relative costs and economic impacts of different formats of effective treatments (e.g., proactive telephone counseling, face-to-face contact, medication)

- Impact of using tobacco intervention performance measures on clinician intervention and patient outcomes, including the use of such measures in "pay for performance" programs

Providing Treatment for Tobacco Use and Dependence as a Covered Benefit

Recommendation: Providing tobacco dependence treatments (both medication and counseling) as a paid or covered benefit by health insurance plans has been shown to increase the proportion of smokers who use cessation treatment, attempt to quit, and successfully quit. Therefore, treatments shown to be effective in the Guideline should be included as covered services in public and private health benefit plans. (Strength of Evidence = A)

Multiple studies have assessed the impact of including tobacco dependence treatment as a covered health insurance benefit for smokers. Most studies have documented that such health insurance coverage increases both treatment utilization rates and the rates of cessation,[210,212,391,415] although some research is not consistent with these findings.[416] A recent Cochrane analysis (2005) concluded that health care financing systems that offered full payment for tobacco use treatment increased self-reported prolonged abstinence rates at relatively low costs when compared with a partial benefit or no benefit. Moreover, the presence of prepaid or discounted prescription drug benefits increases patients' receipt of medication and smoking abstinence rates.[231,348,417] These studies emphasize that removing all cost barriers yields the highest rates of treatment utilization.

Three studies met criteria to be included in a 2008 Guideline update meta-analysis of the effects of providing tobacco use treatments as a covered health insurance benefit. Three different outcomes were examined: rates of treatment provision, quit attempts, and quit rates. As can be seen in Tables 6.37 through 6.39, compared to not having tobacco use treatment as a covered benefit, individuals with the benefit were more likely to receive treatment, make a quit attempt, and abstain from smoking.

Table 6.37. Meta-analysis (2008): Estimated rates of intervention for individuals who received tobacco use interventions as a covered health insurance benefit (n = 3 studies)[a]

Treatment	Number of arms	Estimated odds ratio (95% C.I.)	Estimated intervention rate (95% C.I.)
Individuals with no covered health insurance benefit	3	1.0	8.9
Individuals with the benefit	3	2.3 (1.8–2.9)	18.2 (14.8–22.3)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.38. Meta-analysis (2008): Estimated rates of quit attempts for individuals who received tobacco use interventions as a covered health insurance benefit (n = 3 studies)[a]

Treatment	Number of arms	Estimated odds ratio (95% C.I.)	Estimated quit attempt rate (95% C.I.)
Individuals with no covered benefit	3	1.0	30.5
Individuals with the benefit	3	1.3 (1.01–1.5)	36.2 (32.3–40.2)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Table 6.39. Meta-analysis (2008): Estimated abstinence rates for individuals who received tobacco use interventions as a covered benefit (n = 3 studies)[a]

Treatment	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Individuals with no covered benefit	3	1.0	6.7
Individuals with the benefit	3	1.6 (1.2–2.2)	10.5 (8.1–13.5)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

It may be in the best interests of insurance companies, MCOs, purchasers, and governmental bodies within a specific geographic area to work collaboratively to ensure that tobacco dependence interventions are a covered benefit and that enrollees are aware of these benefits. This would allow the financial benefits of the successful use of these services to be realized by all of the health plans within a community.

Future Research

- Impact of promotion or communication of tobacco dependence treatment benefits on utilization and resulting population health and economic effects
- Cost-effectiveness of specific elements of tobacco dependence treatment
- Appropriate level of payment needed to optimize clinician delivery of tobacco dependence treatment

Chapter 7 Specific Populations and Other Topics

Background

Many factors could affect the acceptability, use, and effectiveness of tobacco dependence treatments. This raises the question of whether interventions should be tailored or modified on the basis of personal characteristics or contextual factors such as gender, race/ethnicity, age, comorbidity, or hospitalization status. Should pregnant smokers receive tobacco dependence medication? Do tobacco dependence interventions interfere with nontobacco chemical dependency treatments? These and other specific populations and issues are considered in this chapter. The answers to these questions are relevant to a range of clinicians who routinely deal with specific populations of smokers (e.g., obstetricians, gynecologists, pediatricians, psychiatrists, internists, cardiologists, nurses, pharmacists, dentists, and dental hygienists).

Recommendation: The interventions found to be effective in this Guideline have been shown to be effective in a variety of populations. In addition, many of the studies supporting these interventions comprised diverse samples of tobacco users. Therefore, interventions identified as effective in this Guideline are recommended for all individuals who use tobacco, except when medication use is contraindicated or with specific populations in which medication has not been shown to be effective (pregnant women, smokeless tobacco users, light smokers, and adolescents). (Strength of Evidence = B)

Effective Treatments for Specific Populations

The above recommendation applies to the broad population of smokers, including HIV-positive smokers; hospitalized smokers; lesbian/gay/bisexual/transgender smokers; those with low socioeconomic status (SES)/limited formal education; smokers with medical comorbidities; older smokers; smokers with psychiatric disorders, including substance use disorders; racial and ethnic minorities; and women smokers. It does not apply to adolescents, pregnant smokers, light smokers, and smokeless tobacco users (see below).

The recommendation that tobacco dependence treatments be used with broad populations of tobacco users arises from several considerations. One is that many of the randomized trials that generated the treatment recommendations comprised diverse samples. A second consideration is that the studies that tested interventions in homogeneous, specific populations show that interventions that are effective in one population tend to be effective in other populations. Finally, the relative safety of the tobacco dependence treatments versus the hazards of continued tobacco use supports some extrapolation from extant data. Table 7.1 reviews the randomized clinical trial (RCT) evidence of effectiveness of various treatments in different populations. Unless specifically stated, this table presents evidence from individual, screened RCTs rather than from meta-analyses. It is not intended to provide a comprehensive review of the relevant literature, but rather to provide some key findings from that review. Importantly, adolescents, pregnant smokers, light smokers, and smokeless tobacco users each have their own sections of this Guideline update, given that they usually are excluded from the RCTs used to evaluate the effectiveness of interventions presented in this Guideline and may have other special issues (e.g., safety).

Table 7.1. Evidence of effectiveness of tobacco dependence interventions in specific populations

Population of Smokers	Review of Evidence
HIV-positive	No long-term RCTs have examined the effectiveness of interventions in this population. More research is needed. • One study with 3-month followup indicated that telephone counseling is promising.[418] • Pilot data indicate that effective treatments work with this population.[419]
Hospitalized patients	2007 Cochrane analyses[420] revealed that intensive intervention (inpatient contact plus followup for at least 1 month) was associated with a significantly higher quit rate compared to control conditions (OR = 1.65; 95% CI = 1.44–1.90, 17 trials). Specific additional Cochrane findings: • Posthospitalization followup appears to be a key component of effective interventions. • No significant effect of medication was seen in this population. However, the effect sizes were comparable to those obtained in other clinical trials, suggesting that nicotine replacement therapy (NRT) and bupropion SR may be effective in this population.

Table 7.1. Evidence of effectiveness of tobacco dependence interventions in specific populations (continued)

Population of Smokers	Review of Evidence
Hospitalized patients (continued)	• Intervention is effective regardless of the patient's reason for admission. There was no strong evidence that clinical diagnosis of the medically comorbid condition affected the likelihood of quitting. Interventions that have been shown to be effective in individual studies are: counseling and medication[57,355,421-423] and other psychosocial interventions, including self-help via brochure or audio/videotape; chart prompt reminding physician to advise smoking cessation; hospital counseling; and postdischarge counseling telephone calls.[424,425] Some data suggest NRT might not be appropriate in intensive care patients.[358]
Lesbian, gay, bisexual, transgender	No long-term RCTs have examined the effectiveness of interventions specifically in this population.
Low SES/ limited formal education[a]	• Meta-analysis (2008): 5 studies met selection criteria and contributed to a 2008 Guideline meta-analysis comparing counseling vs. usual care or no counseling among individuals with low SES/limited formal education. Meta-analytic results showed that counseling is effective in treating smokers with low SES/limited formal education (OR = 1.42; 95% C.I. = 1.04–1.92) (Abstinence rate without counseling = 13.2%; with counseling, abstinence rate = 17.7% [95% C.I. = 13.7%–22.6%]) • Interventions included in the meta-analysis were motivational messages with and without telephone counseling for low-income mothers and low-income African Americans,[172,426] proactive telephone counseling in addition to nicotine patches,[427,428] tailored bedside counseling and followup for hospitalized African-American patients.[429]
Medical comorbidities	Tobacco use treatments have been shown to be effective among smokers with a variety of comorbid medical conditions. The comorbid conditions and effective interventions include: • Cardiovascular disease: psychosocial interventions;[430-439] exercise;[440,441] bupropion SR,[439,442] but one study did not find significant long-term effects;[443] nicotine patch, gum, or inhaler.[439] • Lung/COPD patients: intensive cessation counseling,[444] intensive behavioral (relapse prevention) program combined with nicotine replacement therapy,[445] bupropion SR,[446,447] nortriptyline,[447] nicotine patch or inhaler.[448] • Cancer: counseling and medication,[251,449,450] motivational counseling.[451]

Table 7.1. Evidence of effectiveness of tobacco dependence interventions in specific populations (continued)

Population of Smokers	Review of Evidence
Older smokers	• Research has demonstrated the effectiveness of the "4 A's" (ask, advise, assist, and arrange followup) in patients ages 50 and older.[452-454] Counseling interventions,[455-457] physician advice,[118,456] buddy support programs,[458] age-tailored self-help materials,[456,459-461] telephone counseling,[460,461] and the nicotine patch[454,462,463] all have been shown to be effective in treating tobacco use in adults 50 and older.
Psychiatric disorders, including substance use disorders[a]	• Meta-analysis (2008): Four studies met selection criteria and were relevant to a 2008 Guideline meta-analysis comparing antidepressants (bupropion SR and nortriptyline) vs. placebo for individuals with a past history of depression. Meta-analytic results showed that antidepressants, specifically bupropion SR and nortriptyline, are effective in increasing long-term cessation rates in smokers with a past history of depression (OR = 3.42; 95% C.I. = 1.70–6.84; abstinence rates = 29.9%, 95% C.I. = 17.5%–46.1%). Note that these studies typically included intensive psychosocial interventions for all participants. • Although psychiatric disorders may place smokers at increased risk for relapse, such smokers can be helped by tobacco dependence treatments.[464-468] • Some data suggest that bupropion SR and NRT may be effective for treating smoking in individuals with schizophrenia and may improve negative symptoms of schizophrenia and depressive symptoms.[467,469-472] Data suggest that individuals on atypical antipsychotics may be more responsive to bupropion SR for treatment of tobacco dependence than those taking standard antipsychotics.[472] • Current evidence is insufficient to determine whether smokers with psychiatric disorders benefit more from tobacco use treatments tailored to psychiatric disorder/symptoms than from standard treatments.[266,473] • Evidence indicates that tobacco use interventions, both counseling and medication, are effective in treating smokers who are receiving treatment for chemical dependency.[464,474-476] • There is little evidence that tobacco dependence interventions interfere with recovery from nontobacco chemical dependencies among patients who are in treatment for such dependencies.[475,477-482] One study suggests that delivery of smoking cessation interventions concurrent with alcohol dependence interventions may compromise alcohol abstinence outcomes, although there was no difference in smoking abstinence rates.[483]

Table 7.1. Evidence of effectiveness of tobacco dependence interventions in specific populations (continued)

Population of Smokers	Review of Evidence
Psychiatric disorders, including substance use disorders[a] (continued)	• The use of varenicline has been associated with depressed mood, agitation, suicidal ideation, and suicide. The FDA recommends that patients tell their health care provider about any history of psychiatric illness prior to starting varenicline and that clinicians monitor for changes in mood and behavior when prescribing this medication. In light of these FDA recommendations, clinicians should consider eliciting information on their patients' psychiatric history. For more information, see the FDA package insert.
Racial/ethnic minorities	RCTs have examined the effectiveness of interventions in specific racial/ethnic minority populations: African Americans • Bupropion SR,[484] in-person motivational counseling,[176] nicotine patch,[485] clinician advice,[486,487] counseling,[488] biomedical feedback,[489] tailored self-help manuals and materials, and telephone counseling[486,490] have been shown to be effective with African-American smokers. Asian and Pacific Islanders • No long-term RCTs have examined the effectiveness of interventions specifically in this population. Hispanics • Nicotine patch;[491] telephone counseling;[492] self-help materials, including a mood management component;[493] and tailoring[494] have been shown to be effective with Hispanic smokers. American Indians and Alaska Natives • Screening for tobacco use, clinician advice, clinic staff reinforcement, and followup materials have been shown to be effective for American Indian and Alaska Native populations.[495]
Women	• Evidence shows that both men and women benefit from bupropion SR, NRT, and varenicline;[496] evidence is mixed as to whether women show as great a benefit from NRT as do men.[150,155-157,496-498] • Psychosocial interventions, including proactive phone counseling[462] individually tailored followup,[499] and advice to quit geared toward children's health[500] are effective with women. There is some evidence that exercise is effective for women;[501] however, these findings are not consistent.[502]

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Clinical Issues for Specific Populations

There are population-specific concerns and clinical issues regarding prevalence and treatment of tobacco dependence (see Table 7.2).

Table 7.2. Clinical issues for treating specific populations

Issue	Approach
Language	• Ensure that interventions are provided in a language the patient understands. Most quitlines provide counseling in Spanish, and some provide counseling in other languages.[503] • All textual materials used (e.g., self-help brochures) should be written at an appropriate reading level. This is particularly important given epidemiological data showing that tobacco use rates are markedly higher among individuals of lower educational attainment.[504,505]
Culture	• Interventions should be culturally appropriate to be relevant and acceptable to the patient.[506] The extent to which cultural tailoring enhances intervention effectiveness requires further research.[490] • Clinicians should remain sensitive to individual differences and spiritual and health beliefs that may affect treatment acceptance, use, and success in all populations (see Chapter 6A, Specialized Assessment).
Medical comorbidity	• Examine the possibility of medication interactions (See Chapter 6B, Interactions of First-Line Tobacco Use Medications With Other Drugs).[308] • Address how exposure to tobacco can alter the liver's ability to metabolize different medications (HIV-positive patients).

HIV-Positive Smokers

HIV-positive individuals are more likely to smoke than the general population.[507-510] Currently, HIV-positive individuals are living longer, due to treatment advances, making the issue of cigarette smoking in this population a significant clinical concern.[511,512] HIV-positive smokers have higher mortality rates and report lower quality of life than HIV-positive nonsmokers.[513,516] In addition, HIV-positive smokers appear to be at greater risk for developing invasive pneumococcal diseases and CNS infections compared with non-HIV infected individuals.[514,517] Also, compared to nonsmoking HIV-positive individuals, smoking among HIV-positive persons is associated with increased risk of several opportunistic infections[518-520] and spontaneous pneumothorax.[521] Data suggest that HIV-positive smokers underestimate the effects of smoking on their health, and some state that

they will not live long enough for the health effects of smoking to matter.[507,522] In addition, some HIV-positive smokers report that smoking is an effective way to cope with the stress of their illness.[522]

Future Research

The following topics regarding HIV-positive smokers require additional research:

- Effectiveness of medications and counseling/behavioral interventions, including tailored interventions
- Effectiveness of motivational interviewing and educational approaches in increasing motivation to quit
- Effectiveness of community and social support networks in bolstering quitting motivation and improving treatment outcomes

Hospitalized Smokers

It is vital that hospitalized patients attempt to quit using tobacco because tobacco use may interfere with their recovery and overall health. Among cardiac patients, second heart attacks are more common in those who continue to smoke.[9,523] Lung, head, and neck cancer patients who are successfully treated for their cancer but who continue to smoke are at elevated risk for a second cancer.[524-531] Additionally, smoking negatively affects COPD as well as bone and wound healing.[531-538]

Hospitalized patients may be particularly motivated to make a quit attempt for two reasons. First, the illness resulting in hospitalization may have been caused or exacerbated by tobacco use, highlighting the patient's perceived vulnerability to the health risks of smoking[539] and making the hospitalization a "teachable moment." Second, every hospital in the United States must now be smoke-free if it is to be accredited by The Joint Commission. As a result, every hospitalized smoker is temporarily housed in a smoke-free environment. In addition, more hospitals are adopting policies establishing tobacco-free campuses, thus extending smoke-free space from indoor facilities to surrounding outdoor environments.[540-542] For these reasons, clinicians should use hospitalization as an opportunity to promote smoking cessation.[11,543,544] This also is an opportunity for clinicians to

prescribe medications to alleviate withdrawal symptoms. If patients have positive experiences with the alleviation of their withdrawal symptoms, they may be more likely to use intensive treatments in a future quit attempt or maintain their hospital-enforced abstinence. Patients in long-term care facilities also should receive tobacco dependence interventions identified as effective in this Guideline. Suggested interventions for hospitalized patients can be found in Table 7.3.

Table 7.3. Suggested interventions for hospitalized patients

For every hospitalized patient, the following steps should be taken:

- Ask each patient on admission if he or she uses tobacco and document tobacco use status.
- For current tobacco users, list tobacco use status on the admission problem list and as a discharge diagnosis.
- Use counseling and medications to help all tobacco users maintain abstinence and to treat withdrawal symptoms.
- Provide advice and assistance on how to quit during hospitalization and remain abstinent after discharge.
- Arrange for followup regarding smoking status. Supportive contact should be provided for at least a month after discharge.

The importance of posthospitalization followup has been demonstrated by research.[355,545-546] However, there are systems-level issues that may complicate the ability of hospital-based clinicians to follow up with smoking patients. The development of fax-to-quit links with quitline services may be an effective and efficient way for hospitals to refer patients for smoking cessation followup.[195,199,547]

Future Research

The following topics regarding hospitalized patients require additional research:

- Effectiveness of interventions provided by different hospital personnel, including nurses and respiratory therapists
- Effectiveness of counseling and medications with hospitalized patients
- Relapse prevention once the patient leaves the hospital, including use of fax-to-quit programs

Lesbian/Gay/Bisexual/Transgender (LGBT) Smokers

LGBT individuals, both adolescents and adults, are more likely to smoke than the general population,[548-550] and tobacco marketing is targeted at these communities.[551-554] LGBT individuals are more likely to have other risk factors for smoking, including daily stress related to prejudice and stigma.[555-558]

Future Research

The following topics regarding LGBT smokers require additional research:

- Accessibility and acceptability of tobacco dependence interventions
- Rates of intervention use and effectiveness of both medications and counseling treatments, including quitlines
- Effectiveness of tailored interventions

Low SES/Limited Formal Education

Individuals with low SES and/or limited formal education, including the homeless, bear a disproportionate burden from tobacco.[559] Addressing this particular disparity is an important part of improving the overall health of the American public.[560] These patients are more likely to: smoke,[561,562] have limited access to effective treatment,[563,564] be misinformed about smoking cessation medications,[565] be exposed to more permissive environmental and workplace smoking policies,[562] and be targeted by tobacco companies.[566] They are less likely to receive cessation assistance.[564] Moreover, smokers with low SES/limited formal education are more likely to be uninsured or on Medicaid than are other smokers.[567] Only 25 percent of smokers on Medicaid reported receiving any practical assistance with quitting. However, low SES smokers or those with limited formal education express significant interest in quitting[404,507,508,568] and appear to benefit from treatment.[569,570] Due to the prevalence of smoking in this population, it is vital that clinicians intervene with such individuals. It is important that interventions, particularly written materials, be delivered in a manner that is understandable to the patient.

Future Research

The following topics regarding low SES/limited formal education smokers require additional research:

- Effectiveness of and compliance with medications shown to be effective with general populations of smokers
- Effectiveness and utilization of novel treatment delivery settings (e.g., pharmacy-based, community-based, worksite)
- Effectiveness of quitlines, including ability of this population to access services using this modality
- Strategies for addressing misconceptions about effective cessation treatment that may be more common in these populations
- Cost-effectiveness of cessation interventions delivered as part of chronic disease management programs

Medical Comorbid Conditions, Including Cancer, Cardiac Disease, COPD, Diabetes, and Asthma

Smokers with comorbid medical conditions such as cancer, cardiac disease, COPD, diabetes, and asthma are important to target for tobacco use treatments, given the role that smoking plays in exacerbating these conditions.[447,538,571-581] Clinicians treating smokers with these conditions have an ideal "teachable moment" in that they are treating a disease that may have been caused or exacerbated by smoking and that can be ameliorated by quitting[198,582-588] but not by cutting down. Using chronic disease management programs to integrate tobacco dependence interventions into treatment may be an effective and efficient way to deliver tobacco use interventions to these populations.

Future Research

The following topics regarding smokers with comorbid medical conditions require additional research:

- Effectiveness of counseling and cessation medications among individuals with diabetes and asthma

- Impact and effectiveness of specialized assessment and tailored interventions in these populations

Older Smokers

It is estimated that more than 18 million Americans age 45 and older smoke cigarettes, accounting for 41 percent of all adult smokers in the United States;[589] 4.5 million adults over age 65 smoke cigarettes.[590] Even smokers over the age of 65 can benefit greatly from abstinence.[9,405,523,591] Older smokers who quit can reduce their risk of death from coronary heart disease, COPD, and lung cancer and decrease their risk of osteoporosis.[544,592,593] Moreover, abstinence can promote more rapid recovery from illnesses that are exacerbated by smoking and can improve cerebral circulation.[453,594,595] In fact, age does not appear to diminish the desire to quit[596] or the benefits of quitting smoking,[166,597] and treatments shown to be effective in this Guideline have been shown to be effective in older smokers (see Table 7.1). However, smokers over the age of 65 may be less likely to receive smoking cessation medications identified as effective in this Guideline.[598] Issues particular to this population (e.g., mobility, medications) make the use of proactive telephone counseling appear particularly promising. Importantly, Medicare has expanded benefits for tobacco cessation counseling and prescription medications (through Medicare Part D) for tobacco dependence treatment.[219]

Future Research

The following topics regarding older smokers require additional research:

- Effectiveness of tailored as well as general counseling interventions for older smokers in promoting tobacco abstinence
- Effectiveness and side effects of medications
- Effective methods to motivate older smokers to make a quit attempt

Psychiatric Disorders, Including Substance Use Disorders

Psychiatric disorders are more common among smokers than in the general population. For instance, as many as 30 to 60 percent of patients seeking

tobacco dependence treatment may have a past history of depression,[599,600] and 20 percent or more may have a past history of alcohol abuse or dependence.[601-603] Smoking occurs at rates well above the population average among abusers of alcohol and drugs (i.e., greater than 70 percent),[604-607] and one study found that these individuals have increased mortality from tobacco-related diseases.[608] These individuals may present themselves less frequently for tobacco dependence treatment. However, such treatments could be conveniently delivered within the context of chemical dependence or mental health clinics.[609]

As noted in the Specialized Assessment section in Chapter 6A, smokers currently experiencing a psychiatric disorder are at heightened risk for relapse to smoking after a cessation attempt.[246,466,610-613]

All smokers with psychiatric disorders, including substance use disorders, should be offered tobacco dependence treatment, and clinicians must overcome their reluctance to treat this population.[614] However, the clinician may wish to offer the tobacco dependence treatment when psychiatric symptoms are not severe. Although patients in inpatient psychiatric units are able to stop smoking with few adverse effects (e.g., little increase in aggression),[615-617] stopping smoking or nicotine withdrawal may exacerbate a patient's comorbid condition. For instance, stopping smoking may elicit or exacerbate depression among patients with a prior history of affective disorder.[325,618,619] One study suggests that alcohol treatment should precede tobacco dependence treatment to maximize the effect of the alcohol treatment.[483] Considerable research, however, also indicates that tobacco dependence treatment does not interfere with patients' recovery from the abuse of other substances.[474,475,477,480-482,620] Treating tobacco dependence in individuals with psychiatric disorders is made more complex by the potential for multiple psychiatric diagnoses and multiple psychiatric medications. Stopping tobacco use may affect the pharmacokinetics of certain psychiatric medications.[308,621] Therefore, clinicians should closely monitor the level or effects of psychiatric medications in smokers making a quit attempt.[75]

Future Research

The following topics regarding psychiatric disorders, including substance use disorders, require additional research:

- Relative effectiveness and reach of different tobacco dependence medications and counseling strategies in patients with psychiatric comorbidity, including depression
- Effectiveness and impact of tobacco dependence treatments within the context of nontobacco chemical dependency treatments
- Importance and effectiveness of specialized assessment and tailored interventions in these populations
- Impact of stopping tobacco use on psychiatric disorders and their management

Racial and Ethnic Minority Populations

Some racial and ethnic minority populations in the United States—African Americans, American Indians and Alaska Natives, Asians and Pacific Islanders, Hispanics—experience higher mortality in a number of disease categories compared with others. For example, African Americans experience substantial excess mortality from cancer, cardiovascular disease, and infant death, all of which are directly affected by tobacco use.[622-626] Moreover, they experience greater exposure to tobacco advertising.[627-629] American Indian and Alaska Natives have some of the highest documented rates of infant mortality caused by SIDS,[630,631] which also is affected by tobacco use and exposure to secondhand smoke. Therefore, the need to deliver effective tobacco dependence interventions to ethnic and racial minority smokers is critical. Unfortunately, evidence indicates that large proportions of some racial/ethnic groups lack adequate access to primary care providers and are more likely to have low SES.[632,633] These populations may be less aware of Medicaid or other available benefits[564,633-635] and more likely to harbor misconceptions about tobacco dependence treatments.[636-639] Finally, these populations may be less likely to receive advice to stop smoking[640,641] or use tobacco dependence treatment[635,637,642] than are other individuals. This suggests that special efforts and resources should be provided to meet the treatment needs of these underserved populations.[4,643]

The differences between racial and ethnic minorities and whites in smoking prevalence, smoking patterns, pharmacokinetics of nicotine, and quitting behavior in the United States are well documented.[587,642,644-656] In addition, smoking prevalence and patterns vary substantially across and

within minority subgroups (e.g., gender, level of acculturation, tribal communities).[636,657-663] Racial and ethnic minority groups also differ from whites in awareness of the health effects of smoking[636,664-667] and awareness of the benefits of proven treatments, and some racial and ethnic minority populations report a greater sense of fatalism that may affect disease prevention efforts.[637,660] On the other hand, both tobacco dependence and desire to quit appear to be prevalent across varied racial and ethnic groups.[642,667-671] In fact, smokers in several racial and ethnic groups attempt to quit as often as or more often than nonminority smokers, but use effective treatments less often and have lower success rates.[642,672]

Future Research

The following topics regarding racial and ethnic minorities require additional research:

- Effectiveness of specific tobacco dependence interventions, including medications and quitlines, in these populations (e.g., American Indian and Alaska Native smokers)
- Effectiveness of culturally adapted versus generic interventions for different racial and ethnic minority populations
- Identification and development of interventions to address the specific barriers or impediments to treatment delivery, use, or success (e.g., SES, inadequate access to medical care, treatment misconceptions, not viewing tobacco use as problematic)
- Identification of motivators of cessation that are especially effective with members of racial and ethnic minority populations (e.g., fear of illness requiring long-term care and disability)

Women

Data suggest that women are more likely to seek assistance in their quit attempts than are men.[673] Research suggests that women benefit from the same interventions as do men, although the data are mixed on whether they benefit as much as men.[156,157] Women may face different stressors and barriers to quitting that may be addressed in treatment. These include greater likelihood of depression, greater weight control concerns, hormon-

al cycles, greater nonpharmacologic motives for smoking (e.g., for socialization), educational differences, and others.[248] This suggests that women may benefit from tobacco dependence treatments that address these issues, although few studies have examined programs targeted at one gender.

Future Research

The following topics regarding gender differences require additional research:

- Gender differences in the effectiveness of tobacco dependence treatments found to be effective in this Guideline, including counseling and the effectiveness of varenicline and combination medications
- Impact of gender-specific motives that may increase quit attempts and success (e.g., quitting to improve fertility and reproductive health, pregnancy outcomes, physical appearance, and osteoporosis)

Other Specific Populations and Topics

Children and Adolescents

Recommendation: Clinicians should ask pediatric and adolescent patients about tobacco use and provide a strong message regarding the importance of totally abstaining from tobacco use. (Strength of Evidence = C)

Recommendation: Counseling has been shown to be effective in treatment of adolescent smokers. Therefore, adolescent smokers should be provided with counseling interventions to aid them in quitting smoking. (Strength of Evidence = B)

Recommendation: Secondhand smoke is harmful to children. Cessation counseling delivered in pediatric settings has been shown to be effective in increasing abstinence among parents who smoke. Therefore, to protect children from secondhand smoke, clinicians should ask parents about tobacco use and offer them cessation advice and assistance. (Strength of Evidence = B)

Background

Tobacco use is a pediatric concern. In the United States, about 4,000 children and adolescents under age 18 smoke their first cigarette each day, and an estimated 1,200 children and adolescents become daily cigarette smokers each day.[44,674] Among adults who ever smoked daily, 90 percent tried their first cigarette before age 21.[675] It is estimated that in 2006, 3.3 million U.S. adolescents aged 12 to 17 were current (past month) users of tobacco products and 2.6 million were current cigarette smokers.[43] Although use of cigarettes and cigars declined slightly from 2005 among this age group, the use of smokeless tobacco increased.[43] If current patterns persist, an estimated 6.4 million youth will die prematurely from a smoking-related disease.[675] Young people experiment with or begin regular use of tobacco for a variety of reasons, including social and parental norms, advertising, movies and popular media, peer influence, parental smoking, weight control, and curiosity.[676-685] Nicotine dependence, however, is established rapidly even among adolescents.[686-689] Because of the importance of primary prevention, clinicians should ensure that they deliver tobacco prevention and cessation messages to pediatric patients and their parents. Because tobacco use often begins during preadolescence,[690] clinicians should routinely assess and intervene with this population. Intervention research remains a priority for this population. Current reviews of smoking prevention and cessation interventions for adolescents have, so far, demonstrated limited evidence of effectiveness.[691,692] A 2007 national survey of youth tobacco cessation programs showed a lack of such programs in communities most in need—those in which youth smoking prevalence is increasing.[693] Prevention strategies useful in more general settings can be found in the Institute of Medicine report *Growing Up Tobacco Free*[694] and in the 2000 Surgeon General's Report *Reducing Tobacco Use*[6] and recently have been addressed by several authors.[695,696]

Young people vastly underestimate the addictive potential of nicotine. Adolescent smokers, both occasional and daily smokers, are more likely than nonsmokers to think they can quit at any time.[697] However, only about 4 percent of smokers aged 12 to 19 successfully quit smoking each year,[698,699] and the rate of failed adolescent quit attempts exceeds that of adult smokers.[32] Adolescents are very interested in quitting; 82 percent of 11- to 19-year-olds who smoke are thinking about quitting,[700] and 77 percent have made a serious quit attempt in the past year.[701,702] Adolescent quit attempts are rarely planned, and adolescents tend to choose unassisted

rather than assisted quit methods,[32] even though young people who enroll in a tobacco cessation program are twice as likely to succeed in their quit attempt.[703,704]

Tobacco Use Treatments in Children and Adolescents

Counseling. Seven studies met selection criteria and were included in a new 2008 analysis comparing counseling to usual care among adolescent smokers. Results of this analysis are shown in Table 7.4. As can be seen from this analysis, the use of counseling approximately doubles long-term abstinence rates when compared to usual care or no treatment. In these studies usual care may have included brief advice, self-help pamphlets, reading materials, or a referral. Note that although counseling does significantly boost abstinence rates, absolute abstinence rates were quite low, attesting to the need for improved counseling interventions for adolescents. An inspection of the included studies revealed significant heterogeneity among analyzed articles. Thus, the Panel decided to make a "B" level recommendation rather than "A" level recommendation. A recent Cochrane meta-analysis produced mixed findings for counseling as a tobacco use treatment for youth.[705]

Table 7.4. Meta-analysis (2008): Effectiveness of and estimated abstinence rates for counseling interventions with adolescent smokers (n = 7 studies)[a]

Adolescent smokers	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Usual care	7	1.0	6.7
Counseling	7	1.8 (1.1–3.0)	11.6 (7.5–17.5)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

There were too few studies to perform meta-analyses on specific counseling techniques (e.g., motivational interviewing). The adolescent intervention studies that yielded significant effects used interventions that varied in intensity, format, and content. One study used an intervention that had one in-person counseling session and one telephone call; the other two interventions comprised six and eight sessions of counseling delivered in a group format. The counseling content of these interventions involved efforts to enhance motivation, establish rapport, set goals, promote problemsolving and skill training, and prevent relapse.[482,706,707] One recent meta-analysis found significant effects for studies that employed cognitive-

behavioral strategies (self-monitoring and coping skills), social influence strategies (addressing social influences that serve to promote or maintain smoking), and motivational strategies (techniques to clarify desire for change and reduce ambivalence toward change).[704]

A series of studies comparing intensive group sessions based on social/cognitive therapy to a 10- to 20-minute brief intervention produced promising results, at least when measured at the end of treatment, across diverse adolescent populations.[708-716] Interventions should be developmentally appropriate across the adolescent age span (e.g., appropriate for a 12-year-old vs. an 18-year-old). Additionally, counseling and other interventions have been recommended for young adults ages 18 to 24 years old.[717]

Recent studies indicate that adolescent smokers are identified and counseled to quit in about 33 to 55 percent of physician visits[120,718,719] and about 20 percent of dental visits.[120] Receipt of assistance in quitting was reported by 42 percent of adolescents and followup by only 16 percent of adolescents.[719] Yet, in a survey of 5,000 adolescents (all of the 11th graders in the Memphis City Schools), more than 79 percent reported they would acknowledge their smoking if asked.[718] Therefore, clinicians need to assess adolescent tobacco use, offer counseling, and follow up with these patients. Asking about tobacco use and advising adolescents to quit are the entry points for providing effective interventions. Clinicians may use motivational interventions such as those listed in Chapter 3B, which can be adapted for use with adolescents.[173,706,720,721] It is important for clinicians to intervene with adolescents in a manner that respects confidentiality and privacy (e.g., interviewing adolescents without parents present).

Counseling Provided to Parents During the Pediatric Visit. Recent research suggests that tobacco use interventions provided to parents in pediatric clinics or during child hospitalizations increase parents' interest in stopping smoking,[198,722] parents' quit attempts[198,199] and parents' quit rates,[172,723,724] although one study failed to find such an effect.[428]

Children and adolescents also benefit if parents are given information on secondhand smoke exposure. A review of the studies conducted by the expert Panel showed that giving parents information on the harms of secondhand smoke reduces childhood exposure to such smoke and may reduce parental smoking rates.[198,725]

Questions have been raised about whether and how clinicians caring for children and adolescents might offer treatment for tobacco dependence to their parents who smoke. Would such treatment interfere with the doctor-patient relationship that parents might have with their physicians? In response to this concern, the American Medical Association adopted a policy statement in 2005 supporting the practice of pediatricians addressing parental smoking.[726]

Tobacco Use Medications. Although nicotine replacement has been shown to be safe in adolescents, there is little evidence that these medications and bupropion SR are effective in promoting long-term smoking abstinence among adolescent smokers.[727-731] As a result, they are not recommended as a component of pediatric tobacco use interventions. One small pilot study (N = 22) found some positive initial effects for bupropion SR.[730] However, other studies have found no difference between placebo and patch at 10 or 12 weeks postquit[727] or between placebo versus gum or patch at 6 months postquit.[729,732] The majority of these studies also included an intensive counseling component (6 or more sessions).

Future Research

The following topics regarding adolescents and children require additional research:

- Effectiveness of using the 5 A's in pediatric clinics to treat both adolescents and parents
- Safety and effectiveness of medications in adolescents, including bupropion SR, NRT, varenicline, and a nicotine vaccine
- Effectiveness of counseling interventions designed specifically to motivate youth to stop using tobacco
- Effectiveness of child-focused versus family-focused or peer-focused interventions as well as interventions accessed via the Internet, quitlines, and school-based programs
- Strategies for increasing the efficacy, appeal, and reach of counseling treatments for adolescent smokers

Light Smokers

Recommendation: Light smokers should be identified, strongly urged to quit, and provided counseling cessation interventions. (Strength of Evidence = B)

The field of tobacco dependence research has not achieved consensus regarding the definition of a light smoker. For the purposes of this Guideline, the Panel considered a light smoker to be anyone who smokes fewer than 10 cigarettes per day, given that these individuals frequently are excluded from the RCTs that are the basis of some of the treatment recommendations. This definition includes individuals who may not smoke daily. Light smoking does not refer to smoking low-tar/low-nicotine cigarettes. Despite lower consumption levels, light smokers are at risk for developing smoking-related diseases.[733,734] A large, longitudinal study in Norway (N = 42,722) found an increase in risk of death from ischemic heart disease and other tobacco-related causes for both men and women who smoked one to four cigarettes per day.[735] Similar results were found in a Finnish cohort, in which men who reported being "occasional smokers" demonstrated increased cardiovascular morbidity and mortality.[736]

Light smoking is becoming more common, perhaps due to smoking restrictions and increases in the price of cigarettes.[734,737] A recent National Health Interview Survey (NHIS) survey found that among adult smokers in the United States, approximately 25.4 percent report smoking 10 or fewer cigarettes per day, and 11.6 percent smoke 5 or fewer cigarettes per day.[738] Many light smokers want to quit but have difficulty doing so.[734] This is consistent with evidence that many light smokers are dependent, even though they smoke relatively few cigarettes.[739] Light smokers also are less likely to receive treatment than are heavier smokers.[734,740]

Light smokers should be provided counseling treatments identified as effective in this Guideline. One study found that health education was more effective than motivational interviewing for African-American light smokers (≤ 10 cigarettes per day).[176]

Tobacco Use Medications. Two studies examined the effectiveness of medications with light smokers. One study found that use of the nicotine lozenge significantly increased 12-month abstinence rates among light smok-

ers (≤ 15 cigarettes per day) compared to placebo.[741] Another study found no difference in effectiveness of 2-mg gum versus placebo.[176]

Future Research

The following topic regarding light smokers requires additional research:

- Effectiveness of specific counseling and medication interventions with lighter smokers

Noncigarette Tobacco Users

Recommendation: Smokeless tobacco users should be identified, strongly urged to quit, and provided counseling cessation interventions. (Strength of Evidence = A)

Recommendation: Clinicians delivering dental health services should provide brief counseling interventions to all smokeless tobacco users. (Strength of Evidence = A)

Recommendation: Users of cigars, pipes, and other noncigarette forms of smoking tobacco should be identified, strongly urged to quit, and offered the same counseling interventions recommended for cigarette smokers. (Strength of Evidence = C)

Like cigarette smoking, the use of smokeless tobacco, such as chewing tobacco, snuff, or moist snuff, produces addiction to nicotine and has serious health consequences.[742-744] Smokeless tobacco use was reported among 4 percent of adult men, but less than 1 percent of women in 2005.[591,745] Health risks from these products include abrasion of teeth, gingival recession, periodontal bone loss, leukoplakia, and oral and pancreatic cancer.[745,746] Thus, the use of smokeless tobacco is not a safe alternative to smoking,[747] nor is there evidence to suggest that it is effective in helping smokers quit.

Evidence shows that counseling treatments are effective in treating smokeless tobacco users.[748-750] Therefore, clinicians should offer quitting advice and assistance to their patients who use tobacco, regardless of the formulation of the tobacco product. Some information may be particularly relevant

in the treatment of smokeless tobacco use. For instance, a large majority of moist snuff users have identifiable oral lesions, and emphasizing this information during an oral exam may be useful in motivating a quit attempt. A close review of the literature showed that dental health clinicians (e.g., dental hygienists) delivering brief advice to quit using smokeless tobacco, in the context of oral hygiene feedback, can increase abstinence rates.[250,751]

Cigar smokers are at increased risk for coronary heart disease; COPD; periodontitis; and oral, esophageal, laryngeal, lung, and other cancers; with evidence of dose-response effects.[752-756] The prevalence of cigar smoking was 5 percent for men and less than 1 percent for women.[590] Although cigarette sales have declined over the last decade, cigar sales have increased in the United States, increasing 15.3 percent in 2005,[757] and sales of "little cigars" were at an all-time high in 2006.[758] Cigar smokers are known to discount the health effects of cigar smoking, believing it to be less detrimental than cigarettes.[752,759]

Clinicians should be aware of and address the use of other noncigarette tobacco products, including pipes, water pipes (also known as hookahs and narghile), cigarillos, loose tobacco, bidis, and betel quid. The use of cigars, pipes, and bidis is associated with cancers of the lung, stomach, oral cavity, larynx, and esophagus.[760] Further, the evidence is mixed as to whether or not individuals who use noncigarette tobacco products, either alone or in addition to cigarettes, find it more or less difficult, in comparison to cigarette smokers, to become abstinent from tobacco.[761,762]

Tobacco Use Medications. Current evidence is insufficient to suggest that the use of tobacco cessation medications increases long-term abstinence among users of smokeless tobacco. Studies conducted to date with various medications have not shown that they increase abstinence rates in this population.[750,751,763,764]

Future Research

The following topics regarding noncigarette tobacco products require additional research:

- Effectiveness of advice and counseling treatments in promoting abstinence among users of noncigarette tobacco products, especially among users of pipes, cigars, and hookahs

- Effectiveness of medications to promote abstinence among users of noncigarette tobacco products, including users of smokeless tobacco, pipes, cigars, and hookahs

- Effectiveness of combined medications and counseling and behavioral therapies with users of noncigarette tobacco products

- Effectiveness of medication and counseling interventions with individuals who both smoke cigarettes and use noncigarette tobacco products ("dual users")

Pregnant Smokers

Recommendation: Because of the serious risks of smoking to the pregnant smoker and the fetus, whenever possible pregnant smokers should be offered person-to-person psychosocial interventions that exceed minimal advice to quit. (Strength of Evidence = A)

Recommendation: Although abstinence early in pregnancy will produce the greatest benefits to the fetus and expectant mother, quitting at any point in pregnancy can yield benefits. Therefore, clinicians should offer effective tobacco dependence interventions to pregnant smokers at the first prenatal visit as well as throughout the course of pregnancy. (Strength of Evidence = B)

Psychosocial Interventions. The selection criteria for the pregnancy meta-analysis were adjusted to be appropriate for this unique population. Abstinence data were included only if they were biochemically confirmed, due to reports of deception regarding smoking status among pregnant women.[765-769] Two different followup time periods were analyzed: prebirth abstinence (> 24 weeks gestation) and greater than 5 months postpartum abstinence. For the meta-analysis, either minimal interventions (< 3 minutes) or interventions labeled as "usual care" constituted the reference condition. Eight studies met the criteria and were included in the analysis comparing person-to-person psychosocial smoking cessation interventions with usual care in pregnant women. A "usual care" intervention with pregnant smokers typically consists of a recommendation to stop smoking, often supplemented by provision of self-help material or referral to a stop-smoking program or brief counseling. Person-to-person psychosocial interventions typically involved these treatment components as well as more intensive

counseling than minimal advice. One study included 12 telephone counseling sessions after an initial in-person counseling session, and the remainder of the studies had at least two in-person counseling sessions. One study used a group intervention, and all of the other studies provided individual counseling. Six of the studies provided counseling only during pregnancy, one provided counseling in the hospital, and one provided counseling postdelivery. As Table 7.5 shows, psychosocial interventions are significantly more effective than usual care in getting pregnant women to quit while they are pregnant. These findings are consistent with other independent reviews.[770] A meta-analysis also was conducted to examine the effects of psychosocial interventions on postpartum abstinence. The odds ratio for psychosocial intervention was consistent with a positive effect of counseling on postpartum abstinence; however, the results were not statistically significant (OR = 1.6, 95 percent C.I. = 0.7–3.5). Studies using telephone counseling as the only format that compared biochemically verified outcomes to a minimal intervention suggest a possible differential effect on light versus heavy smokers and underscore the need for further research about this format.[771,772]

Table 7.5. Meta-analysis (2008): Effectiveness of and estimated preparturition abstinence rates for psychosocial interventions with pregnant smokers (n = 8 studies)[a]

Pregnant smokers	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Usual care	8	1.0	7.6
Psychosocial intervention (abstinence preparturition)	9	1.8 (1.4–2.3)	13.3 (9.0–19.4)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Components of some person-to-person psychosocial interventions are listed in Table 7.6. These interventions were selected from articles included in the Table 7.5 meta-analysis and should guide clinicians when treating pregnant smokers.

Table 7.6. Examples of effective psychosocial interventions with pregnant patients

Physician advice regarding smoking-related risks (2–3 minutes); videotape with information on risks, barriers, and tips for quitting; midwife counseling in one 10-minute session; self-help manual; and followup letters.[773]
Pregnancy-specific self-help materials (*Pregnant Woman's Self-Help Guide To Quit Smoking*) and one 10-minute counseling session with a health educator.[774]
Counselor provided one 90-minute counseling session plus bimonthly telephone followup calls during pregnancy and monthly telephone calls after delivery.[775]

Smoking in pregnancy imparts risks to both the woman and the fetus. Cigarette smoking by pregnant women has been shown to cause adverse fetal outcomes, including stillbirths, spontaneous abortions, decreased fetal growth, premature births, low birth-weight, placental abruption, and sudden infant death syndrome (SIDS); and has been linked to cognitive, emotional, and behavioral problems in children.[776,777] Many women are motivated to quit during pregnancy, and health care professionals can take advantage of this motivation by reinforcing the knowledge that cessation will reduce health risks to the fetus and that there are postpartum benefits for both the mother and child.[778-780]

The first step in intervention is assessment of tobacco use status. This is especially important in a population in which a stronger stigma against smoking increases the potential for deception.[781,782] Research has shown that the use of multiple choice questions (see Table 7.7), as opposed to a simple yes/no question, can increase disclosure among pregnant women by as much as 40 percent.[783,784]

Table 7.7. Clinical practice suggestions for assisting a pregnant patient in stopping smoking

Clinical practice	Rationale
Assess pregnant woman's tobacco use status using a multiple-choice question to improve disclosure.	Many pregnant women deny smoking, and the multiple-choice question format improves disclosure. For example: Which of the following statements best describes your cigarette smoking? • I smoke regularly now; about the same as before finding out I was pregnant. • I smoke regularly now, but I've cut down since I found out I was pregnant. • I smoke every once in a while.

Table 7.7. Clinical practice suggestions for assisting a pregnant patient in stopping smoking (continued)

Clinical practice	Rationale
Assess pregnant woman's tobacco use status using a multiple-choice question to improve disclosure.	• I have quit smoking since finding out I was pregnant. • I wasn't smoking around the time I found out I was pregnant, and I don't currently smoke cigarettes.
Congratulate those smokers who have quit on their own.	To encourage continued abstinence.
Motivate quit attempts by providing educational messages about the impact of smoking on both maternal and fetal health.	These are associated with higher quit rates.
Give clear, strong advice to quit as soon as possible.	Quitting early in pregnancy provides the greatest benefit to the fetus.
Use problemsolving counseling methods and provide social support and pregnancy-specific self-help materials.	Reinforces pregnancy-specific benefits and increases cessation rates.
Arrange for followup assessments throughout pregnancy, including further encouragement of cessation.	The woman and her fetus will benefit even when quitting occurs late in pregnancy.
In the early postpartum period, assess for relapse and be prepared to continue or reapply tobacco cessation interventions, recognizing that patients may minimize or deny smoking.	Postpartum relapse rates are high, even if a woman maintains abstinence throughout pregnancy.

Quitting smoking prior to conception or early in the pregnancy is most beneficial, but health benefits result from abstinence at any time.[742,785-787] It is estimated that 20 percent or more of low birth-weight births could be prevented by eliminating smoking during pregnancy.[592,788] Therefore, a pregnant smoker should receive encouragement and assistance in quitting throughout her pregnancy. Women attending preconception or other medical visits also should be offered tobacco use interventions, as smoking may decrease fertility[789,790] and some adverse effects occur early in the pregnancy.[788] In addition, treating tobacco dependence prior to conception

offers more options to the clinician, including medication options, as fetal health concerns are not present.

Even women who have maintained total abstinence from tobacco for 6 or more months during pregnancy have a high rate of relapse in the postpartum period.[787,791,792] Postpartum relapse may be decreased by continued emphasis on the relationship between maternal smoking and poor health outcomes in infants and children (e.g., SIDS, respiratory infections, asthma, and middle ear disease).[793-798] One pilot study found that a relapse prevention intervention was effective;[799] however, two reviews of relapse prevention trials (both pre- and postdelivery) found no significant reduction in relapse.[185,770] There is a great need for research on the prevention of postpartum relapse. Table 7.7 outlines clinical factors to address when counseling pregnant women about smoking.

Meta-analytic results support the effectiveness of self-help materials compared to either basic information sheets or no intervention in assisting women to quit during pregnancy (see Table 7.8). Pamphlets and quitting guides were used as the self-help intervention in both studies analyzed. Other studies document favorable outcomes when self-help materials, with or without brief discussion/counseling, are added to standard advice to quit smoking.[774,800]

Table 7.8. Meta-analysis (2008): Effectiveness of and estimated preparturition abstinence rates for self-help interventions with pregnant smokers (n = 2 studies)[a]

Pregnant smokers	Number of arms	Estimated odds ratio (95% C.I.)	Estimated abstinence rate (95% C.I.)
Usual care	2	1.0	8.6
Self-help materials (preparturition)	2	1.9 (1.2–2.9)	15.0 (10.1–21.6)

[a] Go to *www.surgeongeneral.gov/tobacco/gdlnrefs.htm* for the articles used in this meta-analysis.

Tobacco use medication and pregnant smokers—Effectiveness. The data on the effectiveness of nicotine replacement therapy with pregnant smokers include three randomized, controlled nicotine patch studies. One study randomly assigned 250 pregnant women who still were smoking after the first trimester to either a 15-mg, 16-hour active patch for 8 weeks and a 10-mg, 16-hour patch for 3 additional weeks or to a placebo. No significant

differences were seen in smoking abstinence rates, number of cigarettes smoked, birthweight, or number of preterm deliveries.[801] A similar study of the nicotine patch with 30 pregnant women who still were smoking 15 or more cigarettes a day after the first trimester found moderate but nonsignificant differences in abstinence rates (23% in the active patch and counseling condition vs. 0% in the placebo patch and counseling condition).[802] A recent study[803] randomized 181 pregnant women to cognitive behavioral therapy (CBT) and NRT or CBT alone. Women in the CBT plus NRT group were significantly more likely to be abstinent at 7 weeks post-randomization (29% vs. 10%) and at 38 weeks gestation (22% vs. 7%). This study was stopped prior to completion (see safety section below). Based on these data, the Panel did not make a recommendation regarding medication use during pregnancy.

Tobacco use medication and pregnant smokers—Safety. Cigarette smoking during pregnancy is the greatest modifiable risk factor for pregnancy-related morbidity and mortality in the United States.[804] Adverse effects of smoking during and after pregnancy include increased risks of spontaneous abortion,[805] premature labor and delivery,[806] placental abruption,[807] fetal growth retardation,[808-810] SIDS,[811,812] and many health risks for the woman and her child.[794,813]

Cigarette smoke contains thousands of chemicals, many of which may contribute to reproductive toxicity. Of particular concern are carbon monoxide, nicotine, and oxidizing chemicals.[814] High levels of carbon monoxide exert neuroteratogenic effects.[815,816] Oxidizing chemicals are likely to contribute to an increased risk of thrombotic complications and, by reducing nitric oxide availability, contribute to placental vasoconstriction and premature labor.[817,818]

Nicotine may contribute to adverse effects of cigarette smoking during pregnancy and result in injury to the fetus.[819-821] Nicotine has been postulated to cause uteroplacental insufficiency via vasoconstriction, to produce fetal neurotoxicity resulting in delayed or impaired brain development, to inhibit the maturation of pulmonary cells and to increase the risk of SIDS. These concerns are based primarily on animal studies. Relatively little human research with pure nicotine has been done in pregnant smokers.

Several studies of brief exposure to nicotine patches or nicotine gum have demonstrated small hemodynamic effects in the mother and fetus, gener-

ally less than those seen with cigarette smoking.[822] The three clinical trials of NRT in pregnant women have yielded information relative to safety. The Wisborg trial of 250 women randomized to nicotine patch (15 mg) or placebo for 11 weeks found no evidence of serious adverse effects of nicotine.[801] To the contrary, birth weight was significantly higher in the NRT group, possibly due to reduced cigarette smoking in the NRT group. The Kapur study included 30 women randomized to nicotine patches (15 mg) or placebo, and reported no serious adverse effects of NRT.[802] One placebo-treated woman experienced extreme nicotine withdrawal, associated with increased fetal movements, prompting discontinuation of the trial. The Pollack study included 181 women, 122 randomized to CBT plus NRT, and 59 to CBT alone.[803] The NRT group could select nicotine patches, gum, or lozenge, or no NRT. More than half the women selected nicotine patches, the dose of which was adjusted according to the number of cigarettes smoked per day on study entry. As described in the "effectiveness" section above, women treated with NRT had significantly higher quit rates during pregnancy than did women receiving CBT alone. However, the study was terminated early by the Data Safety Monitoring Board (DSMB) due to a higher incidence of adverse events. Serious adverse events occurred in 30 percent of the NRT group compared to 17 percent of the CBT-alone group. The most frequent cause of serious adverse events was preterm labor. There was evidence that this difference in preterm labor was due to a difference between groups in history of preterm labor that predated study entry. The DSMB indicated that the study had to be terminated due to *a priori* stopping rules; however, they did not believe that the serious adverse events were related to NRT use. The authors concluded that this study cannot support or negate published literature about the harm of NRT during pregnancy.

Morales-Suarez-Varela et al. reported data from a retrospective cohort study suggesting that the use of NRT in women who quit smoking but who used nicotine substitutes during the first 12 weeks of pregnancy was associated with a small but significant increase in congenital malformations compared to mothers who smoked during the first trimester.[823] This study suffers from multiple, substantial methodological problems, however, making its findings difficult to interpret. Also, the number of malformation cases in the NRT group was quite small, and the relative prevalence rate ratios for malformations in cases compared to controls were of borderline significance. Further, concerns exist about possible undetected spontaneous abortion among continuing smokers. In addition, most women who

use NRT do so in the second or third trimester, and no adverse event data were reported in these women.

Safety is not categorical. A designation of "safe" reflects a conclusion that a drug's benefits outweigh its risks. Nicotine most likely does have adverse effects on the fetus during pregnancy. Although the use of NRT exposes pregnant women to nicotine, smoking exposes them to nicotine plus numerous other chemicals that are injurious to the woman and fetus. These concerns must be considered in the context of inconclusive evidence that cessation medications boost abstinence rates in pregnant smokers.

Future Research

The following topics regarding smoking and pregnancy require additional research:

- Relapse prevention with pregnant women and women who have recently given birth
- Effectiveness of psychosocial treatment provided via nonface-to-face modalities, such as quitlines or Web-based programs
- The safety and effectiveness of tobacco dependence medications (bupropion SR, NRTs, and varenicline) during pregnancy for the woman and the fetus, including: the relative risks and benefits of medication use as a function of dependence, and the appropriate formulation and timing of medication use
- Safety and effectiveness of tobacco dependence medications, especially varenicline and bupropion SR as well as various forms of NRT, to the woman and child during nursing
- Effectiveness of economic incentives to promote quitting and sustained abstinence
- Effects of smoking during fertility treatment and the effects and effectiveness of cessation interventions on the infertile population, both men and women

- Effects of reporting smoking status and the provision of cessation interventions as part of the national database for assisted reproductive technology treatments (the Center for Disease Control and Prevention's Assisted Reproductive Technology [ART] database, *www.cdc.gov/art*)

- Effectiveness of relapse prevention programs for spontaneous "self-quitters amongst pregnant women"

- Effectiveness of different types of counseling, behavioral therapies, and motivational interventions (e.g., physiological feedback of adverse impacts, quitting benefits) for pregnant women in general and in high-prevalence populations (e.g., American Indian and Alaska Native women, especially)

- Strategies for linking preconception, pregnancy, and postpartum (including pediatric) interventions

Weight Gain After Stopping Smoking

Recommendation: For smokers who are greatly concerned about weight gain, it may be most appropriate to prescribe or recommend bupropion SR or NRT (in particular, nicotine gum and nicotine lozenge), which have been shown to delay weight gain after quitting. (Strength of Evidence = B)

The majority of smokers who quit smoking gain weight. Most will gain fewer than 10 pounds, but there is a broad range of weight gain, with as many as 10 percent of quitters gaining as much as 30 pounds.[824-827] However, weight gain that follows stopping smoking is a modest health threat compared with the risks of continued smoking.[824]

Women tend to gain slightly more weight than men do.[828] For both sexes, African Americans, people under age 55, and heavy smokers (those smoking more than 25 cigarettes per day) are at elevated risk for major weight gain.[826,829-831]

For some smokers, especially women, concerns about weight or fears about weight gain are motivators to start smoking or continue smoking.[832-836]

Adolescents, even as young as middle-school age, who are concerned about their weight initiate smoking more often than do other adolescents.[683,837-838]

Concern about weight varies substantially by ethnicity. For example, adolescent African-American females are much less likely to report that they smoke to control weight than are white European Americans.[683,839] This is an important area for further study, as little tobacco research focuses on women in racial/ethnic minority groups.[683]

There is no convincing evidence that counseling interventions specifically designed to mitigate weight gain during attempts to stop smoking result in reduced weight gain.[165,499,840] It also is unclear that such interventions affect cessation success; specifically, these interventions do not appear to adversely affect cessation.[499,840-842]

Nicotine replacement—in particular, 4-mg nicotine gum and 4-mg nicotine lozenge—appears to be effective in delaying postcessation weight gain. Moreover, there appears to be a dose-response relation between gum use and weight suppression (i.e., the greater the gum use, the less weight gain occurs). Bupropion SR also appears to be effective in delaying postcessation weight gain.[484,843-845] Once either nicotine gum or bupropion SR therapy is stopped, however, the quitting smoker, on average, gains an amount of weight that is about the same as if she or he had not used these medications.[843,846-848]

Postcessation weight gain appears to be caused both by increased intake (e.g., eating, including high-caloric foods, and alcohol consumption) and by decreased metabolism. The involvement of metabolic mechanisms suggests that even if smokers do not increase their caloric intake upon quitting, they will, on average, gain some weight.[849-852] Once an individual relapses and begins smoking at precessation levels, he or she usually will lose some or all of the weight gained during the quit attempt.

The research evidence reviewed above shows why concerns about weight gain can be barriers to smoking abstinence. Many smokers (especially women) are concerned about their weight and fear that quitting will produce weight gain. Many also believe that they can do little to prevent postcessation weight gain except return to smoking. These beliefs are difficult to address clinically because smoking does appear to affect weight.

Recommendations to Clinicians When Addressing Weight Gain

How should the clinician deal with concerns about weight gain? First, the clinician should neither deny the likelihood of weight gain nor minimize its significance to the patient. Rather, the clinician should inform the patient about the likelihood of weight gain and prepare the patient for its occurrence. The clinician also should counter exaggerated fears about weight gain given the relatively moderate weight gain that typically occurs. Certain types of information may help prepare the patient for postcessation weight gain (see Table 7.9). Clinicians also should inform the patient that smoking presents a much greater health risk than the negligible health risk involved in the modest weight gain associated with smoking abstinence.

Second, during the quit attempt, the clinician should offer to help the patient address weight gain (either personally or via referral) once the patient has successfully quit smoking. The patient should be encouraged to maintain or adopt a healthy lifestyle, including engaging in moderate exercise, eating plenty of fruits and vegetables, and limiting alcohol consumption.[502,853]

Exercise

Available research does not show that interventions to increase exercise reliably boost smoking abstinence rates.[842,854] One recent study, however, showed that an exercise program occurring in three 45-minute sessions per week increases long-term smoking abstinence in women and delays weight gain when it is combined with a cognitive-behavioral smoking cessation program.[853] As was the case for weight loss interventions, there is no evidence that exercise interventions undermine success in stopping smoking. Some evidence suggests that weight gain is reduced if smoking abstinence is accompanied by a moderate increase in physical activity.[855] Vigorous exercise programs should not be implemented without consulting a physician. Although it may be difficult to get smokers to adhere to a vigorous exercise program, smokers should be encouraged to engage in moderate exercise and physical activity as part of a healthy lifestyle.[856]

Table 7.9. Clinician statements to help a patient prepare for and cope with post-cessation weight gain

Clinician statements
The great majority of smokers gain weight once they quit smoking. However, even without special attempts at dieting or exercise, weight gain is usually 10 lbs. or less.
Some medications, including bupropion SR and nicotine replacement medicines, may delay weight gain.
There is evidence that smokers often gain weight once they quit smoking, even if they do not eat more. However, there are medications that will help you quit smoking and limit or delay weight gain. I can recommend one for you.
The amount of weight you will likely gain from quitting will be a minor health risk compared with the risks of continued smoking.
I know that you don't want to gain a lot of weight. However, let's focus on strategies to get you healthy rather than on weight. Think about eating plenty of fruits and vegetables, getting regular exercise, getting enough sleep, and avoiding high-calorie foods and beverages. Right now, this is probably the best thing you can do for both your weight and your health.
Although you may gain some weight after quitting smoking, compare the importance of this with the added years of healthy living you will gain, your better appearance (less wrinkled skin, whiter teeth, fresher breath), and good feelings about quitting.

Future Research

The following topics regarding weight gain during tobacco dependence treatment require additional research:

- Effectiveness of weight control measures during quit attempts and their effect on tobacco abstinence and weight, including issues of timing of weight control interventions
- Effectiveness of medications to control weight gain during quit attempts
- Effectiveness of the use of exercise to control weight gain during a quit attempt, including the optimal "dose" of exercise to minimize weight gain and not jeopardize cessation outcome
- Impact of weight gain concerns on specific populations, including adolescents who smoke and ethnic/minority women
- Strategies to increase adherence to exercise protocols as part of cessation interventions that include efforts to decrease weight gain

Glossary

Abstinence percentage. The percentage of smokers who achieve long-term abstinence from smoking. The most frequently used abstinence measure for this Guideline was the percentage of smokers in a group or treatment condition who were abstinent at a followup point that occurred at least 5 months after treatment.

Acupuncture. A treatment involving the placement of needles in specific areas of the body with the intent to promote abstinence from tobacco use. Acupuncture also can be accomplished using electrostimulation or laser.

Addiction. Compulsive drug use, with loss of control, the development of dependence, continued use despite negative consequences, and specific withdrawal symptoms when the drug is removed.

All-comers. Individuals included in a tobacco treatment study regardless of whether they sought to participate. For example, if treatment was delivered to all smokers visiting a primary care clinic, the treatment population would be coded as "all-comers." Presumably, individuals who seek to participate in tobacco treatment studies ("want-to-quit" smokers) likely are more motivated to quit, and studies limited to these individuals may produce higher quit rates. All-comers can be contrasted with "want-to-quit" or self-selected populations.

Agonist. A drug action that generally mimics or enhances the effect of another drug at a neural receptor site. Nicotine is a cholinergic agonist.

Antagonist. A drug action that generally blocks or neutralizes the effect of another drug at a neural receptor site. Naltrexone and mecamylamine are examples of antagonists.

Anxiolytic. A medication used to reduce anxiety symptoms.

Assessment. All tobacco cessation interventions begin with identifying tobacco users and performing an assessment. The assessment is used to identify the most beneficial intervention for each smoker. Assessments may be specialized and may be ongoing throughout a smoking cessation program or occur at followups.

Aversive smoking. Several types of therapeutic techniques that involve smoking in an unpleasant or concentrated manner. These techniques pair smoking with negative associations or responses. Notable examples include rapid smoking, rapid puffing, focused smoking, and satiation smoking.

Behavioral therapy. A psychotherapeutic approach aimed at identifying and modifying the behaviors associated with human problems.

Benzodiazepine. Medication used as an anxiolytic. Benzodiazepines do not have an FDA indication for treating tobacco use and dependence.

Bidis. Small, thin, hand-rolled cigarettes, often consisting of flavored tobacco wrapped in tendu or temburni leaves. Bidis have a higher concentration of nicotine, tar, and carbon monoxide than conventional cigarettes sold in the United States. They are imported to the United States from India and other Southeast Asian countries.

Biochemical confirmation. The use of biological samples (expired air, blood, saliva, or urine) to measure tobacco-related compounds such as thiocyanate, cotinine, nicotine, and carboxyhemoglobin to verify users' reports of abstinence.

Bupropion SR (bupropion sustained-release). A non-nicotine aid for smoking cessation, originally developed and marketed as an antidepressant. It is chemically unrelated to tricyclics, tetracyclics, selective serotonin re-uptake inhibitors, or other known antidepressant medications. Its mechanism of action is presumed to be mediated through its capacity to block the reuptake of dopamine and norepinephrine centrally.

Buspirone. A nonbenzodiazepine drug with anxiolytic properties. Buspirone does not have an FDA indication for treating tobacco use and dependence.

Coordinated intervention. Tobacco dependence treatment strategy that involves the clinician, health care administrator, insurer, and purchaser to ensure the provision of tobacco dependence treatment as an integral element of health care delivery.

Chronic disease model. Recognizes the long-term nature of tobacco dependence, with an expectation that patients may have periods of relapse and remission. The chronic disease model emphasizes the importance of continued patient education, counseling, and advice over time.

Cigarette fading/smoking reduction prequit. An intervention strategy designed to reduce the number of cigarettes smoked or nicotine intake prior to a patient's quit date. This may be accomplished through advice to cut down or to systematically restrict access to cigarettes. These interventions use computers and/or strategies to accomplish prequitting reductions in cigarette consumption or nicotine intake.

Clinician. A professional directly providing health care services.

Clinic screening system. The strategies used in clinics and medical practices for the delivery of clinical services. Clinic screening system interventions involve changes in protocols designed to enhance the identification of and intervention with patients who smoke. Examples include affixing tobacco use status stickers to patients' charts, expanding the capture of vital signs to include tobacco use, incorporating tobacco use status items into patient questionnaires, and including prompts for tobacco use monitoring in electronic medical records.

Clonidine. An alpha-2-adrenergic agonist typically used as an antihypertensive medication, but also documented in this Guideline as an effective medication for smoking cessation.

Cochrane Review. A service of the Cochrane Collaboration, an international nonprofit and independent organization (*www.cochrane.org/index.htm*) that regularly publishes evidence-based reviews about health care interventions.

Cognitive behavioral therapy (CBT). A psychotherapeutic approach aimed at identifying and modifying faulty or distorted negative thinking styles and the maladaptive behaviors associated with those thinking styles.

Combination medications. Treatment that combines two or more nicotine-containing medications or a nicotine-containing medication with another tobacco treatment medication such as bupropion SR.

Community-level interventions. Interventions for the primary prevention or treatment of tobacco use that usually are not implemented in primary care practice settings. These interventions most often are implemented through mass media campaigns.

Comorbidity. Coexistence of tobacco use with other medical diseases/illnesses, including mental illnesses.

Confidence intervals. Estimated range of values, which is likely to include an unknown population parameter. The estimated range is calculated from a given set of sample data.

Contingency contracting/instrumental contingencies. Interventions that incorporate the use of tangible rewards for cigarette abstinence and/or costs for smoking. For the purposes of analysis, simple agreements about a quit date, or other agreements between treatment providers and patients without specifiable consequences, as well as deposits refunded based on study attendance and/or other incentives that were not contingent on smoking abstinence or relapse were not considered examples of contingency contracting.

Continuous abstinence. A measure of tobacco abstinence based on whether subjects are continuously abstinent from smoking/tobacco use from their quit day to a designated outcome point (e.g., end of treatment, 6 months after the quit day).

Cost effectiveness. Quantified analysis of tobacco dependence program costs relative to tobacco use related costs.

Diazepam. A benzodiazepine medication intended to reduce anxiety.

Discrepancy. A strategy used in motivational interviewing to highlight how a patient's expressed priorities, values, and goals may conflict with the use of tobacco.

Efficacy and effectiveness. *Efficacy* is the outcome achieved from a treatment provided under near-ideal circumstances of control (typically, in a research study). Efficacy studies involve recruitment of motivated participants, random assignment, intensive assessment, and methods designed to keep participants in treatment. *Effectiveness* is the outcome achieved from a treatment provided in a "real-world setting" (in a clinic or community

setting). Such studies typically involve participants who do not seek out the study or treatment, and the treatment is delivered in a manner consistent with its likely use in real-world settings. This 2008 clinical update uses the term "effectiveness" exclusively, recognizing that the majority of the studies summarized here reflect efficacy research that requires random assignment and a high degree of experimental control. This was done for purposes of clarity for its intended clinical audience.

Environmental tobacco smoke (ETS). Also known as "secondhand smoke" (SHS). The smoke inhaled by an individual not actively engaged in smoking, but who is exposed to smoke from the lit end of a cigarette and the smoke exhaled by the smoker.

Exercise/fitness component. Refers to an intervention that contains a component related to exercise/fitness. The intensity of interventions falling within this category varies from the mere provision of information/advice about exercise/fitness to exercise classes.

Extratreatment social support component. Interventions or elements of an intervention in which patients are provided with tools or assistance in obtaining social support outside the treatment environment. This category is distinct from intratreatment social support, in which social support is delivered directly by treatment staff.

Fax-to-quit. Patient referral in which the patient and health care provider fill out a form with pertinent patient information, which is faxed to a quitline for followup.

Food and Drug Administration (FDA). Federal regulatory agency that has control over the safety and release of drugs marketed in the United States.

First-line medications. First-line medications have been found to be safe and effective for tobacco dependence treatment and have been approved by the FDA for this use. First-line medications have an established empirical record of efficacy and should be considered first as part of tobacco dependence treatment, except in cases of contraindications.

Fluoxetine. A selective serotonin re-uptake inhibitor used as a treatment for depression. Fluoxetine does not have an FDA indication for treating tobacco use and dependence.

Formats. Refers to tobacco dependence intervention delivery strategies that include self-help, proactive telephone counseling, computerized or e-health services, individual counseling, and group counseling.

Healthcare Effectiveness Data and Information Set (HEDIS). Serves as a "report card" for providing information on quality, utilization, enrollee access and satisfaction, and finances for managed care organizations and other health care delivery entities.

Higher intensity counseling. Refers to interventions that involve extended contact between clinicians and patients. It is coded based on the length of contact between clinicians and patients (greater than 10 minutes). If that information is unavailable, it is coded based on the content of the contact between clinicians and patients.

Hookah. A smoking pipe designed with a long tube passing through an urn of water that cools the smoke as it is drawn through. Also called "waterpipe," "hubble-bubble," "narghile," "shisha."

Hotline/helpline. A reactive telephone line dedicated to over-the-phone smoking intervention. Hotline/helpline treatment occurs when a hotline/helpline number is provided to a patient, or a referral to a hotline/helpline is made. The key distinction between a hotline/helpline and proactive telephone counseling is that, in the former, the patient must initiate each clinical contact.

Hypnosis. A treatment by which a clinician induces an altered attention state and heightened suggestibility in a tobacco user for the purpose of promoting abstinence from tobacco use. Also referred to as hypnotherapy.

Individualized interventions. Refers to tailoring an intervention to fit the needs of a particular smoker. For example, relapse prevention can be individualized based on information obtained about problems the patient has encountered in maintaining abstinence. See also Tailored Interventions.

Intent-to-treat. Treatment outcome analyses that determine abstinence percentages based on all subjects randomized to treatment conditions, rather than on just those subjects who completed the intervention or those who could be contacted at followup.

Intensive interventions. Comprehensive treatments that may occur over multiple visits for long periods of time and may be provided by more than one clinician.

Internet (Web-based) interventions. Interventions delivered through the use of a computer. The smoker may navigate within a specific Web site to access general treatment and treatment information, or the smoker may interact with a program that delivers a tailored intervention.

Intervention. An action or program that aims to bring about identifiable outcomes. In tobacco dependence treatment, the intervention generally is clinical in nature and may consist of counseling and the use of medications. Also referred to as "treatment."

Intratreatment social support. Refers to an intervention component that is intended to provide encouragement, a sense of concern, and empathic listening as part of the treatment.

Light smoker. The field of tobacco dependence research has not achieved consensus regarding the definition of a light smoker. For this publication, it refers to anyone who smokes between 1 and 10 cigarettes per day.

Literature review. A critical analysis of the research conducted on a particular topic or question in the field of science.

Logistic regression. Statistical technique to determine the statistical association or relation between/among two or more variables, in which the dependent variable is dichotomous (has only two levels of magnitude, e.g., abstinent vs. smoking).

Low-intensity counseling. Low-intensity counseling refers to interventions that involve contact between clinicians and patients that last between 3 and 10 minutes. If the information on length of contact is unavailable, it is coded based on the description of content of the clinical intervention.

Managed care organizations (MCOs). Any group implementing health care using managed care concepts, such as preauthorization of treatment, utilization review, system-wide quality improvement strategies, and a network of providers.

Mecamylamine. A nicotine antagonist used as an antihypertensive agent. Mecamylamine does not have an FDA indication for treating tobacco use and dependence.

Meta-analysis. A statistical technique that estimates the impact of a treatment or variable across a set of related studies, publications, or investigations.

Minimal counseling. Minimal counseling refers to interventions that involve very brief contact between clinicians and patients. It is coded based on the length of contact between clinicians and patients (3 minutes or less). If that information is unavailable, it is coded based on the content of the clinical intervention.

Motivation. Refers to a patient's intent or resolve to quit. Motivation can be bolstered through actions, such as setting a quit date, using a contract with a specified quit date, reinforcing correspondence (letters mailed from clinical/study staff congratulating the patient on his or her decision to quit or on early success), and providing information about the health risks of smoking.

Motivational intervention. An intervention designed to increase the smoker's motivation to quit.

Motivational interviewing (MI). A directive and patient-centered counseling method used to increase motivation and facilitate change.

Naltrexone. An opioid receptor antagonist used in substance abuse treatment. Naltrexone does not have an FDA indication for treating tobacco use and dependence.

National Committee for Quality Assurance (NCQA). Reviews and accredits managed care organizations, develops processes for measuring health plan performance, and disseminates information about quality so consumers can make informed choices (e.g., through "report cards," such as HEDIS).

Negative affect/depression intervention. A type of intervention designed to train patients to cope with negative affect after smoking cessation. The intensity of the interventions in this category may vary from prolonged counseling to the provision of information about coping with negative

moods. To receive this code, interventions target depressed mood, not simply stress. Interventions aimed at teaching subjects to cope with stressors are coded as problemsolving. When it is unclear whether an intervention is directed at negative affect/depression or at psychosocial stress, problemsolving is used as the default code.

Neuroteratogenic. The capability of some substances to cause abnormal development of the nervous system in the fetus.

Neurotoxicity. The capablility of some substances to cause damage to the nervous system.

Nicotine gum. Nicotine-containing gum, a smoking cessation aid, that delivers nicotine through the oral mucosa. It is available without a prescription.

Nicotine inhaler. Nicotine-containing inhaler, a smoking cessation aid, that delivers nicotine in a vapor that is absorbed through the oral mucosa. It is available by prescription only.

Nicotine lozenge. Nicotine-containing hard lozenge, a smoking cessation aid, that delivers nicotine through the oral mucosa. It is available without a prescription.

Nicotine nasal spray. Nicotine-containing spray, a smoking cessation aid, that delivers nicotine in a mist that is absorbed in the nasal passages. It is available by prescription only.

Nicotine patch. A nicotine-containing patch, a smoking cessation aid, that delivers nicotine through the skin; available with or without a prescription.

Nicotine replacement therapy (NRT). Refers to medications containing nicotine that are intended to promote smoking cessation. There are five NRT delivery systems currently approved for use in the United States. These include nicotine gum, nicotine inhaler, nicotine lozenge, nicotine nasal spray, and nicotine patch.

Nortriptyline. A tricyclic antidepressant identified by the Guideline Panel as a second-line medication for smoking cessation. Nortriptyline does not have an FDA indication for treating tobacco use and dependence.

Odds ratio. The odds of an outcome on one variable, given the certain status of another variable(s). This ratio expresses the increase in risk of a given outcome if a specific variable is present.

Opioid antagonists. A class of medications that block action at opiate receptor sites. Naltrexone is one type of opioid antagonist. No opioid antagonist has an FDA indication for treating tobacco use and dependence.

Oral mucosa. The mucous membranes that line the mouth.

Over-the-counter (OTC). Drug or medication for which a prescription is not needed.

Pay for performance. An incentive program in which a health care purchaser provides additional payments or other rewards usually to a clinic or provider if a specified goal is met.

Person-to-person intervention. In-person or face-to-face contact between a clinician and a patient for the purpose of tobacco use intervention or assessment.

Physiological monitoring/biological marker feedback. A treatment by which a clinician provides to a tobacco user biological information, such as spirometry readings, carbon monoxide readings, or genetic susceptibility information, for the purpose of increasing abstinence from tobacco use.

Placebo. An inactive, harmless substance with no known direct beneficial effects. Usually used in clinical studies as a comparison to the effectiveness of an experimental drug or regimen.

Point prevalence. A measure of tobacco abstinence based on smoking/tobacco use occurrence within a set period (usually 7 days), prior to a followup assessment.

Potential reduced exposure products (PREP). Products designed to reduce levels of tobacco intoxicants including: (1) modified tobacco products, (2) tobacco products that are heated rather than burned, (3) oral, low-nitrosamine tobacco products, and (4) medicinal nicotine products (e.g., NRTs). With the exception of NRTs, little research has been conducted to evaluate PREPs.

Practical counseling (problemsolving/skills training). Refers to a tobacco use treatment in which tobacco users are trained to identify and cope with events or problems that increase the likelihood of their tobacco use. For example, quitters might be trained to anticipate stressful events and to use coping skills, such as distraction or deep breathing, to cope with an urge to smoke. Related interventions are coping skill training, relapse prevention, and stress management.

Primary care clinician. A clinician (e.g., in medicine; nursing; psychology; pharmacology; dentistry/oral health; physical, occupational, and respiratory therapy) who provides basic health care services for problems other than tobacco use *per se*. Primary care providers are encouraged to identify tobacco users and to intervene, regardless of whether tobacco use is the patient's presenting problem.

Proactive telephone counseling. A quitline that responds to incoming calls and makes outbound followup calls. Following an initial request by the smoker or via a fax-to-quit program, the clinician initiates telephone contact to counsel the patient (see Hotline/Helpline).

Propranolol. A beta-adrenergic blocker often used as an antihypertensive medication. Propranolol does not have an FDA indication for treating tobacco use and dependence.

Psychosocial interventions. Refers to intervention strategies that are designed to increase tobacco abstinence rates due to psychological or social support mechanisms. These interventions comprise counseling, self-help, and behavioral treatment, such as rapid smoking and contingency contracting.

Purchaser. A corporation, company, Government agency, or other consortium that purchases health care benefits for a group of individuals.

Quality-adjusted life years (QALY). Measure of both the quality and the quantity of life lived. Used as a means of quantifying the benefits of a medical intervention.

Quit day. The day of a given cessation attempt during which a patient tries to abstain totally from tobacco use. Also refers to a motivational intervention, whereby a patient commits to quit tobacco use on a specified day.

Quitline. A telephone counseling service that can provide both proactive telephone counseling and reactive telephone counseling (see Proactive Telephone Counseling and Reactive Telephone Counseling).

Randomized controlled trial. A study in which subjects are assigned to conditions on the basis of chance, and where at least one of the conditions is a control or comparison condition.

Random effects modeling. A model in which both study sampling errors (variance) and between-study variation are included in the assessment of the uncertainty (confidence interval) of the results of a meta-analysis. If there is significant heterogeneity among the results of included studies, random effects models will give wider confidence intervals than fixed effect models.

Rapid puffing/smoking. A smoking cessation technique that involves the pairing of concentrated smoking with negative associations or responses (e.g., nausea).

Reactive telephone counseling. Telephone counseling that provides an immediate response to a patient-initiated call for assistance. It is a quitline intended to respond only to incoming calls (see Hotline/Helpline).

Reference group. In meta-analyses, refers to the group against which other groups are compared (i.e., a comparison or control group).

Relapse. Return to regular smoking by someone who has quit. A distinction is sometimes made between "relapse" and a "lapse" (or a "slip"), which is a return to reduced smoking or brief smoking after quitting that falls short of a return to regular smoking (see also Slip).

Relapse prevention. Various intervention strategies intended to prevent a recent quitter from returning to regular smoking.

Relaxation/breathing. An intervention strategy in which patients are trained in relaxation techniques, such as meditation and breathing exercises. This intervention should be distinguished from "problemsolving," which includes a much wider range of stress-reduction/management strategies.

Restricted environmental stimulation therapy (REST). A treatment involving the use of sensory deprivation to promote abstinence from tobacco use.

Return on investment (ROI). Amount of money gained or lost, including money that would have been spent for health care, in relation to the amount of money needed to provide the treatment.

Screening. See Clinic Screening System.

Secondhand smoke. Also known as environmental tobacco smoke (ETS). The smoke inhaled by an individual not actively engaged in smoking, but who is exposed to smoke from the lit end of a cigarette and the smoke exhaled by the smoker.

Second-line medications. Second-line medications are medications for which there is evidence of efficacy for treating tobacco dependence. They have a more limited role than first-line medications because: (1) the FDA has not approved them for a tobacco dependence treatment indication, and (2) there are more concerns about potential side effects than exist with first-line medications. Second-line treatments should be considered for use on a case-by-case basis after first-line treatments have been used or considered.

Selective Serotonin Re-uptake Inhibitors (SSRIs). A class of antidepressant used in the treatment of clinical depression that has been studied for use in tobacco dependence treatment. No SSRI has an FDA indication for treating tobacco use and dependence.

Self-efficacy. One's beliefs about his/her capability to successfully act to achieve specific goals or influence events that affect one's life.

Self-help. An intervention strategy in which the patient uses a nonpharmacologic physical aid to achieve abstinence from tobacco. Self-help strategies typically involve little contact with a clinician, although some strategies (e.g., reactive hotline/helpline) involve patient-initiated contact. Types of self-help materials include: pamphlets/booklets/mailings/manuals; videos; audios; referrals to 12-step programs; mass media, community-level interventions; lists of community programs; reactive telephone hotlines/helplines; and computer programs/Internet.

Self-reported abstinence. Abstinence based on the patient's claim, which may or may not be verified clinically by biochemical confirmation.

Sertraline. A selective serotonin re-uptake inhibitor. Sertraline does not have an FDA indication for treating tobacco use and dependence.

Serum nicotine. Level of nicotine in the blood. This often is used to assess a patient's tobacco/nicotine self-administration prior to quitting, and to confirm abstinence self-reports during followup. Nicotine commonly is measured in urine and saliva.

Serum nicotine/cotinine levels. Level of nicotine/cotinine in the blood. Cotinine is nicotine's major metabolite, which has a significantly longer half-life than nicotine. This often is used to estimate a patient's tobacco/nicotine self-administration prior to quitting, and to confirm abstinence self-reports during followup. Cotinine commonly is measured in urine and saliva.

Side effects. Undesired actions or effects of a drug used in tobacco use treatment, such as insomnia or dry mouth.

Silver acetate. Silver acetate reacts with cigarette smoke to produce an unpleasant taste and has been investigated as a smoking deterrent. It is not approved by the FDA for this use.

Skills training. Refers to a tobacco use treatment in which tobacco users are trained to identify and cope with events or problems that may increase the risk of tobacco use. For example, quitters might be trained to anticipate stressful events and to use coping skills, such as distraction or deep breathing, to cope with an urge to smoke. Related interventions are practical counseling, relapse prevention, and stress management.

Slip. A brief or reduced return to smoking after quitting. Also referred to as a "lapse" (see Relapse).

Smokeless tobacco. Any form of unburned tobacco, including chewing tobacco, snus, and snuff. Use of smokeless tobacco is as addictive as smoking and can cause cancer of the gum, cheek, lip, mouth, tongue, throat, and pancreas.

Social support. Nonmedicinal support for the smoking cessation patient that provides personal encouragement and empathetic listening. Tobacco dependence treatments include two types of social supports: intratreatment social support and extratreatment social support.

Socioeconomic status (SES). Position of an individual or group in a population or society, usually based on income, education, or occupational categories.

Specialized assessments. Refers to assessment of patient characteristics, such as nicotine dependence and motivation for quitting, that may allow clinicians to tailor interventions to the needs of the individual patient.

Stepped-care. The practice of initiating treatment with a low-intensity intervention and then exposing treatment failures to successively more intense interventions.

Sudden Infant Death Syndrome (SIDS). Unexpected and sudden death of an apparently healthy infant during sleep with no autopsic evidence of disease. It is the leading cause of death in infants between 2 weeks and 1 year of age. The cause is unknown, but certain risk factors have been identified, such as prematurity; low birth-weight; birth in winter months; and mothers who are very young, smoke, are addicted to a drug, or have had a recent upper respiratory infection. Also called "cot death" and "crib death."

Tailored interventions. Tailored interventions are based on a dimension or a subset of dimensions of the individual (i.e., weight concerns, dependency, etc.). See also Individualized Interventions.

The Joint Commission (TJC) (formerly Joint Commission on Accreditation of Healthcare Organizations, JCAHO). An independent, not-for-profit organization that evaluates and accredits more than 19,500 health care organizations in the United States, including hospitals, health care networks, managed care organizations, and health care organizations that provide home care, long-term care, behavioral health care, and laboratory and ambulatory care services.

Tobacco dependence. Dependence on any form of tobacco, including, but not exclusive to, cigarettes, pipes, cigars, and chewing tobacco.

Tobacco treatment specialists. These specialists typically provide intensive tobacco interventions. Specialists are not defined by their professional affiliation or by the field in which they trained. Rather, specialists view tobacco dependence treatment as a primary professional role. Specialists possess the skills, knowledge, and training to provide effective interventions across a range of intensities, and often are affiliated with programs offering intensive treatment interventions or services.

Tobacco user. A person addicted to one or more forms of tobacco products.

Transdermal. Refers to delivery of a substance by absorption through the skin. Transdermal nicotine often is used as a synonym for "nicotine patch."

Treatment matching. Differential assignment of a patient to treatment based on the patient's pretreatment characteristics. Treatment matching is based on the notion that particular types of tobacco users are most likely to benefit from particular types of treatments.

Treatment. An action or program that aims to bring about identifiable outcomes. For tobacco dependence, the treatment generally is clinical in nature and may consist of counseling and the use of medications. Also may be referred to as "intervention."

Unaided quit attempts. Quit attempts made by patients, without the assistance of any clinical intervention or medications. Also known as "quitting cold turkey."

Varenicline. FDA-approved, non-nicotine recommended smoking cessation medication. Its mechanism of action is thought to be a function of its ability to serve both as a partial nicotine receptor agonist and a nicotine receptor antagonist. Available by prescription only.

Vital signs. Standard patient measurements to assess the critical body functions, including blood pressure, pulse, weight, temperature, and respiratory rate. The first step (i.e., the first "A") to providing smoking cessation interventions is identifying smokers. Vital signs should be expanded to include tobacco use status (current, former, never) or an alternative universal identification system in patient records.

Web-based interventions. See Internet Interventions.

Weight/diet/nutrition. An intervention strategy designed to address weight gain or concerns about weight gain. Interventions that teach weight/diet/nutrition management strategies, incorporate daily/weekly weight monitoring (for reasons other than routine data collection), require or suggest energy intake maintenance/reduction, and/or convey nutritional information/tips/counseling receive this code.

Withdrawal symptoms. A variety of unpleasant symptoms (e.g., difficulty concentrating, irritability, anxiety, anger, depressed mood, sleep disturbance, and craving) that occur after use of an addictive drug is reduced or stopped. Withdrawal symptoms are thought to increase the risk for relapse.

Contributors

Guideline Panel

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Dr. Fiore completed medical school at Northwestern University and his internal medicine training at Boston City Hospital. His postgraduate education included a master's degree in public health in epidemiology from Harvard University. Dr. Fiore received additional training in epidemiology as an Epidemic Intelligence Service Officer for the Centers for Disease Control and Prevention, where he completed a preventive medicine residency program. Dr. Fiore worked as a medical epidemiologist at the U.S. Office on Smoking and Health, where he contributed to a wide range of national research, educational, and policy projects to control the epidemic of tobacco-related diseases. He is Director of the Center for Tobacco Research and Intervention and a Professor of Medicine at the University of Wisconsin School of Medicine and Public Health. He served as Chair of the Agency for Healthcare Policy and Research Panel that produced the *Smoking Cessation Clinical Practice Guideline No. 18* (1996) and Chair of the Public Health Service Panel that produced *Treating Tobacco Use and Dependence: A Clinical Practice Guideline* (2000). Dr. Fiore serves as Director (with Dr. Susan Curry) of a Robert Wood Johnson Foundation National Program, Addressing Tobacco in Health Care.

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Dr. Jaén completed medical school at the State University of New York at Buffalo, and his family medicine residency and primary care research fellowship at Case Western Reserve University in Cleveland, Ohio. His graduate education included a PhD in epidemiology, with a concentration in

tobacco control at Roswell Park Cancer Institute. He is Professor and Chair of the Department of Family and Communty Medicine at the University of Texas Health Science Center at San Antonio. He also is Co-Director of the American Academy of Family Physicians-funded Center for Research in Family Medicine and Primary Care. Dr. Jaén, active in primary care and public health research since 1985, has authored more than 70 publications on smoking cessation and related subjects, clinical preventive service delivery in primary care offices, and access to care by the urban poor and Hispanic populations. In 2005, he was appointed to the National Advisory Council to the Agency for Healthcare Research and Quality of the U.S. Public Health Service. He is a practicing family physician in the University of Texas Health Science Center at San Antonio and has been selected to the Best Doctors in America since 2002.

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Dr. Baker is a Professor of Medicine at the University of Wisconsin School of Medicine and Public Health. His principal research goals are to increase understanding of the motivational bases of addictive disorders and to develop and evaluate treatments for such disorders. He also is highly interested in developing and using technological advances to deliver effective treatments to ameliorate health problems such as addictive disorders and cancer. Dr. Baker is a long-serving member of the NIDA-E study section, has served as the Editor of the *Journal of Abnormal Psychology*, is the principal investigator of the University of Wisconsin Transdisciplinary Tobacco Use Research Center award (NIDA), and has contributed chapters to multiple Reports of the Surgeon General.

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Dr. Bailey graduated from Tulane University Medical School in 1965. He is a Diplomate of the American Board of Internal Medicine in both Internal Medicine and Pulmonary Disease, having received certified specialty

training in these disciplines at Tulane University Medical Center and Charity Hospital of Louisiana. He has been on the faculty of the University of Alabama at Birmingham (UAB) since 1973. He has practiced medicine, taught, performed research, and been involved in administrative endeavors for his entire career. He has served on the Board of Directors of the American Thoracic Society and also has served on the Council of the National Heart, Lung, and Blood Institute. He has been a member of many editorial review boards of peer-reviewed journals and has served as a frequent scientific reviewer of both scientific articles and peer-reviewed research. He currently holds the Eminent Scholar Chair in Pulmonary Diseases and also is the Director of the UAB Lung Health Center, which is devoted to research in the prevention of lung disease.

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Dr. Benowitz is Professor of Medicine, Psychiatry, and Biopharmaceutical Sciences and Chief, Division of Clinical Pharmacology and Experimental Therapeutics, University of California, San Francisco (UCSF). He received his MD from the University of Rochester School of Medicine in 1969, and he served as a resident in internal medicine at the Bronx Municipal Hospital Center from 1969 to 1971. He then completed a postdoctoral fellowship in clinical pharmacology at UCSF and joined the faculty at UCSF in 1974. His research interests have focused primarily on the human pharmacology and toxicology of nicotine, caffeine, and other stimulant drugs. He has published more than 300 research papers. Dr. Benowitz was a scientific editor of the 1988 *United States Surgeon General's Report on Smoking and Health: Nicotine Addiction,* and served as a member of the NIH Pharmacology Study Section. Dr. Benowitz is a member of a number of medical societies, including the American Society for Clinical Investigation and the Association of American Physicians. He has served as President of the American Society for Clinical Pharmacology and Therapeutics and the Society for Research on Nicotine and Tobacco. He has received the Ove Ferno, Alton Ochsner, and Rawls Palmer Progress in Medicine awards and the Oscar B. Hunter Award in Therapeutics for his research on nicotine, tobacco, and health, and was the 2002 UCSF Annual Distinguished Clinical Research Lecturer. Dr. Benowitz is currently Director of the Flight Attendants Medical Research Institute Center of Excellence

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Dr. Curry is the Director of the Institute for Health Research and Policy and Professor of Health Policy and Administration at the University of Illinois at Chicago (UIC). Prior to joining UIC in 2001, she was Professor of Health Services in the School of Public Health and Community Medicine at the University of Washington, and Director and Senior Investigator at the Center for Health Studies, Group Health Cooperative. Dr. Curry's research in tobacco includes studies of motivation to quit smoking; randomized trials of promising smoking cessation and prevention interventions; and evaluations of the use and cost-effectiveness of tobacco cessation treatments under different health insurance plans, and health care costs and utilization associated with tobacco cessation. Dr. Curry serves as Director (with Dr. Michael Fiore) of a Robert Wood Johnson Foundation National Program, Addressing Tobacco in Health Care, and heads the Helping Young Smokers Quit national initiative funded by the Robert Wood Johnson Foundation, Centers for Disease Control and Prevention, and the National Cancer Institute (NCI). She currently serves on the Board of Directors for the American Legacy Foundation and is a member of the Board of Scientific Advisors for NCI.

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Dr. Dorfman holds a degree in economics from Harvard College, a master's degree in health services administration, and an MD from Stanford University. She trained in reproductive health epidemiology as an Epidemic Intelligence Service Officer at the Centers for Disease Control and Prevention. She is board certified both in obstetrics and gynecology and in public health/general preventive medicine, and is an alumna of the Public Health Leadership Institute. Dr. Dorfman has consulted for state, regional, national, and international organizations, and was Commissioner of Health

for Orange County, New York, from 1988 to 1994, effectively implementing New York State's then new Clean Indoor Air Act. She has published and presented extensively for professional and lay audiences, co-chaired the American Medical Women's Association (AMWA) Anti-Smoking Task Force, chaired the AMWA Reproductive Health Initiative, and is the recipient of numerous honors and awards. In addition to administrative, research, and editorial responsibilities, Dr. Dorfman remains clinically active as a gynecologist.

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Dr. Froehlicher holds degrees in nursing with a minor in business administration from the University of Washington, Seattle, and an MPH and a PhD from the University of California, Los Angeles. Her areas of research and teaching are in the primary, secondary, and tertiary prevention (rehabilitation) of cardiovascular disease. She served as Co-Chair for the Cardiac Rehabilitation Guideline 1995, and as a reviewer for the Unstable Angina and Congestive Heart Failure Federal Guideline. Her specific research focus is on behavioral interventions to promote physical activity and exercise, women's health issues, and international health. Her focus with respect to smoking is on randomized clinical trials to study the efficacy of nurse-managed smoking cessation in women with cardiovascular disease, the older American smoker, and the African-American population; as well as international initiatives in Korea, Jordan, and Japan.

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Dr. Goldstein is board certified in internal medicine and psychiatry and currently serves as an Associate Director for Clinical Education and Research at the Institute for Healthcare Communication (IHC) in New Haven, Connecticut. The IHC is a nonprofit foundation dedicated to improving health care through enhanced clinician-patient communication. Also, he is an investigator at the Centers for Behavioral and Preventive Medicine

at the Miriam Hospital in Providence, Rhode Island, and an Adjunct Professor of Psychiatry and Human Behavior at the Warren Alpert Medical School of Brown University. Dr. Goldstein's primary research interests have included developing and testing interventions to enhance the delivery of smoking cessation and other preventive care interventions in primary care settings. Dr. Goldstein has served as a member of the Task Force on Nicotine Dependence of the American Psychiatric Association (APA) and also served on the APA Nicotine Dependence Practice Guideline Panel. He has published extensively in the areas of behavioral medicine, smoking cessation, and health care communication.

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Following the creation of the American Legacy Foundation in 1999, Dr. Healton joined the staff as the first President and Chief Executive Officer of this groundbreaking public health nonprofit, created by the historic Master Settlement Agreement between 46 state attorneys general, five U.S. territories, and the tobacco industry. Dr. Healton was selected for this post following a nationwide search, and she has worked tirelessly to further the foundation's ambitious mission: "To build a world where young people reject tobacco and anyone can quit." During her tenure with the Foundation, she has guided the highly acclaimed, national youth tobacco prevention counter-marketing campaign, *truth,*® which has been credited in part with reducing youth smoking prevalence to its current 28-year low.

Although her current focus is aimed at reducing the deadly toll of tobacco on Americans, Dr. Healton's long and dynamic career in the field of public health has earned her national recognition and praise. She holds a doctorate from Columbia University's School of Public Health and a master's degree in public administration at New York University for health policy and planning. She joined the American Legacy Foundation from Columbia University's Joseph L. Mailman School of Public Health in New York, where she served as Head of the Division of Socio-Medical Sciences and Associate Dean for Program Development.

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Dr. Nez Henderson received her bachelor of science degree in biochemistry from the University of Arizona and earned her doctor of medicine and master of public health degrees from Yale University. Upon graduating from medical school, Dr. Nez Henderson joined the Black Hills Center for American Indian Health, an American Indian nonprofit health organization located in Rapid City, South Dakota, where she currently serves as Vice President. In addition, Dr. Nez Henderson is a faculty member at the University of Colorado at Denver Health Sciences Center within the American Indian and Alaska Native Programs. For the past 7 years, her research interest has focused on tobacco-related issues in American Indian communities. Her research findings have been published in peer-reviewed medical journals. Through culturally appropriate and relevant research, she plans to provide Native communities with information that can be used for health planning and policy decisionmaking.

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Dr. Koh graduated from Yale College and Yale University School of Medicine. He completed his postgraduate training at Boston City Hospital and Massachusetts General Hospital, serving as Chief Resident in both institutions. Dr. Koh has earned board certification in four medical fields (internal medicine, hematology, medical oncology, and dermatology) as well as a master of public health degree from Boston University School of Public Health. While serving as Commissioner of Public Health for the Commonwealth of Massachusetts (1997–2003), he oversaw the nationally recognized Massachusetts Tobacco Control Program. During this time, Massachusetts ranked as one of the healthiest states in the country. Dr. Koh is principal investigator of the National Cancer Institute-funded initiative MassCONECT (Massachusetts Community Networks to Eliminate Cancer Disparities through Education, Research, and Training), a project to eliminate cancer disparities in underserved communities. He has published more than 200 scientific articles in the medical and public health literature. President Bill Clinton appointed Dr. Koh to the National Cancer Advisory Board (2000–2002). Dr. Koh also has been elected to the Institute of Medicine (IOM) of the National Academies and is a member of the IOM Roundtable on Racial and Ethnic Health Disparities.

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Dr. Kottke is a clinical cardiologist, epidemiologist, and health services researcher whose primary interest is describing, defining, and overcoming the barriers to the delivery of clinical services for the primordial, primary, and secondary prevention of chronic diseases. He has published widely on

the evidence that clinical support systems are necessary for physicians and other health care professionals to provide these services to the patients they serve. Dr. Kottke was a member of the first U.S. Preventive Services Task Force.

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Dr. Lando is internationally recognized for his work in smoking cessation. He has been active in this field since 1969 and has published extensively in this area, with a total of more than 170 scientific publications. He was a scientific editor of the *1988 Report of the Surgeon General, The Health Consequences of Smoking: Nicotine Addiction* and a member of the Center for Child Health Research Tobacco Consortium of the American Academy of Pediatrics. He is Deputy Regional Editor for *Addiction*. He has consulted actively with such government and voluntary agencies as the National Heart, Lung, and Blood Institute; the National Cancer Institute; the Centers for Disease Control and Prevention; the National Institute on Drug Abuse; the Agency for Healthcare Research and Quality; the American Cancer Society; the American Lung Association; and the World Health Organization. Dr. Lando is a past president of the Society for Research on Nicotine and Tobacco and currently chairs the SRNT Global Network Committee. He is a 2006 recipient of the University of Minnesota Award for Global Engagement; this award carries with it the title of "Distinguished International Professor." He is serving as Vice President of the 14th World Conference on Tobacco OR Health, to be held in 2009 in Mumbai, India.

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Dr. Mecklenburg is a Diplomate of the American Board of Dental Public Health and an Assistant Surgeon General (ret. O-8). He organized and managed dental affairs for the National Cancer Institute's (NCI) Tobacco Control Research Branch and was the Tobacco-Related Research and Development Advisor for the National Institute of Dental and Craniofacial Research's Office of Science Policy and Analysis. He chaired the National Dental Tobacco-Free Steering Committee and was Vice-Chairman of the Dentistry Against Tobacco Section/Tobacco and Oral Health Committee of

the FDI World Dental Federation. He chaired the committee on noncancer oral effects of tobacco for the first Surgeon General's report on smokeless tobacco. He was the principal author of the NCI publications, *Tobacco Effects in the Mouth* and *How to Help Your Patients Stop Using Tobacco: A Manual for the Oral Health Team*. Dr. Mecklenburg has published and lectured widely in the United States and abroad about dental professionals' involvement in the creation of a tobacco-free society.

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Dr. Mermelstein is Professor of Psychology, Director of the Center for Health Behavior Research, and Deputy Director of the Institute for Health Research and Policy at the University of Illinois at Chicago. She holds a PhD in clinical and community psychology from the University of Oregon. Her research interests fall broadly in the area of tobacco use, with studies ranging from longitudinal examinations of the etiology of youth smoking and interventions for adolescents to stop smoking to cessation interventions for adult smokers. Dr. Mermelstein has been the principal investigator on several grants from the National Cancer Institute (NCI) investigating trajectories of adolescent smoking, with a focus on social and emotional contextual factors. In addition, she has been funded by the Centers for Disease Control and Prevention to examine factors related to youth smoking, and by the National Heart, Lung, and Blood Institute and NCI for studies of adult smoking cessation. Dr. Mermelstein was the Director of the Robert Wood Johnson Foundation's (RWJF) Program Office, A Partners with Tobacco Use Research Centers: A Transdisciplinary Approach to Advancing Science and Policy Studies. As part of this program, the RWJF collaborated with both NCI and the National Institute on Drug Abuse in funding the Transdisciplinary Tobacco Use Research Centers.

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Dr. Mullen received her graduate training at the University of California, Berkeley, School of Public Health and has extensive experience in managed care. Her tobacco cessation research has focused on pregnant and postpartum women (non-Hispanic white, African American, and Hispanic) from urban and rural environments, who were both privately insured and covered by Medicaid. She also has collaborated on smoking cessation research with international populations. Dr. Mullen served on the U.S. Expert Panel for the Content of Prenatal Care and on research advisory panels on prenatal smoking cessation for the National Institutes of Health, Centers for Disease Control and Prevention, the American Cancer Society, and the Robert Wood Johnson Foundation Smoke-Free Families Program. She has conducted systematic reviews and meta-analyses of smoking cessation programs for pregnant women and other topics and served as a member and Vice-Chair of the U.S. Community Preventive Services Task Force.

C. Tracy Orleans, PhD
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Dr. Orleans has led or co-led the Robert Wood Johnson Foundation (RWJF) public policy- and health care system-based grant making in the areas of tobacco control, physical activity promotion, childhood obesity prevention, and chronic disease management. She led the Foundation's Health & Behavior Team and has developed and/or managed numerous RWJF national initiatives, including Addressing Tobacco in Healthcare, Smoke-Free Families, Helping Young Smokers Quit, Bridging the Gap/Impact Teen, Substance Abuse Policy Research, Improving Chronic Illness Care, Active Living Research, and Healthy Eating Research. An internationally known clinical health psychologist, Dr. Orleans has authored or co-authored more than 200 publications; contributed to several Surgeon General's reports; served on numerous journal editorial boards, national scientific panels, and advisory groups (e.g., U.S. Preventive Services Task Force, Institute of Medicine, National Commission on Prevention Priorities); and as President of the Society of Behavioral Medicine.

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A graduate of Harvard College, Dr. Robinson received his MD from the University of Pennsylvania School of Medicine. He received his MPH and completed a residency in preventive medicine at Johns Hopkins University. He was a resident and faculty member at Rush and Columbia University while performing his internal medicine training. As Deputy Commissioner for Health Promotion/Disease Prevention for the Philadelphia Department of Public Health, Dr. Robinson is responsible for the development, planning, implementation, and evaluation of various programs delivering medical, chronic disease prevention, and health education services. Local antitobacco projects include banning vending machines, assisting the county jail move to a smoke-free environment, Nicotrol Patch replacement, and the American Cancer Society Fresh Start Program. This train-the-trainer program was provided to the mentally ill and other targeted populations. Dr. Robinson also is a board member of the Pennsylvania American Cancer Society and Chairman of the State Tobacco Core Team. He is a member of various groups, organizations, and agencies in the community working on issues such as the State Tobacco Settlement (No Butts/Do the Right Thing) and smoking prevention for youth and specific populations, such as pregnant women.

Maxine L. Stitzer, PhD
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Dr. Stitzer received her PhD in psychology and training in psychopharmacology from the University of Michigan. At Johns Hopkins University, she has developed a varied and extensive grant-supported research program focusing on both pharmacological and behavioral approaches to the treatment of substance abuse. Her many publications reflect active research interests in both illicit drug abuse and tobacco dependence. She has served as President of the Division on Psychopharmacology and Substance Abuse of the American Psychological Association, President of the Society for Research on Nicotine and Tobacco, and as a member of the Board of Directors of the College on Problems of Drug Dependence.

Anthony C. Tommasello, PhD, MS
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Dr. Tommasello, a pharmacist, is an Associate Professor in the Department of Pharmaceutical Health Services Research at the University of Maryland School of Pharmacy and Director, Office of Substance Abuse Studies, which he founded. He received his PhD in policy sciences from the University of Maryland, Baltimore County, and has worked in the addiction field since 1973. He is active in clinical and policy research and in addictions treatment and has created educational programs that have served as national models for pharmacists and other health and human service workers. Dr. Tommasello is President of the Maryland Pharmacists' Education and Advocacy Council, which provides advocacy and treatment referrals for impaired pharmacists. He has published in the areas of general principles of assessment and treatment, methadone maintenance care, and adolescent drug abuse and addiction and the pharmacist's role in substance abuse and addiction management.

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As Director of the Patient Education Office at the M.D. Anderson Cancer Center, Ms. Villejo is responsible for the design, implementation, evaluation, and management of institution-wide patient and family education programs. She has designed and implemented Patient/Family Learning Centers as well as award-winning, disease-specific patient education programs, and produced more than 100 patient education print materials and videotapes. For the past 10 years, she has served on the National Cancer Institute's Advisory Boards and Patient Education Network's Steering Committee, and on numerous other Federal and private advisory and planning boards and committees. Ms. Villejo's publications include articles on cancer patient education and cultural diversity in health care.

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Dr. Wewers, an Adult Nurse Practitioner, received her PhD in nursing from the University of Maryland and an MPH from Harvard University. She has been funded by the National Institutes of Health (NIH) to investigate reinforcement for nicotine in both human and animal models of dependence. Her current NIH-funded research examines nurse-managed tobacco cessation interventions in underserved groups. Dr. Wewers is past Chair of the Nursing Assembly of the American Thoracic Society and a past member of the Society's Board of Directors. She serves as Co-Program Leader for Cancer Control at The Ohio State University Comprehensive Cancer Center.

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Appendixes

Appendix A. Financial Disclosure for Panel Members, Liaisons, and Peer Reviewers

Panel Members

The evaluation of conflict for the 2008 Guideline Update comprised a two-stage procedure designed to obtain increasingly detailed and informative data on potential conflicts over the course of the Guideline development process.

1. In July 2006 and prior to the initial meeting in October 2006, Panel members completed a general screen, reporting any potential conflicts over the previous 5 years. Where potential conflicts existed, Panel members provided a narrative listing of the relevant organizations and types of conflict. Panel members were asked to update this screen as new information or potential conflicts became known.

2. Prior to the second in-person Panel meeting in June 2007, and before any decisions regarding Panel recommendations were made, Panel members were required to complete a more exhaustive disclosure process for calendar years 2005, 2006, and 2007, based on the United States Department of Health and Human Services, PHS Title 42, Chapter 1, Part 50 guidelines for the conduct of research (*ori.hhs.gov/policies/fedreg42cfr50.shtml*). Moreover, Panel members were asked to update this report as new information or potential conflicts became known. In keeping with the PHS-based guidelines, a potential conflict was designated as "significant" if one or more of three criteria were met:

A. Net reportable compensation in excess of $10,000 in any reporting year to the Panel member, spouse, or dependent child for outside activities from any entity whose interests may be affected by the recommendations in the Guideline (excluding public or nonprofit entities).

B. Leadership as an officer, director, or trustee in any reporting year by the Panel member, spouse, or dependent child in any entity whose interests may be affected by the recommendations in the Guideline (excluding public or nonprofit entities).

C. Ownership interests either in excess of $10,000 or 5 percent of the business in any reporting year by the Panel member, spouse, or dependent child in any entity whose interests may be affected by the recommendations in the Guideline (excluding public or nonprofit entities).

Panel members were asked to complete this PHS-based report for 3 calendar years (2005, 2006, 2007), that comprised both the 18-month period before the Guideline Panel was constituted, as well as the full period of Guideline development. For any significant conflict that was disclosed, Panel members provided a detailed description of the relevant organizational tie, including categorizing the amount of compensation or financial interests involved. Of the Panel members listed in this document, 21 of 24 had no significant financial interests as defined by the PHS-based criteria. In addition to these mandatory disclosures regarding compensation, leadership, and ownership, members were asked to disclose any other information that might be disclosed in a professional publication.

Three Panel members whose disclosures exceeded the PHS criteria for significant financial interest were recused from Panel deliberations relating to their areas of conflict; one additional Panel member voluntarily recused himself.

The following is a summary listing for any of the years 2005, 2006, and 2007 of all significant financial interests as defined above, as well as any additional disclosures Panel members chose to make.

William C. Bailey reported significant financial interests in the form of compensation from three different pharmaceutical companies in 2006 and two in 2007 for speaking engagements.

Timothy B. Baker reported no significant financial interests. Under additional disclosures, he reported that he has served as a co-investigator on research studies at the University of Wisconsin that were sponsored by four pharmaceutical companies.

Neal L. Benowitz reported significant financial interest in the form of compensation from one pharmaceutical company for each of the years 2005–2007, as well as stock ownership in one pharmaceutical company.

Under additional disclosures, he reported providing expert testimony in lawsuits against tobacco companies.

Susan J. Curry reported no significant financial interests and no additional disclosures.

Sally Faith Dorfman reported no significant financial interests. Under additional disclosures, she reported her employment by Ferring Pharmaceuticals, Inc., a company whose business does not relate to treating tobacco dependence.

Michael C. Fiore reported no significant financial interests. Under additional disclosures, he reported that he served as an investigator on research studies at the University of Wisconsin (UW) that were supported wholly or in part by four pharmaceutical companies, and in 2005 received compensation from one pharmaceutical company. In addition, he reported that, in 1998, the UW appointed him to a named Chair, which was made possible by an unrestricted gift to the UW from GlaxoWellcome.

Erika S. Froehlicher reported no significant financial interests and no additional disclosures.

Michael G. Goldstein reported no significant financial interests. Under additional disclosures, he reported that his employer received support from Bayer Pharmaceutical prior to 2005 and that he was employed by Bayer Pharmaceutical Corporation prior to January 1, 2005. His organization received payments for his professional services from two pharmaceutical companies and one commercial Internet smoking cessation site during the period 2005–2007.

Cheryl Healton reported no significant financial interests and no additional disclosures.

Patricia Nez Henderson reported no significant financial interests and no additional disclosures.

Richard B. Heyman reported no significant financial interests and no additional disclosures.

Carlos Roberto Jaén reported no significant financial interests and no additional disclosures.

Howard K. Koh reported no significant financial interests and no additional disclosures.

Thomas E. Kottke reported no significant financial interests and no additional disclosures.

Harry A. Lando reported no significant financial interests. Under additional disclosures, he reported serving on an advisory panel for a new tobacco use cessation medication and attending 2-day meetings in 2005 and 2006 as a member of this panel.

Robert E. Mecklenburg reported no significant financial interests. Under additional disclosures, he reported assisting Clinical Tools, Inc., through a governmental contract to develop a PHS 2000 Guideline-based Internet continuing education course.

Robin Mermelstein reported no significant financial interests and no additional disclosures.

Patricia Dolan Mullen reported no significant financial interests and no additional disclosures.

C. Tracy Orleans reported significant financial interests in the form of a dependent child who owns pharmaceutical stock, and no additional disclosures.

Lawrence Robinson reported no significant financial interests and no additional disclosures.

Maxine L. Stitzer reported no significant financial interests. Under additional disclosures, she reported participation on a pharmaceutical scientific advisory panel for a new tobacco use cessation medication.

Anthony C. Tommasello reported no significant financial interests and no additional disclosures.

Louise Villejo reported no significant financial interests and no additional disclosures.

Mary Ellen Wewers reported no significant financial interests and no additional disclosures.

Liaisons

Liaisons followed the same process as Panel members in reporting significant financial interests. Their disclosures are summarized below:

Glen Bennett reported no significant financial interests and no additional disclosures.

Stephen Heishman reported no significant financial interests and no additional disclosures.

Corinne Husten reported no significant financial interests and no additional disclosures.

Glen Morgan reported no significant financial interests and no additional disclosures.

Ernestine W. Murray reported no significant financial interests and no additional disclosures.

Christine Williams reported no significant financial interests and no additional disclosures.

Peer Reviewers

Peer reviewers were required to report significant financial interests at the time they submitted their peer reviews. The interests were reviewed prior to the adjudication of each reviewer's comments. Any significant financial interests are noted below their listing in the Contributors Section of this Guideline.

Outside Comments

The availability of the draft Guideline report for review was announced in the *Federal Register* on September 28, 2007 (Volume 72, Number 188). Individuals who had informed Panel members or staff that they wished the opportunity to review the document were provided with an opportunity to do so. All those submitting comments were asked to disclose significant financial interests at the time their comments were submitted. Prior to each set of comments being considered and adjudicated, the disclosure information (or lack of disclosure) was noted and taken into consideration.

Appendix B. Helpful Web Site Addresses

The inclusion of Web sites in this appendix is intended to assist readers in finding additional information regarding the treatment of tobacco use and dependence and related topics and does not constitute endorsement of the contents of any particular site. All Web sites listed are either Government-sponsored organizations or nonprofit foundations.

Addressing Tobacco in Healthcare (formerly Addressing Tobacco in Managed Care): *www.atmc.wisc.edu*

Agency for Healthcare Research and Quality: *www.ahrq.gov*

American Academy of Family Physicians: *www.aafp.org*

American Cancer Society: *www.cancer.org*

American College of Chest Physicians: *www.chestnet.org*

American Legacy Foundation: *www.americanlegacy.org*

American Lung Association: (maintains profiles of state tobacco control activities): *www.lungusa.org*

American Psychological Association: *www.apa.org*

Association for the Treatment of Tobacco Use and Dependence: *www.attud.org*

Campaign for Tobacco-Free Kids: *www.tobaccofreekids.org*

Chest Foundation: *www.chestfoundation.org/tobaccoPrevention/index.php*

Kaiser Family State Health Facts: *www.statehealthfacts.org*

Medicare and Medicaid: *www.cms.hhs.gov/mcd/viewdecisionmemo.asp?id=130* and *www.cms.hhs.gov/Smoking Cessation*

North American Quitline Consortium (NAQC): *www.Naquitline.org*

National Cancer Institute: *www.nci.nih.gov*

National Guideline Clearinghouse: *www.guideline.gov*

National Heart, Lung, and Blood Institute: *www.nhlbi.nih.gov*

National Institute on Drug Abuse: *www.nida.nih.gov*

Office on Smoking and Health at the Centers for Disease Control and Prevention: *www.cdc.gov/tobacco*

Robert Wood Johnson Foundation: *www.rwjf.org*

Society for Research on Nicotine and Tobacco: *www.srnt.org*

TobaccoFree Nurses: *www.tobaccofreenurses.org*

Tobacco Technical Assistance Consortium: *www.ttac.org*

University of Wisconsin Center for Tobacco Research and Intervention: *www.ctri.wisc.edu*

World Health Organization: *www.who.int*

World Health Organization – Tobacco Atlas: *www.who.int/tobacco/statistics/tobacco_atlas/en*

Appendix C. Coding Information Regarding the Diagnosis of and Billing for Tobacco Dependence Treatment

Coding for the Treatment of Tobacco Use

Clinicians, clinic administrators, and health care delivery systems require appropriate diagnostic and billing codes for the documentation and reimbursement of tobacco dependence treatment. Information on such codes may help address a common clinical concern regarding the treatment of tobacco-dependent patients: it is difficult to accurately document and obtain reimbursement for this treatment. Although examples of such codes are provided below, clinicians and billing coders may use other diagnostic and reimbursement codes to document and obtain payment for this medical treatment. Additionally, it is incumbent on the clinician to ensure that appropriate billing guidelines are followed and to recognize that reimbursement of these codes may vary by payor or benefits package. For example, although psychiatric therapeutic codes appropriate for treating tobacco dependence exist, some payors or benefits packages have restrictions on mental health benefits. Similarly, reimbursement for preventive visits varies greatly among payors and benefits packages.

A systems-based approach will facilitate the understanding and use of such codes by clinicians. For example, various clinic or hospital meetings (e.g., business sessions, grand rounds, seminars, and coding in-service sessions) can explain and highlight the use of tobacco dependence codes for diagnosis and reimbursement. Additionally, these diagnostic codes can be preprinted on the billing and diagnostic coding sheets as a "check-off" so that clinicians are not required to recall and manually document such treatment. Finally, clinicians can be reminded that counseling by itself is a reimbursable activity and can be billed-for based on the number of minutes of counseling.

1. Diagnostic Codes (ICD-9-CM)

When clinicians provide treatment to patients dependent on tobacco, the following diagnostic codes can be used. They can be found in the ICD-9-CM (*International Classification of Diseases, 9th Revision, Clinical Modification*) coding manual under several sections:

Mental Disorders (290-319)

305.1 Tobacco Use Disorder (Tobacco Dependence). Cases in which tobacco is used to the detriment of a person's health or social functioning or in which there is tobacco dependence. Tobacco dependence is included here rather than under drug dependence because tobacco differs from other drugs of dependence in its psychotropic effect. This excludes: History of tobacco use (V15.82).

V Codes

V15.82 History of Tobacco Use. This excludes: Tobacco dependence (305.1).

Diseases of Oral Cavity, Salivary Glands, and Jaws

523.6 Accretions on teeth
Supragingival: Deposits on teeth: tobacco.

Accidental Poisoning by Other Solid and Liquid Substances, Gases, and Vapors

E869.4 Secondhand tobacco smoke.

Complications Mainly Related To Pregnancy

649.0 Tobacco use disorder complicating pregnancy, childbirth, or the puerperium.

2. Billing Codes (Current Procedural Terminology [CPT] Codes)

A number of billing codes may be used for reimbursement of the provision of tobacco dependence treatment. The examples provided fall under the general categories of preventive medicine services, psychiatric therapeutic procedures, and dental codes.

A. Preventive Medicine Services

The following codes are used to report the preventive medicine evaluation and management of infants, children, adolescents, and adults.

The "comprehensive" nature of the Preventive Medicine Services codes 99383–99397 reflects an age- and gender-appropriate history/exam and is NOT synonymous with the "comprehensive" examination required in Evaluation and Management codes 99201–99350.

Codes 99383–99397 include counseling/anticipatory guidance/risk factor reduction interventions, which are provided at the time of the initial or periodic comprehensive preventive medicine examination. (Refer to codes 99401–99412 for reporting those counseling/anticipatory guidance/risk factor reduction interventions that are provided at an encounter separate from the preventive medicine examination.)

A1. Initial or Periodic Comprehensive Preventive Medicine Examination

New Patient

99383 Initial comprehensive preventive medicine.

Initial comprehensive preventive medicine evaluation and management of an individual, including an age and gender-appropriate history, examination, counseling/anticipatory guidance/risk factor reduction interventions, and the ordering of appropriate immunization(s), laboratory/diagnostic procedures, new patient; late childhood (age 5 through 11 years).

99384 Adolescent (age 12–17 years).

99385 Adult (age 18–39 years).

99386 Adult (age 40–64 years).

99387 Adult (age 65 years and older).

Established Patient

99393 Periodic comprehensive preventive medicine.

Reevaluation and management of an individual, including an age- and gender-appropriate history, examination, counseling/anticipatory guidance/risk factor reduction interventions, and the ordering of appropriate immunization(s), laboratory/diagnostic procedures, established patient; late childhood (age 5 through 11 years).

99394 Adolescent (age 12–17 years).

99395 Adult (age 18–39 years).

99396 Adult (age 40–64 years).

99397 Adult (age 65 years and older).

A2. Counseling and/or Risk Factor Reduction Intervention.

These codes are used to report services provided to individuals at a separate encounter for the purpose of promoting health and preventing illness or injury. As such, they are appropriate for the specific treatment of tobacco use and dependence. They are appropriate for initial or followup tobacco dependence treatments (new or established patient). For the specific preventive medicine counseling codes, the number of minutes counseled determines the level of billing (codes **99400–99404** for 15 to 60 minutes of counseling).

Preventive Medicine, Individual Counseling

99401 Preventive medicine counseling and/or risk factor reduction intervention(s) provided to an individual (separate procedure); approximately 15 minutes.

99402 Approximately 30 minutes.

99403 Approximately 45 minutes.

99404 Approximately 60 minutes.

Smoking Cessation Counseling

These codes are for face-to-face counseling by a physician or other qualified health care professional, using "standardized, evidence-based screening instruments and tools with reliable documentation and appropriate sensitivity."

99406 For intermediate visit of between 3 and 10 minutes.

99407 For an intensive visit lasting longer than 30 minutes.

Preventive Medicine, Group Counseling

99411 Preventive medicine counseling and/or intervention to treat the risk factor of tobacco use provided to an individual (separate procedure); approximately 30 minutes.

99412 Approximately 60 minutes.

B. Psychiatric Therapeutic Procedures/Codes for Billing

The psychiatric therapeutic procedure billing codes are typically used for insight-oriented, behavior modifying, and/or supported psychotherapy. This refers to the development of insight of affective understanding, the use of behavior modification techniques, the use of supportive interactions, the use of cognitive discussion of reality, or any combination of the above to provide therapeutic change. All of the counseling interventions for tobacco dependence demonstrated to be effective in this Guideline fall under these headings.

It should be noted that these billing codes can be modified for those patients receiving only counseling (psychotherapy) and for others that receive counseling (psychotherapy), medical evaluation, and management services. These evaluation and management services involve a variety of responsibilities unique to the medical management of psychiatric patients, such as medical diagnostic evaluation (e.g., evaluation of comorbid medical conditions, drug interactions, and physical examinations); drug management when indicated; physician orders; and interpretation of laboratory or other medical diagnostic studies and observations. Thus, the use of a psychiatric therapeutic billing code with medical evaluation and management services would be appropriate for the clinician who provides both of the key tobacco dependence interventions documented as effective in the Guideline: counseling and medications.

In documenting treatment for tobacco dependence using the psychiatric therapeutic procedure codes, the appropriate code is chosen on the basis of the type of psychotherapy (e.g., insight-oriented, behavior modifying, and/or supportive using verbal techniques); the place of service (office vs. inpatient); the face-to-face time spent with the patient during the treatment (both for psychotherapy and medication management); and whether evaluation and management services are furnished on the same date of service as psychotherapy.

B1. Office or Other Outpatient Facility

Insight-oriented, behavior modifying, and/or supportive psychotherapy.

90804 Individual psychotherapy, insight oriented, behavior modifying and/or supportive, in an office or outpatient facility, approximately 20 to 30 minutes face-to-face with the patient.

90805 With medical evaluation and management services.

90806 Individual psychotherapy, insight-oriented, behavior modifying, and/or supportive, in an office or outpatient facility, approximately 45 to 50 minutes face-to-face with the patient.

90807 With medical evaluation and management services.

90808 Individual psychotherapy, insight-oriented, behavior modifying, and/or supportive, in an office or outpatient facility, approximately 75 to 80 minutes face-to-face with the patient.

90809 With medical evaluation and management services.

B2. Inpatient Hospital, Partial Hospital, or Residential Care Facility

Insight-oriented, behavior modifying, and/or supportive psychotherapy.

90816 Individual psychotherapy, insight-oriented, behavior modifying, and/or supportive, in an inpatient hospital, partial hospital, or residential care setting, approximately 20 to 30 minutes face-to-face with the patient.

90817 With medical evaluation and management services.

90818 Individual psychotherapy, insight-oriented, behavior modifying, and/or supportive, in an inpatient hospital, partial hospital or residential care setting, approximately 45 to 50 minutes face-to-face with the patient.

90819 With medical evaluation and management services.

90821 Individual psychotherapy, insight-oriented, behavior modifying, and/or supportive, in an inpatient hospital, partial hospital or residential care setting, approximately 75 to 80 minutes face-to-face with the patient.

90822 With medical evaluation and management services.

B3. Other Psychotherapy

90853 Group psychotherapy (other than a multiple-family group).

C. Dental Code –CDT Codes

D1320 Tobacco counseling for the control and prevention of oral disease.

Please Note: The following section is included for informational purposes only.

The National Center for Health Statistics (NCHS), the Federal agency responsible for use of the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) in the United States, has developed a clinical modification of the classification for morbidity purposes. The **ICD-10** is used to code and classify mortality data from death certificates, having replaced ICD-9 for this purpose as of January 1, 1999. ICD-10-CM is planned as the replacement for ICD-9-CM, volumes 1 and 2.

An updated July 2007 release **of ICD-10-CM** is available for public viewing. **However, at the time of this printing, the codes in ICD-10-CM are not currently valid for any purpose or use other than mortality coding. Once implemented, this information must be validated as current before use.**

F17 Nicotine dependence

Excludes1: history of tobacco dependence (Z87.82) tobacco use NOS (Z72.0) Excludes2: tobacco use (smoking) during pregnancy, childbirth, and the puerperium (O99.33-) toxic effect of nicotine (T65.2-).

F17.2 Nicotine dependence

F17.20	Nicotine dependence, unspecified
F17.200	Nicotine dependence, unspecified, uncomplicated
F17.201	Nicotine dependence, unspecified, in remission
F17.203	Nicotine dependence, unspecified, with withdrawal nicotine-induced disorders
F17.209	Nicotine dependence, unspecified, with unspecified nicotine-induced disorders

F17.21 Nicotine dependence, cigarettes
F17.210 Nicotine dependence, cigarettes, uncomplicated
F17.211 Nicotine dependence, cigarettes, in remission
F17.213 Nicotine dependence, cigarettes, with withdrawal
F17.218 Nicotine dependence, cigarettes, with other nicotine-induced disorders
F17.219 Nicotine dependence, cigarettes, with unspecified nicotine-induced disorders

F17.22 Nicotine dependence, chewing tobacco
F17.220 Nicotine dependence, chewing tobacco, uncomplicated
F17.221 Nicotine dependence, chewing tobacco, in remission
F17.223 Nicotine dependence, chewing tobacco, with withdrawal
F17.228 Nicotine dependence, chewing tobacco, with other nicotine-induced disorders
F17.229 Nicotine dependence, chewing tobacco, with unspecified nicotine-induced disorders

F17.29 Nicotine dependence, other tobacco product
F17.290 Nicotine dependence, other tobacco product, uncomplicated
F17.291 Nicotine dependence, other tobacco product, in remission
F17.293 Nicotine dependence, other tobacco product, withwithdrawal
F17.298 Nicotine dependence, other tobacco product, with other nicotine-induced disorders
F17.299 Nicotine dependence, other tobacco product, with unspecified nicotine-induced disorders

O99.3 Mental disorders and diseases of the nervous system complicating pregnancy, childbirth, and the puerperium

O99.33 Smoking (tobacco) complicating pregnancy, childbirth, and the puerperium
Use additional code from F17 to identify type of tobacco.
O99.330 Smoking (tobacco) complicating pregnancy, unspecified trimester
O99.331 Smoking (tobacco) complicating pregnancy, first trimester

O99.332 Smoking (tobacco) complicating pregnancy, second trimester
O99.333 Smoking (tobacco) complicating pregnancy, third trimester
O99.334 Smoking (tobacco) complicating childbirth
O99.335 Smoking (tobacco) complicating the puerperium

T65 Toxic effect of other and unspecified substances

T65.2 Toxic effect of tobacco and nicotine

Excludes2: nicotine dependence (F17.-).

T65.21 Toxic effect of chewing tobacco
T65.211 Toxic effect of chewing tobacco, accidental (unintentional)
Toxic effect of chewing tobacco NOS
T65.212 Toxic effect of chewing tobacco, intentional self-harm
T65.213 Toxic effect of chewing tobacco, assault
T65.214 Toxic effect of chewing tobacco, undetermined

T65.22 Toxic effect of tobacco cigarettes
Toxic effect of tobacco smoke
Use additional code for exposure to secondhand tobacco smoke (Z57.31, Z58.7).
T65.221 Toxic effect of tobacco cigarettes, accidental (unintentional)
Toxic effect of tobacco cigarettes NOS
T65.222 Toxic effect of tobacco cigarettes, intentional self-harm
T65.223 Toxic effect of tobacco cigarettes, assault
T65.224 Toxic effect of tobacco cigarettes, undetermined

T65.29 Toxic effect of other tobacco and nicotine
T65.291 Toxic effect of other tobacco and nicotine, accidental (unintentional)
Toxic effect of other tobacco and nicotine NOS
T65.292 Toxic effect of other tobacco and nicotine, intentional self-harm
T65.293 Toxic effect of other tobacco and nicotine, assault
T65.294 Toxic effect of other tobacco and nicotine, undetermined

Z71 Persons encountering health services for other counseling and medical advice, not elsewhere classified

Z71.6 Tobacco abuse counseling
Use additional code for nicotine dependence (F17.-).

Z72 Problems related to lifestyle

Z72.0 Tobacco use
Tobacco use NOS
Excludes1: history of tobacco dependence (Z87.82), nicotine dependence (F17.2-), tobacco dependence (F17.2-), tobacco use during pregnancy (O99.33-).

Z87 Personal history of other diseases and conditions

Z87.8 Personal history of other specified conditions
Z87.82 Personal history of nicotine dependence
Excludes1: current nicotine dependence (F17.2-).

Appendix D. Key Recommendation Changes From the 2000 PHS-Sponsored Clinical Practice Guideline: Treating Tobacco Use and Dependence

Below is a summary of the substantive changes in recommendations from the 2000 Guideline to the 2008 Guideline Update. These changes include new 2008 update recommendations as well as recommendations that were deleted or changed substantially from the 2000 Guideline.

NEW RECOMMENDATIONS IN THE 2008 UPDATE

Most, but not all, of the new recommendations appearing in the 2008 Treating Tobacco Use and Dependence Update resulted from new meta-analyses of the topics chosen by the Guideline Panel.

1. Formats of Psychosocial Treatments

Recommendation: Tailored materials, both print and Web-based, appear to be effective in helping people quit. Therefore, clinicians may choose to provide tailored self-help materials to their patients who want to quit. (Strength of Evidence = B)

2. Combining Counseling and Medication

Recommendation: The combination of counseling and medication is more effective for smoking cessation than either medication or counseling alone. Therefore, whenever feasible and appropriate, both counseling and medication should be provided to patients trying to quit smoking. (Strength of Evidence = A)

Recommendation: There is a strong relation between the number of sessions of counseling when it is combined with medication, and the likelihood of successful smoking abstinence. Therefore, to the extent possible, clinicians should provide multiple counseling sessions, in addition to medication, to their patients who are trying to quit smoking. (Strength of Evidence = A)

3. For Smokers Not Willing To Make a Quit Attempt at This Time

Recommendation: Motivational intervention techniques appear to be effective in increasing a patient's likelihood of making a future quit attempt. Therefore, clinicians should use motivational techniques to encourage smokers who currently are not willing to quit to consider making a quit attempt in the future. (Strength of Evidence = B)

4. Nicotine Lozenge

Recommendation: The nicotine lozenge is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = B)

5. Varenicline

Recommendation: Varenicline is an effective smoking cessation treatment that patients should be encouraged to use. (Strength of Evidence = A)

6. Specific Populations

Recommendation: The interventions found to be effective in this Guideline have been shown to be effective in a variety of populations. In addition, many of the studies supporting these interventions comprised diverse samples of tobacco users. Therefore, interventions identified as effective in this Guideline are recommended for all individuals who use tobacco, except when medically contraindicated or with specific populations in which medication has not been shown to be effective (pregnant women, smokeless tobacco users, light smokers, and adolescents). (Strength of Evidence = B)

7. Light Smokers

Recommendation: Light smokers should be identified, strongly urged to quit, and provided counseling cessation interventions. (Strength of Evidence = B)

RECOMMENDATIONS FROM THE 2000 GUIDELINE THAT WERE DELETED FROM THE 2008 UPDATE

All "C" level recommendations were reconsidered by the Panel, with the goal of limiting those that are based, in part, on Panel opinion. The 2008 Guideline Update has 8 "C" recommendations; the 2000 Guideline had 18. There were additional deletions of recommendations from the 2000 Guideline. Some of these other deletions reflect addressing specific populations differently in the 2008 Guideline update.

1. Advice To Quit Smoking

Recommendation: All clinicians should strongly advise their patients who use tobacco to quit. Although studies independently have not addressed the impact of advice to quit by all types of nonphysician clinicians, it is reasonable to believe that such advice is effective in increasing their patients' long-term quit rates. (Strength of Evidence = B)

2. Types of Counseling and Behavioral Therapies

Recommendation: Aversive smoking interventions (rapid smoking, rapid puffing, other aversive smoking techniques) increase abstinence rates and may be used with smokers who desire such treatment or who have been unsuccessful using other interventions**.** (Strength of Evidence = B)

3. Medications

Recommendation: Long-term smoking cessation medications should be considered as a strategy to reduce the likelihood of relapse. (Strength of Evidence = C)

4. Gender

Recommendation: The same smoking cessation treatments are effective for both men and women. Therefore, except in the case of the pregnant smoker, the same interventions can be used with both men and women. (Strength of Evidence = B)

5. Pregnancy

Recommendation: Medications should be considered when a pregnant woman otherwise is unable to quit, and when the likelihood of quitting,

with its potential benefits, outweighs the risks of the medications and potential continued smoking. (Strength of Evidence = C)

6. Racial and Ethnic Minority Populations

Recommendation: Smoking cessation treatments have been shown to be effective across different racial and ethnic minorities. Therefore, members of racial and ethnic minorities should be provided treatments shown to be effective in this Guideline. (Strength of Evidence = A)

Recommendation: Whenever possible, tobacco dependence treatments should be modified or tailored to be appropriate for the ethnic or racial populations with which they are used. (Strength of Evidence = C)

7. Hospitalized Smokers

Recommendation: Smoking cessation treatments have been shown to be effective for hospitalized patients. Therefore, hospitalized patients should be provided smoking cessation treatments shown to be effective in this Guideline. (Strength of Evidence = B)

8. Psychiatric Illness and/or Nontobacco Chemical Dependency

Recommendation: Smokers with comorbid psychiatric conditions should be provided smoking cessation treatments identified as effective in this Guideline. (Strength of Evidence = C)

Recommendation: Bupropion SR and nortriptyline, efficacious treatments for smoking cessation in the general population, also are effective in treating depression. Therefore, bupropion SR and nortriptyline especially should be considered for the treatment of tobacco dependence in smokers with current or past history of depression. (Strength of Evidence = C)

Recommendation: Evidence indicates that smoking cessation interventions do not interfere with recovery from chemical dependency. Therefore, smokers receiving treatment for chemical dependency should be provided smoking cessation treatments shown to be effective in this Guideline, including both counseling and medications. (Strength of Evidence = C)

9. Children and Adolescents

Recommendation: When treating adolescents, clinicians may consider prescriptions for bupropion SR or NRT when there is evidence of nicotine dependence and desire to quit tobacco use. (Strength of Evidence = C)

10. Older Smokers

Recommendation: Smoking cessation treatments have been shown to be effective for older adults. Therefore, older smokers should be provided smoking cessation treatments shown to be effective in this Guideline. (Strength of Evidence = A)

11. Weight Gain After Stopping Smoking

Recommendation: The clinician should acknowledge that quitting smoking is often followed by weight gain. Additionally, the clinician should: (1) note that the health risks of weight gain are small when compared to the risks of continued smoking; (2) recommend physical activities and a healthy diet to control weight; and (3) recommend that patients concentrate primarily on smoking cessation, not weight control, until exsmokers are confident that they will not return to smoking. (Strength of Evidence = C)

12. Cost-Effectiveness of Tobacco Interventions

Recommendation: Intensive smoking cessation interventions are especially efficacious and cost-effective, and smokers should have ready access to these services as well as to less intensive interventions. (Strength of Evidence = B)

Note: The tobacco dependence treatments shown to be effective in this Guideline still are recommended as highly cost-effective with Strength of Evidence = A. The above recommendation, number 12, was deleted because it refers only to "intensive" smoking cessation interventions.

RECOMMENDATIONS FROM THE 2000 GUIDELINE THAT WERE SUBSTANTIALLY CHANGED IN THE 2008 UPDATE:

The results of meta-analyses or consideration of literature not available for the 2000 Guideline led to substantive changes in some of the 2000 Guideline recommendations. Minor changes in wording are not listed here.

1. Screening and Assessment

2000 Guideline. Recommendation #1: All patients should be asked if they use tobacco and should have their tobacco-use status documented on a regular basis. Evidence has shown that this significantly increases rates of clinician intervention. (Strength of Evidence = A)

2000 Guideline. Recommendation #2: Clinic screening systems, such as expanding the vital signs to include tobacco use status, or the use of other reminder systems, such as chart stickers or computer prompts, are essential for the consistent assessment, documentation, and intervention with tobacco use. (Strength of Evidence = B)

2008 Guideline Update. Recommendation: All patients should be asked if they use tobacco and should have their tobacco use status documented on a regular basis. Evidence has shown that clinic screening systems, such as expanding the vital signs to include tobacco use status, or the use of other reminder systems, such as chart stickers or computer prompts, significantly increase rates of clinician intervention. (Strength of Evidence = A)

2. Types of Counseling and Behavioral Therapies

2000 Guideline. Recommendation: Three types of counseling and behavioral therapies result in higher abstinence rates: (1) providing smokers with practical counseling (problemsolving skills/skills training); (2) providing social support as part of treatment; and (3) helping smokers obtain social support outside the treatment environment. These types of counseling and behavioral therapies should be included in smoking cessation interventions. (Strength of Evidence = B)

2008 Guideline Update. Recommendation: Two types of counseling and behavioral therapies result in higher abstinence rates: (1) providing smokers with practical counseling (problemsolving skills/skills training); and

(2) providing support and encouragement as part of treatment. These types of counseling elements should be included in smoking cessation interventions. (Strength of Evidence = B)

3. Medications

2000 Guideline. Recommendation: All patients attempting to quit should be encouraged to use effective medications for smoking cessation, except in the presence of special circumstances. (Strength of Evidence = A)

2008 Guideline Update. Recommendation: Clinicians should encourage all patients attempting to quit to use effective medications for tobacco dependence treatment, except where contraindicated or for specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents). (Strength of Evidence = A)

4. Combination Medications

2000 Guideline. Recommendation: Combining the nicotine patch with a self-administered form of nicotine replacement therapy (either the nicotine gum or nicotine nasal spray) is more efficacious than a single form of nicotine replacement, and patients should be encouraged to use such combined treatments if they are unable to quit using a single type of first-line medication. (Strength of Evidence = B)

2008 Guideline Update. Recommendation: Certain combinations of first-line medications have been shown to be effective smoking cessation treatments. Therefore, clinicians should consider using these combinations of medications with their patients who are willing to quit. Effective combination medications are long-term (> 14 weeks) nicotine patch + other NRT (gum and spray), the nicotine patch + the nicotine inhaler, and the nicotine patch + bupropion SR. (Strength of Evidence = A)

5. Children and Adolescents

2000 Guideline. Recommendation #1: Counseling and behavioral interventions shown to be effective with adults should be considered for use with children and adolescents. The content of these interventions should be modified to be developmentally appropriate. (Strength of Evidence = C)

2008 Guideline Update. Recommendation #1: Counseling has been shown to be effective in treatment of adolescent smokers. Therefore, adolescent smokers should be provided with counseling interventions to aid them in quitting smoking. (Strength of Evidence = B)

2000 Guideline. Recommendation #2: Clinicians in a pediatric setting should offer smoking cessation advice and interventions to parents to limit children's exposure to secondhand smoke. (Strength of Evidence = B)

2008 Guideline Update. Recommendation #2: Secondhand smoke is harmful to children. Cessation counseling delivered in pediatric settings has been shown to be effective in increasing cessation among parents who smoke. Therefore, to protect children from secondhand smoke, clinicians should ask parents about tobacco use and offer them cessation advice and assistance. (Strength of Evidence = B)

6. Noncigarette Tobacco Users

2000 Guideline. Recommendation: Smokeless/spit tobacco users should be identified, strongly urged to quit, and treated with the same counseling cessation interventions recommended for smokers. (Strength of Evidence = B)

2008 Guideline Update. Recommendation: Smokeless tobacco users should be identified, strongly urged to quit, and provided counseling cessation interventions. (Strength of Evidence = A)

7. Cost-Effectiveness of Tobacco Dependence Interventions

2000 Guideline. Recommendation: Sufficient resources should be allocated for clinician reimbursement and systems support to ensure the delivery of efficacious tobacco use treatments. (Strength of Evidence = C)

2008 Guideline Update. Recommendation: Sufficient resources should be allocated for systems support to ensure the delivery of effective tobacco use treatments. (Strength of Evidence = C)

8. Tobacco Dependence Treatment as a Part of Assessing Health Care Quality

2000 Guideline. Recommendation: Provision of Guideline-based interventions to treat tobacco use and addiction should be included in standard

ratings and measures of overall health care quality (e.g., NCQA HEDIS, the Foundation for Accountability [FACCT]). (Strength of Evidence = C)

2008 Guideline Update. Recommendation: Provision of Guideline-based interventions to treat tobacco use and dependence should remain in standard ratings and measures of overall health care quality (e.g., NCQA, HEDIS). These standard measures also should include measures of outcomes (e.g., use of cessation treatment, short- and long-term abstinence rates) that result from providing tobacco dependence interventions. (Strength of Evidence = C)

9. Providing Smoking Cessation Treatments as a Covered Benefit

2000 Guideline. Recommendation: Smoking cessation treatments (both medication and counseling) should be included as a paid or covered benefit by health benefit plans, because doing so improves utilization and overall abstinence rates. (Strength of Evidence = B)

2008 Guideline Update. Recommendation: Providing tobacco dependence treatments (both medication and counseling) as a paid or covered benefit by health insurance plans has been shown to increase the proportion of smokers who use cessation treatment, attempt to quit, and successfully quit. Therefore, treatments shown to be effective in the Guideline should be included as covered services in public and private health benefit plans. (Strength of Evidence = A)

Index

N

O

P

T

U-V

W-Y

Guideline Availability

This Guideline is available in several formats suitable for health care practitioners, the scientific community, educators, and consumers.

The *Clinical Practice Guideline* presents recommendations for health care providers, with brief supporting information, tables and figures, and pertinent references.

The *Quick Reference Guide* is a distilled version of the clinical practice Guideline, with summary points for ready reference on a day-to-day basis.

The *Consumer Version* is an information booklet for the general public to increase consumer knowledge and involvement in health care decisionmaking.

The full text of the Guideline, with and without the text references and the meta-analyses references (listed by evidence table), is available by visiting the Surgeon General's Web site at: *www.ahrq.gov/path/tobacco.htm#Clinic*.

Single copies of these Guideline products and further information on the availability of other derivative products can be obtained by calling any of the following Public Health Service organizations' toll-free numbers:

Agency for Healthcare Research and Quality (AHRQ)
800-358-9295

Centers for Disease Control and Prevention (CDC)
800-311-3435

National Cancer Institute (NCI)
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Special Article

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Practice parameter: Treatment of the child with a first unprovoked seizure

Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society*

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Abstract—The Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society develop practice parameters as strategies for patient management based on analysis of evidence regarding risks and benefits. This parameter reviews published literature relevant to the decision to begin treatment after a child or adolescent experiences a first unprovoked seizure and presents evidence-based practice recommendations. Reasons why treatment may be considered are discussed. Evidence is reviewed concerning risk of recurrence as well as effect of treatment on prevention of recurrence and development of chronic epilepsy. Studies of side effects of anticonvulsants commonly used to treat seizures in children are also reviewed. Relevant articles are classified according to the Quality Standards Subcommittee classification scheme. Treatment after a first unprovoked seizure appears to decrease the risk of a second seizure, but there are few data from studies involving only children. There appears to be no benefit of treatment with regard to the prognosis for long-term seizure remission. Antiepileptic drugs (AED) carry risks of side effects that are particularly important in children. The decision as to whether or not to treat children and adolescents who have experienced a first unprovoked seizure must be based on a risk–benefit assessment that weighs the risk of having another seizure against the risk of chronic AED therapy. The decision should be individualized and take into account both medical issues and patient and family preference.

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Population-based studies of the incidence of first unprovoked seizures suggest that there are between 25,000 and 40,000 children per year in the United States who experience a first unprovoked seizure.[1-4] Until relatively recently, it was common practice for physicians to begin long-term, daily antiepileptic drug (AED) therapy after a child or adolescent experienced a single seizure of any type. The rationale for this practice was based on the belief that all seizures were likely to recur and that seizures could be dangerous and cause brain damage. Furthermore, it was thought that if any recurrence were to take place, this would lead to progressively more seizures. It was also assumed that AED were safe, had few side effects, and were effective in prevention of seizure recurrences. These assumptions have undergone substantial modification over the last 20 years, leading to a more optimistic view about the nature of seizures and a more conservative approach to the use of treatment. However, no clear evidence-based guidelines have emerged regarding the initiation of treatment after a first unprovoked seizure in the pediatric population.

Practice parameters are developed by the Quality

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This statement has been endorsed by the American Epilepsy Society; the American Academy of Pediatrics; and the Child Neurology Society.

*See the Appendix for a list of Committee members.

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Table 1 *Evidence classification scheme of the American Academy of Neurology: rating of therapeutic article*

Class I: Prospective, randomized, controlled clinical trial with masked outcome assessment, in a representative population. The following are required:
a. Primary outcome(s) is/are clearly defined.
b. Exclusion/inclusion criteria are clearly defined.
c. Adequate accounting for dropouts and crossovers with numbers sufficiently low to have minimal potential for bias.
d. Relevant baseline characteristics are presented and substantially equivalent among treatment groups or there is appropriate statistical adjustment for differences.
Class II: Prospective matched group cohort study in a representative population with masked outcome assessment that meets a–d above *or* a randomized, controlled trial in a representative population that lacks one criteria a–d.
Class III: All other controlled trials (including well-defined natural history controls or patients serving as own controls) in a representative population, where outcome assessment is independent of patient treatment.
Class IV: Evidence from uncontrolled studies, case series, case reports, or expert opinion.

Standards Subcommittee of the American Academy of Neurology and the Child Neurology Society and are evidence-based documents about diagnostic or prognostic evaluations and therapeutic interventions. These involve a systematic evaluation and classification of available evidence (table 1) that determine whether specific recommendations can be made and, if so, the strength of the recommendations (table 2).

This practice parameter reviews the current evidence about treatment with AED after a child experiences a first unprovoked seizure. We examine the risk of seizure recurrence and predictors that may affect that risk. We review and classify the published evidence on whether treatment prevents recurrences as well as chronic epilepsy. We also evaluate potential risks and side effects of AED commonly used to treat seizures in children.

This is the second of two parameters addressing a child's first unprovoked seizure; the first concerned the initial evaluation.[5] Febrile seizures have been addressed separately in recently published recommendations from the American Academy of Pediatrics[6] and are not included here. This parameter pertains to children and adolescents with first seizures only and does not include children diagnosed with epilepsy, defined as the occurrence of two or more seizures without acute provocation. For this reason, absence, myoclonic, and atonic seizures were excluded because they typically are not recognized until there have been multiple occurrences. The seizure types covered by this parameter include all partial seizures as well as generalized onset tonic-clonic or tonic seizures.

We defined the first seizure using the International League Against Epilepsy criteria to include multiple seizures within 24 hours with recovery of consciousness between seizures.[7] Children with a known immediate precipitating head trauma or those with previously diagnosed CNS infection, tumor, or other known acute precipitating causes such as hypoglycemia were excluded. We also excluded neonatal seizures ($\leq$28 days) and febrile seizures because these disorders are diagnostically and therapeutically different. Status epilepticus, defined as a seizure lasting $>$30 minutes without regaining of consciousness,[7] was included when data were available. Most articles describing pediatric studies covered up to age 18 years; studies including both adolescents and adults were also examined. The recommendations of this parameter pertain to children (excluding the neonate) and adolescents.

Before any treatment decisions are approached, it is critical to determine whether the event is truly a seizure and whether it is the child's first.[5] A detailed history from a reliable observer and careful medical history and neurologic examination may provide information allowing the physician to rule out nonepileptic events.

Description of process. A literature search was performed including Ovid Medline and Ovid Biosys and Current Contents for relevant articles published from 1980 to 2001 using the following key words: treatment, antiepileptics, medications, therapy, management, epilepsy, seizures, convulsions, child, newborn, and adolescent. Standard search procedures were used, and subheadings were applied as appropriate. These searches produced 948 titles of journal articles.

Titles and abstracts were reviewed for content re-

Table 2 *Evidence classification scheme of the American Academy of Neurology: recommendations*

Translation of evidence to recommendations	Rating of recommendation
Level A rating requires at least one convincing Class I study or at least two consistent, convincing Class II studies.	A = established as effective, ineffective, or harmful for the given condition in the specified population.
Level B rating requires at least one convincing Class II study or overwhelming Class III evidence.	B = probably effective, ineffective, or harmful for the given condition in the specified population.
Level C rating requires at least two convincing Class III studies.	C = possibly effective, ineffective, or harmful for the given condition in the specified population.
—	U = data inadequate or conflicting. Given current knowledge, treatment is unproven.

garding first unprovoked seizures in children and adults. Articles from the searches were identified as relevant, and additional articles from the references in these primary articles were included. Articles pertaining to children with both first seizures and established epilepsy were included but were excluded if they did not report data from either children or adults who had experienced only a single seizure. References were classified as to whether they contained data related to children and adults or just children. Articles were reviewed from searches, bibliographies, and suggestions by colleagues and committee members. In most reports pertaining to both children and adults, results were not categorized according to subsets of age groups.

A recently revised classification of evidence to determine the quality of data was used for the evaluation of reports of therapeutic studies (see table 1). Each article containing data regarding treatment was reviewed and classified by two or more reviewers. Abstracted data included numbers of subjects, study design, ages, seizure types, whether first seizures only or a mixture of single and multiple seizures, seizure recurrences, types of treatment, side effects, and measurement of compliance and length of follow-up. Methods of data analysis and power were noted when available. Recommendations were based on the level of evidence (see table 2).

What are the potential risks resulting from having a second seizure? Preventing seizure recurrences has been a concern ever since Gowers wrote: "The tendency of the disease is to self perpetuation; each attack facilitates the occurrence of another, by increasing the instability of the nerve elements."[8] This clinical belief has been supported by animal studies on kindling, an experimental technique for inducing epilepsy by a series of subclinical electrical stimulations of the temporal lobe that induce progressive intensification of evoked electrographic and behavioral seizures.[9-11] There is evidence from animal models that prolonged or recurrent seizures, under certain circumstances, cause neuronal injury and predispose to epilepsy.[12,13] There is recent evidence that seizures, some prolonged, that occur during critical periods of brain development in animals may alter neuronal activity and circuitry in a manner that may predispose to the later development of epilepsy.[14,15] The relevance of data from these animal models to seizures in humans is unclear.[10,11,16] Data from children indicate that even prolonged seizures rarely cause clinically discernible brain damage unless associated with an underlying acute neurologic insult.[17]

One reason why treatment may be considered is concern about the risk of physical injury or death from a subsequent seizure. Serious injury from a seizure in a child is a rare event, usually from a fall with loss of consciousness. To reduce that risk, restrictions are recommended that would apply to any young child, such as bicycling on a sidewalk rather than the street and always with a helmet and swimming only with a buddy. Showering rather than bathing is recommended for children and adolescents, unless they are supervised. Sudden unexpected death in children with epilepsy is, fortunately, very uncommon. When death occurs in children, it is nearly always related to an underlying neurologic handicap rather than the epilepsy.[18-20] One population-based study found that the risk of death in those with childhood-onset epilepsy is the same as that for the general population for children without significant neurologic handicap.[21] No studies were found that examined whether treating a child after a first unprovoked seizure would reduce the risk of either subsequent significant injury or sudden death.

Psychosocial considerations. The effect of taking daily medication on the child's self-perception may be a concern in some cases.[22,23] A child who is taking chronic medication is perceived to have a chronic illness by the child, family, and possibly others such as teachers. Additionally, chronic treatment to prevent seizure recurrence may affect the family's ability to obtain health insurance or day care. Issues in teenagers become more complicated as concerns about driving privileges and teratogenicity come into play.[24]

How likely is a second seizure? The probability of having a second seizure has been explored in several large, observational Class III studies with long-term follow-up. Results presented in table 3 are limited to studies that included children with or without adults. The cumulative risk of recurrence increases over time; however, in studies where the information is available, the majority of the recurrences occur early (within the first 1 to 2 years).[25-33] At any given time, the reported risk of recurrence is highly variable. For example, at 1 year, it ranges from a low of 14%[26] to a high of 65%.[33] In all these Class III studies, there is variability in the mix of patients, the nonrandomized use of treatment, and the distributions of important prognostic factors. Some methodologic differences in seizure identification, age ranges included, recruitment, and follow-up of study participants may also contribute to this variability.

How likely are multiple recurrences in children who present with a first unprovoked seizure? A minority of children will go on to experience not just one but many recurrences. One study that enrolled 207 children with follow-up for 2 years found that in addition to an overall recurrence rate of 54%, 26% of the enrolled children were still experiencing one or more seizures during the last 6 months of the study follow-up, that is, >18 months after the index event.[27] Another study with longer follow-up enrolled 407 children and followed them for an average of >10 years. Of these, 46% had one or more recurrences during that period of time. Over the extended follow-up period, 19% of the children

Table 3 *Risk of recurrence after a first seizure*

Study	Age range	n	Treated, %	Risk of recurrence at different times since first seizure, %				
				6 mo	1 y	2 y	3 y	5 y
Children and adolescents only								
27	1–16 y	156	0	40	46	54	—	—
33	3–21 y	78	58	55	65	69	—	—
25,28	1 mo–19 y	407	14	22	29	37	—	42
29	2–16 y	119	61	22	29	—	32	—
30	1 mo–16 y	168	68	36	40	47	—	—
42	1 mo–7 y	284	—	—	—	—	—	69, up to 7 y
Children, adolescents, and adults								
31	All ages	424	?	30	36	45	48	—
32	All ages	564	?	27	37	43	46	—
26	All ages	208	≈80	—	14	25	29	34

enrolled experienced ≥4 seizures and only 10% experienced ≥10 seizure episodes.[28] Few of the children in either study met criteria for intractability.[34]

Are there factors that increase the recurrence risk? Certain factors may elevate the risk of experiencing a second seizure. The underlying etiology and whether the EEG is normal or abnormal are consistently related to the risk of recurrence.[35] The recurrence rate is higher in individuals who have a remote symptomatic etiology. In those with an idiopathic or cryptogenic etiology, it is significantly lower.[25-28,30,33] We use the term "remote symptomatic" to mean without immediate cause but with a prior identifiable major brain insult such as severe trauma or accompanying a condition such as cerebral palsy or mental retardation. Idiopathic seizures are not associated with a known CNS disorder and are of suspected genetic etiology (such as occur with benign rolandic epilepsy), and cryptogenic seizures occur in individuals otherwise normal with no clear etiology.[7] The estimates of risk at 2 years are highly variable. The extent to which treatment was used also varied and may have influenced, to some degree, the overall risk observed. For children with first seizures that are idiopathic/cryptogenic, the recurrence risk is generally between 30 and 50% by 2 years,[25,27-30] and for remote symptomatic seizures, the estimate of recurrence risk is generally above 50%.[25,27,28,30,33] An EEG performed after the initial seizure also helps to predict recurrence,[25-27,29-31,33] particularly if there is an epileptiform abnormality. Patients with remote symptomatic seizures and abnormal EEG were more likely to be treated than those with idiopathic/cryptogenic seizures and normal EEG. All of these studies addressing recurrence risk represent Class III evidence.

Are there special considerations if the first seizure is prolonged? Approximately 10 to 12% of children and adults with a first unprovoked seizure will present with a seizure lasting ≥30 minutes (status epilepticus) as their first seizure.[36] In the absence of an acute or progressive brain injury or disease, the morbidity and mortality of status epilepticus in children are relatively low.[17,37] Of 46 children with "idiopathic" seizures in a study of sequelae of status epilepticus in 193 children, 2 children had mental retardation, but they had been recruited retrospectively and details of the clinical circumstances were not clear. None of children studied prospectively had residual motor or cognitive disability.[17]

Evidence concerning the impact of status epilepticus on the risk of recurrence and, in particular, the risk of a prolonged recurrence is available from one Class III prospective observational study of 407 children with a first unprovoked seizure.[25,36] The overall recurrence risk following a prolonged first seizure was no different from the recurrence risk following a brief first seizure. However, if a child with an initial prolonged seizure did experience a seizure recurrence, it was more likely to be prolonged. Of 24 children with initial episodes of status epilepticus who had a recurrence, 5 (21%) had status epilepticus as a recurrence, whereas of 147 whose first seizures were brief and who had a recurrence, 2 (1%) had status epilepticus as their recurrence.[25] Thus, the risk of a recurrent seizure being prolonged is limited largely to those children whose first seizure was prolonged (Class III studies).

How effective is treatment after a first seizure in prevention of recurrences? *Evidence.* There are four randomized clinical trials including children and adolescents that have examined the efficacy of treatment after a first seizure.[38-41] Only one of these studies consisted solely of children randomized to treatment versus no treatment after a first nonfebrile seizure (Class II).[41] In this study with a total of 31 children, 2 of 14 children (14%) treated with carbamazepine (CBZ) experienced a recurrence compared with 9 of 17 (53%)

Table 4 *Recurrence rate by treatment in studies of children*

Study	Class	n	Recurrence rate, n (%)	Treated vs untreated	Length of follow-up, y
41	II	31	11/31	2/14 vs 9/17, 14.3% vs 52.9%	1
42	III	284	196/284 (69)	No difference	To 7
29	III	119	40/119 (32)	27% vs 38%, no difference	3
25	III	407	151/393 (38) at 2 y, 171/375 (46) at 5 y	No difference	6.3, mean
33	III	78, includes 12 symptomatic	54/78 at 2 y (69)	No difference	5.2

who were not treated. Follow-up was for 1 year, and compliance was monitored. Although the recurrence rate up to 1 year was significantly lower in the treated group, only 6 of 14 (43%) patients randomized to CBZ completed the year with no significant side effects or seizure recurrence and 7 of 17 (41%) assigned to no medication had no seizure recurrence.

In studies involving both children and adults, outcome was not provided based on age. One Class I study in which 228 subjects were randomized to valproic acid (VPA) or placebo included 33 adolescents between the ages of 16 and 19.[38] The follow-up period for this trial was between 9 months and 5 years. Five (4%) of the treated group experienced a recurrence compared with 63 (56%) of those treated with placebo. However, these results were not found in another Class II randomized study (n = 419), in which 114 subjects were between 2 and 16 years old. Twenty-four percent of patients treated after a first seizure and 42% untreated patients had a recurrence by 1 year, but no difference by initial treatment assignment was seen after 2 years; 32% of those treated and 40% of those untreated had a recurrence by 2 years.[39]

In other studies in children (Class III), although the cohorts are prospectively followed, treatment was not randomly assigned and therefore baseline factors affecting risk of recurrence were not comparable.[25,29,33,42] None of these studies found a significant difference in recurrence rate in the treated and untreated children (table 4).

Summary. Studies of children and adults in which treatment assignment was randomized usually indicate that treatment with AED after a first seizure reduces the risk of seizure recurrence. The magnitude of the impact is variable, and the evidence from pediatric studies alone is weak (see table 4). Differences among the studies, the populations targeted, and the method in which treatment was administered may explain some of the variability. In the only randomized study restricted to the pediatric age group, the sample size is small and the confidence intervals are accordingly wide, ranging from 0 to 93% efficacy.[41]

Does treatment with AED after a first seizure change the long-term prognosis for seizure remission? *Evidence.* Although treatment after a first unprovoked seizure may reduce the risk of a second seizure, does treatment at this time make any difference in the patient's long-term prognosis for seizure control? This question is addressed in two randomized, prospective, but not placebo-controlled (Class II) first-seizure studies. One study had 419 subjects, of whom 114 were between 2 and 16 years of age.[39] This study compared the probability of experiencing a remission, that is, 1 or 2 seizure-free years, in patients treated after a first seizure versus in patients treated after a second seizure. Follow-up was for at least 3 years or a minimum of 2 years seizure-free. Patients treated after the first seizure and those treated after a second seizure had the same probability of achieving a 1- or 2-year seizure remission (68%, n = 215 versus 60%, n = 204) (risk of recurrence [RR] = 1.04, 95% CI = 1.30 to 0.82). Another smaller study[43] of 31 children randomized to CBZ (n = 14) or no treatment (n = 17) echoes the results of this large study. After a 15-year follow-up, the rate of 2-year terminal remission was the same in both the treated and the untreated groups (RR = 0.79, 95% CI = 0.3 to 2.1).

Summary. Two Class II studies provide no evidence of a difference when treatment is started after the first seizure versus after a second seizure in achieving a 1-or 2-year seizure remission.

What are the nature and frequency of side effects of AED commonly used after a first seizure in children? *Evidence.* AED may cause systemic side effects such as rash, hirsutism, and weight gain. Severe reactions such as hepatic toxicity, bone marrow toxicity, and Stevens–Johnson syndrome cannot be anticipated and require early recognition of symptoms. Side effects of AED occurring in children include effects on behavior and higher cortical function,[44] which are often dose related and may be under-recognized. Dose-related side effects may be highest initially and amenable to dosage reduction, but this may also limit the potential effectiveness of AED. If the patient is a teenage girl who may become pregnant, the risk of teratogenicity is an additional consideration.[24,45]

Trials that report data relating to efficacy do not always include data relating to side effects. Data regarding toxicity or side effects of AED are not specifically available for treatment after a first seizure. However, studies that include initial treatment of

Table 5 *Behavioral and cognitive side effects of antiepileptic drugs in children treated for epilepsy*

Study	Age, y	Follow-up	Medication (n)	Reported side effects
Class I				
50,51	5–14	1 y	CBZ (23)	Impaired recent recall, reported slow by teachers
			PHT (20)	Impaired information processing at 1 mo
			VPA (21)	No change
49	7–15	6 and 12 mo	CBZ (26)	No change
			PB (25)	Disturbed information processing (auditory event-related potentials prolonged)
			VPA (25)	No change
47	2–16	12 mo	CBZ (78)	29 of total of 116 had moderate/severe behavior problems
			PHT (38)	
48	6–14	6 mo	PB	Did less well on cognitive tests, more hyperactivity
			VPA	No change
53	—	None	CBZ (50)	No difference high vs. low level
54			VPA (46)	Low doses gave better accuracy and response time
55			PHT (50)	No difference high vs. low level
52	4–12	2 y	PB (51)	22% hyperactivity
			VPA (48)	13% hyperactivity
			PHT (52)	8% impaired school performance
Class 2				
56	3–16	3 y	PB (10)	6 withdrew owing to side effects
			PHT (50)	5 withdrew owing to side effects
			CBZ (54)	2 withdrew owing to side effects
			VPA (49)	2 withdrew owing to side effects
51	Average 9	12 mo	VPA (26)	Increase in IQ
			PB (23)	Significant impairment in learning
58	6–17	6 mo	CBZ (17)	No difference
			VPA (11)	No difference
			PHT (1)	No difference
59	7–12	12 mo	VPA (34)	No difference
			CBZ (29)	No difference
60	4–16	26–6 mo	CBZ (5)	No difference
		12–12 mo	VPA (3)	No difference
			Ethosuximide (4)	No difference

CBZ = carbamazepine; PHT = phenytoin; VPA = valproic acid; PB = phenobarbital.

children for epilepsy provide information that may be extrapolated to treatment after a first seizure.

Behavioral and cognitive side effects. Five Class I studies reported on behavioral and cognitive side effects in children with epilepsy treated with AED.[46-52] One study reported that 29 of 116 children treated with either CBZ or phenytoin (PHT) had moderate to severe behavioral or mood changes.[46,47] In a blinded, randomized, crossover study comparing phenobarbital (PB) with VPA, children taking PB had lower scores on four tests of cognitive function and had more behavior problems that were not dose related, particularly hyperactivity.[48] Although Wechsler Intelligence Scale for Children–Revised scores were not different, a study that included auditory event-related potentials found prolonged latencies indicating delayed information processing associated with PB.[49] In a Class I study of children with newly diagnosed epilepsy in which 23 children received CBZ, 20 received PHT, and 21 received VPA, those on CBZ and PHT were slower on tests of information processing, and children on CBZ showed increased irritability[50,51] (table 5).

A series of three Class I studies each designed to compare the cognitive effects of low versus high levels of one AED in children with epilepsy found no differences between low and high levels with either CBZ or PHT.[53,54] Children with a lower level of VPA performed better on specific cognitive tasks such as accuracy and response time than those with a higher level.[55] In one Class II study, 15 of 163 children assigned to AED withdrew because of intolerable side

Table 6 *Systemic side effects of antiepileptic drugs in children treated for epilepsy*

Study	n	Follow-up	Medication (n)	Side effects
Class I				
51	64	1 y	CBZ (23)	3 h/a, anorexia, nausea
			PHT (20)	1 depression, anorexia
			VPA (21)	0
47	116	1 y	CBZ (78)	9 n&v, 10 ataxia, 5 rash, 5 gingival hyperplasia
			PHT (38)	
52	151	29 mo, mean	PB (51)	17 patients including behavioral
			VPA (48)	15 patients, including behavioral
			PHT (52)	33 patients had at least 1, 30 gingival hyperplasia, 13 dose-related ataxia
Class II				
41	31	1 y	CBZ (14)	2 somnolence, 2 allergic rash
56	167	4 y	PB (10)	5 behavior, 1 drowsy
			PHT (54)	2 drowsy, 1 rash, 1 blood dyscrasia, 1 hirsutism
			CBZ (54)	1 drowsy, 1 blood dyscrasia
			VPA (49)	1 behavior problem, 1 tremor
61	260	1 y	VPA (130)	Half had adverse events, e.g., somnolence, ataxia, rash; 12% d/c owing to "adverse events" such as increased appetite, weight gain, alopecia
			CBZ (130)	7% d/c owing to side effects

CBZ = carbamazepine; PHT = phenytoin; VPA = valproic acid; PB = phenobarbital; h/a = headache; n&v = nausea and vomiting; d/c = discontinued.

effects,[56] and in another, children taking PB did not show an expected increase in IQ on retest.[57] In three other studies, which included 48 children taking VPA, 1 taking PHT, and 51 taking CBZ, evidence was not seen of behavioral or cognitive impairment[58-60] (see table 5).

A report from the American Academy of Pediatrics[44] regarding general recommendations for awareness of behavioral and cognitive effects of AED noted that high blood levels of some AED (PHT, PB, primidone) were significantly related to cognitive decline. Cognitive and behavioral effects of AED were described as subtle and affecting isolated functions. These effects were seen in conjunction with academic underachievement and neuropsychological impairment in children with epilepsy.

Systemic side effects. Systemic side effects other than behavioral or cognitive also occur in children placed on AED (table 6). In a Class I study of 116 children randomized to CBZ or PHT, 24 had one or more side effects including nausea and vomiting (9), ataxia (10), rash (5), gingival hyperplasia (3), and dizziness (3).[47] Another Class I study reported that of 23 children on CBZ, 3 experienced headache, anorexia, nausea or abdominal pain, and increased irritability. Systemic side effects were not reported for the 20 children on PHT or the 21 on VPA.[50,51] Dropout because of failure to comply with treatment, possibly due to side effects, occurred in several cases in all three groups.

In the one prospective, randomized, but not blinded study in children that pertains to first seizures only, 2 of 14 children on CBZ discontinued medication because of rash and 2 of 14 because of excessive somnolence.[41] When four drugs were compared in a Class II study of 167 children with newly diagnosed epilepsy, PB was dropped after 6 of 10 children had unacceptable side effects. Side effects occurred at a rate of 9% for PHT, 4% for CBZ, and 4% for VPA.[56] Included were behavioral problems, drowsiness, sleep problems, blood dyscrasia, hirsutism, and tremor. A randomized and blinded prospective study of 151 children with epilepsy found that 32% of children on PB, 19% of children on VPA, and 40% of children on PHT had more than one toxic side effect. Fifty-eight percent of those on PHT experienced gingival hyperplasia, and 25% had dose-related ataxia or sedation. Follow-up was 2 years.[52] In a Class II study of 130 children assigned to VPA and 130 assigned to CBZ, by 1 year, 13% discontinued VPA and 7% discontinued CBZ owing to adverse effects such as somnolence, fatigue, weight gain, headache, nausea, vomiting, and rash.[61]

In a Class III study of first seizures, four AED were used and an overall rate of side effects of 24% was reported. These were noted as behavior disorders, hyperkinesias, and sleepiness.[29] The exacerbation of seizures by CBZ has been reported in 11 of 129 cases of new-onset epilepsy.[62]

Several of the newer AED carry warnings or precautions for Stevens–Johnson syndrome (lamotrigine, zonisamide, felbamate), hepatic toxicity (lamotrigine, felbamate), aplastic anemia (felbamate), renal stones (topiramate, zonisamide), and

other rare medical complications such as hyperthermia secondary to hypohidrosis and hyponatremia (zonisamide and oxcarbazepine). The spectrum and incidence of medical ill effects of the newer AED in special populations such as children may not become apparent until after several years of use.[63] There are not yet adequate data on behavioral or cognitive side effects of newer AED in children, and they are not currently approved for monotherapy in children. A new form of treatment for acute seizure activity that may be used at home is diazepam administered in a rectal solution, but this is approved for use in selected refractory patients to control acute, repetitive seizure activity and is not used after a single unprovoked seizure.[64,65]

Summary. Whereas evidence from studies of treatment after only a single unprovoked seizure is lacking, Class I and II evidence concerning the AED accepted for use as first-line anticonvulsants in children (PB, PHT, VPA, CBZ) indicates that clinically relevant cognitive and behavioral effects may occur, particularly with PB. Parents and teachers may often overlook such cognitive and behavioral effects. In addition, one or more important systemic side effects such as rash, hirsutism, weight gain, or nausea may occur with a frequency ranging from 7 to 58%.

Conclusions. The majority of children who experience a first unprovoked seizure will have few or no recurrences. Only approximately 10% will go on to have many ($\geq$10) seizures regardless of therapy. Treatment with AED after a first seizure as opposed to after a second seizure has not been shown to improve prognosis for long-term seizure remission (Class II evidence).

Treatment has been shown in several studies combining both children and adults to reduce the risk of seizure recurrence (Class II evidence). There is a relative paucity of data from studies involving only children after a first seizure. AED therapy in children who have epilepsy (at least two seizures) has potential serious pharmacologic and psychosocial side effects (Class I evidence). No separate data exist specifically for treatment side effects in children who have experienced only a single seizure.

There is no evidence about whether treatment specifically after the first seizure alters the risk of sudden unexpected death in epilepsy patients in children.

Recommendations. The decision as to whether or not to treat with AED following a first unprovoked seizure in a child or adolescent must be based on a risk–benefit assessment that weighs the risk of another seizure (both the statistical risk of recurrence and the potential consequences of a recurrence) against the risk (cognitive, behavioral, and physical as well as psychosocial) of chronic AED therapy. This decision must be individualized and take into account both medical issues and patient and family preference. Therefore, the following recommendations are made for children and adolescents who have experienced a first seizure:

1. Treatment with AED is not indicated for the prevention of the development of epilepsy (Level B).
2. Treatment with AED may be considered in circumstances where the benefits of reducing the risk of a second seizure outweigh the risks of pharmacologic and psychosocial side effects (Level B).

Future research recommendations. Although evidence reviewed in this practice parameter does not support the routine treatment of every child who presents with a first unprovoked seizure, a minority of children (approximately 10%) will develop difficult-to-control and protracted epilepsy. Prediction of who these children will be is currently not possible; the prognosis becomes evident only after months or years have passed. Research is needed to identify these children after a first seizure and to determine which treatment and management options are best. Imaging studies may help determine if and under what circumstances children may sustain neuronal injury due to seizure. Identifying genetic, immune, or imaging markers may improve prediction of prognosis.

More research is needed on the efficacy and side effects in children of the new AED. Behavioral and cognitive side effects need to be better evaluated, especially for new AED, and individual risks as well as group differences assessed on tests of cognition. A goal of pharmacogenetics will be to minimize the likelihood of adverse events from medication. Identification of children at risk for idiosyncratic adverse reactions to AED and understanding the pharmacogenetics of responders to specific AED may improve our ability to identify those children who should be treated and to use only those treatments to which they are likely to respond.

Determinants of psychosocial factors involved in seizures and AED therapy must be better understood for the different ages of children and their families, so that overall best possible quality of life is the goal of management. Research on seizure disorders in the next decade will be focused on "no seizures, no side effects" and, most importantly, toward strategies for prevention and cure of the underlying process.[66]

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Disclaimer: This statement is provided as an educational service of the American Academy of Neurology (AAN) and the Child Neurology Society (CNS). It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care for a particular neurologic problem or all legitimate criteria for choosing

to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodologies. The AAN and CNS recognize that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved.

Appendix

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Children With Disabilities

The Treatment of Neurologically Impaired Children Using Patterning

ABSTRACT. This statement reviews patterning as a treatment for children with neurologic impairments. This treatment is based on an outmoded and oversimplified theory of brain development. Current information does not support the claims of proponents that this treatment is efficacious, and its use continues to be unwarranted.

ABBREVIATION. AAP, American Academy of Pediatrics.

Patterning has been advocated for more than 40 years for treating children with brain damage and other disorders, such as learning disabilities, Down syndrome, cerebral palsy, and autism.[1–5] A number of organizations have issued cautionary statements about claims for efficacy of this therapy,[6–10] including the American Academy of Pediatrics (AAP) in 1968 and 1982.[3,11] Media coverage,[12] inquiries from parents and public officials, the use of alternative forms of treatment by parents for their children,[13] and the existence of a new generation of pediatricians who may be unaware of the programs that involve patterning have prompted the AAP to review the current status of this controversial treatment.

Patterning is a series of exercises designed to improve the "neurologic organization" of a child's neurologic impairments. It requires that these exercises be performed over many hours during the day by several persons who manipulate a child's head and extremities in patterns purporting to simulate prenatal and postnatal movements of nonimpaired children.[14] Concern about patterning has been raised because promotional methods have made it difficult for parents to refuse treatment for their children without questioning their motivation and adequacy as parents.[3] Moreover, dire health consequences for children are implied if parents do not make arrangements to have their child begin patterning.

Several treatment options are offered, ranging from a home program to an intensive treatment program, which states that each succeeding option "offers greater chance of success." Participation in the intensive treatment program requires completion of 3 of the 5 preceding programs, is by invitation only for the "most capable families," and potentially could deplete substantially a family's financial resources. The regimens prescribed can be so demanding, time-consuming, and inflexible that they may place considerable stress on parents and lead them to neglect other family members.[15,16(pp251–252)]

Patterning programs use a developmental profile designed by the Institute for the Achievement of Human Potential both to assess a child's neurologic functioning and to document change over time.[16(p40),17] However, the validity of using this profile for these domains has not been demonstrated, nor has it been compared with currently accepted methods of measuring a child's development. In addition to making claims that a number of conditions may be improved or cured by patterning, proponents of the program assert that patterning can make healthy children superior in physical and cognitive skills.[18–22]

The aims of treatment programs include attainment of normality of physical, intellectual, and social growth in children with brain injuries. According to providers of patterning therapy,[1] the majority of children treated are claimed to achieve at least 1 of those goals. To our knowledge, however, no new data have been presented to support the use of patterning since the AAP reissued its policy statement in 1982. The lack of supporting evidence for the use of this therapy brings into question once again its effectiveness in neurologically impaired children.

THE THEORY

Neurologic organization, the principle central to the patterning theory of brain functioning, is an oversimplified concept of hemispheric dominance and the relationship of individual sequential phylogenetic development.[16,23–25] This theory also states that failure to complete properly any stage of neurologic organization adversely affects all subsequent stages and that the best way to treat a damaged nervous system is "to regress to more primitive modes of function and to practice them."[17] According to this theory, the majority of cases of mental retardation, learning problems, and behavior disorders are caused by brain damage or improper neurologic organization, and these problems lie on a single continuum of brain damage, for which the most effective treatments are those advocated by patterning.[3,16]

Current information does not support these contentions. In particular, the lack of dominance or sidedness probably is not an important factor in the cause of, or the therapy for, these conditions.[3,16,17] Several careful reviews of the theory have concluded that it is unsupported, contradicted, or without merit based on scientific study.[16,17,23,25] Others have described the hypothesis of neuro-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

logic organization to be without merit[23] and concluded that the theoretical rationale for the treatment is inconsistent with accepted views of neurologic development.[24,27(pp207–235)28(pp207–247)]

STATUS OF CLAIMED THERAPEUTIC RESULTS

Results published on patterning have been inconclusive.[29–31] Although reports of improvement in reading ability after treatment have been heralded as support for the theory,[32,33] statistical analysis revealed few demonstrable benefits.[34,35] Controlled studies of reading skills have shown little or no benefit from treatment.,[16(pp333–352)36–38]

Some disabled children who purportedly benefited from treatment had been given a misdiagnosis or an unduly pessimistic prognosis. The course of maturation in children with neurologic impairments varies, which leads to unwarranted claims that improvements in their conditions were the result of a specific form of treatment.[17,39] Some of the cases publicized involved children with traumatic brain injury or encephalitis, who may make substantial health improvements without special treatment.

A well-controlled investigation[40] compared 3 groups of children, all of whom were severely mentally disabled and institutionalized. One group received patterning, a second was treated by motivational techniques, and a third received routine care. Using a wide variety of behavioral measures, the investigators found no significant differences among the 3 groups. On the basis of this study, the investigators found nothing to recommend patterning treatment over routine care.[40] They concluded that patterning cannot be considered superior to any other method of treatment for institutionalized mentally disabled children.

Other less well-designed studies[41,42] also investigated the effect of patterning therapy on children with a heterogeneous range of disabilities. One showed a significant, but short-term, effect on developmental progress in comparison with that attained by children receiving traditional programs in New Zealand.[41] The investigators disclosed that the relative success of the program was linked to the families' desire to take greater responsibility for their children's education. Another investigation demonstrated no significant progress in the development of mentally disabled children who had undergone patterning therapy.[42] A review of the use of patterning to arouse children in a coma and for sensory stimulation in brain-injured children and adults also gave no scientific evidence or theoretical rationale for its use.[43]

CONCLUSION AND RECOMMENDATION

Pediatricians need to work closely with the families of their patients with neurologic disabilities and ensure that they have access to all standard services available in their communities. After the proper diagnosis is made, physicians should discuss controversial treatments as part of the child's initial management plan. Pediatricians, therefore, need to be acquainted with routine and controversial treatments, schedule ample time for their discussion, and explain to parents the placebo effect and the importance of basing treatment decisions on controlled research trials.

Treatment programs that offer patterning remain unfounded; ie, they are based on oversimplified theories, are claimed to be effective for a variety of unrelated conditions, and are supported by case reports or anecdotal data and not by carefully designed research studies. In most cases, improvement observed in patients undergoing this method of treatment can be accounted for based on growth and development, the intensive practice of certain isolated skills, or the nonspecific effects of intensive stimulation.

Physicians and therapists need to remain aware of the issues in the controversy over this specific treatment and the available evidence. On the basis of past and current analyses, studies, and reports, the AAP concludes that patterning treatment continues to offer no special merit, that the claims of its advocates remain unproved, and that the demands and expectations placed on families are so great that in some cases their financial resources may be depleted substantially and parental and sibling relationships could be stressed.

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Type 2 Diabetes in Children and Adolescents

AMERICAN DIABETES ASSOCIATION

Type 2 diabetes is a serious and costly disease affecting more than 15 million adult Americans. The chronic complications of diabetes include accelerated development of cardiovascular disease, end-stage renal disease, loss of visual acuity, and limb amputations. All of these complications contribute to the excess morbidity and mortality in individuals with diabetes. Moreover, the prevalence of type 2 diabetes in adults is increasing. Superimposed on this disturbing picture in adults are the recent reports of the emerging problem of type 2 diabetes in children and adolescents.

If the incidence and prevalence of type 2 diabetes in children are increasing and if this increase cannot be reversed, our society will face major challenges. That is, the burden of diabetes and its complications will affect many more individuals than currently anticipated, and the cost of diabetes to our society will cause us to consume enormous resources. Also, many more Americans will be taking potent medications, which have attendant risks, for most of their lives.

Despite the wealth of experience and knowledge concerning the epidemiology, pathophysiology, and medical management of type 2 diabetes in adults, we know little about the disease in children. To assess our present knowledge and understanding and to provide guidance to practitioners on medical management, the American Diabetes Association (ADA) convened a consensus development conference on type 2 diabetes in children and adolescents from 30 August 1999 to 1 September 1999.

An eight-member panel of experts in diabetes in children, complemented by representatives from the National Institute of Diabetes and Digestive and Kidney Diseases, the Division of Diabetes Translation at the Centers for Disease Control and Prevention, and the American Academy of Pediatrics, developed a consensus position on the following six questions:

1. What is the classification of diabetes in children and adolescents?
2. What is the epidemiology of type 2 diabetes in children and adolescents?
3. What is the pathophysiology of type 2 diabetes in children and adolescents?
4. Who should be tested for diabetes?
5. How should children and adolescents with type 2 diabetes be treated?
6. Can type 2 diabetes in children and adolescents be prevented?

QUESTION 1: What is the classification of diabetes in children and adolescents?

The diagnostic criteria and etiologic classification (Table 1) of diabetes (Table 2) outlined by the ADA's Expert Committee report apply to children (1). In the pediatric population, the recent experience with nonimmune-mediated diabetes has highlighted the difficulty in distinguishing the etiology of diabetes in some children without sophisticated laboratory evaluation. This experience has created confusion over the criteria that should be used to classify diabetes in children.

Until recently, immune-mediated type 1 diabetes was the only type of diabetes considered prevalent among children, with only 1–2% of children considered to have type 2 diabetes or other rare forms of diabetes. Recent reports indicate that 8–45% of children with newly diagnosed diabetes have nonimmune-mediated diabetes. The variation in the percentages reported appears to depend on race/ethnicity and sampling strategy. The majority of these children have type 2 diabetes, but other types are being increasingly identified. For example, idiopathic or nonimmune-mediated type 1 diabetes has been reported, particularly in the African-American population.

Individuals with nonimmune-mediated diabetes may have clinical presentations indistinguishable from those of patients with immune-mediated type 1 diabetes. This is relevant because as the number of children with type 2 diabetes increases, it becomes increasingly important to classify their diabetes correctly so that appropriate therapy may be instituted.

The initial classification is usually based on the clinical picture at presentation. Typically, children with immune-mediated type 1 diabetes are not overweight and have recent weight loss, polyuria, and polydipsia. As the U.S. population becomes increasingly overweight, however, the percentage of children with immune-mediated type 1 diabetes who are obese is increasing. As many as 24% may be overweight at the time of diagnosis. Children with immune-mediated diabetes usually have a short duration of symptoms and frequently have ketosis; 30–40% have ketoacidosis at presentation (2). After metabolic stabilization, they may have an initial period of diminished insulin requirement (i.e., honeymoon period), after which they require insulin for survival and are at continual risk for ketoacidosis. Of children with immune-mediated type 1 diabetes, 5% have a first- or second-degree relative with the same disease.

In contrast, most children with type 2 diabetes are overweight or obese at diagnosis and present with glycosuria without ketonuria, absent or mild polyuria and polydipsia, and little or no weight loss. But up to 33% have ketonuria at diagnosis, and 5–25% of patients who are subsequently classified as having type 2 diabetes have ketoacidosis at presentation. These patients may have ketoacidosis without any associated stress, other illness, or infection. Children with type 2 diabetes

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Abbreviations: 2-h PG, 2-h plasma glucose; ADA, American Diabetes Association; DKA, diabetic ketoacidosis; FDA, Food and Drug Administration; FPG, fasting plasma glucose; HHNK, hyperglycemic hyperosmolar nonketotic; IA, insulin antibody; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; MODY, maturity-onset diabetes of the young; NHANES III, Third National Health and Nutrition Examination Survey; OGTT, oral glucose tolerance test; PCOS, polycystic ovarian syndrome; SMBG, self-monitoring of blood glucose.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

This statement was endorsed by the American Academy of Pediatrics in January 2000.

Table 1—*Criteria for the diagnosis of diabetes*

- Symptoms of diabetes plus casual plasma glucose concentration ≥200 mg/dl (11.1 mmol/l). Casual is defined as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss.

or

- FPG ≥126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h.

or

- 2-h PG ≥200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by the World Health Organization (20), using a glucose load containing the equivalent of 75-g anhydrous glucose dissolved in water.

In the absence of unequivocal hyperglycemia with acute metabolic decompensation, these criteria should be confirmed by repeat testing on a different day. The third measure (OGTT) is not recommended for routine clinical use. Adapted from the Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus (1).

usually have a family history of type 2 diabetes, and those of non-European ancestry (Americans of African, Hispanic, Asian, and American Indian descent) are disproportionately represented.

While there is heterogeneity in the presentation of both type 1 and type 2 diabetes, there are certain clinical features that suggest type 2 diabetes. As noted above, obesity is a hallmark of type 2 diabetes, with up to 85% of affected children either overweight or obese at diagnosis. Occasionally, obesity may be masked by significant weight loss in the months or year before diagnosis. A family history of diabetes is usually present; 45–80% of patients have at least one parent with diabetes and may have a history of diabetes over several generations. Of the patients, 74–100% have a first- or second-degree relative with type 2 diabetes. Of note, diabetes in the parent or other relative may not be recognized until the child is diagnosed.

Acanthosis nigricans and polycystic ovarian syndrome (PCOS), disorders associated with insulin resistance and obesity, are common in youth with type 2 diabetes. Acanthosis is a cutaneous finding characterized by velvety hyperpigmented patches most prominent in intertriginous areas and is present in as many as 90% of children with type 2 diabetes (A. Fagot-Campagna, D.J. Pettitt, M.M. Engelgau, N.R. Burrows, L.S. Geiss, R. Valdez, G. Beckles, J. Saaddine, E.W. Gregg, D.F. Williamson, K.M. Venkat Narayan, *J Pediatrics*. In press). It is recognized more frequently in darker-skinned obese individuals. PCOS is a reproductive disorder characterized by hyperandrogenism and chronic anovulation not due to specific diseases of the ovaries, adrenals, and pituitary. Lipid disorders and hypertension also occur in children with type 2 diabetes.

Currently, children with type 2 diabetes are usually diagnosed over the age of 10 years and are in middle to late puberty. As the childhood population becomes increasingly overweight, type 2 diabetes may be expected to occur in younger prepubertal children.

Children with idiopathic type 1 diabetes may be difficult to distinguish from those with immune-mediated type 1 diabetes. The majority of those described with idiopathic type 1 diabetes have what has been termed atypical diabetes mellitus (ADM, type 1.5, or "Flatbush" diabetes) and are African-American (3,4). Their family history is positive for early-onset diabetes in many relatives in multiple generations. Insulin may not be required for survival after the resolution of the acute metabolic deterioration. Metabolic control, however, is poor without insulin therapy, and ketoacidosis may recur.

Maturity-onset diabetes of the young (MODY) is a rare form of diabetes in children that includes several disorders caused by monogenic defects in β-cell function inherited in an autosomal-dominant fashion (5). Recent studies suggest that the clinical spectrum of MODY is broad, ranging from asymptomatic hyperglycemia to a severe acute presentation. MODY has been reported in all races/ethnicities. These gene abnormalities are thought to be rare, and molecular diagnostic testing, currently only available in research laboratories, is required for specific classification. Until such testing becomes commonplace, children with MODY should be classified as having the type of diabetes that best fits their clinical picture.

In most patients, classification can be made reliably on the basis of clinical presentation and course. In the unusual circumstance that requires a specific classification to be made, other tests may be necessary, such as a fasting insulin or C-peptide determination, and occasionally, β-cell autoantibody measurements (Fig. 1). Individuals with type 2 diabetes do not generally have autoantibodies to β-cell proteins; fasting insulin and C-peptide levels are usually normal or elevated, although not as elevated as might be expected for the degree of hyperglycemia.

Specific autoantibodies to insulin, to GAD, or to the tyrosine phosphatases insulin antibody (IA)-2 and IA-2β are found at presentation in 85–98% of individuals with immune-mediated type 1 diabetes. To

Table 2—*Etiologic classification of diabetes*

- Type 1 diabetes* (β-cell destruction, usually leading to absolute insulin deficiency)
  - Immune-mediated
  - Idiopathic
- Type 2 diabetes* (may range from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance)
- Other specific types
  - Genetic defects of β-cell function (e.g., MODY)
  - Genetic defects in insulin action (e.g., lipoatrophic diabetes)
  - Diseases of the exocrine pancreas (e.g., cystic fibrosis)
  - Endocrinopathies (e.g., Cushing's syndrome)
  - Drug- or chemical-induced (e.g., glucocorticoids)
  - Infections (e.g., congenital rubella)
  - Uncommon forms of immune-mediated diabetes
  - Other genetic syndromes sometimes associated with diabetes (e.g., Prader-Willi syndrome)
- Gestational diabetes mellitus (GDM)

*Patients with any form of diabetes may require insulin treatment at some stage of their disease. Use of insulin does not, of itself, classify the patient. Adapted from the Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus (1).

Table 3—*Estimates of the magnitude of type 2 diabetes in North American children*

	Years	Race/ethnicity	Age (years)	Estimates
Study types				
Population-based studies				Prevalence per 1,000
Arizona	1992–1996	Pima Indians	10–14	22.3
			15–19	50.9
Manitoba	1996–1997	First Nations	10–19	36.0 in girls
NHANES III, all U.S.	1988–1994	Whites, African-Americans, Mexican Americans	12–19	4.1*
Clinic-based studies				
Indian Health Services (all U.S.)	1996	American Indians	0–14	1.3*
			15–19	4.5*
Manitoba	1998	First Nations	5–14	1.0
			15–19	2.3
Clinic-based studies				Incidence per 100,000/year
Cincinnati, OH	1994	Whites, African-Americans	10–19	7.2
Case series				Percentage of type 2 diabetes among new cases of diabetes
Cincinnati, OH	1994	Whites, African-Americans	0–19	16
			10–19	33
Charleston, SC	1997	Blacks	0–19	46†
San Diego, CA	1993–1994	Whites, African-Americans, Hispanics, Asian Americans	0–16	8
San Antonio, TX	1990–1997	Hispanics, Whites		18
Ventura, CA	1990–1994	Hispanics	0–17	45

*Estimates include type 1 and 2 diabetes; †percentage of type 2 diabetes among nonincident cases of diabetes. Adapted from A. Fagot-Campagna, D.J. Pettitt, M.M. Engelgau, N.R. Burrows, L.S. Geiss, R. Valdez, G. Beckles, J. Saaddine, E.W. Gregg, D.F. Williamson, K.M. Venkat Narayan, *J Pediatrics*. In press.

achieve a high degree of sensitivity, a combination of tests is required, which greatly increases the cost of classification. In the future, these tests may be standardized, more reliable, and less expensive. Immune-mediated type 1 diabetes also has a strong HLA association; however, HLA typing is not a useful diagnostic tool. Endogenous fasting insulin and C-peptide production in type 1 patients is low, with little or no increase after oral or intravenous glucose administration or after ingestion of a mixed meal. Specific laboratory evaluation to classify diabetes in children should only be used by diabetologists with pediatric expertise and only when a definitive classification is clinically required.

Patients with immune-mediated type 1 diabetes more frequently develop autoimmune disorders that may cause thyroid or adrenal disease, vitiligo, or pernicious anemia. Individuals with autoimmune diabetes are also more prone to celiac disease. The presence of other autoimmune disorders or celiac disease may suggest the need for further evaluation of a patient classified as having non–type 1 diabetes. Patients classified as having type 1 diabetes may also need to be reevaluated if their clinical course or family history is more consistent with type 2 diabetes.

QUESTION 2: What is the epidemiology of type 2 diabetes in children and adolescents?

The limited amount of information about the epidemiology of type 2 diabetes in children is in large part due to the relatively recent recognition of its emergence in this age-group. Table 3 summarizes the studies and reports that provide estimates of the frequency of type 2 diabetes in children (A. Fagot-Campagna, D.J. Pettitt, M.M. Engelgau, N.R. Burrows, L.S. Geiss, R. Valdez, G. Beckles, J. Saaddine, E.W. Gregg, D.F. Williamson, K.M. Venkat Narayan, *J Pediatrics*. In press). The Pima Indians in Arizona, known to have a high prevalence of type 2 diabetes, have been extensively studied. An analysis from 1992 to 1996 revealed a prevalence of type 2 diabetes of 22.3 per 1,000 in the 10- to 14-year-old age-group and 50.9 per 1,000 in the 15- to 19-year-old age-group. Affected individuals were identified in the course of clinical care or by having a 2-h blood glucose value ≥200 mg/dl during an oral glucose tolerance test (OGTT) (2-h plasma glucose [2-h PG]).

The Third National Health and Nutrition Examination Survey (NHANES III) constitutes a representative sample of the American population including 2,867 individuals aged 12–19 years who had blood glucose measurements between 1988 and 1994. Thirteen of those sampled had diabetes: nine based on insulin treatment, two based on treatment with oral agents, and two based on elevated blood glucose levels. These results projected a national prevalence estimate for all types of diabetes of 4.1 per 1,000 in this age-group, which can be compared with a prevalence of 0.3 per 1,000 for cystic fibrosis, one of the most common inherited disorders in U.S. children (6).

Additional information comes from reports of diagnosed cases in different areas of the U.S. For example, in Cincinnati, Ohio, the incidence of type 2 diabetes in 10- to 19-year-old patients increased from 0.7 per 100,000 in 1982 to 7.2 per 100,000 in 1994.

Evidence is accumulating suggesting that type 2 diabetes is increasing in children and adolescents in the U.S. The population-based data derived from the Pima Indians show a statistical increase in prevalence from 1967 to 1996 for those aged 10–14 and 15–19 years. Between 1988 and 1996, the Indian Health Service also documented a 54% increase in

prevalence of reported diabetes in 15- to 19-year-old adolescents. Registry data from Allegheny County, Pennsylvania, and Chicago, further suggest an increase in type 2 diabetes. Finally, in other case series, type 2 diabetes constituted an increasing percentage of incident pediatric cases of diagnosed diabetes, with fewer than 4% reported before the 1990s and up to 45% in recent studies.

The emergence of type 2 diabetes in children is not limited to North America. The annual incidence of type 2 diabetes among junior high school children in Tokyo, detected by urine glucose screening and confirmed by glucose tolerance testing, increased from 7.3 per 100,000 in 1976–1980 to 12.1 per 100,000 in 1981–1985, and to 13.9 per 100,000 in 1991–1995. Data from Libya, Bangladesh, and aboriginal children in Australia and Canada indicate that childhood type 2 diabetes is occurring in these populations as well. One possible explanation for the emergence of type 2 diabetes in children is the increase of obesity and decreasing physical activity in children. Obesity is now reaching epidemic proportions in the U.S. and elsewhere.

Obesity is a very common finding in children with type 2 diabetes (A. Fagot-Campagna, D.J. Pettitt, M.M. Engelgau, N.R. Burrows, L.S. Geiss, R. Valdez, G. Beckles, J. Saaddine, E.W. Gregg, D.F. Williamson, K.M. Venkat Narayan, *J Pediatrics*. In press). In a young Pima Indian cohort with diabetes, 85% were obese. This association has been consistent in all reports, although the criteria for obesity and its severity have varied. The reported mean BMI ranges from 27 to 38 kg/m^2, and in most patients, the BMI was greater than the 85th percentile for age and sex. Although it has been well established in adults and in many populations that a "Westernized" lifestyle is associated with an increased frequency of type 2 diabetes, there are no well-controlled studies that have examined this issue in children. Decreased exercise and increased calorie and fat intake have been implicated as risk factors.

Family history of diabetes is strongly associated with type 2 diabetes in children. The frequency of a history of type 2 diabetes in a first- or second-degree relative has ranged from 74 to 100%. Among Pima Indians below the age of 25 years, diabetes has been reported exclusively in individuals with at least one diabetic parent. In the Pimas, offspring of mothers who had diabetes during pregnancy had a markedly increased prevalence of diabetes compared with offspring of mothers without diabetes and those whose mothers developed diabetes after the child's birth. Low birth weight has also been associated with the development of type 2 diabetes in Pima Indian children. These findings have not been reported in other childhood populations.

Sex and puberty are also possible risk factors. In the U.S. adult population, the prevalence of diagnosed type 2 diabetes is slightly higher in women than in men. Most of the studies in children, including those that are population-based, indicate a higher frequency in females. Reported cases of type 2 diabetes in children showed a peak age of diagnosis during the usual pubertal age period, although there have been individuals described who were diagnosed prepubertally. The mean age of diagnosis was between 12 and 16 years. The youngest patient who has been described is a 4-year-old Pima Indian.

There are a number of factors that may influence the accuracy of much of the information discussed above. Although the population-based studies are carefully done and accurately reflect the North American populations examined, case study reports probably underestimate the true magnitude of the problem, since they only describe diagnosed cases. If pediatric type 2 diabetes mirrors the adult experience, there will be many affected individuals who are undiagnosed. There is also suspicion that with the relatively recent recognition of type 2 diabetes in this age-group, many children are still being misdiagnosed as having type 1 diabetes. Indeed, the Chicago Registry indicates that this misclassification occurred as frequently as in 25% of cases.

As this problem continues to be defined and described, there remain a number of research needs. It will be necessary to better define the magnitude of type 2 diabetes in children and confirm that there is a significant trend toward increasing incidence and prevalence. It will also be important to clearly define the characteristics of those affected and the risk factors for developing the disease. Finally, it will be important to describe the natural history of the disease in those affected at young ages.

QUESTION 3: What is the pathophysiology of type 2 diabetes in children and adolescents?

Type 2 diabetes is a complex metabolic disorder of heterogeneous etiology with social, behavioral, and environmental risk factors unmasking the effects of genetic susceptibility (7). There is a strong hereditary (likely multigenic) component to the disease, with the role of genetic determinants illustrated when differences in the prevalence of type 2 diabetes in various racial groups are considered. The recent increases observed in diabetes prevalence have occurred too quickly to be the result of increased gene frequency and altered genetic pool, emphasizing the importance of environmental factors.

Glucose homeostasis depends on the balance between insulin secretion by the pancreatic β-cells and insulin action. For hyperglycemia to develop, insulin resistance alone is not sufficient and inadequate β-cell insulin secretion is necessary. There has been considerable debate about whether insulin resistance or insulin hyposecretion is the primary defect in type 2 diabetes in adults. The constellation of clinical characteristics in children with type 2 diabetes suggests that the initial abnormality is impaired insulin action, compounded later with β-cell failure.

It is well recognized that resistance to insulin-stimulated glucose uptake is a characteristic finding in patients with type 2 diabetes and impaired glucose tolerance. Cross-sectional and longitudinal studies in populations at high risk for developing type 2 diabetes demonstrate that hyperinsulinemia and insulin resistance are present in the prediabetic normoglycemic state. The evolution from normal to impaired glucose tolerance is associated with a worsening of insulin resistance. In patients with type 2 diabetes, impaired insulin action and insulin secretory failure are both present. The failure of the β-cell to continue to hypersecrete insulin underlies the transition from insulin resistance (with compensatory hyperinsulinemia and normoglycemia) to clinical diabetes (with overt fasting hyperglycemia and increased hepatic glucose production).

It has been proposed that hyperglycemia may worsen both insulin resistance and insulin secretory abnormalities, thus enhancing the transition from impaired glucose tolerance to diabetes or aggravating the diabetes. This way, hyperglycemia may beget more hyperglycemia—a concept called glucose toxicity. Glucose toxicity–induced abnormalities of insulin secretion and action can be ameliorated by correction of hyperglycemia.

Puberty appears to play a major role in the development of type 2 diabetes in children. During puberty, there is increased resistance to the action of insulin, resulting

in hyperinsulinemia (8). It has been known for many years that insulin responses during an OGTT increase significantly from the toddler ages to adolescence. After puberty, basal and stimulated insulin responses decline. Hyperinsulinemic-euglycemic clamp studies demonstrate that insulin-mediated glucose disposal is on average 30% lower in adolescents between Tanner stages II and IV compared with prepubertal children in Tanner stage I and compared with young adults. In the presence of normal pancreatic β-cell function, puberty-related insulin resistance is compensated by increased insulin secretion.

Both growth hormone and sex steroids have been considered as candidates for causing insulin resistance during puberty. The fact that sex steroids remain elevated after puberty while insulin resistance decreases makes sex steroids an unlikely cause of insulin resistance. Conversely, mean growth hormone levels increase transiently during puberty coincidental with the decrease in insulin action. In addition, administering growth hormone to non–growth hormone–deficient adolescents is associated with deterioration in insulin action, while testosterone administration has no such effect. Thus, increased growth hormone secretion is most likely responsible for the insulin resistance during puberty, and both growth hormone secretion and insulin resistance decline with completion of puberty.

Given this information, it is not surprising that the peak age at presentation of type 2 diabetes in children coincides with the usual age of mid-puberty. In an individual who has a genetic predisposition for insulin resistance, compounded with environmental risk exposure, the additional burden of insulin resistance during puberty may tip the balance from a state of compensated hyperinsulinemia with normal glucose tolerance to inadequate insulin secretion and glucose intolerance that continues beyond puberty.

The adverse effect of obesity on glucose metabolism is evident early in childhood. In healthy white children, total adiposity accounts for ~55% of the variance in insulin sensitivity. Obese children are hyperinsulinemic and have ~40% lower insulin-stimulated glucose metabolism compared with nonobese children. Moreover, the amount of visceral fat in obese adolescents is directly correlated with basal and glucose-stimulated hyperinsulinemia and inversely correlated with insulin sensitivity. In African-American children, as BMI increases, insulin-stimulated glucose metabolism decreases and fasting insulin levels increase. Furthermore, in these children, the inverse relationship between insulin sensitivity and abdominal fat is stronger for visceral than for subcutaneous fat. In a 7-year longitudinal study of African-American and white young adults 18 years and older, the strongest predictor for increases in both insulin and glucose concentrations was an increase in BMI.

Data about hyperandrogenism and type 2 diabetes are limited in the pediatric age-group. In adults, however, women with PCOS are at increased risk of type 2 diabetes because they have profound insulin resistance, independent of obesity, and they have abnormalities in β-cell function. In women with PCOS, 31% have impaired glucose tolerance and 7.5–16% have type 2 diabetes (9). Adolescents with PCOS have evidence of skeletal muscle insulin resistance with ~40% reduction in insulin-stimulated glucose disposal, compared with body composition–matched nonhyperandrogenic control subjects. Those adolescents with PCOS who have impaired glucose tolerance have ~50% decrement in first-phase insulin secretion.

Racial differences in insulin sensitivity are also evident in childhood. African-American 7- to 11-year-old children have significantly higher insulin levels than age-matched white children. The Bogalusa Heart Study evaluated plasma glucose and insulin levels during an OGTT in 377 children aged 5–17 years from a biracial community. After adjusting for weight, age, ponderal index, and pubertal stage, African-Americans showed higher insulin responses than their white counterparts, suggesting compensated insulin resistance. In other studies using clamp experiments, insulin sensitivity was 30% lower in African-American adolescents compared with white adolescents. These data suggest that minority children may have a genetic predisposition to insulin resistance, which, in the presence of environmental modulators, could increase their risk of type 2 diabetes and result in disease expression during physiologic (puberty) or pathologic (obesity) states of insulin resistance.

QUESTION 4: Who should be tested for diabetes?

Consistent with the recommendations of the ADA for screening in adults, only children at substantial risk for the presence or the development of type 2 diabetes should be tested. Case finding in an at-risk population requires that the condition tested for must be sufficiently common and serious to justify the cost and risks of testing. This criterion is met by the substantial risk for type 2 diabetes in obese children with a positive family history or signs of insulin resistance. Moreover, diabetes is associated with significant morbidity and premature mortality, and its complications are a major burden to individuals and to society.

The condition tested for should also have a prolonged latency period without symptoms during which abnormality can be detected. For example, case finding for type 1 diabetes in asymptomatic individuals is not considered appropriate because the latency period is relatively brief. As with type 2 diabetes in adults, a substantial number of children with type 2 diabetes can be detected in the asymptomatic state. Also, it is likely that, as with adults, there are many undiagnosed children with type 2 diabetes.

Further requirements for testing an asymptomatic group include the availability of a test that is sensitive (few false negatives) and accurate with acceptable specificity (minimal number of false positives). The fasting glucose test and 2-h OGTT have been applied to high-risk populations and are acceptably sensitive and specific. Lastly, there must be an intervention that is effective in the latency phase, and we do have interventions to reverse hyperglycemia, with the goal of preventing complications.

Testing recommendations

Population selection. Acknowledging that there are insufficient data to make definite recommendations, the Consensus Panel recommends that if an individual is overweight (defined as BMI >85th percentile for age and sex [10], weight for height >85th percentile, or weight >120% of ideal [50th percentile] for height) and has any two of the other risk factors listed below, testing should be done every 2 years starting at age 10 years or at onset of puberty if it occurs at a younger age. Testing may be considered in other high-risk patients who display any of the following characteristics:

- Have a family history of type 2 diabetes in first- and second-degree relatives;
- Belong to a certain race/ethnic group (American Indians, African-Americans, Hispanic Americans, Asians/South Pacific Islanders);

Table 4—*Testing for type 2 diabetes in children*

- Criteria*
  - Overweight (BMI >85th percentile for age and sex, weight for height >85th percentile, or weight >120% of ideal for height)
  - Plus
  - Any two of the following risk factors:
    - Family history of type 2 diabetes in first- or second-degree relative
    - Race/ethnicity (American Indian, African-American, Hispanic, Asian/Pacific Islander)
    - Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, PCOS)
- Age of initiation: age 10 years or at onset of puberty if puberty occurs at a younger age
- Frequency: every 2 years
- Test: FPG preferred

*Clinical judgment should be used to test for diabetes in high-risk patients who do not meet these criteria.

- Have signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, PCOS).

Test methods. As stated above, the fasting plasma glucose (FPG) and 2-h PG are both suitable. The FPG is preferred because of its lower cost and greater convenience. Fasting is defined as no consumption of food or beverage other than water for at least 8 h before testing. The recommended criteria for testing are given in Table 4.

The above recommendations are based on limited data. School- or community-based studies are needed. Such studies could establish the strength and risk level of various factors that might influence the development of type 2 diabetes (blood pressure, obesity, fat distribution, acanthosis nigricans, family history, race/ethnicity, and socioeconomic status). They would also provide useful information about the value of individual tests, including the FPG, 2-h PG, random glucose, and HbA_{1c}. These studies should be carried out in populations with sufficient numbers of children who are at high risk. In addition, longitudinal studies are needed to define the natural history and risk factors of the disease.

QUESTION 5: How should children and adolescents with type 2 diabetes be treated?

The ideal goal of treatment is normalization of blood glucose values and HbA_{1c} (11). Successful control of the associated comorbidities, such as hypertension and hyperlipidemia, is also important. The ultimate goal of treatment is to decrease the risk of the acute and chronic complications associated with diabetes. There is strong evidence from the U.K. Prospective Diabetes Study that normalization of blood glucose substantially decreases the frequency of microvascular complications of type 2 diabetes in adults (12). Macrovascular outcomes were not significantly decreased; however, a substudy investigating the effectiveness of tight control of blood pressure did show a decrease in cardiovascular events that was statistically significant. The early age of onset of type 2 diabetes in children may particularly increase the risk of microvascular complications, which are known to be directly related to duration of diabetes and hyperglycemia.

The initial treatment of type 2 diabetes will vary depending on the clinical presentation. The spectrum of disease at diagnosis ranges from asymptomatic hyperglycemia to diabetic ketoacidosis (DKA) and hyperglycemic hyperosmolar nonketotic (HHNK) states. Both DKA and HHNK crisis are associated with high morbidity and mortality in children. Cerebral edema can occur in either circumstance. Early consultation and referral to pediatric and adolescent diabetologists/endocrinologists with experience in the management of DKA and HHNK should be considered.

Patients who are not ill at diagnosis can be managed initially with medical nutrition therapy and exercise, but most will eventually require drug therapy. Although insulin is the only drug approved by the Food and Drug Administration (FDA) for the treatment of diabetes in children, most pediatric diabetologists use oral agents for children with type 2 diabetes. Advantages of oral agents include potentially greater compliance and convenience for the patient and family. There is little evidence that insulin is superior to oral agents for initial treatment of type 2 diabetes in children.

Clinical features suggesting initial treatment with insulin include dehydration, presence of ketosis, and acidosis. In the less ill child with type 2 diabetes, initial treatment with diet, exercise, and an oral agent may be appropriate. In all patients, identification and treatment of comorbid conditions are important. With time and treatment, metabolic control may change, necessitating reevaluation of treatment, such as tapering of insulin and introduction of an oral agent in the patient whose glycemic control improves after insulin therapy.

Lifestyle changes

All children with type 2 diabetes should receive comprehensive self-management education. The National Standards for Diabetes Self-Management Education is a useful framework for providing this invaluable component of treatment (13). Self-management education should include teaching self-monitoring of blood glucose (SMBG). SMBG should be performed as needed and during periods of acute illness or when symptoms of hyper- or hypoglycemia occur. Patients on insulin or sulfonylureas should also monitor periodically for asymptomatic hypoglycemia. Routine blood glucose monitoring should be tailored to individual needs but should probably include a combination of fasting and postprandial glucose measurements. HbA_{1c} should be assayed to monitor glycemic control and the results and their significance shared with the patient and family.

Referral to a dietitian with knowledge and experience in nutritional management of children with diabetes is necessary. Dietary recommendations should be culturally appropriate, sensitive to family resources, and provided to all caregivers. Encouraging healthy eating habits by the entire family is important. Behavior modification strategies for changing lifestyle and decreasing high-caloric high-fat food choices should be discussed (14).

Increasing caloric expenditure by increasing daily physical activity is an important component of therapy. Exercise can decrease insulin resistance and is an important component of weight management. Decreasing sedentary activity, such as television viewing and computer use, has been shown to be an effective way to increase daily physical activity in children. Involvement of family members can pro-

vide positive reinforcement and make overall family health a higher priority.

Successful treatment with diet and exercise is defined as cessation of excessive weight gain with normal linear growth, near-normal fasting blood glucose values (<126 mg/dl), and near-normal HbA_{1c} (less than ~7% in most laboratories). Follow-up should include periodic reevaluation and reinforcement of treatment modalities as well as appropriate SMBG and contact with the health care team when treatment goals are not met.

Successful diabetes management without oral medication or insulin occurs in fewer than 10% of adult patients with diabetes over time. In addition, data from adults suggest that type 2 diabetes is a progressive disorder, and over time, worsening glycemic control will result in the need for one or more oral agents and ultimately insulin alone or in combination with oral agents, even with good adherence to dietary and lifestyle changes.

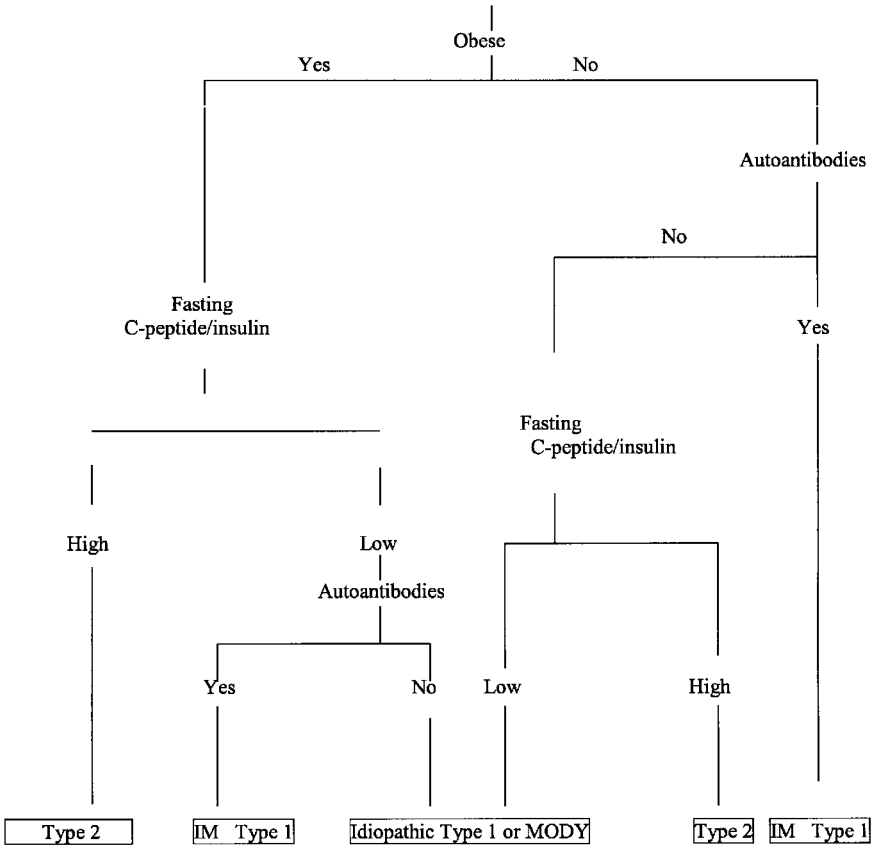

Figure 1—*Research schema for classification of diabetes in children and youth. Americans of non-European descent are at greater risk for type 2 diabetes than those of European ancestry. In addition, 50–90% of youth with type 2 diabetes will have a BMI >27 kg/m^2 (or >85% for age). The prepon - derance of children with type 2 diabetes are over 10 years of age, are in middle or late puberty, and have a strong family history for diabetes. Until the full clinical spectrum of MODY is understood, it cannot be excluded in those not tested for β-cell autoantibodies or in autoantibody-negative individuals. The final diagnostic classification may require knowledge of the patient's clinical course during the initial 1–3 years after diagnosis. IM, immune-mediated.*

Pharmaceutical therapy

Currently, there are five types of glucose-lowering oral agents available in the U.S. for the treatment of type 2 diabetes (15). Because the pathophysiology of type 2 diabetes in children and adolescents appears to be similar to that of type 2 diabetes in adults, it is reasonable to assume that such agents will be effective in children. Of note is the fact that efficacy and safety data are not available for children nor are any of the oral drugs FDA approved for use in children.

The available pharmaceutical agents and their mechanisms of action are as follows:

- Biguanides: decrease hepatic glucose output and enhance primarily hepatic and also muscle insulin sensitivity without a direct effect on β-cell function: metformin
- Sulfonylureas: promote insulin secretion: acetohexamide, chlorpropamide, gliclazide, glimepiride, glipizide, glyburide, tolazamide, and tolbutamide
- Meglitinide: short-term promotion of glucose-stimulated insulin secretion: repaglinide
- Glucosidase inhibitors: slow hydrolysis of complex carbohydrates and slow carbohydrate absorption: acarbose and miglitol
- Thiazolidenediones: improve peripheral insulin sensitivity: troglitazone, rosiglitazone, and pioglitazone.

Troglitazone has been associated with fatal hepatic failure; therefore, its use in children is not recommended. Until additional safety information about the other drugs in this class are available, their routine use in children cannot be recommended.

If treatment goals with nutrition education and exercise are not met, pharmacologic therapy is indicated. The first oral agent used should be metformin. Metformin has the advantage over sulfonylureas of a similar reduction in HbA_{1c} and in overall glucose levels without the risk of hypoglycemia. In addition, weight is either decreased or remains stable, and LDL cholesterol and triglyceride levels decrease.

Treatment with metformin also may normalize ovulatory abnormalities in girls with PCOS and increase the risk of unplanned pregnancy. Therefore, preconception and pregnancy counseling should be part of the treatment regimen, as for all girls and women of childbearing age with type 2 diabetes. No oral agent should be used during pregnancy, highlighting the importance of counseling adolescents with type 2 diabetes about sexuality and pregnancy.

Because of concerns about lactic acidosis, metformin is contraindicated in patients with impaired renal function and should be discontinued with the administration of radiocontrast material. Metformin should not be used in patients with known hepatic disease, hypoxemic conditions, severe infections, or alcohol abuse. Metformin should be temporarily discontinued with any acute illness associated with dehydration or hypoxemia. Insulin should be used if glycemic control deteriorates acutely. The most common side effects of metformin are gastrointestinal disturbances. Because proper dosing in children has not been evaluated and because most patients are near or

at adult weight, it is reasonable to use the doses recommended for adults.

If monotherapy with metformin is not successful over a reasonable period of time (i.e., 3–6 months), several alternatives can be considered. Some clinicians would add a sulfonylurea, whereas others might add insulin. Other insulin secretogogues are acceptable (e.g., meglitinide) as well as a glucosidase inhibitor, but these have been less frequently used in children. In the adolescent with an irregular eating schedule, meglitinide may have special advantages.

With greatly elevated blood glucose levels or in very symptomatic patients, starting treatment with insulin (bedtime insulin alone, twice-a-day insulin or multidose insulin regimens) may most effectively bring hyperglycemia and symptoms under control. When glucose control is established, adding metformin while decreasing insulin is a therapeutic option. Monitoring for urine ketones during this period may be helpful to identify those patients who have been misdiagnosed and actually have type 1 diabetes.

Monitoring for complications

Dilated eye examinations should be performed in adolescents with type 2 diabetes according to the ADA's standards of medical care (11). Screening for microalbuminuria should also be performed yearly. It is unclear whether foot examinations are important in this age-group; however, these examinations are painless, inexpensive, and provide an opportunity for education about foot care.

Other than testing for and treating elevated blood pressure and lipid abnormalities, studies to detect macrovascular disease are probably not indicated, although there are no data in this age-group.

Hypertension treatment

Careful control of hypertension in children is critical. ACE inhibitors are the agents of choice in children with microalbuminuria; because of the beneficial effects of ACE inhibitors on preventing diabetic nephropathy, many diabetologists consider ACE inhibitors the first line of therapy. The Joint National Committee VI report (16) also recommends α-blockers, calcium antagonists (long-acting), and low-dose diuretics. Although there has long been concern that use of β-blockers may worsen hypoglycemia and mask hypoglycemic symptoms, their benefits may outweigh their risks in selected patients. If normotension (for age and sex) is not achieved, combination therapy may be needed.

Hyperlipidemia treatment

Children with type 2 diabetes may be hyperlipidemic. Weight loss, increased activity, and improvement in glycemic control often results in improvement in lipid levels. Changing food choices and their preparation may also be helpful. If these actions fail, medications should be used (17). Dyslipidemia far outweighs all other risk factors for cardiovascular disease in adults with type 2 diabetes, and this may also be true for children with type 2 diabetes. HMG CoA reductase inhibitors ("statins") are absolutely contraindicated in pregnancy and should not be used in females of childbearing potential unless highly effective contraception is in use and the patient has been extensively counseled.

QUESTION 6: Can type 2 diabetes in children and adolescents be prevented?

Attempts to prevent type 2 diabetes in children should follow the same general paradigm as those to prevent type 2 diabetes in adults. Primary prevention efforts can be directed to high-risk individuals or to the overall population of children. Prevention of type 2 diabetes in high-risk children requires the ability to accurately identify those at an increased risk and provide them with the service they need. Prevention of type 2 diabetes should be considered at two stages in its natural history. Intervention can take place at an early stage when blood glucose levels are still normal or at the stage of impaired glucose tolerance (IGT)/impaired fasting glucose (IFG) when glucose levels are elevated but not yet diagnostic of diabetes. To whatever degree hyperinsulinemia and insulin resistance contribute to long-term cardiovascular morbidity and mortality, early lifestyle intervention may have long-term beneficial effects.

Primary care providers have an obligation to encourage lifestyle modifications that might delay or prevent the onset of type 2 diabetes in children at high risk. Lifestyle interventions focusing on weight management and increasing physical activity should be promoted in all children at high risk for the development of type 2 diabetes. For those who have progressed to IGT/IFG, these lifestyle interventions should be more aggressively implemented, along with regular assessment and follow-up.

In the adult population at risk for type 2 diabetes, intervention strategies that have been considered include lifestyle changes in diet and physical activity and pharmacologic interventions. Results of prevention trials using drugs are not likely to become available for several years. Until the results of current trials with oral hypoglycemic agents in children are available, intervention using glucose-lowering drugs for prevention of diabetes in children is not recommended.

In obese adults, weight reduction is known to reduce insulin resistance and circulating insulin levels. This reduction is beneficial in the treatment of the obese type 2 diabetic subject. It is also possible that weight reduction will slow the progression of IGT/IFG to type 2 diabetes. In adults, reduction of calorie and fat intake and increased consumption of fruits and vegetables have been associated with weight loss and a reduced risk of progression to type 2 diabetes. However, sustained weight reduction in adults is unusual. Dietary intervention data in pediatric populations are limited, but nutritional surveys have demonstrated that children eat more fat and fewer servings of fruits and vegetables than is recommended in dietary guidelines.

Nutritional interventions in children should be guided by a health care provider with knowledge and expertise in growth and development in children. The most effective dietary approach has been appropriate reduction of energy intake along with exercise to increase energy expenditure. Specific recommendations need to be individualized, and continued evaluation is crucial for long-term success. Individualized plans need to be based on assessment of food preferences, timing and location of meals and snacks, food preparation, and willingness to change behaviors. Drug therapy to reduce weight (i.e., anti-obesity agents) is not recommended in children until more safety and efficacy data are available. Use of very-low-calorie or high-protein diets as well as other fad diets is also not recommended. Quick-fix weight loss programs are unsafe for children and rarely result in long-term weight control. In addition, they do not promote long-term healthy eating behavior. Weight loss programs with the best results have been those combining exercise and dietary components, along with behavior modification. In the 6-year Da Qing IGT and Diabetes Study (18), 126 Chinese men with IGT who were randomized to a program including both dietary and exercise intervention developed type 2 diabetes 32% less

frequently than 133 men in a control group. Although results of other randomized controlled clinical trials of lifestyle interventions to reduce or delay the onset of type 2 diabetes in adults are not yet available, successful programs to promote improved nutrition and increased physical activity are likely to reduce the risk of type 2 diabetes.

Lack of physical activity is strongly associated with the development of obesity, type 2 diabetes, and cardiovascular morbidity and mortality. Despite information on the importance of exercise, only 25% of high school students participate in daily physical education classes, according to a 1995 survey conducted by the Centers for Disease Control and Prevention's Division of Adolescent and School Health (19). Recommendations for increasing physical activity should include encouraging patients to do at least 30 min of physical activity daily, limit sedentary activity, and participate in sports. Specific recommendations need to be individualized to the family and social situation and include safety considerations. Continued follow-up is critical for long-term success.

Primary prevention of type 2 diabetes in children should ideally include a public health approach that targets the general population. Health professionals need to be involved in developing and implementing school- and community-based programs to promote improved dietary and physical activity behaviors for all children and their families. Programs that provide children and their families with the knowledge, attitudes, behavioral skills, and encouragement to consume a healthy diet and engage in regular physical activity may be effective in attenuating the expanding problem of obesity. At the community level, schools, religious organizations, youth and family organizations, and government agencies should assume some responsibility for promoting a healthy lifestyle. School programs should promote healthy food choices and increased physical activity. Planning of effective preventive efforts for populations at risk needs to involve members of the community.

APPENDIX

Consensus panel members

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Organizational representatives

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CLINICAL REPORT

Update of Newborn Screening and Therapy for Congenital Hypothyroidism

Guidance for the Clinician in Rendering Pediatric Care

AMERICAN ACADEMY OF PEDIATRICS
Susan R. Rose, MD, and the Section on Endocrinology and Committee on Genetics

AMERICAN THYROID ASSOCIATION
Rosalind S. Brown, MD, and the Public Health Committee

LAWSON WILKINS PEDIATRIC ENDOCRINE SOCIETY

ABSTRACT

Unrecognized congenital hypothyroidism leads to mental retardation. Newborn screening and thyroid therapy started within 2 weeks of age can normalize cognitive development. The primary thyroid-stimulating hormone screening has become standard in many parts of the world. However, newborn thyroid screening is not yet universal in some countries. Initial dosage of 10 to 15 μg/kg levothyroxine is recommended. The goals of thyroid hormone therapy should be to maintain frequent evaluations of total thyroxine or free thyroxine in the upper half of the reference range during the first 3 years of life and to normalize the serum thyroid-stimulating hormone concentration to ensure optimal thyroid hormone dosage and compliance.

Improvements in screening and therapy have led to improved developmental outcomes in adults with congenital hypothyroidism who are now in their 20s and 30s. Thyroid hormone regimens used today are more aggressive in targeting early correction of thyroid-stimulating hormone than were those used 20 or even 10 years ago. Thus, newborn infants with congenital hypothyroidism today may have an even better intellectual and neurologic prognosis. Efforts are ongoing to establish the optimal therapy that leads to maximum potential for normal development for infants with congenital hypothyroidism.

Remaining controversy centers on infants whose abnormality in neonatal thyroid function is transient or mild and on optimal care of very low birth weight or preterm infants. Of note, thyroid-stimulating hormone is not elevated in central hypothyroidism. An algorithm is proposed for diagnosis and management.

Physicians must not relinquish their clinical judgment and experience in the face of normal newborn thyroid test results. Hypothyroidism can be acquired after the newborn screening. When clinical symptoms and signs suggest hypothyroidism, regardless of newborn screening results, serum free thyroxine and thyroid-stimulating hormone determinations should be performed.

INTRODUCTION

Congenital hypothyroidism (CH) is one of the most common preventable causes of mental retardation. In most cases, the disorder is permanent and results from an

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Key Words
congenital hypothyroidism, thyroid hormone, thyroid-stimulating hormone, newborn screening

Abbreviations
CH— congenital hypothyroidism
TH—thyroid hormone
T_4—thyroxine
T_3—triiodothyronine
TSH-R—thyrotropin receptor
TRBAb—thyrotropin receptor-blocking antibody
FT_4—free thyroxine
TSH—thyroid-stimulating hormone
TBG—thyroid-binding globulin
LBW—low birth weight
VLBW—very low birth weight
L-T_4—levothyroxine
TRH—thyrotropin-releasing hormone

abnormality in thyroid gland development (dysgenesis or agenesis) or a defect in thyroid hormonogenesis. Less commonly, the altered neonatal thyroid function is transient, attributable to the transplacental passage of maternal medication, maternal blocking antibodies, or iodine deficiency or excess. In rare cases, CH may result from a pituitary or hypothalamic abnormality (central or secondary/tertiary hypothyroidism). Recent advances in molecular and cell biology have led to improved understanding of normal thyroid physiology and of genes involved in thyroid gland development and disease. In addition, the mechanism and precise temporal sequence of thyroid hormone (TH) modulation of target gene expression are being elucidated.[1–8]

The initial American Academy of Pediatrics recommendation for newborn screening for CH was published in 1993.[9] Screening for CH is one of dozens of newborn screening tests conducted. The rapid advances in our knowledge in the decade since the 1993 publication have prompted reevaluation of the problem and the identification of new questions and concerns.

TH concentrations are low in the fetus during the first half of pregnancy. During this time, the fetus is entirely dependent on maternal TH; its supply to the fetus is controlled by the placenta and the thyroid status of the mother. The fetal hypothalamic-pituitary-thyroid axis begins to function by midgestation and is mature in the term infant at delivery. Despite the critical importance of TH on multiple organ systems, especially the brain, most infants with CH appear normal at birth. The hypothyroid fetus appears to be protected at least in part by placental transfer of maternal TH. This was best illustrated by the demonstration that cord blood thyroxine (T_4) concentration at birth in infants unable to synthesize T_4 was nonetheless one third to one half that of normal infants.[10] In addition, there is increased intracerebral conversion of T_4 to triiodothyronine (T_3), resulting in increased local availability of T_3 despite the low serum concentrations.[11–13] Indeed, normal or near-normal cognitive outcome is possible in even the most severely affected infants with CH. This is true as long as postnatal therapy is early and adequate and maternal thyroid function is normal. In contrast, when both maternal and fetal hypothyroidism are present, whether attributable to severe iodine deficiency, potent thyrotropin receptor (TSH-R)-blocking antibodies (TRBAbs) (or TSH-blocking immunoglobulins), or maternal-fetal PIT1 deficiency, there is a significant impairment in neurointellectual development despite adequate therapy soon after birth.[6,14,15] Maternal hypothyroidism alone during early gestation can lead to mild but significant cognitive impairment of the offspring.[6,15–19] In this report, attention is focused on the problem of CH alone; identification and treatment of maternal hypothyroidism has been the subject of several recent reviews.[20,21]

Pilot screening programs for CH were developed in Quebec, Canada, and Pittsburgh, Pennsylvania, in 1974 and have now been established in Western Europe, North America, Japan, Australia, and parts of Eastern Europe, Asia, South America, and Central America.[22–24] In North America, more than 5 million newborns are screened and approximately 1400 infants with CH are detected annually. Certainly the main objective of screening, the eradication of mental retardation after CH, has been achieved. In addition to the profound clinical benefit, it has been estimated that the cost of screening for CH is much lower than the cost of diagnosing CH at an older age. This estimate does not include the loss of tax income resulting from impaired intellectual capacity in the untreated but noninstitutionalized person. Newborn screening also has revealed the prevalence of the various causes of CH, including a series of transient disorders found predominantly in preterm infants. The incidence of CH has been found to be 4 to 5 times more common than phenylketonuria, for which screening programs were originally developed. The overall incidence of CH ranges from 1 in 3000 to 1 in 4000 newborn infants.[15,25] The incidence of CH is higher in Hispanic individuals and lower in black individuals.[25] There is a 2:1 incidence in females compared with males, and there is an increased risk in infants with Down syndrome.

Iodine deficiency remains the most common treatable cause of mental retardation worldwide. Associated nutritional deficiencies in selenium and iron may have an effect on neurologic development and on thyroidal response to iodine therapy.[26] Many countries have initiated salt iodination.[25–28] Although North America is usually considered to be an iodine-sufficient area, recent epidemiologic evidence suggests that a number of pregnant women may be iodine deficient.[29] There is also some concern that maternal iodine deficiency may be reappearing in developed countries despite salt iodination because diet-conscious young women may avoid iodine-supplemented salt and breads.[30,31] Iodine supplementation before or during pregnancy will normalize thyroid function in the mother and the newborn.[31,32]

The hypothalamic-pituitary-thyroid axis is finely tuned to maintain a fairly stable concentration of free thyroxine (FT_4) within any individual.[33] Divergence from this individual optimal "set point" because of underfunction of the thyroid gland results in an increase in thyroid-stimulating hormone/thyrotropin (TSH) concentration. The exception to this is when the hypothalamus or pituitary gland is unable to respond (in central hypothyroidism, rare pituitary resistance to FT_4 feedback, or in an occasional child with Down syndrome).

Thus, TSH is elevated if thyroid gland function is impaired and FT_4 decreases from its individual optimal set point, although TSH concentration is not elevated in central hypothyroidism.

Although much has been learned, some questions

remain. These issues include the optimal screening approach and the follow-up of infants with low T_4 and normal TSH concentrations. Finally, continued efforts are ongoing to establish the optimal therapy that leads to maximum potential for normal development for infants with CH.

SCREENING METHOD

Two screening strategies for the detection of CH have evolved: a primary TSH/backup T_4 method and a primary T_4/backup TSH method (Fig 1). In addition, an increasing number of programs use a combined primary TSH plus T_4 approach.

Primary TSH With Backup T_4 Measurements

Most programs in Europe, Japan, Canada, Mexico, and the United States screen by using primary TSH measurements, supplemented by T_4 determinations for infants with elevated TSH values. With this approach, delayed TSH elevation in infants with thyroid-binding globulin (TBG) deficiency, central hypothyroidism, and hypothyroxinemia will be missed. Delayed TSH elevation is particularly common in infants with low birth weight (LBW [<2500g]) and very low birth weight (VLBW [<1500g]). In the Quebec study, 2 cases of permanent CH (of 93 000 infants screened) would have been missed by the primary TSH approach and detected by the primary T_4 approach.[34] The recall rate (notification of a physician to contact the infant's family to arrange for a blood test) with a primary TSH screening approach is approximately 0.05%. At this rate, 2 infants will be recalled for testing for every case detected.

Current TSH assay techniques (enzyme-linked immunoassays, chemiluminescent assays, and fluoroimmunoassays) use nonradioactive labels and have improved sensitivity with the potential for better separation between normal and abnormal TSH concentrations. Thus, many screening programs are considering switching to a primary TSH approach. However, the trend toward early discharge of mothers and infants (before 48 hours of age) presents a problem with the switch to a primary TSH approach because of the normal increase in TSH postnatally. With early hospital discharge, the first screening specimen commonly is obtained before 48 hours of age. Recent data using a sensitive and specific immunofluorometric assay indicate that normal TSH values before 24 hours of age are not as high as those using previous assays and usually less than the cutoff value of 20 to 25 mU/L.[35,36] A 50% reduction in abnormal values occurred when age-adjusted TSH cutoffs were used.[37] Thus, the current experience using newer assays in a primary TSH screening approach in a population of infants discharged after 24 hours of age shows lower patient recall rates with negligible false-negative test results.

Primary T_4 With Backup TSH Measurements

An initial filter-paper blood-spot T_4 measurement is followed by a measurement of TSH for filter-paper specimens with low T_4 values.[9,25] The primary T_4 approach will detect primary hypothyroidism in infants with low or low-normal T_4 with elevated TSH concentrations (prevalence ranging from 1 in 3000 to 1 in 4000 newborn infants). In addition to detecting primary hypothyroidism, the primary T_4/backup TSH approach can also identify infants with TBG deficiency (prevalence ranging from 1 in 5000 to 10 000 newborn infants) and central hypothyroidism (low or low-normal T_4 with normal TSH concentration; prevalence: l in 50 000 newborn infants). Programs that quantify high T_4 values also have the potential to identify infants with hyperthyroxinemia (1 in 20 000 to l in 40 000 newborn infants). This approach, however, will miss the condition in an infant with an initially normal T_4 concentration and delayed increase in TSH. To ensure identification of infants with CH who have low-normal T_4 values, most screening programs use a T_4 concentration cutoff of <10th percentile for the days' assay. Comparison of the primary T_4 versus primary TSH screening approach was conducted in Quebec (1983).[34] One case (of 93 000 infants screened) would have been missed by the primary T_4 approach and detected by the primary TSH approach.[34]

Programs using a primary T_4 with secondary TSH approach will follow-up on infants with a low T_4 and elevated TSH screening result. The recall rate for primary hypothyroidism in these screening programs is approximately 0.05%, similar to that in primary TSH screening programs.[38] However, some primary T_4 screening programs also report low T_4 results below an absolute cutoff (eg, 3.0 μg/dL [39 nmol/L]) in infants even if the TSH was normal. The recall rate (and therefore the false-positive rate) will be higher (approaching 0.30%) with this practice. For example, in a 1990 study in California, which did not report low T_4 results, the recall rate was 0.08%. In contrast, a study performed in Oregon, which reported infants with 2 low T_4 results <3rd percentile, the recall rate was 0.30%.[39] This means that up to 12 normal infants may be recalled for testing for every 1 case of hypothyroidism.

Combined Primary TSH Plus T_4 Measurements

Methods for the simultaneous measurement of T_4 and TSH are available (DELFIA data). This represents the ideal screening approach, especially once it is possible for FT_4 to be measured accurately and cost-effectively in the eluates from filter-paper blood spots. Until T_4 and TSH determinations can be performed practically for all infants, physicians should be aware of the potential limitations of each method of screening for CH.

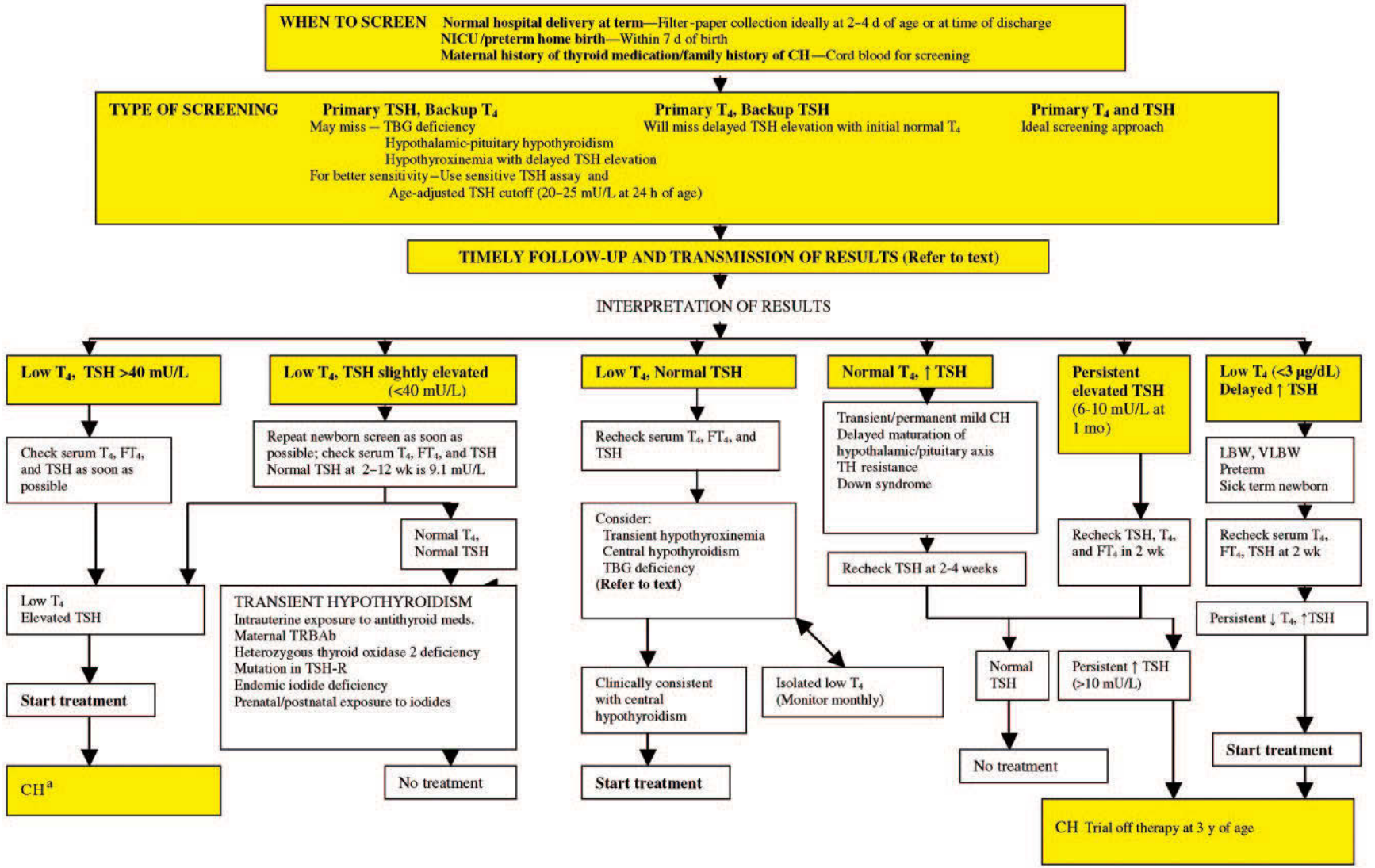

FIGURE 1
Newborn screening for CH. [a] Management of CH is summarized in Table 1.

THE SPECIMEN

Every infant should be tested before discharge from the nursery, optimally by 48 hours to 4 days of age. As noted above, specimens collected in the first 24 to 48 hours of life may lead to false-positive TSH elevations when using any screening test approach. However, screening before hospital discharge or before transfusion is preferable to missing the diagnosis of hypothyroidism. False-negative results may occur by screening a very sick newborn or after transfusion. Because newborn blood specimens are used for a variety of screening tests and shared among different laboratories, every effort should be made to collect adequate and sufficient blood in the recommended manner.[39]

It is highly desirable that the blood be collected when the infant is between 2 and 4 days of age, but there are situations in which this is virtually impossible. In infants discharged from the nursery before 48 hours of age, blood should be obtained before discharge. In instances such as home births or in the case of a critically ill or preterm neonate, blood should be obtained by 7 days of age, recognizing that samples obtained after 4 days of age are late for screening of congenital adrenal hyperplasia or metabolic disease. Particular care must be taken with infants in NICUs. In such cases, more urgent medical problems may result in missed newborn screening. When an infant is transferred to another hospital, the first hospital must indicate whether the specimen has been collected. The second hospital should obtain a specimen if there is no proof that blood was collected before the transfer.

Some state screening programs, testing 10% of newborns in the United States, perform newborn screening on specimens routinely collected at 2 time periods. These programs report that CH is detected in approximately 10% of the affected infants only as a result of collection of a second specimen. The additional incidence of CH based on a second screening at 2 weeks of age is approximately 1 in 30 000.[38,40] Infants with CH detected at the later screening time tend to be of LBW or VLBW, with mild or delayed TSH elevations.[41] Whether these cases represent transient or permanent cases is unknown. Some have thyroid dysgenesis (ectopia, aplasia, or hypoplasia) on thyroid scanning. Others appear to have increased uptake and a large thyroid gland, suggestive of dyshormonogenesis.[8] Either these infants have transient disease or their disease is undiagnosed until a later age, when they appear to have acquired hypothyroidism.

Accurate screening results depend on good-quality blood spots. The filter paper designed for newborn screening bears printed circles. Capillary blood samples are placed in these circular areas to fill and saturate them. Spotting blood over a previous blood spot, or double spotting, causes invalid results, and these blood spots should not be used. The recall of an infant for testing because of an unsatisfactory filter-paper specimen causes needless delay in diagnosis and treatment of a newborn with CH. Specimens that are technically unsatisfactory or contain insufficient amounts of blood should not be assayed. Blood samples should be collected on approved filter-paper forms, dried at room temperature, and not subjected to excessive heat. The blood should completely saturate the filter paper and be applied to 1 side only. Filter-paper spots should not be handled, placed on wet surfaces, or contaminated by coffee, milk, or other substances. Any of these have the potential to invalidate the results regardless of the method used. Testing of an unsatisfactory specimen (because of insufficient blood) can result in a false-negative TSH value. False-negative values can also result from human error in the processing of satisfactory specimens or in erroneous reporting of the results.

TEST RESULTS

Transmission of Results and Follow-up Testing

Newborn screening test results must be communicated rapidly back to the physician or hospital identified on the screening filter-paper card. The responsibility for transmission of these results rests with the authority or agency that performed the test. In general, when an abnormal screening result is found, the responsible physician is notified immediately so that he or she can arrange for follow-up testing. Screening test results should be entered into the patient's record. If the informed physician is no longer caring for or cannot locate the infant, he or she should notify the newborn screening laboratory immediately. In such situations, the local health department is often helpful in locating these infants to ensure that they are not lost to follow-up.

Low T_4 and Elevated TSH Values

Any infant with a low T_4 concentration and TSH concentration greater than 40 mU/L* is considered to have primary hypothyroidism. Such infants should be examined immediately and have confirmatory serum testing performed to verify the diagnosis. Treatment with replacement levothyroxine (L-T_4) should be initiated as soon as confirmatory tests have been drawn and before the results of the confirmatory tests are available. (Clinical management of infants with hypothyroidism is described in the following section.) For cases in which the screening TSH concentration is only slightly elevated but less than 40 mU/L, another filter-paper specimen should be obtained for a second newborn screening. Ten percent of infants with confirmed CH have TSH values between 20 and 40 mU/L. It is important that age-appropriate normative values be used. The reference

* All filter-paper TSH [and T_4] levels here are reported as serum equivalents. Some laboratories report screening results per unit of blood, a value that is approximately half the concentration in serum. We recommend that all laboratories report results per unit of serum, because TSH and T_4 are preferentially distributed into the serum.

range for TSH for the most common time of TSH reevaluation (between 2 and 6 weeks of age) is 1.7 to 9.1 mU/L.[42]

Normal T_4 and Elevated TSH Values

Hyperthyrotropinemia is characterized by elevated serum TSH concentrations during the neonatal period despite normal T_4 and FT_4 concentrations. The etiology is probably heterogeneous and can be either a transient or permanent thyroid abnormality[43–46] or delayed maturation of the hypothalamic-pituitary axis. Inactivation mutations in the TSH-R cause compensated, mild (subclinical) primary hypothyroidism in the neonatal period. The incidence of both transient and persistent hyperthyrotropinemia and CH appears to be higher in infants with Down syndrome. In some cases, transient neonatal hyperthyrotropinemia persists until 10 years of age or later.

There is controversy regarding the need for TH therapy in this setting. There have been no long-term studies to evaluate cognitive development in this group of patients. TSH concentration is the most sensitive indicator that the hypothalamic-pituitary axis is sensing less T_4 than the body "perceives" as optimal. Most physicians would consider a persistent basal TSH concentration higher than 10 mU/L (after the first 2 weeks of age) to be abnormal.[42] Therefore, if the TSH elevation persists, the infant should be treated. If such infants are not treated, measurement of FT_4 and TSH should be repeated in 2 and 4 weeks, and treatment should be initiated promptly if the FT_4 and TSH concentrations have not normalized.

The management of infants with TSH elevations between 6 and 10 mU/L that persist after the first month of life is even more controversial. TSH concentrations are slightly higher in the first few months of life. A TSH range of 1.7 to 9.1 mU/L has been reported for children 2 to 20 weeks of age (Quest Diagnostics reference values, Lyndhurst, NJ). Thus, using the adult reference range for TSH will result in treatment of many euthyroid children. Consequently, if a decision is made to treat such children, a trial off therapy at 3 years of age should be performed.

Low T_4 and Normal TSH Values

Infants with normal TSH but low T_4 values (defined as 2 SDs below the mean for the reference range for age, usually below 10 μg/dL in the newborn infant) may have thyroid insufficiency. The low T_4 with normal TSH profile is seen in 3% to 5% of neonates. This pattern may result from hypothalamic immaturity (particularly in preterm infants, 12% of all newborn infants). Low T_4 but normal TSH results are also observed during illness, with protein-binding disturbances such as TBG deficiency (1 in 5000), in central hypothyroidism (1 in 25 000 to 1 in 50 000 newborn infants; see next 3 paragraphs),[47] or with primary hypothyroidism and delayed TSH elevation (1 in 100 000 newborn infants). Newborn infants who are preterm or ill are found with disproportionate frequency among those with this set of laboratory values.[48] In neonates/infants, inhibition of TSH (causing low T_4 concentrations) can result from constant infusions of dopamine or high-dose glucocorticoids.

Transient hypothyroxinemia is seen to some extent in many preterm infants.[36,48] Immaturity of the hypothalamic-pituitary axis may be physiologically normal for the infant's gestational age. Preterm serum T_4 and FT_4 concentrations are lower than those of term infants, but the TSH concentrations are comparable to term infants.[49,50] Serum TBG concentrations are only slightly low in preterm infants and do not account for the degree of hypothyroxinemia. Consequently, the FT_4 is rarely as low as the total T_4. Serum inhibitors of T_4 binding, present in many patients with nonthyroidal illness, may be an additional contributor to the decreased T_4 values.

In contrast to transient hypothyroxinemia, the presence of midline facial abnormalities, hypoglycemia, microphallus, or visual abnormalities should suggest the possibility of a hypothalamic-pituitary abnormality. Septo-optic dysplasia, often associated with pituitary hormone deficiencies, can manifest as central hypothyroidism.[51,52] Genetic mutation in HESX-1 has been described in septo-optic dysplasia. Clinical symptoms of hypopituitarism, such as neonatal hypoglycemia (from growth hormone and adrenocorticotropic hormone deficiencies), polyuria (from antidiuretic hormone deficiency), or small phallus in boys (from gonadotropin deficiencies), along with the presence of blindness, congenital nystagmus, or midline defects of the brain, should alert the physician to suspect the diagnosis of septo-optic dysplasia. Alternatively, multiple pituitary hormone deficiencies suggest a genetic defect in the cascade leading to fetal pituitary formation, such as PROP1, LHX3, and POU1F1.[4,53] DNA screening for these molecular abnormalities could be beneficial in the future for the rapid and accurate detection of these affected infants during the first weeks of life, but is not yet available clinically.

Isolated TSH-releasing hormone (TRH) deficiency may cause low-normal T_4 and low or normal TSH concentrations. Secondary (or central) hypothyroidism may be suspected in infants with low T_4 and FT_4 and low TSH concentrations.[32,43] Mutations have been identified in the β subunit of TSH, TRH gene, and TRH receptor gene.[54,55] Finally, congenital TSH and growth hormone deficiencies may occur as a result of a difficult birth or anoxia.[56]

In programs that report low T_4 with normal TSH results, there is no clear consensus regarding optimal follow-up. Such programs have elected to take no further action, to follow-up with serial filter-paper screening tests until the T_4 value becomes normal, or to request a second blood sample for measurement of FT_4 and TSH

concentrations. Most infants with low T_4 and normal TSH have normal FT_4 values, and subsequent thyroid function test results are normal. Programs that choose to pursue further laboratory testing must weigh the benefit of detecting TBG deficiency or the rare case of hypopituitary-hypothyroidism or delayed TSH increase against the cost and the psychological effect on the family. The responsibility of deciding which course of action to follow rests with the physician providing the care of the infant. Treatment of these infants (with the exception of those with central hypothyroidism or delayed TSH increase) with L-T_4 has not yet been shown to be beneficial.[48,57–59]

Low T_4 and Delayed TSH Increase

Many infants with low T_4 concentrations and normal TSH values on initial screening (l in 100 000 newborn infants) who are subsequently found to have an elevated TSH concentration are LBW, VLBW, or critically ill preterm and term neonates. Serum TSH values in these infants increase during the first few weeks of life to concentrations characteristic of primary hypothyroidism. It is unclear whether infants with this delayed TSH elevation have an abnormality of pituitary-thyroid feedback regulation, transient hypothyroidism (eg, iodine induced), or a mild form of permanent CH. Long-term follow-up of these infants has not been reported. It is important, therefore, that serum FT_4 and TSH be tested in infants with overtly low T_4 concentrations or in any infant with suggestive signs of hypothyroidism. Infants with low T_4 and a delay in elevation of TSH values and those with normal T_4 concentrations and elevated TSH values might be missed on initial screening. Neither a primary T_4/backup TSH nor a primary TSH/backup T_4 screening strategy will detect the rare infant with a normal T_4 at birth but delayed TSH increase. Even in the absence of technical and human errors, 5% to 10% of LBW and VLBW newborn infants with CH may have normal screening hormone concentrations regardless of the approach used.

Some screening programs routinely obtain a second specimen at 2 to 6 weeks of age and/or obtain a serum sample from any infant with 2 successive T_4 values below an absolute cutoff (<3rd percentile). Whatever strategy is used, subsequent testing should be performed on serum during infancy whenever there is a perceived risk of hypothyroidism, as in familial dyshormonogenesis or in infants with clinical suspicion of hypothyroidism. In addition, a second specimen should be drawn at 2 weeks of age in monozygotic twins, because fetal blood mixing may mask the screening test results.[60]

However, a second screen has not become routine because of (1) increased cost, (2) relatively low yield of cases, (3) diversion and dilution of key personnel, (4) inability to implement new programs, and (5) absence of such cases missed in primary TSH screening programs. Finally, the cognitive and developmental prognosis of this cohort is uncertain because the etiology in most cases is unknown and there are no definitive follow-up data.

As an alternative strategy, other programs have attempted to identify high-risk patient groups so that routine rescreening can be targeted to these infants. There is a disproportionate incidence of delayed TSH increase in VLBW infants (incidence of CH: 1 in 250), LBW infants (incidence of CH: 1 in 1589), and neonates in intensive care settings or with cardiovascular abnormalities.[61] Therefore, some screening programs routinely screen again at 2 weeks and 6 weeks of age all VLBW and all LBW infants in the NICU, especially in newborns known to have cardiac disease. It is likely that most of these infants do not have permanent CH. If hyperthyrotropinemia persists at 6 weeks of age, TH replacement should be started, consistent with therapy of other forms of transient CH, and the infant should be retested after 3 years of age (after stopping therapy for 4–6 weeks) (see "Assessment of Permanence of Hypothyroidism").

Transient TSH Elevation

A small number of infants with abnormal screening values will have transient hypothyroidism as demonstrated by normal serum T_4 and TSH concentrations on the confirmatory (follow-up to screening) laboratory tests. Transient hypothyroidism is relatively rare in North America (estimated at 1 in 50 000) in contrast to iodine-deficient areas of the world; it is much more common in preterm infants but may occur in apparently healthy term infants. Transient hypothyroidism may result from intrauterine exposure to maternal antithyroid drugs, maternal TRBAbs, heterozygous thyroid oxidase 2 deficiency, germ-line mutations in the TSH-R, endemic iodine deficiency, or prenatal or postnatal exposure to excess iodides (povidone iodine, iodinated contrast materials).[31,32,43,62,63] Transient iodine-induced CH is not usually evident at birth and, therefore, may not be detected if newborn screening is performed in the first few days postnatally.

Transplacental passage of potent maternal TRBAbs (incidence: 1 in 180 000) is a much less common cause of transient CH but should be suspected if there is a maternal history of autoimmune thyroid disease or if there is a history of previous affected offspring. In this setting, cord serum can be collected and rapidly tested for thyroid abnormalities. The half-life of immunoglobulin G in the neonate is approximately 3 to 4 weeks,[64] and TRBAbs usually disappear from serum of affected infants by 3 to 6 months of age, depending on the antibody potency.

Because the transient nature of the hypothyroidism will not be recognized clinically or through laboratory tests in some infants, initial treatment will be similar to that in any infant with permanent CH. In these cases, it

is important to determine at some later time whether the hypothyroidism is permanent and whether the infant in fact requires lifelong treatment (see "Assessment of Permanence of Hypothyroidism"). However, in the newborn infant with transient hypothyroidism whose mother is receiving an antithyroid drug, the T_4 and TSH values tend to return to normal within 1 to 3 weeks after birth without treatment.

CLINICAL MANAGEMENT OF NEWBORN INFANTS WITH LOW T_4 AND ELEVATED TSH VALUES

Infants with low T_4 and elevated TSH concentrations have CH until proven otherwise. Management should include the following (Table 1):

1. The infant should be seen by his or her physician without delay. Consultation with a pediatric endocrinologist is recommended to facilitate diagnostic evaluation and optimal management.
2. A complete history, including prenatal thyroid status (maternal drugs and medications) and family history should be obtained, and physical examination should be performed.
3. Serum should be obtained for confirmatory measurements of TSH and FT_4. An elevated thyroglobulin concentration may suggest dyshormonogenesis. Care must be taken to compare the serum results to normal TH concentration for age. When there is history of a maternal autoimmune thyroid disorder or a previously affected infant, measurement of TRBAbs in the infant and/or mother may identify a transient form of neonatal hypothyroidism.
4. Education of parents by trained personnel using booklets or visual aids is highly desirable. Education should focus on (*a*) the etiology of CH, (*b*) the lack of correlation of parental lifestyle during pregnancy with causes of the disease, (*c*) the benefit of early diagnosis in preventing mental retardation, (*d*) the appropriate manner in which TH is administered and the substances (eg, soy, iron, calcium, and fiber) that can interfere with TH absorption, (*e*) the importance of adherence to the treatment plan, and (*f*) the importance of periodic follow-up care.
5. Optional diagnostic studies include thyroid ultrasonography or iodine 123 (^{123}I) or sodium technetium 99m pertechnetate (^{99m}Tc) thyroid uptake and/or scan to identify functional thyroid tissue. Although ^{123}I tends to give a more accurate uptake and scan picture, it may not be readily available in all hospitals. ^{99m}Tc is generally more readily available and a much less expensive radioisotope. The half-life of ^{123}I is 13.3 hours, compared with 8 days for iodine 131 (^{131}I). ^{123}I exposes the infant to much lower doses of ionizing radiation compared with ^{131}I (probably one 100th of the ^{131}I dose [H.-M. Park, MD, Professor Emeritus, Radiology, Indiana University, personal communication, September 16, 2004]).

There remains some controversy regarding the risk-benefit ratio of early thyroid scanning of infants with suspected hypothyroidism. For physicians who opt for imaging, the benefits can be summarized as follows:

1. If an ectopic gland is demonstrated, a permanent form of thyroid disease and CH has been established.
2. The absence of thyroid gland uptake is most often associated with thyroid aplasia or hypoplasia. When radioiodine uptake is absent but ultrasonographic examination reveals a normal gland, a TSH-R defect, iodine-transport defect, or maternal transfer of TRBAbs may be present.
3. Normal scan findings (or a goiter) indicate a functioning thyroid gland with regard to iodine uptake and alert the physician to a probable hereditary defect in T_4 synthesis. Measurement of serum thyroglobulin will help to separate thyroglobulin synthetic defects from other causes of hypothyroidism.[65] Exposure to an exogenous goitrogen other than iodine, such as antithyroid drugs, will produce a similar picture. Finally, some infants exposed to maternal TRBAbs may have a normal scan if their hypothyroidism is partially compensated. The identification of a genetically mediated thyroid synthetic enzyme defect is especially important for families planning on having additional children. In such cases, the scan enables the physician to arrange for genetic counseling.
4. Some infants with normal scan findings at birth who do not fall into one of the above categories may have a transient form of hypothyroidism. These infants should undergo a careful follow-up evaluation after 3

TABLE 1 Management of CH

Initial workup
Detailed history and physical examination
Referral to pediatric endocrinologist
Recheck serum TSH and FT_4
Thyroid ultrasonography and/or thyroid scan (see text for recommendations)
Medications
L-T_4: 10–15 μg/kg by mouth once daily
Monitoring
Recheck T_4, TSH
2–4 wk after initial treatment is begun
Every 1–2 mo in the first 6 mo
Every 3–4 mo between 6 mo and 3 y of age
Every 6–12 mo from 3 y of age to end of growth
Goal of therapy
Normalize TSH and maintain T_4 and FT_4 in upper half of reference range
Assess permanence of CH
If initial thyroid scan shows ectopic/absent gland, CH is permanent
If initial TSH is <50 mU/L and there is no increase in TSH after newborn period, then trial off therapy at 3 y of age
If TSH increases off therapy, consider permanent CH

years of age, when it is safe to discontinue treatment temporarily under the conditions described in "Assessment of Permanence of Hypothyroidism."

Treatment need not be delayed to perform the scan. A thyroid scan can be performed within the first few days of treatment, because the elevated TSH found in patients with permanent CH rarely normalizes within this time period. A serum TSH measurement should be obtained at the time of the scan. If L-T_4 therapy has caused the TSH concentration to be <30 mU/L, ultrasonography can still be performed. A scan can be performed after the child is 3 years of age, when TH treatment can be interrupted without danger to the developing central nervous system.

The usual dose of ^{123}I, the preferred isotope, is 0.925 MBq (25 μCi). This represents a small amount of radiation exposure, equivalent to the amount of exposure with 2 to 3 chest radiographs. However, the radiation exposure is potentially 100 times greater if ^{131}I or large doses of isotope are administered. For this reason, the procedure should be performed by experienced personnel with optimal equipment, using the minimally recommended tracer dose.

To avoid unnecessary radiation, some investigators prefer ultrasonography as the initial imaging procedure to identify the presence and location of thyroid tissue.[66–68] However, gray-scale ultrasonography is much less sensitive than scintigraphy in detecting the presence of ectopic thyroid tissue, the most common cause of CH. Recent studies have indicated markedly improved sensitivity of color Doppler ultrasonography in diagnosing ectopic thyroid tissue.[69] If these studies are confirmed, color Doppler ultrasonography may become the optimal imaging procedure for the initial investigation of suspected CH.

TREATMENT

All infants with hypothyroidism, with or without goiter, should be rendered euthyroid as promptly as possible by replacement therapy with TH.[21,70–72] An optimal cognitive outcome depends on both the adequacy and timing of postnatal therapy, particularly in severe cases of CH (T_4 < 5 μg/dL). However, what constitutes optimal TH therapy is not yet certain. The goal of therapy is to normalize T_4 within 2 weeks and TSH within 1 month. An initial dosage of 10 to 15 μg/kg of L-T_4 (depending on the severity of the initial hypothyroidism) has been recommended. When a higher initial dose of L-T_4 (50 μg [ie, 12–17 μg/kg]) is used, the serum T_4 normalizes in 3 days and the TSH returns to the target range by 2 weeks of therapy.[72] In the long run, evaluation of cognitive outcome is important after use of this increased dose. Currently the evidence base does not indicate cognitive benefit from thyroid therapy of hypothyroxinemia of prematurity in the absence of TSH elevation.[48–50,57–59]

Administration of L-T_4 is the treatment of choice. Although T_3 is the more biologically active TH, most brain T_3 is derived from local monodeiodination of T_4, so T_3 should not be used. The pill should be crushed and suspended in a few milliliters of formula, breast milk, or water. Care should be taken to avoid concomitant administration of soy, fiber, or iron. Breastfeeding can continue. Only T_4 tablets should be used; currently there are no liquid formulations licensed by the US Food and Drug Administration. T_4 suspensions that may be prepared by individual pharmacists may lead to unreliable dosage. T_4 is expected to increase to more than 10 μg/dL, FT_4 is expected to increase to more than 2 ng/dL by 2 weeks after initiating therapy, and TSH should normalize by 1 month.[73] FT_4 measurement at 1 week of therapy can confirm whether the serum concentration is increasing appropriately. The L-T_4 dose should be adjusted according to the infant's clinical response and serum FT_4 and TSH concentrations.

During therapy, the serum total T_4 or FT_4 should and might be in the upper half of the reference range (target values depend on the assay method used [T_4: 10–16 μg/dL (130–206 nmol/L); FT_4: 1.4–2.3 ng/dL (18–30 pmol/L)]) during the first 3 years of life with a low-normal serum TSH. The latter may sometimes be delayed because of relative pituitary resistance. In such cases, characterized by a normal or increased serum T_4 and an inappropriately high TSH concentration, the T_4 value is used to titrate the dose. Nonadherence to the treatment is the most common cause of persistent TSH elevation and should be excluded. Those infants with low serum T_4 concentrations (below 10 μg/dL [129 nmol/L]) and a TSH concentration greater than 15 mU/L during the first year of life have lower IQ values than patients whose T_4 concentrations were held constant at higher concentrations.[35] Thereafter, thyroid function test values should be kept at age-appropriate concentrations, which in children differ from those for adults.[74] On TH-replacement therapy, TSH levels should be maintained between 0.5 and 2.0 mU/L during the first 3 years of life.[75] Clinical evaluation of the infant by the practitioner should be conducted at frequent intervals during the first 3 years of age (see "Follow-up"). Because poor compliance and noncompliance have major sequelae, initial and ongoing counseling of parents is of great importance.

Current international organizations such as the American Clinical Laboratory Association recommend that the FT_4, rather than the total T_4, be measured to assess the concentration of the biologically relevant, unbound or free form of circulating T_4.[75] The cost of total T_4 plus TBG or T_3 resin uptake, versus the FT_4 by most methods (excluding the more costly direct dialyzable or ultrafiltration methods), should be comparable. However, although the total T_4 is a robust measure, it should be recognized that most direct FT_4 assays are influenced,

to some extent, by protein binding. Consequently, the FT_4 values obtained vary between assays.

During TH therapy, 4 or more episodes of insufficiently suppressed TSH (>5 mU/L) after the age of 6 months were the most important variables associated with school delay.[75] Usually, these episodes are caused by poor parental compliance or impaired T_4 bioavailability. The latter may be caused by inhibition of T_4 intestinal uptake by specific foods (soy, fiber) and medications (iron, calcium), malabsorption, or increased degradation (anticonvulsants; large hemangiomas with high deiodinase activity). The Food and Drug Administration has deemed several generic L-T_4 products to be equivalent to some currently branded preparations. Any change in source of the L-T_4, especially if not a standard brand, requires retitration of the dose.

FOLLOW-UP

Clinical examination, including assessment of growth and development, should be performed every few months during the first 3 years of life. Infants with CH appear to be at increased risk of other congenital anomalies (approximately 10% of infants with CH, compared with 3% in the general population). Cardiovascular anomalies, including pulmonary stenosis, atrial septal defect, and ventricular septal defect, are the most common.

Infants need to undergo frequent laboratory and clinical evaluations of thyroid function, growth, and development to ensure optimal T_4 dosage and adherence to their therapy regimen. Serum T_4 and TSH measurements should be performed:

1. at 2 and 4 weeks after the initiation of L-T_4 treatment;
2. every 1 to 2 months during the first 6 months of life;
3. every 3 to 4 months between 6 months and 3 years;
4. every 6 to 12 months until growth is completed; and
5. at more frequent intervals when compliance is questioned, abnormal values are obtained, or dose or source of medication has been changed; FT_4 and TSH measurements should be repeated 4 weeks after any change in L-T_4 dosage.

The aim of therapy is to ensure normal growth and development by maintaining the serum total T_4 or FT_4 concentration in the upper half of the reference range in the first year of life, with a serum TSH in the reference range (optimally 0.5–2.0 mU/L).

Some infants will have serum TSH concentrations in the range of 10 to 20 mU/L despite T_4 concentrations in the upper half of the reference range. Rarely, the elevated TSH relative to the FT_4 value is hypothesized to result from in utero hypothyroidism, producing a resetting of the pituitary-thyroid feedback threshold. A failure of the serum FT_4 concentration to increase into the upper half of the reference range by 2 weeks and/or failure of the TSH concentration to decrease to less than 20 mU/L within 4 weeks after initiation of L-T_4 administration should alert the physician that the child may not be receiving adequate L-T_4 regularly. At this point, careful inquiry should be made regarding compliance, dose of medication, and method of administration. When attempting to achieve the optimal concentration of circulating FT_4, physicians should always bear in mind the adverse effects of excessive medication and thus be prepared to monitor blood concentrations of FT_4 at close intervals. Prolonged hyperthyroidism has been associated with premature craniosynostosis.

DEVELOPMENTAL OUTCOME

Growth rate and adult height are normal in children with CH in whom TH therapy is consistently maintained.[68,76,77] The best outcome occurred with TH therapy started by 2 weeks of age at 9.5 μg/kg or more per day, compared with lower doses or later start of therapy.[71] There are only minor differences in intelligence, school achievement, and neuropsychological tests in adults with CH that was treated early with TH compared with control groups of classmates and siblings.[78–82] Residual defects can include impaired visuospatial processing and selective memory and sensorimotor defects. Whether these minor differences are preventable by further optimizing postnatal therapy remains controversial.

In contrast to the excellent outcome in infants with CH that is treated early, the prognosis for normal mental and neurologic performance is less certain for infants with CH that is not detected early by newborn screening. Although physical recovery is good and stature is normal,[77] when replacement therapy is begun later but within the first 2 months of life, infants with severe hypothyroidism at birth and intrauterine hypothyroidism (retarded skeletal maturation at birth) may still have a low-to-normal IQ.[18] Similarly, although more than 80% of infants given replacement therapy before 3 months of age have an IQ greater than 85, 77% of these infants show some signs of minimal brain damage, including impairment of arithmetic ability, speech, or fine motor coordination in later life. Even in early-treated patients with CH, auditory brainstem evoked potentials were abnormal in 25% of 27 children studied. The reason for this is not known but might suggest that prenatal maternal T_4 production does not provide complete protection for the developing central nervous system.[84] In another study, processing of visuospatial relationships remained affected in adolescents with CH.[85] The effect of underlying severity of CH combines with the effects of TH dose and of age at onset of TH therapy.[35] Otherwise, neurologic and intellectual outcome do not correlate well with the degree of T_4 deficiency found in neonatal screening.

Transplacental transfer of maternal T_4 in the first

trimester may protect the brain during early development.[15] For the same reason, maternal hypothyroidism during fetal development can have persistent neurodevelopmental effects on the child.[15,16,19] Serum T_4 concentrations at term in athyreotic infants are 25% to 50% of those in normal neonates. These concentrations, although low, may contribute to fetal brain development. It is thought that the low-to-normal intelligence of patients with CH treated early in life results most commonly from inadequate treatment or poor compliance.

It must be noted that TH treatment regimens used today are more aggressive in targeting early correction of TSH than were the regimens used 20 or even 10 years ago. Thus, newborn infants with CH today may have an even better intellectual and neurologic prognosis than adults with CH who were evaluated in the reports discussed above.

ASSESSMENT OF PERMANENCE OF HYPOTHYROIDISM

CH is permanent if the thyroid scan reveals an ectopic gland or absent thyroid tissue (confirmed by ultrasonographic examination) or if the serum TSH is seen to increase above 10 mU/L after the first year of life, presumably because of insufficient T_4 replacement.

If no permanent cause of CH was found by scan or there was no TSH increase after the newborn period, then L-T_4 administration should be discontinued for 30 days at some point after the child is 3 years of age.[86] After 30 days, serum should be obtained for measurement of FT_4 and TSH values. It is critical that this follow-up laboratory assessment be obtained in a timely manner and that there be no loss of follow-up. If the FT_4 is low and the TSH value is elevated, permanent hypothyroidism is confirmed and TH therapy should be reinstituted. If the FT_4 and TSH concentrations remain in the reference range, euthyroidism is assumed and a diagnosis of transient hypothyroidism recorded. It is important that the child not be lost to follow-up. The physician should monitor the child carefully and repeat the thyroid function tests at the slightest suspicion of recurrence of hypothyroid symptoms. If the results are inconclusive, careful follow-up and subsequent testing will be necessary.

More severely affected children may become clinically hypothyroid when treatment is discontinued for 30 days. An alternative option is to reduce the TH-replacement dosage by half. If after 30 days the TSH is elevated above 20 mU/L, the permanence of hypothyroidism is confirmed and full replacement therapy should be resumed. If the serum TSH value has not increased, then TH treatment should be discontinued for another 30 days with repeated serum FT_4 and TSH determination as described above.

ADMONITION

Finally, physicians cannot and must not relinquish their clinical judgment and experience in the face of normal newborn thyroid test results. Failure of normal development can result from hypothyroidism in infants who had normal T_4 and TSH newborn screening results. Hypothyroidism can manifest or be acquired after the newborn screening. Rarely, the newborn screening test results can be in error, or human error can result in failure to notify the infant's physician of abnormal test results.[87] When clinical symptoms and signs suggest hypothyroidism, regardless of newborn screening results, serum FT_4 and TSH determinations should be performed.

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American Academy of Pediatrics
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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Ultraviolet Radiation: A Hazard to Children and Adolescents

abstract

FREE

Ultraviolet radiation (UVR) causes the 3 major forms of skin cancer: basal cell carcinoma; squamous cell carcinoma; and cutaneous malignant melanoma. Public awareness of the risk is not optimal, overall compliance with sun protection is inconsistent, and melanoma rates continue to rise. The risk of skin cancer increases when people overexpose themselves to sun and intentionally expose themselves to artificial sources of UVR. Yet, people continue to sunburn, and teenagers and adults alike remain frequent visitors to tanning parlors. Pediatricians should provide advice about UVR exposure during health-supervision visits and at other relevant times. Advice includes avoiding sunburning, wearing clothing and hats, timing activities (when possible) before or after periods of peak sun exposure, wearing protective sunglasses, and applying and reapplying sunscreen. Advice should be framed in the context of promoting outdoor physical activity. Adolescents should be strongly discouraged from visiting tanning parlors. Sun exposure and vitamin D status are intertwined. Cutaneous vitamin D production requires sunlight exposure, and many factors, such as skin pigmentation, season, and time of day, complicate efficiency of cutaneous vitamin D production that results from sun exposure. Adequate vitamin D is needed for bone health. Accumulating information suggests a beneficial influence of vitamin D on many health conditions. Although vitamin D is available through the diet, supplements, and incidental sun exposure, many children have low vitamin D concentrations. Ensuring vitamin D adequacy while promoting sun-protection strategies will require renewed attention to children's use of dietary and supplemental vitamin D. *Pediatrics* 2011;127:588–597

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KEY WORDS

sun, ultraviolet radiation, children, skin cancer, skin cancer prevention, melanoma, vitamin D, prevention, sun protection, sunscreen, tanning, artificial tanning

ABBREVIATIONS

UVR—ultraviolet radiation
NMSC—nonmelanoma skin cancer
BCC—basal cell carcinoma
SCC—squamous cell carcinoma
SPF—sun-protection factor
25(OH)D—25-hydroxyvitamin D

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BACKGROUND

Sunlight sustains life on earth. The sun provides warmth, is needed for photosynthesis, drives biorhythms, and promotes feelings of well-being, and sunlight is essential for vitamin D synthesis in skin.

The sun emits ultraviolet ("above violet") radiation (UVR) waves that range from 200 to 400 nm. UVB (290–320 nm) and UVA (320–400 nm) rays penetrate the atmosphere and have the greatest biological significance. Solar radiation that reaches the earth's surface comprises approximately 95% UVA and 5% UVB rays.[1]

Sand, snow, concrete, and water can reflect up to 85% of sunlight, thus intensifying exposure.[2] UVR can penetrate to a depth of 60 cm in water and result in significant exposure. UVA rays are relatively constant throughout the day and the year. UVB rays have greater intensity in summer than in winter, at midday than in morning or late afternoon, in

places closer to the equator, and at high altitudes. UVR can be produced by man-made lamps (eg, sunlamps) and tools (eg, welding tools).

UVR EFFECTS ON THE SKIN

Erythema and sunburn are acute reactions to excessive amounts of UVR. The minimal erythema (or erythemal) dose (the amount of UVR exposure that will cause minimal erythema or slight pinkness of the skin) depends on factors such as skin type and thickness, the amount of melanin in the epidermis and its capacity to produce melanin after sun exposure, and the intensity of the radiation. Tanning is a protective response to sun exposure.[3] Skin aging is the result of chronic unprotected exposure to UVR, which weakens the skin's elasticity and results in sagging cheeks, deeper facial wrinkles, and skin discoloration later in life.

Chemical photosensitivity refers to an adverse cutaneous reaction that results when certain chemicals or drugs are applied topically or taken systemically at the same time that a person is exposed to UVR or visible radiation. The reaction can occur on first exposure to an agent (phototoxicity) or can be an acquired altered reactivity of the skin (photoallergy), usually triggered by exposure to UVA rays, that depends on antigen-antibody or cell-mediated hypersensitivity. Drugs associated with phototoxic reactions include those commonly used by adolescents, such as nonsteroidal anti-inflammatory agents, tetracyclines, and tretinoin; other medications such as phenothiazines, psoralens, sulfonamides, and thiazides; and para-amino benzoic acid (PABA) esters.[4] Sunscreens, fragrances, sulfonamides, and phenothiazines are associated with photoallergy. Many commonly used medications and furocoumarins in plants[5] have photosensitizing properties. Up to 80% of patients with lupus erythematosus have photosensitivity. The threshold ultraviolet dose that triggers reactions is much lower than that for sunburn in these people, and the latency period is between several days and 3 weeks.[6]

Nonmelanoma skin cancer (NMSC) includes basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). In US adults, NMSC is the most common malignant neoplasm, with more than 2 million cases diagnosed each year. Most of these are BCC; SCC occurs less often.[7] NMSC is rarely fatal.[7] NMSC occurs in maximally sun-exposed areas of fair-skinned people and is uncommon in black people. NMSC is rare in children in the absence of predisposing conditions.[8] The incidence of NMSC is increasing in young adults.[9] Sun exposure is the main environmental cause of NMSC; in SCC, cumulative exposure over long periods, resulting in photodamage, is considered important in pathogenesis.

Likewise, the incidence of melanoma continues to increase. Melanoma incidence has been increasing for at least 30 years. Most recently, rapid increases have occured in young white women (3.0% per year since 1992 in ages 15 to 39 years) and white adults older than 65 years.[10] Melanoma represents less than 5% of all skin cancers but causes the most skin cancer deaths. Melanoma can occur in teenagers and young adults; it is the second most common cancer of women in their 20s and the third most common cancer of men in their 20s.[11] Possible factors that contribute to the increased incidence of melanoma include the decrease in the earth's protective ozone layer, changing patterns of dress that favor more skin exposure, more opportunities for leisure activities in sunny areas, and increased exposure to artificial sources of UVR for tanning purposes. If detected when the tumor is thin and small, melanoma has an excellent prognosis. However, metastatic melanoma has no successful treatment options. Prevention and early detection, therefore, are crucial in this disease.

People at highest risk of melanoma have light skin and eyes and sunburn easily. Risk of developing melanoma is increased for people with a first-degree relative who has had melanoma or those with a personal history of previous melanoma. Those who freckle easily and those with a large number of typical or atypical moles (high nevus count) are also at higher risk of cutaneous malignancy. People with xeroderma pigmentosum (a condition in which there is a genetically determined defect in the repair of DNA damaged by UVR) and related disorders are at increased risk of melanoma.

Melanoma is rare in children but can occur. Characteristics of a child's melanoma lesion may differ from those typically found in adults; a child's lesion may be amelanotic (pink, pink-white, or red), may be raised, and may have regular borders. The key to diagnosis of melanoma in children is often the recognition that the lesion is unlike any other lesions on the child.[12]

EVIDENCE THAT UVR CAUSES SKIN CANCER

In 1992, the International Agency for Research on Cancer concluded that "there is sufficient evidence in humans for the carcinogenicity of solar radiation."[1] Since that time, additional research results have supported a strong causal relationship between sunlight exposure and skin cancer. Evidence comes from cellular, biological, and epidemiologic studies. Epidemiologic evidence includes relationship of high ambient solar UVR with higher rates of BCC and SCC[13]; relationship of BCC, SCC, and melanoma rates to race

and pigmentation[7,14]; increased frequency of skin cancers with higher sun-exposure history[15] or artificial UVR exposures from sunbeds or sunlamps[16]; heightened risk of melanoma for those with increased childhood sun-exposure history[17]; and relationship between sun exposure and increasing number of nevi, which may predispose to melanoma. Exposure to UVR contributes to immunosuppression, which is increasingly recognized as important in the development of skin cancer.[18,19]

UVR EFFECTS ON THE EYE

In adults, most UVR (>99%) is absorbed by the anterior structure of the eye, although some reaches the retina.[20] Acute exposure to UVR can result in photokeratitis.[21] Gazing directly into the sun can cause focal burns to the retina (solar retinopathy).[22] Long-term exposure to UVB is associated with an increased risk of cortical and posterior subcapsular cataracts.[23] UVR can contribute to the development of pterygium, corneal degenerative changes, and cancer of the skin around the eye.[20] There is evidence for a probable relationship between UVR exposure and squamous intraepithelial neoplasms of the conjunctiva or cornea.[24]

ARTIFICIAL SOURCES OF UVR

Sunlamps and tanning beds are the main sources of deliberate artificial UVR exposures.[16] The intensity of UVA radiation produced by large, powerful tanning units may be 10 to 15 times higher than that of the midday sun.[25]

Artificial tanning is a common practice among teenagers. Use of a tanning facility at least once in their lives was reported by 24% of non-Hispanic white teenagers 13 to 19 years of age in a US sample.[26] In another national survey, 10% of youths 11 to 18 years of age reported using indoor tanning sunlamps in the previous year.[27] Women and girls constitute the majority of people who artificially tan.[28]

Artificial UVR exposure causes acute effects such as erythema and sunburn. Other frequently reported effects include skin dryness, pruritus, nausea, photodrug reactions, disease exacerbation (eg, systemic lupus erythematosus), and disease induction (eg, polymorphous light eruption). Long-term health effects include skin-aging, effects on the eyes, and carcinogenesis. Use of tanning devices has been associated with an increased incidence of SCC and BCC[16,29] and melanoma.[30]

One commonly held misconception is that a "prevacation tan"—obtained when people visit tanning salons to prepare skin for a sunny vacation—protects against subsequent skin damage. This practice actually leads to extra radiation exposure not only before the vacation but also afterward, because people use fewer sun-protection precautions during the vacation, believing mistakenly that the tan will protect them.[28] A prevacation tan results in minimal protection (a sun-protection factor [SPF] of 3)[25] and affords virtually no protection against sun-induced DNA damage.[16] The evidence does not support a protective effect of the use of tanning beds against damage to the skin from subsequent sun exposure.[16]

The World Health Organization, the American Medical Association, and the American Academy of Dermatology all support legislation to ban the use of artificial tanning devices by people younger than 18 years. In a review, the International Agency for Research on Cancer concluded that young adults should be discouraged from using indoor tanning equipment and that restricted access to tanning beds and sunlamps by minors should be strongly considered.[16] Currently, more than 60% of US states regulate tanning facilities for minors, and regulatory efforts are increasing.[31] Legislative efforts focus on age limitations and written-consent processes. The tanning industry has fought vigorously to allow teenagers access to tanning salons.[32,33]

Artificial "sunless" tanning with spray products in salons or with self-applied products has been advocated by some organizations as an alternative to tanning through exposure to natural or artificial UVR. A survey of young adults 18 to 24 years of age in the United States revealed that 22% had used sunless tanners in the previous 12 months, and another 22% who had not used these products would consider doing so in the next 12 months.[34] Because most sunless tanners do not afford any significant ultraviolet protection, consumers must be advised that sunburn and sun damage may occur unless they use sunscreen and other sun-protection methods. Consumers must also be warned that sunless tanning products that contain added sunscreen provide UVR protection for a few hours after application but that additional protection from the sun must be used during the duration of the artificial tan.

PREVENTION

Leading organizations have recommended a comprehensive set of sun-safe behaviors.[35–37]

UVR-protective messages include the following:

1. Do not burn; avoid suntanning and tanning beds.
2. Wear protective clothing and hats.
3. Seek shade.
4. Use extra caution near water, snow, and sand.
5. Apply sunscreen.
6. Wear sunglasses.

Clothing can be an excellent UVR barrier. In contrast to sunscreen, the photoprotection afforded by clothing does

not diminish throughout the day unless the clothing becomes wet. Clothes that cover more of the body provide more protection; sun-protective styles cover to the neck, elbows, and knees. Wool and synthetic materials, thickly woven fabrics, darker colors, and tightly woven fabrics with chemical enhancement have higher protective values than do corresponding counterparts.[38] The ultraviolet protection factor (UPF) is a system used to rate a fabric's ability to block UVR from passing through the fabric and reaching the skin. The UPF value can be from 15 to ≥50 and is classified as follows: 15 to 24 is rated as "good" UV protection; 25 to 39 is rated as "very good"; and 40 to ≥50 is rated as "excellent."

Seeking shade is somewhat useful, but people can still sunburn, because light is scattered and reflected. A fair-skinned person sitting under a tree can burn in less than an hour. Clouds decrease UVR intensity but not to the same extent that they decrease heat intensity and, thus, may promote a misperception of protection.[39]

Sunscreen is the main form of protection used by the population.[40–43] Sunscreens reduce the intensity of UVR affecting the epidermis, thus preventing erythema and sunburn. Many sunscreen agents approved by the US Food and Drug Administration are organic chemicals that absorb various wavelengths of UVR, primarily in the UVB range; many are also effective in the UVA range.[44] Some agents are not photostable in the UVA range and degrade with sun exposure, so combinations of chemicals are used to enhance protective effects.[45] The 2 inorganic physical sunscreens approved by the US Food and Drug Administration are zinc oxide and titanium dioxide. These sunscreens prevent penetration of skin by UVB and UVA. Infrequently, topical sunscreen agents (especially chemical screening agents) can have adverse effects, including erythema, itching, burning, or stinging. Allergic contact dermatitis and photoallergic and phototoxic reactions occur rarely.[44]

SPF is a grading system that was developed to quantify the degree of protection from erythema provided by using a sunscreen; the higher the SPF, the greater the protection. For example, a person who would normally experience sunburn in 10 minutes can be protected for approximately 150 minutes (10 × 15) with an SPF-15 sunscreen. SPF pertains only to UVB. Sunscreens do not completely block UVB; for example, an SPF-15 sunscreen will allow approximately one-fifteenth or 6% of UVB photons to penetrate the skin.

In actual use, SPF often is substantially lower than expected because the amount applied to the skin is less than that recommended (2 mg/cm^2).[45] To adequately cover all sun-exposed areas of an average adult wearing a bathing suit, 1 oz (30 mL) of sunscreen would be needed. It is recommended that sunscreen with an SPF of at least 15 be applied liberally 15 to 30 minutes before sun exposure to allow for absorption into the skin and to decrease the likelihood that the sunscreen will be washed off. Furthermore, it is recommended that sunscreens be reapplied every 2 hours and after swimming, sweating, or drying off with a towel.[44] Sunscreen products with a higher SPF provide somewhat greater protection. Products with a higher SPF have been recommended for some people including those who have had skin cancer.[46] For most users, however, proper application and reapplication are more important factors than using a product with a higher SPF.

The regular use of a broad-spectrum sunscreen preparation can prevent solar (actinic) keratoses, which are precursor lesions of SCC.[47,48] One randomized clinical trial revealed that sunscreen also decreases the risk of developing SCC.[49] However, some research has shown that sunscreen users have a higher risk of melanoma and BCC and have more nevi.[50] These observations have led to concerns that people who use sunscreens spend more time in the sun.[51] Two meta-analyses, however, demonstrated that after controlling for skin type and exposure, sunscreen users do not have a higher risk of melanoma.[52,53] No studies have demonstrated that sunscreen use prevents melanoma or BCC. Sunscreen continues to be recommended by the American Academy of Dermatology[54] and many other organizations as part of a total program of protection from the sun.

Sunscreens may be systemically absorbed. In urine samples of a representative sample of the US population older than 6 years, oxybenzone, a commonly used sunscreen agent, was detected in 97% of the samples,[55] which suggests widespread exposure. Concerns have been raised about estrogenic and other systemic effects of oxybenzone and other sunscreen ingredients.[56–58] Sunscreen ingredients have been found in human milk.[59] Because of recent data on bioaccumulation in humans and wildlife, researchers have called for an in-depth analysis of the systemic toxicology of sunscreen ingredients.[57]

Permeability of skin to topically applied products, including sunscreen products, is of concern for young infants, especially preterm infants.[60] The development of the stratum corneum, the part of the epidermis that forms the skin barrier, may not be complete until the first few years of life.[61,62] Issues have arisen regarding the possible increased risk of penetration of ultramicronized physical agents such as zinc oxide and titanium dioxide, which, when micronized, are essentially nano-

particles. To date, no data show toxicity from absorption of sunscreen ingredients in infants and young children. Sunscreen use is advised when other effective means of photoprotection (avoidance, clothing) are not possible. Sunscreen may be used on infants younger than 6 months on small areas of skin if adequate clothing and shade are not available.[63] The known benefits of using sunscreen products for preventing sunburn and SCC, versus the concerns, should be discussed with parents, especially parents of young children.

Sunglasses protect against sun glare and harmful radiation. The latest US standard for sunglasses is voluntary and is not followed by all manufacturers.[64] Major US visual health organizations recommend that sunglasses that absorb 97% or more[65] or 99% or more[20] of the full UVR spectrum be worn. Expensive sunglasses do not necessarily provide better UVR protection; purchasing sunglasses that meet standards for a safe level of UVR should be the goal.

Standard clear window glass absorbs UVB but not UVA wavelengths.[64] Transmission of UVR through automobile glass depends on the type and the tint of the glass.

The UV index predicts the intensity of ultraviolet light for the following day,[66] which allows for the planning of activities. The index is available online for thousands of cities at www.weather.com and through local news media.

VITAMIN D

Sun exposure and vitamin D concentrations are intertwined. Humans get vitamin D from exposure to sun, dietary sources, and vitamin supplements. Vitamin D is essential for normal growth and skeletal development.[67] 25-Hydroxyvitamin D (25[OH]D) concentrations are used to assess vitamin D status; at concentrations of less than 50 nmol/L (20 ng/mL), children are at increased risk of rickets.[68] Relationships between 25(OH)D status and markers of functional outcomes in children vary according to age, race, environment, and genetic predisposition.[68–70] Children at higher risk of low 25(OH)D concentrations include breastfed infants, obese children, children with dark skin pigmentation, and children with many other conditions.[67,71,72] The benefits of vitamin D sufficiency in adults include improved bone health, prevention of fractures, better muscle health, and reduced risk of falling in older people. The nonskeletal actions and health benefits of vitamin D are becoming increasingly understood.[67,73,74] Areas of investigation include the relationship of vitamin D concentrations to risks of cancer, heart disease, multiple sclerosis, and glucose dysregulation.[72] Of particular note is that low vitamin D concentration in prenatal or childhood periods may increase the risk of type 1 diabetes mellitus.[75,76]

Hypovitaminosis D is common among US children.[77,78] Approximately 30% of US teenagers and young adults have 25(OH)D deficiency (ie, 25[OH]D $<$ 50 nmol/L).[79] For younger US children, the prevalence of 25(OH)D deficiency is somewhat less ($\sim$15% for children 6–11 years of age and $\sim$8% for children 1–5 years of age).[79]

Vitamin D concentrations increase with sun exposure. Vitamin D synthesis depends on factors including age, skin pigmentation, amount of skin exposed, time of year, and time of day. It has been stated that at least 20% of the body surface needs to be exposed to UVB for vitamin D concentrations to increase.[67] At latitudes above 35°N and below 35°S, cutaneous vitamin D production is negligible in winter months. One author has called for "sensible sun exposure" (ie, exposure of arms and legs for 5–30 minutes, depending on the time of day, season, latitude and skin pigmentation, between 10 AM and 3 PM twice weekly) to maintain vitamin D concentrations and avoid deficiency.[73,80] In contrast, the American Academy of Dermatology has stated that most people obtain enough vitamin D through incidental exposure during daily activities and that maximum production of vitamin D occurs after only brief exposure to UVR; this amount of time is 2 to 5 minutes of midday exposure for a light-skinned person living in New York, NY, or Boston, MA. Although they agree that vitamin D is important for good health, leaders in skin cancer prevention oppose intentional sun exposure to induce vitamin D production, because UVR is a known human carcinogen.[81,82] There have been no studies of children suggesting a level of sun exposure that would negate the need to comply with dietary vitamin D recommendations. Given the high prevalence of hypovitaminosis D, it seems clear that renewed attention must be paid to evaluating the adequacy of dietary and supplemental vitamin D intake and how much, if any, unprotected sun exposure is beneficial. The American Academy of Pediatrics recommends vitamin D supplementation of 400 IU (10 μg) per day for all breastfed infants and nonbreastfed infants, children, and adolescents who receive less than 400 IU of vitamin D daily in their diets.[71] Most children in the United States receive less than 400 IU of vitamin D daily.[83] Because most vitamin D is endogenously produced after sun exposure, even this degree of supplementation may be insufficient. In young white adults, the supplemental dose of vitamin D required over the winter months at or above 51° latitude for 97.5% of the sample to maintain a 25(OH)D concentration of more than 50 nmol/L was 1120 IU of vitamin D per day and was 1644 IU of vitamin D per day to maintain a 25(OH)D concentration of more than 80 nmol/L.[84] An updated report on

vitamin D from the Institute of Medicine was released in November 2010.[85]

THE PEDIATRICIAN'S ROLE

The US Preventive Services Task Force determined that clinician counseling may have an effect on parents' use of sunscreen for their children but not for using other sun-protection measures.[86] The task force noted that only limited data exist about potential harm of counseling or of specific skin-protection behaviors. Harm includes the possibility that skin cancer counseling that focuses on sunscreen use may result in a false sense of security and more time spent in the sun because users do not sunburn.[51]

The US Preventive Services Task Force concluded that evidence is insufficient to recommend for or against routine screening for skin cancer in adults by using a total-body skin examination for the early detection of cutaneous melanoma, BCC, or SCC.[87] Early detection, however, is recommended by skin cancer authorities as a measure to increase survival rates.[88] Because most melanomas occur in adults, no official recommendations for early detection have been made for children and adolescents. Because melanoma occurs in teenagers and is a common cancer among young adults, it seems prudent to recommend that clinicians caring for these groups include a skin examination as part of a complete physical examination.

PREVENTION PROGRAMS

The Centers for Disease Control and Prevention has published guidelines to protect schoolchildren from excessive sun exposure in schools.[36] Efforts to teach children how to protect themselves from UVR are effective when implemented in primary schools and in recreational settings.[89] The SunWise program, developed by the US Environmental Protection Agency, is a brief, standardized sun-protection education program for use in schools.[90] SunWise has been shown to promote improvement in knowledge, intentions to play in the shade and to use sunscreen, and attitudes regarding healthiness of a tan[91]; SunWise also is cost-effective.[92]

Multicomponent, community-wide approaches have been recommended by health education experts[93] and can be effective. A randomized controlled trial of the SunSafe project, an intervention in New England, involved schools, child care settings, primary care offices, and beach settings. SunSafe was effective in changing sun-protection practices observed at community beaches in children 2 to 10 years of age.[94,95] In adolescence, when sun protection begins to decline, a multicomponent program slowed the deterioration of teenagers' sun-safety practices.[96]

PUBLIC HEALTH CAMPAIGNS

Australia, the country with the highest incidence of skin cancer in the world, has been in the forefront of the public health response to this disease. SunSmart, a population-based skin cancer–prevention program deployed in Australia since 1988, incorporates substantial public education efforts as well as structural and environmental change strategies in schools, workplaces, local government, and pools. Sun protection and sunburn showed substantial general improvement over time but have stalled in recent years.[97] Challenges to effective skin cancer–prevention campaigns include (1) the possible conflict between sun-protection messages to avoid or limit time outdoors during peak sun hours and health-promotion messages to promote physical activity; (2) uncertainty about how much sun exposure is needed for adequate vitamin D synthesis, which possibly results in deliberate and excessive UVR exposure; (3) the finding that skin cancer risk behaviors cluster with other risky behaviors such as smoking and risky drinking; and (4) the benefits of the tanning industry from selling carcinogenic UVR.[98] These challenges suggest that it is uncertain whether primary prevention efforts to reduce skin cancer through UVR protection will be successful.

RECOMMENDATIONS FOR PEDIATRICIANS

1. Pediatricians should incorporate advice about UVR exposure into health-supervision practices. Advice includes avoiding sunburning and suntanning, wearing clothing and hats with brims, and applying sunscreen. When feasible, outdoor activities should be planned to limit exposure to peak-intensity midday sun (10 AM to 4 PM). Sunglasses should be worn when working, driving, participating in sports, taking a walk, running errands, or doing anything in the sun.[21]
2. Sunscreen should be used when a child or adolescent might sunburn. Sunscreen with an SPF of 15 or higher should be applied every 2 hours and after swimming, sweating, or drying off with a towel. People may wish to avoid using sunscreens that contain oxybenzone, which may have weak estrogenic effects when absorbed through the skin. However, using sunscreen is recommended to decrease the known risks of sun exposure and sunburning, both of which raise the risk of developing skin cancer.
3. Advice about UVR exposure is important for all children and especially for children at high risk of developing skin cancer: children with light skin, those with nevi

and/or freckling, and those with a family history of melanoma.

4. Skin cancer prevention is a lifelong effort. Although time is at a premium for most pediatricians, an important aim is to incorporate UVR exposure advice into at least 1 health-maintenance visit per year, beginning in infancy. Not all children sunburn, but all are at risk of adverse effects of UVR exposure on the eyes and immune system. In northern states, advice can be given in the spring and summer. Advice can also be given before anticipated sunny vacations. "Teachable moments" may be found during visits for sunburns.
5. Outdoor physical activity should be strongly encouraged; messages should be framed in the context of promoting outdoor physical activity in a sun-safe manner.
6. Sun-protection practices tend to wane in early childhood. In later childhood, it may be advisable for pediatricians to discuss sun protection with children and parents together beginning at 9 or 10 years of age, thus encouraging joint responsibility for ensuring that the child is protected.
7. Infants require special advice. Infants younger than 6 months of age should be kept out of direct sunlight and covered with appropriate protective clothing and hats. Parents may apply sunscreen when sun avoidance is impossible and, then, only on exposed areas. Preterm infants, because of a thinner stratum corneum, may have a higher susceptibility to the absorption of sunscreen ingredients.
8. Pediatricians should gain familiarity with chemical photosensitizing agents.[99] People who take medications or use topical agents known to be sensitizing should do their best to limit sun exposure and avoid all UVA from artificial sources. They should wear fully protective clothing and apply sunscreen with a high SPF that also blocks UVA wavelengths when sun exposure is inevitable.
9. Guidelines regarding vitamin D supplementation for breastfed and formula-fed infants and other children should be followed. All infants, children, and adolescents should receive at least 400 IU of vitamin D daily. If a child is at risk of hypovitaminosis D because of low intake or other factors, laboratory evaluations of the adequacy of his or her 25(OH)D concentration should be considered.
10. Deliberate UVR exposure to artificial sources and overexposure to sun with the goal of increasing vitamin D concentrations, or for other reasons, is to be avoided. UVR exposure raises skin cancer risk. Guidance should be given about vitamin D adequacy obtained through the diet and supplements.
11. When feasible, pediatricians should advocate for adoption of sun-protective policies such as shaded playgrounds, outdoor time before 10 AM, and allowing hats at schools and child care facilities.
12. Pediatricians should support and advocate for legislation to ban access to tanning parlors for children younger than 18 years.

RECOMMENDATIONS FOR GOVERNMENT

1. Federal, state, and local governments should mount campaigns to raise awareness about the dangers of exposure to artificial sources of UVR and overexposure to sun. These campaigns should include messages directed at children, adolescents, and parents.
2. Federal, state, and local governments and local school districts should support and disseminate successful programs such as the Environmental Protection Agency's SunWise program.
3. Federal, state, and local governments should work toward passing legislation to ban minors' access to tanning salons. Governments should work to ensure that such legislation is enforced.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Technical Report—Ultraviolet Radiation: A Hazard to Children and Adolescents

Sophie J. Balk, MD, and the COUNCIL ON ENVIRONMENTAL HEALTH and SECTION ON DERMATOLOGY

KEY WORDS

sun, ultraviolet radiation, children, skin cancer, skin-cancer prevention, melanoma, vitamin D, prevention, sun protection, sunscreen, tanning, artificial tanning

ABBREVIATIONS

UVR—ultraviolet radiation
NMSC—nonmelanoma skin cancer
PABA—para amino benzoic acid
SPF—sun-protection factor
BCC—basal cell carcinoma
SCC—squamous cell carcinoma
IARC—International Agency for Research on Cancer
FDA—Food and Drug Administration
UPF—ultraviolet protection factor
NHANES—National Health and Nutrition Examination Survey
AAP—American Academy of Pediatrics
25(OH)D—25-hydroxyvitamin D

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abstract

FREE

Sunlight sustains life on earth. Sunlight is essential for vitamin D synthesis in the skin. The sun's ultraviolet rays can be hazardous, however, because excessive exposure causes skin cancer and other adverse health effects. Skin cancer is a major public health problem; more than 2 million new cases are diagnosed in the United States each year. Ultraviolet radiation (UVR) causes the 3 major forms of skin cancer: basal cell carcinoma; squamous cell carcinoma; and cutaneous malignant melanoma. Exposure to UVR from sunlight and artificial sources early in life elevates the risk of developing skin cancer. Approximately 25% of sun exposure occurs before 18 years of age. The risk of skin cancer is increased when people overexpose themselves to sun and intentionally expose themselves to artificial sources of UVR. Public awareness of the risk is not optimal, compliance with sun protection is inconsistent, and skin-cancer rates continue to rise in all age groups including the younger population. People continue to sunburn, and teenagers and adults are frequent visitors to tanning parlors. Sun exposure and vitamin D status are intertwined. Adequate vitamin D is needed for bone health in children and adults. In addition, there is accumulating information suggesting a beneficial influence of vitamin D on various health conditions. Cutaneous vitamin D production requires sunlight, and many factors complicate the efficiency of vitamin D production that results from sunlight exposure. Ensuring vitamin D adequacy while promoting sun-protection strategies, therefore, requires renewed attention to evaluating the adequacy of dietary and supplemental vitamin D. Daily intake of 400 IU of vitamin D will prevent vitamin D deficiency rickets in infants. The vitamin D supplementation amounts necessary to support optimal health in older children and adolescents are less clear. This report updates information on the relationship of sun exposure to skin cancer and other adverse health effects, the relationship of exposure to artificial sources of UVR and skin cancer, sun-protection methods, vitamin D, community skin-cancer–prevention efforts, and the pediatrician's role in preventing skin cancer. In addition to pediatricians' efforts, a sustained public health effort is needed to change attitudes and behaviors regarding UVR exposure. *Pediatrics* 2011;127:e791–e817

BACKGROUND

Sunlight sustains life on earth. The sun provides warmth, is needed for photosynthesis, drives biorhythms, and promotes feelings of well-being, and sunlight is essential for vitamin D synthesis in skin.

The sun emits electromagnetic radiation that ranges from short-wavelength, high-energy x-rays to long-wavelength, lower-energy radio waves. Ultraviolet ("above-violet") radiation (UVR) waves range from 200 to 400 nm. UVR waves are longer than x-rays and shorter than visible light (400–700 nm) and infrared ("below-red" or "heat") radiation (>700 nm). UVR is subdivided into UVC (200–290 nm), UVB (290–320 nm), and UVA (320–400 nm, further subdivided into UVA2 [320–340 nm]) and UVA1[340–400 nm]). UVC rays possess the highest energy but do not penetrate the atmosphere. Thus, middle-wavelength (UVB) and long-wavelength (UVA) UVR, visible light, and infrared radiation have the greatest biological significance.

Solar radiation that reaches the earth's surface constitutes approximately 95% UVA and 5% UVB.[1] Most UVB radiation is absorbed by stratospheric ozone, but ozone absorbs little or no UVA or visible light. The ozone layer does not have uniform thickness; ozone concentration tends to increase toward the poles but is thinning in some areas.[2] Ozone depletion has a significant effect on the amount of UVB that reaches the earth.[2] Chlorofluorocarbons used as aerosol propellants and in refrigeration and air conditioning can destroy ozone.

UVR that passes through the stratosphere (10–50 km above sea level) is scattered by molecules such as oxygen and nitrogen. It then passes through the troposphere (0–10 km above sea level), where it is absorbed and scattered by pollutants, such as soot, and attenuated by clouds. Clouds reduce the intensity of UVR but not to the same extent that infrared intensity is reduced; the sensation of heat is diminished, which results in the potential for overexposure.

The intensity of UVB radiation varies; it has greater intensity in summer than in winter, at midday than in morning or late afternoon, in places closer to the equator, and at higher altitudes. Sand, snow, concrete, and water can reflect up to 85% of sunlight, thus intensifying exposure.[3] Water is not a good photoprotectant, because UVR can penetrate to a depth of 60 cm, which results in a significant exposure. In contrast to the variability of UVB radiation, UVA radiation is relatively constant throughout the day and the year.

UVR can be produced by man-made lamps (eg, sunlamps) and tools (eg, welding tools), but the sun is the primary source of UVR for most people.[4] UVR has been used for decades to treat skin diseases, especially psoriasis.[1]

UVR EFFECTS ON THE SKIN

The skin is the organ most exposed to environmental UVR and to associated sequelae. Exposure to UVR may result in erythema and sunburn, tanning, skin aging, photosensitivity, and carcinogenesis (nonmelanoma skin cancer [NMSC] and cutaneous malignant melanoma).

Erythema and Sunburn

Erythema and sunburn are acute reactions to excessive amounts of UVR. Exposure to solar radiation causes vasodilatation and increases the volume of blood in the dermis, which results in erythema. The minimal erythema (or erythemal) dose (the amount of UVR exposure that will cause minimal erythema or slight pinkness of the skin) depends on factors such as (1) skin type, (2) skin thickness, (3) the amount of melanin in the epidermis, (4) melanin production after sun exposure, and (5) the intensity of the radiation. A classification system of 6 skin types ranging from light to dark (Table 1) takes into account a person's expected sunburn and suntan tendency.[5]

The ability of UVR to produce erythema depends on the radiation wavelength expressed as the erythema "action spectrum" (the rate of a physiologic activity plotted against wavelength of light showing which wavelength of light is most effectively used in a specific chemical reaction). The action spectrum for erythema and sunburn is mainly in the UVB range.[6]

TABLE 1 Classification of Sun-Reactive Skin Types[5]

Skin Type	History of Sunburning or Tanning
I	Always burns easily, never tans
II	Always burns easily, tans minimally
III	Burns moderately, tans gradually and uniformly (light brown)
IV	Burns minimally, always tans well (moderate brown)
V	Rarely burns, tans profusely (dark brown)
VI	Never burns, deeply pigmented (black)

Tanning

Tanning is a protective response to sun exposure.[7] Immediate tanning (or immediate pigment-darkening) results from oxidation of existing melanin after exposure to visible light and UVA. Immediate pigment-darkening becomes visible within several minutes and usually fades within 1 to 2 hours. Delayed tanning occurs when new melanin is formed after UVB exposure. Delayed tanning becomes apparent 2 to 3 days after exposure, peaks at 7 to 10 days, and may persist for weeks or months. According to recent evidence, the tanning response means that DNA damage has occurred in skin.[8]

Skin-Aging (Photoaging)

Chronic unprotected exposure to UVR weakens the skin's elasticity and results in sagging cheeks, deeper facial wrinkles, and skin discoloration. Photoaged skin is characterized by alterations of cellular components and of the extracellular matrix. There is accumulation of disorganized elastin and of fibrillin (its microfibrillar component in the deep dermis) and a severe loss of interstitial collagens, the major

structural proteins of the dermal connective tissue. These changes result primarily from exposure to UVR-generated reactive oxygen species that deplete and damage the skin's enzymatic and nonenzymatic antioxidant defense systems.[9,10]

Photosensitivity

Chemical photosensitivity refers to an adverse cutaneous reaction that results when certain chemicals or drugs are applied topically or taken systemically at the same time that a person is exposed to UVR or visible radiation. Phototoxicity is a form of chemical photosensitivity that does not depend on an immunologic response; the reaction can occur on first exposure to an agent. Most phototoxic agents are activated in the range of 320 to 400 nm (the UVA range). Drugs associated with phototoxic reactions include those commonly used by adolescents, such as nonsteroidal anti-inflammatory agents; tetracyclines and tretinoin; other medications such as phenothiazines, psoralens, sulfonamides, and thiazides; and para amino benzoic acid (PABA) esters.[11] Photoallergy is an acquired altered reactivity of the skin, usually triggered by exposure to UVA, that depends on antigen-antibody or cell-mediated hypersensitivity. Photoallergic reactions involve an immunologic response to a chemical or drug that is altered by UVR. PABA-containing sunscreens, fragrances, sulfonamides, and phenothiazines are associated with photoallergic reactions.[11] The consequences of exposure to a photosensitizing agent can be uncomfortable, serious, or life-threatening. People who take medications or use topical agents known to be sensitizing should do their best to limit sun exposure and avoid UVA from artificial sources. They should wear fully protective clothing and apply sunscreen with a high sun-protection factor (SPF) when some light exposure is inevitable.[12]

Plants that contain furocoumarins may lead to phototoxic reactions or phytophotodermatitis. These commonly encountered plants include anise, diseased celery, dill, fennel, fig, lemon, lime, mustard, parsnip, parsley, and chrysanthemums. Phytophotodermatitis can occur through ingestion of plants or, more commonly, through topical contact.[13]

Up to 80% of patients with lupus erythematosus have photosensitivity. The threshold UVR dose that triggers cutaneous or systemic reactions is much lower than that for sunburn. Many patients are not aware of the association of flares with UVR exposure, because the latency period between exposure and skin eruptions can range from several days to 3 weeks.[14]

Carcinogenesis

Nonmelanoma Skin Cancer

NMSC includes basal cell carcinoma (BCC) and squamous cell carcinoma (SCC). In the US adult population, NMSC is the most common malignant neoplasm, with more than 2 million cases diagnosed each year. Most of these are BCC, SCC occurs less often.[15] The rate of NMSC has been increasing in the United States, but the exact number is not precisely known, because physicians are not required to report NMSC to cancer registries. NMSC is rarely fatal; nevertheless, it is estimated that each year, approximately 2000 people die of NMSC.[15]

In general, NMSC occurs in maximally sun-exposed areas of fair-skinned people. NMSC is uncommon in black people and people with increased natural pigmentation. The head and neck region is the most common site for BCC and SCC; 80% to 90% of cases occur in this area in the general population. NMSC is more common in people older than 50 years, and the incidence in this age group is increasing rapidly.[16–18] People with immune suppression, including organ transplant recipients, also are at higher risk. Genetically based conditions, such as basal cell nevus syndrome, xeroderma pigmentosum (a condition in which there is a genetically determined defect in the repair of DNA damaged by UVR),[19] and albinism, are risk factors for the accelerated development of NMSC. Treatment with UVR for psoriasis also increases risk.[19] NMSC is extremely rare in children in the absence of predisposing conditions.[20]

The incidence of NMSC is increasing in young adults. Researchers examined the gender- and age-specific incidence of BCC and SCC in a young (<40-year-old), primarily white and middle-class population within Olmsted County, Minnesota, by using comprehensive medical records available through the Rochester (MN) Epidemiology Project.[21] Over the period of 1976–2003, the incidence of BCC increased significantly among young women, and the incidence of SCC increased significantly among both men and women.

A trend toward a greater number of BCC cases occurring on the torso in younger patients has been reported.[21–23] This change in location supports the possibility that excessive outdoor tanning, use of tanning booths, or both give rise to BCC. Tanning-bed use has been shown to be a risk factor for NMSC in young women.[24]

Sun exposure is the main environmental cause of NMSC. Cumulative exposure over long periods, which results in photodamage, is considered important in the pathogenesis of SCC.

Melanoma

Melanoma is primarily a disease of the skin. Primary extracutaneous sites include the eye, mucous membranes,

gastrointestinal tract, genitourinary tract, leptomeninges, and lymph nodes. Ninety-five percent of melanomas occur in the skin.[25] If detected when the tumor is thin and small, cutaneous malignant melanoma has an excellent prognosis. However, metastatic melanoma has no successful treatment options. Prevention and early detection, therefore, are crucial in this disease.

Many authorities have stated that the incidence of cutaneous malignant melanoma (hereafter referred to as "melanoma") has reached epidemic proportions. Possible factors contributing to the increased incidence of melanoma include the decrease in the earth's protective ozone layer, changing patterns of dress that favor more skin exposure, more opportunities for leisure activities in sunny areas, and increased exposure to artificial sources of UVR for tanning purposes.

In the United States, melanoma is the fifth most common cancer in men and the sixth most common in women.[26] The incidence of melanoma is increasing rapidly in the United States.[27] In 1935, the lifetime risk for a person in the United States developing invasive melanoma was 1 in 1500. In 2007, this risk was 1 in 63 for invasive melanomas and 1 in 33 when in situ melanomas were included. Worldwide, melanoma is increasing faster than any other malignancy.[28] Melanoma represents fewer than 5% of all skin cancers but is the cause of almost all skin-cancer deaths. The American Cancer Society predicted that approximately 68 130 new melanoma cases would be diagnosed in 2010, with 8700 deaths.[29]

Melanoma is more likely to occur in males and at older ages but also occurs in teenagers and young adults. It is the second most common cancer of women in their 20s and the third most common cancer of men in their 20s.[30] Melanoma incidence is increasing in young women aged 15 to 39 years.[31] People at highest risk have light skin and eyes and sunburn easily. Risk of developing melanoma is increased at older ages, in people who have already had melanoma, or in people who have had a first-degree relative with melanoma. Melanomas frequently are found in people with xeroderma pigmentosum and related disorders. In a large case-control study from the Netherlands, the risk of developing melanoma was increased in women who had used estrogens (either as oral contraceptives or hormone-replacement therapy) for more than half a year.[32]

Melanoma is rare in children, but it does occur. Studies have documented an increase in the incidence in children and adolescents, even in the absence of predisposing conditions such as xeroderma pigmentosum. From 1973 to 2001, the incidence of melanoma in US children younger than 20 years increased 2.9% annually.[33] An increase in incidence was noted in Sweden during 1973–1992,[34] but incidence then decreased.[35] Ferrari et al[36] reviewed a 25-year experience with 33 Italian children with melanoma who were 14 years or younger at presentation. The children's lesions were not typical of melanoma lesions in adults. Melanoma lesions in adults generally follow the "ABCDEs": they are asymmetric (A), have irregular borders (B), variegated color (C), and diameter (D) larger than 6 mm (the size of a pencil eraser), and change or evolve (E).[37] In the Ferrari et al[36] series, however, many lesions in children were amelanotic (pink, pink-white, or red) and tended to be raised and to have regular borders. The key to diagnosis for these children was the recognition that the melanoma lesions were unlike any other lesions on the child.

EVIDENCE THAT UVR CAUSES SKIN CANCER

In 1992, the International Agency for Research on Cancer (IARC) reviewed the evidence for the carcinogenicity of solar radiation. They concluded that "[t]here is sufficient evidence in humans for the carcinogenicity of solar radiation. Solar radiation causes cutaneous malignant melanoma and non-melanocytic skin cancer.[1]" Since that time, evidence has strengthened the link between sunlight exposure and skin cancer.

Cellular Studies

UVB is absorbed by and can directly damage DNA, which ultimately leads to the development of skin cancer.[38] The genotoxic effects of solar UVB radiation are mainly mediated by direct absorption in the epidermis of photons by DNA, which results primarily in cyclobutane pyrimidine dimers (formed between adjacent pyrimidine bases located on the same DNA strand) and pyrimidine (6-4) pyrimidone photoproducts.[7] Incorrect repair of these lesions results in the formation of mutations in epidermal cells, which causes the development of cancer.[7,39]

UVA penetrates more deeply into the skin than does UVB, including reaching the basal layer of the epidermis and dermal fibroblasts.[38] UVA causes oxidative damage to DNA that is potentially mutagenic.[7]

Biological Evidence

Biological evidence suggests that sunlight exposure is important in the pathogenesis of melanoma. Results of studies in opossums suggest that portions of the UVA spectrum may play a role in the pathogenesis of melanoma[40] and that portions of the UVA and UVB spectrums promote development of carcinomas in mice.[41] Melanoma can be induced by UVB and UVA radiation in certain fish.[42] Research ethics make it

impossible to determine directly which wavelengths result in skin cancer in humans.

Melanoma has been induced in human newborn foreskins grafted onto immunologically tolerant animals exposed to UVR.[43] Melanomas and NMSC are often found in people with xeroderma pigmentosum and related disorders.[44]

Epidemiologic Evidence

Latitude or Estimated Ambient Solar UVR

The rates of BCC and SCC increase with increasing ambient solar UVR. There is a direct relationship between the incidence of NMSC and latitude; higher rates are found closer to the equator (where the amount of sunlight is greater).[28] The relationship of melanoma with latitude is not as clear as that for NMSC.[28]

Race and Pigmentation

BCC and SCC occur primarily in white people.[15] Incidence and mortality rates of melanoma are highest in white people (Table 2).[27] There is, in general, an inverse relationship between skin-cancer incidence and the skin pigmentation of people in various countries in the world. Superficial epidermal melanin decreases the transmission of UVR, which may protect the deeper basal layer melanocytes and several layers of keratinocytes from sunlight-induced changes that lead to their malignant transformation.[7]

Melanin, a dark pigment produced by melanocytes, accounts for most of the variation in human skin appearance. Melanin that is genetically determined is termed "constitutive" melanin pigmentation. When this basic pigmentation is increased by exposure to UVR, it is termed "inducible" or "facultative" melanin pigmentation. Melanin is thought to have evolved as an optical and chemical photoprotective filter that functions as a natural "sunscreen" to regulate UVR penetration into skin. In early human evolution, the more highly melanized skins of people indigenous to the tropics afforded better protection against the deleterious effects of UVR. A dark epidermis protected sweat glands from UVR-induced injury and ensured the integrity of somatic thermoregulation. Highly melanized skin also protected against UVR-induced photolysis of folate, a metabolite essential for normal development of the embryonic neural tube.[45] As people migrated outside the tropics to northern areas, a lighter skin color was needed as an adaptation to promote maintenance of UVR-induced synthesis of vitamin D_3 in areas of lower UVR exposure.[45] As the pace of human migrations quickened in recent centuries, however, populations have found themselves in UVR-irradiation patterns to which they are poorly adapted. Cultural practices, such as sunbathing and covering up for religious reasons, exacerbate or mitigate the mismatch in degree of melanin protection to UVR exposures.[45]

TABLE 2 Melanoma Incidence and Mortality Rates According to Race/Ethnicity[27]

Race/Ethnicity	Men, Rate per 100 000 Men		Women, Rate per 100 000 Women	
	Incidence	Mortality	Incidence	Mortality
White	28.9	4.4	18.7	2.0
Black	1.1	0.5	1.0	0.4
Asian/Pacific Islander	1.6	0.5	1.3	0.3
American Indian/Alaska Native	3.9	1.6	2.8	0.9
Hispanic	4.6	0.9	4.7	0.6

History of Sun Exposure

The pattern of sun exposure is important in the etiology of BCC, SCC, and melanoma skin cancers. Personal sun exposure is usually characterized by (1) total sun exposure, (2) occupational exposure (which signifies a more chronic exposure), and (3) nonoccupational or recreational exposure (which signifies intermittent exposure).[46] SCC is significantly associated with estimated total sun exposure and with occupational exposure. Chronic exposure to UVB is now considered the main environmental cause of SCC. SCC seems to be most straightforwardly related to the total sun exposure: these tumors occur on skin areas that are most regularly exposed (face, neck, and hands), and the risk rises with the lifelong accumulated dose of UVR.[47] BCC and melanoma are significantly associated with intermittent sun exposure (ie, sunburning or "brutal" exposure), whereas SCC does not show this relationship. Melanoma is more strongly associated with intermittent sun exposures than is BCC.[46]

Childhood Sun Exposure

Childhood and adolescence are often considered to contain "critical periods of vulnerability" when people are especially susceptible to effects of toxic exposures. Approximately 25% of lifetime sun exposure occurs before 18 years of age.[48] Sun exposure and blistering sunburns during youth may be more intense than later in life because of youths' behavior. Exposure may result in alteration of melanocyte DNA and an increase in the risk of malignant degeneration in nevi as children age.

Sunlight exposure during childhood and adolescence is generally considered to confer increased risk of melanoma compared with exposure at older ages. This issue was reviewed in an analysis of epidemiologic studies categorized into 2 groups.[49] The first

group contained 20 ecologic studies (ie, studies in which the unit of observation is the population or community) relating the risk of melanoma to places of residence. These studies were conducted on the basis of the fact that ambient solar radiation increases with proximity to the equator and included studies of migrants to locations with markedly different levels of sunlight. The second group consisted of case-control studies in which measures of sun exposure between people with melanoma and those without were compared.

In the first group, most studies revealed that people who migrated from "low" to "high" areas of ambient solar radiation had decreasing melanoma risk with arrival at older ages, whereas those who arrived in childhood (younger than 10 years) or adolescence (younger than 15 years) had similar risks as people who were native-born. The 1 study that investigated age-specific "high-to-low" migration demonstrated higher risk in people born in a sunny area or having had more than 1 year living in a sunny area before 10 years of age.[49] The results of most studies of the age of migration, therefore, supported the "critical-period" hypothesis.

Ten case-control studies that examined melanoma risks associated with personal sun exposure during 2 or more age periods were evaluated in the second group. Findings of these studies differed widely without consistent associations with childhood sun exposure. Three studies reported significantly increased risks of melanoma associated specifically with episodes of sunburns during childhood, whereas 1 Swedish study found no effect of childhood sunburn but reported significantly higher risks associated with adulthood sunburns. The remaining 5 studies reported similar risks of melanoma regardless of whether sunburn occurred during childhood or adulthood. The summary odds ratios associated with sunburn during childhood and adulthood were 1.8 (95% confidence interval: 1.6–2.2) and 1.5 (95% confidence interval: 1.3–1.8), respectively, although there was significant heterogeneity among the studies for the estimates of childhood sunburn. The authors underscored the lack of reliability of recalling personal sun exposure as a reason for the inconsistencies between the migrant and case-control studies and considered the evidence from the migrant studies to be of higher quality.[49] In a large multicenter case-control study, the authors concluded that excessive UVR exposure later in life may be as important a risk for melanoma as UVR exposure earlier in life.[50] There was a similar upward gradient of melanoma risk related to sunburns during childhood (defined as age $\leq$ 15 years) and adulthood (defined as age $>$ 15 years). More than 5 sunburns doubled the melanoma risk irrespective of whether those sunburns occurred in childhood or adulthood.[50]

There is biological plausibility to support the heightened susceptibility of young melanocytes. Peak melanocytic activity occurs in early life as demonstrated by the steady acquisition of nevi during childhood and adolescence. Freckling is also prominent at these ages; freckles in children often appear abruptly after high-dose sun exposure and are thought to represent clones of mutated melanocytes. The presence of freckles is associated with an increased risk of melanoma.[7] Young melanocytes may be especially vulnerable to the adverse effects of solar radiation. Sunlight may have both early and late effects on the development of melanoma (akin to cancer "initiation," "promotion," and "progression"[51]), and the biological effectiveness of sunlight in initiating melanoma is greatest during the period of peak melanocytic activity. Populations exposed to high sunlight levels in childhood will have more people with more initiated melanocytes than populations of those who experienced lower sunlight levels. This "melanoma potential" is retained when people move to a different environment.[49]

Nevi

Acute sun exposure is implicated in the development of nevi (moles) in children. The number of nevi increases with age[52]; nevi occur with more frequency on sun-exposed areas, and the number of nevi on exposed areas increases with the total cumulative sun exposure during childhood and adolescence.[53] Children with light skin who tend to burn rather than tan have more nevi at all ages, and children who have more severe sunburns have more nevi.[52]

There is a relationship between the number and type of melanocytic nevi and the development of melanoma. The presence of congenital melanocytic nevi (CMN) (pigment cell malformations formed during gestation and visible at or shortly after birth) increases melanoma risk. In a review of 14 studies—case series with adequate follow-up periods—investigators found an overall risk of melanoma arising in CMN of 0.7%, which was lower than expected. Melanoma risk strongly depended on the size of the CMN and was highest in nevi designated as garment nevi (defined as nevi situated on the trunk that measure $>$40 cm in largest diameter or expected to reach this size in adulthood). The mean age at melanoma diagnosis (15.5 years) and median age of diagnosis (7 years) underscored the maximum risk in childhood and adolescence.[54]

Dysplastic melanocytic nevi typically are 5 mm or larger in diameter; usually have fuzzy, irregular borders; and

have variegated color. Dysplastic nevi are considered precursor lesions that increase melanoma risk.[55] The familial dysplastic nevus syndrome is a disorder with the following features: (1) a distinctive appearance of abnormal melanocytic nevi; (2) unique histologic features of the nevi; (3) autosomal dominant pattern of inheritance; and (4) hypermutability of fibroblasts and lymphoblasts. Fibroblasts and lymphoblasts from patients with this syndrome are abnormally sensitive to UV damage, and people with this syndrome are at markedly higher risk of developing melanoma.[56] Certain families with germ-line mutations in *CDKN2A*, *CDK4*, and other genes are at increased risk of developing dysplastic nevi and melanoma.[57]

History of Exposure to Artificial UVR

Exposure to tanning beds and sunlamps, which produce primarily UVA, is associated with increased risk of developing BCC, SCC, and melanoma.

UVR EFFECTS ON THE EYE

In adults, more than 99% of UVR is absorbed by the anterior structure of the eye, although some of it reaches the retina.[58] Acute exposure to UVR can result in photokeratitis.[59] Gazing directly into the sun (as can occur during an eclipse) can cause focal burns to the retina (solar retinopathy).[60]

Exposure to solar UVB radiation is associated with an increased risk of cataracts.[61] UVR can contribute to the development of pterygium, corneal degenerative changes, and cancer of the skin around the eye.[58] There is evidence for a probable relationship between UVR exposure and squamous intraepithelial neoplasms of the conjunctiva or cornea, but there is insufficient evidence to determine if there is a relationship between UVR exposure and the development of macular degeneration.[62] Melanoma of the uveal tract, the most common primary intraocular malignant neoplasm in adults, is associated with light skin color, blond hair, and blue eyes. There is contradictory evidence regarding the role of UVR in causing uveal melanoma.[63,64]

UVR EFFECTS ON THE IMMUNE SYSTEM

Exposure to UVR contributes to immunosuppression, which is increasingly recognized as important in the development of skin cancer. UVR exposure is thought to have 2 effects: skin-cancer induction and immune suppression.[65] Experiments in mice chronically exposed to UVR have shown that tumors induced by UVR are highly antigenic and are recognized and rejected by animals with normal immune systems. The tumors grow progressively, however, when transplanted into mice with immune systems that are compromised.[65] UVR exposure induces "systemic" immune suppression so that exposure on 1 body site suppresses the immune response when the antigen is introduced at a distant site that was not irradiated. Soluble factors implicated in systemic immune suppression include platelet-activating factor (PAF), prostaglandin E2 (PGE2), *cis*-urocanic acid, histamine, interleukin 4, interleukin 10, and α-melanocyte-stimulating hormone.[65]

Skin cancers are common in people exposed to immunosuppressive agents, which further illustrates the role of the immune system. In people who have had renal transplants, lifelong immunosuppressive treatment needed for adequate graft function leads to a reduction of immunosurveillance and an increased risk of various cancers. With increased duration of transplantation, skin cancer is now one of the commonest causes of death in renal transplant recipients. Twenty years after transplantation, approximately 40% to 50% of white recipients in Western countries and 70% to 80% of those in Australia will have developed at least 1 NMSC (mostly SCC).[66] People who have had renal transplants also have an increased incidence of melanoma.[67] Because ongoing immunosurveillance has been lacking, skin cancers in people who have received organ transplants are likely to behave aggressively with a higher rate of local recurrence and a greater tendency to be invasive and metastatic.[66]

ARTIFICIAL SOURCES OF UVR

People may be exposed to artificial sources of UVR in several ways, including as treatment for medical conditions (such as psoriasis), in occupational settings (such as welding), and for cosmetic purposes. Sunlamps and tanning beds are the main sources of artificial UVR used for deliberate purposes.[68] Artificial tanning is a relatively new phenomenon that results in potentially large exposures to UVA and UVB. The "tanning industry" has grown quickly; it takes in $5 billion in annual revenue, up from $1 billion in 1992.[69] Each day, more than 1 million people tan in one of 50 000 tanning facilities in the United States.[69] Indoor tanning also is popular in northern Europe and is gaining popularity in Australia.[68]

Artificial tanning is a common practice among teenagers. In a national sample of non-Hispanic white teenagers 13 to 19 years of age in the United States, 24% of respondents—representing 2.9 million teenagers—reported using a tanning facility at least once in their lives.[70] In another national survey, 10% of youth 11 to 18 years of age reported using indoor tanning beds or sunlamps in the previous year.[71] Women and girls represent the majority of people who artificially tan. Of the 1 million people daily who are tanning-salon customers, 70% are females 16 to 49 years of age.[69] Twenty-eight per-

cent of white US teenaged girls interviewed in 1996 had used tanning salons 3 or more times during their lives.[70] Tanning-bed use increases with age, from 7% among 14-year-old girls to 16% among 15-year-old girls and to 35% among 17-year-old girls.[72]

Tanning-bed use by adolescent girls is often associated with other unhealthy behaviors. In 1 study, frequent tanning-bed use was associated with smoking cigarettes, binge-drinking, being highly concerned about weight, and other risk behaviors.[73]

Evidence That Tanning May Be Addictive

Exposure to UVR from sunlight or tanning parlors may be addictive. Beachgoers aged 18 years and older in Galveston, Texas, were interviewed using questions to evaluate dependence on tanning. Subjects completed surveys that included a tanning-specific modification of a screening instrument for alcoholism and questions to evaluate criteria for tanning-specific substance-related disorder. Of 145 subjects, 26 (18%) screened positive on both measures, and 63 (43%) screened positive on 1 measure. The authors concluded that those who chronically and repeatedly expose themselves to UVR to tan may have a type of UVR substance-related disorder.[74] In a study of 14 adults, tanners overwhelmingly preferred UVR-emitting beds when asked to choose blindly between UVR-emitting and non–UVR-emitting tanning beds. A more relaxed and less tense mood was reported after UVR exposure compared with after non-UVR exposure.[75] In another study, the opioid antagonist naloxone was given to 8 frequent salon tanners and 8 people who were infrequent tanners. Withdrawal-like symptoms were induced in 4 of 8 frequent salon tanners; no symptoms occurred in the 8 infrequent tanners. It is conjectured that ultraviolet light exposure results in induction of cutaneous endorphins; thus, endorphin release may play a role in driving UVR-exposure behavior. If cutaneous endorphins are induced, an endorphin blockade would be expected to block the effect.[76] A recent study assessed the prevalence of addiction to indoor tanning among college students and its association with substance use and symptoms of anxiety and depression. Two written measures, the CAGE (cut down, annoyed, guilty, eye-opener) Questionnaire, used to screen for alcoholism, and the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR) criteria for substance-related disorders were modified to evaluate study participants for addiction to indoor tanning. Self-report measures of anxiety, depression, and substance use were administered. Among the 229 study participants who had tanned indoors, 70 (30.6%) met CAGE criteria and 90 (39.3%) met DSM-IV-TR criteria for addiction to indoor tanning. Indoor tanners reported significantly greater symptoms of anxiety and greater use of alcohol, marijuana, and other substances than those who did not meet these criteria. Depressive symptoms did not significantly vary according to indoor-tanning-addiction status.[77]

Effects of Artificial UVR on Human Skin

Tanning beds primarily emit UVA radiation, although a small amount (<5%) is in the UVB range.[68] In terms of biological activity, the intensity of UVA radiation produced by large, powerful tanning units may be 10 to 15 times higher than that of the midday sun. Frequent indoor tanners may receive 1.2 to 4.7 times the annual dose of UVA than is received from the sun, in addition to doses from sun exposure.[68] This intensity of exposure is not found in nature and is a new phenomenon in people.[78]

Artificial UVR exposure has been shown repeatedly to induce erythema and sunburn. Erythema or burning effects were reported by 18% to 55% of users of indoor tanning equipment in Europe and North America.[68] Although UVB is much more potent than UVA in causing sunburn, high fluxes of UVA can cause erythema in people who are sensitive to sunlight. In people who tan easily, exposure to tanning appliances will lead first to immediate pigment-darkening. A more permanent tan will occur with accumulated exposure, depending on individual tanning ability and the amount of UVB present in the light spectrum of the tanning lamps. Immediate pigment-darkening has no photoprotective effect against UVR-induced erythema or sunburn. In addition, the permanent tan induced by UVA and UVA-induced skin-thickening provides little photoprotection.

Other frequently reported effects of artificial tanning include skin dryness, pruritus, nausea, photodrug reactions, disease exacerbation (eg, systemic lupus erythematosus), and disease induction (eg, polymorphous light eruption). Long-term health effects include skin-aging, effects on the eye (eg, cataract formation), and carcinogenesis.

In 1992, the IARC[1] classified the "use of sunlamps and sunbeds" as "probably carcinogenic to humans." In 2000, the National Institutes of Health stated that "exposure to sunlamps or sunbeds is known to be a human carcinogen, based on sufficient evidence of carcinogenicity from studies in humans, which indicate a causal relationship between exposure to sunlamps or sunbeds and human cancer."[79]

A case-control study demonstrated a significant association between using any tanning device and the incidence

of SCC and BCC.[80] A prospective cohort study of 106 379 women in Scandinavia examined melanoma risk in females who reported having used a sunbed or sunlamp. A 55% increase in melanoma risk was found in women who reported having used a tanning device at least once per month in at least 1 of the 3 decades between 10 and 39 years of age, compared with those who had never or rarely used a tanning device during those 3 decades.[81]

In 2006, the IARC published an updated analysis of studies of the carcinogenicity of artificial UVR with regard to melanoma, SCC, and BCC.[68] On the basis of 19 studies, any previous use of sunbeds was positively associated with melanoma (summary relative risk: 1.15 [95% confidence interval: 1.00–1.31]), although there was no consistent evidence of a dose-response relationship. First exposure to sunbeds before 35 years of age significantly increased the risk of melanoma on the basis of 7 studies (summary relative risk: 1.75 [95% confidence interval: 1.35–2.26]). The summary relative risk of 3 studies of SCC showed an increased risk. Studies did not support an association for BCC. The evidence did not support a protective effect of the use of sunbeds against damage to the skin from subsequent sun exposure.

Biological evidence supports the epidemiologic studies. The skin of volunteers exposed to UVA lamps used in tanning appliances showed DNA damage.[68] The IARC concluded that young adults should be discouraged from using indoor tanning equipment and that restricted access to sunbeds by minors should be strongly considered.

Tanning-Industry Response

The tanning industry has fought vigorously to allow teenagers access to tanning salons and promotes the purported health benefits and safety of artificial tanning. The Indoor Tanning Association, an industry group founded in 1999, promotes "a responsible message about moderate tanning and sunburn prevention."[82] Their mission is to "protect the freedom of individuals to acquire a suntan, via natural or artificial light."[83] The Indoor Tanning Association claims that "controlled" salon tanning is safer than "uncontrolled" beach tanning; this concept is not supported by laboratory, behavioral, or epidemiologic data.[78] Another commonly held misconception is that getting a "prevacation tan"—when people visit tanning salons to prepare skin for a sunny vacation—will protect against subsequent skin damage during the vacation. This practice actually leads to extra radiation exposure not only before the vacation but also afterward, because people use fewer sun-protection precautions during the vacation because of a mistaken belief that the tan will protect them.[69] A prevacation tan results in minimal protection (an SPF of 3),[78] which provides virtually no protection against sun-induced DNA damage.[68]

Antitanning Legislation and Recommendations

Because of mounting evidence about the carcinogenicity of artificial UVR, support for regulations to limit teenagers' access to tanning facilities has been widespread. The World Health Organization,[84] the American Medical Association,[85] and the American Academy of Dermatology[86] all support legislation to ban the use of artificial tanning devices by people younger than 18 years. The IARC review concluded that young adults should be discouraged from using indoor tanning equipment and that restricted access to sunbeds by minors should be strongly considered.[68]

France has banned indoor tanning for people younger than 18 years since 1997; indoor tanning for those younger than 18 years also is prohibited in the province of New Brunswick, Canada.[87] Currently (as of February 2011), more than 60% of US states regulate tanning facilities for minors.[88] Some states completely ban salon access to children younger than 14 years, whereas other states ban access to adolescents 15 or 16 years of age. Some states require written parental consent or written consent with the parent present at the facility or a doctor's prescription. In California, where tanning-salon use is banned for children younger than 14 years, recent legislation made annual signed parental consent required for tanning-facility use by adolescents 14 to 17 years of age.[89] During the 2010 legislative session, 20 states introduced bills to regulate tanning facilities for minors.[88,*]

The Indoor Tanning Association has fought against legislative initiatives and stated that legislation will harm business[90] and that tanning is an issue of parental rights: "When it involves a suntan, the State has no business inserting itself between child and parent. This notion that government knows more about child rearing than parents is preposterous."[89] Pediatric health advocates have countered this argument by stating that laws to limit minors' access to tanning parlors should be thought of in the same way as laws that limit youth access to tobacco.[87,89] All states prohibit the purchase of tobacco products by those younger than 18 years; some prohibit tobacco sales to those younger than 19 years.[87] Tanning legislation is often not enforced.[91]

Artificial Tanners (Spray Tans and Sunless Tanning Lotions)

Several organizations have suggested that people who wish to obtain the look of a tanned skin use artificial (or "sunless") tanning products to substitute

*For more information on current state laws that restrict the use of tanning beds by children and teenagers, please contact the AAP Division of State Government Affairs.

for tanning obtained by going outside or at tanning salons. Sunless tanners contain dihydroxyacetone, a chemical that reacts with amino acids in the stratum corneum to form brown-black compounds—melanoidins—that deposit in skin. Dihydroxyacetone is a mutagen that induces DNA strand breaks in certain strains of bacteria; it has not been shown to be carcinogenic in animal studies.[92]

Dihydroxyacetone is the only color additive approved by the US Food and Drug Administration (FDA) for use as a tanning agent.[93] Dihydroxyacetone-containing tanning preparations may be applied to the consumer's bare skin by misters at sunless tanning booths. Bronzers are water-soluble dyes that temporarily stain the skin. Bronzers are easily removed with soap and water.

The prevalence of sunless tanner use in Australia has ranged from 9% to 22%[94]; 28% of women between 18 and 24 years of age reported using sunless tanners.[95] A survey of young adults 18 to 24 years of age in the United States revealed that 22% had used sunless tanners in the previous 12 months, and another 22% who had not used these products would consider doing so in the next 12 months.[94] Sunless-tanning-product users were more likely to be female, to be younger, and to report having sunburned during the previous summer than potential users or nonusers.

Dihydroxyacetone-induced tans become apparent within 1 hour; maximal darkening occurs within 8 to 24 hours. Most users report that color disappears over 5 to 7 days. Because neither dihydroxyacetone nor melanoidins afford any significant UV protection, consumers must be advised that sunburn and sun damage may occur unless they use sunscreen and other sun-protection methods. Consumers must also be warned that any sunless products that contain added sunscreen provide UVR protection only during the first few hours after application and that additional sun protection must be used during the duration of the artificial tan.

PREVENTION

The incidence of skin cancer continues to rise despite public health efforts to increase awareness of sun-safety measures. Children and teenagers continue to sunburn: in 1 large study of more than 10 000 white teenagers 12 to 18 years of age, most respondents (83% [$n = 8355$]) reported sunburning at least once, and 36% of children reported 3 or more burns during the previous summer.[72] Only one-third of respondents reported routine use of sunscreen during the past summer. Sunburning during the summer was reported in a nationwide survey of youth, although many reported using sunscreen before their most serious sunburn.[96] Among adolescents 16 to 18 years of age, the prevalence of sunburn and the average number of days spent at the beach increased between surveys conducted in 1998 and 2004.[97]

It has been estimated that sun avoidance could reduce the number of lifetime NMSC cases by almost 80%.[98] Although other risk factors (eg, precursor lesions, older age, race, previous melanoma, and family history) are more closely associated with melanoma than sunburns, exposure to UVR is the only risk factor that is avoidable. Leading organizations (the American Cancer Society,[99] Centers for Disease Control and Prevention,[100] Healthy People,[101] National Council on Skin Cancer Prevention[102]) have recommended sun-safe behaviors. UVR-protective messages include:

1. Do not burn; avoid suntanning and tanning beds.
2. Wear protective clothing and hats.
3. Seek shade.
4. Use extra caution near water, snow, and sand.
5. Apply sunscreen.
6. Wear sunglasses.

Clothing and Hats

Clothing can be an excellent UVR barrier, because it offers a simple and practical means of sun protection. In contrast to sunscreens, the photoprotection afforded by clothing does not diminish throughout the day unless the clothing becomes wet. Infants and children may be dressed in cool, comfortable clothing and wear hats with brims. One study revealed that wearing clothing decreases the development of nevi.[103] Protective factors in clothing include fabric type, thickness, color, and chemical enhancement.[2] Wool and synthetic materials such as polyester are more protective, whereas cotton, linen, acetate, and rayon are less protective. A tighter weave lets in less sunlight than a looser weave. Darker colors are more protective than lighter ones. Clothes that cover more of the body provide more protection; sun-protective styles cover to the neck, elbows, and knees. Treating fabrics with chemical absorbers or washing them with optical brighteners increases UVR protectiveness.

In 1996, Australia and New Zealand established standards for the UVR protectiveness of clothing. The United States developed standards in 2001. The ultraviolet protection factor (UPF) measures a fabric's ability to block UVR from passing through the fabric and reaching the skin. The UPF is classified from 15 to $\geq$50 as follows: 15 to 24 is rated as "good"; 25 to 39 is rated as "very good"; and 40 to $\geq$50 is rated as "excellent." Although garments with a UPF above 50 may be labeled "UPF 50+," these garments may not offer substantially more protection than those with a UPF of 50. Any garment

with a UPF lower than 15 should not be labeled as "sun protective" or "UV protective."[104] Denim provides a UPF of 1700.[2] Typical summer cotton T-shirts provide a UPF of 5 to 9. The UPF of fabrics can be increased by shrinking and decreased by stretching. If cotton fabrics get wet, the UPF decreases. The US Federal Trade Commission monitors advertising claims about sun-protective clothing.[105]

Hats provide variable sun protection for the head and neck, depending on the brim width, material, and weave. A wide-brimmed (3-in) hat provides an SPF of 7 for the nose, 3 for the cheek, 5 for the neck, and 2 for the chin. Medium-brimmed (1- to 3-in) hats provide an SPF of 3 for nose, 2 for the cheek and neck, and none for the chin. A narrow-brimmed hat provides an SPF of 1.5 for the nose but little protection for the chin and neck.[2]

Shade

Infants younger than 6 months should be kept out of direct sunlight. Whenever possible, children's outdoor activities should be planned to minimize peak-intensity midday sun (10 AM to 4 PM). Seeking shade is somewhat useful, but people can still sunburn, because light is scattered and reflected. A fair-skinned person sitting under a tree can burn in less than an hour. Shade provides relief from heat and possibly provides a false sense of security about UVR protection. Clouds decrease UVR intensity but not to the same extent that they decrease heat intensity and, thus, may promote a misperception of protection.[6]

Sunscreen

Sunscreen is the main form of protection used by the population, including parents who use sunscreen to protect children.[106–109] Sunscreens reduce the intensity of UVR affecting the epidermis, thus preventing erythema and sunburn. Most FDA-approved sunscreen agents are organic chemicals that absorb various wavelengths of UVR, primarily in the UVB range; others are effective in the UVA range.[110] Some agents are not photostable in the UVA range and degrade with sun exposure. Combinations of chemicals are needed to provide broad-spectrum protection and increase photostability.[110]

The 2 FDA-approved inorganic physical sunscreens are zinc oxide and titanium dioxide, which prevent penetration of skin by UVB, UVA1, and UVA2. Physical sunscreens are usually white or tinted after application; some newer formulations are less visible on the skin but may be less effective.[110] Physical sunscreens are useful for people with photosensitivity disorders and other conditions that require protection from full-spectrum UVR.[3] Table 3 lists the FDA-approved sunscreen agents.

SPF is a grading system developed to quantify the degree of protection from erythema provided by using a sunscreen; the higher the SPF, the greater the protection. For example, a person who would normally experience sunburn in 10 minutes can be protected up to approximately 150 minutes (10 × 15) with an SPF-15 sunscreen. SPF pertains only to UVB. The SPF is determined indoors according to a standard protocol that uses artificial light sources and application of a defined amount of sunscreen (2 mg/cm^2). An SPF-2 sunscreen applied at this thickness blocks approximately 50% of UVB radiation; an SPF-10 blocks 90%; an SPF-15 blocks 94%; and an SPF-30

TABLE 3 FDA-Approved Sunscreens[110,115]

Sunscreen	Range of protection	Comments
Organic		
PABA derivatives	UVB	—
PABA[a]		
Padimate O (octyl dimethyl PABA)		
Cinnamates	UVB	—
Octinoxate (octyl methoxycinnamate)		
Cinoxate		
Salicylates	UVB	—
Octisalate (octyl salicylate)		
Homosalate		
Trolamine salicylate[a]		
Benzophenones	UVB, UVA2	Penetrates skin; estrogenicity in animal studies
Oxybenzone (benzophenone 3)		
Sulisobenzone (benzophenone 4)		
Dioxybenzone (benzophenone 8)[a]		
Others		
Octocrylene	UVB	In combination with other sunscreen agents, improves product photostability
Ensulizole (phenylbenzimidazole sulfonic acid)	UVB	—
Avobenzone (butyl methoxybenzoyl methane, Parsol 1789)	UVA1, UVA2	Photolabile; efficacy decreases by ~60% after 60 min of exposure
Ecamsule (terephthalylidene dicamphor sulfonic acid)	UVB, UVA2	Photostable; particularly effective for UVA2; approved by the FDA in 2007
Meradimate (menthyl anthranilate)[a]	UVA2	—
Inorganic		
Titanium dioxide	UVB, UVA2/UVA1	—
Zinc oxide	UVB, UVA2/UVA1	—

Note that other agents are approved for use in the European Union.
[a] These agents are rarely used in sunscreen formulations.

blocks 97%. However, sunscreens block the pre-D_3 effective radiation more effectively than the erythemally effective radiation.[111]

In actual use, the SPF often is substantially lower than expected, because the amount applied to the skin is less than half the recommended amount (2 mg/cm^2).[112] To adequately cover all sun-exposed areas of an average adult wearing a bathing suit, 1 oz (30 mL) of sunscreen would be needed. It is recommended that sunscreen with an SPF of at least 15 be applied liberally 15 to 30 minutes before sun exposure to allow for absorption into the skin and to decrease the likelihood that the sunscreen will be washed off. Furthermore, it is recommended that sunscreens be reapplied every 2 hours and after swimming, sweating, or drying off with a towel.[110] Sunscreen products with a greater SPF provide somewhat greater protection. Products with a higher SPF have been recommended for some people, including those who have had skin cancer.[113] For most users, however, proper application and reapplication are more important factors than using a product with a higher SPF.

The formulating, testing, and labeling of sunscreen products is regulated by the FDA. The FDA has approved 17 sunscreen chemicals for use in the United States. Several more are available in the European Union. Four chemicals effective in the UVA range have been approved for use in the United States, although others are available in the European Union. In May 1999, the FDA published its final rule for over-the-counter sunscreen products that protect against UVB. Regulations concerning UVA were delayed until reliable testing methods could be developed. In August 2007, the FDA proposed new sunscreen regulations that focused on manufacturing, testing, and labeling of UVA sunscreens using a 4-star rating system that would rate product protection from "low" (1 star) to "highest" (4 stars).[114] The FDA also proposed that the "sun-protection factor" be changed to "UVB sunburn-protection factor."[115] The proposed grading system would divide sunscreens into 4 protection categories: low (SPF-2–SPF-15); medium (SPF-15 to lower than SPF-30); high (SPF-30–SPF-50); and highest (higher than SPF-50). Manufacturers would be unable to label their products with specific SPF values higher than 50, because the FDA believes that there are no data showing accuracy and reproducibility of SPF determinations higher than 50.[115] The proposed FDA rule had not been finalized as of February 2011.

The regular use of a broad-spectrum sunscreen preparation can prevent solar (actinic) keratoses, which are precursor lesions of SCC.[116,117] One randomized clinical trial revealed that sunscreen also decreases the risk of developing SCC.[118] The role of sunscreen in preventing BCC and melanoma has not been fully elucidated. No studies have demonstrated that sunscreen use prevents melanoma or BCC. Some research has revealed that sunscreen users have a higher risk of melanoma and BCC and more nevi.[103] These observations have led to concern that people who use sunscreens also spend more time in the sun because they do not sunburn.[119] The American College of Preventive Medicine found "insufficient evidence to recommend for or against sunscreen use. Nonmelanoma skin cancers may be reduced with regular, daily sunscreen use. There is insufficient evidence that chemical sunscreens protect against malignant melanoma and they may, in fact, increase risk."[120] Two reviews, however, did not support the association between sunscreen use and an increased risk of melanoma.[121,122] Sunscreen continues to be recommended by the American Academy of Dermatology[123] and many other organizations as part of a total program of sun protection.

Sunscreens may be systemically absorbed. In 1 study, sunscreen products were studied in vitro to assess the extent of absorption after application to excised human skin. Half of the products were marketed specifically for children. Of the 5 chemical sunscreen ingredients present in the products, only oxybenzone (benzophenone 3) penetrated skin.[124] In another report, researchers from the Centers for Disease Control and Prevention examined more than 2500 urine samples collected during 2003–2004 for oxybenzone. The samples selected were representative of the US population aged 6 years and older as part of the National Health and Nutrition Examination Survey (NHANES), an ongoing survey that assesses the health and nutritional status of the US civilian population. The analysis found oxybenzone in 97% of the samples,[125] which suggests widespread exposure to the population. Females and non-Hispanic white people had the highest concentrations regardless of age. Data are not available for children younger than 6 years.

Results of animal studies have shown alterations in liver, kidney, and reproductive organs in rats given oral or transepidermal doses of oxybenzone.[126] A study of 6 commonly used UVB and UVA sunscreens was conducted to determine estrogenicity in vivo and in vitro. Five of the 6 sunscreen ingredients (benzophenone 3, homosalate, 4-methyl-benzylidene camphor [4-MBC], octyl methoxycinnamate [OMC] and octyl-dimethyl-PABA) increased cell proliferation in breast cancer cells, and the sixth sunscreen ingredient, butyl-methoxydibenzoylmethane (avobenzone), was inactive. In the in vivo analysis, rats fed the sunscreen ingre-

dients OMC, 4-MBC, and benzophenone 3 showed dose-dependent increases in uterine weight. Epidermal application of 1 of the products (4-MBC) also increased uterine weight.[127] Researchers investigating human prenatal exposures to phthalate and phenol metabolites and their relationship to birth weight found that higher maternal concentrations of benzophenone 3 were associated with a decrease in birth weight in girls but a greater birth weight in boys.[128] A study in young men and postmenopausal women given generous daily applications of benzophenone 3, OMC, and 4-MBC revealed detectable levels of these chemicals in plasma and urine.[129] There were no effects on serum concentrations of reproductive hormones related to sunscreen exposure in men or women. The authors concluded that although the data showed skin penetration of these sunscreen chemicals, there did not seem to be an effect on the hypothalamic-pituitary-gonadal axis. Caution, however, was suggested for children. Researchers in Europe investigated analyzed samples of human milk for the presence of sunscreens and other chemicals with possible endocrine activity. Mothers were asked about their use of sunscreens and cosmetics that contained sunscreen ingredients (benzophenone 2, benzophenone 3, 3-benzylidene camphor, 4-MBC, OMC, homosalate, octocrylene, and octyl-dimethyl PABA). Responding to questionnaires, 78.8% of the women reported using products that contained sunscreens; 76.5% of human milk samples contained these chemicals. There was a high correlation reported between mothers' use of these chemicals and their concentrations in human milk. The authors concluded that except for lipsticks (the ingestion of which is probably important), their results agree with studies in animals and humans showing dermal absorption of sunscreens. Given that some of these chemicals have endocrine activity in animals, the authors suggested that exposure could be lessened if mothers abstained from using these products during their children's sensitive life stages.[130]

Sunscreens are lipophilic and can bioaccumulate in the environment. Sunscreen ingredients have been identified in fish.[127] Because of recent data on bioaccumulation in humans and wildlife, researchers have called for an in-depth analysis of the systemic toxicology of sunscreen ingredients.[127] Sunscreen ingredients are not listed as known or suspected human carcinogens.[131]

Sunscreen products that contain zinc and titanium oxides are increasingly manufactured by using nanotechnology—the design and manipulation of materials on atomic and molecular scales. Nanoscale particles are measured in nanometers, or billionths of a meter. Using nanoscale particles renders products that contain zinc and titanium oxides nearly transparent and increases cosmetic acceptability. Concerns have been raised, however, about the dearth of safety information available about nanoscale ingredients, including the effect on skin that is damaged by sunburn.[132] There are no data available about the effects of these products on infants and children. Advocacy groups have called on the FDA to require more testing and increased regulatory oversight.

To our knowledge, toxicity in infants and children from absorption of sunscreen ingredients has not been reported. Permeability of skin to topically applied products is, however, of concern for infants and young children, especially preterm infants, in whom the stratum corneum of the epidermis is thinner and a less effective barrier than that of term newborn infants and adults. Well-known toxicity from percutaneous absorption in infants and children include the adverse effects of alcohol, boric acid (in diaper powder), hexachlorophene (in antiseptic cleansers), and mercuric chloride (in diaper rinses).[133] Risks from cutaneous exposure to environmental toxicants and chemicals may be heightened in children compared with adults for reasons that include differing behavior patterns; anatomic and physiologic differences in absorption, metabolism, distribution, and excretion; and developmental differences of vital organs that may result in different end organ effects.[133] Infants have a greater ratio of surface area to body weight compared with older children and adults, which allows infants to percutaneously absorb proportionately greater quantities of topical medications or other preparations.[134]

The development of barrier function of infant skin has been investigated. The skin barrier limits water loss, protects the body from entry by toxic substances, and resists mechanical trauma.[135] Vernix caseosum provides a barrier during fetal life. Once the vernix is removed after birth, the stratum corneum of the epidermis provides protection. It was previously thought that the stratum corneum assumed adult function in the first few weeks of life. Accumulating research suggests, however, that the stratum corneum continues to develop through the early years of life. One study[136] assessed the dynamic transport and distribution of water in the stratum corneum in infants (3–12 months of age) and adults (14–73 years of age) by measuring transepidermal water loss (TEWL) ("insensible water loss," a measure of the amount of water that passively diffuses through the epidermis), capacitance (a measure of skin hydration), rates of absorption and desorption, and concentration of water and natural moisturizing factor (NMF) in the skin. Infants' skin had greater hydration, greater TEWL, greater water ab-

sorption and desorption, and lower concentration of NMF. NMFs normally take up water; lower levels may contribute to faster water desorption, which possibly affects barrier function. The authors concluded that the unique properties of infant skin continue to persist at least through the first 12 months of life. In an Italian study,[137] TEWL, capacitance, and pH were measured in 70 infants (8–24 months of age) without skin disease and 30 healthy adult women (25–35 years of age). TEWL measurements did not differ between the infants and adults. Capacitance values and pH were higher in infants. The authors concluded that, despite the similarities in TEWL, differences found in capacitance and pH indicated functional immaturity, possibly resulting in increased permeability.

Infrequently, topical sunscreen agents can have adverse effects, including erythema, itching, burning, or stinging. Allergic contact dermatitis and photoallergic and phototoxic reactions occur rarely.[110]

It is generally recommended that infants younger than 6 months be kept out of direct sunlight. The Australasian College of Dermatologists recommends the use of a sunscreen for infants when exposure to the sun cannot be prevented by other avoidance measures: "Shade, clothing and broad rimmed hats are the best sun protection measures for infants. Sunscreens should be applied to areas of the skin not protected by clothing."[138] The American Academy of Pediatrics (AAP) has stated that sunscreen may be used on infants younger than 6 months on small areas of skin if adequate clothing and shade are not available.[139]

Sunscreens may increase absorption of the insect repellent DEET (*N,N*-dimethyl-metatoluamide), especially when DEET is applied first.[140] Products that combine a sunscreen agent with an insect repellent such as DEET are available. Using individual DEET and sunscreen products at the same time is an acceptable practice, but the use of combination products is not recommended. A sunscreen should be reapplied after swimming or sweating, whereas insect repellent generally does not need to be reapplied.[141] Furthermore, concerns have been raised about potential toxicity of percutaneously absorbed repellents in children, especially with repeated application.[142]

Window Glass

Standard clear window glass absorbs wavelengths below 320 nm (UVB). UVA, visible light, and infrared radiation are transmitted through standard clear window glass. Large window areas are now commonly part of residential and commercial architectural design. Modern windows increasingly incorporate energy-efficient glazes that decrease heat gain and loss through windows. Many of these energy-efficient glazes provide some UVR protection, but only a few provide full UVR protection.[143]

Transmission of UVR through automobile glass depends on the type and the tint of the glass. Because of safety reasons, all windshields are made of laminated glass, a product made stronger through bonding with a tough, clear plastic. Laminated glass filters out most UVA. Side and rear windows, however, are usually made from nonlaminated glass, which allows significant UVA exposure, especially UVA1. Tinted glass removes more UVA than does clear glass; it is possible for automobile owners to add tinted window films to side and rear windows to reduce transmission of light, UVR, and heat.[143] The parts of a driver's or passenger's body closest to a window receive the most radiation. Individuals with photosensitivity disorders can experience exacerbations of their disease while riding in a car.[143] Most states do not allow plastic films with less than 35% visible light transmittance. The minimum allowable visible light transmission levels for side and rear windows are determined by each state[143] and are available from the International Window Film Association.[144]

It has been hypothesized that the increase in melanoma in indoor workers (but not outdoor workers) during the last century may be a result of their exposure to UVA passing through windows.[145] These researchers agree that overexposure to UVB initiates melanoma but that increased UVA exposures (which can cause mutations and break down cutaneous vitamin D_3) and low vitamin D_3 concentrations in the skin promote melanoma.

Sunglasses

Sunglasses protect against sun glare and harmful radiation. The first sunglass standard was published in Australia in 1971; standards were subsequently adopted in Europe and the United States. The latest US sunglass standard was published in 2001 by the American National Standards Institute. This standard is voluntary and is not followed by all manufacturers.[143]

Major US visual health organizations recommend that sunglasses that absorb 97% to 100%[146] or 99% to 100%[59] of the full UV spectrum (up to 400 nm) should be worn. Expensive sunglasses do not necessarily provide better UVR protection. Purchasing sunglasses that meet standards for a safe level of UVR should be the goal. Wearing a hat with a brim can greatly reduce the UVR exposure to the eyes and surrounding skin. It is recommended that people wear sunglasses outdoors when working, driving, participating in sports, taking a walk, or running errands.[147]

Sunglasses for infants and children are available.

The UV Index

The UV index was developed in 1994 by the National Weather Service in consultation with the US Environmental Protection Agency and the Centers for Disease Control and Prevention. The UV index predicts the intensity of UV light for the following day on the basis of the sun's position, cloud movements, altitude, ozone data, and other factors.[148] It is conservatively calculated on the basis of effects on skin types that burn easily. Higher numbers predict more intense UV light during midday of the following day: 0 to 2, minimal; 3 to 4, low; 5 to 6, moderate; 7 to 9, high; and 10 or higher, very high. Sun-protection strategies should be applied at even minimal levels of the UV index, and increasing stringency should be used as the UV index increases (eg, avoiding outdoor exposures from 10 AM to 4 PM if the UV index is 7 or higher). The index is available online for thousands of cities at www.weather.com. It is printed in the weather section of many daily newspapers and reported through weather reports of local radio, television, and weather stations. The UV index can be used to plan outdoor activities.

VITAMIN D

Sun exposure and vitamin D concentrations are intricately intertwined. Thus, effects of limiting sun exposure on vitamin D status must be understood and addressed.

Metabolism

Humans get vitamin D from exposure to sun, dietary sources (such as fortified milk and oily fish), and vitamin supplements. After sunlight exposure, 7-dehydrocholesterol in the skin is converted to previtamin D_3; previtamin D_3 is then converted to vitamin D_3 (cholecalciferol). Vitamin D from the skin and diet is metabolized primarily in the liver to 25-hydroxyvitamin D (25[OH]D), which is used to determine a patient's vitamin D status; 25(OH)D is metabolized in the kidneys to its active form, 1,25-dihydroxyvitamin D, also known as calcitriol.

Vitamin D synthesis in skin depends on skin type. A person with skin type I who burns easily after a first moderate UVR exposure will rapidly achieve maximal vitamin D synthesis. In contrast, a person with skin type VI will have relatively limited vitamin D synthesis, because UVR will be absorbed by melanin rather than other cellular targets.[149] Because excess previtamin D_3 or vitamin D_3 is destroyed by sunlight, exposure to sunlight does not cause vitamin D intoxication.[150] The action spectrum that induces cutaneous vitamin D_3 synthesis is in the UVB range.[151]

Vitamin D Health Effects

Vitamin D is essential for normal growth and skeletal development.[152] At a 25(OH)D concentration lower than 50 nmol/L (<20 ng/mL), children are at increased risk of developing rickets[153]; concentrations below this amount are considered to be deficient. In adults, a 25(OH)D concentration of 80 nmol/L (32 ng/mL) is generally recognized as the threshold of an optimal level, and a concentration of 50 to 79 nmol/L is considered "insufficient."[150,154,155] The AAP recommends that pregnant women maintain a 25(OH)D concentration of 80 nmol/L or higher.[156]

The benefits of vitamin D in adults are many and include improved bone health, prevention of fractures, better muscle health, and reduced risk of falling in older people.[150] The actions of vitamin D that extend beyond bone mineral metabolism are increasingly being understood. Many human tissues, including brain, prostate, breast, and colon, as well as immune cells, have vitamin D receptors, and some have enzymes capable of producing 1,25-dihydroxyvitamin D from circulating vitamin D.[157] 1,25-Dihydroxyvitamin D controls more than 200 genes, including those responsible for regulating cellular proliferation, differentiation, apoptosis, and angiogenesis.[150] These cell-regulation actions are found at 25(OH)D concentrations higher than 75 nmol/L.[152]

Relationships between 25(OH)D status and markers of functional outcomes in children and adolescents vary according to age, race, environment, and genetic predisposition.[153,158,159] A study of bone health in Australian adolescent boys identified a 25(OH)D concentration of at least 43 to 55 nmol/L as optimal.[160] Several studies reviewed by Wagner et al[156] noted associations of low 25(OH)D concentration with increased parathyroid hormone and reduced bone metabolism. Hypovitaminosis D may reduce maximum peak bone mass in pubertal girls.[161] A subsequent study supported these associations for girls,[162] but another study reported a larger gain in bone area and bone mineral content for children with lower 25(OH)D concentration.[163] In a randomized controlled trial, vitamin D supplementation in girls 10 to 17 years of age was associated with higher lean mass and higher bone mineral content.[164] Authors of a study of girls 11 to 15 years of age reported calcium absorption to be unrelated to 25(OH)D status and to vary according to race; relationships between 25(OH)D status and parathyroid hormone were also found to vary according to race.[165] In observational studies (ie, studies in which people are observed or certain outcomes are measured), higher intakes of vitamin D via food in pregnancy and supplementation in infancy were associated with a lower risk of type 1 diabetes in children.[166,167]

Ecologic studies have revealed a lower incidence of breast, colon, and prostate cancers in areas of higher sun ex-

posure.[150,168–170] A recent meta-analysis of observational studies provided evidence of a decreased risk of colorectal cancer and colorectal adenoma associated with higher serum 25(OH)D concentrations.[171] The analysis also found nonsignificant reduced risk of breast cancer and no evidence for association of vitamin D and prostate cancer. Two double-blind placebo-controlled randomized trials with vitamin D supplementation at 400 IU (10 μg)/day failed to demonstrate effects on colorectal[172] or breast cancer[173] incidence, which suggests that ecologic studies may not adequately control for confounding variables[171] or that vitamin D supplementation needs to be substantially higher to achieve a protective effect.[168,171] Low vitamin D status also is directly associated with increased all-cause mortality; reasons for this association merit further examination.[171]

Ecologic studies have revealed a lower risk of multiple sclerosis in areas of high sun exposures[174]; dietary vitamin D lowers risk of multiple sclerosis,[175] possibly through regulating genetic susceptibility.[176] People with low vitamin D concentrations are at higher risk of insulin resistance and the metabolic syndrome,[177] future abnormal glucose regulation,[178] periodontal disease,[179] diminished heart health,[180] and other conditions. To date, however, the relationships between vitamin D supplementation and cancer risks have not been evaluated by randomized controlled trials providing vitamin D at doses that would be high enough to achieve 25(OH)D concentrations similar to those thought to provide protective effects. Until such data are available, questions will remain about the influence of confounding factors (eg, diet, latitude, skin melanin) on previously reported cancer-related outcomes. New randomized controlled trials are needed to guide the development of guidelines for vitamin D supplementation in relationship to cancer prevention[171] and other outcomes.

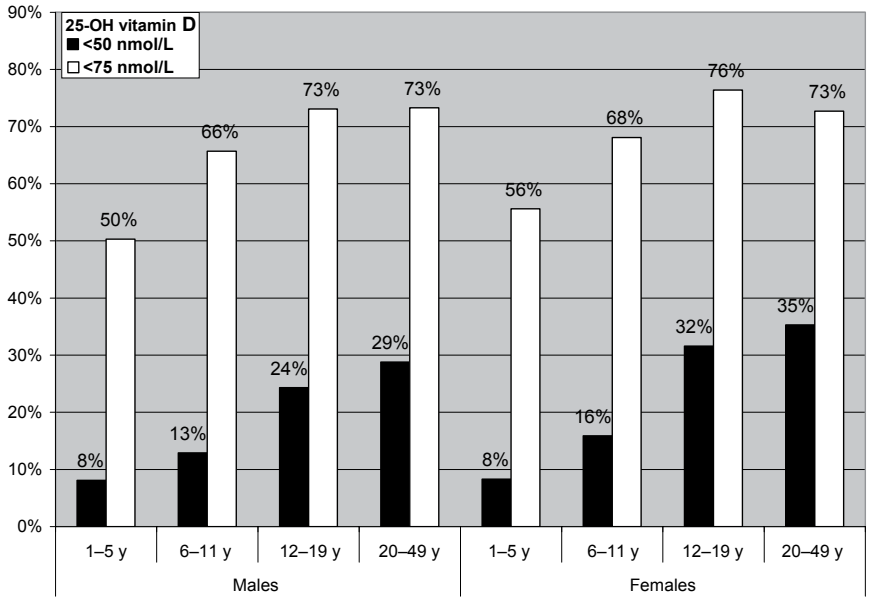

FIGURE 1
Prevalence of serum 25(OH)D concentrations below selected thresholds according to age and gender: NHANES 2000–2004.[183]

Prevalence of Hypovitaminosis D

Hypovitaminosis D is common among US children.[181,182] Data from the 2000–2004 NHANES indicate that approximately 30% of US teenagers and young adults have 25(OH)D deficiency (ie, 25[OH]D < 50 nmol/L), as do approximately 15% of children 6 to 11 years of age and 8% of children 1 to 5 years of age (Fig 1).[183] Because NHANES data are collected in the South in winter months and the North in the summer, these national data may underestimate seasonal variations in 25(OH)D concentrations. The prevalence of hypovitaminosis D is high among samples of women in many areas including Australia,[184] Bangladesh, and Hong Kong, where cutaneous vitamin D synthesis can take place year-round.[185,186]

Risk Factors for Vitamin D Deficiency

Risk factors for hypovitaminosis D in US youth include increasing age, low vitamin D intake, dark skin, winter season, and higher BMI.[181] 25(OH)D deficiency is common in populations such as infants born to mothers at high risk of hypovitaminosis D; breastfed infants; children with sickle cell disease, type 1 diabetes, malabsorption, or obesity; and those who take medications such as anticonvulsants or glucocorticoids. In US non-Hispanic white adults, 25(OH)D concentrations were 5 to 9 nmol/L higher in 1988–1994 compared with 2000–2004; increasing BMI, decreased milk intake, and increased use of sun-protection methods between study periods seemed to be factors accounting for approximately 20% of the difference.[183]

Sun-Exposure Considerations

Many factors influence the efficiency of vitamin D production resulting from sunlight exposures. The amount of skin exposed to the sun results in differences in vitamin D synthesis. In a 1985 study of young infants in Cincinnati, Ohio, who were fully clothed (without hats) and exclusively breastfed, it was determined that 2 hours of sun expo-

sure weekly were needed to maintain 25(OH)D concentrations higher than 27.5 nmol/L, compared with infants who were wearing only a diaper, for whom only 30 minutes/week of sun exposure were required.[187]

It has been stated that at least 20% of the body surface needs to be exposed to UVB for vitamin D concentrations to increase.[152] Dark-skinned people require exposures approximately 5 to 10 times as long as do light-skinned people to achieve similar levels of cutaneous vitamin D production.[188] At latitudes above 35°N (eg, north of Memphis, TN; Kyoto, Japan; and Cyprus) and below 35°S (eg, south of Adelaide, South Australia; and Montevideo, Uruguay), UVB photons do not penetrate to the earth's surface in winter months, which makes cutaneous vitamin D production negligible in those months. Because of the scatter of UVB, sun exposure outside the peak sun hours of 10 AM to 3 PM in the spring, summer, and fall has limited impact on cutaneous vitamin D synthesis.[188] It has been stated that brief exposures to high overhead sunlight have maximum vitamin D benefit with most limited erythema risk.[111]

One author has recommended that children and healthy adults practice "sensible sun exposure" (ie, exposure of arms and legs for 5–30 minutes, depending on the time of day, season, latitude, and skin pigmentation, between 10 AM and 3 PM twice weekly) as a way to maintain vitamin D concentrations and avoid deficiency.[150] This same author recommended that, after such exposure, a sunscreen with an SPF-15 or greater can be applied if the person wishes to remain outdoors.[189] In contrast, the American Academy of Dermatology has stated that maximum production of vitamin D occurs after only brief exposure to UVR; this amount of time is 2 to 5 minutes of midday summer exposure for a light-skinned person living in New York, New York, or Boston, Massachusetts. Although leaders in skin-cancer prevention agree that vitamin D is important for good health, they oppose intentional sun exposure to induce vitamin D production, because UVR is a known human carcinogen.[151,190] There are no studies of children suggesting a level of sun exposure that would negate the need to comply with dietary vitamin D recommendations. Thus, use of deliberate sun exposure to maintain vitamin D sufficiency is not recommended. Given the high prevalence of hypovitaminosis D, however, it seems clear that renewed attention must be paid to evaluating the adequacy of dietary and supplemental vitamin D intake and how much, if any, unprotected sun exposure is beneficial. It is important to keep in mind that infants younger than 6 months should be kept out of direct sunlight as much as possible.

Dietary and Supplemental Vitamin D Recommendations

Many children get less than 400 IU (10 μg) of vitamin D daily from their diets. Approximately 22% of US children 1 to 8 years of age, 50% of girls 9 to 18 years of age, and 35% of boys 9 to 18 years of age get less than 200 IU (5 μg) of vitamin D daily from food or supplements.[191] No primary care–based studies have examined the sensitivity of evaluations of dietary vitamin D intake or sunlight-exposure assessments to determine vitamin D adequacy in children.

The main source of vitamin D is exposure to sunlight,[192–195] which makes it difficult to establish a dietary requirement that has broad generalizability, especially because of the many variables (eg, skin pigmentation, body mass, season, outdoor exposure, clothing, sunscreen use, etc) associated with differences in vitamin D concentrations.[156] In a 1997 report, the Institute of Medicine recommended an adequate intake level for vitamin D of 200 IU/day.[196] An updated report on vitamin D from the Institute of Medicine was released in November 2010.[197] However, because 200 IU/day of vitamin D is insufficient to maintain a 25(OH)D concentration higher than 50 nmol/L, the AAP and others currently recommend that exclusively and partially breastfed infants receive supplements of 400 IU/day of vitamin D shortly after birth and continue to receive these supplements until they are weaned and consume 1000 mL/day or more of vitamin D–fortified formula or vitamin D–fortified milk.[152,156] This level of supplementation in a breastfed infant will generally achieve a 25(OH)D concentration of more than 70 nmol/L and prevent vitamin D deficiency rickets.[151] All nonbreastfed infants who ingest less than 1000 mL/day of vitamin D–fortified formula should receive a vitamin D supplement of 400 IU/day. Formulas for term infants sold in the United States generally provide approximately 400 IU of vitamin D per L, and the majority of vitamin D–only and multivitamin liquid supplements provide 400 IU per dose. The AAP also recommends that older children and adolescents who do not obtain 400 IU/day through vitamin D–fortified milk and foods should take a 400-IU vitamin D supplement daily. The effect of such routine supplementation on 25(OH)D status in children and adolescents has not yet been evaluated. The extent to which 25(OH)D increases with supplementation will vary depending on the amount of vitamin D synthesized over the summer months and the dosage and duration of use.[198] Children at high risk of vitamin D deficiency, such as those with chronic fat malabsorption and those who chronically take antiseizure medications, may need vitamin D doses higher than 400 IU/day,[156] and studies that have tested supplementation in special populations have used

much larger doses safely.[199,200] Treatment of hypovitaminosis D in infants and toddlers is safely done with 2000 IU of vitamin D daily for 6 weeks.[201]

Influence of Vitamin D Supplementation

Several studies have evaluated the influence of the amount of vitamin D supplementation on 25(OH)D levels. In adults, daily supplementation with 400 IU of vitamin D increases 25(OH)D concentration by 7.0 nmol/L.[202] Supplementation of a pregnant woman with 400 IU of vitamin D, as in prenatal vitamins, has little effect on her 25(OH)D concentration.[160] For adult men at latitude 41°N, the amount of supplemental vitamin D (in addition to dietary vitamin D) needed to maintain baseline 25(OH)D concentration over the winter was 500 IU/day.[202] In a sample of young, healthy adults living at ≥51° latitude, the vitamin D supplemental requirement (in addition to dietary vitamin D) for 97.5% of the sample to maintain a 25(OH)D concentration higher than 25 nmol/L was 348 IU of vitamin D per day; the supplemental dose of vitamin D required to maintain a 25(OH)D concentration higher than 50 nmol/L for 97.5% of the sample was 1120 IU of vitamin D per day and was 1644 IU of vitamin D per day to maintain a 25(OH)D concentration higher than 80 nmol/L.[203] The Institute of Medicine report released in November 2010 provided an extensive review of the effects of vitamin D supplementation.[197]

Influence of Sun Protection on 25(OH)D

A few studies of adults, but none of children, have examined associations with sun protection or sunscreen use and 25(OH)D concentrations. Higher use of sun protection was associated with statistically significantly lower 25(OH)D concentrations in non-Hispanic white adult subjects in the 2000–2004 NHANES, compared with similar subjects in the 1988–1994 NHANES.[183] Other studies of adults found expected relationships between reported levels of sun exposure and 25(OH)D concentration but no association between reported sunscreen use and 25(OH)D concentration.[204,205] Authors of a small, controlled trial that involved 24 elderly adult sunscreen users and 19 controls over 2 years reported that lower 25(OH)D concentration in sunscreen users did not result in increases in parathyroid hormone or increases in bone biological markers.[206] Sunscreen users generally apply insufficient amounts to meet the expected SPF level. Sunscreen efficacy also depends on uniform application to exposed body parts, the sunscreen's durability and substantivity (a measure of the sunscreen's ability to be adsorbed by or adhered to the skin while swimming, bathing, or perspiring), and reapplication. Thus, evaluation of sunscreen use without also considering other sun-protection measures may not accurately indicate risk of low 25(OH)D status.

PEDIATRICIAN COUNSELING

Pediatricians can play important roles in counseling about sun protection. In a 2003 report, the US Preventive Services Task Force (USPSTF) determined that clinician counseling may have an effect on parents' use of sunscreen for their children but not for using other sun-protection measures such as wearing protective clothing, reducing excessive sun exposure, avoiding sunlamps/tanning beds, or practicing skin self-examination. The USPSTF noted that only limited data exist about potential harm of counseling or of specific skin-protection behaviors.[207] Harm could include the possibility that focusing on sunscreen use may result in a false sense of security and more time spent in the sun because users do not sunburn.[119] Other harmful outcomes include the possibility that vitamin D deficiency results from sunscreen use; according to the USPSTF, a randomized controlled trial in people older than 40 years found that sunscreen use over the summer had no effect on 25(OH)D concentrations.[207] There are concerns that sun avoidance may result in reduced physical activity levels among children and negative effects on mental health; there have been no studies regarding the effects of protection behaviors on these outcomes.[207]

In a survey of children's caregivers attending a university-based clinic in Florida, only 30% of caregivers reported having been counseled by their physician about sun protection. Caregivers who were counseled had greater sun-protection knowledge, were more likely to report regular use of sun protection for their child, and were more likely to report teaching their child about sun protection.[208] In surveys of Massachusetts and Texas pediatricians, approximately three-quarters of them indicated that they recommended safe sun practices or sunscreen use to a majority of their patients. However, the messages they presented included a limited number of the available sun-protection strategies.[209,210] Counseling regarding sun protection is prioritized lower than counseling on other safety issues.[209,211] Time constraints are often mentioned as a main barrier to providing counseling.[211] A "teachable moment" may arise when the child or adolescent presents with a sunburn.

EARLY DETECTION

The US Preventive Services Task Force concluded that evidence is insufficient to recommend for or against routine screening for skin cancer in adults by using a total-body skin examination for the early detection of cutaneous melanoma, BCC, or SCC in people without a

history of skin cancer or otherwise at high risk.[212] However, because early detection increases survival rates,[213,214] it has been recommended that complete cutaneous examinations be performed by physicians and other health care providers, coupled with periodic self-examination of the skin by the individual person.[214] Skin lesions with malignant features noted in physical examinations should be biopsied. There are no recommendations on skin-cancer screening in children. Because melanoma occurs in teenagers and is a common cancer among young adults, it seems prudent to recommend that clinicians caring for these groups include a skin examination as part of a complete physical examination.

PREVENTION IN SCHOOLS

The Centers for Disease Control and Prevention has published guidelines to protect schoolchildren from excessive sun exposure in schools. Recommendations include reducing skin-cancer risks through policies; creation of physical, social, and organizational environments that facilitate protection from UVR; education of young people; professional development of staff; involvement of families; work by nurses and other school health services staff; and program evaluation.[100] Authors of a systematic review published in 2004 (search updated to June 2000) concluded that efforts to teach children how to protect themselves from UVR were effective when implemented in primary schools and in recreational settings. There was insufficient evidence, however, about the effectiveness of implementation in other settings.[215]

Schools have a role in determining children's attitudes and behaviors. The SunWise Program, developed by the Environmental Protection Agency, is a brief, standardized sun-protection education program.[216] It is the first environmental education program for sun safety designed to teach children in elementary and middle schools (and their caregivers) how to protect themselves from overexposure to the sun. The SunWise program has been shown to promote improvement in knowledge, intentions to play in the shade and to use sunscreen, and attitudes regarding healthiness of a tan.[217] A recent study of the SunWise program demonstrated that every federal dollar invested in it generates $2 to $4 in public health benefits.[218]

COMMUNITY-BASED PROGRAMS

Multicomponent community-wide approaches have been recommended by health education experts[219] and can be effective. Several community-directed campaigns have addressed sun protection in younger children. A randomized controlled trial of the SunSafe project, an intervention in New England, involved schools, child care settings, primary care offices, and beach settings. The SunSafe program was effective in changing sun-protection practices observed at community beaches for children 2 to 10 years of age.[220,221]

Use of sun-protection practices begins to decline in early adolescence[222] as media and peer influences on teen attitudes and behaviors increase and parental influences decrease.[223] A randomized controlled trial of the SunSafe program was conducted in 5 intervention and 5 control communities to assess the impact of a sun education program in the middle school years. The SunSafe in the Middle School Years program augmented the original program by involving sports teams and peer-led activities. After 2 years of intervention, adolescents in intervention communities had less of the expected deterioration in sun-safety practices compared with adolescents in control communities.[224]

Other interventions were not effective. Australian adults who received solar UV forecasts and supporting communications did not implement markedly enhanced personal sun-protection practices.[225] A randomized trial of an educational intervention to reduce sunburn rates and improve sun-protection behavior in schoolchildren showed no difference in sunburn episodes between the study and control groups.[226]

PUBLIC HEALTH CAMPAIGNS

Australia, the country with the highest incidence of skin cancer in the world, has been in the forefront of the public health response to this disease. SunSmart, a population-based skin-cancer–prevention program run by the Australian state of Victoria since 1988, incorporates substantial public education efforts as well as structural and environmental change strategies in schools, workplaces, local government settings, and pools. Paid television advertising has been part of a strategy of public education. The authors of a recent assessment of the SunSmart program concluded that sun-protection methods and rates of sunburn showed substantial general improvement over time but stalled in recent years. Most initial gains were sustained over 15 years of assessments, but there was no further progress with regard to sunburn, sunscreen use, body exposure, and attitudes.[227]

In a 2008 editorial, Martin Weinstock, MD, an internationally known dermatologist and researcher, concluded that data suggest that public health efforts at skin-cancer prevention are inadequate.[228] Four challenges to effective skin-cancer prevention campaigns were identified. First, sun-protection messages to avoid or limit time during peak sun hours may conflict with health-promotion messages regarding physical activity. This potential conflict may be resolved by following the "slip, slop, slap" motto of the Australians to slip on a shirt, slop on sunscreen, and slap on a hat—a message consistent with conducting outdoor physical activity in a sun-protective manner. Next, there is controversy about how much

sun exposure is needed for vitamin D synthesis, which possibly results in excessive exposure to sun and deliberate exposure to artificial UVR. Third, it has been reported that skin-cancer risk behaviors cluster with other risky behaviors, such as smoking and risky drinking. A greater understanding of these behaviors may help with interventions. Fourth, the increasingly profitable tanning industry benefits from unrestrained selling of UVR. These challenges suggest that it is uncertain whether primary prevention efforts to reduce skin cancer through UVR protection will be successful.

RESEARCH NEEDS

Outstanding research questions exist in many areas, including relationships of sunscreen use to melanoma and BCC; safety of absorbed ingredients in sunscreens; effects of long-term use of sunscreen, especially when this practice begins early in life; the role of vitamin D in preventing cancer and other health conditions; the relationship of 25(OH)D to functional outcomes for children; developing and assessing strategies for estimating vitamin D status during a clinical encounter; determining how much sun exposure and vitamin D supplementation is "enough" depending on a person's age and gender, his or her geographic location, the season of the year, and other factors; effects of long-term use of vitamin D supplementation at various levels; and utility of routine counseling on sun-avoidance strategies in clinical encounters.

CONCLUSIONS

UVR is a known human carcinogen and has numerous other adverse health effects. Skin-cancer rates have reached epidemic proportions, and skin cancers occur in young people and sometimes result in death. Excessive exposure to UVR during childhood and adolescence is thought to confer an increased risk of developing skin cancer.

Morbidity and deaths from skin cancer are preventable. Pediatricians may play an important role in providing education about skin-cancer prevention to patients and their parents, yet many do not take opportunities to do so. Pediatricians are urged to provide advice on hundreds of topics,[229] so it may be impractical to expect pediatricians to discuss skin-cancer prevention and sun protection during every health-maintenance visit. It is, however, reasonable to expect that skin-cancer prevention be discussed on at least a few visits during the course of a pediatrician's long-term relationship with a child and his or her family. Because parents' comprehensive sun-protection practices for children start to decline when children are very young,[230] it is important to begin discussions early in the child's life. Discussions are especially important for children at high risk of developing skin cancer—children with light skin, those with nevi and/or freckling, and those with a family history of melanoma. Melanoma is rare in children, but moles are not rare. Education can include a discussion of moles and the need to be aware of changes in them. As children approach puberty, it is important to include information about the dangers of artificial tanning. Pediatricians also have an important role as advocates in helping to support legislation to ban minors' access to tanning salons.

Lifelong sun protection is recommended beginning at an early age. Although sunscreen is the most commonly used method of sun protection, patients should be counseled to not overly rely on sunscreen. A complete program of sun protection includes wearing clothing and hats, timing activities to minimize peak hours of the sun, and wearing sunglasses. Advice should be framed in the context of promoting regular outdoor play and other physical activity.

Vitamin D is available through foods, supplements, and incidental sun exposure. Because current intake levels of vitamin D by children and adolescents may not prevent vitamin D deficiency, it is recommended that all infants, children, and adolescents receive 400 IU of vitamin D per day. Additional vitamin D supplementation and laboratory evaluations of vitamin D status may be needed for some children in some areas. Overexposure to UVR from sunlight and exposure to UVR from artificial sources raise the risk of skin cancer, photoaging, and other adverse effects and should be avoided.

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POLICY STATEMENT

Underinsurance of Adolescents: Recommendations for Improved Coverage of Preventive, Reproductive, and Behavioral Health Care Services

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Adolescence and Committee on Child Health Financing

ABSTRACT

The purpose of this policy statement is to address the serious underinsurance (ie, insurance that exists but is inadequate) problems affecting insured adolescents' access to needed preventive, reproductive, and behavioral health care. In addition, the statement addresses provider payment problems that disproportionately affect clinicians who care for adolescents.

Among adolescents with insurance, particularly private health insurance, coverage of needed services is often inadequate. Benefits are typically limited in scope and amount; certain diagnoses are often excluded; and cost-sharing requirements are often too high. As a result, underinsurance represents a substantial problem among adolescents and adversely affects their health and well-being.

In addition to underinsurance problems, payment problems in the form of inadequate payment, uncompensated care for confidential reproductive services, and the failure of insurers to recognize and pay for certain billing and diagnostic codes are widespread among both private and public insurers. Payment problems negatively affect clinicians' ability to offer needed services to adolescents, especially publicly insured adolescents. *Pediatrics* 2009;123:191–196

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Key Words
underinsurance, health insurance, adolescents

Abbreviations
AAP—American Academy of Pediatrics
STI—sexually transmitted infection
CPT—*Current Procedural Terminology*
SCHIP—State Children's Health Insurance Program

INTRODUCTION

Having health insurance has been associated with better access and utilization of health care, whereas uninsured families are more likely to report experiencing "unmet" health care needs for their children and adolescents.[1,2] In 2006, 13.8% of adolescents 13 through 18 years of age and 28.4% of older adolescents aged 19 through 21 were uninsured.[3] Adolescents at greatest risk of being uninsured are older, are Hispanic, and have low household income. The problems of uninsured adolescents have been a long-standing concern of the American Academy of Pediatrics (AAP) and the subject of several policy statements[4–6] and ongoing state and federal advocacy efforts.

Having health insurance that provides comprehensive and affordable coverage for preventive, behavioral, and reproductive care is particularly important for adolescents, because the major causes of morbidity and mortality in this age group are related to injuries from motor vehicle crashes, suicide, interpersonal violence, alcohol and drug use, and risky sexual behaviors. This policy statement presents a series of recommended strategies to address the serious underinsurance and payment problems affecting insured adolescents and the clinicians who care for them.

INSURANCE COVERAGE

There are no reliable national estimates on the extent of underinsurance among adolescents. Still, the literature on adolescent health care expenditures and private health insurance benefits reveal some important findings. With respect to health care expenditures, nearly 40% of adolescents' health care is paid out-of-pocket. Higher out-of-pocket liabilities are reported among adolescents with private insurance, those in fair to poor overall health, and those with disabilities.[7]

With respect to private health insurance coverage, benefits are often not well matched to meet the needs of adolescents. In a study examining the extent of private health insurance coverage available to hypothetical adolescents

with various conditions or illnesses, substantial levels of underinsurance were found. The specific adolescent conditions that were examined included injuries resulting from motor vehicle crashes, pregnancy and sexually transmitted infections (STIs), major depressive disorder, anorexia nervosa, and bipolar and substance abuse disorders. Overall, physical therapy, occupational therapy, and nutritional counseling, as well as behavioral or mental health therapies, were least likely to be covered at the levels recommended by medical experts to treat adolescents.[8] Additional insurance gaps relate to the refusal by many insurance companies to provide coverage for preexisting conditions when adolescents make transitions from one plan to another.

PROVIDER PAYMENT

In addition to underinsurance, payment problems in the form of inadequate payment, uncompensated care for confidential reproductive services, and rejection by insurers of certain billing and diagnostic codes disproportionately affect clinicians who care for teenagers. For example, fee-for-service Medicaid programs administered by states paid below Medicare reimbursement rates for 70% of the Current Procedural Terminology (CPT) codes in most commonly used in pediatric practices. Overall, Medicaid payments averaged only 80% of Medicare rates.[9] Within Medicaid risk-based managed care systems, capitated rates of payment to cover 13- to 18-year-olds are often substantially lower than those to cover children 12 years old or younger and individuals older than 18 years, thus, penalizing physicians who see a large number of adolescents. Medicaid and State Children's Health Insurance (SCHIP) rates and, to a lesser extent, private health insurance rates do not cover the time needed to serve adolescents.[10] Importantly, research has shown that differences in preventive health care visits by adolescents are linked to physician payment rates.[11]

Providers also report that they are unable to get paid for confidential reproductive, mental health, and substance abuse evaluation and treatment services and for non–face-to-face services such as telephone calls and e-mails. Unfortunately, few insurers have adjusted their administrative and billing systems to protect adolescent confidentiality, and most states do not have fee-for-service payment mechanisms or carve-outs to reimburse providers for this important care. In addition, few public or private insurers reimburse CPT billing codes related to health education and chronic care management, and many also restrict coverage of certain diagnostic *International Classification of Diseases, Ninth Revision* (ICD-9) codes.[8,12]

Adolescent medicine specialists are often not recognized by insurers as both primary care providers and specialists. Adolescent medicine is a specialty recognized by the American Board of Pediatrics, American Board of Family Medicine, and American Board of Internal Medicine and by all state medical organizations as both a primary care specialty and medical subspecialty. Thus, referrals to an adolescent medicine specialist made by other primary care providers often cannot occur when the adolescent medicine specialist also provides primary care services to other patients.

To the extent that these insurance gaps and payment problems represent significant financial losses to the providers caring for adolescents, these issues also represent a very real deterrent to providers expanding their practices to include more adolescents. Moreover, these coverage and payment issues impose significant financial barriers and hardships on adolescents and their families.

PREVENTIVE CARE

The AAP recommends the following strategies to address underinsurance and payment problems among adolescents:

- All insurance plans, including newer consumer-driven health plans, should cover annual preventive health care visits and recommended immunizations for adolescents consistent with national medical guidelines.[13–15]
- Copayments, coinsurance, and deductibles should be eliminated for preventive care visits and immunizations to reduce barriers to adolescents seeking such care.[4,14,16]
- When health problems are identified during the adolescent preventive care visit, insurers should recognize the —25 modifier CPT code to allow for same-day treatment of issues that would otherwise require another separate health care visit.[17] This represents an important window of opportunity for addressing problems in a timely, convenient manner and to reduce the risk of loss to follow-up.
- Insurers' claims systems should recognize and pay for preventive medicine codes for health and behavior assessment and counseling, risk screening, and intervention, which are more frequently needed and appropriate for adolescents.[17]
- Insurers should recognize that physicians trained in adolescent medicine may provide services as both primary care providers and specialists. Adolescent medicine subspecialists should be allowed to provide primary care for teenagers, particularly for those with more complicated problems such as chronic illnesses/disabilities, reproductive health concerns, and mental health/substance abuse conditions. This strategy would allow effective management of both the clinical needs and the health care costs of complicated adolescent patients.
- Insurers should reimburse physicians at higher rates for services provided during nontraditional hours (after 5 PM and on weekends) to increase access to care in the medical home and reduce emergency department and urgent care facility utilization.

The AAP recommends that adolescents have an annual preventive health care visit that includes disease detection and prevention, health promotion, and anticipatory guidance that addresses physical growth and development, social and academic competence, emotional well-being, risk reduction, and violence and in-

jury prevention.[13] This visit should also allow time to provide health guidance to parents, including a discussion of the ongoing psychosocial and physical changes in their adolescents along with ways to support them to adopt healthier lifestyles. In 1997, the National Committee for Quality Assurance, through its Health Employer Data and Information System (HEDIS), affirmed the importance of annual visits for adolescents by adding this yearly visit to its measurements.[18] In addition, the current vaccine financing system and its gaps in coverage need to be addressed, because many underinsured adolescents are unable to access publicly funded vaccines in either the private or public sectors.[16] Unfortunately, a sizeable proportion of Medicaid and private insurers fail to cover annual preventive benefits for adolescents, and almost all insurers exclude coverage for preventive counseling and also do not reimburse providers if more than 1 ambulatory service occurs on the same day.[8,12] Moreover, with the exception of separate SCHIP programs, few private insurers exempt preventive care from deductibles and other forms of cost sharing.

Even when preventive care is covered, low fees paid by Medicaid and SCHIP programs as well as most private health insurance plans fail to adequately cover the work required to perform a comprehensive adolescent preventive health care visit.[10]

The implications of inadequate coverage, significant cost sharing, and low payment rates are numerous: reduced access to preventive health care services to teenagers, including limited or no ongoing preventive counseling; inadequate compliance with recommended AAP guidelines; substitution of brief sports physicals for comprehensive examinations; financial losses for providers who elect to provide comprehensive preventive care services despite inadequate payment; and significant out-of-pocket payments for families. Research suggests that even modest cost sharing makes it less likely that teenagers from low-income families will get effective medical care.[19]

REPRODUCTIVE CARE

The AAP recommends the following strategies to protect teenagers' access to reproductive health care and to ensure adequate payment for comprehensive reproductive care, including confidential care:

- Insurers should cover all contraceptives, including emergency contraception and treatment of STIs, just as they do other medications.
- Copayments, coinsurance, and deductibles for reproductive health care visits and contraceptives should be reduced or eliminated.
- Policies that recognize the rights of adolescents to obtain confidential reproductive health care should be developed by insurers, their governing organizations, and physician offices.
- A unique coding and billing strategy should be implemented by insurers to protect the rights of teenagers to access confidential reproductive health care services.
- Explanations of benefits and other receipts for reproductive care services used by adolescents ideally should not be sent to parents.
- Insurers should recognize that physicians trained in adolescent medicine may provide services as both primary care providers and specialists. Allowing adolescent medicine specialists to provide reproductive health care for teenagers within the context of primary care or consultative services would be a management strategy that serves the needs of the patients clinically and provides cost-effective treatment.
- Incentives should be offered for increased availability of after-hours care in the medical home in the form of higher payments for visits after 5 PM and on weekends.

The AAP recommends that adolescents receive confidential counseling about sexual development, sexuality, and responsible personal decision-making.[20–22] In addition, the AAP recommends that sexually active teenagers receive reproductive health care, which includes appropriate genitourinary and gynecologic evaluations; counseling about contraceptive options, including abstinence; and counseling to prevent, screen for, and treat STIs, including HIV.[13,21] Although parental involvement is desired and encouraged, many sexually active teenagers will not seek reproductive health care services if parental consent is required.[23,24] All states allow minors to obtain confidential screening and treatment for STIs, and many states allow minors to receive contraceptive services without parental notification.[25,26] Yet, coverage of contraceptive services is often limited in Medicaid, SCHIP, and private health insurance plans. Insurance coverage for contraception is highest in states with mandates to cover such services.[27,28]

Coverage of reproductive services, however, is limited in many public and private insurance plans. Routine gynecologic examinations, which are part of the routine preventive care visit for adolescents, are subject to the same limits as the preventive care benefit previously described. Also, a sizeable proportion of insurance plans treat contraceptives differently from other medications by limiting or failing to provide contraceptive coverage even when prescribed for the treatment of menstrual or other gynecologic disorders.[8] In addition, health education and counseling about sexuality, sexual activity and contraception, pregnancy and STI prevention, and reproductive health services for adolescents are seldom covered.

Copayments, coinsurance, and deductibles are routinely applied for both reproductive care visits and contraceptives under private insurance plans.[29] There are many negative implications of these cost-sharing obligations, limitations of coverage, and failure to adopt confidential protections and billing arrangements, including lost opportunities for prevention and early intervention, financial disincentives for pediatricians to provide reproductive health care, and disruptions in continuity of care when adolescents are forced to seek reproductive care outside their primary care medical home. Programs that have been successful in providing reproductive care ser-

vices to teenagers have been funded by public insurance, have ensured confidentiality, and have removed cost barriers.[10,30]

In addition, the extended time and expertise required to provide routine pelvic examinations for teenagers is not recognized. Providing adequate information and education to the adolescent experiencing her first pelvic examination or to the adolescent with previous negative experiences requires more time. Providing contraceptive counseling and prescriptions may represent the first experience of obtaining medication in a confidential setting, thus requiring more time from health care providers and personnel to provide instructions regarding access to and proper use of medication. However, unlike adult gynecology codes, there is no separate billing code for routine gynecologic examinations. The adolescent gynecologic examination is incorporated into the preventive visit code.

BEHAVIORAL HEALTH CARE

The AAP recommends the following strategies for reducing underinsurance and payment problems that adversely affect adolescents' access to early and ongoing mental health and substance abuse prevention and treatment services. Unfortunately, coverage and payment of mental health and substance abuse services for all individuals is seriously flawed. These pervasive failures especially affect adolescents, because their main health issues are behavioral in nature.

- Insurers should cover comprehensive mental health and substance abuse services that are sufficient in amount, duration, and scope to effectively identify and treat such disorders in adolescents.[14]
- Parity in insurance coverage should be established between medical services and mental health and substance abuse services. Coverage of adolescent mental health and substance abuse disorders should be the same as coverage of other adolescent chronic health conditions and disabilities.[31,32]
- Insurers should eliminate condition exclusions for enrollees with mental health and substance abuse disorders.
- Insurers should provide coverage for the care of youth with behavioral disorders affecting physical health, such as eating disorders, which should not be categorized exclusively as mental health disorders.[33]
- All adolescents should have access to the annual adolescent preventive health care visit as a venue for screening for mental health problems and initiating treatment, as recommended in *Bright Futures*.[13,34]
- When health problems are identified during the adolescent preventive care visit, insurers should recognize the —25 modifier CPT code to allow for same-day treatment of issues that would otherwise require another separate health care visit.[17]
- Insurers should recognize codes for providing care for adolescents in various settings, including telephone management and counseling, team conferences, and health and behavior assessment and intervention.[17]
- Insurers should recognize screening codes (V codes) that allow for early identification and treatment of adolescents at risk of mental health and substance abuse disorders.
- Insurers should recognize that physicians trained as adolescent medicine specialists may provide services as both primary care providers and specialists. Allowing adolescent medicine specialists to provide care for mental health problems and substance use problems within the context of primary care or consultative services would be a management strategy that serves the needs of the patient clinically and provides cost-effective treatment.
- Purchasers and payers should be encouraged to establish pilot projects that integrate mental health programs into primary care and other programs, such as reproductive, school health, and community-based programs. Care in these venues improves access and reduces the stigma associated with mental health care.[35]

The AAP recommends that adolescents receive behavior risk assessment and health education at least annually, usually within the context of the preventive health care visit,[23] including screening specifically for substance abuse, depression, anxiety, and other mental health disorders. The role of the pediatrician is critically important in providing early identification and referral to mental health and substance abuse treatment clinicians and in establishing collaborative relationships with these professionals to clarify their respective roles in treatment, coordination, and exchange of information.

Evidence indicates that most psychiatric disorders present during childhood or adolescence.[36] Yet, all too often, adolescents' mental health and substance abuse problems go undiagnosed and untreated. According to the US Surgeon General, 80% of adolescents who need mental health treatment are not receiving care, ultimately at a huge cost to society. This lack of treatment results in worsening symptoms, disability, difficulties with interpersonal relationships, and poor school performance.[37,38] Childhood and adolescent mental disorders typically persist into adulthood; 74% of 21-year-olds with mental disorders had previous problems.[38,39] It has been estimated that for 15- to 44-year-olds, psychiatric illnesses are associated with >50% of disability-adjusted life-years, a measure of the number of expected years of life lost (to death) or lived with disability.[36]

Problems with insurance coverage, payment, and provider availability have all been associated with restricted access to behavioral health care. With respect to mental health and substance abuse benefits, most private insurers and some SCHIP plans limit outpatient benefits, unlike for other ambulatory services. Inpatient benefits are similarly restricted, and authorization for inpatient care among most insurers and managed care plans is extremely limited. In addition, benefit restrictions, as well as condition and treatment exclusions

(such as self-inflicted injuries and family therapy) and high cost-sharing levels, are applied.[29]

Low payment rates and service carve-out arrangements further limit mental health and substance abuse treatment access. Many payers, especially Medicaid and SCHIP plans, reimburse clinicians at extremely low rates.[9] Not surprisingly, a large proportion of mental health clinicians no longer participate in either public or private plans, which makes the already small number of qualified clinicians even smaller.[10] This lack of available mental health providers often leaves primary care physicians to manage adolescents with very difficult, complex problems and disorders. Moreover, assessment, treatment, and collaborative care provided by pediatricians and adolescent medicine specialists are often rejected because of mental health service carve-out arrangements and exclusion of these physicians as participating providers. As a result, adolescents and their families delay seeking care, incur high out-of-pocket-costs, and fail to complete the recommended course of treatment.

SUMMARY

Improvements in the quality of health insurance coverage for adolescents and the adequacy of provider payment for preventive, reproductive, and behavioral health care are critically important for advancing adolescents' access to health care and improving their health and well-being.

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CLINICAL REPORT

Understanding the Behavioral and Emotional Consequences of Child Abuse

Guidance for the Clinician in Rendering Pediatric Care

AMERICAN ACADEMY OF PEDIATRICS
John Stirling, Jr, MD, and the Committee on Child Abuse and Neglect and Section on Adoption and Foster Care

AMERICAN ACADEMY OF CHILD AND ADOLESCENT PSYCHIATRY
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NATIONAL CENTER FOR CHILD TRAUMATIC STRESS
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ABSTRACT

Children who have suffered early abuse or neglect may later present with significant behavior problems including emotional instability, depression, and a tendency to be aggressive or violent with others. Troublesome behaviors may persist long after the abusive or neglectful environment has changed or the child has been in foster care placement. Neurobiological research has shown that early abuse results in an altered physiological response to stressful stimuli, a response that deleteriously affects the child's subsequent socialization. Pediatricians can assist caregivers by helping them recognize the abused or neglected child's altered responses, formulate more effective coping strategies, and mobilize available community resources. *Pediatrics* 2008;122:667–673

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
child abuse, posttraumatic stress disorder, foster care

Abbreviations
PTSD—posttraumatic stress disorder
HPA—hypothalamic-pituitary axis

INTRODUCTION

Early maltreatment can significantly alter a child's normal developmental arc and leave the victim with significant long-term impairments. Health care professionals who provide care for maltreated children must consider the consequences of previous abuse for the child's ongoing development and adaptation when faced with a variety of long-term behavior problems regardless of whether children reside with their birth families, foster families, or adoptive families.

An increasing body of evidence documents the robust relationship between adverse experiences in early childhood and a host of complications, both medical and psychological, that manifest throughout childhood and later in adult life. The Adverse Childhood Events Studies have demonstrated that child abuse, neglect, and other circumstances that disrupt the parent-child relationship are significantly associated with many leading causes of adult death, such as stroke, cancer, and heart disease, and with heavy health service utilization. These disparate consequences, including depression and suicide, hypertension and diabetes, cigarette smoking, alcohol and other substance abuse, and fractured bones, bear compelling testimony to the vulnerability of children to stressful experience.[1]

Pediatricians see children before, during, and after adverse events. In the office, clinicians deal daily with children who are suffering the effects of trauma, including separation and loss, physical and sexual abuse, parental neglect, and witnessing violence. Many of these children, especially those for whom the stress is particularly severe, chronic, or pervasive, will have difficulty overcoming their persistent physiological and psychological responses to their earlier stress. Lingering symptoms of posttraumatic stress disorder (PTSD) or disrupted attachment can present as difficulties with sleep, anxiety, oppositional behavior, violent behaviors, and school failure.[2,3]

The child's problematic behavior may continue long after abuse or neglect have ceased, despite consistent and attentive parenting by foster or adoptive parents or birth parents who have successfully changed their own behaviors. Desperate caregivers may seek the pediatrician's help in diagnosing and treating a suspected "medical condition" or "chemical imbalance." Unless health care professionals recognize the relationships of these common behavior problems to their remote antecedents, their interventions will be at best inefficient and at worst ineffective or even counterproductive. The primary health care professional holds the first, perhaps most critical link for caregivers and

children: to help them understand that the child's unsatisfactory response to stress may have originated as a biologically based adaptation to the child's abnormal world and that persisting problem behaviors are the consequence. Pediatricians can help caregivers understand that there are healthy strategies and interventions that can help children reduce these excessive responses to environmental stress and assist children in resuming a normal developmental trajectory.

WHEN TRAUMATIC STRESS WILL NOT GO AWAY

Children who have survived acute events such as house fires, automobile accidents, major medical illness, or natural disasters frequently complain of disordered sleep, intrusive "flashback" memories, and altered emotional responses to everyday situations. These are classic symptoms that arise from experiencing a single traumatic life event. Such severe stress reactions are particularly common after incidents of interpersonal violence (such as domestic violence, child abuse, and terrorism). In cases of child abuse or neglect or other exposure to violence, in which the stresses are often prolonged and unavoidable, long-term stress reactions are common and can be especially devastating. In patients suffering from the aftereffects of significant early stress, the offending stimulus, sometimes minor, seems to echo the previous abuse and to produce an equivalent, dramatic emotional reaction that is often inappropriate to the provocation. Stimuli that produce such reactions are known as traumatic reminders and may take many forms. Reaction to an old trauma may be brought forth by a smell, sound, or other sensory input or may be triggered by an action, place, or date. In this reaction, the brain is engaging in what seems to be an exaggerated form of pattern recognition, a common form of learning in which similar patterns of stimuli call forth a similar neuroendocrine (and, thus, behavioral) response.[4,5]

Symptoms can be grouped into 3 main behavioral clusters: (1) reexperiencing through intrusive thoughts, dreams, and "flashback" recollections; (2) avoidance of reminders and numbing of responsiveness, including social withdrawal, restricted range of affect, and constriction of play; and (3) physiological hyperarousal in the form of hypervigilance and exaggerated startle response, attention and concentration problems, and sleep disturbance. When disordered stress responses persist long after the trauma, the condition is termed PTSD.[6,7] It is uncertain why some children develop PTSD after trauma but others do not, although severity and chronicity of the initiating stress seem to play a part, as do such host factors as social support and genetic variation.[2]

Diagnostic criteria for PTSD are the same in children as in adults. These may be summarized as: (A) exposure to a traumatic event that involved serious threat of death accompanied by intense fear and horror; (B) a tendency to persistently reexperience the traumatic event (through intrusive thoughts, dreams, and "flashback" recollections); (C) numbing of general responsiveness; and avoidance of stimuli that trigger this reexperience (seen as social withdrawal, restricted range of affect, and constriction of play); and (D) persistent symptoms of arousal (hypervigilance, exaggerated startle, and other physiological measures), (E) duration of above symptoms for more than 1 month and causing clinically significant distress or impaired functioning.[6] In children, these characteristics may manifest in developmentally different ways, such as traumatic play or extreme emotional lability, with "hair-trigger" explosive responses to minor provocations.[8–11]

Research has shown anatomical changes correlated with a history of PTSD symptoms, including smaller brain volumes and size differences in limbic structures.[12–14] Similarly, end-organ responses along the hypothalamic-pituitary axis (HPA) are altered by prolonged exposure to cortisol, a glucocorticoid critical to the body's stress response. Abuse victims have demonstrated abnormalities of the HPA response.[14–18] These observations underscore the premise that the exaggerated behavioral responses seen in complex PTSD have strong—and durable—anatomical and physiological underpinnings. Indeed, complex traumatic stress suffered early in life may be thought of as having both behavioral and developmental consequences.

Caregivers of a child with very difficult behaviors need to hear that the fault is neither entirely theirs nor entirely the child's. They need to learn that their child is dealing with a physiological response unfamiliar to them and to learn new and more effective ways of responding themselves. Although love and consistency are essential, they are not always enough.

THE SIGNIFICANCE OF EARLY STRESS: PSYCHOLOGY OR PHYSIOLOGY?

It is hardly remarkable that the seeds of adult dysfunction are sown in early childhood stress. We have long known, for example, of the lifelong effects of early malnutrition or of exposures to toxins such as lead or alcohol. What is remarkable, however, is the realization that many of the dysfunctional behaviors have their origins not in some random organic dysfunction but, rather, in the otherwise healthy brain's physiological adaptations to the abnormal world in which the developing child finds himself or herself. These adaptations, although initially useful, have not prepared the child for existence in the larger, more normal world outside the home. Behaviors that may have been useful, even life-saving, in a violent or neglectful home (such as hypervigilance or extreme passivity) become the problem behaviors identified at school or in child care (often interpreted as "attention deficit" or "daydreaming"). Once clearly established and internalized, however, the child's typical response to a stimulus (his or her definition of "normal") can be very hard to change.

The past 2 decades have seen remarkable progress in the understanding of neurodevelopment.[19,20] Once thought of as an enigmatic "black box," the brain is now seen as a complex of specialized, interactive organs, constantly developing through interaction with the environment and each other. Nowhere is this development more dramatic than in the first 3 years of life as the young brain undergoes sweeping structural change as it senses and adapts to the environment in which it finds

itself. Neurons develop myelin sheaths and proliferate, developing myriad connections with others throughout the cranium. With experience, some are strengthened, developing more connections with other neurons. Others are cut back through a process known as apoptosis, the "pruning" of unused connections. Significant apoptosis is seen as early as 4 years of age, continuing until the typical adult brain has lost nearly half of the neuronal connections it possessed at age 3.

It is now understood that this pruning is experience dependent—use strengthens neural pathways, and idleness marks others for demolition. As neurophysiologists remark, "neurons that fire together wire together." Although the 3-year-old's brain is optimized for learning, an adult's brain becomes optimized for performance. Use and disuse of specific pathways alter the neuronal structure through a variety of mechanisms, including changes in sensitivity and the number of synaptic connections.

These changes act to adapt the brain structurally to its environment. By allowing experience to alter its structure, the brain can grow to become the best brain for a child's given surroundings. It is, in other words, learning. A more visually complex environment, for example, may favor a larger visual cortex, whereas a child born blind might devote more cortical area to hearing. Similarly, a brain grown in a more threatening world may benefit from a highly developed fight-or-flight response, with appropriate modifications to the limbic system and HPA.[16,21] For instance, the amygdala, a vital part of the limbic system and necessary in emotional regulation, demonstrates a biphasic response to circulating stress hormones.[22] It becomes more sensitive to stress initially but shrinks when chronically exposed to high circulating concentrations of the stress hormone cortisol, adapting by becoming less sensitive. The hippocampus, a cortical region essential to the proper encoding and retrieval of memory, is similarly affected.[23] These structural changes, by affecting the brain's (and, thus, the individual's) response to stimuli, result in an altered behavioral response to stress.[10,16] The more chronic the stress, the more likely and longer lived the physiological changes.

WAR OF THE WORLDS

Unfortunately for the child, a brain specifically adapted for one type of extreme environment is seldom optimized to perform in another. This, in itself, would not be an insurmountable problem. However, children raised in abusive, violent, or neglectful homes are often denied the very tools that would help them adapt to new and different surroundings. Abused or neglected children often suffer impairments in their language abilities and cognitive skills.[24] One recent study found 36% of preschoolers in foster care to be developmentally delayed and found no difference between the developmental effects associated with reported physical abuse, sexual abuse, or neglect.[25] These deficiencies may reflect prenatal insults or postnatal contributors, such as malnutrition or toxic exposures, but almost certainly correlate with inadequate parental care during sensitive periods in early brain development, providing children with less exposure to language and fewer opportunities for cognitive development.

One of the most important tasks of early childhood is learning to discriminate states of affect.[26] Lacking good models, abused and neglected children may grow up unable to explain (or, indeed, to understand) the difference between such feelings as sadness and anger. In extreme cases, this is termed alexithymia (an inability to "read" emotion). Without this important perception, the ability to perceive the intentions of others, or to monitor one's own response, is lost and social learning is severely impaired.

The brain is most easily altered, or adapted, early in its life. Although there are thought to be few true "critical periods" after which alterations become impossible, early childhood may be thought of as a "sensitive period" for many forms of cognitive—and most emotional—learning, after which it becomes difficult to establish new patterns of thinking or reacting.[19,20] Thus, the abused or neglected child is asked to adapt to a new and different world but is given inadequate neural and behavioral tools with which to do so.

POSITIVE FEEDBACK (OF THE NEGATIVE KIND)

A child's hypervigilance and inability to regulate emotional states after maltreatment can result in challenging behaviors in interactions with others. Victims of previous abuse or neglect are far more often identified as "problem children" than are their peers and show higher rates of diagnosis with attention problems and violent and oppositional behaviors.[27] Caregivers and teachers often respond to these behaviors in the traditional fashion: warnings become more brusque (and often louder) and discipline more strict (and often more punitive).

Although such responses from adults usually gain the desired result in normal children, they become problematic when the listener is hypervigilant for threats and has difficulty controlling his or her own emotions. To a child who is physiologically adapted to a high-threat environment, a minor slight or stern admonition can sound like the prelude to real danger. When the child's exaggerated emotional response calls forth an even stronger response, the child may mistakenly assume that his or her initial reaction was warranted. Such responses inadvertently confirm the child's mistaken impression that the world in general is a high-threat environment. This is, in effect, positive feedback in that it reinforces the preceding behavior—behavior that has negative consequences for the child and for all those around him or her. With reinforcement, neural adaptation (learning) continues. Thus, although maltreated children's threat-adapted neuroanatomy can be said to determine their behavior, that behavior (via the responses of those around them) would be expected, in turn, to determine the further growth of their anatomy.

ATTACHMENT ISSUES

The child's sense of the parents' availability and responsiveness to protect him or her and see to his or her needs—a building block of secure attachment[28]—is a

critical mediator of developmental success, especially under conditions of traumatic stress.[29] An attentive caregiver may help the child learn the give-and-take nature of social communication and teaches the child to recognize and regulate his or her own emotions in a continuous "dance" of interaction.[30,31] With such a benefactor, the infant is secure to learn and explore. When the parent is frankly abusive, the resultant attachment can be confused and disorganized, but even less-severe mistreatment can affect attachment. When the caregiver is absent, preoccupied, or inconsistent, it also becomes difficult for the infant to feel safe. Observers describe neglected infants as more demanding, anxious, or more difficult to console, and they can present special challenges to their already compromised parents. Unless the cycle is broken, the challenged parents are likely to respond with anger or by further distancing themselves from the demanding child, and another positive feedback cycle begins to reinforce maladaptive behaviors.

INTERVENTIONS

Across this continuum of outcome possibilities, current caregivers—be they birth parents, foster parents, or adoptive parents—are almost certain to face major challenges in appropriately responding to the child's mental and physical health needs. A previously neglectful birth parent who has stopped using drugs or left a violent domestic situation may now be able to be consistent and attentive but may find the child unresponsive to his or her best efforts. When a previously maltreated child presents with behavior problems, especially when those problems are resistant to intervention, maladaptive physiological responses may contribute to a child's presentation. In fostering or newly adoptive parenting situations, it is not enough to merely provide a loving and consistent environment; the new parents must be helped to see that the child who has suffered abuse or neglect might indeed see, and respond to, that environment differently than might another child who has not suffered abuse.[32] Too often, maladaptive physiological responses are misinterpreted by teachers and parents and the child is dismissed as willfully "mean" or "disrespectful" and punished accordingly, which reinforces the response.

As abused children grow and develop, earlier trauma is revisited and reconsidered. Often, a child who has learned to live with these abnormal responses will experience added challenges in addressing them as an adolescent. Physiological changes and the onset of formal operational thought can complicate adjustment issues, and problematic behavior can resurface in new and often more dangerous forms. Here again, caregivers need preparation to help children respond constructively.

Therapy must be directed to reshaping the child's perceptions and emotional responses while helping the caregivers address their own behaviors. Failure to do so can result in serious long-term consequences that range from violent behavior to dangerous risk taking to impaired domestic relationships.[33,34]

A child's primary health care professional plays a critical role in identifying for caregivers and children the psychological and biological signs and symptoms of child traumatic stress. A careful psychosocial history should be taken whenever a child presents with behavioral symptoms, with attention paid to early abuse, neglect, or abandonment, especially during the first 3 years of life. Domestic violence, drug abuse, or parental mental health diagnoses are "red flags" that should raise concerns. If an accentuated stress response is suspected, the physician can help caregivers understand that the child's problems are more than simple "defiance" or willful misbehavior. Guidance can include discouraging aggressive responses to aggressive behaviors, including corporal punishment, and explaining how noise and anger can further aggravate the child's runaway stress reaction. Furthermore, physicians can clearly state that there are evidence-based treatments that mental health professionals use to help children and adolescents with traumatic stress reactions and assist them in resuming a more normal developmental path. This information can be shared with the caregivers, starting them on the road to better understanding and ability to obtain trauma-specific services. It is important for parents to know that treatment research has demonstrated that one of the most important factors influencing children's psychological adjustment is the degree of support they receive from their parents and other guardians.[35,36]

The best available evidence from controlled trials supports treating child abuse trauma reactions and related symptoms with trauma-specific psychotherapy that emphasizes cognitive-behavioral approaches. Cognitive-behavioral approaches used in treating abused children include education about child abuse and common reactions of children; teaching safety skills, stress-management techniques, and emotion-regulation skills; facilitating a coherent narrative of the traumatic event; and assisting appropriate emotional and cognitive processing (correcting untrue or distorted ideas about how and why the trauma occurred). Dyadic or conjoint parent work is emphasized as well, recognizing that the child's caregivers bear responsibility for continuing the work of therapy on a day-to-day basis.[37–40] This is especially important with younger and preverbal children.

Some children may not be ready immediately to construct a narrative about their trauma. When coping skills have been put into place, however, conversation between the child and a skilled therapist about the trauma has been a critical ingredient in studies that have provided the strongest research evidence. In fact, studies of adult rape victims have suggested not only that telling the story of the trauma is critical to treatment but also that organization of the trauma narrative and a client's emotional engagement in talking about his or her story can predict symptom reduction.[41,42] Art therapy may be a venue for some children to express their experiences nonverbally.[43]

Given the biological nature of the stress response, medications are often considered to assist children in regulating symptoms of physiological hyperarousal (such as nightmares, sleep difficulties, and high anxiety) and can be prescribed by child psychiatrists, pediatric primary health care professionals, or other pediatric medical subspecialists such as developmental/behavioral pediatricians. Pharmacologic approaches should be considered whenever the behaviors symptomatic of the uncontrolled stress response

interfere with the child's ongoing socialization. The evidence base for psychopharmacologic approaches to treating children and adolescents who suffer from PTSD symptoms is emerging, and although medication can often help ameliorate the stress response in youth, it is important to note that the research on these psychopharmacologic approaches lags behind the research in adults.[44] The same can be said about the promising efforts to prevent PTSD pharmacologically by using medications to blunt the acute stress response.[45–47] Such prevention, of course, would be more feasible after a single trauma, such as a criminal act, than for chronic stress. However effective in reducing symptoms, psychopharmacologic intervention should be considered an adjunct to, rather than a substitute for, psychotherapy.

Effective intervention may involve a variety of professionals working together. A skilled therapist can help the child learn to recognize and regulate his or her emotions and can help the family to respond in a way that makes the situation better instead of worse. Neuropsychological testing can aid in identifying the child's cognitive strengths and weaknesses, helping to anticipate future difficulties and indicating possible solutions, particularly in the area of school performance. Psychiatric or pediatric physicians may prescribe medications to help control extreme behaviors, and educators can tailor educational interventions that respect the child victim's special challenges. Social service workers can help the family obtain needed respite care or other support. By providing a "medical home" for the child, the pediatrician can serve as the facilitator for the intervention team.

CONCLUSIONS

In pediatric office practice, physicians and nurses are often asked to treat common behavioral problems. Children with a history of abuse, neglect, or abandonment may present to the pediatrician with symptoms including anger, aggressive behaviors, depression, or difficulties sustaining attention. In many cases, the children are no longer exposed to direct threat but present with residual behaviors that can be linked to neurophysiological responses to previous maltreatment. When the children are in foster or adoptive care or when a birth parent's circumstances have improved, caregivers may be attentive and consistent in their attempts to address a child's maladaptive behaviors but still find typical behavior-modification strategies unsuccessful. In many cases, the child's exaggerated reactions to stressful stimuli can cause the caregivers to act in ways that reinforce the child's misbehavior.

When attentive and consistent parenting seems ineffective, the physician would do well to remember that early maltreatment (physical or sexual abuse, neglect, or exposure to violence and fear) can deprive the child of the tools needed to adapt to a larger social environment. In addition to denying the developing child necessary social interactions, early maltreatment can alter the normal child's neural physiology, significantly changing the expected responses to stress and affecting the child's ability to learn from experience.

The pediatrician can assist directly and in cooperation with other professionals. Pediatricians should continue to advocate for timely evaluation of children entering the foster care system, as recommended by the American Academy of Pediatrics.[48] Given the risks posed by early neglect and abuse, these examinations should include developmental and cognitive screening in addition to the usual medical assessment,[49] although many foster children do not receive these comprehensive evaluations.[50] Ongoing education for the caregivers of previously maltreated children, especially for foster parents, is essential and can be better guided by the results of a comprehensive evaluation.

Using their therapeutic relationship with the child and family, physicians can work to educate the caregivers, helping them understand that their child's behavioral responses may well be different from those of other children in the same situation and that the differences may reflect a physiological difference rather than willful misbehavior or an egregious failure on the part of the caregivers. If such timely educational interventions can change caregivers' perceptions, they can relieve stress and begin to stabilize the family, with the ultimate goal of decreasing turnover in foster care. A change in perception might also open the door to ongoing counseling on referral from the primary health care professional.

Although many patients with a significant history of trauma will need to be followed by mental health professionals, the pediatrician still plays an important role in management. By providing a medical home, the pediatrician can work longitudinally with caregivers and continue to treat symptoms that are obstructing therapy. Pediatricians can facilitate access to community resources, work closely with the child's school to address behavioral challenges to learning, and help coordinate care among specialists in other disciplines.

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CLINICAL REPORT

Update of Newborn Screening and Therapy for Congenital Hypothyroidism

Guidance for the Clinician in Rendering Pediatric Care

AMERICAN ACADEMY OF PEDIATRICS
Susan R. Rose, MD, and the Section on Endocrinology and Committee on Genetics

AMERICAN THYROID ASSOCIATION
Rosalind S. Brown, MD, and the Public Health Committee

LAWSON WILKINS PEDIATRIC ENDOCRINE SOCIETY

ABSTRACT

Unrecognized congenital hypothyroidism leads to mental retardation. Newborn screening and thyroid therapy started within 2 weeks of age can normalize cognitive development. The primary thyroid-stimulating hormone screening has become standard in many parts of the world. However, newborn thyroid screening is not yet universal in some countries. Initial dosage of 10 to 15 μg/kg levothyroxine is recommended. The goals of thyroid hormone therapy should be to maintain frequent evaluations of total thyroxine or free thyroxine in the upper half of the reference range during the first 3 years of life and to normalize the serum thyroid-stimulating hormone concentration to ensure optimal thyroid hormone dosage and compliance.

Improvements in screening and therapy have led to improved developmental outcomes in adults with congenital hypothyroidism who are now in their 20s and 30s. Thyroid hormone regimens used today are more aggressive in targeting early correction of thyroid-stimulating hormone than were those used 20 or even 10 years ago. Thus, newborn infants with congenital hypothyroidism today may have an even better intellectual and neurologic prognosis. Efforts are ongoing to establish the optimal therapy that leads to maximum potential for normal development for infants with congenital hypothyroidism.

Remaining controversy centers on infants whose abnormality in neonatal thyroid function is transient or mild and on optimal care of very low birth weight or preterm infants. Of note, thyroid-stimulating hormone is not elevated in central hypothyroidism. An algorithm is proposed for diagnosis and management.

Physicians must not relinquish their clinical judgment and experience in the face of normal newborn thyroid test results. Hypothyroidism can be acquired after the newborn screening. When clinical symptoms and signs suggest hypothyroidism, regardless of newborn screening results, serum free thyroxine and thyroid-stimulating hormone determinations should be performed.

INTRODUCTION

Congenital hypothyroidism (CH) is one of the most common preventable causes of mental retardation. In most cases, the disorder is permanent and results from an

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Key Words
congenital hypothyroidism, thyroid hormone, thyroid-stimulating hormone, newborn screening

Abbreviations
CH— congenital hypothyroidism
TH—thyroid hormone
T_4—thyroxine
T_3—triiodothyronine
TSH-R—thyrotropin receptor
TRBAb—thyrotropin receptor-blocking antibody
FT_4—free thyroxine
TSH—thyroid-stimulating hormone
TBG—thyroid-binding globulin
LBW—low birth weight
VLBW—very low birth weight
L-T_4—levothyroxine
TRH—thyrotropin-releasing hormone

abnormality in thyroid gland development (dysgenesis or agenesis) or a defect in thyroid hormonogenesis. Less commonly, the altered neonatal thyroid function is transient, attributable to the transplacental passage of maternal medication, maternal blocking antibodies, or iodine deficiency or excess. In rare cases, CH may result from a pituitary or hypothalamic abnormality (central or secondary/tertiary hypothyroidism). Recent advances in molecular and cell biology have led to improved understanding of normal thyroid physiology and of genes involved in thyroid gland development and disease. In addition, the mechanism and precise temporal sequence of thyroid hormone (TH) modulation of target gene expression are being elucidated.[1–8]

The initial American Academy of Pediatrics recommendation for newborn screening for CH was published in 1993.[9] Screening for CH is one of dozens of newborn screening tests conducted. The rapid advances in our knowledge in the decade since the 1993 publication have prompted reevaluation of the problem and the identification of new questions and concerns.

TH concentrations are low in the fetus during the first half of pregnancy. During this time, the fetus is entirely dependent on maternal TH; its supply to the fetus is controlled by the placenta and the thyroid status of the mother. The fetal hypothalamic-pituitary-thyroid axis begins to function by midgestation and is mature in the term infant at delivery. Despite the critical importance of TH on multiple organ systems, especially the brain, most infants with CH appear normal at birth. The hypothyroid fetus appears to be protected at least in part by placental transfer of maternal TH. This was best illustrated by the demonstration that cord blood thyroxine (T_4) concentration at birth in infants unable to synthesize T_4 was nonetheless one third to one half that of normal infants.[10] In addition, there is increased intracerebral conversion of T_4 to triiodothyronine (T_3), resulting in increased local availability of T_3 despite the low serum concentrations.[11–13] Indeed, normal or near-normal cognitive outcome is possible in even the most severely affected infants with CH. This is true as long as postnatal therapy is early and adequate and maternal thyroid function is normal. In contrast, when both maternal and fetal hypothyroidism are present, whether attributable to severe iodine deficiency, potent thyrotropin receptor (TSH-R)-blocking antibodies (TRBAbs) (or TSH-blocking immunoglobulins), or maternal-fetal PIT1 deficiency, there is a significant impairment in neurointellectual development despite adequate therapy soon after birth.[6,14,15] Maternal hypothyroidism alone during early gestation can lead to mild but significant cognitive impairment of the offspring.[6,15–19] In this report, attention is focused on the problem of CH alone; identification and treatment of maternal hypothyroidism has been the subject of several recent reviews.[20,21]

Pilot screening programs for CH were developed in Quebec, Canada, and Pittsburgh, Pennsylvania, in 1974 and have now been established in Western Europe, North America, Japan, Australia, and parts of Eastern Europe, Asia, South America, and Central America.[22–24] In North America, more than 5 million newborns are screened and approximately 1400 infants with CH are detected annually. Certainly the main objective of screening, the eradication of mental retardation after CH, has been achieved. In addition to the profound clinical benefit, it has been estimated that the cost of screening for CH is much lower than the cost of diagnosing CH at an older age. This estimate does not include the loss of tax income resulting from impaired intellectual capacity in the untreated but noninstitutionalized person. Newborn screening also has revealed the prevalence of the various causes of CH, including a series of transient disorders found predominantly in preterm infants. The incidence of CH has been found to be 4 to 5 times more common than phenylketonuria, for which screening programs were originally developed. The overall incidence of CH ranges from 1 in 3000 to 1 in 4000 newborn infants.[15,25] The incidence of CH is higher in Hispanic individuals and lower in black individuals.[25] There is a 2:1 incidence in females compared with males, and there is an increased risk in infants with Down syndrome.

Iodine deficiency remains the most common treatable cause of mental retardation worldwide. Associated nutritional deficiencies in selenium and iron may have an effect on neurologic development and on thyroidal response to iodine therapy.[26] Many countries have initiated salt iodination.[25–28] Although North America is usually considered to be an iodine-sufficient area, recent epidemiologic evidence suggests that a number of pregnant women may be iodine deficient.[29] There is also some concern that maternal iodine deficiency may be reappearing in developed countries despite salt iodination because diet-conscious young women may avoid iodine-supplemented salt and breads.[30,31] Iodine supplementation before or during pregnancy will normalize thyroid function in the mother and the newborn.[31,32]

The hypothalamic-pituitary-thyroid axis is finely tuned to maintain a fairly stable concentration of free thyroxine (FT_4) within any individual.[33] Divergence from this individual optimal "set point" because of underfunction of the thyroid gland results in an increase in thyroid-stimulating hormone/thyrotropin (TSH) concentration. The exception to this is when the hypothalamus or pituitary gland is unable to respond (in central hypothyroidism, rare pituitary resistance to FT_4 feedback, or in an occasional child with Down syndrome).

Thus, TSH is elevated if thyroid gland function is impaired and FT_4 decreases from its individual optimal set point, although TSH concentration is not elevated in central hypothyroidism.

Although much has been learned, some questions

remain. These issues include the optimal screening approach and the follow-up of infants with low T_4 and normal TSH concentrations. Finally, continued efforts are ongoing to establish the optimal therapy that leads to maximum potential for normal development for infants with CH.

SCREENING METHOD

Two screening strategies for the detection of CH have evolved: a primary TSH/backup T_4 method and a primary T_4/backup TSH method (Fig 1). In addition, an increasing number of programs use a combined primary TSH plus T_4 approach.

Primary TSH With Backup T_4 Measurements

Most programs in Europe, Japan, Canada, Mexico, and the United States screen by using primary TSH measurements, supplemented by T_4 determinations for infants with elevated TSH values. With this approach, delayed TSH elevation in infants with thyroid-binding globulin (TBG) deficiency, central hypothyroidism, and hypothyroxinemia will be missed. Delayed TSH elevation is particularly common in infants with low birth weight (LBW [<2500g]) and very low birth weight (VLBW [<1500g]). In the Quebec study, 2 cases of permanent CH (of 93 000 infants screened) would have been missed by the primary TSH approach and detected by the primary T_4 approach.[34] The recall rate (notification of a physician to contact the infant's family to arrange for a blood test) with a primary TSH screening approach is approximately 0.05%. At this rate, 2 infants will be recalled for testing for every case detected.

Current TSH assay techniques (enzyme-linked immunoassays, chemiluminescent assays, and fluoroimmunoassays) use nonradioactive labels and have improved sensitivity with the potential for better separation between normal and abnormal TSH concentrations. Thus, many screening programs are considering switching to a primary TSH approach. However, the trend toward early discharge of mothers and infants (before 48 hours of age) presents a problem with the switch to a primary TSH approach because of the normal increase in TSH postnatally. With early hospital discharge, the first screening specimen commonly is obtained before 48 hours of age. Recent data using a sensitive and specific immunofluorometric assay indicate that normal TSH values before 24 hours of age are not as high as those using previous assays and usually less than the cutoff value of 20 to 25 mU/L.[35,36] A 50% reduction in abnormal values occurred when age-adjusted TSH cutoffs were used.[37] Thus, the current experience using newer assays in a primary TSH screening approach in a population of infants discharged after 24 hours of age shows lower patient recall rates with negligible false-negative test results.

Primary T_4 With Backup TSH Measurements

An initial filter-paper blood-spot T_4 measurement is followed by a measurement of TSH for filter-paper specimens with low T_4 values.[9,25] The primary T_4 approach will detect primary hypothyroidism in infants with low or low-normal T_4 with elevated TSH concentrations (prevalence ranging from 1 in 3000 to 1 in 4000 newborn infants). In addition to detecting primary hypothyroidism, the primary T_4/backup TSH approach can also identify infants with TBG deficiency (prevalence ranging from 1 in 5000 to 10 000 newborn infants) and central hypothyroidism (low or low-normal T_4 with normal TSH concentration; prevalence: l in 50 000 newborn infants). Programs that quantify high T_4 values also have the potential to identify infants with hyperthyroxinemia (1 in 20 000 to l in 40 000 newborn infants). This approach, however, will miss the condition in an infant with an initially normal T_4 concentration and delayed increase in TSH. To ensure identification of infants with CH who have low-normal T_4 values, most screening programs use a T_4 concentration cutoff of <10th percentile for the days' assay. Comparison of the primary T_4 versus primary TSH screening approach was conducted in Quebec (1983).[34] One case (of 93 000 infants screened) would have been missed by the primary T_4 approach and detected by the primary TSH approach.[34]

Programs using a primary T_4 with secondary TSH approach will follow-up on infants with a low T_4 and elevated TSH screening result. The recall rate for primary hypothyroidism in these screening programs is approximately 0.05%, similar to that in primary TSH screening programs.[38] However, some primary T_4 screening programs also report low T_4 results below an absolute cutoff (eg, 3.0 μg/dL [39 nmol/L]) in infants even if the TSH was normal. The recall rate (and therefore the false-positive rate) will be higher (approaching 0.30%) with this practice. For example, in a 1990 study in California, which did not report low T_4 results, the recall rate was 0.08%. In contrast, a study performed in Oregon, which reported infants with 2 low T_4 results <3rd percentile, the recall rate was 0.30%.[39] This means that up to 12 normal infants may be recalled for testing for every 1 case of hypothyroidism.

Combined Primary TSH Plus T_4 Measurements

Methods for the simultaneous measurement of T_4 and TSH are available (DELFIA data). This represents the ideal screening approach, especially once it is possible for FT_4 to be measured accurately and cost-effectively in the eluates from filter-paper blood spots. Until T_4 and TSH determinations can be performed practically for all infants, physicians should be aware of the potential limitations of each method of screening for CH.

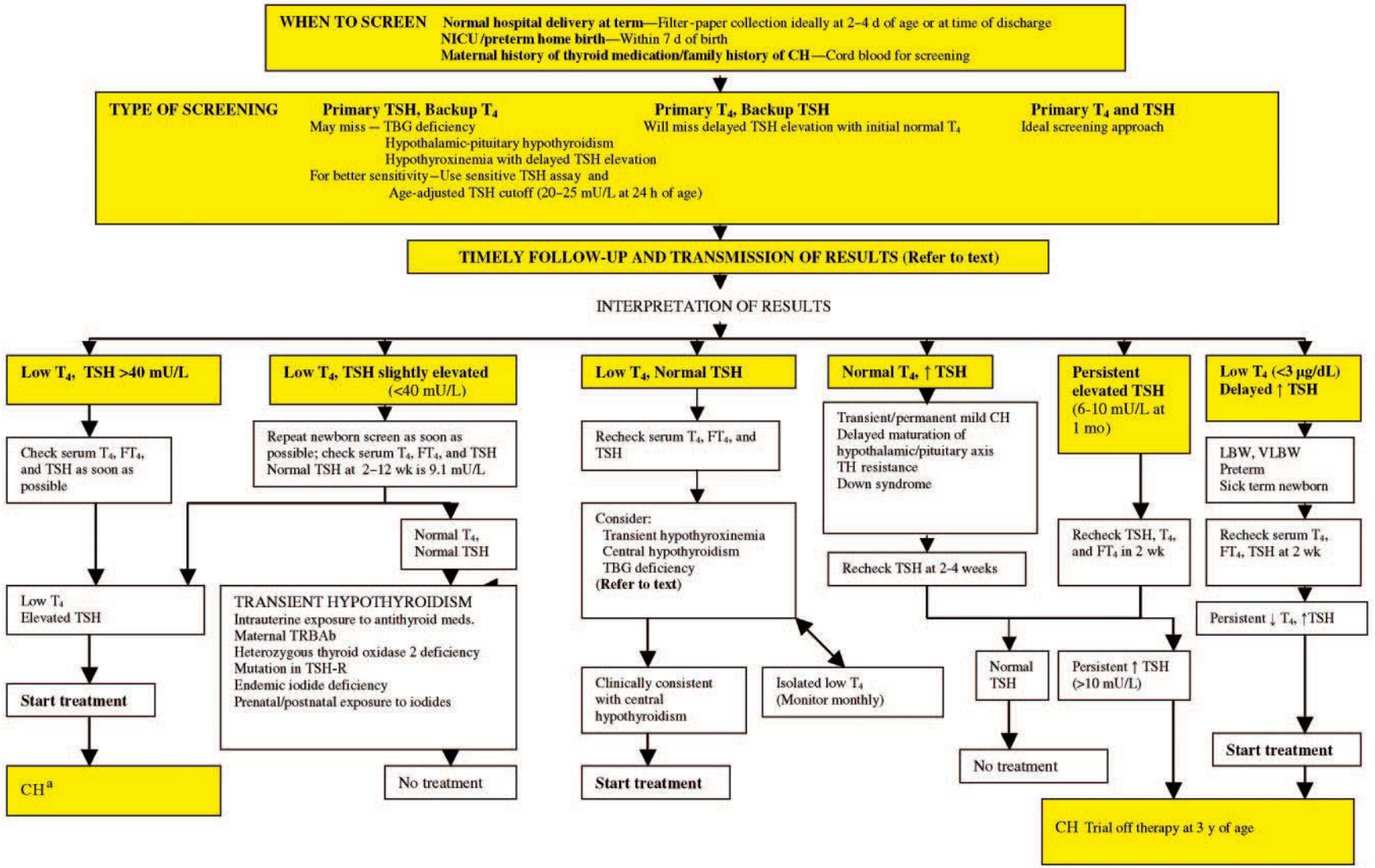

FIGURE 1
Newborn screening for CH. [a] Management of CH is summarized in Table 1.

THE SPECIMEN

Every infant should be tested before discharge from the nursery, optimally by 48 hours to 4 days of age. As noted above, specimens collected in the first 24 to 48 hours of life may lead to false-positive TSH elevations when using any screening test approach. However, screening before hospital discharge or before transfusion is preferable to missing the diagnosis of hypothyroidism. False-negative results may occur by screening a very sick newborn or after transfusion. Because newborn blood specimens are used for a variety of screening tests and shared among different laboratories, every effort should be made to collect adequate and sufficient blood in the recommended manner.[39]

It is highly desirable that the blood be collected when the infant is between 2 and 4 days of age, but there are situations in which this is virtually impossible. In infants discharged from the nursery before 48 hours of age, blood should be obtained before discharge. In instances such as home births or in the case of a critically ill or preterm neonate, blood should be obtained by 7 days of age, recognizing that samples obtained after 4 days of age are late for screening of congenital adrenal hyperplasia or metabolic disease. Particular care must be taken with infants in NICUs. In such cases, more urgent medical problems may result in missed newborn screening. When an infant is transferred to another hospital, the first hospital must indicate whether the specimen has been collected. The second hospital should obtain a specimen if there is no proof that blood was collected before the transfer.

Some state screening programs, testing 10% of newborns in the United States, perform newborn screening on specimens routinely collected at 2 time periods. These programs report that CH is detected in approximately 10% of the affected infants only as a result of collection of a second specimen. The additional incidence of CH based on a second screening at 2 weeks of age is approximately 1 in 30 000.[38,40] Infants with CH detected at the later screening time tend to be of LBW or VLBW, with mild or delayed TSH elevations.[41] Whether these cases represent transient or permanent cases is unknown. Some have thyroid dysgenesis (ectopia, aplasia, or hypoplasia) on thyroid scanning. Others appear to have increased uptake and a large thyroid gland, suggestive of dyshormonogenesis.[8] Either these infants have transient disease or their disease is undiagnosed until a later age, when they appear to have acquired hypothyroidism.

Accurate screening results depend on good-quality blood spots. The filter paper designed for newborn screening bears printed circles. Capillary blood samples are placed in these circular areas to fill and saturate them. Spotting blood over a previous blood spot, or double spotting, causes invalid results, and these blood spots should not be used. The recall of an infant for testing because of an unsatisfactory filter-paper specimen causes needless delay in diagnosis and treatment of a newborn with CH. Specimens that are technically unsatisfactory or contain insufficient amounts of blood should not be assayed. Blood samples should be collected on approved filter-paper forms, dried at room temperature, and not subjected to excessive heat. The blood should completely saturate the filter paper and be applied to 1 side only. Filter-paper spots should not be handled, placed on wet surfaces, or contaminated by coffee, milk, or other substances. Any of these have the potential to invalidate the results regardless of the method used. Testing of an unsatisfactory specimen (because of insufficient blood) can result in a false-negative TSH value. False-negative values can also result from human error in the processing of satisfactory specimens or in erroneous reporting of the results.

TEST RESULTS

Transmission of Results and Follow-up Testing

Newborn screening test results must be communicated rapidly back to the physician or hospital identified on the screening filter-paper card. The responsibility for transmission of these results rests with the authority or agency that performed the test. In general, when an abnormal screening result is found, the responsible physician is notified immediately so that he or she can arrange for follow-up testing. Screening test results should be entered into the patient's record. If the informed physician is no longer caring for or cannot locate the infant, he or she should notify the newborn screening laboratory immediately. In such situations, the local health department is often helpful in locating these infants to ensure that they are not lost to follow-up.

Low T_4 and Elevated TSH Values

Any infant with a low T_4 concentration and TSH concentration greater than 40 mU/L* is considered to have primary hypothyroidism. Such infants should be examined immediately and have confirmatory serum testing performed to verify the diagnosis. Treatment with replacement levothyroxine (L-T_4) should be initiated as soon as confirmatory tests have been drawn and before the results of the confirmatory tests are available. (Clinical management of infants with hypothyroidism is described in the following section.) For cases in which the screening TSH concentration is only slightly elevated but less than 40 mU/L, another filter-paper specimen should be obtained for a second newborn screening. Ten percent of infants with confirmed CH have TSH values between 20 and 40 mU/L. It is important that age-appropriate normative values be used. The reference

* All filter-paper TSH [and T_4] levels here are reported as serum equivalents. Some laboratories report screening results per unit of blood, a value that is approximately half the concentration in serum. We recommend that all laboratories report results per unit of serum, because TSH and T_4 are preferentially distributed into the serum.

range for TSH for the most common time of TSH reevaluation (between 2 and 6 weeks of age) is 1.7 to 9.1 mU/L.[42]

Normal T_4 and Elevated TSH Values

Hyperthyrotropinemia is characterized by elevated serum TSH concentrations during the neonatal period despite normal T_4 and FT_4 concentrations. The etiology is probably heterogeneous and can be either a transient or permanent thyroid abnormality[43–46] or delayed maturation of the hypothalamic-pituitary axis. Inactivation mutations in the TSH-R cause compensated, mild (subclinical) primary hypothyroidism in the neonatal period. The incidence of both transient and persistent hyperthyrotropinemia and CH appears to be higher in infants with Down syndrome. In some cases, transient neonatal hyperthyrotropinemia persists until 10 years of age or later.

There is controversy regarding the need for TH therapy in this setting. There have been no long-term studies to evaluate cognitive development in this group of patients. TSH concentration is the most sensitive indicator that the hypothalamic-pituitary axis is sensing less T_4 than the body "perceives" as optimal. Most physicians would consider a persistent basal TSH concentration higher than 10 mU/L (after the first 2 weeks of age) to be abnormal.[42] Therefore, if the TSH elevation persists, the infant should be treated. If such infants are not treated, measurement of FT_4 and TSH should be repeated in 2 and 4 weeks, and treatment should be initiated promptly if the FT_4 and TSH concentrations have not normalized.

The management of infants with TSH elevations between 6 and 10 mU/L that persist after the first month of life is even more controversial. TSH concentrations are slightly higher in the first few months of life. A TSH range of 1.7 to 9.1 mU/L has been reported for children 2 to 20 weeks of age (Quest Diagnostics reference values, Lyndhurst, NJ). Thus, using the adult reference range for TSH will result in treatment of many euthyroid children. Consequently, if a decision is made to treat such children, a trial off therapy at 3 years of age should be performed.

Low T_4 and Normal TSH Values

Infants with normal TSH but low T_4 values (defined as 2 SDs below the mean for the reference range for age, usually below 10 μg/dL in the newborn infant) may have thyroid insufficiency. The low T_4 with normal TSH profile is seen in 3% to 5% of neonates. This pattern may result from hypothalamic immaturity (particularly in preterm infants, 12% of all newborn infants). Low T_4 but normal TSH results are also observed during illness, with protein-binding disturbances such as TBG deficiency (1 in 5000), in central hypothyroidism (1 in 25 000 to 1 in 50 000 newborn infants; see next 3 paragraphs),[47] or with primary hypothyroidism and delayed TSH elevation (1 in 100 000 newborn infants). Newborn infants who are preterm or ill are found with disproportionate frequency among those with this set of laboratory values.[48] In neonates/infants, inhibition of TSH (causing low T_4 concentrations) can result from constant infusions of dopamine or high-dose glucocorticoids.

Transient hypothyroxinemia is seen to some extent in many preterm infants.[36,48] Immaturity of the hypothalamic-pituitary axis may be physiologically normal for the infant's gestational age. Preterm serum T_4 and FT_4 concentrations are lower than those of term infants, but the TSH concentrations are comparable to term infants.[49,50] Serum TBG concentrations are only slightly low in preterm infants and do not account for the degree of hypothyroxinemia. Consequently, the FT_4 is rarely as low as the total T_4. Serum inhibitors of T_4 binding, present in many patients with nonthyroidal illness, may be an additional contributor to the decreased T_4 values.

In contrast to transient hypothyroxinemia, the presence of midline facial abnormalities, hypoglycemia, microphallus, or visual abnormalities should suggest the possibility of a hypothalamic-pituitary abnormality. Septo-optic dysplasia, often associated with pituitary hormone deficiencies, can manifest as central hypothyroidism.[51,52] Genetic mutation in HESX-1 has been described in septo-optic dysplasia. Clinical symptoms of hypopituitarism, such as neonatal hypoglycemia (from growth hormone and adrenocorticotropic hormone deficiencies), polyuria (from antidiuretic hormone deficiency), or small phallus in boys (from gonadotropin deficiencies), along with the presence of blindness, congenital nystagmus, or midline defects of the brain, should alert the physician to suspect the diagnosis of septo-optic dysplasia. Alternatively, multiple pituitary hormone deficiencies suggest a genetic defect in the cascade leading to fetal pituitary formation, such as PROP1, LHX3, and POU1F1.[4,53] DNA screening for these molecular abnormalities could be beneficial in the future for the rapid and accurate detection of these affected infants during the first weeks of life, but is not yet available clinically.

Isolated TSH-releasing hormone (TRH) deficiency may cause low-normal T_4 and low or normal TSH concentrations. Secondary (or central) hypothyroidism may be suspected in infants with low T_4 and FT_4 and low TSH concentrations.[32,43] Mutations have been identified in the β subunit of TSH, TRH gene, and TRH receptor gene.[54,55] Finally, congenital TSH and growth hormone deficiencies may occur as a result of a difficult birth or anoxia.[56]

In programs that report low T_4 with normal TSH results, there is no clear consensus regarding optimal follow-up. Such programs have elected to take no further action, to follow-up with serial filter-paper screening tests until the T_4 value becomes normal, or to request a second blood sample for measurement of FT_4 and TSH

concentrations. Most infants with low T_4 and normal TSH have normal FT_4 values, and subsequent thyroid function test results are normal. Programs that choose to pursue further laboratory testing must weigh the benefit of detecting TBG deficiency or the rare case of hypopituitary-hypothyroidism or delayed TSH increase against the cost and the psychological effect on the family. The responsibility of deciding which course of action to follow rests with the physician providing the care of the infant. Treatment of these infants (with the exception of those with central hypothyroidism or delayed TSH increase) with L-T_4 has not yet been shown to be beneficial.[48,57–59]

Low T_4 and Delayed TSH Increase

Many infants with low T_4 concentrations and normal TSH values on initial screening (l in 100 000 newborn infants) who are subsequently found to have an elevated TSH concentration are LBW, VLBW, or critically ill preterm and term neonates. Serum TSH values in these infants increase during the first few weeks of life to concentrations characteristic of primary hypothyroidism. It is unclear whether infants with this delayed TSH elevation have an abnormality of pituitary-thyroid feedback regulation, transient hypothyroidism (eg, iodine induced), or a mild form of permanent CH. Long-term follow-up of these infants has not been reported. It is important, therefore, that serum FT_4 and TSH be tested in infants with overtly low T_4 concentrations or in any infant with suggestive signs of hypothyroidism. Infants with low T_4 and a delay in elevation of TSH values and those with normal T_4 concentrations and elevated TSH values might be missed on initial screening. Neither a primary T_4/backup TSH nor a primary TSH/backup T_4 screening strategy will detect the rare infant with a normal T_4 at birth but delayed TSH increase. Even in the absence of technical and human errors, 5% to 10% of LBW and VLBW newborn infants with CH may have normal screening hormone concentrations regardless of the approach used.

Some screening programs routinely obtain a second specimen at 2 to 6 weeks of age and/or obtain a serum sample from any infant with 2 successive T_4 values below an absolute cutoff (<3rd percentile). Whatever strategy is used, subsequent testing should be performed on serum during infancy whenever there is a perceived risk of hypothyroidism, as in familial dyshormonogenesis or in infants with clinical suspicion of hypothyroidism. In addition, a second specimen should be drawn at 2 weeks of age in monozygotic twins, because fetal blood mixing may mask the screening test results.[60]

However, a second screen has not become routine because of (1) increased cost, (2) relatively low yield of cases, (3) diversion and dilution of key personnel, (4) inability to implement new programs, and (5) absence of such cases missed in primary TSH screening programs. Finally, the cognitive and developmental prognosis of this cohort is uncertain because the etiology in most cases is unknown and there are no definitive follow-up data.

As an alternative strategy, other programs have attempted to identify high-risk patient groups so that routine rescreening can be targeted to these infants. There is a disproportionate incidence of delayed TSH increase in VLBW infants (incidence of CH: 1 in 250), LBW infants (incidence of CH: 1 in 1589), and neonates in intensive care settings or with cardiovascular abnormalities.[61] Therefore, some screening programs routinely screen again at 2 weeks and 6 weeks of age all VLBW and all LBW infants in the NICU, especially in newborns known to have cardiac disease. It is likely that most of these infants do not have permanent CH. If hyperthyrotropinemia persists at 6 weeks of age, TH replacement should be started, consistent with therapy of other forms of transient CH, and the infant should be retested after 3 years of age (after stopping therapy for 4–6 weeks) (see "Assessment of Permanence of Hypothyroidism").

Transient TSH Elevation

A small number of infants with abnormal screening values will have transient hypothyroidism as demonstrated by normal serum T_4 and TSH concentrations on the confirmatory (follow-up to screening) laboratory tests. Transient hypothyroidism is relatively rare in North America (estimated at 1 in 50 000) in contrast to iodine-deficient areas of the world; it is much more common in preterm infants but may occur in apparently healthy term infants. Transient hypothyroidism may result from intrauterine exposure to maternal antithyroid drugs, maternal TRBAbs, heterozygous thyroid oxidase 2 deficiency, germ-line mutations in the TSH-R, endemic iodine deficiency, or prenatal or postnatal exposure to excess iodides (povidone iodine, iodinated contrast materials).[31,32,43,62,63] Transient iodine-induced CH is not usually evident at birth and, therefore, may not be detected if newborn screening is performed in the first few days postnatally.

Transplacental passage of potent maternal TRBAbs (incidence: 1 in 180 000) is a much less common cause of transient CH but should be suspected if there is a maternal history of autoimmune thyroid disease or if there is a history of previous affected offspring. In this setting, cord serum can be collected and rapidly tested for thyroid abnormalities. The half-life of immunoglobulin G in the neonate is approximately 3 to 4 weeks,[64] and TRBAbs usually disappear from serum of affected infants by 3 to 6 months of age, depending on the antibody potency.

Because the transient nature of the hypothyroidism will not be recognized clinically or through laboratory tests in some infants, initial treatment will be similar to that in any infant with permanent CH. In these cases, it

is important to determine at some later time whether the hypothyroidism is permanent and whether the infant in fact requires lifelong treatment (see "Assessment of Permanence of Hypothyroidism"). However, in the newborn infant with transient hypothyroidism whose mother is receiving an antithyroid drug, the T_4 and TSH values tend to return to normal within 1 to 3 weeks after birth without treatment.

CLINICAL MANAGEMENT OF NEWBORN INFANTS WITH LOW T_4 AND ELEVATED TSH VALUES

Infants with low T_4 and elevated TSH concentrations have CH until proven otherwise. Management should include the following (Table 1):

1. The infant should be seen by his or her physician without delay. Consultation with a pediatric endocrinologist is recommended to facilitate diagnostic evaluation and optimal management.
2. A complete history, including prenatal thyroid status (maternal drugs and medications) and family history should be obtained, and physical examination should be performed.
3. Serum should be obtained for confirmatory measurements of TSH and FT_4. An elevated thyroglobulin concentration may suggest dyshormonogenesis. Care must be taken to compare the serum results to normal TH concentration for age. When there is history of a maternal autoimmune thyroid disorder or a previously affected infant, measurement of TRBAbs in the infant and/or mother may identify a transient form of neonatal hypothyroidism.
4. Education of parents by trained personnel using booklets or visual aids is highly desirable. Education should focus on (*a*) the etiology of CH, (*b*) the lack of correlation of parental lifestyle during pregnancy with causes of the disease, (*c*) the benefit of early diagnosis in preventing mental retardation, (*d*) the appropriate manner in which TH is administered and the substances (eg, soy, iron, calcium, and fiber) that can interfere with TH absorption, (*e*) the importance of adherence to the treatment plan, and (*f*) the importance of periodic follow-up care.
5. Optional diagnostic studies include thyroid ultrasonography or iodine 123 (^{123}I) or sodium technetium 99m pertechnetate (^{99m}Tc) thyroid uptake and/or scan to identify functional thyroid tissue. Although ^{123}I tends to give a more accurate uptake and scan picture, it may not be readily available in all hospitals. ^{99m}Tc is generally more readily available and a much less expensive radioisotope. The half-life of ^{123}I is 13.3 hours, compared with 8 days for iodine 131 (^{131}I). ^{123}I exposes the infant to much lower doses of ionizing radiation compared with ^{131}I (probably one 100th of the ^{131}I dose [H.-M. Park, MD, Professor Emeritus, Radiology, Indiana University, personal communication, September 16, 2004]).

There remains some controversy regarding the risk-benefit ratio of early thyroid scanning of infants with suspected hypothyroidism. For physicians who opt for imaging, the benefits can be summarized as follows:

1. If an ectopic gland is demonstrated, a permanent form of thyroid disease and CH has been established.
2. The absence of thyroid gland uptake is most often associated with thyroid aplasia or hypoplasia. When radioiodine uptake is absent but ultrasonographic examination reveals a normal gland, a TSH-R defect, iodine-transport defect, or maternal transfer of TRBAbs may be present.
3. Normal scan findings (or a goiter) indicate a functioning thyroid gland with regard to iodine uptake and alert the physician to a probable hereditary defect in T_4 synthesis. Measurement of serum thyroglobulin will help to separate thyroglobulin synthetic defects from other causes of hypothyroidism.[65] Exposure to an exogenous goitrogen other than iodine, such as antithyroid drugs, will produce a similar picture. Finally, some infants exposed to maternal TRBAbs may have a normal scan if their hypothyroidism is partially compensated. The identification of a genetically mediated thyroid synthetic enzyme defect is especially important for families planning on having additional children. In such cases, the scan enables the physician to arrange for genetic counseling.
4. Some infants with normal scan findings at birth who do not fall into one of the above categories may have a transient form of hypothyroidism. These infants should undergo a careful follow-up evaluation after 3

TABLE 1 Management of CH

Initial workup
Detailed history and physical examination
Referral to pediatric endocrinologist
Recheck serum TSH and FT_4
Thyroid ultrasonography and/or thyroid scan (see text for recommendations)
Medications
L-T_4: 10–15 μg/kg by mouth once daily
Monitoring
Recheck T_4, TSH
2–4 wk after initial treatment is begun
Every 1–2 mo in the first 6 mo
Every 3–4 mo between 6 mo and 3 y of age
Every 6–12 mo from 3 y of age to end of growth
Goal of therapy
Normalize TSH and maintain T_4 and FT_4 in upper half of reference range
Assess permanence of CH
If initial thyroid scan shows ectopic/absent gland, CH is permanent
If initial TSH is <50 mU/L and there is no increase in TSH after newborn period, then trial off therapy at 3 y of age
If TSH increases off therapy, consider permanent CH

years of age, when it is safe to discontinue treatment temporarily under the conditions described in "Assessment of Permanence of Hypothyroidism."

Treatment need not be delayed to perform the scan. A thyroid scan can be performed within the first few days of treatment, because the elevated TSH found in patients with permanent CH rarely normalizes within this time period. A serum TSH measurement should be obtained at the time of the scan. If L-T_4 therapy has caused the TSH concentration to be <30 mU/L, ultrasonography can still be performed. A scan can be performed after the child is 3 years of age, when TH treatment can be interrupted without danger to the developing central nervous system.

The usual dose of ^{123}I, the preferred isotope, is 0.925 MBq (25 μCi). This represents a small amount of radiation exposure, equivalent to the amount of exposure with 2 to 3 chest radiographs. However, the radiation exposure is potentially 100 times greater if ^{131}I or large doses of isotope are administered. For this reason, the procedure should be performed by experienced personnel with optimal equipment, using the minimally recommended tracer dose.

To avoid unnecessary radiation, some investigators prefer ultrasonography as the initial imaging procedure to identify the presence and location of thyroid tissue.[66–68] However, gray-scale ultrasonography is much less sensitive than scintigraphy in detecting the presence of ectopic thyroid tissue, the most common cause of CH. Recent studies have indicated markedly improved sensitivity of color Doppler ultrasonography in diagnosing ectopic thyroid tissue.[69] If these studies are confirmed, color Doppler ultrasonography may become the optimal imaging procedure for the initial investigation of suspected CH.

TREATMENT

All infants with hypothyroidism, with or without goiter, should be rendered euthyroid as promptly as possible by replacement therapy with TH.[21,70–72] An optimal cognitive outcome depends on both the adequacy and timing of postnatal therapy, particularly in severe cases of CH (T_4 < 5 μg/dL). However, what constitutes optimal TH therapy is not yet certain. The goal of therapy is to normalize T_4 within 2 weeks and TSH within 1 month. An initial dosage of 10 to 15 μg/kg of L-T_4 (depending on the severity of the initial hypothyroidism) has been recommended. When a higher initial dose of L-T_4 (50 μg [ie, 12–17 μg/kg]) is used, the serum T_4 normalizes in 3 days and the TSH returns to the target range by 2 weeks of therapy.[72] In the long run, evaluation of cognitive outcome is important after use of this increased dose. Currently the evidence base does not indicate cognitive benefit from thyroid therapy of hypothyroxinemia of prematurity in the absence of TSH elevation.[48–50,57–59]

Administration of L-T_4 is the treatment of choice. Although T_3 is the more biologically active TH, most brain T_3 is derived from local monodeiodination of T_4, so T_3 should not be used. The pill should be crushed and suspended in a few milliliters of formula, breast milk, or water. Care should be taken to avoid concomitant administration of soy, fiber, or iron. Breastfeeding can continue. Only T_4 tablets should be used; currently there are no liquid formulations licensed by the US Food and Drug Administration. T_4 suspensions that may be prepared by individual pharmacists may lead to unreliable dosage. T_4 is expected to increase to more than 10 μg/dL, FT_4 is expected to increase to more than 2 ng/dL by 2 weeks after initiating therapy, and TSH should normalize by 1 month.[73] FT_4 measurement at 1 week of therapy can confirm whether the serum concentration is increasing appropriately. The L-T_4 dose should be adjusted according to the infant's clinical response and serum FT_4 and TSH concentrations.

During therapy, the serum total T_4 or FT_4 should and might be in the upper half of the reference range (target values depend on the assay method used [T_4: 10–16 μg/dL (130–206 nmol/L); FT_4: 1.4–2.3 ng/dL (18–30 pmol/L)]) during the first 3 years of life with a low-normal serum TSH. The latter may sometimes be delayed because of relative pituitary resistance. In such cases, characterized by a normal or increased serum T_4 and an inappropriately high TSH concentration, the T_4 value is used to titrate the dose. Nonadherence to the treatment is the most common cause of persistent TSH elevation and should be excluded. Those infants with low serum T_4 concentrations (below 10 μg/dL [129 nmol/L]) and a TSH concentration greater than 15 mU/L during the first year of life have lower IQ values than patients whose T_4 concentrations were held constant at higher concentrations.[35] Thereafter, thyroid function test values should be kept at age-appropriate concentrations, which in children differ from those for adults.[74] On TH-replacement therapy, TSH levels should be maintained between 0.5 and 2.0 mU/L during the first 3 years of life.[75] Clinical evaluation of the infant by the practitioner should be conducted at frequent intervals during the first 3 years of age (see "Follow-up"). Because poor compliance and noncompliance have major sequelae, initial and ongoing counseling of parents is of great importance.

Current international organizations such as the American Clinical Laboratory Association recommend that the FT_4, rather than the total T_4, be measured to assess the concentration of the biologically relevant, unbound or free form of circulating T_4.[75] The cost of total T_4 plus TBG or T_3 resin uptake, versus the FT_4 by most methods (excluding the more costly direct dialyzable or ultrafiltration methods), should be comparable. However, although the total T_4 is a robust measure, it should be recognized that most direct FT_4 assays are influenced,

to some extent, by protein binding. Consequently, the FT_4 values obtained vary between assays.

During TH therapy, 4 or more episodes of insufficiently suppressed TSH (>5 mU/L) after the age of 6 months were the most important variables associated with school delay.[75] Usually, these episodes are caused by poor parental compliance or impaired T_4 bioavailability. The latter may be caused by inhibition of T_4 intestinal uptake by specific foods (soy, fiber) and medications (iron, calcium), malabsorption, or increased degradation (anticonvulsants; large hemangiomas with high deiodinase activity). The Food and Drug Administration has deemed several generic L-T_4 products to be equivalent to some currently branded preparations. Any change in source of the L-T_4, especially if not a standard brand, requires retitration of the dose.

FOLLOW-UP

Clinical examination, including assessment of growth and development, should be performed every few months during the first 3 years of life. Infants with CH appear to be at increased risk of other congenital anomalies (approximately 10% of infants with CH, compared with 3% in the general population). Cardiovascular anomalies, including pulmonary stenosis, atrial septal defect, and ventricular septal defect, are the most common.

Infants need to undergo frequent laboratory and clinical evaluations of thyroid function, growth, and development to ensure optimal T_4 dosage and adherence to their therapy regimen. Serum T_4 and TSH measurements should be performed:

1. at 2 and 4 weeks after the initiation of L-T_4 treatment;
2. every 1 to 2 months during the first 6 months of life;
3. every 3 to 4 months between 6 months and 3 years;
4. every 6 to 12 months until growth is completed; and
5. at more frequent intervals when compliance is questioned, abnormal values are obtained, or dose or source of medication has been changed; FT_4 and TSH measurements should be repeated 4 weeks after any change in L-T_4 dosage.

The aim of therapy is to ensure normal growth and development by maintaining the serum total T_4 or FT_4 concentration in the upper half of the reference range in the first year of life, with a serum TSH in the reference range (optimally 0.5–2.0 mU/L).

Some infants will have serum TSH concentrations in the range of 10 to 20 mU/L despite T_4 concentrations in the upper half of the reference range. Rarely, the elevated TSH relative to the FT_4 value is hypothesized to result from in utero hypothyroidism, producing a resetting of the pituitary-thyroid feedback threshold. A failure of the serum FT_4 concentration to increase into the upper half of the reference range by 2 weeks and/or failure of the TSH concentration to decrease to less than 20 mU/L within 4 weeks after initiation of L-T_4 administration should alert the physician that the child may not be receiving adequate L-T_4 regularly. At this point, careful inquiry should be made regarding compliance, dose of medication, and method of administration. When attempting to achieve the optimal concentration of circulating FT_4, physicians should always bear in mind the adverse effects of excessive medication and thus be prepared to monitor blood concentrations of FT_4 at close intervals. Prolonged hyperthyroidism has been associated with premature craniosynostosis.

DEVELOPMENTAL OUTCOME

Growth rate and adult height are normal in children with CH in whom TH therapy is consistently maintained.[68,76,77] The best outcome occurred with TH therapy started by 2 weeks of age at 9.5 μg/kg or more per day, compared with lower doses or later start of therapy.[71] There are only minor differences in intelligence, school achievement, and neuropsychological tests in adults with CH that was treated early with TH compared with control groups of classmates and siblings.[78–82] Residual defects can include impaired visuospatial processing and selective memory and sensorimotor defects. Whether these minor differences are preventable by further optimizing postnatal therapy remains controversial.

In contrast to the excellent outcome in infants with CH that is treated early, the prognosis for normal mental and neurologic performance is less certain for infants with CH that is not detected early by newborn screening. Although physical recovery is good and stature is normal,[77] when replacement therapy is begun later but within the first 2 months of life, infants with severe hypothyroidism at birth and intrauterine hypothyroidism (retarded skeletal maturation at birth) may still have a low-to-normal IQ.[18] Similarly, although more than 80% of infants given replacement therapy before 3 months of age have an IQ greater than 85, 77% of these infants show some signs of minimal brain damage, including impairment of arithmetic ability, speech, or fine motor coordination in later life. Even in early-treated patients with CH, auditory brainstem evoked potentials were abnormal in 25% of 27 children studied. The reason for this is not known but might suggest that prenatal maternal T_4 production does not provide complete protection for the developing central nervous system.[84] In another study, processing of visuospatial relationships remained affected in adolescents with CH.[85] The effect of underlying severity of CH combines with the effects of TH dose and of age at onset of TH therapy.[35] Otherwise, neurologic and intellectual outcome do not correlate well with the degree of T_4 deficiency found in neonatal screening.

Transplacental transfer of maternal T_4 in the first

trimester may protect the brain during early development.[15] For the same reason, maternal hypothyroidism during fetal development can have persistent neurodevelopmental effects on the child.[15,16,19] Serum T_4 concentrations at term in athyreotic infants are 25% to 50% of those in normal neonates. These concentrations, although low, may contribute to fetal brain development. It is thought that the low-to-normal intelligence of patients with CH treated early in life results most commonly from inadequate treatment or poor compliance.

It must be noted that TH treatment regimens used today are more aggressive in targeting early correction of TSH than were the regimens used 20 or even 10 years ago. Thus, newborn infants with CH today may have an even better intellectual and neurologic prognosis than adults with CH who were evaluated in the reports discussed above.

ASSESSMENT OF PERMANENCE OF HYPOTHYROIDISM

CH is permanent if the thyroid scan reveals an ectopic gland or absent thyroid tissue (confirmed by ultrasonographic examination) or if the serum TSH is seen to increase above 10 mU/L after the first year of life, presumably because of insufficient T_4 replacement.

If no permanent cause of CH was found by scan or there was no TSH increase after the newborn period, then L-T_4 administration should be discontinued for 30 days at some point after the child is 3 years of age.[86] After 30 days, serum should be obtained for measurement of FT_4 and TSH values. It is critical that this follow-up laboratory assessment be obtained in a timely manner and that there be no loss of follow-up. If the FT_4 is low and the TSH value is elevated, permanent hypothyroidism is confirmed and TH therapy should be reinstituted. If the FT_4 and TSH concentrations remain in the reference range, euthyroidism is assumed and a diagnosis of transient hypothyroidism recorded. It is important that the child not be lost to follow-up. The physician should monitor the child carefully and repeat the thyroid function tests at the slightest suspicion of recurrence of hypothyroid symptoms. If the results are inconclusive, careful follow-up and subsequent testing will be necessary.

More severely affected children may become clinically hypothyroid when treatment is discontinued for 30 days. An alternative option is to reduce the TH-replacement dosage by half. If after 30 days the TSH is elevated above 20 mU/L, the permanence of hypothyroidism is confirmed and full replacement therapy should be resumed. If the serum TSH value has not increased, then TH treatment should be discontinued for another 30 days with repeated serum FT_4 and TSH determination as described above.

ADMONITION

Finally, physicians cannot and must not relinquish their clinical judgment and experience in the face of normal newborn thyroid test results. Failure of normal development can result from hypothyroidism in infants who had normal T_4 and TSH newborn screening results. Hypothyroidism can manifest or be acquired after the newborn screening. Rarely, the newborn screening test results can be in error, or human error can result in failure to notify the infant's physician of abnormal test results.[87] When clinical symptoms and signs suggest hypothyroidism, regardless of newborn screening results, serum FT_4 and TSH determinations should be performed.

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FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Use of Chaperones During the Physical Examination of the Pediatric Patient

COMMITTEE ON PRACTICE AND AMBULATORY MEDICINE

KEY WORDS

chaperone, physical examination, physical examination, confidentiality, privacy

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abstract

FREE

Physicians should always communicate the scope and nature of the physical examination to be performed to the pediatric patient and his or her parent. This statement addresses the use of chaperones and issues of patient comfort, confidentiality, and privacy. The use of a chaperone should be a shared decision between the patient and physician. In some states, the use of a chaperone is mandated by state regulations. *Pediatrics* 2011;127:991–993

BACKGROUND

An appropriate physical examination is usually a critical component of a visit to a pediatrician by an infant, child, adolescent, or young adult and represents efficient, sensitive, and effective health care. The extent of the physical examination is determined by both the reason for the visit and diagnostic considerations raised during the taking of the history.

The purpose and scope of the physical examination should be made clear to the parents as well as the patient if he or she is old enough to understand. If any part of the examination may be physically or psychologically uncomfortable, every effort should be made to support the patient and parent, including the use of measures to preserve privacy, such as gowns and drapes.

In the medical office setting, the physical examination of an infant, toddler, or child should always be performed in the presence of a parent or guardian. If a parent or guardian is unavailable or the parent's presence will interfere with the physical examination, such as in a possible case of abuse or parental mental health issues, a chaperone should be present during the physical examination.

If the patient is an adolescent or young adult and the examination requires inspection or palpation of anorectal or genital areas and/or the female breast, a chaperone is recommended. The presence of a chaperone may be useful to reinforce the professional nature of the interaction and content of the examination and to provide a witness in case of misunderstanding.[1] In general, it is wise for male clinicians to have a chaperone during female breast, anorectal, and genital examinations. However, even same-sex examinations can be misunderstood and can benefit from chaperoning. The patient's wishes and comfort should determine the sex of the chaperone.[2] If the patient chooses to have a chaperone, the chaperone should preferably be a nurse or medical assistant. Family members or friends should not be used as chaperones unless specifically requested by the patient and, if at all possible, only in the presence of an additional chaperone who is not a

family member or friend.[3] The name of the chaperone should be documented in the medical record.

The patient or physician might consider the presence of a chaperone problematic in a variety of circumstances. A patient may feel that his or her privacy and confidentiality may be compromised. A patient may experience embarrassment and increased vulnerability with another party present during the examination. Pediatricians could have concerns that providing a chaperone would require additional staff or that they would not have a chaperone of the desired gender available. In these situations, the use of a chaperone may not be possible.

The use of a chaperone should be a shared decision between the patient and physician. The patient's preference should be given the highest priority when deciding on the use of a chaperone.[4–7] If the patient declines the use of a chaperone, the pediatrician should document this fact in the medical record. Regardless of whether a chaperone is used, the physician should review the scope and findings of the examination with the patient and parents at completion of the examination. This review should be documented in the medical record.

In certain situations, a physician may request the presence of a chaperone, particularly when a patient or parent is exhibiting mental health issues; has developmental issues; or displays anxiety, tension, or reluctance toward examination. If the explanation of the scope and confidentiality of the examination does not resolve the tension or conflict, the use of a chaperone during the examination is appropriate.[8] The pediatrician needs to communicate with the patient and parent why a chaperone is required in this situation. For the rare situation in which the patient refuses an appropriate chaperone and the physician is concerned that providing the examination might result in false allegations or medicolegal risk, the physician is not obligated to provide further treatment.[9] If a patient request for a chaperone is not able to be accommodated, the patient may refuse to receive further treatment. If care is not provided, the physician must discuss with the patient the risks of not receiving further care and offer alternatives, including being examined by another provider or seeking care elsewhere. This discussion should be documented in the medical record.

Pediatricians should develop and follow a clear policy for the office or clinic setting regarding the presence of a chaperone during parts of the physical examination. This policy should include respect for privacy and confidentiality by the chaperone.[10] Pediatricians should document in the medical record if they are unable to adhere to the policy or state medical board regulations regarding the use of a chaperone.

RECOMMENDATIONS

1. Communication in advance regarding the components of the physical examination is of critical importance. Effective communication will help ensure that there is no misunderstanding about the reasons for and conduct of the examination.
2. If the patient is an adolescent or young adult and the examination requires inspection or palpation of anorectal or genital areas and/or the female breast, a chaperone is recommended. However, the use of a chaperone should be a shared decision between the patient and physician.
3. If a medical chaperone is indicated and the patient refuses, the patient or parent should be given alternatives, including seeking care elsewhere.
4. Pediatricians should develop policy about the use of chaperones in the office or clinic setting and document in the medical record if they are unable to adhere to the policy or state medical board regulations.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Drugs

Use of Codeine- and Dextromethorphan-Containing Cough Remedies in Children

ABSTRACT. Numerous prescription and nonprescription medications are currently available for suppression of cough, a common symptom in children. Because adverse effects and overdosage associated with the administration of cough and cold preparations in children have been reported, education of patients and parents about the lack of proven antitussive effects and the potential risks of these products is needed.

INDICATIONS AND CONTRAINDICATIONS

Cough is a reflex response to mechanical, chemical, or inflammatory irritation of the tracheobronchial tree mediated by sensory neurons in the airways reflexly through neurons in the brainstem. Cough serves as a physiologic function to clear airways of obstructive or irritating material or to warn of noxious substances in inspired air.[1]

In some pathologic states (eg, asthma, bronchopulmonary dysplasia, cystic fibrosis, and a variety of inflammatory conditions), excessive and/or abnormal airway secretions may be produced. The cough reflex serves to maintain airway patency by clearing these secretions. Clearing of pathologic tracheobronchial secretions is essential to patient management and may be enhanced by chest physiotherapy. Cough suppression may adversely affect patients with these conditions by promoting pooling of secretions, airway obstruction, secondary infection, and hypoxemia.

Many common respiratory conditions in which cough is prominent (eg, respiratory viral infections) are self-limited (lasting a few days). Cough may be an expression of airway reactivity or asthma. The cough that is associated with these conditions may be satisfactorily managed with fluids and increased ambient humidity (especially of value with croup). When cough is persistent, it is usually secondary to infection, allergy (including asthma), environmental irritants (eg, cigarette smoke, dust particles) or, occasionally, a foreign body. Therapy should be directed at the underlying condition for lasting benefit.

ANTITUSSIVE AGENTS

Most cough suppressant preparations are marketed as mixtures of dextromethorphan or codeine with antihistamines, decongestants, expectorants, and/or antipyretics. Some nonprescription preparations substitute diphenhydramine or eucalyptus oil in place of codeine or dextromethorphan. Prescription medications may substitute other narcotic agents (hydrocodone or hydromorphone) for codeine and may be more addictive than codeine.[2,3] In addition, many of these cough products are elixirs, which may contain up to 25% alcohol by volume.[3]

The over-the-counter availability of numerous cough and cold preparations promotes the perception that such medications are safe and efficacious. Although codeine and dextromethorphan are efficacious for cough suppression in adults,[1] similar efficacy has not been demonstrated in children. Taylor et al[4] conducted a randomized, controlled trial of codeine, dextromethorphan, and placebo in children with acute nocturnal cough without evidence of chronic underlying lung disease (asthma, cystic fibrosis, or bronchopulmonary dysplasia). Neither dextromethorphan nor codeine in the dosages used was significantly more effective than placebo in reduction of acute cough. Studies using larger dosages have not been performed. Other studies focusing exclusively on children with cough have not been placebo-controlled trials.[5–7] To our knowledge, studies of the use of other purportedly antitussive agents in children, such as diphenhydramine, have not been reported in the literature.

Demonstration of the efficacy of antitussive preparations in children is lacking, and these medications may be potentially harmful.[8] Decongestant (sympathomimetic) components of these mixtures administered to children have been associated with irritability, restlessness, lethargy, hallucination, hypertension, and dystonic reactions.[8] The clearance and metabolism of the components of cough mixtures may vary with age[9] and disease state.[10,11] Great variability in the enterohepatic circulation of these drugs is noted in adults, which affects drug response, especially with repeated dosing.[3] The relative immaturity of hepatic enzyme systems that metabolize drugs in young children may enhance the risk of adverse effects of such medications, especially in infants younger than 6 months.[9] Metabolism and/or toxicity also may be altered by concurrent use of medications such as acetaminophen.[12] Unfortunately, the dosing guidelines for these agents are based on extrapolation from adult data without consideration of their potentially unique metabolism and disposition in children.

Codeine

In adults, codeine and dextromethorphan have been shown to suppress both artificially induced and

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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disease-related cough, mainly through central nervous system mechanisms.[13] A linear relationship has been shown to exist between a codeine dosage in the range of 7.5 to 60 mg/d and a decrease in the frequency of chronic cough.[14] Complete suppression of cough was not achieved in these trials, even at the highest daily dose of codeine.

Dosage

Pharmacokinetic studies of codeine therapy in children are lacking. The published dosage recommendation for codeine in children is 1 mg/kg/d in four divided doses, not to exceed 60 mg/d.[12] To our knowledge, no well-controlled studies have documented the safety and efficacy of this dosage.

Adverse Reactions and Overdosage

The principal clinical manifestations of codeine toxicity are respiratory depression and obtundation.[14,15] In children, antitussive dosages of 3 to 5 mg/kg/d have produced somnolence, ataxia, miosis, vomiting, rash, facial swelling, and pruritis. Respiratory depression requiring mechanical ventilation occurred in 3% of children receiving dosages greater than 5 mg/kg/d; two of these patients died.[16] Dosages of codeine less than 2 mg/kg are unlikely to be associated with significant adverse reactions. Reports of adverse reactions to codeine are based on single dose ingestions; the repetitive administration of codeine for therapeutic purposes may be associated with adverse symptoms at doses lower than a single dose of 5 mg/kg. In adults, glucuronide conjugation in the liver apparently inactivates codeine, but 10% of an oral dose is demethylated to form morphine, which is believed by some to be the active form of the drug.[17] The hepatic glucoronidation pathway is incompletely developed in infants, which places them at particular risk for adverse dose-related effects. Furthermore, alteration of hepatic enzyme pathways by illness or concurrent drug therapy (such as acetaminophen) may further alter metabolism of this drug and increase the risk of drug toxicity.[10,11]

Other narcotic antitussives that are available in cough preparations, such as hydrocodone and hydromorphone, have no demonstrated advantage as antitussive agents compared with codeine, have similar adverse effects, and have a greater risk of dependency.[12] Hydrocodone and hydromorphone are classified as Schedule III drugs under the Controlled Substances Act.

Dextromethorphan

The addictive potential of codeine encouraged the marketing of dextromethorphan in a variety of cough and cold preparations. Although dextromethorphan is chemically derived from the opiates, it has no analgesic or addictive properties. The cough suppression potency of dextromethorphan in adults is nearly equal to that of codeine.[2] The drug, like codeine, acts on the central nervous system to elevate the threshold for coughing.[2]

Dosages

Pharmacokinetic studies and demonstrations of the efficacy of cough suppression in children are lacking. Dosages of dextromethorphan of equal antitussive potency to codeine produce comparable levels of central nervous system depression in adults.[15] The recommended dosage in children is similar to that for codeine (ie, 1 mg/kg/d divided into 3 to 4 doses).[3]

Adverse Reactions and Overdosage

Acute overdosage of cough mixtures containing dextromethorphan has resulted in behavioral disturbances, including respiratory depression.[8]

CONCLUSIONS AND RECOMMENDATIONS

1. No well-controlled scientific studies were found that support the efficacy and safety of narcotics (including codeine) or dextromethorphan as antitussives in children. Indications for their use in children have not been established.
2. Suppression of cough in many pulmonary airway diseases may be hazardous and contraindicated. Cough due to acute viral airway infections is short-lived and may be treated with fluids and humidity.
3. Dosage guidelines for cough and cold mixtures are extrapolated from adult data and clinical experience, and thus are imprecise for children. Adverse effects and overdosage associated with administration of cough and cold preparations in children are reported. Further research on dosage, safety, and efficacy of these preparations needs to be done in children.
4. Education of patients and parents about the lack of proven antitussive effects and the potential risks of these products is needed.

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American Academy of Pediatrics
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CLINICAL REPORT

The Use of Complementary and Alternative Medicine in Pediatrics

Guidance for the Clinician in Rendering Pediatric Care

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ABSTRACT

The American Academy of Pediatrics is dedicated to optimizing the well-being of children and advancing family-centered health care. Related to these goals, the American Academy of Pediatrics recognizes the increasing use of complementary and alternative medicine in children and, as a result, the need to provide information and support for pediatricians. From 2000 to 2002, the American Academy of Pediatrics convened and charged the Task Force on Complementary and Alternative Medicine to address issues related to the use of complementary and alternative medicine in children and to develop resources to educate physicians, patients, and families. One of these resources is this report describing complementary and alternative medicine services, current levels of utilization and financial expenditures, and associated legal and ethical considerations. The subject of complementary and alternative medicine is large and diverse, and consequently, an in-depth discussion of each method of complementary and alternative medicine is beyond the scope of this report. Instead, this report will define terms; describe epidemiology; outline common types of complementary and alternative medicine therapies; review medicolegal, ethical, and research implications; review education and training for complementary and alternative medicine providers; provide resources for learning more about complementary and alternative medicine; and suggest communication strategies to use when discussing complementary and alternative medicine with patients and families. *Pediatrics* 2008;122:1374–1386

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The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

Key Words
complementary, alternative, patient-centered, communication, ethics, epidemiology, health services, integrative

Abbreviations
NCCAM—National Center for Complementary and Alternative Medicine
NIH—National Institutes of Health
CAM—complementary and alternative medicine
AAP—American Academy of Pediatrics
TCM—traditional Chinese medicine
FDA—Food and Drug Administration
DSHEA—Dietary Supplements Health and Education Act
RCT—randomized, controlled trial

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INTRODUCTION

The National Center for Complementary and Alternative Medicine (NCCAM) of the National Institutes of Health (NIH) defines complementary and alternative medicine (CAM) as a group of diverse medical and health care systems, practices, and products that are not presently considered to be part of conventional Western medicine.[1] Complementary medicine is used in conjunction with conventional medicine; for example, massage, guided imagery, and acupuncture may be used in addition to analgesic medications to help decrease pain. Alternative medicine is used in place of conventional Western medicine; for example, some adolescents use herbs rather than antidepressant medications to treat depression.

The distinction between CAM and mainstream medicine has lessened as many practices have undergone rigorous research and have been integrated increasingly into mainstream care. For example, guided imagery and massage have been proven to be effective in the treatment of pain and are now included in many tertiary care settings.[2–5] Since the American Academy of Pediatrics (AAP) convened the Task Force on Complementary and Alternative Medicine in 2000 and since the creation of the NCCAM, these complexities inherent in the definition of CAM have become more problematic. Given the wide usage and general understanding of the term "CAM," it will be used throughout this report. However, the term "CAM" has been replaced increasingly with "holistic" or "integrative" medicine. Holistic medicine refers to patient-centered care that includes consideration of biological, psychological, spiritual, social, and environmental aspects of health. Integrative medicine is relationship-based care that combines mainstream and complementary therapies for which there is some high-quality scientific evidence of safety and effectiveness to promote health for the whole person in the context of his or her family and community.[1] Integrative medicine also reaffirms the importance of the relationship between the practitioner and the patient, emphasizes wellness and the inherent drive toward healing, and focuses on the whole person, using all appropriate therapies to achieve the patient's goals for health and healing.[6]

The AAP Provisional Section on Complementary, Holistic, and Integrative Medicine, established in 2005, also contributed extensively to this report.

Epidemiology

The use of CAM in Western medicine has grown dramatically in recent decades. Many CAM therapies, such as herbal remedies, are mainstream or traditional in many parts of the world. The World Health Organization estimates that most of the world's population regularly uses "traditional medicine" such as traditional Chinese medicine (TCM), Ayurvedic medicine, and Native American healing practices.

In the United States, more than one third of adults have used CAM.[7] The total number of visits to CAM providers increased by 47.3%, from 420 million visits in 1990 to 629 million visits in 1997.[8] The number of visits to CAM providers in 1997 exceeded the total number of visits to primary care physicians in the same year.[8] Estimated expenditures for CAM services for adults increased by 45.2% between 1990 and 1997, with a conservative estimate of $21.2 billion spent in 1997. Of that total, out-of-pocket expenses were estimated to be $12.2 billion. This figure exceeded the 1997 out-of-pocket expenditures for all US hospitalizations.[8] More recent studies have described CAM use among adults as high as 62%,[9] with 41% of adults using 2 or more CAM therapies in a 12-month period.[10]

Children and adolescents also are using CAM therapies increasingly. Weighted estimates of the amount paid for pediatric expenditures on CAM visits and remedies were $127 million and $22 million, respectively.[11] An analysis of the 1996 US Medical Expenditure Panel Survey indicated that only 2% of the pediatric population uses CAM.[12] However, an early study of Canadian children reported 11% use of professionally provided CAM therapies, with chiropractic, homeopathy, naturopathy, and acupuncture accounting for 84% of CAM use.[13] Approximately 20% to 40% of healthy children seen in outpatient pediatric clinics[14–17] and more than 50% of children with chronic, recurrent, and incurable conditions use CAM, almost always in conjunction with mainstream care.[18–20] The use of CAM is considerably higher in certain groups of children, including children with special health care needs[21] and homeless adolescents, who have a reported use as high as 70%.[22] Use tends to be most common among patients with asthma,[23–25] attention-deficit/hyperactivity disorder,[26–28] autism,[29–31] cancer,[32–36] cerebral palsy,[37] cystic fibrosis,[38] inflammatory bowel disease,[39,40] and juvenile rheumatoid arthritis.[41] Presently, there is little research on the effectiveness of most CAM therapies for many of these conditions.[42] The NCCAM funds various studies, but to date, they have not addressed the pediatric population as a priority focus area for research.

Most pediatric patients who receive complementary therapies also receive conventional care.[13] This fact underscores the importance of pediatricians being aware of the necessity to have an open, respectful relationship and clear communication with families. A 2001 policy statement from the AAP Committee on Children With Disabilities, "Counseling Families Who Choose Complementary and Alternative Medicine for Their Child With Chronic Illness or Disability,"[43] recognized that the use of CAM is increasing and provides information and guidance for pediatricians when counseling families about CAM.

Patients' Characteristics and Reasons for Using CAM

Children who use CAM are more likely to be seeing their pediatrician for an illness, take medication on a regular basis, and have ongoing medical problems.[14] Approximately half of parents/caregivers of children who used CAM saw a CAM provider for themselves. The majority (66%) of parents/caregivers of CAM users had not informed their child's doctor of the use of CAM for their child.[14] There has been no consistent connection between CAM use and parent income, children's gender, or usual source of care,[13,14,16–19,44] and there have been mixed findings connecting CAM use and parent education level, family ethnicity, insurance coverage, and child's age.[13,16–19,44,45]

There are various reasons for the growing use of CAM. Many users of CAM reported use "not so much as a result of being dissatisfied with conventional medicine, but largely because they found these health care alternatives to be more congruent with their own values, beliefs, and philosophical orientations toward health and life."[46] Parents' reasons for seeking care for their children from CAM providers included, in decreasing order of frequency, word of mouth, particular treatment was considered effective, fear of drug adverse effects, dissatisfaction with conventional medicine, and the need for more personal attention.[13] In addition, many cultural groups may use CAM because of cultural values and beliefs.

Insurance Coverage

Many insurers offer coverage for CAM services. A 1996 survey of managed care organizations reported that 70% of surveyed plans have experienced an increased demand from members for CAM services and that 58% intended to offer some services within the next 2 years.[47] A 2004 Kaiser Family Foundation employer survey revealed that 87% of covered employees had chiropractic coverage, and 47% had acupuncture coverage.[48] The Landmark Report II on Health Maintenance Organizations and Alternative Care reported that 67% of health maintenance organizations offer some type of alternative care.[49] In addition, many Medicaid programs pay for the use of some CAM services. Of 46 reporting states, 36 (78.3%) Medicaid programs provide coverage for at least 1 alternative therapy,[50] most commonly chiropractic care (reimbursed by 33 programs), biofeedback (reimbursed by 10 programs), acupuncture (reimbursed by 7 programs), and hypnotherapy and naturopathy (reimbursed by 5 programs each).[50] Because state Medicaid benefits packages change frequently, pediatricians are encouraged to become familiar with their state's list of covered services.

Some states require coverage for CAM services. In 1996, Blue Cross of Washington launched a plan called AlternaPath in response to the passing of a Washington state law in the same year mandating that all commercial health insurance companies cover the services provided by every category of licensed provider.[51] Currently, most states require coverage of chiropractic care, and more than 50% of all health maintenance organizations cover these services.[47] Although very few states mandate coverage of acupuncture or massage therapy, these services are quickly becoming part of many insurers' benefit plans. The scope of services covered by insurers varies considerably; most coverage is disease-treatment oriented, with limited (either by scope or by number) visits allowed per diagnosis. Many plans offer a separate rider for purchase by either the employer or employee at an additional cost, and other plans offer CAM coverage as an embedded benefit to everyone in the program. Another type of program is an affinity discount network, in which certain CAM providers are designated as members of the network. Members of the program pay providers directly at a discounted fee.[52]

In a 1998 survey, the most common treatment modality covered by insurance plans was chiropractic care, with coverage ranging from 41% to 65%. By contrast, homeopathic treatments were covered by only 4% to 11% of all plans; acupuncture was covered by 9% to 19%; biofeedback was covered by 4% to 10%; and massage therapy was covered by 6% to 10%.[52]

Despite the public's increasing use of CAM therapies and willingness to pay out-of-pocket for these services, health insurers have had difficulty including them in their plans because of variation in credentialing, difficulties with accounting, and because there are so few *Current Procedural Terminology* (CPT) codes that cover these services.[52] Although there are CPT codes that cover some CAM techniques, CAM providers may find them difficult to implement because of philosophical differences with a system that singles out disease states or organs from the whole person. Some CAM providers use a separate coding system of more than 4000 codes for CAM procedures and supplies, known as the alternative billing concept or "ABC" codes.[53]

Government Response

The Office of Alternative Medicine was established as part of the NIH by congressional mandate in 1992. In 1998, the Office of Alternative Medicine became the NCCAM. The NCCAM has increased its fiscal-year appropriations from $50 million in 1998 to an estimated $123 million in 2006.[1] Total funding by all institutes and centers of the NIH for research and training on CAM and the training of investigators to study CAM exceeded $225 million in 2006, with additional funding being provided by other agencies and philanthropic foundations.[1] Of the approximately 360 NCCAM-funded research projects in 2006, fewer than 5% were related to pediatrics, including research on the effects of massage for preterm infants, probiotics, omega-3 fatty acids, and food allergies.[1] In 2007 and 2008, the AAP Provisional Section on Complementary, Holistic, and Integrative Medicine urged the NCCAM to consider increasing their priorities and funding for pediatric research, education, and information dissemination (Harry Gewanter, MD, verbal communication).

In 2000, the US President and Congress assembled and mandated the White House Commission on Complementary and Alternative Medicine Policy to make administrative and legislative recommendations to maximize the benefits of CAM for Americans. Comprising 20 physicians and other clinicians, CAM providers, and other experts, the commission was charged with developing a report to address the following:

- education and training of clinicians;
- research to increase knowledge regarding CAM;
- provision of reliable information to clinicians and the public; and
- guidelines for appropriate access to and delivery of CAM.

In March 2002, the commission issued its report, which addressed these charges and examined the relevance of CAM to national efforts to promote health, and created a central coordinating office. The report included 29 recommendations and more than 100 action items for federal agencies, Congress, state government, and other groups.[54]

In 2005, at the request of the NIH and the Agency for Healthcare Research and Quality, the Institute of Medicine released the report *Complementary and Alternative Medicine in the United States*. The report assessed what is known about Americans' reliance on CAM therapies and assisted the NIH in developing research methods and setting priorities for evaluating such products and therapies.[55]

The US Food and Drug Administration (FDA) also has weighed in on CAM-related issues. The Dietary Supplements Health and Education Act of 1994 (DSHEA) amended previous FDA statutes to encompass dietary supplement–specific provisions, including the definition of a "dietary supplement," product safety, nutritional statements and claims, ingredient and nutritional labeling, good manufacturing procedures, and the classification of "new" dietary ingredients.[56]

Under the DSHEA, a dietary supplement is:

- a product (other than tobacco) intended to supplement the diet that bears or contains 1 or more of the following ingredients: a vitamin, a mineral, an herb or other botanical, or an amino acid;
- intended for ingestion in pill, capsule, tablet, or liquid form;
- not used as a conventional food or as the sole item of a meal or diet; and
- labeled as a dietary supplement.

This classification of dietary supplements is specifically separate from food or drug categories and, as such, lies outside the jurisdiction of many of the safety and regulatory rules that cover food and drugs.[56]

According to the DSHEA, manufacturers bear the burden of proof of ingredient safety of dietary supplements. However, unlike pharmaceutical preparations, dietary supplements can be marketed without proven safety or efficacy. A manufacturer does not have to provide the FDA with the evidence on which it relies to substantiate safety or effectiveness before or after it markets its products. For new ingredients, the manufacturer is only required to provide evidence to the FDA that the product is "reasonably expected to be safe."[56]

Manufacturers of supplements are not required to report any data on adverse events to the FDA. The FDA can demonstrate that a supplement is unsafe only after it reaches the market. The FDA must prove that the product is unsafe before it can restrict a product's use or take other legal action. The FDA largely relies on the MedWatch voluntary reporting system to collect safety data on dietary supplements.[57]

The DSHEA also regulates third-party literature regarding dietary supplements. Informational materials (ie, articles, fact sheets, etc) may be displayed in commercial retail sites provided they are displayed separately from the product, do not contain false or misleading information, and do not promote a specific brand of supplement. Most important, the DSHEA regulates the labeling of dietary supplements. Under this provision, any claims to prevent, treat, or cure a specific disease are expressly prohibited (unless approved by the FDA). Labels can include statements describing the supplement's effects on the "structure and function" or general "well-being" of the body as long as they are truthful and bear the statement, "This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease."[56]

Finally, like food products, dietary supplements are allowed to have suggested dosages on the label and must bear nutritional labeling. The label must include the name and quantity of each dietary ingredient, and if the ingredient is botanical in origin, the label must state the part of the plant from which the ingredient is derived.[56]

Physician Awareness, Attitude, and Perception

In 1995, the American Medical Association passed a resolution suggesting that its 300 000 members become better informed regarding the practices and techniques of CAM.[57] Many primary care physicians, including pediatricians, recommend and refer patients for complementary therapies.[58,59] In the 2001 AAP Periodic Survey 49, "Complementary and Alternative Therapies in Pediatric Practice," pediatricians reported that they recognize patients' frequent use of CAM therapies and expressed a strong desire for additional education on CAM topics.[60] Topics of greatest immediate interest included herbs, dietary supplements, special diets, and exercise. More than one third of the pediatricians reported that they or their families used some type of CAM therapy. Of those reporting CAM use, 70% used massage therapy, 21% received chiropractic care, 13.5% consulted a spiritual or religious healer, and 13% had used acupuncture.[60]

TABLE 1 **The Kemper Model of Holistic Care**

Component	Example
Biochemical	Medications, dietary supplements, vitamins, minerals, herbal remedies
Lifestyle	Nutrition; exercise/rest; environmental therapies such as heat, ice, music, vibration, and light; mind-body therapies (behavior management, meditation, hypnosis, biofeedback, counseling)
Biomechanical	Massage and bodywork, chiropractic and osteopathic adjustments, surgery
Bioenergetic	Acupuncture, radiation therapy, magnets, Reiki, healing touch, qi gong, therapeutic touch, prayer, homeopathy

A growing number of pediatric generalists and subspecialists have begun to offer complementary therapies and advice as part of their practice. In addition, there is a growing number of academic pediatric integrative medicine programs and new initiatives to promote systematic sharing, support, and dissemination of information to improve collaborative and comprehensive care. These initiatives include the AAP Provisional Section on Complementary, Holistic, and Integrative Medicine[61]; the International Pediatric Integrative Medicine Network; and the Pediatric Complementary and Alternative Medicine Research and Education Network.[62] However, these initiatives may be insufficient to ensure consistent, quality education across the spectrum of medical education. Standardized curricula or content specifications for physician education on CAM therapies should be considered for medical school, residency, and continuing medical education activities.

COMMON CAM THERAPIES

As a means of understanding and integrating different modalities encompassing complementary and mainstream therapies, the Kemper model of holistic care (Table 1) has been widely accepted.[63] This paradigm integrates complementary and mainstream therapies into a coherent construct of treatment options.[63] Another model for understanding CAM therapies has been developed by the NCCAM. This framework focuses on CAM rather than integration of therapies. The most common CAM therapies used by infants, children, and adolescents within the NCCAM framework follow. A complete description of all therapies and scientific evidence regarding each of them is beyond the scope of this report.

Biologically Based Practices (Use of Vitamins, Herbs, Other Dietary Supplements, Diets, and Foods)

According to the NCCAM, biologically based practices include the use of botanicals, animal-derived extracts, vitamins, minerals, fatty acids, amino acids, proteins, prebiotics and probiotics, whole diets, and functional foods.[1] Of these, multivitamins are the most frequently used CAM products by children, with up to 41% reported usage.[14,15] Among teenagers who use CAM, nearly 75% use herbs and other dietary supplements.[64] Controlled studies have investigated the use of dietary

supplements for various conditions including asthma, upper respiratory infections, diarrhea, depression, anxiety, and attention-deficit/hyperactivity disorder.[65–67] Several studies are in progress, and the research literature is expanding rapidly. For example, the use of probiotics was considered complementary in the mid-1990s but has become mainstream practice in the 21st century as many gastroenterologists recommend and use them in daily practice for patients with inflammatory bowel disease.

There are a number of excellent review articles on the use of herbal products in pediatric populations[64–66,68,69] as well as data on potentially toxic herbal products and herb-drug interactions.[70–79] Because of regulations differing from those governing the use of pharmaceuticals, there are concerns about the purity and potency of herbal products and other dietary supplements sold in the United States. Product quality is influenced by many factors, including which portion of the plant is used (ie, root, stem, leaves, flowers), the time of harvest (ie, young versus old plants), the handling of the product, and proper identification of the plant. Furthermore, labeling is often inaccurate.[80–82] To conduct research, the quality of product must be guaranteed, and to compare clinical trials, the similarity of product must be ensured.

Dietary therapies such as the ketogenic diet in the treatment of seizure disorders[83] have become an accepted practice for some health conditions. However, the popularity of other diets has risen to a new level as the prevalence of obesity and metabolic syndrome has increased and traditional exercise and diet "prescriptions" have failed. The macronutrient content of these popular diets varies widely.[1]

Manipulative and Body-Based Practices

As defined by the NCCAM, manipulative and body-based practices include chiropractic and osteopathic manipulation, massage therapy, reflexology, Rolfing, Bowen technique, and Trager approach.[1]

Chiropractic care is one of the most common professionally provided CAM practices. It focuses on the relationship between body structure (primarily that of the spine) and bodily function and how that relationship affects health. With more than 50 000 chiropractors licensed in the United States, the number of children visiting chiropractors is substantial and increasing.[84] Recent studies have confirmed that up to 14% of all chiropractic visits were for pediatric patients[14,15] and that chiropractors were the most common CAM providers visited by children and adolescents.[14] Few randomized, controlled trials (RCTs) have demonstrated significant clinical benefits of chiropractic practices among pediatric patients[85]; additional studies are needed, and parents need to be cautioned not to rely on chiropractic care as the primary treatment for serious conditions such as cancer. Although anecdotal data suggest that severe complications are possible with chiropractic treatment of infants and children, such adverse effects seem to be rare.[86] Further systematic studies are needed to determine the costs, benefits, and safety of this widely used practice.

Massage is another common manipulative practice that is frequently provided at home by parents and by licensed massage therapists and nurses in clinical settings. Massage is now routine practice in many NICUs to promote growth and development in preterm infants.[2–4] Massage also has been demonstrated to be beneficial in alleviating symptoms from asthma, insomnia, colic, cystic fibrosis, and juvenile rheumatoid arthritis.[87–92]

Mind-Body Medicine

As defined by the NCCAM, mind-body medicine includes diverse practices such as relaxation, visual imagery, tai chi, qi gong, yoga, meditation, prayer, hypnosis, biofeedback, diaphragmatic breathing, progressive muscle relaxation, and cognitive-behavioral therapies. Many of these practices, particularly prayer, are commonly used among adults.[11] In children, popular techniques include prayer, progressive relaxation exercises, meditation, biofeedback, and hypnosis.[14,15] Hypnotherapy encourages the child to use his or her imagination to improve health and health behaviors.

Guided imagery, hypnosis, and biofeedback have been shown to be effective adjuncts to medical therapy for such common conditions as chronic, acute, and recurrent pain; anxiety and stress disorders; enuresis; encopresis; sleep disorders; autonomic nervous system dysregulation; habitual disorders; attention and learning disorders; asthma; cancer; and diabetes.[5] These therapies generally have few or no adverse effects.[5]

Spiritual healing includes prayer and is the most prevalent complementary therapy in the United States.[9] Spiritual healing is sometimes included under the rubric of mind-body therapies and sometimes under the rubric of biofield or bioenergetic therapies.[1] Eighty-two percent of Americans believe in the healing power of personal prayer, 73% believe that praying for someone else can help cure their illness, and 77% believe that God sometimes intervenes to cure people who have a serious illness.[93] Prayer is used by up to two thirds of parents for their children.[14,15]

Studies have suggested that spiritual/religious beliefs and practices may contribute to decreased stress and increased sense of well-being and enhanced immune system functioning.[93] RCTs of the clinical therapeutic effects of prayers in pediatrics are lacking. Some states have pursued legal measures against parents seeking to use prayer or spiritual healing as an alternative to conventional medical therapy for children with serious medical problems such as cancer. However, most families view spiritual healing as a personal practice that is complementary to medical care rather than a replacement for it.

Biofield Therapies

According to the NCCAM, biofield therapies are "intended to affect energy fields that purportedly surround and penetrate the human body." These therapies "manipulate biofields by applying pressure and/or manipulating the body by placing the hands in, or through, these fields."[1] Biofield techniques include acupuncture,

homeopathy, polarity therapy, magnet therapy, Japanese Reiki and Johrei, Chinese qi gong, therapeutic touch, healing touch, and spiritual healing.

Perhaps the best known of the noninvasive biofield therapies is therapeutic touch, which is taught in more than 80 nursing schools and provided in numerous hospitals in the United States. Therapeutic touch is a form of energy medicine that has been developed by nurses on the basis of the premise that healing is promoted when the body's energies are in balance. Nurse-healers are trained to identify and treat energy imbalances to improve the patient's well-being.[94]

Studies on the effectiveness of biofield therapies in pediatric populations have been limited, but the therapies are generally safe.[95,96]

Acupuncture

Acupuncture has been one component of TCM, which also includes herbal remedies, diet, massage, and lifestyle. Today, acupuncture describes a family of procedures involving stimulation of anatomic points on the body by a variety of techniques. American practices of acupuncture incorporate medical traditions from China, Japan, Korea, and other countries. The acupuncture technique that has been most studied scientifically involves penetrating the skin with thin, solid, metallic needles that are manipulated by hand or by electrical stimulation.[1] Variants of needle therapy include stimulation of acupuncture points by vigorous massage (shiatsu), heat (moxibustion), lasers, magnets, gentle massage or pressure (acupressure), or electrical currents.

Acupuncture is used by an increasing number of pediatric patients. A meta-analysis of the use of acupuncture in the treatment of recurrent headaches suggested potential benefit.[97] Additional applications for acupuncture may include nausea, pain, and allergy.[98–101]

Whole or Traditional Medical Systems

Whole medical systems involve complete systems of theory and practice that have evolved independently from or parallel to conventional Western medicine.[1] They include homeopathy, naturopathic medicine, TCM, Ayurvedic medicine (India's traditional system of medicine), and healing systems of American Indian/Alaska Native, African, Middle Eastern, Tibetan, and other indigenous populations.

Homeopathy

Developed by Samuel Hahnemann in 1790, homeopathy is based on the theory that "like cures like," meaning that small, highly diluted quantities of medicinal substances are given to cure symptoms, when the same substances given at higher or more concentrated doses would actually cause those symptoms.[1] Unlike classic pharmacology, homeopathy follows the theory that the greater the dilution, the greater the potency of the product. In the United States, an estimated 3000 clinicians, including physicians, nurses, chiropractors, naturopaths, and dentists, use homeopathy in their practices.[101] A range of 2% to 10% of children use homeopathic remedies, most often for respiratory problems, teething, otitis media, and other conditions related to the ears, neck, and throat.[14,15]

SPECIAL POPULATIONS

Adolescents

Numerous reports have described the frequent use of CAM by adolescents.[44,102–106] In Seattle, Washington, 70% of homeless adolescents reported using some form of CAM,[22] and among 9th- and 12th-grade students in Massachusetts, herbal remedies were used by up to 20% of respondents.[107] In a survey of New York teenagers, the most frequently used therapies were massage, prayer or faith healing, herbs, vitamins, performance-enhancing supplements, and special exercises.[105] Many adolescents use supplements to improve their body image or athletic performance. As many as 4.5% of boys and 0.8% of girls in secondary school used creatine[108]; of those, 73% were student athletes.

In general, adolescents seem to be more open than adults are to using CAM therapies, and adolescents are more inclined to use CAM if their parents also use these therapies.[103] Adolescence is characterized by increasing cognition, independence, increased desire for privacy and autonomy, and higher incidence of risky behavior. In addition, as they begin to take responsibility for their own health needs, adolescents also may use CAM therapies as self-treatment. The Internet is also becoming a larger influence on the lives of teenagers. Many dietary supplements are promoted on the Internet and promise relief of adolescent concerns such as acne and obesity, or they promise enhanced energy and sports performance. Some pediatricians refer patients to CAM providers or provide complementary therapies themselves, integrating them into conventional medical practice.

Children With Chronic Illness or Disability

Children with special health care needs are frequent users of CAM. The rate of CAM use for this population is estimated to be 30% to 70%.[21,29–41] In a recent survey of families of children with developmental disabilities, families wanted their clinicians to be able to counsel them about CAM options.[109] An overview of these issues and recommendations for counseling children with special health care needs and their families is outlined in a 2001 AAP Committee on Children With Disabilities statement, "Counseling Families Who Choose Complementary and Alternative Medicine for Their Child With Chronic Illness or Disability."[43]

Ethnic and Cultural Groups

Use of CAM therapies varies among different ethnic and cultural groups. Excluding prayer, CAM is used less commonly by Hispanic and black individuals than by white individuals, and its use by Hispanic and black people is less likely to be disclosed to clinicians.[110] Families of different cultural backgrounds use different herbs, over-the-counter remedies, and other items traditionally used for cooking as home remedies.[111,112] Many ethnic and cultural groups also use traditional

healing practices such as TCM, Ayurvedic medicine, and American Indian/Alaska Native healing practices, which can include a variety of diverse therapies and native healers within a coherent cultural belief system.[113,114] Use of these remedies is often integrated with conventional medicine but may not be reported unless the clinician specifically inquires about them.[110]

RESEARCH ISSUES

Although many CAM therapies have not yet been evaluated formally in children, a 2002 review identified more than 1400 RCTs and 47 systematic reviews of pediatric CAM.[115] Formal evaluation has suggested that the quality of RCTs of CAM is as good as that of RCTs of conventional medicine,[116] and the quality of systematic reviews of CAM exceeds that of systematic reviews of conventional medicine.[117] It should be noted that publication bias in CAM research is opposite that of conventional medicine; that is, negative studies are more likely to be published in well-known journals, and positive studies are more likely to be published in foreign-language journals.[118] Those interested in promoting an evidence-based approach to the use of CAM therapies must be cognizant of the bias created by applying language restrictions in their search strategy. Other approaches to evidence-based CAM include *n*-of-1 evaluation, whereby methodologic rigor (eg, blinding, randomization) is combined with an individualized approach fundamental to many CAM therapies.[119]

There are some unique considerations when examining the efficacy of CAM, including heterogeneity of both products and practices. Lack of regulation of many commonly used practices exacerbates heterogeneity, making treatment effect difficult to measure. The relative lack of CAM expertise in conventional institutions results in inadequate peer review and undue difficulties when attempting to obtain institutional review board approval to study CAM in children.

Although CAM use is common in children, there have been few reports of serious adverse effects. Most current safety data come from case reports. Some population-based surveillance studies to monitor adverse events have been conducted in adults receiving acupuncture, and the resulting data are reassuring.[120] The need for rigorous safety evaluation is questioned by some who perceive "natural" to be equivalent to "safe." More complete data about safety in children would require prospectively gathered, population-based studies, which are expensive to conduct.

There are numerous challenges inherent in all clinical research, and these difficulties are compounded when performing research in children and on therapies based on different cultural concepts of what causes or constitutes disease and health. The NCCAM has identified women and minority populations as priority groups for federally funded research on CAM, but it has not yet added pediatrics to this priority listing.

EDUCATION AND TRAINING

The number of CAM providers is increasing. The number of CAM providers in the United States is projected to increase 88% between 1994 and 2010, compared with a 16% increase in the number of physicians. However, few CAM providers undergo extensive education or training specific to pediatric populations. For example, although chiropractic training typically lasts 4 years, pediatric certification in chiropractic requires only a 10-module, 120-hour certification program.[121] Naturopathic training at the 4 US colleges also typically requires 2000 hours of training over 4 years, which includes clerkships in dermatology, family medicine, psychiatry, medicine, radiology, pediatrics, obstetrics and gynecology, neurology, surgery, and ophthalmology.[122] Some CAM training programs do not offer any specific training for diagnosing or treating pediatric patients.

Many CAM providers seek additional training in pediatrics.[123] Likewise, many physicians seek additional training in CAM. As of 1998, 64% of US medical schools reported having CAM curricula,[124] and 18 of the 19 colleges of osteopathic medicine offered CAM instruction.[125] These programs have a wide range of content and quality. Although many medical schools and residency programs offer survey courses on CAM,[126,127] the extent to which pediatric residencies and postgraduate courses address educational needs about CAM are unknown.[128–131] However, there have been significant gains in the growth of academic integrative medicine since the establishment of the Consortium for Academic Health Centers for Integrative Medicine in 2000. There are also well-established training programs for physicians in specific modalities such as hypnosis and acupuncture.

LICENSING

Licensure of CAM providers varies significantly from state to state. Licensing does not mean that CAM providers can practice medicine. In some states, CAM providers must have clients sign a form acknowledging that they understand the provider is not a physician and not practicing medicine. As of the writing of this report, chiropractic medicine is licensed in all states, acupuncture and massage therapy are licensed in more than half of the states, and naturopathy and homeopathy are licensed in less than one third of the states. Lobbying efforts by CAM providers to win licensure and expanded scopes of practice are ongoing in many states. It is essential for physicians to understand local and state statutes and regulations governing specific therapeutic modalities. If a CAM provider is unlicensed, then he or she may be engaged in the unauthorized practice of medicine, and if a physician refers a patient to an unlicensed provider, the referring physician may be liable for negligent referral. If a CAM provider is licensed, then he or she must be practicing within his or her "scope of practice" as defined by local and state statutes and regulatory boards.[132] Similar to physician licensing, licensing information about other health care professionals is maintained by state licensing boards.

MEDICOLEGAL AND ETHICAL CONSIDERATIONS

Medicolegal

CAM poses a challenging risk-management issue with the potential for either a medical malpractice lawsuit, disciplinary proceedings from state licensing boards, or fraud and abuse actions from federal or state regulators.[133,134] The use of some types of CAM in adults has been judicially held to be below the standard of care constituting medical negligence[135]; that is, use of complementary therapies in and of themselves does not constitute negligence. In terms of practicing within the standard of care, more clinicians are willing to offer CAM, and more insurers are willing to pay for it.[136]

Clinicians need to be aware of individual state laws relating to CAM, because medicine is regulated by state rather than federal laws.[137] In its database of closed pediatric malpractice claims from 1985–2005, the Physicians Insurers Association of America reported that the average indemnity payment for all CAM claims was $358 333, which was 37.1% higher than the average for all pediatric claims ($261 321).[138] A proposed risk-management model limits liability for the use of CAM if the physician is recommending, accepting, or avoiding CAM depending on availability of evidence relating to safety and/or efficacy.[139]

Some CAM modalities may need to be included in discussions about informed consent for treatment. The informed-consent process may potentially require a discussion about possible risks of CAM, notwithstanding the ability of a patient to acquire CAM without the involvement of the pediatrician (eg, dietary supplements and their interaction with prescribed medication). Case law has placed a burden on clinicians to at least discuss viable options of treatment even though he or she may be unwilling to offer the therapy.[140]

Pediatricians need to be aware of the use of alternative therapies as a substitute for conventional medical care for children with life-threatening conditions and whether they believe such treatment is reportable under state abuse and neglect laws. Another legal duty of pediatricians relates to the assurance that seeking reimbursement for CAM therapy does not trigger a potential violation of fraud and abuse laws for therapy deemed "medically unnecessary." It is prudent to be cautious about any representations or guarantees.

Ethics

There are several ethical challenges to integrating CAM into mainstream pediatric practice. There is a lack of systematic pediatric education about the safety and effectiveness of CAM therapies; uncertainty about the scope of practice, licensing requirements, and credentialing of nonphysician CAM providers; concerns about patient safety and legal liability when recommending CAM therapies or therapists; and uncertainty about how to translate principles of medical ethics into CAM.[141]

The first guideline of ethical practice is to seek reliable, evidence-based information about the safety and effectiveness of specific therapies and therapists. Indeed, the 2001 AAP policy statement "Counseling Families Who Choose Complementary and Alternative Medicine for Their Child With Chronic Illness or Disability" recommended that pediatricians seek information, evaluate the scientific merits of specific therapeutic approaches, and identify risks or potential harmful effects.[43]

It is also prudent to apply common sense to balancing risks and benefits when making therapeutic decisions (see Fig 1).[142] The specific ethical questions in clinical practice vary in different clinical situations. If a therapy is both safe and effective, the pediatrician is ethically obligated to recommend and encourage its use as he or she would for any other such therapy in conventional care.

Factors to be included in a risk/benefit analysis when considering CAM therapies include the severity and acuteness of illness; curability with conventional care; degree of invasiveness; toxicities and adverse effects of conventional treatment; quality of evidence for efficacy and safety of the complementary therapy; and the family's understanding of the risks and benefits of CAM treatment, voluntary acceptance of those risks, and persistence of the family's intention to use CAM therapy.[139] Thus, the level of evidence required for evaluating efficacy can be small when there is little to no risk of harm from a therapy, especially when other therapies are likely to be futile. Likewise, the level of evidence for efficacy required to endorse a particular complementary therapy would be quite high when that therapy is risky and safer, more effective therapies are available.

Situation-specific variables can also affect ethical decision-making. Situation-specific variables include the patient's and parents' personal beliefs, cultural values and practices, and therapeutic goals; the type and severity of illness; and the lack of efficacy and safety data in a specific patient. Even when such data are known for other populations, application of population data to individual pediatric patients requires inference and implies some degree of uncertainty. The tolerance of the patient, family, and clinician for uncertainty varies from one situation to another.[139]

Finally, clinicians should be aware of the 4 basic principles of biomedical ethics: (1) respect for patients' autonomy; (2) nonmaleficence (avoiding harm); (3) beneficence (putting the patient's interest and well-being first); and (4) justice (fairness in providing access to essential care).[139]

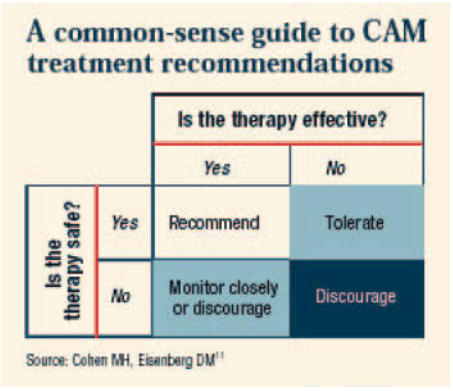

FIGURE 1
Guide to CAM treatment recommendations. (Reproduced with permission from Kemper K, Cohen M. Ethics meet complementary and alternative medicine: new light on old principles. *Contemp Pediatr.* 2004;21:65.)

CONCLUSIONS

Pediatricians and other clinicians who care for children have the responsibility to advise and counsel patients and families about relevant, safe, effective, and age-appropriate health services and therapies regardless of whether they are considered mainstream or CAM. In the 2001 AAP Periodic Survey of Fellows, 73% of pediatricians agreed that it is the role of pediatricians to provide patients/families with information about all potential treatment options for the patient's condition, and 54% agreed that pediatricians should consider the use of all potential therapies, not just those of mainstream medicine, when treating patients.[60] Because most families use CAM services without spontaneously reporting this use to their clinician, pediatricians can best provide appropriate advice and counseling if they regularly inquire about all the therapies the family is using to help the child.[143,144]

Pediatricians should seek continued and updated knowledge about therapeutic options available to their patients, whether they are mainstream or CAM, and about the specific services used by individual patients to ensure that issues of safety, appropriateness, and advisability of CAM can be addressed. Only then can pediatricians appreciate the concerns of their patients and families and offer them the thoughtful and knowledgeable guidance they may require.

Finally, if the pediatrician confirms that the patient is seeing a CAM provider, the pediatrician can (with the permission of the patient and family) include the CAM provider in overall care-coordination activities.

TIPS ON TALKING WITH PATIENTS

- Ask about the different therapies received by your patients. Patients and parents often do not tell their clinicians about CAM use, because many of them believe that it is not relevant or not within the clinician's interest or expertise.[143,144] By asking routinely, pediatricians can learn whether a child is receiving complementary therapies. This knowledge is essential for the pediatrician to evaluate and counsel about potential adverse effects and to enhance the probability of correctly attributing improvements or adverse effects to the specific intervention. Questions that include examples are often helpful in jogging memories and enhancing disclosure. Thus, rather than asking whether a patient is using any "alternative" therapies, the pediatrician might ask whether the patient is using any "vitamins, herbs, supplements, teas, home remedies, back rubs, chiropractic, acupuncture, or other services to enhance health." It is also often useful to ask how the patient manages stress; examples here may include exercise, prayer, music, or talking with friends or trusted adults.
- Respect the family's perspectives, values, and cultural beliefs in open, ongoing communication centered on the patient's well-being. Recognize cultural or educational differences. Demonstrate respect for families and their values. Work together with the parents as a team to consider and evaluate all appropriate treatments. This may require discussing an array of treatment options. By actively listening to families and patients, pediatricians can become important allies in examining all potential treatment options for children. Maintaining a dialogue to promote the best interests of the child is critical to the integrity of the medical home.
- Monitor the patient's response to treatment and establish measurable outcomes for evaluation. Measurable outcomes such as specific goals for symptom relief can be established. The *primum non noceri* ("first do no harm") concept is central to all clinical practice. If there is a lack of response or untoward response, the therapy needs to be reevaluated.
- Maintain current knowledge of popular complementary therapies and evidence-based resources about them. Become familiar with the definitions, terms, and uses of CAM and learn about specific CAM therapies patients are using. Pediatricians are encouraged to educate themselves about the modalities and professionals that are available in their practice area. Provide evidence-based information about relevant therapies, available from the NCCAM, the Consortium of Academic Health Centers for Integrative Medicine member institutions, and an increasing number of publications in peer-reviewed publications and professional review articles.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Fetus and Newborn

Use of Inhaled Nitric Oxide

ABSTRACT. Approval of inhaled nitric oxide by the US Food and Drug Administration for hypoxic respiratory failure of the term and near-term newborn provides an important new therapy for this serious condition. This statement addresses the conditions under which inhaled nitric oxide should be administered to the neonate with hypoxic respiratory failure.

ABBREVIATIONS. ECMO, extracorporeal membrane oxygenation; iNO, inhaled nitric oxide; FDA, US Food and Drug Administration.

Hypoxic respiratory failure in neonates born at or near term may be caused by such conditions as primary persistent pulmonary hypertension, respiratory distress syndrome, aspiration syndromes, pneumonia or sepsis, and congenital diaphragmatic hernia. Conventional therapies, which have not been validated by randomized controlled trials, include administration of high concentrations of oxygen, hyperventilation, high-frequency ventilation, the induction of alkalosis, neuromuscular blockade, and sedation.[1] Despite aggressive conventional therapy, neonatal respiratory failure was associated with a high rate of mortality before the development of extracorporeal membrane oxygenation (ECMO).[2,3] Survival and short-term morbidity rates have been superior in term and near-term infants (≥34 weeks' gestation) treated with ECMO compared with conventional therapy[4]; however, questions remain about the long-term safety of ECMO.

Inhaled nitric oxide (iNO) is a selective pulmonary vasodilator for which the mechanism of action involves guanylyl cyclase activation leading to production of cyclic guanosine monophosphate and subsequent smooth muscle relaxation.[5–7] Although several studies have suggested that iNO improves oxygenation,[8–14] the US Food and Drug Administration (FDA) evaluated 2 large randomized multicenter controlled trials of term and near-term neonates with hypoxic respiratory failure that demonstrated improved outcome with iNO therapy. The Neonatal Inhaled Nitric Oxide Study Group trial documented that iNO reduced the need for ECMO[15] without increasing neurodevelopmental, behavioral, or medical abnormalities at 2 years of age.[16] These results were strengthened by the Clinical Inhaled Nitric Oxide Research Group trial, in which iNO reduced the need for ECMO and the incidence of chronic lung disease.[17] iNO was not effective for infants with congenital diaphragmatic hernia.[18]

The limited data to date on hypoxic preterm neonates suggest that low-dose iNO improves oxygenation but does not improve survival.[14,19] Additional large randomized trials of iNO in premature neonates are required because they may experience more toxic effects than term and near-term infants.[14,19,20]

It is critical that infants with hypoxic respiratory failure in whom conventional ventilator therapy fails or is predicted to fail be cared for in institutions that have **immediate availability** of personnel, including physicians, nurses, and respiratory therapists, who are qualified to use multiple modes of ventilation and rescue therapies. Radiologic and laboratory support required to manage the broad range of needs of these infants is also essential.

iNO should be administered using FDA-approved devices that are capable of administering iNO in constant concentration ranges in parts per million or less throughout the respiratory cycle. Infants who receive iNO therapy should be monitored according to institutionally derived protocols designed to avoid the potential toxic effects associated with iNO administration. These effects include methemoglobinemia (secondary to excess nitric oxide concentrations), direct pulmonary injury (attributable to excess levels of nitrogen dioxide), and ambient air contamination.

In the trials of iNO therapy reported to date, the indication for use has been failure of ventilatory therapy. ECMO, a therapy of proven efficacy, usually is initiated if iNO therapy fails. Therefore, institutions that offer iNO therapy generally should have ECMO capability; if a center lacks ECMO capability, it should work in collaboration with an ECMO center to prospectively establish appropriate iNO failure criteria and mechanisms for the timely transfer of infants to the collaborating ECMO center. The diversity of geography, climate, and transport capabilities necessitates that the "timely transfer" be dictated by the location-specific transport limitations as well as the severity of the infant's illness. Because hypoxic respiratory failure is often rapidly progressive and abrupt discontinuation of iNO may lead to worsening oxygenation,[21] the risk of delayed provision of ECMO must be considered carefully when determining the appropriate time of transfer.

Plans for the care and referral of these infants should incorporate the following recommendations.

RECOMMENDATIONS

1. Infants with progressive hypoxic respiratory failure should be cared for in centers with the expertise and

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

experience to provide multiple modes of ventilatory support and rescue therapies or be transferred in a timely manner to such an institution.
2. iNO therapy should be given using the indications, dosing, administration, and monitoring guidelines outlined on the product label (http://www.fda.gov). An echocardiogram to rule out congenital heart disease is recommended. Center-specific criteria for treatment failure should be developed to facilitate timely consideration of alternative therapies.
3. iNO therapy should be directed by physicians qualified by education and experience in its use and offered only at centers that are qualified to provide multisystem support, generally including on-site ECMO capability.
4. Generally, iNO should be initiated in centers with ECMO capability. If iNO is offered by a center without ECMO capability, for geographic or other compelling reasons, mutually acceptable treatment failure criteria and mechanisms for timely transfer of infants to a collaborating ECMO center should be established prospectively. Transfer must be accomplished without interruption of iNO therapy.
5. Centers that provide iNO therapy should provide comprehensive long-term medical and neurodevelopmental follow-up.
6. Centers that provide iNO therapy should establish prospective data collection for treatment time course, toxic effects, treatment failure, use of alternative therapies, and outcomes.
7. Administration of iNO for indications other than those approved by the FDA or in other neonatal populations, including compassionate use, remains experimental. As such, iNO should be administered according to a formal protocol that has been approved by the FDA and the institutional review board and with informed parental consent.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Nutrition

The Use and Misuse of Fruit Juice in Pediatrics

ABSTRACT. Historically, fruit juice was recommended by pediatricians as a source of vitamin C and an extra source of water for healthy infants and young children as their diets expanded to include solid foods with higher renal solute. Fruit juice is marketed as a healthy, natural source of vitamins and, in some instances, calcium. Because juice tastes good, children readily accept it. Although juice consumption has some benefits, it also has potential detrimental effects. Pediatricians need to be knowledgeable about juice to inform parents and patients on its appropriate uses.

ABBREVIATIONS. FDA, Food and Drug Administration; AAP, American Academy of Pediatrics.

INTRODUCTION

In 1997, US consumers spent almost $5 billion on refrigerated and bottled juice.[1] Mean juice consumption in America is more than 2 billion gal/y or 9.2 gal/y per person.[2] Children are the single largest group of juice consumers. Children younger than 12 years account for only about 18% of the total population but consume 28% of all juice and juice drinks.[3] By 1 year of age, almost 90% of infants consume juice. The mean daily juice consumption by infants is approximately 2 oz/d, but 2% consume more than 16 oz/d, and 1% of infants consume more than 21 oz/d.[2,4,5] Toddlers consume a mean of approximately 6 oz/d.[2] Ten percent of children 2 to 3 years old and 8% of children 4 to 5 years old drink on average more than 12 oz/d.[2] Adolescents consume the least, accounting for only 10% of juice consumption.

DEFINITIONS

To be labeled as a fruit juice, the Food and Drug Administration (FDA) mandates that a product be 100% fruit juice. For juices reconstituted from concentrate, the label must state that the product is reconstituted from concentrate. Any beverage that is less than 100% fruit juice must list the percentage of the product that is fruit juice, and the beverage must include a descriptive term, such as "drink," "beverage," or "cocktail." In general, juice drinks contain between 10% and 99% juice and added sweeteners, flavors, and sometimes fortifiers, such as vitamin C or calcium. These ingredients must be listed on the label, according to FDA regulations.

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COMPOSITION OF FRUIT JUICE

Water is the predominant component of fruit juice. Carbohydrates, including sucrose, fructose, glucose, and sorbitol, are the next most prevalent nutrient in juice. The carbohydrate concentration varies from 11 g/100 mL (0.44 kcal/mL) to more than 16 g/100 mL (0.64 kcal/mL). Human milk and standard infant formulas have a carbohydrate concentration of 7 g/100 mL.

Juice contains a small amount of protein and minerals. Juices fortified with calcium have approximately the same calcium content as milk but lack other nutrients present in milk. Some juices have high contents of potassium, vitamin A, and vitamin C. In addition, some juices and juice drinks are fortified with vitamin C. The vitamin C and flavonoids in juice may have beneficial long-term health effects, such as decreasing the risk of cancer and heart disease.[6,7] Drinks that contain ascorbic acid consumed simultaneously with food can increase iron absorption by twofold.[8,9] This may be important for children who consume diets with low iron bioavailability.

Juice contains no fat or cholesterol, and unless the pulp is included, it contains no fiber. The fluoride concentration of juice and juice drinks varies. One study found fluoride ion concentrations ranged from 0.02 to 2.8 parts per million.[10] The fluoride content of concentrated juice varies with the fluoride content of the water used to reconstitute the juice.

Grapefruit juice contains substances that suppress a cytochrome P-450 enzyme in the small bowel wall. This results in altered absorption of some drugs, such as cisapride, calcium antagonists, and cyclosporin.[11–13] Grapefruit juice should not be consumed when these drugs are used.

Some manufacturers specifically produce juice for infants. These juices do not contain sulfites or added sugars and are more expensive than regular fruit juice.

ABSORPTION OF CARBOHYDRATE FROM JUICE

The 4 major sugars in juice are sucrose, glucose, fructose, and sorbitol. Sucrose is a disaccharide that is hydrolyzed into 2 component monosaccharides, glucose and fructose, by sucrase present in the small bowel epithelium. Glucose is then absorbed rapidly via an active-carrier–mediated process in the brush border of the small bowel. Fructose is absorbed by a facilitated transport mechanism via a carrier but not against a concentration gradient. In addition, fructose may be absorbed by a disaccharidase-related transport system, because the absorption of fructose

is more efficient in the presence of glucose, with maximal absorption occurring when fructose and glucose are present in equimolar concentrations.[14] Clinical studies have demonstrated this, with more apparent malabsorption when fructose concentration exceeds that of glucose (eg, apple and pear juice) than when the 2 sugars are present in equal concentrations (eg, white grape juice).[15,16] However, when provided in appropriate amounts (10 mL/kg of body weight), these different juices are absorbed equally as well.[17] Sorbitol is absorbed via passive diffusion at slow rates, resulting in much of the ingested sorbitol being unabsorbed.[18]

Carbohydrate that is not absorbed in the small intestine is fermented by bacteria in the colon. This bacterial fermentation results in the production of hydrogen, carbon dioxide, methane, and the short-chain fatty acids—acetic, propionic, and butyric. Some of these gases and fatty acids are reabsorbed through the colonic epithelium, and in this way, a portion of the malabsorbed carbohydrate can be scavenged.[19] Nonabsorbed carbohydrate presents an osmotic load to the gastrointestinal tract, which causes diarrhea.[20]

Malabsorption of carbohydrate in juice, especially when consumed in excessive amounts, can result in chronic diarrhea, flatulence, bloating, and abdominal pain.[21–27] Fructose and sorbitol have been implicated most commonly,[15,16,28–30] but the ratios of specific carbohydrates may also be important.[31] The malabsorption of carbohydrate that can result from large intakes of juice is the basis for some health care providers to recommend juice for the treatment of constipation.[32]

JUICE IN THE FOOD GUIDE PYRAMID

Fruit is 1 of the 5 major food groups in the Food Guide Pyramid.[33] It is recommended that children consuming approximately 1600 kcal/d (depending on size, 1–4 years old) should have 2 fruit servings and those consuming 2800 kcal/d (depending on size, 10–18 years old) should consume 4 fruit servings. Half of these servings can be provided in the form of fruit juice (not fruit drinks). A 6-oz glass of fruit juice equals 1 fruit serving. Fruit juice offers no nutritional advantage over whole fruit. In fact, fruit juice lacks the fiber of whole fruit. Kilocalorie for kilocalorie, fruit juice can be consumed more quickly than whole fruit. Reliance on fruit juice instead of whole fruit to provide the recommended daily intake of fruits does not promote eating behaviors associated with consumption of whole fruits.

MICROBIAL SAFETY OF JUICE

Only pasteurized juice is safe for infants, children, and adolescents. Pasteurized fruit juices are free of microorganisms. Unpasteurized juice may contain pathogens, such as *Escherichia coli* and *Salmonella* and *Cryptosporidium* organisms.[34] These organisms can cause serious disease, such as hemolytic-uremic syndrome, and should never be given to infants and children. Unpasteurized juice must contain a warning on the label that the product may contain harmful bacteria.[35]

INFANTS

The American Academy of Pediatrics (AAP) recommends that breast milk be the only nutrient fed to infants until 4 to 6 months of age.[36] For mothers who cannot breastfeed or choose not to breastfeed, a prepared infant formula can be used and is a complete source of nutrition. No additional nutrients are needed. There is no nutritional indication to feed juice to infants younger than 6 months. Offering juice before solid foods are introduced into the diet could risk having juice replace breast milk or infant formula in the diet. This can result in reduced intake of protein, fat, vitamins, and minerals such as iron, calcium, and zinc.[37] Malnutrition and short stature in children have been associated with excessive consumption of juice.[4,38]

After approximately 4 to 6 months of age, solid foods can be introduced into the diets of infants. The AAP recommends that single-ingredient foods be chosen and introduced 1 at a time at weekly intervals. Iron-fortified infant cereals or pureed meats are good choices for first weaning foods. Because foods high in iron are recommended as weaning foods, beverages that contain vitamin C do not offer a nutritional advantage for iron-sufficient individuals.

It is prudent to give juice only to infants who can drink from a cup (approximately 6 months or older). Teeth begin to erupt at approximately 6 months of age. Dental caries have also been associated with juice consumption.[39] Prolonged exposure of the teeth to the sugars in juice is a major contributing factor to dental caries. The AAP and the American Academy of Pedodontics recommendations state that juice should be offered to infants in a cup, not a bottle, and that infants not be put to bed with a bottle in their mouth.[40] The practice of allowing children to carry a bottle, cup, or box of juice around throughout the day leads to excessive exposure of the teeth to carbohydrate, which promotes development of dental caries.

Fruit juice should be used as part of a meal or snack. It should not be sipped throughout the day or used as a means to pacify an unhappy infant or child. Because infants consume fewer than 1600 kcal/d, 4 to 6 oz of juice per day, representing 1 food serving of fruit, is more than adequate. Infants can be encouraged to consume whole fruits that are mashed or pureed.

The AAP practice guideline on the management of acute gastroenteritis in young children recommends that only oral electrolyte solutions be used to rehydrate infants and young children and that a normal diet be continued throughout an episode of gastroenteritis.[41] Surveys show that many health care providers do not follow the recommended procedures for management of diarrhea.[42] The high carbohydrate content of juice (11–16 g %), compared with oral electrolyte solutions (2.5–3 g %), may exceed the intestine's ability to absorb carbohydrate, resulting in carbohydrate malabsorption. Carbohydrate malabsorption causes osmotic diarrhea, increasing the severity of the diarrhea already present.[43] Fruit juice is low in electrolytes. The sodium concentration is 1

to 3 mEq/L. Stool sodium concentration in children with acute diarrhea is 20 to 40 mEq/L. Oral electrolyte solutions contain 40 to 45 mEq/L of sodium. As a replacement for fluid losses, juice may predispose infants to development of hyponatremia.

In the past, there was concern that infants who were fed orange juice were likely to develop an allergy to it. The development of a perioral rash in some infants after being fed freshly squeezed citrus juice is most likely a contact dermatitis attributable to peel oils.[44] Diarrhea and other gastrointestinal symptoms observed in some infants were most likely attributable to carbohydrate malabsorption. Although allergies to fruit may develop early in life, they are uncommon.[45]

TODDLERS AND YOUNG CHILDREN

Most issues relevant to juice intake for infants are also are relevant for toddlers and young children. Fruit juice and fruit drinks are easily overconsumed by toddlers and young children because they taste good. In addition, they are conveniently packaged or can be placed in a bottle and carried around during the day. Because juice is viewed as nutritious, limits on consumption are not usually set by parents. Like soda, it can contribute to energy imbalance. High intakes of juice can contribute to diarrhea, overnutrition or undernutrition, and development of dental caries.

OLDER CHILDREN AND ADOLESCENTS

Juice consumption presents fewer nutritional issues for older children and adolescents, because they consume less of these beverages. Nevertheless, it seems prudent to limit juice intake to two 6-oz servings, or half of the recommended fruit servings each day. It is important to encourage consumption of the whole fruit for the benefit of fiber intake and a longer time to consume the same kilocalories.

Excessive juice consumption and the resultant increase in energy intake may contribute to the development of obesity. One study found a link between juice intake in excess of 12 oz/d and obesity.[4] Other studies, however, found that children who consumed greater amounts of juice were taller and had lower body mass index than those who consumed less juice[46] or found no relationship between juice intake and growth parameters.[47] More research is needed to better define this relationship.

CONCLUSIONS

1. Fruit juice offers no nutritional benefit for infants younger than 6 months.
2. Fruit juice offers no nutritional benefits over whole fruit for infants older than 6 months and children.
3. One hundred percent fruit juice or reconstituted juice can be a healthy part of the diet when consumed as part of a well-balanced diet. Fruit drinks, however, are not nutritionally equivalent to fruit juice.
4. Juice is not appropriate in the treatment of dehydration or management of diarrhea.
5. Excessive juice consumption may be associated with malnutrition (overnutrition and undernutrition).
6. Excessive juice consumption may be associated with diarrhea, flatulence, abdominal distention, and tooth decay.
7. Unpasteurized juice may contain pathogens that can cause serious illnesses.
8. A variety of fruit juices, provided in appropriate amounts for a child's age, are not likely to cause any significant clinical symptoms.
9. Calcium-fortified juices provide a bioavailable source of calcium but lack other nutrients present in breast milk, formula, or cow's milk.

RECOMMENDATIONS

1. Juice should not be introduced into the diet of infants before 6 months of age.
2. Infants should not be given juice from bottles or easily transportable covered cups that allow them to consume juice easily throughout the day. Infants should not be given juice at bedtime.
3. Intake of fruit juice should be limited to 4 to 6 oz/d for children 1 to 6 years old. For children 7 to 18 years old, juice intake should be limited to 8 to 12 oz or 2 servings per day.
4. Children should be encouraged to eat whole fruits to meet their recommended daily fruit intake.
5. Infants, children, and adolescents should not consume unpasteurized juice.
6. In the evaluation of children with malnutrition (overnutrition and undernutrition), the health care provider should determine the amount of juice being consumed.
7. In the evaluation of children with chronic diarrhea, excessive flatulence, abdominal pain, and bloating, the health care provider should determine the amount of juice being consumed.
8. In the evaluation of dental caries, the amount and means of juice consumption should be determined.
9. Pediatricians should routinely discuss the use of fruit juice and fruit drinks and should educate parents about differences between the two.

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AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Sports Medicine and Fitness

Use of Performance-Enhancing Substances

ABSTRACT. Performance-enhancing substances include dietary supplements, prescription medications, and illicit drugs. Virtually no data are available on the efficacy and safety in children and adolescents of widely used performance-enhancing substances. This statement is intended to provide a generalized but functional definition of performance-enhancing substances. The American Academy of Pediatrics strongly condemns the use of performance-enhancing substances and vigorously endorses efforts to eliminate their use among children and adolescents. ***Pediatrics*** **2005;115:1103–1106;** ***ergogenic, anabolic, performance enhancing, banned substance, athlete, adolescent, sport.***

INTRODUCTION

Performance-enhancing substance use in young people is a concern to pediatricians and society because of potential adverse health consequences and the effects that such practices have on moral development of the individual and on fair athletic competition for all. Health care professionals can play a valuable role in counseling the young person using or contemplating use of performance-enhancing substances by conveying factual information about the proven benefits and medical consequences of these substances and providing advice about healthful eating and training. Attempts to discourage use through scare tactics or by dismissing known performance-enhancing effects of these substances may seriously damage the credibility of the physician and do little to diminish use. Efforts to minimize use of performance-enhancing substances require the pediatrician to have an understanding of the incentives for use, a comprehensive definition of performance-enhancing substances, and familiarity with strategies for prevention.

INCENTIVES FOR THE USE OF PERFORMANCE-ENHANCING SUBSTANCES

The temptation for young people to use performance-enhancing substances should be easily understood by anyone who is familiar with high-level sports in our society. Success (that is, winning) is considered by many to be the most important goal of sports. At the level of professional sports, winning is the ultimate goal. This attitude permeates lower levels of sports as well, down to youth sports. Society rewards success in sports with celebrity, status, and favoritism.

For athletes of all ages, the pursuit of excellence in sports is an endeavor to be admired and encouraged. Success in sports involves obtaining an "edge" over the competition. However, sometimes the drive for success can be so engrossing and so compelling that a young person can easily lose sight of what is fair and right. Some individuals may view the use of performance-enhancing substances as a substitute for hard work. For others, performance-enhancing substances may be considered a necessary adjunct to hard work or part of the price of success. From the user's perspective, the prospects for success in sports often outweigh the prospects for serious medical complications from use of performance-enhancing substances.

For some, winning has a monetary incentive as well. The enormous salaries paid to professional athletes in the United States and elsewhere are powerful inducements for a young person with outstanding athletic talent to try anything to ensure continued athletic success.

Adolescents may be uniquely vulnerable to the lure of performance-enhancing substances. Many adolescents engage in risk-taking behavior and experimentation at a time when they are coping with the developmental tasks of adolescence, including defining their sexual identity, emancipating themselves from their families, achieving a sense of mastery and self-efficacy, and finding a peer group with which they can identify.[1] The adolescent, by nature, feels invincible and often shuns any suggestion that use of a substance for purposes other than legitimate therapy might pose a danger to their health or their eligibility for sports.

Adolescents are also intensely preoccupied with body image. Personal rewards perceived from enhancing size, strength, stamina, or body build can be strong motivators. A significant number of adolescents who are not involved in competitive athletics use performance-enhancing substances.[2]

The child athlete, particularly the adolescent, in today's society is caught in a struggle between ideals highly valued by society but often in direct conflict: the attitude of winning at all costs and the values of fairness and wholesomeness.

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RATIONALE FOR A BROAD-BASED STATEMENT ON PERFORMANCE-ENHANCING SUBSTANCES AND YOUTH

In the last 2 decades, a considerable amount of research has been conducted with performance-enhancing substances such as creatine, amino acids, androstenedione, and dehydroepiandrosterone. Virtually no experimental research on either the ergogenic effects or adverse effects of performance-enhancing substances has been conducted in subjects younger than 18 years. The amount of scientific data from well-designed studies on the effects of these substances in adults continues to accumulate at such a rate that systematic reviews are soon made obsolete.

This statement is not intended to provide a review of currently available data on performance-enhancing substances. A list of resources for detailed information on specific performance-enhancing substances is provided at the end of this statement. Rather, this statement is intended to convey a more general policy on the basis of the following 3 points. First, the intentional use of any substance for performance enhancement is unfair and, therefore, morally and ethically indefensible. Second, use of any substance for the purpose of enhancing sports performance, including over-the-counter supplements, the composition and quality of which are not under federal regulation, may pose a significant health risk to the young person. Third, use and promotion of performance-enhancing substances tends to devalue the principles of a balanced diet, good coaching, and sound physical training.

CURRENT DEFINITIONS OF PERFORMANCE-ENHANCING SUBSTANCES

Limitations of Current Definitions

Traditionally, sports organizations such as the International Olympic Committee and the National Collegiate Athletic Association have defined performance-enhancing substances as substances that create an unfair competitive advantage. These organizations have produced lists of banned or prohibited drugs that include substances with known performance-enhancing effects as well as substances used by athletes that have been associated with adverse health effects. Detection of illegal or banned substances by drug testing is a critical element of the enforcement and efficacy of these policies. However, current definitions of performance-enhancing substances have contextual limitations. If the substance does not have adverse medical consequences, if the substance is not detectable by drug testing, or if testing for the drug is not performed (so that a potentially dangerous substance or unfair practice may go undetected), then the substance in question would not be included in a list of banned substances.

To date, there is no definition of performance-enhancing substances that applies to all potential users. A definition of a performance-enhancing substance that is applicable to the pediatric age group should not exclude any individual who may have a substance-abuse problem or any substance that cannot be readily detected. With the prohibitive cost of testing and deficiencies associated with a detection-based banned list, widespread drug testing of children and adolescents is unlikely to be effective or practical. A definition of a performance-enhancing substance for the pediatric age group, therefore, must be independent of whether testing of the substance is conducted in that age group. Because new substances for performance enhancement as well as methods for masking the presence of these substances are continually being discovered, a definition of performance-enhancing substances must remain valid in a changing environment.

General Definition of Performance-Enhancing Substances

A performance-enhancing substance is any substance taken in nonpharmacologic doses specifically for the purposes of improving sports performance. A substance should be considered performance enhancing if it benefits sports performance by increasing strength, power, speed, or endurance (ergogenic) or by altering body weight or body composition. Furthermore, substances that improve performance by causing changes in behavior, arousal level, and/or perception of pain should be considered performance enhancing.

Performance-enhancing substances include the following:

- Pharmacologic agents (prescription or nonprescription) taken in doses that exceed the recommended therapeutic dose or taken when the therapeutic indication(s) are not present (eg, using decongestants for stimulant effect, using bronchodilators when exercise-induced bronchospasm is not present, increasing baseline methylphenidate hydrochloride dose for athletic competition)
- Agents used for weight control, including stimulants, diet pills, diuretics, and laxatives, when the user is in a sport that has weight classifications or that rewards leanness
- Agents used for weight gain, including over-the-counter products advertised as promoting increased muscle mass
- Physiologic agents or other strategies used to enhance oxygen-carrying capacity, including erythropoietin and red blood cell transfusions (blood doping)
- Any substance that is used for reasons other than to treat a documented disease state or deficiency
- Any substance that is known to mask adverse effects or detectability of another performance-enhancing substance
- Nutritional supplements taken at supraphysiologic doses or at levels greater than required to replace deficits created by a disease state, training, and/or participation in sports

STRATEGIES FOR PREVENTING USE OF PERFORMANCE-ENHANCING SUBSTANCES

The methods most widely used to prevent use of performance-enhancing substances, namely drug bans and drug testing, are primarily punitive. Drug

bans imposed by organizations that regulate and oversee sports programs at various levels, from the International Olympic Committee to the National Collegiate Athletic Association and state high-school sports associations, effectively make the use of such substances "against the rules." Enforcement of drug bans has necessarily involved the use of drug testing, with positive tests carrying stiff penalties or sanctions including loss of playing privileges, removal of awards or championships from the entire team, loss of scholarships, and restrictions on future regular-season and postseason play.[3] Drug testing and legal sanctions are intended to be deterrents but have little effect on most children and adolescents involved in sports.

Neither the use of drug bans nor the implementation of drug testing provides the young athlete with any framework or guidelines for resolving the conflict between the drive to win and the imperative to do the right thing.

A variety of programs educating young athletes about substance abuse in general and targeting specific performance-enhancing drugs such as anabolic steroids have been tested at the international, collegiate, and even high-school levels.[4] It is unfortunate that few evaluations of these programs have included measurement of continued drug use after the intervention, and programs appropriately studied have not been highly successful in curbing use. One program that combined drug education with training in personal skills to resist the social influences that drive the use of performance-enhancing substances was successful in decreasing the intention to use anabolic steroids among adolescent football players.[5]

Little effort has been made to target adults who are responsible for collegiate, high-school, middle-school, and youth sports programs. Permissiveness often has the same effect as active encouragement when it comes to using performance-enhancing substances. A "don't-ask" attitude should be as intolerable to parents as the provision of performance-enhancing substances to athletes by coaches would be.

IDENTIFICATION OF THE YOUNG PERSON USING PERFORMANCE-ENHANCING SUBSTANCES

Data from epidemiologic studies and case descriptions have provided information about users of performance-enhancing substances that can help pediatricians to identify them. Users of anabolic or androgenic compounds are more likely to be male; are more likely to be involved in sports that demand high levels of strength, power, size, and speed; and are likely to use other illegal substances such as tobacco and alcohol.[5–7] Young people who participate in sports that demand leanness are also more likely to use performance-enhancing substances than are those involved in sports in which leanness is not essential. Young men and women who are not competitive athletes but who are obsessed with body image and who train intensely primarily to improve their physique are also more likely to use performance-enhancing substances. Users of certain performance-enhancing substances might be identified by outward signs such as virilization in females, testicular atrophy in males, and mood changes produced by anabolic steroids. Unfortunately, most young people who use performance-enhancing substances are not readily identified by outward signs. Therefore, it is imperative that all adolescents be asked about use of performance-enhancing substances in the assessment of high-risk behaviors that should be a part of every adolescent health maintenance visit, including sports physicals, camp physicals, and all other scheduled physician-adolescent encounters.

RECOMMENDATIONS

To assist the pediatrician in dealing with users or potential users of performance-enhancing substances, the American Academy of Pediatrics offers the following recommendations:

1. Use of performance-enhancing substances for athletic or other purposes should be strongly discouraged.
2. Parents should take a strong stand against the use of performance-enhancing substances and, whenever possible, demand that coaches be educated about the adverse health effects of performance-enhancing substances.
3. Schools and other sports organizations should be proactive in discouraging the use of performance-enhancing substances, incorporating this message into policy and educational materials for coaches, parents, and athletes.
4. Interventions for encouraging substance-free competition should be developed that are more positive than punitive, such as programs that teach sound nutrition and training practices along with skills to resist the social pressures to use performance-enhancing substances.
5. Colleges, schools, and sports clubs should make use of educational interventions that encourage open and frank discussion of issues related to the use of performance-enhancing substances, with the aim of promoting decisions about personal drug use based on principles of fair competition and character rather than on the fear of getting caught.
6. Coaches at all levels, including youth sports, should encourage wholesome and fair competition by emphasizing healthy nutrition and training practices, taking a strong stand against cheating, and avoiding the "win-at-all-costs" philosophy.
7. Inquiries about the use of performance-enhancing substances should be made in a manner similar to inquiries about use of tobacco, alcohol, or other substances of abuse. Guidelines for patient confidentiality should be followed and explained to the patient.
8. Athletes who admit using performance-enhancing substances should be provided unbiased medical information about benefits, known adverse effects, and other risks. When appropriate, additional testing may be necessary to investigate or rule out adverse medical effects.
9. The pediatric health care professional providing care for an athlete who admits to using a perfor-

mance-enhancing substance should explore the athlete's motivations for using these substances, evaluate other associated high-risk behaviors, and provide counseling on safer, more appropriate alternatives for meeting fitness or sports-performance goals.

10. Nonusers of performance-enhancing substances should have their decisions reinforced while establishing an open channel of communication if questions about performance-enhancing substances arise in the future.
11. Pediatric health care professionals should promote safe physical activity and sports participation by providing or making available sound medical information on exercise physiology, conditioning, nutrition, weight management, and injury prevention and by helping to care for sports-related medical conditions and injuries.

The November 2004 issue of "Sports Shorts" by the American Academy of Pediatrics Section on Sports Medicine and Fitness concerning performance-enhancing substances[8] is available for download and includes guidelines for pediatricians and parents.

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CLINICAL REPORT

Use of Soy Protein-Based Formulas in Infant Feeding

Guidance for the Clinician in Rendering Pediatric Care

Jatinder Bhatia, MD, Frank Greer, MD, and the Committee on Nutrition

ABSTRACT

Soy protein-based formulas have been available for almost 100 years. Since the first use of soy formula as a milk substitute for an infant unable to tolerate a cow milk protein-based formula, the formulation has changed to the current soy protein isolate. Despite very limited indications for its use, soy protein-based formulas in the United States may account for nearly 25% of the formula market. This report reviews the limited indications and contraindications of soy formulas. It will also review the potential harmful effects of soy protein-based formulas and the phytoestrogens contained in these formulas.

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Key Words
soy protein, infant formula, infant feeding, cow milk protein allergy, nutrition, galactosemia, vegetarian

Abbreviations
AAP—American Academy of Pediatrics
IgE—immunoglobulin E

THE AMERICAN ACADEMY of Pediatrics (AAP) is committed to the use of human milk as the ideal source of nutrition for infant feeding. However, by 2 months of age, the majority of infants in North America are receiving at least some formula. Soy-based infant formulas have been available for almost 100 years.[1] Despite limited indications, soy protein-based formula accounts for approximately 20% of the formula market in the United States. Because an infant formula provides a source of nutrition for an extended interval, its nutritional adequacy must be proven, and the indications for its use must be substantiated and well understood. This statement updates the 1998 AAP review of soy protein-based formulas and addresses the ongoing concern of phytoestrogens in soy formulas.

COMPOSITION

Isolated soy protein-based formulas currently on the market are all free of cow milk protein and lactose and provide 67 kcal/dL. All are iron-fortified and meet the vitamin, mineral, and electrolyte specifications addressed in the 2004 guidelines from the AAP for feeding term infants[2] and established by the US Food and Drug Administration.[3] The protein is a soy isolate supplemented with L-methionine, L-carnitine, and taurine to provide a protein content of 2.45 to 2.8 g per 100 kcal or 1.65 to 1.9 g/dL. The fat content of soy protein-based formulas is derived primarily from vegetable oils. The quantity of specific fats varies by manufacturer and is usually similar to those in the manufacturer's corresponding cow milk-based formula. The fat content ranges from 5.02 to 5.46 g per 100 kcal or 3.4 to 3.6 g/dL. The oils used include soy, palm, sunflower, olein, safflower, and coconut. Docosahexaenoic and arachidonic acids now are added routinely.

In formulas, carbohydrate sources are corn maltodextrin, corn syrup solids, and sucrose, with content ranging from 10.26 to 10.95 g per 100 kcal or 6.9 to 7.4 g/dL. Until 1980, mineral absorption from soy formulas was erratic because of poor stability of the suspensions and the presence of excessive soy phytates.[4] Because soy protein isolate formulas still contain 1.5% phytates, and up to 30% of the total phosphorus is phytate bound, they contain 20% more calcium and phosphorus than cow milk-based formulas and maintain the ratio of calcium to available phosphorus of 1.1 to 2.0:1. With the current formulations, bone mineralization, serum concentrations of calcium and phosphorus, and alkaline phosphatase concentrations in term infants through 12 months of age are equivalent to those observed in infants fed cow milk-based formulas.[5–7] Because soy phytates and fiber oligosaccharides also bind iron and zinc,[9] all soy-based formulas are fortified with iron and zinc.[8,9]

Phytoestrogens in Soy Protein-Based Formulas

Of the many heat-stable factors present in soy formulas, the phytoestrogens are of particular interest in human health. Phytoestrogens consist of several groups of nonsteroidal estrogens, including isoflavones. Isoflavones are commonly found in legumes, with the highest amount found in soybeans.[1,10] Concerns raised in relation to phytoestrogens/isoflavones include their potential negative effects on sexual development and reproduction, neurobehavioral development, immune function, and thyroid function. On the other hand, epidemiologic studies have

suggested a protective effect of isoflavones against a number of adult chronic diseases, including coronary heart disease and breast, endometrial, and prostate cancers.[11,12]

The structural similarity of phytoestrogens with 17-estradiol has prompted studies on the possible effects of soy isoflavones on reproductive function and growth. Numerous toxicity studies in rats have demonstrated some effects on estrogen-related tissues, but overall maternal reproductive function and fetal development were unaffected.[13–15] A recent study of the isoflavone genistein demonstrated adverse consequences of neonatal exposure in mice[16]; however, feeding of soy formula (and not individual components) has not demonstrated these adverse effects in animals.[17]

The possible effects of soy isoflavones on various forms of carcinogen-induced and estrogen-induced tumorigenesis have been investigated in animal models, but no clear conclusion can be drawn.[18,19] Soy diets were reported to stimulate growth of estrogen-dependent mammary tumors in mice in a dose-dependent manner.[20,21] Contrary to these results, phytoestrogens in typical dietary quantities were reported not to have estrogen-like activity in female ovariectomized macaque monkeys, but they antagonized estrogen-induced cellular proliferation in the breast.[22]

In humans, very limited data to date suggest that soy phytoestrogens have a low affinity for human postnatal estrogen receptors and low potency in bioassays.[23] The absorption, distribution, metabolism, and excretion of soy isoflavones vary, depending on age and gender and among cultural groups; interindividual variability has been documented in several studies.[24,25] However, differences in gender have been inconclusive.[26–28] Analysis of maternal and cord plasma and amniotic fluid indicates placental transfer of these compounds after soy consumption; no deleterious effects were discerned in the fetuses of Japanese mothers with relatively high soy consumption.[29]

Isoflavones are excreted in human milk, although the concentration is very low. The concentration of isoflavones in human milk reflects maternal diet, with omnivores demonstrating considerably lower concentrations of isoflavones compared with vegans.[30,31] Setchell and Cassidy[32] estimated that the amount of isoflavones ingested by infants fed soy-based formulas on a body weight basis exceeded those reported to increase the length of the menstrual cycle in adult women. However, an increased incidence of feminization in male infants[33] or an increased incidence of hypospadias in high soy-consuming populations[34] have not been observed. Even in infants fed soy-based formulas exclusively, the sulfate and glucuronide conjugates of phytoestrogens are identified in plasma, although both of these are rapidly excreted.[27] Data on reproductive health in young adults 20 to 34 years of age who had previously participated in a controlled feeding study of soy formula as infants demonstrated a longer duration of menstrual bleeding and greater discomfort in women exposed to soy as infants.[35] We cautioned against overinterpretation of their data, however, because there was no increase in menstrual blood flow in the women exposed to soy formula as infants and no statistically significant differences in >30 other outcome variables measured.[35]

Consumption of soy products by infants with congenital hypothyroidism complicates their management, as evidenced by a prolonged increase in thyroid-stimulating hormone when compared with infants not fed soy formula; the authors of 2 studies suggested closer monitoring and a possible need for an increased dose of levothyroxine.[36,37] In infants receiving replacement hormone, the phytates may interfere with the uptake of exogenous thyroid hormone by binding the thyroxine within the lumen, increasing fecal loss, and reducing the efficacy of oral thyroid hormone.[36,38] In an extensive review of the effects of soy protein and soybean isoflavones, little evidence was found that soy foods or isoflavones adversely affect thyroid function in iodine-replete individuals with euthyroidism.[39] This review also found that, similar to infants, adults with hypothyroidism may need additional doses of thyroid hormone with the concomitant use of soy foods because of the effects on absorption. Trials with dietary soy isoflavones have not reported adverse effects on thyroid function in rats.[40] These data suggest that there is a lack of sufficient evidence suggesting short-term or long-term adverse effects of soy consumption on endocrine function.

In summary, although studied by numerous investigators in various species, there is no conclusive evidence from animal, adult human, or infant populations that dietary soy isoflavones may adversely affect human development, reproduction, or endocrine function.

Aluminum in Soy Protein-Based Formulas

In 1996, the AAP issued a statement (since retired) on aluminum toxicity in infants and children and discussed the relatively high content of aluminum in soy-based formulas.[41] Although the aluminum content of human milk is 4 to 65 ng/mL, that of soy protein-based formula is 600 to 1300 ng/mL.[42,43] Mineral salts used in formula production are the source of the aluminum. Aluminum, which makes up 8% of the earth's crust as the third most common element, has no known biological function in humans.[43] The toxicity of aluminum is traced to increased deposition in bone and in the central nervous system, particularly in the presence of reduced renal function in preterm infants and children with renal failure. Because aluminum competes with calcium for absorption, increased amounts of dietary aluminum from isolated soy protein-based formula may contribute to the reduced skeletal mineralization (osteopenia) observed in preterm infants and infants with intrauterine growth retardation.[44] Term infants with normal renal function do not seem to be at substantial risk of developing aluminum toxicity from soy protein-based formulas.[42]

USE IN TERM AND PRETERM INFANTS

Numerous studies have documented normal growth and development in term neonates fed methionine-supplemented isolated soy protein-based formulas.[42,45–48] Average energy intakes in infants receiving soy protein-based

formulas are equivalent to those achieved with cow milk formulas.[42] In infants fed soy protein-based formulas, the serum albumin concentration, as a marker of nutritional adequacy, is normal,[46,49–51] and bone mineralization is equivalent to that documented with cow milk-based formulas in term infants.[5–7] Literature reviews and clinical studies of infants fed soy protein-based infant formulas raise no clinical concerns with respect to nutritional adequacy, sexual development, thyroid disease, immune function, or neurodevelopment.[1] Additional studies confirm that soy protein-based formulas do not interfere with normal immune responses to oral immunization with poliovirus vaccine.[52,53] The US Food and Drug Administration has approved these formulas as safe for use with infants.

On the other hand, soy protein-based formulas are not recommended for preterm infants. Serum phosphorus concentrations are lower, and alkaline phosphatase concentrations are higher in preterm infants fed soy protein-based formula than they are in preterm infants fed cow milk-based formula.[54,55] As anticipated from these observations, the degree of osteopenia is increased in infants with low birth weight receiving soy protein-based formulas.[50,56] Even with supplemental calcium and vitamin D, radiographic evidence of significant osteopenia was present in 32% of 125 preterm infants fed soy protein-based formula.[56] The cow milk protein-based formulas designed for preterm infants are clearly superior to soy protein-based formula for preterm infants.

USE IN DISORDERS OF CARBOHYDRATE METABOLISM

When strict dietary lactose elimination is required in the management of infants with galactosemia or primary lactase deficiency (extremely rare), soy protein-based formulas are safe and cost-effective. In addition, soy protein-based formulas can be a dietetic alternative for families wishing to avoid feeding their infants formulas containing animal products. Soy protein-based formulas with sucrose as the carbohydrate are contraindicated in sucrase-isomaltase deficiency and in hereditary fructose intolerance.

USE IN ACUTE DIARRHEA AND SECONDARY LACTASE DEFICIENCY

A number of studies have addressed the role of these formulas in the recovery from acute infantile diarrhea complicated by secondary or transient lactase deficiency. However, after immediate rehydration, most infants can be managed successfully with continued breastfeeding or standard cow milk or soy formula.[57,58] In an extensive review, Brown[57] noted that the dietary failure rate of lactose-containing formulas was 22%, whereas that of lactose-free formulas was 12%. In a study comparing human milk, cow milk-based formula, and soy protein-based formula, no difference was found in the rate of recovery from rotavirus or nonrotavirus diarrhea on the basis of nutritional therapy.[49] However, the duration of diarrhea has been reported to be shorter in infants receiving soy protein-based formula,[51,59] and the duration of liquid stools may also be reduced by adding additional soy polysaccharide fiber[60] or by resuming a mixed-staple diet.[61]

Lactose free and reduced lactose-containing cow milk formulas are now available and could be used for circumstances in which elimination or a reduction in lactose in the diet, respectively, is required. Because primary or congenital lactase deficiency is rare, very few individuals would require a total restriction of lactose. Lactose intolerance is more likely to be dose dependent. Thus, the use of soy protein-based lactose-free formulas for this indication should be restricted.

USE IN COLIC AND "FORMULA INTOLERANCE"

Perhaps the most common reason for use of soy formulas by infant care providers is for relief of perceived formula intolerance (spitting, vomiting, fussiness) or symptoms of colic. Colicky discomfort is described by the parents of 10% to 20% of infants during the first 3 months of age.[62] Although many factors have been implicated, parents frequently seek relief by changing infant formulas. Although some calming benefit can be attributed to the sucrose[63,64] and fiber content,[65] controlled trials of cow milk and soy protein-based formulas have not demonstrated a significant benefit from soy.[66,67] The value of parental counseling as to the cause and duration of colic seems greater than the value of switching to soy formula.[68] Because most colicky behavior diminishes spontaneously between 4 and 6 months of age, any intervention at that time can be credited anecdotally.

SEVERE GASTROINTESTINAL REACTIONS TO SOY FORMULA

As with cow milk protein-based formula, severe gastrointestinal reactions to soy protein-based formula have been described for >40 years[69] and encompass the full gamut of disease: enteropathy, enterocolitis, and proctitis. Small-bowel injury, a reversible celiac-like villus injury that produces an enteropathy with malabsorption, hypoalbuminemia, and failure to thrive, has been documented in at least 4 studies.[70–73] In case series of infantile food protein-induced enterocolitis caused by cow milk protein, 30% to 64% of infants had concomitant soy-induced enterocolitis,[74–77] with enterocolitis manifested by bloody diarrhea, ulcerations, and histologic features of acute and chronic inflammatory bowel disease.[69,75,78–80] Afflicted infants have responded to replacing the soy protein-based formula with a hydrolyzed protein formula. It is theorized that the intestinal mucosa damaged by cow milk allows increased uptake and, therefore, increased immunologic response to the subsequent soy antigen. Eosinophilic proctocolitis, a more benign variant of enterocolitis, also has been reported in infants receiving soy protein-based formula.[81,82]

These dietary protein-induced syndromes of enteropathy and enterocolitis, although clearly immunologic in origin, are not immunoglobulin E (IgE)-mediated, reflecting instead an age-dependent transient soy protein hypersensitivity. Because of the reported high frequency of sensitivity to both cow milk and soy antigens in infants, soy protein-based formulas are not indicated in

the management of documented cow milk protein-induced enteropathy or enterocolitis. Hydrolyzed protein formulas should be used for these infants. Most, but not all children, can resume soy protein consumption safely after 5 years of age.

SOY PROTEIN-BASED FORMULAS AND PREVENTION OF ATOPIC DISEASE

Any ingested large molecular weight protein is a potential antigen to the intestinal immune system, including soy protein. In soy protein isolate, 90% of the pulp-derived protein resides in 2 major heat-stable globulins: β-conglycin, with a molecular weight of 180 000; and glycinin, with a molecular weight of 320 000.[83] After enteric digestion, the number of potential antigens generated at the mucosal surface is enormous.[84] As a result, the in vitro demonstration of antigen-specific antibody can be difficult. The antigenicity of soy protein, suspected since 1934,[85] was documented in low-risk infants by Eastham et al in 1982.[86] Intrauterine sensitization has been documented by demonstrating antigen-specific antibody in human amniotic fluid.[87]

Recognizing that soy protein is antigenic does not mean that soy protein is highly allergenic. In a prospective study of healthy infants fed human milk, cow milk formula, or soy protein-based formula, Halpern et al[88] documented true allergic responses in 0.5% and 1.8% of infants to soy formula and cow milk formula, respectively. This frequency is consistent with the summary by Fomon[89] that in 3 decades of study of soy protein-based formulas, <1% of soy formula-fed infants had adverse reactions. In a national survey of pediatric allergists, the occurrence of allergy to cow milk was reported at 3.4%, whereas allergy to soy protein was reported to be 1.1%.[90] Two large studies of infants with atopic dermatitis addressed the frequency with which a double-blind, placebo-controlled challenge with soy protein was positive. Sampson[91] documented a positive soy allergy in 5% of 204 patients, whereas Businco et al[92] implicated soy in 4% of 143 children.

In a recent meta-analysis of 5 randomized or quasi-randomized studies, the authors concluded that feeding with soy formula should not be recommended for the prevention of atopy in infants at high risk of developing allergy.[93] Furthermore, the use of soy protein-based formula during the first 3 months of age does not reduce the frequency of positive antibody responses to cow milk formula introduced later in infancy.[93] When human milk feeding is supplemented with soy formula in infants at high risk, the anticipated frequency of eczema by 2 years of age is not significantly reduced.[94,95] Interpretation of these data are obscured by multiple alterations in the maternal diet and by environmental stimuli. However, isolated soy protein-based formula has no advantage over cow milk-based formula for supplementing the diet of a breastfed infant.

Regarding soy proteins and other food allergies, in 1 partly prospective, partly retrospective study of the risk factors for the development of peanut allergy, feeding of soy milk or soy protein-based formula was associated with the development of peanut allergy (odds ratio: 2.6; 95% confidence interval: 1.3–5.2).[96] However, in a randomized trial of soy formula feeding in infants with cow milk allergy, there was no association between soy formula ingestion with the development of peanut allergy.[97] Thus, the evidence that soy formula feeding increases the risk of developing peanut allergy is contradictory, and additional study is warranted.

Sensitization to soy has been reported in 10% to 14% of infants with cow milk allergy.[98,99] One study documented similar adverse reactions to soy in IgE-associated and non-IgE-associated cow milk allergy (11% vs 9%).[99] A second study evaluated infants and children with IgE-associated cow milk allergy (ages 3–41 months), and 14% (95% confidence interval: 7.7–22.7) were determined to have soy allergy.[98] Thus, although most infants with IgE-mediated cow milk allergy will tolerate soy formula, because of the 10% to 14% crossover rate, the use of an extensively hydrolyzed protein formula rather than a soy formula may be considered in infants allergic to cow milk formula. Although reported in the literature, severe anaphylaxis after soy protein exposure is uncommon, especially in infants.[100,101]

SUMMARY

1. In term infants, although isolated soy protein-based formulas may be used to provide nutrition for normal growth and development, there are few indications for their use in place of cow milk-based formula. These indications include (*a*) for infants with galactosemia and hereditary lactase deficiency (rare) and (*b*) in situations in which a vegetarian diet is preferred.
2. For infants with documented cow milk protein allergy, extensively hydrolyzed protein formula should be considered, because 10% to 14% of these infants will also have a soy protein allergy.
3. Most previously well infants with acute gastroenteritis can be managed after rehydration with continued use of human milk or standard dilutions of cow milk-based formulas. Isolated soy protein-based formulas may be indicated when secondary lactose intolerance occurs.
4. Isolated soy protein-based formula has no advantage over cow milk protein-based formula as a supplement for the breastfed infant, unless the infant has 1 of the indications noted previously.
5. Soy protein-based formulas are not designed for or recommended for preterm infants.
6. The routine use of isolated soy protein-based formula has no proven value in the prevention or management of infantile colic or fussiness.
7. Infants with documented cow milk protein-induced enteropathy or enterocolitis frequently are as sensitive to soy protein and should not be given isolated soy protein-based formula. They should be provided formula derived from hydrolyzed protein or synthetic amino acids.

8. The routine use of isolated soy protein-based formula has no proven value in the prevention of atopic disease in healthy or high-risk infants.

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Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

The Use of Systemic and Topical Fluoroquinolones

John S. Bradley, MD, Mary Anne Jackson, MD, and the COMMITTEE ON INFECTIOUS DISEASES

abstract

FREE

Appropriate prescribing practices for fluoroquinolones are essential as evolving resistance patterns are considered, additional treatment indications are identified, and the toxicity profile of fluoroquinolones in children becomes better defined. Earlier recommendations for systemic therapy remain; expanded uses of fluoroquinolones for the treatment of certain infections are outlined in this report. Although fluoroquinolones are reasonably safe in children, clinicians should be aware of the specific adverse reactions. Use of fluoroquinolones in children should continue to be limited to treatment of infections for which no safe and effective alternative exists. *Pediatrics* 2011;128:e1034–e1045

KEY WORDS

fluoroquinolones, pediatrics, infectious diseases, systemic therapy

ABBREVIATIONS

FDA—Food and Drug Administration
UTI—urinary tract infection
TMP-SMX—trimethoprim-sulfamethoxazole

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

OVERVIEW

Fluoroquinolones are highly active in vitro against both Gram-positive and Gram-negative pathogens and have pharmacokinetic properties that are favorable for treating a wide array of infections. The prototype quinolone antibiotic agent, nalidixic acid, was approved by the US Food and Drug Administration (FDA) for adults in 1964 and generally is considered to be the first generation of such agents. For more than 2 decades, nalidixic acid also has been approved by the FDA and available for children aged 3 months and older. Subsequent chemical modifications of the first quinolone compounds resulted in the development of a series of fluoroquinolone agents with an increased antimicrobial spectrum of activity and better pharmacokinetic tissue-exposure characteristics.

Second-generation agents have a greater Gram-negative spectrum (with activity against *Pseudomonas aeruginosa*) and include ciprofloxacin, levofloxacin, norfloxacin, and ofloxacin. In 2004, ciprofloxacin became the first fluoroquinolone agent approved for use in children 1 through 17 years of age.

Gemifloxacin, a currently marketed third-generation agent, has been approved by the FDA for adults for the treatment of community-acquired pneumonia and acute exacerbations of chronic bronchitis. Compared with earlier agents, gemifloxacin provides substantially increased activity against *Streptococcus pneumoniae* (while retaining activity against many Gram-negative pathogens), *Mycoplasma pneumoniae*, and *Chlamydophila pneumoniae*.

A fourth generation of fluoroquinolones, represented by moxifloxacin, displays increased activity against anaerobes while maintaining the Gram-positive and Gram-negative activity of the third-generation agents. Moxifloxacin also provides excellent activity against many my-

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cobacteria including most strains of *Mycobacterium tuberculosis* currently isolated in the United States.

Animal toxicology data available with the first quinolone compounds documented their propensity to create inflammation and subsequent destruction of weight-bearing joints in juvenile animals.[1,2] This observation effectively sidelined further development or large-scale evaluation of this class of antibiotic agents in children.

A policy statement summarizing the assessment of risks and benefits of fluoroquinolones in pediatric patients was published by the American Academy of Pediatrics in 2006.[3] At that time, parenteral fluoroquinolones were believed to be appropriate for the treatment of infections caused by multidrug-resistant pathogens for which no alternative safe and effective parenteral agent existed. For outpatient management, oral fluoroquinolones were reasonable for treatment of infections when the only other options were intravenous treatment with other classes of antibiotic agents.

Since publication of the previous American Academy of Pediatrics policy statement, the clinical value of fluoroquinolones for the treatment of specific infections in children, particularly those caused by Gram-negative pathogens, has been further documented. The use of topical fluoroquinolone therapy for external otitis is now recommended by the American Association of Otolaryngology.[4] In addition, results of the first randomized, prospective studies on the safety of the fluoroquinolones have been reported.[5,6] No published reports exist of physician-diagnosed cartilage damage in children in the United States, either from controlled clinical trials of fluoroquinolones or from unsolicited reporting to the FDA or drug manufacturers. Quinolones that are currently approved by the FDA and available for use in children are nalidixic acid for urinary tract infections (UTIs), ciprofloxacin for inhalational anthrax and complicated UTI and pyelonephritis, and levofloxacin for inhalational anthrax. Only ciprofloxacin and levofloxacin are available in a suspension formulation. Moxifloxacin is currently under investigation for treatment of complicated intraabdominal infections in children.[7] Other systemic quinolones that may be available in other countries but not the United States are not addressed in this report.

SAFETY

Animal Models

The original toxicology studies with quinolones documented cartilage injury in weight-bearing joints in juvenile animals; damage to the joint cartilage was proportional to the degree of exposure.[1,2] Each quinolone may demonstrate a different potential to cause cartilage toxicity.[8] However, given a sufficiently high exposure, cartilage changes will occur in all animal models with all quinolones, including nalidixic acid.

Although initial reports focused on articular cartilage, the results of subsequent studies suggested the possibility of epiphyseal plate cartilage injury,[9] which led to fluoroquinolone clinical study designs that lasted several years to assess growth potential. Recent data suggest that quinolone toxicity occurs as a result of concentrations present in cartilage that are sufficiently high to form chelate complexes with divalent cations, particularly magnesium, that result in impairment of integrin function and cartilage matrix integrity in the weight-bearing joints, which undergo chronic trauma during routine use.[10]

In studies of ciprofloxacin exposure to very young beagle puppies (one of the most sensitive animal models for quinolone toxicity), clinical evidence of arthrotoxicity was observed during a 14-day treatment course at 90 mg/kg per day but not at 30 mg/kg per day. Apparent joint tenderness at the higher exposure resolved 6 weeks after the last dose of ciprofloxacin.

Histopathologic evidence of cartilage injury was noted in virtually all animals given 90 mg/kg per day. At this exposure level, the observed clinical signs all occurred during and shortly after treatment but resolved by 2 months, with no recurrent signs noted during the 5-month follow-up period. In contrast, histopathologic evidence of cartilage injury was observed at 30 mg/kg per day, the dose currently recommended for children. Histopathologic evidence of inflammation occurred in fewer than half the animals at this dose but persisted for 5 months after treatment, at full skeletal maturation.[5,11] The "no-observed-adverse-event level" was 10 mg/kg per day, a dose at which neither clinical nor histopathologic evidence of toxicity was present.

Similar data, which documented a no-observed-adverse-event level of 3 mg/kg per day for intravenous dosing for 14 days (approximately one-quarter the current FDA-approved dose of 16 mg/kg per day for children who weigh $<$50 kg), were documented before FDA approval of levofloxacin for adults. Levofloxacin has virtually 100% bioavailability; total drug exposure is equivalent between intravenous and oral formulations at the same milligram-per-kilogram dose.[12]

Recent data from investigation of a lamb model, felt to approximate human growth rates and activity more closely than juvenile beagle dogs or rats, have been published. This study addressed epiphyseal cartilage and growth velocity after a 14-day drug exposure to either gatifloxacin or ciprofloxacin that was equivalent to that achieved in children receiving thera-

peutic doses. Gross examination of articular cartilage and microscopic examination of epiphyseal cartilage did not reveal abnormalities consistent with cartilage injury or inflammation.[13]

Preclinical toxicology data are available for all FDA-approved fluoroquinolones. These data document differences in the animal species susceptible to cartilage effects as well as differences between each quinolone in the ability to create cartilage toxicity.

Human Studies

At the time of publication of the last American Academy of Pediatrics policy statement, retrospective studies, case-control series, and case reports represented the published data on fluoroquinolone safety in children available in the peer-reviewed literature.[14–17] Some reports included children with cystic fibrosis, who can develop disease-related arthropathy, and some included more toxic fluoroquinolone agents that were never approved in the United States. These data provided conflicting reports regarding the safety of fluoroquinolones in children. The results of 2 large, prospective safety studies are now available for review; 1 study was performed at the request of the FDA by Bayer for ciprofloxacin, and the second study was performed by Johnson & Johnson for levofloxacin as part of their FDA-coordinated program of pediatric drug development.

In 2008, the FDA's analysis of study data for ciprofloxacin in the treatment of complicated UTI and pyelonephritis in children aged 1 through 17 years from 2004 was posted on the FDA Web site.[5] A series of prospective, randomized, double-blinded studies was performed to compare (1) intravenous ceftazidime with intravenous ciprofloxacin, permitting oral step-down therapy, and (2) oral ciprofloxacin with oral cefixime or trimethoprim-sulfamethoxazole (TMP-SMX). These large studies were conducted in several countries (Table 1). Clinical end points were designed to capture any sign of cartilage or tendon toxicity by eliciting a detailed history of a wide variety of complaints referable to bones and joints (Table 2). Comparing complaints and physical findings between the ciprofloxacin-treated group and the group treated with comparator antimicrobial agents, a difference was detected only in the United States. The difference in rates of complaints varied between countries; the lowest

TABLE 1 Rate of FDA-Defined Arthropathy (See Table 2) 6 Weeks After Treatment With Ciprofloxacin or Comparator, According to Selected Baseline Characteristics

	Ciprofloxacin ($N = 335$)	Comparator ($N = 349$)
All patients, *n*/*N* (%)	31/335 (9.3)	21/349 (6.0)
Country, *n*/*N* (%)		
Argentina	8/77 (10.4)	7/79 (8.9)
Canada	1/8 (12.5)	1/11 (9.1)
Costa Rica	4/21 (19.0)	0/20 (0.0)
Germany	1/13 (7.7)	1/11 (9.1)
Mexico	0/56 (0.0)	0/60 (0.0)
Peru	2/87 (2.3)	3/88 (3.4)
United States	13/62 (21.0)	8/71 (11.3)
South Africa	2/11 (18.2)	1/9 (11.1)
Race, *n*/*N* (%)		
White	18/130 (13.8)	13/134 (9.75)
Black	0/5 (0.0)	1/7 (14.3)
Asian	0/3 (0.0)	1/6 (16.7)
Hispanic	8/102 (7.8)	3/109 (2.8)
Uncoded	5/95 (5.3)	3/93 (3.2)
Gender, *n*/*N* (%)		
Male	6/62 (9.7)	4/65 (6.2)
Female	25/273 (9.2)	17/284 (6.0)

TABLE 2 Rate of FDA-Defined Arthropathy 6 Weeks and 1 Year After Treatment With Ciprofloxacin or a Comparator

	Ciprofloxacin ($N = 335$)		Comparator ($N = 349$)
Arthropathy rate at 6 wk of follow-up, *n* (%)	31 (9.3)		21 (6.0)
95% confidence interval[a]		(−0.8 to 7.2)	
Cumulative arthropathy rate at 1 y of follow-up, *n* (%)	46 (13.7)		33 (9.5)
95% confidence interval[a]		(−0.6 to 9.1)	
Selected musculoskeletal adverse events[b] in patients with arthropathy at 1 y of follow-up			
No. of patients	46[c]		33[c]
Arthralgia, *n* (%)	35 (76)		20 (61)
Abnormal joint and/or gait exam, *n* (%)	11 (24)		8 (24)
Accidental injury, *n* (%)	6 (13)		1 (3)
Leg pain, *n* (%)	5 (11)		1 (3)
Back pain, *n* (%)	4 (9)		0 (0)
Arthrosis, *n* (%)	4 (9)		1 (3)
Bone pain, *n* (%)	3 (7)		0 (0)
Joint disorder, *n* (%)	2 (4)		0 (0)
Pain, *n* (%)	2 (4)		2 (6)
Myalgia, *n* (%)	1 (2)		4 (12)
Arm pain, *n* (%)	0 (0)		2 (6)
Movement disorder, *n* (%)	1 (2)		1 (3)

[a] The study was designed to demonstrate that the arthropathy rate for the ciprofloxacin group did not exceed that of the comparator group by more than 6.0%. At both evaluations, the 95% confidence interval indicated that it could not be concluded that ciprofloxacin had findings comparable to those of the comparator.

[b] Events that occurred in 2 or more patients.

[c] A patient with arthropathy may have had more than 1 event.

rates were reported from Mexico (0% ciprofloxacin, 0% comparator), and the highest rates were reported from the United States (21% ciprofloxacin, 11% comparator). The study used a noninferiority design to assess musculoskeletal complaints between the 2 treatment groups across all countries, and as analyzed, the groups were sufficiently different to suggest potential musculoskeletal toxicity with ciprofloxacin (Table 2).

The levofloxacin safety data collection was prospective and randomized but not blinded. The published safety profile of levofloxacin included a large cohort of 2523 children from 3 large multicenter efficacy trials. Data were collected from a community-acquired pneumonia trial in children aged 6 months to 16 years (a randomized 3:1, prospective, comparative trial with 533 levofloxacin-exposed and 179 comparator-exposed evaluable subjects) and from 2 trials that assessed therapy of acute otitis media in children aged 6 months to 5 years (1 open-label noncomparative study with 204 evaluable subjects and another randomized 1:1, prospective, comparative trial with 797 levofloxacin-exposed and 810 comparator-exposed evaluable subjects).[6] In addition, after completion of the treatment trials, all subjects from both treatment arms were also offered participation in an unblinded, long-term, 12-month follow-up study for safety assessments, and 2233 of 2523 families participated. From these trials, a selected group of children who were judged to benefit from additional follow-up because of the presence of tendon/joint abnormalities or failure to achieve expected vertical growth over the year of observation were continued in the musculoskeletal long-term follow-up study, which consisted of yearly visits for 4 additional years.

The definitions of musculoskeletal events for tendinopathy (inflammation or rupture of a tendon as determined by physical examination and/or MRI or ultrasound), arthritis (inflammation of a joint as evidenced by redness and/or swelling of the joint), arthralgia (pain in the joint as evidenced by complaint), and gait abnormality (limping or refusal to walk) were determined before starting the studies. The identity of study medication was known by parents, study personnel, and the subject's care providers as reports of musculoskeletal events and any other adverse events were collected during the follow-up period. An analysis of these events occurred 1, 2, and 12 months after treatment. The analysis of disorders that involved weight-bearing joints revealed a statistically greater rate between the levofloxacin- and comparator-treated groups at 2 months (1.9% vs 0.7%; $P = .025$) and at 12 months (2.9% vs 1.6%; $P = .047$). A history of joint pain accounted for 85% of all events, and there were no findings of joint abnormality when assessed by physical examination. Computed tomography or MRI was performed for 5 of the patients with musculoskeletal symptoms; no signs of structural injury were identified. No evidence of joint abnormalities was observed at 12 months in the levofloxacin group.

A report on the 5-year safety assessment of the 2233 children who received levofloxacin treatment was recently completed by the manufacturer, Johnson & Johnson. Specified criteria for review included (1) documented height that was less than 80% of the expected height increase, (2) abnormal bone or joint findings, and (3) any other concerns for possible tendon/joint toxicity identified by the data safety monitoring board during treatment or in the 12 months after treatment. A total of 174 of 207 (84%) reviewed subjects were identified by the predetermined growth criteria (124 levofloxacin-treated and 83 comparator-treated subjects), and 49% of each group completed the entire 5-year follow-up. Although an increase in musculoskeletal events in the levofloxacin group had been noted 12 months after treatment, the cumulative long-term outcomes of children with musculoskeletal adverse events reported during the 5-year safety study (including ongoing arthropathy, peripheral neuropathy, abnormal bone development, scoliosis, walking difficulty, myalgia, tendon disorder, hypermobility syndrome, and pain in the spine, hip, and shoulder) were slightly higher in the comparator treatment group (2% levofloxacin, 4% comparator). Among all study participants identified by the growth criteria ($n = 174$), equal percentages of children from each treatment group were documented to fall into the previously defined categories at the 5-year visit: no change in height percentile; improvement; or deterioration in growth characteristics. This 5-year follow-up study enrolled 48% of study participants from US sites compared with 20% from US sites enrolled in the original clinical trials (unpublished data on file, J&J protocol LOFBO-LTSS-001, clinical study report, March 23, 2011).

A rare complication associated with quinolone antibiotic agents, tendon rupture, has a predilection for the Achilles tendon (often bilateral) and is estimated to occur at a rate of 15 to 20 per 100 000 treated patients in the adult population. Advanced age, along with antecedent steroid therapy and a particular subset of underlying diseases, including hypercholesterolemia, gout, rheumatoid arthritis, end-stage renal disease/dialysis, and renal transplantation, have been identified as risk factors and prompted an FDA warning about this serious adverse event for all quinolone agents. Achilles tendon rupture in the pediatric popu-

TABLE 3 Rate of FDA-Defined Neurologic Adverse Events by 6 Weeks After Treatment With Ciprofloxacin or Comparator

Neurologic Adverse Events	Ciprofloxacin ($N = 335$), *n* (%)	Comparator ($N = 349$), *n* (%)
Any event	9 (3)	7 (2)
Dizziness	3 (<1)	1 (<1)
Nervousness	3 (<1)	1 (<1)
Insomnia	2 (<1)	0 (0)
Somnolence	2 (<1)	0 (0)
Abnormal dreams	0 (0)	2 (<1)
Convulsion	0 (0)	2 (<1)
Hypertonia	0 (0)	1 (<1)
Abnormal gait	0 (0)	1 (<1)

lation, in general, is extremely rare, and although tendonitis in athletes is observed, this event usually follows overuse. To date, there have been no reports of this rare complication in a pediatric patient who was exposed to a quinolone, which precludes assessment of the risk of this complication in children.

Other potential toxicities of fluoroquinolone-class antibiotic agents do not occur commonly in children but include central nervous system adverse effects (seizures, headaches, dizziness, lightheadedness, sleep disorders), peripheral neuropathy, hypersensitivity reactions, photosensitivity and other rashes, disorders of glucose homeostasis (hypoglycemia and hyperglycemia), prolongation of QT interval, and hepatic dysfunction.

In the prospective ciprofloxacin study requested by the FDA, the rate of neurologic events was similar between ciprofloxacin- and comparator-treated children (Table 3).[5] Reported rates of neurologic events in the levofloxacin safety database were statistically similar between fluoroquinolone- and comparator-treated children.[18,19]

RESISTANCE

Quinolone resistance has been a concern since the first approval of these agents, given the broad spectrum of activity and the large number of clinical indications. Multiple mechanisms of resistance have been described, including mutations that lead to changes in the target enzymes DNA gyrase and DNA topoisomerase, as well as efflux pumps and alterations in membrane porins.[20] Newly described plasmid-encoded quinolone-resistance proteins have the ability to spread rapidly.[21]

Surveillance studies have tracked fluoroquinolone resistance in *S pneumoniae* strains isolated primarily from adult patients with respiratory tract infections and in *Escherichia coli* isolated from adult patients with UTIs. A number of studies also have assessed resistance in other enteric bacilli,[22–25] *Pseudomonas aeruginosa*,[26] *Neisseria gonorrhoeae*,[27] *Neisseria meningitidis*,[28] and *Streptococcus pyogenes*.[29,30] One recent study in North America addressed fluoroquinolone resistance in both Gram-negative and Gram-positive isolates, specifically from children younger than 7 years.[31] Previous concerns that continuing widespread use of respiratory fluoroquinolones would lead to substantial increases in pneumococcal resistance and subsequent lack of usefulness of this class of agents for respiratory tract infections[32–34] have, fortunately, not been confirmed by current published surveillance data, particularly for pneumococcal isolates from children.[31,35,36] The Active Bacterial Core Surveillance of the Centers for Disease Control and Prevention documented virtually no levofloxacin resistance in children younger than 2 years between 1999 and 2004.[37] In large-scale pediatric studies of levofloxacin for acute otitis media, emergence of levofloxacin-resistant pneumococci was not documented in children with persisting pneumococcal colonization after treatment, which suggests that emergence of resistance during treatment is not a common event.[38] Possible reasons for the lack of increasing multidrug-resistant serotypes in both children and adults in populations in North America and Europe include the almost universal use of conjugate pneumococcal vaccine in children since 2000 as well as the lack of widespread use of fluoroquinolones in children.[37,39–41]

In adult patients, *Pseudomonas* resistance to both fluoroquinolones and other antimicrobial agents is problematic.[42] Data on resistance in *E coli* isolated from adults with UTIs who were seen in emergency departments in the EMERGEncy ID NET, a network of 11 geographically diverse university-affiliated institutions, suggest a low but stable rate of resistance of approximately 5%,[24] although in specific locations, rates of resistance for outpatients are closer to 10%.[22,43] Similar published data do not exist for children, although in recent reports that included outpatient data, stratified according to age, the rates of fluoroquinolone resistance in *E coli* in children have been generally well below 3%.[23,43]

For hospitalized children in a major tertiary care pediatric center, only 3% of 271 bloodstream isolates of *E coli* and *Klebsiella* species collected over 4 years (1999–2003) were resistant to fluoroquinolones.[44] With the exception of children with cystic fibrosis, overall resistance in pediatric Gram-negative isolates, including *P aeruginosa*, has been lower than 5%.[31] Data available from 3 large tertiary care children's hospitals document ciprofloxacin resistance for *E coli* to range from 4% to 7% for 2010 (B. Connelly, MD [Cincinnati Children's Hospital and Medical Center, Cincinnati, OH], M. A. Jackson, MD [Mercy Children's Hospital, Kansas City, MO], and J. Bradley, MD [Rady Children's Hospital, San Diego, CA], verbal communication, May 2011), and the rates have seemed stable for the last 3 years.

TABLE 4 Most Common Infections for Which Fluoroquinolones Are Effective Therapy (See Text)

Infection	Primary Pathogen(s)[a]	Fluoroquinolone
Systemic antibiotic requirement[b]		
UTI	*Escherichia coli*	Ciprofloxacin[c]
	Pseudomonas aeruginosa	
	Enterobacter species	
	Citrobacter species	
	Serratia species	
Acute otitis media; sinusitis	*Streptococcus pneumoniae*	Levofloxacin[d]
	Haemophilus influenzae	
Pneumonia	*Streptococcus pneumoniae*	Levofloxacin
	Mycoplasma pneumoniae (macrolides preferred for *Mycoplasma* infections)	
Gastrointestinal infections	*Salmonella* species	Ciprofloxacin[c]
	Shigella species	
Topical antibiotic requirement[e,f]		
Conjunctivitis	*Streptococcus pneumoniae*	Besifloxacin
	Haemophilus influenzae	Levofloxacin
		Gatifloxacin
		Ciprofloxacin
		Moxifloxacin
		Ofloxacin
Acute otitis externa; tympanostomy tube–associated otorrhea	*Pseudomonas aeruginosa*	Ciprofloxacin[g]
	Staphylococcus aureus	Ofloxacin
	Mixed Gram-positive/Gram-negative organisms	

[a] Assuming that the pathogen is either documented to be susceptible or presumed to be susceptible for fluoroquinolones.
[b] If oral therapy is appropriate, use other classes of oral antibiotics if organisms are susceptible.
[c] Dose of ciprofloxacin: oral administration, 20 to 40 mg/kg per day, divided every 12 hours (maximum dose: 750 mg per dose); intravenous administration, 20 to 30 mg/kg per day, divided every 8 to 12 hours (maximum dose: 400 mg per dose).
[d] Dose of levofloxacin: oral or intravenous administration, 16 to 20 mg/kg per day divided every 12 hours (for children 6 months to 5 years of age) or 10 mg/kg per day once daily (for children 5 years of age and older) (maximum dose: 750 mg per dose).
[e] Systemic toxicity of fluoroquinolones is not a concern with topical therapy; use of topical agents should be determined according to suspected pathogens, efficacy for mucosal infection, tolerability, and cost.
[f] Other systemic therapy may be required for more severe infection.
[g] Available with and without corticosteroid.

As fluoroquinolone use in pediatrics increases, it is expected that resistance will increase, as has been documented in adults. Appropriate use of fluoroquinolones in children should limit the development and spread of resistance.

USE OF FLUOROQUINOLONES FOR PEDIATRIC INFECTIONS

Conjunctivitis

An increasing number of topical fluoroquinolones have been investigated and approved by the FDA for treatment of acute conjunctivitis in adults and children older than 12 months, including levofloxacin, moxifloxacin, gatifloxacin, ciprofloxacin, and besifloxacin (Table 4). Conjunctival tissue pharmacokinetic evaluation was conducted in healthy adult volunteers; besifloxacin, gatifloxacin, and moxifloxacin were compared by using conjunctival biopsy. All 3 agents reached peak concentrations after 15 minutes.[45] Bacterial eradication and clinical recovery of 447 patients aged 1 through 17 years with culture-confirmed bacterial conjunctivitis was evaluated in a posthoc multicenter study that investigated besifloxacin and moxifloxacin ophthalmic drops.[46] Although better clinical and microbiological response was noted for besifloxacin compared with placebo, similar outcomes were noted when compared with moxifloxacin. Both agents were reported to be well tolerated. Although drug concentrations are only 1 indicator of potential clinical efficacy, the utility of agents with higher concentrations is tempered by the observation of a potential increase in ocular adverse events, such as eye pain,[45] and slower corneal reepithelialization with specific agents.[47]

External Otitis, Tympanostomy Tube–Associated Otorrhea

Recommendations for optimal care for patients with otitis externa were outlined in a review of 19 randomized controlled trials, including 2 from a primary care setting, which yielded 3382 participants. Topical antibiotic agents containing corticosteroids seemed to be more effective than acetic acid solutions. Aminoglycoside-containing otic preparations were reported to cause ototoxicity if the tympanic membrane was not intact; fluoroquinolone-containing preparations represent a safer alternative for treating both otorrhea associated with tympanic membrane perforation and tympanostomy tube otorrhea. Eleven trials included aural toilet as a routine intervention, but the authors acknowledged that this treatment is not likely to be available in a typical primary care office setting.[48] The paucity of high-quality studies of antimicrobial-based topical therapy limited conclusions in this review. A small, prospective, randomized, open-label study of 50 patients with tympanostomy tube–associated otorrhea or a tympanic membrane perforation resulted in comparable outcomes with either topical antibiotic therapy or topical plus systemic antibiotic agents.[49] For children with severe acute otitis externa, systemically administered antimicrobial agents should be considered in addition to topical therapy.[50]

Which topical antibiotic agent is best for external otitis is unclear. High-quality studies that evaluated quinolone versus nonquinolone topical solutions have been limited. A systematic review of 13 meta-analyses confirmed

that topical antibiotic agents were superior to placebo and noted a statistically significant advantage of quinolone agents over nonquinolone agents in the rate of microbiological cure ($P = .035$), although the clinical import of this advantage is likely of limited value. Safety profiles were similar between groups.[50] A conclusion that quinolone and nonquinolone agents are similar in both microbiological and clinical cure rates was reached in a study of more than 200 children, 90 of whom were evaluated for microbiological response in a multicenter, randomized, parallel-group, evaluator-blinded study that compared once-daily ofloxacin drops to 4-times-daily neomycin sulfate/polymyxin B sulfate/hydrocortisone otic suspension. Microbial eradication was documented in 95% and 94%, respectively; clinical cure was achieved in 96% and 97%, respectively. Treatment was well tolerated with both regimens.[51]

Acute Otitis Media, Sinusitis, and Lower Respiratory Tract Infections

Newer fluoroquinolones display enhanced in vitro activity against *S pneumoniae* compared with ciprofloxacin. The clinical need for such agents to treat respiratory tract infections has largely been driven by the emergence of multidrug-resistant strains of this pathogen. Pharmacokinetic data for children 6 months of age and older are well defined for levofloxacin, the only currently available fluoroquinolone that has been studied for respiratory tract infections in children.[52] The pharmaceutical manufacturer is currently not intending to present data to the FDA to obtain approval for the use of levofloxacin for acute bacterial otitis media or community-acquired pneumonia in children (S. Maldonado, Johnson & Johnson, written communication, May 2011).

Acute Bacterial Otitis Media

Clinical studies of levofloxacin and gatifloxacin have been conducted in children with recurrent or persistent otitis media but not simple acute bacterial otitis media. Although the results of studies of several fluoroquinolones have been reported, only levofloxacin is currently available in the United States. A prospective, open-label, noncomparative study of levofloxacin was performed in 205 children 6 months of age and older, 80% of whom were younger than 2 years. Tympanocentesis was performed at study entry and at least at 3 to 5 days into therapy for children for whom treatment failed or who had persistent effusion. Bacterial eradication of middle-ear pathogens occurred in 88% of children, including 84% infected by pneumococci and 100% infected by *Haemophilus influenzae*. Levofloxacin treatment was well tolerated; vomiting in 4% of the patients was documented as the most common adverse effect.[53] An evaluator-blinded, active-comparator, noninferiority, multicenter study that involved 1305 evaluable children older than 6 months and compared levofloxacin to amoxicillin-clavulanate (1:1) found equivalent clinical cure rates of 75% in each treatment arm. However, because tympanocentesis was not required, microbiological cure rates could not be determined.[19]

Pneumonia

Although initially approved by the FDA for the treatment of pneumonia and acute exacerbation of chronic bronchitis in adults, ciprofloxacin therapy has not been uniformly successful in treatment of pneumococcal pneumonia in adults at dosages initially studied 30 years ago. Failures are most likely a result of the increasing pneumococcal resistance to ciprofloxacin and other fluoroquinolones documented since their first approval.[54] Ciprofloxacin is currently not considered appropriate therapy for community-acquired pneumonia in adults.

Fluoroquinolones with enhanced activity against *S pneumoniae* compared with ciprofloxacin (levofloxacin, moxifloxacin, gemifloxacin) have been used in adults for single-drug treatment of community-acquired pneumonia. These "respiratory tract" fluoroquinolones have demonstrated in vitro activity against the most commonly isolated pathogens: *S pneumoniae*, *Haemophilus influenzae* (nontypeable), and *Moraxella catarrhalis*, as well as *M pneumoniae*, *C pneumoniae*, and *Legionella pneumophila*.[55–57] Although these agents are not the drugs of choice for pneumonia in previously healthy adults, they are recommended for adults with underlying comorbidities and for those who have been exposed to antibiotic agents within the previous 3 months and, therefore, are more likely to be infected with antibiotic-resistant pathogens.[58] Failures in the treatment of pneumococcal pneumonia have been reported with levofloxacin at 500 mg daily as a result of emergence of resistance on therapy or resistance from previous exposures to fluoroquinolones.[59] An increased dose of levofloxacin—750 mg daily, given for 5 days—is currently approved by the FDA for adults with pneumonia. The increase in drug exposure at the higher dose is designed to overcome the most common mechanism for the development of fluoroquinolone resistance.[60]

Of the fluoroquinolones, only levofloxacin has been studied prospectively in children with community-acquired pneumonia; efficacy in a multinational, open-label, noninferiority-design trial compared with standard antimicrobial agents for pneumonia was documented. For children aged 6 months to 5 years, levofloxacin (oral or intravenous) was compared with amoxicillin/

clavulanate (oral) or ceftriaxone (intravenous). For children 5 years of age and older, levofloxacin (oral) was compared with clarithromycin (oral), and levofloxacin (intravenous) was compared with ceftriaxone (intravenous) in combination with either erythromycin (intravenous) or clarithromycin (oral). Clinical cure rates were 94.3% in the levofloxacin-treated group and 94.0% in the comparator group, and there were similar rates of cure in both the younger and older age groups. Microbiological etiologies were investigated, and *Mycoplasma* was the most frequently diagnosed pathogen (by serologic testing), representing 32% of those receiving levofloxacin in both older and younger age groups and approximately 30% of those receiving comparator agents in both age groups. Pneumococci were infrequently documented to be the cause of pneumonia in study patients, representing only 3% to 4% of those who received levofloxacin and 3% to 5% of those receiving comparator. It should be noted that the clinical response rate of 83% in children younger than 5 years diagnosed by serologic testing with *Mycoplasma* infection and treated with amoxicillin/clavulanate was similar to that in children treated with levofloxacin (89%), which indicates a high rate of spontaneous resolution of disease caused by *Mycoplasma* species in preschool-aged children, poor accuracy of diagnosis by serologic testing, or a clinical endpoint evaluation after a treatment course that could not identify possible differences in response that may have been present in the first days of therapy.[18]

Although fluoroquinolones may represent effective therapy, they are not recommended for first-line therapy of respiratory tract infection in children, because other better-studied and safer antimicrobial agents are available to treat the majority of the currently isolated pathogens.

Gastrointestinal Infections

Alghasham and Nahata[61] summarized the results of 12 efficacy trials that used a number of fluoroquinolone agents for infections caused by *Salmonella* and *Shigella* species. However, data from only 2 of the 12 trials that compared fluoroquinolones to nonquinolone agents were reported. Patients were treated for typhoid fever (8 studies, including 7 for multidrug-resistant strains), invasive nontyphoid salmonellosis (1 study), and shigellosis (3 studies). Clinical and microbiological success with fluoroquinolone therapy for these infections was similar for children and adults. A recent report suggested caution in the use of fluoroquinolones in visitors returning from India with typhoid fever, because antimicrobial-resistant *Salmonella typhi* strains, including strains with decreased susceptibility to fluoroquinolones, have been noted.[62]

A prospective, randomized, double-blind comparative trial of acute, invasive diarrhea in febrile children was conducted by Leibovitz et al,[63] who compared ciprofloxacin with intramuscular ceftriaxone in a double-dummy treatment protocol. Two hundred and one children were treated and evaluated for clinical and microbiological cure as well as for safety. Pathogens were isolated in 121 children, most commonly *Shigella* and *Salmonella* species. Clinical and microbiological cure were equivalent between groups. No arthropathy was detected during or up to 3 weeks after completion of therapy.[63]

In the United States, although cases of typhoid fever and invasive salmonellosis are uncommon, there are up to 280 000 cases of shigellosis per year, most of which occur in preschool-aged children with relatively mild disease. Treatment is recommended primarily to prevent spread of infection. Ampicillin and TMP-SMX resistance is increasing, and multidrug-resistant strains are becoming common; the National Antimicrobial Resistance Monitoring System (NARMS) reported that 38% of the strains isolated from 1999–2003 were resistant to both ampicillin and TMP-SMX. A 2005 outbreak of multidrug-resistant *Shigella sonnei* infection involving 3 states was reported in the *Morbidity and Mortality Weekly Report*[64]; 89% of the strains were resistant to both agents, but 100% of the strains were susceptible to ciprofloxacin. Treatment options for multidrug-resistant shigellosis, depending on the antimicrobial susceptibilities of the particular strain, include ciprofloxacin, azithromycin, and parenteral ceftriaxone.

Although ciprofloxacin has been regarded as an effective agent for traveler's diarrhea in the past, resistance rates are increasing for specific pathogens in many parts of the world. Resistance in *Campylobacter* species is particularly problematic in countries such as Taiwan, Thailand, and Sweden, where rates of 57%, 84%, and up to 88%, respectively, have been reported.[65,66]

Urinary Tract Infection

Standard empiric therapy for uncomplicated UTI in the pediatric population continues to be a cephalosporin antibiotic agent, because TMP-SMX- and amoxicillin-resistant *E coli* are increasingly common. The fluoroquinolones remain a potential first-line agent only in the setting of pyelonephritis or complicated UTI when typically recommended agents are not appropriate on the basis of susceptibility data, allergy, or adverse-event history. The previous American Academy of Pediatrics policy statement (2006) supported the use of

ciprofloxacin as oral therapy for UTI and pyelonephritis caused by *P aeruginosa* or other multidrug-resistant Gram-negative bacteria in children aged 1 through 17 years and remains current.[3]

Mycobacterial Infections

The fluoroquinolones are active in vitro against mycobacteria, including *M tuberculosis* and many nontuberculous mycobacteria.[58,67] Increasing multidrug resistance in *M tuberculosis* has lead to the increased use of fluoroquinolones as part of individualized, multiple-drug treatment regimens; levofloxacin and moxifloxacin have demonstrated greater bactericidal activity than has ciprofloxacin.[68] Treatment regimens that include fluoroquinolones for 1 to 2 years for multidrug-resistant and extensively drug-resistant tuberculosis have not been prospectively studied in children. However, the benefit of treatment of tuberculosis with an active compound when other active alternatives are not available is greater than the potential for arthropathy. No joint toxicity has yet been reported in children who have received long-term therapy for tuberculosis, but data on safety have not been collected systematically.

Other Uses

Ciprofloxacin is effective in eradicating nasal carriage of *Neisseria meningitidis* (single dose: 500 mg for adults and 20 mg/kg for children older than 1 month), is preferred in nonpregnant adult women, and can be considered for younger patients as an alternative to rifampin, depending on results of a risk/benefit assessment.

Good penetration into the cerebrospinal fluid by certain fluoroquinolones has been reported, and concentrations often exceed 50% of the corresponding plasma drug concentration. In cases of multidrug-resistant Gram-negative meningitis in which no other agents are suitable, fluoroquinolones may represent the only treatment option.[69]

P aeruginosa can cause skin infections (including folliculitis) after exposure to inadequately chlorinated swimming pools or hot tubs. For children who require systemic therapy, fluoroquinolone agents offer an oral treatment option that may be preferred over parenteral nonfluoroquinolone antimicrobial therapy.

SUMMARY

Use of a fluoroquinolone in a child or adolescent may be justified in special circumstances in which (1) infection is caused by a multidrug-resistant pathogen for which there is no safe and effective alternative and (2) the options for treatment include either parenteral nonfluoroquinolone therapy or oral fluoroquinolone therapy, and oral therapy is preferred. In other clinical situations outlined previously, fluoroquinolones may also represent a preferred option (eg, topical fluoroquinolones in the treatment of tympanostomy tube–associated otorrhea) or an acceptable alternative to standard therapy because of concerns for antimicrobial resistance, toxicity, or characteristics of tissue penetration.

No compelling published evidence to date supports the occurrence of sustained injury to developing bones or joints in children treated with available fluoroquinolone agents; however, FDA analysis of ciprofloxacin safety data, as well as posttreatment and 12-month follow-up safety data for levofloxacin, suggest the possibility of increased musculoskeletal adverse effects in children who receive fluoroquinolones compared with agents of other classes. Many drugs in common pediatric use lack specific FDA approval for children. In the case of fluoroquinolones, as is appropriate with all antimicrobial agents, practitioners should verbally review common, anticipated potential adverse events, and indicate why a fluoroquinolone is the most appropriate antibiotic agent for a child's infection.

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AMERICAN ACADEMY OF PEDIATRICS

Committee on Drugs

Uses of Drugs Not Described in the Package Insert (Off-Label Uses)

ABSTRACT. New regulatory initiatives have been designed to ensure that new drugs and biologicals include adequate pediatric labeling for the claimed indications at the time of, or soon after, approval. However, because such labeling may not immediately be available, off-label use (or use that is not included in the approved label) of therapeutic agents is likely to remain common in the practice of pediatrics. This policy statement was written to address questions practitioners have regarding off-label use. The purpose of off-label use is to benefit the individual patient. Practitioners may use their professional judgment to determine these uses. Practitioners should understand that the Food and Drug Administration does not regulate off-label use.

ABBREVIATIONS. FDA, Food and Drug Administration; IND, investigational new drug; FDAMA, Food and Drug Administration Modernization Act of 1997.

OFF-LABEL USE OF APPROVED DRUGS

Off-label use of an approved drug refers to a use that is not included in the approved label.* Omission of uses for a specific age group or a specific disorder from the approved label means that the evidence required by law to allow their inclusion in the label has not been submitted to the Food and Drug Administration (FDA). This circumstance is often reflected in statements such as "safety and efficacy in pediatric patients have not been established" in the product label. Off-label use does not imply an improper use and certainly does not imply an illegal use or a contraindication based on evidence. Explicit evidence-based warnings and contraindications are provided in product labels. The distinction between lack of FDA approval of a use or dosing regimen and explicit warnings or contraindications against uses is important medically and legally.

The package insert (label) is intended to provide all of the information judged to be necessary for the drug or biological to be used safely and effectively for the approved indication(s). Special groups, however, such as children and pregnant women, have commonly been excluded by disclaimers in the label because substantial evidence of safety and efficacy has not been submitted to the FDA. Three fourths of the prescription drugs currently marketed in the United States lack pediatric use information and are labeled with such disclaimers.[1,2] Most drugs have not been adequately studied in the pediatric population. Recent regulations and legislation have been introduced to improve this situation. A description of these is provided in Appendix 1.

THE FDA AND FEDERAL LAW

The FDA regulates the manufacture, labeling, and promotion of drugs; it does not regulate the use of drugs by physicians (ie, the practice of medicine). The FDA's approval of a new drug is based on data submitted by the manufacturer. The Food, Drug, and Cosmetic Act[3] requires that "substantial evidence," resulting from "adequate and well-controlled investigations" demonstrating that a new drug "will have the effect it purports or is represented to have under the conditions of use prescribed, recommended, or suggested in the proposed labeling," be submitted to and reviewed and approved by the FDA before the drug is marketed in interstate commerce. For biologicals (eg, vaccines) proof of effectiveness consists of "adequate and well-controlled studies" as defined for new drugs in the Code of Federal Regulations.[4] Biologicals are approved under the Public Health Service Act.[5] Given these requirements as well as the rapid pace of medical discovery, it is not surprising that labels do not reflect all possible uses of an agent.

PRACTITIONER RESPONSIBILITY

The practitioner who prescribes a drug is responsible for deciding which drug and dosing regimen the patient will receive and for what purposes. This decision is made on the basis of the information contained in the drug's label or other data available to the prescriber. The off-label use of a drug should be based on sound scientific evidence, expert medical judgment, or published literature. New uses, doses, or indications will not be approved by the FDA until substantial evidence of safety and effectiveness for that indication or age group is submitted to the FDA. This may take years or may never occur, because until recently, there has been little incentive for manufacturers to conduct trials and submit data for new uses in pediatric patients. Practitioners may be concerned that the off-label use of an approved drug may invite a variety of legal actions. To con-

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

*See also Title 21 Section 201.56 (21 CFS 201.56)–General requirements on content and format of labeling for human prescription drugs. The labeling shall contain a summary of the essential scientific information needed for the safe and effective use of the drug. The labeling shall be informative and accurate and neither promotional in tone nor false or misleading in any particular. The labeling shall be based whenever possible on data derived from human experience.

PEDIATRICS (ISSN 0031 4005).

form to accepted professional standards, the off-label use of a drug should be done in good faith, in the best interest of the patient, and without fraudulent intent.

A practitioner may be accountable for the negligent use of any drug in a civil action whether or not the FDA has approved the use of that drug. Labeling is not intended to preclude the practitioner from using his or her best medical judgment in the interest of patients or to impose liability for off-label use. Indeed, the practice of medicine may require a practitioner to use drugs off-label to provide the most appropriate treatment for a patient.

EXPERIMENTATION AND RESEARCH

One frequently asked question is whether an off-label use of an approved drug should be viewed as experimentation requiring formalized institutional review and informed consent. This question reflects a misunderstanding of what constitutes research. The FDA approval process does not determine whether treatment constitutes experimentation and research. According to federal regulations, "Clinical investigation means any experiment in which a drug is administered or dispensed to, or used involving, one or more human subjects. For the purposes of this part, an experiment is any use of a drug except for the use of a marketed drug in the course of medical practice."[6] In most situations, off-label use of medications is neither experimentation nor research. Any medical intervention is based on consent, albeit implied in many instances. Whether institutional review, consultation, or written consent is required for a given intervention depends on the degree of risk or deviation from standard practices and the extent to which research, rather than individual patient care, is involved. The administration of an approved drug in a way that is not approved by the FDA is not research and does not call for special consent or review if it is given in the individual patient's best interest. However, discussion about the off-label status of a drug may, as a matter of professional judgment, be part of the information provided to the patient or parents. Similarly, the degree of acceptance among physicians of an off-label drug treatment may be an important issue to discuss with a patient or family.

There seems to be confusion also about whether an off-label use requires submission of an investigational new drug (IND) application to the FDA. Use of approved drugs in an off-label manner to treat an individual patient does not require an IND application. The IND regulations "do not apply to the use in the practice of medicine for an unlabeled indication."[7] In fact, the IND process regulates interstate shipment of the drug for investigation of an unapproved use in humans. For further description of the IND process, see Appendix 2.

DEVELOPMENT OF DRUG INFORMATION

Physicians who choose to prescribe a medication with limited pediatric data have a public and a professional responsibility to assist in the systematic development of the information about that drug for the benefit of other patients. Practitioners are encouraged to publish experiences that result from such off-label uses of drugs. It is also important that information about adverse events be reported to the drug manufacturer or directly to the FDA. Physicians or other practitioners should report serious adverse events via the FDA's MedWatch program by mail, phone, or Internet (http://www.fda.gov/medwatch). The law requires manufacturers to report all adverse experience reports they receive or are aware of (eg, published literature) to the FDA. Promising new uses for approved drugs might best be reported to the drug sponsor to encourage formal investigation. The full and ultimate role of a drug is rarely evident at the time of its initial approval and labeling. Many of the most important uses and toxicities emerge from postmarketing clinical experience. Although these uses are often discovered through off-label therapeutic use, confirmation of efficacy and safety in formal studies is usually required. In clinical practice, new uses or dosing regimens often become widespread and well accepted long before they are reflected in the labeling.

Expanded indications and new dosing regimens may eventually be supported by objective data that may be incorporated into the approved labeling. For example, postapproval changes in labeling include imipramine hydrochloride for the treatment of enuresis, lidocaine hydrochloride for the treatment of arrhythmias in children, furosemide for use in children, and naloxone hydrochloride for use in infants. Postmarketing safety experience may ultimately lead to restriction of labeled or off-label uses of the drug or eventual withdrawal from the market. Information about the dosage, metabolism, elimination, and adverse effects of drugs in pediatric patients is often not available when the drugs are approved initially. The decision to prescribe an approved drug for an off-label use should be based on all available data.

APPENDICES

Appendix 1. Recent Regulations and Legislation to Increase the Study of Drugs in Pediatric Patients

A regulation published in 1994 (the "1994 Pediatric Final Rule"[8]) that recognizes several methods of establishing substantial evidence to support pediatric labeling remains in effect. These methods include relying in certain cases on efficacy studies performed in adults and other supporting information to adequately label the product for safe and effective use in the pediatric population. The FDA has issued a new regulation (the "1998 Pediatric Final Rule"[9]), which became effective April 1, 1999, that requires pediatric studies of certain new and marketed drugs and biologicals. This rule establishes a presumption that new drugs and biologicals will be studied in pediatric patients unless the requirement is waived. The 1998 Pediatric Final Rule is designed to ensure that new drugs and biologicals contain adequate pediatric labeling for the claimed indications at the time of, or soon after, approval. Under this rule, the FDA can require studies to assess the safe and effective use of the drug or biological in the pediatric population for the claimed indications. This rule also authorizes the FDA to require pediatric studies of marketed drugs and biologicals when there is a compelling need for studies (ie, the product is used in a substantial number of pediatric patients or the product provides a meaningful therapeutic benefit over existing treatments for pediatric patients and, in either case, the absence of adequate labeling could pose significant risks for pediatric patients).

In 1997, a law was enacted (the Food and Drug Administration

Modernization Act of 1997 [FDAMA][10]) that contains provisions establishing economic incentives to drug manufacturers for conducting pediatric studies of drugs for which exclusivity or patent protection is still available.[9] A manufacturer that conducts pediatric studies required by the 1998 Pediatric Final Rule may qualify for economic incentives provided by FDAMA.

All these changes respond to concerns that drugs and biologicals have not been adequately studied in the pediatric population or if studied, the information required to meet the statutory requirement for the product to be declared safe and effective in this population has not been submitted to the FDA. Whereas current prescription product labels do not include adequate pediatric use information, these regulatory measures have been instituted to improve our knowledge base to provide better prescribing information for practitioners who care for pediatric patients.

Appendix 2. The IND Process

An IND application requires submission of a study protocol, labeling of the drug as investigational, submission of drug and investigator information, and an agreement to obtain the consent of subjects (and/or parents), to submit reports of adverse events, and to account for any unused drug after the study. After receipt of an IND application, the FDA reviews the application to determine whether proceeding with the study is safe. Investigational trials involving marketed drugs do not require IND applications if all of the following apply: 1) the investigation is not intended to be reported to the FDA as a well-controlled study to support a new indication or to support any other significant change in the labeling; 2) the investigation is not intended to support a significant change in the product's advertising; 3) the investigation does not involve a route of administration, dosing level, or use in a patient population or other factor that significantly increases the risks (or decreases the acceptability of the risks) associated with the use of the drug; 4) the investigation is conducted in compliance with the requirements for institutional review and informed consent; and 5) the investigation is conducted in compliance with the requirements concerning promotion and charging for investigational drugs.[7]

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ADDITIONAL RESOURCE

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American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

FROM THE AMERICAN ACADEMY OF PEDIATRICS

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

Policy Statement—Using Personal Health Records to Improve the Quality of Health Care for Children

CONTRIBUTORS:
COUNCIL ON CLINICAL INFORMATION TECHNOLOGY

KEY WORD
personal health records

ABBREVIATIONS
PHR—personal health record
AAP—American Academy of Pediatrics
EHR—electronic health record

The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

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abstract

A personal health record (PHR) is a repository of information from multiple contributors (eg, patient, family, guardians, physicians, and other health care professionals) regarding the health of an individual. The development of electronic PHRs presents new opportunities and challenges to the practice of pediatrics. This policy statement provides recommendations for actions that pediatricians can take to support the development and use of PHRs for children.

Pediatric health care professionals must become actively involved in developing and adopting PHRs and PHR systems. The American Academy of Pediatrics supports development of:

- educational programs for families and clinicians on effective and efficient use of PHRs;
- incentives to facilitate PHR use and maintenance; and
- child- and adolescent-friendly standards for PHR content, portability, security, and privacy.

Properly designed PHR systems for pediatric care can empower patients. PHRs can improve access to health information, improve coordination of preventive health and health maintenance activities, and support emergency and disaster management activities. PHRs provide support for the medical home for all children, including those with special health care needs and those in foster care. PHRs can also provide information to serve as the basis for pediatric quality improvement efforts.

For PHRs to be adopted sufficiently to realize these benefits, we must determine how best to support their development and adoption. Privacy and security issues, especially with regard to children and adolescents, must be addressed. *Pediatrics* 2009;124:403–409

BACKGROUND

A personal health record (PHR) is a repository of information from multiple sources (eg; patient, family, guardians, physicians, and other health care professionals) about the health and health care of an individual that is controlled by the individual or designated people. Documentation of personal health information for children has traditionally been managed in a variety of formal and informal formats, primarily by their parents. Some parents may use tools such as the compact, form-based booklet "Child Health Record From Infancy to Adulthood"[1] from the American Academy of Pediatrics (AAP). This book facilitates standardized and concise tracking of a child's personal health information, including birth and demographic data, physician contacts, medical and family history, and well-child care information. Use of such tools is variable; some parents record nothing, and others maintain extensive and detailed records. For children with special health care needs, similar tools and forms have been developed to summarize clinically relevant information. Two examples are the emergency information form,[2] developed by the AAP and the American College of Emergency Physicians, and care notebooks and medical care plans/assessment forms[3] from the National Center for Medical Home Incentives for Children With Special Needs, which also use electronic forms that have the potential to become interoperable through standard interfaces.

Problems caused by the lack of availability of paper medical records and the lack of data transferability have been well described.[4] Moving these records into an electronic format that is used universally has been proposed as a way to solve some of these problems. As a result, the focus on electronic PHRs has steadily increased over the past several years, with more than 200 systems available in 2006.[5]

On the federal level, the American Health Information Community, which advises the Secretary of Health and Human Services, selected a "consumer empowerment use case" including a registration summary and medication history as a first step for the Health Information Standards Panel and the Certification Commission for Healthcare Information Technology to standardize the exchange of basic patient data.[6] Many electronic health record (EHR) vendors now offer PHRs as extensions of their products. Health plans, employers, and hospitals are also offering PHRs to their subscribers, employees, and patients, either as stand-alone systems or as part of the institution's information systems. Cooperation among organizations is beginning, with America's Health Insurance Plans (AHIP) designing PHRs for their members with "portability" (ie, the ability to transfer and share information between different insurers). Some companies are offering PHR systems to their employees, and an effort to create a common PHR for multiple employers has been launched. Major vendors in the software industry, seeing the opportunities to expand into health care, are establishing various forms of Internet-based PHRs. Electronic PHRs that are populated by a wide variety of organizations, together with health information exchange solutions, may serve as the backbone of efforts to support improved quality of care and a nationwide health information network.

The technical infrastructure of electronic PHR systems may have many forms. In addition to Web-based systems, information in electronic PHRs may be stored on portable computer drives (such as USB "flash drives"), "smart cards," or other electronic storage devices. Functionally, PHRs are diverse. Some contain tools for managing care, such as delivering electronic test results, providing support for remote monitoring (eg, weight, blood pressure, blood glucose), and providing secure communication services between patient/family and health care professional or access to health-related content. Some PHRs have the ability to transfer information using standardized data formats[7] or to transfer data to a patient-controlled health data record or repository.

Ideally, an electronic PHR prevents duplication and delays in services. It may be part of a comprehensive strategy to empower patients to understand the care they are receiving while fostering a closer collaboration with their health care team. For pediatricians, PHRs can provide pediatricians information on events occurring at home and in school between encounters to supplement secure messaging features that may facilitate doctor-patient communication. PHRs integrated with medical devices may allow for direct, automated reporting of important information for real-time clinical management and for evaluation of clinical outcomes, especially for patients with chronic medical conditions. In addition, improved documentation and reporting of electronic clinical interactions and patient-physician communications can be beneficial for reimbursement. PHRs are increasingly being designed to integrate patient data, communication, and management interventions. They have the potential to provide improvements in quality (ie, safety, timeliness, effectiveness, efficiency, equity, and patient-centeredness, as defined by the Institute of Medicine).[8]

Assurance of consumer control of privacy is essential to the acceptance and adoption of PHRs. With appropriate access controls, patients and families can allow portions of the PHR to be

made available to family members, school nurses, and others, with emergency access ("break-the-glass") functionality for use during medical crises or in disaster situations.

Few, if any, PHRs offer the privacy controls that are necessary for adolescent medical care. Adolescents are typically excluded from PHR use because of the wide variation of state laws regarding access to adolescent medical information and to limitations in the ability of adolescents to enter into contracts independently. In general, adolescents should have access to their records as well as control over who else may access these records. The approach to adolescents could start with parental access for records of young adolescents while parents remain in control. Older adolescents who are authorized to seek care alone may start a separate private PHR for those episodes of care, subject to local mandatory disclosures to their parents. At the appropriate time (to be determined by convention and law), a copy of the parent-maintained PHR should be transferred to adolescent control (although special consideration to issues, such as genetic susceptibility known only to parents, might be withheld until the adolescent reaches the age of majority). Because of laws limiting the authority of adolescents to enter into contracts independently in many states, it is likely that such a separate PHR would need to be a part of the original contract agreed to by their parents.

STATEMENT OF THE PROBLEM

Electronic PHRs have the potential for great impact on the medical care of children, especially children with special health care needs. To realize the potential of PHRs in pediatrics, 2 needs must be addressed: (1) standards for content, information assurance, and data exchange that meet the health needs of children, including adolescents; and (2) incentives for adoption and use by pediatric providers and families. There are still many unanswered questions regarding PHRs, including who will bear the costs of their development and adoption, but key issues for children and adolescents must be clarified, because they are not being addressed in the current development of PHRs.

The Need for Standards

Pediatricians have a critical role in defining content standards for PHR use in child health care. Lack of adequate pediatric-specific content standards for PHRs may result in incomplete products (eg, a PHR that lacks immunization functionality). Content requirements for pediatric EHRs[9] and for emergent care for children with special health care needs[3] have been articulated and may be used as a basis for developing pediatric PHR standards.

In addition to developing minimum content standards, pediatricians should support the creation of data-exchange standards that are detailed enough so that the data can be:

- transmitted and received correctly (ie, technical interoperability [eg, using the ASTM/Health Level 7 Continuity of Care Record/Document format]);
- interpreted correctly after transmission (ie, semantic interoperability [eg, vocabulary standards to allow determination whether "fundus" refers to a part of the eye or of the uterus]); and
- shown and used in the correct context (ie, process interoperability [eg, data are presented via consistent, useful, and efficient user interfaces that fit workflow]).

It is highly desirable for pediatricians to be involved in standardization efforts at all of these levels. If successful, PHRs will have reliable and transportable data that are presented in a consistent interface, resulting in decreased time and errors in use, higher adoption rates, and increased medical quality.

Pediatricians must also play a central role in defining PHR information-assurance standards for PHR use in child health care. Such standards include requirements for PHR confidentiality and access controls, for data and source integrity including audit trails, and for physical and functional availability of PHR content. An example of information assurance relevant to pediatrics is the definition of standards to protect the privacy of adolescents and children in foster care.[10] Other information-assurance standards ensure the integrity of the data and source information (ie, who entered it, including nonrepudiation [the prevention of a user's denial that he or she has entered information]) as they are moved between/among health care professionals, health systems, and electronic health information environments.

The Need for Incentives

Despite the promise of improved care through the adoption and use of electronic PHRs, acceptance by patients, parents, and physicians has been slow. In addition to the lack of pediatric standards for PHRs, the business case for a PHR is currently weak,[11] especially if it is not linked to an EHR (for which pediatric adoption is also low[12]), making financial incentives important. Many PHRs do not currently fit physician workflow, often adding steps to an already onerous information-recording and -transfer process. Other issues that must be addressed include language barriers to PHR use for non–English-speaking families, literacy barriers in patients' understanding of

their health information to make decisions, technology-access (ie, "digital-divide") barriers, and the lack of coordination between Medicaid, State Children's Health Insurance Programs (SCHIPs), private insurers, and employers with respect to PHRs.

A stronger business case from employers and third-party payers is necessary to create financial support for PHRs to help manage employee health and to control costs. Insurers, hospitals, and employers are organizing to support various types of PHRs. Government support is being considered, with legislation introduced on a federal level. To make PHRs a routine part of patient care and quality improvement, incentives to accelerate adoption, such as adjusted reimbursement for the time and work of manual duplicate data entry by pediatricians and their office staff, should be used. A reasonable workaround may be for pediatricians to provide these data to patients for them to enter into their own PHRs or, ideally, to provide automatic electronic updates from an EHR by using standard EHR-PHR interfaces. The financial issues associated with potential duplication of data entry and time spent in review of information in individual patients' PHRs need to be addressed if pediatricians and other health care professionals are expected to fully participate.

SUMMARY/CONCLUSIONS

Electronic PHRs are a platform on which pediatricians can improve the quality of pediatric health care and increase patient/family empowerment—both of which facilitate care that is safer, timelier, and more effective, efficient, equitable, and patient centered. The AAP recognizes the potential of PHRs and supports their adoption and use in pediatric care, especially for children with special health care needs. The AAP also supports efforts to create pediatric-specific standards for PHRs and incentives for their adoption and use in pediatrics.

BASIC PRINCIPLES FOR IDEAL PEDIATRIC PHRs

1. Access—All children should have a single PHR, either paper or electronic, as an essential component of a medical home to document and coordinate care and to improve communication between their families and health care providers. Children should have equal access to a PHR regardless of income or method of health care financing.
2. Information Availability—Personal health information from a PHR should be available at all times, especially in emergent situations or disasters. To support availability, PHR information must be redundant (ie, copies on paper, portable electronic media, secure sites on the Internet, or through centralized electronic data repositories).
3. Data Exchange—PHR data should be interoperable as needed at the request of the patient or patient's medical guardian (ie, it should be easily transferable to and from other PHRs, EHRs, and health information systems, including hospital systems and registries such as those for immunizations, hearing screening, and newborn metabolic testing). PHRs should also include provisions for efficient data entry by health care professionals who do not use an EHR.
4. Content—The following should be contained in PHRs for children:
   - demographic data;
   - insurance information;
   - information on family members and other support providers;
   - summary and linkage to advance directives, power of attorney, and other key documents, such as an individualized education plan (IEP);
   - information on health care professionals and encounter lists, including dental and oral health professionals;
   - problem list, including active conditions and illnesses, chronic health problems (such as mental health issues), emergency care procedures (equipment if needed) and contacts, hospitalizations, surgeries/procedures (and current technology support needs [ventilator, monitor, surgical site care, etc]), and privacy issues of individual problems;
   - allergy, adverse-reaction, and other alert data;
   - list of medications and immunizations and date of last reconciliation;
   - anthropometric data including weight, stature, BMI, and head circumference and developmental milestones;
   - results of laboratory, imaging, and other studies including screening results;
   - family health history;
   - birth history; and
   - information on durable medical equipment and supplies.

Pediatric PHR content standards must be aligned with the special requirements for EHRs for children[9] with regard to presentation of data. All payers who provide PHRs should include the content and functionality described in this policy and in pediatric PHR standards as they are developed.

Given the cumulative nature of information contained in a PHR, a key challenge will be to provide the appropriate types and amounts of useful data to specific profession-

als for specific purposes (health maintenance and "sick" visits by primary care professionals versus follow-up care by specialists or emergency care by emergency medical services providers and emergency physicians). Pediatricians and PHR/EHR vendors should work to develop appropriate standard elements for each type of care and health care professional.

5. Privacy—The personal health information of children must be protected from abuse and unauthorized secondary or commercial uses. Key principles for PHR privacy include:
   - Control. PHR data are owned and controlled by the patient or the patient's parent/guardian, who authorizes access to the PHR. PHR access should include an override function for use by health care professionals in emergent situations (eg, individuals brought unconscious to an emergency department).
   - Protections. PHR data (ie, personal health information) require protections (including federal and local jurisdictional laws for oversight, accountability, disclosure, recovery, and penalties), even if the organization hosting the PHR is not a covered entity under the Health Insurance Portability and Accountability Act (HIPAA).[13]
   - Adolescent rights. Adolescents should have the right to exclude parents from their PHRs when law dictates that they may be treated without parental consent. When these features are used, health care professionals need to know that these exclusions are in place.
   - Facilitated portability in emergent care. Children in foster care have special legal requirements for portability of personal health information that vary by state and jurisdiction (discussion and agreement among pediatric health care professionals, foster care authorities, lawmakers, and vendors is needed to develop standards for the availability of PHR information of children in emergent care).
   - Special protections for specific personal data.
   - Specific health information, such as information about sexually transmitted diseases/HIV status, mental health diagnoses and treatment, genetic susceptibility, artificial procreation arrangements, and social conditions such as a family history of parental incarceration, may require special protections that must be enforced by PHR mechanisms.
6. Data Entry and Integrity—All data, regardless of source, must be auditable as to source, date, and time of the change. PHRs should allow for data entry by patients or parents/guardians that is auditable as to source (including nonrepudiation) and date/time of record modifications. Data from health care professionals and institutions should be subject to review and comment by the patient but should not be modifiable. Health care professionals should not be required to reconcile disagreements between the patient and previous caregivers that are recorded in the PHR (eg, if a patient disagrees with an entry made by a previous physician) except as clinically necessary to provide needed care.
7. Extensible Functionality—Pediatric PHRs may contain functions that add value, including tools that help track and document immunization status, growth (including tools to address obesity), and development. Examples of other functions that PHRs could perform include generating standard reports, such as school and camp forms, using data stored in the PHR. The addition of such functions should be structured in a modular fashion that allows their inclusion without disruption of the structure and/or function of existing PHRs.
8. Continuity—When available, PHRs should be used during all clinical encounters. The health care professional should help the patient update the PHR, including the problem/procedure lists, key measurements, immunizations, and medications that were changed during the encounter. Electronic data should be shared using standard interfaces and printouts produced as needed for patients who do not yet use a PHR.
9. Support for PHR Adoption—Programs should be established to provide incentive payments to health care professionals who use and support patient/family use of electronic PHRs as part of a medical home, including an adjusted reimbursement system that acknowledges the value and services of the medical home.[14] Programs with national demonstrations and educational materials should also be established to meet the need for patient and provider education regarding the benefits and proper use of PHRs.

THE VISION OF PEDIATRIC PHR IMPLEMENTATION

The PHR is a lifelong and comprehensive record for a patient and should be used beginning at birth. Newborn infants should be discharged from hospitals and birthing centers with a PHR containing perinatal information, birth history, and relevant medical informa-

tion, including assessments for jaundice. Such PHRs should be available in secure formats that conform to electronic health standards (such as the ASTM/Health Level 7 Continuity of Care Record/Document) for easy export to a medical home EHR from the hospital or at the first office visit. The PHR should interoperate with immunization and newborn metabolic and hearing screening registries and with other stakeholders in regional health information organizations. The PHR should facilitate coordination of care with other agencies (eg, it should help to automate the periodic health assessments collected by school systems and serve as an accurate collection of information about children in foster care). The childhood portion of the PHR should provide a comprehensive view of all aspects of a child's health status over time, including reporting of growth and development, health maintenance, and relevant issues managed in all clinical care settings. It should facilitate the transition from pediatric to adult health care professionals.

To achieve this vision, pediatric advocacy is necessary in the form of partnerships among professional medical societies (such as the AAP), health care professional organizations, health care information technology vendors, and standards-development organizations to help establish the necessary standards and incentives for widespread PHR use. A strong pediatric presence is also necessary in the legislative arena to ensure the clear and vocal representation of the needs of children and pediatricians in policy development that drive standards and adoption of health information technologies, such as PHRs. Pediatric leadership is needed to lead and to teach patients, families, and health care professionals to use PHRs effectively to promote the good care and good health of children and families.

Finally, to sustain the vision, PHRs must be rigorously evaluated so that their use can be optimized and their value can be documented. Potential metrics include:

- Manual data-entry elimination: Percentage of new patients who do not have to fill out a paper form or questionnaire in the physician's waiting room, because they have a PHR that can be imported electronically into an EHR or practice-management system.
- Availability of basic history data from other professionals: Percentage of well-child visits that begin with a complete immunization summary, growth chart, problem list, and medication list reconciled from a PHR that contains data from other health care professionals.
- Providing families with up-to-date health information: Percentage of well-child visits that end with the parents receiving an updated PHR with immunization, growth, problem, and medication summaries.
- External PHR updates: Percentage of emergency department, inpatient, or referral visits that update a PHR with the date, location, health care professional, problem, medications, test results, or outcomes.
- External PHR use: Percentage of emergency department, inpatient, or referral visits that access a PHR to review patient data at the time of the encounter.
- Hospital-office newborn continuity: Percentage of newborn first office visits that include a PHR with the birth history, birth and discharge weight, hearing test results, hepatitis B immunization data, bilirubin and blood type (if determined), any newborn problems, and newborn screening results as they become available.
- Completeness of medical providers list: Percentage of preterm infants or children with special health care needs (including foster care children) who have a list of all health care professionals in a PHR, including contact information, date of last visit, and date of next appointment (as applicable).
- EHR adoption rates: Percentage of practices with an EHR that offer a patient Web portal to their patients.

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POLICY STATEMENT

Ventricular Fibrillation and the Use of Automated External Defibrillators on Children

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Pediatric Emergency Medicine and Section on Cardiology and Cardiac Surgery

ABSTRACT

The use of automated external defibrillators (AEDs) has been advocated in recent years as one part of the chain of survival to improve outcomes for adult cardiac arrest victims. When AEDs first entered the market, they had not been tested for pediatric usage and rhythm interpretation. In addition, the presumption was that children do not experience ventricular fibrillation, so they would not benefit from the use of AEDs. Recent literature has shown that children do experience ventricular fibrillation, which has a better outcome than do other cardiac arrest rhythms. At the same time, the arrhythmia software on AEDs has become more extensive and validated for children, and attenuation devices have become available to downregulate the energy delivered by AEDs to allow their use on children. Pediatricians are now being asked whether AED programs should be implemented, and where they are being implemented, pediatricians are being asked to provide guidance on the use of them on children. As AED programs expand, pediatricians must advocate on behalf of children so that their needs are accounted for. For pediatricians to be able to provide guidance and ensure that children are included in AED programs, it is important for pediatricians to know how AEDs work, be up-to-date on the literature regarding pediatric fibrillation and energy delivery, and understand the role of AEDs as life-saving interventions for children.

INTRODUCTION

Early defibrillation has been shown to be the most effective treatment for adult out-of-hospital cardiac arrest attributable to ventricular fibrillation (VF).[1,2] The likelihood of survival decreases by approximately 7% to 10% with each minute of delay to defibrillation after cardiac arrest. Strategies to decrease the time to defibrillation that have been shown to be effective include the use of an automated external defibrillator (AED) by prehospital care providers and nonmedical personnel.[3–6]

For children, use of defibrillation traditionally has been downplayed, with a focus on early airway and ventilatory assistance as a result of data that showed that asystole was the predominant rhythm and that VF rarely occurred.[7] Although not the most common rhythm, VF does occur in children. In addition, the chance of survival after VF is greater than that from other nonperfusing rhythms, which makes treatment of VF a priority in pediatric resuscitation.[8]

Although the incidence of VF in the pediatric population is low, there is a need for developing strategies to provide early defibrillation to patients younger than 8 years. This strategy may include the need for an AED that is suitable for use in pediatric

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Key Words
automated external defibrillator, ventricular fibrillation, emergency medical services, cardiac resuscitation, school emergency care

Abbreviations
VF—ventricular fibrillation
AED—automated external defibrillator
EMS—emergency medical services

patients from birth to 8 years of age with either an attenuated adult-dosage AED tested for efficacy and safety in children or an AED specifically designed for defibrillation of young children and infants. In the absence of either of such devices, standard nonattenuated adult-dosage AEDs should be used on children on the basis of protocols for use developed with medical oversight. Because of the limited data on effective energy dose, emergency medical services (EMS) systems, medical directors, and pediatric researchers should make efforts to gather information regarding pediatric uses of AEDs and report it by using the pediatric Utstein style,[9] which represents an internationally accepted standard method of collecting and reporting respiratory and cardiac arrest and resuscitation data. In addition, because the use of AEDs on children may be a new concept to many responders, EMS and physician leaders should work with professional organizations, community organizations, and researchers to educate their community members regarding the benefits of early pediatric defibrillation and the use of available varieties of AEDs.

The message for the public and for EMS systems is to recognize the existence of VF in infants and children and use methods to treat it as early as possible to improve the survival of children and infants after sudden cardiac arrest. In addition, this possible life-saving therapy should not be withheld purely on the basis of absolute weight and size issues. The key is to pursue a long-term goal of providing devices that will support rapid pediatric and adult defibrillation. This approach would include the ability to treat infants and children without compromising adult care while minimizing training issues and minimizing the use of limited financial and personnel resources.

RECOMMENDATIONS

1. Although the incidence of VF in children is far less than that in adults, the outcome for VF is better than that for other nonperfusing rhythms and is improved with early defibrillation. Therefore, strategies and equipment availability for treatment of pediatric arrest should be focused on shortening the intervals from collapse to recognition of VF and to defibrillation.
2. Although most data available on the correct energy for defibrillation of children are from animal studies, data suggest that the immature heart is less susceptible to energy-related damage and that there is a wide therapeutic range of defibrillation energy doses. In addition, although using a fixed adult-energy AED on some children has a theoretical potential for harm, not treating VF has the proven potential for even greater harm: death of the child. On the basis of this risk/benefit assessment, prehospital programs and public-access AED programs should not withhold defibrillation because of weight or age criteria alone.
3. Children and infants of all ages who suffer VF must be provided defibrillation as soon as possible after arrest. The following approach to achieve this goal should be used:
   a. Immediately provide defibrillation to all infants and children from birth to 8 years of age with either an attenuated adult-dosage AED tested for efficacy and safety in children or an AED specifically designed for defibrillation of young children and infants, depending on which device is available first. In the absence of the devices listed above, standard nonattenuated adult-dosage AEDs should be used on infants and children from birth to 8 years of age. Protocols for use of adult-dosage AEDs should be developed with medical oversight.
   b. For children 8 years of age and older, immediately provide defibrillation with an adult-dosage AED or manual defibrillation.
4. EMS systems must have protocols to allow for pediatric defibrillation in the timeliest fashion and by all levels of responders. These protocols include pediatric AED capability and, in the interim, protocols for the use of an adult AED on infants and children.
5. Although a cost/benefit assessment of public-access defibrillation specifically for children has not been established, when a community or facility chooses to establish a public-access defibrillation program, the AED chosen for that program must have pediatric capability.
6. Although a cost/benefit assessment of school-based AEDs has not been established yet, school systems must, in their assessment of need for an AED, consider the benefit of AED purchase to adult staff members and adult visitors and as another component of school-based emergency care.
7. When determining the need for a school-based AED program, the following factors should direct the decision[10]:
   a. The frequency of cardiac arrest events is such that there is a reasonable probability of AED use within 5 years of rescuer training and AED placement. This probability can be established if 1 cardiac arrest has been known to have occurred at the site within the last 5 years or can be estimated on the basis of population demographics.
   b. There are children attending the school or adults working at the school who are thought to be at high risk of sudden cardiac arrest (eg, children with conditions such as congenital heart disease and a history of abnormal heart rhythms, children with long QT syndrome, children with cardiomyopathy, adults or children who have had a heart transplant, and adults with a history of heart disease).

c. An EMS call-to-shock interval of less than 5 minutes cannot be achieved reliably with conventional EMS services, and a collapse-to-shock interval of less than 5 minutes can be achieved reliably (in >90% of cases) by training and equipping lay people to function as first responders by recognizing cardiac arrest, telephoning 911 (or other appropriate emergency response number), starting cardiopulmonary resuscitation, and attaching and operating an AED.

8. When placed in schools, AEDs must be part of a comprehensive emergency care plan that includes:
   a. pediatric medical oversight;
   b. staff training in basic first aid and cardiopulmonary resuscitation; and
   c. integration with local EMS.
9. Any legislation that mandates placement of an AED also must provide the funding for such devices, including costs of staff training and maintenance of the equipment.
10. AED legislation must allow for pediatric AED usage and liability protection for those who use these devices and for the physicians who provide the medical oversight for these programs.

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CLINICAL REPORT

When Is Lack of Supervision Neglect?

Guidance for the Clinician in Rendering Pediatric Care

Kent P. Hymel, MD, and the Committee on Child Abuse and Neglect

ABSTRACT

Occasionally, pediatricians become aware of children who are inadequately supervised. More frequently, pediatricians treat children for traumatic injuries or ingestions that they suspect could have been prevented with better supervision. This clinical report contains guidance for pediatricians considering a referral to a child protective services agency on the basis of suspicion of supervisory neglect.

BACKGROUND

Laws in all 50 states mandate that pediatricians report any suspicion of child abuse or neglect to the appropriate child protective services agency. Barriers to physician reporting include lack of knowledge and training, previous negative experiences with a child protective services agency, fear of damaging the relationship with the child's family, and fear of courtroom testimony.[1] There are no guidelines specifically designed to help pediatricians decide when to report suspected supervisory neglect.

In our society, parents, guardians, baby-sitters, and other designated caregivers* are expected to protect children from harmful people or situations. Nevertheless, epidemiologic studies confirm that many young children are injured in their own homes,[2,3] and inadequate supervision is cited frequently as a contributing cause.[4] The extent to which adequate supervision protects children from injury or inadequate supervision increases injury risk remains largely undefined.[5–11] Furthermore, there are no established standards that define adequate (or inadequate) parental supervision across a wide variety of cultures and specific circumstances.[12,13]

Under what circumstances should a pediatrician report a suspicion of supervisory neglect? Are parents neglectful only when an inadequately supervised child suffers harm? Or, can a parent be considered neglectful before actual harm occurs? There are no easy answers to these questions. Many pediatric injuries occur while a child is being supervised, and many poorly supervised children do not get injured. Injury risks in young children are related to their developmental capabilities.[14] Certainly, the attention, proximity, and/or continuity of adult supervision necessary to protect an active toddler is vastly different from that required to safely monitor a responsible 10-year-old.[5]

The American Academy of Pediatrics believes that supervisory neglect occurs whenever a caregiver's supervisory decisions or behaviors place a child in his or her care at significant ongoing risk for physical, emotional, or psychological harm.[1]

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Key Words
child supervision, childhood injury, child neglect

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* For the purposes of this report, a caregiver is defined as a parent, guardian, or other designated individual who is responsible for the supervision of the children under his or her care.

ADVICE FOR PEDIATRICIANS

1. In some jurisdictions, child protective services agencies promote or enforce age-specific guidelines for the supervision of children. Become aware of these guidelines (if any) in the local community and consider educating parents about them. Jurisdictional laws or guidelines may not reflect best practices for prevention of injuries.
2. Consider every allegation or suspicion of supervisory neglect individually.
3. If the information is available, carefully consider:
   a. whether the child has previously demonstrated an ongoing ability to execute appropriate judgments regarding his or her own behaviors;
   b. whether the child has any physical, developmental, genetic, behavioral, emotional, cognitive, or psychiatric disabilities;
   c. the length of time and the time of day that the child was inadequately supervised;
   d. the caregiver's reasoning and understanding of the situation;
   e. the inherent danger(s) of the child's unsupervised environment (eg, a young child left home alone, unattended in a car or bathtub, or with unrestricted access to a swimming pool);
   f. the child's level of discomfort regarding his or her unsupervised situation;
   g. the specific nature of the child's activities while he or she was left unsupervised (eg, age-appropriate play activities versus accessing pornography on the Internet, vandalism, or shoplifting);
   h. the child's knowledge of emergency telephone numbers† and procedures;
   i. the child's knowledge and use of protocols for safely answering the telephone and/or door when he or she has been left unsupervised;
   j. the child's accessibility to his or her parent or to another, specific, informed individual designated to be his or her caregiver;
   k. past allegation(s) of supervisory neglect or abuse involving the child and/or the child's caregiver;
   l. the physical, emotional, and mental capabilities of the designated caregiver (eg, a young baby-sitter or an elderly grandmother asked to care for too many children simultaneously);
   m. the number, ages, and maturity of the other children under the caregiver's supervision; and
   n. the age-appropriateness of the responsibilities given to the child.
4. Remember that some child injury risks are unpredictable or unavoidable; caregivers may underestimate the supervisory requirements for some children, and even the most careful caregiver may experience a brief lapse of supervisory attention, proximity, and/or continuity that leads to childhood injury. In these circumstances, counseling regarding child supervision may be an appropriate initial intervention.
5. Be mindful of the emotional burden a caregiver endures when a child in his or her care suffers a preventable injury.
6. When a reasonable suspicion exists that a pattern of caregiver decisions or behaviors have placed a child at significant ongoing risk for physical, emotional, or psychological harm, report the incident to the appropriate child protective services agency.

† Emergency telephone numbers include the telephone numbers for the police, fire department, emergency medical services, and the parent (or another designated, responsible individual) to be called in the event of an emergency.

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PEDIATRICS

". . .encourages investigators to register their clinical trials in a public trials registry. The members of the International Committee of Medical Journal Editors plan to consider clinical trials for publication only if they have been registered. . . . The National Library of Medicine's www.clinicaltrials.gov is a free registry, open to all investigators, that meets the committee's requirements."

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AMERICAN ACADEMY OF PEDIATRICS

Provisional Section on Breastfeeding

WIC Program

ABSTRACT. This policy statement highlights the important collaboration between pediatricians and local Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) programs to ensure that infants and children receive high-quality, cost-effective health care and nutrition services. Specific recommendations are provided for pediatricians and WIC personnel to help children and their families receive optimum services through a medical home.

ABBREVIATIONS. WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; AAP, American Academy of Pediatrics; SCHIP, State Children's Heath Insurance Program.

Since its inception in 1972, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) has been an important source of nutrition education, supplemental food, and health care referrals for low-income women during and after pregnancy and for infants and children up to age 5 in the United States. Breastfeeding promotion and support are important components of the WIC program.

There has been a steady increase in the number of individuals served, with approximately 47% of infants born in 1998 receiving benefits through the program. Despite this increase, 11% of eligible women, infants, and children still did not participate.[1,2]

Prospective participants in the WIC program must undergo a variety of nutritional screenings to determine eligibility. These include assessments of height, weight, diet, health history, and other indices. Because the WIC program serves a significant number of children younger than 5 years, it is often called on to assess immunization status and screen for child health problems.

The WIC program is an important partner in promoting the health and nutrition of children and their families. Ensuring a medical home[3,4] for all children and using the WIC program as a means to identify children at risk of not receiving comprehensive, coordinated health services should be a priority. A medical home is an approach to providing health care services in a high-quality and cost-effective manner that is accessible, family centered, coordinated, compassionate, culturally competent, and consistent. The medical home should provide continuous comprehensive care, including immunizations, assessment of growth and development, and treatment of acute and chronic illnesses.[3,4] A strong collaboration between pediatricians and the WIC program is a key step in identifying and accessing all of the medical and nonmedical services needed to help children and their families achieve their maximum potential.

The American Academy of Pediatrics (AAP) supports the following recommendations for pediatricians:

1. Pediatricians should disseminate information to all of their potentially eligible patients' families about the nutritional and educational benefits of the WIC program; collaborate with local WIC programs to enhance the treatment, anticipatory guidance, and monitoring of their patients' nutritional status; and promote sound dietary patterns for their patients.
2. Pediatricians should work collaboratively with public health departments and colleagues in related professions to identify and mitigate hindrances to the health and well-being of children in the communities they serve. In many cases, vitally needed services already exist in the community. Pediatricians can play an important role in coordinating and focusing services to realize maximum benefit for all children.[5]
3. Pediatricians, including AAP chapter breastfeeding coordinators, should work collaboratively with state and local WIC agencies to maximize efforts to promote, support, and manage breastfeeding as the preferred feeding method for all infants. Although the WIC program is based on federal regulations, states have the option to develop additional policies. Pediatricians must become knowledgeable about their state and local policies and programs to maximize potential benefits available through the WIC program.
4. Pediatricians should provide information to employers on the improved health of infants who are breastfed, which can result in fewer missed workdays for working mothers and fathers attributable to a child's illness.[6]

The AAP also supports the following recommendations for the WIC program:

1. Breastfeeding should be aggressively promoted among WIC recipients as the preferred feeding method for all infants because of the nutritional value and health benefits of human milk. The AAP recommends that infants be exclusively breastfed for approximately the first 6 months of

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

life. It is further recommended that breastfeeding continue with appropriate food supplementation for at least 12 months and thereafter for as long as mutually desired by the mother and the child.[6]
2. For infants whose mothers do not breastfeed or partially breastfeed, iron-fortified infant formula should be provided through the first year of life. Noncontract formula should be made available through physician prescription for specific medical conditions. Food prescriptions should be nutritionally and culturally appropriate.
3. Hematocrit and hemoglobin screening should be performed consistent with the AAP policy statement "Recommendations for Preventive Health Care."[7] Uniform procedures should be developed to ensure that children who have very low hemoglobin or hematocrit levels are referred to their pediatricians for evaluation before iron treatment is instituted.
4. Breastfeeding women should be certified to receive WIC program benefits for up to 1 year after giving birth. Currently, an infant is certified for the first year of life (up to 12 months). Breastfeeding women, however, have to be recertified 6 months after delivery, with benefits limited to 1 year or less if they stop breastfeeding. It is further recommended that WIC program personnel be encouraged to continue to support breastfeeding women after completion of WIC program benefits.
5. The research component of the WIC program should be expanded to document its effectiveness in the treatment and prevention of nutritional deficiencies in mothers and children.

The AAP supports the following recommendations for a collaborative effort between pediatricians and the WIC program:

1. Pediatricians and WIC breastfeeding coordinators should develop partnership initiatives with local obstetricians, family physicians, hospitals, and other providers of obstetric care to introduce pregnant women to the benefits of breastfeeding.
2. Pediatricians and WIC breastfeeding coordinators should work with local businesses to encourage the establishment of family-friendly work policies and facilities that provide breastfeeding women clean and private places to express and store breast milk.
3. Pediatricians and the WIC program should make special efforts to encourage uninsured WIC recipients and those with nutritional needs to enroll in health programs funded by Medicaid or the State Children's Health Insurance Program (SCHIP).[8] A process should also be established by which families enrolled in separate state programs funded by SCHIP are screened for eligibility for WIC.
4. Although they are important sources of screenings and referrals, local WIC programs are not expected to provide primary care services. Pediatricians and other health care professionals are solely responsible for rendering that care, and outside agencies should develop policies to support the concept of the medical home.[3,4] The WIC program should work collaboratively with the medical home to ensure that patient information is shared and referrals are completed in a timely manner.

The AAP supports the nutrition education, breastfeeding promotion, and food supplementation components of the WIC program and advocates for full funding to support all women, infants, and children who are potentially eligible to receive these benefits.

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POLICY STATEMENT

Year 2007 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs

Joint Committee on Infant Hearing

THE POSITION STATEMENT

The Joint Committee on Infant Hearing (JCIH) endorses early detection of and intervention for infants with hearing loss. The goal of early hearing detection and intervention (EHDI) is to maximize linguistic competence and literacy development for children who are deaf or hard of hearing. Without appropriate opportunities to learn language, these children will fall behind their hearing peers in communication, cognition, reading, and social-emotional development. Such delays may result in lower educational and employment levels in adulthood.[1] To maximize the outcome for infants who are deaf or hard of hearing, the hearing of all infants should be screened at no later than 1 month of age. Those who do not pass screening should have a comprehensive audiological evaluation at no later than 3 months of age. Infants with confirmed hearing loss should receive appropriate intervention at no later than 6 months of age from health care and education professionals with expertise in hearing loss and deafness in infants and young children. Regardless of previous hearing-screening outcomes, all infants with or without risk factors should receive ongoing surveillance of communicative development beginning at 2 months of age during well-child visits in the medical home.[2] EHDI systems should guarantee seamless transitions for infants and their families through this process.

2007 JCIH POSITION STATEMENT UPDATES

The following are highlights of updates made since the 2000 JCIH statement[3]:

1. Definition of targeted hearing loss
   - The definition has been expanded from congenital permanent bilateral, unilateral sensory, or permanent conductive hearing loss to include neural hearing loss (eg, "auditory neuropathy/dyssynchrony") in infants admitted to the NICU.
2. Hearing-screening and -rescreening protocols
   - Separate protocols are recommended for NICU and well-infant nurseries. NICU infants admitted for more than 5 days are to have auditory brainstem response (ABR) included as part of their screening so that neural hearing loss will not be missed.
   - For infants who do not pass automated ABR testing in the NICU, referral should be made directly to an audiologist for rescreening and, when indicated, comprehensive evaluation including ABR.
   - For rescreening, a complete screening on both ears is recommended, even if only 1 ear failed the initial screening.
   - For readmissions in the first month of life for all infants (NICU or well infant), when there are conditions associated with potential hearing loss (eg, hyper-

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Key Word
hearing screening

Abbreviations
JCIH—Joint Committee on Infant Hearing
EHDI—early hearing detection and intervention
ABR—auditory brainstem response
CMV—cytomegalovirus
ECMO—extracorporeal membrane oxygenation
AAP—American Academy of Pediatrics
MCHB—Maternal and Child Health Bureau
HRSA—Health Resources and Services Administration
NIDCD—National Institute on Deafness and Other Communication Disorders
CDC—Centers for Disease Control and Prevention
UNHS—universal newborn hearing screening
OAE—otoacoustic emission
IFSP—individualized family service plan
OME—otitis media with effusion
FM—frequency modulation
DSHPSHWA—Directors of Speech and Hearing Programs in State Health and Welfare Agencies
GPRA—Government Performance and Results Act
OMB—Office of Management and Budgets

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bilirubinemia that requires exchange transfusion or culture-positive sepsis), a repeat hearing screening is recommended before discharge.

3. Diagnostic audiology evaluation
   - Audiologists with skills and expertise in evaluating newborn and young infants with hearing loss should provide audiology diagnostic and auditory habilitation services (selection and fitting of amplification device).
   - At least 1 ABR test is recommended as part of a complete audiology diagnostic evaluation for children younger than 3 years for confirmation of permanent hearing loss.
   - The timing and number of hearing reevaluations for children with risk factors should be customized and individualized depending on the relative likelihood of a subsequent delayed-onset hearing loss. Infants who pass the neonatal screening but have a risk factor should have at least 1 diagnostic audiology assessment by 24 to 30 months of age. Early and more frequent assessment may be indicated for children with cytomegalovirus (CMV) infection, syndromes associated with progressive hearing loss, neurodegenerative disorders, trauma, or culture-positive postnatal infections associated with sensorineural hearing loss; for children who have received extracorporeal membrane oxygenation (ECMO) or chemotherapy; and when there is caregiver concern or a family history of hearing loss.
   - For families who elect amplification, infants in whom permanent hearing loss is diagnosed should be fitted with an amplification device within 1 month of diagnosis.
4. Medical evaluation
   - For infants with confirmed hearing loss, a genetics consultation should be offered to their families.
   - Every infant with confirmed hearing loss should be evaluated by an otolaryngologist who has knowledge of pediatric hearing loss and have at least 1 examination to assess visual acuity by an ophthalmologist who is experienced in evaluating infants.
   - The risk factors for congenital and acquired hearing loss have been combined in a single list rather than grouped by time of onset.
5. Early intervention
   - All families of infants with any degree of bilateral or unilateral permanent hearing loss should be considered eligible for early intervention services.
   - There should be recognized central referral points of entry that ensure specialty services for infants with confirmed hearing loss.
   - Early intervention services for infants with confirmed hearing loss should be provided by professionals who have expertise in hearing loss, including educators of the deaf, speech-language pathologists, and audiologists.
   - In response to a previous emphasis on "natural environments," the JCIH recommends that both home-based and center-based intervention options be offered.
6. Surveillance and screening in the medical home
   - For all infants, regular surveillance of developmental milestones, auditory skills, parental concerns, and middle-ear status should be performed in the medical home, consistent with the American Academy of Pediatrics (AAP) pediatric periodicity schedule. All infants should have an objective standardized screening of global development with a validated assessment tool at 9, 18, and 24 to 30 months of age or at any time if the health care professional or family has concern.
   - Infants who do not pass the speech-language portion of a medical home global screening or for whom there is a concern regarding hearing or language should be referred for speech-language evaluation and audiology assessment.
7. Communication
   - The birth hospital, in collaboration with the state EHDI coordinator, should ensure that the hearing-screening results are conveyed to the parents and the medical home.
   - Parents should be provided with appropriate follow-up and resource information, and hospitals should ensure that each infant is linked to a medical home.
   - Information at all stages of the EHDI process is to be communicated to the family in a culturally sensitive and understandable format.
   - Individual hearing-screening information and audiology diagnostic and habilitation information should be promptly transmitted to the medical home and the state EHDI coordinator.
   - Families should be made aware of all communication options and available hearing technologies (presented in an unbiased manner). Informed family choice and desired outcome guide the decision-making process.
8. Information infrastructure
   - States should implement data-management and -tracking systems as part of an integrated child health information system to monitor the quality of EHDI services and provide recommendations for improving systems of care.

- An effective link between health and education professionals is needed to ensure successful transition and to determine outcomes of children with hearing loss for planning and establishing public health policy.

BACKGROUND

It has long been recognized that unidentified hearing loss at birth can adversely affect speech and language development as well as academic achievement and social-emotional development. Historically, moderate-to-severe hearing loss in young children was not detected until well beyond the newborn period, and it was not unusual for diagnosis of milder hearing loss and unilateral hearing loss to be delayed until children reached school age.

In the late 1980s, Dr C. Everett Koop, then US Surgeon General, on learning of new technology, encouraged detection of hearing loss to be included in the *Healthy People 2000*[4] goals for the nation. In 1988, the Maternal and Child Health Bureau (MCHB), a division of the US Health Resources and Services Administration (HRSA), funded pilot projects in Rhode Island, Utah, and Hawaii to test the feasibility of a universal statewide screening program to screen newborn infants for hearing loss before hospital discharge. The National Institutes of Health, through the National Institute on Deafness and Other Communication Disorders (NIDCD), issued in 1993 a consensus statement on early identification of hearing impairment in infants and young children.[5] In the statement the authors concluded that all infants admitted to the NICU should be screened for hearing loss before hospital discharge and that universal screening should be implemented for all infants within the first 3 months of life.[4] In its 1994 position statement, the JCIH endorsed the goal of universal detection of infants with hearing loss and encouraged continuing research and development to improve methods for identification of and intervention for hearing loss.[6,7] The AAP released a statement that recommended newborn hearing screening and intervention in 1999.[8] In 2000, citing advances in screening technology, the JCIH endorsed the universal screening of all infants through an integrated, interdisciplinary system of EHDI.[3] The *Healthy People 2010* goals included an objective to "increase the proportion of newborns who are screened for hearing loss by one month, have audiological evaluation by 3 months, and are enrolled in appropriate intervention services by 6 months."[9]

The ensuing years have seen remarkable expansion in newborn hearing screening. At the time of the National Institutes of Health consensus statement, only 11 hospitals in the United States were screening more than 90% of their newborn infants. In 2000, through the support of Representative Jim Walsh (R-NY), Congress authorized the HRSA to develop newborn hearing screening and follow-up services, the Centers for Disease Control and Prevention (CDC) to develop data and tracking systems, and the NIDCD to support research in EHDI. By 2005, every state had implemented a newborn hearing-screening program, and approximately 95% of newborn infants in the United States were screened for hearing loss before hospital discharge. Congress recommended cooperation and collaboration among several federal agencies and advocacy organizations to facilitate and support the development of state EHDI systems.

EHDI programs throughout the United States have demonstrated not only the feasibility of universal newborn hearing screening (UNHS) but also the benefits of early identification and intervention. There is a growing body of literature indicating that when identification and intervention occur at no later than 6 months of age for newborn infants who are deaf or hard of hearing, the infants perform as much as 20 to 40 percentile points higher on school-related measures (vocabulary, articulation, intelligibility, social adjustment, and behavior).[10–13] Still, many important challenges remain. Despite the fact that approximately 95% of newborn infants have their hearing screened in the United States, almost half of newborn infants who do not pass the initial screening do not have appropriate follow-up to either confirm the presence of a hearing loss and/or initiate appropriate early intervention services (see www.infanthearing.org, www.cdc.gov/ncbddd/ehdi, and www.nidcd.nih.gov/health).

State EHDI coordinators report system-wide problems including failure to communicate information to families in a culturally sensitive and understandable format at all stages of the EHDI process, lack of integrated state data-management and -tracking systems, and a shortage of facilities and personnel with the experience and expertise needed to provide follow-up for infants who are referred from newborn screening programs.[14] Available data indicate that a significant number of children who need further assessment do not receive appropriate follow-up evaluations. However, the outlook is improving as EHDI programs focus on the importance of strengthening follow-up and intervention.

PRINCIPLES

All children with hearing loss should have access to resources necessary to reach their maximum potential. The following principles provide the foundation for effective EHDI systems and have been updated and expanded since the 2000 JCIH position statement.

1. All infants should have access to hearing screening using a physiologic measure at no later than 1 month of age.
2. All infants who do not pass the initial hearing screening and the subsequent rescreening should have appropriate audiological and medical evaluations to

confirm the presence of hearing loss at no later than 3 months of age.

3. All infants with confirmed permanent hearing loss should receive early intervention services as soon as possible after diagnosis but at no later than 6 months of age. A simplified, single point of entry into an intervention system that is appropriate for children with hearing loss is optimal.
4. The EHDI system should be family centered with infant and family rights and privacy guaranteed through informed choice, shared decision-making, and parental consent in accordance with state and federal guidelines. Families should have access to information about all intervention and treatment options and counseling regarding hearing loss.
5. The child and family should have immediate access to high-quality technology including hearing aids, cochlear implants, and other assistive devices when appropriate.
6. All infants and children should be monitored for hearing loss in the medical home.[15] Continued assessment of communication development should be provided by appropriate professionals to all children with or without risk indicators for hearing loss.
7. Appropriate interdisciplinary intervention programs for infants with hearing loss and their families should be provided by professionals who are knowledgeable about childhood hearing loss. Intervention programs should recognize and build on strengths, informed choices, traditions, and cultural beliefs of the families.
8. Information systems should be designed and implemented to interface with electronic health charts and should be used to measure outcomes and report the effectiveness of EHDI services at the patient, practice, community, state, and federal levels.

GUIDELINES FOR EHDI PROGRAMS

The 2007 guidelines were developed to update the 2000 JCIH position statement principles and to support the goals of universal access to hearing screening, evaluation, and intervention for newborn and young infants embodied in *Healthy People 2010*.[9] The guidelines provide current information on the development and implementation of successful EHDI systems.

Hearing screening should identify infants with specifically defined hearing loss on the basis of investigations of long-term, developmental consequences of hearing loss in infants, currently available physiologic screening techniques, and availability of effective intervention in concert with established principles of health screening.[15–18] Studies have demonstrated that current screening technologies are effective in identifying hearing loss of moderate and greater degree.[19] In addition, studies of children with permanent hearing loss indicate that moderate or greater degrees of hearing loss can have significant effects on language, speech, academic, and social-emotional development.[20] High-risk target populations also include infants in the NICU, because research data have indicated that this population is at highest risk of having neural hearing loss.[21–23]

The JCIH, however, is committed to the goal of identifying all degrees and types of hearing loss in childhood and recognizes the developmental consequences of even mild degrees of permanent hearing loss. Recent evidence, however, has suggested that current hearing-screening technologies fail to identify some infants with mild forms of hearing loss.[24,25] In addition, depending on the screening technology selected, infants with hearing loss related to neural conduction disorders or "auditory neuropathy/auditory dyssynchrony" may not be detected through a UNHS program. Although the JCIH recognizes that these disorders may result in delayed communication,[26–28] currently recommended screening algorithms (ie, use of otoacoustic emission [OAE] testing alone) preclude universal screening for these disorders. Because these disorders typically occur in children who require NICU care,[21] the JCIH recommends screening this group with the technology capable of detecting auditory neuropathy/dyssynchrony: automated ABR measurement.

All infants, regardless of newborn hearing-screening outcome, should receive ongoing monitoring for development of age-appropriate auditory behaviors and communication skills. Any infant who demonstrates delayed auditory and/or communication skills development, even if he or she passed newborn hearing screening, should receive an audiological evaluation to rule out hearing loss.

Roles and Responsibilities

The success of EHDI programs depends on families working in partnership with professionals as a well-coordinated team. The roles and responsibilities of each team member should be well defined and clearly understood. Essential team members are the birth hospital, families, pediatricians or primary health care professionals (ie, the medical home), audiologists, otolaryngologists, speech-language pathologists, educators of children who are deaf or hard of hearing, and other early intervention professionals involved in delivering EHDI services.[29,30] Additional services including genetics, ophthalmology, developmental pediatrics, service coordination, supportive family education, and counseling should be available.[31]

The birth hospital is a key member of the team. The birth hospital, in collaboration with the state EHDI coordinator, should ensure that parents and primary health care professionals receive and understand the hearing-screening results, that parents are provided with appropriate follow-up and resource information, and

that each infant is linked to a medical home.[2] The hospital ensures that hearing-screening information is transmitted promptly to the medical home and appropriate data are submitted to the state EHDI coordinator.

The most important role for the family of an infant who is deaf or hard of hearing is to love, nurture, and communicate with the infant. From this foundation, families usually develop an urgent desire to understand and meet the special needs of their infant. Families gain knowledge, insight, and experience by accessing resources and through participation in scheduled early intervention appointments including audiological, medical, habilitative, and educational sessions. This experience can be enhanced when families choose to become involved with parental support groups, people who are deaf or hard of hearing, and/or their children's deaf or hard-of-hearing peers. Informed family choices and desired outcomes guide all decisions for these children. A vital function of the family's role is ensuring direct access to communication in the home and the daily provision of language-learning opportunities. Over time, the child benefits from the family's modeling of partnerships with professionals and advocating for their rights in all settings. The transfer of responsibilities from families to the child develops gradually and increases as the child matures, growing in independence and self-advocacy.

Pediatricians, family physicians, and other allied health care professionals, working in partnership with parents and other professionals such as audiologists, therapists, and educators, constitute the infant's medical home.[2] A medical home is defined as an approach to providing health care services with which care is accessible, family centered, continuous, comprehensive, coordinated, compassionate, and culturally competent. The primary health care professional acts in partnership with parents in a medical home to identify and access appropriate audiology, intervention, and consultative services that are needed to develop a global plan of appropriate and necessary health and habilitative care for infants identified with hearing loss and infants with risk factors for hearing loss. All children undergo surveillance for auditory skills and language milestones. The infant's pediatrician, family physician, or other primary health care professional is in a position to advocate for the child and family.[2,16]

An audiologist is a person who, by virtue of academic degree, clinical training, and license to practice, is qualified to provide services related to the prevention of hearing loss and the audiological diagnosis, identification, assessment, and nonmedical and nonsurgical treatment of persons with impairment of auditory and vestibular function, and to the prevention of impairments associated with them. Audiologists serve in a number of roles. They provide newborn hearing-screening program development, management, quality assessment, service coordination and referral for audiological diagnosis, and audiological treatment and management. For the follow-up component, audiologists provide comprehensive audiological diagnostic assessment to confirm the existence of the hearing loss, ensure that parents understand the significance of the hearing loss, evaluate the infant for candidacy for amplification and other sensory devices and assistive technology, and ensure prompt referral to early intervention programs. For the treatment and management component, audiologists provide timely fitting and monitoring of amplification devices.[32] Other audiologists may provide diagnostic and auditory treatment and management services in the educational setting and provide a bridge between the child/family and the audiologist in the clinic setting as well as other service providers. Audiologists also provide services as teachers, consultants, researchers, and administrators.

Otolaryngologists are physicians whose specialty includes determining the etiology of hearing loss; identifying related risk indicators for hearing loss, including syndromes that involve the head and neck; and evaluating and treating ear diseases. An otolaryngologist with knowledge of childhood hearing loss can determine if medical and/or surgical intervention may be appropriate. When medical and/or surgical intervention is provided, the otolaryngologist is involved in the long-term monitoring and follow-up with the infant's medical home. The otolaryngologist provides information and participates in the assessment of candidacy for amplification, assistive devices, and surgical intervention, including reconstruction, bone-anchored hearing aids, and cochlear implantation.

Early intervention professionals are trained in a variety of academic disciplines such as speech-language pathology, audiology, education of children who are deaf or hard of hearing, service coordination, or early childhood special education. All individuals who provide services to infants with hearing loss should have specialized training and expertise in the development of audition, speech, and language. Speech-language pathologists provide both evaluation and intervention services for language, speech, and cognitive-communication development. Educators of children who are deaf or hard of hearing integrate the development of communicative competence within a variety of social, linguistic, and cognitive/academic contexts. Audiologists may provide diagnostic and habilitative services within the individualized family service plan (IFSP) or school-based individualized education plan. To provide the highest quality of intervention, more than 1 provider may be required.

The care coordinator is an integral member of the EHDI team and facilitates the family's transition from screening to evaluation to early intervention.[33] This person must be a professional (eg, social worker, teacher, nurse) who is knowledgeable about hearing loss. The care coordinator incorporates the family's preferences for outcomes into an IFSP as required by federal legisla-

tion. The care coordinator supports the family members in their choice of the infant's communicative development. Through the IFSP review, the infant's progress in language, motor, cognitive, and social-emotional development is monitored. The care coordinator assists the family in advocating for the infant's unique developmental needs.

The deaf and hard-of-hearing community includes members with direct experience with signed language, spoken language, hearing-aid and cochlear implant use, and other communication strategies and technologies. Optimally, adults who are deaf or hard-of-hearing should play an integral part in the EHDI program. Both adults and children in the deaf and hard-of-hearing community can enrich the family's experience by serving as mentors and role models. Such mentors have experience in negotiating their way in a hearing world, raising infants or children who are deaf or hard of hearing, and providing families with a full range of information about communication options, assistive technology, and resources that are available in the community.

A successful EHDI program requires collaboration between a variety of public and private institutions and agencies that assume responsibility for specific components (eg, screening, evaluation, intervention). Roles and responsibilities may differ from state to state. Each state has defined a lead coordinating agency with oversight responsibility. The lead coordinating agency in each state should be responsible for identifying the public and private funding sources available to develop, implement, and coordinate EHDI systems.

Hearing Screening

Multidisciplinary teams of professionals, including audiologists, physicians, and nursing personnel, are needed to establish the UNHS component of EHDI programs. All team members work together to ensure that screening programs are of high quality and are successful. An audiologist should be involved in each component of the hearing-screening program, particularly at the level of statewide implementation and, whenever possible, at the individual hospital level. Hospitals and agencies should also designate a physician to oversee the medical aspects of the EHDI program.

Each team of professionals responsible for the hospital-based UNHS program should review the hospital infrastructure in relationship to the screening program. Hospital-based programs should consider screening technology (ie, OAE or automated ABR testing); validity of the specific screening device; screening protocols, including the timing of screening relative to nursery discharge; availability of qualified screening personnel; suitability of the acoustical and electrical environments; follow-up referral criteria; referral pathways for follow-up; information management; and quality control and improvement. Reporting and communication protocols must be well defined and include the content of reports to physicians and parents, documentation of results in medical charts, and methods for reporting to state registries and national data sets.

Physiologic measures must be used to screen newborns and infants for hearing loss. Such measures include OAE and automated ABR testing. Both OAE and automated ABR technologies provide noninvasive recordings of physiologic activity underlying normal auditory function, both are easily performed in neonates and infants, and both have been successfully used for UNHS.[19,34–37] However, there are important differences between the 2 measures. OAE measurements are obtained from the ear canal by using a sensitive microphone within a probe assembly that records cochlear responses to acoustic stimuli. Thus, OAEs reflect the status of the peripheral auditory system extending to the cochlear outer hair cells. In contrast, ABR measurements are obtained from surface electrodes that record neural activity generated in the cochlea, auditory nerve, and brainstem in response to acoustic stimuli delivered via an earphone. Automated ABR measurements reflect the status of the peripheral auditory system, the eighth nerve, and the brainstem auditory pathway.

Both OAE and ABR screening technologies can be used to detect sensory (cochlear) hearing loss[19]; however, both technologies may be affected by outer or middle-ear dysfunction. Consequently, transient conditions of the outer and middle ear may result in a "failed" screening-test result in the presence of normal cochlear and/or neural function.[38] Moreover, because OAEs are generated within the cochlea, OAE technology cannot be used to detect neural (eighth nerve or auditory brainstem pathway) dysfunction. Thus, neural conduction disorders or auditory neuropathy/dyssynchrony without concomitant sensory dysfunction will not be detected by OAE testing.

Some infants who pass newborn hearing screening will later demonstrate permanent hearing loss.[25] Although this loss may reflect delayed-onset hearing loss, both ABR and OAE screening technologies will miss some hearing loss (eg, mild or isolated frequency region losses).

Interpretive criteria for pass/fail outcomes should reflect clear scientific rationale and should be evidence based.[39,40] Screening technologies that incorporate automated-response detection are necessary to eliminate the need for individual test interpretation, to reduce the effects of screener bias or operator error on test outcome, and to ensure test consistency across infants, test conditions, and screening personnel.[41–45] When statistical probability is used to make pass/fail decisions, as is the case for OAE and automated ABR screening devices, the likelihood of obtaining a pass outcome by chance alone is increased when screening is performed repeatedly.[46–48]

This principle must be incorporated into the policies of rescreening.

There are no national standards for the calibration of OAE or ABR instrumentation. Compounding this problem, there is a lack of uniform performance standards. Manufacturers of hearing-screening devices do not always provide sufficient supporting evidence to validate the specific pass/fail criteria and/or automated algorithms used in their instruments.[49] In the absence of national standards, audiologists must obtain normative data for the instruments and protocols they use.

The JCIH recognizes that there are important issues differentiating screening performed in the well-infant nursery from that performed in the NICU. Although the goals in each nursery are the same, numerous methodologic and technological issues must be considered in program design and pass/fail criteria.

Screening Protocols in the Well-Infant Nursery

Many inpatient well-infant screening protocols provide 1 hearing screening and, when necessary, a repeat screening no later than at the time of discharge from the hospital, using the same technology both times. Use of either technology in the well-infant nursery will detect peripheral (conductive and sensory) hearing loss of 40 dB or greater.[19] When automated ABR is used as the single screening technology, neural auditory disorders can also be detected.[50] Some programs use a combination of screening technologies (OAE testing for the initial screening followed by automated ABR for rescreening [ie, 2-step protocol[5]]) to decrease the fail rate at discharge and the subsequent need for outpatient follow-up.[34,35,37,51–53] With this approach, infants who do not pass an OAE screening but subsequently pass an automated ABR test are considered a screening "pass." Infants in the well-infant nursery who fail automated ABR testing should not be rescreened by OAE testing and "passed," because such infants are presumed to be at risk of having a subsequent diagnosis of auditory neuropathy/dyssynchrony.

Screening Protocols in the NICU

An NICU is defined as a facility in which a neonatologist provides primary care for the infant. Newborn units are divided into 3 categories:

- Level I: basic care, well-infant nurseries
- Level II: specialty care by a neonatologist for infants at moderate risk of serious complications
- Level III: a unit that provides both specialty and subspecialty care including the provision of life support (mechanical ventilation)

A total of 120 level-II NICUs and 760 level-III NICUs have been identified in the United States by survey, and infants who have spent time in the NICU represent 10% to 15% of the newborn population.[54]

The 2007 JCIH position statement includes neonates at risk of having neural hearing loss (auditory neuropathy/auditory dyssynchrony) in the target population to be identified in the NICU,[55–57] because there is evidence that neural hearing loss results in adverse communication outcomes.[22,50] Consequently, the JCIH recommends ABR technology as the only appropriate screening technique for use in the NICU. For infants who do not pass automated ABR testing in the NICU, referral should be made directly to an audiologist for rescreening and, when indicated, comprehensive evaluation, including diagnostic ABR testing, rather than for general outpatient rescreening.

Conveying Test Results

Screening results should be conveyed immediately to families so that they understand the outcome and the importance of follow-up when indicated. To facilitate this process for families, primary health care professionals should work with EHDI team members to ensure that:

- communications with parents are confidential and presented in a caring and sensitive manner, preferably face-to-face;
- educational materials are developed and disseminated to families that provide accurate information at an appropriate reading level and in a language they are able to comprehend; and
- parents are informed in a culturally sensitive and understandable manner that their infant did not pass screening and informed about the importance of prompt follow-up; before discharge, an appointment should be made for follow-up testing.

To facilitate this process for primary care physicians, EHDI systems should ensure that medical professionals receive:

- the results of the screening test (pass, did not pass, or missed) as documented in the hospital medical chart; and
- communication directly from a representative of the hospital screening program regarding each infant in its care who did not pass or was missed and recommendations for follow-up.

Outpatient Rescreening for Infants Who Do Not Pass the Birth Admission Screening

Many well-infant screening protocols will incorporate an outpatient rescreening within 1 month of hospital discharge to minimize the number of infants referred for follow-up audiological and medical evaluation. The out-

patient rescreening should include the testing of both ears, even if only 1 ear failed the inpatient screening.

Outpatient screening at no later than 1 month of age should also be available to infants who were discharged before receiving the birth admission screening or who were born outside a hospital or birthing center. State EHDI coordinators should be aware of some of the following situations under which infants may be lost to the UNHS system:

- Home births and other out-of-hospital births: states should develop a mechanism to systematically offer newborn hearing screening for all out-of-hospital births.
- Across-state-border births: states should develop written collaborative agreements among neighboring states for sharing hearing-screening results and follow-up information.
- Hospital-missed screenings: when infants are discharged before the hearing screening is performed, a mechanism should be in place for the hospital to contact the family and arrange for an outpatient hearing screening.
- Transfers to in-state or out-of-state hospitals: discharge and transfer forms should contain the information of whether a hearing screening was performed and the results of any screening. The recipient hospital should complete a hearing screening if one was not previously performed or if there is a change in medical status or a prolonged hospitalization.
- Readmissions: for readmissions in the first month of life when there are conditions associated with potential hearing loss (eg, hyperbilirubinemia that requires exchange transfusion or culture-positive sepsis), an ABR screening should be performed before discharge.

Additional mechanisms for states to share hearing-screening results and other medical information include (l) incorporating the hearing-screening results in a statewide child health information system and (2) providing combined metabolic screening and hearing-screening results to the primary care physician.

Confirmation of Hearing Loss in Infants Referred From UNHS

Infants who meet the defined criteria for referral should receive follow-up audiological and medical evaluations with fitting of amplification devices, as appropriate, at no later than 3 months of age. Once hearing loss is confirmed, coordination of services should be expedited by the infant's medical home and Part C coordinating agencies for early intervention services, as authorized by the Individuals With Disabilities Education Act, following the EHDI algorithm developed by the AAP (Appendix 1).

Audiological Evaluation

Comprehensive audiological evaluation of newborn and young infants who fail newborn hearing screening should be performed by audiologists experienced in pediatric hearing assessment. The initial audiological test battery to confirm a hearing loss in infants must include physiologic measures and, when developmentally appropriate, behavioral methods. Confirmation of an infant's hearing status requires a test battery of audiological test procedures to assess the integrity of the auditory system in each ear, to estimate hearing sensitivity across the speech frequency range, to determine the type of hearing loss, to establish a baseline for further monitoring, and to provide information needed to initiate amplification-device fitting. A comprehensive assessment should be performed on both ears even if only 1 ear failed the screening test.

Evaluation: Birth to 6 Months of Age

For infants from birth to a developmental age of approximately 6 months, the test battery should include a child and family history, an evaluation of risk factors for congenital hearing loss, and a parental report of the infant's responses to sound. The audiological assessment should include:

- Child and family history.
- A frequency-specific assessment of the ABR using air-conducted tone bursts and bone-conducted tone bursts when indicated. When permanent hearing loss is detected, frequency-specific ABR testing is needed to determine the degree and configuration of hearing loss in each ear for fitting of amplification devices.
- Click-evoked ABR testing using both condensation and rarefaction single-polarity stimulus, if there are risk indicators for neural hearing loss (auditory neuropathy/auditory dyssynchrony) such as hyperbilirubinemia or anoxia, to determine if a cochlear microphonic is present.[28] Furthermore, because some infants with neural hearing loss have no risk indicators, any infant who demonstrates "no response" on ABR elicited by tone-burst stimuli must be evaluated by a click-evoked ABR.[55]
- Distortion product or transient evoked OAEs.
- Tympanometry using a 1000-Hz probe tone.
- Clinician observation of the infant's auditory behavior as a cross-check in conjunction with electrophysiologic measures. Behavioral observation alone is not adequate for determining whether hearing loss is present in this age group, and it is not adequate for the fitting of amplification devices.

Evaluation: 6 to 36 Months of Age

For subsequent testing of infants and toddlers at developmental ages of 6 to 36 months, the confirmatory audiological test battery includes:

- Child and family history.
- Parental report of auditory and visual behaviors and communication milestones.
- Behavioral audiometry (either visual reinforcement or conditioned-play audiometry, depending on the child's developmental level), including pure-tone audiometry across the frequency range for each ear and speech-detection and -recognition measures.
- OAE testing.
- Acoustic immittance measures (tympanometry and acoustic reflex thresholds).
- ABR testing if responses to behavioral audiometry are not reliable or if ABR testing has not been performed in the past.

Other Audiological Test Procedures

At this time, there is insufficient evidence for use of the auditory steady-state response as the sole measure of auditory status in newborn and infant populations.[58] Auditory steady-state response is a new evoked-potential test that can accurately measure auditory sensitivity beyond the limits of other test methods. It can determine frequency-specific thresholds from 250 Hz to 8 kHz. Clinical research is being performed to investigate its potential use in the standard pediatric diagnostic test battery. Similarly, there are insufficient data for routine use of acoustic middle-ear muscle reflexes in the initial diagnostic assessment of infants younger than 4 months.[59] Both tests could be used to supplement the battery or could be included at older ages. Emerging technologies, such as broad-band reflectance, may be used to supplement conventional measures of middle-ear status (tympanometry and acoustic reflexes) as the technology becomes more widely available.[59]

Medical Evaluation

Every infant with confirmed hearing loss and/or middle-ear dysfunction should be referred for otologic and other medical evaluation. The purpose of these evaluations is to determine the etiology of hearing loss, to identify related physical conditions, and to provide recommendations for medical/surgical treatment as well as referral for other services. Essential components of the medical evaluation include clinical history, family history of childhood-onset permanent hearing loss, identification of syndromes associated with early- or late-onset permanent hearing loss, a physical examination, and indicated radiologic and laboratory studies (including genetic testing). Portions of the medical evaluation, such as urine culture for CMV, a leading cause of hearing loss, might even begin in the birth hospital, particularly for infants who spend time in the NICU.[60–62]

Pediatrician/Primary Care Physician

The infant's pediatrician or other primary health care professional is responsible for monitoring the general health, development, and well-being of the infant. In addition, the primary care physician must assume responsibility to ensure that the audiological assessment is conducted on infants who do not pass screening and must initiate referrals for medical specialty evaluations necessary to determine the etiology of the hearing loss. Middle-ear status should be monitored, because the presence of middle-ear effusion can further compromise hearing. The primary care physician must partner with other specialists, including the otolaryngologist, to facilitate coordinated care for the infant and family. Because 30% to 40% of children with confirmed hearing loss will demonstrate developmental delays or other disabilities, the primary care physician should closely monitor developmental milestones and initiate referrals related to suspected disabilities.[63] The medical home algorithm for management of infants with either suspected or proven permanent hearing loss is provided in Appendix 1.[15]

The pediatrician or primary care physician should review every infant's medical and family history for the presence of risk indicators that require monitoring for delayed-onset or progressive hearing loss and should ensure that an audiological evaluation is completed for children at risk of hearing loss at least once by 24 to 30 months of age, regardless of their newborn screening results.[25] Infants with specific risk factors, such as those who received ECMO therapy and those with CMV infection, are at increased risk of delayed-onset or progressive hearing loss[64–67] and should be monitored closely. In addition, the primary care physician is responsible for ongoing surveillance of parent concerns about language and hearing, auditory skills, and developmental milestones of all infants and children regardless of risk status, as outlined in the pediatric periodicity schedule published by the AAP.[16]

Children with cochlear implants may be at increased risk of acquiring bacterial meningitis compared with children in the general US population.[68] The CDC recommends that all children with, and all potential recipients of, cochlear implants follow specific recommendations for pneumococcal immunization that apply to cochlear implant users and that they receive age-appropriate *Haemophilus influenzae* type b vaccines. Recommendations for the timing and type of pneumococcal vaccine vary with age and immunization history and should be discussed with a health care professional.[69]

Otolaryngologist

Otolaryngologists are physicians and surgeons who diagnose, treat, and manage a wide range of diseases of the head and neck and specialize in treating hearing and vestibular disorders. They perform a full medical diagnostic evaluation of the head and neck, ears, and related structures, including a comprehensive history and physical examination, leading to a medical diagnosis and appropriate medical and surgical management. Often, a hearing or balance disorder is an indicator of, or related to, a medically treatable condition or an underlying systemic disease. Otolaryngologists work closely with other dedicated professionals, including physicians, audiologists, speech-language pathologists, educators, and others, in caring for patients with hearing, balance, voice, speech, developmental, and related disorders.

The otolaryngologist's evaluation includes a comprehensive history to identify the presence of risk factors for early-onset childhood permanent hearing loss, such as family history of hearing loss, having been admitted to the NICU for more than 5 days, and having received ECMO (see Appendix 2).[70,71]

A complete head and neck examination for craniofacial anomalies should document defects of the auricles, patency of the external ear canals, and status of the eardrum and middle-ear structures. Atypical findings on eye examination, including irises of 2 different colors or abnormal positioning of the eyes, may signal a syndrome that includes hearing loss. Congenital permanent conductive hearing loss may be associated with craniofacial anomalies that are seen in disorders such as Crouzon disease, Klippel-Feil syndrome, and Goldenhar syndrome.[72] The assessment of infants with these congenital anomalies should be coordinated with a clinical geneticist.

In large population studies, at least 50% of congenital hearing loss has been designated as hereditary, and nearly 600 syndromes and 125 genes associated with hearing loss have already been identified.[72,73] The evaluation, therefore, should include a review of family history of specific genetic disorders or syndromes, including genetic testing for gene mutations such as *GJB2* (connexin-26), and syndromes commonly associated with early-onset childhood sensorineural hearing loss[72,74–76] (Appendix 2). As the widespread use of newly developed conjugate vaccines decreases the prevalence of infectious etiologies such as measles, mumps, rubella, *H influenzae* type b, and childhood meningitis, the percentage of each successive cohort of early-onset hearing loss attributable to genetic etiologies can be expected to increase, prompting recommendations for early genetic evaluations. Approximately 30% to 40% of children with hearing loss have associated disabilities, which can be of importance in patient management. The decision to obtain genetic testing depends on informed family choice in conjunction with standard confidentiality guidelines.[77]

In the absence of a genetic or established medical cause, a computed tomography scan of the temporal bones may be performed to identify cochlear abnormalities, such as Mondini deformity with an enlarged vestibular aqueduct, which have been associated with progressive hearing loss. Temporal bone imaging studies may also be used to assess potential candidacy for surgical intervention, including reconstruction, bone-anchored hearing aid, and cochlear implantation. Recent data have shown that some children with electrophysiologic evidence suggesting auditory neuropathy/dyssynchrony may have an absent or abnormal cochlear nerve that may be detected with MRI.[78]

Historically, an extensive battery of laboratory and radiographic studies was routinely recommended for newborn infants and children with newly diagnosed sensorineural hearing loss. However, emerging technologies for the diagnosis of genetic and infectious disorders have simplified the search for a definitive diagnosis, which obviates the need for costly diagnostic evaluations in some instances.[70,71,79]

If, after an initial evaluation, the etiology remains uncertain, an expanded multidisciplinary evaluation protocol including electrocardiography, urinalysis, testing for CMV, and further radiographic studies is indicated. The etiology of neonatal hearing loss, however, may remain uncertain in as many as 30% to 40% of children. Once hearing loss is confirmed, medical clearance for hearing aids and initiation of early intervention should not be delayed while this diagnostic evaluation is in process. Careful longitudinal monitoring to detect and promptly treat coexisting middle-ear effusions is an essential component of ongoing otologic management of these children.

Other Medical Specialists

The medical geneticist is responsible for the interpretation of family history data, the clinical evaluation and diagnosis of inherited disorders, the performance and assessment of genetic tests, and the provision of genetic counseling. Geneticists or genetic counselors are qualified to interpret the significance and limitations of new tests and to convey the current status of knowledge during genetic counseling. All families of children with confirmed hearing loss should be offered, and may benefit from, a genetics evaluation and counseling. This evaluation can provide families with information on etiology of hearing loss, prognosis for progression, associated disorders (eg, renal, vision, cardiac), and likelihood of recurrence in future offspring. This information may influence parents' decision-making regarding intervention options for their child.

Every infant with a confirmed hearing loss should have an evaluation by an ophthalmologist to document

visual acuity and rule out concomitant or late-onset vision disorders such as Usher syndrome.[1,80] Indicated referrals to other medical subspecialists, including developmental pediatricians, neurologists, cardiologists, and nephrologists, should be facilitated and coordinated by the primary health care professional.

Early Intervention

Before newborn hearing screening was instituted universally, children with severe-to-profound hearing loss, on average, completed the 12th grade with a 3rd- to 4th-grade reading level and language levels of a 9- to 10-year-old hearing child.[81] In contrast, infants and children with mild-to-profound hearing loss who are identified in the first 6 months of life and provided with immediate and appropriate intervention have significantly better outcomes than later-identified infants and children in vocabulary development,[82,83] receptive and expressive language,[12,84] syntax,[85] speech production,[13,86–88] and social-emotional development.[89] Children enrolled in early intervention within the first year of life have also been shown to have language development within the normal range of development at 5 years of age.[31,90]

Therefore, according to federal guidelines, once any degree of hearing loss is diagnosed in a child, a referral should be initiated to an early intervention program within 2 days of confirmation of hearing loss (CFR 303.321d). The initiation of early intervention services should begin as soon as possible after diagnosis of hearing loss but at no later than 6 months of age. Even when the hearing status is not determined to be the primary disability, the family and child should have access to intervention with a provider who is knowledgeable about hearing loss.[91]

UNHS programs have been instituted throughout the United States for the purpose of preventing the significant and negative effects of hearing loss on the cognitive, language, speech, auditory, social-emotional, and academic development of infants and children. To achieve this goal, hearing loss must be identified as quickly as possible after birth, and appropriate early intervention must be available to all families and infants with permanent hearing loss. Some programs have demonstrated that most children with hearing loss and no additional disabilities can achieve and maintain language development within the typical range of children who have normal hearing.[12,13,85,90] Because these studies were descriptive and not causal studies, the efficacy of specific components of intervention cannot be separated from the total provision of comprehensive services. Thus, the family-centered philosophy, the intensity of services, the experience and training of the provider, the method of communication, the curricula, the counseling procedures, the parent support and advocacy, and the deaf and hard-of-hearing support and advocacy are all variables with unknown effects on the overall outcomes of any individual child. The key component of providing quality services is the expertise of the provider specific to hearing loss. These services may be provided in the home, a center, or a combination of the 2 locations.

The term "intervention services" is used to describe any type of habilitative, rehabilitative, or educational program provided to children with hearing loss. In some cases of mild hearing losses, amplification technology may be the only service provided. Some parents choose only developmental assessment or occasional consultation, such as parents with infants who have unilateral hearing losses. Children with high-frequency losses and normal hearing in the low frequencies may only be seen by a speech-language pathologist, and those with significant bilateral sensorineural hearing losses might be seen by an educator of the deaf and receive additional services.

Principles of Early Intervention

To ensure informed decision-making, parents of infants with newly diagnosed hearing loss should be offered opportunities to interact with other families who have infants or children with hearing loss as well as adults and children who are deaf or hard of hearing. In addition, parents should also be offered access to professional, educational, and consumer organizations and provided with general information on child development, language development, and hearing loss. A number of principles and guidelines have been developed that offer a framework for quality early intervention service delivery systems for children who are deaf or hard of hearing and their families.[92] Foundational characteristics of developing and implementing early intervention programs include a family-centered approach, culturally responsive practices, collaborative professional-family relationships and strong family involvement, developmentally appropriate practice, interdisciplinary assessment, and community-based provision of services.

Designated Point of Entry

States should develop a single point of entry into intervention specific for hearing impairment to ensure that, regardless of geographic location, all families who have infants or children with hearing loss receive information about a full range of options regarding amplification and technology, communication and intervention, and accessing appropriate counseling services. This state system, if separate from the state's Part C system, should integrate and partner with the state's Part C program. Parental consent must be obtained according to state and federal requirements to share the IFSP information with providers and transmit data to the state EHDI coordinator.

Regular Developmental Assessment

To ensure accountability, individual, community, and state health and educational programs should assume the responsibility for coordinated, ongoing measurement and improvement of EHDI process outcomes. Early intervention programs must assess the language, cognitive skills, auditory skills, speech, vocabulary, and social-emotional development of all children with hearing loss at 6-month intervals during the first 3 years of life by using assessment tools that have been standardized on children with normal hearing and norm-referenced assessment tools that are appropriate to measure progress in verbal and visual language.

The primary purpose of regular developmental monitoring is to provide valuable information to parents about the rate of their child's development as well as programmatic feedback concerning curriculum decisions. Families also become knowledgeable about expectations and milestones of typical development of hearing children. Studies have shown that valid and reliable documentation of developmental progress is possible through parent questionnaires, analysis of videotaped conversational interactions, and clinically administered assessments.* Documentation of developmental progress should be provided on a regular basis to parents and, with parental release of information, to the medical home and audiologist. Although criterion-referenced checklists may provide valuable information for establishing intervention strategies and goals, these assessment tools alone are not sufficient for parents and intervention professionals to determine if a child's developmental progress is comparable with his or her hearing peers.

Opportunities for Interaction With Other Parents of Children With Hearing Loss

Intervention professionals should seek to involve parents at every level of the EHDI process and develop true and meaningful partnerships with parents. To reflect the value of the contributions that selected parents make to development and program components, these parents should be paid as contributing staff members. Parent representatives should be included in all advisory board activities. In many states, parents have been integral and often have taken leadership roles in the development of policy, resource material, communication mechanisms, mentoring and advocacy opportunities, dissemination of information, and interaction with the deaf community and other individuals who are deaf or hard of hearing. Parents, often in partnership with people who are deaf and hard of hearing, have also participated in the training of professionals. They should be participants in the regular assessment of program services to ensure ongoing improvement and quality assurance.

Opportunities for Interaction With Individuals Who Are Deaf or Hard of Hearing

Intervention programs should include opportunities for involvement of individuals who are deaf or hard of hearing in all aspects of EHDI programs. Because intervention programs serve children with mild-to-profound, unilateral or bilateral, permanent conductive, and sensory or neural hearing disorders, role models who are deaf or hard of hearing can be significant assets to an intervention program. These individuals can serve on state EHDI advisory boards and be trained as mentors for families and children with hearing loss who choose to seek their support. Almost all families choose at some time during their early childhood programs to seek out both adults and child peers with hearing loss. Programs should ensure that these opportunities are available and can be delivered to families through a variety of communications means, such as Web sites, e-mail, newsletters, videos, retreats, picnics and other social events, and educational forums for parents.

Provision of Communication Options

Research studies thus far of early-identified infants with hearing loss have not found significant differences in the developmental outcomes by method of communication when measured at 3 years of age.† Therefore, a range of options should be offered to families in a nonbiased manner. In addition, there have been reports of children with successful outcomes for each of the different methods of communication. The choice is a dynamic process on a continuum, differs according to the individual needs of each family, and can be adjusted as necessary on the basis of a child's rate of progress in developing communication skills. Programs need to provide families with access to skilled and experienced early intervention professionals to facilitate communication and language development in the communication option chosen by the family.

Skills of the Early Intervention Professional

All studies with successful outcomes reported for early-identified children who are deaf or hard of hearing have intervention provided by specialists who are trained in parent-infant intervention services.[12,90,97] Early intervention programs should develop mechanisms to ensure that early intervention professionals have special skills necessary for providing families with the highest quality of service specific to children with hearing loss. Professionals with a background in deaf education, audiology, and speech-language pathology will typically have the skills needed for providing intervention services. Professionals should be highly qualified in their respective fields and should be skilled communicators who are knowledgeable and sensitive to the importance of en-

*Refs 10–13, 51, 85, 87–90, and 93–96.

†Refs 10–13, 85, 87, 88, 90, 93, and 96.

hancing families' strengths and supporting their priorities. When early intervention professionals have knowledge of the principles of adult learning, it increases their success with parents and other professionals.

Quality of Intervention Services

Children with confirmed hearing loss and their families have the right to prompt access to quality intervention services. For newborn infants with confirmed hearing loss, enrollment into intervention services should begin as soon after hearing-loss confirmation as possible and no later than 6 months of age. Successful early intervention programs (1) are family centered, (2) provide families with unbiased information on all options regarding approaches to communication, (3) monitor development at 6-month intervals with norm-referenced instruments, (4) include individuals who are deaf or hard of hearing, (5) provide services in a natural environment in the home or in the center, (6) offer high-quality service regardless of where the family lives, (7) obtain informed consent, (8) are sensitive to cultural and language differences and provide accommodations as needed, and (9) conduct annual surveys of parent satisfaction.

Intervention for Special Populations of Infants and Young Children

Developmental monitoring should also occur at regular 6-month intervals for special populations of children with hearing loss, including those with minimal and mild bilateral hearing loss,[98] unilateral hearing loss,[99,100] and neural hearing loss,[22] because these children are at risk of having speech and language delay. Research findings indicate that approximately one third of children with permanent unilateral loss experience significant language and academic delays.[99–101]

Audiological Habilitation

Most infants and children with bilateral hearing loss and many with unilateral hearing loss benefit from some form of personal amplification device.[32] If the family chooses personal amplification for its infant, hearing-aid selection and fitting should occur within 1 month of initial confirmation of hearing loss even when additional audiological assessment is ongoing. Audiological habilitation services should be provided by an audiologist who is experienced with these procedures. Delay between confirmation of the hearing loss and fitting of an amplification device should be minimized.[51,102]

Hearing-aid fitting proceeds optimally when the results of physiologic audiological assessment including diagnostic ABR, OAE, and tympanometry and medical examination are in accord. For infants who are below a developmental age of 6 months, hearing-aid selection will be based on physiologic measures alone. Behavioral threshold assessment with visual reinforcement audiometry should be obtained as soon as possible to cross-check and augment physiologic findings (see www.audiology.org).

The goal of amplification-device fitting is to provide the infant with maximum access to all of the acoustic features of speech within an intensity range that is safe and comfortable. That is, amplified speech should be comfortably above the infant's sensory threshold but below the level of discomfort across the speech frequency range for both ears. To accomplish this in infants, amplification-device selection, fitting, and verification should be based on a prescriptive procedure that incorporates individual real-ear measures that account for each infant's ear-canal acoustics and hearing loss.[32] Validation of the benefits of amplification, particularly for speech perception, should be examined in the clinical setting as well as in the child's typical listening environments. Complementary or alternative technology, such as frequency modulation (FM) systems or cochlear implants, may be recommended as the primary and/or secondary listening device depending on the degree of the infant's hearing loss, the goals of auditory habilitation, the infant's acoustic environments, and the family's informed choices.[3] Monitoring of amplification, as well as the long-term validation of the appropriateness of the individual habilitation program, requires ongoing audiological assessment along with electroacoustic, real-ear, and functional checks of the hearing instruments. As the hearing loss becomes more specifically defined through audiological assessments and as the child's ear-canal acoustics change with growth, refinement of the individual prescriptive hearing-aid gain and output targets is necessary. Monitoring also includes periodic validation of communication, social-emotional, and cognitive development and, later, academic performance to ensure that progress is commensurate with the child's abilities. It is possible that infants and young children with measurable residual "hearing" (auditory responses) and well-fit amplification devices may fail to develop auditory skills necessary for successful spoken communication. Ongoing validation of the amplification device is accomplished through interdisciplinary evaluation and collaboration with the early intervention team and family.

Cochlear implantation should be given careful consideration for any child who seems to receive limited benefit from a trial with appropriately fitted hearing aids. According to US Food and Drug Administration guidelines, infants with profound bilateral hearing loss are candidates for cochlear implantation at 12 months of age and children with bilateral severe hearing loss are eligible at 24 months of age. The presence of developmental conditions (eg, developmental delay, autism) in addition to hearing loss should not, as a rule, preclude the consideration of cochlear implantation for an infant or child who is deaf. Benefits from hearing aids and cochlear implants in children with neural hearing loss

have also been documented. The benefit of acoustic amplification for children with neural hearing loss is variable.[28,103] Thus, a trial fitting is indicated for infants with neural hearing loss until the usefulness of the fitting can be determined. Neural hearing loss is a heterogeneous condition; the decision to continue or discontinue use of hearing aids should be made on the basis of the benefit derived from amplification. Use of cochlear implants in neural hearing loss is growing, and positive outcomes have been reported for many children.[28]

Infants and young children with unilateral hearing loss should also be assessed for appropriateness of hearing-aid fitting. Depending on the degree of residual hearing in unilateral loss, a hearing aid may or may not be indicated. Use of "contralateral routing of signals" amplification for unilateral hearing loss in children is not recommended.[104] Research is currently underway to determine how to best manage unilateral hearing loss in infants and young children.

The effect of otitis media with effusion (OME) is greater for infants with sensorineural hearing loss than for those with normal cochlear function.[73] Sensory or permanent conductive hearing loss is compounded by additional transient conductive hearing loss associated with OME. OME further reduces access to auditory cues necessary for the development of spoken English. OME also negatively affects the prescriptive targets of the hearing-aid fitting, decreasing auditory awareness and requiring adjustment of the amplification characteristics. Prompt referral to either the primary care physician or an otolaryngologist for treatment of persistent OME is indicated in infants with sensorineural hearing loss.[105] Definitive resolution of OME should never delay the fitting of an amplification device.[73,106]

Medical and Surgical Intervention

Medical intervention is the process by which a physician provides medical diagnosis and direction for medical and/or surgical treatment options for hearing loss and/or related medical disorder(s) associated with hearing loss. Treatment varies from the removal of cerumen and the treatment of OME to long-term plans for reconstructive surgery and assessment of candidacy for cochlear implants. If necessary, surgical treatment of malformation of the outer and middle ears, including bone-anchored hearing aids, should be considered in the intervention plan for infants with permanent conductive or mixed hearing loss when they reach an appropriate age.

Communication Assessment and Intervention

Language is acquired with greater ease during certain sensitive periods of infant and toddler development.[107–109] The process of language acquisition includes learning the precursors of language, such as the rules that pertain to selective attention and turn taking.[20,110,111] Cognitive, social, and emotional development are influenced by the acquisition of language. Development in these areas is synergistic. A complete language evaluation should be performed at regular intervals for infants and toddlers with hearing loss. The evaluation should include an assessment of oral, manual, and/or visual mechanisms as well as cognitive abilities.

A primary focus of language intervention is to support families in fostering the communication abilities of their infants and toddlers who are deaf or hard of hearing.[20] Spoken- and/or sign-language development should be commensurate with the child's age and cognitive abilities and should include acquisition of phonologic (for spoken language), visual/spatial/motor (for signed language), morphologic, semantic, syntactic, and pragmatic skills, depending on the family's preferred mode of communication.

Early intervention professionals should follow family-centered principles to assist in developing communicative competence of infants and toddlers who are deaf or hard of hearing.[112–114] Families should be provided with information specific to language development and access to peer and language models as well as family-involved activities that facilitate language development of children with normal hearing and children who are hard of hearing or deaf.[115,116] Depending on family choices, families should be offered access to children and adults with hearing loss who are appropriate and competent language models. Information on spoken language and signed language, such as American Sign Language[117] and cued speech, should be provided.

Continued Surveillance, Screening, and Referral of Infants and Toddlers

Appendix 2 presents 11 risk indicators that are associated with either congenital or delayed-onset hearing loss. A single list of risk indicators is presented in the current JCIH statement, because there is significant overlap among those indicators associated with congenital/neonatal hearing loss and those associated with delayed-onset/acquired or progressive hearing loss. Heightened surveillance of all infants with risk indicators, therefore, is recommended. There is a significant change in the definition of risk-indicator 3, which has been modified from NICU stay more than 48 hours to NICU stay more than 5 days. Consistent with 2000 JCIH position statement,[3] the 2007 position statement recommends use of risk indicators for hearing loss for 3 purposes. Historically, the first use of risk indicators is for the identification of infants who should receive audiological evaluation but who live in geographic locations (eg, developing nations, remote areas) where universal hearing screening is not yet available.‡ This use has become less common as a result of the expansion of

‡Refs 3, 19, 21, 24, 25, 64, and 118–124.

UNHS. The second purpose of risk-indicator identification is to help identify infants who pass the neonatal screening but are at risk of developing delayed-onset hearing loss and, therefore, should receive ongoing medical, speech and language, and audiological surveillance. Third, the risk indicators are used to identify infants who may have passed neonatal screening but have mild forms of permanent hearing loss.[25]

Because some important indicators, such as family history of hearing loss, may not be determined during the course of UNHS,[14,72] the presence of all risk indicators for acquired hearing loss should be determined in the medical home during early well-infant visits. Risk indicators that are marked with a section symbol in Appendix 2 are of greater concern for delayed-onset hearing loss. Early and more frequent assessment may be indicated for children with CMV infection,[118,125,126] syndromes associated with progressive hearing loss,[72] neurodegenerative disorders,[72] trauma,[127–129] or culture-positive postnatal infections associated with sensorineural hearing loss[130,131]; for children who have received ECMO[64] or chemotherapy[132]; and when there is caregiver concern or a family history of hearing loss.[16]

For all infants with and without risk indicators for hearing loss, developmental milestones, hearing skills, and parent concerns about hearing, speech, and language skills should be monitored during routine medical care consistent with the AAP periodicity schedule.

The JCIH has determined that the previously recommended approach to follow-up of infants with risk indicators for hearing loss only addressed children with identifiable risk indicators and failed to consider the possibility of delayed-onset hearing loss in children without identifiable risk indicators. In addition, concerns were raised about feasibility and cost associated with the 2000 JCIH recommendation for audiological monitoring of all infants with risk indicators at 6-month intervals. Because approximately 400 000 infants are cared for annually in NICUs in the United States, and the 2000 JCIH recommendation included audiology assessments at 6-month intervals from 6 months to 36 months of age for all infants admitted to an NICU for more than 48 hours, an unreasonable burden was placed on both providers of audiology services and families. In addition, there was no provision for identification of delayed-onset hearing loss in infants without an identifiable risk indicator. Data from 2005 for 12 388 infants discharged from NICUs in the National Perinatal Information Network indicated that 52% of infants were discharged within the first 5 days of life, and these infants were significantly less likely to have an identified risk indicator for hearing loss other than NICU stay. Therefore, the 2007 JCIH recommends an alternative, more inclusive strategy of surveillance of all children within the medical home based on the pediatric periodicity schedule. This protocol will permit the detection of children with either missed neonatal or delayed-onset hearing loss irrespective of the presence or absence of a high-risk indicator.

The JCIH recognizes that an optimal surveillance and screening program within the medical home would include the following:

- At each visit, consistent with the AAP periodicity schedule, infants should be monitored for auditory skills, middle-ear status, and developmental milestones (surveillance). Concerns elicited during surveillance should be followed by administration of a validated global screening tool.[133] A validated global screening tool is administered to all infants at 9, 18, and 24 to 30 months or, if there is physician or parental concern about hearing or language, sooner.[133]
- If an infant does not pass the speech-language portion of the global screening in the medical home or if there is physician or caregiver concern about hearing or spoken-language development, the child should be referred immediately for further evaluation by an audiologist and a speech-language pathologist for a speech and language evaluation with validated tools.[133]
- Once hearing loss is diagnosed in an infant, siblings who are at increased risk of having hearing loss should be referred for audiological evaluation.[14,75,134,135]
- All infants with a risk indicator for hearing loss (Appendix 2), regardless of surveillance findings, should be referred for an audiological assessment at least once by 24 to 30 months of age. Children with risk indicators that are highly associated with delayed-onset hearing loss, such as having received ECMO or having CMV infection, should have more frequent audiological assessments.
- All infants for whom the family has significant concerns regarding hearing or communication should be promptly referred for an audiological and speech-language assessment.
- A careful assessment of middle-ear status (using pneumatic otoscopy and/or tympanometry) should be completed at all well-child visits, and children with persistent middle-ear effusion that last for 3 months or longer should be referred for otologic evaluation.[136]

Protecting the Rights of Infants and Families

Each agency or institution involved in the EHDI process shares responsibility for protecting infant and family rights in all aspects of UNHS, including access to information including potential benefits and risks in the family's native language, input into decision-making, and confidentiality.[77] Families should receive information about childhood hearing loss in easily understood language. Families have the right to accept or decline hearing screening or any follow-up care for their newborn

infant within the statutory regulations, just as they have for any other screening or evaluation procedures or intervention.

EHDI data merit the same level of confidentiality and security afforded all other health care and education information in practice and law. The infant's family has the right to confidentiality of the screening and follow-up assessments and the acceptance or rejection of suggested intervention(s). In compliance with federal and state laws, mechanisms should be established that ensure parental release and approval of all communications regarding the infant's test results, including those to the infant's medical home and early intervention–coordinating agency and programs. The Health Insurance Portability and Accountability Act (Pub L No. 104-191 [1996]) regulations permit the sharing of health information among health care professionals.

Information Infrastructure

In its 2000 position statement,[3] the JCIH recommended development of uniform state registries and national information databases that incorporate standardized methodology, reporting, and system evaluation. EHDI information systems are to provide for the ongoing and systematic collection, analysis, and interpretation of data in the process of measuring and reporting associated program services (eg, screening, evaluation, diagnosis, and/or intervention). These systems are used to guide activities, planning, implementation, and evaluation of programs and to formulate research hypotheses.

EHDI information systems are generally authorized by legislators and implemented by public health officials. These systems vary from a simple system that collects data from a single source to electronic systems that receive data from many sources in multiple formats. The number and variety of systems will likely increase with advances in electronic data interchange and integration of data, which will also heighten the importance of patient privacy, data confidentiality, and system security. The appropriate agencies and/or officials should be consulted for any projects regarding public health surveillance.[69]

Federal and state agencies are collaborating in the standardization of data definitions to ensure the value of data sets and to prevent misleading or unreliable information. Information management is used to improve services to infants and their families; to assess the quantity and timeliness of screening, evaluation, and enrollment into intervention; and to facilitate collection of demographic data on neonatal and infant hearing loss.

The JCIH endorses the concept of a limited national database to permit documentation of the demographics of neonatal hearing loss, including prevalence and etiology across the United States. The information obtained from the information-management system should assist both the primary health care professional and the state health agency in measuring quality indicators associated with program services (eg, screening, diagnosis, and intervention). The information system should provide measurement tools to determine the degree to which each process is stable and sustainable and conforms to program benchmarks. Timely and accurate monitoring of relevant quality measures is essential.

Since 1999, the CDC and the Directors of Speech and Hearing Programs in State Health and Welfare Agencies (DSHPSHWA) have collected annual aggregate EHDI program data needed to address the national EHDI goals. In 1999, a total of 22 states provided data for the DSHPSHWA survey. Participation had increased to 48 states, 1 territory, and the District of Columbia in 2003. However, many programs have been unable to respond to all the questions on the survey because of lack of a statewide comprehensive data-management and reporting system.

The Government Performance and Results Act (GPRA) of 1993 (Pub L No. 103-62) requires that federal programs establish measurable goals approved by the US Office of Management and Budget (OMB) that can be reported as part of the budgetary process, thus linking future funding decisions with performance. The HRSA has modified its reporting requirements for all grant programs. The GPRA measures that must be reported to the OMB by the MCHB annually for the EHDI program are:

- the number of infants screened for hearing loss before discharge from the hospital;
- the number of infants with confirmed hearing loss at no later than 3 months of age;
- the number of infants enrolled in a program of early intervention at no later than 6 months of age;
- the number of infants with confirmed or suspected hearing loss referred to an ongoing source of comprehensive health care (ie, medical home); and
- the number of children with nonsyndromic hearing loss who have developmentally appropriate language and communication skills at school entry.

One GPRA measure that must be reported to the OMB by the CDC annually for the EHDI program is the percentage of newborn infants with a positive screening result for hearing loss who are subsequently lost to follow-up.

EHDI programs have made tremendous gains in their ability to collect, analyze, and interpret data in the process of measuring and reporting associated program services. However, only a limited number of EHDI programs are currently able to accurately report the number of infants screened, evaluated, and enrolled in intervention, the age of time-related objectives (eg, screening by 1 month of age), and the severity or laterality of hearing loss. This is complicated by the lack of data standards and

by privacy issues within the regulations of the Family Educational Rights and Privacy Act of 1974 (Pub L No. 93-380).

Given the current lack of standardized and readily accessible sources of data, the CDC EHDI program, in collaboration with the DSHPSHWA, developed a revised survey to obtain annual EHDI data from states and territories in a consistent manner to assess progress toward meeting the national EHDI goals and the *Healthy People 2010* objectives. In October 2006, the OMB, which is responsible for reviewing all government surveys, approved the new EHDI hearing screening and follow-up survey. To facilitate this effort, the CDC EHDI Data Committee is establishing the minimum data elements and definitions needed for information systems to be used to assess progress toward the national EHDI goals.

The JCIH encourages the CDC and HRSA to continue their efforts to identify barriers and explore possible solutions with EHDI programs to ensure that children in each state who seek hearing-related services in states other than where they reside receive all recommended screening and follow-up services. EHDI systems should also be designed to promote the sharing of data regarding early hearing loss through integration and/or linkage with other child health information systems. The CDC currently provides funds to integrate the EHDI system with other state/territorial screening, tracking, and surveillance programs that identify children with special health care needs. Grantees of the MCHB are encouraged to link hearing-screening data with such child health data sets as electronic birth certificates, vital statistics, birth defects registries, metabolic or newborn dried "blood-spot" screenings, immunization registries, and others.

To promote the best use of public health resources, EHDI information systems should be evaluated periodically, and such evaluations should include recommendations for improving quality, efficiency, and usefulness. The appropriate evaluation of public health surveillance systems becomes paramount as these systems adapt to revise case definitions, address new health-related events, adopt new information technology, ensure data confidentiality, and assess system security.[69]

Currently, federal sources of systems support include Title V block grants to states for maternal and child health care services, Title XIX (Medicaid) federal and state funds for eligible children, and competitive US Department of Education personnel preparation and research grants. The NIDCD provides grants for research related to early identification and intervention for children who are deaf or hard of hearing.[137]

Universities should assume responsibility for special-track, interdisciplinary, professional education programs for early intervention for infants and children with hearing loss. Universities should also provide training in family systems, the grieving process, cultural diversity, auditory skill development, and deaf culture. There is a critical need for in-service and preservice training of professionals related to EHDI programs, which is particularly acute for audiologists and early interventionists with expertise in hearing loss. This training will require increased and sustained funding for personnel preparation.

Benchmarks and Quality Indicators

The JCIH supports the concept of regular measurements of performance and recommends routine monitoring of these measures for interprogram comparison and continuous quality improvement. Performance benchmarks represent a consensus of expert opinion in the field of newborn hearing screening and intervention. The benchmarks are the minimal requirements that should be attained by high-quality EHDI programs. Frequent measures of quality permit prompt recognition and correction of any unstable component of the EHDI process.[138]

Quality Indicators for Screening

- Percentage of all newborn infants who complete screening by 1 month of age; the recommended benchmark is more than 95% (age correction for preterm infants is acceptable).
- Percentage of all newborn infants who fail initial screening and fail any subsequent rescreening before comprehensive audiological evaluation; the recommended benchmark is less than 4%.

Quality Indicators for Confirmation of Hearing Loss

- Of infants who fail initial screening and any subsequent rescreening, the percentage who complete a comprehensive audiological evaluation by 3 months of age; the recommended benchmark is 90%.
- For families who elect amplification, the percentage of infants with confirmed bilateral hearing loss who receive amplification devices within 1 month of confirmation of hearing loss; the recommended benchmark is 95%.

Quality Indicators for Early Intervention

- For infants with confirmed hearing loss who qualify for Part C services, the percentage for whom parents have signed an IFSP by no later than 6 months of age; the recommended benchmark is 90%.
- For children with acquired or late-identified hearing loss, the percentage for whom parents have signed an IFSP within 45 days of the diagnosis; the recommended benchmark is 95%.
- The percentage of infants with confirmed hearing loss who receive the first developmental assessment with

standardized assessment protocols (not criterion reference checklists) for language, speech, and nonverbal cognitive development by no later than 12 months of age; the recommended benchmark is 90%.

CURRENT CHALLENGES, OPPORTUNITIES, AND FUTURE DIRECTIONS

Despite the tremendous progress made since 2000, there are challenges to the success of the EHDI system.

Challenges

All of the following listed challenges are considered important for the future development of successful EHDI systems:

- Too many children are lost between the failed screening and the rescreening and between the failed rescreening and the diagnostic evaluation.
- There is a shortage of professionals with skills and expertise in both pediatrics and hearing loss, including audiologists, deaf educators, speech-language pathologists, early intervention professionals, and physicians.
- There is often a lack of timely referral for diagnosis of, and intervention for, suspected hearing loss in children.
- Consistent and stable state and federal funding is needed for program sustainability.
- When compared with services provided for adults, pediatric services in all specialties are poorly reimbursed.
- Access to uniform Part C services is inadequate among states and within states.
- There is a lack of integrated state data-management and -tracking systems.
- Demographics and cultural diversity are changing rapidly.
- Funding for hearing aids, loaner programs, cochlear implants, and FM systems is needed.
- There is a lack of specialized services for children with multiple disabilities and hearing loss.
- Children may not qualify for services (state Part C guidelines) before demonstrating language delays (prevention model versus deficit model).
- Children may not qualify for assistive technology (prevention model versus deficit model).
- There is a lack of in-service education for key professionals.
- There are regulatory barriers to sharing information among providers and among states.
- No national standards exist for the calibration of OAE or ABR instrumentation, and there is a lack of uniform performance standards.

Opportunities for System Development and Research

- Establish programs to ensure the development of communication for infants and children with all degrees and types of hearing loss, allowing them access to all educational, social, and vocational opportunities throughout their life span.
- Develop improved, rapid, reliable screening technology designed to differentiate specific types of hearing loss.
- Develop and validate screening technologies for identifying minimal hearing loss.
- Develop state data-management systems with the capacity for the accurate determination of the prevalence for delayed-onset or progressive hearing loss.
- Develop state data-tracking systems to follow infants with suspected and confirmed hearing loss through individual state EHDI programs.
- Track the certification credentials of the service providers for children with confirmed hearing loss who are receiving Part C early intervention services and early childhood special education.
- Track genetic, environmental, and pharmacologic factors that contribute to hearing loss, thus allowing for tailored prevention and intervention strategies.
- Continue to refine electrophysiologic diagnostic techniques, algorithms, and equipment to enable frequency-specific threshold assessment for use with very young infants.
- Continue to refine techniques to improve the selection and fitting of appropriate amplification devices in infants and young children.
- Conduct translational research pertaining to young children with hearing loss, in particular, genetic, diagnostic, and outcomes studies.
- Initiate prospective population-based studies to determine the prevalence and natural history of auditory neural conduction disorders.
- Conduct efficacy studies to determine appropriate early intervention strategies for infants and children with all degrees and types of hearing loss.
- Conduct additional studies on the efficacy of intervention for infants and children who receive cochlear implants at younger than 2 years.
- Conduct additional studies on the efficacy of hearing-aid use in infants and children younger than 2 years.

- Conduct additional studies of the auditory development of children who have appropriate amplification devices in early life.
- Expand programs within health, social service, and education agencies associated with early intervention and Head Start programs to accommodate the needs of the increasing numbers of early-identified children.
- Adapt education systems to capitalize on the abilities of children with hearing loss who have benefited from early identification and intervention.
- Develop genetic and medical procedures that will determine more rapidly the etiology of hearing loss.
- Ensure transition from Part C (early intervention) to Part B (education) services in ways that encourage family participation and ensure minimal disruption of child and family services.
- Study the effects of parents' participation in all aspects of early intervention.
- Test the utility of a limited national data set and develop nationally accepted indicators of EHDI system performance.
- Encourage the identification and development of centers of expertise in which specialized care is provided in collaboration with local service providers.
- Obtain the perspectives of individuals who are deaf or hard of hearing in developing policies regarding medical and genetic testing and counseling for families who carry genes associated with hearing loss.[139]

CONCLUSIONS

Since the 2000 JCIH statement, tremendous and rapid progress has been made in the development of EHDI systems as a major public health initiative. The percentage of infants screened annually in the United States has increased from 38% to 95%. The collaboration at all levels of professional organizations, federal and state government, hospitals, medical homes, and families has contributed to this remarkable success. New research initiatives to develop more sophisticated screening and diagnostic technology, improved digital hearing-aid and FM technologies, speech-processing strategies in cochlear implants, and early intervention strategies continue. Major technological breakthroughs have been made in facilitating the definitive diagnosis of both genetic and nongenetic etiologies of hearing loss. In addition, outcomes studies to assess the long-term outcomes of special populations, including infants and children with mild and unilateral hearing loss, neural hearing loss, and severe or profound hearing loss managed with cochlear implants, have been providing information on the individual and societal impact and the factors that contribute to an optimized outcome. It is apparent, however, that there are still serious challenges to be overcome and system barriers to be conquered to achieve optimal EHDI systems in all states in the next 5 years. Follow-up rates remain poor in many states, and funding for amplification in children is inadequate. Funding to support outcome studies is necessary to guide intervention and to determine factors other than hearing loss that affect child development. The ultimate goal, to optimize communication, social, academic, and vocational outcomes for each child with permanent hearing loss, must remain paramount.

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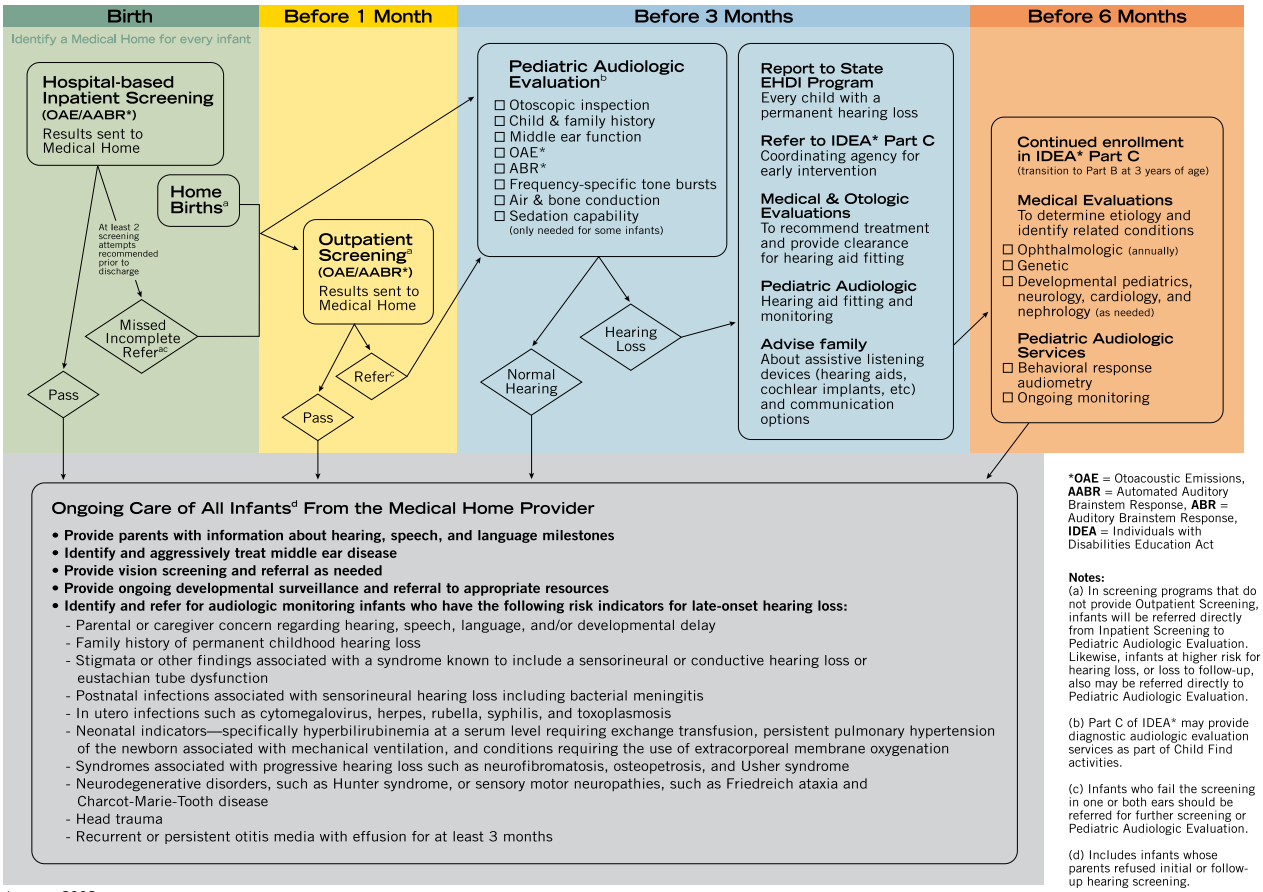
APPENDIX 1 **Algorithm for Hearing Screening. Available at: http://www.medicalhomeinfo.org/screening/Screen%20Materials/Algorithm.pdf**

Universal Newborn Hearing Screening, Diagnosis, and Intervention

Guidelines for Pediatric Medical Home Providers



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APPENDIX 2: RISK INDICATORS ASSOCIATED WITH PERMANENT CONGENITAL, DELAYED-ONSET, OR PROGRESSIVE HEARING LOSS IN CHILDHOOD

Risk indicators that are marked with a "§" are of greater concern for delayed-onset hearing loss.

1. Caregiver concern§ regarding hearing, speech, language, or developmental delay.[62]
2. Family history§ of permanent childhood hearing loss.[24,140]
3. Neonatal intensive care of more than 5 days or any of the following regardless of length of stay: ECMO,§ assisted ventilation, exposure to ototoxic medications (gentimycin and tobramycin) or loop diuretics (furosemide/Lasix), and hyperbilirubinemia that requires exchange transfusion.[64,131]
4. In utero infections, such as CMV,§ herpes, rubella, syphilis, and toxoplasmosis.[64–67,125,126]
5. Craniofacial anomalies, including those that involve the pinna, ear canal, ear tags, ear pits, and temporal bone anomalies.[24]
6. Physical findings, such as white forelock, that are associated with a syndrome known to include a sensorineural or permanent conductive hearing loss.[24]
7. Syndromes associated with hearing loss or progressive or late-onset hearing loss,§ such as neurofibromatosis, osteopetrosis, and Usher syndrome[131]; other frequently identified syndromes include Waardenburg, Alport, Pendred, and Jervell and Lange-Nielson.[72]
8. Neurodegenerative disorders,§ such as Hunter syndrome, or sensory motor neuropathies, such as Friedreich ataxia and Charcot-Marie-Tooth syndrome.[131]
9. Culture-positive postnatal infections associated with sensorineural hearing loss,§ including confirmed bacterial and viral (especially herpes viruses and varicella) meningitis.[130,131,141]
10. Head trauma, especially basal skull/temporal bone fracture§ that requires hospitalization.[127–129]
11. Chemotherapy.§[132]